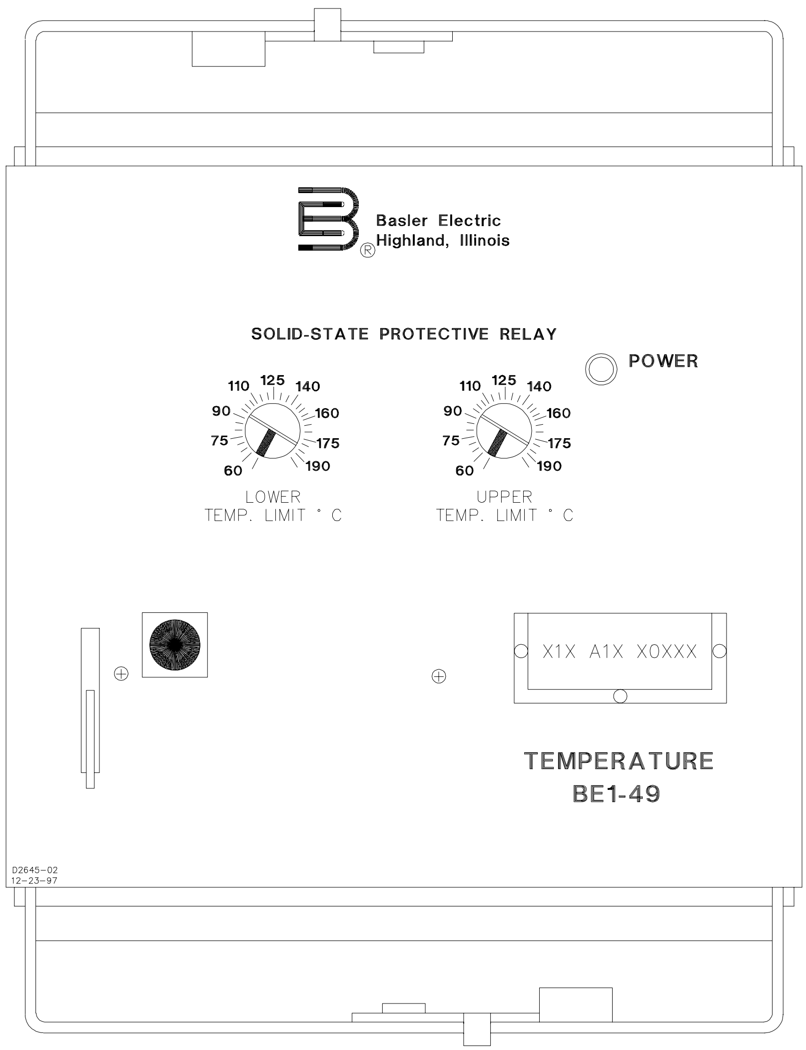
# INSTRUCTION MANUAL

## FOR
## TEMPERATURE RELAY
## BE1-49




Basler Electric


**Publication Number: 9 1267 00 990**
**Revision: D 12/01**

# INTRODUCTION

This Instruction Manual provides information concerning the operation and installation of BE1-49 Temperature Relay. To accomplish this, the following is provided.

- Specifications
- Functional characteristics
- Installation
- Operational Tests
- Mounting Information

**WARNING**
To avoid personal injury or equipment damage, only qualified personnel should perform the procedures presented in this manual.

**First Printing: 1980**

**Printed in USA**



**December 2001**



It is not the intention of this manual to cover all details and variations in equipment, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice. Should further information be required, contact Basler Electric Company, Highland, Illinois.

**BASLER ELECTRIC**
**ROUTE 143, BOX 269**
**HIGHLAND, IL 62249 USA**
**http://www.basler.com, info@basler.com**
**PHONE 618-654-2341** **FAX 618-654-2351**

# CONTENTS

# SECTION 1 • GENERAL INFORMATION

## GENERAL

The BE1-49 Temperature Relay is a solid state device that monitors the temperature of a remotely located resistive temperature detector (RTD), and provides signals to the protective scheme when the sensed temperature goes above or below predetermined limits. A variety of output options provide a selection of latching or non-latching types of normally open or closed contacts.

## DESCRIPTION

The Basler Temperature Relay supplies a constant current to a remotely located resistive temperature detector, and senses the temperature of the detector by measuring the voltage across the resistive element. When a pre-programmed temperature limit is reached, the relay energizes its output relay so that the protection scheme may take appropriate action.

Programming of the temperature limits is accomplished by adjusting the UPPER TEMPERATURE LIMIT and LOWER TEMPERATURE LIMIT controls on the relay front panel. Each control is adjustable over a range of 60° to 190°C. The effect on the protection scheme of exceeding the control setting limits of the relay is defined by the output option selected. Table 1-1 shows the available output options. The dotted horizontal lines represent hypothetical upper and lower temperature limit settings. The circled numbers represent relay case terminals.

A target that indicates when the upper temperature limit has been exceeded is optionally available, and may be either internally operated or current operated. The current operated target requires a minimum of 0.1 A to flow in the trip circuit for proper operation. The internally controlled target MUST be specified if NC output contacts are specified.

The relay assembly is mounted in a drawout cradle and enclosed in a standard, utility style case. Individual circuit components are accessible by removing the individual printed circuit boards from the relay cradle and using an extender board (Basler part number 9 1655 00 100) to test or troubleshoot.

## MODEL AND STYLE NUMBER

The electrical characteristics and optional features included in a particular model BE1-49 Temperature Relay are defined by a combination of letters and numbers that make up its style number. The model number, followed by its style number, appears on the front panel, drawout cradle, and inside the case assembly.

The style charts represented by Figure 1-1, lists all available options and relates them to the style number system. Upon receipt of a temperature relay, be sure to check relay style number against the requisition and packing list to see that they agree.

The callouts in the following figure are referred to in Table 1-1.

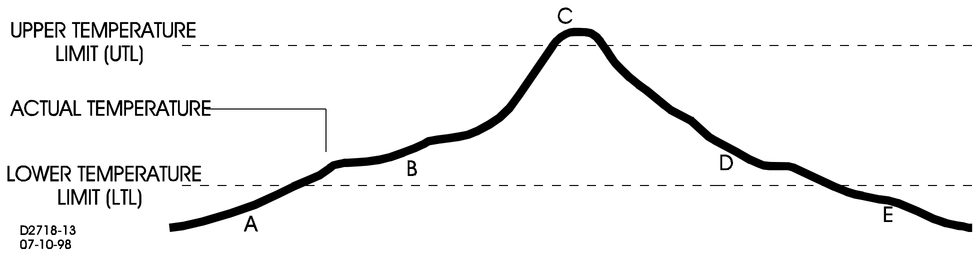
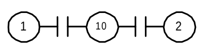
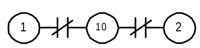
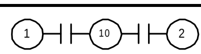
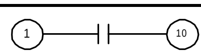
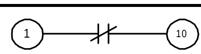
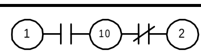
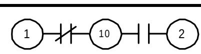
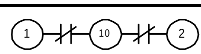
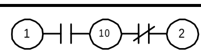
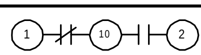



*Table 1-1. Output Characteristics*

| | A | B | C | D | E |
|---|---|---|---|---|---|
| | | OPERATING POWER ON | | | |
| **Output Style** | **Operating power off or operating power on and temperature is less than LTL** | **Temperature greater than LTL but less than UTL** | **Temperature greater than UTL** | **Temperature drops below UTL** | **Temperature drops below LTL** |
| F. Two Relays, NO |   | Open, Closed | Closed, Closed | Open, Closed | Open, Open |
| H. Two relays, NC |   | Closed, Open | Open, Open | Closed, Open | Closed, Closed |
| J. Two relays, NO, Latching (UTL) |   | Open, Closed, | Closed, Closed | Closed, Closed | Open, Open |
| L. One relay, NO, Latching |   | Open | Closed | Closed | Open |
| M. One relay, NC, Latching |   | Closed | Open | Open | Closed |
| N. Two relays: Upper NO Lower NC |   | Open, Open | Closed, Open | Open, Open | Open, Closed |
| P. Two relays: Upper NC Lower NO |   | Closed, Closed | Open, Closed | Closed, Closed | Closed, Open |
| R. Two relays, NC, Latching (UTL) |   | Closed, Open | Open, Open | Open, Open | Closed, Closed |
| S. Two relays: Upper NO Latching Lower NC |   | Open, Open | Closed, Open | Closed, Open | Open, Closed |
| T. Two relays: Upper NC Latching Lower NO |   | Closed, Closed | Open, Closed | Open, Closed | Closed, Open |

## SAMPLE STYLE NUMBER

The style number identification chart above illustrates the manner in which a relay's style number is determined. For example, if the style number were P1J-A1E-B0N5F the device would have the following features.

(P) RTD sensing output
(1) Designed to be used with copper RTD rated 10 ohms at 25°C
(J) Two normally open primary outputs, with the upper temperature limit trip contact latching on closure
(A1) Instantaneous trip timing
(E) Isolated internal operating power obtained from 100/120 Vac source
(B) One current operated target
(0) No Option 1 available
(N) No Option 2 available
(5) SPDT auxiliary contact output
(F) Semi-flush mounting

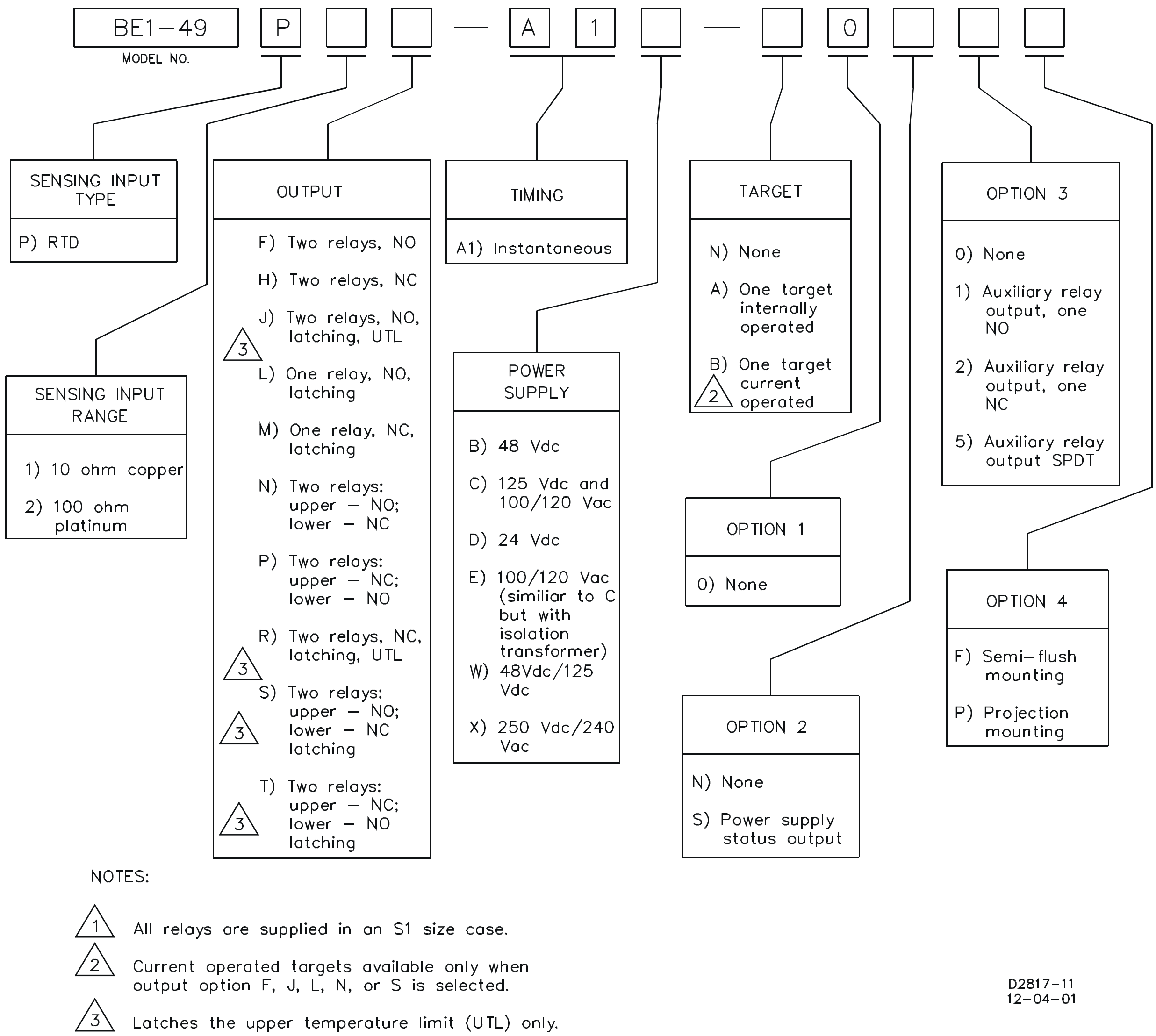



*Figure 1-1. Style Number Identification Chart*

## SPECIFICATIONS

**Sensing Method**

Four wire, using a remotely installed, 10 ohm copper or 100 ohm platinum resistive temperature detector (RTD) located within the protected machine. Relay supplies constant 40 mA current, and senses voltage across the temperature sensitive resistance element.

**Outputs**

Output contacts are rated as follows.

Resistive

120/240 Vac - make 30 A for 0.2 seconds, carry 7 A continuously, break 7 A. 250 Vdc - make and carry 30 A for 0.2 seconds, carry 7 A continuously, break 0.1 A. 500 Vdc - make and carry 15 A for 0.2 seconds, carry 7 A continuously, break 0.1 A.

Inductive

120/240 Vac, 125 Vdc, 250 Vdc - break 0.1 A (L/R = 0.04).

**Power Supply**

One of the six types of power supplies listed in Table 1-2 may be selected to provide internal relay operating power.

*Table 1-2. Power Supply Types And Specifications*

| Type | Nominal Input Voltage | Input Voltage Range | Burden at Nominal |
|---|---|---|---|
| B (Mid Range) | 48 Vdc | 24 to 150 Vdc | 4.0 W |
| C (Mid Range) | 125 Vdc<br>120 Vac | 24 to 150 Vdc<br>90 to 132 Vac | 4.5 W<br>10.3 VA |
| D(Low Range) | 24 Vdc | 12 † to 32 Vdc | 4.0 W |
| E (Mid Range) | 120 Vac | 90 to 132 Vac | 10.3 VA |
| W (Mid Range) | 48 Vdc<br>125 Vdc | 24 to 150 Vdc<br>24 to 150 Vdc | 4.0 W<br>4.5 W |
| X (High Range) | 250 Vdc<br>240 Vac | 62 to 280 Vdc<br>90 to 270 Vac | 5.2 W<br>14.0 VA |

† Type D power supply initially requires 14 Vdc to begin operating. Once operating, the voltage may be reduced to 12 Vdc and operation will continue.

**Target Indicator**

A magnetically latched, manually reset, target indicator is optionally available to indicate that the output has tripped. An internally operated or a current operated target may be specified. A current operated target requires 0.2 A in the output trip circuit to actuate, and
trip circuit current must not exceed 30 A for 0.2 seconds, 7 A for 2 minutes, and 3 A continuous. A current operated target may be selected only when normally open (NO) output contacts have been specified.

**Temperature Adjustment Range**

Two independently adjustable temperature controls, one for upper and one for lower temperature limits, each capable of settings over the range of 60 to 190°C.

| | |
|---|---|
| **Pickup Accuracy** | Relay pickup point will not vary more than +3°C for variations in input power or operating temperature within the operating range. |
| **UL** | UL Recognized under Standard 508, UL File #E97033. |
| **Shock** | In standard tests, the relay has withstood 15 G's in each of three mutually perpendicular axes without structural damage or degradation of performance. |
| **Vibration** | In standard tests, the relay has withstood 2 G's in each of three mutually perpendicular axes swept over the range of 10 to 500 Hz for a total of six sweeps, 15 minutes each sweep, without structural damage or degradation of performance. |
| **Isolation** | In accordance with IEC 255-5 and ANSI/IEEE C37.90, one minute dielectric (high potential) tests as follows:<br><br>All circuits to ground: 2121 Vdc<br>Input to output circuits: 1500 Vac or 2121 Vdc. |
| **Surge Withstand Capability** | Qualified to ANSI/IEEE C37.90.1 1989 (Transient Immunity and Radiated Susceptibility). Qualified to IEC-255-5 (Impulse requirements) and IEC-255-5\6 (Surge requirements). |
| **Temperature** | |
| Operating Range | -20°C (-4°F) to +65°C (+149°F). |
| Storage Range | -50°C (-58°F) to +90°C (+194°F). |
| **Weight** | 11 pounds net. |
| **Case Size** | S1. |

# SECTION 2 • HUMAN-MACHINE INTERFACE (CONTROLS AND INDICATORS)

The following table is the reference for the call-outs in Figure 2-1.

| LOCATOR | CONTROL OR INDICATOR | FUNCTION |
|---|---|---|
| A | LOWER TEMP LIMIT °C Control | Determines the RTD temperature that will be the lower limit for the relay. |
| B | UPPER TEMP LIMIT °C Control | Determines the RTD temperature that will be the upper limit for the relay. |
| C | POWER Indicator | A red light emitting diode (LED) illuminates when the relay power supply is supplying a nominal +12 Vdc to the relay circuitry. |
| D | Target Indicator | An over-temperature condition, as set by the UPPER TEMP LIMIT °C control, trips the normally black target indicator to red. The target is magnetically latched and may be manually reset by the target reset lever after the over temperature indication is terminated. Depending on the option supplied, the temperature indication may be terminated when the over temperature condition has ended, or when the RTD temperature has fallen below the lower temperature limit as set by the LOWER TEMP LIMIT °C control on relays with a latching type of output. |
| E | Target Reset Lever | The target indicator is a magnetically latched device. Therefore, the target must be returned to its normal (black) position after an upper temperature indication is terminated by pushing up on the reset lever that extends through the lower left of the relay case front cover. |

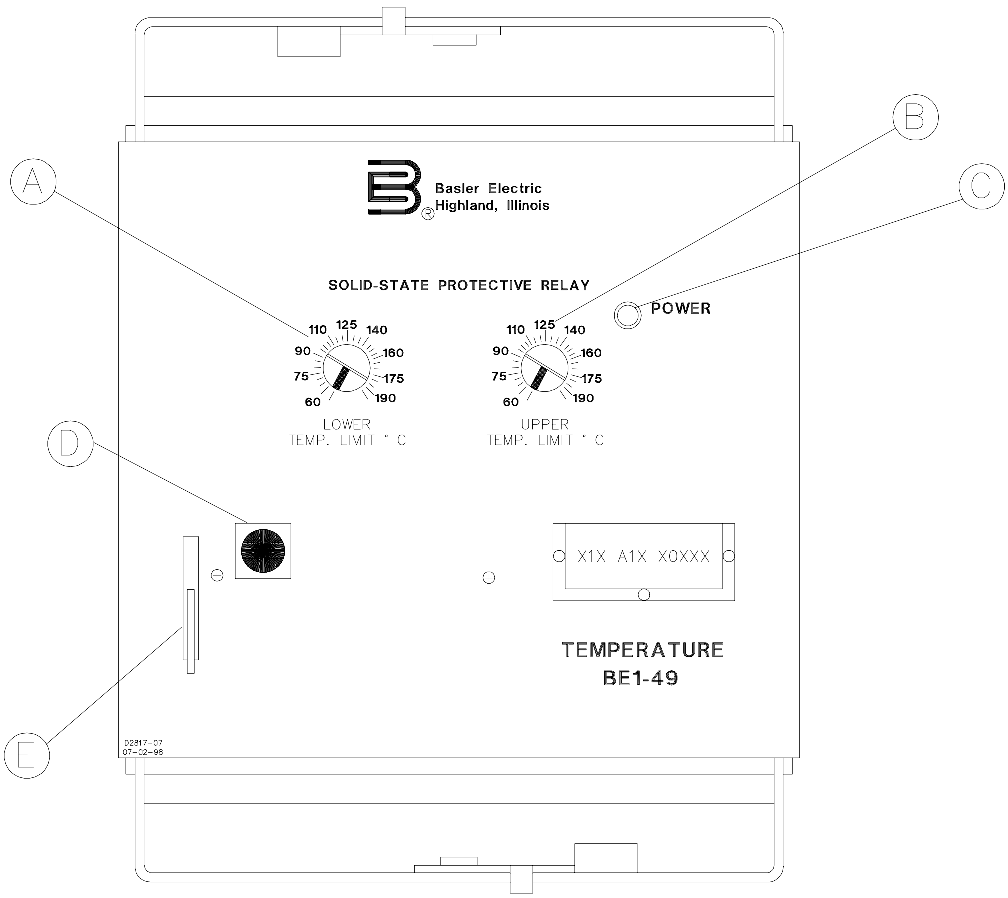



*Figure 2-1. Location of Controls and Indicators*

# SECTION 3 • FUNCTIONAL DESCRIPTION

## GENERAL

The following descriptions are referenced to the Functional Block Diagram in Figure 3-1.

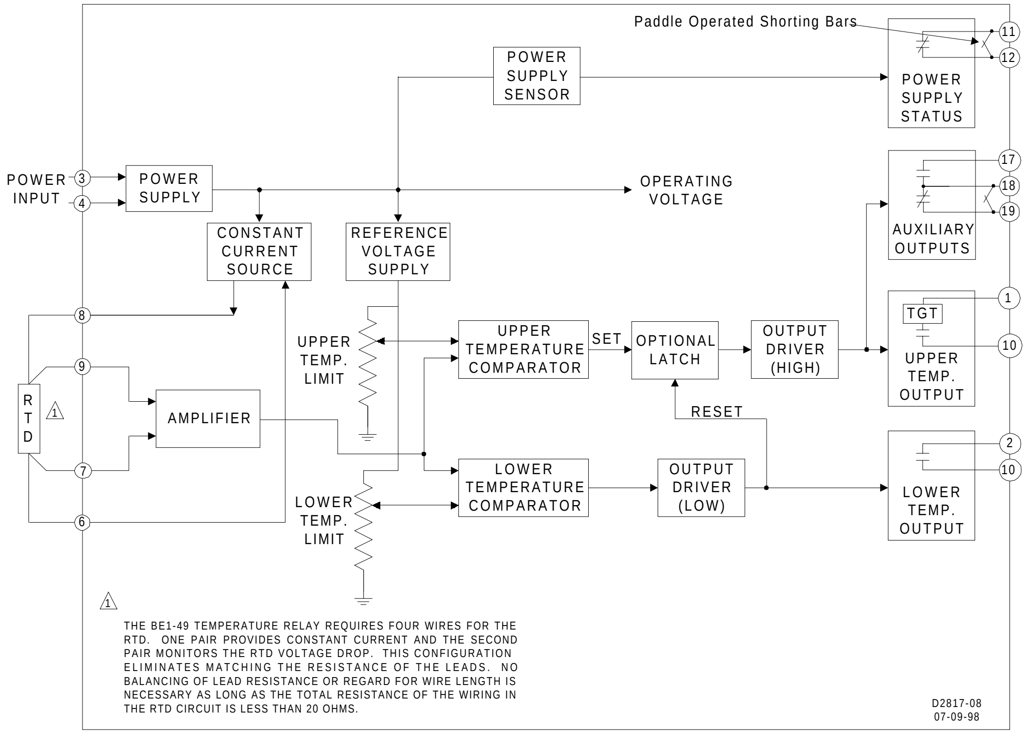



*Figure 3-1. Functional Block Diagram*

### Power Supply

Basler Electric enhanced the power supply design for unit case relays. This new design created three, wide range power supplies that replace the six previous power supplies. Style number identifiers for these power supplies have not been changed so that customers may order the same style numbers that they ordered previously. The first newly designed power supplies were installed in unit case relays with EIA date codes 9638 (third week of September 1996). A benefit of this new design increases the power supply operating ranges such that the 48/125 volt selector is no longer necessary. Specific voltage ranges for the three new power supplies and a cross reference to the style number identifiers are shown in the following table.

*Table 3-1. Wide Range Power Supply Voltage Ranges*

| Power Supply | Style Chart Identifiers | Nominal Voltage | Voltage Range |
|---|---|---|---|
| Low Range | D | 24 Vdc | 12† to 32 Vdc |
| Mid Range | B, C, E, W | 48, 125 Vdc, 120 Vac | 24 to 150 Vdc, 90 to 132 Vac |
| High Range | X | 125, 250 Vdc, 120, 240 Vac | 62 to 280 Vdc, 90 to 270 Vac |

† 14 Vdc is required to start the power supply.

Relay operating power is developed by the wide range, isolated, low burden, flyback switching, solid state power supply. Nominal ±12 Vdc is delivered to the relay internal circuitry. Input (source voltage) for the power supply is not polarity sensitive. A red LED turns ON to indicate that the power supply is functioning properly.

If a grounded RTD is used, a Type E power supply is required. A Type E power supply is a mid range power supply with an additional isolation transformer.

### Power Supply Status Output (Option 2-s)

The power supply status output relay is energized and its NC output contact is opened when power is applied to the relay. Normal internal relay operating voltage maintains the power supply status output relay continuously energized with its output contact open. If the power supply output voltage falls below the requirements of proper operation, the power supply output relay is deenergized, closing the NC output contact.

### Constant Current Source

The constant current source provides a regulated 40 mA to the external RTD. This circuit is relatively unaffected by changes in the ambient temperature. Since resistance of the RTD varies directly with temperature, 40 mA through the RTD develops a voltage which is proportional to RTD temperature. See Section 5 for a graphical representation.

### Amplifier

The amplifier monitors the voltage across the RTD and provides a voltage level signal to both the upper and lower temperature limit comparator stages.

### Reference Voltage Supply

The reference voltage supply provides a regulated voltage to the UPPER TEMPERATURE LIMIT and LOWER TEMPERATURE LIMIT front panel controls. Each of these controls is a potentiometer and functions as a variable voltage divider. The position of the potentiometer wiper determines a reference voltage for one input of the corresponding comparator circuit.

### Upper And Lower Temperature Comparators

Two similar comparators in the relay each compare the amplified voltage across the RTD with a dedicated reference voltage established by the setting of a front panel control. The upper temperature comparator provides an output current to its associated driver circuit when the RTD voltage exceeds the reference voltage from the UPPER TEMPERATURE LIMIT potentiometer. The lower temperature comparator provides an output current to its associated driver circuit when the RTD voltage is less than the reference voltage from the LOWER TEMPERATURE LIMIT potentiometer.

### Latch (Optional)

A latching function is optionally available for the upper temperature output. When this latch is selected, the upper temperature output will latch in its energized condition when the upper temperature limit is exceeded. The output will then remain latched until the RTD temperature falls below its lower limit (as determined by the lower temperature comparator).

### Output Drivers

Two Darlington amplifiers are provided as output drivers in the relay. Each amplifier receives the output current from an associated comparator and amplifies it to provide sufficient current to drive the selected output device. An inverter is provided in the input to the lower limit output driver to cause it to energize the output relay when the lower limit is exceeded.

### Output Relay

A wide variety of relay contact arrangements are available. The contact arrangement is specified by the OUTPUT letter in the relay style number. Refer to Figure 1-1 for a list of all of the available output options.

### Target Indicator

An optional target indicator on the front panel is tripped and magnetically latched when the upper temperature limit is exceeded. It may be reset manually after the upper temperature limit output is de-energized.

# SECTION 4 • INSTALLATION

## GENERAL

When not shipped as part of a control or switchgear panel, the relays are shipped in sturdy cartons to prevent damage during transit. Immediately upon receipt of a relay, check the model and style number against the requisition and packing list to see that they agree. Visually inspect the relay for damage that may have occurred during shipment. If there is evident damage, immediately file a claim with the carrier and notify the Regional Sales Office, or contact Customer Service at Basler Electric, Highland, Illinois.

In the event the relay is not to be installed immediately, store the relay in its original shipping carton in a moisture and dust free environment. When the relay is to be placed in service, it is recommended that the following operational test be performed prior to installation.

## RELAY OPERATING PRECAUTIONS

Before installation or operation of the relay, note the following precautions:

1. A minimum of 0.2 A in the output circuit is required to ensure operation of current operated targets.
2. The relay is a solid-state device. If a wiring insulation test is required, remove the connecting plugs and withdraw the cradle from its case.
3. When the connecting plugs are removed the relay is disconnected from the operating circuit and will not provide system protection. Always be sure that external operating (monitored) conditions are stable before removing a relay for inspection, test, or service. Also, be sure that connecting plugs are in place before replacing the front cover.
4. Be sure the relay case is hard wired to earth ground using the ground terminal on the rear of the unit. Use a separate ground lead to the ground bus for each relay.

## DIELECTRIC TEST

In accordance with IEC 255-5 and ANSI/IEEE C37.90, one minute dielectric (high potential) tests as follows:

| | |
|---|---|
| All circuits to ground: | 2121 Vdc |
| Input to output circuits: | 1500 Vac or 2121 Vdc. |

## MOUNTING

Relay outline dimensions and panel drilling diagrams are supplied in Figures 4-1 through 4-10.

## CONNECTIONS

Incorrect wiring may result in damage to the relay. Be sure to check model and style number against the options listed in the Style Number Identification Chart before connecting and energizing a particular relay. Connections should be made with 14 AWG stranded wire or better. Typical external connections are shown in Figure 4-11 . For internal connections refer to Section 3, Functional Block Diagram.

**NOTE**

Be sure the relay case is hard-wired to earth ground with no smaller than 12 AWG copper wire attached to the ground terminal on the rear of the relay case. When the relay is configured in a system with other protective devices, always use a separate lead to the ground bus from each relay.

To prevent an inductive overload of the relay's contacts, it is necessary to break the trip circuit externally through the 52a contacts. (See Figure 4-11).

Terminals 3 and 4 are external relay power supply voltage inputs and are not polarity sensitive. Terminals 6 and 8 are the constant current supply to the RTD.

**CAUTION**

If a grounded RTD is to be used, power supply type E must be specified.

Terminals 7 and 9 are the voltage sensing inputs to the relay. To achieve the rated temperature accuracy for the relay, a wire should be connected from each of terminals 6, 7, 8, and 9 to the RTD. Each of the four wires should be less than 20 ohms of resistance. If less than rated temperature accuracy is acceptable, terminals 6 and 7 may be jumpered together and terminals 8 and 9 jumpered together.

The relay circuitry is connected to the case terminals by removable connecting plugs (1 for 10 terminal cases, 2 for 20 terminal cases). Removal of the connecting plug(s) opens the NO trip contact circuit and shorts the NC trip contact circuit before opening the power and sensing circuits.

## ADJUSTMENTS

The relay has been calibrated at the factory and it is strongly recommended that the calibration adjustments not be disturbed. If, however, relay pickup accuracy is suspect for any reason, remove the relay from service and check the temperature settings using the procedures given in Section 5 of this manual.

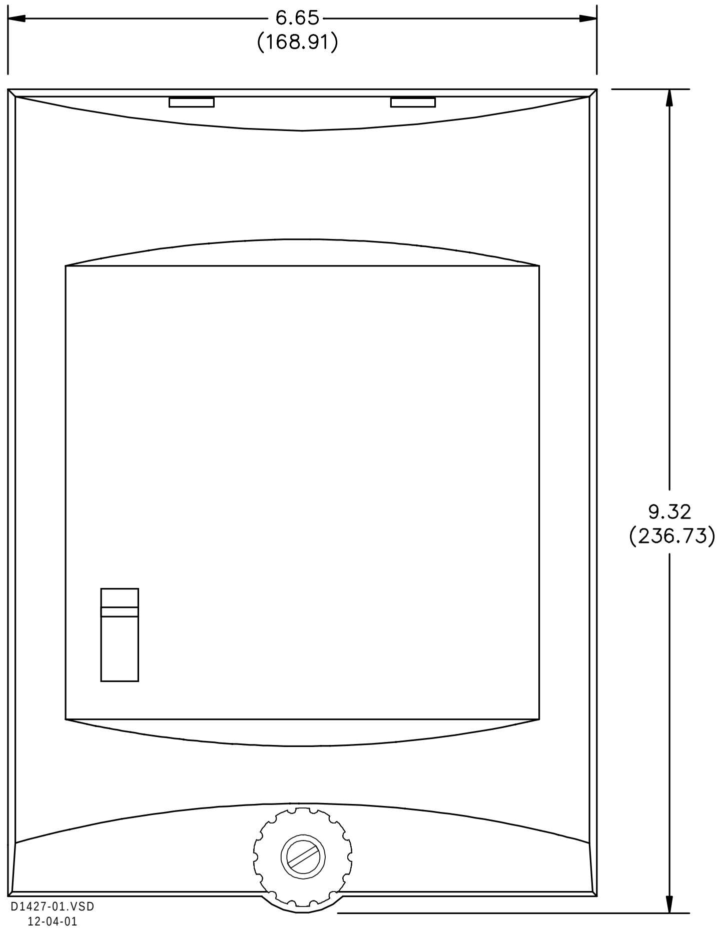



*Figure 4-1 . S1 Case, Outline Dimensions, Front View*

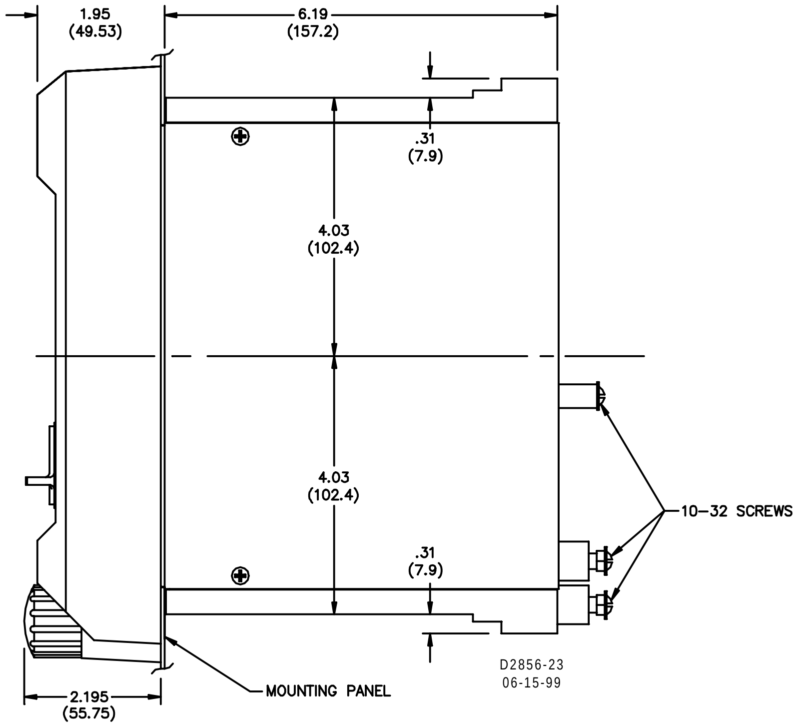



*Figure 4-2 . S1 Case, Single-Ended, Semi-Flush Mounting, Outline Dimensions, Side View*

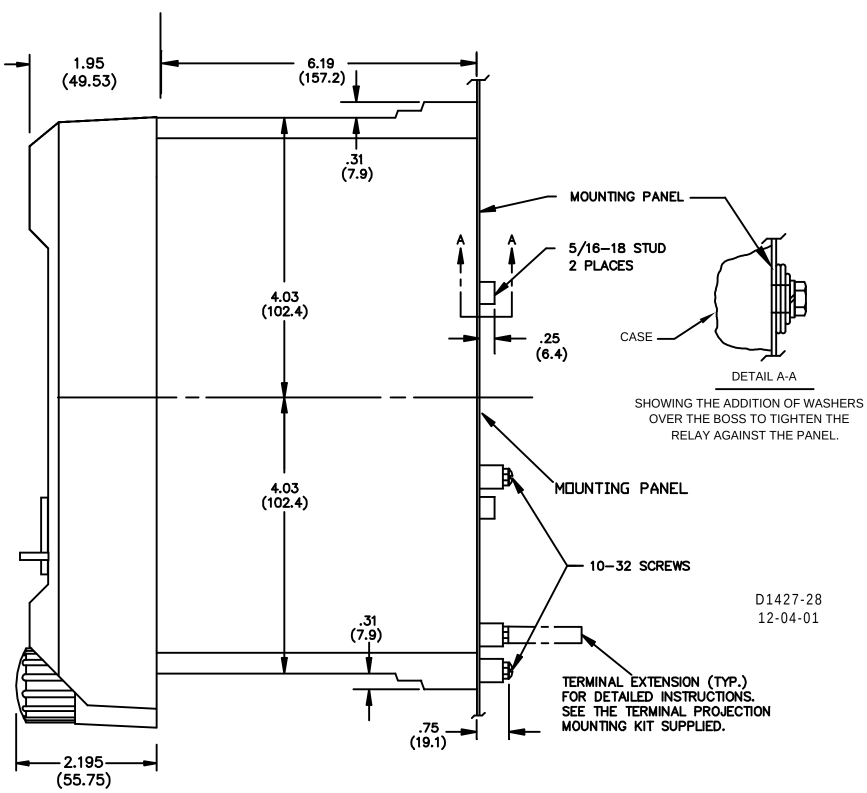



*Figure 4-3 . S1 Case, Single-Ended, Projection Mount, Outline Dimensions, Side View*

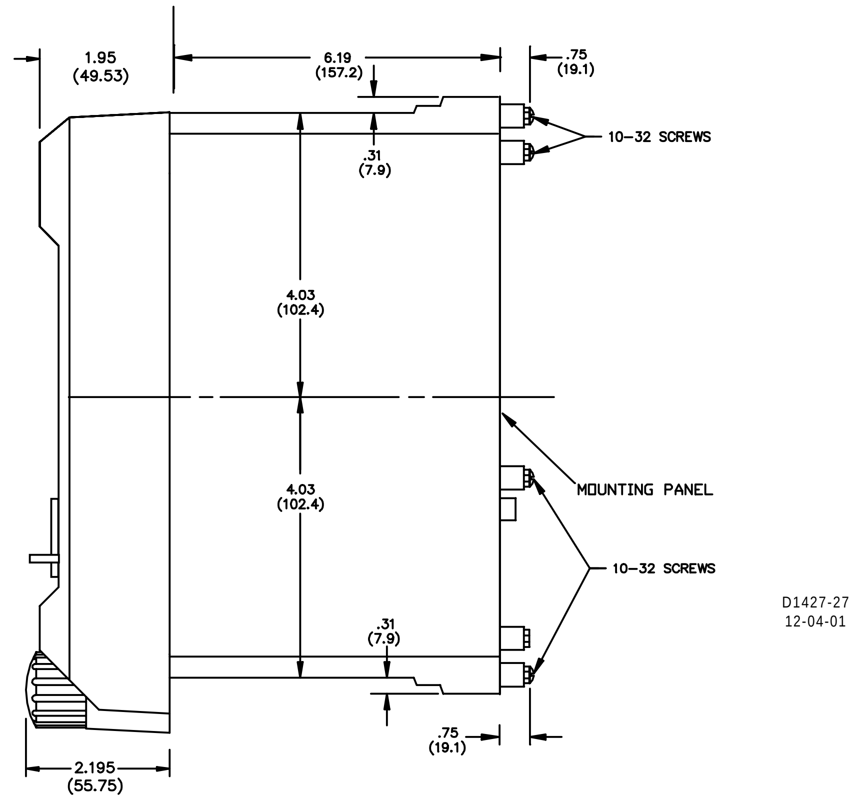



*Figure 4-4 . S1 Case, Double-Ended, Semi-Flush Mounting, Outline Dimensions, Side View*

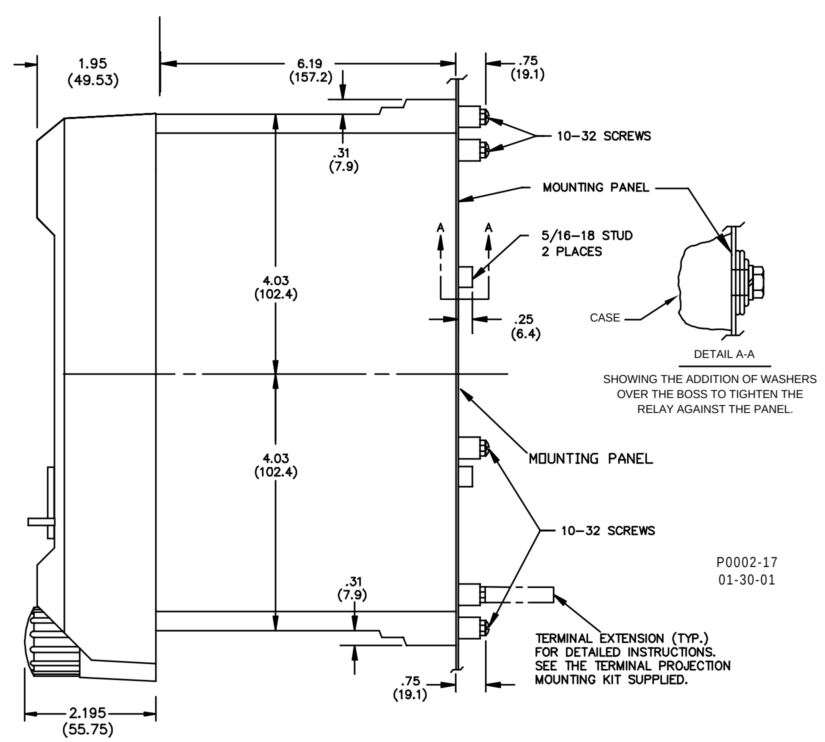



*Figure 4-5 . S1 Case, Double-Ended, Projection Mount, Outline Dimensions, Side View*

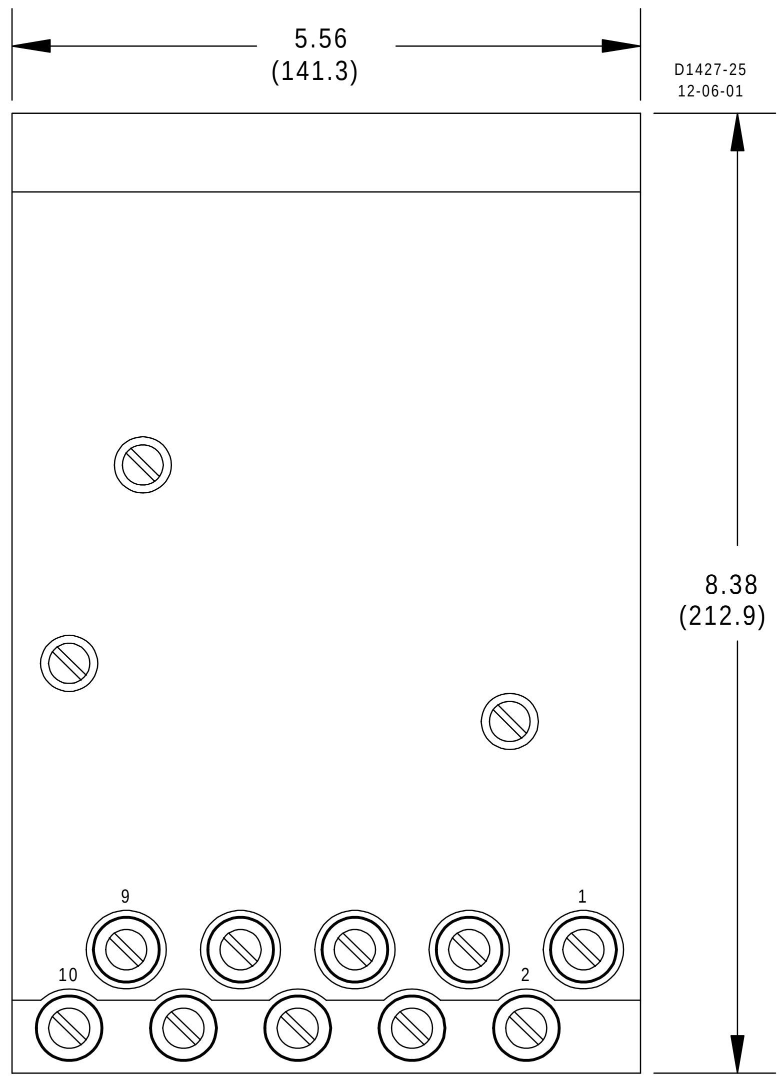



*Figure 4-6 . S1 Case, Single-Ended, Projection Mount, Outline Dimensions, Rear View*

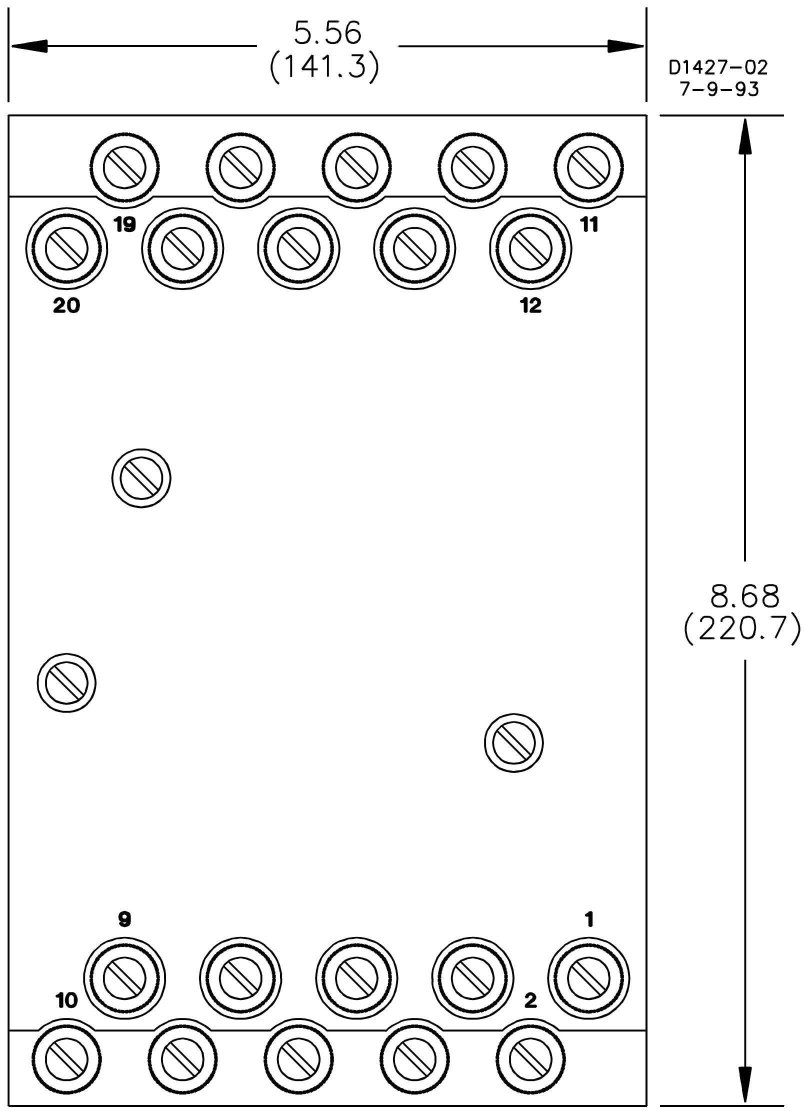



*Figure 4-7 . S1 Case, Double-Ended, Projection Mount, Outline Dimensions, Rear View*

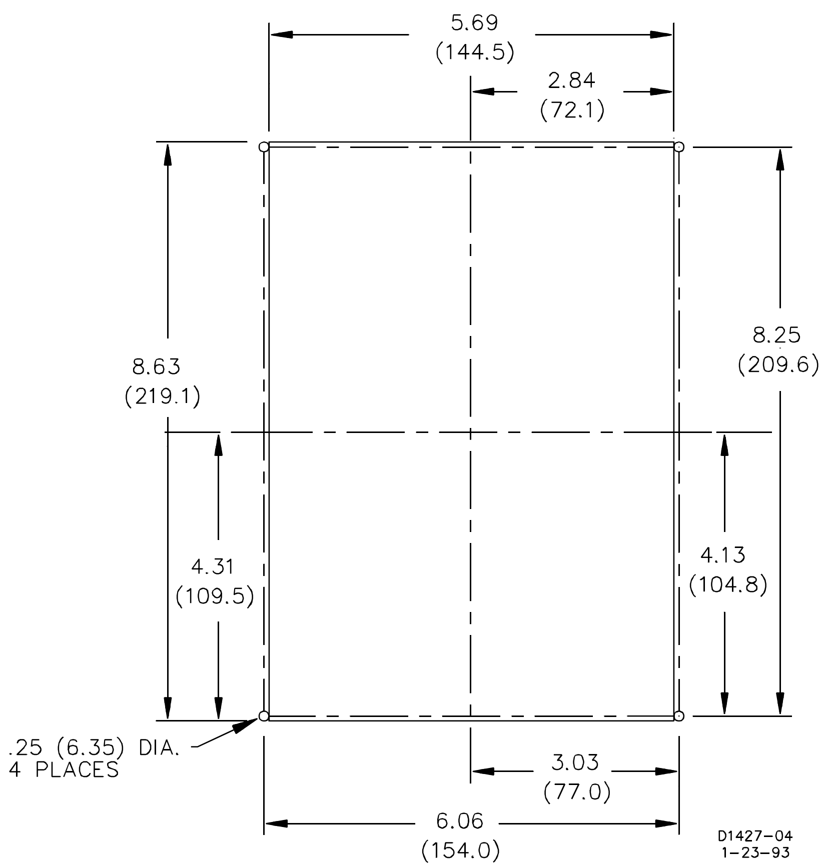



*Figure 4-8 . S1 Case, Panel Drilling Diagram, Semi-Flush Mounting*

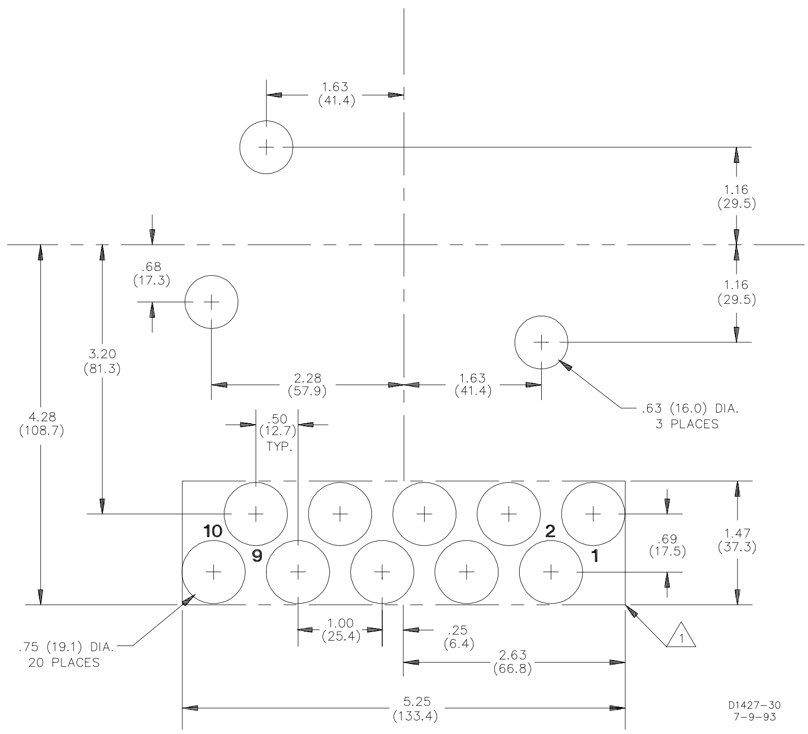



*Figure 4-9 . S1 Case, Single-Ended, Projection Mount, Panel Drilling Diagram, Rear View*

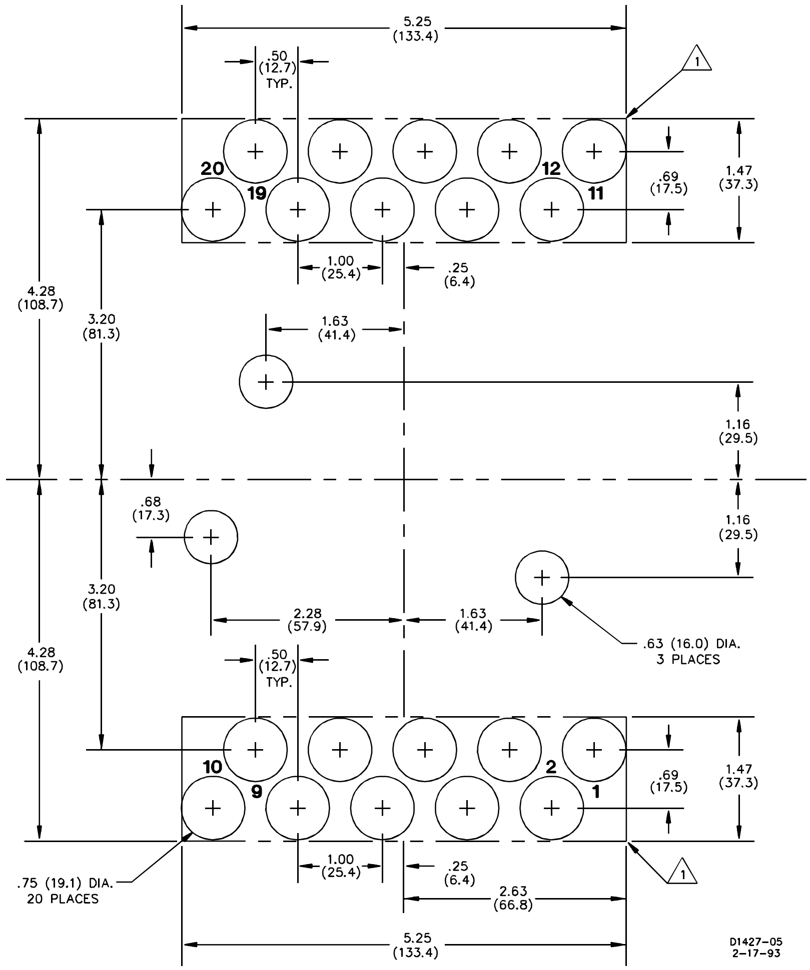



*Figure 4-10 . S1 Case, Double-Ended, Projection Mounting, Panel Drilling Diagram, Rear View*

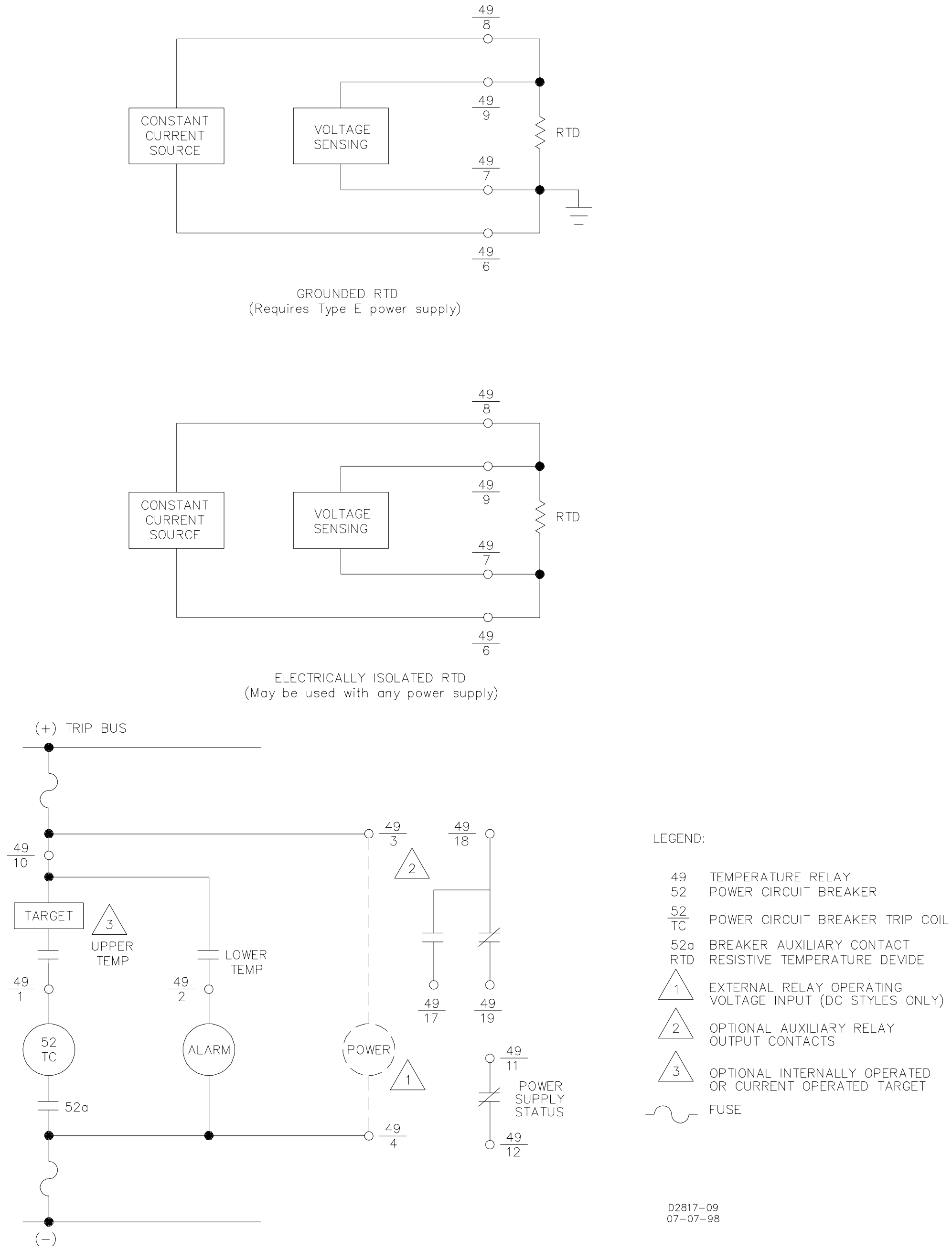



*Figure 4-11. DC Connection Diagram*

# SECTION 5 • OPERATIONAL TEST

## GENERAL

Operational test procedures are provided in this section for use in verifying operation of the temperature relay and for selecting desired upper and lower temperature limit trip points. Temperature calibrations performed on the bench may be affected by the resistance of the relay-to-RTD wiring in the field installation. This effect is minimized by using the 4-wire sensing connection shown in Figure 4-11. These variations will be on the order of 1.5°C or less, provided the field wiring is held at 20 ohms or less per lead. For greater accuracy, it is suggested that a resistance equivalent to that of the RTD current supply wiring be inserted in the test setup.

If a relay fails an operational test, refer to Section 6. Alternatively, the relay may be returned to the factory for repair. When returning the relay to the factory, ship the entire relay cradle assembly, preferably in the case.

Some of the steps in the following procedures call for observations that are dependent on the output option supplied. A table of observable results is provided with those steps.

**CAUTION**

Before performing following tests, refer to relay operating precautions in Section 4.

## POWER SUPPLY STATUS OUTPUT (OPTION 2-S)

Step 1. With the unit in a powered-up condition, verify that the power supply status output contact is energized open (terminals 11 and 12).

Step 2. Remove input power and verify that the status output contact closes. Restore input power.

## OPERATIONAL TEST OF UPPER TEMPERATURE LIMIT TRIP

Step 1. Connect the relay as shown in Figure 5-1.

Step 2. Set the resistor decade box for minimum resistance.

Step 3. Set LOWER TEMP LIMIT °C control to 60.

Step 4. Set UPPER TEMP LIMIT °C control to 190.

Step 5. With relay connecting plug(s) in place, apply appropriate operating power to relay.

Step 6. Observe that the test setup indicators are ON or OFF as listed in the chart which follows.

**Test Setup Indicators, Step 6**

| OUTPUT OPTION | C | D | F | H | J | L | M | N | P | R | S | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DS1 | OFF | OFF | OFF | ON | OFF | OFF | ON | OFF | ON | ON | OFF | ON |
| DS2 | OFF | OFF | OFF | ON | OFF | - | - | ON | OFF | ON | ON | OFF |

| OPTION 3 | 0 | 1 | 2 | 5 |
|---|---|---|---|---|
| DS3 | --- | --- | ON | ON |
| DS4 | --- | OFF | --- | OFF |

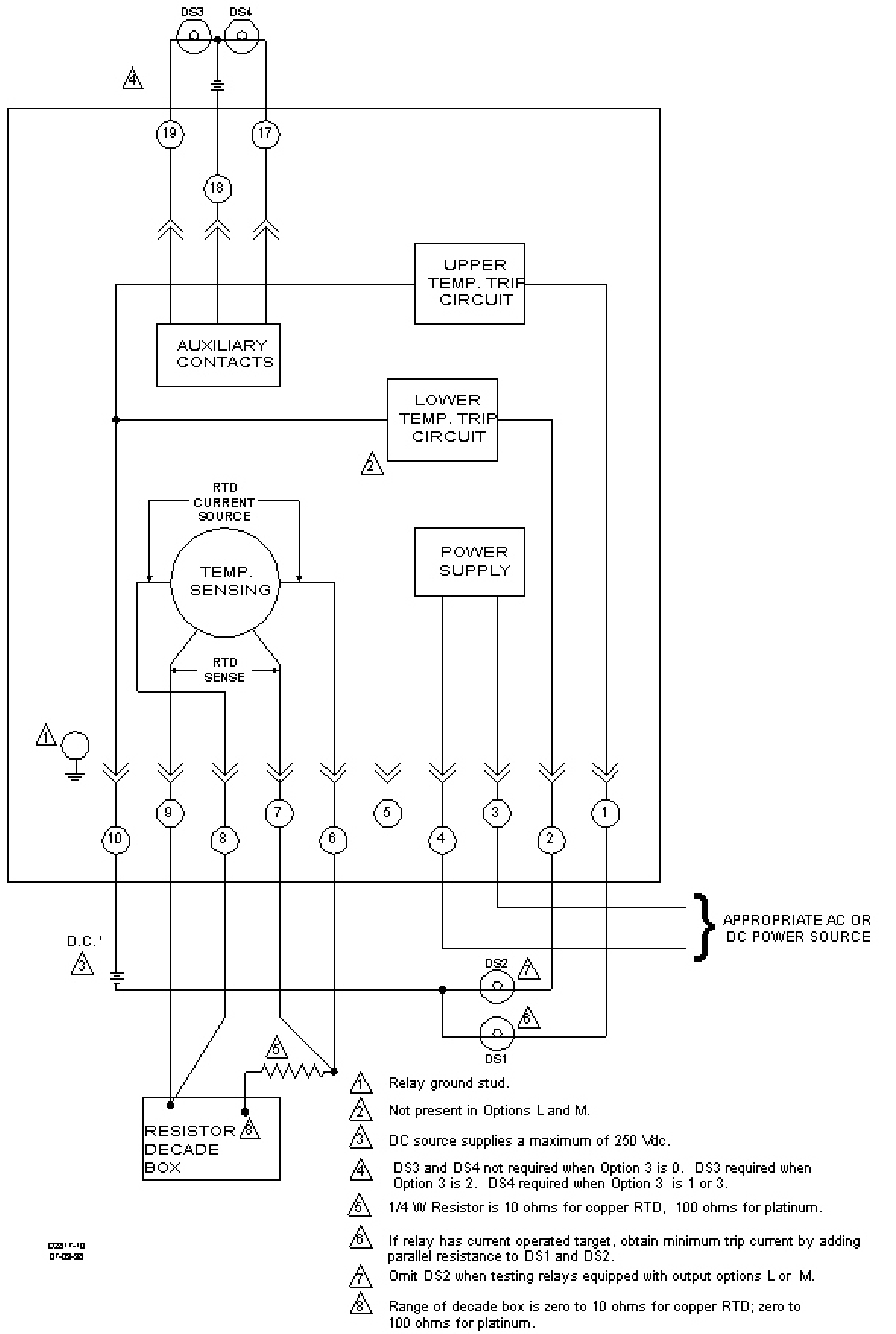



Figure 5-1. Temperature Relay Test Setup

Step 7. Set UPPER TEMP LIMIT °C control to the upper temperature limit to be tested.

Step 8. Adjust resistor decade box for greater resistance until an upper temperature limit trip indication (DS1) is observed. The chart below presents the trip indication for all relay output options. On relays with target option A, target will also indicate trip. On relays with target option B, target will indicate trip if current through terminal 1 is at least 0.2 A.

**Trip Indications, Step 8**

| **OUTPUT OPTION** | **C** | **D** | **F** | **H** | **J** | **L** | **M** | **N** | **P** | **R** | **S** | **T** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DS1 | ON | ON | ON | OFF | ON | ON | OFF | ON | OFF | OFF | ON | OFF |

| **OPTION 3** | **0** | **1** | **2** | **5** |
|---|---|---|---|---|
| DS3 | --- | --- | OFF | OFF |
| DS4 | --- | ON | --- | ON |

Step 9. Read resistance from decade box. Refer to Figure 5-2, Temperature/Resistance, to verify the temperature at which the trip occurred.

Step 10. Adjust UPPER TEMP LIMIT °C as necessary and repeat steps 8 and 9 until upper temperature limit trip occurs at desired temperature.

Step 11. On relays with output options J, L, M, R, S, and T, adjust resistor decade box for 0.96 ohms. For all other relays determine the resistance that corresponds to a level 10°C below the upper limit setting (using Figure 5-2), then adjust resistor decade box for the resistance value obtained. Observe that relay resets per indication chart below.

**Reset Indications, Step 11**

| **OUTPUT OPTION** | **C** | **D** | **F** | **H** | **J** | **L** | **M** | **N** | **P** | **R** | **S** | **T** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DS1 | OFF | OFF | OFF | ON | OFF | OFF | ON | OFF | ON | ON | OFF | ON |

| **OPTION 3** | **0** | **1** | **2** | **5** |
|---|---|---|---|---|
| DS3 | --- | --- | ON | ON |

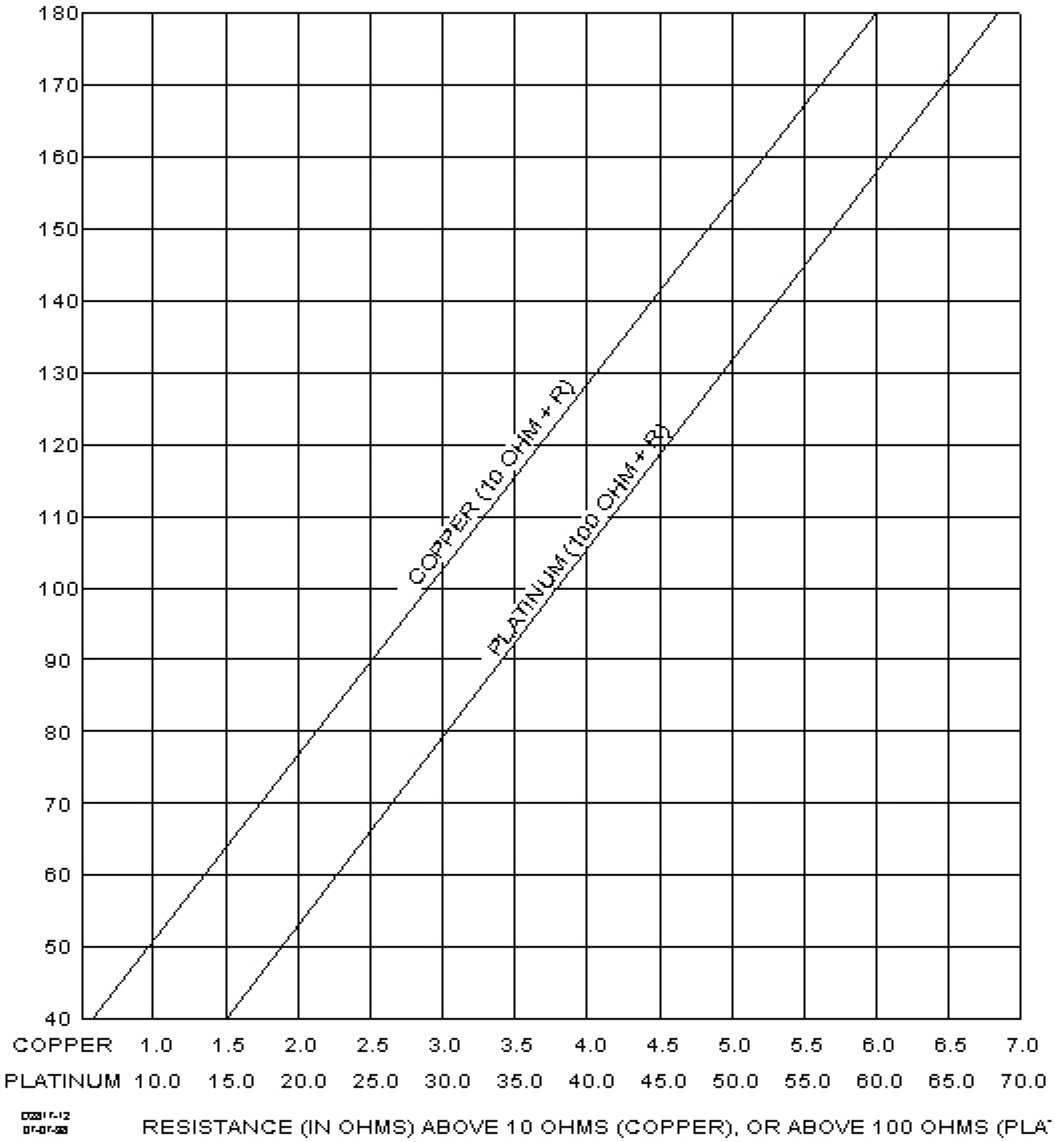



Figure 5-2. RTD Temperature/Resistance Graph

## OPERATIONAL TEST OF LOWER TEMPERATURE LIMIT TRIP

**NOTE**

The operational test for the lower temperature limit trip is not required on relays with output options L and M. (The lower trip on these relays is given in Step 3, page 5-1.)

Step 1. Connect the relay as shown in Figure 5-1.

Step 2. Set the resistor decade box for 0.0 ohms.

Step 3. Set LOWER TEMP LIMIT °C control to 60.

Step 4. Set UPPER TEMP LIMIT °C control to 190.

Step 5. With relay connecting plug(s) in place, apply appropriate operating power to relay.

Step 6. Observe states of test setup indicators as listed in the chart below.

**Test Setup Indicators, Step 6**

| OUTPUT OPTION | C | D | F | H | J | L | M | N | P | R | S | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DS1 | OFF | OFF | OFF | ON | OFF | OFF | ON | OFF | ON | ON | OFF | ON |
| DS2 | OFF | OFF | OFF | ON | OFF | - | - | ON | OFF | ON | ON | OFF |

| OPTION 3 | 0 | 1 | 2 | 5 |
|---|---|---|---|---|
| DS3 | --- | --- | ON | ON |
| DS4 | --- | OFF | --- | OFF |

Step 7. Set LOWER TEMP LIMIT °C control to the lower temperature limit to be tested.

Step 8. Gradually increase the decade box resistance until a lower temperature limit trip indication (DS2) is observed. The chart below presents the trip indications for all relay output options.

**Trip Indications, Step 8**

| OUTPUT OPTION | C | D | F | H | J | L | M | N | P | R | S | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DS2 | ON | ON | ON | OFF | ON | - | - | OFF | ON | ON | OFF | ON |

Step 9. Read resistance from decade box. Refer to Figure 5-2, Temperature/ Resistance, to verify the temperature at which the trip occurred.

Step 10. Adjust LOWER TEMP LIMIT °C as necessary and repeat steps 8 and 9 until lower temperature limit trip occurs at desired temperature.

Step 11. Determine the resistance that corresponds to a level 10°C below the lower limit setting from Figure 5-2, then adjust resistor decade box for resistance value obtained. Observe relay resets by the indication in chart below.

**Reset Indication, Step 11**

| OUTPUT OPTION | C | D | F | H | J | L | M | N | P | R | S | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DS2 | OFF | OFF | OFF | ON | OFF | - | - | ON | OFF | ON | ON | OFF |

## TRIP POINT SELECTION (EXCEPT OUTPUT OPTIONS L and M)

This procedure provides a method for selecting the upper and lower temperature limit trip points. The lower trip point is selected first. If only the upper trip selection is desired, perform steps 1, 3, 9, 10 and 11.

Step 1. Connect the relay as shown in Figure 5-1.

Step 2. Set the LOWER TEMP LIMIT °C control to at least 10°C above the intended lower temperature limit trip point.

Step 3. Set UPPER TEMP LIMIT °C control to 190.

Step 4. Set resistor decade box for minimum resistance.

Step 5. With relay connecting plug(s) in place, apply appropriate operating power to relay.

Step 6. Refer to Figure 5-2, Temperature/Resistance, to obtain resistance value for lower trip point.

Step 7. Set decade box for resistance value obtained in step 6.

Step 8. Slowly adjust LOWER TEMP LIMIT °C control counter-clockwise until trip indication in chart below is observed. The lower temperature limit trip point is now selected.

**Lower Temperature Limit Trip Point Selection, Step 8**

| OUTPUT OPTION | C | D | F | H | J | N | P | R | S | T |
|---|---|---|---|---|---|---|---|---|---|---|
| DS1 | ON | ON | ON | OFF | ON | OFF | ON | OFF | OFF | ON |

Step 9. Refer to Figure 5-2, Temperature/Resistance to obtain resistance value for upper temperature limit trip point.

Step 10. Set resistor decade box for resistance obtained in Step 9.

Step 11. Slowly adjust UPPER TEMP LIMIT °C control counter-clockwise until trip indication in chart below is observed. The upper temperature limit trip point is now selected.

**Upper Temperature Limit Trip Point Selection, Step 11**

| OUTPUT OPTION | C | D | F | H | J | N | P | R | S | T |
|---|---|---|---|---|---|---|---|---|---|---|
| DS1 | ON | ON | ON | OFF | ON | ON | OFF | OFF | ON | OFF |

## TRIP POINT SELECTION (OUTPUT OPTIONS L AND M)

Step 1. Connect the relay as shown in Figure 5-1.

Step 2. Set the UPPER TEMP LIMIT °C control to at least 5°C above the intended upper temperature limit trip point.

Step 3. Set LOWER TEMP LIMIT °C control to 60.

Step 4. Refer to Figure 5-2, Temperature/Resistance, to obtain resistance value for upper trip point.

Step 5. Set decade box for the resistance obtained in step 4.

Step 6. Slowly adjust UPPER TEMP LIMIT °C control counter-clockwise until appropriate trip is observed. For option L, DS1 should go on; for option M, DS1 should go off. The upper temperature limit trip point is now selected.

Step 7. Refer to Figure 5-2, Temperature/Resistance, to obtain resistance value for lower temperature limit trip point.

Step 8. Set decade box for resistance obtained in step 7.

Step 9. Slowly adjust LOWER TEMP LIMIT °C control counterclockwise until appropriate indication is observed. For option L, DS1 should go off; for option M, DS1 should go on. The lower temperature limit trip point is now selected.

# SECTION 6 • MAINTENANCE

## GENERAL

Basler relays are static devices which require no preventive maintenance other than a periodic operational check. The operational test procedure of Section 5 provides an adequate check to verify proper operation of the relay.

Most components are on conformally coated PC boards. In-house replacement of individual components may be difficult and should not be attempted unless appropriate equipment and qualified personnel are available. The relay may be returned to the factory for repair. When returning the relay to the factory ship the entire relay cradle assembly, preferably in its case.

## IN-HOUSE REPAIR

If in-house repair is to be attempted, replacement parts may be purchased locally. The quality of replacement parts must be at least equal to that of the original components.

**CAUTION**

When the printed circuit boards are conformally coated special soldering equipment must be used to prevent thermal damage to the delicate components. Care must be taken not to bridge over the printed circuit board traces. The repaired area must be re-covered with a suitable plastic coating (acrylic) to avoid breakdown of traces due to moisture or dust.

Where special components are involved, Basler Electric part numbers may be obtained from the number stamped on the component or assembly, the schematic, or the parts list. These parts may be ordered directly from Basler Electric. Complete boards or assemblies may be ordered by supplying the following information.

1. Model and style number

2. Relay serial number

3. Board or assembly
    a) part number
    b) serial number
    c) revision letter

4. The name of the board or assembly

**CAUTION**

Removal and direct substitution of printed circuit boards or individual components does not necessarily mean the relay will operate properly. Always check/calibrate relay prior to placing into an operating system.

## STORAGE

This protective relay contains aluminum electrolytic capacitors which generally have a life expectancy in excess of 10 years at storage temperatures less than 40°C. Typically, the life expectancy of the capacitor is cut in half for every 10°C rise in temperature. Storage life can be extended if, at 1 year intervals, power is applied to the relay for a period of thirty minutes.

# SECTION 7 • MANUAL CHANGE INFORMATION

## CHANGES

This section contains information concerning the previous editions of the manual. The substantive changes to date are summarized in Table 7-1.

*Table 7-1. Changes*

| Revision | Change | ECA/Date |
|---|---|---|
| **C** | Deleted reference to Service Manual 9 1267 00 620. Updated the Dielectric Test information. Changed Input Voltage Range and Burden Data in Power supply table in *Specifications*, Section 1. Corrected Style Chart by changing power supply type X from "230 Vac" to "240 Vac". Added new power supply information to Section 3 in *Power Supply* paragraph starting with "Basler Electric enhanced the power supply design...". Added new dimension figures to include all options available (S1 Single-Ended and Double-Ended, and both mounting positions). Added power supply status and terminal connections to *Connection Diagram*. Changed the symbol for case ground in Figure 5-1. Changed the format of the manual. | 16871/07-98 |
| **D** | Updated the figures in section 4 to reflect new covers. Fixed syntax error in style chart under option 3, changing the 3 to a 5. | 15559/12-01 |

Basler Electric
ROUTE 143, BOX 269
HIGHLAND, IL 62249 USA
http://www.basler.com, info@basler.com
PHONE 618-654-2341 FAX 618-654-2351