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O&M DOCUMENTS
Job 4539

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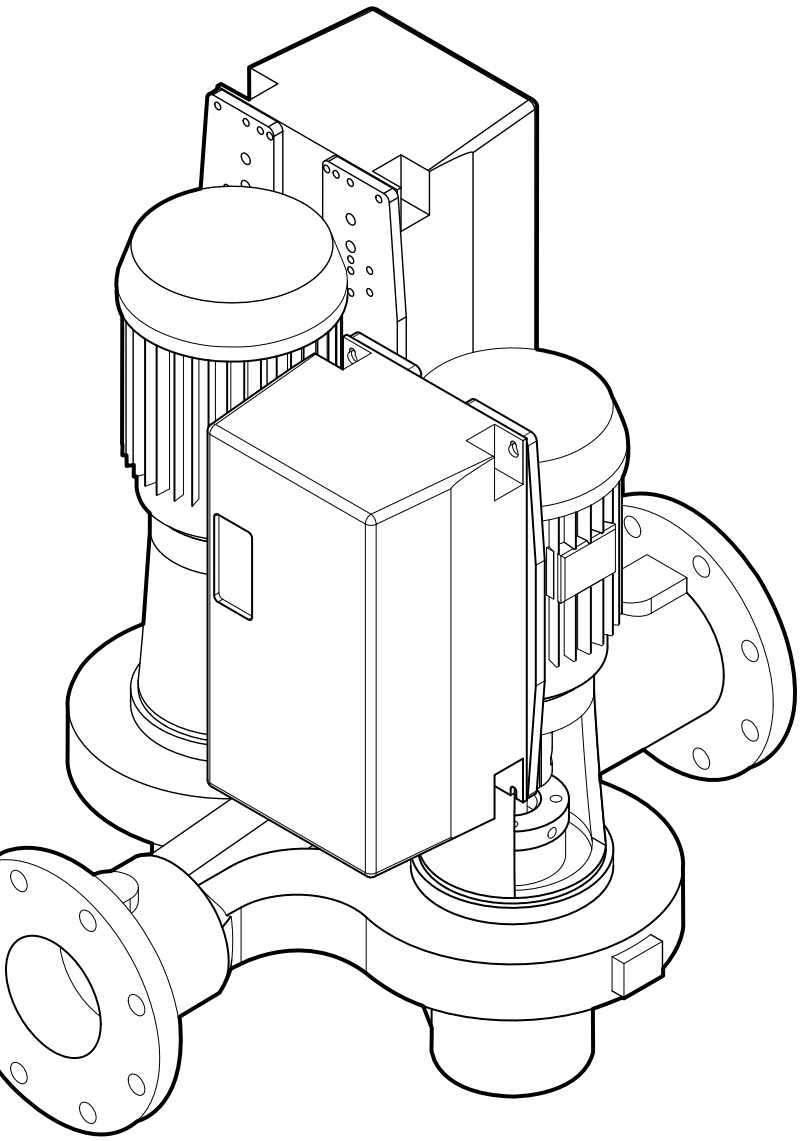
ARMSTRONG



Installation and operating instructions

Design Envelope 4302 and 4382 IVS vertical in-line pumping unit with integrated controls

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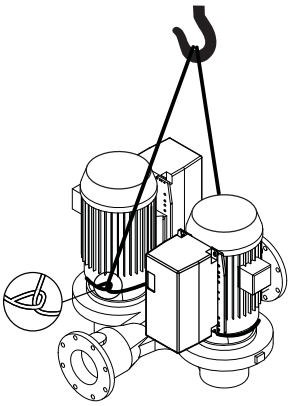
CONTENTS

1.0 UNCRATING

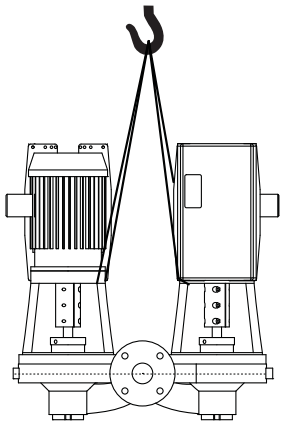
Armstrong dualArm Design Envelope 4302 IVS and 4382 IVS in-line pumps are thoroughly inspected before shipment to assure they meet with your order requirements. After removing the pump from the crate, make sure the equipment is in good order and that all components are received as called for on the packing list. Any shortages or damage should be reported immediately. Use extreme care in handling the unit, placing slings carefully so that stress will not be imposed on the integrated controls, pump or motor. **Never place cable slings around the pump shaft or integrated controls.** The eye bolts or lifting lugs on the motor are intended for lifting only the motor and not the complete unit.

1.1 HANDLING 4302 IVS & 4382 IVS UNITS

Series 4302 IVS and 4382 IVS dualArm units are handled in a similar manner to the normal dualArm units. Extra care is required to ensure the integrated controls do not get damaged during lifting and installation. Remove the coupling guards and insert lifting straps through each pump/motor pedestal on the inner side of each coupling. As the lifting device is engaged (Using a spacer bar if necessary) and the straps tighten ensure no part of the strapping is touching any part of the control or motor fan cover. Lift the pumping unit carefully from the pallet in this manner and allow the unit to stand upright on a flat surface and re-position the straps, if necessary, to ensure safe and damage free transportation into the pipe installation



4382 IVS



4302 IVS

2.0 INSTALLATION

2.1 MECHANICAL INSTALLATION

2.1.1 LOCATION

Locate the unit as close as practical to the liquid being pumped, with a short, direct suction pipe. Ensure adequate space is left above and around the unit for operation, maintenance, service and inspection of parts.

Electric motor driven pumps should not be located in damp or dusty location without special protection.

2.1.2 STORAGE

Pumps not immediately placed into service, or removed from service and stored, must be properly prepared to prevent rusting

Rotate the shaft periodically to keep rotating element free.

For long term storage, the pump must be placed in a vertical position in a dry environment.

Internal rusting can be prevented by removing the plugs at the top and bottom of the casing and drain or air blow out all water to prevent rust build up or the possibility of freezing. Be sure to reinstall the plugs when the unit is made operational. Rust-proofing or packing the casing with moisture absorbing material and covering the flanges is acceptable. When returning to service be sure to remove the drying agent from the pump.

2.1.3 INSTALLATION

The most important consideration when installing a Series 4302 IVS and 4382 IVS pumping unit is to make sure the pump is free to 'float' with expansion and contraction of the piping. Recommended arrangements are:

- Supported from the ceiling by pipe hangers (See Fig. 2.1 on page 9)
- Pipe supported at the ceiling, with the dualArm free-standing and mounted with an Armstrong Suction Guide & Flo-Trex valve. (See Figs. 2.2 & 2.3 on page 9)
- Piping supported at ceiling with additional floor mounted supports under Armstrong Suction Guide and Flo-Trex Valve (See Fig. 2.4 on page 9)
- Floor mounted saddle supports (See Fig. 2.5 on page 10)
- Where required, additional floor support may be obtained as shown in Fig. 2.5. Note that the pump must not be rigidly

attached either to the plate or to the block. Leave a ⅛" (3mm) gap between pump and base. The piping must be installed in such a manner that the pump is not used as a pipe support.

- **Do not** rigidly connect the pump to a permanent base (See Fig. 2.7 on page 10) Note: if the pump must be connected to a permanent base, the pump must be isolated from the piping by flexible connectors and the base isolated from the building structure on an inertia base.
- **Do not** install the unit with the shaft horizontal.
- **Do not** support the installed unit by the motor eye bolts or by supports to any other part of the pump other than stated above.

IMPORTANT

All Series 4302 IVS pumps contain a tapped hole in the motor bracket above the discharge flange for draining the well. Pipe this drain hole to a floor drain to avoid overflow of the cavity caused by collecting chilled water condensate or from seal failure.

2.1.4 PUMP PIPING – GENERAL

Never connect a pump to piping, always start piping from pump.

Use as few bends as possible and preferably long radius elbows.

Do not use flexible connectors on the suction or discharge.

Make sure piping exerts no strain on pump as this would distort the casing and cause pump misalignment.

Suction and discharge pipes may be increased at pump nozzle to suit pump capacity and particular conditions of installation. Use eccentric reducers on suction connection.

Lay out the suction line with a continual rise towards the pump without high points, thus eliminating possibility of air pockets that may prevent the pump from operating.

A strainer of three or four times the area of the suction pipe, installed in the suction line, will prevent the entrance of foreign materials into the pump. ⅛" (3mm) diameter perforations in the strainer are typical.

Test suction line for air leaks before starting; this becomes essential with long suction line or static lift.

Install, at pump suction, a straight pipe of a length equivalent to 4 or 6 times its diameter; this becomes essential when handling liquids above 120°F (49°C). Armstrong suction guides may be used in place of the straight pipe run and in line strainer.

Install isolation valve in both suction and discharge lines on flooded suction application; this valve is used mainly to isolate the pump for inspection or repair.

Install a non-slam check valve in discharge line between pump and isolation valve to protect pump from excessive back pressure and to prevent water running back through the pump in case of driver failure. Armstrong Flo-Trex valve may be used in place of check valve and isolation valve on pump discharge.

CAUTION

Discharge valve only must be used to reduce the pump flow, not the suction valve.

Care must be taken in the suction line layout and installation, as it is usually the major source of concern in centrifugal pump applications.

IMPORTANT

Do not run the pump for any length of time under very low flow conditions or with the discharge valve closed. To do so could cause the water in the casing to reach super heated steam conditions and will cause premature failure and could cause serious and dramatic damage to the pump and surrounding area.

2.1.5 ALIGNMENT

The pumping unit is accurately aligned at the factory prior to being shipped.

Alignment on the 4302 dualArm may be verified by assuring an equal gap between coupling halves on both sides of the coupling.

OPERATION

2.1.6 STARTING PUMP

The pump must be fully primed on start up. Fill the pump casing with liquid and rotate the shaft by hand to remove any air trapped in the impeller. Air trapped in the casing must be removed by the manual air vent in the seal flush line. **Ensure entrained air is removed from series 4302 IVS and 4382 IVS pumps, prior to starting, through the air vent on the seal flush line. Open vent until clear of air.**

"Bump" or energize the motor for a fraction of a second and check that the rotation corresponds with the directional arrow on the pump casing.

To reverse rotation of a three phase motor, interchange any two power leads.

Start the pump with the discharge valve closed and the suction valve open, then gradually open the discharge valve when the motor is at operating speed. The discharge valve may be "cracked" or open slightly at start up to help eliminate trapped air.

When stopping the pump: Close the discharge valve and de- energize the motor.

CAUTION

Centrifugal pump rotation is generally "clockwise" when viewing from the motor end.

Check rotation arrow prior to operating the unit.

2.1.7 GENERAL CARE

Vertical In-Line pumps are built to operate without periodic maintenance. A systematic inspection made at regular intervals, will ensure years of trouble-free operation, giving special attention to the following;

- Keep unit clean
- Provide the motor with correctly sized overload protection
- Keep moisture, refuse, dust or other loose particles away from the pump and ventilating openings of the motor.
- Avoid operating the unit in overheated surroundings (Above 100°F/40°C).
- If mechanical seal environmental accessories are installed, ensure water is flowing through the sight flow indicator and that filter cartridges are replaced as recommended. (See file 43.85 & 43.86 for seal environmental instructions).

WARNING

Whenever any service work is to be performed on pumping unit, disconnect power source to driver. Any possibility of the unit starting while being worked on, must be eliminated.

2.1.8 LUBRICATION

Pump

Lubrication is not required. There are no bearings in the pump.

Motor

Follow the lubrication procedures recommended by the motor manufacturer. Many small and medium sized motors are permanently lubricated.

Check the lubrication instructions supplied with the motor for the particular frame size indicated on the motor nameplate

Mechanical seal

Mechanical seals require no special attention. The mechanical seal is flushed from discharge of the pump casing on 4302 and towards the suction on 4382. Seal environmental controls, installed in flush lines, such as filters and separators, will prolong seal life in HVAC systems

Do not run the pump unless properly filled with water as the mechanical seals need a film of liquid between the faces for proper operation. (For 4302 see file 43d.88 and for 4382 see file 43d.81 for mechanical seal replacement instructions)

2.1.9 SYSTEM CLEANLINESS

Before starting the pump the system must be thoroughly cleaned, flushed and drained and replenished with clean liquid.

Welding slag and other foreign materials, "Stop Leak" and cleaning compounds and improper or excessive water treatment are all detrimental to the pump internals and sealing arrangement.

Proper operation cannot be guaranteed if the above conditions are not adhered to.

NOTE:

Particular care must be taken to check the following before the pump is put into operation:

A Pump primed?

B Alignment correct?

C Rotation **OK**?

D Lubrication **OK**?

E Pipe work properly supported?

F Voltage supply **OK**?

G Overload protection **OK**?

H Is the system clean?

I Is the area around the pump clean?

J Pipe work properly supported?

WARRANTY

Refer to Armstrong General Terms and Warranty sheet. Contact your local Armstrong representative for full information.

ARMSTRONG DUALARM HVAC PUMP FLAPPER VALVE OPERATING INSTRUCTIONS

This dualArm HVAC pumping unit is fitted with internal valves to allow isolation of one pump for service and to automatically prevent recirculation of the flow when only one pump is running.

Procedure for parallel or stand-by pumping

Discharge and suction valve stems should be locked in the center position. This is indicated by both locking handles in the vertical position and the center pin of the locking arms (4) locked by the handles. This procedure allows the discharge flapper valves to pivot freely and locks the suction valve firmly in the center position.

Procedure for isolation of one side

1 Stop the pump to be serviced.

2 Close and lock the suction and discharge valves: as per instructions below.

3 Ensure seal flushline interconnection valve is closed and drain the isolated casing.

4 Service isolated pump as required.

Procedure for starting the pump after servicing

1 Ensure serviced pump is fully re-assembled including all seal flush lines and drain plugs.

2 Fill the dry casing with system fluid by opening the seal flushline interconnecting valve and the air vent fitting.

3 Allow the pressure to equalize in the two casings, if necessary, by opening seal flush line interconnected valve.

4 Unlock the discharge valve as per instructions below.

5 Unlock the suction valve as per instructions below.

6 Close the seal flushline interconnect valve and restart pump.

NOTE:

Keep hands and tools away from locked suction valve arm, as the differential pressure may cause the arm to rotate quickly with force when unlocked.

Valve operation - refer to valve illustration on page 6 (3", 4" & 6" valve) or page 7 (8" valve)

DISCHARGE VALVE

This valve performs the dual function of automatically sealing the discharge of the inactive pump when one pump is running and can manually be closed and locked to isolate one pump for service.

Automatic flapper operation

In the flapper mode the two halves of the discharge valve are free to pivot independently under normal operating conditions. The locking handle (3) should be secured with the set screw (11) in the vertical position with the center pin of the locking arm (4) trapped by the locking handle (3).

Manual valve locking

The locking feature of this valve is to ensure a positive seal (leak proof) of the discharge port on the pump to be serviced**.**

NOTE:

Ensure the pump to be isolated is not operating before attempting to release the locking mechanism. Failure to do so may result in injury to the operator and/or damage to the pump.

Locking

1 Loosen discharge side set screw (11) to release the locking handle (3).

2 Rotate the discharge side locking handle (3) so that the handle points toward the pump to be serviced and secure in the horizontal position, using set screw (11). This releases the discharge locking arm (4).

3 Rotate discharge valve shaft (16) towards the pump to be isolated. The orientation of the shaft is indicated by the center pin on the locking arm (4).

4 Raise the locking handle (3) so that the cam on the base of the handle forces the pin of the locking arm (4) towards the pump to be isolated. The locking handle (3) should be raised to between 45 degrees and the vertical position.

5 Tighten set screw (11) to lock the locking handle (3) in position.

This handle should not be rotated past the vertical position.

NOTE:

Ensure the isolated pump is not operating before attempting to release the locking mechanism. Failure to do so may result in injury to the operator and/or damage to the pump.

Unlocking

1 Open the interconnecting valve on the seal flushline to pressurize the serviced pump and vent air through bleeder valve on series 4302 and 4382. Close these valves once the pressure is equalized and air removed.

2 Loosen set screw (11) and lower locking handle (3) to the horizontal position, secure with set screw (11).

3 Rotate valve to center position so that the center pin of the

locking arm (4) locates in the recess on the locking handle (3).

4 Loosen set screw (11) and raise locking arm (3) to the vertical position, locking the center pin in the locking arm recess, secure with set screw (11).

SUCTION VALVE

Manual operation

The suction side valve is designed for use as a manually operated isolation valve. This valve is not designed to automatically pivot as the discharge flappers do.

WARNING:

Care should be taken when performing procedures (3) and (4) below. Read the following instructions carefully.

Locking

1 Loosen suction side set screw (11) to release the locking handle(3).

2 Rotate the suction side locking handle (3) so that the handle points towards the pump to be serviced and secure in the horizontal position, using set screw (11). This releases the suction locking arm (4).

3 Rotate the suction valve towards the pump to be isolated. The orientation of the shaft is indicated by the center pin on the locking arm (4).

4 Loosen set screw (11) and raise the locking handle (3) so that the cam on the base on the handle forces the pin of the locking arm (4) towards the pump to be isolated. The locking handle (3) should be raised to between 45 degrees and the vertical position.

This handle should not be rotated past the vertical position.

5 Tighten set screw (11) to secure the locking handle (3) in position

NOTE:

The locking handle (3) should only be rotated towards the pump stopped for service. The dualarm suction valve is designed to prevent the locking handle (1) from rotating towards the running pump, as the suction of the running pump could cause the valve to slam shut with sufficient force to injure the operator and/or cause damage to the pump. Do not attempt to circumvent this safety feature.

WARNING:

Care should be taken when performing procedures (3) and (4) below. Read the following instructions carefully.

Unlocking

1 Open the interconnecting valve on the seal flushline to pressurize the serviced pump and vent air through bleeder valve on series 4302 and 4382. Close these valves once the pressure is equalized and air removed.

2 Loosen set screw (11) and lower locking handle (3) to the horizontal position, secure with set screw (11).

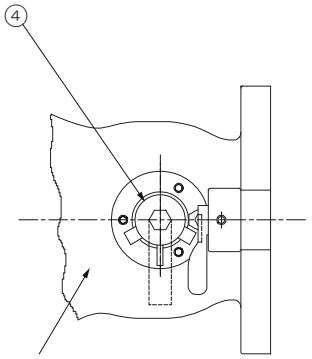
3 Rotate valve to center position so that the center pin of the locking arm (4) is located in the recess on the locking handle (3).

4 Loosen set screw (11) and raise locking arm (3) to the vertical position, locking the center pin in the locking arm recess, secure with set screw.

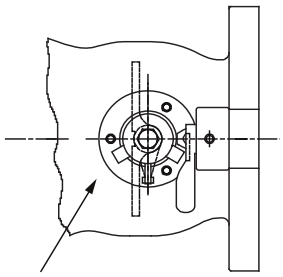
NOTE:

Keep hands and tools away from suction valve locking arm when freed by locking handle as differential pressure may cause arm to rotate quickly with force when unlocked.

FIG. 1.1 Valve illustration (3", 4" and 6")

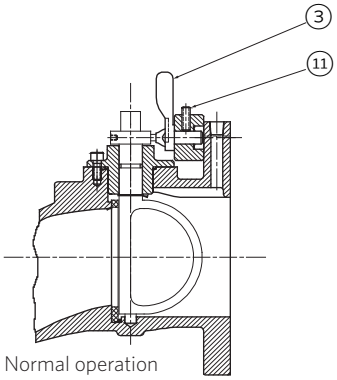


This pump suction is now closed. (Locked when handle is elevated and secured).



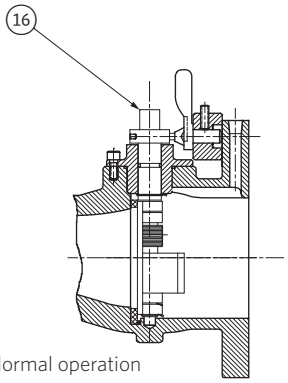
This pump discharge is now closed. (Locked when handle is elevated and secured).

FIG. 1.2 Suction valve



Normal operation

FIG. 1.3 Discharge valve



Normal operation

FIG. 2.1 Hanger supported pipe mounted

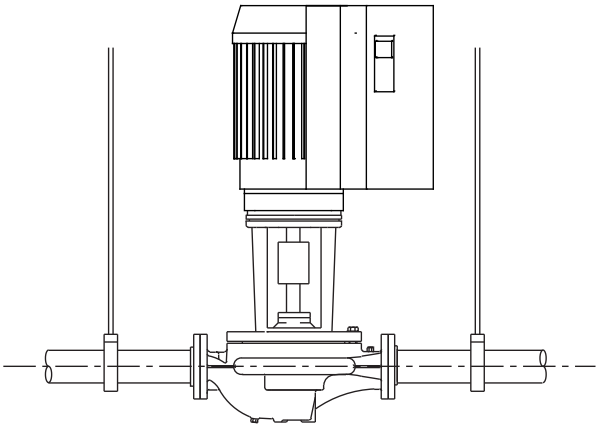
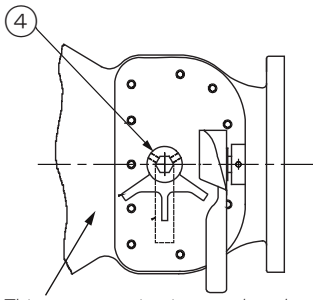
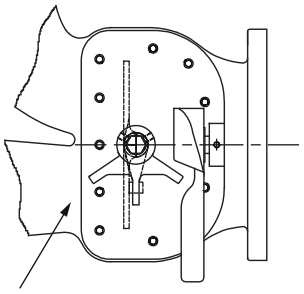


FIG. 1.4 Valve illustration (8")



This pump suction is now closed. (Locked when handle is elevated and secured).



This pump discharge is now closed. (Locked when handle is elevated and secured).

FIG. 2.2 Pipe mounted supported at ceiling

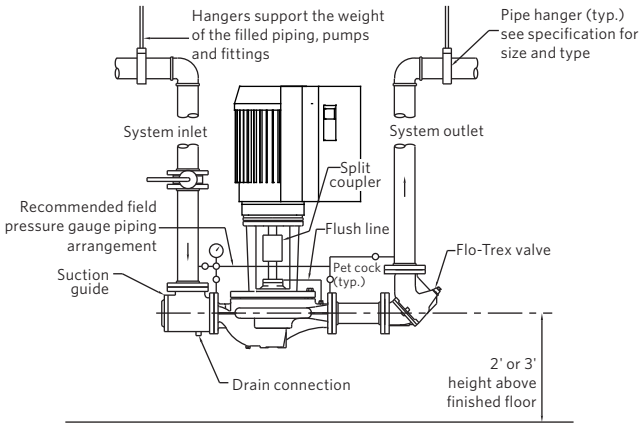
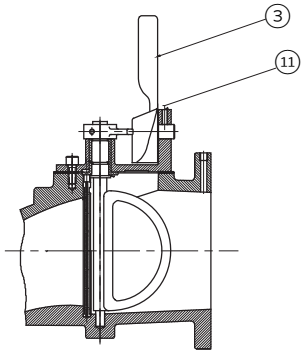
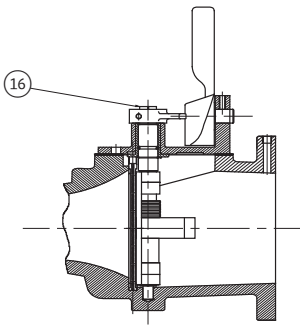


FIG. 1.5 Suction valve



Normal operation

FIG. 1.6 Discharge valve



Normal operation

FIG. 2.3 Discharge elbow for minimum footprint

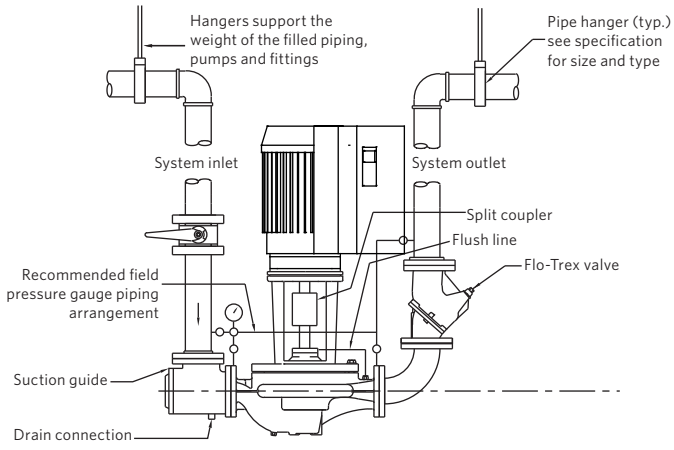


FIG. 2.4 With additional pipe supports

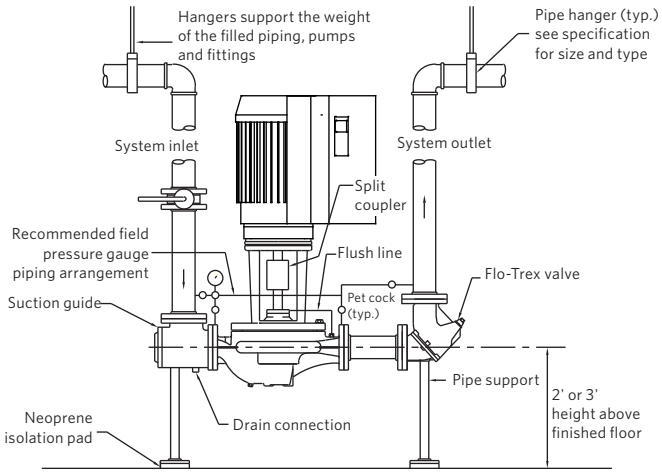


FIG. 2.5 Floor saddle support

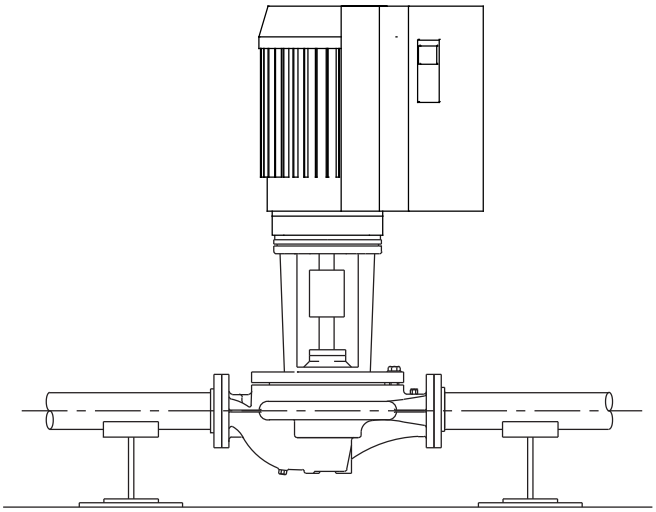


FIG. 2.6 Additional floor support

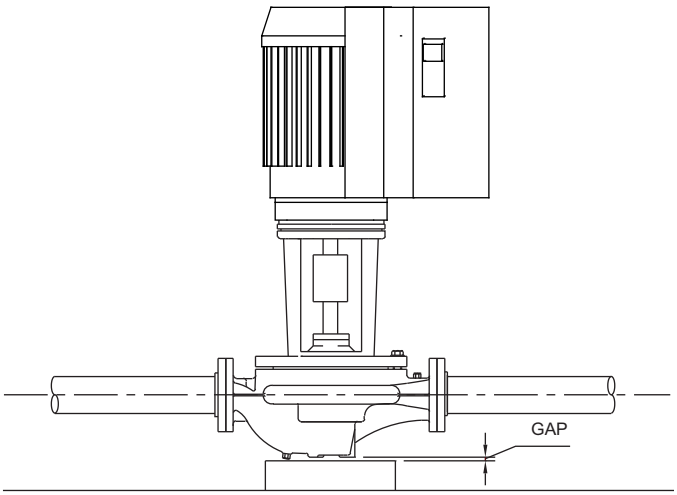


FIG. 2.7 Not recommended

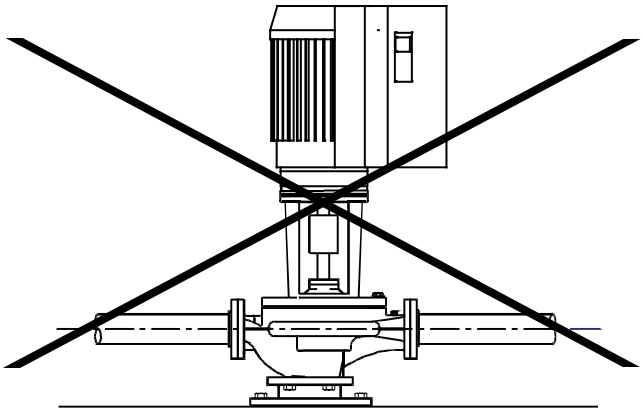
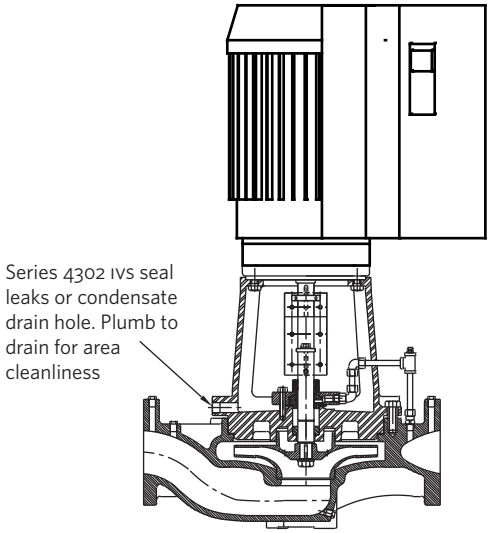


FIG. 2.8 Tapped collection well on Series 4302IVS



INTEGRATED CONTROLS

3.1 ENCLOSURE RATING

The standard enclosure rating for Series 4302 IVS and 4382 IVS integrated controls is NEMA/UL type 12. If the pump is to be installed in a wet or dusty environment then a higher enclosure rating may be required (contact Armstrong)

3.2 AMBIENT TEMPERATURE

To avoid the inverter unit getting overheated, the ambient temperature is not to exceed 133°F (45°C). Operating in higher ambient temperatures will require derating of the inverter.

4.0 ELECTRICAL INSTALLATION

All electrical connections should be carried out by a qualified and authorized electrician in accordance with local site regulations and the latest issue of the iee regulations.

SAFETY, RISK OF DEATH

Before removing the controls cover, the system must be disconnected from the mains supply. After switching off, wait for at least 15 minutes for the capacitors to discharge before opening the cover.

CAUTION

High voltage testing (Megging) of the motor/ controls may cause damage to the electronic components and therefore should not be carried out

4.1 GROUND LEAKAGE CURRENT

Ground leakage current is primarily caused by the capacitance between motor phases and the motor frame. The rfi filter contributes additional leakage current, as the filter circuit is connected to ground through capacitors.

The size of the leakage current to the ground depends on the following factors, in order of priority:

1 Switching frequency

2 Motor grounded on site or not

The leakage current is of importance to safety during handling / operation of the IVS pump if (by mistake) the on-board inverter has not been grounded.

Since the leakage current is >3.5mA (approx 4-20mA), reinforced Grounding must be established which is required if EN 50178 is to be complied with. Never use ELCB relays that are not suitable for DC fault currents (type A).

If ELCB relays are used, they must be:

- Suitable for protecting equipment with a direct current content (DC) in the fault current (three-phase bridge rectifier)
- Suitable for power-up with short charging current to Ground
- Suitable for a high leakage current

4.2 START / STOP OF PUMP

The number of starts/stops via the mains voltage must not exceed one-time per minute.

If a higher number of starts/stops is required then the start/stop digital input must be used (mains voltage directly connected). This is the preferred method of starting and stopping IVS pumps.

The three phase mains must be isolated before performing maintenance of the pump.

4.3 ADDITIONAL MOTOR PROTECTION

With the exception of supply fuses / MCB's to protect the installation (for over-current and short-circuit protection), no additional overload or over-temperature protection is required (i.e. thermal overloads). Protection features include:

- Mains phase loss
- Over voltage
- Under voltage
- Electronic thermal motor protection
- Short circuit on motor terminals
- Ground fault on motor terminals
- Over temperature

4.4 SUPPLY VOLTAGE

The supply voltage details can be found on the inverter nameplate. Please ensure that the unit is suitable for the electrical supply on which it is to be used. The mains supply for IVS pumps is as follows:

3 × 200-240V +/-10%

3 × 380-480V +/- 10%

3 × 525-600V +/- 10%

Supply frequency - 50/60HZ

4.5 SUPPLY FUSING

Branch circuit protection

In order to protect the installation against electrical and fire hazard, all branch circuits in an installation, switch gear, machines etc., must be short-circuit and over-current protected according to the national/international regulations.

Short circuit protection

The inverter must be protected against short-circuit to avoid electrical or fire hazard. Armstrong recommends using the fuses detailed in the separate **IVS102 Operating Instructions** to protect service personnel or other equipment in case of an internal failure in the unit. The frequency converter provides full short circuit protection in case of a short-circuit on the motor output.

4.6 GROUNDING AND IT MAINS

The ground connection cable cross section must be at least 10 mm^2 or two rated mains wires terminated separately according to EN 50178 or IEC 61800-5-1 unless national regulations specify differently. Always comply with national and local regulations on cable cross sections.

The mains is connected to the main disconnect switch if this has been included.

Check the mains voltage corresponds to the mains voltage of the frequency converter name plate.

IT MAINS

Do not connect frequency converters with RFI-filters to mains supplies with a voltage between phase and earth of more than 440V for 400V converters and 760V for 690V converters. For 440V IT MAINS and delta earth (grounded leg), mains voltage may exceed 440V between phase and earth. For 690V IT MAINS and delta earth (grounded leg), mains voltage may exceed 760V between phase and earth.

FIG. 2 Terminals for mains and grounding

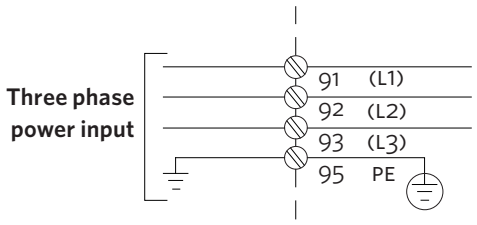


FIG. 3 Mains and grounding connections for A5 units (200-240V – 5HP and below, 380-480V / 525-600V - 10HP and below)

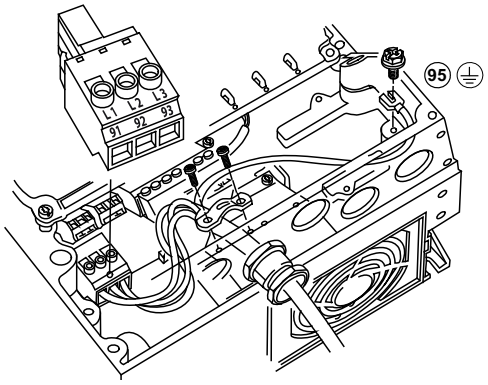


FIG. 4A Mains and grounding connections for B1 and B2 units (200-240V – 7.5 to 20HP, 380-480V – 15 to 40HP, 525-600V – 15 to 50HP)

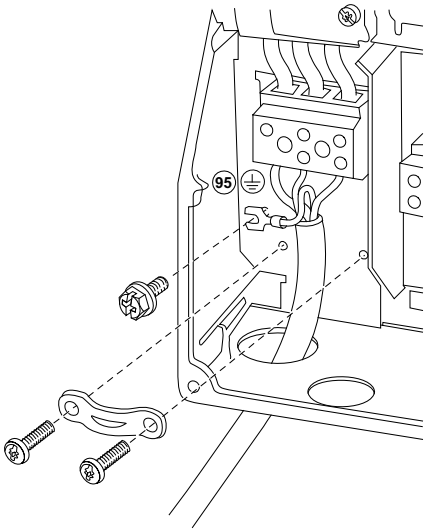
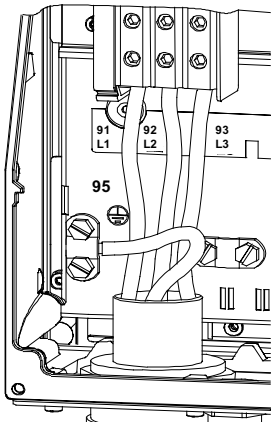


FIG. 4B Mains and grounding connections for C1 and C2 units (200-240V – 25 to 60HP, 380-480V – 50 to 125HP, 525-600V – 60 to 125HP)



4.7 RELAY CONNECTIONS

The relays on the IVS are configured as follows:

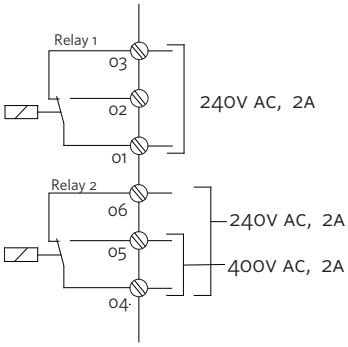
relay 1 – running

- Terminal 01: Common
- Terminal 02: Normal Open 240V AC
- Terminal 03: Normal Closed 240V AC

RELAY 2 – ALARM

- Terminal 04: Common
- Terminal 05: Normal Open 400V AC
- Terminal 06: Normal Closed 240V AC

FIG. 5 Relay contact details



The following illustrations identify the location of the relays within specific inverter sizes:

The illustrations in figures 6, 7 and 8 identify the location of the relays within specific inverter sizes:

FIG. 6 Relay connection: terminals for A5, B1 and B2 units

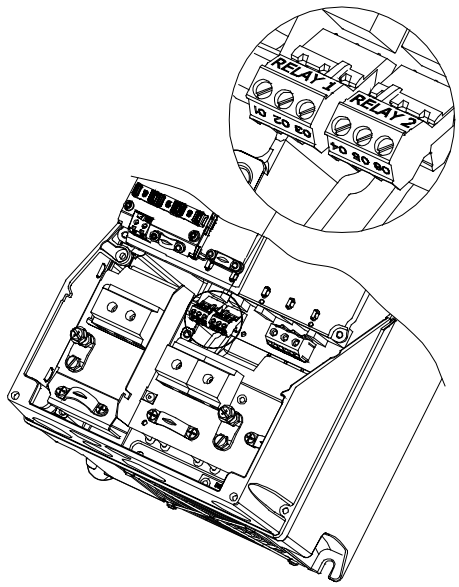
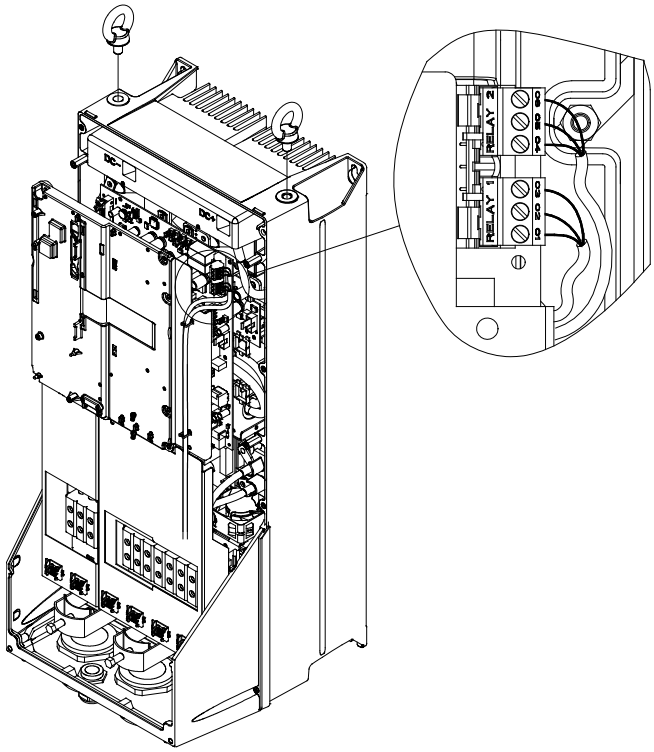
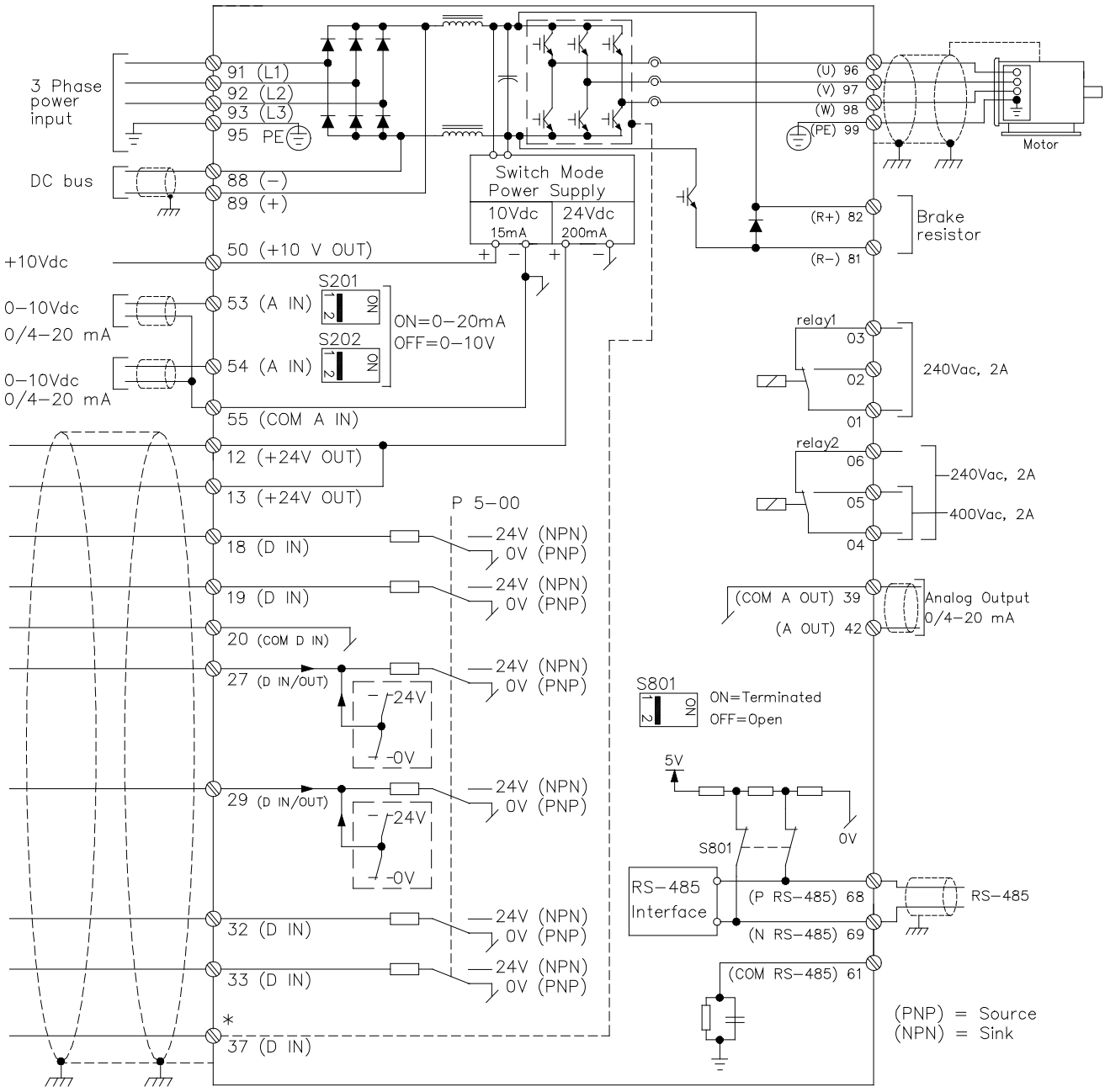


FIG. 7 Relay connection terminals for C1 and C2 units

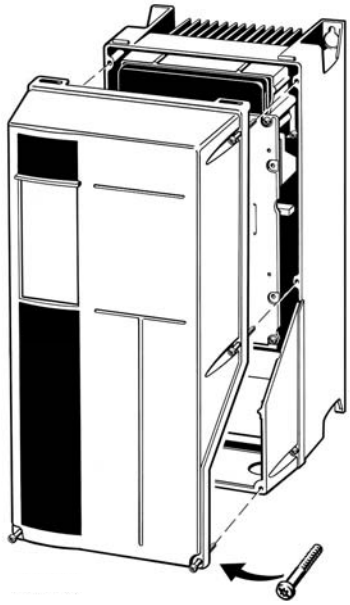


4.8 ELECTRICAL INSTALLATION AND CONTROL CONNECTIONS

FIG. 8 Diagram showing all electrical connections
***Note:** terminal 37 is not available on IVS sensorless pumps



4.8.1 ACCESS TO TERMINALS

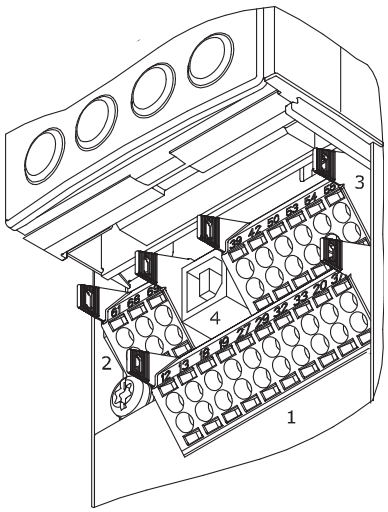


Remove front-cover to access control terminals. When replacing the front cover, please ensure proper fastening by applying a torque of 2 Nm.

4.8.2 CONTROL TERMINALS

With reference to figure 9:

FIG. 9 Control Connections



1 10-way plug for digital I/O

2 3-way plug for RS485 bus

3 6-way plug for analogue I/O

4 USB connection

Control terminal functions and factory settings are as follows:

TERMINAL NO.	TYPE / DESCRIPTION	FACTORY SETTING
1,2,3	Relay 1	Running
4,5,6	Relay 2	Alarm
12	Supply	+24V DC
13	Supply	+24V DC
18	Digital Input	Start
19	Digital Input	Pump Operating Mode
20	Common	OK
27	Digital Input	Low Water Interlock
29	Digital Input	No Operation
32	Digital Input	No Operation
33	Digital Input	No Operation
37	Digital Input	No Operation
42	Analogue Output	Output Frequency (4-20mA - 0-100Hz)
53	Analogue Input	Reference (0-10V)*
54	Analogue Input	Feedback (0-10V)*

*Note that Analogue inputs AI53 and AI54 can be either Voltage (0-10V) or Current (4-20mA) input and by default both inputs are set to Voltage. Switches S201 and S202 (see figure 8) are used to configure the analogue inputs as follows:

S201 (AI53) OFF = Voltage, ON = Current

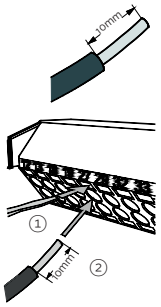
S202 (AI54) OFF = Voltage, ON = Current

Inserting Cables into Control Terminals

I Strip 10mm of insulation from the cable:

II Insert a suitable terminal screwdriver as shown and then push the cable into the terminal.

III Remove the terminal screwdriver and check the terminal has gripped the cable by gently pulling it.



Note:

Terminal plugs can be easily removed for improved access when making connections.

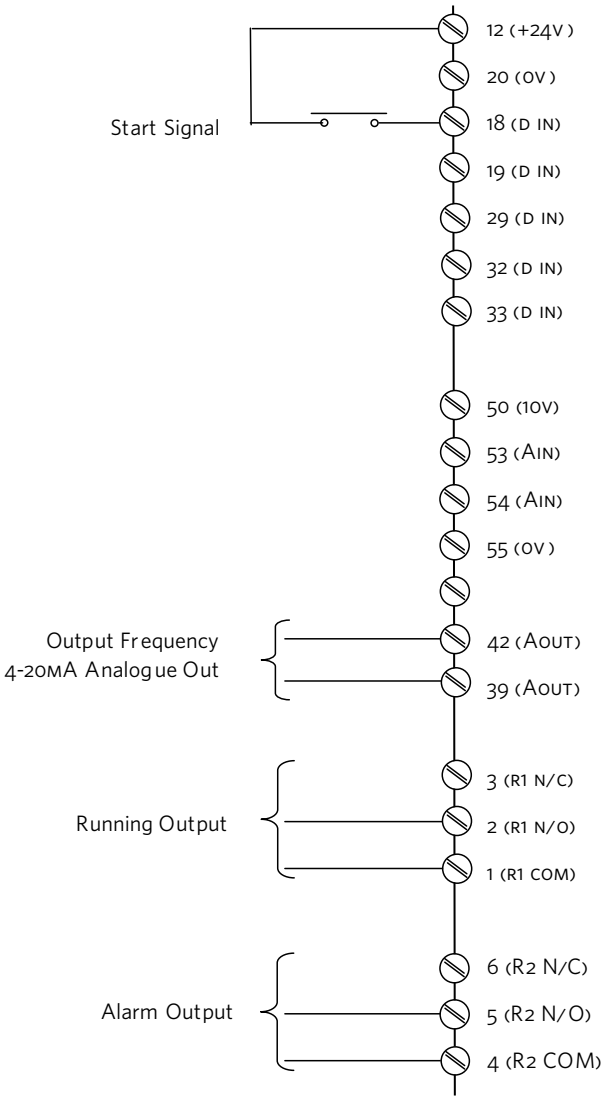
4.8.3 CONNECTION EXAMPLES

IVS Sensorless pumps can be configured in four main ways:

- I Sensorless
- II Closed loop – with feedback sensor
- III Constant Curve Mode – Potentiometer Control
- IV Constant Curve Mode – BMS signal
- IV.I Full Speed Override

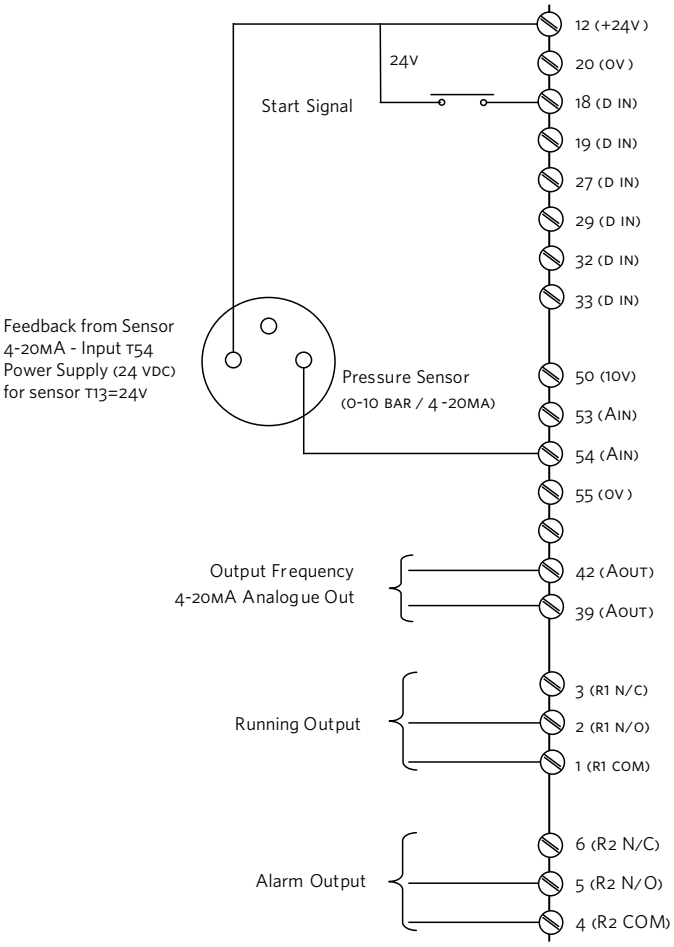
I SENSORLESS

IVS sensorless pumps are factory configured to be connected as shown below.



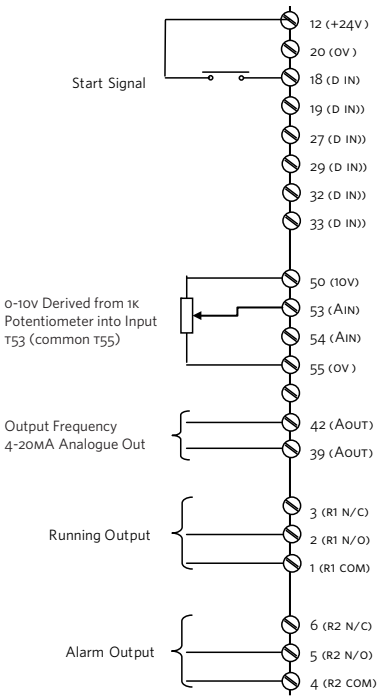
II CLOSED LOOP – WITH SENSOR FEEDBACK

To control the pump based on a 4-20mA feedback signal from a sensor use the following connection.



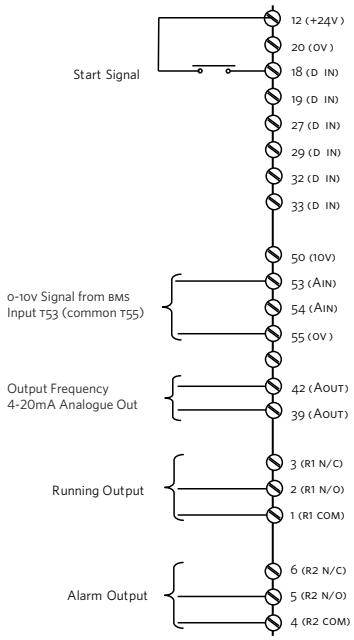
III CONSTANT CURVE MODE – POTENTIOMETER

To control the pump based on a 0-10V potentiometer signal use the connections below.



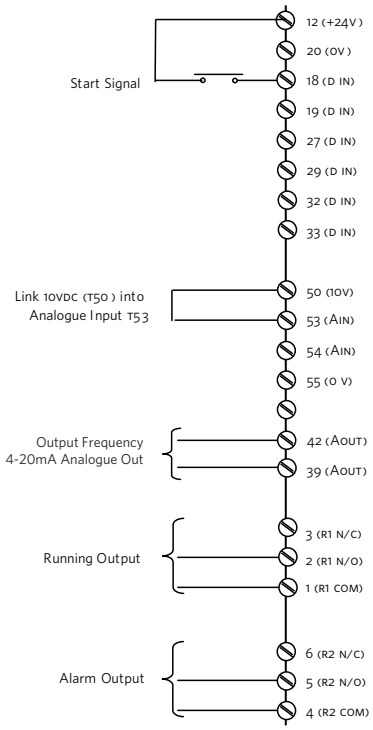
IV CONSTANT CURVE MODE – BMS SIGNAL

When the Building Management System is to be used for speed control it is necessary to disable sensorless control and provide the unit with a 0-10VDC speed reference signal.



IV.I CONSTANT CURVE MODE - BMS SIGNAL

It may be required to run the pump at full speed without automatic speed control (eg during system commissioning). This can be achieved without programming changes by making the connections below.

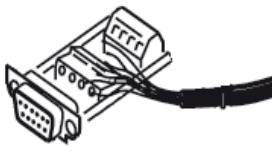


4.8.4 REMOTE LCP KEYPAD WIRING

For large IVS units with remote LCP keypad, see wiring arrangement below.

LCP WIRING ARRANGEMENT

TERMINAL	WIRE COLOR
1	Green
2	Brown
3	Red
4	Yellow
5	Black
6	Orange
7	Blue
8	Purple
9	Grey

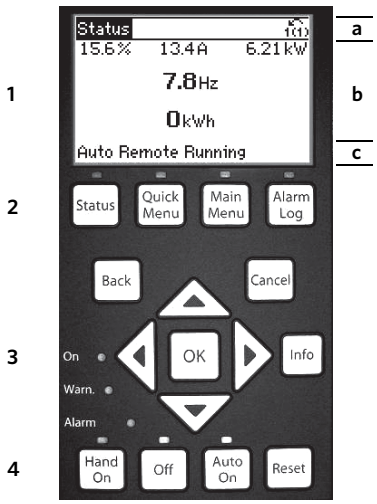


5 PROGRAMMING, MONITORING AND DIAGNOSTICS

IVS pumps incorporate an integrated graphical local control panel (GLCP).

5.1 GLCP FUNCTIONS AND OPERATION

The GLCP is divided into four functional groups:



1 Graphical display with status lines.

2 Menu keys and indicator lights (LEDs) – selecting mode, changing parameters and switching between display functions.

3 Navigation keys and indicator lights (LEDs).

4 Operation keys and indicator lights (LEDs).

Graphical display:

The LCD-display is back-lit with a total of six alpha-numeric lines. All data is displayed on the LCP which can show up to five operating variables while in **Status** mode.

Display lines:

a Status line: Status messages displaying icons and graphics.

b Line 1–2: Operator data lines displaying data and variables de-fined or chosen by the user. By pressing the **Status** key, up to one extra line can be added.

c Status line: Status messages displaying text.

The display is divided into three sections:

Top section (a) shows the status when in status mode or up to two variables when not in status mode and in the case of ALARM/WARNING.

The number of the Active Set-up (Sensorless mode being setup 1) is shown.

The Middle section (b) shows up to five variables with related unit, regardless of status. In case of alarm/warning, the warning is shown instead of the variables.

The Bottom section (c) always shows the state of the inverter in Status mode.

It is possible to toggle between three status read-out displays by pressing the **Status** key.

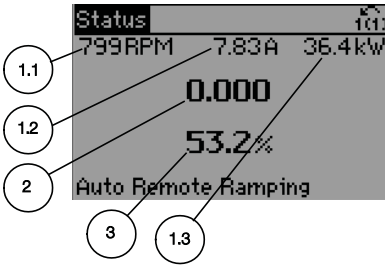
Operating variables with different formatting are shown in each status screen — see below.

Status display I:

This read-out state is standard after start-up or initialisation.
Use **Info** to obtain information about the value/measurement linked to the displayed operating variables (1.1, 1.2, 1.3, 2 and 3). See the operating variables shown in the display in this illustration. 1.1,1.2 and 1.3 are shown in small size. 2 and 3 are shown in medium size.

Status display II:

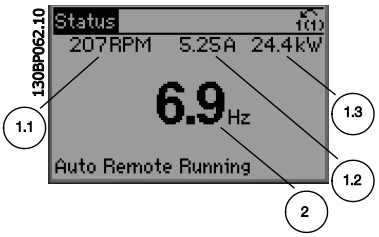
See the operating variables (1.1, 1.2, 1.3 and 2) shown in the display in this illustration.



In the example, Speed, Motor current, Motor power and Frequency are selected as variables in the first and second lines. 1.1, 1.2 and 1.3 are shown in small size. 2 is shown in large size.

Display Contrast Adjustment

Press **Status** and [▲] for darker display



Press **Status** and [▼] for brighter display

5.2 INDICATOR LIGHTS (LEDS)

If certain threshold values are exceeded, the alarm and/or warning LED lights up. A status and alarm text appear on the control panel. The **ON** LED is activated when the frequency converter receives power from mains voltage, a DC BUS terminal, or an external 24V supply. At the same time, the back light is on.

- Green led/**ON**: Control section is working.
- Yellow led/**WARN.**: Indicates a warning.
- Flashing Red led/**ALARM**: Indicates an alarm.

5.3 CONTROL KEYS

Menu keys

The menu keys are divided into functions. The keys below the display and indicator lamps are used for parameter set-up, including choice of display indication during normal operation.

Status

Indicates the status of the frequency converter and/or the motor. Three different readouts can be chosen by pressing the **Status** key: five line readouts, four line readouts or Smart Logic Control.

Use **Status** for selecting the mode of display or for changing back to Display mode from either the Quick Menu mode, the Main Menu mode or Alarm mode. Also use the **Status** key to toggle single or double read-out mode.

Quick Menu

Allows quick set-up of the inverter by access to a limited number of parameters. Quick Menu does not include all the parameters that may need to be changed when utilising Sensorless control and it is therefore recommended that parameter changes are made in Main Menu mode.

Main Menu

Is used for programming all parameters.

Alarm Log

Displays an Alarm list of the five latest alarms (numbered A1-A5). To obtain additional details about an alarm, use the arrow keys to manoeuvre to the alarm number and press **OK**. Information is displayed about the condition of the frequency converter before it enters the alarm mode.

The Alarm log button on the LCP allows access to both Alarm log and Maintenance log.

Back

Reverts to the previous step or layer in the navigation structure.

Cancel

Last change or command will be cancelled as long as the display has not been changed.

Info

Displays information about a command, parameter, or function in any display window. **Info** provides detailed information when needed.

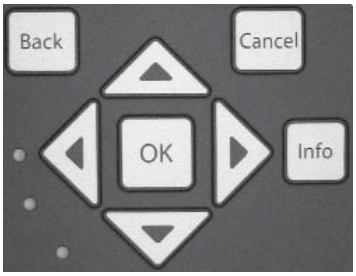
Navigation Keys

The four navigation arrows are used to navigate between the different choices available in **Quick Menu**, **Main Menu** and **Alarm Log**. Use the keys to move the cursor.

OK

Is used for choosing a parameter marked by the cursor and for enabling the change of a parameter.

Operation Keys for local control are found at the bottom of the control panel.



Hand On

Enables control of the pump via the GLCP. It is possible to enter the pump speed data by means of the arrow keys.

The low water device input must be made for the pump to start in either hand mode or auto mode.

Off

Stops the pump.

Auto On

Enables the pump to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals the pump will start.

For the pump to operate in either Sensorless mode or any other automatic control mode it is necessary to have pressed the **Auto On** button.

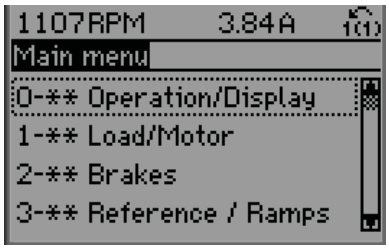
Reset

Is used for resetting the frequency converter after an alarm (trip).

5.4 PROGRAMMING

Select the Main Menu mode by pressing the **Main Menu** key. The below read-out appears on the display. The middle and bottom sections on the display show a list of parameter groups which can be chosen by toggling the up and down buttons.

Each parameter has a name and number which remain the same regardless of the programming mode. In the Main Menu mode, the parameters are divided into groups. The first digit of the parameter number (from the left) indicates the parameter group number.



All parameters can be changed in the Main Menu. However, depending on the choice of configuration (Par.1-00 Configuration Mode), some parameters can be hidden.

5.4.1 PARAMETER SELECTION

In the Main Menu mode, the parameters are divided into groups. You select a parameter group by means of the navigation keys.

The following parameter groups are accessible:

GROUP NO.	PARAMETER GROUP	GROUP NO.	PARAMETER GROUP
0	Operation/display	13	Smart Logic
1	Load/motor	14	Special functions
2	Brakes	15	FC information
3	References/ ramps	16	Data readouts
4	Limits/warnings	18	Data readouts 2
5	Digital in/out	20	Drive closed loop
6	Analog in/out	21	Ext. closed loop
8	Com. and options	22	Application functions
9	Profibus	23	Time-based functions
10	CAN Fieldbus	25	Cascade controller
11	LonWorks	26	Analog I/O option MCB 109

After selecting a parameter group, choose a parameter by means of the navigation keys.

The middle section on the display shows the parameter number and name as well as the selected parameter value.

5.4.2 CHANGING DATA

The procedure for changing data depends on whether the selected parameter represents a numerical data value or a text value.

Changing a text value

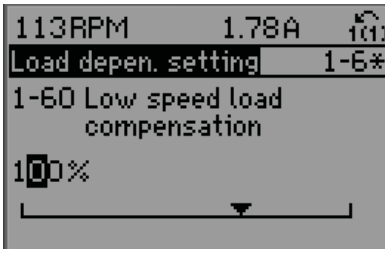
If the selected parameter is a text value, change the text value by means of the [▲] [▼] navigation keys.

The up key increases the value, and the down key decreases the value.

Place the cursor on the value you want to save and press **OK**.

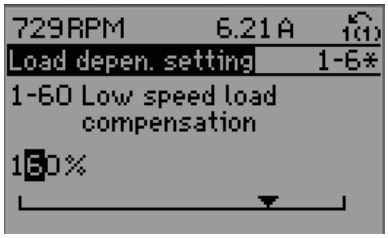
Changing Numeric Data Values

If the chosen parameter represents a numeric data value, change the chosen data value by means of the [◀] [▶] navigation keys as well as the [▲] [▼] navigation keys. .



Use the [◀] [▶] navigation keys to move the cursor horizontally.

Use the [▲] [▼]navigation keys to change the data value. The up key enlarges the data value, and the down key reduces the data value. Place the cursor on the value you want to save and press **OK**.



Readout and Programming of Indexed Parameters

Parameters are indexed when placed in a rolling stack.

Par.15-30 Alarm Log: Error Code to Par.15-33 Alarm Log: Date and Time contain a fault log which can be read out. Choose a parameter, press **OK**, and use the up/down navigation keys to scroll through the value log.

Use Par.3-10 Preset Reference as another example:

Choose the parameter, press **OK**, and use the up/down navigation keys to scroll through the indexed values. To change the parameter value, select the indexed value and press **OK**. Change the value by using the up/down keys. Press **OK** to accept the new setting. Press **Cancel** to abort.

Press **Back** to leave the parameter.

6 SENSORLESS OPERATION

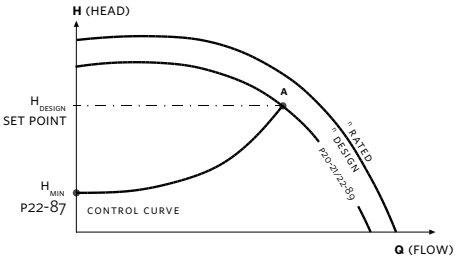
Sensorless control is an innovative concept in circulating pumps. Pump performance and characteristic curves are embedded in the memory of the speed controller during manufacture. This data includes power, speed, head and flow across the flow range of the pump. During operation, the power and speed of the pump are monitored, enabling the controller to establish the hydraulic performance and position in the pumps head-flow characteristic.

These measurements enable the pump to continuously identify the head and flow at any point in time, giving accurate pressure control without the need for external feedback signals. Patented software technology within the controller ensures trouble-free operation in all conditions.

Incorporating the pumps hydraulic data into the controller and removing sensors results in true integration of all components and removes the risk of sensor failure.

6.1 DEFAULT OPERATING MODE — QUADRATIC PRESSURE CONTROL

The default control mode for IVS Sensorless pumps is 'Quadratic Pressure Control' where the controller is set to control the speed according to a 'control curve' between max and min flow (see below diagram). It is widely recognised that fitting a differential pressure sensor at the most remote load, across the supply piping and return piping encompassing the valve & coil set, is the benchmark scheme for energy efficiency.



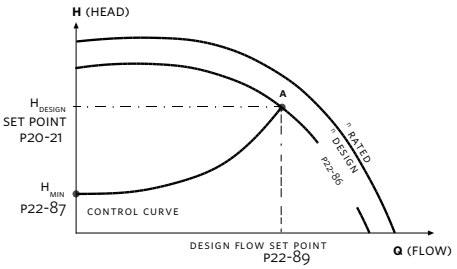
IVS Sensorless pumps can replicate this control without the need for the remote sensor. As the flow required by the system is reduced, the pump automatically reduces the head developed according to the pre-set control curve.

It is often found that using a remote differential pressure sensor to sense the pressure across a remote load could theoretically result in loads close to the pump being under-pumped. The situation would be where the load at a loop extremity is satisfied and the control valve closes while a load close to the pump needs full flow. The probability of this occurring is remote but it is possible. One answer to this is to move the sensor closer to the pump (two-thirds out in the system is a popular recommendation) although physically re-positioning the sensor at commissioning stage can be a costly exercise. With Sensorless pump control it is possible to replicate the moving of a sensor by increasing the head setting H_{MIN}.

6.1.1 SETTINGS FOR QUADRATIC (CONTROL CURVE) PRESSURE CONTROL

The design duty head and flow of the pump (provided at time of order) is shown as point 'A' in figure 10 below.

FIG. 10 QUADRATIC CONTROL SETTINGS



It is not always the case that the design duty point required will fall on the maximum speed of the pump and in the majority of cases (as shown in figure 10) it will be at a reduced speed.

The pump will be supplied with point 'A' set as the design duty point provided at the time of order and the minimum head (at zero flow - H_{MIN}) will be set as 40% of the design head H_{DESIGN}, as the Armstrong default.

To change the control curve from the factory settings, the following parameters can be adjusted:

Par. 20-21 (Setpoint, H_{DESIGN}) in units of pump head

Par. 22-89 (Design Flow Setpoint) in units of pump flow

Par. 22-87 (Pressure at no-flow speed, H_{MIN}) in units of pump head

Note, parameters 20-21 and 22-89 should only be adjusted according to the pump performance curve.

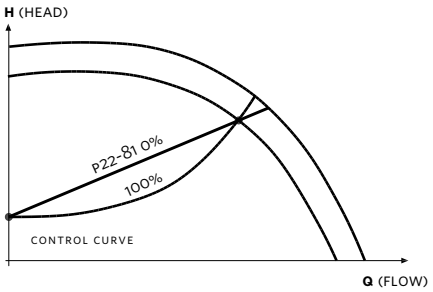
Other settings that are set to enable the pump to operate on a control curve are:

Par. 22-80 (Flow Compensation) which should be set to 'Enabled' [1]

Par 22-81 (Square-linear Curve Approximation) which should be set to '100%'

The effect of adjusting Par. 22-81 is shown in figure 11 below. A setting of 100% gives the ideal theoretical control curve between the design head and minimum head whilst 0% provides a straight line linear approximation.

FIG. 11 CURVE APPROXIMATION SETTINGS



In order for the controller to determine the true fit and position of the control curve it is necessary to set some specific parameters with data relating to specific points within the operating range of the pump. There are two ways of programming the parameters depending on whether the speed at the design duty is known or unknown.

Speed at Required System Design Point is known (Refer to Figure 10):

1. Set the design head, H_{DESIGN}, value in Par. 20-21 (Setpoint 1). after setting unit of head in Par. 20-12 (Reference/Feedback unit)
2. Set the speed of the pump at design head, H_{DESIGN}, and design flow using Par. 22-86 (Speed at Design Point [Hz])
3. Set the minimum head required, H_{MIN}, using Par. 22-87 (Pressure at No-Flow Speed).

4 Adjust the shape of the control curve if required using Par. 22-81 as shown in figure 11.

6.2 CONSTANT PRESSURE CONTROL

IVS Sensorless pumps can be configured to maintain a constant pump head in a system as the demand varies. This effectively simulates the mounting of a differential pressure sensor at, or near, the pump.

6.2.1 SETTINGS FOR CONSTANT PRESSURE CONTROL

To revert to this mode of control simply follow these steps:

1 Set the design head, H_{DESIGN}, value in Par. 20-21 (Setpoint 1). In the units set in Par.20-12 (Reference/Feedback unit.)

2 Turn off flow compensation by setting Par. 22-80 to 'Disabled' [0]

6.3 CHANGING CONTROL MODES

6.3.1 CHANGE TO EXTERNAL SENSOR CONTROL

1 Change parameter 0-10 from 1 to 2

2 Connect the sensor to terminals 54 (+) and 55 (-)

3 Move switch S202 (beside terminal input 54) to ON if the speed command is 4-20mA, or leave it OFF if it's 0-10VDC

4 If the sensor signal is neither 0-10VDC nor 4-20mA, enter the correct voltage or input range in parameters 6-10 to 6-13

5 Enter the sensor and setpoint data in the parameters listed below

PARAM.	NAME	SETUP 2 (EXTERNAL SENSOR)
0-10	Active Set-Up	2
6-24	Terminal 54 Low Ref. /Feedback Value	Minimum sensor value
6-25	Terminal 54 High Ref./Feedback Value	Maximum sensor value
20-02	Feedback 1 Source Unit	Unit of external sensor
20-12	Reference/ Feedback Unit	Unit of external sensor
20-13	Minimum Reference/Feedb.	Low limit of sensor
20-14	Maximum Reference/Feedb.	Upper limit of sensor
20-21	Setpoint 1	Design setpoint
20-93	PID Proportional Gain	Needs to be fine tuned on site	Start at 2
20-94	PID Integral Time	Needs to be fine tuned on site	Start at 1
22-43	Wake Up Speed [Hz]	Need to be fine tuned on site	Start at 20

6.3.2 CHANGE TO OPEN LOOP (BAS) CONTROL

1 Change parameter 0-10 from 1 to 3

2 Connect the BAS command on terminals 53 (+) and 55 (-)

3 Move switch S201 (beside terminal input 53) to ON if the speed command is 4-20mA, or leave it OFF if it's 0-10Vdc

4 If the reference signal is neither 0-10VDC nor 4-20mA, enter the correct voltage or input range in parameters 6-10 to 6-13

5 The maximum speed (at 20mA or 10VDC) can be adjusted in parameter 3-03

6 The drive ON/OFF status can be read as a dry contact between terminals 05 and 06

7 The drive alarm status can be read as a dry contact between terminals 01 and 02

8 Terminals 42(+) and 39(-) can provide a 0/4-20mA output which by default is disabled, but can be configured to provide speed feedback or sensorless flow

6.3.3 CHANGE TO SENSORLESS CONTROL

1 Change parameter 0-10 to 1

The unit will start controlling based on the pump design data

2 If the pump operation point needs to be changed, see the parameters that need to be modified in Section 6.1 Sensorless

7.0 WARNINGS AND ALARMS

A warning or an alarm is signalled by the relevant LED on the front of the inverter and indicated by a code on the display.

A warning remains active until its cause is no longer present. Under certain circumstances operation of the pump may still be continued. Warning messages may be critical, but are not necessarily so.

In the event of an alarm, the inverter will have tripped. Alarms must be reset to restart operation once their cause has been rectified. In many cases the auto reset function will restart the pump. Alternatively, the **Reset** button on the control panel can be pressed.

After a manual reset using the **Reset** button on the control panel, the **Auto On** button must be pressed to restart the pump.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip-locked (see also table on following page).

Alarms that are trip-locked offer additional protection, means that the mains supply must be switched off before the alarm can be reset. After being switched back on, the inverter is no longer blocked and may be reset as described above once the cause has been rectified.

Alarms that are not trip-locked can also be reset using the automatic reset function in Par. 14-20 Reset Mode (Warning: automatic wake-up is possible!). If a warning and alarm is marked against a code in the table on the following page, this means that either a warning occurs before an alarm, or it can be specified whether it is a warning or an alarm that is to be displayed for a given fault. This is possible, for instance, in Par. 1-90 Motor Thermal Protection. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash on the inverter. Once the problem has been rectified, only the alarm continues flashing.

7.1 FAULT MESSAGES

WARNING 1, 10 Volts low:

The 10V voltage from terminal 50 on the control card is below 10V. Remove some of the load from terminal 50, as the 10V supply is over-loaded. Max. 15 mA or minimum 590 Ω.

WARNING/ALARM 2, Live zero error:

The signal on terminal 53 or 54 is less than 50% of the value set in Par. 6-10 Terminal 53 Low Voltage, Par. 6-12 Terminal 53 Low Current, Par. 6-20 Terminal 54 Low Voltage, or Par. 6-22 Terminal 54 Low Current respectively.

WARNING/ALARM 3, No motor:

No motor has been connected to the output of the inverter.

WARNING/ALARM 4, Mains phase loss:

A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears in case of a fault in the input rectifier on the inverter. Check the supply voltage and supply currents to the inverter.

WARNING 5, DC link voltage high:

The intermediate circuit voltage (DC) is higher than the overvoltage limit of the control system. The inverter is still active.

WARNING 6, DC link voltage low:

The intermediate circuit voltage (DC) is below the under voltage limit of the control system. The inverter is still active.

WARNING/ALARM 7, DC over voltage:

If the intermediate circuit voltage exceeds the limit, the inverter trips after a time.

WARNING/ALARM 8, DC under voltage:

If the intermediate circuit voltage (DC) drops below the "voltage warning low" limit, the inverter checks if 24V back-up supply is connected. If no 24V backup supply is connected, the inverter trips after a given time depending on the unit.

WARNING/ALARM 9, Inverter overloaded:

The inverter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection gives a warning at 98% and trips at 100%, while giving an alarm. You cannot reset the inverter until the counter is below 90%.The fault is that the inverter is overloaded by more than nominal current for too long.

WARNING/ALARM 10, Motor ETR over temperature:

According to the electronic thermal protection (ETR), the motor is too hot. You can choose if you want the inverter to give a warning or an alarm when the counter reaches 100% in Par. 1-90 Motor Thermal Protection. The fault is that the motor is overloaded by more than nominal current for too long. Check that the motor Par. 1-24 Motor Current is set correctly.

WARNING/ALARM 11, Motor thermistor over temp:

The thermistor or the thermistor connection is disconnected. You can choose if you want the inverter to give a warning or an alarm in Par. 1-90 Motor Thermal Protection. Check that the thermistor is connected correctly between terminal 53 or 54 (analog voltage input) and terminal 50 (+ 10 Volts supply), or between terminal 18 or 19 (digital input PNP only) and terminal 50. If a KTY sensor is used, check for correct connection between terminal 54 and 55.

WARNING/ALARM 12, Torque limit:

The torque is higher than the value in Par. 4-16 Torque Limit Motor Mode (in motor operation) or the torque is higher than the value in Par.4-17 Torque Limit Generator Mode (in regenerative operation).

WARNING/ALARM 13, Over Current:

The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 sec., then the inverter trips and issues an alarm. Turn off the inverter and check if the motor shaft can be turned and if the motor size matches the inverter.

ALARM 14, Earth fault:

There is a discharge from the output phases to earth, either in the cable between the inverter and the motor or in the motor itself. Turn off the inverter and remove the earth fault.

ALARM 15, In-complete hardware:

A fitted option is not handled by the present control board (hardware or software).

ALARM 16, Short-circuit:

There is short-circuiting in the motor or on the motor terminals. Turn off the inverter and remove the short-circuit.

WARNING/ALARM 17, Control word timeout:

There is no communication to the inverter. The warning will only be active when Par. 8-04 Control Timeout Function is **not** set to **off**. If Par. 8-04 Control Timeout Function is set to Stop and Trip, a warning appears and the inverter ramps down to zero speed, while giving an alarm. Par. 8-03 Control Timeout Time could possibly be increased.

WARNING 22, Hoist Mech. Brake:

Report value will show what kind it is.0 = The torque REF. was not reached before timeout 1 = There was no brake feedback before timeout

WARNING 23, Internal fans:

External fans have failed due to defect hardware or fans not mounted.

WARNING 24, External fan fault:

The fan warning function is an extra protection function that checks if thefan is running / mounted. The fan warning can be disabled in Par.14-53 Fan Monitor, [0] Disabled.

WARNING 25, Brake resistor short-circuited:

The brake resistor is monitored during operation. If it short-circuits, the brake function is disconnected and the warning appears. The inverter still works, but without the brake function. Turn off the inverter and replace the brake resistor (see Par. 2-15 Brake Check).

ALARM/WARNING 26, Brake resistor power limit:

The power transmitted to the brake resistor is calculated as a percentage, as a mean value over the last 120 s, on the basis of the resistance value of the brake resistor (Par. 2-11 Brake Resistor (OHM)) and the intermediate circuit voltage. The warning is active when the dissipated braking power is higher than 90%. If Trip [2] has been selected in Par. 2-13 Brake Power Monitoring, the inverter cuts out and issues this alarm, when the dissipated braking power is higher than 100%.

WARNING/ALARM 27, Brake chopper fault:

The brake transistor is monitored during operation and if it short-circuits, the brake function disconnects and the warning comes up. The inverter is still able to run, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive. Turn off the inverter and remove the brake resistor. Warning: There is a risk of substantial power being transmitted to the brake resistor if the brake transistor is short-circuited.

ALARM/WARNING 28, Brake check failed:

Brake resistor fault: the brake resistor is not connected/working.

WARNING/ALARM 29, Drive over temperature:

If the enclosure is IP00, IP20/NEMA1 or IP21/TYPE 1, the cut-out temperature of the heat-sink is 203°F +9°F (95°C +5°C). The temperature fault cannot be reset, until the temperature of the heat sink is below 158°F (70°C). The fault could be:- Ambient temperature too high-Too long motor cable

ALARM 30, Motor phase U missing:

Motor phase U between the frequency converter and the motor is missing. Turn off the frequency converter and check motor phase U.

ALARM 31, Motor phase V missing:

Motor phase V between the inverter and the motor is missing. Turn off the inverter and check motor phase V.

ALARM 32, Motor phase W missing:

Motor phase W between the inverter and the motor is missing. Turn off the frequency converter and check motor phase W.

ALARM 33, Inrush fault:

Too many power UPS have occurred within a short time period.

WARNING/ALARM 34, Fieldbus

COMMUNICATION FAULT:

The fieldbus on the communication option card is not working

WARNING/ALARM 36, Mains failure:

This warning/alarm is only active if the supply voltage to the inverter is lost and Par. 14-10 Mains Failure is **not** set to **off**. Possible correction: check the fuses to the frequency converter

WARNING/ALARM 37, Phase Imbalance:

There is a current imbalance between the power units.

ALARM 38, Internal fault:

Contact your local Armstrong supplier.

ALARM 39, Heatsink Sensor:

No feedback from the heatsink sensor.

WARNING 40, Overload of Digital Output Terminal 27:

Check the load connected to terminal 27 or remove short-circuit connection. Check Par. 5-00 Digital I/O Mode and Par. 5-01 Terminal 27 Mode.

WARNING 41, Overload of Digital Output Terminal 29:

Check the load connected to terminal 29 or remove short-circuit connection. Check Par. 5-00 Digital I/O Mode and Par. 5-02 Terminal 29 Mode.

WARNING 42, Overload of Digital Output On x 30/6 :

Check the load connected to X 30/6 or remove short-circuit connection. Check Par. 5-32 Term X 30/6 Digi Out (MCB 101).

WARNING 42, Overload of Digital Output On x 30/7 :

Check the load connected to X 30/7 or remove short-circuit connection. Check Par. 5-33 Term X 30/7 Digi Out (MCB 101).

ALARM 46, Pwr. card supply:

The supply on the power card is out of range.

WARNING 47, 24 V supply low:

The external 24 V DC backup power supply may be overloaded, otherwise contact your Armstrong supplier.

ALARM 48, 1.8 V supply low:

Contact your Armstrong supplier.

WARNING 49, Speed limit:

The speed has been limited by range in Par. 4-11 Motor Speed Low Limit [RPM] and Par. 4-13 Motor Speed High Limit [RPM].

ALARM 50, AMA calibration failed:

Contact your Armstrong supplier.

ALARM 51, AMA check Unom and Inom:

The setting of motor voltage, motor current, and motor power is presumably wrong. Check the settings.

ALARM 52, AMA low Inom:

The motor current is too low. Check the settings.

ALARM 53, AMA motor too big:

The motor is too big for the AMA to be carried out.

ALARM 54, AMA motor too small:

The motor is too small for the AMA to be carried out.

ALARM 55, AMA par. out of range:

The Par. values found from the motor are outside acceptable range.

ALARM 56, AMA interrupted by user:

The AMA has been interrupted by the user.

ALARM 57, AMA timeout:

Try to start the AMA again a number of times, until the AMA is carried out. Please note that repeated runs may heat the motor to a level where the resistance RS and RR are increased. In most cases, however, this is not critical.

WARNING/ALARM 58, AMA internal fault:

Contact your Armstrong supplier.

WARNING 59, Current limit:

The current is higher than the value in Par. 4-18 Current Limit.

WARNING 60, External Interlock:

External Interlock has been activated. To resume normal operation, apply 24 V DC to the terminal programmed for External Interlock and reset the inverter (via BUS, Digital I/O or by pressing **Reset**).

WARNING/ALARM 61, Tracking Error:

Tracking error. Contact your supplier.

WARNING 62, Output Frequency at Maximum Limit:

The output frequency is limited by the value set in Par. 4-19 MAX Output Frequency

WARNING 64, Voltage Limit:

The load and speed combination demands a motor voltage higher than the actual DC link voltage.

WARNING/ALARM/TRIP 65, Control Card Over Temperature:

Control card over temperature: The cut-out temperature of the control card is 176°F (80°C).

WARNING 66, Heatsink Temperature Low:

The heat sink temperature is measured as 32°F (0°C). This could indicate that the temperature sensor is defective and thus the fan speed is increased to the maximum in case the power part or control card is very hot. If the temperature is below 59°F (15°C) the warning will be present.

ALARM 67, Option Configuration has Changed:

One or more options has either been added or removed since the last power-down.

ALARM 68, Safe Stop:

Safe Stop has been activated. To resume normal operation, apply 24 V DC to terminal 37 then send a Reset signal (via BUS, Digital I/O or by pressing **Reset**).

ALARM 69, Pwr. Card Temp:

Power card over temperature.

ALARM 70, Illegal Frequency Converter Configuration:

Actual combination of control board and power board is illegal.

ALARM 90, Feedback Mon.:

ALARM 91, Analogue Input 54 Wrong Settings:

Switch s202 has to be set in position **OFF** (voltage input), when a KTY sensor is connected to the analogue input terminal 54.

ALARM 92, No Flow:

A no load situation has been detected for the system. See parameter group 22-2*.

ALARM 93, Dry Pump:

A no flow situation and high speed indicates that the pump has run dry. See parameter group 22-2*.

ALARM 94, End of Curve:

Feed back stays lower than the set point, which may be indicates a leak-age in the pipe system. See parameter group 22-5*.

ALARM 95, Broken Belt:

Torque is below the torque level set for no load indicating a broken belt. See parameter group 22-6*.

ALARM 96, Start Delayed:

Start of the motor has been delayed due to short cycle protection is ac-tive. See parameter group 22-7*.

ALARM 250, New Spare Part:

The power or Switch Mode Power Supply has been exchanged. The inverter type code must be restored in the EEPROM. Select the correct type code in Par. 14-23 Type code Setting according to the label on unit. Remember to select 'Save to EEPROM' to complete.

ALARM 251, New Type Code:

The frequency converter has got a new type code.

8.0 ACOUSTIC NOISE AND VIBRATION

If the pump or the pipework close to the pump is making noise or vibrations at certain frequencies, try the following:

- Speed Bypass, parameters 4-6*
- Over-modulation, parameter 14- 03 set to **OFF**
- Switching pattern and frequency parameters 14-0*
- Resonance Dampening, parameter 1-64

TABLE 1 Alarm/warning code list

NO.	DESCRIPTION	WARNING	ALARM /TRIP	ALARM /TRIP LOCK	PARAMETER REFERENCE
1	10 volts low	x			
2	Live zero error	(x)	(x)		Par. 6-01 **Live Zero Time-out Function**
3	No motor	(x)			Par. 1-80 **Function at Stop**
4	Mains phase loss	(x)	(x)	(x)	Par. 14-12 **Function at Mains Imbalance**
5	DC link voltage high	x			
6	DC link voltage low	x			
7	DC over voltage	x	x		
8	DC under voltage	x	x		
9	Inverter overloaded	x	x		
10	Motor ETR over temperature	(x)	(x)		Par. 1-90 **Motor Thermal Protection**
11	Motor thermistor over termperature	(x)	(x)		Par. 1-90 **Motor Thermal Protection**
12	Torque limit	x	x		
13	Over current	x	x	x	
14	Earth fault	x	x	x	
15	Incomp. HW		x	x	
16	Short circuit		x	x	
17	Control word timeout	(x)	(x)		Par. 8-04 **Control Time-out Function**
23	Internal fans				
24	External fans				
25	Brake resistor short circuited	x			
26	Brake resistor power limit	(x)	(x)		Par. 2-13 **Brake Power Monitoring**
27	Brake chopper short circuited	x	x		
28	Brake check	(x)	(x)		Par. 2-15 **Brake Check**
29	Power board over temp	x	x	x	
30	Motor phase U missing	(x)	(x)	(x)	Par. 4-58 **Missing Motor Phase Function**
31	Motor phase V missing	(x)	(x)	(x)	Par. 4-58 **Missing Motor Phase Function**
32	Motor phase W missing	(x)	(x)	(x)	Par. 4-58 **Missing Motor Phase Function**
33	Inrush fault		x	x	
34	Fieldbus communication fault	x	x		
36	Mains failure				
38	Internal fault		x	x	
40	Overload T27				
41	Overload T29				
42	Overload X30/6-7				
47	24V supply low	x	x	x	
48	1.8V supply low		x	x	
49	Speed limit				

NO.	DESCRIPTION	WARNING	ALARM/TRIP	ALARM/TRIP LOCK	PARAMETER REFERENCE
50	AMA calibration failed		x		
51	AMA check U_{nom} and I_{nom}		x		
52	AMA low I_{nom}		x		
53	AMA motor too big		x		
54	AMA motor too small		x		
55	AMA parameter out of range		x		
56	AMA interrupted by user		x		
57	AMA timeout		x		
58	AMA internal fault	x	x		
59	Current limit	x			
60	External interlock				
62	Output frequency at maximum limit	x			
64	Voltage limit	x			
65	Control board-over temperature	x	x	x	
66	Heat sink temperature low	x			
67	Option configuration has changed		x		
68	Safe stop activated		x		
70	Illegal FC configuration				
80	Drive initialized to Default Value		x		
92	No-flow	x	x		Par. 22-2*
93	Dry pump	x	x		Par. 22-2*
94	End of curve	x	x		Par. 22-5*
95	Broken belt	x	x		Par. 22-6*
96	Start delayed	x			Par. 22-7*
97	Stop delayed	x			Par. 22-7*
98	Clock fault	x			Par. 0-7*

TABLE 2 IVS 102 parameter settings

	PAR.	NAME	SETUP 1 (SENSORLESS)	SETUP 2 (EXTERNAL SENSOR)	SETUP 3 (EXTERNAL BMS)
OPERATION/ DISPLAY	0-20	Display line 1.1 Small	Reference [unit]	Reference [unit]	Reference [%]
	0-21	Display line 1.2 Small	Frequency	Frequency	Frequency
	0-22	Display line 1.3 Small	Power (kW or hp depending on site)	Power (kW or hp depending on site)	Power (kW or hp depending on site)
	0-23	Display line 2 large	Feedback 1 [unit]	Feedback 1 [unit]	Feedback 1 [unit]
	0-24	Display line 3 large	Sensorless Readout	Sensorless Readout	No Function
LOAD AND MOTOR	1-00	Configuration mode	Closed Loop	Closed Loop	Open Loop
	1-03	Torque charasteristics	Variable Torque	Variable Torque	Variable Torque
	1-21	Motor power [hp]	Motor nameplate power	Motor nameplate power	Motor nameplate power
	1-22	Motor voltage	Motor nameplate Volts	Motor nameplate Volts	Motor nameplate Volts
	1-23	Motor frequency	60 or 50 per nameplate	60 or 50 per nameplate	60 or 50 per nameplate
	1-24	Motor current	FLA per nameplate	FLA per nameplate	FLA per nameplate
	1-25	Motor nominal speed [rpm]	Motor nameplate speed	Motor nameplate speed	Motor nameplate speed
	1-73	Flying start	Enabled	Enabled	Enabled
BRAKES	2-17	Over-voltage control	Enabled	Enabled	Enabled
REFERENCE/ RAMPS	3-02	Minimum reference	0	No operation	0
	3-03	Maximum reference	Hdesign [in unit of mapped perf data]	No operation	Max frequency of app (50 or 60Hz)
	3-15	Reference 1 source	No operation	No operation	Analog input 53
	3-16	Reference 2 source	No operation	No operation	No operation
	3-17	Reference 3 source	No operation	No operation	No operation
	3-41	Ramp up time	Desired ramp time (60s typical)	Desired ramp time (60s typical)	Desired ramp time (60s typical)
	3-42	Ramp down time	Desired ramp time (60s typical)	Desired ramp time (60s typical)	Desired ramp time (60s typical)
LIMITS/ WARNINGS	4-10	Motor speed direction	Clockwise	Clockwise	Clockwise
	4-11	Motor speed low limit [rpm]			
	4-12	Motor speed low limit [hz]	Min frequency of application	Min frequency of application	Min frequency of application
	4-13	Motor speed high limit [rpm]			
	4-14	Motor speed high limit [hz]	Max frequency of application	Max frequency of application	Max frequency of application
DIGITAL IN/OUT	5-01	Terminal 27 mode	Input	Input	Input
	5-10	Terminal 18 digital input	Start	Start	Start
	5-11	Terminal 19 digital input	No operation	No operation	No operation
	5-12	Terminal 27 digital input	Depends if float switch is req'd	No operation	Run Permissive
	5-13	Terminal 29 digital input	Jog	Jog	Jog
	5-14	Terminal 32 digital input	No operation	No operation	No operation
	5-15	Terminal 33 digital input	No operation	No operation	No operation
	5-16	Terminal x30/2 digital input	No operation	No operation	No operation
	5-17	Terminal x30/3 digital input	No operation	No operation	No operation
	5-18	Terminal x30/4 digital input	No operation	No operation	No operation
	5-40	Function relay 1	No operation	No operation	Alarm
	5-40	Function relay 2	No operation	No operation	Running

	PAR.	NAME	SETUP 1 (SENSORLESS)	SETUP 2 (EXTERNAL SENSOR)	SETUP 3 (EXTERNAL BMS)
ANALOG IN/OUT	6-00	Live zero timeout time	No operation	1s	No operation
	6-01	Live zero timeout function	No operation	Stop	No operation
	6-10	Terminal 53 low voltage	No operation	No operation	0.07
	6-11	Terminal 53 high voltage	No operation	No operation	10
	6-12	Terminal 53 low current	No operation	No operation	4
	6-13	Terminal 53 high current	No operation	No operation	20
	6-14	Terminal 53 low ref./feedb. value	No operation	No operation	0
	6-15	Terminal 53 high ref./feedb. value	No operation	No operation	60
	6-20	Terminal 54 low voltage	No operation	0.07	No operation
	6-21	Terminal 54 high voltage	No operation	10	No operation
	6-22	Terminal 54 low current	No operation	4	No operation
	6-23	Terminal 54 high current	No operation	20	No operation
	6-24	Terminal 54 low ref./feedb. value	No operation	minimum sensor value	0
	6-25	Terminal 54 high ref./feedb. value	No operation	maximum sensor value	60
	6-50	Terminal 42 output	No operation	No operation	No operation
COMM. AND OPTION	8-30	Protocol	FC, MC	Depends on controller	Depends on controller
	8-31	Address	1	Depends on controller	Depends on controller
	8-32	Baud rate	9600	Depends on controller	Depends on controller
	8-33	Parity/stop bits	Even Prity, 1 Stop bit	Depends on controller	Depends on controller
SPECIAL FUNCTIONS	14-10	Mains failure	[0] No function	[0] No function	[0] No function
	14-11	Main voltage at mains fault	Set to 83.5% of site voltage	Set to 83.5% of site voltage	Set to 83.5% of site voltage
	14-12	Function at mains imbalance	[0] No function	[0] No function	[0] No function
	14-60	Function at over temperature	[1] Derate	[1] Derate	[1] Derate
	14-61	Function at inverter overload	[1] Derate	[1] Derate	[1] Derate
	14-62	Inverter overload derate current (%)	95	95	95
DRIVE CLOSED LOOP	20-00	Feedback 1 source	Sensorless Pressure	Analog input 54	No operation
	20-02	Feedback 1 source unit	Unit used for feedback 1 source	Unit of external sensor	No operation
	20-12	Reference/feedback unit	Unit of par 2021 (ex: ft WG)	Unit of external sensor	No operation
	20-13	Minimum reference/feedback		Low limit of sensor	No operation
	20-14	Maximum reference/feedback	Max of head and flow mapped	Upper limit of sensor	No operation
	20-20	Feedback function	Minimum	Minimum	No operation
	20-21	Setpoint 1	Design Head in unit in par 2012	Design setpoint	No operation
	20-60	Sensorless unit	Unit of par1850 (ex: GPM)	not used	No operation
	20-70	Closed-loop type	not used	Fast Pressure	No operation
	20-71	pid performance	not used	Normal	No operation
	20-93	pid proportional gain	Start at 0.05	Needs to be fine tuned on site	No operation
	20-94	pid integral time	Start at 0.1	Needs to be fine tuned on site	No operation
APPLICATION FUNCTIONS	22-43	Wake up speed [hz]	No operation	Needs to be fine tuned on site	No operation
	22-50	End of curve function	Off	Off	Off
	22-80	Flow compensation	Enabled	No operation	Disabled
	22-81	Square-linear curve approximation	100%	No operation	100%
	22-84	Speed at no-flow [hz]	No operation	Frequency at no flow and minimum head set	No operation
	22-86	Speed at design point [hz]	No operation	No operation	No operation
	22-87	Pressure at no-flow speed	40% of maximum system head	No operation	No operation
	22-89	Flow at design point	Flow at Design Point	No operation	No operation

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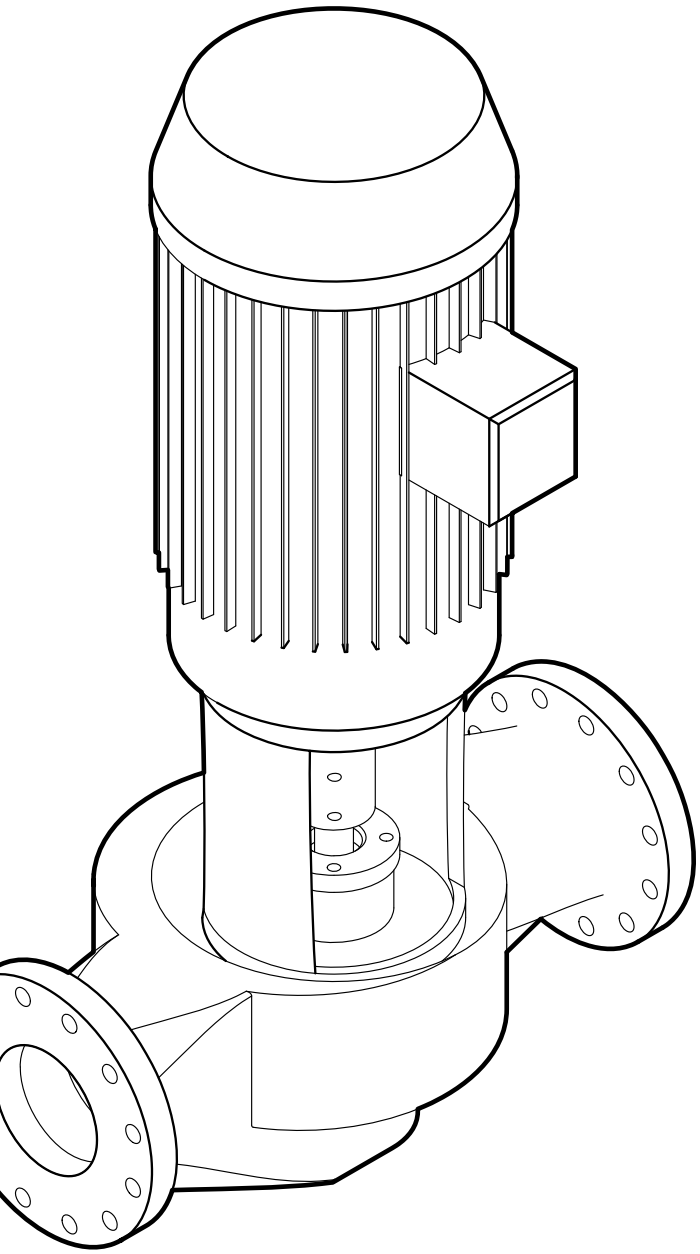
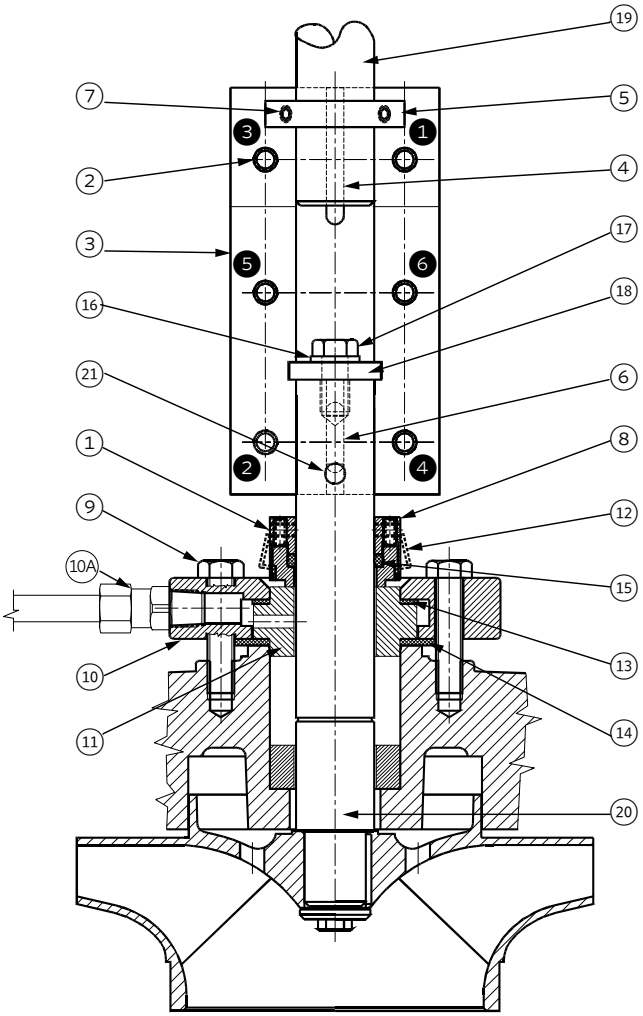


Mechanical Seal Replacement Instructions

Series 4300 & 4302 outside mechanical seal with TC frame motor

File No: 43.88
Date: FEB. 01, 2012
Supersedes: 43.88
Date: MAR.18, 2009



CAUTION

Do not use oil, Vaseline or other petroleum or silicon based products for seal elastomer lubrication. Otherwise elastomer swelling may occur, causing seal failure. Recommended: International Products Corp P-80 Rubber Lubricant Emulsion in USA & UK www.ipcol.com

SEAL REMOVAL

An important feature of the Series 4300 and 4302 pump is that the design permits removal of the mechanical seal without disturbing the pump, motor or electrical wiring.

A Disconnect the power supply at the main switch and close the isolating valves on the suction and discharge. Empty casing by removing drain plug(s) located at the bottom.

B Loosen off the seal collar set screws (1) Remove the coupling screws (2) and separate the coupling halves (3). Remove the motor shaft key (4) and the pump shaft key (6). **Do not remove motor collar (5) for seal replacement**. Use Allan wrench and insert coupling screw into positioning hole (21) to prevent shaft rotation and remove the capscrew, lockwasher and collar (17, 16, & 18) from the pump shaft.

C Remove the mechanical seal rotating assembly (8) through the gap between the pump and motor shafts.

D Disconnect the seal flush piping (10A). Mark seal plate (10) position. Remove the seal plate bolts (9) and seal plate (10). Remove the stationary seat (11) and seat gaskets (13 & 14).

SEAL REPLACEMENT

Handle mechanical seal carefully to protect seal faces from damage. Do not contaminate seal faces with finger prints.

E Replace the stationary seat (11) and gaskets (13 & 14), aligning the seat flush hole with the seal plate flush line connection. Ensure the large diameter gasket (14) is on the bottom. Replace seal plate (10) and tighten the seal plate bolts (9) evenly and diagonally, to the following torque (ft. lbs) values: 1.125" seal – 20; 1.625"/2.125"/2.625" (7.5" diameter plate) – 50; 2.625 (9" diameter) – 90; 3.5" – 90.

F When installing the mechanical seal (8), ensure parts are perfectly clean.

G Apply a small amount of temporary rubber lubricant emulsion to the o-ring (15). Carefully slide the mechanical seal rotating assembly (8) down the shaft onto the stationary seat (11). Do not tighten the set screws (1) on the side of the mechanical seal yet. Do not remove holding clips (12).

If motor is replaced: Loosen set screws (7) on motor shaft collar (5) and remove from old motor shaft. To position the collar (5) correctly on the new motor shaft, temporarily fit motor shaft collar (5) into groove of the keyed coupling half. Slide collar, with coupling half onto new motor shaft until end of shaft lines up with line scored into coupling. Tighten the visible set screws (7) in the collar (5) enough to hold the collar in place on the shaft and remove the coupling half. Tighten all collar set screws (7) evenly and diagonally. Order replacement motors with locked lower bearing.

H Use Allan wrench and insert the coupling screw into positioning hole (21) to prevent pump shaft rotation and replace collar, lockwasher, and capscrew (18, 16, & 17). Capscrew (17) must be firmly tightened on the pump shaft with a wrench.

I Fit the motor shaft key (4) and the pump shaft key (6) then install the keyed coupling half (3) first.

NOTE:
For easier coupling installation, motor and pump shaft keys (4 & 6) should be 180 degrees from the working area. To automatically locate the impeller in the pump, insert the coupling screw Allan wrench into positioning hole (21) and lift pump shaft until the pump shaft collar is positioned in the coupling groove, then rotate shaft to locate the pump shaft key (6) into blind keyway in coupling. Should the pump rotating assembly prove too heavy to lift easily: a piece of 2" × 4" wood may be firmly positioned to allow a pry-bar to be placed securely under the pump shaft collar; the rotating assembly may be levered and raised-up in that manner.

J Place the second coupling half into position and tighten the coupling screws (2) following the tightening pattern shown on the illustration(❶ ❷ ❸ ❹ ❺ ❻).

NOTE:
Snug fit the coupling screws and confirm even gap spacing between coupling halves, then firmly tighten coupling screws following the tightening pattern illustrated. Then push (or slide) mechanical seal (8) firmly onto the stationary seat (11) and tighten the set screws (1) to the following torque (ft. lbs) values: Seal sizes 1.125" to 2.625" – 5; 3.5" – 11. Remove the holding clips (12) for operation. The mechanical seal is now preset at the correct working length.

K Replace the seal flush piping (10A) and drain plug(s). Series 4302: Equalize pump pressure within dualArm pump by temporarily opening valve on connecting tubing. Open all isolating valves prior to operating pump(s). Reconnect power supply.

Submittal

Ref. #: 539622.1 rev3

Design envelope close coupled vertical in-line dualarm pump

Model: Series Design Envelope Sensorless 4382 0306-005.0

Project name:	Immaculate High School		
Location:	Danbury CT	**Representative:**	Mechanical Solutions, Inc.
Date submitted:	11/7/2016 12:52:40 PM	**Phone number:**	
Engineer:		**e-mail:**	kreynolds@msipump.com
Contractor:		**Submitted by:**	Kenneth Reynolds

Application design data

Tag number:	P-1,2	Pipe orientation:	Single
Service:		Suction pressure:	0 ft
Location:		Fluid:	Non-Potable Fluid - Water
Quantity:	1	Operating temperature:	60 F
Duty flow per pump:	100 USgpm	Viscosity:	31 SSU
Duty head:	60 ft	Specific gravity:	1.0000
Environment:	Indoors	Safety factor % head:	0 %
Total dissolved solids:	0 ppm		

Materials of construction

Construction:	BF	Impeller:	Bronze (B584-844)
Rating:	ANSI-125	Shaft sleeve:	316 SS
Connections:	Inlet: 3 in, Outlet: 3 in	Casing gasket:	Confined Non-Asbestos Fiber
Casing (volute):	Cast Iron (A48-30)	Flush line:	Copper

Mechanical seal data

Seal type:	Inside Single Spring	Rotating face:	Resin Bonded Carbon
Manufacturer code:	C-ssc L EPSS 2A	Stationary seat:	Sintered Silicon Carbide
Springs:	Stainless Steel	Secondary seal:	EPDM
Rotating hardware:	Stainless Steel		

Motor electrical data

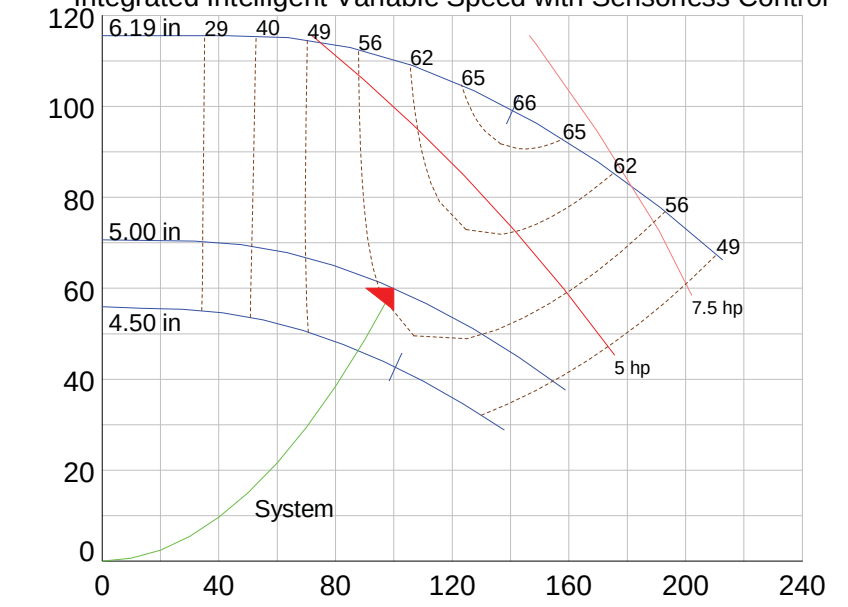
Supplier:	Factory Choice	Insulation class:	Class F Insulation
Size:	5 hp	Inverter motor type:	Inverter Duty
Frame number:	184JM	Efficiency:	NEMA Prem (12.12)
Enclosure:	TEFC	Operating speed @ 100% flow:	2935 rpm
Motor Electrics:	208/3/60	Operating speed @ 50% flow:	2067 rpm

IVS102 controller data

Sensorless control:	Yes-Quadratic press control	Communication port:	RS 485
BMS protocol:	BACnet Native	Analog inputs:	2 (current or voltage)
Enclosure:	UL Type 12	Analog outputs:	1 (current)
Fused disconnect switch:	Yes	Digital inputs:	4 (programmable)
Control orientation:	STD	Digital outputs:	2 (programmable)
Expansion card:	None	Cooling:	Fan cooled through back channel
BHP at 50% load/flow and 55% of design head:	0.67 hp	Ambient temperature:	14F to 113F (up to 3280ft elevation)
Meets ASHRAE 90.1:	No	EMI/RFI control:	Integrated fliter to meet EN61800-3
Min. maintained sys. pressure:	24 ft	Harmonic suppression:	Integrated DC link reactor**

*If minimum maintained system pressure is not known, default is 40% of design head.

** The IVS 102 control is a low harmonic control with a built-in DC link reactor equivalent in performance to a 5% AC line reactor. This does not guarantee performance to any system wide harmonic specification or the costs to meet a system wide specification. If supplied with the system electrical details, Armstrong will run a computer simulation of the system wide harmonics. If system harmonic levels are exceeded, Armstrong can also recommend additional harmonic mitigation and the cost for such mitigation.

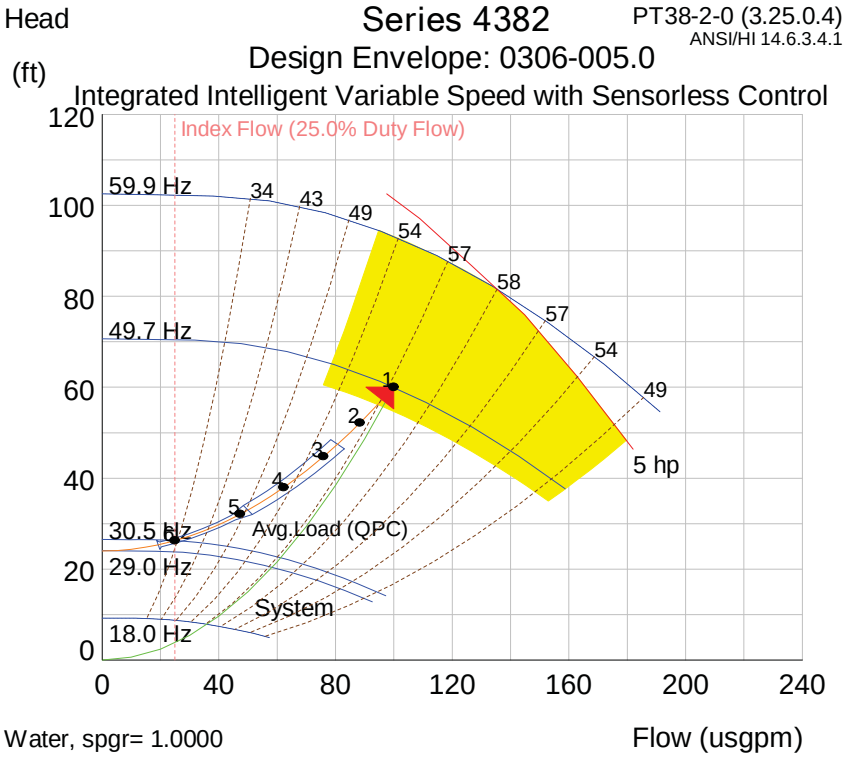


--- Admin Data ---
Tag Num: P-1,2
Service:
Location:

--- Motor Data ---
Motor Size: 5 hp

--- Design Duty Point ---
Flow: 100 usgpm
Head: 60 ft
Impeller: 5 in

--- Performance Data ---
- NPSHR: 12.2 ft
- Eff. @ Design: 56.88 %
- BHP @ Design: 2.66 hp
- Mtr Capability @ Rated Spd: 4.24 hp
- %Mtr Safety: 59.26%
- BEP @ Design Imp.: 57.65 % @ 112.5 usgpm
- %max imp. range: 29.87 %
- Outlet Velocity: 4.34 ft/s
- VFD Op.Speed: 2935 rpm
- VFD Setting: 49.7 Hz



--- Admin Data ---
Tag Num: P-1,2
Service:
Location:

--- Motor Data ---
Motor Size: 5 hp

--- Design Duty Point ---
Flow: 100 usgpm
Head: 60 ft
Impeller: 5 in

--- Control Data ---
1. Hmax @ 49.7 Hz:
- 100 @ 60, 2.66 hp

2. Control (QPC) @ 45.9 Hz:
- 88.4 @ 52.1, 2.07 hp

3. Control (QPC) @ 42.0 Hz:
- 75.9 @ 44.7, 1.55 hp

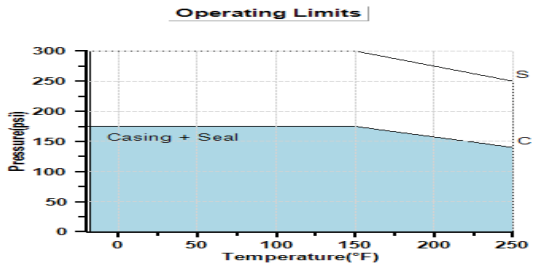
4. Control (QPC) @ 38.1 Hz:
- 62.3 @ 38, 1.13 hp

5. Control (QPC) @ 34.4 Hz:
- 47.3 @ 32.1, 0.79 hp

6. Index @ 30.5 Hz:
- 25 @ 26.3, 0.5 hp

7. Hmin: 24 ft 29.0 Hz:
- Setting= 40.00% Hmax

Operating limits (temperature - pressure)



Maximum pressure: **175 psi**

Maximum temperature: **250 F**

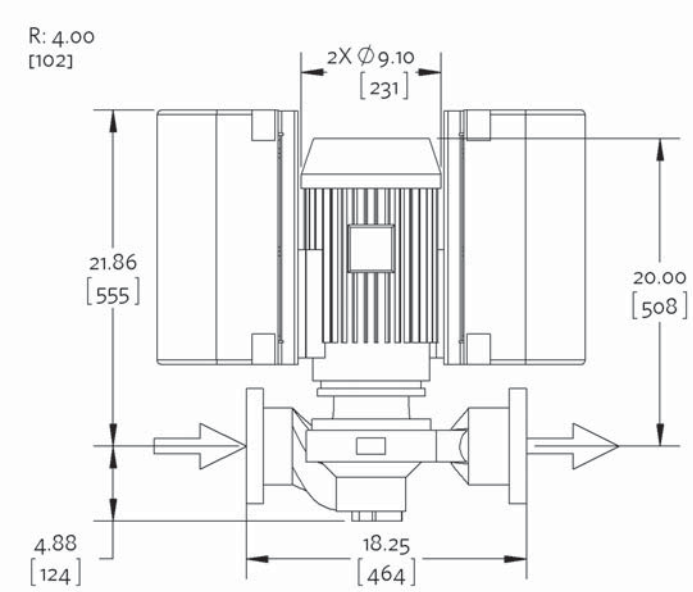
Pump casings are hydrostatically tested to 150% of maximum pump working pressure rating.

Design envelope pumping unit capability

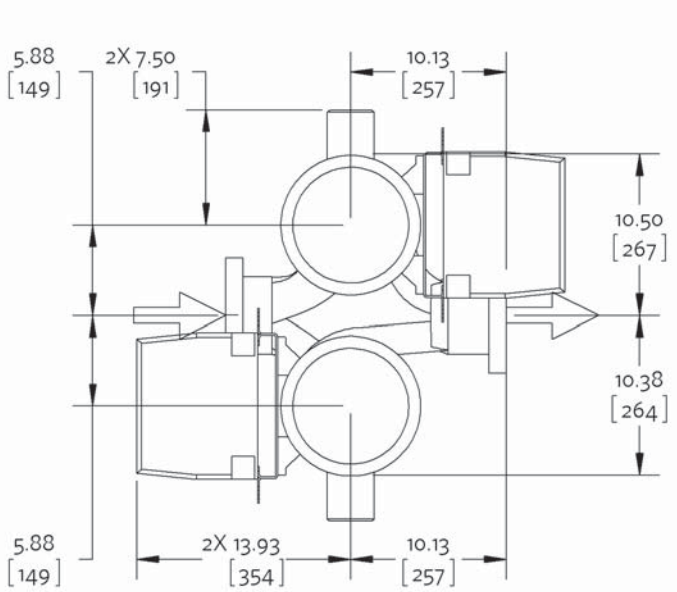
Operating point	Flow	Head	Efficiency
Full capability at 100% design flow	100 USgpm	93.2 ft	53.42 %
Design point	100 USgpm	60 ft	56.88 %
50% average flow (with default load profile)	50 usgpm	33 ft	49.28 %

Dimensional data (not for construction)

Side view



Top view



Weight: 331 lb
- Not to scale
- R = minimum lifting clearance required above motor
- Units of measure : inches [millimeters]
- Coupling guard and flush line (not shown) are supplied
- Tolerance of ± 0.125 inch (± 3 mm) should be used
- For certified dimensions, please contact your Armstrong representative
- Pump equipped with casing drain plug and ¼ inch NPT suction and discharge gauge ports

Connection details

Connection	Size	Rating	OD	Bolt quantity*	BCD	Bolt size
Inlet	3	ANSI-125	7.5	4	6	0.625
Outlet	3	ANSI-125	7.5	4	6	0.625

*Equally spaced straddling centreline

Special instructions

The program has defaulted to a NEMA Premium Efficiency motor supplied with NEMA MG-1 Part 31.4.4.2 insulation standards for inverter-fed polyphase motors.

OSHPD Seismic Certification OSP-0422-10
UL STD 778 & CSA STD C22.2 no.108 certified

Selected options

Environmental Application: Indoors
Integrated Fused Disconnect: Yes

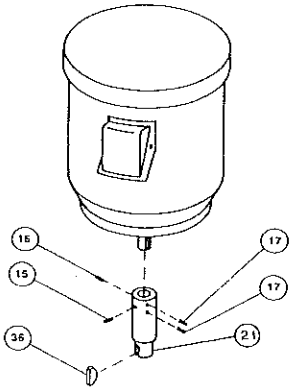
Additional equipment

Flotrex: FTV-2.5GS (570200-386)

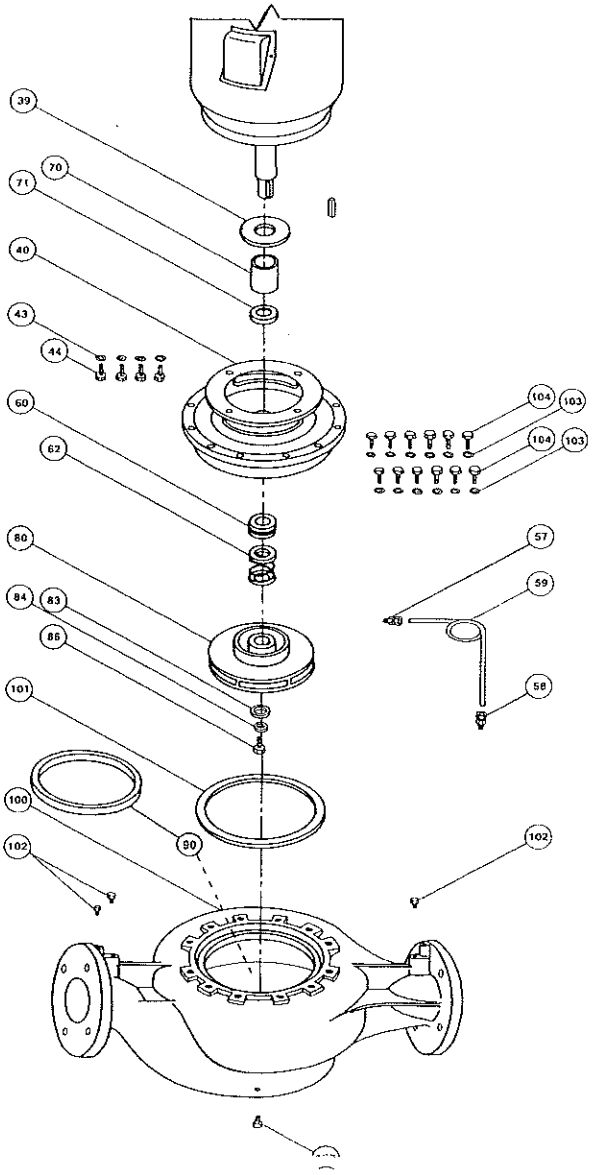
4380 NEW STYLE VERTICAL PUMP

EQUAL SUCTION AND DISCHARGE
"S" DESIGNATION
7/8" IMPELLER BORE -- 1 1/4" MECHANICAL SEAL

EXPLODED VIEW



Frame 56 C Shaft Arrangement



SEE PAGE 3 FOR PARTS INDEX

MODEL 4380 VERTICAL IN-LINE

EQUAL SUCTION AND DISCHARGE

PUMP PARTS

INDEX

ARMSTRONG PUMPS INC.

("ARMSTRONG") TERMS OF SALE AND WARRANTY

File No: 9.10US
Date: JUNE 26, 2012
Supersedes: 9.10US
Date: MAY 24, 2012

ARMSTRONG TERMS

The following terms shall prevail over and cancel any other or different terms or conditions proposed by a customer of Armstrong (the "Customer") through a purchase order or otherwise. Armstrong's acceptance of the Customer's order shall not be construed as an acceptance of printed or inserted provisions on the Customer 's form(s) which are inconsistent with or additional to these terms and conditions, unless specifically accepted in writing by an authorized signing officer of Armstrong. No sales representative, agent, or employee of Armstrong is authorized to alter, vary or waive any of these terms and conditions. Such changes require the written approval of an authorized signing officer of Armstrong.

ACCEPTANCE OF ORDERS

All orders are subject to formal acceptance at Armstrong's head office by an authorized signing officer of Armstrong.

PRICES

Unless otherwise expressly stated by Armstrong, prices quoted do not include any applicable transportation costs or property, sales, use, privilege or export taxes, custom duties or any other applicable tax, fee or charge imposed on or measured by the transaction(s) between the Customer and Armstrong. Customer will be responsible for paying such taxes, fees and costs, unless otherwise expressly stated by Armstrong. Prices quoted are firm for 30 days from date of quotation. [Upon acceptance, quoted] prices will remain firm to time of shipment, provided:

A Delivery is accepted as goods are available.

B The Customer will accept delivery six months or less from date of its order.

C Approval data is returned within 30 days from date of submission.

TERMS

Net 30 days from date of invoice, unless otherwise stated. The Customer will be charged the lesser of (i) 2% per month interest (24% per annum) or (ii) the highest rate permitted by law on all overdue accounts. These terms are subject to credit approval; otherwise, terms are cash with order or C.O.D.

MINIMUM BILLING

Minimum billing of each Customer order will be $150 net.

CONFIRMATION OF TELEPHONE ORDERS

Orders are accepted by telephone for the convenience of the Customer and must be promptly confirmed by Customer in writing. Such orders should be clearly marked as **Confirmation**; otherwise they may be duplicated.

RETURNED GOODS

No goods may be returned without first obtaining a Returned Goods (RG) number from Armstrong. Application [for RG number] must include invoice number and date of original shipment.

A All goods returned will be subject to a re-handling charge a minimum charge of the greater of 25% of invoice amount or $50.00 will apply.

B If, upon inspection, the goods are found to be in need of reconditioning or repair, an additional deduction will be made and the Customer will be advised of the total re-handling charge that will apply.

C All goods approved for return must be clearly tagged with RG number, have transportation charges prepaid and be received by Armstrong within 30 days of return approval and will be accepted for credit on the basis of original invoiced prices.

D Goods which are assembled to order [this includes all pumps, systems, heat exchangers and replacement tube bundles], obsolete, used, non-stock, or over 18 months old (from date of shipment), are not returnable.

WARRANTY

Armstrong warrants Armstrong-manufactured products to be free from defects in material and workmanship under normal use and service for the time periods noted below when installed and used in accordance with Armstrong's printed instructions [normal wear and tear excepted]:

- E.2 series circulators – 36 months from installation, but not more than 42 months from date of manufacture.
- All other circulators and hydronic specialties - 24 months from installation, but not more than 30 months from date of manufacture.
- All other products - 12 months from installation, but not more than 18 months from date of manufacture.

Note: All mechanical seal warranties are restricted to those failures at start-up and must be reported in writing to the Armstrong factory within 48 hours. Armstrong obligations shall be limited to the repair of parts or replacement of any part, at its option and F.O.B. factory (or F.O.B. authorized Armstrong service facility located in the Customer's territory where such facility is available and services the product in question), which may prove

defective under normal use and service during the warranty period and which Armstrong's examination shall disclose to be defective. These warranties shall not apply to any goods which have been subject to accident, alteration, abuse, misuse, tampering, negligence, damage by flood, fire or act of God or where the goods have been improperly installed, maintained or subjected to certain types of and/or improperly applied with water treatment or other system additives. Armstrong shall not be liable for costs of removal, installation, service, labour or transportation charges or for damages for delay caused by defective material or workmanship or for personal injuries or damage to property caused directly or indirectly by any Armstrong-manufactured product or by its use or operation experienced by the Customer or any other person whatsoever.

The above warranties are in lieu of all other warranties expressed or implied. No representative or other person is authorized or permitted to make any warranty or assume for us any liability not strictly in accordance with the foregoing. The foregoing warranties shall not apply to components purchased by Armstrong from other manufacturers; in lieu of providing warranty on such components, Armstrong will make available to the customer any warranties received by it from such manufacturers. Customer must pursue any remedy with respect to such components against such third party. Other than the foregoing warranties, Armstrong makes no representation or warranty of any kind, expressed or implied, with respect to its products, whether as to merchantability, fitness for a particular purpose or any other matter. The customer acknowledges that it uses any products provided by Armstrong for business purposes and therefore agrees that all consumer protection terms implied by law shall not apply.

SHIPMENT (F.O.B. POINT), RISK OF LOSS, TITLE

Prices are F.O.B. Armstrong's warehouse, unless otherwise stated. Where freight allowances are specifically offered, Armstrong reserves the right to select carrier and routing. All deliveries and shipments will be at the Customer's risk from the time of delivery to the carrier by Armstrong, irrespective of whether the principal carrier shall have been designated in the shipping instructions of the Customer. The Customer is required to inspect all inbound documents for accuracy. If there is any evidence of injury to or shortage of containers' contents, the Customer shall not provide receipt to carrier in good condition, but shall give receipt according to the facts. In case of damage, claim must be made on carrier without delay. Armstrong's assistance is available to secure adjustment. Any discrepancy must be reported in writing to Armstrong Customer Service within 5 days of receipt. Title to products will pass to Customer upon Armstrong's receipt of the entire purchase price therefor.

PRIOR SALE

Goods in stock are offered subject to prior sales or shipment.

SHIPMENT, DELIVERIES OR CANCELLATIONS

Shipment dates are estimated and Armstrong will not be liable for late shipments. Armstrong shall not be liable for any charges or damages arising directly or indirectly, out of loss, damage, stoppage or delay and interruption with respect to shipments or to delivery schedules resulting from fire, storm, flood, war, explosion, accident, strike, lockout, labour disturbance, embargos, riots, acts of civil or military authority, acts or omissions of the Customer or acts of God or public enemies, inability to obtain product from supplier, accident or breakdown to, or mechanical failure of, machinery and equipment, changes in economic conditions or other causes beyond Armstrong's reasonable control. If shipments are delayed or deferred by the Customer more than one month beyond the original shipping date, payment for goods shall become due at the time and storage or warehousing charges of the lesser of (i) 2% per month (24% per annum) or (ii) the highest rate permitted by law. No order for assembled to order equipment may be cancelled, materially altered or terminated except upon payment to Armstrong for loss, damage and expense arising from such cancellation, alteration or termination, including a reasonable profit and overhead. Armstrong reserves the right to discontinue the sale of certain of its products and to change the contents and packaging thereof. Armstrong shall not incur any liability thereby or any obligation to change or repurchase any such products sold to the Customer.

LIMITATION OF LIABILITY

Notwithstanding anything to the contrary herein contained, Armstrong shall not be liable to Customer or any third party for any consequential, contingent, incidental, liquidated, indirect or special damages, lost profits or other losses of customer or any third party arising, directly or indirectly, in respect of any products or services provided by Armstrong to the Customer or the sale, transportation, use or failure thereof, whether based on breach of warranty, negligence or otherwise. Without limiting the generality of the foregoing, the parties acknowledge and agree that: (a) Armstrong shall not be liable for any damages which result from the Customer's failure to take reasonable steps to maintain and inspect the products provided by Armstrong and their related components or failure to have appropriate standby procedures in place in relation thereto, (b) Armstrong shall not be liable for any damages arising, directly or indirectly, in respect of any components provided to the Customer by Armstrong which were purchased by Armstrong from other manufacturers or the use or failure thereof and (c) Armstrong's maximum liability to the customer shall be limited to the replacement value of any products provided by Armstrong to the Customer.

STATUTE OF LIMITATIONS

Any action of any nature by Customer against Armstrong must be commenced by Customer within one year after the cause of action first accrued.

DEFAULT

If Customer (a) fails to pay any amount due to Armstrong when due, (b) fails to observe or perform any of its other obligations under these terms and conditions, (c) takes any action that in Armstrong's opinion adversely affects the name, reputation or goodwill of Armstrong or its products, (d) is an entity and the person(s) that controls Customer on the date these terms and conditions are issued to Customer no longer controls Customer or (e) becomes insolvent, is adjudicated a bankrupt, voluntarily files or permits the filing of a petition in bankruptcy, makes an assignment for the benefit of creditors, seeks any similar relief under any bankruptcy laws or related statutes or a receiver is appointed for its assets, then, at Armstrong's sole option, all sums due or to become due from Customer to Armstrong may become immediately due and payable, and concurrently, or in the alternative, Armstrong may terminate any existing order between the Parties in whole or in part, defer shipment or delivery of any products, sell any part of any undelivered products and exercise any other remedies available to Armstrong under applicable law.

COSTS AND EXPENSES; INDEMNIFICATION

Customer will be responsible for all costs and expenses, including attorneys' fees and disbursements, incurred by Armstrong in enforcing any term or condition herein and Customer will indemnify and promptly reimburse Armstrong for such costs and expenses. Customer agrees to indemnify and hold the Armstrong and its officers, directors, employees, agents, affiliates and customers harmless from all costs, expenses and losses incurred by any of them which relate to or arise out of Customer's or Customer's customers use, transportation, handling, installation, sale, distribution or disposal of any products sold hereunder or Customer's failure to perform any obligation hereunder.

[CONFIDENTIAL INFORMATION

Armstrong's technical, trade secret, proprietary or similar information (collectively, "Confidential Information") disclosed by Armstrong to Customer or its officers, directors, employees or agents (collectively, "Representatives") and all copies thereof are the sole and exclusive property of Armstrong. Such disclosure will not be construed as granting to Customer or its Representatives any right, title or interest of any kind in any Confidential Information. Upon Armstrong's request, Customer will promptly deliver to Armstrong all Confidential Information in Customer's possession which is in written or electronically-readable form, including all copies or extracts thereof or based thereon in its possession or in the possession of any of its Representatives. All Confidential Information will be kept confidential by Customer and will not be disclosed to any person or entity without Armstrong prior written consent. Customer will be responsible for any breach of this covenant by Customer or any of Customer's Representatives and will indemnify Armstrong and its officers, directors, employees, agents, affiliates and customers for any costs, expenses or losses incurred or suffered by any of them as a result of such breach.]

TERRITORIAL RESTRICTIONS

The Customer shall not without the express written approval of Armstrong (which shall not be unreasonably withheld) export or use any products provided by Armstrong, or sell or hire such products to a person or entity who to its knowledge intends to export or use it, outside the country of intended use as declared to Armstrong. The Customer undertakes to comply with export control restrictions where applicable. If export or import restrictions are imposed or export or import licenses are cancelled, withdrawn or not renewed, then the Customer shall pay for all goods already delivered at the contract rate and payments already made may be used by Armstrong in respect of claims or demands made or losses incurred hereunder.

SECURITY INTEREST

Customer hereby grants to Armstrong a priority lien and security interest in products sold to Customer and in all proceeds of such products to secure Customer's obligations to Armstrong hereunder. Customer appoints each officer of Armstrong as an attorney-in-fact for Customer for the purpose of executing and filing each financing statement or other documents necessary to perfect such security interest. Upon the failure of Customer to pay the purchase price for any products when due, or to perform any of Customer's obligations under these terms and conditions, Armstrong will (a) without any judicial process, have the right to enter upon Customer's premises and take possession of any such products or to receive such products from Customer upon Armstrong's demand and (b) have all other rights and remedies of a secured party under the Uniform Commercial Code of the [State of New York] and any other applicable law.

GOVERNING LAW; JURISDICTION; VENUE:

Armstrong's offer, sales contract, invoice, these terms and conditions, Armstrong's order acknowledgment and any other document delivered by Armstrong to Customer will be governed by and construed according to the laws of the [State of New York], without reference to the principles of conflicts of law. Armstrong and Customer each hereby irrevocably and unconditionally (a) consents to submit to the exclusive jurisdiction of the United States District Court for the [Western District of New York] or the applicable state court located in the State of New York, [County of Erie] for any action or proceeding arising out of or relating to the

sale of Armstrong's products to Customer, (b) waives any objection to the laying of venue of any such action or proceeding in such courts and (c) waives and agrees not to plead or claim in any such court that any such action or proceeding brought in any such court has been brought in an inconvenient forum.

MISCELLANEOUS

It is understood that neither party hereto is constituted as an agent, employee or servant of the other party for any purpose whatsoever. The Customer shall be solely responsible for its acts, conduct and expenses and the acts, conduct and expenses of its employees and agents. These terms and conditions will be binding upon the Parties and their respective successors and assigns; provided, however, that Customer may not assign any of its rights or duties hereunder without Armstrong's prior written consent. If any of the provisions of these terms and conditions are held by a court or other tribunal of competent jurisdiction to be unenforceable, the remaining provisions of these terms and conditions will remain in full force and effect. Armstrong's offer, sales contract or invoice, these terms and conditions and Armstrong's order acknowledgement constitute the entire agreement between Armstrong and the Customer with respect to the sale of Armstrong's products to Customer, superseding all prior representations, agreements or understandings, written or oral, between the parties with respect to such sale. These terms and conditions cannot be amended orally or by any course of conduct by either party, but may only be amended by a written agreement executed by the Parties. The failure by Armstrong to (a) enforce any provision hereof will not be construed as a waiver of such provision or of Armstrong's right to enforce such provision and (b) object to provisions contained in any purchase order or other communication from Customer will not be construed as a waiver of these terms and conditions nor an acceptance of any such Customer provisions.

ACCEPTANCE

The Customer's acceptance of any goods supplied by Armstrong or on Armstrong's behalf shall without limitation constitute acceptance of all terms and conditions as stated herein.

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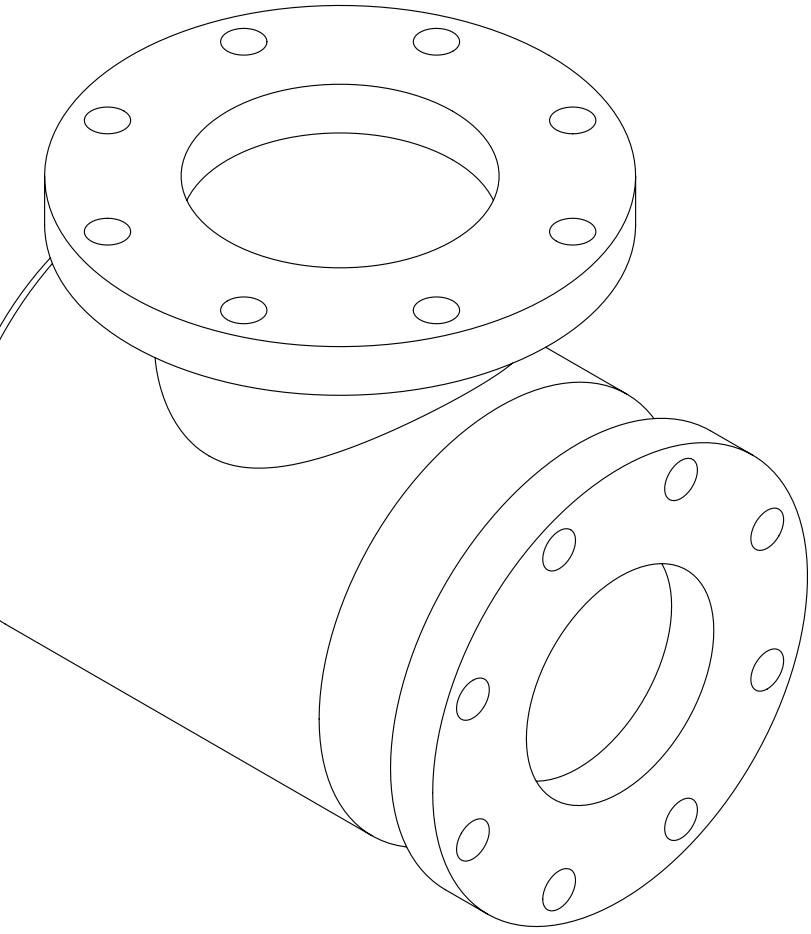
+86 21 3756 6696

ARMSTRONG



Suction Guides

Installation and operating instructions

File No: 35.82
Date: OCTOBER 03, 2013
Supersedes: 35.82
Date: AUGUST 16, 2013

CONTENTS

1.0 INTRODUCTION

Armstrong Suction Guides are designed for bolting directly onto the suction flange of horizontal or vertical shaft centrifugal pumps.

2.0 OPERATING LIMITS

Armstrong Suction Guides are designed in five series:

SERIES DESIGNATION	INLET CONNECTION	PUMP CONNECTION
SG	ANSI 125 / PN16 flange	ANSI 125 / PN16 flange
SG-TF	NPTF / BSPT	ANSI 125 / PN16 flange
SGG	GROOVED*	ANSI 125 / PN16 flange
SGHH	ANSI 250 / PN25 flange	ANSI 250 / PN25 flange
SGH-TF	NPTF / BSPT	ANSI 250 / PN25 flange

*Suitable for straight cut grooved anvil or victaulic fittings.

Each series is designed to be a four-function fitting. Each Suction Guide is a 90º elbow, a pipe strainer and a flow stabilizer. It may also be used as a reducing elbow, should the suction piping be larger than the pump inlet.

3.0 INSPECTION

Armstrong Suction Guides are thoroughly tested and inspected before shipment to assure they meet with your order requirements. All units must be carefully examined upon arrival for possible damage during transit. Any evidence of mishandling should be reported immediately to the carrier and noted on the freight bill.

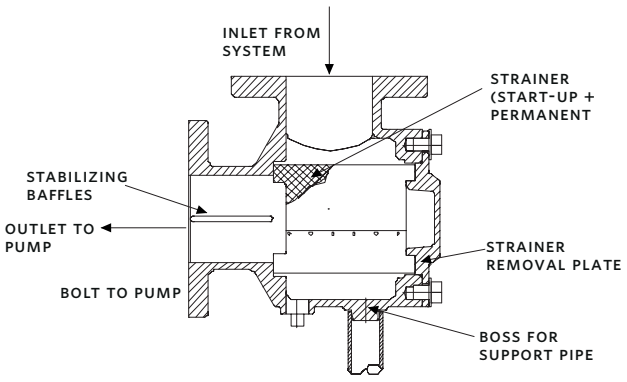


FIG. 1 Armstrong Suction Guide

4.0 INSTALLATION

Install the Suction Guide with the directional arrow, indicated on the body, being aligned with the system flow direction.

Armstrong Suction Guides may be installed in any position, providing the guide vanes are facing the pump inlet flange.

Centrifugal pumps need a minimum of 5 pipe diameters of straight pipe before the pump suction. This length of straight pipe, after the last elbow, tee or fitting, helps to ensure that the flow is stable when entering the pump suction.

Crosspiece guide vanes are fitted into the Armstrong Suction Guide outlet, where it bolts to the pump flange, to stabilize the flow and eliminate the need of long straight suction pipe.

Space must be allowed to remove the end cover and remove the strainer.

A blow-down valve may be installed on the Suction Guide drain connection. Should the Suction Guide be installed with the inlet port facing vertically down: The inlet piping configuration should include a blow-down valve at the lowest point on the down-pipe to exhaust any debris that may fall from the Suction Guide strainer.

The Suction Guide must not be used to support the suction piping. Piping must be supported independently.

On base mounted pumps, a flexible piping connections may allow the Suction Guide to be supported by the pump suction flange. A boss is cast on every SG allowing a supporting pipe-stool to be located under the fitting, thereby removing the weight of the Suction Guide from the pump suction flange.

Suction Guides are supplied with an inlet tapped gauge connection. Monitoring the differential pressure across the fitting, from the suction guide inlet gauge to the pump inlet gauge, will alert the operator should the strainer need to be removed and cleaned.

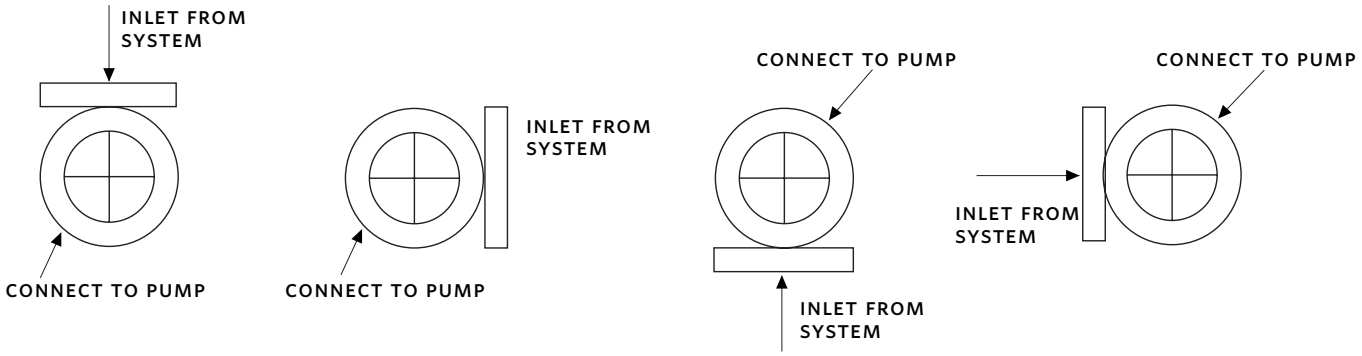


FIG. 2 Armstrong Suction Guide may be installed in any arrangement feasible by pump flange boltholes arrangement.

5.0 OPERATION

No special attention need be paid to the Suction Guide at start-up. The fitting is stationary and will strain the pumped fluid and stabilize the flow into the pump automatically.

Temporary strainer must be removed following system clean up.

After all debris has been removed from the system, or a maximum of 24 running hours, stop the pump and close the pump isolation valves. Drain the Suction Guide by removing the drain plug or opening the blowdown valve, if installed. Remove the Suction Guide cover and remove the strainer assembly from the valve body.

A temporary fine-mesh start-up strainer is tack-welded to the permanent stainless steel strainer. This temporary strainer should now be removed from the permanent strainer. The fine-mesh strainer is designed to remove small particulate from new piping systems and could easily clog with debris if left in place. This will be detrimental to the operation of the pump.

Replace the permanent strainer into the fitting body, once the temporary strainer is removed.

Inspect the cover O-ring and replace if necessary. Replace the cover into the body. Ensuring that the strainer is properly seated, tighten the cover bolts diagonally, evenly and firmly.

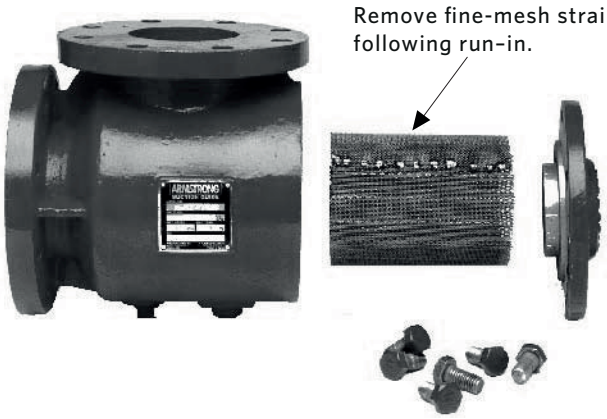


FIG. 3 Remove fine-mesh strainer

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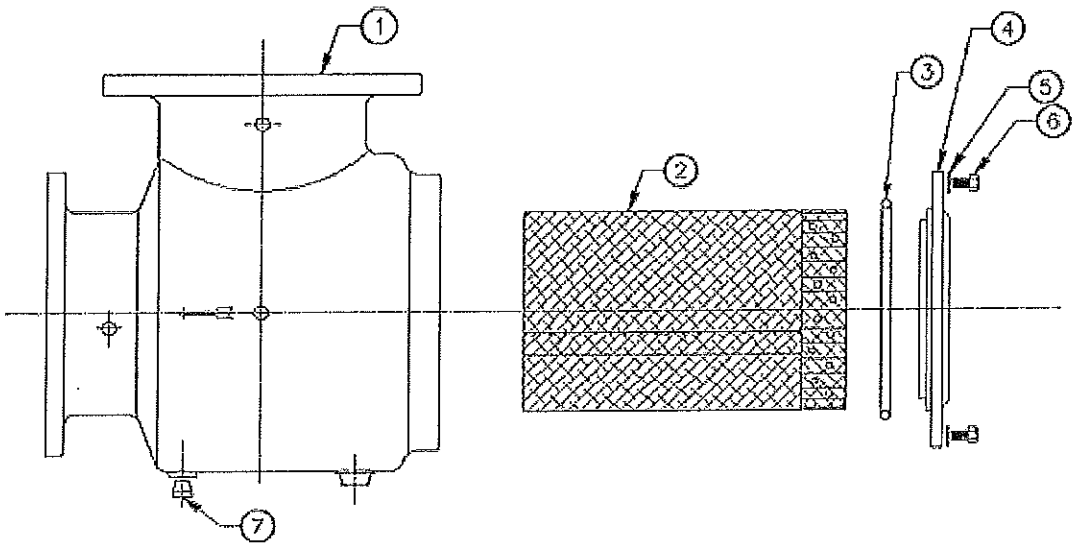
MAKING ENERGY MAKE SENSE™

ARMSTRONG FLUID TECHNOLOGY
ESTABLISHED 1934

ARMSTRONGFLUIDTECHNOLOGY.COM

SUCTION GUIDE PARTS

MODEL NUMBER SG-43



ITEM NO.	PART DESCRIPTION	PART NUMBER	ARMSTRONG BAR CODE
1	BODY	516846-211	
2	STRAINER ASSEMBLY	516897-000	
3	O-RING - edpm, 4.109I.D.x.139cs	AS1270-243	
4	COVER	516886-231	
5	WASHER - stl 5/8" plain (SAE)	927121-100	
6	HEX HEAD CAP SCREW - 5/8"-11 x1"	911125-109	
7	PIPE PLUG - 3/4" npt sq hd	939021-204	

NOTES:

SUPPORT PIPE NOT FURNISHED USE UNTHREADED STEEL PIPE

START-UP STRAINER MUST BE REMOVED AFTER A SHORT RUNNING PERIOD

STRAINER ASSEMBLY INCLUDES PERMANENT AND START-UP STRAINER

PERMANENT STRAINER PERFORATION HOLE SIZE --- .125" DIA.

ARMSTRONG

FILE NO:	35.80
DATE:	Jan. 20, 2009
SUPERSEDES:	10.83
DATE:	Jan. 11,1993

INSTALLATION AND OPERATING INSTRUCTIONS

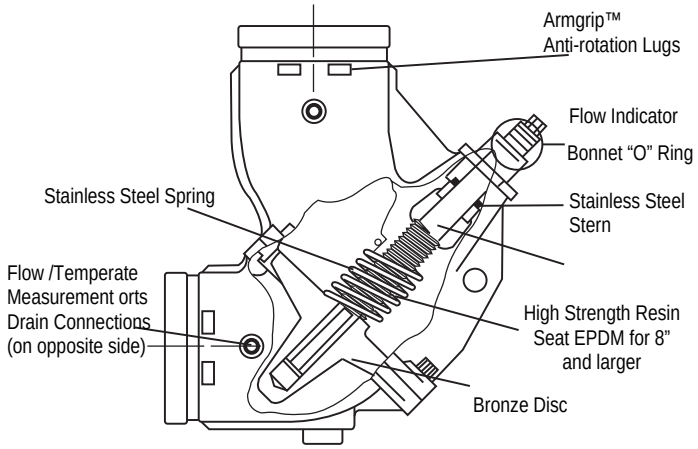
Armstrong Model FTV Grooved End Flo-Trex Combination Valve

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 The Armstrong Model FTV Flo-Trex Combination Valves are designed for installation on the discharge side of centrifugal pumps. The Armstrong Combination Valve incorporates three functions in one valve:

- Drip- tight, shut-off valve
- Spring closure design, Non-slam check valve



Armstrong Model FTV-A Flo-Trex Combination Valve

2.0 INSTALLATION

2.1 The valve should be mounted to a spool piece on the discharge side of the pump. Spool piece required is based on a minimum recommended space of 12" for pump sizes 2x2 to 6x6 and 24" for pump sizes 8x8 to 12x12.

2.2 It is not recommended to mount a valve directly to the pump as this could cause undesirable noise in the system.

2.3 Sufficient clearance around the valve should be left for valve removal or repair.

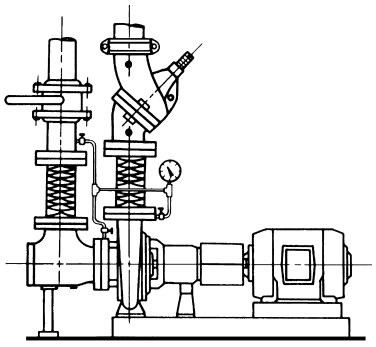
2.4 Install valve in the direction of the flow arrows on the valve body.

2.5 The valve can be mounted to flanged equipment using Armgrip™ Anti-Rotation Flange Adapter or industry standard grooved coupling, suitable for system pressure and temperatures encountered.

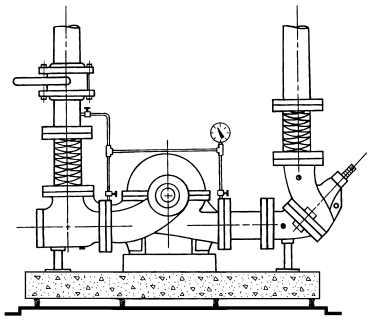
2.6 The Armstrong Model FTV valve bodies have anti-rotation lugs on the inlet and outlet. These lugs, combined with the Armgrip™ Flange Adapters, provide a ridged rotation free installation.

2.7 The valve body has been designed to handle the weight of the pump on vertical in-line installations. The body is not designed to support the piping weight. It is recommended that the piping be supported by hangers. Pipe supports should be provided under the valve and strainer bodies.

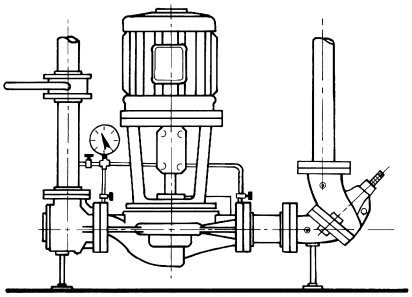
TYPICAL INSTALLATIONS



Base-Mounted Single Suction



Base-Mounted Double Suction



Vertical In-Line

ARMSTRONG

3.0 ARMSTRONG ARMGRIP™ FLANGE ADAPTER INSTALLATION

3.1 Position the two halves of Armstrong Armgrip™ Flangde Adapter on the valve body (fig.1) ensuring that the lugs on each half of the flange adapters are located between the anti-rotation lugs on the valve body. Insert two bolts of specified size (Table 1) to secure the halves of the flange adapter to the valve body (fig. 2). The gasket cavity should face out to the adjoining flange.

Fig. 1

Fig. 2

Fig. 3

Armgrip™ Flange Adapter Details				
Valve Size	125 psi/150 psi Ductile Iron		250 psi/300 psi Ductile Iron	
	Bolt		Bolt	
	No.	Size	No.	Size
2-1/2	4	5/8	8	3/4
3	4	5/8	8	3/4
4	8	5/8	8	3/4
5	8	3/4	8	3/4
6	8	3/4	12	3/4
8	8	3/4	12	7/8
10	12	7/8	16	1
12	12	7/8	16	1-1/8

Table 1

Recommended Bolt Tightening Procedure

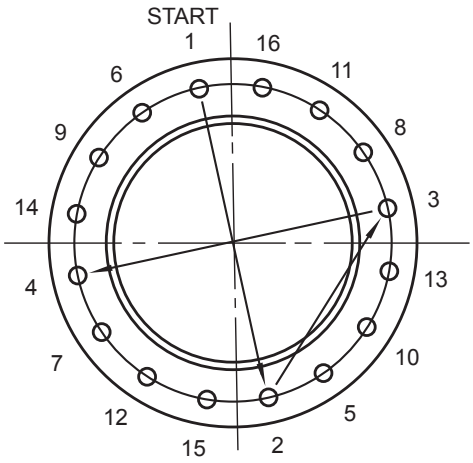


Fig. 4

3.2 Lubricate the inner and outer diameter of the gasket with the lubricant provided or a similar non-petroleum base water soluble grease.

3.3 Press the gasket firmly into the flange cavity ensuring that the sealing lip is pointed outward. When in place, the gasket should not extend beyond the end of the pipe (fig.3).

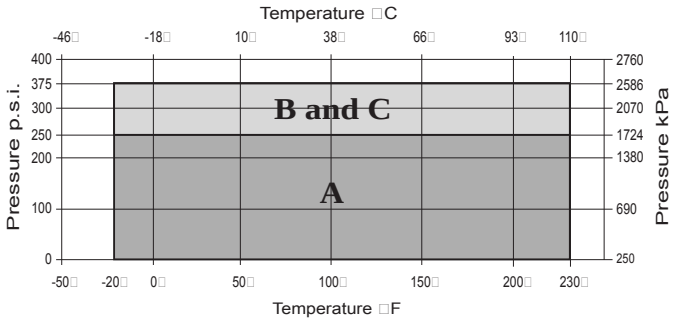
3.4 Position the adjoining flange or the pipe to the Armgrip™ Flange Adapter and install the remaining bolts. The two locking bolts should be tightened first in order to position the flanges correctly as shown in fig.1.

Note: Care should be taken to ensure that the gasket is not pinched or bent between flanges

3.5 Tighten remaining nuts evenly, following bolting instructions (fig.4), so that the flange faces remain parallel. Flange bolts should be tightened to 70 ft/lbs torque minimum to assure firm metal-to-metal contact. When raised face flanges are used, there will be a gap between the faces of the outer diameter.

3.6 Flange gaskets are not interchangeable with other mechanical pipe couplings or flange gaskets.

4.0 PRESSURE-TEMPERATURE LIMITS



Note: for temperatures between 230°F and 300°F (110°C and 149°C) specify Viton Elastormers.

LEGEND	
A	Armgrip ductile iron flange adapters for ANSI 150# flanges
B	Armgrip ductile iron flange adapters for ANSI 300# flanges
C	Grooved end with 375 p.s.i. rated pipe coupling

ARMSTRONG

5.0 FIELD CONVERSION (Straight to Angle pattern valve)

5.1 Open valve at least one complete turn.

5.2 Remove the body bolts from valve body using Allen Key.

5.3 Rotate one half of the valve body 180º making sure the lower valve seat and "O" Ring stay in position. Inspect the "O" Ring for any cuts or nicks and replace if necessary.

5.4 Replace body bolts and torque evenly to 70 ft/lbs

6.0 FLOW MEASUREMENT

6.1 Where approximate indication of flow is acceptable the Armstrong Flo-Trex valve can be used.

6.2 FLOW MEASUREMENT VALVE IN WIDE OEN POSITION

6.2.1 Measure and record the differential pressure across the valve using an Armstrong CompuFlo Meter with high pressure range transducer or pressure gauges with PMP adapters. Caution: Safety glasses should be used and the probe should not be left inserted into fittings for prolonged periods of time (overnight, etc), as leakage from the PMP may occur when probe is removed.

6.2.2 Refer to Flo-Trex Performance Curves with valve in full open position (fig.4).

Locate Pressure Differential on left hand side of chart and extend line horizontally across to valve size being used. Drop line vertically down and read flow rate from bottom of chart.

6.3 DETERMINING FLOW RATE WITH VALVE IN THROTTLED POSITION

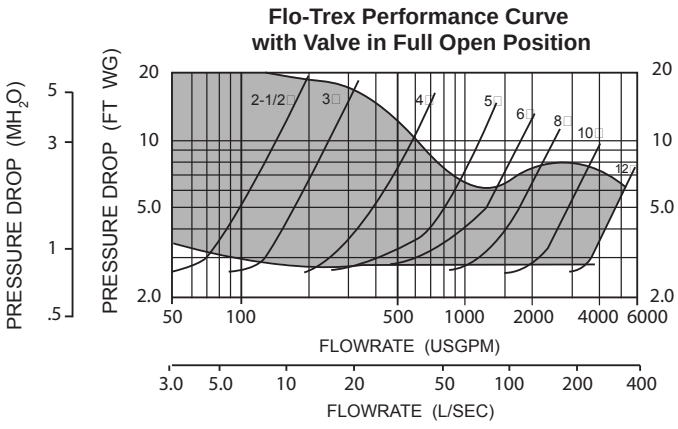


Fig. 5

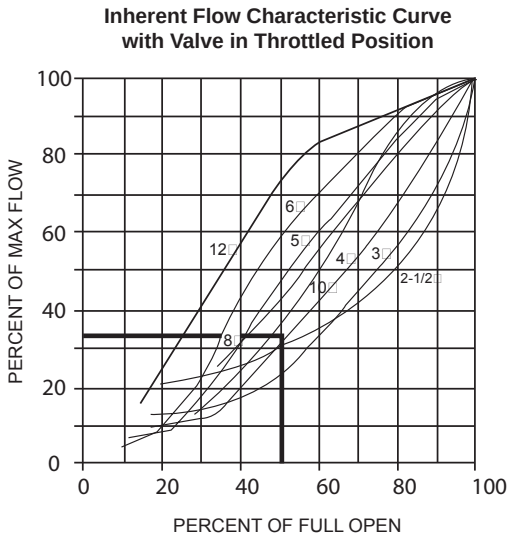


Fig. 6

6.3.1 Record the size of valve and stem position using the Flow Indicator Scale (page 6). Calculate percentage of valve opening referring to table below:

Valve Size	2½	3	4	5	6	8	10	12
Number of Rings (valve full open)	5	5	6	9	10	12	18	28

6.3.2 Measure and record the differential pressure across the valve in the throttled position.

6.3.3 Locate percentage of valve opening on the bottom scale of Flow Characteristic Curve (fig.6). Project line vertically up to intersect with the Valve Characteristic Curve and from this point project line horizontally across to the left of the chart and record the percentage of maximum flow rate.

6.3.4 On the Flo-Trex Performance Curve (fig.5) locate the differential pressure obtained in Step 6.3.2 and project line horizontally across to intercept with Valve Performance Curve. Drop a line vertically down to read the flow rate at the bottom of the chart.

6.3.5 To calculate flow rate of valve in the throttled position, multiply the flow rate from Step 6.3.4 by the percentage flow rate from Step 6.3.2 divided by 100.

Example: Valve size 4 in.
Differential Pressure in 5.4 ft. (1.65 m)
Number of rings open 3, 3 rings ÷ 6 rings x 100 = 50% throttled

- From the Flo-Trex Performance Curve (fig.5), a 4 in. valve with 5.4 ft. pressure drop (1.65 m) represents a flow of 400 USgpm (25.2 l/s)
- From Flow Characteristic Curve (fig 6), a 4 in. valve, 50% open, represents 34% of maximum flow.
- Approximate flow of a 4 in. valve, with a 5.4 ft. (1.65 m) pressure drop when 50% throttled is:

$$\frac{400 \times 34}{100} = 136 \text{ USgpm} \left(\frac{25.2 \times 34}{100} = 8.57 \text{ l/s} \right)$$

Note: To prevent premature valve failure it is not recommended that the valve operate in the throttled position with more than 25 ft pressure differential. Instead the pump impeller should be trimmed or valves located elsewhere in the system to partially throttle the flow.

Flow Indicator Scale

The valve stem with its grooved rings and positioning sleeve indicates the throttled position of the valve. The quarter turn graduations on the sleeve, with the scribed line on the stem, provide for approximate flow measurement.

Note: The valve is shipped in the closed position. The indicator on the plastic sleeve is aligned with the vertical scribed line on the stem.

7.0 OPERATION

7.1 To assure tight shut off the valve must be closed using a wrench with 25 to 30 ft/lbs of torque.

7.2 To assure trouble-free check valve operation and shut off operation, the valve should be periodically opened and closed to keep valve seat and valve disc guide stem free of build up of system contaminants.

8.0 REPACKING OF FTV VALVE UNDER FULL SYSTEM PRESSURE

8.1 Should it be necessary, stem “O” Ring can be changed under full system pressure. Caution: Safety glasses should be worn.

8.2 Record the valve setting.

8.3 Turn the valve stem counterclockwise until the valve is fully open and will not turn any further. Torque to a maximum force of 45 ft/lbs. This will ensure good metal-to-metal contact and minimum leakage.

8.4 The valve bonnet may now be removed. There may be a slight leakage, as the metal-to-metal back seating does not provide a drip-tight seal.

8.5 Clean exposed portion of valve stem (Do not scratch).

8.6 Remove and replace the “O” Ring and gasket.

8.7 Install the valve bonnet.

8.8 Tightening valve bonnet is necessary to stop any leaks.

8.9 Open valve to balance set point as recorded in 8.2.

9.0 MAXIMUM NUMBER OF TURNS FULL OPEN VALVE

Note: On valve sizes 2-1/2” and 3”, full open position of valve is 5 turns. However valve will open to 5-1/2 turns which is just back of seating of valve.

10.0 SEAT REPLACEMENT

10.1 Drain system and remove valve from piping.

10.2 Remove the body bolts from the body using an Allen Key.

10.3 Remove seat and “O” Ring. “O” Ring is not used on valves 8” and larger.

10.4 Inspect and clean “O” Ring cavity and install new “O” Ring and seat. Valve disc stem also should be inspected and replaced if worn. Valve stem “O” Ring should be replaced at this time. Refer to section 8.

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AIR RELEASE VALVES

OPERATION, INSTALLATION AND MAINTENANCE INSTRUCTIONS

The Air Release Valves are fully automatic valves and require no regular maintenance.

The purpose of the "Air Release Valves" is to release air which accumulates in a pipeline during its operation.

OPERATION: The valve, as shipped, is a normally open valve. As the system is being filled, air is vented through the small orifice. When the fluid enters the valve, the float raises and shuts off the orifice, preventing any leakage. As air accumulates and enters the valve, displacing fluid, the float drops, allowing the venting orifice to open. This cycle is repeated as often as necessary during the pumping cycle.

INSTALLATION: Air Release Valves must be installed in a vertical position at high points on a piping system. The valve's inlet must face downward. A shut-off valve should be installed below each valve in the event servicing is required. A drain line is recommended, as the valve may "spit" a small amount of fluid during venting. To vent air quickly during initial start-up, remove the ½-inch pipe plug in the cap of the air vent.

MAINTENANCE: No regular maintenance is necessary; however, periodic inspection for leakage and function can be performed. Close the inlet service valve and slowly remove the ½ -inch pipe plug. The water level within the valve should be within 1" of the top of the opened drain plug. If not, the valve may not be functioning properly and the valve should be removed and inspected for wear and/or possible damage from foreign matter.

Replacement parts are available. Contact Metraflex, your nearest representative or www.metraflex.com.

CUSTOMER _____

PROJECT _____

ENGINEER _____

ARCHITECT _____

PRO. OR P.O. NO. _____

Metraflex.
for pipes in motion

DESCRIPTION:

Air Release Valves

Operation, Installation & Maintenance Instructions

DRAWING BY:	DATE:	DRAWING NO.
JT	08-09-06	AIR RLS VLV-OIM

Installation, Operation, and
Maintenance manual

ecocirc® XL

Bell & Gossett
a xylem brand

Table of Contents

1 Introduction and Safety

1.1 Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance

CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

1.2 Safety terminology and symbols

Hazard levels

Hazard level	Indication
DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	• A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:

Electrical Hazard:

Hot surface hazard

Hot surface hazards are indicated by a specific symbol that replaces the typical hazard level symbols:

CAUTION:

Qualified personnel

WARNING:

This product is intended to be operated by qualified personnel only.

1.3 Environmental safety

The work area

Always keep the station clean.

Waste and emissions regulations

Observe these safety regulations regarding waste and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

Recycling guidelines

Always follow local laws and regulations regarding recycling.

1.4 Spare parts

WARNING:

Only use original spare parts to replace any worn or faulty components. The use of imitation spare parts may cause malfunctions, damage, and injuries as well as void the warranty and the UL listing.

2 Transportation and Storage

2.1 Inspect the delivery

1. Inspect the package for damage or missing items upon delivery.
2. If applicable, unfasten the product by removing any screws, bolts, or straps. For your personal safety, be careful when you handle nails and straps.
3. Remove packing material from the product.
4. Dispose of all packing material in accordance with local regulations.
5. Inspect the product to determine if any parts have been damaged or are missing.

Contact your local B&G representative if there are any issues.

2.2 Transportation guidelines

Precautions

WARNING:

- Observe accident prevention regulations in force.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.

Check the gross weight that is indicated on the package in order to select proper lifting equipment.

Position and fastening

The unit should be transported in an upright position as indicated on the package. Make sure that the unit is securely fastened during transportation and cannot roll or fall over. The product can be safely transported at ambient temperature from -40°F to +158°F (-40°C to +70°C) with humidity <95% (non-condensing) and protected against dirt, heat source, and mechanical damage.

2.3 Storage guidelines

2.3.1 Storage location

NOTICE:

- Protect the product against humidity, dirt, heat sources, and mechanical damage.
- The product must be stored at an ambient temperature from -13°F to +131°F (-25°C to +55°C) and humidity < 95% (non-condensing).

3 Product Description

3.1 Pump design

- The ecocirc XL is a large wet rotor pump with energy efficient, electronically commutated permanent magnet motor.
- The pump is designed for systems with variable flow rates to optimize pump operation thus reducing energy consumption. The pump can be set to any one of the multiple operating modes available, with each designed for a specific application to achieve high performance and maximum energy savings.
- A single pump can handle heating, cooling, and plumbing applications with a choice for cast iron or bronze lead-free body pumps to handle HVAC and potable water applications. The pumps are also suitable for a 50/50 percent water/glycol circulating fluid. The built-in electrical overload and dry run protection provide safety and protection to pump from damage.

Intended use

WARNING:
California Proposition 65 warning! This product contains chemicals known to the state of California to cause cancer and birth defects or other reproductive harm.

The pump is suitable for:

- Potable hot water (only with bronze pump body models)
- Hot water heating systems
- Cooling and cold water systems

The pump can also be used for:

- Solar systems
- Geothermal applications

Improper use

DANGER:
Do not use this pump to handle flammable and/or explosive liquids.

WARNING:
Unintended use of the pump may create dangerous conditions and cause personal injury and damage to property.

WARNING:
Do NOT install this pump in swimming pools or marine areas. Failure to follow these instructions could result in serious personal injury, death and/or property damage.
THIS IS A NON-SUBMERSIBLE PUMP

WARNING:
Do NOT exceed the maximum working pressure of the pump. This information is listed on the nameplate of the pump.

NOTICE:
Do not use this pump to handle liquids containing abrasive, solid, or fibrous substances, toxic or corrosive liquids, potable liquids other than water, or liquids not compatible with the pump construction material. Water pH must be maintained between 7-9 and water hardness must not exceed 14 grains/ gallon.

An improper use of the product leads to the loss of the warranty.

3.2 Product nomenclature

Example: ecocirc XL B 15–75	
ecocirc XL	high efficiency pump series
B	Pump type: Blank = Cast iron B = bronze pump body for potable hot water pumping
-15	Maximum pump head (FT)
-75	Maximum pump flow rate (GPM)

3.3 Technical data

Feature	Description
Motor model	Electronically commutated motor with permanent magnet rotor
Series	ecocirc XL
Rated voltage	1 x 115 V ±10% 1 x 208–230 V ±10%
Frequency	50/60 Hz
Power consumption	The maximum power consumption is indicated on the pump nameplate.
IP protection	IP 44
Insulation class	Class 155 (F)
Maximum working pressure	The maximum pressure is indicated on pump nameplate 175 PSI (12 bars)
Liquid temperature range	14°F (-10°C) to 230°F (110°C) Up to 149°F (+65°C) is recommended for domestic hot water pumps
Ambient temperature range	32°F (0°C) to 104°F (40°C)
Ambient humidity	≤ 95% non-condensing
Pumping media	Water and water/glycol mixtures[1] up to 50%.
Sound pressure	See *Sound pressure levels* (page 5).
EMC (electromagnetic compatibility)	EN 55014-1:2006 + A1:2009 + A2:2011, EN 55014-2:1997 + A1:2001 + A2:2008, EN 61000-3-2:2006 + A1:2009 + A2:2009, EN 61000-3-3:2008, 61800-3:2004+A1:2012.
Leakage current	< 3.5 mA
I/O auxiliary +15 VDC power supply	Imax < 40 mA
Fault signal relay	Vmax < 250 VAC Imax < 2 A
CSA certification	NSF/ANSI-372 compliant (bronze body parts)
UL/cUL Listed	UL 778 - Motor operated water pump UL60730, UL1004

[1] The pump can be used with water/propylene glycol mixtures up to 50% with a maximum viscosity of 50cST at 14°F (-10°C). The pump has built-in overload and thermal protection to protect the pump from overload due to increased fluid viscosity. Pump performance is based on 77°F (25°C). Therefore pumping of glycol mixtures will affect max performance, depending on mixture concentration and temperature.

3.4 Sound pressure levels

Nominal pump HP	Sound pressure level (approximate values)
1/6	≤ 43 dB (A)
1/2	≤ 48 dB (A)
1	≤ 52 dB (A)
2	≤ 55 dB (A)

3.5 Scope of delivery

Inside the package you will find:

- Pump unit
- Insulating shells for pump body – for heating applications
- O-ring to be used as replacement between motor housing and pump body
- Two (2) gaskets for flanged connection
- 20 mm x ½" NPT electrical fitting
- IOM and Quick Start guide
- Two (2) M16 x 1.5 connection cable fitting

3.6 Accessories

- Companion flanges
- Fastener Packs consisting of 4 bolts and 4 nuts (for 2-bolt models)
- Fastener Packs consisting of 8 bolts and 8 nuts (for 4-bolt models)
- Pressure sensor (for details see section 5.2.10 of this manual)
- Temperature sensor (for details see section 5.2.10 of this manual)
- Wireless module
- RS-485 module

4 Installation

Precautions

WARNING:

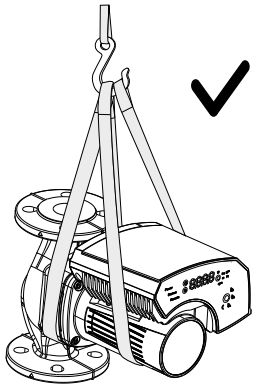
- Observe accident prevention regulations in force.
- Use suitable equipment and protection.
- Always refer to the local and/or national regulations, legislation, and codes in force regarding the selection of the installation site, plumbing, and power connections.

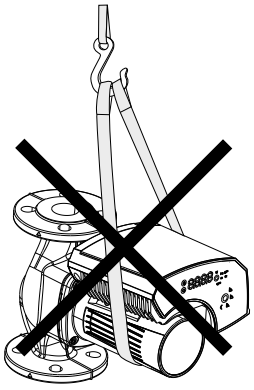
4.1 Pump handling

WARNING:

Observe local codes and regulations setting the limits for manual lifting or handling.

Always lift the pump by the motor housing or pump body. If the pump weight exceeds the manual handling limits, use lifting equipment with lifting straps.





4.2 Tools required for pump installation

- T-Handle with allen screw
- Control screw driver – with 2 mm blade size

Nominal HP	Allen screw size (mm)	T-handle length (in)
1/12	5	8
1/6	5	8
1/2	6	10
1	8	12
2	8	12

4.3 Facility requirements

4.3.1 Pump location

DANGER:

Do not use this unit in environments that may contain flammable/explosive or chemically aggressive gases or powders.

Guidelines

Observe the following guidelines regarding the location of the product:

- Make sure that the installation area is protected from any fluid leaks, or flooding.
- If possible, place the pump slightly higher than the floor level.
- Provide shut-off valves on the suction and discharge sides of the pump.
- The relative humidity of the ambient air must be less than 95% non-condensing.
- This pump is suitable for indoor use only.

CAUTION:

CAUTION: PROPERTY DAMAGE HAZARD. It is not advisable to install circulators in an attic or upper floor over finished living space. If the circulator must be installed over head, or over expensive equipment, provide adequate drainage in the event of leakage. Failure to follow these instructions could result in property damage.

4.3.2 Minimum inlet pressure at the suction port

The values in the table below are the inlet pressures above the atmospheric pressure.

Nominal Suction Diameter	Fluid temperature 77°F (25°C)	Fluid temperature 203°F (95°C)	Fluid temperature 230°F (110°C)
1½"	4.5 PSI	16 PSI	25 PSI
2"	4.5 PSI	16 PSI	25 PSI
3"	7.5 PSI	19 PSI	28 PSI

NOTICE:

- Ensure that the suction pressure is never below the values specified above, as this could cause cavitation and damage the pump.
- The inlet pressure plus the pump pressure against a closed valve must be lower than maximum admissible system pressure.

4.3.3 De-rating table

The following table indicates percent decrease in input power draw, with the increase in temperature of circulating water and the ambient.

Ambient temperature	Fluid Temperature (°C)			
	-10	60	95	110
32°F–77°F (0°C–25°C)	100%	100%	100%	100%

Ambient temperature	Fluid Temperature (°C)			
	-10	60	95	110
86°F (30°C)	100%	100%	80%	70%
104°F (40°C)	100%	100%	70%	55%

4.3.4 Piping requirements

Precautions

CAUTION:
- Use pipes suited to the maximum working pressure of the pump. Failure to do so can cause the system to rupture, with the risk of injury.
- Make sure that all connections are performed by qualified installation technicians and in compliance with the regulations in force.
- Do not use a shut-off valve on the discharge side in the closed position for more than a few seconds. If the pump must operate with the discharge side closed for more than a few seconds, a bypass circuit must be installed to prevent overheating of the water inside the pump.

Piping checklist

- Pipes and valves must be correctly sized.
- Pipe work must not transmit any load or torque to pump flanges.
- Be sure to minimize any pipe-strain on the pump:
  - Support suction and discharge piping by the use of pipe hangers near the pump.
  - Line up the vertical and horizontal piping so that the bolt-holes in the pump flanges match the bolt-holes in the pipe flanges.
  - Do not attempt to spring the suction or discharge lines in position. This may result in unwanted stress in the pump body, flange connections and piping.
  - The code for pressure piping (ANSI B31.1) lists many types of supports available for various applications.

4.4 Electrical requirements

- The NEC and local codes must be followed at all times. If a branch circuit is fitted with ground fault circuit breaker, ensure that the circuit breaker is suitable for use with inverter-driven appliances.

Electrical connection checklist

Check that the following requirements are met:
- The electrical wires are protected from high temperature and vibrations.
- The current type and power supply voltage connection must correspond to the specifications on the name plate on the pump.
- Use wires at least 14 AWG to supply power to the pump. Follow all local and NEC wiring codes and practices.

The electrical control panel checklist

NOTICE:
The electrical supply must match the electrical rating of the pump. Improper combination could fail to guarantee protection of the unit.

Check that the following requirements are met:
- The control panel circuit breaker is sized properly to protect the pump against short-circuit.
- The pump has built in overload and thermal protection, no additional overload protection is required.

The motor checklist

Electrical supply and grounding wires must be suitable for at least 194°F (90°C).

4.5 Pump installation

1. Install the pump according to the liquid flow direction.
   - The arrow on the pump housing shows the flow direction through the pump body.
   - The pump must be installed with the motor in a horizontal position. For more information about allowed positions, refer to the following image:

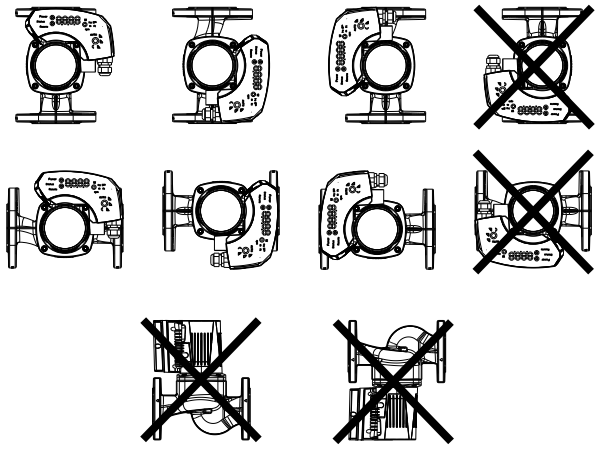


Figure 1: Allowed pump installation

2. If necessary, rotate the position of the motor for better visibility of the user interface.

   Section 4.6 below describes the procedure of changing of motor orientation.
3. If applicable, install the thermal insulation shells.
   - Only use the pump thermal shells that are included in the delivery. Do not insulate the motor housing, the electronics can overheat and cause the pump to thermally overload.
   - The thermal shells that are included with the pump must only be used in hot water circulation applications with fluid temperature above 68°F (20°C). The thermal shells are permeable to water vapor.
   - If the customer installs the vapor barrier insulation shells for cold water application, then the pump housing must not be insulated above the motor flange. The drain opening must be kept unobstructed in order that the accumulated condensation can run out.

4.6 Change the position of the motor housing

WARNING:
- Drain the system if possible or close the service valves on both sides of the pump before disassembling the pump. The pumped fluid can be pressurized and may be scalding hot.
- There is the risk of escaping vapor when the motor is separated from the pump housing.

Electrical Hazard:

Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized.

CAUTION:

Burn hazard. During operation various surfaces on the unit will become hot. To avoid burn injury, use heat protective gloves.

WARNING:
- A strong magnetic field is created when the rotor is removed from or inserted into the motor housing. This magnetic field can be harmful to pacemaker wearers and others with medical implants. In addition, the magnetic field may attract metal parts to the rotor which can cause injuries and/or damage the bearing of the pump.

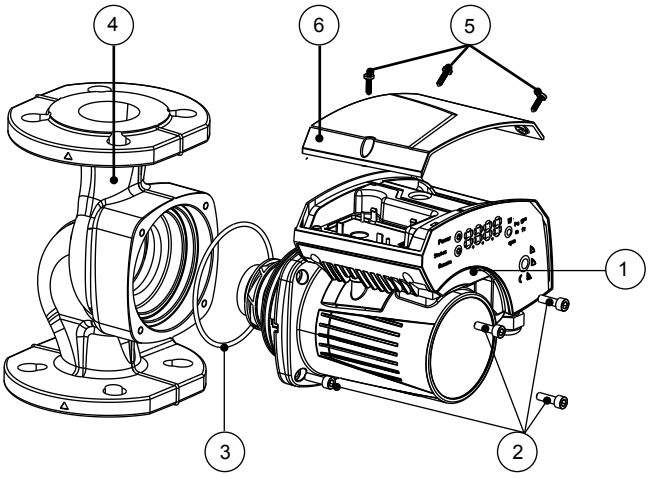


Figure 2: Change the position of the pump head

1. Loosen the four hex-head screws (2) that fix the motor to the pump housing (4) using the T-handle allen wrench described.
2. Rotate the motor (1) in 90° steps to the desired position.
3. In case of separation of the motor housing from the pump body (4):

   a) avoid removing the rotating assembly from motor housing;
   b) pay attention to the magnetic hazard listed before.

   A defective O-ring must be replaced. An O-ring is already available inside the package as spare part.
4. Properly align and tighten the four hex-head screws (2) that affix the motor to the pump body (4) according to the torque table given below in a criss cross pattern.

Nominal HP	Screw size	Torque
1/12 & 1/6	M6	90 in-lb
1/2	M8	170 in-lb
1 & 2	M10	340 in-lb

CAUTION:
Check for the presence of leaks after reassembling the pump.

4.7 Electrical installation

Precautions

WARNING:
- Make sure that all connections are performed by a qualified electrician in accordance with all applicable codes, ordinances and good practices. Failure to follow these instructions could result in serious injury, death and/or property damage.
- Before starting work on the unit, make sure that the unit and the control panel are isolated from the power supply and cannot be energized.

Grounding (earthing)

WARNING:
Reduced risk of electric shock during operation of this pump requires the provision of acceptable grounding.

Be sure the following are adhered to. Failure to follow these instructions could result in serious personal injury, death, and/or property damage.

- If means of connection to the supply connection box (wiring compartment) is other than grounded metal conduit, ground the pump back to service using a copper conductor at least the size of the circuit conductors supplying the pump.
- Connect the ground wire to the green grounding terminal in the wiring compartment.

The number of ON/OFF power cycles for the pump must be less than 3 times per hour and less than 20/24 hours. If more frequent start/stop cycles are required, the use of a dedicated start/stop input is recommended. See *External start/stop* (page 9).

4.7.1 Power supply connection

WARNING:
Do not make any connection in the pump control box unless the power supply has been switched off for at least 2 minutes.

For models with standard terminal block connection:

1. Open the terminal box cover removing the screws (5).
2. Thread the ½" NPT electrical fitting into the conduit connection of the pump.
3. Connect the cable according to the wiring diagram.
   a. Connect the ground wire, if used.
   b. Connect the wires.
4. Close the terminal box cover.

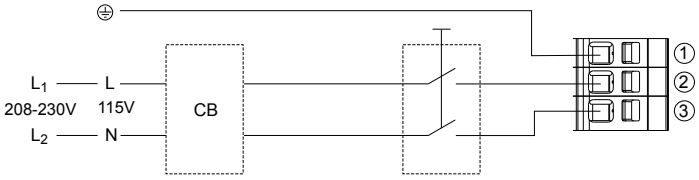


Figure 3: Wiring diagram

CAUTION:
If stranded wire is used to connect power to the pump, make sure that all the individual strands enter the terminal block as the wire is inserted. Peeled back strands can cause a short circuit hazard at the pump terminal block connections.

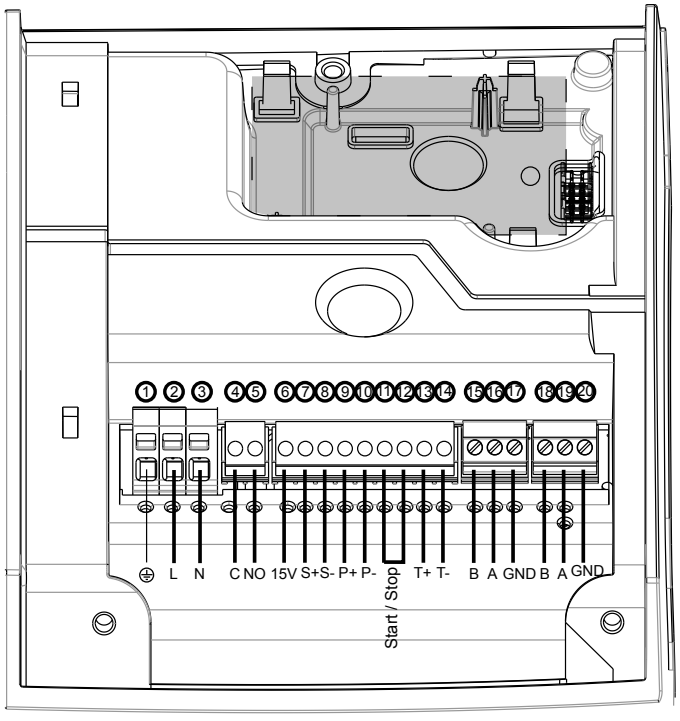


Figure 4: Connection diagram

For cable terminations, see above connection diagram.

4.7.2 I/O connections

1. Open the terminal box cover removing the screws (5). Refer to figure 2 on page 7. Use control screwdriver described under section 4.2 to access terminal blocks.
2. Connect the appropriate wires according to the terminal block diagram and the requirements of section *Connection assignment* (page 8) given below in section 4.7.3.
3. Close the terminal box cover.

- For a two-pump connection, wire them through a communication cable connecting the 2 RS-485 ports at the pumps to terminals 15, 16 & 17.

4.7.3 Connection assignment

- For all electrical connections use heat resistant wires or cable rated for at least 194°F (90°C). The cables should not touch the motor housing, the pump or the piping.
- Power and control wires must be run in separate channels.
- Metal conduit for power wiring must only be attached to 1/2" NPT conduit fitting.

NOTICE:
Cable glands are only available for low voltage wiring to protect against cable slippage and vapor ingress into the terminal box.

5 System Description

5.1 User interface

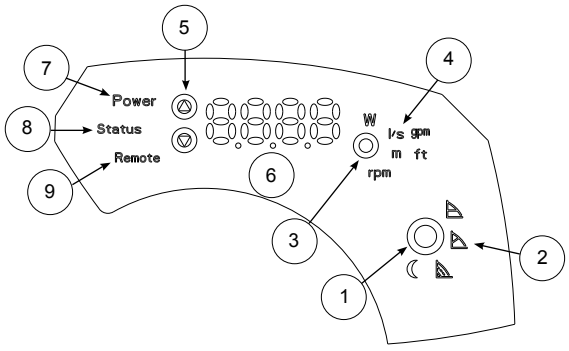


Figure 5: User interface diagram

1. Control mode button
2. Control mode indicators
3. Parameter button
4. Parameter indicators
5. Setting buttons
6. Numeric display
7. Power indicator
8. Status / Fault indicator
9. Remote control indicator

Hot Surface:
Burn hazard. During the normal operation, the pump surfaces may be so hot that only the buttons should be touched to avoid burns.

5.1.1 User interface locking/unlocking

The user interface will automatically lock if no button is pressed for ten minutes, or if the upper setting button (5) and the parameter button (3) are pressed for two seconds. See *User interface* (page 8).

If a button is pressed when the user interface is locked, the display (6) shows:

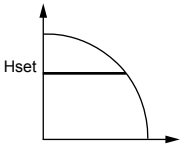
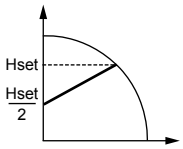
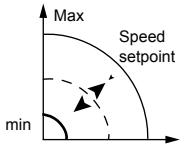
To unlock the user interface, press the upper setting button (5) and the parameter button (3) for two seconds. The display (6) will show:

Now it is possible to change the pump setting as required.

5.2 Functions

The main functions of the pump and control modes are selectable through the pump user interface and the embedded I/O. Advanced functions or communication features, can only be set via bus protocol or the optional Wireless module. See the electronic drive manual at www.bellgossett.com.

5.2.1 Control mode

Mode	Description
Constant pressure 	The pump maintains a constant pressure at any flow demand. The desired head of the pump can be set via user interface. See section 6.1.2 Change set point.
Proportional pressure 	The pump pressure is continuously increased/decreased depending on the increased/decreased flow demand. The maximum head of the pump can be set via user interface. See section 6.1.2 Change set point.
Fixed speed control 	The pump maintains a fixed speed at any flow demand. The speed of the pump can be set via user interface. See section 6.1.2 Change set point.

All the above control modes can be combined with the night mode function.

5.2.2 Night mode

The night mode cannot be used in cooling systems.

Prerequisite

- The pump is installed between boiler outlet and system supply.
- The night mode feature is initiated when the pump recognizes a water temperature change brought about by the boiler or high level control system.

The night mode is active only in combination with:

- Proportional pressure
- Constant pressure
- Fixed speed

This function reduces power consumption of the pump to the minimum when heating system is not running. An algorithm detects the water temperature change and automatically adjusts the speed of the pump.

The pump returns to the original set point as soon as the system restarts.

5.2.3 Δp-T control

This function adjusts the nominal differential pressure set point according to the temperature of the pumped media.

For details refer to the electronic drive manual on www.bellgossett.com

5.2.4 T-Constant temperature control

This functional mode changes the speed of the pump in order to maintain a constant temperature of the pumped media. It is suitable for

heating systems with fixed system characteristics, for example Domestic Hot Water Systems.

For details, refer to the electronic drive manual on www.bellgossett.com

5.2.5 ΔT constant

This function alters the speed of the pump in order to maintain a constant differential temperature of the pumped media.

For details, refer to the electronic drive manual on www.bellgossett.com

5.2.6 External start/stop

The pump can be started or stopped via an external dry contact or a relay that is connected to terminals 11 and 12. The pump unit is provided by default, with the terminals 11 and 12 jumpered. See Figure 4 on page 8.

NOTICE:

- The pump provides 5 VDC through the start / stop terminals.
- No external voltage must be provided to start / stop terminals.
- The cables connected to terminals 11 and 12 shall not exceed 65 feet in length.

5.2.7 Analog Input

The pump integrates a 0-10 V analog input at terminals 7 and 8. See terminal diagram figures for changing the setpoint. See Figure 4 on page 8.

When a voltage input is detected, the pump switches to fixed speed control mode automatically and starts to run according to the following diagram:

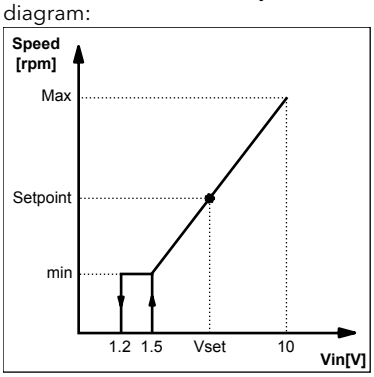


Figure 6: Voltage input detected

Pump stops at 1.2 V

Pump restarts at 1.5 V

5.2.8 Signal relay

A dry contact relay is provided at terminals 4 and 5. See connection diagram, figure 4 on page 8, for location. If there is a fault, the relay contact closes to display a red status light and the error code on the user interface display. See *User interface* (page 8). The relay contact closure can also be used to energize a remote fault display.

Ratings

- Voltage: 115/208 – 230/1
- Imax < 2 A

5.2.9 External sensors (optional)

The pump can be equipped with a differential pressure sensor and a temperature sensor according to the following table:

Sensor description	Type	Terminals
Differential pressure sensor 4-20mA	15 PSI 30 PSI	9 - 10
Temperature sensor	KTY83	13 - 14

Pressure sensor setup

1. Install pressure sensor on the pipe
2. Connect wires at terminals 9 and 10. See Figure 4 on page 8.
3. Power the pump on.
4. Upon startup, the pump detects the sensor and displays the setup menu.
5. Select the right sensor model and confirm the selection using the parameter button (3). See *User interface* (page 8).
6. The pump will run through the startup sequence and automatically start working in constant pressure mode.
7. The setpoint can be changed using the settings button (5). See *User interface* (page 8).

External temperature sensor setup

The external temperature sensor setup and related control modes are available only through RS-485 or wireless module connection.

For details refer to the electronic drive manual on www.bellgossett.com

Wireless module

The wireless module is an optional module, to be coupled with the ecocircXL circulators. When correctly configured, it generates a wireless network accessible by a mobile device, tablet or a personal computer. See wireless module instructions manual for details.

5.2.10 Communication bus

The pump has a built-in RS-485 communication channel (terminals 15-16-17). See Figure 4 on page 8.

The pump can communicate with external BMS systems via Modbus or BACnet protocol. For a complete description of the protocols, refer to the electronic drive manual at www.bellgossett.com.

NOTICE:

When remote control is active, the set points and control modes are managed only through communication channels and cannot be changed via the user interface. The displayed quantity and unit of measurement remain active on the user interface.

5.2.11 Automatic two-pump operation

Backup operation (bcup)

Only the lead pump runs. The second pump starts in case of failure of the lead pump.

Alternate operation (alte)

Only one pump runs at a time. The working time is switched every 24 hours so that workload is balanced between both pumps. The second pump is started immediately in case of failure of the lead pump.

Automatic parallel operation (para)

Both pumps run simultaneously at the same set point. The lead pump determines the behavior of the full system and is able to optimize the performance. To guarantee the required performance with the minimum power consumption, the lead pump starts or stops the lag (second) pump to satisfy system requirement of flow and head.

Forced parallel operation (forc)

Both pumps run simultaneously with the same set point. The master pump determines the behavior of the full system.

6 System Setup and Operation

Precaution

CAUTION:

Always wear protective gloves when handling the pumps and motor. When pumping hot liquids, the pump and its parts may exceed 40°C (104°F).

NOTICE:

The pump must not run dry as this can result in the destruction of the bearings. Fill the system correctly with liquid and vent the air before first start-up.

NOTICE:
- Never operate the pump with discharge valve closed for longer than a few seconds.
- Do not expose an idle pump to freezing conditions. Drain all liquid that is inside the pump. Failure to do so can cause liquid to freeze and damage the pump.
- The suction plus shut-off discharge pressure must not exceed the pump pressure rating.
- Do not use the pump if cavitation occurs. Cavitation can damage the internal components.

6.1 Configure the pump settings

Change the pump settings using one of the following methods:
- User interface
- Bus communication
- Wireless communication

6.1.1 Change the communication parameters

Change pump communication parameters. See *User interface* (page 8).

1. Switch off the pump.
   Wait until the power indicator light turns off.
2. Switch on the pump.
3. When the display shows **COMM**, press the parameter button (3) to access the communication menu.
4. Select one of the four below parameters using the settings button (5).
   - **BAUD** = baud rate setup (available values 4.8 - 9.6 - 14.4 - 19.2 - 38.4 - 56.0 - 57.6 kbps)
   - **PROT** = communication protocol (available protocols “mod” = Modbus; “bac” = BACnet
   - **ADDR** = address setup (available address 1-247 for Modbus 0–127 for BACnet)
   - **MODU** = optional module setup (“none” = no module; “wifi” = Wireless module; “485” = RS-485 module)
5. Press the parameter button to enter the submenu
6. Edit the values using setting buttons.
7. Press the parameter button to confirm and store the new values.
8. Press mode button to exit the submenu.
9. Repeat above procedure for each of the three parameters.

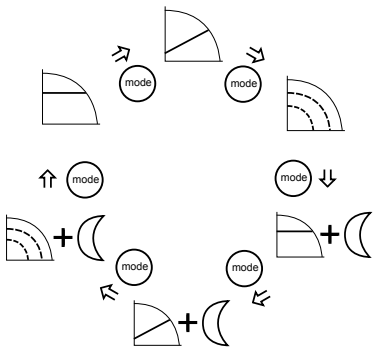
If no buttons are pressed for 10 seconds, then the pump exits the current menu and continues start-up procedure. All the parameters that are changed but not confirmed restore back to previous state.

NOTE: The communication setup menu is available only on display and not through communication bus.

6.1.2 Change the control mode

The pump can be controlled by a BMS (Building management system) or other devices through the RS-485 communication port via Modbus or BACnet protocol.

The following instructions are used when making the change on the user interface. See *User interface* (page 8).
- Press the operating mode button (1).
- The operating modes are cyclically changed by the pressed button.



6.1.3 Change the set point

See *User interface* (page 8).

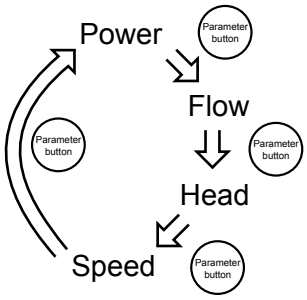
1. Press one of the arrow setting buttons (5).
   The display starts to blink.
2. Change the value using the buttons (5).
3. Wait 3 seconds to store and activate the new set point.
   The display will stop blinking to confirm the change.

NOTICE:
If a check valve is installed on the system, ensure that the pump head is sufficient to allow flow through the system.

6.1.4 Change the displayed unit of measurement

Power, Flow, Head and Speed parameters cyclically change by pressing the parameter button (3). In order to change the unit of measurement, follow these steps:

1. Press the button (3) to change the unit of measurement. See *User interface* (page 8).



2. When flow and head are displayed, by pressing the button (3) for more than one second at each of these parameters, the unit of measurement automatically changes as below:
   - Flow: m3/h ↔ gpm (US)
   - Head: m ↔ ft

6.2 Start or stop the pump

CAUTION:
- The pump must not run dry as this can result in premature failure of the bearings in a very short time. Fill and vent the system correctly before first start-up. The pump rotor chamber will be vented after the pump is powered on with an automatic air venting procedure. "deg" will be displayed indicating degassing process.

NOTICE:
The system cannot be vented through the pump.

- Start the pump in one of the following ways:
  - Switch on power to supply the pump.
  - Close the start/stop contact by jumpering terminals 11 and 12 or through a remote dry contact..
  - Send start command through the communication bus.

  The pump starts pumping in constant pressure mode with the following default set points:

7.5 ft	15-XX (Max head 15 ft)
10 ft	20-XX (Max head 20 ft)
18 ft	36-XX (Max head 36 ft)
20 ft	40-XX (Max head 40 ft)
27.5 ft	55-XX (Max head 55 ft)
32.5 ft	65-XX (Max head 65 ft)

  For more information about how to change setting, see *Configure the pump settings* (page 10).
- Stop the pump in one of the following ways:

- Switch off power supply to the pump.
- Open the start/stop contact.
- Send stop command through the communication bus.

6.2.1 Automatic air venting procedure

At each power-on of the pump unit, an automatic air venting procedure is executed. During this phase, the user interface displays "deg" (degassing) and a count-down begins until the completion of the procedure.

The air venting procedure can be recalled or skipped:

- Manually by pressing simultaneously the two buttons (5). See *User interface* (page 8). The feature will remain disabled until power to pump is disconnected.

The procedure can be permanently enabled or disabled by:

- Manually by pressing simultaneously the two buttons (5) for at least 10 seconds. See *User interface* (page 8). Or
- Via communication bus. See the electronic drive manual on www.bellgossett.com.

6.2.2 Twin pump configuration setup

The circulators are configured as single units by factory default. To activate the 2-pump functions, follow the procedure below only on one of the two units. The other unit will be auto configured. The working modes are described in *Automatic two-pump operation* (page 9) and *Activate automatic two-pump operation* (page 11).

6.2.3 Activate automatic two-pump operation

Once the communication cable is connected, configure only the “lead” pump. The twin pump submenu for this configuration is available at each power-on, when the drive is displaying **SING** (which stands for “Single Pump).

The following procedure must be executed during the start-up phase of the pump.

1. Enter the two-pump sub menu when the display is showing **TWMA (two-pump master)** or **TWSL (two-pump slave)**.
2. Select the applicable two-pump operation.
   - **bcup** = backup operation
   - **alte** = alternative operation
   - **para** = automatic parallel operation
   - **forc** = forced parallel operation
3. Push the parameter button to activate the new setting.

The second pump is configured by the lead pump.

7 Maintenance

Precaution

Electrical Hazard:

Disconnect and lock out electrical power before installing or servicing the unit.

Wait 2 minutes before opening the conduit box.

WARNING:

- Always wear protective gloves when handling the pumps and motor. When pumping hot liquids, the pump and its parts may exceed 40°C (104°F).
- Maintenance and service must be performed by skilled and qualified personnel only.
- Observe accident prevention regulations in force.
- Use suitable equipment and apply personal protection.
- Risk of property damage, serious personal injury or death. You must repair or replace the pump if corrosion or leakage is found.

8 Troubleshooting

Introduction

See *User interface* (page 8).

- In case of any alarm that allows the pump to continue running, the display shows a blinking alarm code and the last quantity selected, while the status indicator (8) becomes orange.
- In case of a failure that stops the pump, the display shows the error code permanently and the status indicator (8) becomes red

8.1 Periodic inspection

Bell & Gossett ecocircXL circulators are designed to provide years of trouble-free service. It is recommended that periodic inspections be made to check for potential problems with the pump. If any leakage or evidence of leakage is present, repair or replace the unit.

8.2 Display messages

Table 1: Default

Operating LEDs / Display	Cause
Power On	Pump powered
All LEDs and display On	Start-up of the pump
Status Green light	Pump is working properly
Remote On	Remote communication is activated

Table 2: Fault messages

Operating LEDs / Display	Cause	Solution
Power Off	Pump is not connected or is incorrectly connected	Check connection
	Power failure	Check power supply and circuit breaker
Status light Orange	Alarm for system problem	Check the displayed alarm code and find cause from table 8.4.
Status light Red	Pump failure	Check the displayed error code and find the cause from table 8.3.
Remote Off	Remote communication is deactivated	If the communication does not work, check the connection and the configuration parameters for communication on the external controller.

8.3 Fault and error codes (Red LED)

Error code	Cause	Solution
E01	Internal communication lost	Restart the pump[2]
E02	High motor current	Restart the pump[2]
E03	DC Bus overvoltage	Indicates excessive power through the pump. Confirm system setup, verify correct position and operation of check valves.
E04	Motor stall	Restart the pump[2]
E05	Data memory corrupted	Restart the pump[2]
E06	Voltage supply out of operating range	Check the electrical system voltage and wiring connection.

[2] Switch off the pump for 5 minutes and then power on. If the problem persists, contact service.

Error code	Cause	Solution
E07	Motor thermal protection trip	Check the presence of foreign material around impeller and rotor that cause overload. Check installation conditions and temperature of the water and ambient air. Wait until the motor is cooled. If the error persists try to restart the pump[2].
E08	Inverter thermal protection trip	Check installation conditions and ambient air temperature.
E09	Hardware error	Restart the pump.
E10	Dry run	Check for system leakage or fill the system.

8.4 Alarm codes (Orange LED)

Alarm code	Cause	Solution
A01	Fluid sensor malfunction	Switch off the pump for 5 minutes and then power on. If the problem persists, contact local B&G representative.
A02	High temperature of the fluid	Check water temperature value
A03	Automatic speed reduction to prevent inverter overheating	Check installation conditions and rectify status of the system
A05	Data memory corrupted	Switch off the pump for 5 minutes and then power on. If the problem persists, contact local B&G representative.
A06	External temperature probe malfunction	Check the probe and the connection to the pump
A07	External pressure sensor malfunction	Check the sensor and the connection to the pump
A08	Cooling fan failure (Only on 2 HP and larger models)	Check for the presence of foreign bodies which could lock the fan rotation. Switch off the pump for 5 minutes and then power on. If the problem persists, contact service.
A12	2–pump communication lost	If both pumps show the A12 alarm, check the connection between the pumps. If one of the pump is switched off or shows another error code, check the section 8.1 and 8.2 to find the problem
A20	Internal alarm	Switch off the pump for 5 minutes and then power on. If the problem persists, contact local B&G representative.

8.5 Faults, causes, and remedies

The pump does not start

Cause	Remedy
No power.	Check the power supply and ensure that it is properly terminated to the pump power.
Tripped circuit breaker or ground-fault protection device or the circuit breaker.	Reset power supply circuit breaker and determine cause for overload.

The pump starts but the thermal protection is triggered after a short time

Cause	Remedy
Incorrect wiring size or circuit breaker rating not suitable for motor current.	Check and replace the components as necessary.
Thermal overload protection due to excessive input.	Check the pump working conditions.
Missing a phase in the power supply.	Verify continuity and ensure proper wiring connections.

The pump is noisy

Cause	Remedy
Not thoroughly vented.	Switch off the pump and after 30 seconds switch on again to restart the automatic air-venting procedure.
Cavitation due to insufficient suction pressure.	Increase the system suction pressure within the admissible range.
Foreign objects in pump.	Clean the system.
Worn out bearing	Replace pump.

9 Other Relevant Documentation or Manuals

9.1 Embedded Software and Driver Software License Agreement

With the purchase of the product, the terms and conditions of the license for the software embedded on the product are considered accepted. For more information see license condition on www.bellgossett.com

FCC Statement — USA only (Federal Communications Commission)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference and
2. this device must accept any interference received, including interference that may cause undesirable operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment.

10 Product warranty

Commercial warranty

Warranty. For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of eighteen (18) months from the date of installation or thirty-six (36) months from the date of shipment (which date of shipment shall not be greater than after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, GUARANTEES, CONDITIONS OR TERMS OF WHATEVER NATURE RELATING TO THE GOODS PROVIDED HEREUNDER, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY DISCLAIMED AND EXCLUDED. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Limited consumer warranty

Warranty. For goods sold for personal, family or household purposes, Seller warrants the goods purchased hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be free from defects in material and workmanship for a period of eighteen (18) months from the date of installation or thirty-six (36) months from the product date code, whichever shall occur first, unless a longer period is provided by law or is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render this Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. The Warranty is conditioned on Buyer giving written notice to Seller of any defects in material or workmanship of warranted goods within ten (10) days of the date when any defects are first manifest.

Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

THE FOREGOING WARRANTY IS PROVIDED IN PLACE OF ALL OTHER EXPRESS WARRANTIES. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO EIGHTEEN (18) MONTHS FROM THE DATE OF INSTALLATION OR THIRTY-SIX (36) MONTHS FROM THE PRODUCT DATE CODE , WHICHEVER SHALL OCCUR FIRST. EXCEPT AS OTHERWISE REQUIRED BY LAW, BUYER'S EXCLUSIVE REMEDY AND SELLER'S AGGREGATE LIABILITY FOR BREACH OF ANY OF THE FOREGOING WARRANTIES ARE LIMITED TO REPAIRING OR REPLACING THE PRODUCT AND SHALL IN ALL CASES BE LIMITED TO THE AMOUNT PAID BY THE BUYER FOR THE DEFECTIVE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY OTHER FORM OF DAMAGES, WHETHER DIRECT, INDIRECT, LIQUIDATED, INCIDENTAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SPECIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOSS OF PROFIT, LOSS OF ANTICIPATED SAVINGS OR REVENUE, LOSS OF INCOME, LOSS OF BUSINESS, LOSS OF PRODUCTION, LOSS OF OPPORTUNITY OR LOSS OF REPUTATION.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To make a warranty claim, check first with the dealer from whom you purchased the product or visit www.xyleminc.com for the name and location of the nearest dealer providing warranty service.

Xylem |’zīləm|

1) The tissue in plants that brings water upward from the roots
2) A leading global water technology company

We're 12,500 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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Morton Grove, Illinois 60053
USA
Tel: (847) 966-3700
Fax: (847) 965-8379
www.bellgossett.com

Visit our Web site for the latest version of this document and more information

The original instruction is in English. All non-English instructions are translations of the original instruction.

P2002548_Rev. C

FTXL™
FIRE TUBE BOILER

Installation & Operation Manual

Models: ~~400, 500, 600,~~ 725, ~~& 850~~

IMG00962

DESIGN CERTIFIED®

CSA CERTIFIED®

⚠ WARNING This manual must only be used by a qualified heating installer / service technician. Read all instructions, including this manual and the FTXL Service Manual, before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

Contents

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

⚠ DANGER DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

Please read before proceeding

⚠ WARNING

Installer – Read all instructions, including this manual and the FTXL Service Manual, before installing. Perform steps in the order given.

User – This manual is for use only by a qualified heating installer/service technician. Refer to the User's Information Manual for your reference.

Have this boiler serviced/inspected by a qualified service technician, at least annually.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

NOTICE

When calling or writing about the boiler – Please have the boiler model and serial number from the boiler rating plate.

Consider piping and installation when determining boiler location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.

⚠ WARNING

Failure to adhere to the guidelines on this page can result in severe personal injury, death, or substantial property damage.

⚠ WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

This appliance MUST NOT be installed in any location where gasoline or flammable vapors are likely to be present.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

⚠ WARNING

DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 10). Failure to comply could result in severe personal injury, death, or substantial property damage.

When servicing boiler –

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow boiler to cool before performing maintenance.

Boiler operation –

- Do not block flow of combustion or ventilation air to the boiler.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this boiler if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

Boiler water –

- Thoroughly flush the system (without boiler connected) to remove sediment. The high-efficiency heat exchanger can be damaged by build-up or corrosion due to sediment.

Freeze protection fluids –

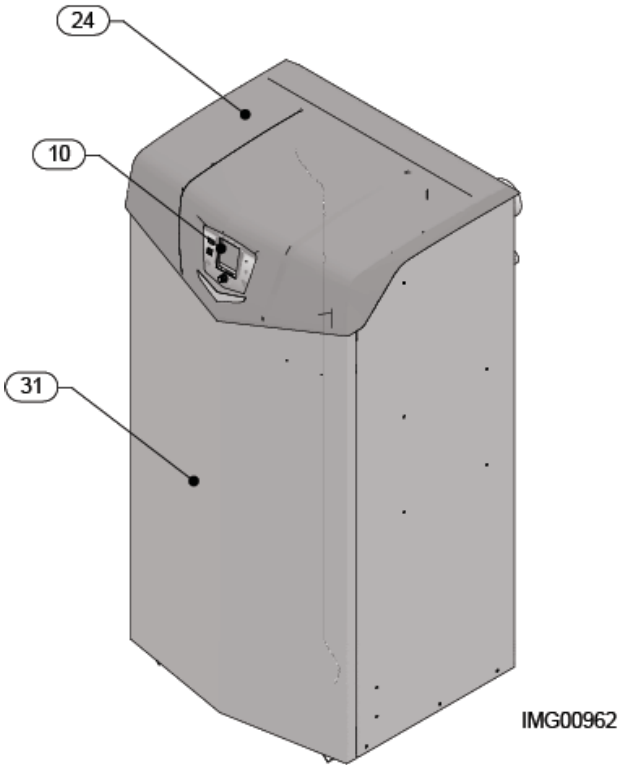
- NEVER use automotive antifreeze. Use only inhibited propylene glycol solutions, which are specifically formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems.

The FTXL - How it works...

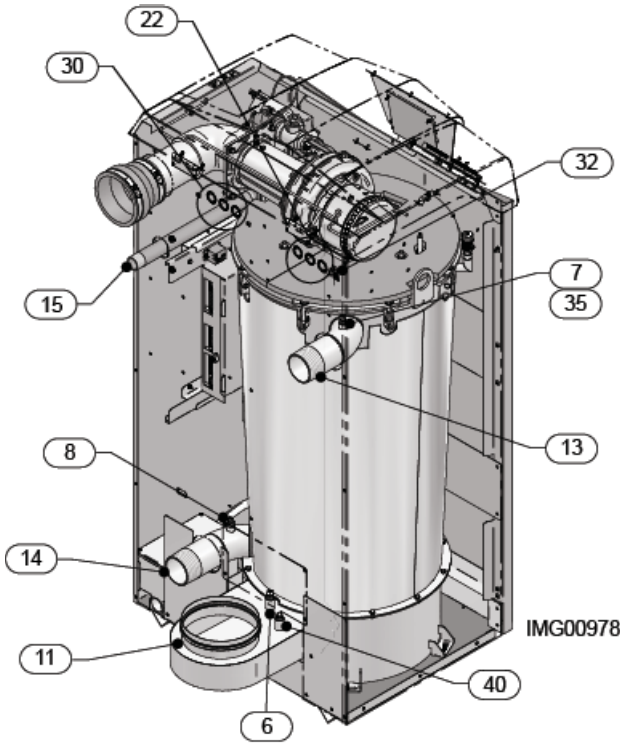
1. **Stainless steel heat exchanger**
   Allows system water to flow around specially designed tubes for maximum heat transfer, while providing protection against flue gas corrosion.
2. **Heat exchanger top plate**
   Removal of the top plate allows access to the combustion chamber and tube sheet.
3. **Blower**
   The blower pulls in air and gas through the venturi (item 5). Air and gas mix inside the blower and are pushed into the burner, where they burn inside the combustion chamber.
4. **Gas valve**
   The gas valve senses the negative pressure created by the blower, allowing gas to flow only if the gas valve is powered and combustion air is flowing.
5. **Venturi**
   The venturi controls air and gas flow into the burner.
6. **Flue gas sensor (limit rated)**
   This sensor monitors the flue gas exit temperature. The control module will modulate and shut down the boiler if the flue gas temperature gets too hot. This protects the flue pipe from overheating.
7. **Boiler outlet temperature sensor (limit rated)**
   This sensor monitors boiler outlet water temperature (system supply). If selected as the controlling sensor, the control module adjusts boiler firing rate so the outlet temperature is correct.
8. **Boiler inlet temperature sensor**
   This sensor monitors return water temperature (system return). If `selected as the controlling sensor, the control module adjusts the boiler firing rate so the inlet temperature is correct.
9. **Temperature and pressure gauge (field installed, not shown)**
   Monitors the outlet temperature of the boiler as well as the system water pressure.
10. **Electronic LCD display**
    The display features a high resolution liquid crystal screen, four (4) buttons, and a navigation dial. A serial and USB port support additional communication with the control.
11. **Flue pipe adapter**
    Allows for the connection of the PVC vent pipe system to the boiler.
12. **Burner (not shown)**
    Made with metal fiber and stainless steel construction, the burner uses pre-mixed air and gas and provides a wide range of firing rates.
13. **Water outlet (system supply)**
    A 2" or 2-1/2" NPT (depending on the model) water connection that supplies hot water to the system.
14. **Water inlet (system return)**
    A 2" or 2-1/2" NPT (depending on the model) water connection that returns water from the system to the heat exchanger.
15. **Gas connection pipe**
    Threaded pipe connection of 1". This pipe should be connected to the incoming gas supply for the purpose of delivering gas to the boiler.
16. **SMART SYSTEM Control Module**
    The SMART SYSTEM Control responds to internal and external signals to regulate the blower, gas valve, and pump functions to meet heating demand. An optional remote connectivity allows boiler settings to be monitored and modified when connected to the internet.
17. **Manual air vent**
    A manual air vent is used to remove trapped air from the heat exchanger shell.
18. **Air intake adapter**
    Allows for the connection of the PVC air intake pipe to the boiler.
19. **High voltage junction box**
    The junction box contains the connection points for the line voltage power and all pumps.
20. **Boiler drain connection**
    A 1" NPT drain connection is provided for easy access in the event the boiler needs to be drained .
21. **Low voltage connection board**
    The connection board provides easy access for connecting external low voltage devices.
22. **Low voltage wiring connections (knockouts)**
    Conduit connection points for the low voltage connection board.
23. **Condensate trap**
    The condensate trap is sized for a 1" PVC outlet connection pipe.
24. **Bezel (hinged)**
    Provides access to the gas train, heat exchanger, and display.
25. **Ignition electrode**
    Provides direct spark for igniting the burner.
26. **Flame inspection window**
    The quartz glass window provides a view of the burner surface and flame.
27. **Gas shutoff valve (Models 500 - 850 only)**
    A manual valve is provided to isolate the gas valve from the boiler.
28. **Relief valve (field installed, not shown)**
    Protects the heat exchanger from an over pressure condition. The relief valve provided with the unit is set at 50 PSI.
29. **Flame sensor**
    Used by the control module to detect the presence of burner flame.
30. **Line voltage wiring connections (knockouts)**
    Conduit connection points for the high voltage junction box.
31. **Front panel**
    Removable panel to gain access to the internal components.
32. **Power switch**
    Turns 120 VAC ON/OFF to the boiler.
33. **Pump relay board**
    The pump relay board is used to connect the boiler, system and DHW pumps.
34. **Transformer**
    The transformer provides 24V power to the integrated control.
35. **High limit sensor (housed with the outlet temperature sensor)**
    Device that monitors the outlet water temperature. If the temperature exceeds its setting, the integrated control will break the control circuit, shutting the boiler down.
36. **Low water cutoff probe (LWCO)**
    Protects the heat exchanger from overheating, by ensuring adequate water is supplied to the boiler. In the event of inadequate water levels, the boiler will shut down.
37. **Stainless steel flue collector**
    Flue gas and condensate enter the stainless steel flue collector through the firetubes. A 1" drain connection allows condensate to flow through the collector into a condensate trap for disposal.
38. **Reset switch**
    Reset switch for the low water cutoff. Hold the switch for 10 seconds to reset.
39. **Test switch**
    The test switch permits manual triggering of the LWCO safety circuit to test the contacts and evaluate the integrity of the circuit. Hold the switch for 10 seconds to test.
40. **Combustion measurement port**
    A port near the flue vent which provides access for a combustion analyzer probe.
41. **Burner plate (not shown)**
    The burner plate attaches the blower to the burner and the heat exchanger. Removal allows easy access to the burner for inspection or replacement.

The FTXL - How it works... *(continued)*

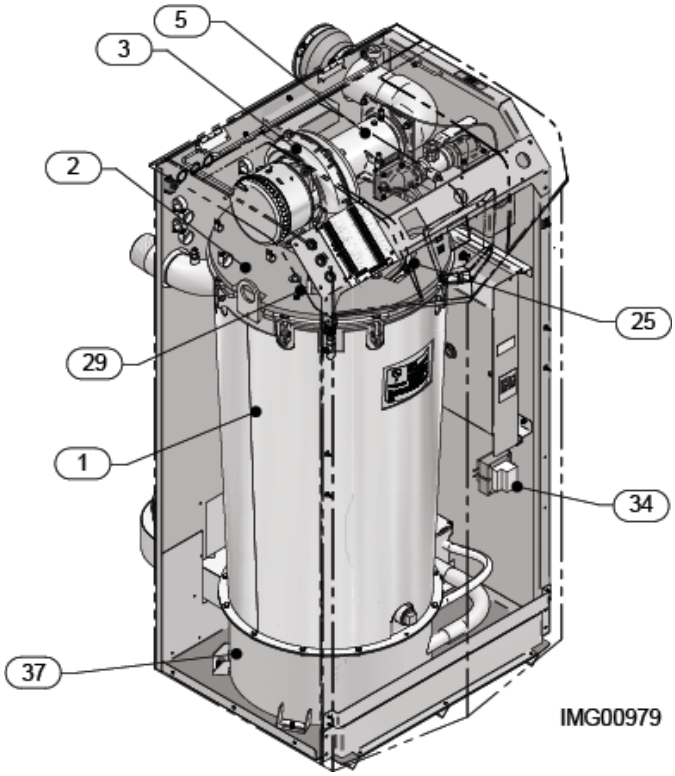
Models 400 - 850



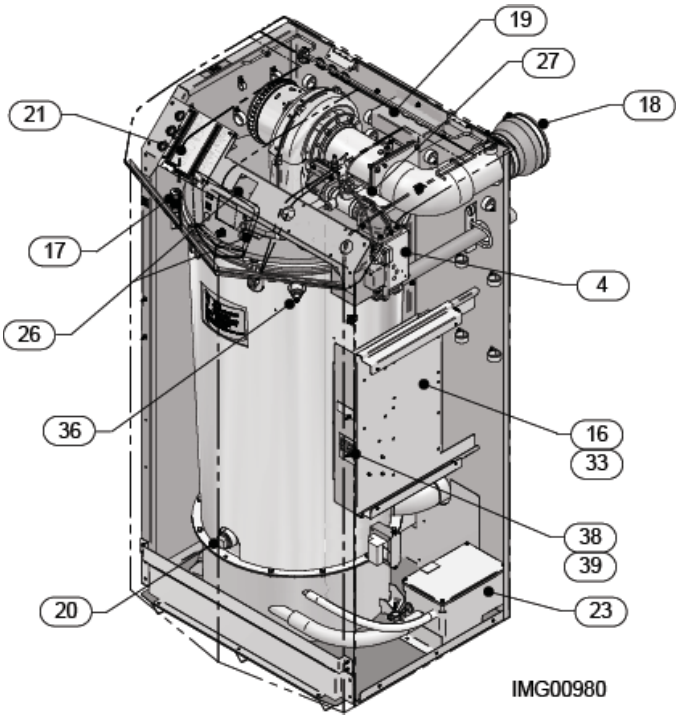
Front View



Rear View



Left Side (inside unit)



Right Side (inside unit)

Ratings

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CERTIFIED ®

ASME H

DOE

AHRI CERTIFIED® www.ahridirectory.org

FTXL Boiler AHRI Rating

Model Number Note: Change "N" to "L" for L.P. gas models.	Input MBH (Note 4)		Gross Output MBH (Note 1)	Net AHRI Ratings Water, MBH (Note 2)
	Min	Max		
FTX400N	40	399	392	341
FTX500N	50	500	489	425
FTX600N	85.7	600	585	509
FTX725N	103.5	725	705	613
FTX850N	121.5	850	825	717

Other Specifications

Boiler Water Content Gallons	Water Connections	Gas Connections	Air Size	Vent Size (Note 3)
13.2	2"	1"	4"	4"
11.9	2"	1"	4"	4"
11.9	2"	1"	4"	4"
17.2	2 1/2"	1"	4"	6"
15.9	2 1/2"	1"	4"	6"

NOTICE Maximum allowed working pressure is located on the rating plate.

Notes:

1. The ratings are based on standard test procedures prescribed by the United States Department of Energy.
2. Net AHRI ratings are based on net installed radiation of sufficient quantity for the requirements of the building and nothing need be added for normal piping and pickup. Ratings are based on a piping and pickup allowance of 1.15.
3. FTXL boilers require special gas venting. Use only the vent materials and methods specified in the FTXL Installation and Operation Manual.
4. Standard FTXL boilers are equipped to operate from sea level to 4,500 feet **only** with no adjustments. The boiler will de-rate by 4% for each 1,000 feet above sea level up to 4,500 feet.
5. High altitude FTXL boilers are equipped to operate from 3,000 to 12,000 feet **only**. The boiler will not de-rate up to 5,400 feet and will de-rate by 1.6% for each 1,000 feet above 5,400 feet. High altitude models are manufactured with a different control module for altitude operation, but the operation given in this manual remains the same as the standard boilers. A high altitude label (as shown in Fig. A) is also affixed to the unit.

   De-rate values are based on proper combustion calibration and CO_2's adjusted to the recommended levels.
6. Ratings have been confirmed by the Hydronics Section of AHRI.
7. FTXL boilers comply with the requirements of CSD-1 Section CW-400 requirements as a temperature operation control. The manual reset high limit provided with the FTXL is listed to UL353.

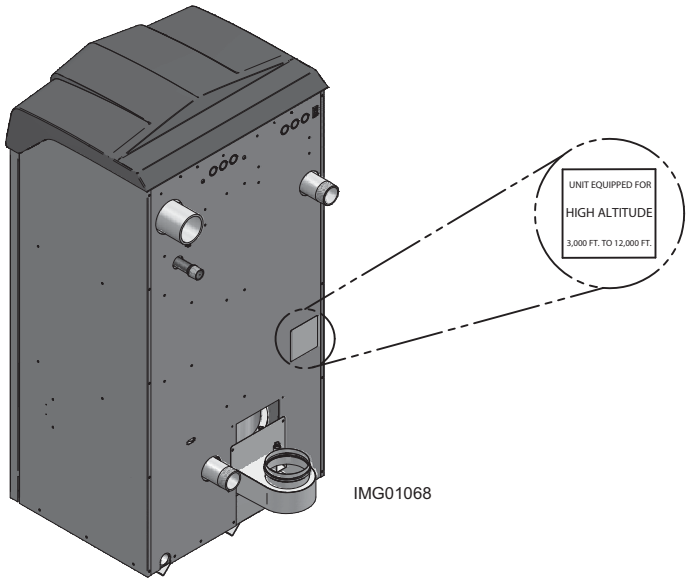


Figure A *High Altitude Label Location*

1 Determine boiler location

Installation must comply with:

- Local, state, provincial, and national codes, laws, regulations, and ordinances.
- National Fuel Gas Code, ANSI Z223.1 – latest edition.
- Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1, when required.
- National Electrical Code.
- For Canada only: B149.1 Installation Code, CSA C22.1 Canadian Electrical Code Part 1 and any local codes.

NOTICE The FTXL gas manifold and controls met safe lighting and other performance criteria when the boiler underwent tests specified in ANSI Z21.13 – latest edition.

Before locating the boiler, check:

1. Check for nearby connection to:
   - System water piping
   - Venting connections
   - Gas supply piping
   - Electrical power
2. Locate the appliance so that if water connections should leak, water damage will not occur. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the appliance. The pan must not restrict combustion air flow. Under no circumstances is the manufacturer to be held responsible for water damage in connection with this appliance, or any of its components.
3. Check area around the boiler. Remove any combustible materials, gasoline and other flammable liquids.

⚠ WARNING Failure to keep boiler area clear and free of combustible materials, gasoline, and other flammable liquids and vapors can result in severe personal injury, death, or substantial property damage.

4. The FTXL must be installed so that gas control system components are protected from dripping or spraying water or rain during operation or service.
5. If a new boiler will replace an existing boiler, check for and correct system problems, such as:
   - System leaks causing oxygen corrosion or heat exchanger cracks from hard water deposits.
   - Incorrectly-sized expansion tank.
   - Lack of freeze protection in boiler water causing system and boiler to freeze and leak.
6. Check around the boiler for any potential air contaminants that could risk corrosion to the boiler or the boiler combustion air supply (see Table 1A on page 10). Prevent combustion air contamination. Remove any of these contaminants from the boiler area.

⚠ WARNING DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 10). Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING This appliance is certified as an indoor appliance. Do not install the appliance outdoors or locate where the appliance will be exposed to freezing temperatures or to temperatures that exceed 100°F.

Do not install the appliance where the relative humidity may exceed 93%. Do not install the appliance where condensation may form on the inside or outside of the appliance, or where condensation may fall onto the appliance.

Failure to install the appliance indoors could result in severe personal injury, death, or substantial property damage.

⚠ WARNING This appliance requires a special venting system. The vent connection to the appliance must be made with the starter CPVC/ stainless steel pipe section provided with the appliance. The field provided PVC vent fittings must be cemented to the CPVC pipe section. Use only the vent materials, primer and cement specified in this manual to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

Closet and alcove installations

A closet is any room the boiler is installed in which is less than 171 cubic feet for FTX400 models, 193 cubic feet for FTX500 models, 223 cubic feet for FTX600 models, 247 cubic feet for FTX725 models and 278 cubic feet for FTX850 models.

An alcove is any room which meets the criteria for a closet with the exception that it does not have a door.

Example: Room dimensions = 5 feet long, 4 feet wide, and 8 foot ceiling = 5 x 4 x 8 = 160 cubic feet. This would be considered a closet for a FTXL Boiler.

⚠ WARNING For closet and alcove installations as shown in FIG.'s 1-1 and 1-2, CPVC or stainless steel vent material must be used inside the structure. The ventilating air openings shown in FIG.'s 1-1 and 1-2 are required for this arrangement. Failure to follow this warning could result in fire, personal injury, or death.

Provide clearances:

Clearances from combustible materials

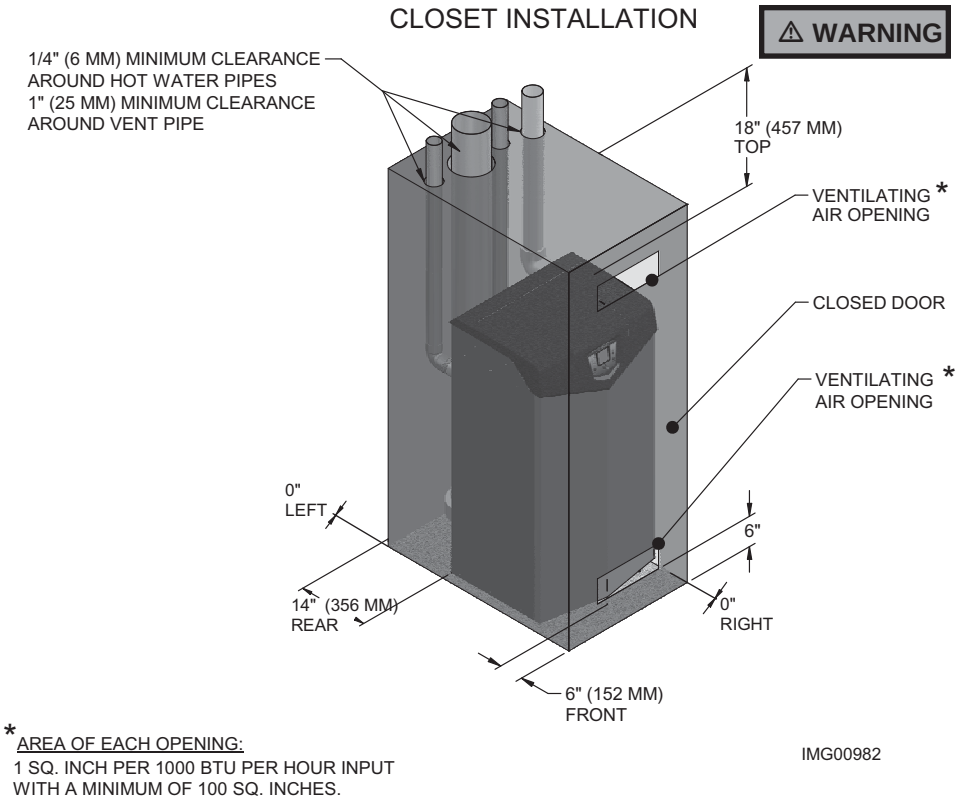
1. Hot water pipes—at least 1/4" (6 mm) from combustible materials.
2. Vent pipe – at least 1" (25 mm) from combustible materials.
3. See FIG.'s 1-1 and 1-2 on page 8 for other clearance minimums.

Clearances for service access

1. See FIG.'s 1-1 and 1-2 on page 8 for recommended service clearances. If you do not provide the minimum clearances shown, it may not be possible to service the boiler without removing it from the space.

1 Determine boiler location *(continued)*

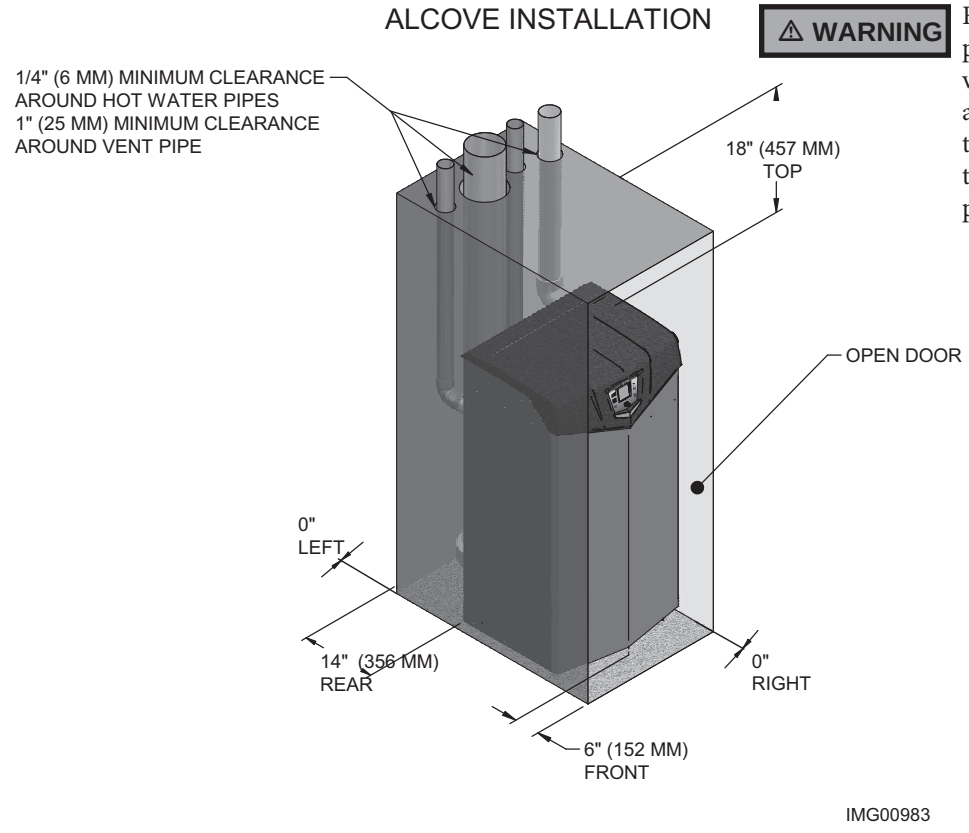
Figure 1-1 *Closet Installation - Minimum Required Clearances*



⚠ WARNING

For closet installations, CPVC, polypropylene or stainless steel vent material MUST BE used in a closet structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

Figure 1-2 *Alcove Installation - Minimum Required Clearances*



⚠ WARNING

For alcove installations, CPVC, polypropylene or stainless steel vent material MUST BE used in an alcove structure due to elevated temperatures. Failure to follow this warning could result in fire, personal injury, or death.

1 Determine boiler location

Provide air openings to room:

FTXL alone in boiler room

1. No air ventilation openings into the boiler room are needed when clearances around the FTXL are at least equal to the SERVICE clearances shown in FIG.'s 1-1 and 1-2. For spaces that do NOT supply this clearance, provide two openings as shown in FIG. 1-1. Each opening must provide one square inch free area per 1,000 Btu/hr of boiler input.

Recommended service clearances

FRONT	- 30" (762 mm)
TOP	- 18" (610 mm)
REAR	- 24" (610 mm)

FTXL in same space with other gas or oil-fired appliances

1. Follow the National Fuel Gas Code (U.S.) or CSA B149.1 (Canada) to size/verify size of the combustion/ventilation air openings into the space.

⚠ WARNING The space must be provided with combustion/ventilation air openings correctly sized for all other appliances located in the same space as the FTXL.

Do not install the boiler in an attic.

Failure to comply with the above warnings could result in severe personal injury, death, or substantial property damage.

2. Size openings only on the basis of the other appliances in the space. No additional air opening free area is needed for the FTXL because it takes its combustion air from outside (direct vent installation).

Flooring and foundation

Flooring

The FTXL is approved for installation on combustible flooring, but must never be installed on carpeting.

⚠ WARNING Do not install the boiler on carpeting even if foundation is used. Fire can result, causing severe personal injury, death, or substantial property damage.

If flooding is possible, elevate the boiler sufficiently to prevent water from reaching the boiler.

Residential garage installation

Precautions

Take the following precautions when installing the appliance in a residential garage. If the appliance is located in a residential garage, it should be installed in compliance with the latest edition of the National Fuel Gas Code, ANSI Z223.1 and/or CAN/CGA-B149 Installation Code.

- Appliances located in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling shall be installed so that all burners and burner ignition devices are located not less than 18 inches (46 cm) above the floor.
- The appliance shall be located or protected so that it is not subject to physical damage by a moving vehicle.

Vent and air piping

The FTXL requires a special vent system, designed for pressurized venting.

The boiler is to be used for either direct vent installation or for installation using indoor combustion air. When room air is considered, see the General Venting Section. Note prevention of combustion air contamination below when considering vent/air termination.

Vent and air must terminate near one another and may be vented vertically through the roof or out a side wall, unless otherwise specified. You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the FTXL using any other means.

Be sure to locate the boiler such that the vent and air piping can be routed through the building and properly terminated. The vent/air piping lengths, routing and termination method must all comply with the methods and limits given in this manual.

Prevent combustion air contamination

Install air inlet piping for the FTXL as described in this manual. Do not terminate vent/air in locations that can allow contamination of combustion air. Refer to Table 1A, page 10 for products and areas which may cause contaminated combustion air.

⚠ WARNING You must pipe combustion air to the boiler air intake. Ensure that the combustion air will not contain any of the contaminants in Table 1A, page 10. Contaminated combustion air will damage the boiler, resulting in possible severe personal injury, death or substantial property damage. Do not pipe combustion air near a swimming pool, for example. Also, avoid areas subject to exhaust fumes from laundry facilities. These areas will always contain contaminants.

1 Determine boiler location *(continued)*

Table 1A *Corrosive Contaminants and Sources*

Products to avoid:
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

When using an existing vent system to install a new boiler:

⚠ WARNING Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

Check the following venting components before installing:

- **Material** - For materials listed for use with this appliance, see Section 3 - General Venting. For polypropylene or stainless steel venting, an adapter of the same manufacturer must be used at the flue collar connection.
- **Size** - To ensure proper pipe size is in place, see Table 3A. Check to see that this size is used throughout the vent system.
- **Manufacturer** - For a stainless steel or polypropylene application, you must use only the listed manufacturers and their type product listed in Tables 3E and 3G for CAT IV positive pressure venting with flue producing condensate.
- **Supports** - Non-combustible supports must be in place allowing a minimum 1/4" rise per foot. The supports should adequately prevent sagging and vertical slippage, by distributing the vent system weight. For additional information, consult the vent manufacturer's instructions for installation.
- **Terminations** - Carefully review Sections 3 through 5 to ensure requirements for the location of the vent and air terminations are met and orientation of these fit the appropriate image from the Sidewall or Vertical options listed in the General Venting Section. For stainless steel vent, only use terminations listed in Table 3H for the manufacturer of the installed vent.
- **Seal** - With prior requirements met, the system should be tested to the procedure listed in parts (c) through (f) of the Removal of an Existing Boiler Section on page 11.

With polypropylene and stainless steel vent, seal and connect all pipe and components as specified by the vent manufacturer used; with PVC/CPVC vent, see the Installing Vent or Air Piping Section on pages 20 and 21.

⚠ WARNING If any of these conditions are not met, the existing system must be updated or replaced for that concern. Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

1 Determine boiler location *(continued)*

When removing a boiler from existing common vent system:

⚠ DANGER Do not install the FTXL into a common vent with any other appliance. This will cause flue gas spillage or appliance malfunction, resulting in possible severe personal injury, death, or substantial property damage.

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

a. Seal any unused openings in the common venting system.

b. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, or other deficiencies, which could cause an unsafe condition.

c. Test vent system – Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

d. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

e. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from another source.

f. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined herein, return doors, windows, exhaust fans, fireplace dampers, and any other gas-burning appliance to their previous conditions of use.

g. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/ NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code.

1 Determine boiler location

Combustion and ventilation air requirements for appliances drawing air from the equipment room

Provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, NFPA 54 / ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

The equipment room MUST be provided with properly sized openings and/or be of sufficient volume to assure adequate combustion air and proper ventilation for all gas fired appliances in the equipment room to assure adequate combustion air and proper ventilation.

The requirements shown are for the **appliance only**; additional gas fired appliances in the equipment room will require an increase in the net free area and/or volume to supply adequate combustion air for all appliances.

No combustion air openings are needed when the appliance is installed in a space with a volume **NO LESS** than 50 cubic feet per 1,000 Btu/hr of all installed gas fired appliances and the building **MUST NOT be of "Tight Construction"**[3].

A combination of indoor and outdoor combustion air may be utilized by applying a ratio of available volume to required volume times the required outdoor air opening(s) size(s). This must be done in accordance with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1.

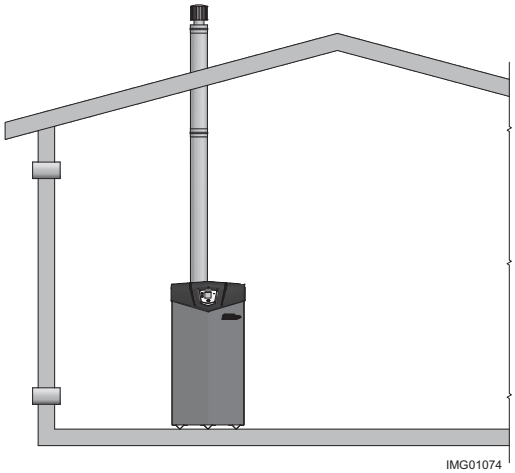


***Figure 1-3**_Combustion Air Direct from Outside*

1. If air is taken directly from outside the building with no duct, provide two permanent openings to the equipment room each with a net free area of one square inch per 4000 Btu/hr input (5.5 cm^2 per kW) (see FIG. 1-3).

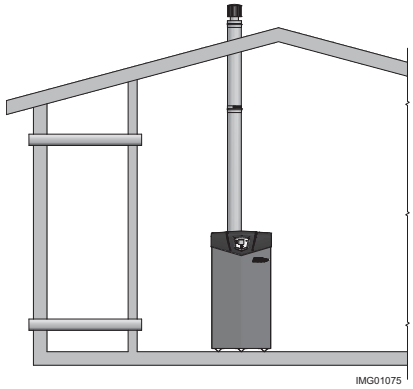


***Figure 1-4**_Combustion Air Through Ducts*

2. If combustion and ventilation air is taken from the outdoors using a duct to deliver the air to the equipment room, each of the two openings should be sized based on a minimum free area of one square inch per 2000 Btu/hr (11 cm^2 per kW) of input (see FIG. 1-4).

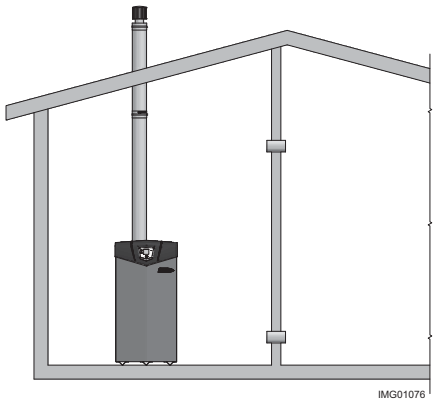


***Figure 1-5**_Combustion Air from Interior Space*

3. If air is taken from another interior space combined with the equipment room:

(a) Two spaces on same story: Each of the two openings specified above should have a net free area of one square inch for each 1000 Btu/hr (22 cm^2 per kW) of input, but not less than 100 square inches (645 cm^2) (see FIG. 1-5).

(b) Two spaces on different stories: One or more openings should have a net free area of two square inches per 1000 Btu/hr (44 cm^2 per kW).

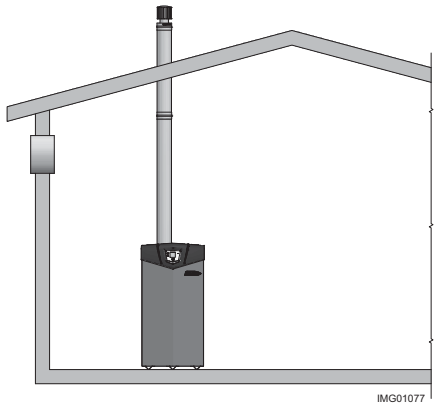


***Figure 1-6**_Combustion Air from Outside - Single Opening*

1 Determine boiler location *(continued)*

4. If a single combustion air opening is provided to bring combustion air in directly from the outdoors, the opening must be sized based on a minimum free area of one square inch per 3000 Btu/hr (7 cm^2 per kW). This opening must be located within 12" (30 cm) of the top of the enclosure (see FIG. 1-6).

Combustion air requirements are based on the latest edition of the National Fuel Gas Code, NFPA 54 / ANSI Z223.1; in Canada refer to the latest edition of CGA Standard CAN/CSA B149.1. Check all local code requirements for combustion air.

All dimensions based on net free area in square inches. Metal louvers or screens reduce the free area of a combustion air opening a minimum of approximately 25%. Check with louver manufacturers for exact net free area of louvers.

Where two openings are provided, one must be within 12" (30 cm) of the ceiling and one must be within 12" (30 cm) of the floor of the equipment room. Each opening must have a net free area as specified in Table 1B. Single openings shall commence within 12" (30 cm) of the ceiling. The minimum dimension of air openings shall not be less than 3" (80 mm).

⚠ CAUTION Under no circumstances should the equipment room ever be under negative pressure. Particular care should be taken where exhaust fans, attic fans, clothes dryers, compressors, air handling units, etc., may take away air from the unit.

The combustion air supply must be completely free of any flammable vapors that may ignite or chemical fumes which may be corrosive to the appliance. Common corrosive chemical fumes which must be avoided are fluorocarbons and other halogenated compounds, most commonly present as refrigerants or solvents, such as Freon, trichlorethylene, perchlorethylene, chlorine, etc. These chemicals, when burned, form acids which quickly attack the stainless steel heat exchanger, headers, flue collectors, and the vent system.

The result is improper combustion and a non-warrantable, premature appliance failure.

EXHAUST FANS: Any fan or equipment which exhausts air from the equipment room may deplete the combustion air supply and/or cause a downdraft in the venting system. Spillage of flue products from the venting system into an occupied living space can cause a very hazardous condition that must be corrected immediately.

TABLE - 1B
MINIMUM RECOMMENDED COMBUSTION AIR SUPPLY TO EQUIPMENT ROOM

Model Number	FIG. 1-3		FIG. 1-4		FIG. 1-5		FIG. 1-6
	*Outside Air from 2 Openings Directly from Outdoors[1]		*Outside Air from 2 Ducts Delivered from Outdoors[1]		Inside Air from 2 Ducts Delivered from Interior Space[2] Same Story		*Outside Air from 1 Opening Directly from Outdoors, in^2 (cm^2)[1]
	Top Opening, in^2 (cm^2)	Bottom Opening, in^2 (cm^2)	Top Opening, in^2 (cm^2)	Bottom Opening, in^2 (cm^2)	Top Opening, in^2 (cm^2)	Bottom Opening, in^2 (cm^2)	
FTX400	100 (646)	100 (646)	200 (1,291)	200 (1,291)	400 (2,581)	400 (2,581)	134 (865)
FTX500	125 (807)	125 (807)	250 (1,613)	250 (1,613)	500 (3,226)	500 (3,226)	167 (1,078)
FTX600	150 (968)	150 (968)	300 (1,936)	300 (1,936)	600 (3,871)	600 (3,871)	200 (1,291)
FTX725	182 (1,174)	182 (1,174)	363 (2,342)	363 (2,342)	725 (4,677)	725 (4,677)	242 (1,561)
FTX850	213 (1,374)	213 (1,374)	425 (2,742)	425 (2,742)	850 (5,484)	850 (5,484)	284 (1,832)

The above requirements are for the **appliance only**; additional gas fired appliances in the equipment room will require an increase in the net free area and/or volume to supply adequate combustion air for all appliances.

No combustion air openings are needed when the appliance is installed in a space with a volume NO LESS than 50 cubic feet per 1,000 Btu/hr of all installed gas fired appliances. **Buildings MUST NOT be of *"Tight Construction"[3].**

[1]Outside air openings shall directly communicate with the outdoors.

[2]Combined interior space must be 50 cubic feet per 1,000 Btu/hr input. **Buildings MUST NOT be of *"Tight Construction".**

[3]**"Tight Construction"** is defined as a building with less than 0.40 ACH (air changes per hour). For buildings of **"Tight Construction"**, provide air openings into the building from outside.

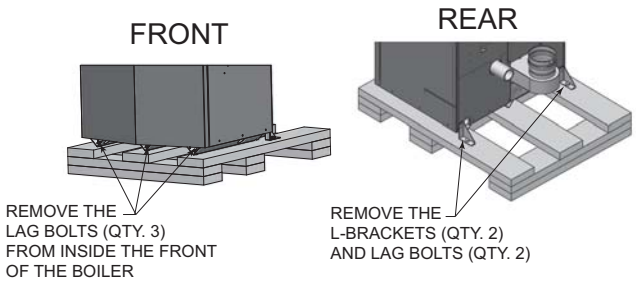
2 Prepare boiler

Remove boiler from wood pallet

1. After removing the outer shipping carton from the boiler, remove the parts box.
2. To remove the boiler from the pallet (after removing the front door):
   a. Remove the three (3) lag bolts from inside the front of the boiler (FIG. 2-1).
   b. Remove the two (2) L-brackets and the two (2) lag bolts inside the L-brackets on the rear of the boiler. Once the lag bolts have been removed, re-install the screws on the rear of the boiler.
   c. Disconnect the ribbon cable and remove the bezel (no tools required for removal) before removing the boiler from the pallet or moving the boiler.

NOTICE Do not drop the boiler or bump the jacket on the floor or pallet. Damage to the boiler can result.

Figure 2-1 *Boiler Mounted on Shipping Pallet*



Gas conversions

⚠ WARNING For a boiler already installed, you must turn off gas supply, turn off power and allow boiler to cool before proceeding. You must also completely test the boiler after conversion to verify performance as described under Start-up, Section 10 of this manual. Failure to comply could result in severe personal injury, death, or substantial property damage.

For the 400 and 500 Models you must install a propane venturi to operate the FTXL on propane gas.

Models 600 - 850 do not require a venturi change for propane operation, but they will require a valve adjustment.

Table 2A *LP Conversion Kit*

Model	Description	Kit Number
400 - 500	LP Kit	100189174

Models 400 and 500 Only (Venturi w/LP Orifices)

1. Remove the top bezel from the unit (no tools required for removal).
2. Disconnect the air inlet piping from the venturi by loosening the band clamp around the rubber boot coupling. Slide the rubber boot off of the venturi.
3. Disconnect gas piping from the venturi by loosening the threaded nut on the venturi (replace gasket if damaged).
4. Remove the bolts connecting the venturi to the fan and then proceed to remove the Natural venturi from the unit (FIG.'s 2-2A and 2-2B).
5. Install the LP venturi onto the fan taking note of the following:
   a. The UP arrow on the plastic housing is indeed pointing up.
   b. The threaded connection for the gas piping is facing towards the front of the unit. Reinstall the bolts connecting the venturi to the fan.
6. Reassemble the gas pipe to the threaded connection on the venturi. Install the new gasket provided in the kit and ensure it is seated properly before tightening the nut.
7. Reconnect the rubber boot on the air inlet to the venturi inlet and tighten the band clamp at this connection.
8. After installation is complete, attach the propane conversion label (in the conversion kit bag) next to the boiler rating plate. Attach the LP caution label (in the conversion kit bag) to the rear of the boiler underneath the gas supply piping.
9. Replace the top bezel removed in Step 1 and resume operation.

⚠ WARNING After converting to LP, check combustion per the Start-up procedure in Section 10 of this manual. Failure to check and verify combustion could result in severe personal injury, death, or substantial property damage.

⚠ DANGER Models 400 and 500: Inspect the O-ring when the blower is disassembled. The O-ring must be in good condition and must be installed. Failure to comply will cause a gas leak, resulting in severe personal injury or death.

2 Prepare boiler *(continued)*

Figure 2-2A *400 Model_Venturi with LP Orifice*

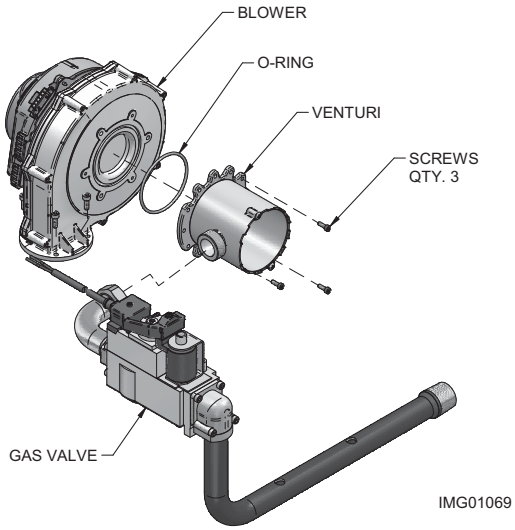
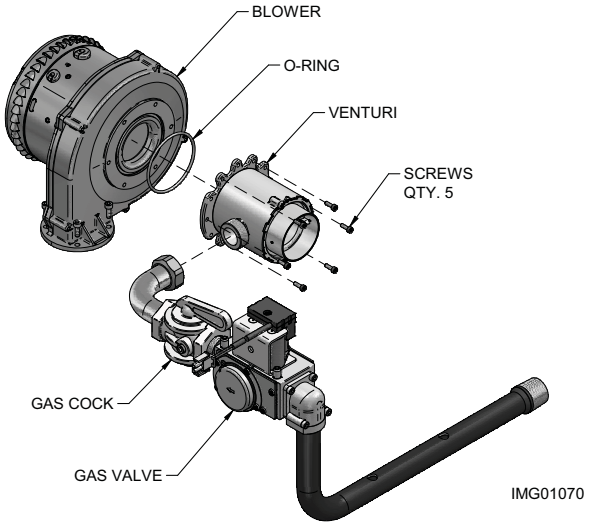


Figure 2-2B *500 Model_Venturi with LP Orifice*

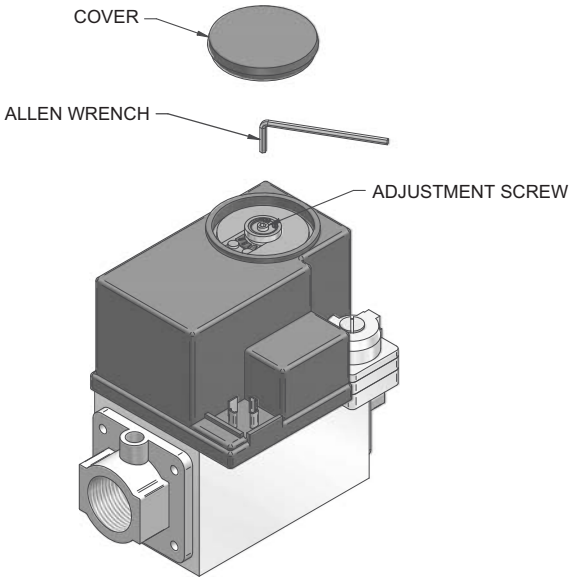


Models 600 - 850

1. Lift the top bezel (prop the bezel up for service).
2. Remove the cover on top of the gas valve (FIG. 2-3).
3. Use a combustion analyzer to verify CO_2 is within the range of 9.0 – 11.0%. If not, adjust the screw **counterclockwise** incrementally to raise CO_2 and **clockwise** to lower CO_2 (FIG. 2-3).
4. After adjustment is complete, attach the propane conversion label (in the conversion kit bag) next to the boiler rating plate. Attach the LP caution label (in the conversion kit bag) to the rear of the boiler underneath the gas supply piping.
5. Replace the gas valve cover and lower the bezel.

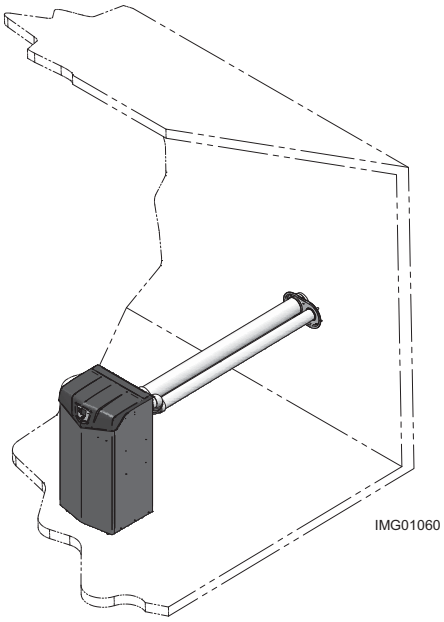
⚠ WARNING Failure to check and verify combustion could result in severe personal injury, death, or substantial property damage.

Figure 2-3 *Gas Valve Adjustment - Models 600 - 850*

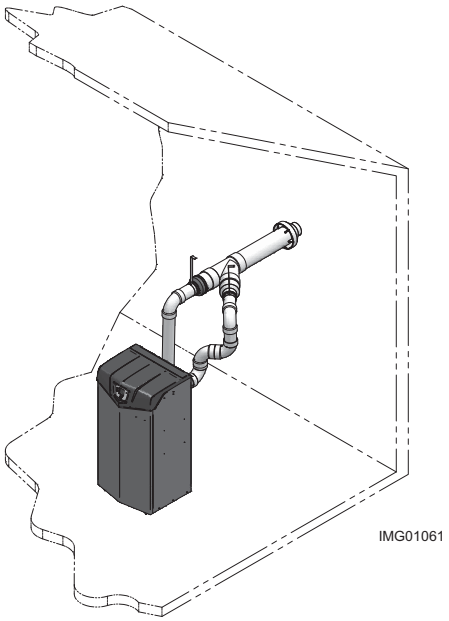


3 General venting

Direct venting options - Sidewall Vent

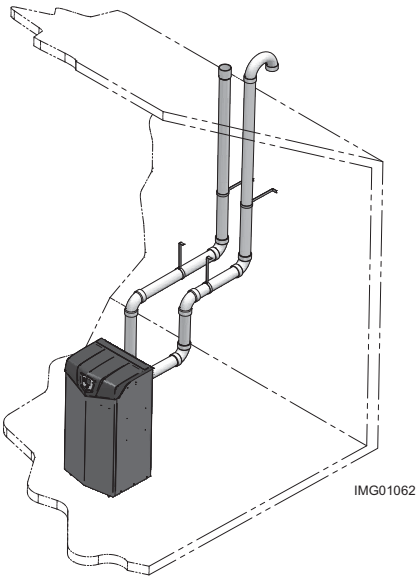


Two Pipe Sidewall
See page 24 for more details

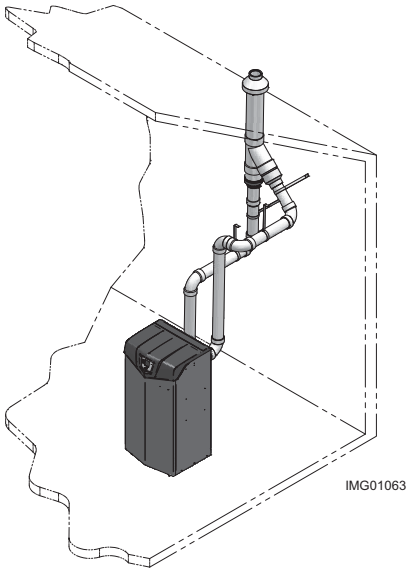


PVC/CPVC Concentric Sidewall
Models 400 - 600 Only
See page 28 for more details

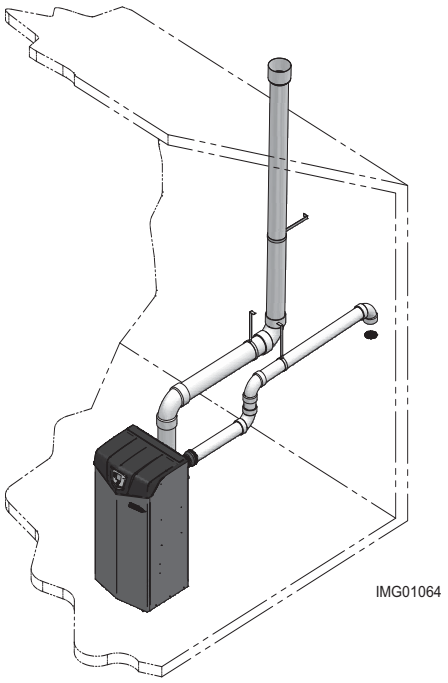
Direct venting options - Vertical Vent



Two Pipe Vertical
See page 31 for more details



PVC/CPVC
Concentric Vertical
Models 400 - 600 Only
See page 33 for more details



Vertical Vent, Sidewall Air

3 General venting *(continued)*

Install vent and combustion air piping

⚠ DANGER The FTXL boiler must be vented and supplied with combustion and ventilation air as described in this section. Ensure the vent and air piping and the combustion air supply comply with these instructions regarding vent system, air system, and combustion air quality. See also Section 1 of this manual.

Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of applicable codes.

Failure to provide a properly installed vent and air system will cause severe personal injury or death.

⚠ WARNING This appliance requires a special venting system. Use only approved stainless steel, PVC, CPVC or polypropylene pipe and fittings listed in Tables 3E, 3F, and 3H for vent pipe, and fittings. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING DO NOT mix components from different systems. The vent system could fail, causing leakage of flue products into the living space. Mixing of venting materials will void the warranty and certification of the appliance.

NOTICE Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

⚠ WARNING For closet and alcove installations, CPVC, polypropylene or stainless steel material MUST BE used in a closet/alcove structure. Failure to follow this warning could result in fire, personal injury, or death.

⚠ CAUTION Improper installation of venting systems may result in injury or death.

NOTICE Follow the instructions in Section 1, page 11 of this manual when removing a boiler from an existing vent system.

⚠ WARNING Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.

The FTXL boiler vent and air piping can be installed through the roof or through a sidewall. Follow the procedures in this manual for the method chosen. Refer to the information in this manual to determine acceptable vent and air piping length.

You may use any of the vent/air piping methods covered in this manual. Do not attempt to install the FTXL boiler using any other means.

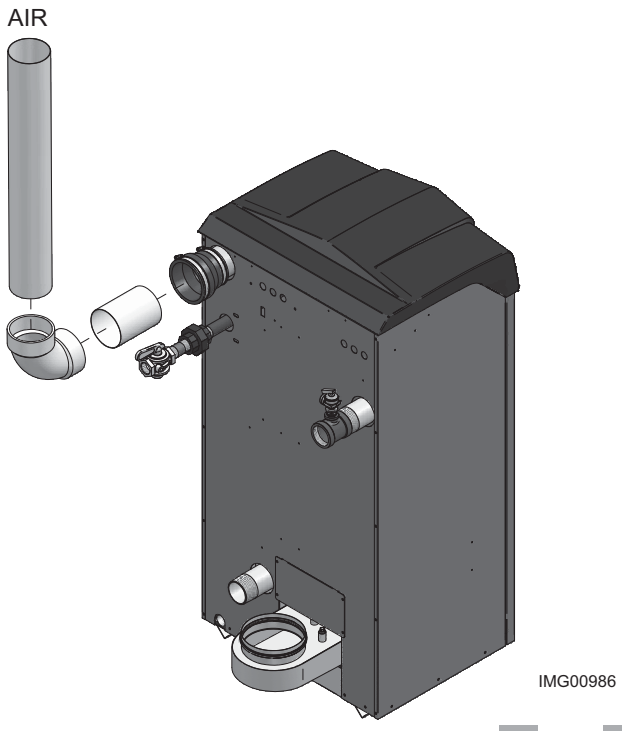
You must also install air piping from outside to the boiler air intake adapter unless following the Optional Room Air instructions on page 19 of this manual. The resultant installation is direct vent (sealed combustion).

The FTXL is certified as a Category II/IV boiler. All venting systems used with this boiler must be suitable for Category IV operation except for factory approved common vent systems operating as allowed in the Common Venting Section on page 20.

Air intake/vent connections

1. **Combustion Air Intake Connector** (FIG. 3-1) - Used to provide combustion air directly to the unit from outdoors. A fitting is provided on the unit for final connection. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.
2. **Vent Connector** (FIG.'s 3-2 thru 3-7) - Used to provide a passageway for conveying combustion gases to the outside. A transition fitting is provided on the unit for final connection. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

Figure 3-1 *Near Boiler Air Piping*



3 General venting

Requirements for installation in Canada

1. Installations must be made with a vent pipe system certified to ULC-S636.
2. The first three (3) feet of plastic vent pipe from the appliance flue outlet must be readily accessible for visual inspection.
3. The components of the certified vent system must not be interchanged with other vent systems or unlisted pipe/fittings. For concentric vent installations, the inner vent tube must be replaced with field supplied certified vent material to comply with this requirement.
4. The 4" Concentric Vent Kit available from Lochinvar (see Section 4 – *Sidewall Termination – Optional Concentric Vent*) and the 4" Concentric Vent Kit available from IPEX are both approved for use on the FTXL (400 - 600 models only) boiler. Both kits are listed to the ULC-S636 standard for use in Canada.

Sizing

The FTXL uses model specific combustion air intake and vent piping sizes as detailed in Table 3A below.

Table 3A *Air Intake/Vent Piping Sizes*

Model	Pipe Diameter		De-rate per 25 feet of Vent	
	Air Intake	Vent	Direct Vent	Room Air
400	4" (102 mm)	4" (102 mm)	0.00%	0.00%
500	4" (102 mm)	4" (102 mm)	0.40%	0.40%
600	4" (102 mm)	4" (102 mm)	1.20%	1.20%
725	4" (102 mm)	6" (152 mm)	1.20%	1.20%
850	4" (102 mm)	6" (152 mm)	1.40%	1.40%

NOTICE Increasing or decreasing combustion air or vent piping sizes is not authorized.

Minimum / Maximum allowable combustion air and vent piping lengths are as follows:

Combustion Air = 12 equivalent feet (3.7 m) minimum / 100 equivalent feet (30.5 m) maximum

Vent = 12 equivalent feet (3.7 m) minimum / 100 equivalent feet (30.5 m) maximum

When determining equivalent combustion air and vent length, add 5 feet (1.5m) for each 90° elbow and 3 feet (.9 m) for each 45° elbow.

EXAMPLE: 20 feet (6 m) of PVC pipe + (3) 90° elbows + (3) 45° elbows + (1) concentric vent kit (100140484) = 49 equivalent feet (15 m) of piping.

NOTICE The appliance output rating will reduce by up to 1.5% for each 25 feet of vent length.

Table 3B *Concentric Vent Kit Equivalent Vent Lengths*

Model	Kit Number	Equivalent Vent Length
400	100140484	5' (1.5 m)
500 - 600	100140484	30' (9 m)

Air inlet pipe materials:

The air inlet pipe(s) must be sealed. Choose acceptable combustion air inlet pipe materials from the following list:

PVC, CPVC, Polypropylene or ABS
Dryer Vent or Sealed Flexible Duct (not recommended for rooftop air inlet)
Galvanized steel vent pipe with joints and seams sealed as specified in this section.
Type "B" double-wall vent with joints and seams sealed as specified in this section.
AL29-4C, stainless steel material to be sealed to specification of its manufacturer.

*Plastic pipe may require an adapter (not provided) to transition between the air inlet connection on the appliance and the plastic air inlet pipe.

⚠ WARNING Using air intake materials other than those specified can result in personal injury, death or property damage.

NOTICE The use of double-wall vent or insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

Sealing of Type "B" double-wall vent material or galvanized vent pipe material used for air inlet piping on a sidewall or vertical rooftop Combustion Air Supply System:

a. Seal all joints and seams of the air inlet pipe using either Aluminum Foil Duct Tape meeting UL Standard 723 or 181A-P or a high quality UL Listed silicone sealant such as those manufactured by Dow Corning or General Electric.
b. Do not install seams of vent pipe on the bottom of horizontal runs.
c. Secure all joints with a minimum of three (3) sheet metal screws or pop rivets. Apply Aluminum Foil Duct Tape or silicone sealant to all screws or rivets installed in the vent pipe.
d. Ensure that the air inlet pipes are properly supported.

3 General venting *(continued)*

The PVC, CPVC, or ABS air inlet pipe should be cleaned and sealed with the pipe manufacturer's recommended solvents and standard commercial pipe cement for the material used. The PVC, CPVC, ABS, Dryer Vent or Flex Duct air inlet pipe should use a silicone sealant to ensure a proper seal at the appliance connection and the air inlet cap connection. Dryer vent or flex duct should use a screw type clamp to seal the vent to the appliance air inlet and the air inlet cap. Proper sealing of the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.

Follow the polypropylene manufacturer's instructions when using polypropylene material as an inlet pipe.

When a sidewall or vertical rooftop combustion air supply system is disconnected for any reason, the air inlet pipe must be resealed to ensure that combustion air will be free of contaminants and supplied in proper volume.

⚠ DANGER Failure to properly seal all joints and seams as required in the air inlet piping may result in flue gas recirculation, spillage of flue products and carbon monoxide emissions causing severe personal injury or death.

Optional room air

NOTICE Optional room air is intended for commercial applications. Combustion air piping to the outside is recommended for residential applications.

Commercial applications utilizing the FTXL boiler may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room. In order to use the room air venting option the following conditions and considerations must be followed.

- The unit MUST be installed with the appropriate bird screen (Table 3C).
- The equipment room MUST be provided with properly sized openings to assure adequate combustion air. Please refer to instructions provided with the room air kit.
- Using the room air kit makes the unit vulnerable to combustion air contamination from within the building. Please review Section 1, Prevent Combustion Air Contamination, to ensure proper installation.
- Vent system and terminations must comply with the standard venting instructions set forth in this manual.

NOTICE There will be a noticeable increase in the noise level during normal operation from the inlet air opening.

⚠ WARNING When utilizing the single pipe method, provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

***Table 3C** Optional Room Air Kit*

Model	Description	Kit Number
400 - 850	Room Air Kit	100157616

Air contamination

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the boiler, they can form strong acids. The acid can eat through the boiler wall, causing serious damage and presenting a possible threat of flue gas spillage or boiler water leakage into the building.

Please read the information given in Table 1A, page 10, listing contaminants and areas likely to contain them. If contaminating chemicals will be present near the location of the boiler combustion air inlet, have your installer pipe the boiler combustion air and vent to another location, per this manual.

⚠ WARNING If the boiler combustion air inlet is located in a laundry room or pool facility, for example, these areas will always contain hazardous contaminants.

⚠ WARNING To prevent the potential of severe personal injury or death, check for areas and products listed in Table 1A, page 10 before installing the boiler or air inlet piping.

If contaminants are found, you MUST:

- Remove contaminants permanently.

—OR—

- Relocate air inlet and vent terminations to other areas.

3 General venting

Common venting

FTXL boilers may be common vented; however, the following criteria MUST BE followed:

1. Only FTXL boilers may be connected to the common vent. DO NOT mix other manufacturer's appliances or other Lochinvar models.
2. FTXL boilers connected to the common vent must all be of the same size.
3. Each FTXL boiler must have a Lochinvar supplied flue damper installed (see Table 3D).
4. A condensate drain must be installed above the flue damper.
5. Only vertical direct vent, positive pressure, Category IV or vertical/chimney vent, negative pressure, Category II may be used when common venting FTXL boilers. Sidewall common venting is not allowed.
6. FTXL boilers in a common vent must be connected and controlled with the integral FTXL SMART SYSTEM Cascade.
   a. The Leader may be controlled through the FTXL SMART SYSTEM control through BMS (external 0 - 10V signal), ModBus, BACnet, or its own internally calculated set point.
   b. The Cascade (Members) must be controlled by the FTXL Leader boiler using the Lead/Lag Cascade option.

For approved common vent sizing, contact the factory.

⚠ WARNING When FTXL boilers are common vented, the criteria above MUST BE followed. Failure to follow all these requirements will result in severe personal injury, death, or substantial property damage.

NOTICE When FTXL boilers are common vented, hot water generators must be piped to the primary heating loop and tank thermostats must not be connected to the FTXL.

***Table 3D** Flue Damper Kits*

Flue Damper Kits		
Model	**Damper Size**	**Kit Number**
400	4"	100056141
500	4"	100056141
600	4"	100056141
725	6"	100056142
850	6"	100056142

PVC/CPVC

This product has been approved for use with the PVC/CPVC vent materials listed in Table 3E on page 21.

Installing vent and air piping

⚠ WARNING The vent connection to the appliance must be made with the starter CPVC pipe section provided with the appliance if PVC/CPVC vent is to be used. The field provided vent fittings must be cemented to the CPVC pipe section using an "All Purpose Cement" suitable for PVC and CPVC pipe. Use only the vent materials, primer, and cement specified in Table 3E to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

NOTICE Use only cleaners, primers, and solvents that are approved for the materials which are joined together.

NOTICE All PVC vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the boiler (to allow drainage of condensate).

⚠ WARNING Insulation should not be used on PVC or CPVC venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

3 General venting *(continued)*

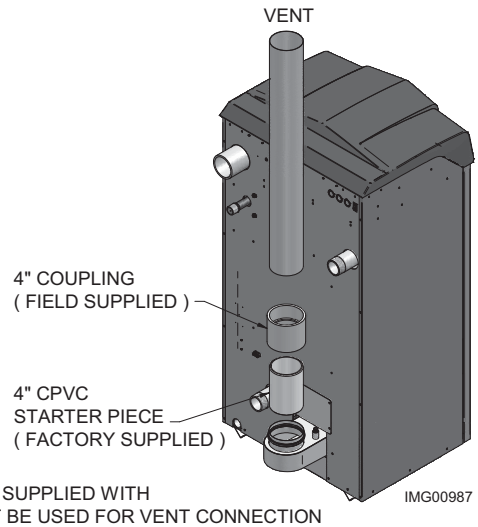
Table 3E *PVC/CPVC Vent Pipe, and Fittings*

Approved PVC/CPVC Vent Pipe and Fittings		
Item	**Material**	**Standard**
Vent pipe	PVC Schedule 40, 80	ANSI/ASTM D1785
	PVC - DWV	ANSI/ASTM D2665
	CPVC Schedule 40, 80	ANSI/ASTM F441
Vent fittings	PVC Schedule 40	ANSI/ASTM D2466
	PVC Schedule 80	ANSI/ASTM D2467
	CPVC Schedule 80	ANSI/ASTM F439
Pipe Cement / Primer	PVC	ANSI/ASTM D2564
	CPVC	ANSI/ASTM F493
NOTICE: DO NOT USE CELLULAR (FOAM) CORE PIPE		

NOTE: In Canada, CPVC and PVC vent pipe, fittings and cement/primer must be ULC-S636 certified.

1. Work from the boiler to vent or air termination. Do not exceed the lengths given in this manual for the air or vent piping.
2. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends.
3. Chamfer outside of each pipe end to ensure even cement distribution when joining.
4. Clean all pipe ends and fittings using a clean dry rag. (Moisture will retard curing and dirt or grease will prevent adhesion.)
5. Dry fit vent or air piping to ensure proper fit up before assembling any joint. The pipe should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
6. Priming and Cementing:
   a. Handle fittings and pipes carefully to prevent contamination of surfaces.
   b. Apply a liberal even coat of primer to the fitting socket and to the pipe end to approximately 1/2" beyond the socket depth.
   c. Apply a second primer coat to the fitting socket.
   d. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket along with an even coat of approved cement to the fitting socket.
   e. Apply a second coat of cement to the pipe.
   f. While the cement is still wet, insert the pipe into the fitting, if possible twist the pipe a 1/4 turn as you insert it. **NOTE:** If voids are present, sufficient cement was not applied and joint could be defective.
   g. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

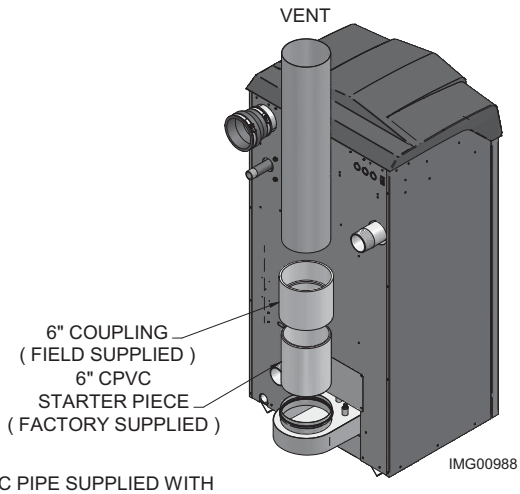
Figure 3-2 *Near Boiler PVC/CPVC Venting - Models 400 - 600*



4" CPVC PIPE SUPPLIED WITH BOILER MUST BE USED FOR VENT CONNECTION

NOTE: CPVC VENT OR STAINLESS STEEL PIPE AND VENT FITTINGS MUST BE USED IN CLOSET AND ALCOVE INSTALLATIONS.

Figure 3-3 *Near Boiler PVC/CPVC Venting - Models 725 - 850*



6" CPVC PIPE SUPPLIED WITH BOILER MUST BE USED FOR VENT CONNECTION

NOTE: CPVC VENT OR STAINLESS STEEL PIPE AND VENT FITTINGS MUST BE USED IN CLOSET AND ALCOVE INSTALLATIONS

3 General venting

Polypropylene

This product has been approved for use with polypropylene vent with the manufacturers listed in Table 3F.

All terminations must comply with listed options in this manual and be a single-wall vent offering.

For support and special connections required, see the manufacturer's instructions. All vent is to conform to standard diameter and equivalent length requirements established.

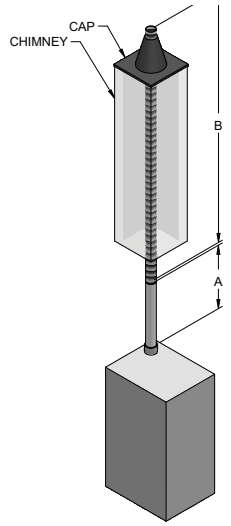
When determining equivalent combustion air and vent length for polypropylene single-wall piping:

- 1 foot of Duravent 4 inch single-wall pipe is equivalent to 1.6 feet of piping

Flexible polypropylene

For use of flex pipe, it is recommended to have the vent material in 32°F or higher ambient space before bending at installation. No bends should be made to greater than 45° and ONLY installed in vertical or near vertical installations (FIG. 3-4).

Figure 3-4 *Near Boiler Flexible Polypropylene Venting*



Duravent 3”

“A” DIM	“B” DIM	
3” RIGID	3” FLEX	4” FLEX
10 FT	60 FT	90 FT
20 FT	53 FT	80 FT
30 FT	47 FT	70 FT
40 FT	40 FT	60 FT
50 FT	33 FT	50 FT
60 FT	27 FT	40 FT
70 FT	20 FT	30 FT
80 FT	13 FT	20 FT
90 FT	7 FT	10 FT

Duravent 4”

“A” DIM	“B” DIM	
4” RIGID	4” FLEX	5” FLEX
10 FT	30 FT	90 FT
20 FT	27 FT	80 FT
30 FT	23 FT	70 FT
40 FT	20 FT	60 FT
50 FT	17 FT	50 FT
60 FT	13 FT	40 FT
70 FT	10 FT	30 FT
80 FT	7 FT	20 FT
90 FT	3 FT	10 FT

Centrotherm 3”

“A” DIM	“B” DIM	
3” RIGID	3” FLEX	4” FLEX
10 FT	45 FT	90 FT
20 FT	40 FT	80 FT
30 FT	35 FT	70 FT
40 FT	30 FT	60 FT
50 FT	25 FT	50 FT
60 FT	20 FT	40 FT
70 FT	15 FT	30 FT
80 FT	10 FT	20 FT
90 FT	5 FT	10 FT

Centrotherm 4”

“A” DIM	“B” DIM
4” RIGID	4” FLEX
10 FT	33 FT
20 FT	29 FT
30 FT	26 FT
40 FT	22 FT
50 FT	18 FT
60 FT	15 FT
70 FT	11 FT
80 FT	7 FT
90 FT	4 FT

*NOTES: 1) FLEX PIPE MAY ONLY BE RUN IN A VERTICAL ORIENTATION
2) ALL VENT LENGTHS REPRESENTED IN ABOVE CHARTS ARE EQUIVALENT LENGTHS.
3) SECTION A IS EQUIVALENT FEET OF RIGID PIPE, WHICH MAY INCLUDE 45 AND 90° ELBOWS. PLEASE SEE SIZING SECTION FOR DETERMINING EQUIVALENT FEET.

IMG00840

NOTICE The installer must use a specific vent starter adapter at the flue collar connection. The adapter is supplied by the vent manufacturer to adapt to its vent system. See Table 3F for approved vent adapters. Discard CPVC starter piece.

NOTICE All vent connections MUST be secured by the vent manufacturer's joint connector (FIG. 3-5).

⚠ WARNING Insulation should not be used on polypropylene venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.

⚠ WARNING Use only the adapters and vent system listed in Tables 3F and 3G. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE Installations must comply with applicable national, state, and local codes. For Canadian installation, polypropylene vent must be listed as a ULC-S636 approved system.

NOTICE Installation of a polypropylene vent system should adhere to the vent manufacturer’s installation instructions supplied with the vent system.

Figure 3-5 *Near Boiler Polypropylene Venting*

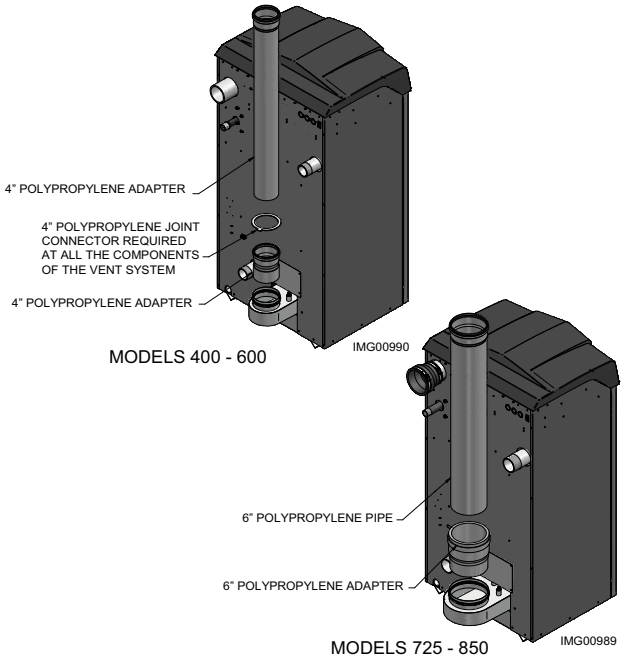


Table 3F *Polypropylene Vent Pipe and Fittings*

Approved Polypropylene Vent Manufacturers	
Make	**Model**
Centrotherm Eco Systems	InnoFlue SW/Flex
Duravent (M & G Group)	PolyPro Single-Wall / PolyPro Flex

Table 3G *Approved Polypropylene Terminations*

Model	Manufacturer	Vent Model	Vent Type	Adapter Number	Joint Connector	Sidewall Kit*	Retaining Bracket / Adapter*
400-600	Centrotherm Eco Systems	Innoflue	Single-Wall Flex	ISAAL0404	IANS04	--	IATP0404/ ISTAGL0404
	DuraVent (M & G)	PolyPro	Single-Wall Flex	4PPS-AD	4PPS-LB	4PPS-HLK	--
725-850	Centrotherm Eco Systems	Innoflue	Single-Wall Flex	ISAAL0606	--	--	IATP0606 / ISTAGL0606
	DuraVent (M & G)	PolyPro	Single-Wall Flex	6PPS-06PVCM-6PPF	--	6PPS-HLK	--

* These parts are only needed if the sidewall termination assembly is used (see FIG. 4-5B on page 27).

3 General venting *(continued)*

Stainless steel vent

This product has been approved for use with stainless steel using the manufacturers listed in Table 3H.

⚠ WARNING Use only the materials, vent systems, and terminations listed in Tables 3G and 3I. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE The installer must use a specific vent starter adapter at the flue collar connection, supplied by the vent manufacturer to adapt to its vent system. See Table 3I for approved vent adapters. Discard CPVC starter piece.

NOTICE Installations must comply with applicable national, state, and local codes. Stainless steel vent systems must be listed as a UL-1738 approved system for the United States and a ULC-S636 approved system for Canada.

NOTICE Installation of a stainless steel vent system should adhere to the stainless steel vent manufacturer's installation instructions supplied with the vent system.

Table 3H *Stainless Steel Vent Pipe and Fittings*

Approved Stainless Steel Vent Manufacturers	
Manufacturer	**Model**
Dura Vent (M & G)	FasNSeal Vent / FasNSeal Flex*
Z-Flex	Z-Vent
Heat Fab	Saf-T Vent
Metal Fab	Corr/Guard
Security Chimney	Secure Seal
ICC	VIC
Jeremias	--

*Use of FasNSeal Flex smooth inner wall vent is to be used in vertical or near vertical sections only, taking precaution to ensure no sagging occurs of the vent system. Connect to the FasNSeal rigid vent using specially designed adapters and sealing method, see manufacturer's instructions.

Figure 3-6 *Near Boiler Stainless Steel Venting Models 400 - 600*

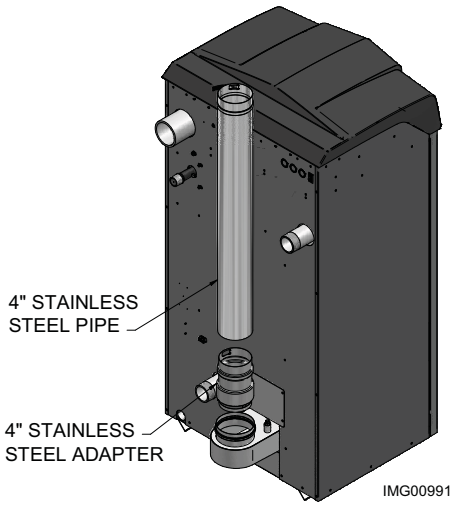


Figure 3-7 *Near Boiler Stainless Steel Venting Models 725 - 850*

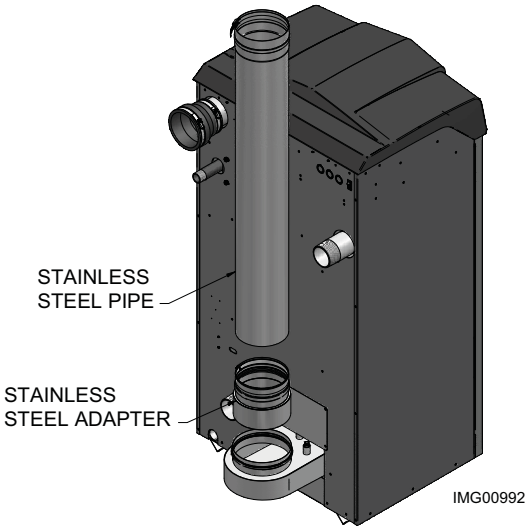


Table 3I *Approved Stainless Steel Adapters and Terminations*

Model	Manufacturer	Adapter		Termination	
		Flue	Intake	Flue	Intake
400-600	DuraVent (M & G) (Fas-N-Seal)	FSA-04-PVC	F303759	FSBS4 FSRC4 (R.C.)	FSAIH04 303888
	Heat Fab (Saf-T-Vent)	9401PVC	9401PVC	0492 5400CI	9414TERM
	Z-Flex (Z-Vent)	2SVSLA04	2SVSLA04	2SVSTP04 2SVSRCX04	2SVSTEX0490
	Metal Fab (Corr/Guard)	4CGPVCA	4CGPVCA	4CGSWHT 4CGSWC	4CGSW90LT
	Security Chimney (Secure Seal)	SS4PVCU	SS4PVCU	SS4STU SS4RCBU	SS4ST90AU
	Jeremias	SWKL4-PVC	SWKL4-PVC	SWKL4-WRC	SWKL4-90ET
725-850	DuraVent (M & G) (Fas-N-Seal)	FSA-06PVC-06FNS 300538	F303759	FSBS6	FSAIH04 303888
	Heat Fab (Saf-T-Vent)	9601PVC	9601PVC	9601PVC	9601PVC
	Metal Fab (Corr/Guard)	6FCGPVCA	6FCGPVCA	6FCGSWMC 6FCGSWC	6CGSW90L
	Security Chimney (Secure Seal)	SS6PVCU	SS6PVCU	SS6STU SS6RCBU	SS6ST90AU
	ICC	HE-6DSA-F	--	HE-6MC-F HE-6RC-F	--
	Jeremias	SWKL6-PVC	SWKL4-PVC	SWKL6-WRC	SWKL4-90ET

4 Sidewall direct venting

Vent/air termination – sidewall

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage.

⚠ WARNING A gas vent extending through an exterior wall shall not terminate adjacent to a wall or below building extensions such as eaves, parapets, balconies, or decks. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe except as noted in Section 3 on page 20. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ CAUTION Sidewall venting commercial products will result in large exhaust plumes in cold climates. Consideration should be taken when locating in proximity to windows, doors, walkways, etc.

NOTICE Installation must comply with local requirements and with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

Determine location

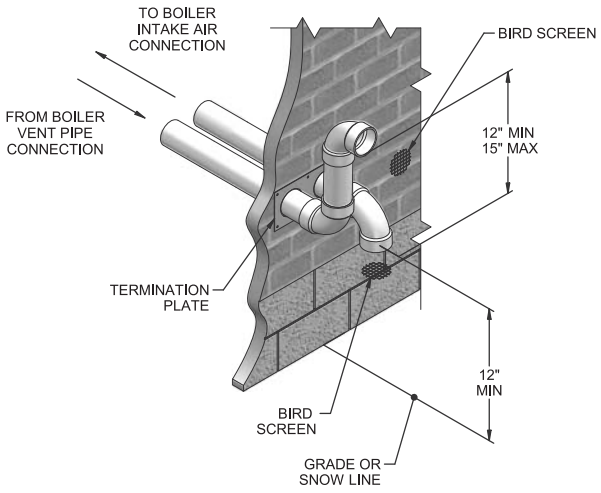
Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 18 of this manual.
2. You must consider the surroundings when terminating the vent and air:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or pets.
   e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.

⚠ WARNING Sidewall vent and air inlet terminations must terminate in the same pressure zone.

   f. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
   g. Locate or guard vent to prevent condensate damage to exterior finishes.

Figure 4-1A *PVC/CPVC/ Polypropylene Sidewall Termination of Air and Vent w/Field Supplied Fittings*



3. The air piping must terminate in a down-turned elbow as shown in FIG. 4-1A. This arrangement avoids recirculation of flue products into the combustion air stream.
4. The vent piping must terminate in an elbow pointed outward or away from the air inlet, as shown in FIG. 4-1A.

⚠ WARNING Do not exceed the maximum lengths of the outside vent piping shown in FIG. 4-1B. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential boiler shutdown.

Figure 4-1B *PVC/CPVC/Polypropylene Sidewall Termination of Air and Vent*

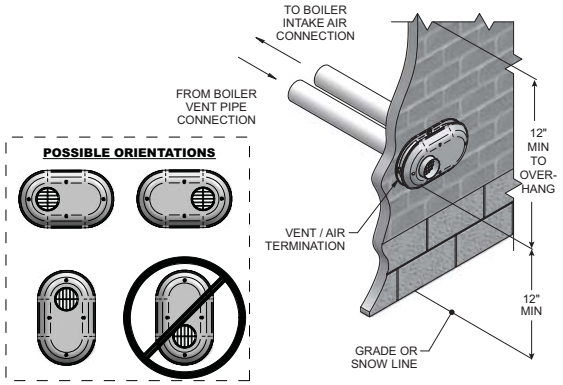


Table 4A *Sidewall Vent Kits*

Model	Kit Number	Air	Vent	Centerline Width
400 - 600	100157611	4" (102 mm)	4" (102 mm)	5 5/8" (143 mm)
725 - 850	100157613	4" (102 mm)	6" (152 mm)	7 3/4" (197 mm)

4 Sidewall direct venting *(continued)*

Vent/air termination – sidewall

Figure 4-2A *PVC/CPVC/ Polypropylene Sidewall Termination Models 400 - 850 w/Field Supplied Fittings*

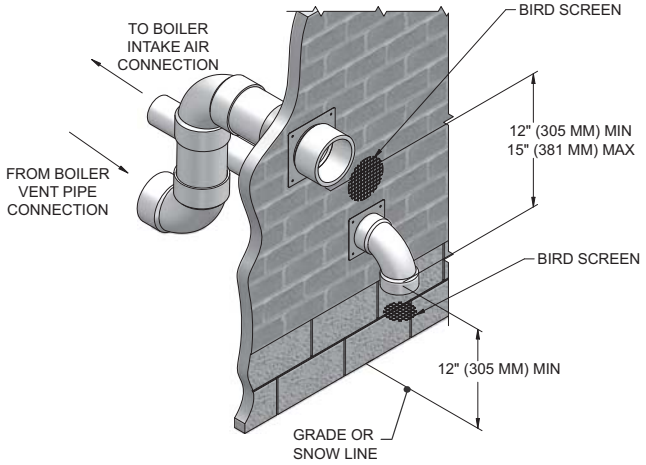
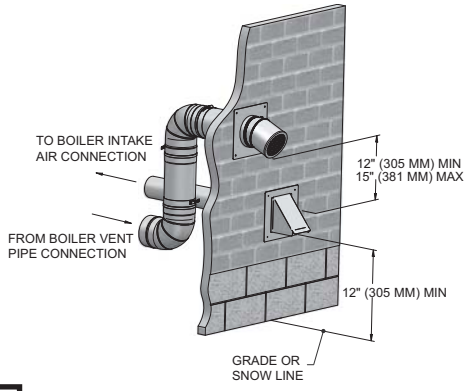


Figure 4-2B *Stainless Steel Sidewall Termination Models 725 - 850 w/Field Supplied Fittings*



NOTICE PVC/CPVC or ABS is acceptable air inlet pipe material.

5. Maintain clearances as shown in FIG.'s 4-1A thru 4-4B, pages 24 thru 26. Also maintain the following:
   a. Vent must terminate:
      - At least 6 feet (1.8 m) from adjacent walls.
      - No closer than 12 inches (305 mm) below roof overhang.
      - At least 7 feet (2.1 m) above any public walkway.
      - At least 3 feet (.9 m) above any forced air intake within 10 feet (3 m).
      - No closer than 12 inches (305 mm) below or horizontally from any door or window or any other gravity air inlet.
   b. Air inlet must terminate at least 12 inches (305 mm) above grade or snow line; at least 12 inches (305 mm) below the vent termination (FIG. 4-1B); and the vent pipe must not extend more than 24 inches (610 mm) vertically outside the building.
   c. Do not terminate closer than 4 feet (1.2 m) horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 4 feet (1.2 m) horizontally.

6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

Figure 4-3A *Clearance to Gravity Air Inlets w/Field Supplied Fittings*

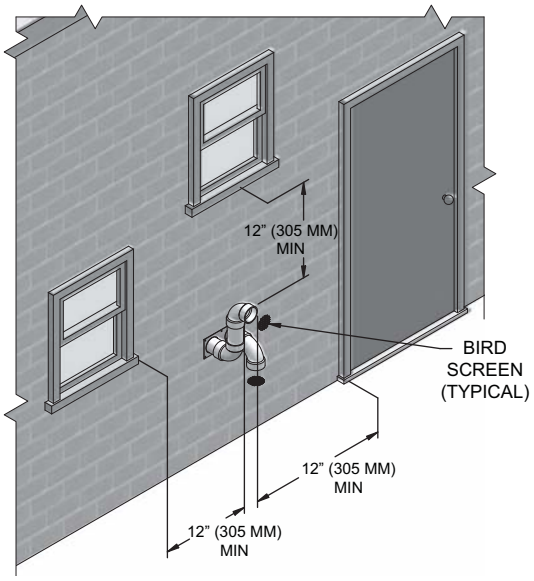
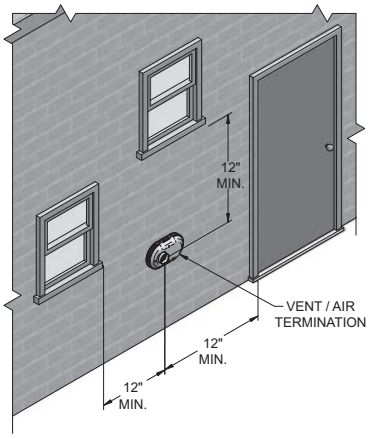


Figure 4-3B *Clearance to Gravity Air Inlets*



4 Sidewall direct venting

Vent/air termination – sidewall

Figure 4-4A *Clearance to Forced Air Inlets w/Field Supplied Fittings*

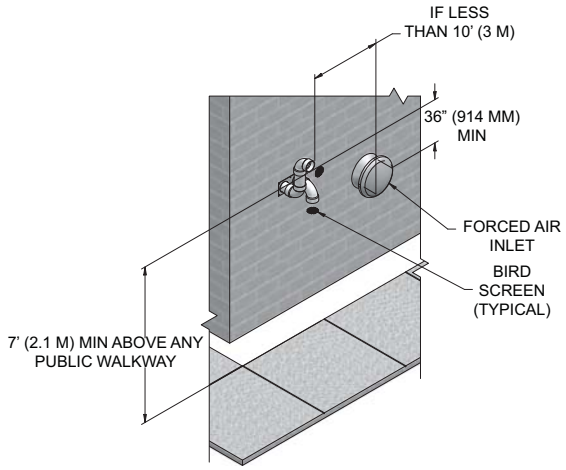
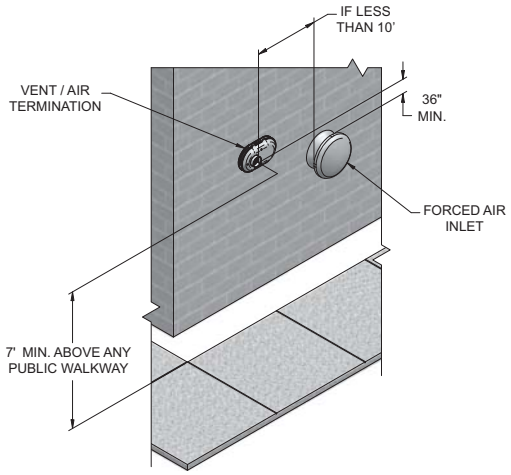


Figure 4-4B *Clearance to Forced Air Inlets*

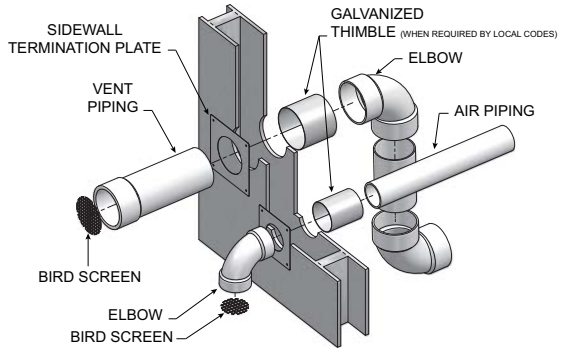


Prepare wall penetrations

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
   - 5½ inch hole (140 mm) hole for 4 inch (102 mm) vent pipe
   - 7½ inch hole (191 mm) hole for 6 inch (152 mm) vent pipe

   b. Insert a galvanized metal thimble in the vent pipe hole as shown in FIG. 4-5A.
3. Use a sidewall termination plate as a template for correct location of hole centers.
4. Follow all local codes for isolation of vent pipe when passing through floors or walls.
5. Seal exterior openings thoroughly with exterior caulk.

Figure 4-5A *A Typical Sidewall Termination Assembly - Models 400 - 850 PVC/CPVC/ Polypropylene or Stainless Steel*



Prepare wall penetrations (Factory Supplied Option)

1. Use the factory supplied wall plate as a template to locate the vent and air intake holes and mounting holes.

   Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.

   Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
   - 5½ inch hole (140 mm) hole for 4 inch (102 mm) vent pipe
   - 7½ inch hole (191 mm) hole for 6 inch (152 mm) vent pipe

   Drill 3/16" diameter holes for inserting the plastic anchors into the wall.

2. For Polypropylene Only: Install the vent and air intake sidewall adapters from Table 3G on page 22 into the vent plate. Slide the sidewall retaining bracket down the sidewall adapters flush to the vent plate (FIG. 4-4A).
3. For PVC/CPVC Only: Install the vent and air intake piping through the wall into the vent plate openings. Use RTV silicone sealant to seal the air pipe. Use the cement/primer listed in Table 3E on page 21 to seal the vent pipe.

4 Sidewall direct venting *(continued)*

4. Mount and secure the vent plate to the wall using stainless steel screws.
5. Seal all gaps between the pipes and wall. Seal around the plate to the wall assuring no air gaps.
6. Assemble the vent cap to the vent plate (see FIG.'s 4-5B and 4-5C). Insert the stainless steel screws into the vent cap screw hole openings and securely attach the vent cap to the vent plate.
7. Seal all wall cavities.
8. PVC/CPVC terminations are designed to accommodate any wall thickness of standard constructions per the directions found in this manual.
9. Stainless steel terminations are designed to penetrate walls with a thickness up to 9.25 inches of standard construction.

Figure 4-5B *PVC/CPVC Sidewall Termination Assembly*

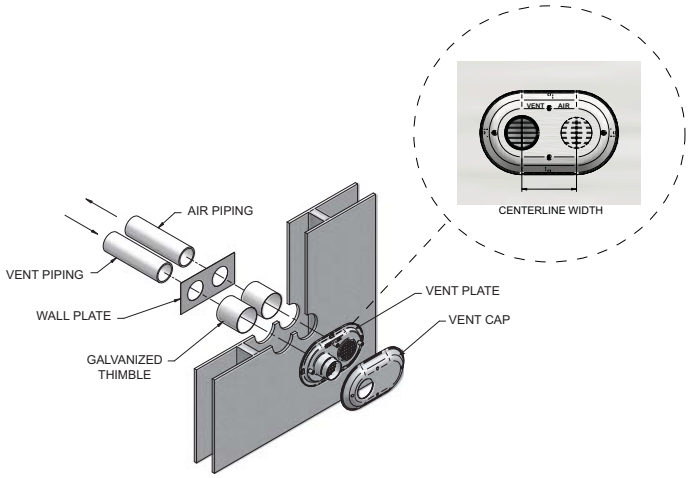
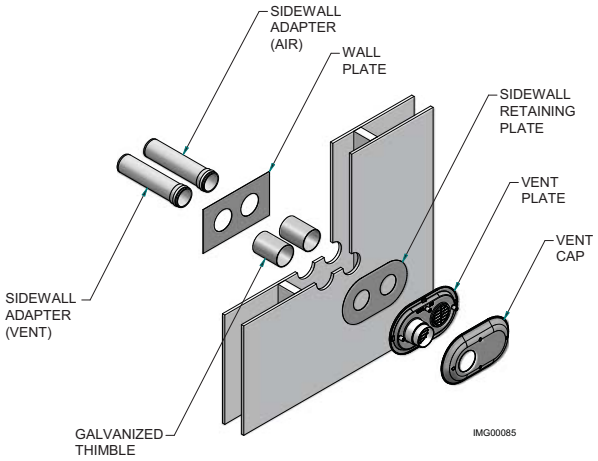


Table 4B *Sidewall Vent Centerline Dimensions*

Model	Air	Vent	Centerline Width
400 - 600	4" (102 mm)	4"(102 mm)	5 5/8" (143 mm)
725 - 850	4" (102 mm)	6" (152 mm)	7 3/4" (197 mm)

Figure 4-5C *Polypropylene Sidewall Termination Assembly*



Multiple vent/air terminations

1. When terminating multiple FTXL's terminate each vent/air connection as described in this manual (FIG. 4-6A).

⚠ WARNING All vent pipes and air inlets must terminate at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place wall penetrations to obtain minimum clearance of 12 inches (305 mm) between vent pipe and adjacent air inlet elbow, as shown in FIG. 4-6B for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 Installation Code.

3. The air inlet of a FTXL is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

Figure 4-6A *Multiple Vent Terminations w/ Field Supplied Fittings (must also comply with* ***Figure 4-1A****)*

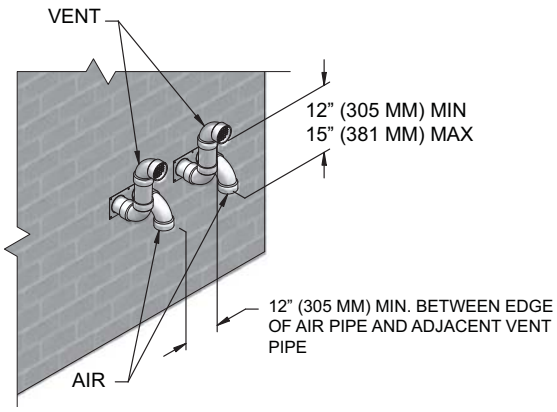
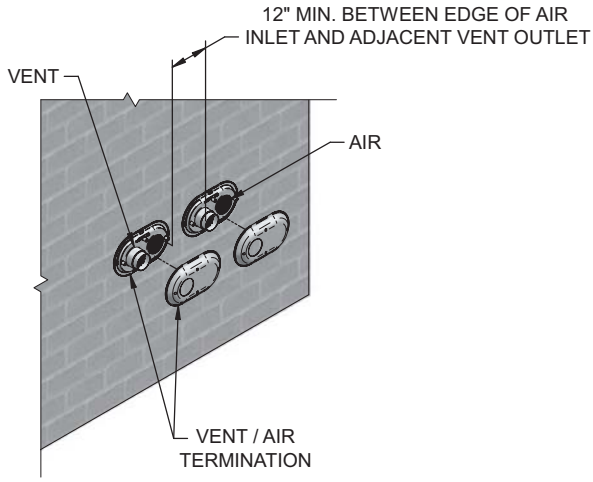


Figure 4-6B *Multiple Vent Terminations (must also comply with* ***Figure 4-1B****)*



4 Sidewall direct venting

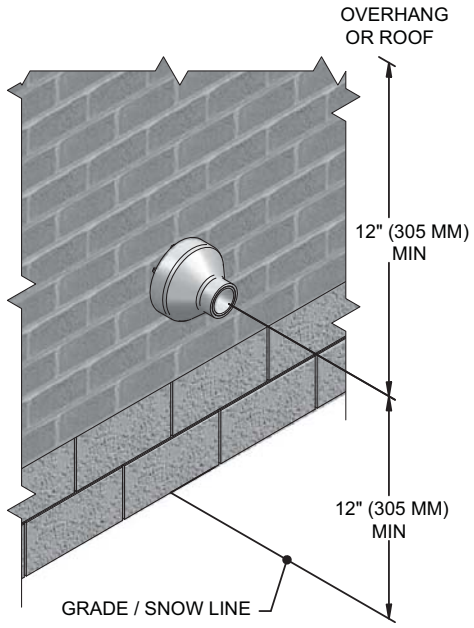
Sidewall termination – optional concentric vent: Models 400 - 600 Only

Description and usage

Lochinvar offers an optional concentric combustion air and vent pipe termination kit (#100140484 for 4" (102 mm) diameter - Models 400 - 600). Both combustion air and vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown below in FIG. 4-7.

The required combustion vent pipe materials are listed in Table 3E, on page 21 of this manual.

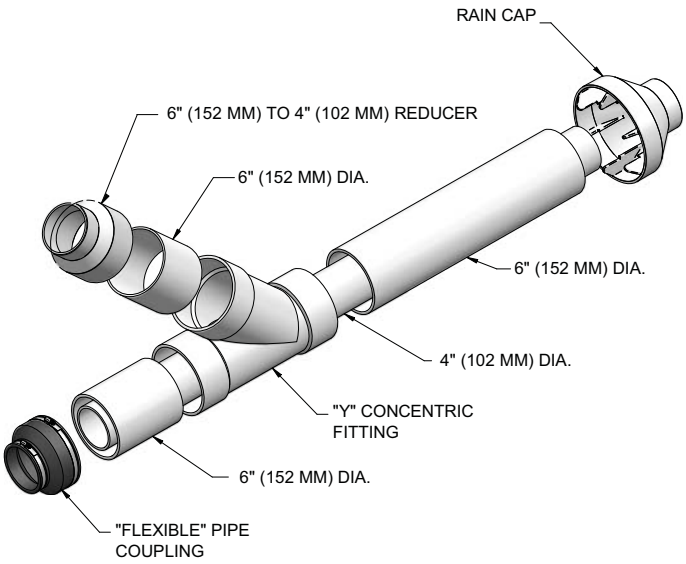
Figure 4-7 *Concentric Sidewall Termination - Models 400 - 600*



Sidewall termination installation

1. Determine the best location for the termination kit (see FIG. 4-7).
2. Reference the *Determine Location Section* on page 24 of this manual for general termination considerations.
3. Cut one (1) hole (7 inch (178 mm) diameter for #100140484 installations into the structure to install the termination kit.
4. Partially assemble the concentric vent termination kit. Clean and cement using the procedures found in these instructions.
   a. Cement the Y concentric fitting to the larger kit pipe (FIG. 4-8).
   b. Cement the rain cap to the smaller diameter kit pipe (FIG. 4-8).

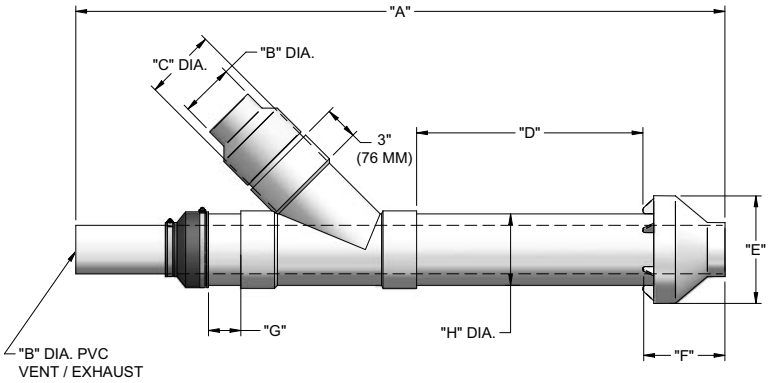
Figure 4-8 *Kit Contents_100140484 - Models 400 - 600*



4 Sidewall direct venting *(continued)*

Sidewall termination – optional concentric vent: Models 400 - 600 Only

Figure 4-9 *Concentric Vent Dimensional Drawing - Models 400 - 600*



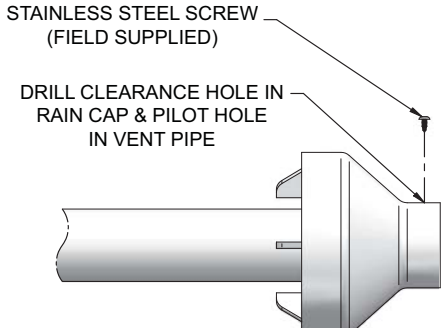
A	B	C	D	E	F	G	H
60" (1524 MM)	4" (102 MM)	6" (152 MM)	21 1/8" (537 MM)	10" (254 MM)	7 5/8" (194 MM)	3" (76 MM)	6 5/8" (168 MM)

NOTICE Instead of cementing the smaller pipe to the rain cap, a field-supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 4-10).

⚠ WARNING When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

⚠ WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

Figure 4-10 *Rain Cap to Vent Pipe Alternate Assembly*



5. Install the Y concentric fitting and pipe assembly through the structure's hole from an inside wall.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

6. Install the rain cap and small diameter pipe assembly into the Y concentric fitting and large pipe assembly from an outside wall. Ensure small diameter pipe is fastened tightly into the rubber adapter for #100140484 installations.

7. Secure the assembly to the structure as shown in FIG. 4-11 using field-supplied metal strapping or equivalent support material.

NOTICE Ensure termination location clearance dimensions are as shown in FIG. 4-7.

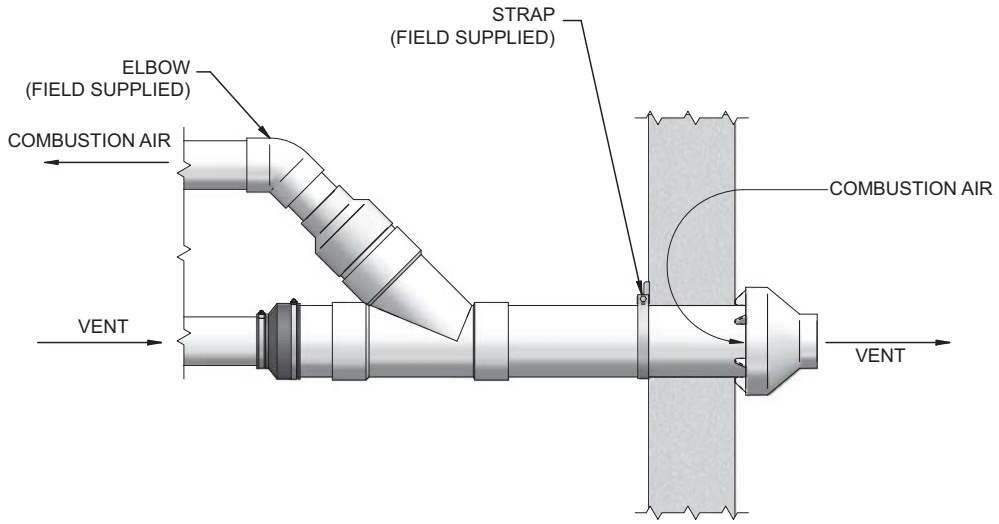
NOTICE If assembly needs to be extended to allow sidewall thickness requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field-supplied standard schedule 40 PVC for #100140484. Do not extend dimension D* more than 60 inches (1524 mm) (see FIG. 4-9).

NOTICE If assembly depth needs to be reduced, dimension D can be as short as possible.

4 Sidewall direct venting

Sidewall termination – optional concentric vent: Models 400 - 600 Only

Figure 4-11 *Concentric Vent Sidewall Attachment*



CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur and may cause intermittent operation.

8. Cement appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 4-11 for proper pipe attachment.

9. Operate the appliance one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing sidewall terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 4-12). When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 4-12. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

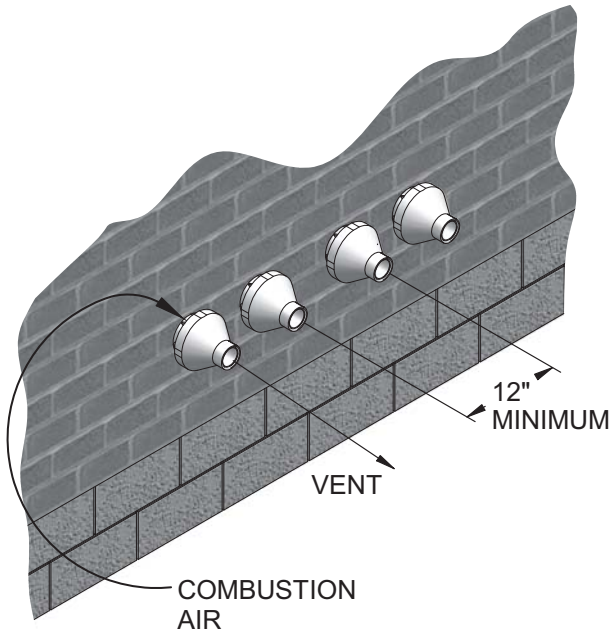


Figure 4-12 *Concentric Vent and Combustion Air Termination*

5 Vertical direct venting

Vent/air termination – vertical

⚠ WARNING Follow instructions below when determining vent location to avoid possibility of severe personal injury, death or substantial property damage.

Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the General Venting Section on page 18 of this manual.

2. Prepare the vent termination and the air termination elbow (FIG. 5-1A) by inserting bird screens. Bird screens should be obtained locally.

3. The vent must terminate at least 3 feet above the highest place in which the vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.

4. The air piping must terminate in a down-turned 180° return pipe no further than 2 feet (.6 m) from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.

5. The vent piping must terminate in an up-turned coupling as shown in FIG. 5-1A. The top of the coupling must be at least 1 foot above the air intake. When the vent termination uses a rain cap as illustrated in FIG. 5-1B maintain at least 36" (914 mm) above the air inlet. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet (.6 m) apart and with the vent termination at least 1 foot above the air intake.

6. Maintain the required dimensions of the finished termination piping as shown in FIG. 5-1A.

7. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

⚠ WARNING Rooftop vent and air inlet terminations must terminate in the same pressure zone, unless vertical vent sidewall air is set up as shown in the General Venting - Vertical Vent, Sidewall Air Section.

Figure 5-1A *PVC/CPVC/Polypropylene Vertical Termination of Air and Vent*

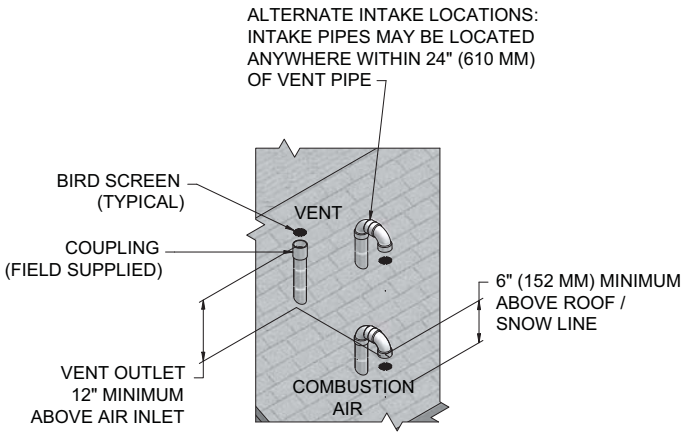
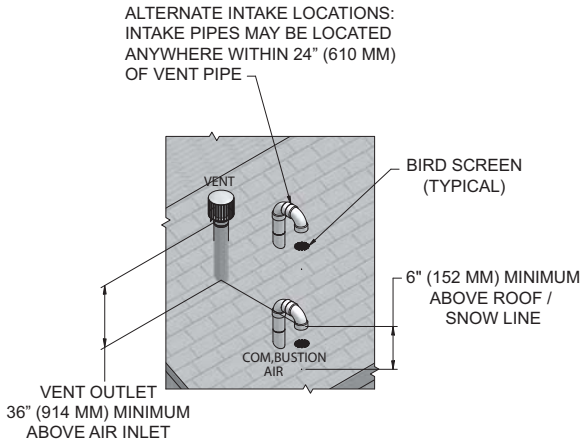


Figure 5-1B *Stainless Steel Vertical Termination of Air and Vent*



8. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

5 Vertical direct venting

Vent/air termination – vertical

Prepare roof penetrations

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.

2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter:
      - 5½ inch hole (140 mm) hole? for 4 inch (102 mm) vent pipe
      - 7½ inch hole (191 mm) hole? for 6 inch (152 mm) vent pipe
   b. Insert a galvanized metal thimble in the vent pipe hole (when required by local codes).

3. Space the air and vent holes to provide the minimum spacing shown in FIG.'s 5-1A and 5-1B, page 31.

4. Follow all local codes for isolation of vent pipe when passing through floors, ceilings, and roofs.

5. Provide flashing and sealing boots sized for the vent pipe and air pipe.

Multiple vent/air terminations

1. When terminating multiple FTXL boilers, terminate each vent/air connection as described in this manual (FIG. 5-2).

⚠ WARNING Terminate all vent pipes at the same height and all air pipes at the same height to avoid recirculation of flue products and the possibility of severe personal injury, death, or substantial property damage.

2. Place roof penetrations to obtain minimum clearance of 12 inches (305 mm) between edge of air intake elbow and adjacent vent pipe of another boiler for U.S. installations (see FIG. 5-2). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.

3. The air inlet of a FTXL boiler is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

Figure 5-2 *Vertical Terminations with Multiple Boilers*

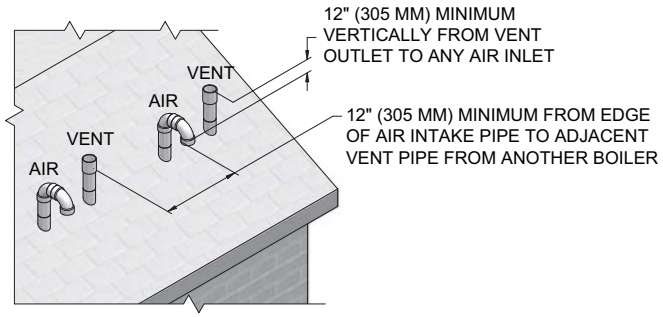
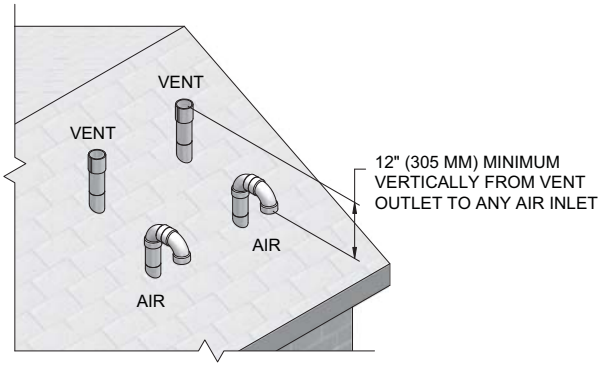


Figure 5-3 *Alternate Vertical Terminations with Multiple Boilers*



5 Vertical direct venting *(continued)*

Vertical termination – optional concentric vent: Models 400 - 600 Only

Description and usage

Lochinvar offers an optional concentric combustion air and vent pipe termination kit. Both combustion air and vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown in FIG. 5-4.

Field supplied pipe and fittings are required to complete the installation.

The required combustion vent pipe fittings are listed in Table 3E, on page 21 of this manual.

Vertical termination installation

1. See Section 5, Vertical Direct Venting - Determine Location (where applicable).

Figure 5-4 *Concentric Vertical Termination*

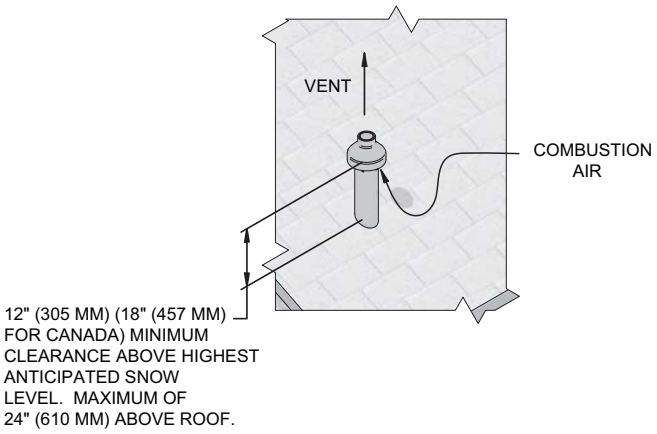


Figure 5-5 *Do Not Install U-Bend to Rain Cap*

2. Cut one (1) hole (7 inch (178 mm) diameter for #100140484 installations) into the structure to install the termination kit.

3. Partially assemble the concentric vent termination kit. Clean and cement following the cleaning procedures in these instructions.
   a. Cement the Y concentric fitting to the larger diameter kit pipe (see FIG. 4-8, page 28).
   b. Cement rain cap to the smaller diameter kit pipe (see FIG. 4-8, page 28).

NOTICE

Instead of cementing the smaller pipe to the rain cap, a field supplied stainless steel screw may be used to secure the two (2) components together when field disassembly is desired for cleaning (see FIG. 4-10, page 29).

⚠ WARNING

When using the alternate screw assembly method, drill a clearance hole in the rain cap and a pilot hole in the vent pipe for the screw size being used. Failure to drill adequate holes may cause cracking of PVC components, allowing combustion products to be recirculated. Failure to follow this warning could result in personal injury or death.

5 Vertical direct venting

Vertical termination – optional concentric vent: Models 400 - 600 Only

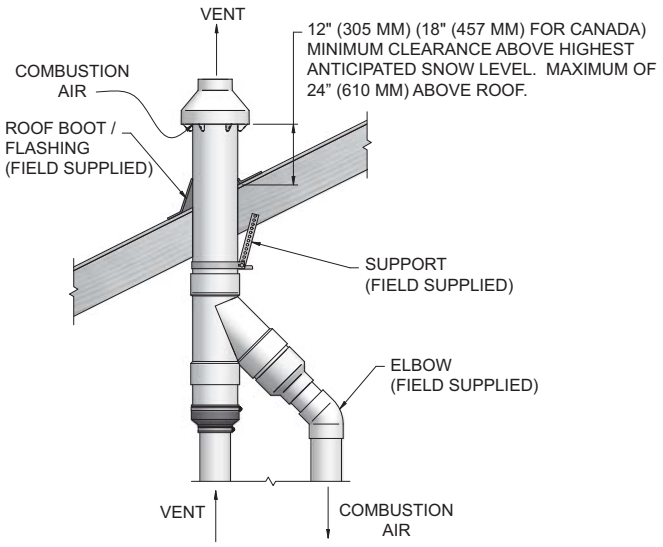
⚠ WARNING Do not operate the appliance with the rain cap removed or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.

4. Install the Y concentric fitting pipe assembly up through the structure's hole and field supplied roof boot/flashing.

NOTICE Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.

5. Secure the assembly to the roof structure as shown below in FIG. 5-6 using field supplied metal strapping or equivalent support material.

Figure 5-6 *Concentric Vent Roof Installation*



NOTICE Ensure termination height is above the roof surface or anticipated snow level (12 inches (305 mm) in U.S.A. or 18 inches (457 mm) in Canada) as shown in FIG. 5-4, page 33.

NOTICE If assembly is too short to meet height requirement, the two (2) pipes supplied in the kit may be replaced by using the same diameter, field supplied standard schedule 40 PVC for 100140484. Do not extend dimension D* more than 60 inches (1524 mm) (see FIG. 4-9, page 29).

CAUTION DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur.

6. Install the rain cap and the small diameter pipe assembly into the roof penetration assembly. Ensure the small diameter pipe is fastened tightly into the rubber adapter for #100140484 installations.

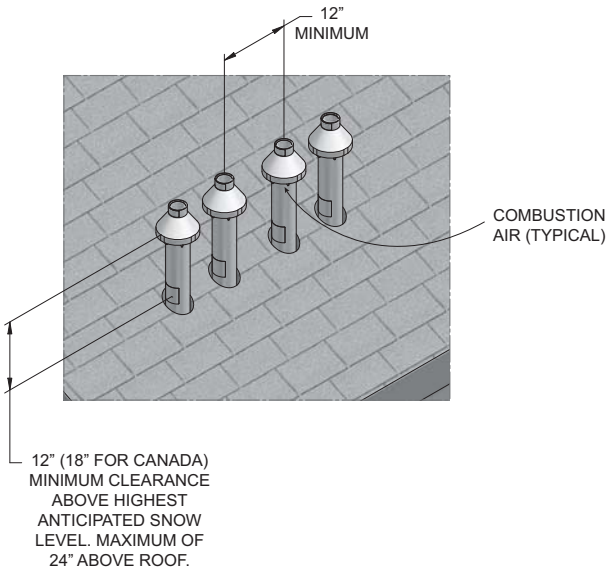
7. Cement the appliance combustion air and vent pipes to the concentric vent termination assembly. See FIG. 5-6 for proper pipe attachment.

8. Operate the appliance through one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

Multiventing vertical terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see FIG. 5-7). When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations may be installed as shown in FIG. 5-7. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

Figure 5-7 *Concentric Vent and Combustion Air Vertical Termination*



5 Vertical direct venting *(continued)*

Alternate vertical concentric venting

This appliance may be installed with a concentric vent arrangement where the vent pipe is routed through an existing unused venting system; or by using the existing unused venting system as a chase for vent and combustion air routing.

Concentric Venting Arrangement

The venting is to be vertical through the roof. The annular space between the O.D. of the vent pipe and the I.D. of the existing unused venting system is utilized for the combustion air source.

The minimum size of the existing vent system required to achieve enough annular space for combustion air can be found in Table 5A.

The upper and lower termination as well as any other unsealed joints in the existing vent system **must be** sealed to ensure that all combustion air is drawn from under the vent cap as shown in FIG.'s 5-8 and 5-9.

Approved venting materials must be used as specified in Table 3E on page 21.

Follow all vent / air termination and clearance requirements per this section to the appropriate example. Installation must comply with local requirements and with the National Fuel Gas Code.

The maximum allowable equivalent vent and air intake lengths for this venting arrangement are to be determined from the General Venting Section.

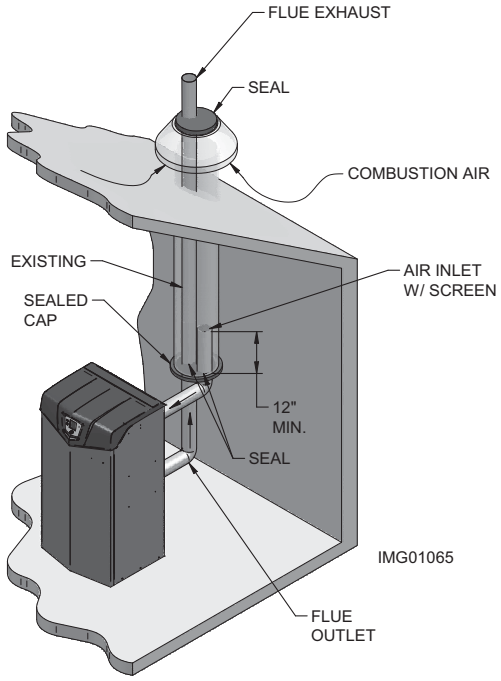
If an existing unused venting system is converted for use with this method of concentric venting, the installer must ensure that the existing venting system is clean and free from particulate contamination that will harm this appliance and cause increased nuisance calls or maintenance. See Table 1A on page 10 for a list of corrosive contaminants and sources.

Two example scenarios of a concentric venting arrangement are shown for illustrative purposes in FIG.'s 5-8 and 5-9.

Table 5A *Alternate Vertical Concentric Vent / Chase Sizes*

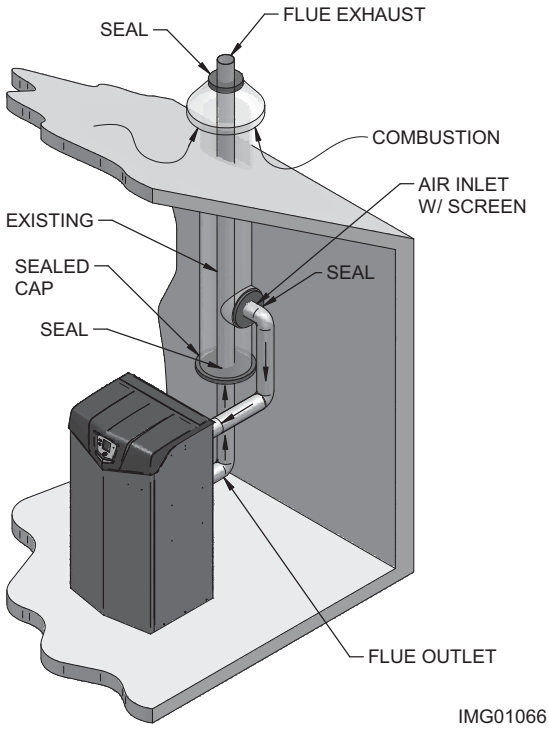
Model	Vent / Air Inlet Size	Minimum Existing Vent / Chase Size
400 - 600	4"	7"
725 - 850	6"	10"

Figure 5-8 *Concentric Vent Example 1*



*For concept illustration only. Individual installations may vary due to job site specific equipment.

Figure 5-9 *Concentric Vent Example 2*



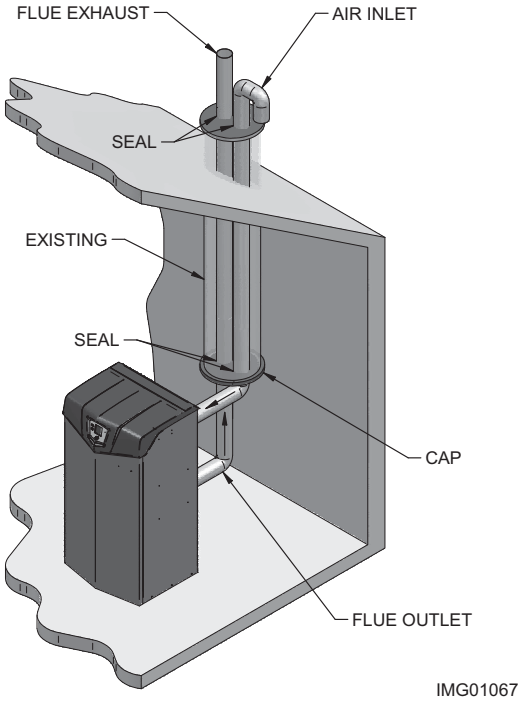
*For concept illustration only. Individual installations may vary due to job site specific equipment.

5 Vertical direct venting

Existing vent as a chase

Follow all existing termination and clearance requirements and allowable pipe lengths. Use only approved venting materials listed in the General Venting Section of this manual.

Figure 5-10 *Existing Vent as a Chase*



*For concept illustration only. Individual installations may vary due to job site specific equipment.

6 Hydronic piping

System water piping methods

The FTXL is designed to function in a closed loop system pressurized to not less than 12 psi (83 kPa). A temperature and pressure gauge is included to monitor system pressure and outlet temperature and should be located on the boiler outlet.

It is important to note that the boiler has a minimal amount of pressure drop which must be accounted for when sizing the circulators. Each boiler installation must have an air elimination device, which will remove air from the system. Install the boiler so the gas ignition system components are protected from water (dripping, spraying, etc.) during appliance operation or basic service of circulator replacement, valves, and others.

Observe a minimum of 1/4 inch (6 mm) clearance around all un-insulated hot water pipes when openings around the pipes are not protected by non-combustible materials.

Low water cutoff device

This boiler comes equipped with a low water cutoff device. On a boiler installed above radiation level, some states and local codes require a low water cutoff device at the time of installation.

Chilled water system

If the boiler supplies hot water to heating coils in air handler units, flow control valves or other devices must be installed to prevent gravity circulation of heater water in the coils during the cooling cycle. A chilled water medium must be piped in parallel with the heater.

Freeze protection

Freeze protection for new or existing systems must use glycol that is specially formulated for this purpose. This includes inhibitors, which prevent the glycol from attacking the metallic system components. Make certain to check that the system fluid is correct for the glycol concentration and inhibitor level. The system should be tested at least once a year and as recommended by the producer of the glycol solution. Allowance should be made for the expansion of the glycol solution in the system piping.

⚠ WARNING Use only inhibited propylene glycol solutions, which are specifically formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems.

General piping information

IMPORTANT All boiler piping must contain an oxygen barrier. This will help prevent any excess oxygen from entering the system.

Basic steps are listed below along with illustrations on the following pages (FIG.'s 6-5 through 6-10), which will guide you through the installation of the FTXL (reference FIG.'s 6-3A and 6-3B).

1. Connect the system return marked "Inlet".
2. Connect the system supply marked "Outlet".
3. Install purge and balance valve or shutoff valve and drain on system return to purge air out of each zone.
4. Install a backflow preventer on the cold feed make-up water line.
5. Install a pressure reducing valve on the cold feed make-up water line, (15 psi (103 kPa) nominal). Check temperature and pressure gauge (shipped separately), which should read a minimum pressure of 12 psi (83 kPa).
6. Install a circulator as shown on the piping diagrams in this section. Make sure the circulator is properly sized for the system and friction loss.
7. Install an expansion tank on the system supply. Consult the tank manufacturer's instruction for specific information relating to tank installation. Size the expansion tank for the required system volume and capacity.
8. Install an air elimination device on the system supply.
9. Install a drain valve at the lowest point of the system. **Note:** The boiler cannot be drained completely of water without purging the unit with an air pressure of 15 psi (103 kPa).
10. This appliance is supplied with a relief valve sized in accordance with ASME Boiler and Pressure Vessel Code, Section IV ("Heating Boilers"). Pipe the discharge of the safety relief valve to prevent injury in the event of pressure relief. Pipe the discharge to a drain. Provide piping that is the same size as the safety relief valve outlet. Never block the outlet of the safety relief valve.

NOTICE The relief valve, tee and any other necessary fittings are shipped in the install kit with the boiler and are to be field installed (FIG.'s 6-1 and 6-2).

11. It is recommended to install an inlet water strainer to prevent debris from entering the heat exchanger or system.

See the piping illustrations included in this section, FIG.'s 6-5 and 6-10 for suggested guidelines in piping the FTXL.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

6 Hydronic piping

Relief valve and temperature and pressure gauge installation

Basic steps are listed below to guide you through the installation of the relief valve, and temperature and pressure gauge provided with the unit.

1. Install the tee directly to the outlet connection of the heat exchanger with the 3/4 inch fitting positioned vertically and on the top (see FIG. 6-2).
2. For Models 725 - 850 install the 3/4 inch close nipple in the tee. Install the relief valve on the 3/4 inch close nipple (FIG. 6-2). For Models 400 - 600 install the relief valve directly into the 3/4 inch fitting on the tee (FIG. 6-1).
3. Install the close nipple on the downstream side of the relief valve tee (FIG. 6-1).
4. Install the tee with the 1 inch fitting positioned vertically and on the top (FIG. 6-1).
5. Install a field provided close nipple on the downstream side of the flow switch (if used), see FIG.'s 6-1 and 6-2.
6. Install a field provided tee with the gauge fitting positioned vertically and on the top (FIG.'s 6-1 and 6-2)
7. Install the temperature and pressure gauge provided with the unit into the top fitting of the tee (a bushing may be necessary) installed in Step 6 (FIG.'s 6-1 and 6-2).

NOTICE If using a flow switch, be sure to install the flow switch so that the arrow on the flow switch is pointing in the direction of the flow.

Figure 6-1 *Flow Switch, Relief Valve and Temperature and Pressure Gauge Installation_Models 400 - 600*

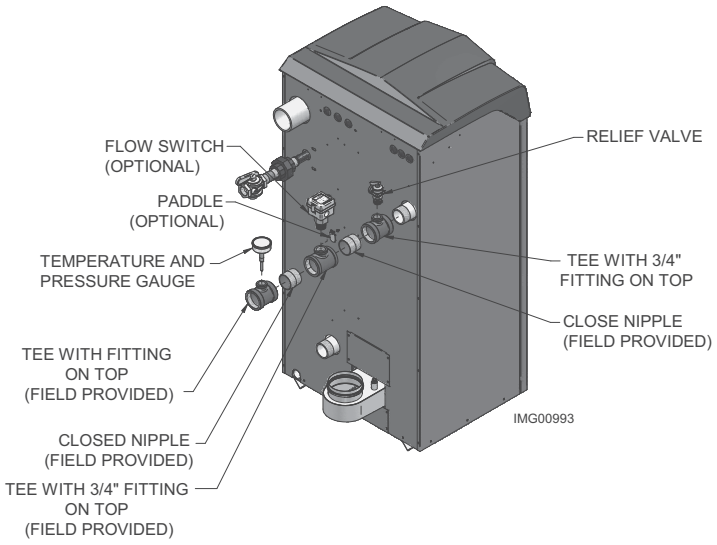
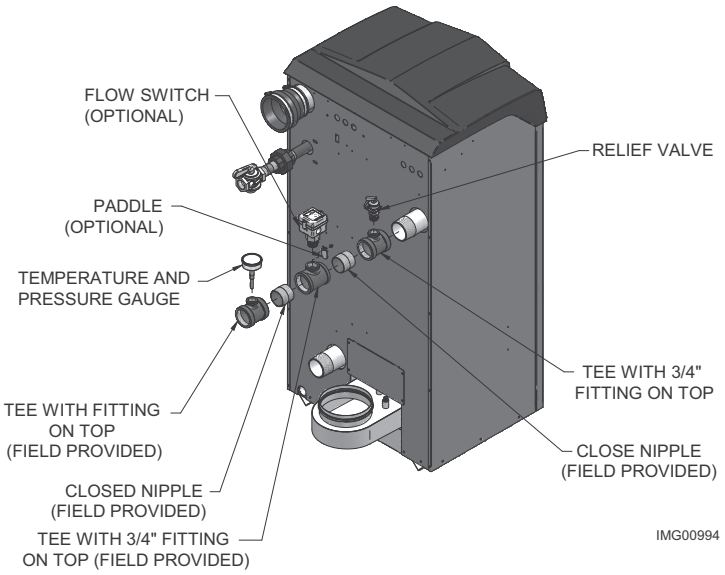


Figure 6-2 *Flow Switch, Relief Valve and Temperature and Pressure Gauge Installation_Models 725 - 850*



6 Hydronic piping *(continued)*

Near boiler piping components

1. **Boiler system piping:**
   Boiler system piping MUST be sized per the pipe requirements listed in Table 6B. Reducing the pipe size can restrict the flow rate through the boiler, causing inadvertent high limit shutdowns and poor system performance. Flow rates are based on a full flow application.
2. **Boiler system circulating pump:**
   Field supplied. The boiler circulating pump should be based on system requirements.
3. **Domestic hot water circulating pump:**
   Field supplied. The pump MUST be sized to meet the specified minimum flow requirements listed in FIG. 6-4. Consult the indirect water heater operating guide to determine flow characteristics for the selected product used.
4. **Variable speed boiler circulator:**
   FTXL boilers are capable of controlling a variable speed boiler circulator. Variable speed circulators MUST be sized to meet the specified minimum flow requirements listed in FIG. 6-4 on page 41 at full speed. To be used in primary/secondary systems only.
5. **Boiler isolation valves:**
   Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the boiler.
6. **Check valves:**
   Field supplied. Check valves are recommended for installation as shown in FIG.'s 6-5 through 6-10. Failure to install check valves could result in a reverse flow condition during pump(s) off cycle.
7. **Domestic indirect hot water isolation valves:**
   Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the boiler.
8. **Anti-scald mixing valve:**
   Field supplied. An anti-scald mixing valve is recommended when storing domestic hot water above 115°F (46°C).
9. **Unions:**
   Field supplied. Recommended for unit serviceability.
10. **Temperature and pressure gauge:**
    Factory supplied. The temperature and pressure gauge is shipped loose. It is the responsibility of the contractor to install the temperature and pressure gauge on the boiler water outlet.
11. **Pressure relief valve:**
    Factory supplied. The pressure relief valve is sized to ASME specifications.
12. **Boiler purge valve:**
    Field supplied. The boiler purge valve is used to remove entrapped air from the heat exchanger during start-up.
13. **System temperature sensor:**
    Lochinvar supplies a system temperature sensor. The sensor is to be installed in the heating loop downstream from the boiler hot water piping and heating loop junction. The sensor should be located far enough downstream to sense system diluted water temperature.
14. **Y-Strainer:**
    Field supplied. A Y-strainer or equivalent multipurpose strainer is recommended at the inlet of the heat exchanger to remove system particles from older hydronic systems and protect newer systems.
15. **Motorized isolation valve (optional):**
    Field supplied. A motorized isolation valve can be used to isolate the boiler from the system piping.

Circulator sizing

The FTXL heat exchanger does have a pressure drop, which must be considered in your system design. Refer to the graphs in FIG. 6-4 for pressure drop through the FTXL heat exchanger.

6 Hydronic piping

Near boiler piping connections

Figure 6-3A *Near Boiler Piping w/Y-Strainer*

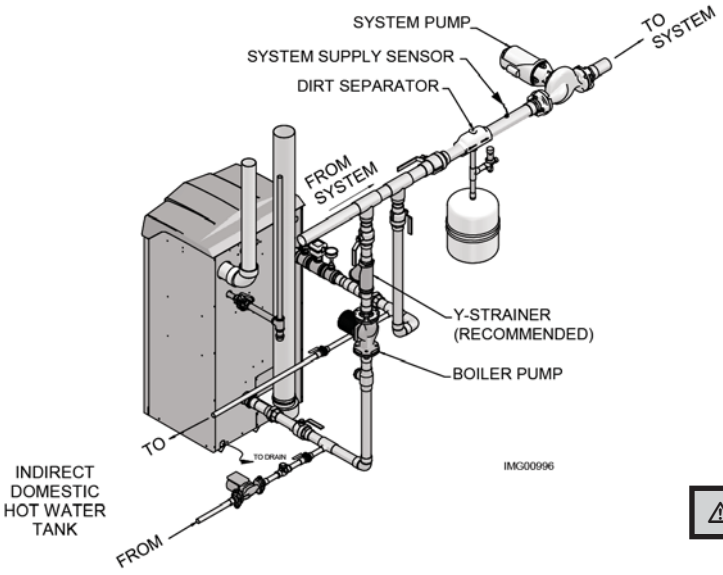
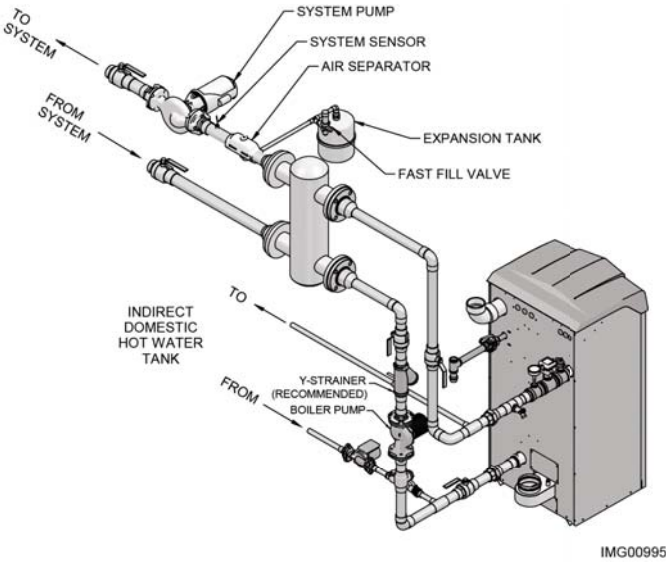


Figure 6-3B *Near Boiler Piping w/Low Loss Header*



Variable speed pump option

Variable speed pump setup

Before operation, ensure the following:

- Pump is set for an input signal of 0 - 10VDC by the dip switches on the pump control
- Pump is set for external signal control (if applicable)
- Pump is set for linear output (if applicable)
- If pump does not come equipped with a 0 - 10 VDC input option, an optional module will be required from the vendor

SMART SYSTEM / Multi-temperature loop control option

The FTXL boiler is capable of producing up to three (3) set point temperatures to meet different space heating demands. When using more than one temperature demand it is necessary to protect the lower temperature loop(s) from overheating. To help aid with this protection, Lochinvar offers the Multi-Temperature Loop Control Board Kit (100167843).

⚠ CAUTION The maximum allowable water flow rate through a single FTXL boiler is 105 GPM (Models 400 - 600) and 150 GPM (Models 725 - 850). Exceeding this flow rate will result in damage to the heat exchanger and/or piping.

NOTICE Reference Table 6A1 for the minimum recommended flow rate through a single FTXL boiler at full fire to maintain a 80°F temperature rise. Reference Table 6A2 for the absolute minimum flow rate through a single FTXL boiler.

Table 6A1 *Minimum Flow Rate with the Boiler at Full Fire*

TEMPERATURE RISE APPLICATIONS	
MODEL	**FLOW RATE (GPM)**
FTX(N,L)400	10
FTX(N,L)500	12
FTX(N,L)600	15
FTX(N,L)725	18
FTX(N,L)850	21
[Based on 80°F Temperature Rise]	

Table 6A2 *Absolute Minimum Flow Rate @ Low Fire*

ABSOLUTE MINIMUM FLOW RATE	
MODEL	**FLOW RATE (GPM)**
FTX(N,L)400	4
FTX(N,L)500	4
FTX(N,L)600	4
FTX(N,L)725	4
FTX(N,L)850	4

6 Hydronic piping *(continued)*

Figure 6-4 *Pressure Drop vs. Flow*

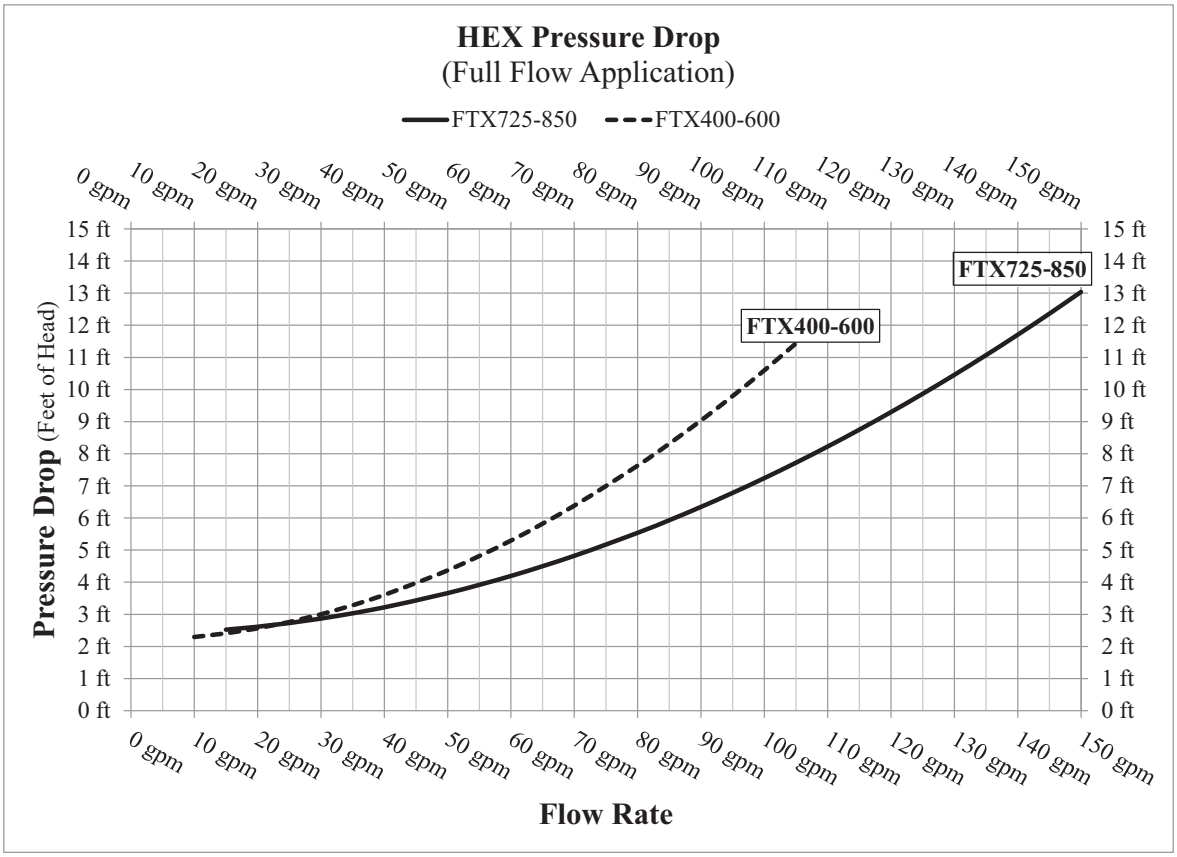


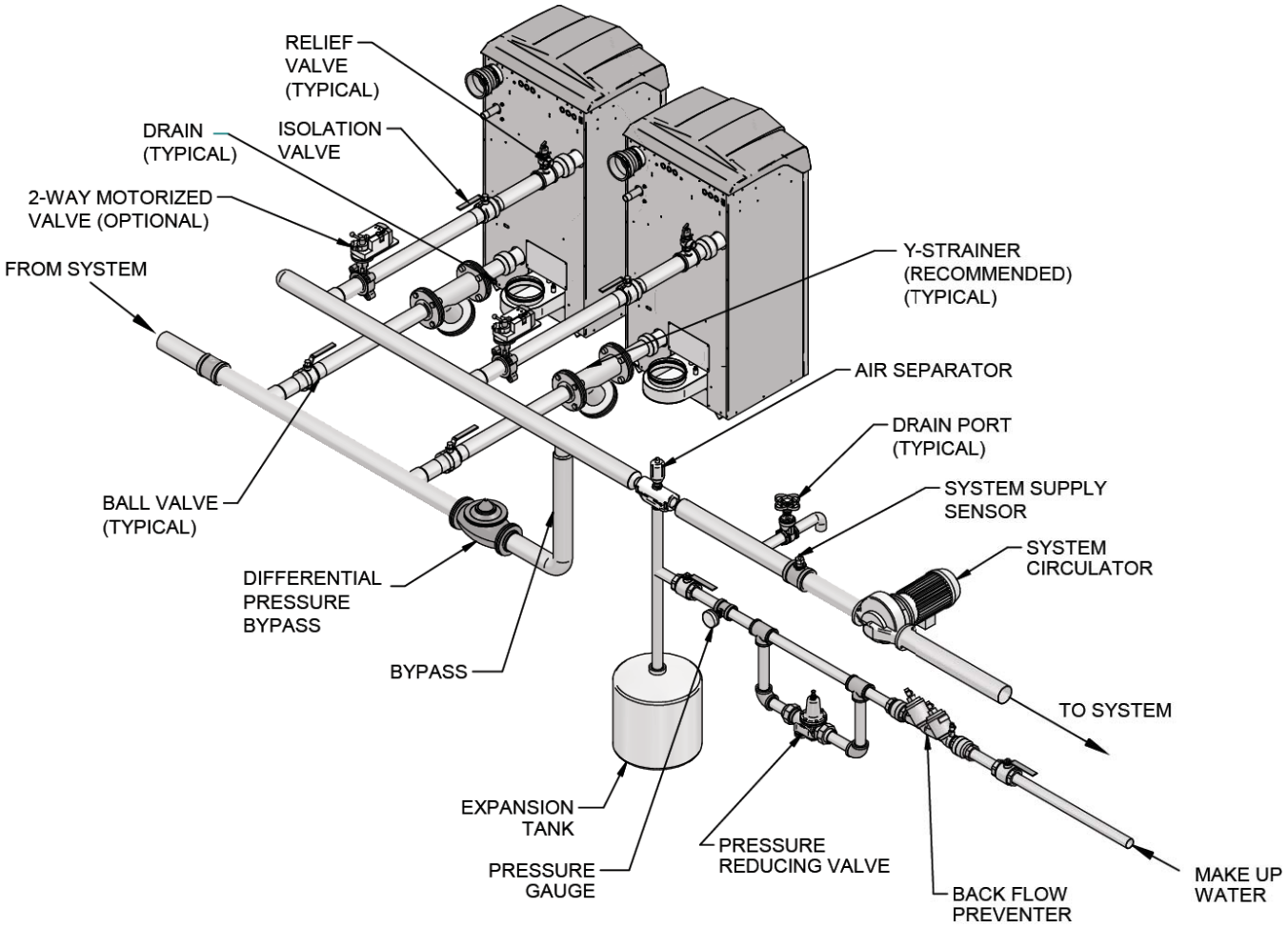
Table 6B *Sizing Information for Temperature Rise Applications_20°F, 30°F, 40°F, 60°F and 80°F*

TEMPERATURE RISE APPLICATIONS											
Model	MINIMUM PIPE SIZE	20°F		30°F		40°F		60°F		80°F	
		GPM	FT/HD	GPM	FT/HD	GPM	FT/HD	GPM	FT/HD	GPM	FT/HD
400	2"	39	3.5	26	2.8	20	2.5	13	2.4	10	2.3
500	2"	49	4.8	33	3.4	24	2.9	16	2.5	12	2.4
600	2"	59	4.4	39	3.2	29	2.8	20	2.5	15	2.3
725	2 1/2"	71	4.9	47	3.5	35	3.0	24	2.7	18	2.6
850	2 1/2"	83	5.7	55	3.9	41	3.3	28	2.8	21	2.6

6 Hydronic piping

Figure 6-5 *Multiple Boilers - Alternate - Fixed or Variable Flow Primary System Piping*

Model	Number of Units						
	2	3	4	5	6	7	8
	Manifold Pipe Sizes in Inches (mm)						
400	3 1/2 (89)	4 (102)	5 (127)	6 (152)	6 (152)	8 (203)	10 (254)
500	3 1/2 (89)	4 (102)	5 (127)	6 (152)	6 (152)	8 (203)	10 (254)
600	3 1/2 (89)	4 (102)	5 (127)	6 (152)	6 (152)	8 (203)	10 (254)
725	4 (102)	5 (127)	6 (152)	8 (203)	8 (203)	8 (203)	10 (254)
850	4 (102)	5 (127)	6 (152)	8 (203)	8 (203)	8 (203)	10 (254)

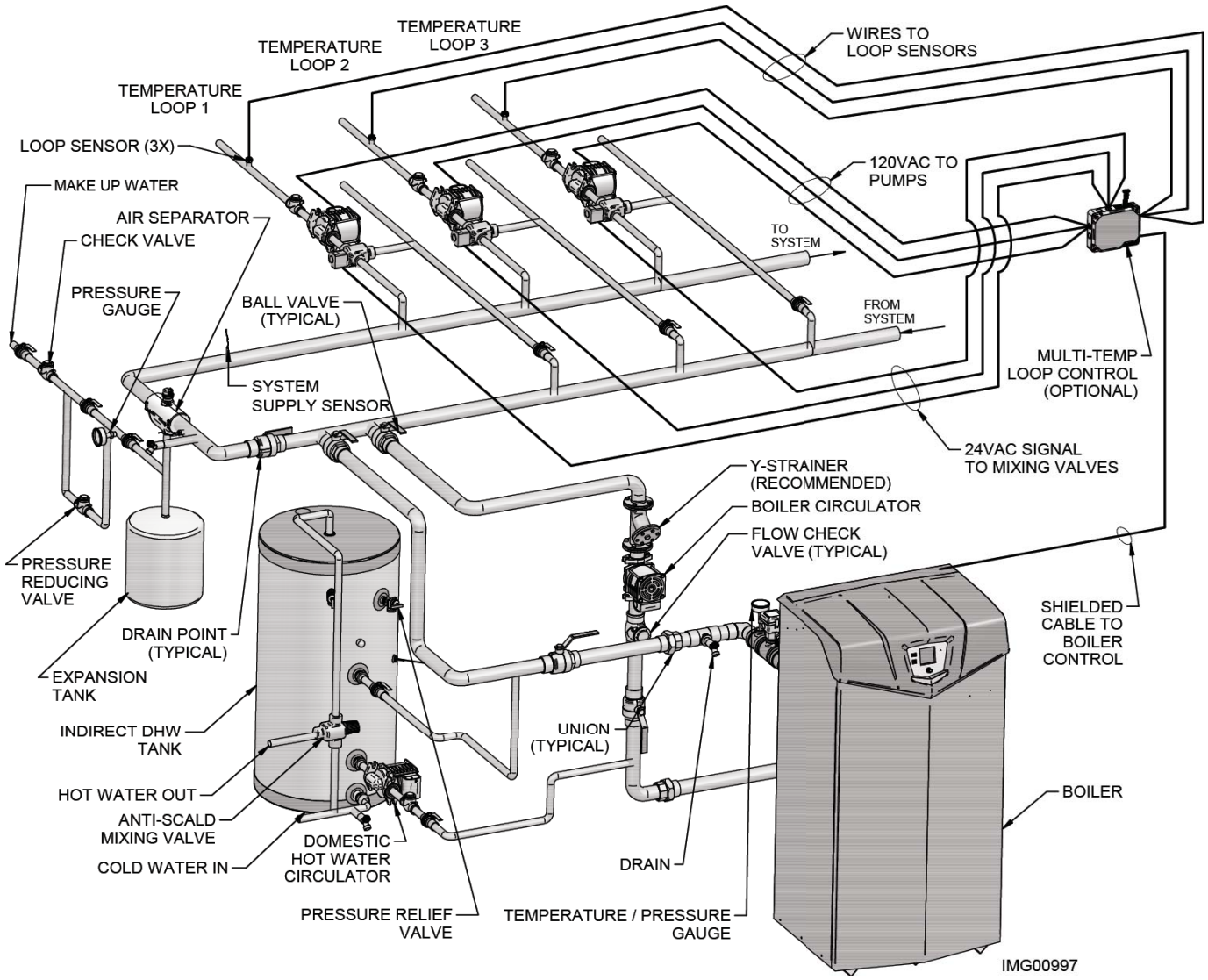


CAUTION Mixing valves are required for the protection of low temperature loops.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

6 Hydronic piping *(continued)*

Figure 6-6 *Single Boiler - Multiple Temperatures*

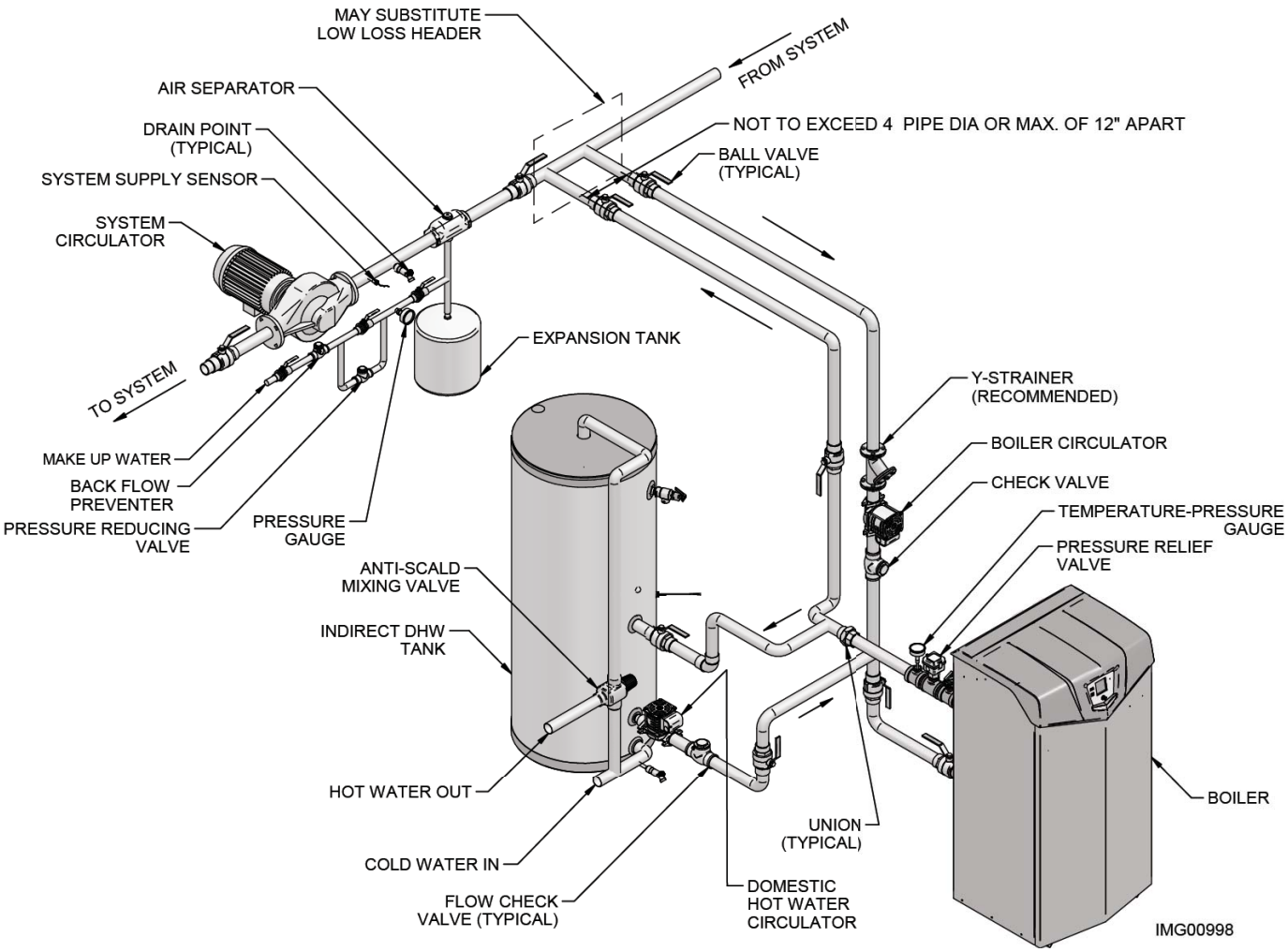


CAUTION Mixing valves are required for the protection of low temperature loops.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

6 Hydronic piping

Figure 6-7 *Single Boiler - Primary/Secondary Piping*



CAUTION Indirect water heaters are capable of transferring a limited number of Btu's into the water. Ensure boiler output does not exceed indirect water heater transfer capabilities.

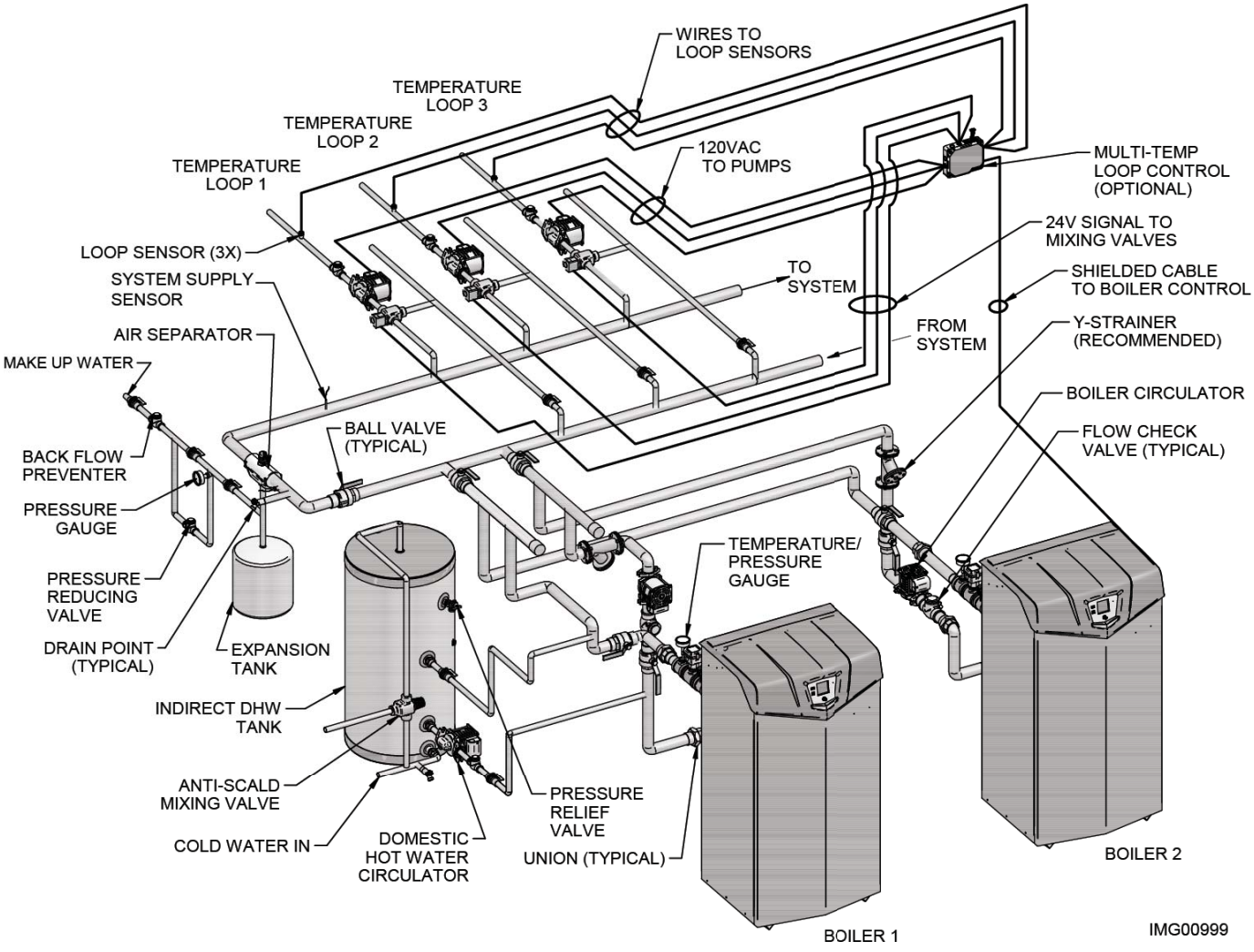
NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

NOTICE System flow should always remain higher than the required flow for the boiler(s) when the boiler(s) is in operation to prevent short cycling and high limit issues.

6 Hydronic piping *(continued)*

Figure 6-8 *Multiple Boilers - Multiple Temperatures*

Model	Number of Units						
	2	3	4	5	6	7	8
	Manifold Pipe Sizes in Inches (mm)						
400	3 1/2 (89)	4 (102)	5 (127)	6 (152)	6 (152)	8 (203)	10 (254)
500	3 1/2 (89)	4 (102)	5 (127)	6 (152)	6 (152)	8 (203)	10 (254)
600	3 1/2 (89)	4 (102)	5 (127)	6 (152)	6 (152)	8 (203)	10 (254)
725	4 (102)	5 (127)	6 (152)	8 (203)	8 (203)	8 (203)	10 (254)
850	4 (102)	5 (127)	6 (152)	8 (203)	8 (203)	8 (203)	10 (254)



CAUTION Indirect water heaters are capable of transferring a limited number of Btu's into the water. Ensure boiler output does not exceed indirect water heater transfer capabilities.

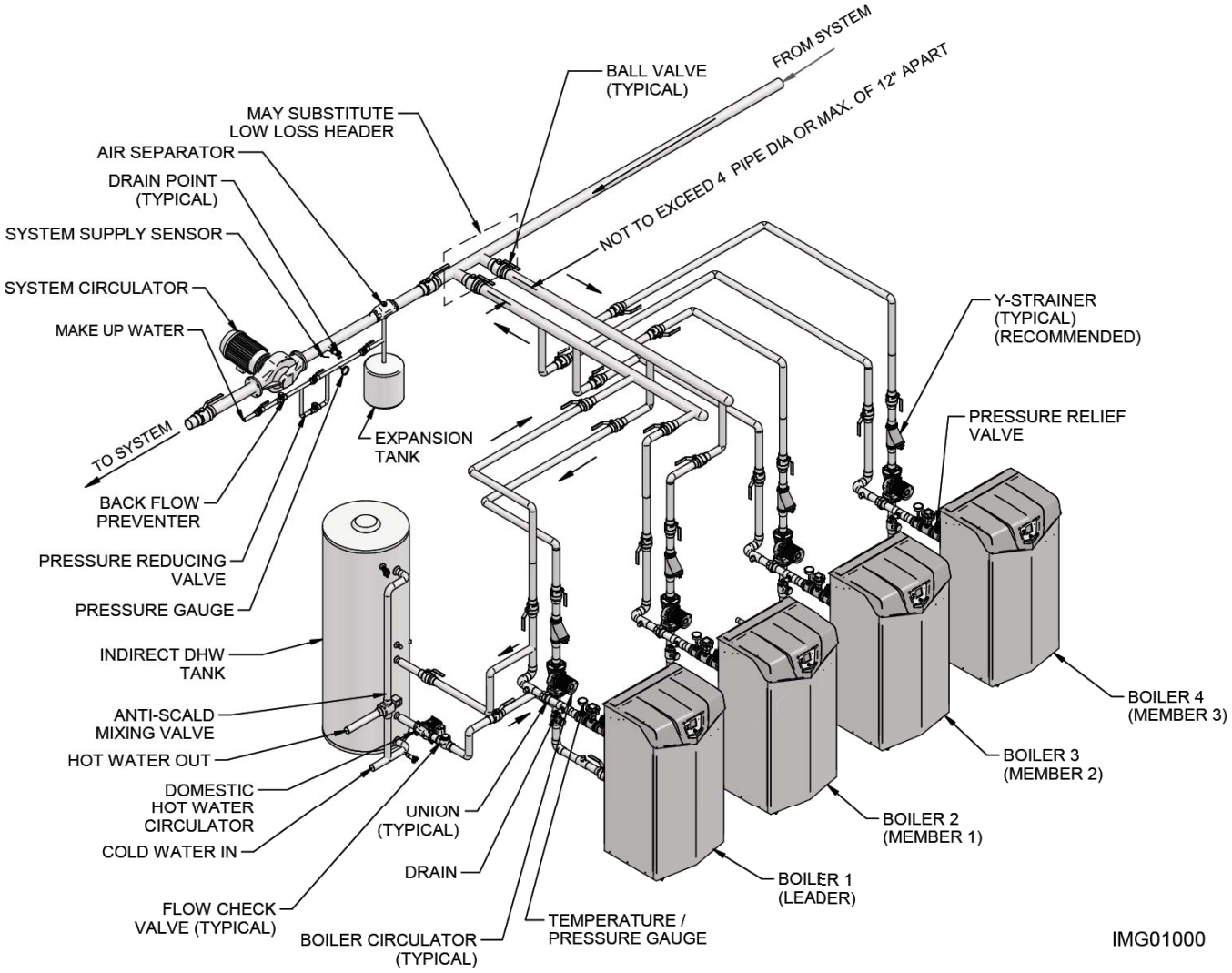
CAUTION Mixing valves are required for the protection of low temperature loops.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

6 Hydronic piping

Figure 6-9 *Multiple Boilers - Primary/Secondary Piping*

Model	Number of Units						
	2	3	4	5	6	7	8
	Manifold Pipe Sizes in Inches (mm)						
400	3 1/2 (89)	4 (102)	5 (127)	6 (152)	6 (152)	8 (203)	10 (254)
500	3 1/2 (89)	4 (102)	5 (127)	6 (152)	6 (152)	8 (203)	10 (254)
600	3 1/2 (89)	4 (102)	5 (127)	6 (152)	6 (152)	8 (203)	10 (254)
725	4 (102)	5 (127)	6 (152)	8 (203)	8 (203)	8 (203)	10 (254)
850	4 (102)	5 (127)	6 (152)	8 (203)	8 (203)	8 (203)	10 (254)



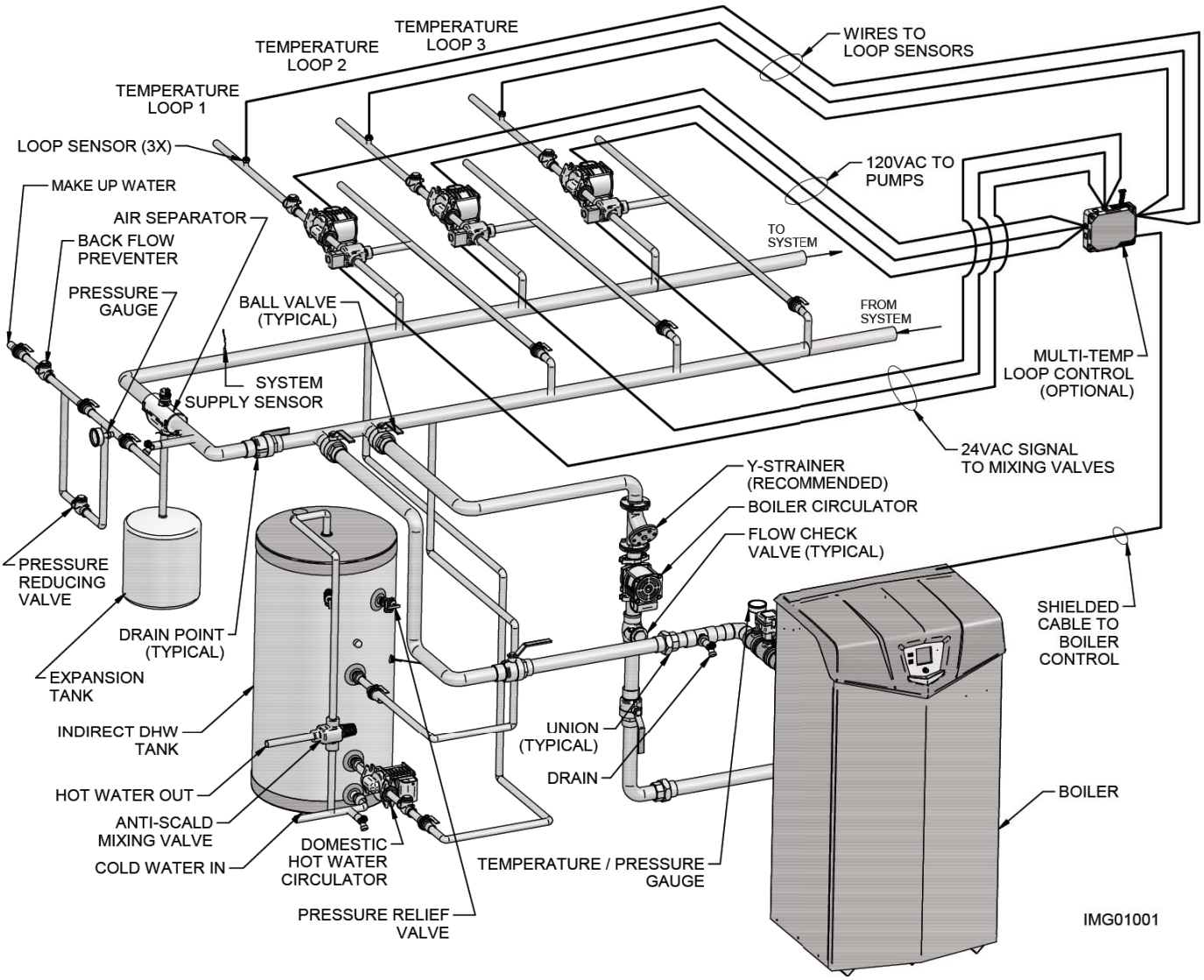
CAUTION Indirect water heaters are capable of transferring a limited number of Btu's into the water. Ensure boiler output does not exceed indirect water heater transfer capabilities.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

NOTICE System flow should always remain higher than the required flow for the boiler(s) when the boiler(s) is in operation to prevent short cycling and high limit issues.

6 Hydronic piping *(continued)*

Figure 6-10 *Single Boiler - Multiple Temperatures with DHW Piped as a Zone*



CAUTION Indirect water heaters are capable of transferring a limited number of Btu's into the water. Ensure boiler output does not exceed indirect water heater transfer capabilities.

CAUTION Mixing valves are required for the protection of low temperature loops.

NOTICE Please note that these illustrations are meant to show system piping concept only, the installer is responsible for all equipment and detailing required by local codes.

NOTICE Please note that the installer is responsible for ensuring DHW prioritization when piped as a zone.

7 Gas connections

Connecting gas supply piping

1. Remove the top access panel and refer to FIG.'s 7-1 and 7-2 to pipe gas to the boiler.
   a. Install ground joint union for servicing, when required.
   b. Install a manual shutoff valve in the gas supply piping outside boiler jacket when required by local codes or utility requirements.
   c. In Canada – When using manual main shutoff valves, it must be identified by the installer.
2. Install sediment trap / drip leg.

Figure 7-1 *Gas Supply Piping - Model 400 - 600*

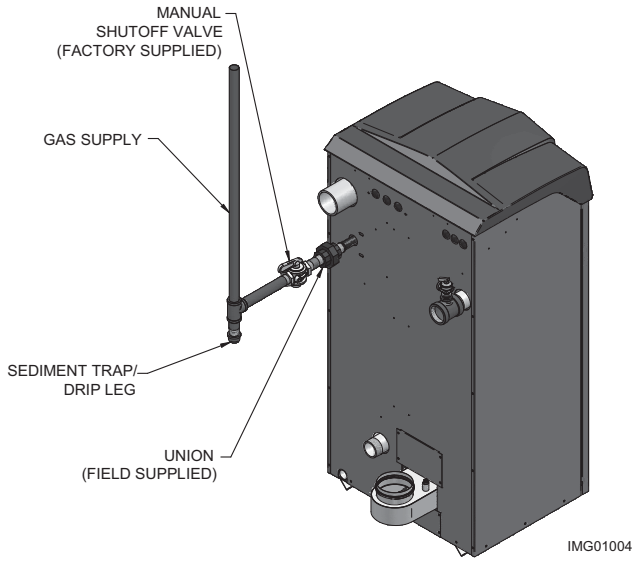
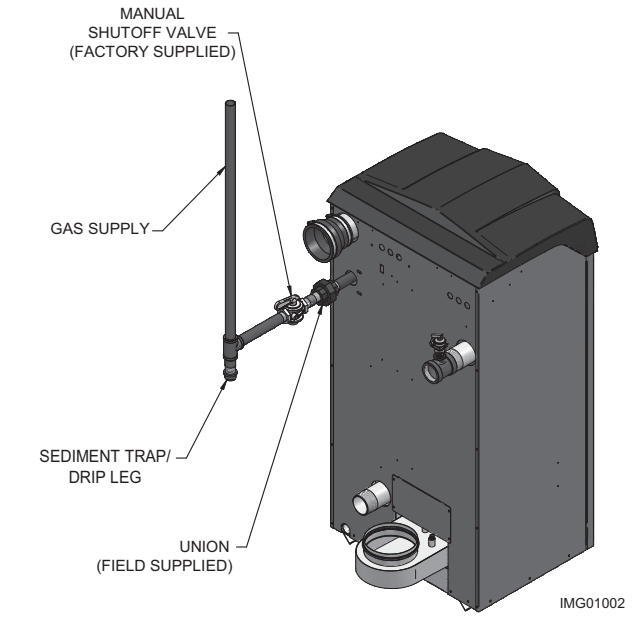


Figure 7-2 *Gas Supply Piping - Models 725 - 850*



3. Support piping with hangers, not by the boiler or its accessories.

⚠ WARNING The gas valve and blower will not support the weight of the piping. Do not attempt to support the weight of the piping with the boiler or its accessories. Failure to comply could result in severe personal injury, death, or substantial property damage.

4. Purge all air from the gas supply piping.
5. Before placing the boiler in operation, check the boiler and its gas connection for leaks.
   a. The appliance must be disconnected from the gas supply piping system during any pressure testing of that system at a test pressure in excess of 1/2 PSIG (3.5 kPa).
   b. The appliance must be isolated from the gas supply piping system by closing a manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG (3.5 kPa).
   c. The appliance and its gas connection must be leak tested before placing it in operation.

⚠ WARNING Do not check for gas leaks with an open flame – use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

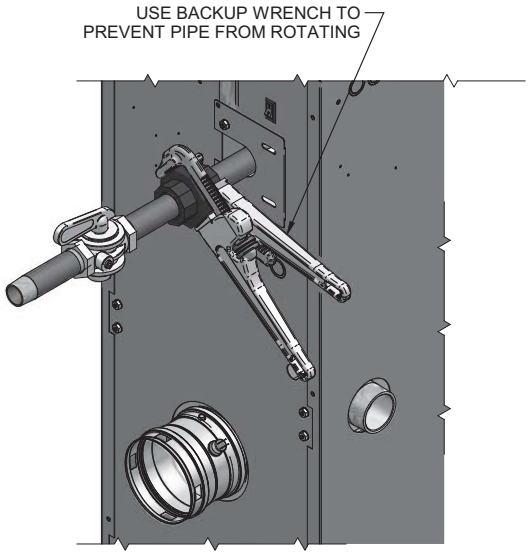
6. Use pipe sealing compound compatible with propane gases. Apply sparingly only to male threads of the pipe joints so that pipe dope does not block gas flow.

7 Gas connections *(continued)*

⚠ WARNING Failure to apply pipe sealing compound as detailed in this manual can result in severe personal injury, death, or substantial property damage.

⚠ WARNING Use two wrenches when tightening gas piping at boiler (FIG. 7-3), using one wrench to prevent the boiler gas line connection from turning. Failure to support the boiler gas connection pipe to prevent it from turning could damage gas line components.

***Figure 7-3** Inlet Pipe with Backup Wrench*



NOTICE Maximum inlet gas pressure must not exceed the value specified. Minimum value listed is for the purposes of input adjustment.

Natural gas:

Pipe sizing for natural gas

1. Refer to Table 7A for pipe length and diameter. Based on rated boiler input (divide by 1,000 to obtain cubic feet per hour).
   a. Table 7A is only for natural gas with specific gravity 0.60 inches, with a pressure drop through the gas piping of 0.3 inches w.c.
   b. For additional gas pipe sizing information, refer to ANSI Z223.1 (or B149.1 for Canadian installations).

Natural gas supply pressure requirements

1. Pressure required at the gas valve inlet pressure port:
   - Maximum 14 inches w.c. (3.5 kPa) with no flow (lockup) or with boiler on.
   - **Models 400 & 600 - 850:** Minimum 4 inches w.c. (.99 kPa) with gas flowing (verify during boiler startup).

     Model 500 Only: Minimum 5 inches w.c. (1.25 kPa) with gas flowing (verify during boiler startup).
2. Install 100% lockup gas pressure regulator in supply line if inlet pressure can exceed 14 inches w.c. (3.5 kPa) at any time. Adjust lockup regulator for 14 inches w.c. (3.5 kPa) maximum.

Propane Gas:

⚠ WARNING FTXL boilers are typically shipped ready to fire on natural gas. Check boiler rating plate to determine which fuel the boiler is set for. If set to natural gas, it may be converted to LP by installing a LP venturi or by making a gas valve adjustment (see pages 14 and 15). In order to operate on LP gas, a LP venturi MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Pipe sizing for propane gas

1. Contact gas supplier to size pipes, tanks, and 100% lockup gas pressure regulator.

Propane Supply Pressure Requirements

1. Adjust propane supply regulator provided by the gas supplier for 14 inches w.c. (3.2 kPa) maximum pressure.
2. Pressure required at gas valve inlet pressure port:
   - Maximum 14 inches w.c. (3.2 kPa) with no flow (lockup) or with boiler on.
   - Minimum 8 inches w.c. (1.9 kPa) with gas flowing (verify during boiler startup).

⚠ WARNING Ensure that the high gas pressure regulator is at least 10 feet (3 m) upstream of the appliance.

7 Gas connections

Table 7A *Natural Gas Pipe Size Chart*

Capacity of Schedule 40 Metallic Pipe in Cubic Feet of Natural Gas Per Hour (based on .60 specific gravity, 0.30" w.c. pressure drop)														
Pipe Size (Inches)	Length of Pipe in Straight Feet													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/2	131	90	72	62	55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3/4	273	188	151	129	114	104	95	89	83	79	70	63	58	N/A
1	514	353	284	243	215	195	179	167	157	148	131	119	109	102
1 1/4	1,060	726	583	499	442	400	368	343	322	304	269	244	224	209
1 1/2	1,580	1,090	873	747	662	600	552	514	482	455	403	366	336	313
2	3,050	2,090	1,680	1,440	1,280	1,160	1,060	989	928	877	777	704	648	602
2 1/2	4,860	3,340	2,680	2,290	2,030	1,840	1,690	1,580	1,480	1,400	1,240	1,120	1,030	960
3	8,580	5,900	4,740	4,050	3,590	3,260	3,000	2,790	2,610	2,470	2,190	1,980	1,820	1,700
4	17,500	12,000	9,660	8,270	7,330	6,640	6,110	5,680	5,330	5,040	4,460	4,050	3,720	3,460

Check inlet gas supply

NOTICE CSA or UL listed flexible gas connections are acceptable, but you must exercise caution to ensure that the line has adequate capacity to allow your boiler to fire at full rate. Consult with local codes for proper installation or service procedures.

⚠ WARNING DO NOT adjust gas valve outlet pressure. Attempting to alter the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

The gas piping must be sized for the proper flow and length of pipe, to avoid excessive pressure drop. Both the gas meter and the gas regulator must be properly sized for the total gas load.

If you experience a pressure drop greater than 1 inch w.c. (249 Pa), the meter, regulator, or gas line is undersized or in need of service. Perform the steps below when checking inlet gas supply:

1. Turn the main power switch to the “OFF” position.
2. Shut off gas supply at the manual gas valve in the gas piping to the appliance.
3. On Models 400 - 500 loosen the set screw one (1) full turn from inside the pressure tap on top of the gas valve. On Models 600 - 850 remove the 1/8" (3 mm) pipe plug on the inlet flange to the valve and install a suitable 1/8" (3 mm) fitting (field supplied) for the manometer tubing. Place the tubing of the manometer over the tap once the set screw is loosened or the 1/8" (3 mm) fitting is installed (depending on model) as shown in FIG.’s 7-5 and 7-6 on page 51.
4. Slowly turn on the gas supply at the field installed manual gas valve.
5. Turn the power switch to the “ON” position.
6. Adjust the temperature set point on the control panel of the SMART SYSTEM control module to call for heat.
7. Observe the gas supply pressure as the burner fires at 100% of rated input. Percent of burner input will be displayed on the control panel.
8. Ensure inlet pressure is within specified range. Minimum and maximum gas supply pressures are specified in this section of the manual.
9. If gas supply pressure is within normal range and no adjustments are needed, proceed on to Step 11.
10. If the gas pressure is out of range, contact the gas utility, gas supplier, qualified installer or service agency to determine the necessary steps to provide proper gas pressure to the control.
11. Turn the power switch to the “OFF” position.
12. Shut off the gas supply at the manual gas valve in the gas piping to the appliance.
13. Remove the manometer from the pressure tap on top of the gas valve. On Models 400 - 500 re-tighten the set screw inside the pressure tap. On Models 600 - 850 remove the 1/8" (3 mm) field supplied fitting and reinstall the pipe plug removed in Step 3.

7 Gas connections *(continued)*

⚠ WARNING When re-tightening the set screw, be sure to tighten securely to prevent gas leaks.

Do not check for gas leaks with an open flame -- use the bubble test. Failure to use the bubble test or check for gas leaks can cause severe personal injury, death, or substantial property damage.

14. Turn on the gas supply at the manual gas valve.
15. Turn the power switch to the "ON" position.
16. Adjust the temperature set point on the control panel of the SMART SYSTEM control module to the desired water temperature so the appliance will call for heat.
17. Check burner performance by cycling the system while you observe burner response. The burner should ignite promptly. Flame pattern should be stable. Turn system off and allow burner to cool, then cycle burner again to ensure proper ignition and flame characteristics.

Figure 7-5 *Inlet Gas Supply Check - Model 400 - 500*

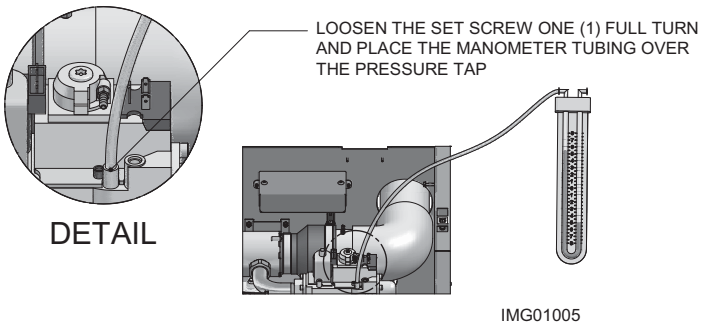
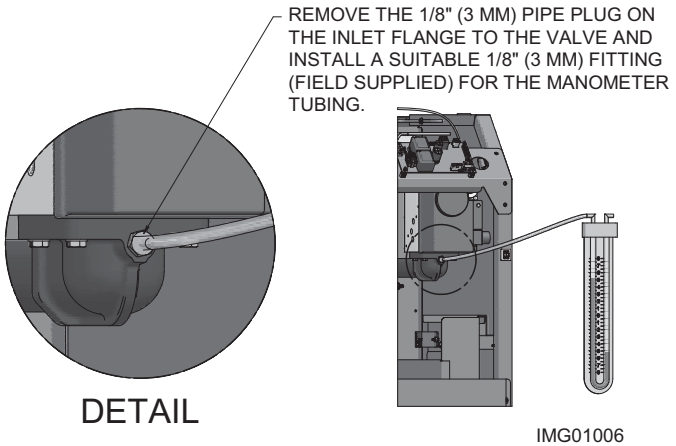


Figure 7-6 *Inlet Gas Supply Check - Models 600 - 850*



Gas pressure

The gas pressure must remain between 4 inches w.c. (.99 kPa) on Model 400 and Models 600 - 850 or minimum 5 inches w.c. (1.25 kPa) on Model 500, and maximum 14 inches w.c. (3.5 kPa) for Natural gas and between 8 inches w.c. (1.9 kPa) minimum and 14 inches w.c. (3.2 kPa) maximum for LP gas during standby (static) mode and while in operating (dynamic) mode. If an in-line regulator is used, it must be a minimum of 10 feet (3 m) from the FTXL boiler. It is very important that the gas line is properly purged by the gas supplier or utility company. Failure to properly purge the lines or improper line sizing, will result in ignition failure.

The problem is especially noticeable in NEW LP installations and also in empty tank situations. This can also occur when a utility company shuts off service to an area to provide maintenance to their lines.

Gas valve replacement

The gas valve MUST NOT be replaced with a conventional gas valve under any circumstances. As an additional safety feature, this gas valve has a flanged connection to the venturi and blower.

⚠ WARNING Failure to follow all precautions could result in fire, explosion, or death!

⚠ WARNING DO NOT adjust gas valve outlet pressure. Attempting to alter the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

8 Field wiring

⚠ WARNING ELECTRICAL SHOCK HAZARD – For your safety, turn off electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

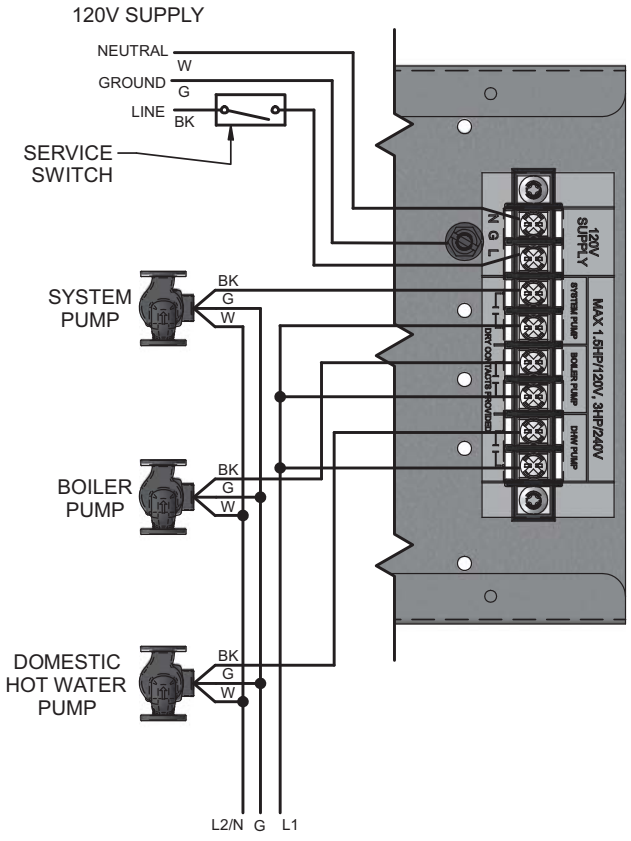
NOTICE Wiring must be N.E.C. Class 1.

If original wiring as supplied with boiler must be replaced, use only type 105°C wire or equivalent.

Boiler must be electrically grounded as required by National Electrical Code ANSI/NFPA 70 – latest edition.

⚠ CAUTION Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

Figure 8-1 *Line Voltage Field Wiring Connections*



Installation must comply with:

1. National Electrical Code and any other national, state, provincial, or local codes, or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

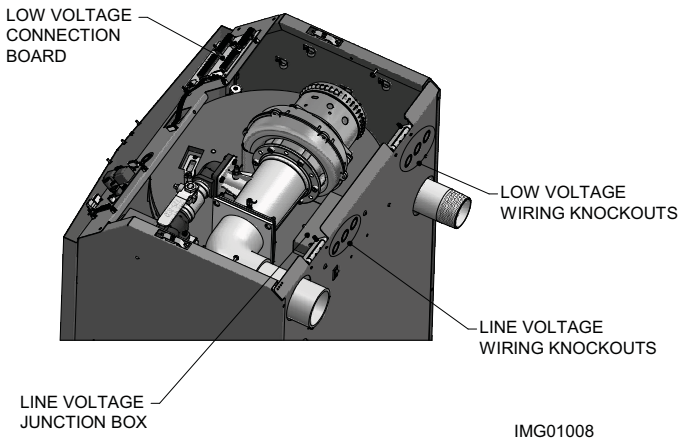
Line voltage connections

1. Connect 120 VAC power wiring to the line voltage terminal strip in the junction box, as shown in FIG. 8-1.
2. Provide and install a fused disconnect or service switch (15 amp recommended) as required by the code (see FIG. 8-1).
3. When connecting a domestic hot water (DHW) pump, connect the wiring to the line voltage terminal strip as shown in FIG. 8-1.
4. To activate a system pump, wire as shown in FIG. 8-1. Dry contacts are sized for 1.5 hp/120V, 3 hp/240V or 30 amps.

Low voltage connections

1. Route all low voltage wires through the knockouts in the rear of the boiler, as shown in FIG. 8-2.
2. Continue to route the wires through the plastic bushings to the left of the low voltage connection board.
3. Connect low voltage wiring to the low voltage connection board as shown in FIG. 8-3 on page 55 of this manual and the boiler wiring diagram. Make certain the wires will stay well away from the top of the heat exchanger.

Figure 8-2 *Routing Field Wiring*



Thermostat

1. Connect the room thermostats or end switches (isolated contact only) to heat/loop demand 1, 2, or 3, as shown in FIG. 8-3.
2. Install the thermostat on the inside wall away from influences of drafts, hot or cold water pipes, lighting fixtures, television, sunlight, or fireplaces.
3. Thermostat anticipator (if applicable):
   a. If connected directly to boiler, set for 0.1 amps.
   b. If connected to relays or other devices, set to match total electrical power requirements of connected devices. See device manufacturers' specifications and thermostat instructions for details.

8 Field wiring *(continued)*

Outdoor temperature sensor

1. Mount the sensor on an exterior wall, shielded from direct sunlight or flow of heat or cooling from other sources.
2. Route sensor wires through a knockout at the rear of the boiler (see FIG. 8-2).
3. Connect the outdoor temperature sensor (FIG. 8-3) to the outdoor sensor terminals on the connection board to enable outdoor reset operation of the FTXL. If fixed temperature operation is required, do not install outdoor sensor.

DHW (Domestic Hot Water) thermostat

Connect storage indirect water heater (DHW) thermostat (FIG. 8-3) to the DHW thermostat terminals on the connection board. If a tank sensor is connected (see DHW Tank Sensor below) the tank thermostat is ignored.

DHW tank sensor

By installing a tank sensor, the SMART SYSTEM control can perform the tank thermostat function. The SMART SYSTEM control automatically detects the presence of this sensor, and generates a DHW call for heat when the tank temperature drops 6°F (3°C) below the tank set point, and finishes the call for heat when the tank temperature reaches the tank set point. The tank sensor included with the Lochinvar Squire® indirect DHW tanks (100170544) is the only sensor suitable for use with the SMART SYSTEM control. Connect the sensor leads to the Tank Sensor terminals on the low voltage connection board (FIG. 8-3).

⚠ WARNING Failure to use the correct sensor may result in the tank temperature being either above or below the set point.

If 100170544 is not compatible with the indirect tank, a tank thermostat can be used to control the boiler. The tank thermostat should be installed per the manufacturer's instructions and wired to the DHW Thermostat terminals on the low voltage connection board (FIG. 8-3).

Louver proving switch

1. When the operation of the louvers needs to be verified before the boiler fires, remove the jumper wire from these terminals and connect them to the normally open contacts on its proving switch (FIG. 8-3).

High gas pressure switch

1. If a switch is provided to detect excessive gas pressure, remove the jumper wire from the terminals on the connection board, and then connect them to its normally closed contacts (FIG. 8-3).

Low gas pressure switch

1. If a switch is provided to detect low gas pressure, remove the jumper wire from the terminals on the connection board and connect them to its normally open contacts (FIG. 8-3).
2. If both a high and low gas pressure switch is used, connect their respective contacts in series, and connect them to the terminals on the connection board (FIG. 8-3).

Variable speed system pump

If a variable speed pump is used in the primary loop, and a 0-10V signal is available from the pump speed control, this signal can be used by the SMART SYSTEM control to anticipate changes in the building heat load. By connecting this 0 - 10V signal to the 0 - 10V SYS PUMP IN terminals, the boiler (or cascade) can modulate up and down as the primary flow increases and decreases.

Boiler pump speed output

This 0 - 10V output is available to control the speed of a variable speed boiler pump. The SMART SYSTEM control will vary the speed of this pump in order to maintain a minimum ΔT across the heat exchanger, as well as prevent high limit lockouts when the flow in the primary loop is extremely low. NOTE: This feature is to be used with Primary / Secondary piping systems only. A system supply sensor MUST be installed. Connect this output to the 0 - 10V input on the boiler pump speed control.

Rate output

This output provides a 0 - 10V signal that is proportional to the firing rate of the boiler. This may be used by a BMS system to monitor the actual rate of the boiler.

ModBus/BACnet

When an optional ModBus or BACnet interface module is installed, the RS-485 cable is connected to these terminals. Use shielded, 2-wire twisted pair cable. If desired, the shield can be connected to ground by installing a jumper wire between terminals 1 and 3 on connector X5 on the optional ModBus or BACnet interface module.

Flow switch

1. A flow switch is used to guarantee flow through the boiler before allowing it to fire. The flow switch must be installed at the boiler outlet.
2. Remove the jumper wire from the terminals on the connection board and connect these terminals to the normally open contacts on the flow switch (FIG. 8-3).

System supply sensor

1. By installing the system supply sensor into the supply of the primary loop, the temperature of the system supply can be controlled. The SMART SYSTEM control automatically detects the presence of this sensor, and controls the boiler firing rate to maintain the system supply temperature to the set point (if outlet sensor control is currently selected).

8 Field wiring

See the FTXL Service Manual for instructions on how to use the inlet sensor as the controlling sensor. When the inlet sensor is programmed as the controlling sensor, it is vital that the SYSTEM SUPPLY sensor be installed. DO NOT INSTALL THE SYSTEM SUPPLY SENSOR INTO THE SYSTEM RETURN.

2. The 100170581 sensor provided with the boiler must be used for the system sensor.
3. Connect these terminals to the system supply sensor (FIG. 8-3).

Boiler management system

1. An external control may be connected to control either the firing rate or the set point of the boiler. If the external control uses a set of contacts to enable the boiler, connect the contacts to the heat/loop demand 1 terminals. Otherwise, the SMART SYSTEM control will be enabled by the 0-10V signal.
2. Make sure the (-) terminal is connected to the (-) or common output terminal of the external control, and the (+) terminal is connected to the 0 - 10 VDC or (+) terminal of the external control. Make sure that the (-) voltage is not below ground.

Runtime contacts

The SMART SYSTEM control closes a set of dry contacts whenever the burner is running. This is typically used by Building Management Systems to verify that the boiler is responding to a call for heat.

Alarm contacts

The SMART SYSTEM control closes another set of contacts whenever the boiler is locked out or the power is turned off. This can be used to turn on an alarm, or signal a Building Management System that the boiler is down.

DHW recirculation sensor

The FTXL is able to control a DHW recirculation pump. To operate this feature, a 100170581 temperature sensor must be installed in the circulation loop return. Connect this sensor to the DHW recirculation sensor terminals on the Low Voltage Connection Board.

DHW recirculation pump

When the DHW recirculation sensor (as described above) is connected, the FTXL SMART SYSTEM control will output 24VAC to control a DHW recirculation pump relay (field supplied). Connect the coil of the DHW recirculation pump relay to the 24VAC recirculation pump relay coil terminals on the Low Voltage Connection Board.

Wiring of the cascade

When wiring the boilers for Cascade operation, select one boiler as the Leader boiler. The remaining boilers will be designated as Members. See page 63 “Configuration of the Cascade” for a detailed explanation of this procedure.

Connect the system supply sensor and outdoor air sensor (if used) to the Leader boiler. For the Cascade system to work properly the system supply sensor must be installed. The location of the system supply sensor should be downstream of the boiler connections in the main system loop (FIG.’s 6-5 through 6-10). The system supply sensor should be wired to the Low Voltage Connection Board at the terminals marked for the system sensor (see FIG. 8-3). The Leader control will use the water temperature at the system supply sensor to control the operation of the Cascade.

If outdoor air reset is desired, the outdoor air sensor should be wired to the Low Voltage Connection Board at the terminals marked for the outdoor air sensor (FIG. 8-3). If the outdoor air sensor is connected, the Leader control will calculate the water temperature set point based on the programmed reset curve parameters. If the outdoor air sensor is not connected, the Leader control will maintain the fixed water temperature set point that is programmed into the control.

If a Thermostat or Zone Control enable output is available, it should be wired to the Low Voltage Connection Board on the Leader boiler at the terminals marked for one of the heat/loop demands 1-3 (FIG. 8-3). If the boilers are to run continuously, connect a jumper wire between the R and W terminals for the heat/loop demand input. This will initiate a call for heat on the Cascade.

Communication between the Leader boiler and the Member boilers is accomplished by using shielded, 2-wire twisted pair communication cable. Connect one of the twisted pair wires to Cascade terminal A on each of the Low Voltage Connection boards, and the other wire of the twisted pair to Cascade terminal B on each of the Low Voltage Connection Boards. Connect the shield wires to one of the shield terminals on the Low Voltage Connection Boards (FIG. 8-3). If more than two boilers are on the Cascade, daisy chain the wiring from the Cascade terminals on the second boiler to the Cascade terminals on the third boiler, then from the third to the forth, and so on. The connections between boilers can be made in any order, regardless of the addresses of the boilers. Try to keep each cable as short as possible.

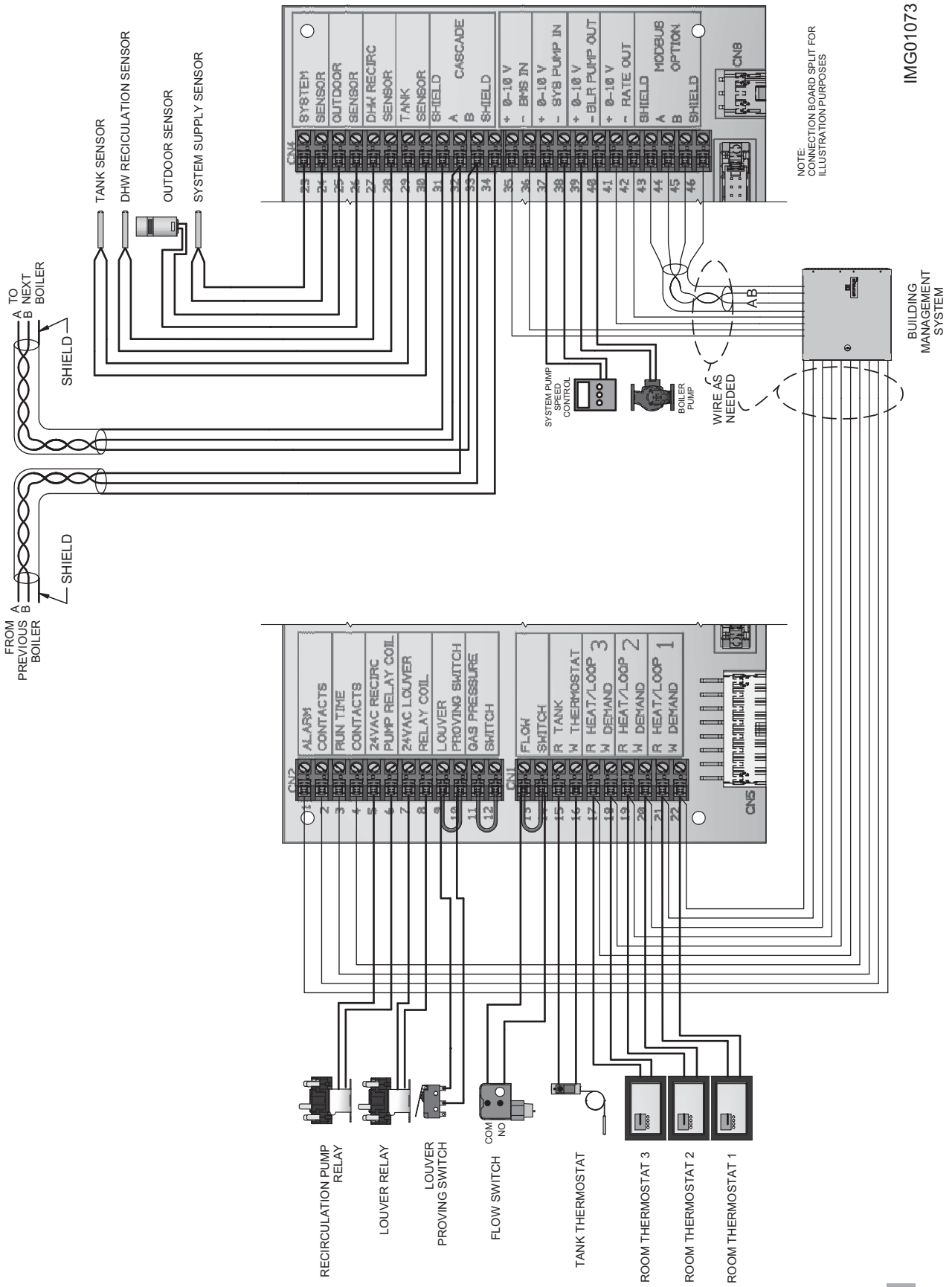
When the Member 1 boiler is programmed as an alternate leader this allows the Member 1 boiler to automatically assume control of the Cascade should it lose communication with the Leader boiler. When programmed to YES, it is recommended that the Member 1 boiler have its own set of external sensors installed (such as the system supply sensor), to maintain the same level of temperature control as with the Leader boiler. Voltage signals (such as 0 - 10V system pump speed input) can be connected to both boilers.

⚠ WARNING Do not connect the sensors connected to the Leader boiler to the Member 1 boiler. The actual water temperatures will be higher than expected, which could lead to property damage, personal injury, or death.

When communication is re-established with the Leader boiler, Member 1 will automatically relinquish control of the Cascade to the Leader boiler.

8 Field wiring *(continued)*

Figure 8-3 *Low Voltage Field Wiring Connections*



9 Condensate disposal

Condensate drain

1. The FTXL is a high efficiency appliance that produces condensate.
2. The condensate trap is sized for a 1" PVC outlet connection pipe.
3. Plug the wiring connection from the condensate trap into the connector located on the back of the unit.
4. Slope condensate tubing down and away from the boiler into a drain or condensate neutralizing filter. Condensate from the FTXL will be slightly acidic (typically with a pH from 3 to 5). Install a neutralizing filter if required by local codes.

   A Neutralizer Kit (FIG. 9-1) is available from the factory (100157721 for Models 400 - 500 and 100157700 for Models 600 - 850).100157700 must be placed on a surface that is a minimum of 3 inches lower than the condensate trap with field supplied piping (vacuum break) installed between the condensate trap and the neutralizer kit.
5. Do not expose condensate line to freezing temperatures.

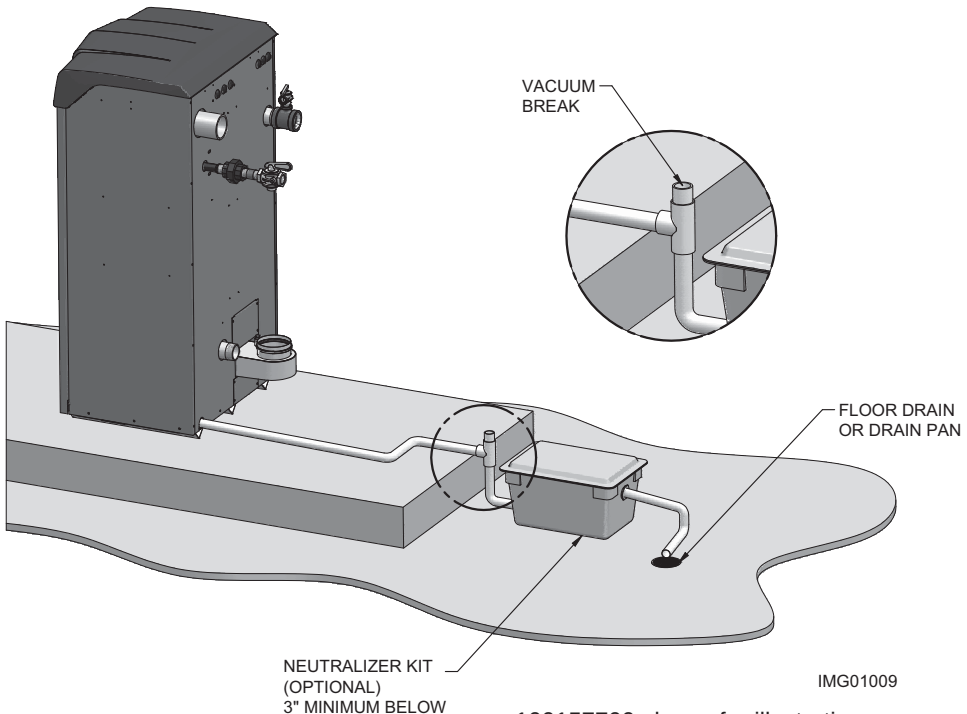
NOTICE Use materials approved by the authority having jurisdiction. In the absence of other authority, PVC and CPVC pipe must comply with ASTM D1785 or D2845. Cement and primer must comply with ASME D2564 or F493. For Canada use CSA or ULC certified PVC or CPVC pipe, fittings, and cement. Do not use copper or black iron pipe, or fittings.

NOTICE To allow for proper drainage on large horizontal runs, a second line vent may be required and tubing size may need to increase to 1 inch (25 mm).

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate is allowed to freeze in the line or if the line is obstructed in any other manner, condensate can exit from the boiler tee, resulting in potential water damage to property.

6. A condensate removal pump is required if the boiler is below the drain. When installing a condensate pump, select one approved for use with condensing boilers and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. The switch should be wired in series with the blocked drain switch inside the boiler (see FIG. 10-1 on page 59).

Figure 9-1 *Condensate Disposal*



100157700 shown for illustration purposes.

10 Start-up

Fill water

Check/control fill water chemistry

IMPORTANT Conduct water quality testing prior to installing the appliance. Various solutions are available to adjust water quality.

The manufacturer recommends the following for properly filling your boiler with the appropriate water chemistry for closed loop boilers. Good fill water quality will help extend the life of the appliance by reducing the effects of lime scale buildup and corrosion in closed loop systems.

Hardness between 5 and 15 grains per gallon

1. Consult local water treatment companies for hard water areas (above 15 grains per gallon hardness).
2. Hardness levels that are above 15 grains/gallon can lead to lime scale buildup throughout the boiler system. If the fill water is below 5 grains/gallons, usually due to use of a water softener, it is recommended to mix in some potable water at the inlet to increase the hardness of the water to above 5 grains/gallons.

pH between 6.5 and 9.5

1. pH levels below 6.5 can cause an increase in the rate of corrosion. pH of 9.5 or higher can potentially cause lime scale buildup.

Total Dissolved Solids (TDS) below 2,000 ppm

1. Total dissolved solids are all minerals, salts, metals, and charged particles that are dissolved in water.
2. The greater the amounts of TDS present, the higher the corrosion potential due to increased conductivity in the water.
3. If using softened water to fill the boiler, it is still possible to have high TDS. This water can be corrosive. It is recommended to mix in some potable water with the softened water to reduce this affect.

Chlorine concentration less than 200 ppm

1. Do not fill boiler or operate with water containing chlorine in excess of 200 ppm.
2. Filling with fresh drinking water should be acceptable.
3. Do not use the boiler to directly heat swimming pool or spa water.

Freeze protection

⚠ WARNING Ethylene glycol is toxic, DO NOT use as your freeze protection. Ethylene glycol has a sweet aroma which children and pets could mistake as food and ingest; leading to death.

1. Use glycol only if needed for freeze protection.
2. Propylene glycol is the recommended freeze protection.
3. Make sure to flush the boiler system before adding glycol.
4. Determine the freeze protection fluid quantity using system water content, following the fluid manufacturer's instructions. Boiler water content is listed on page 6. Remember to include expansion tank water content.
5. Local codes may require a backflow preventer or actual disconnect from city water supply.
6. When using freeze protection fluid with automatic fill, it is suggested to install a water meter to monitor water makeup. Freeze protection fluid may leak before the water begins to leak, causing the concentration to drop, which reduces the freeze protection level.
7. The freeze protection set points may be lowered when freeze protection fluid is used (see the FTXL Service Manual).
8. Consult the glycol manufacturer for details on the suggested mix of glycol and water for the desired freeze protection level and the de-rate effect it will have on the boiler output.

Test / replace freeze protection fluid

1. For systems using freeze protection fluids, follow the fluid manufacturer's instructions.
2. Freeze protection fluid must be replaced periodically due to degradation of inhibitors over time.
3. It is recommended to test the glycol concentration annually and adjust within the desired set points.

10 Start-up

Oxygen prevention

CAUTION Eliminate all system leaks. Continual fresh makeup water will reduce boiler life. Minerals can build up in the heat exchanger, reducing heat transfer, overheating the heat exchanger, and causing heat exchanger failure.

Dissolved oxygen can have a negative effect on the boiler system. Oxygen can cause iron oxide to generate iron deposits. Oxygen may also increase the rate of corrosion on non-stainless steel parts of the system. A low pH level combined with oxygen further enhances its corrosive effects. After boiler installation, check for air leaks in the following areas:

- Suction gasket
- Pump
- Air valve
- O-ring gaskets

Precautions include installing a water meter to evaluate the fresh water volume entering the system. Additional volumes of fresh water could indicate that a leak is present.

Boiler water

CAUTION Do not use petroleum based cleaning or sealing compounds in the boiler system. Gaskets and seals in the system may be damaged. This can result in substantial property damage.

CAUTION DO NOT use "homemade cures" or "boiler patent medicines". Serious damage to boiler, personnel, and/or property may result.

- Monitoring pH, TDS and hardness levels can prolong the life of the appliance by reducing lime scale buildup, corrosion, and erosion. Check for leaks to ensure that fresh water is not entering the system.
- Continual fresh make-up water will reduce boiler life.
- Mineral buildup in the heat exchanger reduces heat transfer, overheats the stainless steel heat exchanger, and causes failure.
- The addition of oxygen carried in by make-up water can cause internal corrosion in system components.
- Leaks in the boiler or piping must be repaired at once to prevent make-up water. It could be helpful to install a water meter for this purpose to easily check the amount of make-up water entering the system.

Fill and test water system

1. Fill system only after ensuring the water meets the requirements of this manual.
2. Close automatic and manual air vents and boiler drain valve.
3. Fill to correct system pressure. Correct pressure will vary with each application.
   a. The minimum cold water fill pressure for a system is 12 psi.
   b. Pressure will rise when the boiler is turned ON and system water temperature increases.
4. At initial fill and during boiler startup and testing, check the system thoroughly for any leaks. Repair all leaks before proceeding further.

Purge air from water system

1. Purge air from system:
   a. Connect a hose to the purge valve (see purge/drain valve in the piping diagrams on pages 42 through 47). Route the hose to an area where water can drain and be seen.
   b. Close the boiler or system isolation valve between the purge valve and fill connection to the system.
   c. Close zone isolation valves.
   d. Open the quick-fill valve on the cold water makeup line.
   e. Open purge valve.
   f. Open the isolation valves one zone at a time. Allow water to run through the zone, pushing out the air. Run until no noticeable air flow is present. Close the zone isolation valves and proceed with the next zone. Follow this procedure until all zones are purged.
   g. Close the quick-fill water valve and purge valve and remove the hose. Open all isolation valves. Watch that system pressure rises to correct cold-fill pressure.
   h. After the system has operated for a while, eliminate any residual air by using the manual air vents located throughout the system.
   i. If purge valves are not installed in the system, open the manual air vents in the system one at a time, beginning with the lowest floor. Close the vent when water squirts out. Repeat with remaining vents.
2. Open the automatic air vent (diaphragm-type or bladder type expansion tank systems only) one turn.
3. Open other vents:
   a. Starting on the lowest floor, open air vents one at a time until water squirts out.
   b. Repeat with remaining vents.
4. Refill to correct pressure.

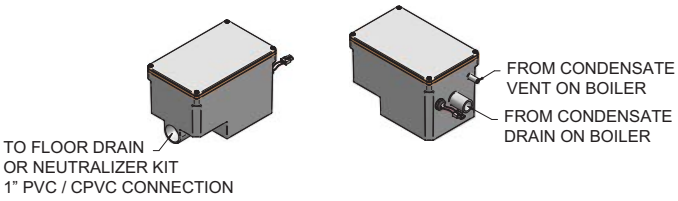
10 Start-up *(continued)*

Check for gas leaks

⚠ WARNING Before starting the boiler, and during initial operation, smell near the floor and around the boiler for gas odorant or any unusual odor. Remove the top access panel and smell the interior of the boiler enclosure. Do not proceed with startup if there is any indication of a gas leak. Use an approved leak detection solution. Repair any leaks at once.

⚠ WARNING DO NOT adjust gas valve outlet pressure. The gas valve is factory set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

Figure 10-1 *Condensate Trap*



⚠ WARNING Propane boilers only – Your propane supplier mixes an odorant with the propane to make its presence detectable. In some instances, the odorant can fade, and the gas may no longer have an odor. Before startup (and periodically thereafter), have the propane supplier verify the correct odorant level in the gas.

Check thermostat circuit(s)

1. Disconnect the two external wires connected to each of the heat/loop demand terminals on the connection board.
2. Connect a voltmeter across these two incoming wires. Close each thermostat, zone valve, and relay in the external circuit one at a time and check the voltmeter reading across the incoming wires.
3. There should NEVER be a voltage reading.
4. If a voltage does appear under any condition, check and correct the external wiring. (This is a common problem when using 3-wire zone valves.)
5. Once the external thermostat circuit wiring is checked and corrected if necessary, reconnect the external thermostat circuit wires to the connection board. Allow the boiler to cycle.

Inspect condensate system

Inspect/check condensate lines and fittings

1. Inspect the condensate drain line, condensate PVC fittings and condensate trap.

10 Start-up

Final checks before starting the boiler

- ❑ Read the FTXL Service Manual to familiarize yourself with SMART SYSTEM control module operation. Read this manual, page 61 for proper steps to start boiler.
- ❑ Verify the boiler and system are full of water and all system components are correctly set for operation.
- ❑ Verify the preparation procedures of Section 10, pages 57 through 59 have been completed.
- ❑ Verify electrical connections are correct and securely attached.
- ❑ Inspect vent piping and air piping for signs of deterioration from corrosion, physical damage or sagging. Verify air piping and vent piping are intact and correctly installed per this manual.

Start the boiler

1. Read and follow the Operating instructions in FIG. 10-2, page 61.

If boiler does not start correctly

1. Check for loose connections, blown fuse or service switch off?
2. Is boiler water temperature above 200°F (93°C)?
3. Is thermostat set below room temperature?
4. Is gas turned on at meter or boiler?
5. Is incoming gas pressure less than 4 inches w.c. (.99 kPa)?

If none of the above corrects the problem, refer to the Troubleshooting Section of the FTXL Service Manual.

Check system and boiler

❑ Check water piping

1. Check system piping for leaks. If found, shut down the boiler and repair immediately. (See WARNINGS on pages 57 - 59 (startup) regarding failure to repair leaks.)
2. Vent any remaining air from the system using manual vents. Air in the system will interfere with circulation and cause heat distribution problems and noise.

❑ Check vent piping and air piping

1. Check for gastight seal at every connection, seam of air piping, and vent piping.

⚠ WARNING Venting system must be sealed gastight to prevent flue gas spillage and carbon monoxide emissions, which will result in severe personal injury or death.

❑ Check gas piping

1. Check around the boiler for gas odor following the procedure on page 48 of this manual (connecting gas supply piping).

⚠ WARNING If you discover evidence of any gas leak, shut down the boiler at once. Find the leak source with a bubble test and repair immediately. Do not start the boiler again until corrected. Failure to comply could result in severe personal injury, death, or substantial property damage.

❑ Propane boilers – verify conversion

1. Verify propane conversion has been completed per the Propane Conversion instructions.

⚠ WARNING DO NOT adjust gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter the gas valve outlet pressure could result in damage to the valve, causing potential severe personal injury, death, or substantial property damage.

⚠ WARNING FTXL boilers are typically shipped ready to fire on natural gas. Check boiler rating plate to determine which fuel the boiler is set for. If set to natural gas, it may be converted to LP by installing a LP venturi or by making a gas valve adjustment (see pages 14 and 15). In order to operate on LP gas, a LP venturi MUST BE installed or a gas valve adjustment MUST BE made. Failure to comply could result in severe personal injury, death, or substantial property damage.

Check flame and combustion

1. Turn the main power off to the boiler by placing the "On/Off" switch in the OFF position.
2. Remove the brass plug from the combustion measurement port inside the flue collector. NOTE: Combustion measurements will be made at this point.
3. Turn the main power on to the boiler by placing the "On/Off" switch in the ON position.

10 Start-up *(continued)*

Figure 10-2 *Operating Instructions*

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

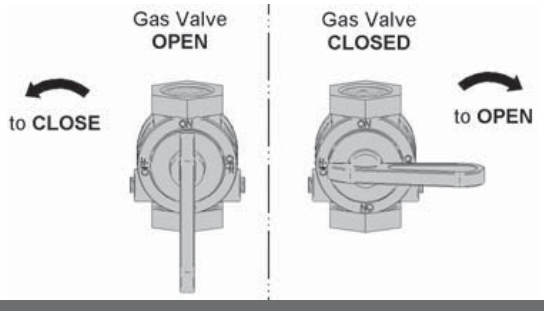
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control knob. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove top cover.
6. Turn gas shutoff valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Turn gas shutoff valve clockwise to "ON". Handle will be parallel to pipe.
9. Install top cover.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove top cover.
4. Turn gas shut off valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force
5. Install top cover.

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10 Start-up

Check flame and combustion *(continued)*

4. Place the boiler into the active position by pressing the RIGHT SELECT [ON] key (FIG. 11-1, page 71).
5. Locate the pinhole button above the RESET button on the display board (FIG. 11-1). Insert a thin wire (such as a paper clip) into the hole and press the button once and hold for 5 seconds to place the boiler into Service Mode. In Service Mode the boiler will fire at ignition speed and will then modulate up to full fire.
6. Insert the probe from a combustion analyzer into the combustion measurement port (see FIG. 10-3). There is a stop underneath the combustion measurement port to prevent the probe from collecting condensate at the bottom of the flue collector.
7. Once the boiler has modulated up to full fire, measure the combustion. The values should be in the range listed in Table 10A below. The CO levels should be less than 150 ppm for a properly installed unit.

   If the combustion is not within the specified range, reference the Troubleshooting Section of the FTXL Service Manual for possible causes and corrective actions.

Figure 10-3 *Combustion Measurement Port*

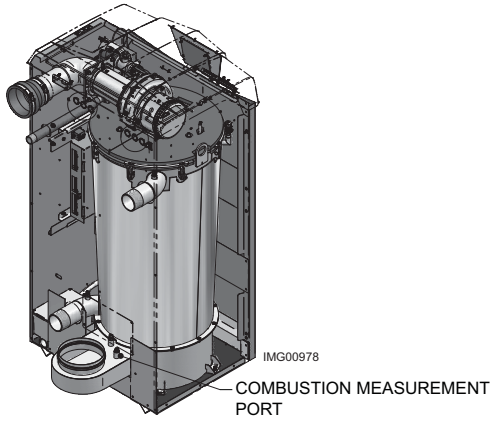


Table 10A *Flue Products Chart*

Natural Gas		Propane	
CO_2	O_2	CO_2	O_2
8.0% - 10%	3.0% - 6.5%	9.0% - 11%	4.1% - 6.9%

8. Once the combustion analysis is complete, test the safety shutoff device by turning the manual shutoff valve to the OFF position and ensuring that the boiler shuts down and registers an alarm. Turn the manual shutoff switch to the ON position and reset the control.
9. Turn the main power off to the boiler and replace the plug in the flue sample port.
10. Place the boiler back into normal operation.

⚠ WARNING You must replace the plug in the flue sample port to prevent flue gas spillage into the room. Failure to comply could result in severe personal injury, death, or substantial property damage.

Set space heating operation

Determine controlling sensor

For space heating systems, the temperature control can be based on one of three sensors; the inlet, outlet, or system supply sensor. The SMART SYSTEM control is programmed at the factory to control the temperature of the outlet sensor. The control will automatically switch to the system supply sensor once it is connected. If it is desired to base the temperature control on the inlet sensor, the appropriate parameter must be changed in the control. See the FTXL Service Manual for a detailed explanation of this procedure.

Verify space heat circulator mode

The Space Heating Mode controls both the system pump (if connected), and the boiler pump. When the SMART SYSTEM control receives a space heating call for heat, it turns on the system pump. If the set point is not met, or the system sensor is not connected, it also turns on the boiler pump. After the space heating call for heat ends, the system pump continues to run for a short period of time. The system pump can be programmed to run continuously, except during outdoor shutdown. Other settings may affect the operation of the boiler and system pumps, as explained on the following pages. If the boiler pump was running, it continues to run for a short period of time as well. These pump delays are factory set to 30 seconds. If different delays are desired, the appropriate parameters in the control must be changed. See the FTXL Service Manual for a detailed explanation of this procedure.

Adjust set point temperature(s)

NOTICE Please note that the brackets ([]) denote screen status.

The NAVIGATION dial may be used during normal operation to adjust the space heating and tank set point temperatures.

1. From the Status Screen press the NAVIGATION dial.
2. Turn the NAVIGATION dial counterclockwise to select the appropriate set point.
3. Press the NAVIGATION dial to adjust the temperature. Rotate the NAVIGATION dial to change the setting.
4. Once the desired temperature is displayed, press the RIGHT SELECT [SAVE] key.
5. If necessary repeat Steps 3 and 4 to make adjustments to additional set points.
6. Press the RIGHT SELECT [HOME[key to upload the changes.
7. If the RIGHT SELECT [SAVE] key is not pressed, the new settings will be discarded.

10 Start-up *(continued)*

Set domestic hot water (DHW) operation

Verify DHW mode

There are two (2) modes of operation for DHW. In Normal Mode, when a DHW demand begins, the control will start the DHW pump, turn off the boiler pump (if running), and modulate to bring the outlet temperature to the DHW boiler set point. The maximum firing rate may be limited in this mode if desired.

In Zone Mode it is assumed that the indirect DHW tank is piped as a zone on the primary loop. When a DHW demand begins, the control will turn on the DHW pump output, and raise the system temperature set point to the DHW boiler set point (if higher). The boiler pump will be turned on. The system pump may be forced on, forced off, or not changed, depending on the System Pump Mode selected (reference the FTXL Service Manual for details). In this mode, any low temperature zones (such as radiant heating) may need additional controls to limit the water temperature sent to those zones.

Set DHW boiler target temperature

When in the DHW Mode, the control will modulate to maintain the boiler outlet temperature or system supply temperature to a set point. This set point is set at the factory to 180°F. If a different set point is desired, the appropriate parameter in the control must be changed. See the FTXL Service Manual for a detailed explanation of this procedure.

Set maximum DHW fan speed

If the rated input of the indirect tank is less than the maximum output of the boiler, change the maximum DHW fan speed setting to limit the boiler output accordingly. See the FTXL Service Manual for a detailed explanation of this procedure.

Set clock

NOTICE Please note that the brackets ([]) denote screen status.

The SMART SYSTEM control has a built-in clock that it uses for its night setback feature and for logging events. This clock must be set when the boiler is installed, and anytime the boiler has been powered off for more than 4 hours. Use the following procedure to set the clock:

1. Press and hold the LEFT SELECT [MENU] key for at least 5 seconds.
2. The display changes to read [PASSWORD], with four (4) zeros below it.
3. Press the RIGHT SELECT [SAVE] key.
4. The display will then show a menu with the time and date and temperature unit.
5. Press the NAVIGATION dial twice.
6. Turn the NAVIGATION dial to adjust the hours. Press the NAVIGATION dial.
7. Turn the NAVIGATION dial to adjust the minutes. Press the NAVIGATION dial.
8. Turn the NAVIGATION dial to adjust the month. Press the NAVIGATION dial.
9. Turn the NAVIGATION dial to adjust the date. Press the NAVIGATION dial.
10. Turn the NAVIGATION dial to adjust the year. Press the RIGHT SELECT [SAVE] key.
11. Press the RIGHT SELECT [HOME] key.

NOTICE The internal clock does not adjust for Daylight Savings Time and therefore, will require a manual adjustment.

The clock is automatically updated whenever a PC is connected and the Win_Pro-Installer program is started.

Configuration of the cascade

NOTICE Please note that the brackets ([]) denote screen status.

When installed in a Cascade system, the individual controls must be programmed for cascade operation. This is accomplished by accessing the control parameters.

Press the [MENU] key for at least five (5) seconds. Input the Installer code as described in the FTXL Service Manual. Once the control parameters have been accessed, use the NAVIGATION DIAL to select the Control Mode parameters. Press the NAVIGATION DIAL to access these parameters.

Rotate the NAVIGATION dial to select the parameter “Cascade Address”. Press the NAVIGATION dial to access this parameter. Each appliance in the Cascade system must be programmed with its own address. The boiler designated as the Leader will have an address of 0. The remaining boilers in the Cascade will be Members and have addresses from 1 - 7. Rotate the NAVIGATION dial to select the appropriate address. Press the RIGHT SELECT [SAVE] key.

Press the RIGHT SELECT [HOME] key to upload the address into the control. Repeat this procedure for all boilers in the Cascade, designating the Leader control and the Member controls.

11 Operating information

General

How the boiler operates

The FTXL uses an advanced stainless steel heat exchanger and electronic control module that allows fully condensing operation. The blower pulls in air and pushes flue products out of the boiler through the heat exchanger and flue piping. The control module regulates blower speed to control the boiler firing rate. The gas valve senses the amount of air flowing into the boiler and allows only the right amount of gas to flow.

How the control module operates

The SMART SYSTEM control module receives inputs from boiler sensors and external devices. The control module activates and controls the blower and gas valves to regulate heat input and switches the boiler, Domestic Hot Water (DHW), DHW recirculation, and system pumps on and off as needed. The user programs the module to meet system needs by adjusting control parameters. These parameters set operating temperatures and boiler operating modes. Boiler operation can be based on boiler outlet water temperature, boiler inlet water temperature, system temperature, a 0 - 10V signal, Modbus, or BACnet, depending on the parameter settings.

Control inputs and outputs

Room thermostat

There are three (3) heat/loop demand connections available on this control. These inputs tell the boiler to provide water for space heating. Each demand connection has its own set point and outdoor air reset curve. When multiple demands have a call for heat the control will give priority to the demand with the highest set point.

Example: Assume that both heat/loop demand 1 and heat/loop demand 2 have a call for heat. Demand 1 has a set point of 110°F. Demand 2 has a set point of 140°F. The boiler will regulate the system temperature to 140°F until Demand 2 has been satisfied. Once Demand 2 has been satisfied the boiler will provide 110°F water to the system.

⚠ CAUTION When multiple temperature loops are used, mixing valves are required for the protection of any low temperature loops.

SMART SYSTEM Multi-temp loop control

The FTXL boiler is capable of producing up to three (3) set point temperatures to meet different space heating demands. This device controls the temperatures of up to three (3) separate loops, based on the settings for the three (3) heat/loop demands (reference Lochinvar kit 100167843).

0 - 10V input (set point or power)

The FTXL can be controlled by a Building Management System (BMS) using a 0 - 10 VDC signal. The control can be configured by the installer to use this signal to either control set point or firing rate.

The FTXL can also be programmed to accept a call for heat from a 0 - 10V signal, reference the FTXL Service Manual for a detailed explanation of this procedure.

DHW priority

The SMART SYSTEM control allows the connection of a DHW thermostat or tank sensor to the low voltage connection board. When a tank sensor is connected, the DHW thermostat input is ignored. When a boiler is programmed for DHW Normal Mode, the maximum firing rate can be limited to match the input rating of the indirect tank coil.

DHW / space heating (SH) cycling

If a DHW call for heat is received while a space heating call is in progress, and the DHW is in Normal Mode, the control will start the DHW pump and shut the boiler pump off. The system pump will remain on. For stand-alone boilers, if the space heating call is still active while the DHW call is in operation, the control will wait for 30 minutes (time adjustable by installer) then it will switch back to the space heating demand. There is a timer to switch from space heating to DHW and a timer to switch from DHW to space heating. The control will switch back and forth until one of the heat demands end. This function does not apply to cascade systems.

11 Operating information *(continued)*

Programmable controlling sensor

The control module is programmed to use the outlet sensor as the control sensor by default. If a system supply sensor is connected, the control automatically uses it as the control sensor. For stand-alone boilers, the control sensor can be changed by the installer to the inlet sensor. If the inlet sensor is chosen as the controlling sensor, it is recommended that the system supply sensor be installed in the system supply in order to provide the best control of the inlet temperature.

Anti-cycling

After the burner turns off, the control will delay the next burner cycle for a set time period (time is adjustable by the installer). The time delay will be bypassed if the inlet water temperature drops too far during the delay.

Boiler and system pump control

The boiler pump will run whenever the burner is firing, unless the DHW is programmed for Normal Mode and the boiler is heating the DHW tank. The boiler pump will run during Freeze Protection Mode as well. It will continue to run for a short time after the burner turns off or the Freeze Protection Mode ends.

The system pump will run whenever there is a space heating call for heat, or the boiler goes into Freeze Protection Mode. It may be programmed to run during a DHW call for heat when the DHW is programmed for Zone Mode. It will continue to run for a short time after the end of the heat demand or the Freeze Protection Mode. The system pump can be programmed to run continuously if desired, except during outdoor shutdown and/or a DHW call for heat.

DHW recirculation pump control

When a DHW recirculation loop is used, the FTXL boiler can control the recirculation pump. To activate this function, simply install the DHW recirculation sensor into the return water from the DHW circulation loop. The control will turn on the DHW recirculation pump when the return water drops 10°F (5.5°C) below the DHW tank set point, and will turn back off when the return water rises to within 5°F (2.5°C) of the DHW tank set point. The control will turn the DHW recirculation pump off whenever DHW night setback is active.

Temperature control

Modulation

The FTXL is capable of modulating its firing rate from a minimum of 10% to a maximum of 100%. The firing rate is dictated by the call for heat (i.e., space heating or domestic hot water), the heating load, ramp delay (if enabled), and various other temperature limitations.

Ramp delay

For systems with lower flow, the SMART SYSTEM can limit the firing rate (when enabled) when a space heating call for heat starts, when the set point is controlled by the BMS, or when switching from a DHW call for heat to a space heating call for heat. There are six (6) limits that can be programmed, as well as six (6) time intervals corresponding to each limit. The sixth limit will also limit the firing rate for the rest of the call for heat.

Gradient limiting

If during operation of the boiler the outlet water temperature is rising too quickly, the control will reduce the firing rate to its lowest setting.

Outdoor air reset

If an outdoor air sensor is connected, the control module will calculate the set points of the three (3) space heating demands based on the programmed reset curves. The installer can change the slope of the reset curves by several adjustable parameters. The user can limit the maximum set points for each demand using the space heating set points.

Boost function

If outdoor air reset is active, and any space heating demand has been active continuously for a set period of time (time adjustable by installer) and there has been no DHW demands, the control can increase the set point of that demand by a fixed number of degrees (adjustable by installer). This process will continue until the space heating demand ends, the set point reaches the programmed set point or a maximum of 20 increases has occurred. Once the system heat demand is satisfied, the set point will revert to the value determined by the reset curve.

11 Operating information

Night setback

The controller may be programmed to reduce the space heating and DHW set points during certain times each week. Seven different start and stop times may be programmed for the space heating setback and seven start and stop times for the DHW setback.

Vacation mode

Vacation Mode is used to lower the Space Heat (SH) and/or DHW set points much like night setback. The set points will remain lowered until Vacation Mode is disabled. Night setback will not function when Vacation Mode is enabled.

Flame current support

To prevent nuisance shutdowns when the boiler is firing at minimum rates, the control will increase the firing rate when the flame signal drops too low.

Protection features

Outlet temperature, flue temperature, and temperature rise limiting

The outlet temperature is monitored by the boiler outlet temperature sensor. When the outlet temperature exceeds 185°F, the unit will reduce the fan speed. If the outlet water temperature exceeds 195°F (90°C) the control will shut the unit down until it cools off.

The control module monitors the flue temperature by a sensor located in the flue exhaust. If the flue temperature exceeds 215°F (102°C) the control will reduce the maximum fan speed. If the flue temperature exceeds 240°F (115°C) the control will shut the unit down. The unit will restart automatically once the flue temperature drops 25°F (14°C) and the minimum off time has expired.

The control monitors the temperature difference between the inlet and the outlet sensor. If this difference exceeds 70°F (39°C) the control will reduce the maximum fan speed. If the temperature difference exceeds 80°F (44°C) the control will shut the unit down. The unit will restart automatically once the temperature difference has dropped below 70°F (39°C) and the minimum off time has expired.

Freeze protection

DO NOT install the boiler in a room likely to freeze.

The following integral feature of the SMART SYSTEM control module provides some protection for the boiler only -- not for the system.

- The SMART SYSTEM control module provides freeze-up protection as follows when the boiler water temperature drops below 45°F (7°C):
- Below 45°F (7°C), the boiler and system pumps operate constantly.
- Below 37°F (3°C), the boiler turns on.
- Boiler and pumps turn off if boiler water temperature rises above 45°F (7°C).
- Lower temperatures may be programmed for systems with anti-freeze solutions.

NOTICE When system return temperatures are maintained below the dew point, condensation will form on the inside of the boiler jacket causing some internal sheet metal components to rust.

⚠ CAUTION This feature of the SMART SYSTEM control module does not eliminate the possibility of freezing. The installation must still use recognized design, installation and maintenance practice to prevent freeze potential for the boiler and system.

Low voltage blocking

The blower and gas valve require a minimum amount of voltage in order to operate properly. If an ignition attempt is made when the line voltage is temporarily low (such as during a brownout), the control could enter a manual reset lockout. To prevent this, the control monitors the voltage and blocks any heat demands until the voltage returns to an acceptable level.

11 Operating information *(continued)*

Monitor external limits

Connections are provided on the connection board for a flow switch and a louver proving switch. The SMART SYSTEM will shut off the burner and inhibit relighting whenever either of these external limits open.

Run-time and alarm outputs

The boiler provides dry contacts for indicating when the boiler is running, and when it is unable to operate.

Run-time and cycle counting

The control uses two timers to monitor the total hours of burner operation. One timer monitors the time the boiler is in the Space Heating Mode. The other timer monitors the time the boiler is firing in the DHW Mode.

The control uses two (2) ignition counters to monitor the amount of boiler cycles. The first counter counts all ignitions of the control. The second counter counts only ignition attempts that have failed.

Service reminder

The control can be programmed for service reminder notification. This notification will become active when either a set time frame has expired, or a set amount of running hours or cycles has expired (all adjustable by the installer). The display will show a Maintenance Required screen. The installer's name and phone number can be programmed into the control. This information will appear on the Maintenance Required screen. The service reminder notification can be reset or disabled by the installer.

Error logging

The control will hold in memory the last 10 lockouts. The date and time of the occurrence will be recorded as well. Only the 10 most current occurrences will be held in memory.

Boiler temperature regulation

Operating temperature (target)

The SMART SYSTEM control module senses water temperature and regulates boiler firing and firing rate to achieve a target temperature. The target temperature can be set between 32°F (0°C) and 190°F (88°C).

- Target temperature is fixed when the outdoor sensor is not installed.
- Target temperature is calculated as described on this page under "Outdoor Reset Operation" and "Target Temperature Boost" when the outdoor sensor is connected.

High limit operations

The FTXL is equipped with adjustable automatic reset and manual reset high limits. The automatic reset high limit has a maximum set point of 200°F and the manual reset high limit has a maximum set point of 210°F.

When the outlet temperature exceeds 200°F, the automatic high limit action occurs. The boiler shuts down until the outlet water temperature cools below 190°F, and a 60 second timer has expired. If the outlet temperature continues to increase, the manual reset high limit action will occur at 210°F.

High limit test procedure

NOTICE Please note that the brackets ([]) denote screen status.

1. Turn ON the main power to the boiler by placing the ON/OFF switch in the ON position.
2. From the Status Screen, press the NAVIGATION dial to access the Set Points Screen.
3. Press the LEFT SELECT (LIMITS) key.
4. Select the manual reset high limit (MRHL) by rotating the NAVIGATION dial counterclockwise, then press the NAVIGATION dial.
5. Decrease the set point of the MRHL to below the current outlet temperature (or to its minimum setting, whichever is higher) by turning the NAVIGATION dial counterclockwise.
6. Press the RIGHT SELECT [SAVE] key.
7. Press the RIGHT SELECT [HOME] key. The new parameter will upload to the control.
8. If the current outlet temperature is above the new MRHL set point, the MRHL will function causing boiler lockout. If this occurs, skip to Step 11.
9. If the current outlet temperature is below the new MRHL set point, locate the pinhole (SERVICE button) below the RESET button on the display board. Insert a thin probe (such as a paper clip) into the hole and press the button continuously for five (5) seconds to place the boiler into Service Mode. In Service Mode, the boiler will fire at ignition speed and will then modulate up to full fire.
10. Once the outlet temperature rises up to the MRHL set point, the MRHL will function, causing the boiler to shut down and lock out.
11. Repeat Steps 2 through 7 to adjust the MRHL to its normal setting.

11 Operating information

Low water cutoff protection

1. The SMART SYSTEM control module uses temperature sensing of both supply and return areas of the heat exchanger. If the flow rate is too low or the outlet temperature too high, the control module modulates and shuts the boiler down. This ensures boiler shutdown in the event of low water or low flow conditions.
2. In addition, an electronic low water cutoff control is provided.

Outdoor reset operation, if used

Target temperature with outdoor reset

This feature improves the system's efficiency as the outdoor temperature warms up.

See the FTXL Service Manual to change the settings.

Reset curve

The reset curves look at outdoor air temperature and adjust the set points.

Cascade

When multiple boilers are installed, they can be wired together in a cascade sequence. A maximum of eight boilers can be controlled from a single control. In this application one boiler would be designated as the Leader control and all others would be designated as Member controls. Member 1 can be configured to take over control of the Cascade should the Leader stop communicating with the Members. The Leader control can be programmed to use Lead/Lag or Efficiency Optimization control methods.

Once the Leader boiler receives a call for heat from a room thermostat, BMS, Modbus, or BACnet the control will determine what the set point will be. If outdoor air reset is desired, connect the outdoor air sensor to the terminals on the Low Voltage Connection Board on the Leader boiler. The set point will be calculated based on the programmed reset curve parameters. See the FTXL Service Manual to program the reset curve. If outdoor air reset is not desired, do not connect the outdoor air sensor. A fixed temperature set point can be programmed into the control. See page 62 of this manual to program the set point.

If the water temperature at the system supply sensor is less than the set point + the turn-off offset - the off-on differential, then the control will initiate a call for heat on the Cascade (see the FTXL Service Manual for an explanation of the offset and differential). The Leader will energize the lead boiler on the Cascade. For a new startup this will be the Leader boiler.

Sequence of the cascade

To equalize the run time of all boilers on the Cascade, the firing sequence will automatically be changed at set intervals.

For the first 24 hours, the sequence will be changed once every hour. The switching on/off sequence will be as follows:

TIME	SWITCHING ON SEQUENCE
Start	L-M1-M2-M3-M4-M5-M6-M7
1 hour	M1-M2-M3-M4-M5-M6-M7-L
2 hours	M2-M3-M4-M5-M6-M7-L-M1

After the first 24 hours, the sequence will change every night at 2:00 a.m. If a boiler locks out or is used to heat an indirect DHW tank, it will automatically be given the lowest priority until 2:00 a.m.

DHW, Night Setback, and Ramp Delay operation with cascade

For normal mode DHW operation any boiler(s) in the Cascade can be selected to provide heat for a DHW call. Select a boiler to be designated as the DHW boiler. Connect the DHW thermostat or sensor to the terminals on the Low Voltage Connection Board marked for the corresponding device. When the boiler receives a DHW call, the Leader control will take that boiler out of the Cascade sequence. If another boiler is available, the Leader will start it up to take its place.

The DHW boiler will adjust its set point to the programmed DHW boiler set point and will adjust its firing rate to maintain this. Once the DHW call has been satisfied, the Leader control will place that boiler back into the Cascade sequence.

Switching of the boiler between DHW operation and SH operation when there is a call for both does not occur in Cascade Mode.

When DHW is programmed for Zone Mode, connect the DHW thermostat or tank sensor to the Leader boiler. When a DHW call is received, the Leader will modulate the entire Cascade to bring the system supply temperature up to the DHW boiler set point (if higher).

Night Setback operation of the boilers within the Cascade is available. Programming of the Night Setback will be done through the Leader boiler. Refer to the FTXL Service manual for information regarding Night Setback.

Ramp Delay operation of the boilers as described in the FTXL Service Manual is available when the boilers are part of a Cascade system.

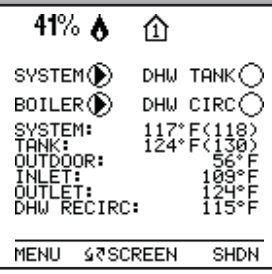
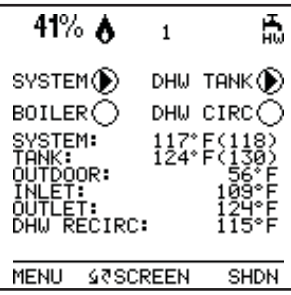
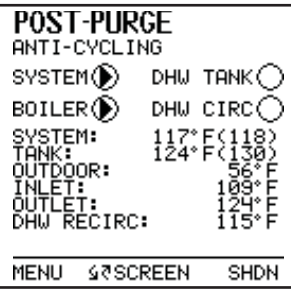
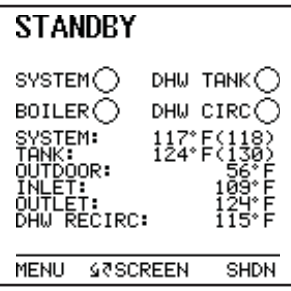
11 Operating information *(continued)*

Sequence of operation

OPERATION	DISPLAY
1. Upon a call for heat, the gas pressure switch(es) must be closed.	STANDBY SYSTEM ○ DHW TANK ○ BOILER ○ DHW CIRC ○ SYSTEM: 117°F(118) TANK: 124°F(130) OUTDOOR: 56°F INLET: 109°F OUTLET: 124°F DHW RECIRC: 115°F MENU ↺↻SCREEN SHDN
2. Once the gas pressure switch(es) are closed, the control turns on the appropriate pumps (system and boiler pumps for space heating, DHW pump for DHW). The flow switch and/or LWCO must close.	STANDBY SYSTEM ▶ DHW TANK ○ BOILER ▶ DHW CIRC ○ SYSTEM: 117°F(118) TANK: 124°F(130) OUTDOOR: 56°F INLET: 109°F OUTLET: 124°F DHW RECIRC: 115°F MENU ↺↻SCREEN SHDN
3. The control turns on power to the louver relay. The louver proving switch, and blocked drain switch must close.	START SYSTEM ▶ DHW TANK ○ BOILER ▶ DHW CIRC ○ SYSTEM: 117°F(118) TANK: 124°F(130) OUTDOOR: 56°F INLET: 109°F OUTLET: 124°F DHW RECIRC: 115°F MENU ↺↻SCREEN SHDN
4. The control starts the prepurge cycle by initiating the blower.	PRE-PURGE SYSTEM ▶ DHW TANK ○ BOILER ▶ DHW CIRC ○ SYSTEM: 117°F(118) TANK: 124°F(130) OUTDOOR: 56°F INLET: 109°F OUTLET: 124°F DHW RECIRC: 115°F MENU ↺↻SCREEN SHDN
5. The control starts the trial for ignition by firing the spark electrode and opening the gas valve.	IGNITION SYSTEM ▶ DHW TANK ○ BOILER ▶ DHW CIRC ○ SYSTEM: 117°F(118) TANK: 124°F(130) OUTDOOR: 56°F INLET: 109°F OUTLET: 124°F DHW RECIRC: 115°F MENU ↺↻SCREEN SHDN
6. If flame is not detected after the sparking ends, the control will perform a postpurge, then start another prepurge cycle and try to light the burner again. On the 500 and larger models, the control will lock out if this second attempt also fails. On the 400 model, the control will perform a total of 4 attempts before locking out.	POST-PURGE SYSTEM ▶ DHW TANK ○ BOILER ▶ DHW CIRC ○ SYSTEM: 117°F(118) TANK: 124°F(130) OUTDOOR: 56°F INLET: 109°F OUTLET: 124°F DHW RECIRC: 115°F MENU ↺↻SCREEN SHDN

11 Operating information

Sequence of operation

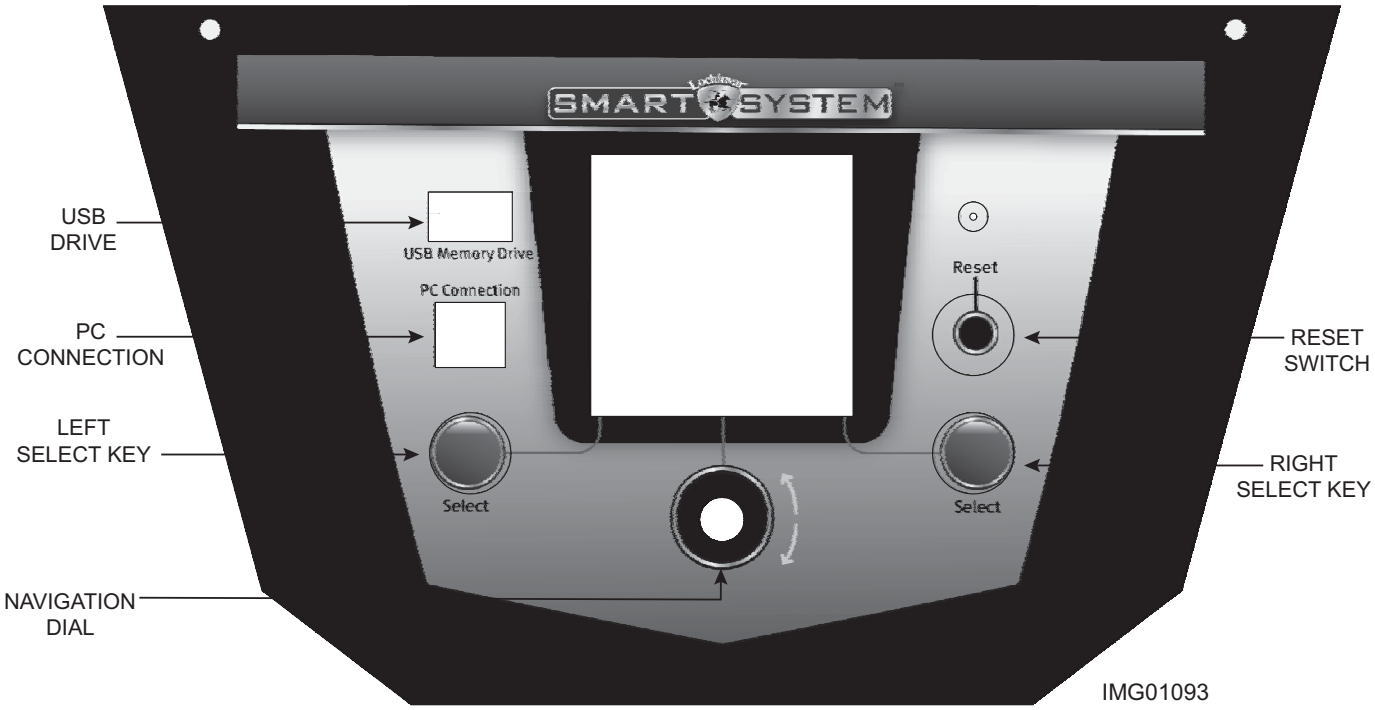
OPERATION	DISPLAY
7. If flame is detected, it holds the firing rate steady for a few seconds to let the flame stabilize, then it begins to modulate the firing rate based on a set point or some other command (such as a 0-10V BMS signal).	
8. If the space heating call for heat is active, and the tank thermostat or sensor starts a DHW call for heat, the boiler will switch to the DHW mode. If programmed for normal DHW operation (not as a zone), the DHW pump will turn on first, then the boiler pump will turn off (boiler and DHW pump operation briefly overlap to ensure flow is maintained through the unit). This will divert the boiler's outlet water from the heating system and send it to the tank coil instead. The control will then modulate to maintain the outlet temperature to the DHW boiler set point.	
9. If the boiler is not part of a Cascade, and both the space heating and DHW calls for heat remain active long enough, the boiler will switch back and forth between the two heating modes until one of them is satisfied.	
10. Once both calls for heat are satisfied, the control will turn off the burner. The blower will continue to run during the postpurge period.	
11. Any pumps that are running will continue to run for their respective pump delay times before turning off, unless programmed to remain on continuously. A 60 second anti-cycle period will start, which will delay any new call for heat until it times out.	
12. In Standby, ready to start a new cycle.	

11 Operating information *(continued)*

SMART SYSTEM™ FTXL control module

Use the control panel (FIG. 11-1) to set temperatures, operating conditions, and monitor boiler operation.

Figure 11-1 *Control Panel*



The information on the bottom of the display shows the functions of the two SELECT keys (on either corner), and the NAVIGATION dial (in the center):

MENU = Left SELECT Key
SETPOINTS = NAVIGATION Dial - Pressing Down
SHDN = Right SELECT Key

Access modes

User

The user can adjust space heating and tank target temperatures by pressing the NAVIGATION dial when "↓SETPOINTS" is flashing at the bottom of the display. The date and time, and the temperature units can also be changed (see page 63).

Installer

Most parameters are available only to the installer, accessible by entering the installer password, see the FTXL Service Manual.

Saving parameters *(reference the Parameter Table in the FTXL Service Manual)*

NOTICE Please note that the brackets ([]) denote screen status.

To save parameters and exit programming:

Press the RIGHT SELECT [SAVE] key and then press the RIGHT SELECT [HOME] key.

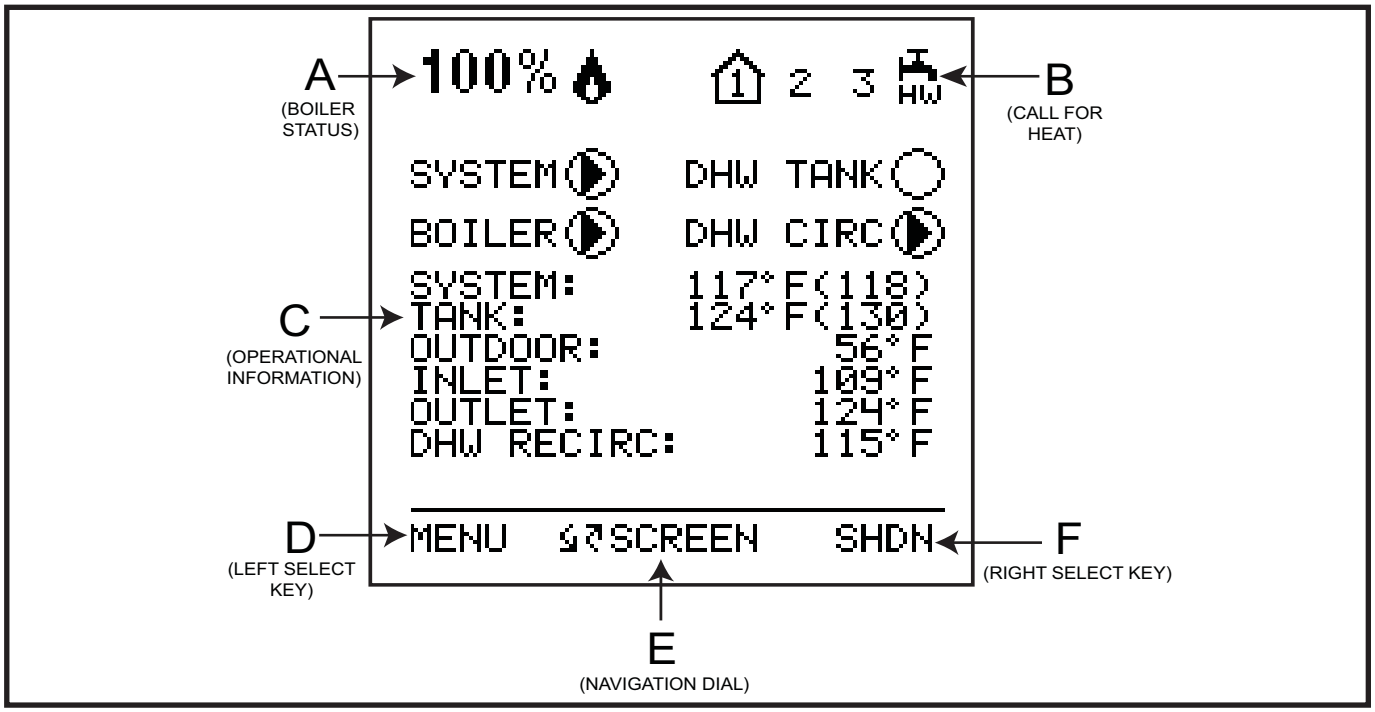
To enter a parameter and continue programming:

Press the RIGHT SELECT [SAVE] key 1 time to return to the parameter listings; press again to return to the menu listings. Remember to press the RIGHT SELECT [HOME] key when finished programming in order to save the changes made.

See the FTXL Service Manual for a detailed description of parameters and access modes.

11 Operating information

Figure 11-2 *Status Display Screen*



Status Display Screens NOTE: All screens show burner status, heat demands, lockout/blocking, pump status, and soft keys.		
Section	**Display**	**Description**
A (Boiler Status Bar)	**STANDBY**	The unit has not received a call for heat from a remote thermostat nor has it received a call for heat from a DHW thermostat.
	START	The unit has begun a burn cycle and is checking all safety circuits.
	PREPURGE	The unit has initiated a prepurge period on a call for heat.
	IGNITION	The unit has begun a spark period to ignite the main burner.
	%	The unit has fired and is running at the displayed percentage.
	POSTPURGE	The call for heat has been satisfied and the unit runs the fan for an additional postpurge period to clear the combustion chamber and vent system of residual flue products.
	SHUTDOWN	The unit has been placed in the OFF position.
	SETPOINT MET	The controlled temperature has exceeded its set point and its offset.
	BLOCKED	The unit has detected a condition that has temporarily interrupted the current call for heat.
B (Call for Heat Indicators)	1	Room Thermostat 1 has a call for heat.
	2	Room Thermostat 2 has a call for heat.
	3	Room Thermostat 3 has a call for heat.
	HW	The tank thermostat or sensor has a call for heat.
	1 2 3	Indicates which room thermostat demand has priority.
	V	The unit is being controlled by a 0 - 10V BMS signal.
	C	The member unit is supplying heat while in Cascade Mode.

11 Operating information *(continued)*

Status Display Screens *(cont'd)* NOTE: All screens show burner status, heat demands, lockout/blocking, pump status, and soft keys.		
Section	**Display**	**Description**
C (Operational Information)	**DETAILS SCREEN 1**	a. SYSTEM TEMP b. TANK TEMP c. OUTDOOR TEMP d. INLET TEMP e. OUTLET TEMP f. DHW RECIRC TEMP - The temperature read by the DHW recirculation sensor (if connected).
	DETAILS SCREEN 2	a. DELTA T b. FLUE TEMP c. FLAME CURRENT d. FAN SPEED e. LOOP 1 TEMP - The temperature of Loop 1 reported by the MTLC control. f. LOOP 2 TEMP - The temperature of Loop 2 reported by the MTLC control. g. LOOP 3 TEMP - The temperature of Loop 3 reported by the MTLC control.
	I/O SCREEN	a. GAS PRESS SW - The state of the gas pressure switch. b. FLOW SW - The state of the flow switch. c. LOUVER RELAY - The state of the louver relay output. d. LOUVER SW - The state of the louver proving switch. e. BLOCKED DRAIN - The state of the blocked drain switch. f. GAS VALVE - The state of the gas valve output.
	BMS SCREEN	a. 0 - 10V BMS IN b. 0 - 10V RATE OUT c. BMS ADDRESS d. BMS CONTROL? e. SYS PUMP SPEED f. BLR PUMP OUT
	HISTORY SCREEN	a. SH RUN TIME - Total time running for Space Heat (SH). b. SH CYCLES - Total Space Heat (SH) demand cycles. c. DHW RUN TIME - Total time running for DHW. d. DHW CYCLES - Total DHW demand cycles. e. POWER TIME - Total time powered ON. f. IGNITIONS - Total number of successful ignitions. g. IGN ATTEMPTS - Total number of ignition attempts.
	LAST 10 FAULTS	a. FAULT NO. b. FAULT c. DATE d. TIME

11 Operating information

Status Display Screens *(cont'd)* NOTE: All screens show burner status, heat demands, lockout/blocking, pump status, and soft keys.		
Section	**Display**	**Description**
C (Operational Information cont.)	**CASCADE STATUS**	a. CASCADE STATUS b. CASCADE POWER c. PRESENT
	NIGHT SETBACK	a. TRIGGER 1 - Next Space Heat (SH) night setback trigger. b. TRIGGER 2 - Next DHW night setback trigger.
D (LEFT SELECT key function)	**USB**	Press the LEFT SELECT key to access the USB and Installer menu.
E (NAVIGATION dial function)	**MODIFY**	Pressing the NAVIGATION dial will allow the installer to change the text.
F (RIGHT SELECT key function)	**SHDN**	Press the RIGHT SELECT key to turn the boiler OFF.
	ON	Press the RIGHT SELECT key to turn the boiler ON.
	NO	Press the RIGHT SELECT key to cancel the shutdown operation.
	SAVE	Press the RIGHT SELECT key to save the current change.
	HOME	Press the RIGHT SELECT key to return to the Status Screen and upload parameter changes.

12 Maintenance

Maintenance and annual startup

Table 12A *Service and Maintenance Schedules*

Service technician (see the following pages for instructions)	
ANNUAL START-UP	**General:** • Address reported problems • Inspect interior; clean and vacuum if necessary; • Clean condensate trap and fill with fresh water • Check for leaks (water, gas, flue, condensate) • Verify flue and air lines in good condition and sealed tight • Check system water pressure/system piping/expansion tank • Check control settings • Check ignition and flame sense electrodes (sand off any deposits; clean and reposition) • Check wiring and connections • Perform start-up checkout and performance verification per Section 10. • Flame inspection (stable, uniform) • Flame signal (at least 10 microamps at high fire) • Clean the heat exchanger if flue temperature is more than 54°F (30°C) above return water temperature. **If combustion or performance indicate need:** • Clean heat exchanger • Remove and clean burner using compressed air only • Clean the blower wheel

Owner maintenance (see the FTXL User's Information Manual for instructions)	
Daily	• Check boiler area • Check pressure/temperature gauge
Monthly	• Check vent piping • Check air piping • Check air and vent termination screens • Check relief valve • Check condensate drain system • Check air vents
Periodically	• Test low water cutoff • Reset button (low water cutoff)
Every 6 months	• Check boiler piping (gas and water) for leaks • Operate relief valve
End of season months	• Shut boiler down (unless boiler used for domestic hot water)

12 Maintenance

⚠ WARNING Follow the Service and maintenance procedures given throughout this manual and in component literature shipped with the boiler. Failure to perform the service and maintenance could result in damage to the boiler or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.

⚠ WARNING The boiler should be inspected annually only by a qualified service technician. In addition, the maintenance and care of the boiler designated in Table 12A and explained on the following pages must be performed to assure maximum boiler efficiency and reliability. Failure to service and maintain the boiler and system could result in equipment failure.

⚠ WARNING Electrical shock hazard – Turn off power to the boiler before any service operation on the boiler except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.

Address reported problems

1. Inspect any problems reported by the owner and correct before proceeding.

Inspect boiler area

1. Verify that boiler area is free of any combustible materials, gasoline and other flammable vapors and liquids.
2. Verify that air intake area is free of any of the contaminants listed in Section 1 of this manual. If any of these are present in the boiler intake air vicinity, they must be removed. If they cannot be removed, reinstall the air and vent lines per this manual and the FTXL Service Manual.

Inspect boiler interior

1. Lift the top bezel (prop the bezel up for service) and inspect the interior of the boiler.
2. Vacuum any sediment from inside the boiler and components. Remove any obstructions.

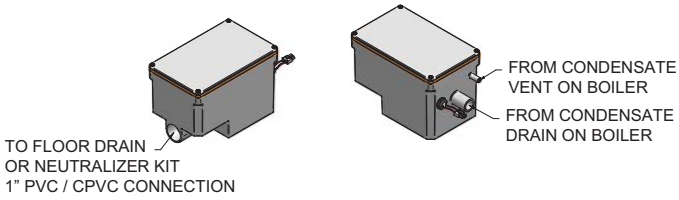
Clean condensate trap

1. Inspect the condensate drain line, vent line, condensate PVC fittings, and condensate trap.

Flush condensate trap with water

1. Remove the four (4) screws securing the top cover to the condensate trap and remove the cover (FIG. 12-1).
2. Locate the plastic ball inside the float tube. Verify there is nothing under the ball causing it to not seat properly.
3. Fill with fresh water until the water begins to pour out of the drain.
4. Replace the top cover and the screws removed in Step 1.

Figure 12-1 *Condensate Trap*



Check all piping for leaks

⚠ WARNING Eliminate all system or boiler leaks. Continual fresh makeup water will reduce boiler life. Minerals can build up in sections, reducing heat transfer, overheating heat exchanger, and causing heat exchanger failure. Leaking water may also cause severe property damage.

1. Inspect all water and gas piping and verify to be leak free.
2. Look for signs of leaking lines and correct any problems found.
3. Check gas line using the procedure found in Section 7 - Gas Connections.

12 Maintenance *(continued)*

Flue vent system and air piping

1. Visually inspect the entire flue gas venting system and air piping for blockage, deterioration or leakage. Repair any joints that show signs of leakage. Verify that air inlet pipe is connected and properly sealed.

2. Verify that boiler vent discharge and air intake are clean and free of obstructions.

⚠ WARNING Failure to inspect for the above conditions and have them repaired can result in severe personal injury or death.

Check water system

1. Verify all system components are correctly installed and operational.

2. Check the cold fill pressure for the system. Verify it is correct (must be a minimum of 12 psi (82.7 kPa)).

3. Watch the system pressure as the boiler heats up (during testing) to ensure pressure does not rise too high. Excessive pressure rise indicates expansion tank sizing or performance problem.

4. Inspect automatic air vents and air separators. Remove air vent caps and briefly press push valve to flush vent. Replace caps. Make sure vents do not leak. Replace any leaking vents.

Check expansion tank

1. Expansion tanks provide space for water to move in and out as the heating system water expands due to temperature increase or contracts as the water cools. Tanks may be open, closed or diaphragm or bladder type. See Section 6 - Hydronic Piping for suggested best location of expansion tanks and air eliminators.

Check boiler relief valve

1. Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read Section 6 - Hydronic Piping before proceeding further.

⚠ WARNING Safety relief valves should be re-inspected AT LEAST ONCE EVERY THREE YEARS, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner. Failure to re-inspect the boiler relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

⚠ WARNING Following installation, the valve lever must be operated AT LEAST ONCE A YEAR to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal. Otherwise severe personal injury may result. If no water flows, valve is inoperative. Shut down the boiler until a new relief valve has been installed.

2. After following the above warning directions, if the relief valve weeps or will not seat properly, replace the relief valve. Ensure that the reason for relief valve weeping is the valve and not over-pressurization of the system due to expansion tank waterlogging or undersizing.

12 Maintenance

Inspect ignition and flame sense electrodes

1. Remove the ignition and flame sense electrodes from the boiler heat exchanger access cover.
2. Remove any deposits accumulated on the ignition/flame sense electrode using sandpaper. If the electrodes cannot be cleaned satisfactorily, replace with new ones.
3. Replace ignition/flame sense electrode, making sure gasket is in good condition and correctly positioned.

Check ignition ground wiring

1. Inspect boiler ground wire from the heat exchanger access cover to ground terminal strip.
2. Verify all wiring is in good condition and securely attached.
3. Check ground continuity of wiring using continuity meter.
4. Replace ground wires if ground continuity is not satisfactory.

Check all boiler wiring

1. Inspect all boiler wiring, making sure wires are in good condition and securely attached.

Check control settings

1. Set the SMART SYSTEM control module display to Parameter Mode and check all settings. See Section 1 of the FTXL Service Manual. Adjust settings if necessary. See Section 1 of the FTXL Service Manual for adjustment procedures.
2. Check settings of external limit controls (if any) and adjust if necessary.

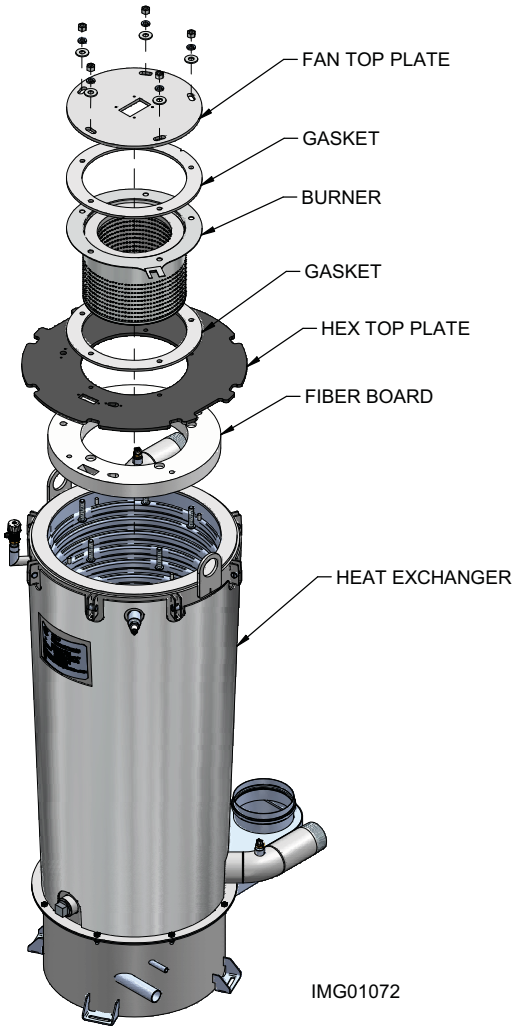
Perform start-up and checks

1. Start boiler and perform checks and tests specified in Section 10 - Start-up.
2. Verify cold fill pressure is correct and that operating pressure does not go too high.

Check burner flame

1. Inspect flame through observation window.
2. If the flame is unsatisfactory at either high fire or low fire, turn off boiler and allow boiler to cool down. Remove the burner and clean it thoroughly using a vacuum cleaner or compressed air. Do not use compressed air to clean burner if performed inside a building.
3. Remove the burner, reference FIG. 12-2.
4. When replacing the burner, ensure gasket is in good condition and positioned correctly (FIG. 12-2).

Figure 12-2 *Burner Assembly - Model 400 - 850*



12 Maintenance *(continued)*

Check flame signal

1. At high fire the flame signal shown on the display should be at least 10 microamps.
2. A lower flame signal may indicate a fouled or damaged flame sense electrode. If cleaning the flame sense electrode does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the flame sense electrode.
3. See Section 3 - Troubleshooting in the FTXL Service Manual for other procedures to deal with low flame signal.

Review with owner

1. Review the FTXL User's Information Manual with the owner.
2. Emphasize the need to perform the maintenance schedule specified in the FTXL User's Information Manual (and in this manual as well).
3. Remind the owner of the need to call a licensed contractor should the boiler or system exhibit any unusual behavior.
4. Remind the owner to follow the proper shutdown procedure and to schedule an annual start-up at the beginning of the next heating season.

Cleaning boiler heat exchanger

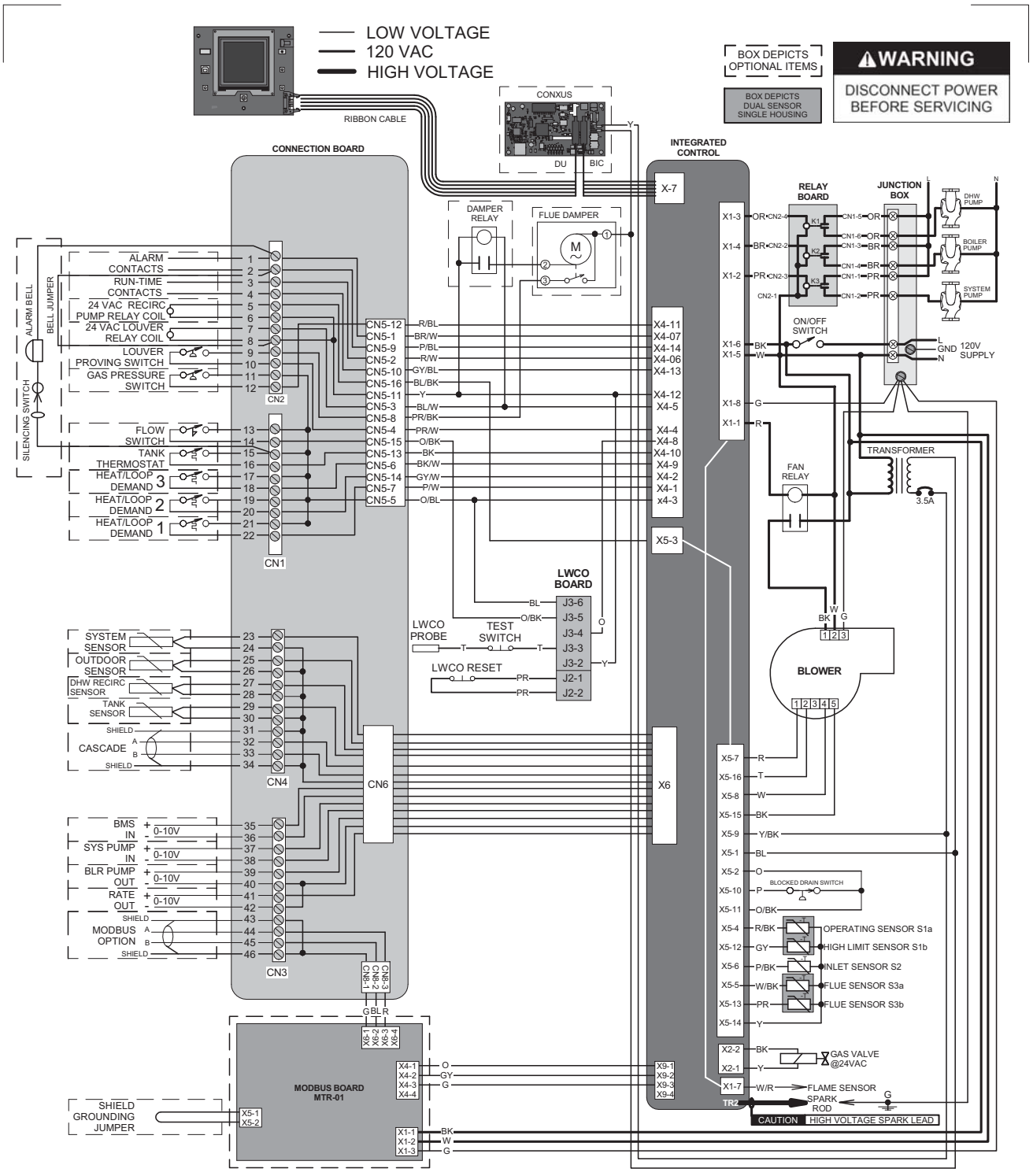
1. Shut down boiler:
   - Follow the "To Turn Off Gas to Appliance" instructions for the boiler in Section 10 - Startup.
   - Do not drain the boiler unless it will be exposed to freezing temperatures. If using freeze prevention fluid in system, do not drain.
2. Allow time for the boiler to cool to room temperature if it has been firing.
3. Remove the bezel from the unit.
4. Remove the screw securing the fan and venturi from the fan plate and set aside.
5. Remove the nuts securing the fan plate and burner from the heat exchanger plate and set aside (FIG. 12-2).
6. Loosen the heat exchanger bolts to remove the heat exchanger top plate (FIG. 12-2).

⚠ WARNING The boiler contains ceramic fiber materials. Use care when handling these materials per instructions in the FTXL Service Manual. Failure to comply could result in severe personal injury.

7. Disconnect the condensate hose from the condensate trap and route to drain.
8. Use a vacuum cleaner to remove any accumulation on the boiler heating surfaces. Do not use any solvent.
9. Using a clean cloth dampened with warm water, wipe out the combustion chamber. Rinse out debris with a low pressure water supply.
10. Allow the heat exchanger to thoroughly dry.
11. Reinstall the condensate hose, heat exchanger top plate, burner, fan plate, fan, venturi, and bezel (FIG. 12-2).
12. Perform a combustion analysis by following the instructions in Section 10 - Start-up - *Check Flame and Combustion*, on pages 59 and 61 of this manual.
13. Resume operation.

13 Diagrams

Figure 13-1 *Wiring Diagram*



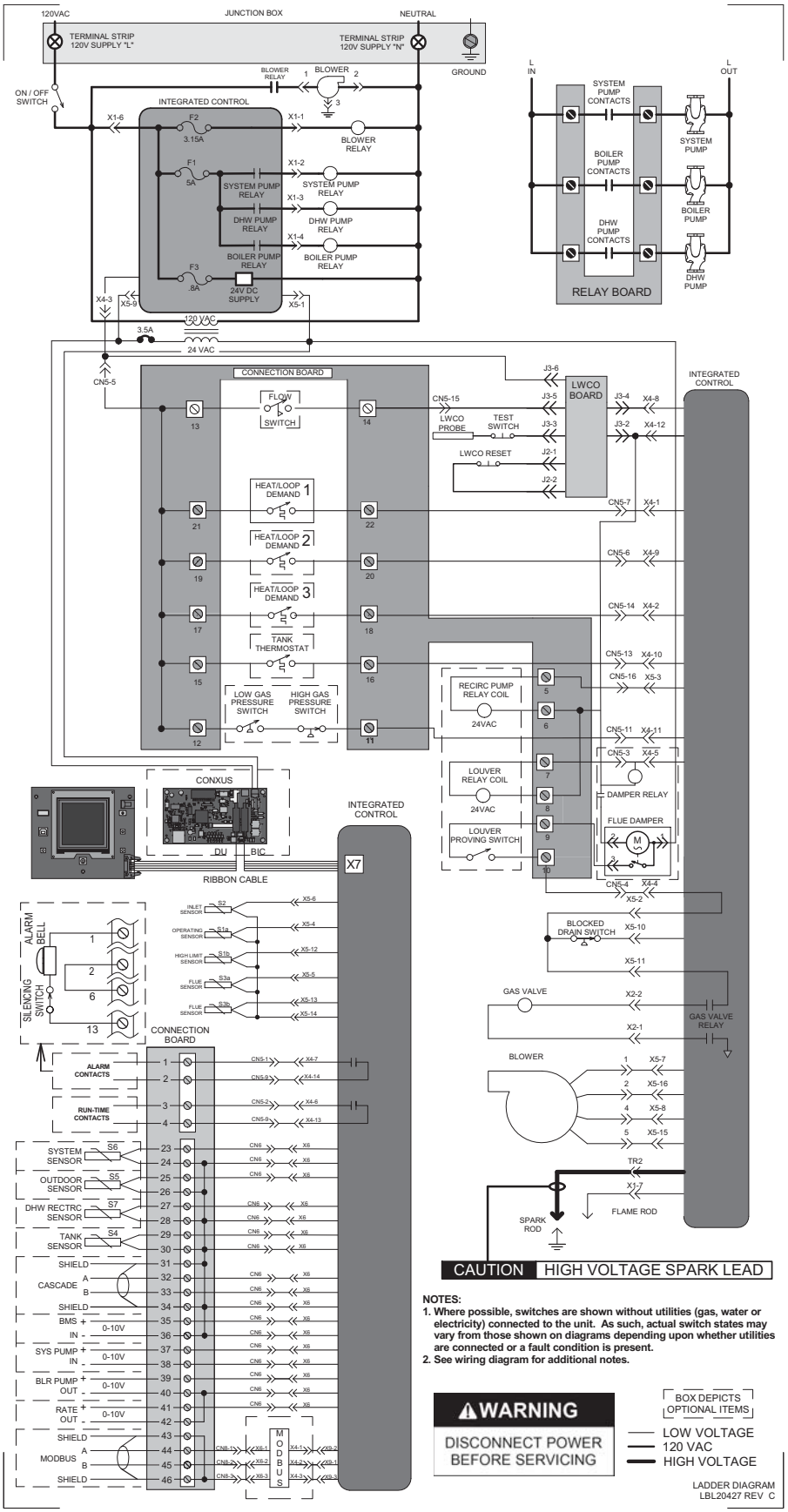
Notes:

1. All wiring must be installed in accordance with: local, state, provincial and national code requirements per either N.E.C. in USA or C.S.A. in Canada.
2. If any original equipment wire as supplied with the appliance must be replaced, it must be replaced with wire having same wire gauge (AWG) and rated for a minimum of 105℃. Exceptions: Rep lacement high voltage spark lead and ribbon cables must be purchased from the factory. Use of a non-approved spark lead or ribbon cables can lead to operational problems which could result in non-repairable damage to the integrated controller or other components.
3. Actual connector block locations may vary from those shown on diagrams. Refer to actual components for proper connector block locations when using diagrams to troubleshoot unit.

WIRING DIAGRAM
LBL20426 REV C

13 Diagrams *(continued)*

Figure 13-2 *Ladder Diagram*



Revision Notes: *Revision A (ECO #C15743) initial release.*

Revision B (ECO #C16066) reflects updates made to the room air kit on page 19 along with updates made to the wiring and ladder diagrams.

Revision C (ECO C17014) reflects the standardization of pressure drop information on pages 49 and 50 as well as the the addition of the system supply sensor note on page 53.

Revision D (Process #3000001405_Change #500002005) reflects the addition of the ICC and Jeremias information along with updated SAP numbers.

Revision E (PCP# 3000001143 / CN# 500002167) reflects the addition of edits made to Boiler Water on page 3, along with the addition of the Important and Notice items under General Piping Information on page 37, as well as edits to section 10 (Start-up) on pages 57 and 58. SAP part numbers have been updated.

Revision F (PCP# 3000002702 / CN# 500003259) reflects an update to the wiring diagram on page 80.

Revision G (PCP# 3000001665 / CN# 500001821) reflects the addition of Step 4 under the Common Venting section on page 20 as well as edits made to the Multiventing Vertical Terminations section on page 34.

Revision H (PCP# 3000003998 / CN# 500004062) reflects a change to the Duravent Polypro Adapter number in Table 3G on page 22.

Revision J (PCP# 3000004157 / CN# 500004298) reflects an update to the minimum gas supply pressure to 5" for the FTX500 models on pages 49 and 51.

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FTXL-I-O_MM #100059358_DIR #2000005000_Rev J
09/16

FTXL™
FIRE TUBE BOILER

User's Information Manual

Models: ~~400, 500, 600~~, 725, ~~& 850~~

IMG00962

⚠ WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

This appliance MUST NOT be installed in any location where gasoline or flammable vapors are likely to be present.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a near by phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

Save this manual for future reference.

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Contents

Hazard definitions

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important information concerning the life of the product.

⚠ DANGER DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE NOTICE indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

Please read before proceeding

NOTICE

The FTXL Installation and Operation Manual along with the FTXL Service Manual are for use only by a qualified heating installer/service technician. Refer only to this User's Information Manual for your reference. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury (exposure to hazardous materials) or loss of life. Installation and service must be performed by a qualified installer, service agency or the gas supplier (who must read and follow the supplied instruction before installing, servicing, or removing this boiler. This boiler contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans).

NOTICE

When calling or writing about the boiler – Please have the boiler model and serial number from the boiler rating plate.

Consider piping and installation when determining boiler location.

Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Factory warranty (shipped with unit) does not apply to units improperly installed or improperly operated.

⚠ WARNING

Failure to adhere to the guidelines on this page can result in severe personal injury, death, or substantial property damage.

⚠ WARNING

DO NOT install units in rooms or environments that contain corrosive contaminants (see Table 1A on page 4). Failure to comply could result in severe personal injury, death, or substantial property damage.

Boiler service and maintenance –

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow boiler to cool before performing maintenance.

Boiler operation –

- Do not block flow of combustion or ventilation air to the boiler. This boiler is equipped with a control which will automatically shut down the boiler should air or vent be blocked. If vent or air blockage is easily accessible and removable, remove it. The boiler should attempt to restart. If blockage is not obvious or cannot be removed, have the boiler and system checked by a qualified service technician.
- Should overheating occur or gas supply fail to shut off, do not turn off or disconnect electrical supply to the circulator. Instead, shut off the gas supply at a location external to the appliance.
- Do not use this boiler if any part has been under water. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

Boiler water –

- Thoroughly flush the system (without boiler connected) to remove sediment. The high-efficiency heat exchanger can be damaged by build-up or corrosion due to sediment.
- Do not use petroleum-based cleaning or sealing compounds in the boiler system. Gaskets and seals in the system may be damaged. This can result in substantial property damage.
- Do not use "homemade cures" or "boiler patent medicines". Serious damage to the boiler, personnel, and/or property may result.
- Continual fresh make-up water will reduce boiler life. Mineral buildup in the heat exchanger reduces heat transfer, overheats the stainless steel heat exchanger, and causes failure. Addition of oxygen carried in by makeup water can cause internal corrosion. Leaks in boiler or piping must be repaired at once to prevent makeup water.

Freeze protection fluids –

- NEVER use automotive antifreeze. Use only inhibited propylene glycol solutions, which are specifically formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems.

1 Prevent combustion air contamination

⚠ WARNING If the boiler combustion air inlet is located in any area likely to cause contamination, or if products which would contaminate the air cannot be removed, you must have the combustion air and vent re-piped and terminated to another location. Contaminated combustion air will damage the boiler, resulting in possible severe personal injury, death, or substantial property damage.

⚠ WARNING If the boiler combustion air inlet is located in a laundry room or pool facility, for example, these areas will always contain hazardous contaminants.

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the boiler, they can form strong acids. The acid can eat through the boiler wall, causing serious damage and presenting a possible threat of flue gas spillage or boiler water leakage into the building.

Please read the information listed in Table 1A. If contaminating chemicals will be present near the location of the boiler combustion air inlet, have your installer pipe the boiler combustion air and vent to another location, per the FTXL Installation and Operation Manual.

⚠ WARNING To prevent the potential of severe personal injury or death, check for areas and products listed in Table 1A before installing the boiler or air inlet piping.

If contaminants are found, you MUST:

- Remove contaminants permanently.

—OR—

- Relocate air inlet and vent terminations to other areas.

Table 1A *Corrosive Contaminants and Sources*

Products to avoid:
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

2 Maintenance schedule

Service technician
(see the FTXL Service Manual)

ANNUAL START-UP

General:

- Address reported problems
- Inspect interior; clean and vacuum if necessary
- Clean condensate trap and fill with fresh water
- Check for leaks (water, gas, flue, condensate)
- Verify flue and air lines in good condition and sealed tight
- Check system water pressure/ system piping/expansion tank
- Check control settings
- Check ignition and flame sense electrodes (sand off any deposits; clean and reposition)
- Check wiring and connections
- Perform start-up, checkout and performance verification per Section 10 in the FTXL Installation and Operation manual
- Flame inspection (stable, uniform)
- Flame signal (at least 10 microamps at high fire)
- Clean the heat exchanger if flue temperature is more than 54°F (30°C) above return water temperature

If combustion or performance indicate need:

- Clean heat exchanger
- Remove and clean burner using compressed air only
- Clean the blower wheel

Owner maintenance
(see pages 6 - 8 for detailed instructions)

Daily	• Check boiler area • Check pressure/ temperature gauge
Monthly	• Check vent pipng • Check air piping • Check air and vent a • termination screens • Check relief valve • Check condensate drain system • Check air vents
Periodically	• Test low water cutoff • Reset button (LWCO)
Every 6 months	• Check boiler piping (gas and water) for leaks • Operate relief valve
End of season months	• Shut boiler down (unless boiler is used for domestic hot water)

⚠ WARNING Follow the maintenance procedures given throughout this manual. Failure to perform the service and maintenance or follow the directions in this manual could result in damage to the boiler or system, resulting in severe personal injury, death, or substantial property damage.

2 Maintenance schedule

Maintenance procedures

Boiler must be serviced and maintained

⚠ WARNING The boiler must be inspected and started annually at the beginning of the heating season by a qualified service technician. In addition, the maintenance and care of the boiler designated on page 5 of this manual and explained on pages 6 through 8 must be performed to assure maximum boiler efficiency and reliability. Failure to service and maintain the boiler and system could result in equipment failure, causing possible severe personal injury, death, or substantial property damage.

NOTICE The following information provides detailed instructions for completing the maintenance items listed in the maintenance schedule on page 5. In addition to this maintenance, the boiler must be serviced and started up at the beginning of each heating season by a qualified service technician.

Check boiler area

⚠ WARNING To prevent potential of severe personal injury, death, or substantial property damage, eliminate all materials discussed below from the boiler vicinity and the vicinity of the boiler combustion air inlet. If contaminants are found:

Remove products immediately from the area. If they have been there for an extended period, call a qualified service technician to inspect the boiler for possible damage from acid corrosion.

If products cannot be removed, immediately call a qualified service technician to re-pipe vent and air piping and locate vent termination/air intake away from contaminated areas.

1. Combustible/flammable materials -- Do not store combustible materials, gasoline or any other flammable vapors or liquids near the boiler. Remove immediately if found.

2. Air contaminants -- Products containing chlorine or fluorine, if allowed to contaminate the boiler intake air, will cause acidic condensate in the boiler. This will cause significant damage to the boiler if allowed to continue.

   Read the list of potential materials listed in Table 1A on page 4 of this manual. If any of these products are in the room from which the boiler takes its combustion air, they must be removed immediately or the boiler combustion air (and vent termination) must be relocated to another area.

Check pressure/temperature gauge

1. Make sure the pressure reading on the boiler pressure/temperature gauge does not exceed 24 psi (165.5 kPa). Higher pressure may indicate a problem with the expansion tank.
2. Contact a qualified service technician if problem persists.

Check vent piping

1. Visually inspect the flue gas vent piping for any signs of blockage, leakage, or deterioration of the piping. Notify your qualified service technician at once if you find any problems.

⚠ WARNING Failure to inspect the vent system as noted above and have it repaired by a qualified service technician can result in vent system failure, causing severe personal injury or death.

Check air piping

1. Visually inspect the air inlet termination to be sure it is unobstructed. Inspect the entire length of air piping to ensure piping is intact and all joints are properly sealed.
2. Call your qualified service technician if you notice any problems.

Check relief valve

1. Inspect the boiler relief valve and the relief valve discharge pipe for signs of weeping or leakage.
2. If the relief valve often weeps, the expansion tank may not be working properly. Immediately contact your qualified service technician to inspect the boiler and system.

Check condensate drain system

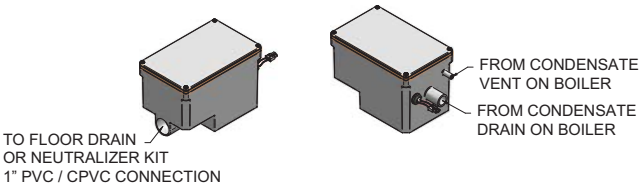
1. Inspect the condensate drain line, vent line, condensate PVC fittings, and condensate trap.

Flush condensate trap with water

1. Remove the four (4) screws securing the top cover to the condensate trap and remove the cover (FIG. 2-1).
2. Locate the plastic ball inside the float tube. Verify there is nothing under the ball causing it to not seat properly.
3. Fill with fresh water until the water begins to pour out of the drain.
4. Replace the top cover and the screws removed in Step 1.

2 Maintenance schedule *(continued)*

Figure 2-1 *Condensate Trap*



Condensate disposal

1. The FTXL is a high efficiency appliance that produces condensate.
2. The condensate trap is sized for a 1" PVC outlet connection pipe.
3. Plug the wiring connection from the condensate trap into the connector located on the back of the unit.
4. Slope condensate tubing down and away from the boiler into a drain or condensate neutralizing filter. Condensate from the FTXL will be slightly acidic (typically with a pH from 3 to 5). Install a neutralizing filter if required by local codes.

   A Neutralizer Kit (FIG. 9-1) is available from the factory (KIT3087 for Models 400 - 500 and KIT3046 for Models 600 - 850). KIT3046 must be placed on a surface that is a minimum of 3 inches lower than the condensate trap with field supplied piping (vacuum break) installed between the condensate trap and the neutralizer kit.
5. Do not expose condensate line to freezing temperatures.

NOTICE

Use materials approved by the authority having jurisdiction. In the absence of other authority, PVC and CPVC pipe must comply with ASTM D1785 or D2845. Cement and primer must comply with ASME D2564 or F493. For Canada use CSA or ULC certified PVC or CPVC pipe, fittings, and cement.

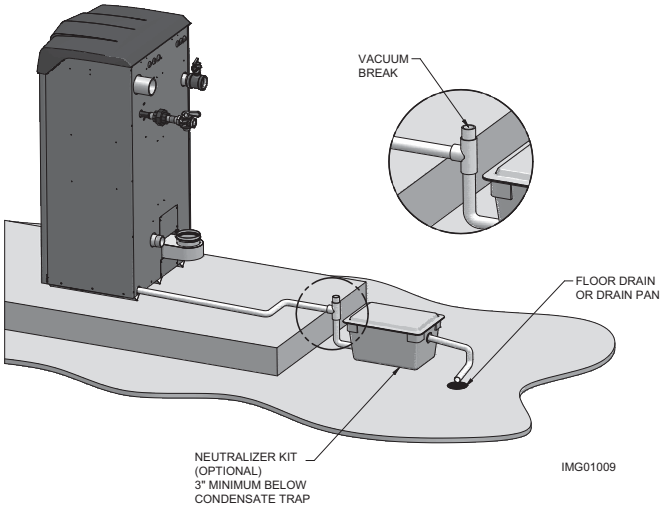
NOTICE

To allow for proper drainage on large horizontal runs, a second line vent may be required and tubing size may need to increase to 1 inch.

The condensate line must remain unobstructed, allowing free flow of condensate. If condensate is allowed to freeze in the line or if the line is obstructed in any other manner, condensate can exit from the boiler tee, resulting in potential water damage to property. Call your qualified service technician to inspect the boiler and system.

6. A condensate removal pump is required if boiler is below the drain. When installing a condensate pump, select one approved for use with condensing boilers and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage. The switch should be wired to the auxiliary device proving switch terminals on the low voltage connection board.

Figure 2-2 *Condensate Disposal*



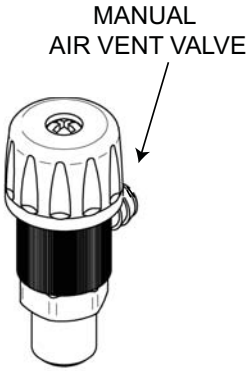
KIT3046 shown for illustration purposes.

2 Maintenance schedule

Check air vents

1. Reference FIG. 2-3 below.
2. Visually inspect vent to make sure that no leaks are present.
3. If there is leaking, tighten the pin valve.
4. If the leaking continues, replace the air vent.

Figure 2-3 *Manual Air Vent*



Test low water cutoff

1. Test the low water cutoff periodically during the heating season, following the low water cutoff manufacturer's instructions.

Reset button (low water cutoff)

1. Testing the low water cutoff shuts the unit off. Press the RESET button on the low water cutoff to turn the unit back on.

Check boiler piping (gas and water)

1. Lift the top bezel (prop the bezel up for service) and perform a gas leak inspection per steps 1 through 7 of the Operating Instructions on page 9. If gas odor or leak is detected, immediately shut down the boiler following the procedure on page 9. Call a qualified service technician.

2. Visually inspect for leaks around water piping. Also inspect the circulators, relief valve, and fittings. Immediately call a qualified service technician to repair any leaks.

⚠ WARNING Have leaks fixed at once by a qualified service technician. Failure to comply could result in severe personal injury, death, or substantial property damage.

3. Replace the bezel.

Operate relief valve

1. Before proceeding, verify that the relief valve outlet has been piped to a safe place of discharge, avoiding any possibility of scalding from hot water.

⚠ WARNING To avoid water damage or scalding due to valve operation, a metal discharge line must be connected to the relief valve outlet and run to a safe place of disposal. This discharge line must be installed by a qualified heating installer or service technician in accordance with the instructions in the FTXL Installation and Operation Manual. The discharge line must be terminated so as to eliminate possibility of severe burns or property damage should the valve discharge.

2. Read the boiler pressure/temperature gauge to make sure the system is pressurized. Lift the relief valve top lever slightly, allowing water to relieve through the valve and discharge piping.

3. If water flows freely, release the lever and allow the valve to seat. Watch the end of the relief valve discharge pipe to ensure that the valve does not weep after the line has had time to drain. If the valve weeps, lift the seat again to attempt to clean the valve seat. If the valve continues to weep afterwards, contact your qualified service technician to inspect the valve and system.

4. If water does not flow from the valve when you lift the lever completely, the valve or discharge line may be blocked. Immediately shut down the boiler, following the operating instructions on page 9 of this manual. Call your qualified service technician to inspect the boiler and system.

Shut boiler down (unless boiler is used for Domestic Water)

1. Follow "To Turn Off Gas to Appliance" on page 9 of this manual.

2. Do not drain the system unless exposure to freezing temperatures will occur.

3. Do not drain the system if it is filled with an antifreeze solution.

4. DO NOT shut down boilers used for domestic water heating, they must operate year-round.

3 Operating instructions

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

Do not try to light any appliance.

Do not touch any electric switch; do not use any phone in your building.

Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

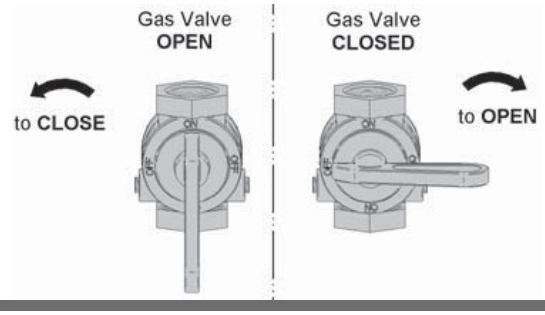
If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to turn the gas control knob. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove top cover.
6. Turn gas shutoff valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force.
7. Wait five (5) minutes to clear out any gas. If you then smell gas, **STOP!** Follow "B" in the safety information above this label. If you don't smell gas, go to next step.
8. Turn gas shutoff valve clockwise to "ON". Handle will be parallel to pipe.
9. Install top cover.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove top cover.
4. Turn gas shut off valve counterclockwise to "OFF". Handle will be perpendicular to pipe. Do not force
5. Install top cover.

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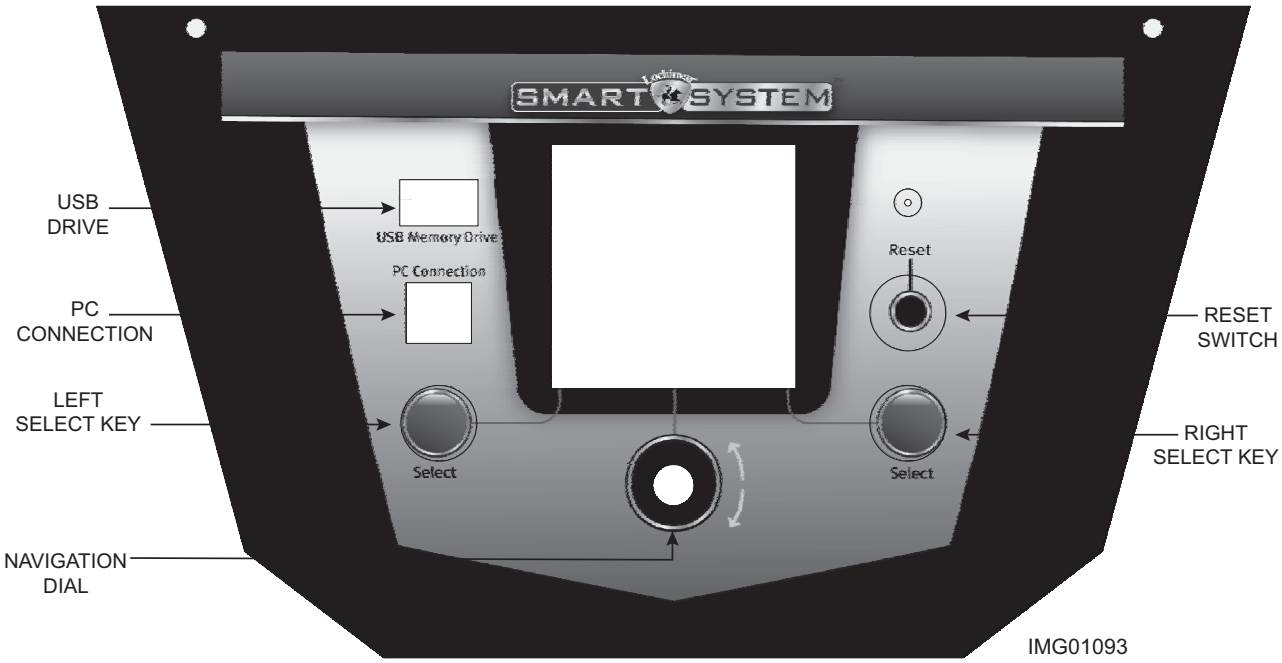
4 SMART SYSTEM control module

SMART SYSTEM™ FTXL control module

Use the control panel (FIG. 4-1) to set temperatures, operating conditions, and monitor boiler operation.

Figure 4-1 *Control Panel*



The information on the bottom of the display shows the functions of the two SELECT keys (on either corner), and the NAVIGATION dial (in the center): MENU = Left SELECT Key
SETPOINTS = NAVIGATION Dial - Pressing Down
SHDN = Right SELECT Key

Access modes

NOTICE Please note that the brackets ([]) denote screen status.

User

The user can adjust space heating and tank target temperatures by pressing the NAVIGATION dial when "↓SETPOINTS" is flashing at the bottom of the display. The user can adjust the date and time, temperature units, and night setback override (if active) by pressing the LEFT SELECT [MENU] key for 5 seconds. When the user password "0000" appears, then press the RIGHT SELECT [SAVE] key (do not change the password).

Installer

Most parameters are available only to the installer.

Saving parameters

Press the RIGHT SELECT [SAVE] key one time to return to the parameter listing. Press the RIGHT SELECT [HOME] key again to store the new settings and return to the Status Screen.

Adjusting parameters

CAUTION Before changing parameters, note the settings so that the unit can be returned to its original operating parameters.

The control uses an internal clock for the night setback feature and for logging of events. For these features to work properly, the clock must be set when the boiler is first installed or any time the boiler has been powered off for more than four (4) hours. This parameter must be accessed to set the clock.

NOTICE The internal clock does not adjust for Daylight Savings Time and therefore, will require a manual adjustment.

To set the clock, access the clock menu as described in the *User* section. Rotate the NAVIGATION dial (if needed) until the arrow (>) is pointing to "TIME & DATE". Press the NAVIGATION dial once. The hours value will begin flashing. Rotate the NAVIGATION dial until the hour and AM/PM values are correct. Press the NAVIGATION dial again. The minutes value will begin flashing. Rotate the NAVIGATION dial to adjust the minutes. Repeat this procedure to adjust the month, date and year. Save the new settings as described in the *Saving Parameters* section (this page).

4 SMART SYSTEM control module *(continued)*

Night setback override

Any Night Setback On trigger currently active or scheduled within the next seven (7) days can be skipped. To skip a trigger, rotate the NAVIGATION dial until the arrow (>) is next to the trigger you wish to skip. Press the NAVIGATION dial once. "SK" will appear next to that trigger to indicate that it will be skipped. You can restore an upcoming trigger by selecting that trigger, and pressing the NAVIGATION dial again. The "SK" next to that trigger will disappear.

To save any changes and return to the Home Screen, press the RIGHT SELECT [HOME] key. To return to the Status Screen without saving the changes, press the LEFT SELECT [EXIT] key.

Vacation mode

The SH and tank set points can be reduced indefinitely. They will be reduced by an amount equal to their respective night setback offsets. This feature can be activated by the user by accessing the clock menu as described in the *User* section (page 10). Rotate the NAVIGATION dial until the arrow (>) is pointing to VACATION MODE. Press the NAVIGATION dial once. The current setting will begin to flash. Rotate the NAVIGATION dial until the desired setting is shown. Save the new setting as described in the *Saving Parameters* section on page 10.

Temperature units

The control can be configured to display temperature in either °F or °C. This parameter can be changed by the user or the installer by accessing the *Temperature Units parameter*. The default is °F. To change the temperature units, access the clock menu as described in the *User* section (page 10). Rotate the NAVIGATION dial until the arrow (>) is pointing to "TEMPERATURE UNIT °F". Press the NAVIGATION dial once. The temperature unit will begin to flash. Rotate the NAVIGATION dial until the desired temperature unit is shown. Save the new setting as described in the *Saving Parameters* section (page 10).

Manual and auto reset high limit set points

The set points used by the Manual Reset High Limit and the Auto Reset High Limit are adjustable through the display. To access these settings, press the NAVIGATION dial once, then press the LEFT SELECT [LIMITS] key once. The two settings appear. Rotate the NAVIGATION dial as needed so the arrow (>) points to the limit setting you wish to adjust. Press the NAVIGATION dial once. The value of that setting will begin to flash. Rotate the NAVIGATION dial to change the value to the desired set point. Press the RIGHT SELECT [SAVE] key to save the new value, or the LEFT SELECT [EXIT] key to leave the set point at the original value. The other high limit setting may then be changed using the same procedure, if desired. When finished, press the RIGHT SELECT [HOME] key to store the new settings, or the LEFT SELECT [EXIT] key to return to the Space Heating and DHW Set Points Menu.

Space heating (SH1, SH2, SH3) and tank set points

CAUTION Mixing valves are required for the protection of any low temperature loops.

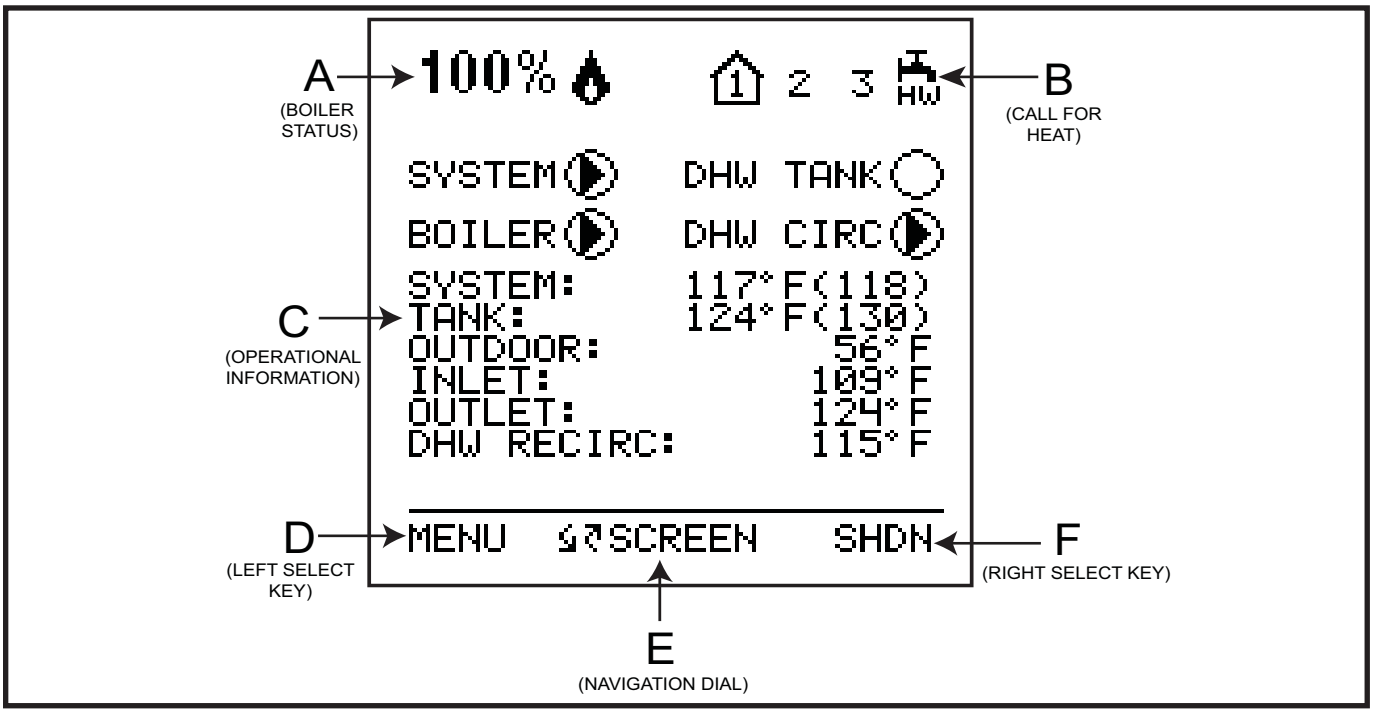
There are three (3) individual user set points for better zone control. These are listed as SH1 Set Point through SH3 Set Point. If multiple set points are calling for heat the highest set point has priority. The range is *SH Minimum Set point* to *SH Maximum Set point (32*°F (0°C) - 190°F (88°C)). The default is 125°F (52°C).

By installing a tank sensor, the SMART SYSTEM control can perform the tank thermostat function. The SMART SYSTEM control automatically detects the presence of this sensor, and generates a DHW call for heat when the tank temperature drops 6°F (-14°C) below the tank set point (*Tank Set point parameter)*, and finishes the call for heat when the tank temperature reaches tank set point. This parameter can be changed by the installer by accessing the *DHW Tank Set point parameter*. The temperature range of this parameter is 68°F (20°C) to 190°F (88°C). The default value is 125°F (52°C).

Press the NAVIGATION dial once. A menu will appear showing the SH1, SH2, SH3, and DHW Set Points. Rotate the NAVIGATION dial until the arrow (>) is pointing to the setting you wish to change. Press the NAVIGATION dial again. The value of the selected setting will begin to flash. Rotate the NAVIGATION dial to adjust the value. Save the new setting as described in the *Saving Parameters* section (page 10).

4 SMART SYSTEM control module

Figure 4-2 *Status Display Screen*



Status Display Screens		
Section	**Display**	**Description**
A (Boiler Status Bar)	**STANDBY**	The unit has not received a call for heat from a remote thermostat nor has it received a call for heat from a DHW thermostat.
	START	The unit has begun a burn cycle and is checking all safety circuits.
	PREPURGE	The unit has initiated a prepurge period on a call for heat.
	IGNITION	The unit has begun a spark period to ignite the main burner.
	% 🔥	The unit has fired and is running at the displayed percentage.
	POSTPURGE	The call for heat has been satisfied and the unit runs the fan for an additional postpurge period to clear the combustion chamber and vent system of residual flue products.
	SHUTDOWN	The unit has been placed in the OFF position.
	SETPOINT MET	The controlled temperature has exceeded its set point and its offset.
	BLOCKED	The unit has detected a condition that has temporarily interrupted the current call for heat.
B (Call for Heat Indicators)	1	Room Thermostat 1 has a call for heat.
	2	Room Thermostat 2 has a call for heat.
	3	Room Thermostat 3 has a call for heat.
	HW	The tank thermostat or sensor has a call for heat.
	1 2 3	Indicates which room thermostat demand shows priority.
	V	The unit is being controlled by a 0 - 10V BMS signal.
	C	The member unit is supplying heat while in Cascade Mode.

4 SMART SYSTEM control module *(continued)*

Status Display Screens *(cont'd)* NOTE: All screens show burner status, heat demands, lockout/blocking, pump status, and soft keys.		
Section	**Display**	**Description**
C (Operational Information)	**DETAILS SCREEN 1**	a. SYSTEM TEMP b. TANK TEMP c. OUTDOOR TEMP d. INLET TEMP e. OUTLET TEMP f. DHW RECIRC TEMP - The temperature read by the DHW circulation sensor (if connected).
	DETAILS SCREEN 2	a. DELTA T b. FLUE TEMP c. FLAME CURRENT d. FAN SPEED e. LOOP 1 TEMP - The temperature of Loop 1 reported by the MTLC control. f. LOOP 2 TEMP - The temeperature of Loop 2 reported by the MTLC control. g. LOOP 3 TEMP - The temperature of Loop 3 reported by the MTLC control.
	I/O SCREEN	a. GAS PRESS SW - The state of the gas pressure switch. b. FLOW SW/LWCO - The state of the flow switch and LWCO (if installed). c. LOUVER RELAY - The state of the louver relay output. d. LOUVER SW - The state of the louver proving switch. e. APS/HEX TEMP - The state of the air pressure switch and HEX overtemp switch. f. BLOCKED DRAIN - The state of the blocked drain switch. g. GAS VALVE - The state of the gas valve output.
	BMS SCREEN	a. 0 - 10V BMS IN b. 0 - 10V RATE OUT c. BMS ADDRESS d. BMS CONTROL? e. SYS PUMP SPEED f. BLR PUMP OUT
	HISTORY SCREEN	a. SH RUN TIME - Total time running for Space Heat (SH). b. SH CYCLES - Total Space Heat (SH) demand cycles. c. DHW RUN TIME - Total time running for DHW. d. DHW CYCLES - Total DHW demand cycles. e. POWER TIME - Total time powered ON. f. IGNITIONS - Total number of successful ignitions. g. IGN ATTEMPTS - Total number of ignition attempts.
	LAST 10 FAULTS	a. FAULT NO. b. FAULT c. DATE d. TIME

4 SMART SYSTEM control module

Status Display Screens *(cont'd)* NOTE: All screens show burner status, heat demands, lockout/blocking, pump status, and soft keys.		
Section	**Display**	**Description**
C (Operational Information cont.)	**CASCADE STATUS**	a. CASCADE STATUS b. CASCADE POWER c. PRESENT
	NIGHT SETBACK	a. TRIGGER 1 - Next Space Heat (SH) night setback trigger. b. TRIGGER 2 - Next DHW night setback trigger.
D (LEFT SELECT key function)	**USB**	Press the LEFT SELECT key to access the USB menu.
E (NAVIGATION dial function)	**MODIFY**	Pressing the NAVIGATION dial will allow the installer to change the text.
F (RIGHT SELECT key function)	**SHDN**	Press the RIGHT SELECT key to turn the boiler OFF.
	ON	Press the RIGHT SELECT key to turn the boiler ON.
	NO	Press the RIGHT SELECT key to cancel the shutdown operation.
	SAVE	Press the RIGHT SELECT key to save the current change.
	HOME	Press the RIGHT SELECT key to return to the Status Screen and upload parameter changes.

Notes

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS
300 Maddox Simpson Parkway
Lebanon, TN 37090
615-889-8900 / Fax: 615-547-1000
www.Lochinvar.com

Revision Notes: *Revision A (ECO C15743) initial release.*

Control Wizards, Inc.
89 Taylor Avenue • Norwalk, CT 06854
Ph. 203.274.5284

Automatic Temperature Controls
Sequence of Operation

Immaculate High School
73 Southern Blvd, Danbury, CT 06810

As-Built: 5-24-2017

Table of Contents

Project Overview (BMS):

General: This project consists of:

- A new boiler plant with new condensing gas fired boilers.
- New Variable Speed Controls for the Hot Water Pumps.
- New DDC Controls for Perimeter Baseboard in the Classrooms.
- New DDC Thermostats for Gym, Chapel, and Cafe Units

HVAC/Building Management System (BMS)

General: The BMS system is a Honeywell WEBS based Building Management System based upon a WEBS 600 Series (JACE) WebServer/Controller. Each individual JACE 600 Controller performs multiple functions:

- Operates as a DDC Controller with its own Input/Output modules.
- Operates as a WebServer to serve up the Graphics Pages for the site to any Browser that can "see" the webserver via an Ethernet (Intranet or Internet).
- Communicate with and manage a number of DDC Equipment Controllers and DDC Terminal Equipment Controllers (BACnet thermostat, DDC Controllers, etc.) via BACNET network communications.
- Perform 'global functions for all equipment: Scheduling, Data communications (for example, sending the supply air temperature from an Air Handler to all VAV boxes), trending, and alarming.

The WEBS DDC (JACE) 600 Controller will be located in the Boiler Room.

Communications: A connection with the buildings Router or a dedicated Internet connection (Cable or DSL) will be required for the graphics pages to be viewed via the Internet or Intranet and the alarm email system to function. This connection is by others.

Each WEBS-600 Controller will include the following communication ports:

- Optional Local Input and Output for monitoring and control at the WEBS-600 Controller (for example an Air Handling Unit). The input and output for a WEBS 600 Controller can consist of up to 64 points per controller, made up with at least one 34 Point module and optionally one or two 16-port modules. This input/output will be used for the Boiler Plant.
- Primary Ethernet Port: A standard Ethernet port is provided for Ethernet communication to the Intranet/Ethernet.
- Secondary Ethernet Port: A second standard Ethernet and is normally used for connecting a service laptop.
- RS485 Port: This port is provided and Drivers will be included for each WEBS 600 as required to communicate to Field Devices. This will be used for BACnet Communications.

- RedLink Port (Added Circuit Board in Webserver): Allows communications to two Honeywell Redlink Antennas to communicate to Honeywell Redlink Thermostats.

Alarms: The Honeywell WEBS System will have 3 Classes of Alarms: Log-only, Warnings, and Critical Alarms defined as follows:

- Log-Only alarms will be recorded at the Webserver and can be viewed at any time from the system, but no notification will be emailed.
- Warnings will be emailed, but only during regular business hours of 8am to 4pm (schedule can be field-modified). This is for items that the maintenance staff needs to be aware of, but the repair is not urgent, for example when a lead pump has failed, but the backup pump is operating properly. The lead pump does need to be fixed, but not at 2am.
- Critical Alarms are alarms that will be emailed 24/7 – something that the maintenance staff needs to know as soon as it happens.
- The alarm class for each alarm is listed below. Please review the alarm class for these alarms listed below during the submittal process to insure that they meet the requirements of the buildings operation and maintenance staff.
- Once a week (default is Wednesday at 10am, schedule adjustable), the Webserver will send a Heartbeat Message to confirm operation of the Webserver, and email system.
- NOTE: Generally, the email alarms are sent to one address (warning or alarm) and the owners email system (Exchange) will forward the email alarms to the required recipients. This simplifies the changes to the actual email addresses used as staff and assigned duties change. The controllers can be set up to email alarms to a number of individual email addresses, but this makes changes more time consuming.

Scheduling

The system will have the following independent time of day schedules:

All Schedules will share a common holiday list.

A: Office Areas.
B: Gym
C: Chapel
D: Classrooms
E: Café
F: Locker Rooms
G: General Area Exhaust Fans

Hot Water (Boiler) Plant:

General Description:

- Two Hot Water Boilers, each with a boiler pump, and a Main and Standby Primary pump on a VFD will provide heating hot water for the Air Handing Units, Baseboard Heat, Fan Coil Unit, Unit Heaters, etc. These boilers do not make Domestic Hot Water.

Fail Safe Mode:

- Where wired to the BMS System, all outputs will be wired to Normally Closed Relays so that upon failure of the BMS system, the boilers and hot water pumps will be enabled.

Operation:

- The Hot Water Plant will be enabled whenever the Outside Air Temperature is below 60 F (field adjustable) with a differential of 4 Degrees and an unoccupied offset to lower the setpoint if no zones are occupied.

- When the Hot Water Plant is disabled:
  - All Boilers will be disabled, which will disable Boilers Pumps
  - The Primary HHW Pumps P1 and P2 will be disabled

- When the Hot Water Plant is Enabled:
  - The Heating Hot Water Primary Loop Pumps will be enabled (see below)
  - The Boilers will be enabled to operate based upon an outdoor reset schedule (see below).
  - The intent of the system is to provide heating to the building at the lowest possible water temperature, as the condensing boilers increase in efficiency when the water temperature is lower.

- Hot Water Reset Schedule:
  - The Boiler System has a single thermostat 'input' to start the boiler.
  - These inputs will be wired to the BMS system with a Normally Closed Relay with a Local HAND/OFF/AUTO switch.
  - The Boiler Pumps (P1 and P2) will be wired to the Boiler Controls, so that these pumps operate based upon the requirements of the Factory Provided Boiler Controllers.
    - The BMS will monitor if P1 and P2 are running via a Current Sensor Switch.
    - A flow switch (factory installed and wired) will prevent operation of the burner if the Boiler Pump does not run to provide flow to the boiler.
  - The BMS will enable the boilers to maintain the following HHW supply water temperature in the primary hot water loop:
    - OAT at 30 F; HHW Setpoint at 160 F
    - OAT at 60 F, HHW Setpoint at 110 F
    - HHW Setpoint limited to a maximum of 180 and a minimum of 140 F
    - All Setpoints field adjustable via BMS Graphics.
    - An unoccupied offset to lower the Heating Hot Water Setpoint if no zone is occupied.

- Once the boilers are enabled and given a HHW Setpoint, the boiler controls operate the boilers to provide the desired water temperature. Due to the efficiency curves, it will not be unusual to see both boilers running, as both boilers operating at 30% capacity is more efficient than one boiler at 60% capacity.

- Heating Hot Water primary Pumps (Pumps 1 and 2):
  - The Lead Primary Pump will be enabled when the hot water plant is enabled.
  - The Lead Pump is:
    - P1: If any Zone is occupied.
    - P2: If no Zones are occupied (runs at a lower speed)
  - The speed of the pumps via the VFD is modulated by the controls in the VFD, which will vary the speed based upon the amp draw and RPM of the pump.
  - Upon failure of the lead pump, as determined by HZ feedback of the VFD not matching speed command or measured differential pressure less than 5 psi, the lead pump will be disabled and the lag pump will be enabled.
  - The Pumps are monitored via a BACnet Connection.

Points:

- Pump VFDs:
  - Hardwired Control for:
    - Start/Stop
  - BACnet communications to VFD Drives for other data points
    - If VFDs have BACnet option.
- See Points list on Drawings for other points.

Alarms:

- Boiler 1: Alarm output from Boiler 1 controls (warning)
- Both Boiler in Alarm (Critical)
- Pump 1 Failure: Warning
- Pump 2 Failure: Warning
- Lead Pump Failure: Warning.
- Lag Pump Failure: Warning
- Both Lead and Lag Pump Fail: Critical.
- HHW Plant issue: OAT less than 50 F and HHW temperature less than 90 F.
- HHW Pump issue: OAT less than 50 F and Primary Loop Pressure less than 5 psi.
- HHW Plant Critical Issue: OAT less than 30 F and HHW Supply less than 130 F.

Baseboard Radiation (Classrooms and other Spaces)

General:

- Each section of Baseboard (typically a classroom) will be controlled by a Honeywell Spyder Series DDC Controller (one Spyder may control multiple zones) to maintain the space temperature in the room. Each room has a space sensor and control valve.

Control Mode: The unit will be indexed to Occupied Mode based upon the Floor/Building Schedule (see schedule section above).

- Setpoints: Each Unit will have the following setpoints (shown on the graphics pages and adjustable with the proper password level):

Sequence:

Unoccupied Heating (Default 65 F)
Occupied Heating (Default: 70 F)

Unoccupied Mode:

- If the space temperature drops below the Unoccupied Heating Setpoint the baseboard valve will modulate open to maintain the Unoccupied Heating Setpoint.

Occupied Mode (see above for Mode above occupied/unoccupied control):

- If the space temperature drops below the Occupied Heating Setpoint the baseboard valve will modulate open to maintain the Occupied Heating Setpoint.

Alarms: An alarm will be generated at the BMS front end for:

- Loss of communication
- Space Temperature Sensor Failure (warning)
- Invalid Setpoints (Heating higher than cooling for example) (warning).

BMS Monitoring: The BMS system will monitor the following

- Space Temperature: Monitor and trend

The BMS system will provide an alarm if the space temperature drops more than 5 F below the current setpoint for more than 30 minutes.

Redlink Programmable Thermostat Units: Two Gym AHUs, Locker Room AHU

General: Each unit will have a Redlink thermostat that controls the heating for that unit. The thermostat will operate in a standalone mode, but all setpoints and scheduled can be viewed and changed from the BMS System.

Control Mode: The unit will be indexed to Occupied Mode based upon the Floor/Building Schedule (see schedule section above).

Setpoints: Each Unit will have the following setpoints (shown on the graphics pages and adjustable with the proper password level):

Unoccupied Heating (Default 65 F)
Occupied Heating (Default: 70 F)
Occupied Cooling (Default 74 F)
Unoccupied Cooling (Default 90 F) Gym Only
Tenant Adjustment Limits (Default -2 F to 2 F)

Control Operation: At the current time, these units have the Hot Water Control Valves open 100% (pneumatic valves with no air). The unit is controlled in heating only via turning the Fan On (full heat) or Off (No Heat).

Unoccupied Mode:

- The Unit Fan will switched to Cycling Mode and will only be on if the space requires unoccupied heating or cooling.
- If the space temperature drops below the Unoccupied Heating Setpoint the Unit will be energized in the heating mode, until the space temperature rises above the unoccupied setpoint.
- If the space temperature rises above the Unoccupied Cooling Setpoint, unit will be energized in the cooling mode, until the space temperature falls below the Unoccupied Cooling Setpoint.

Occupied Mode (see above for Mode above occupied/unoccupied control):

- The unit will operate to maintain the space occupied heating and cooling setpoints.
- If the space temperature drops below the Occupied Heating Setpoint the Unit will be energized in the heating mode, until the space temperature rises above the Occupied setpoint. This will modulate the Hot Water Valve open to maintain the space temperature.

Alarms: An alarm will be generated at the BMS front end for:

- Loss of communication
- Space Temperature Sensor Failure (warning)

BMS Monitoring: The BMS system will monitor the following

- Supply Air Temperature: Monitor and trend only.
- Space Temperature: Monitor and trend
- Tenant Setpoint Adjustment: Monitor and Trend

Redlink Programmable Thermostat Units: Chapel, Entry Vestibule, and Cafe

General: There will be one Redlink thermostat each for the Chapel and Café, and entry vestibule. When the thermostat energizes the heat, it turns on the fans in the fan coil/convector units/Unit Ventilator in the space. The existing pneumatic control valves are currently 100% and will not be upgraded during this phase.

Control Mode: The unit will be indexed to Occupied Mode based upon the Floor/Building Schedule (see schedule section above).

Setpoints: Each Unit will have the following setpoints (shown on the graphics pages and adjustable with the proper password level):

Unoccupied Heating (Default 65 F)
Occupied Heating (Default: 70 F)
Tenant Adjustment Limits (Default -2 F to 2 F)

Unoccupied Mode:

- If the space temperature drops below the Unoccupied Heating Setpoint the Units will be energized until the space temperature rises above the unoccupied setpoint.

Occupied Mode (see above for Mode above occupied/unoccupied control):

- The unit will operate to maintain the space occupied heating setpoint.
- If the space temperature drops below the Occupied Heating Setpoint the Units will be energized until the space temperature rises above the Occupied setpoint.

Alarms: An alarm will be generated at the BMS front end for:

- Loss of communication
- Space Temperature Sensor Failure (warning)

BMS Monitoring: The BMS system will monitor the following

- Space Temperature: Monitor and trend
- Tenant Setpoint Adjustment: Monitor and Trend

Exhaust Fan Control:

The only fans that are controlled are the fans with existing control contacts in the boiler room.

The fans are broken up into 5 Zones (see control drawings).

Classroom Zones:

- The fans will run when:
  - The Classroom Scheduled is on AND
  - The Outside Air Temperature is above a low limit setpoint (50 F) AND
  - The Outside Temperature is below a high Limit Setpoint (78 F)
  - All setpoints are adjustable from the graphics.

- Non-Classroom Zones (Bathrooms, Locker rooms, etc.)
  - The General Exhaust Fan Scheduled is on:

Unit Heaters/Cabinet Unit Heaters/Convectors:

- No work.

Mini-Split Systems (Office, Library)

- Existing Units – No Work.

Variable Refrigerant Flow Systems (VRF)

Possible future option for office area.
No work currently.

General Alarm Monitoring

BMS Alarm Monitoring: The BMS system will monitor the following data points and take the defined actions:

- Water on Floor in Boiler room (under control panel)

---- END ----

VALVE SCHEDULE

Control Wizards, Inc
89 Taylor Avenue
Norwalk, CT 06854
203-274-5284

PROJECT: Immaculate HS, Danbury, CT
ENGINEER:
DATE : Rev 2, August 18,2016 (add Gen Office 2, Split Lounges)
REVISIONS: As Built 5-2017

DUTY	QTY	GPM	BTUH	TYPE	Valve Size	Design Delta-P (psi)	Desig n CV	Actual CV	Actual Delta P (psi)	Max Closeoff (psi)	FAIL-SAFE	VALVE MODEL	ACTUATOR MODEL	Count	Rev & Note
Rm 104-BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	1	1
Rm 103-BB	1	4.6	41,630	2-Way - Modulating	3/4"	2.0	3.27	4.7	1.0	200	Open	B217B	TFRB24-SR	2	1
RM 102-BB	1	5.6	50,500	2-Way - Modulating	3/4"	2.0	3.97	4.7	1.4	200	Open	B217B	TFRB24-SR	3	1
RM-101 BB	1	4.6	41,630	2-Way - Modulating	3/4"	2.0	3.27	4.7	1.0	200	Open	B217B	TFRB24-SR	4	1
Rm 105 BB	1	5.0	45,250	2-Way - Modulating	3/4"	2.0	3.56	4.7	1.1	200	Open	B217B	TFRB24-SR	5	1
Rm 106 - BB	1	4.6	41,630	2-Way - Modulating	3/4"	2.0	3.27	4.7	1.0	200	Open	B217B	TFRB24-SR	6	1
Rm 213 BB	1	5.4	48,300	2-Way - Modulating	3/4"	2.0	3.79	4.7	1.3	200	Open	B217B	TFRB24-SR	7	1
Rm 212 BB	1	5.4	48,300	2-Way - Modulating	3/4"	2.0	3.79	4.7	1.3	200	Open	B217B	TFRB24-SR	8	1
Rm 211 BB	1	4.2	38,010	2-Way - Modulating	3/4"	2.0	2.99	4.7	0.8	200	Open	B217B	TFRB24-SR	9	1
Rm 210 BB	1	5.4	48,300	2-Way - Modulating	3/4"	2.0	3.79	4.7	1.3	200	Open	B217B	TFRB24-SR	10	1
Rm 208 BB	1	4.4	39,820	2-Way - Modulating	3/4"	2.0	3.13	4.7	0.9	200	Open	B217B	TFRB24-SR	11	1
Rm 207 BB	1	6.1	55,200	2-Way - Modulating	3/4"	2.0	4.34	4.7	1.7	200	Open	B217B	TFRB24-SR	12	1
Rm 209 BB	1	6.1	55,200	2-Way - Modulating	3/4"	2.0	4.34	4.7	1.7	200	Open	B217B	TFRB24-SR	13	1

DUTY	QTY	GPM	BTUH	TYPE	Valve Size	Design Delta-P (psi)	Design CV	Actual CV	Actual Delta P (psi)	Max Closeoff (psi)	FAIL-SAFE	VALVE MODEL	ACTUATOR MODEL	Count	Rev & Note
Library BB	1	11.8	105,800	2-Way - Modulating	3/4"	2.0	8.31	10.0	1.4	200	Open	B219B	TFRB24-SR	14	1
Rm 202 BB	1	4.2	38,101	2-Way - Modulating	3/4"	2.0	2.99	4.7	0.8	200	Open	B217B	TFRB24-SR	15	1
Rm 204 BB	1	4.2	38,010	2-Way - Modulating	3/4"	2.0	2.99	4.7	0.8	200	Open	B217B	TFRB24-SR	16	1
Rm 206 BB	1	4.4	39,820	2-Way - Modulating	3/4"	2.0	3.13	4.7	0.9	200	Open	B217B	TFRB24-SR	17	1
Rm 205 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	18	1
Rm 203 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	19	1
Rm 317 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	20	1
Rm 318 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	21	1
Rm 319 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	22	1
Rm 316 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	23	1
Rm 314 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	24	1
Rm 312 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	25	1
Rm 315 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	26	1
Rm 313 BB	1	6.4	57,500	2-Way - Modulating	3/4"	2.0	4.52	4.7	1.8	200	Open	B217B	TFRB24-SR	27	1
Rm 311 BB	1	5.9	52,900	2-Way - Modulating	3/4"	2.0	4.16	4.7	1.6	200	Open	B217B	TFRB24-SR	28	1
Rm 307 BB	1	7.9	71,300	2-Way - Modulating	3/4"	2.0	5.60	7.4	1.1	200	Open	B218B	TFRB24-SR	29	1
Rm 305 BB	1	7.9	71,300	2-Way - Modulating	3/4"	2.0	5.60	7.4	1.1	200	Open	B218B	TFRB24-SR	30	1

DUTY	QTY	GPM	BTUH	TYPE	Valve Size	Design Delta-P (psi)	Design CV	Actual CV	Actual Delta P (psi)	Max Closeoff (psi)	FAIL-SAFE	VALVE MODEL	ACTUATOR MODEL	Count	Rev & Note
Rm 302 BB	1	6.1	55,200	2-Way - Modulating	3/4"	2.0	4.34	7.4	0.7	200	Open	B218B	TFRB24-SR	31	1
Rm 301 BB	1	5.4	48,300	2-Way - Modulating	3/4"	2.0	3.79	4.7	1.3	200	Open	B217B	TFRB24-SR	32	1
Rm 303 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	33	1
Rm 304 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	34	1
Rm 306 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	35	1
Rm 308 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	36	1
Rm 310 BB	1	5.6	50,600	2-Way - Modulating	3/4"	2.0	3.98	4.7	1.4	200	Open	B217B	TFRB24-SR	37	1
Chem Lab	1	8.2	73,600	2-Way - Modulating	3/4"	2.0	5.78	7.4	1.2	200	Open	B218B	TFRB24-SR	38	1
Priest Sacristy	1	2.4	21,720	2-Way - Modulating	1/2"	2.0	1.71	1.9	1.6	200	Open	B211B	TFRB24-SR	39	1
Principle 132	1	3.8	34,390	2-Way - Modulating	1/2"	2.0	2.70	3.0	1.6	200	Open	B212B	TFRB24-SR	40	1
Conf Rm 134	1	3.8	34,390	2-Way - Modulating	1/2"	2.0	2.70	3.0	1.6	200	Open	B212B	TFRB24-SR	41	1
General Office 131	1	5.1	46,000	2-Way - Modulating	3/4"	2.0	3.61	4.7	1.2	200	Open	B217B	TFRB24-SR	42	1
General Office B	1	5.1	46,000	2-Way - Modulating	3/4"	2.0	3.61	4.7	1.2	200	Open	B217B	TFRB24-SR	43	2, A
Nuns Lounge 103	1	1.4	12,670	2-Way - Modulating	1/2"	2.0	1.00	1.2	1.4	200	Open	B210B	TFRB24-SR	44a	2, C
Priest Lounge 102	1	1.6	14,480	2-Way - Modulating	1/2"	2.0	1.14	1.2	1.8	200	Open	B211B	TFRB24-SR	44b	2, C
Women Lounge 106	1	1.4	12,670	2-Way - Modulating	1/2"	2.0	1.00	1.9	0.5	200	Open	B210B	TFRB24-SR	45a	2, C

DUTY	QTY	GPM	BTUH	TYPE	Valve Size	Design Delta-P (psi)	Desig n CV	Actual CV	Actual Delta P (psi)	Max Closeoff (psi)	FAIL-SAFE	VALVE MODEL	ACTUATOR MODEL	Count	Rev & Note
Boys Exam 101	1	1.2	10,860	2-Way - Modulating	1/2"	2.0	0.85	1.2	1.0	200	Open	B210B	TFRB24-SR	45b	2, C
Girls Exam	1	1.2	10,860	2-Way - Modulating	1/2"	2.0	0.85	1.2	1.0	200	Open	B210B	TFRB24-SR	45c	2, C
~~Nun Priest Lounge~~	~~1~~	~~3.0~~	~~27,150~~	~~2-Way - Modulating~~	~~1/2"~~	~~2.0~~	~~2.13~~	~~3.0~~	~~1.0~~	~~200~~	~~Open~~	~~B212B~~	~~TFRB24-SR~~	n/a	2, B
~~Women, Boy&Girls Exam~~	~~1~~	~~3.8~~	~~34,390~~	~~2-Way - Modulating~~	~~1/2"~~	~~2.0~~	~~2.70~~	~~3.0~~	~~1.6~~	~~200~~	~~Open~~	~~B212B~~	~~TFRB24-SR~~	n/a	2 ,B

Flow Rate: Based upon BTUH with Temperature drop (per Base Bldg Dwgs) of: 9-18-1962 20.0
BTUH=500*GPM*Delta-T GPM=BTU/500/15

NOTES:
A: Not Sized on Blueprints - Used Size of General Office 131
B: Rev 2: Delete Combination valve for multiple offices (change to one valve per room, see Note C).
C Rev 2: Add one valve per room - replace Combination Valve
Nuns and Priest Lounges controlled in parallel (one Zone)
Women's Lounge, Boy's Exam, and Girls Exam Controlled in Parallel (one Zone)

BELIMO

B2 Series, 2-Way, Characterized Control Valve
Stainless Steel Ball and Stem

5 YEAR WARRANTY

Application

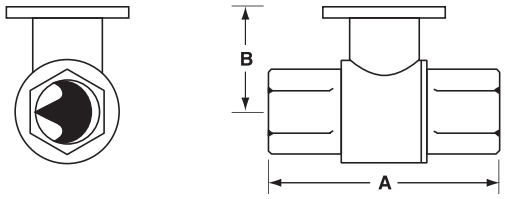
This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Technical Data

Service	chilled or hot water, 60% glycol
Flow characteristic	A-port equal percentage
Controllable Flow Range	75°
Sizes	½", ¾", 1", 1¼", 1½", 2", 2½", 3"
Type of end fitting	NPT female ends
Materials:	
Body	forged brass, nickel plated
Ball	stainless steel
Stem	stainless steel
Seats	PTFE
Characterizing disc	Tefzel®
Packing	2 EPDM O-rings, lubricated
Body pressure rating	
600 psi	½" - 1¼" (B230)
400 psi	1¼" (B231) - 3"
Media temp. range	0°F to 250°F [-18°C to 120°C]
Close off pressure	
200 psi	½" - 2" (B250)
100 psi	2" (B251) - 3"
Maximum differential pressure (ΔP)	50 psi for typical applications
Leakage	0% for A to AB
External leakage	according to EN 12266-1:2003
C_V rating	A-port: see product chart for values

Tefzel® is a registered trademark of DuPont

Dimensions



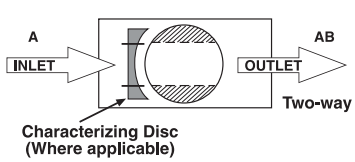
2WayValve-B207-B220

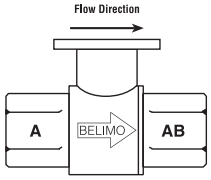
	Valve Nominal Size		Dimensions (Inches [mm])	
Valve Body	Inches	DN [mm]	A	B
B207-B211	½"	15	2.41" [61.1]	1.39" [35.2]
B212-B216	½"	15	2.38" [60.4]	1.78" [45.2]
B217-B221	¾"	20	2.73" [69.3]	1.87" [47.4]
B222-B225	1"	25	3.09" [78.4]	1.87" [47.4]
B229-B230	1¼"	32	3.72" [94.6]	1.87" [47.4]
B231-B232	1¼"	32	3.72" [94.6]	2.04" [51.9]
B238-B240	1½"	40	3.88" [98.5]	2.04" [51.9]
B248-B250	2"	50	4.21" [107.0]	2.27" [57.7]
B251-B254	2"	50	4.93" [125.2]	2.73" [69.5]
B261-B265	2½"	65	5.55" [140.9]	2.73" [69.5]
B277-B280	3"	80	5.82" [147.9]	2.73" [69.5]

	Valve Nominal Size		Type	Suitable Actuators				
				Non-Spring			Spring	
C_V	Inches	DN [mm]	2-Way NPT	TR Series	LR Series	NR...N4 Series	TF Series	LF Series
0.3	½	15	B207					
0.46	½	15	B208					
0.8	½	15	B209					
1.2	½	15	B210					
1.9	½	15	B211					
3	½	15	B212					
4.7	½	15	B213					
7.4	½	15	B214					
10	½	15	B215					
16	½	15	B216					
4.7	¾	20	B217					
7.4	¾	20	B218					
10	¾	20	B219					
14	¾	20	B220					
24	¾	20	B221*					
7.4	1	25	B222					
10	1	25	B223					
19	1	25	B224					
30	1	25	B225*					
10	1¼	32	B229					
19	1¼	32	B230*					
25	1¼	32	B231					
37	1¼	32	B232*					
19	1½	40	B238					
29	1½	40	B239					
37	1½	40	B240*					
29	2	50	B248					
46	2	50	B249					
57	2	50	B250*					
65	2	50	B251					
85	2	50	B252					
120	2	50	B253					
240	2	50	B254*					
60	2½	65	B261					
75	2½	65	B262					
110	2½	65	B263					
150	2½	65	B264					
210	2½	65	B265*					
70	3	80	B277					
130	3	80	B278					
170	3	80	B280*					

*Models without characterizing disc

Flow Patterns





TFRB(X)24-SR Actuators, Proportional

Models

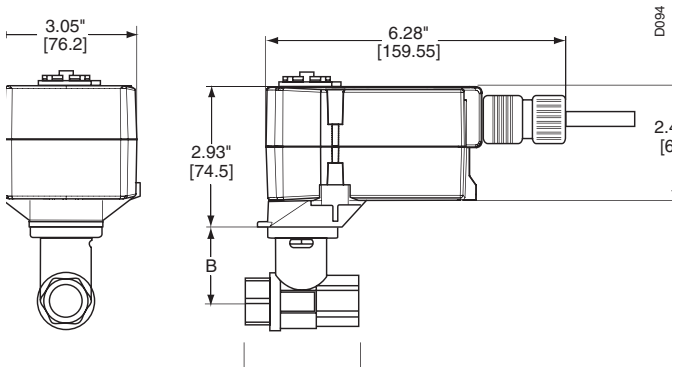
TFRB(X)24-SR
TFRB(X)24-SR-S w/built-in Aux. Switch

Technical Data	
Control	proportional
Power supply	24 VAC ± 20%, 50/60 Hz 24 VDC ± 10%
Power consumption running	2.5 W
holding	1.0 W
Transformer sizing	4 VA (class 2 power source)
Electrical connection (-S models have 2 cables) TFRB(X)24-SR...	½" conduit connector 18 GA plenum rated cable 3 ft [1m] 10 ft [3m] 16 ft [5m]
Electrical protection	actuators are double insulated
Overload protection	electronic throughout 0° to 95° rotation
Operating range Y	2 to 10 VDC, 4 to 20 mA
Input impedance	100k Ω (0.1mA), 500 Ω
Angle of rotation	95°
Direction of rotation spring	reversible with CW/CCW mounting
motor	reversible with built-in ↷/↶ switch
Position indication	visual indicator, 0° to 95°
Running time motor	95 sec constant, independent of load
spring	<25 sec @-4°F to 122°F [-20°C to 50°C] <60 sec @-22°F [-30°C]
Humidity	5 to 95% RH non-condensing
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA type 2/IP42
Housing material	UL94 - 5VA
Agency listings†	cULus according to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE according to 2004/108/EC and 2006/95/EC for line voltage and/or –S versions
Noise level (max) running	<35 db (A)
spring return	<62 dB (A)
Quality standard	ISO 9001

TFRB(X)24-SR-S	
Auxiliary switch	1 x SPDT, 3A (0.5A) @ 250 VAC, UL Listed, adjustable 0° to 95°

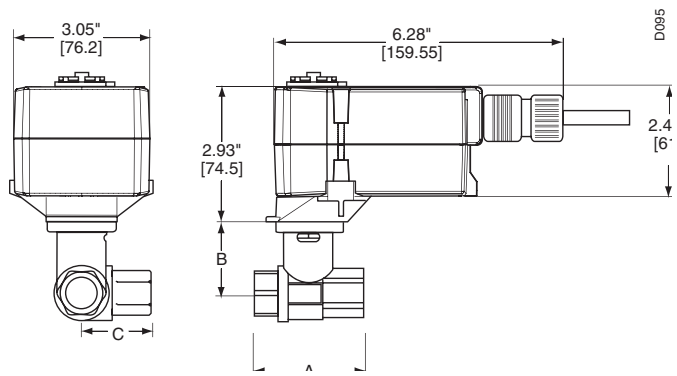
† Rated impulse voltage 800V (4kV for 120V model), Control pollution degree 3, Type of action 1.AA (1.AA.B for -S models)

Dimensions with 2-Way Valve



	Valve Nominal Size		Dimensions (Inches [mm])	
Valve Body	Inches	DN [mm]	A	B
B207(B)-B211(B)	½"	15	2.41" [61.1]	1.39" [35.2]
B212(B)-B215(B)	½"	15	2.38" [60.4]	1.78" [45.2]
B217(B)-B221(B)	¾"	20	2.73" [69.3]	1.87" [47.4]

Dimensions with 3-Way Valve



	Valve Nominal Size		Dimensions (Inches [mm])		
Valve Body	Inches	DN [mm]	A	B	C
B307(B)-B311(B)	½"	15	2.41" [61.1]	1.39" [35.2]	1.20" [30.6]
B312(B)-B315(B)	½"	15	2.38" [60.4]	1.78" [45.2]	1.29" [32.8]
B317(B)-B321(B)	¾"	20	2.73" [69.3]	1.87" [47.4]	1.47" [37.3]

Wiring Diagrams

INSTALLATION NOTES

△2 ***CAUTION** Equipment damage!*
Actuators may be connected in parallel.
Power consumption and input impedance must be observed.

△4 Up to 4 actuators may be connected in parallel. With 4 actuators wired to one 500 Ω resistor, a +2% shift of control signal may be required.
Power consumption must be observed.

△3 Actuators may also be powered by 24 VDC.

△5 Only connect common to neg. (—) leg of control circuits.

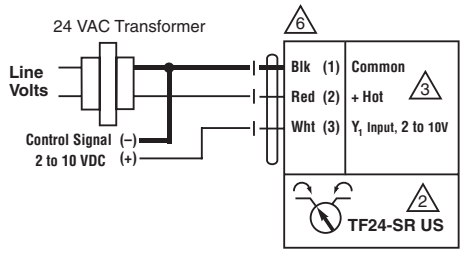
△6 Actuators with plenum rated cable do not have numbers on wires; use color codes instead.

△7 For end position indication, interlock control, fan startup, etc., TF24-SR-S US incorporates one built-in auxiliary switch: 1 x SPDT, 3A (0.5A) @250 VAC, UL listed, adjustable 0° to 95°.

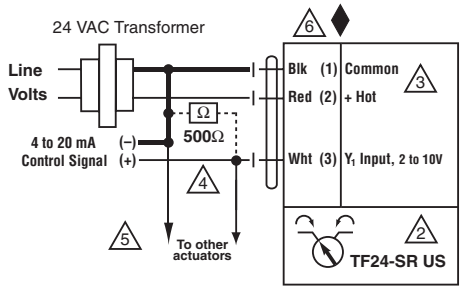
APPLICATION NOTES

♦ Meets cULus or UL and CSA requirements without the need of an electrical ground connection.

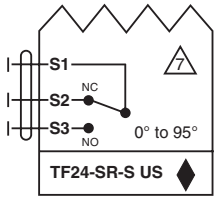
***WARNING** Live Electrical Components!*
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



2 to 10 VDC control



4 to 20 mA control



Auxiliary switch

Control Wizards, Inc.
89 Taylor Avenue • Norwalk, CT 06854
Ph. 203.274.5284

Automatic Temperature Controls
Damper/Damper Actuator Data

Immaculate High School
73 Southern Blvd, Danbury, CT 06810

There are no Control Dampers/Damper Actuators on this Project.

Submittal Date: 25-2017

---- END ----

Control Wizards, Inc.
89 Taylor Avenue • Norwalk, CT 06854
Ph. 203.274.5284

N: Network Products
D: DDC Controller Products
S: Sensor Products
A: Accessory Products

SCHEDULE OF CONTROL PRODUCTS BEING PROVIDED

PROJECT: Immaculate High School
ENGINEER: Eastern Mechanical Services
DATE SUBMITTED: 5-2017
REVISIONS: As-Built

Control Wizards, Inc
89 Taylor Avenue
Norwalk, CT 06854
203-274-5284

FILE REF	ITEM/TAG	MANUFACTURER	MODEL NUMBER	DESCRIPTION	Notes	WHERE USED
N-1	WEBS 600	Honeywell	WEB-600-O	DDC Controller		Boiler Room/Webserver
N-2	N300	NetGear	Internet Router	IP Router		Internet Router
N-3	BasRouter	Contemp Controls	BASRouter	BACnet IP/MSTP Router		BACnet IP/MSTP Router
N-4	IO-34	Honeywell	IO-34-H	Input Output Module		Boiler Room
N-5	Redlink Card	Honeywell	RedLink-2-Driver	WEBs-Redlink Interface		Boiler Room (inside WEB 600)
N-6	Antenna	Honeywell	THM4000R01	Redlink Antenna		Outside Gym
D-1	Spyder	Honeywell	PUB6438S, PUB4024S	DDC Controller		Programmable BACnet Controller
D-2	SIO	Honeywell	SIO-6042	DDC Controller		Spyder Slyk Expansion Module
D-3	Redlink Tstat	Honeywell	TR8110R	Redlink Thermostat		Ducted Units-See Prints
S-1	CT-S	Functional Devices	RIBXGF	Current Sensor Switch		Misc
S-2	Duct-T	Honeywell	C7041B	Duct Sensors (Spot)		Misc
S-3	TR-21	Honeywell	TR-21	Wall Sensor		Sensor only: Space Temp Monitor
A-1	Panel	Kele	RET Series	Control Panel		Boiler Room
A-2	RIB	Functional Devices	RIB-U1C	Control Relay		Misc
A-3	Relay	Idec	RH2B-UL-VV	Plug in Panel Mount Relay		VV=Voltage, SH2B-05 Socket

NOTE: For valves and valve actuators, see Valve Section
For Dampers and Damper Actuators, see Damper section of submittal

KELE NEMA 1 ENCLOSURES
RET SERIES

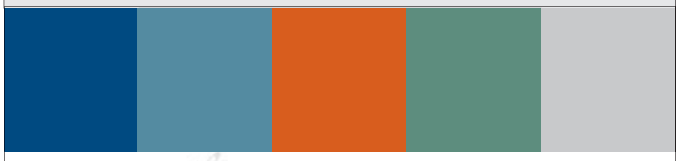
DESCRIPTION

The **RET Series** includes attractive, economical NEMA 1 enclosures designed to house controls and instruments in areas which do not require oil-tight and dust-tight ratings. The **RET Series** enclosures are furnished with a perforated metal subpanel for easy mounting of components. No drilling or layout is needed. Simply set the control components on the panel and attach with #7 or #8 self-tapping screws in the prepunched holes. The **RET Series** is also available in a UL listed version.

FEATURES

- ***Low-cost NEMA 1 enclosure***
- ***Mounted with door hinged on left or right side***
- ***Removable door***
- ***Attractive powder-coated finish, standard brown enclosure with tan door***
- ***Optional colors available***
- ***Key lock, two keys, and attractive gray powder-coated perf panel furnished***
- ***Mounting of control components simplified with perf panel***
- ***Optional UL-listed enclosures available***
- ***UL listed, File #E155405, for RET UL-listed panels***

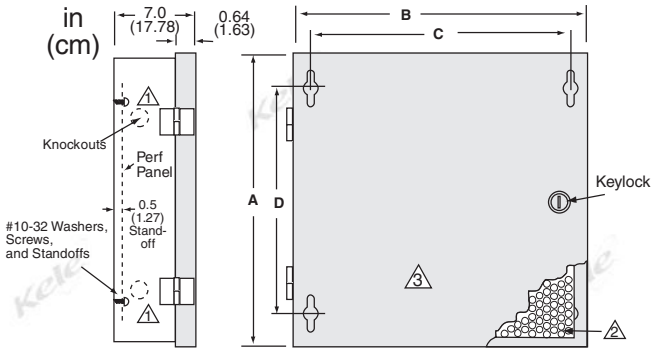
RET OPTIONAL COLOR CHART



Dark Blue | Powder Blue | Orange | Green | Gray

Optional colors shown in approximate hue

DIMENSIONS



1. Knockouts are for 3/4" conduit, two knockouts on both sides, three knockouts top and bottom (except two on RET 1812).
2. Perf Panel is 16-ga powder-coated steel.
3. Standard color is brown enclosure with tan door.

ORDERING INFORMATION

ENCLOSURE MODEL	DIMENSIONS in (cm) A	B	C	D	ENCLOSURE MATERIAL	PERF PANEL	WEIGHT lb (kg)	PERF PANEL H x W in (cm)
RET2620†	26 (66)	20 (51)	18.75 (47)	17.75 (51)	16-ga steel	Included	36 (16.4)	23.5 x 17.5 (60 x 44)
RET3826†	38 (97)	26 (66)	24.75 (62)	29.75 (81)	16-ga steel	Included	61 (27.8)	35.5 x 23.5 (90 x 60)
RET4230†	42 (107)	30 (76)	28.75 (66)	33.75 (97)	14-ga steel	Included	83 (37.8)	39.5 x 27.5 (100 x 70)
RET1812ULP†	18 (46)	12 (31)	10.75 (28)	9.75 (36)	16-ga steel	Included	16 (7.3)	15.5 x 9.0 (39 x 23)
RET2018ULP†	20 (51)	18 (46)	16.75 (42)	11.75 (36)	16-ga steel	Included	27 (12.3)	17.5 x 15.5 (44 x 39)
RET2620ULP†	26 (66)	20 (51)	18.75 (47)	17.75 (51)	14-ga steel	Included	41 (18.6)	23.5 x 17.5 (60 x 44)
RET3626ULP†	36 (91)	26 (66)	24.75 (62)	27.75 (76)	14-ga steel	Included	69 (31.3)	33.5 x 23.5 (85 x 60)

† **-DB**: Dark Blue, **-PB**: Powder Blue, **-OR**: Orange, **-GN**: Green, **-GY**: Gray (Note: No suffix - Brown/Tan)

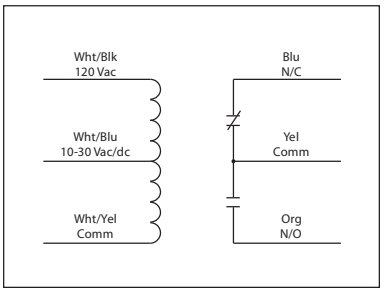
ACCESSORIES

RET-KEY	Replacement Key for Ret-Lock
RET-LOCK	Lock with key for RET enclosure

Functional Devices, Inc. • p: 800.888.5538 • f: 765.883.7505 • www.functionaldevices.com • sales@functionaldevices.com

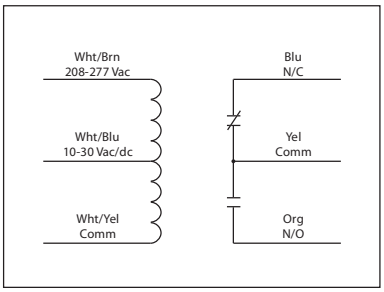
RIBU1C

Enclosed Relay 10 Amp SPDT with
10-30 Vac/dc/120 Vac Coil



RIBH1C

Enclosed Relay 10 Amp SPDT with
10-30 Vac/dc/208-277 Vac Coil



10 Amp Pilot Control Relays

RIBU1C-RD
RIBH1C-RD
• Red housing

RIBU1C-N4
RIBH1C-N4
• NEMA 4X housing, UL508 only

c UL us LISTED

Made in USA
Meets
"Buy American"
of ARRA 2009

Specifications

 # Relays & Contact Type: One (1) SPDT Continuous Duty Coil
Expected Relay Life: 10 million cycles minimum mechanical
Operating Temperature: -30 to 140° F
Humidity Range: 5 to 95% (noncondensing)
Operate Time: 20mS
Relay Status: LED On = Activated
Dimensions: 1.70˝ x 2.80˝ x 1.50˝ with .50˝ NPT nipple
Wires: 16˝, 600V Rated
Approvals: UL Listed, UL916, UL864, C-UL
California State Fire Marshal, CE, RoHS
Housing Rating: UL Accepted for Use in Plenum, NEMA 1
Gold Flash: Yes
Override Switch: No

Contact Ratings:
10 Amp Resistive @ 277 Vac
10 Amp Resistive @ 28 Vdc
480 VA Pilot Duty @ 240-277 Vac
480 VA Ballast @ 277 Vac
600 Watt Tungsten @ 120 Vac N/O
240 Watt Tungsten @ 120 Vac N/C
1/3 HP for N/O @ 120-240 Vac
1/6 HP for N/C @ 120-240 Vac
1/4 HP for N/O @ 277 Vac
1/8 HP for N/C @ 277 Vac

Coil Current:

33 mA @ 10 Vac	13 mA @ 10 Vdc
35 mA @ 12 Vac	15 mA @ 12 Vdc
46 mA @ 24 Vac	18 mA @ 24 Vdc
55 mA @ 30 Vac	20 mA @ 30 Vdc

28 mA @ 120 Vac (RIBU1C)
39 mA @ 208-277 Vac (RIBH1C)

Coil Voltage Input:
10-30 Vac/dc ; 120 Vac ; 50-60 Hz (RIBU1C)
10-30 Vac/dc ; 208-277 Vac ; 50-60 Hz (RIBH1C)
Drop Out = 2.1 Vac / 2.8 Vdc
Pull In = 9 Vac / 10 Vdc

RELAYS & CONTACTORS

IDEC GENERAL-PURPOSE RELAYS
RH, RJ, RR SERIES

DESCRIPTION

IDEC general-purpose relays are available in the **RH Series** blade-style relays and the **RR Series** pin-style relays and the **RJ Series** compact relays.

The **RH Series** features a 10A switching capacity. They are available in SPDT, DPDT, 3PDT, and 4PDT contact configurations, driven by AC or DC coils, and they have blade terminals for socket mounting.

The **RR Series** has a 10A contact rating. The **RR Series** relays are available in SPDT, DPDT, and 3PDT configurations driven by AC or DC coils, and they have pin or blade terminals for socket mounting.

The **RJ Series** is compact to reduce space requirements. They are available in a 12A SPDT version and an 8A DPDT version. They are driven by AC or DC coils and have blade terminals for socket mounting.

RJ Series RH Series RR Series

FEATURES

- ***Blade style, pin style, and compact models***
- ***Indicator light and/or check button available***
- ***Surface or DIN rail mount***
- ***UL recognized, CSA certified***

SPECIFICATIONS

COIL RATINGS

RH SERIES

RATED VOLTAGE		RATED CURRENT (mA) ±15% @ 20°C 60 Hz SPDT	DPDT	3PDT	4PDT	50 Hz SPDT	DPDT	3PDT	4PDT	COIL RESISTANCE (Ω) ±10% @ 20°C SPDT	DPDT	3PDT	4PDT
AC	12	75	100	140	165	86	121	165	196	165	39.3	25.3	21.2
	24	37	50	70	83	42	60.5	81	98	83	153	103	84.5
	120	7.5	–	14.2	16.5	8.6	–	16.4	19.5	16.5	–	10,800	7,360
	240	4.3	–	7.1	8.3	4.9	–	8.2	9.8	8.3	–	12,100	9,120
		SPDT		DPDT		3PDT		4PDT		SPDT	DPDT	3PDT	4PDT
DC	12	64		75		120		125		188	160	100	96
	24	32		36.9		60		62		750	650	400	388

RR Series

RATED VOLTAGE		Rated Current (mA) ±15% @ 20°C 60 Hz	50 Hz	COIL RESISTANCE (Ω) ±10% @ 20°C
AC	12	210	245	365
	24	105	121	182
	120	20.5	24	35
	240	10.5	12.1	18
DC	12	120		–
	24	60		–

RJ Series

	MODELS		Rated Current (mA) ±15% @ 20°C WITHOUT LED[1] 60 Hz	50 Hz	WITH LED[1] 60 Hz	50 Hz	COIL RESISTANCE (Ω) ±10% @ 20°C
AC	BLADE & PCB	24V	37.5	43.9	41.1	47.5	243
		120V	7.5	8.8	7.4	8.7	6,400
DC	BLADE	24V	22.1		25.7		1,080
	PCB	24V	22.1		–		1,080

1. LED indicator is only available on Blade relays.

Maximum continuous applied voltage
- RH, RR: 110% of rated voltage
- RJ: 140% of rated voltage

Pull-in voltage
- RH, RR, RJ/AC: 80% of rated voltage
- RJ, RJ/DC: 70% of rated voltage

Drop-out voltage
- AC: 30% or more of rated voltage
- DC: 10% or more of rated voltage

Contact material
- RH: Silver cadmium oxide
- RR: Silver
- RJ: Silver nickel alloy

CONTACT RATINGS

RH SERIES (UL ratings)

VOLTAGE	RESISTIVE RH1 RH2	RH3	RH4	GENERAL USE RH1 RH2	RH3	RH4	HORSEPOWER RATING RH1 RH2	RH3	RH4
240V AC	10A	7.5A	7.5A	7A	6.5A	5A	1/3 hp	1/3 hp	–
120V AC	–	10A	10A	–	7.5A	7.5A	1/6 hp	1/6 hp	–
30V DC	10A	10A	–	7A	–	–	–	–	–
28V DC	–	–	10A	–	–	–	–	–	–

RR SERIES (UL ratings)

VOLTAGE	RESITIVE (A)	INDUCTIVE (A) cosΘ= 0.3	MOTOR LOAD (hp)
240 AC	10	7	1/3
120 AC	10	7.5	1/4
30 DC	10	7	–

RJ Series (UL ratings)

	CONTACT	RJ1S	RJ2S
Resistive Load (Maximum)	N.O.	12A @ 250 VAC/30 VDC	8A @ 250 VAC/30 VDC
	N.C.	12A @ 250 VAC; 6A @ 30 VDC	8A @ 250 VAC; 4A @ 30 VDC
Inductive Load (Maximum)	N.O.	7.5A @ 250 VAC; 6A @ 30 VDC	4A @ 250 VAC; 4A @ 30 VDC
	N.C.	7.5A @ 250 VAC; 3A @ 30 VDC	4A @ 250 VAC; 2A @ 30 VDC

Contact resistance
- RH: 50 mΩ maximum
- RR: 30 mΩ maximum
- RJ: 50 mΩ maximum

Operate time
- RH, RR: 25 ms maximum
- RJ: 15 ms maximum

Release time
- RH, RR: 25 ms maximum
- RJ: 10 ms maximum

Min load
- RH: 24 VDC/30 mA, 5 VDC/100 mA
- RR: 24 VDC/10 mA, 5 VDC/20 mA
- RJ: 5 VDC/100 mA

Operating temp: -22° to 158°F (-30° to 70°C)

Agency approvals: UL-recognized component, **(RH, RR):** File #E66043, **(RJ):** File #E55996, CSA certified, File #LR35144; CE certified (not RR blade style)

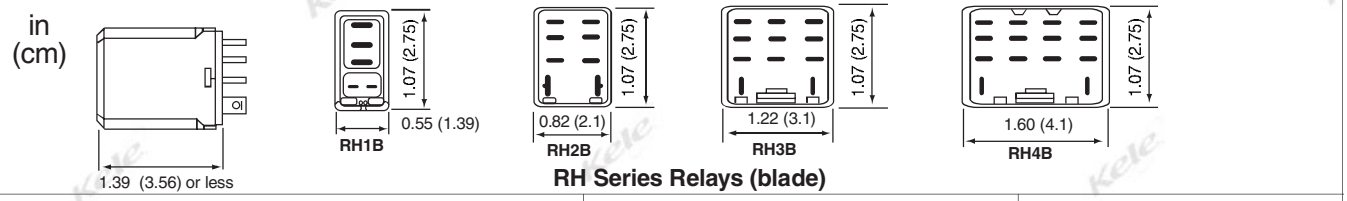
Warranty: 1 year

RELAYS & CONTACTORS

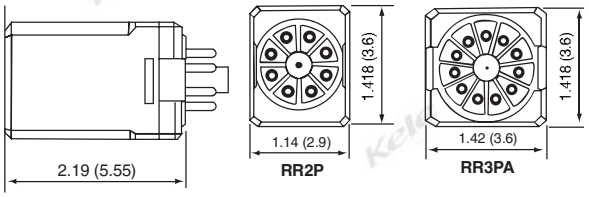
IDEC GENERAL-PURPOSE RELAYS

RH, RJ, RR SERIES

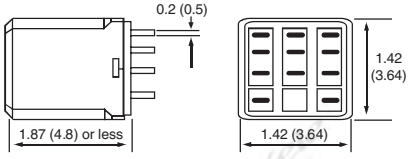
DIMENSIONS



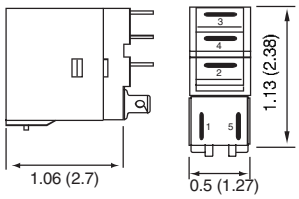
RH Series Relays (blade)



RR Series Relays (pin)

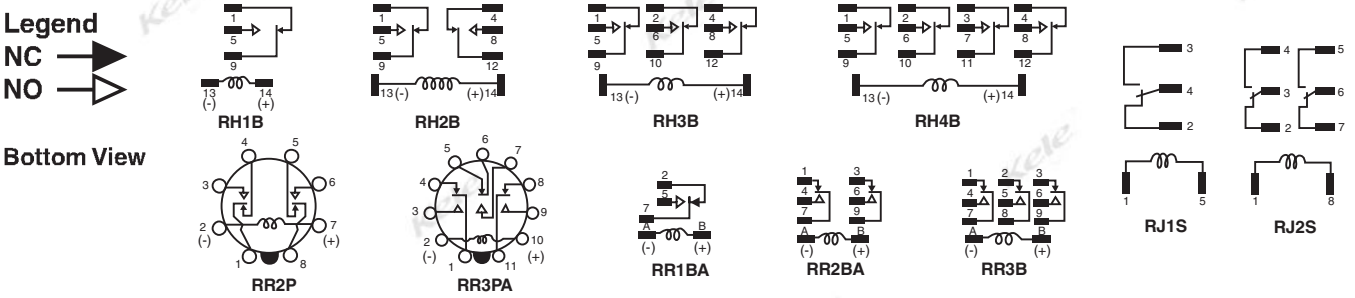


RR Series Power Relays (blade)



RJ Series Relays (blade)

WIRING



ORDERING INFORMATION

MODEL	DESCRIPTION
RH1B	Relay, SPDT, blade (use SH1B-05 socket)
RH2B	Relay, DPDT, blade (use SH2B-05 socket)
RH3B	Relay, 3PDT, blade (use SH3B-05 socket)
RH4B	Relay, 4PDT, blade (use SH4B-05 socket)

U	Standard relay
UL	Indicator light
ULC	Indicator light and check button

AC12V	12 VAC coil voltage
AC24V	24 VAC coil voltage
AC120V	120 VAC coil voltage
AC240V	240 VAC coil voltage
DC12V	12 VDC coil voltage
DC24V	24 VDC coil voltage

RH1B	U	AC24V

MODEL	DESCRIPTION
RR2P	Relay, DPDT, 8 pin (use SR2P-05 or SR2P-06)
RR3PA	Relay, 3PDT, 11 pin (use SR3P-06 socket)
RR1BA	Relay, SPDT, 11 blade (use SR3B-05 socket)
RR2BA	Relay, DPDT, 11 blade (use SR3B-05 socket)
RR3B	Relay, 3PDT, 11 blade (use SR3B-05 socket)

U	Standard relay
UL	Indicator light
ULC	Indicator light and check button

AC12V	12 VAC coil voltage
AC24V	24 VAC coil voltage
AC120V	120 VAC coil voltage
AC240V	240 VAC coil voltage
DC12V	12 VDC coil voltage
DC24V	24 VDC coil voltage

RR2P	U	AC24V

Example: **RR2PUAC24V** DPDT relay 8 pin with 24VAC coil

MODEL	DESCRIPTION
RJ1S	Relay, SPDT (use SJ1S-05B socket)
RJ2S	Relay, DPDT (use SJ2S-05B socket)

C	No options
CL	LED indicator

A24	24 VAC coil voltage
A120	120 VAC coil voltage
D24	24 VDC coil voltage

RJ1S	C	A24

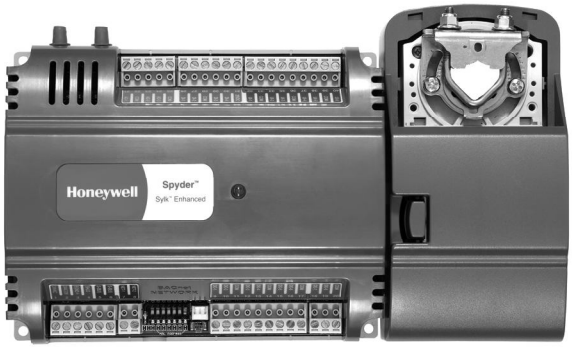
RELATED PRODUCTS

		PAGE
DIN-3F	35 mm DIN rail, steel, 39.4" (1m), RoHS compliant	860
DIN-3F, BAM-1000	DIN rail	860
SH, SR, SJ Series	Relay sockets	1123

Honeywell

Spyder® BACnet® Programmable Controllers

PRODUCT DATA



PRODUCT DESCRIPTION

The PUB and PVB controllers are part of the Spyder family. These controllers are BACnet MS/TP network devices designed to control HVAC equipment. These controllers provide many options and advanced system features that allow state-of-the-art commercial building control. Each controller is programmable and configurable through software.

The Spyder BACnet controllers require the Spyder BACnet Programmable Feature to be licensed in the WEBpro workbench tool and the WEBS AX JACE Controller for programming and downloading. The Spyder BACnet Models are also available as Individually Licensed Controllers (ILC). The ILC versions are identical in design and capability in every detail except for the licensing. The Individual Licensing of the Spyder ILCs (the License is built in) allows them to be programmed and downloaded with any brand of the Niagara Workbench or JACE controller. The Spyder ILCs are identified with a suffix on the Part Number of -ILC. Example: PUB6438S-ILC follows all the same Installation Instructions information as the PUB6438S.

These controllers are for use in VAV (Variable Air Volume), Unitary and advanced HVAC control applications. Each controller has flexible, universal inputs for external sensors, digital inputs, and a combination of analog and digital Triac outputs. All the models are described in Table 1. The photo to the left is the model PVB6436AS, which includes the actuator.

Table 1. Controller configurations.

Controller Model	Programmable Type	Universal Inputs (UI)	Digital Inputs (DI)	Analog Outputs (AO)	Digital Outputs (DO)	Velocity Pressure Sensor (Microbridge)	Series 60 Floating Actuator
PUB1012S	Unitary	1	0	1	2	NO	NO
PUB4024S	Unitary	4	0	2	4	NO	NO
PUB6438S	Unitary	6	4	3	8	NO	NO
PUB6438SR	Unitary	6	4	3	8 Relays	NO	NO
PVB0000AS	VAV	0	0	0	0	YES	YES
PVB4022AS	VAV	4	0	2	2	YES	YES
PVB4024NS	VAV	4	0	2	4	YES	NO
PVB6436AS	VAV	6	4	3	6	YES	YES
PVB6438NS	VAV	6	4	3	8	YES	NO

Each controller communicates via an EIA-485 BACnet MS/TP communications network, capable of baud rates between 9.6 and 115.2 kbits/s.

Controllers are field-mountable to either a panel or a DIN rail.

63-2689-06

SPECIFICATIONS

General Specifications

Rated Voltage: 20–30 Vac; 50/60 Hz
Power Consumption:
100 VA for controller and all connected loads (including the actuator on models PVL0000AS, PVL4022AS and PVL6436AS).
Controller Only Load: 5 VA maximum; models PUB1012S, PUB4024S, PUB6438S, PVB4024NS and PVB6438NS.
Controller and Actuator Load: 9 VA maximum; models PVL0000AS, PVL4022AS and PVL6436AS.
External Sensors Power Output: 20 Vdc ±10% @ 75 mA maximum.
VAV Operating & Storage Temperature Ambient Rating (models PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS and PVB6438NS):
Minimum 32 ºF (0 ºC); Maximum 122 ºF (50 ºC)
Unitary Operating & Storage Temperature Ambient Rating (models PUB1012S, PUB4024S and PUB6438S):
Minimum -40 ºF (-40 ºC); Maximum 150 ºF (65.5 ºC)
Relative Humidity: 5% to 95% non-condensing
LED: Provides status for normal operation, controller download process, alarms, manual mode, and error conditions

Velocity Pressure Sensor (models PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS and PVB6438NS)

Operating Range: 0 to 1.5 in. H_2O (0 to 374 Pa)

Series 60 Floating Actuator (models PVB0000AS, PVB4022AS and PVB6436AS)

Rotation Stroke: 95° ± 3° for CW or CCW opening dampers
Torque Rating: 44 lb-in. (5 Nm)
Run Time for 90° rotation: 90 seconds at 60 Hz
Operating Temperature: -4 ºF to 140 ºF (-20 to 60 ºC)

Real Time Clock

Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic daylight savings time adjustment to occur at 2:00 a.m. local time on configured start and stop dates
Power Failure Backup: 24 hours at 32°F to 100°F (0°C to 38°C), 22 hours at 100°F to 122°F (38°C to 50°C)
Accuracy: ±1 minute per month at 77 °F (25 °C)

Digital Input (DI) Circuits

Voltage Rating: 0 to 30 Vdc open circuit
Input Type: Dry contact to detect open and closed circuit
Operating Range: Open circuit = False; Closed circuit = True
Resistance: Open circuit > 3,000 Ohms;
Closed circuit < 500 Ohms

Digital Triac Output (DO) Circuits

Voltage Rating: 20 to 30 Vac @ 50/60Hz
Current Rating: 25 mA to 500 mA continuous, and 800 mA (AC rms) for 60 milliseconds

Digital Relay Output (DO) Circuits (PUB6438SR)

Voltage Rating: 20 to 30 Vac @ 50/60Hz
Current Rating: 0 mA to 1 A continuous, 3.5 A inrush (AC RMS) for 100 milliseconds

Analog Output (AO) Circuits

Analog outputs can be individually configured for current or voltage.

ANALOG CURRENT OUTPUTS:
Current Output Range: 4.0 to 20.0 mA
Output Load Resistance: 550 Ohms maximum

ANALOG VOLTAGE OUTPUTS:
Voltage Output Range: 0.0 to 10.0 Vdc
Maximum Output Current: 10.0 mA

Analog outputs may be configured as digital outputs and operate as follows:
– False (0%) produces 0 Vdc, (0 mA)
– True (100%) produces the maximum 11 Vdc, (22 mA)

Universal Input (UI) Circuits

See Table 2 for the UI circuit specifications.

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number. If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Environmental and Combustion Controls Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386
3. http://customer.honeywell.com or http://customer.honeywell.ca

International Sales and Service Offices in all principal cities of the world. Manufacturing in Belgium, Canada, China, Czech Republic, Germany, Hungary, Italy, Mexico, Netherlands, United Kingdom, and United States.

Table 2. Universal input circuit specifications.

Input Type	Sensor Type	Operating Range
Room/Zone Discharge Air Outdoor Air Temperature	20K Ohm NTC	-40 to 199 °F (-40 to 93 °C)
Outdoor Air Temperature	C7031G[a]	-40 to 120 °F (-40 to 49 °C)
	C7041F[a]	-40 to 250 °F (-40 to 121 °C)
	PT1000 (IEC751 3850)	-40 to 199 °F (-40 to 93 °C)
TR23 Setpoint Potentiometer	500 Ohm to 10,500 Ohm	-4° DDC to +4° DDC (-8° DDF to +7° DDF) or 50 F to 90 F (10 C to 32 C)
Resistive Input	Generic	100 Ohms to 100K Ohms
Voltage Input	Transducer, Controller	0–10 Vdc
Discrete Input	Dry Contact closure	Open Circuit > 3000 Ohms Closed Circuit < 3000 Ohms
Pulse Input[b]	Counter/Meter	Max. frequency: 15 Hz Min. pulse width: 20 ms

[a] C7031G and C7041F are recommended for use with these controllers, due to improved resolution and accuracy when compared to the PT1000.

[b] One Universal Input (UI-1*) on the PUB1012S, PUB4042S, PVB4022AS, and PVB4042NS is user selectable as a fast digital pulse meter.

BEFORE INSTALLATION

The controller is available in three models (see Table 1).

Review the power, input, and output specifications on page 2 before installing the controller.

— Hardware driven by Triac outputs must have a minimum current draw, when energized, of 25 mA and a maximum current draw of 500 mA.

— Hardware driven by the analog current outputs must have a maximum resistance of 550 Ohms, resulting in a maximum voltage of 11 volts when driven at 20 mA.
If resistance exceeds 550 Ohms, voltages up to 18 Vdc are possible at the analog output terminal.

⚠ WARNING

Electrical Shock Hazard.

Can cause severe injury, death or property damage.

Disconnect power supply before beginning wiring or making wiring connections to prevent electrical shock or equipment damage.

INSTALLATION

The controller must be mounted in a position that allows clearance for wiring, servicing, removal, connection of the BACnet MS/TP Molex connector and access to the MS/TP MAC address DIP switches (see Fig. 15 on page 13).

The controller may be mounted in any orientation.

IMPORTANT

Avoid mounting in areas where acid fumes or other deteriorating vapors can attack the metal parts of the controller, or in areas where escaping gas or other explosive vapors are present. Fig. 6–Fig. 7 on page 6 for mounting dimensions.

For the PVB6436AS model, the actuator is mounted first and then the controller is mounted. For the other models, go to “Mount Controller” on page 5 to begin the installation.

Mount Actuator onto Damper Shaft (PVB0000AS, PVB4022AS and PVB6436AS)

PVB0000AS, PVB4022AS and PVB6436AS controllers include the direct-coupled actuator with Declutch mechanism, which is shipped hard-wired to the controller.

The actuator mounts directly onto the VAV box damper shaft and has up to 44 lb-in. (5 Nm) torque, 90-degree stroke, and 90 second timing at 60 Hz. The actuator is suitable for mounting onto a 3/8 to 1/2 in. (10 to 13 mm) square or round VAV box damper shaft. The minimum VAV box damper shaft length is 1-9/16 in. (40 mm).

The two mechanical end-limit set screws control the amount of rotation from 12° to 95°. These set screws must be securely fastened in place. To ensure tight closing of the damper, the shaft adapter has a total rotation stroke of 95° (see Fig. 1).

NOTES:

1. The actuator is shipped with the mechanical end-limit set screws set to 95 degrees of rotation. Adjust the two set screws closer together to reduce the rotation travel. Each “hash mark” indicator on the bracket represents approximately 6.5° of rotation per side.
2. The Declutch button, when pressed, allows you to rotate the universal shaft adapter (see Fig. 1).

IMPORTANT

Determine the damper rotation and opening angle prior to installation. See Fig. 2 below and Fig. 3 on page 4 for examples.

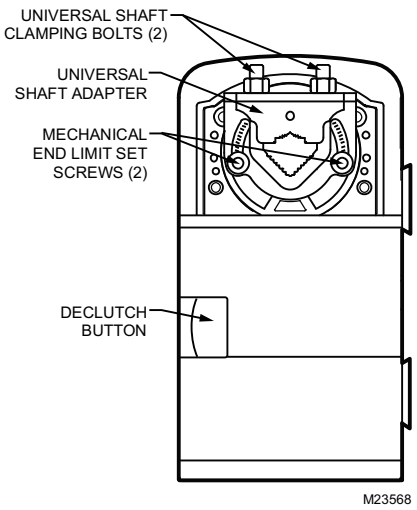


Fig. 1. Series 60 Floating Actuator.

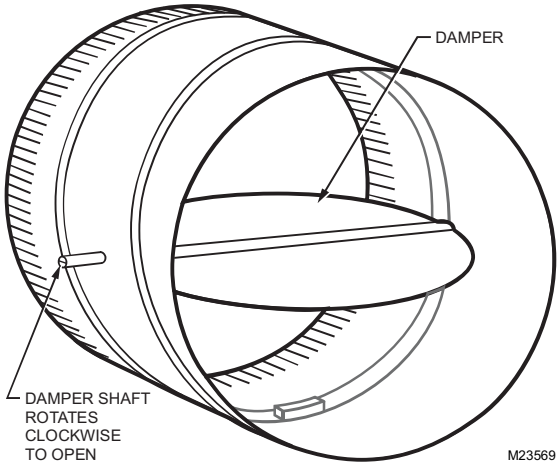


Fig. 2. Damper with 90 degree CW rotation to open.

IMPORTANT

Mount actuator flush with damper housing or add a spacer between the actuator mounting surface and damper box housing.

Before Mounting Actuator onto Damper Shaft (PVB0000AS, PVB4022AS and PVB6436AS)

Tools required:
— Phillips #2 screwdriver - end-limit set screw adjustment
— 8 mm wrench - centering clamp

Before mounting the actuator onto the VAV box damper shaft, determine the following:

1. Determine the damper shaft diameter. It must be between 3/8 in. to 1/2 in. (10 to 13 mm).
2. Determine the length of the damper shaft. If the length of the VAV box damper shaft is less than 1-9/16 in. (40 mm), the actuator cannot be used.
3. Determine the direction the damper shaft rotates to open the damper (CW or CCW) (see Fig. 3). Typically, there is an etched line on the end of the damper shaft that indicates the position of the damper. In Fig. 2, the indicator shows the damper open in a CW direction.
4. Determine the damper full opening angle (45, 60, or 90 degrees). In Fig. 2, the damper is open to its full open position of 90 degrees.

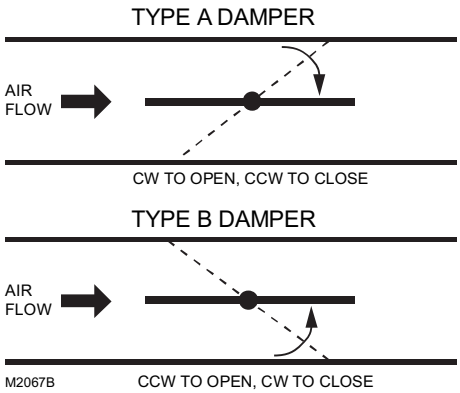


Fig. 3. Determining the rotation direction (CW or CCW) for damper opening.

Mounting Actuator Onto Damper Shaft (PVB0000AS, PVB4022AS and PVB6436AS)

The unit is shipped with the actuator set to rotate open in the clockwise (CW) direction to a full 95 degrees. The extra 5 degrees ensures a full opening range for a 90 degree damper. The installation procedure varies depending on the damper opening direction and angle:

1. If the damper rotates clockwise (CW) to open, and the angle of the damper open-to-closed is 90 degrees:
   a. Manually open the damper fully (rotate clockwise).
   b. Using the Declutch button, rotate the universal shaft adapter fully clockwise.
   c. Mount the actuator to the VAV damper box and shaft.
   d. Tighten the two bolts on the centering clamp (8 mm wrench; 70.8–88.5 lb-in. [8–10 Nm] torque). When the actuator closes, the damper rotates CCW 90 degrees to fully close.
2. If the damper rotates clockwise (CW) to open, and the angle of the damper open-to-closed is 45 or 60 degrees:
   a. Manually open the damper fully (rotate clockwise).
   b. The actuator is shipped with the mechanical end-limits set at 95 degrees. Adjust the two mechanical end-limit set screws to provide the desired amount of rotation. Adjust the two set screws closer together to reduce the rotation travel.
   c. Tighten the two mechanical end-limit screws (Phillips #2 screwdriver; (26.5–31 lb-in. [3.0–3.5 Nm] torque).
   d. Using the Declutch button, rotate the universal shaft adapter fully clockwise.
   e. Mount the actuator to the VAV damper box and shaft.
   f. Tighten the two bolts on the centering clamp (8 mm wrench; 70.8–88.5 lb-in. [8–10 Nm] torque).
   g. When the actuator closes, the damper rotates CCW either 45 or 60 degrees to fully close.
3. If the damper rotates counterclockwise (CCW) to open, and the angle of the damper open-to-closed is 90 degrees:
   a. Manually open the damper fully (rotate counterclockwise).
   b. Using the Declutch button, rotate the universal shaft adapter fully counterclockwise.

c. Mount the actuator to the damper box and shaft.
d. Tighten the two bolts on the centering clamp (8 mm wrench; 70.8–88.5 lb-in. [8–10 Nm] torque). When the actuator closes, the damper rotates CW 90 degrees to fully close.

4. If the damper rotates counterclockwise to open, and the angle of the damper open-to-closed is 45 or 60 degrees:
a. Manually open the damper fully (rotate counterclockwise).
b. The actuator is shipped with the mechanical end-limits set at 95 degrees. Adjust the two mechanical end-limit set screws to provide the desired amount of rotation. Adjust the two set screws closer together to reduce the rotation travel.
c. Tighten the two mechanical end-limit screws (Phillips #2 screwdriver; (26.5–31 lb-in. [3.0–3.5 Nm] torque).
d. Using the Declutch button, rotate the universal shaft adapter fully counter-clockwise.
e. Mount the actuator to the VAV damper box and shaft.
f. Tighten the two bolts on the centering clamp (8 mm wrench; 70.8–88.5 lb-in. [8–10 Nm] torque).
g. When the actuator closes, the damper rotates CW either 45 or 60 degrees to fully close.

IMPORTANT

Special precautions must be taken for dampers that open in a CCW direction. The actuator is shipped with its rotation direction set to CW to Open, which applies to the damper direction in steps 1 and 2 above. If the damper shaft rotates in the CCW direction to open, the controller software must be programmed to change the rotation to "Reverse to Open," which applies to the damper direction in steps 3 and 4 above.

IMPORTANT

It is advisable to leave the dampers in an open position after installation to avoid the possibility of over-pressurizing the duct work on fan startup. Use the Declutch button (see Fig. 1 on page 4) to open the box damper on controllers that are powered down, to prevent over-pressurization in the duct work on fan startup. To Declutch, press and hold the button to disengage the motor. Turn the damper shaft until the damper is open and release the button. When power is restored to the controller, the controller synchronizes the damper actuator, so that the damper is in the correct position upon startup.

Mount Controller

NOTE: The controller may be wired before mounting to a panel or DIN rail.

Terminal blocks are used to make all wiring connections to the controller. Attach all wiring to the appropriate terminal blocks (see "Wiring" on page 9).

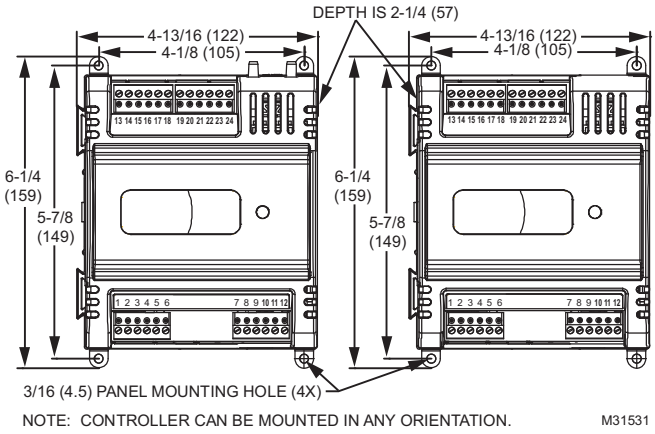


Fig. 4. Panel mounting - controller dimensions in inches (mm) for PUB1012S, PUB4024S and PVB4024NS only (PUB4024S and PVB4024NS shown).

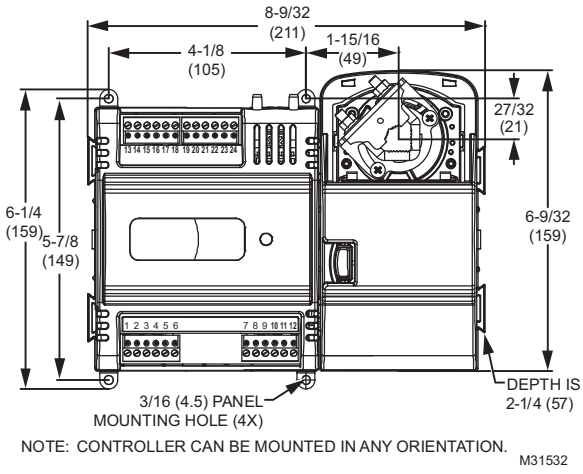


Fig. 5. Panel mounting - controller and actuator dimensions in inches (mm) for PVB0000AS and PVB4022AS only (PVB4022AS shown).

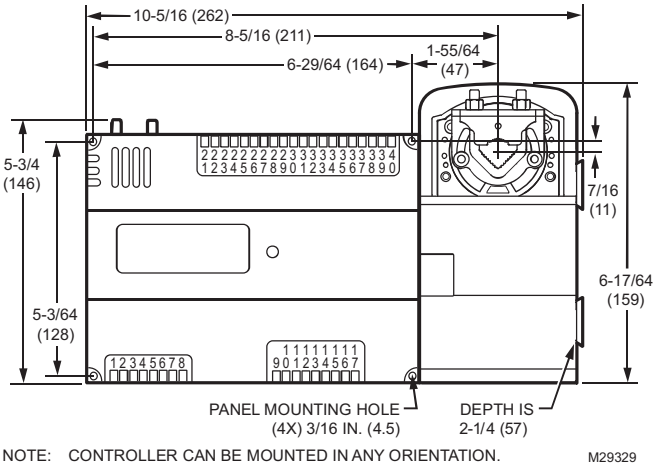


Fig. 6. Panel mounting - controller and actuator dimensions in inches (mm) for PVB6436AS.

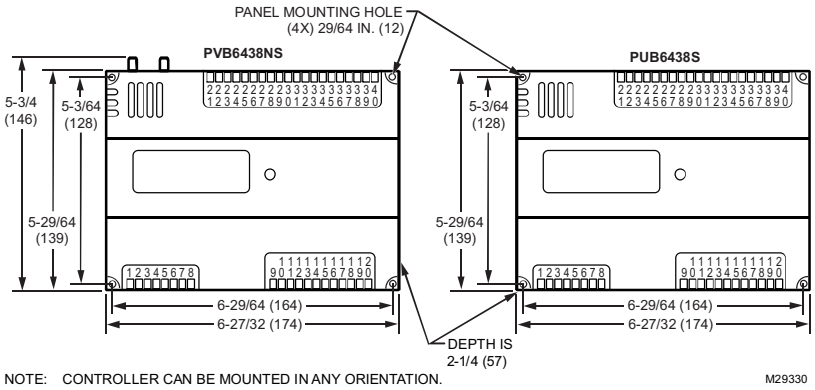


Fig. 7. Panel mounting - controller dimensions in inches (mm) for models PUB6438S, PVB6438NS and PUB6438SR.

Panel Mounting

The controller enclosure is constructed of a plastic base plate and a plastic factory-snap-on cover.

NOTE: The controller is designed so that the cover does not need to be removed from the base plate for either mounting or wiring.

The controller mounts using four screws inserted through the corners of the base plate. Fasten securely with four No. 6 or No. 8 machine or sheet metal screws.

The controller can be mounted in any orientation. Ventilation openings are designed into the cover to allow proper heat dissipation, regardless of the mounting orientation.

DIN Rail Mounting (PUB1012S, PUB4024S, PUB6438S, PUB6438SR, PVB4024NS and PVB6438NS)

To mount the PUB1012S, PUB4024S, PUB6438S, PUB6438SR, PVB4024NS and PVB6438NS controllers on a DIN rail [standard EN50022; 1-3/8 in. x 9/32 in. (7.5 mm x 35 mm)], refer to Fig. 8 and perform the following steps:

1. Holding the controller with its top tilted in towards the DIN rail, hook the two top tabs on the back of the controller onto the top of the DIN rail.
2. Push down and in to snap the two bottom flex connectors of the controller onto the DIN rail.

IMPORTANT

To remove the controller from the DIN rail, perform the following:

1. *Push straight up from the bottom to release the top tabs.*
2. *Rotate the top of the controller out towards you and pull the controller down and away from the DIN rail to release the bottom flex connectors.*

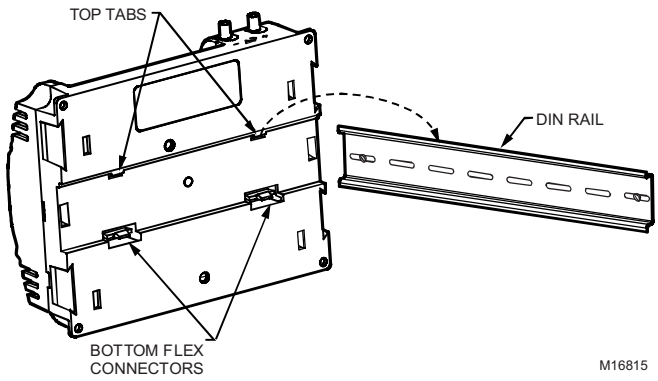


Fig. 8. Controller DIN rail mounting (models PUB1012S, PUB4024S, PUB6438S, PUB6438SR, PVB4024NS and PVB6438NS).

Piping (PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS and PVB6438NS)

Air flow Pickup

For PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS and PVB6438NS, connect the air flow pickup to the two restrictor ports on the controller (see Fig. 9).

NOTES:

- Use 1/4 inch (6 mm) outside diameter, with a 0.040 in. (1 mm) wall thickness, plenum-rated 1219 FR (94V-2) tubing.
- Always use a fresh cut on the end of the tubing that connects to the air flow pickups and the restrictor ports on the controller.

Connect the high pressure or upstream tube to the plastic restrictor port labeled (+), and the low pressure or downstream tube to the restrictor port labeled (-). See labeling in Fig. 9. When twin tubing is used from the pickup, split the pickup tubing a short length to accommodate the connections.

NOTES:

- If controllers are mounted in unusually dusty or dirty environments, an inline, 5-micron disposable air filter (use 5-micron filters compatible with

pneumatic controls) is recommended for the high pressure line (marked as +) connected to the air flow pickup.

— The tubing from the air flow pickup to the controller should not exceed three feet (0.914 m). Any length greater than this will degrade the flow sensing accuracy.

— Use caution when removing tubing from a connector. Always pull straight away from the connector or use diagonal cutters to cut the edge of the tubing attached to the connector. Never remove by pulling at an angle.

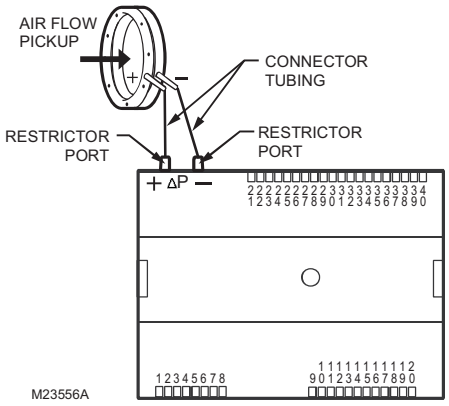


Fig. 9. Air flow pickup connections (PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS and PVB6438NS).

Power

Before wiring the controller, determine the input and output device requirements for each controller used in the system. Select input and output devices compatible with the controller and the application. Consider the operating range, wiring requirements, and the environment conditions when selecting input/output devices. When selecting actuators for modulating applications consider using floating control. In direct digital control applications, floating actuators will generally provide control action equal to or better than an analog input actuator for lower cost.

Determine the location of controllers, sensors, actuators and other input/output devices and create wiring diagrams. Refer to Fig. 17–Fig. 23 beginning on page 15 for illustrations of typical controller wiring for various configurations.

The application engineer must review the control job requirements. This includes the sequences of operation for the controller, and for the system as a whole. Usually, there are variables that must be passed between the controller and other Spyder BACnet controller(s) that are required for optimum system wide operation. Typical examples are the TOD, Occ/Unocc signal, the outdoor air temperature, the demand limit control signal, and the smoke control mode signal.

It is important to understand these interrelationships early in the job engineering process, to ensure proper implementation when configuring the controllers. Refer to the controller Application Guides.

Power Budget

A power budget must be calculated for each device to determine the required transformer size for proper operation. A power budget is simply the summing of the maximum power draw ratings (in VA) of all the devices to be controlled. This includes the controller itself and any devices powered from the controller, such as equipment actuators (ML6161 or other motors) and various contactors and transducers.

IMPORTANT

- *When multiple controllers operate from a single transformer, connect the same side of the transformer secondary to the same power input terminal in each device. The earth ground terminal (terminal 3) must be connected to a verified earth ground for each controller in the group (see Fig. 12 on page 10).*
- *Half-wave devices and full-wave devices must not use the same AC transformer. If a Spyder controller will share its power supply with another device, make sure the other device utilizes a half-wave rectifier and that the polarity of the wiring is maintained.*

POWER BUDGET CALCULATION EXAMPLE

Table 3 is an example of a power budget calculation for a typical PVB6436AS controller. While the example is shown for only this model, the process is applicable for all controller models.

Table 3. Power budget calculation example.

Device	VA Information	Obtained From
PVB6436AS controllers (include Series 60 Floating Damper Actuator)	9.0	See “Specifications” on page 2.
R8242A Contactor fan rating	21.0	TRADELINE® Catalog inrush rating
D/X Stages	0.0	For example, assume cooling stage outputs are wired into a compressor control circuit and have no impact on the budget.
M6410A Steam Heating Coil Valve	0.7	TRADELINE® Catalog, 0.32A 24 Vac
TOTAL	30.7	

The system example above requires 30.7 VA of peak power. Therefore, a 100 VA AT92A transformer could be used to power one controller of this type. Because the total peak power is less than 33 VA, this same transformer could be used to power three of these controllers and meet NEC Class 2 restrictions (no greater than 100 VA).

See Fig. 11–Fig. 12 beginning on page 9 for illustrations of controller power wiring. See Table 4 for VA ratings of various devices.

Table 4. VA ratings for transformer sizing.

Device	Description	VA
PVB6436AS controllers and Series 60 Floating Damper Actuator	Controller and Actuator	9.0
PUB6438S or PVB6438NS	Controller	5.0
ML684	Versadrive Valve Actuator	12.0
ML6161	Damper Actuator, 35 lb-in.	2.2

Device	Description	VA
ML6185	Damper Actuator SR 50 lb-in	12.0
ML6464	Damper Actuator, 66 lb-in.	3.0
ML6474	Damper Actuator, 132 lb-in.	3.0
R6410A	Valve Actuator	0.7
R8242A	Contactor	21.0

For contactors and similar devices, the in-rush power ratings should be used as the worst case values when performing power budget calculations. Also, the application engineer must consider the possible combinations of simultaneously energized outputs and calculate the VA ratings accordingly. The worst case, which uses the largest possible VA load, should be determined when sizing the transformer.

Each controller requires 24 Vac power from an energy-limited Class II power source. To conform to Class II restrictions (U.S. only), transformers must not be larger than 100 VA. A single transformer can power more than one controller.

GUIDELINES FOR POWER WIRING ARE AS FOLLOWS:

- For multiple controllers operating from a single transformer, the same side of the transformer secondary must be connected to the same power input terminal in each device. The earth ground terminal must be connected to a verified earth ground for each controller in the group (see Fig. 12 on page 10). Controller configurations are not necessarily limited to three devices, but the total power draw, including accessories, cannot exceed 100 VA when powered by the same transformer (U.S. only).
- See Fig. 11 on page 9 for controller power wiring used in UL 1995 equipment (U.S. only).
- Many controllers require all loads to be powered by the same transformer that powers the controller.
- Keep the earth ground connection wire run as short as possible (refer to Fig. 11–Fig. 12 beginning on page 9).
- Do not connect earth ground to the controller's digital or analog ground terminals (refer to Fig. 11 and Fig. 12).
- Unswitched 24 Vac power wiring can be run in the same conduit as the LONWORKS® Bus cable.

Line-Loss

Controllers must receive a minimum supply voltage of 20 Vac. If long power or output wire runs are required, a voltage drop due to Ohms Law (I x R) line-loss must be considered. This line-loss can result in a significant increase in total power required and thereby affect transformer sizing. The following example is an I x R line-loss calculation for a 200 ft. (61m) run from the transformer to a controller drawing 37 VA and using two 18 AWG (1.0 sq mm) wires.

The formula is:

Loss = [length of round-trip wire run (ft.)] x [resistance in wire (ohms per ft.)] x [current in wire (amperes)]

From specification data:

18 AWG twisted pair wire has a resistance of 6.52 ohms per 1000 feet.

Loss = [(400 ft.) x (6.52/1000 ohms per ft.)] x [(37 VA)/(24V)] = 4.02 volts

This means that four volts are going to be lost between the transformer and the controller. To assure the controller receives at least 20 volts, the transformer must output more than 24 volts. Because all transformer output voltage levels depend on the size of the connected load, a larger transformer outputs a higher voltage than a smaller one for a given load. Fig. 10 shows this voltage load dependence.

In the preceding I x R loss example, even though the controller load is only 37 VA, a standard 40 VA transformer is not sufficient due to the line-loss. Looking at Fig. 10, a 40 VA transformer is just under 100 percent loaded (for the 37 VA controller) and has a secondary voltage of 22.9 volts. (Use the lower edge of the shaded zone in Fig. 10 that represents the worst case conditions.) When the I x R loss of four volts is subtracted, only 18.9 volts reaches the controller. This is not enough voltage for proper operation.

In this situation, the engineer has three alternatives:

1. Use a larger transformer. For example, if an 80 VA model is used, an output of 24.4 volts, minus the four volt line-loss, supplies 20.4V to the controller (see Fig. 10). Although acceptable, the four-volt line-loss in this example is higher than recommended.

IMPORTANT

No installation should be designed where the line-loss is greater than two volts. This allows for nominal operation if the primary voltage drops to 102 Vac (120 Vac minus 15 percent).

2. Use heavier gauge wire for the power run. 14 AWG (2.0 sq mm) wire has a resistance of 2.57 ohms per 1,000 ft. Using the preceding formula results in a line-loss of only 1.58 volts (compared with 4.02 volts). This would allow a 40 VA transformer to be used. 14 AWG (2.0 sq mm) wire is the recommended wire size for 24 Vac wiring.
3. Locate the transformer closer to the controller. This reduces the length of the wire run, and the line-loss.

The issue of line-loss is also important in the case of the output wiring connected to the Triac digital outputs. The same formula and method are used. Keep all power and output wire runs as short as practical. When necessary, use heavier gauge wire, a bigger transformer, or install the transformer closer to the controller.

To meet the National Electrical Manufacturers Association (NEMA) standards, a transformer must stay within the NEMA limits. The chart in Fig. 10 shows the required limits at various loads.

With 100 percent load, the transformer secondary must supply between 23 and 25 volts to meet the NEMA standard. When a purchased transformer meets the NEMA standard DC20-1986, the transformer voltage regulating ability can be considered reliable. Compliance with the NEMA standard is voluntary.

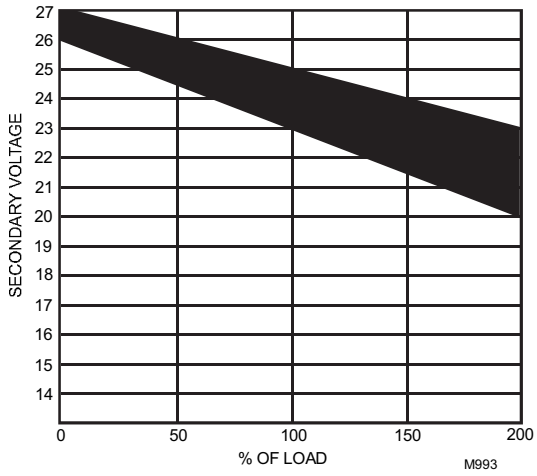


Fig. 10. NEMA Class 2 transformer voltage output limits.

The Honeywell transformers listed in Table 5 meet the NEMA standard DC20-1986.

Table 5. Honeywell transformers that meet NEMA standard DC20-1986.

Transformer Type	VA Rating
AT40A	40
AT72D	40
AT87A	50
AK3310 Assembly	100

NOTE: The AT88A and AT92A transformers do not meet the voluntary NEMA standard DC20-1986.

Wiring

All wiring must comply with applicable electrical codes and ordinances, or as specified on installation wiring diagrams. Controller wiring is terminated to the screw terminal blocks located on the top and the bottom of the device.

⚠ WARNING

Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Disconnect power supply before beginning wiring or making wiring connections, to prevent electrical shock or equipment damage.

NOTES:

— For multiple controllers operating from a single transformer, the same side of the transformer secondary must be connected to the same power input terminal in each controller. Controller configurations will not necessarily be limited to three devices, but the total power draw, including accessories, cannot exceed 100 VA when powered by the same transformer (U.S. only). For power and wiring recommendations, See “Power” on page 7. The earth ground terminal (terminal 3) must be connected to a verified earth ground for each controller in the group (see Fig. 12 on page 10).

— All loads on the controller must be powered by the same transformer that powers the controller itself. A controller can use separate transformers for controller power and output power.

— Keep the earth ground connection (terminal 3) wire run as short as possible.

— Do not connect the universal input COM terminals, analog output COM terminals or the digital input/output COM terminals to earth ground. Refer to Fig. 16–Fig. 21 beginning on page 14 for wiring examples.

The 24 Vac power from an energy limited Class II power source must be provided to the controller. To conform to Class II restrictions (U.S. only), the transformer must not be larger than 100 VA.

Fig. 11 depicts a single controller using one transformer.

IMPORTANT

Power must be off prior to connecting to or removing connections from the 24 Vac power (24 Vac/24 Vac COM), earth ground (EGND), and 20 Vdc power (20 Vdc) terminals.

IMPORTANT

Use the heaviest gauge wire available, up to 14 AWG (2.0 sq mm), with a minimum of 18 AWG (1.0 sq mm), for all power and earth ground wiring.

Screw-type terminal blocks are designed to accept up to one 14 AWG (2.0 sq mm) conductor or up to two 18 AWG (1.0 sq mm) conductors. More than two wires that are 18 AWG (2.0 sq mm) can be connected with a wire nut. Include a pigtail with this wire group and attach the pigtail to the terminal block.

IMPORTANT

Connect terminal 2, (the 24 Vac common [24 VAC COM] terminal) to earth ground (see Fig. 11).

NOTE: Unswitched 24 Vac power wiring can be run in the same conduit as the LONWORKS® cable.

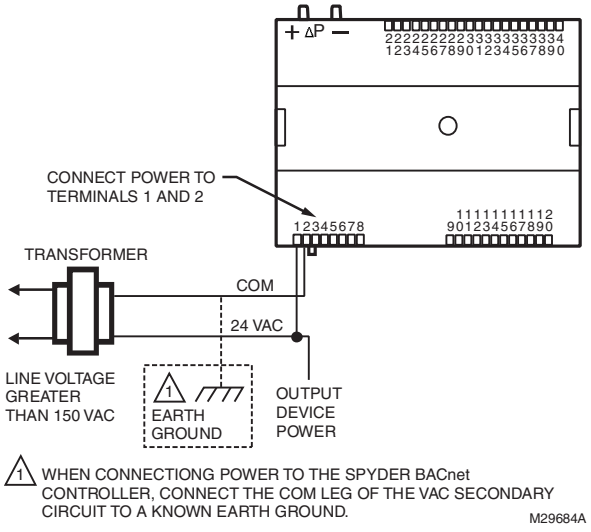


Fig. 11. Power wiring details for one controller per transformer.

More than one controller can be powered by a single transformer. Fig. 12 shows power wiring details for multiple controllers.

NOTE: Controller configurations are not necessarily limited to three devices, but the total power draw, including accessories, cannot exceed 100 VA when powered by the same transformer (U.S. only). For power wiring recommendations, see "Power" on page 7.

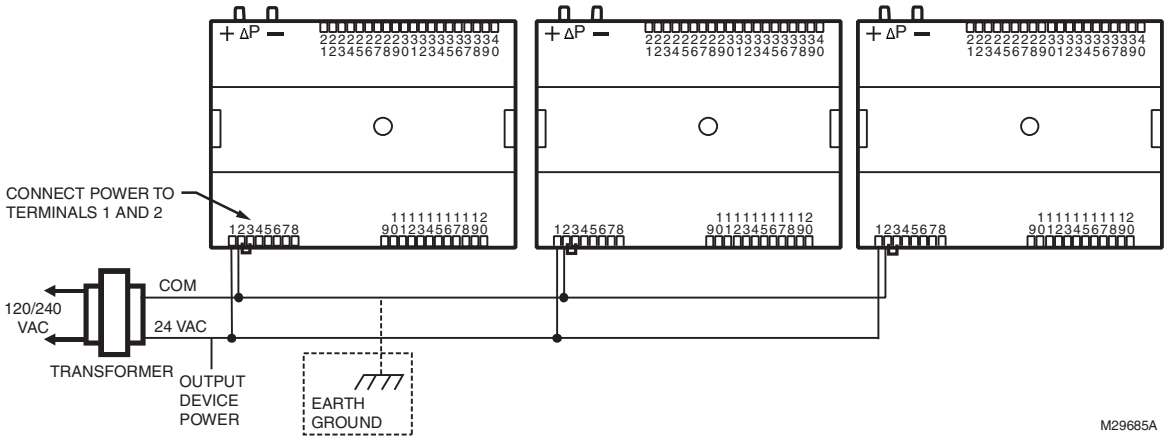


Fig. 12. Power wiring details for two or more controllers per transformer.

Communications

Each controller uses a BACnet MS/TP communications port. The controller's data is presented to other controllers over a twisted-pair MS/TP network, which uses the EIA-485 signaling standard capable of the following baud rates: 9.6, 19.2, 38.4, 76.8 or 115.2 kilobits per second (configured at global controller). The Spyder BACnet controllers are master devices on the MS/TP network. Each Spyder BACnet controller uses a high-quality EIA-485 transceiver and exerts 1/4 unit load on the MS/TP network.

Cabling should be selected that meets or exceeds the BACnet Standard which specifies the following: An MS/TP EIA-485 network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 130 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot). Distributed capacitance between conductors and shield shall be less that 200 pF per meter (60 pF per foot). Foil or braided shields are acceptable. The Honeywell tested and recommended MS/TP cable is Honeywell Cable 3322 (18 AWG, 1-Pair, Shielded, Plenum cable), alternatively Honeywell Cable 3251 (22 AWG, 1-Pair, Shielded, Plenum cable) is available and meets the BACnet Standard requirements (www.honeywellcable.com).

The maximum BACnet MS/TP network Bus segment length is 4,000 ft. (1,219 m) using recommended wire. Repeaters must be used when making runs longer than 4,000 ft. (1,219 m). A maximum of three repeaters can be used between any two devices.

Setting the MS/TP MAC address

The MS/TP MAC address for each device must be set to a unique value in the range of 0-127 on an MS/TP network segment (address 0, 1, 2, & 3 should be avoided as they are commonly used for the router, diagnostic tools, and as spare addresses). DIP switches on the Spyder BACnet controller are used to set the controller's MAC address.

To set the MS/TP MAC address of a Spyder BACnet controller:

1. Find an unused MAC address on the MS/TP network to which the Spyder BACnet controller connects.
2. Locate the DIP switch bank on the Spyder BACnet for addressing. This is labeled MAC Address
3. With the Spyder BACnet Controller powered down, set the DIP switches for the MAC Address you want. Add the value of DIP switches set to ON to determine the MAC address. See Table 6. Example, if only DIP switches 1, 3, 5, and 7 are enabled the MAC address would be 85 (1 + 4 + 16 + 64 = 85).

   NOTE: See Fig. 15 on page 13 for DIP switch orientation and arrangement.

Table 6. DIP Switch Values For MS/TP MAC Address.

DIP	7	6	5	4	3	2	1
VALUE	64	32	16	8	4	2	1

Setting the Device Instance Number

The Device Instance Number must be unique across the entire BACnet system network because it is used to uniquely identify the BACnet devices. It may be used to conveniently identify the BACnet device from other devices during installation. The Spyder BACnet Controllers Device Instance Number is automatically set when it is added to a WEBStation-AX project. The Device Instance Number can be changed by the user, which may be necessary when integrating with a third party or when attempting to replace an existing controller and it is desired to maintain the existing Device Instance Number.

To edit the Device Instance Number using WEBs AX:

1. Identify an unused Device Instance Number on the BACnet Network, in the range of 0 - 4194302.
2. Open the Spyder Bacnet Device Mgr View
   a. Double click on the BacnetNetwork located in the Nav tree.
   b. Select the Spyder Controller to be modified.

c. Click on the Edit button.
d. Enter an unused value in the Device Id field.
e. Select OK

3. Right Click on the Spyder Controller and select Actions > Write Device Instance to complete the update

Termination Resistors

Matched terminating resistors are required at each end of a segment bus wired across (+) and (-). Use matched precision resistors rated 1/4W ±1% / 80 - 130 Ohms. Ideally, the value of the terminating resistors should match the rated characteristic impedance of the installed cable. For example, if the installed MS/TP cable has a a listed characteristic impedance of 120 Ohm, install 120 Ohm matched precision resistors.

NOTE: The controller does not provide any network biasing.

Shield Terminating

Following proper MS/TP cabling shield grounding procedures is important to minimize the risk of communication problems and equipment damage caused by capacitive coupling. Capacitive coupling is caused by placing MS/TP cabling close to lines carrying higher voltage. The shield should be grounded on only one end of the MS/TP segment (typically the router end). Tie the shield through using the SHLD (terminal 4) on the Spyder BACnet Controller.

Sylk™ Bus

Sylk is a two wire, polarity insensitive bus that provides both 18 VDC power and communications between a Sylk-enabled sensor and a Sylk-enabled controller. Using Sylk-enabled sensors saves I/O on the controller and is faster and cheaper to install since only two wires are needed and the bus is polarity insensitive. Sylk sensors are configured using the latest release of the Spyder Tool for WEBPro and WEBStation.

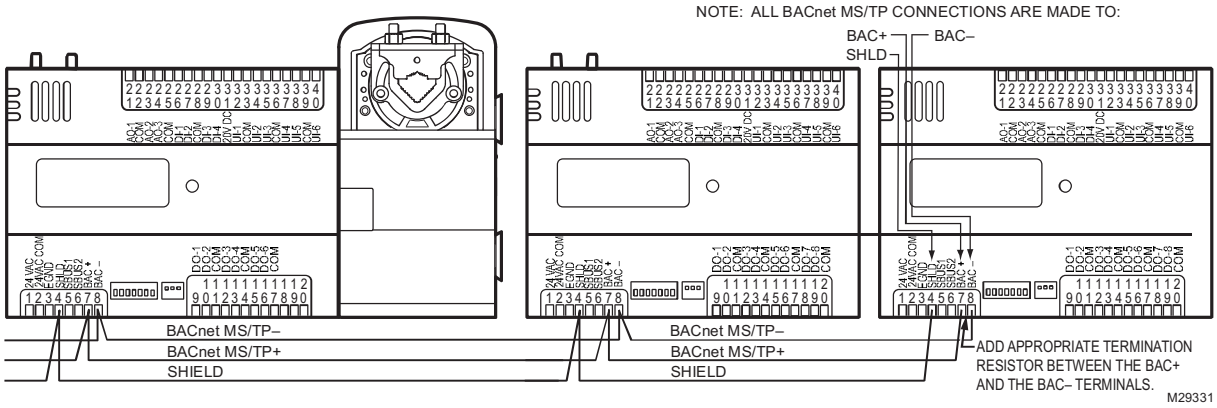


Fig. 13. Termination modules.

Wiring Method

⚠ WARNING

Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Disconnect power supply before beginning wiring, or making wiring connections, to prevent electrical shock or equipment damage.

NOTE: When attaching two or more wires to the same terminal, other than 14 AWG (2.0 sq mm), be sure to twist them together. Deviation from this rule can result in improper electrical contact (see Fig. 14).

Each terminal can accommodate the following gauges of wire:
— Single wire: from 22 AWG to 14 AWG solid or stranded
— Multiple wires: up to two 18 AWG stranded, with 1/4 watt wire-wound resistor

Prepare wiring for the terminal blocks, as follows:

1. Strip 1/2 in. (13 mm) insulation from the conductor.
2. Cut a single wire to 3/16 in. (5 mm). Insert the wire in the required terminal location and tighten the screw.
3. If two or more wires are being inserted into one terminal location, twist the wires together a minimum of three turns before inserting them (see Fig. 14).
4. Cut the twisted end of the wires to 3/16 in. (5 mm) before inserting them into the terminal and tightening the screw.
5. Pull on each wire in all terminals to check for good mechanical connection.

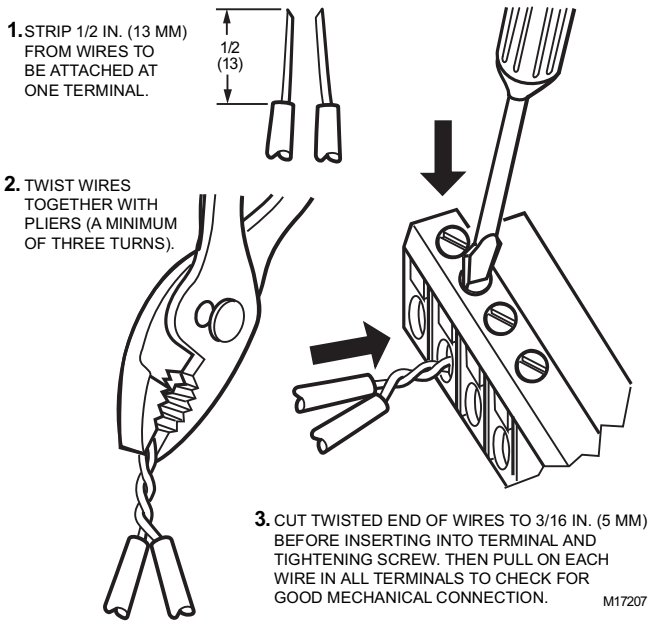


Fig. 14. Attaching two or more wires at terminal blocks.

Wiring Details

Each controller is shipped with the digital outputs, which switch the 24 Vac to the load (High Side).

The three analog outputs (AO) are used to control modulating heating, cooling and economizer equipment. Any AO may be used as a digital output, as follows:
— False (0%) produces 0 Vdc, (0 mA)
— True (100%) produces the maximum 11 Vdc (22 mA)

The wiring connection terminals described in Table 7 are shown in Fig. 15 starting on page 13.

Table 7. Description of wiring terminal connections for PUB6438S, PUB6438SR, PVB6436AS, and PVB6438NS.

Terminal	Label	Connection
INPUT POWER & GROUND		
1	24 Vac	24 Vac Power
2	24 Vac COM	24 Vac Power
3	EGND	Earth Ground
4	SHLD	MS/TP Shield
5	SBUS 1	Sylk
6	SBUS 2	Sylk
NETWORK CONNECTIONS		
7	BAC +	LONWORKS® communications
8	BAC -	LONWORKS® communications
DIGITAL OUTPUTS[a]		
9	DO-1	Digital Output
10	DO-2	Digital Output
11	COM	Common
12	DO-3	Digital Output
13	DO-4	Digital Output
14	COM	Common
15	DO-5	Digital Output
16	DO-6	Digital Output
17	COM	Common
18	DO-7	Digital Output
19	DO-8	Digital Output
20	COM	Common
ANALOG OUTPUTS[b]		
21	AO-1	Analog Output
22	COM	Common
23	AO-2	Analog Output
24	AO-3	Analog Output
25	COM	Common
DIGITAL INPUTS[c]		
26	DI-1	Digital Input
27	DI-2	Digital Input
28	COM	Common
29	DI-3	Digital Input
30	DI-4	Digital Input
ATTACHED DEVICE(S) POWER		
31	20 Vdc	20 Vdc Power
UNIVERSAL INPUTS		
32	UI-1	Universal Input
33	COM	Common
34	UI-2	Universal Input
35	UI-3	Universal Input
36	COM	Common
37	UI-4	Universal Input
38	UI-5	Universal Input
39	COM	Common
40	UI-6	Universal Input

[a] For the PVB6436AS controller ONLY, terminals 18, 19, and 20 (DO7, DO8, & COM) are not present. The actuator is internally hardwired to these terminals.

[b] Analog outputs may be configured as digital outputs and operate as follows:
– False (0%) produces 0 Vdc, (0 mA)
– True (100%) produces the maximum 11 Vdc (22 mA)

[c] Digital inputs: Open circuit = False; Closed circuit = True

IMPORTANT

If the controller is not connected to a good earth ground, the controller's internal transient protection circuitry is compromised and the function of protecting the controller from noise and power line spikes cannot be fulfilled. This could result in a damaged circuit board and require replacement of the controller. Refer to installation diagrams for specific wiring.

All controllers have the terminal arrangements similar to the examples shown in Fig. 15 as described in Table Table 7 on page 12.

MS/TP MAC ADDRESS DIP SWITCHES

The MS/TP MAC address DIP switches are used to set the unit's MAC address. Each Spyder BACnet on an MS/TP network must have a unique MAC address in the range of 0-127 (address 0 should be avoided as it is the Honeywell factory default MAC address for all MS/TP devices).

MS/TP SERVICE CONNECTOR PINS

Local device MS/TP network connection is provided via the molex connector pins (0.100-in. molex connector—part number: 22-01-2035).

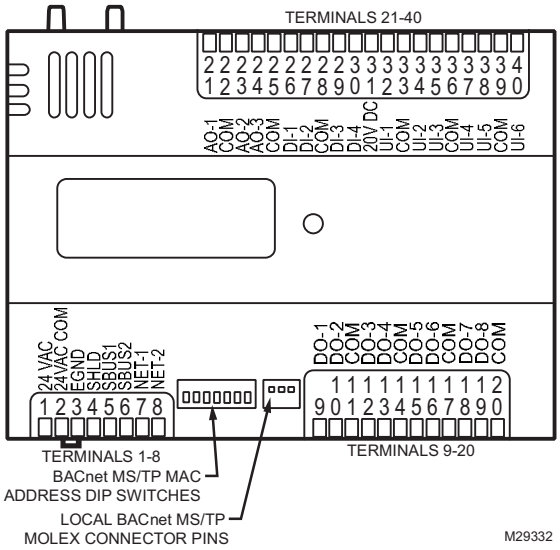
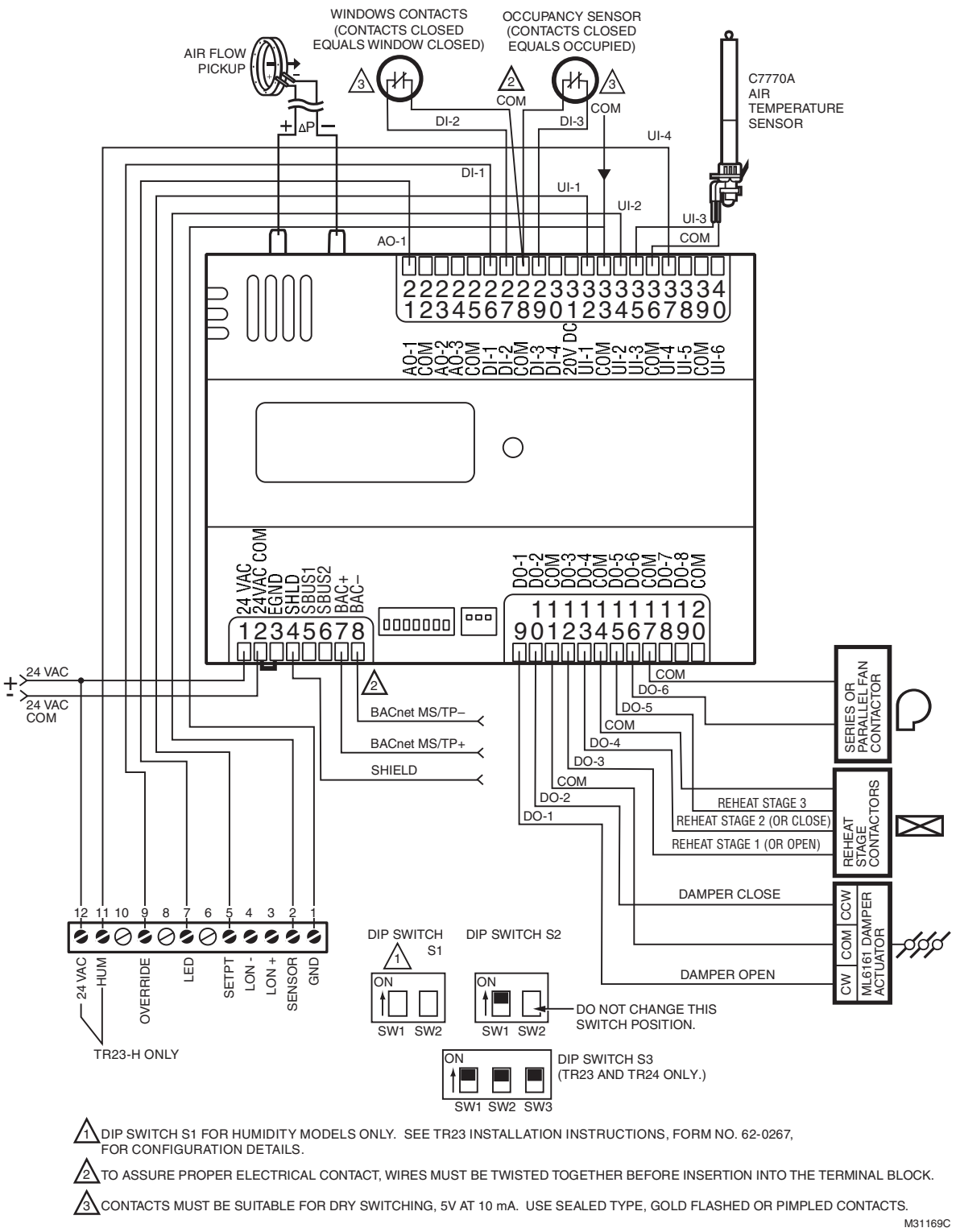


Fig. 15. Controller Terminal Connections, MS/TP MAC address DIP switches, MS/TP service connector pins, and BACnet Status LED for the PUB's and PVB's (PVB6438NS shown).

Wiring Applications (Examples)

Fig. 16–Fig. 22, beginning on page 14, illustrate controller wiring for the following configurations.

- Typical controller wiring for VAV application using the TR23 Wall Module and a C7770A Air Temperature Sensor (see Fig. 16 on page 14).
- Typical controller wiring for VAV application with staged reheat (see Fig. 17 on page 15).
- Typical controller wiring for PWM reheat and PWM peripheral heat valve actuator (see Fig. 18 on page 16).
- Typical controller wiring for AHU application (see Fig. 19 on page 17).
- Typical controller wiring for 4 to 20 mA enthalpy sensors and digital inputs (see Fig. 20 on page 18).
- Typical controller wiring for 4 to 20 mA heating, cooling, and model ML6161 floating motor control (see Fig. 21 on page 19).
- Typical controller wiring for a pneumatic transducer, model RP7517B (see Fig. 22 on page 20).



1 DIP SWITCH S1 FOR HUMIDITY MODELS ONLY. SEE TR23 INSTALLATION INSTRUCTIONS, FORM NO. 62-0267, FOR CONFIGURATION DETAILS.

2 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTION INTO THE TERMINAL BLOCK.

3 CONTACTS MUST BE SUITABLE FOR DRY SWITCHING, 5V AT 10 mA. USE SEALED TYPE, GOLD FLASHED OR PIMPLED CONTACTS.

M31169C

Fig. 16. Controller wiring diagram (model PVB6438NS shown) for typical VAV application, using the TR23 wall module and a C7770A air temperature sensor. (For note 2, refer to Fig. 14.)

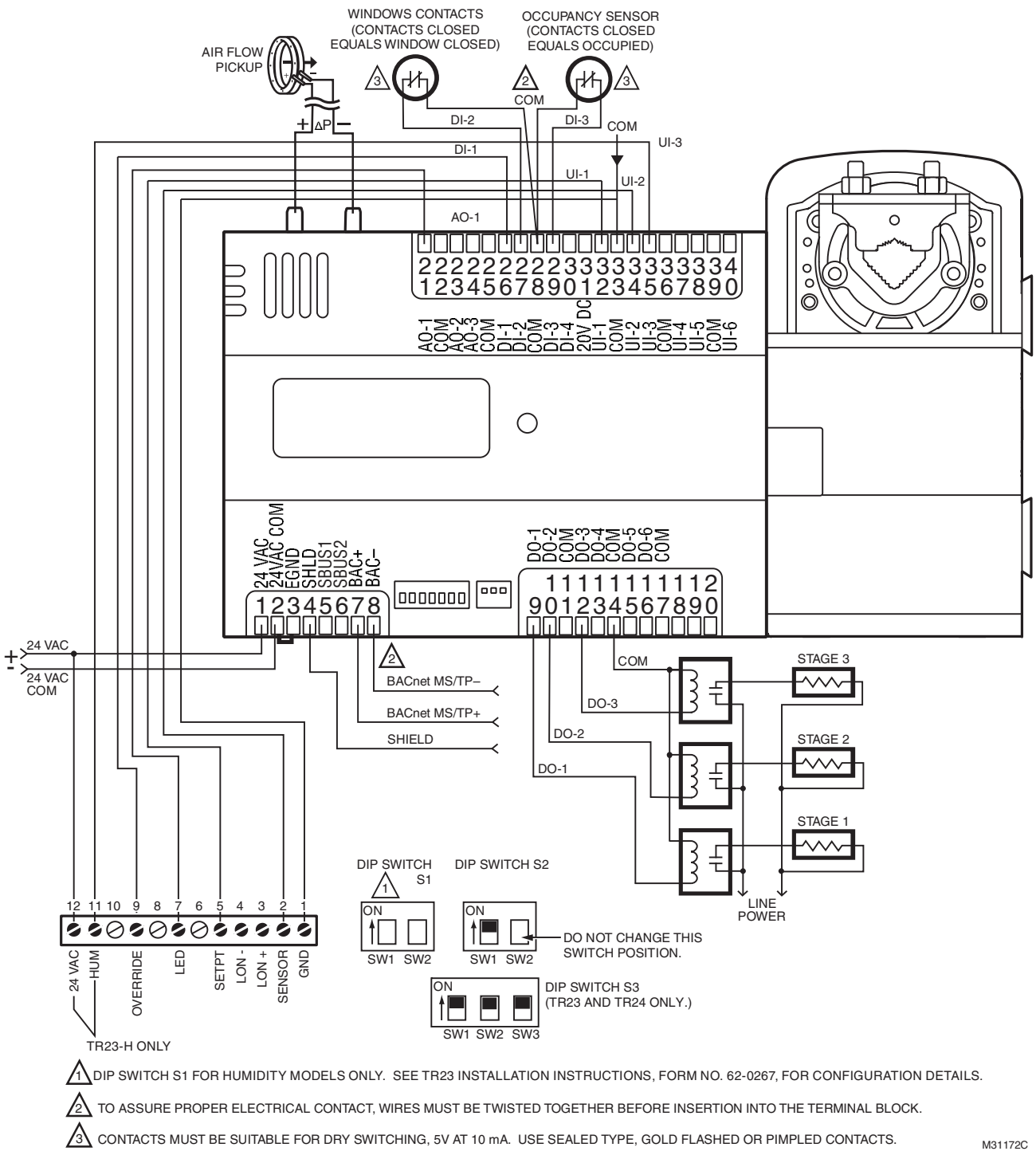


Fig. 17. Controller wiring diagram (model PVB6436AS shown) for typical VAV application with staged reheat. (For note 2, refer to Fig. 14.)

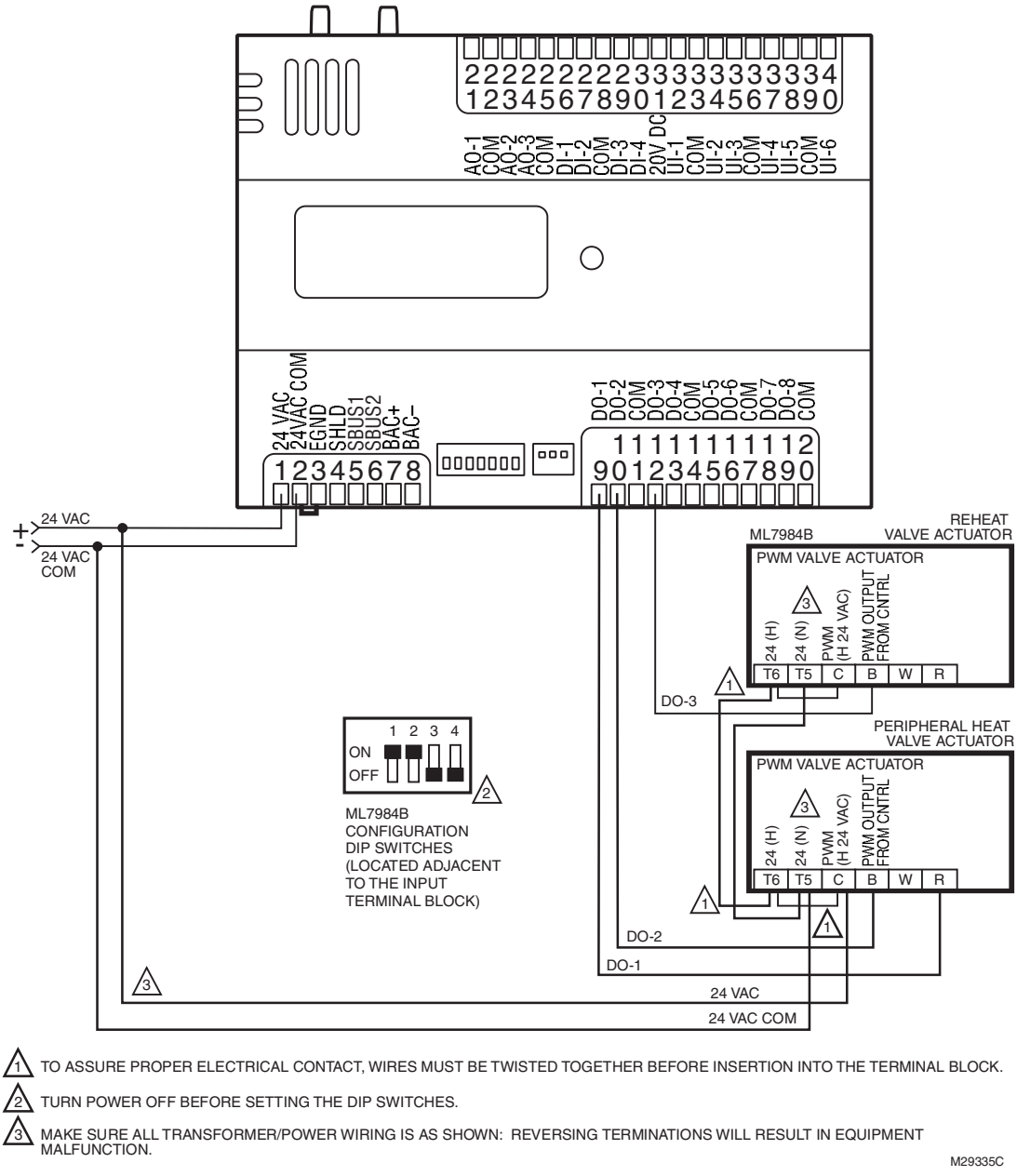


Fig. 18. Controller wiring diagram (model PUB6438S shown) for typical PWM reheat and PWM peripheral heat valve actuator. (For note 2, refer to Fig. 14.)

NOTE: Make sure to set the Configuration DIP Switch as shown in Fig. 18. Switches 1 through 3 set the timing of the ML7984B valve actuator to match the controller outputs (0.1 second minimum with a maximum time of 25.6 seconds). Switch 4 determines the action of the actuator (Off = Direct Acting, On = Reverse Acting).

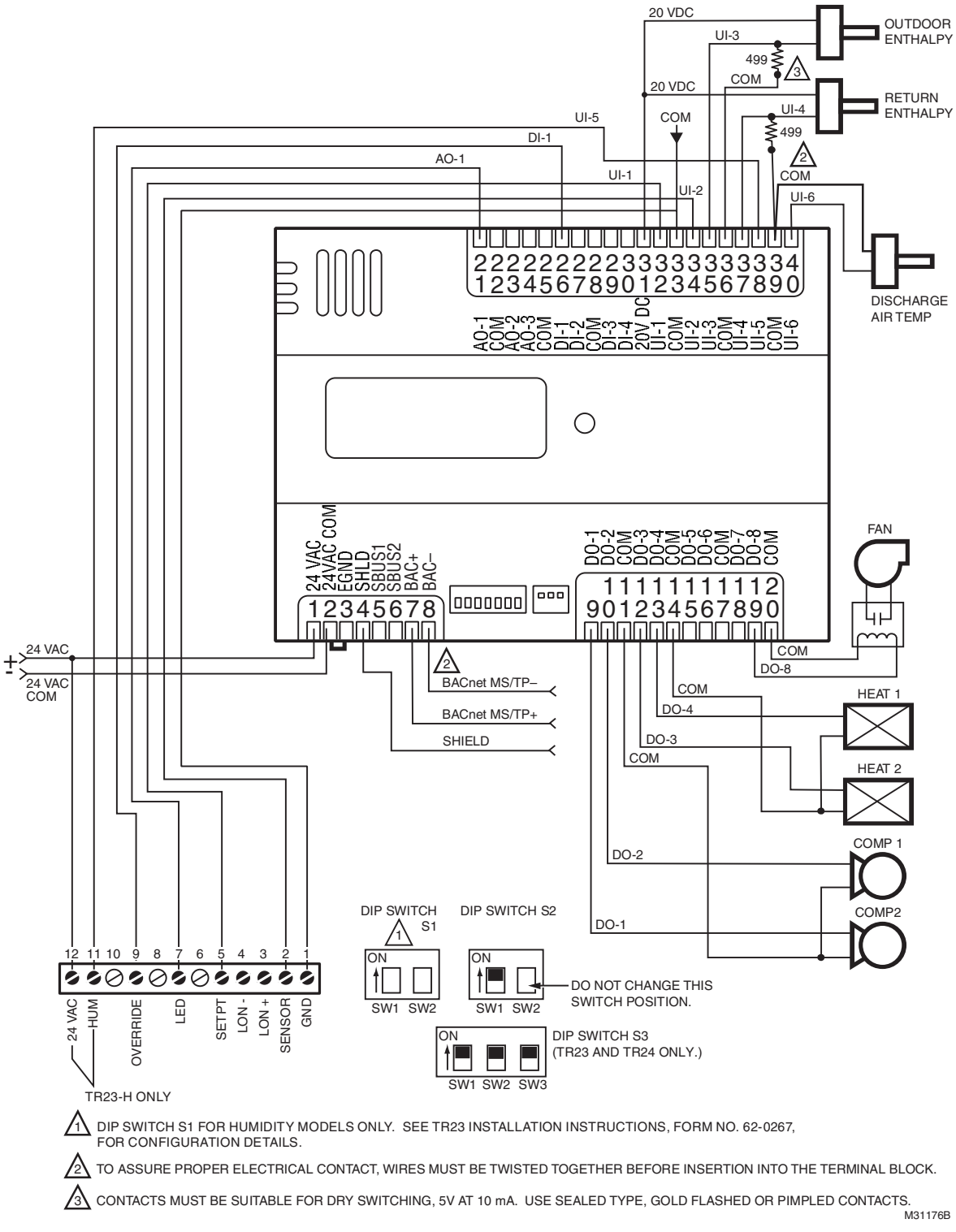


Fig. 19. Controller wiring diagram (model PUB6438S shown) for typical AHU application. (For note 2, refer to Fig. 14.)

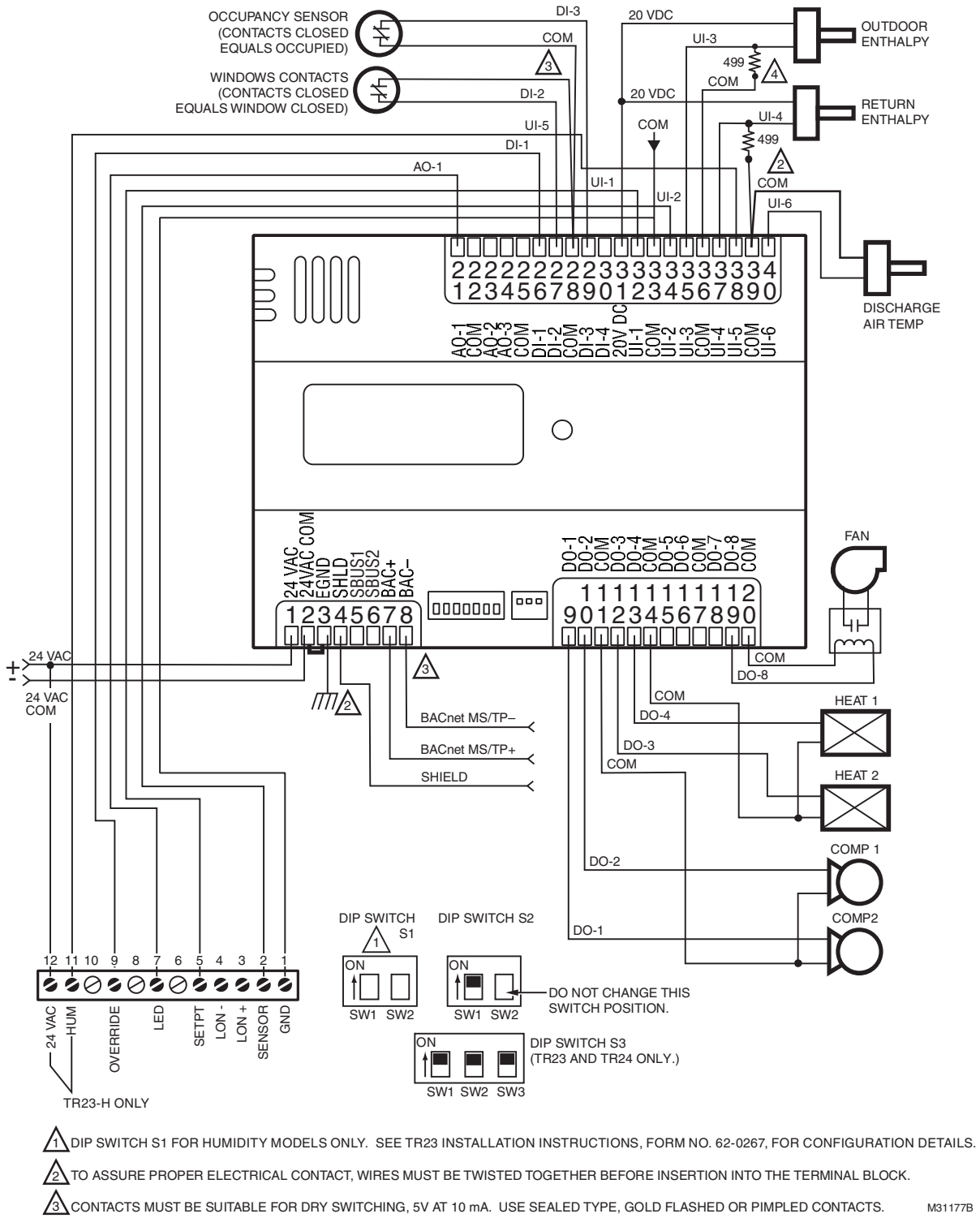
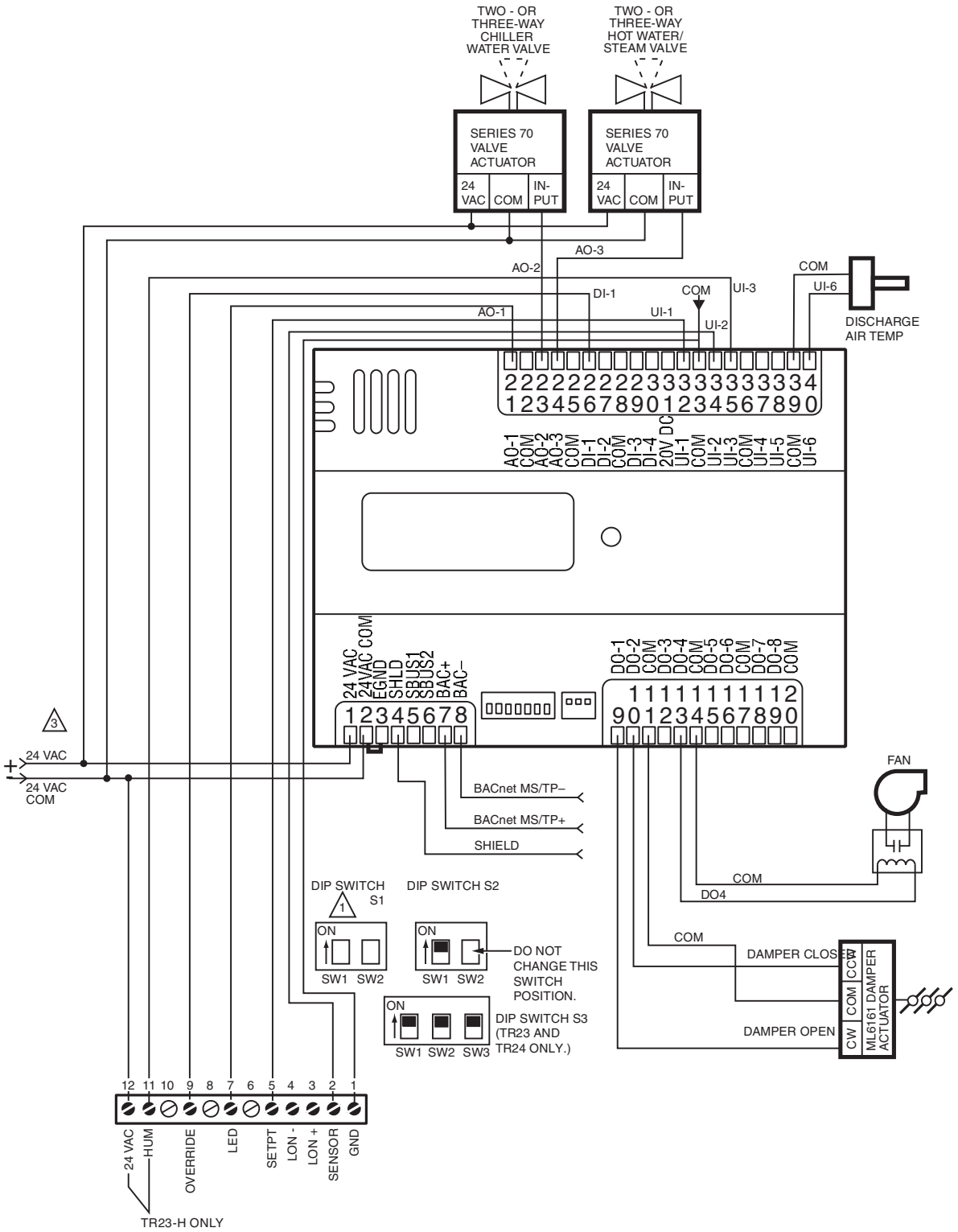


Fig. 20. Controller wiring diagram (model PUB6438S shown) with 4 to 20 mA enthalpy sensors and digital inputs. (For note 2, refer to Fig. 14.)



1 DIP SWITCH S1 FOR HUMIDITY MODELS ONLY. SEE TR23 INSTALLATION INSTRUCTIONS, FORM NO. 62-0267, FOR CONFIGURATION DETAILS.

2 EARTH GROUND WIRE LENGTH SHOULD BE HELD TO A MINIMUM. USE THE HEAVIEST GAUGE WIRE AVAILABLE, UP TO 14 AWG (2.0 MM^2) WITH A MINIMUM OF 18 AWG (1.0 MM^2), FOR EARTH GROUND WIRE.

3 TO ASSURE PROPER ELECTRICAL CONTACT, WIRES MUST BE TWISTED TOGETHER BEFORE INSERTION INTO THE TERMINAL BLOCK.

4 CONTACTS MUST BE SUITABLE FOR DRY SWITCHING, 5V AT 10 mA. USE SEALED TYPE, GOLD FLASHED OR PIMPLED CONTACTS.

M31178A

Fig. 21. Controller wiring diagram (model PUB6438S shown) with 4 to 20 mA heating, cooling, and model ML6161 damper actuator. (For note 2, refer to Fig. 14.)

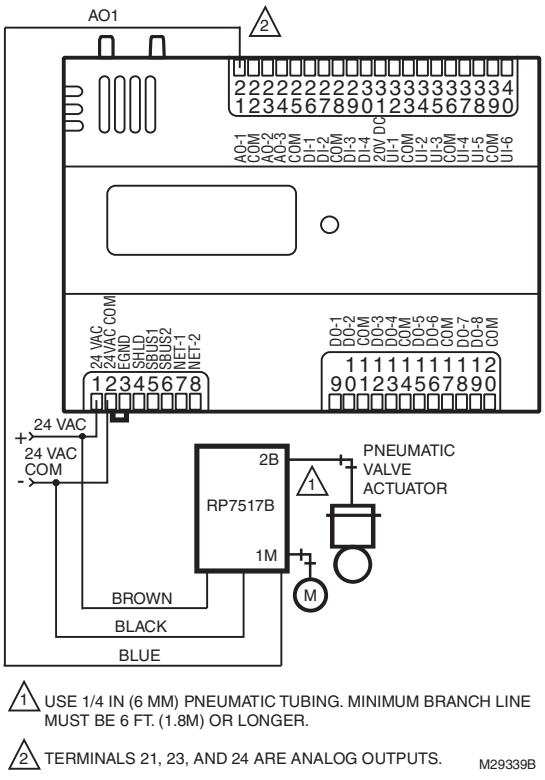


Fig. 22. Controller wiring diagram (model PUB6438S shown) for RP7517B pneumatic transducer.

CHECKOUT

Step 1. Check Installation and Wiring

Inspect all wiring connections at the controller terminals, and verify compliance with installation wiring diagrams. If any wiring changes are required, *first* be sure to remove power from the controller *before* starting work. Pay particular attention to:

— 24 Vac power connections. Verify that multiple controllers being powered by the same transformer are wired with the transformer secondary connected to the same input terminal numbers on each controller. Use a meter to measure 24 Vac at the appropriate terminals (see Fig. 12 on page 10). Controller configurations are not necessarily limited to three devices, but the total power draw, including accessories, cannot exceed 100 VA when powered by the same transformer (U.S. only).

— Be sure that each controller has terminal 3 wired to a verified earth ground, using a wire run as short as possible with the heaviest gauge wire available, up to 14 AWG (2.0 sq mm) with a minimum of 18 AWG (1.0 sq mm) for each controller in the group (see Fig. 12 on page 10).

— Check that the MS/TP network polarity has been connected properly on each controller. BACnet MS/TP is polarity sensitive; communication will be lost for the entire segment if one controller is connected improperly (see Fig. 13 on page 11).

— Verify that Triac wiring of the digital outputs to external devices uses the proper load power and 24 Vac common terminal (digital output common terminals) for High-Side switching.

NOTE: All wiring must comply with applicable electrical codes and ordinances or as specified on installation wiring diagrams.

For guidelines for wiring run lengths and power budget, see “Power” on page 7.

VERIFY END-OF-LINE TERMINATION RESISTOR PLACEMENT

The installation wiring diagrams should indicate the locations for placement of the end of line termination resistors. See Fig. 13 on page 11.

Correct placement of the end-of-line termination resistors is required for proper LONWORKS® Bus communications.

Step 2. Startup

Refer to Fig. 23 and the following text for startup information.

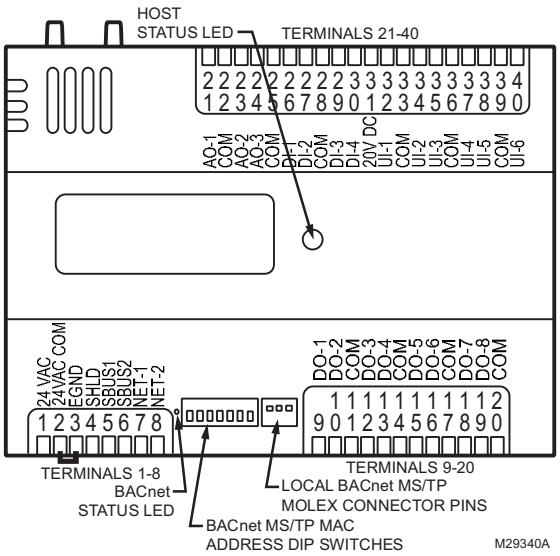


Fig. 23. LED, service, and network connection locations.

SET THE MS/TP MAC ADDRESS

The MS/TP MAC address DIP switches are used to set the unit's MAC address. Each Spyder BACnet on an MS/TP network must have a unique MAC address in the range of 0-127 (address 0 should be avoided as it is the Honeywell factory default MAC address for all MS/TP devices).

CONTROLLER STATUS LED:

The LED on the front of the controller provides a visual indication of the status of the device. When the controller receives power, the LED appears in one of the following allowable states, as described in Table 8.

Table 8. Status LED States.

LED State	Blink Rate	Status or Condition
OFF	Not applicable	No power to processor, LED damaged, low voltage to board, first second of power up or loader damaged.
ON	ON steady; not blinking	Processor not operating. Application Program CRC being checked. This takes 1-2 seconds and occurs on each restart (power up, reset and reflash, and following configuration file download).
Very Slow Blink (continuous)	1 second ON, 1 second OFF	Controller is operating normally.
Slow Blink (continuous)	0.5 second ON, 0.5 second OFF	Controller alarm is active or controller in process of configuration file download.
Medium Blink (continuous)	0.3 second ON, 0.3 second OFF	Controller is in reflash mode or awaiting/ receiving reflash data via the BACnet network.

BACNET STATUS LED:
The LED on the front of the controller, between the BACnet MS/TP terminals and MAC Address DIP Switches, provides a visual indication of the BACnet MS/TP communication status. When the controller receives power, the LED appears in one of the following allowable states, as described in Table 9.

Table 9. BACnet Status LED States.

BACnet LED Status	Status or Condition
Solid on	Controller has power, loader is not running.
Solid on, blinking off once in 2.5 sec.	Controller is in reflash mode, no MS/TP communication.
Solid on, blinking off twice in 2.5 sec.	Controller is in reflash mode, MS/TP communication present.
Solid on, blinking off thrice in 2.5 sec	Controller is in reflash mode, MS/TP communication data transfer in progress.
Solid off, there is no power	No power to processor, LED damaged, low voltage to board, or loader damaged.
Solid off, blinking on once in 2.5 sec.	Controller is running, no MS/TP communication.
Solid off, blinking on twice in 2.5 sec.	Controller is running, MS/TP communication present.
Solid off, blinking on thrice in 2.5 sec	Controller is running, MS/TP communication data transfer in progress.

Step 3. Checkout Completion

At this point the controller is installed and powered. To complete the checkout, the NIAGARA FRAMEWORK® application (run on a PC) is used to configure the I/O and functions of the controller. Refer to the Programming Tool User Guide, form no. 63-2662, for controller configuration and programming details.

CONTROLLER REPLACEMENT

There are no serviceable or repairable parts inside the controller.

WARNING
Fire, Explosion, or Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Do not attempt to modify the physical or electrical characteristics of this device in any way. Replace the controller if troubleshooting indicates a malfunction.

WARNING
Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Disconnect power supply before beginning controller replacement to prevent electrical shock or equipment damage.

Terminal Block Removal

To simplify controller replacement, all terminal blocks are designed to be removed with the wiring connections intact and then re-installed on the new controller. See Fig. 24 and refer to the following procedure:

IMPORTANT

To prevent bending or breaking the alignment pins on longer terminal blocks, insert the screwdriver at several points to evenly and gradually lift up the terminal block.

Insert the screwdriver blade no more than 1/8 in. (3 mm) to prevent damage to the terminal block alignment pins on the controller circuit board.

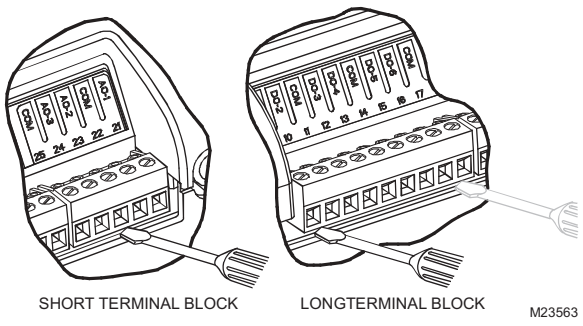


Fig. 24. Removing Terminal Blocks.

1. Use a thin-bladed screwdriver to evenly raise the terminal block from its alignment pins:
   a. For short terminal blocks (1 to 5 terminals), insert screwdriver blade in the center of the terminal block and use a back and forth twisting motion to gently raise the terminal block from its alignment pins 1/4 in. (6.35 mm).
   b. For long terminal blocks (6 or more terminals), insert screwdriver blade on one side of the terminal block and gently rotate the blade 1/4 turn. Then, move to the other side of the terminal block and do the same. Repeat until the terminal block is evenly raised 1/4 in. (6.35 mm) from its alignment pins.

2. Once the terminal block is raised 1/4 in. (6.35 mm) from its alignment pins, grasp the terminal block at its center (for long terminal blocks grasp it at each end) and pull it straight up.

Controller Replacement (PVB0000AS, PVB4022AS and PVB6436AS)

For PVB0000AS, PVB4022AS and PVB6436AS controllers, which are hard-wired to an actuator, perform the following actions to replace the complete assembly (controller and actuator):

1. Remove all power from the controller.
2. Remove the two air flow pickup connections from the pressure sensor.
3. Remove the terminal blocks (See “Terminal Block Removal”).
4. Remove the old controller and actuator assembly from its mounting.
   - Loosen the two bolts on the actuator clamp to release the actuator from the shaft.
   - Remove the controller’s mounting screws.
   - Gently pull the controller and actuator assembly straight out, until the assembly is clear of the actuator shaft.
5. Mount the new controller and actuator assembly (See “Installation” on page 3.).
6. Reconnect the two air flow pickup tubes to the pressure sensor (See “Piping (PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS and PVB6438NS)” on page 6.).
7. Replace the terminal blocks:
   - Insert each terminal block onto its alignment pins.
   - Press straight down to firmly seat it.
   - Repeat for each terminal block.
8. Restore power to the controller.
9. Perform “Checkout” on page 20.

Controller Replacement (PVB4024NS and PVB6438NS)

Perform the following to replace the PVB4024NS and PVB6438NS controllers:

1. Remove all power from the controller.
2. Remove the two air flow pickup connections from the pressure sensor.
3. Remove the terminal blocks.
   - See “Terminal Block Removal” on page 21.
4. Remove the old controller from its mounting.

IMPORTANT

(FOR CONTROLLERS MOUNTED TO A DIN RAIL):

1. *Push straight up from the bottom to release the top pins.*
2. *Rotate the top of the controller outwards to release the bottom flex connectors (see Fig. 8 on page 6).*

5. Mount the new controller.
   - See “Installation” on page 3.
6. Reconnect the two air flow pickup tubes to the pressure sensor (See “Piping (PVB0000AS, PVB4022AS, PVB4024NS, PVB6436AS and PVB6438NS)” on page 6.).
7. Replace the terminal blocks:
   - Insert each terminal block onto its alignment pins.
   - Press straight down to firmly seat it.
   - Repeat for each terminal block.
8. Restore power to the controller.
9. Perform “Checkout” on page 20.

Controller Replacement (PUB1012S, PUB4024S, PUB6438S and PUB6438SR)

Perform the following to replace the PUB1012S, PUB4024S PUB6438S and PUB6438SR controllers:

1. Remove all power from the controller.
2. Remove the terminal blocks (See “Terminal Block Removal” on page 21.).
3. Remove the old controller from its mounting.

IMPORTANT

(FOR CONTROLLERS MOUNTED TO A DIN RAIL):

1. *Push straight up from the bottom to release the top pins.*
2. *Rotate the top of the controller outwards to release the bottom flex connectors (see Fig. 8 on page 6).*

4. Mount the new controller. (See “Installation” on page 3.)
5. Replace the terminal blocks:
   - Insert each terminal block onto its alignment pins.
   - Press straight down to firmly seat it.
   - Repeat for each terminal block.
6. Restore power to the controller.
7. Perform “Checkout” on page 20.

Automation and Control Solutions
Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422
customer.honeywell.com

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Printed in United States

Honeywell

Sylk™ I/O Devices

SPECIFICATION DATA

APPLICATION

The Sylk IO devices are part of the Spyder family. The three IO devices are designed to seamlessly integrate with Spyder with relay controllers using only Sylk™ for communication. These devices expand the footprint of a single Spyder, increasing the controller's ability to be applied in applications that require a large amount of physical I/O. The Sylk IO devices are programmable using existing Spyder wire sheets through the Niagara Framework® software. Since the Sylk IO devices are extensions of the Spyder LON and Spyder BACnet controllers, the same Spyder feature will be leveraged in the WebPro workbench tool and the WEBs-AX JACE controller. To utilize the Sylk IO devices, the Spyder with Relay models, PUL6438SR (for LON) and PUB6438SR (for BACnet), need to be selected.

The Sylk IO devices are intended for use in HVAC applications that require a programmable controller where the IO count is more than the full sized Spyder point count. All devices provide flexible, universal inputs for external sensors while SIO6042 and SIO4022 provide a combination of analog and digital outputs.

FEATURES

- **Expands a single Spyder controller's IO count by 8-12 IO per device.**
- **Up to three devices for Lon Spyders and up to two devices for BACnet Spyders can be applied.**
- **Communicates through Sylk™ bus freeing up IO for more applications.**
- **Program logic resides in a single controller and uses the existing Spyder wire sheet.**
- **Programming is built directly into the Spyder tool.**
- **Installation can be done locally or remotely.**
- **Field configurable and programmable for control, input, and output functions using the Niagara Framework® software.**
- **All wiring connections are made to removable terminal blocks to simplify device installation and replacement.**
- **The device housing is UL plenum rated.**

Sylk™ Enabled
Easy 2-wire installation

c UL US LISTED

DESCRIPTION

The Sylk IO devices are available in three models, as described in Table 1.

Table 1. Device Configurations.

Devices	UI (Universal Input)	DI (Digital Input)	AO (Analog Output)	DO (Digital Output)
SIO6042	6	0	4	2
SIO4022	4	0	2	2
SIO12000	12	0	0	0

Each device is programmable because the user chooses which function blocks to use and how to connect them. It is configurable because each function block has user-defined behavior.

SPECIFICATIONS

Electrical

Rated Voltage: 20-30 Vac; 50/60 Hz
Power Consumption:
100 VA for Sylk IO device and all connected loads
Sylk IO Device only Load: 3 VA maximum (SIO12000), 4 VA maximum (SIO4022), 5 VA maximum (SIO6042)

Environmental

Operating & Storage Temperature Ambient Rating:
Minimum -40° F (-40° C); Maximum 150° F (65.5° C)
Relative Humidity: 5% to 95% non-condensing

Dimensions (H/W/D)

See Fig. 1 on page 4 for dimensioned drawings.

Dimensions: 6.266 x 4.750 x 2.26 in.
(159 x 120.6 x 57.4 mm)

Approval Bodies

UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.

CSA (LR95329-3) listed.

Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.

Meets Canadian standard C108.8 (radiated emissions).

EMC Directive: 2014/30/EU:
Standards Applied:
- IEC 61000-4-8:2009
- IEC 61000-4-11:2004
- EN 61000-6-1: 2007; EN 61000-6-3:2007/A1:2011;

EN 61000-6-3:2007/A1:2011/AC: 2012
- EN 60730-2-9: 2010, EN 60730-2-14: 1997 + EN60730-2-14/A1: 2001.
- In conjunction with EN 60730-2-9:2010 and in conjunction with EN 60730-2-14:1997 and amendments: EN 60730-1: 2000 + A1: 2004 + A16: 2007 + A2: 2008 -Annex H.26.

RoHS Directive: 2011/65/EU

Standards Applied:
- EN 50581: 2012

Inputs and Outputs

Each device has a combination of digital outputs (DO), analog outputs (AO), and universal input (UI) circuits.

Digital Triac Output (DO) Circuits

Voltage Rating: 20 to 30 Vac @ 50-60Hz
Current Rating: 25 mA to 500 mA continuous, 800 mA (AC rms) for 60 milliseconds

Analog Output (AO) Circuits

Analog outputs are individually configurable for current or voltage.

ANALOG CURRENT OUTPUTS:
Current Output Range: 4.0 to 20.0 mA
Output Load Resistance: 550 Ohms maximum

ANALOG VOLTAGE OUTPUTS:
Voltage Output Range: 0.0 to 10.0 Vdc
Maximum Output Current: 10.0 mA

Analog outputs may be configured as digital outputs and operate as follows:
- False (0%) produces 0 Vdc, (0 mA)
- True (100%) produces the maximum 11 Vdc, (22 mA)

Universal Input (UI) Circuits

See Table 2 for the UI specifications.

Table 2. Universal Input Circuit Specifications.

Input Type	Sensor Type	Operating Range
Room/Zone Discharge Air Outdoor Air Temperature	20K Ohm NTC	-40° F to 199° F (-40° C to 93° C)
Outdoor Air Temperature	C7031G[a]	-40° to 120°F (-40° to 49°C)
	C7041F[a]	-40° to 250°F (-40° to 121°C)
	PT1000 (IEC751 3850)	-40° F to 199° F (-40° C to 93° C)
TR23 Setpoint Potentiometer	500 Ohm to 10,500 Ohm	-4° DDC to 4° DDC (-8° DDF to 7° DDF) or 50° F to 90° F (10° C to 32° C)
Resistive Input	Generic	100 Ohms to 100K Ohms
Voltage Input	Transducer, Controller	0 - 10 Vdc
Discrete Input	Dry Contact closure	OpenCircuit ≥ 3000Ohms ClosedCircuit < 3000Ohms

[a] C7031G and C7041F are recommended for use with these controllers, due to improved resolution and accuracy when compared to the PT1000.

CPU

Each device uses a 32 bit ATMEL ARM 7 microprocessor.

Memory Capacity

Flash Memory: 512 kilobytes. The device is able to retain Flash memory settings for up to ten (10) years.

RAM: 128 kilobytes

Device Status LED

The LED on the front of the device provides a visual indication of the status of the device. When the device receives power, the LED appears in one of the following allowable states, as described in Table 3.

Table 3. Status LED States.

LED State	Blink Rate	Status or Condition
OFF	not applicable	No power to processor, LED damaged, low voltage to board, first second of power up, or loader damaged.
ON	ON steady; not blinking	Processor not operating. Application Program CRC being checked. This takes 1-2 seconds and occurs on each restart (power up, reset and reflash, and following configuration file download).
Very Slow Blink (continuous)	1 second ON, 1 second OFF	Device is operating normally.
Slow Blink (continuous)	0.5 second ON, 0.5 second OFF	Device alarm is active or device in process of configuration file download.

Sylk™ Bus

Sylk is a two wire, polarity insensitive bus that provides both 18 VDC power and communications between a Sylk-enabled sensor and a Sylk-enabled controller. Using Sylk-enabled sensors saves I/O on the controller and is faster and cheaper to install since only two wires are needed and the bus is polarity insensitive. Sylk sensors are configured using the latest release of the Spyder Tool for WEBPro and WEBStation.

Mounting

The Sylk IO device enclosure is constructed of a plastic base plate and a plastic factory-snap-on cover. The cover does not need to be removed from the base plate for either mounting or wiring. Removable terminal blocks are used for all wiring connections, which allow the device to be wired before or after mounting.

The Sylk IO device can be mounted in any orientation. Ventilation openings are designed into the cover to allow proper heat dissipation, regardless of the mounting orientation.

The device mounts to either a panel or a DIN rail [standard EN50022; 1-3/8 in. x 9/32 in. (7.5 mm x 35 mm)].

- For panel mounting, use four No. 6 or No. 8 machine sheet metal screws inserted through the corners of the base plate.
- For DIN rail mounting, refer to the Installation Instructions, form 62-0310.

NOTE: The Sylk IO device must be mounted in a position that allows clearance for wiring, servicing, and removal.

NOTE: For complete mounting information, refer to the Installation Instructions, form 62-0310.

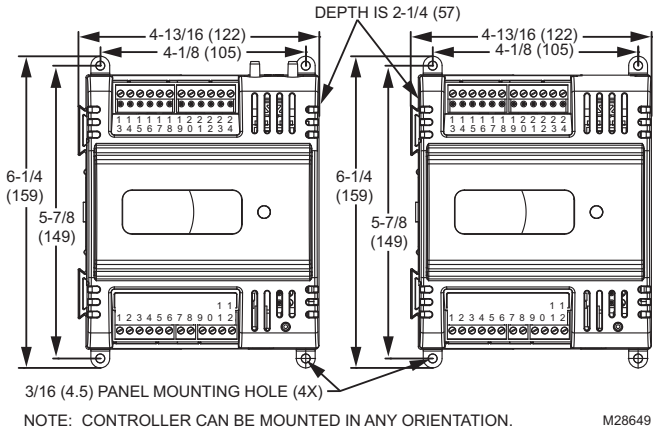

Fig. 1. Device dimensions in in. (mm).

Home and Building Technologies

In the U.S.:

Honeywell

1985 Douglas Drive North

Golden Valley, MN 55422-3992

customer.honeywell.com

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Printed in United States

Honeywell

VisionPRO® 8000 with RedLINK™

PRODUCT DATA

APPLICATION

The VisionPRO® 8000 with RedLINK™ features an effortless, 7-Day programmable touchscreen thermostat that provides control of temperature, humidification, dehumidification, and ventilation for up to 4 Heat/2 Cool heat pump systems or up to 3 Heat/2 Cool conventional systems for residential and commercial applications.

FEATURES

- **RedLINK™ Compatible**
  Increase your content and profit per job by including RedLINK™ accessories that meet your customers' comfort and convenience needs. RedLINK accessories include the Wireless Outdoor Sensor, Portable Comfort Control (PCC), Equipment Interface Module (EIM), RedLINK Internet Gateway, Wireless Indoor Sensor, TrueSTEAM™ humidifier with Wireless Adapter, TrueZONE™ zoning panel with Wireless Adapter, Vent Boost Remote and Entry/Exit Remote.

- **Also Compatible with Equipment Remote Module (ERM) ERM5220R**

- **Customizable Service Reminders**
  Set up to 10 service reminders. Choose from the pre-set options or customize your own. Reminders can be based on date or the outdoor temperature.

- **Universal Inputs**
  Thermostat - S1
  EIM - S1, S2, S3, S4
  Assignable inputs allow you to setup Indoor and Outdoor Temperature Sensors, Discharge and Return Air Sensors or Dry Contact Devices. Dry Contact Devices can be used to trip pre-set or customized alerts on the thermostat home screen. Note: Dry Contact Alerts require an Equipment Interface Module (EIM).

- **User Interaction Log**
  The interaction log stores history of thermostat setting changes including temperature, system and installer setup. You can use the interaction log to save time by determining if the issue is a system error or an accidental user error. The Interaction Log is only viewable on a computer after you download it from the thermostat to a microSD card.

- **Selectable for Residential and Light Commercial Applications**
  One thermostat does it all to meet the needs of Residential and Light Commercial applications. Simply select Residential or Commercial during the installer setup. If Commercial is selected, the thermostat will use commercial language, meet building codes and offer 365 day holiday scheduling.

- **MicroSD Card Port for Quick Installer Setup**
  Save time by using a microSD card to upload installer settings and service reminders in one simple step.

- **Selectable Sensors**
  When paired with a Wireless Indoor Sensor(s) you have the ability to choose which sensor(s) to use for temperature, humidification and dehumidification. They can be used in combination for temperature averaging—or individually—to condition humidity levels in separate spaces.

68-0312-04

CONTENTS

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number. If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Environmental and Combustion Controls Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386
3. http://customer.honeywell.com or http://customer.honeywell.ca

International Sales and Service Offices in all principal cities of the world. Manufacturing in Belgium, Canada, China, Czech Republic, Germany, Hungary, Italy, Mexico, Netherlands, United Kingdom, and United States.

SPECIFICATIONS

Thermostat Description:

Feature	Description
Powering method	• Common wire or battery
System types (up to 4 heat/2 cool heat pump and up to 3 heat/2 cool conventional)	• Gas, oil or electric heat with air conditioning • Warm air, hot water, high-efficiency furnaces, heat pumps, steam and gravity • Cool only
Changeover	Manual or Auto changeover selectable
System setting	Em Heat-Heat-Off-Cool-Auto
Fan setting	Auto-On-Circ-Follow Schedule

Electrical Ratings for: the Equipment Interface Module and VisionPRO Thermostats

NOTE: To find what terminals are available on the Equipment Interface Module and the VisionPRO Thermostats, see "Terminal Designations" below the table.

Terminal	Voltage (50/60 Hz)	Max. Current Rating
W - O/B	18 to 30 VAC and 750 mVDC	1.00A
Y (cooling)	18 to 30 VAC	1.00A
G (fan)	18 to 30 VAC	0.50A
W2 - Aux 1 (heating)	18 to 30 VAC	0.60A
W3 - Aux 2 (heating)	18 to 30 VAC	0.60A
Y2 (cooling)	18 to 30 VAC	0.60A
A-L/A (Output)	18 to 30 VAC	1.00A
U1, U1 U2, U2 U3, U3	30 VAC max.	0.50A

Terminal Designations:
— Equipment Interface Module: R, RC, RH, C, W-O/B, W2-AUX 1, W3-AUX 2, Y, Y2, G, A-L/A, U1 U1, U2 U2, U3 U3, S1 S1, S2 S2, S3 S3, S4 S4, A, B, C, D
— TH8321 Thermostat: R, RC, C, W-O/B, W2-AUX/E, Y, Y2, G, A-L/A, K, U1 U1, S1 S1
— TH8320 Thermostat: R, RC, C, W-O/B, W2-AUX/E, Y, Y2, G, A-L/A, K, S1 S1
— TH8110 Thermostat: R, RC, C, W-O/B, Y, G, K, S1 S1

Power Consumption of TH8321/TH8320/TH8110:
Backlight on: 1.44 VA
Backlight off: 1.32 VA

RedLINK Communication:
Frequency: 900 Mhz frequency range
Re-Sync Time: RedLINK devices re-establish communication within 6 minutes after AC power resumes.

Temperature Setting Range:
Heating: 40 to 90 °F (4.5 to 32 °C).
Cooling: 50 to 99 °F (10 to 37 °C).

Temperature Sensor Accuracy:
± 1.5 F at 70 F (0.75 C at 21.0 C)

Humidification Setting Range:
10% to 60% RH.

Dehumidification Setting Range:
40% to 80% RH.

Humidity Display Range:
0% to 99%.

Humidity Sensor Accuracy:
± 5% RH from 30% to 50% RH at 75 F.

Cool Indication:
VisionPRO® 8000 with RedLINK™ displays “Cool On” when the thermostat turns the cooling on.

Heat Indication:
VisionPRO® 8000 with RedLINK™ displays “Heat On” when the thermostat turns the heating on.

Auxiliary Heat Indication:
VisionPRO® 8000 with RedLINK™ displays “Aux Heat On” when the thermostat turns the auxiliary heat on.

Interstage Differential:
Comfort: The thermostat keeps the indoor temperature within 1 degree of the setpoint (droop less control). The thermostat turns on stage 2 when the capacity on stage 1 reaches 90%.
When the interstage differential is set to 1.0 or higher, the thermostat stages the equipment based on how far the indoor temperature is from the setpoint (ISU 303 to 309). See page 27 for more information.

Clock Accuracy: 1 minute per month at 77 °F (25 °C). ± 2 minutes per month over the operating ambient temperature range.

Mounting Means:
Thermostat mounts directly on the wall in the living space using mounting screws and anchors provided. Fits a horizontal 2 x 4 in. junction box.
Equipment Interface Module (EIM) mounts on HVAC equipment or on a wall in the equipment room.

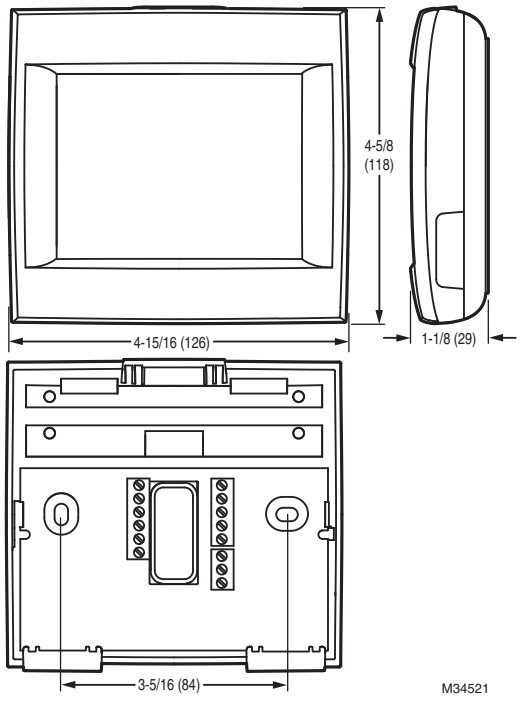


Fig. 1. Dimensions of thermostat in in. (mm).

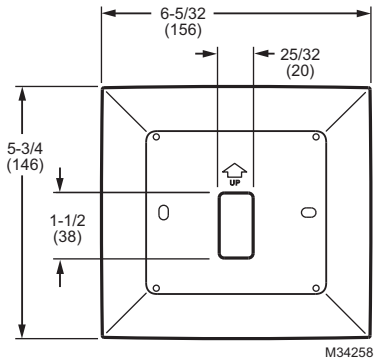


Fig. 2. Dimensions of VisionPRO cover plate in in. (mm).

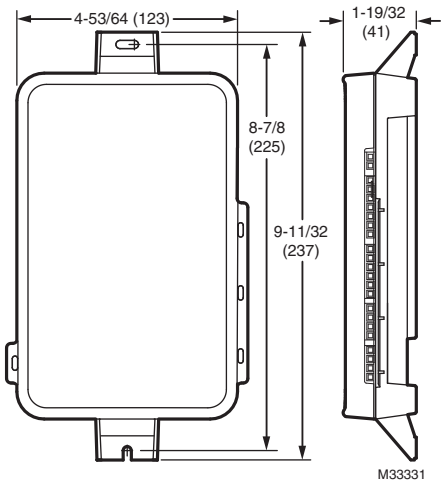


Fig. 3. Dimensions of Equipment Interface Module in in. (mm).

Product	Part Number	Operating Ambient Temperature	Operating Relative Humidity	Shipping Temperature	Physical Dimensions in in. (mm)	Color(s)
Thermostat	TH8321R1001 TH8321WF1001 TH8320R1003 TH8110R1008	32 to 120 °F (0 to 48.9 °C)	5% to 90% Non-Condensing	-20 to 120 °F (-28.9 to 48.9 °C)	4-15/16 x 4-5/8 x 1-1/8 (126 x 118 x 29)	Arctic White
Equipment Interface Module	YTHM5421R1010* THM5421R1021	-40 to 165 °F (-40 to 73.9 °C)	5% to 95% Non-Condensing	-20 to 165 °F (-28.9 to 73.9 °C)	9-11/32 x 4-53/64 x 1-19/32 (237 x 123 x 41)	Gray
Wireless Adapter (For TrueZONE, TrueSTEAM or extend wireless range of EIM)	THM4000R1000	-40 to 165 °F (-40 to 73.9 °C)	5% to 95% Non-Condensing	-20 to 165 °F (-28.9 to 73.9 °C)	5-9/16 x 4-3/8 x 1-1/4 (141 x 112 x 32)	Gray
RedLINK Internet Gateway	THM6000R1002	32 to 120 °F (0 to 48.9 °C)	5% to 95% Non-Condensing	-20 to 120 °F (-28.9 to 48.9 °C)	6 x 4-7/8 x 2-1/2 (152 x 124 x 64)	Black
Portable Comfort Control	REM5000R1001	32 to 120 °F (0 to 48.9 °C)	5% to 90% Non-Condensing	-20 to 120 °F (-28.9 to 48.9 °C)	6-1/4 x 3-1/8 x 1-5/8 (158 x 80 x 38)	Arctic White, Gray
Wireless Entry/Exit Remote	REM1000R1003	32 to 120 °F (0 to 48.9 °C)	5% to 90% Non-Condensing	-20 to 120 °F (-28.9 to 48.9 °C)	3-15/16 x 1-15/16 x 5/8 (101 x 50 x 16)	Arctic White
Wireless Vent and Filter Boost Remote	HVC20A1000	32 to 120 °F (0 to 48.9 °C)	5% to 90% Non-Condensing	-20 to 120 °F (-28.9 to 48.9 °C)	3-15/16 x 1-15/16 x 5/8 (101 x 50 x 16)	Arctic White
Wireless Outdoor Sensor	C7089R1013	-40 to 140 °F (-40 to 60 °C)	0% to 100% Condensing	-40 to 120 °F (-40 to 48.9 °C)	5 x 3-1/2 x 1-11/16 (127 x 89 x 43)	Gray
Wireless Indoor Sensor	C7189R1004	0 to 120 °F (-17.8 to 48.9 °C) For optimal Battery Life: 35 to 114 °F (1.7 to 45.6 °C)	5% to 90% Non-Condensing	-20 to 120 °F (-28.9 to 48.9 °C)	2-7/8 x 1-7/8 x 15/16 (74 x 48 x 24)	Arctic White
Wired Outdoor Sensor (10K ohm Negative Temperature Coefficient)	C7089U1006	-40 to 120 °F (-40 to 48.9 °C)	5% to 95% Non-Condensing	-40 to 130 °F (-40 to 54.4 °C)	1-1/2 (38)	- -

Product	Part Number	Operating Ambient Temperature	Operating Relative Humidity	Shipping Temperature	Physical Dimensions in in. (mm)	Color(s)
Wired Wall Mount Indoor Sensor (10K ohm Negative Temperature Coefficient)	C7189U1005	45 to 88 °F (7 to 32 °C)	5% to 95% Non-Condensing	-20 to 120 °F (-28.9 to 48.9 °C)	2-9/32 x 1-1/2 x 11/16 (58 x 38 x 18)	Premier White
Wired Wall Mount Indoor Sensor (20K ohm Negative Temperature Coefficient)	TR21	45 to 99 °F (7 to 37 °C)	5% to 95% Non-Condensing	-40 to 150 °F (-40 to 65.5 °C)	4-9/16 x 3 x 7/8 (116 x 76.5 x 22)	White
Wired Wall Mount Indoor Sensor (10K ohm Negative Temperature Coefficient)	TR21-A	45 to 99 °F (7 to 37 °C)	5% to 95% Non-Condensing	-40 to 150 °F (-40 to 65.5 °C)	4-9/16 x 3 x 7/8 (116 x 76.5 x 22)	White
Wired Flush Mount Indoor Sensor (20K ohm Negative Temperature Coefficient)	C7772A1004	45 to 99 °F (7 to 37 °C)	5% to 95% Non-Condensing	-40 to 150 °F (-40 to 65.5 °C)	4-1/2 x 2-3/4 x 5/16 (114 x 70 x 8)	Brushed Stainless Steel
Wired Flush Mount Indoor Sensor (20K ohm Negative Temperature Coefficient)	C7772A1012	45 to 99 °F (7 to 37 °C)	5% to 95% Non-Condensing	-40 to 150 °F (-40 to 65.5 °C)	4-1/2 x 2-3/4 x 5/16 (114 x 70 x 8)	Brushed Stainless Steel
Discharge or Return Air Sensor (10K ohm Negative Temperature Coefficient)	C7735A1000*	0 to 200 °F (- 17.8 to 93.3 °C)	- -	-20 to 120 °F (-28.9 to 48.9 °C)	Probe: 3-3/4 x 1/4 (77 x 6.4) Cap Diameter: 2-7/16 (62)	Gray
Discharge or Return Air Sensor (20K ohm Negative Temperature Coefficient)	C7041	- -	- -	- -	4-3/16 x 2-5/16 x 1-11/16 (107 x 59 x 43)	- -
Discharge or Return Air Sensor (20K ohm Negative Temperature Coefficient)	C7770A1006	45 to 99 °F (7 to 37 °C)	5% to 95% Non-Condensing	-40 to 150 °F (-40 to 65.5 °C)	Probe: 6 x 1/4 (152 x 6.4)	- -
Occupancy Sensor for Remote Setback (Requires an Equipment Interface Module)	WSK-24	Receiver: - 5 to 140 °F (-21 to 60 °C) Door Sensor: -4 to 140 °F (-20 to 60 °C) PIR Sensor: -4 to 104 °F (-20 to 40 °C)	- -	- -	Receiver: 3.6 x 3.4 x 1.2 (91.4 x 86.4 x 30.5) Door Sensor: 1.4 x 2.3 x 0.6 (35.8 x 57.6 x 15.2) PIR Sensor: 2.8 x 3.9 x 1.1 (71 x 100 x 28)	White
Coverplate (covers marks left by old thermostats)	THP2400A1019	- -	- -	- -	5-3/4 x 6-5/32 (146 x 156)	Arctic White
Wire Saver Module	THP9045A1023	-40 to 163 °F (-40 to 73 °C)	5% to 90% Non-Condensing	-40 to 185 °F (-40 to 85 °C)	- -	Gray

* The YTHM5421R1010 Equipment Interface Module Kit includes 50062329-001 Discharge/Return Air Sensors. Replacement Discharge/Return Air Sensor part number is C7735A1000.

SYSTEM INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow the instructions can damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After completing installation, use these instructions to verify the product operation.

Finding Your Password (Date Code)

You will need the thermostat password to:

- Add or remove RedLINK accessories
- Make changes to Installer Setup
- Perform an Installer Test
- Reset Thermostat to Factory Default Settings

The password (date code) is located on the back of the thermostat (see Fig. 4)

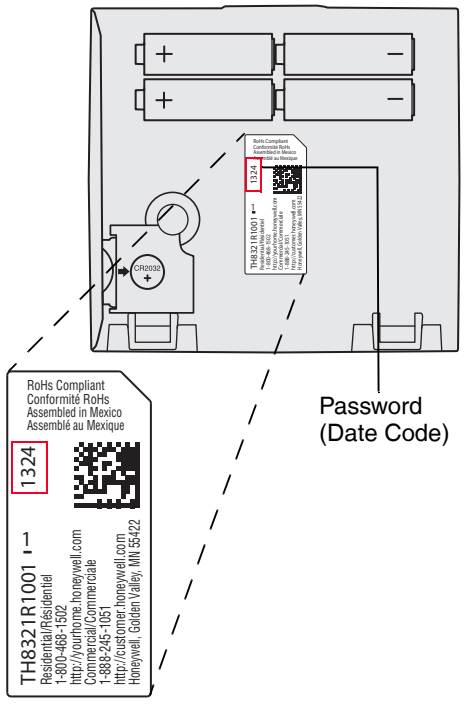


Fig. 4. Finding thermostat password.

You can also find the password (date code) by pressing MENU, selecting Dealer Information and then scrolling down to see the Date Code.

INSTALLATION OPTIONS

The VisionPRO® 8000 with RedLINK™ system can be wired directly to the equipment, used with an Equipment Interface Module, or with a TrueZONE wireless adapter.

If using the Equipment Interface Module, see “Installing Equipment Interface Module (if used)” on page 8.

If using a TrueZONE wireless adapter, follow the installation instructions that came with the TrueZONE panel, and go to “Selecting Thermostat Location” beginning on page 11.

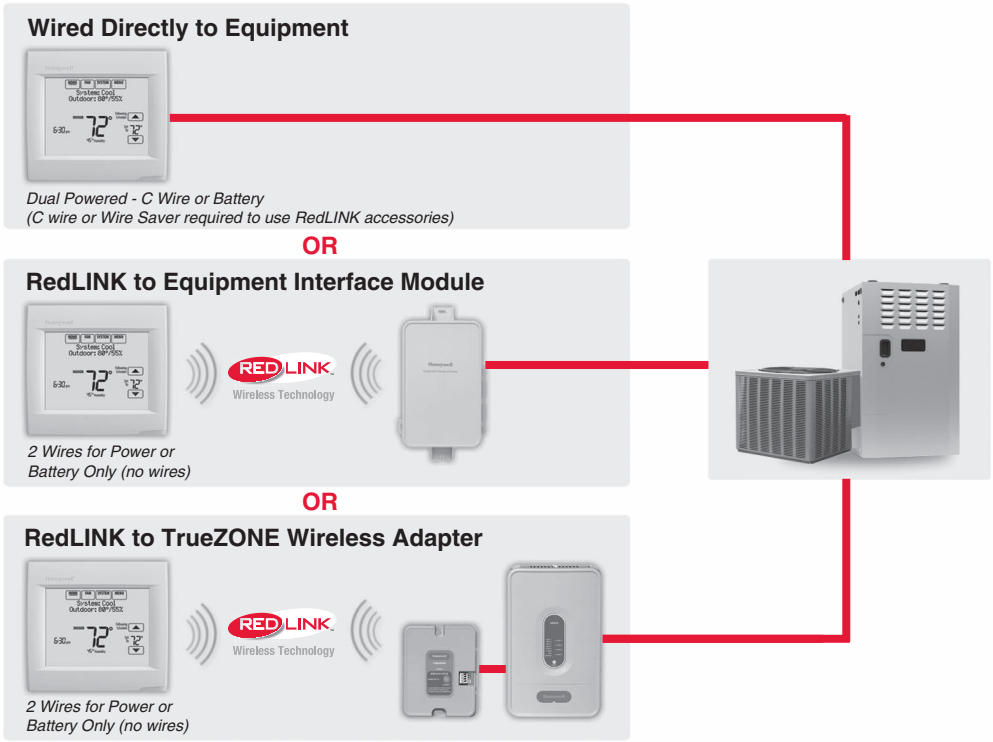


Fig. 5. VisionPRO® 8000 with RedLINK™ installation options.

Model Numbering	TH8321	TH8320	TH8110
Stages	3H/2C HP 2H/2C CONV	3H/2C HP 2H/2C CONV	1H/1C HP 1H/1C CONV
Residential or Commercial	✓	✓	✓
Dual Powered - C Wire or Battery	✓	✓	✓
Onboard Humidity Sensor	✓		
Number of Universal Relays	1	0	0
Number of Universal Sensor Inputs	1	1	1
Economizer / TOD Output	✓	✓	
Works with Optional Equipment Interface Module*	✓	✓	✓
Works with Optional TrueZONE Wireless Adapter*	✓	✓	✓

* The relay outputs and inputs on the thermostat do not function when used with an Equipment Interface Module or the TrueZONE Wireless Adapter.
* If the thermostat has been setup WITHOUT an Equipment Interface Module or the TrueZONE Wireless Adapter and you would like to add one, you must reset the thermostat back to factory defaults. Press MENU > Installer Options > scroll down to select Reset to Defaults.

Guidelines for Installing RedLINK Devices

— When installing more than one Thermostat and Equipment Interface Module, mount the Equipment Interface Modules at least 2 feet apart for best RedLINK performance. No minimum distance is required between the Thermostats if the Thermostat is linked to an Equipment Interface Module.
— When the Thermostat is wired directly to the equipment (No Equipment Interface Module and No TrueZONE Wireless Adapter), mount the Thermostats at least 2 feet apart for best RedLINK performance.
— To determine if a RedLINK device will communicate properly in the installed location, during the connection process, press and quickly release the connect button on the RedLINK device at the desired mounting location. If the RedLINK device connects, then it will work reliably during normal operation. If the RedLINK device does NOT connect, try a new location. During the connection process, the signal is sent at low power and during normal operation the signal is sent at high power.
— To connect a RedLINK device, make sure to press and quickly release the connect button on the RedLINK device. Press and holding the connect button down too long will not allow the device to connect.
— If you link the Thermostat to the TrueZONE Wireless Adapter, you will NOT be able to do the following: control humidification, dehumidification or ventilation, setup a program schedule remotely from a computer, smart phone or tablet, work with the Wireless Indoor Sensor, Entry / Exit Remote or the Vent and Filter Boost Remote. To use these features, wire the Thermostat directly to the zone panel or use an Equipment Interface Module.
— If you are using a RedLINK device from a previous installation, you must reset the device first before you re-connect it to the new Thermostat/Equipment Interface Module. See page 116 for more information.

Installing Equipment Interface Module (if used)

If no Equipment Interface Module is used, skip to “Selecting Thermostat Location” beginning on page 11.

NOTE: If an EIM is mounted inside a metal cabinet, such as a commercial rooftop unit, it is recommended to use a THM4000R1000 Wireless Adapter for extended wireless range. Mount the Wireless Adapter outside the metal cabinet and connect to the ABCD terminals at the EIM. The Wireless Adapter functions as a remote antenna for the EIM. After it is wired to the EIM, it automatically takes over as the antenna for RedLINK communication. For best RedLINK performance, avoid mounting the Wireless Adapter above the roof deck or outside the exterior walls.

NOTE: If you install more than one thermostat and EIM, the EIMs must be at least 2 feet apart for best RedLINK performance.

⚠ CAUTION
Electrical Hazard.
Can cause electrical shock or equipment damage.
Disconnect power before wiring.

The Equipment Interface Module (EIM) can be mounted vertically on the HVAC equipment or on a wall in the equipment room.

1. Mount the EIM near the HVAC equipment, or on the equipment itself. Use screws & anchors as appropriate for the mounting surface.
2. To wire the EIM, strip 1/4” insulation, then insert wires (see Fig. 7). For wiring diagrams, see “Wiring” beginning on page 117.

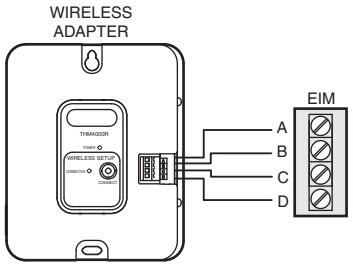


Fig. 6. THM4000R1000 Wireless Adapter wired to the EIM.

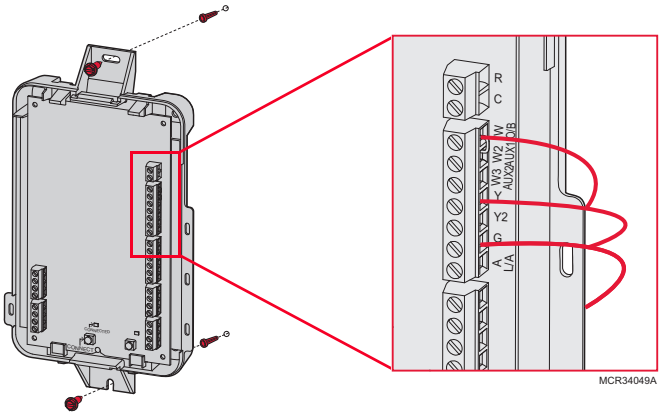


Fig. 7.

NOTE: Link EIM to thermostat BEFORE linking any RedLINK accessories. See “Linking RedLINK Accessories” on page 14.

3. If you are installing discharge and return air sensors, see “Selecting Discharge and Return Air Temperature Sensor Mounting Locations” beginning on page 9).

Wiring 24 Vac Common

- Single-Transformer System—Connect the common side of the transformer to the C screw terminal of the EIM. Leave the metal jumper wires in place between R, RC, and RH.
- Two-Transformer System—Connect the common side of the cooling transformer to the C screw terminal of the EIM. Remove the metal jumper wire between RC and RH. Connect the hot side of heating transformer to RH and leave the jumper wire between R and RC and connect the hot side of cooling transformer to R or RC.

Selecting Discharge and Return Air Temperature Sensor Mounting Locations

Refer to the guidelines below and Fig. 8–12 for mounting locations of the Discharge and Return Air Temperature Sensors.

Selecting Discharge Air Temperature Sensor Mounting Location

1. Mount the Discharge Air Temperature Sensor on the supply duct in a location where the air is mixed well. Mount the Discharge Air Temperature Sensor out of sight of the A-Coil/Heat Exchanger when possible. See Fig. 8.
2. When possible, mount the Discharge Air Temperature Sensor upstream of a Steam Humidifier, a Fan Powered Humidifier or a Dehumidifier that is ducted to the supply. See Fig. 9–10.
3. If space does not allow a Discharge Air Temperature Sensor upstream of a Steam Humidifier or Fan Powered Humidifier, mount the Discharge Air Temperature Sensor downstream of the Humidifier. See Fig. 9.
4. If a Bypass Humidifier is installed, mount the Discharge Air Temperature Sensor downstream of the Bypass Humidifier. See Fig. 11–12.

Selecting Return Air Temperature Sensor Mounting Location

1. Install the Return Air Temperature Sensor on the return duct in a location where the air is mixed well. Mount the Return Air Temperature Sensor downstream of a Bypass Humidifier, Dehumidifier or Ventilator. See Fig. 8–12.

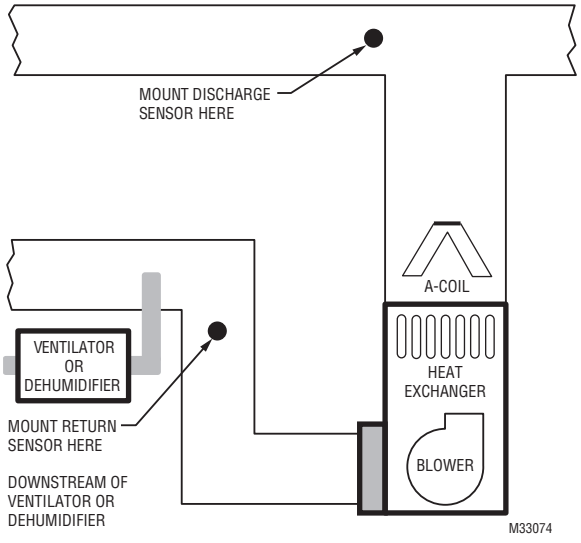


Fig. 8.

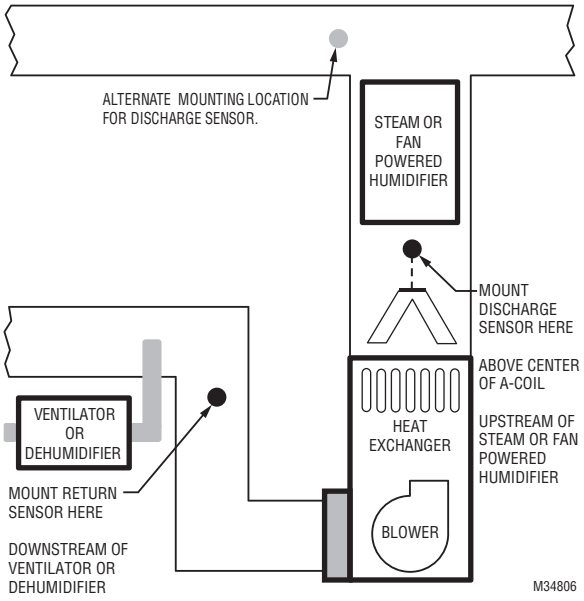


Fig. 9.

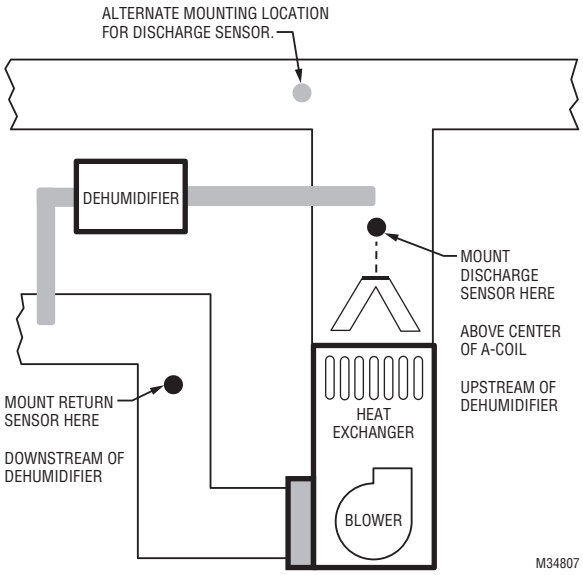


Fig. 10.

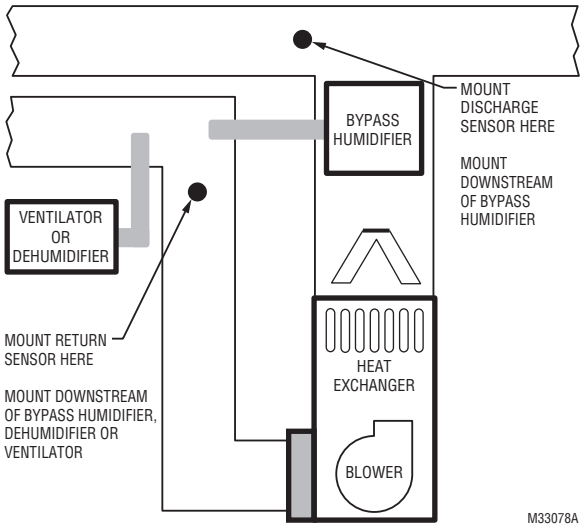


Fig. 11.

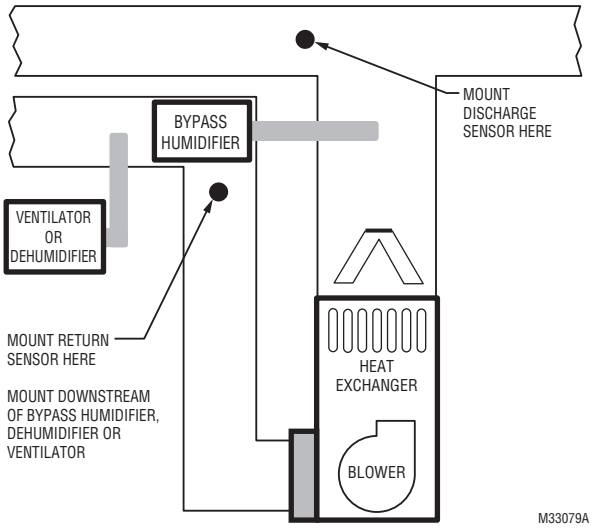


Fig. 12.

Installing Discharge and Return Air Temperature Sensors

Use the following steps to mount the Discharge/Return Air Sensors:

1. Attach plastic cover to the sensor probe.
2. Drill 1/4-inch hole for the sensor probe and mount it to the ductwork with enclosed screws (see Fig. 13).
3. Connect wires to S1, S2, S3 or S4 terminals at the EIM.
4. Setup the S1, S2, S3 or S4 terminals in the Installer Setup at the thermostat.

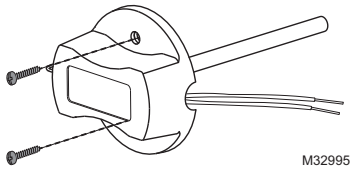


Fig. 13. Mounting Discharge/Return Air Sensor.

Selecting Thermostat Location

Install the thermostat about 5 ft. (1.5m) above the floor in an area with good air circulation at average temperature. See Fig. 14.

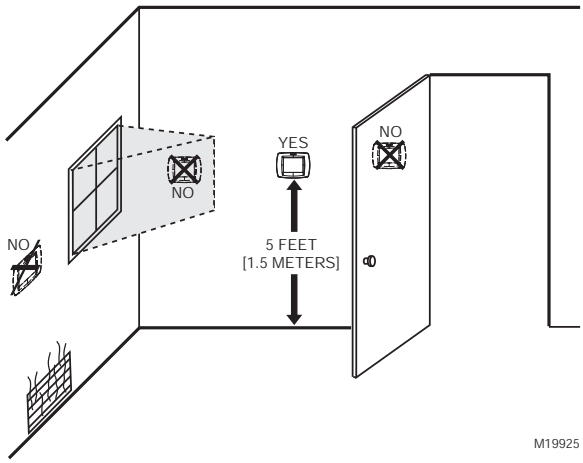


Fig. 14. Selecting thermostat location.

Do not install the thermostat where it can be affected by:
— Drafts or dead spots behind doors and in corners.
— Hot or cold air from ducts.
— Radiant heat from sun or appliances.
— Concealed pipes and chimneys.
— Unheated (uncooled) areas such as an outside wall behind the thermostat.

Installing Wallplate

⚠ CAUTION
Electrical Hazard.
Can cause electrical shock or equipment damage.
Disconnect power before wiring.

NOTE: For best RedLINK performance, mount thermostats at least 2 feet apart.

The thermostat can be mounted horizontally on the wall or on a 4 in. x 2 in. (101.6 mm x 50.8 mm) wiring box.

1. Press button on top and pull to remove the wallplate.

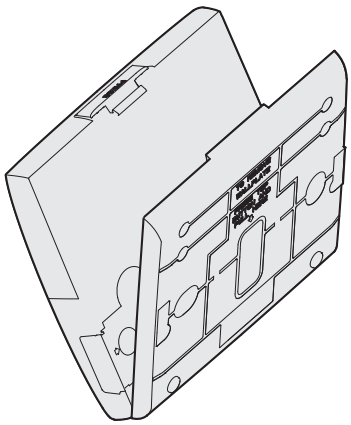


Fig. 15. Separate wallplate from thermostat.

2. Position and level the wallplate (for appearance only).
3. Use a pencil to mark the mounting holes.
4. Remove the wallplate from the wall and, if drywall, drill two 3/16-in. holes in the wall, as marked. For firmer material such as plaster, drill two 7/32-in. holes. Gently tap anchors (provided) into the drilled holes until flush with the wall.
5. Position the wallplate over the holes, pulling wires through the wiring opening. See Fig. 16.
6. Insert the mounting screws into the holes and tighten.

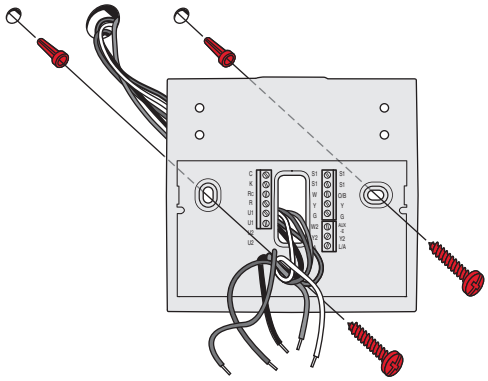


Fig. 16. Mounting wallplate.

Installing VisionPRO® 8000 with RedLINK™

Connect Power

1. Insert supplied AA alkaline batteries for primary or backup power.

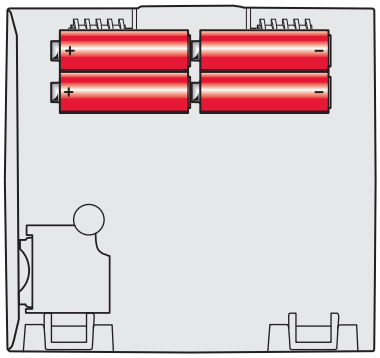


Fig. 17. Insert AA batteries.

NOTE: When the thermostat is NOT used with the Equipment Interface Module or the TrueZONE Wireless Adapter, a C wire is required for RedLINK.

2. For 24VAC primary power, connect common side of transformer to C terminal.

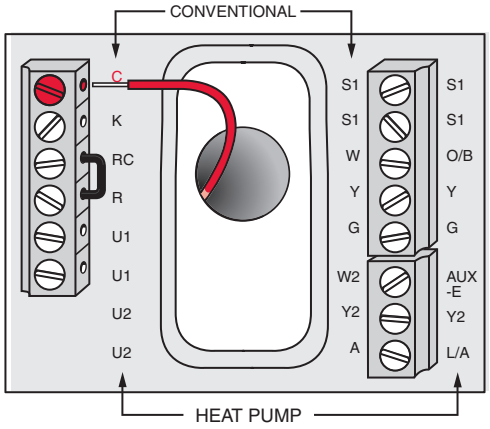


Fig. 18. Connecting C wire to terminal block.

Wiring the Thermostat

IF THE THERMOSTAT IS WIRED DIRECTLY TO THE EQUIPMENT

1. Refer to Fig. 19. See Table 10 on page 118 for terminal designations and “Wiring” beginning on page 117 for more information.
2. Turn on 24VAC NOW.

NOTE: 24VAC (C wire) is required to connect RedLINK accessories.

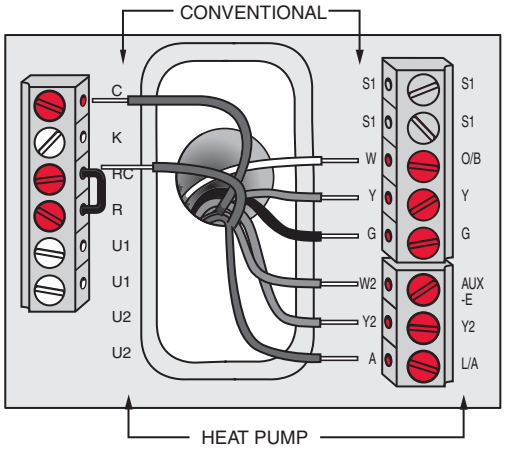


Fig. 19. Thermostat wired directly to equipment.

IF THE THERMOSTAT IS USED WITH AN EQUIPMENT INTERFACE MODULE OR TRUEZONE WIRELESS ADAPTER

1. Power the thermostat using Rc and C terminals or with batteries. Refer to Fig. 20.

NOTE: The relay outputs and inputs on the thermostat do not function when used with an Equipment Interface Module or TrueZONE Wireless Adapter.

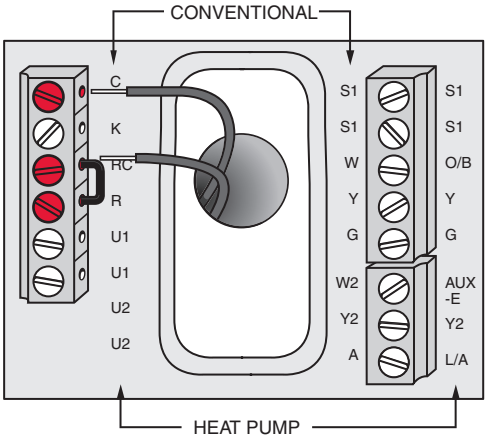


Fig. 20. Inserting wires in thermostat terminal block.

Remove Coin Cell Battery Tab

1. Remove tab to activate coin cell battery.

NOTE: Coin cell battery saves time and date during a power loss.

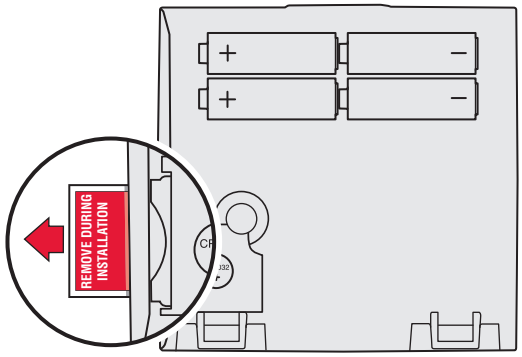


Fig. 21. Remove coin cell battery tab.

Mounting Thermostat on Wallplate

1. Align thermostat at bottom and snap into place as shown.

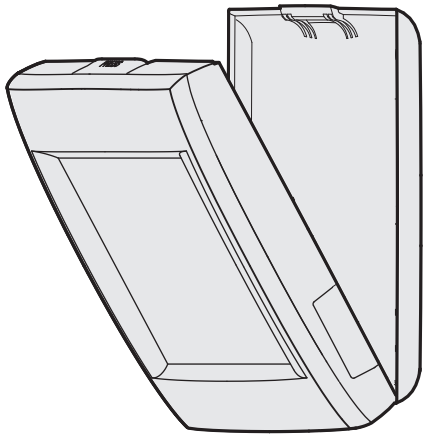


Fig. 22. Mount thermostat.

POWER OPTIONAL REDLINK™ ACCESSORIES

Outdoor air sensor

1. Install 2 fresh AA lithium batteries.

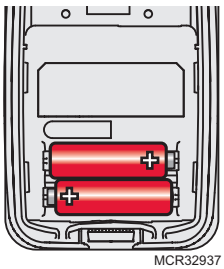


Fig. 23.

Portable Comfort Control

1. Install 3 fresh AA alkaline batteries.

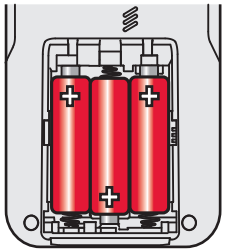


Fig. 24.

Indoor air sensor

1. Install 2 fresh AAA alkaline batteries.

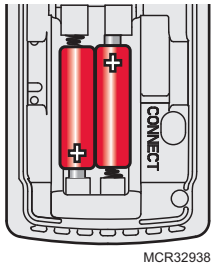


Fig. 25.

RedLINK™ Internet Gateway

1. Connect power cord to an electrical outlet not controlled by a wall switch.
2. Connect ethernet cable to router and the RedLINK Internet Gateway.

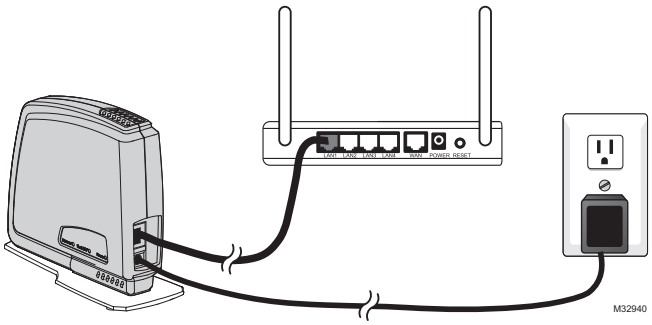


Fig. 26.

TrueSTEAM

1. Wire and power TrueSTEAM.
2. Connect the ABCD terminals between TrueSTEAM and the THM4000 Wireless Adapter.
3. Adjust the DIP Switches on TrueSTEAM as follows when using the Wireless Adapter:
   - DIP3: UP
   - DIP4: UP
   - DIP5: DOWN

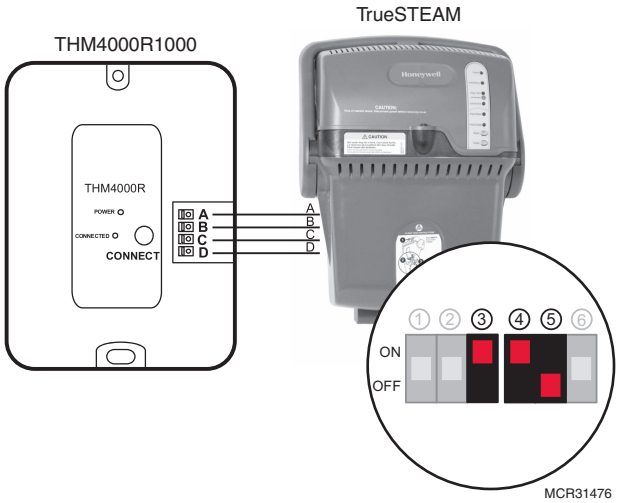


Fig. 27. Powering TrueSTEAM wireless adapter.

Entry/Exit Remote or Vent Boost Remote

1. Remove the cover.
2. Insert the CR2450 coin cell battery (included) into the slot at the bottom of the remote. See polarity marking on the remote.

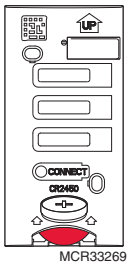


Fig. 28. Installing Entry/Exit Remote or Vent Boost Remote battery.

3. The LED will briefly flash green. If it flashes red, battery is not good.

PERFORMING INITIAL SETUP

NOTE: If the thermostat is wired directly to the equipment, 24 VAC (C wire) is required to connect RedLINK accessories. Turn on 24 VAC before performing the initial setup.

Initial setup options define the type of system you are installing:
- Residential or commercial
- Non-zoned or zoned
- Used with or without an Equipment Interface Module (THM5421)
- Used with or without the TrueZONE Wireless Adapter (THM4000)

1. Follow prompts on the screen to select the appropriate options.

Fig. 29. Select application (residential or commercial).

NOTE: If you are connecting the thermostat to the TrueZONE Wireless Adapter (THM4000), refer to the TrueZONE instructions to link the thermostat and RedLINK accessories.

Linking Thermostat to Equipment Interface Module (if used)

1. In thermostat setup, when you are prompted to answer TSTAT CONTROLS AN EQUIP. MODULE: select yes, then press Next.

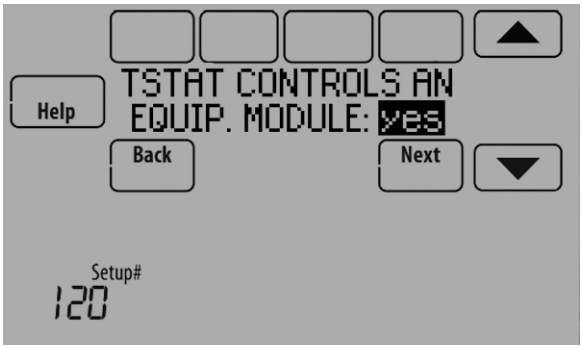


Fig. 30.

2. Press and quickly release the CONNECT button on the EIM. Make sure the “Connected” light is flashing green.

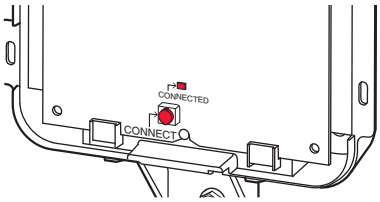


Fig. 31. EIM CONNECT button.

NOTE: If the “Connected” light does NOT flash green, another system may be in the listening mode. Please exit the listening mode at the other system and then try again.
Green Flashing: In Listening Mode - system is ready to add RedLINK devices.
Green Steady: RedLINK devices are communicating.
Red: RedLINK device(s) are NOT communicating. Check EIM and RedLINK devices.

3. While the “Connected” light is flashing green on the EIM, press Next on the thermostat. After a short delay, the screen will show the thermostat is connected.

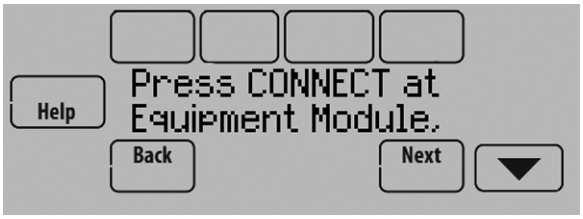


Fig. 32.

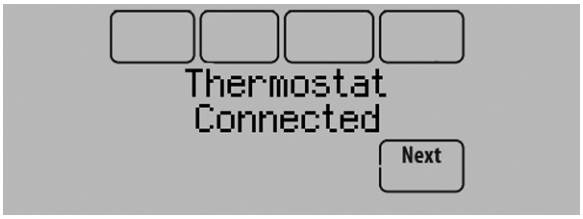


Fig. 33.

4. Press Next, as directed on screen, to link RedLINK accessories.

Linking RedLINK Accessories

1. When you see the prompt Connect RedLINK Accessories?, touch No or Yes.
   a. If you select No, continue to step 5.
   b. If you select Yes, you will be prompted to Press Connect on New Accessories. Continue to step 2.

MCR33970

Fig. 34. Connect RedLINK accessories.

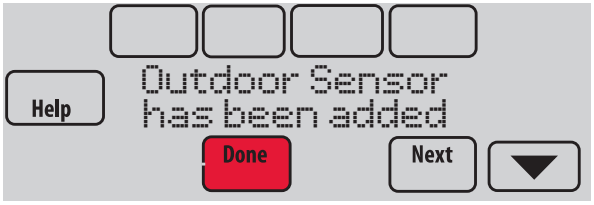
NOTE: Accessories must be at least 2 feet away from the thermostat or EIM during the linking process.

2. While the Press Connect message is displayed (listening mode), press and quickly release the CONNECT button on each new RedLINK accessory.

   NOTE: For locations of CONNECT buttons on RedLINK accessories, see “Locating the Connect Buttons on RedLINK Accessories” beginning on page 16.

Fig. 35. Thermostat in listening mode.

3. After a short delay (up to 15 seconds), check thermostat to confirm the connection of each RedLINK accessory. Touch ▲ or ▼ to review the list.



MCR33972

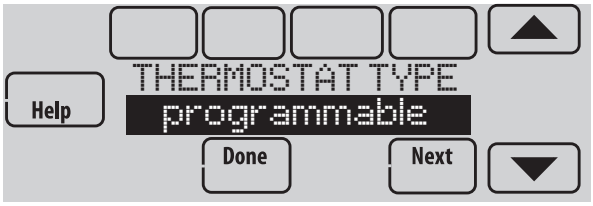
Fig. 36. Outdoor sensor added.

4. Touch Done at the thermostat after all new RedLINK accessories are connected.

NOTE: Thermostat displays a countdown timer while in the listening mode. If it detects no activity for 15 minutes, it exits listening mode.

Completing Initial Setup

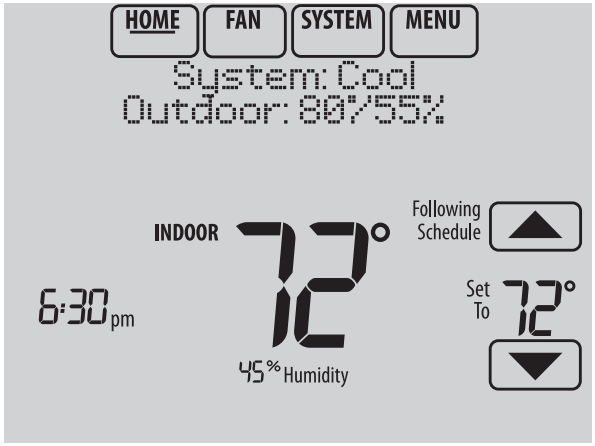
5. Finish the setup by selecting the desired options. Touch Done after you select the last option you want to change.



M34150

Fig. 37. Thermostat type.

The thermostat now displays its Home screen and the thermostat setup is complete.



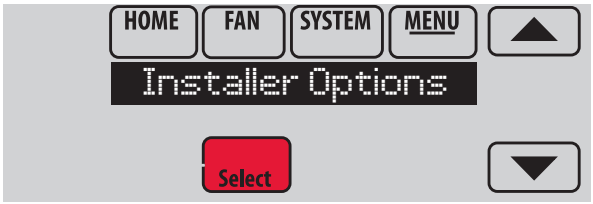
M33985

Fig. 38. Thermostat home screen.

Adding RedLINK Accessories to the Thermostat

If you want to add RedLINK accessories after the thermostat has been setup, follow these steps.

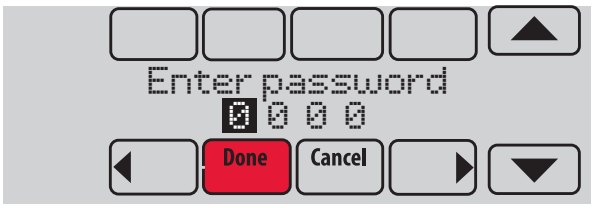
1. Touch Menu.
2. Select Installer Options.



MCR33976

Fig. 39.

3. Enter password (date code) and touch Done. See “Finding Your Password (Date Code) to Access Installer Options” beginning on page 19 for more information.



MCR33977

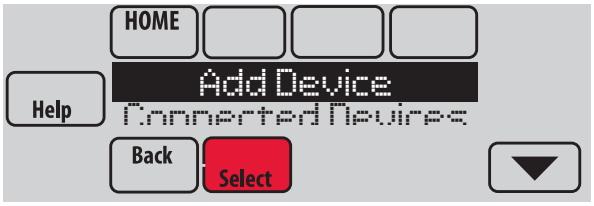
Fig. 40.

4. Select Wireless Manager.

MCR33980

Fig. 41.

5. Select Add Device. The screen displays “Press Connect on New Accessories.” The thermostat is now in listening mode.



MCR33981

Fig. 42.

NOTE: Accessories must be at least 2 feet away from the thermostat or EIM during the linking process.

6. Press and quickly release the CONNECT button on each new RedLINK accessory.

   NOTE: For locations of CONNECT buttons on RedLINK accessories, see “Locating the Connect Buttons on RedLINK Accessories” beginning on page 16.

MCR34058

Fig. 43. Thermostat in listening mode.

7. After a short delay (up to 15 seconds), check thermostat to confirm the connection of each RedLINK accessory. Touch ▲ or ▼ to review the list.
8. Touch Done at the thermostat after all new RedLINK accessories are connected.

MCR33972

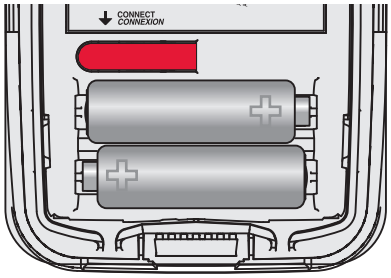
Fig. 44.

NOTE: Thermostat displays a count-down timer while in the listening mode. If it detects no activity for 15 minutes, it exits listening mode.

Locating the Connect Buttons on RedLINK Accessories

Wireless Outdoor Sensor

1. Press and quickly release the CONNECT button on the Wireless Outdoor Sensor. After a short delay (up to 15 seconds), the thermostat will display “Outdoor Sensor has been added.”

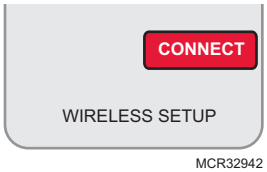


MCR28847A

Fig. 45. Wireless outdoor sensor connect button.

Portable Comfort Control

1. Press CONNECT on the Portable Comfort Control display screen.



MCR32942

Fig. 46. Portable Comfort Control connect button.

2. Press DONE on the Portable Comfort Control when it displays “Connected.”

3. Press “No” at the next screen to save and exit, or press “Yes” if you need to connect additional thermostats to the Portable Comfort Control. See Fig. 47.

NOTE: The Portable Comfort Control can control up to 16 thermostats.

Fig. 47. Connect additional thermostats to Portable Comfort Control.

4. Follow the same linking procedure as above to connect additional thermostats.

ERROR MESSAGES:
E1 29: Incompatible device cannot be connected.
E1 34: Low RF signal. Move device to a different location and try again.
E1 38: Make sure the thermostat, EIM, or TrueZONE Wireless Adapter is in Wireless Setup mode, and the Portable Comfort Control is at least 2 feet away (600 mm).

NOTE: The linking procedure will time out if there is no keypress for 30 minutes. To begin again, press and hold in the lower right corner of the screen until the display changes (about 3 seconds). See Fig. 48.

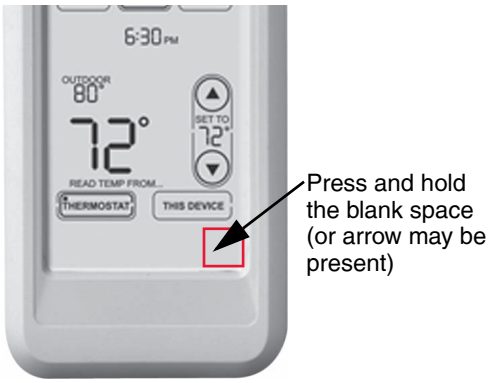


Fig. 48. Restarting the linking process.

RedLINK Internet Gateway

1. Press and quickly release the button on the bottom of the Internet Gateway. After a short delay, the RedLINK status light will glow steady green.

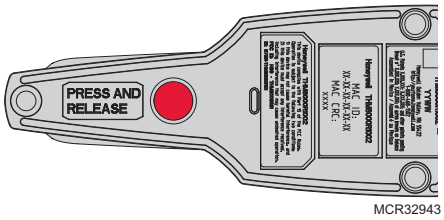


Fig. 49. RedLINK Internet Gateway connect button.

NOTE: The Internet Gateway must be registered online before use at www.mytotalconnectcomfort.com. Enter the MAC ID and MAC CRC numbers located on the bottom of the Internet Gateway. For additional information, see instructions provided with the device.

TrueSTEAM

1. Press and quickly release the CONNECT button on THM4000 Wireless Adapter. After a short delay, the CONNECTED status light will glow steady green.

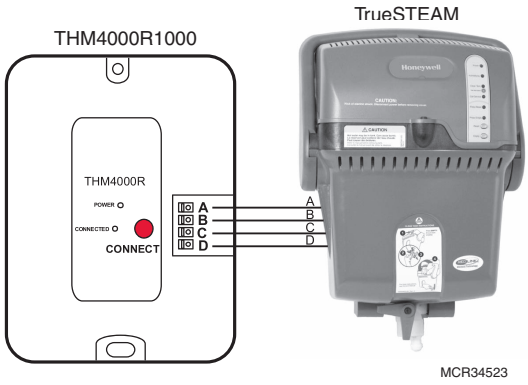


Fig. 50. Connect button on TrueSTEAM wireless adapter.

Wireless Indoor Sensor

1. Press and quickly release the CONNECT button. After a short delay, the status light (see Fig. 51) will glow green for 15 seconds. If the status light turns red, the sensor did not link with the thermostat.

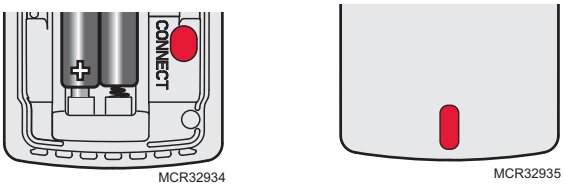


Fig. 51. Wireless indoor sensor connect button and status light.

NOTE: In normal operation, the status light remains off. If it begins flashing red, batteries are low (power will be depleted after 2–3 weeks).

2. After a short delay (up to 15 seconds), check thermostat to confirm the connection of the sensor.

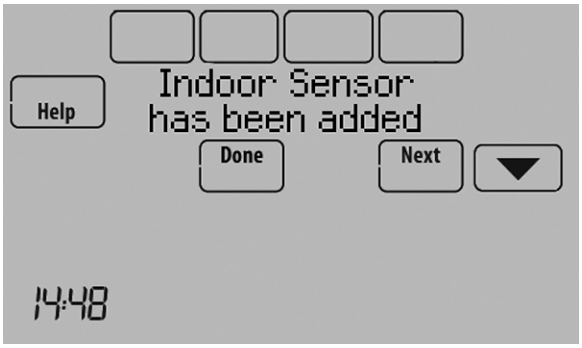


Fig. 52.

3. If you are installing more than 1 wireless indoor sensor, give each sensor a name as you install it. Press Yes when the “Rename Indoor Sensor?” screen is displayed, as shown in Fig. 53.

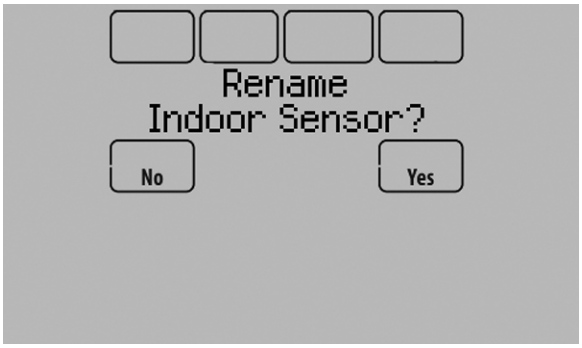


Fig. 53.

4. Select the Indoor Sensor name from the list and press Done. The Indoor Sensor names are used when selecting which sensor to use for temperature control, humidification control, and dehumidification control.

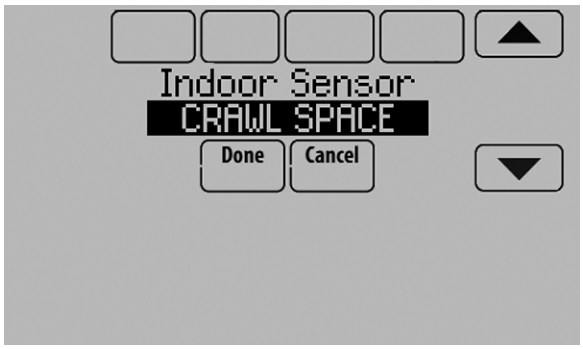


Fig. 54.

NOTE: If you link more than 1 wireless indoor sensor, and forget to name them, you will be prompted to name each wireless indoor sensor after you exit wireless setup. See Fig. 55.

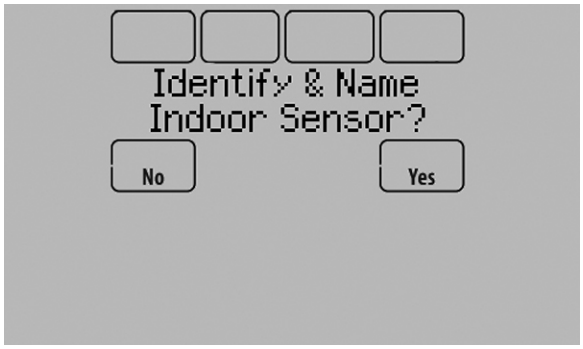


Fig. 55.

Entry/Exit Remote or Vent Boost Remote

1. Press and quickly release the CONNECT button.

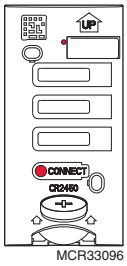


Fig. 56. Connect button and status light on Entry/Exit Remote or Vent Boost Remote.

2. After a short delay, the status light will glow green for 15 seconds. If the status light turns red, the remote did not link with the thermostat for the connection process.

NOTE: The thermostat can work with up to 3 Entry/Exit remotes. Each Entry/Exit remote can control up to 16 thermostats.

NOTE: The thermostat can work with up to 6 Vent Boost remotes.

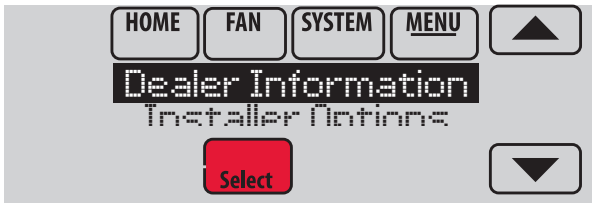
Finding Your Password (Date Code) to Access Installer Options

You need a password (Date Code) to access Installer Options. Installer Options allow you to:

- Make changes to the Installer Setup.
- Perform an Installer Test.
- Add, remove, rename or view connected RedLINK accessories.
- Reset the thermostat to Factory Default settings.

The password (Date Code) is located on the back of the thermostat. It can also be found by following these steps:

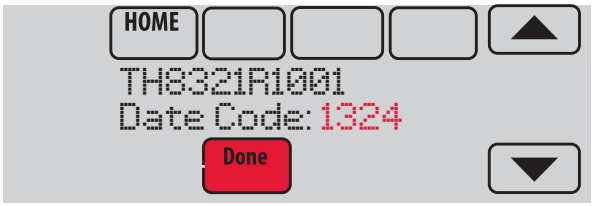
1. Touch Menu.
2. Select Dealer Information.



MCR34022

Fig. 57.

3. Scroll down to see the Date Code.



MCR33975

Fig. 58.

Thermostat Password (Date Code)

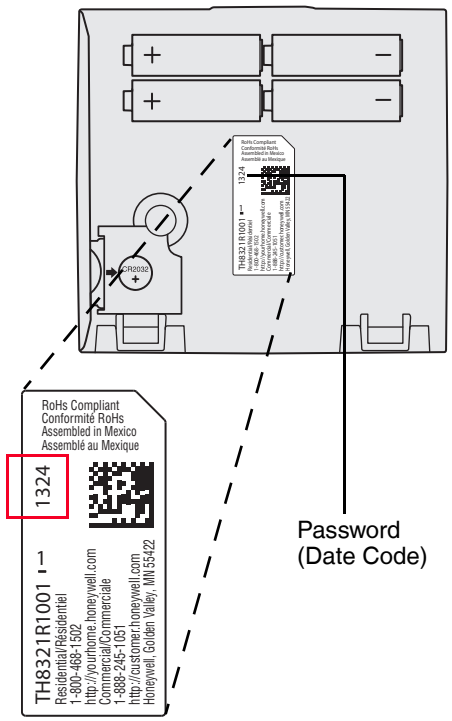


Fig. 59. Locate password.

The following options are available when you access Installer Options. For more information on each, press Help on the thermostat or see Table 1.

Fig. 60.

Table 1. Installer Options.

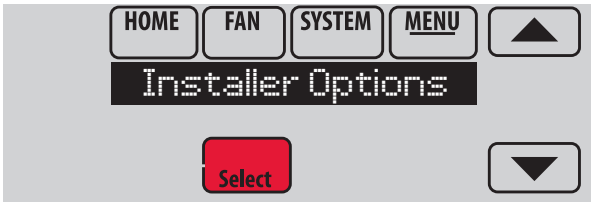
Menu Item	Description
Installer Setup	Select INSTALLER SETUP to set system settings one by one.
Installer Test	Select INSTALLER TEST to quickly determine if the heat, cool, fan and thermostat are operating properly. Minimum off timers are ignored during the test.
Data Logs	Select DATA LOGS to turn off/on the Alerts Log or Interaction Log.
Wireless Manager	Select WIRELESS MANAGER to add, remove, rename or view the connected wireless accessories.
Reset To Defaults	Select RESET TO DEFAULTS to place all thermostat settings back to the factory settings. Note: If the thermostat has been setup WITHOUT an Equipment Interface Module or the TrueZONE Wireless Adapter and you would like to add one, you must reset the thermostat back to factory defaults.
Device Info	For Honeywell use only.

NOTE: You can use the thermostat microSD port to download all Installer Setup settings, including your company name and contact information. You can upload this data to each thermostat you install, to save time.

Make Changes to Installer Setup

NOTE: Use a microSD card to save set up time. See "To Use the MicroSD Card in the Thermostat" on page 101.

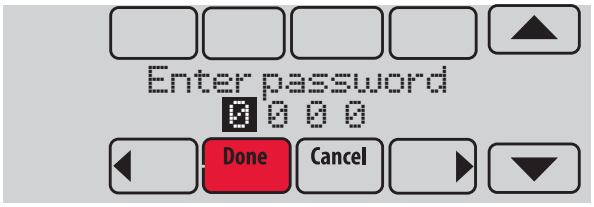
1. Touch Menu.
2. Select Installer Options.



MCR33976

Fig. 61.

3. Enter password (date code) and touch Done. See "Finding Your Password (Date Code) to Access Installer Options" beginning on page 19 for more information.



MCR33977

Fig. 62.

4. Select Installer Setup.

MCR34015

Fig. 63.

5. Follow prompts on the screen to select the desired setup options. See Table 2 for Installer Setup options.

Table 2. Installer Setup (ISU) Table.

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
101	Application	Residential Commercial	Residential	Both	No	
102	Zone Number	1-16	1	Both	No	This ISU is only displayed on a thermostat that is controlling a zone panel through the THM4000 Wireless.
103	Thermostat Name	[Select Thermostat Name]	Thermostat	Both	No	The Portable Comfort Control remote and Web Interface displays the name of the thermostat that you enter on this screen.
104	Thermostat Type	Non-Programmable Programmable	Programmable	Both	No	
105	Temperature Scale	Fahrenheit Celsius	Fahrenheit	Both	No	

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
106	Outdoor Air Sensor	No Yes	No	Both	No	This ISU automatically defaults to Yes when a Wireless Outdoor Sensor is connected. An Outdoor Sensor is required to set the following ISUs: ISU 312 Outdoor Temperature Lockouts (Heat Pump Lockout and Backup Heat Lockout) ISU 405 Outdoor Temperature used with Minimum Heat Recovery Ramp Rate ISU 406 Outdoor Temperature used with Maximum Heat Recovery Ramp Rate ISU 407 Outdoor Temperature used with Minimum Cool Recovery Ramp Rate ISU 408 Outdoor Temperature used with Maximum Cool Recovery Ramp Rate ISU 805 Humidification - Window Protection ISU 1013 Low Outdoor Temperature Ventilation Lockout ISU 1013 High Outdoor Temperature Ventilation Lockout ISU 1013 High Outdoor Dew Point Ventilation Lockout (requires Wireless Outdoor Sensor)
200	Heating System	Conv. Forced Air Heat Pump Radiant Heat Other None (Cool Only)	Conv. Forced Air	Both	No	
201	Heating Equipment	**Heat Pump:** Air to Air Heat Pump Geothermal Geothermal Radiant	Air to Air Heat Pump	Both	No	This ISU is not displayed when ISU 200 Heating System is set to **Conv. Forced Air, Radiant Heat, Other** or **None (Cool Only)**. See “Geothermal Radiant Heat” beginning on page 78.
203	Radiant Stage 1	None U1 U2 U3	Default varies based on previous selections	Both	No	This ISU is only displayed when ISU 201 Heating Equipment is **Geothermal Radiant**. Geothermal Radiant Heat must be wired to a universal terminal (U1, U2, or U3). U1, U2 and U3 are normally open dry contacts when configured for a stage of Heat. U1, U2 and U3 require power from the system transformer or a separate transformer. U2 and U3 are only available on the Equipment Interface Module (EIM).
204	Radiant Stage 2	None U1 U2 U3	Default varies based on previous selections	Both	No	This ISU is only displayed when ISU 201 Heating Equipment is **Geothermal Radiant**. Geothermal Radiant Heat must be wired to a universal terminal (U1, U2, or U3). U1, U2 and U3 are normally open dry contacts when configured for a stage of Heat. U1, U2 and U3 require power from the system transformer or a separate transformer. U2 and U3 are only available on the Equipment Interface Module (EIM).

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
205	Geo Forced Air	None Cooling Only Heating and Cooling	Heating and Cooling	Both	No	This thermostat has the capability of controlling Geothermal Radiant Heat, Geothermal Forced Air and Backup Heat. If this thermostat is not controlling the Geothermal Forced Air System, select **None.** This setting is typically used if the thermostat is only controlling Geothermal Radiant Heat. If this thermostat is using the Geothermal Forced Air System for cooling and not for heating, select **Cooling Only**. If this thermostat is using the Geothermal Forced Air System for both heating and cooling, select **Heating and Cooling**.
206	Reversing Valve	O (O/B on Cool) B (O/B on Heat)	O/B on Cool	Both	No	Only displayed if the equipment type is Air to Air Heat Pump, Geothermal or Geothermal Radiant.
207	Cool Stages / Compressor Stages	1-4	1 if ISU 101 is Residential 2 if ISU 101 is Commercial	Both	No	**Conventional:** Cool Stage 3 and 4 are only available if ISU 101 is Commercial. Cool Stage 3 and 4 must be wired to a universal terminal (U1, U2 or U3). **Heat Pumps:** Maximum of 2 Compressor Stages for heat pump systems.
202, 207	Heat Stages / Backup Heat Stages	1 - 3	Default is 1 stage if ISU 101 Application is Residential Default is 2 stages if ISU 101 Application is Commercial	Both	No	Maximum of 3 Heat Stages for conventional systems. Maximum of 2 Backup Heat Stages for systems with more than 1 heating equipment type.
208	Cool Stage 3	None U1 U2 U3	Default varies based on previous selections	Commercial	No	Cool Stage 3 is only available if ISU 1010 is Commercial. Cool Stage 3 must be wired to a universal terminal (U1, U2 or U3). U1, U2 and U3 are normally open dry contacts when configured for a stage of Cool. U1, U2 and U3 require power from a system transformer or a separate transformer. U2 and U3 are only available on the Equipment Interface Module (EIM).

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
209	Cool Stage 4	None U1 U2 U3	Default varies based on previous selections	Commercial	Yes	Cool Stage 4 is only available if ISU 101 is Commercial. Cool Stage 4 must be wired to a universal terminal (U1, U2 or U3). U1, U2 and U3 are normally open dry contacts when configured for a stage of Cool. U1, U2 and U3 require power from a system transformer or a separate transformer. U2 and U3 are only available on the Equipment Interface Module (EIM).
210	Heat Stage 3	None U1 U2 U3	Default varies based on previous selections	Both	No	**TH8321 Thermostat Only:** This ISU is only displayed on the TH8321 thermostat when it is wired directly to the equipment (Equipment Interface Module is NOT used). Heat Stage 3 must be wired to a universal terminal (U1). U1 is a normally open dry contact when configured for a stage of Heat. U1 requires power from a system transformer or a separate transformer.
211	Fan Control in Heat	No Fan Equip Controls Fan Tstat Controls Fan	Equip Controls Fan	Both	No	**No Fan** is only displayed when ISU 201 Heating Equipment is **Other.**
212	Backup Heat Type	None Electric Gas/Oil	None	Both	No	This ISU is only displayed when ISU 201 Heating Equipment is **Radiant Heat** or **Other.** When ISU 201 Heating Equipment is **Radiant Heat,** the thermostat keeps the Radiant Heat on when it calls for Backup Heat. When ISU 201 Heating Equipment is **Other,** you can select how the backup operates. See ISU 215.
213	Backup Heat Stages	0 - 2	1	Both	No	This ISU is only displayed when a backup heat source is selected at ISU 212 Backup Heat Type. Maximum of 2 Backup Heat stages.
214	Backup Heat Stg 2	None U1	Default varies based on previous selections	Both	No	**TH8321 Thermostat Only:** This ISU is only displayed on the TH8321 thermostat when it is wired directly to the equipment (Equipment Interface Module is NOT used). The thermostat can support up to 3 conventional heat stages. When there are a total of 3 conventional heat stages, the last stage of heat must be wired to U1. U1 is a normally open dry contact when configured for a stage of Heat. U1 requires power from a system transformer or a separate transformer.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
215	Run Backup Heat with Primary	No Yes	No	Both	No	This ISU is only displayed when ISU 201 Heating Equipment is **Other.** When ISU 201 Heating Equipment is **Other,** you can select how the Backup Heat operates. The thermostat can be setup to keep the primary heat source on when it calls for Backup Heat or the thermostat can be setup to turn off the primary heat source when it calls for Backup Heat. When ISU 201 Heating Equipment is **Radiant Heat**, the thermostat keeps the Radiant Heat on when it calls for Backup Heat.
216	Backup Heat Fan	Equip Controls Fan Tstat Controls Fan	Tstat Controls Fan	Both	No	This ISU is only displayed for conventional systems when ISU 212 Backup Heat Type is **Electric**. Backup Heat Fan Operation automatically defaults to **Equip Controls Fan** when ISU 212 Backup Heat Type is **Gas/Oil.**
217	Backup Heat Stage 2	None U1	Default varies based on previous selections	Both	No	**TH8321 Thermostat Only:** This ISU is only displayed on the TH8321 thermostat when it is wired directly to the equipment (Equipment Interface Module is NOT used). The thermostat can support up to 2 backup heat stages for heat pump applications. When there are 2 backup heat stages, backup heat stage 2 must be wired to U1. U1 is a normally open dry contact when configured for a stage of Heat. U1 requires power from a system transformer or a separate transformer.
218	Backup Heat Type	Electric Gas/Oil	Electric	Both	No	This ISU is only displayed when ISU 201 Heating Equipment is **Air to Air Heat Pump, Geothermal** or **Geothermal Radiant** and there is at least one stage of backup heat. See “Heat Pump and Backup Heat Operation” beginning on page 78.
219	External Fossil Fuel Kit	No Yes	No	Both	No	This ISU is only displayed when ISU 201 Heating Equipment is **Air to Air Heat Pump, Geothermal** or **Geothermal Radiant** and ISU 218 Backup Heat Type is **Gas/Oil.**

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
222	A-L/A Terminal	None Time Of Day Economizer Heat Pump Fault	None	Commercial	No	This ISU is only displayed when ISU 101 Application is **Commercial**. Note: When the thermostat is setup for Residential, the L/A terminal operates as described under "Heat Pump Fault". The L/A terminal requires no setup for residential applications. **None:** The A-L/A terminal is not used. **Time of Day:** The A-L/A terminal is energized during Occupied periods and when the user overrides the temperature. The terminal is de-energized during Unoccupied periods and in Standby mode. **Economizer:** The thermostat controls an economizer module to provide ventilation during Occupied periods and free cooling when outdoor conditions are favorable. The A-L/A terminal is energized during Occupied periods and during a call for cooling in Unoccupied periods. See “Economizer and Time of Day (TOD) Operation” beginning on page 106. Notes: The economizer module determines when outdoor conditions are favorable for free cooling. **Heat Pump Fault:** When 24 volts is detected on the L/A terminal (compressor monitor), the thermostat displays a message to alert the user when the heat pump requires service. The L/A terminal sends a continuous output to a zone panel when the thermostat is set to Emergency Heat mode. The zone panel will not turn on the heat pump when a zone is set to Emergency Heat mode.
300	System Changeover	Manual Automatic	**Manual:** if ISU 101 is Residential **Automatic:** if ISU 101 is Commercial	Both	No	**Manual:** The user must select heating or cooling as needed to maintain the desired indoor temperature. **Automatic:** The user has the option to select Auto for the system setting. In Auto mode, the thermostat controls heating and cooling equipment as needed to maintain the desired indoor temperature.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
300	Auto Changeover Deadband	2° F to 9° F (in 1° F increments)	3° F	Both	No	This ISU is only displayed when ISU 300 is set to **Automatic.** Deadband is the minimum separation between heat and cool settings when the thermostat is setup for Auto Changeover. For example, if the deadband is set to 3° F and the cool setpoint is 75° F, the warmest heat setpoint allowed would be 72° F. If the heat setpoint is adjusted above 72° F, it will automatically adjust the cooling setpoint higher to maintain the 3° F deadband. When ISU 907 or ISU 910 (Dehum Over Cooling Limit) is set to 1, 2, 3, 4 or 5 F, the thermostat will not show the full Deadband range. For example, if you set a Deadband of 3 F and an Over Cooling Limit of 2 F, the minimum Deadband that you can select will be 5 F. This prevents the heating system from turning on when the thermostat over cools to reach the dehumidification setting.
301	Control Options	Basic Options Advanced Options	Basic Options	Both	No	**Basic Options:** The Installer Setup displays basic temperature control options which include Backup Heat Droop, Backup Heat Upstage Timer, Outdoor Temperature Lockouts and Cycle Rate settings per stage. Note: Outdoor Temperature Lockouts only apply to Heat Pump applications. **Advanced Options:** The Installer Setup displays both Basic and Advanced Options. Advanced temperature control options include Finish With High Cool Stage, Finish With High Heat Stage, and Temperature Differential settings between all stages.
302	Finish With High Cool Stage	No Yes	No	Both	No	ISU 301 Control Options must be set to **Advanced** to view or adjust **Finish With High Cool Stage.** This ISU is only displayed when the thermostat is set for 2 or more cool stages. When set to **Yes**, this feature keeps the high stage of the cooling equipment running until the desired setpoint is reached.
302	Finish With High Heat Stage	No Yes	No	Both	No	ISU 301 Control Options must be set to **Advanced** to view or adjust **Finish With High Heat Stage.** This ISU is only displayed when the thermostat is set for 2 or more heat stages. When set to **Yes**, this feature keeps the high stage of the heating equipment running until the desired setpoint is reached.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
303	Cool Differential Stage 2	Comfort 1.0° F to 3.5° F from setpoint (in 0.5° F increments)	Comfort	Both	No	ISU 301 Control Options must be set to **Advanced** to view or adjust this ISU. This ISU is only displayed when the thermostat is set to 2 cool stages. The indoor temperature must rise to the selected differential setting before the thermostat turns on the stage of cooling. For example, if stage 2 is set to 2° F (1.0° C), the indoor temperature must be 2° F (1.0° C) away from the setpoint before stage 2 turns on. When set to **Comfort**, the thermostat uses the stage of cooling as needed to keep the indoor temperature within 1° F (0.5° C) degree of the setpoint.
303	Cool Differential Stage 3	Comfort 1.0°F - 4.0°F from setpoint (in 0.5° F increments)	Comfort	Commercial	No	ISU 301 Control Options must be set to **Advanced** to view or adjust this ISU. This ISU is only displayed when the thermostat is set to 3 cool stages. The indoor temperature must rise to the selected differential setting before the thermostat turns on the stage of cooling. For example, if stage 3 is set to 2° F (1.0° C), the indoor temperature must be 2° F (1.0° C) away from the setpoint before stage 3 turns on. When set to **Comfort**, the thermostat uses the stage of cooling as needed to keep the indoor temperature within 1° F (0.5° C) degree of the setpoint.
303	Cool Differential Stage 4	Comfort 1.0° F to 4.5° F from setpoint (in 0.5° F increments)	Comfort	Commercial	Yes	ISU 301 Control Options must be set to **Advanced** to view or adjust this ISU. This ISU is only displayed when the thermostat is set to 4 cool stages. The indoor temperature must rise to the selected differential setting before the thermostat turns on the stage of cooling. For example, if stage 4 is set to 2° F (1.0° C), the indoor temperature must be 2° F (1.0° C) away from the setpoint before stage 4 turns on. When set to **Comfort**, the thermostat uses the stage of cooling as needed to keep the indoor temperature within 1° F (0.5° C) degree of the setpoint.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
304	Radiant Heat Diff. Stage 2	Comfort 1.0° F to 3.5° F from setpoint (in 0.5° F increments)	Comfort	Both	No	ISU 301 Control Options must be set to **Advanced** to view or adjust this ISU. This ISU is only displayed if ISU 201 Heating Equipment is **Geothermal Radiant** and there are 2 radiant heat stages. The indoor temperature must drop to the selected differential setting before the thermostat will turn on the stage of heating. For example, if stage 2 is set to 2° F (1.0° C), the indoor temperature must be 2° F (1.0° C) away from the setpoint before stage 2 turns on. When set to **Comfort**, the thermostat will use the stage of heating as needed to keep the indoor temperature within 1° F (0.5° C) degree of the setpoint.
305	Heat Differential Stage 2 Note: Depending on the application, the text displayed on the screen may show the specific heating equipment type	Comfort 1.0° F to 3.5° F from setpoint (in 0.5° F increments)	Comfort	Both	No	ISU 301 Control Options must be set to **Advanced** to view or adjust this ISU. This ISU is only displayed for conventional systems that have 2 heat stages. The indoor temperature must drop to the selected differential setting before the thermostat will turn on the stage of heating. For example, if stage 2 is set to 2° F (1.0° C), the indoor temperature must be 2° F (1.0° C) away from the setpoint before stage 2 turns on. When set to **Comfort**, the thermostat will use the stage of heating as needed to keep the indoor temperature within 1° F (0.5° C) degree of the setpoint.
305	Heat Differential Stage 3 Note: Depending on the application, the text displayed on the screen may show the specific heating equipment type	Comfort 1.0° F to 4.0° F from setpoint (in 0.5° F increments)	Comfort	Both	No	ISU 301Temperature Control Options must be set to **Advanced** to view or adjust this ISU. This ISU is only displayed for conventional systems that have 3 heat stages. The indoor temperature must drop to the selected differential setting before the thermostat will turn on the stage of heating. For example, if stage 3 is set to 2° F (1.0° C), the indoor temperature must be 2° F (1.0° C) away from the setpoint before stage 3 turns on. When set to **Comfort**, the thermostat will use the stage of heating as needed to keep the indoor temperature within 1° F (0.5° C) degree of the setpoint.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
306	Compressor Heat Diff. Stage 1	Comfort 1.0° F to 4.0° F from setpoint (in 0.5° F increments)	Comfort	Both	No	ISU 301 Control Options must be set to **Advanced** to view or adjust this ISU. This ISU is only displayed if ISU 201 Heating Equipment is **Geothermal Radiant** and ISU 205 Geo Forced Air is set to **Heating and Cooling.** The indoor temperature must drop to the selected differential setting before the thermostat will turn on the stage of heating. For example, if stage 1 is set to 2° F (1.0° C), the indoor temperature must be 2° F (1.0° C) away from the setpoint before stage 1 turns on. When set to **Comfort**, the thermostat will use the stage of heating as needed to keep the indoor temperature within 1° F (0.5° C) degree of the setpoint.
306	Compressor Heat Diff. Stage 2	Comfort 1.0° F to 4.5° F from setpoint (in 0.5° F increments)	Comfort	Both	No	ISU 301 Control Options must be set to **Advanced** to view or adjust this ISU. This ISU is only displayed if ISU 201 Heating Equipment is **Air to Air Heat Pump, Geothermal** or **Geothermal Radiant** and there are 2 compressor stages. The indoor temperature must drop to the selected differential setting before the thermostat will turn on the stage of heating. For example, if stage 2 is set to 2° F (1.0° C), the indoor temperature must be 2° F (1.0° C) away from the setpoint before stage 2 turns on. When set to **Comfort**, the thermostat will use the stage of heating as needed to keep the indoor temperature within 1° F (0.5° C) degree of the setpoint.
308, 309	Backup Heat Droop Stage 1 Note: “Stage 1" is not displayed if there is only 1 stage of Backup Heat.	Comfort 2.0° F to 15.0° F from setpoint (in 0.5° F increments)	Comfort	Both	No	A backup heat droop can be set on any system that has more than one heating equipment type. See “Backup Heat Droop” beginning on page 76. The **Comfort** setting is NOT available for Dual Fuel systems. For example, Heat Pumps with Gas Forced Air.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
308, 309	Backup Heat Droop Stage 2	Comfort 2.0° F to 15.5° F from setpoint (in 0.5° F increments)	Comfort	Both	No	ISU 301 Control Options must be set to **Advanced** to view or adjust **Backup Heat Droop Stage 2.** This ISU is only displayed if there are 2 backup heat stages. The indoor temperature must drop to the selected droop setting before the thermostat will turn on backup heat stage 2. For example, if backup heat stage 2 is set to 2° F (1.0° C), the indoor temperature must be 2° F (1.0° C) away from the setpoint before backup heat stage 2 turns on. When set to Comfort, the thermostat will use backup heat stage 2 as needed to keep the indoor temperature within 1° F (0.5° C) degree of the setpoint.
311	Upstage Timer for Backup Heat	Off (30, 45, 60, 75, 90) minutes (2, 3, 4, 5, 6, 8, 10, 12, 14, 16) hours	Off	Both	No	The Backup Heat Upstage Timer starts when the highest stage of the previous heating equipment type turns on. Backup heat will be used (if needed) when the timer expires. See “Backup Heat Upstage Timer” beginning on page 77. This ISU is only displayed when Backup Heat Droop Stage 1 is set to 2 F or higher (ISU 308, 309).
312	Outdoor Lockout Heat Pump	Off 5° F to 60° F (in 5° F increments)	Off (See Notes)	Both	No	ISU 312 Heat Pump Outdoor Lockout requires an outdoor sensor. Default is 40 F if ISU 201 Heating Equipment is **Air to Air Heat Pump** and ISU 218 Backup Heat Type is **Gas/Oil**. Default is Off if ISU 201 Heating Equipment is **Air to Air Heat Pump** and ISU 218 Backup Heat Type is **Electric**. Default is Off if ISU 201 Heating Equipment is **Geothermal** or **Geothermal Radiant.** Heat Pump Outdoor Lockout is optional for any type of heat pump (Air to Air Heat Pump, Geothermal Heat Pump or Geothermal Radiant Heat). See “Heat pump with outdoor temperature lockouts” beginning on page 78.
312	Outdoor Lockout Backup Heat	Off 5° F to 65° F (in 5° F increments)	Off	Both	No	ISU 312 Backup Heat Outdoor Temperature Lockout requires an outdoor sensor. This ISU is only displayed if ISU 201 Heating Equipment is **Air to Air Heat Pump**, **Geothermal** or **Geothermal Radiant** and ISU 219 External fossil fuel kit is set to **No.** See “Heat pump with outdoor temperature lockouts” beginning on page 78.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
313	Radiant Cycles Per Hour Stage 1 Note: “Stage 1" is not displayed if there is only 1 stage of Radiant Heat.	1 to 12 CPH	3	Both	No	This ISU is only displayed when ISU 201 Heating Equipment is **Geothermal Radiant**. The thermostat automatically defaults to the recommended setting for Geothermal Radiant Heat (3 CPH). Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load.
313	Radiant Cycles Per Hour Stage 2	1 to 12 CPH	3	Both	Yes	This ISU is only displayed when ISU 201 Heating Equipment is **Geothermal Radiant**. The thermostat automatically defaults to the recommended setting for Geothermal Radiant Heat (3 CPH). Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load.
314	Cool / Compressor Cycles Per Hour Stage 1 Note: “Stage 1" is not displayed if there is only 1 stage.	1 to 6 CPH	3	Both	No	This ISU is only displayed when ISU 207 Cool / Compressor Stages is set to 1 stage. Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load.
314	Cool / Compressor Cycles Per Hour Stage 2	1 to 6 CPH	3	Both	No	This ISU is only displayed when ISU 207 Cool / Compressor Stages is set to 2 stages. Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
314	Cool Cycles Per Hour Stage 3	1 to 6 CPH	3	Commercial	No	This ISU is only displayed when ISU 101 Application is set to **Commercial** and ISU 207 Cool Stages is set to 3 stages. Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load.
314	Cool Cycles Per Hour Stage 4	1 to 6 CPH	3	Commercial	Yes	This ISU is only displayed when ISU 101 Application is set to **Commercial** and ISU 207 Cool Stages is set to 4 stages. Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load.
315	Heat Cycles Per Hour Stage 1 Note: Depending on the application, the text displayed on the screen may show the specific heating equipment type. “Stage 1" is not displayed if there is only 1 stage.	1 to 12 CPH	Conv. Forced Air = 5 CPH Heat Pump = 3 CPH Radiant Heat = 3 CPH	Both	No	This ISU is only displayed when ISU 207 Heat Stages is set to 1 stage. Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load. The recommended cycle rate settings are below for each heating equipment type: Standard Efficiency Gas Forced Air = 5 CPH High Efficiency Gas Forced Air = 3 CPH Oil Forced Air = 5 CPH Electric Forced Air = 9 CPH Hot Water Fan Coil = 3 CPH Hot Water Radiant Heat = 3 CPH Geothermal Radiant Heat = 3 CPH Steam = 1 CPH Gravity = 1 CPH

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
315	Heat Cycles Per Hour Stage 2 Note: Depending on the application, the text displayed on the screen may show the specific heating equipment type.	1 to 12 CPH	Conv. Forced Air = 5 CPH Heat Pump = 3 CPH Radiant Heat = 3 CPH	Both	No	This ISU is only displayed when ISU 207 Heat Stages is set to 2 stages. Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load. The recommended cycle rate settings are below for each heating equipment type: Standard Efficiency Gas Forced Air = 5 CPH High Efficiency Gas Forced Air = 3 CPH Oil Forced Air = 5 CPH Electric Forced Air = 9 CPH Hot Water Fan Coil = 3 CPH Hot Water Radiant Heat = 3 CPH Geothermal Radiant Heat = 3 CPH Steam = 1 CPH Gravity = 1 CPH
315	Heat Cycles Per Hour Stage 3 Note: Depending on the application, the text displayed on the screen may show the specific heating equipment type.	1 to 12 CPH	Conv. Forced Air = 5 CPH Heat Pump = 3 CPH Radiant Heat = 3 CPH	Both	No	This ISU is only displayed when ISU 207 Heat Stages is set to 3 stages. Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load. The recommended cycle rate settings are below for each heating equipment type: Standard Efficiency Gas Forced Air = 5 CPH High Efficiency Gas Forced Air = 3 CPH Oil Forced Air = 5 CPH Electric Forced Air = 9 CPH Hot Water Fan Coil = 3 CPH Hot Water Radiant Heat = 3 CPH Geothermal Radiant Heat = 3 CPH Steam = 1 CPH Gravity = 1 CPH

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
316	Backup Heat Cycles Per Hour Stage 1 Note: “Stage 1" is not displayed if there is only 1 stage.	1 to 12 CPH	Electric = 9 CPH Gas / Oil = 5 CPH	Both	No	This ISU is only displayed when ISU 207 or 213 Backup Heat Stages is set to 1 stage. Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load. The recommended cycle rate settings are below for each heating equipment type: Standard Efficiency Gas Forced Air = 5 CPH High Efficiency Gas Forced Air = 3 CPH Oil Forced Air = 5 CPH Electric Forced Air = 9 CPH Hot Water Fan Coil = 3 CPH Hot Water Radiant Heat = 3 CPH Geothermal Radiant Heat = 3 CPH Steam = 1 CPH Gravity = 1 CPH
316	Backup Heat Cycles Per Hour Stage 2	1 to 12 CPH	Electric = 9 CPH Gas / Oil = 5 CPH	Both	No	This ISU is only displayed when ISU 207 or 213 Backup Heat Stages is set to 2 stages. Cycle rate limits the maximum number of times the system can cycle in a 1 hour period measured at a 50% load. For example, when set to 3 CPH, at a 50% load, the most the system will cycle is 3 times per hour (10 minutes on, 10 minutes off). The system cycles less often when load conditions are less than or greater than a 50% load. The recommended cycle rate settings are below for each heating equipment type: Standard Efficiency Gas Forced Air = 5 CPH High Efficiency Gas Forced Air = 3 CPH Oil Forced Air = 5 CPH Electric Forced Air = 9 CPH Hot Water Fan Coil = 3 CPH Hot Water Radiant Heat = 3 CPH Geothermal Radiant Heat = 3 CPH Steam = 1 CPH Gravity = 1 CPH
324	Compressor Off Time	Off 1 - 5 minutes	5 minutes	Both	No	The thermostat has a built in compressor protection (minimum off timer) that prevents the compressor from restarting too early after a shutdown. The minimum-off timer is activated after the compressor turns off. If there is a call during the minimum-off timer, the thermostat shows “Wait” in the display.
326	Extended Fan Run Time in Cool	0, 30, 60, 90 seconds, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 minutes	0 seconds	Both	No	After the call for cooling ends, the thermostat keeps the fan on for the selected amount of time for increased efficiency. This may re-introduce humidity into the living space.
326	Extended Fan Run Time in Heat	0, 30, 60, 90 seconds, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 minutes	0 seconds	Both	No	After the call for heating ends, the thermostat keeps the fan on for the selected amount of time for increased efficiency.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
400	Scheduled Periods	2 or 4 periods per day	4 periods per day	Both	No	Residential: 4 Periods = Wake, Leave, Return, Sleep 2 Periods = Wake, Sleep Commercial: 4 Periods = Occupied 1, Unoccupied 1, Occupied 2, Unoccupied 2 2 Periods = Occupied 1, Unoccupied 1
401	Pre-Occupancy Purge	Off 1 hour 2 hour 3 hour	Off	Commercial	No	Runs the fan 1 to 3 hours before each occupied period to provide a comfortable workplace upon arrival.
402	Type of Override	Standard Initiate Occupancy	Standard	Commercial	No	Standard: The system maintains temperatures programmed for the occupied and unoccupied time periods. Pressing OVERRIDE will allow the user to make a temporary schedule change. Initiate Occupancy: The system maintains temperature at an energy saving level until the user touches the message center area on the thermostat. Note: The message center displays **Press HERE to Start Occupancy**. The system will then maintain a comfortable temperature until the occupied period ends. This option is recommended for cost savings when the workplace is used infrequently or arrival times change from day to day (example - schools). After the user touches **Press HERE to Start Occupancy**, the user will still be able to perform a standard **OVERRIDE** of the schedule.
403	Override Duration	No Limit 1 to 12 Hours	3 hours	Commercial	No	When the user presses the OVERRIDE button, the thermostat will maintain the new temperature for at least 1 hour. The user can adjust the Hold Until time from 1 hour to the amount set for the **Override Duration** (1-12 hours). Default setting is 3 hours. If set to No Limit, the user can adjust the Hold Until time up to 24 hours.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
405	Min. Heat Recovery Ramp Rate	Off 1° F/hr to 20° F/hr	5° F/hr	Commercial	No	Off: The heating system will begin recovery at the time that is scheduled. When a **Minimum Recovery Ramp Rate** is set, the thermostat will begin recovery early to ensure the temperature is reached at the scheduled time. Set a **Minimum Recovery Ramp Rate** based on the rate that the heating system can recover at for a cold day in your region. Default setting is 5° F / hour. If an outdoor sensor is installed, set an **Outdoor Temperature** that is representative of a cold day in your region to be associated with the **Minimum Recovery Ramp Rate**. The thermostat will begin recovery at the optimal time based on a calculated ramp rate, allowing the system to recover on time and save energy during changing outdoor conditions. During recovery, the setpoint changes at a rate in degrees per hour depending on the outdoor temperature. If there is no outdoor sensor, the **Minimum Recovery Ramp Rate** is used.
405	Min. Heat Recovery Outdoor Temp	Off -20° F to 100°F	0° F	Commercial	No	Off: The heating system will begin recovery at the time that is scheduled. When a **Minimum Recovery Ramp Rate** is set, the thermostat will begin recovery early to ensure the temperature is reached at the scheduled time. Set a **Minimum Recovery Ramp Rate** based on the rate that the heating system can recover at for a cold day in your region. Default setting is 5° F / hour. If an outdoor sensor is installed, set an **Outdoor Temperature** that is representative of a cold day in your region to be associated with the **Minimum Recovery Ramp Rate**. The thermostat will begin recovery at the optimal time based on a calculated ramp rate, allowing the system to recover on time and save energy during changing outdoor conditions. During recovery, the setpoint changes at a rate in degrees per hour depending on the outdoor temperature. If there is no outdoor sensor, the **Minimum Recovery Ramp Rate** is used.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
406	Max. Heat Recovery Ramp Rate	Off 1° F/hr to 20° F/hr	8° F/hr	Commercial	No	Off: The heating system will begin recovery at the time that is scheduled. When a **Maximum Recovery Ramp Rate** is set, the thermostat will begin recovery early to ensure the temperature is reached at the scheduled time. Set a **Maximum Recovery Ramp Rate** based on the rate that the heating system can recover at for a mild day in your region. Default setting is 8° F / hour. Set an **Outdoor Temperature** that is representative of a mild day in your region to be associated with the **Maximum Recovery Ramp Rate**. The thermostat will begin recovery at the optimal time based on a calculated ramp rate, allowing the system to recover on time and save energy during changing outdoor conditions. During recovery, the setpoint changes at a rate in degrees per hour depending on the outdoor temperature.
406	Max. Heat Recovery Outdoor Temp	Off -20° F to 100° F	40° F	Commercial	No	Off: The heating system will begin recovery at the time that is scheduled. When a **Maximum Recovery Ramp Rate** is set, the thermostat will begin recovery early to ensure the temperature is reached at the scheduled time. Set a **Maximum Recovery Ramp Rate** based on the rate that the heating system can recover at for a mild day in your region. Default setting is 8° F / hour. Set an **Outdoor Temperature** that is representative of a mild day in your region to be associated with the **Maximum Recovery Ramp Rate**. The thermostat will begin recovery at the optimal time based on a calculated ramp rate, allowing the system to recover on time and save energy during changing outdoor conditions. During recovery, the setpoint changes at a rate in degrees per hour depending on the outdoor temperature.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
407	Min. Cool Recovery Ramp Rate	Off 1° F/hr to 20° F/hr	3° F/hr	Commercial	No	Off: The cooling system will begin recovery at the time that is scheduled. When a **Minimum Recovery Ramp Rate** is set, the thermostat will begin recovery early to ensure the temperature is reached at the scheduled time. Set a **Minimum Recovery Ramp Rate** based on the rate that the cooling system can recover at for a hot day in your region. Default setting is 3° F / hour. If an outdoor sensor is installed, set an **Outdoor Temperature** that is representative of a hot day in your region to be associated with the **Minimum Recovery Ramp Rate**. The thermostat will begin recovery at the optimal time based on a calculated ramp rate, allowing the system to recover on time and save energy during changing outdoor conditions. During recovery, the setpoint changes at a rate in degrees per hour depending on the outdoor temperature. If there is no outdoor sensor, the **Minimum Recovery Ramp Rate** is used.
407	Min. Cool Recovery Outdoor Temp	Off -20° F to 100° F	90° F	Commercial	No	Off: The cooling system will begin recovery at the time that is scheduled. When a **Minimum Recovery Ramp Rate** is set, the thermostat will begin recovery early to ensure the temperature is reached at the scheduled time. Set a **Minimum Recovery Ramp Rate** based on the rate that the cooling system can recover at for a hot day in your region. Default setting is 3° F / hour. If an outdoor sensor is installed, set an **Outdoor Temperature** that is representative of a hot day in your region to be associated with the **Minimum Recovery Ramp Rate**. The thermostat will begin recovery at the optimal time based on a calculated ramp rate, allowing the system to recover on time and save energy during changing outdoor conditions. During recovery, the setpoint changes at a rate in degrees per hour depending on the outdoor temperature. If there is no outdoor sensor, the **Minimum Recovery Ramp Rate** is used.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
408	Max. Cool Recovery Ramp Rate	Off 1° F/hr to 20° F/hr	6° F/hr	Commercial	No	Off: The cooling system will begin recovery at the time that is scheduled. When a **Maximum Recovery Ramp Rate** is set, the thermostat will begin recovery early to ensure the temperature is reached at the scheduled time. Set a **Maximum Recovery Ramp Rate** based on the rate that the cooling system can recover at for a mild day in your region. Default setting is 6° F / hour. Set an **Outdoor Temperature** that is representative of a mild day in your region to be associated with the **Maximum Recovery Ramp Rate**. The thermostat will begin recovery at the optimal time based on a calculated ramp rate, allowing the system to recover on time and save energy during changing outdoor conditions. During recovery, the setpoint changes at a rate in degrees per hour depending on the outdoor temperature.
408	Max. Cool Recovery Outdoor Temp	Off -20° F to 100°F	70° F	Commercial	No	Off: The cooling system will begin recovery at the time that is scheduled. When a **Maximum Recovery Ramp Rate** is set, the thermostat will begin recovery early to ensure the temperature is reached at the scheduled time. Set a **Maximum Recovery Ramp Rate** based on the rate that the cooling system can recover at for a mild day in your region. Default setting is 6° F / hour. Set an **Outdoor Temperature** that is representative of a mild day in your region to be associated with the **Maximum Recovery Ramp Rate**. The thermostat will begin recovery at the optimal time based on a calculated ramp rate, allowing the system to recover on time and save energy during changing outdoor conditions. During recovery, the setpoint changes at a rate in degrees per hour depending on the outdoor temperature.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
409	Adaptive Recovery	No Yes	Yes	Residential	No	No: The system will begin heating or cooling recovery at the scheduled time. Yes: The thermostat will begin heating or cooling recovery early to ensure that the temperature is reached at the scheduled time. The thermostat will adjust the start time of the equipment based on how quickly the scheduled temperature was reached on previous days. See page 71 for more information on Adaptive Intelligent Recovery.
410	Minimum Cool Setpoint	50° F to 99° F	50° F	Both	No	The user cannot set the temperature below this level.
410	Maximum Heat Setpoint	40° F to 90° F	90° F	Both	No	The user cannot set the temperature above this level.
411	Keypad Lockout	Unlocked Partially Locked Fully Locked	Unlocked	Both	No	Unlocked: User has access to all thermostat settings. Partially Locked: User can modify only temperature settings. Fully Locked: User cannot modify any settings.
412	**Residential:** Entry / Exit Remote - Home Cool Setpoint **Commercial:** Entry / Exit Remote - Occupied Cool Setpoint	None 50° F to 99° F Note: setpoint is limited based on setting at ISU 410.	75° F	Both	No	The thermostat maintains this Cool setting when the user presses Home / Occupied at the Entry / Exit Remote. Select **None** to delete this temperature setting. The thermostat only responds to the Entry / Exit Remote if a temperature is pre-set at this screen. See “Wireless Entry/Exit Remote” beginning on page 110.
412	**Residential:** Entry / Exit Remote - Home Heat Setpoint **Commercial:** Entry / Exit Remote - Occupied Heat Setpoint	None 40° F to 90° F Note: setpoint is limited based on setting at ISU 410.	70° F	Both	No	The thermostat maintains this Heat setting when the user presses Home / Occupied at the Entry / Exit Remote. Select **None** to delete this temperature setting. The thermostat only responds to the Entry / Exit Remote if a temperature is pre-set at this screen. See “Wireless Entry/Exit Remote” beginning on page 110.
413	**Residential:** Entry / Exit Remote - Away Cool Setpoint **Commercial:** Entry / Exit Remote - Unoccupied Cool Setpoint	None 50° F to 99° F Note: setpoint is limited based on setting at ISU 410.	78° F	Both	No	The thermostat maintains this Cool setting when the user presses Away / Unoccupied at the Entry / Exit Remote. Select **None** to delete this temperature setting. The thermostat only responds to the Entry / Exit Remote if a temperature is pre-set at this screen. See “Wireless Entry/Exit Remote” beginning on page 110.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
413	**Residential:** Entry / Exit Remote - Away Heat Setpoint **Commercial:** Entry / Exit Remote - Unoccupied Heat Setpoint	None 40° F to 90° F Note: setpoint is limited based on setting at ISU 410.	65° F	Both	No	The thermostat maintains this Heat setting when the user presses Away / Unoccupied at the Entry / Exit Remote. Select **None** to delete this temperature setting. The thermostat only responds to the Entry / Exit Remote if a temperature is pre-set at this screen. See “Wireless Entry/Exit Remote” beginning on page 110.
414	**Residential:** Entry / Exit Remote - Vacation Cool Setpoint **Commercial:** Entry / Exit Remote - Holiday Cool Setpoint	None 50° F to 99° F Note: setpoint is limited based on setting at ISU 410.	82° F	Both	No	The thermostat maintains this Cool setting when the user presses Vacation / Holiday at the Entry / Exit Remote. Select **None** to delete this temperature setting. The thermostat only responds to the Entry / Exit Remote if a temperature is pre-set at this screen. See “Wireless Entry/Exit Remote” beginning on page 110.
414	**Residential:** Entry / Exit Remote - Vacation Heat Setpoint **Commercial:** Entry / Exit Remote - Holiday Heat Setpoint	None 40° F to 90° F Note: setpoint is limited based on setting at ISU 410.	60° F	Both	No	The thermostat maintains this Heat setting when the user presses Vacation / Holiday at the Entry / Exit Remote. Select **None** to delete this temperature setting. The thermostat only responds to the Entry / Exit Remote if a temperature is pre-set at this screen. See “Wireless Entry/Exit Remote” beginning on page 110.
500	Wired Sensor on S Terminals	No Yes	No	Both	No	This ISU is only displayed if an S1–S4 terminal is available.
500	Wired Remote Indoor Sensor	No Yes	No	Both	No	The thermostat will not display the **Wired Remote Indoor Sensor** option if 6 wireless indoor air sensors are already connected to the thermostat. If you have a wired Indoor Air Temperature network (1, 4, 9 etc), the thermostat will allow up to 5 wireless indoor air sensors.
500	Wired Outdoor Sensor	No Yes	No	Both	No	The thermostat will not display the **Wired Outdoor Sensor** option if a wireless outdoor air sensor is already connected to the thermostat.
500	Wired Return Sensor	No Yes	No	Both	Yes	The thermostat will not display the **Wired Return Sensor** option if there is no fan in the system.
500	Wired Discharge Sensor	No Yes	No	Both	No	The thermostat will not display the **Wired Discharge Sensor** option if there is no fan in the system.
501	Indoor Sensor Name	[Select Indoor Sensor Name]	Indoor Sensor	Both	No	Select a name (location) of the Wired Remote Indoor Sensor.
502	Indoor Sensor	None S1 S2 S3 S4	None	Both	No	Select the terminals wired to the Remote Indoor Sensor. Number of Sensor Inputs: Thermostat = S1 Equipment Interface Module = S1, S2, S3 and S4

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
503	Indoor Sensor Type	10K 20K	**10K:** if ISU 101 Application is Residential **20K:** if ISU 101: Application is Commercial	Both	No	Select 10K or 20K based on the sensor installed. Refer to resistance values below: C7189U1005 = 10K ohm C7772 = 20K ohm TR21 = 20K ohm TR21-A = 10K ohm (IMPORTANT - the TR21-A must be used in combination with a TR21 sensor or another TR21-A sensor for the thermostat to calculate the correct indoor temperature reading). See “Wiring guide — Wired Indoor Sensors” beginning on page 135 for information on the sensor type you should select based on how the sensors are wired. For example, you would select 20K when you have two TR21-A (10K) sensors wired in series.
504	Use [T-Stat Sensor] for Temp Ctrl Use [Remote Indoor Sensor Name] for Temp Ctrl Use [T-Stat Sensor] in Temp Avg Use [Remote Indoor Sensor Name] in Temp Avg	Use T-Stat Sensor for Temp Ctrl - Yes or No Use [Remote Indoor Sensor Name] for Temp Ctrl - Yes or No Use T-Stat Sensor in Temp Avg - Yes or No Use [Remote Indoor Sensor Name] in Temp Avg - Yes or No (Up to 6 Remote Indoor Sensors)	Sensors are Averaged (T-Stat Sensor and Remote)	Both	No	Select the sensors to be used for temperature control. If you select more than one, the thermostat will average the temperature readings from each sensor. See “Remote Indoor Sensors” beginning on page 112.
505	Outdoor Sensor	None S1 S2 S3 S4	None	Both	No	Select the terminals wired to the Outdoor Sensor. Number of Sensor Inputs: Thermostat = S1 Equipment Interface Module = S1, S2, S3 and S4
507	Return Sensor	None S1 S2 S3 S4	None	Both	Yes	Select the terminals wired to the Return Sensor. Number of Sensor Inputs: Thermostat = S1 Equipment Interface Module = S1, S2, S3 and S4
508	Return Sensor Type	10K 20K	10K	Both	Yes	Select 10K or 20K based on the sensor installed. Refer to resistance values below: 50062329-001 = 10K ohm 32005180-002 = 10K ohm C7735A1000 = 10K ohm C7770A = 20K ohm C7041 = 20K ohm
509	Discharge Sensor	None S1 S2 S3 S4	None	Both	No	Select the terminals wired to the Discharge Sensor. Number of Sensor Inputs: Thermostat = S1 Equipment Interface Module = S1, S2, S3 and S4

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
510	Discharge Sensor Type	10K 20K	10K	Both	No	Select 10K or 20K based on the sensor installed. Refer to resistance values below: 50062329-001 = 10K ohm 32005180-002 = 10K ohm C7735A1000 = 10K ohm C7770A = 20K ohm C7041 = 20K ohm
511	A-Coil Low Temp. Cutoff	Off 35° F to 65° F (in 5° F increments)	Off	Both	No	If an optional Discharge Sensor is used, this feature can help prevent icing on the air conditioning A-Coil. When temperature reaches the limit you set, compressor(s) will shutoff while the system fan continues to run, until the temperature rises to a safe level.
600	Dry Contact Device on S Terminals	No Yes	No	Both	Yes	Dry Contact Alerts and Remote Setback require an Equipment Interface Module. This ISU is only displayed if an S1-S4 terminal is available. See “Dry Contact Alerts” beginning on page 74 and “Remote Setback (Commercial Use)” beginning on page 105.
600	Remote Setback Dry Contact	No Yes	No	Commercial	Yes	Remote Setback requires an Equipment Interface Module. This ISU is only displayed if an S1-S4 terminal is available.
600	Full Drain Pan Dry Contact Alert	No Yes	No	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. This ISU is only displayed if an S1-S4 terminal is available. See “Dry Contact Alerts” beginning on page 74.
600	Dirty Filter Dry Contact Alert	No Yes	No	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. This ISU is only displayed if an S1-S4 terminal is available. See “Dry Contact Alerts” beginning on page 74.
600	Water Leak Dry Contact Alert	No Yes	No	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. This ISU is only displayed if an S1-S4 terminal is available. See “Dry Contact Alerts” beginning on page 74.
600	Sys. Shutdown Dry Contact Alert	No Yes	No	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. This ISU is only displayed if an S1-S4 terminal is available. See “Dry Contact Alerts” beginning on page 74.
600	Service Needed Dry Contact Alert	No Yes	No	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. This ISU is only displayed if an S1-S4 terminal is available. See “Dry Contact Alerts” beginning on page 74.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
600	Fan Failure Dry Contact Alert	No Yes	No	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. This ISU is only displayed if an S1-S4 terminal is available. See “Dry Contact Alerts” beginning on page 74.
600	Custom Dry Contact Alert	No Yes	No	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. This ISU is only displayed if an S1-S4 terminal is available. See “Dry Contact Alerts” beginning on page 74.
601	Remote Setback	None S1 S2 S3 S4	None	Commercial	Yes	Remote Setback requires an Equipment Interface Module. Select the terminals wired to the Remote Setback Dry Contact Device.
602	Remote Setback is [See Settings]	N.O. when Occupied N.C. when Occupied	N.O. when Occupied	Commercial	Yes	Remote Setback requires an EIM (Equipment Interface Module). Choose an option appropriate for the type of device installed: Normally Open when Occupied: The Dry Contact device is open when the room is occupied and will close when the room is unoccupied. Normally Closed when Occupied: The Dry Contact device is closed when the room is occupied and will open when the room is unoccupied.
603	Remote Setback Time Delay	0 to 30 minutes (in 5 minute increments)	0 minutes	Commercial	Yes	Remote Setback requires an EIM (Equipment Interface Module). The **Remote Setback Time Delay** forces the thermostat to wait before it switches from Occupied to the Remote Setback temperature settings. When set to 0 minutes, the thermostat will switch from Occupied to the Remote Setback temperature settings immediately when the room is unoccupied.
604	Remote Setback Cool Setpoint	72° F to 90° F	85° F	Commercial	Yes	Remote Setback requires an EIM (Equipment Interface Module). During occupied periods, the occupancy sensor tells the thermostat to go to setback settings when no one is in the room. If someone is in the room, then it follows the settings of the occupied period. The occupancy sensor is ignored during unoccupied periods. If the thermostat is setup for non-programmable, the occupancy sensor tells the thermostat to go to setback settings when no one is in the room. If someone is in the room, then it follows the settings set by the user.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
604	Remote Setback Heat Setpoint	50° F to 70° F	64° F	Commercial	Yes	Remote Setback requires an EIM (Equipment Interface Module). During occupied periods, the occupancy sensor tells the thermostat to go to setback settings when no one is in the room. If someone is in the room, then it follows the settings of the occupied period. The occupancy sensor is ignored during unoccupied periods. If the thermostat is setup for non-programmable, the occupancy sensor tells the thermostat to go to setback settings when no one is in the room. If someone is in the room, then it follows the settings set by the user.
605	Drain Pan Alert	None S1 S2 S3 S4	None	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. Select the terminals wired to the Full Drain Pan Dry Contact Device.
606	Drain Pan Alert is [See Settings]	Normally Open Normally Closed	Normally Open	Both	Yes	Dry Contact Alerts require an EIM (Equipment Interface Module). Choose an option appropriate for the type of device installed. Normally Open: The Dry Contact device is normally open and will close when the device detects the drain pan is full. Normally Closed: The Dry Contact device is normally closed and will open when the device detects the drain pan is full.
607	Dirty Filter Alert	None S1 S2 S3 S4	None	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. Select the terminals wired to the Dirty Filter Dry Contact Device.
608	Dirty Filtr Alert is [See Settings]	Normally Open Normally Closed	Normally Open	Both	Yes	Dry Contact Alerts require an EIM (Equipment Interface Module). Choose an option appropriate for the type of device installed: Normally Open: The Dry Contact device is normally open and will close when the device detects a dirty filter. Normally Closed: The Dry Contact device is normally closed and will open when the device detects a dirty filter.
609	Water Leak Alert	None S1 S2 S3 S4	None	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. Select the terminals wired to the Water Leak Dry Contact Device (wet switch).

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
610	Water Leak Alert is [See Settings]	Normally Open Normally Closed	Normally Open	Both	Yes	Dry Contact Alerts require an EIM (Equipment Interface Module). Choose an option appropriate for the type of device installed: Normally Open: The Dry Contact device is normally open and will close when the device detects water. Normally Closed: The Dry Contact device is normally closed and will open when the device detects water.
611	Shutdown Alert	None S1 S2 S3 S4	None	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. Select the terminals wired to the System Shutdown Dry Contact Device.
612	Shutdown Alert is [See Settings]	Normally Open Normally Closed	Normally Open	Both	Yes	Dry Contact Alerts require an EIM (Equipment Interface Module). Choose an option appropriate for the type of device installed: Normally Open: The Dry Contact device is normally open and will close when the device detects a problem. Normally Closed: The Dry Contact device is normally closed and will open when the device detects a problem.
613	Service Alert	None S1 S2 S3 S4	None	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. Select the terminals wired to the Service Needed Dry Contact Device.
614	Service Alert is [See Settings]	Normally Open Normally Closed	Normally Open	Both	Yes	Dry Contact Alerts require an EIM (Equipment Interface Module). Choose an option appropriate for the type of device installed: Normally Open: The Dry Contact device is normally open and will close when the device detects a problem. Normally Closed: The Dry Contact device is normally closed and will open when the device detects a problem.
615	Fan Failure Alert	None S1 S2 S3 S4	None	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. Select the terminals wired to the Fan Failure Dry Contact Device.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
616	Fan Failure Alert is [See Settings]	N.O. when Fan Runs N.C. when Fan Runs	N.C. when Fan Runs	Both	Yes	Dry Contact Alerts require an EIM (Equipment Interface Module). Choose an option appropriate for the type of device installed: Normally Open when Fan is Running: The Dry Contact device is open when the fan is running and will close when the fan is not running. Normally Closed when Fan is Running: The Dry Contact device is closed when the fan is running and will open when the fan is not running.
617	Custom Alert	None S1 S2 S3 S4	None	Both	Yes	Dry Contact Alerts require an Equipment Interface Module. Select the terminals wired to the Custom Dry Contact Device.
618	Custom Alert is [See Settings]	Normally Open Normally Closed	Normally Open	Both	Yes	Dry Contact Alerts require an EIM (Equipment Interface Module). Choose an option appropriate for the type of device installed: Normally Open: The Dry Contact device is normally open and will close when the device detects a problem. Normally Closed: The Dry Contact device is normally closed and will open when the device detects a problem.
619	Custom Alert Name	View/Edit Custom Alert	View/Edit Custom Alert	Both	Yes	Dry Contact Alerts require an EIM (Equipment Interface Module). Enter a name for the custom alert dry contact. The thermostat displays this name including a brief message (entered on the next screen - ISU 620) when a dry contact device detects a problem.
620	Cust Alert Message	View/Edit Custom Alert	View/Edit Custom Alert	Both	Yes	Dry Contact Alerts require an EIM (Equipment Interface Module). Enter a message for the custom alert dry contact. The thermostat displays this message when a dry contact device detects a problem.
700	Filter Type	None Elec. Air Cleaner Media	Media	Both	No	
702	Number of Air Filters	1 to 2	1	Both	No	

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
711	Air Filter 1 Reminder Note: “1” is not displayed if there is only 1 filter.	Off Run Time: 10, 20, 30, 45, 60, 90, 120, 150 days Calendar: 30, 45, 60, 75 days 3, 4, 5, 6, 9, 12, 15 months	Off	Both	No	
711	Air Filter 2 Reminder	Off Run Time: 10, 20, 30, 45, 60, 90, 120, 150 days Calendar: 30, 45, 60, 75 days 3, 4, 5, 6, 9, 12, 15 months	Off	Both	No	
712	EAC Cell Reminder	Off Calendar Months: 6, 7, 8, 9, 10, 11, 12 months	Off	Both	No	Electronic Air Cleaner Cell Cleaning Reminder
712	EAC Pre-Filter Reminder	Off Calendar Months: 3, 4, 5, 6 months	Off	Both	No	Electronic Air Cleaner Pre-Filter Cleaning Reminder
712	EAC Post Filter Reminder	Off Calendar Months: 6, 7, 8, 9, 10, 11, 12 months	Off	Both	No	Electronic Air Cleaner Post-Filter Replacement Reminder
800	Humidifier Type	None Steam Bypass / Fan Pwrd	None	Both	No	
801	Sensor for Hum	T-Stat Sensor Remote Indoor Sensor Name Remote Indoor Sensor Name Remote Indoor Sensor Name Remote Indoor Sensor Name Remote Indoor Sensor Name Remote Indoor Sensor Name (Up to 6 Remote Indoor Sensors)	T-Stat Sensor	Both	No	Select a sensor to control humidification (thermostat or an optional remote sensor). If multiple sensors are installed, you can use a different sensor for dehumidification control. See “Humidification control” beginning on page 112. Note: Humidity sensing cannot be averaged.
803	Humidifier Wiring	None U1 U2 U3	Thermostat defaults to the next unused universal terminal (U1, U2, U3).	Both	No	**Number of Universal Outputs:** TH8321 Thermostat: U1 terminals Equipment Interface Module (EIM): U1, U2 and U3 terminals U1, U2, U3 are dry contacts that require power. See “Wiring IAQ Equipment or a Heat/Cool Stage to the Universal Terminals” beginning on page 129.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
805	Window Protection	Off On	Off	Both	No	Requires an optional outdoor sensor. Off: The thermostat controls the humidity level to the user's desired humidity setting. Frost or condensation may appear on windows. On: The thermostat prevents frost or condensation on windows by not allowing the humidifier to run above a certain level. To prevent frost or condensation, the thermostat may turn off the humidifier before the humidity setting is reached. See “Window Protection” beginning on page 80.
806	User Humidifier in Heat Mode Use Humidifier in Cool Mode Use Humidifier in Off Mode	User Humidifier in Heat Mode - No or Yes Use Humidifier in Cool Mode - No or Yes Use Humidifier in Off Mode - No or Yes	User Humidifier in Heat Mode - Yes Default varies based on heating/cooling equipment selected	Both	No	Heat: Includes Heat, Emergency Heat and Auto. If the system is in Auto mode, the thermostat will allow humidification if the last call was for heat. Cool: Includes Cool and Auto. If the system is in Auto mode, the thermostat will allow humidification if the last call was for cool. A discharge air temperature sensor is required to humidify in the Cool mode. Off: The thermostat will allow humidification when the system setting is Off. See “Set up Humidification” beginning on page 80.
807	Humidifier Control	Hum when Heat is On Hum when Fan is On Tstat Controls Fan Hum Controls Fan	Defaults to **Hum when Heat is On** when ISU 800 Humidifier Type is Bypass or Fan Pwrd Defaults to **Tstat Controls Fan** when ISU 800 Humidifier Type is Steam	Both	No	**Hum when Heat is On:** The thermostat turns on the humidifier only if the heat is currently running and humidification is needed. **Hum when Fan is On**: The thermostat turns on the humidifier only if the fan is currently running and humidification is needed. **Tstat Controls Fan**: The thermostat turns on the humidifier and the fan when humidification is needed. **Hum Controls Fan**: The thermostat turns on the humidifier when humidification is needed and the humidifier controls the fan.
808	Run Humidifier when Cool is On	Yes No	Yes	Both	No	Yes: Humidifier can run when the cooling system is on. No: Humidifier can NOT run when the cooling system is on.
810	Hum Tank / Filter Reminder	Off 60 Run Time Days 90 Run Time Days 6 Calendar Months 12 Calendar Months	Off	Both	No	This ISU is only displayed if ISU 800 Humidifier Type is Steam. Run Time Days are not shown if ISU 800 Humidifier Type is set to None.
810	Humidifier Pad Reminder	Off 60 Run Time Days 90 Run Time Days 6 Calendar Months 12 Calendar Months	Off	Both	No	This ISU is only displayed if ISU 800 Humidifier Type is Bypass or Fan Pwrd. Run Time Days are not shown if ISU 800 Humidifier Type is set to None.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
900	Dehumidification Equipment	**Residential:** None A/C with Low Fan A/C with High Fan Dehumidifier **Commercial:** None A/C with Low Fan A/C with High Fan Hot Gas Bypass Dehumidifier	None	Both	No	See "Dehumidification - Residential" beginning on page 83 or "Dehumidification - Commercial" beginning on page 87.
901	Sensor for Dehum	Change to: T-Stat Sensor Remote Indoor Sensor Name Remote Indoor Sensor Name Remote Indoor Sensor Name Remote Indoor Sensor Name Remote Indoor Sensor Name Remote Indoor Sensor Name (Up to 6 Remote Indoor Sensors)	T-Stat Sensor	Both	No	Select a sensor to control dehumidification (thermostat or an optional remote sensor). If multiple sensors are installed, you can use a different sensor for humidification control. See "Dehumidification control" beginning on page 112. Note: Humidity sensing cannot be averaged.
902	Humidity Sensor on Home Screen	Hum Dehum	Hum	Both	No	This ISU is only displayed when separate humidity sensors are used to control humidification and dehumidification. Only one of the sensors can be displayed on the home screen. Select either the Humidification Sensor or the Dehumidification Sensor.
904	Dehum Wiring	None U1 U2 U3	Thermostat defaults to the next unused universal terminal (U1, U2, U3).	Both	No	**Number of Universal Outputs:** TH8321 Thermostat: U1 terminals Equipment Interface Module (EIM): U1, U2 and U3 terminals U1, U2, U3 are dry contacts that require power. See "Wiring IAQ Equipment or a Heat/Cool Stage to the Universal Terminals" beginning on page 129.
905	Dehum Terminal - U1 Dehum Terminal - U2 Dehum Terminal - U3 Note: The U terminal shown on the screen depends on the terminal you selected at ISU 904 (Dehum Wiring).	Normally Closed Normally Open	Defaults to **Normally Closed** when ISU 900 Dehum Equipment is A/C with Low Fan Defaults to **Normally Open** when ISU 900 Dehum Equipment is Hot Gas Bypass	Both	No	Choose an option appropriate for the type of equipment installed. Normally Open: U1, U2 or U3 will normally be open and will close when the thermostat calls for dehumidification. Normally Closed: U1, U2 or U3 will normally be closed and will open when the thermostat calls for dehumidification. **Number of Universal Outputs:** TH8321 Thermostat: U1 terminals Equipment Interface Module (EIM): U1, U2 and U3 terminals

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
907	Dehum Over Cooling Limit	0°, 1°, 2°, 3° F	3° F	Residential	No	This ISU is only displayed when ISU 900 Dehum Equipment is set to **A/C with Low Fan** or **A/C with High Fan.** The thermostat uses the cooling system to reduce humidity by lowering the temperature up to 3° F below the current cool setpoint until the desired humidity level is reached. The thermostat keeps the temperature below the cooling setpoint until the desired humidity level is reached. 0° F is only an option when ISU 900 Dehum Equipment is set to **A/C with Low Fan.**
908	DehumControl	Basic Minimum On Time Cooling Droop Reheat	Basic	Commercial	No	See “Dehumidification - Commercial” beginning on page 87.
909	Dehum Minimum On Time	5 to 15 minutes	10 minutes	Commercial	No	This ISU is only displayed if ISU 908 Dehum Control is set to **Minimum On Time**. This option ensures that the compressor runs long enough to effectively reduce humidity when the cooling equipment is cycled on. The compressor will run for the “minimum on time” you set until the desired humidity level is reached.
910	Dehum Over Cooling Limit	1° F to 5° F	2° F	Commercial	No	This ISU is only displayed if ISU 908 Dehum Control is set to **Cooling Droop**. The thermostat uses the cooling system to reduce humidity by lowering the temperature up to 5° F below the current cool setpoint until the desired humidity level is reached. The thermostat keeps the temperature below the cooling setpoint until the desired humidity level is reached.
912	User Dehumidifier in Heat Mode Use Dehumidifier in Cool Mode Use Dehumidifier in Off Mode	User Dehumidifier in Heat Mode - No or Yes Use Dehumidifier in Cool Mode - No or Yes Use Dehumidifier in Off Mode - No or Yes	Use Dehumidifier in Cool Mode - Yes Default varies based on heating/cooling equipment selected	Both	No	This ISU is only displayed when ISU 900 Dehum Equipment is set to **Dehumidifier.** Heat: Includes Heat, Emergency Heat and Auto. If the system is in Auto mode, the thermostat will allow dehumidification if the last call was for heat. Cool: Includes Cool and Auto. If the system is in Auto mode, the thermostat will allow dehumidification if the last call was for cool. Off: The thermostat will allow dehumidification when the system setting is Off. See “Dehumidification - Residential” beginning on page 83 or “Dehumidification - Commercial” beginning on page 87.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
913	Dehum Fan Control	Tstat Controls Fan Equip Controls Fan	Tstat Controls Fan	Both	No	This ISU is only displayed when ISU 900 Dehum Equipment is set to **Dehumidifier.** Tstat Controls Fan: The thermostat turns on the dehumidifier and the fan when dehumidification is needed. Equip Controls Fan: The thermostat turns on the dehumidifier when dehumidification is needed. The fan is controlled by the equipment.
914	Run Dehumidifier when Cool is On	Yes No	Yes	Both	No	This ISU is only displayed when ISU 900 Dehum Equipment is set to **Dehumidifier.** Yes: Dehumidifier can run when the cooling system is on. No: Dehumidifier can NOT run when the cooling system is on.
918	Dehum Away Mode	Not Allowed Allowed	Not Allowed	Both	No	This ISU is NOT displayed when ISU 900 Dehum Equipment is **None.** ISU 919 to 920 are only displayed when ISU 918 Dehum Away Mode is **Allowed.** See “Dehumidification Away Mode” beginning on page 85.
919	Dehum Away Mode Fan Setting	Automatic On Circulate	Automatic	Both	No	The **On** and **Circulate** settings may re-introduce humidity into the living space.
920	Dehum Away Mode Low Limit Temp	70° F to 80° F	76° F	Both	No	If the cooling system is used to control humidity while Dehumidification Away Mode is active, the thermostat allows the cooling system to lower the indoor air to the Low Limit Temperature Setting to reach the dehumidification setting at ISU 920.
920	Dehum Away mode Temp Setting	70° F to 99° F	85° F	Both	No	The temperature maintained while Dehumidification Away Mode is active and the desired humidity level is satisfied.
920	Dehum Away mode Dehum Setting	40% to 70% (in 5% increments)	65%	Both	No	The desired humidity level while Dehumidification Away Mode is active.
921	Dehumidifier Filter Reminder	Off 30, 60, Calendar Days 3 to 12 Calendar Months (in 1 month increments)	Off	Both	No	
1000	Ventilation Type	None ERV / HRV Passive (Fan Only) Fresh Air Damper	None	Both	No	None: The thermostat does not control ventilation. ERV/HRV: The thermostat controls an Energy Recovery Ventilator or Heat Recovery Ventilator for ventilation. Passive (Fan Only): The thermostat turns on the fan for ventilation. Fresh Air Damper: The thermostat turns on the fan and opens a fresh air damper for ventilation.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
1002	Ventilation Wiring	None U1 U2 U3	Thermostat defaults to the next unused universal terminal (U1, U2, U3).	Both	No	**Number of Universal Outputs:** TH8321 Thermostat: U1 terminals Equipment Interface Module (EIM): U1, U2 and U3 terminals U1, U2, U3 are dry contacts that require power. See "Wiring IAQ Equipment or a Heat/Cool Stage to the Universal Terminals" beginning on page 129.
1005	Ventilation Method	ASHRAE Percent On Time	Defaults to **ASHRAE** when ISU 101 Application is set to Residential. **Percent on Time** is the only choice when ISU 101 Application is set to Commercial.	Both	No	See "Ventilation Control Methods (ISU 1005)" beginning on page 91.
1006	Vent Fan Control	Tstat Controls Fan Equip Controls Fan	Tstat Controls Fan	Both	No	Tstat Controls Fan: The thermostat turns on the ventilation equipment and the fan when ventilation is needed. Equip Controls Fan: The thermostat turns on the ventilation equipment when ventilation is needed. The fan is controlled by the equipment.
1009	Number of Bedrooms	1 to 6	2 bedrooms	Residential	No	This ISU is only displayed when ISU 1005 Ventilation Method is set to **ASHRAE** (Residential only).
1009	Size of House	1000 to 5000 sq. ft. (in 100 sq. ft. increments) (90 to 460 sq. m.)	1000 sq. feet	Residential	No	This ISU is only displayed when ISU 1005 Ventilation Method is set to **ASHRAE** (Residential only).
1010	Ventilation Rate	30 to 350 CFM (in 5 CFM increments) (850 - 9900 LPM)	150	Residential	No	This ISU is only displayed when ISU 1005 Ventilation Method is set to **ASHRAE** (Residential only).
1012	Vent Percent On Time	10% to 100% (in 10% increments)	30%	Both	No	The thermostat operates ventilation equipment based on a percentage entered in the installer setup (ISU 1012). For example, if Percent on Time is set to 50%, the ventilation equipment will run at random times during a 1 hour period until it reaches a 50% run time (approximately 30 minutes).

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
1012	Vent Priority	Lockouts ASHRAE	Lockouts	Residential	No	**Lockouts are Priority:** The thermostat places a priority on lockouts versus the ASHRAE 62.2 ventilation standard. The thermostat will not run ventilation during the following lockout conditions (if configured) unless you manually call for ventilation: • Lockout Ventilation during Outdoor Conditions (ISU 1013) • Lockout Ventilation on Humidification or Dehumidification Calls (ISU 1014) • Lockout Ventilation during “Sleep” (Residential) or “Unoccupied” (Commercial) program periods. Note: This option is set by the user on the Ventilation screen in the Menu. **ASHRAE is Priority:** ASHRAE requires additional ventilation following a long off cycle. The thermostat meets the ASHRAE 62.2 ventilation standard by running additional ventilation when outdoor conditions are favorable. If ASHRAE cannot be met when outdoor conditions are favorable, the thermostat will override the outdoor lockouts and run ventilation. When using this option, it is recommended to increase the rate (CFM) of the ventilation equipment to meet the ASHRAE 62.2 ventilation standard in a shorter run time. Notes: • ISU 1014 Lockout Ventilation on Humidification or Dehumidification calls is not an option when you select ASHRAE is Priority. • The ability to lockout ventilation during the “Sleep” or Unoccupied program periods is not an option when you select ASHRAE is Priority.
1013	Low Outdoor Temp Vent Lockout	Off -20° F to 40° F (in 5° F increments)	Off	Both	No	Requires an outdoor sensor. This ISU is only displayed when ISU 1000 Ventilation Type is set to **ERV / HRV** or **Fresh Air Damper**. See “Ventilation — Outdoor Condition Lockouts (ISU 1013)” beginning on page 91.
1013	High Outdoor Temp Vent Lockout	Off 80° F to 110° F (in 5° F increments)	Off	Both	No	Requires an outdoor sensor. This ISU is only displayed when ISU 1000 Ventilation Type is set to **ERV / HRV** or **Fresh Air Damper**. See “Ventilation — Outdoor Condition Lockouts (ISU 1013)” beginning on page 91.
1013	High Out. Dew Point Vent Lockout	Off 65° F to 85° F (in 5° F increments)	Off	Both	No	Requires a Wireless Outdoor Sensor (sense outdoor humidity). This ISU is only displayed when ISU 1000 Ventilation Type is set to **ERV / HRV** or **Fresh Air Damper**. See “Ventilation — Outdoor Condition Lockouts (ISU 1013)” beginning on page 91.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
1014	Vent During Hum or Dehum Calls	Yes No	Yes	Both	No	This feature is used to help reach the user's desired humidity level by not allowing the ventilation equipment to run during a call for humidification or dehumidification. Yes: Ventilation is allowed to run during a call for humidification or dehumidification. No: Ventilation is NOT allowed to run during a call for humidification or dehumidification.
1016	Vent On High Indoor Humidity	Off On	On	Both	No	This ISU is only displayed when ISU 1000 Ventilation Type is set to **ERV / HRV**. Off: The humidity level has no effect on ventilation. On: The thermostat removes excess humidity by turning on the ventilator when the indoor humidity rises 10% above the user's humidification setting. The thermostat must be in the heat mode to ventilate on high humidity.
1017	Ventilator Core Reminder	Off 3, 6, 9, 12 Calendar Months	Off	Both	No	Ventilator Core Cleaning Reminder
1017	Ventilator Filter Reminder	Off 3, 6, 9, 12 Calendar Months	Off	Both	No	Ventilator Filter Cleaning Reminder
1100	Number of UV Devices	0, 1, 2	0	Both	No	Press the up/down arrows to select the number of UV devices installed in the system. Some systems may have two UV devices, one for the A-Coil and another for Air Treatment. A replacement reminder can be setup for each one. Select 0 if no UV devices are installed.
1105	UV Bulb 1 Reminder *Note: "1" is not displayed if there is only 1 UV Bulb*	Off, 6, 12, 24 Calendar Months	Off	Both	No	UV Bulb 1 Replacement Reminder
1105	UV Bulb 2 Reminder	Off, 6, 12, 24 Calendar Months	Off	Both	No	UV Bulb 2 Replacement Reminder
1200	Custom Reminders	View / Edit Custom Reminders Add Custom Reminders	None	Both	No	See "Customizable Reminders" beginning on page 96.
28	Backlighting	On Demand Continuous	On Demand	Both	No	Select Continuous or On Demand backlighting. Select Continuous backlighting if you would like the backlight to be on all the time (C wire is required for Continuous backlighting). Select On Demand backlighting if you would like the backlight to only turn on after a key press. After you complete your changes, the screen stays lit for 16 seconds if the thermostat is battery powered only or it stays lit for 45 seconds if the thermostat is system powered (C wire).
1400	Clock Format	12 hour 24 hour	12	Both	No	
1401	Daylight Saving Time	Off On	On	Both	No	Set to Off in areas that do not follow Daylight Saving Time.

Table 2. Installer Setup (ISU) Table. (Continued)

ISU Number	Installer Setup Name	Settings	Default	Residential, Commercial or Both	Requires EIM	Notes
1402	Indoor Temperature Offset	-3° F to 3° F (in 1° F increments)	0° F	Both	No	0° F - No difference in displayed temperature and the actual room temperature. The thermostat displays up to 3°F (1.5°C) lower or higher than the actual measured temperature.
1402	Indoor Humidity Offset	-12% to 12% (in 1% increments)	0%	Both	No	0% - No difference in displayed humidity and the actual room humidity. The thermostat displays up to 12% lower or higher than the actual measured humidity.
1404	Alert Light Indicator	On Off	On	Both	No	The thermostat has a built in light indicator. When an alert is active, the light will be on continuous if the thermostat is powered with 24 VAC (C wire) or it will flash if the thermostat is powered with batteries only. The light also turns on when the system setting is set to Em Heat. Select On to use the light indicator or select Off to turn off the light.
1500	Dealer Name	[Dealer Name]	None	Both	No	Dealer information is displayed to the user when an alert is active and the user can access this information by selecting "Dealer Information" in the Menu.
1500	Dealer Phone	[Dealer Phone]	None	Both	No	
1501	Dealer Email Address	[Dealer Email Address]	None	Both	No	
1501	Dealer Website	[Dealer Website]	None	Both	No	
1502	Dealer Message	[Dealer Message]	None	Both	No	

INSTALLER TESTS

Use the installer tests to check out the system:

- **Equipment Test:** Tests the heating, cooling, fan, and IAQ equipment. The test allows you to manually call for each system to ensure the equipment and thermostat operate properly. Any minimum off timers are ignored during the system test. You can test the following equipment:
  - — Heat
  - — Em Heat
  - — Cool
  - — Fan
  - — Humidification
  - — Dehumidification
  - — Ventilation
  - — Economizer
  - — Time of Day
- **Wireless Test:** Run this test to verify that the thermostat can communicate properly in the installed location. The test measures the signal strength between the
  - — Thermostat and the Equipment Interface Module (in non-zoned applications)
  - — Thermostat and the TrueZONE Wireless Adapter (in zoned applications)

Accessing Installer Tests

1. Press MENU on the home screen, then scroll down to Installer Options and press SELECT.
2. Enter the password (date code) when prompted. See “Finding Your Password (Date Code) to Access Installer Options” beginning on page 19 for more information.
3. Scroll down to Installer Test and press SELECT.

Fig. 64.

4. Select Equipment Test or Wireless Test.

Fig. 65.

⚠ CAUTION

Equipment Damage Hazard.
Minimum compressor off time is bypassed during the Equipment Test
Avoid cycling compressor quickly.

Using the Equipment Test

1. Select the equipment you want to test and press the arrow buttons to turn the equipment on/off. Press Back to test the remaining equipment.

   NOTE: The time out for the Equipment Test mode is 30 minutes (if there is no keypress for 30 minutes, the thermostat will automatically exit the Equipment Test).

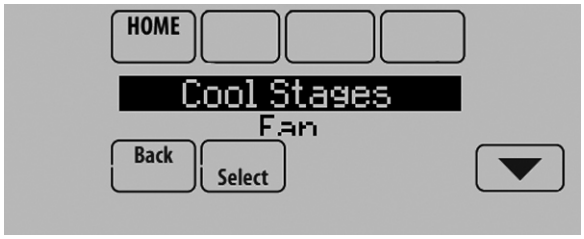


Fig. 66.

Fig. 67.

2. Run Time, Discharge, Return and Delta T data are displayed for heating and cooling tests (requires Discharge and Return Air Sensors). See Fig. 68.
   The Discharge, Return and Delta T are updated every 30 seconds during the test. The Run Time counter starts over when the next stage is turned on.

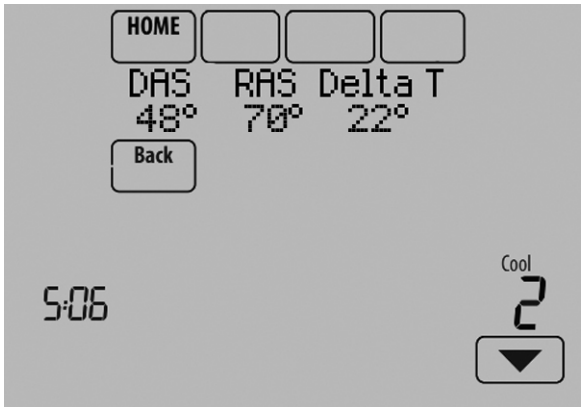


Fig. 68.

Using the Wireless Signal Strength Test

1. Select Installer Test (see Fig. 64), then select **Wireless Test**.

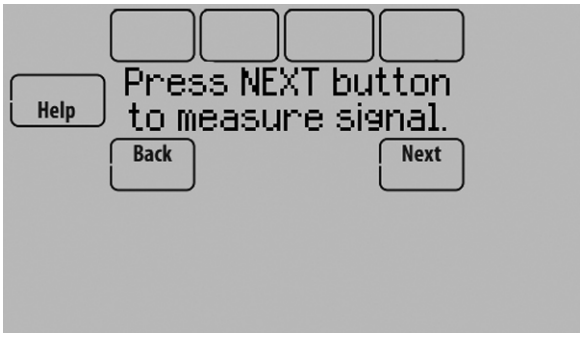


Fig. 69.

2. Press **Next** to measure the signal strength. After a brief pause, the thermostat will display test results.
3. A number from 5-10 means communication is good.

Fig. 70.

4. If the screen displays “No Signal,” move the thermostat to a different location and test again.

Fig. 71.

Mounting Optional Accessories

Outdoor Sensor

Mount the sensor where:
- it cannot be tampered with.
- there is good air circulation.
- it can measure true outdoor ambient temperature and humidity.
- wire distance between C7089U1006 and thermostat/EIM is less than 200 feet (wired sensor only).

Do *not* mount the sensor:
- in direct sunlight.
- where hot or cold air blows on the sensor. Discharge line from an outdoor compressor unit, vent or fan causes inaccurate temperature readings.
- where snow, ice or debris can cover it.

MOUNTING C7089R1013 WIRELESS OUTDOOR SENSOR

Use the following steps to mount the sensor (see Fig. 72):
1. Mount the sensor on a vertical exterior wall, at least 6 inches below any overhang. Choose a location protected from direct sunlight.
2. Place sensor securely in bracket, facing away from wall.

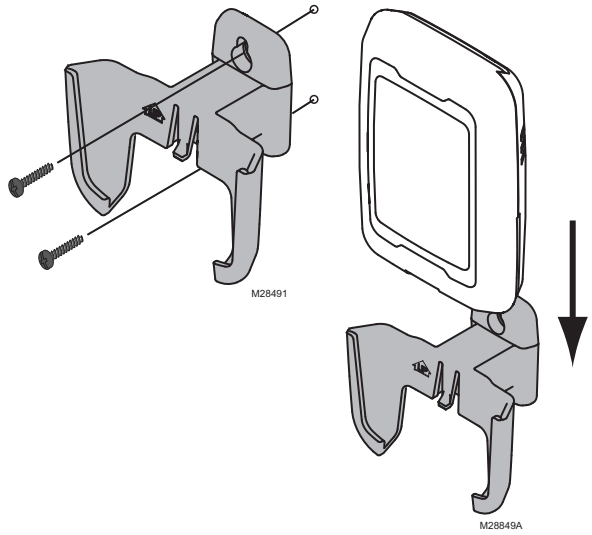


Fig. 72. Mounting Outdoor Sensor.

MOUNTING C7089U1006 WIRED OUTDOOR TEMPERATURE SENSOR

Use the following steps to mount the sensor:
1. Remove the sensor from the mounting clip.
2. Mark the area on the location selected for mounting the sensor mounting clip.
3. Mount the clip.
4. See “Wiring C7089U1006 Outdoor Sensor” on page 134.

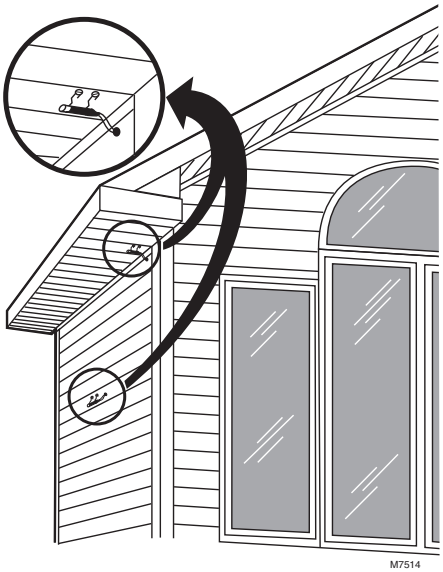


Fig. 73. Typical locations for C7089U1006 Outdoor Sensor.

C7189R1004 Wireless Indoor Sensor

Use the following steps to mount the sensor (see Fig. 74):

1. Remove the wallplate and mount it 4 to 6 feet above the floor on an interior wall. Drill 3/16-inch holes for drywall, 7/32-inch for plaster.
2. Attach sensor securely to wallplate as shown.

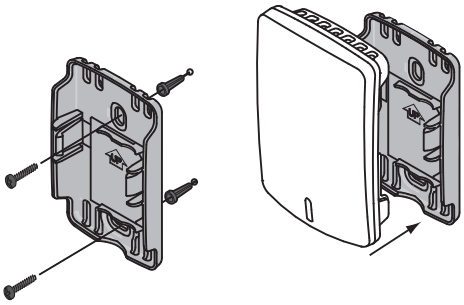


Fig. 74. Mounting Indoor Sensor.

C7189U1005 Wired Indoor Sensor

Use the following steps to mount the sensor:

1. Remove the cover from the remote sensor (see Fig. 75).

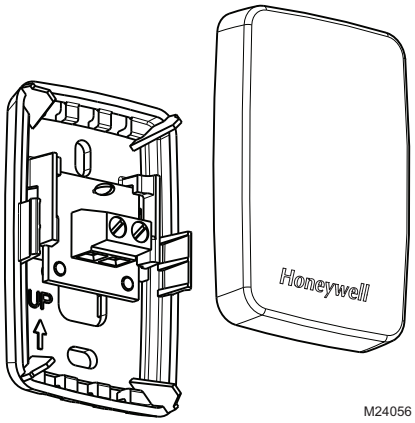


Fig. 75. Remove the cover.

2. Pull wires through wire hole.
3. Position wallplate on wall, level and mark screw hole positions with pencil.
4. Drill holes at marked positions, then tap in supplied wall anchors.
5. Place wallplate over anchors, insert and tighten mounting screws (see Fig. 76).

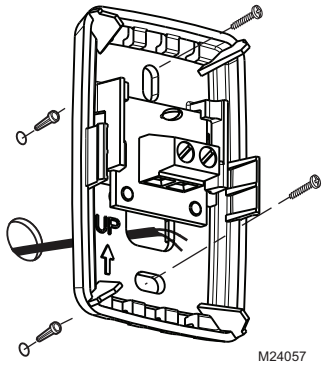


Fig. 76. Mount wallplate to wall.

6. Replace the cover on the remote sensor.

Entry/Exit Remote or Vent Boost Remote

Mounting the remote is optional.

1. Remove the front cover from the remote.
2. Use provided screws and wall anchors to fasten the remote to the wall. Drill 3/16-inch holes for drywall, 7/32-inch for plaster.

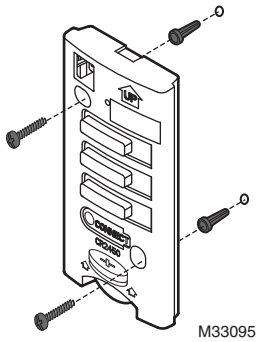
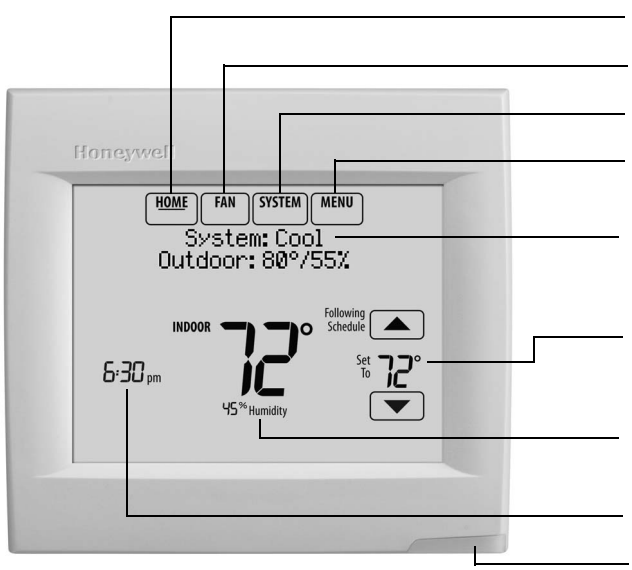


Fig. 77. Mounting Entry/Exit Remote or Vent Boost Remote.

3. Replace the cover on the remote.

OPERATION



HOME. Touch to display Home screen.

FAN. Select fan mode.

SYSTEM. Select system mode (Heat/Cool).

MENU. Touch to display options. Start here to set a program schedule.

Current status. Shows system mode (heat/cool), outdoor temperature and humidity (with optional outdoor sensor).

Current schedule. Touch an arrow to change temperature setting and select a Temporary or Permanent Hold.

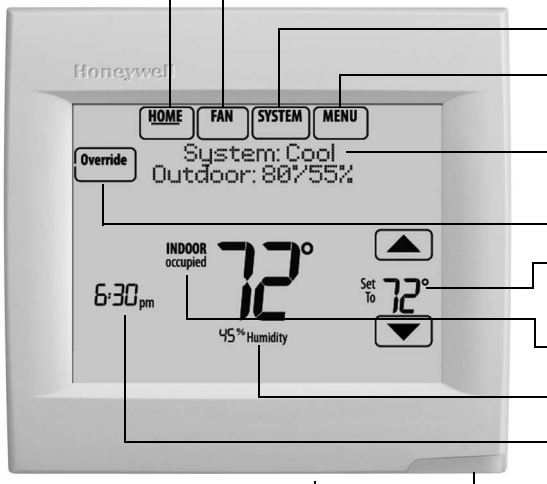
Indoor conditions. Shows indoor temperature and humidity.

Current time. Touch to set the current time/date.

Alert Light. On when alert message is active or system is set to EmHeat. Flashes for battery-only power; on continuous if system powered.

Fig. 78. Quick reference to residential display.

NOTE: The screen lights when you press any button. After you complete your changes, the screen stays lit for 16 seconds if the thermostat is battery powered only or it stays lit for 45 seconds if the thermostat is system powered (C wire). Depending on how your thermostat was installed, the screen light may always be on.



HOME. Touch to display Home screen.

FAN. Select fan mode.

SYSTEM. Select system mode (Heat/Cool).

MENU. Touch to display options. Start here to set a program schedule.

Current status. Shows system mode (heat/cool), outdoor temperature and humidity (with optional outdoor sensor).

Override. Touch to override program schedule.

Current schedule. Touch an arrow to change temperature setting and set a Temporary Hold.

Current program status.

Indoor conditions. Shows indoor temperature and humidity.

Current time. Touch to set the current time/date.

Alert Light. On when alert message is active or system is set to EmHeat. Flashes for battery-only power; on continuous if system powered.

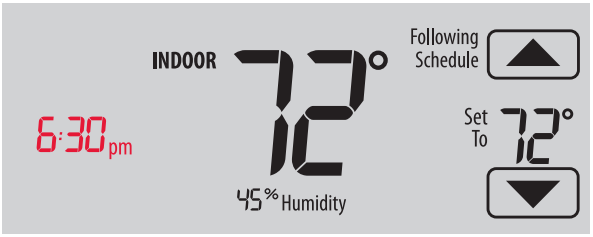
Micro SD Card port. Use card to load holiday schedules and custom events.

Fig. 79. Quick reference to commercial display.

NOTE: The screen lights when you press any button. After you complete your changes, the screen stays lit for 16 seconds if the thermostat is battery powered only or it stays lit for 45 seconds if the thermostat is system powered (C wire). Depending on how your thermostat was installed, the screen light may always be on.

Setting the Time/Date

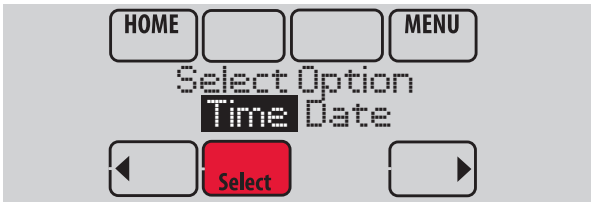
1. Touch the current time. The screen displays Select Option.



MCR34092

Fig. 80.

2. Touch Time or Date, then touch Select.



MCR34155

Fig. 81.

3. Touch ▲ or ▼ until the proper time/date is displayed.
4. Touch Done to save or Cancel to ignore changes.

MCR34094

Fig. 82.

5. Touch Home to redisplay the Home screen.

NOTE: The date is not shown on the home screen; however, it should be set to allow the thermostat to adjust time automatically for daylight saving time and for other features such as vacation hold.

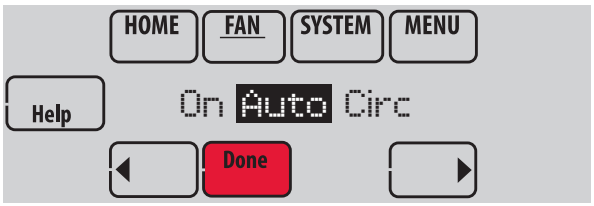
Setting the Fan

1. Touch FAN to display fan settings.

MCR34096

Fig. 83.

2. Touch On, Auto, Circ, or Follow Schedule.
3. Touch Done to save and exit.
   - On: Fan is always on.
   - Auto: Fan runs only when heating or cooling system is on.
   - Circ: Fan runs randomly, about 35% of the time (residential only).
   - Follow Schedule: Fan controlled by program.



MCR34097

Fig. 84.

NOTE: In commercial use, touch Auto or On to temporarily override the programmed fan schedule.

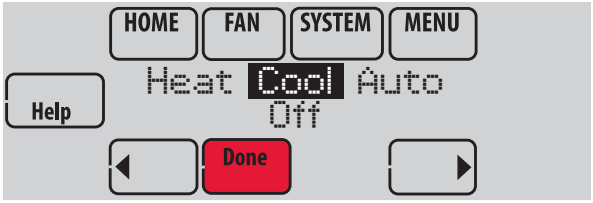
Setting System Mode

1. Touch SYSTEM to display system settings.

MCR34098

Fig. 85.

2. Touch desired option
   - Heat: Controls only the heating system.
   - Cool: Controls only the cooling system.
   - Off: Heating/cooling systems are off.
   - Auto: Selects heating or cooling depending on the indoor temperature.
   - Em Heat (heat pumps with aux. heat): Controls auxiliary/emergency heat. Compressor is locked out.



MCR34099

Fig. 86.

3. Touch Done to save and exit.

NOTE: The Auto and Em Heat system settings may not appear, depending on how your thermostat was installed.

Preset Energy-Saving Schedules

These default Energy Saver settings can reduce expenses.

Table 3. Residential Use Default Schedule.

Period	Start Time	Heat (Mon-Fri)	Cool (Mon-Fri)	Heat (Sat-Sun)	Cool (Sat-Sun)
Wake	6:00 am	70°	78°	70°	78°
Leave	8:00 am	62°	85°	62°	85°
Return	6:00 pm	70°	78°	70°	78°
Sleep	10:00 pm	62°	82°	62°	82°

Table 4. Commercial Use Default Schedule.

Period	Start Time	Heat	Cool	Fan
Occupied 1	8:00 am	70°	75°	On
Unoccupied 1	10:00 pm	55°	85°	Auto
Occupied 2*	12:00 am	70°	75°	On
Unoccupied 2*	12:00 am	55°	85°	Auto

* Period 2 is cancelled by default. If you activate it, the values shown above are default settings.

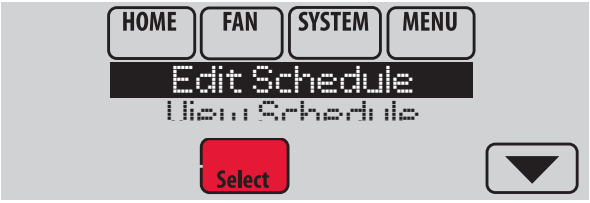
Adjusting Program Schedules

1. Touch MENU.

MCR34100

Fig. 87.

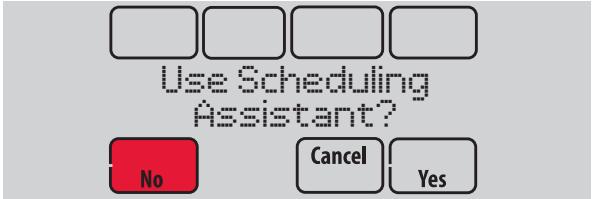
2. Select Edit Schedule to display Use Scheduling Assistant?



MCR34101

Fig. 88.

- Touch Yes to create a schedule by answering simple questions.
- Touch No to manually create a program schedule.

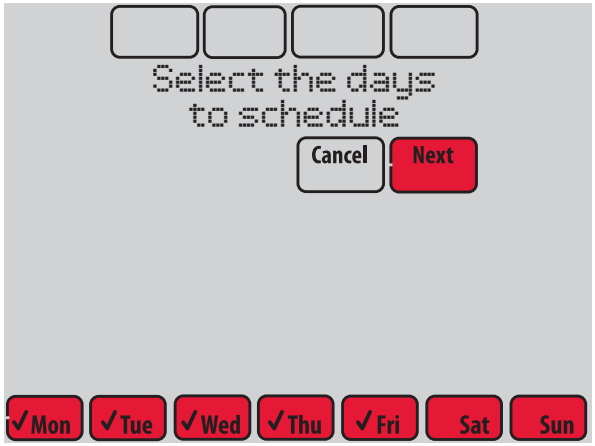


MCR34102

Fig. 89.

NOTE: To reduce costs, use the "Preset Energy-Saving Schedules" on page 62.

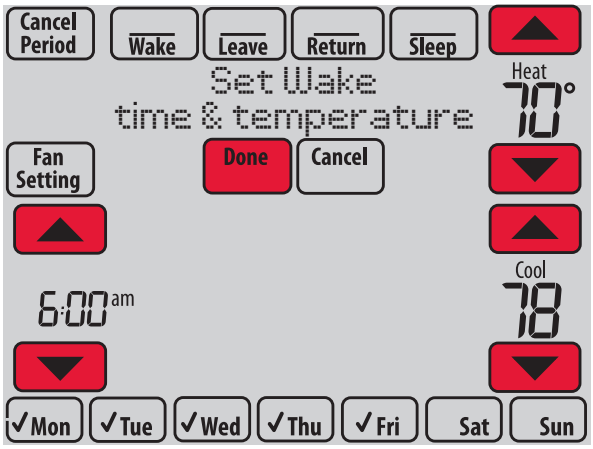
3. Select the days to schedule, touch Next.



MCR34151

Fig. 90.

4. Touch ▲ or ▼ to set your Wake time for selected day(s).
5. Touch ▲ or ▼ to set Heat and Cool temperatures for the Wake period.
6. Touch other time periods (Leave, Return, Sleep) to set time and temperatures for each.
7. Touch Done to save and exit (Touch Cancel to exit without saving changes).



MCR34152

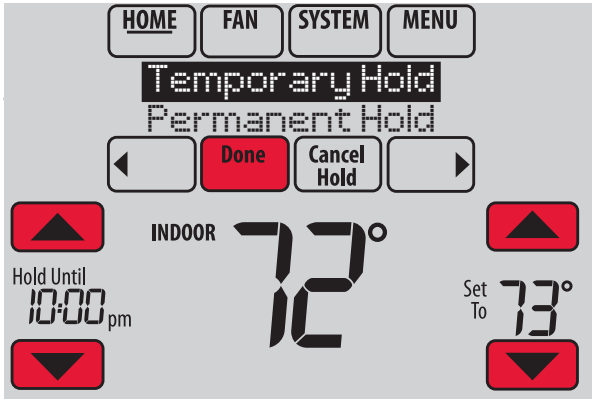
Fig. 91.

NOTE: Touch Cancel Period to eliminate any unwanted time period.

Touch Fan Setting to customize fan settings for any time period.

Overriding Schedules: Residential Use

1. Touch ▲ or ▼ to adjust the temperature (right side of screen) and the Hold Until time (left side). The schedule will resume when the Hold Until time expires.



MCR34103

Fig. 92.

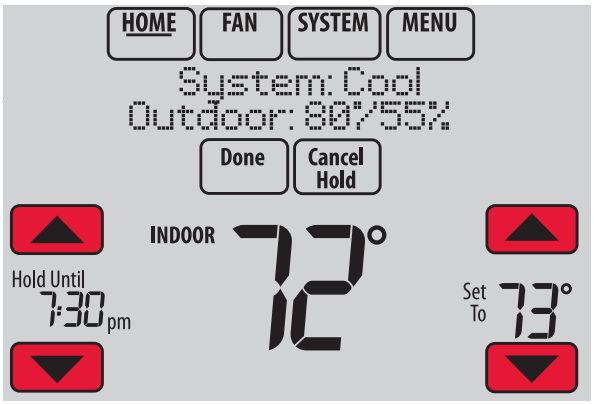
2. Select Permanent Hold to keep the same temperature until you change it or resume the program schedule.

Touch Cancel Hold at any time to resume the program schedule.

Overriding Schedules: Commercial Use

Touch ▲ or ▼ to adjust the temperature. It will be maintained until the hold time you set.

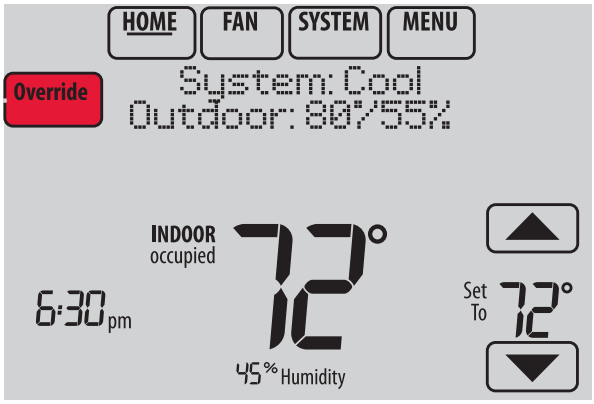
- To change the hold time, touch the Hold Until arrow buttons. This time can be adjusted up to the maximum time set by the installer.



MCR34169

Fig. 93.

- Touch Override to use a pre-set occupied temperature if a person uses the room during an unoccupied period. The new temperature will be maintained for 1 hour and can be adjusted up to the maximum time set by the installer.



MCR34106

Fig. 94.

The programmed schedule will resume when the override timer expires. Touch Cancel Hold at any time to resume the program schedule.

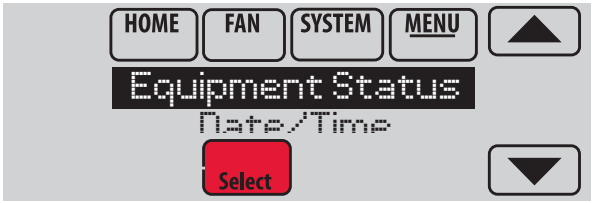
Viewing Equipment Status

1. Touch MENU.

MCR34100

Fig. 95.

2. Select Equipment Status.

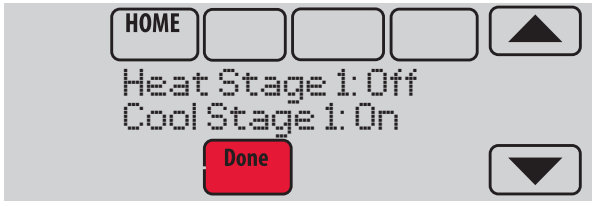


MCR34108

Fig. 96.

3. Touch ▲ or ▼ to view the status of all the equipment your thermostat is controlling. Depending on how your thermostat was installed, the Equipment Status screen can report data about the following systems:

- Heating and cooling
- Fan
- Humidification
- Dehumidification
- Ventilation
- Maintenance reminders
- Thermostat information



MCR34109

Fig. 97.

Setting Vacation Hold: Residential Use

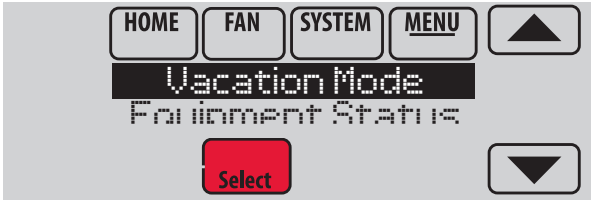
This feature helps you save energy while you are away, and restores comfortable settings just before you return home.

1. Touch MENU.

MCR34100

Fig. 98.

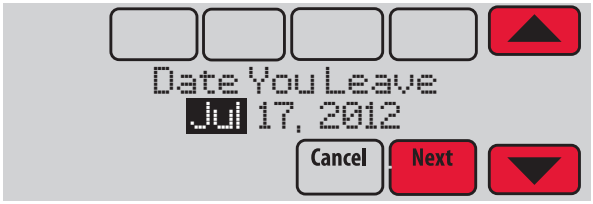
2. Select Vacation Mode.



MCR34110

Fig. 99.

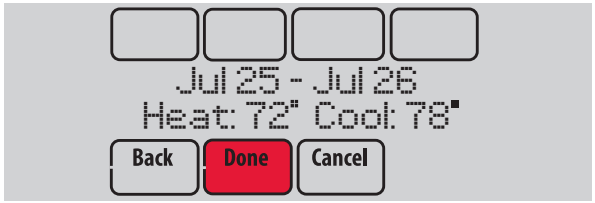
3. Touch ▲ or ▼ to select the date you leave, then touch Next for further scheduling details, including times of day, temperature settings, return date, and return settings.



MCR34111

Fig. 100.

4. Review your selections on the last display, and touch Done to save your settings. Touch Cancel to ignore the changes.



MCR34112

Fig. 101.

Setting Holiday/Event Schedules: Commercial Use

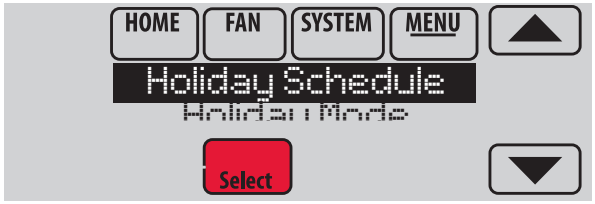
This feature helps you conserve energy when the workplace is unoccupied for special events and holidays.

1. Touch MENU.

MCR34100

Fig. 102.

2. Select Holiday Schedule.



MCR34113

Fig. 103.

3. Select the item you want to schedule and touch Next for further scheduling details.
   - Custom Events lets you set up other days for special schedules.
   - US and Canadian Holiday options let you select from a list of holidays commonly observed in each country.

MCR34114

Fig. 104.

4. Make selections as prompted on each screen. For more information, see next two pages.
5. Touch Done to save your settings.

Setting Custom Events: Commercial Use

This feature lets you customize temperature settings to be maintained during a specific event. You can set up an event for a specific date or day in a month. The thermostat resumes normal scheduling after the event. The thermostat can be scheduled for up to 25 Custom Events.

1. Select Custom Events from the Holiday Schedule menu.

MCR34114

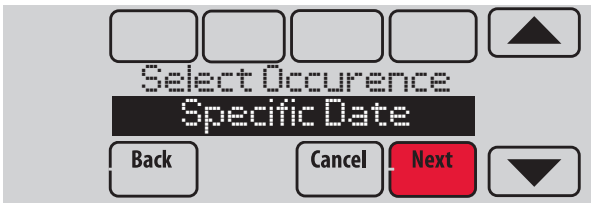
Fig. 105.

2. Select Create New Event.

MCR34116

Fig. 106.

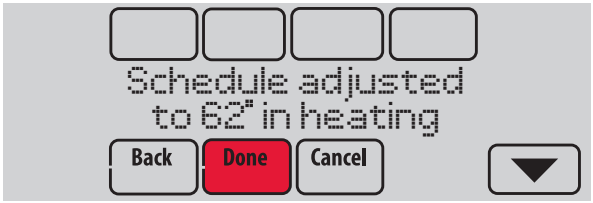
3. Select Specific Date or Month/Weekday.
   - For Specific Date, you are prompted to select the event's start date, settings, end date, and frequency.
   - For Month/Weekday, you are prompted to select the month, day of the week, week of the month, settings, length of event, and frequency for the event.



MCR34117

Fig. 107.

4. Review the settings and touch Done to save them. Touch Cancel to ignore the changes.



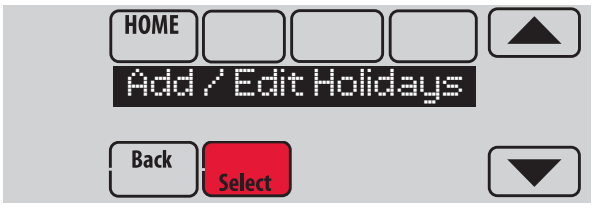
MCR34118

Fig. 108.

Setting Holiday Schedule: Commercial Use

This feature lets you customize temperature settings to be maintained on specified national holidays. The thermostat resumes normal scheduling between selected holidays.

1. Select US Holidays or Canadian Holidays from the Holiday Schedule menu.
2. Select Add/Edit Holidays. A list of national holidays is displayed.

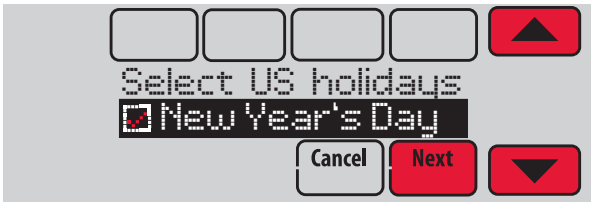


MCR34119

Fig. 109.

3. Touch the check box next to each holiday for which you want to maintain specific settings, (Touch ▲ or ▼ to scroll through the holiday list.) then touch Next.

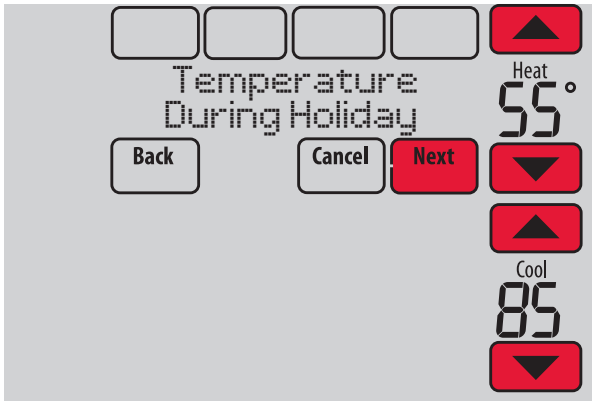
   Set the holiday schedule for Occupied or Unoccupied temperatures, depending whether the building will be in use.



MCR34120

Fig. 110.

4. Touch ▲ or ▼ to select the Heat and Cool temperatures.



MCR34121

Fig. 111.

5. Review the settings and touch Done to save them. Touch Cancel to ignore changes.

Setting Holiday Override: Commercial Use

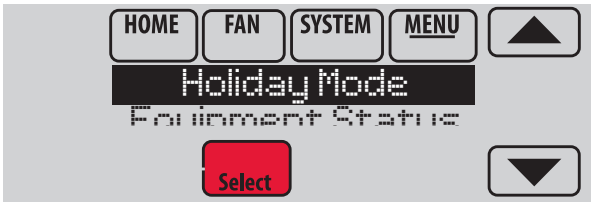
This feature lets you customize temperature settings to be maintained from now until a specified date. The thermostat resumes normal scheduling on the date you select.

1. Touch MENU.

MCR34100

Fig. 112.

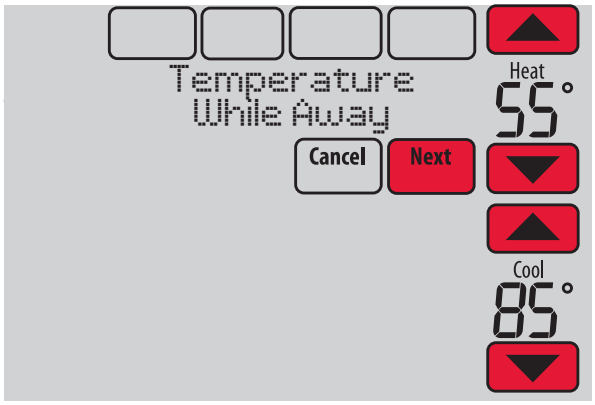
2. Select Holiday Mode to display Temperature While Away.



MCR34122

Fig. 113.

3. Touch ▲ or ▼ to select the Heat and Cool temperatures, then touch Next to select return date.



MCR34123

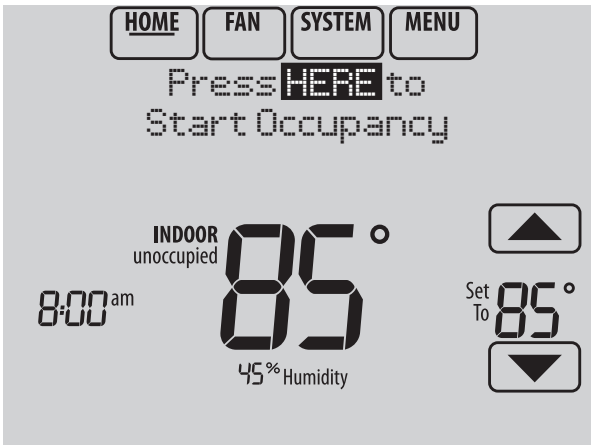
Fig. 114.

4. Review the settings and touch Done to save them. Touch Cancel to ignore the changes.

NOTE: The cool temperature can only be set higher than the unoccupied program setting and the heat temperature can only be set lower than the unoccupied program setting.

Initiating Occupancy Mode: Commercial Use

This feature keeps temperature at an energy saving level until you touch **Press HERE to Start Occupancy**. When you arrive, touch the message to maintain a comfortable temperature while the room is occupied.



M34127

Fig. 115.

Touch the ▲ or ▼ buttons to set the temperature or the Hold Until time. The temperature is maintained until the time you set. Temperature returns to an energy-saving level after the timer expires, or the “Occupied” period ends.

NOTE: This feature is available only when programmed by the installer.

Remote Setback: Commercial Use

During Occupied program periods, an occupancy sensor directs the thermostat to go to REMOTE SETBACK settings when the room is empty. If someone is in the room, it uses the Occupied program period settings. The thermostat ignores the occupancy sensor during Unoccupied program periods.

If the thermostat is set up to be non-programmable, the sensor directs the thermostat to go to REMOTE SETBACK settings when the room is empty. If someone is in the room, then it follows the settings set by the user.

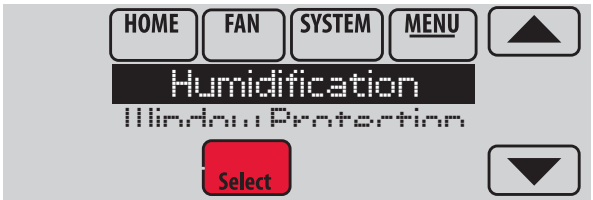
Depending on how your thermostat was installed, it may delay for up to 30 minutes before switching to REMOTE SETBACK settings. This delay allows the room to stay comfortable if the room is unoccupied for only a short time.

Adjusting Humidification Settings

1. Touch MENU and select Humidification.

MCR34100

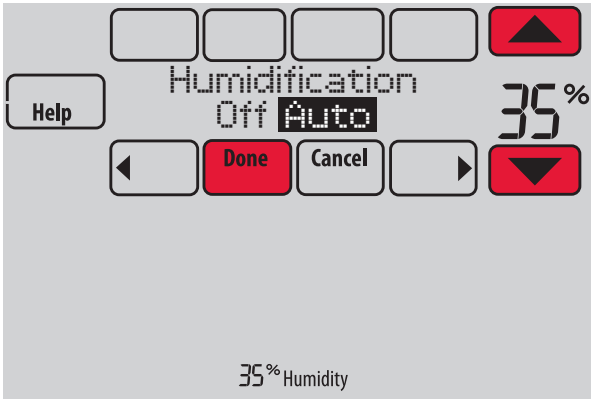
Fig. 116.



MCR34128

Fig. 117.

2. Select Auto.



MCR34129

Fig. 118.

3. Touch ▲ or ▼ to select humidity level.
4. Touch Done to save your settings. Touch Cancel to ignore changes.
5. If frost or condensation appears on the windows, press MENU, scroll down and select Window Protection.

Fig. 119.

6. Window Protection is set on a scale from 1–10. A setting of 1 represents poorly insulated windows and a setting of 10 represents well insulated windows. A lower number automatically reduces the humidity to help prevent frost or condensation on your windows. Use a higher number if indoor air seems too dry. To prevent frost/condensation on your windows during cold outdoor temperatures, poorly insulated windows require a lower Window Protection setting, which will limit how much your humidifier can run.
7. After you set the Window Protection setting, check for frost/condensation on your windows in the morning. If frost/condensation is present, adjust the Window Protection setting to the next lowest number and check for frost/condensation on your windows the next morning. Continue to adjust the Window Protection setting to a lower number until frost/condensation is no longer present.

NOTE: Window Protection is available only if an outdoor air sensor is installed.

NOTE: The thermostat controls humidification and dehumidification as needed to maintain the desired humidity level. Depending on how your thermostat was installed, the thermostat may maintain a 15% separation between humidification and dehumidification settings.

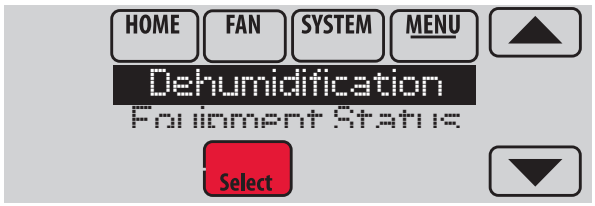
Adjusting Dehumidification Settings: Residential Use

This feature can control a dehumidifier or use your air conditioner to reduce humidity.

1. Touch MENU and select Dehumidification.

MCR34100

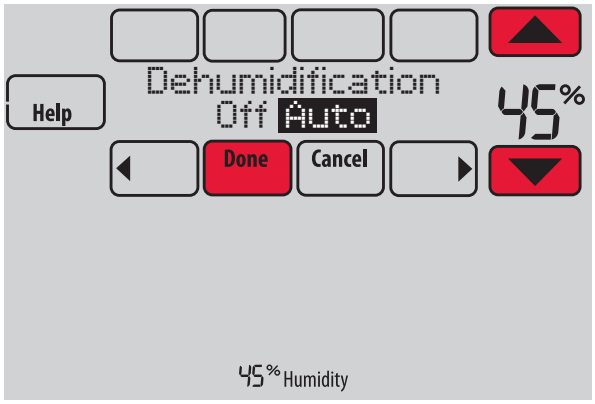
Fig. 120.



MCR34130

Fig. 121.

2. Select Auto.



MCR34131

Fig. 122.

3. Touch ▲ or ▼ to select humidity level.
4. Touch Done to save your settings. Touch Cancel to ignore changes.

NOTE: If your air conditioner is used to control humidity, the temperature may drop up to 3° F below your temperature setting until humidity reaches the desired level.

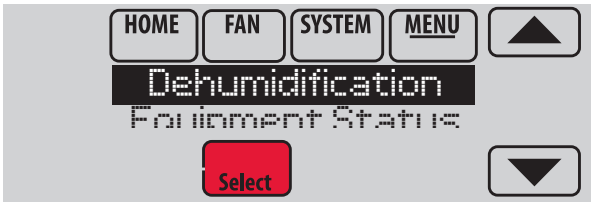
Adjusting Dehumidification Settings: Commercial Use

This feature can control a dehumidifier or use your air conditioner to reduce humidity.

1. Touch MENU and select Dehumidification.

MCR34100

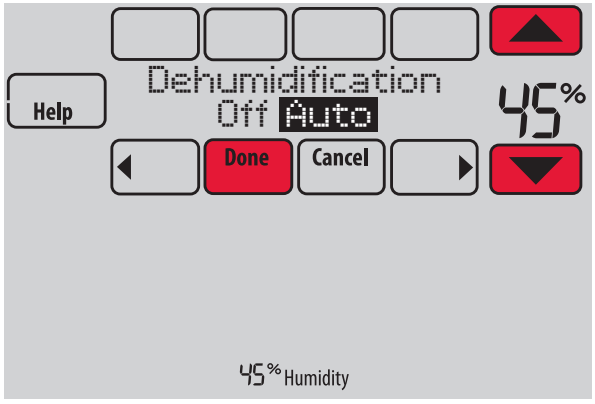
Fig. 123.



MCR34130

Fig. 124.

2. Select Auto.



MCR34131

Fig. 125.

3. Touch ▲ or ▼ to select humidity level.
4. Touch Done to save your settings. Touch Cancel to ignore changes.

If your air conditioner is used to control humidity, the thermostat may use the following methods to maintain humidity:

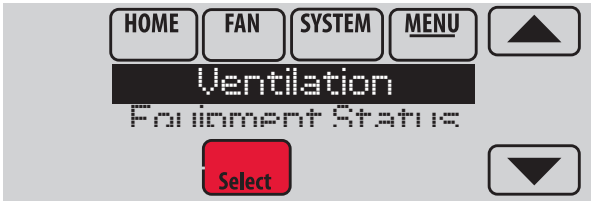
- Cool from 1° to 5° F lower than your temperature setting.
- Run cooling for the minimum “on” time to reduce humidity.
- Run cooling and heating at the same time to reduce humidity without lowering the temperature.

Adjusting Ventilation Settings

1. Touch MENU, and select Ventilation.

MCR34100

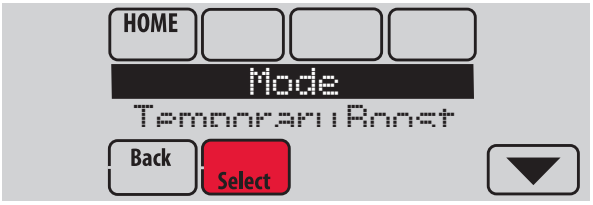
Fig. 126.



MCR34132

Fig. 127.

2. Select Mode, Temporary Boost, or Lockout, then select appropriate options.



MCR34133

Fig. 128.

3. Touch Done to save your settings. Touch Cancel to ignore changes.

MCR34134

Fig. 129.

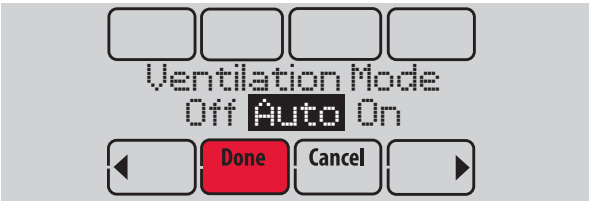
Ventilation Options

Mode:

Auto: Ventilation runs as programmed by the installer.

Off: Ventilation remains off unless turned on using the timer.

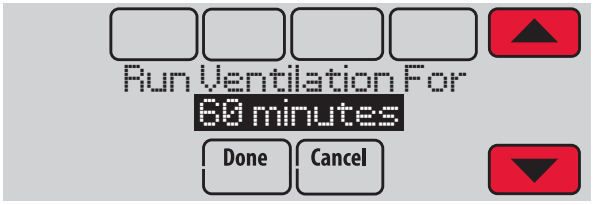
On: Ventilation is always on.



MCR34135

Fig. 130.

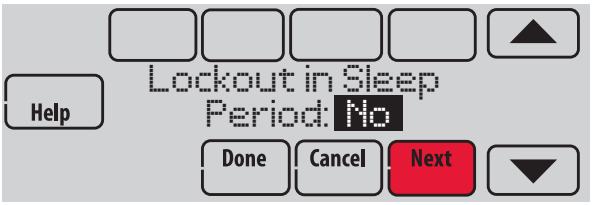
Temporary Boost: Touch ▲ or ▼ to select how long to run ventilation temporarily. To turn it off, set it to zero.



MCR34136

Fig. 131.

Lockout: Touch ▲ or ▼ to select Yes or No, then touch Next. Select Yes to prevent ventilation from running during the Sleep or Unoccupied (commercial) program periods or when outdoor conditions exceed values set by the installer.



MCR34137

Fig. 132.

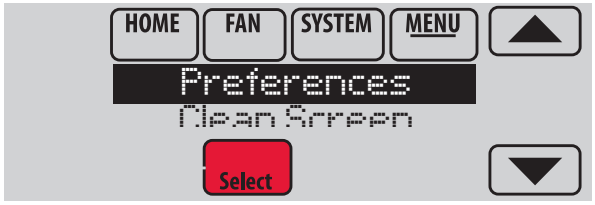
Setting Preferences

Preference menu options let you select how the thermostat displays information or responds to certain situations.

1. Touch MENU and select Preferences.

MCR34100

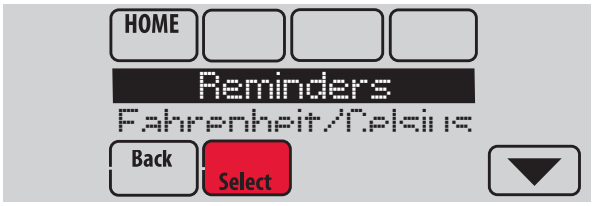
Fig. 133.



MCR34170

Fig. 134.

2. Select an option and follow prompts:
   - Reminders to change filters
   - Fahrenheit/Celsius display
   - 12/24-hour clock display
   - Display Options
     –Backlighting (Continuous or On Demand)
     –Inactive Backlight (Backlight level while the screen is not in use. Requires C wire and Backlighting must be set to Continuous.)
     –Screen Contrast
   - Alert light options
   - Scheduling options
   - Adaptive recovery
   - Default schedule
   - Daylight saving time



MCR34139

Fig. 135.

3. Touch Done to save your settings. Touch Cancel to ignore changes.

Cleaning the Thermostat Screen

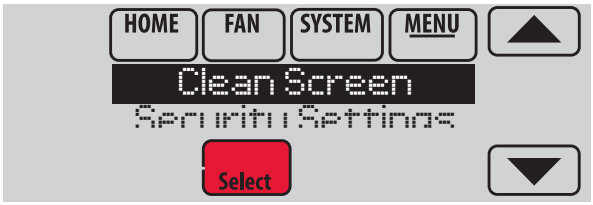
When you select the Clean Screen option, the screen is locked to prevent accidental changes to the thermostat while you clean the screen.

1. Touch MENU.

MCR34100

Fig. 136.

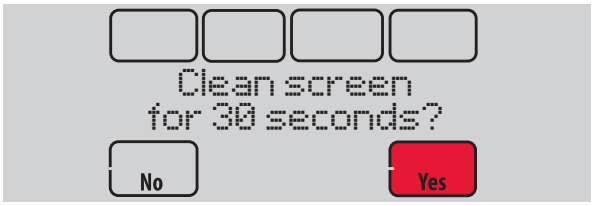
2. Select Clean Screen. A prompt asks if you want to clean the screen for 30 seconds.



MCR34140

Fig. 137.

3. Touch Yes. A countdown timer displays elapsed time until the screen is reactivated.



MCR34141

Fig. 138.

NOTE: Do NOT spray any liquid directly on the thermostat. Spray liquids onto cloth, then use the damp cloth to clean the screen. Use water or household glass cleaner. Avoid abrasive cleansers.

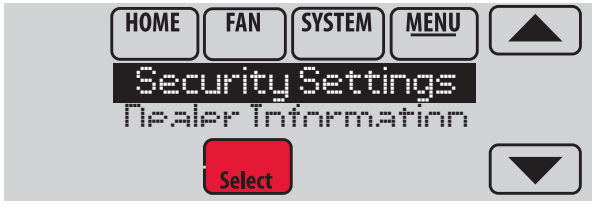
Adjusting Security Settings

You can adjust security options to prevent unauthorized changes to system settings.

1. Touch MENU and select Security Settings.

MCR34100

Fig. 139.



MCR34142

Fig. 140.

2. Select an option and follow prompts:

MCR34143

Fig. 141.

- **Unlocked:** Full access allowed.
- **Partially locked:** Only temperature can be changed.
- **Fully locked:** No access allowed.

M34197

Fig. 142.

NOTE: If you choose to use a password for additional security, write it down for reference.

Viewing Dealer Information

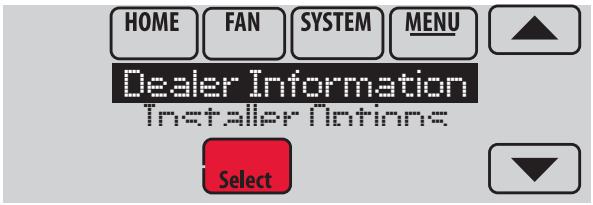
Check dealer information if you need to contact your installer for maintenance, repairs, or upgrades.

1. Touch MENU.

MCR34100

Fig. 143.

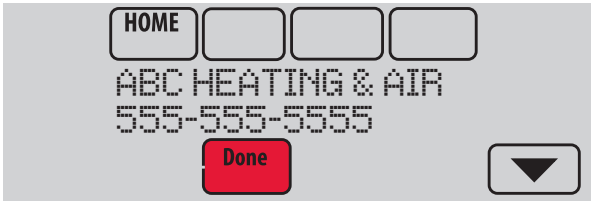
2. Select Dealer Information.



MCR34022

Fig. 144.

3. Scroll through the displayed information.
4. Touch Done to return to the menu.



MCR34162

Fig. 145.

Advanced Features

ADAPTIVE INTELLIGENT RECOVERY (RESIDENTIAL USE ONLY)
Over time, the VisionPRO® thermostat "learns" how long it takes your system to reach your programmed temperature setting.

The thermostat turns on the heating/cooling system early and assures that the programmed temperature setting is reached at the programmed time regardless of weather conditions. For example, if the Wake program period is set to 6:00 am with a heat setting of 70 degrees, the heat will turn on before 6:00 am, so the temperature is 70 degrees at 6:00 am. The thermostat displays "In Recovery" when it turns the system on early.

Adaptive Intelligent Recovery® calculates the recovery ramp based on how far the room temperature is away from the temperature setting, previous equipment performance and weather history, allowing the thermostat to start recovery at the optimal time so it can reach the programmed temperature setting at the programmed time.

The VisionPRO® thermostat uses two recovery ramps when setup to control a heat pump system. One ramp for the compressor and one ramp for the auxiliary heat. Once the room temperature intersects the compressor ramp, the compressor turns on until the setpoint is reached. If the room temperature does not rise quickly enough and intersects the second ramp, the auxiliary heat turns on. It takes about one week for the thermostat to adjust to weather conditions, equipment performance and construction of the home. If the temperature setting is reached too early or too late, the ramp is adjusted for the next day's recovery. See Fig. 146.

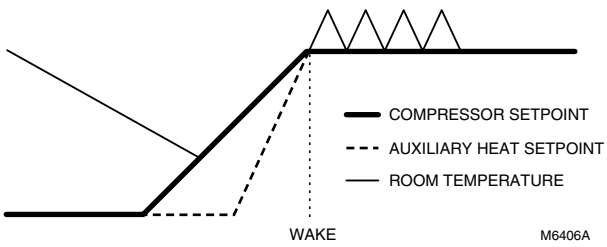


Fig. 146.

DEHUMIDIFICATION AWAY MODE
Your system can be set to control indoor climate while your home is vacant during the humid season. Before you leave, touch MENU, then select Dehum Away Mode. Temperature and humidity will be kept at levels that protect your home and possessions. When you return, touch Cancel to resume normal operation.

COMPRESSOR PROTECTION
The thermostat keeps the compressor off for a few minutes before restarting, to prevent equipment damage. During this "off" time, the message "Wait" is displayed on screen.

PRE-OCCUPANCY PURGE (COMMERCIAL USE ONLY)
This feature turns on the fan 1 to 3 hours before each “occupied” time period, to provide a comfortable workplace when you arrive.

P + I CONTROL
A conventional mechanical or electronic thermostat does not control temperature precisely at setpoint. Typically there is an offset (droop) in the control point as the system load changes. Many factors contribute to offset including the switch differential, thermal lag, overshoot, cycle rates and system load.

The VisionPRO® thermostat however, works much differently than a conventional mechanical or electronic thermostat. The proprietary algorithm in the thermostat eliminates the factors causing offset (droop). This makes temperature control more accurate than the conventional mechanical or electronic thermostat. The temperature control algorithm is called proportional plus integral (P + I) control.

The thermostat sensor or a remote indoor sensor senses the current space temperature. The proportional error is calculated by comparing the sensed temperature to the setpoint temperature. The deviation from the setpoint is the proportional error.

The thermostat also determines integral error, which is a deviation based on the length of error time (how long the sensed room temperature has been away from the setpoint temperature). The sum of the two errors is the (P + I) error. The cycle rate used to reach and maintain the setpoint temperature is computed using the P + I control algorithm. The addition of the integral error is what differentiates the thermostat from many other mechanical and electronic thermostats. See Fig. 147.

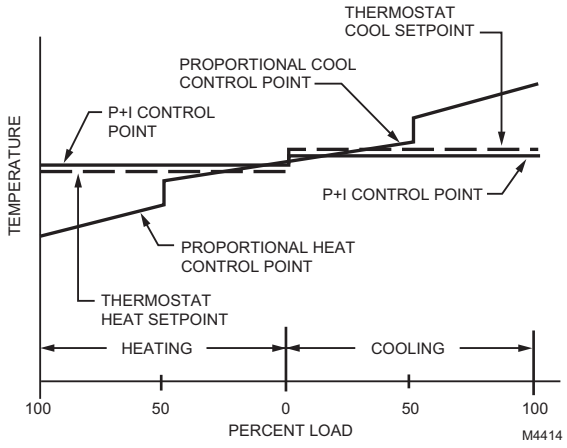


Fig. 147.

Installer Options

Installer options require a password and should only be changed by a qualified technician.

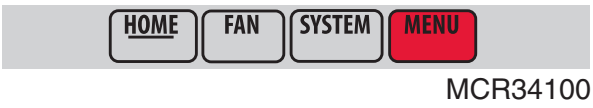


Fig. 148.

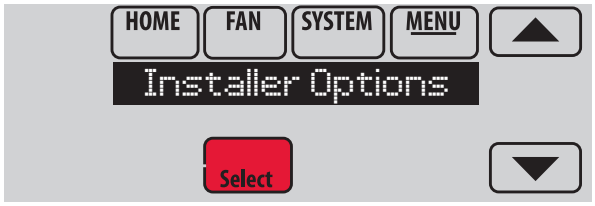


Fig. 149.

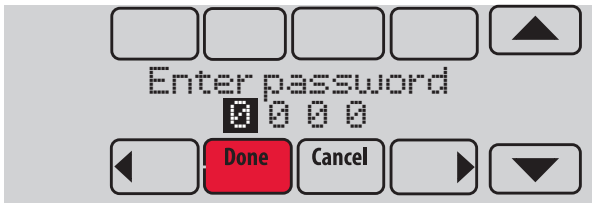
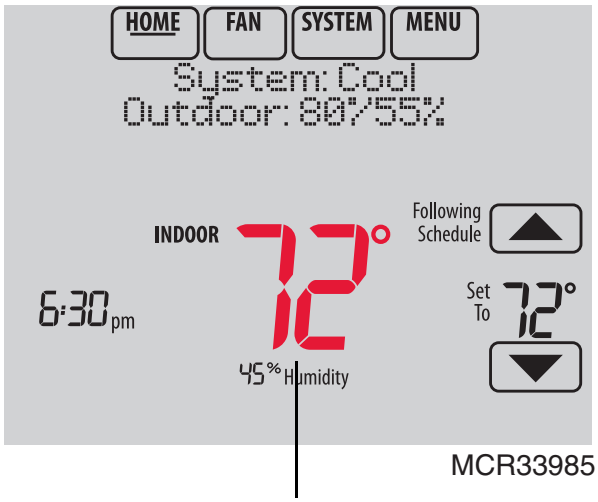


Fig. 150.

Using the Temperature Display

In some circumstances, the temperature displayed on the Home screen may not match the temperature near the thermostat.

If your system is set up to use remote indoor sensors, it may be reading a sensor in another location.



Temperature reading depends on location of sensor

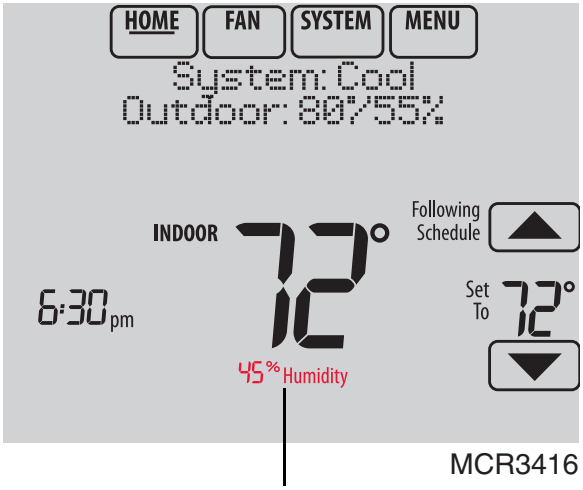
Fig. 151.

Using the Humidity Display

In some circumstances, the humidity displayed on the Home screen may not match humidity near the thermostat.

Some systems are set up to use two sensors, one to control humidification, the other for dehumidification. These sensors are often installed in different locations.

Depending on how your thermostat was installed, the thermostat Home screen will display humidity readings from only one sensor.



Humidity reading depends on location of sensor.

Fig. 152.

Universal Outputs (U1, U2, U3)

U1, U2, U3 are universal outputs that can be setup to control IAQ equipment and a stage of heating or cooling in the Installer Setup. Setup options are listed below. See Thermostat Wiring Guides on page 129 and Equipment Interface Module wiring guides on page 130.

Universal Output Options

With Equipment Interface Module (U1, U2, U3):

- Humidification (ISU 803)
- Dehumidification (ISU 904)
- Ventilation (ISU 1002)
- Cool Stage 3 (ISU 208)
- Cool Stage 4 (ISU 209)
- Geothermal Radiant Heat (ISU 203, 204)

TH8321 Thermostat Only (U1)

- Humidification (ISU 803)
- Dehumidification (ISU 904)
- Ventilation (ISU 1002)
- Cool Stage 3 (ISU 208)
- Conventional Heat Stage 3 (ISU 210, 214)
- Backup Heat Stage 2 for Heat Pumps (ISU 217)
- Geothermal Radiant Heat (ISU 203)

Universal Inputs (S1, S2, S3, S4)

S1, S2, S3 and S4 are universal inputs that can be setup to work with a sensor or dry contact device in the Installer Setup. Setup options and compatible sensors are listed below. See wiring diagrams on page 74 and page 135. The thermostat has 1 Universal Input and the Equipment Interface Module has 4 Universal Inputs.

Universal Input Options

Indoor Air Sensor (ISU 500)
- C7189U1005 (10K)
- C7772A1004 (20K)
- C7772A1012 (20K)
- TR21 (20K)
- TR21-A (10K)

Outdoor Air Sensor (ISU 500)
- C7089U1006 (10K)

Discharge/Return Air Sensors (ISU 500)
- C7735A1000 (10k)
- C7770A1006 (20K)
- C7041 (20K)

Occupancy Sensor for Remote Setback (ISU 600) (Requires Equipment Interface Module)
- WSK-24

Dry Contact Alerts (ISU 600) (Requires Equipment Interface Module)
- Low Voltage Dry Contact Device

Data Logs

The Data Logs collect system information that can help point a service technician in the right direction when troubleshooting.

To access a Data Log, it must be saved to a MicroSD card. See “Using the Data Logs” beginning on page 73 and “MicroSD card” beginning on page 100 for more information.

Data Logs include the Alerts Log and the User Interactions Log.

Alerts Log

The Alerts Log stores a history of the most recent 25 alerts and records the date and time of each alert. It can be turned on, off, and reset at the thermostat.

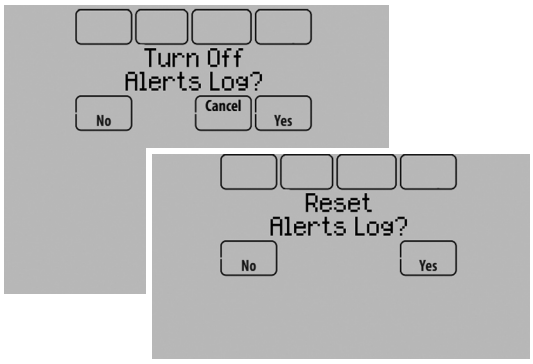


Fig. 153.

The Alerts Log contains information about the alert and system information.

The Alerts Log can include:
- The alert name and description.
- System details at the time of the alert.
- The alert status (snoozed, dismissed, recovered).

User Interactions Log

The User Interactions Log can help a service technician save time by determining if the issue is related to a system problem or an accidental user error.

The User Interactions Log records the date and time for most changes made by the user, whether made at the thermostat or from a remote location (smart phone, tablet, web, or Portable Comfort Control, etc.). The log saves the most recent 250 user changes, including:
- Indoor Air Quality Settings
- Maintenance Reminders
- Temperature Settings
- System/Fan Mode
- Alerts (snoozed or dismissed)
- Installer Setup
- Date/Time

The User Interactions Log can be turned on, off, and reset at the thermostat.

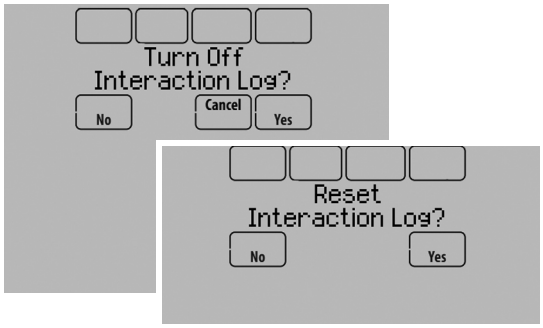


Fig. 154.

Using the Data Logs

To view a data log, you must download the log to a microSD card and then view it on your computer. For more information on using the MicroSD card, see “MicroSD card” beginning on page 100.

Dry Contact Alerts

A Dry Contact device such as a wet switch can be connected to the S1, S2, S3 or S4 terminals at the Equipment Interface Module.

When the dry contact device detects a problem, the thermostat displays an alert on the home screen. When the user touches **Press HERE for info** on the Home Screen, the alert message will be displayed.

Fig. 155.

Pressing Select displays options for addressing the Alert message:

- View More Info
- Remind Me Later
- Dismiss
- View Dealer Info

To clear the Alert, (and turn off the Red Alert Light on the thermostat), select Dismiss.

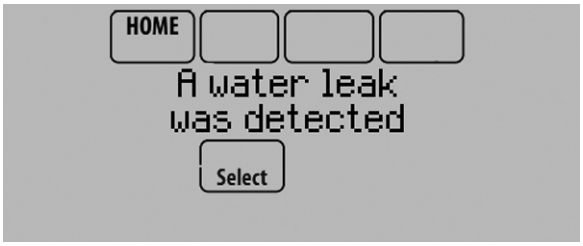


Fig. 156.

The following dry contact alerts are available.

Full Drain Pan Alert

When the dry contact device detects that the condensate drain pan is full, the thermostat provides an alert to the user.

NOTE: If you want the compressor to turn off when the drain pan is full, wire the system so the dry contact device turns off the compressor when the drain pan is full.

Dirty Filter Alert

When the dry contact device detects a dirty air filter (pressure drop across the filter), the thermostat provides an alert to the user to replace the filter.

Water Leak Alert

When the dry contact device detects a water leak, the thermostat provides an alert to the user.

System Shutdown Alert

When the dry contact device detects a critical problem with the system, the thermostat provides an alert to the user indicating that the system was shut down.

When the dry contact device detects a problem with the system (for example, smoke detection), the thermostat will not call for heating, cooling, fan or IAQ equipment until the dry contact is deactivated or the feature is unconfigured at the thermostat.

Service Needed Alert

When the dry contact device detects an issue that requires service, the thermostat provides an alert to the user.

Fan Failure Alert

The Fan Failure Alert protects the equipment when there is no airflow. When the dry contact device (for example, sail switch) detects no air flow for 5 minutes after a call for forced air heat, cool, or fan, the thermostat provides an alert to the user indicating that the system was shut down due to a lack of airflow.

The thermostat will call for the fan and lockout all other equipment until the dry contact device senses air flow again or the feature is unconfigured at the thermostat.

Custom Alert

Allows the dealer to enter a custom alert to be displayed when a dry contact device is activated. For example, a float switch can detect when your sump pump is not working.

Set Up the Dry Contact Alerts

You can connect the S1, S2, S3 and S4 terminals on the EIM to a dry contact device to display an alert. Dry contact alerts include Full Drain Pan, Dirty Filter, Water Leak, System Shutdown, Service Needed, Fan Failure and Custom Alert. Dry contact device can be normally open (shown in diagram) or normally closed.

⚠ WARNING

Equipment Damage Hazard.

Do not apply power to S1, S2, S3 or S4 terminals. Do not connect a temperature sensor to the S1, S2, S3 or S4 terminals if setup for a dry contact device.

IMPORTANT

The dry contact device must be rated for low voltage.

NOTE: You can connect multiple Dry Contact devices in parallel to the S1, S2, S3 or S4 terminals.

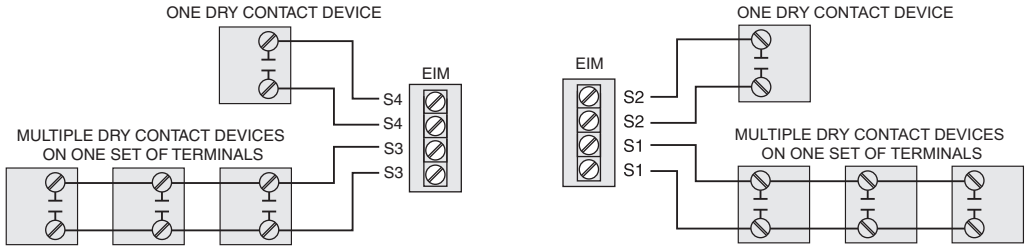


Fig. 157. Wiring dry contact devices.

1. Wire the dry contact device to S1, S2, S3 or S4 terminals at the EIM.
2. Enter Installer Setup (see “Make Changes to Installer Setup” beginning on page 20).
3. Dry Contacts are selected at ISU 600. Select the appropriate Dry Contact(s) and press Next.

Fig. 158.

4. Select the terminals wired to the Dry Contact device, and press Next.

Fig. 159.

5. Select Normally Open or Normally Closed, and press Next.

   NOTE: For example, if a wet switch is normally open, it will close when the device detects water. If the wet switch is normally closed, it will open when the device detects water. Refer to the instructions packed with the dry contact device to determine if it is normally open or normally closed.

Fig. 160.

6. If you are creating a custom alert, type the alert name and press Done. The alert name is what appears on the Home screen when the alert is detected. See Fig. 161. You can edit or confirm the alert name after you enter it.

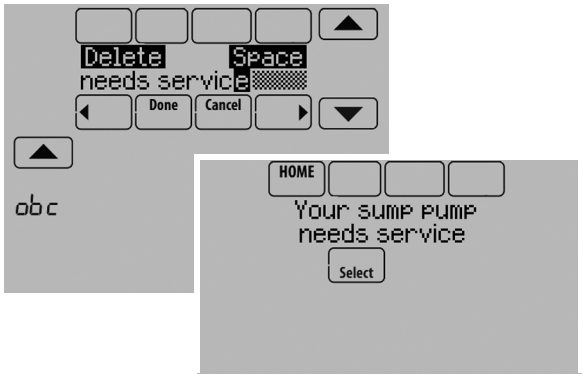


Fig. 161.

7. Type the custom alert message and press Done. The custom alert message appears after selecting the alert and pressing "View More Info". See Fig. 162. You can edit or confirm the alert message after you enter it.

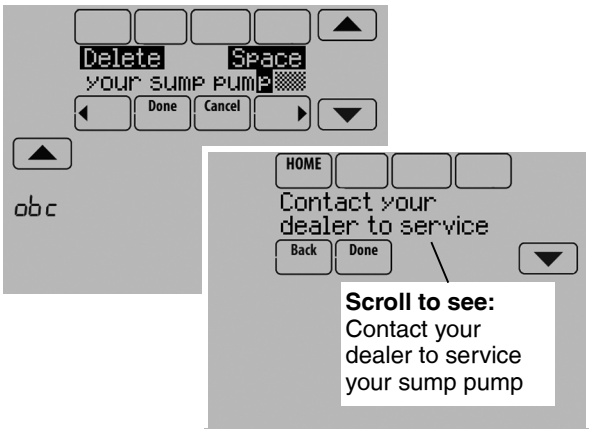


Fig. 162.

8. Repeat steps 4–5 for the other Dry Contact, if necessary.

Staging Control

Differential Between All Stages

The thermostat provides Differential settings between all stages. The equipment changes stages based on how far the indoor temperature is from the setpoint. Differential settings provide a way to balance comfort and conservation.

Heat Differential

The indoor temperature must drop to the selected differential setting before the thermostat will turn on the stage of heating. For example, if stage 2 is set to 2 °F (1.0 °C), the indoor temperature must be 2 °F (1.0 °C) away from the setpoint before stage 2 turns on. When set to Comfort, the thermostat will use the stage of heating as needed to keep the indoor temperature within 1 °F (0.5 °C) degree of the setpoint. The thermostat turns on stage 2 when the capacity on stage 1 reaches 90%.

Cool Differential

The indoor temperature must rise to the selected differential setting before the thermostat turns on the stage of cooling. For example, if stage 2 is set to 2 °F (1.0 °C), the indoor temperature must be 2 °F (1.0 °C) away from the setpoint before stage 2 turns on. When set to Comfort, the thermostat uses the stage of cooling as needed to keep the indoor temperature within 1 °F (0.5 °C) degree of the setpoint. The thermostat turns on stage 2 when the capacity on stage 1 reaches 90%.

TO CHANGE DIFFERENTIAL SETTINGS

1. Select Advanced Options to view/adjust differentials between all stages.

Fig. 163.

2. Default is Comfort. Adjust differentials as needed.

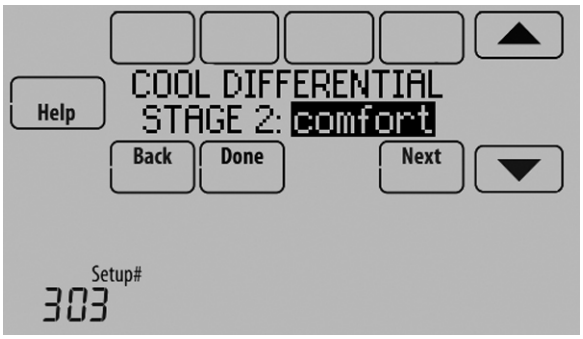


Fig. 164.

Backup Heat Droop

A Backup Heat Droop is available for any system with 2 heating types. For example:

- Heat Pumps with any type of Backup Heat
- Radiant Heat with any type of Backup Heat
- Hot Water Fan Coil with any type of Backup Heat

The Backup Heat Droop restricts backup heat during the following conditions:

- Normal Operation
- Manual Setpoint Changes

The options are:

- **Comfort** – keeps temperature within 1 degree of the setpoint.
- **2 to 15 °F** – Backup heat is not used unless the indoor temperature drops to the selected Backup Heat Droop. For example, if the Backup Heat Droop is set to 2 °F (1.0 °C), the indoor temperature must be 2 °F (1.0 °C) away from the setpoint before the backup heat turns on.

NORMAL OPERATION

When the Backup Heat Droop is set to Comfort, the thermostat uses backup heat as needed to keep the indoor temperature within 1 °F (0.5 °C) of the setpoint. The Comfort setting is NOT an option on heat pumps with fossil fuel backup heat.

When the Backup Heat Droop is set to 2 °F or higher, backup heat is not used unless the indoor temperature drops to the Backup Heat Droop setting or the Backup Heat Upstage Timer expires, whichever occurs first. The upstage timer starts when the highest stage of the previous equipment type turns on.

MANUAL TEMPERATURE CHANGE
When the Backup Heat Droop is set to Comfort, the thermostat uses backup heat as needed to keep the indoor temperature within 1 °F (0.5 °C) of the setpoint. The Comfort setting is NOT an option on heat pumps with fossil fuel backup heat.

When the Backup Heat Droop is set to 2 °F or higher, if the primary heat is making progress as expected, backup heat will not be used to reach the new setpoint. Set to a higher number to use less backup heat (a greater difference between the current indoor temperature and the new setpoint is required to turn on backup heat). See notes below.

PROGRAMMED RECOVERY
If the primary heat is making progress as expected, backup heat will not be used to reach the setpoint of the next program period. Backup heat is always restricted during a programmed recovery when the Adaptive Intelligent Recovery feature is used. See note below.

NOTE: During a programmed recovery (or when the temperature setpoint is changed by the user), the thermostat waits to turn on the backup heat depending on system performance, load conditions and how many degrees the temperature setpoint is changed. Backup heat will be used ONLY when the temperature is not rising quickly enough to reach the setpoint in a reasonable time.

NOTE: If the backup heat was used in the last 2 hours because the primary heat was not able to maintain the setpoint, the thermostat may turn on the backup heat earlier when the user raises the setpoint. This does NOT apply to heat pumps with fossil fuel backup heat.

TO CHANGE BACKUP HEAT DROOP SETTINGS

1. Select Basic Options or Advanced Options to view/adjust Backup Heat Droop settings.

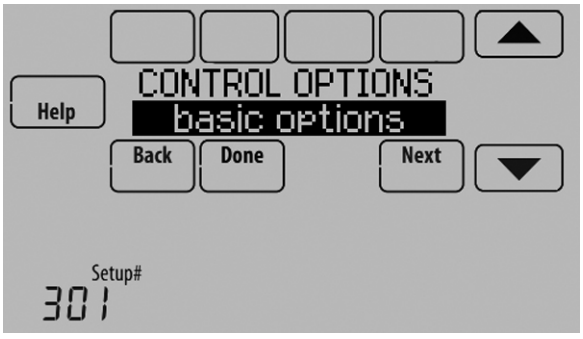


Fig. 165.

2. Default is Comfort. Adjust differentials as needed.

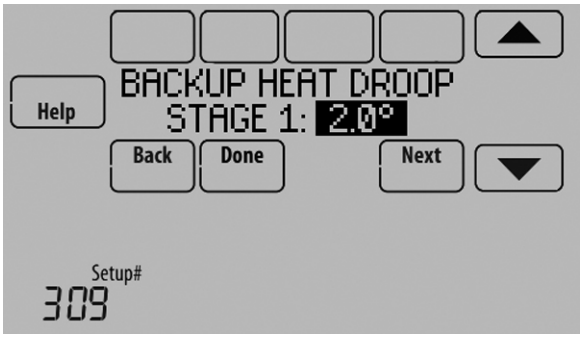


Fig. 166.

Backup Heat Upstage Timer

The Backup Heat Upstage Timer is available for any system with 2 heating types and the Backup Heat Droop is set to 2 °F (1.0 °C) or higher.

Backup heat is not used unless the indoor temperature drops to the Backup Heat Droop setting or the Backup Heat Upstage Timer expires, whichever occurs first. The upstage timer starts when the highest stage of the previous equipment type turns on.

Backup Heat Upstage Timer options are Off, 30 minutes to 16 hours. Default is Off.

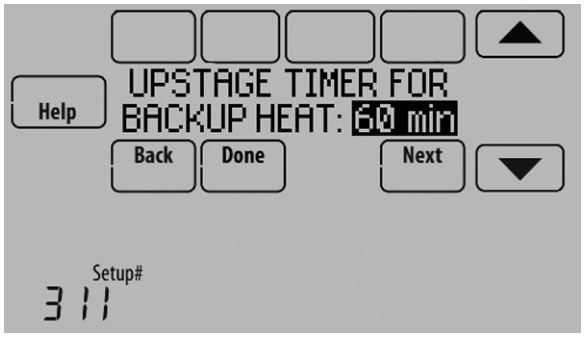


Fig. 167.

Multistage Control

Multistage Control keeps the high stage of the equipment running until the desired setpoint is reached. This setting is recommended for Geothermal Heat Pumps to allow the loop to rest.

To view/adjust “Finish with High Heat Stage” or “Finish with High Cool Stage,” set ISU 301 Control Options to “Advanced Options.” See Fig. 168. Select Yes to turn on this feature. Default is No.

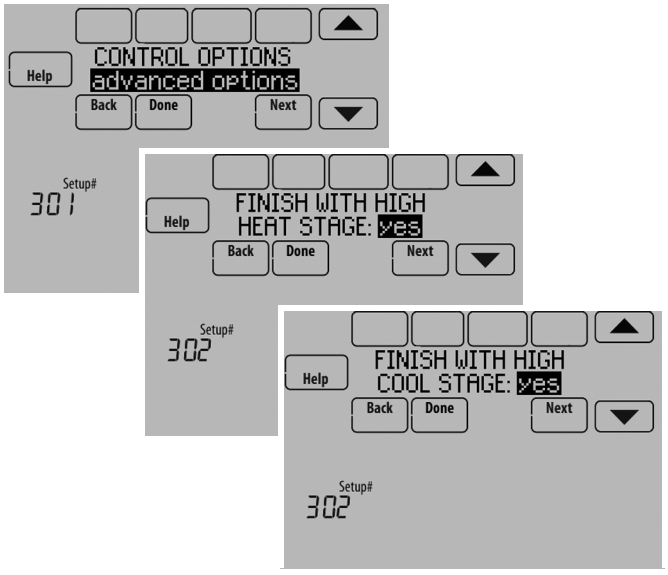


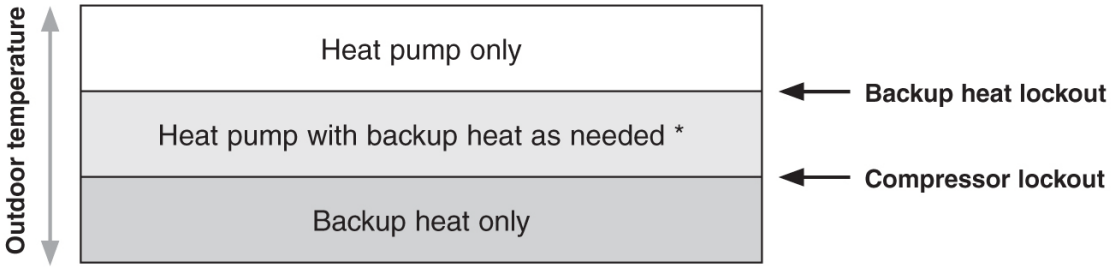
Fig. 168.

HEAT PUMP AND BACKUP HEAT OPERATION

Heat pump with outdoor temperature lockouts

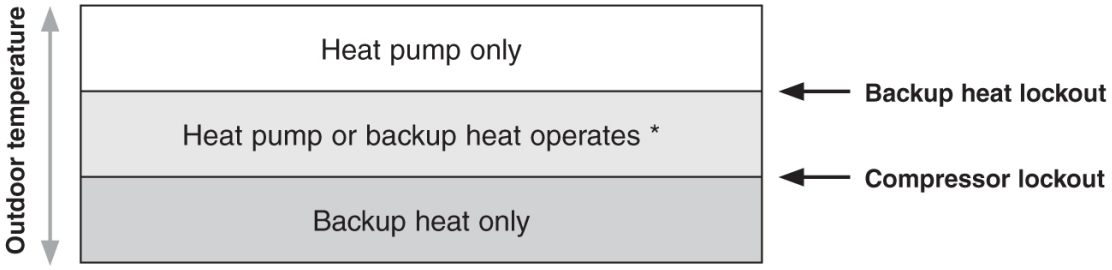
Outdoor temperature lockouts are optional. See Installer Setup options (ISU 312).

Electric - Backup heat allowed to run with heat pump



* No backup heat unless indoor temperature drops to selected Backup Heat Droop setting, or Backup Heat Upstage Timer expires. **Heat pump stays ON when backup heat turns on.**

Fossil Fuel - Backup heat NOT allowed to run with heat pump



* No backup heat unless indoor temperature drops to selected Backup Heat Droop setting, or Backup Heat Upstage Timer expires. **Heat pump turns OFF when backup heat turns on.**

Alert Light - General

An alert light is located in the lower right corner of the thermostat. See Fig. 78 and 79. This light turns red when an alert is active or the system is set to the Em. Heat mode. The alert light is on continuous when the thermostat is system powered (C Wire) and flashes if the thermostat is battery powered.

Alert Light - Heat Pump Systems

When the L terminal is wired to a compressor monitor and it receives 24 volts, the alert light on the thermostat will turn red to indicate a system problem. The thermostat monitors 24 volts on the L terminal in Heat, Cool and Auto modes.

Alert Light - Emergency Heat Indication

When the thermostat is setup for a Heat Pump with an Auxiliary Heat source, the alert light will turn red when the user sets the system to the Em. Heat mode. It is normal for the alert light to turn red in the Em. Heat mode to remind the user that they are currently operating their Emergency Heat and the Heat Pump is locked out.

Geothermal Radiant Heat

The thermostat can be setup to control Geothermal Radiant Heat, Geothermal Forced Air Heat and Backup Heat, all from one thermostat. The thermostat stages the equipment starting with the Geothermal Radiant Heat followed by Geothermal Forced Air Heat and then Backup Heat as needed to maintain the desired temperature. The thermostat allows you to set differential temperature settings between each stage if you want the equipment to stage a certain way (see ISU 303 to ISU 309, page 27). For additional wiring diagrams, see “Wiring” beginning on page 117.

NOTE: To turn off Radiant Heat during the shoulder seasons, install an outdoor reset control and connect to the Radiant Heat or switch the thermostat to Emergency Heat mode.

Electric Backup Heat (Backup Heat Allowed to Run with Heat Pump)

HEAT MODE

The thermostat turns on Backup Heat only when the indoor temperature drops to the selected Backup Heat Droop setting or the Backup Heat Upstage Timer expires (whichever occurs first). Geothermal Radiant Heat and Geothermal Forced Air Heat stay on when the Backup Heat turns on.

EMERGENCY HEAT MODE

The thermostat turns on the Backup Heat to maintain the desired temperature setting. Geothermal Radiant Heat and Geothermal Forced Air Heat are not used.

Fossil Fuel Backup Heat (Backup Heat NOT Allowed to Run with Heat Pump)

HEAT MODE

The thermostat turns on Backup Heat only when the indoor temperature drops to the selected Backup Heat Droop setting or the Backup Heat Upstage Timer expires (whichever occurs first). Geothermal Forced Air Heat turns off when the Backup Heat turns on. Geothermal Radiant Heat stays on when the Backup Heat turns on.

EMERGENCY HEAT MODE

The thermostat turns on the Backup Heat to maintain the desired temperature setting. Geothermal Radiant Heat and Geothermal Forced Air Heat are not used.

Set Up Geothermal Radiant Heat

1. Select Geothermal Radiant Heat as shown in Fig. 169.

Fig. 169.

2. Select the number of Radiant Heat Stages. See Fig. 170.

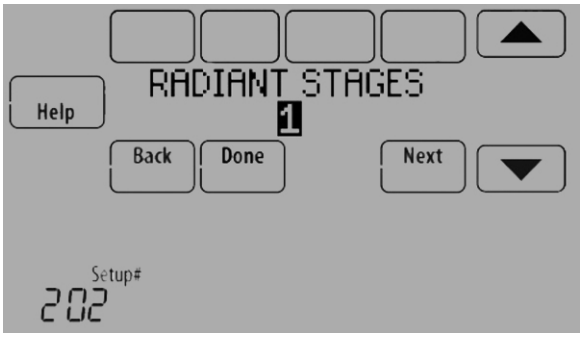


Fig. 170.

3. Select the universal terminals wired to the Geothermal Radiant Heat. See Fig. 171.

Fig. 171.

4. Select a Geothermal Forced Air Option. For example, if Geothermal Forced Air is used for both heating and cooling, select the "Heating and Cooling" option. See Fig. 172. Other options are "None" (Geothermal Forced Air is not used) and "Cool Only" (Geothermal Forced Air is only used for cooling).See Fig. 172.

Fig. 172.

5. Select the Reversing Valve. See Fig. 173.

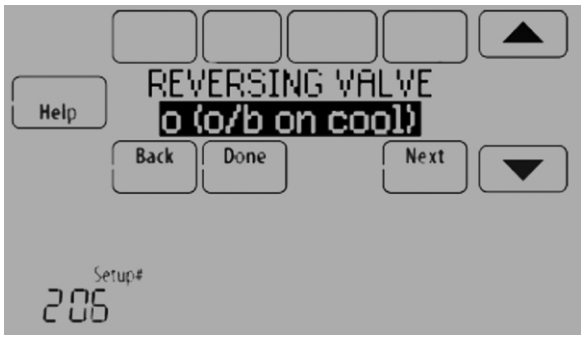


Fig. 173.

6. Select the number of Compressor and Backup Heat Stages. See Fig. 174.

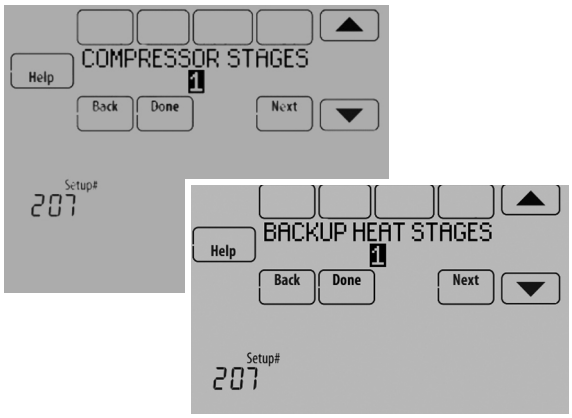


Fig. 174.

7. Select the Backup Heat Type. See Fig. 175.

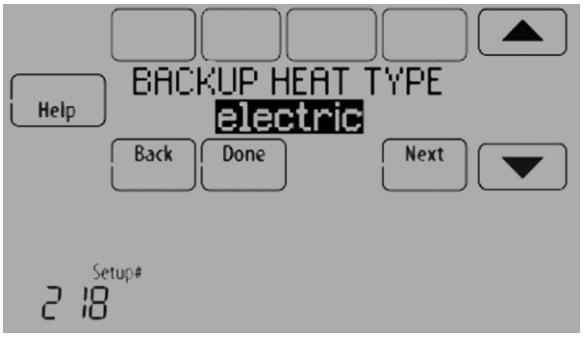


Fig. 175.

INDOOR AIR QUALITY (IAQ) CONTROL

Humidification

The thermostat reads the indoor humidity level and allows the user to set a humidification setting with or without window protection.

The thermostat can be set up to control a humidifier in any system mode in the Installer Setup (ISU 806). A discharge air sensor is required to humidify in the cool mode.

If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from one location, the thermostat will automatically enforce a 15% deadband between the humidification and dehumidification settings. The thermostat will automatically switch between humidification and dehumidification to maintain the desired humidity level.

If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from two different locations using a remote wireless indoor sensor, the thermostat will allow humidification and dehumidification to operate at the same time, and there is no deadband between humidification and dehumidification settings.

Window Protection

Window Protection limits the amount of humidity to prevent frost or condensation on windows. Window Protection (ISU 805) requires an outdoor sensor.

The thermostat prevents frost or condensation on windows by not allowing the humidifier to run above a certain level. To prevent frost or condensation, the thermostat may turn off the humidifier before the humidity setting is reached.

To adjust the Window Protection setting, press MENU, scroll down and select Window Protection. Window Protection is set on a scale from 1-10. A setting of "1" represents poorly insulated windows and a setting of "10" represents well insulated windows. A lower number automatically reduces the humidity to help prevent frost or condensation on your windows. Use a higher number if indoor air seems too dry. To prevent frost/condensation on your windows during cold outdoor temperatures, poorly insulated windows require a lower Window Protection setting, which will limit how much your humidifier can run.

After you set the Window Protection setting, check for frost/condensation on your windows in the morning. If frost/condensation is present, adjust the Window Protection setting to the next lowest number and check for frost/condensation on your windows the next morning. Continue to adjust the Window Protection setting to a lower number until frost/condensation is no longer present.

Fig. 176.

If Window Protection is turned Off, the thermostat controls the humidity level to the user's desired humidity setting. Frost or condensation may appear on windows.

Set up Humidification

1. Select the Humidifier Type at ISU 800. See Fig. 177.

   NOTE: Based on the humidifier type you select, the thermostat defaults to the most commonly used settings for that humidifier type.
   For example, a Bypass or Fan Powered humidifier will default ISU 807 to “Hum when Heat is On.”
   A Steam humidifier will default ISU 807 to "Tstat Controls Fan."

Fig. 177.

2. If optional remote wireless indoor sensors are installed, you can choose which sensor you want to use for humidification control. You can use a different sensor for dehumidification. See “Wireless Indoor Sensor” beginning on page 113 for more information.

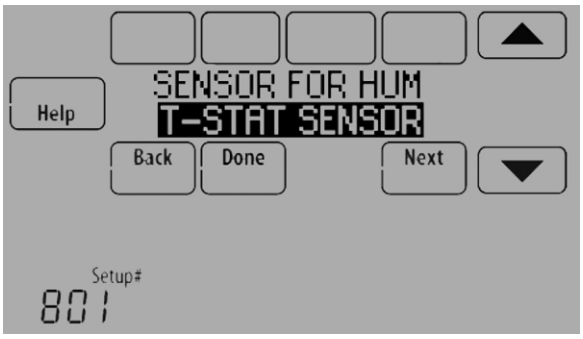


Fig. 178.

3. Select the terminals wired to the humidifier. See Fig. 179.

   NOTE: U1, U2, and U3 are Normally Open Dry Contacts that require power from the system transformer or a separate transformer. See “Wiring IAQ Equipment or a Heat/Cool Stage to the Universal Terminals” beginning on page 129.

Fig. 179.

4. Set Window Protection setting. See Fig. 180.

   NOTE: Outdoor sensor is required for Window Protection.

Fig. 180.

5. Select the system mode(s) to allow humidification. See Fig. 181.

   NOTE: **Heat** includes Heat, Emergency Heat and Auto. If the system is in Auto mode, the thermostat will allow humidification if the last call was for heat.

   Cool includes Cool and Auto. If the system is in Auto mode, the thermostat will allow humidification if the last call was for cool. A discharge sensor is required to humidify in the Cool mode. The thermostat prevents condensation in the duct work by not allowing the humidifier to run when the discharge temperature goes below the dew point temperature. The humidifier is allowed to run again after the discharge temperature rises above the dew point temperature.

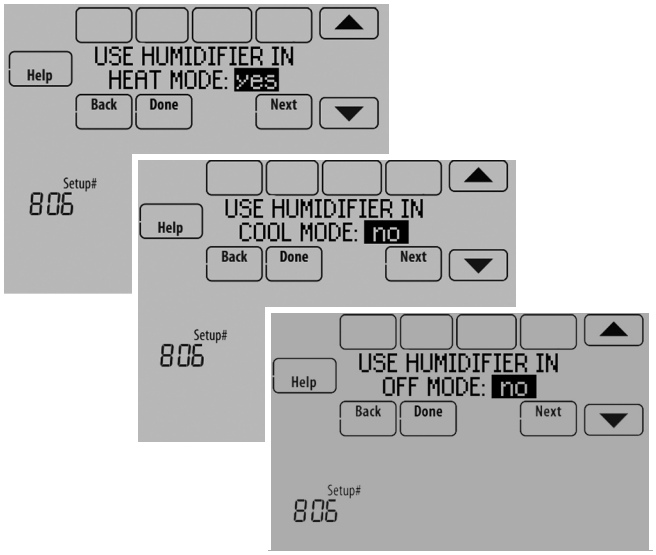


Fig. 181.

6. Select from one of the Humidification Control Options (ISU 807). See Fig. 182.
   - **Hum when Heat is On**
     The thermostat turns on the humidifier only if the heat is currently running and humidification is needed.
   - **Hum when Fan is On**
     The thermostat turns on the humidifier only if the fan is currently running and humidification is needed.
   - **Tstat Controls Fan**
     The thermostat turns on the humidifier and the fan when humidification is needed.
   - **Hum Controls Fan**
     The thermostat turns on the humidifier when humidification is needed and the humidifier controls the fan.

Fig. 182.

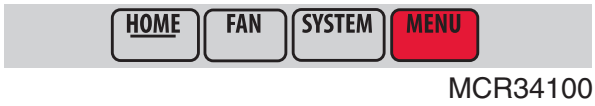
7. Set the desired lockout option. See Fig. 183.

Fig. 183.

NOTE: ISU 1014 gives the option to lockout ventilation during calls for humidification. This helps maintain the desired humidity level.

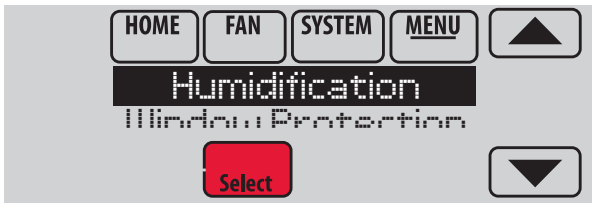
Control Humidification Level

1. Touch MENU and select Humidification.



MCR34100

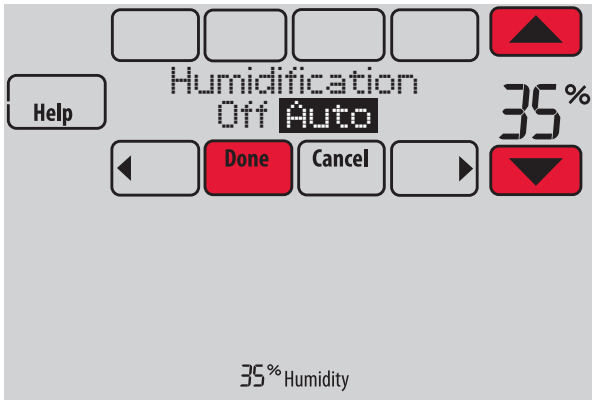
Fig. 184.



MCR34128

Fig. 185.

2. Select Auto.



MCR34129

Fig. 186.

3. Touch ▲ or ▼ to select humidity level.
4. Touch Done to save your settings. Touch Cancel to ignore changes.
5. If frost or condensation appears on the windows, press MENU, scroll down and select Window Protection.

Fig. 187.

6. Window Protection is set on a scale from 1–10. A setting of 1 represents poorly insulated windows and a setting of 10 represents well insulated windows. A lower number automatically reduces the humidity to help prevent frost or condensation on your windows. Use a higher number if indoor air seems too dry. To prevent frost/condensation on your windows during cold outdoor temperatures, poorly insulated windows require a lower Window Protection setting, which will limit how much your humidifier can run.
7. After you set the Window Protection setting, check for frost/condensation on your windows in the morning. If frost/condensation is present, adjust the Window Protection setting to the next lowest number and check for frost/condensation on your windows the next morning. Continue to adjust the Window Protection setting to a lower number until frost/condensation is no longer present.

NOTE: The Window Protection option is only available if an optional outdoor sensor is installed.

NOTE: If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from one location, the thermostat will automatically enforce a 15% deadband between the humidification and dehumidification settings. The thermostat will automatically switch between humidification and dehumidification to maintain the desired humidity level.

If humidification and dehumidification are setup

to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from two different locations using a remote wireless indoor sensor, the thermostat will allow humidification and dehumidification to operate at the same time, and there is no deadband between humidification and dehumidification settings.

Dehumidification - Residential

The thermostat reads the indoor humidity level and allows the user to set a dehumidification setting. The thermostat controls the humidity level using the cooling system or a whole house dehumidifier.

If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from one location, the thermostat will automatically enforce a 15% deadband between the humidification and dehumidification settings. The thermostat will automatically switch between humidification and dehumidification to maintain the desired humidity level.

If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from two different locations using a remote wireless indoor sensor (for example, main level and crawl space), the thermostat will allow humidification and dehumidification to operate at the same time, and there is no deadband between humidification and dehumidification settings.

Dehumidification using the Cooling System

When set for A/C with Low Speed Fan or A/C with High Speed Fan, an overcooling limit can be set from 0 °F to 3 °F (ISU 907). The thermostat uses the cooling system to reduce humidity by lowering the temperature up to 3° F below the current cool setpoint until the desired humidity level is reached.

If set for A/C with Low Speed Fan, configure U1, U2, or U3 as normally open or normally closed (ISU 905) and wire to the Low Speed Fan terminal on the equipment. For example, if the U1, U2, or U3 terminal is normally closed, it will open when the thermostat calls for dehumidification.See “Wiring IAQ Equipment or a Heat/Cool Stage to the Universal Terminals” beginning on page 129.

NOTE: The thermostat will not lower the fan speed when the second stage of cooling is on.

Set up Dehumidification With Cooling System

Some screens shown in this section may not appear on the thermostat, depending on how you set up dehumidification.

1. Select the Dehumidification Equipment in ISU 900. See Fig. 188.

Fig. 188.

2. If optional remote wireless indoor sensors are installed, you can choose which sensor you want to use for dehumidification control. For example, you can use one sensor for humidification control, and another for dehumidification. See “Wireless Indoor Sensor” beginning on page 113 for more information.

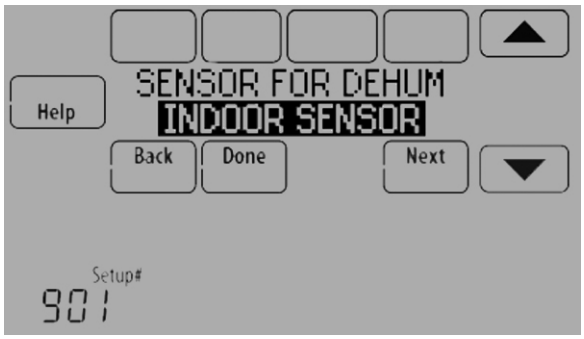


Fig. 189.

3. If you are sensing humidity from two separate locations (one for humidification and another for dehumidification), you can select which humidity reading to display on the home screen. See “Wireless Indoor Sensor” beginning on page 113 for more information.

Fig. 190.

4. Select the terminals wired to the A/C with Low Speed Fan. See Fig. 191.

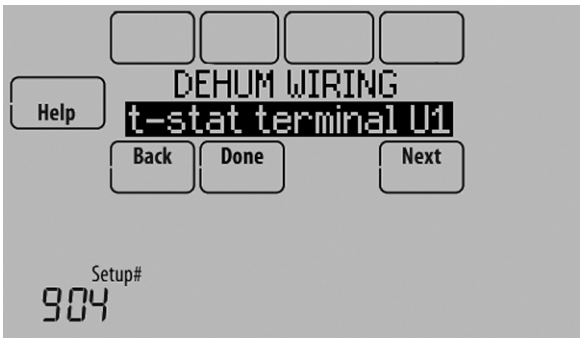


Fig. 191.

5. Select whether the U1, U2, or U3 terminals are Normally Open or Normally Closed. See Fig. 192.
   - **Normally Open** – contacts are normally open and will close during a call for dehumidification
   - **Normally Closed** – contacts are normally closed and will open during a call for dehumidification.

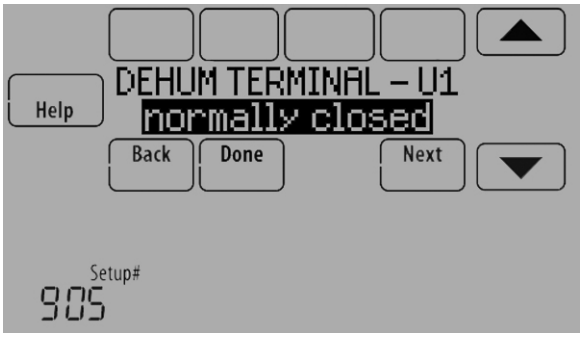


Fig. 192.

6. Set the Overcooling Limit. See Fig. 193. Options:
   - 0 °F to 3 °F (A/C with Low Speed Fan)
   - 1 °F to 3 °F (A/C with High Speed Fan)

Fig. 193.

NOTE: ISU 1014 gives the option to lockout ventilation on calls for dehumidification. This helps maintain the desired humidity level.

Dehumidification using a Whole House Dehumidifier

The Whole House Dehumidifier option requires a dedicated unit for dehumidification. The thermostat can be set to control dehumidification in all modes (Heat, Off, Cool [ISU 912]).

Set up Dehumidification With Whole House Dehumidifier

Some screens shown in this section may not appear on the thermostat, depending on how you set up dehumidification.

1. Select the Dehumidification Equipment in ISU 900. See Fig. 194.

Fig. 194.

2. If optional remote wireless indoor sensors are installed, you can choose which sensor you want to use for dehumidification control. For example, you can use one sensor for humidification control, and another for dehumidification. See “Wireless Indoor Sensor” beginning on page 113 for more information.

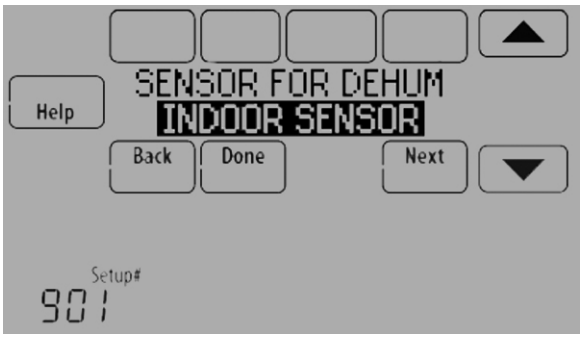


Fig. 195.

3. If you are sensing humidity from two separate locations (one for humidification and another for dehumidification), you can select which humidity reading to display on the home screen. See “Wireless Indoor Sensor” beginning on page 113 for more information.

Fig. 196.

4. Select the terminals wired to the Whole House Dehumidifier. See Fig. 197.

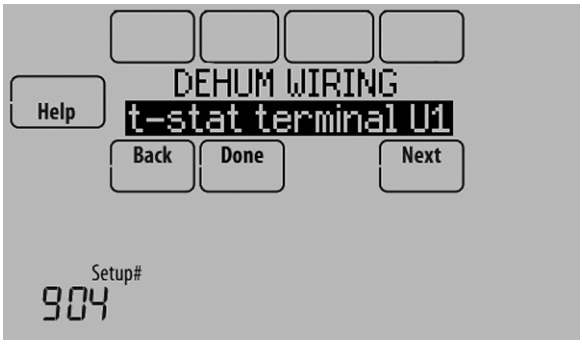


Fig. 197.

5. Select the system mode(s) to allow dehumidification. See Fig. 198.

NOTE: **Heat** includes Heat, Emergency Heat and Auto. If the system is in Auto mode, the thermostat will allow dehumidification if the last call was for heat.

Cool includes Cool and Auto. If the system is in Auto mode, the thermostat will allow dehumidification if the last call was for cool.

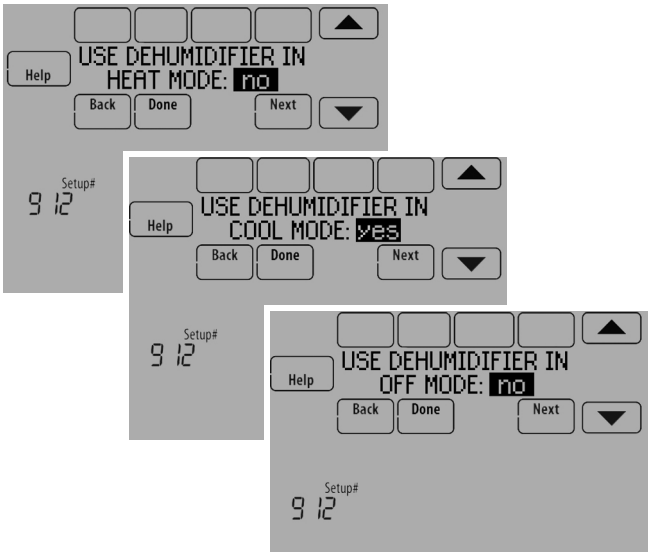


Fig. 198.

6. Set Dehumidifier Fan Control settings. See Fig. 199.
   - **Tstat Controls Fan**
     Thermostat turns on the dehumidifier and the fan when dehumidification is needed.
   - **Equip Controls Fan**
     Thermostat turns on the dehumidifier when dehumidification is needed. The fan is controlled by the equipment.

Fig. 199.

7. Set the desired lockout option. See Fig. 200.

Fig. 200.

NOTE: ISU 1014 gives the option to lockout ventilation during calls for dehumidification. This helps maintain the desired humidity level.

Dehumidification Away Mode

Dehumidification Away Mode protects the home when unoccupied for long periods of time during hot and humid weather by maintaining the desired humidity and temperature settings.

To start Dehumidification Away Mode, press MENU, then select Dehum Away Mode.

Fig. 201.

The thermostat automatically follows settings that are set by the dealer during installer setup.

Press Cancel to end Dehumidification Away Mode.

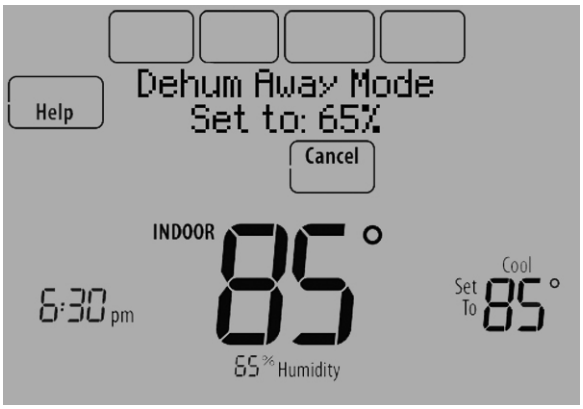


Fig. 202.

Set up Dehumidification Away Mode

1. Select Allowed at ISU 918. See Fig. 203.

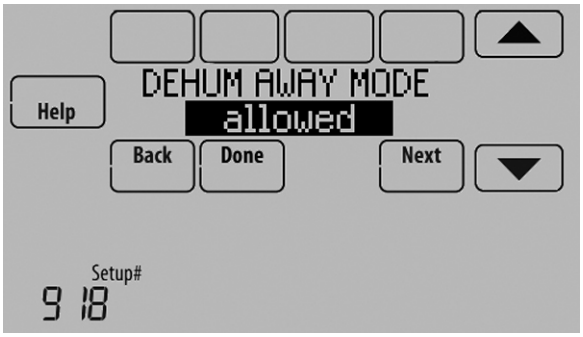


Fig. 203.

2. Set Fan Control settings. See Fig. 204.
   - On: Fan is always on.
   - Automatic: Fan runs only when cooling system is on.
   - Circulate: Fan runs randomly, about 35% of the time.

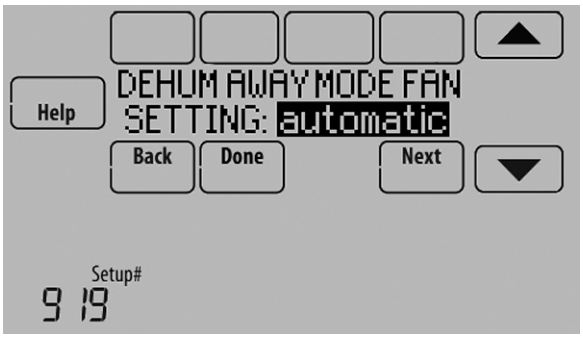


Fig. 204.

3. Set temperature and dehumidification settings. See Fig. 205.

- **Low Limit Temperature Setting**
  If the cooling system is used to control humidity while Dehumidification Away Mode is active, the thermostat allows the cooling system to lower the indoor air to the Low Limit Temperature Setting to reach the Dehumidification Setting at ISU 920.
- **Temperature Setting**
  The temperature maintained while Dehumidification Away Mode is active and the desired humidity level is satisfied.
- **Dehumidification Setting**
  The desired humidity level while Dehumidification Away Mode is active.

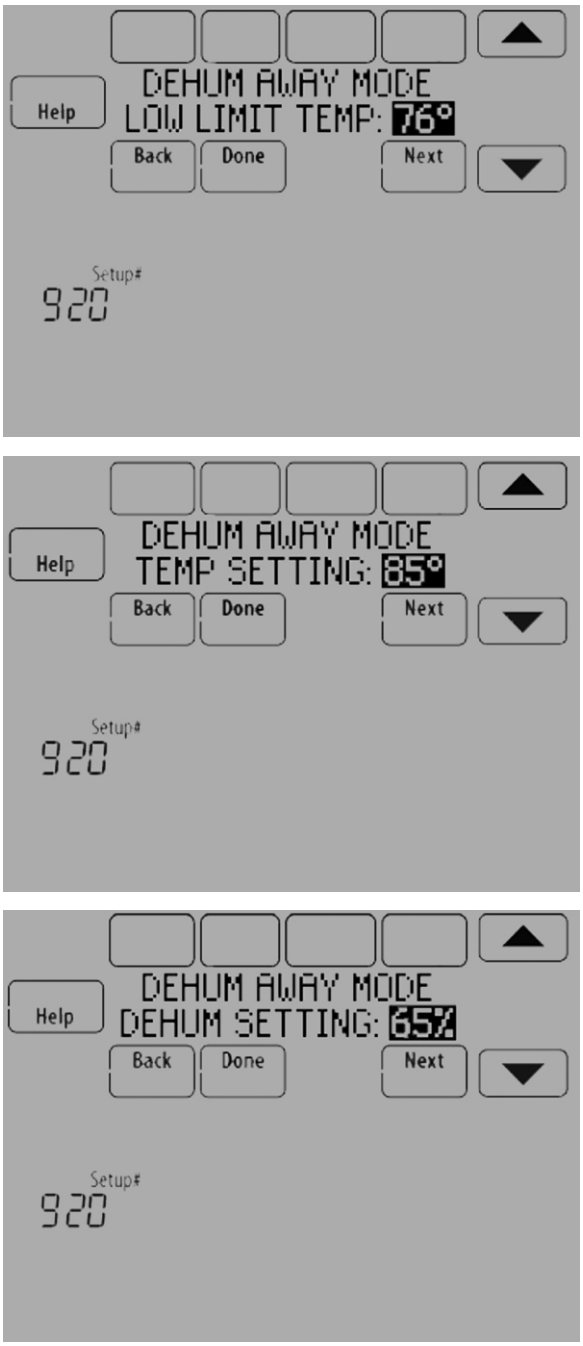


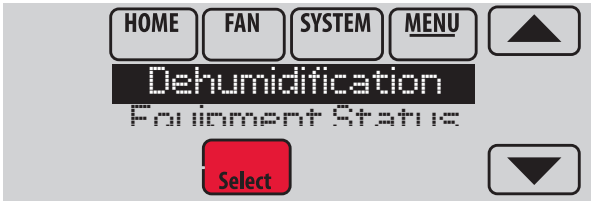
Fig. 205.

Control Dehumidification Level

1. Touch MENU and select Dehumidification.

MCR34100

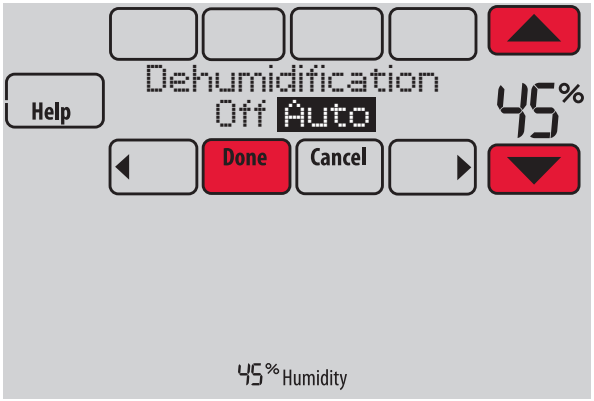
Fig. 206.



MCR34130

Fig. 207.

2. Select Auto.



MCR34131

Fig. 208.

3. Touch ▲ or ▼ to select humidity level.
4. Touch Done to save your settings. Touch Cancel to ignore changes.

NOTE: If your air conditioner is used to control humidity, the temperature may drop up to 3° F below your temperature setting until humidity reaches the desired level.

NOTE: If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from one location, the thermostat will automatically enforce a 15% deadband between the humidification and dehumidification settings. The thermostat will automatically switch between humidification and dehumidification to maintain the desired humidity level.

If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from two different locations using a remote wireless indoor sensor (for example, main level and crawl space), the thermostat will allow humidification and dehumidification to operate at the same time, and there is no deadband between humidification and dehumidification settings.

Dehumidification - Commercial

The thermostat reads the indoor humidity level and allows the user to set a dehumidification setting. The thermostat controls the humidity level using the cooling system or a dehumidifier.

If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from one location, the thermostat will automatically enforce a 15% deadband between the humidification and dehumidification settings. The thermostat will automatically switch between humidification and dehumidification to maintain the desired humidity level.

If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from two different locations using a remote wireless indoor sensor (for example, main level and crawl space), the thermostat will allow humidification and dehumidification to operate at the same time, and there is no deadband between humidification and dehumidification settings.

Dehumidification Equipment Options: (ISU 900)
- A/C with Low Fan
- A/C with High Fan
- Hot Gas Bypass
- Dehumidifier

NOTE: Hot Gas Bypass - During a call for dehumidification, the cooling capacity will be used to remove more latent heat than sensible heat. The operation of Hot Gas Bypass varies by equipment. For more details, contact the equipment manufacturer.

Dehumidification using the Cooling System

Dehumidification using A/C with Low Speed Fan, A/C with High Speed Fan or Hot Gas Bypass, has the following methods of dehumidification control (ISU 908):

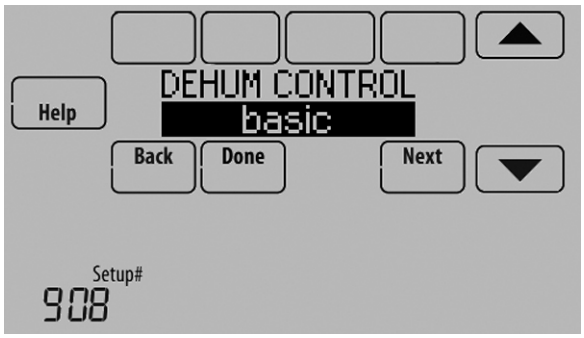


Fig. 209.

Basic (ISU 908): This option uses the cooling system to reach the desired humidity level. Minimum On Time, Cooling Droop and Reheat are not used with this method. This setting is commonly used if your dehumidification equipment is Hot Gas Bypass.

Minimum On Time (ISU 908 and 909): This option ensures that the compressor runs long enough to effectively reduce humidity when the cooling equipment is cycled on. The compressor will run for the minimum “on time” you set until the desired humidity level is reached.

Cooling Droop (ISU 908 and 910): This option uses the cooling system to lower the temperature up to 5° F below the current cool setpoint until the desired humidity is reached. The Dehum Over Cooling Limit range is from 1° to 5° F.

Cooling Droop with Minimum On Time (ISU 908, 909, and 910): This method uses both options above to reduce humidity while maintaining a comfortable temperature.

Reheat (ISU 908): This option allows heating to run during dehumidification to help maintain a comfortable temperature. If only cooling stage 1 is used, during the “off” cycle, both cooling and heating run at the same time as needed to dehumidify without overcooling. This option cannot be used in the Heat mode. This option is effective only if using a system with the A-Coil located before the heating coil (heat exchanger). This feature requires a conventional forced air heating system (gas, oil, or electric) in the application.

NOTE: Reheat can be used on heat pump applications that have a forced air backup heat source (gas, oil, or electric). The thermostat will turn on the first stage of forced air backup heat during Reheat.

NOTE: Reheat can be used on systems where the A-Coil is located after the heating coil (heat exchanger), but it is not effective at removing humidity.

Reheat with Minimum On Time (ISU 908 and 909): This method uses both Reheat and Minimum On Time options above to reach the desired humidity level.

If set for A/C with Low Speed Fan, configure U1, U2, or U3 as normally open or normally closed (ISU 905) and wire to the Low Speed Fan terminal on the equipment. For example, if the U1, U2, or U3 terminal is normally closed, it will open when the thermostat calls for dehumidification.See “Wiring IAQ Equipment or a Heat/Cool Stage to the Universal Terminals” beginning on page 129.

NOTE: The thermostat will not lower the fan speed when the second stage of cooling is on.

Set up Dehumidification With Cooling System

Some screens shown in this section may not appear on the thermostat, depending on how you set up dehumidification.

1. Select the Dehumidification Equipment in ISU 900. See Fig. 210.

Fig. 210.

2. If optional remote wireless indoor sensors are installed, you can choose which sensor you want to use for dehumidification control. For example, you can use one sensor for humidification control, and another for dehumidification. See “Wireless Indoor Sensor” beginning on page 113 for more information.

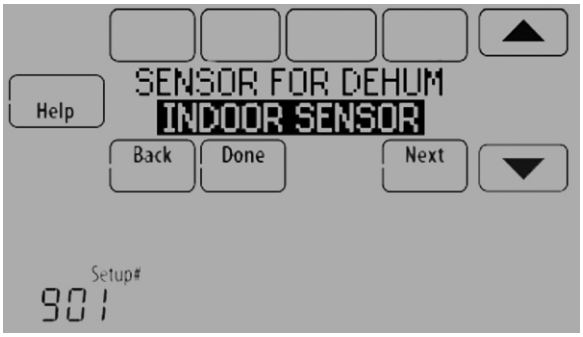


Fig. 211.

3. If you are sensing humidity from two separate locations (one for humidification and another for dehumidification), you can select which humidity reading to display on the home screen. See “Wireless Indoor Sensor” beginning on page 113 for more information.

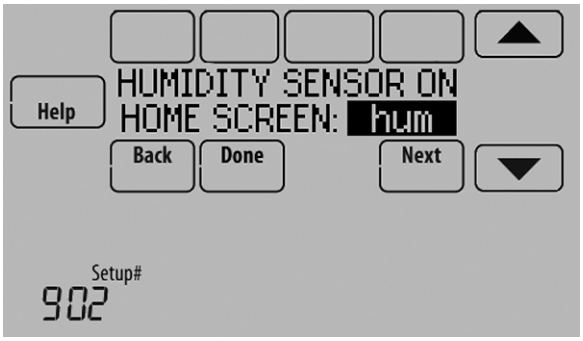


Fig. 212.

4. Select the terminals wired to the A/C with Low Speed Fan or Hot Gas Bypass. See Fig. 213.

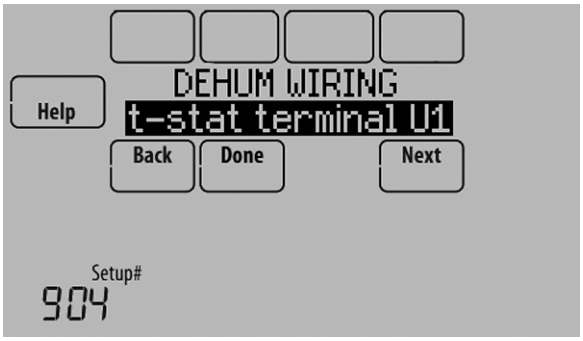


Fig. 213.

5. Select whether the U1, U2, or U3 terminals are Normally Open or Normally Closed. See Fig. 214.
   - **Normally Open** – contacts are normally open and will close during a call for dehumidification
   - **Normally Closed** – contacts are normally closed and will open during a call for dehumidification.

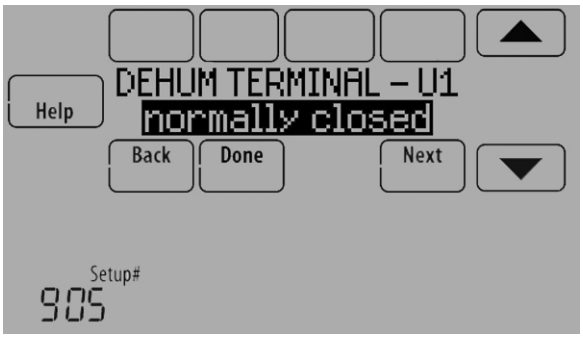


Fig. 214.

6. Set the Dehumidification Control. See Fig. 215. For more information about these options, see “Dehumidification using the Cooling System” on page 87.

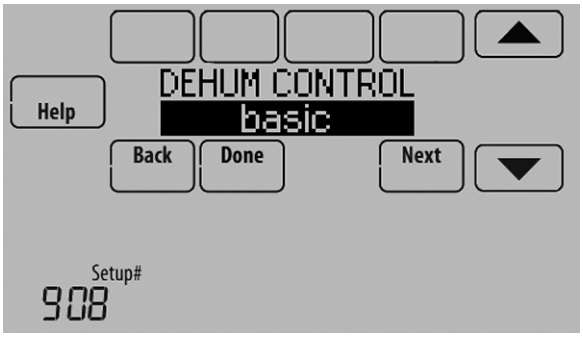


Fig. 215.

NOTE: ISU 1014 gives the option to lockout ventilation on calls for dehumidification. This helps maintain the desired humidity level.

Dehumidification using a Dehumidifier

The Dehumidifier option requires a dedicated unit for dehumidification. The thermostat can be set to control dehumidification in all modes (Heat, Off, Cool [ISU 912]).

Set up Dehumidification With Dehumidifier

Some screens shown in this section may not appear on the thermostat, depending on how you set up dehumidification.

1. Select the Dehumidification Equipment in ISU 900. See Fig. 216.

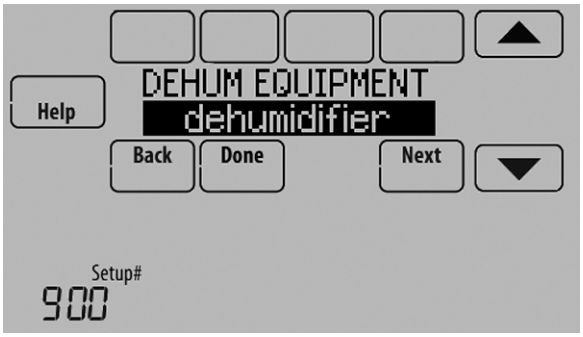


Fig. 216.

2. If optional remote wireless indoor sensors are installed, you can choose which sensor you want to use for dehumidification control. For example, you can use one sensor for humidification control, and another for dehumidification. See “Wireless Indoor Sensor” beginning on page 113 for more information.

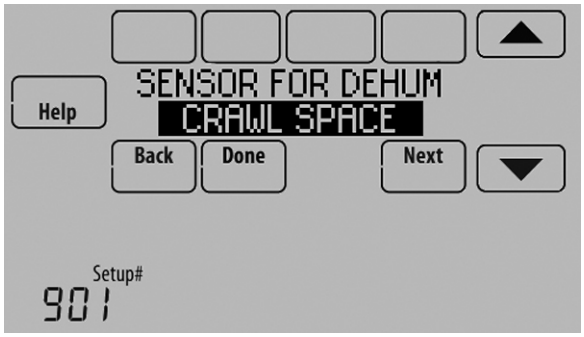


Fig. 217.

3. If you are sensing humidity from two separate locations (one for humidification and another for dehumidification), you can select which humidity reading to display on the home screen. See “Wireless Indoor Sensor” beginning on page 113 for more information.

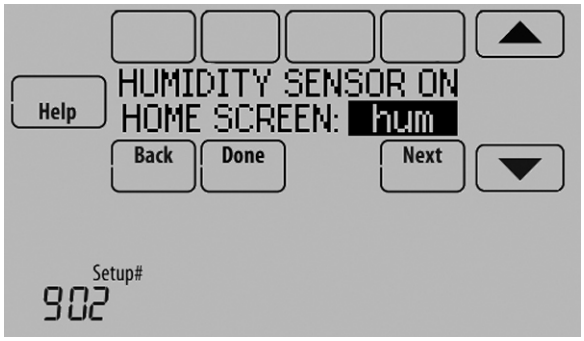


Fig. 218.

4. Select the terminals wired to the Dehumidifier. See Fig. 219.

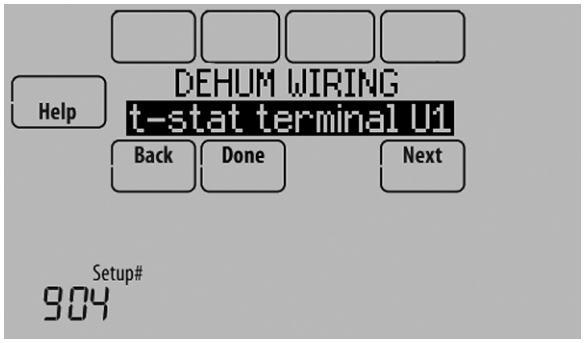


Fig. 219.

5. Select the system mode(s) to allow dehumidification. See Fig. 220.

   NOTE: **Heat** includes Heat, Emergency Heat and Auto. If the system is in Auto mode, the thermostat will allow dehumidification if the last call was for heat.
   Cool includes Cool and Auto. If the system is in Auto mode, the thermostat will allow dehumidification if the last call was for cool.

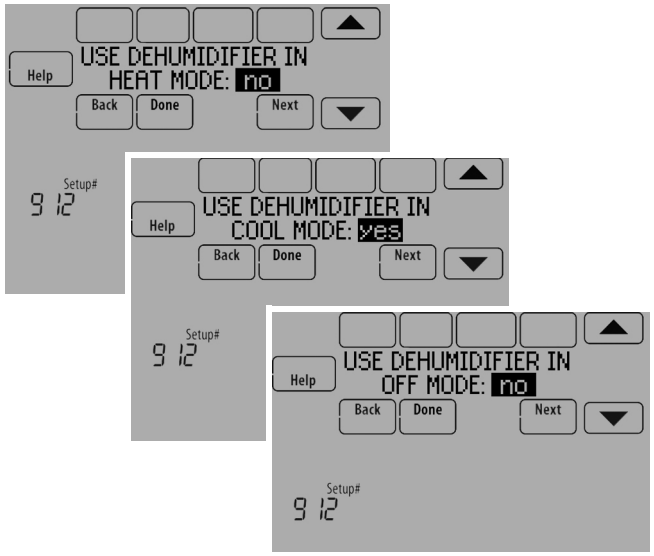


Fig. 220.

6. Set Dehumidifier Fan Control settings. See Fig. 221.
   - **Tstat Controls Fan**
     Thermostat turns on the dehumidifier and the fan when dehumidification is needed.
   - **Equip Controls Fan**
     Thermostat turns on the dehumidifier when dehumidification is needed. The fan is controlled by the equipment.

Fig. 221.

7. Set the desired lockout option. See Fig. 222.

Fig. 222.

   NOTE: ISU 1014 gives the option to lockout ventilation on calls for dehumidification. This helps maintain the desired humidity level.

Dehumidification Away Mode

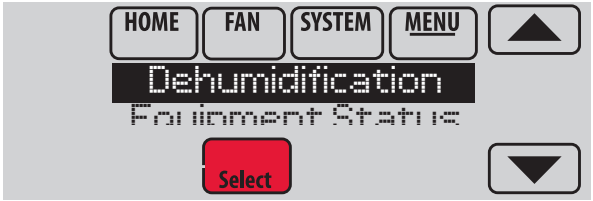
Dehumidification Away Mode for a commercial application is identical to Dehumidification Away Mode for a residential application. See “Dehumidification Away Mode” on page 85 and “Set up Dehumidification Away Mode” beginning on page 86.

Control Dehumidification Level

1. Touch MENU and select Dehumidification.

MCR34100

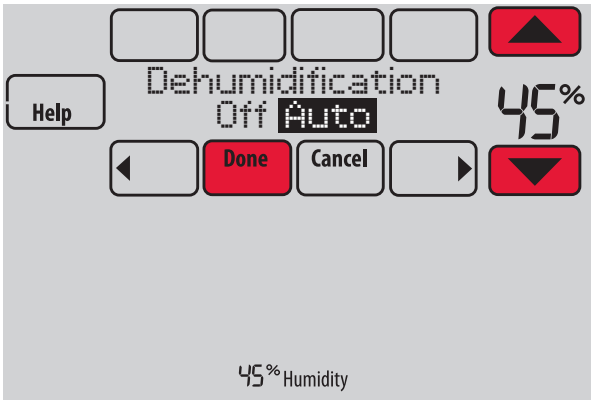
Fig. 223.



MCR34130

Fig. 224.

2. Select Auto.



MCR34131

Fig. 225.

3. Touch ▲ or ▼ to select humidity level.
4. Touch Done to save your settings. Touch Cancel to ignore changes.

If your air conditioner is used to control humidity, the thermostat may use the following methods to maintain humidity:

- Cool from 1° to 5° F lower than your temperature setting.
- Run cooling for the minimum “on” time to reduce humidity.
- Run cooling and heating at the same time to reduce humidity without lowering the temperature.

NOTE: If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from one location, the thermostat will automatically enforce a 15% deadband between the humidification and dehumidification settings. The thermostat will automatically switch between humidification and dehumidification to maintain the desired humidity level.

If humidification and dehumidification are setup to operate in the same system mode (Heat, Cool, Off) and you are sensing humidity from two different locations using a remote wireless indoor sensor (for example, main level and crawl space), the thermostat will allow humidification and dehumidification to operate at the same time, and there is no deadband between humidification and dehumidification settings.

Ventilation

The thermostat can be set for the following ventilation types: (ISU 1000)

- ERV/HRV
- Passive (Fan Only)
- Fresh Air Damper

Ventilation Control Methods (ISU 1005)

Ventilation can be setup to meet either ASHRAE or Percent On Time settings. To meet these settings, the thermostat will ventilate during calls for heat, cool, and fan. If the required ventilation has not been achieved for ASHRAE or Percent On Time, the thermostat will force the ventilation equipment on.

- **ASHRAE**
  The thermostat operates ventilation equipment to meet the ASHRAE 62.2 ventilation standard based on CFM, number of bedrooms, and square footage of the house. ASHRAE 62.2 can only be met if the ventilation equipment is running. If the ventilation equipment is off for any reason (outdoor ventilation lockouts, set up to turn Off during Sleep period, turned off by user, etc.), ASHRAE 62.2 is not met during those times. See ISU 1012 to select a Ventilation Priority.
- **Percent On Time**
  The thermostat operates ventilation equipment based on a percentage entered in the installer setup (ISU 1012). For example if Percent On Time is set to 50%, the ventilation equipment will run at random times during a 1 hour period until it reaches a 50% run time (approximately 30 minutes). Default setting is 30%. Range is 10% to 100% in 10% increments.

Ventilation Fan Control (ISU 1006)

- **Tstat Controls Fan**
  The thermostat turns on the ventilator and the fan when ventilation is needed.
- **Equip Controls Fan**
  The thermostat turns on the ventilator when ventilation is needed. The fan is controlled by the equipment.

Ventilation Priority (ISU 1012)

- **Lockouts are Priority**
  The thermostat places a priority on lockouts versus the ASHRAE 62.2 ventilation standard. The thermostat will not run ventilation during the following lockout conditions (if configured) unless you manually call for ventilation:
  — Lockout Ventilation during Outdoor Conditions (ISU 1013)
  — Lockout Ventilation on Humidification or Dehumidification Calls (ISU 1014)
  — Lockout Ventilation during “Sleep” (Residential) or “Unoccupied” (Commercial) program periods. Note: This option is set by the user on the Ventilation screen in the Menu.
- **ASHRAE is Priority**
  ASHRAE requires additional ventilation following a long off cycle. The thermostat meets the ASHRAE 62.2 ventilation standard by running additional ventilation when outdoor conditions are favorable. If ASHRAE cannot be met when outdoor conditions are favorable, the thermostat will override the outdoor lockouts and run ventilation. When using this option, it is recommended to increase the rate (CFM) of the ventilation equipment to meet the ASHRAE 62.2 ventilation standard in a shorter run time.

NOTES: ISU 1014 Lockout Ventilation on Humidification or Dehumidification Calls is not an option when you select ASHRAE is Priority.

The ability to lockout ventilation during the “Sleep” or “Unoccupied” program periods is not an option when you select ASHRAE is Priority.

Ventilation — Outdoor Condition Lockouts (ISU 1013)

Ventilation will not operate when outdoor conditions exceed the lockout settings unless you manually call for ventilation or Ventilation Priority (ISU 1012) is set to **ASHRAE is Priority**

and ventilation is needed to meet ASHRAE. Lockouts can prevent ventilation during extreme weather conditions to keep humid, hot, and cold air out of the home.

NOTE: This feature requires an outdoor sensor.

If the outdoor sensor also measures humidity, ventilation will not be allowed when the outdoor dewpoint is above the level you set. Options are:
- Ventilation Low Temperature Lockout Setpoint (Off, -20° to 40° F)
- Ventilation High Temperature Lockout Setpoint (Off, 80° to 110° F)
- Ventilation High Dewpoint Lockout Setpoint (Off, 65° to 85° F)

Refer to the information below if you need assistance setting the High Dewpoint Lockout.
- Higher than 80: Extremely uncomfortable
- 75 to 80: Very uncomfortable
- 70 to 74: Quite uncomfortable
- 65 to 69: Somewhat uncomfortable

Ventilate on High Indoor Humidity (ISU 1016)

If set to ventilate on high indoor humidity, the ventilator turns on to remove excess humidity if the indoor humidity is 10% above the Humidification setting. The thermostat must be in the heat mode to ventilate on high indoor humidity.

Set up Ventilation

Some screens shown in this section may not appear on the thermostat, depending on how you set up ventilation.

1. Select the Ventilation Type in ISU 1000. See Fig. 226.

Fig. 226.

2. Select the terminals wired to the Ventilator (or Fresh Air Damper). See Fig. 227.

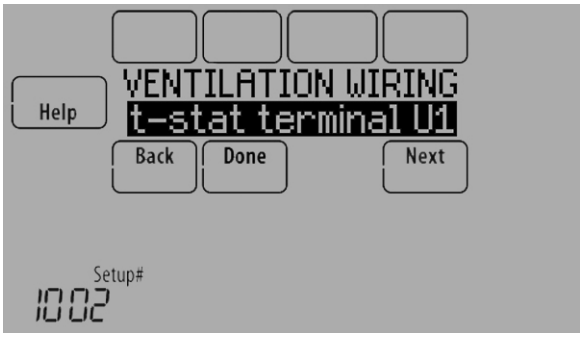


Fig. 227.

3. Select the Ventilation Control Method. See “Ventilation Control Methods (ISU 1005)” on page 91 for more information. See Fig. 228.

Fig. 228.

4. Select the Ventilation Fan Control. See “Ventilation Fan Control (ISU 1006)” on page 91 for more information. See Fig. 229.

   NOTE: ISU 1006 is only displayed if the Ventilation Type is ERV / HRV. The thermostat controls the fan if the Ventilation Type is Fresh Air Damper.

Fig. 229.

5. If ASHRAE was selected for ISU 1005, select the Number of Bedrooms and Size of House. See Fig. 230.

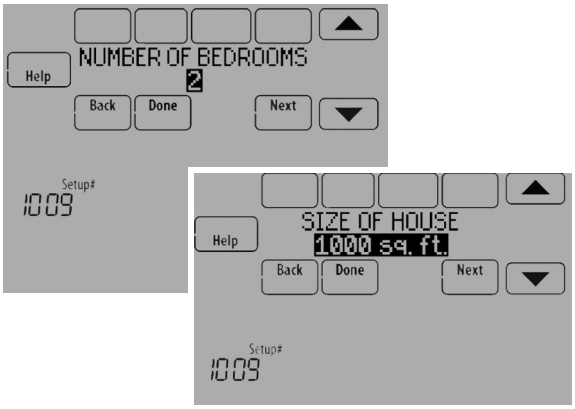


Fig. 230.

6. If ASHRAE was selected for ISU 1005, enter the Equipment Ventilation Rate (CFM). Be sure this setting corresponds with the actual ventilation speed. This setting determines how often the ventilation equipment will operate to meet the ASHRAE 62.2 Standard. The thermostat

will indicate the following based on the Equipment Ventilation Rate, Square Footage and Number of Bedrooms. See Fig. 231.

- Provides an indication if it meets or does not meet the ASHRAE 62.2 Standard.
- Provides % run time that is needed to meet the ASHRAE 62.2 Standard.

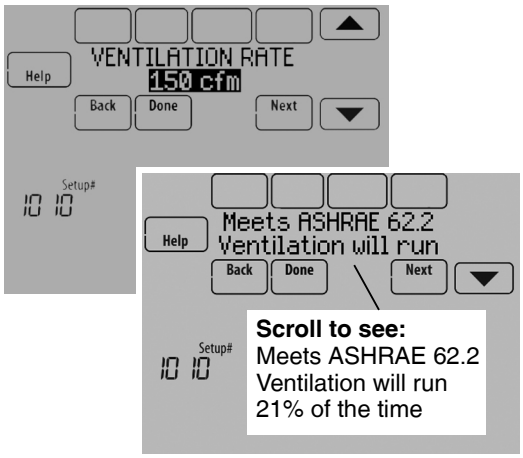


Fig. 231.

7. Select a Ventilation Priority (see Fig. 232):

c. **Lockouts are Priority:** The thermostat places a priority on lockouts versus the ASHRAE 62.2 ventilation standard. The thermostat will not run ventilation during the following lockout conditions (if configured) unless you manually call for ventilation:
(1) Lockout Ventilation during Outdoor Conditions (ISU 1013)
(2) Lockout Ventilation on Humidification or Dehumidification Calls (ISU 1014)
(3) Lockout Ventilation during “Sleep” (Residential) or “Unoccupied” (Commercial) program periods. Note: This option is set by the user on the Ventilation screen in the Menu.

d. **ASHRAE is Priority:** ASHRAE requires additional ventilation following a long off cycle. The thermostat meets the ASHRAE 62.2 ventilation standard by running additional ventilation when outdoor conditions are favorable. If ASHRAE cannot be met when outdoor conditions are favorable, the thermostat will override the outdoor lockouts and run ventilation.

When using this option, it is recommended to increase the rate (CFM) of the ventilation equipment to meet the ASHRAE 62.2 ventilation standard in a shorter run time.

NOTE: ISU 1014 Lockout Ventilation on Humidification or Dehumidification Calls is not an option when you select ASHRAE is Priority.

The ability to lockout ventilation during the “Sleep” or “Unoccupied” program periods is not an option when you select ASHRAE is Priority.

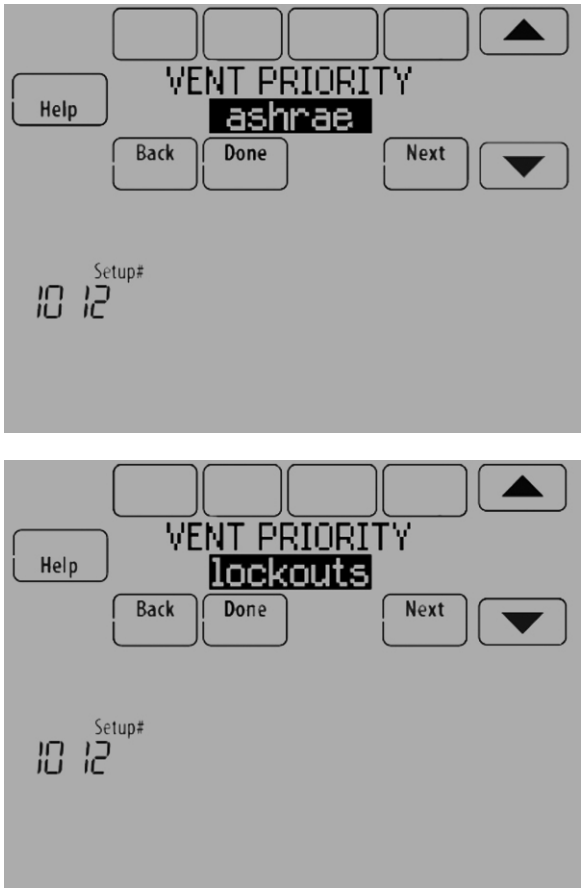


Fig. 232.

8. If Percent On Time was selected for ISU 1005, select the Ventilation Percent on Time. See Fig. 233.

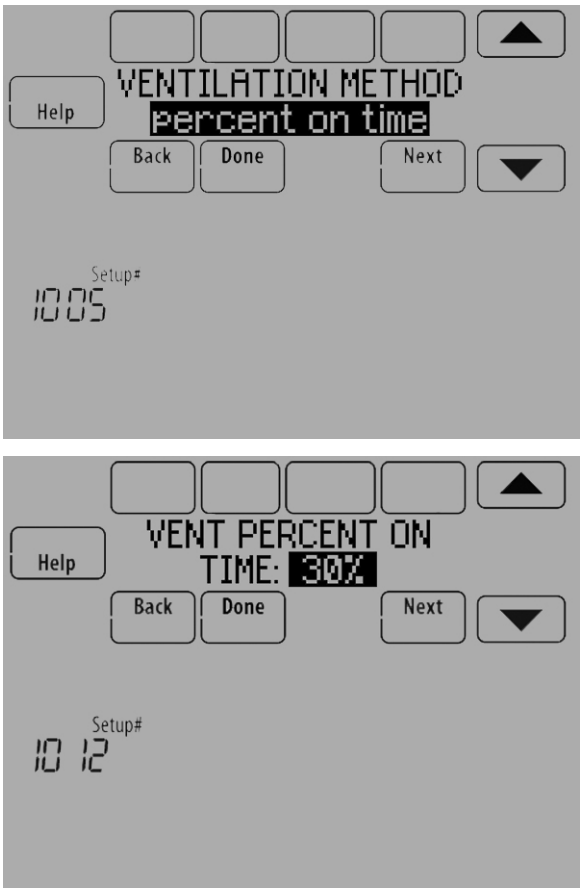


Fig. 233.

9. Select the Outdoor Condition Lockouts. See Fig. 234. See “Ventilation — Outdoor Condition Lockouts (ISU 1013)” on page 91 for more information.

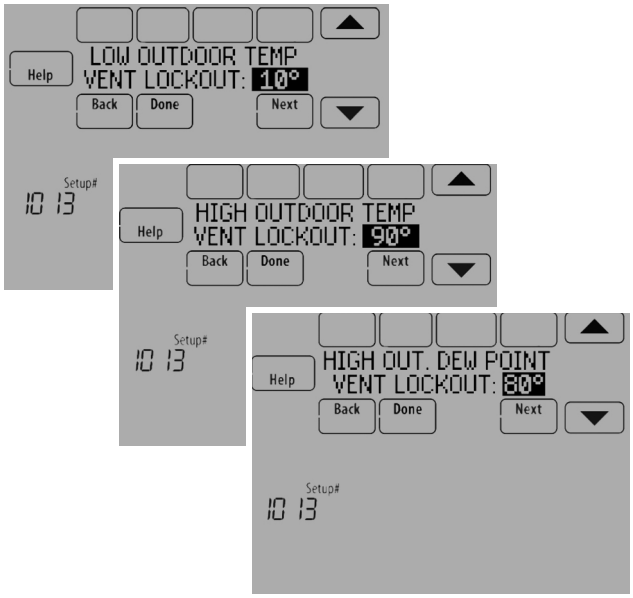


Fig. 234.

When ISU 1012 Ventilation Priority is set to Lockouts are Priority, or ISU 1005 Ventilation Control Methods is set to Percent On Time, the thermostat will indicate whether this meets or may not meet the ASHRAE 62.2 Standard or the Percent On Time setting. See Fig. 235.

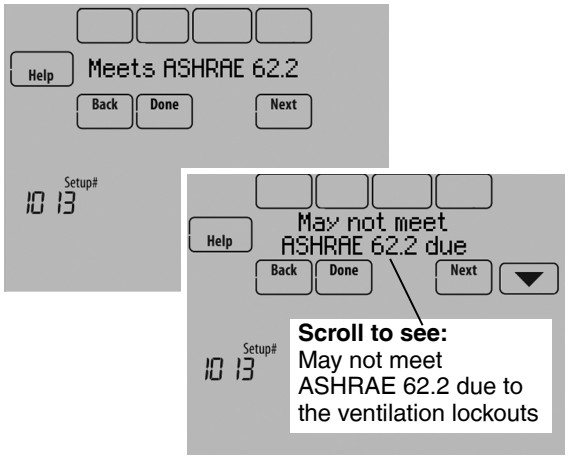


Fig. 235.

When ISU 1012 Ventilation Priority is set to ASHRAE is Priority, the screen below will indicate the maximum length of time that ventilation can be locked out over a 21 hour time period. For example, Ventilation Lockout Will Not Exceed 12.5 hours. The length of time that ventilation is locked out is limited to ensure that the ASHRAE 62.2 Ventilation Standard is met. See Fig. 236.

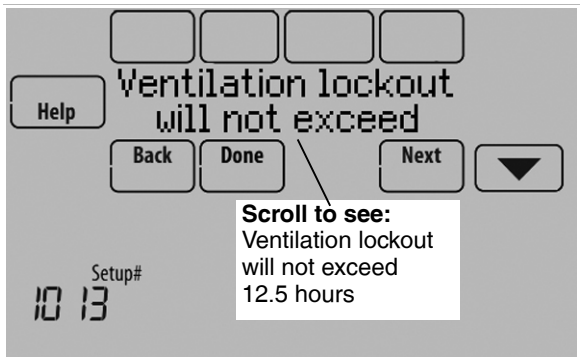


Fig. 236.

10. Select whether to lockout ventilation on humidification or dehumidification calls. This feature is used to help reach the user's desired humidity level by not allowing the ventilation equipment to run during a call for humidification

or dehumidification. The thermostat will indicate whether this meets or may not meet the ASHRAE 62.2 Standard or the Percent On Time setting. See Fig. 237.

NOTE: ISU 1014 Lockout Ventilation on Humidification or Dehumidification Calls is not an option when you select ASHRAE is Priority at ISU 1012.

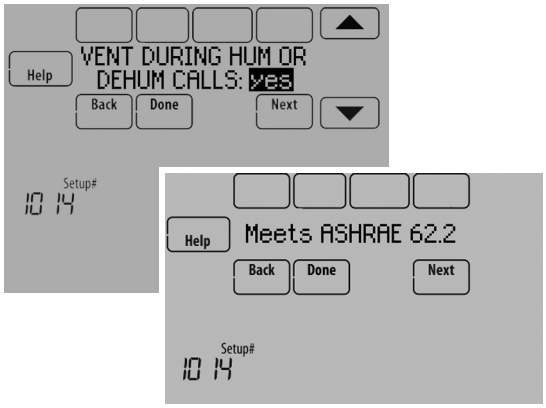


Fig. 237.

11. Select whether to Ventilate on High Indoor Humidity. See “Ventilate on High Indoor Humidity (ISU 1016)” on page 92 for more information. See Fig. 238.

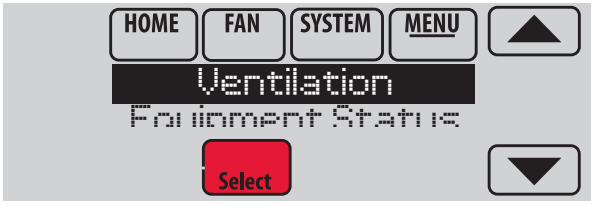
Fig. 238.

Control Ventilation Level

1. Touch MENU, and select Ventilation.

MCR34100

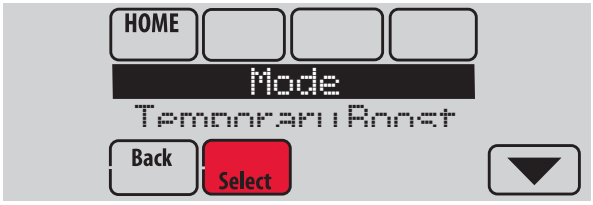
Fig. 239.



MCR34132

Fig. 240.

2. Select Mode, Temporary Boost, or Lockout, then select appropriate options.



MCR34133

Fig. 241.

3. Touch Done to save your settings. Touch Cancel to ignore changes.

MCR34134

Fig. 242.

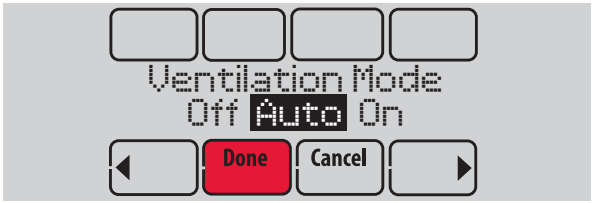
Ventilation Options

Mode:

Auto: Ventilation runs as programmed by the installer.

Off: Ventilation remains off unless turned on using the timer.

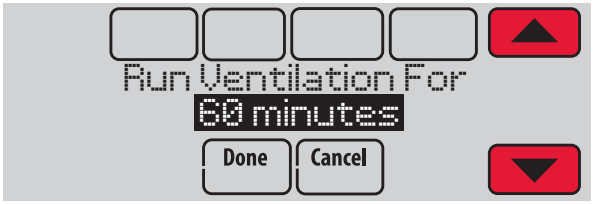
On: Ventilation is always on.



MCR34135

Fig. 243.

Temporary Boost: Touch ▲ or ▼ to select how long to run ventilation temporarily. To turn it off, set it to zero.



MCR34136

Fig. 244.

Lockout: Touch ▲ or ▼ to select Yes or No, then touch Next. Select Yes to prevent ventilation from running during the Sleep or Unoccupied (commercial) program periods or when outdoor conditions exceed values set by the installer.

Fig. 245.

NOTE: If set up for humidification in heat mode, the ventilator will turn on to remove excess humidity if 10% or more above your humidity setting.

IAQ REMINDERS

You can set up IAQ reminders in the thermostat to remind users when filters, pads, bulbs, etc. need cleaning or replacement. The following reminders can be set:

- Air Filter 1
- Air Filter 2
- Humidifier Pad
- Humidifier Clean Tank / Water Filter
- Dehumidifier Filter
- Ventilator Core
- Ventilator Filter
- Electronic Air Cleaner Pre-Filter
- Electronic Air Cleaner Cells
- Electronic Air Cleaner Post-Filter
- UV Bulb 1
- UV Bulb 2

Reminders that are displayed under Preferences will change based on the IAQ equipment installed. Reminders for equipment that is already set up can be set using the steps below. Reminders for IAQ equipment that is not yet set up must be turned on from the installer setup.

NOTE: Air Filter, Humidifier Pad, Dehumidifier Filter, and Ventilator Filter are displayed under Preferences even if they have not been set up. Humidifier Pad is not displayed if a steam humidifier has been installed.

Some screens shown in this section may be different from those on the thermostat, depending on how you set up IAQ equipment.

1. Press MENU, then scroll to select Preferences.
2. Press Reminders. Fig. 246 is displayed.

Fig. 246.

3. Select the reminder you want to set.
4. Press ▲ or ▼ to set the timer length. Ranges, increments, and units will change based on the reminder.

   NOTE: When set for run time days, the thermostat tracks the amount of time the fan has run and compares that time against the number of run time days selected. Fan run time is counted when there is a call for forced air heating, cooling, or fan.

Fig. 247.

5. Press Done to save the reminder.
6. Press Reset Timer when you have completed the recommended maintenance or you can extend the timer setting to turn off the alert and remind you later to do the recommended maintenance.
7. Repeat these steps for all reminders you want to set.

CUSTOMIZABLE REMINDERS

The thermostat can be set to alert the user when it is time for system maintenance or warranty renewal. You can set up to 10 total Custom Reminders on the thermostat and save them to a microSD card for easy download to multiple thermostats.

Custom Reminders include:

- **Service Reminder**
  - — Set up for recurring or one time only.
- **Spring Service Reminder**
  - — Provide an alert based on date or outdoor temperature.
- **Fall Service Reminder**
  - — Provide an alert based on date or outdoor temperature.
- **Warranty Reminder**
  - — Set up for recurring or one time only.
- **New Custom Reminder**
  - — Enter new reminders or advertisements
  - — Set up for recurring or one time only.

You can change or create custom reminders in ISU 1200.

Fig. 248.

For example, to set up a Fall Service Reminder based on Outdoor Temperature:

1. Touch **Press HERE to edit** (see Fig. 248).
2. Select Fall Reminder and press Next.

Fig. 249.

3. Press up or down arrows until “Based on Out. Temp” is displayed, then press Next.

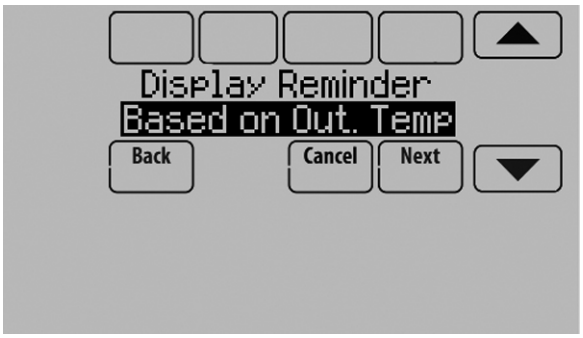


Fig. 250.

4. Press the up or down arrows to set the outdoor temperature and press Next.

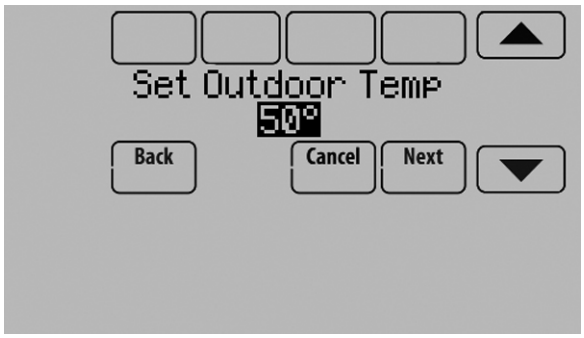


Fig. 251.

NOTE: A seasonal maintenance reminder will appear when the outdoor temperature reaches the level you select, after a specified date.

5. Press the up or down arrows to set the date to begin monitoring outdoor temperature. The thermostat will not display a reminder unless the temperature you set is reached after the date you set at this screen.

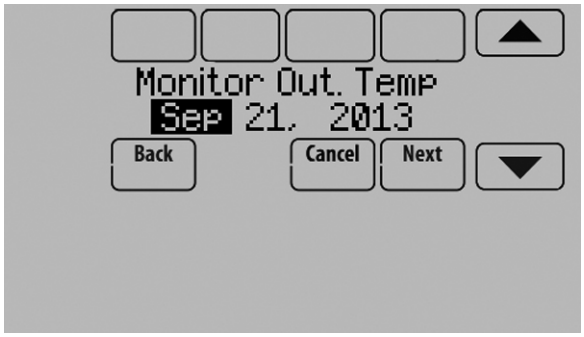


Fig. 252.

6. The preview of the Fall Service Reminder shows you what you’ve selected. Press Done when finished.

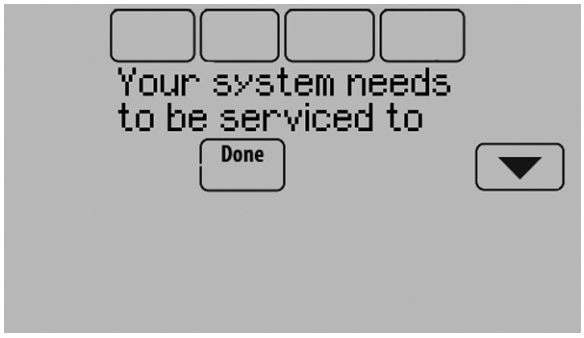


Fig. 253.

7. When the user touches **Press HERE for info** on the Home Screen, the reminder message will be displayed.

Fig. 254.

8. Pressing Select displays options for addressing the Fall Service Reminder message:
   - View More Info
   - Remind Me Later
   - Dismiss
   - View Dealer Info

Fig. 255.

9. Selecting View More Info displays the Fall Service Reminder message.

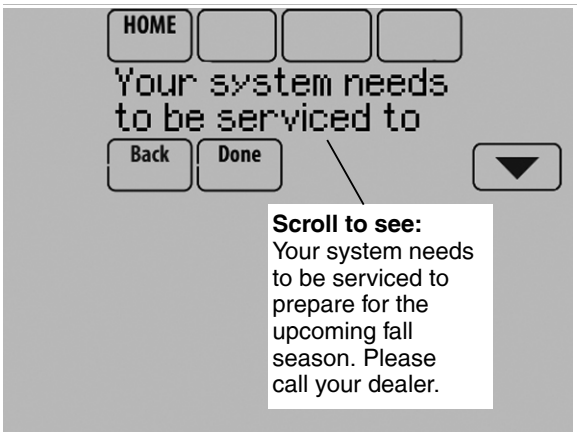


Fig. 256.

10. To clear the Alert, (and turn off the Red Alert Light on the thermostat), select Dismiss.

To create a new custom reminder:

1. Touch **Press HERE to edit** at ISU 1200 (see Fig. 248).
2. Press up or down arrows until Custom Reminder is displayed, then press Next (Fig. 257).

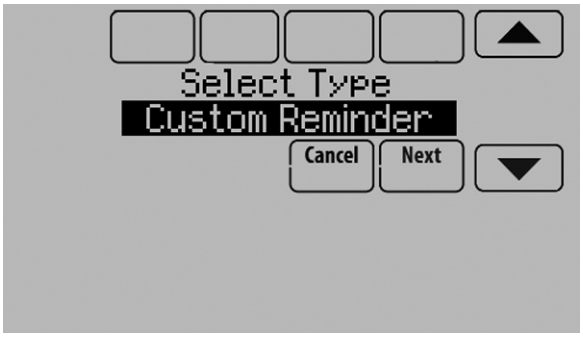


Fig. 257.

3. Touch **Press HERE to edit** to set the name of the reminder (Fig. 258).

Fig. 258.

4. Use the arrows, Delete, and Space buttons to enter the name of the reminder, and press Done.

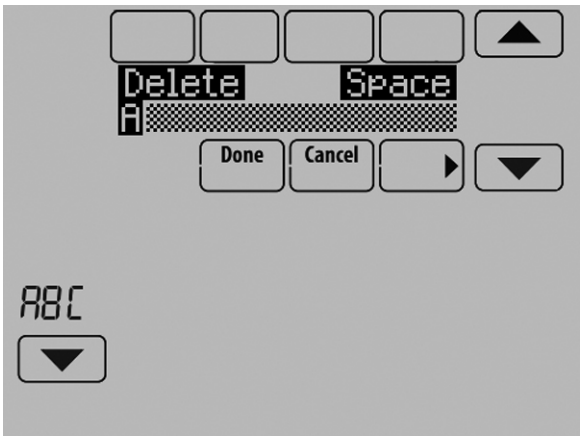


Fig. 259.

5. Touch **Press HERE to edit** to set the reminder message (see Fig. 260).

Fig. 260.

6. Use the arrows, Delete, and Space buttons to enter the reminder message, and press Done.

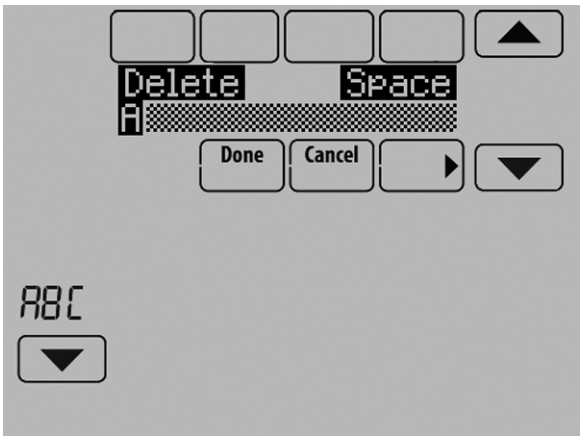


Fig. 261.

7. Press the up or down arrows to set the date when the New Custom Reminder should appear, and press Next.

Fig. 262.

8. Select whether you want the reminder to appear only once or to be recurring, and press Next.

Fig. 263.

9. If Recurring, select how often you want the reminder to appear and press Next.

Fig. 264.

10. The preview of the custom reminder shows you what you've selected. You can load Custom Reminders to a microSD card to transfer from one thermostat to another.
11. The New Custom Reminder will look like this on the Home Screen:

Fig. 265.

12. When the user touches **Press HERE for info** on the Home Screen, the reminder message will be displayed:

Fig. 266.

13. Pressing Select displays options for addressing the Custom Reminder message:
    - View More Info
    - Remind Me Later
    - Dismiss
    - View Dealer Info
14. Selecting View More Info displays the Custom Reminder message.

Fig. 267.

15. To clear the Alert (and turn off the red alert light on the thermostat), select Dismiss.

MICROSD CARD

Use a microSD (secure digital) card to save setup time by loading Installer Setup settings, Dealer Information, Holiday Schedules, and Custom Reminders to multiple thermostats.

The microSD card plugs into the thermostat. You will then need a USB adapter to plug the microSD card into your computer. These adapters are inexpensive and widely available at electronics retailers and online.

For troubleshooting help, you can save the thermostat Data Logs (Alerts Log and Interaction Log) to a microSD card - then view them on your computer. Also use the microSD card to upgrade the thermostat software.

Visit http://thermostatsetup.honeywell.com to enter your dealer information or load new thermostat software.

Updating Thermostat Software

New thermostat software can be saved to a microSD card and then uploaded to the VisionPRO® thermostat using the microSD port.

1. In a web browser on your computer, go to http://thermostatsetup.honeywell.com
2. Connect a microSD card to a USB adapter. Then connect the USB adapter to your computer.

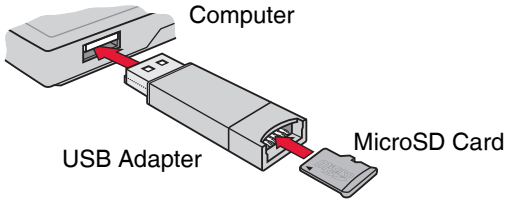


Fig. 268.

3. Download the software upgrade file to the microSD USB adapter by clicking the indicated link on the web site.
4. When the File Download box opens, click Save.
5. When the Save As box opens, navigate to the directory of your USB device and save the file. For example, if your USB drive is letter “F”, navigate to “My Computer” and then drive “F”.
6. After the file is saved, remove the microSD card from the adapter and connect it to the thermostat. Then select the “Software Update” option on the thermostat.

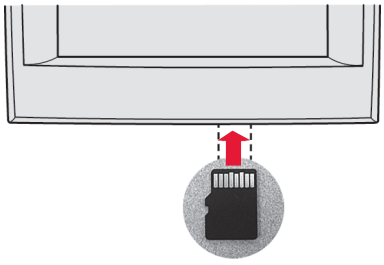


Fig. 269.

7. See “To Use the MicroSD Card in the Thermostat” on page 101.

Loading Dealer Information

VisionPRO thermostats can display the dealer's contact information on the screen, making it easy for users to contact them for post-sale support and service. After saving the dealer's contact information to a microSD card, the dealer can upload this information to the VisionPRO thermostat using the microSD port.

1. In a web browser on your computer, go to http://thermostatsetup.honeywell.com
2. Enter your dealer information into the text boxes provided on the web site.
3. Connect a microSD card to a USB adapter. Then connect the USB adapter to your computer. See Fig. 268.
4. Download the dealer information file to the microSD USB adapter by clicking the indicated link on the web site.
5. When the File Download box opens, click Save.

6. When the Save As box opens, navigate to the directory of your USB device and save the file. For example, if your USB drive is letter “F,” navigate to “My Computer” and then drive “F.”
7. After the file is saved, remove the microSD card from the adapter and connect it to the thermostat. See Fig. 269. Then select the “Dealer Information” option on the thermostat.
8. See “To Use the MicroSD Card in the Thermostat” on page 101.

To Use the MicroSD Card in the Thermostat

1. Slide card into the bottom of thermostat. See Fig. 269.
2. Select the item to load or save.

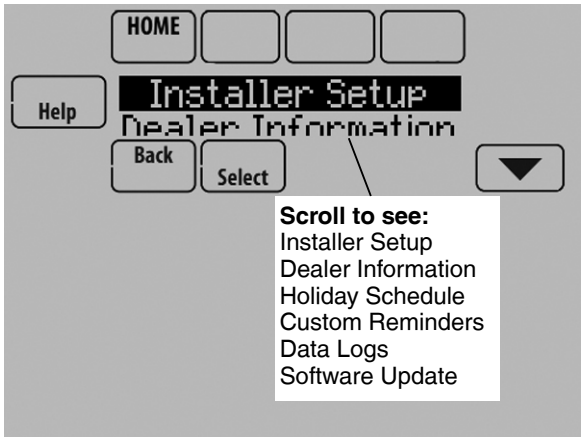


Fig. 270.

3. Follow the prompts on the screen.
   - To add information from the card to the thermostat, select Load from SD Card.
   - To put thermostat information on the card, select Save to SD Card.

Fig. 271.

4. When you are finished, touch Done, then Home, and remove the microSD card.

COMMERCIAL FEATURES

The thermostat can be setup for residential or light commercial applications (ISU 101). When the thermostat is setup for commercial, the thermostat meets commercial code, Title 24 and provides the following features:

- Commercial language (occupied and unoccupied)
- Temporary override (permanent hold is not allowed)
- Temporary override duration is limited to the amount set by the installer
- Guide me through scheduling
- Adjustable ramp rates
- 365 holiday schedule
- Schedule up to 25 custom events
- Initiate occupancy
- Remote setback using an occupancy sensor
- Economizer or Time of Day output
- Pre-occupancy purge
- Additional dehumidification control options

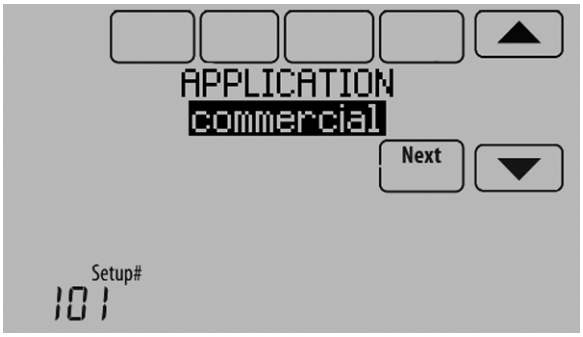
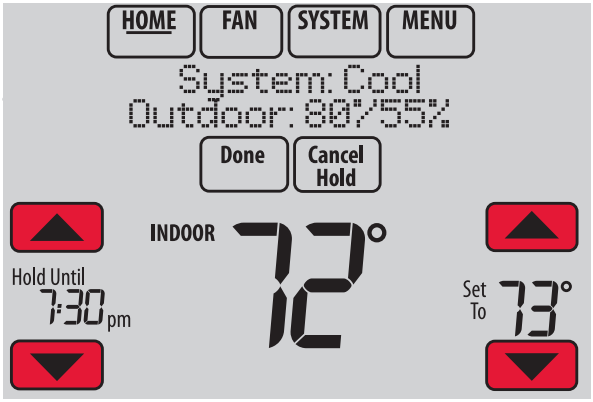


Fig. 272.

Overriding Schedules: Commercial Use

Touch ▲ or ▼ to adjust the temperature. It will be maintained until the hold time you set.

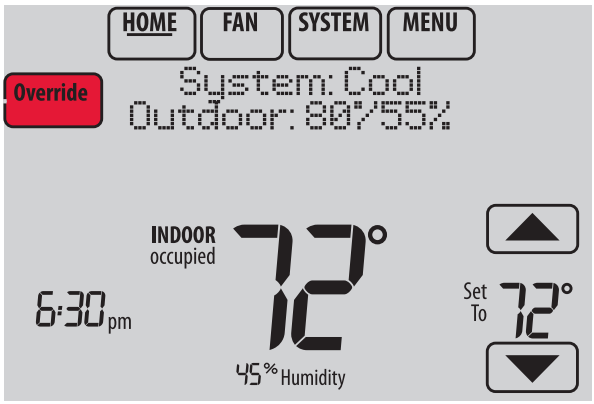
- To change the hold time, touch the Hold Until arrow buttons. This time can be adjusted up to the maximum time set by the installer.



MCR34169

Fig. 273.

- Touch Override to use a pre-set occupied temperature if a person uses the room during an unoccupied period. The new temperature will be maintained for 1 hour and can be adjusted up to the maximum time set by the installer.



MCR34106

Fig. 274.

The programmed schedule will resume when the override timer expires. Touch Cancel Hold at any time to resume the program schedule.

Setting Holiday/Event Schedules: Commercial Use

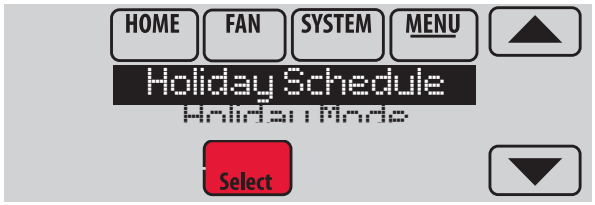
This feature helps you conserve energy when the workplace is unoccupied for special events and holidays.

1. Touch MENU.

MCR34100

Fig. 275.

2. Select Holiday Schedule.



MCR34113

Fig. 276.

3. Select the item you want to schedule and touch Next for further scheduling details.
   - US and Canadian Holiday options let you select from a list of holidays commonly observed in each country.
   - Custom Events lets you set up other days for special schedules.

MCR34114

Fig. 277.

4. Make selections as prompted on each screen. For more information, see next two pages.
5. Touch Done to save your settings.

Setting Custom Events: Commercial Use

This feature lets you customize temperature settings to be maintained during a specific event. You can set up an event for a specific date or day in a month. The thermostat resumes normal scheduling after the event. The thermostat can be scheduled for up to 25 Custom Events.

1. Select Custom Events from the Holiday Schedule menu.

MCR34114

Fig. 278.

2. Select Create New Event.

MCR34116

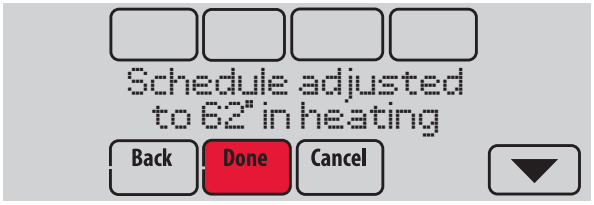
Fig. 279.

3. Select Specific Date or Month/Weekday.
   - For Specific Date, you are prompted to select the event's start date, settings, end date, and frequency.
   - For Month/Weekday, you are prompted to select the month, day of the week, week of the month, settings, length of event, and frequency for the event.

MCR34117

Fig. 280.

4. Review the settings and touch Done to save them. Touch Cancel to ignore the changes.



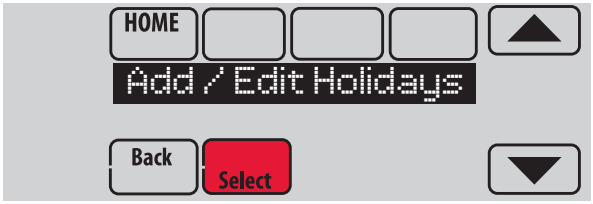
MCR34118

Fig. 281.

Setting Holiday Schedule: Commercial Use

This feature lets you customize temperature settings to be maintained on specified national holidays. The thermostat resumes normal scheduling between selected holidays.

1. Select US Holidays or Canadian Holidays from the Holiday Schedule menu.
2. Select Add/Edit Holidays. A list of national holidays is displayed.

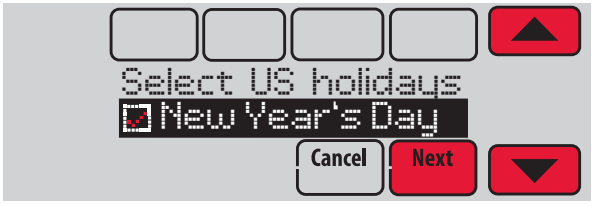


MCR34119

Fig. 282.

3. Touch the check box next to each holiday for which you want to maintain specific settings, (Touch ▲ or ▼ to scroll through the holiday list.) then touch Next.

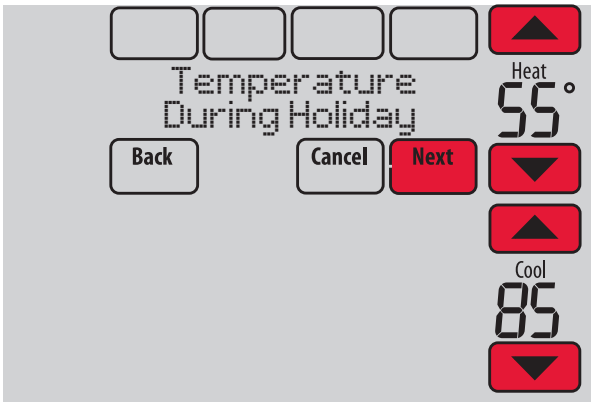
   Set the holiday schedule for Occupied or Unoccupied temperatures, depending whether the building will be in use.



MCR34120

Fig. 283.

4. Touch ▲ or ▼ to select the Heat and Cool temperatures.



MCR34121

Fig. 284.

5. Review the settings and touch Done to save them. Touch Cancel to ignore changes.

Setting Holiday Override: Commercial Use

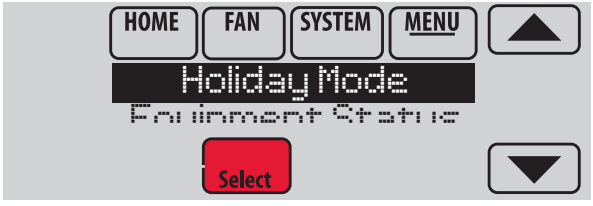
This feature lets you customize temperature settings to be maintained from now until a specified date. The thermostat resumes normal scheduling on the date you select.

1. Touch MENU.

MCR34100

Fig. 285.

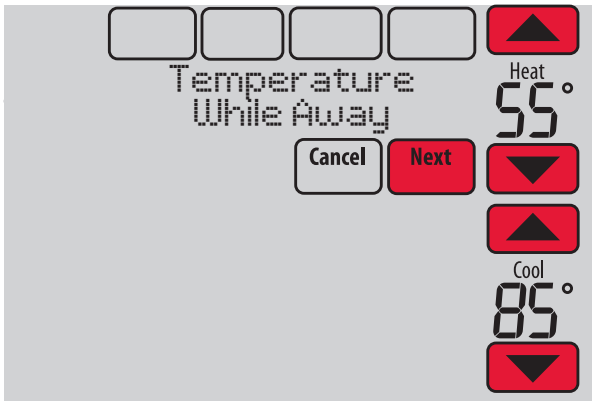
2. Select Holiday Mode to display Temperature While Away.



MCR34122

Fig. 286.

3. Touch ▲ or ▼ to select the Heat and Cool temperatures, then touch Next to select return date.



MCR34123

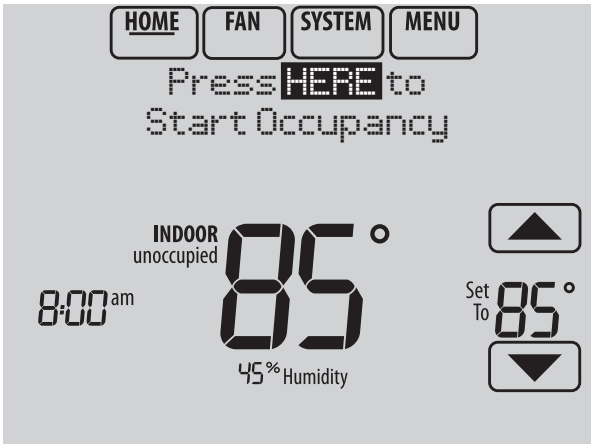
Fig. 287.

4. Review the settings and touch Done to save them. Touch Cancel to ignore the changes.

NOTE: The cool temperature can only be set higher than the unoccupied program setting and the heat temperature can only be set lower than the unoccupied program setting.

Initiating Occupancy Mode: Commercial Use

This feature keeps temperature at an energy saving level until you touch **Press HERE to Start Occupancy**. When you arrive, touch the message to maintain a comfortable temperature while the room is occupied.



M34127

Fig. 288.

Touch the ▲ or ▼ buttons to set the temperature or the Hold Until time. The temperature is maintained until the time you set. Temperature returns to an energy-saving level after the timer expires, or the “Occupied” period ends.

NOTE: This feature is available only when programmed by the installer.

Ramp Rates (Commercial Use)

When the ramp rate is set to Off, the thermostat begins recovery at the scheduled time.

When a ramp rate is set, recovery begins early to reach the setpoint by the program time. Based on your recovery ramp setting and how far the thermostat is set back, the thermostat determines how early to turn on the system.

If an outdoor sensor is installed, you can set outdoor temperatures for mild, cold and hot days in your region. By setting these outdoor temperatures, the thermostat will automatically adjust the ramp rate based on outdoor conditions. This allows the thermostat to save energy by starting recovery at the optimum time as outdoor conditions change.

NOTE: The thermostat uses an adjustable ramp rate when the thermostat is setup for commercial. This allows the thermostat to recover on time during changing conditions (occupancy changes, temperature overrides, load conditions, opening/closing of doors etc) which are common in commercial applications.

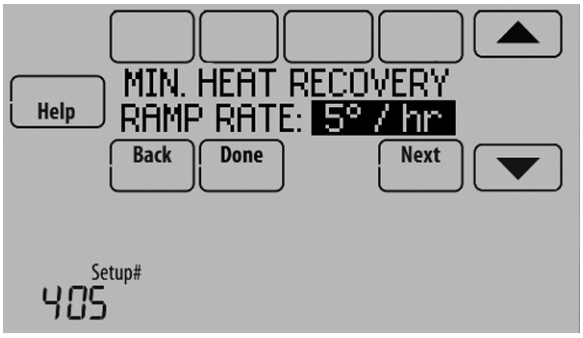


Fig. 289.

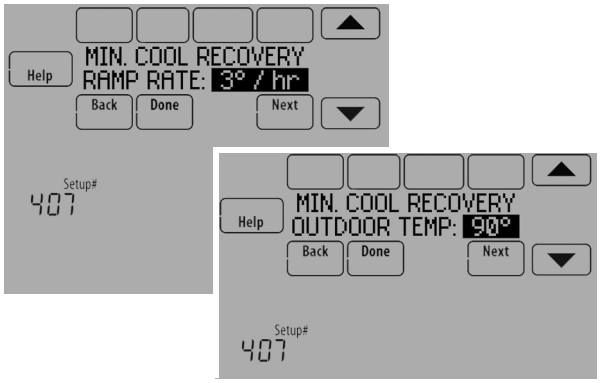


Fig. 290.

Remote Setback (Commercial Use)

The thermostat allows you to do REMOTE SETBACK when set up for commercial use. This feature requires an occupancy sensor connected to the S1, S2, S3 or S4 terminals at the Equipment Interface Module.

During Occupied program periods, an occupancy sensor directs the thermostat to go to REMOTE SETBACK settings when the room is empty. If someone is in the room, it uses the Occupied program period settings. The thermostat ignores the occupancy sensor during Unoccupied program periods.

If the thermostat is set up to be non-programmable, the sensor directs the thermostat to go to REMOTE SETBACK settings when the room is empty. If someone is in the room, then it follows the settings set by the user.

Depending on how your thermostat was installed, it may delay for up to 30 minutes before switching to REMOTE SETBACK settings. This delay allows the room to stay comfortable if the room is unoccupied for only a short time.

Set Up Remote Setback

1. Select “Remote Setback” as shown in Fig. 291.

Fig. 291.

2. Select the terminals wired to the Remote Setback Dry Contact device (occupancy sensor) and press Next.

Fig. 292.

3. Select Normally Open when Occupied or Normally Closed when Occupied based on the type of dry contact device installed.

   NOTE: **Normally Open when Occupied:** The Dry Contact device is open when the room is occupied and will close when the room is unoccupied.
   Normally Closed when Occupied: The Dry Contact device is closed when the room is occupied and will open when the room is unoccupied.

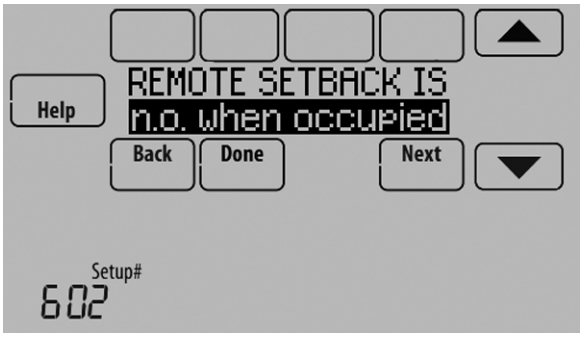


Fig. 293.

4. Select a Remote Setback Time Delay. The Remote Setback Time Delay forces the thermostat to wait before it switches from occupied settings to the Remote Setback settings. When set to 0 minutes, the thermostat will switch from occupied settings to the Remote Setback settings immediately when the room is unoccupied.

Fig. 294.

5. Select the Remote Setback settings that you would like to maintain when the occupancy sensor detects the room is unoccupied.

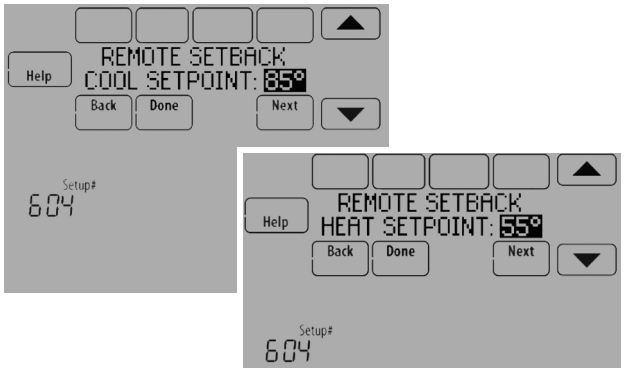


Fig. 295.

Economizer and Time of Day (TOD) Operation

Economizer

The thermostat controls an economizer module to provide ventilation during occupied periods and free cooling when outdoor conditions are favorable. In some climates the cooling system may run several hours when it may not be required to maintain indoor comfort. When outdoor conditions are favorable, ventilation with outdoor air can achieve the same level of comfort at lower cost. Table 5 explains how the Economizer Module is controlled by the thermostat.

The thermostat works with the W7220, W7212, W7213 and W7214 Economizer Modules for both heat pump and conventional systems.

Table 5. Economizer Operation.

Thermostat Mode	Equipment Operation	A-L/A terminal: Economizer
Occupied	Heat/Cool/Fan running	ON
Occupied temporarily	Heat/Cool/Fan running	
Occupied	Heat/Cool/Fan NOT running	
Occupied temporarily	Heat/Cool/Fan NOT running	
Pre-occupancy purge	Fan running	
Unoccupied	Cooling system running	
Unoccupied temporarily	Cooling system running	
Standby	Cooling system running	
Unoccupied	Cooling system NOT running	OFF
Unoccupied temporarily	Cooling system NOT running	
Standby	Cooling system NOT running	ON
Non-programmable	Fan running	
Non-programmable	Fan NOT running	OFF

Time of Day (TOD)

The thermostat can be set up for a Time of Day output in the installer setup. This output is commonly used to control lighting panels, turning them on for occupied periods and off for unoccupied periods. Table 6 explains how the TOD feature works with various thermostat modes.

Table 6. TOD Operation.

Thermostat Mode	A-L/A terminal: TOD
Occupied	ON
Occupied temporarily	
Temperature overrides	
Unoccupied	OFF
Unoccupied temporarily	
Standby	
Non-programmable	

The Economizer Module and Time of Day output connect to the A-L/A terminal at the thermostat or EIM and are set up at ISU 222.

Fig. 296.

Pre-Occupancy Purge

The thermostat can be set up for Pre-Occupancy Purge in the installer setup (ISU 401). When setup for Pre-Occupancy Purge, the thermostat runs the fan 1 to 3 hours before each occupied period to provide a comfortable workplace upon arrival. Options are Off and 1 to 3 hours.

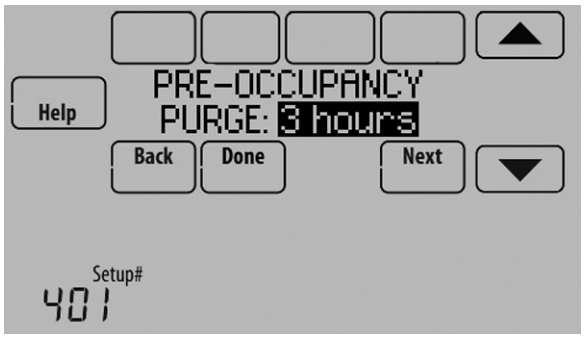
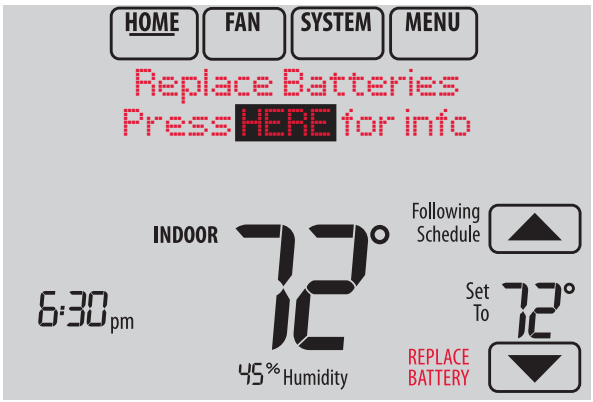


Fig. 297.

Battery Replacement

Thermostat

Install fresh batteries when the REPLACE BATTERY warning begins flashing. The warning flashes about 60 days before batteries are depleted.



MCR34144

Fig. 298.

Even if the warning does not appear, it is recommended to replace batteries once a year, or before leaving home for more than a month.

Press the release button on top of the thermostat to remove it from the wall plate. Install 4 fresh AA alkaline batteries.

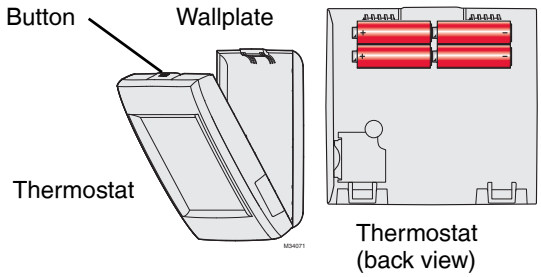
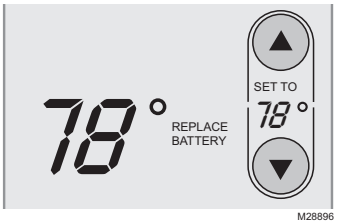
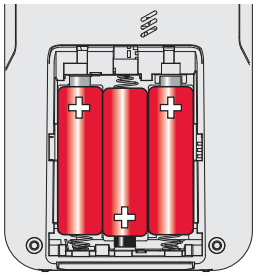


Fig. 299.

Portable Comfort Control





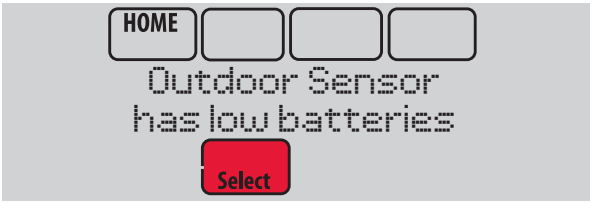
MCR28475

Install fresh batteries when the REPLACE BATTERY warning begins flashing. The warning flashes about 60 days before batteries are depleted.

The Portable Comfort Control will restore communication with the thermostat a few seconds after new batteries are installed.

Wireless Outdoor Sensor

Replace batteries in your outdoor sensor when a warning appears on the thermostat screen, about 60 days before batteries are depleted.



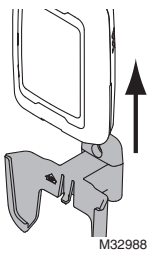
MCR34145

Fig. 300.

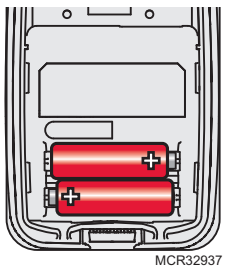
To replace the batteries:

1. Remove the sensor from the bracket.
2. Detach cover.
3. Install 2 fresh AA lithium batteries.
4. Replace cover and set sensor back into bracket.

The outdoor sensor will restore communication with the thermostat a few seconds after new batteries are installed.



M32988

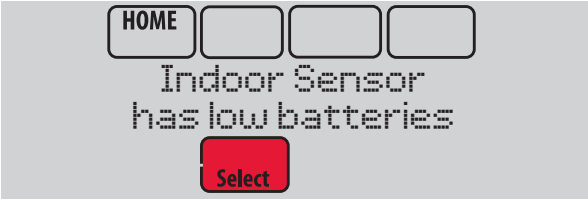


MCR32937

Wireless Indoor Sensor

Replace batteries in your indoor sensor when a warning appears on the thermostat screen, about 60 days before batteries are depleted.

When the sensor status light begins flashing red, battery power is critically low and will be depleted within 2–3 weeks. During normal operation, the status light remains off.



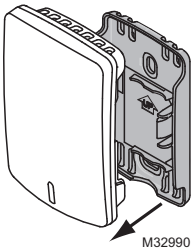
MCR34146

Fig. 301.

To replace the batteries:

1. Remove the sensor from wallplate.
2. Install 2 fresh AAA alkaline batteries. If the status light flashes green, batteries are good; if it flashes red, you must use fresh batteries.
3. Attach sensor to wallplate.

The sensor will restore communication with the thermostat a few seconds after new batteries are installed.



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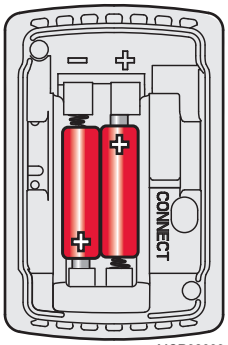


MCR32933

OPTIONAL ACCESSORIES

PORTABLE COMFORT CONTROL
If you have only one thermostat, you move this remote control from room to room (like a portable thermostat), to make sure the temperature is comfortable in the room you're using. If you have multiple thermostats, you can view and adjust the temperature in each room from your armchair. A Portable Comfort Control can control up to 16 thermostats.

WIRELESS OUTDOOR SENSOR
With a wireless outdoor sensor, your VisionPRO® thermostat can display outside temperature and humidity. This information can also be displayed on your handheld Portable Comfort Control.

WIRELESS INDOOR SENSOR
If an indoor sensor is installed, your VisionPRO thermostat will respond to temperature and humidity readings at the sensor location—providing comfort where the sensor is located. With multiple sensors, the thermostat can average temperature readings from each, to optimize comfort throughout your home. The thermostat can be used with up to 6 Wireless Indoor Sensors.

REDLINK™ INTERNET GATEWAY
The Honeywell RedLINK Internet Gateway gives you remote access to your VisionPRO® thermostat from the web, smart phone or tablet. You can view or adjust indoor temperature, system mode and other settings. The Gateway can also send alerts to as many as 6 email addresses to notify you if a problem occurs.

WIRELESS ENTRY/EXIT REMOTE
This device mounts beside your door for one-touch control. Press AWAY to control to an energy saving temperature when you leave home. Press HOME to control to a comfortable temperature when you return. To change pre-set temperatures, go to MENU > Entry/ Exit Remote. Two covers are sold with the device that allow it to be used in residential or commercial applications. The Residential cover is labeled HOME, AWAY and VACATION and the Commercial cover is labeled OCCUPIED, UNOCCUPIED and HOLIDAY. The thermostat can be used with up to 3 Entry/Exit remotes. Each Entry/Exit remote can control up to 16 thermostats.

WIRELESS VENT AND FILTER BOOST REMOTE
This device mounts anywhere in your home (typically bathroom or kitchen) for convenient, on-demand ventilation. Select 20, 40 or 60 minutes for increased ventilation. The thermostat can be used with up to 6 Vent Boost remotes.

PORTABLE COMFORT CONTROL

The Portable Comfort Control communicates wirelessly with the thermostat, and can control up to 16 thermostats.

NOTE: Each thermostat can only be connected to 1 Portable Comfort Control.

If you have one thermostat, you move this remote control from room to room (like a portable thermostat), to make sure the temperature is comfortable in the room you're using. If you have multiple thermostats, you can view and adjust the temperature in each room from the Portable Comfort Control.

If you have one thermostat, temperature is measured at the thermostat (Fig. 302) or Portable Comfort Control (Fig. 303), as you choose.

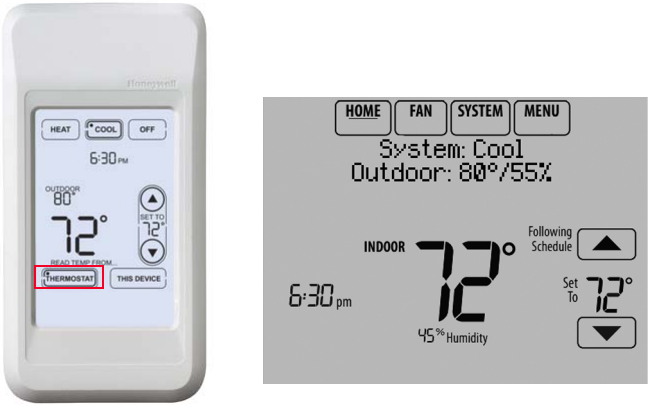


Fig. 302. Reading temperature at the thermostat.

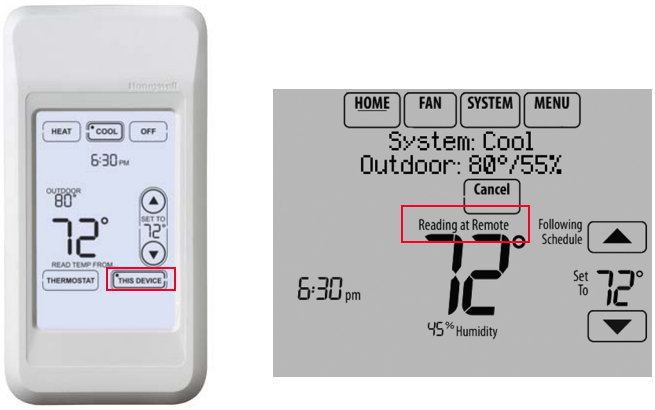


Fig. 303. Reading temperature at the Portable Comfort Control.

If the thermostat is being averaged with remote indoor sensors, and you select THERMOSTAT on the Portable Comfort Control, you will see the temperature average from the remote indoor sensors and the thermostat.

NOTE: If the thermostat is not part of the temperature average, then you will only see the temperature average from the remote indoor sensors when you select THERMOSTAT on the Portable Comfort Control.

If the thermostat is being averaged with remote indoor sensors, and you select THIS DEVICE on the Portable Comfort Control, you will see the temperature measured at the Portable Comfort Control only.

If you have multiple thermostats, temperature is measured at each thermostat. Press the TOGGLE ZONE arrows to choose which room to display and adjust. See Fig. 304.

Fig. 304. Portable Comfort Control used with Multiple Thermostats. Temperature is measured at each thermostat.

REMOTE INDOOR SENSORS

For installation, see “C7189R1004 Wireless Indoor Sensor” on page 59, and “C7189U1005 Wired Indoor Sensor” on page 59. For wiring, see “Wiring guide — Wired Indoor Sensors” on page 135.

Indoor Sensor Operation

Temperature Control

The thermostat can be set to respond to its internal temperature sensor, or to an optional remote indoor sensor. If multiple sensors are used, the thermostat will average the temperature detected at each sensor.

In Fig. 305, both the thermostat internal sensor and remote indoor sensor are being used for Temperature Control and are being averaged since both sensors are set to “Yes.” Select “No” if you do NOT want a specific sensor to be used for temperature control or be part of the temperature average.

When using multiple remote indoor sensors, you should name each sensor after you link it to the thermostat. See “Wireless Indoor Sensor” beginning on page 18 for more information. Naming the sensors allows you to select the appropriate sensor(s) for Temperature Control in the Installer Setup.

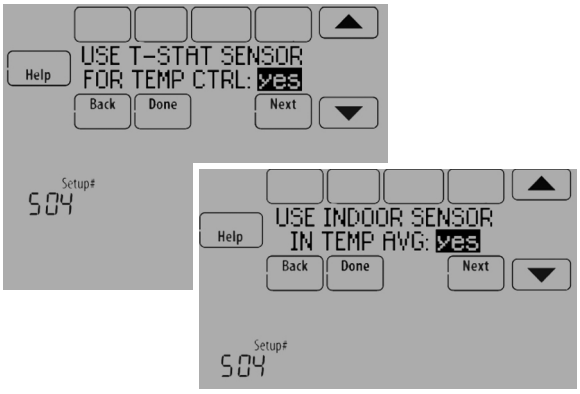


Fig. 305.

Humidification control

If optional remote indoor sensors are installed, you can choose which sensor you want to use for humidification control. You can use a different sensor for dehumidification.

When using multiple remote indoor sensors, you should name each sensor after you link them to the thermostat. See “Wireless Indoor Sensor” beginning on page 18 for more information. Naming the sensors allows you to select the appropriate sensor for Humidification Control in the Installer Setup. For example, in Fig. 306, the MAIN LEVEL remote indoor sensor is selected for Humidification Control.

NOTE: Requires wireless indoor sensor. Humidity sensing can not be averaged.

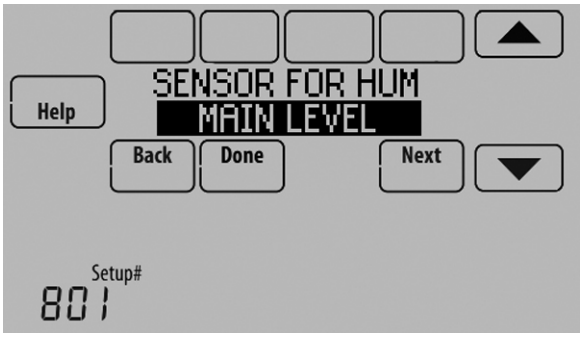


Fig. 306.

Dehumidification control

If optional remote indoor sensors are installed, you can choose which sensor you want to use for dehumidification control. For example, you can use one sensor for humidification control, and another for dehumidification.

When using multiple remote indoor sensors, you should name each sensor after you link them to the thermostat. See “Wireless Indoor Sensor” beginning on page 18 for more information. Naming the sensors allows you to select the appropriate sensor for Dehumidification Control in the Installer Setup. For example, in Fig. 307, the CRAWL SPACE remote indoor sensor is selected for Dehumidification Control.

NOTE: Requires wireless indoor sensor. Humidity sensing can not be averaged.

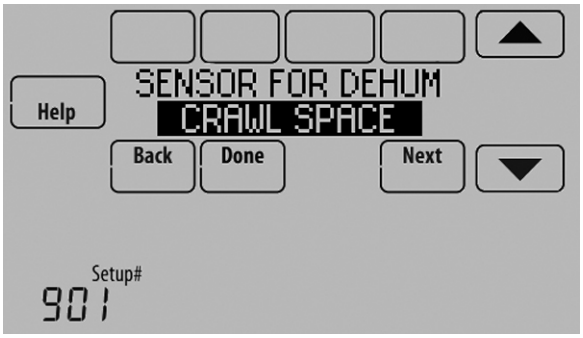
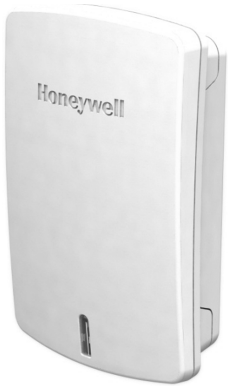


Fig. 307.

Wireless Indoor Sensor



The wireless indoor sensor senses temperature and humidity in remote locations and communicates that information wirelessly to the thermostat.

The indoor sensor can be used to do the following:
- Maintain a more consistent temperature throughout the building by averaging temperatures. Temperatures from all sensors, including the thermostat, are weighted equally.
- Relocate sensing location (thermostat is in a poor location).
- Relocate the thermostat (if you want to hide the thermostat).
- Humidify and dehumidify in separate spaces (for instance, humidify on the main level, and dehumidify in the crawl space).

You can connect up to 6 Wireless Indoor Sensors to the thermostat. If you connect a Wired Indoor Sensor network to the S1, S2, S3 or S4 terminals, you can connect up to 5 Wireless Indoor Sensors to the thermostat.

The indoor air sensor has a 1 year battery life.

Battery level indicators (when batteries are inserted)
- Good: Status light flashes green for 5 seconds.
- Low: Status light flashes red for 5 seconds. Use fresh batteries.

Battery level indicators (during use)
- Good: Status light remains off.
- Low: Battery power will be depleted in about 2 months. Thermostat displays Low Battery warning. Status light remains off.
- Critical: Battery power will be depleted in about 2–3 weeks. Status light flashes red.

Temperature Display

The temperature reading displayed on the home screen is from the sensor or sensors that are being used for temperature control.

In Fig. 308, the temperature reading is the average of the thermostat internal sensor and the remote indoor sensor.

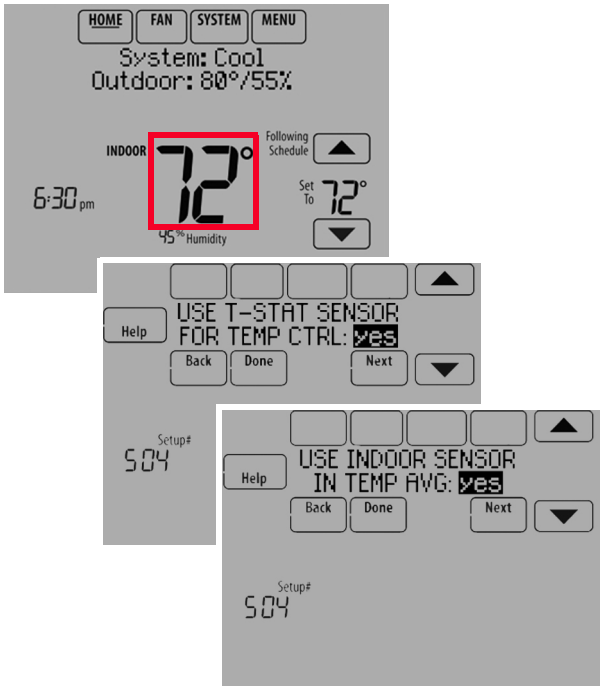


Fig. 308.

Humidity Display

If you are sensing Humidity from one location (internal or remote), the humidity reading displayed on the home screen is from the sensor that is being used for control. In Fig. 309, the humidity reading is from the remote indoor sensor.

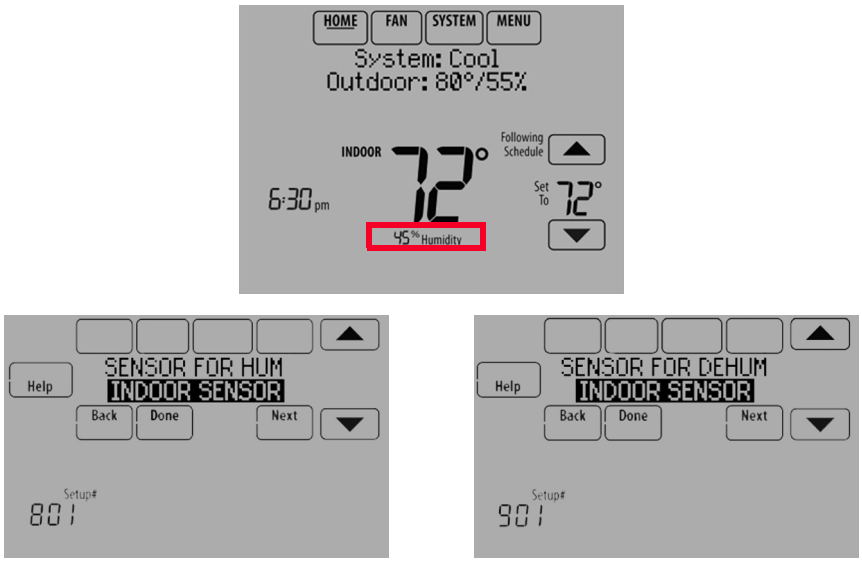


Fig. 309.

If you are sensing Humidity from two separate locations (one for humidification and another for dehumidification), you can select which humidity reading to display on the home screen. In Fig. 310, the humidity reading is from the Main Level remote indoor sensor based on the setting in ISU.

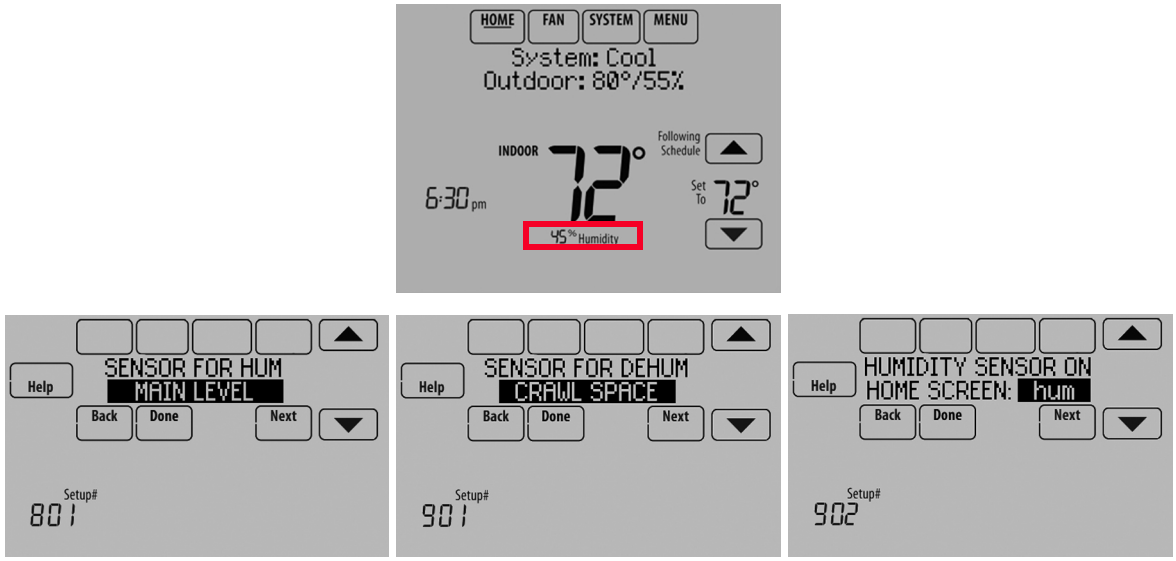


Fig. 310.

Calibration - Outdoor Sensor

The C7089U1006 Outdoor Sensor is calibrated at the factory and cannot be recalibrated in the field.

Table 7. C7089U1006 Sensor Resistance at Outdoor Temperature.

Outdoor Temperature		Ohms of Resistance	Outdoor Temperature		Ohms of Resistance
°F	°C		°F	°C	
-20	-28.9	106926	52	11.1	17136
-18	-27.8	100923	54	12.2	16387
-16	-26.7	95310	56	13.3	15675
-14	-25.6	90058	58	14.4	14999
-12	-24.4	85124	60	15.6	14356
-10	-23.3	80485	62	16.7	13743
-8	-22.2	76137	64	17.8	13161
-6	-21.1	72060	66	18.9	12607
-4	-20.0	68237	68	20.0	12081
-2	-18.9	64631	70	21.1	11578
0	-17.8	61246	72	22.2	11100
2	-16.7	58066	74	23.3	10644
4	-15.6	55077	76	24.4	10210
6	-14.4	53358	78	25.6	9795
8	-13.3	49598	80	26.7	9398
10	-12.2	47092	82	27.8	9020
12	-11.1	44732	84	28.9	8659
14	-10.0	42506	86	30.0	8315
16	-8.9	40394	88	31.1	7986
18	-7.8	38400	90	32.2	7672
20	-6.7	36519	92	33.3	7372
22	-5.6	34743	94	34.4	7086
24	-4.4	33063	96	35.6	6813
26	-3.3	31475	98	36.7	6551
28	-2.2	29975	100	37.8	6301
30	-1.1	28558	102	38.9	6062
32	0.0	27219	104	40.0	5834

Table 7. C7089U1006 Sensor Resistance at Outdoor Temperature. (Continued)

Outdoor Temperature		Ohms of Resistance	Outdoor Temperature		Ohms of Resistance
°F	°C		°F	°C	
34	1.1	25949	106	41.1	5614
36	2.2	24749	108	42.2	5404
38	3.3	23613	110	43.3	5203
40	4.4	22537	112	44.4	5010
42	5.6	21516	114	45.6	4826
44	6.7	20546	116	46.7	4649
46	7.8	19626	118	47.8	4479
48	8.9	18754	120	48.9	4317
50	10.0	17926	—		

Calibration - Indoor Sensor

The C7189U1005 Wall Mount Temperature Sensor is calibrated at the factory and cannot be recalibrated in the field.

Table 8. C7189U1005 Sensor Resistance at Room Temperature.

Room Temperature		Ohms of Resistance	Room Temperature		Ohms of Resistance
°F	°C		°F	°C	
40	4.4	22537	72	22.2	11100
42	5.6	21516	74	23.3	10644
44	6.7	20546	76	24.4	10210
46	7.8	19626	78	25.6	9795
48	8.9	18754	80	26.7	9398
50	10.0	17926	82	27.8	9020
52	11.1	17136	84	28.9	8659
54	12.2	16387	86	30.0	8315
56	13.3	15675	88	31.1	7986
58	14.4	14999	90	32.2	7672
60	15.6	14356	92	33.3	7372
62	16.7	13743	94	34.4	7086

Backup Control

This section explains when backup control is used. For example, if batteries in the wireless indoor sensors are depleted.

If the Thermostat is Part of the Temperature Average

1. The thermostat controls the system using the remaining sensors that are part of the temperature average.
2. If there are no remote indoor sensors remaining, the thermostat controls the system using its internal sensor.
3. If the internal thermostat sensor is not available and a Return Air Sensor is connected, the Backup Control in the EIM is used. The backup control maintains 55 °F in heat, 85 °F in cool and operates the fan continuously to sense and control temperature.

If the Thermostat is NOT Part of the Temperature Average

1. The thermostat controls the system using the remaining sensors that are part of the temperature average.
2. If there are no remote indoor sensors remaining and a Return Air Sensor is connected, the Backup Control in the EIM is used. The backup control maintains 55 °F in heat, 85 °F in cool and operates the fan continuously to sense and control temperature.

REPLACING A THERMOSTAT

When you replace a thermostat, you must reset the RedLINK accessories before connecting them to the new thermostat.

Follow the instructions below:

At the Equipment Interface Module (EIM)

1. Press and hold the CONNECT button on the EIM until the CONNECTED LED glows amber (hold for about 10 seconds).
2. Follow the prompts on the screen to connect the new thermostat to the EIM. See page 14.

At the Portable Comfort Control

1. Press and hold the blank space (or arrow) in the lower right hand corner of the screen until the display changes (hold for about 4 seconds).

Fig. 311.

2. Press REMOVE, then YES to disconnect from the old thermostats.
3. To reconnect the thermostat, go to “Linking RedLINK Accessories” beginning on page 14.

At the Indoor Sensor, RedLINK Internet Gateway, Entry/Exit Remote, Vent-Filter Boost Remote or TrueSTEAM Wireless Adapter

1. Press and hold the CONNECT button on the accessory until the status light glows amber (hold for about 10 seconds).
2. To reconnect the thermostat, go to “Linking RedLINK Accessories” beginning on page 14.

REPLACING AN EQUIPMENT INTERFACE MODULE

When you replace an EIM, you must reset the RedLINK accessories before connecting them to the new thermostat.

Follow the instructions below:

At the thermostat

1. Press MENU, scroll down and select Installer Options, enter the password (Date Code) when prompted, scroll down and select Wireless Manager, scroll down and select Remove Device, then select This Thermostat.
2. Follow the prompts on the screen to connect the thermostat to the new EIM.

At the Portable Comfort Control

1. Press and hold the blank space (or arrow) in the lower right hand corner of the screen until the display changes (hold for about 4 seconds). See Fig. 311.
2. Press REMOVE, then YES to disconnect from the old thermostats. To reconnect the thermostat, go to “Linking RedLINK Accessories” beginning on page 14.

At the Indoor Sensor, RedLINK Internet Gateway, Entry/Exit Remote, Vent-Filter Boost Remote or TrueSTEAM Wireless Adapter

1. Press and hold the CONNECT button on the accessory until the status light glows amber (hold for about 10 seconds).
2. To reconnect the thermostat, go to “Linking RedLINK Accessories” beginning on page 14.

WIRING

See Table 9 for Equipment Interface Module terminal descriptions and Table 10 for thermostat terminal descriptions.

Table 9. Equipment Interface Module Terminal Designation Descriptions.

Conventional System		Heat Pump	
Terminal	**Description**	**Terminal**	**Description**
C	Common wire from 24 VAC transformer.	C	Common wire from 24 VAC transformer.
R*	Power wire from 24 VAC transformer.	R	Power wire from 24 VAC transformer.
RH*	Heating power	RH	Heating power
RC*	Cooling power	RC	Cooling power
W	Heat Stage 1	O/B	Changeover valve for heat pumps
W2	Heat Stage 2	AUX 1	Backup Heat Stage 1/Emergency Heat Stage 1
W3	Heat Stage 3	AUX 2	Backup Heat Stage 2/Emergency Heat Stage 2
Y	Compressor Stage 1	Y	Compressor Stage 1
Y2	Compressor Stage 2	Y2	Compressor Stage 2
G	Fan Relay	G	Fan Relay
A	Connect to Economizer Module or Lighting Panel (TOD).	L/A	Connect to Compressor Monitor, Zone Panel, Economizer Module or Lighting Panel (TOD).
U1 / U1† U2 / U2† U3 / U3†	Universal relay for humidification, dehumidification, ventilation, or a stage of heating/cooling. U terminals are dry contacts that require power.	U1 / U1† U2 / U2† U3 / U3†	Universal relay for humidification, dehumidification, ventilation, or a stage of heating/cooling. U terminals are dry contacts that require power.
S1 / S1‡ S2 / S2‡ S3 / S3‡ S4 / S4‡	Universal input for a wired indoor sensor, outdoor sensor, discharge sensor, return sensor, dry contact device for alerts or dry contact device for remote setback.	S1 / S1‡ S2 / S2‡ S3 / S3‡ S4 / S4‡	Universal input for a wired indoor sensor, outdoor sensor, discharge sensor, return sensor, dry contact device for alerts or dry contact device for remote setback.
A B C D	Connect to THM4000R1000 Wireless Adapter for extended wireless range.	A B C D	Connect to THM4000R1000 Wireless Adapter for extended wireless range.

* Remove jumpers when separate transformers are used.

† See “Wiring IAQ Equipment or a Heat/Cool Stage to the Universal Terminals” beginning on page 130.

‡ See “Dry Contact Alerts” beginning on page 74 for wiring Dry Contact Devices to display alerts.

Table 10. Thermostat Terminal Designation Descriptions.

Conventional System		Heat Pump	
Terminal	**Description**	**Terminal**	**Description**
C	Common wire from secondary side of cooling transformer (if 2 transformers).	C	Common wire from secondary side of cooling transformer.
Rc*	Cooling power	Rc	Cooling power
R*	Heating power	R	Heating power
W	Heat Stage 1	O / B	Changeover valve for heat pumps
W2	Heat Stage 2	AUX-E	Backup Heat/Emergency Heat
Y	Compressor Stage 1	Y	Compressor Stage 1
Y2	Compressor Stage 2	Y2	Compressor Stage 2
G	Fan Relay	G	Fan Relay
A	Connect to Economizer Module or Lighting Panel (TOD).	L / A	Connect to Compressor Monitor, Zone Panel, Economizer Module or Lighting Panel (TOD).
U1 / U1	Universal relay for humidification, dehumidification, ventilation, or a stage of heating/cooling.	U1 / U1	Universal relay for humidification, dehumidification, ventilation, or a stage of heating/cooling.
S1 / S1	Universal input for a wired indoor, outdoor or discharge sensor.	S1 / S1	Universal input for a wired indoor, outdoor or discharge sensor.
K†	Connect to K on Wire Saver module.	K†	Connect to K on Wire Saver module.

* Remove factory installed jumper for two transformer systems.

† The THP9045A1023 Wire Saver module is used on heat/cool systems when you only have four wires at the thermostat and you would like the thermostat to be powered with a common wire. Use the K terminal in place of the Y and G terminals on conventional or heat pump systems to provide control of the fan and the compressor through a single wire—the unused wire then becomes your common wire. See THP9045 instructions for more information.

⚠ CAUTION
Electrical Hazard.
Can cause electrical shock or equipment damage.
Disconnect power before wiring.

All wiring must comply with local electrical codes and ordinances. See Fig. 314–350.

1. Select wiring diagram that corresponds with system type and the equipment being installed (using the EIM or wiring the thermostat directly to the HVAC equipment).
2. Loosen the screws for the appropriate terminals. Insert wires in the terminal block under the loosened screw. See Fig. 312 and 313.
3. Securely tighten each screw.
4. Push excess wire back into the hole.
5. Plug the hole with nonflammable insulation to prevent drafts from affecting the thermostat.
6. See Fig. 314–337 for typical wiring hookups.

Table 11. Wiring Diagrams by System Type.

System Type	Wiring Diagram Reference
Standard Heat/Cool	314
Heat Pump with Auxiliary Heat	315
Geothermal radiant heat	316
Heat pump with oil forced air backup.	320
Geothermal radiant heat with geothermal forced air and backup heat using separate transformer for the radiant heat	321
Wood stove-fired hot water fan coil with forced air furnace backup heat	322
Hot water radiant heat with backup heat (single zone application)	323
Hot water radiant heat with backup forced air heat. Zoned with forced air zone panel and zone valves	324
Hot water radiant heat with backup forced air heat. Zoned with forced air zone panel and hot water panel.	325
Hot water fan coil with forced air furnace backup heat.	326
Wood stove with heat pump and backup electric strips. (For applications in which the thermostat only needs to run the blower fan when stove is hot).	
Wiring IAQ Equipment or a stage of Heating/Cooling to U1, U2 or U3 terminals	327–337
Wired Remote Sensors	342–346

Table 12. Zoning Diagrams by System Type.

System Type	Wiring Diagram Reference
RedLINK VisionPRO thermostats with an HZ432 zone panel and no IAQ control	347
RedLINK VisionPRO thermostat controlling one zone with an HZ432 zone panel and a TrueSTEAM humidifier	348
RedLINK VisionPRO thermostat with an HZ432 zone panel and a ventilator	349
RedLINK VisionPRO thermostat with an HZ432 zone panel and a TrueDRY dehumidifier	350

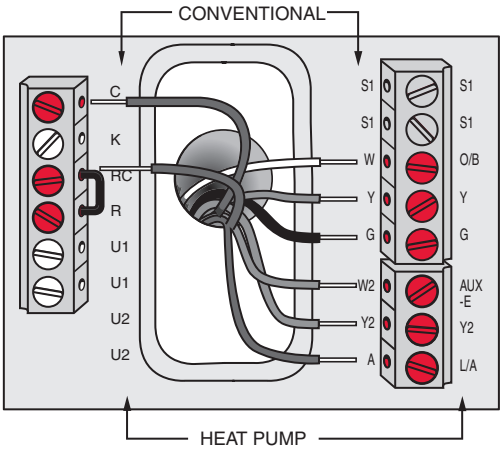


Fig. 312. Inserting wires in thermostat terminal block.

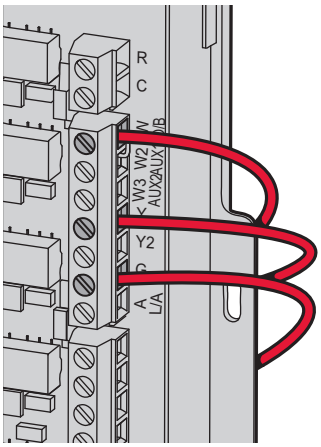


Fig. 313. Inserting wires in EIM terminal block

IMPORTANT

Use 18–22 gauge thermostat wire.

EIM Wiring Diagrams

Typical wiring of a conventional system with up to 3-stage heat and 2-stage cool with one transformer.

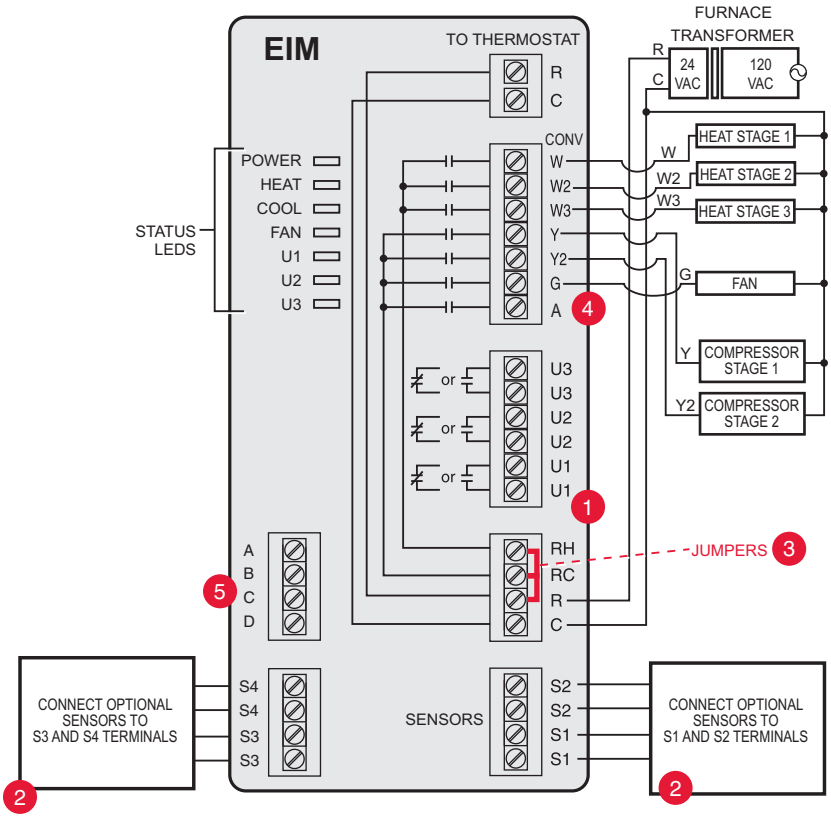


Fig. 314. EIM wiring guide — conventional systems.

1 See guides on following pages for geothermal radiant heat wiring.
2 Wire a maximum of 4 sensors using the S1-S4 terminals. S1-S4 terminals can be connected to an indoor sensor, outdoor sensor, discharge sensor, return sensor, dry contact device to display an alert or an occupancy sensor for remote setback.
3 Remove jumper(s) if using separate transformers.
4 See “Economizer Module Wiring Diagrams” beginning on page 132.
5 Connect wireless adapter to ABCD for extended wireless range.

Typical wiring of a heat pump system with up to four-stage heat and two-stage cool with one transformer.

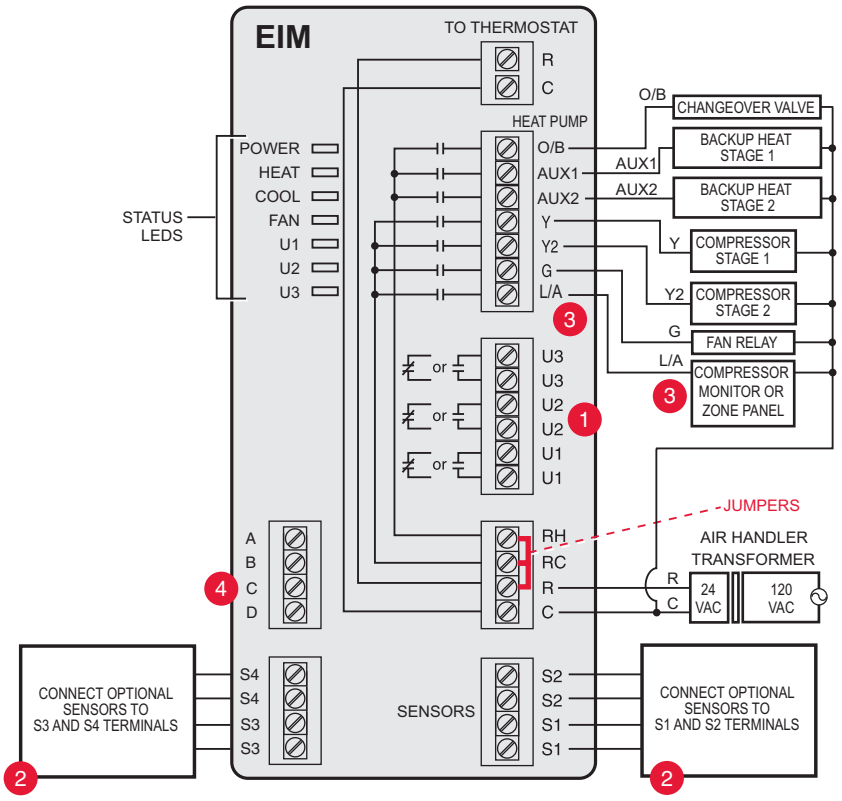


Fig. 315. EIM wiring guide — heat pump systems.

1 See guides on following pages for geothermal radiant heat wiring.
2 Wire a maximum of 4 sensors using the S1-S4 terminals. S1-S4 terminals can be connected to an indoor sensor, outdoor sensor, discharge sensor, return sensor, dry contact device to display an alert or an occupancy sensor for remote setback..
3 L/A terminal sends continuous output when thermostat is set to EM HEAT mode, except when set up for Economizer or TOD. See "Economizer Module Wiring Diagrams" beginning on page 132.
4 Connect wireless adapter to ABCD for extended wireless range.

Typical wiring for geothermal radiant heat, geothermal forced-air, and backup heat with one transformer.

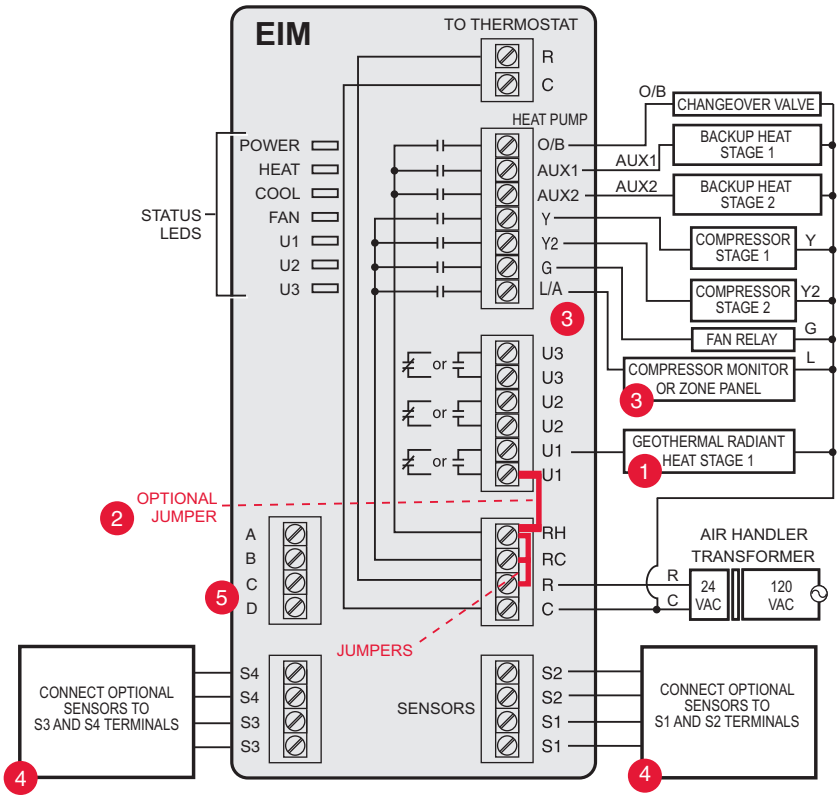


Fig. 316. EIM wiring guide — geothermal radiant heat.

1 U1, U2 or U3 terminals must be used for geothermal radiant heat (ISU 201). Thermostat allows 2 stages of radiant heat—geothermal (stage 1) and boiler (stage 2).
2 "U" terminals are normally open dry contacts when set up for geothermal radiant heat. You must install a field jumper if radiant heat is powered by system transformer. Do NOT install a field jumper if radiant heat has its own transformer.
3 L/A terminal sends continuous output when thermostat is set to EM HEAT mode except when set up for Economizer or TOD. See "Economizer Module Wiring Diagrams" beginning on page 132.
4 Wire a maximum of 4 sensors using the S1-S4 terminals. S1-S4 terminals can be connected to an indoor sensor, outdoor sensor, discharge sensor, return sensor, dry contact device to display an alert or an occupancy sensor for remote setback.
5 Connect wireless adapter to ABCD for extended wireless range.

NOTE: For setup and operation, see "Geothermal Radiant Heat" beginning on page 78.

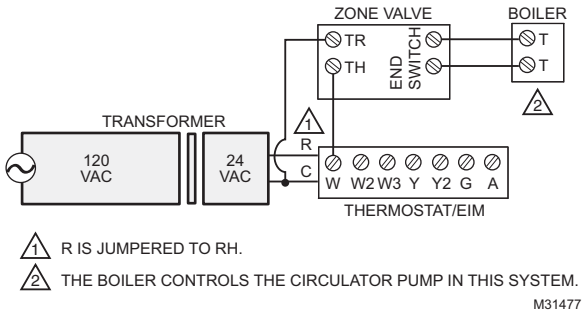


Fig. 317. 2-Wire Zone Valve with end switch.

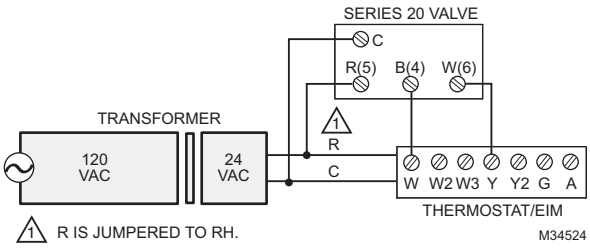


Fig. 318. Series 20 hot water heat.

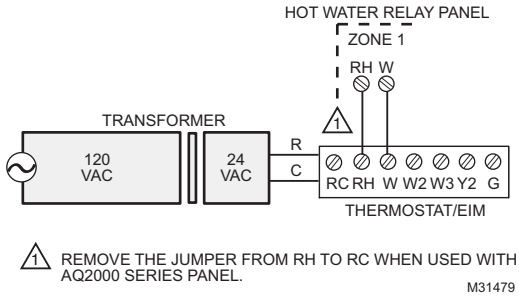


Fig. 319. AQ2000 series panels or other hot water relay panels.

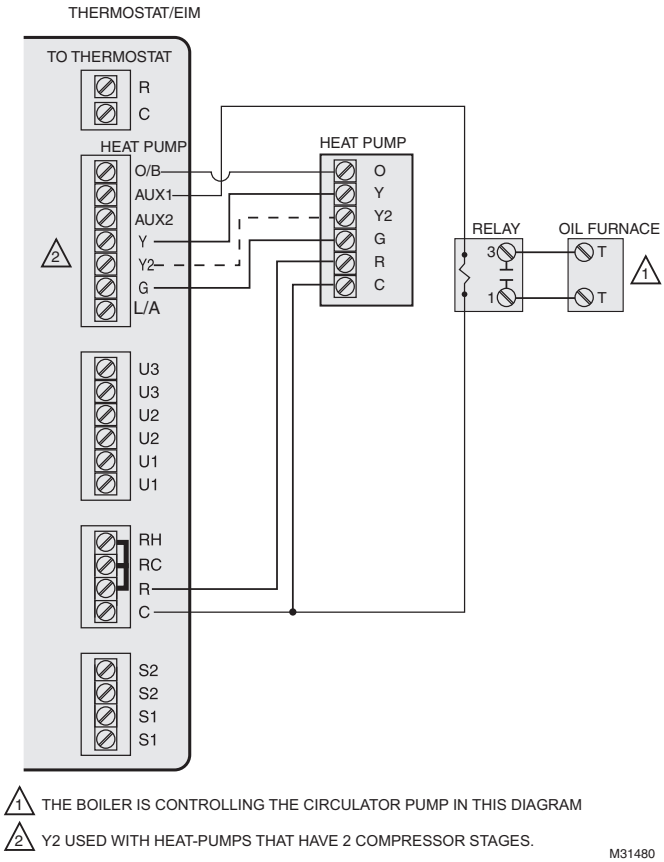


Fig. 320. Heat pump with oil forced air backup.

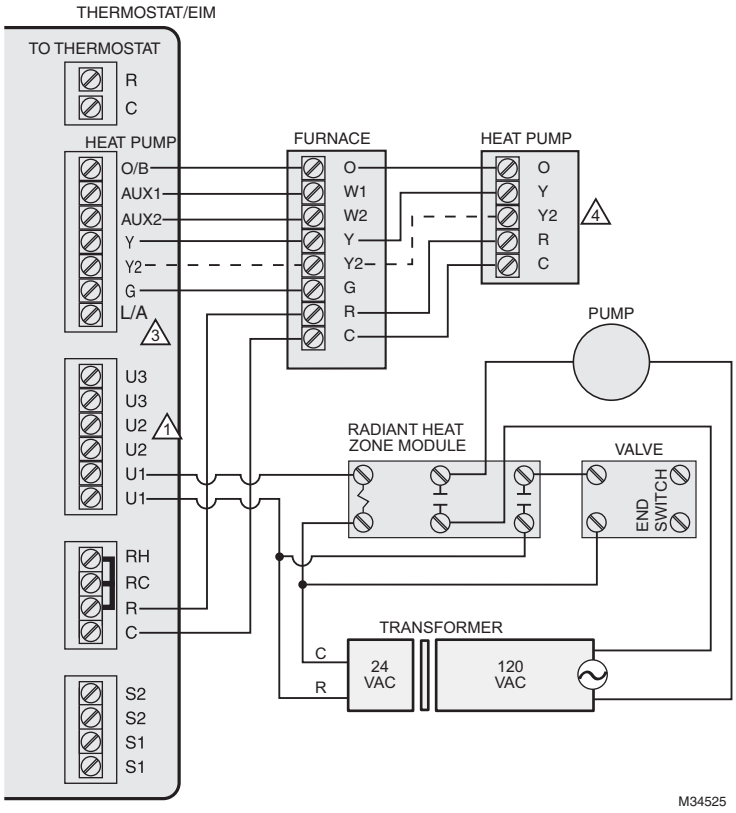
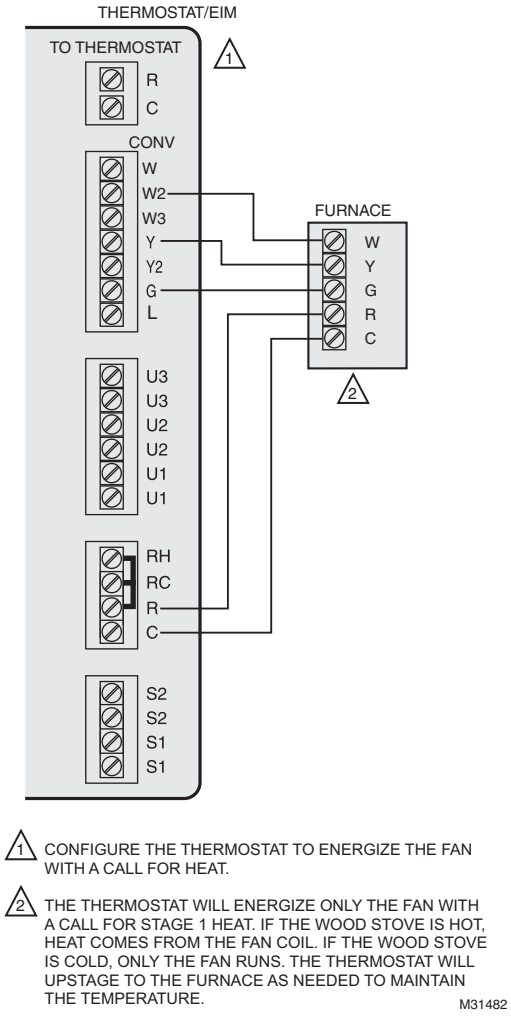


Fig. 321. Geothermal radiant heat with geothermal forced air and backup heat using separate transformer for the radiant heat.

1 U1, U2 or U3 terminals must be used for geothermal radiant heat (ISU 201). Thermostat allows 2 stages of radiant heat—geothermal (stage 1) and boiler (stage 2).
2 "U" terminals are normally open dry contacts when set up for geothermal radiant heat. You must install a field jumper if radiant heat is powered by system transformer. Do NOT install a field jumper if radiant heat has its own transformer.
3 L/A terminal sends continuous output when thermostat is set to EM HEAT mode except when set up for Economizer or TOD. See "Economizer Module Wiring Diagrams" beginning on page 132.
4 Y2 used with heat pumps that have 2 compressor stages.

NOTE: For setup and operation, see "Geothermal Radiant Heat" beginning on page 78.

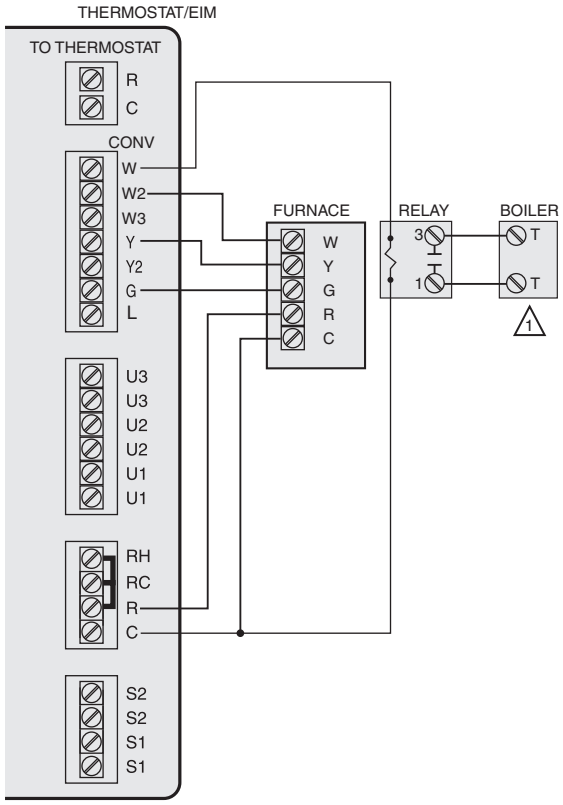


1 CONFIGURE THE THERMOSTAT TO ENERGIZE THE FAN WITH A CALL FOR HEAT.

2 THE THERMOSTAT WILL ENERGIZE ONLY THE FAN WITH A CALL FOR STAGE 1 HEAT. IF THE WOOD STOVE IS HOT, HEAT COMES FROM THE FAN COIL. IF THE WOOD STOVE IS COLD, ONLY THE FAN RUNS. THE THERMOSTAT WILL UPSTAGE TO THE FURNACE AS NEEDED TO MAINTAIN THE TEMPERATURE.

M31482

Fig. 322. Wood stove-fired hot water fan coil with forced air furnace backup heat.



1 THE BOILER IS CONTROLLING THE CIRCULATOR PUMP IN THIS DIAGRAM.

M31483

Fig. 323. Hot water radiant heat with backup heat (single zone application).

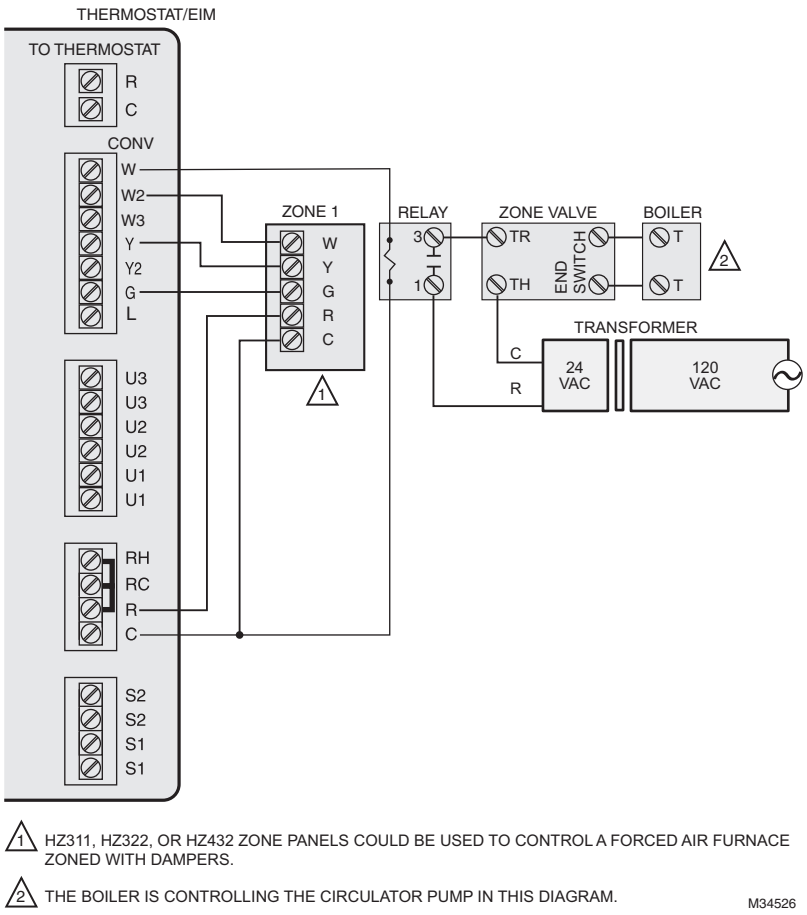


Fig. 324. Hot water radiant heat with backup forced air heat. Zoned with forced air zone panel and zone valves.

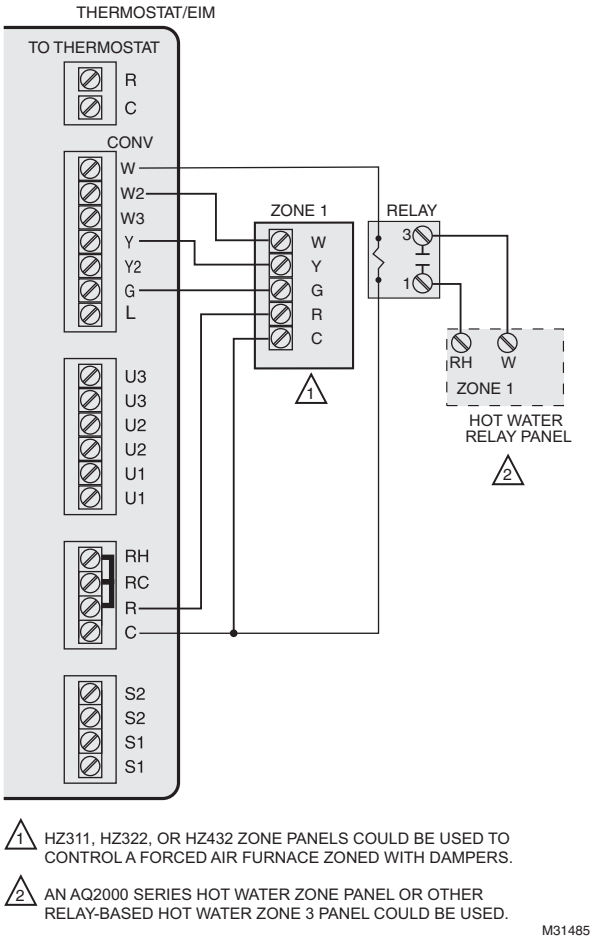


Fig. 325. Hot water radiant heat with backup forced air heat. Zoned with forced air zone panel and hot water panel.

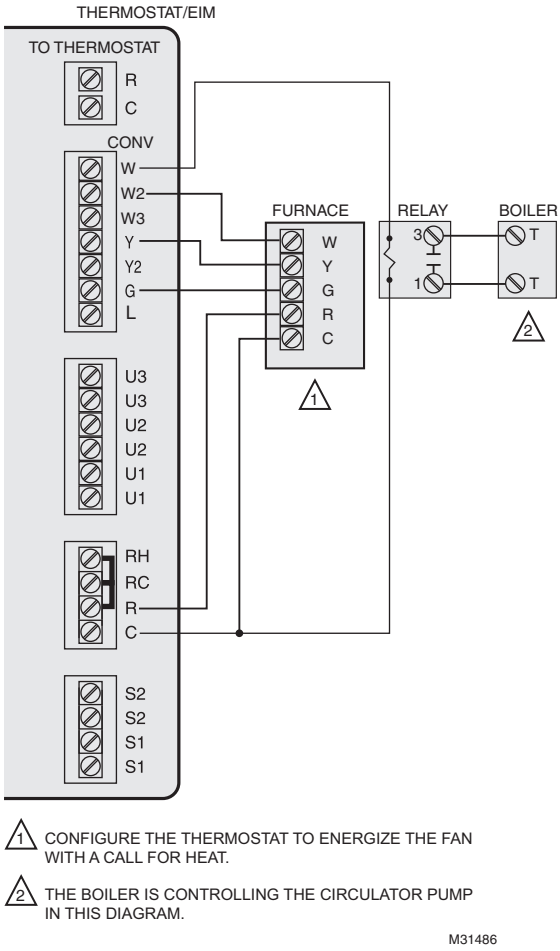
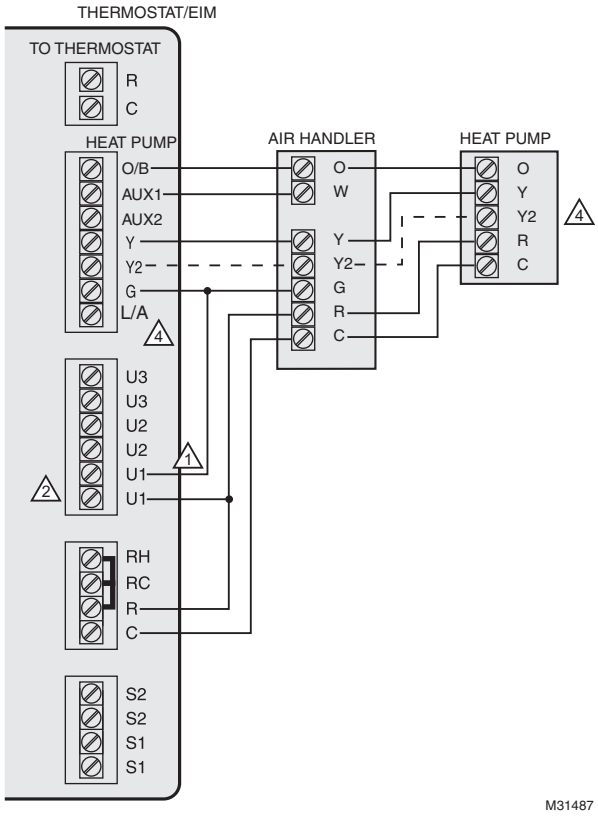


Fig. 326. Hot water fan coil with forced air furnace backup heat.



Wood stove with heat pump and backup electric strips. (For applications in which the thermostat only needs to run the blower fan when stove is hot).

1 Select Geothermal Radiant Heat at ISU 201. Connect Fan to U1, U2, or U3 as shown in the wiring diagram.

2 "U" terminals are normally open dry contacts when set up for geothermal radiant heat.

3 L/A terminal sends continuous output when thermostat is set to EM HEAT mode except when set up for Economizer or TOD. See "Economizer Module Wiring Diagrams" beginning on page 132.

4 Y2 used with heat pumps that have 2 compressor stages.

NOTE: In Fig. , the thermostat will energize only the fan with a call for stage 1 heat. If the wood stove is hot, heat comes from the fan coil. If the wood stove is cold, only the fan runs. The thermostat will upstage to the heat pump and backup heat as needed to maintain the temperature.

Wiring IAQ Equipment or a Heat/Cool Stage to the Universal Terminals

To Thermostat

"U" terminals can be used for humidification, dehumidification, ventilation or a stage of heating/cooling.

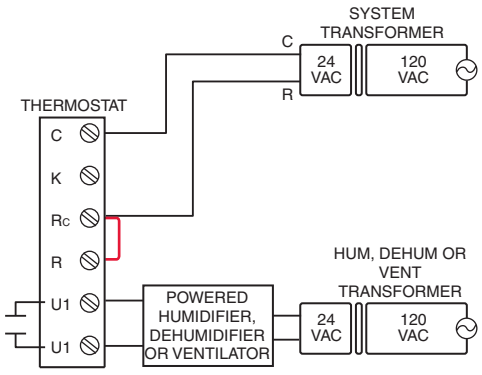


Fig. 327. Wiring a powered humidifier, dehumidifier, or ventilator.

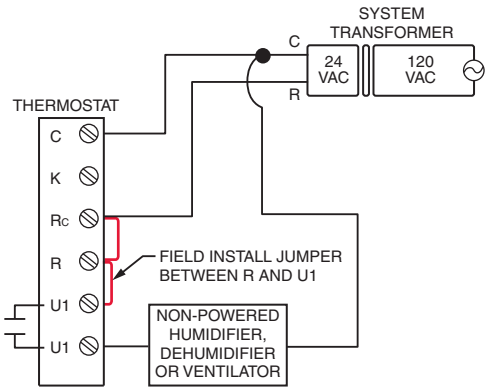


Fig. 329. Wiring a non-powered humidifier, dehumidifier, or ventilator.

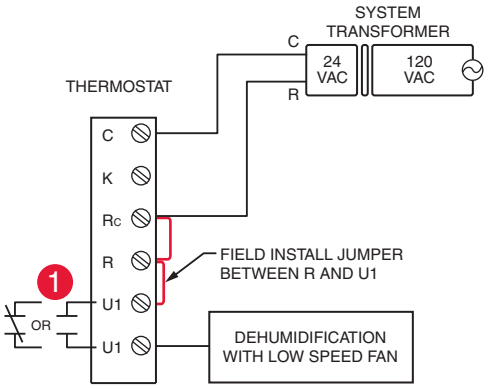


Fig. 328. Dehumidification with low speed fan using a variable speed blower.

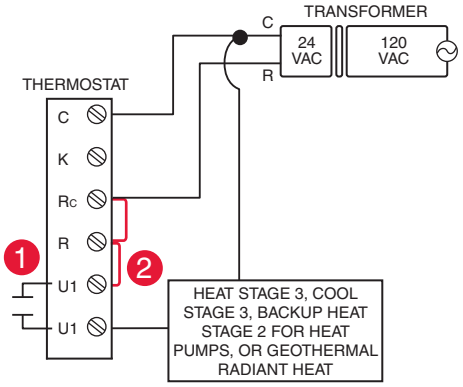


Fig. 330. Wiring a heat or cool stage to U1.

1 Wire the thermostat universal relay to the low speed fan for dehumidification control at the equipment. The thermostat relay can be set to normally open or normally closed in the thermostat installer setup.

Normally open, dry contacts

Normally closed, dry contacts

1 U1 terminals are normally open dry contacts when set up for a stage of heating or cooling.

2 You must install a field jumper if the stage of heating or cooling is powered by system transformer. Do NOT install a field jumper if the stage of heating has its own transformer.

Wiring IAQ Equipment or a Heat/Cool Stage to the Universal Terminals

To Equipment Interface Module

"U" terminals can be used for humidification, dehumidification, ventilation or a stage of heating/cooling.

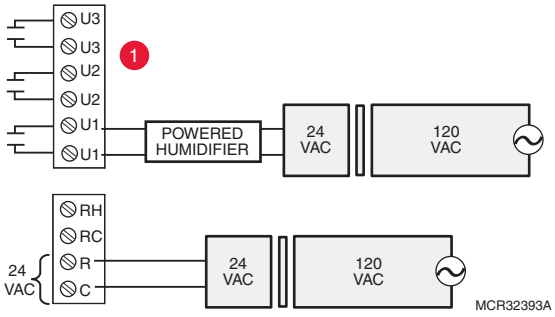


Fig. 331. Typical hookup of powered humidifier.

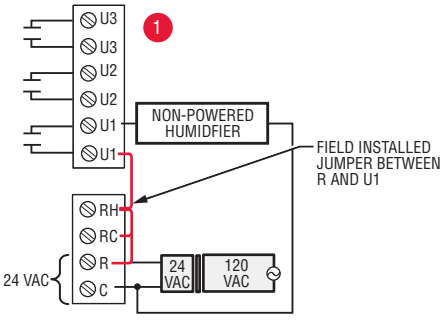


Fig. 334. Typical hookup of non-powered humidifier.

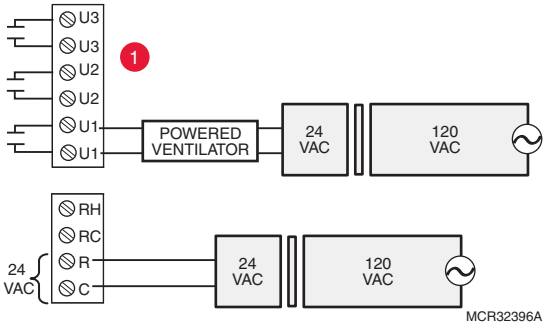


Fig. 332. Typical hookup of powered ventilation.

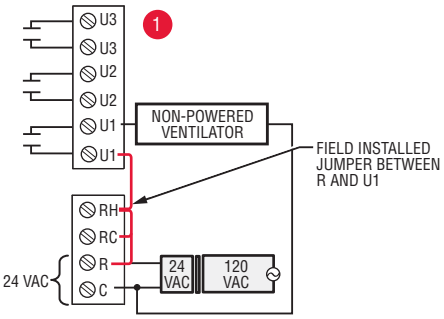


Fig. 335. Typical hookup of non-powered ventilation.

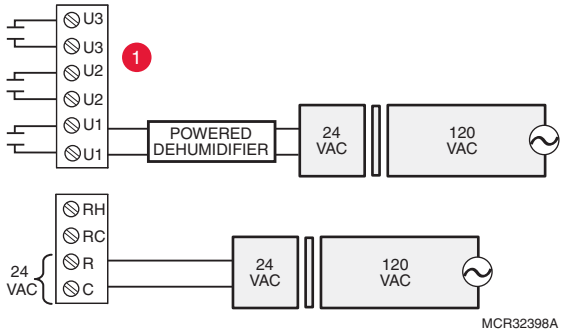


Fig. 333. Typical hookup of powered dehumidifier (whole house dehumidifer).

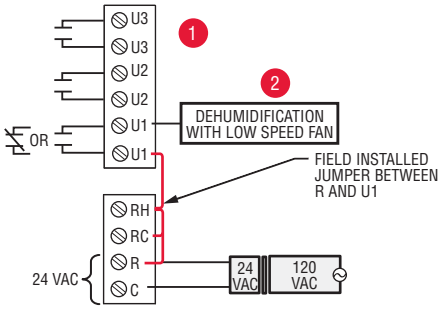


Fig. 336. Typical hookup of variable speed blower for dehumidification in low speed.

1 Any combination of universal relays (U1, U2, U3) can be used. They are set in the thermostat installer setup.
2 Wire the universal EIM relay to the low speed fan for dehumidification control at the equipment. The EIM relay can be set to be normally open or normally closed in the thermostat installer setup.

Normally open, dry contacts

Normally closed, dry contacts

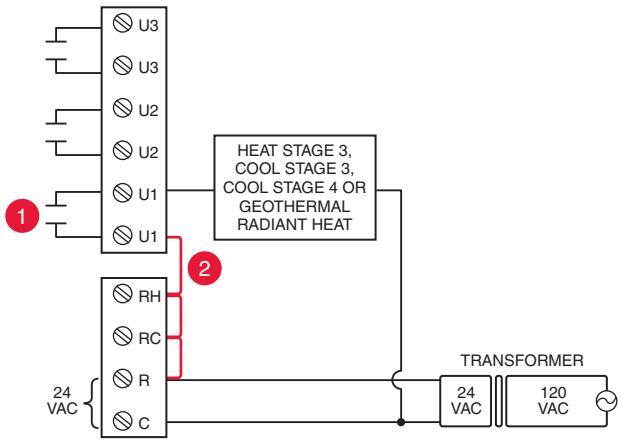


Fig. 337. Connecting a stage of heating or cooling to a universal relay (U1, U2, U3).

1 U1, U2, and U3 are normally open dry contacts when set up for a stage of heating or cooling.
2 You must install a field jumper if the stage of heating or cooling is powered by the system transformer. Do NOT install a field jumper if the stage of heating has its own transformer.

Economizer Module Wiring Diagrams

Typical wiring of a W7220 Economizer Module for a heat pump system, using a VisionPRO with RedLINK thermostat or Equipment Interface Module.

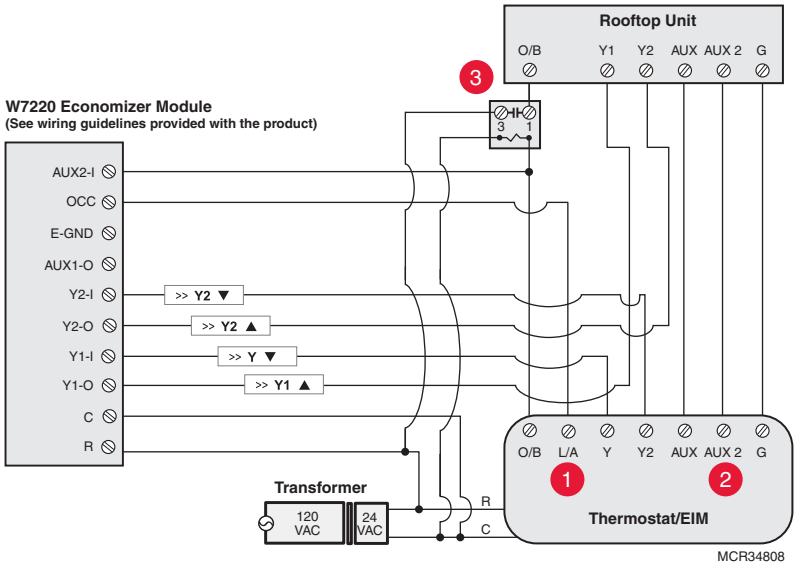


Fig. 338. Wiring a W7220 Economizer Module for a heat pump system.

Typical wiring of a W7220 Economizer Module for a conventional system, using a VisionPRO with RedLINK thermostat or Equipment Interface Module.

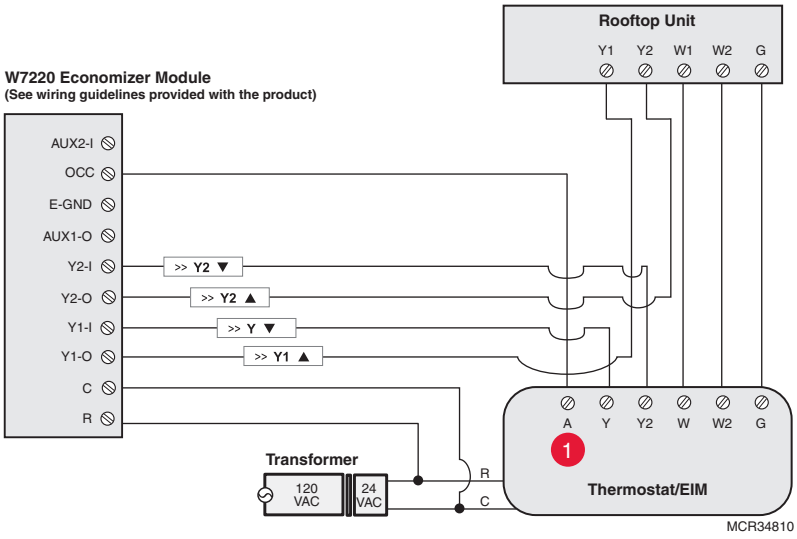


Fig. 339. Wiring a W7220 Economizer Module for a conventional system.

1 "A" or "L/A" terminal must be configured for Economizer in the installer setup (ISU 222). These terminals are powered by the cooling transformer (Rc terminal).
2 Terminal AUX 2 is present only on the Equipment Interface Module.
3 Connect the changeover valve from the roof top unit to the normally open contacts of an isolation relay to prevent feedback into the economizer module during defrost. If this is not done when the system goes into defrost, it will change the economizer into cooling mode due to the feedback and open the outside damper while in heating mode.

Typical wiring of a W7213/W7214 Economizer Module for a heat pump system, using a VisionPRO with RedLINK thermostat or Equipment Interface Module.

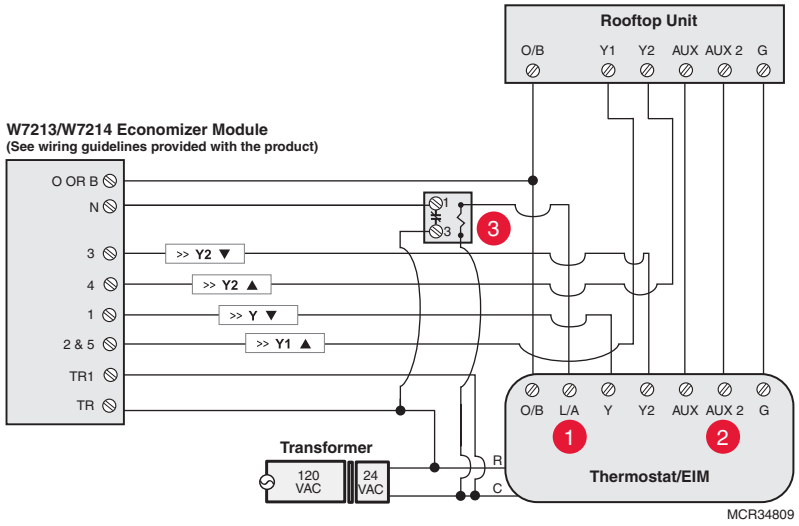


Fig. 340. Wiring a W7213/W7214 Economizer Module for a heat pump system.

Typical wiring of a W7212 Economizer Module for a conventional heating system, using a VisionPRO with RedLINK thermostat or Equipment Interface Module.

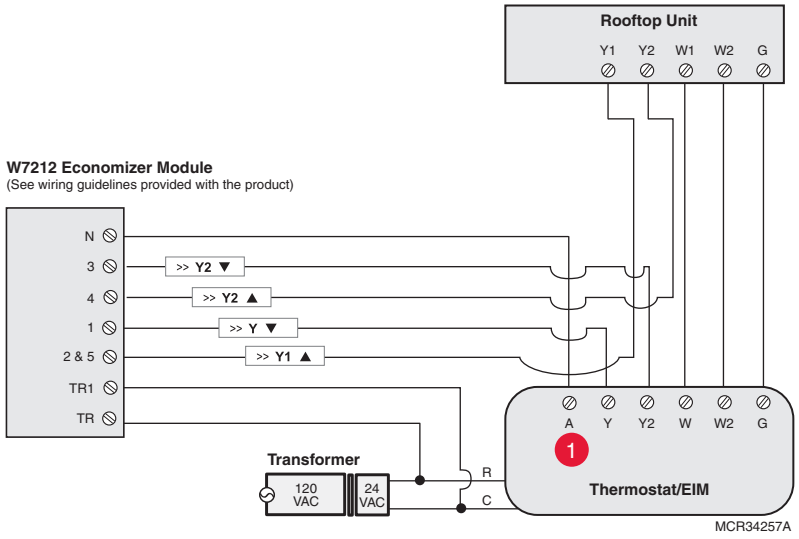


Fig. 341. Wiring a W7212 Economizer Module for a conventional heating system.

1 “A” or “L/A” terminal must be configured for Economizer in the installer setup (ISU 222). These terminals are powered by the cooling transformer (Rc terminal).
2 Terminal AUX 2 is present only on the Equipment Interface Module.
3 Add a normally closed relay as shown to make the W7213/W7214 Economizer Module compatible with the thermostat. The thermostat energizes the "A" or "L/A" terminal during Occupied Periods.

Wiring C7089U1006 Outdoor Sensor

CAUTION

Electrical Interference (Noise) Hazard.
Can cause erratic system operation.
Keep wiring at least one foot away from large inductive loads such as motors, line starters, lighting ballasts and large power distribution panels.
Use shielded cable to reduce interference when rerouting is not possible.

IMPORTANT

Erratic temperature readings from a sensor can occur as a result of any of the wiring practices described below. Avoid these practices to assure correct operation. Use shielded cable to reduce interference if rerouting sensor wiring is not possible.

- *— Be sure wires have a cable separate from the thermostat cable.*
- *— Do not route temperature sensor wiring with building power wiring, next to control contactors or near light dimming circuits, electric motors or welding equipment.*
- *— Avoid poor wiring connections.*
- *— Avoid intermittent or missing building earth ground.*

CAUTION

Electrical Shock Hazard.
Can cause electrical shock or equipment damage.
Disconnect power supply before connecting wiring.

Wiring must comply with applicable codes, ordinances and regulations:

1. Wire C7089U1006 Outdoor Sensor to S terminals on the thermostat or EIM. If leadwire provided is not long enough (60 in.), run a cable to a hole at C7089U1006 location.
   a. Using color-coded, 18-gauge thermostat wire is recommended. For example of general wiring of C7089U1006, see Fig. 342.
   b. Pigtail wiring can be used.
2. Mount C7089U1006 in its mounting clip.
3. Plug wiring hole using nonhardening caulk or putty.

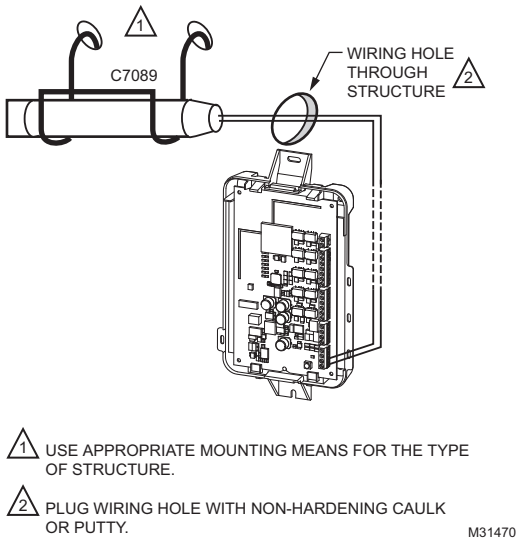


Fig. 342. Wire C7089U1006 Outdoor Sensor to the EIM.

Wiring guide — Wired Indoor Sensors

⚠ CAUTION

Electrical Interference (Noise) Hazard.
Can cause erratic system operation.
Keep wiring at least one foot away from large inductive loads such as motors, line starters, lighting ballasts and large power distribution panels.
Use shielded cable to reduce interference when rerouting is not possible.

IMPORTANT

Erratic temperature readings from a sensor can occur as a result of any of the wiring practices described below. Avoid these practices to assure correct operation. Use shielded cable to reduce interference if rerouting sensor wiring is not possible.

- *— Be sure wires have a cable separate from the thermostat cable.*
- *— Do not route temperature sensor wiring with building power wiring, next to control contactors or near light dimming circuits, electric motors or welding equipment.*
- *— Avoid poor wiring connections.*
- *— Avoid intermittent or missing building earth ground.*

⚠ CAUTION

Electrical Shock Hazard.
Can cause electrical shock or equipment damage.
Disconnect power supply before connecting wiring.

Use the S1, S2, S3 or S4 terminals for wired sensors.

Wiring 4 C7189U1005 sensors (10k ohm) for temperature averaging network. Select 10K in the Installer Setup (ISU 503) when using C7189U1005 sensor(s).

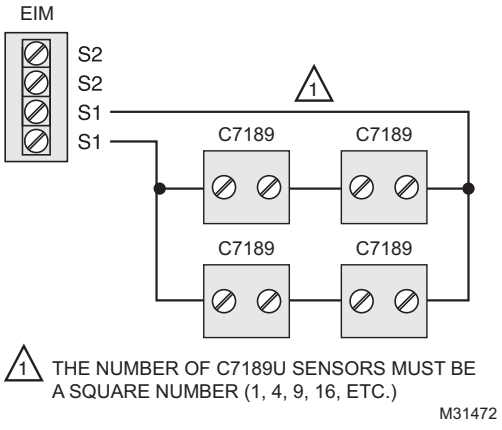


Fig. 343. Wiring 4 C7189U sensors.

Wiring 2 TR21 sensors (20k ohm) and 1 TR21-A sensor (10k ohm) for temperature averaging network. Select 20K in the Installer Setup (ISU 503) when using 2 TR21 sensors and 1 TR21-A sensor.

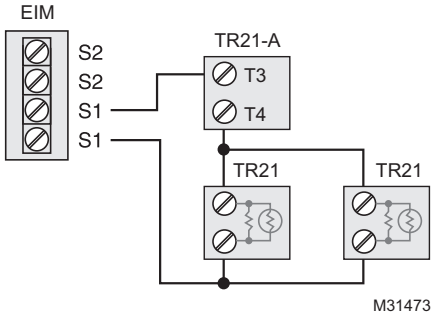


Fig. 344. Wiring 2 TR21 sensors and 1 TR21-A sensor.

Wiring 4 TR21 sensors (20k ohm). Select 20K in the Installer Setup (ISU 503) when using TR21 sensor(s).

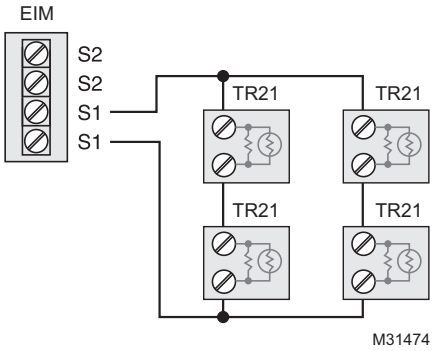


Fig. 345. Wiring 4 TR21 sensors.

Wiring 2 TR21-A sensors (10k ohm) for temperature averaging network. Select 20K in the Installer Setup (ISU 503) when using 2 TR21-A sensors in series. Note: The TR21-A sensor must be used in combination with TR21 or TR21-A sensor.

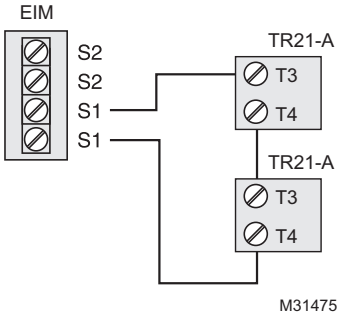
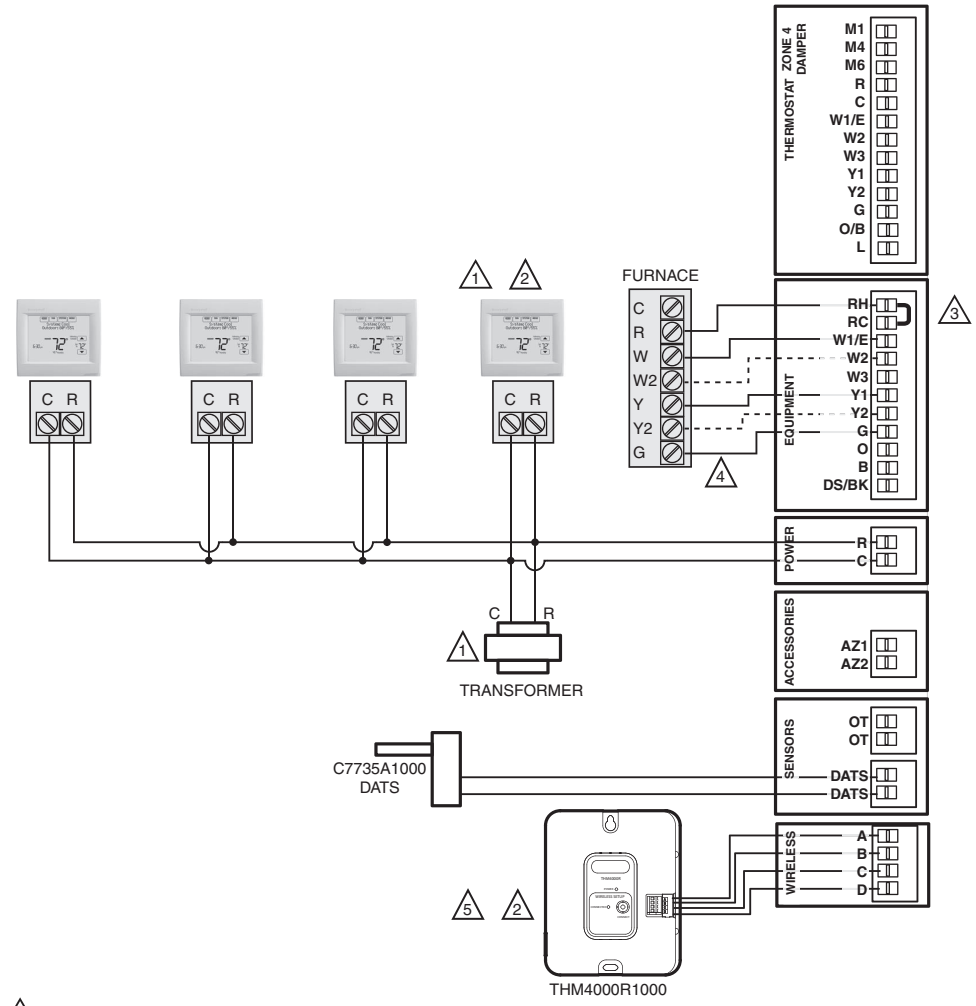


Fig. 346. Wiring 2 TR21-A sensors.

ZONING

The following diagrams show the wiring for zoning with different IAQ equipment.



1 VISIONPRO THERMOSTATS CAN BE POWERED BY ANY TRANSFORMER. IN THIS EXAMPLE THEY ARE POWERED BY THE SAME TRANSFORMER THAT POWERS THE HZ432.

2 THERE CAN BE UP TO 4 VISIONPRO THERMOSTATS USED WITH A SINGLE THM4000R WIRELESS ADAPTER AND HZ432 ZONE PANEL. THE THM4000R CANNOT BE USED IF THERE ARE MORE THAN 4 ZONES IN THE SYSTEM.

3 RH/RC JUMPER INSTALLED WHEN SINGLE HEAT/COOL TRANSFORMER IS USED.

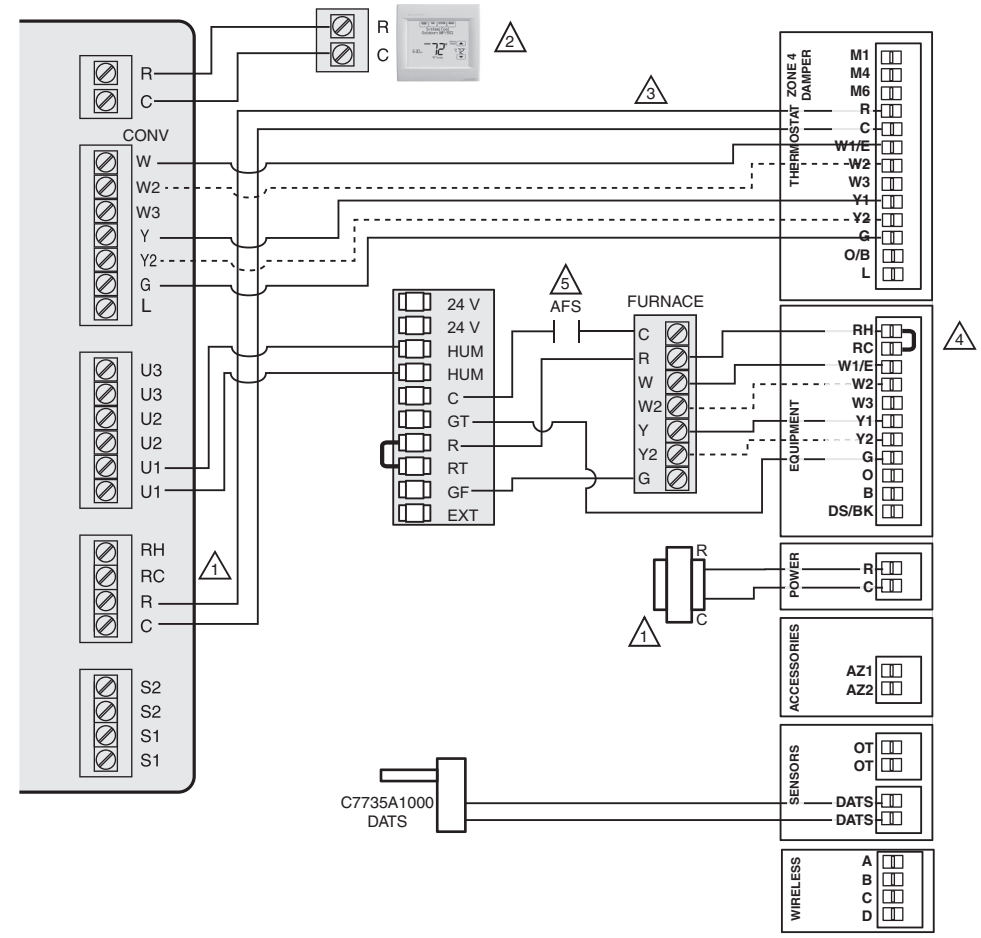
4 DOTTED LINES APPLY ONLY TO MULTI-STAGE EQUIPMENT. SEE HZ432 INSTALLATION INSTRUCTIONS FOR HEAT PUMP WIRING.

5 A THM4000R CANNOT BE USED WITH THE VISIONPRO THERMOSTAT IF THE THERMOSTAT IS CONTROLLING HUMIDIFICATION, DEHUMIDIFICATION, OR VENTILATION.

M34527

Fig. 347. RedLINK VisionPRO thermostats with an HZ432 zone panel and no IAQ control.

Zoning and Humidification



1. A DEDICATED TRANSFORMER SHOULD POWER THE HZ432. IF A DIFFERENT TRANSFORMER IS USED TO POWER THE EIM, THE JUMPER FROM R TO RH NEEDS TO BE REMOVED AND THE RH AND RC FROM EIM GETS WIRED TO R ON THE ZONE THAT THE EIM IS WIRED TO.
2. THE VISIONPRO THERMOSTAT CAN BE POWERED FROM ANY TRANSFORMER. IN THIS EXAMPLE IT IS WIRED BACK TO THE EIM.
3. DOTTED LINES ONLY APPLY TO MULTI-STAGE EQUIPMENT. SEE HZ432 INSTALLATION INSTRUCTIONS FOR HEAT PUMP WIRING.
4. RH/RC JUMPER INSTALLED WHEN SINGLE HEAT/COOL TRANSFORMER IS USED.
5. TO SIMPLIFY THE DIAGRAM, THE VISIONPRO IS CONTROLLING ZONE 4 BECAUSE IT IS LOCATED ON THE SAME SIDE OF THE EQUIPMENT WIRING ON THE PANEL. THE VISIONPRO COULD BE WIRED TO ANY ZONE ON THE HZ432 AND IS MOST COMMONLY WIRED TO ZONE 1.

M34528

Fig. 348. RedLINK VisionPRO thermostat controlling one zone with an HZ432 zone panel and a TrueSTEAM humidifier.

Setting up Humidification Control on RedLINK VisionPRO Thermostats

Select the terminals wired to the humidifier at ISU 803 (U1, U2, U3). In Fig. 348, the humidifier is wired to U1. To humidify in all zones, set ISU 807 Humidifier Control to “Hum Controls Fan.” Call Honeywell zoning at 1-800-828-8367 if you need assistance with the zoning controls.

Zoning and Ventilation

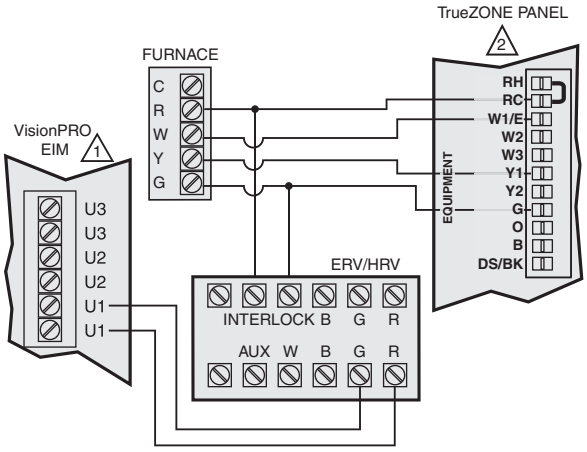


Fig. 349. RedLINK VisionPRO thermostat with an HZ432 zone panel and a ventilator.

Setting up Ventilation Control on RedLINK VisionPRO Thermostats

Select the terminals wired to the ventilator at ISU 1002 (U1, U2, U3). In Fig. 349, the ventilator is wired to U1. To ventilate in all zones, set ISU 1006 Vent Fan Control to “Equip Controls Fan.”

TrueDRY dehumidifier with Zoning

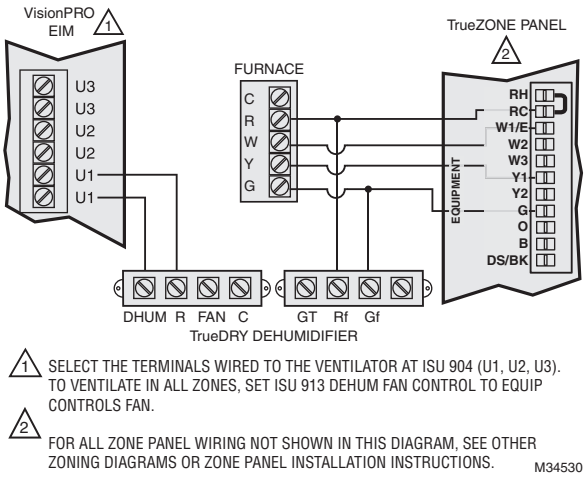


Fig. 350. RedLINK VisionPRO thermostat with an HZ432 zone panel and a TrueDRY dehumidifier.

Setting up Dehumidification Control on RedLINK VisionPRO Thermostats

Select the terminals wired to the dehumidifier at ISU 904 (U1, U2, U3). In Fig. 350, the dehumidifier is wired to U1. To dehumidify in all zones, set ISU 913 Dehum Fan Control to “Equip Controls Fan.”

Zoning FAQs

Q: How does the RedLINK VisionPRO thermostat control a humidifier in zoned systems?
A: If ISU 807 Humidifier Control is set to Tstat Controls Fan, then the zone panel will close the dampers for the other zones with a call for humidification.
If ISU 807 Humidifier Control is set to Hum Controls Fan, then all dampers will be open with a call for humidification (unless another zone is calling for heat, cool or fan at that time).
See Fig. 348.

Q: How does the RedLINK VisionPRO thermostat control a ventilator in zoned systems?
A: If ISU 1006 Vent Fan Control is set to Tstat Controls Fan, then the zone panel will close the dampers for the other zones with a call for ventilation.
If ISU 1006 Vent Fan Control is set to Equip Controls Fan, then all dampers will be open with a call for ventilation (unless another zone is calling for heat, cool or fan at that time).
See Fig. 349.

Q: How does the RedLINK VisionPRO thermostat control a dehumidifier in zoned systems?
A: If ISU 913 Dehum Fan Control is set to Tstat Controls Fan, then the zone panel will close the dampers for the other zones with a call for dehumidification.
If ISU 913 Dehum Fan Control is set to Equip Controls Fan, then all dampers will be open with a call for dehumidification (unless another zone is calling for heat, cool or fan at that time).
See Fig. 350.

Q: Will the RedLINK VisionPRO thermostat work with a zone panel?
A: It depends on the zone panel:

- **HZ322 or HZ432 (without an add-a-zone):** If you have an HZ322 or HZ432 on a 2-4 zone system and you are not going to control a humidifier, dehumidifier, or ventilator with the thermostat, you can use a THM4000R1000 wireless adapter with the zone panel and connect the RedLINK VisionPRO thermostat as one of the zones. A single THM4000R1000 wireless adapter allows you to connect up to three RedLINK VisionPRO thermostats with an HZ322 or up to four RedLINK VisionPRO thermostats with an HZ432.
- **HZ432 (with a TAZ-4 add-a-zone):** You cannot use a wireless adapter when a TAZ-4 is used. Each RedLINK VisionPRO thermostat used would need a separate THM5421R Equipment Interface Module or you can wire the RedLINK VisionPRO directly to the zone panel. The Equipment Interface Module would wire to the zone it is controlling on the HZ432 or TAZ-4.
- **Zone panel with no master or slave:** As long as all zones on the zone panel are wired the same and they use typical terminals with an R and C plus Y, G, etc, the RedLINK VisionPRO thermostat should work. Each RedLINK VisionPRO thermostat used would need a separate THM5421R Equipment Interface Module or you can wire the RedLINK VisionPRO directly to the zone panel. The Equipment Interface Module would wire to the zone it is controlling on the zone panel.
- **Master zone:** A master uses separate O and B wires. The RedLINK VisionPRO thermostat cannot be used as a master thermostat.

Q: Can I use the remote indoor sensors with the RedLINK VisionPRO thermostats if I have zoning?
A: It depends. The RedLINK VisionPRO thermostats can only control 1 zone, even if it is used with multiple sensors. The RedLINK VisionPRO thermostat cannot be used with a remote sensor if it is used with a THM4000R adapter. The RedLINK VisionPRO thermostat can be used with a remote sensor if it is used with a THM5421R Equipment Interface Module or if the thermostat is wired directly to the panel.

Q: Can I use a telephone access module with the RedLINK VisionPRO thermostat?
A: No. The telephone access module only works with the TH9421C or TH5320C communicating thermostats and the EIM or zone panel used with those controls. See the Gateway section for information on using RedLINK VisionPRO thermostats with a THM6000R Gateway for Internet access.

TROUBLESHOOTING

Table 13. Troubleshooting.

Symptom	Action
Screen is blank	• Check circuit breaker and reset if necessary. • Make sure power switch at heating and cooling system is on. • Make sure furnace door is closed securely. • If thermostat is battery powered, make sure fresh AA alkaline batteries are installed correctly.
Screen is difficult to read	• Change screen brightness using Preferences menu.
Red light is on	• If thermostat is in Emergency Heat mode, the red light is normal. It shows that the thermostat is in Emergency Heat mode. • If thermostat is not in Emergency Heat mode, an alert is active. Check message on the thermostat screen.
Heating or cooling system does not respond	• Touch SYSTEM to set system to Heat. Make sure the temperature is set higher than the Inside temperature. • Touch SYSTEM to set system to Cool. Make sure the temperature is set lower than the Inside temperature. • Check circuit breaker and reset if necessary. • Make sure power switch at heating & cooling system is on. • Make sure furnace door is closed securely. • If “Wait” is displayed, the compressor protection timer is on. Wait 5 minutes for the system to restart safely, without damaging the compressor.

REGULATORY INFORMATION

FCC Compliance Statement (Part 15.19) (USA only)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC Warning (Part 15.21) (USA only)

Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

FCC Interference Statement (Part 15.105 (b)) (USA only)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Equipment interface module, thermostats and outdoor sensor

To comply with FCC and Industry Canada RF exposure limits for general population/ uncontrolled exposure, the antenna(s) used for these transmitters must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Portable Comfort Control

This portable transmitter with its antenna complies with FCC and Industry Canada RF exposure limits for general population/uncontrolled exposure. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

Section 7.1.2 of RSS-GEN

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Section 7.1.3 of RSS-GEN

Operation is subject to the following two conditions:

1. this device may not cause interference, and
2. this device must accept any interference, including interference that may cause undesired operation of the device.

Automation and Control Solutions

Honeywell International Inc.

1985 Douglas Drive North

Golden Valley, MN 55422

customer.honeywell.com

Honeywell

68-0312—04 M.S. Rev. 10-15
Printed in United States

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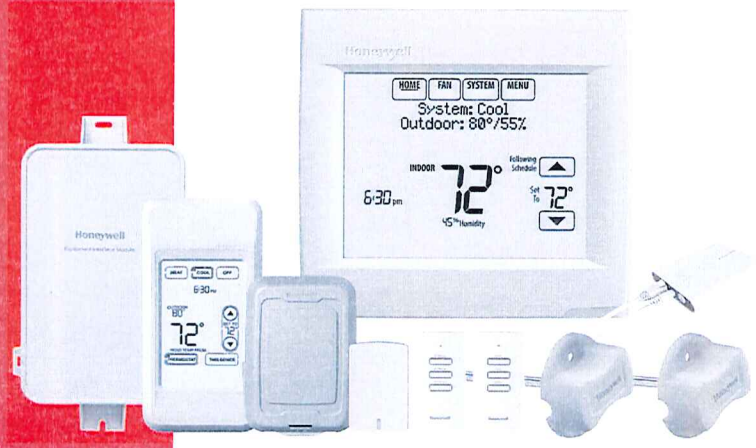
VisionPRO® Series with RedLINK™

Installation Guide



RED LINK Wireless Technology

PRO install

Wired Directly to Equipment

Dual Powered – C Wire or Battery
(C wire or Wire Saver required to use RedLINK accessories)

OR

RedLINK to Equipment Interface Module

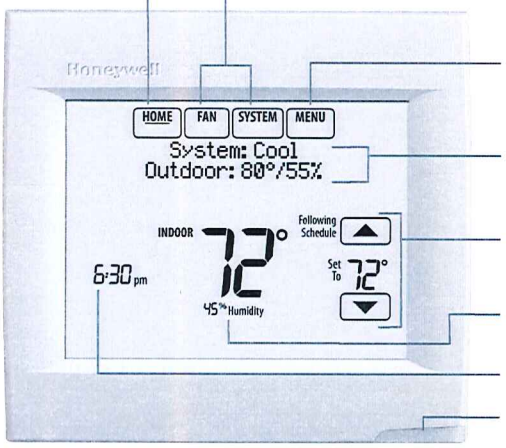
2 Wires for Power or
Battery Only (no wires)

OR

RedLINK to TrueZONE Wireless Adapter

2 Wires for Power or
Battery Only (no wires)

Reference to key features



Current display. Underlined label signifies the current display.

Mode control buttons. Use to change settings for Fan or System Heat/Cool.

Menu. Select options to: set schedules, view equipment status, change IAQ settings, access installer options*, etc.

Current status. Shows system mode (heat/cool), outdoor temperature and humidity (with optional outdoor sensor).

Current schedule. Shows desired temperature and schedule status.

Indoor conditions. Shows indoor temperature and humidity.

Current Time.

Alert Light. On when alert message is active or system is set to Em Heat. Flashes for battery-only power; on continuous for 24 VAC.

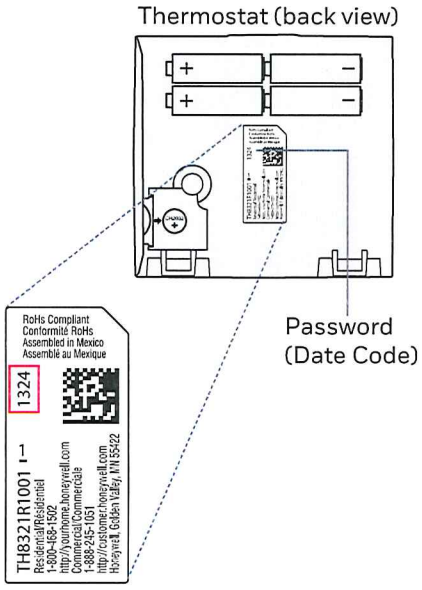
microSD **microSD Card Port.** Use card to load settings and dealer information.

* Password is the date code.

Getting started

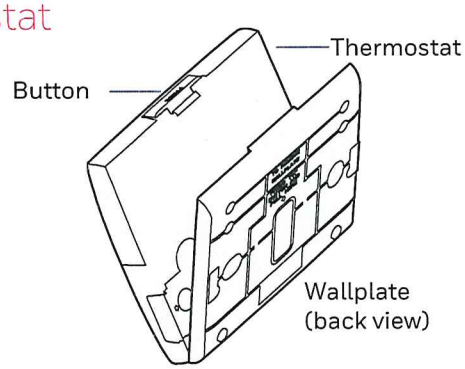
Follow these basic steps to install this thermostat, link it with the wireless accessories, and set installer options.

1. Installing the thermostat
2. Powering optional RedLINK accessories
3. Performing initial setup
4. Finding your password (Date Code)
   - To add or remove RedLINK accessories
   - To make changes to Installer Setup
   - To perform an Installer Test



1 Installing the thermostat

NOTE: For best RedLINK performance, mount thermostats at least 2 feet apart.

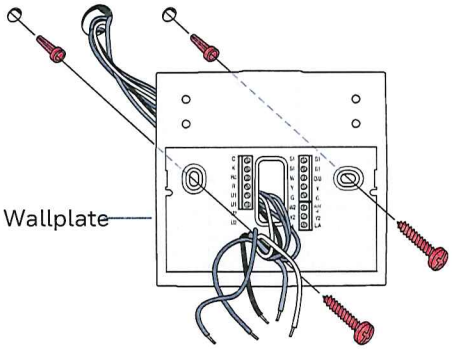


1.1 Separate wallplate from thermostat.
Press button on top and pull to remove the wallplate.

1.2 Mount wallplate as shown.
Mount new wallplate using screws and anchors included with the thermostat.

Drill 3/16-in holes for drywall.

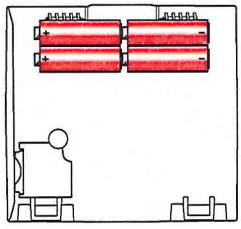
Drill 7/32-in holes for plaster.



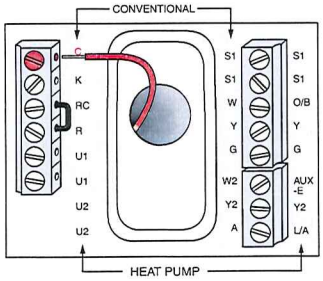
1.3 Connect power.

1.3a Insert supplied AA alkaline batteries for primary or backup power.

NOTE: When the thermostat is NOT used with the Equipment Interface Module or the TrueZONE Wireless Adapter, a C wire is required for RedLINK.

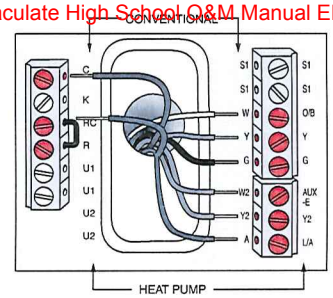

Thermostat (back view)

1.3b For 24VAC primary power, connect common side of transformer to C terminal.

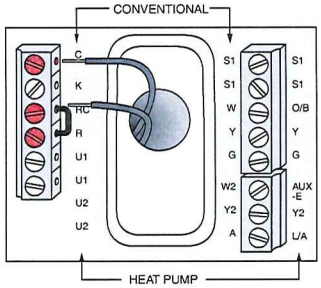


1.4 Wire the thermostat.
Is the thermostat wired directly to the equipment?

- If the thermostat is wired directly to the equipment:
  - a Refer to the table and wiring diagrams on the next page.
  - b Turn on 24VAC **NOW**. 24VAC (C wire) is required to connect RedLINK accessories.



- If the thermostat is used with an Equipment Interface Module or TrueZONE Wireless Adapter, power the thermostat using Rc and C terminals or with batteries.

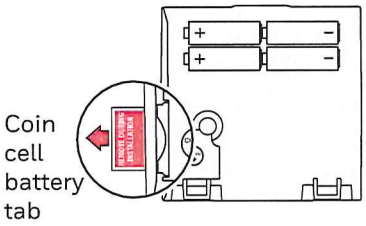


NOTE: The relay outputs and inputs on the thermostat do not function when used with an Equipment Interface Module or TrueZONE Wireless Adapter.

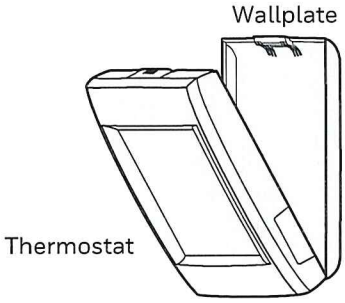
1.5 Remove coin cell battery tab

1.5a Remove tab to activate coin cell battery.

NOTE: Coin cell battery saves time and date during a power loss.



1.6 Mount thermostat on wallplate.
Align thermostat at bottom and snap into place as shown.



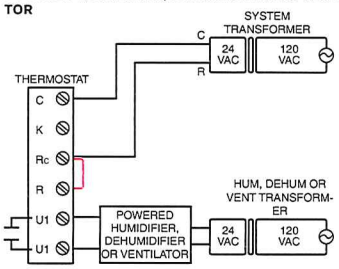
Terminal Designations

Conventional System		Heat Pump	
Terminal	Description	Terminal	Description
C	Common wire from secondary side of cooling transformer (if 2 transformers).	C	Common wire from secondary side of cooling transformer.
Rc*	Cooling power.	Rc	Cooling power.
R*	Heating power.	R	Heating power.
W	Heat Stage 1	O/B	Changeover valve for heat pumps.
W2	Heat Stage 2	AUX-E	Backup Heat/Emergency Heat
Y	Compressor Stage 1	Y	Compressor Stage 1
Y2	Compressor Stage 2	Y2	Compressor Stage 2
G	Fan Relay	G	Fan Relay
A	Connect to Economizer Module or Lighting Panel (TOD).	L/A	Connect to Compressor Monitor, Zone Panel, Economizer Module or Lighting Panel (TOD).
U1 / U1	Universal relay for humidification, dehumidification, ventilation, or a stage of heating/cooling.	U1 / U1	Universal relay for humidification, dehumidification, ventilation, or a stage of heating/cooling.
S1 / S1	Universal input for a wired indoor, outdoor or discharge sensor.	S1 / S1	Universal input for a wired indoor, outdoor or discharge sensor.
K**	Connect to K on Wire Saver module.	K**	Connect to K on Wire Saver module.

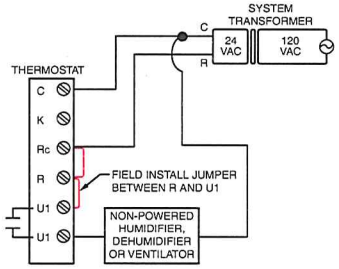
* Remove factory installed jumper for two transformer systems.

** The THP9045A1023 Wire Saver module is used on heat/cool systems when you only have four wires at the thermostat and you would like the thermostat to be powered with a common wire. Use the K terminal in place of the Y and G terminals on conventional or heat pump systems to provide control of the fan and the compressor through a single wire—the unused wire then becomes your common wire. See THP9045 instructions for more information.

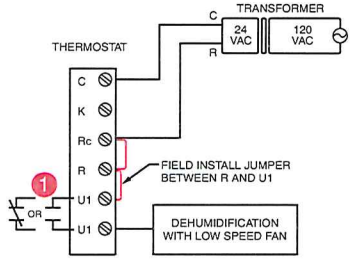
POWERED HUMIDIFIER, DEHUMIDIFIER OR VENTILATOR



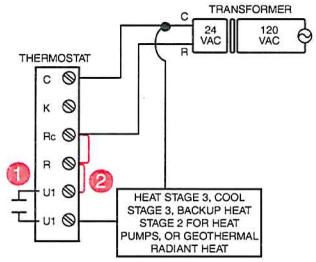
NON-POWERED HUMIDIFIER, DEHUMIDIFIER OR VENTILATOR



DEHUMIDIFICATION WITH LOW SPEED FAN



CONNECTING A HEAT OR COOL STAGE TO U1



1. Wire the thermostat universal relay to the low speed fan for dehumidification control at the equipment. The thermostat relay can be set to normally open or normally closed in the thermostat installer setup.
   - Normally open, dry contacts
   - Normally closed, dry contacts

1. U1 terminals are normally open dry contacts when set up for a stage of heating or cooling.
2. You must install a field jumper if the stage of heating or cooling is powered by system transformer. Do NOT install a field jumper if the stage of heating has its own transformer.

2 Powering optional RedLINK accessories

2.1 Install batteries in RedLINK accessories.

- Portable Comfort Control
- Wireless Outdoor Sensor*
- Wireless Indoor Sensor*
- Wireless Entry/Exit Remote*
- Wireless Vent and Filter Boost Remote*

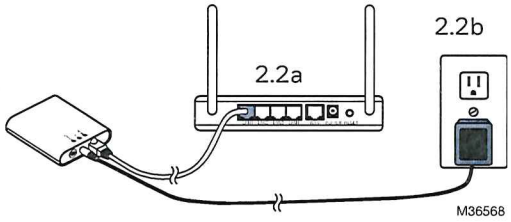
* Requires setup. See Installer Setup options in Step 3.4.

2.2 Connect gateway to internet and connect to power.

2.2a Connect RedLINK Internet Gateway to router or modem with Ethernet cable (RJ45).

2.2b Connect gateway's power cord to an electrical outlet that is not controlled by a wall switch.

NOTE: If the thermostat is wired directly to the equipment, 24VAC (C wire) is required to connect RedLINK accessories. Turn on 24VAC before performing initial setup in Step 3.



3 Performing initial setup

Initial setup options define the type of system you are installing:

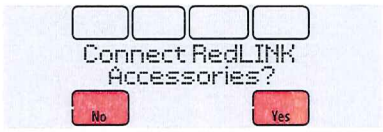
- Residential or commercial
- Non-zoned or zoned
- Used with or without an Equipment Interface Module (THM5421)
- Used with or without the TrueZONE Wireless Adapter (THM4000)

3.1 Follow prompts on the screen to select the appropriate options.

NOTE: If you are connecting the thermostat to the TrueZONE Wireless Adapter (THM4000), refer to the TrueZONE instructions to link the thermostat and RedLINK accessories. Then go to Step 3.4.

3.2 When you see the prompt Connect RedLINK Accessories? Touch No or Yes.

- If you select **No**, continue to Step 3.4.
- If you select **Yes**, you will be prompted to Press Connect on New Accessories. Continue to Step 3.3.



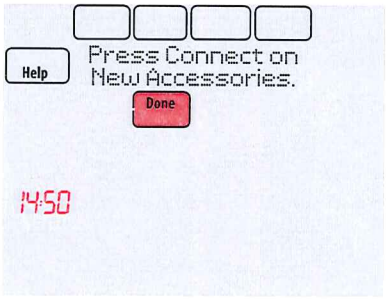
3.3 Connect each RedLINK accessory.

NOTE: Accessories must be at least 2 feet away from the thermostat during the linking process.

3.3a While the Press Connect message is displayed (listening mode), **press and quickly release** the CONNECT button on each new RedLINK accessory.

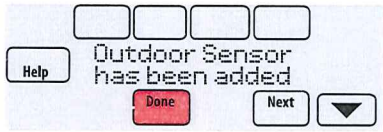
3.3b After a short delay (up to 15 seconds), check thermostat to confirm the connection of each RedLINK accessory. Touch ▲ or ▼ to review the list.

3.3c Touch **Done** at the thermostat after all new RedLINK accessories are connected.



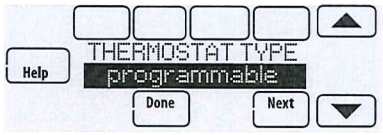
Listening mode

NOTE: Thermostat displays a countdown timer while in the listening mode. If it detects no activity for 15 minutes, it exits listening mode.

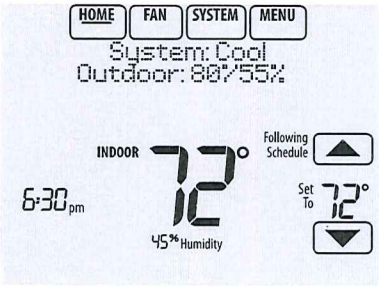


3.4 Finish the initial setup.

Finish the setup by selecting the desired options. Touch **Done** after you select the last option you want to change.



The thermostat now displays its Home screen and the *thermostat setup is complete*.

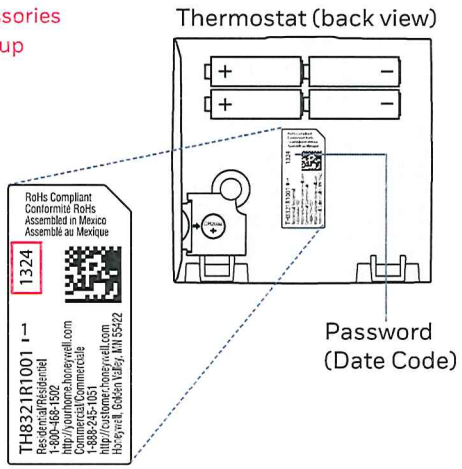


4 Finding your password (Date Code)

- To add or remove RedLINK accessories
- To make changes to Installer Setup
- To perform an Installer Test

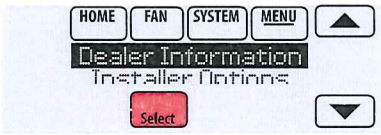
Finding your password

You can find the date code on the back of the thermostat, or

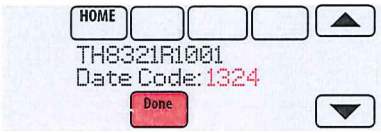


1 Touch **Menu**.

2 Select **Dealer Information**.



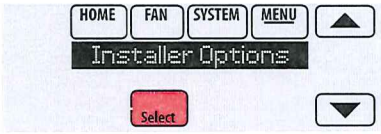
3 Scroll down to see the Date Code.



Linking RedLINK accessories to the thermostat

1 Touch **Menu**.

2 Select **Installer Options**.



3 Enter password (date code) and touch **Done**.

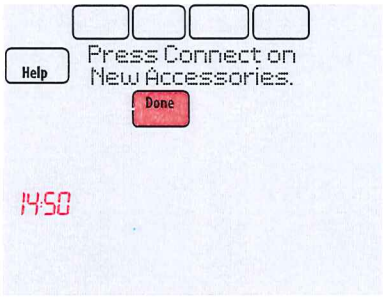
4 Select **Wireless Manager**.

5 Select **Add Device**. The screen displays "Press Connect on New Accessories." The thermostat is now in listening mode.

NOTE: Accessories must be at least 2 feet away from the thermostat during the linking process.

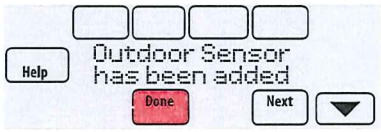
5a **Press and quickly release** the CONNECT button on each new RedLINK accessory.

5b After a short delay (up to 15 seconds), check thermostat to confirm the connection of each RedLINK accessory. Touch ▲ or ▼ to review the list.



Listening mode

5c Touch **Done** at the thermostat after all new RedLINK accessories are connected.



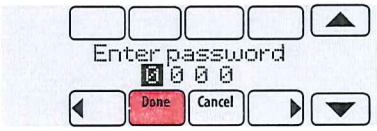
NOTE: Thermostat displays a count-down timer while in the listening mode. If it detects no activity for 15 minutes, it exits listening mode.

Making changes to Installer Setup and performing an Installer Test

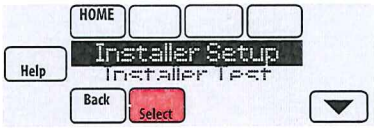
NOTE: Use a microSD card to save set up time. See next page.

1 Touch **Menu**.

2 Select **Installer Options**.



3 Enter password (date code) and touch **Done**.



4 Select **Installer Setup** or **Installer Test**.

5 Follow prompts on the screen to select the desired setup options or to perform an equipment test.

Using a microSD card for setup, data logs and software upgrades

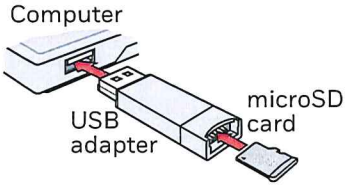
Use a microSD (secure digital) card to save setup time by loading Installer Setup settings, Dealer Information, Holiday Schedules, and Custom Reminders to multiple thermostats. For troubleshooting help, you can save the thermostat Data Logs (Alerts Log and Interaction Log) to a microSD card - then view them on your computer. Also use the microSD card to upgrade the thermostat software.

Loading Dealer Information and New Thermostat Software:

1 Visit http://thermostatsetup.honeywell.com to enter your dealer information or load new thermostat software.

2 Connect a **microSD USB Adapter** to your computer to download the file(s).

3 After the file(s) are downloaded, remove the microSD card from the adapter and insert into thermostat.



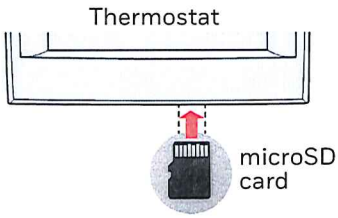
To use the microSD card in the thermostat:

1 Slide card into the bottom of thermostat.

2 Select the item to load or save.

3 Follow the prompts on the screen.
- To add information from the card to the thermostat, select **Load from SD Card**.
- To put thermostat information on the card, select **Save to SD Card**.

4 When you are finished, touch **Done**, then **Home**, and remove the microSD card.

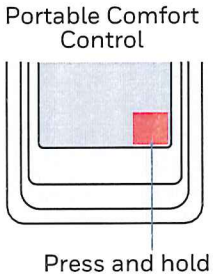


To replace a thermostat

When you replace a thermostat, you must reset the RedLINK accessories before connecting them to the new thermostat. Follow the instructions below:

At the Portable Comfort Control:

Press and hold the blank space (or arrow) in the lower right hand corner of the screen until the display changes (hold for about 4 seconds). Press REMOVE, then YES to disconnect from the old thermostats. To reconnect the thermostat, go to Step 3.2.



At the Indoor Sensor, RedLINK Internet Gateway, Entry/Exit Remote, Vent-Filter Boost Remote or TrueSTEAM Wireless Adapter:

Press and hold the CONNECT button on the accessory until the status light glows amber (hold for about 10 seconds). To reconnect the thermostat, go to Step 3.2.

At the Equipment Interface Module (EIM):

Press and hold the CONNECT button on the EIM until the CONNECTED LED glows amber (hold for about 10 seconds). Follow the prompts on the screen to connect the new thermostat to the EIM.

Operating Ambient Temperature

Thermostat: 32 to 120° F (0 to 48.9° C)
Portable Comfort Control: 32 to 120° F (0 to 48.9° C)
Wireless Outdoor Sensor: -40 to 140° F (-40 to 60° C)
Wireless Indoor Sensor: 0 to 120° F (-17.8 to 48.9° C)
-For Optimal Battery Life: 35 to 114° F (1.7 to 45.6° C)
Equipment Interface Module: -40 to 165° F (-40 to 73.9° C)
Return Air Sensor: 0 to 200° F (-17.8 to 93.3° C)
Discharge Air Sensor: 0 to 200° F (-17.8 to 93.3° C)
RedLINK Internet Gateway: 32 to 120° F (0 to 48.9° C)

Operating Relative Humidity

Thermostat: 5% to 90% (non-condensing)
Portable Comfort Control: 5% to 90% (non-condensing)
Wireless Outdoor Sensor: 0% to 100% (condensing)
Wireless Indoor Sensor: 5% to 90% (non-condensing)
Equipment Interface Module: 5% to 95% (non-condensing)
RedLINK Internet Gateway: 5% to 95% (non-condensing)

Physical Dimensions (height, width, depth)

Thermostat: 4-15/16 x 4-5/8 x 1-1/8 inches (126 mm x 118 mm x 29 mm)
Equipment Interface Module: 9-5/16 x 4-13/16 x 1-19/32 inches (91 x 147 x 42 mm)
Wireless Outdoor Sensor: 5 x 3-1/2 x 1-11/16 inches (127 x 89 x 43 mm)
Wireless Indoor Sensor: 2-7/8 x 1-7/8 x 15/16 inches (74 x 48 x 24 mm)
Portable Comfort Control: 6-1/4 x 3-1/8 x 1-5/8 inches (158 x 80 x 38 mm)
RedLINK Internet Gateway: 3-7/8 x 3-9/16 x 1-1/8 (99 x 91 x 29 mm)

RedLINK Communication

Frequency: 900 Mhz frequency range
Re-Sync Time: RedLINK devices re-establish communication within 6 minutes after AC power resumes.

Electrical ratings

Terminal	Voltage (50/60 Hz)	Max. Current Rating
W - OB	18 to 30 VAC and 750 mVDC	1.00A
Y (cooling)	18 to 30 VAC	1.00A
G (fan)	18 to 30 VAC	0.50A
W2 - Aux (heating)	18 to 30 VAC	0.60A
Y2 (cooling)	18 to 30 VAC	0.60A
A-L/A (output)	18 to 30 VAC	1.00A
U1/U1	30 VAC max.	0.50A

Accessories and replacement parts

Accessories / Replacement Parts	Part Number
Equipment Interface Module	YTHM5421R1010, THM5421R1021
Wireless Adapter for TrueZone, TrueSteam, or extend wireless range of EIM	THM4000R1000
RedLINK Internet Gateway	THM6000R7001
Wireless Entry/Exit Remote	REM1000R1003
Wireless Vent and Filter Boost Remote	HVC20A1000
Portable Comfort Control	REM5000R1001
Wireless Outdoor Sensor	C7089R1013
Wireless Indoor Sensor	C7189R1004
Wired Outdoor Sensor 10k ohm NTC	C7089U1006
Wired Wall-mount Indoor Sensor 10k ohm NTC	C7189U1005
Wired Flush-mount Indoor Sensor 20k ohm NTC	C7772A1004, C7772A1012
Wired Wall-mount Indoor Sensor 20k ohm NTC	TR21
Wired Wall-mount Indoor Sensor 10k ohm NTC	TR21-A
Supply or Return Air Sensor 10k ohm NTC	C7735A1000
Supply or Return Air Sensor 20k ohm NTC	C7041
Supply or Return Air Sensor 20k ohm NTC	C7770A1006
Cover Plate (covers marks left by old thermostats)	THP2400A1019
Wire Saver Module	THP9045A1023

Model Numbering			
Stages	3H/2C HP 2H/2C CONV	3H/2C HP 2H/2C CONV	1H/1C HP 1H/1C CONV
Residential or Commercial	✓	✓	✓
Dual Powered - C Wire or Battery	✓	✓	✓
Onboard Humidity Sensor	✓		
Number of Universal Relays	1	0	0
Number of Universal Sensor Inputs	1	1	1
Economizer / TOD Output	✓	✓	
Works with Optional Equipment Interface Module*	✓	✓	✓
Works with Optional TrueZONE Wireless Adapter*	✓	✓	✓

* The relay outputs and inputs on the thermostat do not function when used with an Equipment Interface Module or the TrueZONE Wireless Adapter.

* If the thermostat has been setup WITHOUT an Equipment Interface Module or the TrueZONE Wireless Adapter and you would like to add one, you must reset the thermostat back to factory defaults. Press **MENU** > **Installer Options** > scroll down to select **Reset to Defaults**.

DISCONNECT POWER BEFORE INSTALLATION. Can cause electrical shock or equipment damage.

This thermostat contains a Lithium battery which may contain Perchlorate material. Perchlorate Material—special handling may apply. See www.dtsc.ca.gov/hazardouswaste/perchlorate

MERCURY NOTICE: If this product is replacing a control that contains mercury in a sealed tube, do not place the old control in the trash. Contact the Thermostat Recycling Corporation at www.thermostat-recycle.org or 800-238-8192 for information on how and where to properly and safely dispose of your old thermostat.

PRO install **Must be installed by a trained, experience technician.** Read these instructions carefully. Failure to follow these instructions can damage the product or cause a hazardous condition.

Need Help?

For assistance please visit
http://customer.honeywell.com,
or call toll-free:
1-800-468-1502 (residential installation)
1-888-245-1051 (commecial installation)

Scan for more information

Home and Building Technologies
In the U.S.:
Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422
http://customer.honeywell.com

Honeywell

69-2760—05 Rev. M.S. Rev. 12-16
Printed in U.S.A.

RED LINK Wireless Technology

69-2760-05

Honeywell

WEB-600

MODELS: WEB-600, WEB-600-O, WEB-600-US, WEB-600-O-US

SPECIFICATION DATA

GENERAL

The WEB-600 is a compact, embedded controller/server platform. It combines integrated control, supervision, data logging, alarming, scheduling and network management functions with Internet connectivity and web serving capabilities in a small, compact platform. The WEB-600 makes it possible to control and manage external devices over the Internet and present real time information to users in web-based graphical views.

The WEB-600 is a member of the WEBs-AX™ suite of Java®-based controller/server products, software applications and tools, which are designed to integrate a variety of devices and protocols into unified, distributed systems. WEBs-AX™ products are powered by the revolutionary Niagara^{AX} Framework®, the industry's first software technology designed to integrate diverse systems and devices into a seamless system. Niagara^{AX} supports a wide range of protocols including LONWORKS®, BACnet®, Modbus®, and Internet standards. The Niagara^{AX} Framework® also includes integrated network management tools to support the design, configuration, installation and maintenance of interoperable networks.

FEATURES

- **Supports open and legacy protocols.**
- **Web User Interface (standard) serves rich presentation and live data to a browser.**
- **Run stand-alone control, energy management, and multi-protocol integration.**
- **Standard and optional communications boards.**
- **Can be expanded with optional 16 and 34 point I/O Modules.**
- **Small compact design is easy to install and supports multiple power options.**
- **Embedded IBM® Power PC Platform.**

APPLICATION

The WEB-600 is ideal for smaller facilities, remote sites, and for distributing control and monitoring throughout large facilities. Optional I/O modules can be plugged in for applications where local control is required. The WEB-600 controller also supports a wide range of field busses for connection to remote I/O and stand-alone controllers. In small facility applications, the WEB-600 controller is all you need for a complete system.

The WEB-600 controller serves data and rich graphical displays to a standard web browser via an Ethernet LAN or remotely over the Internet, or dial-up modem. In larger facilities, multi-building applications and large-scale control system integrations, WEBStation-AX™ software can be used to aggregate information (real-time data, history, alarms, etc.) from large numbers of WEBs-AX™ controllers into a single unified application. The WEBStation-AX™ Supervisor can manage global control functions, support data passing over multiple networks, connect to enterprise level softwa

74-4067-02

applications, and host multiple, simultaneous client workstations connected over the local network, the Internet, or dial-up modem.

Table 1.

Part Number	Description
WEB-600	Based unit including two Ethernet ports, one RS-232 port, one RS-485 port, one USB port, Web User Interface, Niagara^{AX} Connectivity, and oBix™ driver included.
WEB-600-O	WEB-600 with open license (NiCS has accept.wb.in="*")
WEB-600-US	WEB-600 controller manufactured in the USA.
WEB-600-O-US	WEB-600 controller with open license manufactured in the USA.

SPECIFICATIONS

Model: WEB-600 Controller: Base Unit including two Ethernet ports, one RS-232 port, one RS-485 port, one USB port, Web User Interface, Niagara^{AX} Connectivity, and oBix driver.

Platform: IBM® PowerPC® 440 524 MHz processor.
128 MB DDR RAM & 128 MB Serial Flash. Optional 256 MB DDR RAM.
Battery Backup - 5 minutes typical - shutdown begins within 10 seconds.
Real-time clock - 3 month backup maximum via battery.

Communications: 2 Ethernet Ports - 10/100 Mbps (RJ-45 Connectors).
1 RS-232 Port (9 pin D-shell connector).
1 RS-485 non isolated port (3 Screw Connector on base board).

256 MB Memory Upgrade Option: Memory upgrade option (NPM-256) increases memory to 256 MB DDR.

Operating System: QNX® RTOS, IBM J9™ JVM® Java Virtual Machine, Niagara^{AX} 3.1 or later.

Chassis: Construction: Plastic, din rail or screw mount chassis, plastic cover.
Cooling: Internal air convection.
Dimensions: 6.3 in. (160 mm) W x 4.8 in. (122 mm) H (including connectors) x 2.4 in. (61 mm) D.

Temperature Ratings: Operating temperature range: 32° to 122° F (0° to 50° C).
Storage Temperature range: 32° to 158° F (0° to 70° C).

Humidity Rating: 5% to 95% RH, non-condensing.

Approvals: RoHS, BTL (with optional BACnet driver), UL 916, C-UL listed to Canadian Standards Association (CSA) C22.2 No. 205-M1983 "Signal Equipment", CE, FCC part 15 Class A, C-tick (Australia).

Optional Communications Cards: Manufactured in the US

Table 2.

Part Number	Description
DR-LONFT10-AX	Optional 78 Kbps FTT10 A LON® Adapter and LonWorks communication driver. (card and driver bundle).
NBP-LON	Optional 78 kbps FTT10 LON adapter (card only).
NPB-RS232	Optional RS-232 port adapter with 9 pin D-shell connector.
NPB-2X-RS485	Optional dual port RS-485 adapter, electrically isolated.
NPB-MDM	Optional Auto-dial / Auto-answer 56 KBPS modem; consumes one option card slot; cannot be used if NPB-GPRS-H modem is selected.
NPB-GPRS-H	Optional GPRS Modem communications card with SIM card for connection via Wyless network; Wyless is the only approved service provider for the continental US, consumes one option card slot.

Power Supply Options:

Table 3.

Part Number	Description
NPB-PWR-H	Optional: 24 Vac/dc power supply module, Din Rail mounted. Manufactured in the US.
NPB-PWR-UN-H	Optional universal voltage input power supply module, Din Rail mounted. Input voltage is 90 - 263 Volts AC, 50/60 Hz, auto adjusting.
NPB-WPM-US	Optional Wall Power Module. Input 120 Vac, 50-60 Hz. US wall plug power supply.

Optional I/O Modules: Table 4 lists the I/O models that can be connected to the WEB-600. Optionally, IO-16-REM-H can be connected; details can be found in the data sheet 74-5082.

Table 4.

Feature	IO-16 WEB-IO-16	IO-16-US	IO-34 WEB-IO-34	IO-34-US
Manufactured in	China	USA	China	USA
Universal Inputs	8		16	
Relay Outputs	4		10	
Analog Outputs	4		8	
Dimensions (in inches)	3.2W x 4.8H x 2.4D		6.3W x 4.8H x 2.4D	
Dimensions (in mm)	82W x 122H x 61D		160W x 122H x 61D	
Max per WEB-600 controller	4 / 2*		1	

*4 or 2 in combination with IO-34/IO-34-US.

I/O Specifications - All Modules: Connection to WEB-600 Controller is via a single multi-pin plug.

Removable screw terminals (0.2 in. [5.08 mm] centers) for all inputs and outputs.

Universal Input types supported:

Type 3 (10K) Thermistors; Thermistor Sensor Range -10° to +240° F (23° to +116° C). Input accuracy is in the range of +/-1% of span. Others may be supported by entering custom non-linear curve interpolation points for each unique non-linear input.

0 to 10 volt; accuracy is +/- 2% of span, without user calibration; uses an external resistor for current input (four provided, mounted by installer on terminal connections) 4/20 mA current loop; accuracy is +/- 2% of span, without user calibration; self-powered or board-powered sensors accepted.

Dry contact; V open circuit, 300-uA short-circuit current.

Pulsing dry contact at a rate of up to 20 Hz; 50% duty cycle.

Digital Outputs (4 ea.) Pilot Duty.

Form A relay contacts suitable for on/off control only; floating control not supported.

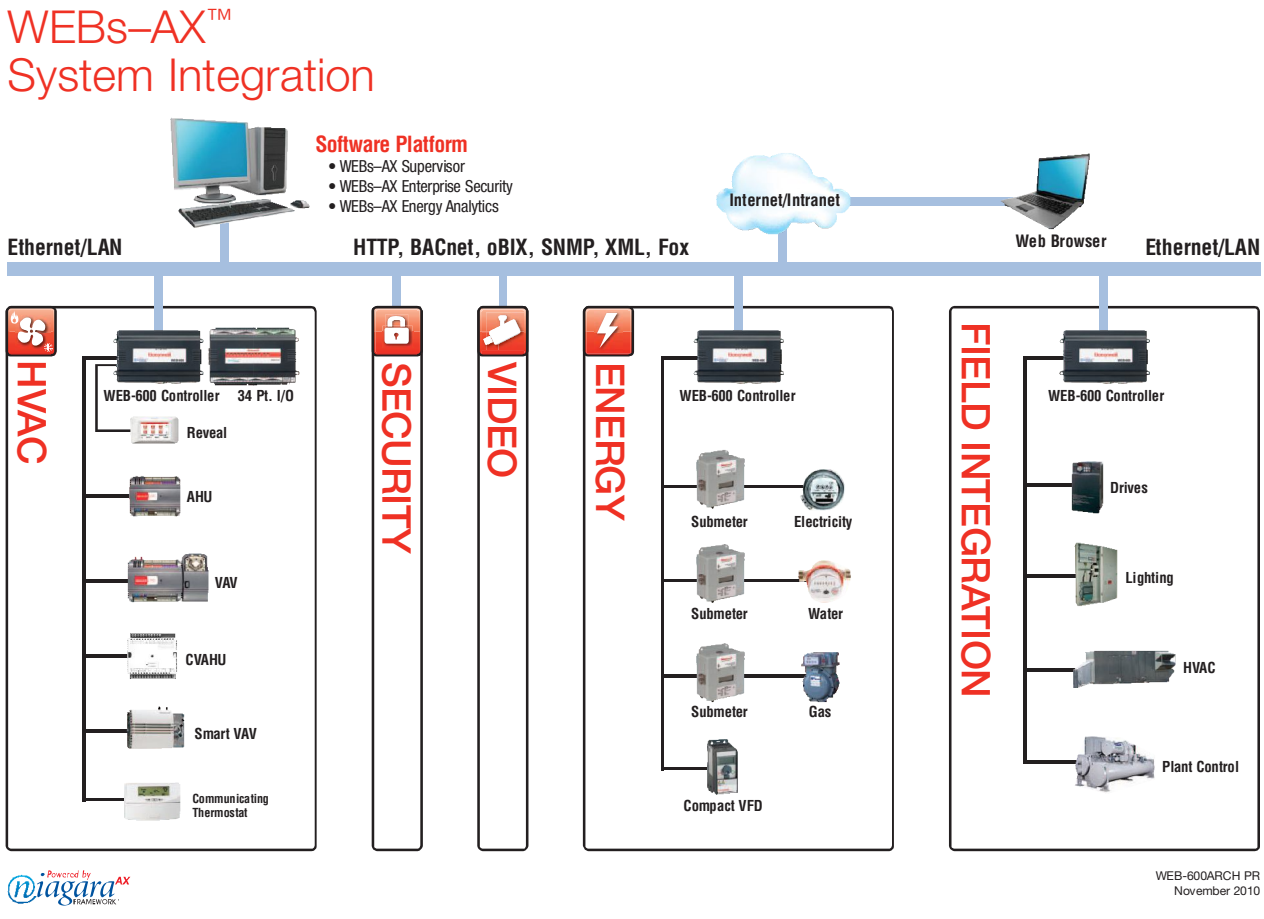
Maximum voltage - 30V DC or AC.

1/2 Amp maximum current rating.

Analog Outputs:

0 -10 Volt DC.

Minimum load supported per output is 2500 ohms minimum or 4 mA drain maximum.



WEB-600ARCH PR
November 2010

WEB-600

Automation and Control Solutions
Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Toronto, Ontario M1V 4Z9
customer.honeywell.com

Honeywell

74-4067—02 T.D. Rev. 11-10
Printed in U.S.A.

NETGEAR®

N300 Wireless Router

Data Sheet

WNR2000

Performance & Use

- N300 WiFi speed—Faster downloads & Internet gaming
- WiFi range for medium-sized homes
- Parental Controls keep your Internet experience safe
- NETGEAR® genie® App—Home networking simplified

The NETGEAR Difference - WNR2000

- NETGEAR® genie®
- Live Parental Controls
- Lifetime Warranty

Overview

The NETGEAR N300 Wireless Router (WNR2000) offers WiFi for work and play. This router delivers high performance wireless speeds of up to 300 Mbps and is a better router for medium-sized homes. The WNR2000 delivers the speed and reliability needed for applications such as online gaming and multimedia streaming and a secure and reliable connection to the Internet. Simultaneous dual band dramatically reduces interference that can cause dropped connections. The WNR2000 includes features such as Live Parental Controls for safer web surfing on connected devices and NETGEAR genie® home network manager for easy installation and home network management.

GET IT ON Google play

Available on the App Store

NETGEAR genie® Home Networking Simplified

- Home network manager
- Makes any printer AirPrint® compatible to print from an iPad® or iPhone®
- MyMedia™—Find & play media files in your network
- EZ Mobile connect—Scan QR code to connect to your home network
- For PC, Mac®, iPhone®, iPad®, & Android™ devices

NETGEAR®

N300 Wireless Router

Data Sheet

WNR2000

Speed

Speed makes HD video better. Speed makes online gaming awesome. Speed makes all your devices really go. And anyplace you need speed, with NETGEAR you got it. Fast download speeds up to 300Mbps. WiFi technology provides whole home coverage. Everything you need for a fast connected home.

Better WiFi Speed

N300 WIFI—Faster downloads & Internet gaming

WiFi Range

Homes come in all shapes and sizes. The NETGEAR N300 Wireless Router provides better WiFi connectivity throughout your home for all your Internet enabled devices.

Better WiFi Range

RANGE—For medium-sized homes

Sharing

Relive memories and share them with others. Find photos, videos and music stored on a shared USB hard drive. If it's secure and shared storage access you want NETGEAR has easy ways to do it.

Share & stream your movies, music, photos

WIRELESS-N—Email, chat, surf, music, video

Reliable Connections

Stay connected—with your devices, your media, and your friends. The advanced QoS technology provides higher priority for media streaming application for smoother HD video streaming and low latency online gaming.

Enjoy better connectivity throughout your home

ADVANCED QoS—Optimized for smooth HD streaming & gaming

NETGEAR®

N300 Wireless Router

Data Sheet

WNR2000

Ease Of Use

NETGEAR makes it easy to do more with your digital devices. Manage your network with genie® App—a personal, icon-based dashboard that can control and monitor all your devices. Or, use Push 'N' Connect to add devices to your WiFi network with a push of a button. And the simple browser-based installation with no CD makes router installation easy using an iPad, tablet, smartphone, or computer.

Simple network management

- EASY INSTALL—Easy setup for iPad®, tablets, smartphones & computers
- NETGEAR GENIE® APP—Personal dashboard to monitor, control & repair your home network
- PUSH 'N' CONNECT—Easy push button WiFi connections (WPS)
- WIFI & POWER ON/OFF—Convenient power savings

Security

Keep your Internet browsing experience safe and secure with the free parental controls. It allows you to limit access to certain web sites at certain times. For example no social networking or gaming site access after dinner time. Guest networks create a completely separate WiFi network for your guests' devices, ensuring they do not have access to your home network or to the shared USB hard drive with all your personal data. Secure WiFi connections offer the highest level of WPA/WPA2 security.

Safeguard your network

- PARENTAL CONTROLS—Safer web surfing for all your connected devices
- GUEST NETWORK ACCESS—Separate & secure access for guests
- SECURE WIFI CONNECTIONS—Highest level wireless security with WPA/WPA2

Applications

With the N300 Wireless Router create a better home network for applications such a fast reliable connection to the Internet and a secure wireless connection.

Ideal Uses

- EMAIL, CHAT, SURF, MUSIC, VIDEO—Enjoy a fast, reliable and secure wireless connection to the Internet
- ONLINE GAMING—Optimized for multi-player gaming with no lags

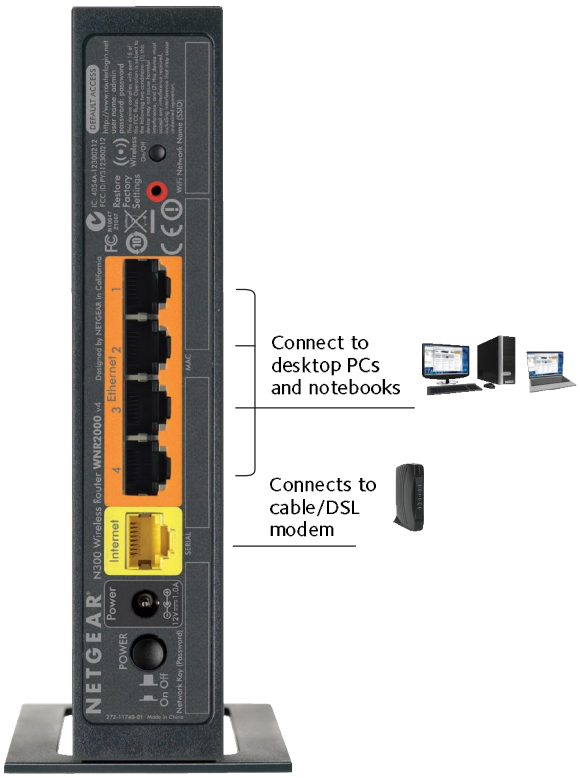
NETGEAR®

N300 Wireless Router

Data Sheet

WNR2000

Connection Diagram



NETGEAR®

N300 Wireless Router

Data Sheet

WNR2000

Package Contents

- N300 Wireless Router (WNR2000v4)
- Stand
- Ethernet cable
- Power adapter
- Quick install guide

Physical Specifications

- Dimensions: 7 x 5.1 x 2.1 in (178 x 130 x 54 mm)
- Weight: 0.62lb (0.28kg)

Warranty

- Lifetime Warranty (For full warranty details go to www.netgear.com/lifetimewarranty)

Support

- 24/7 basic technical support for 90 days from date of purchase

Technical Specifications

- Wi-Fi transmitters/receivers (Tx/Rx)—2x2 (2.4 GHz)
- Simultaneous Dual Band—runs 2.4 and 5GHz bands concurrently
- Supports Wireless Multimedia (WMM) based QoS
- IPv6 Support (Internet Protocol Version 6)

Standards

- IEEE 802.11 b/g/n 2.4 GHz
- Five (5) 10/100 (1 WAN and 4 LAN) Ethernet ports with auto-sensing technology

System Requirements

- Broadband (cable, DSL) Internet service and modem with Ethernet connection
- 802.11 b/g/n 2.4 GHz wireless adapter or Ethernet adapter and cable for each computer
- Microsoft® Windows® 7, 8, Vista®, XP, 2000, Mac® OS, UNIX®, or Linux®
- Microsoft® Internet Explorer® 5.0, Firefox® 2.0 or Safari® 1.4 or higher
- Use with an N300 Wireless USB Adapter (WNA3100) for maximum performance

Security

- Wi-Fi Protected Access® (WPA/WPA2—PSK) and WEP
- Double firewall protection (SPI and NAT firewall)
- Denial-of-service (DoS) attack prevention
- DMZ for secure gaming

†Maximum wireless signal rate derived from IEEE standard 802.11 specifications. Actual data throughput and wireless coverage will vary. Network conditions and environmental factors, including volume of network traffic, interference, and building construction may lower actual data throughput and wireless coverage. NETGEAR makes no express or implied representations or warranties about this product's compatibility with any future standards.

This product is packaged with a limited warranty, the acceptance of which is a condition of sale. This product has been tested for quality assurance and it or its components may have been recycled.

NETGEAR, Inc. 350 E. Plumeria Drive, San Jose, CA 95134-1911 USA, 1-888-NETGEAR (638-4327), E-mail: info@NETGEAR.com, www.NETGEAR.com

data SHEET

BAS Router — BACnet® Multi-Network Router

The BAS Router provides stand-alone routing between BACnet networks such as BACnet/IP, BACnet Ethernet, and BACnet MS/TP — thereby allowing the system integrator to mix BACnet network technologies within a single BACnet internetwork. The BAS Router has two physical communication ports. One is a 10/100 Mbps Ethernet port and the other is an optically isolated MS/TP port. Router configuration is accomplished via a web page.

Versatile Routing Between …

- BACnet/IP and BACnet MS/TP
- BACnet Ethernet and BACnet MS/TP
- BACnet/IP and BACnet Ethernet
- BACnet/IP and BACnet Ethernet and BACnet MS/TP
- Two BACnet/IP networks

IP Network Support

- Web server for commissioning and troubleshooting
- Communication diagnostic web page
- BACnet/IP Broadcast Management Device (BBMD)
- Foreign Device Registration (FDR)

Flexible Communications

- 10/100 Mbps Ethernet with auto-negotiation and Auto-MDIX
- Optically isolated MS/TP port
- MS/TP baud rates range from 9.6–76.8 kbps
- Jumper-selectable MS/TP bias and termination

Convenient Installation

- 24 VAC/VDC (± 10%), 47–63 Hz input voltage
- Din-rail mounted

BASautomation®

BAS Router — BACnet® Multi-Network Router

The BAS Router is housed in a metal case that mounts on 35-mm DIN-rail and is powered from a 24 VAC/VDC (± 10%) source. There is one MS/TP port and one 10/100 Mbps Ethernet port.

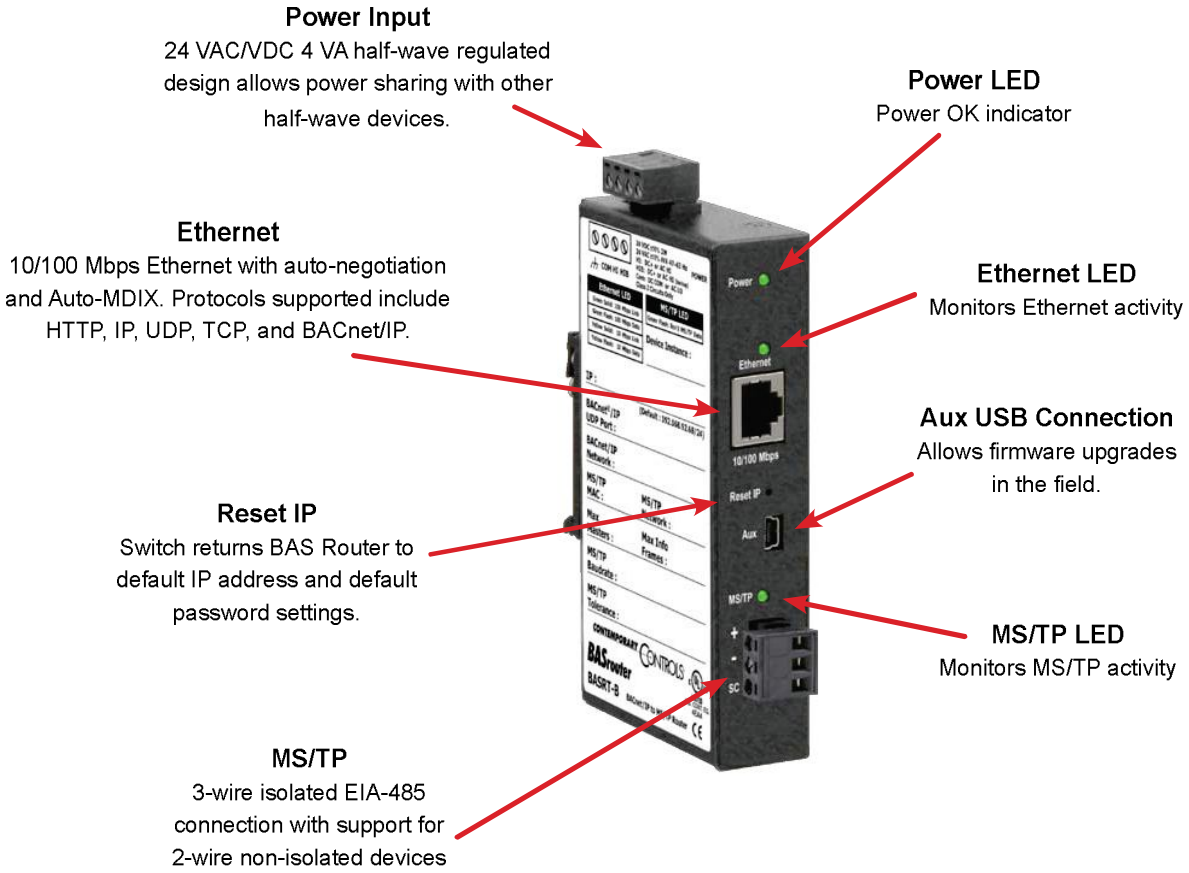
The MS/TP port offers an optically-isolated transceiver. It has a removable 3-pin terminal block for the EIA-485 connection. Logically, 255 devices can be addressed, but physically, the number of devices depends upon device loading.

Up to 31 full-load EIA-485 devices can share the same MS/TP bus segment as the BAS Router. For half-load devices, there can be 62. All MS/TP standard baud rates are supported — from 9.6 to 76.8 kbps.

The Ethernet port offers a shielded RJ-45 connector. Through auto-negotiation and Auto-MDIX, it automatically matches connections to the attached equipment. Therefore, either straight-through or crossover CAT5 cable can be used for hook-up.

A resident web server allows for commissioning, and troubleshooting via a standard web browser. A reset switch is provided on the router to return the unit to the factory default IP address. Three LEDs are provided: The power LED glows green when proper power is provided. A bicolour Ethernet LED glows green for 100 Mbps operation and yellow for 10 Mbps and indicates activity by flashing. A green LED flashes with MS/TP activity.

Internal MS/TP bias and termination jumpers allow flexible bias and termination options. They can be removed for mid-span installations.



Web Page Configuration

CONTEMPORARY CONTROLS

BASRT-B Configuration

Device Name	BASRT-B0050b6
Device Instance	0
Ethernet Network	0
BACnet/IP UDP Port 1	BAC0
BACnet/IP Network 1	1
IP Address	192.168.92.68
IP Subnet	24
IP Gateway	192.168.92.1
MS/TP MAC	00
MS/TP Network	2001
Max Masters	127
Max Info Frames	100
MS/TP Baudrate	38400
MS/TP Tolerance	Strict / Lenient

Advanced | Status | Security

Save Changes

MAC Address 00-50-DB-00-50-B6

Firmware Revision 2.6.9

CONTEMPORARY CONTROLS

Advanced BASRT-B Configuration

BBMD Enable	
BBMD UDP Port	Primary
Accept FDR	

Broadcast Distribution Table

Foreign Device Table

Secondary BACnet/IP UDP Port	0000
Secondary BACnet/IP Network	0
Public IP Address	0.0.0.0

Save Changes

BAS Router Parameters Main Settings

Device Parameters	*Default Value*	*Description*
Device Name	BASRT-Bxxxxxx	The unique default value ends with the last 6 characters of the unit's Ethernet MAC address. You can edit it to be up to 20 characters.
Device Instance	0	The router device instance is a 22-bit decimal value (0–4,194,303). Each BACnet device has a unique device instance.
BACnet Ethernet Parameter	***Default Value***	***Description***
BACnet Ethernet Network	0	16-bit decimal value (1–65534). Each BACnet network, regardless of technology, must have a unique network number. By retaining the default value of 0, BACnet Ethernet routing is disabled.
BACnet/IP Parameters	***Default Value***	***Description***
BACnet/IP UDP Port	BAC0	16-bit hex value (0–FFFF) is set to BAC0 as the default value and should be used. All BACnet/IP devices on the same BACnet network must have the same UDP port assignment. For other assignments choose ports in the range from BAC1 to BACF while verifying that these ports are available.
BACnet/IP Network	1	16-bit decimal value (1–65534). Each BACnet network, regardless of technology, must have a unique network number. It is recommended that all subnets of the same BACnet/IP network be given the same BACnet network number as well.
IP Address	192.168.92.68	IP address in dotted decimal format. Select a valid address in the range from 0.0.0.1 through 255.255.255.254.
IP Subnet	24	Decimal value (0–30) in the "slash" notation is the number of bits with a "1" in the mask. The default value of 24 corresponds to 255.255.255.0 in the dotted decimal format. All devices on the same subnet which communicate via BACnet/IP should use the same subnet mask.
IP Gateway	192.168.92.1	IP Gateway address in dotted decimal format. Select a valid address in the range from 0.0.0.1 through 255.255.255.254.
MS/TP Parameters	***Default Value***	***Description***
MS/TP MAC Address	0	Decimal value (0–127) represents the MAC address of the router's MS/TP port. Lower MAC address numbers are preferred.
MS/TP Network	2001	16-bit decimal value (1–65535). Each BACnet network, regardless of technology, must have a unique network number.
Max Masters	127	This 8-bit decimal value (1–127) represents the highest master MAC address in the MS/TP network. If the highest value MAC address is unknown or if additional devices are to be added in the future above the current highest MAC address, use the default setting of 127.
Max Info Frames	100	This is the maximum number of messages (1–100) that can be routed onto the MS/TP network by the router per token pass. Values above 20 are typical.
MS/TP Baud Rate	38400	The baud rate of the MS/TP network can be 9600, 19200, 38400 or 76800 bps. All MS/TP devices on the same MS/TP network must use the same baud rate. Auto-bauding devices will set their baud rates to that of the BAS Router.
MS/TP Tolerance	Lenient	Affects the degree to which interoperability with devices is successful. Lenient option causes less efficient traffic but optimises interoperability.

BAS Router Parameters Advanced Settings — BBMD

BBMD Parameters	*Default Value*	*Description*
BBMD Enable	Unchecked	Check to enable BACnet/IP Broadcast Management Device (BBMD).
BBMD UDP Port	Primary	Normally the primary port is selected. The secondary port is used in very special applications.
Accept FDR	Checked	Uncheck to disable foreign devices from registering with this router.
Secondary BACnet/IP UDP Port	0000	Enter secondary UDP port as a 16-bit hex value (0-FFFF) when operating with two BACnet/IP BACnet networks. In this caseuse BAC1 if it is available.
Secondary BACnet/IP Net	0	Assign a unique network number from all other BACnet networks.
Public IP Address	0.0.0.0	Enter the public IP address in dotted decimal format of the IP router in the system.

BAS Router Additional Tables and Screens

Table or Screen Name	*Description*
Broadcast Distribution Table (BDT)	This table must contain the entries of any other BBMDs located on the network. The IP address and subnet mask of the BBMDs must be listed.
Foreign Device Table (FDT)	This table is automatically lists all the foreign devices that have registered with this router. Information includes IP address, port number, time-to-live, and remaining time on its lease.
Status Screen	Displays a log of events (automatically refreshed each second) to facilitate troubleshooting. Use this information when discussing any routing issues with Contemporary Controls' technical support.
Security Screen	Authentication menu. Allows the user to change user name and password. Depressing the Reset IP button restores user name and password to default settings.

BACnet Protocol Implementation Conformance (PIC) Statement

CONTEMPORARY CONTROLS

BAS Router

BACnet Multi-network Router

BACnet Protocol Implementation Conformance Statement (Annex A)

Date: 17 February 2012
Vendor Name: Contemporary Controls
Product Name: BAS Router
Product Model Number: BASRT-B
Applications Software Version: **Firmware Revision:** 2.6 **BACnet Protocol Revision:** 2
Product Description: Device to route between BACnet/IP, ISO 8802-3 and MS/TP networks.

BACnet Standardized Device Profile (Annex L):
- ☐ **BACnet Operator Workstation (B-OWS)**
- ☐ **BACnet Building Controller (B-BC)**
- ☐ **BACnet Advanced Application Controller (B-AAC)**
- ☐ **BACnet Application Specific Controller (B-ASC)**
- ☐ **BACnet Smart Sensor (B-SS)**
- ☐ **BACnet Smart Actuator (B-SA)**

List all BACnet Interoperability Building Block Supported (Annex K):
DS-RP-B Data Sharing — ReadProperty – B
DM-DDB-B Device Management — Dynamic Device Binding – B
NM-RC-B Network Management — Router Configuration – B

Segmentation Capability:
- ☐ Able to transmit segmented messages Window Size:
- ☐ Able to receive segmented messages Window Size:

Standard Object Types Supported:

Object Type Supported	Can Be Created Dynamically	Can Be Deleted Dynamically
Device	No	No

No optional properties are supported. **NOTE:** The above object is directed supported on the router. The router will pass to the appropriate network all BACnet communications not directed to the router.

Data Link Layer Options:
- ☒ BACnet IP, (Annex J)
- ☒ BACnet IP, (Annex J), Foreign Device
- ☒ ISO 8802-3, Ethernet (Clause 7)
- ☐ ANSI/ATA 878.1, EIA-485 ARCNET (Clause 8), baud rate(s):
- ☒ MS/TP master (Clause 9), baud rate(s): 9600; 19,200; 38,400; 76,800
- ☐ MS/TP slave (Clause 9), baud rate(s):
- ☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s):
- ☐ Point-To-Point, modem, (Clause 10), baud rate(s):
- ☐ LonTalk, (Clause 11, medium:
- ☐ Other:

Device Address Binding:
Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☐ Yes ☒ No

Networking Options:
- ☒ Router, Clause 6 — routing between BACnet/IP, ISO 8802-3, and MS/TP
- ☐ Annex H, BACnet Tunnelling Router over IP
- ☒ BACnet/IP Broadcast Management Device (BBMD)
  Does the BBMD support registrations by Foreign Devices? ☒ Yes ☐ No

Character Sets Supported:
Indicating support for multiple character sets does not imply that they can all be supported simultaneously.
- ☒ ANSI X3.4
- ☐ IBM™/Microsoft™ DBCS
- ☐ ISO 8859-1
- ☐ ISO 10646 (UCS-2)
- ☐ ISO 10646 (UCS-4)
- ☐ JIS C 6226

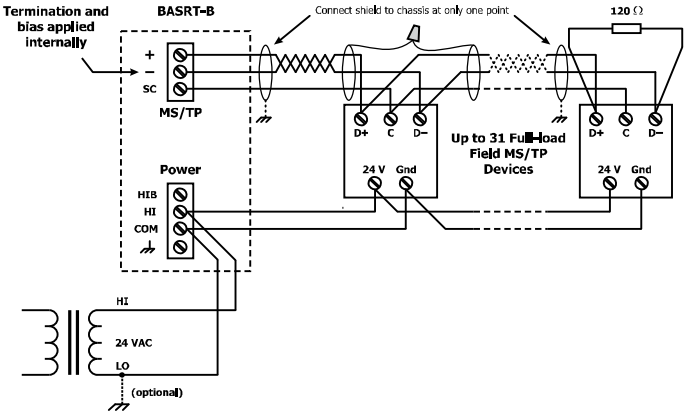
If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports:
No gateway support.

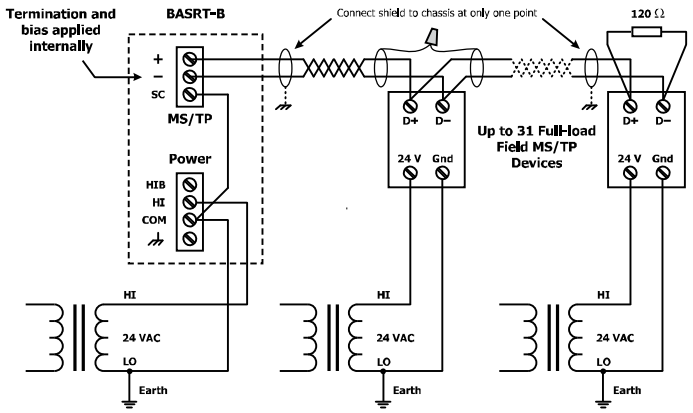
17 February 2012 TD071200-0XD

Wiring Diagrams

Since the BAS Router incorporates a half-wave rectifier circuit, it can share the same 24 VAC power with other half-wave rectified devices. It can also be powered from a 24 VDC source. A redundant power connection exists for back-up power schemes.

The BAS Router incorporates a 3-wire optically-isolated EIA-485 interface for the MS/TP connection, allowing better circuit protection and noise immunity. To connect to other 3-wire devices simply make a one-to-one connection to the other devices. But when connecting to 2-wire non-isolated devices, the signal common (SC) on the BAS Router must share the reference used by the 2-wire devices. This is accomplished by tying the SC pin to COM on the BAS Router and by grounding the low-side of each power supply on all connected devices. In this way all EIA-485 transceivers share the same earth reference. Notice that the SC pin is signal common and not a shield pin.

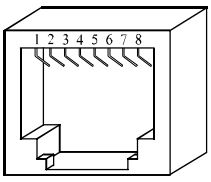




Connector Pin Assignments

Ethernet

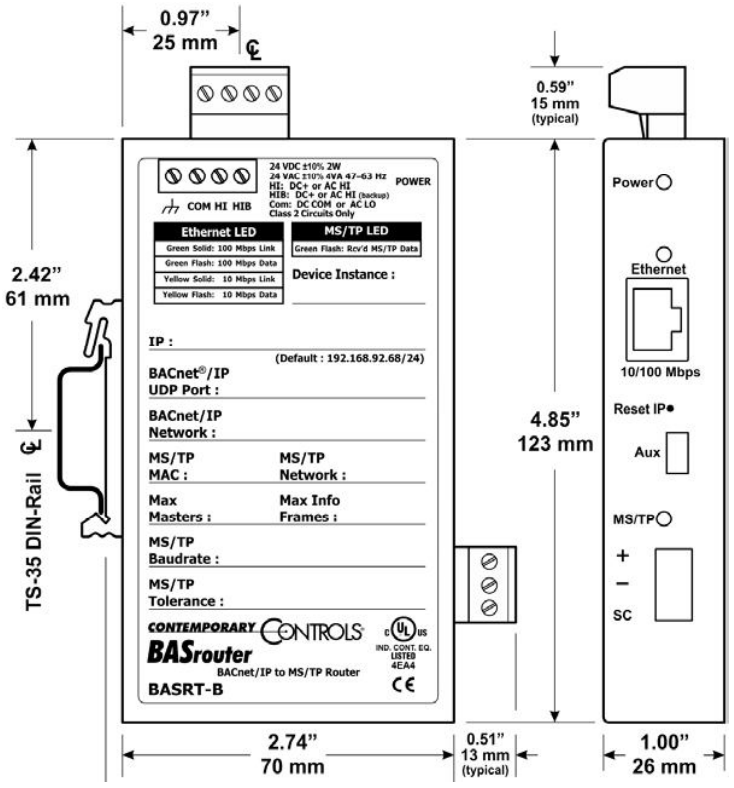
Pin	Function
1	Signal 1
2	Signal 2
3	Signal 3
4	N/C
5	N/C
6	Signal 4
7	N/C
8	N/C



MS/TP

Pin	Function
+	Signal High
–	Signal Low
SC	Signal Common

Mechanical Drawing



Specifications

Power Requirements	24 VDC ±10% 2 W or 24 VAC ±10% 4 VA 47–63 Hz	
Operating Temperature	0°C to 60°C	
Storage Temperature	–40°C to 85°C	
Relative Humidity	10–95%, non-condensing	
Protection	IP30	
Ethernet Communications	IEEE 802.3 10/100 Mbps data rate 10BASE-T, 100BASE-TX physical layer 100 m (max) CAT5 cable length	
MS/TP Communications	ANSI/ASHRAE 135 (ISO 16484-5) 9600, 19200, 38400, 76800 bps data rate EIA-485 physical layer 1200 m (max) cable length	
LEDs	Power	Green = power OK
	Ethernet	Green = 100 Mbps Yellow = 10 Mbps Flash = activity
	MS/TP	Flashing Green = receive activity
Regulatory Compliance	CE Mark; CFR 47, Part 15 Class A; RoHS UL 508, C22.2 No. 142-M1987	

Ordering Information

Model	***RoHS***	***Description***
BASRT-B	✔	BAS Router BACnet multi-network router DIN-rail mount

United States
Contemporary Control Systems, Inc.
2431 Curtiss Street
Downers Grove, IL 60515
USA

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Fax:+1 630 963 0109

info@ccontrols.com
www.ccontrols.com

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Science & Technology Industrial Park
New District, Suzhou
PR China 215009

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Fax: +86 512 68093760

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www.ccontrols.asia

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Coventry CV5 6SP
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Fax:+44 (0)24 7641 3923

info@ccontrols.co.uk
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Germany

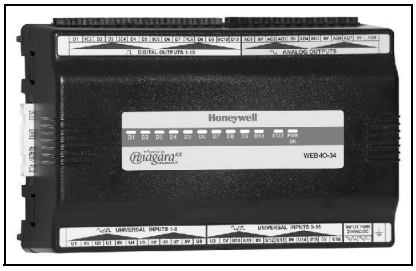
Tel: +49 341 520359 0
Fax: +49 341 520359 16

info@ccontrols.de
www.ccontrols.eu

Honeywell

WEB-IO-34 Input/Output Module

INSTALLATION INSTRUCTIONS



GENERAL

This document covers the mounting, wiring, and initial start-up of WEB-IO-34 expansion module. It assumes that you are an engineer, technician, or service person who is performing control system installation using the Niagara Framework®. Please read this entire document before beginning the installation procedures.

This document does not discuss software installation or station configuration. For more information on these topics, refer to the documents listed in the RELATED DOCUMENTATION section.

PRODUCT DESCRIPTION

The Honeywell WEB-IO-34 is a compact direct WEB-IO module for auxiliary monitoring and control when used with a WEB-201 series controller or other controller platforms as identified in their respective data sheets. This option expands the controller an additional 34 logic-controlled points. Included are 16 universal inputs, 10 form “A” (SPST) relay outputs and 8 analog (voltage only) outputs. This greatly expands the controller monitoring and control capabilities with fast, reliable, direct inputs and outputs for monitoring power, temperature, humidity and status. In addition, the WEB-IO-34 provides power to the attached controller using either an externally-supplied 24 Vac transformer or 24 Vc power supply.

The on-board I/O can be used to monitor pulse contacts from power/demand meters, analog sensors, or transducers, as well as to control energy-consuming devices such as fans, lights or pumps with digital relay outputs. Also included are 8 analog outputs to proportionally control dampers, valves and other devices.

A maximum of one WEB-IO-34 module may be used per WEB-201 controller. However, 2 additional WEB-IO-16 modules can also be used, to provide a total of 32 UIs, 18 relay outputs, and 16 analog output points.

BEFORE INSTALLATION

1. Unpack the WEB-IO-34 Compact Direct Expansion Module.
2. Inspect contents of the package for damaged or missing components.
3. Check the equipment and report any damage to a Honeywell representative at once and return any damaged components for immediate repair or replacement. See RETURNING A DEFECTIVE UNIT section.
4. Read all of these instructions and ensure they are understood.

Included in this Package

Included in this package you should find the following items:

- One WEB-IO-34 module, with grounding wire having a quick-disconnect 0.187 in. (4.75 mm) female connector.
- WEB-IO-34 INSTALLATION INSTRUCTIONS, literature no. 95-7724.
- One 15-position terminal plug and three 12-position terminal plugs, for I/O wiring.
- One 2-position terminal plug, for 24 Vac power.
- Sixteen 499-ohm resistors for 4-20 mA inputs.

Materials and Tools Required

The following tools and supplies are required for installation:

- A suitable power source, as one of the following:
  - UL listed, Class 2, 24 Vac transformer, rated a minimum of 8.5 VA to 20 VA (approximate range of WEB-201 with WEB-IO-34 alone, to fully-expanded unit with 2 additional WEB-IO-16 modules and other option boards). A *dedicated* transformer is required (cannot power additional equipment).
  - 24 Vdc power supply, capable of supplying at least 1 A (24 W).
- DIN rail, type NS35/7.5 (35 mm x 7.5 mm) recommended for mounting with WEB-201 controller. The DIN rail should be sufficient length to accommodate both the WEB-201 controller and WEB-IO-34 module. See Fig. 2.
- Suitable screws and screwdriver for mounting DIN rail, or if DIN rail not used, for mounting bases of WEB-201 controller and WEB-IO-34 module.
- Small flat-blade screwdriver: used for mounting or removing the WEB-IO-34 module from DIN rail, also for screw terminals on I/O connectors and 24 V power connector.

95-7724

SAFETY INSTRUCTIONS

NOTES REGARDING DEVICE DESCRIPTION

These instructions include guidelines for use and mounting of the device. In case of questions that cannot be answered with these instructions, please consult the product supplier or manufacturer. It is the responsibility of the equipment installer to ensure that all federal, state and local codes are followed.

SAFETY INSTRUCTIONS

- Keep these Installation Instructions for industrial safety and the prevention of accidents.
- The information in these instructions must be read and understood by every person using this device.
- The following items share warnings of a general nature relating to the installation and start-up of the WEB-201 series controller.
- Be sure to heed these warnings to prevent personal injury or equipment damage.

⚠ WARNING

- **A 24 Vac or 24 Vdc circuit powers the WEB-IO-34 module and attached WEB-201 controller. Disconnect power before installation or servicing to prevent electrical shock or equipment damage.**
- **Make all connections in accordance with national and local electrical codes. Use copper conductors only.**
- **To reduce the risk of fire or electrical shock, install in a controlled environment relatively free of contaminants.**
- **WEB controllers and I/O modules are only intended for use as monitoring and control devices. To prevent data loss or equipment damage, do not use for any other purposes.**

Static Discharge Precautions

The following items are cautionary notes that will help prevent equipment damage or loss of data caused by static discharge.

⚠ CAUTION

- **Static charges produce voltages high enough to damage electronic components. The microprocessors and associated circuitry within WEB-IO-34 modules are sensitive to static discharge. Follow these precautions when installing, servicing or operating the system:**
- **Work in a static free area.**
- **Discharge any static electricity you may have accumulated. Discharge static electricity by touching a known securely grounded object.**
- **Do not handle the printed circuit board (PCB) without proper protection against static discharge. Use a wrist strap when handling PCBs, with the wrist strap clamp secured to earth ground.**

I/O Module Connection Precautions

⚠ CAUTION

- **Avoid "hot" plug-in or removal of any WEB-IO module from the controller (or other accessory module), meaning first remove power from the unit. If the unit switches to battery operation, wait for all LEDs to go out.**
- **Plugging or unplugging a WEB-IO module from a powered WEB controller should not cause damage to either the controller or WEB-IO module hardware. However, note that all WEB-IO modules are initialized upon station startup and if not (continuously) present following a power cycle, will be inoperable.**
- **Do not plug in more than (2) WEB-IO-16 modules into a single WEB-201 controller. Doing so will have unexpected effects on the software, and may overload the power supply.**
- **WEB-IO modules are designed to be directly plugged into the WEB-201 controller or directly attached modules. Do not use a ribbon cable or extend the length of the I/O cable as this will increase radiated signal noise, decreasing analog stability, and may introduce communication problems.**

INSTALLATION AND START-UP OUTLINE

NOTE: If installing the WEB-201 controller and WEB-IO-34 module at the same time, refer to the WEB-201 INSTALLATION INSTRUCTIONS guide literature no. 95-7722 to install the WEB-201 controller. In this case, the WEB-IO-34 module is typically the "approved power source", used *in place* of a WEB-NPB-PWR module. A maximum of 2 additional WEB-IO-16 modules are supported. See Fig. 2.

The major steps to installing and starting the WEB-IO-34 module are outlined as follows:

1. Physically mount the WEB-IO-34 module with the WEB-201 controller. See MOUNTING section. Make sure that the I/O input connector is properly seated into the I/O connector on the WEB-201 controller (or if used, another WEB-IO-16 module). Refer to the previous I/O Module Connector Precautions section.
2. Make wiring connections for earth ground, 24 Vac power and I/O wiring. See WIRING section.
3. Apply power and perform an initial checkout. See POWER UP AND INITIAL CHECKOUT section.

MOUNTING

The following applies to mounting a WEB-IO-34 module with a WEB-201 controller:

- The units may be mounted in any orientation. It is not necessary to remove the covers before mounting.
- Mounting on a 1.4 in. (35 mm) wide DIN rail is recommended. Both the WEB-201 unit base and the WEB-IO-34 unit base have a molded DIN rail slot and locking clip as does the WEB-IO-16 expansion module. Mounting a DIN rail ensures accurate alignment of connectors between all modules.
- If DIN rail mounting is impractical, screws in mounting tabs may be used on the WEB-201 controller and then in the WEB-IO-34 module. Mounting tab dimensions are shown in Fig. 1.

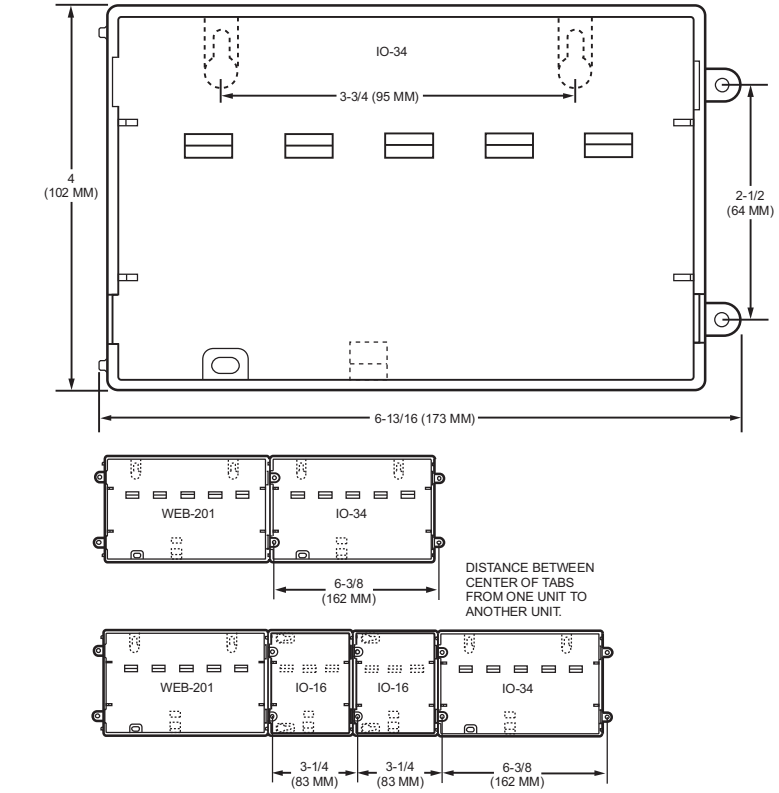


Fig. 1. Tab mounting dimensions in inches (mm).

Procedure 1 provides step by step mounting instructions for the WEB-IO-34 module on an existing installed DIN rail.

NOTES: If the WEB-201 controller is already in use:

a. Back up its configuration to your PC using Niagara AX™ Workbench 3.n.nn. This is done using a platform connection to the controller, using the backup command in the **Platform Administration** view.

b. Turn off the power to the controller and disconnect the power cord. Be sure that all of the LEDs are off. Make sure that the controller is not running off of battery power.

c. Remove any other power source: NPB-WPM-US (wall mount) or WEB-NPB-PWR (DIN mount) module. **Do not reconnect a NPB-WPM-US** (wall mount module) after installing and powering the WEB-IO-34 module. The WEB-IO-34 should be the only power source for the WEB-201 controller.

Procedure 1. Din rail mount.

Step 1	Remove the bottom I/O connector plug(s) that cover the plastic DIN locking clip.
Step 2	Position the WEB-IO-34 module on the rail, tilting to hook DIN rail tabs over one edge of the DIN rail. (See Fig. 2)
Step 3	Use a screwdriver to pry down the plastic locking clip, and push down and in on the WEB-IO-34, to force the clip to snap over the edge of the DIN rail.
Step 4	Slide the WEB-IO-34 module along the DIN rail to connect its 20-position plug into WEB-201 controller (or if used, another WEB-IO-16 module). With all modules connected, the WEB-IO-34 module is at one end. Make sure that all modules are firmly seated.
Step 5	To keep this assembly from sliding on the DIN rail, secure the WEB-IO-34 (last module) with clips provided by the DIN rail vendor, or place a screw in one of the mounting tabs in the base of the WEB-IO-34 module.

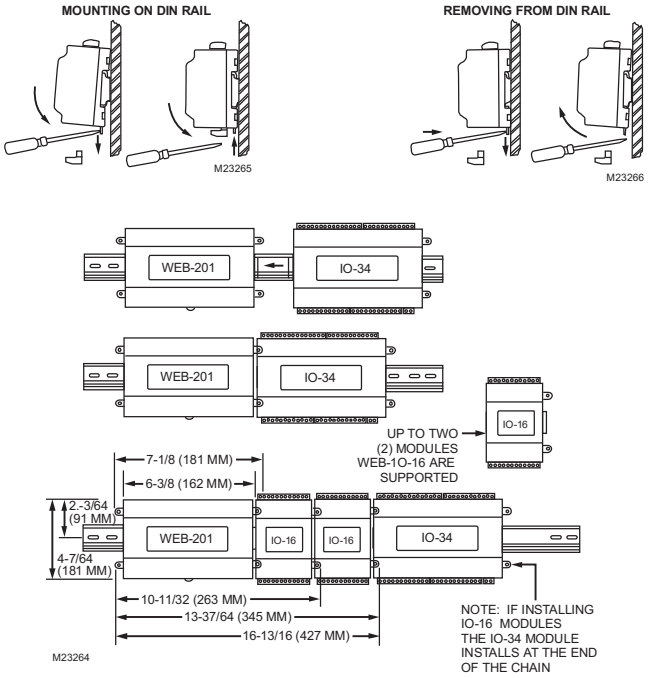


Fig. 2. WEB-IO-34 Module mounting details.

NOTE: To remove WEB-IO-34 module from DIN rail, slide it away from other modules. Insert a screwdriver in the center plastic locking tab and pull downwards, then lift the unit outwards. It may be necessary to remove an I/O connector plug as shown at the top of Fig 2.

BOARD LAYOUT AND TERMINAL LOCATIONS

The WEB-IO-34 module provides 16 universal inputs supporting analog inputs (temperature, resistance, voltage and current) and digital inputs (contact closure, pulse count) and 18 outputs: 10 relay (24 Vac/cd, 0.5 A max.) outputs and 8 analog outputs (0-10 Vdc). Wiring terminal positions are shown in Fig. 3 along with LED locations.

WIRING

See Fig. 3 to locate connectors and other components on the controller.

Make connections to the WEB-IO-34 controller in the following order.

1. Connect the earth ground wire (with spade connector) from the earth ground lug on the WEB-IO-16 module to a nearby earth ground point. See GROUNDING section for details.
2. Prepare power wiring (leave the unit powered off). See Power Wiring section for details.
3. Connect I/O wiring. See Inputs and Outputs sections.
4. Apply power to the unit. See POWER UP AND INITIAL CHECKOUT sections.

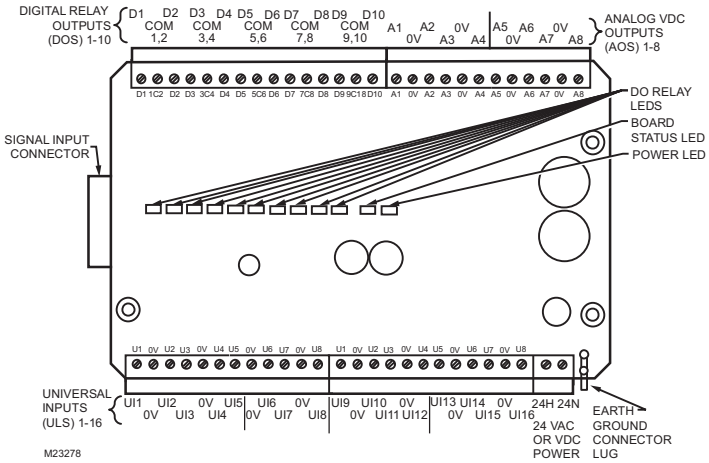


Fig. 3. WEB-IO-34 Wiring terminal locations.

Grounding

An earth ground spade lug 0.187 in. (4.75 mm) is provided on the base of the WEB-IO-34 module (as well as the WEB-201, WEB-IO-16 controller) for connection to earth ground. For maximum protection from electrostatic discharge or other forms of EMI, connect each earth ground using a #16 AWG or larger wire. Keep these wires as short as possible.

See Fig. 4 for the location of the earth grounding wire for WEB-IO-34.

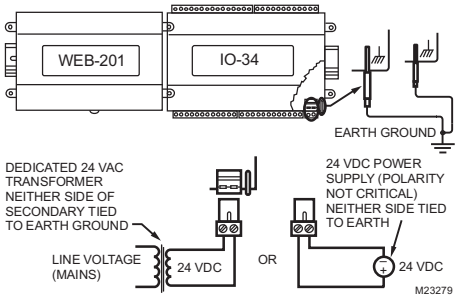


Fig. 4. WEB-IO-34 earth ground connection.

Power Wiring

The WEB-IO-34 module can be powered by wiring to a **dedicated** Class 2, 24 V transformer, or to a 24 Vdc power source. The WEB-IO-34 provides power to the attached WEB-201 controller and up to two attached WEB-IO-16 modules (if used).

NOTE: If powering from a 24 V transformer, do not power other equipment with it. Otherwise, conducted noise problems may result. Also, do not ground either side of the transformer's 24 V secondary.

Power consumption depends on installed accessories and option cards, and may vary from:

- WEB-201 controller with WEB-IO-34 module alone: approximately 8.5 VA (AC) or 8.5 W (DC)
- WEB-201 with WEB-IO-34, 2 additional WEB-IO-16 modules, plus option boards: up to 20 VA (AC) or 20 W (DC).

As shown in Fig. 4, the WEB-IO-34 module's 2-position power connector is located at the lower corner of the unit. Unplug the connector from the module and make connections to it as shown.

NOTE: Do not apply 24 V power (reinsert connector plug into the WEB-IO-34) until all other wiring is completed, including WEB-IO-34 inputs and outputs. See POWER UP AND INITIAL CHECKOUT section.

Inputs

Each of the 8 universal inputs (UI) can support any one of the following:

- Type-3 10K ohm Thermistor (also see Note in Resistive 0-100k ohms section)
- Resistive 0-100K ohms
- 0-10 Vdc
- 4-20 mA
- Binary Input

Thermistor

The inputs support 10K Thermistor temperature sensors using a **ThermistorInputPoint**. Input accuracy is in the range of ±1% of span. By default, conversion is for standard Type 3 thermistor sensor, with a sensor range of -10° to 135° F (23.3° to 57.2° C). Using a conversion type of "Tabular Thermistor", a different thermistor response curve can be specified by importing a thermistor curve.xml file. Currently, the Ndio module contains an xml folder with thermistor curves for a Radio Shack sensor model 271-0110 and TE-6300 10K type sensor. Customized thermistor xml files may be edited or exported (for reuse). See the Niagara AX Ndio Guide for more details. Fig. 5 shows the wiring diagram.

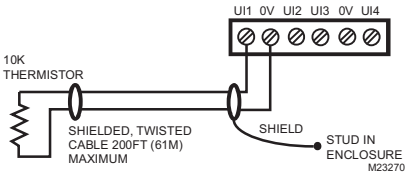


Fig. 5. Thermistor wiring.

Resistive 0-100K ohms

The inputs can read a resistive signal within a range from 0 to 100,000 ohms. Wiring is the same as shown for a Thermistor temperature sensor. See Fig. 5.

Resistive signals require a **ResistiveInputPoint**.

NOTE: UI inputs are optimized to provide the best resolution around the 10K ohm range. For a sensor with a range far from 10K ohms (such as 100-ohm type), resolution will be poor. To use such a sensor, it is recommended a transmitter that produces a Vdc or mA signal be installed. Wire the transmitter to the UI according to the 0-10 Vdc or 4-20 mA instructions.

0-10 Vdc

The inputs support self-powered 0-10 Vdc sensors. Input impedance is greater than 5K ohms. 0-10 volt accuracy is ±2% of span, without user calibration. Fig. 6 shows the wiring diagram. 0-10 Vdc sensors requires a **VoltageInputPoint**.

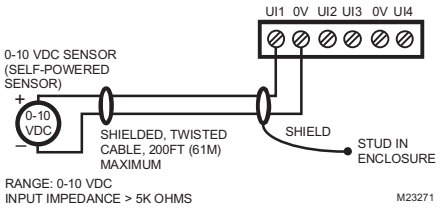


Fig. 6. 0-10 Vdc wiring.

4-20 mA

The inputs support self-powered 4-20 mA sensors. Input accuracy is ±2% of span, without user calibration. Fig. 7 shows the wiring diagram, which requires a 499 ohm resistor wired across the input terminals. 4-20 mA sensors also require the **VoltageInputPoint**.

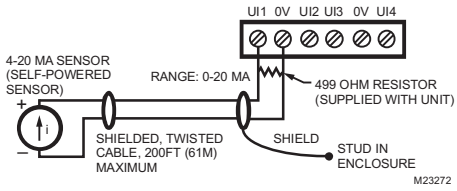


Fig. 7. 4-20 mA wiring.

Binary Input

The universal inputs support both pulse contacts and normal dry (equipment status) contacts.

- Pulse contacts may have a change-of-state (COS) frequency of up to 20 Hz with a 50% duty cycle.

NOTE: Minimum dwell time must be >25 ms. (Contacts must remain open at least 25 ms and be closed at least 25 ms)

- Standard dry contacts must have a 1 Hz (or less) COS frequency, with minimum dwell time >500 ms. (Contacts must remain open at least 500 ms and be closed at least 500 ms)

Both types of dry contacts support 3.3 Vdc open circuits or 330 µA short-circuit current.

Fig. 8 shows the wiring diagram. For a pulse diagram contact use the **CounterInputPoint** in the station database. For other dry contacts, use the **BooleanInputPoint**.

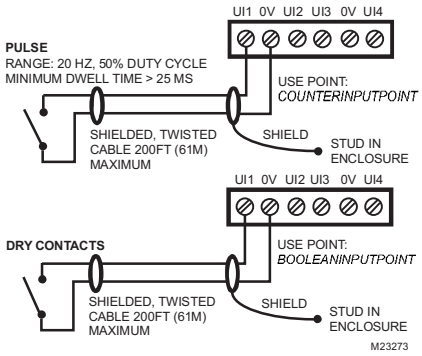


Fig. 8. Binary input wiring.

Outputs

The WEB-IO-34 module has 10 digital relay outputs and 8 0-10 volt analog outputs.

Relay Outputs

Each relay output is rated at 24 Vac or Vdc at 0.5 A. Relay outputs have MOV (metal oxide varistor) suppressors to support inductive type loads such as heavy duty relay coils.

⚠ WARNING

Relays are not rated for AC mains (line level) powered loads (instead, 24 V maximum). Never use the controllers power transformer to power I/O loads. Using controller transformer introduces potentially damaging switching transients into the controller.

Use a **BooleanOutputWritable** in the station for each output. Fig. 9 shows an example wiring diagram.

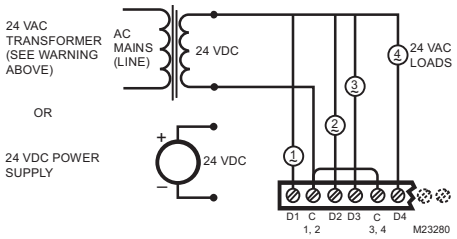


Fig. 9. Relay output wiring diagram.

NOTE: 15-position DO connector plug has 5 common terminals “C” (1 -2, 3 - 4, 5 - 6, 7 - 8, 9 - 10), which are isolated from each other. This can be useful when powering loads from different 24 Vac sources.

A yellow LED status indicator for each relay (D1 - D10) is located on the board (Fig. 3), and also visible through the cover. Under normal operation, each digital status LED indicates activity as follows:

- **Off** - relay open/no current flows.
- **On** - relay closed/load current flows.

Therefore, an **On** status indicates that the load is powered.

Analog Outputs

Analog Outputs (AO) are referenced by the terminals labeled A*n* and 0 V (ground). Each AO can supply a maximum of 4 mA over the entire 0 to 10 Vdc range. The minimum input impedance of a device controlled by an AO must be greater than 2500 ohms. Typical wiring for an AO is shown in Fig. 10.

For each AO, use a **VoltageOutputWritable** in the station database.

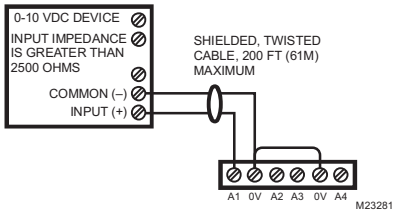


Fig. 10. Analog output wiring diagram.

SOFTWARE DESCRIPTION

In the Niagara station interface to the WEB-201 controller, each I/O module appears as one **NdioBoard** under the station's **NdioNetwork**. If a WEB-201 controller has only one WEB-IO-34 module, the NdioNetwork has a single **NdioBoard** component, where the "Io Port" property of the **NdioBoard** is 1. See Fig. 10, top.

Upon discovery, if the WEB-201 controller has multiple WEB-IO-16 modules, the module closest to the WEB-201 controller is the first **NdioBoard** (property Io Port **1**), the next module in the chain is **NdioBoard1** (property Io Port **2**), and the third module is **NdioBoard2** (property Io Port **3**). See Fig. 11, bottom.

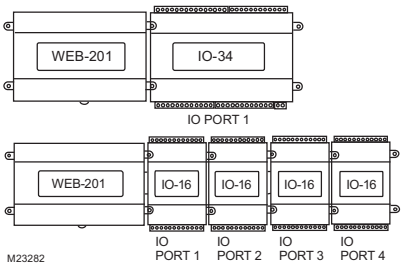


Fig. 11. WEB-201 controller NdioBoard (port) assignment.

Once the operating system identifies the NDIO processors, the I/O board status LED on each WEB-IO module turns green. The green status LED means that the controller is able to communicate with the I/O. It does not indicate anything about the status of the Niagara station or its Ndio components.

NOTE: Any time a powered WEB-IO module's status LED is not lit, all outputs are in "failsafe" state (all relay outputs OFF, and all AOs are at a 0-volt level). See Fig. 3 for location of the WEB-IO-16 status LED.

Each type input or output used requires a special Niagara Direct Input/Output (Ndio) point to be added in the station database. These components act as the station interface to the physical I/O points. The Ndio points needed for each input or output type are noted in previous wiring sections in **boldface**.

For Ndio component details, see the Ndio Guide in Niagara AX online Help, or the same document in PDF.

POWER UP AND INITIAL CHECKOUT

1. Plug in the 24 V connector plug to apply power. The WEB-IO-34 board and status LED will initially be Off (Fig. 3), but the Power LED on the WEB-IO-34 should be lit. Allow the controller sufficient time to boot (at least 2 minutes).
2. Upgrade the controller firmware if necessary (if controller has a Niagara build earlier than the Workbench). Using a Workbench, open a platform connection to the controller. Use the **Commissioning Wizard** to do this. For more details, see the JACE® Niagara AX Install and Startup Guide, also available in the Workbench online HELP (doc Jace Startup). Make sure to install the Ndio software module.
3. Verify that the WEB-IO-34 board status LED is now lit to green.
4. Using WorkBench, open the station (if running), or open a platform connection and start the station using **Station Director**.
5. If not already present, add an NdioNetwork component to the station's Drivers Container and use "Manager" views and "Learn Mode" to discover and add Ndio components to the station database. See SOFTWARE DESCRIPTION section. For more details about Ndio components, refer to the Ndio Guide, also available in Workbench online Help (doc Ndio).

RELATED DOCUMENTATION

For more information on configuring and using WEB-201 series controllers, consult the following documents:

- WEB-201 Installation Instructions.
- JACE Niagara AX Install and Startup Guide
- Niagara AX Ndio Guide
- Niagara AX User Guide
- WEB-IO-16 Installation Instructions

REPLACEMENT PARTS

Servicing the WEB-IO-34 modules may call for replacement parts. There are two categories of parts:

- Standard Replacement Parts
- New Replacement Units

Standard Replacement Parts

Standard replacement parts are listed in Table 1 and can be ordered from stock without restriction. Standard replacement parts cannot be returned for credit and should be disposed of in an appropriate manner.

Table 1. Standard replacement parts.

Part Number	Description
10149	Resistor, 499 ohm, 1%, 0.6 w
10600	Connector plug, 15-position screw terminal, 180 deg. (1 used for DOs)
10599	Connector plug, 12-position screw terminal, 180 deg. (3 used: 2 for UIs, 1 for AOs)
10598	Connector plug, 2-position screw terminal, 180 deg. (1 used for 24 V power)
10370	Grounding wire with quick-disconnect 0.187 in. (4.75 mm) female connector

New Replacement Units

To replace a faulty unit, order and install a new WEB-IO-34 accessory module.

NOTE: WEB-201 series products do not have special "field replacement units", or FRU's, with separate part numbers.

If the faulty WEB-IO-34 module is still in warranty credit may be received by returning it to Honeywell. Be sure to contact Honeywell for a return authorization (RA) number before shipping an item for return credit. See RETURNING A DEFECTIVE UNIT section for details.

NOTE: Before ordering a new WEB-IO-34 module, it is strongly recommended that normal technical support resource be used to eliminate the possibility of a software issue or mis-configuration problem.

MAINTENANCE

Module Replacement

⚠ CAUTION

Before handling circuit boards, discharge any accumulated static by touching the nearby earth grounding point. For details, see Static Discharge Precaution section.

To replace the WEB-IO-34 accessory module in the field, proceed as follows:

Procedure 2. Accessory Module Replacement.

Step 1	Using the appropriate Niagara software tool, back up the controller configuration to your PC.
Step 2	Remove power to the WEB-IO-34 controller. The unit should power down automatically.
Step 3	Record positions of all I/O wiring going to the WEB-IO-34. If necessary, label connectors to avoid mis-connection later (after WEB-IO-34 module is replaced).
	NOTE: The software that runs on the WEB-201 controller expects the terminal positions to be the same in the replacement WEB-IO-34 module, in order to collect data from or to control the attached devices.
Step 4	If any I/O points have voltage, turn the devices off, or disconnect power to them.
Step 5	Unplug all connectors from the WEB-IO-34 module, including all I/O connectors and earth ground wire.
Step 6	Remove any screws or DIN rail clips securing the WEB-IO-34 module, removing it from its mounting.
Step 7	Mount the replacement WEB-IO-34 module as it was previously, using the same DIN rail location and/or screws.
Step 8	Reconnect the earth ground wire to the grounding lug.
Step 9	Reconnect all I/O connectors to the WEB-IO-34 module.
Step 10	If any of your I/O points have voltage, turn the devices back on, or reconnect power to them.
Step 11	Restore power to the WEB-IO-34 module and perform a checkout using Niagara AX Workbench (see POWER UP AND INITIAL CHECKOUT section).
Step 12	For more details, see the Niagara AX Ndio Guide and JACE Niagara AX Install and Startup Guide.

RETURNING A DEFECTIVE UNIT

NOTES: If the defective unit is under warranty, follow return instructions provided in this section. If the unit is out of warranty, discard the unit.

— Do not return an out-of-warranty WEB-IO-34 module to Honeywell.

— There is no "return for repair-and-return" service available for any of the WEB-201 series products.

For proper credit on an in-warranty unit, ship the defective unit to Honeywell within 30 days.

Prior to returning the unit, contact one of the Honeywell offices to obtain a return authorization (RA) number and other instructions. See last page of document for Honeywell contact information. Please provide:

- Product model
- Serial number
- Number of the defect
- Nature of defect

Automation and Control Solutions

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Honeywell

95-7724 J.I. 03-06

Honeywell

RedLINK™ Driver Option Card NPB-2X-RedLINK

INSTALLATION INSTRUCTIONS

APPLICATION

This document covers the mounting and wiring of the RedLINK Driver option card in a WEB-201, CP-201, WEB-600 or WEB-7XX series controller. Refer to the RedLINK Operating Guide form 31-00002 for details on setting up a RedLINK thermostat network.

IMPORTANT:

The RedLINK driver has only been tested with a single option card on a WEBs controller, connected to two RedLINK wireless adaptors. In addition, Honeywell has only tested the driver with up to ten thermostats connected per wireless adaptor. Until further testing is completed, Honeywell does not recommend using the RedLINK driver with more than 20 thermostats connected to a WEBs controller (with 10 max per wireless adaptor), or using more than one option card per Jace.

Table 1. RedLINK Driver Option Description.

Description	Notes
RedLINK option card adaptor with two ABCD terminal blocks for connection up to two wireless adaptors, part THM4000R1000.	The RedLINK option card can be placed in option slot 1, and the addresses are Com 3 and Com 4; or in slot 2, and the addresses are Com 5 and Com 6. See Fig. 2 for location of option slots.

For related mounting and wiring details, please see the Mounting and Wiring Instructions document, form no. 95-7722.

CONTENTS

Included in this package are the following items:

- One RedLINK option card, for wiring to a RedLINK wireless adaptor part THM4000R1000.
- This RedLINK Driver Installation Instructions.

MATERIAL AND TOOLS REQUIRED

The following tools and supplies may be required for installation:

- #2 phillips screwdriver: use to install the RedLINK Driver.

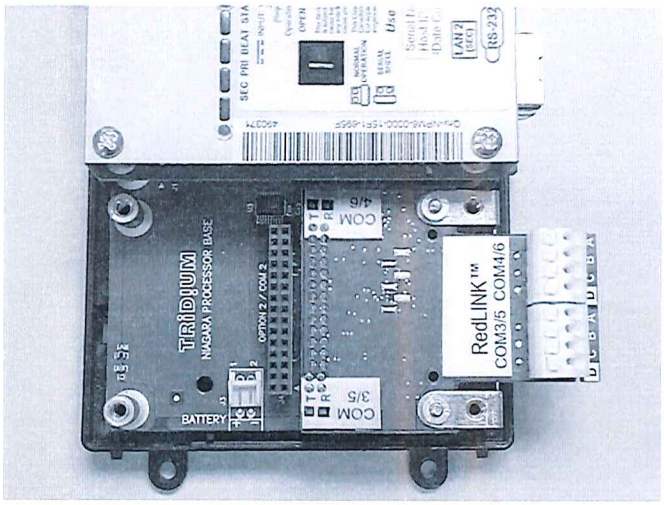

Fig. 1. RedLINK Driver Option Card.

MOUNTING

⚠ WARNING

Power to the controller must be off when installing or removing option cards or damage will occur! Also, be very careful to plug any option card into its connector properly (pins aligned).

Mount the RedLINK option card in slot 1 and set your COM ports in the driver to COM3 or COM4, to match the label next to the terminal block you are using on the option card.

Mounting RedLINK Driver option card on a controller

1. Remove power — See the above warning.
   a. Remove the cover. To do this press the four tabs on both ends of the unit and lift the cover off.

NOTE: **If accessory modules are plugged into the controller, you may have to unplug them to get to the cover tabs.**

2. Note the labeling on the RedLINK card:

a. It should be placed in option slot 1 and the addresses are Com 3 and Com 4.
b. If slot 2 is used, the addresses are Com 5 and Com 6.

3. Remove the battery and bracket assembly (if installed) by taking out the four screws holding it in place and set them aside for later. Unplug the battery from the connector on the controller (See Fig. 2).

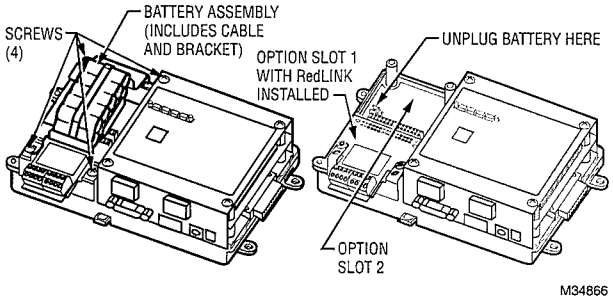

Fig. 2. Remove Screws and Battery Assembly.

4. Remove the blanking end plate for the slot the option card will be installed into (retain the blanking end plate in case the option card is removed at a later date).
5. Carefully insert the pins of the RedLINK Driver into the socket of the appropriate option card slot. The mounting holes on the option board should line up with the standoffs on the base board. If they do not, the connector is not properly aligned. Press until the option card is completely seated.
6. Place the end plate over the connector/standoffs (See Fig. 3).

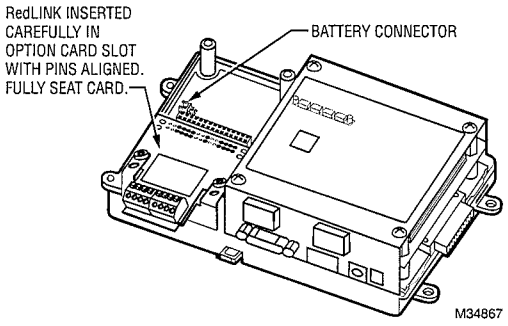

Fig. 3. RedLINK Driver Inserted, End Plate on Top.

7. Plug the battery cable into the battery connector on the controller (See Fig. 3 for location).
8. Set the battery and bracket assembly back over the option card slots, with the mounting holes aligned with the standoffs.
9. Place the four screws through the battery bracket, end plates and into the standoffs on the controller base board. Hand tighten these screws (see Fig. 4).

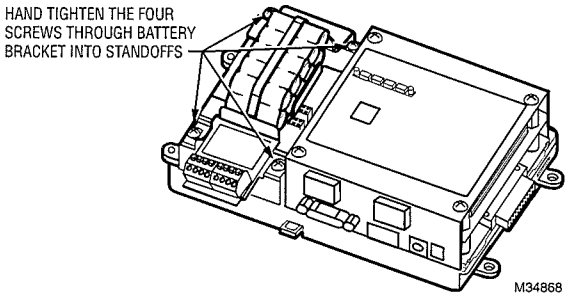

Fig. 4. Re-Fasten Screws through Battery Bracket.

10. Replace the cover. If accessory modules were unplugged, plug them back into the controller as before and secure.

WIRING

Connect the A, B, C, and D terminals on the wireless adapter to the A, B, C, and D terminals on the option card using the push-in quick connect terminals. Wireless gateways can be installed up to 100 ft. from the WEBs controller using CAT-3 wire, and up to 50 ft. using 18-24 AWG (UL rating not required) discrete wiring or thermostat wire.

⚠ WARNING

The two COM ports on each card use a common power supply. If a short occurs on the wiring to one adaptor, it will also short the power to the second adaptor.

LEDS

Two LEDs are visible on the top of the RedLINK Driver option card (cover must be removed):

- RX (green) — Receive, indicates RedLINK wireless adapter device is transmitting a message.
- TX (yellow) — Transmit, indicates that the controller is transmitting a message to the RedLINK adapter.

These LEDs are included on the top label of the RedLINK option card (see Fig. 1). Under normal operation, Rx and Tx LEDs will blink once every 15 seconds.

Automation and Control Solutions
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Honeywell

31-00001—02 M.S. Rev. 12-13
Printed in United States

Honeywell

Adaptateur sans fil RedLINK™

Remarque importante :

Il n'y a pas de mode d'emploi pour ce produit.

Prière de consulter les manuels qui accompagnent les appareils compatibles pour obtenir de l'information sur l'installation et l'utilisation. (Il est également possible de télécharger les manuels à partir du site Web ci-dessous.)

Ce produit s'utilise avec :

- Le module d'interface avec le matériel (EIM) de Honeywell
- Le tableau TrueZONE™ de Honeywell
- L'humidificateur TrueSTEAM de Honeywell
- D'autres appareils compatibles RedLINK™

Vous faut-il de l'aide ?

Pour obtenir de l'assistance concernant ce produit, visitez
http://customer.honeywell.com
ou appelez gratuitement l'assistance client d'Honeywell au
1-800-468-1502

Automation and Control Solutions

Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422
http://yourhome.honeywell.com

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Scarborough, Ontario M1V 4Z9

69-2095EFS-03
07-2008

Printed in USA

69-2095EFS-03

Honeywell

Adaptador inalámbrico RedLINK™

Nota importante:

Este producto no cuenta con manual de instrucciones.

Consulte los manuales de los dispositivos compatibles para obtener información sobre la instalación y el uso. (También puede descargar manuales del sitio de Internet que se detalla más abajo).

Utilice este producto con:

- Módulo de interfaz del equipo (EIM) Honeywell
- Panel TrueZONE™ Honeywell
- Humidificador TrueSTEAM Honeywell
- Otros dispositivos RedLINK™ compatibles

¿Necesita ayuda?

Consulte sobre este producto en
http://customer.honeywell.com
o llamando sin cargo a atención al cliente de Honeywell
1-800-468-1502

Automation and Control Solutions

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Honeywell

RedLINK™ Wireless Adapter

Important Note:

There is no instruction manual for this product.

Please see manuals provided with compatible devices for information on installation and use. (Manuals can also be downloaded from the Web site listed below.)

Use this product with:

- Honeywell Equipment Interface Module (EIM)
- Honeywell TrueZONE™ panel
- Honeywell TrueSTEAM humidifier
- Other compatible RedLINK™ devices

Need Help?

For assistance with this product please visit
http://customer.honeywell.com
or call Honeywell Customer Care toll-free at
1-800-468-1502

Automation and Control Solutions

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69-2095EFS-03

Regulatory information

FCC Compliance Statement (Part 15.19) (USA only)
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
1 This device may not cause harmful interference, and
2 This device must accept any interference received, including interference that may cause undesired operation.

FCC Warning (Part 15.21) (USA only)
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement (Part 15.105 (b)) (USA only)
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Wireless adapter
To comply with FCC and Industry Canada RF exposure limits for general population/uncontrolled exposure, the antenna(s) used for these transmitters must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Section 7.1.5 of RSS-GEN
Operation is subject to the following two conditions:
1 this device may not cause interference, and
2 this device must accept any interference, including interference that may cause undesired operation of the device.

Información reguladora

Declaración de conformidad con las regulaciones FCC (Sección 15.19) (solo en los EE. UU.)
Este dispositivo cumple con la Sección 15 de las regulaciones FCC. El funcionamiento está sujeto a las dos condiciones siguientes:
1 Este dispositivo no debe causar interferencia perjudicial.
2 Este dispositivo deberá aceptar cualquier interferencia que se reciba, incluso la interferencia que pudiese causar el funcionamiento no deseado.

Advertencia de la FCC (Sección 15.21) (solo en los EE. UU.)
Los cambios o las modificaciones que no hayan sido expresamente aprobados por la parte responsable del cumplimiento de las regulaciones podrían anular la autoridad del usuario para hacer funcionar el equipo.

Declaración de la FCC sobre interferencias (Sección 15.105(b)) (solo en los EE. UU.)
Este equipo fue probado y cumple con los límites de los dispositivos digitales clase B, conforme a la Sección 15 de las regulaciones FCC. Estos límites están diseñados para ofrecer una protección razonable contra la interferencia perjudicial en una instalación residencial. Este equipo genera usos y puede irradiar energía de frecuencia de radio y, si no se instala y se utiliza según las instrucciones, puede producir una interferencia perjudicial en la comunicación radial. Sin embargo, no se garantiza que no habrá interferencia en una instalación particular. Si este equipo produce una interferencia perjudicial en la recepción televisiva o radial, lo cual puede determinarse al apagar y encender el equipo, se recomienda que el usuario intente corregir la interferencia con una o más de las siguientes medidas:
- Vuelva a orientar y ubicar la antena receptora.
- Aumente la distancia entre el equipo y el receptor.
- Conecte el equipo a un tomacorriente en un circuito diferente a aquel en el que está conectado el receptor.
- Consulte con su distribuidor o con un técnico experto en radio/televisión para recibir ayuda.

Adaptador inalámbrico
Para cumplir con los límites de exposición RF que establecen la FCC y Industry Canada para la población en general/exposición no controlada, la o las antenas usadas para estos transmisores deben instalarse a una distancia de separación de, al menos, 20 cm de todas las personas, y no deben colocarse ni utilizarse junto con otra antena o transmisor.

Sección 7.1.5 de RSS-GEN
El funcionamiento está sujeto a las dos condiciones siguientes:
1 Este dispositivo no debe causar interferencia.
2 Este dispositivo deberá aceptar cualquier interferencia, incluso la interferencia que pudiese causar el funcionamiento no deseado del dispositivo.

Information sur la réglementation

Déclaration de conformité à la FCC (partie 15,19) (États-Unis seulement)
Cet appareil est conforme à la Partie 15 des règles de la FCC. Le fonctionnement de ce système est assorti aux deux conditions suivantes :
1 L'appareil ne peut causer d'interférences nuisibles, et
2 L'appareil doit accepter les interférences reçues, y compris celles qui pourraient nuire à son fonctionnement.

Avis de la FCC (partie 15,21) (États-Unis seulement)
Toute modification qui n'est pas autorisée expressément par la partie responsable de la conformité de l'appareil aux règles en vigueur pourrait rendre l'utilisateur inapte à faire fonctionner le matériel.

Déclaration sur l'interférence selon la FCC (partie 15,105 (b)) (États-Unis seulement)
Ce dispositif a été testé et déclaré conforme aux normes spécifiées dans la partie 15 des règlements de la FCC (Federal Communications Commission) concernant les dispositifs numériques de classe B. Ces limites sont conçues pour offrir une protection raisonnable contre les interférences nocives pouvant survenir lorsque le produit est utilisé dans un environnement résidentiel. Ce dispositif produit, utilise et émet de l'énergie radioélectrique qui peut perturber les communications radio s'il n'est pas installé et utilisé conformément aux instructions du fabricant. Toutefois, rien ne garantit qu'il n'y aura pas d'interférences dans une installation donnée. Si l'appareil produit des interférences qui nuisent à la réception radio ou télé, ce qu'on peut déterminer en mettant l'appareil en service et hors service, l'utilisateur est invité à corriger la situation de l'une ou l'autre des façons suivantes :

- Réorienter ou déplacer l'antenne de réception.
- Augmenter l'espace qui sépare l'appareil du récepteur.
- Brancher l'appareil à une prise faisant partie d'un circuit différent de celui du récepteur.
- Consulter un détaillant ou technicien radio-télé d'expérience pour obtenir de l'aide.

Adaptateur sans fil
Pour être conformes aux limites d'exposition aux radiofréquences établies par la FCC et Industrie Canada pour le grand public/l'exposition non contrôlée, la ou les antennes employées par le transmetteur doivent être installées à au moins 20 cm de distance de toute personne et ne peuvent être situées au même endroit qu'une autre antenne ou un autre transmetteur ou fonctionner conjointement avec une autre antenne ou un autre transmetteur.

Industrie Canada Alinéa 7.1.5 de CNR-GEN
Le fonctionnement de ce système est assorti aux deux conditions suivantes :
1 L'appareil ne peut causer d'interférences nuisibles, et
2 L'appareil doit accepter les interférences reçues, y compris celles qui pourraient nuire à son fonctionnement.

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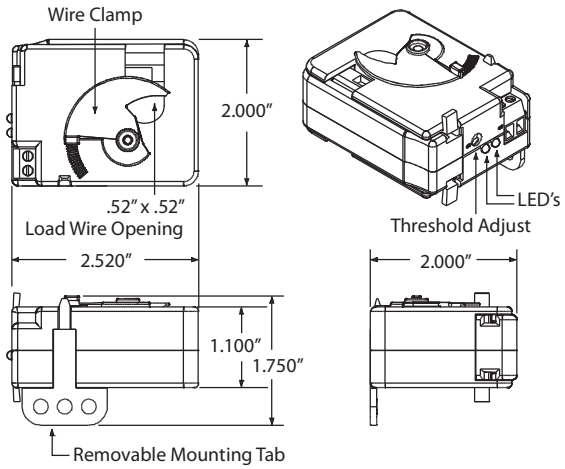
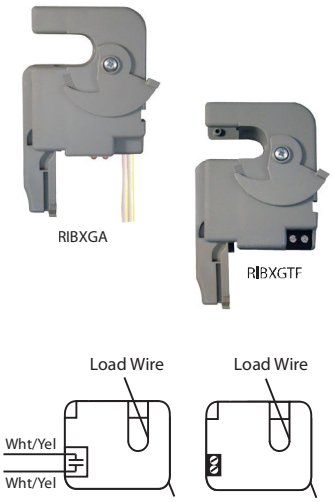
RIBXG Series

Enclosed Split Core AC Sensors

AC Sensors Low-Voltage-Switching





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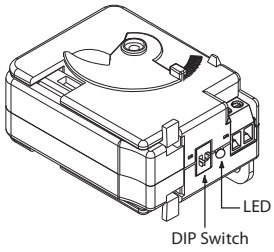
Specifications

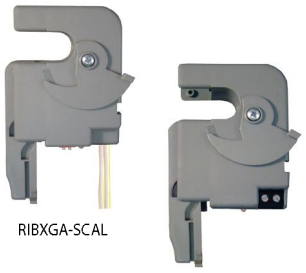
Operating Temperature: -30 to 140° F
Humidity Range: 5 to 95% (noncondensing)
Max Sense Voltage: 600 Vac
Approvals: UL Listed, UL916, UL864, C-UL, California State Fire Marshal, CE, RoHS
Mounting/Installation: Removable mounting tab provided. The wire clamp locks against the load wire, securing the unit in place.

Sensor Output:
- Solid State Contact
- 30 Vac/dc, .4 Amp Max.
- When current sensor status is off (open), leakage <30 uA @ 30Vac/dc
- When current sensor status is on (closed), voltage drop
  < .3 Vac/dc @ .1 Amp
  < 1.6 Vac/dc @ .4 Amp

Self-Calibrating AC Sensors (Models with -SCAL Suffix)



-SCAL LED Table	
LED Off	No Current
Two Winks	Current Below Range
Three Winks	Current In Range
Four Winks	Current Above Range
Continuous Winks	Calibration in Progress



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The SCAL unit begins the 30 second self-calibration process the first time current is applied in the operating range. The threshold is permanently set. Subsequent calibrations may be performed by moving SW1 to the position opposite of its current position with or without current applied (hands can be safely away from live voltage). Once current begins flowing, or if it already is, the calibration process will begin. At the end of the 30 seconds, amperage will be read and set as the threshold. SW2 in the ON position provides a 15% (+/-3%) differential, in the OFF position it provides a 25% (+/-3%) differential. SW2 can be selected at anytime and does not affect the threshold setting. Current in-range closes the status contacts. Current above or below range opens the status contacts. Ex. With a current of 10 amps set as the threshold and a 15% differential, status contacts will be closed between 8.5 amps and 11.5 amps and open outside of this range. A small amount of hysteresis is provided to prevent dithering near the differential limits.

RIBXG Series Selection Guide

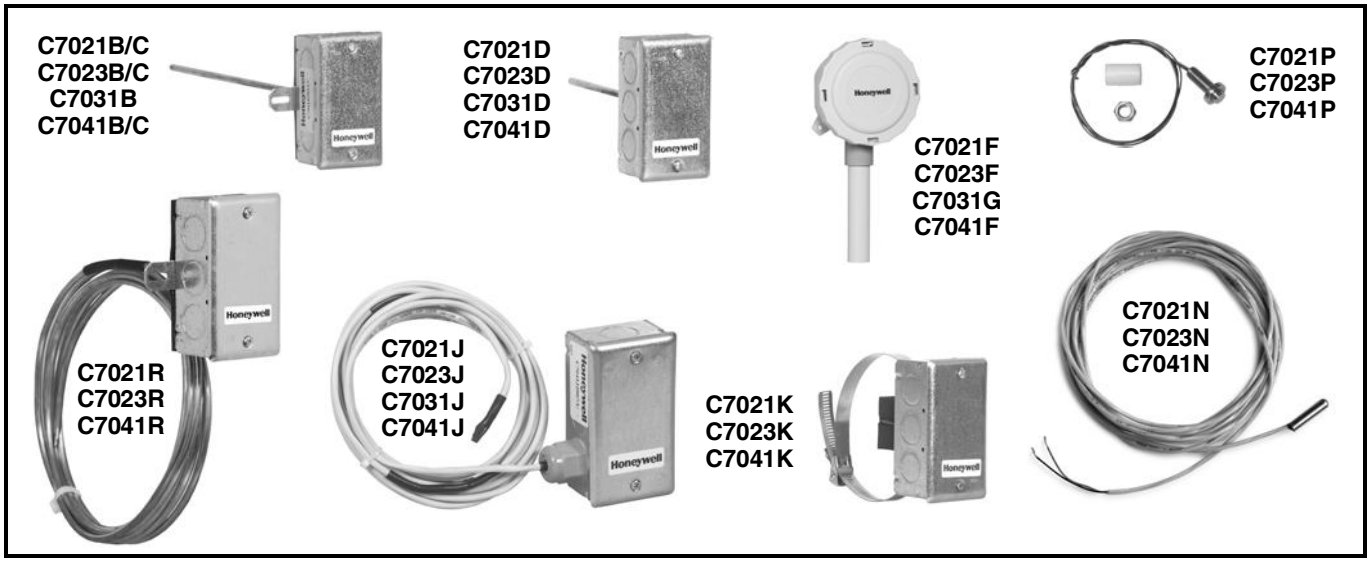
Model#	Range	Type	Threshold	Output	LED 1	LED 2
RIBXGF	.35-150 Amp	Split Core	Fixed, .35 Amp	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Wht/Yel 16˝ 18 AWG Wire Leads)		
RIBXGFL*	.75-150 Amp	Split Core	Fixed, .75 Amp	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Wht/Yel 16˝ 18 AWG Wire Leads)	Over Trip Point	
RIBXGTF	.35-150 Amp	Split Core	Fixed, .35 Amp	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Terminal Strip, Accepts #14-22 AWG Wire)		
RIBXGTFL*	.75-150 Amp	Split Core	Fixed, .75 Amp	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Terminal Strip, Accepts #14-22 AWG Wire)	Over Trip Point	
RIBXGA	.75-150 Amp	Split Core	Adjustable	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Wht/Yel 16˝ 18 AWG Wire Leads)	Over Trip Point	Under Trip Point
RIBXGTA	.75-150 Amp	Split Core	Adjustable	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Terminal Strip, Accepts #14-22 AWG Wire)	Over Trip Point	Under Trip Point
RIBXGA-SCAL	3-150 Amp	Split Core	Self-Cal.	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Wht/Yel 16˝ 18 AWG Wire Leads)	See -SCAL Table	
RIBXGTA-SCAL	3-150 Amp	Split Core	Self-Cal.	Solid State Switch SPST ; 30 Vac/dc ; .4 Amps Max (Terminal Strip, Accepts #14-22 AWG Wire)	See -SCAL Table	

* = Not approved by California State Fire Marshal

Honeywell

Series 2000
Electronic Temperature Sensors

PRODUCT DATA



APPLICATION

The Series 2000 C7021, C7023, C7031 and C7041 Electronic Temperature Sensors are designed for use with electronic controllers in domestic or commercial heating and cooling systems.

FEATURES

- **C7021D, C7023D, C7031D, C7041D for immersion mounting sense water temperature.**
- **C7021F, C7023F, C7031G, C7041F sense outdoor air temperature and are weatherproof for outdoor use (knockouts allow for 1/2 in. conduit connection).**
- **C7021J/R, C7023J/R, C7031J, C7041J/R sense average duct air temperature.**
- **C7021B/C, C7023B/C, C7031B, C7041B/C sense duct air temperature.**
- **C7021K, C7023K, C7041K with strap-on mounting senses water temperature.**
- **C7021N, C7023N, C7041N probe senses water or air temperature.**
- **C7021P, C7023P, C7041P senses air temperature.**
- **Solid state components not affected by dust or dirt.**

Contents

63-2590-06

SPECIFICATIONS

See Table 1 for additional specifications.

Compatability:

Use Series 2000 C7031, C7041 Temperature Sensors with Excel 10, 15, 80, 100, and 500 controllers.

Series 2000 C7031B,D,G,J sensors are compatible with various Honeywell controllers. The C7031G2014 is compatible with the T7350 Commercial Thermostat.

Series 2000 C7021 temperature sensors are compatible with TB7600, TB7300 and TB7200 communicating thermostats.

Series 2000 C7023 temperature sensors are compatible with WEBs-AX I/O modules.

Dimensions:

See Fig. 1 through Fig. 11.

Sensor Accuracy:

±0.36°F at 77°F (±0.2°C at 25°C) for 20K ohm NTC sensors and 10K ohm NTC Type II and Type III sensors.

Long-term Temperature Sensor Drift (for C7041 models only): Maximum sensor drift is nominally +/-0.13°F after 5 years of operation, no appreciable drift thereafter. No calibration of the device is possible. Long term drift calibration/maintenance through controller software is typically not necessary.

Accessories:

32006523-001 20K Probe: to allow replacement of old style C7031D1062-1 with non-threaded well.

50001774-001 Stainless Steel 304 Well Assembly: 1/2 in. external and internal NPT threading. Use with C7021D/C7023D/C7031D/C7041D.

50001775-001 Well Adapter: Used with C7021D/C70231D/C7031D/C7041D to allow threading sensor into previously installed Series 1000 32005960-001 Well.

Table 1. Sensor Selection and Application Guide

Model	Control Application	Element Insertion Length	Element Operating Range	Element Max Ambient Temperature	Sensor Resistance in Ohms	Sensitivity[a]
C7021B	Duct discharge air	6 in. (152) or 12		250°F (121°C)	10K Ohms NTC @ 77° F Type II	—
C7021C	Duct discharge air	18 in. (457 mm)				
C7021D	Hot or chilled water [b]	5 in. (127 mm)				
C7021F	Outdoor air	—	-40° to 158°F (-40° to 70°C)			
C7021J	Duct discharge air (averaging sensor with 4 elements)	12 ft (3.7m)	-40° to 250°F (-40° to 121°C)			
C7021K	Hot water (strap-on mounting)[f]					
C7021N	Water / Air (bullet probe)					
C7021P	Space air temperature (button probe)					
C7021R	Duct discharge air (rigid copper averaging sensor)	12 ft (3.7m) or 24 ft (7.3m)				

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

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Table 1. Sensor Selection and Application Guide

Model	Control Application	Element Insertion Length	Element Operating Range	Element Max Ambient Temperature	Sensor Resistance in Ohms	Sensitivity[a]
C7023B	Duct discharge air	6 in. (152) or 12 in. (305 mm)	-40° to 250°F (-40° to 121°C)	250°F (121°C)	10K Ohms NTC @ 77° F Type III	—
C7023C	Duct discharge air	18 in. (457 mm)				
C7023D	Hot or chilled water [b]	5 in. (127 mm)				
C7023F	Outdoor air		-40° to 158°F (-40° to 70°C)	250°F (121°C)	10K Ohms NTC @ 77° F Type III	—
C7023J	Duct discharge air (averaging sensor with 4 elements)	12 ft (3.7m)	-40° to 250°F (-40° to 121°C)			
C7023K	Hot water (strap-on mounting)[f]					
C7023N	Water / Air (bullet probe)					
C7023P	Space air temperature (button probe)					
C7023R	Duct discharge air (rigid copper averaging sensor)	12 ft (3.7m) or 24 ft (7.3m)	-40° to 250°F (-40° to 121°C)			
C7031B	Duct discharge air	6 in. (152 mm)	-40° to 250°F (-40° to 121°C)	250°F (121°C)	1097 at 77° (25°C)[c]	2.1 (3.9)
C7031D	Hot or chilled water	5 in. (127 mm)	40° to 350°F (4° to 115°C)	370°F (187°C)	1097 at 77° (25°C)[c]	2.1 (3.9)
C7031G -2006	Outdoor air	—	-40° to 120°F (-40° to 49°C)	120°F (49°C)	1715 at 90°F (32°C)[c]	2.2 (3.4)
C7031G -2014[d]	Outdoor air	—	-40° to 120°F (-40° to 49°C)	120°F (49°C)	3484 at 77°F (25°C)[c]	2.1 (3.9)
C7031J	Duct discharge air (averaging sensor with 4 elements)	12 ft (3.7m)	40° to 180°F (4° to 82°C)	250°F (121°C)	1097 at 77° (25°C)[c]	2.1 (3.9)
C7041B	Duct discharge air	6 in. (152 mm) or 12 in. (305 mm)	-40° to 250°F (-40° to 121°C)	250°F (121°C)	20K Ohms NTC at 77°F (25°C)[e]	—
C7041C	Duct discharge air	18 in. (457 mm)				
C7041D	Hot or chilled water [b]	5 in. (127 mm)				
C7041F	Outdoor air	—	-40° to 158°F (-40° to 70°C)			
C7041J	Duct discharge air (averaging sensor with 4 elements)	12 ft (3.7m)	-40° to 250°F (-40° to 121°C)			

Table 1. Sensor Selection and Application Guide

Model	Control Application	Element Insertion Length	Element Operating Range	Element Max Ambient Temperature	Sensor Resistance in Ohms	Sensitivity[a]
C7041K	Hot water (strap-on mounting)[f]	—				
C7041N	Water / Air (bullet probe)					
C7041P	Space air temperature (button probe)	—				
C7041R	Duct discharge air (rigid copper averaging sensor)	12 ft (3.7m) or 24 ft (7.3m)				

[a]Control sensitivity in ohms per degree F (per degree C) for element operating range.

[b] Order immersion well separately (50001774-001)

[c] Resistance increases as temperature increases.

[d] Use with T7350 Commercial Thermostat.

[e] Nonlinear resistance decreases as temperature increases.

[f] Not equipped with well; temperature sensed at surface of pipe.

Sensor Resistance

Table 2. Typical Resistance of Sensor Models.

	Typical Resistance (in ohms)			
	C7021 Sensors (10K Ohm NTC Type II)	**C7023 Sensors (10K Ohm NTC Type III)**	**C7031 Sensors (1097 Ohms PTC)**	**C7041 Sensors (20K ohm NTC)**
At 41°F (5°C)	25,392	23,467	1,020	54,200
At 50°F (10°C)	19,901	18,789	1,039	41,758
At 59°F (15°C)	15,712	15,137	1,059	32,427
At 68°F (20°C)	12,493	12,268	1,078	25,370
At 77°F (25°C)	10,000	10,000	1,097	20,000
At 86°F (30°C)	8,057	8,196	1,117	15,856
At 95°F (35°C)	6,531	6,754	1,136	12,654

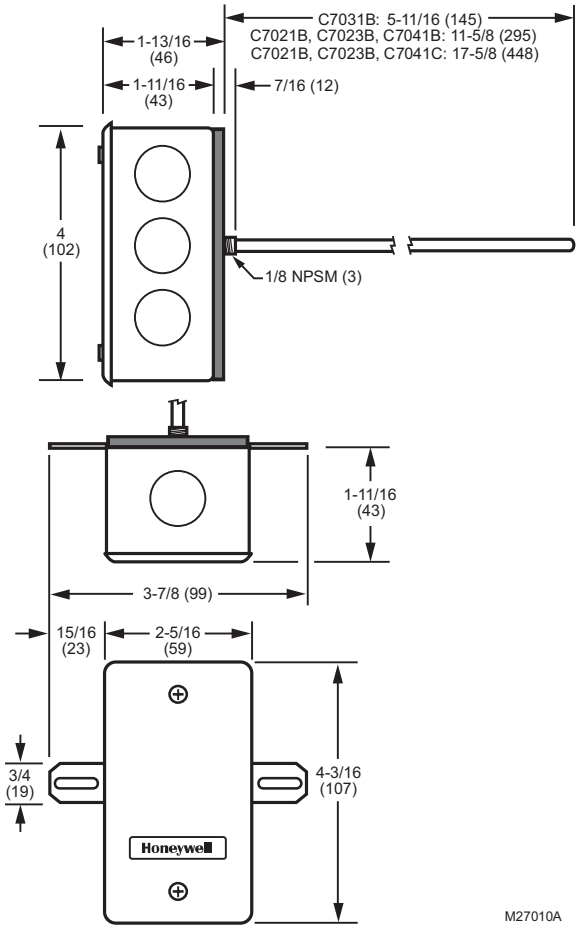

Fig. 1. C7021B/C, C7023B/C, C7041B/C dimensions in in. (mm).

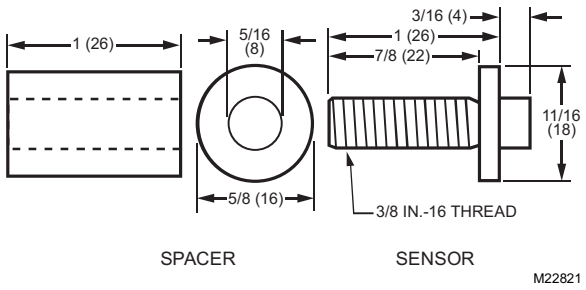

Fig. 2. Dimensions of C7021P, C7023P, C7041P in in. (mm)

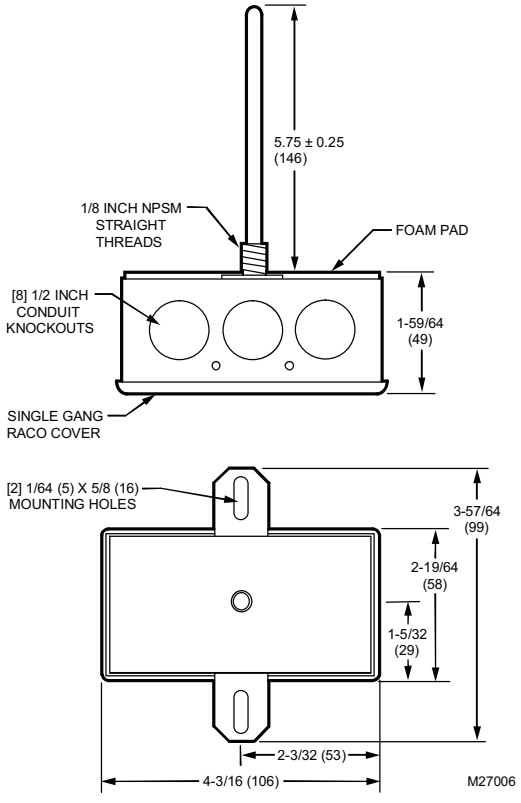

Fig. 3. C7031B dimensions in in. (mm)

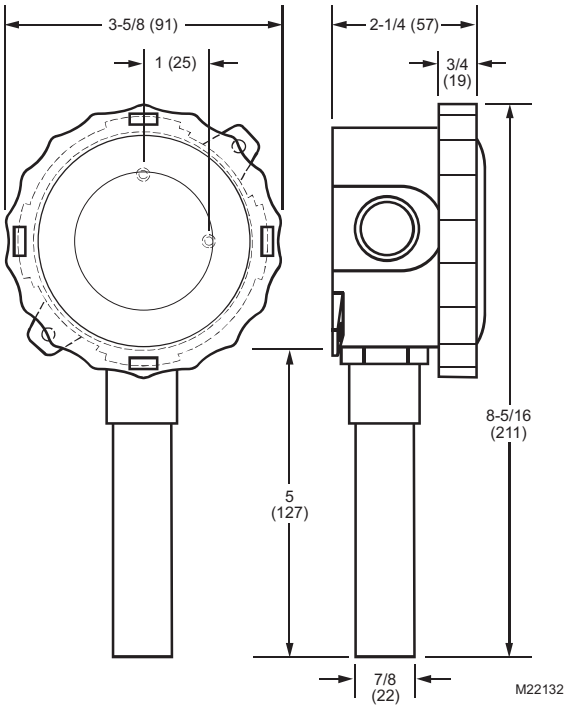

Fig. 4. C7031G, C7021F, C7023F, C7041F dimensions in in. (mm).

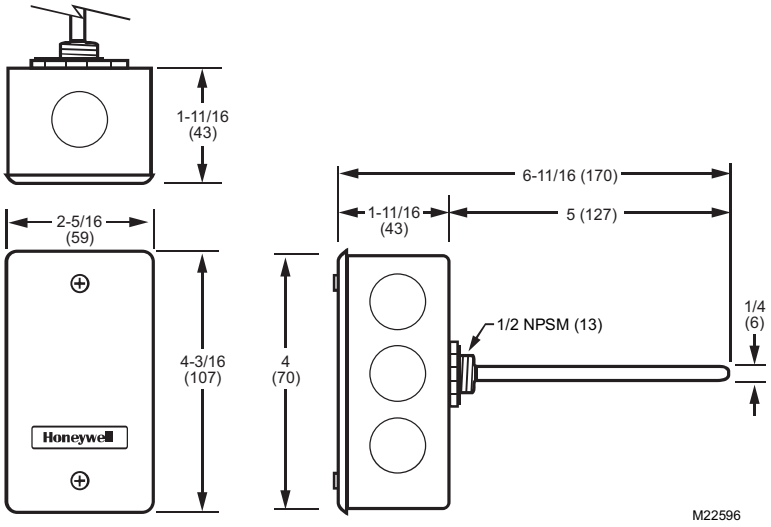

Fig. 5. C7021D, C7023D, C7031D, C7041D dimensions in in. (mm)

NOTE: The C7021D, C7023D, C7041D uses the 50001774-001 Well Assembly. See Fig. 4 for dimensions.

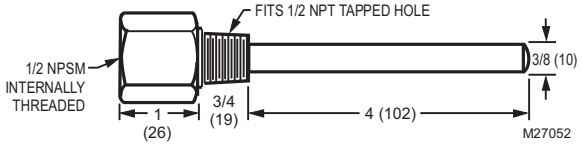

Fig. 6. 50001774-001 Immersion Well dimensions in in. (mm)

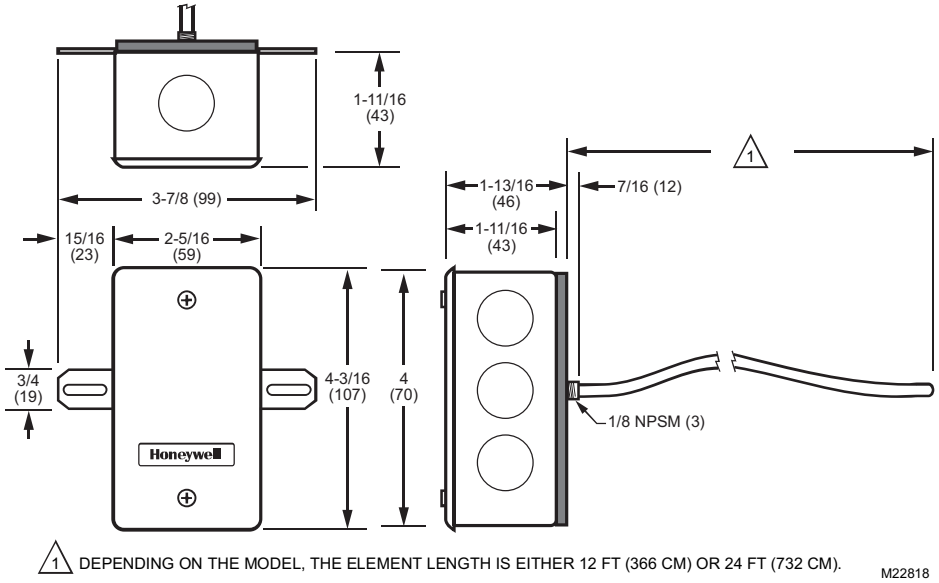

Fig. 7. C7021R, C7023R, C7041R dimensions in in. (mm).

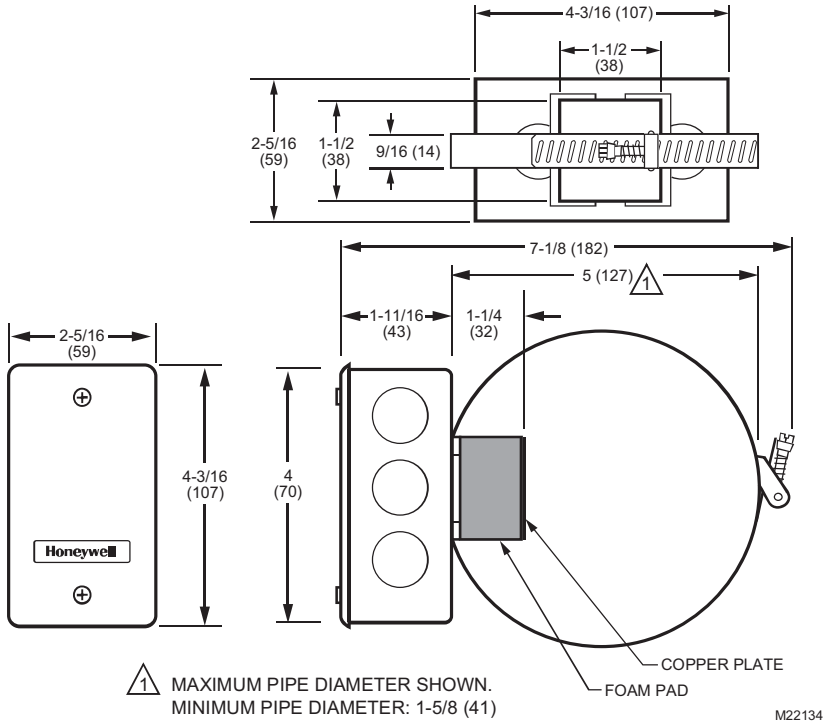

Fig. 8. C7021K, C7023K, C7041K dimensions in in. (mm).

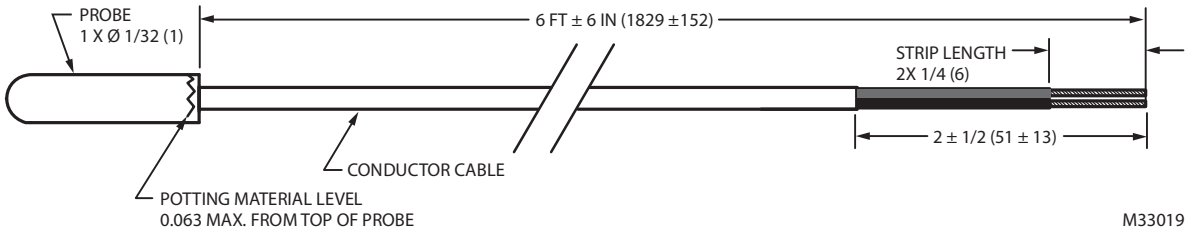

Fig. 9. C7021N, C7023N, C7041N dimensions in in. (mm).

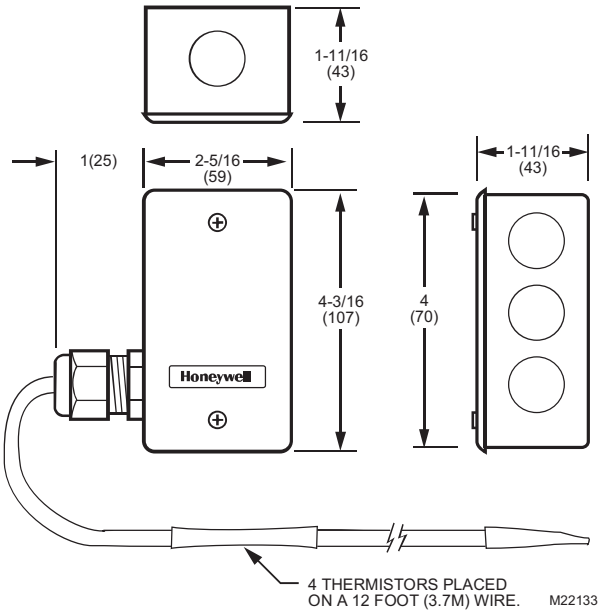

Fig. 10. C7021J, C7023J, C7031J, C7041J dimensions in in. (mm).

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check out product operation as provided in these instructions.

⚠ CAUTION

Electrical Shock or Equipment Damage Hazard. Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

Mounting

The method of mounting depends on the particular application of the temperature sensor. The following procedures include outdoor, duct, immersion well and strap-on applications. Also refer to the instructions for the electronic control.

Outdoor Mounting (C7031G, C7021F, C7023F, C7041F)

The C7031G, C7021F, C7023F and C7041F sense outdoor air temperature. Mount this control where it can sense average outdoor air temperature. Normally, the north side of a building provides a suitable location.

NOTE: These sensors are weatherproof for outdoor use. Knockouts allow for 1/2 in. conduit connection.

1. Remove and set aside the wiring box cover.
2. Mount the sensor to standard 1/2 in. conduit.

   NOTE: Mount sensor so that the element points down.
3. Make wiring connections using two wire nuts.
4. Reattach the wiring box cover.

Duct Mounting

The C7031B, C7031J, C7021B/C/J, C7023B/C/J, C7041B/C/J can be mounted in a duct to sense air temperature.

IMPORTANT

Select a spot for the sensor where it will be exposed to average duct air temperature. Avoid locations where stratification can cause sensing errors.

C7021B,C/C7023B/C, C7041B/C MOUNTING

1. Cut a hole in the duct just large enough to accept the sensing element.
2. Use the sensor case to mark the locations of the pilot holes for the mounting screws.
3. Drill the pilot holes and fasten the sensor to the duct.

C7021J, C7023J, C7031J, C7041J MOUNTING

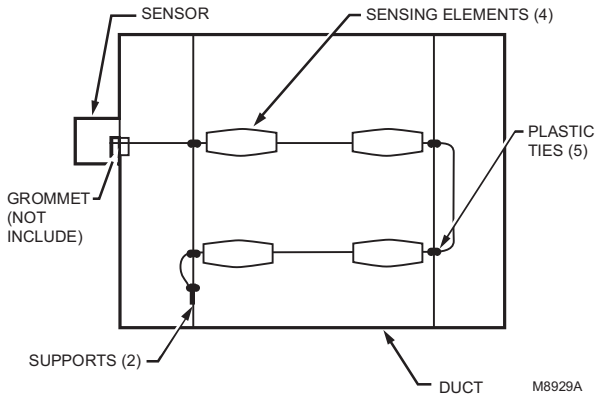

Fig. 11. Duct cross section showing method of installing C7021J, C7023J, C7031J, C7041J Averaging Electronic Sensor.

1. Install two supports inside the duct to hold the averaging element.
2. Cut a 7/8 in. (22 mm) hole in the side of the duct to insert the averaging element.
3. Fasten the terminal box to the outside of the duct and thread the element through the hole and into the duct.
4. Use plastic wire ties to fasten the element to supports. Seal the hole around the element with a rubber grommet.
5. Secure the end of the element to the duct on the support to prevent continuous flexing or abrasion.

IMPORTANT

To assure that the C7021J, C7023J, C7031J, C7041J senses average duct temperature, position the temperature elements approximately as shown in Fig. 11. Do not allow the elements to touch or be close to the duct sides.

NOTE: When the sensor is used as a deck sensor in a multizone system, be sure to space the elements equally in the duct midstream as shown in Fig. 12.

Install one C7021J, C7023J, C7031J, C7041J just upstream from the cold deck zone dampers and the other C7021J, C7023J, C7031J, C7041J upstream from the hot deck zone dampers. Position the thermistors to sense the average deck temperature.

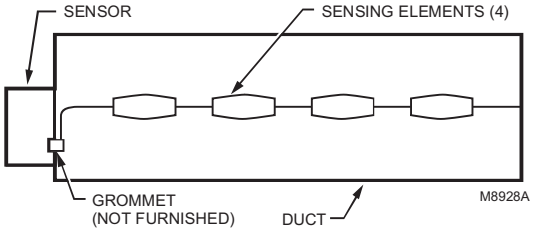

Fig. 12. Duct cross section showing method of installing C7021J, C7023J, C7031J, C7041J in a multizone system.

C7021R, C7023R, C7041R MOUNTING

1. Install two supports inside the duct to hold the averaging element.
2. Cut a 7/8 in. (22 mm) hole in the side of the duct.
3. Insert the averaging element into the duct through the hole.
4. Fasten the terminal box to the outside of the duct and thread the element through the hole and into the duct.
5. Use plastic wire ties to fasten the element to the supports. Seal the hole around the element with a rubber grommet.
6. Secure the end of the element to the duct on the support to prevent continuous flexing or abrasion.

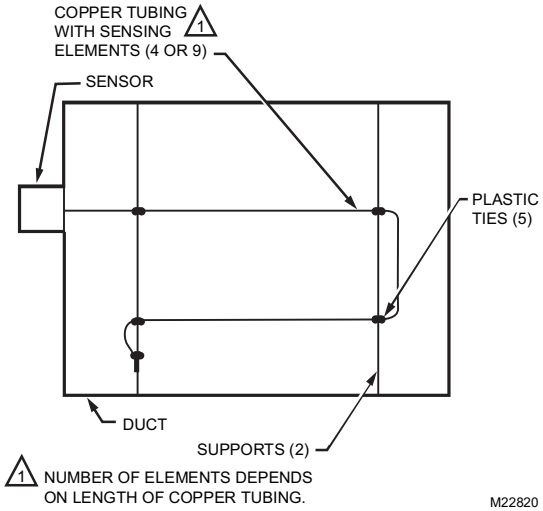

Fig. 13. Duct cross section showing method of installing C7021R, C7023R, C7041R Averaging Electronic Sensor.

IMPORTANT

To ensure that the C7021R, C7023R, C7041R senses average duct temperature, position the temperature elements approximately as shown in Fig. 13. Do not allow the elements to touch or be close to the duct sides.

NOTE: When the sensor is used as a deck sensor in a multizone system, be sure to space the elements equally in the duct midstream as shown in Fig. 14.

Install one C7021R, C7023R, C7041R just upstream from the cold deck zone dampers and the other C7021R, C7023R, C7041R upstream from the hot deck zone dampers. Position the thermistors to sense the average deck temperature.

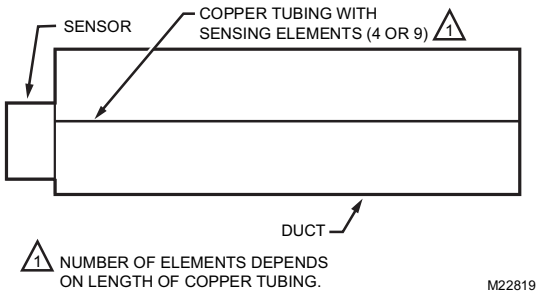

Fig. 14. Duct cross section showing method of installing C7021R, C7023R, C7041R in a multizone system.

Immersion Well Mounting (C7021D, C7023D, C7031D, C7041D)

The C7031D Sensor includes an immersion well. The C7021D, C7023D, and C7041D sensors do not include a well. For the C7021D, C7023D, and C7041D, order the well as an accessory (part no.: 50001774-001).

When used on a boiler, follow the manufacturer instructions for location. If a tapped hole is not provided for the immersion well, provide one as follows:

1. Drain boiler and drill a 23/32 in. (18 mm) hole at the selected location.
2. Cut threads in the hole with a 1/2 in. (13 mm) by 14 NPT tap.

In other installations, mount the immersion well in an elbow with a heel outlet as shown in Fig. 15.

1. Drain the system, if you have not already done it, and open the tapped hole.
2. Put pipe joint compound on the threads of the immersion well and screw it into the tapped hole or elbow, tightening it securely.
3. Refill the system and check for leaks.

Mount the C7021D, C7023D, C7031D and C7041D into the well:

NOTE: Mounting using previously installed Honeywell wells (part no.: 32005960-001) requires an adapter (part no.: 50001775-001).

1. When an adapter is required, first thread it into the well no more than one or two turns.
2. Slide the sensor into the well.
3. Rotate the sensor to thread it tightly into the adapter and the adapter tightly into the well.

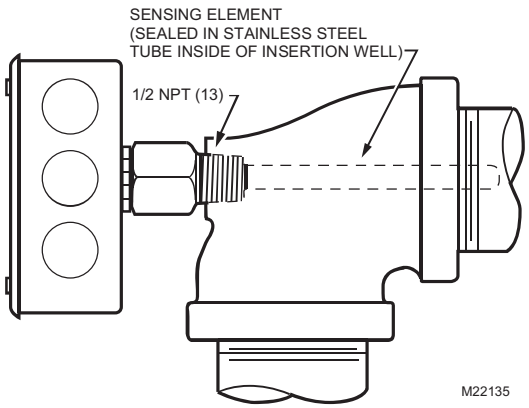

Fig. 15. Method of mounting C7021D, C7023D, C7031D, C7041D Sensor.

Strap-On Mounting (C7021K, C7023K, C7041K)

Strap-on mounting is well-suited for retrofit applications where installation costs can be reduced by not draining the system. The C7021K, C7023K, C7041K Sensor mounts on metal pipes from 1-5/8 inch to five inches in diameter using the straps supplied. Clean the surface of the pipe where the sensor makes contact before mounting (remove insulation from the pipe at the point of installation if necessary). Thermal compound is recommended with the strap-on C7021K, C7023K, C7041K Sensor. Locate the sensor on the discharge pipe within 3 feet (0.9m) of the boiler. See Fig. 16.

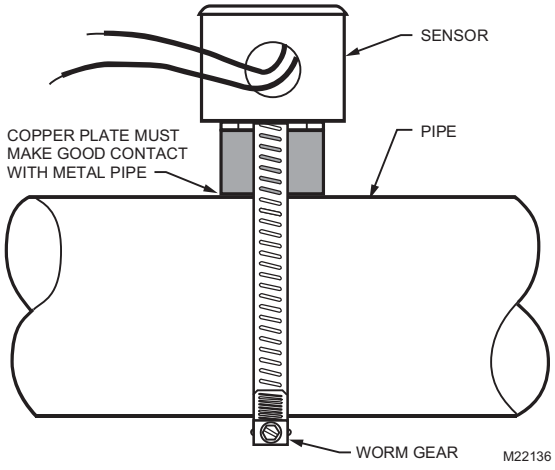

Fig. 16. Strap-on mounting of C7021K, C7023K, C7041K Sensor.

NOTE: Insulation around the contact area increases sensor accuracy.

Button Probe Mounting

The C7021P, C7023P, C7041P Button Probe Sensor design simplifies mounting into a variety of standard structural materials.

The locking nut can be used to secure the probe. See Fig. 18.

The plastic spacer helps insulate the probe from drywall, wood, or other material in which the probe is mounted. The spacer is sized to fit snugly into 1/2 in. metal conduit. See Fig. 17.

NOTES:
- The plastic spacer is threaded for easy installation.
- Use of both the locking nut and spacer requires cutting spacer to shorter length.

C7041P MOUNTING RECOMMENDATIONS

Determine the proper location based upon the following:
- Mount the probe to an inside wall approximately 54 in. (1372 mm) from the floor (or in the specified location) to allow exposure to the average zone temperature.
- Do not mount the probe to an outside wall, a wall containing waterpipes, or near air ducts.
- Avoid locations exposed to register discharge air, or radiation from lights, appliances, or the sun.

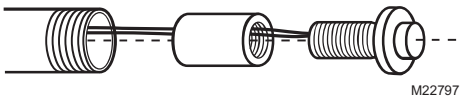

Fig. 17. Mounting sensor in conduit.

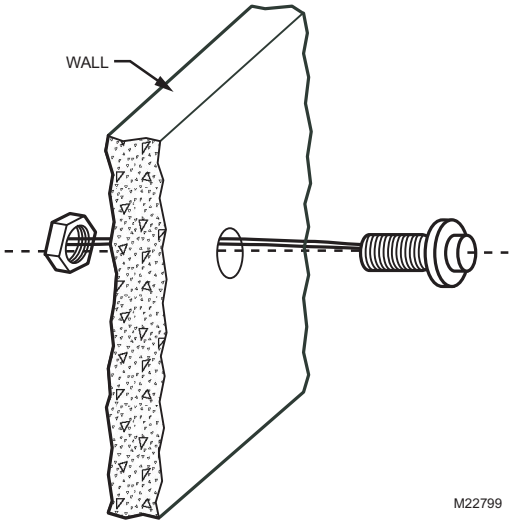

Fig. 18. Mounting sensor in wall with nut only.

Bullet Probe Sensor Mounting (C7021N, C7023N, C7041N)

The bullet probe sensor is a water-resistant sensor that provides a cost-effective solution for surface contact temperature measurement of conditioned water pipes, low pressure steam or refrigerant lines. These sensors are ideal for applications where immersion wells are not practical to install. These sensors can also be use to sense air temperature.

WIRING

CAUTION

Erratic System Operation Hazard.
Failure to follow proper wiring practices can introduce disruptive electrical interference (noise).

Keep wiring at least one foot away from large inductive loads such as motors line starters, lighting ballasts, and large power distribution panels.

Shielded cable is required in installations where these guidelines cannot be met.

Ground shield only to grounded controller case.

CAUTION

Electrical Shock or Equipment Damage Hazard.
Can shock individuals or short equipment circuitry.

Disconnect power supply before installation.

IMPORTANT

1. *All wiring must agree with applicable codes, ordinances and regulations.*
2. *Do not mount sensor in incorrect environment.*
3. *Wire according to the applicable controller instructions.*

OPERATION AND CHECKOUT

Operation

The C7041 Temperature Sensors are designed for use with XL500, XL100, XL50, XL15, XL10, and Honeywell LCBS Controllers or any controller requiring 20K ohm NTC non-linear input. As the temperature at the C7041 Sensor increases, the resistance of the sensor decreases, causing the controller to operate and offset the temperature change.

The C7021 Temperature Sensors are designed for use with the TB7600, TB7300, and TB7200 Series Communicating Thermostats or any controller requiring a 10K ohm NTC Type II input.

The C7023 Temperature Sensors are designed for use with WEBs-AX I/O Modules or any controller requiring a 10K ohm NTC Type III input.

Checkout

Refer to the applicable controller instructions when checking out the complete heating and cooling systems.

To check out the sensors, move the thermostat or remote setpoint potentiometer below the temperature of the cooling or heating medium. Watch the motor, valve or damper for the correct movement.

Honeywell

TR21, TR22, TR23, and TR24 Wall Modules

INSTALLATION INSTRUCTIONS

FEATURES

The TR21, TR22, TR23, and TR24 family of wall modules include:

- **Models with setpoint adjustment.**
- **Models with humidity output.**
- **Models with occupied/unoccupied override (bypass) with LED.**
- **Models with 3-position (auto/0/1) or 5-position (auto/0/1/2/3 speed) fan switch.**
- **LONWORKS® bus jack on all models except the TR21 and TR21-A models.**
- **Locking cover on all models.**
- **Operating range 45° to 99° F (7° to 37° C).**
- **Models (TR22 and TR23) with user-selectable temperature setpoint dials in Fahrenheit, Celsius, and Relative (- to +).**

PRODUCT DESCRIPTION

The TR21, TR22, TR23, and TR24 are a family of direct-wired wall modules for use with:

- Honeywell Excel 800, 600, 500, 100, and 80 (all fully programmable) controllers
- Excel 10 W7750, W7751[a], W7752, and W7753 controllers
- W7761 Controller
- Spyder Unitary Controllers: PUL, PVL
- ComfortPoint LON Controllers: CP-UL, CP-VL

All models have a space temperature sensor. Some models have a temperature dial, setpoint adjustment, LONWORKS bus jack, override (bypass) with LED, and fan switch.

NOTE: Refer to the *TR21, TR22, TR23, and TR24 Wall Modules – Specification Data*, form 63-1321, for specific model features and additional information.

[a] The TR21, TR22, TR23, and TR24 wall modules are not compatible with W7751A,C,E,G Controllers.

SPECIFICATIONS

Models: For specific model information, see *TR21, TR22, TR23, and TR24 Wall Modules – Specification Data*, form 63-1321.

Environmental Ratings:

- Operating Temperature: 45° to 99° F (7° to 37° C).
- Shipping Temperature: -40° to 150° F (-40° to 65.5° C).

Accessories: 50007298-001 (pack of 12) medium, cover plate; 6-7/8 x 5 in. (175 x 127 mm).

Approvals: CE; UL94 plastic enclosure; FCC Part 15, Class B

Temperature Sensor

TR21, TR22, TR23, and TR24 20K Ohm Nonlinearized Sensor:
All models are furnished with a 20K Ohm nonlinear NTC temperature sensor that follows a specific temperature resistance curve. See Fig. 1 on page 2.

NOTE: The TR21-A wall module model has two (2) 20K Ohm nonlinear NTC temperature sensors in parallel, which provide 10K NTC temperature sensing necessary for averaging.

LONMARK 3.0

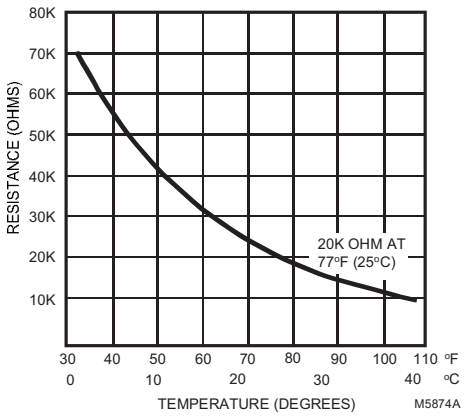

Fig. 1. Temperature vs. Resistance for Nonlinear Sensor.

Communications

All wall modules (except the TR21 and TR21-A models) have a LONMARK® bus communications port. If needed, the jack plug must be removed in the field, and terminals 3 and 4 wired according to the installation instructions.

The recommended wire size for the LONMARK® bus is Level IV, 22 AWG (0.34 sq.mm) plenum or non-plenum rated, non-shielded, twisted pair, solid conductor wire.

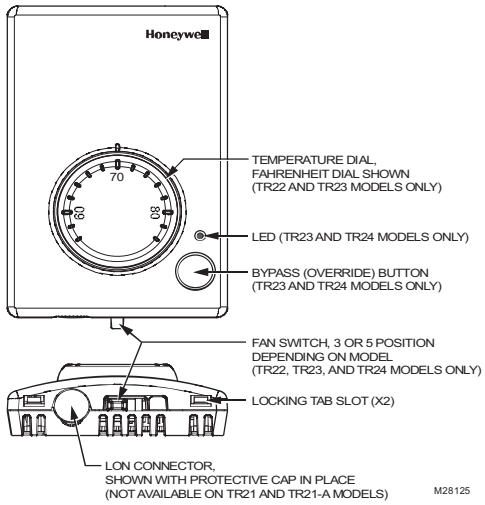

Fig. 2. Wall Module Features (TR23-F Shown).

TR22 and TR23 Setpoint Adjustment

For models TR22 and TR23 with a setpoint adjustment, the controller must be programmed for the values in Table 1.

Table 1. Wall Module Setpoint Configuration

Model	Setpoint	Resistance (Ohms)
F Absolute	55° F	9574
	85° F	1426
Relative	-9° F offset from 70° F	9574
	+9° F offset from 70° F	1426
C Absolute	12° C	9945
	30° C	1150

BEFORE INSTALLATION

⚠ CAUTION

Erratic System Operation Hazard.
Failure to follow proper wiring practices can introduce disruptive electrical interference (noise).
Keep wiring at least one foot away from large inductive loads such as motors, line starters, lighting ballasts, and large power distribution panels.
Shielded cable is required in installations where these guidelines cannot be met.
Ground shield only to grounded controller case.

IMPORTANT

All wiring must comply with local electrical codes and ordinances or as specified on installation wiring diagrams.

— Wall module wiring can be sized from 16 to 22 AWG (1.31 to 0.33 sq. mm) depending on the application.
— The maximum length of wire from a device to a wall module is 1000 ft. (305 m).
— Twisted pair wire is recommended for wire runs longer than 100 ft. (30.5 m).

INSTALLATION

Mount the wall module on an inside wall approximately 54 in. (1372 mm) from the floor (or in the specified location) to allow exposure to the average zone temperature. Do not mount the wall module on an outside wall, on a wall containing water pipes, or near air ducts. Avoid locations that are exposed to discharge air from registers or radiation from lights, appliances, or the sun. See “Cover Disassembly” on page 3.

The wall module can be mounted on a wall, on a standard utility conduit box using No. 6 (3.5 mm) screws or on a 60 mm wall outlet box (see Fig. 3). When mounting directly on a wall, use the type of screws appropriate for the wall material.

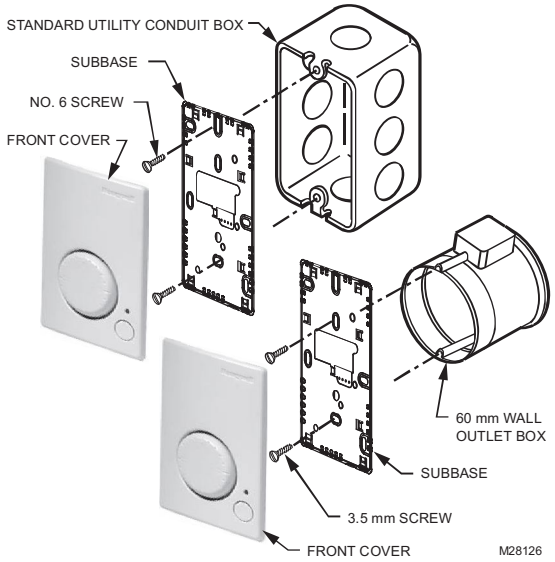

Fig. 3. Mounting on Standard Utility Conduit Box or 60 mm Wall Outlet Box (TR23 Shown).

NOTES

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2. FIA INC. MAKES NO WARRANTIES ON THESE DRAWINGS. IN NO EVENT SHALL FIA BE LIABLE FOR ANY DAMMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS, LOST OPPORTUNITIES, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THESE DRAWINGS.

3. THIS IS ONLY A CONCEPT DRAWING. THE DESIGNER MUST DETERMINE WHETHER THIS APPLICATION WILL WORK IN THEIR SYSTEM, USECORRECT PIPING PRACTICES, FOLLOW GOOD ENGINEERING PRINCIPLES AND ENSURE COMPLIANCE WITH CODE REQUIREMNTS.

4. WHILE DRAWINGS ARE TO SCALE, THEY ARE NOT TO BE USED FOR CONSTRUCTION PURPOSES. IF YOU REQUIRE CERTIFIED DIMENSIONAL DRAWINGS, PLEASE CONTACT FIA INC.

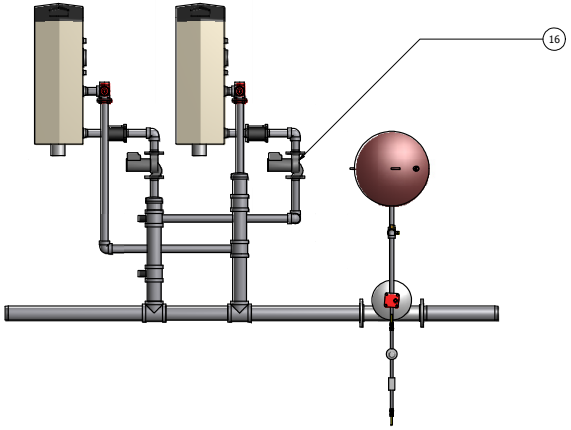
5. SYSTEM FLOW SHOULD ALWAYS REMAIN HIGHER THAN THE REQUIRED FLOW FOR THE BOILERS WHEN THE BOILERS ARE IN OPPERATION TO PREVENT SHORT CYCLING AND HIGH LIMIT ISSUES.

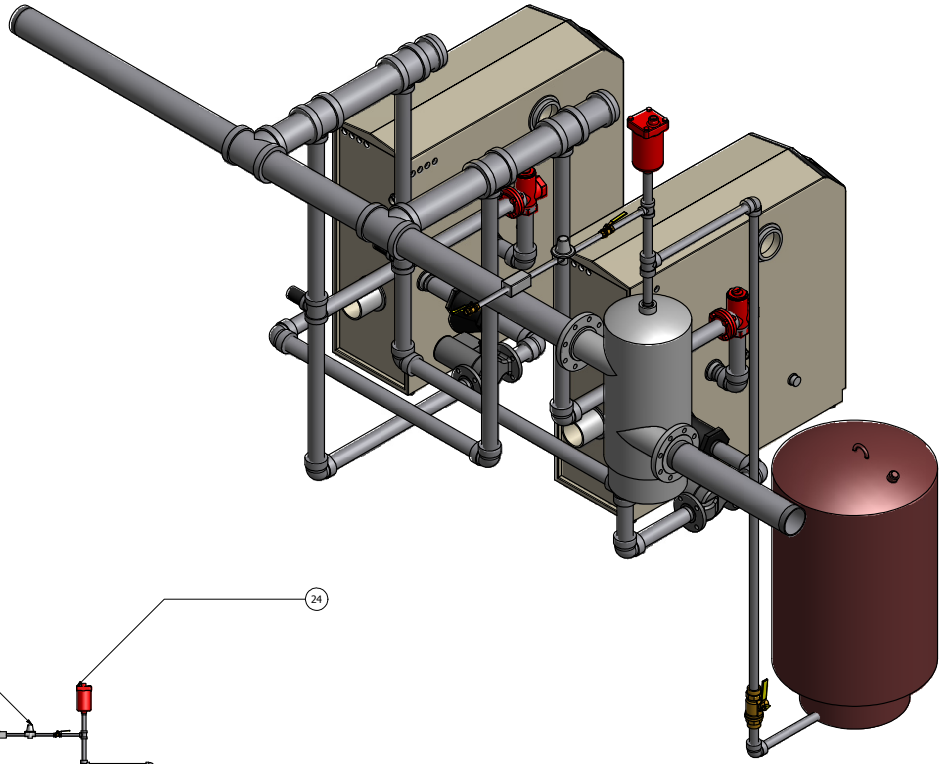
6. REFER TO THE WIRING DIAGRAM FOR WIRING AND DIP SETTINGS.

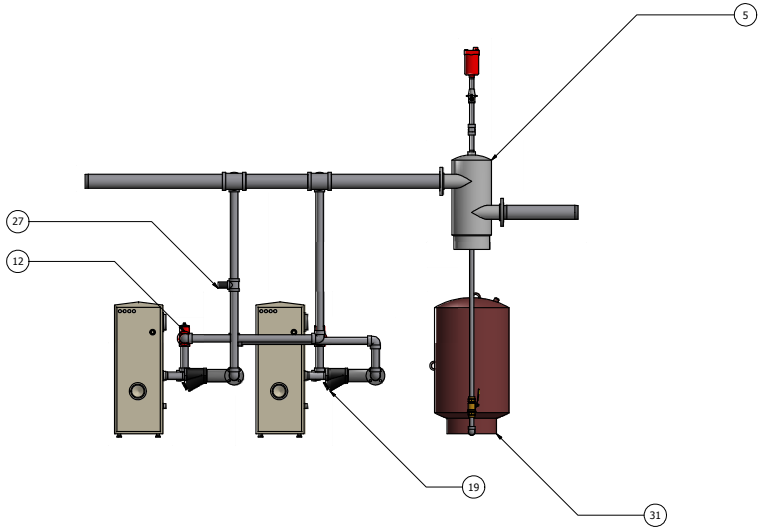
7. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

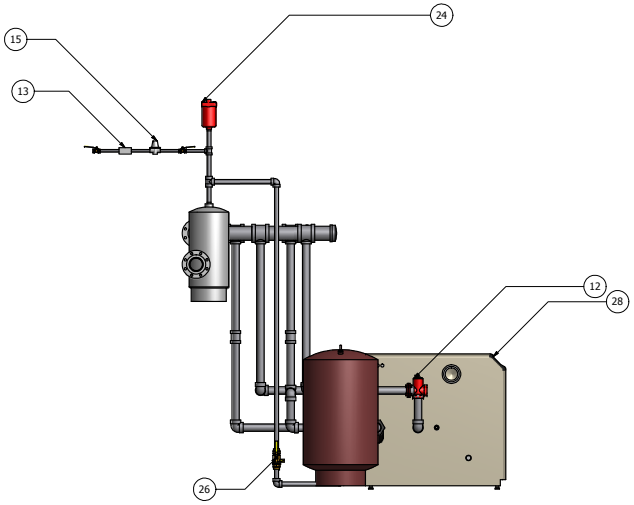
8. BOILER CONTROLS SHALL MODULATE FROM 180°F TO 70°F

REVISION HISTORY				
REV	DESCRIPTION	AUTHOR	DATE	APPROVED
A	INITIAL RELEASE	DSalerno	8/16/2011	









ITEM	QTY	PART NUMBER	DESCRIPTION
31	1	D120V	EXPANSION TANK
28	2	LOCHINVAR_BOILER_MODEL_KBN801	
27	2	WTR20009	LOW WATER CUTTOFF
26	1	WEBSTONE UNION DRAN BALL	
24	1	792	HIGH CAPACITY AIR VENT
19	2	415C 2in	Y STRAINER
16	2	PUM30001	CIRCULATOR PUMP
15	1	FB38	PRESSURE REDUCING VALVE
13	1	BACKFLOW PREVENTOR	
12	2	SA2	STRAIGHT ANGLE FLOW CHECK VALVE
5	1	5360-04F-12-003	4 INCH FLANGED ROLAIRTROL

PARTS LIST

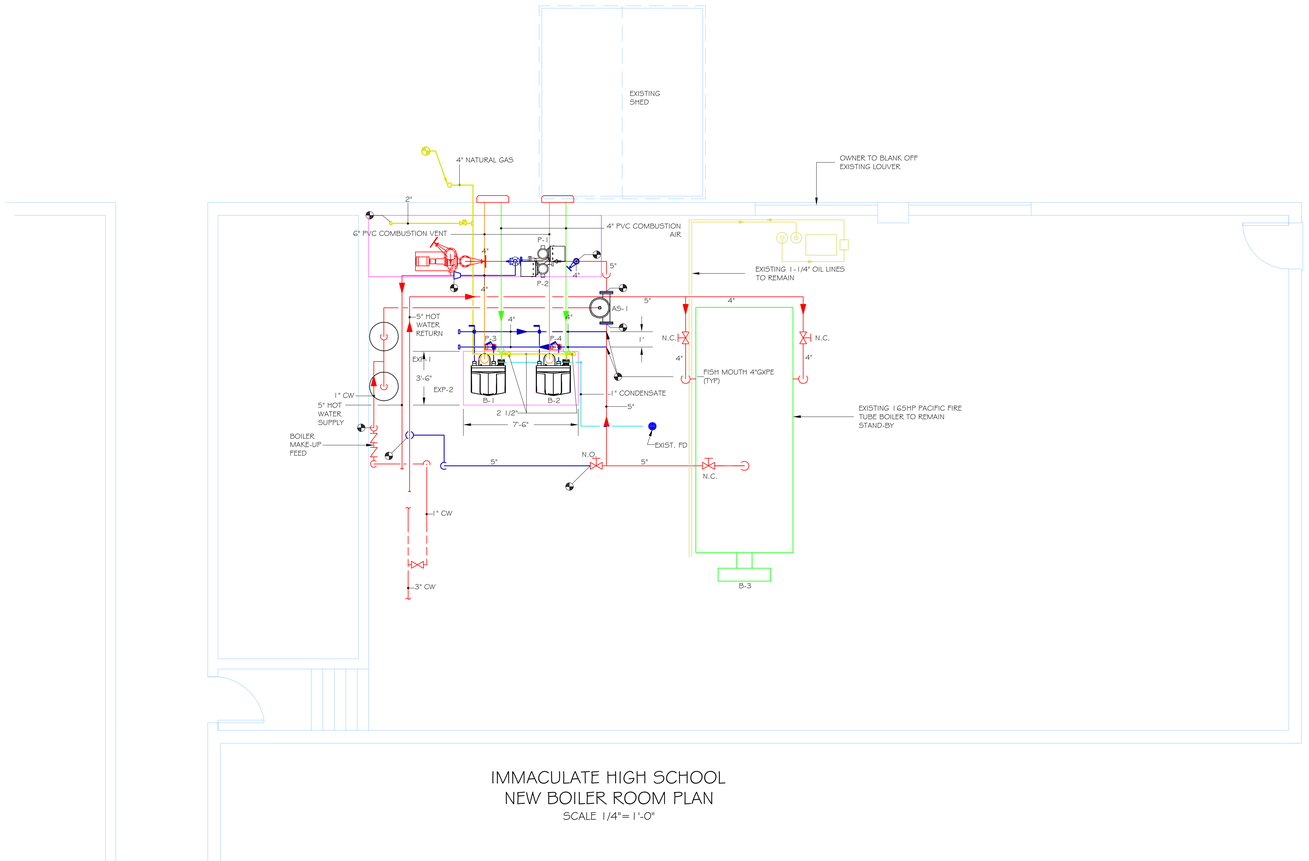
FIA INC.
FLUID INDUSTRIAL ASSOCIATES
7 SIXTH ROAD
WOBURN, MA 01801
TEL: 1-781-938-8900
FAX: 1-781-933-3965

DRAWN: DSalerno 8/16/2011
CHECKED:
APPROVED:

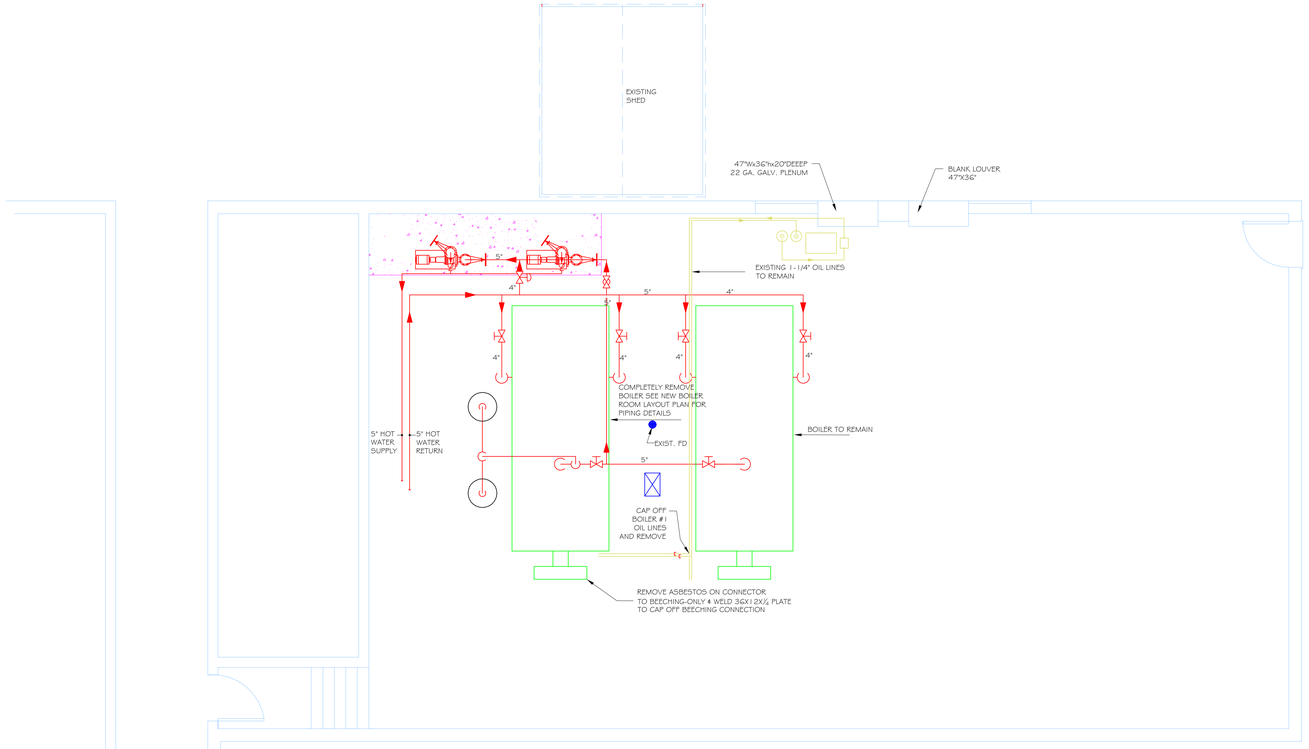
TITLE: ESSEX COUNTY REGIONAL HOLDING FACILITY

SIZE: D | DWG NO: 0121W-1A | REV: A

SCALE: | SHEET 1 OF 1



IMMACULATE HIGH SCHOOL
NEW BOILER ROOM PLAN
SCALE 1/4"= 1'-0"



IMMACULATE HIGH SCHOOL
EXISTING BOILER ROOM PLAN
SCALE 1/4"= 1'-0"

EQUIPMENT SCHEDULE

TAG	DESCRIPTION	FUEL	INPUT	CAPACITY	HP	AMPS
B-1	LOCHINVAR FTXL 850N HYDRONIC BOILER	NATL GAS	725MBH	705MBH	21HP	N/A
B-2	LOCHINVAR FTXL 850N HYDRONIC BOILER	NATL GAS	725MBH	705MBH	21HP	N/A
B-3	PACIFIC HYDRONIC BOILER - EXISTING TO REMAIN	#2 OIL	5,540MBH	4,150MBH	124 HP	N/A
P-1	ARMSTRONG CIRCULATOR 4382-0306.005 DA	N/A	208 V 3ϕ	100 GPM/60'	5HP	17.9
P-2	ARMSTRONG CIRCULATOR 4382-0306.005 DA	N/A	208 V 3ϕ	100 GPM/60'	5HP	17.9
P-3	B&G ECOCIRC XL 36-45 115/1Ø	N/A	115 V 1ϕ	50 GPM/5'	1/6HP	1.08
P-4	B&G ECOCIRC XL 36-45 115/1Ø	N/A	115 V 1ϕ	50 GPM/5'	1/6HP	1.08
EXP-1	EXISTING EXPANSION TANK TO REMAIN	N/A	1"	X GAL	N/A	N/A
EXP-2	EXISTING EXPANSION TANK TO REMAIN	N/A	1"	X GAL	N/A	N/A
AS-1	B&G ROLAIRTROL AIR SEPARATOR	N/A	5"	300 GPM	N/A	N/A

NOTE:

1) DRAWINGS ARE THE PROPERTY OF EMS, INC. AND MAY NOT BE REPRODUCED OR USED WITH OUT WRITTEN CONSENT.

2) NEW BOILER PLANT IS TWO (2) LOCHINVAR GAS FIRED FTXL BOILERS (850,000 BTUH INPUT / NATURAL GAS 97% EFFICIENCY. NET OUTPUT IS 825 MBH EA.

3) ALL ASBESTOS REMOVALS BY THE SCHOOL.

4) NEW BOILERS SIT ON 4" CONCRETE HOUSE-KEEPING PAD WITH WIRE MESH AND 4,000 LB MIX.

5) PIPING ARRANGEMENT IS PRIMARY / SECONDARY.

6) CHEMICAL FEED SYSTEM IS NOT REQUIRED.

7) LICENSED ELECTRICIAN WILL WIRE CONTROLS AS REQUIRED.

8) EXISTING BOILER #2 IS ISOLATED VIA EXISTING VALVES, BUT WILL NOT BE DRAINED - RECOMMEND COREX BOILER TREATMENT TO PRESERVE WATER SIDE OF BOILER IN CASE OF NEW BOILER FAILURE DURING WINTER.

FOR PERMIT DRAWING

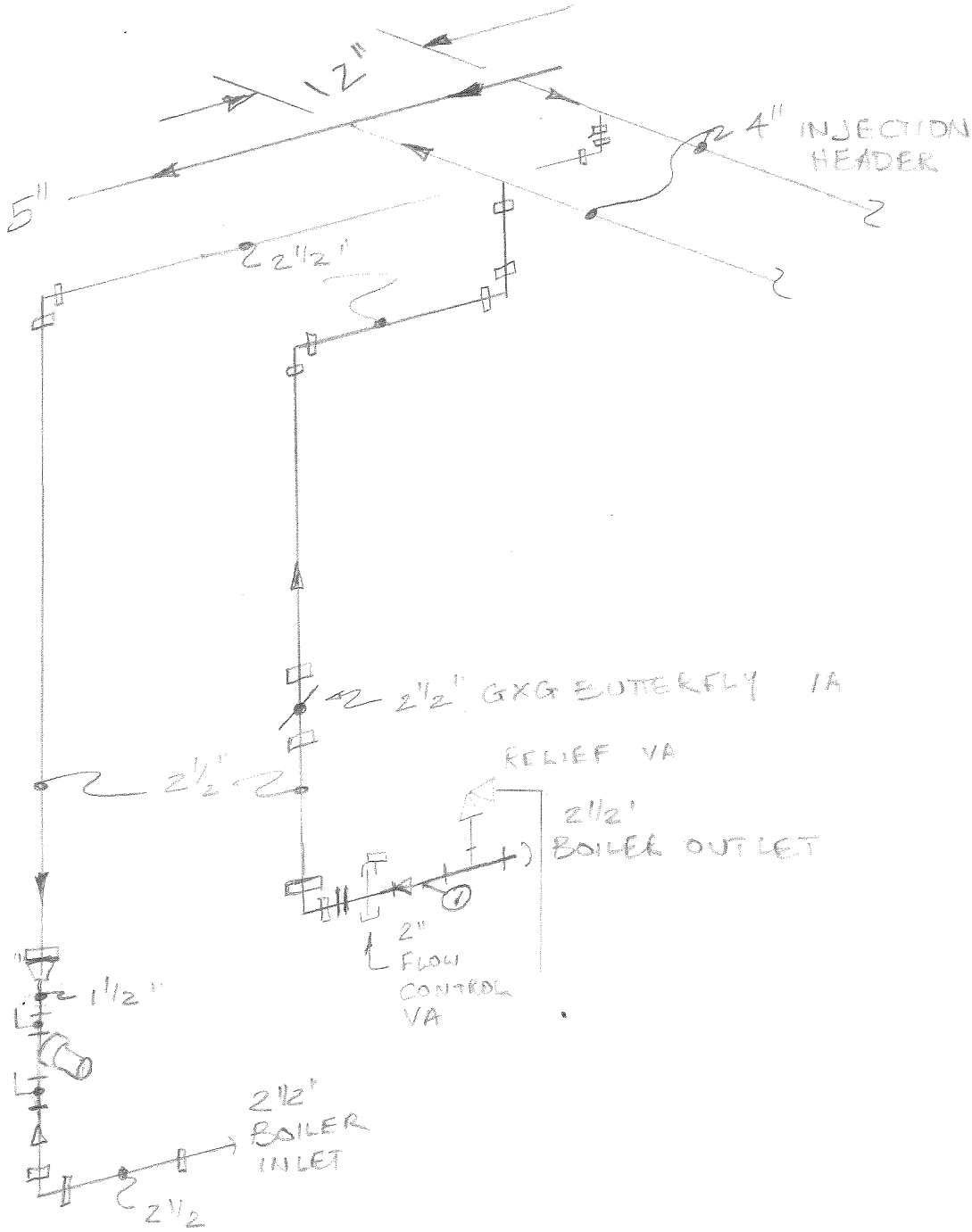
EMS
EASTERN MECHANICAL SERVICES, INC
3 STARR STREET
DANBURY, CT 06810

IMMACULATE HIGH SCHOOL BOILER REPLACEMENT
73 SOUTHERN BLVD
DANBURY, CT 06810

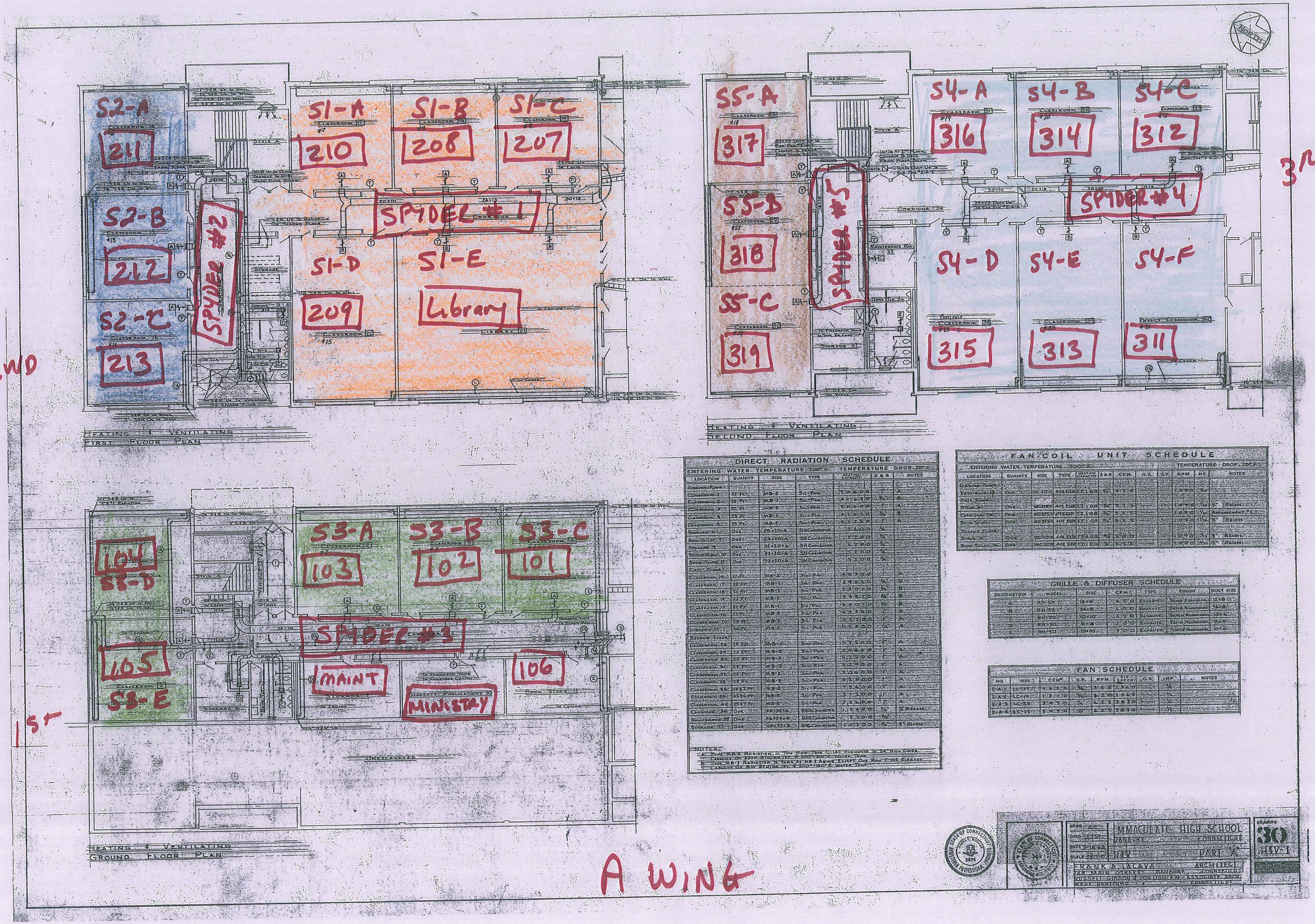
EASTERN MECHANICAL SERVICES, INC.
3 STARR STREET
DANBURY, CT 06810

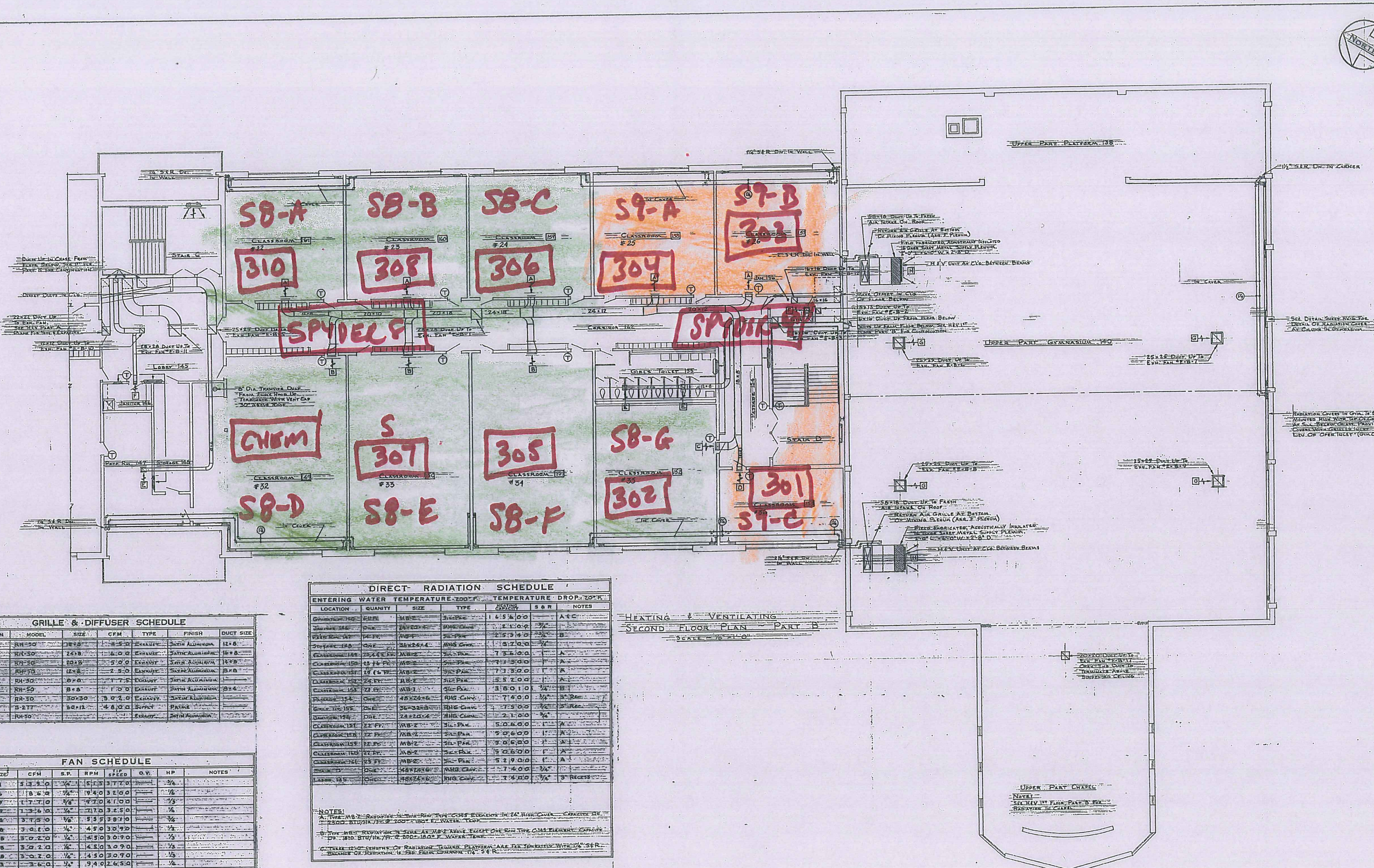
REV	DATE	
0	1/30/10	ORIGINAL ISSUE
1	2/23/10	CHANGED PIPING AND NOTES
2	5/13/10	CHANGED BOILER AND LAYOUT
3	3/9/16	CHANGED BOILERS (PRELIM).
4	7/5/16	CONSTRUCTION LAYOUT

DRAWN BY: T.H.
CHECKED BY: T.H.
ISSUE DATE: 1/30/10
EMS JOB NUMBER: 4539
SCALE: 1/4" = 1'-0"
DRAWING NUMBER: M-1



IMMACULATE
BOILER PRIMARY PIPING ISO


S2-A
211
S2-B
212
S2-C
213
SPYDER #2
S1-A
210
S1-B
208
S1-C
207
SPYDER #1
S1-D
209
S1-E
Library
2ND
HEATING & VENTILATING
FIRST FLOOR PLAN
S5-A
317
S5-B
318
S5-C
319
SPYDER #5
S4-A
316
S4-B
314
S4-C
312
SPYDER #4
S4-D
315
S4-E
313
S4-F
311
3RD
HEATING & VENTILATING
SECOND FLOOR PLAN
104
S3-D
S3-A
103
S3-B
102
S3-C
101
SPYDER #3
105
S3-E
MAINT
MINISTRY
106
1ST
UNEXCAVATED
HEATING & VENTILATING
GROUND FLOOR PLAN
DIRECT RADIATION SCHEDULE
FAN COIL UNIT SCHEDULE
GRILLE & DIFFUSER SCHEDULE
FAN SCHEDULE
IMMACULATE HIGH SCHOOL
DANBURY CONNECTICUT
FRANK A. LACAVA ARCHITECT
30
H&V-1
A WING



GRILLE & DIFFUSER SCHEDULE

DESIGNATION	MODEL	SIZE	CFM	TYPE	FINISH	DUCT SIZE
A	RH-50	[illegible]	[illegible]50	Exhaust	Satin Aluminum	12×8
B	RH-50	24×8	600	Exhaust	Satin Aluminum	16×8
C	RH-50	20×8	500	Exhaust	Satin Aluminum	14×8
D	RH-50	12×8	250	Exhaust	Satin Aluminum	8×8
E	RH-50	8×8	175	Exhaust	Satin Aluminum	—
F	RH-50	8×8	100	Exhaust	Satin Aluminum	8×4
G	RH-50	30×30	3020	Exhaust	Satin Aluminum	—
H	S-277	60×12	4800	Supply	Prime	—
I	RH-50			Exhaust	Satin Aluminum	

FAN SCHEDULE

NO.	SIZE	CFM	S.P.	RPM	TIP SPEED	O.V.	HP	NOTES
E-B-1	LC-31	5150	1/4"	515	3770	—	3/4	
E-B-2	LC-16	860	1/4"	940	3200	—	1/6	
E-B-3	LC-19	1770	3/8"	970	4100	—	1/3	
E-B-4	LC-19	1360	1/4"	770	3250	—	1/6	
E-B-5	LC-28	3750	3/8"	555	3810	—	3/4	
E-B-6	LC-28	3020	1/4"	450	3090	—	1/3	
E-B-7	LC-28	3020	1/4"	450	3090	—	1/3	
E-B-8	LC-28	3020	1/4"	450	3090	—	1/3	
E-B-9	LC-28	3020	1/4"	450	3090	—	1/3	
E-B-10	LC-13	360	1/4"	940	2650	—	1/6	
E-B-11	LC-31	4480	3/8"	515	3770	—	3/4	
E-B-12	LC-19	1010	3/8"	770	3250	—	1/6	
E-B-13	NCT-45	1085	1/4"	1140	4530	—	1/6	
E-B-14	WLW-80	1910	1/8"	860	4050	—	1/4	
E-B-15	WLW-80	1910	1/8"	860	4050	—	1/4	
E-B-16	CV-180	2080	1/4"	700	—	—	1/4	Equal To Loren Cook
E-B-17	LC-[illegible]	[illegible]	1/2"	920	2860	—	1/6	

DIRECT RADIATION SCHEDULE

ENTERING WATER TEMPERATURE - 200° F. TEMPERATURE DROP - 20° F.

LOCATION	QUANITY	SIZE	TYPE	HEATING CAPACITY	S & R	NOTES
Gymnasium 140	[illegible]	MB-2	Sil-Pak	165[illegible]00	—	A & C
Janitor 146	One	24×20×4	RHG Conv.	2100	3/4"	
Exer. Rm. 147	14 Ft.	MB-1	Sil-Pak	25340	3/4"	B
Storage 148	One	36×24×4	RHG Conv.	3700	3/4"	
Classroom 149	[illegible] Ft.	MB-2	Sil-Pak	73600	1"	A
Classroom 150	25 1/6 Ft.	MB-2	Sil-Pak	71300	1"	A
Classroom 151	28 1/6 Ft.	MB-2	Sil-Pak	71500	1"	A
Classroom 152	24 Ft.	MB-2	Sil-Pak	55200	1"	A
Classroom 153	21 Ft.	MB-1	Sil-Pak	38010	3/4"	B
Passage 154	One	48×24×6	RHG Conv.	7400	3/4"	3" Rec.
Girls Tlt. 155	One	36×32×6	RHG Conv.	7500	3/4"	3" Rec.
Janitor 156	One	24×20×4	RHG Conv.	2100	3/4"	
Classroom 157	22 Ft.	MB-2	Sil-Pak	50600	1"	A
Classroom 158	22 Ft.	MB-2	Sil-Pak	50600	1"	A
Classroom 159	22 Ft.	MB-2	Sil-Pak	50600	1"	A
Classroom 160	22 Ft.	MB-2	Sil-Pak	50600	1"	A
Classroom 161	23 Ft.	MB-2	Sil-Pak	52900	1"	A
Stair D	One	48×24×6	RHG Conv.	7400	3/4"	
Lobby 145	One	48×24×6	RHG Conv.	7400	3/4"	3" Recess

NOTES:

A. Type MB-2 Radiation Is Two Row Type C-145 Elements In 26" High Cover. Capacity Of 2300 BTU/Hr./Ft. @ 200°-180° F. Water Temp.

B. Type MB-1 Radiation Is Same As MB-2 Above Except One Row Type C-145 Element. Capacity Of 1810 BTU/Hr./Ft. @ 200°-180° F Water Temp.

C. Three 12'-0" Lengths Of Radiation Toward Platform Are Fed Separately With 1 1/4" S & R. Balance Of Radiation Is Fed From Common 1 1/4" S & R.

FAN-COIL UNIT SCHEDULE

ENTERING WATER TEMPERATURE - 200° F. TEMPERATURE DROP - 20° F.

LOCATION	QUANITY	SIZE	TYPE	HEATING CAPACITY	S & R	CFM	O.V.	S.P.	RPM	HP	NOTES
Gymnasium 140	Two	CS-212-B	[illegible]	466510	2" Ea.	4640	1500	1/4	615	3/4	A
Stair C	One	WO-575-1	302-CWH	22100	3/4	375	—	—	1090	1/30	5" Recess

NOTE:

A. Actual Location Of Units Is At C/C Between Beams. Units To Be Suspended From Overhead Construction. Coil To Be Type W.D., 2 Row, Double Serpentine With Area Of 10.31 Sq. Ft. All Capacities Are For Each Unit.

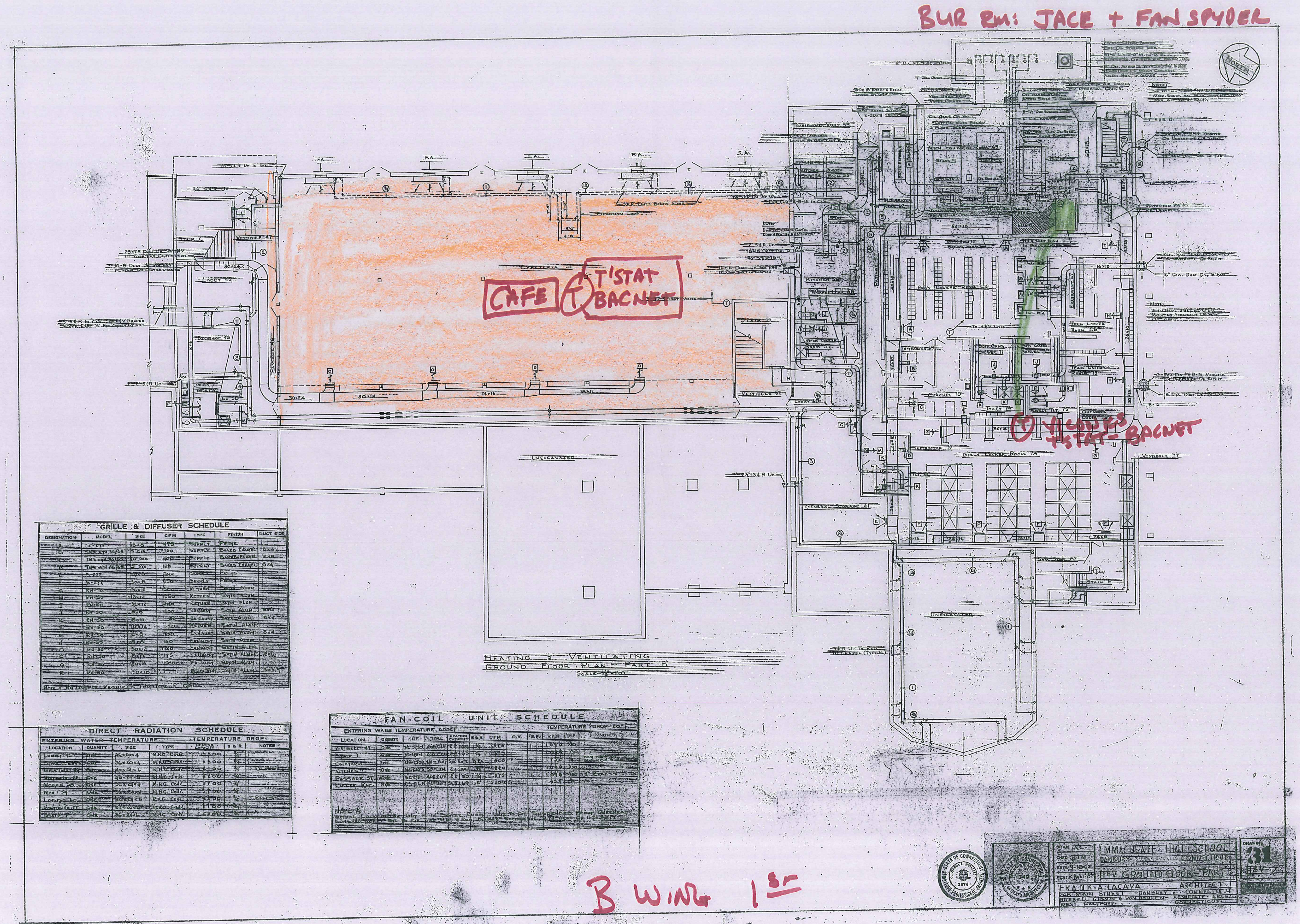
STATE OF CONNECTICUT · JEROME F. MUELLER · 2874 · REGISTERED PROFESSIONAL ENGINEER

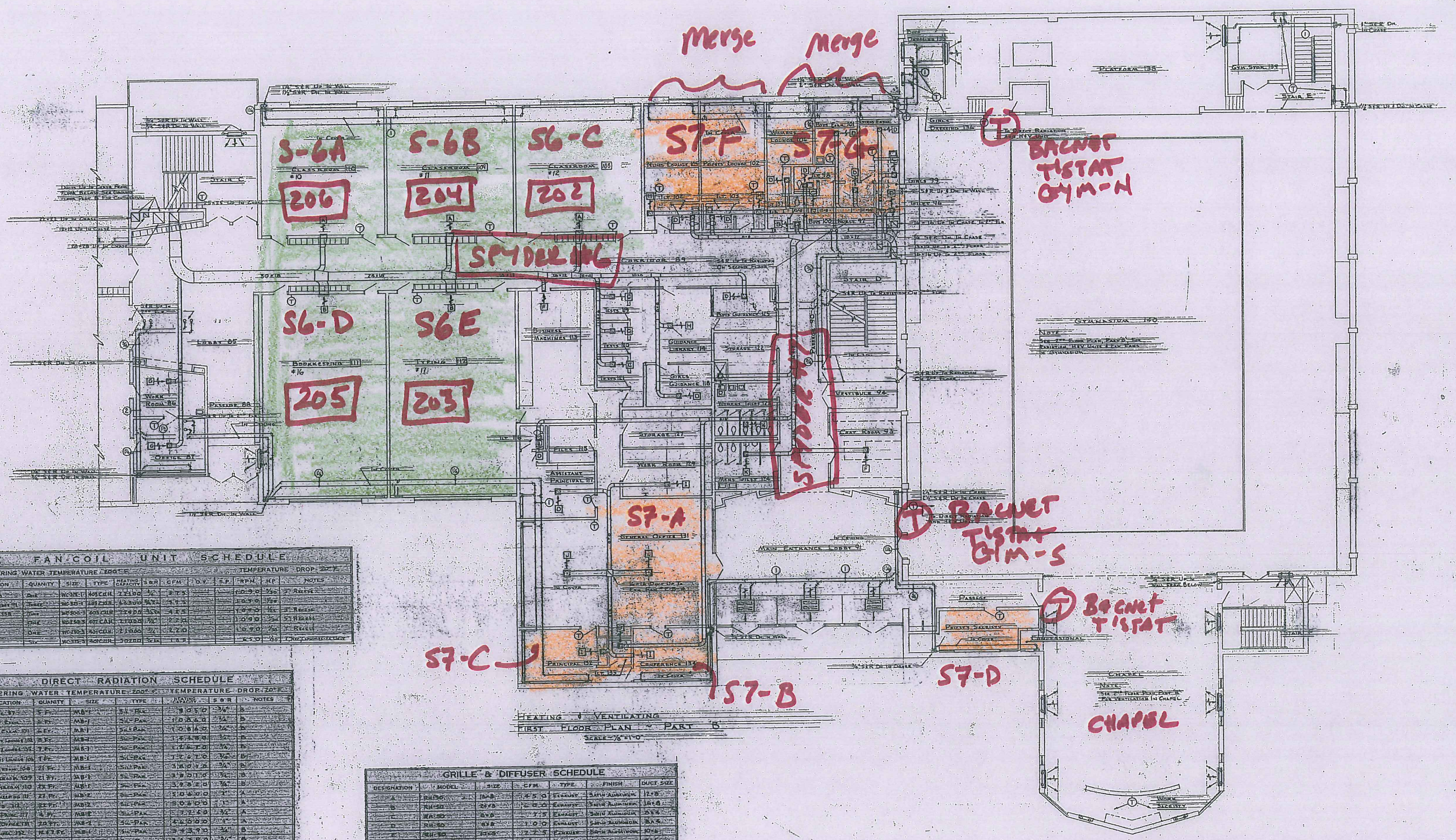
STATE OF CONNECTICUT · FRANCIS A. LA CAVA · 349 · REGISTERED ARCHITECT

DRWN A.C.	IMMACULATE HIGH SCHOOL	DRAWING 33
CHKD J.F.M.	DANBURY, CONNECTICUT	
DATE 9-18-62		
SCALE 1/8"=1'-0"	H & V SECOND FLOOR PART "B"	H&V-4

FRANK A. LACAVA ARCHITECT
248 MAIN STREET DANBURY, CONNECTICUT
RUSSELL GIBSON & VON DOHLEN - ASSOCIATE ARCH.
WEST HARTFORD CONNECTICUT

B WING 3RD


BLR RM: JACE + FAN SPYDER
CAFE
T'STAT BACNET
VICONICS T'STAT - BACNET
GRILLE & DIFFUSER SCHEDULE
DIRECT RADIATION SCHEDULE
FAN-COIL UNIT SCHEDULE
HEATING & VENTILATING
GROUND FLOOR PLAN - PART B
IMMACULATE HIGH SCHOOL
DANBURY CONNECTICUT
H&V GROUND FLOOR - PART B
FRANK A. LACAVA ARCHITECT
248 MAIN STREET DANBURY CONNECTICUT
STATE OF CONNECTICUT REGISTERED PROFESSIONAL ENGINEER
2874
STATE OF CONNECTICUT REGISTERED ARCHITECT
349
DRAWING 31
H&V-2
NORTH
B WING 1st



Heating & Ventilating
First Floor Plan ~ Part B
Scale ~ 1/8" = 1'-0"

FAN-COIL UNIT SCHEDULE											
ENTERING WATER TEMPERATURE 200° F.									TEMPERATURE DROP 20° F.		
LOCATION	QUANITY	SIZE	TYPE	HEATING CAPACITY	S&R	CFM	O.V.	S.P.	RPM	HP	NOTES
Passage 88	One	WC-35-1	405CCH	22100	3/4	275	—	—	1090	1/30	2" Recess
Main Ent. Lobby 91	Three	WC-35-1	405CCH	66300	3/4	275	—	—	1090	1/30	
Platform 138	Two	WC-500-3	405CCH	72500	3/4	425	—	—	1090	1/25	3" Recess
Stair E	One	WC-250-3	402CCH	21000	3/4	220	—	—	1090	1/30	5" Recess
Stair C	One	WC-250-3	401CCH	21000	3/4	220	—	—	1090	1/30	7" Recess
Chapel	Six	WC-315-3	401CCH	30200	[illegible]	185	—	—	650	1/60	[illegible]

DIRECT RADIATION SCHEDULE						
ENTERING WATER TEMPERATURE 200° F.				TEMPERATURE DROP 20° F.		
LOCATION	QUANITY	SIZE	TYPE	HEATING CAPACITY	S&R	NOTES
Office 87	5 Ft.	MB-1	Sil-Pak	9050	3/4"	B
Girls Exam	6 Ft.	MB-1	Sil-Pak	10860	3/4"	B
Boys Exam 101	6 Ft.	MB-1	Sil-Pak	10860	3/4"	B
Priests Lounge 102	8 Ft.	MB-1	Sil-Pak	14480	3/4"	B
Nuns Lounge 105	7 Ft.	MB-1	Sil-Pak	12670	3/4"	B
Womens Lounge 106	7 Ft.	MB-1	Sil-Pak	12670	3/4"	B
Classroom 108	21 Ft.	MB-1	Sil-Pak	38010	3/4"	B
Classroom 109	21 Ft.	MB-1	Sil-Pak	38010	3/4"	B
Classroom 110	22 Ft.	MB-1	Sil-Pak	39820	3/4"	B
Bookkeeping 111	22 Ft.	MB-2	Sil-Pak	50600	1"	A
Typing 112	22 Ft.	MB-2	Sil-Pak	50600	1"	A
Asst. Princ. 117	4 Ft.	MB-2	Sil-Pak	17250	3/4"	A
Gen. Office 131	20 Ft.	MB-2	Sil-Pak	46000	1"	A
Principal 132	[illegible] Ft.	MB-1	Sil-Pak	34390	3/4"	B
Conference 134	[illegible] Ft.	MB-1	Sil-Pak	34390	3/4"	B
Boys Dressing 135	One	[illegible]	MBG Conv.	8000	3/4"	
Girls Dressing 136	One	32×24×6	MBG Conv.	4200	3/4"	
Gym. Stor. 139	One	40×24×6	MBG Conv.	8100	3/4"	
Stair E	One	[illegible]	RHG Conv.	18000	3/4"	3" Recess
Priests Sac. & Conf.	[illegible] Ft.	MB-1	Sil-Pak	21720	3/4"	B
Work Sacristy	One	36×24×6	MBG Conv.	10800	3/4"	

NOTES:
A. Type MB-2 Radiation Is Two Row Type [illegible] Elements In 24" High Cover. Capacity Of 2300 BTU/HR/FT. @ 200°-180° F. Water Temp.
B. Type MB-1 Radiation Is Same As MB-2 Above Except One Row [illegible] Elements. Capacity Of 1810 BTU/HR/FT. @ 200°-180° F. Water Temp.

GRILLE & DIFFUSER SCHEDULE						
DESIGNATION	MODEL	SIZE	CFM	TYPE	FINISH	DUCT SIZE
A	RH-50	18×8	450	Exhaust	Satin Aluminum	12×8
B	RH-50	24×8	600	Exhaust	Satin Aluminum	16×8
C	RH-50	8×8	75	Exhaust	Satin Aluminum	8×4
D	RH-50	8×8	100	Exhaust	Satin Aluminum	8×4
E	RH-50	12×8	225	Exhaust	Satin Aluminum	10×6
F	RH-50	8×8	180	Exhaust	Satin Aluminum	8×6
G	RH-50	8×8	120	Exhaust	Satin Aluminum	8×4
H	RH-50	8×8	150	Exhaust	Satin Aluminum	8×6
I	RH-50	8×8	130	Exhaust	Satin Aluminum	8×6
J	RH-50	12×12	550	Exhaust	Satin Aluminum	12×6
K	RH-50	8×8	175	Exhaust	Satin Aluminum	8×6

B WING 2ND

State of Connecticut — Registered Professional Engineer — 2874
State of Connecticut — Registered Architect — 349

DRWN. A.C.	IMMACULATE HIGH SCHOOL		DRAWING 32
CHKD. J.J.M.	DANBURY	CONNECTICUT	HV-3
DATE 9-18-62	HV FIRST FLOOR - PART "B"		
SCALE 1/8"=1'-0"			

FRANK A. LACAVA — ARCHITECT
248 MAIN STREET — DANBURY — CONNECTICUT
RUSSELL GIBSON & VON DOHLEN - ASSOCIATE ARCH.
WEST HARTFORD — CONNECTICUT

Eastern Mechanical Services, Inc.
3 Starr Street
Danbury, CT 06810
Phone: 203.792.7668 Fax: 203.748.0385

November 16, 2016

WARRANTY

We hereby warrant that the **Heating**

Which we have performed at the Immaculate High School

Has been done in strict accordance with International Mechanical Code, 2012 edition. The work installed will fulfill the requirements of those codes. We agree to repair or replace or cause to be repaired or replaced any or all of work which may prove to be defective in workmanship or materials, together with any adjacent work which requires repair or replacement because of our defective work, within a period of ***1*** year from November 9, 2016 to November 8, 2017 ordinary wear and tear and unusual abuse or neglect excepted.

If we fail to commence to comply with the above paragraph within ten (10) days after receipt of written notice from Owner to do so or fail to pursue such as compliance with diligence, we, jointly, and severally, do hereby authorize the Owner to proceed to have the defects repaired and made good at our sole expense, and we will honor and pay the costs and charges for it together with interest at the maximum rate permitted by law upon demand. If we fail to fulfill the preceding obligations, and if the Owner brings an action to enforce this warranty, we agree to pay the Owner's reasonable attorney's fees incurred in connection therewith.

Signed: 

Date November 16, 2016