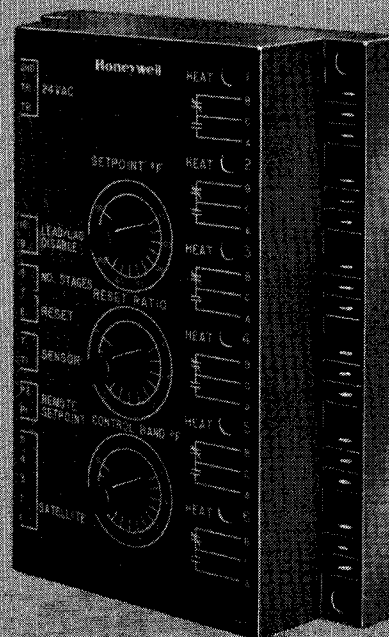


Honeywell

THE MICROPROCESSOR-BASED W7100J DISCHARGE WATER CONTROL MAINTAINS AN AVERAGE DISCHARGE WATER TEMPERATURE FOR MULTIPLE BOILER AND STAGED ELECTRIC BOILER APPLICATIONS, BY STAGING ON AND OFF BOILERS AS REQUIRED. THE W7100 CAN PROVIDE UP TO 10 STAGES OF HEATING USING A W7101B SATELLITE SEQUENCER.

- Up to six stages of heating provided.
- Expandable system up to 10 heating stages using a W7101B Satellite Sequencer.
- Advanced proportional plus derivative microprocessor control algorithm minimizes droop and overshoot.
- Staging lead/lag function to equalize stage run time. This function may also be disabled.
- Soft start to minimize boiler rapid cycling during system start up.
- Minimum on and off stage timings.
- Adjustable set point from 80°F to 220°F [27° C to 104° C].
- Adjustable reset ratios from 1:4 to 4:1.
- Adjustable control band set point from 2°F to 16°F [1.1° C to 8.8° C].
- Reset signal from a C7031G outdoor air thermistor sensor.
- C7170A sensor can be used for sensing water temperature.
- LEDs on W7100J show which stage of heating is energized.
- Remote set point capability using an S963B potentiometer.

DISCHARGE WATER TEMPERATURE CONTROL



W7100J

SPECIFICATIONS

W7100J MODEL FEATURES:

- 6 stage heating controls multiple staged electric, multiple gas or oil fired packaged hydronic boilers.
- W7101B satellite expansion to 10 heating stages.
- Adjustable set point.

ELECTRICAL RATINGS:

Input voltage and Frequency (terminals TR-TR) 20 to 30Vac at 60 Hz (20 to 26.4 Vac at 50 Hz).
 Power Consumption—12 VA at 24 Vac and 50 to 60 Hz

ON/OFF STAGES (HEAT 1 THROUGH 6)

CONTACT	VOLTAGE (V)	INRUSH (VA)	RUNNING (VA)
N.O.	24	240	60
N.C.	24	75	30
N.O.	120/240	750	75
N.C.	120/240	240	40

SWITCHING:

Spdt relays.

WIRING TERMINALS:

1/4 in. quick-connect.

INPUT SIGNAL:

Sensor—positive temperature coefficient of 4.8 ohms/degree F [8.6 ohms/degree C]; resistance of 3484 ohms at 77°F [25 C].

NUMBER OF STAGES INPUT:

Resistor value (across terminal 7 and 8) to determine number of ON/OFF stages (See Table 2).

TEMPERATURE RATINGS:

Ambient: -40°F to +150°F [-40 C to +66 C].
 Shipping: -30°F to +150°F [-34 C to +66 C].

HUMIDITY RATING:

5 to 90 percent RH noncondensing.

MOUNTING:

Four mounting holes in base, use No. 8 screws (screws not provided).

DIMENSIONS:

See Fig. 1.

UNDERWRITERS LABORATORIES INC.

COMPONENT RECOGNIZED: File no. E94528, Guide No. SDFY2

CANADIAN STANDARDS ASSOCIATION CERTIFIED:

Report No. LR46034.

ADDITIONAL SYSTEM COMPONENTS:

Discharge Water Sensor—C7170A1010 senses discharge water temperature, provides input to W7100J sensor terminals T and T1.

Transformers (required)—Provides 24 Vac power for all components of the W7100J control system. (Size transformer to match system load.)

(continued on page 3)

ORDERING INFORMATION

WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR AUTHORIZED ENERGY MANAGEMENT DISTRIBUTOR, REFER TO TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING NUMBER.

IF YOU HAVE ADDITIONAL QUESTIONS, NEED FURTHER INFORMATION, OR WOULD LIKE TO COMMENT ON OUR PRODUCTS OR SERVICES, PLEASE WRITE OR PHONE:

1. YOUR LOCAL HONEYWELL BUILDING CONTROLS SALES OFFICE (CHECK WHITE PAGES OF YOUR PHONE DIRECTORY), ASK FOR THE ENERGY PRODUCTS SALES REPRESENTATIVE.

**2. BUILDING CONTROLS CUSTOMER SERVICE
 HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH
 MINNEAPOLIS, MINNESOTA 55422 (612) 542-7500**

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TABLE 1—W7100J ACCESSORY CHART.

MODEL	QUANTITY	DESCRIPTION	APPLICATION
C7031G1016	1	Outdoor Air Sensor	Reset of discharge water from outdoor air temperature.
S963B1193	1	Remote Set point Potentiometer	Permits remote set point adjustment for W7100J; 500 ohm. 80°F to 220°F [27 C to 104 C] temperature range.
C7170A1010	1	Discharge Water	Senses discharge water temperature Temperature Sensor for input to W7100J.
W7101B1001	as needed	Satellite Sequencer	Adds up to 4 ON/OFF stages of heating to W7100 switching capability.
121371A	1	Copper Immersion Well	Required for C7170A immersion sensor.
121371E	1	Stainless Steel Immersion Well	Required for C7170A immersion sensor.
107408	as needed	Heat Conduction Compound	Required for minimum thermal lag.
AT72D1683 AT87A1106 AT88A1005 AT88A1021	as needed	System Transformer 40 VA, 120 Vac 50 VA, 120/208/240 Vac 75 VA, 120 Vac 75 VA, 208/240 Vac	Size VA to system load.
4074EDJ	1	Resistor Kit and Test Plug	Used in controller checkout.
4074EFV	1	Resistor Kit for W7100J System Configuration	Used to select number of stages controlled.

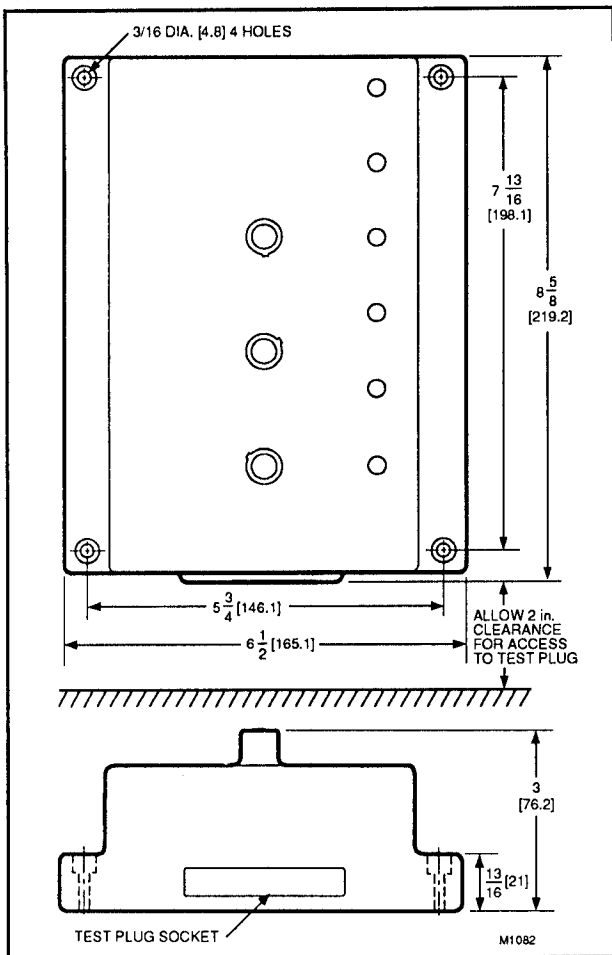


FIG. 1—W7100 DISCHARGE AIR OR WATER CONTROLLER MOUNTING DIMENSIONS IN IN. [mm IN BRACKETS].

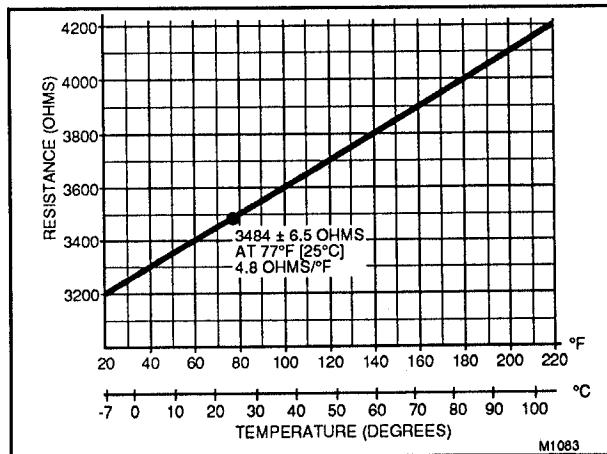


FIG. 2—VARIATION OF C7170A SENSOR RESISTANCE AS COMPARED TO TEMPERATURE.

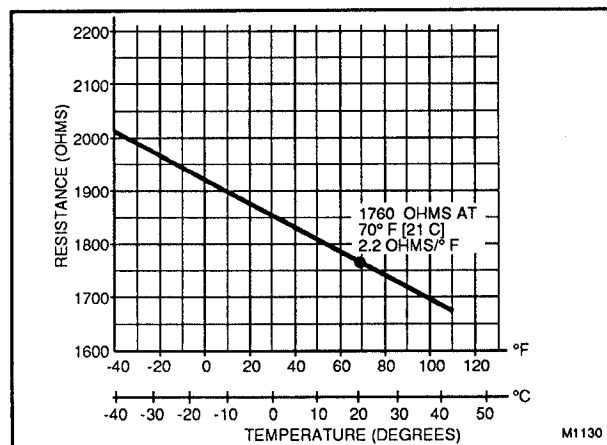


FIG. 3—C7031G SENSOR RESISTANCE VS TEMPERATURE CHARACTERISTICS.

INSTALLATION

WHEN INSTALLING THIS PRODUCT...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the controller is suitable for your application.
3. Installer must be a trained, experienced service or installation technician.
4. After installation is complete, check out product operation as provided in these instructions.

CAUTION

Disconnect power supply before making connections to avoid electrical shock and/or equipment damage.

WARNING

The W7100J is not intended for use as a primary limit control. Another control, that is intended and certified as a high limit control, must be placed into the control circuit.

WARNING

This equipment generates, uses and can radiate radio frequency energy. If this equipment is not installed and used in accordance with the instruction manual, it may cause interference to radio and television reception. It has been tested and found to comply with the limits for a Class B computing device pertinent to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Relocate the receiver with respect to the device.

GENERAL INSTALLATION

LOCATION AND MOUNTING

Choose a location for the W7100J controller that is not exposed to the weather and where controls, connections and the diagnostic analyzer socket are accessible. Mount

the controller with four No. 8 screws through the mounting holes in the base. See Fig. 1.

Mount the C7170A sensor in the discharge water line using the selected immersion well and heat-conductive compound.

Mount auxiliary control system components, such as remote potentiometers, reset sensors, etc. according to instructions packed with the individual units.

WIRING

Disconnect power supply before making connections to avoid electrical shock and/or equipment damage. All wiring must comply with local codes and ordinances.

W7100J wiring and hookup diagrams are shown in Figs. 8, 9, 10, 11 and 12.

CAUTION

When routing wires from the W7100 to sensors, set point potentiometers, or the satellite sequencer, it is necessary to isolate this wiring from line voltage wiring. In addition, ensure that wiring is kept at least 1 foot away from large inductive loads such as contactors, large motors, power distribution panels and fluorescent lighting ballasts. Failure to follow these guidelines may result in erratic temperature control and operation of the W7100.

CHANGING NUMBER OF CONTROLLED STAGES

A fixed resistor is installed across the number of stages input (terminals 7 and 8). The resistor value tells the W7100J how many stages of heating are to be controlled. This affects the control behavior and determines how many stages the W7100J will turn on and off.

A resistor (600 ohm) has been initially installed by the factory on terminals 7 and 8 (see Table 2). This corresponds to the value for controlling 6-stages of heating. If the system being installed has more or fewer stages of heating, this resistor must be changed to any value shown in Table 2. The new value will represent the actual number of stages operating under the control of the W7100J. This includes any stages on a W7101B sequencer connected to the W7100J control.

CONNECTING ADDITIONAL STAGES

Control of up to 4 additional stages of ON/OFF heating can be added by using a W7101B Satellite Sequencer connected to the W7100J system as shown in Fig. 12.

The fixed resistor value across the W7100J terminals 7 and 8 (Table 2) must agree with the total number of stages controlled by the W7100J and W7101B satellite. See W7101 specification sheet, Form 63-2119, for additional details.

TABLE 2—INPUT RESISTANCE FOR NUMBER OF CONTROLLED STAGES.

TOTAL NO. OF HEATING STAGES	RESISTANCE IN OHMS \pm 1% ACROSS TERMINALS 7 AND 8 ^a	4074EFV BAG ASSY WIRE COLORS ^b
1 (W7100 only)	100	Blue
2 (W7100 only)	200	Red
3 (W7100 only)	300	Yellow
4 (W7100 only)	400	Brown
5 (W7100 only)	500	Green
6 (W7100 only)	600	Grey (Shipped with Control)
7 (W7100 and W7101B)	700	Orange
8 (W7100 and W7101B)	800	White
9 (W7100 and W7101B)	900	Violet
10 (W7100 and W7101B)	1000	Black

^aUse 1/8 W resistors.

^b4074EFV Bag Assembly available separately.

OPERATION

BOILER OPERATION

Boiler systems are used in many types of applications. Some systems heat water for domestic purposes such as dish washing and locker room showers. Other common uses for hot water systems are space heating through perimeter baseboard systems or through the use of hot water heating coils in air handling units. In any case, accurate discharge water temperature control is required to maintain user comfort and to minimize energy use.

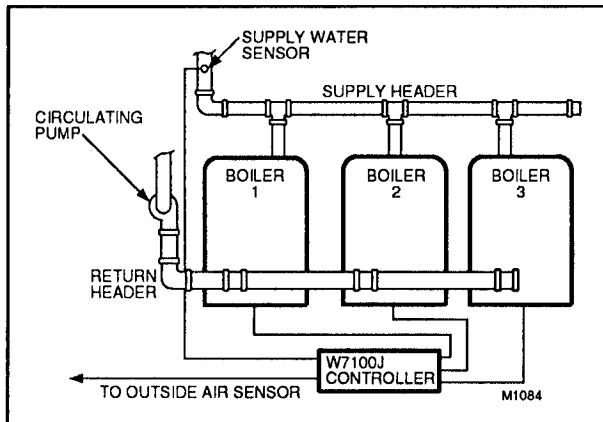


FIG. 4—TYPICAL BOILER SYSTEM.

W7100J DISCHARGE WATER TEMPERATURE CONTROL OPERATION

The W7100J uses a derivative control band concept to provide close stable temperature control in discharge water heating systems. The control band concept matches required operating capacity to system load, while the derivative action minimizes the offset from the control set point which normally occurs in proportional-only type controllers.

The control band setting is centered on the discharge water set point (see Fig. 5). The control band setting is adjustable from 2 F to 16 F [1.1 C to 9 C]. This adjustment is used to stabilize system operation. Following is a description of how control stages operate.

Using Figure 5 and beginning at point A, the discharge

water temperature is below the lower control band limit and the minimum OFF time has elapsed (1 minute). The first stage will energize on the W7100. At point B, the discharge water temperature is still below the upper control band limit. If the minimum time between stages has elapsed (2 minutes), the next highest stage will energize. At point C, the discharge water temperature has risen above the upper control band. If the minimum ON time has elapsed for that stage (1 minute), the lowest stage on will shut off. This sequence will continue until the demand for heating increases (point D) at which time stages will sequence ON in the same manner as before. As a rule, any time the discharge water temperature is below the lower control band limit, a stage will go ON and any time the discharge water temperature rises above the upper control band limit, a stage will go OFF.

W7100J LEAD/LAG OPERATION

Using a 3 stage system as an example, at point A in Figure 5, the first stage on the W7100J would energize. At point B the second stage on the W7100J would energize. At point C the first stage on the W7100J would de-energize and at point D the third stage on the W7100J will energize. The method of energizing and de-energizing stages on the W7100J in this manner will allow run time equalization for each stage of heating. This type of staging is termed first on, first off sequencing.

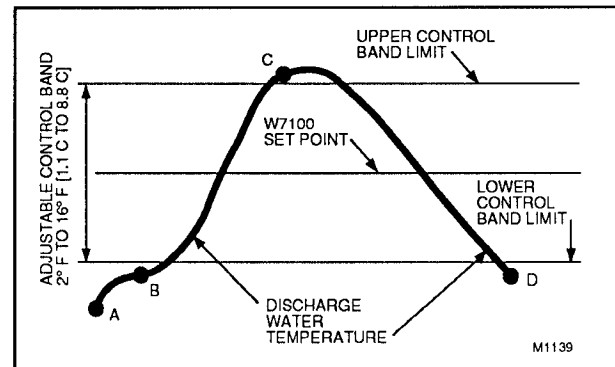
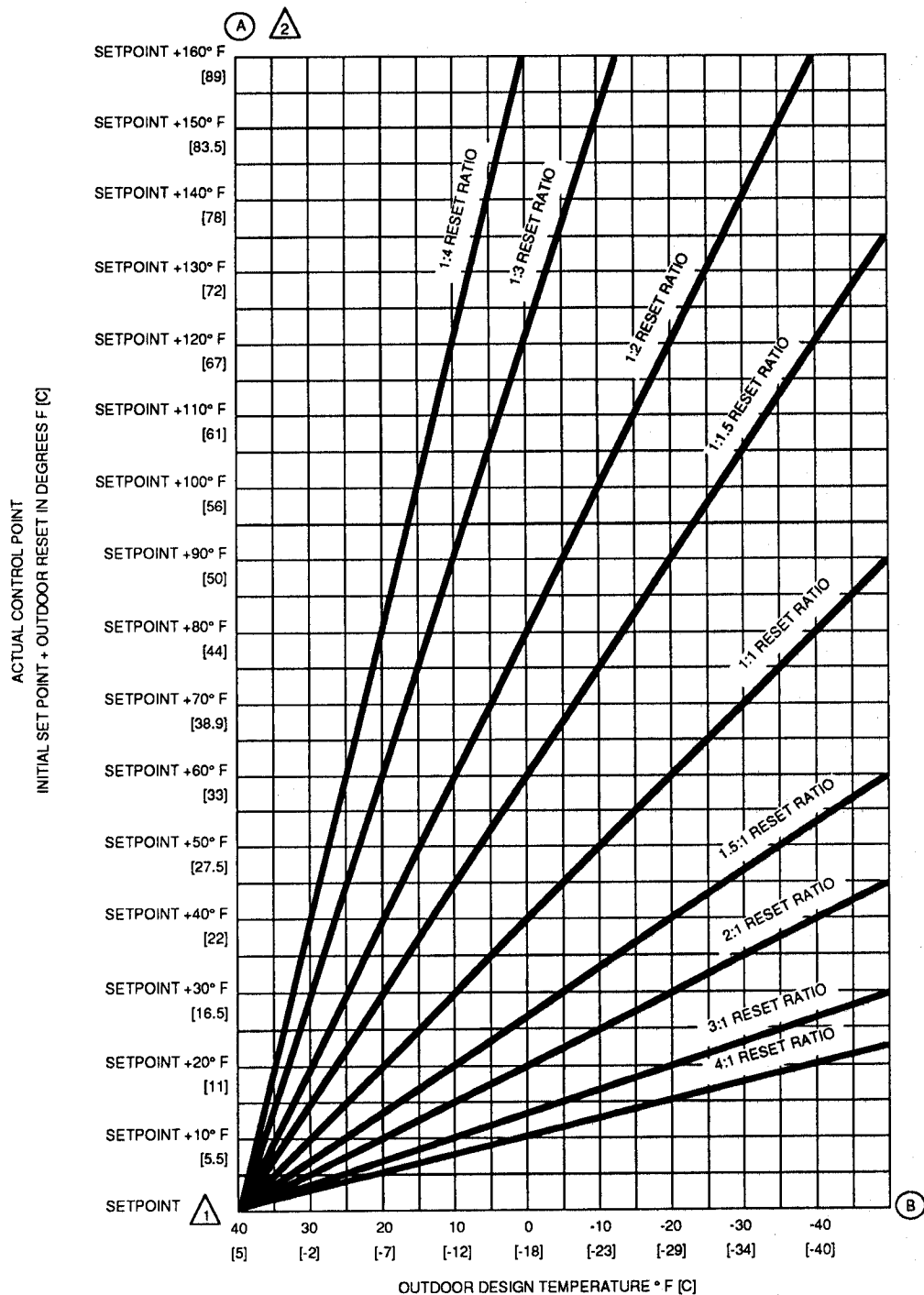


FIG. 5—W7100J DISCHARGE WATER CONTROL ALGORITHM OPERATION.



1 NOTE THAT THE SETPOINT IS THE ACTUAL CONTROL POINT WHEN THE OUTDOOR TEMPERATURE IS 40° F [4.5 C].

2 MAXIMUM CONTROL POINT OF THE W7100J IS 220° F [104 C].

M1136

FIG. 6—DETERMINE MAXIMUM CONTROL POINT AT THE SELECTED RESET RATIO BEFORE PUTTING SYSTEM INTO OPERATION.

TABLE 3—RESET SELECTION GUIDE FOR RESET FROM OUTDOOR TEMPERATURE

HEATING APPLICATION	TYPICAL HEATING MEDIUM TEMP. AT DESIGN COND.		TYPICAL INITIAL SET POINT AT 40 F		RESET RATIO SET POINT FOR DESIGN TEMPERATURE		
	F	C	F	C	-20 F	0 F	20 F
					[-29 C]	[-18 C]	[-7 C]
					RESET RATIO	RESET RATIO	RESET RATIO
HYDRONIC							
Direct							
Standing	190	88	100	38	1:1.5	1:2.2	1:4
Convactor/Baseboard	200	93	120	49	1:1.3	1:2	1:4
Fan Coil Heating	190	88	90	32	1:1.7	1:2.5	1:4
Indirect							
Floor Radiant	100	38	80	27	3:1	2:1	1:1
Ceiling Radiant	120	49	80	27	1.5:1	1:1	1:2

RESET OF DISCHARGE WATER TEMPERATURE

IF NO RESET IS DESIRED, JUMPER TERMINALS 6 AND 7 ON THE W7100J.

ENVIRONMENTAL APPLICATIONS

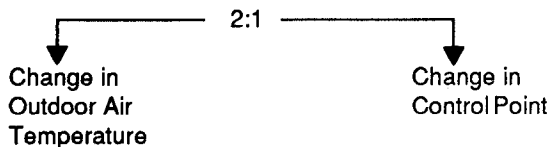
In order to save additional energy under lighter loading conditions, it may be desirable to change or reset the discharge water temperature based on outdoor air temperature. Reset has proved itself as an energy saving technique, as well as a way of improving comfort.

DOMESTIC HOT WATER APPLICATIONS

Domestic hot water applications do not typically reset the discharge water temperature set point as constant water temperature is usually desired. However, should you desire reset in this application, the same operation as described below applies.

RESET FROM OUTDOOR AIR TEMPERATURE

The reset ratio is an indication of how much the actual control point will increase as the outdoor temperature decreases. The reset ratio is expressed in the following manner:



For example, with a reset ratio of 2:1, when outdoor air temperature goes from 40° F to 0° F [4.5 C to -18 C], the discharge water temperature set point goes from 120° F to 140° F [49 C to 60 C].

In other words, as outdoor air temperature drops 40° F, the discharge water set point is reset upwards 20° F (2:1).

The first number in the reset ratio refers to the change in outdoor temperature, while the second number refers to the change in the W7100J set point. A reset ratio set point of 2:1 means that the W7100 set point will change 1° F [1 C] for every 2° F [2 C] decrease in outdoor air temperature from 40° F [4.5 C]. The initial start point for reset on the W7100J is 40° F [4.5 C]. The discharge water set point will

be reset upward as the outside air temperature falls below this point.

The selection of the correct reset ratio must take into account the initial temperature setting and the desired hot water set point at design temperature conditions. The setting of the reset ratio must be such that the controller will raise the hot water set point from the initial set point to the maximum temperature required when the outdoor temperature drops from 40° F [4.5 C] to the design temperature. See Table 3 for suggested reset ratio starting set points.

SELECTING RESET RATIO SETPOINT

Using Figure 6 as a guide for the following instructions:

1. Select ratio and initial set point from the reset selection guide in Table 3.
2. Draw a line straight up from the design temperature for your area (scale B) until it intersects with the selected reset ratio.
3. From this point, draw a line horizontal to the left until you reach the vertical axis (scale A).
4. The actual control point at design temperature is the figure read from scale A plus the initial set point of the W7100J. If the resulting hot water temperature set point exceeds the water temperature required for design conditions, or if it exceeds manufacturer's recommendations, select either a lower initial set point or a higher reset ratio and then repeat steps 1 through 4.

CHANGING THE W7100 RESET STARTING POINT

The W7100J control algorithm (program) contains the reset starting point of 40° F [4.5 C], and cannot be modified through software changes. However, using a resistor in series with the C7031G outdoor air sensor, you can raise the reset start point by an amount equal to adding 2.2 ohms per degree fahrenheit that you wish to raise the reset set point.

For example, if you wish to raise the reset start point from the preset set point of 40° F [4.5 C] to a start point of 60° F [15.5 C], you are trying to raise the reset start point by 20° F [11 C]. To accomplish this, take the difference between the preset W7100J reset start point (40° F) and the temperature that you wish to start the reset (in this case

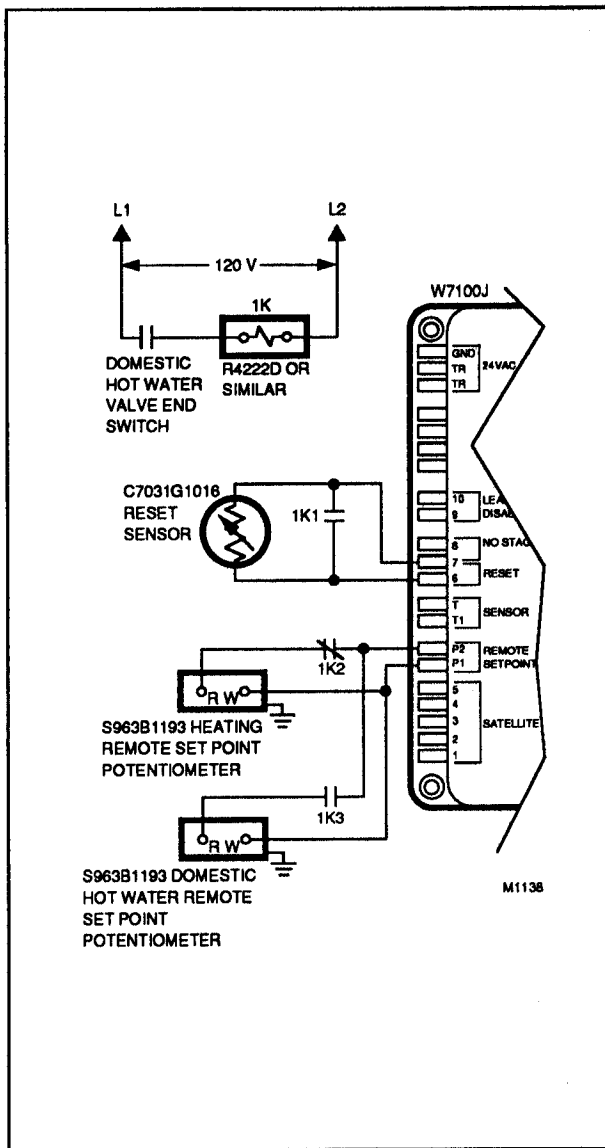


FIG. 7—SWITCHING SET POINTS OF THE W7100J FOR DOMESTIC HOT WATER USAGE.

60° F) multiply that number (in this case 20° F) times the 2.2 ohms mentioned above. Use this number (in this case 44 ohms) as the value of the resistor (R_1) to place in series with the C7031G sensor and the W7100J terminal 6 or 7 (see Figure 8).

To determine the proper reset ratio take the temperature difference in the preset W7100J reset start point (40° F) and the temperature you wish to start the reset (in this case 60° F) and add that number (in this case 20° F) to the temperatures along the B scale (outdoor design temperature) of Fig. 6 (e.g., 40 becomes 60, 30 becomes 50, 0 becomes 20, etc.). The A scale (actual control point) remains unchanged.

IF NO RESET IS DESIRED, JUMPER TERMINALS 6 AND 7 ON THE W7100J.

W7100 LED OPERATION

The W7100 has one LED for each staged output. The LED on the W7100 will light simultaneously as that stage relay energizes. If the LED is not lit, the stage will not energize. When the relay stage energizes, the normally closed contacts open, and the normally open contacts close.

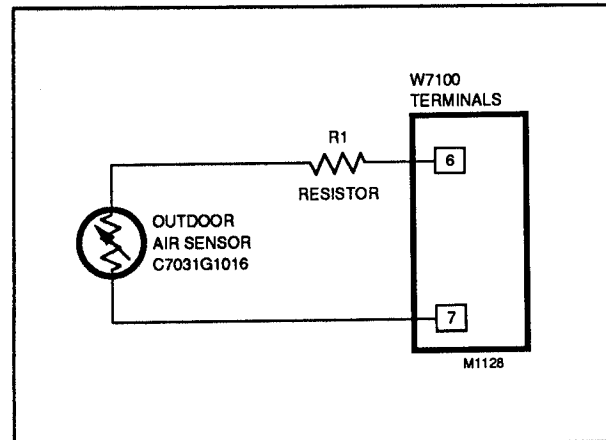


FIG. 8—W7100 RESET MODIFICATION SCHEMATIC WIRING DIAGRAM

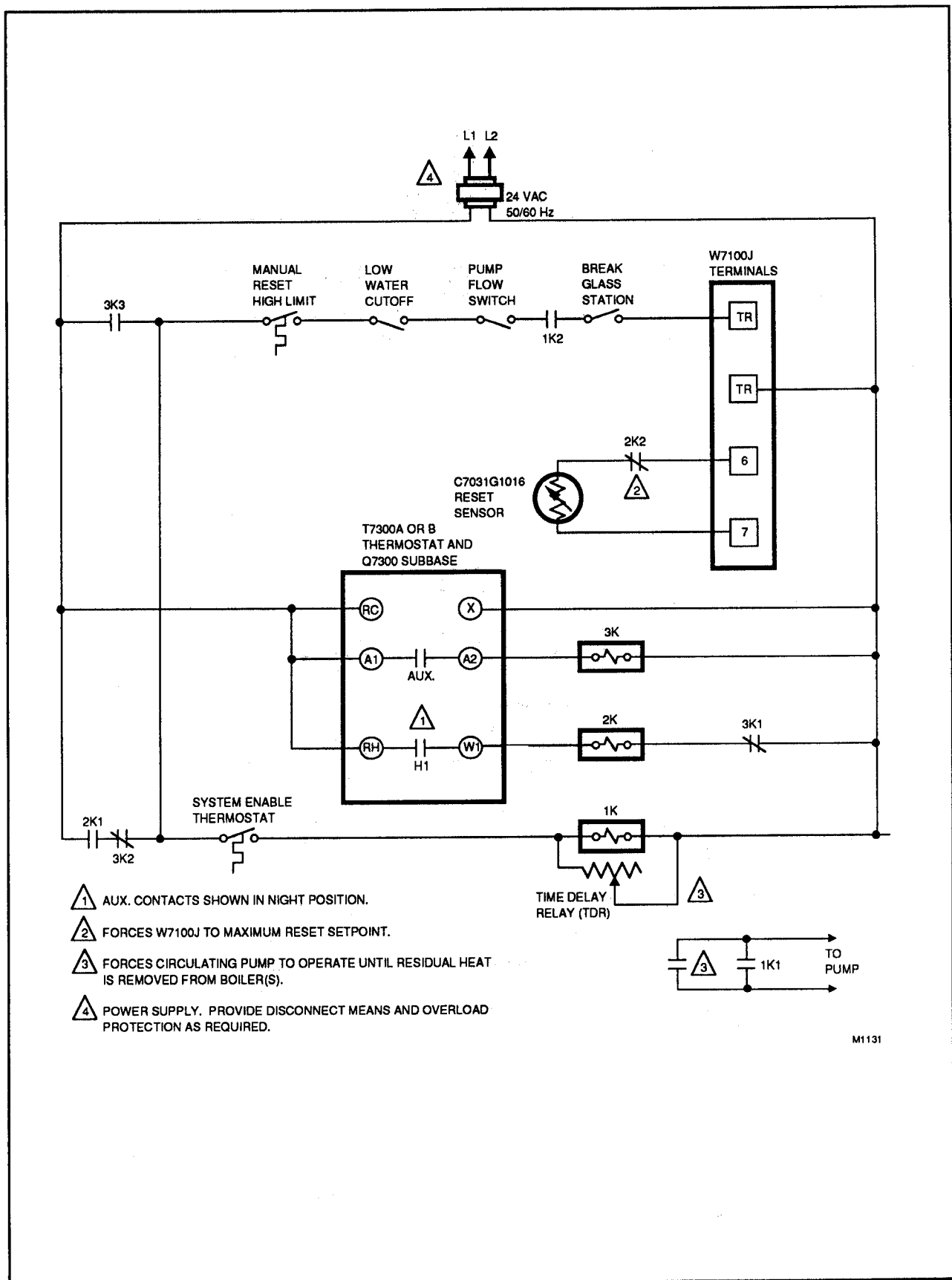


FIG. 9—TYPICAL SYSTEM LADDER DIAGRAM OF W7100J USING T7300 FOR NIGHT SETBACK WITH MORNING WARMUP. CIRCULATOR PUMP SHUTDOWN AND MAXIMUM RESET OVERRIDE DURING NIGHT AND MORNING WARMUP OPERATION.

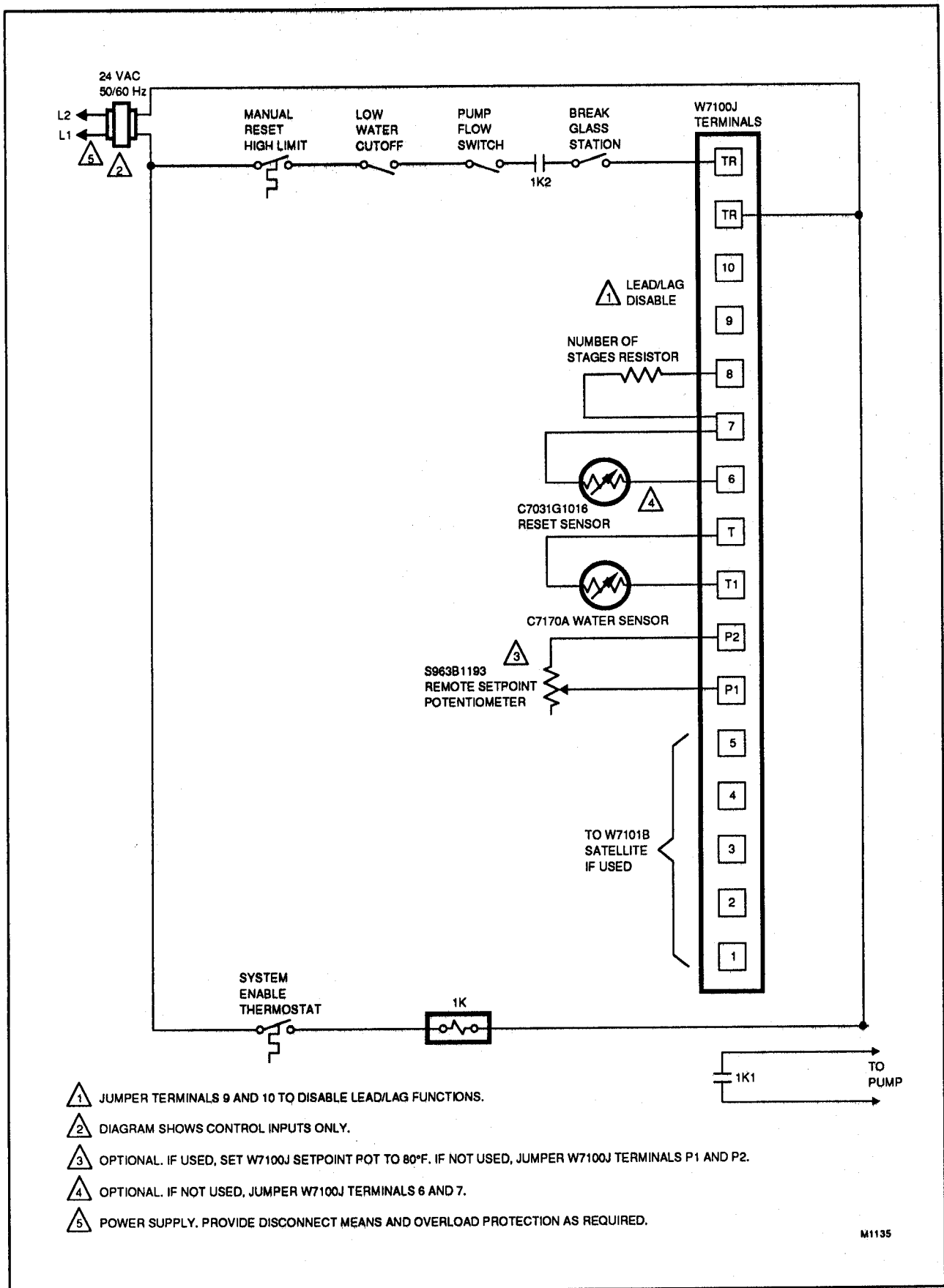
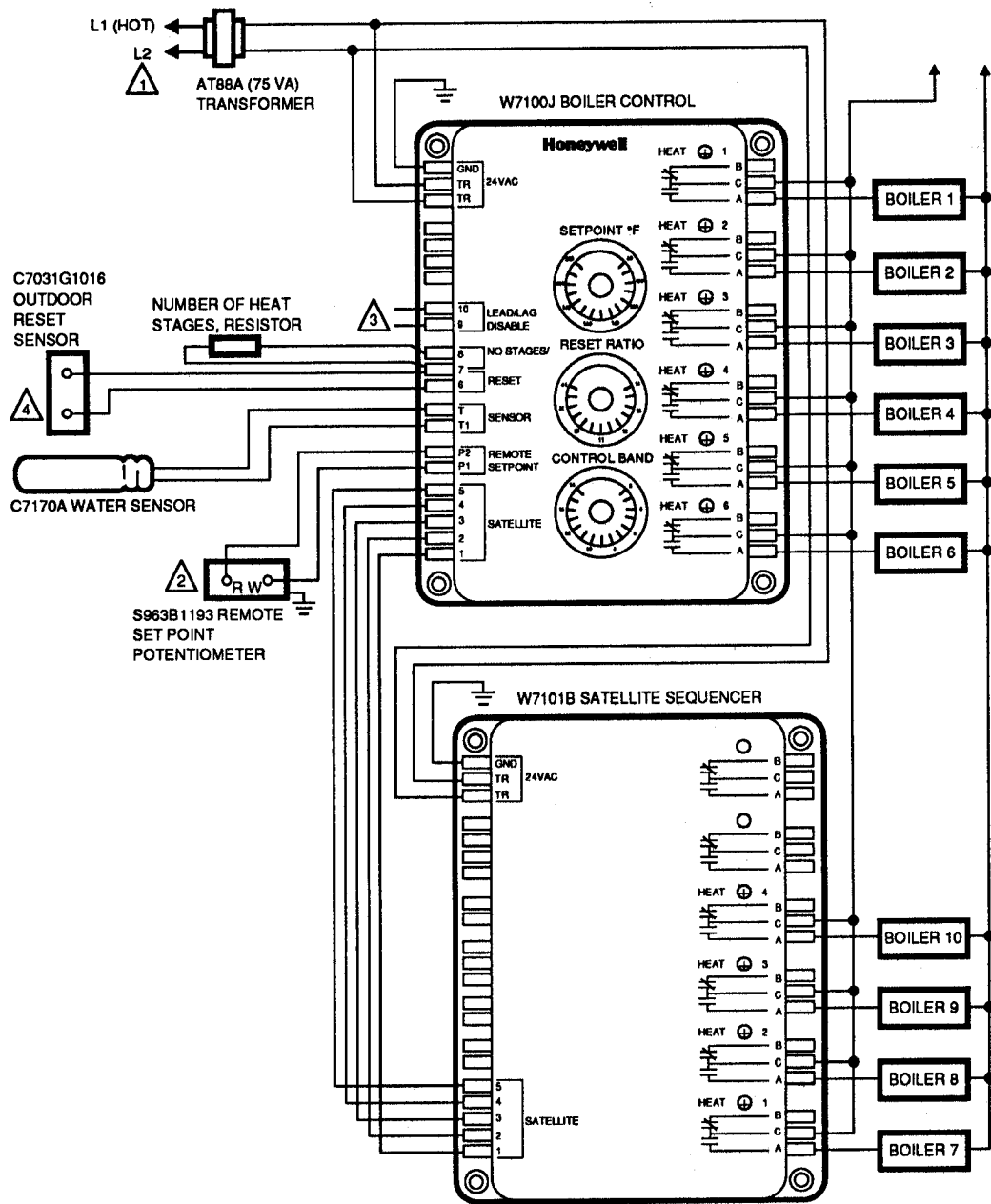


FIG. 11—TYPICAL SYSTEM LADDER DIAGRAM SHOWING CONTROL INPUTS. FOR CONTROL OUTPUT DIAGRAM AND SATELLITE CONNECTIONS SEE FIGURE 12.



- 1 POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
- 2 OPTIONAL, IF USED, SET W7100J SET POINT AT 80° F. IF NOT USED, JUMPER TERMINALS P1 AND P2 ON W7100J.
- 3 JUMPER TERMINALS 9 AND 10 TO DISABLE LEAD/LAG FUNCTION.
- 4 OPTIONAL, IF NO RESET IS DESIRED, JUMPER TERMINALS 6 AND 7 ON W7100J.

M1137

FIG. 12—W7100J WITH 10 HEAT STAGES, NUMBER OF STAGES RESISTOR, RESET SENSOR, DISCHARGE WATER SENSOR, AND S963B REMOTE SET POINT POTENTIOMETER.

SETTINGS AND ADJUSTMENTS

SET POINT KNOB

HOT WATER HEATING APPLICATIONS—follow recommendations listed in Table 3 of this specification sheet.

DOMESTIC HOT WATER APPLICATIONS—follow the guidelines suggested by the manufacturer of the equipment using the hot water.

RESET RATIO KNOB

HOT WATER HEATING APPLICATIONS—follow recommendations listed in Table 3 of this specification sheet.

DOMESTIC HOT WATER APPLICATIONS—reset is generally not used in these applications as constant temperature hot water is normally required. If reset is not used jumper terminals 6 and 7.

NUMBER OF STAGES INPUT

Select the proper resistor from Table 2 of this specification sheet that represents the total number of stages controlled by the W7100J. Place this resistor between input terminals 7 and 8 on the W7100J.

CONTROL BAND KNOB

Set for desired control band. Increasing the control band slows down the response time of the W7100J and increases the temperature deviation from set point. Lowering the control band speeds up the response of the W7100, while decreasing the temperature deviation from the W7100 set point.

The control band set point should be as narrow as possible without causing hunting or rapid cycling. If instability occurs, widen the control band set point.

LEAD/LAG DISABLE

If the lead/lag function as described in the operation section of this specification sheet is not desired, jumper input terminals 9 and 10 on the W7100J.

REMOTE SET POINT

An optional remote set point can be added (see figure 12, note 2). If a remote set point is not used jumper P1 and P2 together. Failure to do so indicates a very low outdoor temperature to the W7100J and all stages will energize resulting in overheating.

SYSTEM CHECKOUT

EQUIPMENT REQUIRED FOR CONTROLLER CHECKOUT

1. 4074EDJ—Test plug and resistor bag assembly for controller checkout.
2. 4074EFV—Resistor bag assembly for selecting the number of stages to be controlled.
3. Digital VOM meter.

STEP	ACTION	VERIFICATION
1.	Disconnect power from the W7100J.	Check voltage at W7100 Tr-Tr terminals. Should measure 0 Vac.
2.	Remove power to the boiler(s).	Check power at control transformer. Should measure 0 Vac.
3.	Remove C7170A sensor leads from W7100J terminals T-T1, and replace with a 3650 ohm resistor (included in 4074EDJ) to simulate a 115 F [46 C] discharge water temperature.	None
4.	Install jumper on lead/lag terminals 9 and 10 on W7100J.	None
5.	Install jumper on P1 and P2 terminals on W7100J.	None
6.	Install jumper on W7100 reset terminals 6 and 7.	None
7.	Remove red dust cover from bottom of W7100J and install test plug from bag assembly 4074EDJ.	None
8.	Set W7100J set point at 150 F	None
9.	Apply power to the W7100J.	Check for 24 Vac at W7100 terminals Tr-Tr.
10.	Wait 60 seconds. (100 seconds for 10 stages)	None
11.	After 60 seconds, all heating stages on the W7100J and the W7101B satellite (if used) should energize.	LEDs of connected stages should be on.
12.	Turn the W7100J Set point down to 80 F.	
13.	Wait 60 seconds. (100 seconds for 10 stages)	None
14.	All connected stages of the W7100J and the W7101B satellite should be off.	All LEDs should be off.
15.	Remove power from the W7100J TR-TR terminals.	Voltage at W7100J terminal should measure 0 Vac.
16.	Remove test plug from bottom of the W7100J and replace with the red dust cover.	None
17.	Remove system from test mode by reconnecting all previously disconnected wiring to sensors, set point potentiometers, and lead/lag terminals.	
18.	Reset W7100J setpoint to the normal operating set point.	None
19.	Reapply power to the W7100J and the connected loads.	System should operate normally.

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Heat stage locks on.	<ol style="list-style-type: none"> 1. Remote set point terminals open causes set point to be interpreted as 243 F [117 C]. 2. Shorted sensor terminals T-T1 interpreted as minus 2 F [minus 19 C]. 3. System malfunction. 	<ol style="list-style-type: none"> 1. Correct wiring or jumper P1-P2 2. Correct wiring. 3. Consult manufacturer's equipment manual and/or building engineering requirements.
Discharge temperature too high.	<ol style="list-style-type: none"> 1. Integral set point not at minimum position when used with remote setpoint. 2. System malfunction. 	<ol style="list-style-type: none"> 1. Set integral set point at minimum position if remote set point used. 2. Consult manufacturer's equipment manual and/or building engineering requirements.
No heat.	<ol style="list-style-type: none"> 1. Open sensor terminals T-T1 interpreted as 239 F [115 C] discharge. 2. System malfunction. 	<ol style="list-style-type: none"> 1. Correct wiring. Check sensor resistance (Fig. 2). 2. Consult manufacturer's equipment manual and/or building engineering requirements.
System short cycling	<ol style="list-style-type: none"> 1. Test plug left in bottom of W7100. 2. Electrical interference (noise). 3. System malfunction. 	<ol style="list-style-type: none"> 1. Remove test plug. 2. See caution in Installation Section. 3. Consult manufacturer's equipment manual and/or building engineering requirements.

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