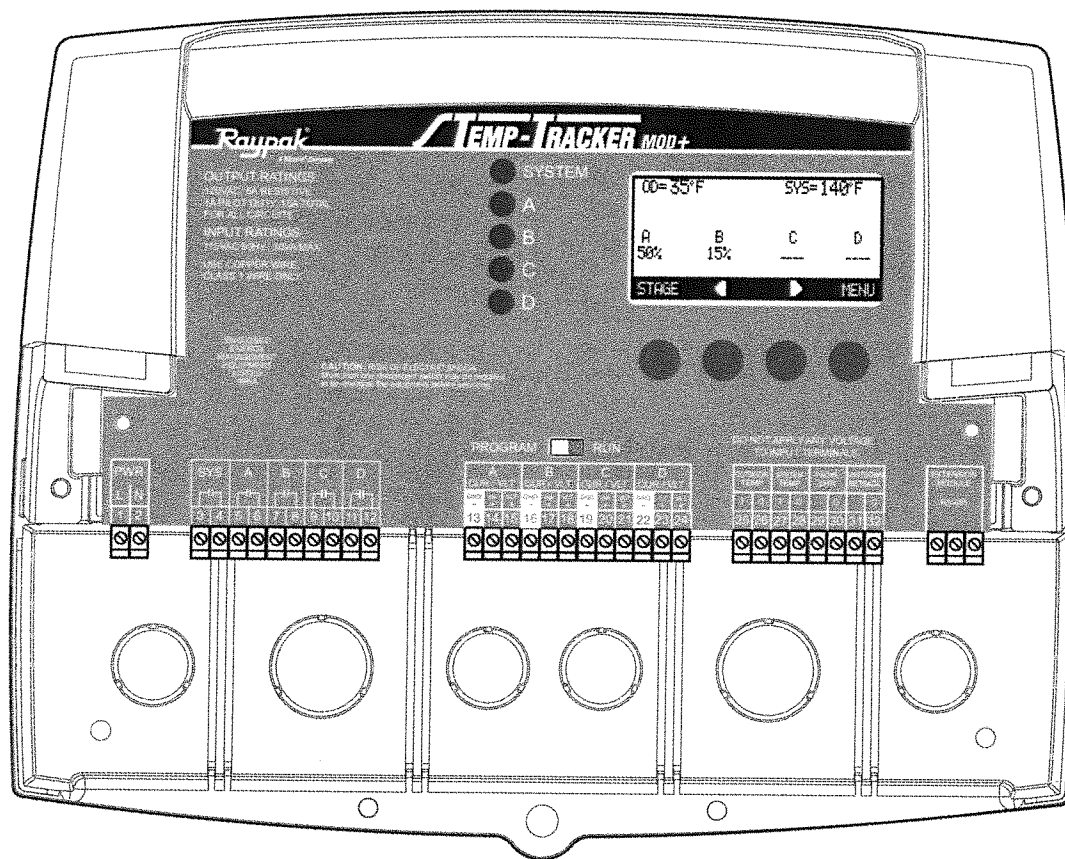




INSTALLATION AND OPERATION INSTRUCTIONS

TEMP-TRACKER MOD+ TEMP-TRACKER MOD+ EXTENSION

SEQUENCING MODULATING CONTROLS for Hydronic Heating Systems



This manual attempted to be complete and accurate at the time of publication. Additional upgrades and new features may change Temp-Tracker mod+ functions. Upgrades to this manual may occur at any time. Contact the factory for further details.

⚠ WARNING

The Temp-Tracker mod+ is strictly an operating control. It **CANNOT** be used as a limit control. All boilers must have all safety and limit controls required by code. It is the responsibility of the installer to verify that all the safety and limits are working properly before the Temp-Tracker mod+ is installed.

This control must be installed by a licensed electrician.

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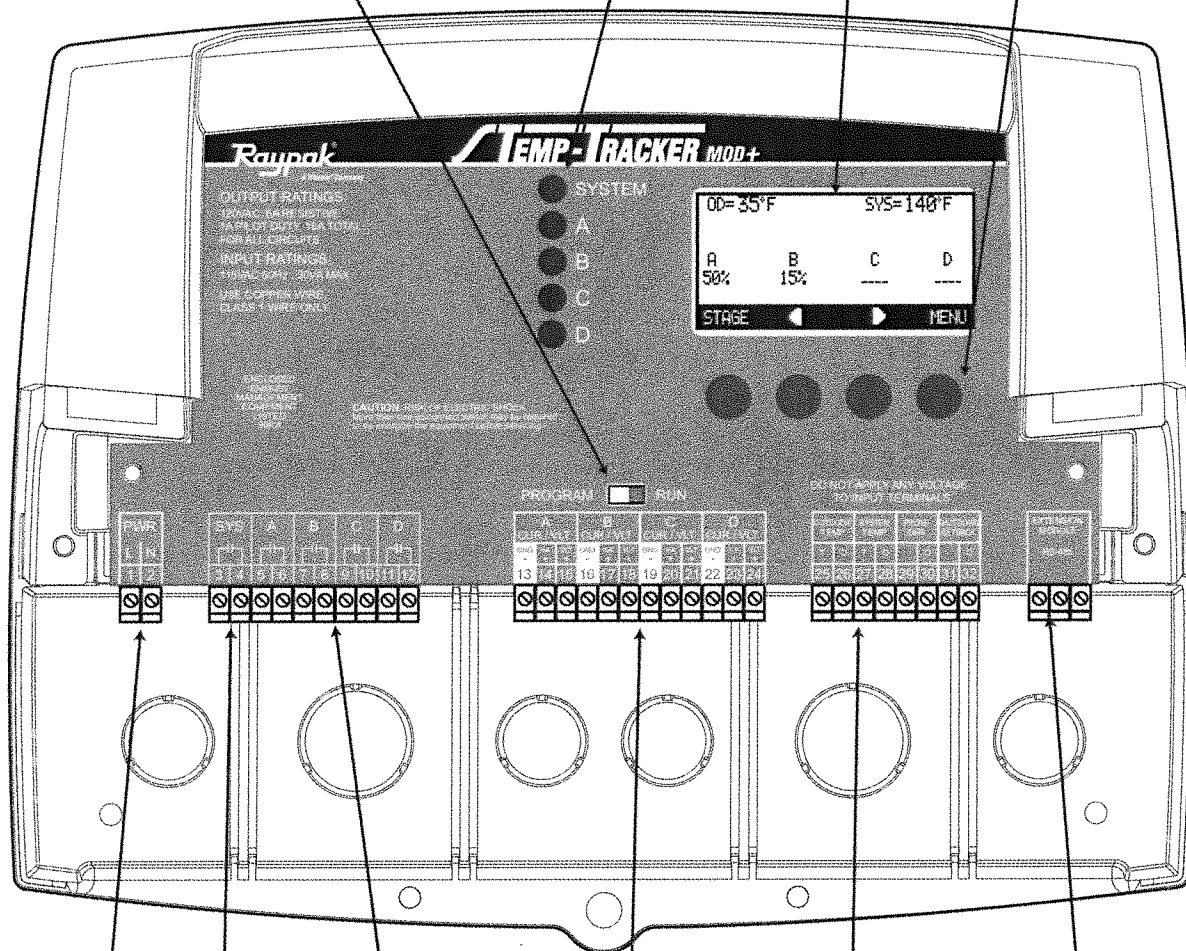
TEMP-TRACKER MOD+ LAYOUT

Program Switch to restrict access to function changes. This switch is covered with Wiring Enclosure.

The digital display shows the system status, set point, lead stage <in brackets>, and status of each stage. To view and adjust settings, press the appropriate buttons.

LED indicates the associated relay status.

Buttons function is presented on Bottom Row of display.



120VAC Power

Four N.O. Boiler startup relay outputs. Each is wired in series with each boiler's limit circuit.

When connecting Outdoor and System Sensors, no Polarity is observed. Prove terminals must be connected for Temp Tracker mod+ to operate boilers.

System Output controls pumps, valves, or other system components.

Four modulation outputs can be 4-20mA, 0-5V, 0-10V, 1-5V, or 2-10V. Go to Startup Menu to determine the type of output for each stage.

Connect Extension panels to add additional stages using a 6 pin phone line only (cable provided with Temp Tracker mod+ Extension).

TEMP-TRACKER MOD+ OVERVIEW

SEQUENCES UP TO 4 FULLY MODULATING STAGES.

The Temp-Tracker mod+ is the perfect control whenever multiple fully modulating stages are required for hydronic heating applications. The Temp-Tracker mod+ controls the on/off and the modulation of each stage to maintain precise system set point control.

PID TYPE LOGIC

The Temp-Tracker mod+'s control algorithms allow it to look at the rate of change in the system. If the system temperature is changing quickly, the Temp-Tracker mod+ will react quickly to adjust the modulating stages' output. If the system temperature changes slowly, the Temp-Tracker mod+ will make slow and gradual output adjustments. Therefore, the Temp-Tracker mod+ adapts to specific system requirements and minimizes fluctuations around the set point.

CONTROLS 4-20MA MODULATING MOTORS OR 0-5 V, 0-10 V, 1-5V, 2-10V MODULATING MOTORS

The Temp-Tracker mod+ is designed to accurately control the output from 25% to 100% of modulation for each of these different types of motors. One Temp-Tracker mod+ can even control a variety of the above different motors.

ONLY ONE SENSOR

When Set Point sensor type is selected, the Temp-Tracker mod+ requires only one sensor located in the common output header of all stages. However, when Reset is selected, an additional Outdoor Sensor is required for Outdoor Reset Ratio input.

DIGITAL DISPLAY OF ALL SYSTEM SETTINGS

The Temp-Tracker mod+'s alphanumeric digital display names each system parameter in simple English and shows its precise value. The easy to follow menu system allows users to quickly make changes to any system setting without having to learn any specialized codes or keyboard commands.

AUTOMATIC ROTATION AMONG STAGES

Rotating the first stage to be activated on a call for output promotes even wear on each stage. The Temp-Tracker mod+ has three modes of rotation: Manual, Last On, or Time. The Time rotates the lead stage every selected time period from every hour to every 60 days.

OUTDOOR RESET

The Temp-Tracker mod+ has a hydronic outdoor temperature reset function. This allows the Temp-Tracker mod+ to change the set point based on outdoor temperature. Furthermore, additional settings have been added to fine tune this operation, like Offset, Minimum, and Maximum Water Temperature and night setback schedule.

STANDBY BOILERS

Each of the Temp-Tracker mod+ stages can be configured as a Standby boiler with an adjustable Standby delay. A boiler can be used as a backup during extended large demand periods.

SYSTEM OUTPUT

In Set Point or Outdoor Reset modes, the System Output will activate whenever the outdoor temperature is below the Outdoor Cutoff setting. A System Prove input checks the status of components activated by the System output before stages can be activated.

PARALLEL MODULATION

The Temp-Tracker mod+ uses parallel modulation that can modulate several boilers together as a one large boiler. This mode is useful for boilers with lower water content, which are usually more efficient at lower firing points.

ADD UP TO 16 BOILER STAGE (OPTIONAL)

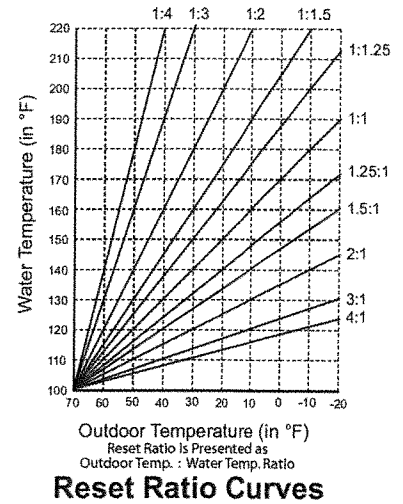
As a stand-alone, the Temp-Tracker mod+ is designed to control four modulating boilers. However, it has the capability of expanding its control to two extension panels each with six boiler stages. Thus, the Temp-Tracker mod+ can control a total of up to 16 boiler stages.

UNDERSTANDING OPERATION CONCEPT

The Temp-Tracker mod+ has multiple operating modes that satisfy most hydronic systems. It can change the System Set Point based on outdoor temperature (Outdoor Reset) or it can modulate its stages to achieve an adjustable fixed Set Point.

In Outdoor Reset, the Temp-Tracker mod+ controls a hot water heating system to provide a building with comfortable and even heat levels. The Temp-Tracker mod+ varies the temperature of the circulating heating water in response to changes in the outdoor temperature. The heating water temperature is controlled through the modulation of stages.

The Temp-Tracker mod+ also controls the system circulating pump with an adjustable Outdoor Cutoff. When the outdoor temperature is above Outdoor Cutoff, the pump is off and no heating water is circulated through the system. When the outdoor temperature drops below the Outdoor Cutoff, the system pump relay is activated and the heating water circulates through the system. The temperature of the heating water is controlled by the Reset Ratio, Water Offset, and changes with Outdoor temperature.



RESET RATIO/OUTDOOR RESET

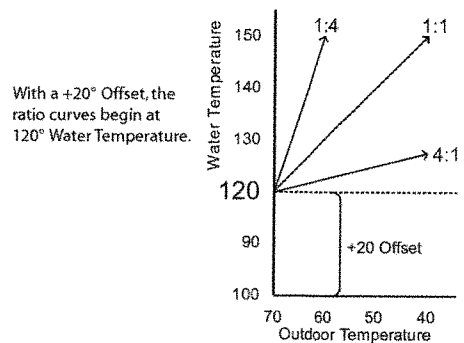
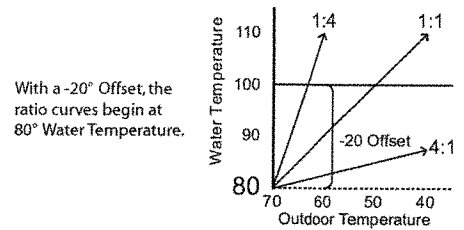
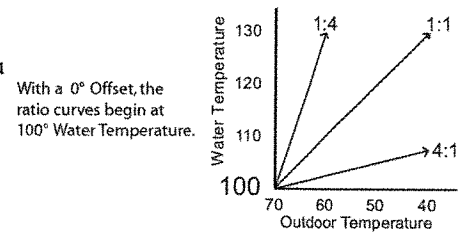
When a building is being heated, heat escapes through the walls, doors, and windows to the colder outside air. The colder the outside temperature, the more heat escapes. If you can input heat into the building at the same rate that it is lost out of the building, then the building temperatures will remain constant. The Reset Ratio is an adjustment that lets you achieve this equilibrium between heat input and heat loss.

The starting point for most systems is the 1.00 (OD):1.00 (SYS) (Outdoor Air Temperature : Heating Water Temperature) ratio. This means that for every degree the outdoor temperature drops, the temperature of the heating water will increase one degree. The starting point of the curves is adjustable, but comes factory selected at 70°F Outdoor Temp. and 100°F Water Temp. For example with a 1.00 (OD):1.00 (SYS) ratio, if the outdoor temperature is 40°F, this means the temperature has fallen 30° from the starting point of 70°F. Therefore, the heating water temperature will increase 30° to 130°F.

Each building has different heat loss characteristics. A very well insulated building will not lose much heat to the outside air, and may need a Reset Ratio of 2.00 (OD):1.00 (SYS) (Outdoor:Water). This means the outdoor temperature would have to drop 2 degrees to increase the water temperature 1 degree. On the other hand, a poorly insulated building with insufficient radiation may need a Reset Ratio of 1.00 (OD):2.00 (SYS). This means that for each degree the outdoor temperature dropped the water temperature will increase 2 degrees. The Temp-Tracker mod+ has a full range of Reset Ratios to match any buildings heat loss characteristics.

A heating curve that relies not only on Outdoor temperature but also on type of radiation will improve heat comfort. The following are suggested initial settings for different types of radiation based on average building insulation and heat loss. The contractor can fine tune these adjustments based on the specific building need.

Type of Radiation in Building	Reset Ratio	Offset
Radiators (Steel & Cast Iron)	1.00 (OD) : 1.00 (SYS)	0°F
Baseboard (Finned copper tube & Cast Iron)	1.00 (OD) : 1.00 (SYS)	0°F
Radiant (High Mass/Concrete)	4.00 (OD) : 1.00 (SYS)	-10°F
Radiant (Low Mass/Joists)	2.00 (OD) : 1.00 (SYS)	-10°F
Fan Coils & Air Handlers	1.00 (OD) : 1.00 (SYS)	20°F



⚠ WARNING

When controlling a non condensing boiler directly without the use of a mixing valve, minimum boiler water temperature must be set to boiler manufacturer specifications. In that case, system temperature must not go below such temperature.

MAKE SURE YOU HAVE THE RIGHT CONTROL

If you need the Temp-Tracker mod+ to do additional tasks that either are not listed or do not know how to configure them, contact your local Raypak representative.

INITIAL SETUP

Setting an Initial Program will ease the configuration of the Temp-Tracker mod+ and will give the opportunity to utilize many of the energy saving features and give more comfortable heat when needed.

The program should consist of the following:

- Selecting the features that your system can utilize,
- Installation: Install the Control, switches and sensors,
- Setting the System Startup,
- Setting the System Settings,
- Setting the Stages
- Adjusting Reset Ratio and Water Offset (In Reset Mode Only)

SELECTING THE SYSTEM FEATURES

The Temp-Tracker mod+ has been designed with Hydronic building heating as the primary purpose. With this in mind, many of the Temp-Tracker mod+ features can be utilized to ease, enhance and improve your system performance. Some of these features are listed in this section.

OUTDOOR RESET OR SET POINT

- The Temp-Tracker mod+ can control the System Temperature either by adjusting the calculated temperature according to the Outdoor Temperature (Outdoor Reset) or by maintaining an adjustable Set Point. The earlier relies on an Outdoor Sensor (supplied with the control) and achieves better fuel savings in addition to better comfort.

NUMBER OF STAGES

- The Temp-Tracker mod+ can be configured to control up to 4 modulating boilers. It can control up to 16 boiler stages using a maximum of two Temp-Tracker mod+ Extension Panels

MODULATION MODE

- The Temp-Tracker mod+ stages boilers using parallel modulation. Parallel modulation can modulate several boilers together as a one large boiler. This is useful for boilers which are more efficient at lower firing points.

MODULATING SIGNAL

- The Temp-Tracker mod+ is designed to accurately control the output from 25% to 100% of modulation for each of these different types of equipment. One Temp-Tracker mod+ can even control a variety of the above different modulation equipment.

AUTOMATIC ROTATION AMONG BOILERS

- Rotating the first burner to be activated on a call for output promotes even wear on all burners. The Temp-Tracker mod+ has three modes of rotation: Manual, Last-ON, or Time automatically rotating every selected time period from every hour to every 60 days.

STANDBY BOILER

- Any boiler can be configured as a Standby boiler. It withholds a specific boiler from being included in the Lead Rotation. However, the Standby boiler will be fired only as a backup when all other stages combined cannot satisfy the demand and after an adjustable delay period.

SETBACK OR DAY/NIGHT SCHEDULING

Two Setback modes are available for the Temp-Tracker mod+:

- The Day/Night Scheduling provides an adjustable time-based schedule for the Setback.
- The Setback mode uses an external signal to switch the operation of the Temp-Tracker mod+ in and out of setback mode.

System Run-On

- This feature lets the Temp-Tracker mod+ run the SYS relay for a longer period after the boilers have been turned off. When this relay is used to control a pump, it helps in dissipating the excess heat from the boilers combustion chamber.

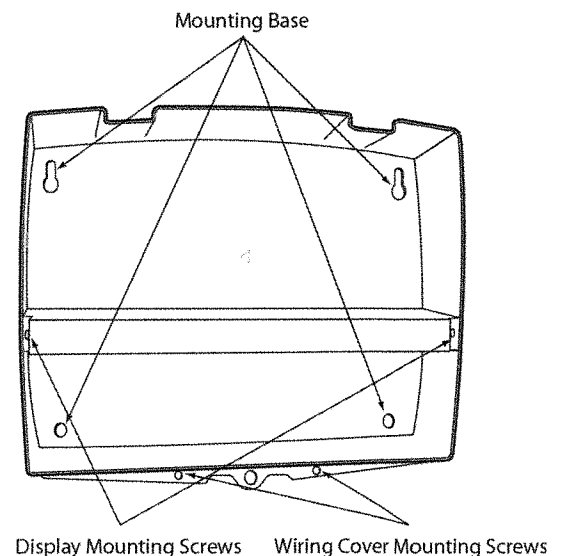
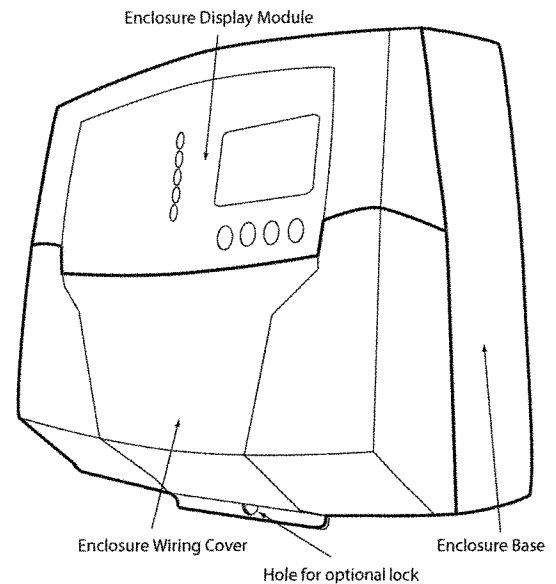
INSTALLATION

Each of the Temp-Tracker mod+ or Temp-Tracker mod+ Extension consists of three primary enclosure components.

- **The Enclosure Display Module:** contains the display, buttons, LEDs and electric wiring terminals. It has two screws to hold it to the base. A program configuration switch, used to adjust Temp-Tracker mod+ settings, is placed above the terminals. This switch is enclosed with the enclosure wiring cover for security. Wiring terminals are of the plug-in type to ease installation and removal.
- **The Enclosure Base:** contains the holes to mount and hold the control against the wall or any flat surface. All other enclosure components mount on the base. The bottom section of the Enclosure Base contains the wiring chamber with knockouts on the bottom to easy installation.
- **The Enclosure Wiring Cover:** seals the wires from the external environment. It has two screws to hold it the base and a hole to secure a lock on the wiring enclosure. A plastic web that separates the wiring chamber into high and low volt sections has been provided.

MOUNTING THE ENCLOSURE

- Select a location near the equipment to be controlled.
- The surface should be flat, and be sufficiently wide and strong to hold the Temp-Tracker mod+ or Temp-Tracker mod+ Extension.
- Keep the control away from extreme heat, cold, or humidity. Ambient control operating temperature is from 20 to 120°F.
- Remove the Enclosure Wiring Cover from the control enclosure by removing the two bottom screws.
- Remove the Enclosure Display Module by removing the middle screws.
- Screw the Enclosure Base to the surface through the upper and lower mounting holes on the back of the enclosure.
- Replace the Enclosure Display Module and replace the middle screws.
- Do not replace the enclosure wiring cover until all wiring is done.



INSTALL THE SENSORS

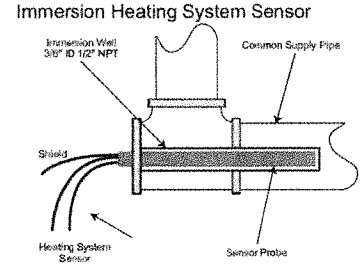
HEATING/STORAGE TANK SYSTEM SENSOR (HSS) INSTALLATION

LOCATING HSS

- The sensor must be located where it sees the output of all the boiler stages. If a boiler is piped so that the sensor does not see its output, the Temp-Tracker mod+ will not sequence the boilers correctly.
- Only use a Standard Brass Tube sensor.
- The sensor wires can be extended up to 500' using a shielded 2-conductor cable (Belden #8760 or equivalent.) Do not ground the shield at the sensor but at the panel using one of the terminals marked with an "O".
- Do not run sensor wires in conduit with line voltage wiring.

IMMERSION HEATING SYSTEM SENSOR (HSS) INSTALLATION

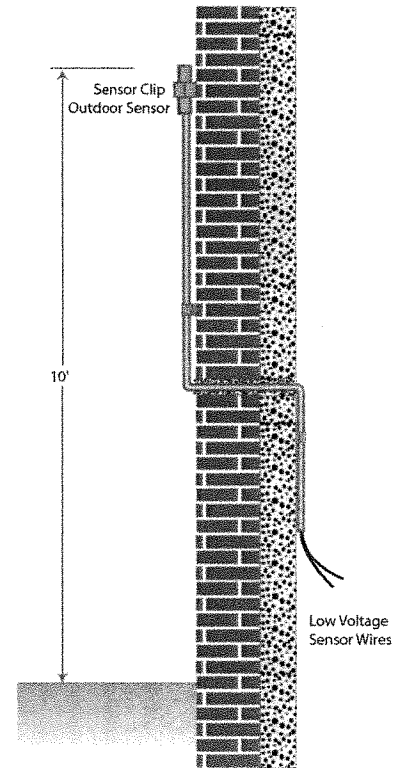
- Install a 3/8"ID 1/2"NPT immersion well.
- Insert the sensor probe of the supplied sensor into the well.



⚠ CAUTION
 If the System Sensor can not sense the correct heating system water temperature supplied to the building, the Temp-Tracker mod+ will not provide comfortable heat levels. Be sure the System Sensor is located on a main supply pipe which can not easily be isolated from the system.

OUTDOOR SENSOR INSTALLATION

- Only use the Raypak sensor included with the unit.
- Locate the sensor in the shade on the north side of the building. The sensor should never be in direct sunlight.
- Be sure the location is away from doors, windows, exhaust fans, vents, or other possible heat sources.
- The sensor should be mounted approximately 10' feet above ground level.
- Mount the sensor clip base to the outside of the building. Insert the sensor in the middle and snap close the clip on the sensor.
- The sensor wires can be extended up to 500' using shielded 2-conductor cable. Do not ground the shield at the sensor but at the panel using one of the terminals marked with an "O".
- Do not run sensor wires in conduit with line voltage wiring.



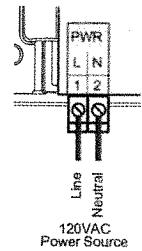
⚠ WARNING
 The Temp-Tracker mod+ is an operating control only. All boilers must have all safety and limit controls required by code. It is the responsibility of the installer to verify that all the safety and limits are working properly before the Temp-Tracker mod+ is installed.

⚠ CAUTION
 Determining the proper location for the Outdoor Sensor is very important. The Temp-Tracker mod+ will base the heat on the outdoor temperature information it receives from this location. If the sensor is in the sun, or covered with ice, its reading will be different from the actual Outdoor temperature (OD).

WIRING

WIRING THE POWER (TERMINALS 1, 2)

- Bring the 120VAC 60Hz power wires through the bottom Knockout of the enclosure.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.
- Connect the hot line to terminal marked L.
- Connect the neutral line to the terminal marked N.
- Raypak recommends installing a surge suppressor on the power source to the Temp-Tracker mod+.



⚠ WARNING

Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring. Raypak recommends installing a surge suppressor on the power source to the Temp-Tracker mod+.

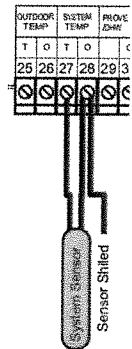
⚠ WARNING

Connect the shield at the control terminal end and cut the shield wire at the sensor end.

WIRING THE SENSORS

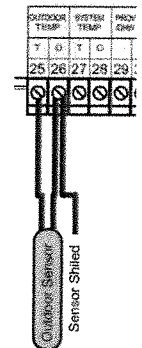
SYSTEM SENSOR WIRING (TERMINALS 27, 28)

- A Temp-Tracker mod+ must be connected to a temperature sensor located in the common header.
- The Temp-Tracker mod+ is designed to be connected to a temperature sensor for immersion in a 3/8ID well.
- Temperature sensor wires can be extended up to 500' by splicing shielded 2-conductor cable (Belden #8760 or equivalent).
- Temperature sensors have no polarity. Connect the two wires from the sensor to the Temp-Tracker mod+ terminals marked *SYSTEM TEMP* 27, 28.
- Connect the sensor shield to the circled terminal 28 with one of the sensor wires.



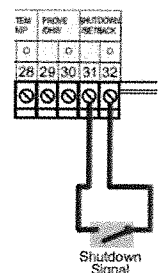
OUTDOOR SENSOR WIRING (TERMINALS 25, 26)

- The Temp-Tracker mod+ will vary the system Set Point when Outdoor Reset is selected based on outdoor temperature.
- Whether in Set Point or Outdoor Reset modes, the outdoor sensor can be used as an Outdoor Cutoff. The Temp-Tracker mod+ will disable all Boilers when the outdoor temperature is above the adjustable Outdoor Cutoff temperature. This feature will automatically be activated when an outdoor sensor is connected.
- For an outdoor sensor use a Raypak outdoor sensor.
- The sensor wires can be extended up to 500' using shielded 2-conductor cable (Belden #8760 or equivalent).
- Temperature sensors have no polarity. Connect the wires from the outdoor sensor to the Temp-Tracker mod+ terminals marked *OUTDOOR TEMP* - 25, 26.
- Connect the shield to the circled terminal 26 with one of the sensor wires.



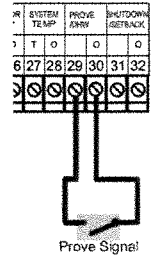
WIRING THE SYSTEM ENABLE/DISABLE (SHUTDOWN) (TERMINALS 31, 32)

- This feature can be used whenever it is desirable to turn off the Temp-Tracker mod+ stage outputs from a remote location or another controller (i.e. EMS input).
- When the Shutdown feature is enabled by closing a dry contact, all active boilers will immediately modulate down to low. The lead boiler will remain in low for a Soft-Off period and then turn off.
- The System Output relay will remain active until the System Delay is over and then it will turn off.
- The Shutdown signal must be a dry contact only. No voltage can be placed across the SHUTDOWN terminals.
- Bring the two wires from the dry contact to the terminals marked *SHUTDOWN*- 31,32.



WIRING THE SYSTEM PROVE (TERMINALS 29, 30)

- The Prove feature is provided to check system component operation.
- A typical use of this feature is to check for flow before firing any boiler.
- If the PROVE input is open on a call, the Temp-Tracker mod+ will enable only the System Output. All Boiler outputs will be off when the PROVE input is open.
- A factory-installed jumper provides the Prove signal. Do not remove the jumper unless it will be replaced by a System Prove signal or use the terminals for DHW call.
- The Prove signal must be a dry contact only. No voltage can be placed across the *PROVE - 29, 30* terminals.
- Bring the two wires from the dry contact to the terminals marked *PROVE - 29, 30*.

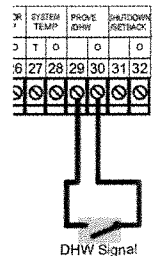


⚠ WARNING

The **PROVE** input can not be used as a safety limit. All equipment must have its own certified limit and safety controls as required by local codes. If Prove is selected in the startup menu, no boiler stage will start unless Prove terminals are shorted. **DO NOT** remove the **PROVE** jumper supplied unless replacing it with a Prove signal.

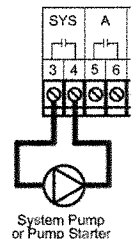
WIRING FOR DOMESTIC HOT WATER PRIORITY (TERMINALS 29, 30)

- DHW can be used to raise system Set Point to 200°F or Maximum Water temperature, whichever is lower.
- DHW Call terminals are dry contact N.O. terminals.
- Wire an aquastat or other controls to provide closure on the DHW Call terminals.
- Remove the jumper on the DHW terminals for proper operation.



WIRING THE SYSTEM OUTPUT (TERMINALS 3, 4)

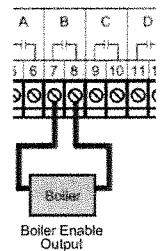
- The SYS output relay will energize whenever the outdoor temperature is below the Outdoor Cutoff.
- The SYS will remain constantly energized while the outdoor temperature is below the Outdoor Cutoff.
- When the outdoor temperature rises 2°F above the Outdoor Cutoff, the SYS output will remain energized for the period set by the System Run-On.
- The SYS output has one Normally Open (N.O.) relay contact.
- The N.O. contacts are dry contacts only. They do not source any voltage.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.
- Each N.O. contact is capable of switching 6A resistive at 120VAC.



WIRING THE BOILERS

WIRING THE BOILER OUTPUTS (A TERMINALS 5,6), (B TERMINALS 7,8), (C TERMINALS 9,10), ...

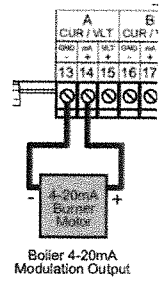
- Each Boiler output (A through D) has one Normally Open (N.O.) relay contact.
- The N.O. contacts are dry contacts only. They do not source any voltage.
- Each N.O. contact is capable of switching 6A resistive at 120VAC.
- Total output of all Boilers, including the SYS, must not exceed 15A.
- Wire the N.O. relay contacts to the Enable/Disable connection at the associated unit.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.



WIRING TO MODULATING MOTORS

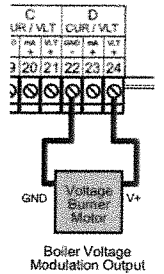
WIRING THE 4-20mA MODULATING MOTORS (A TERMINALS 13, 14), (B TERMINALS 16, 17),...

- The Temp-Tracker mod+ can be equipped to operate up to four 4-20 mA modulating motors.
- The Temp-Tracker mod+ Extension can be equipped to operate up to six additional modulating motors.
- The Temp-Tracker mod+ and the Temp-Tracker mod+ Extension sources 24VDC excitation voltage for the 4-20mA signal.
- Wire the (-) from the modulating motor to the boiler terminal on the Temp-Tracker mod+ marked (GND). That is for boiler A, the modulating (-) terminal will be 13.
- Wire the (+) from the modulating motor to the boiler terminal on the Temp-Tracker mod+ marked (mA). That is for boiler A, the modulating (+) terminal will be 14.



WIRING THE CURRENT VOLTAGE MODULATING MOTORS (A TERMINALS 13,15), (B TERMINALS 16,18),...

- The Temp-Tracker mod+Extension can be equipped to operate up to six additional 0-5V, 0-10V, 1-5V, or 2-10V modulating motors.
- Wire the (GND) from the modulating motor to the boiler terminal on the Temp-Tracker mod+ marked (GND). That is for boiler D, the modulating (GND) terminal will be 22.
- Wire the (V+) from the modulating motor to the boiler terminal on the Temp-Tracker mod+ marked (VLT+). That is for boiler D, the modulating (V+) terminal will be 23.

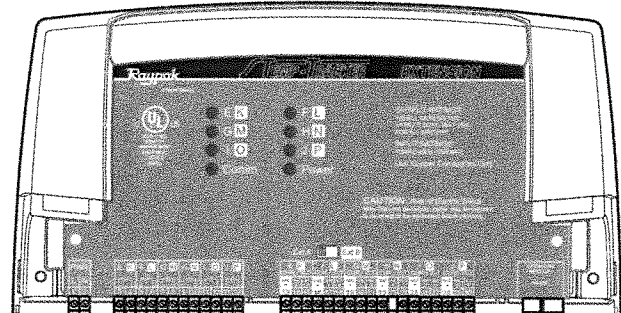
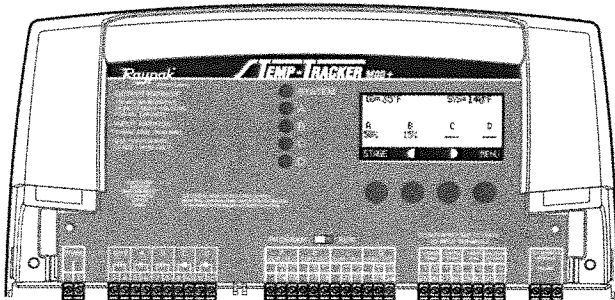


CONNECTING TO THE TEMP-TRACKER MOD+ EXTENSION PANELS

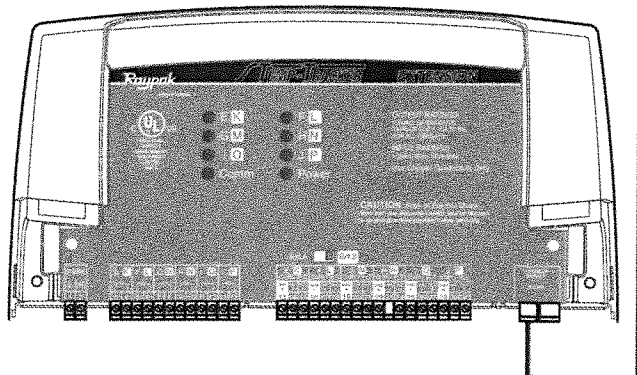
- The Temp-Tracker mod+ is equipped with a 6-pin phone socket to connect to extension panels.
- The Temp-Tracker mod+ Extension is equipped with two 6-pin phone sockets to connect to Temp-Tracker mod+ and an additional Temp-Tracker mod+ Extension panel.
- Connection cable is provided as part of the Temp-Tracker mod+ Extension package.
- Phone cables must be of a 6-wire with 6-pin terminals. Phone cables can extend up to 100'.

Temp Tracker mod+

Temp Tracker mod+ Extension A

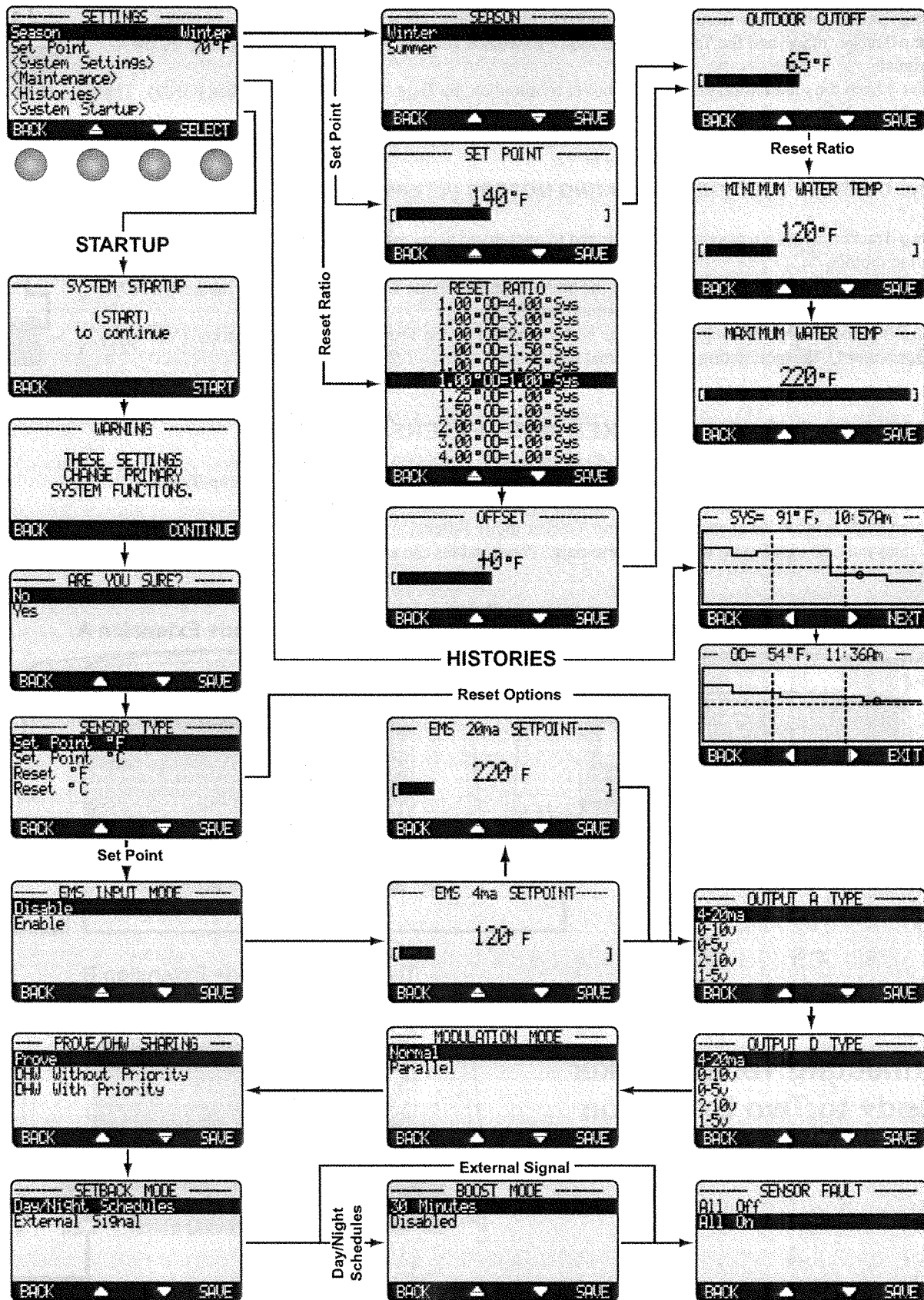


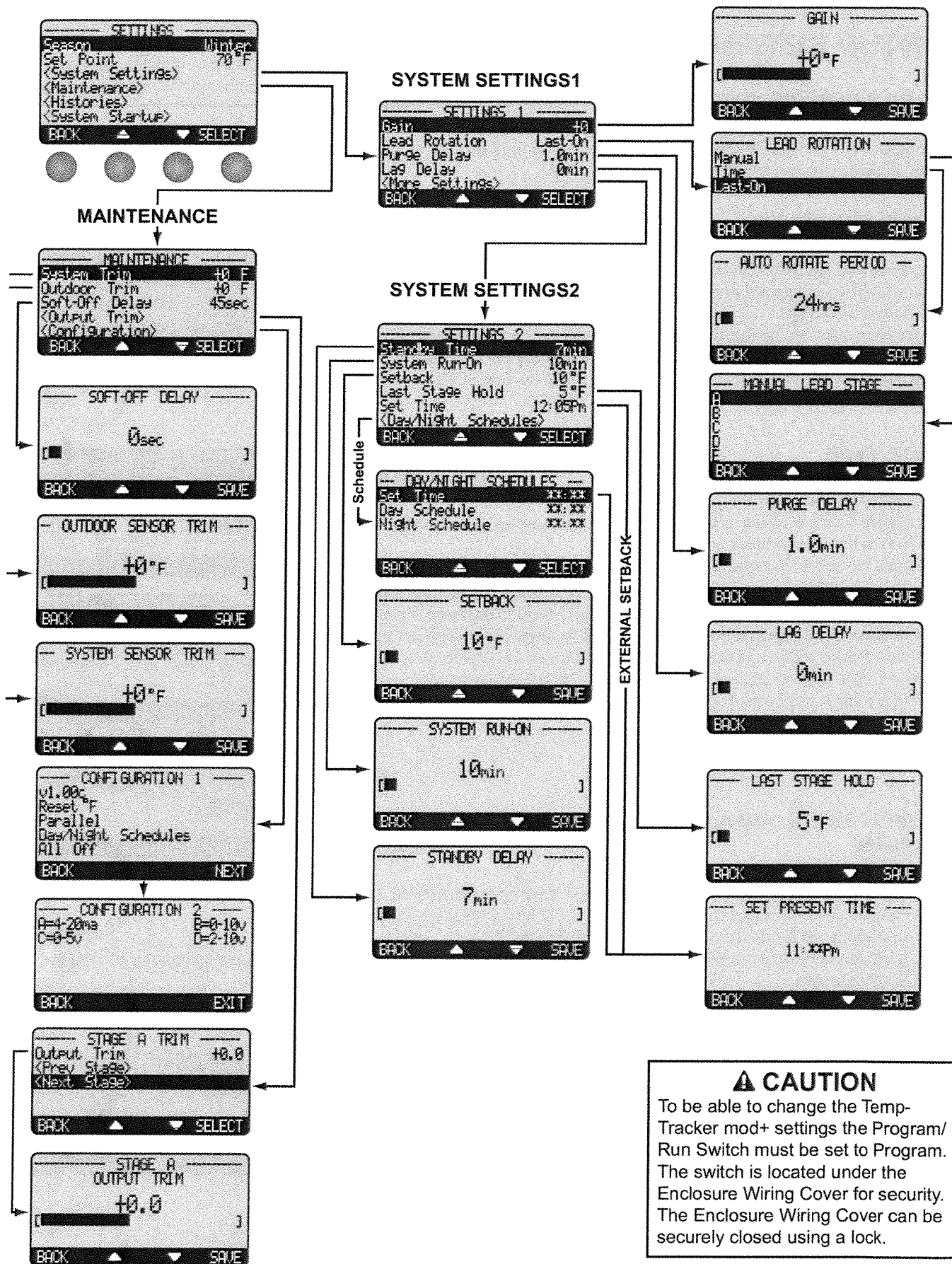
Temp Tracker mod+ Extension B



Connecting Temp Tracker mod+ to Two Extension Panels using RS485

MENU SEQUENCE





CAUTION

To be able to change the Temp-Tracker mod+ settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a lock.

STARTUP SETTINGS

⚠ CAUTION

A good practice after performing any Startup menu modifications is to check all operating settings and adjustments to match the new settings.

PROGRAM CHANGE SETTINGS

To be able to change the Temp-Tracker mod+ settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a lock.



STARTUP SEQUENCE

Button: MENU/<System Startup>

- When powered, the Temp-Tracker mod+ performs a self-test on its components.
- After the self-test diagnostics have been successfully completed, the Temp-Tracker mod+ will initialize the panel.
- On the first power up, the System Startup screen will appear after the initialization is complete. If it doesn't, the Temp-Tracker mod+ has already been configured.
- The System Startup menu sets the main parameters like the type of sensor, the type of output, and the modulating mode.

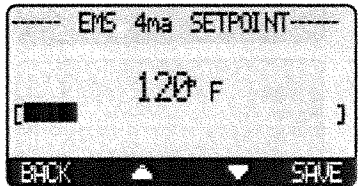
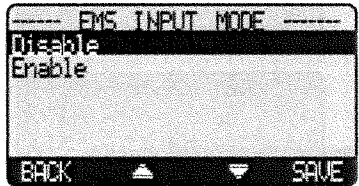
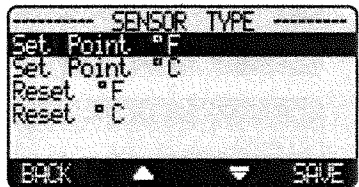


SENSOR TYPE

Set Point °F, Set Point °C, Reset °F, Reset °C Default: Set Point °F

Button: MENU/<System Startup>/.../Sensor type

- Reset mode is only available if an outdoor sensor is connected to terminals 25 and 26. DO NOT select Reset without an outdoor sensor.
- The same Raypak temperature sensor can display either in °F or °C.
- If °F is selected, all temperatures and settings will be displayed in degrees Fahrenheit and the Temp-Tracker mod+ will operate as a Set Point Control in degrees Fahrenheit.
- If °C is selected, all temperatures and settings will be displayed in degrees Celsius and the Temp-Tracker mod+ will operate as a Set Point Control in degrees Celsius.
- Set point mode does not require an outdoor sensor. If an outdoor sensor is connected in Set Point mode it will be used only as an outdoor cutoff point. That is, to turn the boilers and system pump off.



EMS INPUT MODE (AVAILABLE IN SET POINT ONLY)

Disable, Enable Default: Disable

Button: MENU/<System Startup>/.../EMS Input Mode

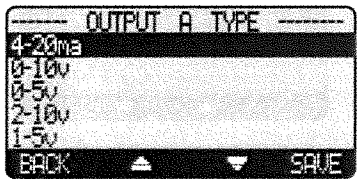
- This allows the Temp-Tracker mod+ to receive an external set point from an EMS/BMS system.
- You must select the 4mA (min) and 20 mA (max) Set Points in the following screen.
- The 4mA can be set to any temperature between 70°F to 200°F.
- The 20mA can be set to any temperature between 90°F to 240°F. However, the 20mA minimum setting must be 20°F higher than the 4mA setting.
- Connect the 4-20mA EMS Control Interface to the Temp-Tracker mod+ RS485 connection.

SELECTING THE OUTPUT TYPE

4-20mA, 0-5V, 0-10V, 1-5V, or 2-10V Outputs Default: 4-20mA

Button: MENU/<System Startup>/.../Output A type/Output B type

- Outputs can be configured for 4-20mA operation (current) or the voltage range can be selected (0-5V, 0-10V, 1-5V, 2-10V).
- Check the modulating motor to determine its control requirements.
- Select the appropriate Output Type for each of the Boilers. The Temp-Tracker mod+ can have a different Output type for each Boiler.



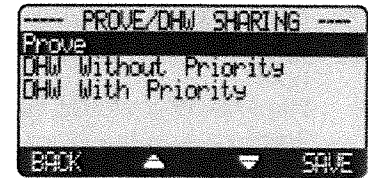
PROVE/DOMESTIC HOT WATER (DHW)

Prove, DHW Without Priority, DHW With Priority

Default: Prove

Button: MENU/<System Startup>/.../Prove-DHW Sharing

- Input Terminals 29 and 30 can be used with either of the above features.
- When Prove is selected, the Temp-Tracker mod+ will not start any boiler stage unless Prove terminals are connected.
- Using those terminals to connect to an aquastat for a Domestic Hot Water call and selecting either of the DHW options will raise the calculated water temperature to the lower of 200°F or Max Water Temperature.
- Domestic hot water without priority allows the SYS relay, mostly controlling a primary system pump, to remain energized during a domestic hot water call (aquastat call on terminals 29 and 30). In Summer or when outdoor temperature is above Outdoor Cutoff, a DHW call will energize the SYS relay. After the DHW call termination, the SYS relay will continue to run for the System Run-On period before turning off.
- However, domestic hot water with priority de-energizes the SYS relay during a domestic hot water call (aquastat call on terminals 29 and 30) for a period of one hour. If after the hour period the DHW call still exist, the SYS relay will energize and the Temp-Tracker mod+ will continue in the higher temperature setting until the domestic hot water call has terminated.



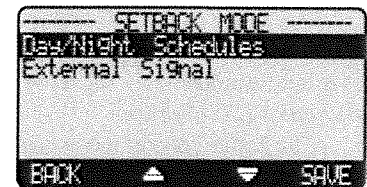
SETBACK MODE

Day/Night Schedules, External Signal

Default: Day/Night Schedules

Button: MENU/<System Startup>/.../Setback Mode

- The Temp-Tracker mod+ has two levels of heat, a normal/day and a setback/night. The normal heat level is good for when buildings are occupied and people are active. The setback/night heat level holds a lower system temperature and is for when buildings are unoccupied or inactive.
- The Day/Night Schedules provides the user with a Day Time setting for normal operation and a Night Time setting for setback.
- The External Signal option switches the Temp-Tracker mod+ to Setback mode when an external signal is received through the Setback terminals. This allows the Temp-Tracker mod+ to be managed by an external device or control to provide setback.



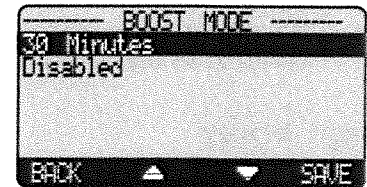
BOOST MODE

30 Minutes, Disabled

Default: 30 Minutes

Button: MENU/<System Startup>/.../Boost Mode

- If you do not want a Boost simply select Disabled from the boost menu.
- Boost is only available if Day/Night Schedules is selected as a Setback option.
- The morning Boost is designed to return the building to comfortable ambient temperatures after the cooler Night (Setback) period. The Temp-Tracker mod+ will accomplish this by running elevated water temperatures (will add Setback setting to calculated water temperature) for 30 minutes before the start of the Day schedule setting. That is, if the normal day set point at a specific outdoor was 145°F and the Setback setting was 20°F, the boost will raise the system calculated temperature to 165°F for 30 minutes before the start of the Day Schedule setting.



SENSOR FAULT

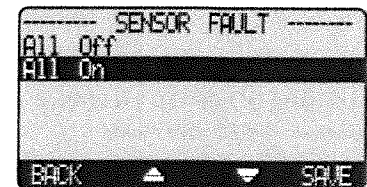
All Off, All On

Default: All On

Button: MENU/<System Startup>/.../Sensor Fault

The Sensor Fault will determine the operating status of all output stages that are set to Auto when a sensor reads Short or Open.

RESET MODE



- When All-On is selected, the Temp-Tracker mod+ will turn all boilers On to a 100% when System reads Short or Open and Outdoor is below Outdoor Cutoff. When Outdoor reads Short or Open, the Temp-Tracker mod+ will turn all boilers On to a 100%.
- When All-Off is selected, the Temp-Tracker mod+ will turn all boilers Off when either System or Outdoor sensor reads Short or Open.

SET POINT MODE

- When All-On is selected, the Temp-Tracker mod+ will turn all boilers On to a 100% when the System sensor reads Short or Open.
- When All-Off is selected, the Temp-Tracker mod+ will turn all boilers Off when the System sensor reads Short or Open.
- The Outdoor Sensor Short or Open status will not affect the control operation in Set Point mode.

OPERATING SETTINGS

PROGRAM CHANGE SETTINGS

To be able to change the Temp-Tracker mod+ settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a lock.



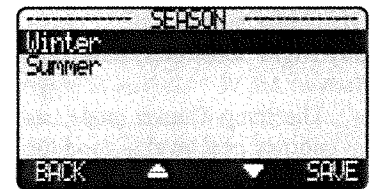
SEASON

Winter, Summer

Default: Winter

Button: MENU/Season

- The Temp-Tracker mod+ will turn all boiler relays off when it is in Summer setting. However, a DHW call will bring boilers back on if needed. The Message Display Line will display *Summer* to show status.
- When in Winter, the Temp-Tracker mod+ will activate the Sys relay whenever the Outdoor temperature (OD) falls to or below the Outdoor Cutoff setting. In addition, it will begin heating whenever the System temperature (SYS) falls below the Set Point Temperature.
- When the heating season is over, it is a good practice to switch the Temp-Tracker mod+ to Summer setting. This will allow DHW calls to operate the boilers when needed.



CAUTION
 DO NOT turn power off to the Temp-Tracker mod+ when heating season is over. If you do so, the battery will run down and will have to be replaced. Instead switch to Summer.

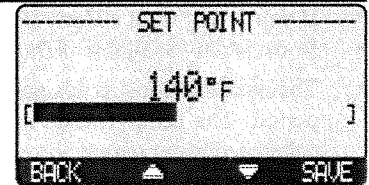
SET POINT

Adjustable 70°F - 250°F

Default: 140°F

Button: MENU/Set Point

- The Set point is the temperature the Temp-Tracker mod+ will use to control the system.
- The Temp-Tracker mod+ will increase, decrease or hold the modulation of the boilers to maintain the system temperature around the Set point.
- The system can be expected to fluctuate around the set point. The amount of fluctuation depends on the Modulation Mode, System Settings, and Stage Settings.

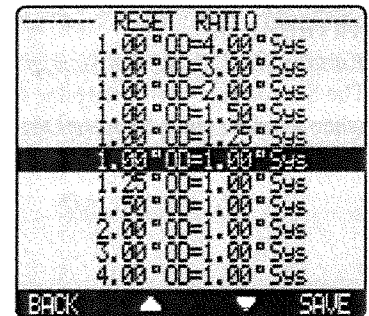


RESET RATIO

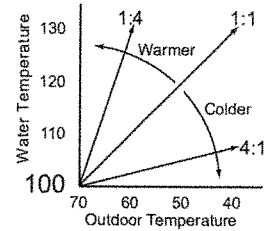
Adjustable 1.00°OD : 4.00°Sys to 4.00°OD : 1.00°Sys Default: 1.00°OD : 1.00°Sys

Button: MENU/Set Point

- The Reset Ratio determines how the System water temperature (SYS) will vary with Outside temperature (OD). With any of the ratios, the colder it becomes outside, the hotter the temperature of the system water. The ratios are adjustable from 1.00 (OD):4.00 (SYS) to 4.00 (OD):1.00 (SYS). (See Understanding Operation Concept on page 5)
- With a 1.00 (OD):4.00 (SYS) ratio, the System water temperature (SYS) will increase rapidly as the outside temperature falls, hitting the maximum of 240°F at 24°F outside temperature. With a 4.00 (OD):1.00 (SYS) ratio, the System water temperature (SYS) will increase slowly as the outside temperature falls. Even at -30°F, the system water will only be 125°F, and at 24°F outside, the system water will be 112°F. Such a low Reset Ratio might be used with radiant floor heating applications.



- With most baseboard heating applications, a 1.00 (OD):1.00 (SYS) setting is a good place to start. With a 1.00 (OD):1.00 (SYS) ratio, for every degree the outside temperature falls, the system water temperature is increased one degree.
- If required: **Adjust the RESET RATIO in cold weather.** If the ambient building temperatures are too cold in cold weather, move the ratio to a higher selection. That is, if 1.00 (OD):1.00 (SYS) was initially selected, change the selection to 1.00 (OD):1.25 (SYS). If the building temperatures are too warm in cold weather, move the ratio to a lower selection. That is, if 1.00 (OD):1.00 (SYS) was initially selected, change the selection to 1.25 (OD):1.00 (SYS).



OUTDOOR CUTOFF TEMPERATURE

Adjustable Off, 20°F - 100°F, On

Default: 65°F

Button: MENU/Set Point/Outdoor Cutoff

in Set Point

Button: MENU/Set Point/Offset/Outdoor Cutoff

in Reset

- If the outdoor sensor is installed, the Outdoor Cutoff screen will automatically appear after the temperature Set Point has been selected.
- When the outdoor temperature falls to the adjustable Outdoor Cutoff temperature, the Temp-Tracker mod+ will control and modulate Boilers to hold the calculated temperature.
- When the outdoor temperature rises to the Outdoor Cutoff plus a 2°F differential, the Temp-Tracker mod+ will disable the system. The Message Display Line will display *Outdoor Cutoff*.
- The Outdoor Cutoff can be set from 20°F to 100°F. In addition, the Setting can be set to ON or OFF. In the ON position, the System Relay will run regardless of the Outdoor temperature (OD) and the burner stages will be active to hold the calculated water temperature. (Note: The lowest water temperature the Temp-Tracker mod+ will circulate is 70°F. If the Outdoor Cutoff is turned ON and the Season is set to Winter, the Temp-Tracker mod+ will circulate at least 70°F water even in the hottest of weather.) In the OFF position, the system pump will always be off and all burner stages will be off for heating.



OFFSET

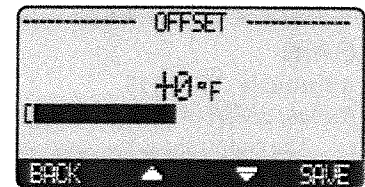
Adjustable 50°F - (-50°F)

Default: 0°F

Button: MENU/Set Point/Offset

in Reset only

- The Offset setting lets you adjust the starting points of the Reset Ratio curves. This means that, regardless of the Outdoor temperature (OD), or the Reset Ratio that has been selected, when the Offset setting is changed, that change is directly added to or subtracted from the calculated temperature. For example, if the Set Point temperature was 130°F and the Offset was changed from 0° to 10° (an increase of 10°), then the Set Point temperature would increase to 140°F
- The Offset setting does not change the ratio selection. For instance, with 1.00 (OD):1.00 (SYS) Reset Ratio, the System water temperature (SYS) will always increase one degree for each degree change in the Outdoor temperature (OD). What the Offset does is add or subtract a constant temperature value. (See Understanding Operation Concept)
- If required: **Adjust the Water Offset in mild weather.** If the ambient building temperatures are too warm in the mild weather, decrease the Water Offset. If the ambient building temperatures are too cold in the mild weather, increase the Water Offset. The rule of thumb for baseboard radiation is to change the Offset 4°F for every 1°F you wish to change the building temperatures. In radiant heat applications, change the Offset 1°F or 2°F for every 1°F you wish to change the building temperature.



MINIMUM WATER TEMP

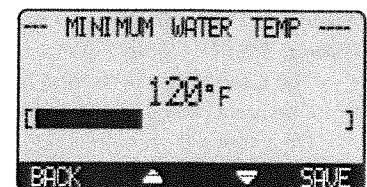
Adjustable 70°F - 180°F

Default: 120°F

Button: MENU/Set Point/Offset/Outdoor Cutoff/Minimum Water Temp

in Reset only

- The Minimum Water Temperature must be set to the boiler manufacturer's specification. The Temp-Tracker mod+ will calculate the Set Point based on the Outdoor temperature (OD), the Reset Ratio, and the Offset value. The Temp-Tracker mod+ will control all boilers modulation to hold either the Set Point temperature, or the Minimum Water Temperature, whichever is higher.
- The Minimum Water Temperature must be at least 20°F lower than the Maximum Temperature (See next setting).



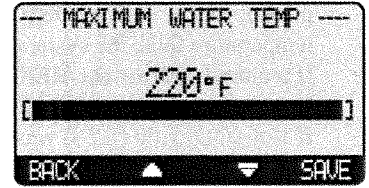
MAXIMUM WATER TEMP

Adjustable 90°F - 240°F

Default: 240°F
in Reset only

Button: MENU/Set Point/Offset/.../Maximum Water Temperature

- This is the highest temperature heating water the Temp-Tracker mod+ will circulate through the heating system. It is available in Reset mode only.
- When using a radiation system, it should be set according to the tubing or floor manufacturer's specification.
- The Maximum Temperature must be at least 20°F higher than the Minimum Temperature.

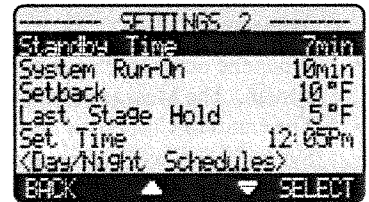
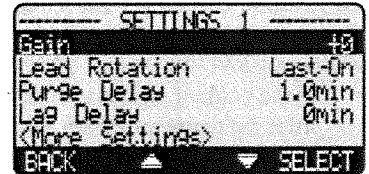


SYSTEM SETTINGS

Button: MENU/<System Settings>

The Settings 1 and Settings 2 menus provide access to adjusting and fine-tuning the system for enhanced comfort and more fuel savings. The Temp-Tracker mod+ behaves differently based on the selected Control Modes (see Startup Settings).

- | | |
|-----------------|-----------------------|
| • Gain | • System Run-On |
| • Lead Rotation | • Setback |
| • Purge Delay | • Last Stage Hold |
| • Lag Delay | • Day/Night Schedules |
| • Standby Time | |



CAUTION

To be able to change the Temp-Tracker mod+ settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a lock.

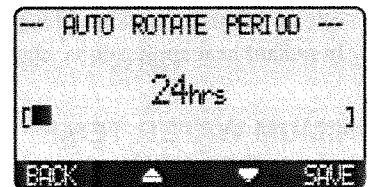
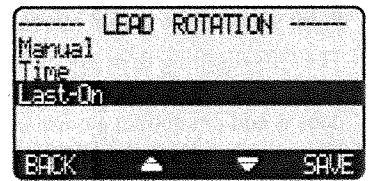
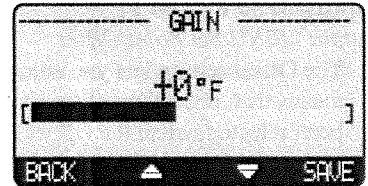
GAIN

Adjustable -10 to +10

Default: 0

Button: MENU/<System Settings>/Gain

- The Gain adjusts the aggressiveness of the Temp-Tracker mod+ PID logic to control how much modulation is changed when the system temperature is different from the Set Point.
- A Gain of 0 is a good starting point for all systems.
- If during normal load conditions, the system temperature tends to fluctuate significantly, decrease the Gain by two numbers (for example, from 0 to -2). Wait for at least 15 minutes before evaluating how the change has affected the system.
- If, during normal load conditions the system temperature tends to remain consistently below the Set Point (or consistently above the Set Point), increase the Gain by two numbers (for example, from 0 to 2). Wait for at least 15 minutes before evaluating how the change has affected the system.



LEAD BOILER ROTATION

Adjustable Manual, Time (1 hr to 60 Days), Last-On

Default: Last-On

Button: MENU/<System Settings>/Lead Rotation

- The Lead Boiler is the first boiler brought on when output is required.
- The Lead Boiler can be rotated automatically, manually or based on Last-On. The Last-On rotation is recommended.
- The current Lead Boiler is shown in brackets on the main display.
- Only Boilers which are set to Auto Mode can be Lead. Therefore, not all the Boilers may be available when manually selecting a new Lead Boiler.

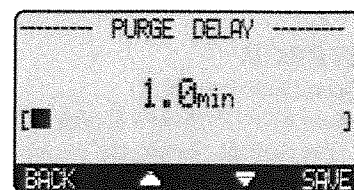
PURGE DELAY

Adjustable 1.0min to 10.0min

Default: 1.0min

Button: MENU/<System Settings>/Purge Delay

- Many boilers go through a purge cycle before they are brought on line.
- When the Temp-Tracker mod+ activates a boiler, it does not start to calculate its output until the Purge Delay is over. This allows the boiler to fully come on line and begin producing output.
- The Purge Delay helps to prevent short cycling of a newly activated burner. Once the burner is activated, it **MUST** run through the entire Purge Delay period.
- The minimum Purge Delay setting **MUST** be set to the time required by the boiler manufacturer. Time entry is in 0.1 of a minute (i.e. 1.5min will equal 90 seconds.)
- The Message Display Line will display *Purge Delay* and the amount of time remaining in the purge.



CAUTION

Set Purge Delay as per boiler manufacturer recommendation.

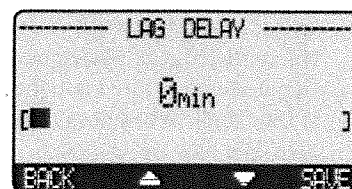
LAG DELAY

Adjustable 0min to 60min

Default: 0min

Button: MENU/<System Settings>/Lag Delay

- The Lag Delay requires the previous stage to remain at 100% modulation for the full period of the Lag Delay before another Stage can be activated. For example, if the Lag Delay was set to 10 minutes, the Lead Stage would need to remain at 100% modulation for a full ten minutes (never backing down to even 99%) before a lag stage could be activated. The Message Display Line will display *Lag Delay* and the remaining time.
- Set the Lag Delay to 0 min when two or more Stages will generally be needed to hold the load.
- The Lag Delay is useful in installations where one unit should usually have enough output to hold the load unless it fails or load conditions become extreme.
- The Lag Delay overrides the value of the Modulation Point selected for each stage. Regardless of that setting, the previous stage must reach 100% and stay there before another Stage can be activated.
- The full Lag Delay must always elapse regardless of what happens to system temperature. Therefore, set the Lag Delay to 0 min if you want smooth set point control using multiple units.



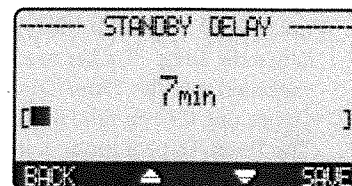
STANDBY TIME

Adjustable 1min to 60min

Default: 10min

Button: MENU/<System Settings>/<More Settings>/Standby Time

- The Standby Delay Time only applies to Boilers in Standby Mode.
- A Standby Boiler can only be activated after all the boilers in Auto Mode have run at 100% modulation for the full Standby Time.
- Standby boilers are used for backup or extreme load conditions only. A Standby Boiler can never be a Lead Stage
- The full Standby Delay Time must always elapse regardless of what happens to system temperature. Therefore, shorter Standby Times will result in smoother set point operation in extreme conditions. Longer Standby Times may prevent a Standby Boiler from firing if the other boilers can eventually meet the load, or if the load decreases.



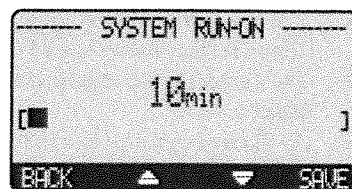
SYSTEM RUN-ON

Adjustable 0min to 360min

Default: 10min

Button: MENU/<System Settings>/<More Settings>/System run-On

- The SYS relay will energize whenever the Outdoor temperature (OD) is below the Outdoor Cutoff. When the Outdoor temperature increases 2°F above the Outdoor Cutoff after the last burner relay has de-energized, the SYS relay will stay on for a period set by the System Run-On. This allows the Pump to dissipate the residual heat within the boilers back into the system.
- A common use for the System Run-On is to control a system pump in a heating system. The extra time helps transfer the heat from the boilers to the heating system.
- The System Run-On time should be set based on the size and type of the boilers and pumps. In general, a boiler with low water content and high horsepower will need a longer System Run-On than a boiler with the same horsepower and more water content. (Refer to boiler manufacturer recommendation)



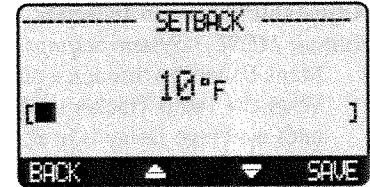
SETBACK

Adjustable 0°F to 75°F

Default: 10°F

Button: MENU/<System Settings>/<More Settings>/Setback

- The Setback feature can be used to provide the Temp-Tracker mod+ with a lower temperature Set Point when less load is required.
- The lower Set Point will appear on the main display indicating this condition.
- For an example, if the calculated temperature is 180°F and the Setback is 20°F, then when in Setback, the Temp-Tracker mod+ will hold a Set Point of 160°F.
- A typical use for Setback is to provide less system temperature to a building during the night or on the weekends when building is not occupied, but heat is still required.
- The amount of Setback selected is subtracted from the Set Point when a Setback External Signal is received or the Night Time schedule setting started.
- If External Signal is selected as a Setback Mode (See Startup menu), the Setback will not be activated unless a dry contact signal source is wired into the Shutdown/Setback terminals (31 and 32) and the Temp-Tracker mod+ receives a SHORT signal.
- If Day/Night Schedules is selected as a Setback Mode (See Startup menu), the Setback will be activated only when Night Schedule time has started.



⚠ CAUTION

When using Soft-Off and Last Stage Hold, the last boiler stage will not turn off until both parameters have elapsed. In this case, Soft-Off will start after the Last Stage Hold.

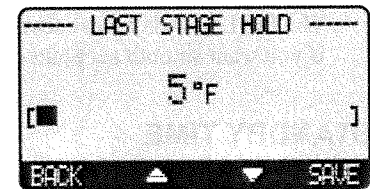
LAST STAGE HOLD

Adjustable 0°F to 30°F

Default: 5°F

Button: MENU/<System Settings>/<More Settings>/Last Stg Hold

- The Last Stage Hold prevents short cycling of the Lead Stage during low load periods.
- In low load conditions, the system might require only 5% of the output of one Stage. When the Temp-Tracker mod+ brings on the Lead Stage, the Set Point is quickly exceeded, and the Temp-Tracker mod+ turns the Lead Stage off.
- To prolong the run time during this type of condition, use the Last Stage Hold setting.
- The Temp-Tracker mod+ will let the system temperature exceed the Set Point by the number of degrees selected, before the Lead Stage is turned off.
- For example, with a Set Point of 160°F and a Last Stage Hold setting of 10°F, the Lead Stage boiler will remain on, at low modulation, until the Set Point reaches 170°F.
- From an efficiency stand point, it is better to overshoot slightly than to short cycle a boiler.



⚠ WARNING

The temperature limits set on the boilers must be higher than the Temp-Tracker mod+ Set Point. Read the section at left for details that will prevent erratic system operation.

Avoiding Conflicting Boiler Limits

- The temperature limits set on the boilers MUST be set considerably higher than the Temp-Tracker mod+'s Set Point for the reasons detailed below.
- The Temp-Tracker mod+ sensor is located in a common header some distance from the boilers.
- As the temperature rises in the header and before reaching the sensor location, energy is dissipated. Therefore, the temperature in the header could be lower than that registered by boiler sensors.
- In addition to the normal drop experienced between the boiler's temperature and that read by the Temp-Tracker mod+ sensor, the Last Stage Hold setting must be accounted for. The boiler limit must be set above the Set Point PLUS the Last Stage Hold PLUS the normal drop experienced in the piping.
- Using the previous example of a 10°F Last Stage Hold with a 160°F Set Point, the boilers' limits must be set enough over 170°F to prevent the boilers' internal limits being reached. In this situation, the boiler high limit should be set at approximately 180°F to prevent the difference in boiler temperature vs. header temperature causing erratic operation.

DAY/NIGHT SCHEDULES

(Available when "Day/Night Schedules" is selected from the Setback Startup menu option only)

Button: MENU/<System Settings>/<More Settings>/Day/Night Schedules

- The Temp-Tracker mod+ has two levels of heat. The Day level is used when a building is occupied and people are active.
- The Night (Setback) level is used when a building is not occupied, or when people are sleeping. This setting reduces the calculated temperature by the Setback setting. If the Day calculated water temperature was 150°F and the Setback was 20°F, the Night Schedule will run at $(150^{\circ}\text{F} - 20^{\circ}\text{F}) = 130^{\circ}\text{F}$.
- If the Boost feature is being used, it uses the Day Schedule as a Boost ending point. That is, if the Day Schedule is set to start at 6:00AM, the Boost will start 30 minutes prior to the Day setting at 5:30AM. The Temp-Tracker mod+ will then raise the calculated water temperature by the Setback amount. Using the previous example, at 5:30AM the Temp-Tracker mod+ will raise the calculated water to 170°F $(150^{\circ}\text{F} + 20^{\circ}\text{F})$ until 6:00AM.



SET TIME

Button: MENU/<System Settings>/<More Settings>/Set Time

Button: MENU/<System Settings>/<More Settings>/<Day/Night Schedules>/Set Time

- Adjust the time by selecting Time from the menu and then scrolling through the hours followed by the minutes. If hours are to be set to PM, scroll through the AM hours to reach the PM hours.



⚠ CAUTION

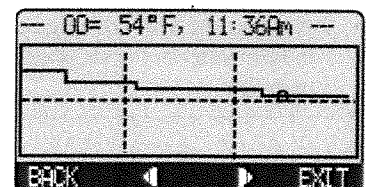
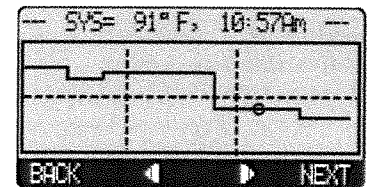
Remember that the battery is the backup for the Time. If no power is supplied to the Temp-Tracker mod+ and there was no battery or battery had no power, time values will be lost and will need to be reset.

HISTORY

Button: MENU/<Histories>

The Temp-Tracker mod+ provides users with a graphical history of the System and Outdoor temperatures for the previous 24 hours. The temperatures are sampled every 12 minutes. That is, readings of both System and Outdoor temperatures are recorded and stored every 12 minutes for the last 24 hours.

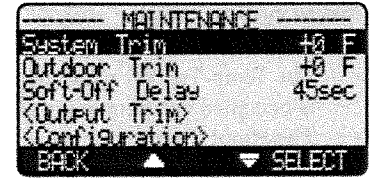
- To view the values of specific time period, use the two middle buttons to scroll to that time and read the upper left temperature.
- The first screen will be the System Temperature History. By clicking on the Next button, you'll be able to view the Outdoor Temperature History.



MAINTENANCE

Button: MENU/<Maintenance>

The Maintenance menu gives access to sensor and outputs trimming and Soft-Off. In addition, you'll have access to view the Startup configuration settings.



⚠ CAUTION

To be able to change the Temp-Tracker mod+ settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a lock.

SYSTEM & OUTDOOR SENSOR TRIM

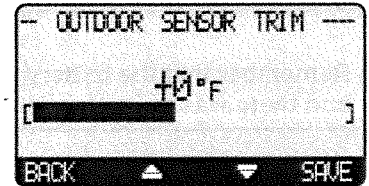
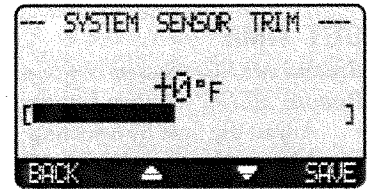
Adjustable -5°F to +5°F

Default: 0°F

Button: MENU/<Maintenance>/System Trim

Button: MENU/<Maintenance>/Outdoor Trim

- The Raypak thermistor type sensors are very accurate, and normally require no calibration. Sometimes it may be desirable to make small adjustments to the displayed value for either the Outdoor temperature (OD) or the System temperature (SYS). The Trim setting can adjust the displayed value by ± 5°F.
- Do not use the Trim setting to make the Outdoor temperature sensor match that reported on the radio or TV. Outdoor temperature can vary widely over a broadcast range. Only trim the outdoor sensor based on an accurate thermometer reading taken where the sensor is located.



SOFT-OFF DELAY

Adjustable 0sec to 60sec

Default: 0sec

Button: MENU/<Maintenance>/Soft-Off Delay

- When a stage is no longer needed, the Soft-Off keeps that stage burner in Low Fire prior to turning it off.
- The display will show a percent that is equal to the Ignition % for the stage in Soft-Off delay. That number will blink for the Soft-Off delay period.
- If during the Soft-Off stage delay period the Temp-Tracker mod+ needed that stage to turn back on, the stage will be released from the Soft-Off delay and resume normal operation.



⚠ CAUTION

When using Soft-Off and Last Stage Hold, the last boiler stage will not turn off until both parameters have elapsed. In this case, Soft-Off will start after the Last Stage Hold.

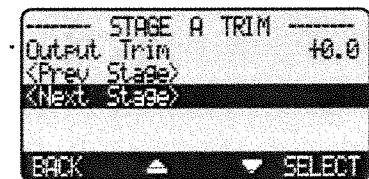
OUTPUT TRIM

Adjustable -5 to +5

Default: 0

Button: MENU/<Maintenance>/Output Trim

- Each of the stages controlled by the Temp-Tracker mod+ has a separate Output Trim setting.
- Output Trim acts as an adjustment to a stage output percent to match the burner motor.
- After adjusting the Output Trim, test the operation to make sure the results match your expectation.



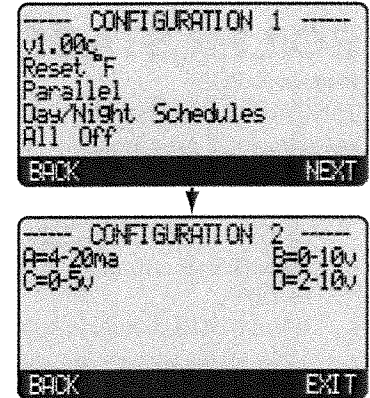
⚠ CAUTION

DO NOT use the Output Trim for a Stage unless it is absolutely necessary. Test burner operation and modulation output matching after adjusting the Output Trim.

CONFIGURATION

Button: MENU/<Maintenance>/<Configuration>

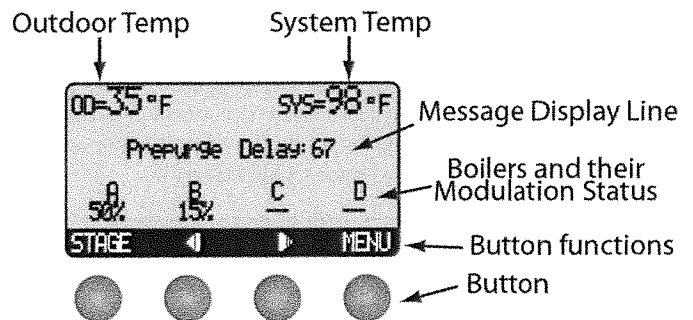
- This menu option provides a consolidated view of the Startup settings the Temp-Tracker mod+ has been set to.
- Additional stage settings will be available by selecting the NEXT option.



DISPLAY

The Temp-Tracker mod+ display layout provides a variety of information that gives an immediate picture of the operation status. The display shows four boilers at a time. The two middle buttons scrolls the screen to view additional boilers. Moreover, all the information is brightly displayed. It can be viewed in brightly or dimly lit rooms.

- The buttons' functionality changes based on the screen and menu level your in. The buttons' functionality are displayed on a dark background on the screen bottom line.
- Horizontal arrows are to scroll through the available stages.
- Vertical arrows are to scroll through the menu functions when in menus or to change values of settings when in its specific screen.



DISPLAY BOILER MODULATION STATUS

The Temp-Tracker mod+ boiler modulation status gives immediate access to each boiler status. The following list show all possible boiler status:

- Boiler is off due to no call for heat.
- 97% Boiler is modulating at the indicated percentage.
- ON Boiler Stage Mode is set to ON and boiler is firing at 100% (boiler is in bypass).
- OFF Boiler Stage Mode is set to OFF and boiler stage is unavailable or boiler does not exist.
- m95% Boiler Stage Mode is set to Manual and set to the specified percent.
- h50% Boiler is in post purge for 30 seconds.
- C/E Boiler on Extension panel is communicating back to the Temp-Tracker mod+.

DISPLAY MESSAGES

The Temp-Tracker mod+ normal display layout reserved the second line for message indications. The following is a list of the most common Message Display Line information:

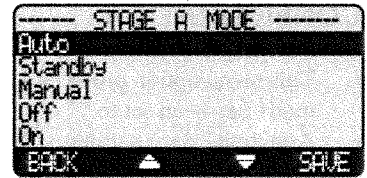
- Summer The control is set to Summer. No heat is active.
- Shutdown Active The Shutdown Terminals are Shorted. No boilers will be active.
- DHW Call (171°F) There is a DHW (Domestic Hot Water) call. The Temp-Tracker mod+ will Raise system Set Point to the indicated temperature. DHW increases calculated temperature to 200°F or Max Water Temperature, whichever is lower.
- Purge Delay: 23 The current boiler is in purge cycle and the remaining purge time in seconds is 23.
- Holding Until 150°F The Lead boiler is in Last Stage Hold. This example shows that the lead stage will turn off when system temperature reaches 150°F.
- System Run-On: 46 The System relay is ON for the System Run-On Delay. This example shows that it will remain in System Run-On for an additional 46 seconds before turning off.

BOILER STAGE SETTINGS

Button: STAGE/

The Maintenance menu gives access to sensor and outputs trimming and Soft-Off. In addition, you'll have access to view the Startup configuration settings.

- In most installations, all active Boiler adjustments are the same, but each can be configured differently if desired.
- If the Boilers are not set up properly, the Temp-Tracker mod+ operation may appear to be erratic.
- When STAGE button is depressed, the Boiler A Settings menu will be shown.
- Make all the appropriate settings for Boiler A (See below).
- After completing all the settings for Boiler A (See below), you have the option of copying these settings to all other Boilers. Everything but the Mode -- Auto/Standby/Manual/Off/On -- will be copied.
- Then select the Next Stage option from the menu to bring up the Boiler B Settings menu and make all the settings. Continue until all Boilers have been set.
- If a Temp-Tracker mod+ Extension is connected to the Temp-Tracker mod+, scrolling through stages using the Next and Prev Stage menu options will scroll through the Temp-Tracker mod+ Extension stages as well.



⚠ CAUTION
Remember to set the Mode for each stage. For Stages that do not have a boiler, contractor must change their Mode to OFF. Otherwise the Temp-Tracker mod+ will include them in the modulation calculation and rotation. That might have dire effects on system response.

⚠ CAUTION
To be able to change the Temp-Tracker mod+ settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a lock.



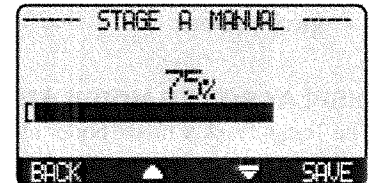
MODE

Auto, Standby, Manual, Off, On

Default: Auto

Button: STAGE/Mode

- The Temp-Tracker mod+ only controls the modulation of Boilers set to Auto or (after a delay) those set to Standby. None of the other settings is recommended for output Boilers connected to active units.
- Any Boiler without an active unit connected must be set to Off.
- The following list describes the MODE options:



- Auto -** The Temp-Tracker mod+ will control the Boiler's operation to maintain the desired Set Point. Only Boilers set to Auto can be Lead Boilers.
- Standby** Standby Boilers can only be activated when all Boilers in Auto have been at 100% modulation for a selectable period of time. Standby is generally used when you want a specific boiler to be available in extreme load conditions. Note that a Standby Boiler Cannot be a Lead Boiler.
- Manual** The Manual Mode should only be used when testing a Boiler. Manual overrides the System Prove input. The exact percent of modulation for a Boiler can be set with the Manual mode. Once selected, the unit will immediately turn on and modulate to the selected percentage.
- Off** Any output Boiler A through D not connected to a physical unit should be set to Off. The Off Mode can also be used to disable units that are being serviced.
- On** The On Mode should only be used when testing a Boiler. The On Mode overrides the SYSTEM PROVE input. Once set to On the Boiler will immediately start firing and modulate to 100%.

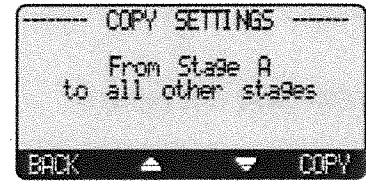
COPY SETTINGS - BOILER A ONLY

Button: STAGE/Copy Settings

- If all the active Boilers will have the same Ignition Start Point and Modulation Point, they can be set for Boiler A and then copied to the other Boilers.
- It is still required to select the Mode for all other Boilers. The Mode will not be copied.

⚠ IMPORTANT

The Mode **MUST** be set for each Boiler. The Copy Settings command will not set the Mode for Boilers B, C, and D. Only Ignition % and Modulation Start % are copied.



TROUBLESHOOTING

TEMPERATURE INPUTS

Display shows Sensor OPEN

Check the sensor is connected and the wires are continuous to the Temp-Tracker mod+. Finally follow the procedure for Incorrect Temperature Display.

Display shows Sensor SHORT

The Temp-Tracker mod+ sees a short across the input terminals. Remove the wires from either the SYSTEM TEMP or OUT TEMP terminals (whichever is reading SHORT). The display should change to read OPEN. If it doesn't, the Temp-Tracker mod+ may be damaged.

Display shows an Incorrect Temperature Display

Remove the wires from either the SYSTEM TEMP or OUT TEMP terminals (whichever is reading incorrectly). The display should change to read OPEN. If it doesn't, the Temp-Tracker mod+ may be damaged. Take an ohm reading across the detached sensor wires. The ohm reading should correspond to the side chart. If it doesn't, the sensor may be damaged.

CONTROL OPERATION

No Heat

- (Check Diagram on next page)

Too Much Heat

Check if the control has any of the following:

- **Domestic Hot Water call** - The Temp-Tracker mod+ will raise the temperature of the system to either 200°F or Maximum Water Temperature on a DHW call, connected to terminals 29 and 30. Check to see if there is a call for DHW and the length of time it lasts.
- **Reset Ratio and Offset** - If excessive heat occurs only in certain weather, adjust the Reset Ratio and Offset (See Understanding Operating Concept). If excessive heat occurs year round, reduce the Offset.
- **Boiler Mode Settings** - The Temp-Tracker mod+ will only modulate boilers their mode is set to Auto or Standby. Check to if any boiler stage is set to Manual or On.
- **Control Settings** - The Last Stage Hold will allow only the Lead boiler to stay on for an additional number of degrees. If the setting is too high, and only the Lead boiler is on, the system can over heat. Reduce the Last Stage Hold setting.

Too Little Heat

Check if the control has any of the following:

- **Reset Ratio and Offset** - If reduced heat occurs only in certain weather, adjust the Reset Ratio and Offset (See Understanding Operating Concept). If reduced heat occurs year round, increase the Offset.
- **Setback and Day/Night Schedule** - If reduced heat occurs only during specific hours, check the Day/Night Schedule and the Setback values. Either reduce the Setback setting or change the Day and Night Schedules.
- **Boiler Mode Settings** - The Temp-Tracker mod+ will only modulate boilers their mode is set to Auto or Standby. Check to if any boiler stage is set to Manual, Off, or Standby.

Boilers are Short-Cycling

- **Lag Delay** - Increase the Lag Delay only if all boilers tend to short-cycle.
- **Last Stage Hold** - Increase the Last Stage Hold only if the lead boiler tends to short-cycle.

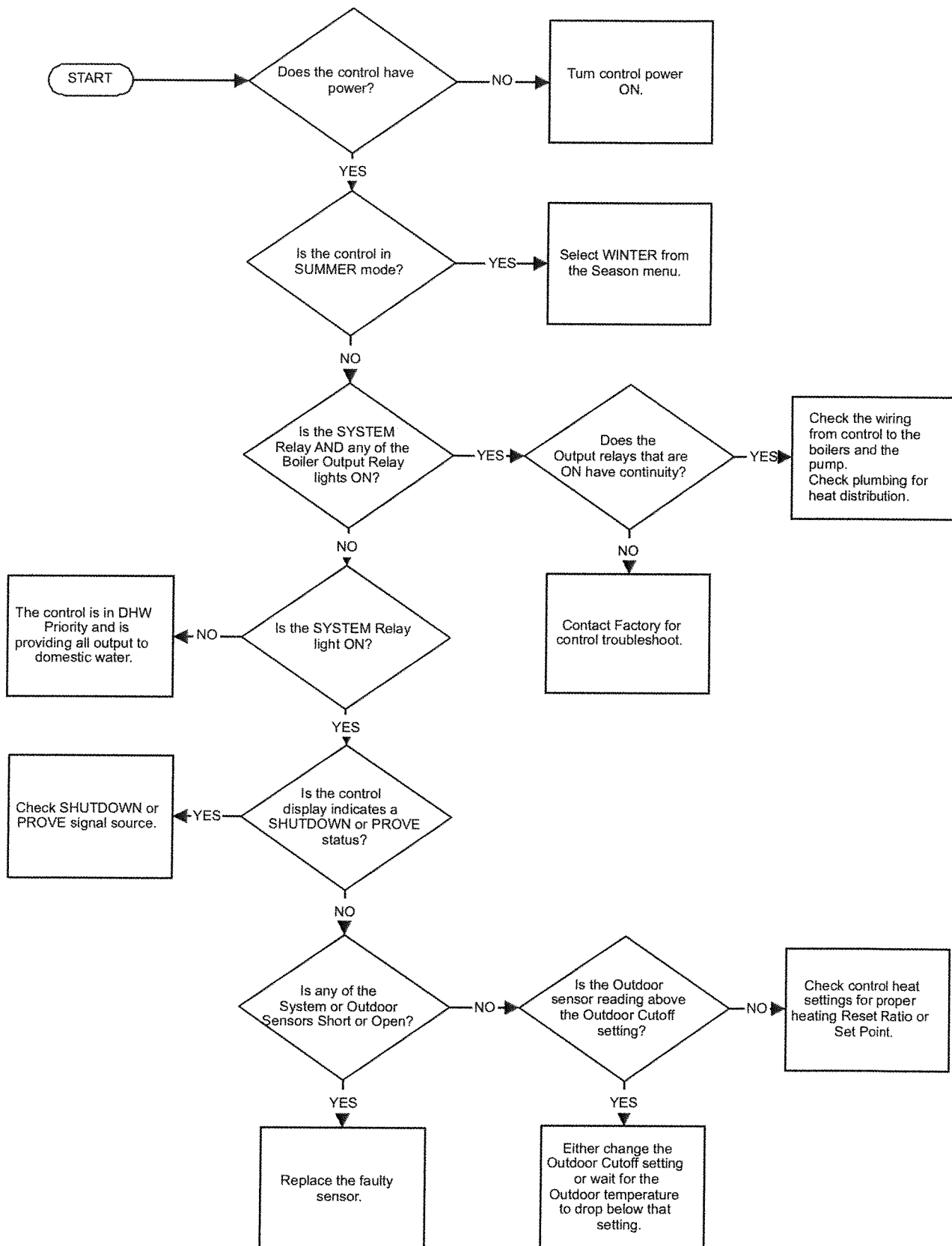
System is Overshooting or Undershooting

- **Gain** - If the system is overshooting reduce the Gain.
- **Gain** - If the system is undershooting increase the Gain.

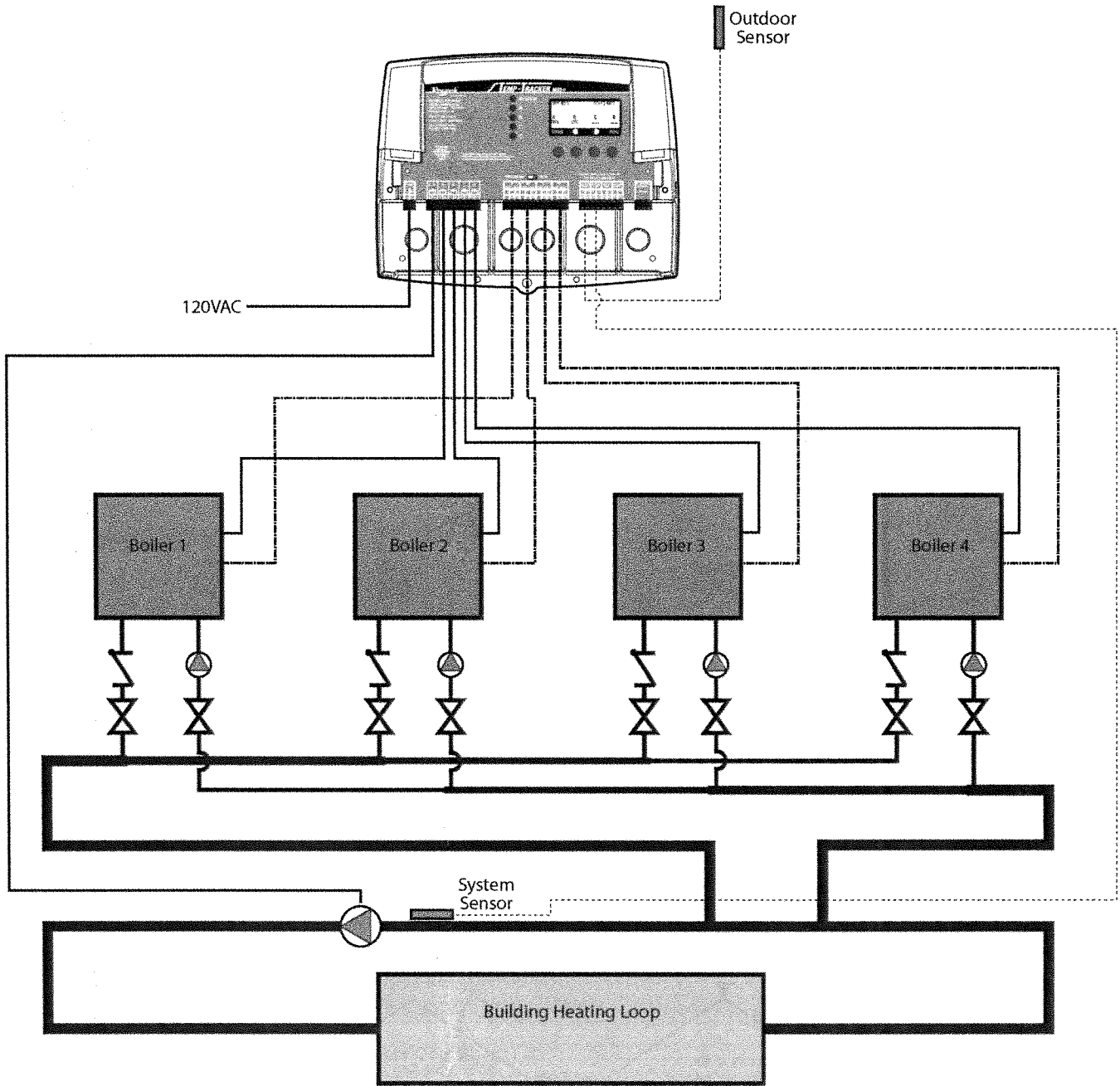
Temperature Sensor Chart

TEMPERATURE (in Degrees °F)	Value (in Ohms)
-30	117720
-20	82823
-10	59076
0	42683
10	31215
20	23089
25	19939
30	17264
35	14985
40	13040
45	11374
50	9944
55	8714
60	7653
70	5941
80	4649
90	3667
100	2914
110	2332
120	1879
130	1524
140	1243
150	1021
160	842
170	699
180	583
190	489
200	412
210	349
220	297
230	253
240	217
250	187

TROUBLESHOOT - NO HEAT



MULTIPLE MODULATING BOILERS DIRECT HEATING PIPING DIAGRAM

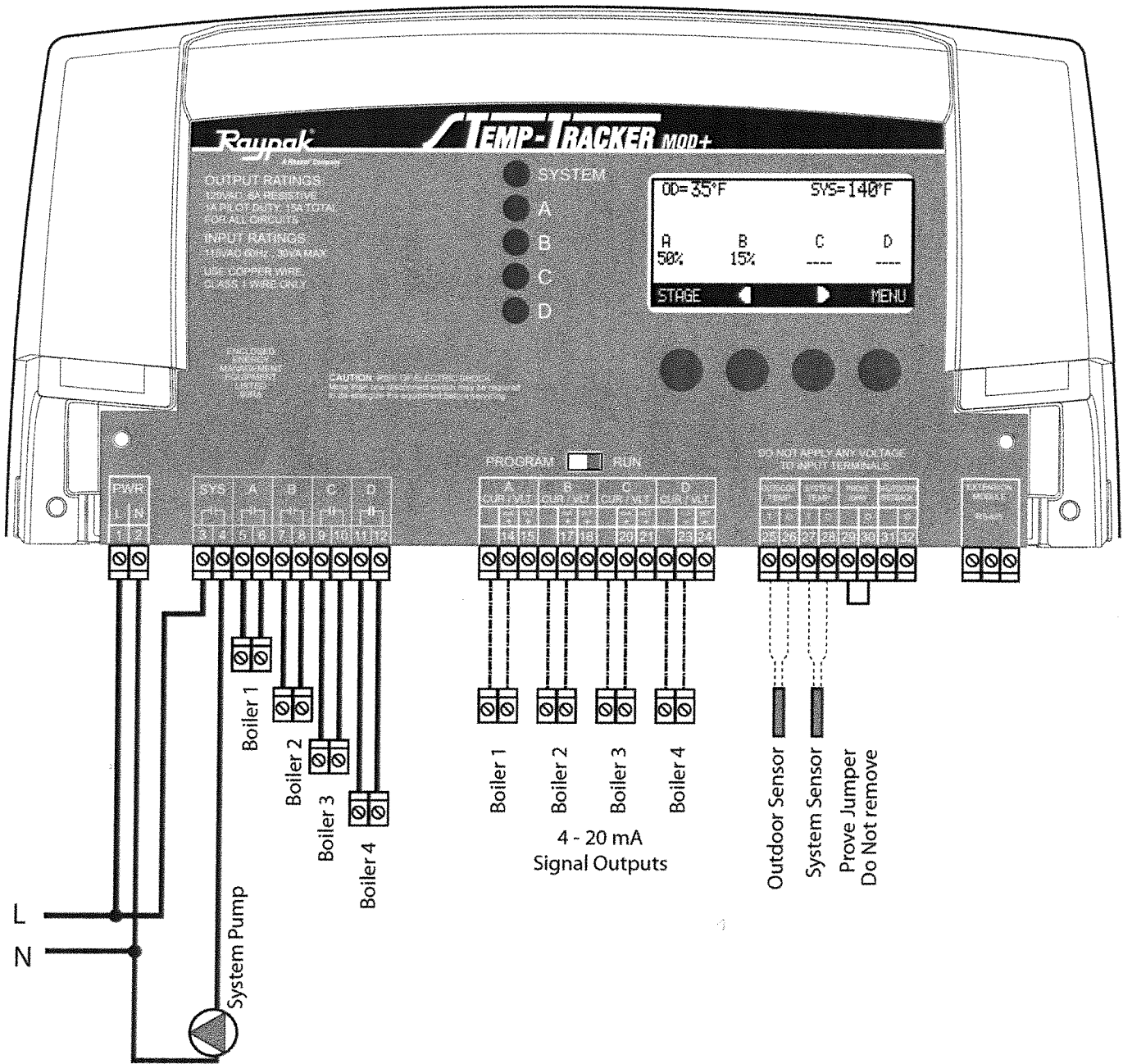


System:

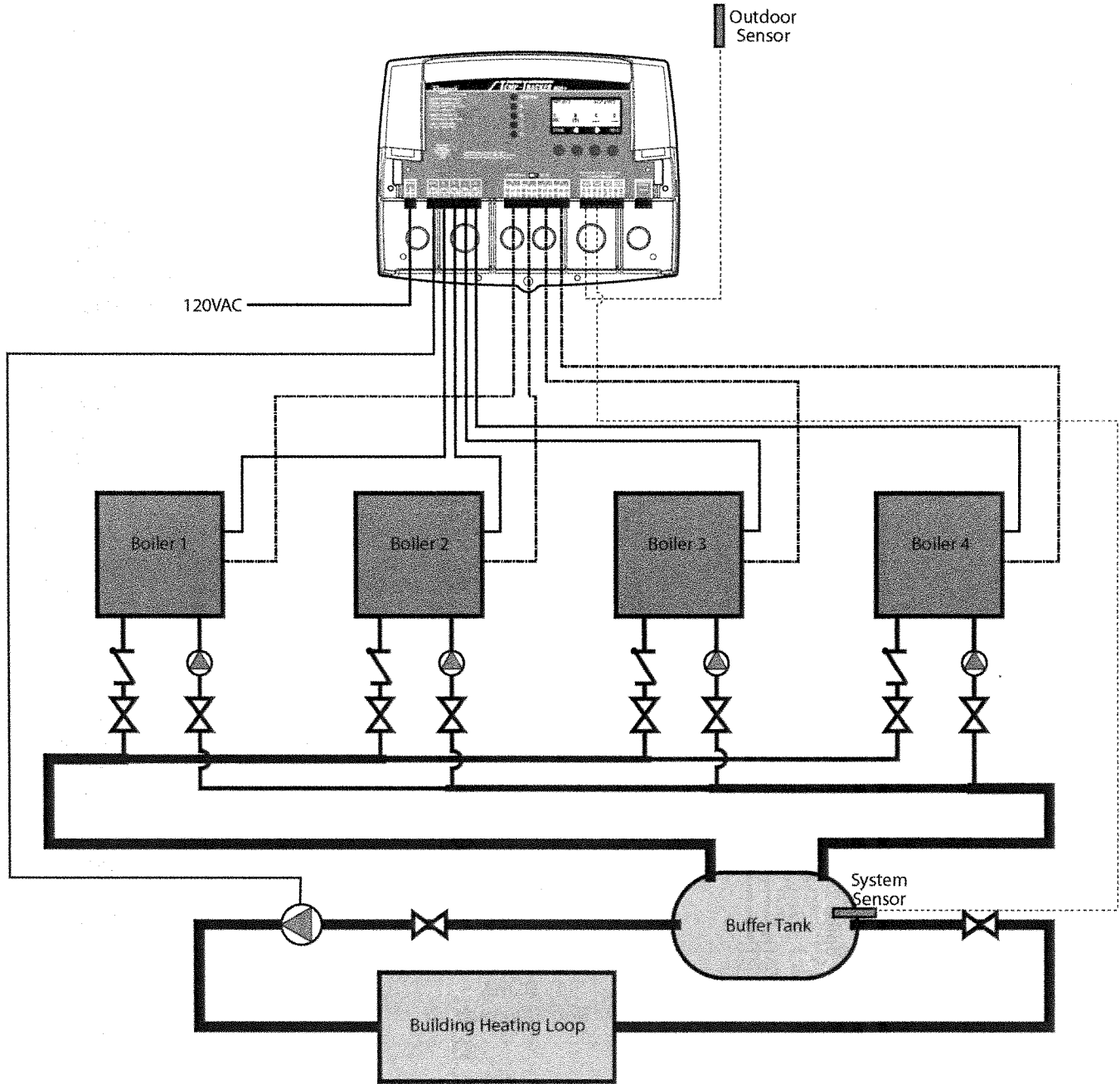
The Temp Tracker provides 4 Raypak modulating boilers using a 4 - 20mA modulating signal. The boilers are piped in Reverse Return on the primary loop. The System output is controlling the System Pump.

Raypak is aware that each installation is unique. Thus, Raypak is not responsible for any installation related to any electrical or plumbing diagram generated by Raypak. The provided illustrations are to demonstrate Raypak's control operating concept only.

MULTIPLE MODULATING BOILERS DIRECT HEATING WIRING DIAGRAM



MULTIPLE MODULATING BOILERS HEATING WITH BUFFER TANK PIPING DIAGRAM

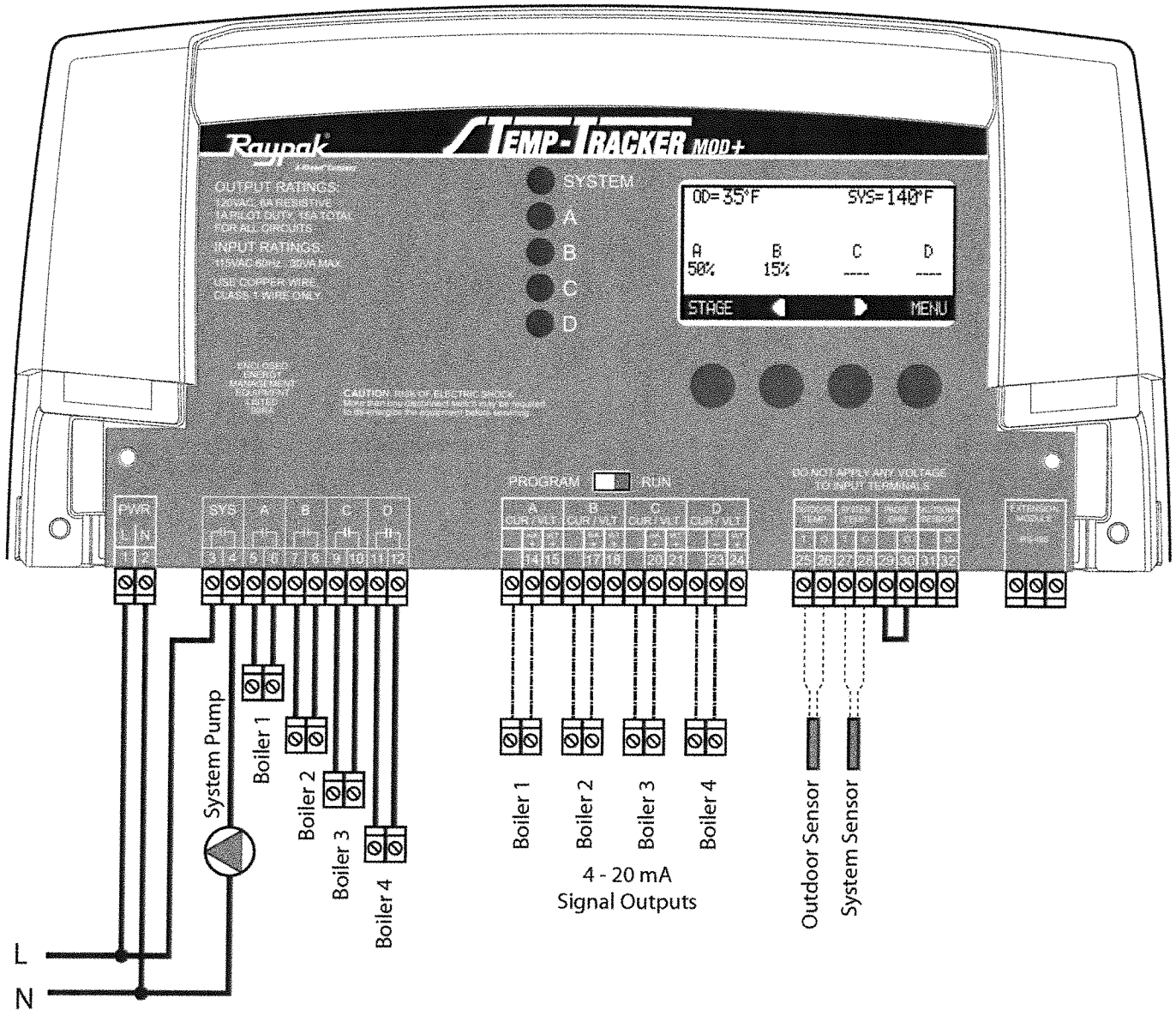


System:

The Temp Tracker provides 4 Raypak modulating boilers using a 4 - 20mA modulating signal. The System output relay is controlling a the Primary System Pump.

Raypak is aware that each installation is unique. Thus, Raypak is not responsible for any installation related to any electrical or plumbing diagram generated by Raypak. The provided illustrations are to demonstrate Raypak's control operating concept only.

MULTIPLE MODULATING BOILERS HEATING WITH BUFFER TANK WIRING DIAGRAM



Specifications

Voltage Input:	120 VAC 60 Hz
Power Consumption:	12 VA Max
Operating Temperature:	20°F to 120°F
Operating Humidity:	20% to 80%
Dimensions:	11"W x 9" H x 3 3/4" D
Weight:	2.5 pounds

Temp-Tracker mod+ Specifications

Lead Stage Rotation:	Time (1 to 1440 Hours (60 days)), Manual, Last-On
Pump Output:	(1) N.O. S.P.S.T
Boiler Modes:	Auto, Manual, Standby, On, Off
Standby Time:	1 to 60 minutes
Modulating Output Types:	(4) 4-20mA, 0-5V, 0-10V, 1-5V, 2-10V
Output Relay Ratings:	(5) 1 Amp inductive, 6Amp resistive at 120 VAC 60 Hz, 15A total for all circuits
Add-On Temp-Tracker mod+ Extension Panels:	up to two Temp-Tracker mod+ Extension Panels using RS485
Ignition Point %:	---
Modulation Start Point %:	75%
Modulation Mode:	Parallel
Temperature Display:	Fahrenheit or Celsius.
Display:	Graphical Alphanumeric (7 rows x 21 char. each)
LED:	(1) System Output relay, (4) Boiler Output relays
Sensor Ranges:	Outdoor temperature sensor - minus 35°F to 250°F Heating system sensor - minus 35°F to 250°F
Outdoor Cutoff Range:	20°F to 100°F, ON and OFF
Reset Ratio Range:	(1.00 : 4.00) to (4.00 : 1.00) (Outdoor : System Water)
Offset Adjustment:	minus -40°F to plus 40°F
Minimum Water Temperature:	70°F to 170°F
Maximum Water Temperature:	90°F to 240°F
Set Point Temperature Range:	70°F to 250°F
EMS Temperature Range:	70°F to 240°F
Domestic Hot Water:	with Priority or without Priority
Pump Run-On:	10 to 360 minutes
Purge Delay:	1.0 to 10.0 minutes
Lag Delay:	0 to 60 minutes
Last Stage Hold:	0 to 30°F
Schedules:	(1) Day and (1) Night (Setback) settings per day
Night Setback:	0°F to 75°F
Power Backup:	Lithium coin battery, 100 days minimum 5 year replacement (Maintains Clock in power outages).
External Inputs:	Shutdown Input, and Prove Input. (Dry Contacts Only)
Season:	Winter and Summer.

Temp-Tracker mod+ Extension Specifications

(Each Temp-Tracker mod+ Extension can add up to (6) additional modulating boilers. A maximum of two Temp-Tracker mod+ Extensions can be added to a single Temp-Tracker mod+.)

Extension Numbering:	Toggle Switch A or B
Boiler Outputs:	(6) N.O. S.P.S.T.
Modulating Output Types:	(6) 4-20mA, 0-5V, 0-10V, 1-5V, 2-10V
Output Relay Ratings:	1 Amp inductive, 6Amp resistive at 120 VAC 60 Hz, 15A total for all circuits
Connection to Temp-Tracker mod+ and another extension:	Two RS485 connections using 6 wire phone cable (Cable is provided)



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Oxnard, CA 93030

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PH: (905) 677-7999
FAX: (905) 677-6036

tekmar® - Data Brochure

Snow Detector & Melting Control 665

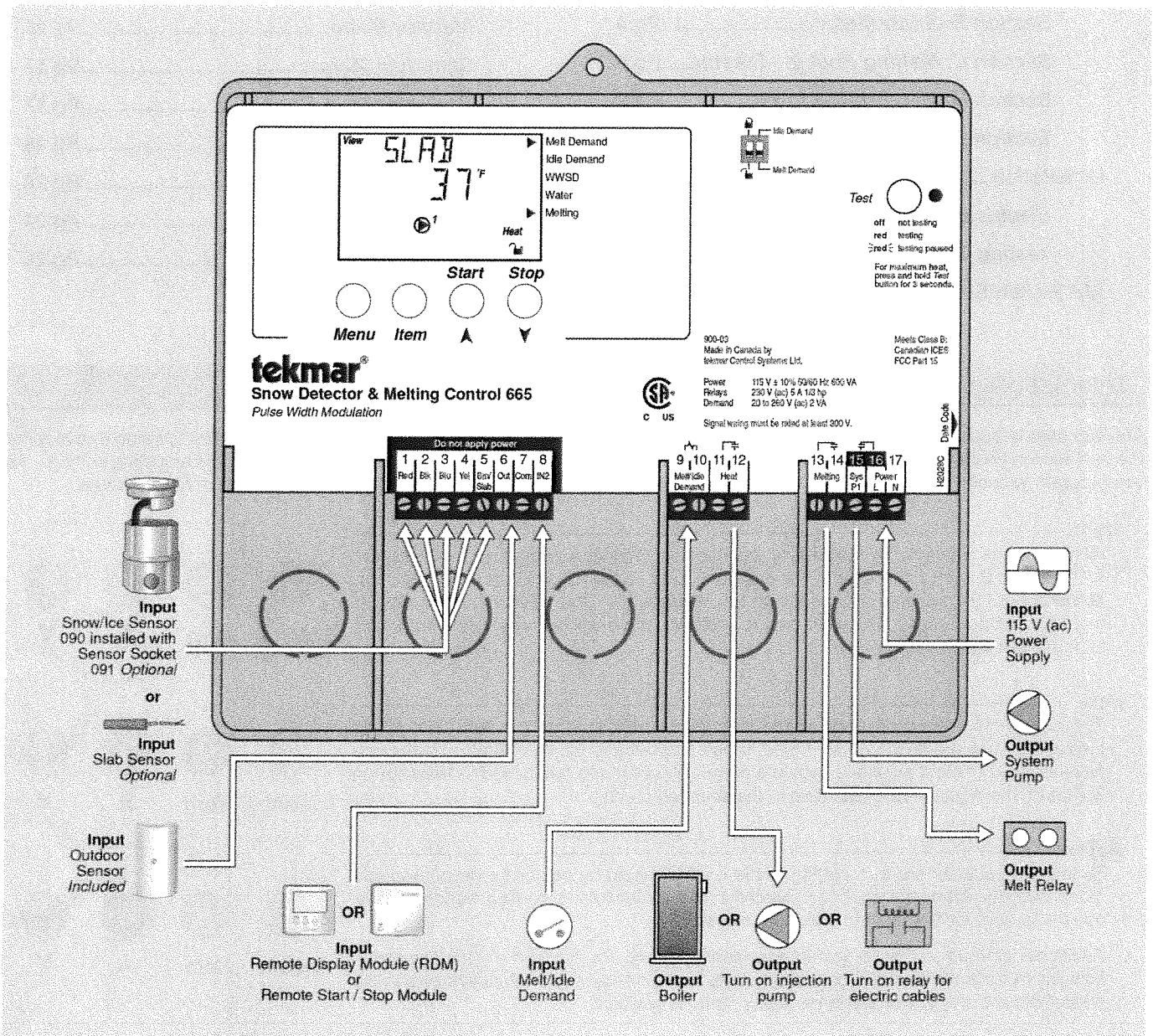
D 665

12/08

The Snow Detector & Melting Control 665 is a microprocessor-based control which operates a single zone snow melting system. The control can operate automatically when a Snow / Ice Sensor 090 is installed or the user can manually enable and/or disable the system. When the control is in the melting mode, the slab is maintained at a "Melting" temperature through an on/off output which operates a contactor for electrical cables, a boiler, an injection pump or an injection valve. When the control is not in the melting mode, the melt system can either be shut down or it can be maintained at an idle temperature for faster response and improved safety. The 665 control includes a large Liquid Crystal Display (LCD) in order to view system status and operating information.

Additional features include:

- Temporary Idle
- Manual Override
- Adjustable Warm Weather Shut Down (WWSD)
- Cold Weather Cut Out (CWCO)
- Remote display and adjustment capabilities
- Test sequence to ensure proper component operation
- Pump and valve exercising
- CSA C US Certified (approved to applicable UL standards)



How To Use The Data Brochure

This brochure is organized into four main sections. They are: 1) *Sequence of Operation*, 2) *Installation*, 3) *Control Settings*, and 4) *Troubleshooting*. The *Sequence of Operation* section has 5 sub-sections. We recommend reading Section A: General of the *Sequence of Operation*, as this contains important information on the overall operation of the control. Then read to the sub-sections that apply to your installation.

The *Control Settings* section (starting at DIP Switch Settings) of this brochure describes the various items that are adjusted and displayed by the control. The control functions of each adjustable item are described in the *Sequence of Operation*.

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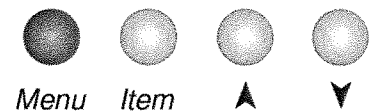
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User Interface

The 665 uses a Liquid Crystal Display (LCD) as the method of supplying information. You use the LCD in order to setup and monitor the operation of your system. The 665 has four push buttons (**Menu**, **Item**, ▲ (Start), ▼ (Stop)) for selecting and adjusting settings. As you program your control, record your settings in the ADJUST Menu table which is found in the second half of this brochure.

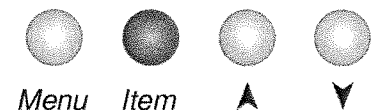
Menu

All of the items displayed by the control are organized into various menus. These menus are listed on the left hand side of the display (Menu Field). To select a menu, use the **Menu** button. By pressing and releasing the **Menu** button, the display will advance to the next available menu. Once a menu is selected, there will be a group of items that can be viewed within the menu.



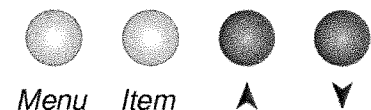
Item

The abbreviated name of the selected item will be displayed in the item field of the display. To view the next available item, press and release the **Item** button. Once you have reached the last available item in a menu, pressing and releasing the **Item** button will return the display to the first item in the selected menu.



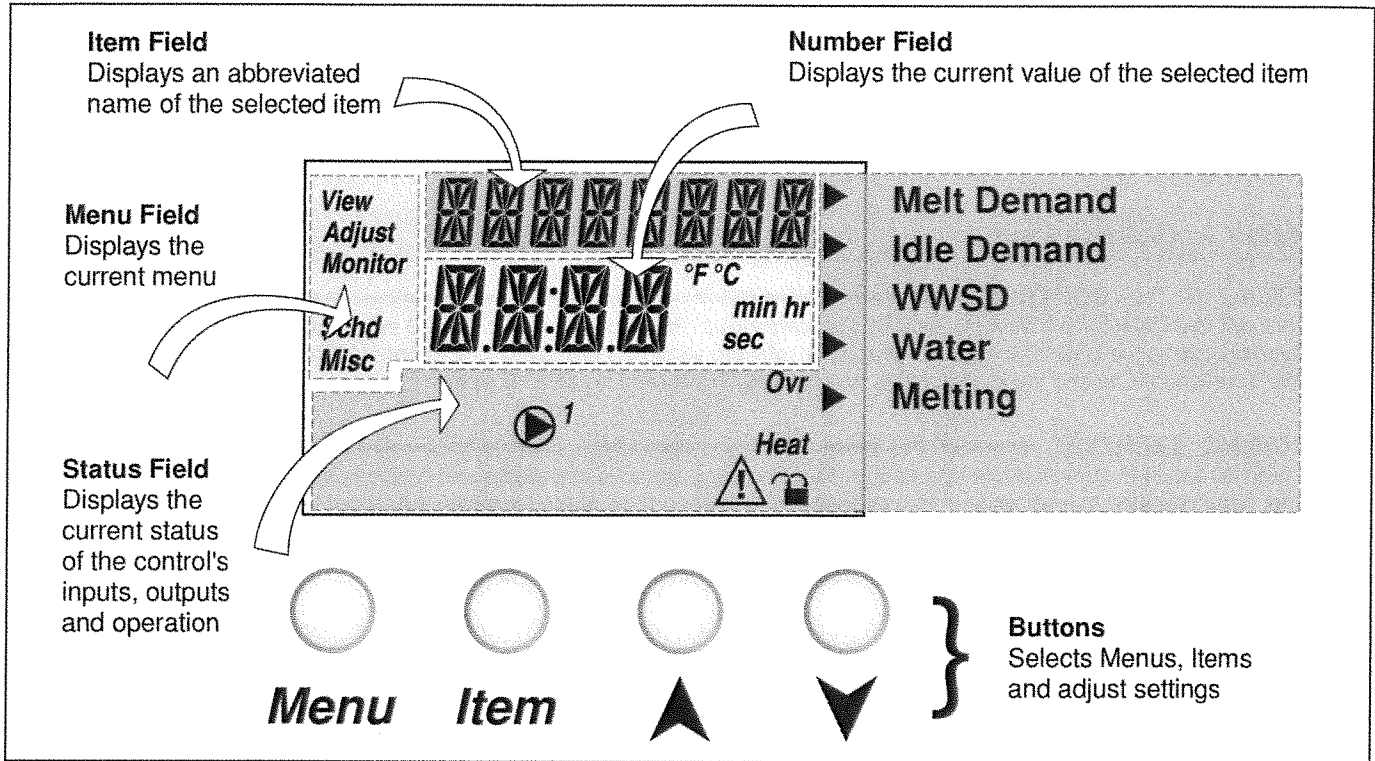
Adjust

To make an adjustment to a setting in the control, begin by selecting the appropriate menu using the **Menu** button. Then select the desired item using the **Item** button. Finally, use the ▲ and / or ▼ button to make the adjustment.



Additional information can be gained by observing the Status field of the LCD. The status field will indicate which of the control's outputs are currently active. Most symbols in the status field are only visible when the VIEW Menu is selected.

Display



Symbol Description

	Pump Displays when the system pumps are operating.		Pointer Displays the control operation as indicated by the text.
Ovr	Override Displays when the control is in override mode.	°F °C min hr sec	°F, °C, min, hr, sec Units of measurement.
	Warning Displays when an error exists or when a limit has been reached.	Heat	Heat Displays when the Heat relay is turned on.
	Lock / Unlock Displays when the access levels are locked or unlocked.		

Definitions

The following defined terms and symbols 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.

- Warning Symbol: Indicates presence of hazards which can cause severe personal injury, death or substantial property damage if ignored.
- Double insulated
- INSTALLATION CATEGORY II** - Local level, appliances

Sequence of Operation

Section A
General
Operation
Page 4

Section B
Snow
Melting
Page 4 - 5

Section C
Melting Enable
/ Disable
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Section D
Melting
Operation
Page 8 - 9

Section E
Idling
Operation
Page 9

Section A: General Operation

POWERING UP THE CONTROL

When the Snow Detector & Melting Control 665 is powered up, the control displays all LCD segments for 2 seconds, then the control type number in the LCD for 2 seconds. Next, the software version is displayed for 2 seconds. Finally, the control enters into the normal operating mode and the LCD defaults to displaying the current outdoor air temperature.

EXERCISING (EXERCISE)

The 665 has a built-in pump exercising function. The exercising period is adjustable and is factory set at 70 hours. If a pump output has not been operated at least once during every exercising period, the control turns on the output for 10 seconds. This minimizes the possibility of a pump or valve seizing during a long period of inactivity.

Note: The exercising function does not work if power to the control or pumps is disconnected.

Section B: Snow Melting

Section B1
General
Snow Melting

Section B1: General Snow Melting

WARM WEATHER SHUT DOWN (WWSD)

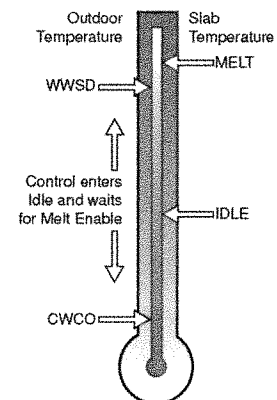
The control has a warm weather shut down that prevents the control from entering the melt or idle modes in order to conserve energy. While in WWSD, the word WWSD is displayed in the STATUS item in the VIEW menu and the WWSD pointer is on the display. The WWSD item in the ADJUST menu can be either set to Automatic or it can be set to a temperature.

Automatic (Auto)

When the WWSD is set to *AUTO*, the WWSD occurs when the slab temperature and the outdoor temperature exceed the *Melting* setting by 2°F (1°C). The control exits the WWSD when the slab or outdoor temperature falls to the *Melting* setting temperature.

Adjustable WWSD

When the WWSD is set to a temperature, the WWSD occurs when the outdoor air temperature exceeds the WWSD setting by 1°F (0.5°C) and when the slab temperature exceeds 34°F (1°C). The control exits WWSD when the outdoor air temperature falls 1°F (0.5°C) below the WWSD setting or if the slab temperature falls below 34°F (1°C). This allows the *Melting Temperature* setting to be set higher than the WWSD. This is useful where high slab temperatures are required to melt the snow or ice. A good example of this is installations using paving bricks on top of sand and concrete layers.



COLD WEATHER CUT OUT (CWCO)

Maintaining the system at either the melting or idling temperature during extremely cold temperatures can be expensive or impossible. The control turns the snow melting system off when the outdoor air temperature drops below the Cold Weather Cut Out (CWCO) temperature. While the control is in CWCO, the word CWCO is displayed in the STATUS item in the VIEW menu. The heater in the sensor is kept on during CWCO until the control detects moisture. If water is detected, the heater is turned off but the control retains the moisture detected information. When the outdoor temperature rises above the CWCO temperature, the control exits CWCO and if the Snow / Ice Sensor 090 detected moisture during CWCO, the control initiates Melting mode. If the control has been started prior to the CWCO, it resumes the Melting mode once the outdoor air temperature rises above the CWCO temperature.

RUNNING TIME (RUN TIME)

The running time is the length of time that the system operates once it has reached its slab target temperature. During the time that the system is approaching its slab target temperature, the RUN TIME does not decrease. Once the system reaches its slab target temperature, the RUN TIME begins counting down. When the RUN TIME reaches 0:00 as displayed in the Status item in the VIEW menu, the system has finished melting.

Note: The running time is only applicable when a manual melting enable signal starts the snow melting system. Refer to Section C1 for a description of a manual melting enable.

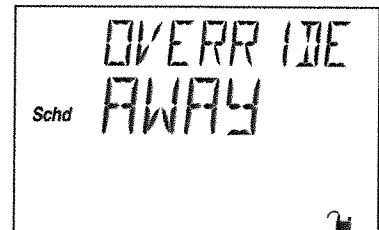
STATUS (STATUS)

While in the VIEW menu there are a number of items available to determine the current status of the system. To view the current status of the system, select the STATUS item in the VIEW menu.

- **STRT** The word STRT is displayed after the snow melting system has been manually enabled. It is displayed until the zone reaches its slab target temperature. If the zone is at its slab target temperature, STRT is displayed for five seconds after the snow melting system has started operation. This is to verify that the control has entered into the Melting mode.
- **STOP** The word STOP is displayed for five seconds after the snow melting system has been manually disabled. The word STOP is also displayed if either a Remote Start / Stop Module 039, Remote Display Module 040 or the **Stop** on the control stops the snow melting system and an external melt demand is still present.
- **IDLE** The word IDLE is displayed as long as the zone is operating at its idling temperature.
- **"IDLE"** The word IDLE is flashed on the display as long as the zone is operating in temporary idle.
- **EXT** The word EXT is displayed when the RUN TIME has reached 0:00 and the control still has an external melt demand. In this situation, the zone continues melting until the melt demand is removed or the control is stopped.
- **DET** The word DET is displayed after the snow melting system has been automatically enabled by the Snow / Ice Sensor 090 and the zone is at its slab target temperature. DET is also displayed once the control is manually enabled after automatic detection by the 090 and the running time has counted down to 0:00.
- **0:00 to 23:59 hr** While the zone is up to temperature and melting, the remaining RUN TIME is displayed.
- **INF** If an infinite RUN TIME is selected and the zone is melting, INF is displayed.
- **WWSD** When the zone is in Warm Weather Shut Down, WWSD is displayed.
- **CWCO** When the control is in Cold Weather Cut Out, CWCO is displayed.

SNOW MELTING OVERRIDE

If the **AWAY** setting is selected in the SCHEDULE menu, the snow melting system is shut down. Both the Melting and Idling temperatures are ignored as long as the control remains in the Away mode.

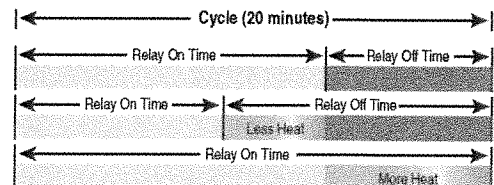


SYSTEM PUMP OPERATION (SYS P1)

The system pump (*Sys P1*) contact closes and remains closed as long as the system is either in the Melting or Idling mode. The system pump contact shuts off if the control is in CWCO, WWSD, or if there is no call for Melting or Idling.

HEAT CONTACT OPERATION

The control uses the *Heat* contact to control the temperature of the slab. When the control is either Melting or Idling, the *Heat* contact operates on a 20 minute cycle. If the slab requires more heat, the on time in each cycle is increased. If the slab requires less heat, the on time of each cycle is decreased. The *Heat* contact shuts off if the control is in Cold Weather Cut Out (CWCO), Warm Weather Shut Down (WWSD), or if there is no call for Melting or Idling.



MELTING CONTACT OPERATION

The *Melting* contact (terminals 13 and 14) closes and remains closed as long as the system is in the melting mode. This contact can be used as an external signal to indicate that the system is currently in the melting mode. This contact can also be used as a means of prioritizing or enabling multiple snow melting controls.

PURGE

The system pump (*Sys P1*) and zoning device continue to operate for 20 seconds after the last demand is removed. This purges the residual heat from the boiler(s) into the snow melting slab.

Section C: Melting Enable / Disable

Section C1
Snow Melting
Enable

Section C2
Snow Melting
Disable

Section C1: Snow Melting Enable

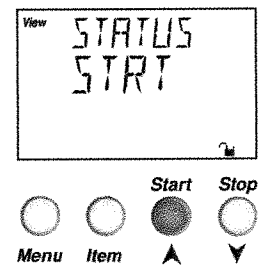
The snow melting system can be enabled manually or automatically. A melting enable signal applied to the control places the system into the melting mode. If a melting enable signal is applied once the system is already in the melting mode, the control responds to the last command received.

MANUAL MELTING ENABLE

A manual melting enable signal requires the user to manually start the snow melting system and can be provided from the **Start** button on the control, Remote Start / Stop Module 039, Remote Display Module 040, or an external melt demand.

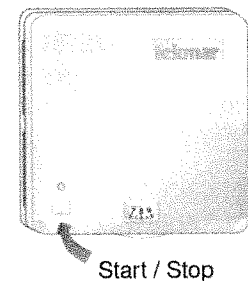
Start Button on the Control

The snow melting system is enabled by pressing the **Start** button on the control while in the VIEW menu. The control then displays the *RUN TIME* setting to allow the user to adjust it. Once the snow melting system is enabled, the word **STRT** is displayed for at least 5 seconds in the STATUS item while in the VIEW menu. If the **Start** button on the control is pressed while the system is already melting and up to temperature, the running time counter is reset to the *RUN TIME* setting.



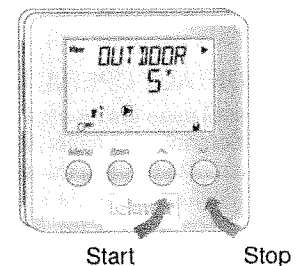
Remote Start / Stop Module 039

The snow melting system is enabled by pressing the button on the front of the 039. While the zone is coming up to temperature, a green indicator light flashes on the front of the 039. Once the zone is up to temperature and the *RUN TIME* is counting down, the green indicator light on the front of the 039 is on solid.



Remote Display Module 040

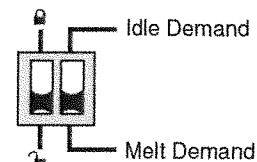
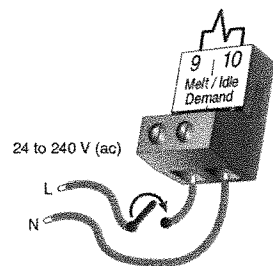
The snow melting system is enabled by pressing the ▲ button on the 040 while in the VIEW menu. The 040 then displays the *RUN TIME* setting to allow the user to adjust it. Once the snow melting system is enabled, the word **STRT** is displayed for at least 5 seconds in the STATUS item while in the VIEW menu.



External Melt Demand (DIP switch set to Melt Demand)

The snow melting system is enabled when a voltage between 24 and 240 V (ac) is applied across the *Melt/Idle Demand* terminals (9 and 10). An external melt demand must be present for at least 4 seconds in order to start the snow melting system. If the RUN TIME reaches 0:00 and the external melt demand is still present, the control continues melting until the external melt demand is removed or the system is otherwise stopped.

Note: This operation only occurs if the Idle Demand / Melt Demand DIP switch is set to the *Melt Demand* position.

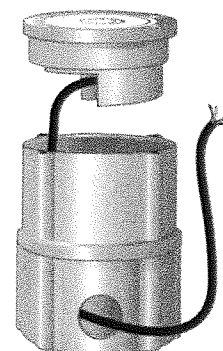


AUTOMATIC MELTING ENABLE (Snow / Ice Sensor 090)

The 665 uses the Snow / Ice Sensor 090 to provide an automatic melting enable signal to start the snow melting system. The control continually monitors the 090 for the presence of moisture. Once moisture is detected, the *water pointer* is displayed in the LCD and the snow melting system is enabled.

Water Detection Sensitivity (SENSTVTY)

The 665 has a *Sensitivity* setting which compensates for varying outdoor conditions which could affect how the moisture detector in the 090 interprets the presence of moisture. This adjustable setting is available through the SENSTVTY item in the ADJUST menu of the control. As snow becomes contaminated with dirt, and as the sensor itself becomes dirty, the control may incorrectly indicate the presence of water. If this condition occurs, clean the surface of the sensor and / or turn down the SENSTVTY setting. If the snow in your area is very clean, the SENSTVTY setting may need to be increased before snow is detected. If AUTO is selected, the control automatically adjusts the sensitivity level used to detect moisture.



Section C2: Snow Melting Disable

The snow melting system can be disabled manually or automatically. A melting disable signal applied to the control takes the zone out of the melting mode. Once the snow melting system is disabled, the zone operates in the idling mode. The idling mode allows the zone to be operated at either a lower temperature or turned off.

MANUAL MELTING DISABLE

A manual melting disable signal requires the user to manually stop the snow melting system and can be provided from the **Stop** button on the control, Remote Start / Stop Module 039, Remote Display Module 040, or an external idle demand.

Stop Button on the Control

The **Stop** button on the control can be used to stop the snow melting system. The snow melting system is disabled by pressing the **Stop** button on the control while in the VIEW menu. Once the snow melting system is disabled, the word STOP is displayed for 5 seconds in the STATUS item of the appropriate zone while in the VIEW menu.

Remote Start / Stop Module 039

A Remote Start / Stop Module 039 can be used to stop the snow melting system. The snow melting system is disabled by pressing the button on the face of the 039. When the system is stopped, a solid Red Indicator Light is displayed on the face of the 039 for five seconds. If the snow melting system is disabled while there is still an external melt demand for snow melting, the 039 displays a solid red indicator light until the external demand is removed.

Remote Display Module 040

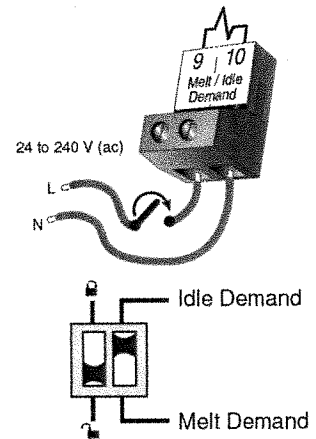
A Remote Display Module 040 can be used to stop the snow melting system. The snow melting system is disabled by pressing the ▼ button on the 040 while in the VIEW menu. Once the snow melting system is disabled, the word STOP is displayed for 5 seconds in the STATUS item while in the VIEW menu.

External Idle Demand (DIP switch set to Idle Demand)

The snow melting system is disabled when a voltage between 24 and 240 V (ac) is applied across the *Melt/Idle Demand* terminals (9 and 10). An external idle demand must be present for at least 4 seconds in order to stop the snow melting system.

Note: This operation only occurs if the Idle Demand / Melt Demand DIP switch is set to the Idle Demand position.

If the snow melting system is placed into Idling mode by an external idle demand, then a manual melting enable signal is applied, the idle demand is overridden until either the running time has expired, a stop signal is given, or the external idle demand is removed and reapplied.



AUTOMATIC MELTING DISABLE (Snow / Ice Sensor 090)

Once the 090 is dry, the *Water* pointer turns off in the LCD. The system slab temperature has to be at least the slab target temperature for a minimum of thirty minutes in order for the system to turn off. If a manual melting disable signal is applied the snow melting system turns off immediately.

Section D: Melting Operation

**Section D1
General Melting
Operation**

Section D1: General Melting Operation

In order for the snow melting system to be started, one of the methods described in section D1 must be used. Once a melting enable signal is applied and the system is not in WWSD or CWCO, the Melting mode begins. When the control is in the Melting mode, the *Melting* pointer is visible in the VIEW menu. The *MELT* setting in the ADJUST menu sets the slab surface temperature. When the system is melting and the slab temperature is warming up to the slab target temperature, *STRT* is displayed in the STATUS item while in the VIEW menu. The system finishes melting when the slab temperature has been at least the slab target temperature for a period of time. This period of time is based on whether an automatic or manual melting enable signal starts the snow melting system.

If an automatic melting enable signal starts the snow melting system and the slab temperature reaches the slab target temperature, *DET* is displayed in the STATUS item while in the VIEW menu. The system continues to melt until the 090 becomes dry and any additional running time has expired. Once the Melting mode is complete, the system operates in the Idling mode.

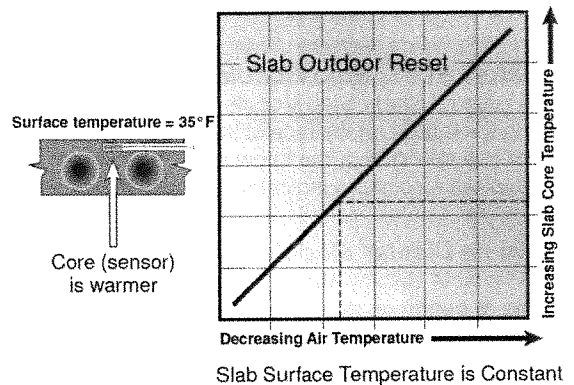
If a manual melting enable signal starts the snow melting system, the Running Time is displayed in the STATUS item while in the VIEW menu and begins counting down once the slab temperature reaches the slab target temperature. The system continues to melt until the running time counts down to 0:00 and there is no external melt demand. Once the Melting mode is complete, the system operates in the Idling mode. The table on page 14 describes how the control responds to enable and disable signals.

SLAB TEMPERATURE CONTROL

The 665 uses a snow/ice sensor or slab sensor to provide slab temperature control.

Slab Sensor

If a Slab Sensor is used, the control assumes that the sensor is approximately 1 inch below the surface of the snow melting slab. Since this point is closer to the source of the heat, this point is warmer than the surface of the slab. Therefore, the sensor must be maintained at a higher temperature in order to ensure that the surface of the slab is maintained at the correct temperature. The amount of temperature difference between the surface of the slab and the slab sensor changes with the outdoor temperature. Therefore, the slab core temperature is increased as the outdoor air temperature drops. The temperature displayed as SLAB is the temperature of the slab sensor.



Snow / Ice Sensor 090

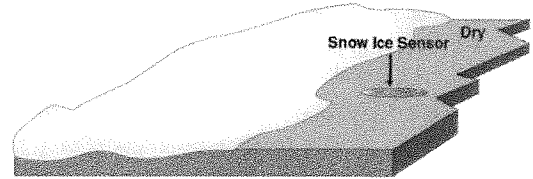
The slab temperature is displayed as SLAB in the VIEW menu. This temperature is calculated from the edge and center sensors built into the 090.

SLAB TARGET TEMPERATURE (SLB TRG)

The SLAB TRG temperature is determined from the *Melting* setting, or *Idle* setting and the outdoor air temperature. The control displays the temperature that it is currently trying to maintain at the slab sensor. If the control does not presently have a requirement for heat, it displays "---" in the STATUS item while in the VIEW menu.

ADDITIONAL MELTING TIME (ADD MELT)

In cases where areas of the snow melting system haven't completely melted after the melting mode has finished and the 090 is dry, the 665 has a function in which additional time can be added to melt the zone. This is an adjustable time through the ADD MELT item in the ADJUST menu of the control. The ADD MELT time is calculated into a running time and is displayed in the STATUS item while in the VIEW menu. Once the 090 becomes dry and the slab temperature is at least the slab target temperature, the ADD MELT time starts counting down.



Section E: Idling Operation

Section E1
General Idling
Operation

Section E2
Temporary
Idle

Section E1: General Idling Operation

When the snow melting system starts from a cold temperature, the time required for the system to reach the melting temperature may be excessive. To decrease this start up time, the 665 has an idling feature which can maintain the zone at a lower temperature. This feature is also useful for preventing frost and light ice formation. The *IDLING* setting in the ADJUST menu sets the slab surface temperature while the control is in the idling mode. When in the idling mode, *IDLE* is displayed in the STATUS item of the VIEW menu. If idling is not desirable, the *IDLING* setting may be set to *OFF*.

Section E2: Temporary Idle (TMPY IDL)

The temporary idle allows the control to enter the idle state for a set amount of time. If the snow ice detector does not detect snow during the temporary idle period, the control then leaves the idle state and returns to the OFF state. This is useful in applications where there is the possibility of snow and the slab can be pre-heated in order to have a short heat up time if snow is detected.

To enable a temporary idle, the *Temporary Idle* setting in the ADJUST menu must be set from OFF to the length of the temporary idle. The DIP Switch must be set to IDLE DEMAND and the *IDLING* must be set to a temperature. To activate a temporary idle, a voltage between 24 and 240 V (ac) must be applied across the *Melt/Idle Demand* terminals for at least 4 seconds.

When a *Temporary Idle* time is selected, the control has three available states: OFF, Temporary Idle, and Melting. The table below describes the action of the control:

Control State	Action	Result
OFF	External Idle Demand	Temporary Idle
OFF	Manual or Auto Melt Start	Melting
Melting	External Idle Demand	Melting
Melting	Manual or Auto Melt Start	Melting
Melting	Manual or Auto Melt Stop	OFF
Temporary Idle	Temporary Idle Expires	OFF
Temporary Idle	Manual or Auto Melt Start	Melting
Temporary Idle	Manual Melt Stop	OFF

Installation

CAUTION

Improper installation and operation of this control could result in damage to the equipment and possibly even personal injury. It is your responsibility to ensure that this control is safely installed to all applicable codes and standards. This electronic control is not intended for use as a primary limit control. Other controls that are intended and certified as safety limits must be placed into the control circuit. Do not open the control. Refer to qualified personnel for servicing. Opening voids warranty and can result in damage to the equipment and possibly even personal injury.

STEP ONE — GETTING READY

Check the contents of this package. If any of the contents listed are missing or damaged, please contact your wholesaler or tekmar sales representative for assistance.

Type 665 includes: One Snow Detector & Melting Control 665, One Outdoor Sensor 070, Data Brochures D 665, D 070, D 001, User Brochure U 665, and Application Brochure A 665.

Note: Carefully read the details of the Sequence of Operation to ensure that you have chosen the proper control for your application.

STEP TWO — MOUNTING THE BASE

Remove the control from its base by pressing down on the release clip in the wiring chamber and sliding the control away from it. The base is then mounted in accordance with the instructions in the Data Brochure D 001.

STEP THREE — ROUGH-IN WIRING

All electrical wiring terminates in the control base wiring chamber. The base has standard 7/8" (22 mm) knockouts which accept common wiring hardware and conduit fittings. Before removing the knockouts, check the wiring diagram and select those sections of the chamber with common voltages. Do not allow the wiring to cross between sections as the wires will interfere with safety dividers which should be installed at a later time.

- Power must not be applied to any of the wires during the rough-in wiring stage.
- All wires are to be stripped to a length of 3/8" (9mm) to ensure proper connection to the control.
- Install the Outdoor Sensor 070, Boiler Sensor 071 and Mixing Sensor(s) 071 according to the installation instructions in the Data Brochure D 070 and run the wiring back to the control.
- Install the Snow / Ice Sensor 090 according to the installation instructions in the Data Brochure D 090 and run the wiring back to the control. See Data Brochure D 090 for very important details on sensor location and installation.
- If a Slab Sensor is used, install the slab sensor according to the installation instructions in the Data Brochure D 079 and run the wiring back to the control. See page 8 for very important details on sensor location and installation.
- If a Remote Display Module (RDM) 040 is used, install the RDM according to the installation instructions in the Data Brochure D 040 and run the wiring back to the control.
- If a Remote Start / Stop Module 039 is used, install the module according to the installation instructions in the Data Brochure D 039 and run the wiring back to the control.
- Run wire from other system components (pumps, boiler, etc.) to the control.
- Run wires from the 115 V (ac) power to the control. Use a clean power source with a minimum 15 A circuit to ensure proper operation. Multi-strand 16 AWG wire is recommended for all 115 V (ac) wiring due to its superior flexibility and ease of installation into the terminals.

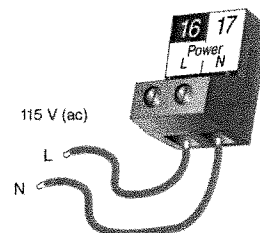
STEP FOUR — ELECTRICAL CONNECTIONS TO THE CONTROL

The installer should test to confirm that no voltage is present at any of the wires. Push the control into the base and slide it down until it snaps firmly into place.

⚠ **Powered Input Connections**

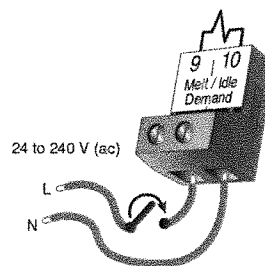
115 V (ac) Power

Connect the 115 V (ac) power supply to the *Power L* and *Power N* terminals (16 and 17). This connection provides power to the microprocessor and display of the control. As well, this connection provides power to the *Sys P1* terminal (15) from the *Power L* terminal (16).



Melt / Idle Demand

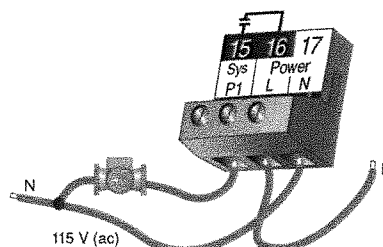
To generate a melt demand or idle demand, a voltage between 24 V (ac) and 240 V (ac) must be applied across the *Melt / Idle Demand* terminals (9 and 10).



⚠ Output Connections

System Pump Contact (Sys P1)

The *Sys P1* output terminal (15) on the 665 is a powered output. When the relay in the 665 closes, 115 V (ac) is provided to the *Sys P1* terminal (15) from the *Power L* terminal (16). To operate the system pump, connect one side of the system pump circuit to terminal and the second side of the pump circuit to the neutral (N) side of the 115 V (ac) power supply.



Melting Contact

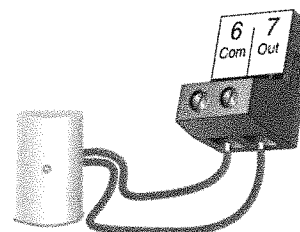
The *Melting* terminals (11 and 12) are an isolated output in the 665. There is no power available on these terminals from the control. These terminals are used as a switch to make or break an external circuit.

⚠ Sensor and Unpowered Input Connections

Do not apply power to these terminals as this will damage the control.

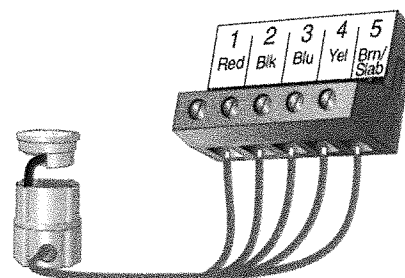
Outdoor Sensor

Connect the two wires from the Outdoor Sensor 070 to the *Out* and *Com* terminals (6 and 7). The outdoor sensor is used by the 665 to measure the outdoor air temperature.



EITHER: Snow / Ice Sensor 090

Connect the red wire from the sensor cable to the *Red* terminal (1), connect the black wire from the sensor cable to the *Blk* terminal (2), connect the blue wire from the sensor cable to the *Blu* terminal (3), connect the yellow wire from the sensor cable to the *Yel* terminal (4) and connect the brown wire from the sensor cable to the *Brn / Slab* terminal (5). The snow / ice sensor is used by the 665 to measure the slab surface temperature of the zone. This sensor must be installed flush with the slab surface and 1/2 way between the heating pipes. See Data Brochure D 090 for installation instructions regarding the Snow / Ice Sensor 090 and Sensor Socket 091



OR: Slab Sensor

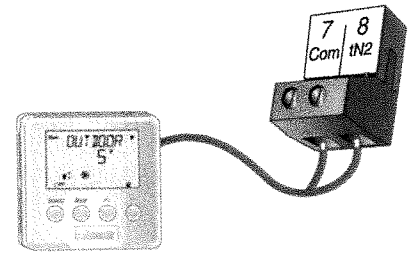
If a Snow / Ice Sensor 090 is not used, a slab sensor can be used. If a slab sensor is used, connect the two wires from the slab sensor to the *Blk* and *Brn / Slab* terminals (2 and 5). The slab sensor is used by the 665 to measure the slab temperature of the zone.

Note: Proper sensor placement is critical for correct operation of the 665 control. The slab sensor must be installed 1/2 way between the heating pipes and 1" (25 mm) below the surface of the slab. Although the sensor can be installed directly into the slab, we recommend that the sensor be installed in tubing or conduit in such a manner that the sensor can be removed and replaced in case of failure.

tekmar Net™ (tN2) Device

A Remote Display Module (RDM) 040 or Remote Start / Stop Module 039 can be connected to the tekmar Net™ (tN2) input. Connect the Com terminal from the appropriate tN2 device to the Com terminal (7) on the 665. Connect the tN2 terminal from the appropriate tN2 device to the tN2 terminal (8) on the 665.

Note: The wires from the RDM and Remote Start / Stop Module are polarity sensitive. The tN2 device does not operate correctly if the wires are reversed.



STEP FIVE TESTING THE WIRING

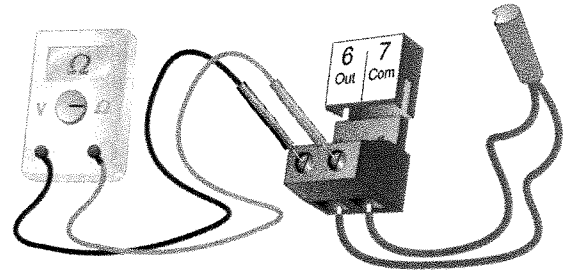
Each terminal block must be unplugged from its header on the control before power is applied for testing. To remove the terminal block, pull straight down from the control.

The following tests are to be performed using standard testing practices and procedures and should only be carried out by properly trained and experienced persons.

A good quality electrical test meter, capable of reading from at least 0 – 300 V (ac) and at least 0 – 2,000,000 Ω, is essential to properly test the wiring and sensors.

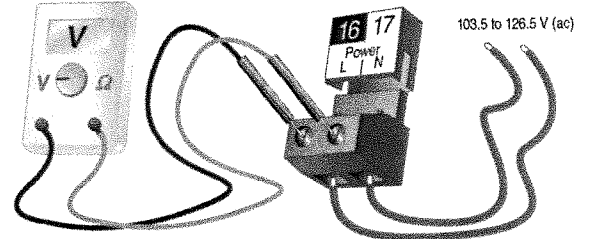
⚠ Test The Sensors

In order to test the sensors, the actual temperature at each sensor location must be measured. A good quality digital thermometer with a surface temperature probe is recommended for ease of use and accuracy. Where a digital thermometer is not available, a spare sensor can be strapped alongside the one to be tested and the readings compared. Test the sensors according to the instructions in the Data Brochure D 070, D 079 or D 090.



⚠ Test The Power Supply

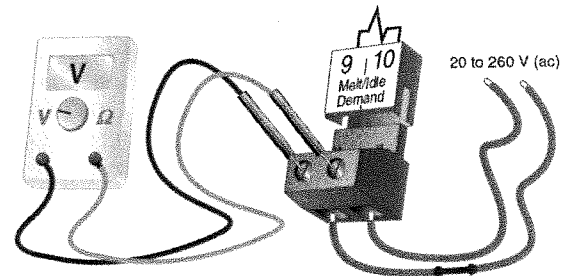
Make sure exposed wires and bare terminals are not in contact with other wires or grounded surfaces. Turn on the power and measure the voltage between the Power L and Power N terminals (16 and 17) using an AC voltmeter, the reading should be between 103.5 and 126.5 V (ac).



⚠ Test The Powered Inputs

Melt / Idle Demand

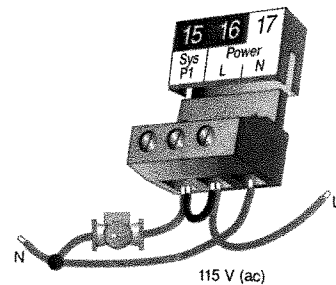
If a Melt/Idle demand is used, measure the voltage between the Melt/Idle Demand terminals (9 and 10). When the melting or idling device calls for heat, you should measure between 20 and 260 V (ac) at the terminals. When the melting or idling device is off, you should measure less than 5 V (ac).



⚠ Test The Outputs

System Pump (Sys P1)

If a system pump is connected to the Sys P1 terminal (15), make sure that power to the terminal block is off and install a jumper between the Sys P1 and Power L terminals (15 and 16). When power is applied to the Power L and Power N terminals (16 and 17), the system pump should start. If the pump does not turn on, check the wiring between the terminal block and pump and refer to any installation or troubleshooting information supplied with the pump. If the pump operates properly, disconnect the power and remove the jumper.



Heat Contact

If a zone pump or zone valve is connected to *Heat* terminals (11 and 12), make sure power to the pump or valve circuit is off and install a jumper between the *Heat* terminals (11 and 12). When the circuit is powered up, the zone pump should turn on or the valve should open completely. If no response occurs, check the wiring between the terminal and the pump or valve and refer to any installation or troubleshooting information supplied with these devices.

Melting

If a device is connected to the *Melting* terminals (13 and 14), make sure power to the circuit is off, and install a jumper between the terminals. When the circuit is powered up, the device should operate. If the device does not operate, refer to any installation or troubleshooting information supplied with the device. If the device operates properly, disconnect the power and remove the jumper.

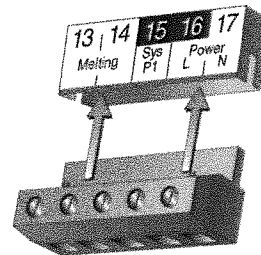
⚠ **Connecting The Control**

Make sure all power to the devices and terminal blocks is off, and remove any remaining jumpers from the terminals.

Reconnect the terminal blocks to the control by carefully aligning them with their respective headers on the control, and then pushing the terminal blocks into the headers. The terminal blocks should snap firmly into place.

Install the supplied safety dividers between the unpowered sensor inputs and the powered wiring chambers.

Apply power to the control. The operation of the control on power up is described in the Sequence of Operation section of the brochure.

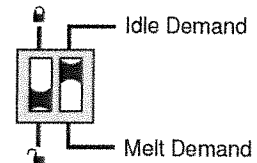


Cleaning

The control's exterior can be cleaned using a damp cloth. Moisten cloth with water and wring out prior to wiping control. Do not use solvents or cleaning solutions.

DIP Switch Settings

The DIP switch settings on the control are very important and should be set to the appropriate settings prior to making any adjustments to the control through the User Interface. The DIP switch settings change the items that are available to be viewed and / or adjusted in the User Interface.



LOCK / UNLOCK (FACTORY SETTING IS UNLOCK)

The Lock / Unlock DIP switch is used to lock and unlock the access level of the control and tekmar Net™ tN2 device. Once locked, access levels can not be changed. To determine if the control is currently locked or unlocked, a small segment representing a padlock is viewed in the bottom right hand corner of the display. When the padlock is closed, the access level cannot be changed.

To change the access level, set the DIP switch to the unlocked, or down position. The current access level of the control or tekmar Net™ tN2 device is viewed in its Miscellaneous (*Misc*) menu. While viewing the access level, use the ▲ and ▼ keys to select between the Limited (LTD), User (USER), Installer (INST) or Advanced (ADV) access levels.

To lock the access level, select the appropriate access level in the Miscellaneous (*Misc*) and move the DIP switch from the unlocked position to the locked position. As long as the DIP switch is in the locked position, the access level of the control or tekmar Net™ tN2 device can no longer be viewed or adjusted in its Miscellaneous (*Misc*) menu.

IDLE DEMAND / MELT DEMAND (FACTORY SETTING IS MELT DEMAND)

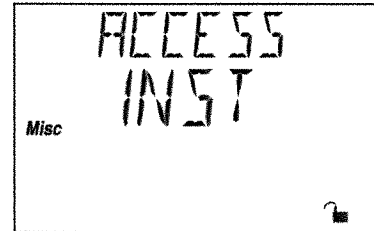
The Idle Demand / Melt Demand DIP switch is used for melting and idling operation. The position of the DIP switch determines what the *Melt/Idle Demand* terminals (9 and 10) are used for. When the DIP switch is set to the Melt Demand position, the *Melt/Idle Demand* terminals (9 and 10) are used to place the snow melting system into melting mode.

When the DIP switch is set to the Idle Demand position, the *Melt/Idle Demand* terminals (9 and 10) are used to force the snow melting system into idling mode.

Access Levels

The tekmar Snow Detector & Melting Control 665 comes with four Access Level settings. These Access Levels restrict the number of Menus, Items and Adjustments that can be accessed by the user. The four access levels are Limited (LTD), User (USER), Installer (INST) and Advanced (ADV).

The access level of the control is found in the Miscellaneous (Misc) menu when the Lock / Unlock DIP switch is set to the Unlocked position. In the Advanced access level, all of the control settings are available to the user. In the User access level, only a few of the menus and items are available. The Limited access level is the most restricted of them all. The control's factory setting is Installer (INST). This access level is sufficient for the normal set up of the control. Once the control is set up, the appropriate access level should be selected for the people that deal with the control on a regular basis.



665 View Menu (1 of 1)

Item Field	Access Level				Description	Range
	Section	LTD	USER	INST		
OUTDOOR		●	●	●	●	Outdoor Current outdoor air temperature as measured by the outdoor sensor. -67 to 149°F (-55 to 65°C)
SLAB TRG	D1			●	●	Slab Target Slab sensor target temperature. ---, 20 to 110°F (---, -7 to 43°C)
SLAB	D1		●	●	●	Slab Current slab sensor temperature. -58 to 167°F (-50 to 75°C)
STATUS	B1	●	●	●	●	Status Operating status. STRT, STOP, IDLE, EXT, 0:00 to 23:59 hr, ---, INF, WWSD, CWCO, DET, IDLE

Item Field	Access Level				Description	Range	Actual Setting	
	Section	LTD	USER	INST				ADV
RUN TIME	B1	•	•	•	•	Run Time The time for which a zone is operated once it has reached its melting temperature. This item cannot be viewed if a Remote Start / Stop Module 039 has been connected.	0:30 to 17:00 hr, INF (Infinity) Default = 4:00 hr	
ADD MELT	D1			•		Add Melt The additional time for which a zone is operated once the Snow / Ice Sensor 090 becomes dry. 090 is present	0:00 to 6:00 hr Default = 0:30 hr	
SENSVTY	C1		•	•	•	Sensitivity Sensitivity of water detection of the Snow / Ice Sensor 090. 090 is present	AUTO, 20 to 80% Default = AUTO	
MELTING	D1		•	•	•	Melting The desired slab surface temperature while in the Melting mode.	32 to 95°F (0 to 35°C) Default = 36°F (2°C)	
IDLING	E1			•	•	Idling The desired slab surface temperature while in the Idling mode.	OFF, 20 to 95°F (OFF, -7 to 35°C) Default = OFF	
TMPY IDL	A			•		Temporary Idle Time for which the temporary idle is active.	OFF, 0:30 to 40:00 hr Default = OFF	
WWSII	B			•	•	WWSI Warm Weather Shut Down. Slab must exceed 34°F to enter WWSI.	AUTO, 32 to 95°F (AUTO, 0 to 36°C) Default = AUTO	
CWCO	B1			•	•	CWCO The Cold Weather Cut Out temperature for the snow melting system.	OFF, -30 to 50°F (OFF, -34 to 10°C) Default = 10°F (-12°C)	
EXERCISE	A			•		Exercise The frequency with which the control exercises the pumps and valves that are operated by the control.	30 to 240 hours, (in 10 hour steps) Default = 70 hr	

665 Monitor Menu (1 of 1)

Note: To clear the recorded information in the specific item field, press and hold ▲ and ▼.

Item Field	Access Level				Description	Range
	LTD	USER	INST	ADV		
OUT HI	•	•	•	•	Outdoor High The highest recorded outdoor air temperature since this item was last cleared.	-67 to 149°F (-55 to 65°C)
OUT LO	•	•	•	•	Outdoor Low The lowest recorded outdoor air temperature since this item was last cleared.	-67 to 149°F (-55 to 65°C)
SLAB HI		•	•	•	Slab High The highest recorded temperature at the slab sensor since this item was last cleared.	-58 to 167°F (-50 to 75°C)
SLAB LO		•	•	•	Slab Low The lowest recorded temperature at the slab sensor since this item was last cleared.	-58 to 167°F (-50 to 75°C)
SYS PUMP			•	•	System Pump The total number of system pump (Sys P1) running hours since this item was last cleared.	0 to 9999 hr
HEAT			•	•	Heat The total number of running hours of the <i>Heat</i> contact since this item was last cleared.	0 to 9999 hr
HEAT CYC			•		Heat Cycle The total number of cycles of the <i>Heat</i> contact since this item was last cleared. This item can be used in conjunction with the Heat item to determine the average cycle length of the <i>Heat</i> contact.	0 to 9999 hr
NO HEAT			•		No Heat This item is an adjustable warning. If the slab temperature does not reach its slab target temperature within the set time, the control displays a warning message.	1 to 24 hr, OFF Default = OFF
COP			•		Cop The number of times that the microprocessor in the control has reset since this item was last cleared. The control will reset itself if it has experienced some form of interference that has disrupted its operation. This can be used to give an indication of the quality of the electrical environment that the control has been installed in.	0 to 255
NON-COP			•		Non-Cop The number of times that the control has been powered up since this item was last cleared. This number will increase if there is a lowering of the input voltage beyond the control's usable range. This item can be used as an indication of the quality of the power source.	0 to 255
tN2 COMM			•		tN2 Communication The number of times that a communication error has been detected between the control and either an RDM or Remote Start / Stop Module since this item was last cleared. If the wires between the control and the tekmar Net™ tN2 device are run in a noisy electrical environment, this can cause interference in the communication between the control and the tN2 device.	0 to 255

665 **Schd** (Schedule) Menu (1 of 1)

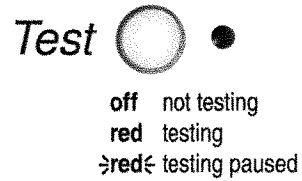
Item Field	Access Level				Description	Range
	Section	LTD	USER	INST		
OVERRIDE	B1	•	•	•	Override The setback override that is in effect for the snow melting system.	NONE, AWAY (Ovr) Default = NONE

665 **Misc** (Miscellaneous) Menu (1 of 1)

Item Field	Access Level				Description	Range
	LTD	USER	INST	ADV		
UNITS	•	•	•		Units The units of measure that all of the temperatures are to be displayed in by the control.	°F, °C Default = °F
BACKLITE	•	•	•		Backlite The operating mode for the back lighting on the LCD as well as time of keypad inactivity until the control automatically returns to the default display.	OFF, 30 sec, ON Default = ON
ACCESS	•	•	•	•	Access The access level that is to be used by the control. DIP switch = <i>Unlock</i>	ADV, INST, USER, LTD Default = INST

Testing the Control

The Snow Detector & Melting Control 665 has a built-in test routine which is used to test the main control functions. The 665 continually monitors the sensors and displays an error message whenever a fault is found. See the following pages for a list of the 665's error messages and possible causes. When the **Test** button is pressed, the test light is turned on. The individual outputs and relays are tested in the following test sequence.



TEST SEQUENCE

Each step in the test sequence lasts 10 seconds.

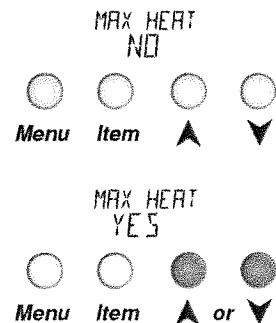
During the test routine, the test sequence is paused by pressing the **Test** button. While paused, the control displays the testing step as well as the word PAUS. If the **Test** button is not pressed again for 5 minutes while the test sequence is paused, the control exits the entire test routine. If the test sequence is paused, the **Test** button can be pressed again to advance to the next step. This can also be used to rapidly advance through the test sequence. To reach the desired step, repeatedly press and release the **Test** button until the appropriate device and segment in the display turn on.

- Step 1 The system pump contact (*Sys P1*) is turned on for 10 seconds.
- Step 2 The *Heat* contact is turned on for 10 seconds. After 10 seconds, the *Heat* relay and the *Sys P1* relay are turned off.
- Step 3 The *Melting* contact is turned on for 10 seconds. After 10 seconds, the melting relay is turned off.

MAX HEAT

The Snow Detector & Melting Control 665 has a function called Max Heat. In this mode, the 665 turns on and operates the system up to the maximum set temperatures, and the mixing device at the set percentage. The control continues to operate in this mode for up to 24 hours or until either the **Item**, **Menu** or **Test** button is pressed. This mode may be used for running all circulators during system start-up in order to purge air from the piping. To enable the Max Heat feature, use the following procedure.

- 1) Press and hold the **Test** button for more than 3 seconds. At this point, the control displays the words MAX HEAT and the word NO.
- 2) Using the ▲ or ▼ buttons, select the word YES. After 3 seconds, the control flashes the word MANUAL and the number 100. This number represents the % on time of the Heat relay during each 20 minute cycle.
- 3) Set the desired Heat relay % on time by using the ▲ and / or ▼ buttons on the control.
- 4) To cancel the Max Heat mode, press either the **Item**, **Menu**, or **Test** button.
- 5) Once the Max Heat mode has either ended or is cancelled, the control resumes normal operation.



Troubleshooting

When troubleshooting any heating system, it is always a good idea to establish a set routine to follow. By following a consistent routine, many hours of potential headaches can be avoided. Below is an example of a sequence that can be used when diagnosing or troubleshooting problems in a hydronic heating system.

Establish the Problem

Establish the problem. Get as much information from the customer as possible about the problem. Is there too much heat, not enough heat, or no heat? Is the problem only in one particular zone or area of the building or does the problem affect the entire system? Is this a consistent problem or only intermittent? How long has the problem existed for? This information is critical in correctly diagnosing the problem.

Understanding the Sequence of Operation

Understand the sequence of operation of the system. If a particular zone is not receiving enough heat, which pumps or valves in the system must operate in order to deliver heat to the affected zone? If the zone is receiving too much heat, which pumps, valves or check valves must operate in order to stop the delivery of heat?

Use the Test Routine

Press the **Test** button on the control and follow the control through the test sequence as described in the Testing section. Pause the control as necessary to ensure that the correct device is operating as it should.

Sketch the Piping in the System

Sketch the piping of the system. This is a relatively simple step that tends to be overlooked, however it can often save hours of time in troubleshooting a system. Note flow directions in the system paying close attention to the location of pumps, check valves, pressure bypass valves and mixing valves. Ensure correct flow direction on all pumps. This is also a very useful step if additional assistance is required.

Document the Control

Document the control for future reference. Before making any adjustments to the control, note down all of the items that the control is currently displaying. This includes items such as error messages, current temperatures and settings, and which devices should be operating as indicated by the LCD. This information is an essential step if additional assistance is required to diagnose the problem.

Isolate the Problem

Isolate the problem between the control and the system. Now that the sequence of operation is known and the system is sketched, is the control operating the proper pumps and valves at the correct times? Is the control receiving the correct signals from the system as to when it should be operating? Are the proper items selected in the menus of the control for the device that is to be operated?

Test the Contacts, Voltages and Sensors

Test the contacts, voltages and sensors. Using a multimeter, ensure that the control is receiving adequate voltage to the power terminals and the demand terminals as noted in the technical data. Use the multimeter to determine if the internal contacts on the control are opening and closing correctly. Follow the instructions in the Testing the Wiring section to simulate closed contacts on the terminal blocks as required. Test the sensors and their wiring as described in the sensor Data Brochures.

Monitor the System

Monitor the system over a period of time. Select the applicable items in the MONITOR menu of the control and reset them to zero. Allow the system and the control to operate over a known period of time and then record the Monitor items. Use this information to help diagnose any remaining problems.

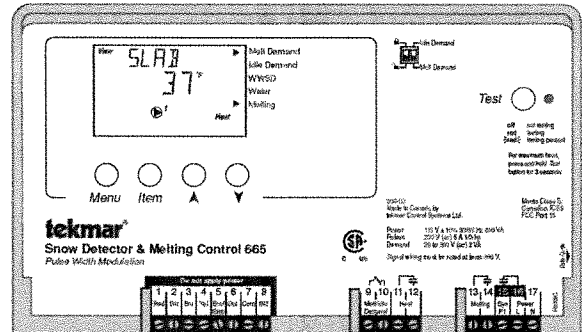
Error Displayed	Description of Error
CTRL ERR EE W	The control was unable to store a piece of information into its EEPROM. This error can be caused by a noisy power source. The control will display the error message and will continue to operate as normal. Pressing either the Menu or Item button will clear this error.
CTRL ERR ADJUS	The control was unable to read a piece of information stored in the ADJUST menu. Because of this, the control was required to load the factory settings into all of the items in the ADJUST menu. The control will stop operation until all of the items available in the ADJUST menu of the control have been checked by the user or installer. Note: Access level must be ADV in order to clear the error.
CTRL ERR MNTR	The control was unable to read a piece of information stored in the MONITOR menu. Because of this, the control was required to load the factory settings into all of the items in the MONITOR menu. The control will continue to display the error message until all of the items available in the MONITOR menu of the control have been checked by the user or installer. Note: Access level must be ADV in order to clear the error.
CTRL ERR SCHD	The control was unable to read a piece of information stored in the SCHEDULE menu. Because of this, the control was required to load the factory settings into all of the items in the SCHEDULE menu. The control will continue to display the error message until all of the items available in the SCHEDULE menu of the control have been checked by the user or installer. Note: Access level must be ADV in order to clear the error.
CTRL ERR MISC	The control was unable to read a piece of information stored in the MISCELLANEOUS menu. Because of this, the control was required to load the factory settings into all of the items in the MISCELLANEOUS menu. The control will continue to display the error message until all of the items available in the MISCELLANEOUS menu of the control have been checked by the user or installer. Note: Access level must be ADV in order to clear the error.
tN2 TYPE	An incorrect device has been connected to the <i>tekmar Net™</i> tN2 input terminal. Once the problem has been corrected, press either the Menu or Item button to clear the error message from the control.
tN2 SHRT	A short circuit has been read between the tN2 terminal and a Com terminal on the control. Either the wires leading to the tN2 device are shorted or the polarity of the wires is reversed. Determine the cause and remove the short. To clear this error, press either the Menu or Item button.
OUT DOOR SHRT	The control is no longer able to read the outdoor sensor due to a short circuit. In this case the control assumes an outdoor temperature of 32°F and continues operation. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button.
OUT DOOR OPEN	The control is no longer able to read the outdoor sensor due to an open circuit. In this case the control assumes an outdoor temperature of 32°F and continues operation. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button.
SLAB SHRT	The control is no longer able to read the slab sensor due to a short circuit. In this case, if the control is currently in the Melting mode, the control turns off the Heat relay. Locate and repair the problem as described in the Data Brochure D 079 or D 090. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button.

Error Displayed	Description of Error
SLAB OPEN	The control is no longer able to read the slab sensor due to an open circuit. In this case, if the control is currently in the Melting mode, the control will turn off the Heat relay. Locate and repair the problem as described in the Data Brochure D 079 or D 090. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button.
YELLOW SHRT	The control is no longer able to read the yellow sensor due to a short circuit. In this case, the control will turn off the heater in the Snow / Ice Sensor 090. Check the 090 yellow temperature sensor (<i>black</i> and <i>yellow</i> wires, terminals 2 and 4), and the wiring from the terminal plug to the sensor. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button.
YELLOW OPEN	The control is no longer able to read the yellow sensor due to an open circuit. In this case, the control will turn off the heater in the Snow / Ice Sensor 090. Check the 090 yellow temperature sensor (<i>black</i> and <i>yellow</i> wires, terminals 2 and 4), and the wiring from the terminal plug to the sensor. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button.
BLUE SHRT	The control is no longer able to read the water detection circuit due to a short circuit. In this case, if the control is currently in the Melting mode, the control will finish the snow melting cycle. The snow melting system can only be operated using an external melt demand, Remote Display Module 040, Remote Start / Stop Module 039 or the Start button on the control. Otherwise, the control will operate as if the Snow / Ice Sensor 090 is dry. Check the 090 water detection circuit (<i>black</i> and <i>blue</i> wires, terminals 2 and 3) according to the Data Brochure D 090. To clear the error message from the control after the error has been repaired, press either the Menu or Item button.
BLUE OPEN	The control is no longer able to read the water detection circuit due to an open circuit. In this case, if the control is currently in the Melting mode, the control will finish the snow melting cycle. The snow melting system can only be operated using an external melt demand, Remote Display Module 040, Remote Start / Stop Module 039 or the Start button on the control. Otherwise, the control will operate as if the Snow / Ice Sensor 090 is dry. Check the 090 water detection circuit (<i>black</i> and <i>blue</i> wires, terminals 2 and 3) according to the Data Brochure D 090. To clear the error message from the control after the error has been repaired, press either the Menu or Item button.
RED ERR	The control is reading a heater malfunction. In this case, unless the yellow sensor becomes too hot, the heater continues to try to operate. The snow melting system can only be operated using an external melt demand, Remote Display Module 040, Remote Start / Stop Module 039 or the Start button on the control. Check the 090 heater circuit (<i>red</i> and <i>black</i> wires, terminals 1 and 2) according to the Data Brochure D 090. Make sure the yellow and brown wires are not reversed. To clear the error message from the control after the error has been repaired, press either the Menu or Item button.
CTRL ERR HOT	The control's internal sensor is too hot (Above 160°F (71°C)). In this case, the control will turn off the heater in the Snow / Ice Sensor 090 until the control cools off. To clear the error message from the control after the error has been repaired, press either the Menu or Item button.
NO HEAT SLAB	This warning message will be displayed if the Slab temperature does not increase to the SLAB TRG temperature while the system is melting within a set time. The time limit is set using the NO HEAT item in the MONITOR menu. To clear this warning, press either the Menu or Item button.

Technical Data

Snow Detector & Melting Control 665 Pulse Width Modulation

Literature	— D 665, A 665's, U 665, D 001, D 070.
Control	— Microprocessor PID control; This is not a safety (limit) control .
Packaged weight	— 3.1 lb. (1400 g), Enclosure A, blue PVC plastic
Dimensions	— 6-5/8" H x 7-9/16" W x 2-13/16" D (170 x 193 x 72 mm)
Approvals	— CSA C US, CSA 22.2 N°24 and UL 873, meets class B: ICES & FCC Part 15.
Ambient conditions	— Indoor use only, 32 to 104°F (0 to 40°C), < 90% RH non-condensing.
Power supply	— 115 V (ac) ±10%, 50/60 Hz, 600 VA
Relay capacity	— 230 V (ac) 5 A, 1/3 hp
Demands	— 20 to 260 V (ac) 2 VA
Sensors included	— NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) β=3892 Outdoor Sensor 070
Optional devices	— tekmar type #: 039, 040, 072, 073, 090, 091.



The installer must ensure that this control and its wiring are isolated and/or shielded from strong sources of electromagnetic noise. Conversely, this Class B digital apparatus complies with Part 15 of the FCC Rules and meets all requirements of the Canadian Interference-Causing Equipment Regulations. However, if this control does cause harmful interference to radio or television reception, which is determined by turning the control off and on, the user is encouraged to try to correct the interference by re-orientating or relocating the receiving antenna, relocating the receiver with respect to this control, and/or connecting the control to a different circuit from that to which the receiver is connected.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Caution The nonmetallic enclosure does not provide grounding between conduit connections. Use grounding type bushings and jumper wires.

Attention Un boîtier nonmétallique n'assure pas la continuité électrique des conduits. Utiliser des manchons ou des fils de accord spécialement conçus pour la mise à la terre.

Limited Warranty and Product Return Procedure

Limited Warranty The liability of tekmar under this warranty is limited. The Purchaser, by taking receipt of any tekmar product ("Product"), acknowledges the terms of the Limited Warranty in effect at the time of such Product sale and acknowledges that it has read and understands same.

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Any representations or warranties about the Products made by Purchaser to its customers which are different from or in excess of the tekmar Limited Warranty are

the Purchaser's sole responsibility and obligation. Purchaser shall indemnify and hold tekmar harmless from and against any and all claims, liabilities and damages of any kind or nature which arise out of or are related to any such representations or warranties by Purchaser to its customers.

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THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH THE GOVERNING LAW ALLOWS PARTIES TO CONTRACTUALLY EXCLUDE, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, DURABILITY OR DESCRIPTION OF THE PRODUCT, ITS NON-INFRINGEMENT OF ANY RELEVANT PATENTS OR TRADEMARKS, AND ITS COMPLIANCE WITH OR NON-VIOLATION OF ANY APPLICABLE ENVIRONMENTAL, HEALTH OR SAFETY LEGISLATION; THE TERM OF ANY OTHER WARRANTY NOT HEREBY CONTRACTUALLY EXCLUDED IS LIMITED SUCH THAT IT SHALL NOT EXTEND BEYOND TWENTY-FOUR (24) MONTHS FROM THE PRODUCTION DATE, TO THE EXTENT THAT SUCH LIMITATION IS ALLOWED BY THE GOVERNING LAW.

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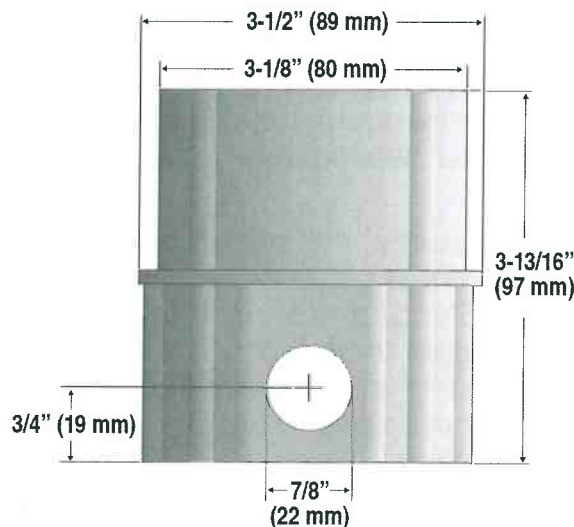
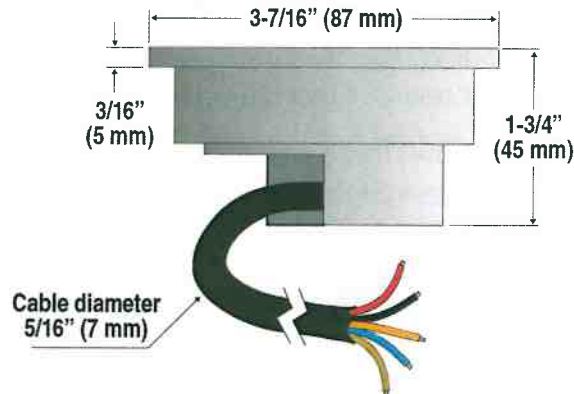


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The tekmar Snow/Ice Sensor 090/094 and tekmar Sensor Socket 091 are used with all tekmar snow/ice melt controls. The 090 has a 65' (20 m) cable while the 094 has a 208' (64 m) cable.

The Snow/Ice Sensor is designed to sit flush with the slab surface after being mounted into the Sensor Socket. The socket is installed directly into the snow melt slab halfway between the heating elements or pipes.

The sensor measures the slab temperature, sensor surface temperature and sensor surface moisture level.



Installation

Caution

Improper installation and operation of this sensor could result in damage to equipment and possibly even personal injury. It is your responsibility to ensure that this sensor is safely installed according to all applicable codes and standards. Please follow these step-by-step instructions to gain a full understanding of this device.

STEP ONE — GETTING READY

Check the Contents

Check the contents of this package. If any of the contents listed are missing or damaged, please refer to the Limited Warranty and Product Return Procedure on the back of this brochure and contact your wholesaler or tekmar sales representative for assistance.

Type 090 includes: • One Snow/Ice Sensor 090 with “O” ring • Four, #6-32 x 3/8” screws • Four, #4-40 x 7/16” screws • One Data Brochure D090

Type 094 includes: • One Snow/Ice Sensor 094 with “O” ring • Four, #6-32 x 3/8” screws • Four, #4-40 x 7/16” screws • One Data Brochure D090

Type 091 includes: • One Snow/Ice Sensor Socket 091 • One protective plastic plug • One plastic mounting plate • Eight, #6-32 x 3/8” screws • One Data Brochure D090

STEP TWO — MOUNTING THE SENSOR

Location of the Sensor

- The location of the snow/ice sensor determines how well the snow melt detector responds to conditions on the snow melting slab. The sensor measures the temperature of the slab surface, and would normally be installed in a location that is representative of the average surface temperature and moisture conditions. The only exception to this practice would be those applications where the sensor is placed in a specific problem area where ice or snow often forms first.
- The installer should be careful to place the sensor in a location where it will not be affected by abnormal temperature conditions that may occur near buildings, hot air exhaust ducts or other heat sources, or sunny areas within a larger slab area.
- As well as reading temperatures, the sensor also detects surface water. The installer should be careful not to place the sensor where standing water could accumulate on its surface. Standing water in the socket may cause the snow melt system to be held on far longer than necessary, as the control will be getting a signal that water is present even though the rest of the slab surface may be dry. In addition, the sensor should not be placed in areas where drainage is considerably better than the surrounding area.
- The snow/ice sensor should not be installed in locations where vehicles park, near building overhangs or near trees since this may interfere with snow fall accumulation. If in doubt about the location of these obstacles, a second spare

socket and conduit can be installed in order to provide a backup sensor location if the first location is not found to be ideal.

- Vehicle tire and pedestrian traffic can track water and contaminants onto the snow melt area. If the snow/ice sensor is located in the traffic area, snow melting will be triggered by the passing traffic. This may be desirable in commercial areas where excessive traffic can cause the surface to become icy. In residential installations, the amount of traffic is usually limited, and it may be desirable to locate the snow/ice sensor away from the traffic area. This will reduce the number of snow melt events that occur and thereby reduce the annual fuel consumption.
- The location of the sensor should be midway between the heating pipes or elements.

Conduit

Place the sensor socket at the chosen location and run a conduit for the cable from the socket to the snow/ice detection control. If more than 210' (64 m) of cable is required to reach the control, run the conduit to a weatherproof junction box. The sensor cable should be run in its own conduit and not in combination with high voltage wiring.

The conduit length from the sensor to the junction box should be less than the 210' (64 m) of cable supplied with the 094 snow/ice sensor.

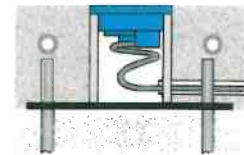
At the junction box, additional 18 AWG, 5 conductor cable can be spliced on to increase the total length to 500' (150 m) from the sensor to control.

Avoid tying the conduit to the rebar within 6' (2 m) of the socket. This allows the rebar grid to move without disturbing the position of the socket.

Sloped Surfaces

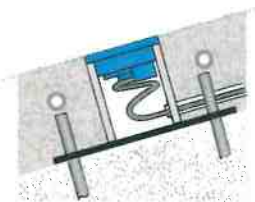
The top of the snow/ice sensor should be flush and parallel to that of the snow melt surface.

When the sensor is installed on a sloped driveway, the sensor must be installed near the lowest elevation of the slope. This is required since the melting snow or ice runoff water will drain toward the lowest point on the driveway and keep this area wet for longer periods of time.



Installing the Socket

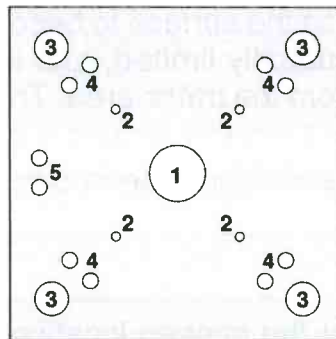
A mounting plate has been included to simplify the installation of the sensor socket. When possible, the mounting plate should be located directly on top of gravel in order to provide good drainage. If the slab is more than 4" thick, a mound of crushed rock or a styrofoam or wooden block can be used to elevate the socket. A hole must be punched or drilled in the styrofoam or wooden block in order to provide drainage.



Failure to provide adequate drainage under the socket may reduce the life expectancy of the snow/ice sensor.

The mounting plate can be fastened to the ground by driving 1/2" (12.7 mm) rebar through the four holes located on each of the four corners and then tying the mounting plate to the rebar.

- 1) Cut four pieces of rebar at least 12" (300 mm) long.
- 2) Drive the rebar into the ground through each of the mounting plate rebar holes. Leave approximately 2" (50 mm) of rebar above the ground.

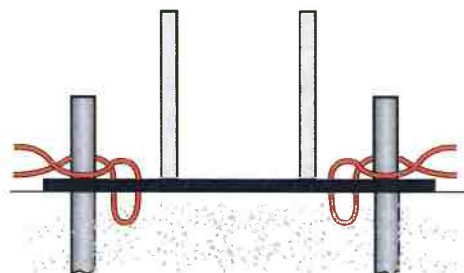
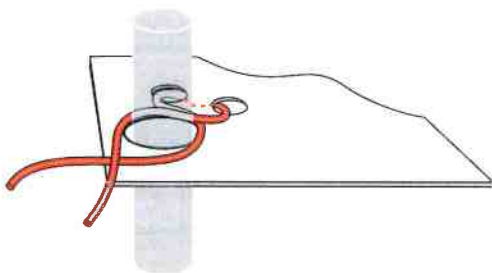


Mounting Plate

1. Drainage hole
2. Socket screw holes
3. Rebar holes
4. Rebar tie holes
5. Conduit tie holes

- 3) Cut several 12" (300 mm) pieces of steel wire.
- 4) Form a "U" shape and pull wire through the rebar tie hole from the bottom to the top side.
- 5) Repeat by pulling the "U" shape from the top to the bottom side.
- 6) Repeat (4) and (5) for each of the four corners.
- 7) Cross the wire, then wrap around the rebar.
- 8) Twist wire using pliers to tighten.

The mounting plate also has conduit tie holes to allow a cable tie or steel wire to fasten the conduit to the mounting plate.



Placing Concrete

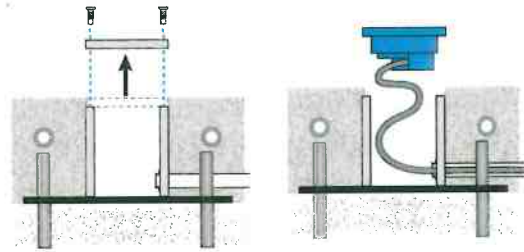
A plastic plug is provided with the socket to prevent it from being accidentally filled with concrete. The plastic plug is the same thickness as the sensor flange. This allows the finished surface of the concrete (asphalt, etc.) to be troweled flush with the plug. The plug must be installed prior to placing the concrete. Also ensure that the mounting plate drainage hole remains unplugged once the concrete has cured.

Installing Brick Pavers

If using brick pavers instead of concrete, it is recommended to mortar surrounding brick pavers to the side of the socket. This ensures good thermal conduction from the brick pavers to the socket. The top of the brick pavers should be level with the socket when the plastic plug is installed.

Install the Sensor and Cable

When the snow melt surface is finished, remove the plastic plug from the socket and fish the cable through the conduit until there is only 6 to 12" (150 to 300 mm) of cable between the sensor and conduit. Loop this remaining extra wire in a loose coil so as to not twist it, and place it, and the sensor into the socket. Secure the sensor to the socket with the four screws provided, making sure the "O" ring is in place and properly seated.



Replacing old 090 or 094

Current versions of the Snow/Ice socket 091 use #6-32 screws. Previous versions of the 091 used smaller #4-40 screws. When replacing an 090 or 094, both sets of screws are provided. It is recommended to try the smaller screws first to avoid cross threading.

Salt and Brine Contamination

The performance of the snow/ice sensor water detection can be compromised when exposed to de-icing agents such as road salt, magnesium chloride, or calcium chloride. These contaminants can permanently damage the sensor. It is recommended to locate the sensor away from areas exposed to these deicing agents when at all possible. Locations to avoid could include tire track areas or areas close to a curb where traveling vehicles may splash contaminated water on to the sensor.

Maintenance

The Snow/Ice Sensor is installed in a hostile environment. Accumulation of dirt, salty grime, etc., on its surface will inhibit proper water detection. It should be checked on a regular basis and, when necessary, cleaned. Before cleaning, the control power should be shut off to prevent the control from entering the snow melt mode. Next, use a soft bristle brush and warm soapy water to clean the sensor surface. Do not use a steel wire brush as this will damage the sensor. Then use a paper towel to thoroughly dry the sensor surface. After cleaning, re-power the control and push the test button to cycle the control through the test routine.

STEP THREE — WIRING THE SENSOR

Electrical Connections

The snow/ice sensor cable has 5 wires: Red, Black, Blue, Yellow, and Brown. The wires connect to the respective Red, Black, Blue, Yellow and Brown terminals on the Snow Detector & Melting Control.

Testing and Troubleshooting

TEST THE SENSOR

When performing these tests:

- The sensor head should be installed in the slab.
- The five cable wires at the control should be disconnected (unplug terminal plug).
- Use a good quality electrical testing meter with an ohm scale range of 0 to 2,000,000 Ohms.

The sensor has two 10k Ohm thermistors. One reads slab surface temperature, and the other checks sensor heater temperature.

If the sensor has been disconnected from the control for an hour or more, the readings for both thermistors should be very close.

- Using the ohmmeter and standard testing practices, measure the resistance between:
 - (a) the yellow and black sensor wires (sensor temperature), and
 - (b) the brown and black sensor wires (slab temperature).

The table below lists the expected resistance values at various sensor temperatures.

- Measure the resistance between the blue and black wires. When the sensor surface is dry, the reading should be 2,000,000 Ohms. When the sensor surface is wet it should be between 10,000 and 300,000 Ohms.
- Measure the resistance between the red and black wires of the heating element. This reading should be close to 50 Ohms.

Temperature		Resistance	Temperature		Resistance	Temperature		Resistance
°F	°C	Ω	°F	°C	Ω	°F	°C	Ω
-49	-45	472,000	5	-15	72,900	59	15	15,700
-40	-40	337,000	14	-10	55,300	68	20	12,500
-31	-35	243,000	23	-5	42,300	77	25	10,000
-22	-30	177,000	32	0	32,600	86	30	8,060
-13	-25	130,000	41	5	25,400	95	35	6,530
-4	-20	97,000	50	10	19,900	104	40	5,330

Technical Data

Snow/Ice Sensor 090 / 094	
Literature	D 090
090 Packaged weight	4.4 lbs (2000 g)
094 Packaged weight	10.5 lbs (4762 g)
Dimensions	1-3/4" H x 3-7/16 O.D. (45 x 87 O.D. mm)
Material	Brass, epoxy
Cable material	18 AWG, 5 conductor stranded wire with polyethylene jacket
090 Cable length	65' +/- 1' (20 +/- 0.3 m)
094 Cable length	208' +/- 2' (64 +/- 0.6 m)
Approvals	CSA C US with applicable tekmar snow melting controls
Operating range	-30 to 170°F (-34 to 77°C)
Sensor	NTC thermistor, 10kΩ @ 77°F (25°C ± 0.2°C), β = 3892

Snow/Ice Sensor Socket 091	
Literature	D 090
Packaged weight	1.5 lbs (675 g)
Dimensions	3-13/16" H x 3-1/2 O.D. (97 x 89 O.D. mm)
Socket material	Brass
Cap material	Polyethylene
Mounting plate material	Polyethylene
Approvals	CSA C US with applicable tekmar snow melting controls

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