

Level Lance Model 5100

GENERAL DESCRIPTION

The Robertshaw Model 5100 Level-Lance is a microprocessor based, advanced technology On-Off level detection instrument. By utilizing the microprocessor, the device can be calibrated without screwdriver adjustments or knobs to turn. The simplicity of the "Auto Set" calibration is the ultimate in level control ease of adjustment.

The Model 5100 has eight (8) separate and individual programs preprogrammed into its memory. These programs let the user select the "type" of On-Off control action best suited for the application. The eight programs are field selectable by means of a 10 position rotary switch. These program selections are as follows:

Indicated By Rotary Switch Position Number.

0. **AVERAGING** - sets the control point midway between the selected high and low point on a vertically mounted probe. This is applicable to certain special applications.
1. **CYCLIC (Differential) Control** - used where a level difference or deadband between the high and low points on a vertically mounted probe is desired. Typically used for motor or pump control.
2. **CONTROL (Fixed Differential)** - Used to provide relay operation at a given point on a vertical or horizontal mounted sensing probe.
3. **ALARM+ (Fixed Differential)** - used to provide single point control. Allows high level calibration while the tank or vessel level is below the desired trip point. Used with low di-electric materials and horizontally mounted probes.
4. **ALARM ++** - same as above except for use with high di-electric materials.
5. **ALARM - (Fixed Differential)** - used to provide single point control. Allows low level calibration while the tank or vessel level is above the desired trip point. Used with low dielectric materials and horizontally mounted probes.
6. **ALARM --** - same as above except for use with high di-electric materials.
7. **WINDOW** - This mode is designed for special applications only. The relay actuation occurs whenever the level is between the selected High and Low points on the probe (HLFS) or whenever the level is not between the two points (LLFS).

Selection of the desired control type is made prior to beginning the calibration process.

Probe shown for illustration only.
Not included.



FEATURES AND BENEFITS

- Microprocessor Based.
- Auto-Set Calibration
- Calibration Data Retained on Loss of Power (no battery required)
- Digitally Set time delays.
- Selectable Fail-Safe Modes.
- Eight Pre-programmed Control Modes (user selectable).
- Built in self diagnostics.
- Optional Status Indicating Lights (Rain tight version only).
- Optional Explosion-Proof Enclosure.
- No Special Cables (Transmitter can be located up to 1 mile from the receiver using standard twisted pair instrument wire).
- Utilizes Robertshaw's Patented PFM Transmitter Technology.
- Supports Robertshaw's Short-Stop Probe for tough applications where product buildup or coating occurs.
- Intrinsically Safe PFM Transmitter, UL/C-UL listed (Non Short Stop version only).

General Description (continued)

The Model 5100 also has user selectable "Fail-Safe" modes of operation. High Level Fail Safe (HLFS) or Low Level Fail-Safe (LLFS) are selected by a switch located on the main circuit board.

Field selectable time delays are also provided. The Model 5100 provides the user with a choice of time delay modes. These modes are selected with a pair of switches located on the main circuit board. The user may select no time delay, delay when the relay operates, delay when the relay returns to normal or delay when the relay operates and when it returns to normal. The length of the time delay is set by means of a pair of 10 position rotary switches. The delay duration is adjustable in one (1) second steps from 00 to 99 seconds.

The relay output is a Double Pole Double Throw (DPDT) type rated at 10 amps.

The system utilizes ROBERTSHAW'S patented Pulse Frequency Modulation (PFM) method of level transmission. This allows the transmitter to be located up to one (1) mile from the controller. The connections between them can be made with either two (2) wires, standard probe, or three (3) wires, Short-Stop probe. No special cables are required.

Calibration of the system is accomplished by the "Auto-Set" feature. By pressing the appropriate calibration pushbutton the micro-processor is automatically set to look for the current level as a control point. Thus the levels corresponding to the high and low relay trip points are stored in the microprocessor's non-volatile memory. Single level trip points, with fixed differential, can be set without varying the level in the vessel by using the special control modes provided.

Power supply options include 120 VAC and 240 VAC as well as 18 to 30 VDC operation.

OPTIONS

The system is available in either rain tight (NEMA 4) enclosures or corrosion resistant (NEMA 4X) enclosures or explosion proof enclosures. Rain tight enclosures are available with, or without, indicating lights. These indication lights provide the user with convenient indication of the system status.

Another option available with the Model 5100 is the "Short-Stop" PFM transmitter and sensing probe. This option permits use of the system in applications where the product being measured will build up on the probe and/or vessel wall and eventually short the sensing probe. The "Short-Stop" feature will allow continued operation even if these conditions occur.

SPECIFICATIONS

(Subject to change without notice)

ELECTRICAL/ELECTRONICS:

Supply Voltage:

120 VAC, $\pm 10\%$, 50/60 Hz Standard.

240 VAC, $\pm 10\%$, 50/60 Hz Optional.

18 to 30 VDC, Optional.

Supply Power: 10 VA (max.)

Control Range: 0.1 to 3000 pF

Adjustable Differential: 2 pF to 100% of Control Range

Adjustable Time Delay: 0 to 99 Seconds

Ambient Temperature Effect: ± 0.005 pF/ $^{\circ}$ F or ± 0.01 %/ $^{\circ}$ F whichever is greater

Supply Variation Effect: None

Linearity: ± 0.5 %

Resolution: 0.1 pF

Repeatability: ± 0.1 pF

Relay Output: .Electro-Mechanical, DPDT 10 amp @ 120/240 VAC, 10 amp @ 30 VDC, Non-Inductive

Maximum Distance Between

Transmitter and Receiver: One (1) mile

Type Of Interconnection Cable: Two (2) wires (Twisted Pair) for Standard PFM Transmitter (BELDEN #8205 or #8762, Shielded) or Three (3) Wires (BELDEN #9492 or #9364, Shielded) For Short-Stop™ PFM Transmitter.

ENVIRONMENTAL:

Temperature (Operating or Storage):

-40 to +140 $^{\circ}$ F

-40 to + 60 $^{\circ}$ C

Relative Humidity: 0 to 95% Non-Condensing

Vibration: ± 2 G, 10 to 200 Hz

Shock: ... 75 G's for 11 ms without permanent Damage

Intrinsic Safety: UL/C-UL listed PFM and probe input circuit intrinsically safe for Class I, Div. 1, Groups A, B, C & D; Class II, Div. 1, Groups E, F & G; Class I, Zone 0, Group IIC (Requires safety barrier, wiring connections, and sensors per Robertshaw Dwg. # 907GA811) Non Shortstop version only.

ENCLOSURE:

PFM Transmitter:

Material: Cast Aluminum

Finish: Polyurethane Enamel, Blue - Standard

Epoxy Enamel, Gray - Optional

Rain-Tight, NEMA 4 - Standard

Rain-Tight, Corrosion Resistant, NEMA 4X - Optional

Explosion-Proof: Class I, Division 1, Groups C & D

Class II, Division 1, Groups E, F & G Standard

Explosion-Proof, Corrosion Resistant: Class I, Division 1, Groups C & D; Class II, Division 1, Groups E, F, & G Optional.

Model 5100 Receiver:

Material: Cast Aluminum

Finish: Polyurethane Enamel, Blue -
Standard

Epoxy Enamel, Gray - Optional.

Rain tight, NEMA 4 -
Standard.

Rain tight, Corrosion Resistant, NEMA 4X -
Optional.

Explosion-Proof: Suitable for Class I,
Division 1, Groups C & D; Class II,
Division 1, Groups E, F & G -
Optional.

Explosion-Proof, Corrosion Resistant:
Suitable for Class I, Division 1, Groups
C & D; Class II, Division 1, Groups E,
F & G - Optional.

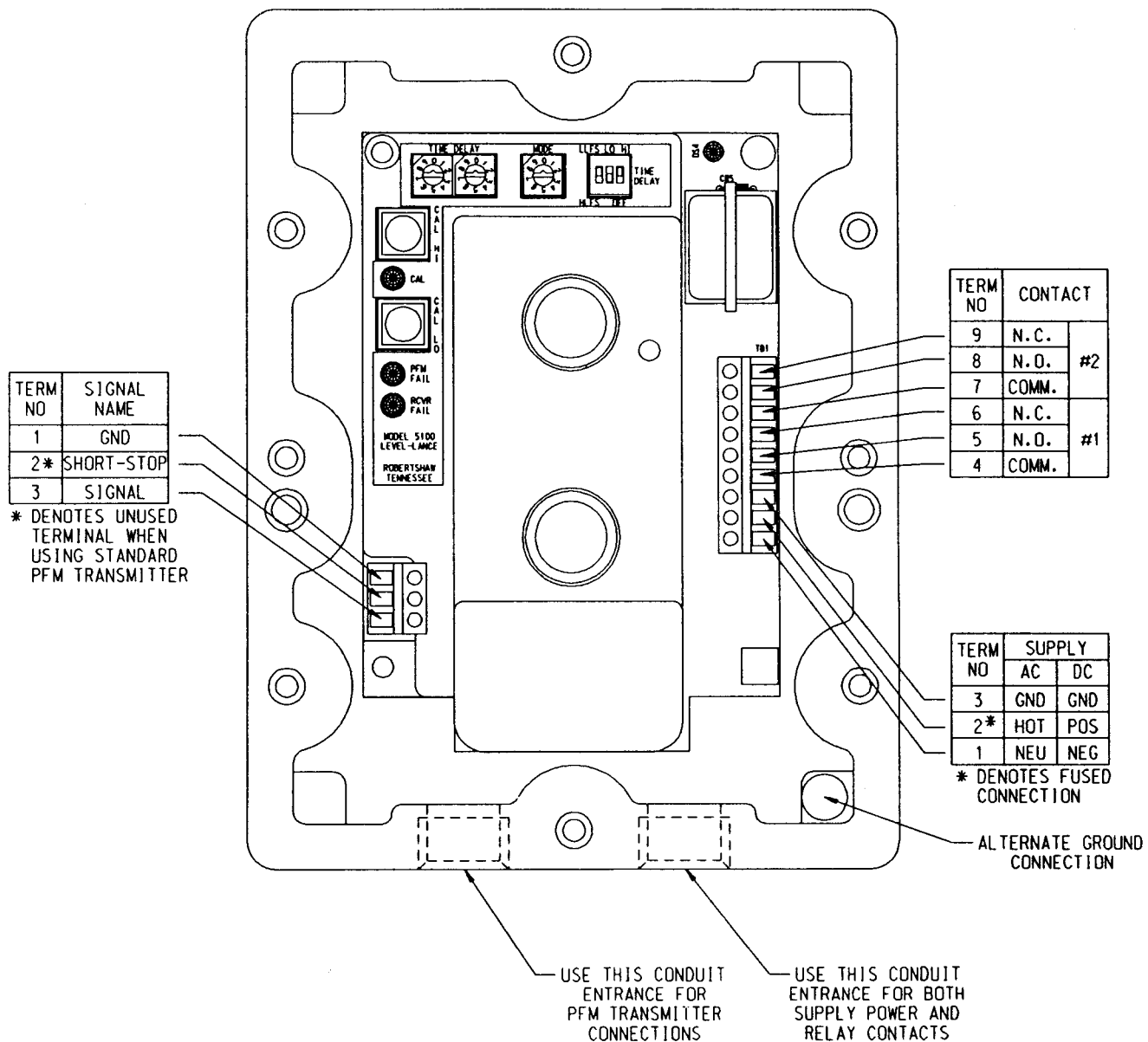
Weight:

PFM Transmitter: All - 2.5 lbs. (1.14 Kg)

Receiver: Rain tight: 6.5 lbs. (2.95 Kg)

Explosion-Proof: 8 lbs. (3.63 Kg)

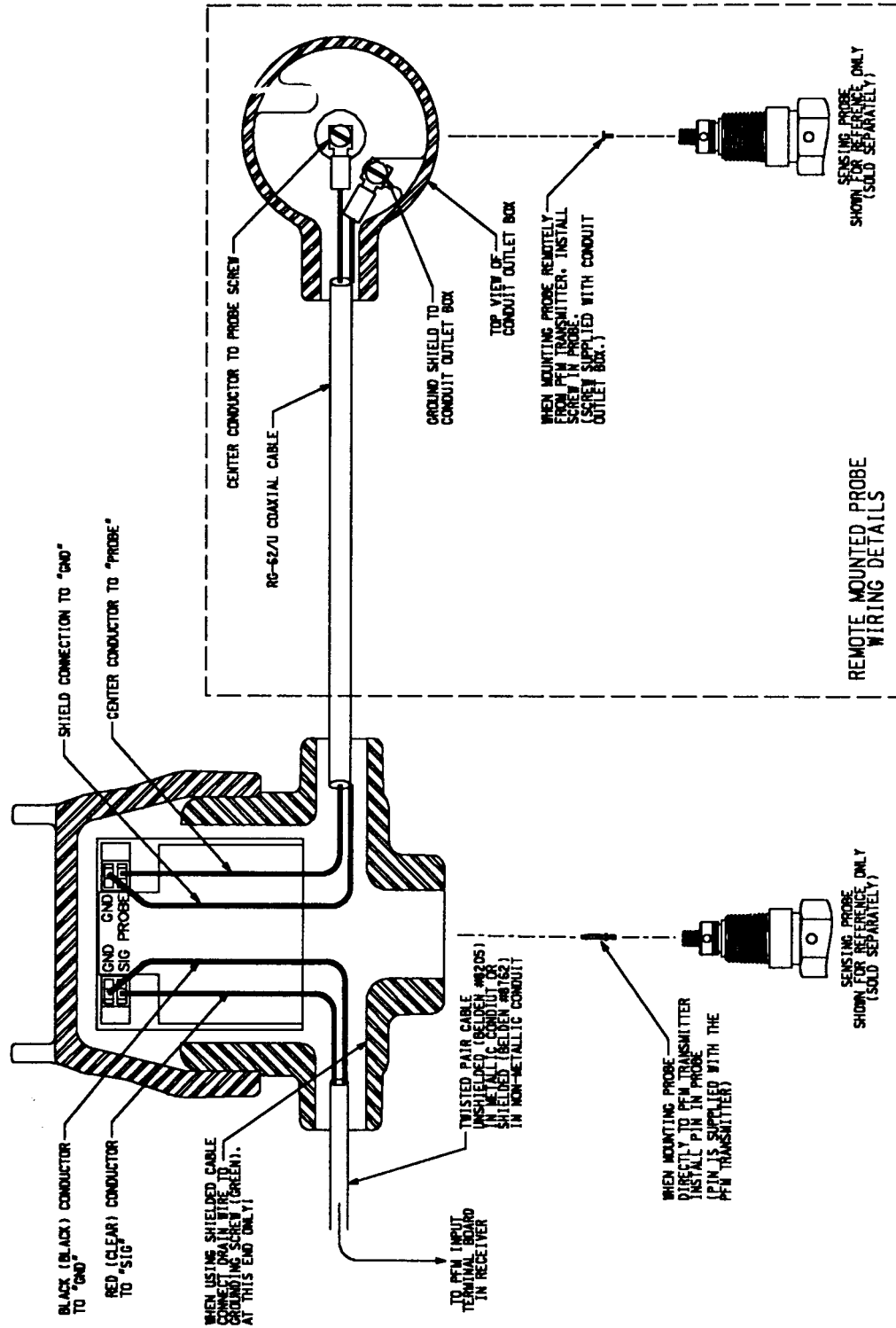
WIRING, RECEIVER (All Versions)



THE ALARM CONTACTS ARE SHOWN IN THE DE-ENERGIZED, ALARM, CONDITION

NOTICE
TIGHTEN FIELD WIRING TERMINAL
SCREWS TO 5 POUND-INCHES (0.56 NM)

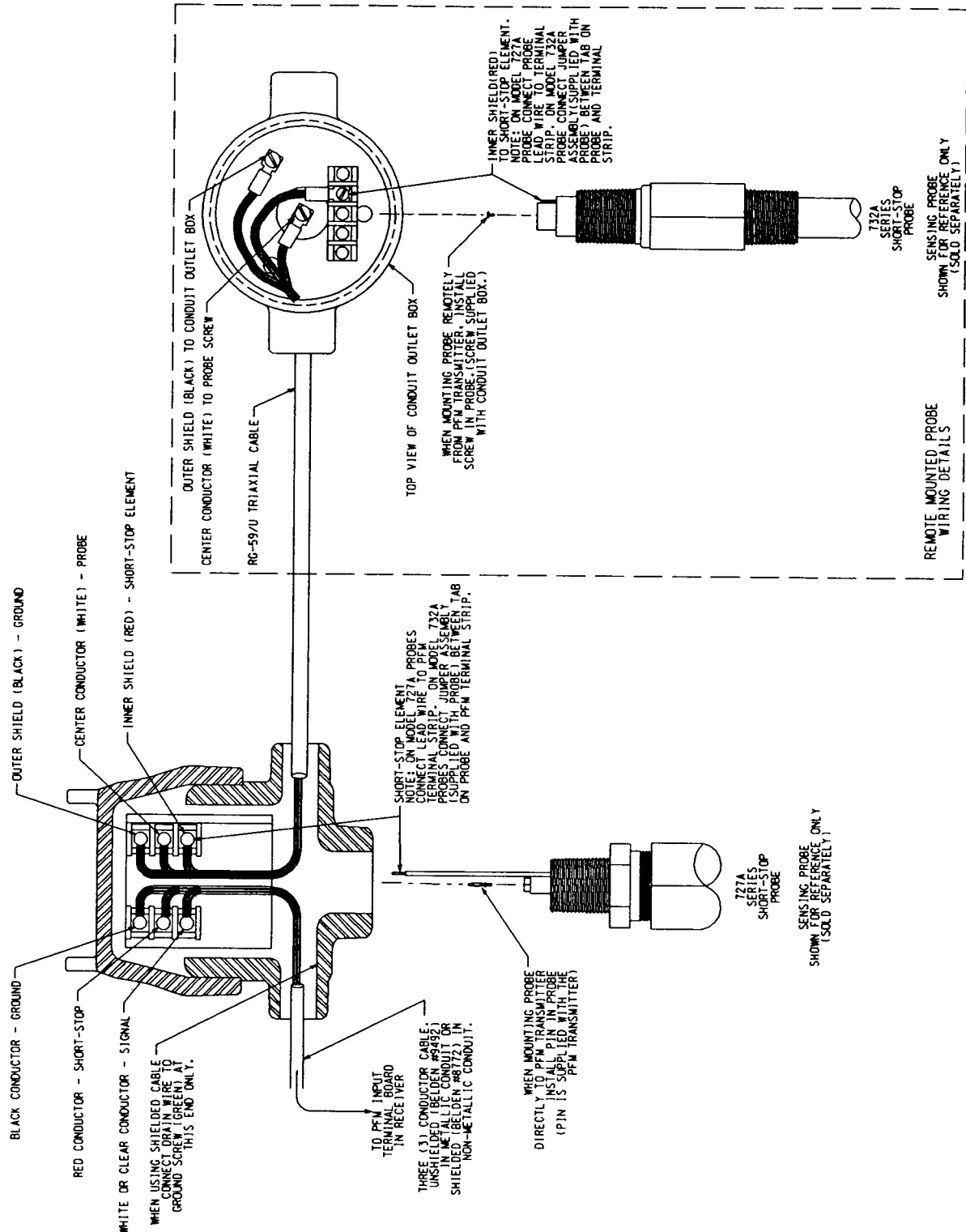
WIRING, STANDARD PFM TRANSMITTER (All Versions)



NOTICE

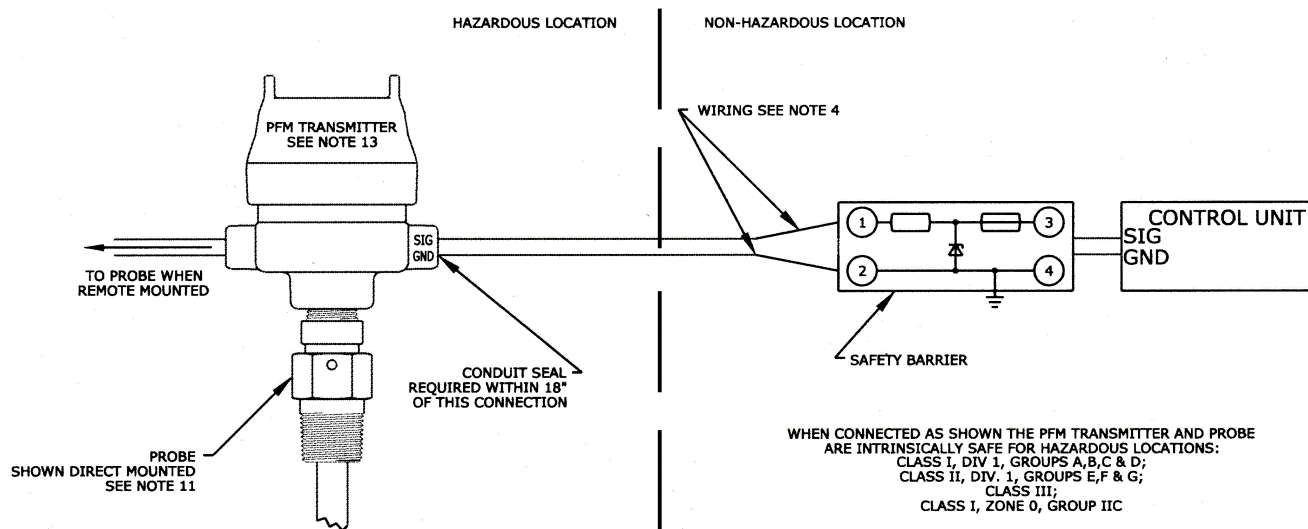
TIGHTEN FIELD WIRING TERMINAL SCREWS TO 5 POUND-INCHES (0.56 NM)

WIRING, SHORT-STOP™ PFM TRANSMITTER (All Versions)



NOTICE
 TIGHTEN FIELD WIRING TERMINAL SCREWS TO 5 POUND-INCHES (0.56 NM)

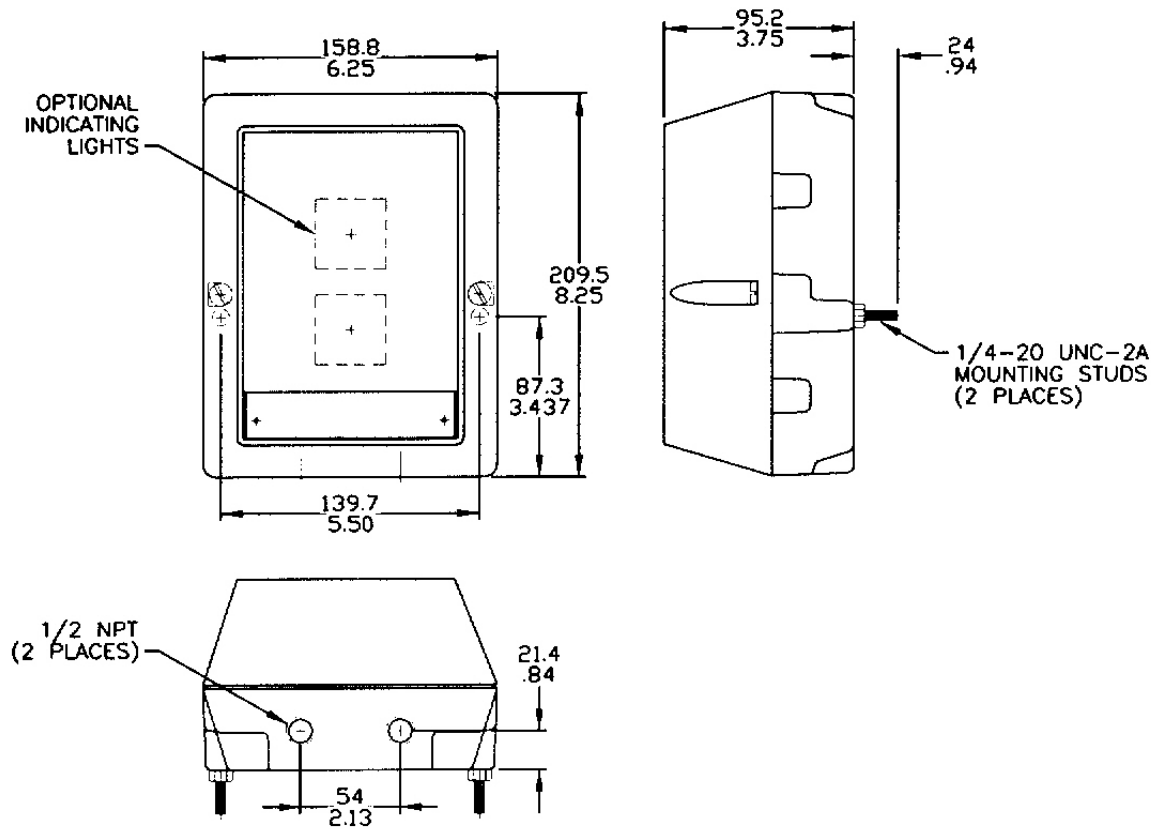
DRAWING 907GA811



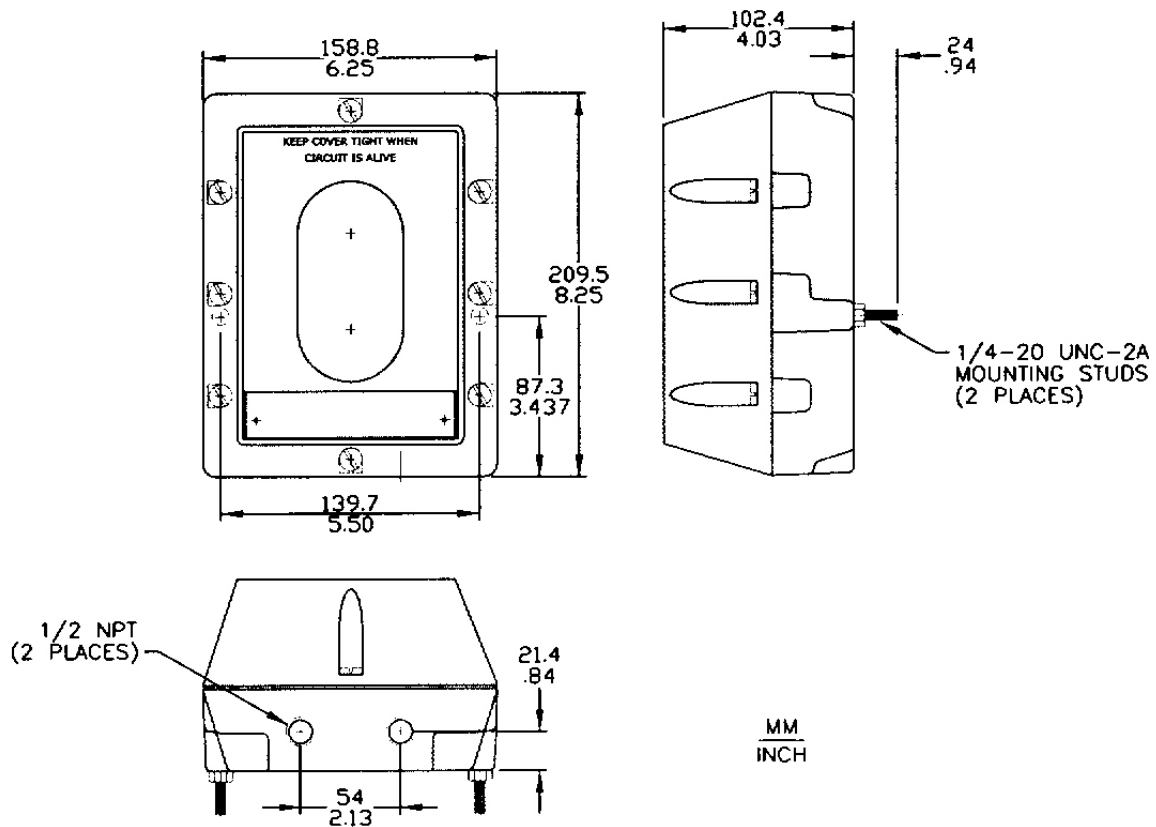
NOTES

- Selected safety barriers shall be listed or approved with intrinsically safe circuits for Class I, II and III, Division 1, Groups A, B, C, D, E, F and G, and Class I, Zone 0, Group IIC as appropriate for the application.
- Output current of the barrier must be limited by a resistor such that the output voltage current plot is a straight line drawn between open circuit voltage and short circuit current.
- Safety barriers must be installed in accordance with manufacturer's installation instructions.
- Safety barriers and its intrinsically safe wiring must be installed in accordance with articles 504 of the NEC ANSI/NFPA 70 or, if applicable, with the Canadian Electrical Code.
- The safety barrier must meet the following parameters:
 $V_{oc} \leq V_{max} = 15.7 \text{ V}$
 $I_{sc} \leq I_{max} = 386.8 \text{ mA}$
 $C_a \geq C_i + C_{\text{cable}}$
 $L_a \geq L_i + L_{\text{cable}}$
- If the electrical parameters of the cable are unknown, the following values must be used:
 Capacitance = 60 pF/ft.
 Inductance = 0.20 uH/ft.
 Example: 1000 feet of cable would equal: $C_{\text{cable}} = 1000 \times 60 \text{ pF} = 0.06 \text{ uF}$ $L_{\text{cable}} = 1000 \times 0.20 \text{ uH} = 0.2 \text{ mH}$
- If the safety barrier requires an earth ground then the resistance between the terminal on the safety barrier and earth ground shall be less than 1 ohm.
- The PFM Transmitter entity parameters are:
 $V_{max} = 15.7 \text{ V}$
 $I_{max} = 386.8 \text{ mA}$
 $C_i = 0.54 \text{ uF}$
 $L_i = 0$
- Recommended safety Barriers:
 A. R. Stahl incorporated No. 9001/01-158-390-10 (UL listed, FM Approved & CSA Certified)
 B. Measurement technology Ltd. No. MTL 715P+ (FM Approved & CSA Certified)
- Not applicable.
- Robertshaw Model 702, 728, 729, 736, 737, 738, 739, 740, 741, 750, 150KB284 or 150KB285 probe. Insulated probes only may be used in Class II, Group E & F areas.
- Tighten PFM field wiring terminal screws to 5 pound-inches (0.56Nm)
- PFM Transmitter, Part Numbers 900GA336-01 & -03 are probe mounted. Part Numbers 900GA336-02 & -04 are remote mounted.

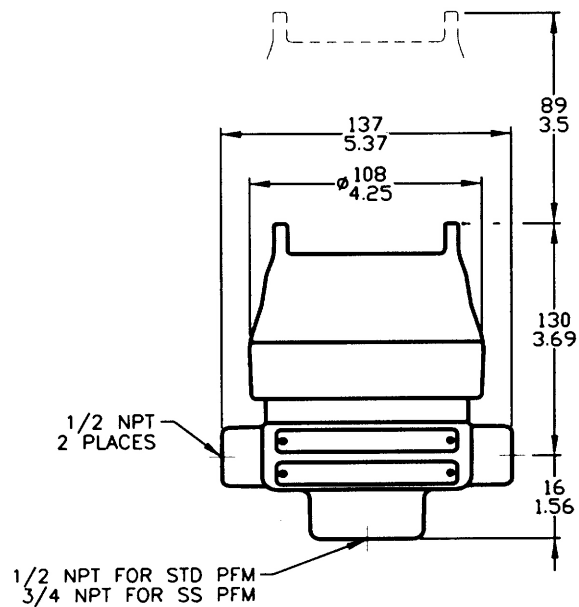
DIMENSIONS, RECEIVER (Rain Tight, NEMA 4 or NEMA 4X)



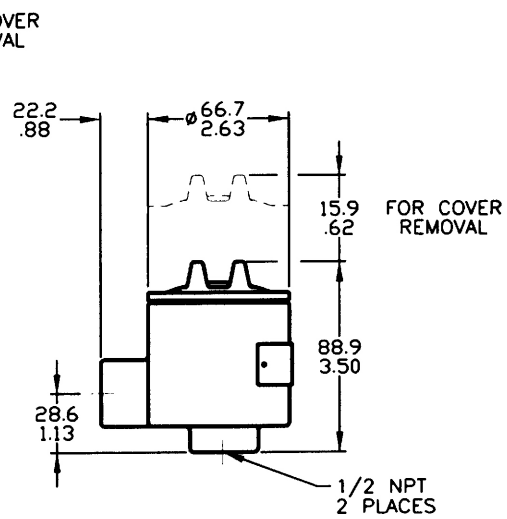
DIMENSIONS, RECEIVER (Explosion-Proof)



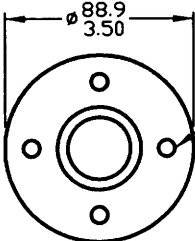
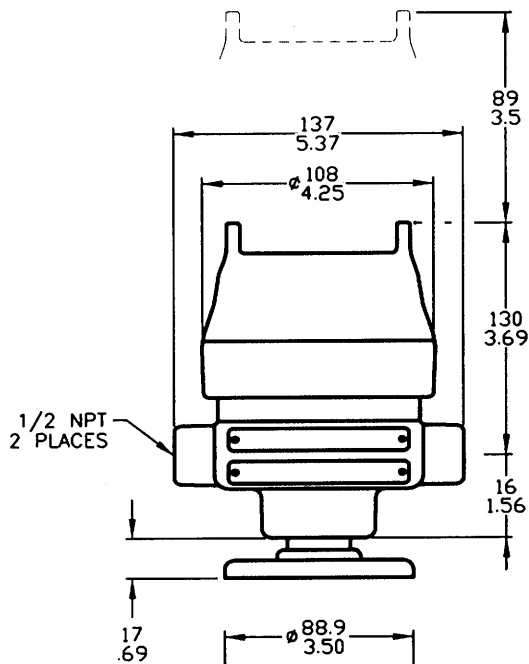
DIMENSIONS, TRANSMITTER (All Versions)



PFM TRANSMITTER
PROBE MOUNTED

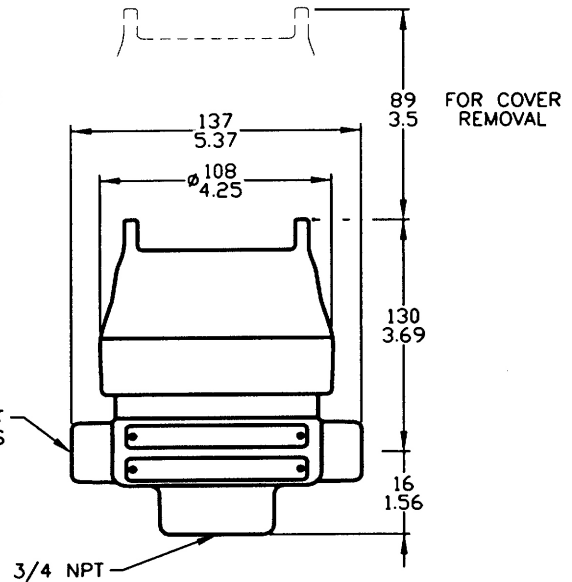


CONDUIT JUNCTION BOX FOR REMOTE MOUNTING
STANDARD PFM TRANSMITTER
(SOLD SEPARATELY)



PFM TRANSMITTER
REMOTE MOUNTED

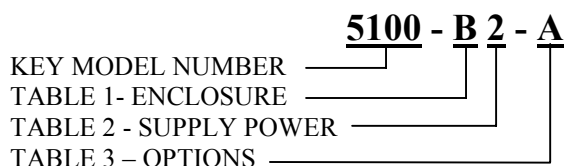
CLEARANCE HOLE FOR
 $\phi .6$ FLAT HEAD SCREW
ON A $\phi 3.5$ BOLT CIRCLE
4 PLCS EQUALLY SPACED



CONDUIT JUNCTION BOX FOR REMOTE MOUNTING
SHORT-STOP PFM TRANSMITTER
(SOLD SEPARATELY)

MM
INCH

Ordering Information:



KEY MODEL NUMBER

DESIGNATION	DESCRIPTION
5100	MICROPROCESSOR BASED ON/OFF LEVEL DETECTOR. RECEIVER UNIT, IN AN ENCLOSURE, PER TABLE 1. ALSO INCLUDES A PROBE MOUNTED PFM TRANSMITTER IN AN EXPLOSION-PROOF ENCLOSURE

TABLET-ENCLOSURE

DESIGNATION	DESCRIPTION
A	NEMA 4, RAIN TIGHT, WITHOUT INDICATOR LIGHTS
B	NEMA 4, RAIN TIGHT WITH INDICATOR LIGHTS
C	EXPLOSION-PROOF WITHOUT INDICATOR LIGHTS
E	NEMA 4X, CORROSION RESISTANT (EPOXY PAINTED), WITHOUT INDICATOR LIGHTS
F	NEMA 4X, CORROSION RESISTANT (EPOXY PAINTED), WITH INDICATOR LIGHTS
G	EXPLOSION-PROOF, CORROSION RESISTANT (EPOXY PAINTED) WITHOUT INDICATOR LIGHTS

TABLE 2 - SUPPLY POWER

DESIGNATION	DESCRIPTION
1	18 TO 30 VDC
2	120 VAC $\pm 10\%$, 50/60 HZ
3	240 VAC $\pm 10\%$, 50/60 HZ

TABLE 3 - PFM TRANSMITTER OPTIONS

DESIGNATION	DESCRIPTION
A	PROBE MOUNTED PFM TRANSMITTER
B	REMOTE MOUNTED PFM TRANSMITTER*
C	PROBE MOUNTED SHORT-STOPT™ PFM TRANSMITTER
D	REMOTE MOUNTED SHORT-STOPT™ PFM TRANSMITTER*
E	PROBE MOUNTED, CORROSION RESISTANT (EPOXY PAINTED), PFM TRANSMITTER
F	REMOTE MOUNTED, CORROSION RESISTANT (EPOXY PAINTED), PFM TRANSMITTER*
G	PROBE MOUNTED, CORROSION RESISTANT (EPOXY PAINTED), SHORTSTOP™ PFM TRANSMITTER
H	REMOTE MOUNTED, CORROSION RESISTANT (EPOXY PAINTED), SHORT-STOP™ PFM TRANSMITTER*

* INCLUDES NIPPLE AND FLOOR FLANGE. REQUIRES CABLE AND CONDUIT ASSEMBLY SHOWN IN ACCESSORIES BELOW (MAXIMUM ALLOWABLE CABLE LENGTH IS 15 FEET).

ACCESSORIES – STANDARD PFM TRANSMITTER

PART NO.	DESCRIPTION
032KC190-XX	1/2" Liquid tight, Flexible, Conduit Only Assembly. General Purpose. (1/2" NPT Connections)*
032KC600-XX	Coaxial Cable, Teflon Dielectric, Assembly with Spade Lugs (on one end only). General Purpose.*
032KC650-XX	Combination of the above two items. General Purpose.*
032KC700-XX	Same as 032KC600-XX except includes Conduit Outlet Box. Explosion-Proof/NEMA 4.*
032KC710-XX	Same as 032KC650-XX except includes Conduit Outlet Box. Explosion-Proof/NEMA 4.*
032KC720-02	Coaxial Cable, Teflon Dielectric, Assembly in 2 ft. long, 1/2" Explosion-Proof, Flexible, Conduit with Conduit Outlet Box. Explosion-Proof/NEMA 4.
032KC720-05	Same as above except 5 ft. long.
032KC720-08	Same as above except 8 ft. long.
032KC720-10	Same as above except 10 ft. long.
032KC800-XX	Same as 032KC700-XX except Conduit Outlet Box is Epoxy Painted. Explosion-Proof/NEMA 4X.*
032KC810-XX	Same as 032KC710-XX except Conduit Outlet Box is Epoxy Painted. Explosion-Proof/NEMA 4X.*
032KC820-02	Same as 032KC720-02 except Conduit Outlet Box is Epoxy Painted. Explosion-Proof/NEMA 4X.
032KC820-05	Same as above except 5 ft. long.
032KC820-08	Same as above except 8 ft. long.
032KC820-10	Same as above except 10 ft. long.
032KC900-XX	Same as 032KC700-XX except Conduit Outlet Box is Stainless Steel. Explosion-Proof/NEMA 4X.*
032KC910-XX	Same as 032KC710-XX except Conduit Outlet Box is Stainless Steel. Explosion-Proof/NEMA 4X.*
032KC920-02	Same as 032KC720-02 except Conduit Outlet Box is Stainless Steel. Explosion-Proof/NEMA 4X.
032KC920-05	Same as above except 5 ft. long.
032KC920-08	Same as above except 8 ft. long.
032KC920-10	Same as above except 10 ft. long.
909SD029	Conduit Outlet Box, Explosion-Proof/NEMA 4.
909SD029-50	Conduit Outlet Box, Epoxy Painted, Explosion-Proof/NEMA 4X.
909SD029-51	Stainless Steel Conduit Outlet Box, Explosion-Proof/NEMA 4X.

* Substitute the desired cable length, in feet, for "XX" to complete the Cable Assembly Part Number. Maximum Recommended Coax Cable Length is 15 feet.

NOTE: All Coaxial Cables Have A Maximum Operating Temperature of 350°F.

ACCESSORIES - SHORT-STOP™ PFM TRANSMITTER

PART NUMBER	DESCRIPTION
032KF12X-XX	TRIAxIAL CABLE, TEFLON DIELECTRIC, CABLE ASSEMBLY WITH SPADE LUGS. GENERAL PURPOSE.
032KF130-XX	TRIAxIAL CABLE, TEFLON DIELECTRIC, ASSEMBLY WITH CONDUIT OUTLET BOX AND SPADE LUGS. NEMA 4. **
032KF140-XX	TRIAxIAL CABLE, TEFLON DIELECTRIC, ASSEMBLY WITH CONDUIT OUTLET BOX LIQUID TIGHT FLEXIBLE CONDUIT AND SPADE LUGS. NEMA 4. **
032KF150-05	TRIAxIAL CABLE, TEFLON DIELECTRIC, ASSEMBLY, 5 FEET LONG, WITH CONDUIT OUTLET BOX, EXPLOSION-PROOF FLEXIBLE CONDUIT AND SPADE LUGS. EXPLOSION-PROOF.
032KF150-10	SAME AS ABOVE EXCEPT 10 FEET LONG.
032KF330-XX	SAME AS 032KF130-XX EXCEPT EPOXY PAINTED CONDUIT OUTLET BOX. NEMA 4X. **
032KF340-XX	SAME AS 032KF140-XX EXCEPT EPOXY PAINTED CONDUIT OUTLET BOX. NEMA 4X. **
032KF350-05	SAME AS 032KF150-05 EXCEPT EPOXY PAINTED CONDUIT OUTLET BOX. CORROSION RESISTANT.
032KF350-10	SAME AS 032KF150-10 EXCEPT EPOXY PAINTED CONDUIT OUTLET BOX. CORROSION RESISTANT
040KB534	CONDUIT OUTLET BOX. EXPLOSION-PROOF/NEMA 4.
040KB534-01	CONDUIT OUTLET BOX, EPOXY PAINTED. EXPLOSION-PROOF/NEMA-4X.

* SUBSTITUTE THE DESIRED CABLE LENGTH, IN FEET, FOR "XX" TO COMPLETE THE CABLE ASSEMBLY PART NUMBER (MAXIMUM ALLOWABLE CABLE LENGTH IS 15 FEET).

** SUBSTITUTE THE DESIRED CABLE LENGTH, IN FEET, FOR "XX" TO COMPLETE THE CABLE ASSEMBLY PART NUMBER (MAXIMUM ALLOWABLE CABLE LENGTH IS 15 FEET).

NOTE: ALL CABLES HAVE A MAXIMUM OPERATING TEMPERATURE OF 350° F.

Robertshaw

U.S.A. and CANADA

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