INSTRUCTION MANUAL

FOR

MODEL 158A

LEVEL-TEL

We do our level best



Probe, Cable and Conduit Outlet Box
shown for illustration only.
Must be ordered separately.

Robertshaw INDUSTRIAL CONTROLS
Industrial Products
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INSTRUCTION MANUAL NUMBER

909GF197C

P-2410

Revision History

Revision C

1. **SECTION II, Paragraph 2.1 ENVIRONMENTAL** – Ambient Temperature Limits were -40ºF to +160 ºF.

2. **SECTION IV, CALIBRATION** – This entire section was revised to clarify the calibration procedures. The requirement for a 30 minute warm-up prior to calibration was added.

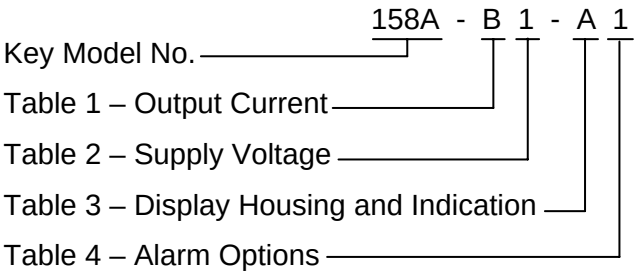
Section I – DESCRIPTION

1.1 GENERAL

The Robertshaw Model 158A Level-Tel is a capacitance operated DC current transmitter with noninteracting and independent zero and span adjustments internally located. The transmitter is remotely mounted from the probe with a triax cable interconnected between the probe and the transmitter.

1.2 MODEL IDENTIFICATION

Identify instrument models in accordance with the descriptions and variations listed in each table.



KEY MODEL NO.

Model No.	Description
158A	Capacitance-to-current transmitter system for remotely mounted probe assemblies. Control Unit is available with or without indication and optional alarms.

Table 1 – OUTPUT CURRENT

Desig.	Description
A	1-5 mADC
B	4-20 mADC
C	10-50 mADC
D	0-10 mADC

Table 2 – SUPPLY VOLTAGE

Desig.	Description
1	26.5 VDC, ± 10%
2	120 VAC, ± 10%, 50/60 Hz
3	240 VAC, ± 10%, 50/60 Hz

Table 3 – DISPLAY HOUSING AND INDICATION

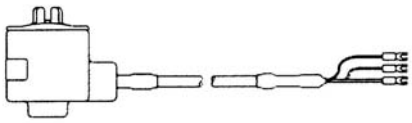
Desig.	Description
A	Water tight enclosure without indicator. Meets NEMA Type 4 and CSA Enclosure 5.
B	Water tight housing with indicator. Meets NEMA Type 4 and CSA Enclosure 5.
C	Explosion proof housing without indicator. For Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F and G, areas.
D	Explosion proof housing with indicator. For Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F and G, areas.
E	Large weatherproof enclosure with indicator to be used with optional alarms. Meets NEMA Type 12 & 13 and CSA Encl 3.

Table 4 – ALARM OPTIONS

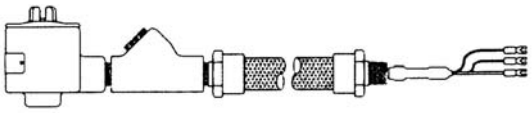
Desig.	Description
1	None
2	∗Alarm Relays for High or Low Alarm.
3	∗Alarm Relays for High and Low Alarms.

∗ May only be used with Designation E on Table 3.

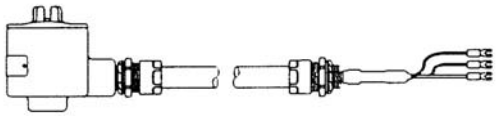
1.3 TRIAXIAL CABLE ACCESSORY ITEMS



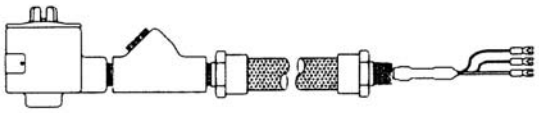
032KE03X-XX∗
GENERAL PURPOSE (polyethylene insulated) Triax Cable with probe connection conduit outlet box. (Recommended for use with customer supplied rigid or flexible conduit.) Maximum temperature 185° F.



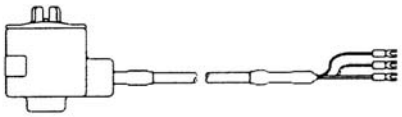
032KE090-05 (5 ft long)
032KE090-10 (10 ft long)
GENERAL PURPOSE (polyethylene insulated) Triax Cable in explosion proof flexible conduit (protective armor) with seal fitting and probe connection conduit outlet box. Maximum temperature 185° F.



032KE05X-XX∗
GENERAL PURPOSE (polyethylene insulated) Triax Cable in flexible conduit (protective armor) with probe connection conduit outlet box. Maximum temperature 185° F.

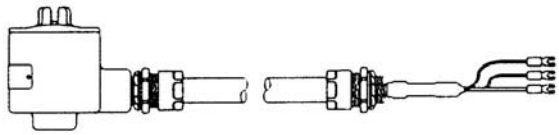


032KE100-05 (5 ft long)
032KE100-10 (10 ft long)
HIGH TEMPERATURE (Teflon insulated) Triax Cable in explosion proof flexible conduit (protective armor) with seal fitting and probe connection conduit outlet box. Maximum temperature 350° F.



032KE04X-XX∗
HIGH TEMPERATURE (Teflon insulated) Triax Cable with probe connection conduit outlet box. (Recommended for use with customer supplied rigid or flexible conduit.) Maximum temperature 350° F.

∗ Substitute length in feet for X-XX in part number.
Example: For 10 feet substitute 0-10
For 120 feet substitute 1-20
Explosion proof cables are standard in 5 and 10 foot lengths.



032KE06X-XX∗
HIGH TEMPERATURE (Teflon insulated) Triax Cable in flexible conduit (protective armor) with probe connection conduit outlet box. Maximum temperature 350° F.

Section II - SPECIFICATIONS

2.1 ENVIRONMENTAL

Ambient Temperature Limits..... 32° F to +160° F

Vibration Limits ..... ± 2 G from 10 to 200 Hz

2.2 ELECTRICAL

Supply Voltage..... 120 VAC ± 10%, 50/60 Hz
240 VAC ± 10%, 50/60 Hz
26.5 VDC ± 10%

Supply Power..... 5 watts, 7 VA max.

Terminal Capacitance Range ..... 0 to 1000 pF

Span Capacitance Range..... 10 pF plus 1 pF for each 10 feet of Triax cable up to 2000 pF

Maximum Recommended Terminal/Span Ratio 10:1

Output Signal and Load.....1-5 mADC into 0-2500 ohms
4-20 mADC into 0-700 ohms
10-50 mADC into 0-250 ohms
0-10 mADC into 0-1000 ohms

Connecting Cable Length .....150 feet max.

2.3 PERFORMANCE

Linearity ..... 0.5% max. for span less than 1000 pF
1% max. for span greater than 1000 pF

Repeatability..... ± 0.1%

Sensitivity.....0.01% minimum

Frequency Response.....-3 db at 1 Hz

Supply Variation Effect .....0.5%/10% supply

Ambient Temperature Effect:
Span .....0.01%/° F
Zero ..... 0.01%/F or 0.01 pF/F, whichever is greater

Output Signal Ripple..... 0.2% max.

Output Meter Accuracy..... ± 2%

2.4 ENCLOSURE

Water Tight ..... NEMA 4, CSA Enclosure 5, Polyurethane painted cast aluminum

Explosion Proof...Class I, Division 1, Groups C, D; Class II, Division 1, Groups E, F, G; Polyurethane painted cast aluminum

Weatherproof ..... NEMA 12, 13, CSA Enclosure 3, Polyurethane painted steel

2.5 INTRINSIC SAFETY

Models 158A – (A, B) (1, 2) – (A, B, C, D) – 1:
Probe circuit is CSA Certified intrinsically safe for Class I, Division 1, Group C & D; Class II, Division 1, Group E, F & G hazardous locations when connected as shown on drawing 907GA518 (Figure 8).

2.6 AGENCY CERTIFICATIONS

Models 158A – (A, B) (1, 2) – (A, B, C, D) – 1:
CSA Certified .....File LR 18690

Section III - INSTALLATION

3.1 GENERAL

Examine the instrument for possible shipping damages. IMPORTANT: If for any reason it is determined that parts should be returned to the factory, please notify the nearest Robertshaw sales representative prior to shipment. Each unit must be properly packaged to prevent damage. Robertshaw assumes no responsibility for equipment damaged in shipment due to improper packaging.

Choose the location in accordance with good instrument practice, avoiding extremes of temperature, humidity and vibration (see Specifications, Section II).

3.2 PROBE MOUNTING

Level-Tel probes for use with the Model 158A are purchased separately from a variety of styles and types which provide for various specific applications involving liquids or granular materials. Insulated rod-type probes are normally used for liquid solutions or liquid-interface junctions.

Since many materials have a tendency to build up on the probe over extended periods of operation, it is advisable on horizontally mounted probes to place the probe so that its lower tip is below the gland entrance. This encourages self-cleaning by permitting the material to drip from the probe. However, some materials will continue to build up and cause the Level-Tel to become insensitive or fail to operate. If such material is being used, the installation should be made so that the probe is easily removed for periodic cleaning.

The face of the gland on the rod-type probes must be installed until nearly flush with the vessel wall. DO NOT install the probe in a nozzle, recess, or open-end well, unless the probe was supplied with a factory assembled sheath as there is danger of material collecting in such a recess and causing false operation.

3.3 TRANSMITTER UNIT MOUNTING

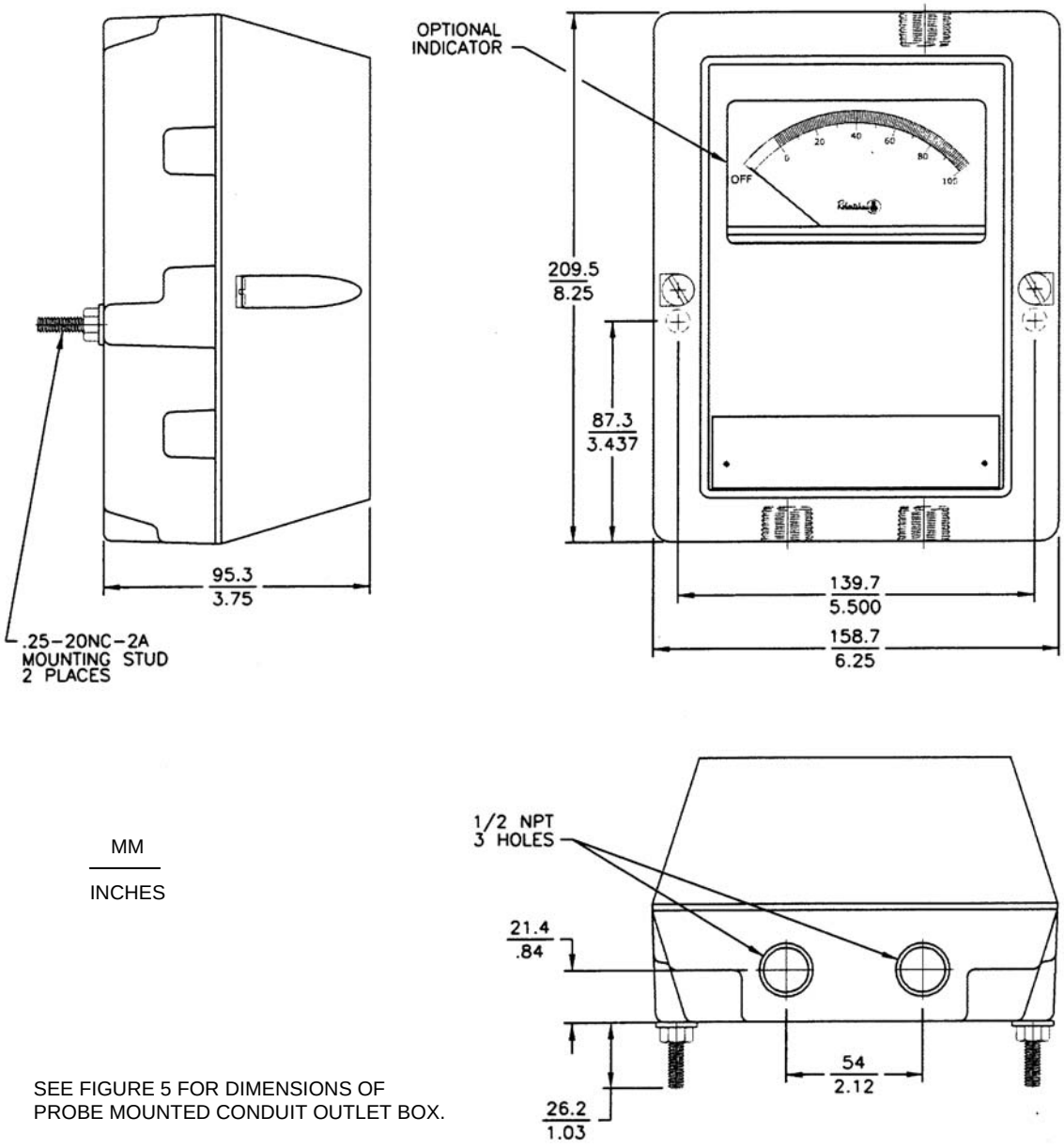
The Model 158A is designed for vertical surface mounting: e.g. wall, panel or column. Choose the mounting location to avoid extremes of ambient temperature or vibration (see Specifications, Section II).

3.4 WATER TIGHT & WEATHERPROOF TRANSMITTER MOUNTING & ELECTRICAL CONNECTIONS

See Figures 1, 3, 4, 5, 6 and 7 for the mounting dimensions and electrical connections of the Water Tight and Weatherproof Transmitters. See Figure 8 for interconnection diagram for those models certified for intrinsically safe probe installations.

3.5 EXPLOSION PROOF TRANSMITTER MOUNTING & ELECTRICAL CONNECTIONS

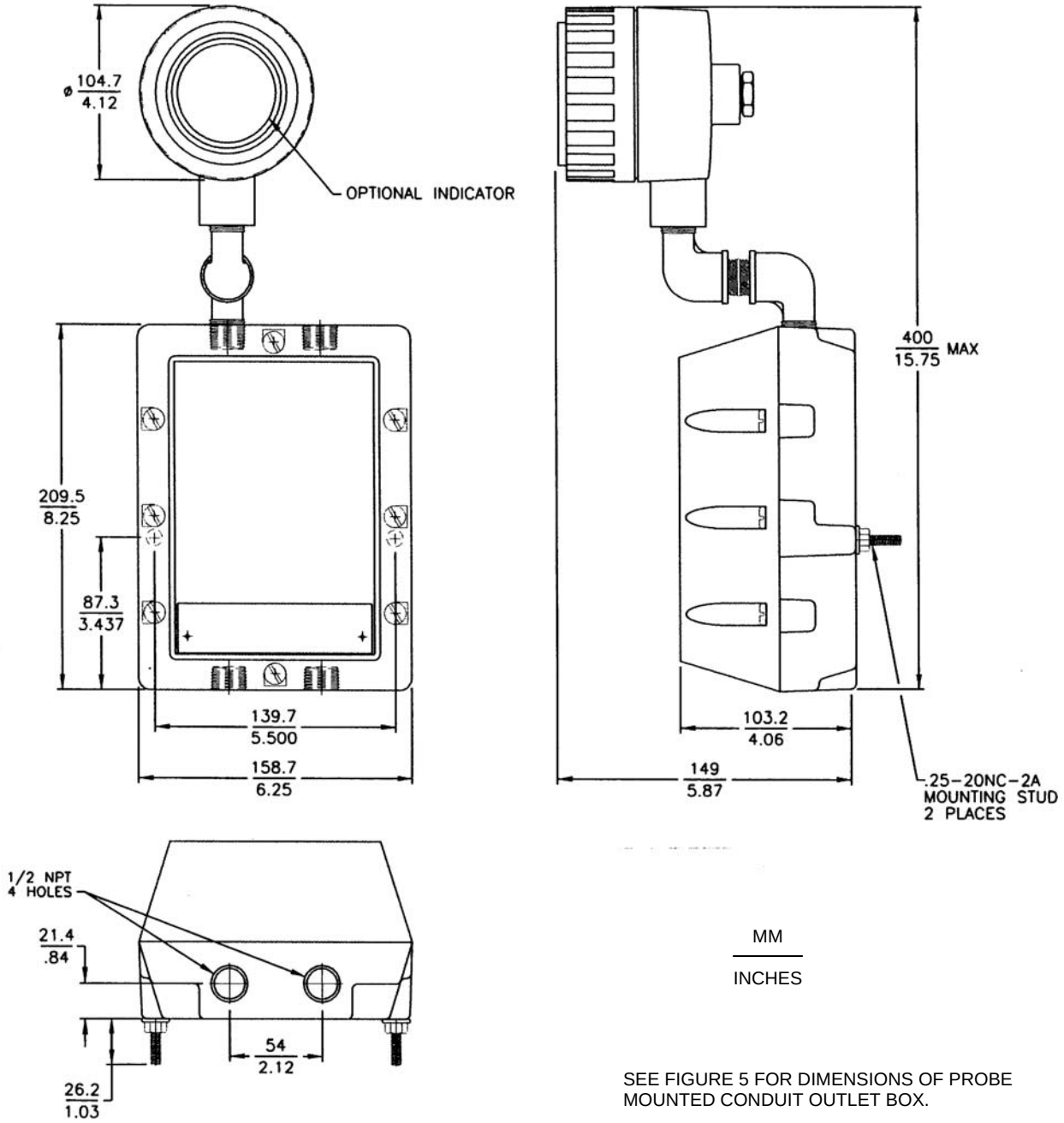
See Figures 2, 3 and 5 for the mounting dimensions and electrical connections of the Explosion Proof Transmitter. See Figure 8 for the interconnection diagram for those models certified for intrinsically safe probe installations.



SEE FIGURE 5 FOR DIMENSIONS OF PROBE MOUNTED CONDUIT OUTLET BOX.

FIGURE 1

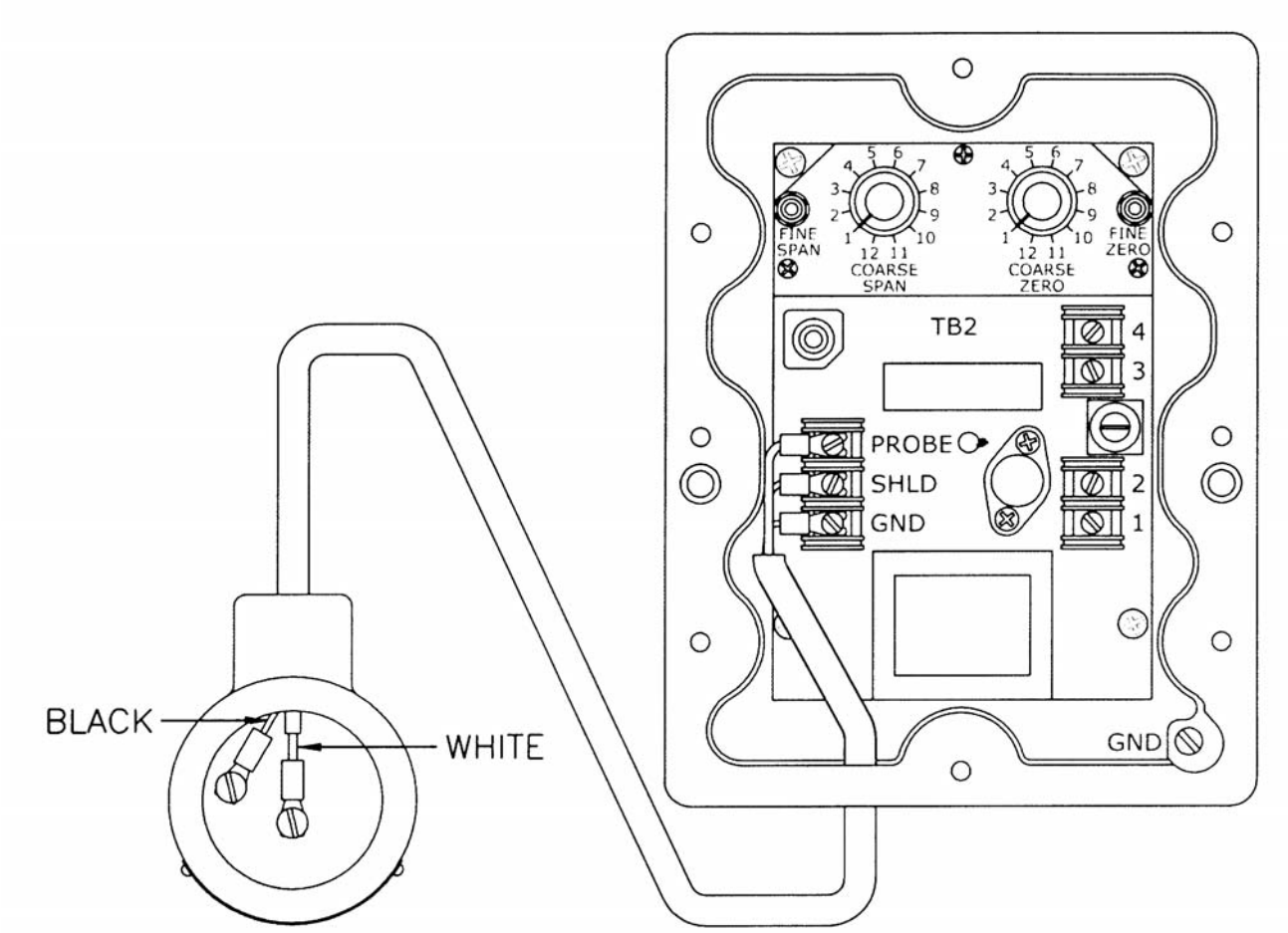
MOUNTING DIMENSIONS FOR MODEL 158A WATER TIGHT ENCLOSURE WITH AND WITHOUT INDICATOR, MODELS 158A – ( ) ( ) – A1 AND 158A – ( ) ( ) B1.



SEE FIGURE 5 FOR DIMENSIONS OF PROBE MOUNTED CONDUIT OUTLET BOX.

FIGURE 2

MOUNTING DIMENSIONS FOR MODEL 158A EXPLOSION PROOF ENCLOSURE WITH AND WITHOUT INDICATOR, MODELS 158A – ( ) ( ) – C1 AND 158A – ( ) ( ) – D1.



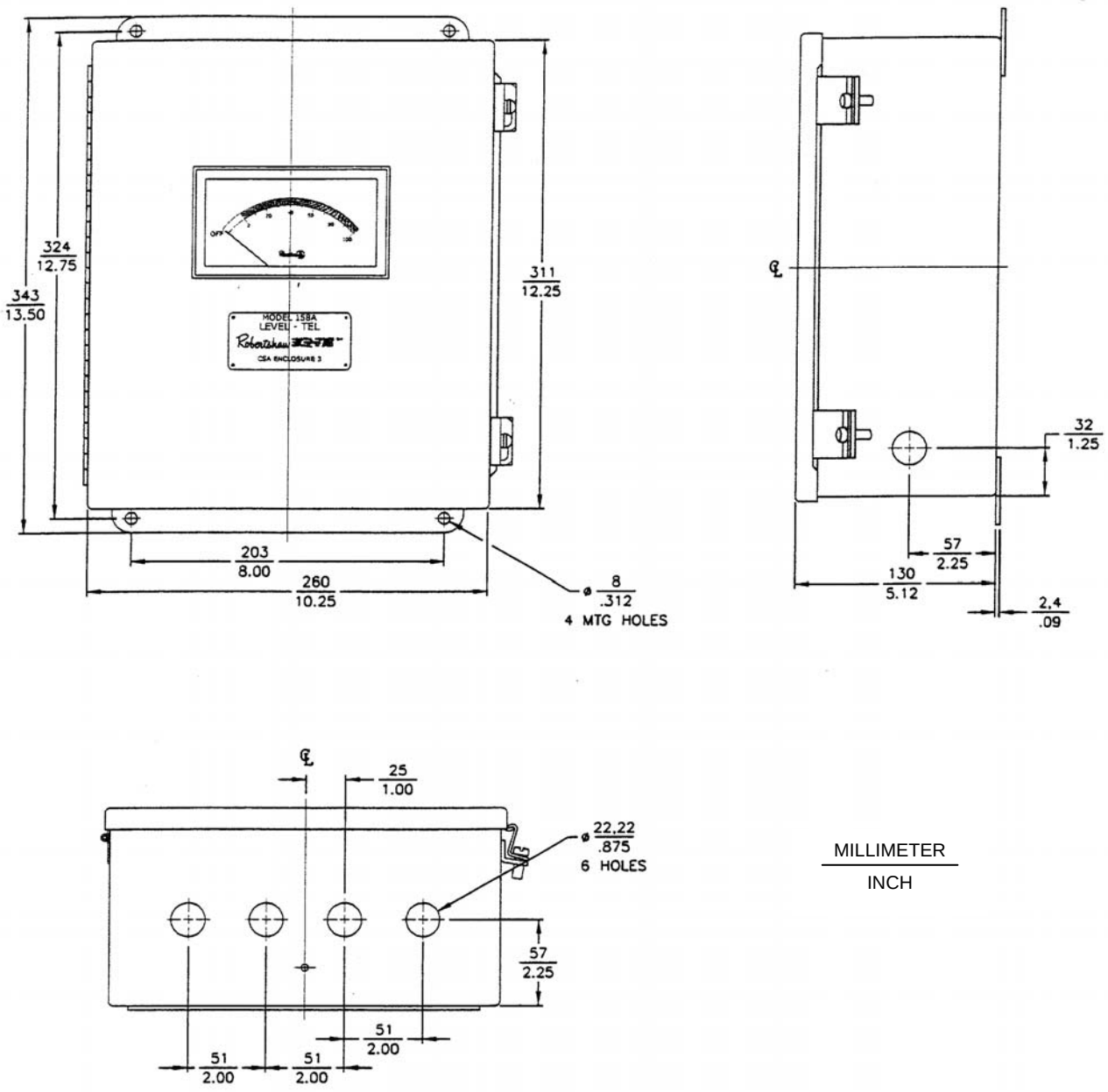
TERMINAL		
TERMINAL	**CONNECTION**	**REMARKS**
PROBE	TRIAX WHITE LEAD	
SHLD	TRIAX RED LEAD	
GND	TRIAX BLACK LEAD	
1	N (–) SUPPLY	SEE RATING PLATE (120 VAC, 240 VAC OR 26.5 VDC)
2	H (+) SUPPLY	
GND	CHASSIS GROUND	
3	(–) OUTPUT SIGNAL	SEE NOTE 1
4	(+) OUTPUT SIGNAL	

NOTES:

1. REMOVE JUMPER ACROSS OUTPUT TERMINALS 3 AND 4 WHEN RECORDER, CONTROLLER, ETC. IS USED.

FIGURE 3

ELECTRICAL CONNECTIONS FOR WATER TIGHT AND EXPLOSION PROOF ENCLOSURES, MODELS 158A – ( ) ( ) – (A, B, C, D) ( ).



MILLIMETER
INCH

SEE FIGURE 5 FOR DIMENSIONS OF PROBE MOUNTED CONDUIT OUTLET BOX.

FIGURE 4

MOUNTING DIMENSIONS FOR LARGE WEATHERPROOF ENCLOSURE WITH INDICATOR (USED WITH OPTIONAL ALARMS) MODEL 158A – ( ) ( ) – E ( ).

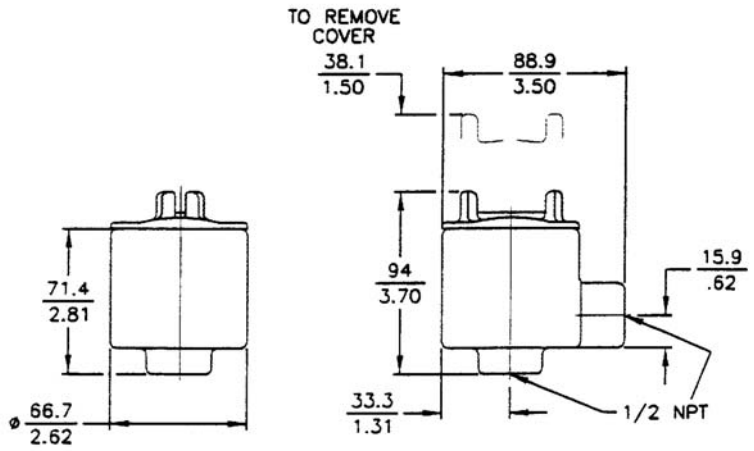


FIGURE 5

DIMENSIONS OF PROBE MOUNTED CONDUIT OUTLET BOX SUPPLIED WITH TRIAX CABLE.
(TRIAX CABLE ORDERED SEPARATELY)

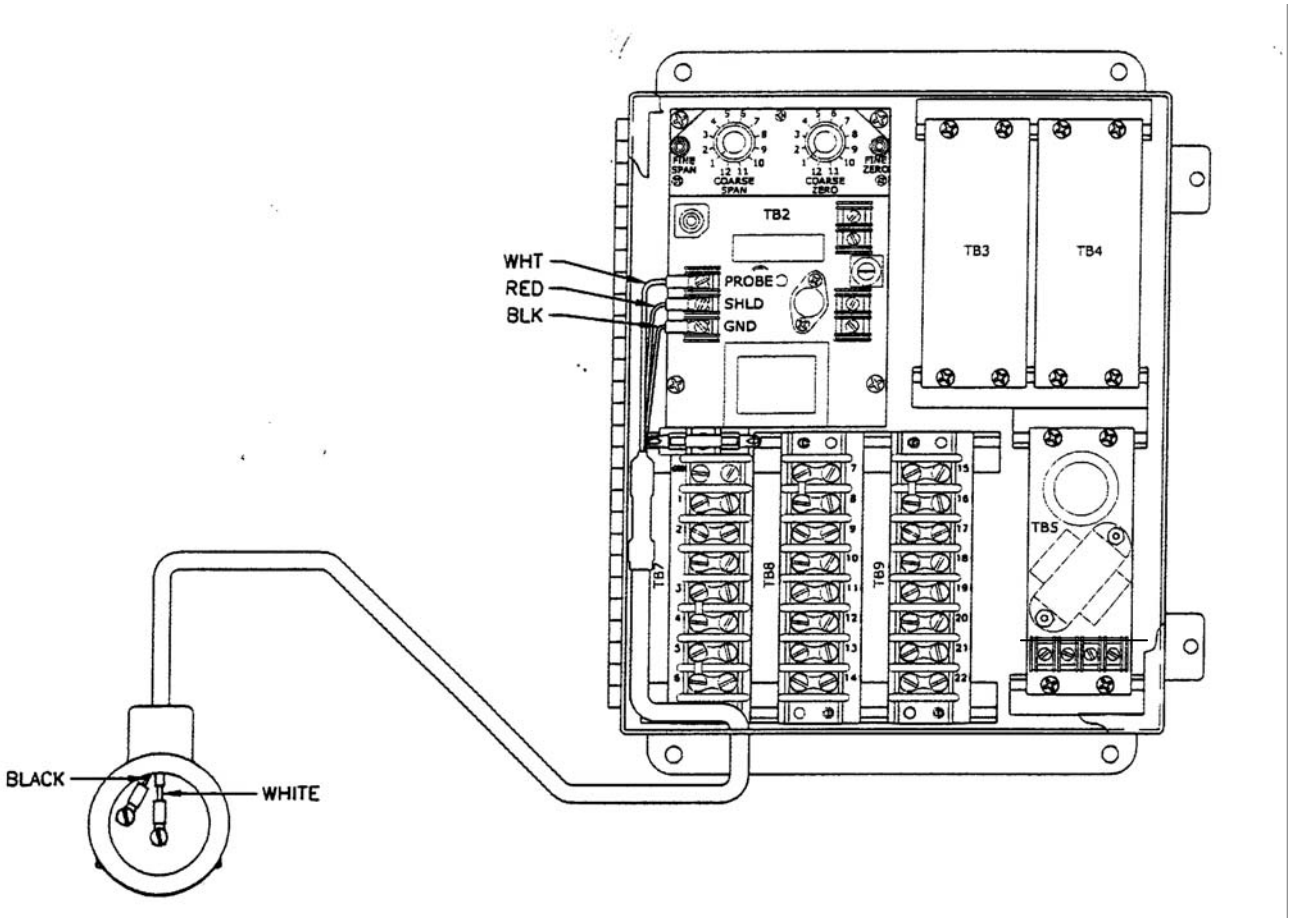


FIGURE 6

ELECTRICAL CONNECTIONS FOR LARGE WEATHERPROOF ENCLOSURE,
MODEL 158A – ( ) ( ) – E ( ).

FIELD WIRING			
TERMINAL		**CONNECTION**	**REMARKS**
TB2	PROBE	TRIAX WHITE LEAD	
	SHLD	TRIAX RED LEAD	
	GND	TRIAX BLACK LEAD	
TB7	G	CHASSIS GROUND	
	1	N (–) SUPPLY	SEE RATING PLATE (120 VAC, 240 VAC OR 26.5 VDC)
	2	H (+) SUPPLY	
	3	(–) OUTPUT	SEE NOTES 2 AND 5
	4	(+) OUTPUT	
	5	NO CONNECTION	SEE NOTE 5
	6		
TB8	7		
	8		
	9	N.C.	OPTIONAL NO. 1 ALARM CONTACTS SEE NOTES 1 AND 3
	10	COM.	
	11	N.O.	
	12	N.C.	
	13	COM.	
	14	N.O.	
TB9	15	NO CONNECTION	
	16		
	17	N.C.	OPTIONAL NO. 2 ALARM CONTACTS SEE NOTES 1 AND 4
	18	COM.	
	19	N.O.	
	20	N.C.	
	21	COM.	
	22	N.O.	

NOTES:

1. THE ALARM RELAY CONTACTS ARE SHOWN IN THE DE-ENERGIZED CONDITION. FOR NORMAL OPERATION THE RELAY IS ENERGIZED AND BECOMES DE-ENERGIZED WHEN THE OUTPUT SIGNAL REACHES THE ALARM POINT.

2. REMOVE JUMPER ACROSS OUTPUT TERMINALS 3 AND 4 WHEN RECORDER, CONTROLLER, ETC. IS USED.

3. UNLESS OTHERWISE SPECIFIED ALARM NO. 1 SUPPLIES HLFS.

4. UNLESS OTHERWISE SPECIFIED ALARM NO. 2 SUPPLIES LLFS.

5. TERMINALS 3 AND 4, 5 AND 6, 7 AND 8 ARE NORMALLY JUMPERED TOGETHER.

FIGURE 7

ELECTRICAL CONNECTIONS FOR LARGE WEATHERPROOF ENCLOSURE,
MODEL 158A – ( ) ( ) – E ( ).

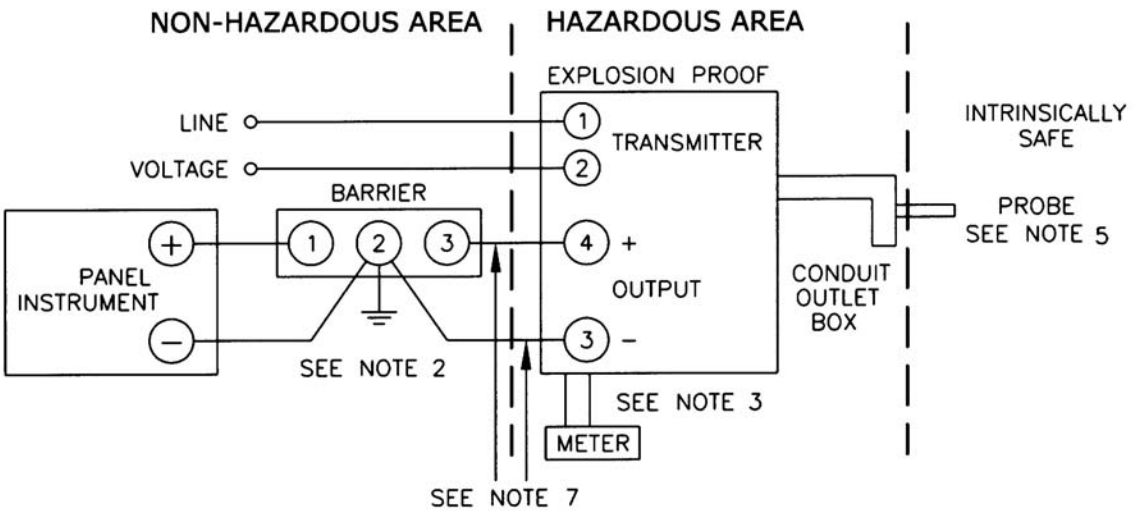


FIGURE 1

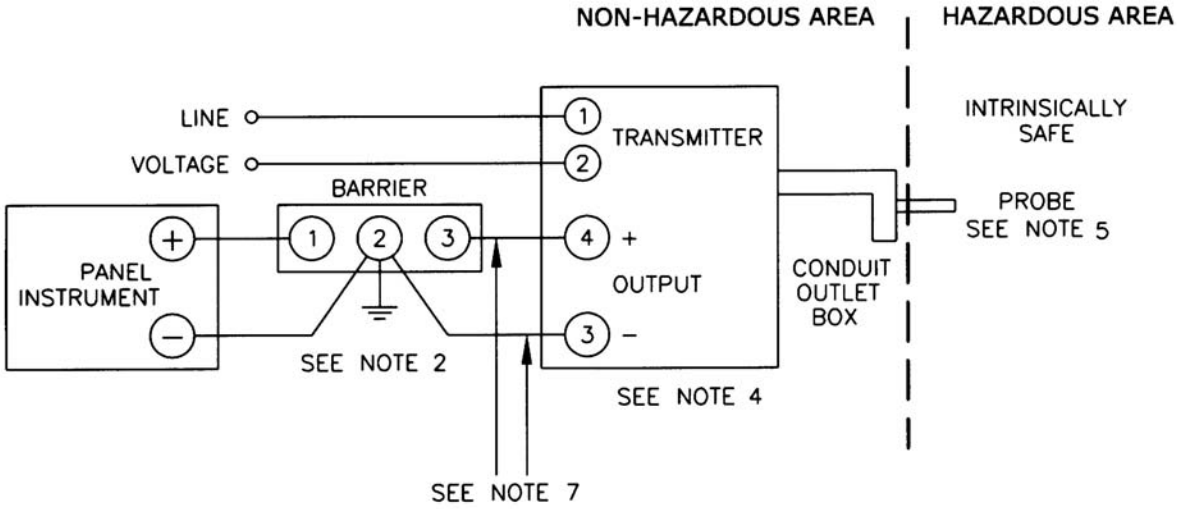


FIGURE 2

NOTES:

1. IN FIGURE 1, THE TRANSMITTER IS CSA CERTIFIED FOR HAZARDOUS LOCATIONS, CLASS I, DIVISION 1, GROUPS C & D; CLASS II, DIVISION 1, GROUPS E, F & G. THE PROBE IS INTRINSICALLY SAFE FOR CLASS I, DIVISION 1, GROUPS A, B, C & D; CLASS II, DIVISION 1, GROUPS E, F & G.
   IN FIGURE 2, THE TRANSMITTER IS CSA CERTIFIED FOR ENCLOSURE 5. THE PROBE IS INTRINSICALLY SAFE FOR CLASS I, DIVISION 1, GROUPS A, B, C & D; CLASS II, DIVISION 1, GROUPS E, F & G.
2. R. STAHL INC., MODEL 8901/33-293/000-79 OR CSA CERTIFIED EQUIVALENT (28.1V MAX., 300 OHM MIN.) POSITIVE-POTENTIAL SIGNAL RETURN LINE BARRIER WITH INTRINSICALLY SAFE TERMINALS 2 (GROUND) AND 3. BARRIER MUST BE MOUNTED AND GROUNDED OUTSIDE THE HAZARDOUS AREA IN ACCORDANCE WITH THE INSTRUCTIONS PACKED WITH BARRIER. POTENTIAL TO GROUND MUST NOT EXCEED 250V RMS (360V PEAK).
3. ROBERTSHAW MODELS 158A – (A, B) (1, 2) – (C, D) 1.
4. ROBERTSHAW MODELS 158A – (A, B) (1, 2) – (A, B) 1.
5. ROBERTSHAW MODEL 702, 728, 729, 736, 738, 739, 740 0R 741 PROBE. INSULATED PROBES ONLY MAY BE USED IN CLASS II, GROUPS E & F AREAS.
6. 650 OHMS MAXIMUM TOTAL LOOP RESISTANCE, EXCLUDING BARRIER RESISTANCE.
7. FOR AN INTRINSICALLY SAFE INSTALLATION, ALL WIRING BETWEEN THE BARRIER AND THE TRANSMITTER MUST BE INSTALLED IN RIGID METAL CONDUIT.

FIGURE 8 – DRAWING 907GA518

DIAGRAM FOR INTRINSICALLY SAFE INTERCONNECTIONS FOR
MODELS 158A – (A, B) (1, 2) – (A, B, C, D) 1.

Section IV – OPERATION

4.1 CALIBRATION ADJUSTMENTS

All adjustments for calibrating the Model 158A Level-Tel are located on the printed circuit board assembly, PCA, and consist of the following (see Figure 8):

4.1.1. Zero Adjustment (0% Process Level Point)

The zero adjustment can be obtained by the use of the Fine and Coarse Zero adjustments. The Fine Zero adjustment is a multi-turn potentiometer (approximately 20 turns). The Coarse Zero adjustment is a 12-position switch. A clockwise rotation of the zero adjustments will increase the output signal. When used in combination, the zero adjustments are capable of varying the 0% Process Level Point through an approximate range of 0 to 1,000 pF of terminal capacitance.

4.1.2. Span Adjustment (100% Process Level Point)

The span adjustment can be obtained by the use of the Fine and Coarse Span adjustments. The Fine Span adjustment is a multi-turn potentiometer (approximately 20 turns). The Coarse Span adjustment is a 12-position switch. A clockwise rotation of the span adjustments will increase the output signal. When used in combination, the span adjustments are capable of varying the 100% Process Level Point through an approximate range of 10 to 2,000 pF of input capacitance.

4.1.3. Null Adjustment

The Null adjustment is a multi-turn potentiometer (approximately 20 turns) that reduces interaction between the zero and span adjustments during calibration of the instrument. **This adjustment is factory set and should not require readjustment.** However, calibration of the Null adjustment (Ref. Para. 4.3.2) will be required if a shift in the Zero point is experienced following calibration of the Span.

4.2 OPERATIONAL MODE (For Models 158A-( )( )-E(2,3) only)

Unless otherwise specified, the operational mode for the optional alarms No. 1 & No. 2 when they leave the factory is as specified in Figure 7. The operational mode of either of the alarms may be changed by relocating the links on the Alarm Relay Modules. See Figure 6 for the location of the modules. TB3 is Alarm Module No. 1 and TB4 is Alarm Module No. 2. Refer to Figure 9 and the following paragraphs for detailed instructions on how to change the position of the links to obtain the desired mode.

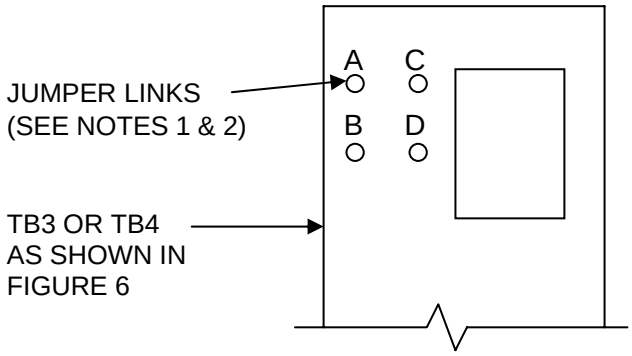
NOTE – The supply voltage must be disconnected when changing the position of these links.

4.2.1. Low Level Fail Safe

Applications for low level detection should utilize the Low Level Fail Safe (LLFS) mode which is defined as a decrease in input signal level will cause the relay to become de-energized or “alarmed”. This mode is accomplished by jumpering “A” to “B” and “C” to “D”. (Ref. Figure 9)

4.2.2. High Level Fail Safe

Applications for high level detection should utilize the High Level Fail Safe (HLFS) mode which is defined as an increase in signal level will cause the relay to become de-energized or “alarmed”. This mode is accomplished by jumpering “A” to “D” and “B” to “C”. (Ref. Figure 9)



NOTES:

1. JUMPER “A” TO “B” AND “C” TO “D” FOR LLFS MODE OF OPERATION.
2. JUMPER “A” TO “D” AND “B” TO “C” FOR HLFS MODE OF OPERATION.

FIGURE 9
MODES OF OPERATION

4.3 CALIBRATION PROCEDURE

NOTE – The instrument should be allowed to warm-up for a minimum of 30 minutes before attempting any calibration.

4.3.1. Zero and Span Calibration

With Model 158A Level-Tel mounted and all electrical connections made, the following steps should be followed when calibrating the instrument:

a) On units without an integral indicator (meter), connect an accurate (at least 3-1/2 digits) milliamp meter in series with the output terminals 3(-) and 4(+).

b) Place the Coarse Span switch in position No. 10.

c) With the process level in the tank, or vessel, at the desire 0% (low) level. Adjust the Coarse Zero switch and Fine Zero potentiometer until the output current representing 0% (1, 0, 4 or 10 mA; depending on the output span of the Model 158A Level-Tel being calibrated) is indicated on the meter. Clockwise rotation of the controls will result in an increase in output current.

d) Place the Coarse Span switch in position No. 1. Verify that the output reading does not change. If there is a change go to paragraph 4.3.2 and perform the Null Adjustment Calibration before proceeding.

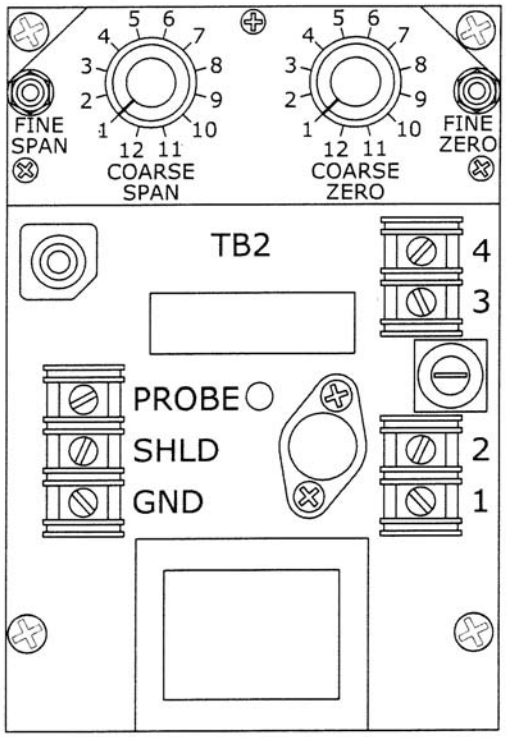


FIGURE 10
CALIBRATION ADJUSTMENTS

e) Change the process level in the tank, or vessel, to the desired 100% (high) level. Adjust the Coarse Span switch and the Fine Span potentiometer until the output representing 100% (5, 10, 20 or 50 mA; depending on the output span of the Model 158A Level-Tel being calibrated) is indicated on the meter. Clockwise rotation of the controls will result in an increase in output current.

NOTE – The instrument is now calibrated. However it is recommended that the zero and span calibration be repeated, at least once, to obtain the best accuracy. *This is especially important when using long cables and small spans*.

4.3.2. Null Adjustment

NOTE – This adjustment is factory set and user adjustment should not be required.

If adjustment of the Null setting is required (See paragraph 4.3.1 d) above), the following steps should be followed:

a) With the Model 158A Level-Tel mounted and all electrical connections made adjust the Coarse Span switch to position No. 10.

b) With the process level in the tank, or vessel, at the desire 0% (low) level. Adjust the Coarse Zero switch and Fine Zero potentiometer until the output current representing 0% (1, 0, 4 or 10 mA; depending on the output span of the Model 158A Level-Tel being calibrated) is indicated on the meter. Clockwise rotation of the controls will result in an increase in output current.

c) Adjust the Coarse Span switch to position No. 1.

d) Adjust the Null potentiometer until the meter indicates 0% (1, 0, 4 or 10 mA; depending on the output span of the Model 158A Level-Tel being calibrated). Clockwise rotation of the potentiometer will result in increased output current.

e) Repeat steps “a)” through “d)” until the output current remains at 0% when the Coarse Span switch is moved from position No. 1 to position No. 10.

Section IV – SPARE PARTS

SPARE PARTS

DESIG.	DESCRIPTION	SUPPLY	OUTPUT	USED ON	PART NO.
TB2	TRANSMITTER PRINTED CIRCUIT ASSY	26.5 VDC	1-5 mADC	158A-A1-XX	044KB766-01
			4-20 mADC	158A-B1-XX	044KB766-04
			10-50 mADC	158A-C1-XX	044KB766-07
			0-10 mADC	158A-D1-XX	044KB766-10
		120 VAC 50/60 Hz	1-5 mADC	158A-A2-XX	044KB766-02
			4-20 mADC	158A-B2-XX	044KB766-05
			10-50 mADC	158A-C2-XX	044KB766-08
			0-10 mADC	158A-D2-XX	044KB766-11
		240 VAC 50/60 Hz	1-5 mADC	158A-A3-XX	044KB766-03
			4-20 mADC	158A-B3-XX	044KB766-06
			10-50 mADC	158A-C3-XX	044KB766-09
			0-10 mADC	158A-D3-XX	044KB766-12
F1	FUSE, 1/8 A, SLO-BLO	ALL	ALL	ALL	130GD020
K1	RELAY	ALL	ALL	158A-XX-E2 158A-XX-E3	250KB051-02



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Q-3882 (12/06) **Printed in U.S.A.**