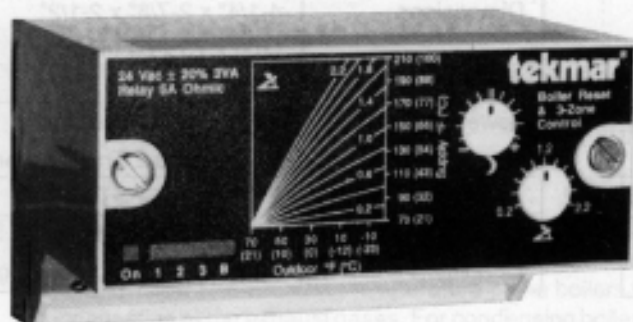
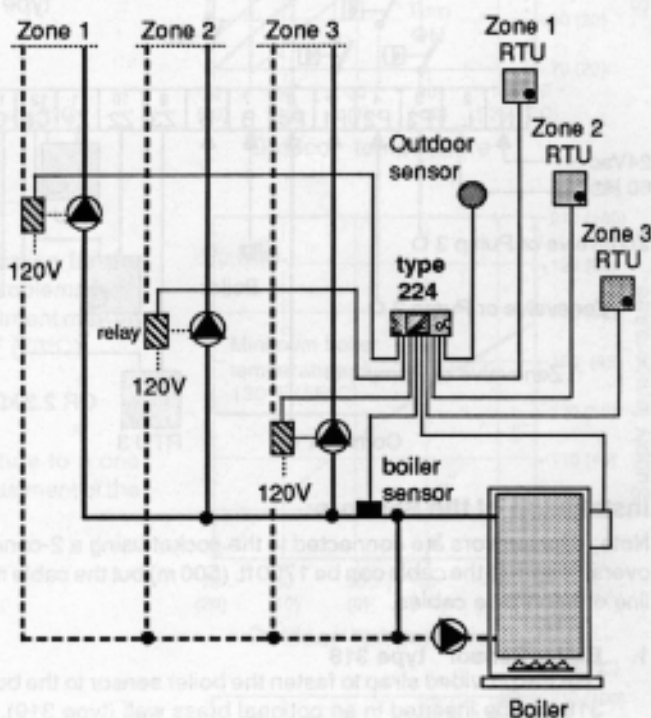
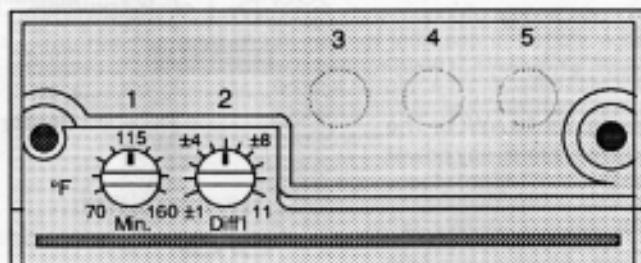


The tekmar<sup>®</sup> Boiler Reset & 3-Zone Control type 224 controls the air temperature in up to three zones and simultaneously resets the operating temperature of the boiler as a function of the outdoor temperature. The control includes three Room Temperature Units (RTU's) type 304, one per zone, each operating as a two stage thermostat. The first stage turns on a pump or opens a zone valve and the second stage allows the boiler to operate. The RTU will add heat to its zone whenever the zone air temperature approaches within 0.5°F (0.3°C) of the RTU setting, and will stop adding heat once the air temperature has risen 2°F (1°C) above the RTU setting. The boiler water temperature will be reset depending on the outdoor temperature and the zone with the highest heat demand. In this zone the boiler turns on when the air temperature drops 1.5°F (0.8°C) below its RTU setting. The boiler turns off when either the calculated boiler supply temperature is reached, the minimum boiler supply temperature is reached, or the air temperature of the zone with the highest demand approaches within 0.5°F (0.3°C) of the RTU setting. The control has adjustments for the heating curve, differential, minimum boiler temperature, and night setback temperature (one for all three zones). An external timer can be connected to the control to switch between normal and setback modes.

**Typical Application:**



5/8 Actual size



**type 224 includes:**

- 1. Electronic Control
- 2. Plug-in Socket
- 3. Boiler sensor (type 318) and strap
- 4. Outdoor sensor (type 315)
- 5. 3 x Room Temperature Units (type 304)

**Features:**

| Type  | 224                                 |
|---|-------------------------------------|
| Number of individually adjustable heating zones   | 3                                   |
| Heating Curve (adjustable)                        | 0.2 to 2.2                          |
| Differential (adjustable)                         | ± 1°F to ± 11°F (± .5°C to ± 6.0°C) |
| Minimum Boiler Operating Temperature (adjustable) | 70°F to 160°F (20°C to 70°C)        |
| Night setback temperature (adjustable)            | 0°F to 20°F (0°C to 11°C)           |
| Warm Weather Shut Down for the boiler             | when all three zones are satisfied  |
| Warm Weather Shut Down for the zone pumps/valves  | when all three zones are satisfied  |
| Maximum wire length to the supply sensor          | 1700 ft (500 m) 18 AWG wire         |
| Maximum wire length to the outdoor sensor         | 1700 ft (500 m) 18 AWG wire         |

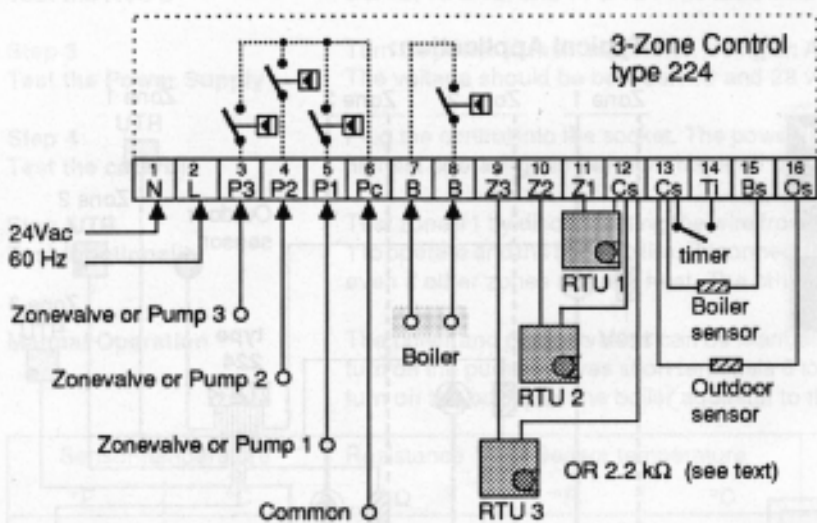
## Installation

### Mechanical:

The control's socket can be mounted on a rail system or attached to a flat surface.

### Electrical:

The tekmar control terminates the wires in a plug-in socket; no wires are directly connected to the control. This plug-in system simplifies installation and troubleshooting procedures. Terminals N & L (1 & 2) of the socket must be connected to the secondary side of a 24 Vac class 2 transformer. The total load of the control is approximately 3 VA.



### Technical Data

|                              |   |
|------------------------------|---|
| Dimensions                   | 4-1/4" x 2-7/8" x 2-1/2"<br>(108 x 73 x 64 mm)        |
| Gross Weight                 | 1.8 lbs (0.8 kg)                                      |
| Power Supply                 | 24 Vac $\pm$ 30%, 60 Hz,<br>3 VA, Class 2 Transformer |
| Relay Capacity               | 2 A Ohmic SPST  |
| Ambient Operating Conditions | 30 - 120°F (0 - 50°C)<br><95% RH Non-condensing       |

### Installation of the Sensors:

Note: The sensors are connected to the socket using a 2-conductor cable (eg. 2 x 18 AWG). The overall length of the cable can be 1700 ft. (500 m) but the cable must not be run parallel to any power line or telephone cables.

#### 1. Boiler Sensor type 318

Use the provided strap to fasten the boiler sensor to the boiler supply pipe. Alternatively, type 318 can be inserted in an optional brass well (type 319), or any well with a minimum inside diameter of 7/32" (5.5 mm) and a depth of 1-9/16" (40mm). Do not submerge the sensor itself into a liquid. Connect this sensor's two conductor cable to terminals 13 & 15 of the socket.

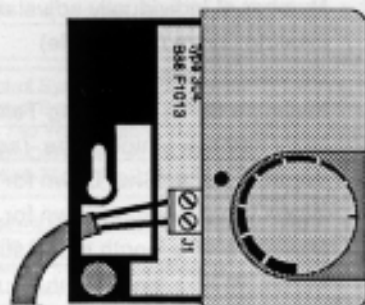
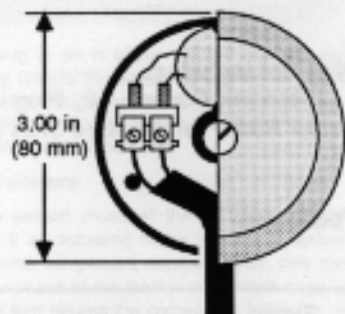
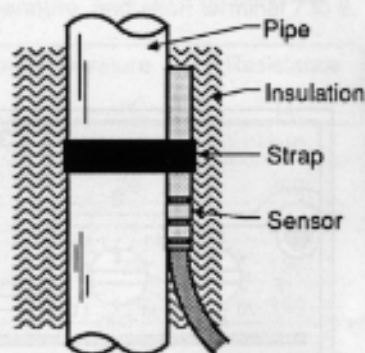
#### 2. Outdoor Sensor type 315

The outdoor sensor should be mounted on the side of the building where the main, occupied rooms are. It should not be mounted immediately above a window or ventilation opening. With two round or pan head screws, attach the black base of the sensor to the wall. **The hole for the cable entry must face downward** for proper moisture drainage. Connect a two conductor cable from the outdoor sensor terminals to terminals 13 & 16 of the control's socket.

#### 3. Room Temperature Units type 304

The 3-zone control will operate the heating zone's pump or open/close zone valve whenever heat is required in that zone. The Room Temperature Unit (RTU) provides the necessary information to the control as to the status of a particular zone. Therefore, the RTU must be installed in the area of the heating zone that is the most representative in terms of average zone air temperature.

Using a screwdriver, gently pry the adjusting dial off the front of the RTU. The beige cover can now be removed from the black base. Fasten this base to the wall using two screws. Connect a two conductor cable to the RTU's terminal block (Cs-RT). Replace the beige cover and dial. Set the RTU to 68°F (20°C). At the control's socket, remove the 2.2 kΩ resistor(s) and connect the two conductor cable to terminals 9 & 12, 10 & 12, or 11 & 12 depending on the zone number. If a zone is not used, its 2.2 kΩ resistor must remain in place.



## Adjustments

### 1. Differential (Diff'l)

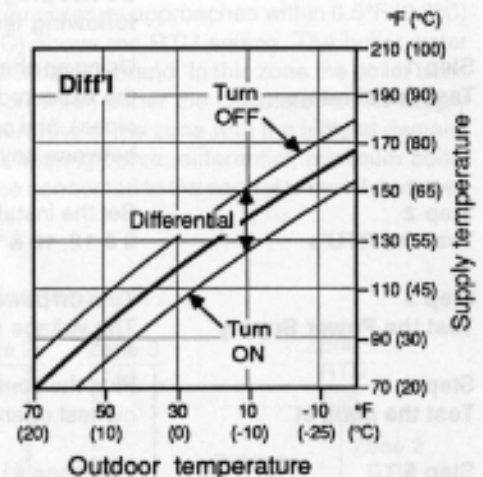
The differential adjustment sets how much the actual supply water temperature may deviate from the desired temperature before the boiler is turned on or off. To prevent short operating cycles of the boiler, the differential should be set at least as large the following formula indicates.

**Example**

$$\text{Differential} = \pm \frac{\text{Btu/hr}}{\text{US GPM} \times 1000} \quad \text{Eg: } \pm \frac{90,000 \text{ Btu/hr}}{9 \text{ US GPM} \times 1000} = \pm 10^\circ\text{F}$$

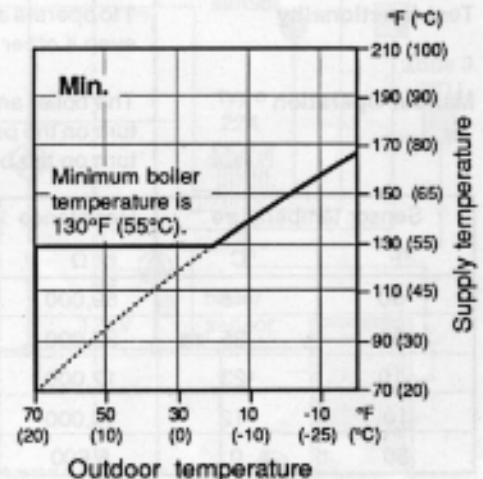
**Example**

$$\text{Differential} = \pm \frac{\text{Watts}}{\text{litres/hr} \times 2.32} \quad \text{Eg: } \pm \frac{9,000 \text{ Watts}}{2000 \text{ l/hr} \times 2.32} = \pm 2^\circ\text{C}$$



### 2. Minimum Boiler Operating Temperature (Min.)

This adjustment should be set to the boiler manufacturer's specification for the minimum allowable operating temperature of the boilers to prevent problems from condensation of the exhaust gases. For condensing boilers this adjustment may be set to 70°F (20°C). The range of adjustment is 70°F (20°C) to 160°F (70°C).



### 3. Heating Curve (Δ)

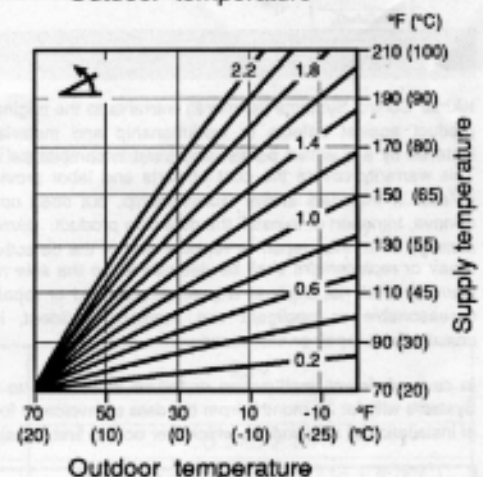
The heating curve is the ratio of increase in supply water temperature to a one degree decrease in the outdoor ambient temperature. The correct adjustment of the heating curve is defined by the following formula:

$$\text{Heating curve} = \frac{\text{design supply temp.} - \text{room temperature}}{\text{room temp.} - \text{design outdoor temperature}}$$

**Example**

- Design outdoor temperature = -20°F (-30°C)
- Design room temperature = 70°F (20°C)
- Design supply temperature = 160°F (70°C)

$$\text{Heating curve} = \frac{160^\circ\text{F} - 70^\circ\text{F}}{70^\circ\text{F} - (-20^\circ\text{F})} = 1.0 \quad \text{OR} \quad \frac{70^\circ\text{C} - 20^\circ\text{C}}{20^\circ\text{C} - (-30^\circ\text{C})} = 1.0$$



### 4. Timer Input (TI)

The terminal TI (14), when shorted to Cs (13), forces the control into a setback mode and enables the control's moon dial. When this occurs the control will setback all three zones the same amount. The range of setback adjustment is 2°F (1°C) to 22°F (12°C). When the moon dial is in the centre (|) position, the air temperature in all three zones will be setback 12°F (6°C) below each RTU setting.



Setback dial

### 5. Warm Weather Shut Down

The boiler will be turned off when all zones are warm enough.

## Testing

**Do not plug the control in the socket until the following tests have been performed. If any of the following tests fail, check the wiring to and from the socket.**

- Step 1  
Test the sensors** Using an ohmmeter, measure the resistance between terminals 13 & 15 and 13 & 16. The table below lists the expected resistance values at various sensor temperatures. The resistance between ground (the pipes), and any of terminals 9 to 16 should be greater than 1,000,000 ohms. No voltage should be present between any of these terminals and ground.
- Step 2  
Test the RTU's** Set the installed RTU's to 68°F (20°C). Using an ohmmeter, measure the resistance between terminals 9 & 12, 10 & 12, and 11 & 12. The table below lists the expected resistance values versus temperature.
- Step 3  
Test the Power Supply** Turn on power to the transformer. Using an AC voltmeter, measure the voltage between terminals 1 & 2. The voltage should be between 16 and 28 volts AC.
- Step 4  
Test the control** Plug the control into the socket. The power light should be on. The boiler's aquastat should be set to the highest operating temperature required by the system.
- Step 5  
Test functionality** Test zone #1 by disconnecting the wire from terminal 11 (Z1). This should cause the pump/valve of zone 1 to operate and the boiler to fire. Reconnect the wire. Once the boiler turns off it will stay off for five minutes even if other zones request heat. The other zones can be similarly tested.
- Manual Operation** The boiler and pumps/valves can be manually operated once the control is removed from its socket. To turn on the pumps/valves short terminals 6 to 5 for zone #1, 6 to 4 for zone #2, and 6 to 3 for zone #3. To turn on the boiler set the boiler aquastat to the required supply temperature, and short terminal 7 to 8.

| Sensor temperature |     | Resistance | Sensor temperature |    | Resistance | Sensor temperature |     | Resistance |
|--------------------|-----|------------|--------------------|----|------------|--------------------|-----|------------|
| °F                 | °C  | Ω          | °F                 | °C | Ω          | °F                 | °C  | Ω          |
| -50                | -45 | 59,000     | 50                 | 10 | 3,700      | 150                | 65  | 500        |
| -30                | -35 | 33,000     | 70                 | 20 | 2,400      | 170                | 76  | 360        |
| -10                | -23 | 17,000     | 90                 | 32 | 1,500      | 190                | 88  | 250        |
| 10                 | -12 | 10,000     | 110                | 43 | 1,000      | 210                | 100 | 180        |
| 30                 | 0   | 5,600      | 130                | 54 | 720        | 230                | 110 | 140        |

## Limited Warranty

tekmar Control Systems (tekmar®) warrants to the original purchaser each tekmar product against defects in workmanship and materials when the product is installed by a qualified person and used in compliance with tekmar's instructions. This warranty covers the cost of parts and labor provided by tekmar to correct defects in materials and/or workmanship, but does not cover parts or labor to remove, transport or reinstall the defective product. tekmar will not be liable for any damage other than repair or replacement of the defective part or parts and such repair or replacement shall be deemed to be the sole remedy from tekmar. This warranty shall not apply to any defects caused or repairs required as a result of unreasonable or negligent use, neglect, accident, improper installation, or unauthorized repair or alterations.

In case of defect, malfunction or failure to conform to warranty, tekmar Control Systems will, for 24 months from the date of invoice or for 12 months from the date of installation of the product, whichever occurs first, repair or exchange, at tekmar's

option, the defective product. The warranty is not in effect until the warranty card has been filled out and returned to tekmar Control Systems. Any express or implied warranty which the purchaser may have, including merchantability and fitness for a particular purpose, shall not extend beyond 24 months from the date of invoice or 12 months from the date of installation, whichever occurs first.

### Warranty Procedure

The installer or other qualified service person must, at the owner's expense, determine which component has failed. If an actuating motor, electronic control, mixing valve, pump, sensor, or other tekmar component requires repair, only that component, together with the proof of purchase of the tekmar equipment must be returned to the original purchaser who in turn returns the component to tekmar. In order for tekmar to process any warranty claim, the type number and fabrication number of the product and your name and address must be included with the defective component or product.

|  |  |
|--|--|
|  | <p><b>In North America:</b> tekmar Control Systems, Ltd., Canada<br/>tekmar Control Systems, Inc., USA<br/>Office: #7 - 740 Waddington Drive<br/>Vernon, B.C. CANADA V1T 8T6<br/>Tel.: (604) 545-7749 Fax.: (604) 545-0650</p> |
|  | <p><b>In Europe:</b> tekmar Angewandte Elektronik GmbH<br/>Dückerstraße 4<br/>D-4300 Essen 16, WEST GERMANY<br/>Tel.: (0201) 49841 Fax.: (0201) 49935</p>  |