BB3600 Series

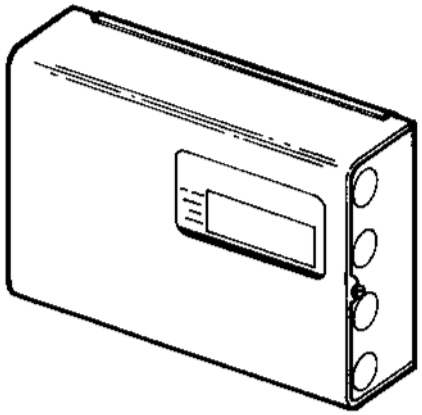
Proportional Valve Control
General Instructions

Application

The Erie™ BB3600 Proportional Valve Control with outdoor reset provides accurate control of water temperature in the secondary (radiant) loop of a heating system, using a proportional control modulating valve.

The BB3600 also protects against boiler condensation by monitoring and anticipating the boiler return water temperature in the primary loop.

The air and water temperatures are sequentially displayed, along with the secondary loop setpoint and valve position.



BB3600 Proportional Valve Control

Features

- Microprocessor control
- Built in transformer and relays
- Real application data inputs
- Large, bright display and indicators
- Boiler short cycle and low temperature protection
- Controls a modulating valve with either a 0 to 10 V or 4 to 20 mA signal

SPECIFICATIONS

Inputs

Line Voltage

External Power Supply (L-N): 120 Vac +10/-15% @ 50/60 Hz, 20 VA.
Connections: Screw terminals, 12 to 14 AWG copper wire only. Power supply wiring must be adequately sized for the sum of all line voltage loads.
Fuse: 250 V 15 A slow blow, ¼" x 1¼" (MDA15A).

Low Voltage

Heat Demand Input (T1-T2): Normally open dry contact closure, class 2, 24 Vac, 20 mA.
Connections: Lever terminals, 14 to 24 AWG copper wire.
Temperature Sensors (OA1-OA2, PL1-PL2, SL1-SL2): Three thermistors (included), 10k @ 77 °F (25 °C), -60 to 221°F (-51 to 105 °C), Class 2, 5 Vdc.
Connections: Lever terminals, 14 to 24 AWG copper wire.

Outputs

Line Voltage

Circulator (L-N): Normally open relay contact (switched Line) 1/3 HP, 120 Vac.
Connections: Screw terminals, 12 to 14 AWG copper wire only.

Low Voltage

Modulating Valve:
- **Supply (24 Vac-Com):** Class 2, 24 Vac, 10 VA.
- **Control:** Jumper-selectable output 0 to 10 V or 4 to 20mA, direct or reverse acting.
  - **0 to 10 V (0 to 10 V - Com):** 0 to 10 Vdc into 500 Ω minimum load.
  - **4 to 20 mA (4 to 20 mA - Com):** 4 to 20 mA into 300 Ω maximum load.
- **Connections:** Lever terminals, 14 to 24 AWG copper wire.

Boiler Control Signal (X1-X2): Normally open relay contact (dry contact), class 2, 24 Vac, pilot duty 75 VA.
- **Connections:** Lever terminals, 14 to 24 AWG copper wire.

Environment

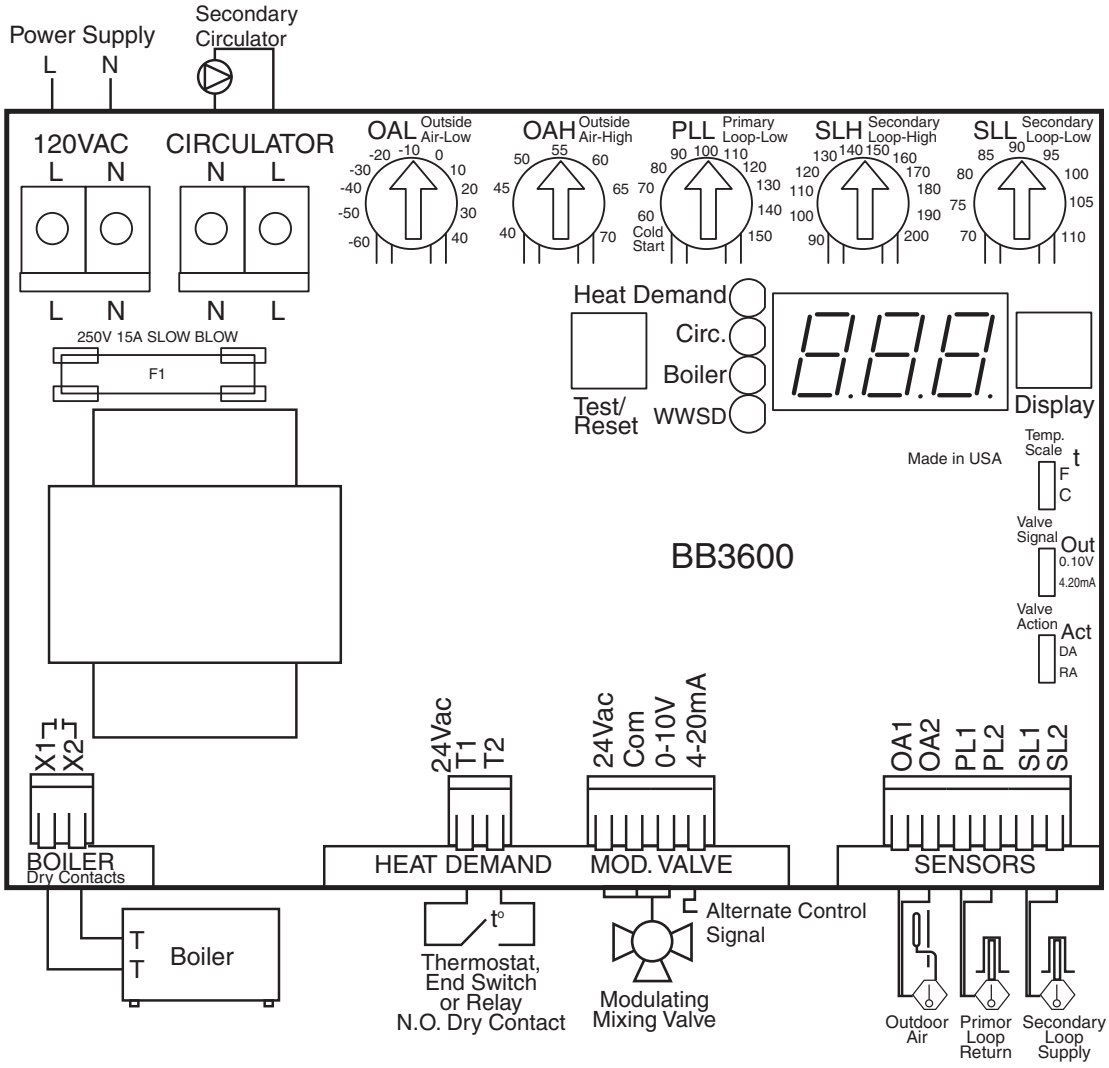
Temperature Limits:
- **Shipping and Storage:** -20 to 140 °F (-29 to 60 °C).
- **Operating:** 40 to 104 °F (4 to 40 °C).

Humidity: Up to 95% RH, non-condensing.
Location: NEMA Type 1 (IP23), solid wall, away from heat source and direct sun.

Regulatory Agencies

UL/CUL: Listed, File #E9429.
FCC: Tested to comply with FCC Part 15, Subpart B.

TYPICAL APPLICATIONS

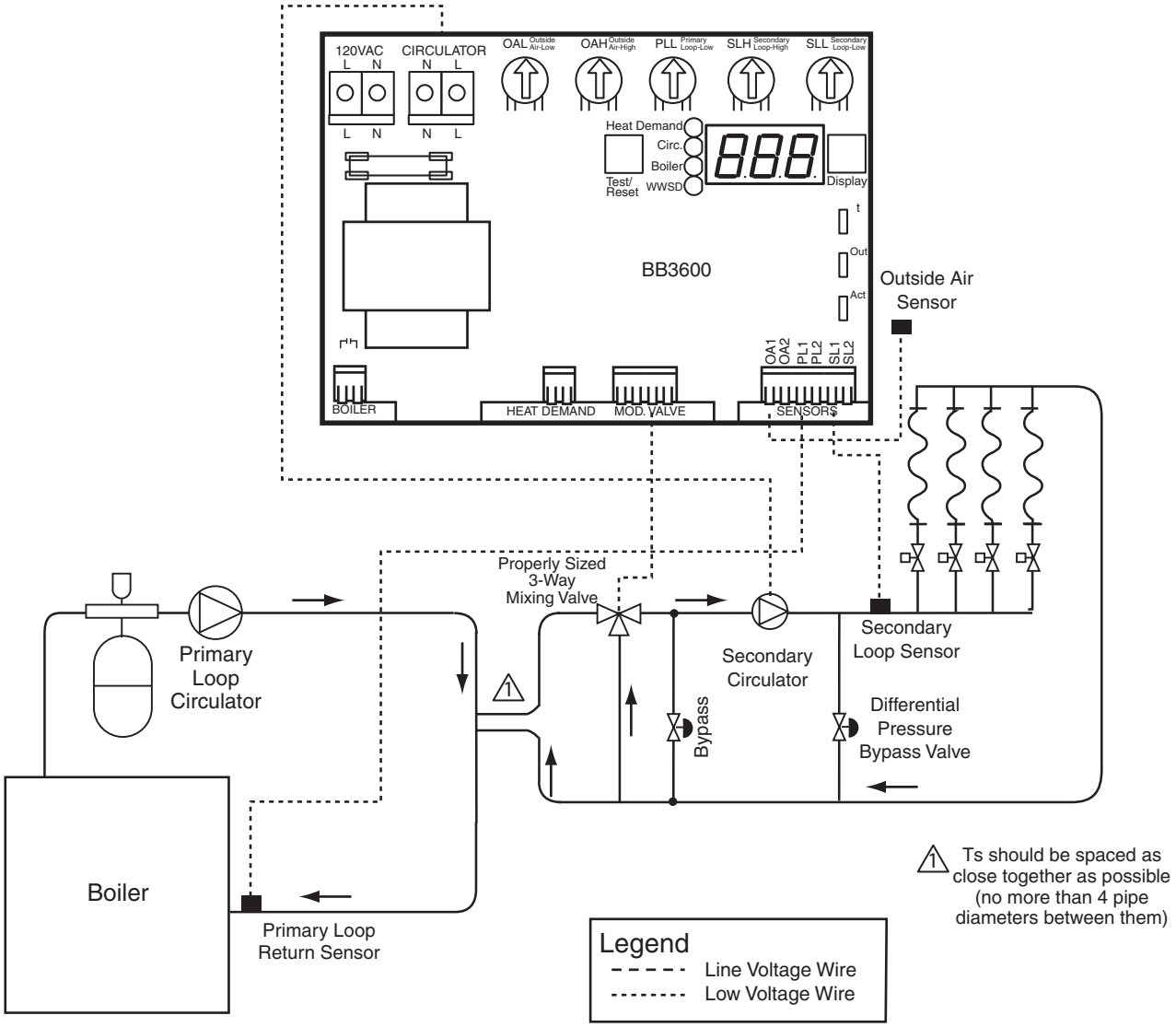


Note: The BB3600 enclosure must be earth grounded at the green ground screw.

Figure-1 Basic Wiring.

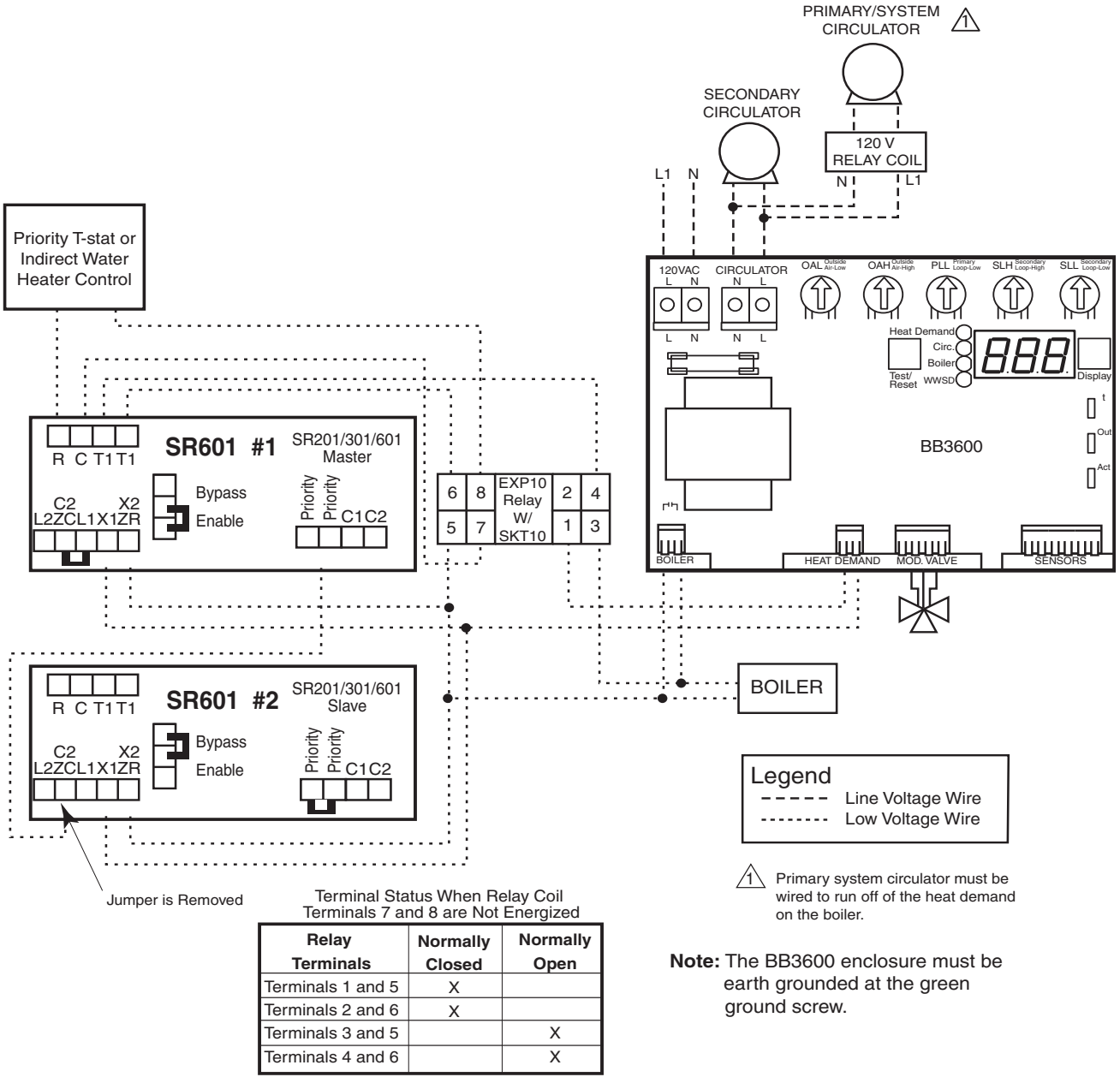
NOTE

The primary loop circulator must run any time there is a heat demand on the secondary loop.



Note: The BB3600 enclosure must be earth grounded at the green ground screw.

Figure-2 Typical Wiring and Piping for Three-way Mixing Valve Control of a Secondary Radiant Loop.



Terminal Status When Relay Coil Terminals 7 and 8 are Not Energized

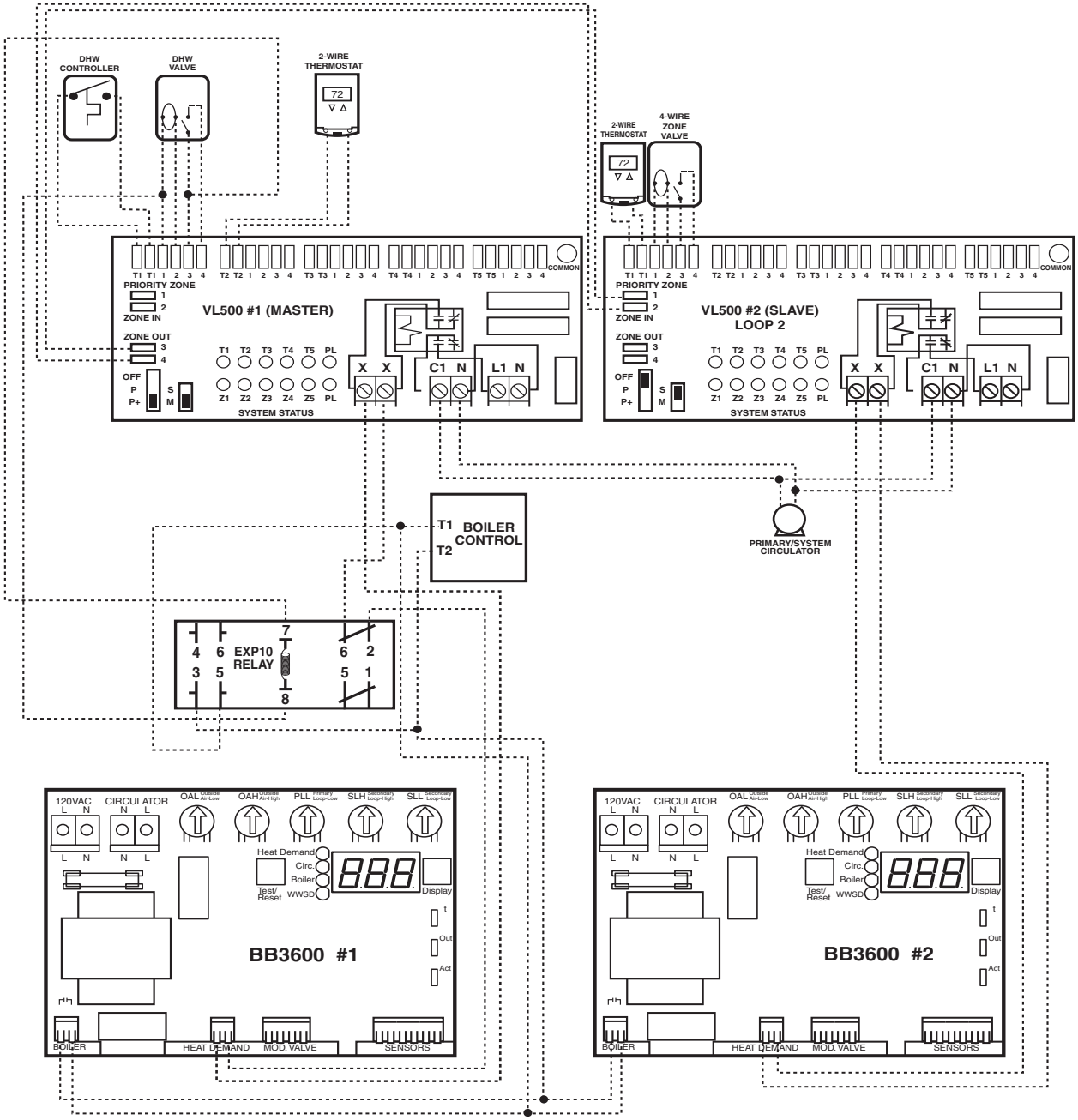
Relay Terminals	Normally Closed	Normally Open
Terminals 1 and 5	X	
Terminals 2 and 6	X	
Terminals 3 and 5		X
Terminals 4 and 6		X

Note: The BB3600 enclosure must be earth grounded at the green ground screw.

Figure-3 Typical Wiring for Single Temperature, Two Secondary Loops with BB3600 and Two SR201/301/601 Units with DHW Priority.

NOTE

See page 18 for sequence of operation.



Note: The BB3600 enclosure must be earth grounded at the green ground screw.

Figure-4 Typical Wiring for Two Temperature, Two Secondary Loops with Two BB3600s and Two VL500s with Priority.

NOTE

See page 19 for sequence of operation.

INSTALLATION

Inspection

Inspect the package for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the package and inspect the device for obvious damage. Return damaged products.

Requirements

These items are required for a typical installation, but are not provided.

- Job wiring diagram
- Tools
  - — Wiring tools
  - — Screwdrivers for mounting and wire terminals
  - — Drill and bits for mounting
- Hardware and accessories as needed
  - — Four mounting screws (and anchors or nuts as appropriate)
  - — Wire and conduit
  - — Outdoor sensor enclosure
  - — Two sensor wells
- Training: Installer must be a qualified, experienced technician.

Precautions

General

WARNING

- Electrical shock hazard! Disconnect power before installation to prevent electrical shock or equipment damage.
- Make all connections in accordance with the electrical wiring diagram and in accordance with national and local electrical codes.
- Follow static electricity precautions when installing this equipment.
- Use copper conductors suitable for operation at 167 °F (75 °C).
- The BB3600 enclosure must be grounded.
- The power supply for the control signal is a grounded half-wave supply, intended for connection to a half-wave-supplied valve actuator. A valve actuator with a full-wave power supply requires a separate isolated transformer for its power supply. If uncertain, or for further information, refer to document EN-206 (#F-26363), *Guidelines for Powering Multiple Full-wave and Half-wave Rectifier Devices from a Common Transformer*.

CAUTION

- Avoid locations where excessive moisture, corrosive fumes, explosive vapors, or vibration are present.
- Avoid electrical noise interference. Do not install near large conductors, electrical machinery, or welding equipment.

Federal Communications Commission (FCC)

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 residential installations. This equipment generates, uses, and can radiate radio frequency energy and may cause harmful interference if not installed and used in accordance with the instructions. Even when instructions are followed, there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio and 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.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Canadian Department of Communications (DOC)

N O T E

This class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

European Standard EN 55022

CAUTION

This is a class B (European Classification) product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

System Design

Good system design is essential for proper performance. Figures 2 through 4 offer portions of typical systems, but a full discussion of system requirements is beyond the scope of this document. Refer to modern hydronic heating textbooks and industry training for further information.

Mounting The BB3600

The BB3600 is designed for vertical wall or cabinet mounting. Select a mounting location on a solid (non-vibrating) vertical surface near the modulating valve or boiler. Do not mount on boiler surface or any other surface that exceeds 100 °F (38 °C). Do not mount in direct sunlight.

1. Loosen two screws holding the cover and remove the cover.
2. For wall mounting, fasten a screw through one of the top holes in the back plate. Level the unit and fasten the other top screw then the bottom screws. For panel mounting, the enclosure may be used as a template to mark the top of the four keyholes on the mounting surface.
3. Replace the cover (may be left off until wiring is completed).

Loop Sensors

Install sensors in wells with heat conductive compound for fastest response, or strap the sensor securely to the metal pipe and cover with aluminum tape. Cover with at least one inch of thick insulation extending two inches beyond each end of the sensor.

Primary Loop Sensor

For boiler low temperature return protection, the primary loop sensor must be located on the return line of the boiler loop, downstream from any secondary returns to ensure proper mixing and accurate reading. It may alternatively be used as a minimum supply sensor, which is installed on the supply side of the boiler loop.

N O T E

To get an accurate measurement, the primary circulator must be wired to run whenever there is a heat demand.

Secondary Loop Sensor

The secondary loop sensor should be located downstream of the secondary circulator to ensure proper mixing and an accurate reading.

Outdoor Air Sensor

Mount the outdoor air sensor in a shaded location (northerly exposure) not affected by the sun or by other heating or cooling sources (air or dryer vents, heat pump, air conditioning equipment, etc.). Mount above the snow line.

CAUTION

To minimize interference, do not position the sensors beyond 75 ft. (23 m) from the BB3600. While not normally needed, twisted pair or shielded cable may be used in electrically noisy environments.

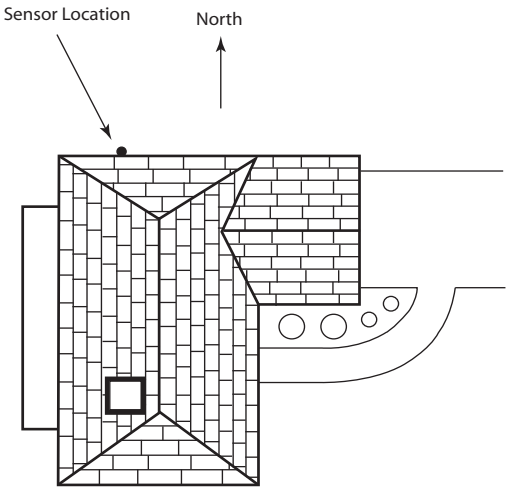


Figure-5 Outdoor Air Sensor Placement.

Wiring

N O T E

- A true earth ground must be wired to the BB3600 enclosure ground screw.
- Use 18 to 22 AWG for low voltage wiring, and 12 to 14 AWG for line voltage wiring.
- Use copper wire of a gauge and insulation class sufficient for the current and voltage applied.

CAUTION

- Locate wires away from any electric noise generating devices.

Do not run sensor or valve control wire in close proximity and parallel to line voltage wiring.

WARNING

Do not run sensor or valve control wire in conduit with line voltage wire. All inputs supply Class 2 power to the input device. Do not connect external power source to inputs.

See Figure-1 or the label inside the enclosure cover for terminal locations on the BB3600 circuit board. See Figures 2 through 4 for sample system wiring. Refer to Specifications to verify that wiring and connected devices meet the required ratings.

Sensors (OA1-OA2, PL1-PL2, SL1-SL2)

Sensors are non-polarized. Connect the wires from the Outdoor Air Sensor to the OA1-OA2 terminals, the Primary Loop Sensor to PL1-PL2, and the Secondary Loop Sensor to SL1-SL2, running the wires through one of the bushings provided. While not normally needed, twisted pair or shielded cable may be used in electrically noisy environments.

Heat Demand Input (T1-T2)

Connect an external Class 2 normally open dry contact (that closes with heat demand) to the T1-T2 terminals, running the wires through one of the provided bushings.

Modulating Valve Output (24Vac - Com - 0-10V - 4-20mA)

WARNING

The power supply for the control signal is a grounded half-wave supply, intended for connection to a half-wave-supplied valve actuator. A valve actuator with a full-wave power supply requires a separate isolated transformer for its power supply. If uncertain, or for further information, refer to document EN-206 (#F-26363), *Guidelines for Powering Multiple Full-wave and Half-wave Rectifier Devices from a Common Transformer*.

Connect a half-wave actuator using three-conductor wire to the 24 Vac-COM-0 to 10 V terminals, running the wires through one of the bushings provided. The 4 to 20 mA terminal may be used instead of the 0 to 10 V terminal if required by the valve or the application. A full-wave actuator requires a separate transformer.

Boiler Output (X1-X2)

Connect the internal Class 2 normally open dry contact from the X1-X2 terminals to the T-T (heat demand) terminals on the boiler, running the wires through one of the provided bushings.

Circulator (L-N)

This output may operate a secondary circulator directly, or it may operate a relay that controls both a primary and a secondary circulator. Connect the circulator (or relay) to the circulator terminals, observing the polarity L to L and N to N. Ground the circulator per its instructions.

Line Voltage Power Supply (L1-N/L2)

Connect the supply to the 120 VAC terminals, observing the polarity L to L and N to N.

Ground

Connect an earth ground to the green ground screw on the left side of the metal housing. Do not rely on conduit for grounding.

INITIAL SETUP

Prior to supplying power to the system, the following board level parameters should be selected or adjusted using the dials and jumpers. Refer to Figure-1 for circuit board layout.

NOTE

Changes to settings must be followed by either cycling power or by pressing the Test/Reset or Display button.

Temperature Scale

The BB3600 control can display operating temperature in Celsius or Fahrenheit. Locate the jumper on the right side of the circuit board. It is factory set on the upper pins for Fahrenheit. To change the display to Celsius, move the jumper to the lower pins.

Valve Signal

The BB3600 can control a proportional valve with either a 0 to 10 V or 4 to 20 mA control signal. The jumper is factory set on the upper pins for 0 to 10 V. To change to a 4 to 20 mA signal, locate the jumper on the right side of the circuit board and move the jumper to the lower pins.

Valve Action

The BB3600 can control a valve that is either direct acting (DA) or reverse acting (RA). The valve action jumper should be set to direct acting (DA) for a valve that opens the service port with an increasing signal and to reverse acting (RA) for a valve that closes with an increasing signal. The jumper is factory set to direct acting. To change to reverse acting, locate the jumper on the right side of the circuit board and move the jumper to the lower pins.

NOTE

Some valve actuators may define DA and RA differently. Ensure that the settings match the actual valve operation.

System Temperature Settings

The BB3600 has five dials for setting all system temperatures independently. Five design parameters must be set: Outside Air Low - OAL (outdoor design temperature), Outdoor Air High - OAH (warm weather shutdown), Primary Loop Low - PLL (minimum return temperature), Secondary Loop High - SLH (maximum radiant loop temperature), and Secondary Loop Low - SLL (minimum radiant loop temperature). The design temperatures are read from the potentiometers when displayed after power-up, and may be changed while displayed or when followed by a reset. The temperatures may be preset approximately prior to power-up, then adjusted precisely during start-up.

Temperature Setting Guidelines

OAL - Outside Air Low—Set the outside design temperature according to the standard design temperature for the geographic area, or the outside temperature at which maximum heat is desired.

OAH - Outdoor Air High—The Warm Weather Shutdown (WWSD) temperature should be set to the outdoor temperature at which no heat is desired, typically 65 to 70 °F. To establish a reset curve OAH must be at least 20F (11C) degrees higher than OAL.

PLL- Primary Loop Low—The minimum boiler return temperature should be set according to boiler specifications. PLL must be set lower than the turn-on point (high limit minus differential) of the boiler. If PLL is set higher than the boiler turn-on point, the boiler may not fire while the BB3600 is waiting for the primary loop temperature to rise above PLL. For cold start boilers, or to disable boiler condensation protection, set PLL to “Cold Start.” If the primary loop sensor is positioned on the primary supply, set PLL for the minimum supply temperature desired. The PLL must be set lower than the turn-on point of the boiler to prevent a lockout condition.

The PLL uses a 10F degree differential. For example: with PLL set to 130 °F the boiler output will turn on when the primary loop return drops to 130 °F during a heat demand and will remain on until the temperature reaches 140 °F (as long as there is a heat demand).

SLH - Secondary Loop High—Set the maximum radiant loop temperature to the water temperature desired when it is coldest outside (at design temperature). Do not exceed the recommended temperature for the flooring being used.

SLL - Secondary Loop Low—Set the minimum radiant loop temperature desired when the outdoor temperature is near the WWSD point. A typical setting is 90 °F. To establish a reset curve SLL must be at least 20F (11C) degrees lower than SLH.

STARTUP

Status Indicators

Before power-up, note the location and purpose of each of the following indicators

Heat Demand LED: Lit when there is a contact closure at the "Heat Demand" input (when any of the heating zones are calling for heat).
Circ. LED: Lit when the circulator output is turned on by the BB3600.
Boiler LED: Lit when the boiler output is turned on by the BB3600.
WWSD LED: Lit when the BB3600 is in warm weather shutdown mode.
Three-Character LED Display:

Run Mode (Normal Operation), Displays the three sensors (Outdoor Air, Primary Loop, and Secondary Loop), the Secondary Loop Setpoint and the valve output sequentially.

Test and Setup Modes, Sequentially displays all system settings, inputs and outputs.

Test Mode

Turn on the power to the system. Left untouched, the display will begin scrolling through all the parameters set previously, and then the control will continue in the Run Mode. Hold down the Display button and press the Test/Reset button to enter test mode. The Display button can then be used to advance through the test sequence in Table-1. Verify the display shows the proper values and the inputs and outputs function properly.The display must be advanced manually in this mode to allow for system testing.

NOTE

The test sequence can be repeated at any time by holding down the Display button and pressing the Test/Reset button.

Table-1 Test Mode Display Sequence.

Feature	Displayed		Description
Display Test	8.8.8.		Verify that all segments are lit.
24 VAC Supply Voltage Test	AC	15.0...30.0	Verify that transformer voltage is 20-30 Vac.
Heat Demand (thermostat) Input Test The thermostat or end switch may be cycled to verify proper operation.	tt	OFF ON	Open contact: Heat Demand LED off Closed contact: Heat Demand LED on
Circulator Output Test	crc	ON	Relay, circulator, and Circ. LED on
Boiler Output Test	blr	ON	Relay, boiler, and Boiler LED on
Warm Weather Shutdown (WWSD) LED test	OAC (Outdoor Air Cutoff)	ON	WWSD LED on
DC Output (Valve Control) Test	dc	0...10.0	DC output ramps from 0-10V (0-20mA) repeatedly
Continue in setup mode	t		See Power-up/Setup Display Sequence

Setup Mode

This mode is entered on power up or any time the Display or Reset button is pressed. On power up or reset the settings are scrolled through automatically. To scroll through them manually press the Display button once and then press it again after each setting has been reviewed.

After the test mode, the display will continue as it did at power up except it is advanced manually by pressing the Display button.

Verify each of the settings shown in Table-2. The jumper settings can be changed and the temperatures can be fine tuned to the desired settings while they are displayed. Subsequent changes will not be implemented until the power is reset or one of the buttons is pressed to repeat the sequence. The three sensor readings can also be verified

NOTE

While in the Setup Mode, the display will remain at the current parameter long enough to adjust the setting or view the sensor reading. If the Display button is not pressed for 60 seconds, the display will start advancing automatically. To stop the display again, press the Display button. To start at the beginning of the Setup Mode, press the Reset button then the Display button to stop it from advancing.

Table-2 Power-Up/Setup Display Sequence.

Feature	Displayed		Description
Temperature Scale (Jumper-selectable)	t	°F °C	Fahrenheit Celsius
Control Signal Output (Jumper-selectable)	Out	0.10 4.20	0 to 10 VDC 4 to 20 mADC
Valve Action (Jumper-selectable)	act	DA RA	Direct Acting Reverse Acting
Outdoor Air Low (Outdoor Design Temperature) (Potentiometer adjustable)	OAL	-60..41 -51..5	°F range °C range
Outdoor Air High (Warm Weather Shutdown) (Potentiometer adjustable)	OAH	40..70 4..21	°F range (must be ≥ OAL+20) °C range (must be ≥ OAL+11)
Primary Loop Low (Min. Return Temperature) (Potentiometer adjustable)	PLL	0, 60..150 0, 15..65	°F range (0=Cold Start) °C range (0=Cold Start)
Secondary Loop High (Max. Radiant Loop Temp.) (Potentiometer adjustable)	SLH	90..200 32..93	°F range °C range
Secondary Loop Low (Min. Radiant Loop Temp.) (Potentiometer adjustable)	SLL	70..110 21..43	°F range (must be ≤ SLH-20) °C range (must be ≤ SLH-11)
Outdoor Air Temperature (Current Outdoor Temp.) (Sensor input)	OA	-30..122 -51..50 Err...Opn Err...Sht	°F range °C range Opened sensor error Shorted sensor error
Primary Loop Temperature (Current Return Temp.) Sensor input)	PL	32..221 0..105 Err...Opn Err...Sht	°F range °C range Opened sensor error Shorted sensor error
Secondary Loop Temperature (Current Radiant Temp.) (Sensor input)	SL	32..221 0..105 Err...Opn Err...Sht	°F range °C range Opened sensor error Shorted sensor error
Continue in Run Mode	run	. . .	(If scrolling manually, press the Display button to continue.) Brief delay between modes

Run Mode

After the Setup Mode is complete, the display will indicate “Run”. Pressing the Display button once more will advance the control into the Run mode. It will continuously loop until the Test/Reset or Display button is pressed.

Verify that the five values are displayed repeatedly as shown in Table-3 without indicating a low power condition (“LO...AC”) or sensor fault (flashing display and “Err” displayed instead of temperature).

NOTE

Once in the Run mode, changes in settings are ignored until a button is pressed or power is lost and restored. Pressing the Display button does not interrupt normal operation, whereas pressing Test/Reset resets the control to a power-up condition.

The Outdoor Air (OA), Primary Loop (PL), Secondary Loop (SL) and Secondary Loop Setpoint (SLS) temperatures are monitored continuously and displayed during normal operation. The SLS is calculated based on the design settings and the current OA temperature. The valve control signal is also displayed after the temperatures.

With the system now operating, it may be further tested by operating the thermostats or heat demand relays. Sensors may be disconnected to accommodate abnormal startup conditions.

If the outdoor temperature is above the OAH setting, the system will indicate a Warm Weather Shutdown condition and prevent heating operation. To temporarily override this and allow further system testing, disconnect one lead of the OA sensor. This results in a default temperature at the midpoint between 32 °F (0 °C) and OAL.

If the primary return temperature is below the PLL setting the system will indicate a low return temperature (flashing “L” after “PL”) which may prevent further heating operation until the system reaches operating temperature. To temporarily override this and allow further system testing, disconnect one lead of the PL sensor. This results in a default PL temperature of 151 °F (66 °C).

Table-3 Run Mode Sequence.

Feature	Displayed		Description
Outdoor Air Temperature (Sensor Input)	OA	-60..122 -51..50 Err (continuously flashing)	°F range °C range Sensor error
Primary Loop Temperature (Current Return Temp.) (Sensor Input) (A flashing L appears after PL indicating low return)	PL	32..221 0..105 Err (continuously flashing)	°F range °C range Sensor error
Secondary Loop Setpoint (Calculated Radiant Setpoint)	SLS	70..110 21..93	°F range (SLL≤SLS≤SLH) °C range (SLL≤SLS≤SLH)
Secondary Loop Temperature (Current Radiant Temp.)	SL	32..221 0..105 Err (continuously flashing)	°F range °C range Sensor error
Modulating Valve Output	dc	0..100	Modulating valve output (%)
Low AC condition (24 Vac supply <20.0 Vac)	LO...AC...15.0..19.9 (blank if below 15.0 Vac)		Circulator and Boiler off, valve closed

THEORY OF OPERATION

System Indicators

Refer to "Status Indicators" and "Run Mode" in the "STARTUP" section above for details on the status LEDs and the 3-character display.

Valve Control

Three sensors provide feedback for the control system. The colder it is outside the warmer the desired water temperature or Secondary Loop Setpoint (SLS). At design temperature (OA = OAL), SLS = SLH. At warm weather shutdown (OA = OAH), SLS = SLL. Between OAL and OAH, SLS is determined by a straight line relation. See Figure-6 and Figure-7. The modulating valve output is enabled whenever there is a heat demand. To provide the proper temperature in the radiant loop, the valve output is controlled using a proportional-integral (PI) algorithm.

Heat Demand

When a heating zone is calling for heat, the "Heat Demand" LED indicates a contact closure provided to the "Heat Demand" input. The contact must be maintained closed or open for five seconds before the control changes its state.

Zone Controls

For On/Off zones, use electronic thermostats with small differentials (1F degree) to provide close control. The frequent cycling of anticipating-type thermostats may prevent the system from stabilizing. If the system has only a few zones which are on for short periods of time, the secondary loop temperature may not stabilize. If stability is not achieved, the “Heat Demand” inputs can be shorted (using a switch or relay contact) to keep the secondary circulator running and provide consistent secondary loop temperature.

Circulator Operation

The circulator contacts are closed and the Circ. LED is turned on whenever there is a heat demand, except during warm weather shutdown.

Boiler Operation

The boiler contacts are closed and the boiler LED is turned on whenever the modulating valve opens to 50%. When the SL temperature is high enough to allow the valve to close to 30% the boiler output is turned off. To prevent short-cycling the boiler output will not turn off until it has been on for at least five minutes and will not restart until it has been off for at least one minute.

Primary Loop Return Protection

If the PL sensor indicates a possibility of the return temperature falling below the selected minimum, the modulating valve is gradually closed to prevent condensation of flue gases, and the boiler is turned on to raise the primary loop temperature. Once the boiler is turned on due to a low return temperature, it will remain on until the temperature is at least 10 °F above the minimum (PLL). If the return temperature actually falls below PLL, the valve is closed completely while the boiler recovers. This function is active only while there is a heat demand. Setting PLL to "Cold Start" disables the function.

N O T E

To get an accurate PL measurement needed for boiler protection, the primary circulator must be wired to run whenever there is a heat demand.

Warm Weather Shutdown

When the OA temperature reaches the warm weather shutdown level the control will close the modulating valve, turn off the radiant loop circulator and boiler, and turn on the WWSD LED.

Sensor Failure

In the event of a sensor failure, the control will continue to operate in a “safe” mode to prevent freeze up. The system will not shut down. The display will flash rapidly to alert the building owner, and “Err” will be displayed instead of the temperature, but operation will continue as detailed. The fault handling techniques also allow replacement of the sensors while the control continues to run.

OA

If the OA sensor fails, the OA temperature will default to the midpoint between 32 °F and OAL ("Err" displayed after "OA"). This will keep the SLS at the reset temperature corresponding to 32 °F-(32 °F-OAL)/2. The sensor fault may result in insufficient heating at lower temperatures but the default condition should help prevent freeze up. This default allows for a warm weather test mode by temporarily disconnecting the OA sensor (no need for a fixed resistor to be installed). It also allows for a normally open switch or time delay relay contact to be placed in parallel with the sensor. This could be used as a temperature boost for seasonal start up or override of the WWSD.

PL

If the primary loop return sensor fails, the PL temperature will default to 151°F "Err" displayed after "PL". This is above any possible setting for the return protection (PLL), so it effectively allows continued operation without the benefit of return protection. If PLL is set to "Cold Start" a sensor fault will cause "Off" to be displayed after "PL" while running. This allows the control to be installed without the sensor if it is not needed for the application.

SL

If the secondary loop sensor fails, the mixing valve will provide a minimum delivery of heat to the secondary loop during a heat demand. The valve signal is set to 3.5 V for 40 seconds every five minutes (and "Err" is displayed after "SL"). The sensor fault may result in insufficient heating but should help prevent freeze-up.

Fine Tuning

N O T E

Changes to the temperature settings are read only when displayed, either after pressing a button or after power-up.

1. If heating is inadequate at relatively warmer outdoor temperatures (below OAH) increase the minimum loop temperature (SLL) by 5 to 10F degrees. See Figure-6.
2. If heat output is excessive at relatively warm outdoor temperatures (below OAH) decrease the minimum loop temperature (SLL) 5 to 10F degrees. See Figure-6.

If heating is inadequate at relatively cold outdoor temperature (above OAL) raise OAL by 5 to 10F degrees. See Figure-7. If the outdoor temperature is below OAL the SL temperature should be at its maximum.

WARNING

Do not increase SLH above the maximum temperature limitations for the installation method.

3. If the heat output is excessive at moderately cold outdoor temperatures (above OAL), decrease the outdoor design temperature (OAL) by 10 to 20F degrees. See Figure-7. If the outdoor temperature is at or below OAL, SLH may be decreased by 10 to 20F degrees.

Radiant Heating Reset Curves

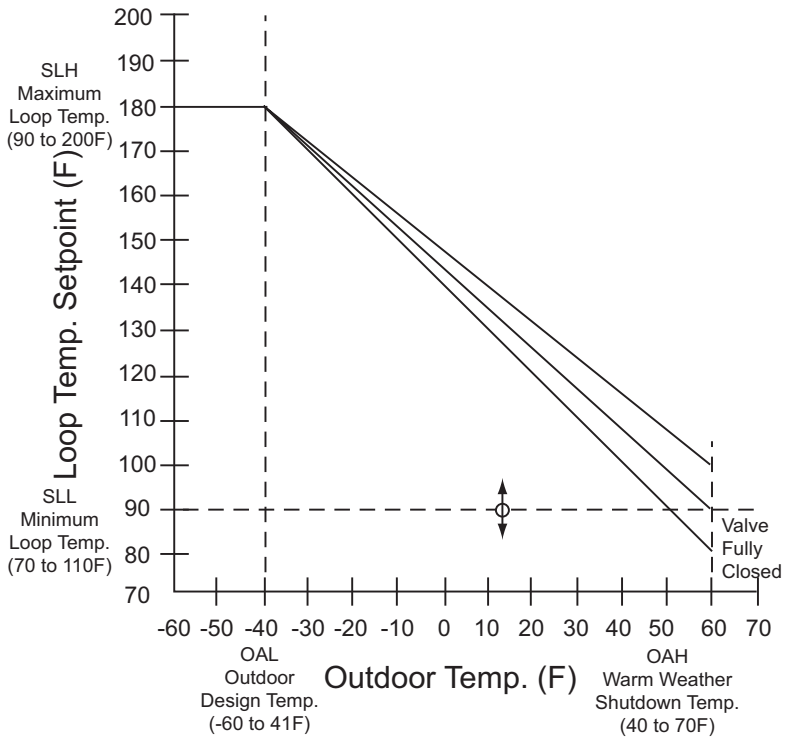


Figure-6 Adjustment of SLL for Proper Floor Temperature When Warmer Outside.

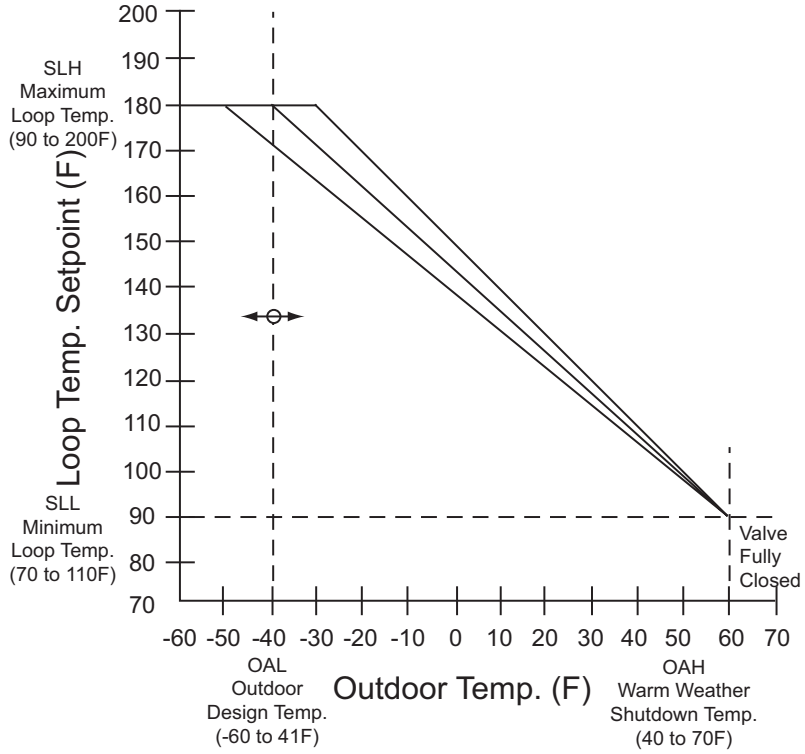


Figure-7 Adjustment of OAL for Proper Floor Temperature When Colder Outside.

APPLICATION EXAMPLES

Figures 3 and 4 show wiring of two typical systems. The operation of these systems is discussed in detail below.

N O T E

EXP10/SKT10 Relay: When coil terminals 7 and 8 are not energized; terminals 2-6 and 1-5 are closed; terminals 4-6 and 3-5 are open.

BB3600 with SR601

In this system, a BB3600, two SR601s and an EXP10 relay are used to control a modulating valve, zone pumps, a primary loop pump, and a boiler (see Figure-3).

Zone 1 on SR601 #1 is the priority domestic hot water (DHW). The DHW zone is presumed to be piped in parallel to the primary loop and served by its own circulator. Zones 2 thru 6 on SR601 #1 and zones 1 thru 6 on SR601 #2 are non-priority zones.

Whenever a contact closure occurs at any zone input (T1/T1-T6/T6) on the SR601, the corresponding zone relay is powered, closing its normally open contacts. This results in two actions on the SR601:

1. C1/C1 zone circulator terminals are powered with 120 V.
2. Normally open dry contacts X1-X2/ZR are closed.

When a DHW call occurs all other heating zone circulators wired to SR601 #1 and SR601 #2 are locked out.

On A Call For Heat By Any Or All Non-Priority Zones

1. Zone 2 (for example) thermostat contacts close, completing the heat demand input circuit across terminals T2/T2 of heating zone 2 on the master SR601.
2. Zone 2 relay on SR601 #1 is powered, completing 120 V power to Zone #2 circulator wired to C2/C2 of master SR601.
3. The master SR601's normally open dry contacts, X1 and X2/ZR, close, completing the heat demand input to terminals T/T of the BB3600.
4. BB3600 operates secondary loop modulating valve, secondary loop circulator and boiler per specifications.
5. A relay in parallel to the secondary loop circulator output of the BB3600 will provide power to the primary loop circulator whenever there is a demand for heat on any BB3600 heating zone.

N O T E

To supply hot water to the secondary loop and to ensure a valid primary temperature measurement, the primary loop circulator must be powered whenever there is a heat demand on the secondary loop.

On A Call For Heat By The DHW Priority Zone

1. On a call for domestic hot water the normally open dry contacts in the DHW controller close, completing a 24 V circuit which energizes the EXP10 relay coil at terminals 7 and 8. The 24 V power is provided via the R and C terminals on the master SR601. The R and C terminals are wired in parallel to the 24 V transformer on the SR601.
2. The EXP10 coil is energized, closing the normally open contacts and opening the normally closed contacts.
   a. EXP10 N.O. contacts 4 and 6, close, completing a circuit through terminals T1/T1 of the master SR601. Circuit closure across T1/T1 results in power to the DHW circulator that is wired to terminals C1/C1 of the master SR601.
   b. EXP10 N.O. contacts 3 and 5 close, completing the circuit to terminals T/T of the boiler. The boiler will cycle based on its high limit and differential settings as long as the DHW demand exists.
3. The master SR601's normally open dry contacts X1 and X2/ZR have now closed.
4. The coil relay EXP10 has been energized by the logic in step #1. Normally closed dry contacts terminals 1 and 5 of EXP10 will open, disabling the heat demand input to the T1/T2 terminals on the BB3600.

BB3600 with VL500

In this system, two BB3600s, two VL500s and an EXP10 relay are used to control modulating valves, zone valves, a primary and secondary loop pumps, and a boiler (see Figure-4). There are two separate secondary radiant floor loops, each controlled by a BB3600. Each secondary loop provides supply water to the associated zone valves that are controlled by the VL500s. The water temperature for each secondary zone loop is controlled and reset by the BB3600, depending on the outdoor air temperature and the heating demands of the floor loops.

On A Call For Heat By Any Non-Priority Zone

1. Thermostat contacts close the circuit to T1/T1 on VL500 #2.
2. Terminals 1 and 2 of zone 1 are energized on VL500 #2 which powers the zone valve open.
3. End switch N.O. contacts 3 and 4 are closed on the zone 1 valve on VL500 #2.
4. C1 and N are energized on VL500 #2.
5. Primary circulator is started.
6. Normally open contacts are closed at terminals X/X on VL500 #2.
7. Circuit is completed to terminals T1/T2 on the BB3600 #2.
8. BB3600 #2 operates the secondary loop pump, modulating valve, and boiler per specifications.

On A Call For Heat From A Priority Zone

1. DHW controller contacts close the circuit to T1/T1 on VL500 #1.
2. Terminals 1 and 2 of zone 1 are energized on VL500 #1. Zone #1 valve and EXP10 relay are energized.
3. End switch N.O. contacts 3 and 4 are closed on the zone 1 valve on VL500 #1.
4. C1 and N are energized on VL500 #2.
5. Primary circulator is started.
6. Zone valves 2-5 on VL500 #1 are de-energized.
7. Circuit is opened at Zone Out 3 & 4 on VL500 #1.
8. Zone In 1 and 2 circuit is opened on VL500 #2.
9. Zone Out 3 and 4 circuit is opened on VL500 #2.
10. All zones on VL500 #2 are de-energized.
11. Circuit at terminals 3 and 5 is closed on EXP10 relay.
12. Circuit to T1 and T2 is closed at the boiler.
13. Circuit at terminals 2 and 6 is opened on EXP10 relay.
14. VL500 #2 and both BB3600s are locked out.

MAINTENANCE

The BB3600 requires no maintenance.

Regular maintenance of the total system is recomended to assure sustained, optimum performance.

FIELD REPAIR

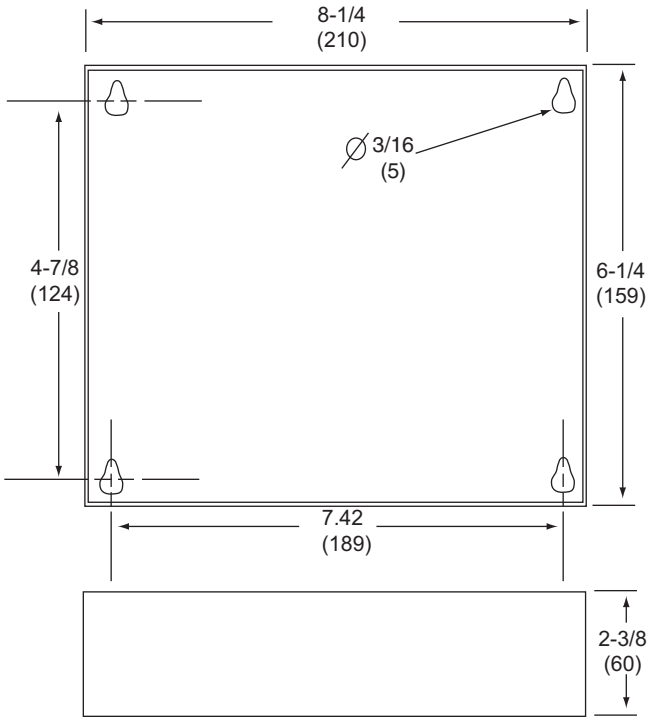
Replace any damaged or failed units with new replacements. Fuses are the only replaceable components.

Fuse Replacement

1. Turn off power to the BB3600.
2. Remove the BB3600 cover.
3. Remove the fuse.
4. Check continuity across the fuse.

5. If the fuse is faulty replace it with one of the same type and rating (see specifications).
6. Re-install the BB3600 cover.
7. Turn on the power to the BB3600.

DIMENSIONAL DATA



TROUBLESHOOTING

Symptom	Possible Cause	Action
No display	No 120 Vac power.	Check circuit breaker or fuse. Reset or replace as necessary. If it continues to fault, call a qualified technician.
	Blown internal fuse F1.	Check fuse F1; replace if necessary.
Unit displays "LO AC" or no display.	Short or excessive load present on 24Vac output.	Disconnect valve from 24Vac output to verify fault.
	Brownout condition.	Measure supply voltage to verify.
Unit flashes and displays "Err" after "OA", "PL", or "SL".	Offending sensor or wiring is either open or shorted.	Check offending sensor for damage to wire or sensor. The Setup mode can be used to determine whether the sensor wiring is shorted or open.

On October 1st, 2009, TAC became the Buildings business of its parent company Schneider Electric. This document reflects the visual identity of Schneider Electric, however there remains references to TAC as a corporate brand in the body copy. As each document is updated, the body copy will be changed to reflect appropriate corporate brand changes.

Schneider Electric
1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL 61132-2940

www.schneider-electric.com/buildings