tekmar® - Data Brochure

Snow Detector & Melting Control 665

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

Additional features include:

- Manual Override
- Warm Weather Shut Down (WWSD)
- Cold Weather Cut Out (CWCO)
- Remote display and adjustment capabilities.

- Test sequence to ensure proper component operation.
- Pump and valve exercising.
- CSA C US Certified (approved to applicable UL standards)
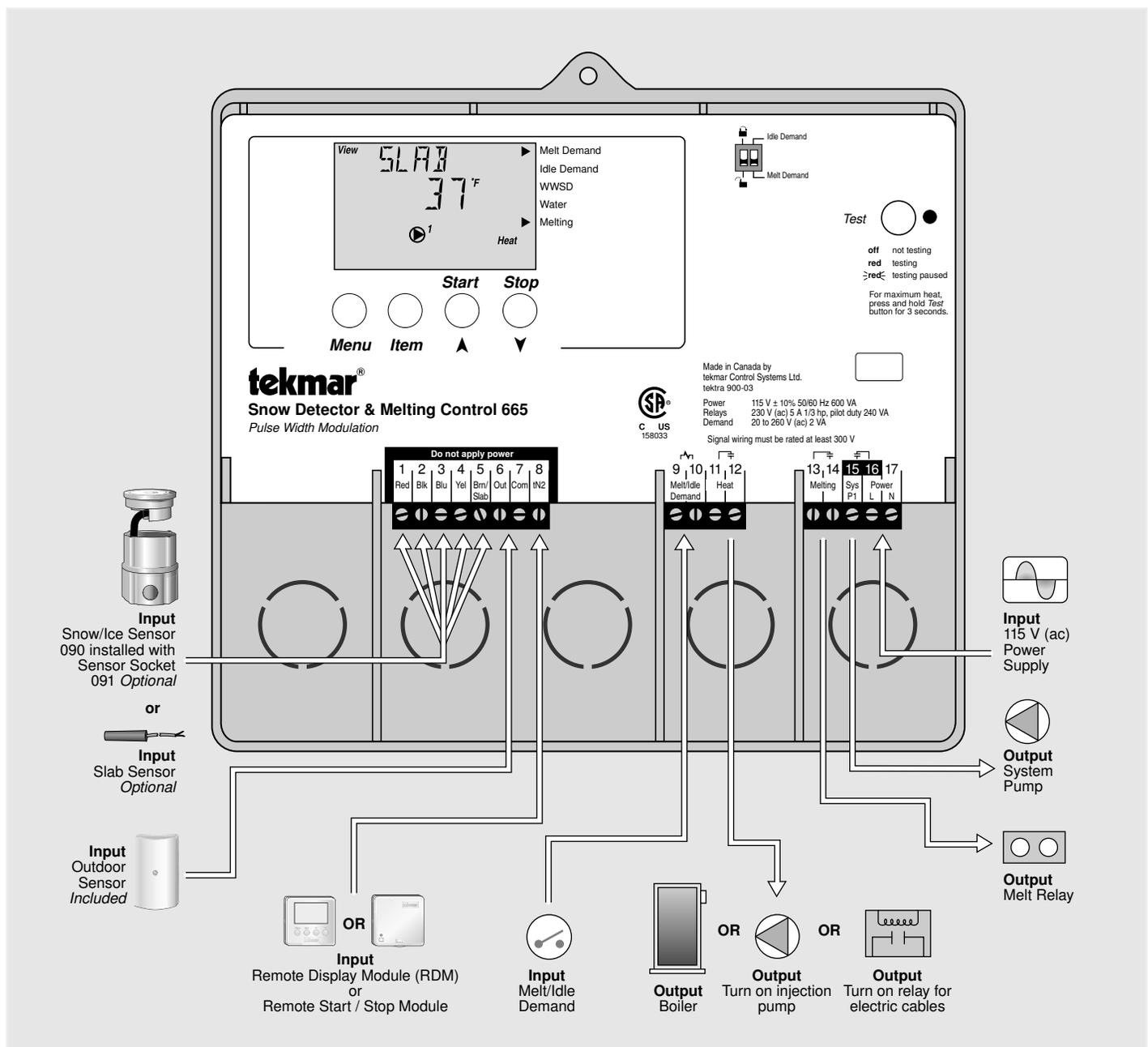
How To Use The Data Brochure

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

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

Table Of Contents

Reference Material: Essay E 021:   Mixing Methods and Sizing of Variable Speed Injection Pumps

User Interface

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

Menu

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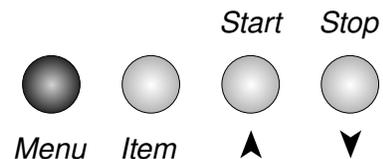
Item

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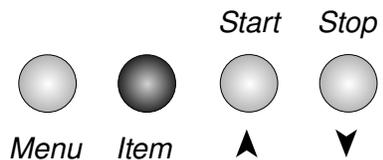
Adjust

To make an adjustment to a setting in the control, begin by selecting the appropriate menu using the ***Menu*** button. Then select the desired item using the ***Item*** button. Finally, use the ▲ and / or ▼ button to make the adjustment.
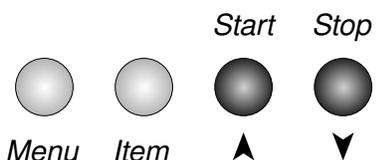
Additional information can be gained by observing the Status field of the LCD. The status field will indicate which of the control's outputs are currently active. Most symbols in the status field are only visible when the View Menu is selected.

Display

Item Field
Displays an abbreviated name of the selected item

Number Field
Displays the current value of the selected item

Menu Field
Displays the current menu

Status Field
Displays the current status of the control's inputs, outputs and operation

View
Adjust
Monitor

Schd
Misc

°F °C
min hr
sec

Ovr

Heat

Melt Demand
Idle Demand
WWSD
Water
Melting

Start   **Stop**

Menu   **Item**   ▲   ▼

Buttons
Selects Menus, Items and adjusts settings

Symbol Description

▶①¹	**Pump** Displays when the system pump is operating.	▶	**Pointer** Displays the control operation as indicated by the text.
Ovr	**Override** Displays when the control is in override mode.	°F, °C, sec, min, hr	**°F, °C, sec, min, hr** Units of measurement.
⚠	**Warning** Displays when an error exists or when a limit has been reached.	Heat	**Heat** Displays when the Heat relay is turned on.
🔓	**Lock / Unlock** Displays whether the access levels are locked or unlocked.		

Definitions

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

⚠ - Warning Symbol: Indicates presence of hazards which can cause severe personal injury, death or substantial property damage if ignored.

▢ - Double insulated

INSTALLATION CATEGORY II - Local level, appliances

Sequence of Operation

Section A General Operation Page 4	Section B Snow Melting Page 4 - 5	Section C Melting Enable/ Disable Page 6 - 7	Section D Melting Operation Page 8	Section E Idling Operation Page 9

Section A: General Operation

POWERING UP THE CONTROL

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

EXERCISING (EXERCISE)

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

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

Section B: Snow Melting

Section B1 General Snow Melting

Section B1: General Snow Melting

WARM WEATHER SHUT DOWN (WWSD)

There is a warm weather shut down for the system. When both the slab temperature of a zone and the outdoor temperature exceed the zone's melting temperature by more than 2°F (1°C), the zone enters into WWSD. In WWSD, the zone is shut down in order to conserve energy. While the zone is in WWSD, the word WWSD is displayed in the STATUS item in the View menu. The 665 turns on the WWSD pointer in the display.

COLD WEATHER CUT OUT (CWCO)

Maintaining the zone 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 the system. To view the current status of the system, select the STATUS item in the View menu.

- **STRT** — The word STRT is displayed after the snow melting system has been manually enabled. It is displayed until the zone reaches its slab target temperature. If the zone is at its slab target temperature, STRT is displayed for five seconds after the snow melting system has started operation. This is to verify that the control has entered into the melting mode.

- **STOP** — The word STOP is displayed for five seconds after the snow melting system has been manually disabled. The word STOP is also displayed if either a Remote Start / Stop Module 039, Remote Display Module 040 or the Stop button 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.

- **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 control is in Warm Weather Shut Down, WWSD is displayed.

- **CWCO** — When the control is in Cold Weather Cut Out, CWCO is displayed.

SNOW MELTING OVERRIDE

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

SYSTEM PUMP OPERATION (Sys P1)

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

HEAT CONTACT OPERATION

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

MELTING CONTACT OPERATION

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

PURGE

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

Section C: Melting Enable / Disable

Section C1: Snow Melting Enable

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 zone 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.

Start / Stop

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.

Start   Stop

External Melt Demand (DIP switch set to Melt Demand)

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

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

24 to 240 V (ac)

Idle Demand

Melt Demand
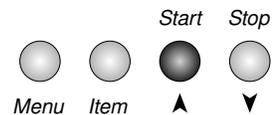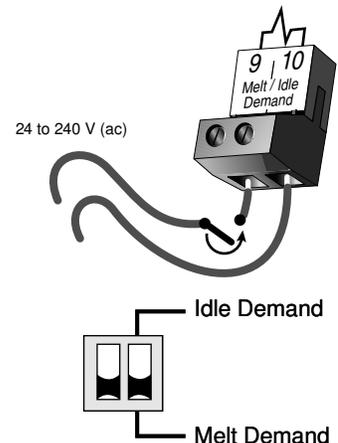
AUTOMATIC MELTING ENABLE (Snow / Ice Sensor 090) ━━━━━━━━

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

Water Detection Sensitivity (SENSTVTY) ━━━━━━━━

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

Section C2: Snow Melting Disable

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

MANUAL MELTING DISABLE ━━━━━━━━

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

Stop Button on the Control ━━━━━━━━

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

Remote Start / Stop Module 039 ━━━━━━━━

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

Remote Display Module 040 ━━━━━━━━

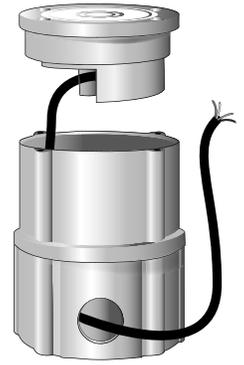A Remote Display Module 040 can be used to stop the snow melting system. The snow melting system is disabled by pressing the ▼ button on the 040 while in the View menu. Once the snow melting system is disabled, the word STOP is displayed for 5 seconds in the STATUS item while in the View menu.

External Idle Demand (DIP switch set to Idle Demand) ━━━━━━━━

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

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

If the snow melting system is placed into idling mode by an external idle demand, then a manual melting enable signal is applied, the idle demand is overridden until either the running time has expired, a stop signal is given, or the external idle demand is removed and reapplied.
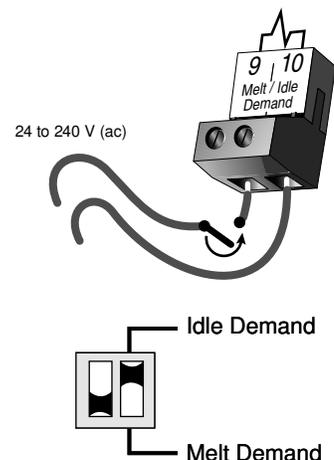
AUTOMATIC MELTING DISABLE (Snow / Ice Sensor 090) ━━━━━━━━

Once the 090 is dry, the *Water* pointer turns off in the LCD. The 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 D1
General Melting
Operation

Section D1: General Melting Operation

In order for the snow melting system to be started, one of the methods described in section C1 must be used. Once a melting enable signal is applied and the zone 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 melting setting in the Adjust menu sets the slab surface temperature. When the zone is melting and its slab temperature is warming up to the slab target temperature, STRT is displayed in the STATUS item while in the View menu. The zone finishes melting when its 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, DET is displayed in the STATUS item of the View menu once the slab temperature reaches slab target temperature. The zone continues to melt until the 090 becomes dry and any additional running time has expired. Once the melting mode is complete, the zone operates in idling mode.

If a manual melting enable signal starts the snow melting system, the running time is displayed in the STATUS item of the View menu and begins counting down once the slab temperature reaches the slab target temperature. The zone 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 zone operates in the idling mode.

SLAB TEMPERATURE CONTROL

The 665 uses a snow / ice sensor or a 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 the slab temperature is the temperature of the slab sensor.

Surface temperature = 35˚F

Core (sensor)
is warmer

Slab Outdoor Reset

Increasing Slab Core Temperature

Decreasing Air Temperature

Slab Surface Temperature is Constant
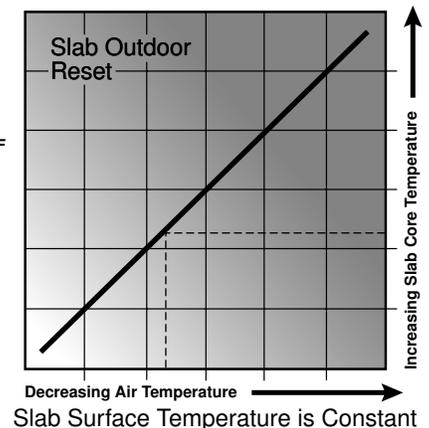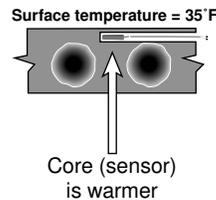
Snow / Ice Sensor 090

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 SLB TRG temperature is determined from the melting setting (MELTING), or idle setting (IDLING) 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 a STATUS item of "---" while in the View menu.

ADDITIONAL MELTING TIME (ADD MELT)

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

Dry
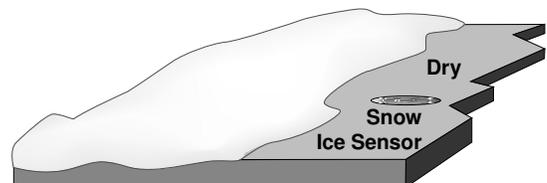
Snow
Ice Sensor

Section E: Idling Operation

Section E1: General Idling Operation

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

Installation

CAUTION

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

STEP ONE ════════ GETTING READY ═══════

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

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

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

STEP TWO ════════ MOUNTING THE BASE ═══════

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

STEP THREE ════════ ROUGH-IN WIRING ═══════

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

- Power must not be applied to any of the wires during the rough-in wiring stage.

- All wires are to be stripped to a length of 3/8 in (9 mm) to ensure proper connection to the control.

- Install the Outdoor Sensor 070 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 10 for very important details on sensor location and installation.

- If a Remote Display Module (RDM) 040 is used, install the RDM according to the installation instructions in the Data Brochure D 040 and run the wiring back to the control.

- If a Remote Start / Stop Module 039 is used, install the module according to the installation instructions in the Data Brochure D 039 and run the wiring back to the control.

- Run wire from other system components (pumps, boiler, etc.) to the control.

- Run wires from the 115 V (ac) power to the control. Use a clean power source with a minimum 15 A circuit to ensure proper operation. Multi-strand 16 AWG wire is recommended for all 115 V (ac) wiring due to its superior flexibility and ease of installation into the terminals.

STEP FOUR ═══════ ELECTRICAL CONNECTIONS TO THE CONTROL ═══════

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

⚠ *Powered Input Connections* ─────────────────────────────────

115 V (ac) Power

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

Melt / Idle Demand

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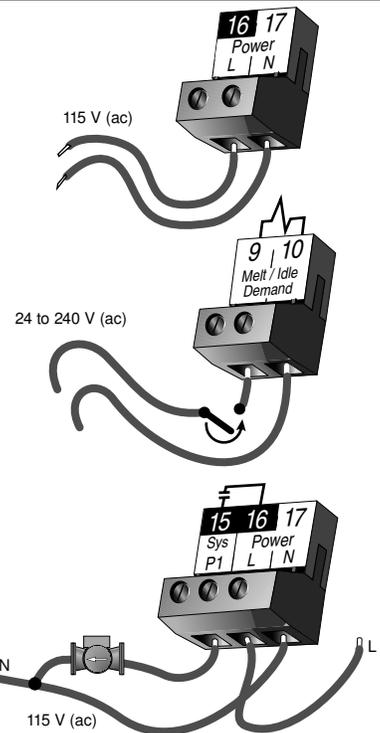
⚠ *Output Connections* ─────────────────────────────────

System Pump Contact (Sys P1)

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

Melting Contact

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

⚠ *Sensor and Unpowered Input Connections* ──────────────────────

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

Outdoor Sensor

Connect the two wires from the Outdoor Sensor 070 to the *Out* and *Com* terminals (6 and 7). The outdoor sensor is used by the 665 to measure the outdoor air temperature.
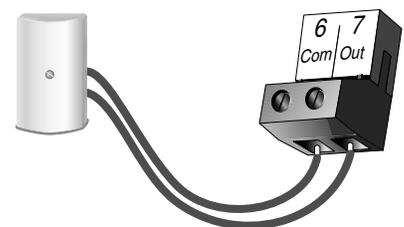
EITHER: Snow / Ice Sensor 090

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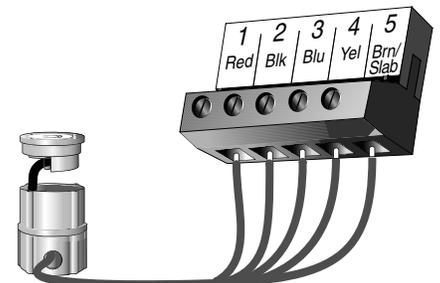
OR: Slab Sensor

If a Snow / Ice Sensor 090 is not used, a slab sensor can be used. If a slab sensor is used, connect the two wires from the slab sensor to the *Blk* and *Brn/Slab* terminals (4 and 7). The slab sensor is used by the 665 to measure the slab temperature of the zone.

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

tekmar Net™ (tN2) Device

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

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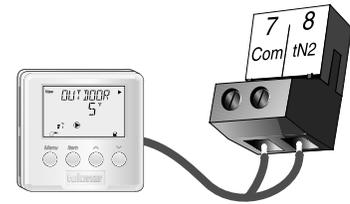
STEP FIVE ━━━━━ TESTING THE WIRING ━━━━━

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

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

A good quality electrical test meter, capable of reading from at least 0 – 300 V (ac) and at least 0 – 2,000,000 Ohms, 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, D079 or D090.
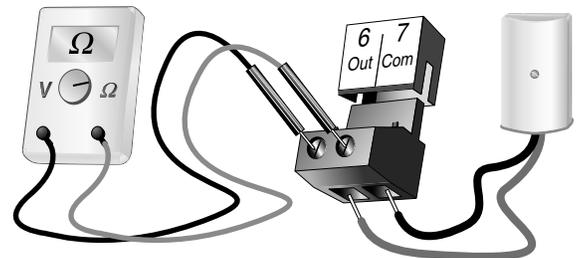
⚠ *Test The Power Supply* ─────────

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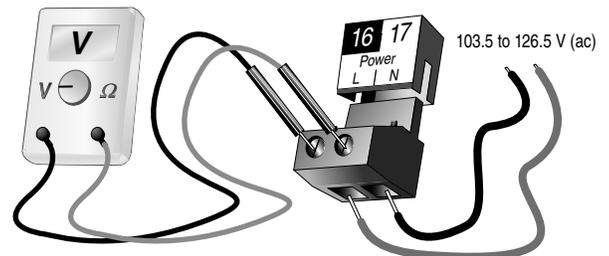
⚠ *Test The Powered Inputs* ─────────

Melt/Idle Demand

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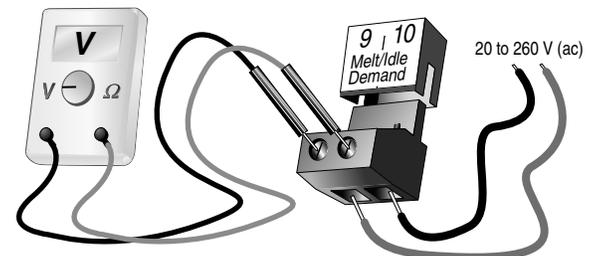
⚠ *Test The Outputs* ─────────

System Pump (Sys P1)

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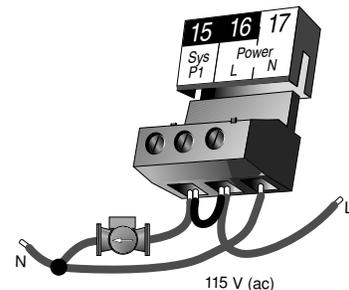
Heat Contact

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

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Melting

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

⚠ *Connecting The Control*

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

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

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

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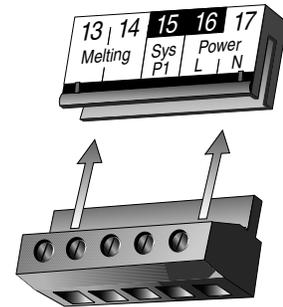
Cleaning

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

DIP Switch Settings

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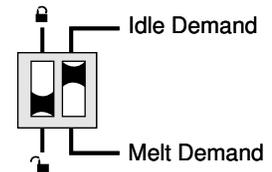
LOCK / UNLOCK (FACTORY SETTING IS UNLOCK)

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

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

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

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

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

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

Access Levels

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

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

665 **View** Menu (1 of 1)

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

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

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

Item Field	Access Level				Description	Range
	LTD	*USER*	*INST*	*ADV*		
⊡UT HI	●	●	●	●	The highest recorded outdoor air temperature since this item was last cleared.	-67 to 149°F (-55 to 65°C)
⊡UT L⊡	●	●	●	●	The lowest recorded outdoor air temperature since this item was last cleared.	-67 to 149°F (-55 to 65°C)
SLAB HI		●	●	●	The highest recorded temperature at the slab sensor since this item was last cleared.	-58 to 167°F (-50 to 75°C)
SLAB L⊡		●	●	●	The lowest recorded temperature at the slab sensor since this item was last cleared.	-58 to 167°F (-50 to 75°C)
SYS PUMP			●	●	The total number of system pump (*Sys P1*) running hours since this item was last cleared.	0 to 9999 hr
HEAT			●	●	The total number of running hours of the *Heat* contact since this item was last cleared.	0 to 9999 hr
HEAT CYC				●	The total number of cycles of the *Heat* contact since this item was last cleared. This item can be used in conjunction with the HEAT item to determine the average cycle length of the heat contact.	0 to 9999 hr
N⊡ HEAT				●	This item is an adjustable warning. If the slab temperature does not reach the slab target temperature within the set time, the control displays a warning message.	1 to 24 hr, OFF Default = OFF
C⊡P				●	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
N⊡N-C⊡P				●	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 C⊡MM				●	The number of times that a communication error has been detected between the control and either an RDM or Remote Start/Stop Module since this item was last cleared. If the wires between the control and the tekmar Net™ tN2 device are run in a noisy electrical environment, this can cause interference in the communication between the control and the tN2 device.	0 to 255

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

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

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

Item Field	Access Level				Description	Range
	LTD	USER	INST	ADV		
UNITS		●	●	●	The units of measure that all of the temperatures are to be displayed in by the control.	°F, °C Default = °F
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	●	●	●	●	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 665 has a built-in test routine which is used to test the main control functions. The 665 continually monitors the sensors and displays an error message whenever a fault is found. See the following pages for a list of the 665's error messages and possible causes. When the **Test** button is pressed, the test light is turned on. The individual outputs and relays are tested in the following test sequence.

Test ◯ ●

off   not testing
red   testing
⋝**red**⋜ testing paused
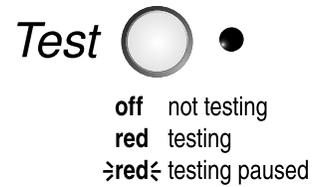
TEST SEQUENCE

Each step in the test sequence lasts 10 seconds.

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

Step 1   The system pump contact (*Sys P1*) is turned on for 10 seconds.

Step 2   The *Heat* contact is turned on for 10 seconds. After 10 seconds, the *Heat* relay and the *Sys P1* relay are turned off.

Step 3   The *Melting* contact is turned on for 10 seconds. After 10 seconds, the melting relay is turned off**.**

MAX HEAT

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

1)   Press and hold the **Test** button for more than 3 seconds. At this point, the control displays the words MAX HEAT and the word NO.

2)   Using the ▲ or ▼ buttons, select the word YES. After 3 seconds, the control flashes the word MANUAL and the number 100. The number represents the % ontime of the Heat relay during each 20 minute cycle.

3)   Set the desired *Heat* relay % ontime by using the ▲ 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.

MAX HEAT
NO

◯   ◯   ◯   ◯
Menu   *Item*   ▲   ▼

MAX HEAT
YES

◯   ◯   ●   ●
Menu   *Item*   ▲ *or* ▼

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 ADJS	The control was unable to read a piece of information stored in the Adjust menu. Because of this, the control was required to load the factory settings into all of the items in the Adjust menu. The control will stop operation until all of the items available in the Adjust menu of the control have been checked by the user or installer. *Note:* Access level must be ADV in order to clear the error.
CTRL ERR MNTR	The control was unable to read a piece of information stored in the Monitor menu. Because of this, the control was required to load the factory settings into all of the items in the Monitor menu. The control will continue to display the error message until all of the items available in the Monitor menu of the control have been checked by the user or installer. *Note:* Access level must be ADV in order to clear the error.
CTRL ERR SCHD	The control was unable to read a piece of information stored in the Schedule menu. Because of this, the control was required to load the factory settings into all of the items in the Schedule menu. The control will continue to display the error message until all of the items available in the Schedule menu of the control have been checked by the user or installer. *Note:* Access level must be ADV in order to clear the error
CTRL ERR MISC	The control was unable to read a piece of information stored in the Miscellaneous menu. Because of this, the control was required to load the factory settings into all of the items in the Miscellaneous menu. The control will continue to display the error message until all of the items available in the Miscellaneous menu of the control have been checked by the user or installer. *Note:* Access level must be ADV in order to clear the error.
tN2 TYPE	An incorrect device has been connected to the tekmar Net™ tN2 input terminal. Once the problem has been corrected, press either the *Menu* or *Item* button to clear the error message from the control.
tN2 SHRT	A short circuit has been read between the tN2 terminal and a Com terminal on the control. Either the wires leading to the tN2 device are shorted or the polarity of the wires is reversed. Determine the cause and remove the short. To clear this error, press either the *Menu* or *Item* button.
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.
SLAB SHRT	The control is no longer able to read the slab sensor due to a short circuit. (Black and Brown wires 2 and 5) In this case, if the control is currently in the Melting mode, the control turns off the *Heat* relay. Locate and repair the problem as described in the Data Brochure D 079 or D 090. To clear the error message from the control after the sensor has been repaired, press either the *Menu* or *Item* button.

Error Displayed	Description of Error
SLAB OPEN	The control is no longer able to read the slab sensor due to an open circuit. (black and brown wires 2 of 5) In this case, if the control is currently in the Melting mode, the control will turn off the *Heat* relay. Locate and repair the problem as described in the Data Brochure D 079 or D 090. To clear the error message from the control after the sensor has been repaired, press either the **Menu** or **Item** button.
YELLOW SHRT	The control is no longer able to read the yellow sensor due to a short circuit. In this case, the control will turn off the heater in the Snow / Ice Sensor 090. Check the 090 yellow temperature sensor (black and yellow wires, terminals 2 & 4), and the wiring from the terminal plug to the sensor. To clear the error message from the control after the sensor has been repaired, press either the **Menu** or **Item** button.
YELLOW OPEN	The control is no longer able to read the yellow sensor due to an open circuit. In this case, the control will turn off the heater in the Snow / Ice Sensor 090. Check the 090 yellow temperature sensor (black and yellow wires, terminals 2 & 4), and the wiring from the terminal plug to the sensor. To clear the error message from the control after the sensor has been repaired, press either the **Menu** or **Item** button.
BLUE SHRT	The control is no longer able to read the water detection circuit due to a short circuit. In this case, if the control is currently in the Melting mode, the control will finish the snow melting cycle. The snow melting system can only be operated using an external melt demand, Remote Display Module 040, Remote Start / Stop Module 039 or the **Start** button on the control. Otherwise, the control will operate as if the Snow / Ice Sensor 090 is dry. Check the 090 water detection circuit (black and blue wires, terminals 2 & 3) according to the Data Brochure D 090. To clear the error message from the control after the error has been repaired, press either the **Menu** or **Item** button.
BLUE OPEN	The control is no longer able to read the water detection circuit due to an open circuit. In this case, if the control is currently in the Melting mode, the control will finish the snow melting cycle. The snow melting system can only be operated using an external melt demand, Remote Display Module 040, Remote Start / Stop Module 039 or the **Start** button on the control. Otherwise, the control will operate as if the Snow / Ice Sensor 090 is dry. Check the 090 water detection circuit (black and blue wires, terminals 2 & 3) according to the Data Brochure D 090. To clear the error message from the control after the error has been repaired, press either the **Menu** or **Item** button.
RED ERR	The control is reading a heater malfunction. In this case, unless the yellow sensor becomes too hot, the heater continues to try to operate. The snow melting system can only be operated using an external melt demand, Remote Display Module 040, Remote Start / Stop Module 039 or the **Start** button on the control. Check the 090 heater circuit (red and black wires, terminals 1 & 2) according to the Data Brochure D 090. Make sure the yellow and brown wires are not reversed. To clear the error message from the control after the error has been repaired, press either the **Menu** or **Item** button.
CTRL ERR HOT	The control's internal sensor is too hot. (Above 160°F (71°C)) In this case, the control will turn off the heater in the Snow / Ice Sensor 090 until the control cools off. To clear the error message from the control after the error has been repaired, press either the **Menu** or **Item** button.
NO HEAT SLAB	This warning message will be displayed if the SLAB temperature does not increase to the SLAB TRG temperature while the system is melting within a set time. The time limit is set using the NO HEAT item in the Monitor menu. To clear this warning, press either the **Menu** or **Item** button.

Snow Detector & Melting Control 665 *Pulse Width Modulation*

Literature	—	D 665, A 665, D 001, D 070, U 665.
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
Demand	—	20 to 260 V (ac) 2 VA
Sensors included	—	NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) ß=3892 Outdoor Sensor 070
Optional devices	—	tekmar type #: 039, 040, 072, 073, 090, 091.

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

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

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

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

tekmar ®
Control Systems

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Printed in Canada. D 665 - 09/02.