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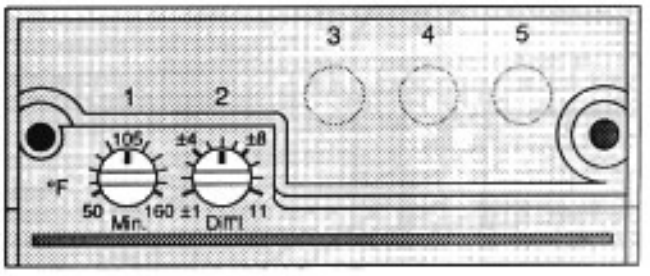
Boiler Reset Controls types 230, 231, & 232

tekmar®
Control Systems

The tekmar® Boiler Reset Controls regulate the supply water temperature in one or two boilers as a function of the outdoor and *optionally* indoor air temperatures. All three controls have a minimum delay of 5 minutes between firing cycles of the boiler with type 232 additionally having a 4 minute delay between stages.

5/8 Actual size



types 230, 231, & 232 include:
1. Electronic Control 2. Plug-in Socket 3. Boiler sensor (type 318) and strap 4. Outdoor sensor (type 317)

Features:

Type	230	231	232
Control output signal	dry contacts on/off	dry contacts on/off	dry contacts on/off
Plug-in System (wires terminate into a plug-in base)	yes	yes	yes
System status indicator lights for	power, boiler	power, boiler	power, boilers
Number of boiler stages	1	1	2
Differential between stages	N/A	N/A	4 °F (fixed)
Heating Curve (adjustable)	0.2 to 2.2	0.2 to 2.2	0.2 to 2.2
Differential (adjustable)	± 1°F to ± 11°F	± 1°F to ± 11°F	± 1°F to ± 11°F
Minimum Boiler Operating Temperature (adjustable)	50 °F to 160 °F	50 °F to 160 °F	50 °F to 160 °F
Warm Weather Shut Down for the boiler(s) at 68°F (20°C)	yes	yes	yes
Warm Weather Shut Down for the pump at 68°F (20°C)	no	yes	yes
Optional Room Temperature Unit type 304, 307 and 308	yes	yes	yes
Optional adjustable night setback (with RTU type 308)	yes	yes	yes
Optional Multi-Zone control type 240 input	yes	yes	yes
Maximum wire length to the outdoor and supply sensors	500 ft 18 AWG wire	500 ft 18 AWG wire	500 ft 18 AWG wire

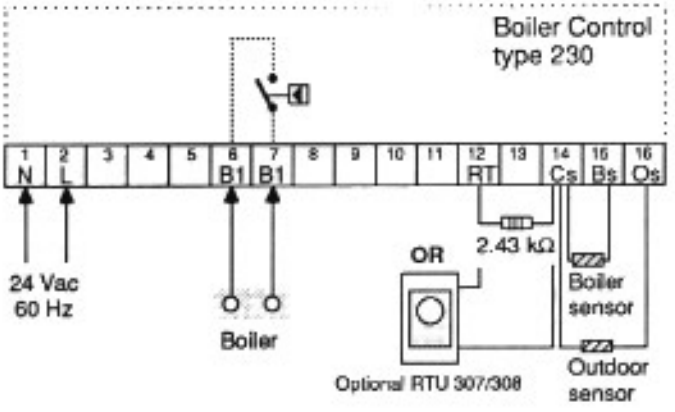
Installation

Mechanical:

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

Electrical:

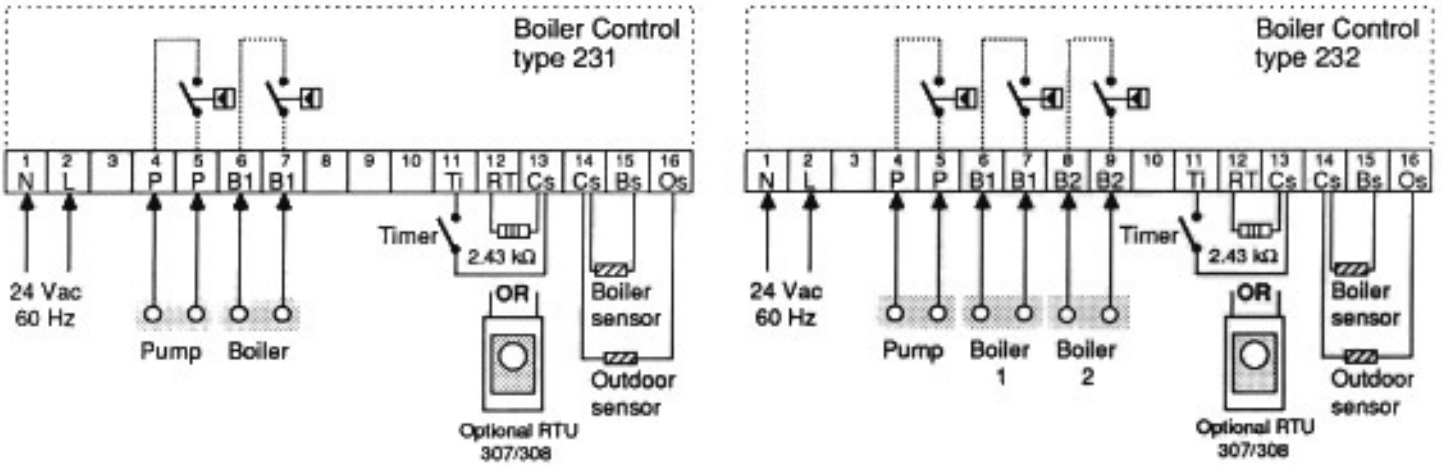
The tekmar control terminates the wires in a plug-in socket; no wires are directly connected to the control. This plug-in system simplifies installation and troubleshooting procedures. Terminals N & L (1 & 2) of the socket must be connected to the secondary side of a 24 Vac class 2 transformer. The total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



Technical Data

Dimensions	4-1/4" x 2-7/8" x 2-1/2" (108 x 73 x 64 mm)
Gross Weight	1.1 lbs (0.5 kg)
Power Supply	24 Vac ± 30%, 60 Hz, 2 VA, Class 2 Transformer
Relay Capacity	6 A Ohmic SPST
Ambient Operating Conditions	30 - 120°F (0 - 50°C) <95% RH Non-condensing

Wiring:

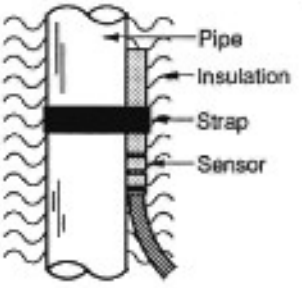


When the control is initially powered up, boiler stage 1 and/or the pump may not turn on immediately for the following reasons:

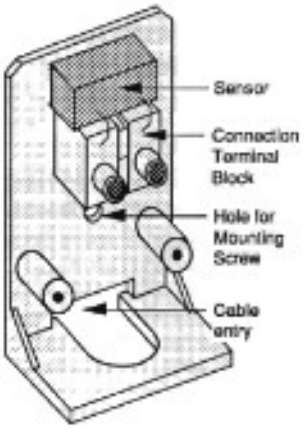
1. **The outdoor temperature is warm enough to cause warm weather shut down, thereby turning the pump and boiler(s) off.**
2. **The 5 minute time delay for stage 1 must time out first, after which the boiler may fire. The pump is unaffected by this delay.**

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 500 ft. (150 m) but the cable must not be run parallel to any power line or telephone cables.

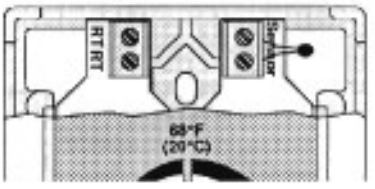


1. **Boiler Sensor type 318**
   Use the provided strap to fasten the boiler sensor to the boiler supply (output) pipe. Type 318 sensors can be inserted in an optional brass well (type 319), or any well with a minimum inside diameter of 7/32" (5.5 mm) and a depth of 1-9/16" (40 mm). Connect the sensor's two wires to terminals 14 & 15 of the control's socket.



2. **Outdoor Sensor type 317**
   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 one round or pan head screw, attach the 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 14 & 16 of the control's socket. Slide the cover of the outdoor sensor onto its base.

3. **Room Temperature Unit type 307/type 308**
   To compensate for indoor heat gains/losses from solar radiation or wind infiltration, an *optional* Room Temperature Unit may be wired to the control, replacing the 2430Ω resistor in terminals 12 & 13. RTU type 307 has an adjustable dial for the room temperature, a bimetal temperature indicator, and a thermistor sensing element. The setback RTU type 308 adds an adjustment dial for setback room temperature and a 7-day digital clock. See brochure D06.



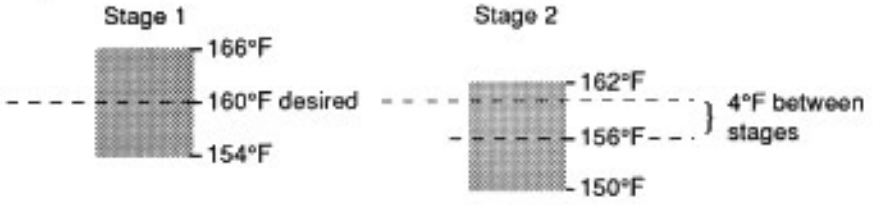
Adjustments

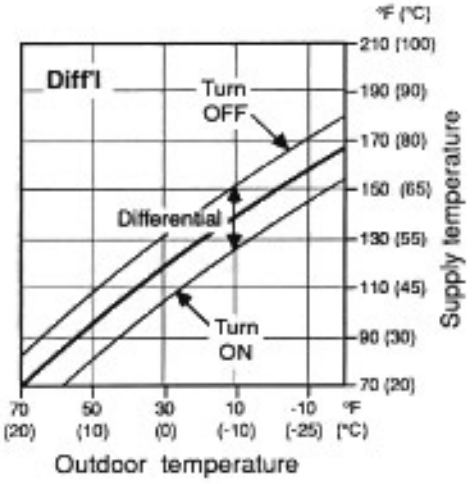
1. **Differential (Diff'l)**

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 controls have a minimum time delay of 5 minutes between firing cycles.

$$\text{Differential} \geq \pm \frac{\text{Btu/hr}}{\text{US GPM x 1000}} \quad \text{Eg:} \quad \pm \frac{100{,}000\ \text{Btu/hr}}{17\ \text{US GPM x 1000}} \approx \pm 6°\text{F}$$

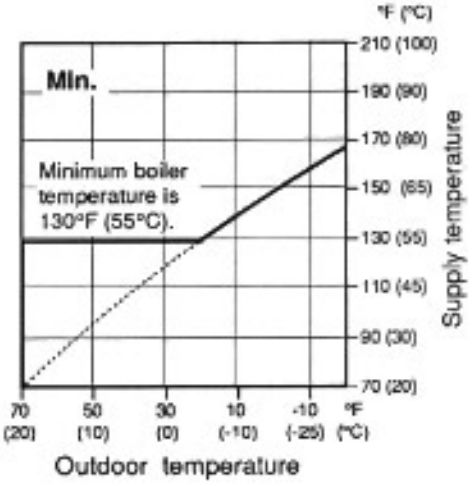
Note for type 232: There is a fixed 4°F differential and 4 minute delay between stages. For example, a differential setting of ± 6°F would cause the following sequence of operation around a desired supply water temperature of 160°F.





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 should be set to 50°F (10°C). The range of adjustment is 50°F (10°C) to 160°F (70°C).



3. **Heating Curve ($\mathcal{X}$)**

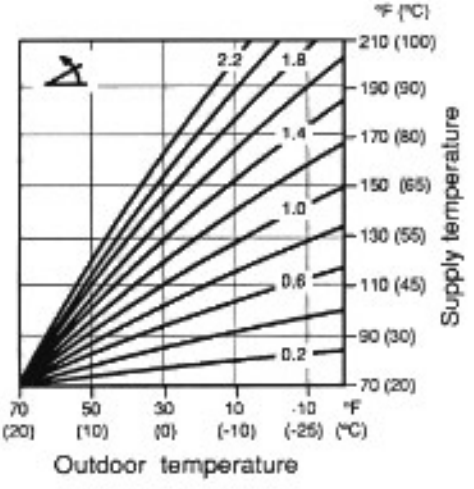
The heating curve is the ratio of increase in supply water temperature to a one degree decrease in the outdoor ambient temperature. The correct adjustment of the heating curve is defined by the following formula:

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

Example

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

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



4. **Timer Input (Ti)**

When terminal Ti (11) is shorted to Cs (13), the control enters a setback mode. If a Room Temperature Unit (RTU) is installed then the room air temperature is lowered 10°F (5°C). If an RTU is not connected then the room air temperature is lowered 5°F (3°C) to 12°F (7°C) depending on the system's heating curve.

5. **Warm Weather Shut Down**

If the resistor (2430Ω) is installed between terminals 12 & 13, then the pump and boiler (boiler only in type 230) are shut down at 68°F (20°C) during normal operation and 40°F (5°C) during setback (when Cs is shorted to Ti). If an RTU is connected, the warm weather shut down temperature is equal to the RTU setting.

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 14 & 15, 14 &16, and if an RTU is connected, between 12 & 14. The table below lists the expected resistance values at various sensor temperatures. The resistance between ground (the pipes), and any of terminals 10 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 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 3
Test the Boilers

For types 231 & 232, ensure the heating system pump is running by shorting terminals 4 & 5. Shorting terminals 6 & 7 should turn on boiler stage 1, and shorting terminals 8 & 9 should turn on boiler stage 2. During normal operation of the control, once the boiler turns off it will stay off for five minutes.

Step 4
Test the control

Set the control adjustments according to the instructions on page 3. Plug the control into the socket. When the power light comes on the control is operational. The boiler(s) and pump may not turn on immediately due to a possible warm weather shut down or the 5 minute boiler delay.

Manual Operation

The boilers and pump can be manually operated once the control is removed from its socket. To turn on the pump in types 231 & 232, short terminal 4 to 5. To turn on the boilers set the boiler aquastats to the required supply temperatures, and short terminal 6 to 7 to turn on boiler stage 1, and for type 232 short terminal 8 to 9 to turn on boiler stage 2.

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 merchantibility 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, 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 after receiving a Return Goods Authorization (RGA) number from tekmar. In order to process any warranty claim, the type number and fabrication number of the product, description of the problem, and return name and address must be included with the defective component or product.

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