IB 7.7.1.7-2
Issue A

INSTRUCTIONS

Temperature Relay

CIRCUIT SHIELD ®

TYPE 49T TEMPERATURE RELAY

Catalog Series 236 Standard Case

Catalog Series 436 Drawout Test Case

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INTRODUCTION

These instructions contain the information required to properly install, operate, and test the ABB Circuit-Shield™ Type 49T Temperature Relay.

The relay is housed in a case suitable for conventional semiflush panel mounting. All connections to the relay are made to terminals at the rear of the case which are clearly numbered.

Relays of the 436 catalog series are similar to relays of the 236 series. Both series provide the same basic functions and are of totally drawout construction; however, the 436 series relays provide integral test facilities. Also, sequenced disconnects on the 436 series prevent nuisance operation during withdrawal or insertion of the relay if the normally open contacts are used in the application.

Settings are made on the front panel of the relay, behind a removable clear plastic cover. The target indicator is reset by means of a pushbutton extending through the relay cover.

PRECAUTIONS

The following precautions should be taken when applying these relays:

1. Incorrect wiring may result in damage. Be sure wiring agrees with the connection diagram for the particular relay before energizing.

2. Note that the Type 49T requires ac control voltage at terminals 7 and 8. Apply only the rated control voltage marked on the front panel. (Do not apply dc to these terminals.)

3. High voltage insulation tests are not recommended. See the section on testing for additional information.

5. The entire circuit assembly of the relay is removable. The unit should insert smoothly. Do not use excessive force.

6. Follow test instructions to verify that the relay is in proper working order.

CAUTION: ***since troubleshooting entails working with energized equipment, care should be taken to avoid personal shock. Only competant technicians familiar with good safety practices should service these devices. Note that failure of the RTD insulation at the motor or generator could result in hazardous voltage at the relay terminals.***

PLACING THE RELAY INTO SERVICE

1. RECEIVING, HANDLING, STORAGE

Upon receipt of the relay (when not included as part of a switchboard) examine for shipping damage. If damage or loss is evident, file a claim at once and promptly notify Asea Brown Boveri. Use normal care in handling to avoid mechanical damage. Keep clean and dry.

2. INSTALLATION

Mounting:
The outline dimensions and panel drilling information is given in Figure 1.

Connections:

Internal connections are shown in Figure 3. Typical external connections are shown in Figure 4a for motor-starter applications, and Figure 4b for circuit-breakers.

The three-wire connection to the RTD must be used in order that the resistance of the connecting leads be cancelled out in the measurement. Shielded leads are preferred for the RTD connections.

The Type 49T requires ac control power to operate. An internal ac control power transformer provides the basic isolation between the control power circuits and the bridge circuit used to measure the RTD resistance. The output contacts of the Type 49T may be used in ac or dc control circuits, for example to trip a circuit breaker or drop-out a motor starter. See contact ratings under Specifications. Add suffix "-CAP" to the catalog number of the relay if the output contacts are to be used at 250vdc or 240vac capacitor trip voltages for tripping.

These relays have metal front panels which are connected through printed circuit board runs and connector wiring to a terminal at the rear of the relay case. The terminal is marked "G". In all applications this terminal should be wired to ground.

3. SETTINGS

PICKUP

The pickup taps are labelled with the actual temperature in degrees C which will cause the output contacts to transfer. (based on the pickup vernier screwdriver adjustment being in its fully counterclockwise position)

The pickup vernier allows adjustment of pickup temperature to 10° below the tap setting, up to the tap setting. For example, a relay with 130-180° tap range, with tap set at 130°, may be set to trip at approximately 120°C by rotating the vernier from the fully counterclockwise (CCW) position to the fully clockwise position (CW). A midrange setting of 125°C can be obtained by rotating the vernier to the midpoint 12 o'clock position indicated by the dot on the front panel. If the vernier adjustment is used it is best to verify the operating point by test.

DROPOUT

The amount the machine must cool down before the 49T relay will reset its contacts is determined by the dropout setting. The dropout taps are identified as 60, 70, 80, 90 percent dropout. (with the dropout vernier potentiometer adjustment in its fully counterclockwise position)

The value of machine temperature below which the 49T relay will reset is determined by the Pickup setting and the Dropout setting. For example: with a pickup setting of 130°C and a Dropout setting of 80%, the temperature at which reset will occur is 104°.

The dropout vernier allows adjustment of the dropout value. Rotating the dropout vernier in the clockwise direction raises the dropout temperature. The effect of the vernier varies with the dropout tap setting, so if used it should be set by test.

4. TARGET INDICATOR

An operation target is provided. The target is set electronically when the output contacts transfer. The target will retain its indication on loss of dc control power. In order to reset the target, normal ac control power must be present.

APPLICATION DATA

The ABB Circuit-Shield™ Type 49T Relay is used to protect motors and generators which are equipped with a resistance-temperature-detector (RTD) against overtemperature. The 49T relay employs an accurate solid-state bridge circuit to measure the resistance of the RTD. The particular type of RTD supplied with the machine, and the insulation class of the machine must be known to select the catalog number of the relay.

The variation of RTD resistance with temperature is illustrated in Figure 2 for the 10 ohm copper type RTD. Table 1 lists the resistance values versus temperature for the three types of RTD's.

The relay may be used as a protective device to trip the machine on overtemperature; or alternatively, as an alarm to alert an operator to take appropriate action to reduce the loading of the machine. Since an RTD has an inherently slow response this type of protection is suitable only for overload conditions, and related situations such as high ambient temperatures or loss of cooling air flow. Other relays or devices are required to protect against rapidly changing conditions such as occur during faults or machine starting.

For general purpose applications the following relay ranges and settings are suggested. The pickup settings shown allow for a 10 degree hotspot temperature rise above the temperature value measured by the RTD.

Insulation System		Suggested Settings		
Class	Rated	Tap Range	Pickup	Dropout
A	105°C	70 - 120°	95°	70%
B	130°C	130 - 180°	120°	70%
D	155°C	130 - 180°	145°	70%
H	180°C	130 - 180°	170°	70%

If the relay is used for alarm, a dropout setting of 90% is suggested, and a lower pickup setting should be considered.

Typical relay connections are shown in Figure 4. The three wire connection to the RTD must be used in order that the resistance of the connecting leads be cancelled. Figure 5a shows this connection, indicating the RTD resistance and the resistance of each of the three connecting leads. Figure 5b is a simplified illustration of the measurement bridge. Note how the resistance of the RTD and connecting leads fit into the bridge such that the lead 1 and lead 2 resistances cancel each other in the measurement. The resistance of lead 3 is essentially outside the bridge.

CHARACTERISTICS OF COMMON UNITS

RTD Type	Pickup Range	Control Voltage	Catalog Numbers Std Case	Catalog Numbers Test Case
10 ohm copper	60 - 120°	120Vac 50/60Hz	236B2065	436B2065
	120 - 180°		236D2065	436D2065
	150 - 210°		236E2065	---
120 ohm nickel	60 - 120°	120Vac 50/60Hz	236B5065	436B5065
	120 - 180°		236D5065	436D5065
100 ohm platinum	60 - 120°	120Vac 50/60Hz	236B6065	436B6065
	120 - 180°		236D6065	436D6065
	120 - 180°	100Vac 50/60Hz	---	436D6005

Note: Test-case units preferred for new applications due to their improved test features.

Pickup range includes effect of the pickup vernier adjustment which can be used to set the operating point 10 degrees below the tap value, including the lowest tap.

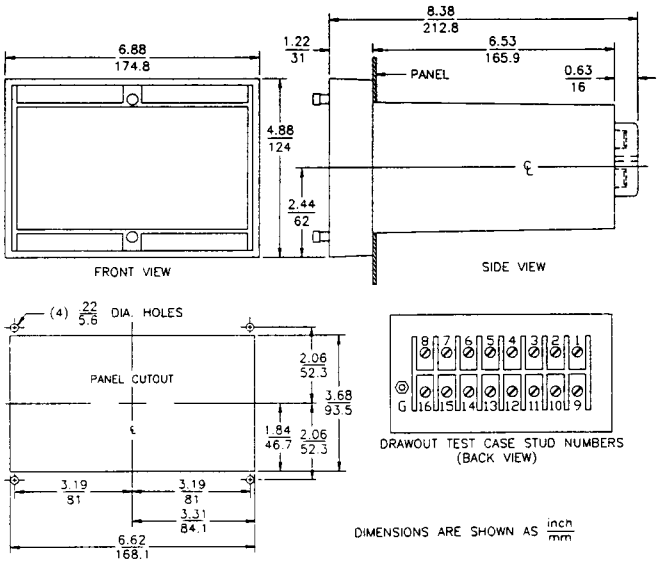


Figure 1: Relay Outline and Panel Drilling

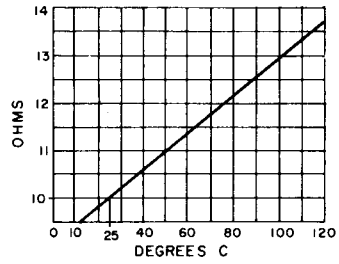


Figure 2: 10 ohm Copper RTD Characteristic

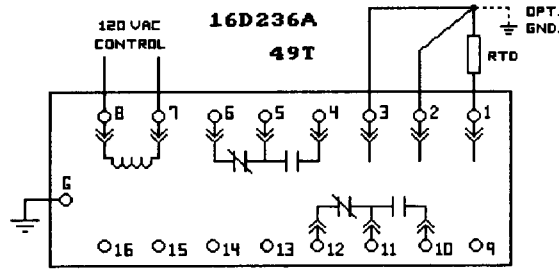


Figure 3: Internal Connections

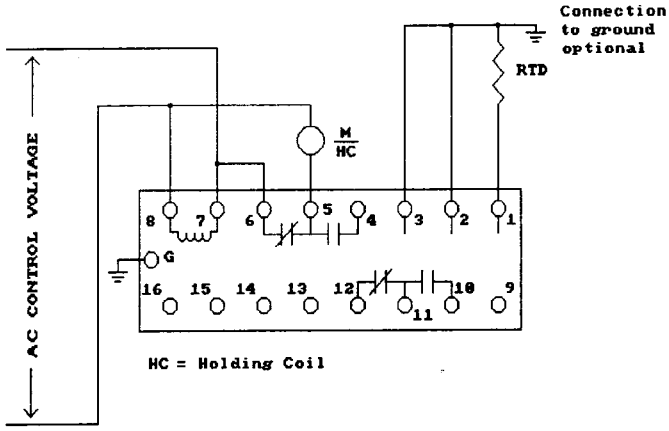


Figure 4a:

Typical External Connections

With Motor Starter and AC Control.

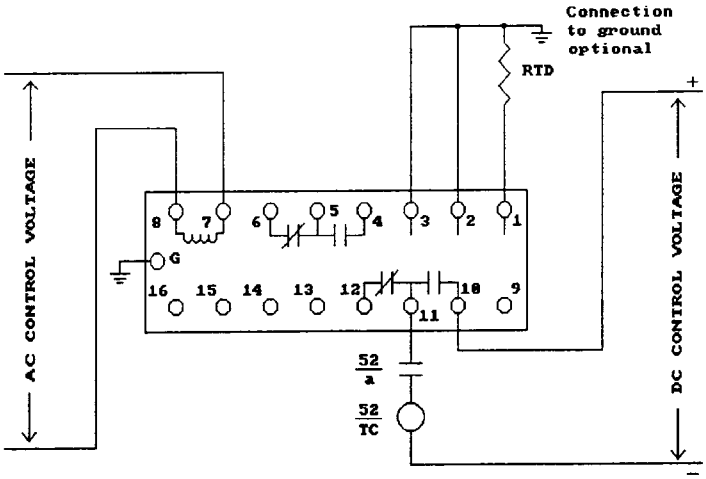


Figure 4b:

Typical External Connections

With Circuit Breaker and both AC and DC Control Voltages.

Figure 5a: Connection of RTD to the 49T Relay Showing Lead Resistances

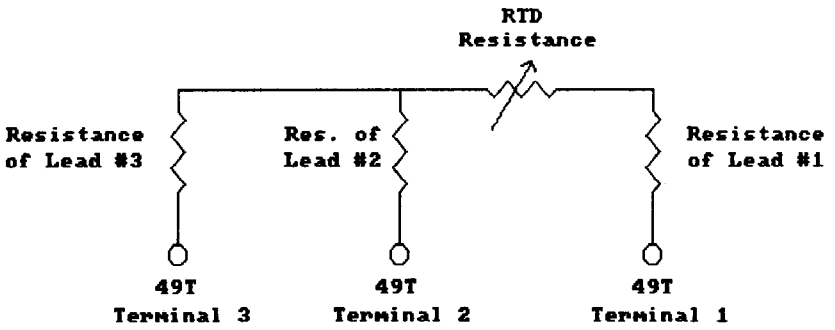
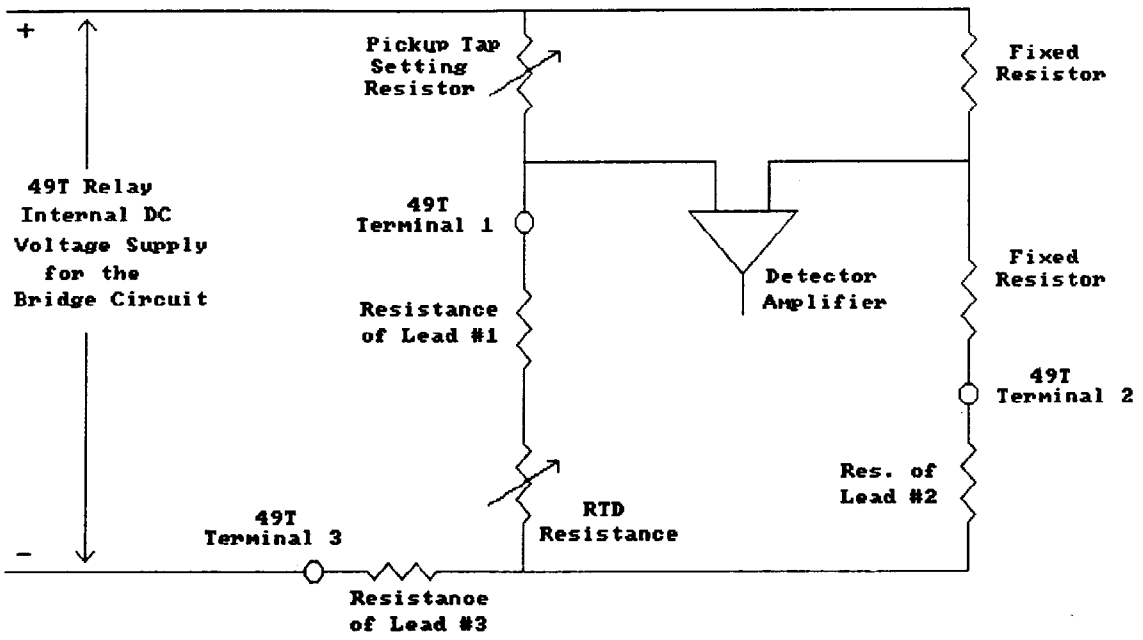


Figure 5b: Simplified Bridge Circuit



Specifications:

RTD Characteristic: Models available for Copper, 10 ohms @ 25°C
Platinum, 100 ohms @ 0°C
Nickel, 120 ohms @ 0°C

Adjustment Range: Pickup: models available for 60-120°C, 120-180°C.
Dropout: adjustable 60-90% of pickup setting.

Control Power: Models available for 120Vac, 50/60 Hz, 100Vac, 50/60Hz.
Drain: 0.08A.

Relay Operating Temperature Range: -20°C to +70°C.

Output Circuit: 2 form C contacts. Standard output suitable for tripping voltages up to 175vdc (120vac capacitor trip). Order catalog suffix "-CAP" for 250vdc or 350vdc (240vac capacitor trip).

Contact Ratings:

	@ 120 Vac	@ 125 Vdc	@ 250 Vdc (-CAP models)
Tripping	30A	30A	30A
Continuous	5A	5A	5A
Break	3A	0.3A	0.1A

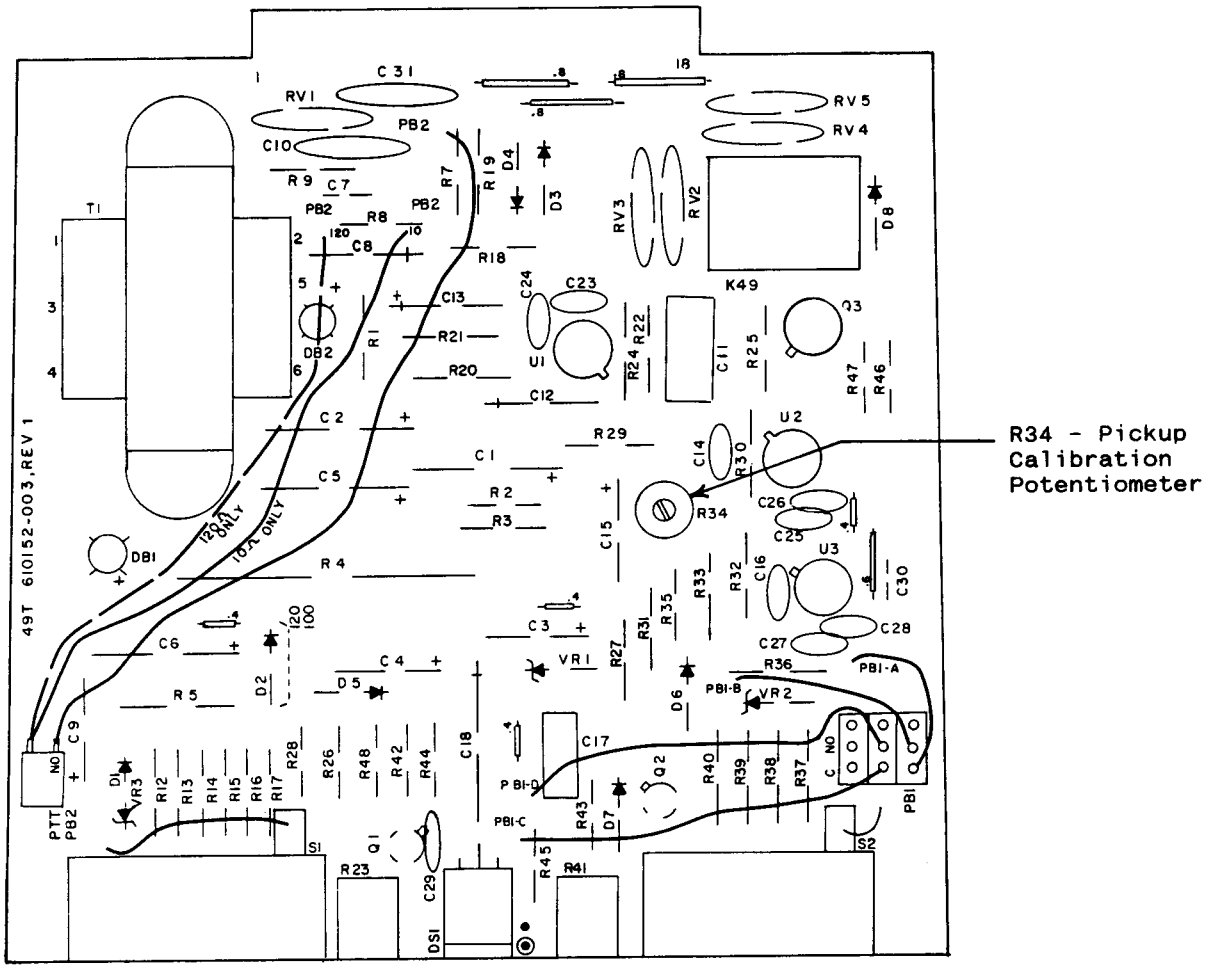


Figure 6: Typical Printed Circuit Board Layout

Specifications (continued):

Dielectric Strength: 1500 Vac, 60 seconds, all circuits to ground.

Weight: net: 3.7 lbs (1.7 Kg); shipping: 4.4 lbs (2.0 Kg).

Seismic Capability: More than 6g ZPA biaxial broadband multifrequency vibration per ANSI C37.98.

TESTING

1. MAINTENANCE AND RENEWAL PARTS

No routine maintenance is required on these relays. Periodic testing should be conducted to verify that the relay is in proper working order. Follow test instructions given below. We recommend that an inoperative relay be returned to the factory for repair; however, a schematic diagram will be provided on request. Renewal parts will be quoted by the factory on request.

236 Series Units

Drawout circuit boards of the same catalog number are interchangible. A unit is identified by the catalog number stamped on the front panel and a serial number stamped on the bottom side of the drawout circuit board.

The board is removed by using the metal pull knobs on the front panel. *Removing the board with the unit in service may cause an undesired operation.*

An 18 point extender board (cat 200X0018) is available for use in troubleshooting and calibration of the relay.

In the event a 236 series unit must be replaced, the equivilent 436 series unit should be ordered. The dimensions, mounting, and connections are the same for both series.

436 Series Units

Metal handles provide leverage to withdraw the relay assembly from the case. The assembly is identified by the catalog number stamped on the front panel and a serial number stamped on the bottom of the circuit board. (Note: if you are using a normally-closed contact in your application, this circuit will be opened upon removal of the drawout element from its case.)

Test connections are readily made to the drawout relay unit by using standard banana plug leads at the rear vertical circuit board. This rear board is marked for easier identification of the connection points.

A test plug assembly, catalog 400X0002 is available for use with the 436 series units. This device plugs into the relay case on the switchboard and allows access to all external circuits wired to the case. See Instruction Book IB 7.7.1.7-8 for details on the use of this device.

2. HIGH POTENTIAL TESTS

High potential tests are not recommended. A hi-pot test was performed at the factory before shipping. If a control wiring insulation test is required, partially withdraw the relay unit from its case sufficient to break the rear connections before applying the test voltage.

3. BUILT-IN TEST FUNCTION

Be sure to take all necessary precautions if tests are run with the main circuit energized.

The built-in test is provided as a convenient functional test of the relay and associated circuit. When you depress the button labelled TRIP, the measuring circuit of the relay is actuated, simulating an overtemperature condition. The contacts of the 49T relay should transfer immediately, and the target should be displayed.

4. ACCEPTANCE TESTS

A high accuracy resistance box should be used to simulate the RTD. Connect the resistance box to relay terminals 1 and 2, and a jumper from terminals 2 to 3.

(As an alternate to the resistance box, a potentiometer and a very accurate ohmmeter could be used. The potentiometer must be disconnected from the relay to make a reading of its resistance value.)

Apply rated ac control voltage per the front panel rating to terminals 7 and 8. Use a contact state monitor or ohmmeter across terminals 10 and 11.

Set the front panel vernier pickup and dropout adjustment pots to their full counterclockwise positions. Make the desired pickup and dropout tap settings. If none are specified, select the center pickup tap and 90% dropout.

Note the RTD type from the relay front panel data, and referring to Tables 1 and 2, determine the resistance values for the selected pickup and dropout settings.

Vary the resistance box around these values and confirm proper relay operation. Relay pickup should be within +/-5° C of the expected value.

If the settings for the application are known, these can be made and trimmed to obtain the desired operation using the front panel vernier adjustments. Turning the pickup vernier clockwise reduces the operating temperature. Turning the dropout vernier clockwise increases the dropout (reset) temperature.

Note: Use of the internal factory calibration potentiometer should not usually be necessary; however, the pickup tap operating value can be recalibrated by using potentiometer R34. (Be sure that the vernier adjustment is in its full counterclockwise position when making the internal adjustment.)
Refer to the printed circuit board layout, Figure 6.

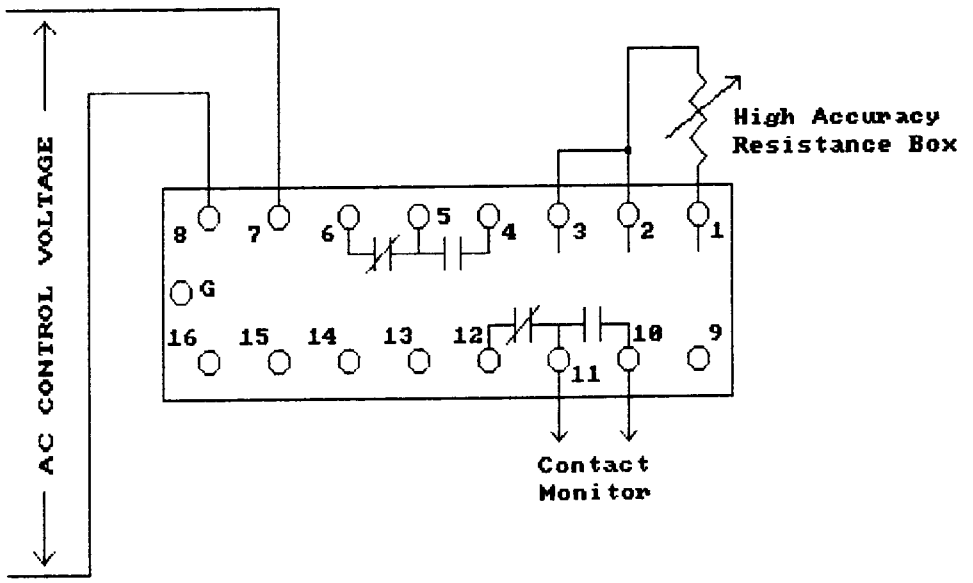


Figure 7: Typical Test Circuit Connections

Table 1 RTD RESISTANCE vs TEMPERATURE VALUES

Temperature degrees C	10 ohm copper	100 ohm platinum	120 ohm nickel
0	9.04	100.0	120.0
20	9.81	107.8	134.5
25	10.00	109.7	138.1
30	10.20	111.7	142.1
40	10.58	115.5	149.8
50	10.97	119.4	157.7
60	11.35	123.2	165.9
70	11.74	127.1	174.2
80	12.12	130.9	182.8
90	12.51	134.7	191.6
100	12.89	138.5	200.6
110	13.28	142.3	209.9
120	13.67	146.1	219.3
130	14.05	149.8	229.0
140	14.44	153.6	238.9
150	14.82	157.3	249.0
160	15.20	161.0	259.3
170	15.59	164.8	269.9
180	15.97	168.5	280.8
190	16.36	172.1	292.0
200	16.75	175.8	303.5

RTD Types are: 10 ohm copper (at 25°C)
100 ohm platinum (at 0°C)
120 ohm nickel (at 0°C)

Table 2: Relay Tap Setting Reference Chart

Pickup Tap Setting	Dropout Temperature in Degrees C vs Tap Setting 60%	70%	80%	90%
70°C	42°	49°	56°	63°
80	48	56	64	72
90	54	63	72	81
100°	60°	70°	80°	90°
110	66	77	88	99
120	72	84	96	108
130°	78°	91°	104°	117°
140	84	98	112	126
150	90	105	120	135
160°	96°	112°	128°	144°
170°	102	119	136	153
180°	108	126	144	162