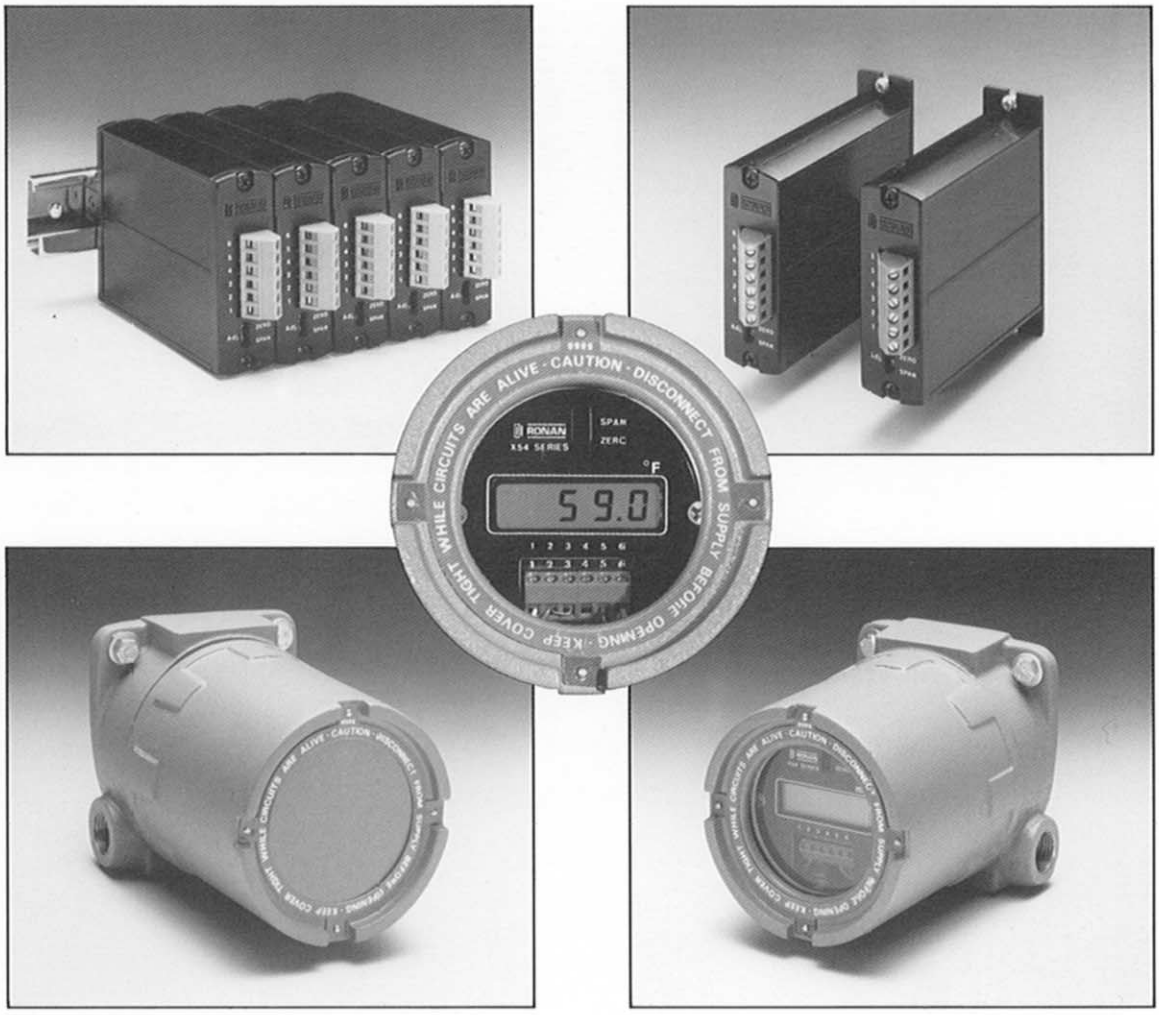
Instructions and Operating Manual

SERIES X54

RTD & POTENTIOMETER ISOLATED 2-WIRE TRANSMITTERS



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WARRANTY

1.0 GENERAL DESCRIPTION

The Ronan Series X54-200 two-wire transmitter design utilizes state of the art, micropower, solid-state devices, holding the internal current consumption to less than the zero span current of 4 mA. The available options such as linearized output, integral 3-1/2 or 4-1/2-digit LCD, local readout and various types of housings and mountings, establish the X54-200 Series as one of the most versatile transmitter lines on the market. The input is isolated from the output/power supply through the use of a transformer, providing immunity to ground loops.

The transmitter is available in various types of housings, such as: explosion-proof NEMA Type 7, suitable for Class I, Division 1, Groups B, C and D locations (X54-230, -231), NEMA Type 4 weatherproof for indoor/outdoor installation or general pupose.

The general purpose, aluminum extrusion housing is suitable for direct surface mounting (X54-235) or rail mounting (X54-236). Front-mounted compression-type terminals allow convenient sensor and output lead connections.

The transmitter, mounted in the explosion-proof housing, is available with a 3-1/2 or 4-1/2-digit LCD readout and linearized output. The readout indicates temperature or engineering units scaled to customer requirements. Scaling can be altered by the use of range plugs (DIP headers), which are available from Ronan and are easily installed in the field.

The transmitter output current is jumper-selectable in two ranges: 4-20 mA and 10-50 mA. The high impedance of the output current stage enables the transmitter to maintain its accuracy with wide dc voltage variations in the power/output leads. The operating voltage may vary from 12 to 80 Vdc. To determine the maximum loop resistance use the equation in Section 2.0.

2.0 SPECIFICATIONS

NOTE: Specifications apply to an ambient temperature of 25°C ±2°C unless otherwise stated. Specifications subject to change without notice.

Inputs: X54-230 Series–RTD sensor type: platinum, nickel, copper.

Input Impedance: All RTD's >100 Kohms.

Span Adjustment: Front-accessible, multi-turn, infinite resolution potentiometer permits ±10% adjustment.

Zero Adjustment: Front-accessible, multi-turn, infinite resolution potentiometer permits ±10% adjustment.

Input Open Circuit Response: Upscale drive standard.

Calibrated Accuracy, Including Linearity: ±0.1% of span plus linearization.

Isolation: Input circuits isolated from power/output by transformer.

Common Mode Rejection: 110 dB, at 60 Hz.

Common Mode Voltage: 600 Vdc or peak ac maximum without damage.

Ambient Temperature Coefficient:
Ambient temperature range: +32°F to 158°F (0°C to 70°F).
Gain: Less than ±0.01%/°F.
Zero: Less than ±2 µV/°F referred to the input.

Operating Ambient Temperature Range:
Two-wire transmitter:
–20° to 175°F (–25° to 80°C).
Liquid crystal display:
–20° to 175°F (–25° to 80°C).

Output:
Standard: 4-20 mA or 10-50 mA, jumper-selectable.
Optional: Scaled in engineering units for a specified range.

Load Effect: Less than .05% change in output current for load variation from short circuit to maximum resistance at 24 Vdc.

Power Supply Range: 12 to 60 Vdc (12 to 30 Vdc for 10-50 mA).

Power Supply Effects: <±0.01% of range for a ±10 V change.

Maximum Loop Resistance versus Power Supply Voltage (PSV):
4-20 mA Range:
$$\text{R loop maximum} = \frac{\text{PSV} - 12\ \text{V}}{20\ \text{mA}}$$

10-50 mA range:
$$\text{R loop maximum} = \frac{\text{PSV} - 12\ \text{V}}{50\ \text{mA}}$$

Display Module:
LCD digit size 0.35" (9 mm).
Optimal view angle 60°.

Radio Frequency Effects: <0.1 mV (referred to input), +0.1% of span (referred to output) when exposed to 5 W transmitter with frequency range 20-460 MHz at a distance of 1 m.

Terminals: Compresion type, wire size 14 AWG max., 10 A max., 300 V max.

Weight:
General purpose housing: 0.05 lbs. (0.23 kg).
Explosion-proof housing: 4.2 lbs. (1.88 kg).

3.0 OPERATION

3.1 General Circuit Operation (See Figure 1)

The basic two-wire transmitter consists of a DC-DC power supply, a voltage reverence V_S, a differential amp A1, current sources I_A and I_B, an output current amplifier A2, an output sense resistor RB, and transformer T2 with two analog switches for modulation/demodulation to provide input/output isolation.

The power supply derives its operating voltage from the drop across V_S. This voltage powers an oscillator which drives T1 to provide the required operating voltages.

Two current sources I_A and I_B, provide a sense current for the RTD and the zero resistor, RA. The developed voltages are applied to the input of A1, a differential amplifier which provides the correct gain and offset for the desired input span. The output is switched through "M" to T2. The output of T2 is demodulated by "D" and applied to A2. Resistor RB senses the output current and provides a feedback to A2 to control the current source I_S. Fuse F1 protects the output/power supply circuitry from a reversed power connection.

3.2 Detailed Circuit Description (See Drawing X54-1004)

Transistors Q1, zener diode D1, and resistors R4 and R5 form two constant current sources. One current is passed through the RTD through the "+" lead, the other through the zero resistor RN1(4-11) and the "–" lead to develop a voltage which is applied to the inputs of U2 (configured as a differential amplifier). RN1(4-11) is selected to be the same resistance of the RTD at zero span so when the input is at zero, the difference will be zero. The gain is controlled by R1 and the zero is controlled by R2 to provide an output of typically .2 to 1.0 volts.

If the linearizer circuit is not used, the output of U2 is passed through U4B to Q2. (See Section 3.3 for a description of the linearizer.) Transistor Q2 is switched by the power supply transformer to drive T2 with pulses which are proportional in amplitude to the input signal. On the secondary side, Q3 is driven by a separate, isolated winding of T1 to sample the pulses in phase with the input. The demodulated signal is filtered by R19, C13 and applied to U5.

The current output stage consists of op-amp U5, FET Q4, and current-sense resistor R26. The output current develops a voltage across R26 which is fed back to U5 to control the current through Q4. The developed sense voltage is .1 to .5 volts. For a 10 to 50 mA output, jumper "5" is used to reduce the sense resistance so the developed sense voltage is kept at .1 to .5 volts. Q5 and R28 are used as a current limit. When the output exceeds approximately 65 mA, Q5 begins to conduct and pull down the input at U5 - pin 3 to prevent any further increase in output current.

The two-wire operating voltage is applied to pins V+ and V–. Fuse F1 protects the circuitry from a reversed power connection. The voltage drop across zener diode D14 is used to power oscillator U1, C9 and R17 which drives T1 to produce the required operating voltages. When

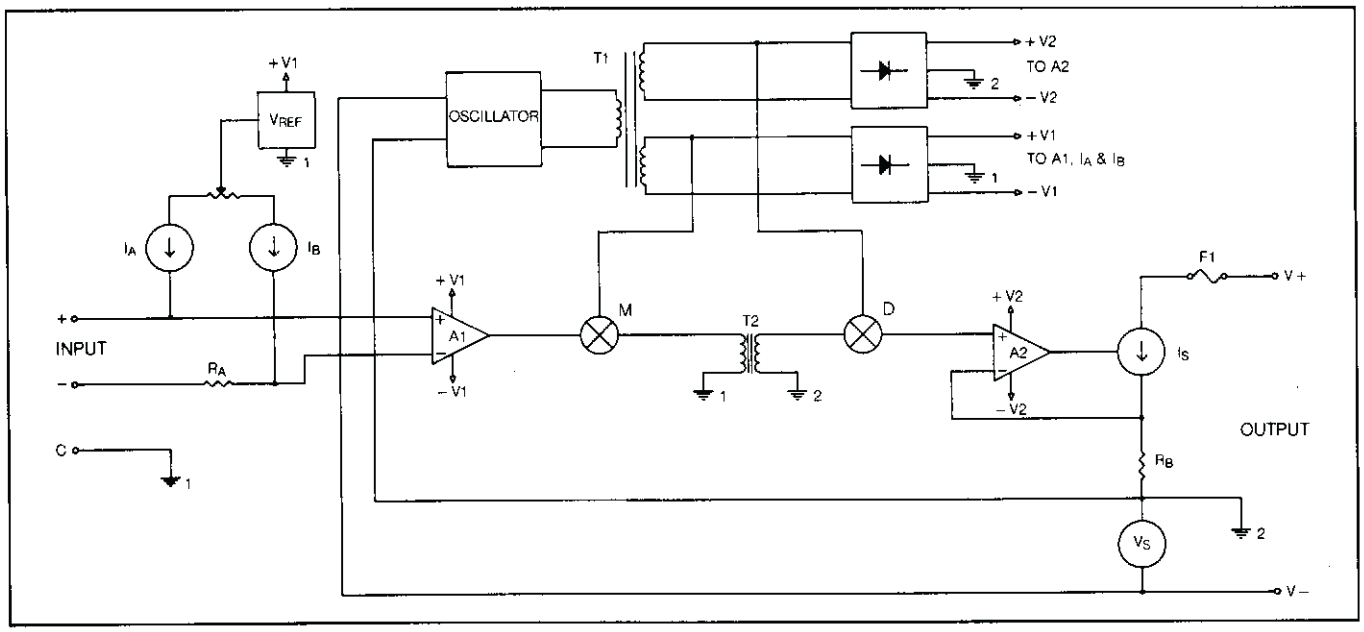


Figure 1: Simplified Block Diagram.

two-wire voltage is first applied, current sources D3 provides a small current for D14 to allow normal circuit operation so Q4 can begin conducting.

3.3 Linearizer Circuit Description

In applications where a linear output is required, a linearizer circuit is used to compensate for the non-linearity of the input sensor. The linearizer circuit operates by providing gain and offset changes to amplifier U4B.

Linearization is accomplished by dividing the input span into five segments using quad op-amp U3, and its associated components, and linearizing each segment. Since each amplifier operates the same, the following description will refer only to U3A.

The signal from U2 is applied through input resistor RN2(2-15) to the summing junction of U3A and to U4B through R12. A fixed current is taken from U3-2 through resistor RN3 and below the break point, a smaller current is supplied to this summing junction through RN2(2-15). The larger offset current through RN3 causes the output of U3 to go positive, supplying current through D10 to balance the currents at the summing junction. As the current through RN2(2-15) becomes larger, the current required through D10 becomes less. When the current through RN2(2-15) becomes slightly larger than that going through RN3, the output of U3 will go to a negative voltage level and start drawing current from the summing junction through RN4 and D11. When the transition from a positive to a negative voltage occurs, this segment of the linearizer starts to modify, or *linearize,* the primary signal at U4B through RN2(7-10). An increase or a decrease in the gain is selected by jumper "1".

3.4 Digital Display Modules

3.4.1 3-1/2-Digit Display Module (See Drawings X54-1001 and X54-1002): The X54 3-1/2-digit display module consists of two boards: the X54-1001 display board and the X54-1002 interface board. The display board contains the analog to digital converter (ADC) and the liquid crystal display (LCD). The interface board contains the circuitry to change the offset and gain and the decimal point drivers. The operating voltages for both boards is derived from the 7-8 winding of T1 on the transmitter board.

The signal for the display is taken from across R26 on the transmitter. This signal is applied to a divider consisting of RN1(2-13) and RN1(1-14) on the interface board. The ratio of this divider is determined by the desired readout range. RN1(7-8), CR2 and RN1(3-12), CR1 provide a stable ±2.5 volts which, through potentiometer R4, RN1(4-11) and RN1(6-9) or RN1(5-10) provide the required offset to the signal. Potentiometer R3 with R1 and R2 provide an adjustable 1 volt reference for the ADC on the display board. U1 inverts the backplane signal from the LCD board and provides for the display of one of two decimal points, if required.

The conditioned signal is then applied to the input of the ADC (U1) on the display board. The ADC uses the dual-slope conversion method to give a stable and accurate display. With a 1 volt reference, the display will be "1999" for a 1.999 volt input.

3.4.2 4-1/2-Digit Display Module (See Drawings X54-1012 and X54-1013): The X54 4-1/2-digit module consists of two boards: the X54-1012 display board and the X54-1013 interface board. The display board contains the analog to digital converter (ADC) and the liquid crystal display (LCD). The interface board contains the circuitry to change the offset and gain and the decimal point drivers. The operating voltages for both boards is derived from the 7-8 winding of T1 on the transmitter board.

The signal for the display is taken from across R26 on the transmitter. This signal is applied to a divider consisting of HDR1(7-8) and HDR1(6-9) on the interface board. The ratio of this divider is determined by the desired readout range. HDR1(4-11), D2 and HDR1(2-13), D1 provide a stable ±2.5 volts which, through potentiometer R1, HDR1(5-10) and HDR1(1-14) or HDR1(3-12) provide the required offset to the signal. Potentiometer R2 with R3 and R4 provide an adjustable 1 volt reference for the ADC on the display board. U1 inverts the backplane signal from the LCD board and provides for the display of one of three decimal points, if required.

The conditioned signal is then applied to the input of the ADC (U1) on the display board. The ADC uses the dual-slope conversion method to give a stable and accurate display. With the "2V" jumper installed and a 1 volt reference, the display will be "19999" for a 1.9999 volt input. With the 2 V jumper not installed, "19999" will be displayed for a 199.99 mV input.

4.0 CALIBRATION

Calibration of the X54-230 series transmitter entails adjusting the zero and span potentiometers for the correct output currents when an accurate input signal is applied.

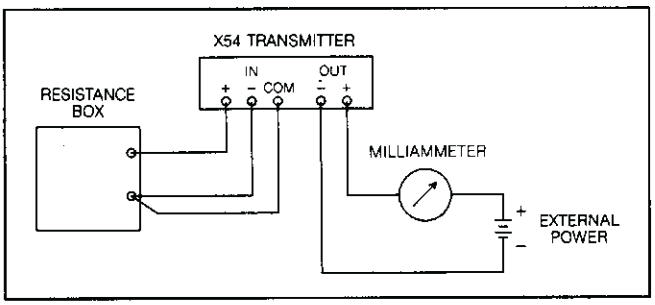


Figure 2: Input Circuit Connection for RTD Calibration.

4.1 RTD Input Model X54-230

A precision resistor box should be used (.05% or better) to simulate an RTD input and should be connected in the three-wire configuration (See Figure 2).

To measure the output current, an accurate milliammeter is connected in the output current loop as shown in Figure 2.

To perform the calibration, begin by setting the input to the zero of the transmitter's span (e.g. for a 100° to 500°C span, set the resistance box to provide the equivalent resistance of a 100°C output). Refer to Ronan catalog RTP-100 for resistance tables of various RTD's. Adjust the front panel ZERO control to obtain an output current of 4 mA (or 10 mA for a 10-50 mA output). Change the resistance box to the full-span value and adjust the front panel SPAN control to obtain a 20 mA (or 50 mA) output. Repeat until both zero and full-span outputs are correct. Several mid-span values should also be checked to verify proper operation of the transmitter.

4.2 3-1/2-Digit Display

The 3-1/2-digit display module is calibrated separately from the transmitter. Before the display module is calibrated, the calibration of the transmitter must be verified.

With the transmitter at the zero of its span, adjust the potentiometer R4 on the X54-1002 PC board for the zero of the display range (not necessarily the same as the transmitter range).

Test Step	Test Points	Expected Test Value	Test Equipment	Notes
10 V power to oscillator U1	Across CR14	9.5 to 10.5 V	DC voltmeter	
Oscillator U1 output	U1, pins 8, 9 10 or 11 to pin 7	Square wave approximately 100 KHz	Scope	10 V peak
Input amplifier power supply	Cathode CR16 to ground 1	Approximately 4 Vdc	Scope	Ripple should be unobserved except for thin spikes. If large ripple, suspect faulty filter cap C16 or input circuit.
Input amplifier power supply	Anode CR15 to ground 1	Approximately –4 Vdc	Scope	Ripple should be unobserved except for thin spikes. If large ripple, suspect faulty filter cap C17.
Output amplifier power supply	Cathode CR17 to ground 2	Approximately 4 Vdc	Scope	Ripple should be unobserved except for thin spikes. If large ripple, suspect faulty filter cap C15 or output circuit.
Output amplifier power supply	Anode CR18 to ground 2	Approximately –4 Vdc	Scope	Ripple should be unobserved except for thin spikes. If large ripple, suspect faulty filter cap C14.
Input amplifier response	U2A, pin 7 ground 1	Direct response to an in-range input signal	Scope or DC voltmeter	In-range signal is approximately .2 to 1.0 Vdc
Modulator/ Demodulator response	Across C7	Direct response to an in-range input signal	Scope or DC voltmeter	In-range signal is approximately .2 to 1.0 Vdc
Modulator/ Demodulator response	U5, pin 3 to ground 2	Direct response to an in-range input signal	Scope or DC voltmeter	In-range signal is approximately .1 to .5 Vdc
Output amplifier response	Current loop	In-range output current	DC milliammeter	Using ZERO and SPAN controls, a full-scale reading should be obtained.

Table 1: Transmitter Test Sequence.

Set the transmitter to full-span and adjust potentiometer R3 for the correct display. Repeat if necessary.

4.3 4-1/2-Digit Display

The 4-1/2-digit display module is calibrated separately from the transmitter. Before the display module is calibrated, the calibration of the transmitter must be verified.

With the transmitter at the zero of its span, adjust potentiometer R1 on the X54-1013 PC board for the zero of the display range (not necessarily the same as the transmitter range). Set the transmitter to full-span and adjust potentiometer R2 for the correct display. Repeat if necessary.

5.0 TROUBLESHOOTING/REPAIR

The Model X54 transmitter may be removed from the housing without disconnecting any external wiring, allowing easy access to all circuit components. Visually inspect the module(s) for any obvious damage to the components or printed circuit board(s).

The troubleshooting procedure should be started with a check of the loop voltage and the compliance with the connections as shown in Figure 2.

When troubleshooting always apply an input signal that is within the operating range of the unit under test and monitor the output signal. If power is properly applied, trace the signal from the input toward the output following the test sequence in Table 1.

For additional support refer to "Detailed Circuit Description" in Section 2.

PARTS LIST–3-1/2-DIGIT DISPLAY BOARD

Model X54-1001

Item	Qty.	Ident.	Description	Part No.	Mfg.
1	1	PCB	LCD Display Module	X54-1001C	Ronan
2	1	LCD	3-1/2-Digit LCD	33D9R02GHJ or 3937-363-020	Epson or Hamlin
3	1	U1	3-1/2-Digit LCD Driver	ICL7126CPL	Intersil or Teledyne
4	1	U1	40 Pin IC Socket	D1LB40P-11	CA
5	2	R1, 5	Resistor, 5%, 1/4 W, 15 ohm	RC07GF150J	AB
6	1	R2	Resistor, 1%, 1/4 W, 237 k	RN55C2373F	Mepco
7	1	R3	Resistor 5%, 1/4 W, 2.4 Mohm	RC07GF245J	AB
8	1	R4	Resistor 1%, 1/4 W, 750 ohm	RN55C7500F	Mepco
9	1	C2	Capacitor, Mica 47 pF	470R501M05	Sprague
10	2	C3, 4	Capacitor, Poly, 0.1 µF	104R101K10	Mepco
11	1	C6	Capacitor, Poly, 0.047 µF	473R251K10	Mepco
12	2	C1, 5	Capacitor, Ceramic, 0.1 µF	104A101C10	Kemet
13	1	PC Connector	Dual Row Header	10-89-2123	Amp

NOTE: All components on component side except the LCD (LCD on circuit side).

PARTS LIST–3-1/2-DIGIT INTERFACE BOARD

Model X54-1002

Item	Qty.	Ident.	Description	Part No.	Mfg.
1	1	PCB	X54 Interface Board	X54-1002D	Ronan
2	1	U1	CMOS, Hex Schmitt Trigger	74C14N	National
3	3	C1, 2, 3	Capacitor, Ceramic, .1 µF	104A101C20	Sprague
4	1	RN1	14 Pin Socket	CA-14LS2-10SD	CA
5	2		Connector	1716034	Phoenix
6	1	Header*	Dual 5 Pin Connector	86418-9	Amp
7	1	J1	Header, 6 Pin	6-910-11	Molex
8	1	J1**	Header, 6 Pin	X54B147	Ronan
9	2	CR1, 2	Diode, Voltage Reference	LM385Z-2.5V	National
10	1	R1	Resistor, M.F., 1%, 60.4 k	RN55C6042F	Mepco
11	1	R2	Resistor, M.F., 1%, 4.53 k	RN55C4531F	Mepco
12	1	R4	Potentiometer, 2M	89PR2M	Beckman
13	3	W1, 2, 3	Line Plug, 3 Pin	CAS36SP100230430	RNI
14		R3		89PR50K	Beckman
15	6		EMI, Filter Cap.	ME1214-001	Mu-Rata/ Erie
16	1		Holder	X54B129	Ronan
17	2		4-40 x 3/8 Ph Pn Hd Screw		West Valley
18	2		Spacer	9015	H.H. Smith

NOTES:
* Item #11 is on circuit side. Other items are on component side.
** Install X54B147 in J1 positions 1 through 6.

PARTS LIST–TERMINAL CONNECTOR

Model X54-1003

Item	Qty.	Ident.	Description	Part No.	Mfg.
1	1	PCB	PC Board	X54-1003B	Ronan
2	2		Connector Block	1716034	Phoenix
3	1		Connector Pins	6-910-11	Aries
4*	1		#6		
5*	1		22 Gage Wire, 4", Green		

* NOTE:
Used only for X54-600. The lug is crimped on one end of the wire. The other end is soldered to Pin 4 of the connector clock (on back of board).

PARTS LIST–RTD INPUT TWO-WIRE TRANSMITTER

Model X54-1004

Item	Qty.	Ident.	Description	Part No.	Mfg.
1	1	PCB	PC Board	X54-1004F	Ronan
2	1	R28	Resistor, M.F., 1%, 6.19 ohm	RN55C6R19F	Mepco
3	1	R27	Resistor, M.F., 1%, 16.9 ohm	RN55C16R9F	Mepco
4	1	R26	Resistor, M.F., 1%, 24.9 ohm	RN55C24R9F	Mepco
5	5	R4, 5, 12, 14, 16	Resistor, M.F., 1%, 10.0 k	RN55C1002F	Mepco
6	1	R6	Resistor, M.F., 1%, 422 k	RN55C4223F	Mepco
7	3	R10, 11, 17	Resistor, M.F., 1%, 75.0 k	RN55C7502F	Mepco
8	1	R29	Resistor, 1/4 W, 5%, 5.6 ohm	RC07GF5R6J	AB
9	1	R15	Resistor, 1/4 W, 5%, 220 ohm	RC07GF221J	AB
10	2	R31, 32	Resistor, 1/4 W, 5%, 15 ohm	RC07GF150J	AB
11	2	R19, 24	Resistor, 1/4 W, 5%, 4.7 k	RC07GF472J	AB
12	1	R20	Resistor, 1/4 W, 5%, 6.8 k	RC07GF682J	AB
13	2	R8, 23	Resistor, 1/4 W, 5%, 8.2 k	RC07GF822J	AB
14	2	R7, 9	Resistor, 1/4 W, 5%, 10 k	RC07GF103J	AB
15	1	R30	Resistor, 1/4 W, 5%, 1 k	RC07GF102J	AB
16	2	R18, 21	Resistor, 1/4 W, 5%, 470 k	RC07GF474J	AB
17	1		Jumper	360-0017-010300	
18	1	R1	Potentiometer, 10 k	89PR10K	Beckman
19	1	C10	Capacitor, Mica 20 pF	200R501M05	Arco
20	1	C11	Capacitor, Mica 47 pF	470R501M05	Arco
21	1	C9	Capacitor, Mica 82 pF	820R501M05	Arco
22	1	C12	Capacitor, Mica 820 pF	821R301M05	Arco
23	2	C1, 2	Capacitor, Ceramic, .22/50 V	224R500C20	Sprague
24	2	C3, 4	Not Used		
25	5	C5, 7, 20, 21, 23	Capacitor, Ceramic, .1	104A101C20	Unitrode
26	2	C19, 22	Capacitor, Ceramic, .005/100 V	502R101C20	Unitrode
27	1	*	Capacitor, Ceramic, .001/1 KV	102R102C20	Sprague
28	1	C18	Capacitor, Ceramic, .01/100 V	103R101C20	Sprague
29	2	C6, 8	Capacitor, Ceramic, .05/50 V	503R500C20	
30	4	C14, 15, 16, 17	Capacitor, Ceramic, .1/50 V	104R500C20	Kemet
31	1	C13	Capacitor, Ceramic	224R500C20	Kemet
32	1	D23	Diode, Rectifier	1N4005	Motorola
33	4	D15, 16, 17, 18	Diode, Germanium	1N270	Motorola
34	3	D19, 20, 2	Diode, Low Leakage	1N457A	Motorola
35	1	D14	Diode, Zener, 10 V	1N4740A	Motorola
36	2	D21, 22	Diode, Zener, 10 V	1N961B	Motorola

*Add capacitor between the end of C7 connected to U4-5 and U1-14.

PARTS LIST–RTD INPUT TWO-WIRE TRANSMITTER (CONT.)

Model X54-1004

Item	Qty.	Ident.	Description	Part No.	Mfg.
37	3	D1, 5, 4	Diode, Voltage Reference 2.5 V	LM385Z-2.5	National
38	1	D3	Current Source, 3.0 mA	1N5309	Knox
39	2	Q1A, 1B	Span >10 mV, Transistor PNP	2N4249	Motorola
40	1	Q1A, 1B	Span <10 mV, Transistor, Dual	MAT-03FH	PMI
41	2	Q2, 3	FET, N-Channel	2N4393	Motorola
42	1	Q5	Transistor, NPN	2N6715-5	National
43	1	Q4	DMOC Power FET	VN0109N5	Supertex
44	1		Heat Sink for Q4	X54B122	Thermalloy
45	1	U2	Dual Op-Amp	LT1013CN8	Linear Tech.
46	1	U4	Dual Op-Amp	LF442CN	National
47	1	U5	Op-Amp	LM308N	National
48	1	U1	Hex Inverter	74C14N	National
49	1	T1	Transformer, Signal	EPA1144	PCA
50	1	T2	Transformer, Signal	EPA1143	PCA
51	2	5	Line Plug, 2 Pin	S36SP10023043030	RNI
52	1	5	4-20 mA 10-50 mA Not Used Shunt	531220-2	
53	2	F1	Socket	450-3703-010400	Cambion
54	1	F1	Fuse, 125 mA	273.125	Littlefuse
55	1		Connector, Dual 6 Pin	535512-1	Amp
56	1		Screw, 6-32 x 3/8, Flathead		Phillip
57	1		Lock Washer, Split, #6		
58	1		Nut, Small Pattern, #6		
59	1	RN1	Socket, 15 Pin DIP	14-511-11	
60	1	R2	Potentiometer, 50 k	89PR50K	Beckman
61	1	R3	Potentiometer, 200 ohm	68WR200	Beckman
			Parts For Linearized Output		
62	1	RN3	Resistor, Network, 49.9 k	RKH5BP4992F	Speer
63	1	RN4	Resistor, Network, 4.99 k	RKH4SP4991F	Speer
64	8	D6, 7, 8, 9, 10, 11, 12, 13	Diode, Low Leakage	1N457A	Fairchild
65	1	R13	Resistor, M.F., 1%, 10.0 k	RN55C1002F	Mepco
66	2	R22, 25	Resistor, 1/4 W, 5%, 3.3 m	RC07GF335J	AB
67	12	J1, 2, 3, 4	Line Plug, 3 Pin	S36SP100230430	RNI
68	1	U3	Quad Op-Amp	LM346N	National
69	1	RN2	Socket, 16 Pin DIP	16-511-11	Aries

PARTS LIST–4-1/2-DIGIT DISPLAY BOARD

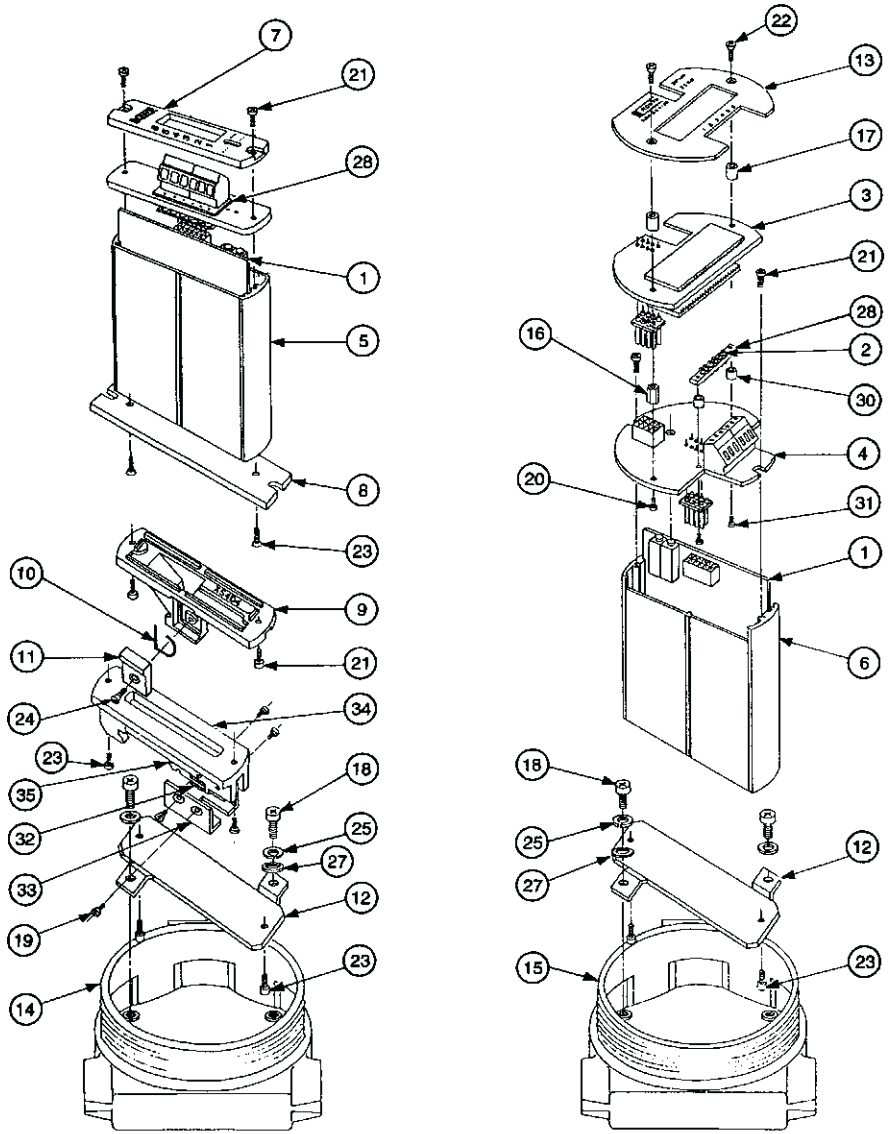
Model X54-1012

Item	Qty.	Ident.	Description	Part No.	Mfg.
1	1	PCB	PC Board	X54-1012B	Ronan
2	2	R5, 6	Resistor, 1/4, 5%, 150 ohm	RC07GF150J	
3	2	R1, 3	Resistor, 1/4 W, 5%, 100 k	RC07GF104J	AB
4	1	R2	Resistor, M.F., 1%, 15.4 k	RN55C1542F	Mepco
5	1	R4	Resistor, M.F., 1%, 80.6 k	RN55C8062F	Mepco
6	3	C5, 1, 2	Capacitor, Ceramic, .1/100 V	104A101C20	Unitrode
7	2	C3, 4	Capacitor, Polycarb, 1/50 V	105R500K05	ECI
8	1	C6	Capacitor, Mica, 47 pF	470R501M05	Arco
9	1	U1	4-1/2-Digit A/D	ICL7129ACPL	Maxim
10	1		4-1/2-Digit LCD	4201-363-020	Hamlin
11	1		Strip Line Plug, 3 Pin	4201-363-420 or CA-S36SP-230-430	Hamlin CA
12	1		Strip Line Plug, 2 Pin	CA-S36SP-230-430	CA
13	1	DP3, 4	Shunt	531220-2	
14	1		Header, 8 Pins	10-89-1243	

PARTS LIST–4-1/2-DIGIT INTERFACE BOARD

Model X54-1013

Item	Qty.	Ident.	Description	Part No.	Mfg.
1	1	PCB	PC Board	X54-1013B	Ronan
2	2	R3, 4	Resistor, M.F., 1%, 16.5 k	RN55C1652F	Mepco
3	2	C1, 2	Capacitor, Ceramic, .1/100 V	104A101C20	Unitrode
4	2	D1, 2	Diode, Voltage Reference	LM385-2.5V	National
5	1	R2	Potentiometer, 15 Turn, 50 k	89PR50K	Beckman
6	1	R1	Potentiometer, 15 Turn, 500 k	89PR500K	Beckman
7	1	J2	8 Pin Socket	86418-7	Amp
8	2	HDR1, 2	14 Pin Socket	CA-14LS2-105D	CA
9	6		EMI Filter Capacitor	ME1214-001	Mu-Rata/ Erie
10	1		Holder	X54B129	Ronan
11	2		4-40 x 3/8 Ph Pn Hd Screw		West Valley
12	2		Spacer	9015	HH Smith
13	1	J1	Header, 6 Pin	6-910-11	Molex
14	1	J1	Header, 8 Pin	X54B147	Ronan



Terminal Connector	T/C Input Type	RTD Input Type		mA Input Type
		Two-Wire	3-Wire	
Pin 1 to Pin 2				Loop Resistor 3.125 Ohm
Pin 2 to Pin 3	Compensation Resistor X80A209	Jumper 360-0017-03-00		

X54D23 (-1) (-2) (-3) (-4) (-5)

- (-5) Without LCD DIN-Rail Mounting Type TS-35 x 7.5
- (-4) With LCD Explosion Proof Housing
- (-3) Without LCD Explosion Proof Housing Mounting
- (-2) Without LCD DIN-Rail Mounting Type TS-32
- (-1) Without LCD Surface Mounting

Item	Quantity -1	-2	-3	-4	-5	Part Number	Description	Mfg.
1	1	1	1	1	1	X54-1000E	T/C Transmitter PCB Assy.	Ronan
	1	1	1	1	1	X54-1004E	RTD Transmitter PCB Assembly	Ronan
	1	1	1	1	1	X54-1005	Freq. Transmitter PCB Assembly	Ronan
2	–	–	–	6	–	ME1214-001	EMI Suppression Filter	Murate
3	–	–	–	1	–	X54-1001B/1012A	Display PCB Assembly	Ronan
4	–	–	–	1	–	X54-1002C/1013A	Interface PCB Assembly	Ronan
5	1	1	1	–	1	X54C7-3	Extrusion	Ronan
6	–	–	–	1	–	X54C7-2	Extrusion	Ronan
7	1	1	1	–	1	X54B128	Cover Modification	Ronan
8	1	–	–	–	–	X54B3	Surface Mounting Plate	Ronan
9	–	1	–	–	–	X54D4	DIN-Rail Mounting Bottom Cover	Ronan
10	–	2	–	–	–	X54B5	DIN-Rail Mounting Spring	Ronan
11	–	2	–	–	–	X54D4-1	Spring Retainer	Ronan
12	–	–	1	1	–	X54B8	Mounting Plate	Ronan
13	–	–	–	1	–	X54B9	LCD Cover Plate	Ronan
14	–	–	1	–	–	X1HDC	Exp. Proof Housing (Glass Top*)	Adalet
15	–	–	–	1	–	X1HDGC	Exp. Proof Housing (Solid Top*)	Adalet
16	–	–	–	2	–	9293	6-32 x 7/16" Hex Spacer	H. H. Smith
17	–	–	–	2	–	9207	1/4 O.D. x 3/16" Round Spacer	H. H. Smith
18	–	–	2	2	–		8-32 x 5/16" Ph Pan Hd Ms	
19	–	–	–	–	4		4-40 x 1/4" Ph Flat Hd Black Ms	
20	–	–	–	2	–		6-32 x 1/4" Ph Pan Hd Ms	
21	2	4	2	–	2		4-40 x 5/16" Ph Pan Hd Black Ms	
22	–	–	–	2	–		6-32 x 1/2" Ph Flat Hd 100° Csk Black Ms	
23	2	–	2	2	2		4-40 x 5/16" Ph Flat Hd Black Ms	
24	–	2	–	–	–		6-32 x 1/4" Ph Flat Hd Black Ms	
25	–	–	2	2	–		#8 Split Lock Washer	
27	–	–	2	2	–		#8 Flat Washer	
28	1	1	1	–	1	X54C127	RFI Module Assembly	Ronan
	–	–	–	1	–	X54B129	Filter Holder	Ronan
30	–	–	–	2	–	9015	Spacer	H. H. Smith
31	–	–	–	2	–		4-40 x 3/8 Ph Rd Hd Ms	
32	–	–	–	–	1	NN-37	Spring	Century Spring
33	–	–	–	–	1	X54B145	Locker Holder	Ronan
34	–	–	–	–	1	X54C146	X54 Base	Ronan
35	–	–	–	–	1	X54C168	Locker	Ronan

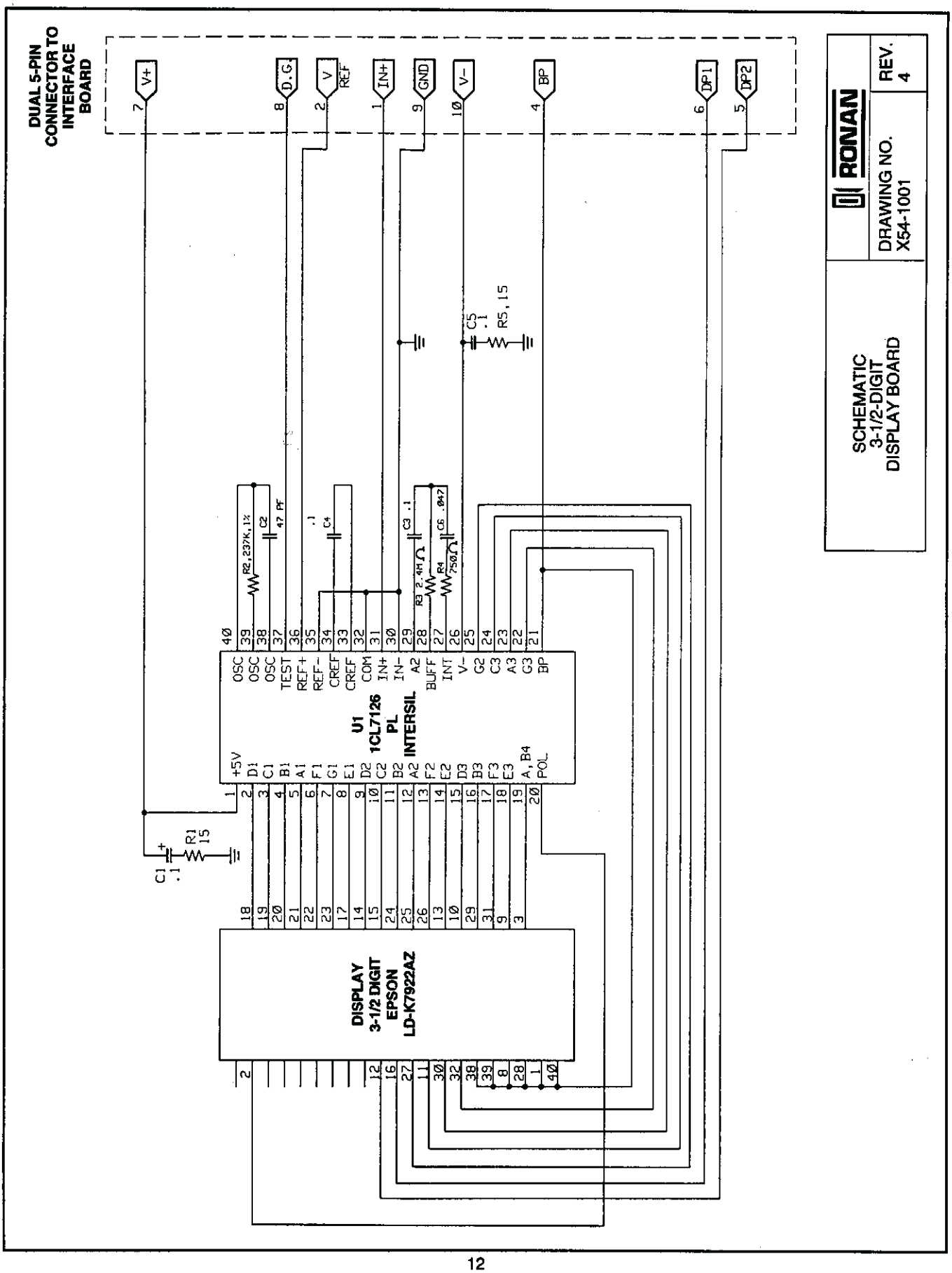
* Not Shown

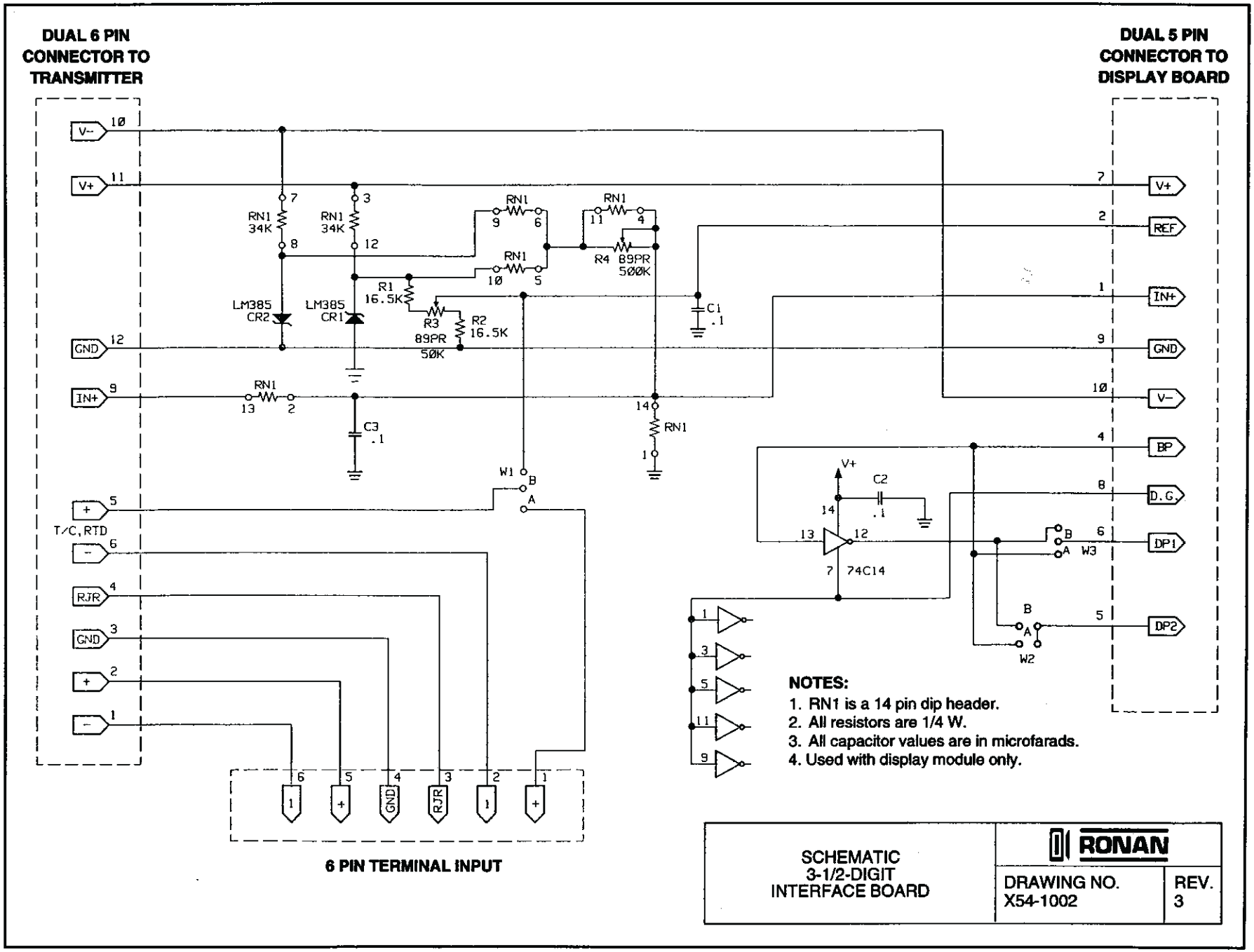
MECHANICAL AND ELECTRONIC ASSEMBLY X54 SERIES

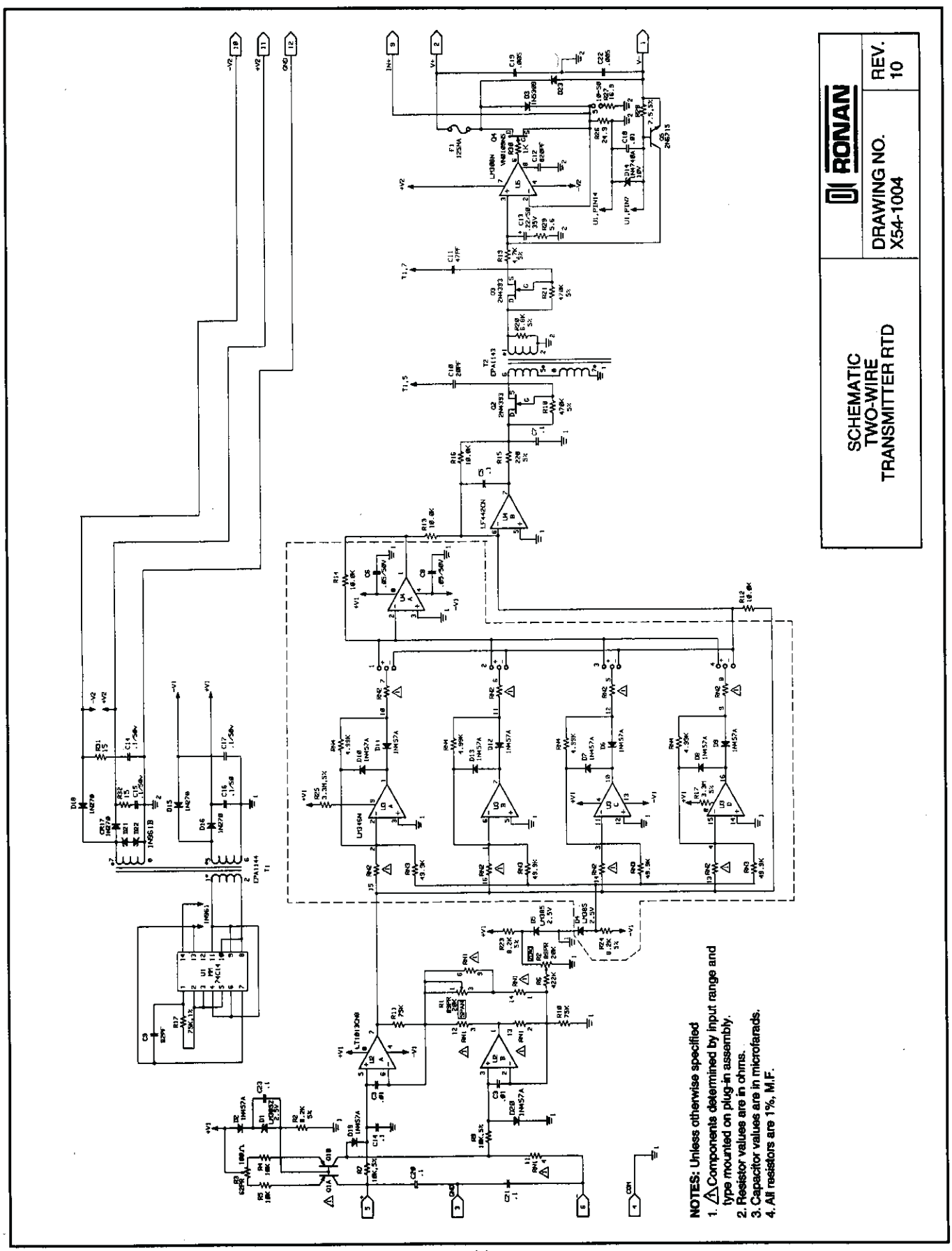
RONAN

DRAWING NO. X54D23

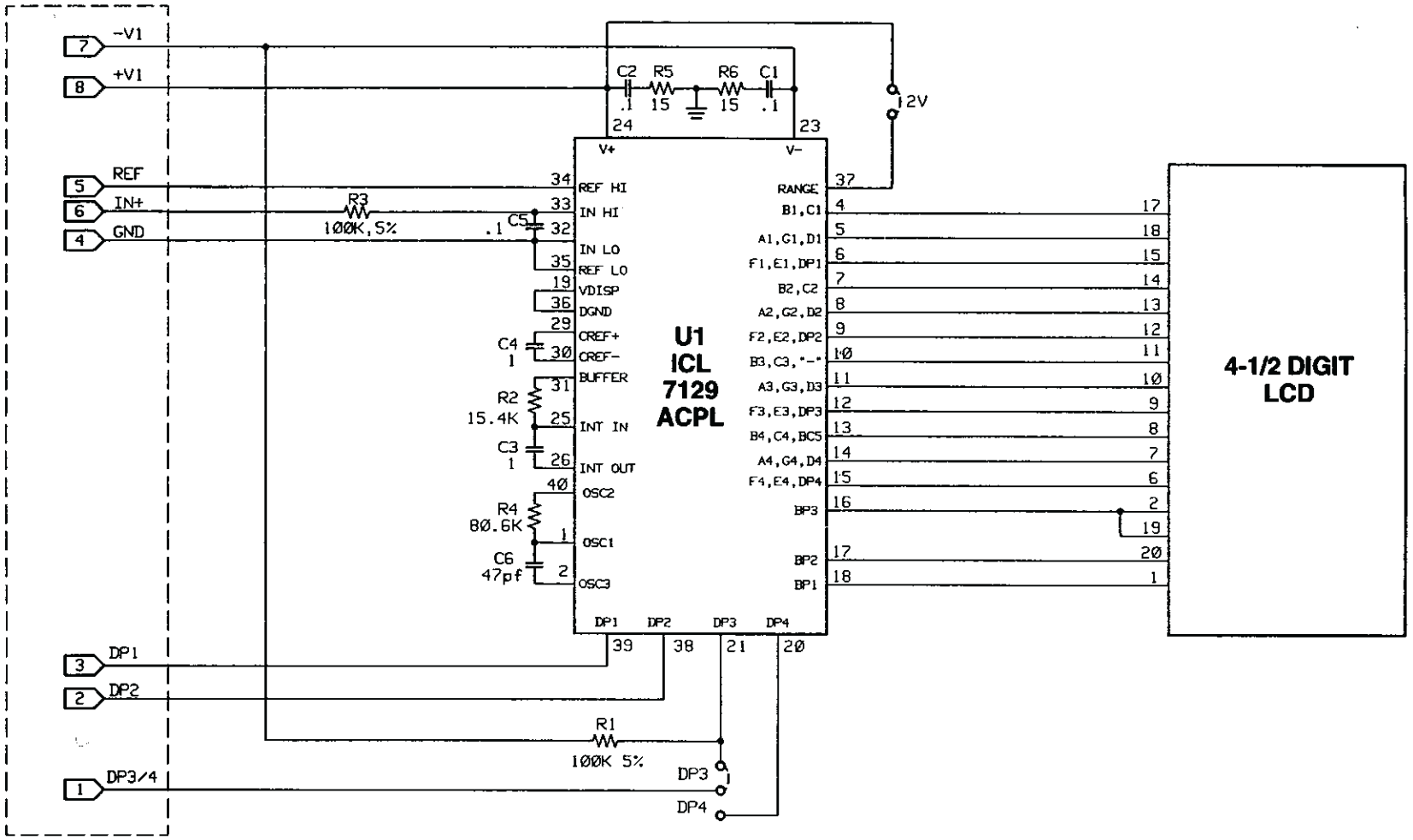
REV. 11


DUAL 5-PIN CONNECTOR TO INTERFACE BOARD
V+
D.G
V REF
IN+
GND
V-
BP
DP1
DP2
U1 ICL7126 PL INTERSIL
DISPLAY 3-1/2 DIGIT EPSON LD-K7922AZ
C1 .1
R1 15
C5 .1
R5, 15
SCHEMATIC 3-1/2-DIGIT DISPLAY BOARD
RONAN
DRAWING NO. X54-1001
REV. 4


DUAL 6 PIN CONNECTOR TO TRANSMITTER
DUAL 5 PIN CONNECTOR TO DISPLAY BOARD
V--
V+
GND
IN+
T/C, RTD
RJR
RN1 34K
LM385 CR2
LM385 CR1
R1 16.5K
R2 16.5K
R3 89PR 50K
R4 89PR 500K
C1 .1
C2 .1
C3 .1
W1
W2
W3
74C14
REF
BP
D.G.
DP1
DP2
6 PIN TERMINAL INPUT
NOTES:
1. RN1 is a 14 pin dip header.
2. All resistors are 1/4 W.
3. All capacitor values are in microfarads.
4. Used with display module only.
SCHEMATIC
3-1/2-DIGIT
INTERFACE BOARD
RONAN
DRAWING NO.
X54-1002
REV.
3


SCHEMATIC
TWO-WIRE
TRANSMITTER RTD
RONAN
DRAWING NO.
X54-1004
REV.
10
NOTES: Unless otherwise specified
1. △Components determined by input range and type mounted on plug-in assembly.
2. Resistor values are in ohms.
3. Capacitor values are in microfarads.
4. All resistors are 1%, M.F.

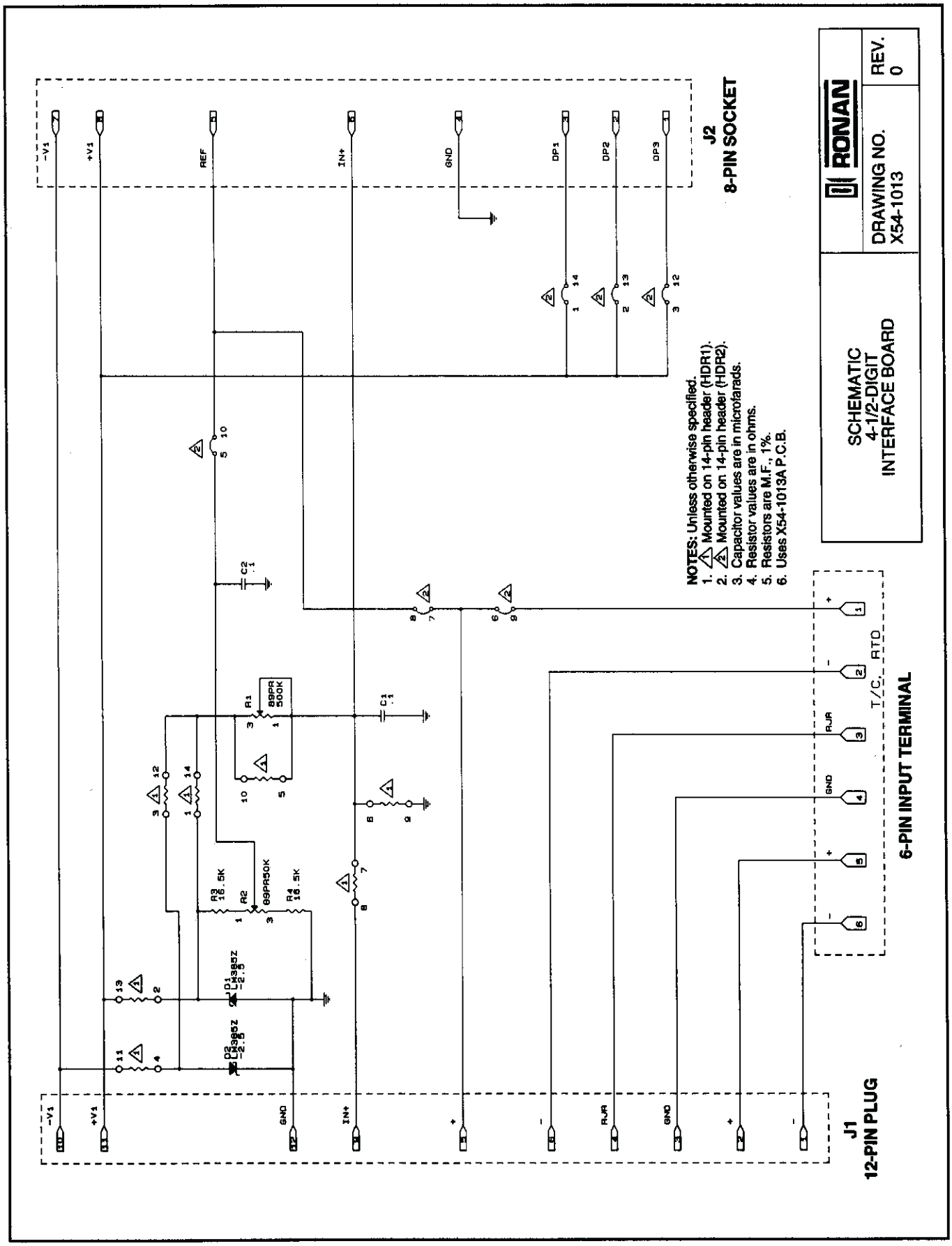
8 PIN PLUG

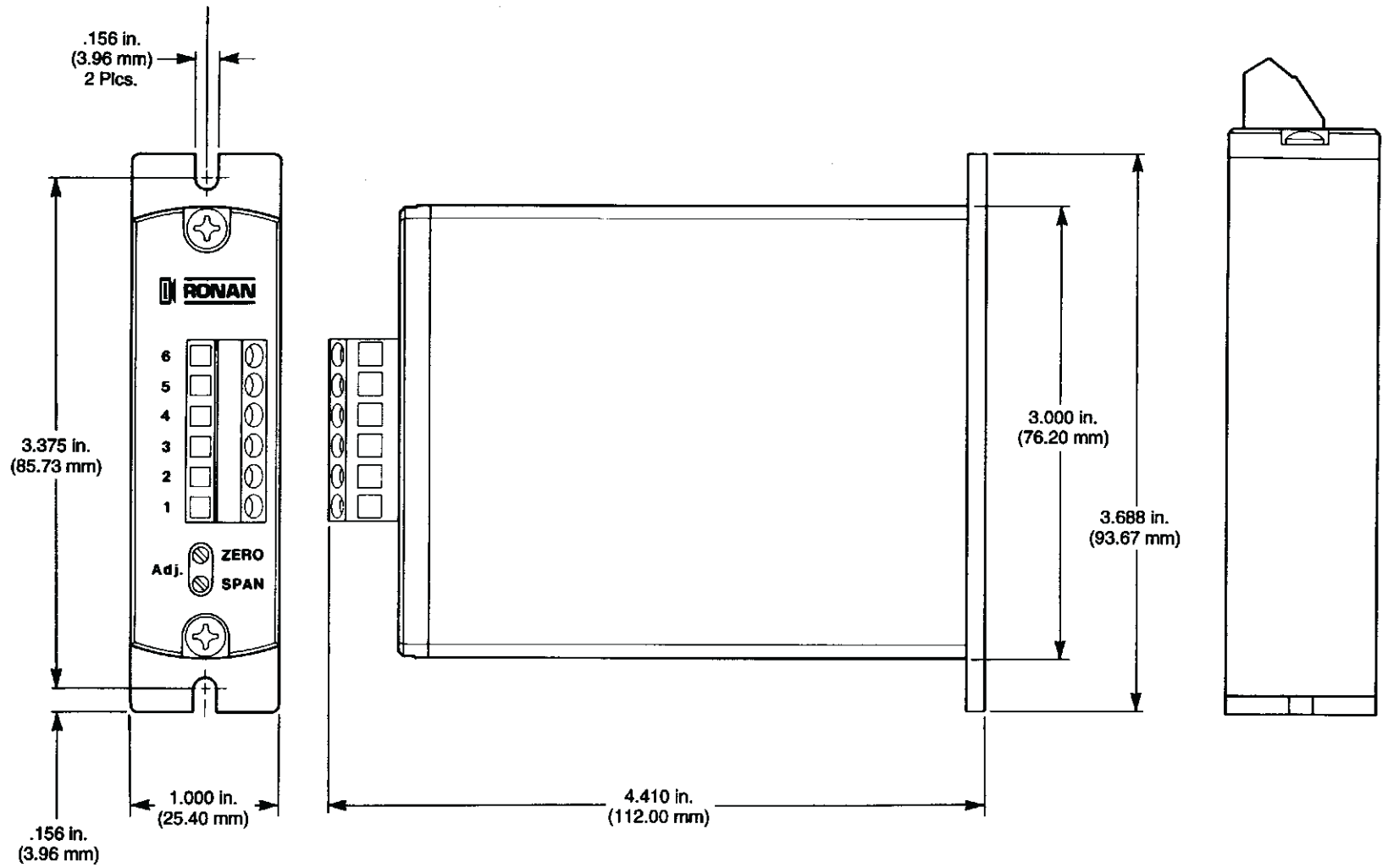


NOTES: Unless otherwise specified.

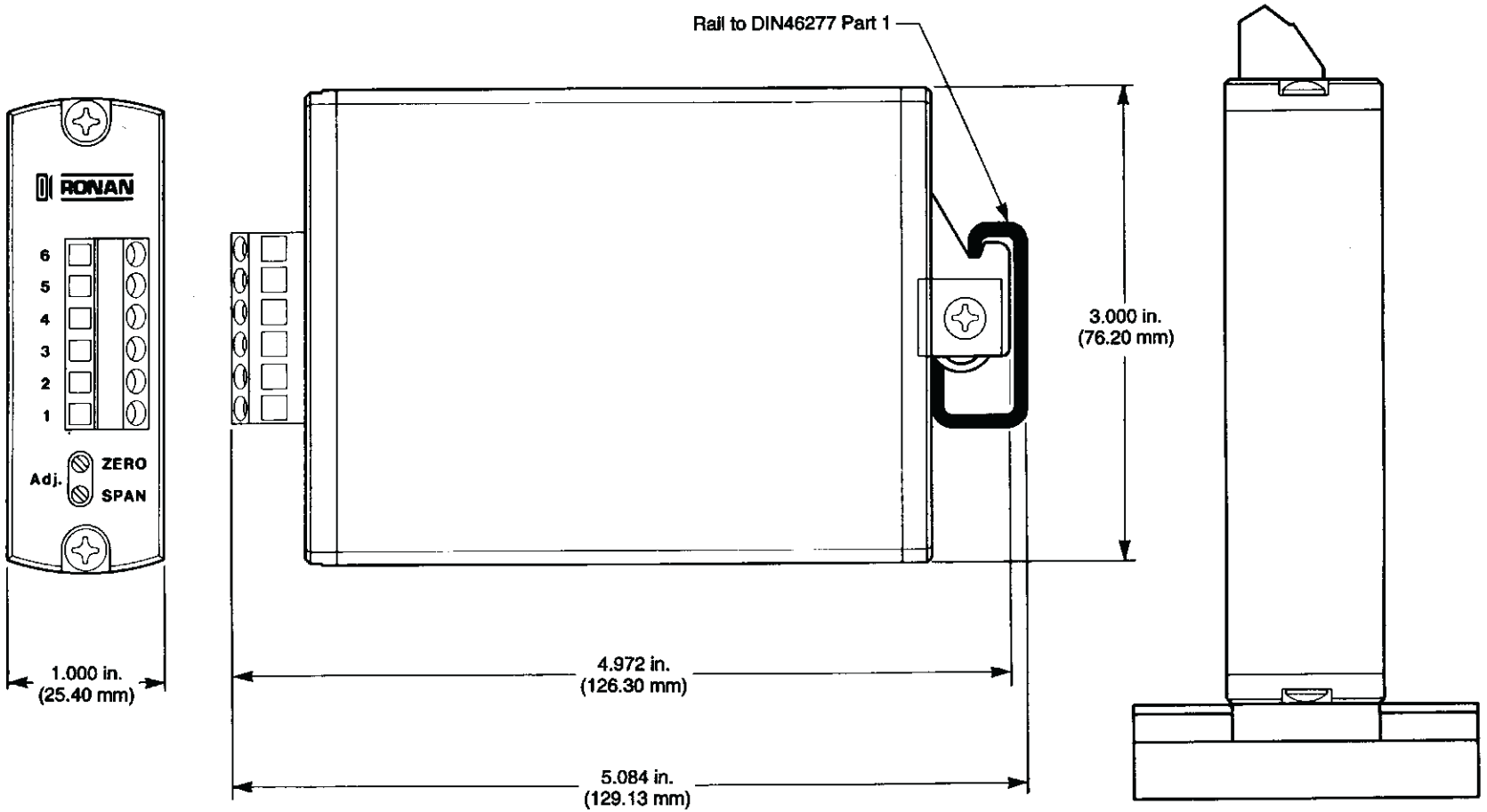
1. Capacitor values are in microfarads.
2. Resistor values are in ohms.
3. Resistors are M.F., 1%.
4. Uses X54-1012A P.C.B.

SCHEMATIC 4-1/2-DIGIT DISPLAY BOARD	RONAN	
	DRAWING NO. X54-1012	REV. 1


SCHEMATIC
4-1/2-DIGIT
INTERFACE BOARD
RONAN
DRAWING NO.
X54-1013
REV.
0
J2
8-PIN SOCKET
J1
12-PIN PLUG
6-PIN INPUT TERMINAL
T/C, RTD
NOTES: Unless otherwise specified.
1. Mounted on 14-pin header (HDR1).
2. Mounted on 14-pin header (HDR2).
3. Capacitor values are in microfarads.
4. Resistor values are in ohms.
5. Resistors are M.F., 1%.
6. Uses X54-1013A P.C.B.

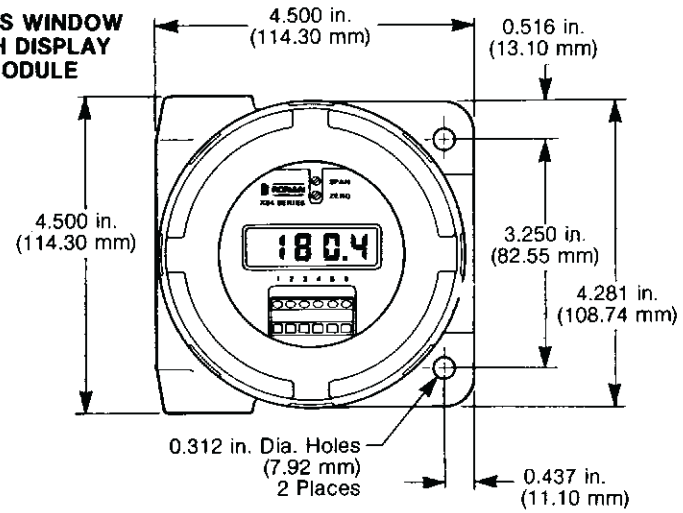


OUTLINE DRAWING TWO-WIRE TRANSMITTER SURFACE MOUNT	RONAN	
	DRAWING NO. X54C12	REV. 2

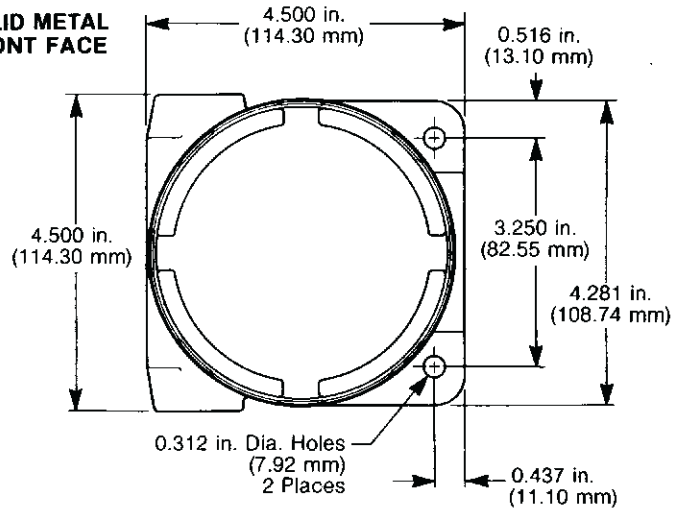


OUTLINE DRAWING TWO-WIRE TRANSMITTER DIN RAIL MOUNT	RONAN	
	DRAWING NO. X54C13	REV. 2

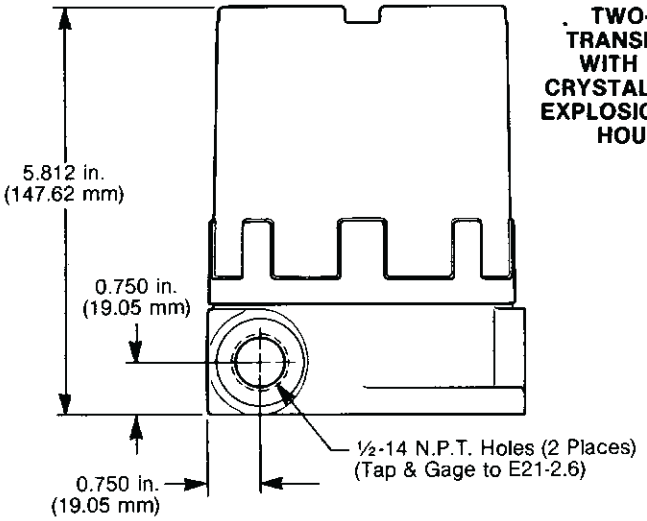
GLASS WINDOW WITH DISPLAY MODULE



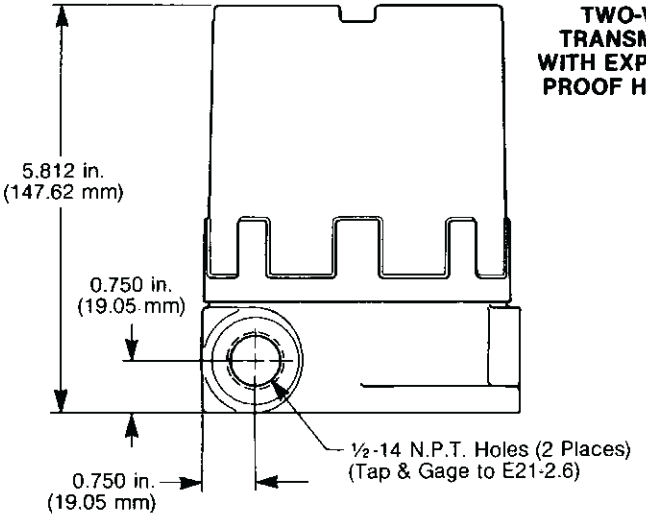
SOLID METAL FRONT FACE



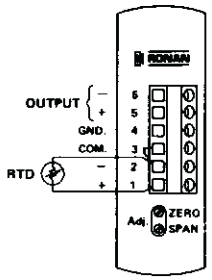
TWO-WIRE TRANSMITTER WITH LIQUID CRYSTAL DISPLAY EXPLOSION-PROOF HOUSING



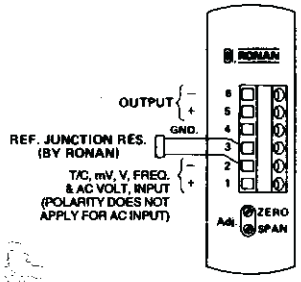
TWO-WIRE TRANSMITTER WITH EXPLOSION-PROOF HOUSING



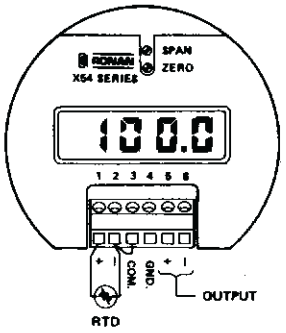
OUTLINE DRAWING EXPLOSION-PROOF HOUSING	RONAN	
	DRAWING NO. X54C14/X54C15	REV. 0/0



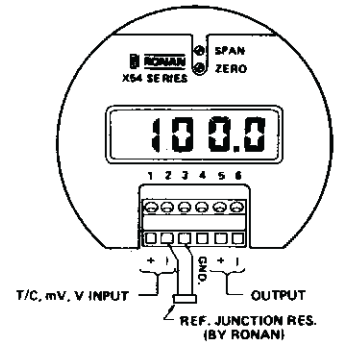
2 WIRE RTD INPUT
mA OUTPUT



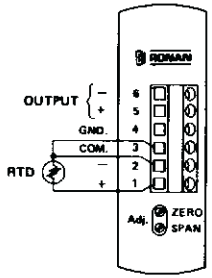
THERMOCOUPLE, mV, V, AC V, FREQ. INPUT
mA OUTPUT



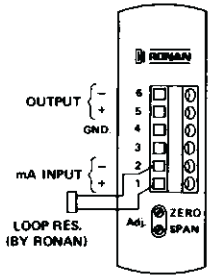
2 WIRE RTD INPUT, mA OUTPUT
WITH DISPLAY



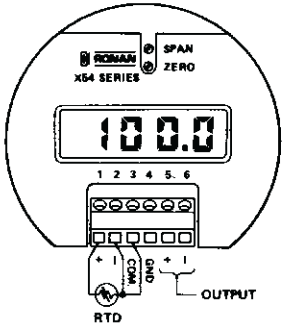
THERMOCOUPLE, mV, V, AC V, FREQ. INPUT
mA OUTPUT WITH DISPLAY



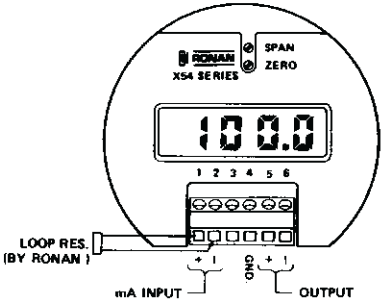
3 WIRE RTD INPUT
mA OUTPUT



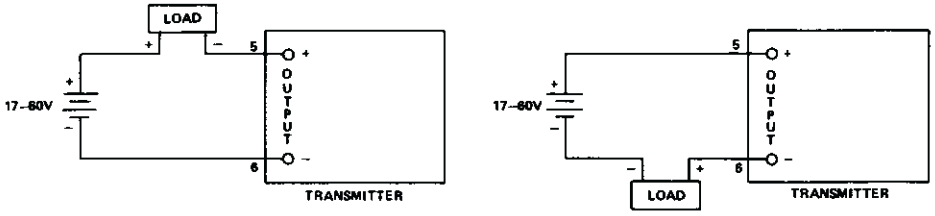
mA INPUT
mA OUTPUT



3 WIRE RTD INPUT, mA OUTPUT
WITH DISPLAY



mA INPUT, mA OUTPUT
WITH DISPLAY



LOAD AND POWER SUPPLY CONNECTION

WIRING DIAGRAM TWO-WIRE TRANSMITTER SERIES X54	RONAN	
	DRAWING NO. X54C16	REV. 2

RONAN

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