TYPE II

SERIES 35 TEMPERATURE MONITORS

Using 10 ohm Resistance Detectors

Model 2076A36H010 with 3 Alarms and 3 Trips

Using 100 ohm Resistance Detectors

Model 2076A36H011 with 3 Alarms and 3 Trips

Using 120 ohm Resistance Detectors

Model 2076A36H012 with 3 Alarms and 3 Trips

Operating Procedure

The temperature monitor is solid state device used for indication and alarm of (RTD) inputs. The unit consists basically of three plug-in printed circuit cards per probe position and a single meter indicator card (CMI), which is switched to read any position whether the unit is single or dual alarm:

1. Alarm Card #1 - For alarm condition.
2. Alarm Card #2 - For trip condition.
3. Meter Indicator Card.
4. Power Supply Card.

Plus a front panel mounted indicator and selector switch.

The temperature is sensed by means of (RTS's) Resistance Temperature Detectors, one of which (PT) is used in a bridge circuit consisting of resistor (R3) and (PT) in one leg of the bridge, and resistors (R2), (R6) and (P1) rheostat in the other leg of the bridge. The output of this bridge feeds alarm card (#1). The Alarm Card (#1) operates the Alarm Temperature Relay providing a single pole double throw contact, for customer use. Alarm Card (#2) operates the Trip Temperature Relay providing a SPDT contact, for customer use. This is shown on Figure 2 schematic for temperature monitor.

The temperature set points for the alarm and shutdown curcuits are (P1) and (P2) potentiometers and are located on the rear of the instrument. The set point potentiometers are uncalibrated and is necessary to connect a known resistance, at the motor, in order to correct for the error introduced by the lead resistance. This is particularly important for 10 ohm probes, where the lead resistance can be appreciable compared to the 10 ohm probe.

NOTE: 10 ohms corresponds to 25°C. 13.3 ohms corresponds to 112°C. (Readings are linear between these points). For other range detectors, refer to Table 5 attached, and follow instructions for linearity calibration.

The instrument is calibrated for short leads and in order to make the instrument match the application, connect the motor (RTD) resistor, per the table, on the leads at the motor, connected to probe terminals of the instrument.

Remove side hole covers, on instrument and adjust the (P1) zero (top) and (P2) span (bottom) potentiometers, located on the Plug-in CMI Card, to get the linearity on the indicator dial. The motor resistance (RTD) is connected to (P1) terminals and set the selector switch on the front of the unit to position (1). The meter should read 25°C. or the ambient temperature with 10 ohms connected on lead wires. If not, adjust (P1) on the CMI Card. It should read 180°C. with 170 ohms connected on point probes leads, if not, adjust (P2) span potentiometer. These are trial and error adjustments and it may be necessary to repeat a few times. Not necessary if error is less than 4°C.

CAUTION: Do not adjust trimpots on any Plug-in Cards, except CMI Card (extreme right position).

Once the instrument is corrected to compensate for lead resistance, replace plug cap and proceed to set the trip points by depressing the Read pushbutton, on the rear of the instrument and vary the set potentiometer for relay pickup. Use and ohmmeter to check the relay contact closure. Set the high limit tripping, to suit the machine safe operating temperature.

Model No. 2076A36H10 is a Dual Alarm Unit, for 10 ohm RTD.

Model No. 2076A36H11 is a Dual Alarm Unit, for 100 ohm RTD.

Model No. 2076A36H12 is a Dual Alarm Unit, for 120 ohm RTD.

The set points are individually adjustable, for each point. Once the instrument is aligned re-connect the leads to the temperature detectors and check operation.

When it is desired to know where the alarm point is set the Alarm pushbutton, on the rear of the instrument, is depressed and held until the set point temperature is read on the meter. Likewise, when it is desired to know where the shutdown point is set, the Trip pushbutton is depressed and read on the meter.

Normally the trip points adjustments are made on the initial startup and only checked occasionally. If it is desirable to change a particular set point it is only necessary to rotate the screw driver adjustment on the respective set point potentiometer, until the set point reads the desired value, then release the pushbutton.

When neither pushbutton is depressed, the meter reads the temperature of the (RTD) connected to the P1, P2, P3, P4, P5, P6, P7 or P8 terminals depending on whether the selector switch is on position #1, 2, 3 thru 8. The indicating circuit consists of one side of the meter card being connected to the common side of the probes and the other side connected between (R3) and the (RTD) connected on (PT) terminals. One input goes through the normally closed side of pushbutton switches (PB-1), (PB-2) and (PB-3), before connecting to the meter indicator card.

The instrument will alarm and trip correctly even though the meter has friction or is sticking. The alarm and trip is independent of the meter reading.

When three lead (RTD's) are supplied, connect the two common leads, at one end of the probe together, on the units together.

This industrial type control is designed to be installed, operated and maintained by adequately trained workmen. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operation, or maintenance. Care must be exercised to comply with local, state and national regulations, as well as safety practices, for this class of equipment.

CAUTION: DO NOT TRY TO "RING-OUT" LEADS WITH THEM CONNECTED TO THE INSTRUMENT. IT WILL BURN OUT OR DAMAGE THE LOW VOLTAGE COMPONENTS. ALSO DO NOT "HI-POT" THE (RTD) CIRCUIT.

No routine maintenance is required and should the instrument be defective, call the factory.

METER CALIBRATION RESISTORS

	RESISTOR	METER READING
Zero	100 ohms	0°C.
Span	169 ohms	178°C.

CALIBRATION PROCEDURE

A. Connect (100 ohm) Zero Resistor, between two leads, at Motor end, for PT point. Adjust Zero screwdriver adjustment, until meter reads 0°C.

B. Connect (169 ohm) Span Resistor, between two leads, at Motor end, for PT point. Adjust Span screwdriver adjustment, until meter reads 178°C.

C. Repeat Steps A and B, until calibration is as close as desired.

NOTE: Zero and Span screwdriver adjustments are located on Plug-in CMI Card, located behind hole plug (right hand side). Top Adjustment - Zero. Botton Adjustment - Span.

WIRE SIZE:

AWG

#20	1.0 ohms per 100 feet.
#18	0.65 ohms per 100 feet.
#16	0.40 ohms per 100 feet.
#14	0.25 ohms per 100 feet.

Double above figure, for two leads of probe i.e., for 100 ft. cable run to motor, total lead resistance will be for #14 wire 0.5 ohms or #20 wire 2.0 ohms.

FIG. 5 - LINEARITY AND LEAD RESISTANCE CALIBRATION

Style No.	Connect A Resistor on probe Terminals at motor (disconnect from probe).	Remove Cover Over (P1) Pot. on top of the Instrument.	Connect a Resistor on (P1) Leads and Set Sel. Sw. to Position No. 1.	Depress Pushbutton on Front of Inst. and Read Adjust (P2) Pot.
2076A36H10	* Use 10 Ohm resistor in the Motor on (PT).	Adjust (P1) for Meter Reading 25°C.	Use 12 3 Ohm Resistor.	Meter should Read 112 °C.
2076A36H11	* Use 121 Ohm resistor in the Motor on (PT).	Adjust (P1) for Reading 52°C.	Use 169 Ohm Resistor.	Meter should Read 178 °C.
2076A36H12	* Use 121 Ohm resistor in the Motor on (PT).	Adjust (P1) for Reading 0°C.	Use 301 Ohm Resistor.	Meter should Read 196°C.

By making the calibration adjustments per the table, it eliminates the effect of lead resistance and provides for meter linearity. There is enough range in the potentiometer, to take care of 2 Ohms in total lead resistance (both leads).

Customer Installation

A. Connect the eight RTD probe lead wires, from the motor to the terminals labeled (1) one thru (8) eight. The common side of the eight thermocouples are connected together and this single common wire connected to terminal labeled Probe COMM.

B. Connect the Alarm and Trip control circuits to the relay contacts labeled NO, C, NC, for the trip and alarm functions, for each of the three RTD sensors (#1, #2, and #3 probe positions).

C. Connect 230 or 115VAC power to the AC power terminals, on rear of case.

Note: (1) Where possible #14AWG wire should be run, for the probe connecting from each of the 4 RTD probes at the motor, for best accuracy. This is particularly true, when long runs from the instrument to the motor are used. #14 AWG wire is 2.5 ohms per 1000 ft. and for the 100 and 120 ohm probes no calibration for lead wire resistance would be necessary.

(2) The Monitor wiring from the RTD sensor located at the motor should not be run in close proximity to the Motor AC power wiring.

FIELD CALIBRATION
(Resistance values are for 10 ohm RTD)

When field calibrating the temperature Monitor, the following procedure should be followed:

The calibration can be checked by use of the two fixed resistors furnished. The resistors are the correct value of RTD probe resistance and can be substituted for the probe to simulate the probe temperature. The resistor should therefore be connected to the probe leads, by removing them, from the point of connection, at the motor and substituting the resistor at that point.

A. To start-out, the lead length calibration trimpots, located on the rear lower right-hand side, should be turned completely clockwise (this will result in 0 resistance for each of the 8 points).

B. By observing the temperature, at each of the 8 probe positions, with the 25°C. resistor (10 ohms), on each of the eight probes, the point that reads the highest temperature will be used for the Meter Calibration.

C. The Meter Calibration adjustments are located on the lower right-hand side of the instrument (looking from the rear). The snap-button covering these adjustments, must be removed.

(1) With the 25°C. resistor on the point reading the highest temperature, adjust the Zero adjustment (upper trimpot), until the meter reads 25°C.

(2) With the 112°C. resistor placed on the probe leads, of the same point, adjust the Span adjustment (lower trimpot), until the meter reads 112°C. (13.3 ohms).

(3) It would be necessary to repeat steps (1) and (2), until the calibration is as close as possible.

D. The Meter is now calibrated for the point reading the highest temperature. The other points can now be made to read correctly, by placing the (25°C. - 10 ohm) resistor on each point and adjusting the trim-

pot, located on the rear, for the point so each point reads correctly at 25°C. (with the probe resistor, for 25°C., on that probe point).

The above procedure will correctly calibrate the instrument, for 25°C. and 112 C., on the point with the highest resistance lead length (reads highest temperature on meter). The other points are then made to read correct at 25°C., by adding resistance to each point, by use of the unit, until they read 25°C., also.

CIRCUIT DESCRIPTION

The Temperature Monitor is a solid state device used for indication and alarm on RTD inputs. The unit consists of (9) nine plug-in printed circuit cards:

1. Alarm Card #1 - 1 Alarm
2. Alarm Card #2 - 1 Trip
3. Alarm Card #3 - 2 Alarm
4. Alarm Card #4 - 2 Trip
5. Alarm Card #5 - 3 Alarm
6. Alarm Card #6 - 3 Trip
7. Power Supply PS2-3
8. Power Supply PS2-3A
9. Meter Indicator C-MI

The unit also has a front panel mounted indicator, selector switch and pushbutton.

The temperature is sensed by means of (RTD's) Resistance Temperature Detectors. RTD Probe #1, connected across pins #1 and #9, of the Probe - Power terminal board, is used in a bridge circuit consisting of resistor R8 and Probe #1 in one leg and R7, P4 and R9 in the Alarm leg. The output of this bridge feeds Alarm Card #1. The Alarm Card operates the Alarm Temperature Relay (RLY 1) providing single pole double throw contacts for customers use. The TRIP leg, consisting of R6, P5 and R11 in conjunction with the Probe #1 leg, provides an input for alarm card #2. This alarm card's output operates the Trip Temperature Relay (RLY 2) providing single pole double throw contacts for customers use. Millivoltage developed by Probe #1 is provided through the front pushbutton to the C-MI Metering Card, whose output drives the meter. Probe #1 reads continually. To read any other probe, it is necessary to select the appropriate probe point and depress the pushbutton. Both the Probe Selector Switch and READ pushbuttons are front panel mounted.

RTD Probe #2, connected between pins #2 and #9, of the Probe - Power terminal board, is used in a bridge consisting of R25 and Probe #2 in one leg and R24, P6 and R26 in the Alarm leg. The output of this bridge feeds Alarm Card #3. The Alarm Card output operates the Point #2 Alarm Temperature Relay (RLY 3) providing single pole double throw contacts for customers use. The Trip leg consists of R23, P7 and R28 in conjunction with the Probe #2 leg providing an input to Alarm Card #4. The Alarm Cards output operates the Point #2 Trip Temperature Relay (RLY 4) providing single pole double throw contacts for customers use. Millivoltage developed by Probe #2 is provided to the meter through the selector switch, Point #2, and can be read by depressing the READ pushbutton.

NOTE: 10 ohms corresponds to 25°C.
13.3 ohms corresponds to 112°C.

(Readings are linear between these points)

For other range detectors, refer to table, Figure 5, attached and follow instructions for linearity calibration.

The instrument is factory calibrated with short lead lenghts and some discrepancies may be noted in meter indications due to lead resistances in actual field operations.

Connect all probes to the appropriate terminals on the Probe - Power terminal board. It is suggested the hottest point to be connected between pins #1 and #9, as this point is read at all times. When RTD probe reads 10 ohms, the temperature corresponds to 25°C., as read on the meter. When RTD Probe reads 13.3 ohms, the meter should be indicating 112°C. If not, remove the side hole cover, adjust P1, on the C-MI Card for 25°C. at 10 ohms and P2, should the meter not read 112°C. at 13.3 ohms. Positions 1, 2 and 3, on the Probe - Power terminal board can be equalized by adjusting P1, P2 and P3, on the back plate.

To adjust the Alarm and Trip points, an ohmmeter is used on the appropriate terminals, of the Alarm or Trip terminal board. Depress the appropriate READ pushbutton and adjust the SET potentiometer to the desired setting viewed on the front meter.

If it is desired to read the temperature of any point (RTD) other than the one connected to point 1 on the Probe - Power terminal board, it is necessary to set the selector switch to the desired point and press the READ pushbutton. When the READ pushbutton is released, the indicator transfers and control is returned to the RTD connected to point 1 on the Probe - Power terminal board, regardless of the switch position.

Temperature monitoring is independent of the meter readings. As a result, a total loss of the metering will not affect the instruments monitoring and alarm capabilities.

Refer to the back plate drawing for typical connection.

One lead of each (RTD) should be connected together and grounded at the meter. The other lead from the RTD should run to the back of the monitor and should be in a separate conduit. Keep parallel runs away from high power leads, as far as practical.

Probe number 1 reads continually on meter regardless of front switch position. The ALARM and TRIP set points can be read and adjusted by depressing the appropriate number 1 READ pushbutton and adjusting the ALARM or TRIP SET pots.

Probe number 2 is on front switch position 1 and can be read by depressing the front pushbutton. The ALARM and TRIP can be read and adjusted by depressing the appropriate number 2 READ pushbutton and the ALARM and TRIP pots.

Probe number 3 is on front switch position 2 and can be read by depressing the front pushbutton. The ALARM and TRIP can be read and adjusted by depressing the appropriate number 3 READ pushbutton and ALARM and TRIP SET pots.

Points 4 thru 8 are read only. The points can be read by switching position 3 thru 7 as listed below and depressing the front pushbutton.

PROBE POSITION	SWITCH POSITION
4	3
5	4
6	5
7	6
8	7

RTD Probe #3, connected between pins #3 and #9, of the Probe - Power terminal board, is used in a bridge consisting of R22 and Probe #3 in one leg and R21, P8 and R30 in the alarm leg. The output of this brodge is provided to Alarm Card #5. The output of the Alarm Card operates the Point #3 Alarm Temperature Relay (RLY 5) providing single pole double throw contacts for customers use. The Trip leg consists of R20, P9 and R32, in conjunction with, the Probe #3 leg providing an input to Alarm Card #6. The alarm cards output operates the Point #3 Trip Temperature Relay (RLY 6) providing single pole double throw contacts for customers use. Millivoltage developed by Probe #3 is provided to the meter through the selector switch, Point #3, and can be read by depressing the READ pushbutton.

RTD Probe #4, connected between pins #4 and #9 of the Probe - Power terminal board, is connected in series with R5 to the bridge supply to provide a millivoltage through the selector switch, Point #4, to the meter circuit.

RTD Probe #5, connected between pins #5 and #9 of the Probe - Power terminal board is connected in series with R4 to the bridge supply to provide a millivoltage through the selector switch, Point #5, to the meter circuit.

RTD Probe #6, connected between pins #6 and #9 of the Probe - Power terminal board, is connected in series with R3 to the bridge supply to provide a millivoltage through the selector switch, Point #6, to the meter circuit.

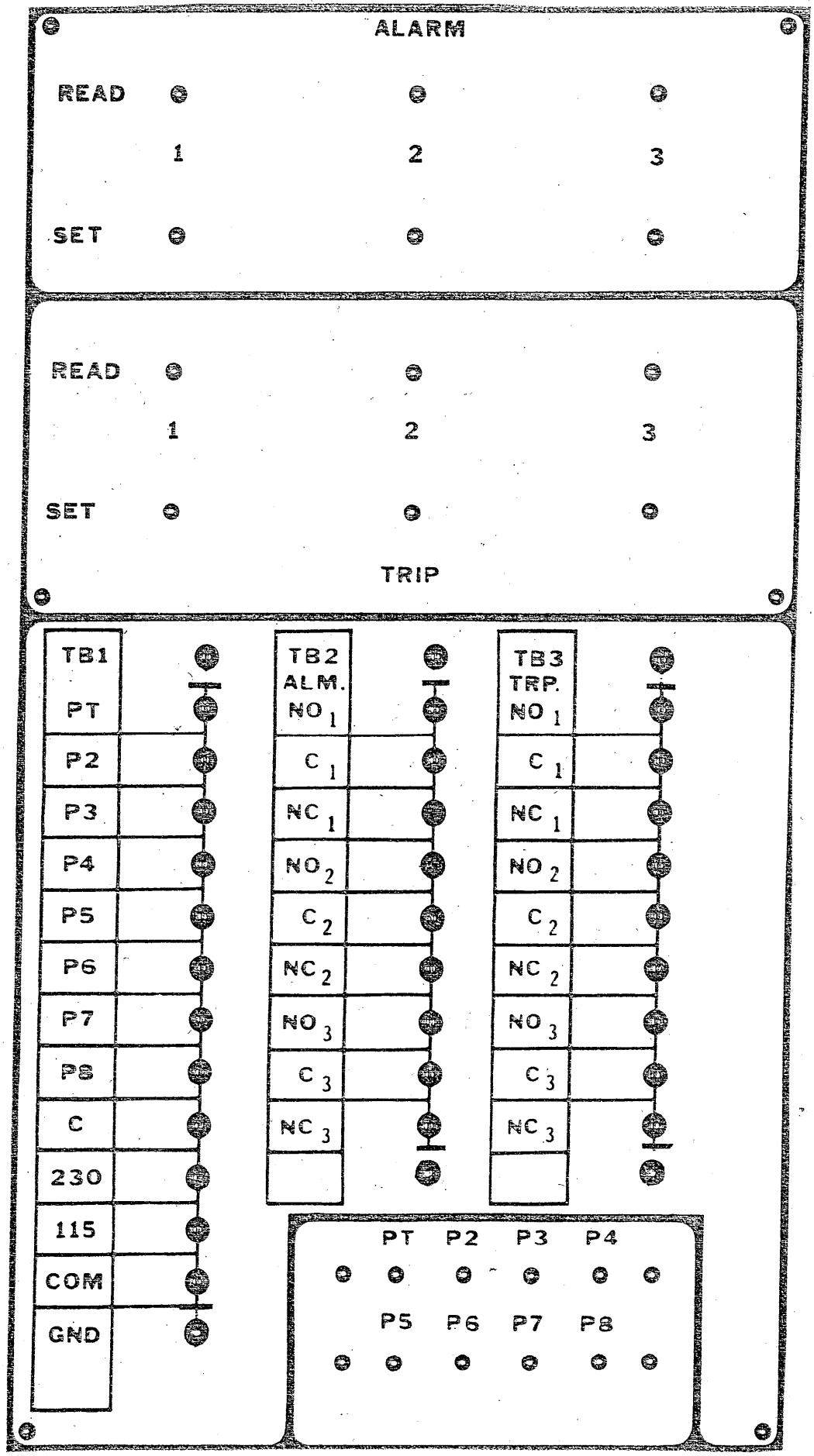
RTD Probe #7, connected between pins #7 and #9 of the Probe - Power terminal board, is connected in series with R19 to the bridge supply to provide a millivoltage through the selector switch, Point #7, to the meter circuit.

RTD Probe #8, connected between pins #8 and #9 of the Probe - Power terminal board, is connected in series with R18 to the bridge supply to provide a millivoltage through the selector switch, Point #8, to the meter circuit.

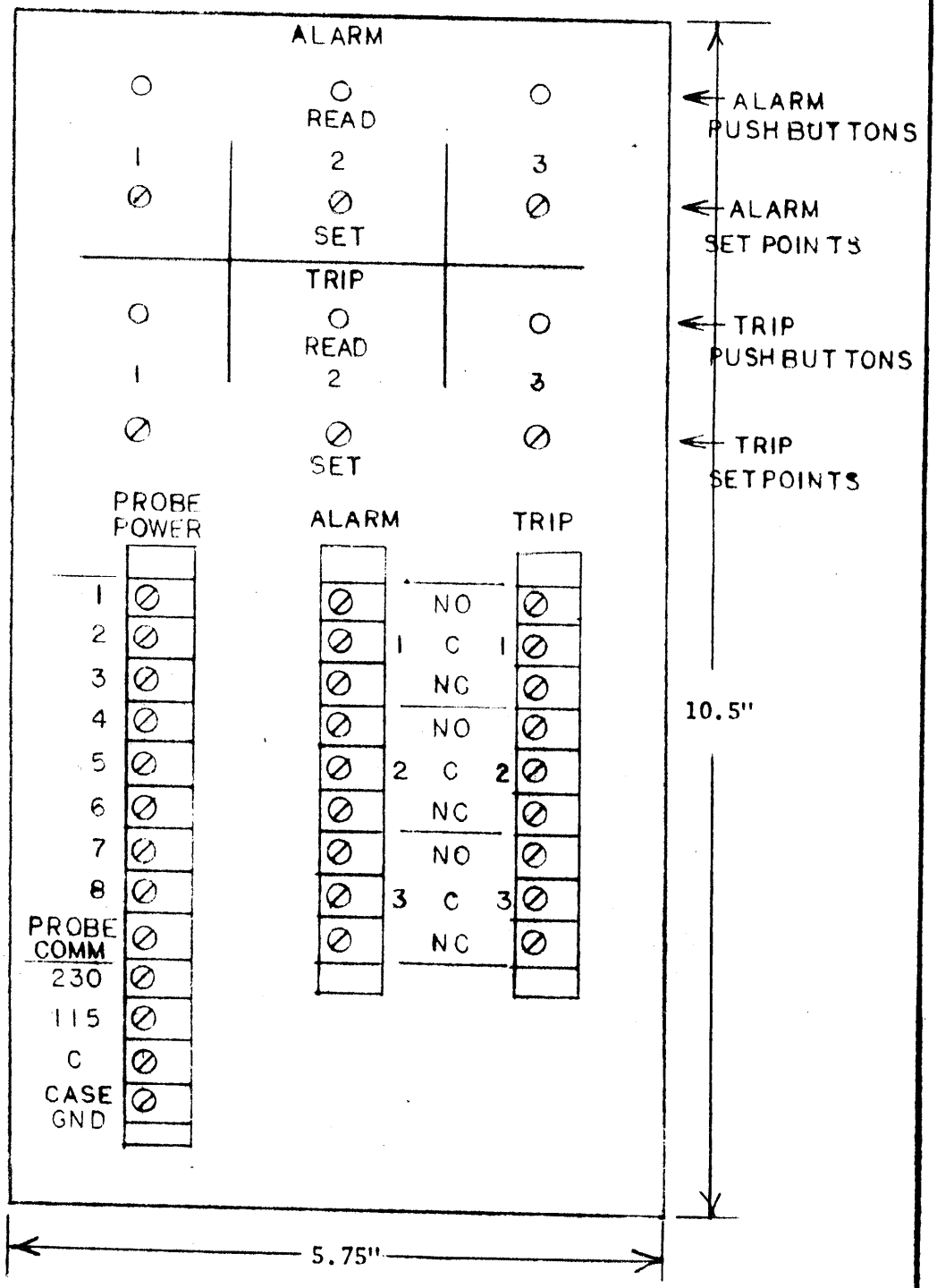
P1, P2 and P3, located on the back panel, are used as lead length compensators. P1 in conjunction with Probe #1, P2 in conjunction with Probe #2 and P3 in conjunction with Probe #3.

The temperature SET potentiometers and READ switches for the Alarm and Trip are located on the back panel with the following references:

P4	(ALARM)	Probe #1
P5	(TRIP)	Probe #1
P6	(ALARM)	Probe #2
P7	(TRIP)	Probe #2
P8	(ALARM)	Probe #3
P9	(TRIP)	Probe #3


ALARM
READ
1
2
3
SET
READ
1
2
3
SET
TRIP
TB1
PT
P2
P3
P4
P5
P6
P7
P8
C
230
115
COM
GND
TB2
ALM.
NO 1
C 1
NC 1
NO 2
C 2
NC 2
NO 3
C 3
NC 3
TB3
TRP.
NO 1
C 1
NC 1
NO 2
C 2
NC 2
NO 3
C 3
NC 3
PT P2 P3 P4
P5 P6 P7 P8

REAR VIEW



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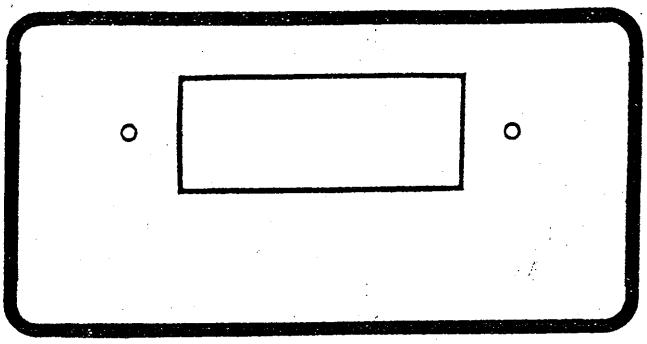
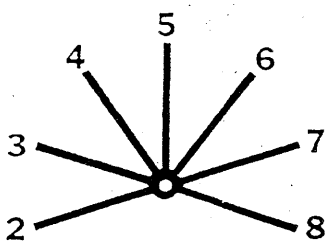




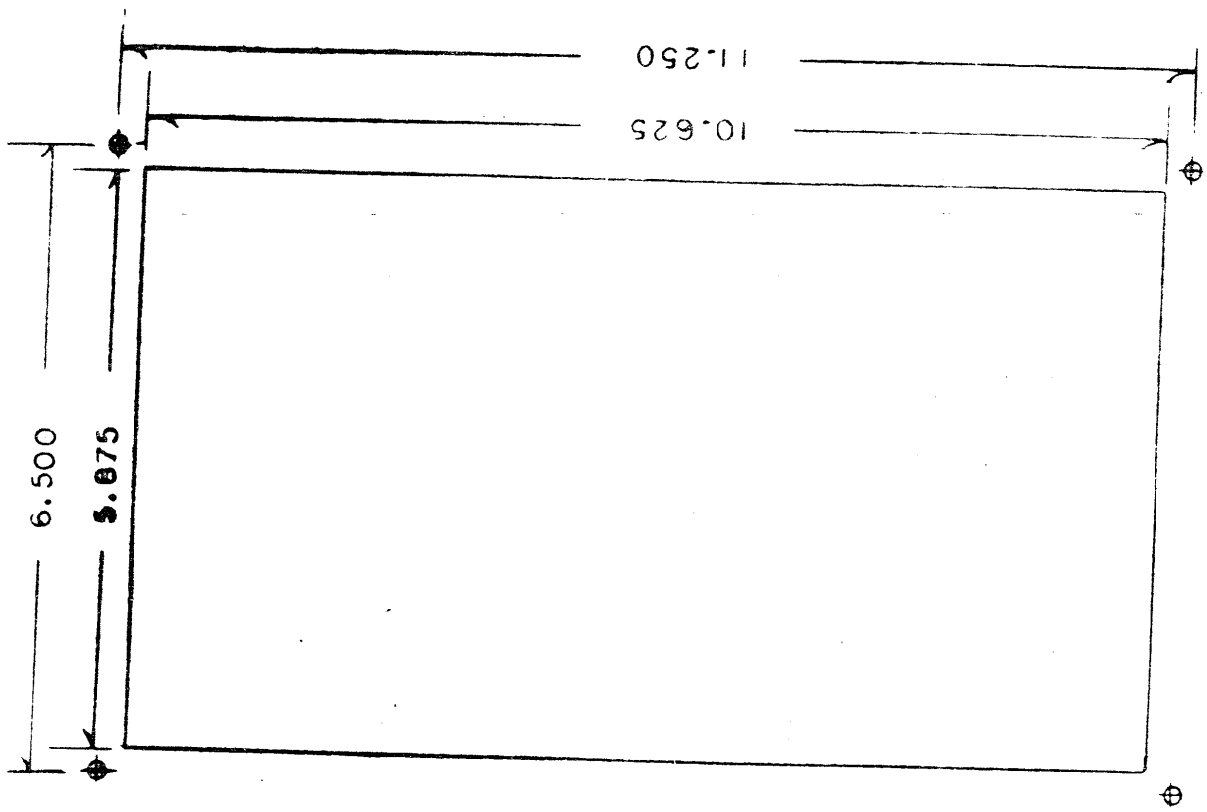
PUSH
TO READ

PROBE SELECTOR

BATES ELECTRO, INC.

P.O. BOX 6944

LONGVIEW, TEXAS 75608



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PANEL CUTOUT

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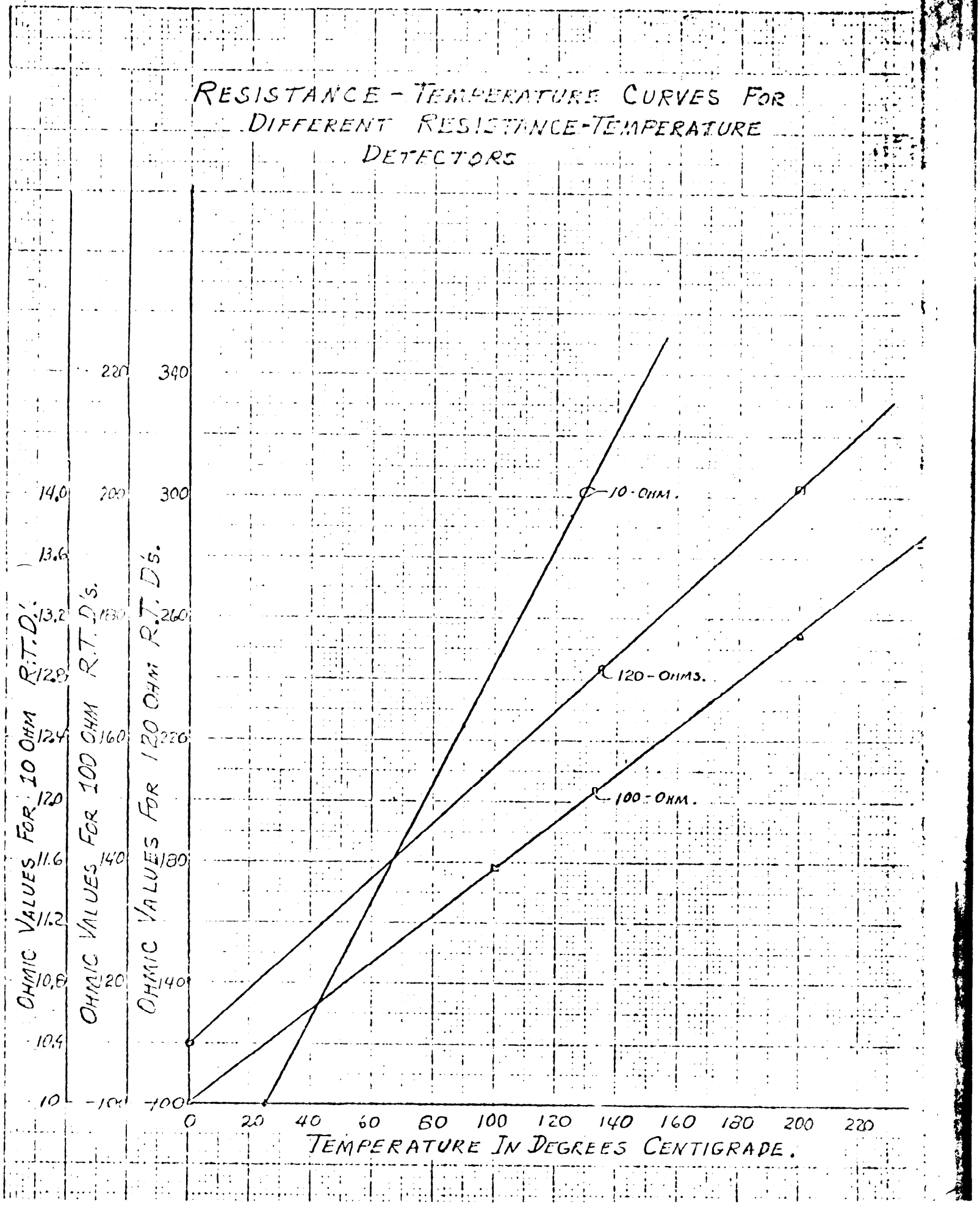
RESISTANCE - TEMPERATURE CURVES FOR DIFFERENT RESISTANCE-TEMPERATURE DETECTORS
OHMIC VALUES FOR 10 OHM R.T.D's.
OHMIC VALUES FOR 100 OHM R.T.D's.
OHMIC VALUES FOR 120 OHM R.T.D's.
14.0
13.6
13.2
12.8
12.4
12.0
11.6
11.2
10.8
10.4
10
220
200
180
160
140
120
100
340
300
260
220
180
140
100
10-OHM.
120-OHMS.
100-OHM.
0
20
40
60
80
100
120
140
160
180
200
220
TEMPERATURE IN DEGREES CENTIGRADE.