tekmar® - Data Brochure

Boiler Control 265

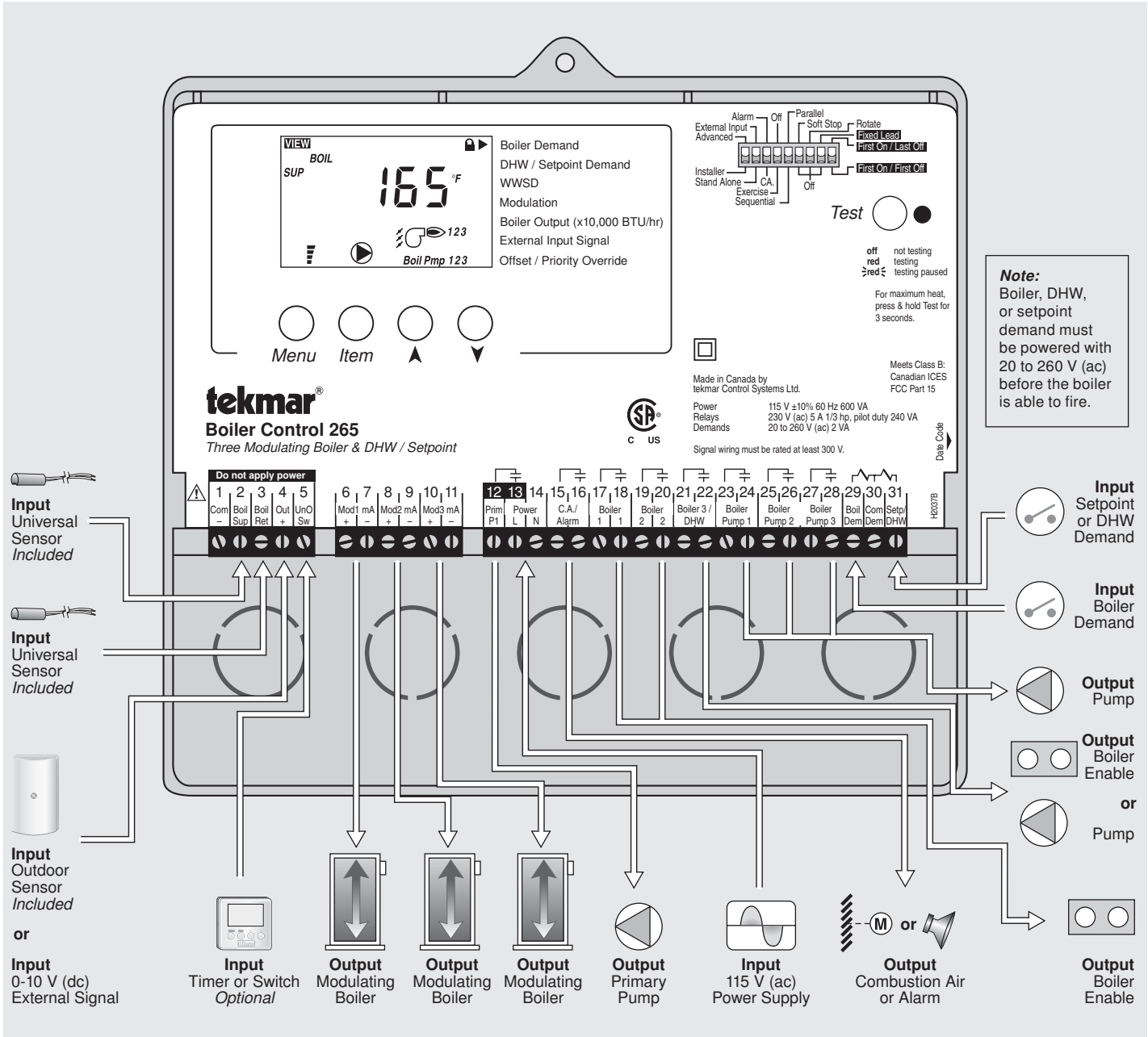
D 265

12/08

The tekmar Boiler Control 265 can control the supply water temperature on up to three modulating boilers based on outdoor temperature or setpoint requirements. The control can be set to control up to two modulating boilers based on outdoor temperature or domestic hot water requirements. A large easy to read display provides current system temperatures and operating status. The control has outputs for a primary pump, individual boiler pumps, and either a combustion air damper or an alarm.

Additional functions include:

- Outdoor Reset
- Sequential or Parallel Modulation
- Installer and Advanced access levels
- Primary pump output
- Individual boiler pump outputs
- Pump purging
- Boiler demand for space heating loads
- DHW demand for domestic hot water loads
- Setpoint demand for setpoint loads
- 0 – 10 V (dc) BAS / EMS input
- Test sequence to ensure proper component operation
- Setback input for energy savings
- CSA C US certified
- Pump exercising



How To Use The Data Brochure

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

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

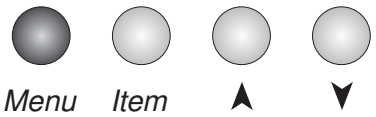
Table of Contents

User Interface

The 265 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 265 has four push buttons (***Menu, Item,*** ▲, ▼) for selecting and adjusting settings. As you program your control, record your settings in the ADJUST Menu table which is found in the second half of this brochure.

Menu

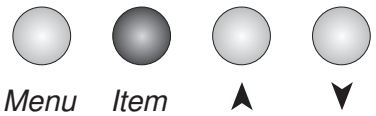
All of the items displayed by the control are organized into various menus. These menus are listed on the left hand side of the display (Menu Field). To select a *menu*, use the ***Menu*** button. By pressing and releasing the ***Menu*** button, the display will advance to the next available menu. Once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



Item

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

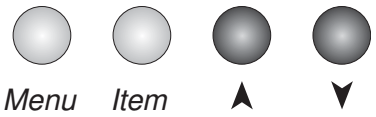
The items can be quickly scrolled through by holding the ***Item*** button and then pressing the ▼ button. To rapidly scroll through the items in the reverse order, hold the ***Item*** button and press the ▲ button.



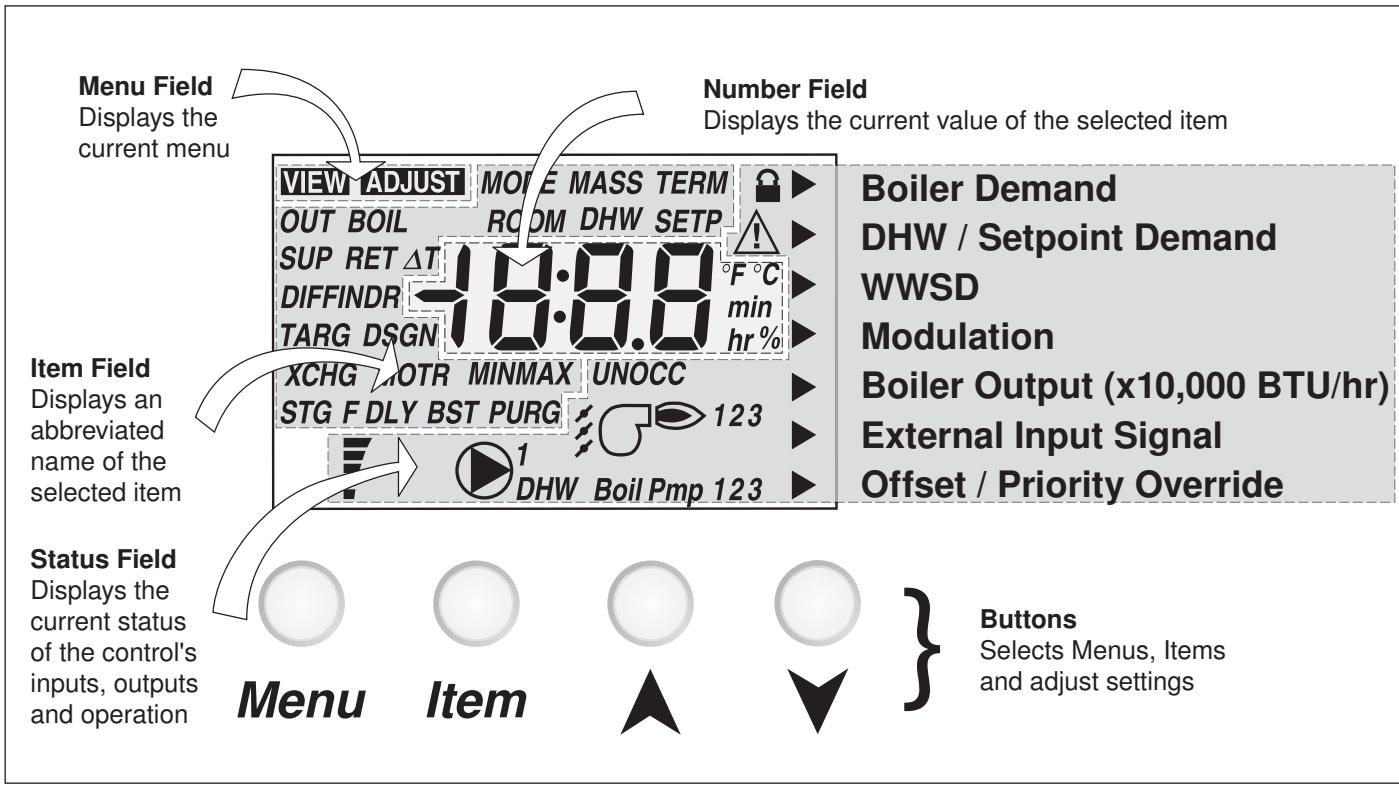
Adjust

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

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



Display



Symbol Description

123	**Stage** Displays which boiler relays are turned on.	UNOCC	**UnOccupied Schedule** Displays when the control is in UnOccupied Mode.
1	**Primary Pump** Displays when the primary pump relay is turned on.	OCC	**Occupied Schedule** Displays when the control is in Occupied Mode.
Boil Pmp 123	**Boiler Pump** Displays which boiler pump relays are turned on.		**Installer Access Level** Displays when the Advanced / Installer Dip switch is set to Installer.
	Combustion Air Damper Displays when the Combustion Air Damper relay is turned on.	▶	**Pointer** Displays the control operation as indicated by the text.
ΔT	**Delta T** The current difference between the supply and return temperatures.	⚠	**Warning / Alarm** Displays when an error exists or the alarm relay is turned on.
°F °C min hr	**°F, °C, min, hr** Units of measurement.		**Modulating Output Scale** Displays the total modulation output level of the boilers.
DHW	**DHW** Displays when the DHW relay is turned on.		

Definitions

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

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

- Double insulated

INSTALLATION CATEGORY II - Local level, appliances

Sequence of Operation

Section A: General Operation

POWERING UP THE CONTROL

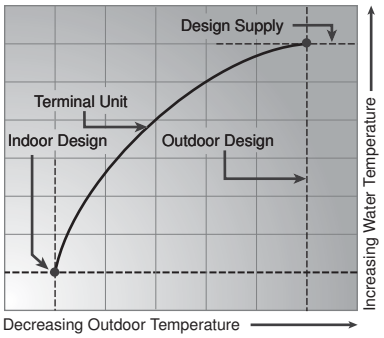
When the control is powered up, all segments in the LCD are turned on for 2 seconds. Next, the control displays the control type number in the LCD for 2 seconds. Next, the software version is displayed for 2 seconds. Finally, the control enters into the normal operating mode.

BOILER TARGET TEMPERATURE

The control operates up to three modulating boilers to control the supply water temperature to a hydronic space heating system or setpoint. When using the control to provide Domestic Hot Water (DHW) requirements, only two modulating boilers can be operated. The supply water temperature is based on boiler reset, an external 0 – 10 V (dc) signal, DHW requirements, or a setpoint temperature.

Boiler Reset (Stand Alone)

When a boiler demand signal from the heating system is present, the control operates the boiler(s) to maintain the supply temperature based on the outdoor air temperature and the Characterized Heating Curve settings. Refer to section C.



DHW

When a DHW demand is present, the control operates the boiler(s) to maintain the supply water temperature at least as hot as the DHW exchange setting. Refer to section D.

Setpoint

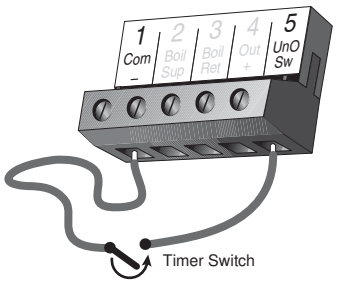
When a setpoint demand signal is present, the control operates the boiler(s) to maintain the supply water temperature at least as hot as the Setpoint setting. Refer to section E.

External Input 0 – 10 V (Dc) or 2 – 10 V (Dc)

When an external input signal is present, the control converts the signal to a target supply temperature. The control operates the boiler(s) to maintain the required supply water temperature. Refer to section F.

SETBACK (OCC and UNOCC)

To provide greater energy savings, the control has a setback feature. With setback, the supply water temperature in the system is reduced when the building is unoccupied. By reducing the supply water temperature, the air temperature in the space may be reduced even when thermostat(s) are not turned down. Any time the *UnO Sw* (5) and the *Com* (1) terminals are shorted together, the control operates in the unoccupied mode. When in the unoccupied mode, the *UNOCC* segment is displayed in the LCD. The control adjusts the supply water temperature based on the *UNOCC* settings in the control.



COMBUSTION AIR OR ALARM CONTACT

The control has an isolated contact that can be used as either a combustion air damper contact or an alarm contact. This selection is made using the C.A. / Alarm DIP switch.

Combustion Air (C.A.)

When the DIP switch is set to C.A., terminals 15 and 16 can be used as a switch to operate a combustion air damper. This contact closes prior to the first boiler operating on the control. The amount of time that the contact closes prior to the first boiler firing is set using the combustion delay setting.

The combustion air contact remains closed for a minimum of 15 seconds after the last boiler is turned off.

Alarm

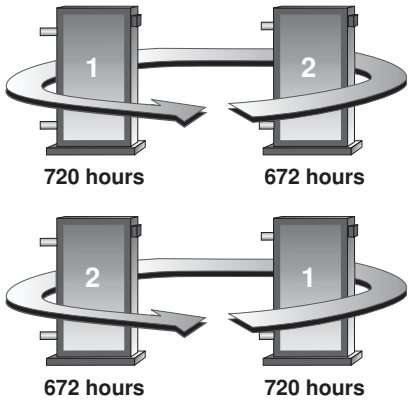
When the DIP switch is set to Alarm, terminals 15 and 16 can be used as a switch to operate an alarm circuit. This contact closes whenever an error message is present on the control display. When the alarm contact is activated, refer to the Error Messages section of this brochure to determine the cause of the alarm. Once the fault has been fixed, pressing either the ***Menu***, ***Item***, ▲ or ▼ button will clear the alarm.

Boiler Alarm

The control can monitor the boiler supply temperature and provide an alarm if the temperature does not increase within a certain amount of time. The amount of time can be set using the Boiler Alarm setting. This alarm can be used to determine if the boilers have failed to fire. To reset the alarm, press and hold the ▲ and ▼ buttons for 5 seconds while in the VIEW menu.

ROTATION

The control includes an Equal Run Time feature which changes the firing order of the boilers whenever one boiler accumulates 48 hours more running time than any other boiler. After each rotation, the boiler with the least running hours is the first to fire and the boiler with the most running hours is the last to fire. This function ensures that all of the boilers that are being rotated receive equal amounts of use. When the *Rotate / Off* DIP switch is set to the *Off* position, the firing sequence always begins with lowest boiler to the highest boiler.



Fixed Lead Rotation

In some applications, it may be desirable to have the first boiler fire first at all times while the firing sequence of the remaining boilers is changed using Equal Run Time Rotation. This rotation option is selected by setting the *Fixed Lead / Off* DIP switch to the *Fixed Lead* position.

First On / Last Off or First On / First Off

When using the *Fixed Lead* rotation option, a selection must be made between *First On / Last Off* and *First On / First Off* using the DIP switch. When *First On / Last Off* is selected, the lead boiler is always modulated first and shut off last. When *First On / First Off* is selected, the lead boiler is always modulated first and shut off first. This DIP switch is only read by the control when the *Fixed Lead / Off* DIP switch is set to *Fixed Lead*.

Resetting the Rotation Sequence

To reset the rotation sequence, set the *Rotate / Off* DIP switch to the *Off* setting for 5 seconds and then return the DIP switch to the *Rotate* setting.

RUNNING TIMES

The control displays the accumulated running time of each boiler in the VIEW menu.

Resetting the Running Times

To reset the running time for each boiler, select the appropriate running time in the VIEW menu. Next press the ▲ and ▼ buttons simultaneously until *CLr* is displayed.

EXERCISING

The control has a built-in exercising feature that is selected through the *Exercise / Off DIP* switch. To enable the exercising feature set the *Exercise / Off* DIP switch to *Exercise*. If exercising is enabled, the control ensures that each pump is operated at least once every 3 days. If a pump has not been operated at least once every 3 days, the control turns on the output for 10 seconds. This minimizes the possibility of the pump seizing during a long period of inactivity. While the control is exercising, the *Test* LED flashes quickly.

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

FACTORY DEFAULTS

The control comes preset with several factory defaults. These defaults are based on the terminal unit selection (see section C). To fine-tune building requirements, these defaults may be changed.

To reload the factory defaults listed in the ADJUST Menu, power down the control and wait for 10 seconds. Power up the control while simultaneously holding the ***Menu*** and ▼ buttons. An E01 error occurs forcing the installer to go through the ADJUST menu to ensure the settings are correct.

Section B: Boiler Operation

Section B1
Boiler
Modulation

Section B1: Boiler Modulation

MODULATION

The control provides three modulating output signals, three boiler enable contacts, and three boiler pumps contacts to operate up to three modulating boilers. The boiler enable contact may not be required, depending on the make and model of the boiler(s).

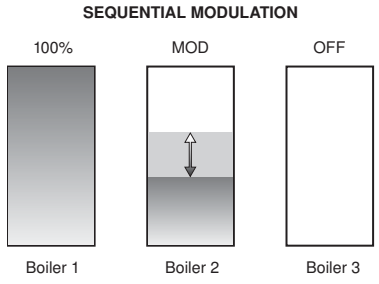
The control operates a boiler by first closing the boiler pump contact. The boiler enable contact is closed next and then the control provides a modulating output signal to the boiler.

The modulation output signal is then modulated from the minimum modulation using Proportional, Integral and Derivative (PID) logic in order to satisfy the boiler target temperature.

SEQUENTIAL MODULATION

The control offers a sequential modulation option. This is selected by setting the *Sequential / Parallel* DIP switch to *Sequential*. Sequential modulation should be used on boilers that are more efficient when operating at high fire.

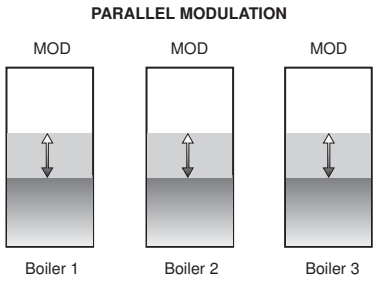
In sequential modulation, the first boiler is turned on and is modulated to satisfy light loads. Once the first boiler does not have enough capacity to satisfy the load, the first boiler reduces its modulation to provide a smooth transition when the second boiler fires at low fire. The first boiler then modulates up to maximum modulation as the load increases. Only then is the second boiler able to increase its output as the load continues to increase. When the third boiler is required, the second boiler reduces its modulation to allow the third boiler to operate at low fire. As the load continues to increase, the second boiler is modulated to its maximum and then the third boiler is modulated. The operation is reversed when shutting off the boilers.



PARALLEL MODULATION

The control offers a parallel modulation option. This is selected by setting the *Sequential / Parallel* DIP switch to *Parallel*. Parallel modulation should be used on boilers that are more efficient when operating at low fire.

In parallel modulation, the first boiler turns on at low fire and begins to increase its modulation. Once the first boiler's output is greater than the combined output of the first and second boiler's low fire, the first boiler is modulated down to low fire and the second boiler is fired at low fire. The two boilers now modulate together. Once the two boiler's combined output is greater than the combined output of all three boilers operating at low fire, the first and second boilers are modulated down to low fire, and all three boilers are operated at low fire. The boilers are then modulated as the load increases. The operation is reversed when shutting off the boilers.



MODULATION RANGE (4 to 20 mA or 0 to 20 mA)

The modulation output (Mod 1, Mod 2, and Mod 3) for each boiler can be adjusted from a 4 to 20 mA output range to a 0 to 20 mA output range using the *Boil Modulation 1, Boil Modulation 2,* or *Boil Modulation 3* setting. The resulting modulation output signal can be converted to a 0 to 5 V (dc), 1 to 5 V (dc), 0 to 10 V (dc), and 2 to 10 V (dc) output using external resistors. The modulation output signal can be converted to a 0 to 135 Ω (W R B) output using a 0 - 135 Ω Converter 005. Refer to the Modulation Output section in Step 4 of the Installation section.

MINIMUM MODULATION

The minimum modulation defines the minimum output signal from the control to the boiler burner. It is based on a percentage of the control's output signal range.

The minimum modulation setting for boilers with power burners is typically set to 0%.

For boilers with electronic operators, the boiler's input signal range may not match the output signal range of the 265 control. The Minimum Modulation setting limits the control output range in order to match the boiler's input range.

To calculate the Minimum Modulation, use the following formulae:

For 4 to 20 mA:

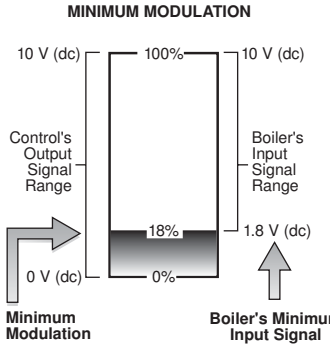
$$\text{Minimum Modulation} = \frac{\text{4 mA – Boiler's Minimum Input Signal}}{\text{4 - 20 mA}} \times 100\%$$

For 0 to 10 V (dc):

$$\text{Minimum Modulation} = \frac{\text{0 V (dc) – Boiler's Minimum Input Signal}}{\text{0 – 10 V (dc)}} \times 100\%$$

For 2 to 10 V (dc):

$$\text{Minimum Modulation} = \frac{\text{2 V (dc) – Boiler's Minimum Input Signal}}{\text{2 – 10 V (dc)}} \times 100\%$$



Example 1:

A boiler requires a 1.8 V (dc) signal to fire the boiler at low fire. The boiler can be modulated to 10 V (dc) where it reaches high fire. This means the boiler's input signal range is 1.8 to 10 V (dc). The 265 control has an output signal range of 0 to 20 mA which can be externally converted to 0 to 10 V (dc) using a 500 Ω resistor (Refer to Modulation Output section in Step 4 of the Installation section).

To make the two signal ranges the same, the Minimum Modulation required is:

$$\text{Minimum Modulation} = \frac{\text{0 V – 1.8 V}}{\text{0 V – 10 V}} \times 100\% = 18\%$$

Example 2:

If the boiler's input signal range is 6 to 20 mA the required Minimum Modulation is:

$$\text{Minimum Modulation} = \frac{\text{4 mA – 6 mA}}{\text{4 mA – 20 mA}} \times 100\% = 13\%$$

MAXIMUM MODULATION

The maximum modulation defines the maximum output signal from the control to the boiler burner. It is based on a percentage of the control's output signal range.

The maximum modulation setting for boilers with power burners is typically set to 100%.

For boilers with electronic operators, the boiler's input signal range may not match the output signal range of the 265 control. The Maximum Modulation setting limits the control output range in order to match the boiler's input range.

To calculate the Maximum Modulation, use the following formulae:

For 4 to 20 mA:

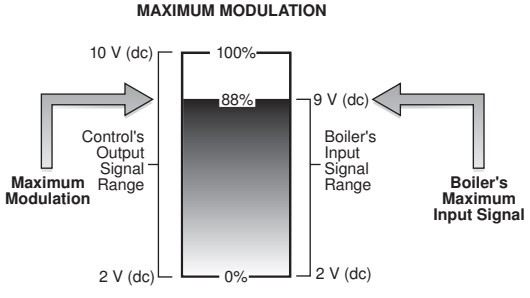
$$\text{Maximum Modulation} = \frac{\text{4 mA – Boiler's Maximum Input Signal}}{\text{4 – 20 mA}} \times 100\%$$

For 0 to 10 V (dc):

$$\text{Maximum Modulation} = \frac{\text{0 V (dc) – Boiler's Maximum Input Signal}}{\text{0 – 10 V (dc)}} \times 100\%$$

For 2 to 10 V (dc):

$$\text{Maximum Modulation} = \frac{\text{2 V (dc) – Boiler's Maximum Input Signal}}{\text{2 – 10 V (dc)}} \times 100\%$$



Example 1:

A boiler's input signal range is 2 to 9 V (dc). The 265 control has an output signal range of 2 to 10 V (dc). To make the two signal ranges the same, the Maximum Modulation required is:

$$\text{Maximum Modulation} = \frac{2\text{ V} - 9\text{ V}}{2\text{ V} - 10\text{ V}} \times 100\% = 88\%$$

Example 2:

If the boiler's input signal range is 6 to 19 mA the required Maximum Modulation is:

$$\text{Maximum Modulation} = \frac{4\text{ mA} - 19\text{ mA}}{4\text{ mA} - 20\text{ mA}} \times 100\% = 94\%$$

MINIMUM BOILER OUTPUT

In order to accommodate different boiler capacities in the same system, a minimum boiler output for each boiler can be set. This allows the control to properly operate the boilers using either sequential or parallel modulation. The minimum boiler output range is from 10,000 BTU / hour to 19,990,000 BTU / hour.

Each boiler typically has a rating plate that specifies the minimum output. This information is also available in the boiler manual. The Minimum Boiler Output setting has units of 10,000 BTU / hour. Divide the minimum output rating by 10,000 and enter the number as the Minimum Boiler Output setting.

For example, if a boiler has a minimum output of 20 MBH:

$$\text{Minimum Boiler Output} = \frac{20{,}000\text{ BTU/hr}}{10{,}000} = 2 \times 10{,}000\text{ BTU/hr}$$

MAXIMUM BOILER OUTPUT

In order to accommodate different boiler capacities in the same system, there is a maximum boiler output for each boiler. This allows the control to properly operate the boilers using either sequential or parallel modulation. The maximum boiler output range is from 10,000 BTU / hour to 19,990,000 BTU / hour.

Each boiler typically has a rating plate that specifies the maximum output. This information is also available in the boiler manual. The Maximum Boiler Output setting has units of 10,000 BTU / hour. Divide the maximum output rating by 10,000 and enter the number into the Maximum Boiler Output setting.

For example, if a boiler has a maximum output of 100 MBH:

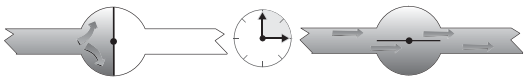
$$\text{Maximum Boiler Output} = \frac{100{,}000\text{ BTU/hr}}{10{,}000} = 10 \times 10{,}000\text{ BTU/hr}$$

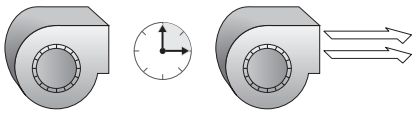
MOTOR SPEED

The Motor Speed is the amount of time the boiler requires to go from 0% modulation to 100% modulation. The control includes a Motor Speed setting for each individual boiler.

Gas valve actuating motors have a design time from fully closed to fully opened which can be found in the manufacturer's manual. The Motor Speed should be set to this time.

The Motor Speed setting for a Variable Frequency Drive (VFD) is the amount of time required to go from a stopped position to 100% fan speed. Since a VFD has a very quick response rate, it may be necessary to increase the Motor Speed setting in order to increase the stability of the boiler modulation.





BOILER MASS

The boiler mass setting allows the installer to adjust the control to the thermal mass of the type of heat sources used in the application. There is a boiler mass setting for each boiler. The modulation of the boiler can become unstable if the incorrect Boiler Mass setting is chosen. A key sign of the boiler modulation being unstable is the flame will continue to increase and then decrease in short periods of time. By choosing a lower boiler mass setting, the boiler response will become more stable.

Lo (1)

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

The Lo mass setting provides a fast response to the heating system.

Med (2)

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

The Med mass setting provides a moderate response to the heating system.

Hi (3)

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

The Hi mass setting provides a slow response to the heating system.

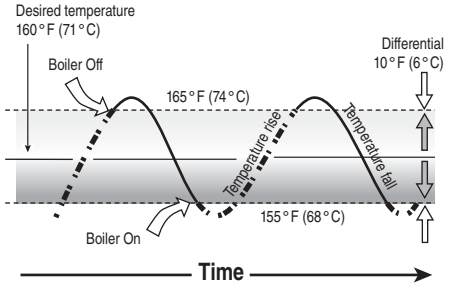
DIFFERENTIAL

A modulating boiler must be operated with a differential while operating in low fire. The boiler differential is divided around the boiler target temperature. The boiler starts at low fire when the supply water temperature is ½ of the differential setting below the boiler target temperature. The boiler is shut off in low fire as the supply temperature reaches at least ½ of the differential above the boiler target temperature. With the control, either a fixed or an auto differential may be selected.

When the boiler is modulating above low fire, the differential does not apply. Instead, the modulation output signal is determined using Proportional, Integral and Derivative (PID) logic in order to satisfy the boiler target temperature.

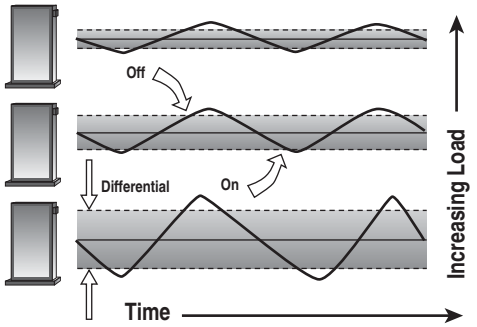
Fixed Differential

If the user desires to have a fixed differential, this is set using the boiler differential setting in the ADJUST menu.



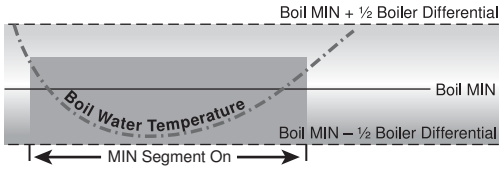
Auto Differential

If the Auto Differential is selected, the control automatically determines the best differential as the load changes. This reduces potential short cycling during light load conditions.



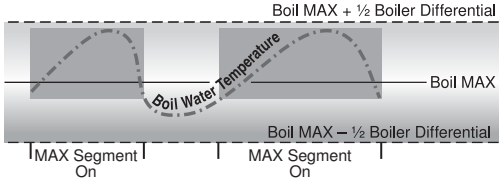
BOILER MINIMUM

The boiler minimum is the lowest temperature that the control is allowed to use as a boiler target temperature. During mild conditions, if the control calculates a boiler target temperature that is below the boiler minimum setting, the boiler target temperature is adjusted to at least the boiler minimum setting. During this condition, if the boiler(s) is operating, the minimum segment is turned on in the display when viewing either the boiler supply temperature or the boiler target temperature. Set the boiler minimum setting to the boiler manufacturer's recommended temperature.



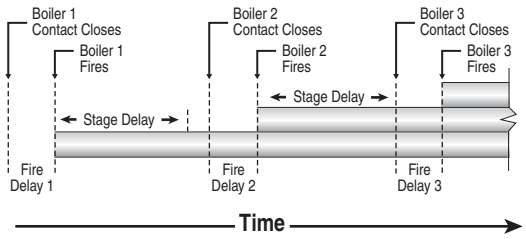
BOILER MAXIMUM

The boiler maximum is the highest temperature that the control is allowed to use as a boiler target temperature. If the control does target the boiler maximum setting, and the boiler temperature is near the boiler maximum temperature, the maximum segment will be turned on in the display while either the boiler target temperature or the boiler supply temperature is being viewed. At no time does the control operate the boiler(s) above 248°F (120°C).



FIRE DELAY

The Fire Delay is the time delay that occurs between the time that the control closes a boiler enable contact to fire a boiler and when the boiler fires at low fire.



STAGE DELAY

The stage delay is the minimum time delay between the firing of stages. After this delay has expired the control can fire the next stage if it is required. This setting can be adjusted manually or set to an automatic setting. When the automatic setting is used, the control determines the best stage delay based on the operation of the system.

SOFT STOP

It is possible to thermally shock a boiler when it is shut off at high fire. The *Soft Stop* feature forces the boiler to modulate down to minimum before turning off. This is designed to prevent large volumes of cold air being introduced into the combustion chamber of the boiler when it is shut off. This can occur in applications where the burner includes a fan.

Once all demands are removed, the control allows for the firing rate to be modulated down to the *MIN Modulation* setting prior to turning off the burner. This feature is enabled by setting the *Soft Stop / Off* DIP switch to the *Soft Stop* position. If the *Soft Stop / Off* DIP switch is in the *Off* position, the control turns off the boiler at the current firing rate once all demands are removed.

COPY BOILER 1 SETTINGS

Many boiler installations will have multiple identical boilers. To reduce the number of settings required, the settings of boiler 1 (Fire Delay, Boiler Mass, Motor Speed, Minimum Boiler Output, Maximum Boiler Output, Boiler Modulation, Minimum Modulation, Maximum Modulation, and Purge Boiler Pump) are copied to boiler 2 by setting the Boiler 2 setting to CP1. Likewise, setting Boiler 3 to CP1 copies the settings of boiler 1 to boiler 3. Boiler 2 and Boiler 3 settings are set to CP1 by default.

The setting of CP1 allows the control to enable the boiler similar to the setting of Au (automatic). If a boiler is set to OFF, the control disables that boiler.

If required, each of the three modulating boilers can have individual boiler settings. This allows for three different type, size, and make of modulating boilers. To select individual boiler settings for boiler 2, set Boiler 2 to Au (automatic). Likewise, to select individual boiler settings for boiler 3, set Boiler 3 to Au (automatic).

Section C: Outdoor Reset

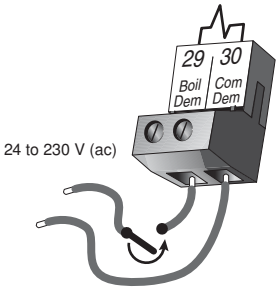
Section C1
Boiler Reset
(Stand Alone)

Section C1: Boiler Reset (Stand Alone)

Boiler Reset operation only applies when the *Stand Alone / External Input* DIP switch is set to *Stand Alone*.

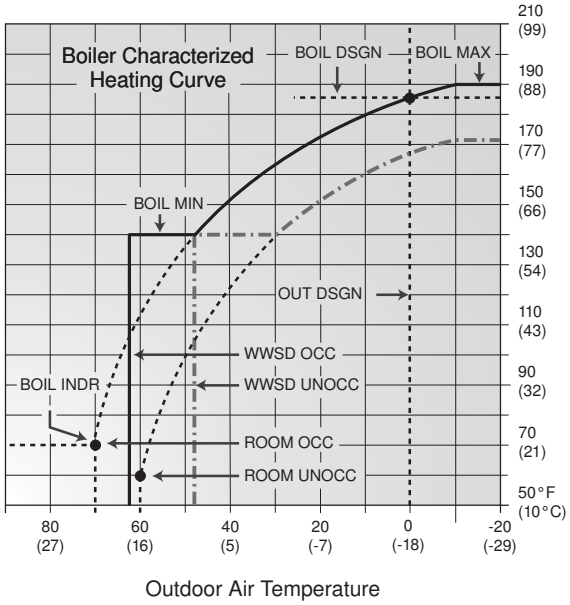
BOILER DEMAND

A boiler demand is required in order for the control to provide heat to the heating system. A boiler demand is generated by applying a voltage between 24 and 230 V (ac) across the *Boil Dem* and *Com Dem* terminals (29 and 30). Once voltage is applied, the *Boiler Demand* pointer is displayed in the LCD. If the control is not in Warm Weather Shut Down *(WWSD*), the control closes the primary pump contact. The control calculates a boiler target supply temperature based on the outdoor air temperature and the characterized heating curve settings. The control then fires the boiler(s), if required, to maintain the target supply temperature.



CHARACTERIZED HEATING CURVE

The control varies the supply water temperature based on the outdoor air temperature. The control takes into account the type of terminal unit that the system is using. Since different types of terminal units transfer heat to a space using different proportions of radiation, natural convection and forced convection, the supply water temperature must be controlled differently. Once a terminal unit is selected, the control varies the supply water temperature according to the type of terminal unit. This improves the control of the air temperature in the building.



OUTDOOR DESIGN TEMPERATURE

The outdoor design temperature is the outdoor air temperature that is the typical coldest temperature of the year where the building is located. This temperature is used when doing the heat loss calculations for the building. If a cold outdoor design temperature is selected, the boiler supply temperature rises gradually as the outdoor temperature drops. If a warm outdoor design temperature is selected, the boiler supply temperature rises rapidly as the outdoor temperature drops.

BOILER DESIGN TEMPERATURE

The boiler design supply temperature is the supply water temperature required to heat the building when the outdoor air temperature is as cold as the outdoor design temperature.

BOILER INDOOR DESIGN TEMPERATURE

The indoor design temperature is the room temperature that was used in the original heat loss calculations for the building. This setting establishes the beginning of the characterized heating curve.

ROOM

The *ROOM* setting is the desired room temperature for the building and provides a parallel shift of the heating curve. The room temperature desired by the occupants is often different from the design indoor temperature. If the room temperature is not correct, adjusting the room setting increases or decreases the amount of heat available to the building. A room setting is available for both the occupied (day) and unoccupied (night) periods.

BOILER TARGET TEMPERATURE

The boiler target temperature is determined from the characterized heating curve settings and the outdoor air temperature. The control displays the temperature that it is currently trying to maintain as the boiler supply temperature. If the control does not presently have a requirement for heat, it does not show a boiler target temperature. Instead, "– – –" is displayed in the LCD.

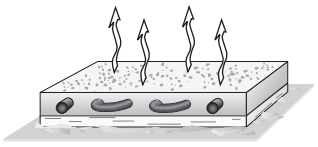
TERMINAL UNITS

The control provides for a selection between six different terminal unit types: two types of radiant floor heat, fancoil, fin-tube convector, radiator and baseboard. When a terminal unit is selected, the control automatically loads the design supply temperature, maximum supply temperature, and minimum supply temperature. The factory defaults are listed below. These factory defaults can be changed to better match the installed system.

Terminal Unit	High Mass Radiant (1)	Low Mass Radiant (2)	Fancoil (3)	Fin-Tube Convector (4)	Radiator (5)	Baseboard (6)
BOIL DSGN	120°F (49°C)	140°F (60°C)	190°F (88°C)	180°F (82°C)	160°F (71°C)	150°F (66°C)
BOIL MAX	140°F (60°C)	160°F (71°C)	210°F (99°C)	200°F (93°C)	180°F (82°C)	170°F (77°C)
BOIL MIN	OFF	OFF	140°F (60°C)	140°F (60°C)	140°F (60°C)	140°F (60°C)

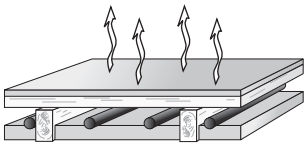
High Mass Radiant (1)

This type of a hydronic radiant floor is embedded in either a thick concrete or gypsum pour. This heating system has a large thermal mass and is slow acting.



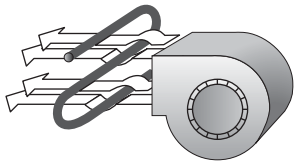
Low Mass Radiant (2)

This type of radiant heating system is either attached to the bottom of a wood sub-floor, suspended in the joist space, or sandwiched between the sub-floor and the surface. This type of radiant system has a relatively low thermal mass and responds faster than a high mass system.



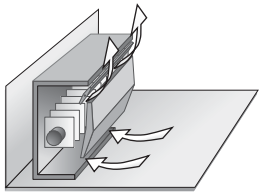
Fancoil (3)

A fancoil terminal unit or Air Handling Unit (AHU) consists of a hydronic heating coil and either a fan or blower. Air is forced across the coil at a constant velocity by the fan or blower, and is then delivered into the building space.



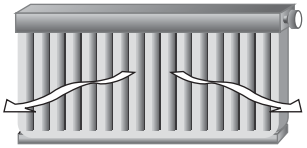
Fin-Tube Convector (4)

A convector terminal unit is made up of a heating element with fins on it. This type of terminal unit relies on the natural convection of air across the heating element to deliver heated air into the space. The amount of natural convection to the space is dependant on the supply water temperature to the heating element and the room air temperature.



Radiator (5)

A radiator terminal unit has a large heated surface that is exposed to the room. A radiator provides heat to the room through radiant heat transfer and natural convection.



Baseboard (6)

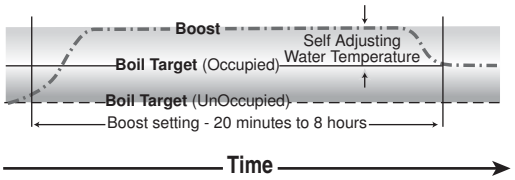
A baseboard terminal unit is similar to a radiator, but has a low profile and is installed at the base of the wall. The proportion of heat transferred by radiation from a baseboard is greater than that from a fin-tube convector.

WARM WEATHER SHUT DOWN (OCC and UNOCC)

The Warm Weather Shut Down (*WWSD*) disables the space heating system during warm outdoor weather. There is a separate WWSD for both the occupied and the unoccupied periods. When the outdoor air temperature rises above the WWSD setting, the control turns on the *WWSD* pointer in the display. When the control is in WWSD, the *Boiler Demand* pointer is displayed if there is a boiler demand. However, the control does not operate the heating system to satisfy this demand. The control does respond to a DHW demand or a setpoint demand and operates as described in sections D and E. WWSD is not active when using an external input signal.

BOOST

When the control changes from the unoccupied mode to the occupied mode, it enters into a boosting mode. In this mode, the supply water temperature to the system is raised above its normal values for a period of time to provide a faster recovery from the setback temperature of the building. The maximum length of the boost is selected using the *BST* setting.



Typical settings for the boost function vary between 30 minutes and two hours for buildings that have a fast responding heating system. For buildings that have a slow responding heating system, a setting between four hours and eight hours is typical. After a boost time is selected, the setback timer must be adjusted to come out of setback some time in advance of the desired occupied time. This time in advance is normally the same as the *BST* setting.

If the building is not up to temperature at the correct time, the *BST* setting should be lengthened and the setback timer should be adjusted accordingly. If the building is up to temperature before the required time, the *BST* setting should be shortened and the setback timer should be adjusted accordingly. If the system is operating near its design conditions or if the supply water temperatures are being limited by settings made in the control, the time required to bring the building up to temperature may be longer than expected.

Section D: Domestic Hot Water Operation

Section D1
Domestic Hot Water (DHW)

Section D2
DHW w/ Low Temp Boilers

Section D1: Domestic Hot Water (DHW)

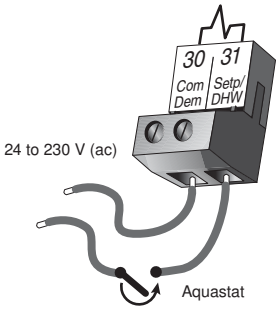
DHW operation is available during Boiler Reset (Stand Alone) and External Input operation.

The DHW operation requires the use of the *Boiler 3 / DHW* contact; therefore, only 2 boilers can be connected to the control. The BOIL 3 setting must be set to *OFF* before the DHW MODE item will be available.

DHW DEMAND

A *DHW Demand* is required in order for the control to provide heat to the DHW system. A DHW aquastat or setpoint control is used as a switch in the DHW demand circuit. Once the control detects a DHW demand, the *DHW Demand* pointer turns on in the LCD and the control operates the boiler to provide a sufficient boiler supply water temperature to the DHW tank. The control operates the pumps as described below.

The control registers a *DHW Demand* when a voltage between 24 and 230 V (ac) is applied across the *Setp / DHW* and *Com Dem* terminals (31 and 30).



BOILER TARGET DURING DHW GENERATION

The boiler target temperature is at least as hot as the DHW exchange setting *(DHW XCHG*). The DHW demand overrides the boiler reset target temperature, except when the boiler reset target is higher than the DHW Exchange setting.

DHW MODE AND PRIORITY OPERATION

The control has five different settings available for DHW MODE. The required DHW MODE setting will depend on the piping arrangement of the DHW tank.

It is often desirable to have a priority for the DHW allowing for quick recovery of the DHW tank temperature. This is achieved by limiting or even stopping the flow of heat to the heating system when the DHW tank calls for heat.

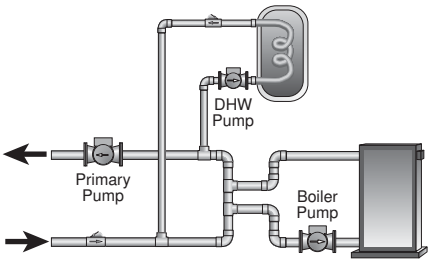
DHW Mode Off – No DHW

The DHW feature is not selected.

DHW MODE 1 - DHW in Parallel no Priority

When a DHW Demand is present, the *Boiler 3 / DHW* contact (terminals 21 and 22) closes with the DHW demand. The primary pump contact does not turn on, but may operate based on a Boiler Demand, or an External Input Signal.

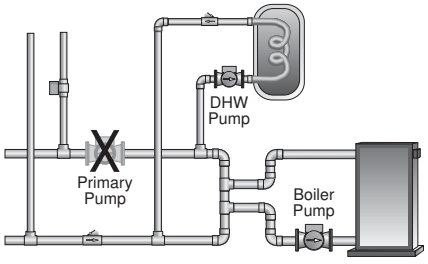
It is assumed that the DHW pump will provide adequate flow through the heat exchanger and the boiler.



DHW MODE 2 - DHW in Parallel with Priority

When a *DHW Demand* is present, the Boiler 3 / *DHW* contact (terminals 21 and 22) closes and the primary pump contact is opened.

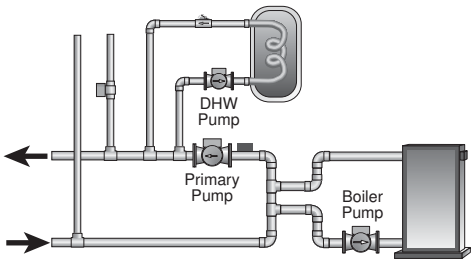
It is assumed that the DHW pump will provide adequate flow through the heat exchanger and the boiler.



DHW MODE 3 - DHW in Primary / Secondary no Priority

When a *DHW Demand* is present, the *Boiler 3 / DHW* contact (terminals 21 and 22) is closed and the primary pump contact is closed.

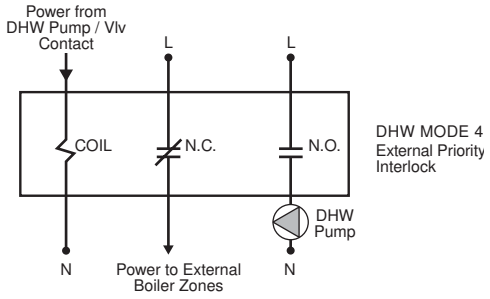
This mode can be used if a DHW tank is piped in direct return and a DHW valve is installed.

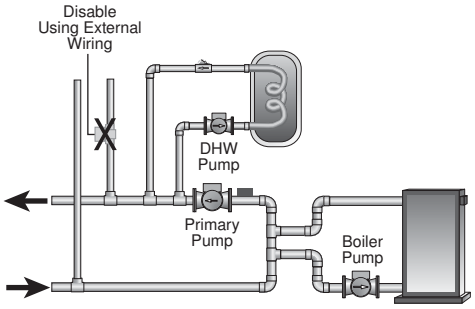


DHW MODE 4 - DHW in Primary / Secondary with Priority

When a *DHW Demand* is present, the *Boiler 3 / DHW* contact (terminals 21 and 22) is closed and the primary pump contact is closed. Priority can only be obtained using external wiring. During a priority override, the *Boiler 3 / DHW* contact is opened until the heating system has recovered before returning to DHW operation.

This mode can be used if a DHW tank is piped in direct return and a DHW valve is installed.





DHW PRIORITY OVERRIDE

The DHW *Priority Override* applies to *DHW MODE 2* and *4*. To prevent the building from cooling off too much or the possibility of a potential freeze up during DHW priority, the control limits the amount of time for DHW priority. The length of DHW priority time is determined using the *Priority Override* setting. Once the allowed time for priority has elapsed, the control overrides the DHW priority and resumes space heating.

To provide external DHW priority, the space heating zones must be interlocked with the Boiler 3 / DHW contact. During DHW demands, the Boiler 3 / DHW contact must remove any power to all space heating zone valves or zone pumps.

CONDITIONAL DHW PRIORITY

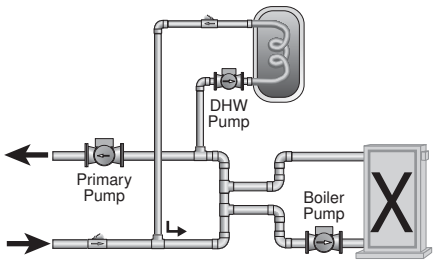
The Conditional DHW Priority Override applies to DHW MODE *2* and *4*. If the boiler supply temperature is maintained at or above the required temperature during DHW generation, this indicates that the boiler(s) has enough capacity for DHW and possibly heating as well. As long as the boiler supply temperature is maintained near its target and the heating and DHW targets are similar, DHW and heating occurs simultaneously.

DHW POST PURGE

After the DHW Demand is removed, the control performs a purge (PURG) on the boiler(s). The control shuts off the boiler(s) and continues to operate either the DHW pump or the DHW valve and the system and boiler pump if applicable. This purges the residual heat from the boiler(s) into the DHW tank. The control continues this purge for a maximum of two minutes or until the boiler supply water temperature drops 20°F (11°C) below the boiler target temperature during the DHW operation. The control also stops the purge if the boiler supply temperature is close to the current boiler target temperature.

DHW MIXING PURGE

After DHW operation, the boiler(s) is extremely hot. At the same time, the heating zones may have cooled off considerably after being off for a period of time. To avoid thermally shocking the boiler(s) after DHW in parallel with priority (DHW MODE 2), the control shuts off the boiler(s), but continues to operate the DHW while restarting the heating system. This allows some of the DHW return water to mix with the cool return water from the zones and temper the boiler return water.



DHW DURING UNOCCUPIED

If the control receives a *DHW Demand* during an unoccupied period, the control can either continue operation of the DHW system as it would during the occupied period or the control can ignore a DHW Demand for the duration of the unoccupied period.

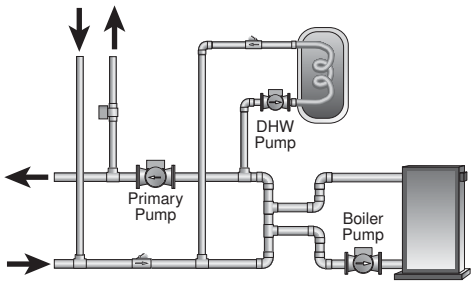
NUMBER OF BOILERS USED FOR DHW GENERATION

The number of boilers used for DHW generation can be selected to either one or two using the BOIL DHW setting. This applies when only a DHW Demand is present. If there are other demands present, the control does not limit the number of boilers operated.

Section D2: DHW with Low Temperature Boilers

If DHW is to be incorporated into a low temperature system such as a radiant heating system, a mixing device is often installed to isolate the high DHW supply temperature from the lower system temperature. If a mixing device is not installed, high temperature water could be supplied to the low temperature system while trying to satisfy the DHW demand. This may result in damage to the low temperature heating system. The control is capable of providing DHW in such a system while maximizing the chance that the temperature in the heating system does not exceed its allowed maximum setting.

To prevent high temperature water from being introduced into the heating system, the primary pump (*Prim P1)* must be turned off during a call for DHW. To do this, the control must be set to DHW MODE 2 or DHW MODE 4 and Boil MIN must be set to OFF.



DHW MODE 2 OPERATION

On a call for DHW, the control provides DHW priority by shutting off the primary pump (Prim P1) for a period of time. This time is based on the DHW Priority Override setting. However, if the DHW Demand is not satisfied within the allotted time, the boiler(s) shuts off and the heat of the boiler is purged into the DHW tank.

Once the boiler supply temperature is sufficiently reduced, the Boiler 3 / DHW contact shuts off. The heating system is turned on for a period of time to prevent the building from cooling off. After a period of heating, and if the DHW Demand is still present, the control shuts off the heating system and provides heat to the DHW tank once again.

For correct operation, close attention must be paid to the mechanical layout of the system. When the control turns off the primary pump (*Prim P1*), flow to the heating system must stop. If flow is not stopped, the temperature in the heating system can exceed the maximum desired temperature and can result in damage to the heating system.

DHW MODE 4 OPERATION

In DHW MODE 4, the space heating zones must be prevented from coming on during DHW demands using external wiring. This can be done using an external relay to remove power from zone pumps or zone valves while a DHW Demand is present. This external relay is interlocked with the Boiler 3 / DHW contact.

During a DHW Demand, the control closes the primary pump (Prim P1) contact and the Boiler 3 / DHW contact. Once the DHW Demand is removed, or during a DHW priority override, the Boiler 3 / DHW contact is opened, and the external wiring should allow the space heating zones to operate.

There is no mixing purge available in DHW MODE 4. After DHW priority, the boiler supply water temperature may exceed the design water temperature of the space heating system and can result in damage to the heating system.

Section E: Setpoint Operation

Section E1
Setpoint

Section E1: Setpoint

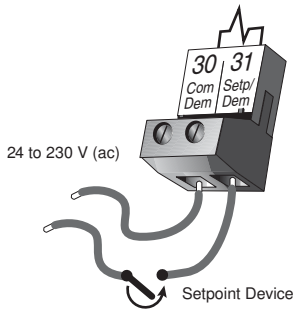
Note: Setpoint operation is only available when DHW MODE is set to OFF.

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 Dem* and *Com Dem* terminals (31 and 30). 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

SETP MODE 1 - Setpoint in Parallel

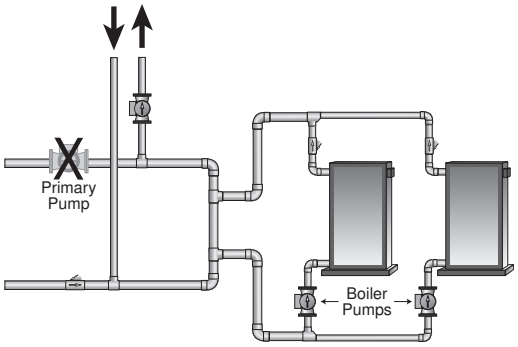
Whenever a setpoint demand is present, the boiler(s) is operated to maintain the setpoint target. The primary pump contact does not close, but may operate based on a Boiler Demand or on an external input system.

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

SETP 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 P1*) contact is opened.

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



SETP MODE 3 – Primary Pump during Setpoint

Whenever a setpoint demand is present, the primary pump *(Prim P1*) is turned on and the boiler(s) is operated to maintain the setpoint target.

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 P1*).

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.

Section F: External Input Operation

Section F1
External
Input

Section F1: External Input

DHW or Setpoint operation is available during External Input operation. Boiler Demands are not active when the Stand Alone / External Input DIP switch is set to External Input.

EXTERNAL INPUT

The control can accept an external DC signal in place of the outdoor sensor. The control converts the DC signal into the appropriate boiler target temperature between 50°F (10°C) and 210°F (99°C) based on the External Input Signal and Offset settings. To use the external input signal, the External Input / Stand Alone DIP switch must be set to External Input.

When operating in the external input mode, an external signal is required in order for the control to provide heat to the heating system. An external signal is generated by applying a voltage between 0 V (dc) and 10 V (dc) across the *Out +* and *Com –* terminals (4 and 1). Voltages that exceed 10 V (dc) will still be considered a 10 V (dc) signal. Once voltage is applied, the control closes the primary pump contact and the control calculates a boiler target supply temperature based on the external input signal and the settings made in the control. The control then fires the boiler(s), if required, to maintain the target supply temperature. If the external signal goes below the minimum voltage, the boiler target temperature is displayed as "– – –" to indicate that there is no longer a call for heating. The primary pump and boiler pumps operate as described in section G.

INPUT SIGNAL

The control can accept either a 0 - 10 V (dc) signal or a 2 - 10 V (dc) signal. The External Input Signal setting must be set to the proper setting based on the signal that is being sent to the control.

0 - 10 V (dc) or 0 - 20 mA

When the 0 - 10 V (dc) signal is selected, an input voltage of 1 V (dc) corresponds to a boiler target temperature of 50°F (10°C). An input voltage of 10 V (dc) corresponds to a boiler target temperature of 210°F (99°C). As the voltage varies between 1 V (dc) and 10 V (dc) the boiler target temperature varies linearly between 50°F (10°C) and 210°F (99°C). If a voltage below 0.5 V (dc) is received the boiler target temperature is displayed as "– – –" indicating that there is no longer a call for heating.

A 0 - 20 mA signal can be converted to a 0 - 10 V (dc) signal by installing a 500 Ω ¼ W resistor between the *Out +* and *Com –* terminals (4 and 1).

2 - 10 V (dc) or 4 - 20 mA

When the 2 - 10 V (dc) signal is selected, an input voltage of 2 V (dc) corresponds to a boiler target temperature of 50°F (10°C). An input voltage of 10 V (dc) corresponds to a boiler target temperature of 210°F (99°C). As the voltage varies between 2 V (dc) and 10 V (dc) the boiler target temperature varies linearly between 50°F (10°C) and 210°F (99°C). If a voltage below 1.5 V (dc) is received the boiler target temperature is displayed as "– – –" indicating that there is no longer a call for heating.

A 4 - 20 mA signal can be converted to a 2 - 10 V (dc) signal by installing a 500 Ω resistor between the *Out +* and *Com –* terminals (4 and 1).

OFFSET

The Offset setting allows the boiler target temperature to be fine tuned to the external input signal. The control reads the external input signal and converts this to a boiler target temperature. The Offset setting is then added to the boiler target temperature

CONVERSION TABLE 0 - 10		
0 - 20 mA*	**0 - 10 V (dc)**	**Boiler Target**
0	0	– – – (OFF)
2	1	50°F (10°C)
4	2	68°F (20°C)
6	3	86°F (30°C)
8	4	103°F (39°C)
10	5	121°F (49°C)
12	6	139°F (59°C)
14	7	157°F (69°C)
16	8	174°F (79°C)
18	9	192°F (89°C
20	10	210°F (99°C)

*Requires 500 Ω Resistor in Parallel

CONVERSION TABLE 2 - 10		
4 - 20 mA*	**2 - 10 V (dc)**	**Boiler Target**
0	0	– – – (OFF)
4	2	50°F (10°C)
6	3	70°F (21°C)
8	4	90°F (32°C)
10	5	110°F (43°C)
12	6	130°F (54°C)
14	7	150°F (66°C)
16	8	170°F (77°C)
18	9	190°F (88°C)
20	10	210°F (99°C)

*Requires 500 Ω Resistor in Parallel

Example	Range	=	0 - 10 V (dc)	
	Input	=	7 V (dc)	→ 157°F (69°C)
	Offset	=	+5°F (3°C)	→ +5°F (3°C)
	Boiler Target	=		162°F (72°C)

Section G: Pump Operation

Section G1
Pump
Operation

Section G1: Pump Operation

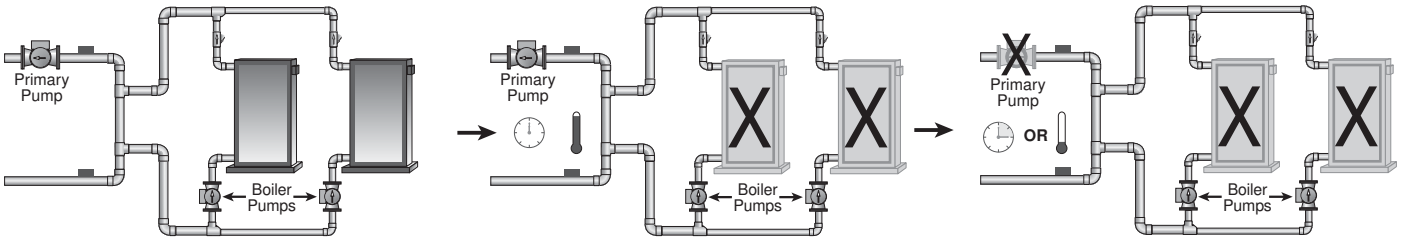
PRIMARY PUMP OPERATION

The primary pump operates under the following conditions:

- A boiler demand is present and the control is not in Warm Weather Shut Down (WWSD).
- An external input signal is present.
- A DHW demand is present and DHW MODE is set to 3 or 4.
- A setpoint demand is present and Setpoint MODE is set to 3.

Primary Pump Purge

After all demands are removed, the control continues to operate the primary pump for a period of time. The maximum length of time that the primary pump continues to run is adjustable using the Purge setting. The primary pump continues to run until either the purging time has elapsed or the boiler supply temperature drops more than ½ of the differential below the boiler minimum setting.

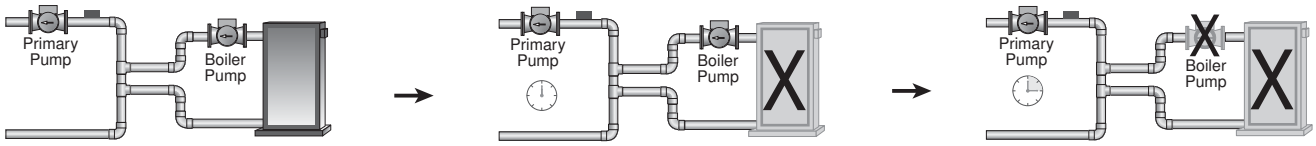


BOILER PUMP OPERATION

The control can operate a boiler pump on each boiler in addition to the primary pump. The boiler pump turns on prior to the boiler firing and continues to run after the boiler is turned off. The amount of time that the boiler pump turns on prior to the boiler firing is determined by the boiler mass setting. As the boiler mass setting is increased, the boiler pump pre-purge time of the also increases. However, if the control is operating only on a setpoint demand, the boiler pump turns on immediately before the boiler fires.

Boiler Pump Purge

The amount of time that the boiler pump continues to run after the boiler turns off is adjustable using the boiler pump purge setting *(PURG Boil Pmp*).



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 limits 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.

STEP ONE — GETTING READY

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

Type 265 includes: One Boiler Control 265, One Outdoor Sensor 070, Two Universal Sensors 071, Data Brochures D 265, D 070, D 001, Application Brochure A 265, Four 500 Ω resistors.

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

STEP TWO — MOUNTING THE BASE

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

⚠ STEP THREE — ROUGH-IN WIRING

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

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

- All wires are to be stripped to a length of 3/8" (9 mm) to ensure proper connection to the control.
- If an Outdoor Sensor 070 is used, install the sensor according to the installation instructions in the Data Brochure D 070 and run the wiring back to the control.
- Install the Boiler Supply Sensor 071 according to the installation instructions in the Data Brochure D 070 and run the wiring back to the control.
- If a Boiler Return Sensor 071 is used, install the sensor according to the installation instructions in the Data Brochure D 070 and run the wiring back to the control.
- Run wire from other system components (pumps, boilers, etc.) to the control.
- Run wires from the 115 V (ac) power to the control. Use a clean power source with a 15 A circuit to ensure proper operation. Multi-strand 16 AWG wire is recommended for all 115 V (ac) wiring due to its superior flexibility and ease of installation into the terminals.

STEP FOUR — ELECTRICAL CONNECTIONS TO THE CONTROL

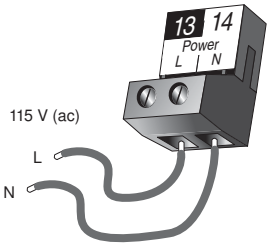
General

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

⚠ *Powered Input Connections*

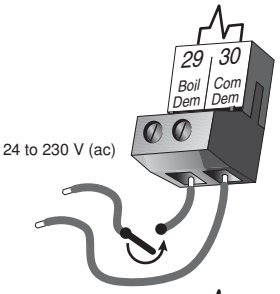
115 V (ac) Power

Connect the 115 V (ac) power supply to the *Power L* and *Power N* terminals (13 and 14). This connection provides power to the microprocessor and display of the control. As well, this connection provides power to the *Prim P1* terminal (12) from the *Power L* terminal (13).



Boiler Demand

To generate a Boiler Demand, a voltage between 24 V (ac) and 230 V (ac) must be applied across the *Boil Dem* and *Com Dem* terminals (29 and 30).

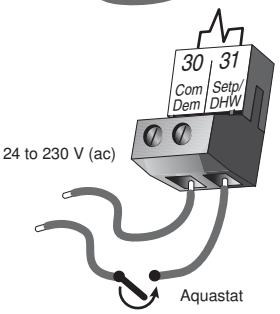


DHW Demand

To generate a DHW Demand, a voltage between 24 V (ac) and 230 V (ac) must be applied across the *Setp / DHW Dem* and *Com Dem* terminals (31 and 30). The Boil 3 setting must be set to OFF and DHW MODE must also be set to 1 through 4.

Setpoint Demand

To generate a Setpoint Demand, a voltage between 24 V (ac) and 230 V (ac) must be applied across the *Setp / DHW Dem* and *Com Dem* terminals (31 and 30). The DHW MODE must also be set to OFF.

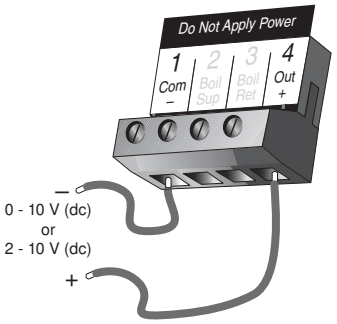


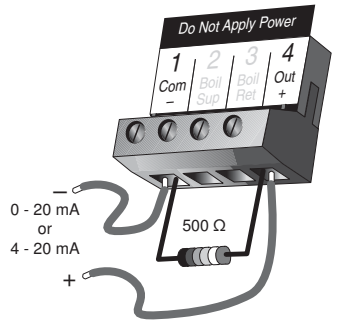
External Input (0 -10 V dc)

To generate an external input signal, a voltage between 0 and 10 V (dc) must be applied to the *Com –* and *Out +* terminals (1 and 4).

A 0 - 20 mA signal can be converted to a 0 - 10 V (dc) signal by installing a 500 Ω resistor between the *Com –* and *Out +* terminals (1 and 4).

A 4 - 20 mA signal can be converted to a 2 - 10 V (dc) signal by installing a 500 Ω resistor between the *Com –* and *Out +* terminals (1 and 4).

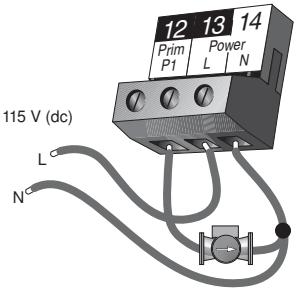




⚠ *Output Connections*

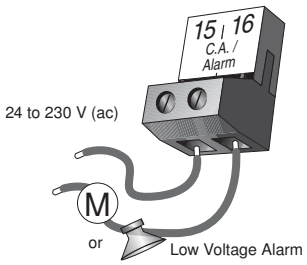
Primary Pump Contact (Prim P1)

The *Prim P1* output terminal (12) is a powered output. When the relay in the control closes, 115 V (ac) is provided to the *Prim P1* terminal (12) from the *Power L* terminal (13). To operate the primary pump, connect one side of the primary pump circuit to terminal (12) and the second side of the pump circuit to the neutral *(Power N)* side of the 115 V (ac) power supply.



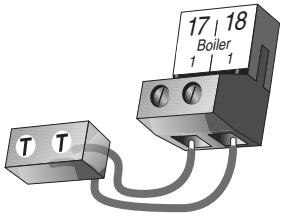
Combustion Air / Alarm Contact (C.A./Alarm)

The Combustion Air / Alarm Contact (*C.A. / Alarm*) terminals (15 and 16) are an isolated output in the control. There is no power available on these terminals from the control. These terminals are to be used as a switch to either make or break power to the combustion air damper or alarm. Since this is an isolated contact, it may switch a voltage between 24 V (ac) and 230 V (ac).



Boiler 1 and Boiler 2 Contacts

The *Boiler 1* and *Boiler 2* terminals (17 and 18, 19 and 20) are isolated outputs in the control. There is no power available on these terminals from the control. These terminals are to be used as a switch to enable the modulating boiler. Since this is an isolated contact, it may switch a voltage between 24 V (ac) and 230 V (ac).



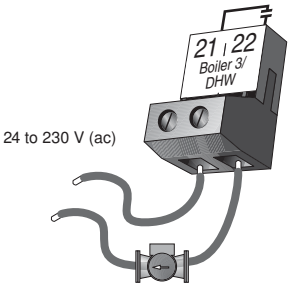
Boiler 3 / DHW Contact

Boiler Operation

The *Boiler 3 / DHW* terminals (21 and 22) are isolated outputs in the control. There is no power available on these terminals from the control. These terminals are to be used as a switch to enable the modulating boiler. Since this is an isolated contact, it may switch a voltage between 24 V (ac) and 230 V (ac).

DHW Operation

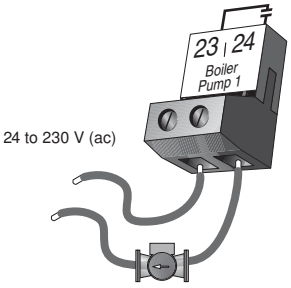
The *Boiler 3 / DHW* terminals (21 and 22) are an isolated output. There is no power available on these terminals from the control. These terminals are to be used as a switch to either make or break power to the DHW pump or the DHW valve. Since this is an isolated contact, it may switch a voltage between 24 V (ac) and 230 V (ac).



Boiler Pump 1 to Boiler Pump 3 Contacts

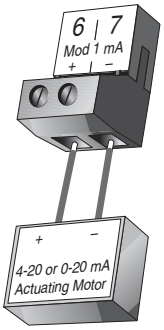
The *Boiler Pump 1* to *Boiler Pump 3* terminals (23 and 24, 25 and 26, 27 and 28) are isolated outputs in the control. There is no power available on these terminals from the control. These terminals are to be used as a switch to either make or break power to a boiler pump. Since these are isolated contacts, they may switch a voltage between 24 V (ac) and 230 V (ac).

Note: When a Boiler is set to OFF, the Boiler Pump contact becomes inactive.



Mod 1 to Mod 3 Outputs

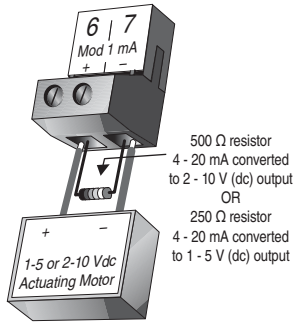
The Mod 1 to Mod 3 outputs *(Mod 1, Mod 2, Mod 3)* on terminals (6 and 7, 8 and 9, 10 and 11) provide a 4 to 20 mA or a 0 to 20 mA output to each boiler. The modulating outputs replace any mechanical operator such as a T991. Observe polarity when connecting the control to the boiler.



Connection to Operate a 4 - 20 or 0-20 mA Device

The 4 to 20 mA output can be converted to 1 to 5 V (dc) using an external 250 Ω resistor across the *Mod 1 (Mod 2, Mod 3)* terminals.

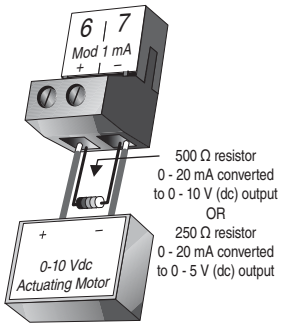
The 4 to 20 mA output can be converted to 2 to 10 V (dc) using an external 500 Ω resistor across the *Mod 1 (Mod 2, Mod 3)* terminals.



Converting the 4 - 20 mA Output to Operate a 1 - 5 or 2 - 10 V (dc) Device

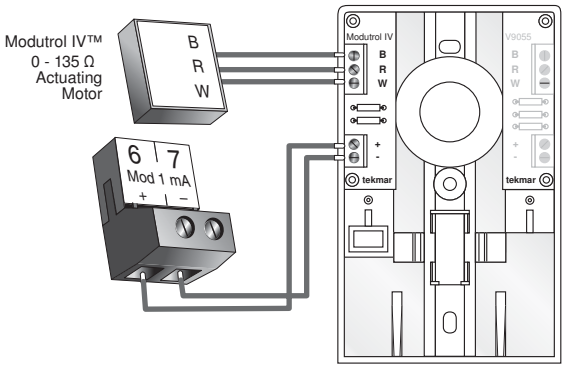
The 0 to 20 mA output can be converted to 0 to 5 V (dc) using an external 250 Ω resistor across the *Mod 1 (Mod 2, Mod 3)* terminals.

The 0 to 20 mA output can be converted to 0 to 10 V (dc) using an external 500 Ω resistor across the *Mod 1 (Mod 2, Mod 3)* terminals.

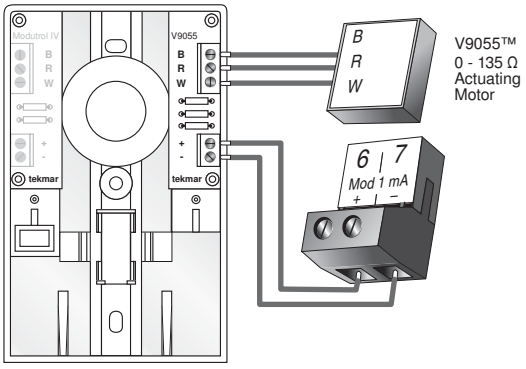


Converting the 0 - 20 mA Output to Operate a 0 - 10 V (dc) Device

The 4 to 20 mA output can be converted to a 0 - 135 Ω output for a Modutrol IV™ gas valve actuating motor using a 0 - 135 Ω tekmar Converter 005 (sold separately).



The 4 to 20 mA output can be converted to a 0 - 135 Ω output for a V9055™ gas valve actuating motor using a 0 - 135 Ω tekmar Converter 005 (sold separately).



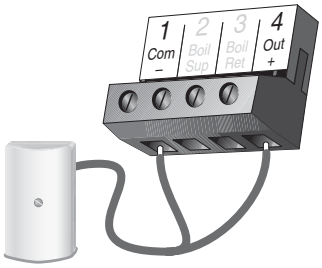
™Modutrol IV and V9055 are trademarks of Honeywell, Inc.

⚠ SENSOR AND UNPOWERED INPUT CONNECTIONS

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

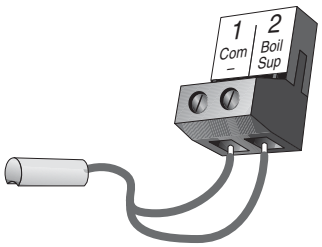
Outdoor Sensor

Connect the two wires from the Outdoor Sensor 070 to the *Com* and *Out* terminals (1 and 4). The outdoor sensor is used by the control to measure the outdoor air temperature.



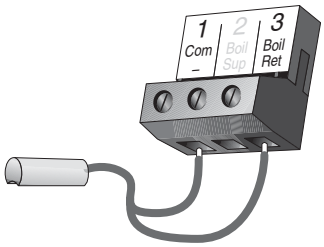
Boiler Supply Sensor

Connect the two wires from the Boiler Supply Sensor 071 to the *Com* and *Boil Sup* terminals (1 and 2). The boiler supply sensor is used by the control to measure the boiler supply water temperature.



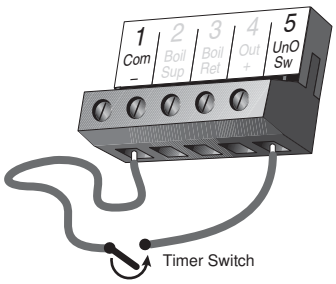
Boiler Return Sensor

Connect the two wires from the Boiler Return Sensor 071 to the *Com* and *Boil* terminals (1 and 3). The boiler return sensor is used by the control to measure the boiler return water temperature.



UnOccupied Switch

If an external timer (tekmar Timer 032) or switch is used, connect the two wires from the external switch to the *Com* and *UnO Sw* terminals (1 and 5). When these two terminals are shorted together, the control registers an unoccupied *(UNOCC)* signal.



⚠ General

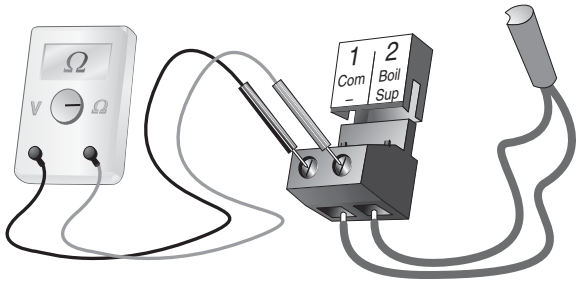
Each terminal block must be unplugged from its header on the control before power is applied for testing. To remove the terminal block, pull straight down from the control.

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

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

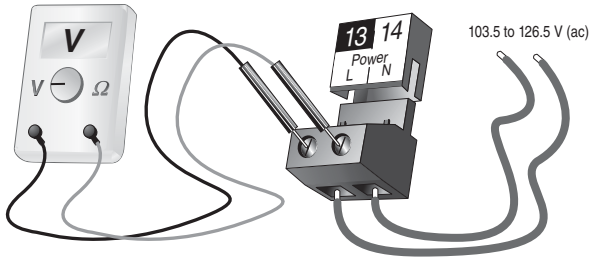
⚠ Test the Sensors

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



⚠ Test the Power Supply

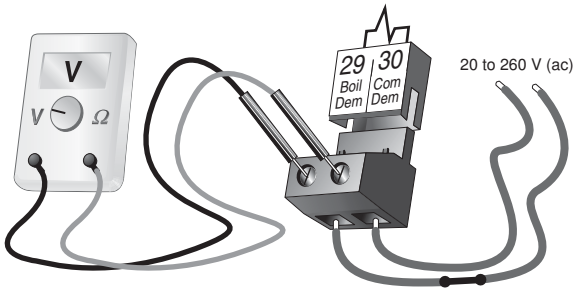
Make sure exposed wires and bare terminals are not in contact with other wires or grounded surfaces. Turn on the power and measure the voltage between the *Power L* and *Power N* terminals (13 and 14) using an AC voltmeter, the reading should be between 103.5 and 126.5 V (ac).



⚠ Test the Powered Inputs

Boiler Demand

If a boiler demand is used, measure the voltage between the *Boil Dem* and *Com Dem* terminals (29 and 30). When the boiler demand device calls for heat, a voltage between 20 and 260 V (ac) should be measured at the terminals. When the boiler demand device is off, less than 5 V (ac) should be measured.

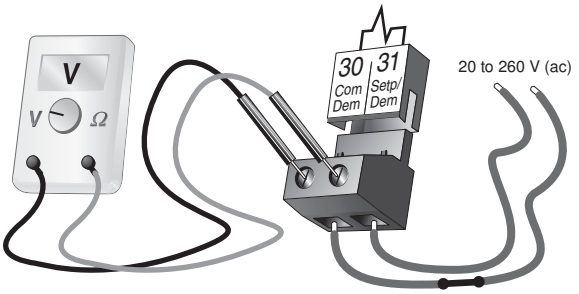


DHW Demand

If a DHW demand is used, measure the voltage between the *Setp / DHW* and the *Com Dem* terminals (31 and 30). When the DHW demand device calls for heat, a voltage between 20 and 260 V (ac) should be measured at the terminals. When the DHW demand device is off, less than 5 V (ac) should be measured.

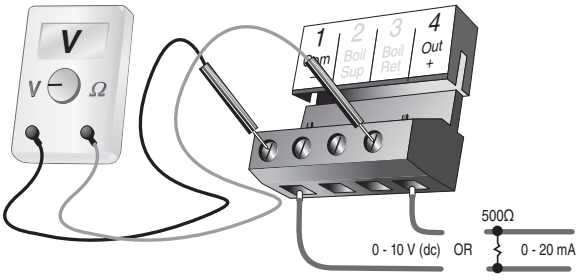
Setpoint Demand

If a setpoint demand is used, measure the voltage between the *Setp / DHW* and the *Com Dem* terminals (31 and 30). When the setpoint demand device calls for heat, a voltage between 20 and 260 V (ac) should be measured at the terminals. When the setpoint demand device is off, less than 5 V (ac) should be measured.



External Input

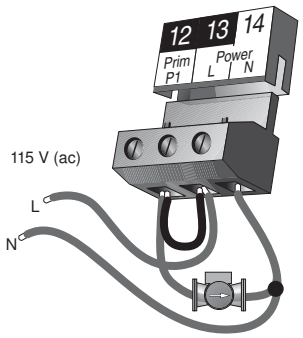
If an external input is used, measure the voltage between the *Com –* and the *Out +* terminals (1 and 4). When the external input device calls for heat, a voltage between 0 and 10 V (dc) should be measured at the terminals.



⚠ *Test the Outputs*

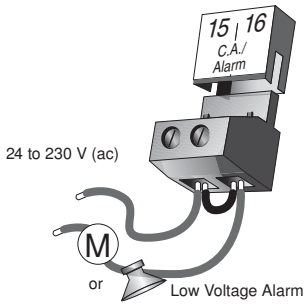
Primary Pump (Prim P1)

If a primary pump is connected to the *Prim P1* terminal (12), make sure that power to the terminal block is off and install a jumper between the *Power L* and *Prim P1* terminals (13 and 12). When power is applied to the *Power L* and *Power N* terminals (13 and 14), the primary pump should start. If the pump does not turn on, check the wiring between the terminal block and pump and refer to any installation or troubleshooting information supplied with the pump. If the pump operates properly, disconnect the power and remove the jumper.



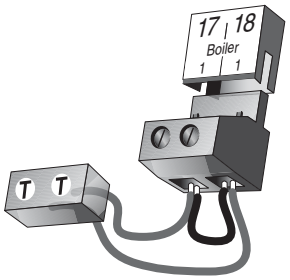
Combustion Air or Alarm (C.A. / Alarm)

If a combustion air damper or an alarm is connected to the *C.A. / Alarm* terminals (15 and 16), make sure power to the damper or alarm circuit is off and install a jumper between terminals (15 and 16). When the circuit is powered up, the combustion air damper should open or the alarm should activate. If the damper or the alarm fails to operate, check the wiring between the terminals and the damper or the alarm and refer to any installation or troubleshooting information supplied with these devices. If the damper or the alarm operates properly, disconnect the power and remove the jumper.



Boiler 1 and Boiler 2 Contacts

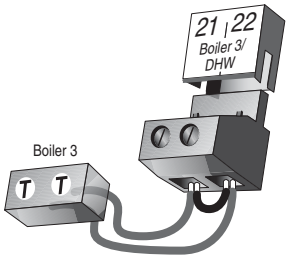
If a boiler is connected to the *Boiler 1* and / or *Boiler 2* contacts (17 and 18, 19 and 20), make sure power to the boiler circuit(s) is off, and install a jumper between the terminals. When the boiler circuit is powered up, the boiler should fire. If the boiler does not turn on, refer to any installation or troubleshooting information supplied with the boiler. (The boiler may have a flow switch that prevents firing until the primary pump *(Prim P1)* or boiler pumps *(Boiler Pump 1, 2)* are running). If the boiler(s) operates properly, disconnect the power and remove the jumper.



Boiler 3 / DHW Contact

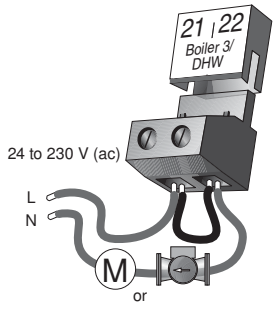
Boiler Operation

If a boiler is connected to the *Boiler 3* / DHW contact (21 and 22), make sure power to the boiler circuit is off, and install a jumper between the terminals. When the boiler circuit is powered up, the boiler should fire. If the boiler does not turn on, refer to any installation or troubleshooting information supplied with the boiler. (The boiler may have a flow switch that prevents firing until the primary pump *(Prim P1)* or boiler pump *(Boiler Pump 3)* is running). If the boiler operates properly, disconnect the power and remove the jumper.



DHW Operation

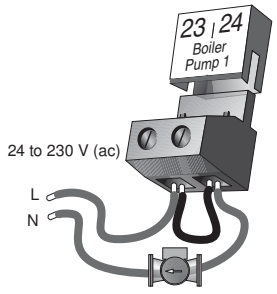
If a DHW pump or DHW valve is connected to the *Boiler 3 / DHW* contact (21 and 22), make sure the power to the pump or valve circuit is off and install a jumper between those terminals. When the DHW circuit is powered up, the DHW pump should turn on or the DHW valve should open completely. If the DHW pump or valve fails to operate, check the wiring between the terminals and the pump or valve and refer to any installation or troubleshooting information supplied with these devices. If the DHW pump or valve operates correctly, disconnect the power and remove the jumper.



Boiler Pump 1 to Boiler Pump 3 Contacts

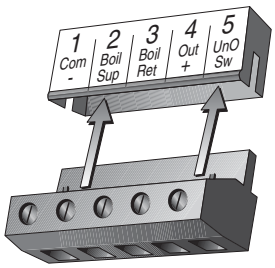
If a boiler pump is connected to *Boiler Pump 1* contact (23 and 24), make sure that power to the terminal block is off and install a jumper between the terminals. When power is applied to circuit, the boiler pump should start. If the pump does not turn on, check the wiring between the terminal block and pump and refer to any installation or troubleshooting information supplied with the pump. If the pump operates properly, disconnect the power and remove the jumper.

Repeat the same procedure for *Boiler Pump 2* contacts (25 and 26) and for *Boiler Pump 3* contacts (27 and 28) as necessary.



Connecting the Control

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



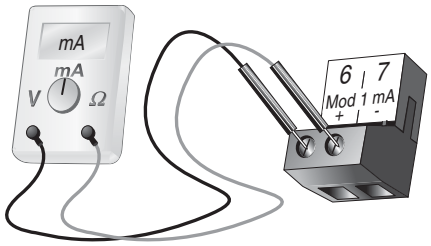
Reconnect the terminal blocks to the control by carefully aligning them with their respective headers on the control, and then pushing the terminal blocks into the headers. The terminal blocks should snap firmly into place.

Install the supplied safety dividers between the unpowered sensor inputs and the powered or 115 V (ac) wiring chambers.

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

⚠ *Test the Modulating Outputs*

Connect an ammeter to the modulating output *Mod 1* terminals (6 and 7) and observe the current reading during operation or during the Test Sequence in the Test the Control section. For example, when using a 4 - 20 mA output, the initial percentage output is zero and the meter should read 4 mA. As the Boiler 1 Modulation increases in the VIEW menu, the meter reading should increase until 100% Boiler 1 Modulation is reached at which point the meter should read 20 mA. When the 4 - 20 mA modulation decreases, the meter should start at 20 mA and eventually reach 4 mA when the display shows 0% Boiler 1 Modulation.



Repeat the same procedure for modulating output *Mod 2* terminals (8 and 9) and *Mod 3* terminals (10 and 11).

Cleaning The Control

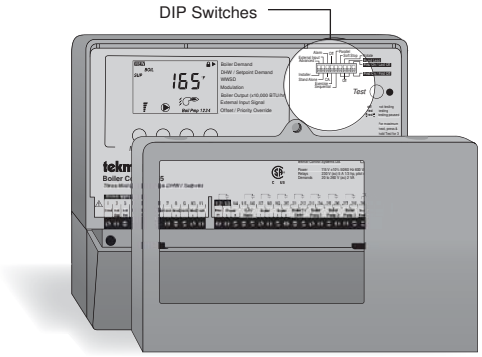
The control's exterior can be cleaned using a damp cloth. Moisten the cloth with water and wring out prior to wiping the control. Do not use solvents or cleaning solutions.

Dip Switch Settings

GENERAL

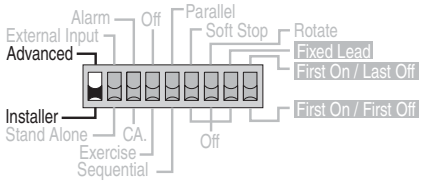
The DIP switch settings on the control are very important and should be set to the appropriate settings prior to making any adjustments to the control through the User Interface. The DIP switch settings change the items that are available to be viewed and / or adjusted in the User Interface.

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.



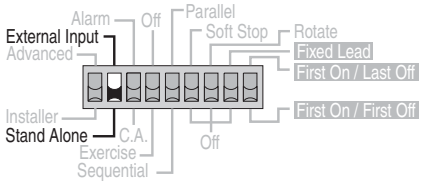
Advanced / Installer

The Advanced / 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.



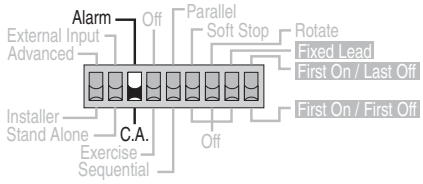
External Input / Stand Alone

The External Input / Stand Alone DIP switch selects whether a tekmar Outdoor Sensor 070 or an external 0 - 10 V (dc) input signal is to be connected to the *Com* – and the *Out +* terminals (1 and 4).



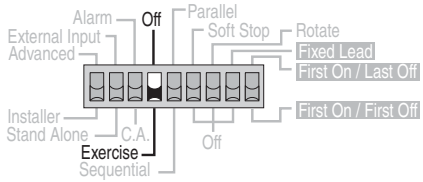
Alarm / Combustion Air

The Alarm / Combustion Air DIP switch selects whether a combustion air damper or alarm device is to be connected to the *C.A. / Alarm* terminals (15 and 16).



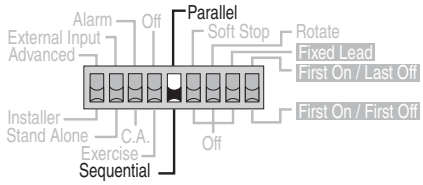
Off / Exercise

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.



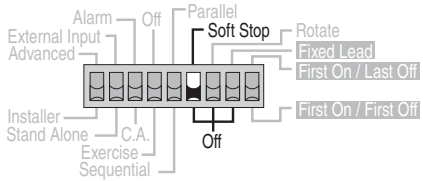
Parallel / Sequential

The Parallel / Sequential DIP switch selects whether to modulate the boilers using parallel modulation or sequential modulation when operating multiple boilers.



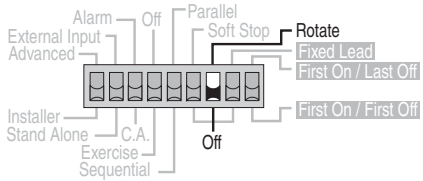
Soft Stop / Off

The Soft Stop / Off DIP switch selects whether or not to provide the boiler with a Soft Stop. If the switch is set Soft Stop, the control modulates the burner down to minimum and holds it at the minimum for an amount of time before shutting off the burner. If the switch is set to Off, the control turns off the burner at the current firing rate once a demand is removed.



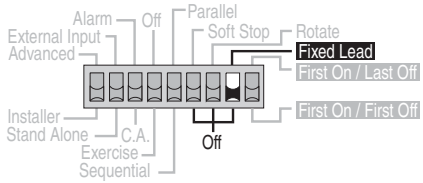
Rotate / Off

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



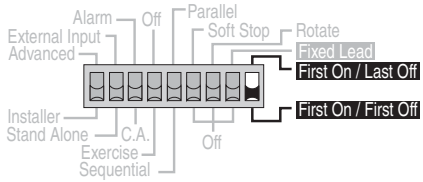
Fixed Lead / Off

The Fixed Lead / Off DIP switch selects whether or not the first boiler is to be included in the rotation sequence. If the DIP switch is set to Fixed Lead, the first boiler is always the first to fire. This DIP switch is only active when the Rotate / Off DIP switch is set to Rotate.



First On / Last On or First On / First Off

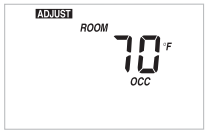
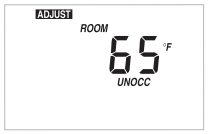
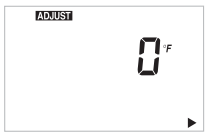
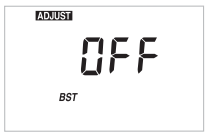
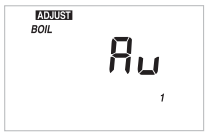
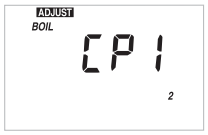
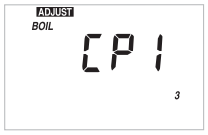
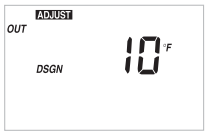
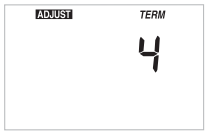
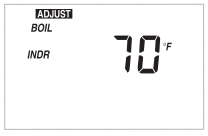
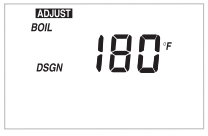
The First On / Last Off or First On / First Off DIP switch selects whether the first boiler is the first to fire and the last to shut off or the first to fire and the first to shut off. This DIP switch is only active when the Rotate / Off DIP switch is set to Rotate and the Fixed Lead / Off DIP switch is set to Fixed Lead.



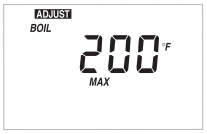
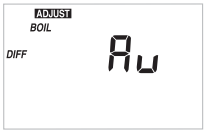
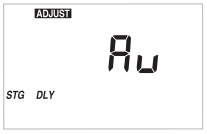
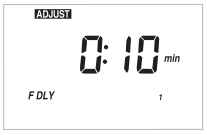
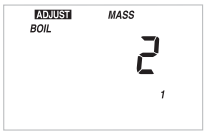
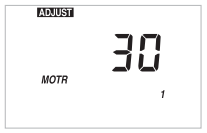
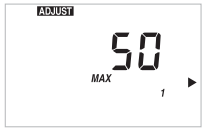
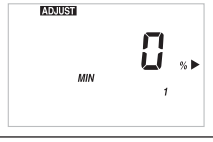
View Menu (1 of 1)

Display	Section	Installer	Adv	Description	Range
VIEW OUT 10 °F OCC		●	●	**Outdoor** Current outdoor air temperature as measured by the outdoor sensor. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	-76 to 149°F (-60 to 65°C)
VIEW BOIL SUP 149 °F OCC		●	●	**Boiler Supply** Current boiler supply water temperature as measured by the boiler supply sensor.	-22 to 266°F (-30 to 130°C)
VIEW BOIL TARG 155 °F OCC			●	**Boiler Target** Boiler target temperature is the temperature the control is currently trying to maintain at the boiler supply sensor.	_ _ _, 35 to 230°F (_ _ _, 2 to 110°C)
VIEW BOIL RET 84 °F OCC			●	**Boiler Return** Current boiler return water temperature as measured by the boiler return sensor. A boiler return sensor must be installed to view this item.	-22 to 266°F (-30 to 130°C)
VIEW ΔT 65 °F OCC			●	**Boiler ΔT** The actual temperature difference between the boiler supply and the boiler return sensors. A boiler return sensor must be installed to view this item.	0 to 252°F (0 to 140°C)
VIEW BOIL 71 % ▶ 1			●	**Boiler 1 Modulation** Current percent modulation of the boiler's burner. This item is only available when Boiler 1 is set to Au (automatic).	0 to 100%
VIEW BOIL 71 % ▶ 2			●	**Boiler 2 Modulation** Current percent modulation of the boiler's burner. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	0 to 100%
VIEW BOIL 71 % ▶ 3			●	**Boiler 3 Modulation** Current percent modulation of the boiler's burner. This item is only available when Boiler 3 is set to Au (Automatic) or CP1 (copy 1) and DHW MODE is set to OFF.	0 to 100%
VIEW BOIL 009 hr 1	A		●	**Boiler 1 Hours** The total running time of boiler 1 since this item was last cleared. To clear this item, press the ▲ and ▼ button simultaneously while viewing this item. This item is only available when Boiler 1 is set to Au (automatic).	0 to 1999 hr
VIEW BOIL 009 hr 2	A		●	**Boiler 2 Hours** The total running time of boiler 2 since this item was last cleared. To clear this item, press the ▲ and ▼ button simultaneously while viewing this item. This item is only available when Boiler 2 is set to Au (automatic) or CP1.	0 to 1999 hr
VIEW BOIL 003 hr 3	A		●	**Boiler 3 Hours** The total running time of boiler 3 since this item was last cleared. To clear this item, press the ▲ and ▼ button simultaneously while viewing this item. This item is only available when Boiler 3 is set to Au (automatic) or CP1 and DHW MODE is set to OFF.	0 to 1999 hr

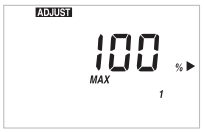
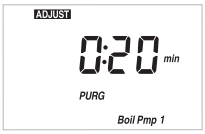
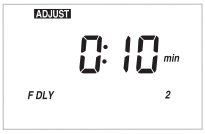
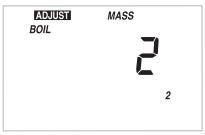
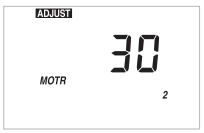
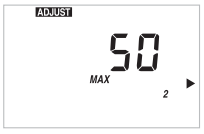
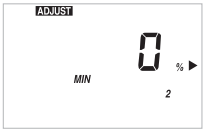
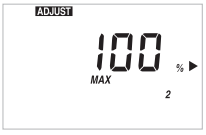
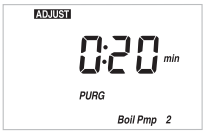
Adjust Menu (1 of 5)

Display	Section	Installer	Adv	Description	Range	Actual Setting
	C	●	●	**Room Occupied** The desired room air temperature during the occupied period. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	35 to 100°F (2 to 38°C) Default = 70°F (21°C)	
	C	●	●	**Room Unoccupied** The desired room air temperature during the UnOccupied period. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	35 to 100°F (2 to 38°C) Default = 65°F (18°C)	
	F		●	**External Input Signal** Selects the range of the external input signal. This item is only available when the *External Input / Stand Alone DIP switch* to External Input.	0:10, 2:10 Default = 0:10	
	F		●	**Offset** Sets the temperature offset used in calculating the boiler target temperature with an external input signal. This item is only available when the *External Input / Stand Alone DIP switch is set to* External Input.	-10 to 10°F (-6 to 6°C) Default = 0°F (0°C)	
	C		●	**Boost** The amount of morning boost when changing from the UnOccupied to the Occupied period. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	OFF, 0:20 to 8:00 hr (5 minute increment) Default = OFF	
	B	●	●	**Boiler 1** Selects whether or not boiler 1 is operational.	Au (Auto), OFF Default = Au	
	B	●	●	**Boiler 2** Selects whether or not boiler 2 is operational. CP1 copies the settings of Boiler 1 to Boiler 2.	CP1, Au (Auto), OFF Default = CP1	
	B	●	●	**Boiler 3** Selects whether or not boiler 3 is operational. This item is only available when DHW MODE is set to OFF. CP1 copies the settings of Boiler 1 to Boiler 3.	CP1, Au (Auto), OFF Default = CP1	
	C	●	●	**Outdoor Design** The design outdoor air temperature used in the heat loss calculations for the heating system. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	-60 to 45°F (-51 to 7°C) Default = 10°F (-12°C)	
	C	●	●	**Terminal Unit** The type of terminal units that are being used in the heating system. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	**1** (HRF1), **2** (HRF2), **3** (COIL), **4** (CONV), **5** (RAD), **6** (BASE) Default = **4**	
	C		●	**Boiler Indoor** The design indoor air temperature used in the heat loss calculation for the heating system. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	35 to 100°F (2 to 38°C) Default = 70°F (21°C)	
	C		●	**Boiler Design** The design supply water temperature used in the heat loss calculations for the heating system. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	70 to 220°F (21 to 104°C) Default = 180°F (82°C)	

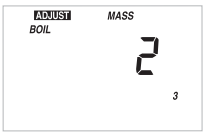
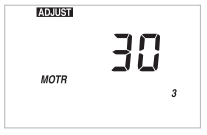
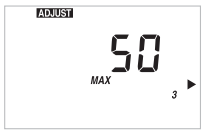
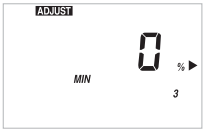
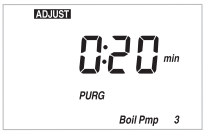
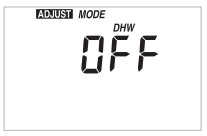
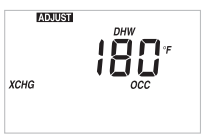
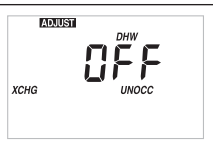
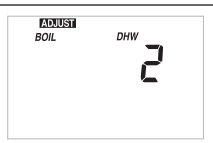
Adjust Menu (2 of 5)

Display	Section	Installer	Adv	Description	Range	Actual Setting
	B		●	**Boiler Minimum** The minimum allowed boiler target temperature. Check the boiler(s) manufacturer's manual for recommend supply water temperatures.	OFF, 80 to 180°F (OFF, 27 to 82°C) Default = 140°F (60°C)	
	B		●	**Boiler Maximum** The maximum allowed boiler target temperature.	120 to 225°F, OFF (49 to 107°C, OFF) Default = 200°F (93°C)	
	B		●	**Boiler Differential** The temperature differential that the control is to use when it is operating the boiler(s).	Au (Auto), 2 to 42°F (Au, 1 to 23°C) Default = Au	
	A		●	**Combustion Air Damper Delay** The time allowed for the combustion air damper to open before the first boiler is fired. This item is only available if the Alarm / C.A. DIP switch is set to C.A.	0:00 to 3:00 minutes (1 sec increment) Default = 1:00 min	
	B		●	**Stage Delay** The minimum time delay between the operation of boilers. This item is only available when at least two boilers are set to Au (automatic) or CP1 (copy 1).	Au (Auto), 0:30 to 19:55 min (5 second increment) Default = Au	
	B		●	**Fire Delay 1** The time delay the control can expect between the time that the boiler contact closes to enable the boiler and when the burner actually fires. This item is only available when Boiler 1 is set to Au (automatic).	0:00 to 4:00 minutes (1 sec increment) Default = 0:10 min	
	B	●	●	**Boiler Mass 1** The thermal mass characteristics of Boiler 1. This item is only available when Boiler 1 is set to Au (automatic).	**1** (Lo), **2** (Med), **3** (Hi) Default = 2	
	B		●	**Motor Speed 1** The amount of time required for the modulating actuating motor to fully open the gas valve or operate the fan speed from a stopped position to full speed. This item is only available when Boiler 1 is set to Au (automatic).	10 to 230 sec Default = 30	
	B		●	**Minimum Boiler 1 Output** The minimum boiler 1 output in 10,000's of BTU / hour. This item is only available when Boiler 1 is set to Au (automatic).	1 to 1999 Default = 10	
	B		●	**Maximum Boiler 1 Output** The maximum boiler 1 output in 10,000's of BTU / hour. This item is only available when Boiler 1 is set to Au (automatic).	1 to 1999 Default = 50	
	B		●	**Boiler Modulation 1** Selects either a 4 to 20 mA or a 0 to 20 mA output signal. This item is only available when Boiler 1 is set to Au (automatic).	4:20, 0:20 Default = 4:20	
	B		●	**Minimum Modulation 1** The minimum percent modulation of the burner. This item is only available when Boiler 1 is set to Au (automatic).	0 to 50% Default = 0%	

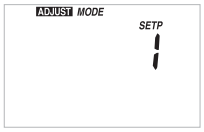
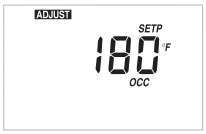
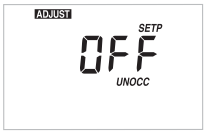
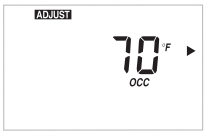
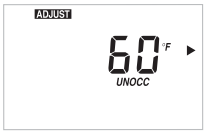
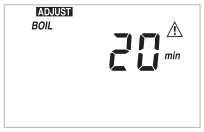
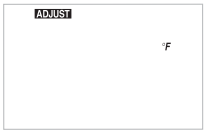
Adjust Menu (3 of 5)

Display	Section	Installer	Adv	Description	Range	Actual Setting
	B		●	**Maximum Modulation 1** The maximum percent modulation of the burner. This item is only available when Boiler 1 is set to Au (automatic).	50 to 100% Default = 100%	
	G		●	**Purge Boiler Pump 1** The length of time that the boiler pump 1 will continue to run after Boiler 1 is shut off. This item is only available when Boiler 1 is set to Au (automatic).	OFF, 0:10 to 19:55 min (1 sec increment) Default = 0:20 min	
	B		●	**Fire Delay 2** The time delay the control can expect between the time that the boiler contact closes to enable the boiler and when the burner actually fires. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	0:00 to 4:00 minutes (1 sec increment) Default = 0:10 min	
	B	●	●	**Boiler Mass 2** The thermal mass characteristics of Boiler 2. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	1 (Lo), 2 (Med), 3 (Hi) Default = 2	
	B		●	**Motor Speed 2** The amount of time required for the modulating actuating motor to fully open the gas valve or operate the fan speed from a stopped position to full speed. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	10 to 230 sec Default = 30	
	B		●	**Minimum Boiler 2 Output** The minimum boiler 2 output in 10,000's of BTU / hour. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	1 to 1999 Default = 10	
	B		●	**Maximum Boiler 2 Output** The maximum boiler 2 output in 10,000's of BTU / hour. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	1 to 1999 Default = 50	
	B		●	**Boiler Modulation 2** Selects either a 4 to 20 mA or a 0 to 20 mA output signal. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	4:20, 0:20 Default = 4:20	
	B		●	**Minimum Modulation 2** The minimum percent modulation of the burner. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	0 to 50% Default = 0%	
	B		●	**Maximum Modulation 2** The maximum percent modulation of the burner. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	50 to 100% Default = 100%	
	G		●	**Purge Boiler Pump 2** The length of time that the boiler pump 2 will continue to run after Boiler 2 is shut off. This item is only available when Boiler 2 is set to Au (automatic) or CP1 (copy 1).	OFF, 0:10 to 19:55 min (10 sec increment) Default = 0:20 min	
	B		●	**Fire Delay 3** The time delay the control can expect between the time that the boiler contact closes to enable the boiler and when the burner actually fires. This item is only available when Boiler 3 is set to Au (automatic) and DHW MODE is set to OFF or CP1 (copy 1).	0:00 to 4:00 min (1 sec increment) Default = 0:10 min	

Adjust Menu (4 of 5)

Display	Section	Installer	Adv	Description	Range	Actual Setting
	B	●	●	**Boiler Mass 3** The thermal mass characteristics of Boiler 3. This item is only available when Boiler 3 is set to Au (automatic) or CP1 (copy 1) and DHW MODE is set to OFF.	**1** (Lo), **2** (Med), **3** (Hi) Default = 2	
	B		●	**Motor Speed 3** The amount of time required for the modulating actuating motor to fully open the gas valve or operate the fan speed from a stopped position to full speed. This item is only available when Boiler 3 is set to Au (automatic) or CP1 (copy 1) and DHW MODE is set to OFF.	10 to 230 sec Default = 30	
	B		●	**Minimum Boiler 3 Output** The minimum boiler 3 output in 10,000's of BTU / hour. This item is only available when Boiler 3 is set to Au (automatic) or CP1 (copy 1) and DHW MODE is set to OFF.	1 to 1999 Default = 10	
	B		●	**Maximum Boiler 3 Output** The maximum boiler 3 output in 10,000's of BTU / hour. This item is only available when Boiler 3 is set to Au (automatic) or CP1 (copy 1) and DHW MODE is set to OFF.	1 to 1999 Default = 50	
	B		●	**Boiler Modulation 3** Selects either a 4 to 20 mA or a 0 to 20 mA output signal. This item is only available when Boiler 3 is set to Au (automatic) or CP1 (copy 1) and DHW MODE is set to OFF.	4:20, 0:20 Default = 4:20	
	B		●	**Minimum Modulation 3** The minimum percent modulation of the burner. This item is only available when Boiler 3 is set to Au (automatic) or CP1 (copy 1) and DHW MODE is set to OFF.	0 to 50% Default = 0%	
	B		●	**Maximum Modulation 3** The maximum percent modulation of the burner. This item is only available when Boiler 3 is set to Au (automatic) or CP1 (copy 1) and DHW MODE is set to OFF.	50 to 100% Default = 100%	
	G		●	**Purge Boiler Pump 3** The length of time that the boiler pump 3 will continue to run after Boiler 3 is shut off. This item is only available when Boiler 3 is set to Au (automatic) or CP1 (copy 1) and DHW MODE is set to OFF.	OFF, 0:10 to 19:55 min (10 sec increment) Default = 0:20 min	
	D1		●	**DHW Mode** Selects the DHW mode of operation. This item is only available when Boiler 3 is set to OFF.	**OFF** **1** (parallel, no priority), **2** (parallel, priority), **3** (pri-sec, no priority), **4** (pri-sec, priority) Default = OFF	
	D1		●	**DHW Exchange Occupied** The minimum boiler supply temperature to the DHW heat exchanger during the Occupied period. This item is only available when Boiler 3 is set to OFF and DHW MODE is set to 1 through 4.	OFF, 100 to 220°F (OFF, 38 to 104°C) Default = 180°F (82°C)	
	D1		●	**DHW Exchange Unoccupied** Selects whether DHW is operational during the UnOccupied period. This item is only available when Boiler 3 is set to OFF and DHW MODE is set to 1 through 4.	OFF, On Default = OFF	
	D1		●	**DHW Boilers** Selects how many boilers are to be operated during DHW generation. This item is only available when Boiler 3 is set to OFF and DHW MODE is set to 1 through 4.	1, 2 Default = 2	

Adjust Menu (5 of 5)

Display	Section	Installer	Adv	Description	Range	Actual Setting
	E		●	**Setpoint Mode** Selects the Setpoint Mode of operation. This item is only available when DHW MODE is set to OFF.	**1** (parallel, no priority), **2** (parallel, priority),) **3** (primary pump) Default = 1	
	E		●	**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.	OFF, 60 to 220°F (OFF, 16°C to 104°C) Default = 180°F (82°C)	
	E		●	**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.	OFF, On Default = OFF	
	D1		●	**Priority Override** Determines the amount of time the override waits to provide DHW or Setpoint priority before resuming space heating. This item is only available when Boiler Minimum is not set to OFF.	0:20 to 4:00 hr, OFF (10 minute increments) Default = OFF	
	C		●	**WWSD Occupied** The system's warm weather shut down temperature during the Occupied period. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	35 to 100°F, OFF (2 to 38°C, OFF) Default = 70°F (21°C)	
	C		●	**WWSD UnOccupied** The system's warm weather shut down temperature during the UnOccupied period. This item is only available when the *External Input / Stand Alone DIP switch* is set to Stand Alone.	35 to 100°F, OFF (2 to 38°C, OFF) Default = 60°F (16°C)	
	G		●	**Primary Pump Purge** The maximum length of time that the primary pump will continue to operate after the boiler demand has been removed.	OFF, 0:10 to 19:55 min (5 sec increment) Default = 0:20 min	
	A		●	**Boiler Alarm** The alarm signal will be activated if the boiler supply temperature does not increase within the selected time. This item is only available when the Alarm / C.A. DIP switch is set to Alarm.	OFF, 3 to 40 min (1 min increment) Default = 20 min	
		●	●	The units of measure that all of the temperatures are to be displayed in by the control.	°F, °C Default = °F	

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.

off not testing
red testing
red testing paused

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 C.A. / Alarm contact is closed.

Step 2 – The C.A. / Alarm contact is opened if the Alarm / C.A. DIP switch is set to Alarm.

Step 3 – The primary pump is turned on.

Step 4 – For each Boiler that is set to automatic or CP1, the following sequence is used:

- The Boiler Pump is turned on.
- The Modulation Output is modulated up to the Minimum Modulation setting.
- The Boiler Enable Contact is closed and waits for at least 10 seconds or the Fire Delay time.
- If there is a demand, the Boiler is modulated up to Maximum Modulation according to the Motor Speed setting.
- If there is a demand, the Boiler is modulates down to Minimum Modulation.
- The Boiler Enable Contact is opened.
- The Modulation Output is modulated down to 0%.
- Boiler Pump is shut off.
- Step 4 is repeated for each additional boiler set to automatic, or CP1.

Step 5 – If Boiler 3 is set to OFF and DHW MODE is set to 3 or 4, the DHW contact is closed and the primary pump stays on.
– If Boiler 3 is set to OFF and DHW MODE is set to 1 or 2, the DHW contact is closed, and the primary pump is shut off.

Step 6 – The control exits the Test sequence.

MAX HEAT

The control has a function called Max Heat. In this mode, the control turns on and operates the system up to the maximum set temperatures as long as there is a demand for heat. The control continues to operate in this mode for up to 24 hours or until the ***Item***, ***Menu*** or ***Test*** button is pressed. This mode may be used for running all circulators during system start-up in order to purge air from the piping. To enable the Max Heat feature, use the following procedure.

1) Press and hold the ***Test*** button for more than 3 seconds. At this point, the control flashes the MAX segment and displays the word OFF.

2) Using the ▲ or ▼ buttons, select the word On. After 3 seconds, the control turns on all outputs. However, the max heat mode is still limited by the *BOIL MAX* setting.

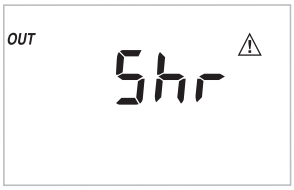
3) To cancel the Max Heat mode, press the ***Item***, ***Menu***, or ***Test*** button.

4) Once the Max Heat mode has either ended or is cancelled, the control resumes normal operation.

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 / Advanced DIP Switch must be set to Advanced in order to clear the error.

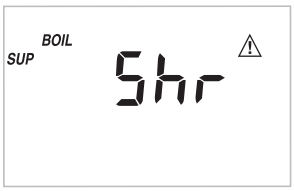


The control is no longer able to read the outdoor sensor due to a short circuit. In this case the control assumes an outdoor temperature of 32°F (0°C) and continues operation. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.

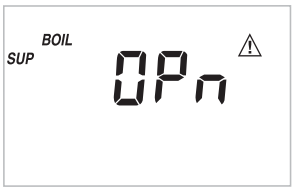
This error message can only occur if the *External Input / Stand Alone DIP switch* is set to Stand Alone.

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 as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.

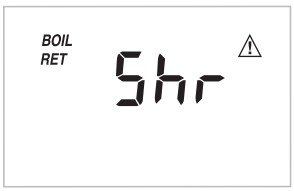
This error message can only occur if the *External Input / Stand Alone DIP switch* is set to Stand Alone.



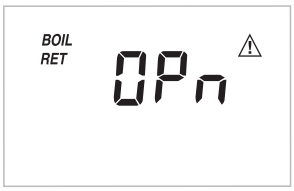
The control is no longer able to read the boiler supply sensor due to a short circuit. The control will not operate the boiler(s) until the sensor is repaired. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.



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 as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.



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 as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.



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 as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press either the ***Menu*** or ***Item*** button.

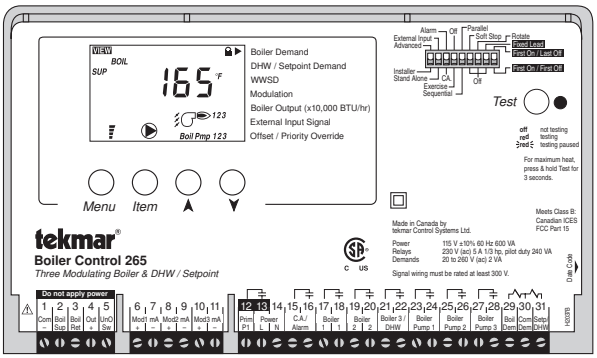
If the boiler return sensor was deliberately removed from the control, remove power from the control and repower the control to clear the error message.

The control has detected no increase in the supply water temperature within the BOIL Alarm time setting. Check to see if the boilers are operating properly using the ***Test*** button. To reset the alarm, press and hold the ▲ and ▼ buttons for 5 seconds while in the VIEW menu.

Technical Data

Boiler Control 265 *Three Modulating Boiler & DHW / Setpoint*

Literature	—	D 265, A 265's, D 001, D 070.
Control	—	Microprocessor PID control; This is **not a safety (limit) control**.
Packaged weight	—	3.5 lb. (1600 g), Enclosure A, blue modified PVC plastic
Dimensions	—	6-5/8" H x 7-9/16" W x 2-13/16" D (170 x 193 x 72 mm)
Approvals	—	CSA C US, CSA/UL 61010-1, meets Class B: ICES & FCC Part 15
Ambient conditions	—	Indoor use only, 32 to 122°F (0 to 50°C), < 90% RH non-condensing. Altitude <6560 feet (2000 m) Installation Category II, Pollution Degree 2
Power supply	—	115 V (ac) ±10% 60 Hz 600 VA
Relay capacity	—	230 V (ac) 5 A 1/3 hp pilot duty 240 VA
Modulation Outputs	—	0-20 mA / 4-20 mA (up to 1000Ω load)
Demands	—	20 to 260 V (ac) 2 VA
Sensors included	—	NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) ß=3892 Outdoor Sensor 070 and 2 of Universal Sensor 071, 4 x 500Ω Resistors
Optional devices	—	tekmar type #: 032



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

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

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

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

Limited Warranty and Product Return Procedure

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

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

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

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

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

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

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

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

tekmar® Control Systems

tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
Head Office: 5100 Silver Star Road
Vernon, B.C. Canada V1B 3K4
(250) 545-7749 Fax. (250) 545-0650
Web Site: www.tekmarcontrols.com

All specifications are subject to change without notice.
Printed in Canada. D 265 - 12/08.