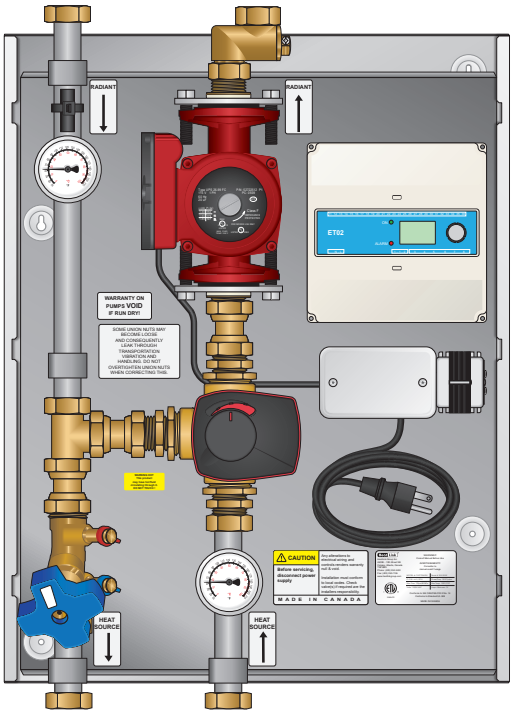
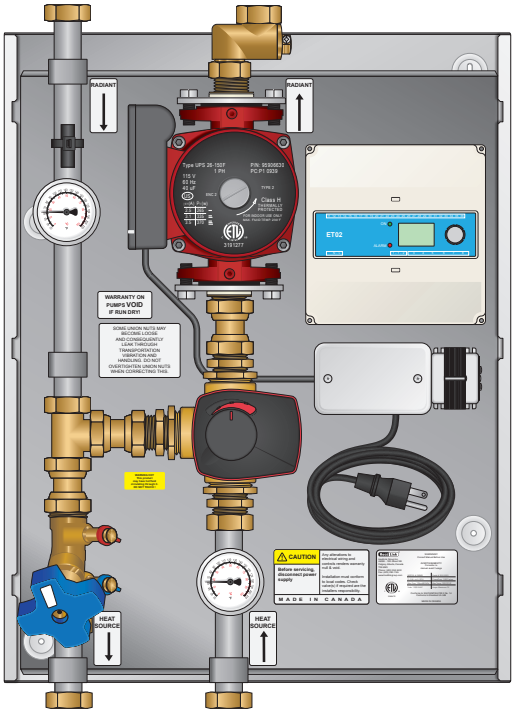
3WMIX-SMCP

Installation, Operation, and Maintenance Manual





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Disclaimer

Warnings

The zone control panel is for indoor use only and must be installed by a qualified installer/service technician. This product must be installed and operated in strict accordance with the terms set out in this manual and in accordance with the relevant requirements of the Local Authority Having Jurisdiction. Failure to comply will result in a void of warranty, and may also result in property damage, serious injury, or death.

Servicing

Prior to commencing installation of this panel it is necessary to read and understand all sections of this manual. The symbols below are used throughout this document to ensure proper operation of the panel, and your safety. Please pay attention to these symbols.

Warning
Possible Hazard

Warning
Live Power

Warning
Hot Pipes

Warning
Treated Water

In order to avoid injury or death, switch off the power to the panel prior to inspecting or making connections to the terminal strip.

Tools

- Level
- Screwdriver or power drill
- Flat head bit
- Phillips head bit # 2
- 2 adjustable wrenches (or 2 × 30mm wrenches)

Function

This zone control panel can provide mixing, distribution, and zoning for a wide variety of hydronic heating applications.
The effectiveness of the system is dependant on the system being designed and installed correctly. Proper consideration of factors such as BTU loads, outdoor design temperature, indoor design temperature, room set-point temperature(s), differential fluid temperatures, head loss, flow rates, and transfer capacities of the heat emitters is critical.
Once these factors have been considered and the system requirements determined, these can then be evaluated and compared to the panel capabilities.

Note: This panel does not regulate or monitor the operating safety limit temperatures of the fluid leaving the heat source.

Unpacking

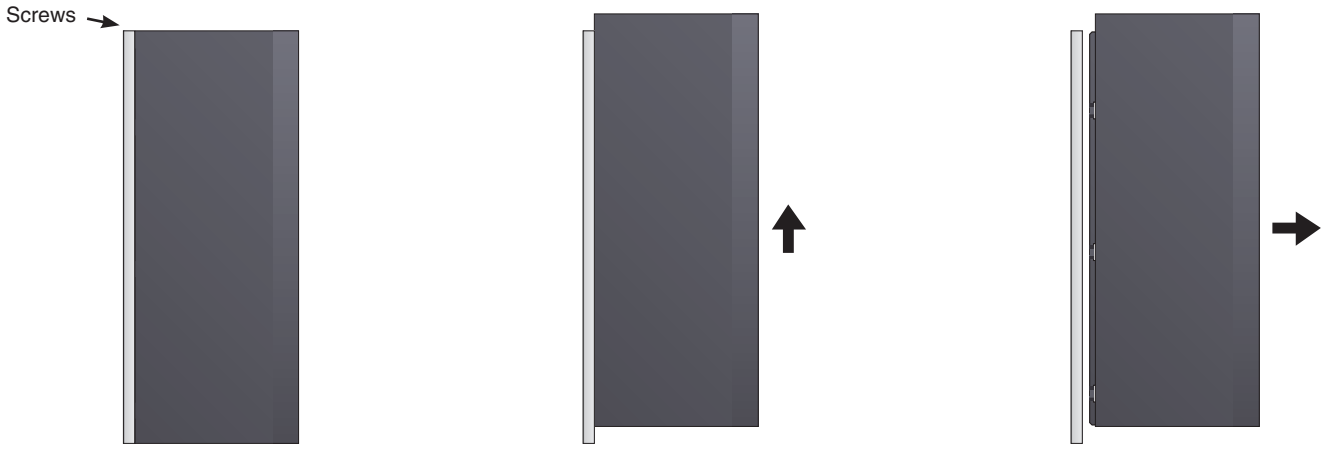
Step 1 Examine carton for any damage that may have occurred during shipping. If damage is visible notify your courier and supplier immediately.

Step 2 Open the carton by removing the staples.

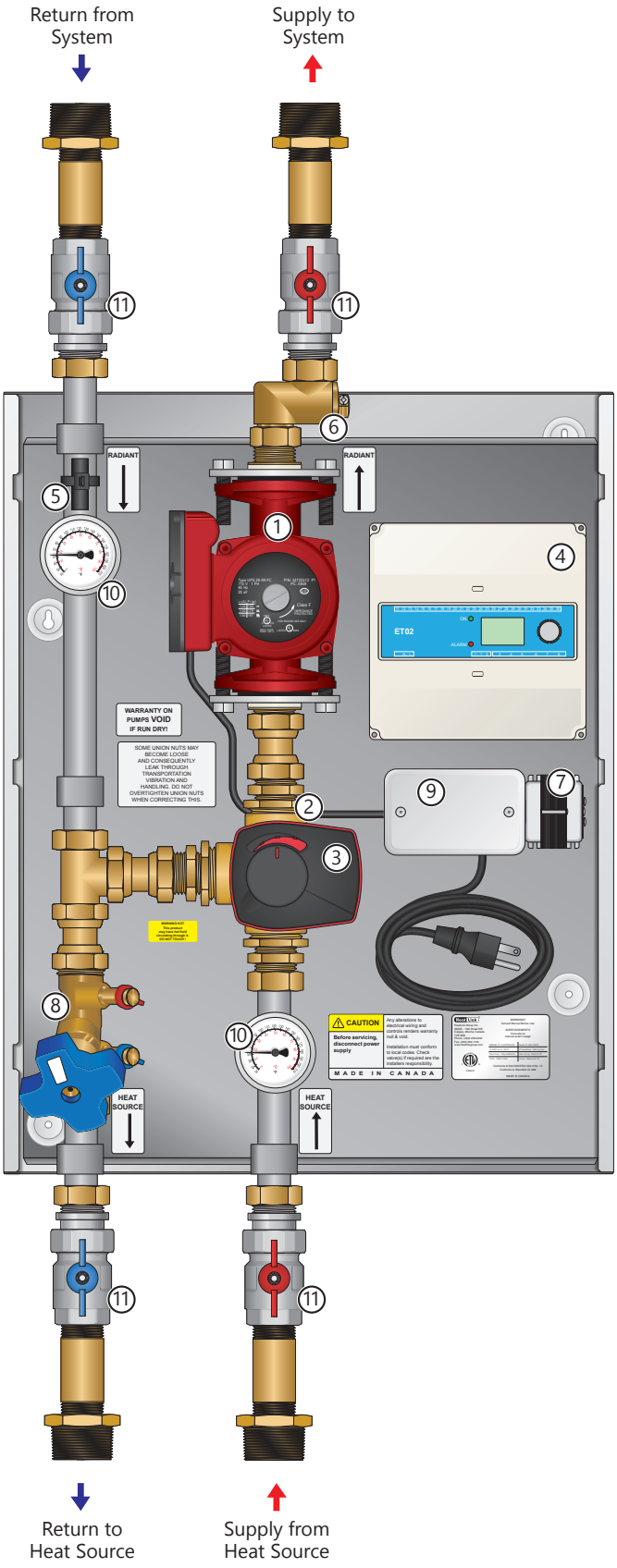
Step 3 Remove the cardboard spacers from the carton, then remove the panel from the carton. Lift the panel by the base, not the enclosure.

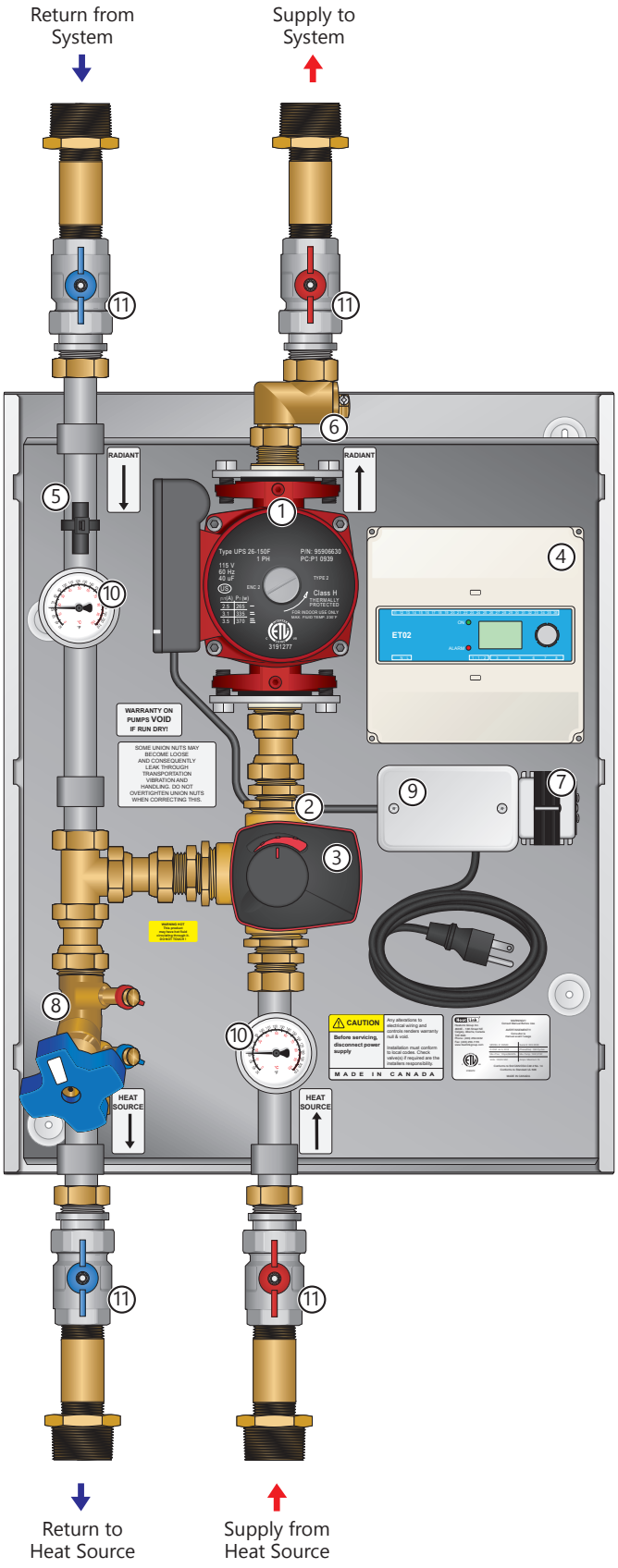
Step 4 There are 2 screws holding the enclosure in place during shipping. They are located at the top left & right of the panel base. Remove these 2 screws.

Step 5 Remove the enclosure from the panel by sliding it upwards until it stops, then gently pulling outwards off.



Panel Components





Panel Components (cont'd)

#	Components	Component Description	Part Number	
			3WMIX-SMCP	3WMIXHH-SMCP
1	Secondary pump	Moves the heated fluid through the system when there is a call for heat from the system controller.	UPS26-99	UPS26-150
2	1¼" Mixing valve (hidden)	3-way brass mixing valve regulates the temperature in the hydronic system with the help of the electric motor actuator and system controller.	63539	
3	DDC Mixing Valve Motor	Mounted to the control valve and moves the valve appropriately to allow the heated fluid to enter. Works in conjunction with the system controller.	58132	
4	Snow Melt control	The system controller regulates the panel operation.	ETO2SMCNTR	
5	Return sensor	Temperature sensor on the system return piping.	ETF1899ASNS	
6	Supply sensor	Temperature sensor on the system supply piping.	ETF1899ASNS	
7	24V(ac) transformer	Coverts power for the Snow Melt Control.	n/a	
8	Electrical Box	Houses transformer wiring.	n/a	
9	Balancing valve	Adjusts flow.	n/a	
10	Thermometer	Shows system temperature.	n/a	
11	Isolation valve assemblies*	Zone valve used to isolate the panel from the system during fill & purge, and maintenance.	n/a	

*Packaged in accessory box for shipping. See page 10 for piping hookup instructions.

Panel Component Specifications

	3WMIX-SMCP	3WMIXHH-SMCP
Listing	cETLus	
Conforms to	CAN/CSA-C22 No.14, UL508	
Dimensions	24"H ×18¾"W × 8"D	
Weight		
Max ambient temperature	120ºF	
Max water temperature	200ºF	
Settable fluid temperature range	100-145ºF	
Power supply	120V(ac)	
Pump	Ferrous, Grundfos UPS26-99FC	Ferrous, Grundfos UPS26-150FC
Auxiliary terminal	none	
Temperature control method	1-1⁄4" 3-Way Mixing Valve and DDC Motor	
Temperature control range		
Mixing valve Cv	18.7	
Piping	1" 304 stainless steel tubing, 1" brass	
Piping connections	1½" MNPT	
Backplate	Galvanized steel	
Enclosure	Powder coated steel	

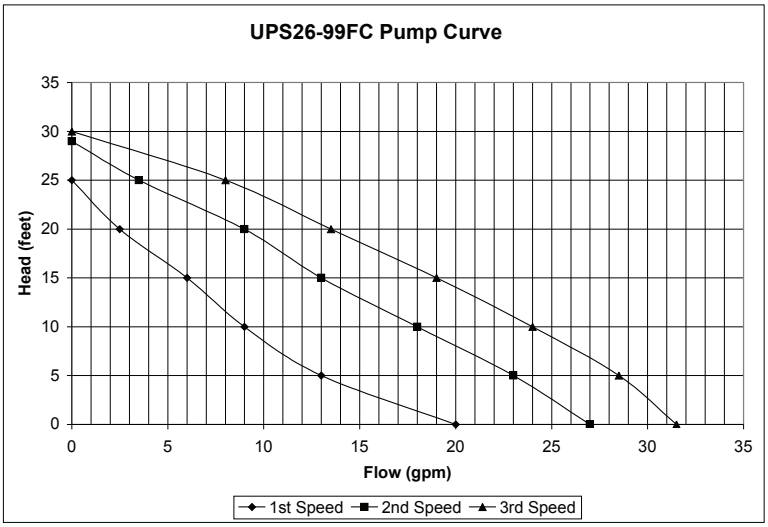
Pump Technical Data

	Model Number	
	UPS 26-99FC	UPS 26-150 FC
Material		
Inlet cone, bearing plate, bearing retainers, rotor can, rotor cladding, shaft retainer	Stainless steel	
Stator housing	Aluminum	
Shaft, upper and lower radial bearings	Aluminum oxide ceramic	
Thrust bearing	Carbon bearing and EPDM retainer	
Check valve	ACETA with 302 SS spring and nitrile rubber seats	
Pump housing (volute)	Cast iron	
O-ring and gaskets	EPDM	
Impeller	PES composite (30% glass filled)	
Terminal box	Noryl® with EPDM gasket	
Flow range	0-33 US gpm (0-7.5 m^3/h)	0-53 US gpm (0-12 m^3/h)
Head range	0-29 ft(0-8.8 m)	0-46 ft (0-14 m)
Motors	2-pole, single phase	
Max. liquid temperature	230ºF (110ºC)	
Min. liquid temperature	36ºF (2ºC)	
Max. system temperature	145 psi (10 bar)	

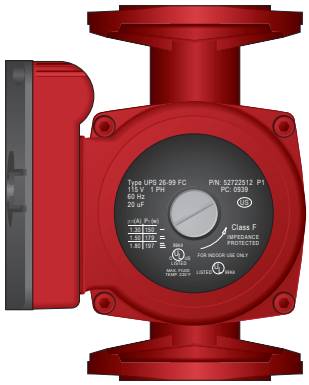
Pump Technical Data

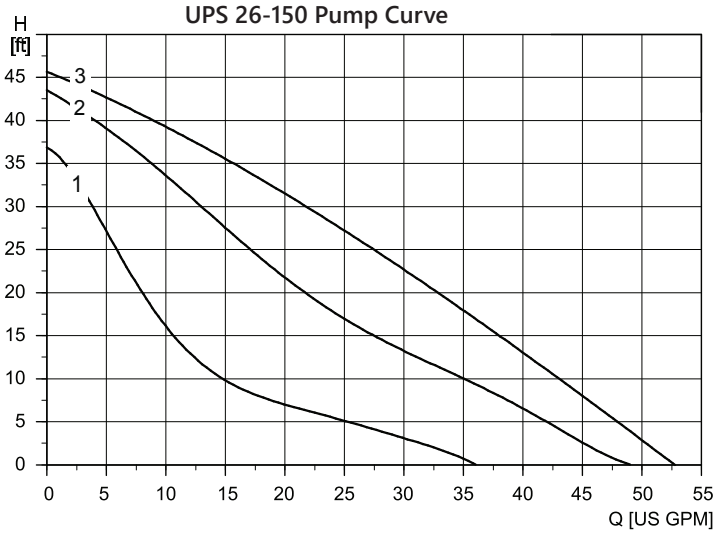
The pump moves the heated fluid through the system when there is a call for heat from the system controller.

The addition of glycol to the system will result in higher demand from the pump due to the change in viscosity of the fluid.



Speed	Volts	Amps	Watts	Hp	Capacitor
3	115	1.8	197	1/6	20 µF/180V
2		1.5	179	1/6	
1		1.3	150	1/6	

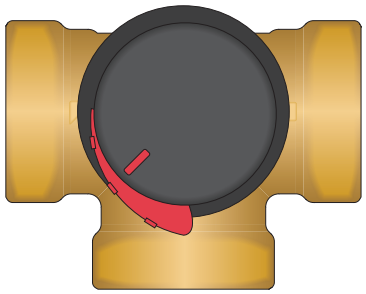


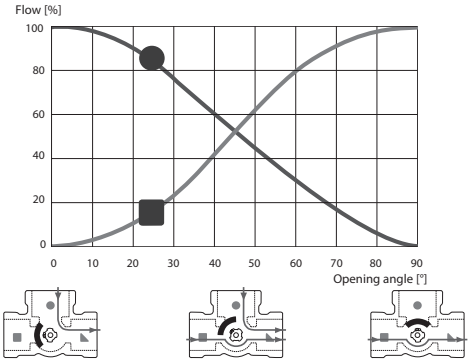


Speed	Volts	Amps	Watts	Hp	Capacitor
3	115	3.5	370	1/6	40 µF/180V
2		3.1	335	1/6	
1		2.5	265	1/6	

Control Valve

3-way brass mixing valve regulates the temperature in the hydronic system with the help of the electric motor actuator and system controller.





Technical Data - 3-way Mixing Valve

Mixing Valve Nominal Size:	1-¼"
Mixing Valve Cv:	18.7
Material - Valve Body & Slide:	Brass DZR
Material - Shaft & Bushing:	PPS composite
Material - O-ring:	EPDM
Max. Operating Temperature:	230°F (110°C)
Min. Operating Temperature:	-15°F (-10°C)
Max. Operating Pressure:	145 psi (10 bar)
Max. Differential Pressure:	Mixing - 14.5 psi (1 bar)
	Diverting - 20 psi (2 bar)
Leaking in % of flow*:	Mixing - <0.05%
	Diverting - <0.02%
Max. Torque:	<44lbf*in (<5Nm)

*based on diff. pressure of 14.5 psi (1 bar)

Mixing Valve Motor

The mixing valve motor is mounted to the control valve and moves the valve appropriately to allow the heated fluid to enter. This motor works in conjunction with the system controller.

Manual Operation of Mixing Valve Motor

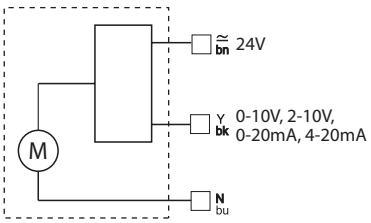
NOTE: Mixing Valve Motor should not be placed in manual mode for an extended period of time.

- Pull knob out on motorized actuator.
- Rotate knob clockwise or counter-clockwise.
- To return to automatic mode, push the knob in.

Technical Data - DDC Mixing Valve Motor

Ambient Temperature:	max. 131°F (55°C)
	min. 23°F (-5°C)
Power Supply:	24±10% Vac/dc, 50/60 Hz
Enclosure Rating:	IP41
Protection Class:	II
Torque:	6 Nm
Power Consumption - Operation:	AC: 5W
	DC: 2.5W
Power Consumption - Dimensioning:	AC: 8 VA
	DC: 4 VA
Rating Auxiliary Switch:	6(3)A 250Vac
Running Time 90°:	45/120 sec
Control Signal	0-10V, 2-10V, 0-20mA, 4-20mA

The motor should be preceded by a multi-pole contact breaker in the fixed installation.



CE LVD 2006/95/EC
EMC 2004/108/EC
RoHS 2002/95/EC

Panel Mounting

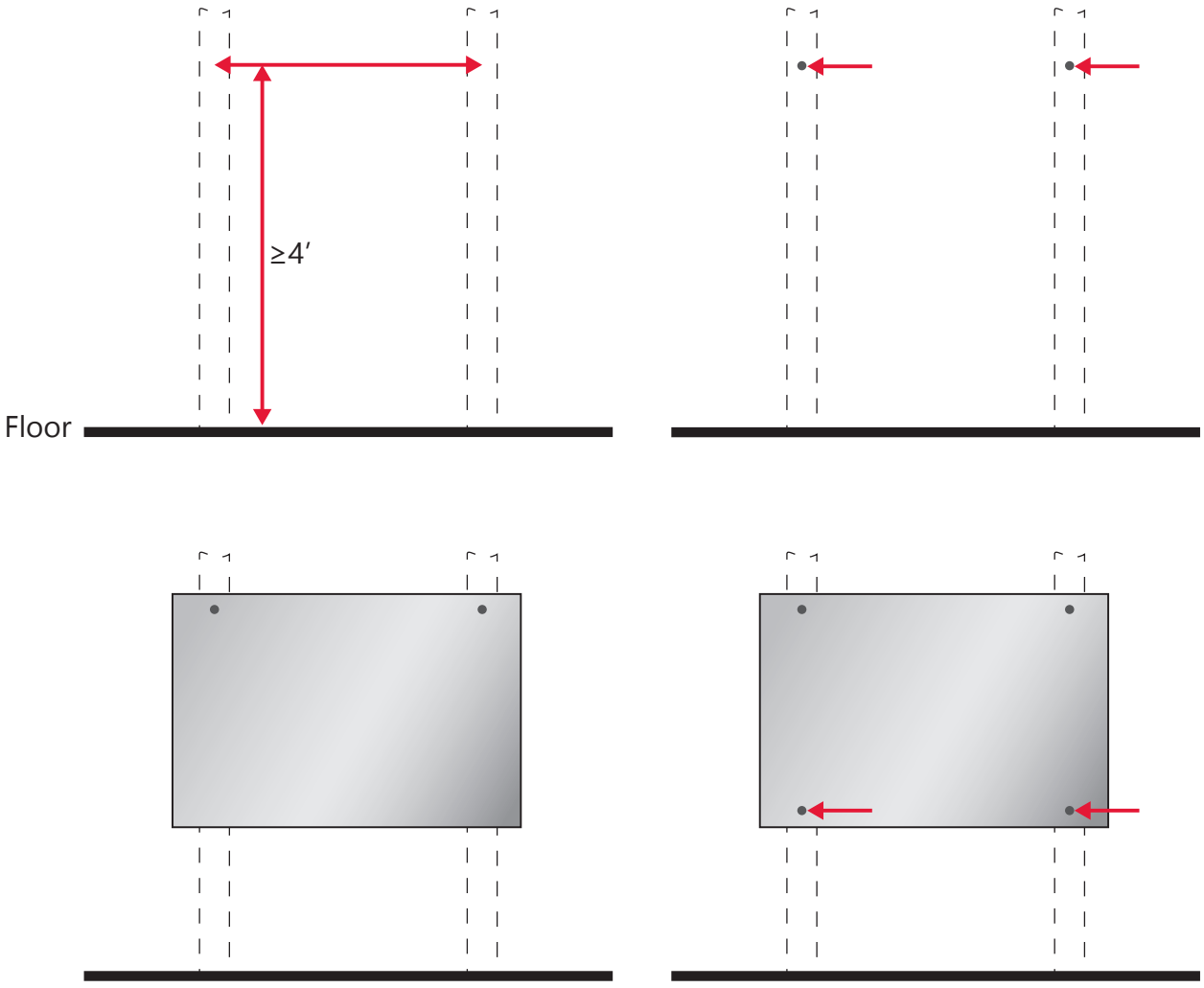
Prior to mounting the panel, ensure the wall is capable of supporting the weight of the panel, and that all required power outlets and/or wiring is available at the installation location.

Step 1 Determine the location and distance beteen the wall studs. With a level at a minimum height of 4' from the floor, draw a straight line and mark the stud locations. If the panel cannot be secured directly to the studs, or suitable backing boards, plywood may need to be installed behind the panel to properly secure it in place.

Step 2 Screw two of the supplied mounting screws into the wall studs (or backing plywood) 3/4" and 61/2" from the top of the desired height, and 16" apart, leaving 1/4"of the screw out from the wall.

Step 3 Lift and place the panel onto the mounting screws. Two person lift may be required.

Step 4 Screw the remaining mounting screws into the holes at the bottom of the panel, and tighten the top two screws.

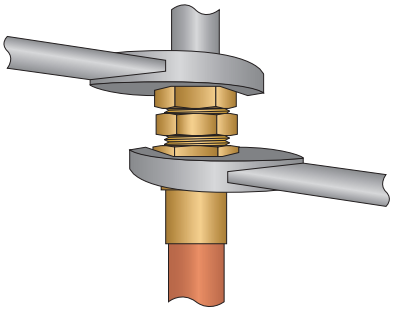


Piping Hookup

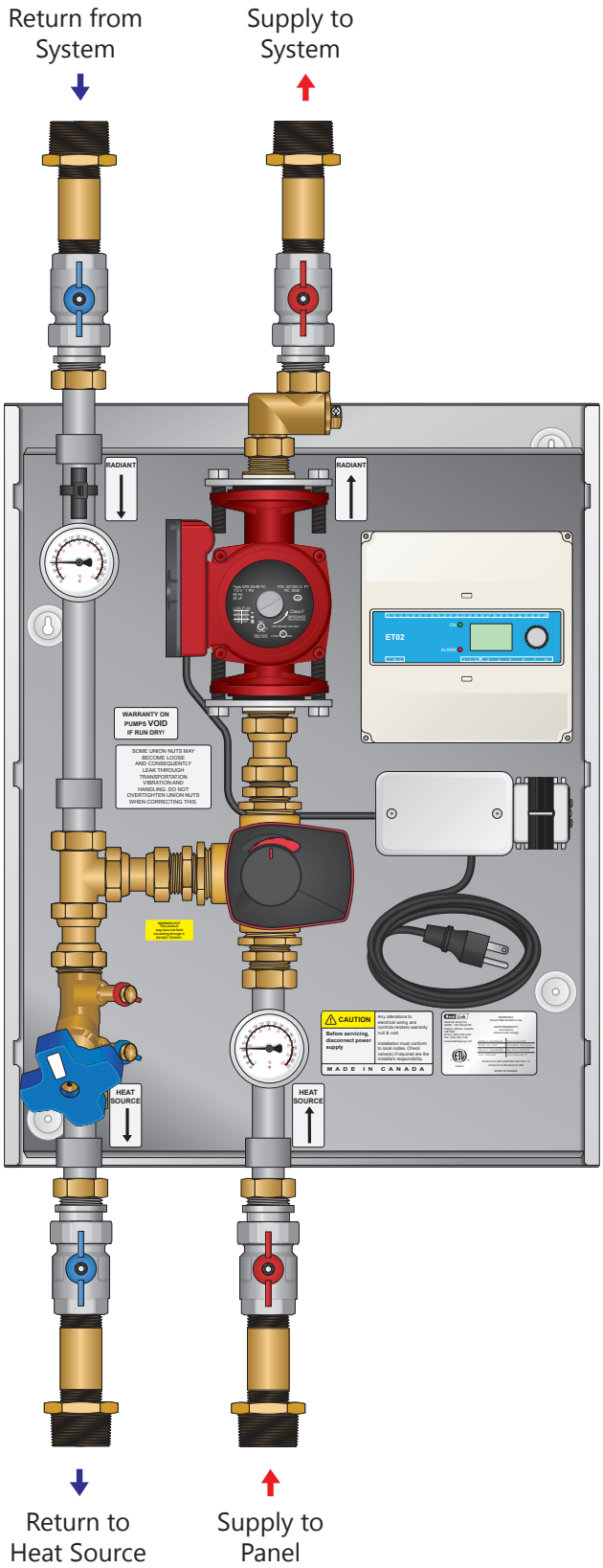
The 3WMIX-SMCP ships with the adapter assemblies packaged in the accessory pack, and must be connected to the panel *after* the system connections have been made.

Step 1 Piping connections are 1-1⁄2" MNPT. Use appropriate thread sealant and backup wrench when making connections.

Step 2 Connect adapter assemblies to the panel. The supplied washers must be used, and nuts must not be overtightened as this may damage the washers.



Always use a Backup Wrench
Do not overtighten brass nuts!



Fill & Purge

Step 1 Ensure the panel is not plugged in.

Step 2 Fuly open the mixing valve.

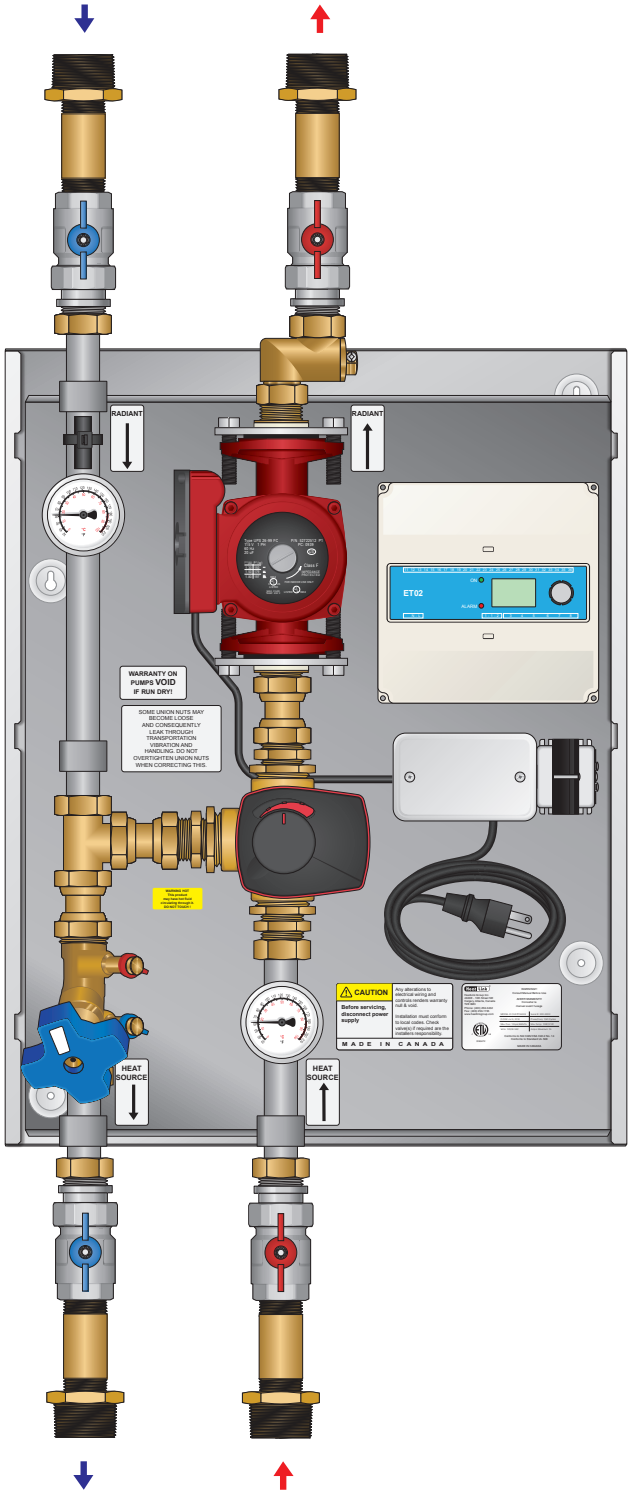
Step 3 Close all isolation ball valves, and attach the fill and purge hoses (not included) to the system fill and purge valves. Open valves.

Step 4 Open isolation valves and allow water to run until it is free of bubbles.

Step 5 Close system fill and purge valves.

Step 6 Detach fill and purge hoses.

Step 7 Check for leaks at connections. If any leaks are found, use a back-up wrench and carefully tighten until the leak stops. ***Do not overtighten!***



Piping Options

For all options hot water migration/gravity flow is possible in the supply riser. Unless the load has a positive shut off, a Flow check or Spring loaded check valve is required.

Option #1: Low Loss Header

Low Loss Header - default (using 3rd party low loss header)

Pros:

- Supply water temperature the same for each load
- Simple piping, reduced installation labour
- No dissimilar pump interference

Cons:

- Premanufactured header cost
- Requires check valve to prevent reverse flow in loop with pump off. (The above mentioned measures to prevent heat migration/gravity flow in the supply riser will at the same time prevent reverse flow.)

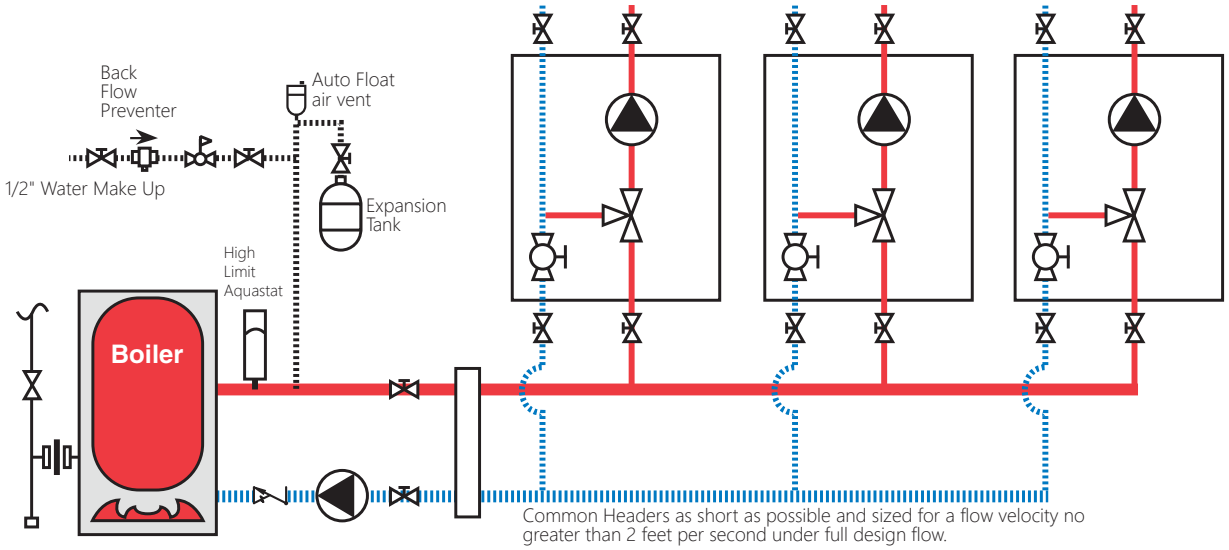
Low Loss Header - alternative (job site piped low loss header)

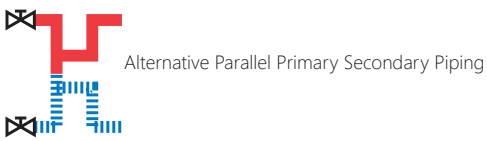
Pros:

- Supply water temperature the same for each load
- No dissimilar pump interference

Cons:

- Critical on site installation (Tee spacing and pipe sizing)
- Requires check valve to prevent reverse flow in loop with pump off. (The above mentioned measures to prevent heat migration/gravity flow in the supply riser will at the same time prevent reverse flow.)





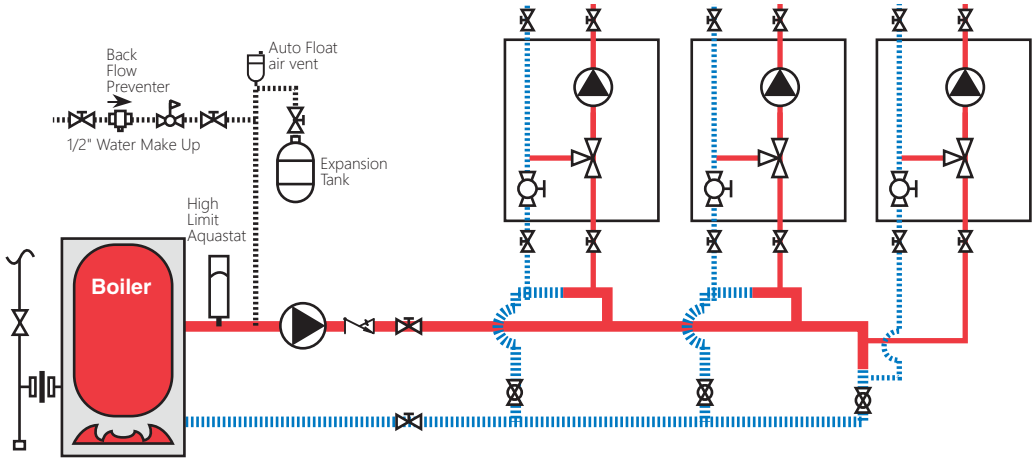
Option #2: Parallel Primary/Secondary

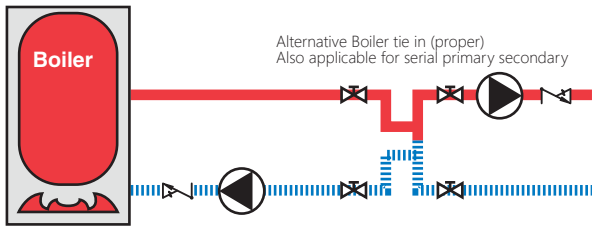
Pros:

- Supply water temperature the same for each load
- No possible pump interference

Cons:

- Requires additional balancing valves for each load take off.
- Hot water migration/gravity flow possible in return riser. Flow check, Spring loaded check valve or thermal trap required in return riser.
- Critical on site installation (Tee spacing and pipe sizing)
- Complex piping





Proper Primary/Secondary piping (shown as alternative boiler tie in), requires an additional pump and triple (rather then the much more common double) pole relays (see page 22).

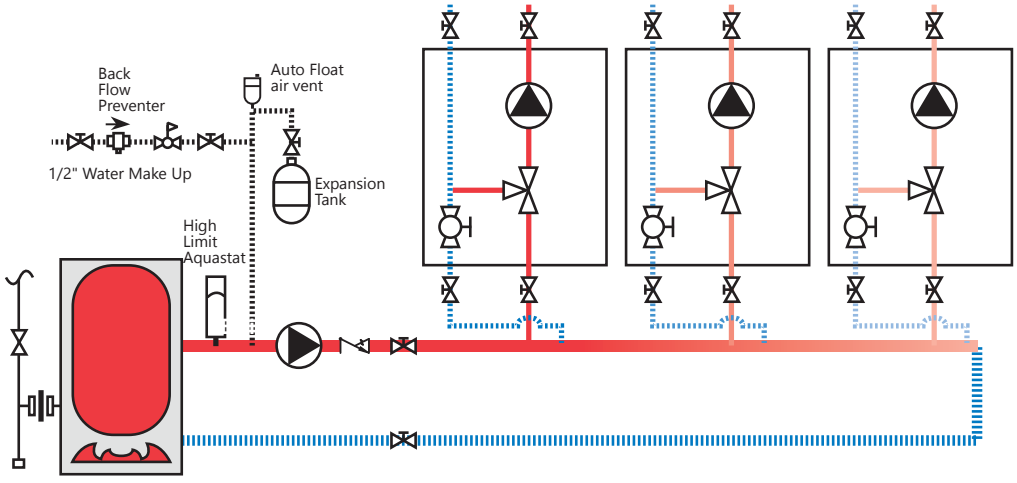
Option #3: Series Primary/Secondary

Pros:

- Automatic priority
- No possible pump interference

Cons:

- Supply water temperature lowers for each load, this change of temperature is not constant. Some loads may not function if temperature is too low.
- Very expensive to alter priority sequence (note: all loads are prioritized)
- Hot water migration/gravity flow possible in return line. Flow check, Spring loaded check valve or thermal trap required in return riser.
- Critical on site installation (Tee spacing and pipe sizing)

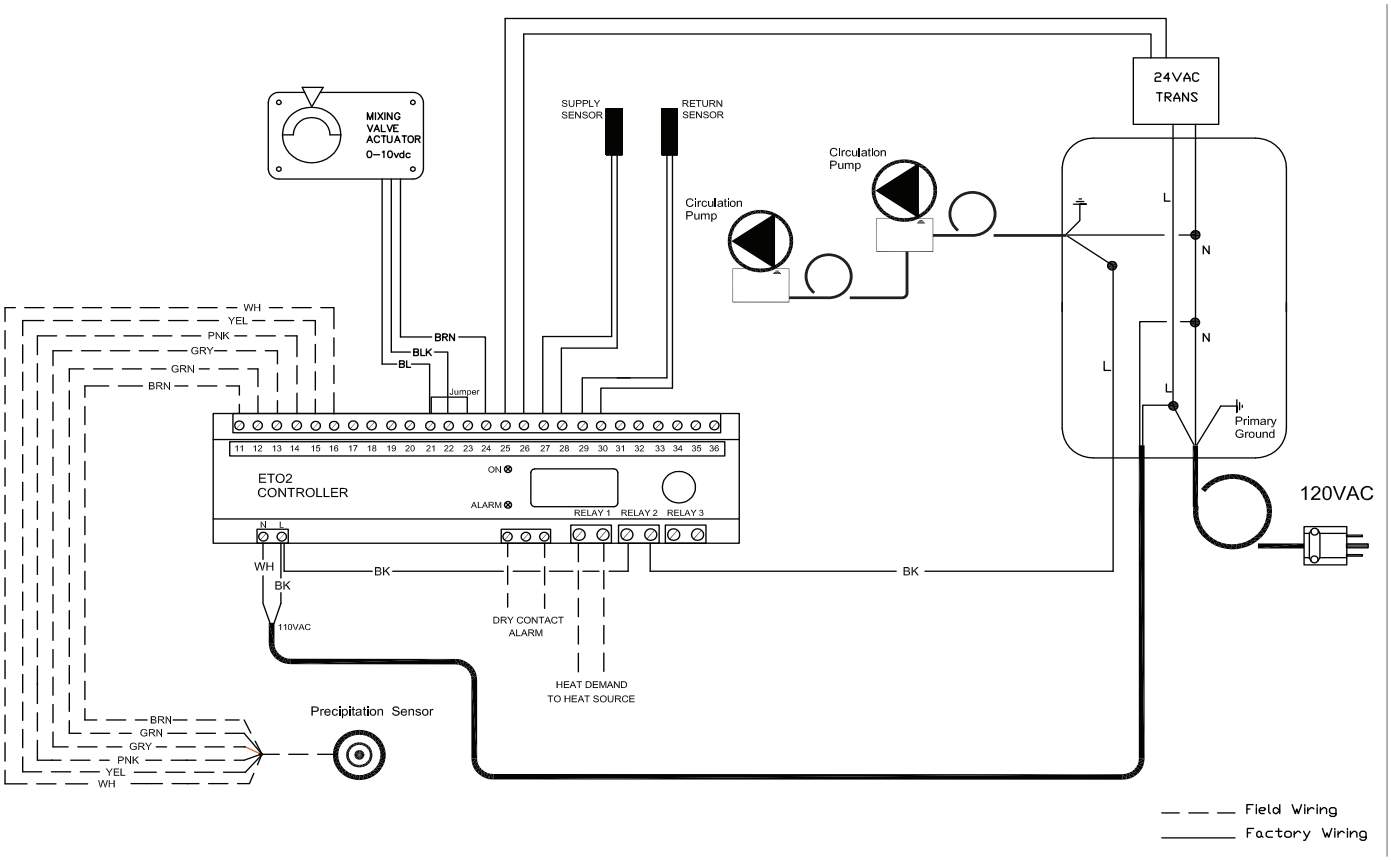


Panel Wiring

- Wiring should be done by a qualified electrician and should meet local codes and jurisdictions.

Auxiliary Contacts — The auxiliary contact set is dry, meaning no supply of power is present at the terminal. The maximum allowable load is 1.5A. The auxiliary dry contact located on the terminal is to switch another device (ie. the heat source) when there is a call for heat from any zone.

Wiring Diagram

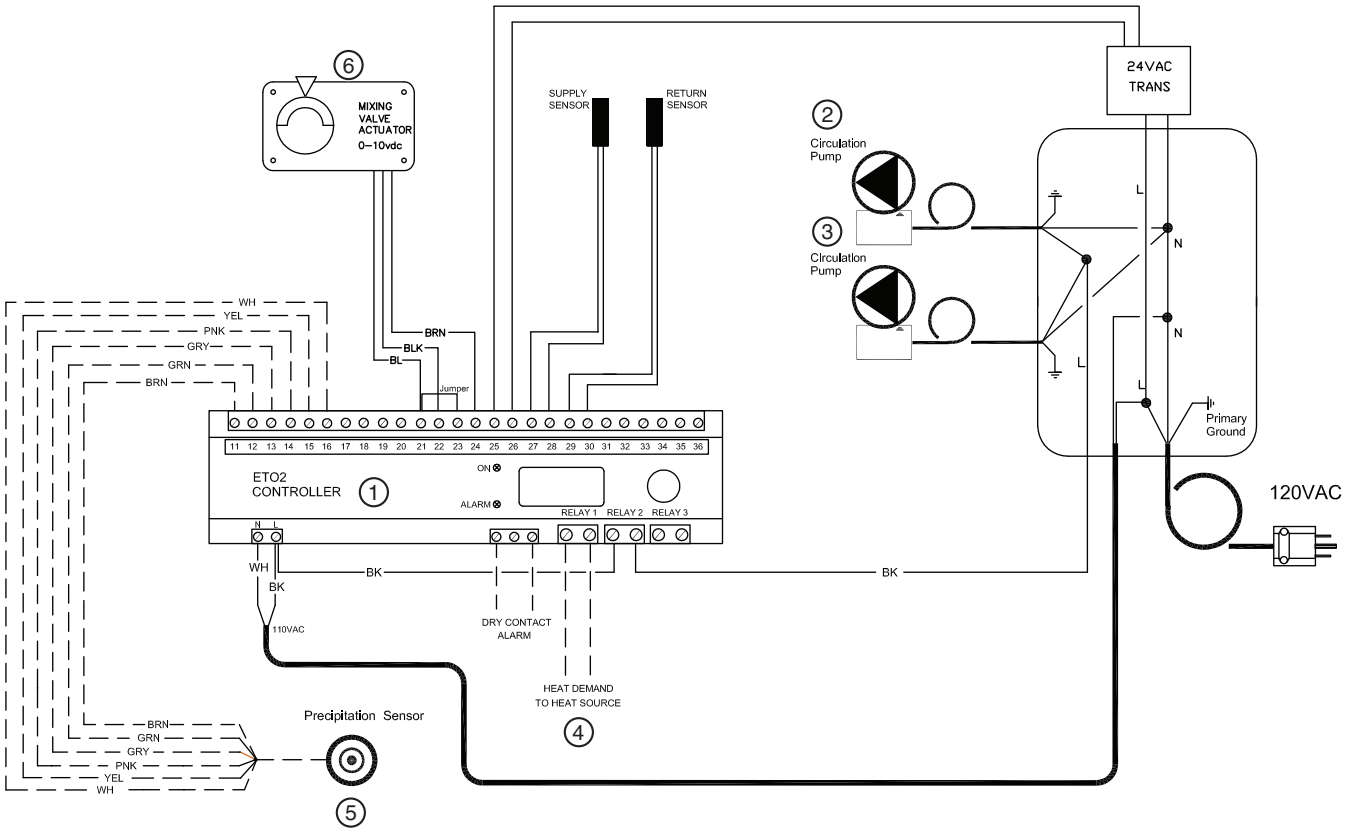


Panel Control Sequence

Step 1 When the Precipitation Sensor ⑤ detects temperature below SET TEMP 1 (warm weather shutdown), the System Controller ① will activate. It will start the Primary ② and Secondary ③ Pumps, close the Auxiliary Terminals ④ for 1 minute every 15 minutes to check the return water temperature. If the return water temperature is below the minimum return water temperature (MIN WATER) the System Controller will start the Primary ② and Secondary ③ Pumps, close the Auxiliary Terminals ④, and open the mixing valve ⑥ to increase the return water temperature to the required level (MIN WATER).

Step 2 When the Precipitation Sensor ⑤ detects snow fall, the System Controller ① will start the Primary ② and Secondary ③ Pumps, close the Auxiliary Terminals ④, and open the mixing valve ⑥ to increase the flow temperature to the maximum supply water temperature (MAX WATER). When no more snow is detected by the Precipitation Sensor ⑤, the System Controller ① continues to operate the system for an additional user adjustable period of time (default 2 h; AFTERRUN 1).

Step 3 When the Precipitation Sensor ⑤ detects temperature below OFF TEMP 1 (cold weather cutoff), the System Controller ① will be in standby mode.

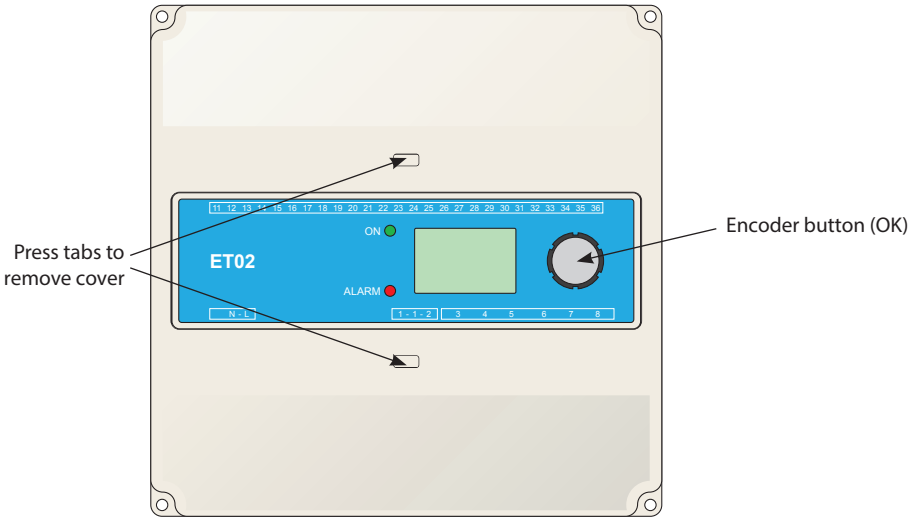


System Controller

The system controller has been setup at the factory. Minimal or no adjustments should be required for operation.

Glossary:

Zone 1, 2: Independent heating zones in which ice and snow can be melted. SMP panel only uses Zone 1.
Encoder button: Button which can be turned or pressed to easily configure the settings.
ETOG: DRVWSNS-SS embedded sensor for detecting moisture and temperature.
ETOR: Not used (Gutter sensor for detecting moisture.)
ETF: Not used (Outdoor sensor for detecting temperature.)
Y/Δ: Not used (2-stage control of electric heating systems.)
Afterrun: The heat provided by the system for a specified length of time after the moisture/temperature signal has been eliminated by a heating cycle.



Operation

ETO2 system controller is equipped with an easily operated encoder button (press and turn) and a display which describes the current situation. The display is backlit and is illuminated by pressing the encoder button (OK). The illumination is automatically switched off after 30 seconds.

Press the encoder button and the main menu will be shown on the display. Turn the button to scroll through the options. Not all the options are shown on the display at once, but they can be accessed by turning the encoder button.
Press encoder button to select a highlighted option.

Startup (this has already been done at the factory)

SELECT SCALE:
CELSIUS
FAHRENHEIT

When the ETO2 system controller is switched on for the first time, Celsius or Fahrenheit must be selected. Turn the encoder button until the desired temperature scale is highlighted. Press encoder button to set selection.

SENSOR 1:
ETOG
ETOR

SENSOR 1 is shown on the display, allowing the type of sensor connected for input 1 to be selected:
ETOG: DRVWSNS-SS embedded sensor
ETOR: Not applicable (Gutter sensor + outdoor sensor)
Press encoder button to set selection.

SENSOR 2:
OFF
ETOG

SENSOR 2 is then shown on the display, allowing the type of sensor connected for input 2 to be selected. If no sensor is connected for input 2, OFF must be selected. Press encoder button to set selection.

OUTDOOR SENSOR
OFF
ETF

Select if outdoor sensor ETF is connected terminals 31-32. If none sensor ETF is connected, OFF must be selected. Press encoder button to set selection.

APPLICATION:
ELECTRIC 1-ZONE
ELECTRIC 2-ZONE
ELECTRIC 2-STEP
WATER BASED

Select the application type by turning the encoder button an pressing OK.
ELECTRIC 1-ZONE : 1 zone electric/heating control/simple water based
ELECTRIC 2-ZONE: 2 zones individual electrical heating control/simple waterbased
ELECTRIC 2-STEP : 2 stage electric heating control (Y/Δ) for 1 zone.
WATERBASED: 1 zone waterbed heating control with supply water control.

Select the appropriate option and press OK. The system is now set up and will begin operating fully automatically in accordance with the pre-configured standard program, see FACTORY SETTINGS. Alternative settings can also be made, see SETTINGS.

ZONE 1 HEAT	OFF
ZONE 2 HEAT	OFF
AFTERRUN 1	0.00
AFTERRUN 2	0.00
STANDBY	OFF

Status and afterrun data for zones 1 and 2 are now shown on the display.

Main Menu

ZONE 1	OFF
ZONE 2	OFF
SENSOR 1	##.#°C
SENSOR 2	##.#°C
MOIST 1	NO
MOIST 2	NO
OUT. TEMP	##.#°C
SUPPLY W.	##.#°C
RETURN W.	##.#°C
ALARM	NO
SHOW INFO	
SETUP	
RESTART	
EXIT	

Display Texts

ZONE 1 OFF Heating zone 1 active (ON) or inactive (OFF)

ZONE 2 OFF Not used. Heating zone 2 active (ON) or inactive (OFF)

SENSOR 1 ##.#°C Sensor 1 temperature, only with ETOG sensor

SENSOR 2 ##.#°C Not used. Sensor 2 temperature, only with ETOG sensor

MOIST 1 NO Sensor 1 moisture

MOIST 2 NO Not used. Sensor 2 moisture

OUT. TEMP ##.#°C Not used. Outdoor temperature, ETF

SUPPLY W. ##.#°C Supply water temperature, only water-based application

RETURN W. ##.#°C Return water temperature, only water-based application

ALARM NO Fault message, fault type will be displayed. Red LED on front of unit will flash.

SHOW INFO Application Info

- **APP: WATER** Application type: electric or water-based heating
- **SW VERSION 1.00** Software version
- **SENSOR 1 ETOG** Sensor type, sensor 1
- **SENSOR 2 OFF** Not used. Sensor type, sensor 2
- **SENSOR ETF OFF** Not used. ETF sensor connected
- **EXIT** Return to main menu

SETUP Settings

Please note that incorrect sensor setup may lead to insufficient ice and snow melting.

FORCE HEAT OFF Manual start of forced heat. Press OK and select ON to start Forced heat. ETO2 controller will heat in the pre-programmed afterrun time, see AFTERRUN 1 and 2.

SELECT SCALE C Whether temperature is to be displayed in Celsius (C) or Fahrenheit (F) can be selected here. Select the required scale and press OK. Press OK to return to the SETUP menu.

SET TEMP 1 5.0C Set temperature to Zone 1: The maximum temperature at which ice and snow should be melted can be set here (Warm Weather Shut Down). Set the required temperature and press OK.

SET TEMP 2 3.0C Not used. Set temperature to Zone 2: The maximum temperature at which ice and snow should be melted can be set here. Set the required temperature and press OK.

OFF TEMP 1 -10.0C Lowest operating limit Zone 1 : From set temperature to lowest operating limit, the ETO2 will operate in normal mode (Cold Weather Cut Off). Below this temperature it will be in stand by mode. To change the OFF temperature, press OK and turn the encoder button to the desired value, confirm with OK.

OFF TEMP 2 -10.0C Not used. Lowest operating limit zone 2 can be set here. To change the OFF temperature press OK and turn the encoder button to the desired value, confirm with OK.

AFTERRUN 1 2:0 Afterrun time Zone 1: An afterrun duration of between 0 and 18 hours can be set here. The system will continue to provide heat for the specified time after the moisture/temperature signal has been eliminated by a heating cycle. Use the encoder button to set the required afterrrun time and press OK.

AFTERRUN 2 2:0 Not used. Afterrun time Zone 2: An afterrun duration of between 0 and 18 hours can be set here. Use the encoder button to set the required afterrrun time and press OK.

OFFSET T1 0.0C Zone 1 temperature can be calibrated here. The temperature recorded by the ETOG sensor can be adjusted so that the exact temperature is displayed on ETO2. Measure the temperature beside the sensor using a thermometer. Adjust the necessary offset using the encoder button. Press OK.

OFFSET T2 0.0C Not used. Zone 2 temperature can be calibrated in the same way here. Adjust the necessary offset using the encoder button. Press OK.

OFFSET OUT. 0.0C Not used. Outdoor temperature can be calibrated here. The temperature recorded by the ETF outdoor senosr can be adjusted so that the exact temperature is displayed on ETO2. Measure the temperature beside the sensor using at thermometer. Adjust the necessary offset using the encoder button. Press OK.

MIN WATER 5.0C The minimum return water temperature can be set here. Set the required minimum temperature and press OK. This menu option is only available when water-based heating is used.

MAX WATER 55.0C The maximum supply water temperature can be set here. Set the required maximum temperature and press OK. This menu option is only available when water-based heating is used.

SENSOR HEAT OFF

In special options or extreme cold weather the sensor heat can be selected on continuously. Select ON and press OK.

MOIST CTRL ON

The moist control on sensor can switches off here. The thermostat will only control by the set temperature, see SET TEMP. Select OFF for switch off the moist control and press OK.

FACTORY RESET

All ETO2 factory settings can be restored here. Selecting this option deletes all customized settings.

REINSTALL

REINSTALL PASSWORD XXXX

Whether setup failure in startup menu, or new hardware connection has been done, the primary setup must be changed in STARTUP menu. Select PASSWORD and turn the enocder button to the factor code (1202) The controller will then return to the startup menu, see STARTUP.

EXIT

Select this option and press OK to return to the main menu.

RESTART

Restart
When changing the settings or require a new process start, the ETO2 can be restarted in this menu. Keeping your current settings. The ETO2 will go to the initial status display.

Factory Settings

Setup	Factory Settings	SMP Panel Settings	Own Settings
Application	Electric	Water Based	
Zone 1	ETOG	ETOG	
Zone 2	OFF	OFF	
Select scale	Celsius	Celsius	
Afterheat time Zone 1	2.00 hours	2.00 hours	
Afterheat time Zone 2	2.00 hours	2.00 hours	
Temp. offset Zone 1	0.0°C / 0.0°F	0.0°C / 0.0°F	
Temp. offset Zone 2	0.0°C / 0.0°F	0.0°C / 0.0°F	
Temp. offset ETF	0.0°C / 0.0°F	0.0°C / 0.0°F	
Set temperature	3.0°C / 37.4°F	5.0°C / 41.0°F	
OFF temperature	OFF	OFF	
Min. water temperature	5°C / 41°F	5°C / 41°F	
Max. water temperature	55°C / 131°F	55°C / 131°F	

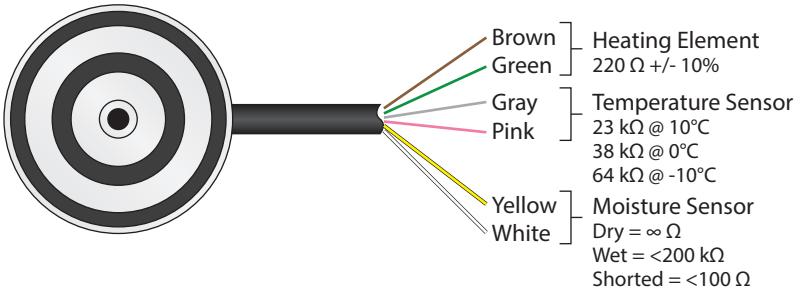
Troubleshooting

Problem	Check / Verify	Possible Cause
Low Temperature Within Snow Melt System (Snow and ice not melting)	Water on the snow/ice detector.	If the snow/ice detector is dry, it may need to be relocated.
	Outdoor temperature is above SET TEMP 1.	System may be in Warm Weather Shut Down. Increase SET TEMP 1.
	Outdoor temperature is below OFF TEMP 1.	System may be in Cold Weather Cut Off. Decrease OFF TEMP 1. Or turn off.
	The panel fails to turn on.	The panel may not be powered. Check if the power module is in the ON position and there is power to the panel.
	The motor actuator fails to open during a call for heat.	The motor actuator may have been left in a manual position, see page 12.
	Without power to the panel take an Ohm reading across each of the sensors. See Testing the Sensors on the next page.	A sensor may be defective. Replace sensor.
	Low supply mixed fluid temperature.	Check heat demand is wired to boiler.
	Wiring from heat source to snow melt panel.	Check that the wiring is done properly. Consult qualified electrician prior to alteration of wiring between heat source and snow melt panel.
	Output of heat source is unable to meet demand of the required system.	Compare output of heat source to the requirements of the snow melting system.
	Pump is not on during a call for heat. (Use a stethoscope or similar device to verify)	The system controller or pump may be defective or the cut off temperature is not set properly.
Excessive High Temperature Within Snow Melt System	Check current settings of the system controller.	Adjust the settings on the system controller appropriately.
	High supply mixed fluid temperature.	Adjust the MAX WATER setting on the system controller appropriately.
	The motor actuator remains open after the thermostat is satisfied.	An obstruction inside the valve is not allowing the actuator to fully close or the system controller is still calling for heat.

Testing the Sensor

Precipitation Sensor

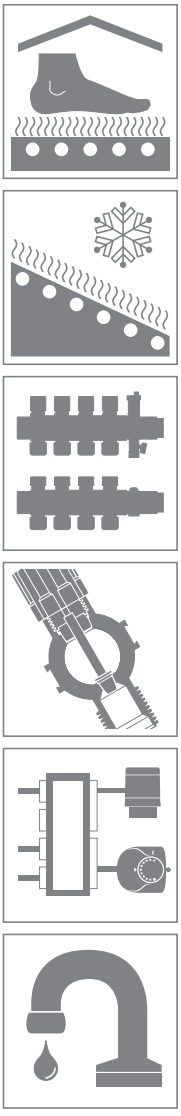
Measure resistance between the Precipitation Sensor wires.



Supply and Return Sensors

Measure resistance between the sensor wires and compare to the NTC 12k resistance table below.

Celsius	Fahrenheit	Resistance
-20°C	-4°F	112246Ω
-10°C	14°F	63929Ω
0°C	32°F	37942Ω
5°C	41°F	29645Ω
10°C	50°F	23364Ω
11°C	51.8°F	22300Ω
12°C	53.6°F	21292Ω
13°C	55.4°F	20335Ω
14°C	57.2°F	19428Ω
15°C	59°F	18567Ω
16°C	60.8°F	17750Ω
17°C	62.6°F	16974Ω
18°C	64.4°F	16237Ω
19°C	66.2°F	15537Ω
20°C	68°F	14871Ω
21°C	69.8°F	14238Ω
22°C	71.6°F	13636Ω
23°C	73.4°F	13064Ω
24°C	75.2°F	12519Ω
25°C	77°F	12000Ω
26°C	78.8°F	11506Ω
27°C	80.6°F	11035Ω
28°C	82.4°F	10587Ω
29°C	84.2°F	10159Ω
30°C	86°F	9752Ω
35°C	95°F	7978Ω
40°C	104°F	6569Ω
45°C	113°F	5442Ω
50°C	122°F	4535Ω
55°C	131°F	3800Ω
60°C	140°F	3201Ω
70°C	158°F	2306Ω
80°C	176°F	1692Ω
90°C	194°F	1263Ω
100°C	212°F	958Ω



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