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Motor-Electronic for Hydronic Snow/Ice Melting type 215

tekmar®
Control Systems

The tekmar Motor-Electronic for Hydronic Snow/Ice Melting systems, when used in conjunction with a four way mixing valve, precisely controls the rate at which heat is transfered into a snow or ice melting slab. If the slab is brought up to operating temperature too quickly, then it may crack due to uneven thermal expansion, and if it is heated up too slowly then the response time for the system will be rather lengthy. This Motor-Electronic automatically solves these two problems. In addition, the Motor-Electronic has an adjustment for the minimum boiler return water temperature and can therefore protect the boiler from "cold shocks".

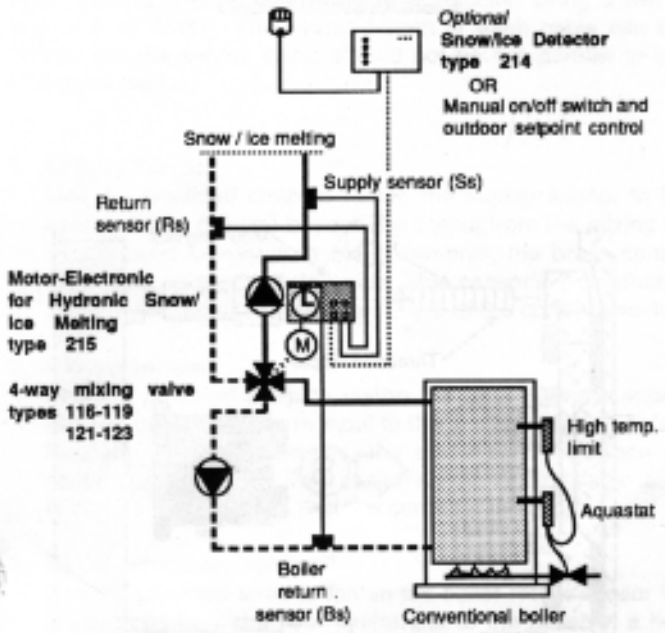
When snow/ice melting is not required, the Motor-Electronic can be programmed to maintain the slab at an idle temperature so that the response time to bring the slab up to operating temperature is reduced. The programmable quartz timer has a self-charging 72 hour battery backup and can operate in either a 24-hour or a 7-day mode.

type 215 includes:

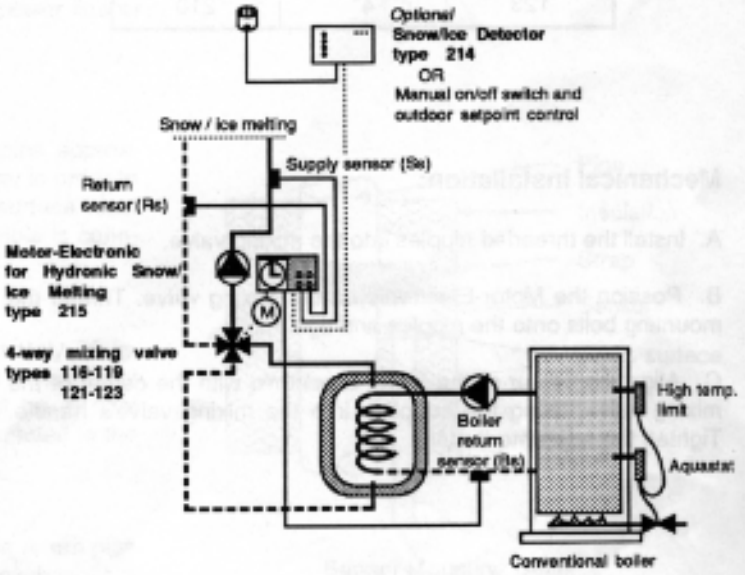
1. PID electronic control
2. Actuating motor
3. Supply sensor
4. Return sensor
5. Boiler sensor
6. Mounting hardware

Typical Applications:

1) Direct to Boiler



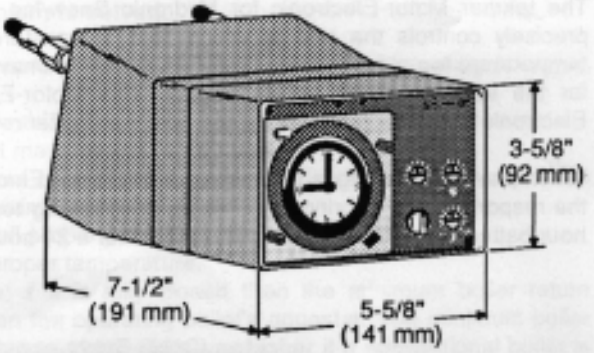
2) Connection through a heat exchanger.



Important Notice: Since the temperature sensors for this control are mounted on the pipes, the pumps and boiler must continually operate when the outdoor air temperature is colder than 40°F (5°C).

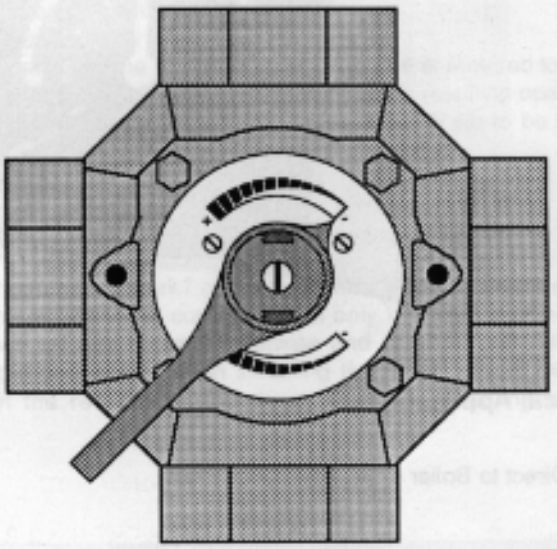
Technical Data:

Relative Humidity	<95%, non-condensing
Temperature Range	30 - 120 °F (0 - 50°C)
Power Supply	21 - 28 Vac, 60 Hz, 6VA Class 2 transformer
Weight	6.7 lbs (3 kg)



Installation

The Motor-Electronic is easily attached to any of the tekmar® 4 - way mixing valves. These quality mixing valves have cast iron bodies and therefore should be used only in 'closed' heating systems. The valve shaft has double O-ring seals which enable it to withstand 90 psi (600kPa) operating pressure. The operating temperature range for pure water is 34°F (1°C) to 230°F (110°C). For glycol solutions and other liquids the operating temperature range can be obtained by contacting tekmar® Control Systems.
For more information about the mixing valves, ask for tekmar brochure D07.



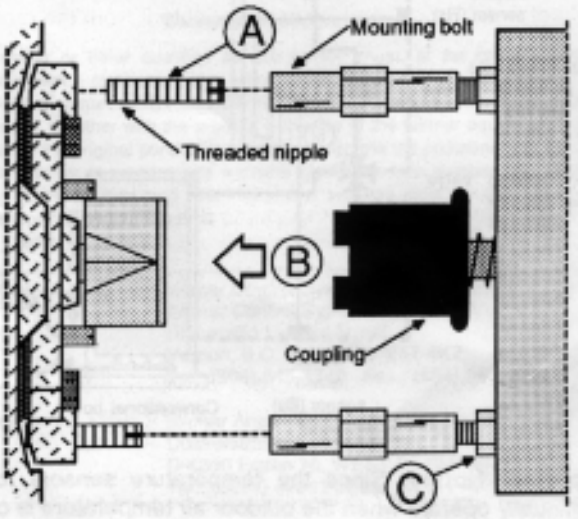
type number	pipe size	Cv value
116	1"	9
117	1-1/4"	14
118	1-1/2"	40
119	2"	60
121	2-1/2"	100
122	3"	150
123	4"	210

Mechanical Installation:

A. Install the threaded nipples into the mixing valve.

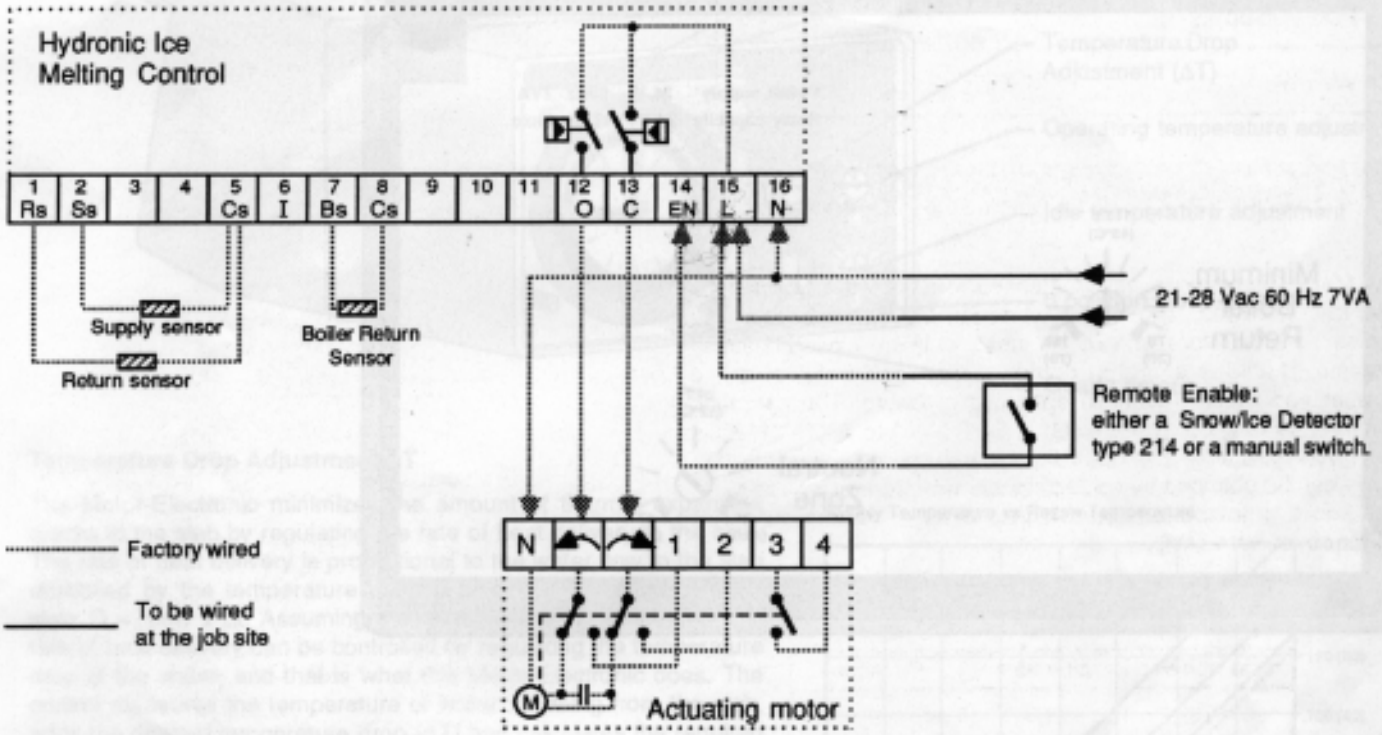
B. Position the Motor-Electronic on the mixing valve. Thread the mounting bolts onto the nipples and tighten.

C. Align the center of the Motor-Electronic with the center of the mixing valve, fitting the coupling into the mixing valve's handle. Tighten the adjustment nuts.



Electrical Installation:

The tekmar® Motor-Electronic 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 L & N (15 & 16) of the socket must be connected to the secondary side of a 24 Vac class 2 transformer. The total load of the control and motor is approximately 7 VA.



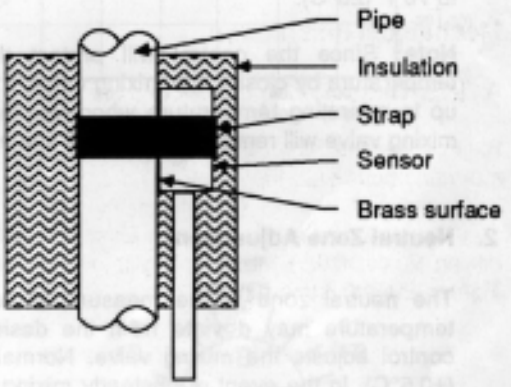
Installation of the temperature sensors:

Note: Each sensor is connected to the socket using a two conductor cable (e.g. 2 x 18 AWG). The overall length of each cable can be up to 1700 ft. (500m) but the sensor cable should not be run parallel to any power line or telephone cables.

1. **Supply Sensor**
   Use the provided strap to fasten the supply sensor to the pipe approximately 20 in. (50 cm) beyond the output from the mixing valve. In order to obtain exact temperature measurements, the brass sensor surface must be in tight contact with the pipe. This sensor's 2-conductor cable is connected in the factory to terminals 2 & 5 of the control's socket.

2. **Return sensor**
   Use the provided strap to fasten the return sensor approximately 20 in. (50 cm) before the return input to the mixing valve. In order to obtain exact temperature measurements, the brass sensor surface must be in tight contact with the pipe. This sensor's 2-conductor cable is connected in the factory to terminals 1 & 5 of the control's socket.

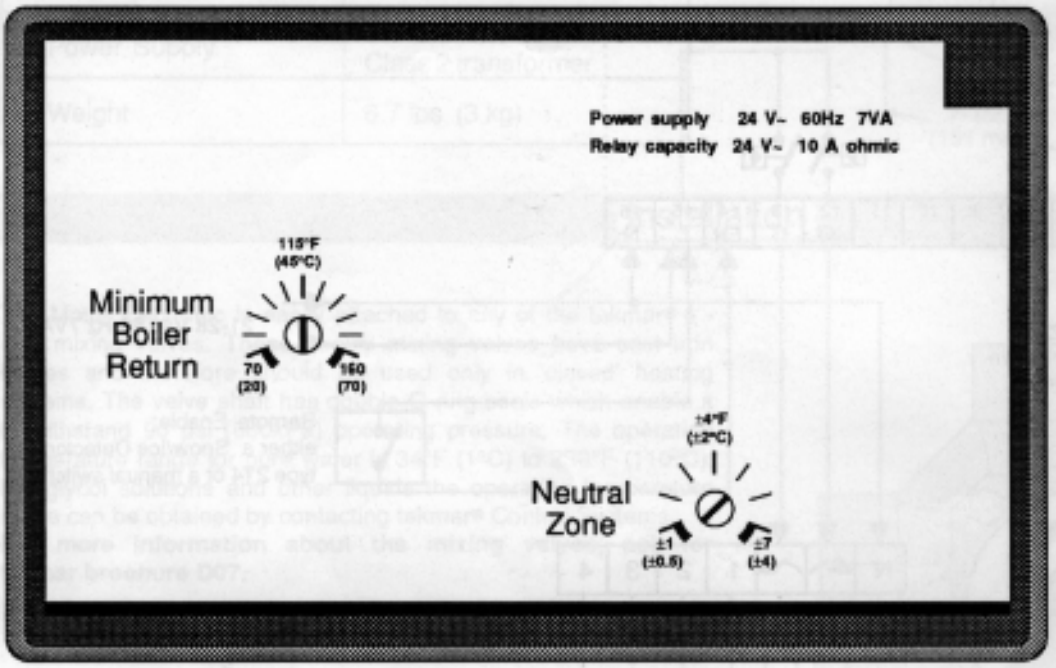
3. **Boiler return sensor**
   Use the provided strap to fasten the boiler return sensor to the return pipe which goes from the heat exchanger to the boiler. If a heat exchanger is not used, then fasten the sensor to the return pipe which goes from the mixing valve back to the boiler. The sensor's 2 conductor cable is connected in the factory to terminals 7 & 8 of the control's socket.



Sensor Mounting Detail

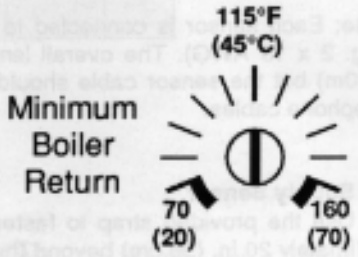
Adjustments

On the back of the Control:



1. **Minimum Boiler Return Adjustment**

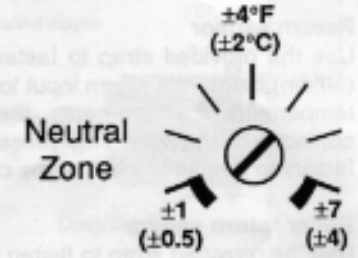
The Motor-Electronic will protect the boiler from too cool return water. If the boiler return water is too cool, then the control reduces the heat output to the snow/ice melting system so that, through the four way mixing valve, more of the hot water is returned to the boiler. The range of adjustment is 70°F (20°C) to 160°F (70°C). If a conventional boiler heats the water then this adjustment should be set higher than 130°F (55°C) to prevent condensation of the flue gases. However, if a condensing boiler is used, then the adjusment can be set to 70°F (20°C).



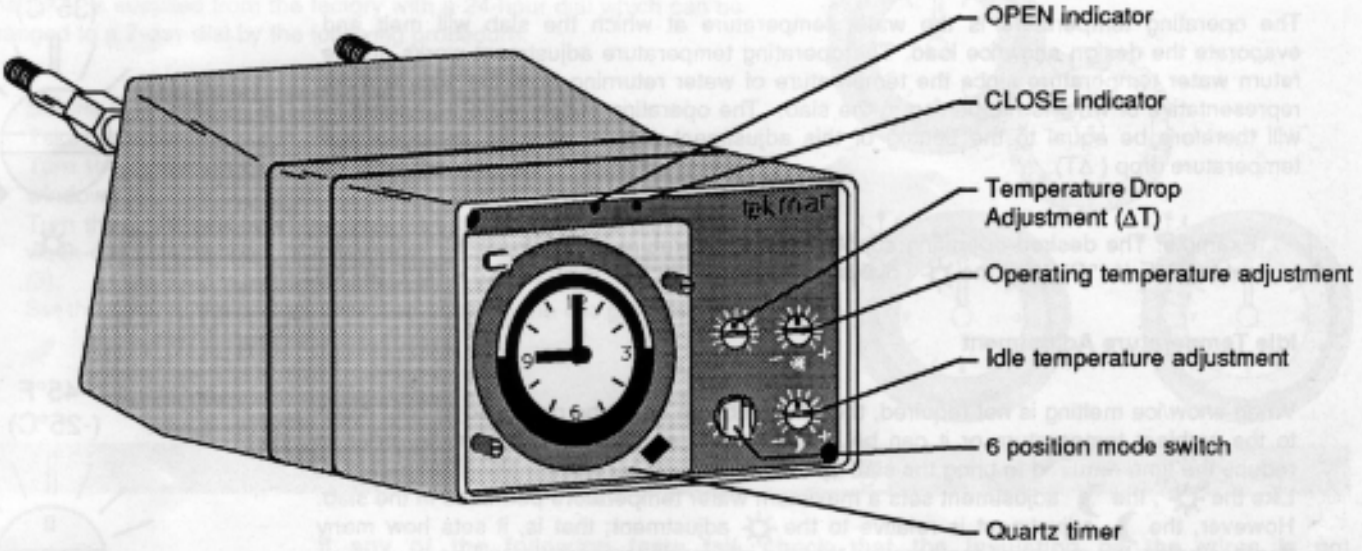
Note: Since the control will protect the boiler from cool return water temperature by closing the mixing valve, it is important that the boiler is on and up to operating temperature whenever the control is to be used or else the mixing valve will remain closed in an attempt to protect the boiler.

2. **Neutral Zone Adjustment**

The neutral zone is the measure of how much the actual supply water temperature may deviate from the desired supply temperature before the control adjusts the mixing valve. Normally the neutral zone is set at ±1°F (±0.5°C). In the event of unsteady mixing valve behavior increase the neutral zone.



On the front of the Control:



1. **Temperature Drop Adjustment ΔT**

The Motor-Electronic minimizes the amount of thermal expansion cracks in the slab by regulating the rate of heat delivery to the slab. The rate of heat delivery is proportional to the water flow to the slab multiplied by the temperature drop (ΔT) of the water through the slab: Q = flow x Δt. Assuming the water flow is constant, then the rate of heat delivery can be controlled by regulating the temperature drop of the water, and that is what this Motor-Electronic does. The control measures the temperature of water returning from the slab, adds the desired temperature drop (ΔT) and calculates the required supply water temperature. The control then opens (or closes) the mixing valve until this supply water temperature is obtained.
The setting of the temperature drop adjustment (ΔT) can be calculated from the following formula:

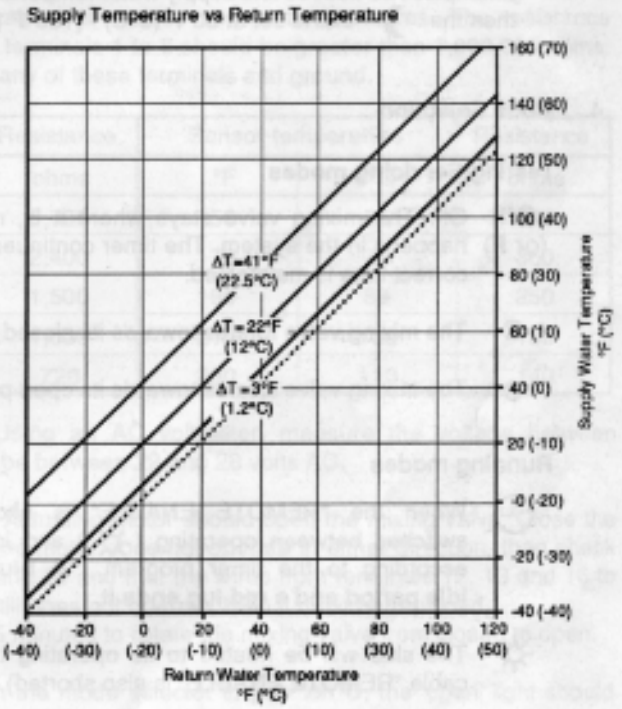
$$\text{Temperature drop} = \text{Constant} \times \frac{\text{Rate of heat delivery}}{\text{Water flow rate}}$$

Where:

Rate of heat delivery = the total design heat output from the snow/ice melting slab.
Water flow rate = the water flow rate from the mixing valve to the slab.

•In standard units: $\Delta T = 0.002 \times \frac{\text{Btu/hr}}{\text{USGPM}}$

•In metric units: $\Delta T = 0.86 \times \frac{\text{Watts}}{\text{litres/hr}}$

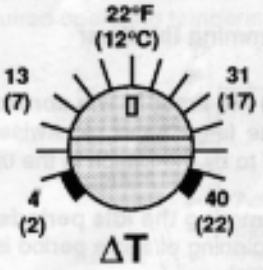


Example

- Rate of heat delivery = 100 Btu/hr•ft² (315 Watts/m²)
- Heated surface total area = 600 ft² (56 m²)
- Water flow rate = 6 US GPM (1360 litres/hr)

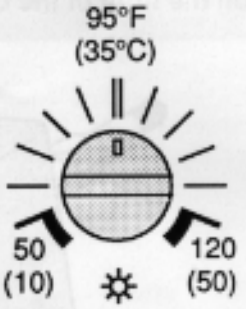
$$\Delta T = 0.002 \times \frac{100 \text{ Btu/hr•ft}^2 \times 600 \text{ ft}^2}{6 \text{ US GPM}} = 20°F$$

$$\Delta T = 0.86 \times \frac{315 \text{ Watts/m}^2 \times 56 \text{ m}^2}{1360 \text{ litres/hr}} = 11°C$$



The ΔT adjustment would be set to 20°F (11°C) for this example.

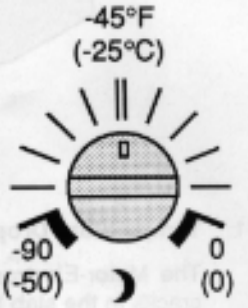
2. Operating Temperature Adjustment



The operating temperature is the water temperature at which the slab will melt and evaporate the design snow/ice load. The operating temperature adjustment works on the return water temperature since the temperature of water returning from the slab is most representative of what is happening in the slab. The operating supply water temperature will therefore be equal to the setting of this adjustment (☼) plus the setting of the temperature drop (ΔT).

Example: The desired operating supply water temperature is 100°F (38°C) and ΔT is set to 20°F (11°C), then the ☼ dial is set to 100°F (38°C) - 20°F (11°C) = 80°F (27°C).

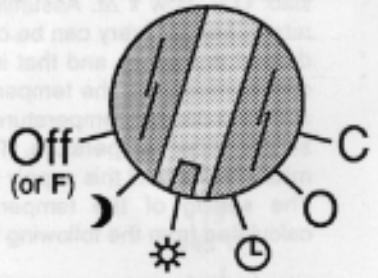
3. Idle Temperature Adjustment



When snow/ice melting is not required, then the slab can either be permitted to cool down to the ambient temperature or it can be maintained at an idling temperature in order to reduce the time required to bring the slab up to its operating snow/ice melting temperature. Like the ☼ , the ☽ adjustment sets a maximum water temperature permitted in the slab. However, the ☽ adjustment is relative to the ☼ adjustment; that is, it sets how many degrees below the operating temperature that the idle mode temperature will be.

Example: The desired idle supply water temperature is 30°F (0°C) and ΔT is 20°F (11°C), then the ☽ dial is set at 30°F (0°C) - [100°F (38°C)- 20°F (11°C)] = -50°F (-27°C).

4. Mode Selection



6 - position mode switch

Testing/Servicing modes

Off (or F) Off. The mixing valve stays where it is, regardless of what happens in the system. The timer continues to operate so the correct time is maintained.

C The mixing valve rotates towards its closed position.

O The mixing valve rotates towards its open position.

Running modes

◷ When the "REMOTE ENABLE" is shorted, the control switches between operating (☼) and idle (☽) modes according to the timer program. **A blue lug begins an idle period and a red lug ends it.**

☼ The slab will be heated to its operating temperature (if the cable "REMOTE ENABLE" is also shorted).

☽ The slab will be maintained at the set idle temperature.

Device	Condition				
• Remote Enable	shorted	shorted	shorted	shorted	open
• Mode Selector	☼	☽	◷	◷	—
• Timer ◷	—	—	☼	☽	—
Result	operate	idle	operate	idle	idle

5. Programming the timer

The clock here is set to 9:00 a.m. as indicated by the timer ring, not 21.00 hours (9 p.m.).

Setting the timer to the correct time

Turn the large hand clockwise until the correct time on the ring is pointed to by the switch in the upper left hand corner.

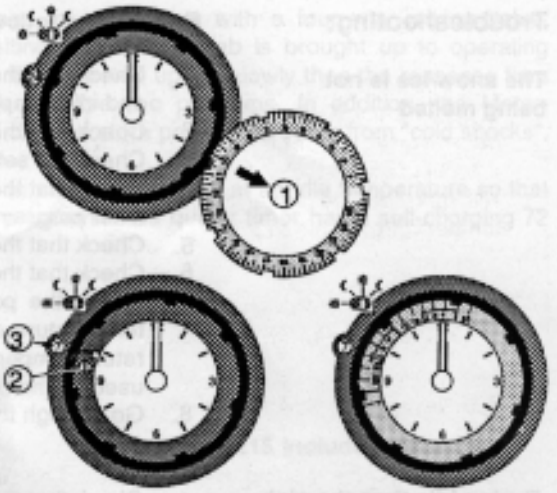
Programming the idle periods

The beginning of a idle period is set by a blue lug. A red lug ends the idle period.

7-day Program

The timer is supplied from the factory with a 24-hour dial which can be changed to a 7-day dial by the following procedure:

1. Set the time to 24.00 hours (12 midnight)
2. Take the timer ring out of its recess. (1)
3. Turn the screw (2) clockwise until the number '7' appears in the window (3).
4. Turn the timer ring over and insert it such that the corresponding week-day (I = Sunday, II = Monday. . .) is adjacent to the window (3).
5. Set the timer to the correct time and program the idle periods.



Testing and Troubleshooting

Testing:

If any of the following tests fail, check that the insulation on the wires is not preventing proper connection to the terminals.

Step 1 Test the sensors

Using an ohmmeter, measure the resistance between terminals 1 & 5, 2 & 5, and 7 & 8. The table below lists the expected resistance values at various sensor temperatures. The resistance between ground (the pipes) and any of terminals 1 to 8 should be greater than 1,000,000 ohms. No voltage should be present between any of these terminals and ground.

Sensor temperature		Resistance	Sensor temperature		Resistance	Sensor temperature		Resistance
°F	°C	ohms	°F	°C	ohms	°F	°C	ohms
-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

Step 2 Test the power supply

Turn on power to the transformer. Using an AC voltmeter, measure the voltage between terminals 15 & 16. The voltage should be between 22 and 28 volts AC.

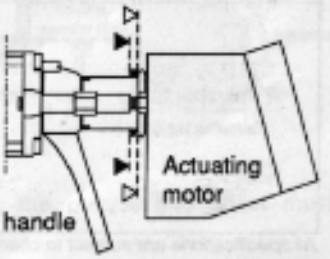
Step 3 Test the Actuating Motor

Bridge terminal 12 to terminal 15. The Actuating Motor should open the mixing valve. Close the valve by bridging terminal 13 to 15. If the motor does not operate in either direction, then check that power is supplied to terminals 15 and 16 and that the wires from terminals 12, 13 and 16 to the motor are connected. If the motor still does not operate, then it must be replaced.
Note: The Actuating Motor requires 3.5 minutes to rotate the mixing valve from closed to open.

Step 4 Test the control

Plug the control into the socket. Switch the mode selector to position **O**; the 'open' light should come on and the Actuating Motor should turn the mixing valve towards the open position. Similarly, when the mode selector is switched to **C** the mixing valve should turn towards the closed position. Turn on the remote enable switch. Switch the mode selector to ☼ and the control should bring the snow/ice melting slab up to the required operating temperature. If the control does not perform as stated, then it should be sent to tekmar for repair.

Manual Operation The mixing valve can be manually operated once the Actuating Motor is disengaged. To disengage the cylindrical coupling of the Actuating Motor from the handle of the mixing valve, pull the coupling towards the Actuating Motor and turn the mixing valve handle. Turn the handle towards '0' to close the mixing valve and towards '9' to open it.



Troubleshooting:

Perform the following checks until the problem is solved.

The snow/ice is not being melted

1. Check that the ☼ and ☽ dials on the control are properly set and that the resulting operating and idle temperatures are reasonable.
2. Check that the remote enable device is enabling the Motor-Electronic when it is required to.
3. Check the setting of the ΔT adjustment. It may have to be increased.
4. Check that the timer shows the correct time of day (and day of week if in the 7-day mode). Is the timer programmed for the present slab, stairs, etc. usage?
5. Check that the temperature sensors are all properly installed (See page 3).
6. Check that the boiler is on and up to its proper temperature.
7. Check the position of the mixing valve; if it is fully closed then the minimum boiler return temperature adjustment is set higher than the operating boiler's aquastat. The minimum boiler return temperature adjustment must be set to 130°F (55°C) or higher if a conventional boiler is used so the boiler's aquastat should be set higher than 150°F (65°C).
8. Go through the four steps of the test procedure on page 7.

During idle time the slab melts snow/ice.

1. Check that the timer shows the correct time of day (and day of week if in the 7-day mode). Is the timer programmed for the present slab, stairs, etc. usage?
2. Check that the temperature sensors are all properly installed (See page 3).
3. Check that the remote enable device is enabling the Motor-Electronic when it is required to.
4. Check that the ☼ and ☽ dials on the control are properly set and that the resulting operating and idle temperatures are reasonable, ie. that the resulting idle temperature is set to be below 30°F (0°C). See page 6 for an example.
5. Go through the four steps of the test procedure on page 7.

The timer doesn't operate

1. Does O and C (open & close) on the mode switch work? (ie. Is the control's power supply ok?).
2. If the electronic control is operating the mixing valve correctly, then only the timer needs to be repaired. Turn the two fastening screws 1/4 turn counter-clockwise and carefully pull the timer out of the electronic control. Unplug the connector. When installing the timer, ensure that the red dot on the connector aligns with the red dot on the timer. Turn the mounting screws clockwise.

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 filed 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, 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.

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