

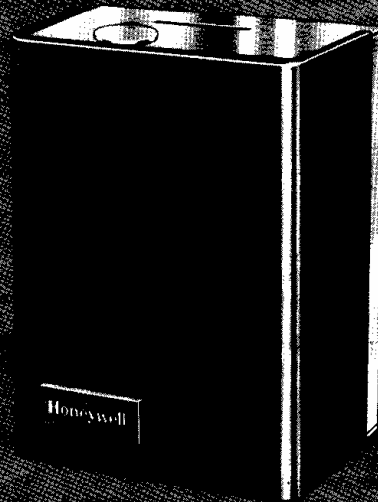
Honeywell

THE R7412 DIFFERENTIAL TEMPERATURE CONTROLLER PROVIDES AUTOMATIC CONTROL OF CIRCULATING PUMPS, VALVES, DAMPERS, MOTORS, AND OTHER ACCESSORIES USED IN SOLAR ENERGY SYSTEMS.

- All models contain a solid state differential temperature controller.
- R7412B,C include freeze protection.
- R7412D,E include overtemperature protection.
- R7412F includes freeze and overtemperature protection (field adjustable), and an auxiliary relay driver.
- Plug-in resistors permit changing on and off temperature differential and adapting R7412 for single function temperature control.
- R7412B-E overtemperature and freeze protection set points are selectable for factory setting, but are not field adjustable.
- Uses one or two C773 Temperature Sensors.
- Separate sensors are not required for freeze and/or overtemperature protection.

R.L.
REV. 2-78 (.09)

DIFFERENTIAL TEMPERATURE CONTROLLER



R7412A-F

Form Number

60-2305 -2

IMPORTANT

THE SPECIFICATIONS GIVEN IN THIS PUBLICATION DO NOT INCLUDE NORMAL MANUFACTURING TOLERANCES. THEREFORE, THIS UNIT MAY NOT MATCH THE LISTED SPECIFICATIONS EXACTLY. ALSO, THIS PRODUCT IS TESTED AND CALIBRATED UNDER CLOSELY CONTROLLED CONDITIONS, AND SOME MINOR DIFFERENCES IN PERFORMANCE CAN BE EXPECTED IF THOSE CONDITIONS ARE CHANGED.

TRADELINE MODELS

TRADELINE MODELS are selected and packaged for ease of stocking, ease of handling, and maximum replacement value. TRADELINE specifications are the same as those of standard models except as noted below.

TRADELINE MODEL AVAILABLE:

R7412F Differential Temperature Controller.

TRADELINE FEATURES:

- Includes freeze and overtemperature protection and an auxiliary relay driver.
- TRADELINE Pack with cross reference label.

STANDARD MODELS

MODEL	DIFF. TEMP. CONTROL	FREEZE PROTECTION	OVERTEMPERATURE PROTECTION	AUXILIARY RELAY DRIVER
R7412A	Yes ^a			
R7412B	Yes ^a	Yes ^{ad}		
R7412C	Yes ^a	Yes ^{cd}		Yes ^c
R7412D	Yes ^a		Yes ^{bd}	
R7412E	Yes ^a		Yes ^{cd}	Yes ^c
R7412F	Yes ^a	Yes ^{acd}	Yes ^{bcd}	Yes ^c

^aInternal relay energizes. ^bInternal relay de-energizes. ^cAuxiliary relay energizes. ^dProtection setpoint is factory fixed.

TEMPERATURE SETTING RANGES:

Control Range—0 to plus 210 F [minus 18 to plus 99 C] as defined by temperature of low temperature sensor.

Differential Temperature Controller—Adjustable ON and OFF differentials from minus 10 to plus 40 F [minus 5.6 to plus 22.2 C]. Factory-set at 18 F [10 C] temperature difference ON and 3 F [1.7 C] temperature difference OFF. Plug-in resistors vary settings (see Table 1, page 7).

Freeze Protection—

R7412B,C set point may be specified at 37, 42, or

47 F [3, 6, or 8 C], but it is factory fixed.

R7412F has field adjustable settings at 37, 42, or 47 F [3, 6, or 8 C].

Freeze differential—3 F [1.7 C].

Overtemperature Protection—

R7412D,E set point may be specified at 5 F [3.2 C] increments from 140 to 190 F [60 to 88 C], but it is factory fixed.

R7412F has field adjustable settings in 5 F [3.2 C] increments from 140 to 190 F [60 to 88 C].

Overtemperature differential—10 F [5.5 C].

(continued on page 3)

ORDERING INFORMATION

WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR TRADELINE WHOLESALE OR YOUR DISTRIBUTOR, REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING NUMBER, OR SPECIFY—

1. Differential Temperature Controller order number.
2. Temperature Sensor order number (two required).

3. Freeze protection (R7412B,C) or overtemperature protection (R7412D,E) set point desired.
4. Immersion well order number.
5. Accessories, if desired.
6. Optional specifications, if desired.

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 RESIDENTIAL DIVISION SALES OFFICE (CHECK WHITE PAGES OF PHONE DIRECTORY).
2. RESIDENTIAL DIVISION CUSTOMER SERVICE
HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH
MINNEAPOLIS, MINNESOTA 55422 (612) 542-7500

(IN CANADA—HONEYWELL CONTROLS LIMITED, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO M1P 2V9)
INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

ELECTRICAL RATINGS:

- Input Voltage—120V ac, 60 Hz.
- Load Relay Contacts—
 - 1 N.O. Pole—10 AFL/60 ALR at 120V ac.
 - 1 N.C. Pole—125 VA at 120V ac.
- Auxiliary Relay Drive—5 VA maximum at 24V ac, 60 Hz.
- Power Consumption—7 watts maximum.

AMBIENT TEMPERATURE RANGE:

- Controller—plus 20 to 115 F [minus 7 to plus 46 C].
- Temperature Sensor—Minus 50 to plus 450 F [minus 46 to plus 232 C].

MOUNTING:

- Controller—two screw holes in opposite corners of case. Mounting screws not included.
- Electronic Temperature Sensor—Sensor is available for mounting with clip or has a flattened end with a mounting hole. Tank sensor mounts in an immersion well. See ACCESSORIES.

WIRING CONNECTIONS: 9 screw terminals. Also, 2 leadwires on R7412C,E,F.

DIMENSIONS: See Fig. 2.

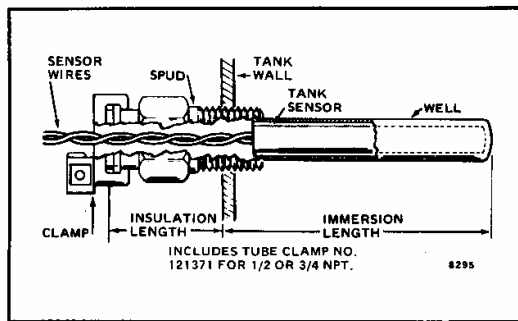


FIG. 1—TANK SENSOR INSERTED IN IMMERSION WELL.

AUXILIARY RELAYS:

- R856A Fan Centers—
 - Line voltage spst and spdt switching.
 - Low voltage terminal strip for wiring thermostat and high side panel.
- R8225A Fan Relay—spdt switching, one double throw contact.
- R8225B Fan Relay—spst switching; normally open contacts.
- R8225C Fan Relay—dpst switching; one normally open and one normally closed contact.
- R8225D Fan Relay—dpst switching; one normally open main and one normally open auxiliary pole.

OPTIONAL SPECIFICATIONS:

- Indicator Light—indicates when pump or fan are operating.
- Auto-Off-On Switch—manual override switch which permits automatic operation of the controller or allows the controller to be switched directly ON and OFF. Switch does not affect the operation of the auxiliary relay in R7412C,E, and F.

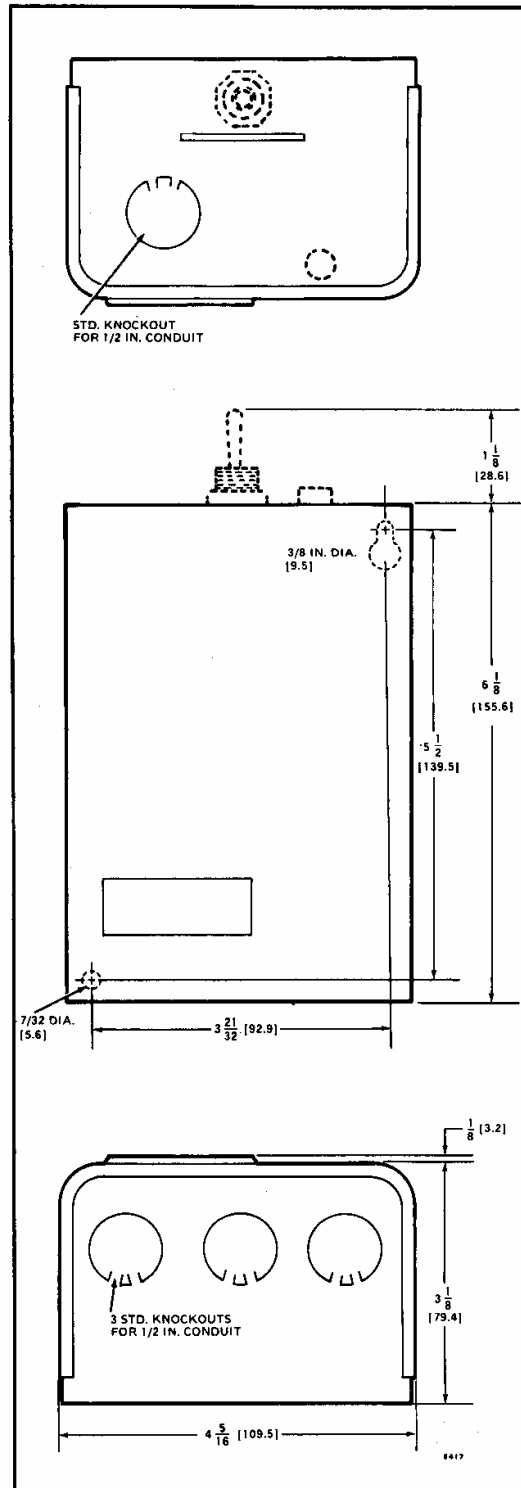


FIG. 2—R7412 MOUNTING DIMENSIONS IN INCHES [MILLIMETRES IN BRACKETS].

ACCESSORIES:

C773A Temperature Sensor. Single sensor mounts in storage tank with immersion well or on collector with mounting clip.

C773B Temperature Sensor. Double sensor mounts in storage tank with immersion well or on collector with mounting clip.

C773C Temperature Sensor. Single sensor has flattened end with mounting hole for collector installation.

C773D Temperature Sensor. Double sensor has flattened end with mounting hole for collector installation.

Immersion Well—for mounting sensor in storage tank. See immersion well table and Fig. 1.

Remote Sensor Wiring Compartment—mounts to immersion well. Part No. 111892F.

WELL DIMENSIONS				SELECT WELL MATERIAL AND ORDER NUMBER BELOW			
INSERTION LENGTH		INSULATION LENGTH		COPPER		STAINLESS STEEL	
in	mm	in	mm	1/2 NPT	3/4 NPT	1/2 NPT	3/4 NPT
3-3/8	85.7	1-1/2		121371A	121371B	121371E	121371F
3-3/8	85.7	1-1/2		—	121371K ^a	—	—
3-3/8	85.7	3		121371L	121371M	—	—
5-3/8	85.7	4		122554B ^a	122555B ^a	—	—
3-3/8	136.5	4		122554A ^a	122555A ^a	—	—
6	152.4	1-1/4	31.8	112620BB	—	—	—

^aHas plastic sleeve on insertion well.

INSTALLATION

CAUTION

1. Installer must be a trained, experienced service technician.
2. Disconnect power supply before connecting wiring.
3. Conduct thorough checkout when installation is complete.

IMPORTANT

Do NOT mount collector sensor to collector fluid channels. Protect sensor from extreme temperature conditions which may be encountered when the fluid channels are drained.

MOUNTING CONTROLLER

Loosen the cover screw and remove the cover. Locate the controller case on any convenient flat surface near the circulator or storage tank. Ambient temperature at location should not exceed 115 F [46 C]. Secure the controller using the 2 mounting holes located in opposite corners of the case and 2 mounting screws (not included).

MOUNTING TEMPERATURE SENSORS

Mount tank sensor and immersion well as follows:

1. Drain system fluid to a point below the sensor fitting. (Refer to Fig. 1.)

2. Screw the well into the threaded fitting. Use an approved pipe dope or Teflon tape to seal the threads.

3. Refill system and check for leaks.

4. Insert the sensor probe into the immersion well until it bottoms.

5. Attach retainer clamp over groove on well spud. Fit wires in clamp groove and lightly tighten screw. Do not over tighten.

Mount collector sensor according to the collector manufacturers recommendations. Fasten the sensor to the panel with a No. 8 or 10 screw (Fig. 3). Do NOT mount collector sensor to collector fluid channels. Do not exceed ambient temperature ratings.

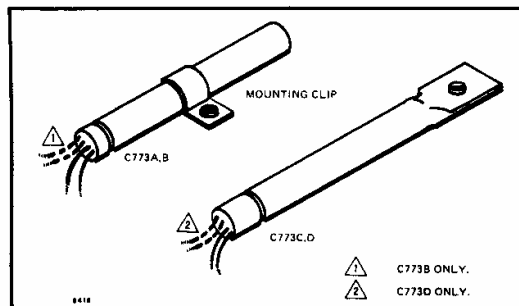


FIG. 3—MOUNTING THE C773 TEMPERATURE SENSOR.

WIRING

All wiring must comply with applicable codes and ordinances. The R7412 can be used for numerous applications in solar energy systems. Refer to Figs. 4 through 7 for typical examples of R7412 hookups. Also, the OPTIONAL APPLICATIONS section depicts the R7412 using only one temperature sensor.

The temperature sensors are wired to the controller through the 1/2 inch knockout for conduit in the top of the controller case. Wire the power supply, relay contacts, and auxiliary relay driver using the three knockouts for

1/2 inch conduit in the bottom of the controller case (Fig. 1).

If the amount of sensor cable used exceeds 100 feet [30.5 m], use No. 14 wire and grounded metallic conduit or two conductor shielded cable. Connect the shield to ground at the controller. Grounded metallic conduit and shielded cable (such as Belden 8762 or equivalent) minimizes possible radio frequency signal interference.

111892F Remote Sensor Wiring Compartment is available for tank sensor wiring (see ACCESSORIES).

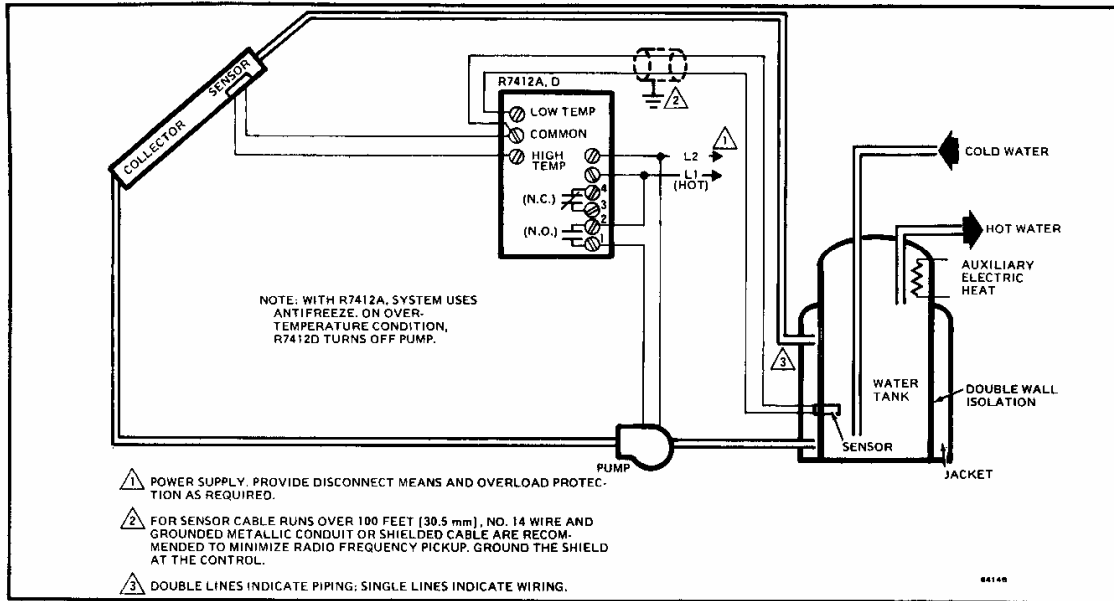


FIG. 4—USING THE R7412A,D WITH A SOLAR WATER HEATER.

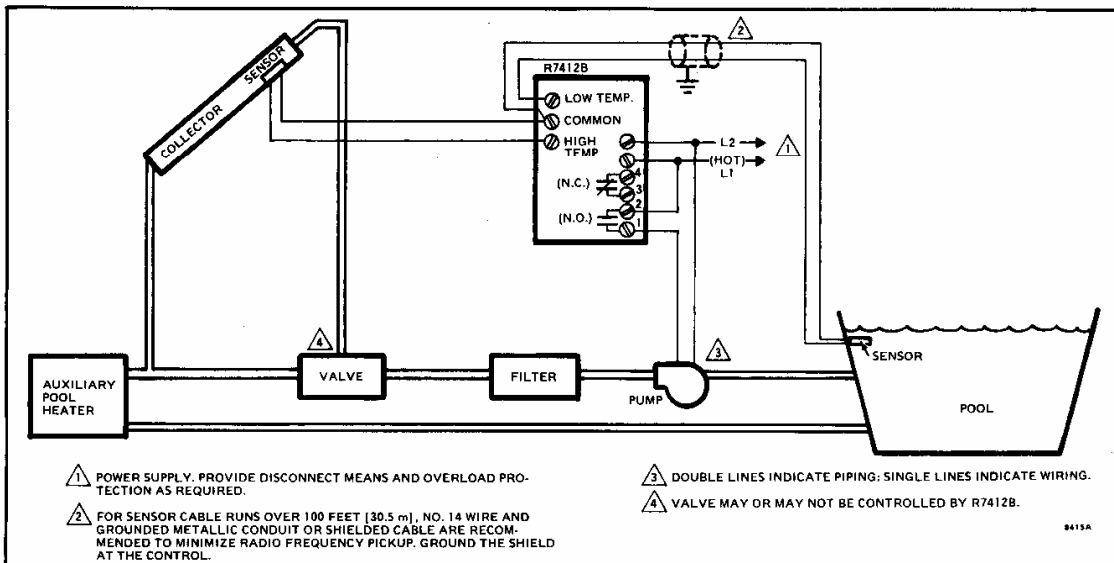


FIG. 5—USING THE R7412B WITH A SOLAR POOL HEATER. CONTROLLER ENERGIZES PUMP DURING FREEZE CONDITION.

*Does freeze protection take place upon loss of power? - Yes -
 - D.O. valve opens -
 or check valve*

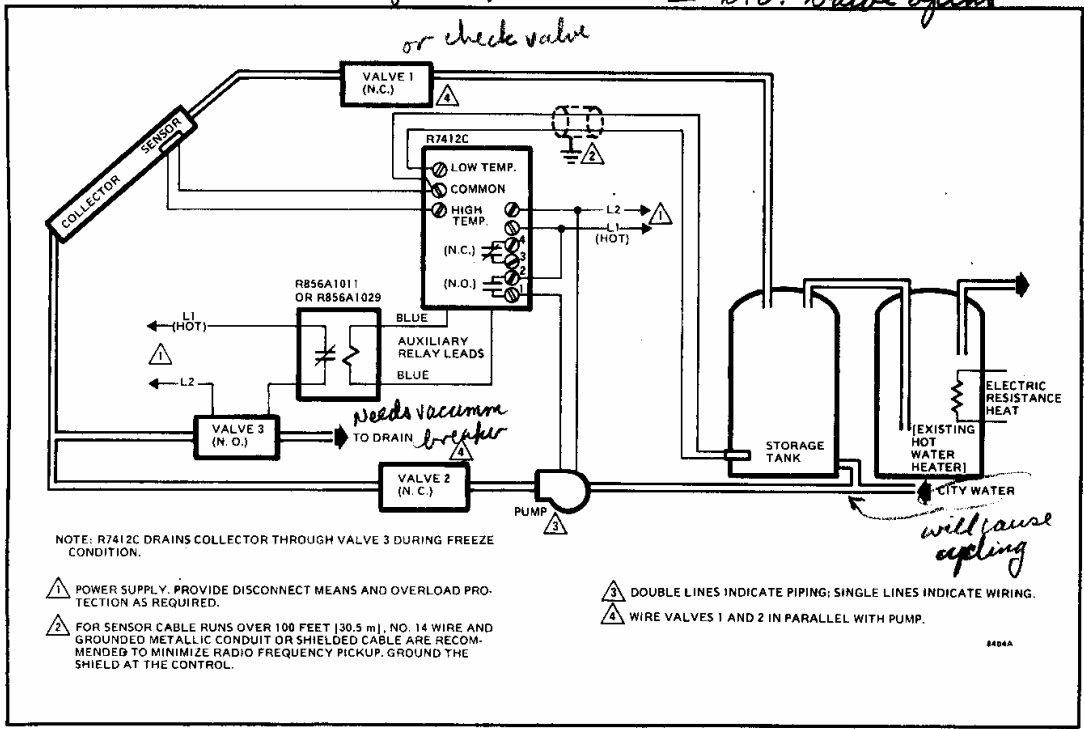


FIG. 6—INSTALLING THE R7412C IN A SOLAR HOT WATER HEATING SYSTEM.

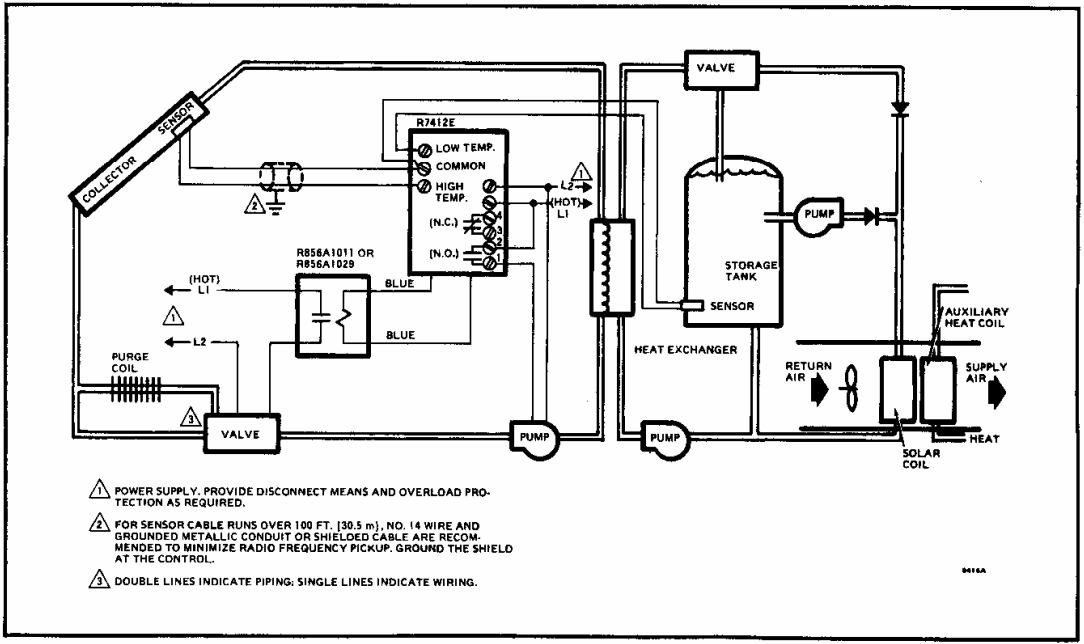


FIG. 7—TYPICAL INSTALLATION OF THE R7412E IN A SOLAR HOT WATER TO WARM AIR HEATING SYSTEM.

ADJUSTMENTS AND CHECKOUT

DIFFERENTIAL TEMPERATURE SELECTION

The control settings may be adjusted by changing the ON and OFF plug-in resistors (see Fig. 8). The R7412 is factory-set for pull-in at 18 F [10 C] temperature difference with a 4750 ohm ON resistor. Dropout is set for 3 F [1.7 C] temperature difference with a 9760 ohm OFF resistor.

To change either setting, refer to Table 1 to select the resistor(s) needed. See Fig. 9 to prepare resistor for installation. Remove the old resistor and plug in the replacement. Be sure the correct resistor is inserted in the proper position. Use 1/8 watt, 1 percent resistors, available locally.

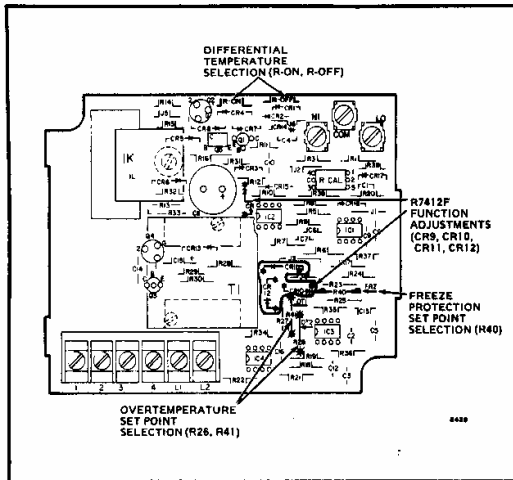


FIG. 8—ADJUSTMENT COMPONENTS OF THE R7412.

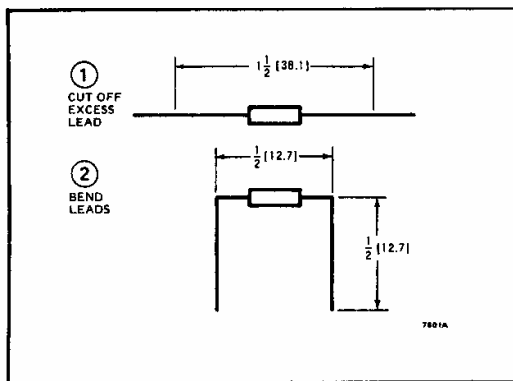


FIG. 9—PLUG-IN RESISTOR PREPARATION. DIMENSIONS IN INCHES [MILLIMETRES IN BRACKETS].

TABLE 1—ON, OFF DIFFERENTIAL TEMPERATURE CONTROL

FOR TEMPERATURE DIFFERENCE OF:		USE RESISTANCES BELOW FOR ON OR OFF RESISTORS (IN OHMS)
F	C	
-10	- 6.0	27500
- 5	- 3.0	15400
0	0	11500
1	0.6	11000
2	1.0	10500
3	1.7	9760
4	2.2	9310
5	3.0	8870
6	3.3	8250
7	4.0	7870
8	4.4	7500
9	5.0	7150
10	6.0	6810
12	7.0	6340
14	8.0	5620
16	9.0	5230
18	10.0	4750
20 ^a	11.0 ^a	4220 ^a
25	14.0	3320
30	17.0	2430
35	19.0	1750
40	22.0	1210

^aMaximum OFF setting must not exceed 20 F [11 C]; resistor value must be greater than 4220 ohms.

R7412F FREEZE PROTECTION TEMPERATURE SELECTION

Freeze protection setting is adjusted by changing the freeze protection plug-in resistor, R40 (see Fig. 8). The R7412 freeze protection is factory-set at 37 F [3 C].

To change the setting to 37 F [3 C], simply remove the freeze protection resistor and leave it open circuited. For a setting of 42 F [6 C], install a 110 kilohm resistor using the resistor preparation indicated in Fig. 9. Use a 48.7 kilohm resistor to change the freeze protection setting to 47 F [8 C].

R7412F OVERTEMPERATURE SETTING SELECTION

Overtemperature protection setting may be adjusted by changing the overtemperature protection resistors, OT1 (R41) and OT2 (R26) (see Fig. 8). The R7412 overtemperature limit is factory-set at 140 F [66 C].

To change the setting, refer to Table 2 to select the resistors needed. See Fig. 9 to prepare resistor for installation. Remove the old overtemperature resistors and insert the correct resistor in the proper position. Use 1/8 watt, 1 percent resistors, available locally.

TABLE 2—OVERTEMPERATURE CONTROL

FOR OVER-TEMPERATURE LIMIT OF:		CHANGE RESISTOR OT1 (R41) TO: (OHMS)	CHANGE RESISTOR OT2 (R26) TO: (OHMS)
F	C		
140	60	11,800	174,000
145	63	16,900	113,000
150	66	19,100	61,900
155	68	22,100	44,200
160	71	25,500	33,200
165	74	30,900	27,400
170	77	38,300	23,200
175	79	52,300	20,000
180	82	78,700	17,800
185	85	154,000	15,800
190	88	Open	14,300

ADJUSTING FUNCTIONS OF THE R7412F

Refer to Fig. 8 for the location of the components which can be removed to change the function of the R7412F.

The R7412F can be modified to provide freeze protection through the internal relay, the auxiliary relay, both the internal and the auxiliary relay, or neither. Diodes CR9 and CR11 control these types of freeze protection. If both CR9 and CR11 remain in the controller, the internal relay will be energized as well as the auxiliary relay. Removing CR9 disables the internal relay; clipping out CR11 disables the auxiliary relay. When both CR9 and CR11 are taken out, the freeze protection feature of the R7412F is completely disabled.

Usually, CR9 or CR11 is removed to provide freeze protection which is operated by either the internal relay or the auxiliary relay, but not both.

Also, the R7412F may be adjusted to give over-temperature protection through the internal relay, the auxiliary relay, both the internal and the auxiliary relay, or neither. Diodes CR10 and CR12 control these types of overtemperature protection. If both CR10 and CR12 remain in the controller, the internal relay will be de-energized and the auxiliary relay will be energized. Removing CR10 prevents the internal relay from locking out the pump during overtemperature; clipping out CR12 disables the auxiliary relay. If both CR10 and CR12 are clipped out, the overtemperature protection capabilities of the R7412F are completely disabled.

Normally, CR10 or CR12 is clipped out to give over-temperature protection through the internal relay or auxiliary relay, but not through both.

In most cases the auxiliary relay is used for freeze protection or overtemperature protection, but not both. Therefore, CR11 or CR12 is usually removed when modifying the R7412F.

To convert the R7412F to models R7412A, B, C, D, or E use Table 3.

TABLE 3—R7412F ADJUSTMENTS

TO CONVERT R7412F TO:	CLIP OUT:	LEAVE IN:
R7412A	CR9, CR10, CR11, CR12	
R7412B	CR10, CR11, CR12	CR9
R7412C	CR9, CR10, CR12	CR11
R7412D	CR9, CR11, CR12	CR10
R7412E	CR9, CR10, CR11	CR12

OPERATION AND CHECKOUT

OPERATION

The controller relay contacts make when the differential temperature is greater than the ON setting and breaks when the temperature difference is less than the OFF setting.

2. Remove jumper. Relay should drop out.

Observe system operation for one automatic cycle. Make certain that system comes on and turns off in response to the R7412 Differential Temperature Controller. Check for proper operation of freeze and over-temperature protection and of controlled equipment such as circulators and valves.

CHECKOUT

Check control for proper operation as follows:

1. Disconnect low temperature terminal, jumper low temperature and common terminal. Relay should pull in.

Shorting out the high and common terminals will simulate a freeze condition.

Shorting out the common and low terminals will simulate an overtemperature condition.

OPTIONAL APPLICATIONS

In addition to the differential temperature control, the R7412A can serve as a single function temperature controller such as a high temperature limit or an Aquastat. The R7412A is adapted to these functions by changing the ON and OFF resistors and the sensor connections. When changing functions, use 1/8 watt, 1 percent resistors, available locally.

Use the following procedures to change the factory-set differential temperature controller to a single function temperature controller as indicated in Figs. 10 and 11.

1. Remove cover. Remove the OFF resistor and replace with an 11,500 ohm resistor according to resistor preparation shown in Fig. 9.

2. To adjust the temperature differential, remove the ON resistor and select a resistor value according to Table 1. Install the selected resistor.

3. To adjust the temperature setpoint, select a resistor value according to the graph in Fig. 12. Connect the selected setpoint resistor to the low temperature and common terminals for make on temperature rise control (Fig. 10). Connect to high and common terminals for make on temperature fall.

4. Wire the sensor to the high temperature and common terminals for make on temperature rise; wire the sensor to the low temperature and common terminals on temperature fall.

5. Check the resistors for proper location and value. Replace the cover.

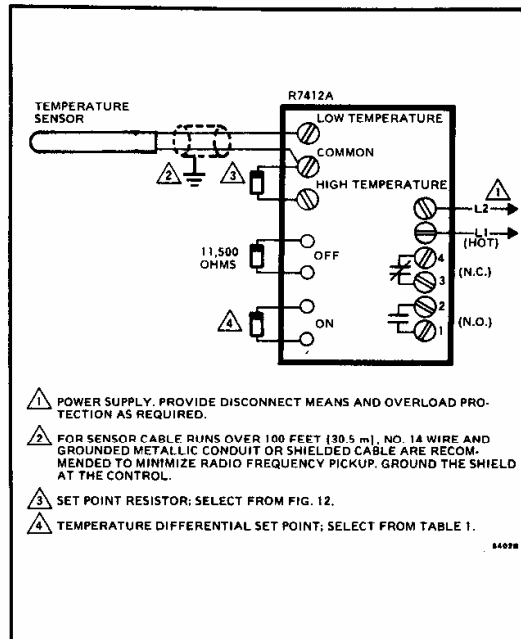


FIG. 11—SINGLE FUNCTION SET POINT CONTROL. CONTROL MAKES ON TEMPERATURE FALL TO SET POINT MINUS DIFFERENTIAL, BREAKS ON TEMPERATURE RISE TO SET POINT.

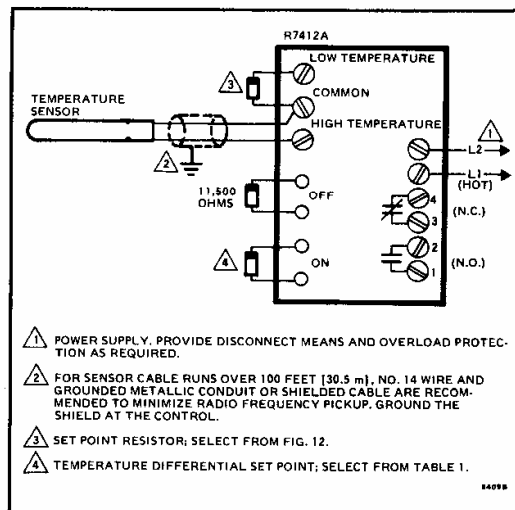


FIG. 10—SINGLE FUNCTION SET POINT CONTROL. CONTROL MAKES ON TEMPERATURE RISE TO SET POINT PLUS DIFFERENTIAL, BREAKS ON TEMPERATURE FALL TO SET POINT.

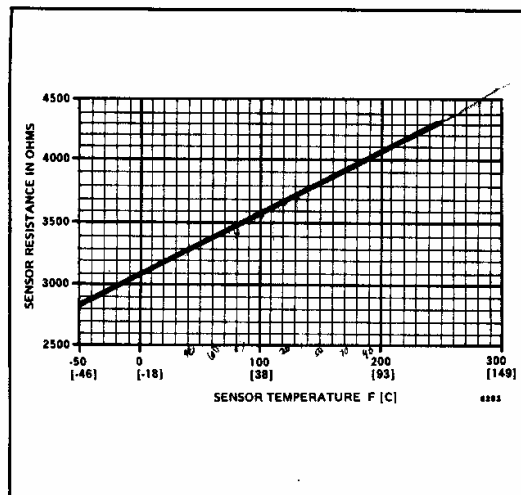


FIG. 12—R7412A SINGLE FUNCTION TEMPERATURE SET POINT. CHOOSE A RESISTANCE ACCORDING TO THE DESIRED SET POINT.