D 44
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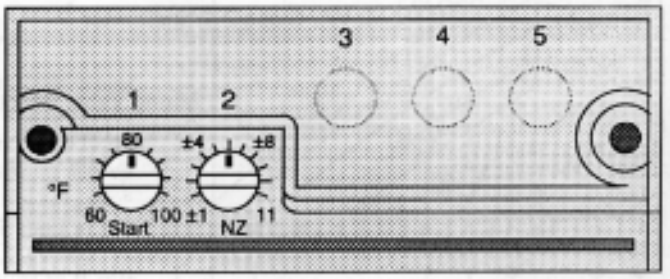
Mixing Valve Reset Control type 228
Mixing Valve Reset Control with Minimum Boiler Return Limit type 229

tekmar®
Control Systems

The tekmar® Mixing Valve Reset Controls regulate the supply water temperature of a heating system as a function of the outdoor and *optionally* indoor temperatures through the operation of either the tekmar Actuating Motor type 216 or any other actuator with a reversible motor for floating operation. The actuator operates 3-way or 4-way mixing valves. Type 228 includes a maximum supply water temperature limit. Type 229 includes a boiler return sensor and a minimum boiler return temperature limit which closes the mixing valve until the return water to the boiler is hot enough to prevent condensation of the combustion gases.

5/8 Actual size



type 228 includes: 1. Electronic Control 2. Plug-in socket 3. Supply sensor (type 318) 4. Outdoor sensor (type 317)

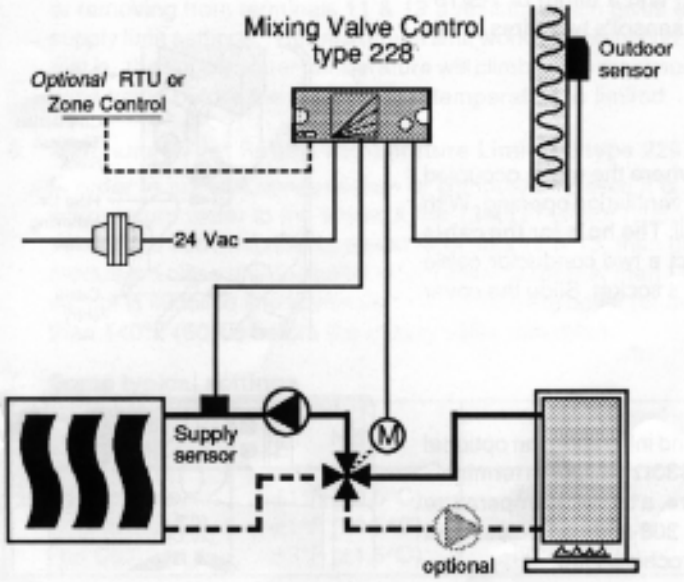
type 229 includes: 1. Electronic Control 2. Plug-in socket 3. Supply & return sensors (types 318) 4. Outdoor sensor (type 317)

Features:

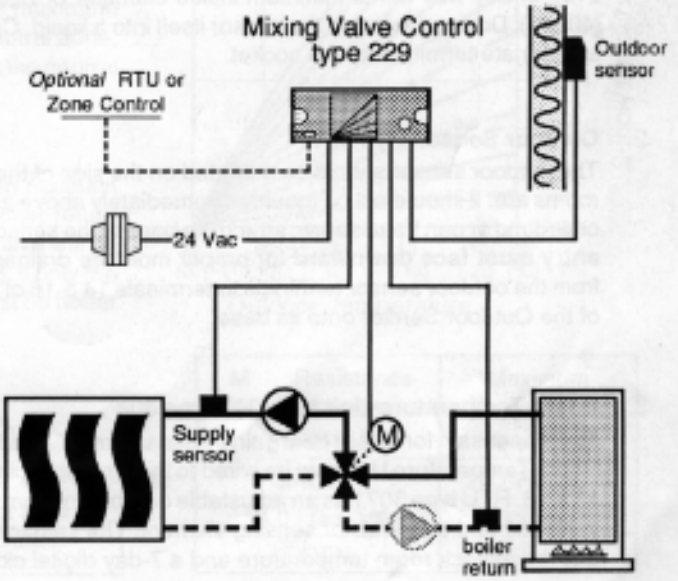
Type	228	229
Heating Curve (adjustable)	0.2 to 2.2	0.2 to 2.2
Heating Curve Starting Temperature (adjustable)	70°F (20°C) to 100°F (40°C)	70°F (20°C) to 100°F (40°C)
Neutral Zone (adjustable)	±1 °F (±0.5°C) to ±11°F (±6°C)	±1 °F (±0.5°C) to ±11°F (±6°C)
Maximum Supply Water Temperature limit	130, 180 or 230°F (55, 80 or 110°C)	no
Minimum Boiler Return Water Temperature limit	no	110°F (43°C) or 140°F (60°C)
Optional Room Temperature Unit	yes	yes
Night setback (requires optional timer)	yes	yes
Maximum wire length to the sensors	1700 ft (500 m) 18 AWG wire	1700 ft (500 m) 18 AWG wire

Applications:

1. Mixing Valve Reset Control



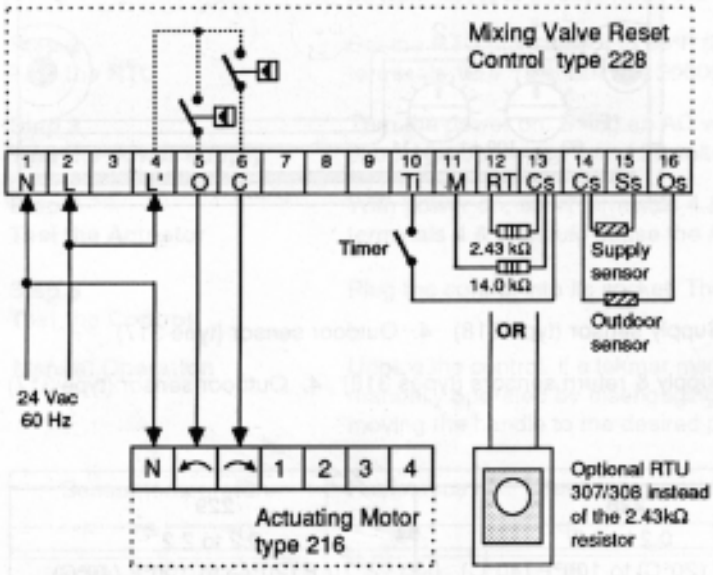
2. Mixing Valve Reset Control with Return Limit

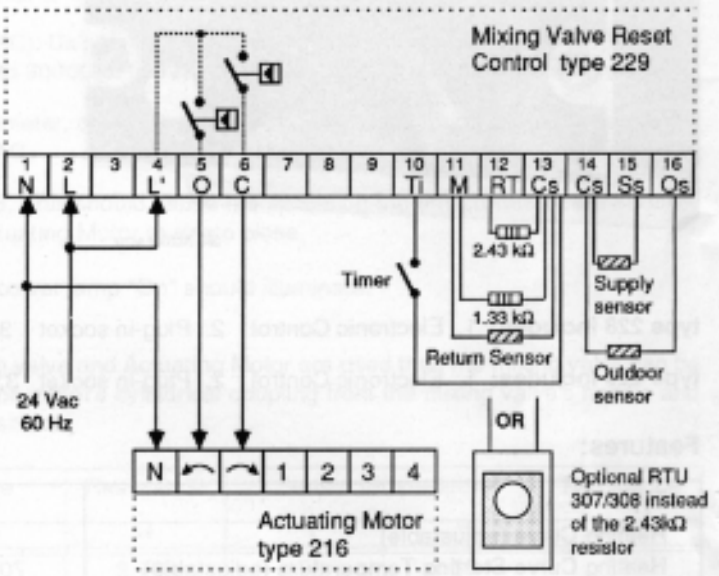


Installation

Technical Data

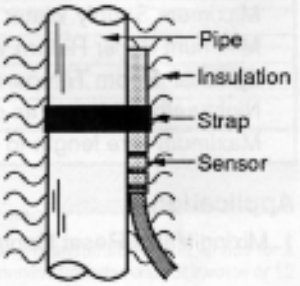
Dimensions	4-1/4" x 2-7/8" x 2-1/2" (108 x 73 x 64 mm)	Relay Capacity	3 A Ohmic SPST
Weight	0.8 lbs (0.35 kg)	Ambient Operating Conditions	30 - 120°F (0 - 50°C) <95% RH Non-condensing
Power Supply	24 Vac ± 30%, 60 Hz, 2 VA, Class 2 Transformer		



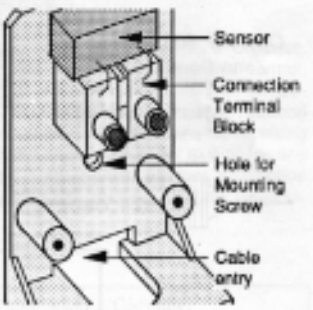


Installation of the Sensors:

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.

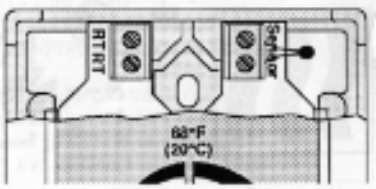


1. **Supply Sensor/Boiler Return Sensor type 318**
   Install the supply sensor on the supply pipe which goes from the mixing valve to the heating system. Install the return sensor (only with type 229) onto the return pipe which goes from the mixing valve to the boiler. Type 318 sensors can be inserted 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" (40mm). Do not submerse the sensor itself into a liquid. Connect the sensor's two wires to the appropriate terminals of the 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. **Neutral Zone (NZ)**
The Neutral Zone is a measure of how much the actual supply water temperature may deviate from the desired temperature before the mixing valve is adjusted. In the event of unsteady mixing valve behavior, increase the Neutral Zone. The range of adjustment is ±1°F (±0.5°C) to ±11°F (±6°C).

2. **Heating Curve Starting Temperature (Start)**
The Heating Curve Starting Temperature is the point at which the supply water temperature equals the outdoor temperature. For suggested settings see the table below. In buildings with significant internal heat gains this setting may need to be as low as 60°F (15°C). For maximum operating efficiency the Heating Curve Starting Temperature should be set as low as possible.

3. **Heating Curve ( )**
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)

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

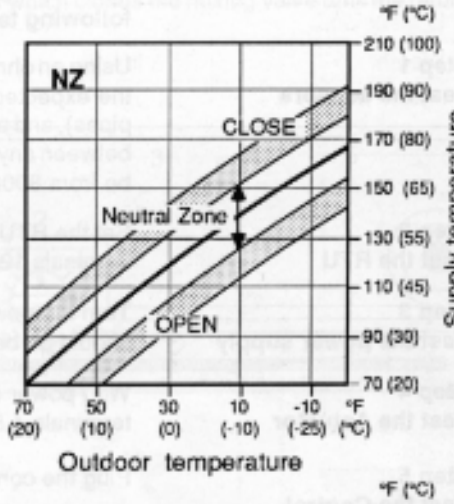
4. **Timer Input (TI)**
The terminal Ti (10), when shorted to Cs (13), forces the control into a setback mode. If a Room Temperature Unit (RTU) type 307 is installed then the room air temperature will be lowered 10°F (5°C). If an RTU in not connected then the room air temperature is lowered 30°F (15°C).

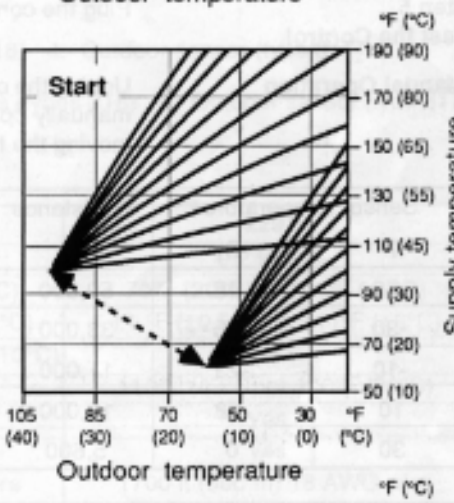
5. **Maximum Supply Temperature Limit (M) type 228**
If radiant floor heating is used, it is important to limit the maximum supply water temperature in order to protect the plastic pipes. This function is adjusted by installing or removing from terminals 11 & 13 a resistor which gives one of three maximum supply limit settings. This maximum limit works in conjuction with the Neutral Zone, that is, the supply water temperature will climb to the maximum limit plus the neutral zone value before the supply water temperature is limited.

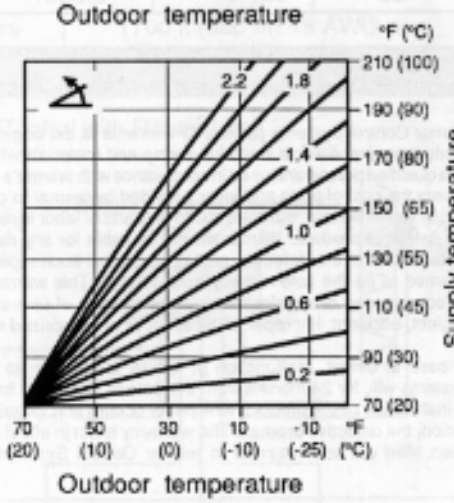
6. **Minimum Boiler Return Temperature Limit (M) type 229**
In order to prevent condensation of combustion gases it is important to maintain warm return water to the boiler. If the 1330Ω resistor (supplied) and boiler return sensor are both installed between terminals 11 & 13, then the mixing valve will be modulated close until the boiler return water is warmer then 110°F (43°C). If only the sensor is installed into terminals 11 & 13 then the boiler return water must be hotter than 140°F (60°C) before the mixing valve can open.

7. **Some typical settings**

Heating System	NZ	Start	
Radiant Floor	±1°F (±0.5°C)	70°F (20°C)	must be calculated
Convectors	±1°F (±0.5°C)	75°F (24°C)	
Fan Coil	±3°F (±1.5°C)	80°F (27°C)	







M Resistance between terminals 11 and 13	Maximum Temperature Limit
SHORT	230°F (110°C)
14.0 kΩ ± 1%	180°F (80°C)
OPEN	130°F (55°C)

Testing

Do not plug the control into its 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 and 14 &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. On type 229, the resistance between terminals 11 & 13 should be from 800Ω to 3000Ω when the boiler is at room temperature.

Step 2
Test the RTU

Set the RTU (if installed) to 68°F (20°C). Using an ohmmeter, the resistance of RTU type 307 between terminals 12 & 13 should be 2000Ω to 3000Ω. RTU type 308 cannot be tested with an ohmmeter.

Step 3
Test the power supply

Turn the power on. 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 Actuator

With power on, short terminals 4 & 5. This should cause the Actuating Motor to rotate open. Shorting terminals 4 & 6 should cause the Actuating Motor to rotate close.

Step 5
Test the Control

Plug the control into its socket. The power lamp "On" should illuminate.

Manual Operation

Unplug the control. If a tekmar mixing valve and Actuating Motor are used then the mixing valve can be manually operated by disengaging the motor's cylindrical coupling from the mixing valve's handle and moving the handle to the desired position.

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 material's 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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