tekmar® - Data Brochure

Universal Reset Control 374

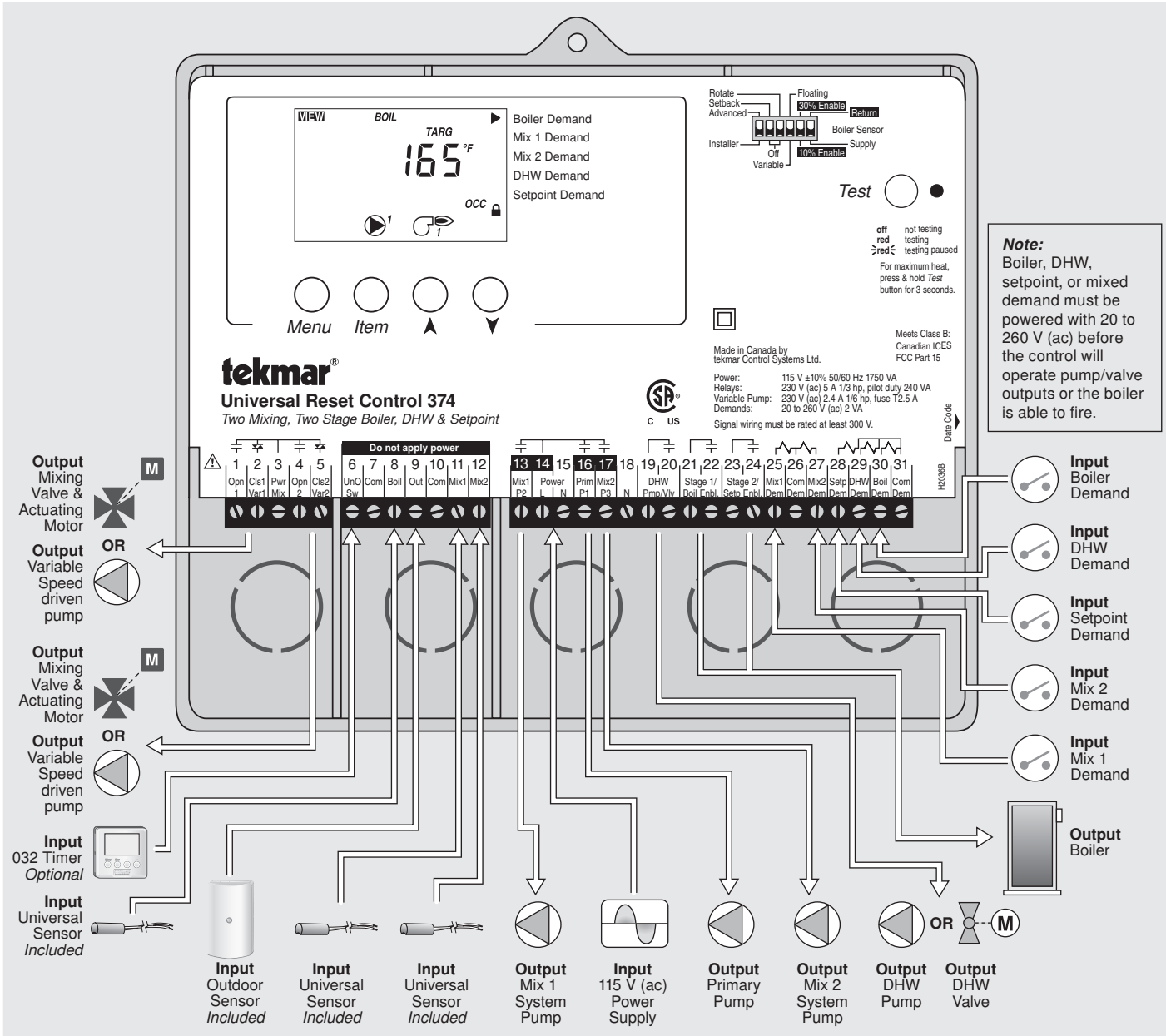
D 374

03/09

The tekmar Universal Reset Control 374 is designed to maximize the comfort and efficiency provided by a hydronic heating system. The control automatically adjusts the boiler and mix water temperatures that are delivered to the heating system by using outdoor reset. The 374 can control two separate on / off stages (or one low / high fire) to provide outdoor reset while providing equal run time rotation of the boilers. The 374 can operate two mixing devices, which can be either two variable speed injection pumps or two floating action valves. The mixing devices can be used to supply two different reset water temperatures or one reset and one setpoint water temperature to a space heating system. The 374 is capable of controlling an indirect Domestic Hot Water (DHW) storage tank and setpoint load. A large easy to read display provides current system temperatures and operating status. The control has an internal timer, which can have 2 events per day on a 24 hour, 5-1-1 day or 7 day schedule.

Additional functions include:

- Outdoor Reset
- Two Mixing Devices
- Two Boiler Stages
- Two separate mix demands for space heating loads
- Boiler demand for space heating loads
- DHW demand for domestic hot water loads
- Setpoint demand for setpoint loads
- Installer and Advanced access levels
- Primary pump and mixing system pump outputs
- Exercising
- Test sequence to ensure proper component operation
- Internal setback timer for energy savings
- Setback input for energy savings
- CSA C US certified



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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 five 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

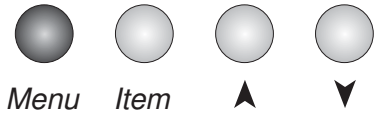
User Interface

The 374 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 374 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*, and *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 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.

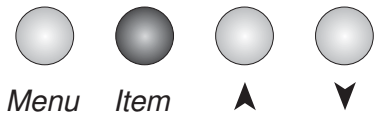
Note: The TIME and SCHEDULE menus are not available when there is no Setback selected.



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.

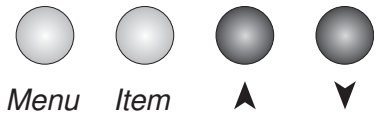
The items can be quickly scrolled through by holding the ***Item*** button and then pressing the ▼ button. To rapidly scroll through the items in the reverse order, hold the ***Item*** button and press the ▲ button.



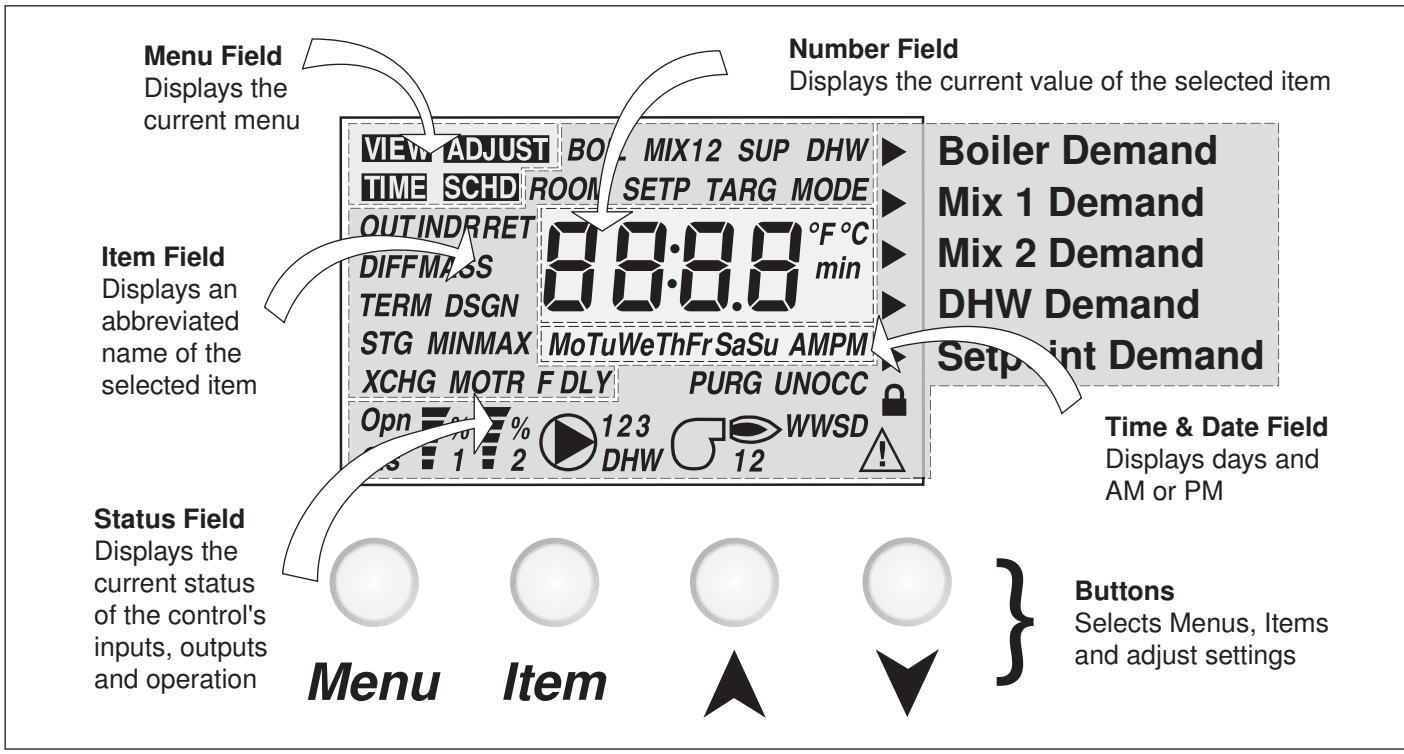
Adjust

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

Opn Cls	**Open / Close** Displays when the actuator is opening or closing the mixing valve.		**Installer Access Level** Displays when the Installer / Advanced Dip switch is set to Installer
% 1 % 2	**Mixing Device Output Scale** Shows output of injection pump or mixing valve.	°F °C min	**°F, °C, min** Units of measurement.
12	**Burner** Displays which stage relay is turned on.	▶	**Pointer** Displays the control operation as indicated by the text.
123	**Pump** Displays when the primary pump 1, mix 1 system pump and mix 2 system pump is operating.	UNOCC	**UnOccupied Schedule** Displays when the control is in UnOccupied Mode.
DHW	**DHW** Displays when the DHW pump or valve is on.	OCC	**Occupied Schedule** Displays when the control is in Occupied Mode.
⚠	**Warning** Displays when an error exists or when a limit has been reached.		

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

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Sequence of Operation

Section A: General Operation

POWERING UP THE CONTROL

When the 374 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.

TYPES OF DEMANDS

The control can control the supply water temperatures of two mix temperature systems and the boiler supply water temperature. The type of demand the control receives determines the operation of the control.

Boiler Demand

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

DHW Demand

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 C.

Setpoint Demand

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 D.

Mix 1 Demand

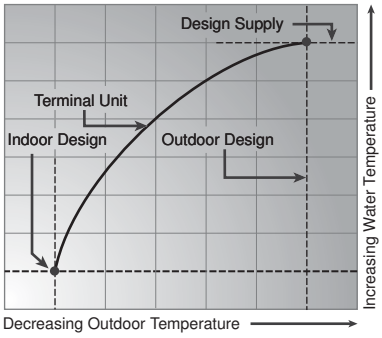
When a mix 1 demand signal from the heating system is present, the control operates the mixing 1 device and the boiler(s) to maintain the mix 1 supply temperature based on the outdoor air temperature and the Mix 1 Characterized Heating Curve settings. Refer to section E.

Mix 2 Demand

When a mix 2 demand signal from the heating system is present, the control operates the mixing 2 device and boiler(s) to maintain the mix 2 supply temperature based on the outdoor air temperature and the Mix 2 Characterized Heating Curve settings or the control can provide a setpoint temperature. Refer to section E.

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.

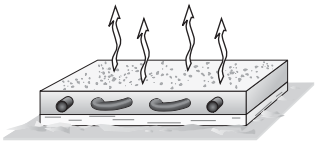


TERMINAL UNITS

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. See section B for Boiler Terminal Units and section E for Mixing Terminal Units.

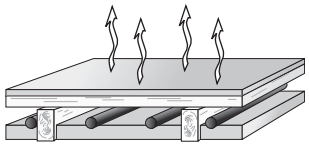
High Mass Radiant (1)

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.



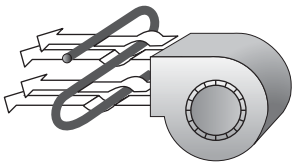
Low Mass Radiant (2)

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.



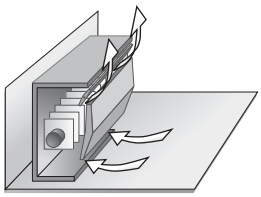
Fancoil (3)

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.



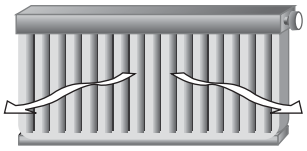
Fin-Tube Convector (4)

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.

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 supply water temperature rises gradually as the outdoor temperature drops. If a warm outdoor design temperature is selected, the supply water temperature rises rapidly as the outdoor temperature drops.

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 and does not operate the space heating system to satisfy boiler, mix 1 or mix 2 demands. Mix 2 setpoint demands remain active. The control does respond to a DHW demand or a setpoint demand and operates as described in sections C and D.

SETBACK

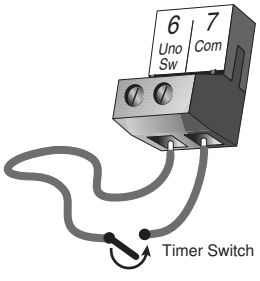
To provide greater energy savings, the control has a setback feature. With setback, the supply water temperature in the system is reduced when the building is unoccupied. By reducing the supply water temperature, the air temperature in the space may be reduced even when thermostat(s) are not turned down.

The control has an internal setback timer with two events per day on a 24 hour, a 5-1-1 day or a 7 day schedule.

The control also has an external setback input. Any time the *UnO Sw* (6) and the *Com* (7) are shorted together, the control operates in the unoccupied mode.

The external setback overrides the internal setback timer schedule to place the control into the unoccupied period.

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.



FACTORY DEFAULTS

The control comes preset with several factory defaults. These defaults are based on the terminal unit selection (see section B for Boilers and section E for Mixing Devices). 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.

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EXERCISING

The control has a built-in exercising feature, which ensures that each pump or valve 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.

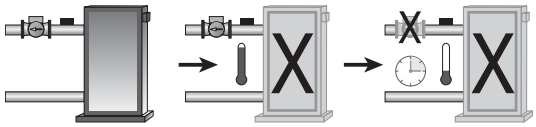
Note: The exercising function does not work if power to the control or pumps is disconnected.

BOILER PROTECTION

The control is capable of providing boiler protection from cold mixing system return temperatures. The control protects the boilers by either reducing the variable speed injection pump speeds or by closing the four way valves. This limits the amount of cool return water to the boiler and allows the boiler water temperature to recover.

PRIMARY PUMP OPERATION

The primary pump operates when the control receives boiler, mix 1 or mix 2 demands and is not in Warm Weather Shut Down (WWSD). The primary pump will operate in DHW MODES 3 and 4 when a DHW demand is present. The primary pump also operates in Setpoint MODE 3 during setpoint demands.



Primary Pump Purge

After any demand that operates the primary pump is removed, the control continues to operate the primary pump for an additional 20 seconds.

Section B: Boiler Operation

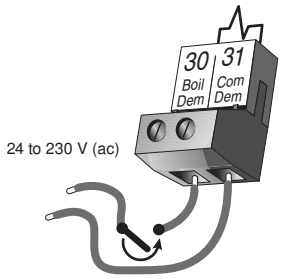
Section B1
Boiler
Reset

Section B2
Boiler
Enable

Section B1: Boiler Reset

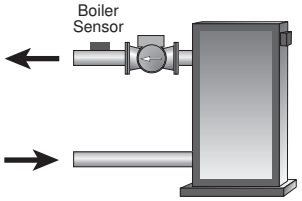
BOILER DEMAND

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 (30 and 31). 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 boiler characterized heating curve settings. The control then fires the boiler(s), if required, to maintain the boiler target supply temperature.



BOILER SUPPLY SENSOR

The boiler sensor can be located on the boiler supply if the 374 is the only control that is operating the boiler(s). When the *Return / Supply* DIP switch is set to *Supply*, the control determines the required operating temperature for the boiler supply and operates the Stage 1 and Stage 2 contacts in order to maintain the correct boiler supply water temperature.



BOILER CHARACTERIZED HEATING CURVE

The boiler(s) have a Boiler Characterized Heating Curve determined by the following settings:

Boiler Design Temperature

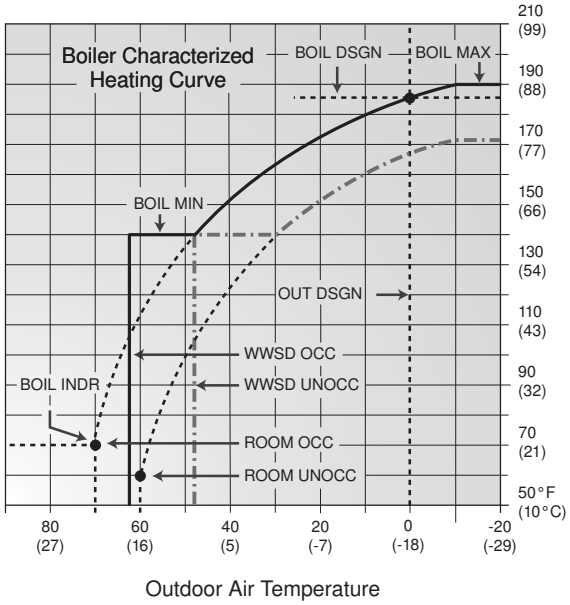
The boiler design supply temperature is the supply water temperature required to heat the building when the outdoor air temperature is as cold as the outdoor design temperature.

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 boiler characterized heating curve.

Boil Room

The *Boil Room* setting is the desired room temperature for the building and provides a parallel shift of the boiler characterized 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 *Boil Room* setting increases or decreases the amount of heat available to the boiler zones in the building. A *Boil Room* setting is available for both the occupied (day) and unoccupied (night) periods.



BOILER TERMINAL UNITS

When a terminal unit is selected, the control automatically loads the boiler design temperature, boiler maximum supply temperature, and boiler minimum supply temperature. The factory defaults can be changed to better match the installed system. If a factory default has been changed, refer to section A to reload the factory defaults.

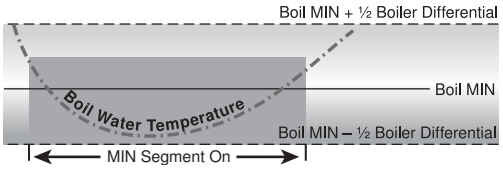
Terminal Unit	High Mass Radiant (1)	Low Mass Radiant (2)	Fancoil (3)	Fin-Tube Convector (4)	Radiator (5)	Baseboard (6)
BOIL DSGN	120°F (49°C)	140°F (60°C)	190°F (88°C)	180°F (82°C)	160°F (71°C)	150°F (66°C)
BOIL MAX	140°F (60°C)	160°F (71°C)	210°F (99°C)	200°F (93°C)	180°F (82°C)	170°F (77°C)
BOIL MIN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

Boiler Target Temperature

The boiler target temperature is determined from the boiler 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.

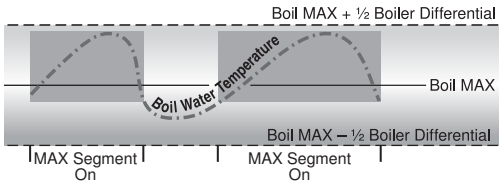
Boiler Minimum

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(s) 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 displayed in the LCD 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).



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STAGING

The control operates up to two on / off boiler stages (or one low / high fire) in order to provide the required supply temperature. After a stage is turned on in the firing sequence, the control waits for a minimum time delay. The minimum time delay is adjustable using the Stage Delay setting. After the Stage Delay has expired, the control examines the control error to determine when the next stage is to fire. The control error is determined using Proportional, Integral and Derivative (PID) logic.

Proportional – compares the actual supply temperature to the boiler target temperature. The colder the supply water temperature, the sooner the next stage is turned on.

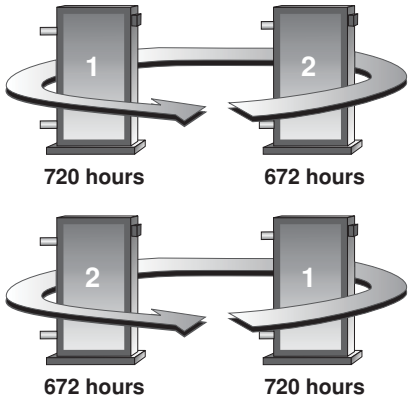
Integral – compares the actual supply temperature to the boiler target temperature over a period of time.

Derivative – compares how fast or slow the supply water temperature is changing. If the supply temperature is increasing slowly, the next stage is turned on sooner. If the supply temperature is increasing quickly, the next stage is turned on later, if at all.

ROTATION

The control's Equal Run Time Rotation function is fixed at 48 hours. The firing order of the boilers changes whenever one boiler accumulates 48 hours more running time than the 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 both boilers receive equal amounts of use. When the *Rotate / Off DIP* switch is set to the *Off* position, the firing sequence always begins with boiler one and then boiler two.

Note: When using a single two-stage boiler, ensure that the *Rotate / Off DIP* switch is set to *Off*.

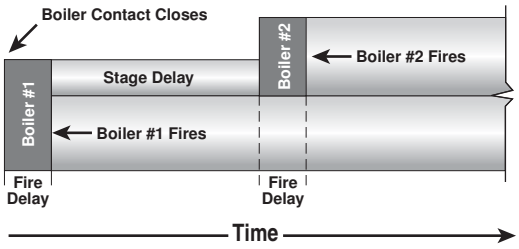


Resetting the Rotation Sequence

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.

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.



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.

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. If the heating system is causing the boiler(s) to be staged on and off in rapid succession, a higher boiler mass setting will result in a decrease in the amount of cycling. Conversely, if the system is slow to respond to heat requirements, then decreasing the boiler mass setting will increase the response rate by staging the boilers at a faster rate.

Lo (1)

The Lo setting is selected if the boiler(s) that is used has a low thermal mass. This means that the boiler(s) 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 staging rate of on / off boiler stages.

Med (2)

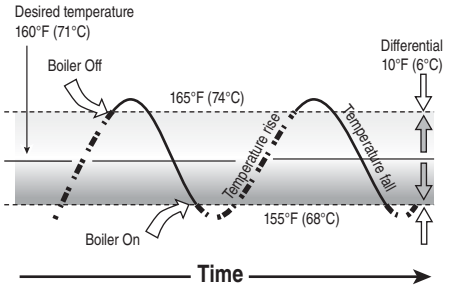
The Med setting is selected if the boiler(s) that is used has a medium thermal mass. This means that the boiler(s) either has a large water content and a low metal content or a small water content and a high metal content. This is typical of many modern residential cast iron boilers or steel tube boilers. The Med mass setting provides a moderate staging rate of on / off boiler stages.

Hi (3)

The Hi setting is selected if the boiler(s) that is used has a high thermal mass. This means that the boiler(s) 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 staging rate of on / off boiler stages.

DIFFERENTIAL

An on / off heat source must be operated with a differential in order to prevent short cycling. With the control, either a fixed or an auto differential may be selected. The boiler differential is divided around the boiler target temperature. The stage contact closes when the supply water temperature is ½ of the differential setting below the boiler target temperature. Additional staging occurs if the first stage is unable to raise the supply water temperature up to the boiler target temperature at a reasonable rate. As the supply temperature reaches ½ of the differential above the boiler target temperature, stages are staged off.

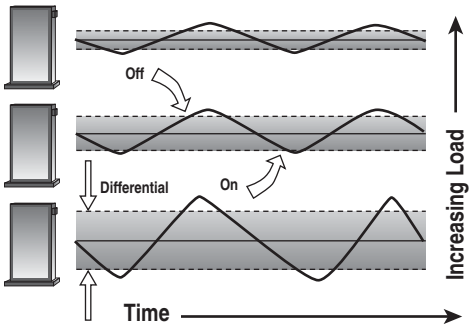


Fixed Differential

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

Auto Differential

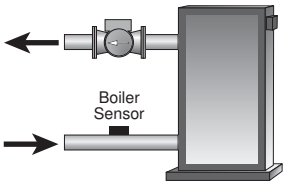
If the Auto Differential is selected, the control automatically determines the best differential as the load changes. This reduces potential short cycling during light load conditions.



Section B2: Boiler Enable

BOILER RETURN SENSOR

The boiler sensor should be located on the boiler return if the 374 is one of many controls that can call for boiler operation or the boiler has its own control with outdoor reset and setpoint operation. The boiler return sensor provides boiler return protection.



Boiler Enable Contact

When the *Return / Supply* DIP switch is set to *Return*, the 374 provides a boiler enable when there is a requirement for heat. The 374 no longer tries to control the boiler supply water temperature directly but allows the boiler to operate at its operating aquastat setting. The boiler enable contact is closed at either 30% or 10% operation of the mixing device, which is set using the *30% Enable / 10% Enable* DIP switch. The boiler enable contact remains closed until the mixing device(s) no longer requires heat.

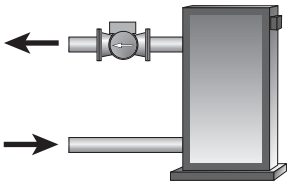
Setpoint Enable Contact

If a DHW demand or a Setpoint demand is registered, the Setpoint Enable contact is closed to provide a setpoint demand to the boiler's control if a setpoint input is available. When a return sensor is being used, the boiler should operate its own boiler pump.

NO BOILER SENSOR

The 374 is capable of operating without a boiler sensor if desired. In this case, there is no boiler protection provided by the 374.

To operate the 374 without a boiler sensor, the *Return / Supply* DIP switch is set to *Return* and the control must be powered up without the boiler sensor connected. This type of application is typical if the 374 is drawing heat from a heat source that already incorporates some form of boiler return protection.



Boiler Enable Contact

When the *Return / Supply* DIP switch is set to *Return*, the 374 provides a boiler enable when there is a requirement for heat. The 374 no longer tries to control the boiler supply water temperature directly but allows the boiler to operate at its operating aquastat setting. The boiler enable contact is closed at either 30% or 10% operation of the mixing device, which is set using the *30% Enable / 10% Enable* DIP switch. The boiler enable contact remains closed until the mixing device(s) no longer requires heat.

Setpoint Enable Contact

If a DHW demand or a Setpoint demand is registered, the Setpoint Enable contact is closed to provide a setpoint demand to the boiler's control if a setpoint input is available.

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Section C: DHW Operation

Section C1
Domestic Hot Water (DHW)

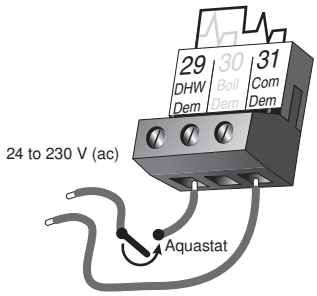
Section C2
DHW with Low Temperature Boilers

Section C1: Domestic Hot Water (DHW)

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 Dem* and *Com Dem* terminals (29 and 31).



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.

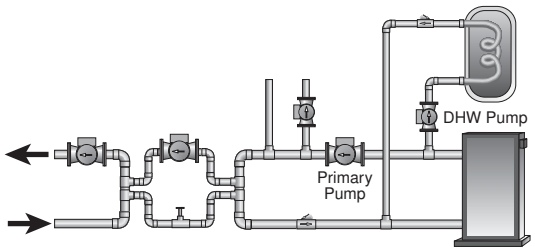
DHW MODE AND PRIORITY OPERATION

The control has four 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 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 closes. The primary pump (*Prim P1*) does not turn on, but may operate based on either a Boiler Demand, Mixing Demand or a Setpoint Demand. Refer to sections B and D.

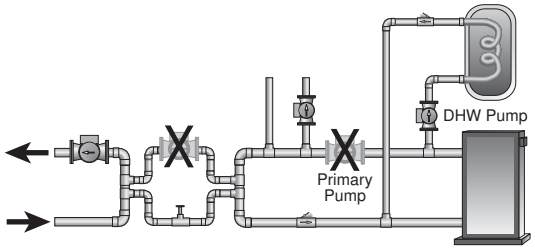
It is assumed that the DHW pump will provide adequate flow through the heat exchanger and the boiler.



DHW MODE 2 - DHW in Parallel with Priority

When a *DHW Demand* is present, the *DHW Pmp / Vlv* contact closes and the primary pump (*Prim P1*) contact is opened.

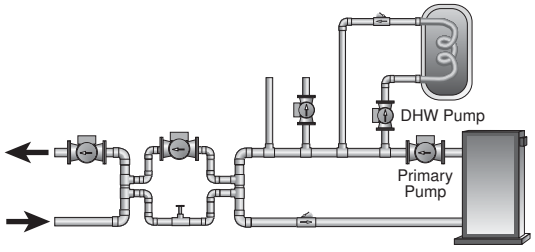
It is assumed that the DHW pump will provide adequate flow through the heat exchanger and the boiler.



DHW MODE 3 - DHW in Primary / Secondary no Priority

When a *DHW Demand* is present, the *DHW Pmp / Vlv* contact is closed and the primary pump (*Prim P1*) is operated.

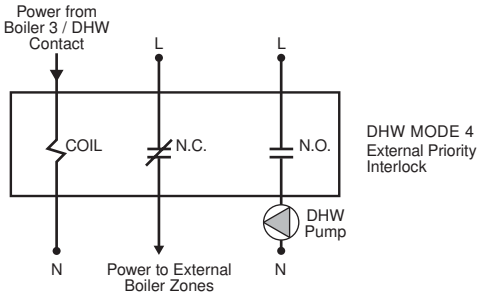
This mode can be used if a DHW tank is piped in direct return and a DHW valve is installed.

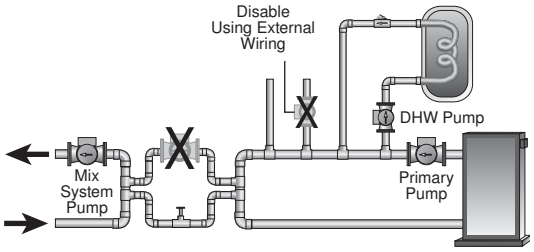


DHW MODE 4 - DHW in Primary / Secondary with External Priority

When a *DHW Demand* is present, the *DHW Pmp / Vlv* contact is closed and the primary pump is operated. Priority can only be obtained using external wiring on boiler zones. The mix system pumps continue to operate but the variable speed pumps(s) is shut off or the mixing valve(s) is closed. This allows DHW priority over the mix zones. 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.

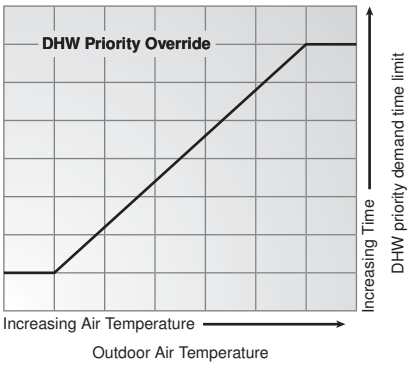




DHW PRIORITY OVERRIDE

The DHW *Priority Override* applies to *DHW 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. 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 boiler temperature space heating zones must be interlocked with the DHW Pmp / Vlv contact. During DHW demands, the DHW Pmp / Vlv contact must remove any power to all boiler temperature space heating zone valves or zone pumps.



CONDITIONAL DHW PRIORITY

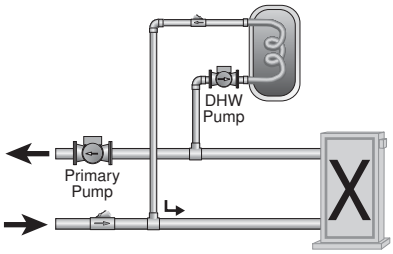
If the boiler supply temperature is maintained at or above the required temperature during DHW generation, this indicates that the boiler(s) has enough capacity for DHW and possibly heating as well. As long as the boiler supply temperature is maintained near its target, DHW and heating occurs simultaneously.

DHW POST PURGE

After the *DHW Demand* is removed, the control performs a purge 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 primary 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 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(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 priority, the control shuts off the boiler(s), 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

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.

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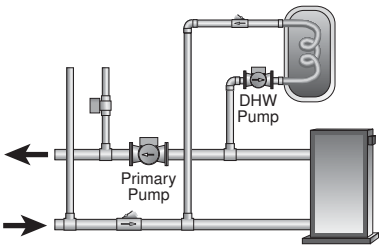
Section C2: DHW with Low Temperature Boilers

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 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(s) 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 powered 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.

Section D: Setpoint Operation

Section D1
Setpoint

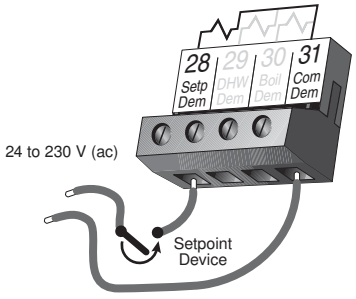
Section D1: Setpoint

SETPOINT

The control can operate to satisfy the requirements of a setpoint load in addition to a space heating load and a DHW 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 Dem* and *Com Dem* terminals (28 and 31). 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 MODES

Mode 1 - Setpoint in Parallel

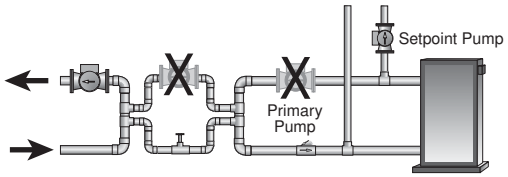
Whenever a setpoint demand is present, the boiler(s) is operated to maintain the setpoint target. The primary pump does not turn on, but may operate based on either a Boiler Demand or a DHW Demand. Refer to sections B and C.

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

Mode 2 - Setpoint in Parallel with Priority

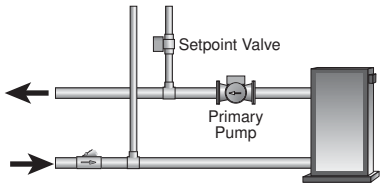
Whenever a setpoint demand is present, the boiler(s) is operated to maintain the setpoint target and the primary pump (*Prim P1*) contact is opened.

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



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. As the outdoor air temperature becomes colder, the length of time the control provides setpoint priority is reduced. 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, setpoint and heating occur at the same time.

Section E: Mixing Operation

Section E1
Mixing

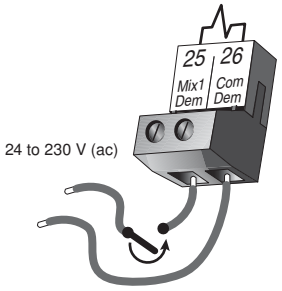
Section E1: Mixing

GENERAL

The control is capable of providing either two reset supply temperatures or one reset supply temperature and one mix setpoint temperature using two mixing devices. Each mixing device reduces the supply water temperature from the primary boiler loop to a secondary mixed loop. Each mixed secondary loop has its own supply water target temperature, which is determined by its own Mixing Characterized Heating Curve or Mix Target setpoint temperature.

MIX 1 DEMAND

The mix 1 demand allows the operation of the mixing 1 device to provide outdoor reset to the mix 1 supply loop. A conventional thermostat system can be used for zoning from the mix 1 supply loop. A mix 1 demand is generated by applying a voltage between 24 and 230 V (ac) across the *Mix1 Dem* and *Com Dem* terminals (25 and 26). Once voltage is applied, the *Mix 1 Demand* pointer is displayed in the LCD. If the control is not in WWSD, it will operate the mix 1 device and the mix 1 system pump (*Mix1 P2*) to maintain the mixing 1 target temperature.



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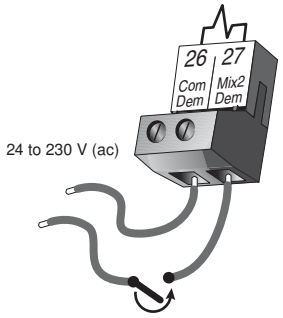
MIX 2 DEMAND

The mix 2 demand allows the operation of the mixing 2 device to provide outdoor reset to the mix 2 supply loop or a mix 2 setpoint temperature can be set. A conventional thermostat system can be used for zoning from the mix 2 supply loop. A mix 2 demand is generated by applying a voltage between 24 and 230 V (ac) across the *Mix2 Dem* and *Com Dem* terminals (27 and 26). Once voltage is applied, the *Mix 2 Demand* pointer is displayed in the LCD. If the control is not in WWSD, it will operate the mix 2 device and the mix 2 system pump (*Mix2 P3*) to maintain the mixing 2 target temperature.



MIX MODES

The following modes can be set for mixing device 1:

Mix 1 Mode 0 – Mixing device 1 OFF
Mix 1 Mode 1 – Mixing Characterized Heating Curve 1

The following modes can be set for mixing device 2:

Mix 2 Mode 0 – Mixing device 2 OFF
Mix 2 Mode 1 – Mixing Characterized Heating Curve 2
Mix 2 Mode 2 – Mixing Setpoint

MIX MODE 1 - MIXING CHARACTERIZED HEATING CURVES

Each mixing device can have its own Mixing Characterized Heating Curve. The following settings will determine the Mixing Characterized Heating Curve:

Mix Design

The Mix Design setting is the supply water temperature required to heat the mixing zones when the outdoor air is as cold as the Outdoor Design temperature.

Mixing Indoor

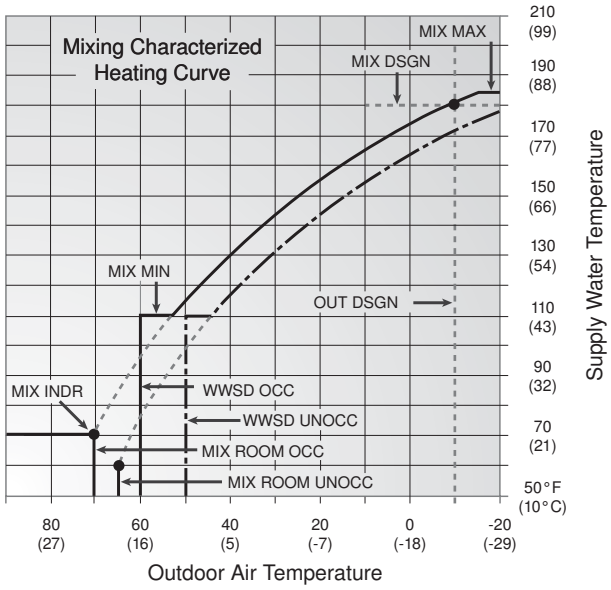
The Mix Indoor setting is the room temperature used in the original heat loss calculations for the building. This setting establishes the beginning of the Mixing Characterized Heating Curve for the mixing zones.

Mixing Room

The Mix Room setting is the desired room temperature for the mixing zones and it provides a parallel shift of the Mixing Characterized Heating Curve. The room temperature desired by the occupants is often different from the designed indoor temperature. If the room temperature is not correct, adjusting the Mix Room setting increases or decreases the amount of heat available to the building.

Mixing Target Temperature

The Mixing Target temperature is determined from the Mixing Characterized Heating Curve settings. The control displays the temperature that it is currently trying to maintain as the mixing supply temperature. If the control does not presently have a requirement for heat, it displays "– – –" in the LCD.



Mixing Minimum

The Mixing Minimum setting is the lowest temperature that the control is allowed to use as a mix target temperature. During mild conditions, if the control calculates a mix target temperature that is below the Mixing Minimum setting, the mix target temperature is adjusted to match the Mix Minimum setting. During this condition, if the mixing supply temperature is near the Mixing Minimum setting, the *Min* segment turns on in the LCD when either the mix target temperature or the mix supply temperature is being viewed.

Mixing Maximum

The Mixing Maximum sets the highest water temperature that the control is allowed to use as a mix target temperature. If the control does target the mix maximum setting, and the mix supply temperature is near the mixing maximum temperature, the *Max* segment turns on in the LCD while either the mixing target temperature or the mixing supply temperature is viewed.

MIXING TERMINAL UNITS

When a terminal unit is selected, the control automatically loads the mixing design temperature, mixing maximum supply temperature, and mixing minimum supply temperature. The factory defaults are listed below. The factory defaults can be changed to better match the installed system. If a factory default has been changed, refer to section A to reload the factory defaults.

Terminal Unit	High Mass Radiant (1)	Low Mass Radiant (2)	Fancoil (3)	Fin-Tube Convector (4)	Radiator (5)	Baseboard (6)
MIX 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)
MIX 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)
MIX MIN	OFF	OFF	100°F (38°C)	OFF	OFF	OFF

MIX MODE 2 – MIXING SETPOINT OPERATION

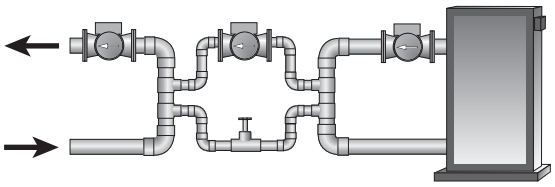
Mixing device 2 can operate at a mixing setpoint temperature by setting Mix 2 Mode to 2. The Mix 2 Target temperature can then be set to the desired temperature. While the boiler supply temperature is close to the boiler minimum temperature, the mix 1 device has priority over the mix 2 device when set to Mix 2 Mode 2.

MIXING DEVICE SELECTION

The control can supply a lower water temperature to part of the heating system by varying the speed of an injection pump or modulating a mixing valve. This selection is made using the *Floating / Variable* DIP switch.

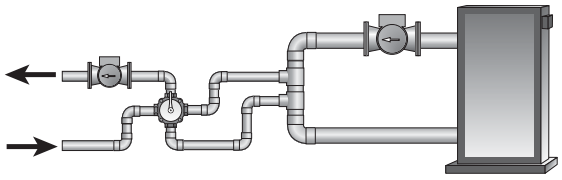
Variable Speed Injection

Standard wet rotor circulators are connected to the control on *Var1* terminal (2) for mix 1 demands and *Var2* terminal (5) for mix 2 demands. The control increases or decreases the power output to the circulator when there is mix demand. The circulator speed varies to maintain the correct mixed supply water temperature at the mix supply sensor. For correct sizing and piping of the variable speed injection driven circulator, refer to essay E 021. A visual indication of the current variable speed output is displayed in the LCD in the form of a segmented bar graph. There are separate bar graphs for each mix 1 and mix 2 outputs as indicated by a 1 or a 2 next to the bar graph.



Floating Action

Floating action actuator motors are connected to the control on the *Opn* and *Cls* terminals. Mix 1 has *Opn* and *Cls* terminals (1 and 2) and Mix 2 has separate *Opn* and *Cls* terminals (4 and 5). Power for both floating action actuator motors are shared on the *Pwr Mix* terminal (3).



The control pulses the actuator motor open or close to maintain the correct supply water temperature at the mix supply sensor when there is a mix demand. The mixing valve that the actuator is connected to can be either a 2-way, 3-way or 4-way valve. A visual indication as to whether the control is currently opening or closing the mixing valve is displayed in the LCD with the words Open and Close while viewing the Mix Supply and Mix Target temperatures. Also, a visual indication of the current position of the valve is displayed in the LCD in the form of a segmented bar graph. There are separate bar graphs for each mix 1 and mix 2 outputs as indicated by a 1 or a 2 next to the bar graph.

BOILER MINIMUM PROTECTION

The control is capable of providing boiler protection from cold mixing system return water temperatures. If the boiler water temperature is cooler than the Boiler Minimum setting while the boiler is firing, the control reduces the output from the mixing devices. If mix2 is operating in setpoint mode 2, it is the first to reduce its output. Otherwise, both outputs are reduced at the same rate. Reducing the mixing output limits the amount of cool return water to the boiler and allows the boiler water temperature to recover. This feature can only be used if the boiler sensor is on the supply or on the return.

MIX 1 PUMP CONTACT

If the control receives a *Mix 1 Demand* and is not in WWSD, the control closes the *Mix1 P2* pump contact and the mixing pump 2 segment is displayed in the LCD.

MIX 2 PUMP CONTACT

If the control receives a *Mix 2 Demand* and is not in WWSD, the control closes the *Mix2 P3* pump contact and the mixing pump 3 segment is displayed in the LCD.

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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 374 includes: One Universal Reset Control 374, One Outdoor Sensor 070, Three Universal Sensors 082, Data Brochures D 374, D 070, D 001, Application Brochure A 374.

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 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.
- 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 Sensor 082 according to the installation instructions in the Data Brochure D 070 and run the wiring back to the control.
- Install the Mix1 and Mix2 Sensors 082 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.
- 120 V (ac) to be provided from a 15 A circuit breaker and must have a circuit disconnect installed.
- Connect ground wires to ground bus bar in wiring area.

STEP FOUR — ELECTRICAL CONNECTIONS TO THE CONTROL

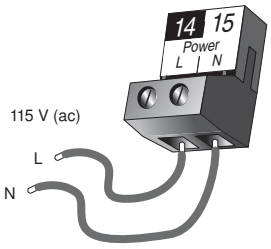
General

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

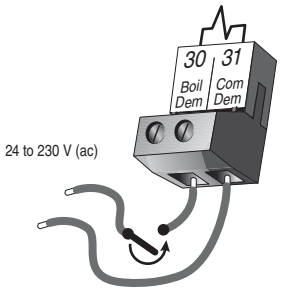
Connect the 115 V (ac) power supply to the *Power L* and *Power N* terminals (14 and 15). This connection provides power to the microprocessor and display of the control. As well, this connection provides power to the *Prim P1* terminal (16), the *Mix1 P2* terminal (13), and the *Mix2 P3* terminal (17) from the *Power L* terminal (14).



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

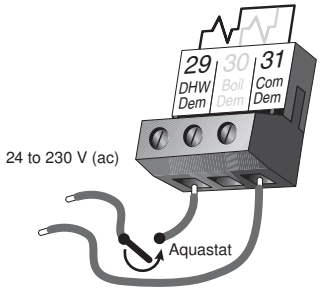
Caution: The same power supply must be used to power the Boiler Demand, DHW Demand and the Setpoint Demand circuits since they share the *Com Dem* terminal.



DHW Demand

To generate a *DHW Demand*, a voltage between 24 V (ac) and 230 V (ac) must be applied across the *DHW Dem* and *Com Dem* terminals (29 and 31).

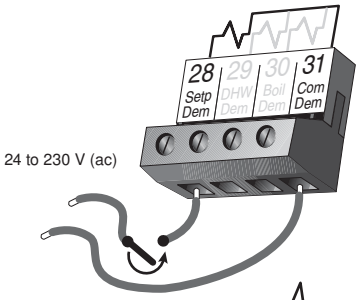
Caution: The same power supply must be used to power the Boiler Demand, DHW Demand and the Setpoint Demand circuits since they share the *Com Dem* terminal.



Setpoint Demand

To generate a *Setpoint Demand*, a voltage between 24 V (ac) and 230 V (ac) must be applied across the *Setp Dem* and *Com Dem* terminals (28 and 31).

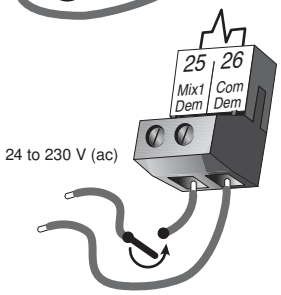
Caution: The same power supply must be used to power the Boiler Demand, DHW Demand and the Setpoint Demand circuits since they share the *Com Dem* terminal.



Mix 1 Demand

To generate a *Mix 1 Demand*, a voltage between 24 V (ac) and 230 V (ac) must be applied across the *Mix 1 Dem* and the *Com Dem* terminals (25 and 26).

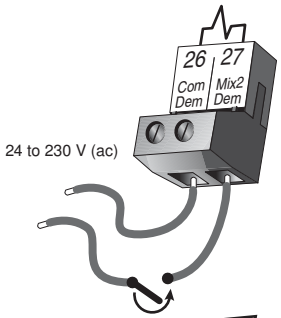
Caution: The same power supply must be used to power the Mix 1 Demand and the Mix 2 Demand circuits since they both share the *Com Dem* terminal.



Mix 2 Demand

To generate a *Mix 2 Demand*, a voltage between 24 V (ac) and 230 V (ac) must be applied across the *Mix 2 Dem* and the *Com Dem* terminals (27 and 26).

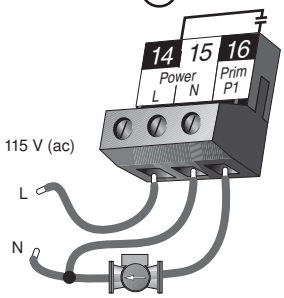
Caution: The same power supply must be used to power the Mix 1 Demand and the Mix 2 Demand circuits since they both share the *Com Dem* terminal.



⚠ *Output Connections*

Primary Pump Contact (Prim P1)

The *Prim P1* output terminal (16) is a powered output. When the relay in the control closes, 115 V (ac) is provided to the *Prim P1* terminal (16) from the *Power L* terminal (14). To operate the primary pump, connect one side of the primary pump circuit to terminal 16 and the second side of the pump circuit to the neutral (*Power N*) side of the 115 V (ac) power supply.



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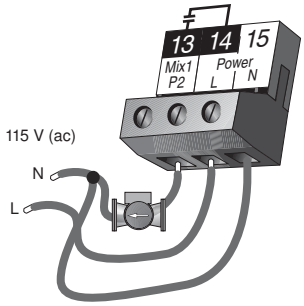
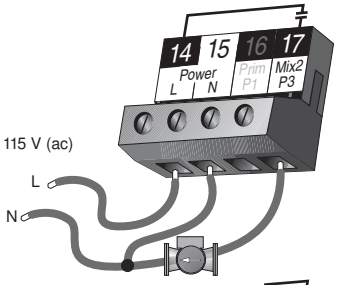
Mix 1 System Pump (Mix1 P2)

The *Mix1 P2* output terminal (13) is a powered output. When the relay in the control closes, 115 V (ac) is provided to the *Mix1 P2* terminal (13) from the *Power L* terminal (14). To operate the mix 1 pump, connect one side of the mix 1 pump circuit to terminal 13 and the second side of the pump circuit to the neutral (*Power N*) side of the 115 V (ac) power supply.



Mix 2 System Pump (Mix2 P3)

The *Mix2 P3* output terminal (17) is a powered output. When the relay in the control closes, 115 V (ac) is provided to the *Mix2 P3* terminal (17) from the *Power L* terminal (14). To operate the mix 2 pump, connect one side of the mix 2 pump circuit to terminal 17 and the second side of the pump circuit to the neutral (*Power N*) side of the 115 V (ac) power supply.

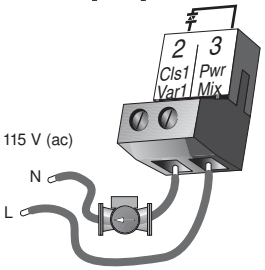


Variable Speed Injection Pump

The control can vary the speed of a permanent capacitor, impedance protected or equivalent pump motor that has a locked rotor current of less than 2.4 A. Most small wet rotor circulators are suitable as described in Essay E 021. The control has an internal overload fuse that is rated at 2.5 A 250 V (ac) for each variable speed output. Contact your tekmar sales representative for details on the repair procedures if the fuse(s) is blown.

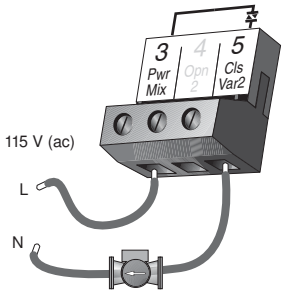
Mix 1

Connect one of the wires from the variable speed injection pump to the *Cls Var1* terminal (2) on the control. Connect the *Pwr Mix* terminal (3) to the live (L) side of the 115 V (ac) power source. The other wire on the variable speed injection pump must be connected to the neutral (N) side of the 115 V (ac) power supply.



Mix 2

Connect one of the wires from the variable speed injection pump to the *Cls Var2* terminal (5) on the control. Connect the *Pwr Mix* terminal (3) to the live (L) side of the 115 V (ac) power source. The other wire on the variable speed injection pump must be connected to the neutral (N) side of the 115 V (ac) power supply.

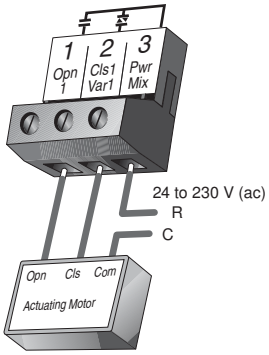


Mixing Valve Actuator

Mix 1

Connect one side of the 24 V (ac) power to the *Pwr Mix* terminal (3) on the control. The output relay *Opn 1* (1) is then connected to the open terminal of the actuating motor and the output relay *Cls Var1* (2) is connected to the close terminal of the actuating motor. Connect the second side of the 24 V (ac) circuit to the common terminal of the actuating motor.

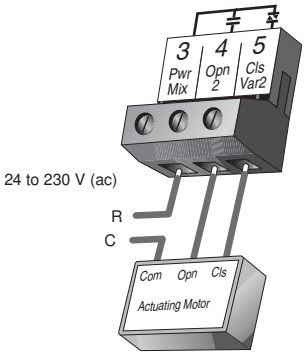
Caution: The same 24 V (ac) transformer must be used to power the mix 1 and the mix 2 floating action actuating motors.



Mix 2

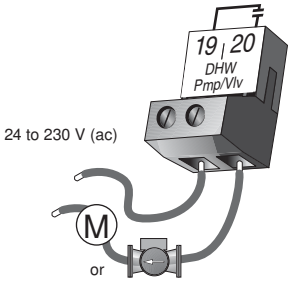
Connect one side of the 24 V (ac) power to the *Pwr Mix* terminal (3) on the control. The output relay *Opn* (4) is then connected to the open terminal of the actuating motor and the output relay *Cls Var2* (5) is connected to the close terminal of the actuating motor. Connect the second side of the 24 V (ac) circuit to the common terminal of the actuating motor.

Caution: The same 24 V (ac) transformer must be used to power the mix 1 and the mix 2 floating action actuating motors.



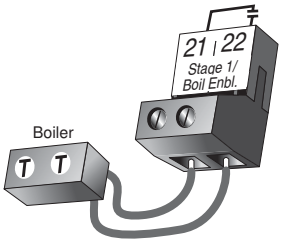
DHW Pmp / Vlv Contact

The *DHW Pmp / Vlv* terminals (19 and 20) 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).



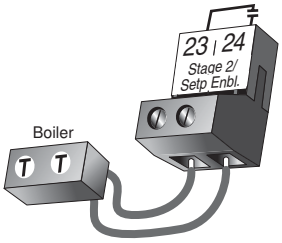
Stage 1 / Boil Enable Contact

The *Stage 1 / Boil Enbl.* 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 either make or break power to a boiler or a Lo fire stage on a single boiler. Since this is an isolated contact, it may switch a voltage between 24 V (ac) and 230 V (ac).



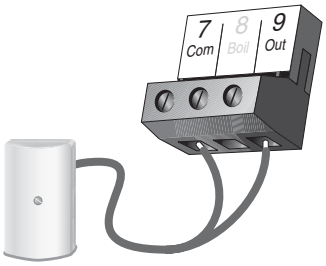
Stage 2 / Setp Enable Contact

The *Stage 2 / Setp Enbl.* terminal (23 and 24) 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 or a Hi fire stage on a single boiler. In the case where the boiler sensor is connected to the return or there is no boiler sensor installed, these terminals are used to provide a setpoint demand to the boiler's control if applicable. Since this is an isolated contact, it may switch a voltage between 24 V (ac) and 230 V (ac).



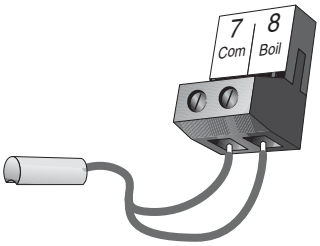
⚠ *Sensor and Unpowered Input Connections*

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



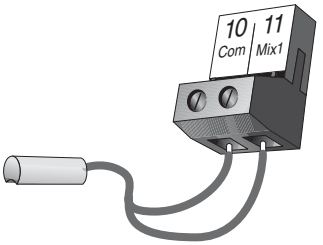
Outdoor Sensor

Connect the two wires from the Outdoor Sensor 070 to the *Com* and *Out* terminals (7 and 9). The outdoor sensor is used by the control to measure the outdoor air temperature.



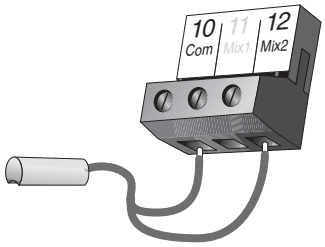
Boiler Sensor

Connect the two wires from the Boiler Sensor 082 to the *Com* and *Boil* terminals (7 and 8). When the *Return / Supply* DIP switch is set to *Supply*, the boiler sensor is used by the control to measure the boiler supply water temperature. When the *Return / Supply* DIP switch is set to *Return*, the boiler sensor is used by the control to measure boiler return water temperature to provide boiler return protection.



Mix1 Sensor

Connect the two wires from the Mix1 Sensor 082 to the *Com* and *Mix1* terminals (10 and 11). The Mix1 sensor is used by the control to measure the mix 1 system temperature.



Mix2 Sensor

Connect the two wires from the Mix2 Sensor 082 to the *Com* and *Mix2* terminals (10 and 12). The Mix2 sensor is used by the control to measure the mix 2 system temperature.

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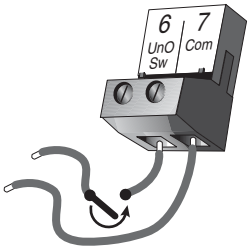
Unoccupied Switch

If an external timer (tekmar Timer 032) or switch is used, connect the two wires from the external switch to the *UnO Sw* and *Com* terminals (6 and 7). When these two terminals are shorted together, the control registers an unoccupied (*UNOCC*) signal.



STEP FIVE — TESTING THE WIRING

⚠ *General*

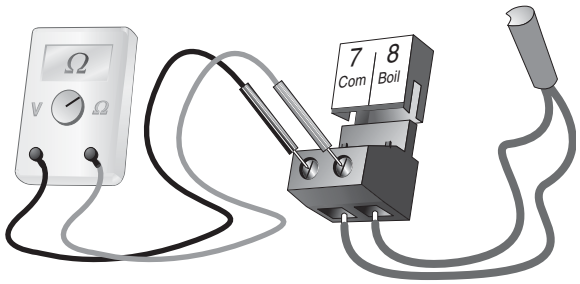
Each terminal block must be unplugged from its header on the control before power is applied for testing. To remove the terminal block, pull straight down from the control.

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

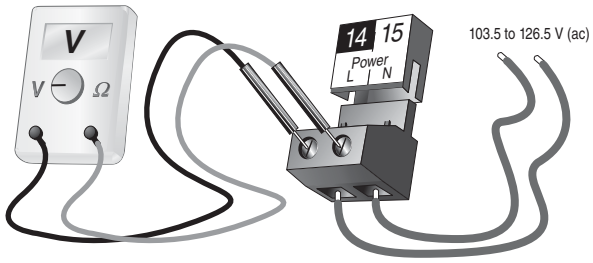
⚠ *Test the Sensors*

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*

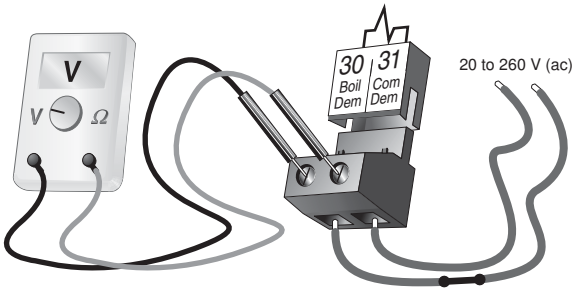
Make sure exposed wires and bare terminals are not in contact with other wires or grounded surfaces. Turn on the power and measure the voltage between the *Power L* and *Power N* terminals (14 and 15) using an AC voltmeter, the reading should be between 103.5 and 126.5 V (ac).



⚠ *Test the Powered Inputs*

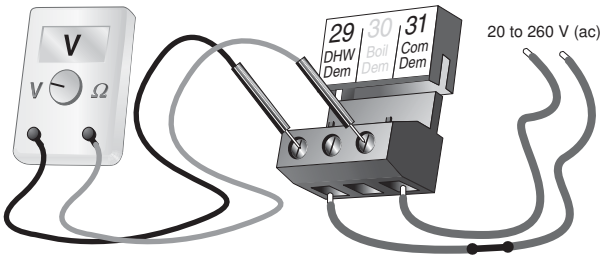
Boiler Demand

If a boiler demand is used, measure the voltage between the *Boil Dem* and *Com Dem* terminals (30 and 31). 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 (29 and 31). 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.

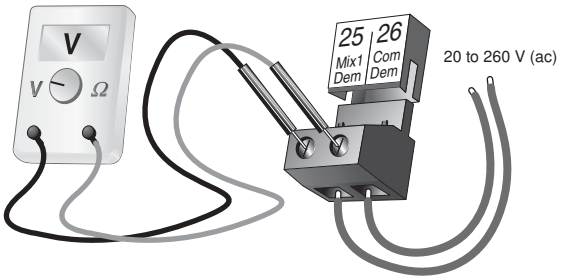


Setpoint Demand

If a setpoint demand is used, measure the voltage between the *Setp Dem* and the *Com Dem* terminals (28 and 31). When the setpoint demand device calls for heat, 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.

Mix 1 Demand

If a mix 1 demand is used, measure the voltage between the *Mix1 Dem* and the *Com Dem* terminals (25 and 26). When the mix 1 demand device calls for heat, between 20 and 260 V (ac) should be measured at the terminals. When the mix 1 demand device is off, less than 5 V (ac) should be measured.



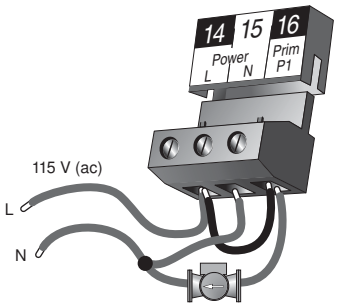
Mix 2 Demand

If a mix 2 demand is used, measure the voltage between the *Mix2 Dem* and the *Com Dem* terminals (27 and 26). When the mix 2 demand device calls for heat, between 20 and 260 V (ac) should be measured at the terminals. When the mix 2 demand device is off, less than 5 V (ac) should be measured.

⚠ *Test the Outputs*

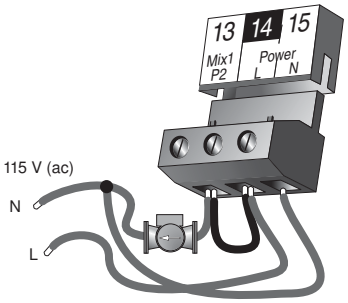
Primary Pump (Prim P1)

If a primary pump is connected to the *Prim P1* terminal (16), make sure that power to the terminal block is off and install a jumper between the *Power L* and *Prim P1* terminals (14 and 16). When power is applied to the *Power L* and *Power N* terminals (14 and 15), 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.



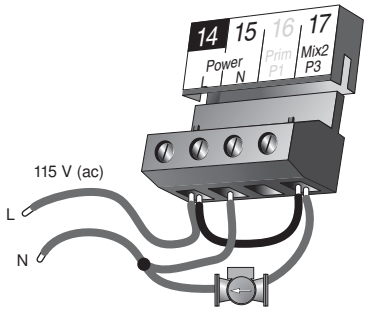
Mix 1 Pump (Mix 1 P2)

If a mix 1 pump is connected to the *Mix1 P2* terminal (13), make sure that power to the terminal block is off and install a jumper between the *Power L* and *Mix1 P2* terminals (14 and 13). When power is applied to the *Power L* and *Power N* terminals (14 and 15), the mix 1 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.



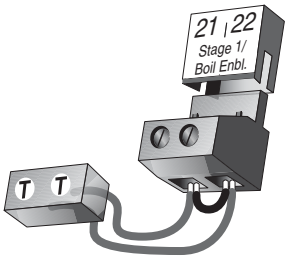
Mix 2 Pump (Mix 2 P3)

If a mix 2 pump is connected to the *Mix2 P3* terminal (17), make sure that power to the terminal block is off and install a jumper between the *Power L* and *Mix2 P3* terminals (14 and 17). When power is applied to the *Power L* and *Power N* terminals (14 and 15), the mix 2 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.



Stage 1 / Boil Enable Contact

If an on / off boiler or a Lo fire boiler stage is connected to the *Stage 1 / Boil Enbl.* terminals (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*) is running). If the boiler operates properly, disconnect the power and remove the jumper.



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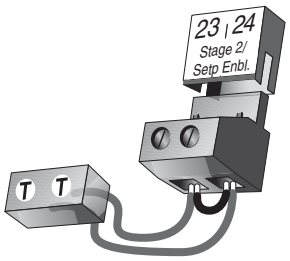
Stage 2 / Setp Enable Contact

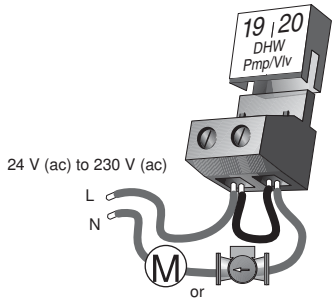


If an on / off boiler is connected to the *Stage 2 / Setp Enbl.* terminals (23 and 24), make sure power to the boiler circuit is off, and install a jumper between the terminals. When the boiler circuit is powered up, the boiler should fire. If the boiler does not turn on, refer to any installation or 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 (*P2*) is running). If the boiler operates properly, disconnect the power and remove the jumper.

To test the second stage of a two stage boiler, the Lo fire must be firing before the Hi fire will operate. Once the Low stage is firing, test the Hi fire stage in the same way as an on / off boiler.

When the Boiler Sensor *Return / Supply* DIP switch is set to *Return*, the setpoint enable contact can be used to provide a setpoint demand to the boiler's internal control if applicable.

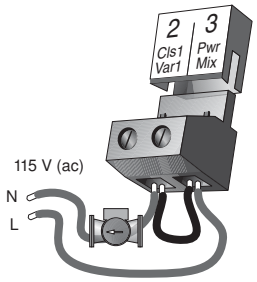
DHW Pump Or Valve (DHW Pmp / Vlv)



If a DHW pump or DHW valve is connected to the *DHW Pmp / Vlv* terminals (19 and 20), 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 the devices. If the DHW pump or valve operates correctly, disconnect the power and remove the jumper.

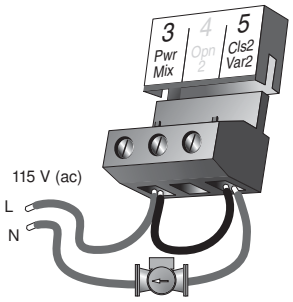
⚠ Variable Speed Injection Pump

Mix 1



If a variable speed injection pump circuit is connected to the *Cls Var1* terminals (2), make sure the power to the terminal block is off and install a jumper between the *Pwr Mix* and *Cls Var1* terminals (3 and 2). When the variable speed pump circuit is powered up, the variable speed pump should operate at full speed. If the pump does not operate, check the wiring between the terminal block and the 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.

Mix 2



If a variable speed injection pump circuit is connected to the *Cls Var2* terminals (5), make sure the power to the terminal block is off and install a jumper between the *Pwr Mix* and *Cls Var2* terminals (3 and 5). When the variable speed pump circuit is powered up, the variable speed pump should operate at full speed. If the pump does not operate, check the wiring between the terminal block and the 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.

⚠ Mixing Valve Actuator

Mix 1

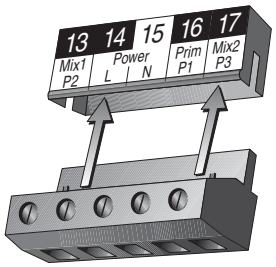
If a floating action actuating motor circuit is connected to the *Pwr Mix*, *Opn* and *Cls Var1* terminals (3, 1 and 2), make sure power to the motor circuit is off and install a jumper between the *Pwr Mix* and *Opn* terminals (3 and 1). When the circuit is powered up, the actuator should move in the opening direction. If it does not, check the wiring between the terminals and the actuating motor. Refer to any installation or troubleshooting information supplied with the motor. If the motor closes instead of opening, the wiring of the actuating motor must be reversed. If the valve opens correctly, turn off the power to the circuit and remove the jumper. Install a jumper between the *Pwr Mix* and *Cls Var1* terminals (3 and 2). When the circuit is powered up, the actuator should move in the closing direction. If it does not, check the wiring between the terminals and the actuating motor. Refer to any installation or troubleshooting information supplied with the motor. If the motor closes correctly, turn off the power to the circuit and remove the jumper.

Mix 2

If a floating action actuating motor circuit is connected to the *Pwr Mix*, *Opn* and *Cls Var2* terminals (3, 4 and 5), make sure power to the motor circuit is off and install a jumper between the *Pwr Mix* and *Opn* terminals (3 and 4). When the circuit is powered up, the actuator should move in the opening direction. If it does not, check the wiring between the terminals and the actuating motor. Refer to any installation or troubleshooting information supplied with the motor. If the motor closes instead of opening, the wiring of the actuating motor must be reversed. If the valve opens correctly, turn off the power to the circuit and remove the jumper. Install a jumper between the *Pwr Mix* and *Cls Var2* terminals (3 and 5). When the circuit is powered up, the actuator should move in the closing direction. If it does not, check the wiring between the terminals and the actuating motor. Refer to any installation or troubleshooting information supplied with the motor. If the motor closes correctly, turn off the power to the circuit 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.

Cleaning The Control

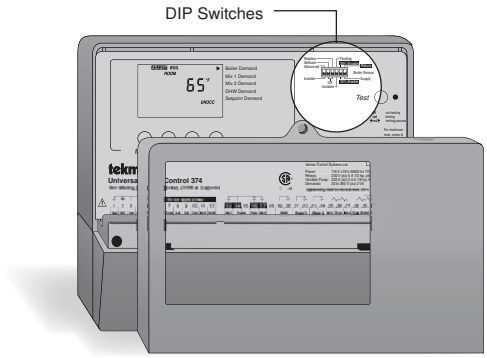
The control's exterior can be cleaned using a damp cloth. Moisten the cloth with water and wring out prior to wiping the control. Do not use solvents or cleaning solutions.

Dip Switch Settings

GENERAL

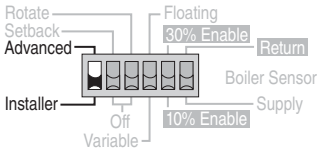
The DIP switch settings on the control are very important and should be set to the appropriate settings prior to making any adjustments to the control through the User Interface. The DIP switch settings change the items that are available to be viewed and / or adjusted in the User Interface.

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.



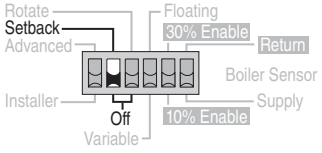
Advanced / Installer

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.



Setback / Off

The *Setback / Off* DIP switch selects whether or not the internal setback timer and schedule is to be used. If the switch is set to *Setback*, the timer must be set and the setback schedule must be entered to provide setback events.



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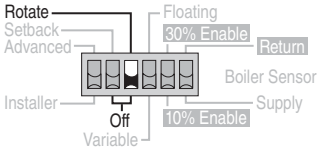
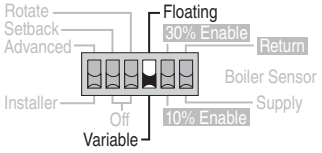
Rotate / Off

The *Rotate / Off* DIP switch selects whether or not the control is to provide Equal Run Time Rotation of the boiler stages. If the switch is set to *Rotate*, the stages will be rotated accordingly. If the switch is set to *Off*, the firing sequence is fixed starting with Stage 1 then Stage 2.



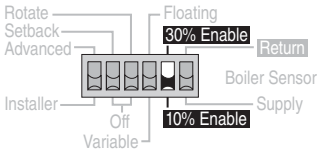
Floating / Variable

The *Floating / Variable* DIP switch selects whether the control is to operate the mixing devices using floating action actuating motors or variable speed injection pumps.



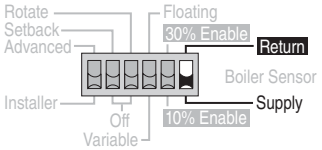
30% Enable / 10% Enable

The *30% Enable / 10% Enable* DIP switch is only active when the *Boiler Sensor Return / Supply* DIP switch is set to *Return*. When set to *30% Enable*, the Boiler Enable terminals (21 and 22) close when the mixing device reaches 30% operation. When set to *10% Enable*, the Boiler Enable terminals (21 and 22) close when the mixing device reaches 10% operation.



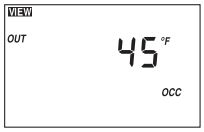
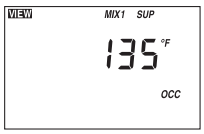
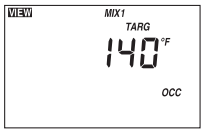
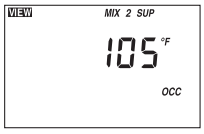
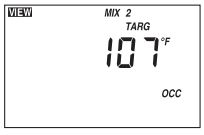
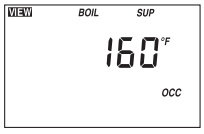
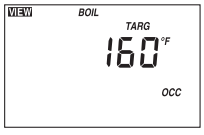
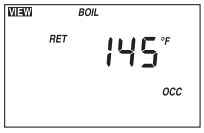
Boiler Sensor Return / Supply

The *Boiler Sensor Return / Supply* DIP switch selects the installation location of the boiler sensor. When the boiler sensor is installed on the supply side of the boiler loop, the DIP switch must be set to *Supply*. The boiler's aquastat should be set at least 20°F (11°C) higher than the required design boiler water temperature.



For systems where the control provides a heat demand to an external boiler control, the boiler sensor should be installed on the return side of the boiler loop and the *Boiler Sensor Return / Supply* DIP switch must be set to *Return*. The control only enables the boiler when the output of the mixing device exceeds the *30% Enable / 10% Enable* DIP switch setting. The Boiler contact is controlled as described in section B. The boiler's operating temperature is controlled by its aquastat, or an external boiler reset control.

View Menu (1 of 1)

Display	Section	Installer	Adv	Description	Range
		●	●	**Outdoor** Current outdoor air temperature as measured by the outdoor sensor. This item is only available when Mix 1 Mode is set to 1, Mix 2 Mode is set to 1 or the Boiler sensor Return / Supply DIP switch is set to Supply.	-67 to 149°F (-55 to 65°C)
	E1	●	●	**Mix 1 Supply** Current mix 1 supply water temperature as measured by the mix 1 supply sensor. This item is only available when Mix 1 Mode is set to 1.	14 to 266°F (-10 to 130°C)
	E1		●	**Mix 1 Target** Mix 1 target temperature is the temperature the control is currently trying to maintain at the mix 1 supply sensor. This item is only available when Mix 1 Mode is set to 1.	_ _ _, 14 to 266°F (_ _ _, -10 to 130°C)
	E1	●	●	**Mix 2 Supply** Current mix 2 supply water temperature as measured by the mix 2 supply sensor. This item is only available when Mix 2 Mode is set to 1 or 2.	14 to 266°F (-10 to 130°C)
	E1		●	**Mix 2 Target** Mix 2 target temperature is the temperature the control is currently trying to maintain at the mix 2 supply sensor. This item is only available when Mix 2 Mode is set to 1 or 2.	_ _ _, 14 to 266°F (_ _ _, -10 to 130°C)
	B1	●	●	**Boiler Supply** Current boiler supply water temperature as measured by the boiler sensor. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	14 to 266°F (-10 to 130°C)
	B1		●	**Boiler Target** Boiler target temperature is the temperature the control is currently trying to maintain at the boiler supply sensor. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	_ _ _, 14 to 266°F (_ _ _, -10 to 130°C)
	B2	●	●	**Boiler Return** Current boiler return water temperature as measured by the boiler sensor. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Return*.	14 to 266°F (-10 to 130°C)

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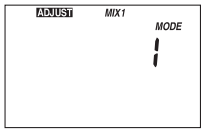
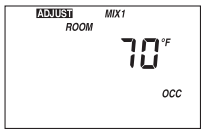
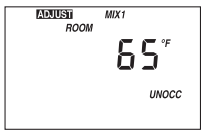
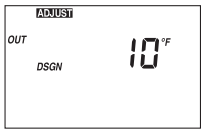
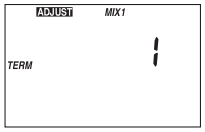
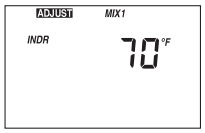
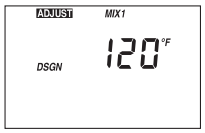
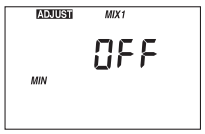
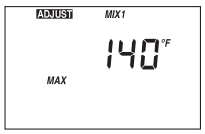
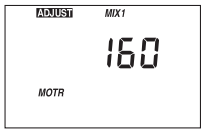
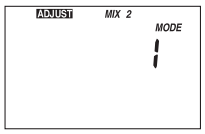
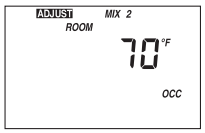
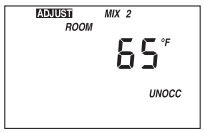
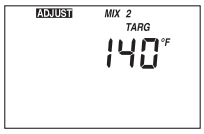
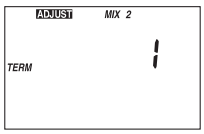
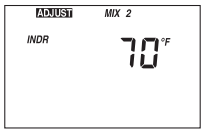
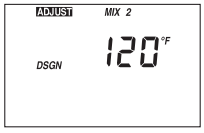
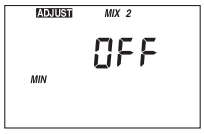
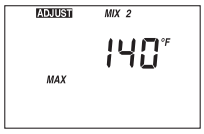
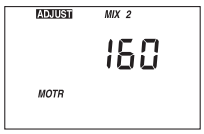
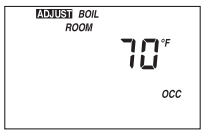
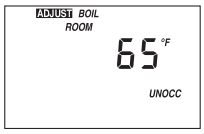
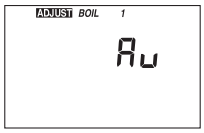
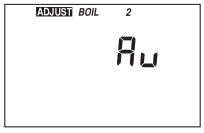
Adjust Menu (1 of 4)

Display	Section	Installer	Adv	Description	Range	Actual Setting
	E1		●	**Mix 1 Mode** Selects the mode of operation for mixing device 1.	**0** (off) **1** (reset) Default = **1**	
	E1	●	●	**Mix 1 Room Occupied** The desired room air temperature during the occupied period for mix 1 zones. This item is only available when Mix 1 Mode is set to 1.	35 to 100°F (2 to 38°C) Default = 70°F (21°C)	
	E1	●	●	**Mix 1 Room Unoccupied** The desired room air temperature during the unoccupied period for mix 1 zones. This item is only available when the *Setback / Off* DIP switch is set to *Setback* and when Mix 1 Mode is set to 1.	35 to 100°F (2 to 38°C, OFF) Default = 65°F (18°C)	
	A	●	●	**Outdoor Design** The design outdoor air temperature used in the heat loss calculations for the heating system. This item is only available when Mix 1 Mode is set to 1, Mix 2 Mode is set to 1 or the Boiler sensor Return / Supply DIP switch is set to Supply	-60 to 32°F (-51 to 0°C) Default = 10°F (-12°C)	
	A	●	●	**Mix 1 Terminal Unit** The type of terminal units that are being used in mix 1 zones. This item is only available when Mix 1 Mode is set to 1.	**1** (HRF1), **2** (HRF2), **3** (COIL), **4** (CONV), **5** (RAD), **6** (BASE) Default = **1**	
	E1		●	**Mix 1 Indoor** The design indoor air temperature used in the heat loss calculation for mix 1 zones. This item is only available when Mix 1 Mode is set to 1.	35 to 100°F (2 to 38°C, OFF) Default = 70°F (21°C)	
	E1		●	**Mix 1 Design** The design supply water temperature used in the heat loss calculations for mix 1 zones. This item is only available when Mix 1 Mode is set to 1.	70 to 220°F (21 to 104°C, OFF)	
	E1		●	**Mix 1 Minimum** The minimum allowed mix 1 target temperature. This item is only available when Mix 1 Mode is set to 1.	OFF, 35 to 150°F (OFF, 2 to 66°C)	
	E1		●	**Mix 1 Maximum** The maximum allowed mix 1 target temperature. This item is only available when Mix 1 Mode is set to 1.	80 to 220°F (27 to 104°C)	
	E1		●	**Mix 1 Motor** The time that the actuating motor requires to operate from fully closed to fully open. This item is only available when the *Floating / Variable* DIP switch is set to *Floating* and Mix 1 Mode is set to 1.	30 to 230 seconds Default = 160 seconds	
	E1		●	**Mix 2 Mode** Selects the mode of operation for mixing device 2.	**0** (off) **1** (reset) **2** (setpoint) Default = **1**	
	E1	●	●	**Mix 2 Room Occupied** The desired room air temperature during the occupied period for mix 2 zones. This item is only available when Mix 2 Mode is set to 1.	35 to 100°F (2 to 38°C, OFF) Default = 70°F (21°C)	

Adjust Menu (2 of 4)

Display	Section	Installer	Adv	Description	Range	Actual Setting
	E1	●	●	**Mix 2 Room Unoccupied** The desired room air temperature during the unoccupied period for mix 2 zones. This item is only available when the *Setback / Off* DIP switch is set to *Setback* and when Mix 2 Mode is set to 1.	35 to 100°F (2 to 38°C) Default = 65°F (18°C)	
	E1	●	●	**Mix 2 Target** The mix 2 setpoint temperature. This item is only available when Mix 2 Mode is set to 2.	60 to 200°F (16 to 93°C) Default = 140°F (60°C)	
	A	●	●	**Mix 2 Terminal Unit** The type of terminal units that are being used in mix 2 zones. This item is only available when Mix 2 Mode is set to 1.	**1** (HRF1), **2** (HRF2), **3** (COIL), **4** (CONV), **5** (RAD), **6** (BASE) Default = **1**	
	E1		●	**Mix 2 Indoor** The design indoor air temperature used in the heat loss calculation for mix 2 zones. This item is only available when Mix 2 Mode is set to 1.	35 to 100°F (2 to 38°C) Default = 70°F (21°C)	
	E1		●	**Mix 2 Design** The design supply water temperature used in the heat loss calculations for mix 2 zones. This item is only available when Mix 2 Mode is set to 1.	70 to 220°F (21 to 104°C)	
	E1		●	**Mix 2 Minimum** The minimum allowed mix 2 target temperature. This item is only available when Mix 2 Mode is set to 1.	OFF, 35 to 150°F (OFF, 2 to 66°C)	
	E1		●	**Mix 2 Maximum** The maximum allowed mix 2 target temperature. This item is only available when Mix 2 Mode is set to 1.	80 to 220°F (27 to 104°C)	
	E1		●	**Mix 2 Motor** The time that the actuating motor requires to operate from fully closed to fully open. This item is only available when the *Floating / Variable* DIP switch is set to *Floating* and Mix 2 Mode is set to 1 or 2.	30 to 230 seconds Default = 160 seconds	
	B1	●	●	**Boiler Room Occupied** The desired room air temperature during the occupied period for boiler zones. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	35 to 100°F (2 to 38°C) Default = 70°F (21°C)	
	B1	●	●	**Boiler Room Unoccupied** The desired room air temperature during the unoccupied period for boiler zones. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply* and when the *Setback / Off* DIP switch is set to *Setback*.	35 to 100°F (2 to 38°C) Default = 65°F (18°C)	
	B1	●	●	**Boiler 1** Selects whether or not boiler 1 is operational. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	Au (automatic), OFF Default = Au	
	B1	●	●	**Boiler 2** Selects whether or not boiler 2 is operational. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	Au (automatic), OFF Default = Au	

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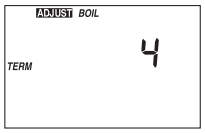
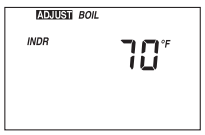
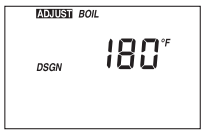
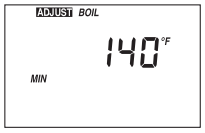
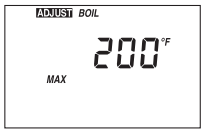
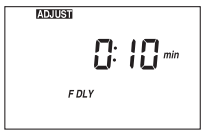
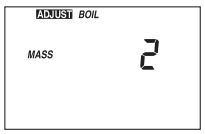
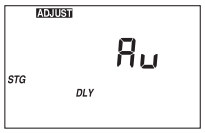
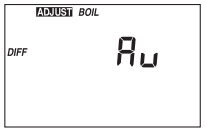
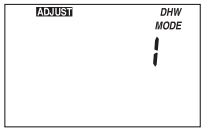
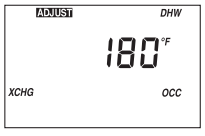
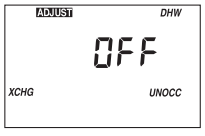
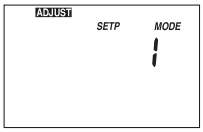
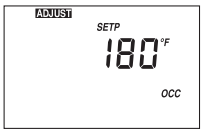
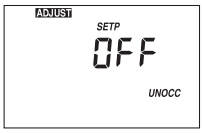
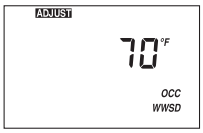
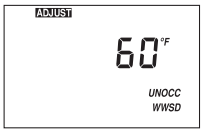
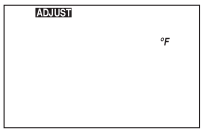
Adjust Menu (3 of 4)

Display	Section	Installer	Adv	Description	Range	Actual Setting
	A	●	●	**Boiler Terminal Unit** The type of terminal units that are being used in boiler zones. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	**1** (HRF1), **2** (HRF2), **3** (COIL), **4** (CONV), **5** (RAD), **6** (BASE) Default = **4**	
	B1		●	**Boiler Indoor** The design indoor air temperature used in the heat loss calculation for the boiler zones. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	35 to 100°F (2 to 38°C) Default = 70°F (21°C)	
	B1		●	**Boiler Design** The design supply water temperature used in the heat loss calculations for the heating system. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	70 to 220°F (21 to 104°C)	
	B1		●	**Boiler Minimum** The minimum allowed boiler target temperature and boiler protection temperature. Check the boiler(s) manufacturer's manual for recommend supply water temperatures.	OFF, 80 to 180°F (OFF, 27 to 82°C)	
	B1		●	**Boiler Maximum** The maximum allowed boiler target temperature. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	120 to 225°F (49 to 107°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. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	0:00 to 3:00 minutes (1 sec increment) Default = 0:10 min	
	B1		●	**Boiler Mass** The thermal mass characteristics of the boilers that are being used. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	**1** (Lo), **2** (Med), **3** (Hi) Default = **2**	
	B1		●	**Stage Delay** The minimum time delay between the operation of stages. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	Au, 0:30 to 20:00 minutes (5 sec increments) Default = Au	
	B1		●	**Boiler Differential** The temperature differential that the control is to use when it is operating the boiler(s). This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	Au, 2 to 42°F (Au, 1 to 23°C) Default = Au	
	C1		●	**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**	
	C1		●	**DHW Exchange Occupied** The minimum boiler temperature to the DHW heat exchanger during the Occupied period. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply.*	OFF, 100 to 220°F (OFF, 38 to 104°C) Default = 180°F (82°C)	
	C1		●	**DHW Exchange Unoccupied** Selects whether the control should respond to DHW demands during the Unoccupied period. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply* and the *Setback / Off* DIP switch is set to *Setback*.	OFF, On Default = OFF	

Adjust Menu (4 of 4)

Display	Section	Installer	Adv	Description	Range	Actual Setting
	D1		●	**Setpoint Mode** Selects the Setpoint mode of operation.	**1** (parallel, no priority), **2** (parallel, priority), **3** (primary pump) Default = **1**	
	D1		●	**Setpoint Occupied** The minimum target supply temperature when a setpoint demand is present during the Occupied period. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	OFF, 60 to 220°F (OFF, 16 to 104°C) Default = 180°F (82°C)	
	D1		●	**Setpoint Unoccupied** Selects whether or not a setpoint demand will be responded to during the Unoccupied period. This item is only available when the *Boiler Sensor Return / Supply* DIP switch is set to *Supply* and when the *Setback / Off* DIP switch is set to *Setback*.	OFF, On Default = OFF	
	A	●	●	**WWSD Occupied** The system's warm weather shut down temperature during the Occupied period. This item is only available when Mix 1 Mode is set to 1 and / or Mix 2 Mode is set to 1 and / or the *Boiler Sensor Return / Supply* DIP switch is set to *Supply*.	35 to 100°F, OFF (2 to 38°C, OFF) Default = 70°F (21°C)	
	A		●	**WWSD Unoccupied** The system's warm weather shut down temperature during the Unoccupied period. This item is only available when Mix 1 Mode is set to 1 or Mix 2 Mode is set to 1 and / or the *Boiler Sensor Return / Supply* DIP switch is set to *Supply* and the *Setback / Off* DIP switch is set to *Setback*.	35 to 100°F, OFF (2 to 38°C, OFF) Default = 60°F (21°C)	
		●	●	The units of measure that all of the temperatures are to be displayed in by the control.	°F, °C Default = °F	

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Time Menu (1 of 1)

Note: The *Setback / Off* DIP switch must be in the *Setback* position in order to have access to the TIME menu.

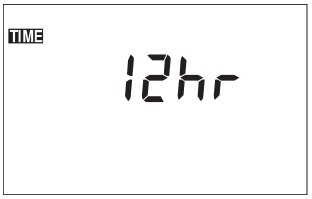
SETTING THE TIME

Step One
Press and release the ***Menu*** button until the TIME menu is reached.

Step Two
Press the ***Item*** button. While the minutes are flashing, use the ▲ or ▼ button to set the proper minutes.

Step Three
Press and release the ***Item*** button. While the hours are flashing, use the ▲ or ▼ button to set the proper hour.

Step Four
Press and release the ***Item*** button. While the day is flashing, use the ▲ or ▼ button to set the proper day.



Step Five (Only available in advanced access level.)
Press and release the ***Item*** button. Use the ▲ or ▼ button to select between 12 and 24 hour time.

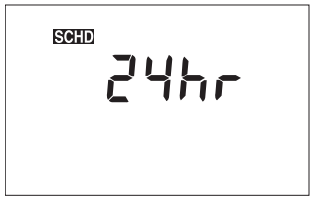
Schedule Menu (1 of 1)

Note: The Setback / Off DIP switch must be in the setback position in order to have access to the SCHEDULE menu.

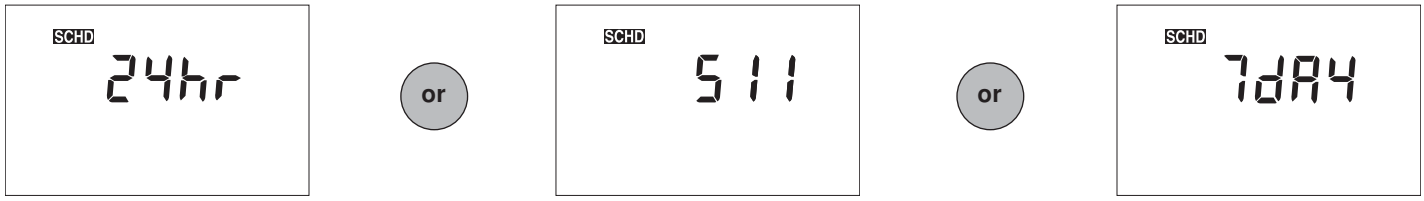
SETTING THE SCHEDULE

A schedule allows the timer to automatically change between two preset events based on the time of day. The schedule divides the day into Occupied and UnOccupied periods. To set the time of day at which each period is to begin, use the following procedure.

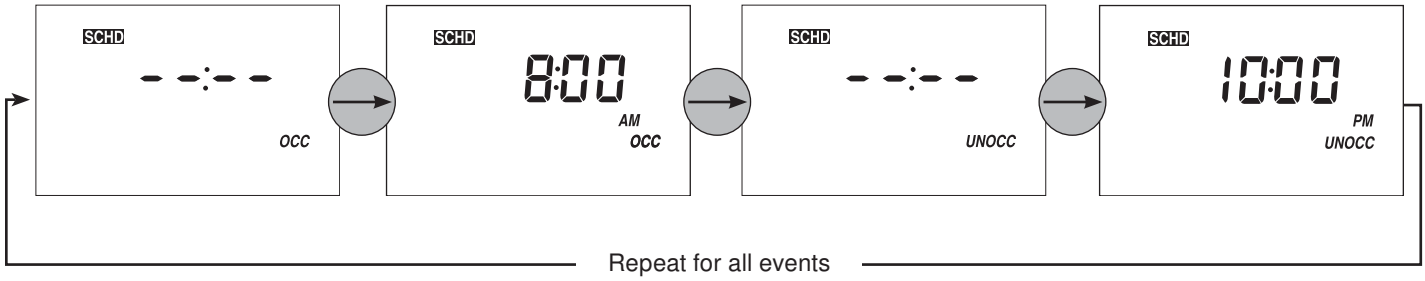
Step One
Press and release the ***Menu*** button until the SCHD (Schedule) menu is displayed



Step Two (Only available in advanced access level.)
Use the ▲ or ▼ button to select a 24 hour, 5-1-1 day, or a 7 day schedule..



Step Three
Press and release the ***Item*** button. Use the ▲ or ▼ button to set the event's beginning time. If the event is not required, select the "– – : – –" time. This time is found between 11:50 PM and 12: 00 AM. Record the event time in the schedule table found at the bottom of this page for future. Press the ***Item*** button to advance to the next setting.



TWO EVENT SCHEDULE

Event	24 hr Schedule	Sat	Sun	Mon	Tue	Wed	Thu	Fri
Occ								
UnOcc								

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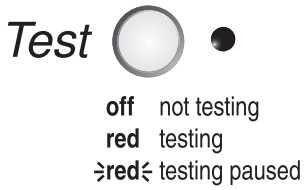
Testing the Control

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 mix 1 device ramps up to 100% or full open for 10 seconds.

Step 2 – The mix 1 device ramps down to 0% or closes fully for 10 seconds.

Step 3 – The mix 1 pump turns on for 10 seconds then shuts off.

Step 4 – The mix 2 device ramps up to 100% or opens fully for 10 seconds.

Step 5 – The mix 2 device ramps down to 0% or closes fully for 10 seconds.

Step 6 – The mix 2 pump turns on for 10 seconds then shuts off.

Step 7 – The primary pump turns on and remains on and remains on.

Step 8 – Boiler 1 fires if set to automatic.

Step 9 – Boiler 2 fires if set to automatic.

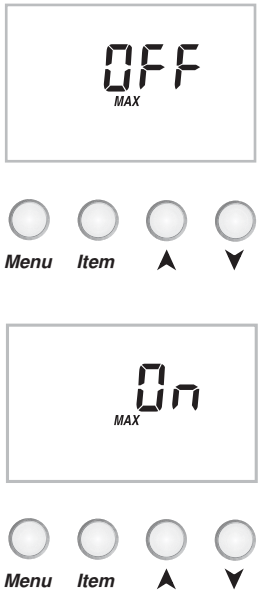
Step 10 – Both Boilers are shut off.
- If DHW MODE is set to 1 or 2, the primary pump is shut off and the DHW Pmp/Vlv contact is closed.
- If DHW MODE is set to 3 or 4, the primary pump stays on and the DHW Pmp/Vlv contact is closed.

Step 11 – 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.



Troubleshooting

When troubleshooting any heating system, it is always a good idea to establish a set routine to follow. By following a consistent routine, many hours of potential headaches can be avoided. Below is an example of a sequence that can be used when diagnosing or troubleshooting problems in a hydronic heating system.

Establish the Problem

Establish the problem. Get as much information from the customer as possible about the problem. Is there too much heat, not enough heat, or no heat? Is the problem only in one particular zone or area of the building or does the problem affect the entire system? Is this a consistent problem or only intermittent? How long has the problem existed for? This information is critical in correctly diagnosing the problem.

Understanding the Sequence of Operation

Understand the sequence of operation of the system. If a particular zone is not receiving enough heat, which pumps or valves in the system must operate in order to deliver heat to the affected zone? If the zone is receiving too much heat, which pumps, valves or check valves must operate in order to stop the delivery of heat?

Use the Test Routine

Press the ***Test*** button on the control and follow the control through the test sequence as described in the Testing section. Pause the control as necessary to ensure that the correct device is operating as it should.

Sketch the Piping in the System

Sketch the piping of the system. This is a relatively simple step that tends to be overlooked, however it can often save hours of time in troubleshooting a system. Note flow directions in the system paying close attention to the location of pumps, check valves, pressure bypass valves and mixing valves. Ensure correct flow direction on all pumps. This is also a very useful step if additional assistance is required.

Document the Control

Document the control for future reference. Before making any adjustments to the control, note down all of the items that the control is currently displaying. This includes items such as error messages, current temperatures and settings, and which devices should be operating as indicated by the LCD. This information is an essential step if additional assistance is required to diagnose the problem.

Isolate the Problem

Isolate the problem between the control and the system. Now that the sequence of operation is known and the system is sketched, is the control operating the proper pumps and valves at the correct times? Is the control receiving the correct signals from the system as to when it should be operating? Are the proper items selected in the menus of the control for the device that is to be operated?

Test the Contacts, Voltages and Sensors

Test the contacts, voltages and sensors. Using a multimeter, ensure that the control is receiving adequate voltage to the power terminals and the demand terminals as noted in the technical data. Use the multimeter to determine if the internal contacts on the control are opening and closing correctly. Follow the instructions in the Testing the Wiring section to simulate closed contacts on the terminal blocks as required. Test the sensors and their wiring as described in the sensor Data Brochures.

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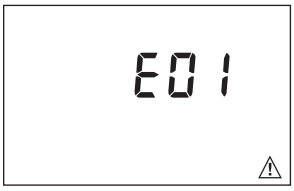
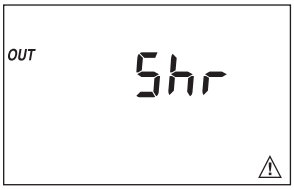
Error Messages (1 of 2)

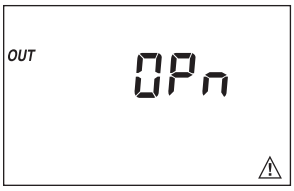


The control was unable to read a piece of information stored in its memory. Because of this, the control was required to reload the factory settings into all of the items in the ADJUST menu. The control will stop operation until all of the items in the ADJUST menu of the control have been checked by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

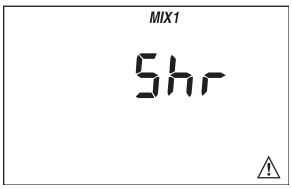
Note: The *Installer / Advanced* DIP switch must be set to *Advanced* in order to clear the error.



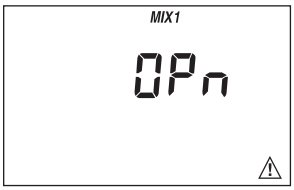
The control is no longer able to read the outdoor sensor due to a short circuit. In this case the control assumes an outdoor temperature of 32°F (0°C) and continues operation. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the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



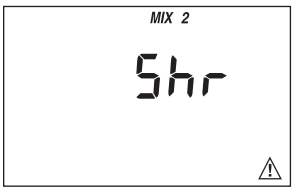
The control is no longer able to read the outdoor sensor due to an open circuit. In this case the control assumes an outdoor temperature of 32°F (0°C) and continues operation. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the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



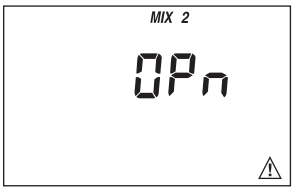
The control is no longer able to read the mix 1 supply sensor due to a short circuit. In this case the control will operate mixing device 1 at a fixed output as long as there is a mix 1 demand. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press any button.



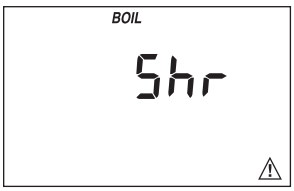
The control is no longer able to read the mix 1 supply sensor due to an open circuit. In this case the control will operate the mixing device 1 at a fixed output as long as there is a mix 1 demand. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press any button.



The control is no longer able to read the mix 2 supply sensor due to a short circuit. In this case the control will operate the mixing device 2 at a fixed output as long as there is a mix 2 demand. 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 any button.

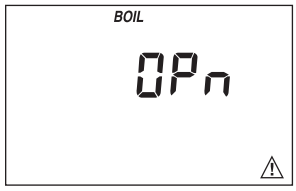


The control is no longer able to read the mix 2 supply sensor due to an open circuit. In this case the control will operate the mixing device 2 at a fixed output as long as there is a mix 2 demand. Locate and repair the problem as described in the Data Brochure D 070. To clear the error message from the control after the sensor has been repaired, press any button.



The control is no longer able to read the boiler sensor due to a short circuit. When there is a demand, the control will not control the boiler(s), but will provide a boiler enable to the boiler's aquastat or boiler control until the sensor is repaired. The control will not operate the boiler contact if the Boil Minimum setting is less than 100°F (38°C). 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 any button.

Error Messages (2 of 2)

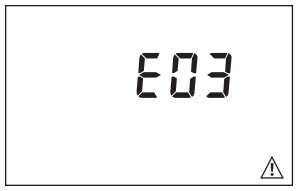


The control is no longer able to read the boiler sensor due to an open circuit. When there is a demand, the control will not control the boiler(s), but will provide a boiler enable to the boiler's aquastat or boiler control until the sensor is repaired. The control will not operate the boiler contact if the Boil Minimum setting is less than 100°F (38°C). 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 any button.

If the Boiler Sensor has been intentionally removed, the Boiler Sensor Return / Supply DIP switch should be set to Return, and the control must be powered down and then re-powered.

The control has an internal sensor that monitors the temperature inside the enclosure. The internal sensor has a short circuit that is not field repairable. Contact your tekmar sales representative for details on the repair procedures if this error occurs.

Note: The control will continue to operate normally with this error present



The control has an internal sensor that monitors the temperature inside the enclosure. The internal sensor has an open circuit that is not field repairable. Contact your tekmar sales representative for details on the repair procedures if this error occurs.

Note: The control will continue to operate normally with this error present.

The control has an internal sensor that monitors the temperature inside the enclosure. The internal temperature of the control is too hot. The control will shut off both variable speed outputs until the control has cooled off. Make sure the ambient temperature is less than 120°F (50°C). To clear the error message from the control after the control has cooled off, press any button.

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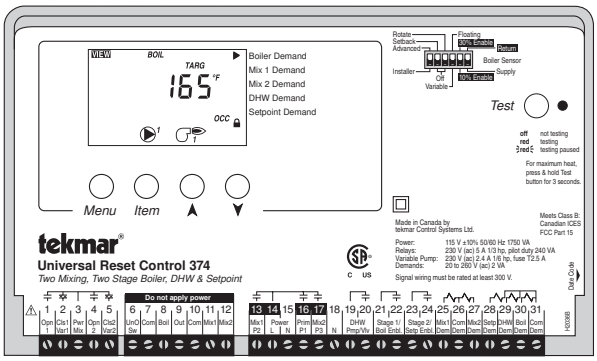
Technical Data

Universal Reset Control 374 *Two Mixing, Two Stage Boiler, DHW, & Setpoint*

Literature	–	D 374, A 374's, D 070, D 001, E 021
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% ,50/60 Hz, 1750 VA
Relays	–	230 V (ac) 5 A 1/3 hp, pilot duty 240 VA
Var. Pump	–	230 V (ac) 2.4 A 1/6 hp, fuse T2.5 A 250 V
Demand	–	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 3 of Universal Sensors 082
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

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