

tekmar® - Data Brochure

Boiler Control 270

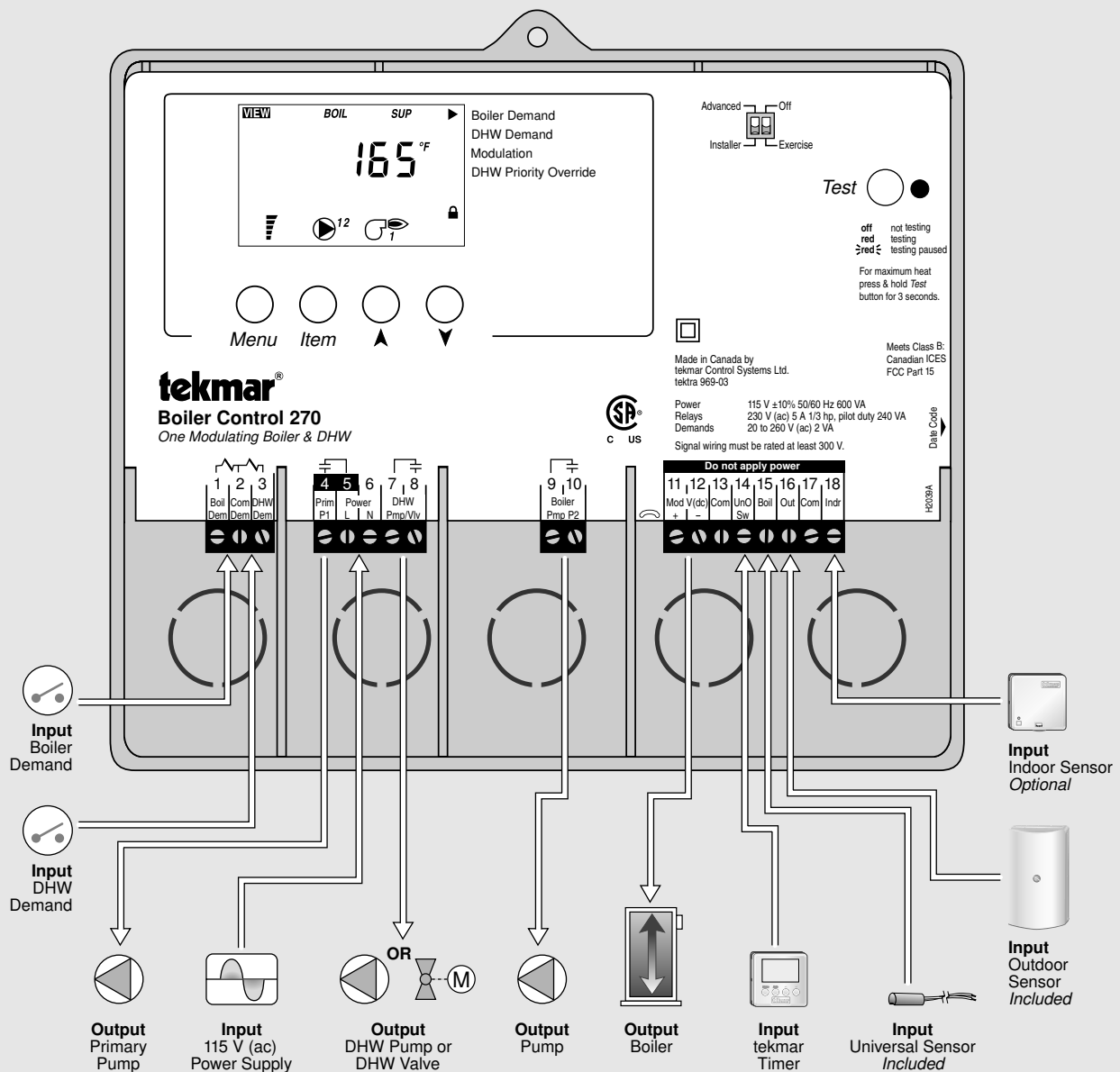
D 270

07/05

The tekmar Boiler Control 270 can control the supply water temperature from a single modulating boiler based on outdoor temperature or domestic hot water requirements. A large easy to read display provides current system temperatures and operating status.

Additional functions include:

- Outdoor Reset
- Installer and Advanced access levels
- Primary pump output
- Pump exercising
- Pump purging
- Boiler demand for space heating loads
- DHW demand for domestic hot water loads
- Optional indoor sensor for room air temperature control
- Test sequence to ensure proper component operation
- Setback input for energy savings
- CSA C US certified



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 six 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.

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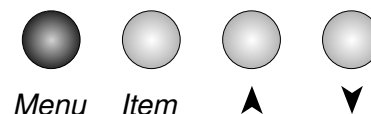
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User Interface

The control uses a Liquid Crystal Display (LCD) as the method of supplying information. You use the LCD in order to setup and monitor the operation of your system. The control has four push buttons (*Menu*, *Item*, **▲**, **▼**) 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

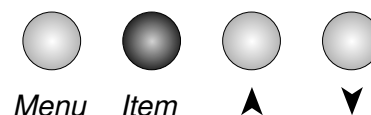
All of the items displayed by the control are organized into four menus (*View*, *Adjust*, *Time*, *Schedule*). These menus are listed on the top left hand side of the display (Menu Field). To select a menu, use the **Menu** button. By pressing and releasing the **Menu** button, the display sequences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



Item

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

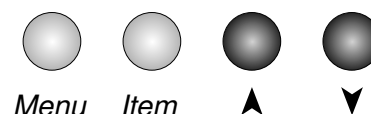
The items can be quickly scrolled through by holding the **Item** button and then pressing the **▼** button. To rapidly scroll through the items in the reverse order, hold the **Item** button and press the **▲** button.



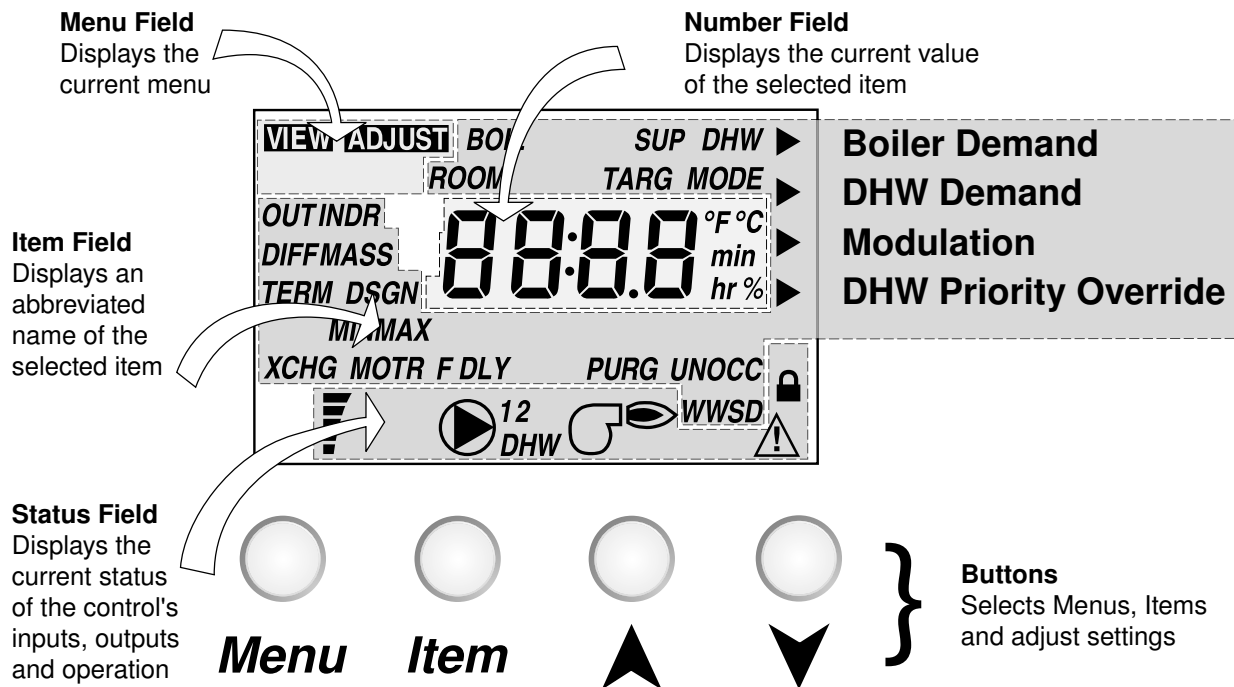
Adjust

To make an adjustment to a setting in the control, begin by selecting the ADJUST, TIME or SCHEDULE 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

| | | | |
|---|--|---|--|
|  | Burner Displays when Relay 1 is turned on. |  | Warning Displays when an error exists or when a limit has been reached. |
|  | Pump Displays when the primary or boiler pump is operating. |  | Lock / Unlock Displays when the Advanced / Installer DIP switch is set to Installer. |
| DHW | DHW Displays when the DHW pump is on. | °F °C min hr % | °F, °C, min, hr, % Units of measurement. |
| OCC | Occupied Schedule Displays when the control is in occupied mode. |  | Pointer Displays the control operation as indicated by the text. |
| UNOCC | UnOccupied Schedule Displays when the control is in unoccupied mode. |  | Modulating Output Scale Displays the total modulation output level of the boiler. |

Definitions

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



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



- Double insulated

**INSTALLATION
CATEGORY II**

- Local level, appliances

Sequence of Operation

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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.

OPERATION

The control stages or modulates the boiler to control supply water temperature to a hydronic system. The supply water temperature is based on outdoor reset or a fixed temperature for DHW.

Outdoor Reset

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 D.

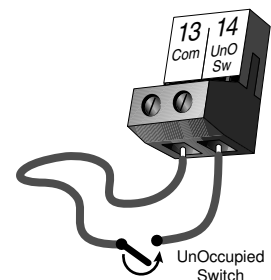
DHW

When a DHW demand is present, the control operates the boiler to maintain the supply water temperature at least as hot as the DHW exchange setting or high enough to satisfy tank temperature. Refer to section E.

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* (18) and the *Com* (17) 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 made in the control.



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.

RUNNING TIMES

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

Resetting the Running Time

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

FACTORY DEFAULTS

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

To reload the factory default, 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

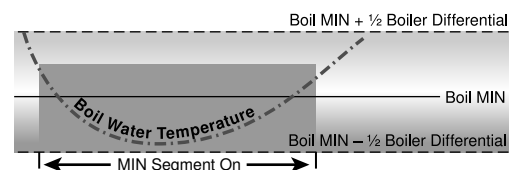
BOILER TARGET TEMPERATURE

The boiler target temperature is determined by the type of demand received by the control. A boiler demand calculates a boiler target based on the characterized heating curve settings and the outdoor air temperature. A DHW demand has a temperature setting to which the boiler is operated to meet.

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.

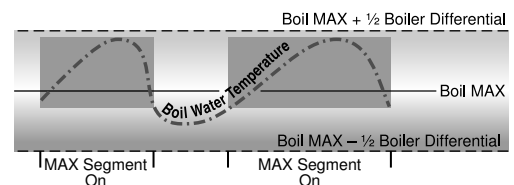
BOILER MINIMUM

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 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.



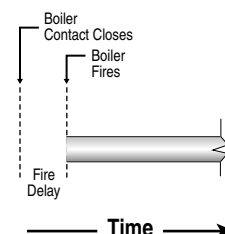
BOILER MAXIMUM

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 displayed in the LCD while either the boiler target temperature or the boiler temperature is being viewed. At no time does the control operate the boiler above 248°F (120°C).



FIRE DELAY

The Fire Delay is the time delay that occurs between the time that the control closes a stage contact to fire a stage and the burner fires for that stage.



MODULATION

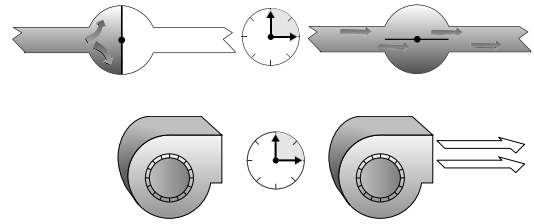
The Boiler Control 270 provides a modulating output signal to operate a single modulating boiler. The control first closes the boiler contact on to ignite the ignition sequence. The boiler is then modulated from the minimum modulation using Proportional, Integral and Derivative (PID) logic in order to satisfy the boiler target temperature.

MOTOR SPEED

The *Motor Speed* is the amount of time the boiler requires to go from 0% modulation to 100% modulation.

Gas valve actuating motors have a design time from fully closed to fully open 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.



MODULATION RANGE (0 to 10 V (dc), 2 to 10 V (dc), 0 to 20 mA, 4 to 20 mA)

The modulation output can be adjusted from a 0 to 10 V (dc) or to a 2 to 10 V (dc) output range using the *Boil Modulation* setting. If a 0 to 20 mA range is required, set the Boil Modulation item to 0 to 10 V (dc) and cut the jumper wire located next to the modulation output.

If a 4 to 20 mA range is required, set the Boil Modulation item to 2 to 10 V (dc) and cut the jumper wired located next to the modulation output.

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 270 control. The *Minimum Modulation* setting limits the control output range in order to match the boiler's input range.

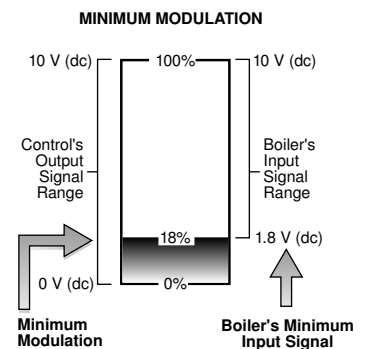
To calculate the Minimum Modulation, use the following formula:

For 0 to 10 V (dc):

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

For 2 to 10 V (dc):

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



Example:

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 270 control has an output signal range of 0 to 20 mA.

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

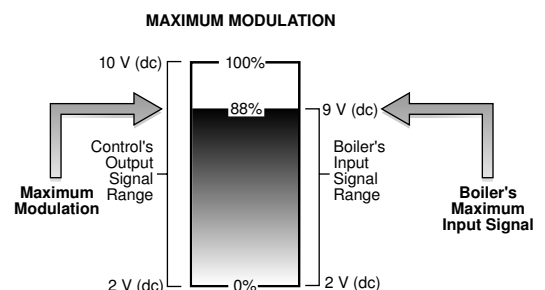
$$\text{Minimum Modulation} = \frac{0 \text{ V} - 1.8 \text{ V}}{0 \text{ V} - 10 \text{ V}} \times 100\% = 18\%$$

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 270 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 formula:

For 0 to 10 V (dc):

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

For 2 to 10 V (dc):

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

Example:

A boiler's input signal range is 2 to 9 V (dc). The 270 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:

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

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. 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.

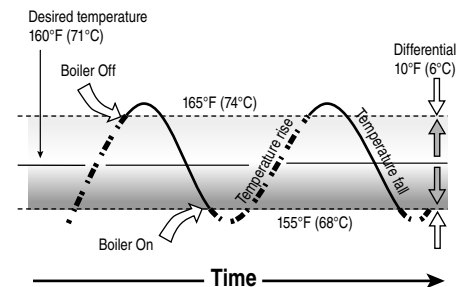
DIFFERENTIAL

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 burner ignites at low fire when the supply water temperature is $\frac{1}{2}$ of the *Boiler Differential* setting below the boiler target temperature. The boiler is shut off in low fire as the supply temperature reaches at least $\frac{1}{2}$ 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.

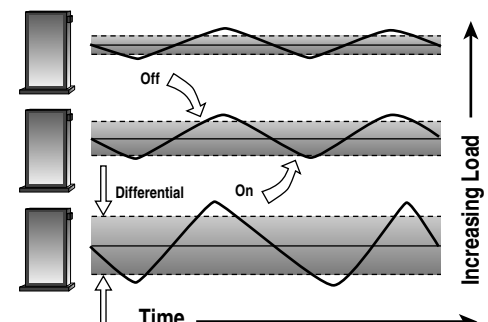
Fixed Differential

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.



Section C: Pump Operation

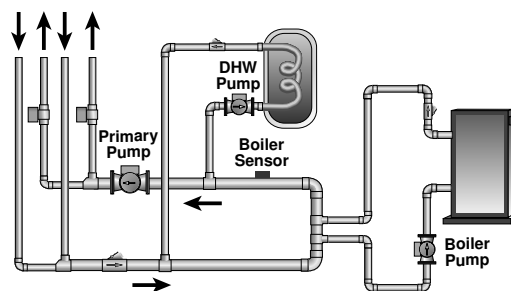
PRIMARY PUMP OPERATION

The primary pump operates under the following conditions:

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

Primary Pump Purge

After a demand is 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 *Primary Pump Purge* setting. The primary pump continues to run until either the purging time has elapsed or the boiler supply temperature drops more than a differential below the *Boiler Minimum* setting.

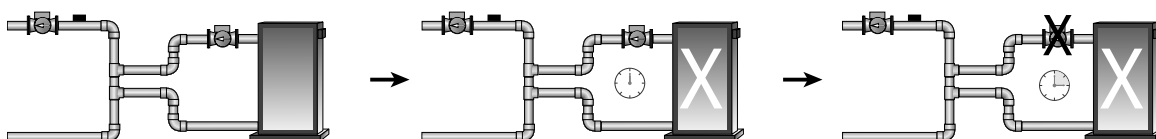


BOILER PUMP OPERATION

The boiler pump turns on prior to the boiler firing (pre-purge) and continues to run after the boiler is turned off (post-purge). The boiler pump pre-purge time is determined by the *Boiler Mass* setting. As the *Boiler Mass* setting is increased, the boiler pump pre-purge time of the boiler also increases.

Boiler Pump Purge

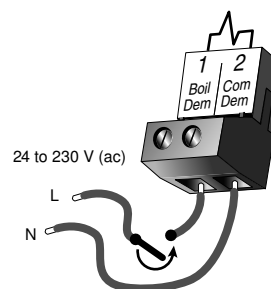
The amount of time that the boiler pump continues to run after the boiler turns off is adjustable using the *Boiler Pump Purge* setting.



Section D: Boiler Reset Operation

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 *Boiler Demand* terminals (1 and 2). 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, if required, to maintain the target supply temperature.



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.

CHARACTERIZED HEATING CURVE

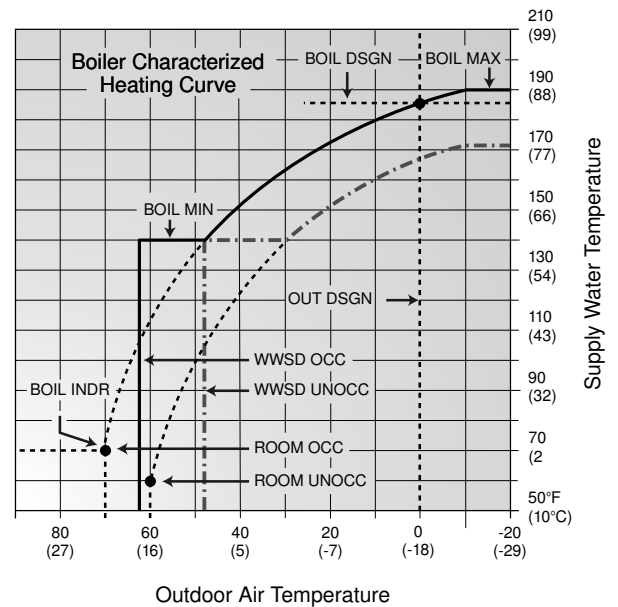
The control varies the supply water temperature based on the outdoor air temperature. The control takes into account the type of terminal unit that the system is using. Since different types of terminal units transfer heat to a space using different proportions of radiation, natural convection and forced 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.

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.

INDOOR SENSOR

With the indoor sensor connected, the control is able to sense the actual room temperature. Indoor temperature feedback fine-tunes the supply water temperature in the heating system to maintain room temperature. To adjust the room temperature, use the *Room Occ* or *Room UnOcc* setting in the ADJUST menu at the control.

The indoor sensor is connected to the *InDr* and *Com* terminals (17 and 18). In addition, power must be applied to the *Boiler Demand* terminals (1 and 2) as described in the Boiler Demand section.

If a multiple zone system is used with an indoor sensor, proper placement of the indoor sensor is essential. The indoor sensor should be located in an area which best represents the average air temperature of the zones.

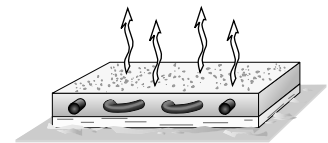
TERMINAL UNITS

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) |

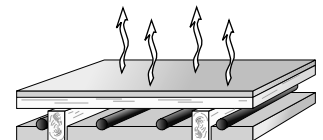
High Mass Radiant (1)

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.



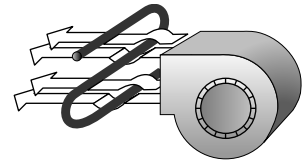
Low Mass Radiant (2)

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.



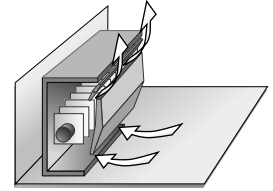
Fancoil (3)

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.



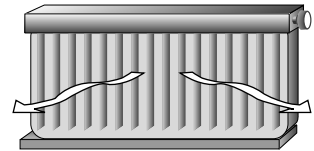
Fin-Tube Convectector (4)

A convectector 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 dependent 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 convectector.



WARM WEATHER SHUT DOWN (OCC AND UNOCC)

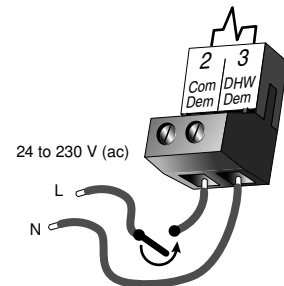
The warm weather shut down (*WWSD*) disables the space heating system during warm outdoor weather. There is a separate *WWSD* for both the occupied and the unoccupied periods. When the outdoor air temperature rises above the *WWSD* setting, the control turns on the *WWSD* pointer in the display. When 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* and operates as described in section E.

Section E1: Domestic Hot Water Operation

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 *DHW Demand* terminals (2 and 3).



BOILER TARGET DURING DHW GENERATION

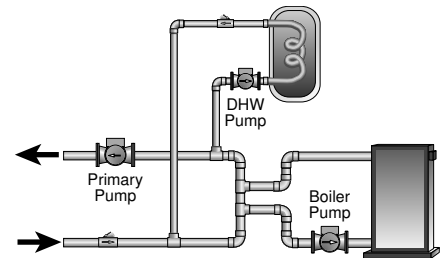
The *DHW demand* overrides the reset water temperature, except when the reset water temperature requirement is higher than that of the *DHW* tank. When the control receives a *DHW demand* through an aquastat, the boiler target temperature is at least as hot as the *DHW* heat exchange setting (*DHW XCHG*).

DHW MODE AND PRIORITY OPERATION

The control has four different modes of *DHW* operation, which depends on the piping arrangement of the *DHW* tank. It is often desirable to limit or even stop the flow of heat to the heating system when the *DHW* tank calls for heat. This allows for a faster recovery of the *DHW* tank.

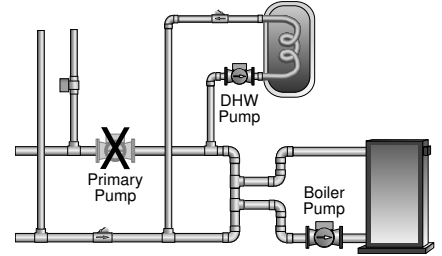
DHW Mode 1 - DHW in Parallel no Priority

When a *DHW Demand* is present, the *DHW Pmp / Vlv* contact (terminals 7 and 8) closes. The primary pump contact does not turn on, but may operate based on a boiler demand.



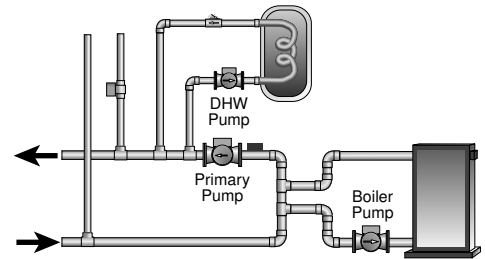
DHW Mode 2 - DHW in Parallel with Priority

When a *DHW Demand* is present, the *DHW Pmp / Vlv* contact (terminals 7 and 8) closes and the primary pump contact is opened.



DHW Mode 3 - DHW in Primary / Secondary no Priority

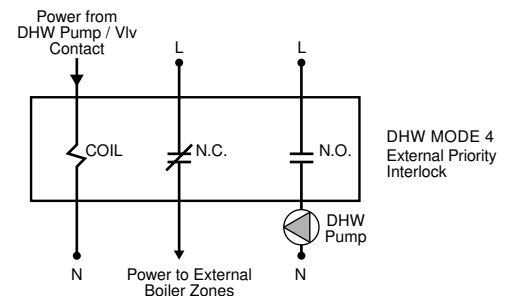
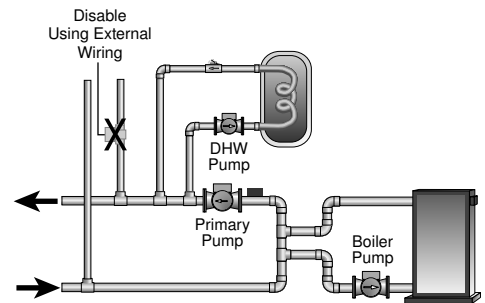
When a *DHW Demand* is present, the *DHW Pmp / Vlv* contact (terminals 7 and 8) is closed and the primary pump contact is closed. This mode can be used if DHW tank is piped in direct return and a DHW valve is installed.



DHW Mode 4 - DHW in Primary / Secondary with Priority

When a *DHW Demand* is present, the *DHW Pmp / Vlv* contact (terminals 7 and 8) is closed and the primary pump contact is closed. Priority can only be obtained using external wiring. During a priority override, the *DHW Pmp / Vlv* contact is opened until the heating system has recovered before returning to DHW operation.

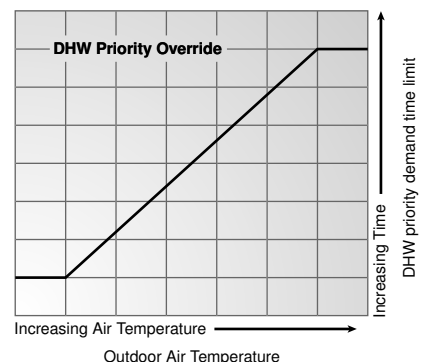
This mode can be used if a DHW tank is piped in direct return and a DHW valve is installed.



DHW PRIORITY OVERRIDE

The *DHW Priority Override* applies to DHW modes 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. As the outdoor air temperature becomes colder, the length of time that the control provides DHW priority is reduced. 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 *DHW Pmp / Vlv* contact. During demands, the *DHW Pmp / Vlv* contact must remove any power to all space heating zone valves or zone pumps.



CONDITIONAL DHW PRIORITY

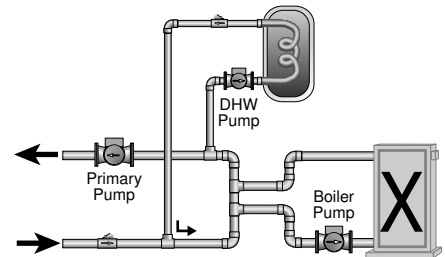
The Conditional DHW Priority Override applies to *DHW MODE 2* and Boiler Minimum is not set to OFF. If the boiler supply temperature is maintained at or above the required temperature during DHW generation, this indicates that the boiler has enough capacity for DHW and possibly heating as well. As long as the boiler supply temperature is maintained near its target, DHW and heating occurs simultaneously.

DHW POST PURGE

After the *DHW Demand* is removed, the control performs a purge on the boiler. The control shuts off the boiler 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 into the DHW tank. The control continues this purge for a maximum of four 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 drops below the current boiler target temperature.

DHW MIXING PURGE

After DHW operation, the boiler 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 after DHW in parallel with priority (*DHW MODE 2*), the control shuts off the boiler, but continues to operate the DHW pump 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.



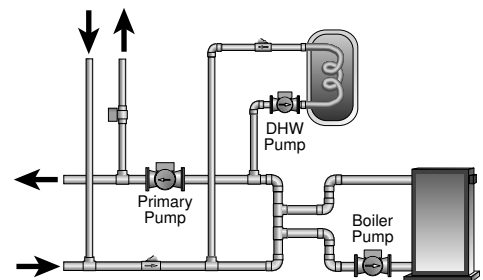
DHW DURING UNOCCUPIED

When an external *DHW Demand* is present, the control can either continue operation of the DHW system as it would during the occupied period or the control can ignore a call for DHW as long as the control is in an unoccupied mode.

Section E2: 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 *Boiler 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 outdoor air temperature as described in the DHW Priority Override section. However, if the *DHW Demand* is not satisfied within the allotted time, the boiler shuts off and the heat of the boiler is purged into the DHW tank.

Once the boiler supply temperature is sufficiently reduced, the *DHW Pmp / Vlv* 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 *DHW Pmp / Vlv* contact.

During a DHW Demand, the control closes the primary pump (*Prim P1*) contact and the *DHW Pmp / Vlv* contact. Once the DHW Demand is removed, or during a DHW priority override, the *DHW Pmp / Vlv* 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.

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 270 includes: One Boiler Control 270, One Outdoor Sensor 070, One Universal Sensor 071, Data Brochures D 270, D 070, D 001, Application Brochure A 270.

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 $\frac{7}{8}$ in (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 $\frac{3}{8}$ in (9 mm) to ensure proper connection to the control.
- Install the Outdoor Sensor 070 according to the installation instructions in the Data Brochure D 070 and run the wiring back to the control.
- Install the Boiler Supply Sensor 071 according to the installation instructions in the Data Brochure D 070 and run the wiring back to the control.
- If an Indoor Sensor 076 or 077 is used, install the indoor sensor according to the instructions in the Data Brochure D 074 and run the wiring back to the control.
- Run wire from other system components (pumps, boiler, etc.) to the control.
- Run wires from the 115 V (ac) power to the control. Use a clean power source with a 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 (5 and 6). This connection provides power to the microprocessor and display of the control. As well, this connection provides power to the *Prim P1* terminal (4) from the *Power L* terminal (5).

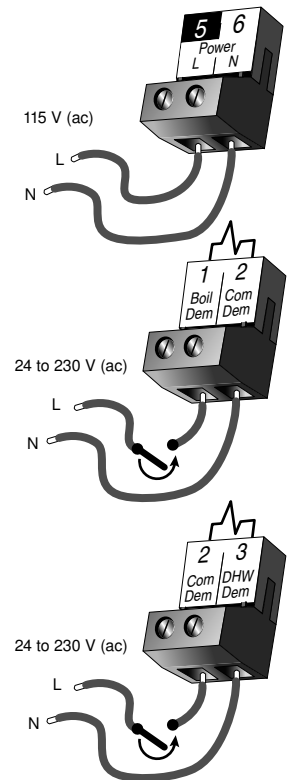
Boiler Demand

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 (1 and 2).

DHW Demand

To generate a *DHW Demand*, a voltage between 24 V (ac) and 230 V (ac) must be applied across the *Com Dem* and *DHW Dem* terminals (2 and 3).

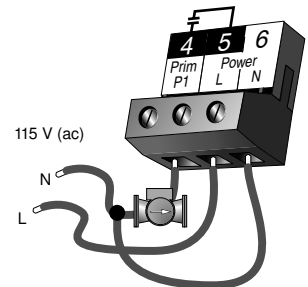
Caution: The same power supply must be used to power both the DHW Demand and the Boiler Demand circuits since they both share the *Com Dem* terminal.



Output Connections

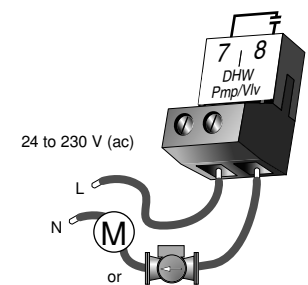
Primary Pump Contact (Prim P1)

The *Prim P1* output terminal (4) is a powered output. When the relay in the control closes, 115 V (ac) is provided to the *Prim P1* terminal (4) from the *Power L* terminal (5). To operate the primary pump, connect one side of the primary pump circuit to terminal 4 and the second side of the pump circuit to the neutral (*Power N*) side of the 115 V (ac) power supply.



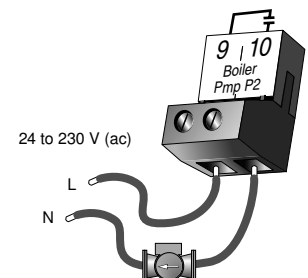
DHW Pmp / Vlv Contact

The *DHW Pmp / Vlv* terminals (7 and 8) 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 Pmp P2 Contact

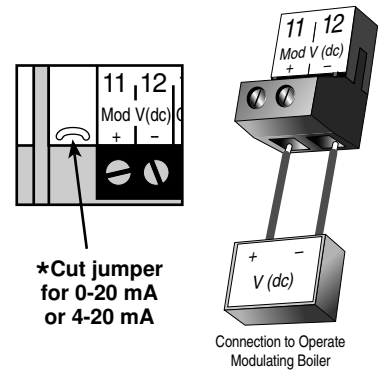
The *Boiler Pmp P2* terminals (9 and 10) are isolated output in the control. There is no power available on these terminals from the control. These terminals are to be used as a switch to either make or break power to a boiler pump. Since this is an isolated contact, it may switch a voltage between 24 V (ac) and 230 V (ac).



Modulation Output

The Modulation Output terminals (11 and 12) provide a 0 to 10 V (dc) or a 2 to 10 V (dc) output to the boiler. If a 0 to 20 mA or a 4 to 20 mA output is required, cut the jumper wire located next to the modulation output.

The modulating outputs replace any mechanical operator such as a T991. Observe polarity when connecting the control to the boiler.

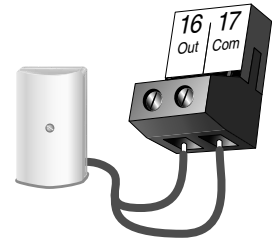


SENSOR AND UNPOWERED INPUT CONNECTIONS

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

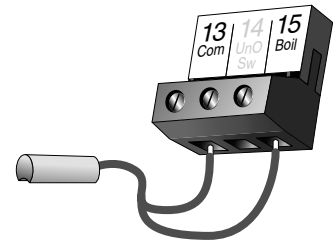
Outdoor Sensor

Connect the two wires from the Outdoor Sensor 070 to the *Com* and *Out* terminals (17 and 16). The outdoor sensor is used by the control to measure the outdoor air temperature.



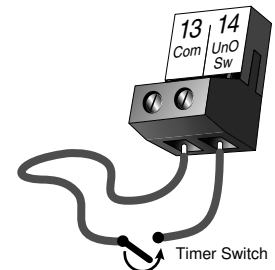
Boiler Supply Sensor

Connect the two wires from the Boiler Supply Sensor 071 to the *Com* and *Boil* terminals (15 and 13). The boiler supply sensor is used by the control to measure the boiler supply 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 (14 and 13). When these two terminals are shorted together, the control registers an unoccupied (*UNOCC*) signal.



STEP FIVE TESTING THE WIRING

General

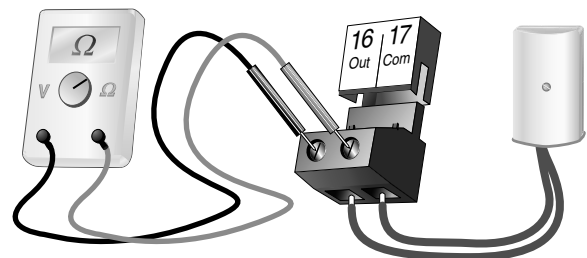
Each terminal block must be unplugged from its header on the control before power is applied for testing. To remove the terminal block, pull straight down from the control.

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 to 300 V (ac) and at least 0 to 2,000,000 Ω , is essential to properly test the wiring and sensors.

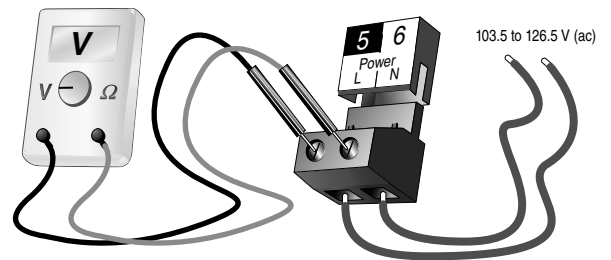
Test The Sensors

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



⚠ Test The Power Supply

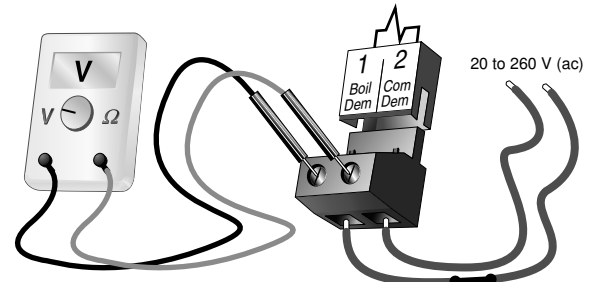
Make sure exposed wires and bare terminals are not in contact with other wires or grounded surfaces. Turn on the power and measure the voltage between the *Power L* and *Power N* terminals (5 and 6) using an AC voltmeter, the reading should be between 103.5 and 126.5 V (ac).



Test the Powered Inputs

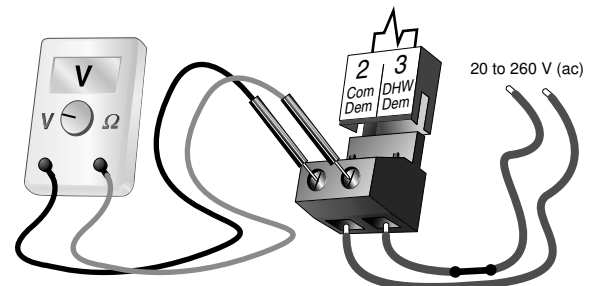
Boiler Demand

If a boiler demand is used, measure the voltage between the *Boil Demand* terminals (1 and 2). When the boiler demand device calls for heat, 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 *DHW Dem* and the *Com Dem* terminals (2 and 3). When the DHW demand device calls for heat, 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.



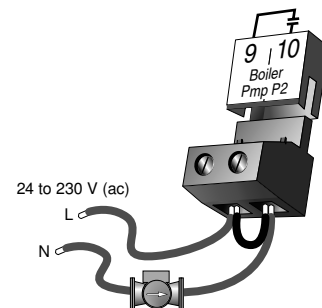
TEST THE OUTPUTS

Primary Pump (Prim P1)

If a primary pump is connected to the *Prim P1* terminal (4), make sure that power to the terminal block is off and install a jumper between the *Power L* and *Prim P1* terminals (5 and 4). When power is applied to the *Power L* and *Power N* terminals (5 and 6), 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.

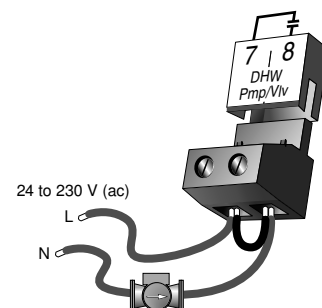
Boiler Pmp P2

If a boiler pump is connected to the *Boiler Pmp P2* terminals (9 and 10), 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.



DHW Pump Or Valve (DHW Pmp / Vlv)

If a DHW pump or DHW valve is connected to the *DHW Pmp / Vlv* terminals (7 and 8), 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.



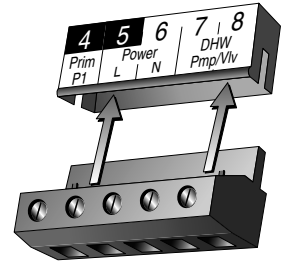
CONNECTING THE CONTROL

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.

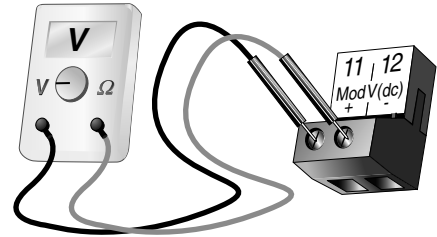
Install the supplied safety dividers between the unpowered sensor inputs and the powered or 115 V (ac) wiring chambers.

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 OUTPUT

If a modulating device is used, connect an ammeter to the modulating output *Mod V (dc)* terminals (11 and 12) and observe the current reading during operation. For example, when using a 0 to 10 V (dc) output, the initial percentage output is zero and the meter should read 0 V (dc). As the Boiler Modulation in the VIEW menu increases, the meter reading should increase until the Boiler Modulation reaches 100% at which point the meter should read 10 V (dc). When the 0 to 10 V (dc) modulation decreases, the meter should start at 10 V (dc) and eventually reach 0 V (dc) when the display shows 0% Boiler Modulation.



Cleaning the Control

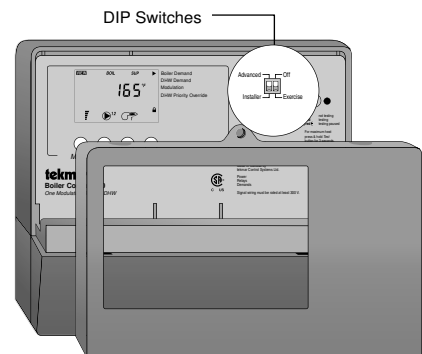
The control's exterior can be cleaned using a damp cloth. Moisten the cloth with water and wring out prior to wiping control. Do not use solvents or cleaning solutions.

DIP Switch Settings

GENERAL

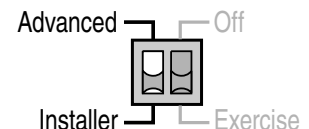
The DIP switch settings on the control are very important and should be set to the appropriate settings prior to making any adjustments to the control through the User Interface. The DIP switch settings change the items that are available to be viewed and / or adjusted in the User Interface.

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.



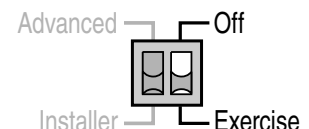
Advanced / Installer

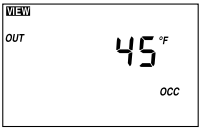
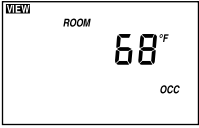
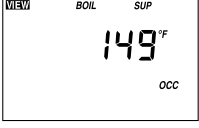


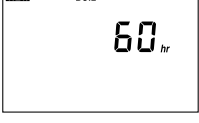
The *Advanced / Installer* DIP switch selects the access level of the control. In the *Installer* access level, a limited number of items may be viewed and / or adjusted. In the *Advanced* access level, all items may be viewed and / or adjusted.

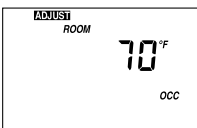
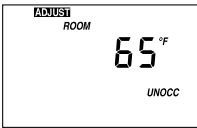
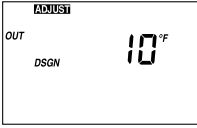
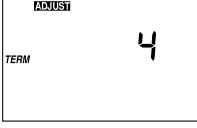
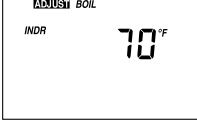
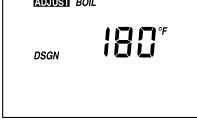
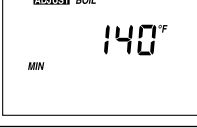
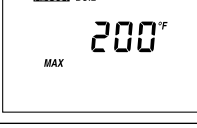
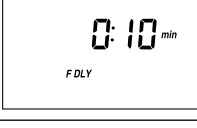
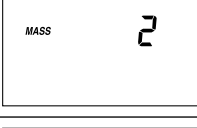

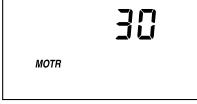


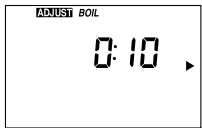
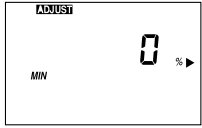
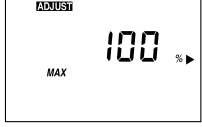
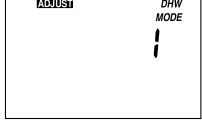
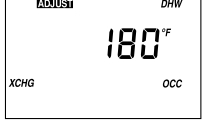
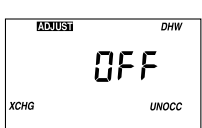
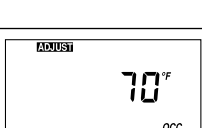
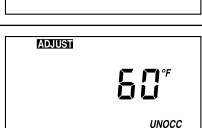
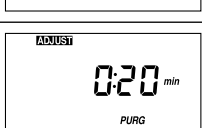
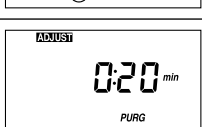
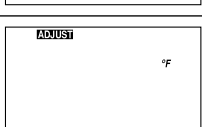
Off / Exercise

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.



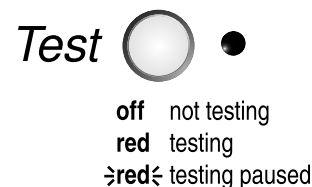
| Display | Section Installer Advanced | Description | Range |
|---|----------------------------------|---|---------------------------------------|
|  | ● ● | Outdoor Current outdoor air temperature as measured by the outdoor sensor. | -76 to 149°F (-60 to 65°C) |
|  | ● ● | Room Current room air temperature as measured by the indoor sensor. This item is only available when an indoor sensor is connected to the control. | 23 to 113°F (-5 to 45°C) |
|  | ● ● | Boiler Supply Current boiler supply water temperature as measured by the boiler supply sensor. | -22 to 266°F (-30 to 130°C) |
|  | ● | Boiler Target Boiler target temperature is the temperature the control is currently trying to maintain at the boiler supply sensor +/- 1/2 of the differential. | ---, 35 to 230°F (---, 2 to 110°C) |
|  | B3 ● | Boiler Modulation Current percent modulation of the boiler's burner. | 0 to 100% |
|  | ● | Boiler Hours The total running time of the boiler since this item was last cleared. To clear this item, press the ▲ and ▼ button simultaneously while viewing this item. | 0 to 1999 hr |

| Display | Section Installer Advanced | Description | Range | Actual Setting |
|---|----------------------------------|---|--|-------------------|
|  | ● ● | Room Occupied The desired room air temperature during the occupied period. | 35 to 100°F (2 to 38°C) Default = 70°F (21°C) | |
|  | D1 ● ● | Room Unoccupied The desired room air temperature during the unoccupied period. | 35 to 100°F (2 to 38°C, OFF) Default = 65°F (18°C) | |
|  | D1 ● ● | Outdoor Design The design outdoor air temperature used in the heat loss calculations for the heating system. | -60 to 45°F (-51 to 7°C) Default = 10°F (-12°C) | |
|  | D1 ● ● | Terminal Unit The type of terminal units that are being used in the heating system. | 1 (HRF1), 2 (HRF2), 3 (COIL), 4 (CONV), 5 (RAD), 6 (BASE) Default = 4 | |
|  | D1 ● | Boiler Indoor The design indoor air temperature used in the heat loss calculation for the heating system. | 35 to 100°F (2 to 38°C) Default = 70°F (21°C) | |
|  | D1 ● | Boiler Design The design supply water temperature used in the heat loss calculations for the heating system. | 70 to 220°F (21 to 104°C) Default = 180°F (82°C) | |
|  | B1 ● | Boiler Minimum The minimum allowed boiler target temperature. Check the boiler manufacturer's manual for a recommended setting. | OFF, 80 to 180°F (OFF, 27 to 82°C) Default = 140°F (60°C) | |
|  | B1 ● | Boiler Maximum The maximum allowed boiler target temperature. | 120 to 225°F, OFF (49 to 107°C, OFF) Default = 200°F (93°C) | |
|  | B1 ● | Fire Delay The time delay the control can expect between the time that the relay contact closes to fire the boiler and when the burner actually fires. | 0:00 to 4:00 minutes (1 sec increment) Default = 0:10 minutes | |
|  | B2 ● B3 ● | Boiler Mass The thermal mass characteristics of the boiler that is being used. | 1 (Lo) 2 (Med) 3 (Hi) Default = 2 (Med) | |
|  | B2 ● B3 ● | Boiler Differential The temperature differential that the control is to use when it is operating the boiler. | Au, 2 to 42°F (Au, 1 to 23°C) Default = Au | |
|  | B3 ● | Motor Speed 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. | 10 to 230 seconds Default = 30 | |

| Display | Section | Installer | Advanced | Description | Range | Actual Setting |
|---|----------|-----------|----------|---|--|----------------|
|  | B3 | ● | | Boiler Modulation Selects either a 2 to 10 V (dc) or a 0 to 10 V (dc) output signal. | 2:10, 0:10 Default = 0:10 | |
|  | B3 | ● | | Minimum Modulation The minimum percent modulation of the burner. | 0 to 50% Default = 0% | |
|  | B3 | ● | | Maximum Modulation The maximum percent modulation of the burner. | 50 to 100% Default = 100% | |
|  | E1 E2 | ● | | DHW Mode Selects the DHW mode of operation. | 1 (parallel, no priority), 2 (parallel, priority), 3 (pri-sec, no priority), 4 (pri-sec, priority) Default = 1 | |
|  | | ● | | DHW Exchange Occupied The minimum boiler supply temperature to the DHW heat exchanger during the Occupied period. | OFF, 100 to 220°F (OFF, 38 to 104°C) Default = 180°F (82°C) | |
|  | | ● | | DHW Exchange Unoccupied Selects whether or not a DHW demand will be responded to during the UnOccupied period. | OFF, On Default = OFF | |
|  | | ● | ● | WWSD Occupied The system's warm weather shut down temperature during the Occupied period. | 35 to 100°F, OFF (2 to 38°C, OFF) Default = 70°F (21°C) | |
|  | | ● | | WWSD Unoccupied The system's warm weather shut down temperature during the Unoccupied period. | 35 to 100°F, OFF (2 to 38°C, OFF) Default = 60°F (16°C) | |
|  | C1 | ● | | 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 second increments) Default = 0:20 min | |
|  | C1 | ● | | Boiler Pump Purge The length of time that the boiler pump will continue to run after the boiler demand is removed. | OFF, 0:10 to 19:55 min. (5 second increments) Default = 0:20 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.



TEST SEQUENCE

Each step in the test sequence lasts 10 seconds.

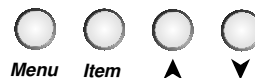
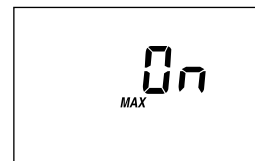
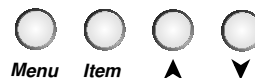
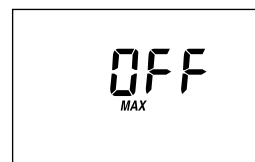
During the test routine, if a demand from the system is present, the test sequence may be paused by pressing the **Test** button. If the **Test** button is not pressed again for 5 minutes while the test sequence is paused, the control exits the entire test routine. If the test sequence is paused, the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

- Step 1 – The primary pump contact is closed.
- Step 2 – The boiler pump contact is closed.
- Step 3 – The Boiler contact is closed and the modulation output is set to the Minimum Modulation setting.
- Step 4 – If there is a demand present, the modulation output increases to Maximum Modulation according to the Motor Speed setting.
- Step 5 – If there is a demand present, the modulation output decreases to Minimum Modulation according to the Motor Speed setting.
- Step 6 – The Boiler and boiler pump contacts are opened.
 - If DHW MODE is set to 1 or 2, the DHW Pmp / Vlv contact is closed and the primary pump contact is opened.
 - If DHW MODE is set to 3 or 4, the DHW Pmp / Vlv contact is closed and the primary pump contact remains closed.
- Step 7 – After the test sequence is completed, the control resumes its normal operation.

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.



The display shows the error code "E01" in a large, bold, black font.

E01

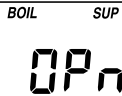
The control was unable to read a piece of information stored in its memory. Because of this, the control was required to reload the factory settings into all of the items in the ADJUST menu. The control will stop operation until all of the items in the ADJUST menu of the control have been checked by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

Note: The *Advanced / Installer* DIP switch must be set to *Advanced* in order to clear the error.

The display shows "BOIL" and "SUP" at the top, and "Shr" in the center. "Shr" is in a large, bold, black font.

Boil Supply Sensor Short

The control is no longer able to read the boiler supply sensor due to a short circuit. The control will not operate the boiler 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 display shows "BOIL" and "SUP" at the top, and "OPn" in the center. "OPn" is in a large, bold, black font.

Boil Supply Sensor Open

The control is no longer able to read the boiler supply sensor due to an open circuit. The control will not operate the boiler 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 display shows "OUT" at the top left, and "Shr" in the center. "Shr" is in a large, bold, black font.

Outdoor Sensor Short

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.

The display shows "OUT" at the top left, and "OPn" in the center. "OPn" is in a large, bold, black font.

Outdoor Sensor Open

The control is no longer able to read the outdoor sensor due to an open circuit. In this case the control assumes an outdoor temperature of 32°F (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.

The display shows "INDR" at the top left, and "Shr" in the center. "Shr" is in a large, bold, black font.

Indoor Sensor Short

The control is no longer able to read the indoor sensor due to a short circuit. The control will operate the system as if an indoor sensor were not installed until the indoor sensor is repaired. Locate and repair the problem as described in the Data Brochure D 074. To clear the error message from the control after the sensor has been repaired, press either the **Menu** or **Item** button.

The display shows "INDR" at the top left, and "OPn" in the center. "OPn" is in a large, bold, black font.

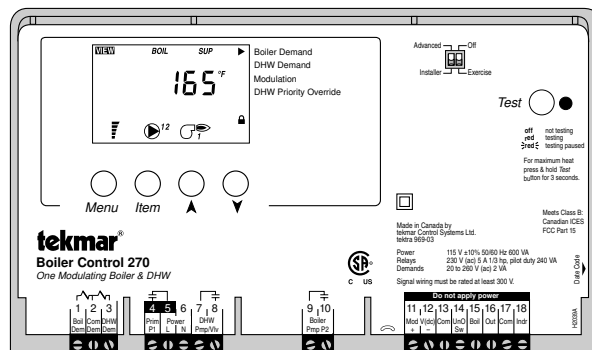
Indoor Sensor Open

The control is no longer able to read the indoor sensor due to an open circuit. The control will operate the system as if an indoor sensor were not installed until the indoor sensor is repaired. Locate and repair the problem as described in the Data Brochure D 074. To clear the error message from the control after the sensor has been repaired, press either the **Menu** or **Item** button.

Technical Data

Boiler Control 270 One Modulating Boiler & DHW

| | |
|--------------------|---|
| Literature | — D 270, A 270, D 001, D 070. |
| Control | — Microprocessor PID control; This is not a safety (limit) control . |
| Packaged weight | — 3.3 lb. (1500 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, meets ICES & FCC regulations for EMI/RFI. |
| Ambient conditions | — Indoor use only, 32 to 104°F (0 to 40°C), < 90% RH non-condensing. |
| Power supply | — 115 V (ac) ±10% 50/60 Hz 600 VA |
| Relay capacity | — 230 V (ac) 5 A 1/3 hp pilot duty 240 VA |
| Modulation Output | — 0 – 10 V (dc) |
| Demands | — 20 to 260 V (ac) 2 VA |
| Sensors included | — NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) β=3892 |
| | — Outdoor Sensor 070 and Universal Sensor 071 |
| Optional devices | — Indoor Sensor 076/077 |



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

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

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

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

Limited Warranty and Product Return Procedure

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

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

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

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

Any representations or warranties about the Products made by Purchaser to its customers which are different from or in excess of the tekmar Limited Warranty are

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

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

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

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



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