Instructions
and
Operating Manual

SERIES X54-201L/SR

LOOP-POWERED INDICATOR

RONAN

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Warranty

Ronan warrants equipment of its own manufacture to be free from defects in material and workmanship under normal conditions of use and service, and will repair or replace any component found to be defective, on its return, transportation charges prepaid, within one year of its original purchase. This warranty carries no liability, either expressed or implied, beyond our obligation to replace the unit which carries the warranty.

1.0 GENERAL DESCRIPTION

Ronan's Models X54-201L and -201SR are 3½-digit loop powered indicators which display linear (-201L) and square root (-201SR) values of the associated loop current. The loop containing one of these indicators is barely effected as the indicators require less than 1 V to operate. These versatile modules allow the selection of a linear or square root display, zero value, span and decimal point through the placement of plug-in jumpers. Spans from 0.100 to 1999 and span zeros from –360 to +1300 are selected by the plug-in jumpers. The decimal point selector plug may be placed in any one of four positions which selects one, two or three digits to the right of the decimal point or in position 0 for no decimal point.

2.0 SPECIFICATIONS

Note: Specifications apply at 25ºC ± 2ºC unless otherwise stated. Specifications subject to change without notice.

Input: 4-20 mA.

Input Protection: Diode and fuse protected against current overloads or reverse polarity.

Voltage Drop: Less than 1 V.

Span Selection: Spans from 0.100 to 1999 digits are selected by DIP-switch settings accessible at the top board of the module. Refer to Table 3-1 on page 3.

Span Adjustment: Front-accessible, multi-turn potentiometer allows ± 20% adjustment of all ranges.

Zero-offset Selection: Offsets from –360 to +1300 digits are selected by DIP-switch settings accessible at the top board of the module. Refer to Table 3-2 on page 3.

Zero Adjust: Front accessible, multi-turn potentiometer allows ± 10% adjustment of selected span range.

Decimal Point Selection: Plug-in jumpers, accessible at the top board of the module, allow selection of the decimal point position. See section 3.5.

Accuracy:
Linear Display: ± 0.1% of span or ±1 digit.
Square Root Display: ± 0.3% of span or ± 1 digit (applies from 4.3 to 20 mA input).

Operating Ambient Temperature Range: –10º to +55ºC.

Temperature Coefficient:
Zero: ± 0.01% of Span/ºC, ± 0.01% of elevated zero value/ºC.
Span: ± 0.015% of Span/ºC.

Display: 3½-digit LCD, black digits on a reflective background.

Terminals: Compression type for wire size up to #14 AWG.

X54-201 Approvals (_PM2 and _EXP2)

Factory Mutual Approvals		
-EXP2 Housing	= Explosion Proof	-Class I-III, Div. 1, Grps B-G and NEMA 4
	= Intrinsic Safe	-Class I-III, Div, Div. 1, Grps A-G and NEMA 4
-PM2 Housing	= Div. 2 Applications	-Class I, Div. 2, Grps A-D
	= Intrinsic Safe	-Class I, Div.1, Grps A-D
CSA Approvals		
-EXP2 Housing	= Explosion Proof	-Class I-II, Div. 1, Grps B-G
	= Intrinsic Safe	-Class I-II, Div. 1, Grps A-G
	= Div. 2 Applications	-Class I-II, Div. 2, Grps A-G
-PM2 Housing	= Div. 2 Applications	-Class I, Div. 2, Grps A-D
	= Intrinsic Safe	-Class I-II, Div. 1, Grps A-G
CENELEC Approvals		
X54-201-MI (EXP housing)		
	Intrinsic Safe	-EEx ia IIC T4 (Tamb = 85°C)
		-EEx ia IIC T5
X54-201-MX (EXP Housing)		
	Flame Proof	-EEx d IIC T6

3.0 OPERATION

3.1 General

Model X54-201 is put into service by connecting it in series with 4-20 mA current loop. The connections are made to the two-position compression-type screw terminal mounted on the lower board and accessible from the top of the module. The loop indicator module needs to be removed from the enclosure in order to feed the wires past the bottom board and into the screw terminals. To remove the module from the explosion-proof enclosure:

A. Unscrew and remove the enclosure cap.
B. Snap off the top plate of the module and insert your index finger into cutout and remove the plate.
C. Loosen the two module captive mounting screws until the module is free.
D. Remove the module from the enclosure and fasten the input wiring to the screw terminals.
E. Connect the lead that returns back to the – output of the power supply, either directly or through a two wire transmitter, to the – terminal of the X54-201. Connect the other wire to the + terminal. See Figure 3-1.
F. Re-install the module and enclosure cap.

The Model X54-201 Loop Powered Indicator is normally shipped calibrated to ranges as specified by the purchaser. However, it is designed to allow easy reconfiguration in the field. The span is changed by changing the position of one or two of the SW1 switches -1 through -5. The span zero value is changed by changing the settings of SW2 switches -1 through -6 and SW1-6.

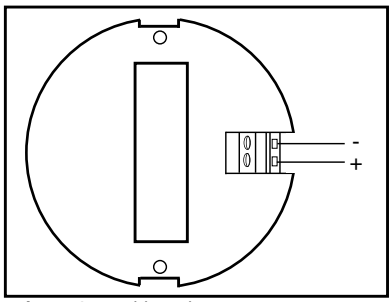


Figure 3-1: Wiring Diagram

3.2 Span Selection

Refer to Table 3-1 to obtain the spans shown in the left column which indicates the positions of SW1-1 through SW1-5. For example, a span of 2.00, 20.0 or 200, SW1-2 and -5 are set to the ON position and SW1-1, -3 and -4 are OFF.

3.3 Zero Selection

Table 3-2 indicates which positions of SW2-1 through SW2-6 and S1-6 are set to ON to obtain the zero offset, in digits, indicated in the columns directly below the switch. The indicated offsets are additive, i.e., two or more of the switches may be set to their ON position to obtain the sum of their indicated offsets. The display span is located in the left column, then the offset digits are found in the same row as the display range. When the desired offset digits are found, the switch or switches, at the head of the column(s) should be set to the ON position.

When changing spans or offsets, the zero and span controls will need to be fine tuned to obtain the specified accuracy. See Section 4.0 Calibration, for a procedure to adjust the zero and span controls.

3.4 Decimal Point Selection

The decimal point position is selected by the position of the DP-jumper plug located at the lower left edge of the display board. The jumper plug can be placed in any one of the following four positions: 0, 1, 2 or 3, and corresponds to (0) no decimal point, (1) one digit to the right of the decimal point, (2) two digits to the right of the decimal point, or (3) three digits to the right of the decimal point.

Display Spans Digits ± 20%	**Selection of Span Switches, SW 1**				
	SW1-1	**SW1-2**	**SW1-3**	**SW1-4**	**SW1-5**
1.00, 10.0, 100	Off	Off	Off	On	On
1.40, 14.0, 140	Off	Off	On	Off	On
2.00, 20.0, 200	Off	On	Off	Off	On
3.00, 30.0, 300	On	Off	Off	Off	On
4.00, 40.0, 400	Off	Off	Off	Off	On
5.00, 50.0, 500	Off	Off	Off	On	Off
7.00, 70.0, 700	Off	Off	On	Off	Off
10.00, 100.0, 1000	Off	On	Off	Off	Off
15.00, 150.0, 1500	On	Off	Off	Off	Off
19.99, 199.9, 1999	Off	Off	Off	Off	Off

Table 3-1: Selection of Span Switches, SW1

Display Spans Digits ± 20%	**Digits Offset Vs Offset Switches, SW2 and SW1-6**							Max. Offset
	SW2-1	SW2-2	SW2-3	SW2-4	SW2-5	SW2-6	SW1-6	
1.00, 10.0, 100	5	10	20	40	80	160	–60	200 *120
1.40, 14.0, 140	7	14	28	56	110	220	–90	275 *160
2.00, 20.0, 200	10	20	40	80	160	320	–125	400 *240
3.00, 30.0, 300	15	30	60	120	240	480	–190	600 *360
4.00, 40.0, 400	20	40	80	160	300	600	–230	760 *460
5.00, 50.0, 500	25	50	100	200	400	800	–100	1000 *600
7.00, 70.0, 700	35	70	140	280	560	1120	–140	1300 *1300
10.00, 100.0, 1000	50	100	200	400	800	N/A	–200	1000 *1000
15.00, 150.0, 1500	75	150	300	600	N/A	N/A	–300	500 *500
19.99, 199.9, 1999	N/A	N/A	N/A	N/A	N/A	N/A	–360	N/A

* Equals Square Root Mode.
Note: Offset of 2 or more switches may be combined.

Table 3-2: Digits Offset.

3.5 Linear or Square Root Function Selection

Model X54-201L provides a display which is a linear representation of the input, and Model X54-201SR provides a display which is the square root function of the input. The square root display versus the input current can be found as follows:

$$\text{DISPLAY} = \sqrt{(\text{mA} - 4\ \text{mA}) \div 16\ \text{mA}} \times \text{Display Range} + \text{Display Zero};$$

Or,

$$\text{DISPLAY} = 0.25\ \sqrt{\text{mA Input} - 4} \times \text{Display Range} + \text{Display Zero}.$$

In order to change the X54-201's function from linear to square root, or vice versa, the module must be removed from its enclosure as the function jumper plugs are located on the bottom board. The jumpers are located at JP1 and JP2

	JP1 Position Jumpered	JP2 Position Jumpered
Linear	1,2	1,3
Square Root	Not used	1,2,3,4

Table 3-3: JP1 and JP2 plug positions for selection of linear or square root function.

near the right center section of the bottom P.C. Board. Table 3-3 shows the location of the jumper plugs for linear or square root operation.

4.0 CALIBRATION

The Models X54-201L and -201SR can be readily calibrated with the use of an accurate calibrator like Ronan's Models X85 or X86 (Figure 4-1). Alternately, a stable power supply in series with an accurate milliammeter and current setting resistor may be utilized (Figure 4-2). When using the circuit of Figure 4-2, ensure that the current limiting resistor is large enough to limit the loop current to less than 50 mA to avoid blowing the protective fuse before turning on the power supply.

4.1 Linear Display, Model X54–201L

A. Set the calibrator to its mA output range and 4.00 mA, or set the current using the circuit of Figure 2 to 4.00 mA.

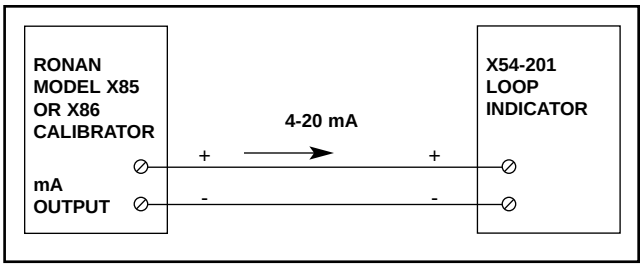


Figure: 4-1: Calibrator used to provide 4-20 mA.

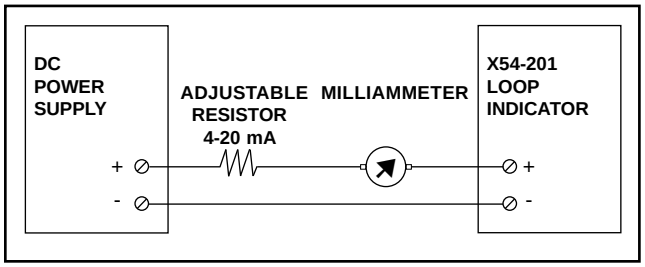


Figure: 4-2: Calibrator circuit using dc power supply.

B. Adjust the zero control for the correct span zero display.

C. Repeat Step A using 20.00 mA.

D. Adjust the span control for the correct span full scale display.

E. Repeat Steps A through D until the controls no longer need adjustment.

4.2 Square Root Display, Model X54–201SR

A. Set the calibrator to its mA output range and 4.3 mA, or set the current using the circuit of Figure 4-2 to 4.3 mA.

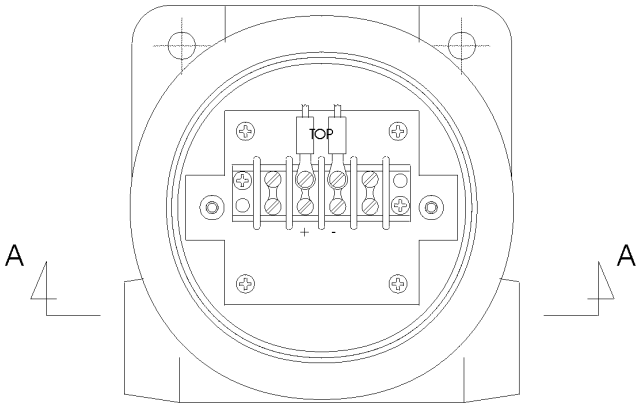
B. Adjust the zero control for the correct display:

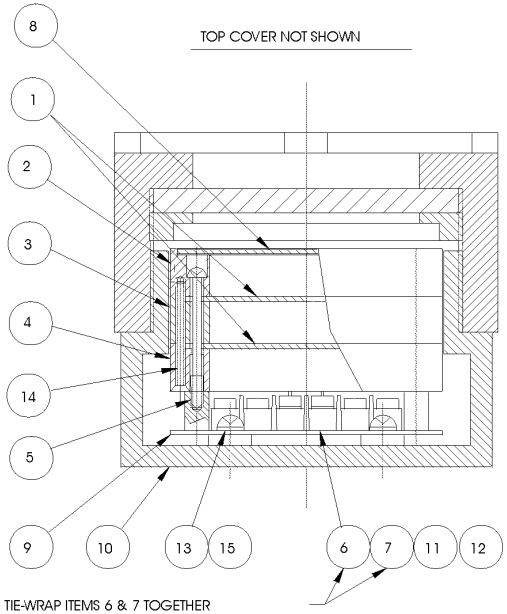
DISPLAY = .137 x Display Span + Span Zero

C. Repeat Step A using 20.00 mA

D. Adjust the span control for the correct span full scale display.

E. Repeat Steps A through D until the controls no longer need adjustment.



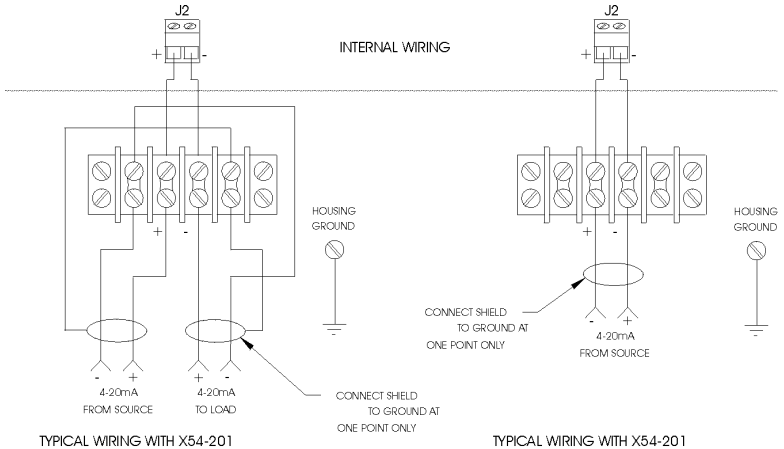


TOP COVER NOT SHOWN

TIE-WRAP ITEMS 6 & 7 TOGETHER
AT BOTH ENDS & MIDDLE

SECTION A-A

NOTES:
1. FOR SCHEMATIC SEE X54-1026.
2. FOR INSTALLATION SEE X54C222.
3 PACKAGE DECAL SET IN BOX WITH UNIT.



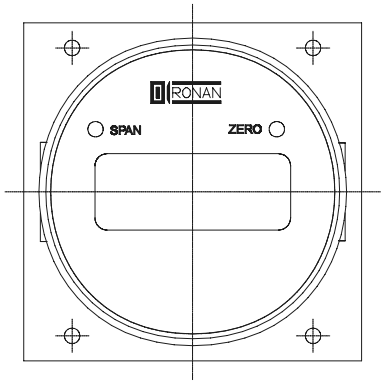
CUSTOMER FIELD WIRING

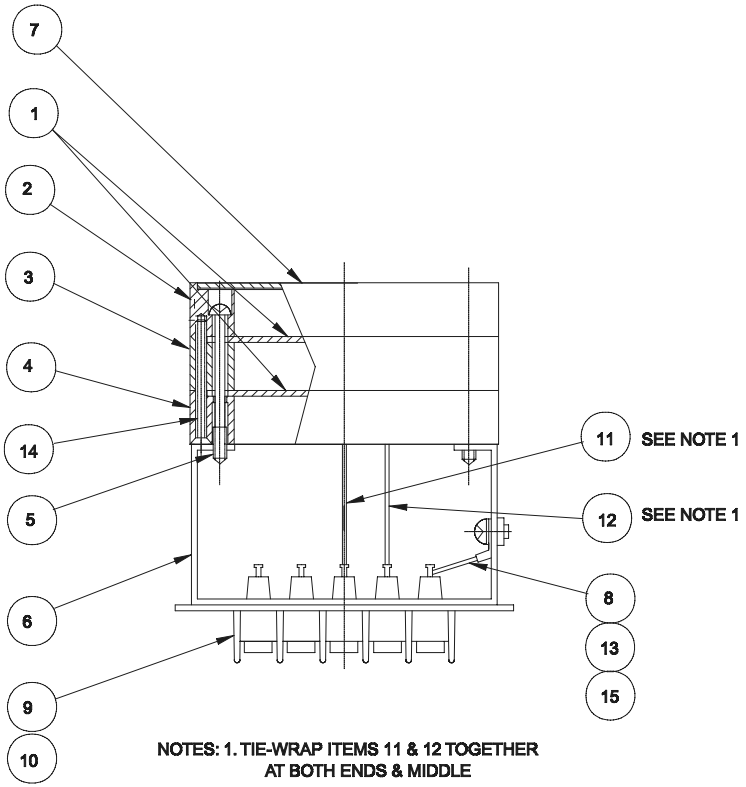
Item No.	Qty.	Code/Part No.	Description	Spec.
1	1	X54-201L, -201SR	PCB X54-1026 & X54-1027 Assy.	RONAN
2	1	X54B156	MTG. RING, TOP	RONAN
3	1	X54B157	MTG. RING, MIDDLE	RONAN
4	1	X54B158	MTG. RING, BOTTOM	RONAN
5	2	X54B159	CAPTIVE SCREW	RONAN
6	1	X54B165-1	WIRE ASSY.	RONAN
7	1	X54B165-2	WIRE ASSY.	RONAN
8	1	X54B86-1	FRONT PLATE	RONAN
9	1	X54B88	BASE PLATE	RONAN
10	1	XIHFGCX2LS42311	E.P. HOUSING	ADALET
11	1	600-4	TERMINAL BLOCK	KULKA
12	2		6-32 X 0.375 PH PAN HD MS	
13	4		8-32 X 0.250 PH PAN HD MS	
14	2		4-40 X 1.250 PH FLAT HD MS	
15	4		#8 INTER TOOTH LKWR	
16	1	X54B229	DECAL SET	

X54-201
Exp. Proof Assy.

RONAN

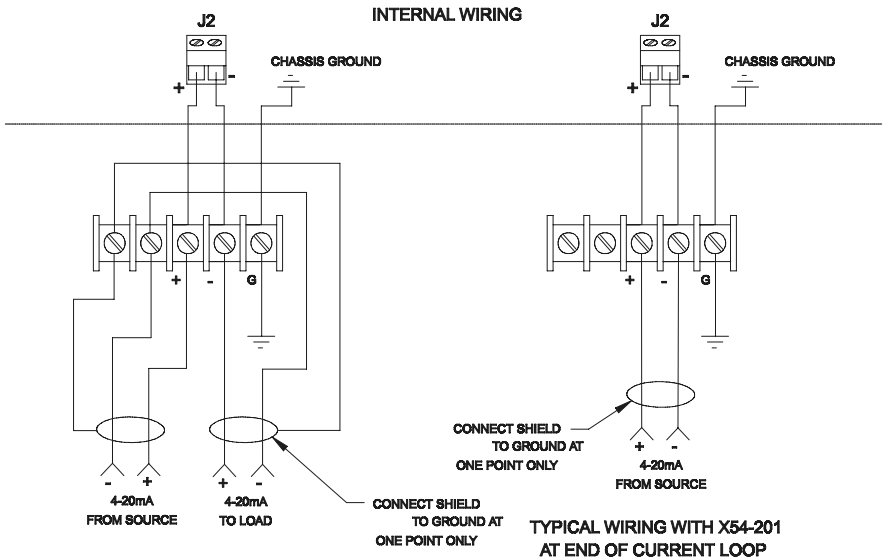
DRAWING NUMBER	REV
X54C92	8





NOTES: 1. TIE-WRAP ITEMS 11 & 12 TOGETHER AT BOTH ENDS & MIDDLE

INTERNAL WIRING



TYPICAL WIRING WITH X54-201 BETWEEN SOURCE AND LOAD

TYPICAL WIRING WITH X54-201 AT END OF CURRENT LOOP

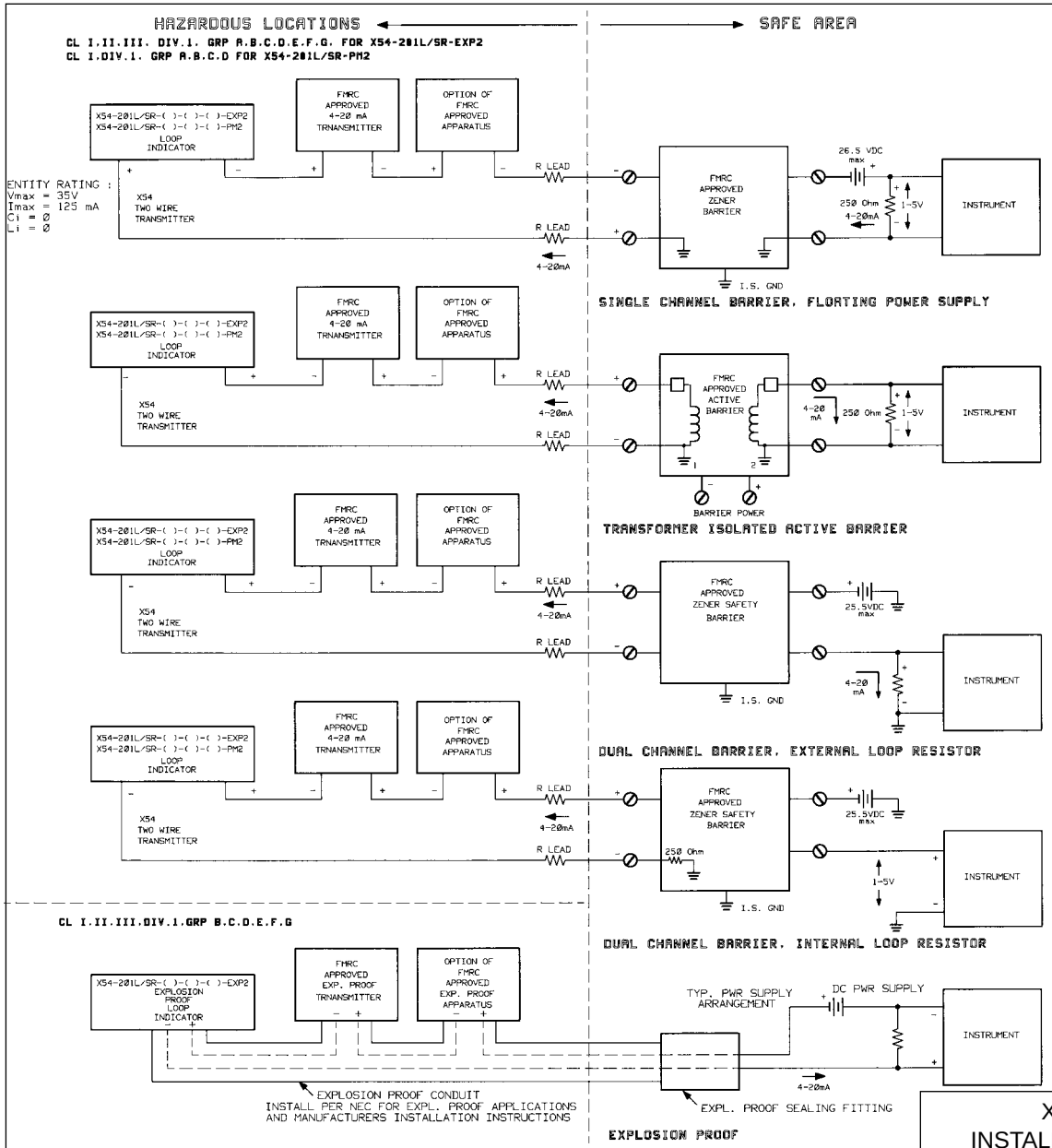
CUSTOMER FIELD WIRING

Item No.	Qty.	Code/Part No.	Description	Spec.
1	1	X54-201L, -201SR	PCB X54-1026 & X54-1027 Assy.	RONAN
2	1	X54B156	MTG. RING, TOP	RONAN
3	1	X54B157	MTG. RING, MIDDLE	RONAN
4	1	X54B158	MTG. RING, BOTTOM	RONAN
5	2	X54B159	CAPTIVE SCREW	RONAN
6	1	X54C119	TERMINAL PLATE	RONAN
7	1	X54B86	FRONT PLATE	RONAN
8	1	X54B165-3	WIRE ASSY.	RONAN
9	1	GFTCX-5	TERMINAL BLOCK	CURTIS
10	2		TINNERMAN NUT	CURTIS
11	1		20 AWG 6.00 IN. LG. RED UL1429 WIRE	
12	1		22 AWG 6.00 IN. LG. BLK UL1429 WIRE	
13	1		6-32 X 0.250 PH PAN HD MS	
14	2		4-40 X 1.250 PH FLAT HD MS	
15	1		#6 INTER TOOTH LKWR	

X54-201
PANEL MOUNT ASSY.

RONAN

DRAWING NUMBER	REV
X54C112	5



NOTES:

1. Subject loops must be connected in accordance with ANSI/ISA RP12.6
2. Barrier parameters must meet the following requirements:

   CAUTION: THESE REQUIREMENTS MUST BE FOLLOWED FOR NEW INSTALLATIONS OR MODIFICATIONS TO EXISTING INSTALLATIONS.

   Vt or Voc ≤ The lowest Vmax of the three FMRC Approved apparatus installed in the loop, and greater than 4.5 VDC

   It OR Ioc ≤ The lowest Imax of the three FMRC Approved apparatus installed in the loop.

   La > The sum of the cable inductance and the internal inductance Li of each FMRC Approved apparatus installed in the loop.

   Ca > The sum of the cable capacitance and the internal capacitance Ci of each FMRC Approved apparatus installed in the loop.
3. Maximum safe area voltage should not exceed 250 Vrms.
4. De-energize supply power before disconnecting loop apparatus.
5. Vmax and Imax values do not apply in explosion proof installation.
6. For Class II and III applications, model X54-201L/SR-EXP2 housing must be installed with Approved seal.
7. For Division 2 installations, connection of the X54-201 l/SR in the panel mount or EXP. PROOF ENCLOSURES does not require a safety barrier when installed per the national electrical code and when connected in a loop whose voltage source cannot exceed 35 Vdc.

X54-201L/SR INSTALLATION DRAWING USING I.S. BARRIERS OR EXPL. PROOF CONDUIT	RONAN	
	DRAWING NUMBER X54D105	REV 6

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