D 13
6/86

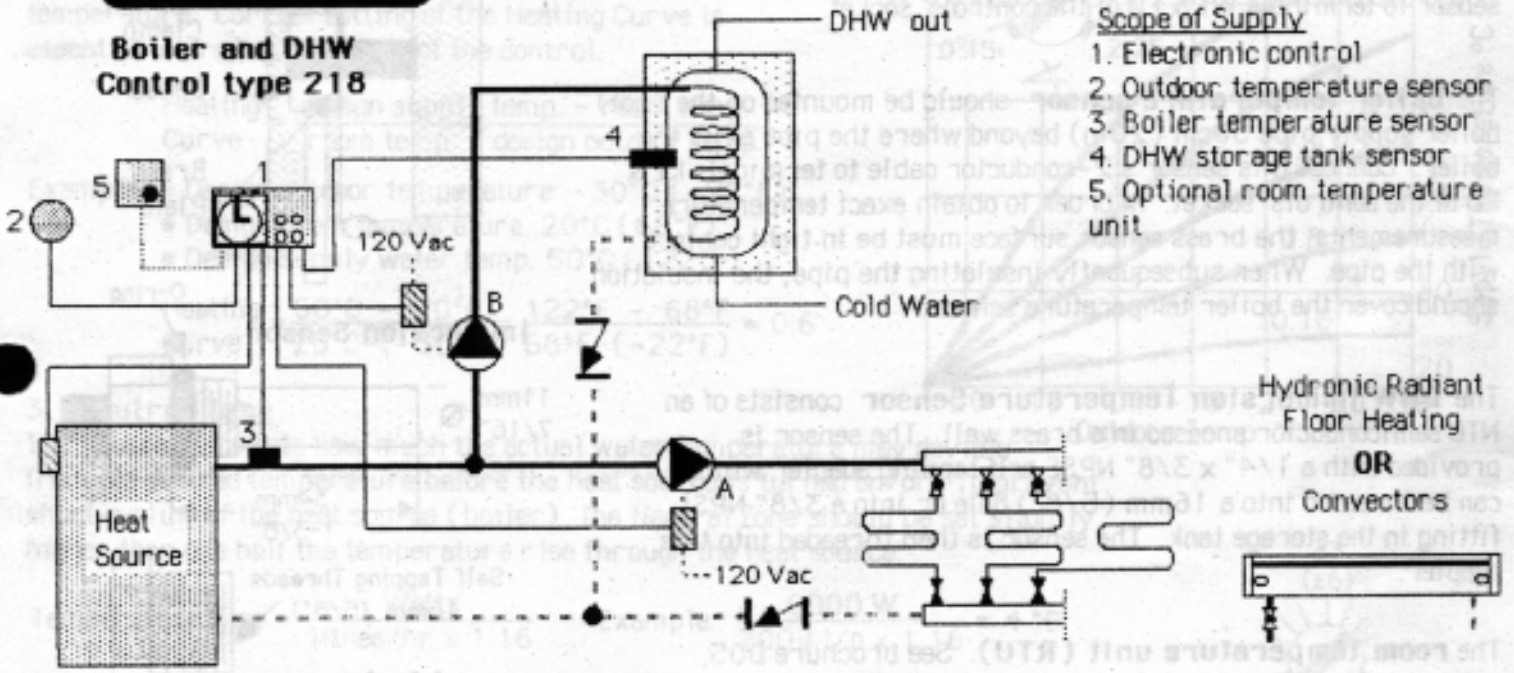
Boiler and Domestic Hot Water Control

tekmar®
Control Systems

The tekmar Boiler & DHW Control precisely regulates the supply water temperature of a heating system as a function of outdoor and indoor air temperatures and gives priority to the generation of domestic hot water. When heating the building, pump 'A' is on and the control regulates the supply water temperature by cycling the heat source on and off. When domestic hot water is needed, pump 'A' is turned off, pump 'B' is turned on, and the control cycles the heat source to provide the desired domestic hot water temperature.

The control has a minimum 5 minute delay between heating cycles to protect the compressor motor of a heat pump. During the setback period (generally night-time), the heating system operates at a reduced water temperature and the DHW storage tank receives no heat from the boiler. 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.

Boiler and DHW Control type 218

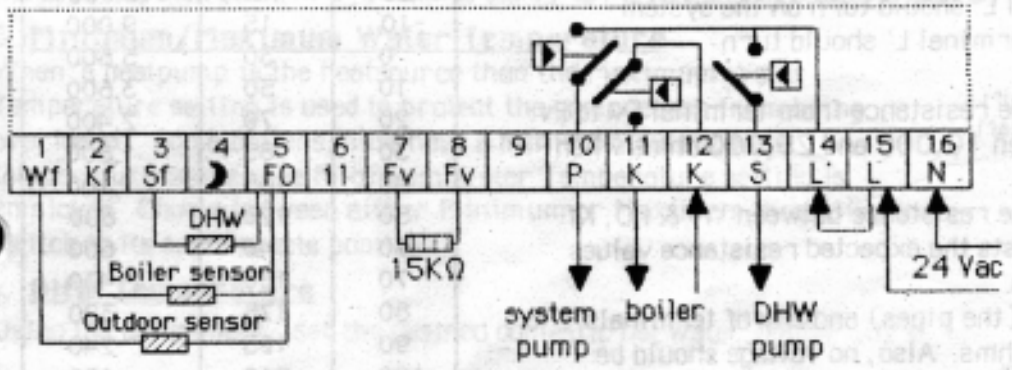


Scope of Supply

1. Electronic control
2. Outdoor temperature sensor
3. Boiler temperature sensor
4. DHW storage tank sensor
5. Optional room temperature unit

Electrical Installation

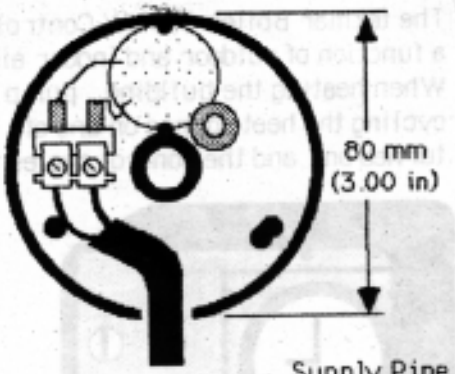
The tekmar control terminates the wires in a plug-in socket; no wires are directly connected to the control. This plug-in system simplifies installation and troubleshooting procedures. Fasten the socket to a firm surface in a convenient location. Terminals N & L (15 & 16) of the socket must be connected to the secondary side of a 24 Vac class 2 transformer. The total load of the control is less than 3VA.



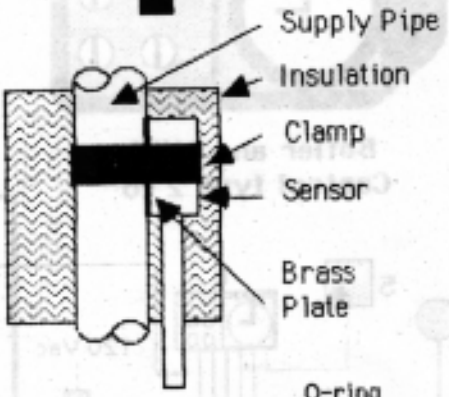
Caution: The power supply must not be switched off for extended periods of time (e.g. summer), otherwise the NiCad battery in the timer may be destroyed. (The battery keeps the timer operating up to 72 hours during a power failure).

Installation of the Temperature Sensors

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

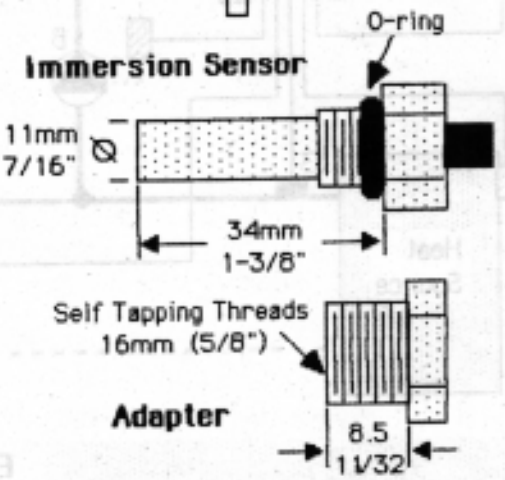


The **outdoor temperature sensor** should be mounted on the side of the building where the main rooms are. It should not be fitted immediately above a window or ventilation opening. With two screws, attach the black base of the sensor to the outside surface of the wall. Be sure that the hole for the cable entry faces downward. By means of a 2-conductor cable, connect the outdoor temperature sensor to terminals Wf & FO of the controls' socket.



The **boiler temperature sensor** should be mounted on the (hot) boiler supply pipe 50cm (20in) beyond where the pipe exits the boiler. Connect this sensor's 2-conductor cable to terminals Kf & FO of the controls' socket. In order to obtain exact temperature measurements, the brass sensor surface must be in tight contact with the pipe. When subsequently insulating the pipe, the insulation should cover the boiler temperature sensor.

The **DHW Immersion Temperature Sensor** consists of an NTC semiconductor encased in a brass well. The sensor is provided with a 1/4" x 3/8" NPSE self tapping adapter which can be threaded into a 16mm (5/8") hole or into a 3/8" NPSI fitting in the storage tank. The sensor is then threaded into this adapter.



The **room temperature unit (RTU)**. See brochure D05.

Testing and Troubleshooting

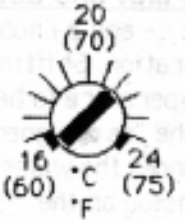
1. Turn on the power to the transformer. The voltage between terminals L & N should be approximately 24V AC.
2. Shorting terminal K to terminal K should turn on the boiler. Shorting terminal P to terminal L' should turn on the system pump. Shorting terminal S to terminal L' should turn on the DHW pump.
3. Using an ohmmeter, measure the resistance from terminal Fv to Fv. The resistance should be between 10,000 and 25,000 ohms when the dial on the RTU is at 20° C.
4. Using an ohmmeter, measure the resistance between Wf & FO, Kf & FO, ans Sf & FO. The table lists the expected resistance values at various sensor temperatures.
5. The resistance between ground (the pipes) and any of terminals 1 to 8 should be greater than 10M ohms. Also, no voltage should be present between any of these terminals and ground.

Approximate Sensor Temperature		Resistance
°C	°F	Ohms
-40	-40	44,000
-30	-20	25,000
-20	- 5	15,000
-10	15	9,000
0	30	5,600
10	50	3,600
20	70	2,400
30	85	1,600
40	105	1,100
50	120	800
60	140	600
70	160	430
80	175	320
90	195	240
100	210	190

Adjustments to be set by the Installer

1. Warm Weather Shut-Down

When the outdoor air temperature is above this setpoint, the control keeps both the boiler and pump relays off, thereby automatically shutting down the heating system during the summer and turning it on again in autumn. For increased energy savings during setback (night-time), the heating system is kept off until the outdoor air temperature is 15°C (27°F) below the setting of this dial. (Eg. if the Warm Weather Shutdown is 20°C (68°F) then the boiler won't turn on until the nightime temperature is below 5°C (42°F).



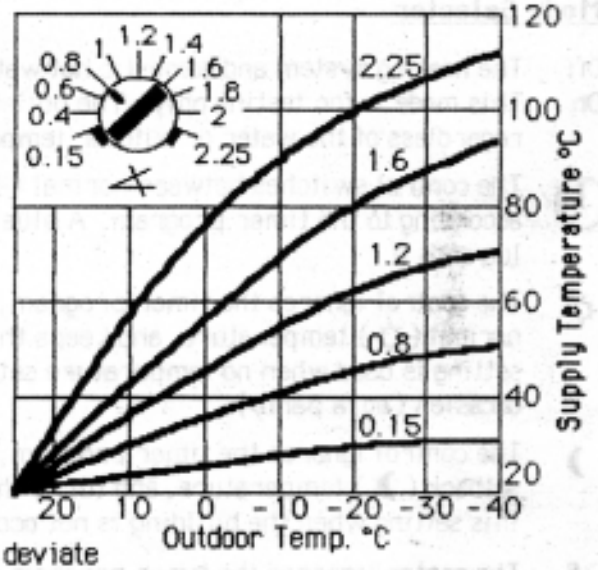
2. Heating Curve

The Heating Curve is the ratio of increase in supply water temperature to a decrease in the outdoor ambient temperature. Correct setting of the Heating Curve is essential to proper operation of the control.

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

Example:
- Design outdoor temperature -30°C (-22°F)
- Design room temperature 20°C (68°F)
- Design supply water temp. 50°C (122°F)

$$\text{Heating Curve} = \frac{50°C - 20°C}{20°C-(-30°C)} = \frac{122°F - 68°F}{68°F-(-22°F)} = 0.6$$



3. Neutral Zone

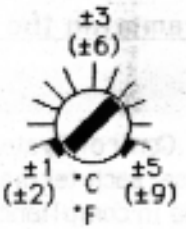
The Neutral Zone sets how much the actual water temperature may deviate from the desired temperature before the heat source is turned on/off. To prevent short cycling of the heat source (boiler), the Neutral Zone should be set slightly higher than one half the temperature rise through the heat source.

$$\text{Temperature Rise} = \frac{\text{Watts}}{\text{litres/hr} \times 1.16} \qquad \text{Example: } \frac{9000\ \text{W}}{2000\ \text{l/h} \times 1.16} \approx 4\ °C$$

The temperature rise is ≈ 4°C, thus set the Neutral Zone to more than ± 2°C.

$$\text{Temperature Rise} = \frac{\text{BTU/hr}}{\text{GPM} \times 500} \qquad \text{Example: } \frac{90{,}000\ \text{BTU/hr}}{9\ \text{GPM} \times 500} \approx 20°F$$

The temperature rise is ≈ 20 °F, thus set the Neutral Zone to more than ± 10°F.

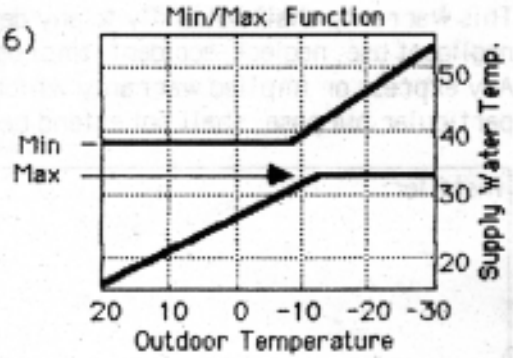


4. Minimum 'off' Period

If the minimum boiler 'off' period of 5 minutes between heating cycles is not desired, then connect a jumper from i1 to F0 in the socket (pins 5 & 6)

5. Minimum/Maximum Water Temperature

When a heatpump is the heatsource then the Maximum Water Temperature setting is used to protect the compressor from being overloaded. Some boilers must have a minimum output water temperature so then the Minimum Water Temperature setting is employed. Choose between either Minimum or Maximum by setting the switch to its appropriate position



6. DHW Temperature

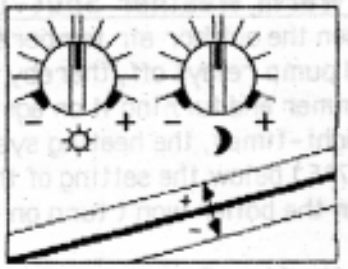
Using the adjustment, set the desired domestic hot water temperature.

Plug the control into the socket and lightly fasten the two screws.

Adjustments for the User

Normal and Setback Operation

The ☼ and ◗ knobs shift the heating curve during normal and setback operation. Shifting the heating curve causes the average room temperature to be increased or decreased. The "II" setting corresponds to the "as designed" condition. Adjusting the knob towards "+" or "–" changes the water temperature by approximately 2°C (4°F) per division on the ☼ knob and 3°C (5°F) per division on the ◗ knob.



Mode Selector

Off The heating system and domestic hot water are off.

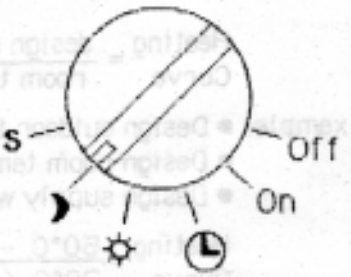
On This mode is for testing only. The boiler and one of the pumps turn on, regardless of the water or outdoor temperatures, and the lamp 'on' lights.

(L) The control switches between normal (☼) and setback (◗) operation according to the timer program. A blue lug begins a setback period and a red lug ends it.

☼ The control ignores the timer program, maintains the heating system at the normal (☼) temperature, and keeps the DHW at its set temperature. This setting is used when no temperature setback is desired during a special occasion (eg. a party).

◗ The control ignores the timer program, maintains the heating system at the setback (◗) temperature, and turns the DHW off. We recommend you use this setting when the building is not occupied (eg. during holidays).

S The control ignores the timer program aand turns off the heating system but maintains the DHW at its normal temperature.



Programming the Timer

See back of brochure U02.

Warranty

tekmar Control Systems (tekmar) warrants, to the original purchaser for twelve (12) months from date of purchase, each tekmar product against defects in workmanship and materials, when the product is installed 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 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 then 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.

Any express or implied warranty which the user may have, including merchantibility and fitness for a particular purpose, shall not extend beyond twelve (12) months from the date of purchase.

Installer:	tekmar Control Systems, Ltd. Site 15, Comp. 27, RR #6 Vernon, B.C. CANADA V1T 6Y5 Tel: (604) 545-7749 Telex: 048-85384 tekmar Angewandte Elektronik GmbH & Co. KG D-4300 Essen 16, WEST GERMANY Tel: (0201) 49841 Telex: 8579935

All specifications are subject to change without notice.