



SNOWpro™ 411 Installation Manual



RADIANT FLOORS
COMFORT HEATING

Bringing
comfort
to life



Uponor

SNOWpro™ 411

Installation Manual

is published by Uponor Wirsbo

5925 148th Street West

Apple Valley, MN 55124

(952) 891-2000

© 2003 Uponor Wirsbo

All rights reserved

Second Edition

First Printing July 2002

Printed in the United States of America

TABLE OF CONTENTS

INTRODUCTION

Control Overview2-3
 Navigating the Control 4-5
 Viewing the Status of the System Performance 6-7

INSTALLATION

Step 1 – Checking Contents 9
 Step 2 – The Control Base 10-12
 Step 3 – Rough-in Wiring 13
 Step 4 – Attaching the Control to the Base 14
 Step 5 – Mounting the Sensors 15-18
 Step 6 – Electrical Connections to the Control..... 19-22
 Powered Input Connection 19
 Output Connections 19-20
 Sensor Connections 20-21
 Unpowered Input Connections 21
 Temperature Resistance Chart 22
 Step 7 – Testing the Wiring 23-25
 Test the Sensors 23
 Test the Power Supply 24
 Test the Powered Inputs 24
 Test the Outputs 24-25
 Step 8 – Completing the Installation 26

PROGRAMMING

Step 1 – Programming the Control 28-31
 "Misc" Menu Settings 29
 "Adjust" Menu Settings 30-31
 Step 2 – Test Sequence..... 32-33
 Test Sequence 32
 Max Heat 33

CONTROL FUNCTION OVERVIEW

Section A – General..... 35-37
 Section B – Snow and Ice Melting 38-41
 Section C – Troubleshooting 42-43

APPENDIX

I Variable Speed Injection Mixing 45-47
 II SNOWpro 411 Menu Tree 48
 III Application Drawings 49-51
 IV Error Message Overview 52-56
 V SNOWpro 411 Program Setup 57

Quick Guide

If you are only INSTALLING the SNOWpro™ 411, go to:

INSTALLATION Steps 1-8

If you are only PROGRAMMING the SNOWpro 411, go to:

PROGRAMMING Steps 1-2

If you are TESTING the SNOWpro 411, go to:

INSTALLATION Step 7

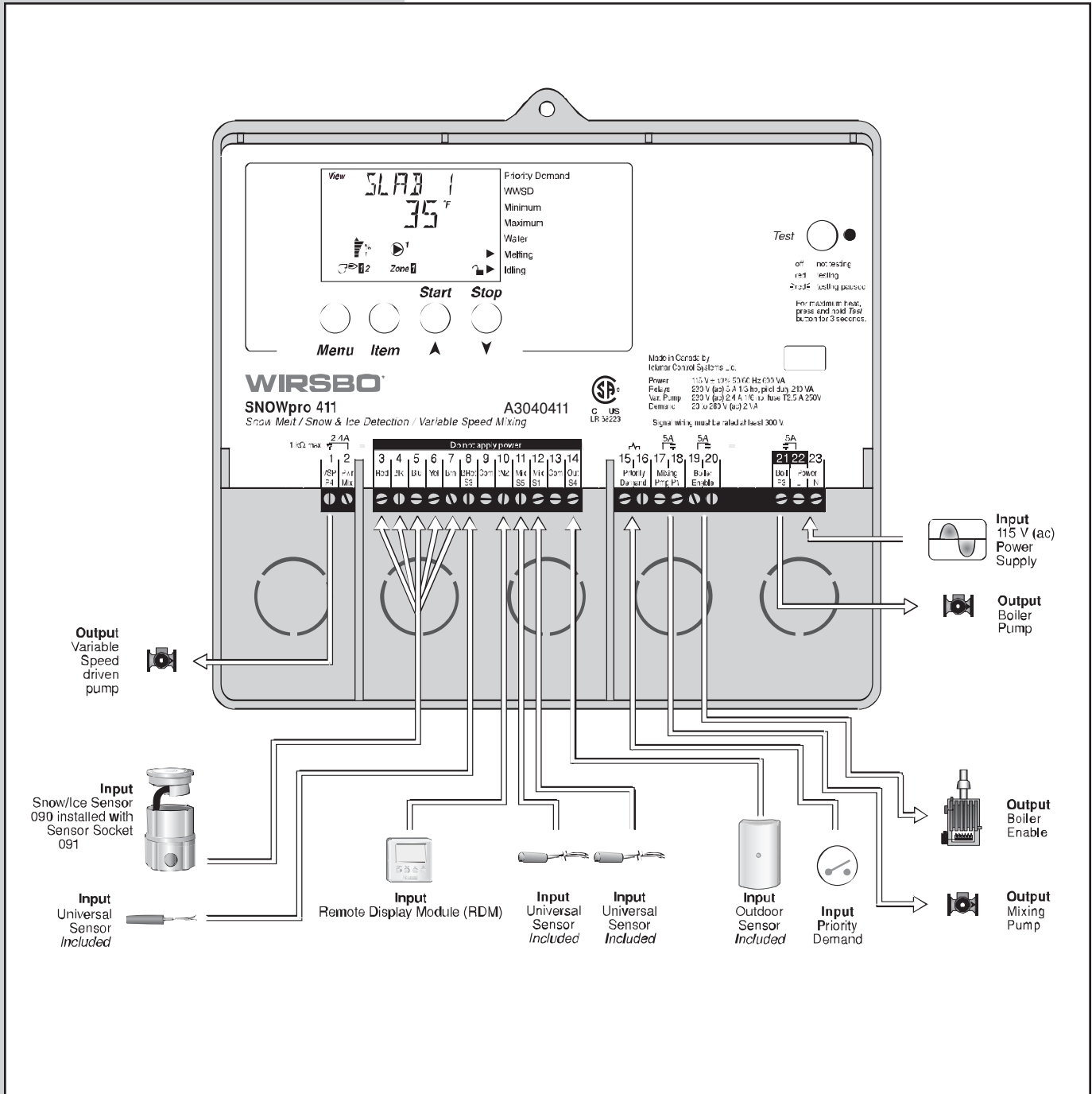
If you are interested in the OPERATION of the SNOWpro 411, go to:

CONTROL FUNCTION OVERVIEW

IMPORTANT NOTE:

If you are not familiar with how the Wirsbo SNOWpro 411 operates, or the theory behind the operation of a snow and ice melting system, it is important you review the Control Function Overview. It will help with understanding the settings you need to perform for the proper function of the control within the hydronic snow and ice melting system.

RADIANT FLOORS
COMFORT HEATING



INTRODUCTION

CONTROL OVERVIEW

The SNOWpro™ 411 is a fully automatic snow and ice melting control that responds to changing weather conditions. It offers one-temperature reset using a variable speed injection mixing device for use in snow and ice melting applications. The 411 can also provide boiler protection from low-return water temperatures which may result in boiler flue gas condensation and buildup. A boiler enable signal (not boiler reset) is used to turn on the boiler and the boiler pump. Included with the SNOWpro 411 is a Wirsbo Snow and Ice Detector for totally automatic snow and ice melting system control. Together, they also protect the slab from thermal shock and control maximum fluid temperature to the snow and ice melting system.



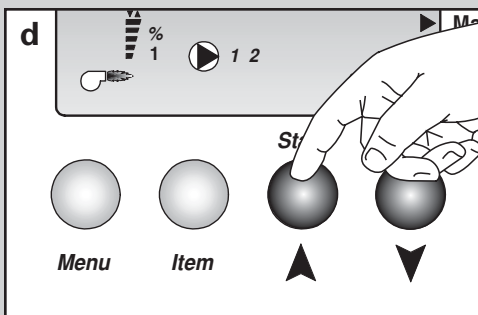
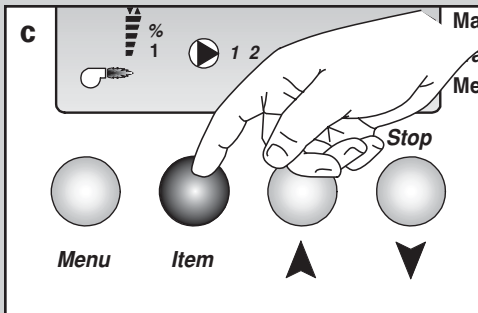
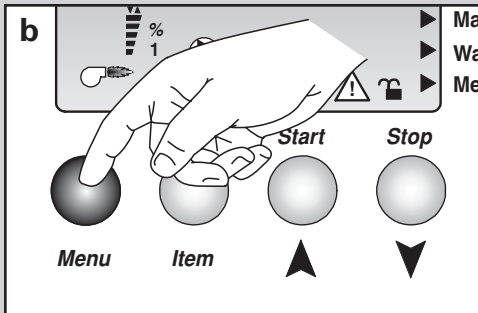
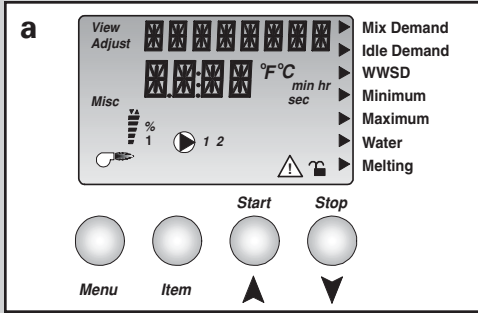
INTRODUCTION

NAVIGATING THE CONTROL

The SNOWpro 411 (also referred to as "control") has a liquid crystal display (LCD) that lets users set up the operation of the system. The SNOWpro 411 has four push buttons for selecting and adjusting settings.

(See fig. a.)

Note: It is recommended that the user record control settings (for later review) on the Program Setup Sheet provided in Appendix V.



Menu (See fig. b.)

- All items displayed by the control are organized into various menus.
- Menus are listed on the left 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.
- Within specific menu selections, a group of items can be viewed and selected.

Item (See fig. c.)

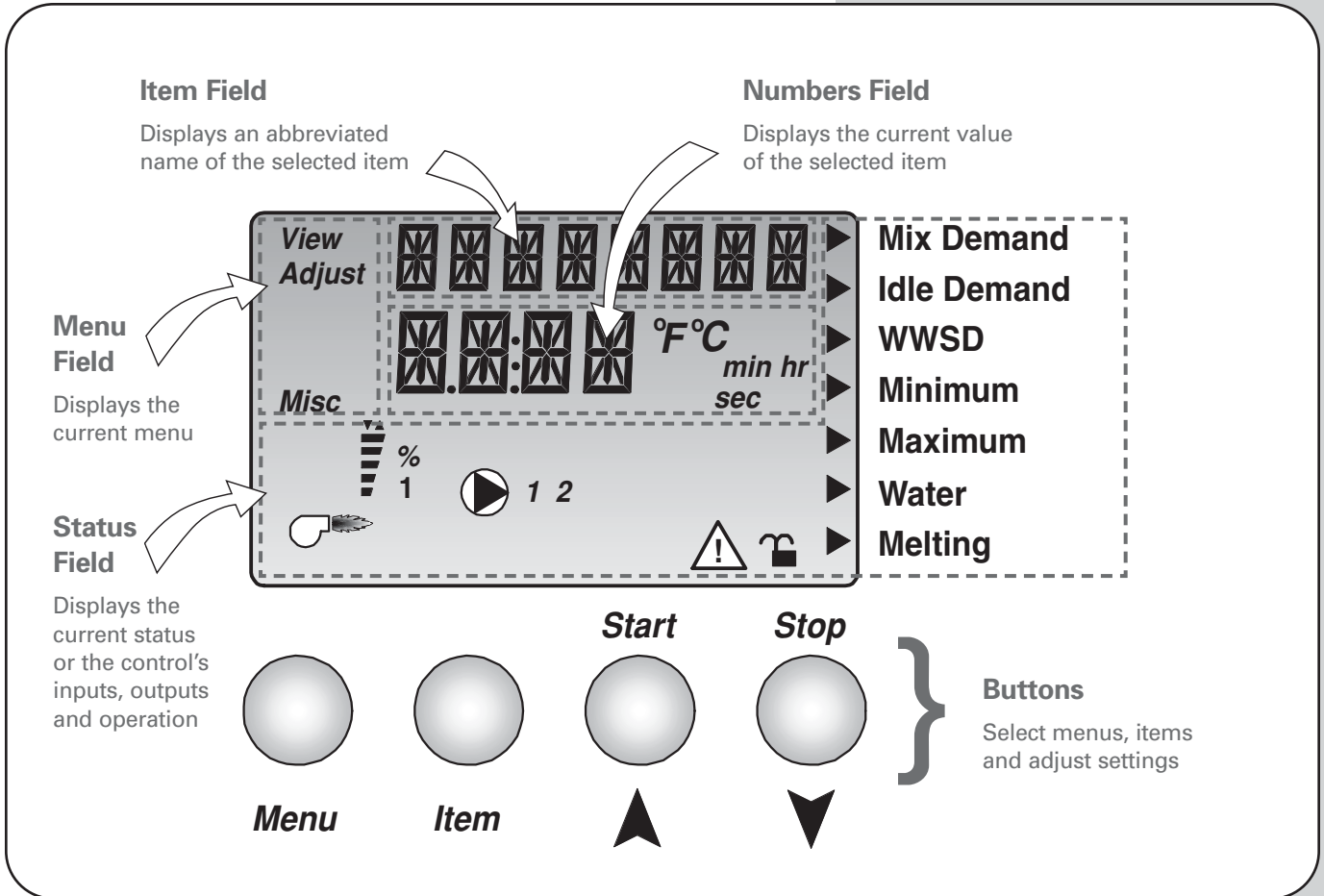
- The abbreviated name of the selected item will be displayed in the item field of the display.
- To view the next available item, press and release the Item button.
- Once you have reached the last available item in a menu, press and release the Item button to return the display to the first item in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

Adjustments (See fig. d.)







- To make an adjustment to a control setting, first select the appropriate menu with the Menu button.
- Select the item you want using the Item button.
- Use the up or down button to make the change.

Note: You can get more information by viewing the status field of the LCD. The status field shows which of the control's outputs are active. Most symbols in the status field can only be seen when the View Menu is selected.

Display



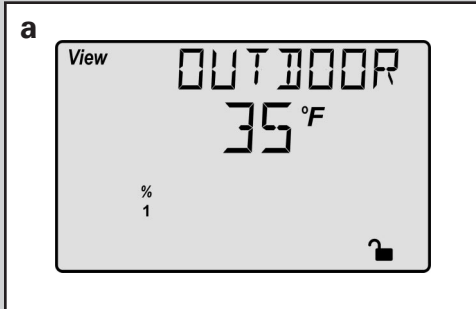
Symbol Description

<p>Pointer</p> <p>Displays the control operation as indicated by the text</p> 	<p>Pump</p> <p>Indicates specific pump operation 1 - boiler pump (P3) 2 - mixing pump (P1)</p> 	<p>Lock/Unlock</p> <p>Displays when the access levels are locked or unlocked</p> 
<p>Mixing Device Output Scale</p> <p>Shows output of injection pump. Arrows show whether the output is increasing or decreasing</p> 	<p>Units of Measurement</p> <p>°F, °C, min, hr, sec</p>	
<p>Burner</p> <p>Displays when the boiler relay is turned on</p> 	<p>Warning</p> <p>Displays when an error exists or when a limit has been reached</p> 	

INTRODUCTION

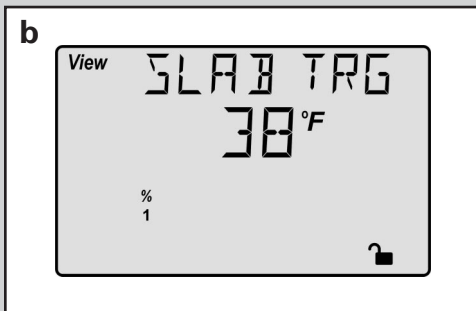
VIEWING THE STATUS OF THE SYSTEM PERFORMANCE

- The View Menu is available for viewing the current status of the system performance.
- By selecting the View Menu, and then pushing the item button, you can scroll through the available menu items showing the current settings and temperatures in the system.



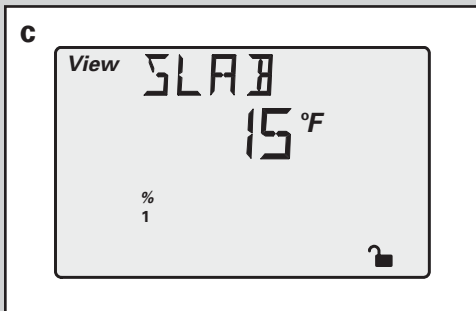
OUTDOOR (See fig. a.)

Shows the actual outdoor temperature as read from the outdoor sensor (S4) location.



SLAB TRG (See fig. b.)

Shows temperature in which the system is targeting to achieve based on reset temperature and whether the system is in melting or idle.

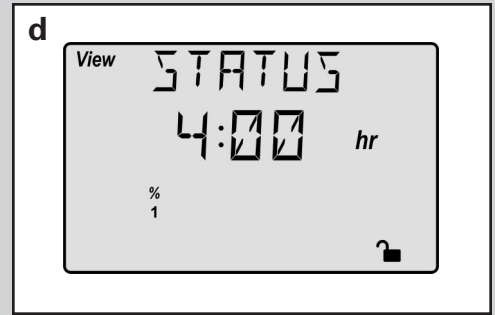


SLAB (See fig. c.)

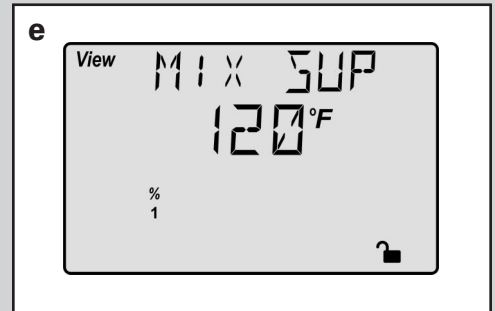
Shows the current slab temperature as measured by the Snow and Ice Detector.

STATUS (See fig. d.)

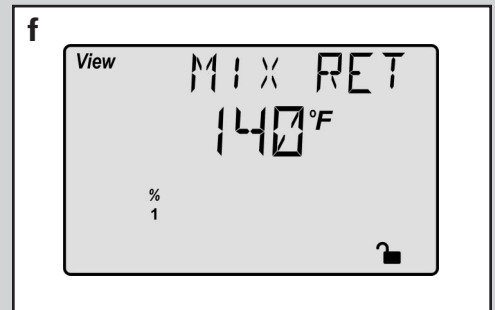
Shows the operating status of the snow/ice melt system. Refer to Control Function Overview on **page 38** for detailed information.


MIX SUP (See fig. e.)

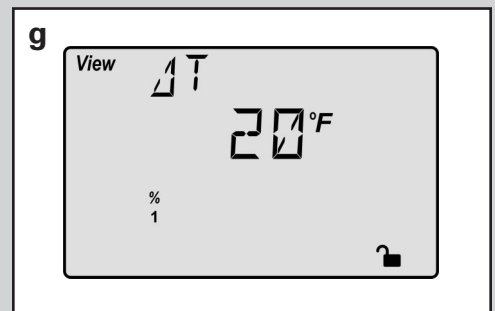
Shows the current supply fluid temperature to the snow and ice melting system.


MIX RET (See fig. f.)

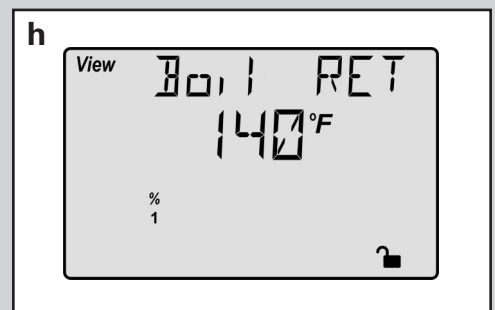
Shows the current return fluid temperature from the snow/ice melt system.


 ΔT (See fig. g.)

Shows the current differential temperature between the supply and return fluid temperatures of the snow and ice melting system.


Boil RET (See fig. h.)

Shows the current return fluid temperature to the boiler.



INSTALLATION

TABLE OF CONTENTS

Step 1 – Checking Contents	9
Step 2 – The Control Base	10-12
Step 3 – Rough-in Wiring.....	13
Step 4 – Attaching the Control to the Base	14
Step 5 – Mounting the Sensors	15-18
Step 6 – Electrical Connections to the Control.....	19-22
Powered Input Connection	19
Output Connections	19-20
Sensor Connections	20-21
Unpowered Input Connections	21
Temperature Resistance Chart	22
Step 7 – Testing the Wiring	23-25
Test the Sensors	23
Test the Power Supply	24
Test the Powered Inputs	24
Test the Outputs	24-25
Step 8 – Completing the Installation	26

INSTALLATION - STEP 1

CHECKING CONTENTS

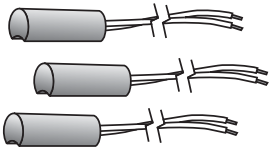
Check the contents of this package.
The Wirsbo® SNOWpro 411 should have:



SNOWpro 411
(A3040411)



Outdoor Sensor
(A3060070)



Three Universal Sensors
(A3060071)



Snow & Ice Detector
(A3040090) + (A3040091)



Product Manual

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

Control Optional Components (sold separately)



Remote Display
(A3040040)

CAUTIONS AND DISCLAIMERS

Failure to install and/or operate this control properly could result in:

- **Damage to the equipment**
- **Personal injury**
- **Property damage**

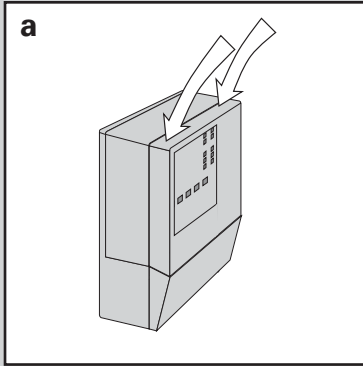
It is up to you to make sure this control is installed safely in a way that meets all codes and standards that apply. Do not use this electronic control as a primary limit control. Other controls that are meant to be used and certified to be used as safety limits must be placed into the control circuit.

Carefully read the Control Overview (page 3) to make sure you have chosen the proper control for your application.



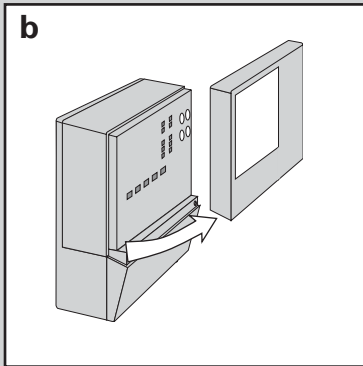
Warning Symbol: Indicates presence of hazards which can cause severe personal injury, death or substantial property damage if ignored

INSTALLATION - STEP 2 THE CONTROL BASE

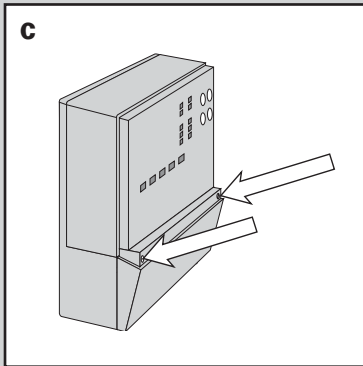


Removing the Control from the Base

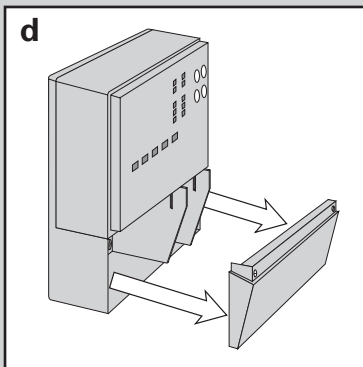
Press down at the fingertip grips on top of the front cover and pull out and down. (See fig. a.)



Lift the front cover up and away from the control. (See fig. b.)

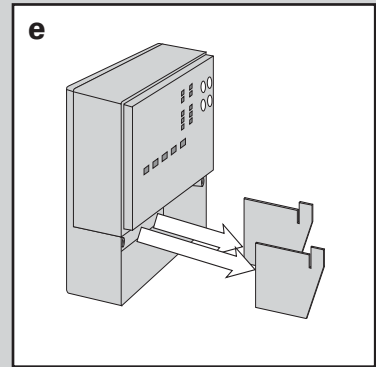


Loosen the screws at the front of the wiring cover. (See fig. c.)

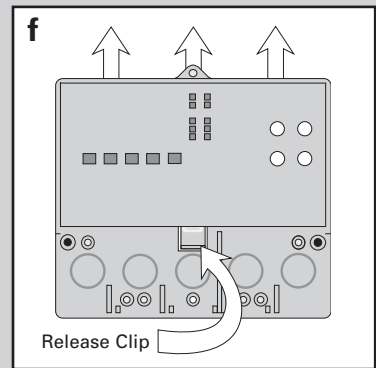


The wiring cover pulls straight out from the wiring chamber. (See fig. d.)

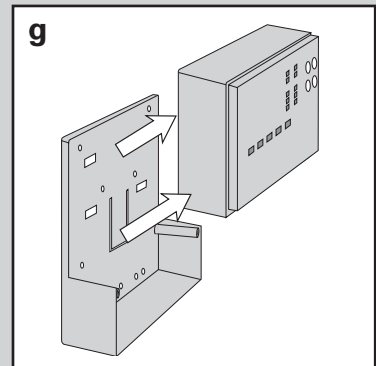
Remove the safety dividers from the wiring chamber by pulling them straight out of their grooves. (See fig. e.)



Press the control release clip on the base inside the wiring chamber and slide the control upwards. (See fig. f.)

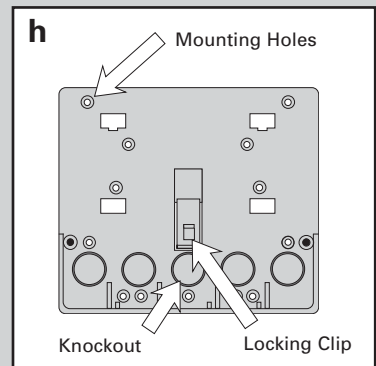


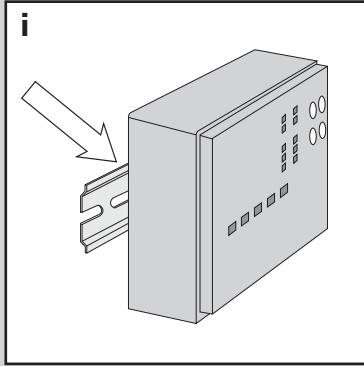
The control lifts up and away from the base. (See fig. g.)



Mounting the Base (See fig. h.)

- 1) Find a convenient and accessible location typically in the mechanical room.
- 2) Following the hole pattern, mount the control base using the appropriate screws.





The control can also be mounted on a standard DIN rail. (See fig. i.)

First, remove the control from its base and, using the hooks and spring clip on the back of the control (ordered separately), mount it onto the DIN rail. This is a popular option for those who prefer to mount the control inside a larger electrical panel.

The wiring can enter the bottom or the back of the enclosure. Knockouts provided in the base allow the wiring to be run in conduit up to the enclosure. The base also has holes that line up with the mounting holes of most common electrical boxes.

INSTALLATION - STEP 3

ROUGH-IN WIRING



Things to Note Before you Start Wiring:

- All electrical wiring should end in the control base wiring chamber.
- The base has standard 3/8" (22 mm) knockouts.
- Knockouts accept common wiring hardware and conduit fittings.
- Before removing knockouts, check wiring diagram and select those sections of the chamber with common voltages.
- Do not allow the wiring to cross between low and high voltage sections or else wires will interfere with safety dividers (these dividers should be installed at a later time).
- Do not apply power to any of the wires during rough-in wiring stage.
- All wires should be stripped to 3/8" (9 mm) for the correct connection to the control.

Wiring Components:

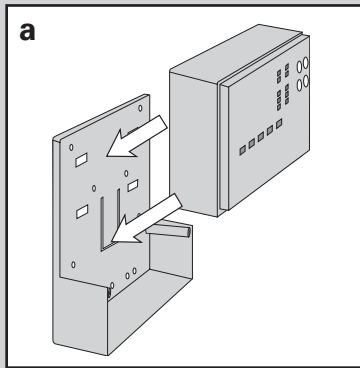
- 1) Install the various sensors as per instructions listed and run the wiring back to the control base.

- Main Sensors:**
- Outdoor Sensor S4
 - Mixing Supply Sensor S1
 - Mixing Return Sensor S5
 - Boiler Return Sensor S3

- Snow and Ice Melting Sensors:**
- Snow and Ice Detector S8

- Optional Modules:**
- Remote Display Module (RDM)

- 2) Run appropriate wire from all other system components (pump, boiler, etc.) to the control base.
- 3) Run wires from the 120VAC power to the control base.
 - Use a clean power source to ensure proper operation.
 - Comply with local codes for minimum gauge and breaker requirements.



INSTALLATION - STEP 4

ATTACHING THE CONTROL TO THE BASE

- 1) Push the SNOWpro 411 control into the base you mounted in step 2.
- 2) Slide the control down until it snaps firmly into place. (See fig. a.)

INSTALLATION - STEP 5

MOUNTING THE SENSORS



Outdoor Sensor (S4) (See fig. a.)

The Outdoor Sensor includes a 10 kΩ thermistor, which provides an accurate measurement of the outdoor temperature. The sensor is protected by a white UV-resistant PVC plastic enclosure.

Step 1: Mounting (See fig. b.)

Note: The temperature sensor (thermistor) is built into the enclosure.

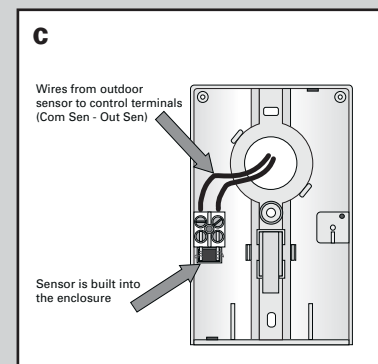
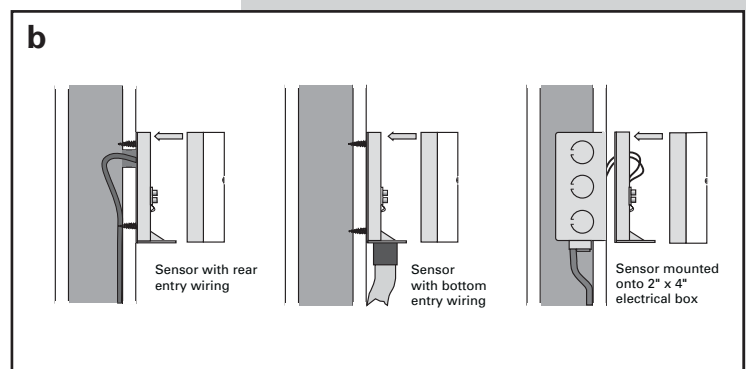
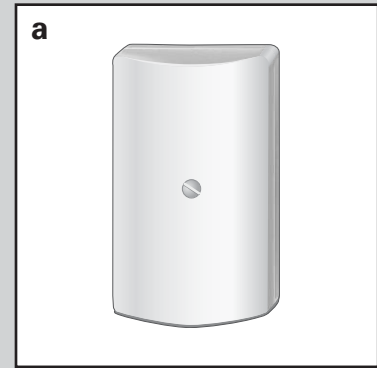
- Remove the screw and pull the front cover off the sensor enclosure.
- The outdoor sensor can either be mounted directly onto a wall or a 2" x 4" electrical box. When the sensor is wall mounted, the wiring should enter through the back or bottom of the enclosure. Do not mount the sensor with the conduit knockout facing upwards as rain could enter the enclosure and damage the sensor.
- In order to prevent heat transmitted through the wall from affecting the sensor reading, it may be necessary to install an insulating barrier behind the enclosure.
- The outdoor sensor should be mounted on an exterior wall which best represents actual outdoor temperature (a north-facing wall). It should not be exposed to heat sources such as solar gain, exhaust ventilation or window openings.
- The outdoor sensor should be installed at an elevation above the ground that will prevent accidental damage or tampering. Installing the sensor in the shadow of the roof eave is common.

Step 2: Wiring and Testing (See fig. c.)

- Connect 18 AWG or similar wire to the two terminals provided in the enclosure and run the wires from the outdoor sensor to the control.

CAUTION: Do not run sensor wires parallel to telephone or power cables. If the sensor wires are located in an area with strong sources of electromagnetic interference (EMI), shielded cable or twisted pair should be used, or the wires can be run in a grounded metal conduit. If using shielded cable, the shield wire should be connected to the Com Sen terminal on the control and not to earth ground.

- Follow the sensor testing instructions in this brochure and connect the wires to the control as per installation – **step 6**.
- Replace the front cover of the sensor enclosure.



Universal Sensors (S1, S3 & S5)

(See fig. d.)

These Universal Sensors have a zinc sleeve for fast response and a wide operating range. They can be used in a multitude of applications. They are supplied with 10 inches (250mm) of 2 conductor wire.

Step 1: Mounting (See figs. e thru g.)

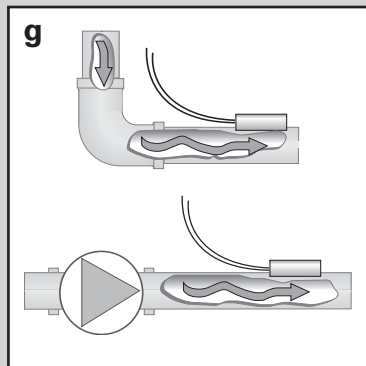
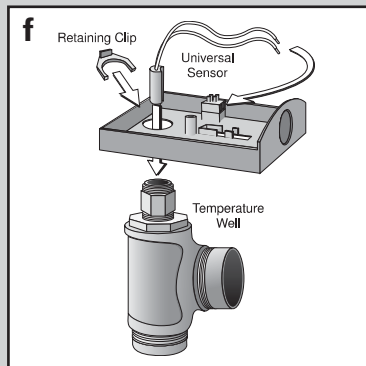
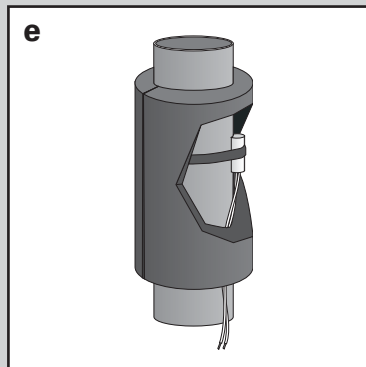
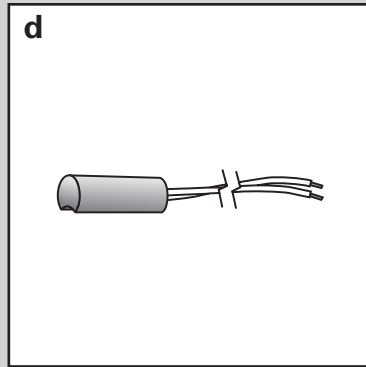
Note: The Sensor is designed to mount on a pipe or in a temperature immersion well.

- The Universal Sensor can be strapped directly to the pipe using the cable tie provided. Insulation should be placed around the sensor to reduce the effect of air currents on the sensor measurement.
- The Universal Sensor should be placed downstream of a pump or after an elbow or similar fitting. This is especially important if large diameter pipes are used, as the thermal stratification within the pipe can result in erroneous sensor readings. Proper sensor location requires that the fluid is thoroughly mixed within the pipe before it reaches the sensor.

Step 2: Wiring and Testing

CAUTION: Do not run sensor wires parallel to telephone or power cables. If the sensor wires are located in an area with strong sources of electromagnetic interference, shielded cable or twisted pair should be used, or the wires can be run in a grounded metal conduit. If using shielded cable, the shield wire should be connected to the Com Sen terminal on the control and not to earth ground.

- If it is necessary to connect 18 AWG wire to the two sensor wires, wire nuts can be used to hold the wires together.
- Follow the sensor testing instructions given in this manual, and then connect the wires to the control.



Snow & Ice Detector (S8) (See fig. h.)

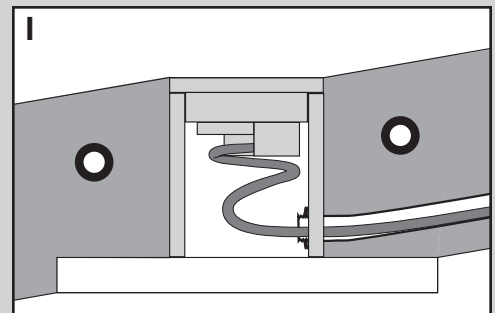
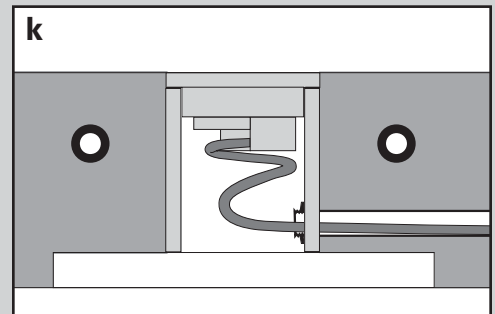
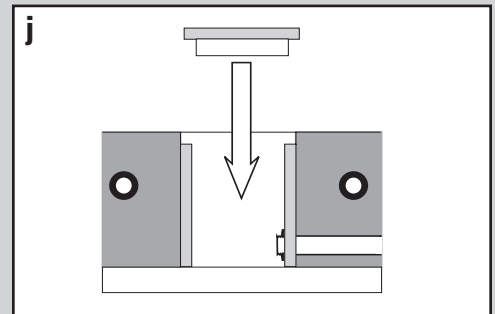
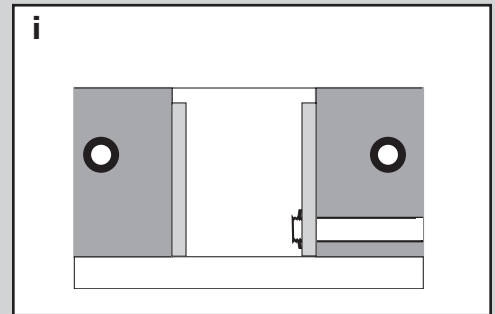
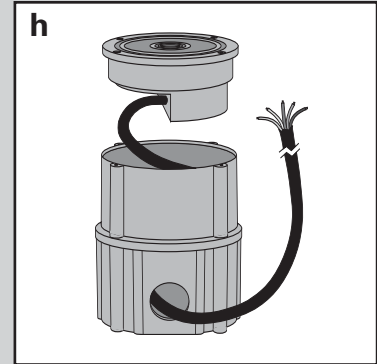
The snow and ice detector is to be installed with the surface of the sensor flush with the surface of the slab surface. The sensor comes with a 65-foot (20m) five-strand jacketed sensor cable and a sensor socket for installation in the slab and the snow and ice sensor. The sensor measures the slab temperature, sensor surface temperature and the sensor surface moisture level.

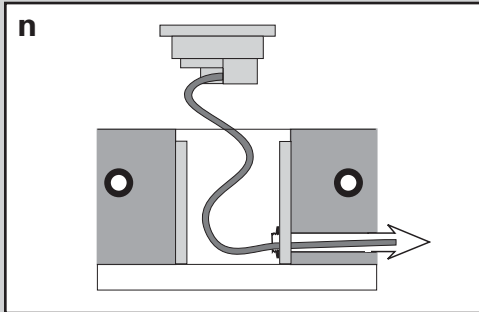
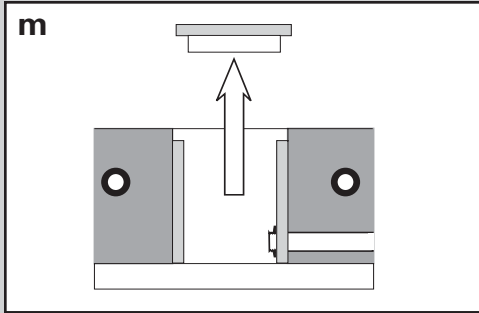
Step 1: Installing the Sensor Socket

- Place the sensor socket at the chosen location (equal distance between tubing), and run a conduit for the cable from the socket to the SNOWpro 411 control. **(See fig. i.)**
- If more than 65 feet (20m) of cable is required to reach the control, run the conduit to a weatherproof junction box. The sensor cable should be run in its own conduit and not in combination with high voltage wiring.
- At the junction box, additional 18 AWG, 5 conductor cable can be spliced in order to increase the total length to 500 feet (150m) from sensor to the control.
- A wooden plug is provided with the socket to prevent it from being accidentally filled with concrete or asphalt. It is suggested that a stable object, such as a brick or patio stone, be placed directly under the socket to give it a level, firm base. This base should be adjusted up or down to bring the top of the wooden plug flush with what will eventually be the finished slab surface. **(See fig. j.)**
- The sensor is installed flush with the level surface of the slab in an area that represents the worst case scenario for the snowmelt system (e.g. shaded, wind blown). **(See fig. k.)**

Note: Try to locate the sensor away from high traffic exposure

- If the sensor is installed on a sloped surface, plan for a level area for the sensor to be installed. If the sensor is installed in a sloped surface, the system may not run long enough to completely remove the snow and ice from the surface due to the lack of surface moisture. **(See fig. l.)**





Step 2: Installing the Sensor and Cable

- When the concrete is cured, remove the wooden plug from the socket and fish the cable through the conduit until there is only 6 to 12" of cable between the sensor and the conduit. **(See fig. m.)**
- Loop this remaining extra cable in a loose coil to avoid twisting, and place the cable and the sensor into the socket. **(See fig. n.)**
- Secure the sensor to the socket with the four screws provided. Make sure the O-ring is in place and properly seated.

Note: The Snow and Ice Detector is installed in a hostile environment. Accumulation of dirt and salty grime on its surface may inhibit proper water detection by the sensor. It should be checked routinely and when necessary, cleaned with a wire brush. After cleaning, press the Test button to cycle the control through a test routine.

INSTALLATION - STEP 6

ELECTRICAL CONNECTIONS TO THE CONTROL



IMPORTANT: Test to be certain no voltage is present in any wires.

Powered Input Connections (1-2)

1) 120VAC Power (See fig. a.)

- Provides power to microprocessor and control display as well as power to Boil P3 terminal (21) from Power L terminal (22).
- Connect 120VAC power supply to Power L and Power N terminals (22 and 23).

2) Priority Demand (See fig. b.)

- In order to generate a priority demand, a voltage between 24 to 240VAC must be applied across the Priority Demand terminals (15 and 16).

Output Connections (3-5)

3) Boiler Enable (See fig. c.)

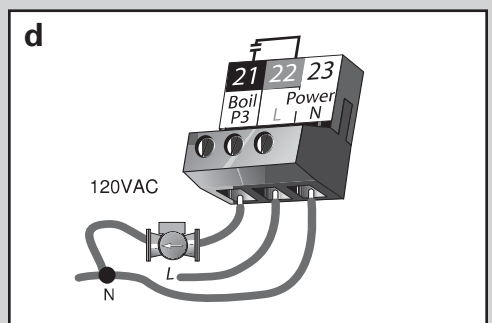
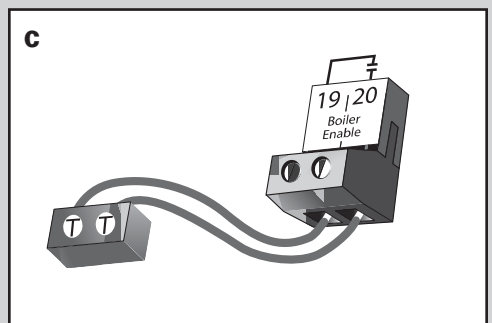
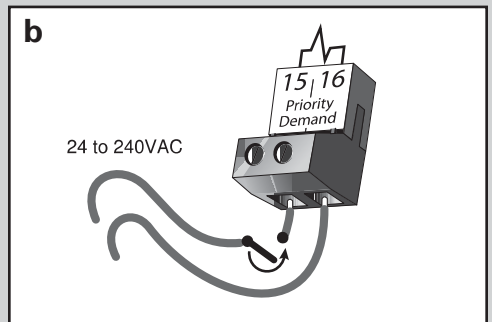
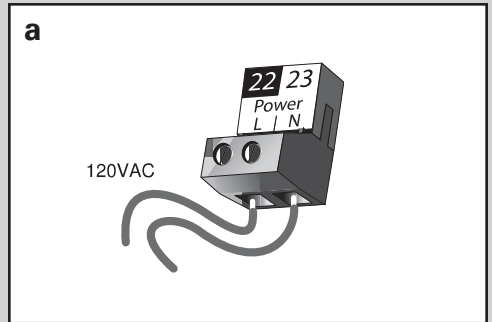
Boiler Enable terminals (19 and 20) are isolated outputs. No power is available on these terminals from the control.

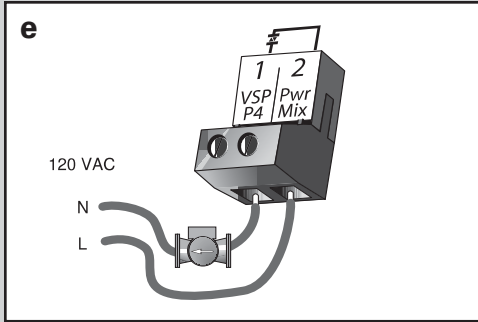
- Use terminals as switch to make or break the boiler circuit.
- When the SNOWpro 411 requires the boiler to fire, contact closes between terminals 19 and 20.

4) Boiler Pump (P3) (See fig. d.)

Boiler pump terminal (21) is a powered output. When the relay in the SNOWpro 411 closes, 120VAC is provided to boiler pump terminal (21) from Power L terminal (22).

- To operate the boiler pump, connect one side of the boiler pump circuit to terminal 21 and the second side of the pump to the neutral (N) side (terminal 23) of the 120VAC power supply



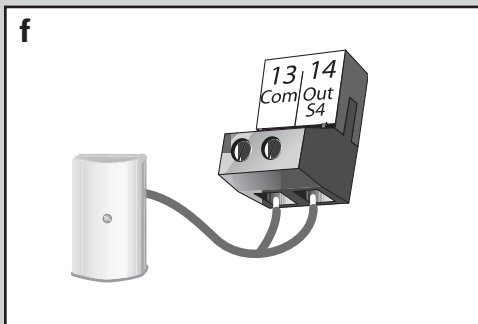


5) Variable Speed Injection Pump (P4) (See fig. e.)

The SNOWpro 411 can vary the speed of most small wet rotor circulators (see **Appendix I - page 45**).

- Connect one of the wires from the variable speed injection pump to the VSP 4 terminal (1) on the control.
- Connect the other wire from the variable speed injection pump to the neutral (N) side of the 120VAC power source.
- Connect the Pwr Mix terminal (2) on the control to the Load (L) side of the 120VAC power source.

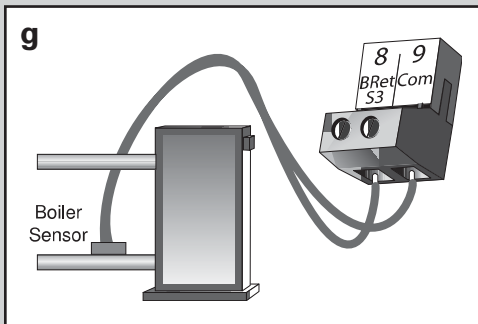
Note: The SNOWpro 411 has an internal overload fuse rated at 2.5A 250 VAC. Contact your Wirsbo sales representative for repair information if fuse is blown.



Sensor Connections (6-10)

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

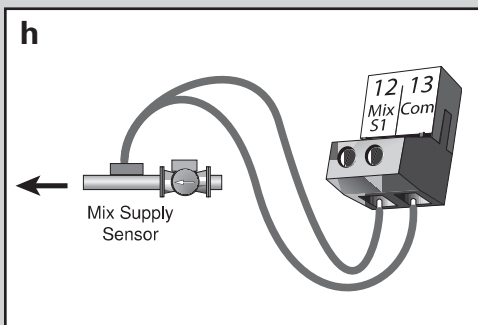
Connect the two wires from the sensors to the terminals described below. Use 18 AWG thermostat wire to extend the length of the sensor wire if needed.



6) Outdoor Sensor (S4) (See fig. f.)

Senses outdoor temperature to create the appropriate supply water temperature to the snow and ice melting slab

- Connect to the Com (13) and Out S4 (14) terminals on the control.



7) Boiler Return Sensor (S3) (See fig. g.)

Part of the boiler protection by sensing return water temperature to the boiler

- Connect to the BRet S3 (8) and Com (9) terminals on the control.

8) Mixing Supply Sensor (S1) (See fig. h.)

Measures the fluid temperature on the supply to the snow and ice melting slab

- Connect to the the Mix S1 (12) and Com (13) terminals on the control.

Note: Sensor is normally attached downstream of mixing system pump (P1).

9) Mixing Return Sensor (S5) (See fig. i.)

Measures the return fluid temperature from the snow and ice melting slab

- Connect to the Ret S5 (11) and Com (13) terminals on the control.

Snow and Ice Detector (S8) (See fig. j.)

Senses the presence of moisture and slab temperature

- Connect the red wire from the sensor to the Red (3) terminal on the control.
- Connect the black wire from the sensor to the Blk (4) terminal on the control.
- Connect the blue wire from the sensor to the Blu (5) terminal on the control.
- Connect the yellow wire from the sensor to the Yel (6) terminal on the control.
- Connect the brown wire from the sensor to the Brn (7) terminal on the control.

Note: The Snow and Ice Detector must be installed flush with the slab surface and halfway between the heating pipes.

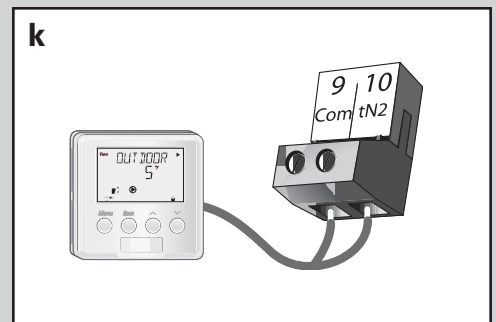
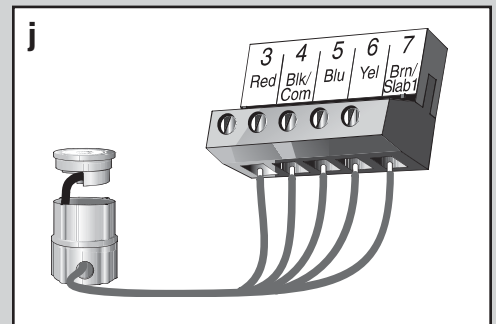
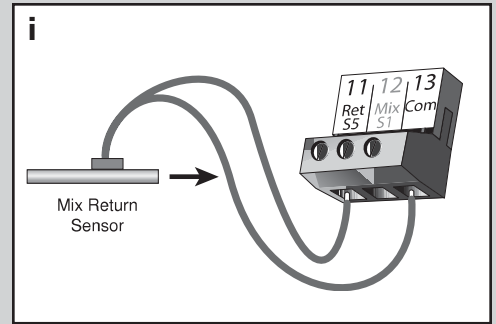
Unpowered Input Connections (11)

WARNING: Wires from unpowered input connections are polarity sensitive. The communication of these devices will not operate correctly if the wires are reversed.

11) Remote Display Module (See fig. k.)

A Remote Display Module may be connected to the tN2 input on the SNOWpro 411. This allows remote access to snow and ice melting function display or the ability to turn the system on or off without going to the mechanical room.

- Connect the Com terminal from the Remote Display Module to Com terminal (9) on SNOWpro 411.
- Connect the tN2 terminal from the Remote Display Module to the tN2 terminal (10) on SNOWpro 411.



Temperature Resistance Chart

Temperature		Resistance	Temperature		Resistance	Temperature		Resistance	Temperature		Resistance
°F	°C	Ω	°F	°C	Ω	°F	°C	Ω	°F	°C	Ω
-50	-46	490,813	20	-7	46,218	90	32	7,334	160	71	1,689
-45	-43	405,710	25	-4	39,913	95	35	6,532	165	74	1,538
-40	-40	336,606	30	-1	34,558	100	38	5,828	170	77	1,403
-35	-37	280,279	35	2	29,996	105	41	5,210	175	79	1,281
-30	-34	234,196	40	4	26,099	110	43	4,665	180	82	1,172
-25	-32	196,358	45	7	22,763	115	46	4,184	185	85	1,073
-20	-29	165,180	50	10	19,900	120	49	3,760	190	88	983
-15	-26	139,402	55	13	17,436	125	52	3,383	195	91	903
-10	-23	118,018	60	16	15,311	130	54	3,050	200	93	829
-5	-21	100,221	65	18	13,474	135	57	2,754	205	96	763
0	-18	85,362	70	21	11,883	140	60	2,490	210	99	703
5	-15	72,918	75	24	10,501	145	63	2,255	215	102	648
10	-12	62,465	80	27	9,299	150	66	2,045	220	104	598
15	-9	53,658	85	29	8,250	155	68	1,857	225	107	553

INSTALLATION - STEP 7 TESTING THE WIRING



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

Things to Note Before you Start any Testing:

- **Before supplying power for testing, each terminal block must be unplugged from its header on the control.**
- **To remove the terminal block, pull straight down from the control (See fig. a.).**
- **The following tests should only be carried out by properly trained and experienced installers.**
- **When testing, use standard testing practices and procedures.**
- **To properly test wiring and sensors, a good quality electrical test meter capable of reading at least 0 – 300VAC and at least 0 – 2,000,000 ohms is essential.**

Test the Sensors

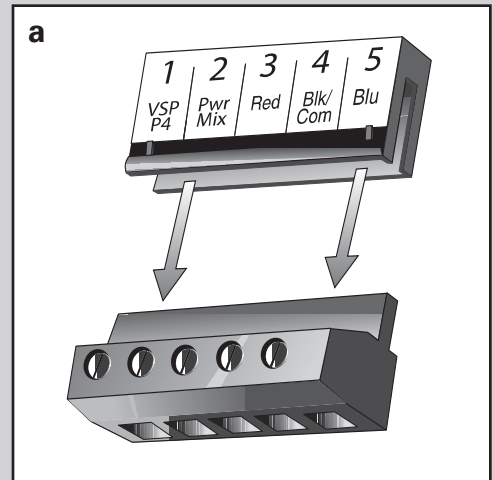


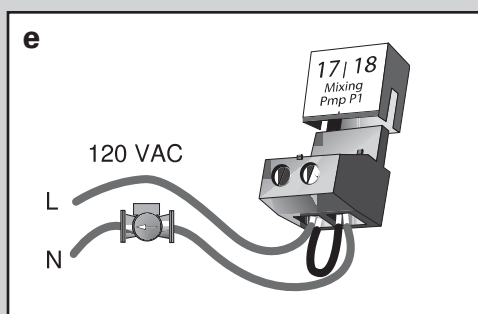
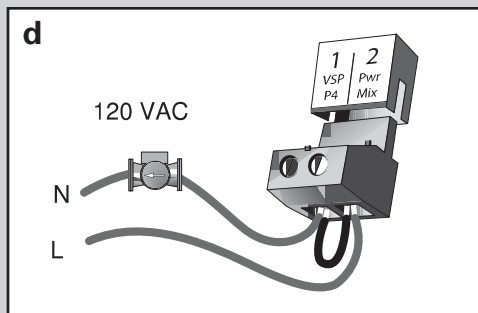
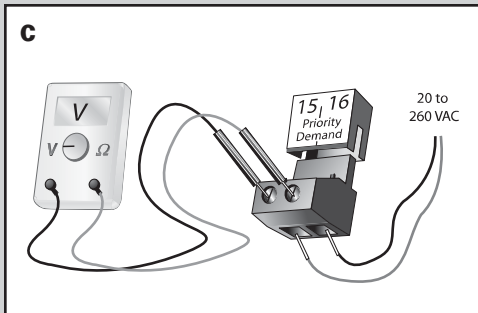
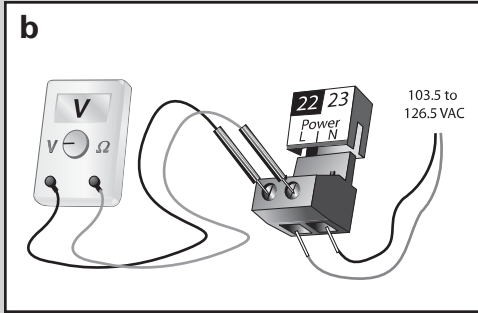
To test the sensors, the actual temperature at each sensor location must be measured.

A good quality test meter capable of measuring up to 5,000 k Ω (1 k Ω = 1000 Ω) is required to measure the sensor resistance. In addition to this, the actual temperature must be measured with either a good quality digital thermometer, or if a thermometer is not available, a second sensor can be placed alongside the one to be tested and the readings compared.

First, measure the temperature using the thermometer and then measure the resistance of the sensor at the control. The wires from the sensor must not be connected to the control while the test is performed. Using the chart on the previous page, estimate the temperature measured by the sensor. The sensor and thermometer readings should be close. If the test meter reads a very high resistance, there may be a broken wire, a poor wiring connection or a defective sensor. If the resistance is very low, the wiring may be shorted, there may be moisture in the sensor or the sensor may be defective. To test for a defective sensor, measure the resistance directly at the sensor location.

Do not apply voltage to a sensor at any time as damage to the sensor may result.





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 N terminals (22 and 23) using an AC voltmeter. The reading should be between 108 and 132VAC. (See fig. b.).

Test The Powered Inputs

- When any of the demand devices described below call for heat, you should measure between 20 and 260 VAC at the terminals.
- When these demand devices are off, you should measure less than 5VAC.

Priority Demand

- Measure voltage between Priority Demand terminals (15 and 16). (See fig. c.)

Test The Outputs

IMPORTANT NOTE FOR ALL OUTPUT DEVICES:
Once you have verified that a device described below operates properly, shut off the power to the device and remove the jumper you were asked to install during the testing procedure below. If any device fails to start, see troubleshooting information on page 26.

Variable Speed Injection Pump (VSP P4) (See fig. d.)

- Make sure power to the pump circuit is off.
- Install a jumper between terminals (1 and 2).
- When the circuit is powered up, the VSP P4 pump should operate at full speed.

Mixing Pump 1 (Mixing Pmp 1 P1) (See fig. e.)

- Make sure power to the pump circuit is off.
- Install a jumper between terminals (17 and 18).
- When the circuit is powered up, the pump should operate at full speed.

Boiler Enable (See fig. f.)

- Make sure power to the boiler circuit is off.
- Install a jumper between the terminals (19 and 20).
- When the boiler circuit is powered up, the boiler should fire.

Note: Boiler may have a flow switch that prevents firing until the primary pump (P3) is running.

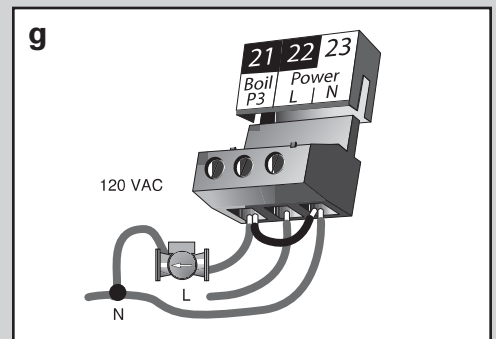
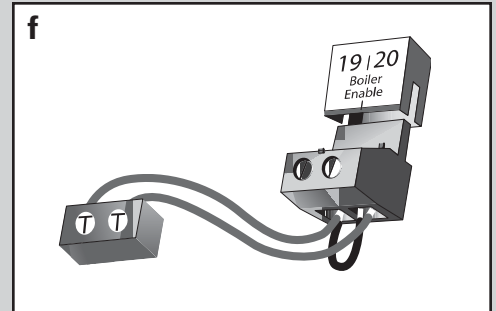
Primary Pump (Boil P3) (See fig. g.)

- Make sure that power to terminal block is off.
- Install a jumper between Power N and Boil P3 terminals (21 and 23).
- When power is applied to the Power L and Power N terminals (22 and 23) the primary pump should start.

Troubleshooting for all Output Devices

Described Above:

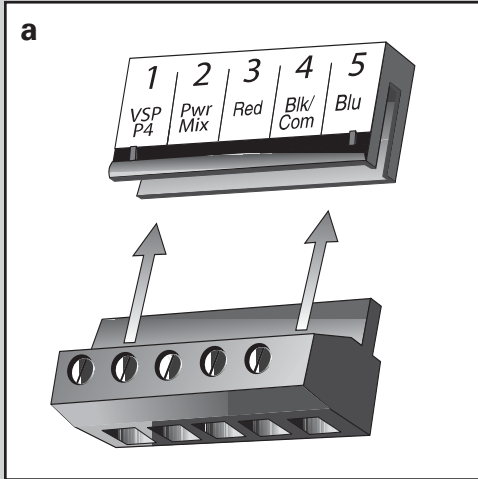
- If the device does not start, check all wiring connections.
- If the device still fails to start, refer to the manufacturers installation or troubleshooting information supplied with the device.



INSTALLATION - STEP 8 COMPLETING THE INSTALLATION



Once you have successfully tested all the wiring and found that everything is operational, you are ready to complete the installation.



- 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.
- Push the terminal blocks into the headers — they should snap firmly into place **(See fig. a.)**
- Install supplied safety dividers between unpowered sensor inputs and powered or 120VAC wiring chambers.
- Apply power to the control.

Note: The operation of the control on power up is described in the Control Function Overview section of this manual (page 35).

Cleaning the Control

- Moisten cloth with water and wring out prior to wiping control.
- Do not use solvents or cleaning solutions on the control.

PROGRAMMING

TABLE OF CONTENTS

Step 1 – Programming the Control	28-31
"Misc" Menu Settings	29
"Adjust" Menu Settings	30-31
Step 2 – Test Sequence	32-33
Test Sequence	32
Max Heat	33

PROGRAMMING - STEP 1

PROGRAMMING THE CONTROL

Note: This section will guide you through the programming of each function in a logical order based on area of control. For more detailed functions of any particular item, please refer to the Control Overview Section.

IMPORTANT (PLEASE READ): The SNOWpro 411 is now fully installed and ready for a trained, qualified individual to begin entering the settings that will help it control a hydronic radiant heating system at its most efficient level.

Before you start PROGRAMMING you should:

Review the Control Function Overview if you are not familiar with how the control functions operate in conjunction with the specific systems installed.

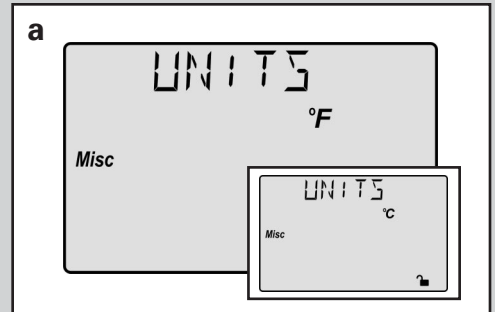
PROGRAMMING THE "MISC" MENU

UNITS (See fig. a.)

- 1) Go to UNITS item field in Miscellaneous (MISC) Menu.
- 2) Select the temperature measurement units you want all temperatures to be displayed.

RANGE: °F or °C

DEFAULT: °F

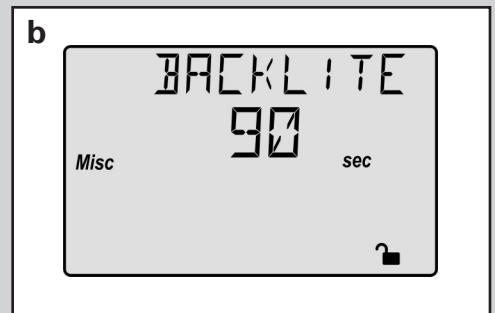


BACKLITE (See fig. b.)

- 1) Go to BACKLITE item field in Miscellaneous (MISC) Menu.
- 2) Select the operating mode for the backlighting function of the LCD as well as the time of keypad inactivity until the control automatically returns to the default display.

RANGE: OFF, 90 seconds, ON

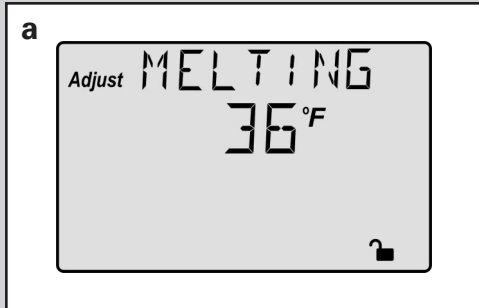
DEFAULT: 90 seconds



PROGRAMMING THE “ADJUST” MENU

Push the Menu button until ADJUST is seen in the upper left corner of the screen. Use the Item button to scroll through the ADJUST section.

- Use the UP and DOWN arrows to make the desired selection within each Item field.

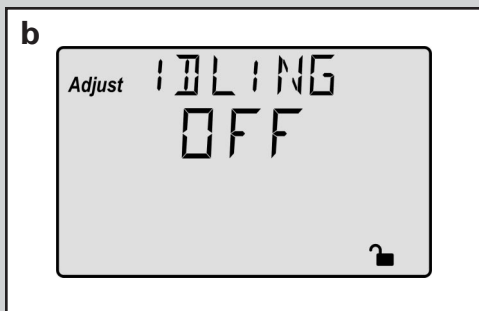


MELTING MODE (MELTING) (See fig. a.)

- 1) Go to the MELTING item field in the ADJUST Menu.
- 2) Select the surface temperature for the snow and ice melting system to operate while in the MELTING mode.

RANGE: 32 to 95°F (0 to 35°C)

DEFAULT: 36°F (2°C)

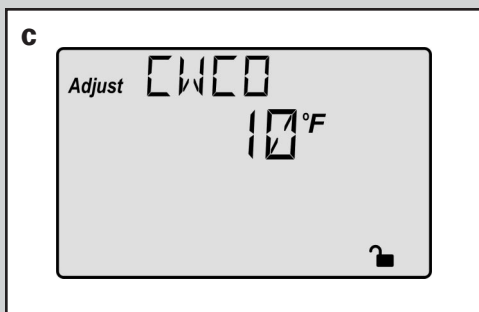


IDLING MODE (IDLING) (See fig. b.)

- 1) Go to the IDLING item field in the ADJUST Menu.
- 2) Select the surface temperature for the snow and ice melting system to operate while in the IDLING mode or turn this function OFF.

RANGE: OFF, 20 to 95°F (OFF, 7 to 35°C)

DEFAULT: OFF

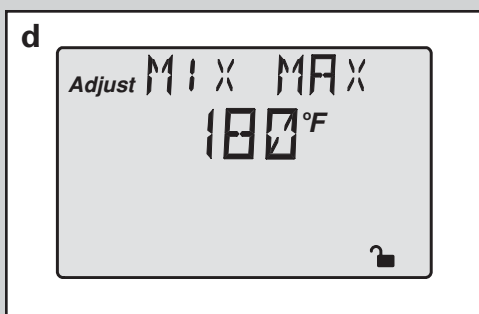


COLD WEATHER CUT OFF (CWCO) (See fig. c.)

- 1) Go to the CWCO item field in the ADJUST Menu.
- 2) Select the outdoor temperature that will terminate operation of the snow/ice melt system or turn this function OFF.

RANGE: OFF, -30 to 50°F (OFF, -34 to 10°C)

DEFAULT: 10°F (-12°C)



MIX MAX (See fig. d.)

- 1) Go to the MIX MAX item field in the ADJUST Menu.
- 2) Select the maximum supply temperature required for proper operation of the snow/ice melt system or turn this function OFF.

RANGE: 80 to 210°F or OFF (27 to 99°C or OFF)

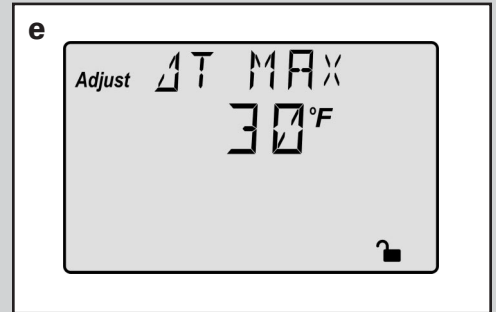
DEFAULT: 180°F (82°C)

ΔT MAX (See fig. e.)

- 1) Go to the ΔT MAX item field in the ADJUST Menu.
- 2) Select the maximum differential temperature allowed between the supply and return of the snow and ice melting system or turn this function OFF.

RANGE: 10 to 70°F or OFF (6 to 39°C or OFF)

DEFAULT: 30°F (17°C).

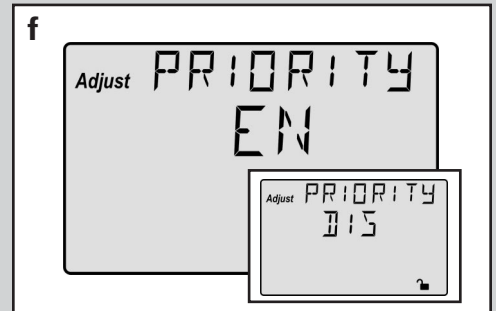


SNOW/ICE MELT PRIORITY (PRIORITY) (See fig. f.)

- 1) Go to the PRIORITY item field in the ADJUST Menu.
- 2) Select either DIS to disable the control from an outside priority or EN to enable the control to be influenced by another control's priority.

RANGE: EN or DIS

DEFAULT: EN

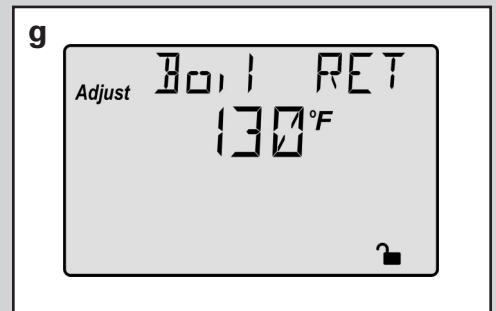


BOILER RETURN (Boil RET) (See fig. g.)

- 1) Go to the Boil RET item field in the ADJUST Menu.
- 2) Set to the minimum boiler return water temperature recommended by the boiler's manufacturer.

RANGE: OFF, 80 to 180°F (OFF, 27 to 82°C)

DEFAULT: 130°F (54°C).

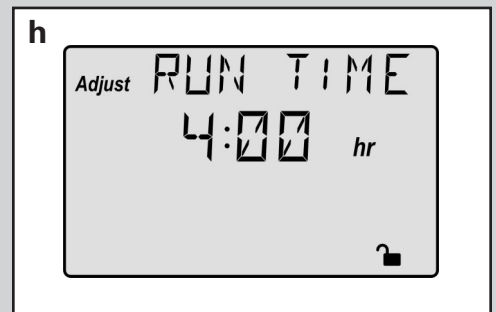


RUNNING TIME (RUN TIME) (See fig. h.)

- 1) Go to the RUN TIME item field in the ADJUST Menu
- 2) Select the run time for the snow and ice melting system to operate once the slab warms to the MELTING mode temperature or turn this function to INF (infinity).

RANGE: 00:30 to 17:00 or INF

DEFAULT: 04:00

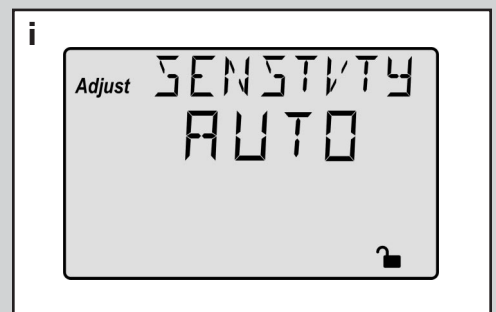


DETECTION SENSITIVITY (SENSTVTY) (See fig. i.)

- 1) Go to the SENSTVTY item field in the ADJUST Menu.
- 2) Select the percentage of water detection sensitivity for the Snow and Ice Detector or turn this function to AUTO.

RANGE: AUTO, 20 to 80%

DEFAULT: AUTO



NOTE:

Before you begin testing, all appropriate settings must be entered into the control using the LCD screen. If you are unfamiliar with the theory behind a hydronic radiant heating system, please refer to the Control Function Overview for more help.

PROGRAMMING - STEP 2 TEST SEQUENCE

The SNOWpro 411 has a built-in test routine which is used to test the main control functions. The control monitors the sensors and displays an error message whenever a fault is found. See **Appendix IV (page 52)** for a list of the SNOWpro's error messages and possible causes. When the Test button is pressed, the test light is turned on. The outputs and relays are tested in the following sequence.

- Each step in the test sequence lasts 10 seconds.
- The Test button can be pressed 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 Variable Speed Injection pump (P4) is ramped up for 10 seconds to 100%.

Step 2

- The Variable Speed Injection pump (P4) is ramped down for 10 seconds.

Step 3

- The boiler pump (P3) contact is turned on for 10 seconds and then shuts off.

Note: The control can only be paused in step 3 if there is a boiler demand.

Step 4

- The system pump (P1) is turned on for 10 seconds and then shuts off.

Step 5

- The boiler enable and Boiler Pump P3 contacts are turned on for 10 seconds.
- After 10 seconds, the Boiler and Boil P3 contacts are shut off.

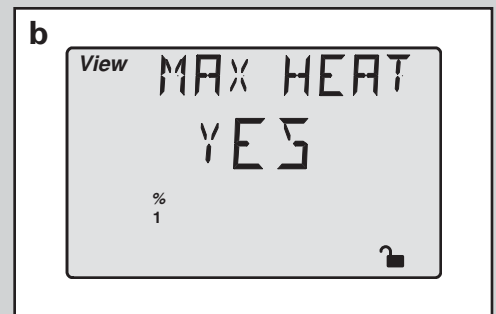
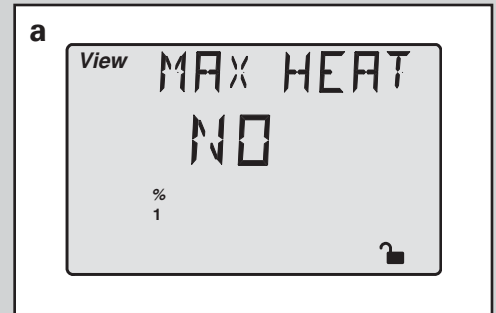
Step 6

- After test sequence is completed, the word COMPLETE is displayed for one second and control resumes normal operation

MAX HEAT (See fig. a & b.)

The SNOWpro 411 has a function called Max Heat. In this mode, the control turns on and operates the system up to the maximum set temperatures, and the mixing device at the set percentage.

- This mode may be used for running all circulators during system start-up in order to purge air from the piping.
- Once started, control continues to operate in MAX HEAT mode for up to 24 hours or until either the Item, Menu or Test button is pressed.
- To enable the Max Heat feature, use the following procedure:
 - 1) Press and hold the Test button for more than three seconds. At this point, control displays the words MAX HEAT and the word NO.
 - 2) Using the up and down buttons, select the word YES. After three seconds, the control flashes the word MANUAL and the number 100. This number represents the desired output from the mixing device.
 - 3) Set desired output of mixing device by using the up and down arrow buttons on the control.
 - 4) To cancel Max Heat mode, press either Item, Menu, or Test button.
 - 5) Once Max Heat mode ends or is cancelled, control resumes normal operation.



CONTROL FUNCTION OVERVIEW

TABLE OF CONTENTS

Section A – General	35-37
Section B – Snow and Ice Melting	38-41
Section C – Troubleshooting	42-43

CONTROL FUNCTION OVERVIEW - SECTION A

GENERAL

The SNOWpro 411 is a single zone snow and ice melting control. This control is designed to work exclusively with the Wirsbo Snow and Ice Detector. This control will not function properly using only a slab sensor or in sensorless applications.

Systems designed with the SNOWpro 411 can idle the snow and ice melting slab at a desired temperature and then accelerate to snow-melting mode (higher temperature) when moisture is present on the Snow and Ice Detector.

The SNOWpro 411 is able to provide exact supply fluid temperature to the snow and ice melting system through the use of a variable speed injection (VSP) pump. This VSP pump injects the correct amount of hot boiler loop fluid into the secondary snow and ice melting system that blends with the return fluid to achieve the desired supply fluid temperature.

The Snow and Ice Detector is a five-wire sensor that is installed in the snow and ice melting slab mounted in a cup. The sensor is mounted flush with the slab surface. This single sensor has the ability to sense slab temperature and determine if moisture is present on the slab. The Snow and Ice Detector initiates the demand to the control for idling or melting action.

POWERING UP THE CONTROL

When the SNOWpro 411 is powered up:

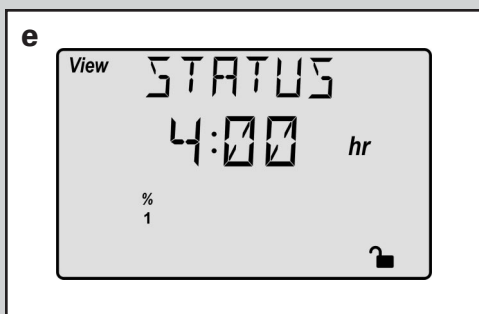
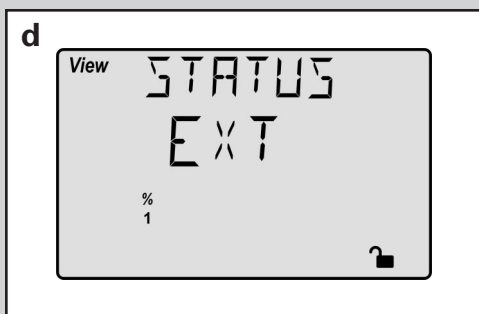
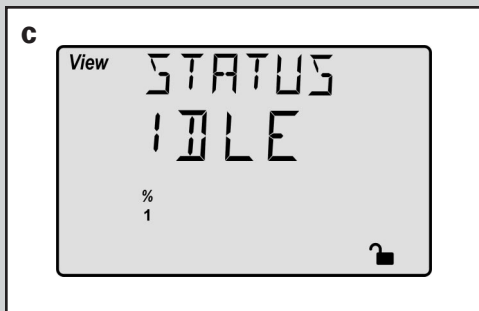
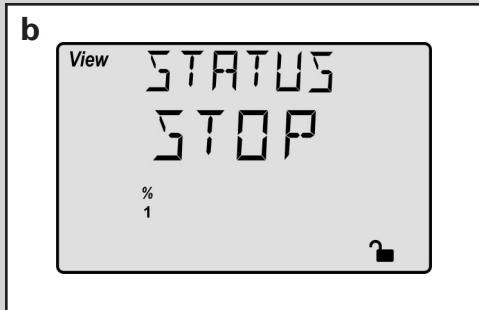
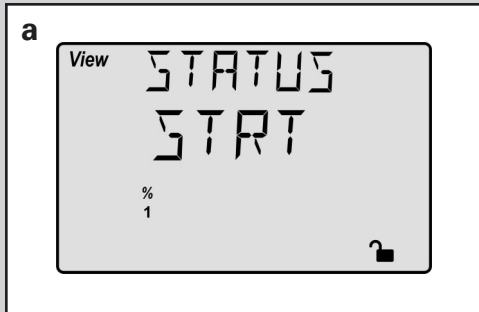
- Displays control type number in the LCD for two seconds
- Displays software version for another two seconds
- Defaults to normal operating mode displaying current outdoor air temperature

EXERCISING

- The SNOWpro 411 has a built-in pump exercising function. If a pump on the control has not been operated at least once during every exercising period (every 70 hours), the control turns on the output for 10 seconds.
- The exercising function will not work if power to the control or pumps is disconnected.
- Exercising reduces the possibility of a pump seizing during a long period of inactivity.

WARM WEATHER SHUT DOWN (WWSD)

The snow and ice melting system will shut down when both the slab and the outdoor temperatures are 2°F warmer than the MELTING setting. The WWSD will be visible in the View Menu under the STATUS item field when active.



VARIABLE SPEED INJECTION (VSP)

The SNOWpro 411 can vary the the supply fluid temperature to the snow and ice melting system by adjusting the speed of the injection pump.

- A standard wet rotor circulator is connected to the SNOWpro 411 on terminals 1 (VSP P4) and 2 (Pwr Mix).
- The control increases or decreases power output to circulator when there is mix demand.
- Circulator speed varies to maintain correct mixed supply water temperature at mix supply sensor.
- A visual indication of current variable speed output is displayed in the LCD as a segmented bar graph. (Two small indicators at the top of the graph indicate whether the output is increasing or decreasing).
- For correct sizing and piping of variable speed injection driven circulator, refer to the essay in **Appendix I, Variable Speed Injection Mixing**.

OPERATING STATUS (STATUS)

While in snow-melting mode, an additional item is available in the View menu called STATUS. It displays current operating status of the snow and ice melting system.

STRT – Displayed after snow and ice melting system has been enabled, and remains on until slab reaches melting temperature. If the slab is at melting temperature, STRT is displayed for five seconds after snow-melting system has started operation. This is to verify that the control has entered into snow-melting mode. (See fig. a.)

STOP – Displayed after the snow and ice melting system is disabled (See fig. b.)

IDLE – Displayed as long as the control is operating slab at idling temperature (See fig. c.)

EXT – Displayed when RUN TIME has reached 0:00 and control still has an external demand for melting. In this situation, control continues melting until snow-melting demand is removed or the control is stopped. (See fig. d.)

0:00 to 17:00 hr – RUN TIME is displayed as long as the slab has reached temperature and the control is in melting mode. (See fig. e)

INF – Displayed if an infinite run time is selected and the control is melting. (See fig. f.)

WWSD – When the snow and ice melting system is in the Warm Weather Shut Down mode, WWSD is displayed. (See fig. g.)

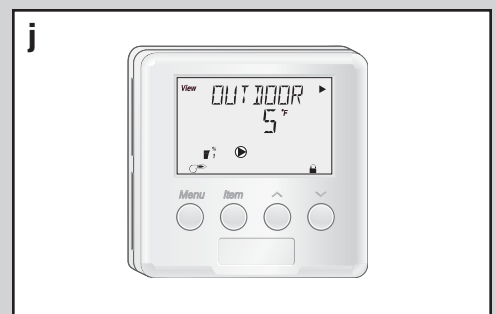
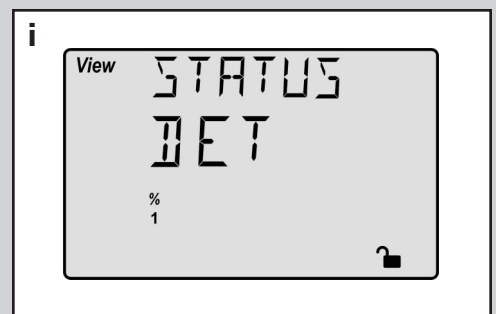
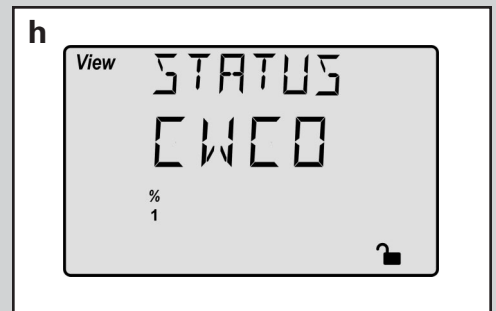
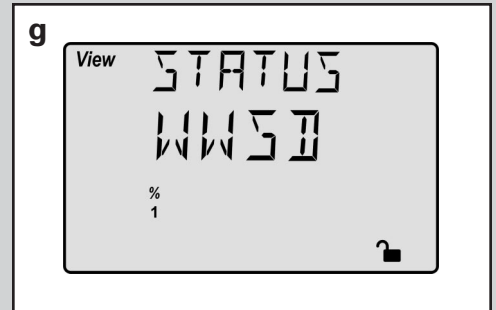
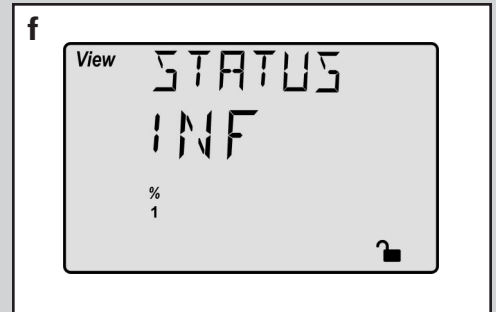
CWCO – Displayed when control is in a Cold Weather Cut Out mode (See fig. h.)

DET – Displayed after snow-melting system has been automatically enabled by the Snow and Ice Detector and the zone is at its slab target temperature. DET is also displayed once the control is manually enabled after automatic detection by the Snow and Ice Detector and the running time has counted down to 0:00. (See fig. i.)

REMOTE DISPLAY MODULE (A3040040)
(See fig. j.)

A Remote Display Module allows remote viewing and access of the LCD display on the SNOWpro 411 control. The Remote Display Module can also be used to start and stop the snow-melting system.

- The snow-melting system is enabled by pressing the Start button on the Remote Display Module while in the View Menu.
- Once snow-melting system is enabled, the word STRT is displayed in the LCD for at least five seconds.
- The Remote Display Module then displays RUN TIME setting to allow user to adjust it.
- To disable snow-melting system when it is in melting mode, press the Stop button on the Remote Display Module.



CONTROL FUNCTION OVERVIEW - SECTION B

SNOW AND ICE MELTING

SNOW/ICE MELT MODE (MELTING) (See fig. a.)

The SNOWpro 411 is an automatic snow and ice melting control. The MELTING setting in the ADJUST Menu sets slab surface temperature that is maintained while control is in the MELTING mode

Note: When control is in melting mode, Melting pointer is visible in the View Menu and either EXT, INF or a running time may be read under STATUS item in the View Menu.

IDLING MODE (IDLING) (See fig. b.)

When the snow and ice melting system starts from a cold temperature, the time required for the slab to reach the MELTING temperature may be excessive.

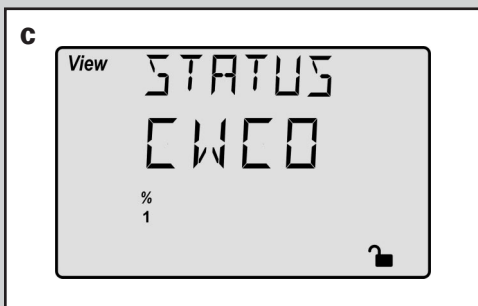
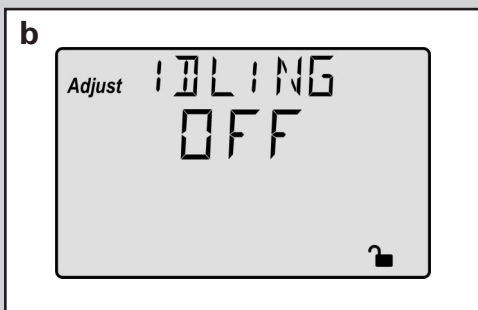
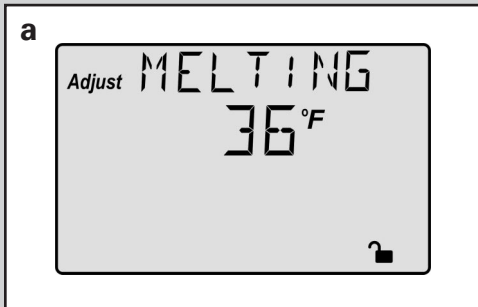
- To decrease melting start-up time, slab can be maintained at an IDLING temperature.
- Idle feature is also useful for preventing frost and light ice formation when the temperature is set above freezing.
- The IDLING setting in the ADJUST menu sets slab surface temperature that is maintained while control is in the idling mode.

Note: When control is in idling mode, the word IDLE can be read under STATUS item in the View Menu.

COLD WEATHER CUT OUT (CWCO) (See fig. c.)

Maintaining a slab temperature at either a melting or idling temperature when outdoor conditions has dropped below system design parameters can be both expensive and impossible. Cold Weather Cut Out (CWCO) is a feature that allows the control to automatically shut the system down at a particular outdoor temperature setting to save energy.

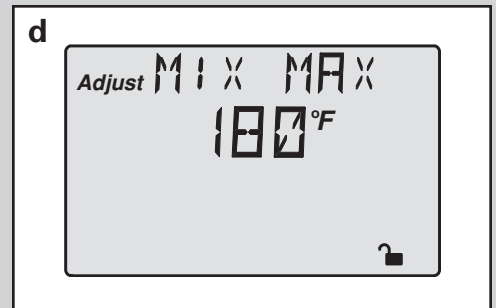
- When the control is not in melting mode and the outdoor temperature drops below the CWCO setting, the control goes into CWCO mode which prevents any melting events to take place until the outdoor temperature rises above the CWCO setting.
- When the control is already in melting mode, the CWCO only occurs when the outdoor temperature is less than CWCO setting and slab surface is less than 29°F. This allows the control to finish the current melting cycle and helps prevent refreezing of leftover moisture on the slab surface.



- If control had been started prior to CWCO, it resumes IDLE or MELTING mode once outdoor air temperature rises above CWCO setting.
- While in the CWCO mode, "CWCO" is displayed in the STATUS item in the VIEW Menu.

MIXING MAXIMUM (MIX MAX) (See fig. d.)

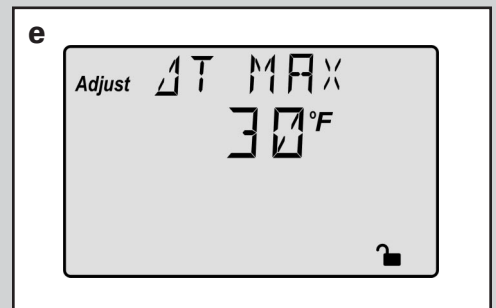
- MIX MAX sets the highest supply fluid temperature the control is allowed to use as a mixing target (MIX TRG) temperature.
- Should the control calculate a mixing target temperature setting that exceeds the MAXIMUM temperature, the LCD pointer will turn on and indicate the MAXIMUM temperature is being viewed.



SLAB PROTECTION (ΔT MAX) (See fig. e.)

A mixing device is installed between the snow-melting slab and boiler(s) to control rate at which heat is transferred to the snow and ice melting system and to protect the slab from thermal stress damage. The control limits the rate at which heat is applied to slab through ΔT (delta T) MAX setting.

- ΔT (delta T) is the temperature difference between the slab supply temperature and the slab return temperature
- The rate at which heat is applied to slab can be controlled, and thermal stresses in slab can be minimized by limiting this temperature difference.
- When slab is operating, control ensures the slab supply temperature does not exceed the slab return temperature by more than ΔT MAX setting.



Note: When control is operating and actual ΔT is near ΔT MAX, the Maximum pointer can be seen when viewing the MIX ΔT item in the VIEW menu.

VISCOSITY COMPENSATION (EXCEEDING ΔT MAX)

At low temperatures, glycol solutions used in snow-melting systems become thick and difficult to pump. In order to overcome this condition during a cold start of a snow-melting system, the control is allowed to exceed ΔT MAX setting for a time to warm the glycol solution.

- Allows control to compensate for the high viscosity of the glycol solution
- Is used when return temperature is below 30°F (-1°C)

Note: When control exceeds the ΔT MAX setting, Min/Max pointer flashes when viewing MIX ΔT item in the View menu.

RAMPING OF THE ΔT

When control starts applying heat to the slab, the supply temperature to snow and ice melting system is ramped up over a period of time until it reaches maximum allowed ΔT .

BOILER PURGE

After all demands are satisfied, the SNOWpro 411 continues to operate the primary pump (P3) for 20 seconds to purge heat from the boiler.

BOILER PROTECTION (Boil RET) (See fig. f.)

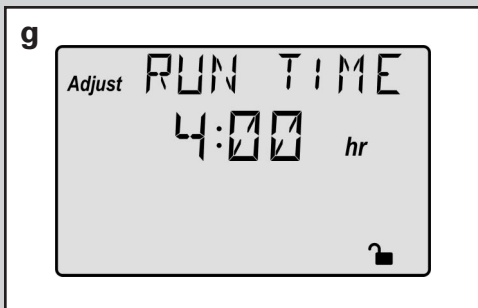
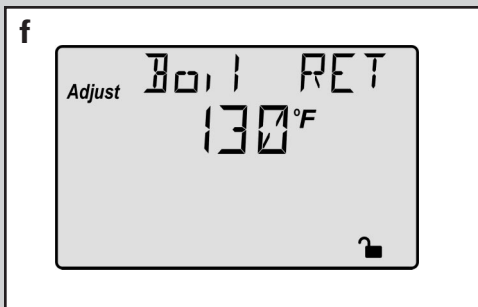
The SNOWpro 411 ensures the boiler return water temperature remains above the Boil RET setting.

- If boiler return water temperature begins to drop due to cold slab return temperature, the mixing device is throttled back to allow the boiler to recover.
- Throttling back minimizes time boiler operates below its condensing temperature and prolongs life expectancy of boiler.

RUNNING TIME (RUN TIME) (See fig. g.)

Run time is the length of time the snow-melting system operates once the slab has reached melting temperature.

- During the time the slab approaches melting temperature, run time does not decrease.
- Once the slab has reached melting temperature, run time begins counting down.
- When the display reaches 0:00, the control has completed the melting run time.



DETECTION SENSITIVITY (SENSTVTY) (See fig. h.)

The SNOWpro 411 has a sensitivity setting to compensate for varying outdoor conditions which could affect how the moisture detector in the Snow and Ice Detector interprets the presence of moisture. This adjustable setting is available through the SENSTVTY item in the ADJUST Menu of the control.

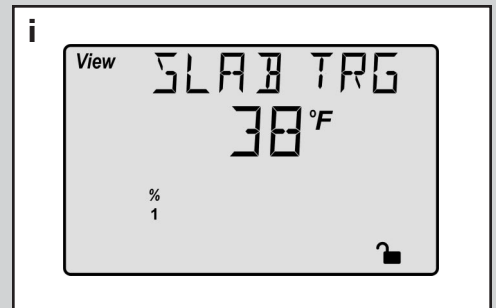
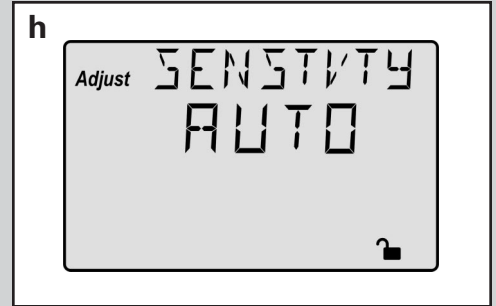
- As snow becomes contaminated with dirt, and as the sensor itself becomes dirty, the control may incorrectly indicate the presence of water. If this condition occurs, clean the surface of the sensor and turn down the SENSTVTY setting.
- If snow in your area is very clean, the SENSTVTY setting may need to be increased before snow is detected. If AUTO is selected, the control automatically adjusts the sensitivity level used to detect moisture.

TARGET SLAB TEMPERATURE (SLAB TRG) (See fig. i.)

Depending on which snow and ice melting mode the system is in, the control will establish a target temperature for the system to satisfy current demand. The target slab temperature is determined by the control through the inputs of MELTING, IDLE and OUTDOOR temperature.

MIXING SYSTEM PUMP P1 OPERATION

The mixing system pump (Mixing Pmp P1) contact closes and remains closed as long as control is either in the MELTING or IDLE mode. The mixing system pump contact shuts off if control is in CWCO, or if there is no call for MELTING or IDLE.



CONTROL FUNCTION OVERVIEW - SECTION C

TROUBLESHOOTING

When troubleshooting any heating system, it is a good idea to establish a set routine to follow. Below is an example of a sequence you can use when diagnosing or troubleshooting problems in a hydronic heating system.

IDENTIFY 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 zone or does the problem affect the entire system?
- Is this a consistent problem or only intermittent?
- For how long has the problem existed?

This information is critical in correctly diagnosing the problem.

UNDERSTAND THE SEQUENCE OF OPERATION

If a particular zone is not receiving enough heat, check:

- Which pumps or valve in the system must operate to deliver heat to the affected zone

If the zone is receiving too much heat, check:

- Which pumps, valves or check valves must operate to stop delivery of heat

Now, press the Test button on the control and follow it through the test sequence as described in the Testing section. Pause the control as necessary to make sure the correct device is operating as it should.

SKETCH THE SYSTEM PIPING

This is a relatively simple step that tends to be overlooked, however it can often save hours of time in troubleshooting a system. Use your sketch to:

- Note flow directions in the system — paying close attention to the location of the pumps, check valves, pressure bypass valves and mixing valves
- Ensure the correct flow direction on all pumps

This is also a very useful step if additional assistance is required.

DOCUMENT THE CONTROL FOR REFERENCE

Before making any adjustments to the control, write down all items that the control is currently displaying. Include items such as:

- Error messages
- Current temperatures
- Settings (use SNOWpro 411 Program Setup Sheet in **Appendix V - page 57**)
- Devices that 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

Now that the sequence of operation is known and the system is sketched:

- Is the control operating proper pumps and valves at the correct times?
- Is the control receiving correct signals from the system about when it should be operating?
- Are proper items selected in menus of the control for the device that is to be operated?

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.
- Determine if the internal contacts on the control are opening and closing correctly.
- Follow the instructions in the Testing the Wiring section to simulate the closed contacts on the terminal blocks as required.
- Test the sensors and their wiring as described previously.

APPENDIX

TABLE OF CONTENTS

I	Variable Speed Injection Mixing	45-47
II	SNOWpro 411 Menu Tree	48
III	Application Drawings	49-51
IV	Error Message Overview	52-56
V	SNOWpro 411 Program Setup	57

Variable Speed Injection Mixing For Hydronic Heating Systems

The purpose of this section is to discuss the use of variable speed injection mixing to precisely transfer heat from the high temperature boiler (primary) loop to the lower temperature radiant (secondary) loop in hydronic heating systems.

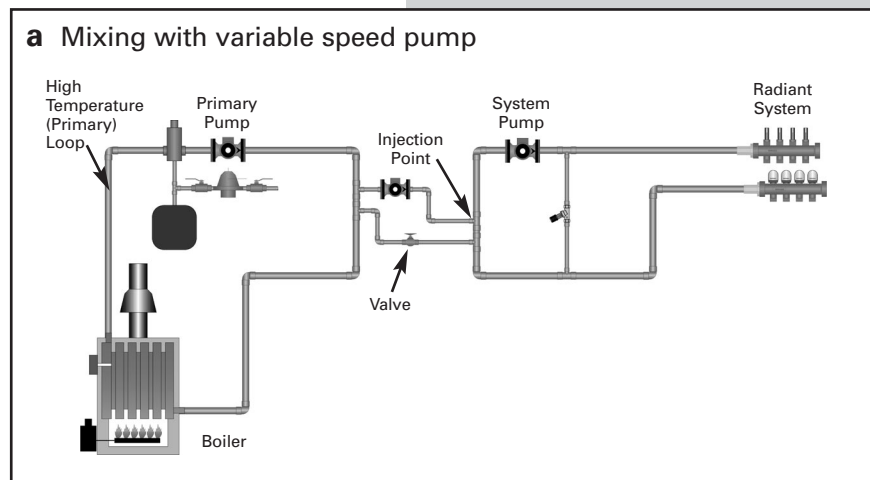
Various devices and plumbing arrangements can be used to accomplish this transfer. In the past, it was common to use a mixing valve in order to temper the water between the primary and secondary loops in a system. In some instances, the heat source (condensing or electric boiler, geo-thermal heat pump, etc.) can be operated at lower temperatures and dedicated solely to operating a low temperature radiant heating system. In the vast majority of systems, mixing is required because:

- A boiler minimum operating temperature is required
- High temperature water is required for other system needs
- Water temperatures vary over a wide range (e.g. solar heat sources, waste heat utilization, wood fired boilers, etc.)

When the available heat source produces higher water temperatures than is required by the radiant heating system, a tempering device is required. To achieve the lower water temperature required for the radiant system, the high temperature boiler water must be blended or injected into the return side of the radiant system to a level that meets the required supply water temperature for the radiant side. Technologies have evolved to the point of using small "wet rotor" pumps to accurately adjust the secondary radiant supply water temperature regardless of the flow activities on either primary or secondary loops. **(See fig. a.)**

The speed of the injection pump is automatically adjusted to deliver the desired volume of hot boiler water to the lower temperature radiant loop. The injection pump speed is constantly adjusted as the radiant heating system demand and the supply water temperature change. If the boiler return temperature becomes too cold, the injection pump can be slowed down to reduce the heat injection rate, resulting in an increased boiler return temperature.

Wirsbo offers a variety of controls that utilizes variable speed injection pump output. This output modulates the power supply to the circulator to vary its rotational speed. For residential and many commercial systems, the controls have a 120 VAC 50/60Hz output to directly power small circulators.



A permanent capacitor, impedance protected motor (no start switch) on the circulator is required. The maximum allowable amperage for this output is 2.2 amps, which limits the allowable circulator size to $\frac{1}{2}$ hp.

This type of system can use a small circulator to inject a high BTU input into a relatively large system flow. Typically, the injection pump need only deliver one-sixth to one-fourth of the system flow for low temperature radiant panels if high temperature water is available for injection. In small hydronic systems, the smallest available circulator for variable speed injection may be too large. It is important to properly size the injection pump and use a globe valve on the return injection leg.

For proper injection pump sizing, the designer must know the following information: **(See fig. b.)**

F_V = Flow Rate (Injection Loop) in gpm

F_1 = Radiant (Secondary Loop) Flow Rate in gpm

T_1 = Boiler (Primary Loop) Supply Temperature

T_2 = Radiant (Secondary Loop) Supply Temperature

T_R = Radiant (Secondary Loop) Return Temperature

T_D = Radiant (Secondary Loop) Temperature Differential ($T_2 - T_R$)

Note: All values are to be given at design conditions. The formula used for sizing the injection pump is shown below.

$$F_V = (F_1 \times T_D) / (T_1 - T_R)$$

Example:

If values at design conditions are:

F_1 = Radiant (Secondary) Flow = 30 gpm

T_1 = Boiler (Primary) Supply = 180°F

T_2 = Radiant (Secondary) Supply = 140°F

T_R = Radiant (Secondary) Return = 120°F

T_D = Radiant (Secondary) Differential = 20°F

To find the injection pump flow rate:

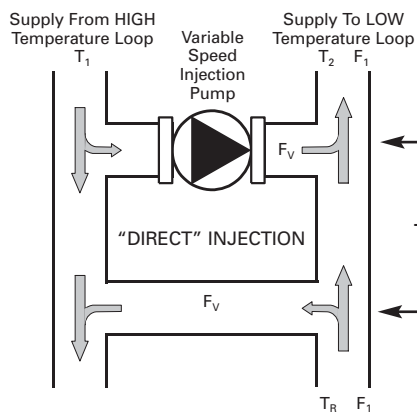
$$F_V = (30 \times 20) / (180 - 120)$$

$$F_V = (600) / (60)$$

$$F_V = 10 \text{ gpm}$$

b Direct Injection Mixing
"F_V" to be calculated

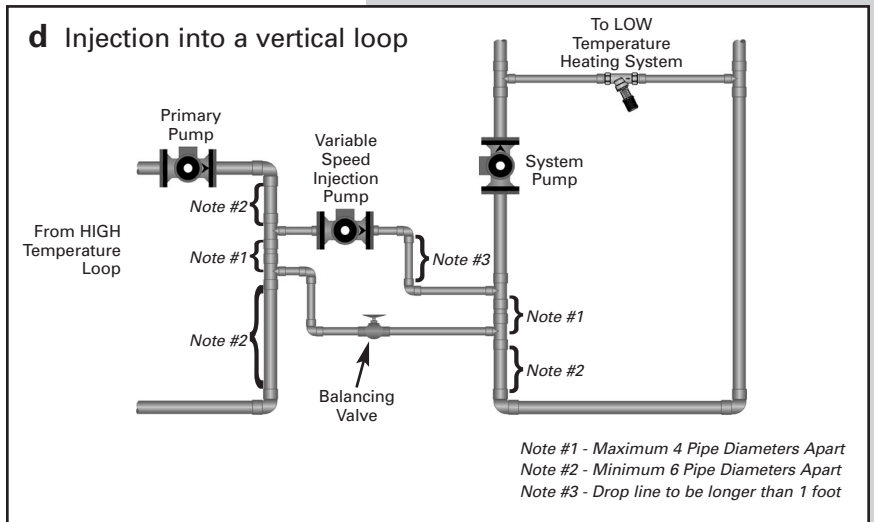
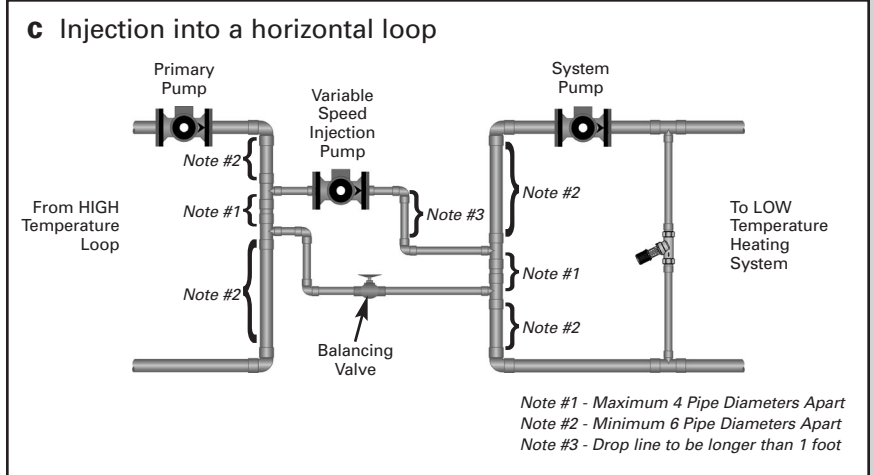
Direct Injection $F_V = (F_1 \times T_D) / (T_1 - T_R)$



In order to provide the proper amount and temperature of supply water on the radiant heating loop, the variable speed injection pump needs only to inject 10 gpm at design conditions.

Figures c and d show the two most common piping layouts for variable speed injection mixing. Pay particular attention to the drop lines (or thermal traps) shown in the injection legs. These are particularly important to prevent "thermal siphoning" from the primary loop into the secondary loop. Consult the pump manufacturers' chart (below) to assist in the selection of the proper injection pump for the project.

In the piping arrangement shown, the variable speed injection pumps are plumbed in such a way as to limit head pressure in the injection legs to only a few feet at most. Use standard pressure drop calculations and equivalent length of feet charts for exact calculations if required.



Variable Speed Injection Design Flow Rates

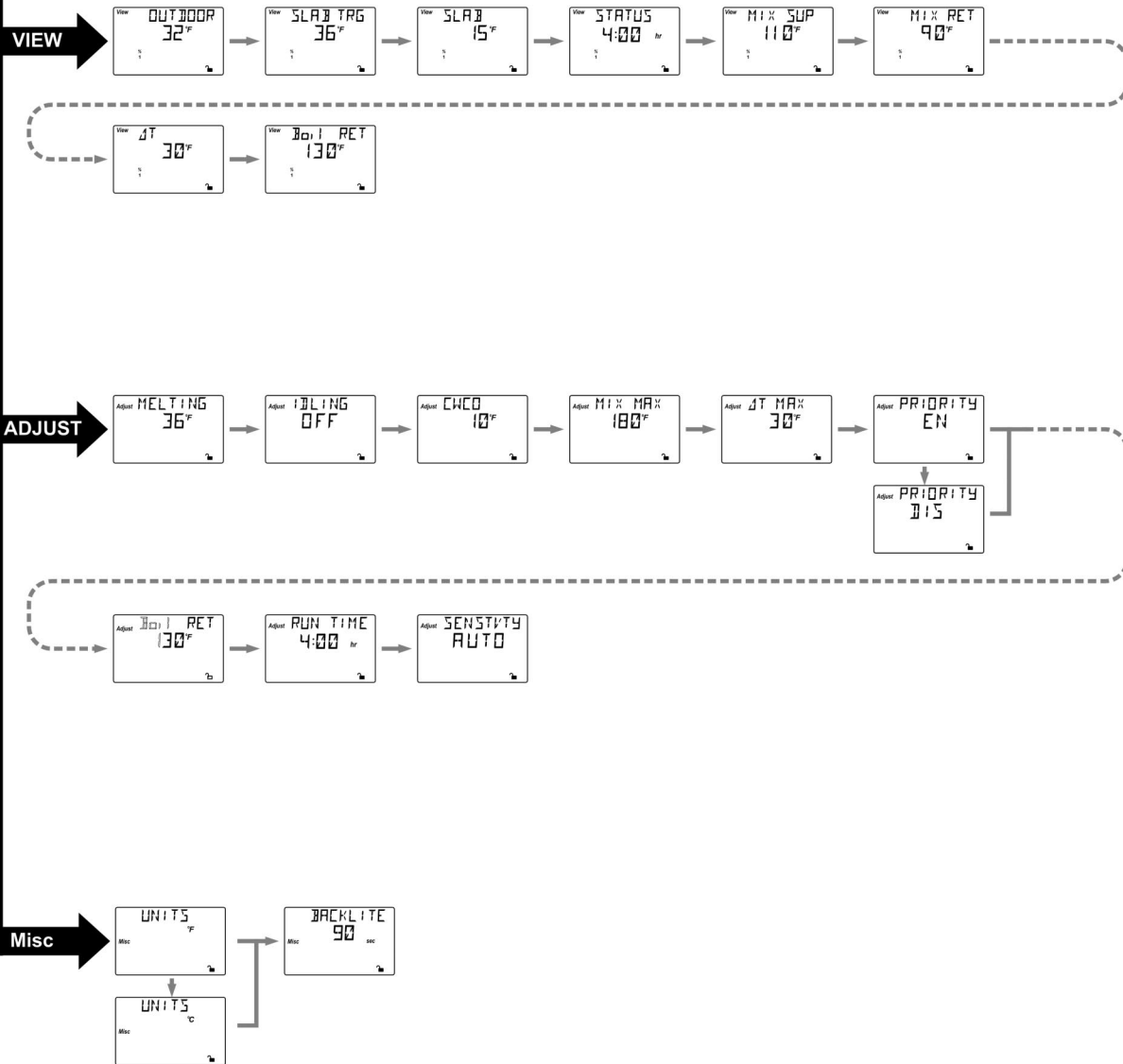
Design Injection Flow Rate (US GPM)		Turns open of the Globe Valve (%)	Nominal Pipe Diameter (inches)	Manufacturer Approved Pump Models													
Without Globe Valve	With Globe Valve			Grundfos (F)				Taco			B&G			Armstrong			
				15-42	26-64	43-75	003	007	0010	0012	NRF 9	NRF 22	NRF 33	Astro 30	Astro 50		
-	1.5 - 2.0	20	0.5	X	X				X	X				X		X	
2.5	2	100	0.5					X									
4 - 5.5	3.0 - 4.5	100	0.5	X	X				X				X	X		X	
4.5 - 6.5	4 - 5.5	100	0.75		X			X					X			X	
9 - 10.5	7.5 - 8.5	100	0.75										X				
9	8	100	1											X			
14 - 15	12 - 13	100	1		X					X				X			
19	17	100	1.25														X
22 - 24	19 - 21	100	1.25			X					X					X	
26 - 28	-	100	1.5			X					X					X	
35 - 37	31 - 32	100	1.5				X					X					
33	30	100	2													X	
41 - 45	39 - 42	100	2				X					X					

* Speed 2, ** Speed 3 (Brute)

Table courtesy of tekmar - This table assumes there are 5 feet of pipe, 4 elbows, and branch trees of the listed diameter. These circulators have been tested and approved by the manufacturers for use with proSeries controls.

SNOWpro 411

MENU



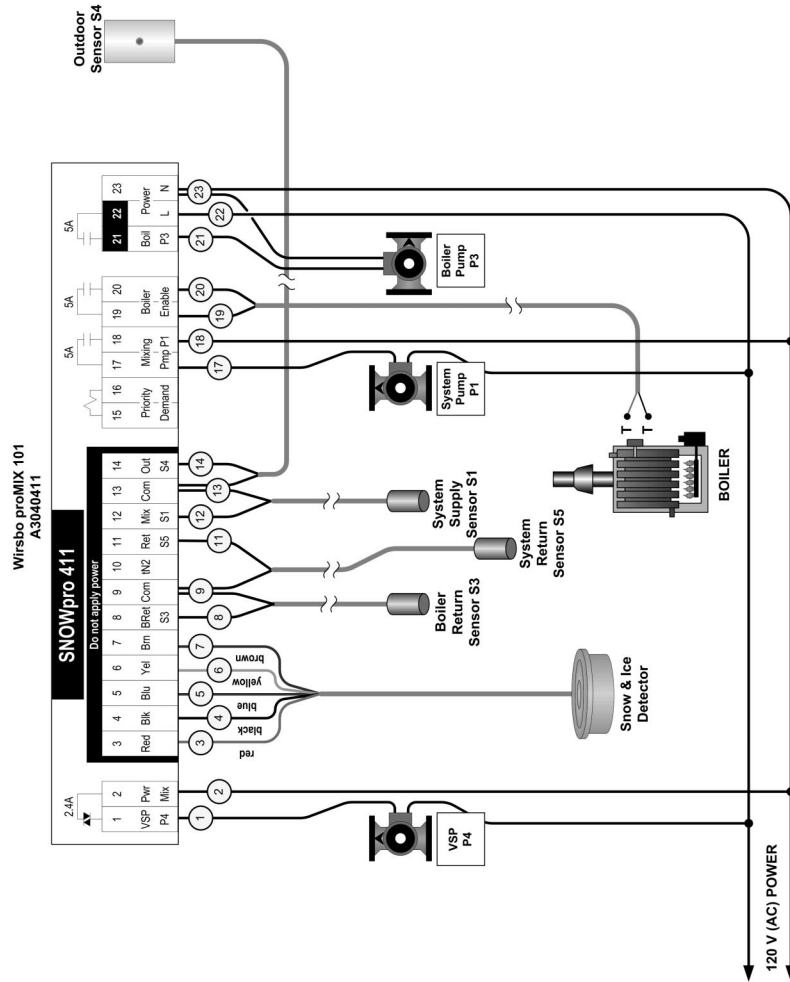
SNOWpro 411



WIRSBO
Life, Safety, Comfort Systems

Bringing **comfort** to life

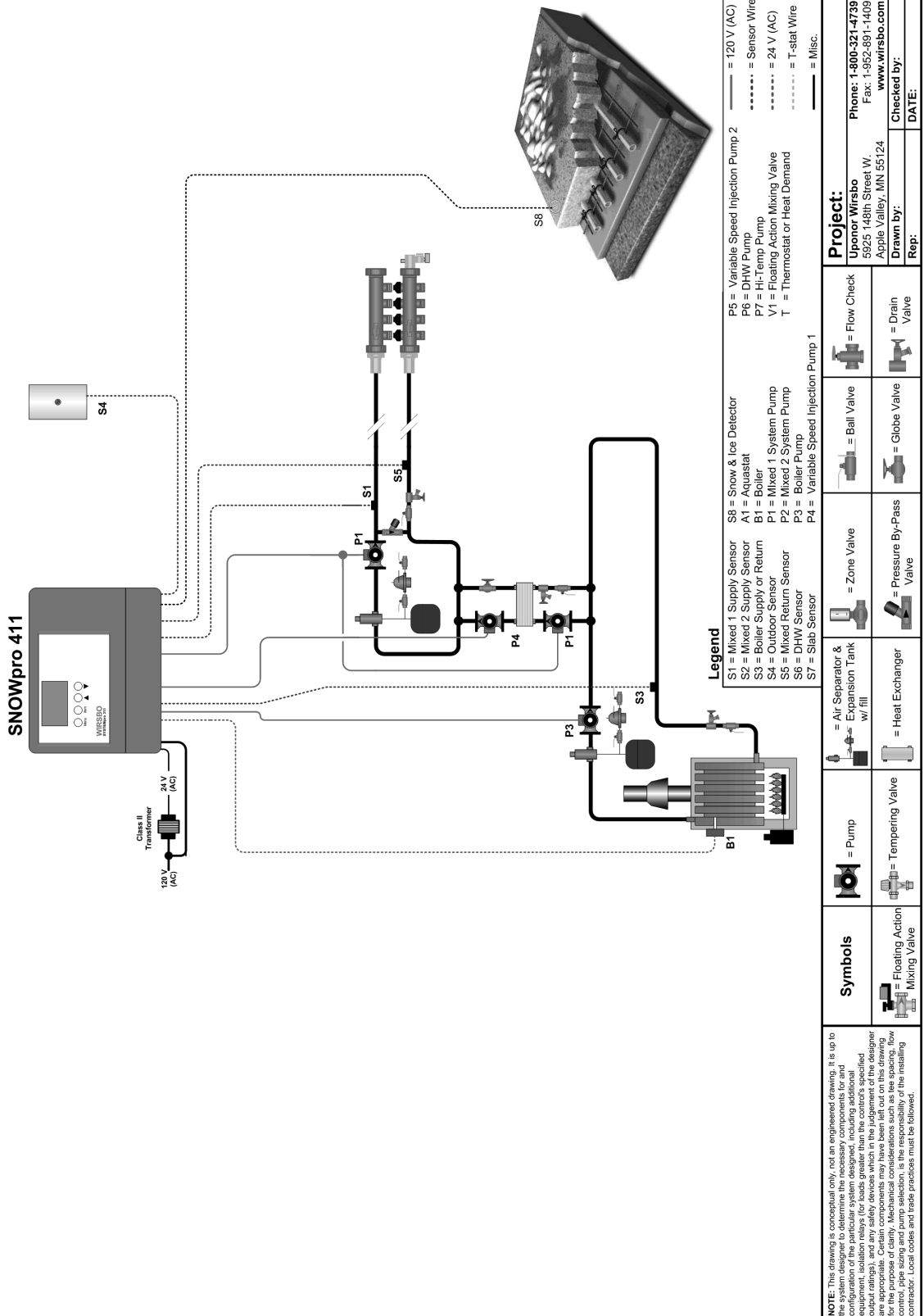
Application Drawing
SM411-1





Bringing
comfort
to life

Application Drawing
W411-1s



NOTE: This drawing is conceptual only, not an engineered drawing. It is up to the contractor to verify the load capacity of the particular system designed, including additional equipment, isolation relays (for loads greater than the control's specified output ratings), and any safety devices which in the judgement of the designer are necessary for the purpose of safety. Mechanical considerations such as the spacing, flow control, pipe sizing and pump selection, as the responsibility of the installing contractor. Local codes and trade practices must be followed.

Symbols	
	= Pump
	= Tempering Valve
	= Floating Action Mixing Valve

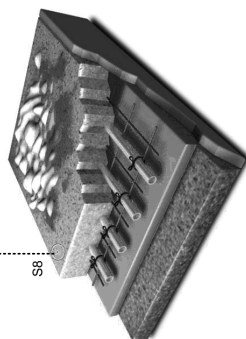
	= Air Separator & Expansion Tank w/ fill
	= Zone Valve
	= Ball Valve
	= Globe Valve
	= Pressure By-Pass Valve

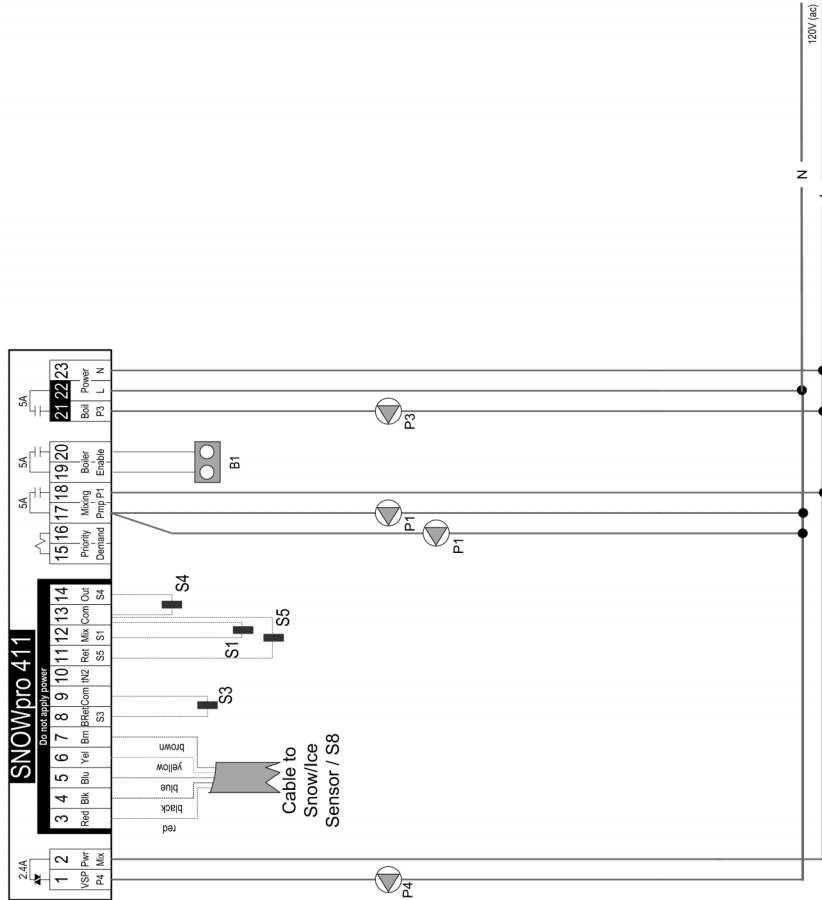
	= Flow Check
	= Drain Valve

Project:	
Uponor, Wirsbo	Phone: 1-800-321-4739
5925 148th Street W	Fax: 1-952-891-1489
Apple Valley, MN 55124	www.wirsbo.com
Drawn by:	Checked by:
Rep:	DATE:

Legend

- S1 = Mixed 1 Supply Sensor
- S2 = Mixed 2 Supply Sensor
- S3 = Outdoor Sensor
- S4 = Outdoor Sensor
- S5 = Mixed 2 System Pump
- S6 = DHW Sensor
- S7 = Slab Sensor
- S8 = Snow & Ice Detector
- A1 = Aquastat
- B1 = Boiler
- P1 = Mixed 1 System Pump
- P2 = Mixed 2 System Pump
- P3 = Boiler Pump
- P4 = Variable Speed Injection Pump 1
- P5 = Variable Speed Injection Pump 2
- P6 = DHW Pump
- P7 = Hi-Temp Pump
- V1 = Floating Action Mixing Valve
- T = Thermostat or Heat Demand
- = 120 V (AC)
- = Sensor Wire
- = 24 V (AC)
- = T-stat Wire
- = Misc.





NOTE: This drawing is conceptual only, not an engineered drawing. It is up to the system designer to determine the necessary components for and configuration of the particular system designed, including additional equipment, isolation relays (for loads greater than the control's specified capacity), and other components. Certain components may have been left out on this drawing for the purpose of clarity. Mechanical considerations such as wire spacing, flow control, pipe sizing and pump selection, as the responsibility of the installing contractor. Local codes and local practices must be followed.

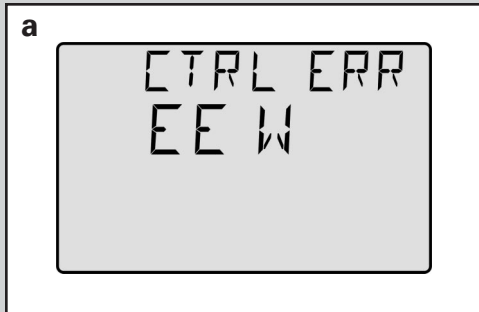
Legend

- S1 = Mixed 1 Supply Sensor
- S2 = Mixed 2 Supply Sensor
- S3 = Boiler Supply or Return
- S4 = Outdoor Sensor
- S5 = Mixed 1 System Pump
- S6 = Mixed 2 System Pump
- S7 = Slab Sensor
- S8 = Snow & Ice Detector
- A1 = Acoustat
- B1 = Boiler
- P1 = Variable Speed Injection Pump 1
- P2 = Variable Speed Injection Pump 2
- P3 = DHW Pump
- P4 = HI-Temp Pump
- P5 = Floating Action Mixing Valve
- T = Thermostat or Heat Demand

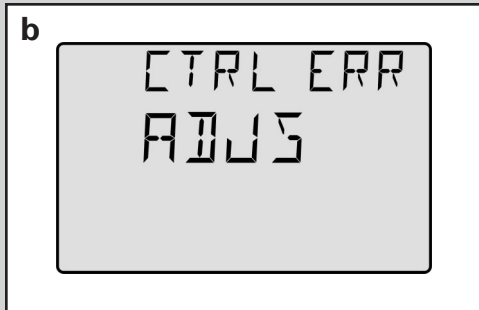
- = 120 V (AC)
- = Sensor Wire
- = 24 V (AC)
- = T-stat Wire
- = Misc.

Project:	
Uponor Wirsbo	Phone: 1-800-321-4739
5925 148th Street W.	Fax: 1-952-891-1409
Apple Valley, MN 55124	www.wirsbo.com
Drawn by:	Checked by:
Rep:	DATE:

Error Messages



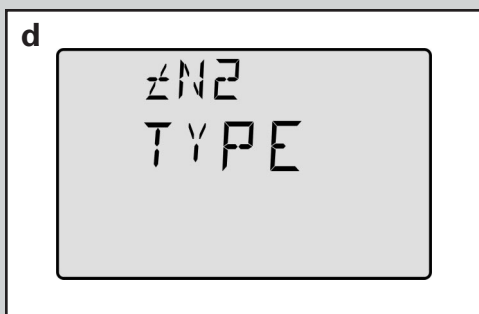
The control was unable to store a piece of information into its EEPROM. This error can be caused by a noisy power source. The control will display the error message and will continue to operate as normal. Pressing either the Menu or Item button will clear this error. **(See fig. a.)**



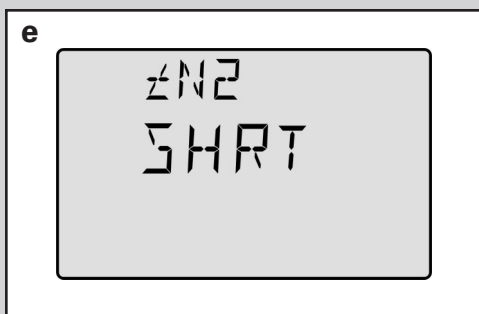
The control was unable to read a piece of information stored in the Adjust menu. Because of this, the control was required to load the factory settings into all of the items in the Adjust menu. The control will stop operation until all of the items available in the Adjust menu of the control have been checked by the user or installer. **(See fig. b.)**



The control was unable to read a piece of information stored in the Miscellaneous menu. Because of this, the control was required to load 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 Misc menu of the control have been checked by the user or installer. **(See fig. c.)**



The control will stop operation until the A/D fault is corrected. An incorrect device has been connected to the (tN2) input terminal. To correct this error, ensure that the correct device is being used. Once the problem has been corrected, press either the Menu or Item button to clear the error message from the control. **(See fig. d.)**



A short circuit has been read between the (tN2) 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. The error message can be cleared by pressing either the Menu or Item button. **(See fig. e.)**

Error Messages (cont.)

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 **Installation - Step 7 (page 23)**. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. f.)

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 **Installation - Step 7 (page 23)**. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. g.)

The control is no longer able to read the mix supply sensor due to a short circuit. In this case, the control operates the mixing device at a fixed output as long as there is a mixing demand. Locate and repair the problem as described in **Installation - Step 7 (page 23)**. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. h.)

The control is no longer able to read the mix supply sensor due to an open circuit. In this case, the control operates the mixing device at a fixed output as long as there is a mixing demand. Locate and repair the problem as described in **Installation - Step 7 (page 23)**. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. i.)

The control is no longer able to read the mix return sensor due to a short circuit. The control continues to operate without ΔT protection of the slab. Locate and repair the problem as described in **Installation - Step 7 (page 23)**. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. j.)

f

OUTDOOR
SHRT

g

OUTDOOR
OPEN

h

MIX SUP
SHRT

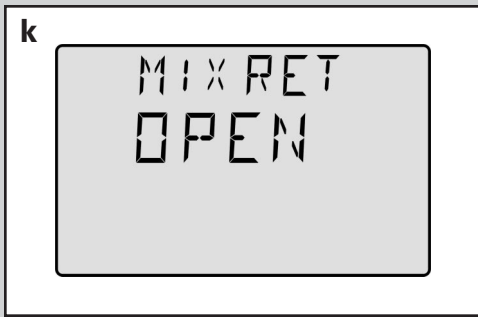
i

MIX SUP
OPEN

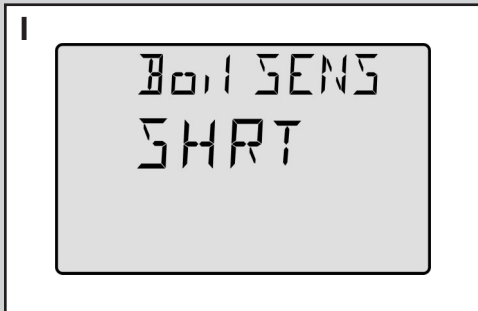
j

MIX SUP
SHRT

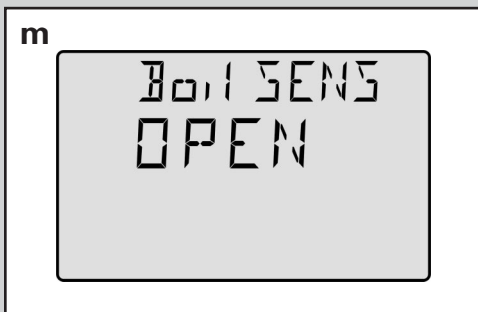
Error Messages (cont.)



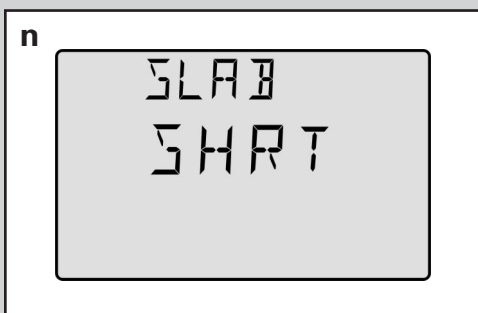
The control is no longer able to read the mix return sensor due to an open circuit. The control continues to operate without ΔT protection of the slab. Locate and repair the problem as described in **Installation - Step 7 (page 23)**. If the mix return sensor was deliberately not installed, set the ΔT MAX item to OFF. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. k)



The control is no longer able to read the boiler sensor due to a short circuit. If the Boil MIN item is set higher than 100°F (38°C), the control closes the Boiler contact when there is a call for heat in the system. The boiler temperature is limited by the operating aquastat. If the Boil MIN is set lower than 100°F (38°C), the control does not operate the Boiler contact. Locate and repair the problem as described in **Installation - Step 7 (page 23)**. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. l.)



The control is no longer able to read the boiler sensor due to an open circuit. If the Boil MIN item is set higher than 100°F (38°C), the control closes the Boiler contact when there is a call for heat in the system. The boiler temperature is limited by the operating aquastat. If the Boil MIN is set lower than 100°F (38°C), the control does not operate the Boiler contact. Locate and repair the problem as described in **Installation - Step 7 (page 23)**. If the boiler sensor was deliberately not installed, set the Boil SENS item to NONE. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. m.)



The control is no longer able to read the slab sensor due to a short circuit. In this case, if the control is currently in the MELTING mode, the control will target a fixed mixing water temperature until the melting cycle is finished. Locate and repair the problem as described in **Installation - Step 7 (page 23)**. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. n.)



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 **Installation - Step 7 (page 23)**. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. o.)

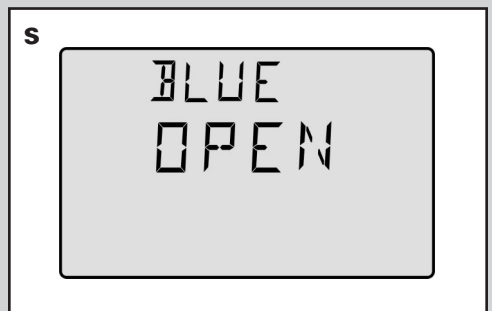
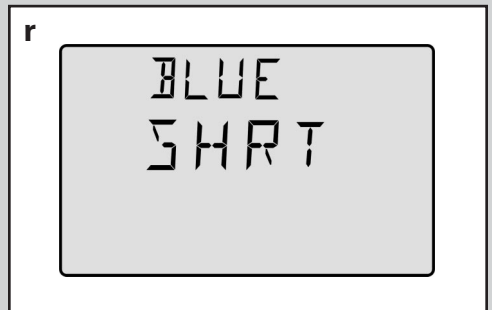
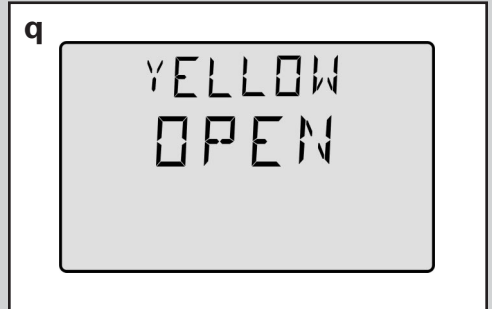
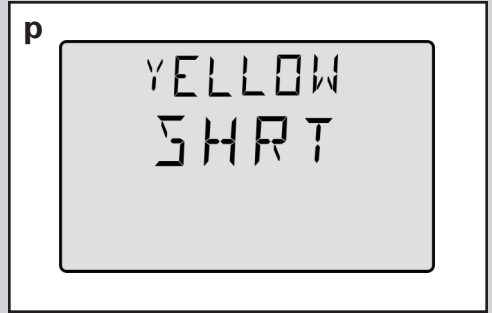
Error Messages (cont.)

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 and Ice Detector. Check the yellow and the black wires at the 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. (See fig. p.)

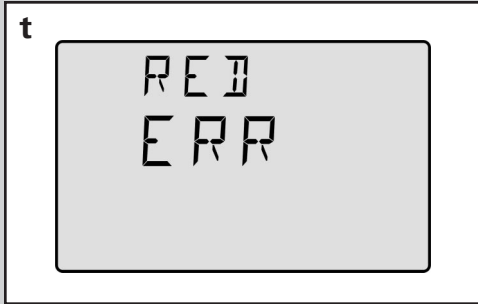
The control is no longer able to read the yellow sensor due to an open circuit. In this case, the control will turn off the heater in the Snow and Ice Detector. Check the yellow and the black wires at the terminals (4 and 6) and the wiring from the terminal plug to the sensor. To clear the error message from the control after the sensor has been repaired, press either the Menu or Item button. (See fig. q.)

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 and ice melting system can only be operated using an external melt demand, Remote Display Module, Remote Start/Stop Module or the Start button on the control. Otherwise, the control will operate as if the Snow and Ice Detector is dry. Check the blue and the black wires at the terminals (4 and 5) 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. (See fig. r.)

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 and ice melting system can only be operated using an external melt demand, Remote Display Module, Remote Start/Stop Module or the Start button on the control. Otherwise, the control will operate as if the Snow and Ice Detector is dry. Check the blue and the black wires at the terminals (4 and 5) 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. (See fig. s.)



Error Messages (cont.)



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 and ice melting system can only be operated using an external melt demand, Remote Display Module, Remote Start/Stop Module or the Start button on the control. Otherwise, the control will operate as if the Snow and Ice Detector is dry. Check the red and the black wires at the terminals (3 and 4). 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. (See fig. t.)



The control's internal sensor is too hot. In this case, the control will turn off the heater in the Snow and Ice Detector 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. (See fig. u.)



RADIANT FLOORS
COMFORT HEATING

www.wirsbo.com

SNP411MAN5/03

Uponor Wirsbo
5925 148th STREET WEST
APPLE VALLEY, MN 55124

TEL: (800) 321-4739
FAX: (952) 891-1409
www.wirsbo.com

