Slant/Fin®

FOR GAS-FIRED, OIL FIRED AND DUAL FUEL HOT WATER HEATING PLANTS

CARAVAN **SC-3 Controller**

MODULAR BOILER CONTROLLER SERIES

INSTALLATION AND OPERATING INSTRUCTIONS

CONTENTS

SC-3 Applications

- Space Heat Systems With Outdoor Reset
- Constant Temperature Setpoint Control

If your system is different than the above, call the Slant/Fin technical services group at 800-873-4346 to determine the proper control.

The SC-3 is a microprocessor control which will sequence up to three heating stages based on outdoor air temperature and supply water temperature. Designed to handle a Caravan gas-fired, oil-fired or *dual fuel-fired hot water heating plant for space heating or “Setpoint” operation. A large easy to read display provides current system temperatures and operating status.

ADDITIONAL FUNCTIONS INCLUDE:
Pump exercising. Pump purging. Boiler demand for space heating loads. Set point demands for set point loads. Test sequence to ensure proper component operation. CSA C US certified. Setback input for energy savings.

SPACE HEATING OPERATION: When the outdoor air temperature drops below a preset value, the heating system is energized. The SC-3 Controller determines the number of stages required to meet the space heating needs and fires them. During operation, the Controller scans system temperatures, adding or deleting stages as necessary to satisfy heating load.

Controller Packing List

1- SC-3 Modular Controller	**P/N 435081**
1- Outdoor sensor with enclosure	**P/N 339070**
1- Universal sensor	**P/N 339071**

SETPOINT OPERATION:
The SC-3 adds and deletes stages to minimize the difference between the desired Setpoint temperature and the actual measured Supply Water Temperature.

Dual-Fuel
* Not available in Canada

Printed in U.S.A. 605
Part No. 435083000

PUBLICATION SC-3-40

INSTALLATION

CAUTION

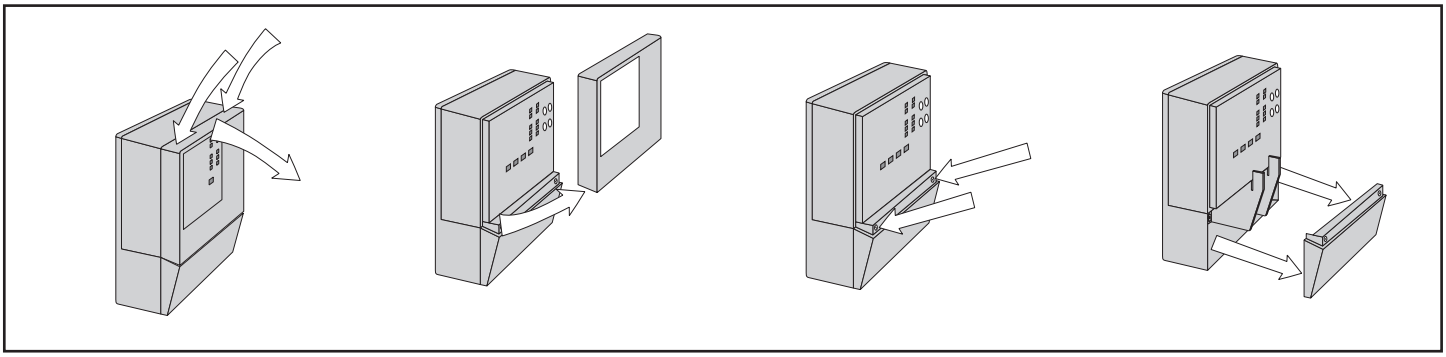
Improper installation and operation of this control could result in damage to the equipment and possibly even personal injury. It is your responsibility to ensure that this control is safely installed according to all applicable codes and standards. This electronic control is not intended for uses as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

CONTROL PANEL MOUNTING

The control panel is to be mounted in an indoor area where the ambient temperature range will be 30 to 120˚F (0 to 50˚C) and less that 95% RH. Power Supply is to be 115 V (ac) +/- 10% 50/60 Hz 600 VA.

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

WARNING: The nonmetallic enclosure does not provide grounding between conduit connections. Use grounding type bushings and jumper wires as needed.

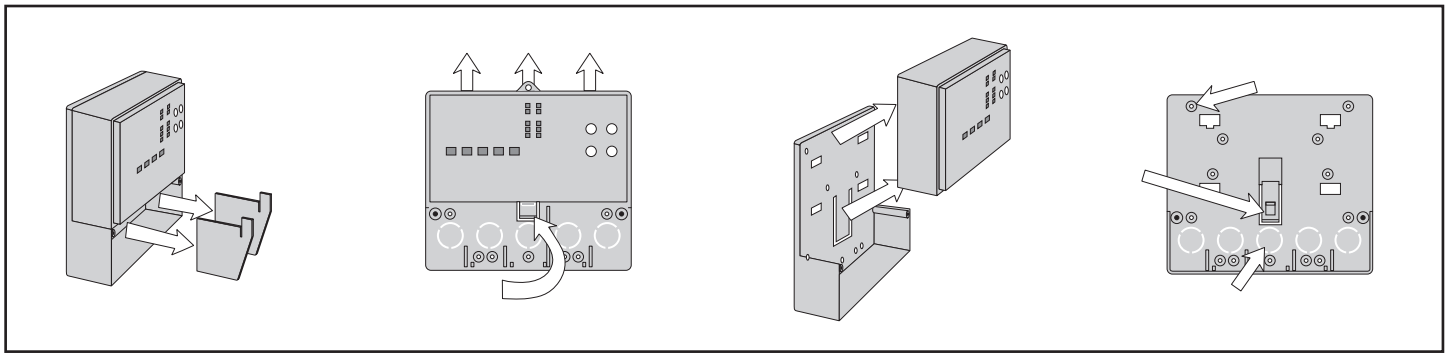


Press down at the fingertip grips on top of the front cover and pull out and down.

Lift the front cover up and away from the control.

Loosen the screws at the front of the wiring cover.

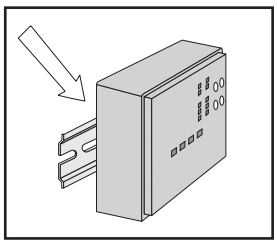
The wiring cover pulls straight out from the wiring chamber.



Remove the safety dividers from the wiring chamber by pulling them straight out of their grooves.

The control can be mounted on a standard DIN rail. First remove the control from its base and then, using the hooks and spring clip on the back of the control, mount it onto the DIN rail. This will be a popular option for those who prefer to mount the control inside a larger electrical panel.

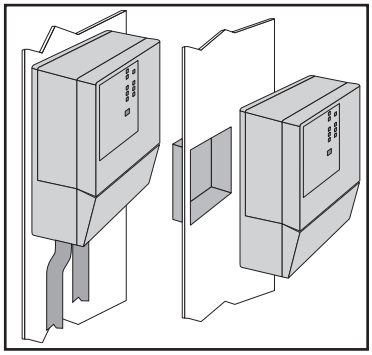
Press the control release clip on the base inside the wiring chamber and slide the control upwards.



The control lifts up and away from the base.

The wiring can enter the bottom or the back of the enclosure. Knock-outs 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.

The base is ready for mounting.



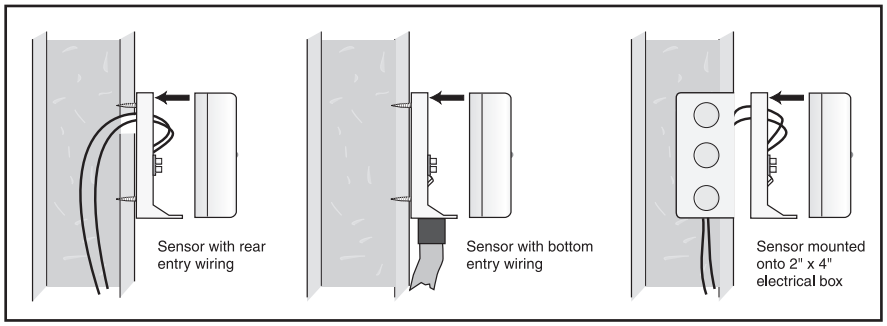
INSTALLING THE SENSORS

OUTDOOR SENSOR SF P/N 339070

MOUNTING THE SENSOR

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

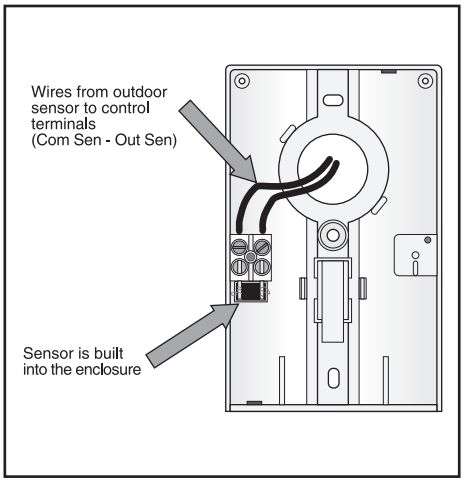
- Remove the screw and pull the front cover off the sensor enclosure.
- The enclosure can either be mounted directly onto a wall or a 2” x 4” electrical box. When it is wall mounted, the wiring should enter through the back or bottom of the enclosure. Do not mount the enclosure with the conduit knockout 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 and insulating barrier behind the enclosure.
- The sensor should be mounted on a northern wall of the building. It should not be exposed to heat sources such as ventilation or window openings. **Caution**: If sunlight strikes the sensor enclosure or the surface area surrounding it, the system will provide water temperatures that are not high enough to meet the demand.
- It should be installed at an elevation above the ground that will prevent accidental damage or tampering.

WIRING AND TESTING THE SENSOR

- Connect 18 AWG or similar wire to the two terminals provided in the enclosure and run the wires from the sensor to the control. Do not run the wires close to and 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 instruction that follows and connect the wires to the control.
- Replace the front cover of the sensor enclosure.



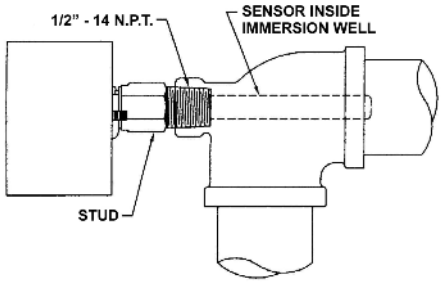
UNIVERSAL SENSORS

MOUNTING THE SENSOR SF P/N 339071

Note: These sensors are designed to mount in an immersion well or on a pipe.

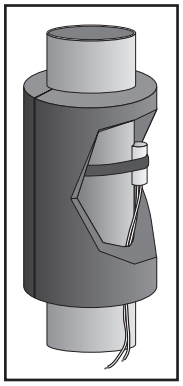
For example - If a Sensor is mounted onto a 1” type L copper pipe, there is approximately an 8 second delay between a sudden change in water temperature and the time the sensor measures the change. This delay increases considerably when steel pipe is used.

It is strongly recommended that an immersion well be used, especially when steel pipe of greater than 1-1/4” is used and also when large diameter pipes are used and fluid stratification is probable.

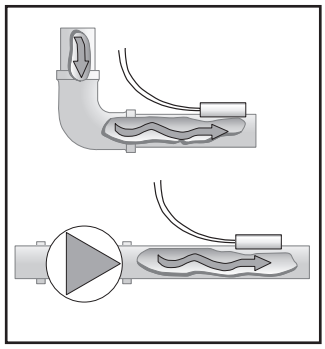


Sensor Mounted In Immersion Well
SF P/N 410569

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 flat portion of the sensor should be mounted against the pipe.



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.



WIRING AND TESTING THE SENSOR

WARNING: Do not run sensor wires close to and 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.

- 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 that follow and then connect the wires to the control.

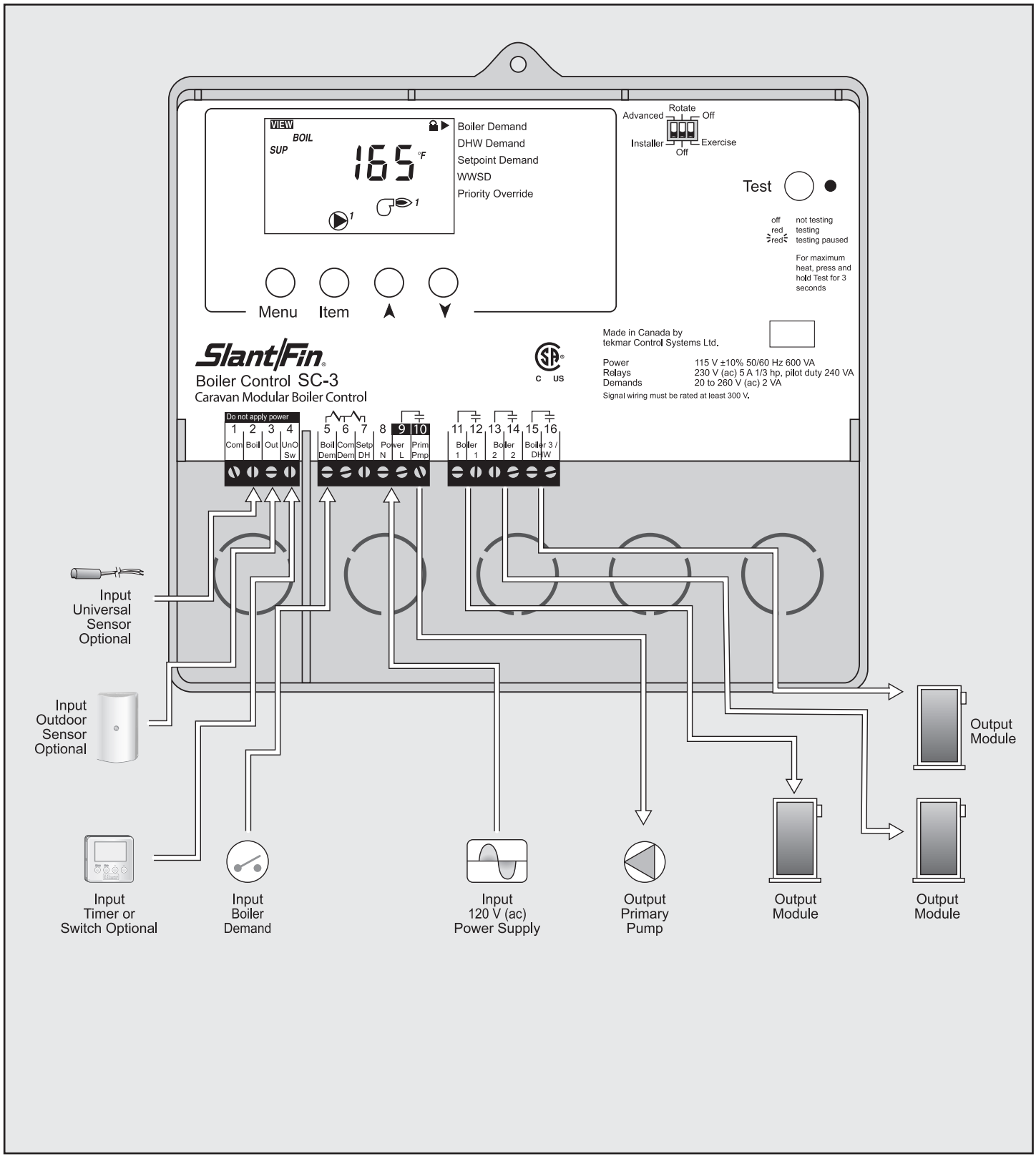
SENSOR TESTING INSTRUCTIONS

A good quality test meter capable of measuring up to 5,000 kΩ (1 kΩ = 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 below, 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.

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


VIEW
BOIL
SUP
165 °F
Boiler Demand
DHW Demand
Setpoint Demand
WWSD
Priority Override
Advanced
Rotate
Off
Installer
Exercise
Off
Test
off not testing
red testing
red testing paused
For maximum heat, press and hold Test for 3 seconds
Menu
Item
Made in Canada by tekmar Control Systems Ltd.
SlantFin
Boiler Control SC-3
Caravan Modular Boiler Control
c US
Power 115 V ±10% 50/60 Hz 600 VA
Relays 230 V (ac) 5 A 1/3 hp, pilot duty 240 VA
Demands 20 to 260 V (ac) 2 VA
Signal wiring must be rated at least 300 V.
Do not apply power
1 Com
2 Boil
3 Out
4 UnO Sw
5 Boil Dem
6 Com Dem
7 Setp DH
8 Power N
9 L
10 Prim Pmp
11 Boiler 1
12 Boiler 1
13 Boiler 2
14 Boiler 2
15 Boiler 3 / DHW
16
Input Universal Sensor Optional
Input Outdoor Sensor Optional
Input Timer or Switch Optional
Input Boiler Demand
Input 120 V (ac) Power Supply
Output Primary Pump
Output Module
Output Module
Output Module

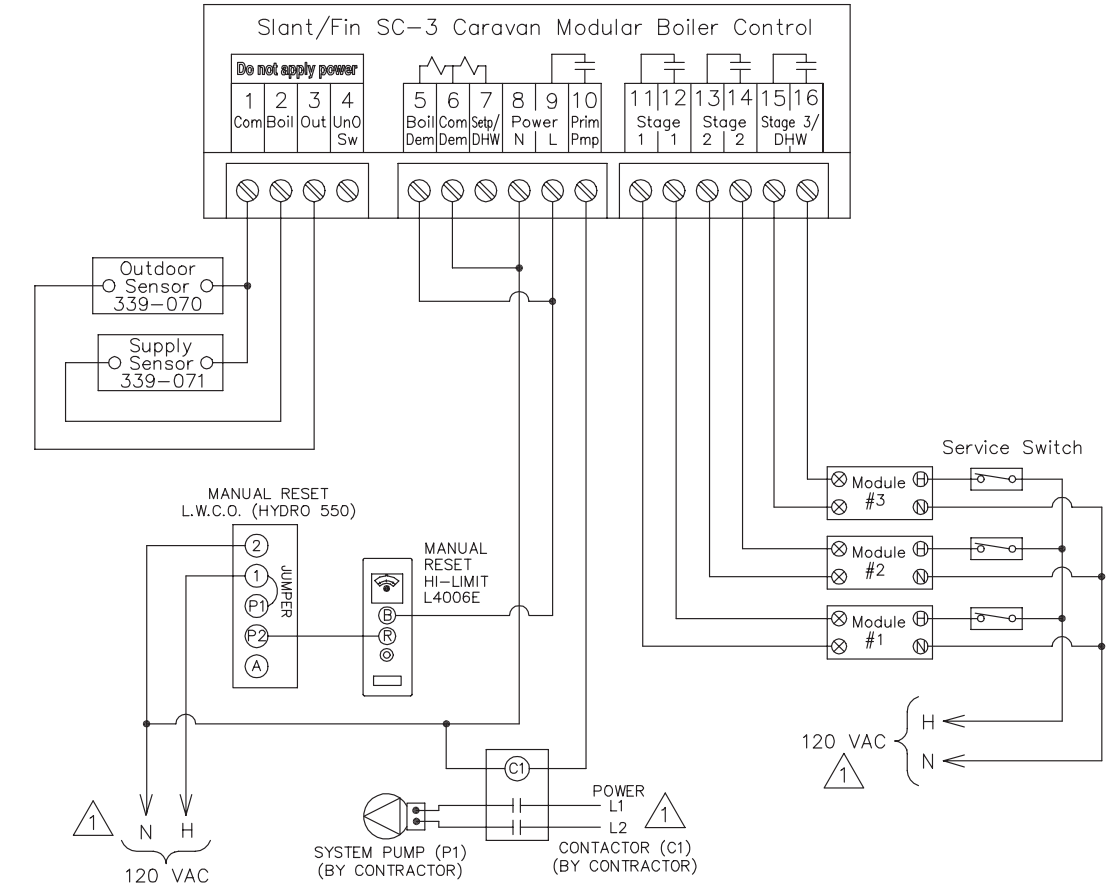
WIRING THE SYSTEM

Use one of the following wiring diagrams to wire your system, along with the appropriate diagram on **page 9**.

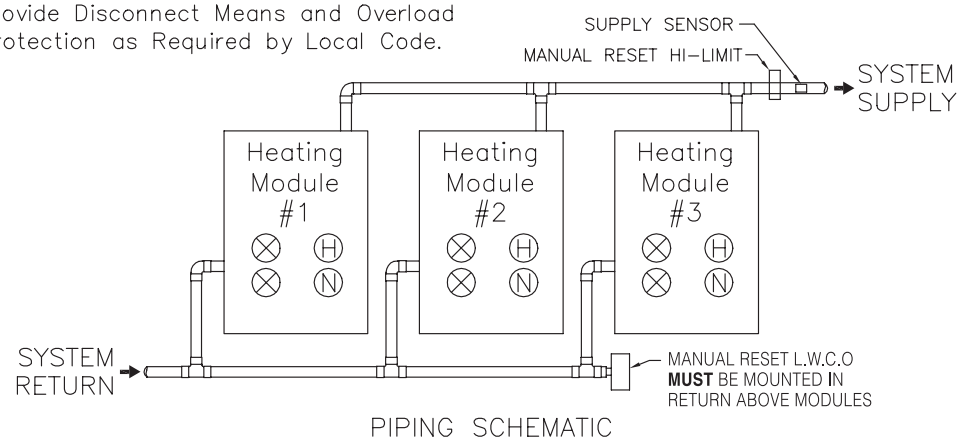
1. Gas fired - Space Heating only
3. Oil fired - Space Heating only

If using MM 750P-MT120 L.W.C.O. use Figure C6 on page 9 to wire the control

1. Gas fired - Space Heating only



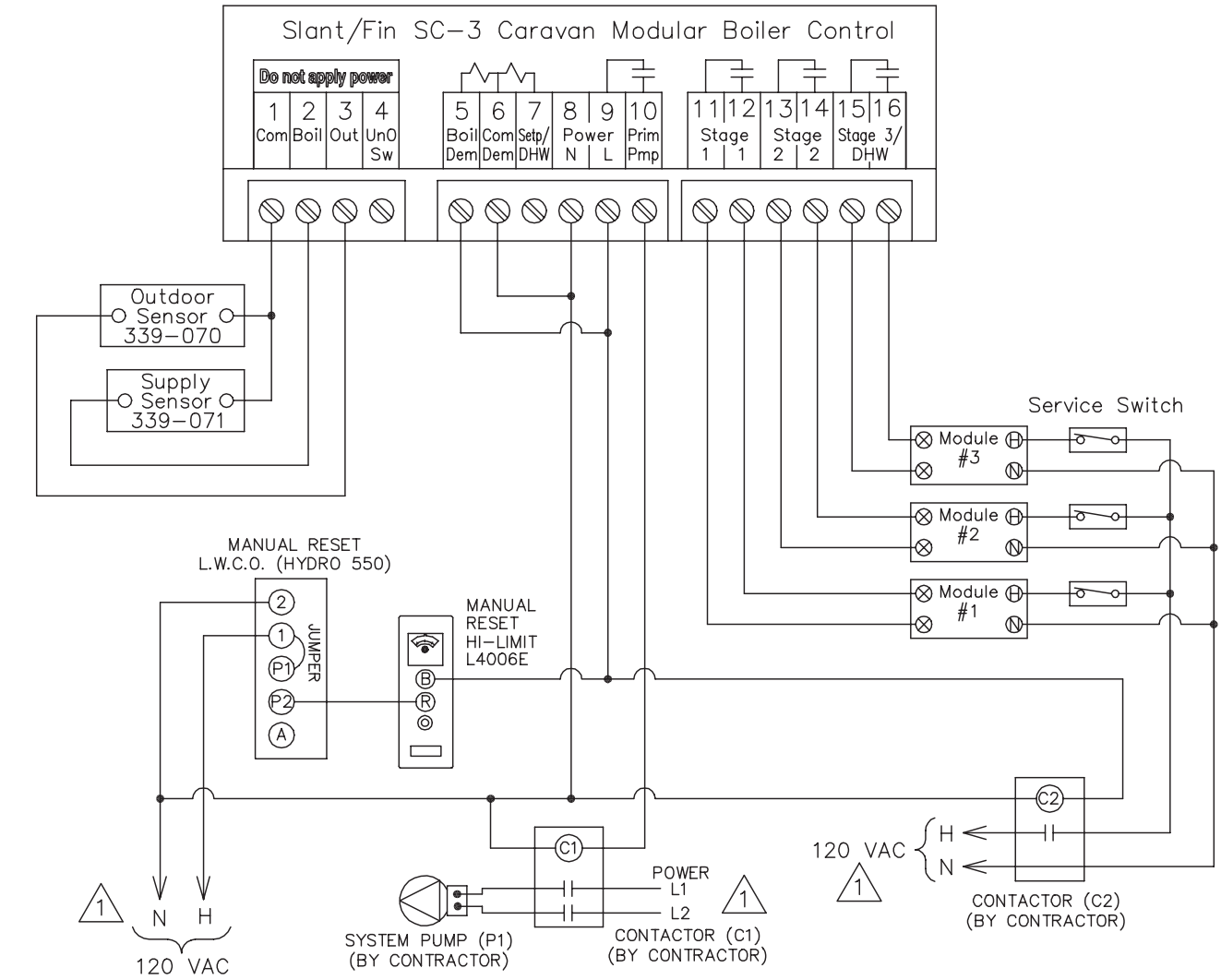
1 – Provide Disconnect Means and Overload Protection as Required by Local Code.



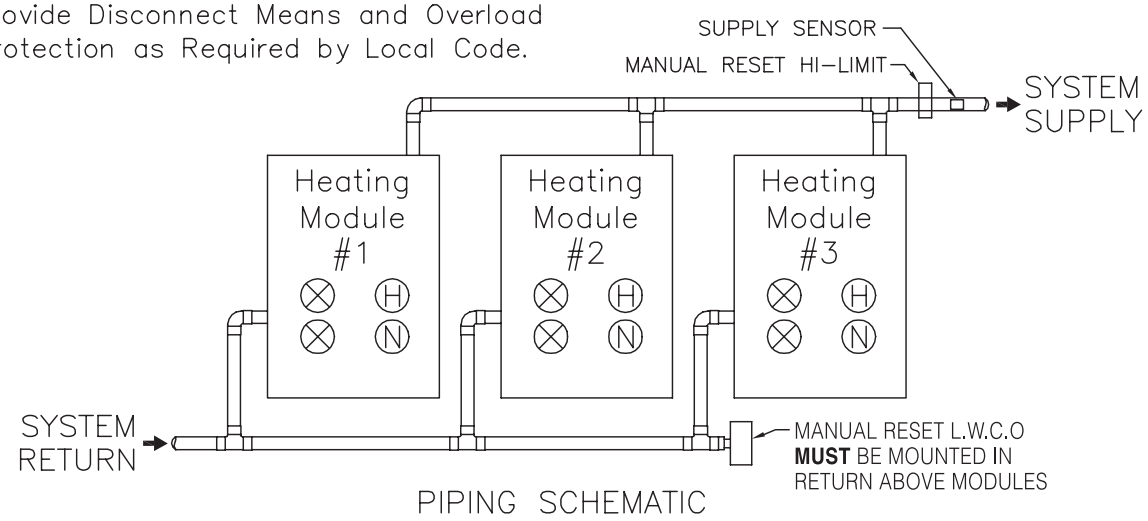
PIPING SCHEMATIC

NOTE: **For boiler termination wiring at modules, see page 9**

2. Oil fired - Space Heating only



1 – Provide Disconnect Means and Overload Protection as Required by Local Code.



PIPING SCHEMATIC

NOTE: **For boiler termination wiring at modules, see page 9**

Figure C1 OIL FIRED BURNER WIRING

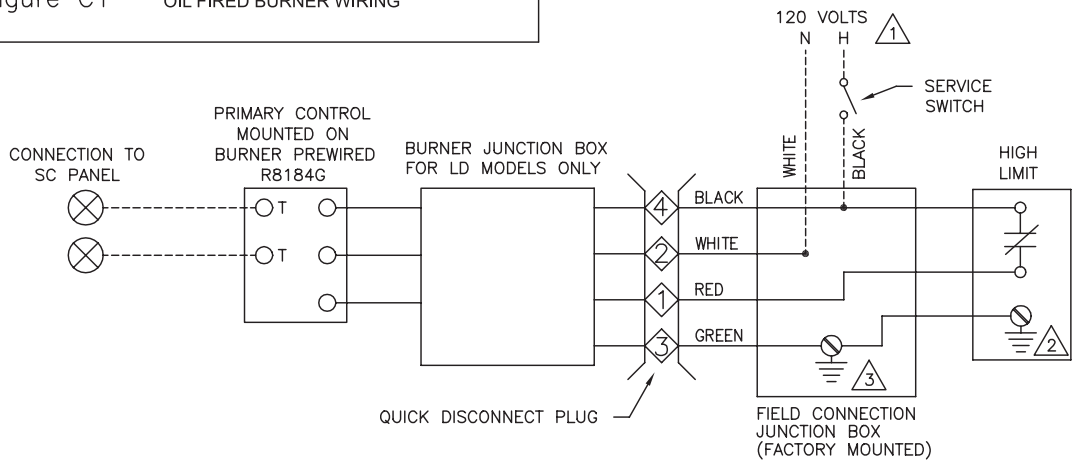


Figure C2 GAS STANDING PILOT WITH OR WITHOUT VENT DAMPER

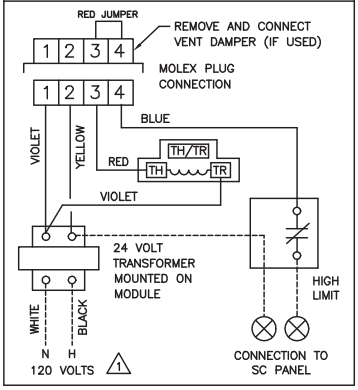


Figure C3 GAS INTERMITTENT IGNITION WITH OR WITHOUT VENT DAMPER

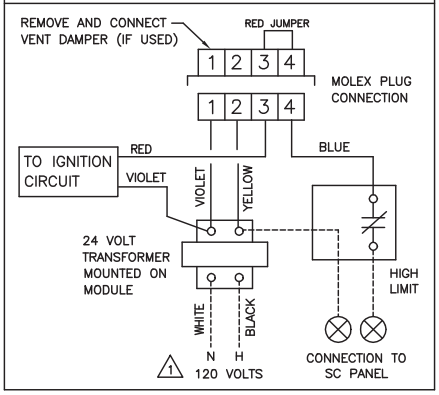


Figure C4 MULTIPLE MANUAL RESET HIGH LIMIT WIRING (IF USED)

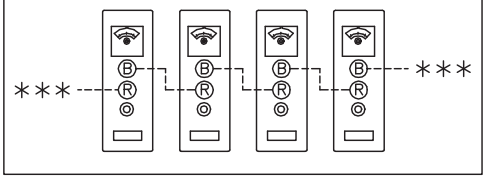


Figure C5 MULTIPLE HYDROLEVEL 550 L.W.C.O. WIRING (IF USED)

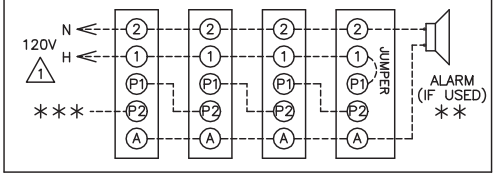


Figure C6 MM 750P-MT-120 L.W.C.O. ALTERNATE WIRING (IF USED)

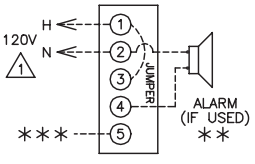
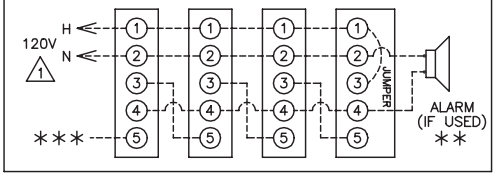


Figure C7 MULTIPLE MM 750P-MT-120 L.W.C.O. WIRING (IF USED)



1 – PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED BY LOCAL CODE.

2 – CONTROL CASE MUST BE CONNECTED TO EARTH GROUND. USE GROUND SCREW PROVIDED.

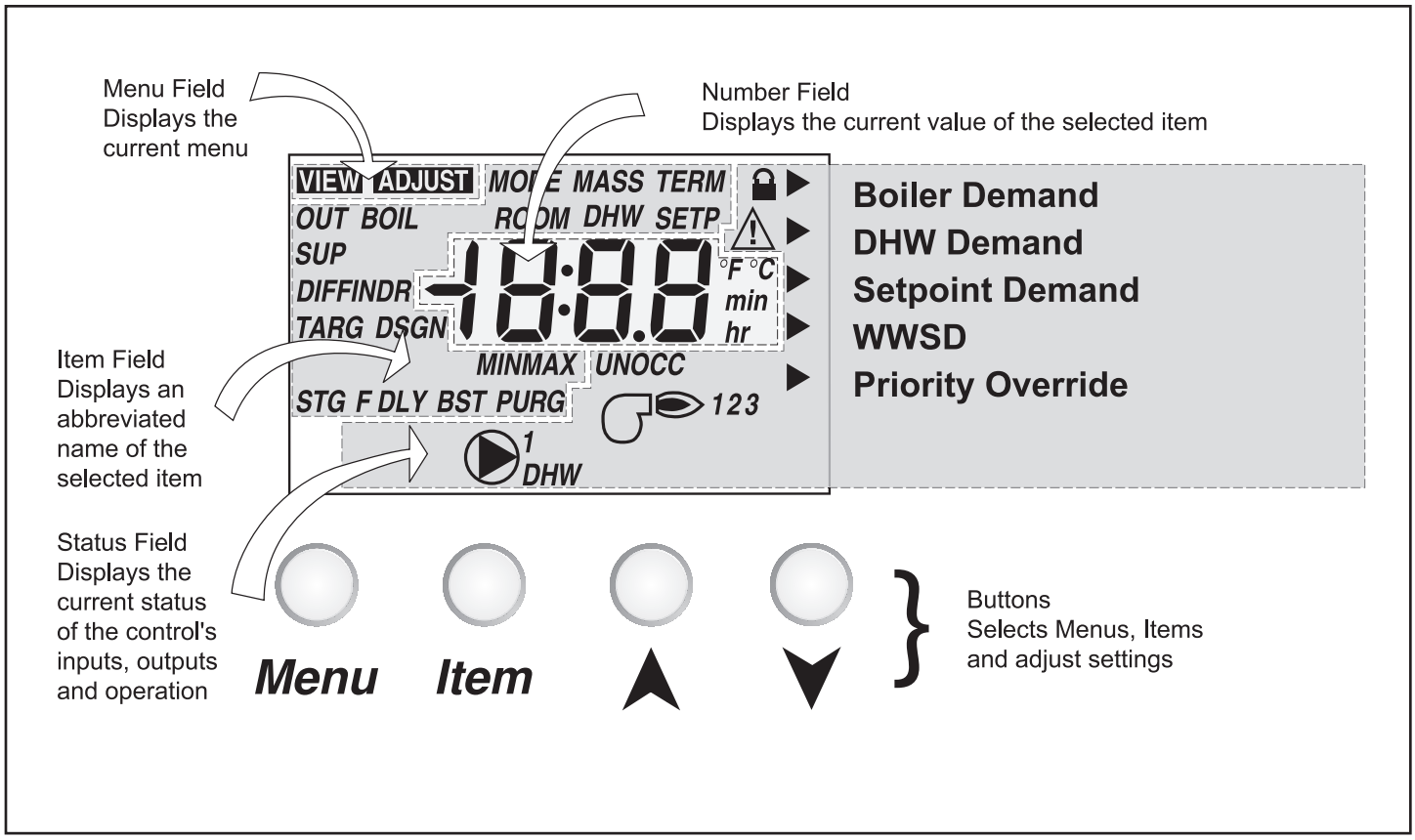
3 – GROUNDING CONDUCTOR: TWO GREEN GROUND WIRES ARE FACTORY CONNECTED TO THE GREEN GROUND SCREW IN THIS BOX. FIELD WIRE A GROUNDED CONDUCTOR TO THIS SCREW TOGETHER WITH THE TWO GREEN FACTORY CONNECTED GREEN GROUND WIRES.

** – OPTIONAL ALARM CIRCUIT BY CONTRACTOR.

*** – REFER TO SC-3 OR SC-9 WIRING DIAGRAM FOR PROPER WIRE CONNECTION.

LEGEND:
------ FIELD WIRING
——— FACTORY WIRING

DISPLAY:



Symbol Description

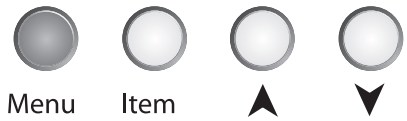
123	**Stage** Displays which stage relays are turned on.	UNOCC	**UnOccupied Schedule** Displays when the control is in UnOccupied Mode.
1	**Pump** Displays when the primary pump relay is turned on.		**Installer Access Level** Displays when the Installer/Advanced Dip switch is set to Installer
°F °C min hr	**°F, °C, min, hr** Units of measurement.		**Pointer** Displays the control operation as indicated by the text.
OCC	**Occupied Schedule** Displays when the control is in Occupied Mode.		**Warning/Alarm** Displays when an error exists or the alarm relay is turned on.

User Interface

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

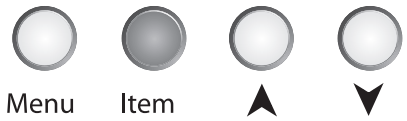
Menu

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



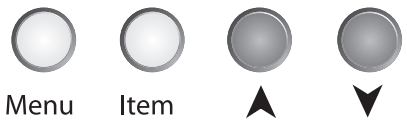
Item

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



Adjust

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



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

SELECT SYSTEM TYPE:

To set up the control, go to the appropriate page for your system.

If your system is different than the above, call the Slant/Fin technical services group at 800-873-4346 to determine which control can accommodate it.

A. SPACE HEATING ONLY WITH OUTDOOR RESET

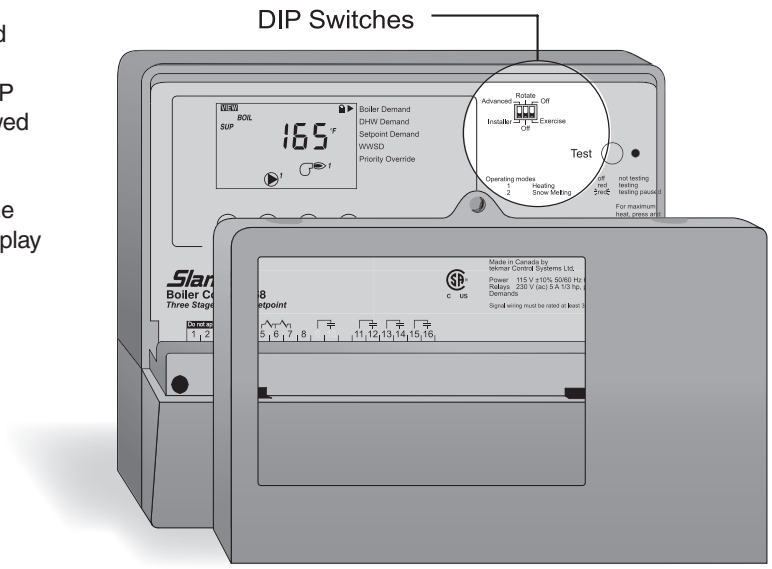
CONTROL SET UP

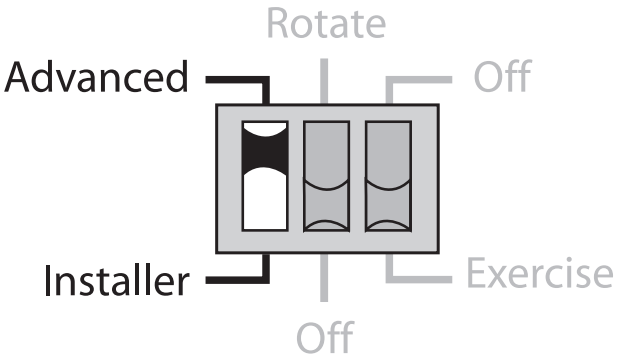
DIP SWITCH SETTINGS:

General

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

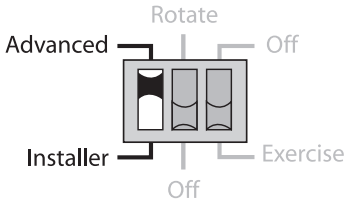
If a DIP switch is changed while the control is powered up, the control responds to the change in setting by returning the display to the VIEW menu.





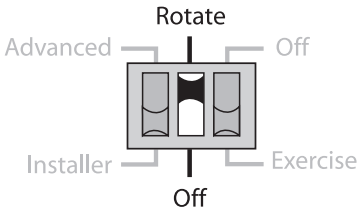
Advanced / Installer

The Adv / Installer DIP switch selects the access level of the control. In the Installer access level, a limited number of items may be viewed and / or adjusted. In the Advanced access level, all items may be viewed and / or adjusted.
Set to Advanced



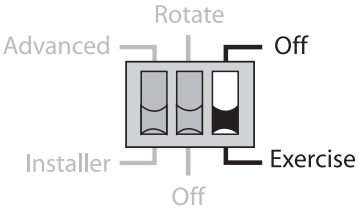
Rotate / Off

The Rotate / Off DIP switch selects whether or not the control is to provide Equal Run Time Rotation of the boiler stages. If the switch is set to Rotate, the stages will be rotated accordingly. If the switch is set to Off, the firing sequence is fixed starting with the module 1 to module 3.
We recommend that it be set to Rotate for most systems



Off / Exercise

The Off / Exercise DIP switch selects whether or not the control is to exercise the primary pump and boiler pumps. If the DIP switch is set to Exercise, the pumps are operated for 10 seconds after every three days of inactivity.
We recommend that it be set to Exercise for most systems.

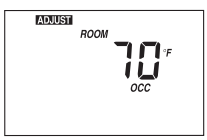
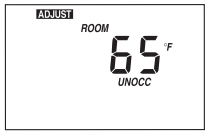


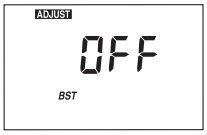
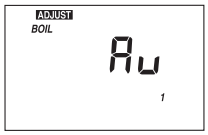
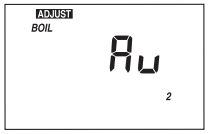
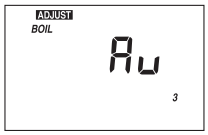
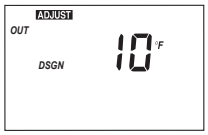
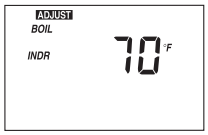
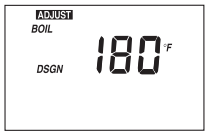
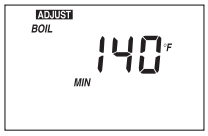
THE CONTROL MUST BE ADJUSTED FOR YOUR APPLICATION.

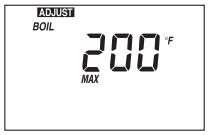
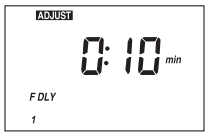
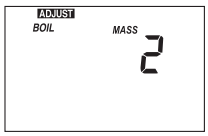
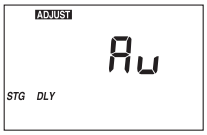
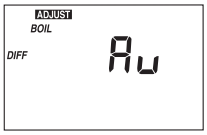
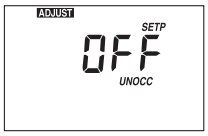
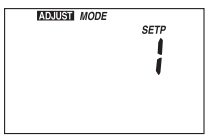
IF ANY OF THE DEFAULT SETTINGS DO NOT SUIT YOUR APPLICATION, GO TO THE ADJUSTING SECTION THAT FOLLOWS EACH FUNCTION AND WRITE IN THE DESIRED SETTING IN THE SQUARE BOX PROVIDED FOR THAT FUNCTION. THEN PERFORM THE ADJUSTMENT AS LISTED.

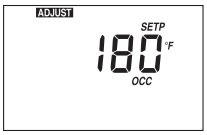
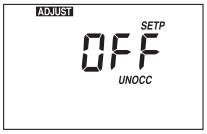
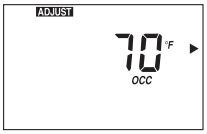
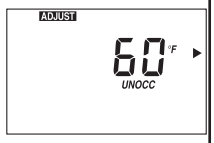
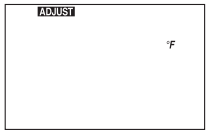
THESE INSTRUCTIONS ARE WRITTEN WHERE EACH FUNCTION IS ADJUSTED IN A "STAND ALONE" MANNER MEANING YOU ARE PROGRAMMING THAT ONE FUNCTION ONLY. IF YOU WANT TO PROGRESSIVELY GO THROUGH EACH STEP, JUST SKIP THE INSTRUCTIONS WRITTEN IN *ITALIC LETTERS* FOR EACH STEP AND PROGRAM THE CONTROL PROGRESSIVELY THROUGH EACH FUNCTION.

IT IS BEST IF YOU TAKE A FEW MINUTES TO GO THROUGH THE ENTIRE LIST OF FUNCTIONS AND ENTER ANY NEW SETTINGS THAT ARE APPROPRIATE FOR YOUR INSTALLATION. WHEN FINISHED, GO TO THE CONTROL AND ADJUST ONLY THOSE FUNCTIONS THAT HAVE A NEW SETTING LISTED.

Display	Description	Default Setting	New Setting
	**Room Occupied -** The desired room air temperature during the occupied period. *Press the **Menu** button until **ADJUST** is visible on the top line of the display*. Press the **Item** button until **ROOM** appears above the temperature readout and **OCC** is flashing below it. Use the up and down arrow buttons to change to the desired reading. **Range Available: 35˚ to 100˚F (2˚ to 38˚C)**	**70˚F (21˚C)**	
	**Room Unoccupied -** The desired room air temperature during the unoccupied period. *Press the **Menu** button until **ADJUST** is visible on the top line of the display*. Press the **Item** button until **ROOM** appears above the temperature readout and **UNOCC** is flashing below it. Use the up and down arrow buttons to change to the desired reading. **Range Available: 35˚ to 100˚F (2˚ to 38˚C)**	**65˚F (18.5˚C)**	

Display	Description	Default Setting	New Setting
	**Boost -** The amount of morning boost. *Press the **Menu** button until **ADJUST** is visible on the top line of the display*. Press the **Item** button until **OFF** appears with **BST** below and to the left of **OFF**. Keep setting on **OFF**. This is only used when a setback timer is used. Contact Slant/Fin if you have any questions.	**OFF**	
	**Boiler 1 -** Selects whether or not module 1 is operational - Au (auto) or OFF **DO NOT CHANGE** *Press the **Menu** button until **ADJUST** is visible on the top line of the display*. Press **Item** button until **BOIL** to the left of, and above Au and 1 is below it. Use the up and down arrow buttons to change to the desired setting. However for the setting of **Au** should be retained, do not change to **OFF.**	**Au**	
	**Boiler 2 -** Selects whether or not module 2 is operational - Au (auto) or OFF **DO NOT CHANGE** *Press the **Menu** button until **ADJUST** is visible on the top line of display*. Press the **Item** button until **BOIL** to the left of, and above **Au** and **2** is below it. Use the up and down arrow buttons to change to the desired setting. However, the setting of **Au** should be retained, do not change to **OFF**.	**Au**	
	**Boiler 3 -** Selects whether or not module 3 is operational - Au (auto) or OFF **If you do not have 3 boiler modules** *Press the **Menu** button until **ADJUST** is visible on the top line of the display*. Press the **Item** button until **BOIL** to the left of, and above **Au** and **3** is below it. Use the up and down arrow buttons to change to **OFF**.	**Au**	
	**Outdoor design -** The design outdoor temperature used in the heat loss calculations for the heating system. *Press the **Menu** button until **ADJUST** is visible on the top line of the display*. Press the **Item** button until **OUT and DSGN** appear. Use the up and down arrow buttons to change to the desired setting. **Range Available: -60˚ to 45˚F (-51˚ to 7˚C)**	**10˚F (-12˚C)**	
	**Boiler Indoor -** The design indoor air temperature used in the heat loss calculation for the heating system. *Press the **Menu** button until **ADJUST** is visible on the top line of the display.* Press **ITEM** button until **BOIL and INDR** appear. Use the up and down arrow buttons to change to the desired setting.	**70˚F (21˚C)**	
	**Boiler Design -** The design supply water temperature used in the design of the system. *Press the **Menu** button until **ADJUST** is visible on the top line of the display*. Press the **Item** button until **BOIL and DSGN** appears. Use the up and down arrow buttons to change to the desired temperature. **Range Available: 70˚ to 220˚F (21˚ to 104˚C)**	**180˚F (82˚C)**	
	**Boiler Minimum -** The minimum allowed boiler target temperature for Slant/Fin cast iron boilers we recommend **130˚F** minimum. *Press the **Menu** button until **ADJUST** is visible on the top line of the display*. Press the **Item** button until **BOIL and MIN** appears. Use the up and down arrow buttons to change to the **DESIRED SETPOINT** temperature -140˚F or more. **Range Available: OFF, 80˚ - 180˚F (OFF, 27˚ - 82˚C)**	**140˚F (60˚C)**	

Display	Description	Default Setting	New Setting
	**Boiler Maximum -** The maximum allowed boiler target temperature. **Set at least 10˚F above Boiler Design setting.** *Press the **Menu** button until **ADJUST** is visible on the top line of display.* Press the **Item** button until **BOIL and MAX** appears. Use the up and down arrow buttons to change to the desired temperature. **Range Available: 120˚ to 225˚F or OFF (49˚ to 107˚C or OFF)**	**200˚F (93.5˚C)**	
	**Fire Delay 1 -** The time delay the control can expect between the time that the relay contact closes to fire the first stage of the boiler and the burner actually fires. *Press the **Menu** button until **ADJUST** is visible on the top line of display.* Press the **Item** button until **F DLY** appears. Use the up and down arrow buttons to change to the desired time delay. **Range Available: 0:00 to 3:00 minutes (1 sec increment)**	**0:10 min**	
	**Boiler Mass -** This inputs the thermal mass characteristics of the boiler modules. *Press the **Menu** button until **ADJUST** is visible on the top line of display.* Press the **Item** button until **BOIL** is below **ADJUST** and **MASS** is to the right of **ADJUST**. Default is **2** with **1** being low mass and **3** being high mass. For Slant/Fin boilers we recommend you retain the default setting of **2**.	**2**	
	**Stage Delay -** The minimum time delay between the operation of stages. Under **Au (Auto)** setting the control determines the best stage delay based on operation of the system. *Press the **Menu** button until **ADJUST** is visible on the top line of the display.* Press the **Item** button until **STG DLY** appears. Use the up and down arrow buttons to change to the desired setting. **Range Available: Au (Auto), 0:30 to 19:55 min (5 sec increment)**	**Au**	
	**Boiler Differential -** The temperature differential that the control is to use when it is operating the boiler(s). Under **Au (Auto)** the control determines the best differential as the load changes. This reduces potential short cycling during light load conditions. *Press the **Menu** button until **ADJUST** is visible on the top line of the display.* Press the **Item** button until **BOIL and DIFF** appears. Use the up and down arrow buttons to change to the desired setting. **Range Available: Au (Auto), 2˚ to 42˚F (Au, 1˚ to 23˚C)**	**Au**	
The following step will happen only when module step 3 is set to OFF			
	**DHW Mode -** Selects the DHW MODE of operation. This item is only available when *Boiler 3* is set to *OFF*. *Press the **Menu** button until **ADJUST** is visible on the top line of the display.* Press the **ITEM** button until **MODE and DHW** appear. Keep setting on **OFF.** **Range Available:** **OFF** **1** (parallel, no priority) **2** (parallel, priority) **3** (pri-sec, no priority) **4** (pri sec, priority) **Default = OFF**	**OFF**	**OFF**
If you change setting of **DHW MODE** to **1, 2, 3, or 4** you will go to (**XCHG)** a different step than the next step. If this happens go back to **DHW MODE** and change setting to **OFF.**			
	**Setpoint Mode -** Selects the Setpoint Mode of operation. This item is only available when *DHW MODE* is set to *OFF*. *Press the **MENU** button until **ADJUST** is visible on the top line of the display.* Press the **ITEM** button until **MODE and SETP** appear. Keep setting on **1.** **Range Available:** **1** (parallel, no priority) **2** (parallel, priority) **3** (Primary pump) **Default = 1**	**1**	

Display	Description	Default Setting	New Setting
	**Setpoint Occupied -** The minimum supply temperature when a setpoint demand is present during the Occupied period. This item is only available when *DHW MODE* is set to *OFF.* *Press the **Menu** button until **ADJUST** is visible on the top line of display.* Press the **Item** button until **SETP** appears above the temperature and **OCC** appears below the temperature. Keep default setting of **180˚F**. **Range Available: OFF, 60 to 220˚F (OFF, 16 to 104˚C)** **Default = 180˚F (82˚C)**	**180˚F (82˚C)**	
	**Setpoint UnOccupied -** Selects whether or not a setpoint demand will be responded to during the UnOccupied period. This item is only available when *DHW MODE* is set to *OFF.* *Press the **Menu** button until **ADJUST** is visible on the top line of display.* Press the **Item** button until **SETP** and **UNOCC** appear. Keep default setting of **OFF**. **Range Available: OFF, On** **Default = OFF**	**OFF**	
	**WWSD Occupied -** The system's warm weather shut down temperature during the occupied period. *Press the **Menu** button until **ADJUST** is visible on the top line of display.* Press the **Item** button until **OCC** appears and arrow points to **WWSD**. Use the up and down arrow buttons to change to the desired temperature. **Range Available: 35˚ to 100˚F (2˚ to 28˚C or OFF)**	**70˚F (21˚C)**	
	**WWSD UnOccupied -** The system's warm weather shut down temperature during the **UnOccupied** period. *Press the **Menu** button until **ADJUST** is visible on the top line of the display.* Press the **Item** button until **UNOCC** appears and arrow points to **WWSD**. Use the up and down arrow buttons to change to the desired temperature. This is available with optional timer terminals 1 (com) and 4 (UnO Sw) are made. **Range Available: 35˚ to 100˚F, OFF (2˚ to 38˚C, OFF)**	**60˚F (15.5˚C)**	
	**Primary Pump Purge -** The maximum length of time that the primary pump will continue to operate after the boiler demand has been removed. *Press the **Menu** button until **ADJUST** is visible on the top line of the display.* Press the **Item** button until **PURG** and **MIN** appear. Use the up and down arrow buttons to adjust to the desired setting. **Range Available: OFF, 0:10 to 19:55 min (5 sec increment)**	**0:20 min**	
	**Units -** The units of measure that all of the temperatures are to be displayed by the control. *Press the **Menu** button until **ADJUST** is visible on the top line of the display.* Press the **ITEM** button until **˚F or ˚C** appears. Use the up and down arrow buttons to change to the desired setting **-˚F or ˚C**	**˚F**	

NOTE: When you press **ITEM** button again you will go to the beginning of the sequence

B. SPACE HEATING ONLY WITH SETPOINT CONTROL

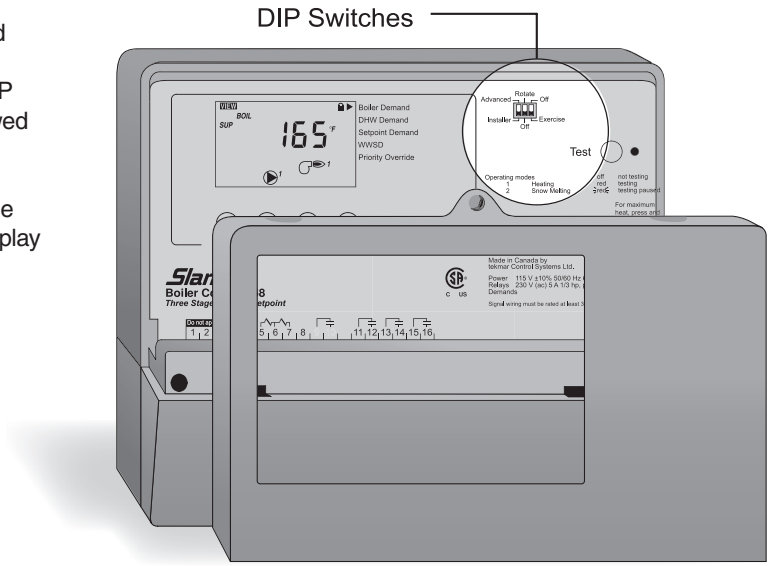
CONTROL SET UP

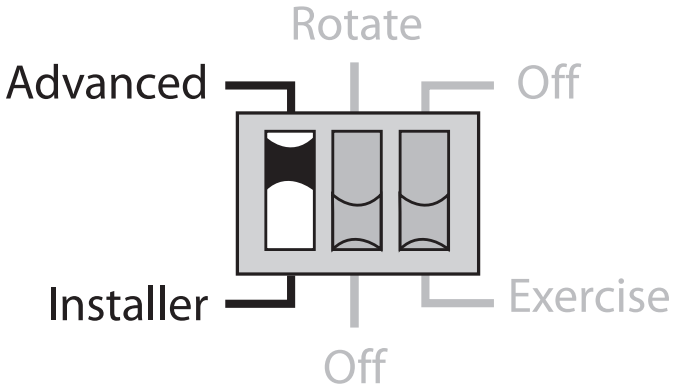
DIP SWITCH SETTINGS:

General

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

If a DIP switch is changed while the control is powered up, the control responds to the change in setting by returning the display to the VIEW menu.

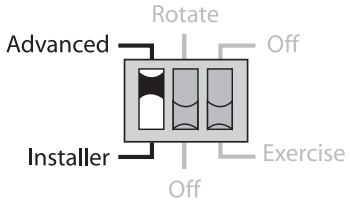




Advanced / Installer

The Adv / Installer DIP switch selects the access level of the control. In the Installer access level, a limited number of items may be viewed and / or adjusted. In the Advanced access level, all items may be viewed and / or adjusted.

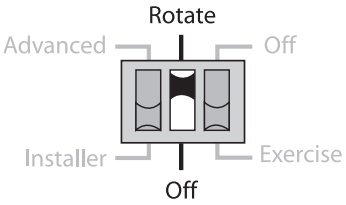
Set to Advanced



Rotate / Off

The Rotate / Off DIP switch selects whether or not the control is to provide Equal Run Time Rotation of the boiler stages. If the switch is set to Rotate, the stages will be rotated accordingly. If the switch is set to Off, the firing sequence is fixed starting with the module 1 to module 3.

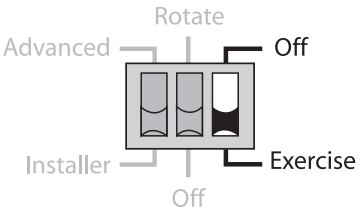
We recommend that it be set to Rotate for most systems.



Off/Exercise

The Off / Exercise DIP switch selects whether or not the control is to exercise the primary pump and boiler pumps. If the DIP switch is set to Exercise, the pumps are operated for 10 seconds after every three days of inactivity.

We recommend that it be set to Exercise for most systems.



THE CONTROL MUST BE ADJUSTED FOR YOUR APPLICATION.

IF ANY OF THE DEFAULT SETTINGS DO NOT SUIT YOUR APPLICATION, GO TO THE ADJUSTING SECTION THAT FOLLOWS EACH FUNCTION AND WRITE IN THE DESIRED SETTING IN THE SQUARE BOX PROVIDED FOR THAT FUNCTION. THEN PERFORM THE ADJUSTMENT AS LISTED.

IT IS BEST IF YOU TAKE A FEW MINUTES TO GO THROUGH THE ENTIRE LIST OF FUNCTIONS AND ENTER ANY NEW SETTINGS THAT ARE APPROPRIATE FOR YOUR INSTALLATION. WHEN FINISHED, GO TO THE CONTROL AND ADJUST ONLY THOSE FUNCTIONS THAT HAVE A NEW SETTING LISTED.

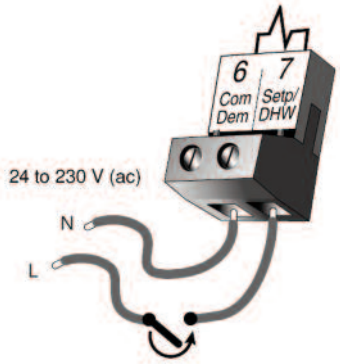
Setpoint operation is only available when **DHW MODE** is set to **OFF**. Since **DHW MODE** is only available if **BOILER 3** is set to **OFF**, **DHW** will default to **OFF** if **BOILER 3** is set to **AU**.

SETPOINT

The control can operate to satisfy the requirements of a setpoint load in addition to a space heating load. A setpoint load overrides the current outdoor reset temperature and *WWSD* setting in order to provide heat to the setpoint load.

SETPOINT DEMAND

A setpoint demand is required in order for the control to provide heat to the setpoint load. The control registers a setpoint demand when a voltage between 24 and 230 V (ac) is applied across the *Setp* / *DHW* and *Com Dem* terminals (7 and 6). Once voltage is applied, the Setpoint Demand pointer turns on in the LCD. The control operates the boiler(s) to maintain at least the *SETPOINT* setting.



BOILER TARGET DURING SETPOINT

The boiler target temperature during a setpoint demand is increased to at least the *SETPOINT* setting. This temperature is maintained as long as the control has a setpoint demand.

SETPOINT MODE

A setpoint demand is required in order for the control to provide heat to the setpoint load. The control registers a setpoint demand when a voltage between 24 and 230 V (ac) is applied across the *Setp / DHW* and *Com Dem* terminals (7 and 6). Once voltage is applied, the Setpoint Demand pointer turns on in the LCD. The control operates the boiler(s) to maintain at least the *SETPOINT* setting.

Setpoint MODE 1 - Setpoint in Parallel

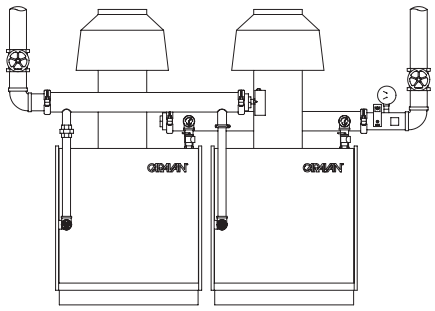
Whenever a setpoint demand is present, the boiler(s) is operated to maintain the setpoint target. The primary pump (Prim Pmp) does not turn on, but may operate based on a Boiler Demand.

It is assumed that the Setpoint pump will provide adequate flow through the heat exchanger and the boiler.

Setpoint MODE 2 - Setpoint in Parallel with Priority

Whenever a setpoint demand is present, the boiler(s) is operated to maintain the setpoint target and the primary pump (*Prim Pmp*) contact is opened.

It is assumed that the Setpoint pump will provide adequate flow through the heat exchanger and the boiler.



Setpoint MODE 3 - Primary Pump during Setpoint

Whenever a setpoint demand is present, the primary pump (Prim Pmp) is turned on and the boiler(s) is operated to maintain the setpoint target. Setpoint MODE 3 is the most common application to Slant/Fin setpoint operation. MODE 3 is used in this manual.

SETPOINT PRIORITY OVERRIDE

The setpoint has a Priority Override while in SETP MODE 2. In order to prevent the building from cooling off too much or the possibility of a potential freeze up during setpoint priority, the control limits the amount of time for setpoint priority. The length of Setpoint priority is determined by the *PRIORITY OVERRIDE* setting. Once the allowed time for priority has elapsed, the control overrides the setpoint priority and operates setpoint and heating simultaneously by turning on the primary pump (Prim Pmp).

CONDITIONAL SETPOINT PRIORITY

If the boiler(s) supply temperature is maintained at or above the required temperature during setpoint generation, this indicates that the boiler(s) has enough capacity for setpoint and possibly heating as well. As long as the boiler target temperature is maintained and the heating and setpoint targets are similar, setpoint and heating occur at the same time.

STEP ONE:

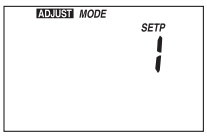
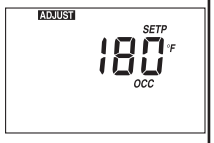
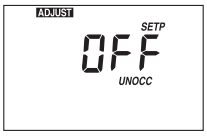
Go to page 12.

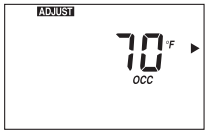
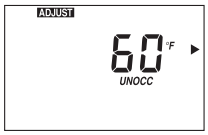
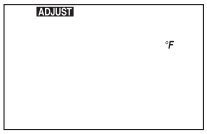
A. SPACE HEATING ONLY WITH OUTDOOR RESET

If **BOILER 3** is set to **Au** program all steps up to and including **BOILER DIFFERENTIAL**. If **BOILER 3** is set to **OFF** program all steps up to and including **DHW MODE**. If **BOILER 3** is set to **Au** the **DHW MODE** will not be present. Since **DHW MODE** is only available if **BOILER 3** is set to **OFF**, DHW will default to **OFF** if **BOILER 3** is set to **AU**.

STEP TWO:

Continue programming as listed on the following pages

Display	Description	Default Setting	New Setting
	**Setpoint Mode -** Selects the Setpoint Mode of operation. This item is only available when *DHW MODE* is set to *OFF*. *Press the **Menu** button until **ADJUST** is visible on the top line of display*. Press the **Item** button until **MODE and SETP** appear. Use the up and down arrow buttons to change to the desired setting. **Range Available:** **1** (parallel, no priority) **2** (parallel, priority) **3** (primary pump) **Default = 1**	**1**	**3**
	**Setpoint Occupied -** The minimum supply temperature when a setpoint demand is present during the Occupied period. This item is only available when *DHW MODE* is set to *OFF*. *Press the **Menu** button until **ADJUST** is visible on the top line of display*. Press the **Item** button until **SETP** appears above the temperature and **OCC** appears below the temperature. Use the up and down arrow buttons to change to the desired setpoint temperature. **Range Available:** **OFF, 60 to 220˚F (OFF, 16 to 104˚C)** **Default = 180˚F (82˚C)**	**180˚F (82˚C)**	
	**Setpoint UnOccupied -** Selects whether or not a setpoint demand will be responded to during the UnOccupied period. This item is only available when *DHW MODE* is set to *OFF*. *Press the **Menu** button until **ADJUST** is visible on the top line of display*. Press the **Item** button until **SETP and UNOCC** appear. Use the up and down arrow buttons to change to the desired setting. **Range Available:** **OFF, On** **Default = OFF**	**OFF**	
	**Priority Override -** Sets the maximum amount of time the control provides DHW or Setpoint priority before resuming space heating. This item is only available when *SETPOINT MODE* is set to 2, or when *DHW MODE* is set to 2 or 4. *Press the **Menu** button until **ADJUST** is visible on the top line of display*. Use the up and down arrow buttons to change to the desired setting. **Range Available:** **0:20 to 4:00 hr, OFF (10 minute increments)** **Default = OFF**	**OFF**	

Display	Description	Default Setting	New Setting
	**WWSD Occupied -** The systems warm weather shut down temperature during the **Occupied** period. A setpoint demand overrides this setting. *Press the **Menu** button until **ADJUST** is visible on the top line of display.* Press the **Item** button until **OCC** appears and arrow points to **WWSD**. Use the up and down arrow buttons to change to the desired temperature. **Range Available: 35˚ to 100˚F (2˚ to 38˚C or OFF)**	**70˚F (21˚C)**	
	**WWSD UnOccupied -** The systems warm weather shut down temperature during the **UnOccupied** period. *Press the **Menu** button until **ADJUST** is visible on the top line of display.* Press the **Item** button until **UNOCC** appears and arrow points to **WWSD**. Use the up and down arrow buttons to change to the desired temperature. This is available with optional timer. Terminals 1 (com) and 4 (UnO Sw) are made. **Range Available: 35˚ to 100˚F (2˚ to 38˚C or OFF)**	**60˚F (15.5˚C)**	
	**Primary Pump Purge -** The maximum length of time that the primary pump will continue to operate after the boiler demand has been removed. *Press the **Menu** button until **ADJUST** is visible on the top line of display.* Press the **Item** button until **PURG and MIN** appear. Use the up and down arrow buttons to adjust to the desired setting. **Range Available: OFF, 0:10 to 19:55 min (5 sec increment)**	**0:20 min**	
	**Units -** The units of measure that all of the temperatures are to be displayed by the control. *Press the **Menu** button until **ADJUST** is visible on the top line of the display.* Press the **Item** button until **˚F or ˚C** appears. Use the up and down arrow buttons to change to the desired setting **-˚F or ˚C.**	**˚F**	

NOTE: When you press **ITEM** button again you will go to the beginning of the sequence

VIEW THE PERFORMANCE

FUNCTION	DESCRIPTION	STEPS
OUTDOOR	Current outdoor air temperature as measured by the outdoor sensor.	Press the **Menu** button until **VIEW** is visible on the top line of the display. Press the **Item** button until **OUT** appears. Read the numeric display.
BOILER SUPPLY	Current boiler supply water temperature as measured by the boiler supply sensor.	Press the **Menu** button until **VIEW** is visible on the top line of the display. Press the **Item** button until **BOIL SUP** appears. Read the numeric display.
BOILER TARGET	Boiler target temperature is the temperature the control is trying to maintain at the boiler supply sensor.	Move the **Adv/ Installer** DIP switch to the **Adv** position ***temporarily***. Press the **Menu** button until **VIEW** is visible on the top line of the display. Press the **Item** button until **BOIL TARG** appears. Read the numeric display. Move the **Adv/ Installer** DIP switch back to the **Installer** position.
BOILER 1 HOUR	The total running time of module 1 since this item was last cleared.	Move the **Adv/Installer** DIP switch to the **Adv** position ***temporarily***. Press the **Menu** button until **VIEW** is visible. Press the **Item** button until **BOIL** appears on the second line of the display, and **1** in the lower right section. Read the numeric display in hours. To clear this item back to 0, press the **Up** and **Down** buttons simultaneously while viewing this item. Move the **Adv/Installer** DIP switch back to the **Installer** position.
BOILER 2 HOURS	The total running time of module 2 since this item was last cleared.	Move the **Adv/Installer** DIP switch to the **Adv** position ***temporarily***. Press the **Menu** button until **VIEW** is visible. Press the **Item** button until **BOIL** appears on the second line of the display, and **2** in the lower right section. Read the numeric display in hours. To clear this item back to 0, press the **Up** and **Down** buttons simultaneously while viewing this item. Move the **Adv/Installer** DIP switch back to the **Installer** position.
BOILER 3 HOURS	The total running time of module 3 since this item was last cleared.	Move the **Adv/Installer** DIP switch to the **Adv** position ***temporarily***. Press the **Menu** button until **VIEW** is visible. Press the **Item** button until **BOIL** appears on the second line of the display, and **3** in the lower right section. Read the numeric display in hours. To clear this item back to 0, press the **Up** and **Down** buttons simultaneously while viewing this item. Move the **Adv/Installer** DIP switch back to the **Installer** position.

Follow the above procedure for all remaining boiler stages

USEFUL HINTS

Hint #1

Reloading Factory Defaults

To reload the factory defaults, power down the control for 10 seconds. Power up the control while simultaneously holding the **Menu** and t buttons. The control will now display the **E01** error message. To clear this error message, follow the procedure in the Error Message section below.

The control was reloaded to factory default settings. However, the control will stop operation until all of the items in the **ADJUST** menu of the control have been checked by the user or installer. After checking all items press **MENU**.

NOTE: The Installer / Adv DIP Switch must be set to Adv in order to clear the error.

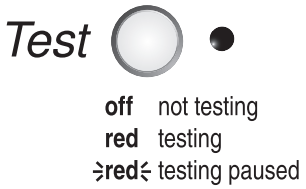
Hint #2

Room Occupied Setting

Changing the **Room Occupied** setting will change the heating curve. If you want more heat you should increase this setting above 70˚F (21˚C). If you want less heat you can decrease the setting below 70˚F (21˚C).

TESTING THE CONTROL

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



Test Sequence

Each step in the test sequence lasts 10 seconds.

During the test routine, if a demand from the system is present, the test sequence may be paused by pressing the **Test** button. If the **Test** button is not pressed again for 5 minutes while the test sequence is paused, the control exits the entire test routine. If the test sequence is paused, the **Test** button can be pressed again to advance to the next step. This can also be used to rapidly advance through the test sequence. To reach the desired step, repeatedly press and release the **Test** button until the appropriate device and segment in the display turn on.

STEP 1: The primary pump is turned on and remains on for the entire test routine.

STEP 2: If Boiler 1 is set to **Auto**, the Boiler 1 contact is closed and waits for the ***FIRE DELAY*** setting for 10 seconds.

STEP 3: If Boiler 2 is set to **Auto**, the Boiler 2 contact is closed and waits for the ***FIRE DELAY*** setting or 10 seconds.

STEP 4: If Boiler 3 is set to **Auto**, the Boiler 3 / DHW contact is closed and waits for the ***FIRE DELAY*** setting or 10 seconds.

STEP 5: All boiler contacts are opened.

STEP 6: If **DHW MODE** is set to 1 or 2, the primary pump shuts off and the Boiler 3 / DHW contact is closed.

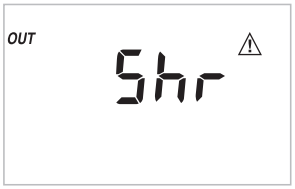
If **DHW MODE** is set to 3 or 4, the primary pump remains on and the Boiler 3 / DHW contact is closed.

STEP 7: All contacts are opened and the control exits the test sequence.

Error Messages

The control was unable to read a piece of information stored in its memory. Because of this, the control was required to reload the factory settings into all of the items in the ADJUST menu. The control will stop operation until all of the items in the ADJUST menu of the control have been checked by the user or installer.

Note: The Installer / Adv DIP Switch must be set to Adv in order to clear the error.

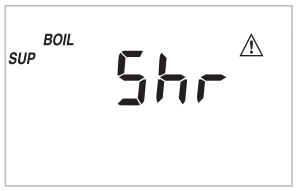


The control is no longer able to read the outdoor sensor due to a short circuit. In this case the control assumes an outdoor temperature of 32˚F (0˚C) and continues operation. Locate and repair the problem. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.

This error message only occurs if the *External Input/Stand Alone DIP switch* is set to Stand Alone.

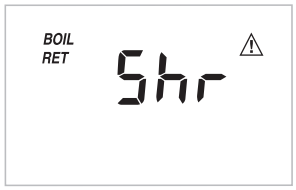
The control is no longer able to read the outdoor sensor due to an open circuit. In this case the control assumes an outdoor temperature of 32˚F (0˚C) and continues operation. Locate and repair the problem. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.

This error message only occurs if the *External Input/Stand Alone DIP switch* is set to Stand Alone.

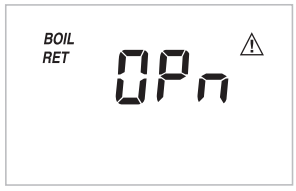


The control is no longer able to read the boiler supply sensor due to a short circuit. The control will not operate the boiler(s) until the sensor is repaired. Locate and repair the problem. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.

The control is no longer able to read the boiler supply sensor due to an open circuit. The control will not operate the boiler(s) until the sensor is repaired. Locate and repair the problem. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.



The control is no longer able to read the boiler return sensor due to a short circuit. The control will continue to operate normally. Locate and repair the problem. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.

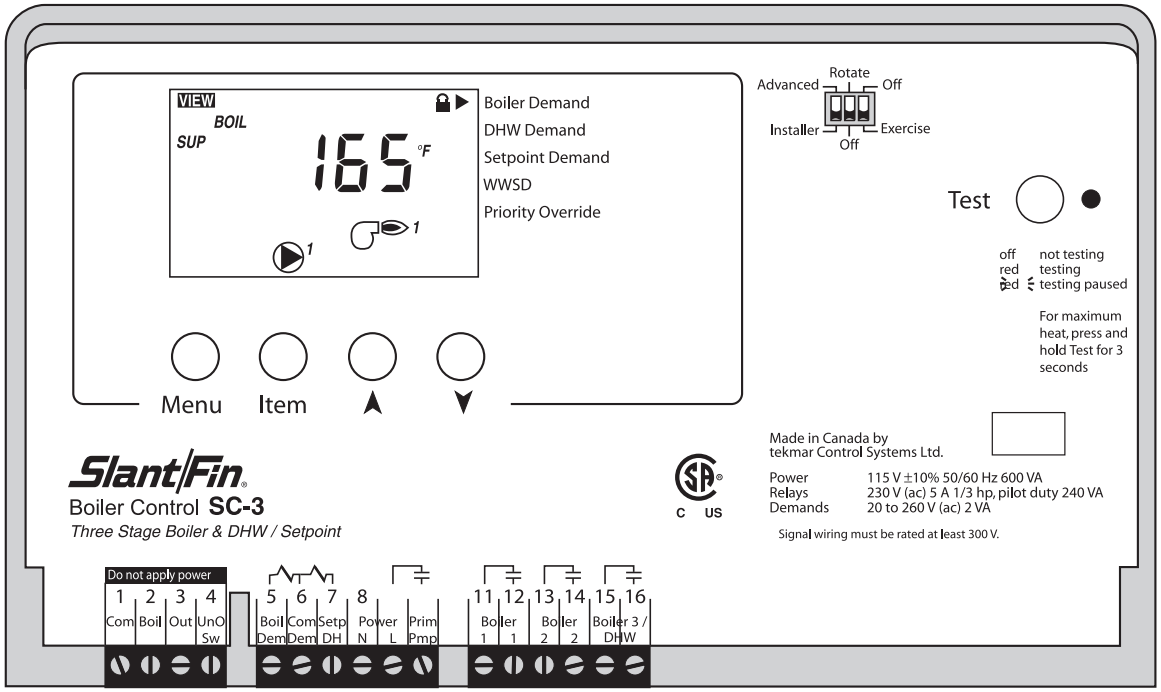


The control is no longer able to read the boiler return sensor due to an open circuit. The control will continue to operate normally. Locate and repair the problem. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.

If the boiler return sensor was deliberately removed from the control, remove power from the control and repower the control to clear the error message.

Boiler Control SC-3 - Three Stage Boiler & Setpoint

Control	—	Microprocessor PID control; This is **not a safety (limit) control.**
Packaged weight	—	3 lb. (1400g), Enclosure A, blue modified PPO plastic
Dimensions	—	6-5/8" H x 7-9/16" W x 2-13/16" D (170 x 193 x 72 mm)
Approvals	—	CSA C US, meets ICES & FCC regulations for EMI/RFI.
Ambient conditions	—	Indoor use only, 30 to 120˚F (0 to 50˚C), <95% RH non-condensing.
Power Supply	—	115 V (ac) ± 10% 50/60 Hz 600 VA
Relays	—	230 V (ac) ± 5 A 1/3 hp pilot duty 240 VA
Demands	—	20 to 260 V (ac) 2 VA
Sensors included	—	NTC thermistor, 10 k‰ @ 77˚F (25˚C ± 0.2˚C) §=3892 Outdoor Sensor 339070 and Universal Sensor 339071.



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

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

NOTES

LISTING OF ALL FACTORY DEFAULT SETTINGS

FUNCTION	DEFAULT SETTING
ROOM OCC	70˚F (21˚C)
ROOM UN OCC	65˚F (18˚C)
BST	OFF
MODE	1
BOIL 1	Au
BOIL 2	Au
BOIL 3	Au
OUT DSGN	10˚F (12˚C)
BOIL INDR	70˚F (21˚C)
BOILER DESIGN	180˚F (82˚C)

FUNCTION	DEFAULT SETTING
BOIL MIN	140˚F (60˚C)
BOIL MAX	210˚F (98˚C)
F DLY 1	0:10 Min
DLY	1:00 Min
BOIL MASS	2
STG DLY	Au
BOIL DIFF	Au
DHW MODE	OFF
SETP OCC	180˚ (82˚C)
SETP UNOCC	OFF
OCC WWSD	70˚ (21˚C)
UN OCC WWSD	60˚
PURGE	0:20 Min
˚F or ˚C	˚F
DHW EXCHANGE OCCUPIED	180˚F (82˚C)
DHW EXCHANGE UNOCCUPIED	OFF
DHW BOILERS	2
SETPOINT MODE	1

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