

tekmar® - Data Brochure

Snow Detector & Melting Control 667

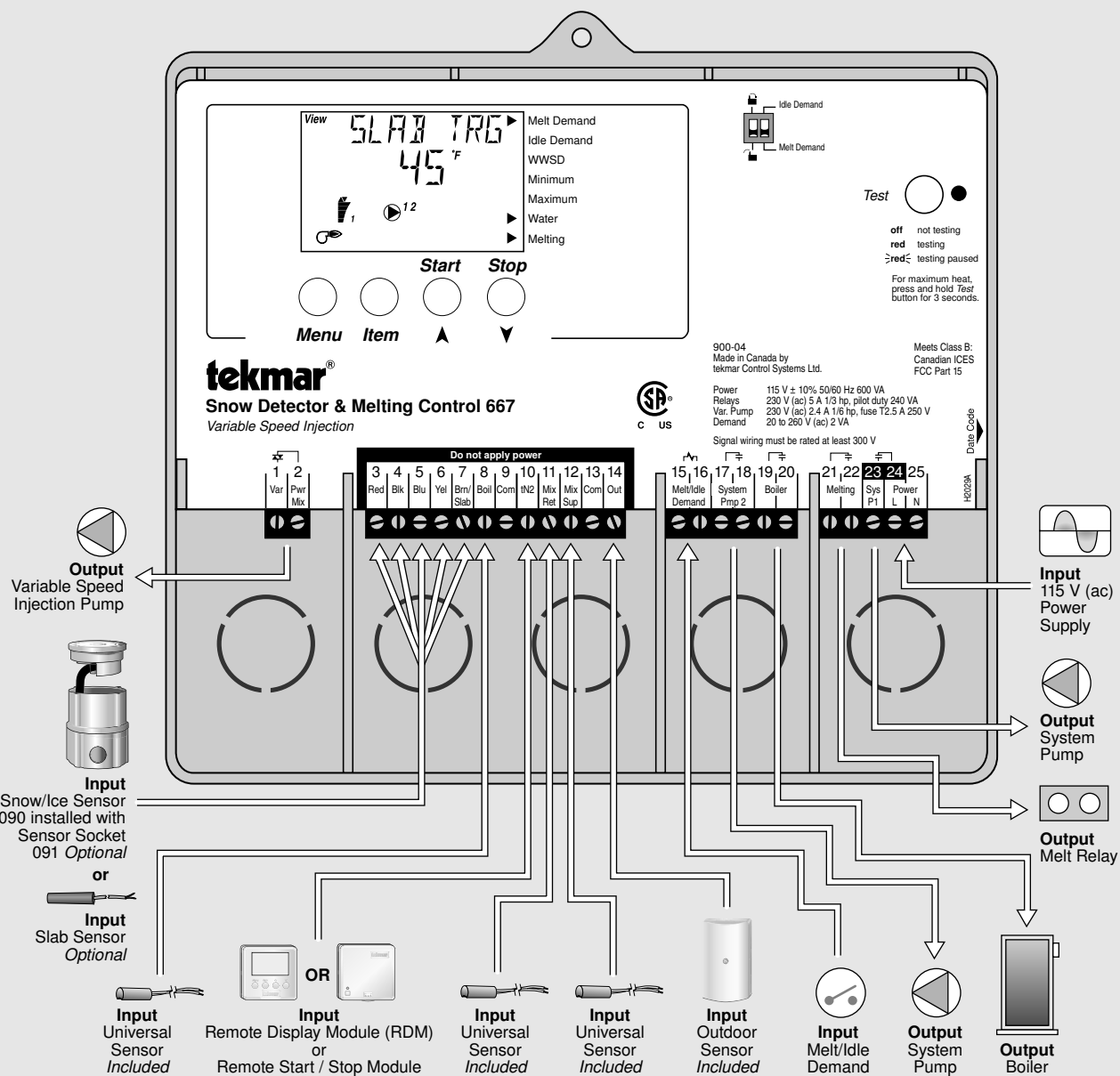
D 667

06/04

The Snow Detector & Melting Control 667 is a microprocessor-based control which operates a 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. The 667 controls a variable speed injection pump to provide both boiler and slab protection. When the control is not in the Melting mode, the system can either be shut down or it can be maintained at an idle temperature for faster response and improved safety. The 667 control includes a large Liquid Crystal Display (LCD) in order to view system status and operating information.

Additional features include:

- Temporary Idle
- Slab protection for the snow melting system
- Boiler protection
- 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 exercising
- Viscosity compensation
- 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 7 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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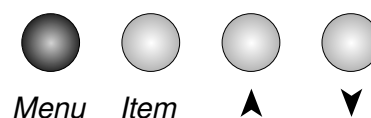
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User Interface

The 667 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 667 has four push buttons (**Menu**, **Item**, **▲**, **▼**) 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.

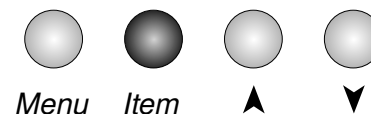
Menu

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

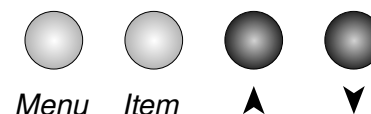
The abbreviated name of the selected item will be displayed in the item field of the display. To view the next available item, press and release the **Item** button. Once you have reached the last available item in a menu, pressing and releasing the **Item** button will return the display to the first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



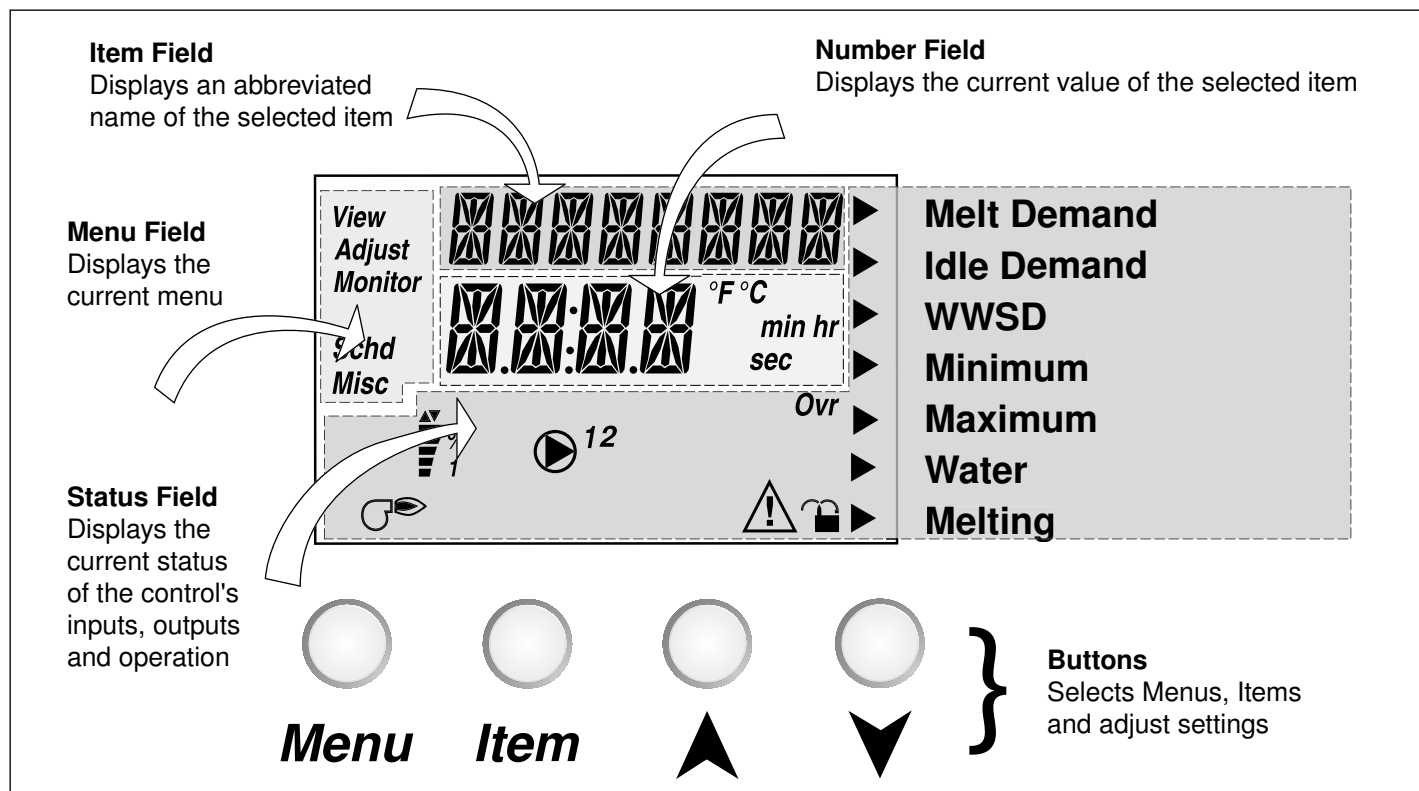
Adjust

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

	Mixing Device Output Scale Shows output of injection pump, mixing valve or 4-20 mA device. Arrows show whether the output is increasing or decreasing.		Lock / Unlock Displays when the access levels are locked or unlocked.
	Pump Displays when the system pumps are operating.		Burner Displays when the Boiler relay is turned on.
Ovr	Override Displays when the control is in override mode.		Pointer Displays the control operation as indicated by the text.
	Warning Displays when an error exists or when a limit has been reached.	°F °C min hr sec	°F, °C, min, hr, sec Units of measurement.

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

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General
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Section A: General Operation

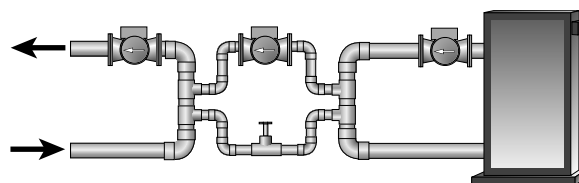
POWERING UP THE CONTROL

When the Snow Detector & Melting Control 667 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.

MIXING DEVICE

Variable Speed Injection Pump

A standard wet rotor circulator is connected to the 667 on the *Var* and *Com* terminals (1 and 2). The 667 increases or decreases the power output to the circulator based on the system requirements. For correct sizing and piping of the variable speed injection pump, refer to Essay E 021. A visual indication of the current variable speed output is displayed in the LCD in the form of a segmented bar graph.



MIXING TARGET (MIX TRG)

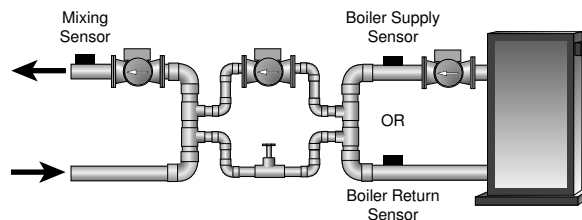
The mix target temperature is the supply fluid temperature calculated by the control. The control will operate the snow melt system so that the mix supply temperature reaches the mixing target except while providing boiler return protection for the boiler.

MIXING MAXIMUM (MIX MAX)

The MIX MAX sets the highest fluid temperature that the control is allowed to calculate as the mixing target temperature. If the control does target the *Mix Max* setting, and the MIX SUP temperature is near the MIX MAX, the Maximum pointer is displayed in the LCD while the MIX SUP temperature is being viewed.

BOILER PROTECTION (Boil MIN)

The 667 is capable of providing boiler protection from cold mixing system return fluid temperatures. If the boiler sensor temperature is cooler than the *Boil Min* setting while the boiler is firing, the 667 reduces the output from the mixing device. This limits the amount of cool return water to the boiler and allows the boiler temperature to recover. This feature can only be used if the Boil Sens item is set to *Sup* or *Ret*. The 667 can not provide boiler protection if the Boil Sens item is set to *None*.



EXERCISING (EXERCISE)

The 667 has a built-in pump and valve 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 seizing during a long period of inactivity.

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

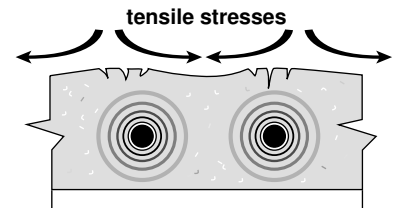
Section B: Snow Melting

Section B1 General Snow Melting

Section B1: General Snow Melting

SLAB PROTECTION (ΔT MAX)

The control can limit the rate at which heat is applied to the zone through the ΔT Max setting. The ΔT (delta T) is the temperature difference between the snow melting supply temperature and the snow melting return temperature. By limiting this temperature difference, the rate at which heat is applied to the zone can be controlled and thermal stresses in the slab can be minimized. When the control is operating at the ΔT MAX, the *Maximum* pointer can be seen when viewing the ΔT item in the VIEW menu. The control provides slab protection differently based on boiler sensor placement.



VISCOSITY COMPENSATION (EXCEEDING ΔT MAX)

At low temperatures, the glycol solutions used in snow melting systems become very viscous and difficult to pump. In order to overcome this condition during a cold start of a snow melting system, the 667 is allowed to exceed the ΔT Max setting for a period of time in order to warm the glycol solution. This allows the control to compensate for the high viscosity of the glycol solution and is used when the mixing return temperature is below 30°F (-1°C). When the control exceeds the ΔT Max setting, the *Maximum* pointer will flash when viewing the ΔT item in the VIEW menu.

SOFT START

When the control starts applying heat to the slab, the supply temperature to the snow melting system is ramped up over a period of time until it reaches the target mixed supply temperature. This feature helps reduce thermal stresses in the slab.

Note: This operation only occurs if the Boil Sens item is set to *Ret* or *None*.

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 D1 for a description of a manual melting enable.

WARM WEATHER SHUT DOWN (WWSD)

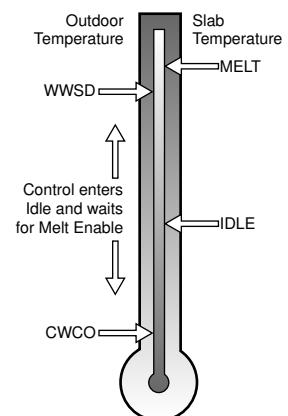
The control has a warm weather shut down that prevents the control from entering the Melt or Idle modes in order to conserve energy. While in WWSD, the word WWSD is displayed in the Status item in the VIEW menu and the WWSD pointer is on the display. The WWSD can be either set to Automatic or it can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

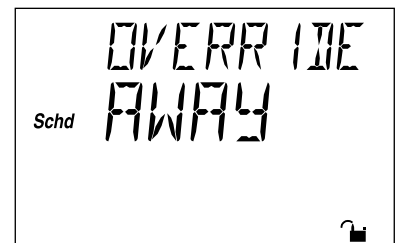
STATUS (STATUS)

While in the VIEW menu there are a number of items available to determine the current status of zone 1 and zone 2. To view the current status of zone 1, select the Status 1 item in the VIEW menu. To view the current status of zone 2, select the Status 2 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 and System Pmp 2)

The system pump contacts close and remain closed as long as the system is either in the Melting or Idling mode. The system pump contacts shut off if the control is in CWCO, WWSD, or if there is no call for Melting or Idling.

MELTING CONTACT OPERATION

The *Melting* contact (terminals 21 and 22) closes and remains closed as long as the system is in Melting mode. This contact can be used as an external signal to indicate that the system is currently in Melting mode. This contact can also be used as a means of prioritizing or enabling multiple snow melting controls.

PURGE

The system pumps continue to operate for up to 2 minutes after the last demand is removed. This purges the residual heat from the boiler into the snow melting slab. If the boiler temperature drops below the *Boil Min* setting after 20 seconds, the purge is aborted and the system pumps are turned off.

Section C: Boiler Operation

Section C1 Boiler Supply Sensor

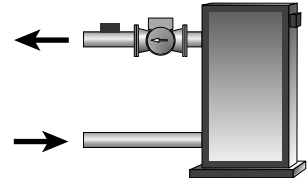
Section C2 Boiler Return Sensor

Section C3 No Boiler Sensor

Section C1: Boiler Supply Sensor

BOILER SENSOR ON THE SUPPLY (Boil SENS = SUP)

When operating a boiler that is dedicated to a snow melting system, the 667 is designed to operate the boiler as efficiently as possible. The boiler is cycled based on the mixing supply fluid temperature. This is to provide longer and more efficient boiler cycles. This mode of operation only works if the Boil Sens item is set to *Sup*.

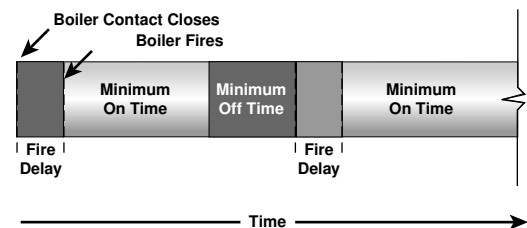


BOILER MINIMUM (Boil MIN)

The Boil MIN is the lowest water temperature that the control is allowed to use as a boiler target temperature. If the boiler is operating, and the boiler supply temperature is near the *Boil Min* setting, the *Minimum* pointer turns on in the LCD while the Boil SUP temperature is being viewed. If the installed boiler is designed for condensing or low temperature operation, set the Boil MIN adjustment to OFF.

FIRE DELAY (FIRE DLY)

The FIRE DLY is the delay time that may occur between the time that the 667 closes the *Boiler* contact and when the burner fires. This delay is usually the result of burner pre-purge or other forms of time delay built into the burner's safety circuits.



BOILER MASS (Boil MASS)

The *Boil Mass* setting allows the 667 to adjust to different types of heat sources depending on their thermal mass.

Light (LITE)

The *Lite* setting is selected if the boiler that is used has a low thermal mass. This means that the boiler has a very small water content and has very little metal in the heat exchanger. A boiler that has a low thermal mass comes up to temperature quite rapidly when fired. This is typical of many copper fin-tube boilers.

Medium (MED)

The *Med* setting is selected if the boiler that is used has a medium thermal mass. This means that the boiler either has a large water content and a low metal content or a low water content and a high metal content. This is typical of many modern residential cast iron boilers or steel tube boilers.

Heavy (HEVY)

The *Hevy* setting is selected if the boiler that is used has a high thermal mass. This means that the boiler has both a large water content and a large metal content. A boiler that has a high thermal mass is relatively slow in coming up to temperature. This is typical of many commercial cast iron and steel tube boilers.

DIFFERENTIAL (DIFF)

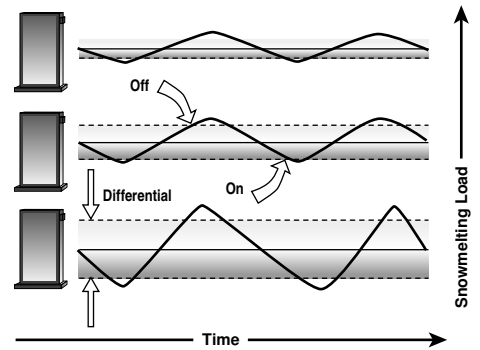
An on / off heat source such as a boiler must be operated with a differential in order to prevent short cycling. With the 667, either a fixed or an automatic differential may be selected.

Fixed Differential

The differential is centered around the target temperature. If the temperature drops 1/2 the differential below the target temperature, the 667 closes the *Boiler* contact to fire the boiler. If the temperature rises 1/2 of the differential above the target temperature, the 667 opens the *Boiler* contact to turn off the boiler.

Auto Differential (AUTO)

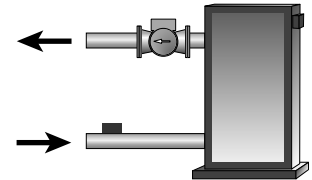
If the AUTO differential is selected, the 667 automatically adjusts the *Differential* setting under the current load conditions to avoid short cycling.



Section C2: Boiler Return Sensor

BOILER SENSOR ON THE RETURN (Boil SENS = RET)

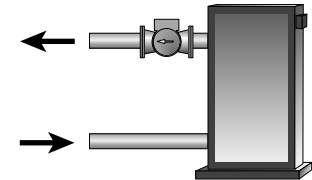
The boiler sensor should be located on the boiler return if the 667 is one of many controls that can call for boiler operation. When in the return mode, the 667 provides a boiler enable through the *Boiler* contact. The 667 no longer tries to control the boiler supply water temperature directly, but allows the boiler to operate at its operating *Aquastat* setting when required. If this mode of operation is selected, the boiler pump should either operate continuously, or be operated in parallel with the *System Pump* contact (*Sys P1*). When the mixing device begins to ramp up, the *Boiler* contact closes on the 667. The *Boiler* contact remains closed until the mixing device no longer requires heat. With the sensor on the boiler return, the 667 is still capable of providing boiler protection as described in section A.



Section C3: No Boiler Sensor

NO BOILER SENSOR (Boil SENS = NONE)

The 667 is capable of operating without a boiler sensor if desired. Without a boiler sensor, the 667 is unable to provide boiler protection. In this mode of operation, the *Boiler* contact is used to provide a boiler enable. When the mixing device begins to ramp up, the *Boiler* contact on the 667 closes. The *Boiler* contact remains closed until the mixing device no longer requires heat. This type of application is typical if the 667 is drawing heat from a source that already incorporates some form of boiler protection.



Section D: Melting Enable / Disable

Section D1 Snow Melting Enable

Section D2 Snow Melting Disable

Section D1: Snow Melting Enable

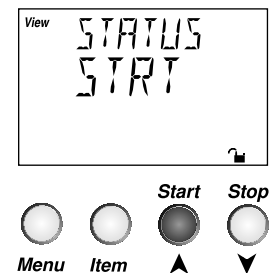
The snow melting system can be enabled manually or automatically. A melting enable signal applied to the control places the system into the Melting mode. If a melting enable signal is applied once the system is already in the Melting mode, the control responds to the last command received.

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.



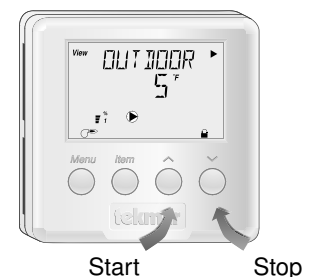
Remote Start / Stop Module 039

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

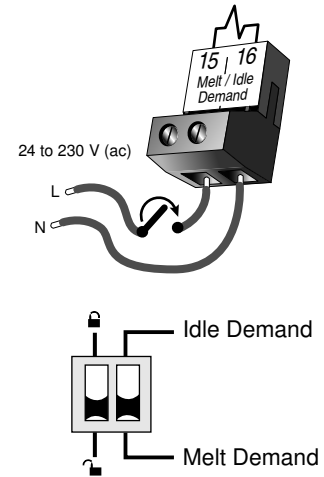
The snow melting system is enabled by pressing the ▲ button on the 040 while in the VIEW menu. The 040 then displays the *Run Time* setting to allow the user to adjust it. Once the snow melting system is enabled, the word *STRT* is displayed for at least 5 seconds in the Status item while in the VIEW 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 (15 and 16). 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.

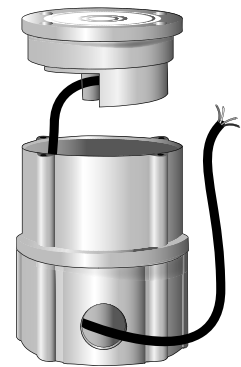


AUTOMATIC MELTING ENABLE (Snow / Ice Sensor 090)

The 667 can use 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 667 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 *Sensvty* 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 *Sensvty* setting. If the snow in your area is very clean, the *Sensvty* 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 D2: 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 either at 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 while in the VIEW menu.

Remote Start / Stop Module 039

A Remote Start / Stop Module 039 can be used to stop the snow melting. 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

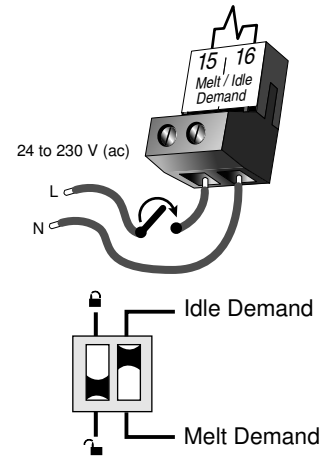
A Remote Display Module 040 can be used to stop the snow melting system. The snow melting system is disabled by pressing the ▼ button on the 040 while in the VIEW menu. Once the snow melting system is disabled, the word *Stop* is displayed for 5 seconds in the Status item while in the VIEW menu.

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 (15 and 16). 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 E: Melting Operation

Section E1 General Melting Operation

Section E1: 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.

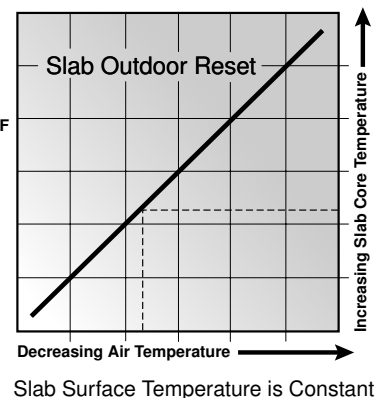
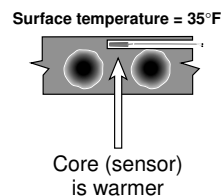
If a manual melting enable signal starts the snow melting system, the running time is displayed in the Status item while in the VIEW menu and begins counting down once the slab temperature reaches the slab target temperature. The system continues to melt until the running time counts down to 0:00 and there is no external melt demand. Once the Melting mode is complete, the system operates in the Idling mode. The table on page 12 describes how the control responds to enable and disable signals.

SLAB TEMPERATURE CONTROL

The 667 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

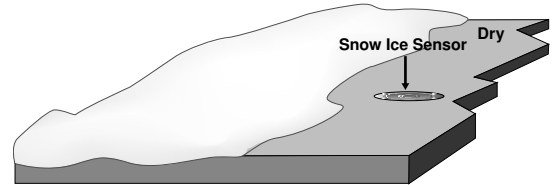
The slab temperature is displayed as SLAB in the VIEW menu. This temperature is calculated from the edge and center sensors built into the 090.

SLAB TARGET TEMPERATURE (SLB TRG)

The SLAB TRG temperature is determined from the *Melting* setting, *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 667 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 running time starts counting down.



Section F: Idling Operation

Section F1 General Idling Operation

Section F2 Temporary Idle

Section F1: 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 667 has an idling feature which can maintain the system 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, IDLING is displayed in the Status item while in the VIEW menu. If idling is not desirable, the *Idling* setting may be set to *Off*.

Section F2: 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 setting 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

Section G: ΔT Hours (Relative Energy Usage)

Section G1 ΔT Hours

Section G1: ΔT Hours

The control records the temperature difference (ΔT) multiplied by the number of hours the control is in the Melt or Idle modes. This allows the user to estimate the amount of energy used by the snow melt system. The energy consumption can be estimated by multiplying the ΔT Hours by the system flow rate (in US GPM) and by the constant K shown below. **Note:** K values are calculated averages for most ethylene glycol solutions at 50°F (10°C). K increases with higher temperatures.

% Glycol by Weight	Freezing Point	K (°F x hr)	K (°C x hr)
0	32°F (0°C)	500	900
10	25°F (-4°C)	496	893
20	15°F (-9°C)	487	877
30	3°F (-16°C)	477	857
40	-13°F (-25°C)	462	832
50	-35° (-37°C)	439	720

Example: ΔT Hours = 5225°F x hr, System flow = 20 US GPM, Fluid = 40% glycol and 60% water, therefore K= 462.
Energy Usage = 5225 x 20 x 462 = 48,279,000 BTU.

To clear the current ΔT Hours recorded, press the ▲ and ▼ arrow buttons while viewing the ΔT Hours in the MONITOR menu.

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 tektra sales representative for assistance.

Type 667 includes: One Snow Detector & Melting Control 667, One Outdoor Sensor 070, Three Universal Sensors 071, Data Brochures D 667, D 070, D 001, User Brochure U 667, Application Brochure A 667, Essay E 021.

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 11 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.

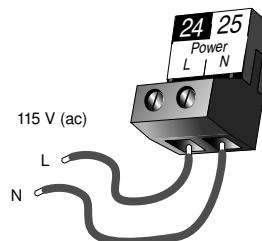
STEP FOUR — ELECTRICAL CONNECTIONS TO THE CONTROL

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**

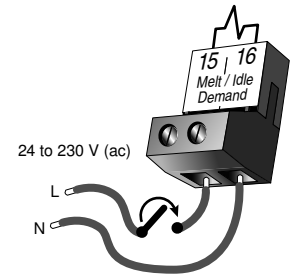
115 V (ac) Power

Connect the 115 V (ac) power supply to the *Power L* and *Power N* terminals (24 and 25). This connection provides power to the microprocessor and display of the control. As well, this connection provides power to the *Sys P1* terminal (23) from the *Power L* terminal (24).



Melt / Idle Demand

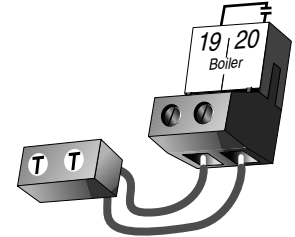
To generate a melt demand or idle demand, a voltage between 24 V (ac) and 240 V (ac) must be applied across the *Melt / Idle Demand* terminals (15 and 16).



⚠ Output Connections

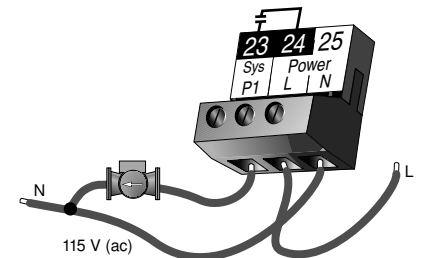
Boiler Contacts

The *Boiler* terminals (19 and 20) are an isolated output in the 667. There is no power available on these terminals from the control. These terminals are used as a switch to either make or break the boiler circuit. When the 667 requires the boiler to fire, it closes the contact between terminals 19 and 20.



System Pump Contact (Sys P1)

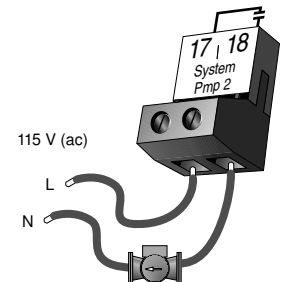
The *Sys P1* output terminal (23) on the 667 is a powered output. When the relay in the 667 closes, 115 V (ac) is provided to the *Sys P1* terminal (23) from the *Power L* terminal (24). To operate the system pump, connect one side of the system pump circuit to terminal 23 and the second side of the pump circuit to the neutral (N) side of the 115 V (ac) power supply.



System Pump Contact (System Pmp 2)

The *System Pmp 2* terminals (17 and 18) are an isolated output in the 667. There is no power available on these terminals from the control.

If the *System Pmp 2* contact is used, connect the pump circuit to the *System Pmp 2* terminals (17 and 18).



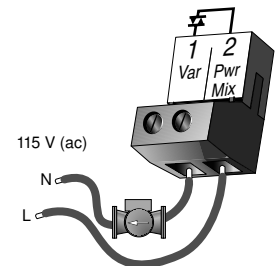
Melting Contact

The *Melting* terminals (21 and 22) are an isolated output in the 667. 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.

Variable Speed Injection Pump

The 667 can vary the speed of a permanent capacitor, impedance protected or equivalent pump motor that has a locked rotor current of less than 2.4 A. Most small wet rotor circulators are suitable as described in Essay E 021. The 667 has an internal overload fuse which is rated at 2.5 A 250 V (ac). Contact your tekmar sales representative for details on the repair procedures if the fuse is blown.

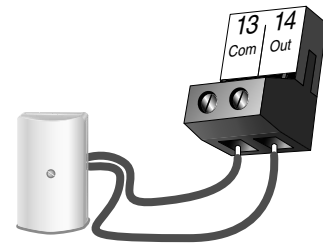
If a variable speed injection pump is used, connect one of the wires from the variable speed injection pump to the *Var* terminal (1) on the 667. Connect the *Com* terminal (2) to the live (L) side of the 115 V (ac) power source. The other wire on the variable speed injection pump must be connected to the neutral (N) side of the 115 V (ac) power supply.



⚠ Sensor and Unpowered Input Connections —————
Do not apply power to these terminals as this will damage the control.

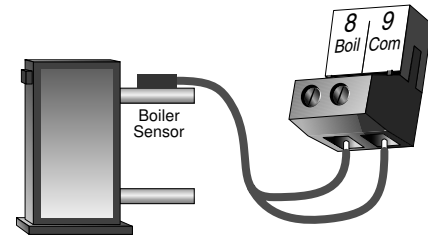
Outdoor Sensor

Connect the two wires from the Outdoor Sensor 070 to the *Com* and *Out* terminals (13 and 14). The outdoor sensor is used by the 667 to measure the outdoor air temperature.



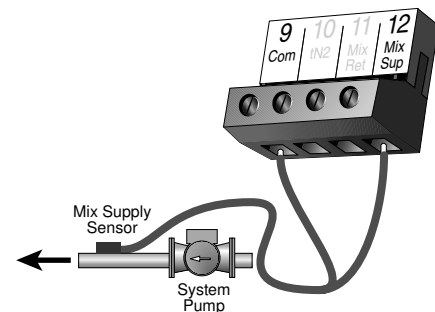
Boiler Sensor

Connect the two wires from the Boiler Sensor 071 to the *Boil* and *Com* terminals (8 and 9). The boiler sensor is used by the 667 to measure the water temperature of the boiler.



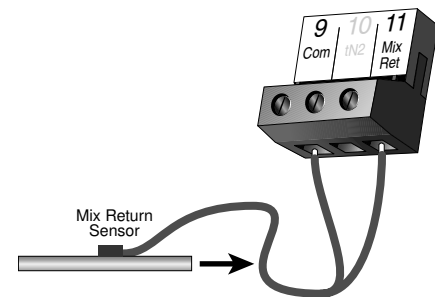
Mixing Supply Sensor

Connect the two wires from the Mixing Supply Sensor 071 to the *Mix Sup* and *Com* terminals (12 and 9). The mixing supply sensor is used by the 667 to measure the fluid supply temperature after the mixing device. Normally the sensor is attached downstream of the system pump.



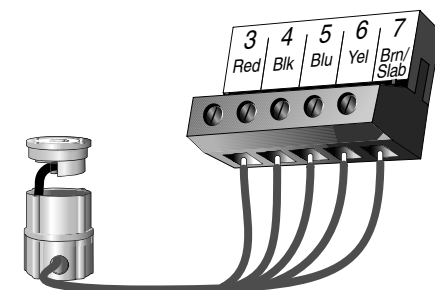
Mixing Return Sensor

Connect the two wires from the Mixing Return Sensor 071 to the *Com* and *Mix Ret* terminals (9 and 11). The mixing return sensor is used by the 667 to measure the fluid return temperature from the snow melting slab.



EITHER: Snow / Ice Sensor 090

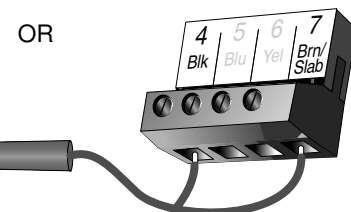
Connect the red wire from the sensor cable to the *Red* terminal (3), connect the black wire from the sensor cable to the *Blk* terminal (4), connect the blue wire from the sensor cable to the *Blu* terminal (5), connect the yellow wire from the sensor cable to the *Yel* terminal (6) and connect the brown wire from the sensor cable to the *Brn / Slab* terminal (7). The snow / ice sensor is used by the 667 to measure the slab surface temperature. 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 (4 and 7). The slab sensor is used by the 667 to measure the slab temperature.

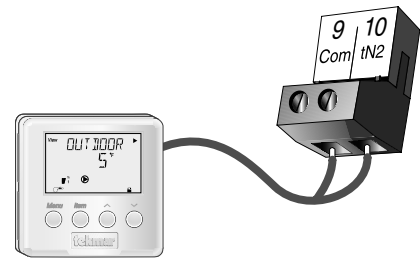
Note: Proper sensor placement is critical for correct operation of the 667 control. The slab sensor must be installed 1/2 way between the heating pipes and 1" (25 mm) below the surface of the slab. Although the sensor can be installed directly into the slab, we recommend that the sensor be installed 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 (9) on the 667. Connect the tN2 terminal from the appropriate tN2 device to the tN2 terminal (10) on the 667.

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

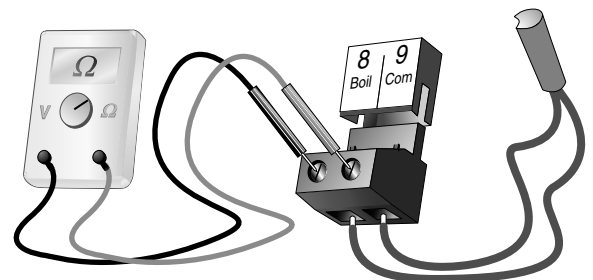
Each terminal block must be unplugged from its header on the control before power is applied for testing. To remove the terminal block, pull straight down from the control.

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.

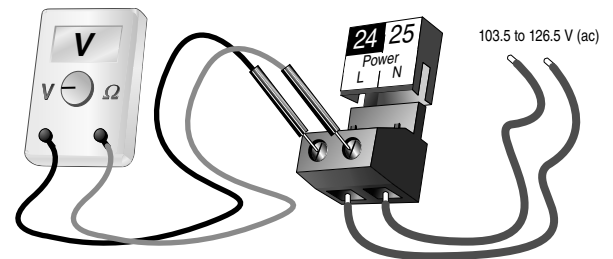
⚠ Test The Sensors

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

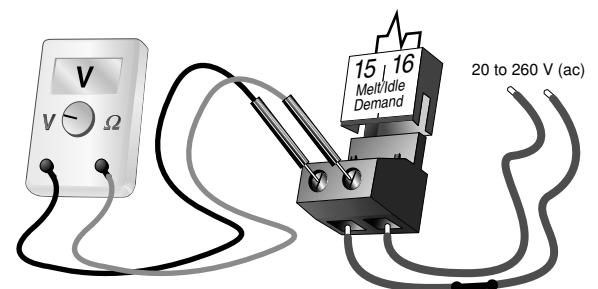
Make sure exposed wires and bare terminals are not in contact with other wires or grounded surfaces. Turn on the power and measure the voltage between the *Power L* and *Power N* terminals (24 and 25) using an AC voltmeter, the reading should be between 103.5 and 126.5 V (ac).



⚠ Test The Powered Inputs

Melt / Idle Demand

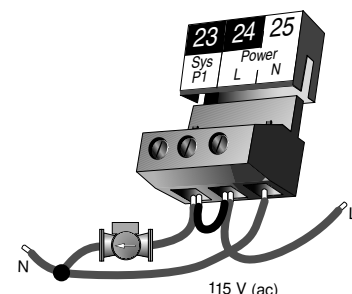
If a Melt / Idle demand is used, measure the voltage between the *Melt / Idle Demand* terminals (15 and 16). When the melting or idling device calls for heat, you should measure between 20 and 260 V (ac) at the terminals. When the melting or idling device is off, you should measure less than 5 V (ac).



⚠ Test The Outputs

System Pump (Sys P1)

If a system pump is connected to the *Sys P1* terminal (23), make sure that power to the terminal block is off and install a jumper between the *Sys P1* and *Power L* terminals (23 and 24). When power is applied to the *Power L* and *Power N* terminals (24 and 25), 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.



System Pump (System Pmp 2)

If a pump is connected to the *System Pmp 2* terminals (17 and 18), make sure power to the pump circuit is off and install a jumper between the *System Pmp 2* terminals (17 and 18). When the circuit is powered up, the pump should turn on. If no response occurs, check the wiring between the terminal and the 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.

Boiler

If the boiler circuit is connected to the *Boiler* terminals (19 and 20), make sure power to the boiler circuit is off, and install a jumper between the terminals. When the boiler circuit is powered up, the boiler should fire. If the boiler does not turn on, refer to any installation or troubleshooting information supplied with the boiler. (The boiler may have a flow switch that prevents firing until the boiler pump is running). If the boiler operates properly, disconnect the power and remove the jumper.

Melting

If a device is connected to the *Melting* terminals (21 and 22), 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.

Variable Speed Injection Pump

If a variable speed injection pump circuit is connected to the *Var* and *Com* terminals (1 and 2), make sure the power to the terminal block is off and install a jumper between the *Var* and *Com* terminals (1 and 2). When the variable speed pump circuit is powered up, the variable speed pump should operate at full speed. If the pump does not operate, check the wiring between the terminal block and the 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.

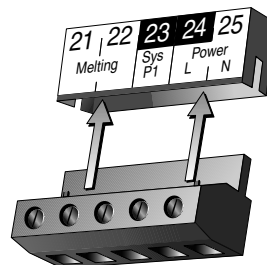
Connecting The Control

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.



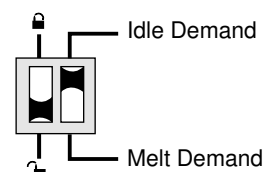
Cleaning

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 an 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.

If a DIP switch is changed while the control is powered up, the control responds to the change in setting by returning the display to the VIEW menu. This is true for all the DIP switches except for the Lock / Unlock DIP switch.



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 (15 and 16) are used for. When the DIP switch is set to the Melt Demand position, the *Melt / Idle Demand* terminals (15 and 16) 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 (15 and 16) are used to force the snow melting system into Idling mode.

Access Levels

The tekmar Snow Detector and Melting Control 667 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.



Item Field	Access Level					Description	Range
	Section	LTD	USER	INST	ADV		
OUT DOOR		•	•	•	•	Outdoor Current outdoor air temperature as measured by the outdoor sensor.	-67 to 149°F (-55 to 65°C)
SLAB TRG	E1		•	•		Slab Target Slab sensor target temperature.	---, 20 to 110°F (---, -7 to 43°C)
SLAB	E1		•	•	•	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
MIX TRG	C			•		Mix Target The current mix target temperature as calculated by the control.	---, -25 to 248°F (---, -32 to 120°C)
MIX SUP	B1		•	•	•	Mix Supply Current mixed supply water temperature as measured by the mixing supply sensor.	-31 to 266°F (-35 to 130°C)
MIX RET	B1		•	•	•	Mix Return Current mixed return water temperature as measured by the mixing return sensor. Mix Ret Sensor present	-58 to 167°F (-50 to 75°C)
ΔT	B1		•	•		ΔT Current mixed ΔT difference between the mixed supply sensor and the mixed return sensor. ΔT MAX ≠ OFF	-85 to 170°F (-47 to 94°C)
Boil SUP	A C1		•	•	•	Boil Supply Current boiler supply water temperature as measured by the boiler sensor. Boil SENS = SUP	-31 to 266°F (-35 to 130°C)
Boil RET	A C2	•	•	•	•	Boil Return Current boiler return water temperature as measured by the boiler sensor. Boil SENS = RET	-31 to 266°F (-35 to 130°C)

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	E1			•		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	
SENSITVITY	D1		•	•	•	Sensitivity Sensitivity of water detection of the Snow / Ice Sensor 090. 090 is present	AUTO, 20 to 80% Default = AUTO	
MELTING	E1		•	•	•	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	F1			•	•	Idling The desired slab surface temperature of the Idling mode.	OFF, 20 to 95°F (OFF, -7 to 35°C) Default = OFF	
TMPLY IDL	A			•		Temporary Idle Time for which the temporary idle is active.	OFF, 0:30 to 40:00 hr Default = OFF	
WWSD	B			•	•	WWSD Warm Weather Shut Down. Slab must exceed 34°F to enter WWSD.	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.	-30 to 50°F, OFF (-34 to 10°C) Default = 10°F (-12°C)	
MIX MAX	A			•	•	Mix Maximum The maximum supply water temperature for the mixing system.	80 to 210°F, OFF (27 to 99°C, OFF) Default = 150°F (66°C)	
Boil SENS	C			•	•	Boiler Sensor The location of the boiler sensor. This affects operation of the <i>Boiler</i> contact.	SUP, RET, NONE Default = SUP	
ΔT MAX	B1			•	•	ΔT Maximum The maximum ΔT for the snow melting system.	10 to 70°F, OFF (5 to 39°C, OFF) Default = OFF	

667 **Adjust** Menu (2 of 2)

Item Field	Access Level				Description	Range	Actual Setting
	Section	LTD	USER	INST			
DIFF	C1				Differential The differential for the snow melting system. Boil SENS = SUP	AUTO, 2 to 42°F (AUTO, 1 to 23°C) Default = AUTO	
Boil MIN	A C1				Boiler Minimum The minimum temperature allowed for the boiler target temperature. Boil SENS ≠ NONE	OFF, 80 to 180°F (OFF, 27 to 82°C) Default = 140° (60°C)	
FIRE DLY	C1				Fire Delay The time delay the control can expect between the time the <i>Boiler</i> contact closes and the boiler fires. Boil SENS = SUP	0:00 to 3:00 minutes Default = 0:10 min	
Boil MASS	C1				Boiler Mass The thermal mass characteristics of the boiler that is being used. Boil SENS = SUP	LITE, MED, HEVY Default = MED	
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	

667 **Monitor** Menu (1 of 3)

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)

Item Field	Access Level				Description	Range
	LTD	USER	INST	ADV		
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)
MIX HI		•	•		Mix High The highest recorded temperature at the mixing supply sensor since this item was last cleared.	-25 to 230°F (-32 to 110°C)
MIX LO		•	•		Mix Low The lowest recorded temperature at the mixing supply sensor since this item was last cleared.	-25 to 230°F (-32 to 110°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
ΔT HOURS		•	•		ΔT HOURS The amount of energy that has been used.	0 to 9999°F hr (0 to 9999°C hr)
Boil FIRE		•	•		Boil Fire The total number of boiler running hours since this item was last cleared. This total time does not include the FIRE DLY time set in the ADJUST menu. Boil SENS = SUP	0 to 9999 hr
Boil CYC			•		Boil 1 Cycle The total number of firing cycles since this item was last cleared. This item can be used in conjunction with the Boil Fire item to determine the average cycle length. If the cycle length is too short, a larger differential will allow for a longer cycle length. Boil SENS = SUP	0 to 9999 hr
Boil HI		•	•		Boil High The highest temperature recorded at the boiler sensor since this item was last cleared. Boil SENS ≠ NONE	-25 to 230°F (-32 to 110°C)
Boil LO		•	•		Boil Low The lowest temperature recorded at the boiler sensor since this item was last cleared. Boil SENS ≠ NONE	-25 to 230°F (-32 to 110°C)
NO HEAT			•		No Heat This item is an adjustable warning. If a 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

667 Monitor Menu (3 of 3)

Item Field	Access Level				Description	Range
	LTD	USER	INST	ADV		
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

667 Schd (Schedule) Menu (1 of 1)

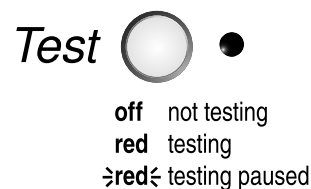
Item Field	Access Level				Description	Range
	LTD	USER	INST	ADV		
OVERRI IE	•	•	•	•	Override The setback override that is in effect for the snow melting system.	NONE, AWAY (Ovr) Default = NONE

667 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 = Unlock	ADV, INST, USER, LTD Default = INST

Testing the Control

The Snow Detector & Melting Control 667 has a built-in test routine which is used to test the main control functions. The 667 continually monitors the sensors and displays an error message whenever a fault is found. See the following pages for a list of the 667'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.

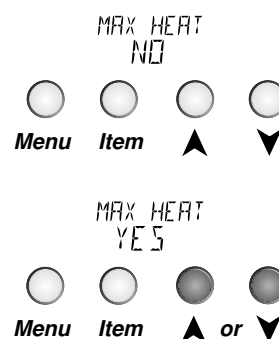
During the test routine, the test sequence is paused by pressing the **Test** button. While paused, the control displays the testing step as well as the word PAUS. If the **Test** button is not pressed again for 5 minutes while the test sequence is paused, the control exits the entire test routine. If 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 injection pump is ramped up over 10 seconds.
- Step 2 The injection pump is ramped down over 10 seconds
- Step 3 The *System Pmp 2* contact is turned on for 10 seconds. After 10 seconds, the *System Pmp 2* contact is turned off.
- Step 4 The *System Pump* contact (*Sys P1*) is turned on for 10 seconds.
- Step 5 The *Boiler* contact is turned on for 10 seconds. After 10 seconds, the *Boiler* contact and *Sys P1* contacts are shut off.
- Step 6 The *Melting* relay is turned on for 10 seconds.

MAX HEAT

The Snow Detector & Melting Control 667 has a function called MAX HEAT. In this mode, the 667 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 desired output from the mixing device.
- 3) Set the desired output of the mixing device 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.
tN 2 TYPE	An incorrect device has been connected to the <i>tekmar Net™ tN2</i> 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 <i>tN2</i> terminal and a <i>Com</i> terminal on the control. Either the wires leading to the <i>tN2</i> 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.
OUTDOOR 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.
OUTDOOR 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.
MIX SUP SHRT	The control is no longer able to read the mixing supply sensor due to a short circuit. In this case, the control does not operate the snow melting system. 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.

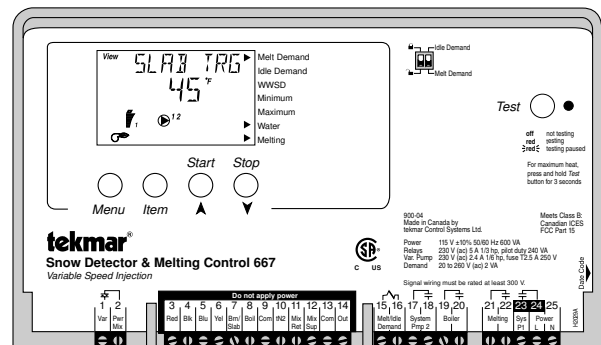
Error Displayed	Description of Error
MIX SUP OPEN	The control is no longer able to read the mixing supply sensor due to an open circuit. In this case, the control does not operate the snow melting system. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button.
MIX RET SHRT	The control is no longer able to read the mixing return sensor due to a short circuit. If the ΔT Max item is set to <i>Off</i> , the control will continue to operate as if the as if the mixing return sensor was not connected to the control. If the ΔT Max item is not set to <i>Off</i> , the control does not operate the snow melting system. 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.
MIX RET OPEN	The control is no longer able to read the mixing return sensor due to an open circuit. If the ΔT Max item is set to <i>Off</i> , the control will continue to operate as if the mixing return sensor was not connected to the control. If the ΔT Max item is not set to <i>Off</i> , the control does not operate the snow melting system. 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.
Boil SENS SHRT	The control is no longer able to read the boiler sensor due to a short circuit. If the Boil Min item is set to <i>Off</i> , the control operates the <i>Boiler</i> contact when the mixing device starts to operate. If the Boil Min is not set to <i>off</i> , the control does not operate the snow melting system. 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.
Boil SENS OPEN	The control is no longer able to read the boiler sensor due to an open circuit. If the Boil Min item is set to <i>Off</i> , the control operates the <i>Boiler</i> contact when the mixing device starts to operate. If the Boil MIN is not set to <i>Off</i> , the control does not operate the snow melting system. Locate and repair the problem as described in the Data Brochure D 070. If the boiler sensor was deliberately not installed, set the Boil Sens item to <i>None</i> . 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 of due to a short circuit. In this case, if the control is currently in the Melting mode, the control will target a fixed mixing water temperature until the melting cycle is finished. 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 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 target a fixed mixing water temperature until the melting cycle is finished. 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.
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 (black and yellow wires, terminals 4 and 6), 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 (black and yellow wires, terminals 4 and 6), 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 (black and blue wires, terminals 4 and 5) 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.

Error Displayed	Description of Error
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 (black and blue wires, terminals 4 and 5) 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 (red and black wires, terminals 3 and 4) 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 667 Variable Speed Injection

Literature	— D 667, A 667's, D 001, D 070, E 021, U 667.
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, meets ICES & FCC regulations for EMI/RFI.
Ambient conditions	— Indoor use only, 32 to 104°F (0 to 40°C), < 90% RH non-condensing.
Power Supply	— 115 V ±10% 50/60 Hz 600 VA
Relays	— 230 V (ac) 5 A 1/3 hp, pilot duty 240 VA
Variable Pump	— 230 V (ac) 2.4 A 1/6 hp, fuse T2.5 A 250 V
Demand	— 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 and 3 of Universal Sensor 071
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.*

The tekmar Limited Warranty to the Purchaser on the Products sold hereunder is a manufacturer's pass-through warranty which the Purchaser is authorized to pass through to its customers. Under the Limited Warranty, each tekmar Product is warranted against defects in workmanship and materials if the Product is installed and used in compliance with tekmar's instructions, ordinary wear and tear excepted. The pass-through warranty period is for a period of twenty-four (24) months from the production date if the Product is not installed during that period, or twelve (12) months from the documented date of installation if installed within twenty-four (24) months from the production date.

The liability of tekmar under the Limited Warranty shall be limited to, at tekmar's sole discretion: the cost of parts and labor provided by tekmar to repair defects in materials and/or workmanship of the defective product; or to the exchange of the defective product for a warranty replacement product; or to the granting of credit limited to the original cost of the defective product, and such repair, exchange or credit shall be the sole remedy available from tekmar, and, without limiting the foregoing in any way, tekmar is not responsible, in contract, tort or strict product liability, for any other losses, costs, expenses, inconveniences, or damages, whether direct, indirect, special, secondary, incidental or consequential, arising from ownership or use of the product, or from defects in workmanship or materials, including any liability for fundamental breach of contract.

The pass-through Limited Warranty applies only to those defective Products returned to tekmar during the warranty period. This Limited Warranty does not cover the cost of the parts or labor to remove or transport the defective Product, or to reinstall the repaired or replacement Product, all such costs and expenses being subject to Purchaser's agreement and warranty with its customers.

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.

The pass-through Limited Warranty does not apply if the returned Product has been damaged by negligence by persons other than tekmar, accident, fire, Act of God, abuse or misuse; or has been damaged by modifications, alterations or attachments made subsequent to purchase which have not been authorized by tekmar; or if the Product was not installed in compliance with tekmar's instructions and/or the local codes and ordinances; or if due to defective installation of the Product; or if the Product was not used in compliance with tekmar's instructions.

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.

Product Warranty Return Procedure All Products that are believed to have defects in workmanship or materials must be returned, together with a written description of the defect, to the tekmar Representative assigned to the territory in which such Product is located. If tekmar receives an inquiry from someone other than a tekmar Representative, including an inquiry from Purchaser (if not a tekmar Representative) or Purchaser's customers, regarding a potential warranty claim, tekmar's sole obligation shall be to provide the address and other contact information regarding the appropriate Representative.



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