LEVEL-TEL MODEL 158A

GENERAL DESCRIPTION

The Robertshaw Model 158A capacitance to current RF transmitter is designed for remote mounting from the sensing probe and is used for continuous level measurement and control. Housed in a weather-tight or explosion-proof enclosure, with or without local indication, the Model 158A may be mounted up to 150 feet from the sensing probe allowing convenient and accessible installation.

A true DC current output signal, unaffected by varying load resistance, is produced which is directly and linearly proportional to input capacitance change. All calibration adjustments for the system are within the transmitter enclosure and are completely independent and non-interacting resulting in a simple "one-shot" calibration method. Wide adjustment ranges for both zero and span are provided to insure satisfactory operation on virtually any measurement application.

Unique circuit design concepts are employed in the Model 158A to effectively "cancel-out" the capacitance inherent in the Triaxial cable used to couple the transmitter to the probe. This permits the use of long lengths of interconnecting cable without any degradation in performance of the system – and without the need for compensating cables, padding capacitors, or other calibration "tricks." Extensive use of integrated circuit operational amplifiers and other state-of-the-art semiconductors are used in the Model 158A to achieve reliability and long-term stability.

A wide variety of standard sensing probes for use with the Model 158A are available from Robertshaw to satisfy virtually any level measurement application.

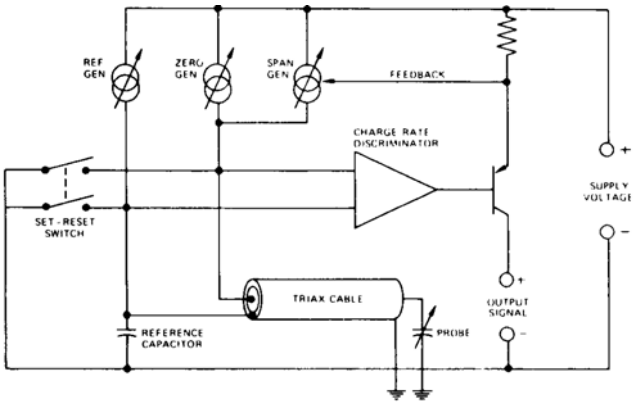
Probe, Cable and Conduit Outlet Box
shown for illustration only.
Must be ordered separately.

FEATURES AND BENEFITS

- **CSA Certified (See Specifications)**
- **Independent and non-interacting adjustments- Simple initial calibration**
- **Remote mounting capability- Convenient installation location**
- **True Current Output Signals- Insensitive to load variations**
- **All solid-state circuitry- Long-term stability and reliability**

PRINCIPLE OF OPERATION

The Model 158A makes use of a unique circuit design concept developed by Robertshaw to provide a true DC current output signal as a function of input capacitance change. Referring to the block diagram, Figure 1, two free running saw tooth oscillators are utilized; one being used as a reference and consisting of a reference capacitor and reference current generator, the second being the zero generator and probe capacitor connected through the Triaxial cable. Both capacitors, reference and probe, charge up linearly until a pre set voltage is reached causing the "set-reset" solid-state switch to momentarily close "shorting" out both capacitors - thus starting the charging cycle once again and developing a "saw tooth" waveform across both capacitors.



Connected directly across both capacitors is the "charge rate discriminator" amplifier which produces a voltage output when the charging rate of the probe capacitor differs from that of the reference capacitor. When a change in probe capacitance occurs (due to a change in process level), the discriminator amplifier causes an output signal change, which, with voltage feedback, readjusts the probe charging rate through the span generator until the charging rates are again equal.

Since the sensing probe is remotely mounted from the Model 158A, any change in the connecting cable capacitance between the probe and the transmitter would normally affect the measurement accuracy. This error is eliminated, however, in the Model 158A by using a Triaxial cable with the inner shield of the cable connected to the reference capacitor. This causes the inner shield to be "driven" in phase with the center conductor of the cable, keeping the voltage difference near zero, thereby canceling out the effects of the inherent cable capacitance. This permits long lengths of cable to be used between the Model 158A and the sensing probe – without sacrifice of performance.

SPECIFICATIONS

ENVIRONMENTAL:

Intrinsic Safety: Models 158A – (A,B) (1,2) – (A,B,C,D)1 have CSA Certified intrinsically safe probe input circuit for Class I, Div. 1, Group A, B, C & D; Class II, Div. 1, Group E, F & G hazardous areas when connected as shown on Robertshaw drawing no. 907GA518. Safety barrier required.

Storage .....-55° F to 225° F (-48° C to 107° C)
Operating Temperature Limits.....-40° F to 160° F (-40° C to 70° C)
Operating Vibration Limits.....2 g's, 10 to 200 Hz
Operating Humidity Limits.....95% RH @ 100° F
Mechanical Shock.....75 g's for 11 ms duration without permanent damage

PERFORMANCE:

Supply Variation Effect ..... 0.5%/10% supply change
Temperature Coefficient.....1.0%/100° F ambient (including connecting cable) change, or 1 pF/100° F whichever is greater
Load Resistance Effect.....0.25% from no load to full load
Output Signal Ripple .....0.2% PP maximum @ supply voltage frequency
Terminal Non-linearity.....0.5% maximum for spans less than 1000 pF, 1.0% maximum for spans greater than 1000 pF

ELECTRICAL:

Supply Voltage:
- **Standard** ..... 120 VAC ± 10%, 50/60 Hz
- **Optional** .....26.5 VDC ± 10%
- **Optional** ..... 240 VAC ± 10%, 50/60 Hz

Supply Power:
- **AC** .....5 watts, 7 VA maximum
- **DC** .....85 mA maximum

Output Signal:
- **Standard** .....4-20 mA into 0 to 650 ohms
- **Optional** .....1-5 mA into 0 to 2500 ohms
- **Optional** .....10-50 mA into 0 to 250 ohms
- **Optional** .....0-10 mA into 0 to 1200 ohms

Input Signal (Capacitance):
- **Terminal Adjustment** .....0 to 1000 pF
- **Span Adjustment** .....10 pF plus 1 pF per each 10 feet of connecting cable minimum, 2000 pF maximum

Maximum Zero Suppression .....10 times span
Connecting Cable Length .....150 feet maximum

ENCLOSURE:

- **Standard** ..... Weather tight, cast aluminum, painted with blue polyurethane enamel, CSA Enclosure 5 & NEMA 4
- **Optional** ..... Explosion proof, cast aluminum, painted with blue polyurethane enamel, suitable for Class I, Div. 1, Group C & D; Class II, Div. 1, Group E, F & G hazardous areas
- **Optional** .....Large weather tight, steel, painted with blue polyurethane enamel, CSA Enclosure 3, NEMA 12 & 13

ORDERING INFORMATION

* **STANDARD MODEL 158A-B2-B1**

OPTIONAL MODELS
Select from Tables.
(Allow additional delivery time.)

158A - B 2 - B 1

Key Model Number

Table 1 - Output Current

Table 2 - Supply Voltage

Table 3 - Display Housing & Indication

Table 4 - Alarm Options

Key Model Number

Designation	Description
*158A	Capacitance to current transmitter system for remotely mounted probe assemblies. Control unit is available as blind transmitter or with indication.

Table 1 - Output Current

Designation	Description
A	1-5 mADC
*B	4-20 mADC
C	10-50 mADC
D	0-10 mADC

Table 2 - Supply Voltage

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

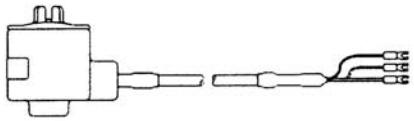
Table 3 - Display Housing & Indication

Designation	Description
A	Weathertight Housing without Indicator
*B	Weathertight Housing with Indicator
C	Explosion Proof Housing without Indicator
D	Explosion Proof Housing with Indicator
E	Large weathertight Housing with Indicator

Table 4 - Alarm Options

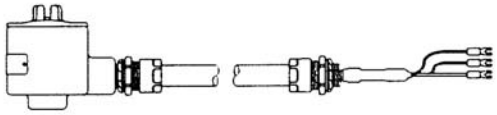
Designation	Description
*1	None

TRIAXIAL CABLE ACCESSORY ITEMS



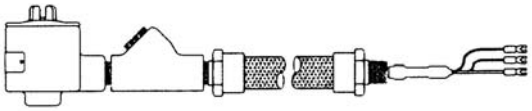
032KE03X-XX*
GENERAL PURPOSE (polyethylene insulated) Triax Cable with probe connection conduit outlet box. (Recommended for use with customer supplied rigid or flexible conduit.) Maximum temperature 185° F.

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.



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

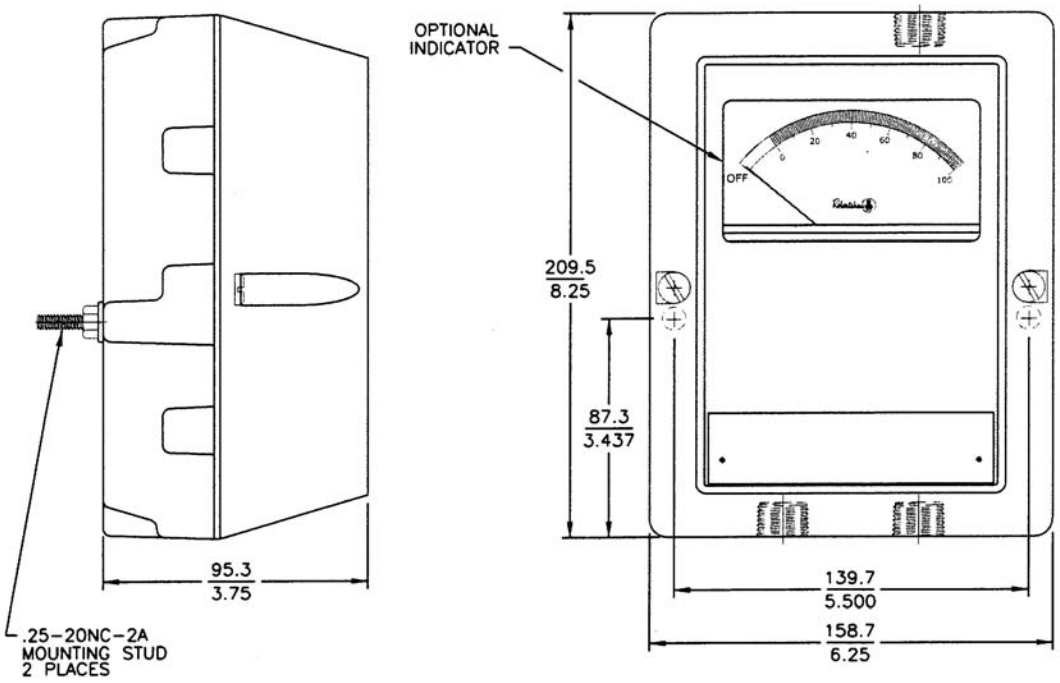
032KE06X-XX*
HIGH TEMPERATURE (Teflon insulated) Triax Cable in flexible conduit (protective armor) with probe connection conduit outlet box. Maximum temperature 350° F.

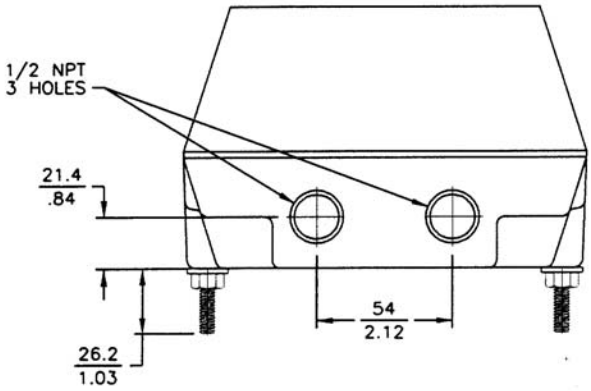


032KE090-05 (5 ft long)
032KE090-10 (10 ft long)
GENERAL PURPOSE (polyethylene insulated) Triax Cable in explosion proof flexible conduit (protective armor) with seal fitting and probe connection conduit outlet box. Maximum temperature 185° F.

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.

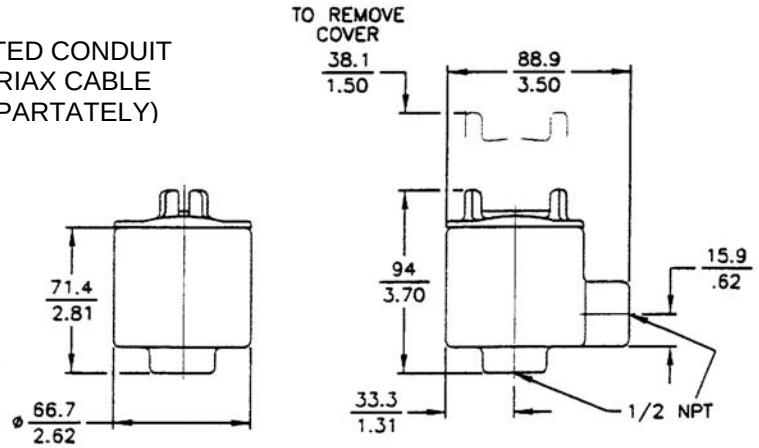
* Substitute length in feet for X-XX in part number.
Example: For 10 feet substitute 0-10
For 120 feet substitute 1-20
Explosion proof cables are standard in 5 and 10 foot lengths.

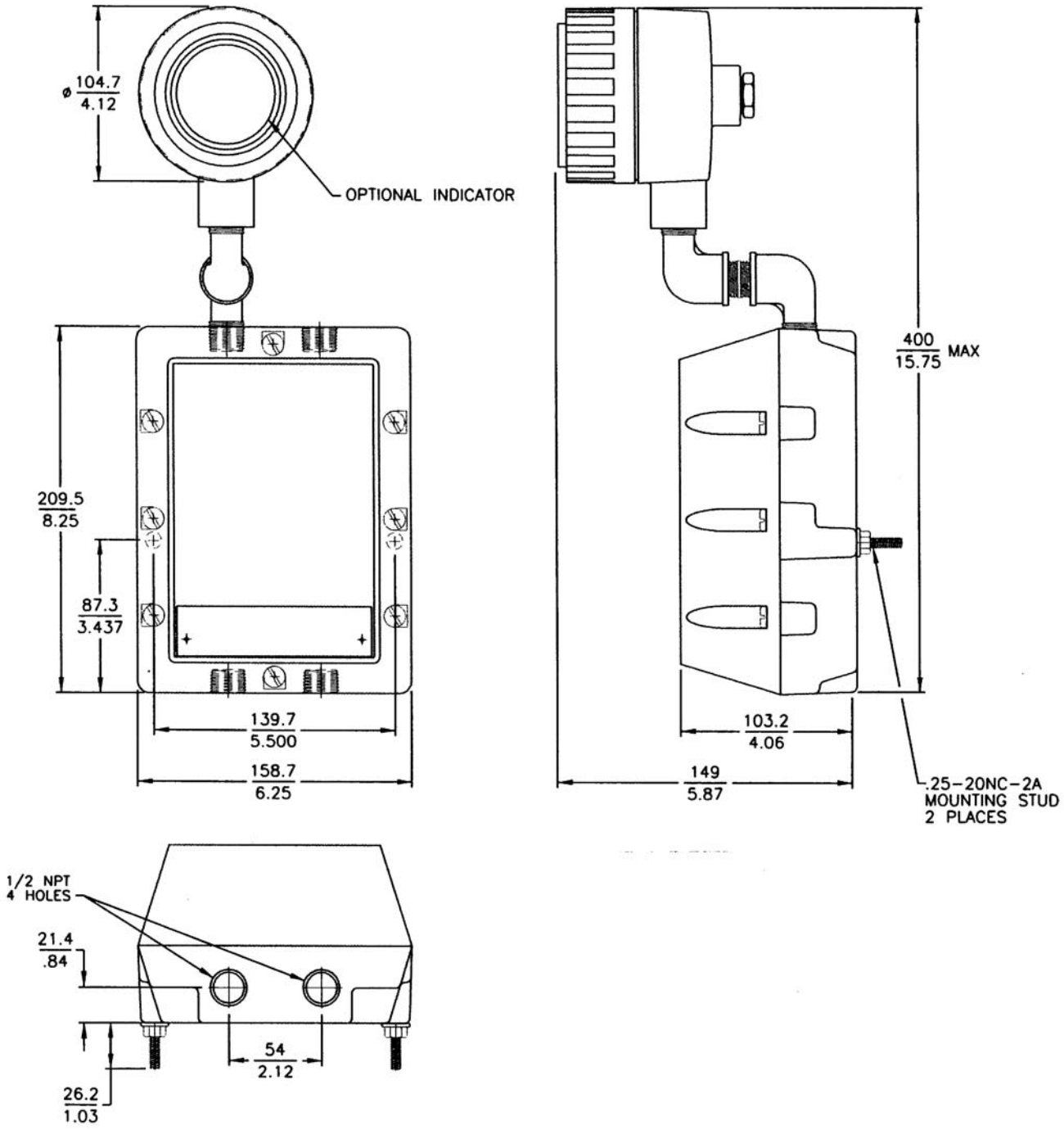




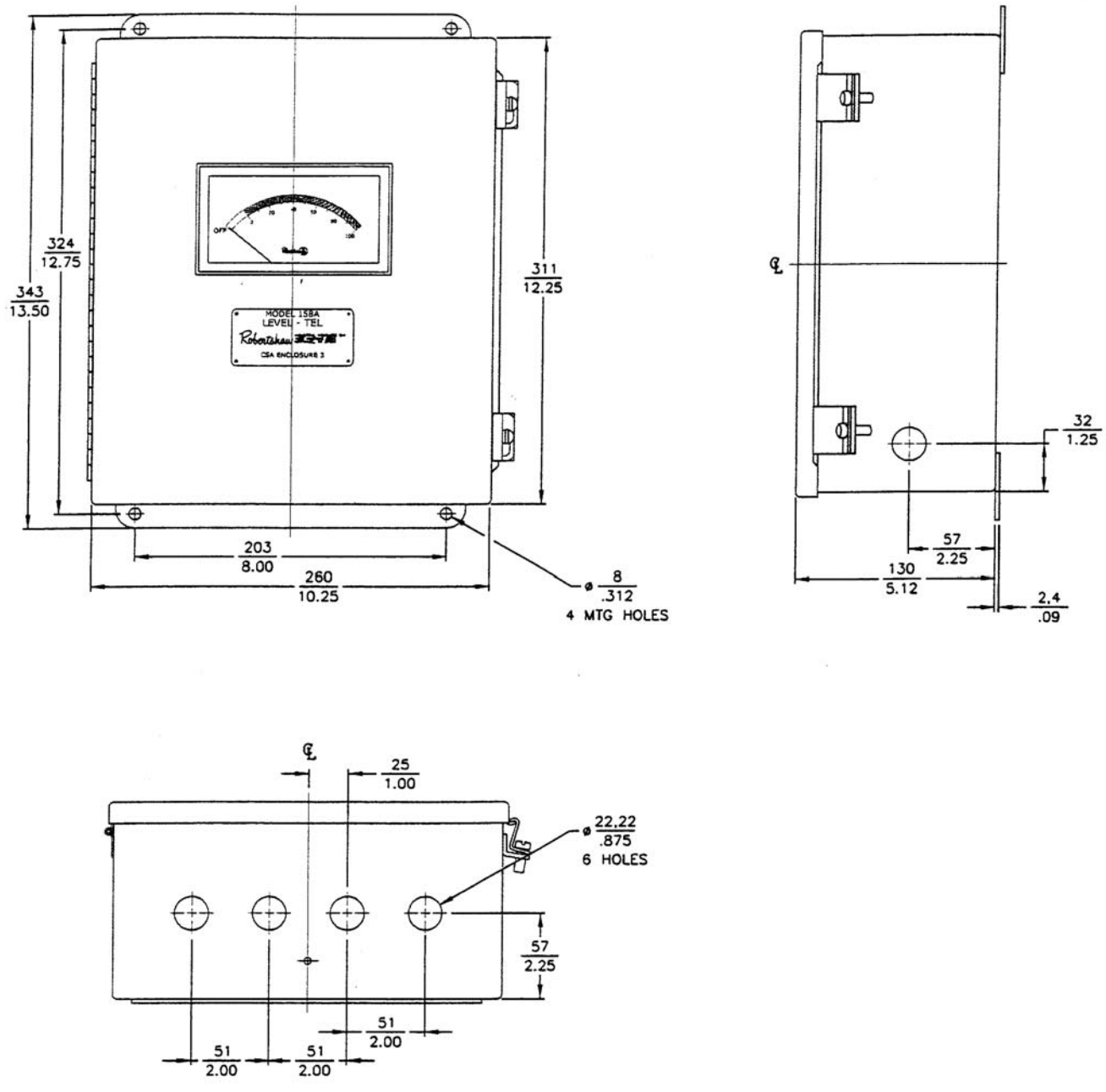
MOUNTING DIMENSIONS FOR 158A WEATHERTIGHT ENCLOSURE WITH AND WITHOUT INDICATOR (TABLE 3 DESIGNATIONS A & B)

DIMENSIONS OF PROBE MOUNTED CONDUIT OUTLET BOX SUPPLIED WITH TRIAX CABLE (CABLE AND BOX ORDERED SEPARTATELY)





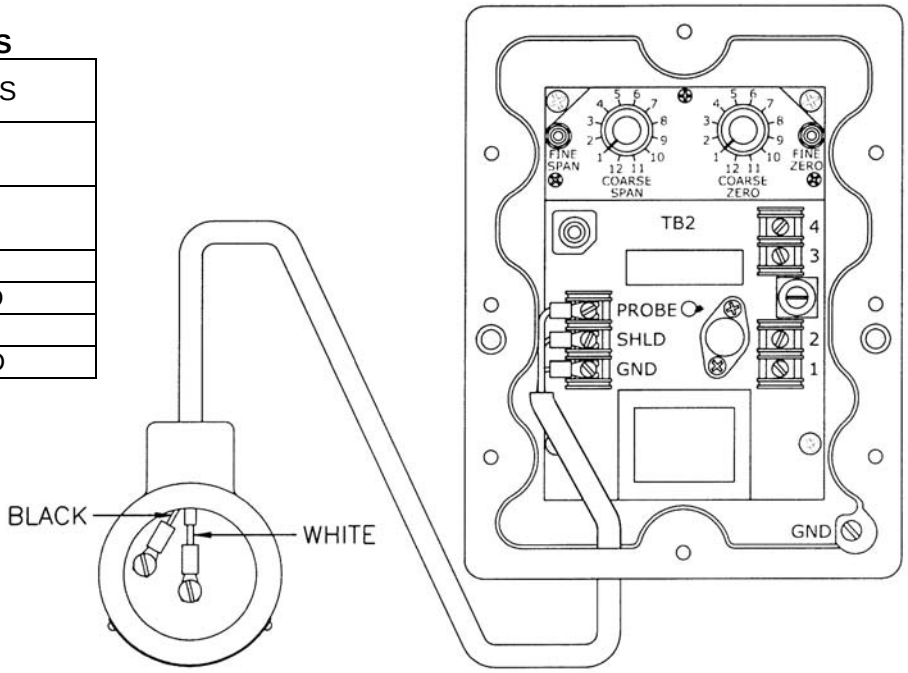
MOUNTING DIMENSIONS FOR 158A EXPLOSION PROOF ENCLOSURE WITH AND WITHOUT INDICATOR
(TABLE 3 DESIGNATIONS C & D)



MOUNTING DIMENSIONS FOR 158A LARGE WEATHERTIGHT ENCLOSURE WITH INDICATOR
(TABLE 3 DESIGNATION E)

CUSTOMER CONNECTIONS

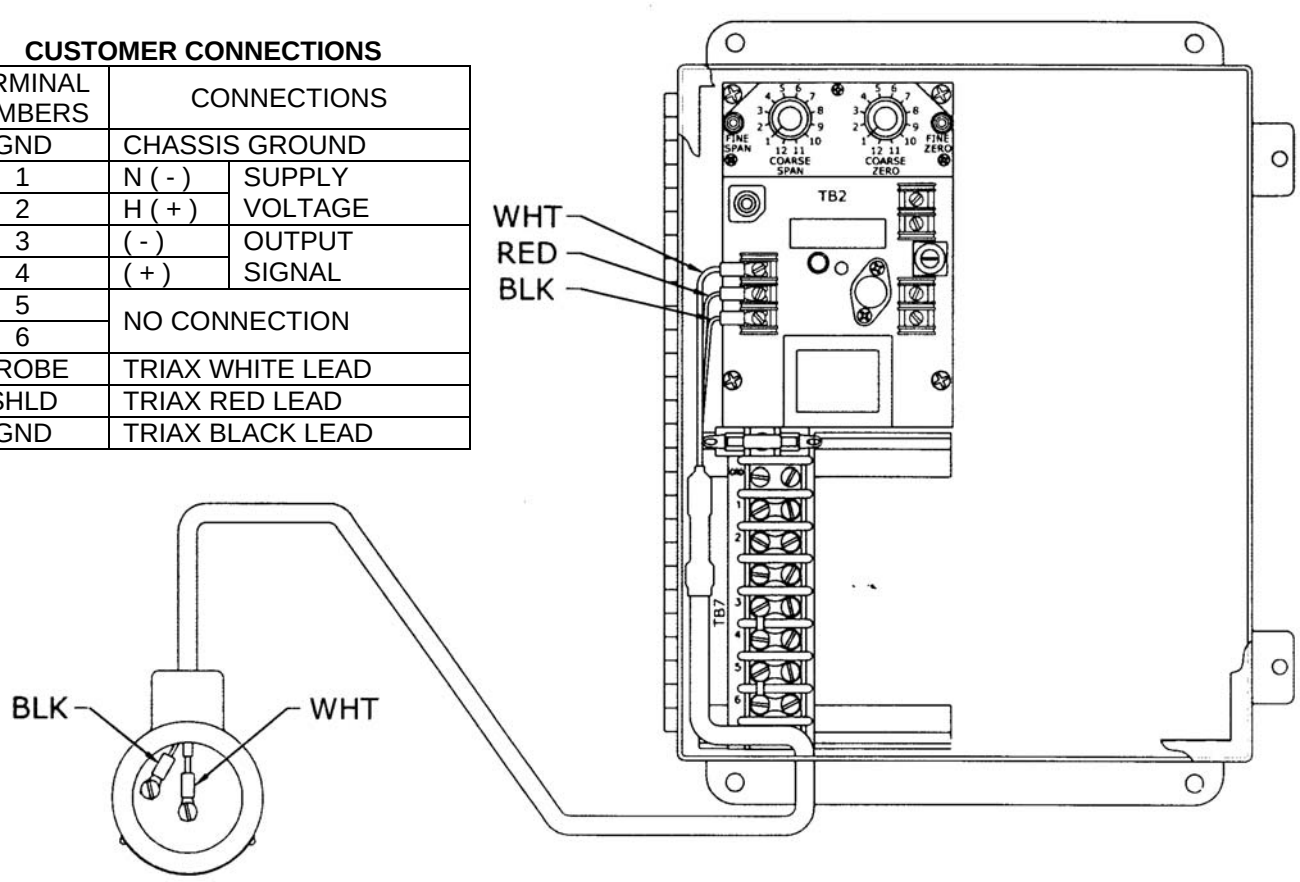
TERMINAL NUMBERS	CONNECTIONS	
1	N (-)	SUPPLY
2	H (+)	VOLTAGE
3	(-)	OUTPUT
4	(+)	SIGNAL
GND	CHASSIS GROUND	
PROBE	TRIAX WHITE LEAD	
SHLD	TRIAX RED LEAD	
GND	TRIAX BLACK LEAD	



ELECTRICAL CONNECTIONS FOR WEATHERTIGHT AND EXPLOSION PROOF ENCLOSURES
(TABLE 3 DESIGNATIONS A, B, C & D)

CUSTOMER CONNECTIONS

TERMINAL NUMBERS	CONNECTIONS	
GND	CHASSIS GROUND	
1	N (-)	SUPPLY
2	H (+)	VOLTAGE
3	(-)	OUTPUT
4	(+)	SIGNAL
5	NO CONNECTION	
6		
PROBE	TRIAX WHITE LEAD	
SHLD	TRIAX RED LEAD	
GND	TRIAX BLACK LEAD	



ELECTRICAL CONNECTIONS FOR LARGE WEATHERTIGHT ENCLOSURE
(TABLE 3 DESIGNATION E)

DRAWING 907GA518

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

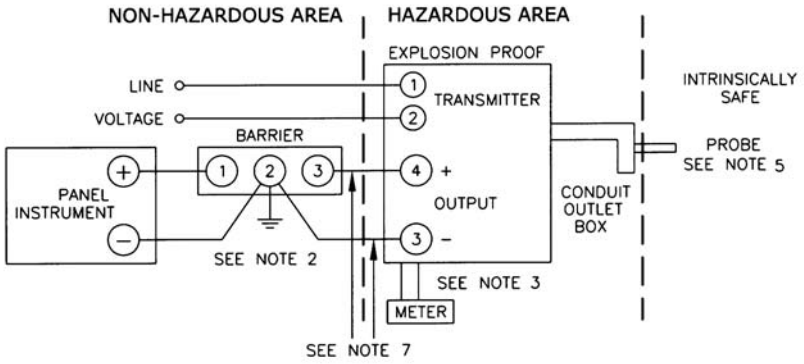
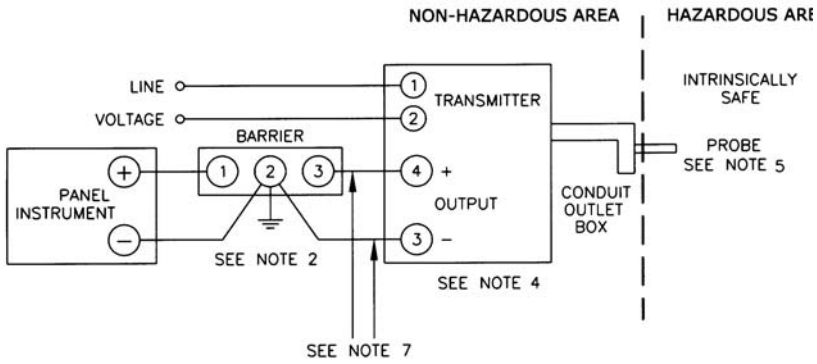


FIGURE 1



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.

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Q-3867 (11/05) **Printed in the U.S.A.**