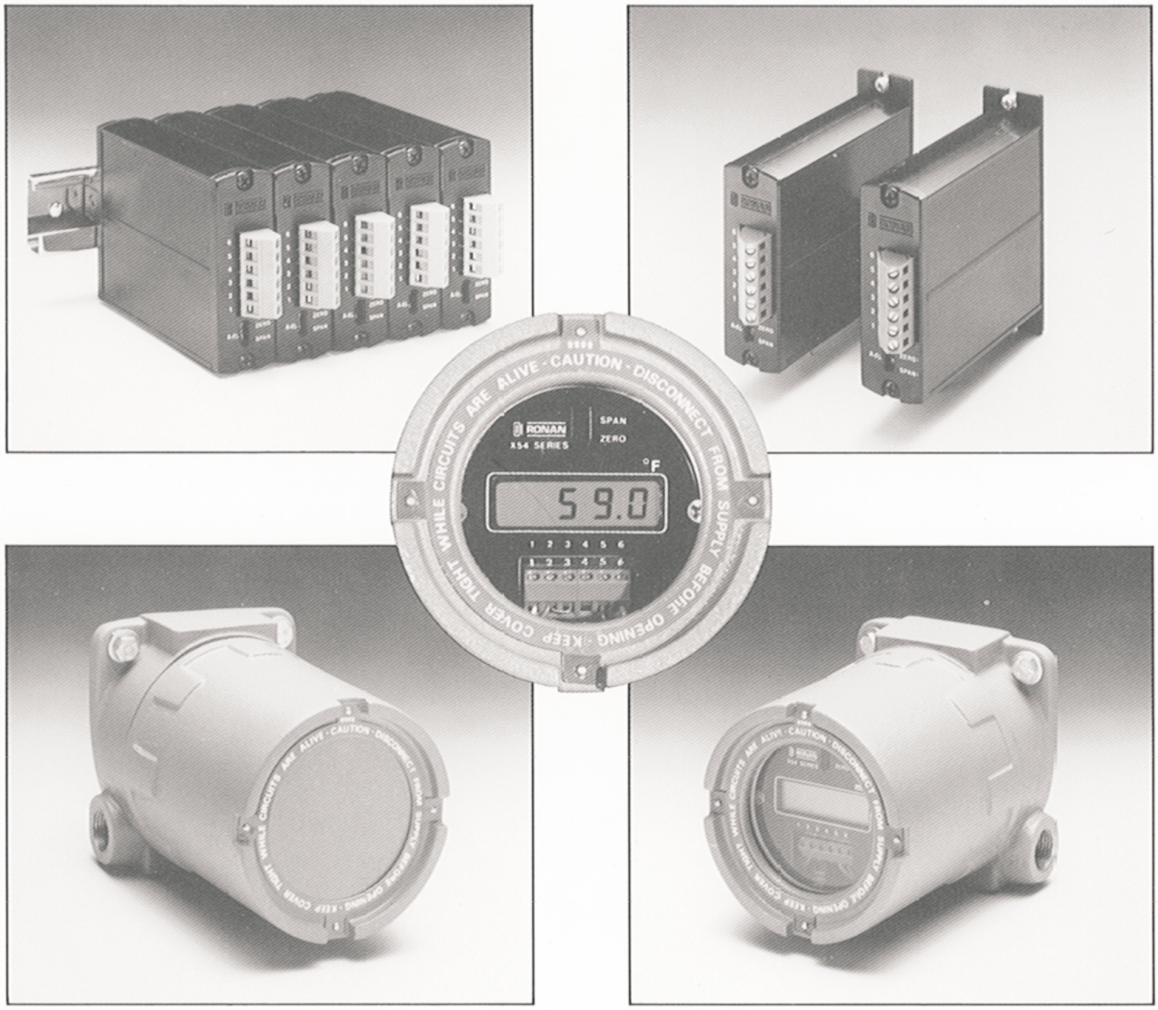
Instructions and Operating Manual

SERIES X54

Frequency Input Two-Wire Transmitters



RONAN

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1.0 GENERAL DESCRIPTION

The Ronan Series X54-200 Frequency Input Two-Wire Transmitter design utilizes state-of-the-art, micro-powered, solid-state devices, holding the internal current consumption to less than the zero span current of 4 mA. The available options, such as integral 3½- or 4½-digit liquid crystal display (LCD) local readout and various types of housings and mountings, establish the Series X54-200 as one of the most versatile transmitter lines on the market. The input/output transformer-isolated transmitter provides very accurate measurements, immune to ground loop currents, while grounding both the signal source and the output instrumentation or the power supply.

The transmitters are available in a selection of housings, such as the explosion-proof NEMA Type 7, which is suitable for Class I, Division 1, Groups B, C and D locations (X54-240); NEMA Type 4, suitable for weatherproof indoor/outdoor installation; or general purpose enclosure. The general purpose, aluminum extrusion housing is suitable for direct surface mounting (X54-245) or rail mounting (X54-246). Front-mounted, compression-type terminals allow convenient sensor and output lead connections.

The transmitter, mounted in the explosion-proof housing, is available with a 3½- or 4½-digit LCD readout. The readout indicates frequency or engineering units scaled to customer requirements. Scaling of the display 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 output/power leads. The operating voltage may vary from 12-80 VDC. To determine the maximum loop resistance, use the equation in section 2.0, "Specifications."

2.0 SPECIFICATIONS

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

Input:
Periodic wave form: pulse, triangle, sine. *Amplitude:* 50 mV to 200 V, peak to peak.

Input Impedance: >300 K Ohms.

Span Adjustment: Front-accessible, multiturn, infinite resolution potentiometer permits ±10% deviation from nominal span.

Zero Adjustment: Front-accessible, multiturn, infinite resolution potentiometer permits ±10% adjustment from nominal zero.

Sensitivity Adjustment: Factory set to customer requirements.

Input Open Circuit Response: Down-scale drive standard.

Accuracy: Calibrated accuracy, including linearity, ±0.1% of span.

Isolation: Input and output circuits isolated from power and each other by transformers.

Temperature Coefficient:
32°F to 158°F (0°C to 70°C).
Gain: <±0.01%/°F.
Zero: ±.005% of span/°C referred to the output.

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

Standard Output: 4-20 mA or 10-50 mA, jumper-selectable.

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

Power Supply Range: 12-80 VDC (12-60 VDC for 10-50 mA.)

Power Supply Effects: <±.01% of range for a ±10 V change.

Maximum Loop Resistance Vs. Power Supply Voltage (PSV):

For 4-20 mA range:

$$\text{R loop maximum} = \frac{\text{PSV} - 12\ \text{V}}{20\ \text{mA}}$$

For 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: <.4 mV (referred to input), ±.2% of span (referred to output), when exposed to 5 W transmitter with frequency range of 20-460 mHz at a distance of 1 m.

Terminals: Compression type; wire size 14 AWG maximum; 10 A maximum; 300 V maximum.

Weight:
General purpose housing: 0.5 lb. (.23 kg).
Explosion-proof housing: 4.2 lbs. (1.88 kg).

3.0 CIRCUIT OPERATION

3.1 General Circuit Operation (See Figure 1)

The basic two-wire transmitter consists of a DC-DC power supply, input comparator A1, isolation transformer T2, one-shot and filter, output current amplifier A2, voltage-controlled current source I_S, and output sensing resistor RA.

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 isolated operating voltages.

The input is shaped by A1 which provides a sensitivity adjustment by changing VR. The signal is passed through T2 for isolation and triggers a one-shot. The output is averaged by the filter and the DC output is applied to A2. Resistor RA senses the output current and provides a feedback to A2 to control the current source I_S.

3.2 Detailed Circuit Description (See Drawing X54-1016)

The input waveform is applied to comparator U3 through R6 and C4. C4 blocks any DC offset and CR5 removes the negative half of the signal. An adjustable voltage, set by R19, determines the sensitivity of the comparator. Input/output/power isolation is obtained with T1. C15 allows only pulses to pass through T1 and CR7 allows the positive part of the pulse to trigger U1.

A one-shot consists of U4, U2, and their associated components. Q3 and R5 form a current source to supply zener diode CR6. Before U1 is clocked, the $\overline{Q}$ output is high which turns on Q4 and discharges C13. CR6 and R4 + R3 form a very accurate and stable current source. When U1 is triggered, Q4 is turned off and C13 begins to charge and the voltage at U4-1 begins increasing. When the voltage equals the voltage at U2-2, the output of U2 goes high and resets U1. This results in a constant-width pulse at U1-1.

U4 and its associated components form a three-pole, low pass filter and, along with Q1 and sense resistor R12, the current output stage. Since the output pulses are a constant width, the output of the filter will be a DC voltage proportional to the frequency of the pulses. The output current develops a voltage across R12 which is fed back to U4 to control the current through Q1. The developed sense voltage is .1 to .5 volts. For a 10 to 50 mA output, the "10-50 mA" jumper is installed so the developed sense voltage is kept at .1 to .5 volts. Q2 and R1 are used as a current limit. When the output exceeds approximately 65 mA, Q2 begins to conduct and pull down the input at U4-5 to prevent any further increase in output current.

The two-wire operating voltage is applied to pins V+ and V−. Diode CR4 protects the circuitry from a reversed power connection. The voltage drop across zener diodes CR1 and CR2 is used to provide power for the output circuitry and to power oscillator U5, C19 and R28. The oscillator drives T2 to provide the operating voltage for the

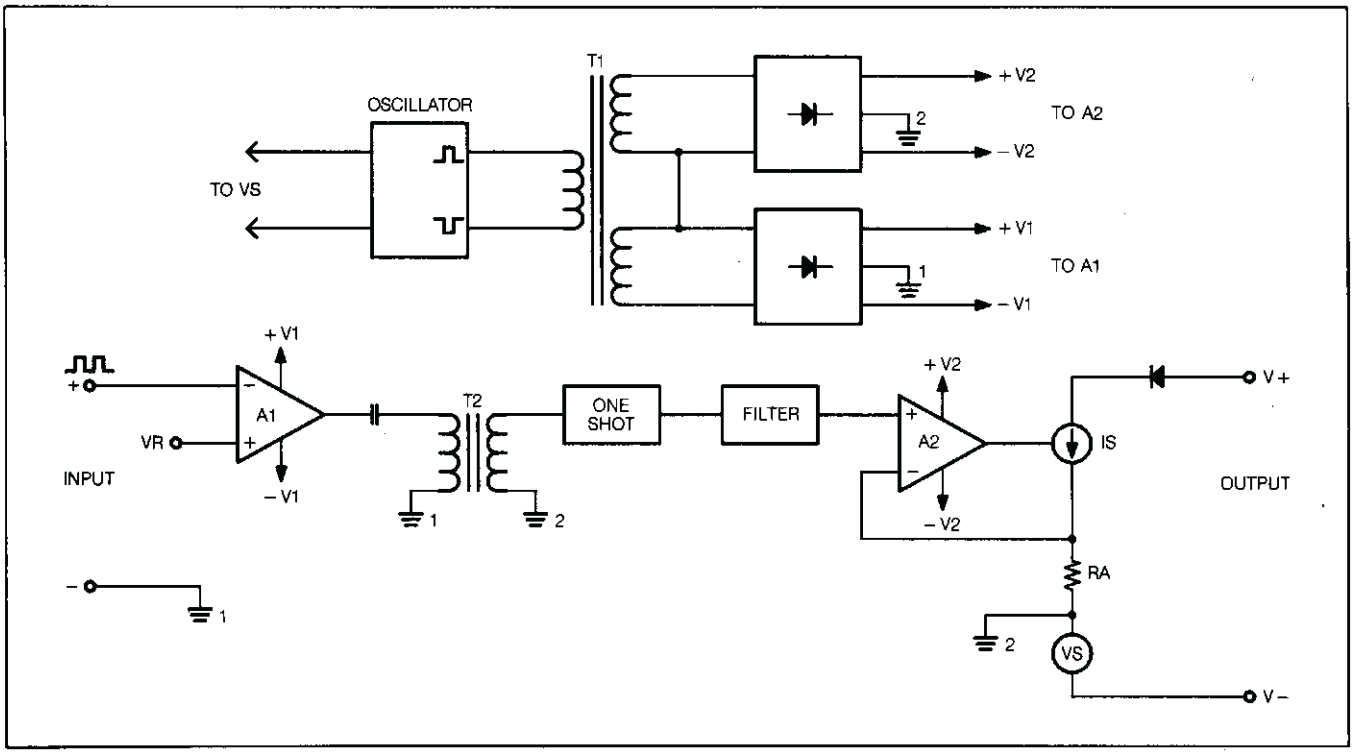


Figure 1: Simplified Block Diagram

input circuitry and a negative supply for the output section.

3.3 Display Modules

3.3.1 3½-Digit Display Module (See Drawing X54-1001 and X54-1002): The X54 3½-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 R12 on the transmitter board. 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 read-out 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.

3.3.2 4½-Digit Display Module (See Drawing X54-1012 and X54-1013): The X54 4½-digit display 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 the interface board. The ratio of this divider is determined by the desired read-out range. HDR1(4-11), D2 and HDR1(2-13), D2 provide a stable ±2.5 volts, which through potentiometer R2, HDR(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 2V jumper not installed, "19999" will be displayed for a 199.99 mV input.

4.0 CALIBRATION

The calibration of the X54-240 Series Frequency Input Transmitters entails adjusting the zero and span potentiometer for the correct output current when an accurate frequency generator is connected to the inputs.

4.1 Frequency Input-Model X54-210

An accurate frequency generator should be used to provide the calibration input signal. Connect its output directly to the transmitter's input terminals (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 connecting a jumper across the input terminals. Adjust the front panel ZERO control to obtain an output current of 4 mA (or 10 mA for a 10-50 mA output). Remove the jumper and connect the frequency generator. Set its output to the full-scale frequency and amplitude of the input range. Adjust the sensitivity control, R19, for a square wave with a 50% duty cycle (observed at U3-1). 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 3½-Digit Display

The 3½-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 R4 on the X54-1002 printed circuit 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 R3 for the correct display. Repeat if necessary.

4.3 4½-Digit Display

The 4½-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 printed circuit 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 Series X54 Frequency Input Two-Wire Transmitters may be removed from their housings without disconnecting any external wiring, allowing easy access to all circuit components. Visually inspect the boards for any obvious damage to the component traces.

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 3.2.

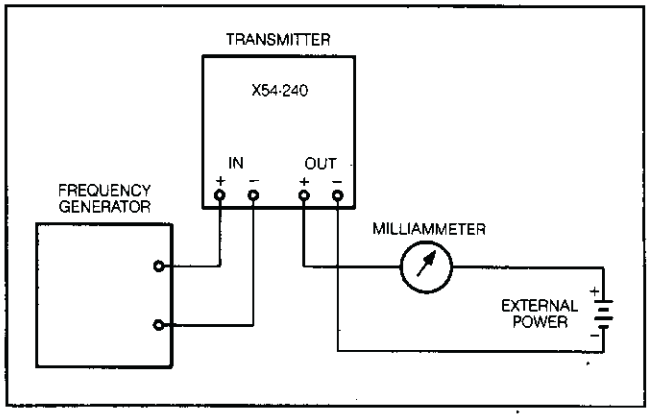


Figure 2: Input Circuit Connection for Frequency Calibration

Test Step	Test Points	Expected TestValue	Test Equipment	Notes
5 V power to oscillator U1	Across CR1 + CR2	5 VDC	DC voltmeter	
Oscillator U1 output	U1, pins 8, 9, 10 or 11 to pin 7	Square wave approx. 100 KHz	Scope	5 V peak
Input circuit power supply	Cathode CR11 to ground 1	5 VDC	Scope	Ripple should be unobserved except for thin spikes. If large ripple, suspect faulty filter cap C18 or input circuit
Output circuit power supply	Anode CR10 to output ground 2	−4.5 VDC	Scope	Ripple should be unobserved except for thin spikes. If large ripple, suspect faulty filter cap C17
Input comparator response	U3, pin 1 to ground 1	Square wave at same frequency of input	Scope	Should be approx. 5 V peak
Modulator/ Demodulator response	Across R24	Pulses of same frequency of input	Scope	Should be approx. 4 V peak
One-shot Pulse Width	U1, pin 1 to ground 2	Pulse width should remain constant with varyng input frequency	Scope	Pulse width depends on input span
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

PARTS LIST—3½-DIGIT DISPLAY BOARD

Model X54-1001

Item	Qty.	ID	Part No.	Description	Vendor
1	1	P.C.B.	X54-1001B	L.C.D. Display Module	Ronan
2	1	L.C.D.	33D9R02GHJ or 3937-363-020	3½-Digit L.C.D.	Epson or Hamlin
3	1	U1	ICL7126CPL	3½-Digit L.C.D. Driver	Intersil or Teledyne
4	1	U1	D1LB40P-11	40 Pin IC Socket	CA
5	1	R2	RN55C2373F	Resistor, 1%, ¼ W, 237 K	Mepco
6	1	R3	RC07GF245J	Resistor, 5%, ¼ W, 2.4 M Ohm	AB
7	1	R4	RN55C7500F	Resistor, 1%, ¼ W, 750 Ohm	Mepco
8	1	C2	470R501M05	Capacitor, Mica 47 pF	Sprague
9	2	C3,4	104R101K10	Capacitor, Poly, 0.1 μF	Mepco
10	1	C6	473R251K10	Capacitor, Poly, 0.047 μF	Mepco
11	2	C1,5	685R350T20	Capacitor, Tantalum, 6.8 μF	Sprague
12	1	P.C. Connector	10-89-2123	Dual Row Header	Amp

Note: All components on component side except the L.C.D (L.C.D on circuit side). Insert L.C.D. so that it reads in the same direction as 1.2-6 silkscreen on the P.C.B.

PARTS LIST—3½-DIGIT DISPLAY INTERFACE BOARD

Model X54-1002

Item	Qty.	ID	Part No.	Description	Vendor
1	1	P.C.B.	X54-1002C	X54 Interface Board	Ronan
2	1	U1	74C14N	CMOS, Hex Schmitt Trigger	National
3	3	C1,2,3	104A101C20	Capacitor, Ceramic .1 μF	Sprague
4	1	RN1	CA-14LS2-105D	14 Pin Socket	CA
5	2	Connector*	1716034	3 Pin Input Terminal	Phonix
6	1	Header*	86418-9	Dual 5 Pin Connector	Amp
7	1	Connector	10-89-2123	Dual 6 Pin Connector	Molex
8	2	CR1,2	LM385Z-2.5 V	Diode, Voltage Ref	National
9	2	R1,2	RN55C1652F	Resistor, M.F. 1% 16.5 K	Mepco
10	1	R3	89PR50K	Potentiometer, 50 K	Beckman
11	1	R4	89PR2M	Potentiometer, 2 M	Beckman
12	3	W1,2,3	CAS36SP100230430	Line Plug, 3 Pin	RNI

*NOTE: Items #5 and #6 are on circuit side. Other items are on component side.

PARTS LIST—TERMINAL CONNECTOR

Model X54-1003

Item	Qty.	ID	Part No.	Description	Vendor
1	1		X54-1003B	P.C. Board	Ronan
2	2		1716034	Connector Block	Phonix
3	1		6-910-11	Connector Pins	Aries
4	1*		#6	Screw	
5	1*			22 Gage Wire, 4" Long, 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 block (on back of the board).

PARTS LIST—4½-DIGIT DISPLAY BOARD

Model X54-1013

Item	Qty.	ID	Part No.	Description	Vendor
1	1	P.C.B.	X54-1012A	Printed Circuit Board	Ronan
2	2	R1,3	RC07GF104J	Resistor, ¼W, 5% 100 K	AB
3	1	R2	RN55C1542F	Resistor, M.F., 1% 15.4 K	Mepco
4	1	R4	RN55C8062F	Resistor, M.F., 1% 80.6 K	Mepco
5	1	C5	104A101C20	Capacitor, Ceramic, .1/100 V	Unitrode
6	2	C3,4	105R500K05	Capacitor, Polycarb 1/50 V	ECI
7	1	C6	470R501M05	Capacitor, Mica 47 pF	Arco
8	2	C1,2	224R350T20	Capacitor, Tant .22/35 V	Sprague
9	1	U1	ICL7129ACPL	4½-Digit A/D	Maxim
10	1		4201-363-020	4½-Digit LCD (Mount on Back of Board)	Hamlin
11	1		CA-S36SP-230-430	Strip Line Plug, 3-Pin	CA
12	1		CA-S36SP-230-430	Strip Line Plug, 2-Pin	CA
13	1	DP3-DP4	531220-2	Shunt	

PARTS LIST—4½-DIGIT DISPLAY INTERFACE BOARD

Model X54-1012

Item	Qty.	ID	Part No.	Description	Vendor
1	1	P.C.B.	X54-1013A	Printed Circuit Board	Ronan
2	2	R3,4	RN55C1652F	Resistor, M.F., 1% 16.5 K	Mepco
3	2	C1,2	104A101C20	Capacitor, Ceramic .1/100 V	Unitrode
4	2	D1,2	LM385-2.5 V	Diode, Voltage Reference	National
5	1	R2	89PR50K	Potentiometer, 15 Turn 50 K	Beckman
6	1	R1	89PR500K	Potentiometer, 15 Turn 500 K	Beckman
7	2		1716034	3 Pin Input Terminal (Mount on Back)	Phonix
8	1	J2	86418-7	8 Pin Socket (Mount on Back)	Amp
9	1	J1	10-89-2123	12 Pin Plug	Molex
10	2	HDR1,HDR2	CA-14LS2-105D	14 Pin Socket	CA

PARTS LIST—FREQUENCY INPUT TWO-WIRE TRANSMITTERS

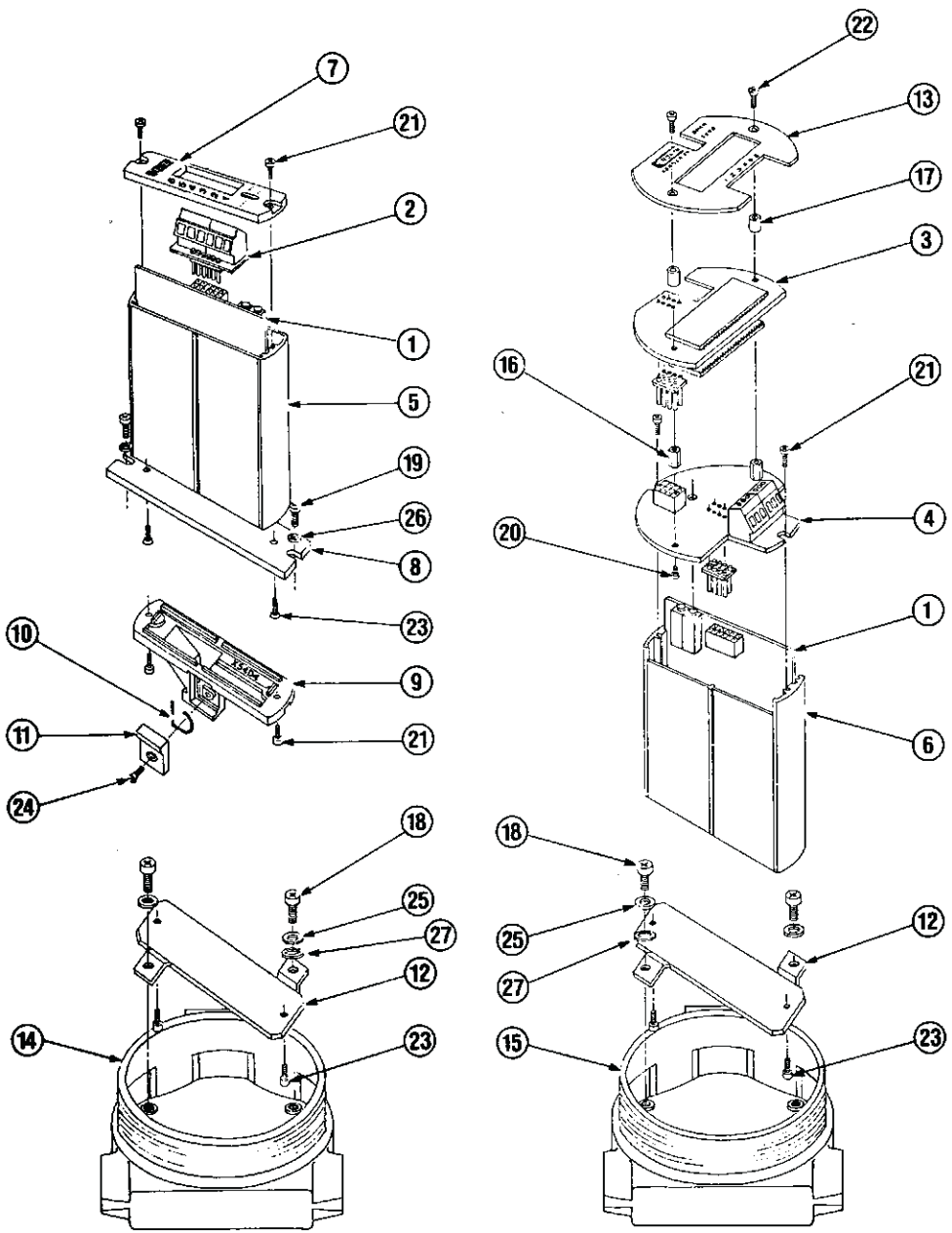
Model X54-1016

Item	Qty.	ID	Part No.	Description	Vendor
1	1	P.C.B.	X54-1016A	Printed Circuit Board	Ronan
2	1	U1	CD4013B	Dual D-Flip Flop	National
3	2	U2,3	LT1017CN8	Dual Comparator	Linear Tech.
4	1	U4	OP220FZ	Dual Op Amp	P.M.I.
5	1	U5	74C14	Hex Schmitt Trigger	National
6	1	R15		Jumper	
7	1	R29	RC07GF201J	Resistor, ¼ W, 5% 200 Ohm	AB
8	3	R22,23,24	RC07GF103J	Resistor, ¼ W, 5% 10 K	AB
9	1	R6	RC07GF273J	Resistor, ¼ W, 5% 27 K	AB
10	1	R18	RC07GF104J	Resistor, ¼ W, 5% 100 K	AB

PARTS LIST—FREQUENCY INPUT TWO-WIRE TRANSMITTERS (CONT.)

Model X54-1016

Item	Qty.	ID	Part No.	Description	Vendor
11	1	R14	RC07GF334J	Resistor, ¼ W, 5% 330 K	AB
12	1	R16		NOT USED	
13	1	R13	RN55C16R9F	Resistor, M.F. 1% 16.9	Mepco
14	1	R12	RN55C24R9F	Resistor, M.F. 1% 24.9	Mepco
15	1	R1	RN55C6R19F	Resistor, M.F. 1% 6.19	Mepco
16	1	R3	RN55C3010F	Resistor, M.F. 1% 301 Ohm	Mepco
17	1	R5	RN55C7151F	Resistor, M.F. 1% 7.15 K	Mepco
18	1	R9	RN55C1002F	Resistor, M.F. 1% 10.0 K	Mepco
19	2	R26,27	RN55C1102F	Resistor, M.F. 1% 11.0 K	Mepco
20	1	R28	RN55C7502F	Resistor, M.F. 1% 75 K	Mepco
21	1	R10	RN55C1003F	Resistor, M.F. 1% 100 K	Mepco
22	1	R8	RN55C4993F	Resistor, M.F. 1% 499 K	Mepco
23	6	R7,11,17,20,21,25	RN55C1004F	Resistor, M.F. 1% 1.0 M	Mepco
24	2	CR10,11	1N270	Diode, Signal	Fairchild
25	1	CR7	1N457A	Diode, Signal	Fairchild
26	1	CR4	1N4005	Diode, Rectifier	Fairchild
27	1	CR5	1N4148	Diode, Signal	Fairchild
28	1	CR3	1N5310	Current Source	Fairchild
29	1	CR6	LM385Z-1.2	Zener, 1.2 V	National
30	4	CR1,2,8,9	LM385Z-2.5	Zener, 2.5 V	National
31	7	C1,2,6,12,14 20,21	104A101C20	Capacitor, Ceramic 100 V .1 μF	Sprague
32	3	C8,17,18	105R500C20	Capacitor, Ceramic 50 V 1 μF	Sprague
33	1	C10	184R300K05	Capacitor, Polycarb 30 V .18 μF	Sprague
34	1	C4	474R500K05	Capacitor, Polycarb 50 V .47 μF	Sprague
35	1	C9	684R300K05	Capacitor, Polycarb 30 V .68 μF	Sprague
36	1	C11	105R101K10	Capacitor, Polycarb 30 V 1 μF	Sprague
37	1	C19	820R501M05	Capacitor, Mica 500 V, 82 pF	Sprague
38	2	C7,16	331R501M05	Capacitor, Mica 500 V, 330 pF	Sprague
39	1	C15	471R501M05	Capacitor, Mica 500 V, 470 pF	Sprague
40	2	C3,5	681R301M05	Capacitor, Mica 680 pF	Sprague
41	1	Q3	2N5396	FET, N Channel	Motorola
42	1	Q2	2N6715-5	Transistor, NPN	Motorola
43	1	Q4	VN0106N3	FET, N Channel	Motorola
44	1	Q1	VN0109N5	FET, N Channel	Motorola
45	2	T1,2	PE-2231X	Transformer	Pulse
46	1	R19	72PR50K	Potentiometer, 50 K	Beckman
47	1	R2	89PR200K	Potentiometer, 200 K	Beckman
48	1	J1	6-87729-0	Dual 6 Pin Connector	Amp
49	1	W1	CAS365P100-230-430	2 Pin Strip Line Plug	RIE
50	1	R3	Value Determined by Input Span		
51	1	R4	Value Determined by Input Span		
52	1	C13	Value Determined by Input Span		



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

- With LCD Explosion-Proof Housing Mounting
- Without LCD Explosion-Proof Housing Mounting
- Without LCD DIN-Rail Mounting
- Without LCD Surface Mounting

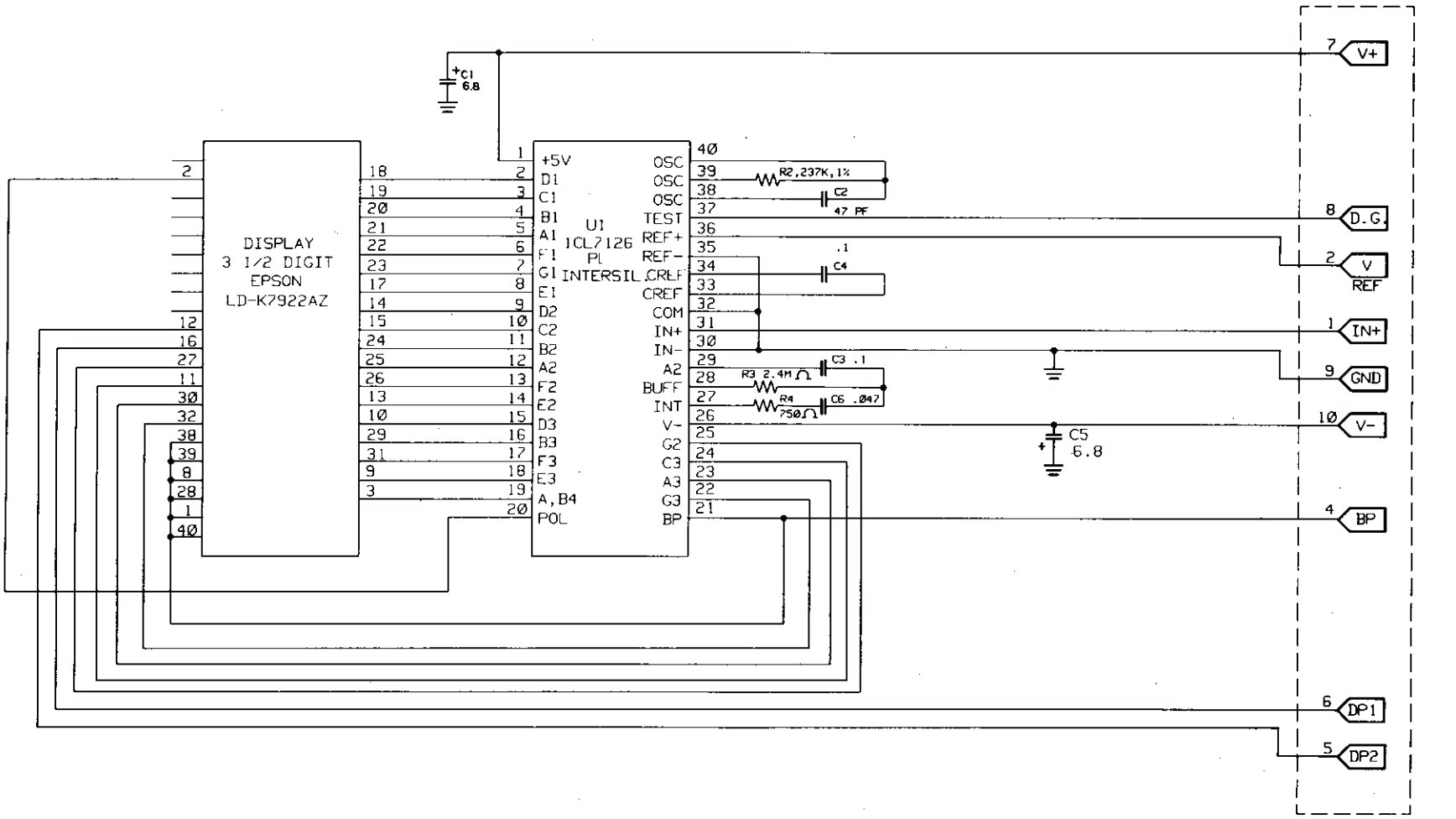
	Quantity						
Item	-1	-2	-3	-4	Part Number	Description	Mfg.
1	1	1	1	1	X54-1000E	T/C Transmitter PCB Assy.	Ronan
	1	1	1	1	X54-1004E	RTD Transmitter PCB Assy.	Ronan
	1	1	1	1	X54-1005	Frequency Transmitter PCB Assy.	Ronan
2	1	1	1	-	X54-1003B	Connecting PCB Assy.	Ronan
3	-	-	-	1	X54-1001B/1012A	Display PCB Assy.	Ronan
4	-	-	-	1	X54-1002C/1013A	Interface PCB Assy.	Ronan
5	1	1	1	-	X54C7-1	Extrusion	Ronan
6	-	-	-	1	X54C7-2	Extrusion	Ronan
7	1	1	1	-	X54C2	Top Cover	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	L.C.D. Cover Plate	Ronan
14	-	-	1	-	X1HDC	Explosion-Proof Housing (Solid Top-Not Shown)	Adalet
15	-	-	-	1	X1HDGC	Explosion-Proof Housing (Glass Top-Not Shown)	Adalet
16	-	-	-	2	9293	6-32 × 7/16" Hex Spacer	H.H. Smith
17	-	-	-	2	9207	¼ O.D. × 3/16" Round Spacer	H.H. Smith
18	-	-	2	2		8-32 × 5/16" PH Pan HD MS	
19	2	-	-	-		6-32 × 3/8" PH Pan HD Black MS	
20	-	-	-	2		6-32" × ¼" PH Pan HS MS	
21	2	2	-	2		6-32 × 3/8" PH Pan HD Self Tap Black MS	
22	-	-	-	2		6-32 × 7/16" PH Flat HD 100° CSK MS	
23	2	-	2	2		6-32 × 3/8" PH Flat HD Self Tap MS	
24	-	2	-	-		6-32 × ¼" PH Flat HD Black MS	
25	-	-	2	2		#8 Split Lock Washer	
26	2	-	-	-		#6 Inter. Tooth Lock Washer	
27	-	-	2	2		#8 Flat Washer	

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

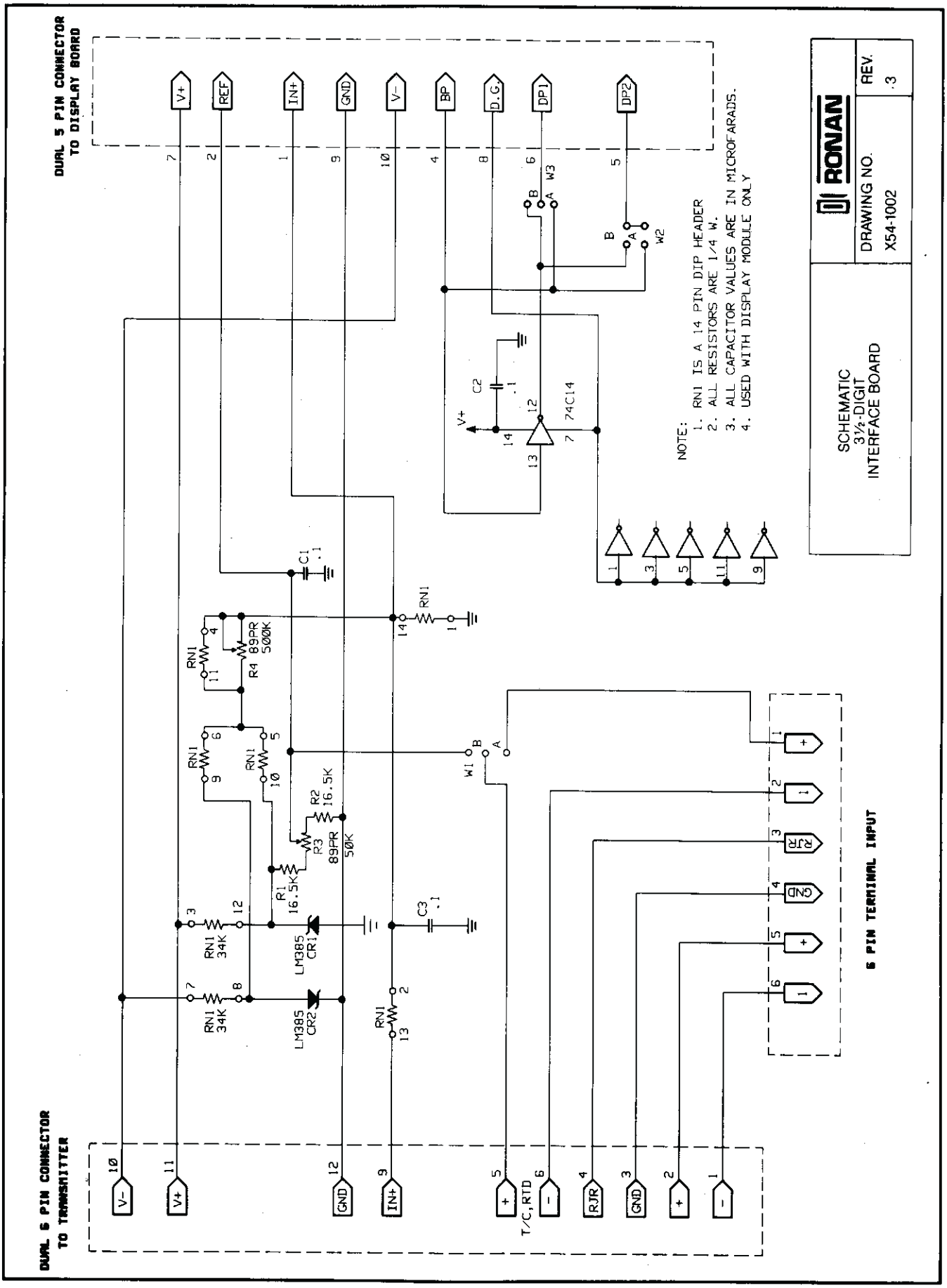
MECHANICAL AND ELECTRONIC ASSEMBLY
X54 SERIES

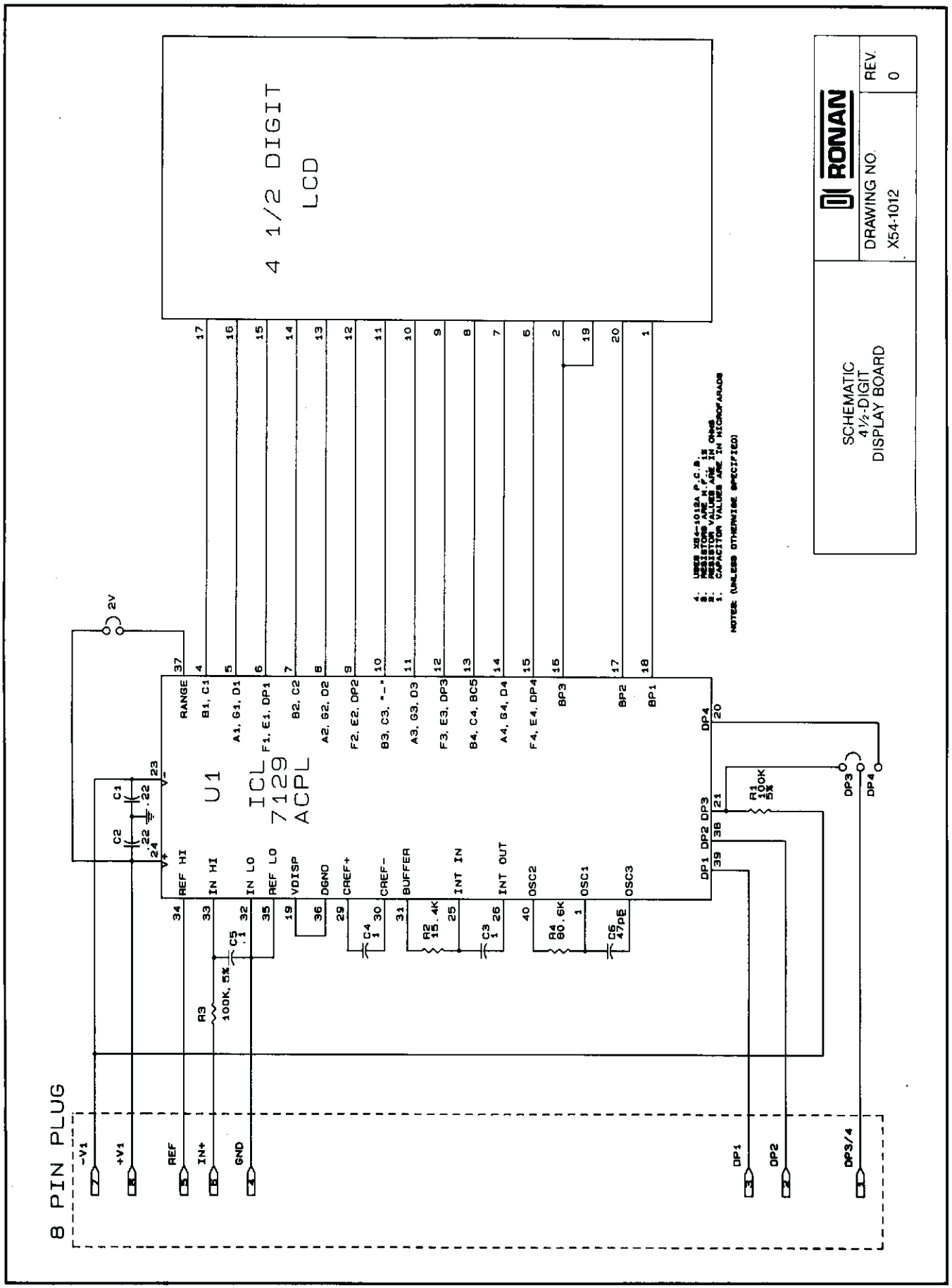
RONAN

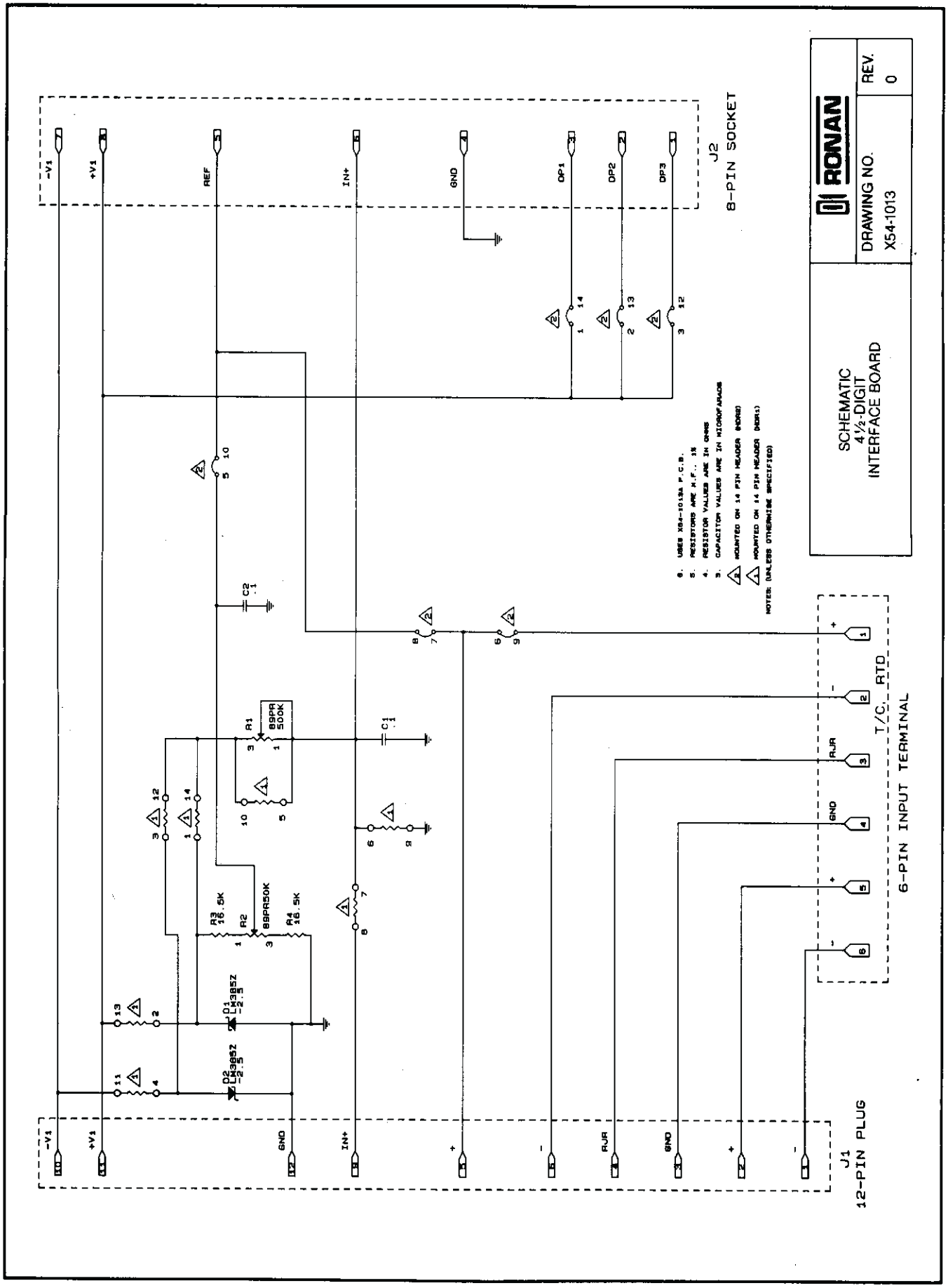
DRAWING NO.	REV.
X54D23	5

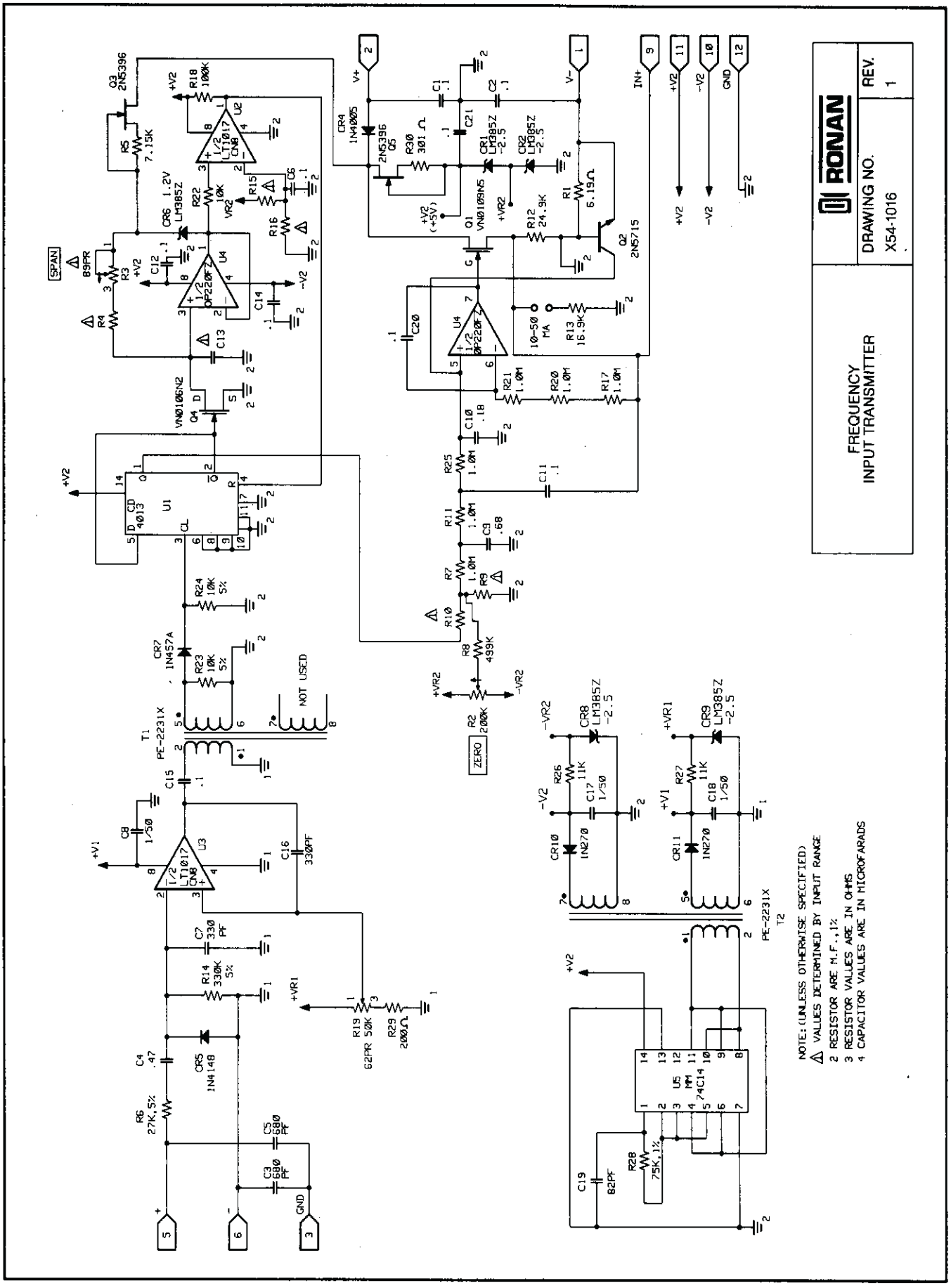


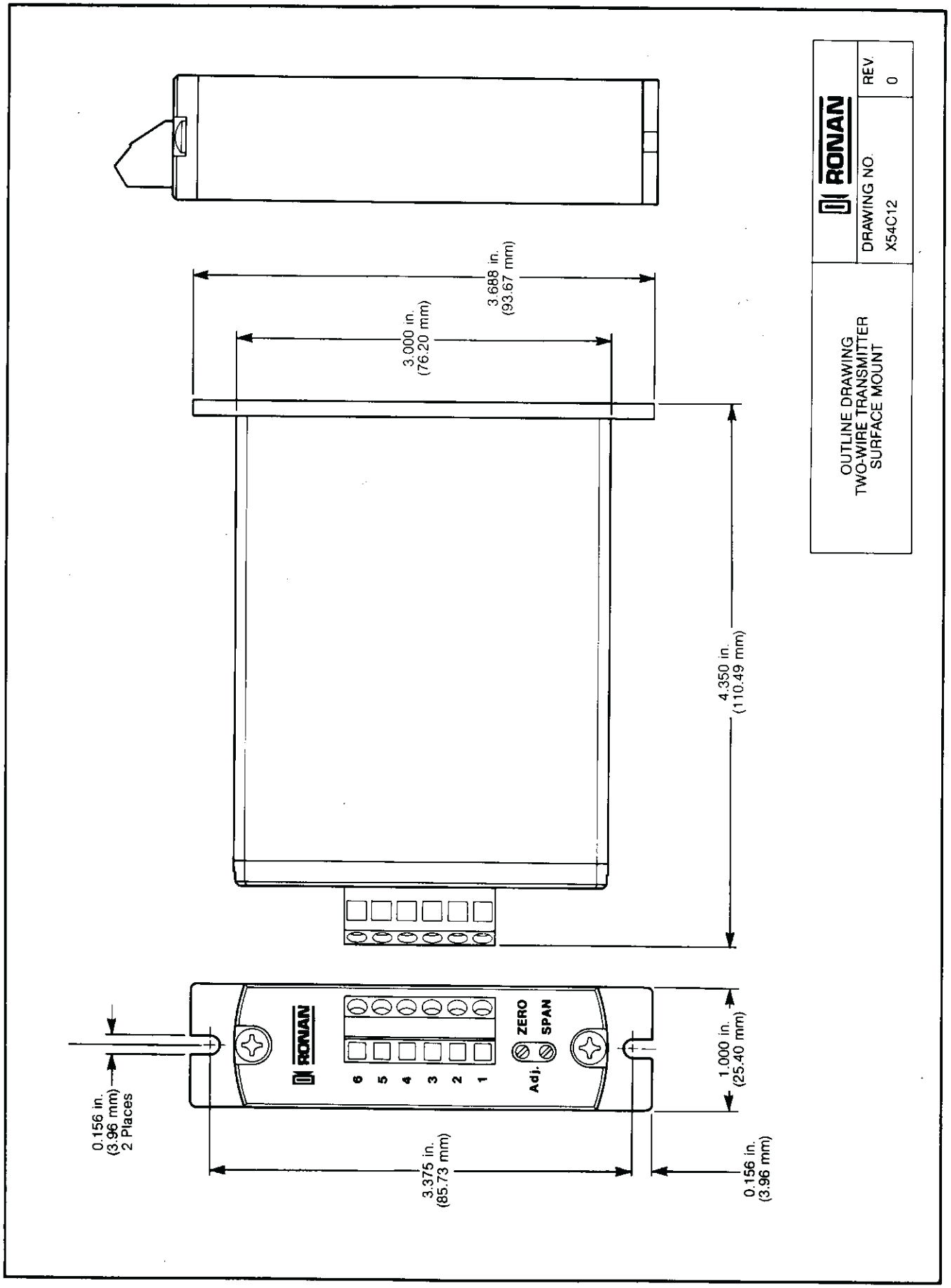
SCHEMATIC 3½-DIGIT DISPLAY BOARD	RONAN	
	DRAWING NO.	REV.
	X54-1001	3

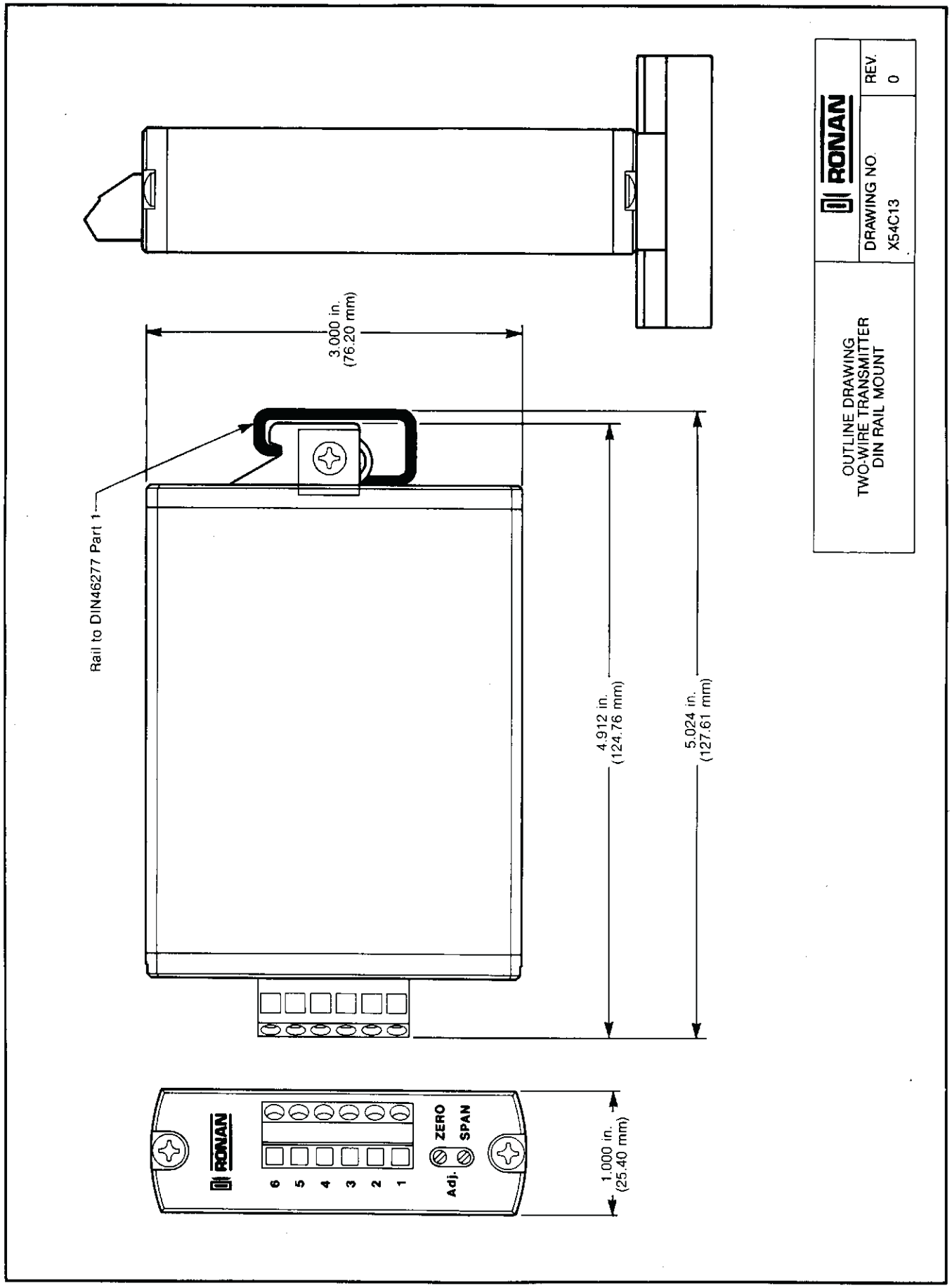

DUAL 5 PIN CONNECTOR
TO DISPLAY BOARD
V+
REF
IN+
GND
V-
BP
D.G
DP1
DP2
W3
W2
C2
.1
74C14
NOTE:
1. RN1 IS A 14 PIN DIP HEADER
2. ALL RESISTORS ARE 1/4 W.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. USED WITH DISPLAY MODULE ONLY
RONAN
DRAWING NO.
X54-1002
REV.
3
SCHEMATIC
3½-DIGIT
INTERFACE BOARD
C1
.1
RN1
R4 89PR 500K
R2 16.5K
R3 89PR 50K
R1 16.5K
C3
.1
RN1 34K
LM385
CR1
RN1 34K
LM385
CR2
W1
DUAL 6 PIN CONNECTOR
TO TRANSMITTER
V-
V+
GND
IN+
T/C,RTD
RJR
GND
6 PIN TERMINAL INPUT


4 1/2 DIGIT
LCD
U1
ICL
7129
ACPL
SCHEMATIC
4½-DIGIT
DISPLAY BOARD
RONAN
DRAWING NO.
X54-1012
REV.
0
8 PIN PLUG
-V1
+V1
REF
IN+
GND
DP1
DP2
DP3/4
2V
R1
100K
5%
R2
15.4K
R3
100K, 5%
R4
80.6K
C1
.22
C2
.22
C3
1
C4
1
C5
.1
C6
47pF
RANGE
REF HI
IN HI
IN LO
REF LO
VDISP
DGND
CREF+
CREF-
BUFFER
INT IN
INT OUT
OSC2
OSC1
OSC3
DP1
DP2
DP3
DP4
BP3
BP2
BP1
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. CAPACITOR VALUES ARE IN MICROFARADS
2. RESISTOR VALUES ARE IN OHMS
3. ALL P.C.B.
4. USED X54-1012A P.C.B.

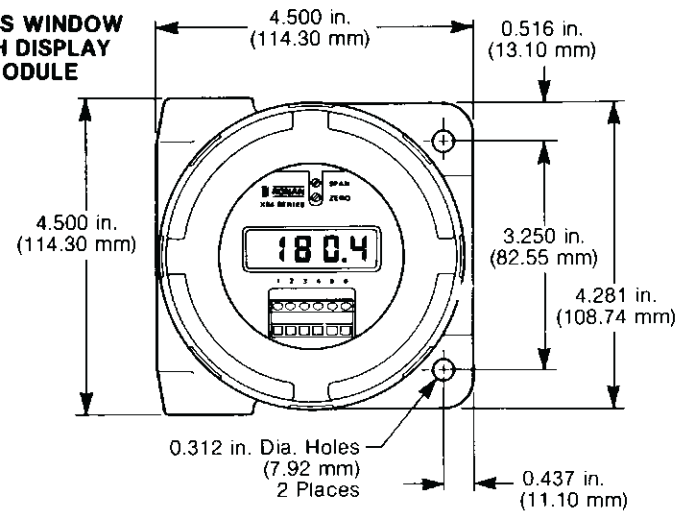

SCHEMATIC
4½-DIGIT
INTERFACE BOARD
RONAN
DRAWING NO.
X54-1013
REV.
0
J2
8-PIN SOCKET
J1
12-PIN PLUG
6-PIN INPUT TERMINAL
T/C, RTD
-V1
+V1
REF
IN+
GND
DP1
DP2
DP3
AJR
C1
.1
C2
.1
R1
R2
R3
16.5K
R4
16.5K
D1
D2
NOTES: (UNLESS OTHERWISE SPECIFIED)


FREQUENCY
INPUT TRANSMITTER
RONAN
DRAWING NO.
X54-1016
REV.
1
NOTE: (UNLESS OTHERWISE SPECIFIED)
△ VALUES DETERMINED BY INPUT RANGE
2 RESISTOR ARE M.F., 1%
3 RESISTOR VALUES ARE IN OHMS
4 CAPACITOR VALUES ARE IN MICROFARADS

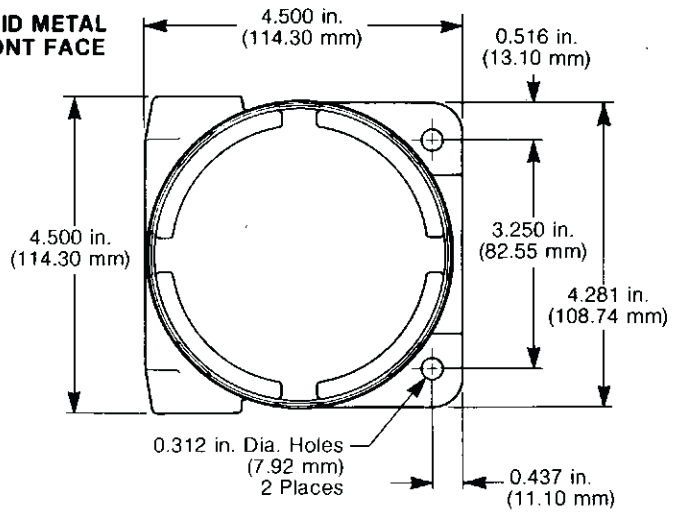

RONAN
DRAWING NO.
X54C12
REV.
0
OUTLINE DRAWING
TWO-WIRE TRANSMITTER
SURFACE MOUNT
3.688 in.
(93.67 mm)
3.000 in.
(76.20 mm)
4.350 in.
(110.49 mm)
RONAN
6
5
4
3
2
1
ZERO
SPAN
Adj.
0.156 in.
(3.96 mm)
2 Places
1.000 in.
(25.40 mm)
3.375 in.
(85.73 mm)
0.156 in.
(3.96 mm)


RONAN
DRAWING NO.
X54C13
REV.
0
OUTLINE DRAWING
TWO-WIRE TRANSMITTER
DIN RAIL MOUNT
3.000 in.
(76.20 mm)
Rail to DIN46277 Part 1
4.912 in.
(124.76 mm)
5.024 in.
(127.61 mm)
RONAN
6 5 4 3 2 1
ZERO
SPAN
Adj.
1.000 in.
(25.40 mm)

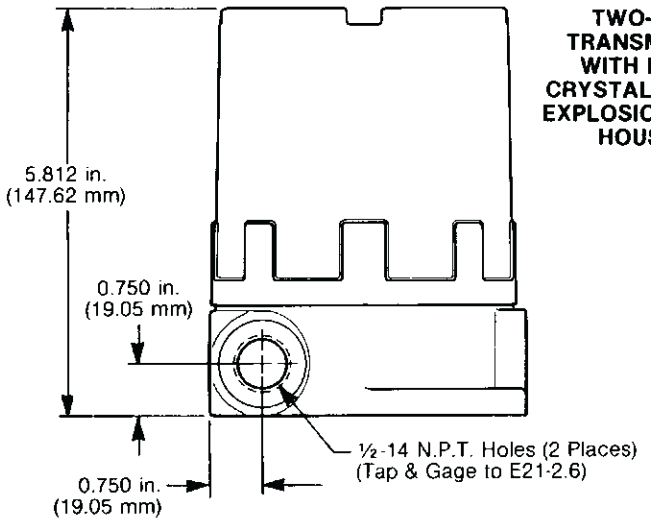
GLASS WINDOW WITH DISPLAY MODULE



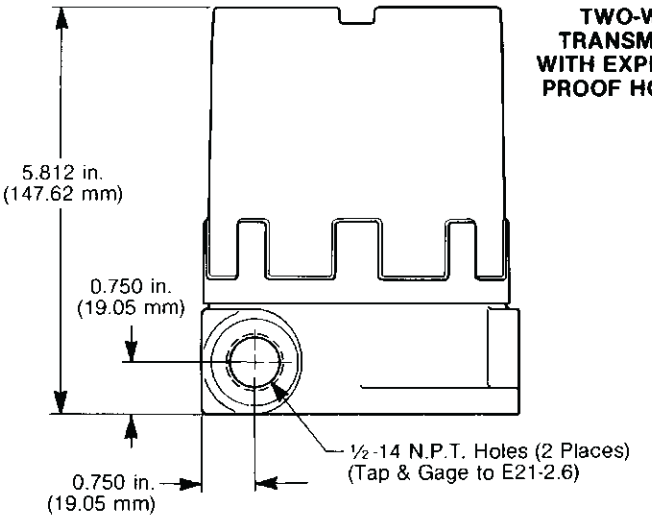
SOLID METAL FRONT FACE



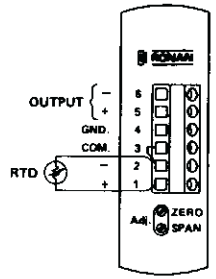
TWO-WIRE TRANSMITTER WITH LIQUID CRYSTAL DISPLAY EXPLOSION-PROOF HOUSING



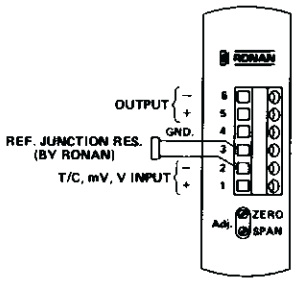
TWO-WIRE TRANSMITTER WITH EXPLOSION-PROOF HOUSING



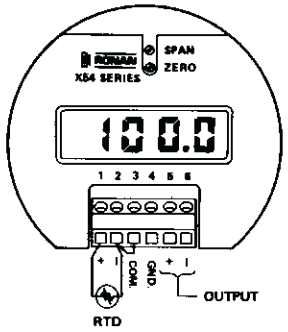
OUTLINE DRAWING EXPLOSION-PROOF HOUSING	RONAN	
	DRAWING NO. X54C14/X54C15	REV. 0/0



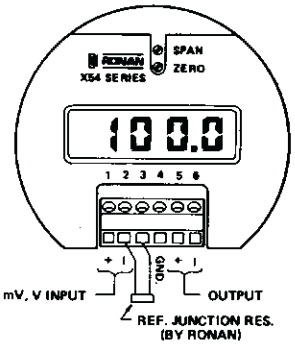
2 WIRE RTD INPUT
mA OUTPUT



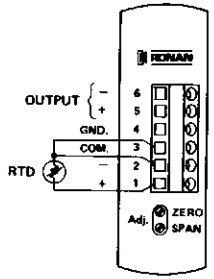
THERMOCOUPLE, mV, V INPUT
mA OUTPUT



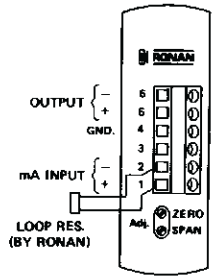
2 WIRE RTD INPUT, mA OUTPUT
WITH DISPLAY



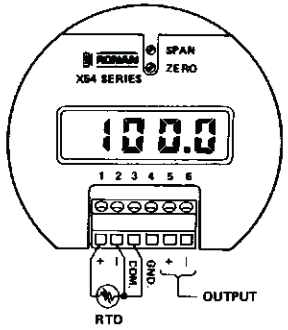
THERMOCOUPLE, mV, V INPUT, mA OUTPUT
WITH DISPLAY



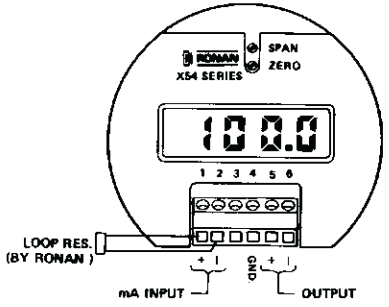
3 WIRE RTD INPUT
mA OUTPUT



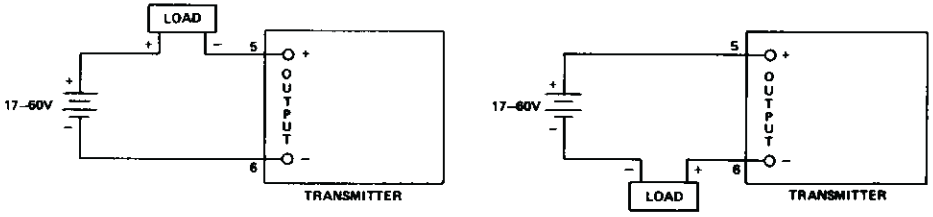
mA INPUT
mA OUTPUT



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. 1

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