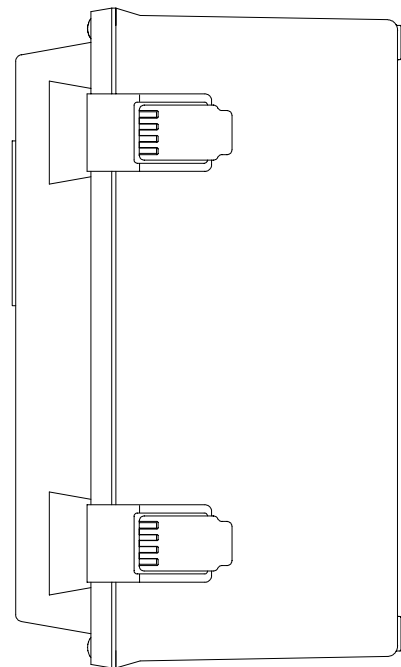
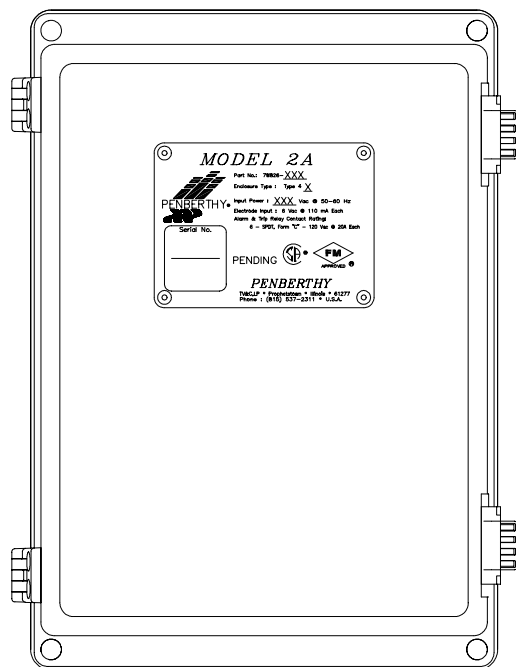


PENBERTHY®

Installation, Operation and Maintenance for Penberthy Electronic Water Level Gauge

Model 2A



Installation, Operation and Maintenance
Instructions

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PENBERTHY PRODUCT WARRANTY

Tyco Valves & Controls Prophetstown warrants its Penberthy products as designed and manufactured by TV&C Prophetstown to be free of defects in the material and workmanship for a period of one year after the date of installation or eighteen months after the date of manufacture whichever is earliest. TV&C Prophetstown will, at its option, replace or repair any products which fail during the warranty period due to defective material or workmanship.

Prior to submitting any claim for warranty service, the owner must submit proof of purchase to TV&C Prophetstown and obtain written authorization to return the product. Thereafter, the product shall be returned to TV&C in Prophetstown, Illinois, with freight paid.

This warranty shall not apply if the product has been disassembled, tampered with, repaired or otherwise altered outside of TV&C Prophetstown factory, or if it has been subject to misuse, neglect or accident.

The responsibility of TV&C Prophetstown hereunder is limited to repairing or replacing the product at its expense. TV&C Prophetstown shall not be liable for loss, damage or expenses related directly or indirectly to the installation or use of its products, or from any other cause or for consequential damages. It is expressly understood that TV&C Prophetstown is not responsible for damage or injury caused to other products, buildings, personnel or property, by reason of the installation or use of its products.

THIS IS TV&C PROPHETSTOWN'S SOLE WARRANTY AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This document and the warranty contained herein may not be modified and no other warranty, expressed or implied, shall be made by or on behalf of TV&C Prophetstown unless made in writing and signed by the General Manager or Director of Engineering of TV&C Prophetstown.

INSTALLATION, OPERATION and MAINTENANCE MANUAL FOR PENBERTHY Model 2A

1.0 Description

The Penberthy Model 2A is an accurate and ultra-reliable instrument for detection of steam/water presence in subcritical pressure steam generators. The unit provides up to 2 channels for steam/water indication and is complete with control outputs. Prior to performing any work, personnel responsible for the installation of the system should read these instructions and become familiar with the unit.

This I.O.M. is organized so that article 2 describes the essentials of installation and wiring to allow initial turn-on. Articles 3 and 4, covering the same basic subjects, may seem redundant but describe the details of operation beyond initial turn-on. They should be perused to maximize the utility of the Model 2A.

2.0 Supply & Installation

2.1 Packing

Prior to installing this equipment, clean all packing material from around the unit and inspect for any damage that may have occurred during shipment. Any claims for loss or damage must be filed by the purchaser with the carrier. A copy of the bill of lading and freight bill will be supplied on request by TV&C – Prophetstown.

2.2 Wiring Requirements

All wiring shall be terminated in a screw type terminal block, a screwed crimp-on terminal or a screwed lug point.

All wiring for mains in and control relays out shall be dressed away from all probe wiring, bundled and tie wrapped to maintain separation. Probes and their wiring that are in steam/vapor are essentially antennas and are susceptible to noise pick-up. To reduce RFI/EMI pick-up, a cable with an overall shield should be used for the probe/junction box to electronic module connections. This is a low current line so small wire diameters are acceptable. The maximum distance is 150' [45M], refer to section 2.3 for other details. If the installation is to be in an area with high electrical noise or to fully comply with EMC directives, all enclosures should be specified as metallic or with a conductive coating rather than the basic polymer enclosures.

Wiring shields should be terminated on both ends to the enclosures' ground lugs – not to circuit common.

TV&C – Prophetstown recommends that all wiring be enclosed in electrical metallic tubing (EMT) and that drip loops are established at each enclosure entry point. Spiral wrap cable conduits (e.g. Greenfield, BX) should not be used.

2.3 Location of the Electronics

The section on Startup and Operation, Sensitivity Control (Section 3.2) explains how to set the sensitivity range according to the conductivity of the water in your application. Water with a low conductivity requires a higher sensitivity and consequentially has greater noise susceptibility. The standard sensitivity range (10-100 μ S) places an upper limit of 80 ft. [25M] for the shielded cable distance. The lowest sensitivity greater than about 50 μ S allows the shielded cable distance to be up to 250 ft. [75M]. The coolest, most accessible location for mounting the electronics is preferred, usually on an outside wall. Dimensions of enclosures are shown in fig's 2 and 3.

2.4 Plumbing

If a water column was supplied with the system, refer to the water column manual for complete details.

The water column is fixed to the steam drum either by being welded directly to the isolating valves or welded to flanges that mate with existing flanges on the steam drum tapping points.

The metal probe covers should be removed from the water column after it is fully plumbed into the system and remain off until the system is in service and a satisfactory inspection of all the probes and the associated wiring is completed.

Water Columns with three maximum pressure ratings are available – 850 [58 bar], 1800 [124 bar] and 3000 psi [206.9 bar] design. The fittings on steam generators of lower pressure usually have a lesser rating. As a result, the overall rating of a system is governed by the lowest rating of any of the components.

The model 2A can, as an alternative, be supplied with fittings for one of three installation options:

- Type "A" fitting (for HP probe) or half-coupler (for LP probe) - for installation on water column or pressure vessel.
- 1 ½" male SW connector - for installation into a pipe fitting.
- 1 ½" male SW connector welded in a 3000# tee - for installation into existing 1 ½" piping.

The probe can be mounted horizontally, or vertically with the electrical connection up. All welding should be done in accordance with approved welding procedures as required by local authorities. The probe and probe housing must be removed from the supplied fitting before any welding is performed.



WARNING



The nature of the electronics, the harsh operating environment and the potential hazards associated with live steam require that only qualified personnel install and maintain this equipment. Without adequate qualifications, an operator could allow live steam to escape which may cause property damage or severe personal injury.

2.5 Probes

The Model 2A is supplied with either of two probe styles. For applications below 525°F [274°C] / 850 psi [58 bar], an economical probe is available with a PTFE wetted insulator. It can not be used if either parameter (525°F [274°C] or 850 psi [58 bar]) is exceeded.

For all other applications, probes with the zirconium oxide (ceramic) insulators must be used. The high pressure (HP) probes are easily recognized by the brazing between the insulator and the body (fig 1). The two styles of probes are not interchangeable and will not fit in a receptacle designed for the other, the LP probe uses a threaded fitting, the HP a compression fitting. In this I.O.M., all instructions address the HP style probe (see figure 1). Refer to the water column I.O.M. for details on both the HP and LP probes.

Note: The probe hex nut and hex jam nut located on the post used for the electrical connection have been pre-torqued to exact specification. If the hex nuts are inadvertently moved, the probe must be replaced.

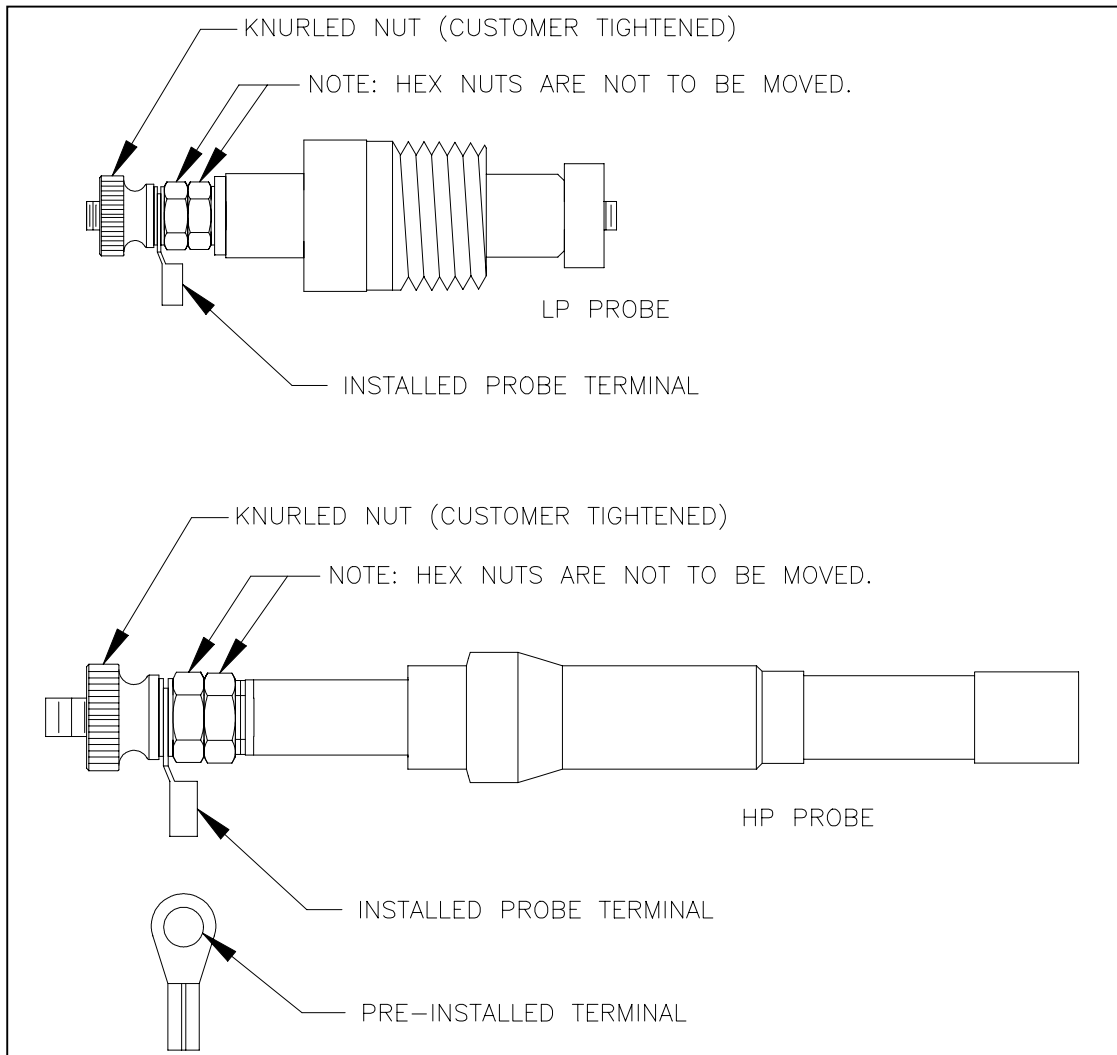


Figure 1 – Probe Assembly

2.6 Probe Housing (refer to Fig 2)

The probe housing is a two-piece protective stainless steel enclosure. It is held to the probe / probe fitting by a snap ring supplied with the probe / fitting.

2.7 Probe Wiring Junction Box

If the optional probe wiring junction box is supplied (not column mounted), refer to Fig 4 for mounting details.

2.8 Wiring (refer to figures 4 and 5)

Note: All wiring should be in accordance with applicable national and local codes by qualified personnel.



CAUTION



Before making any connections, make sure that the power source to be used is isolated by use of the appropriate circuit breakers and switches so that no work is being performed with “live wires”, otherwise personal injury or property damage may result.

2.8.1 At the Probes

For proper operation of the electronics, the system must be properly grounded. When a water column is supplied with probe covers, there is a column ground located on the underside of each probe cover upper bracket. When individual probe housings are supplied, each housing has a separate ground connection. Wiring at the probe is via the crimp type eyelet supplied with each probe. If the eyelet is not used, intermittent operation may result. At least one ground wire must be connected to the water column ground.

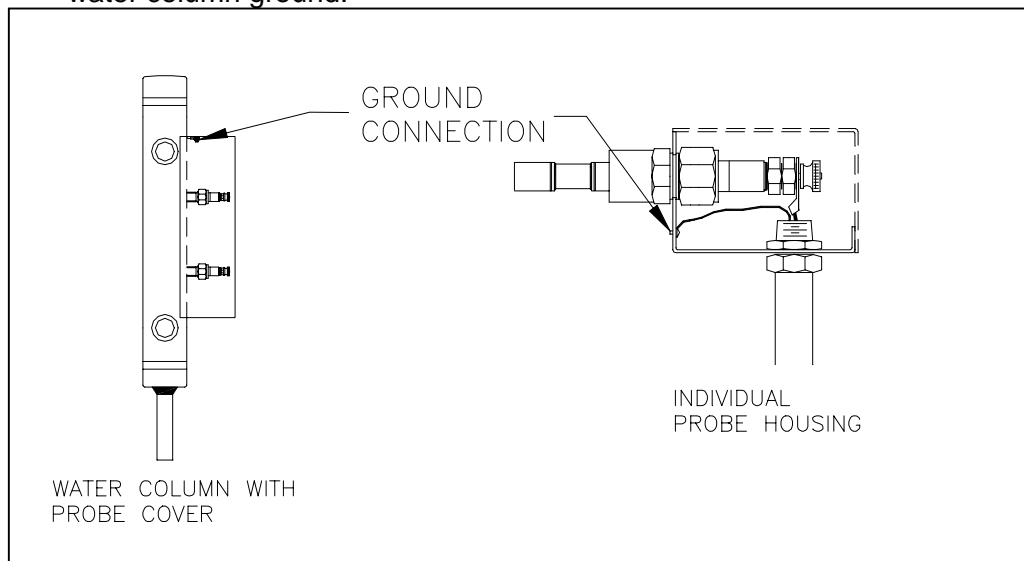


Figure 2 - Ground connection location

If the column mounted junction box option is ordered, the unit is pre-wired from the probes to the junction box mounted on the water column. Probe to junction box wiring must be high temperature (e.g., mineral / glass insulated or thermocouple wire).

The cabling between the standard off-column junction box and the Electronic Module does not require any high temperature capability. It is recommended, however, the cable should have an overall shield, 18-24 gauge tin or silver plated wire and have a minimum rating of 221°F, [105°C]. If the junction box is located on the water column, higher temperature wiring may be required.

The lowest probe on ALL systems is numbered 1 and the corresponding terminal in the Electronic Module is E1 at TB3. Wire successively higher probes in the same manner.

SAFETY INSTRUCTION

Do not run input power through spare conductors in multi-conductor cables used for probes and display module wiring. Input power is to be run in separate cable runs.

2.8.2 At the Electronic Module

No wiring access holes are drilled in the enclosure. Access holes may be placed at any convenient point during installation. Use appropriate fittings, consider EMI and RFI, also maintain the NEMA/IP rating of the enclosure. The access hole for the probe wiring should contain only probe wiring.

It is recommended that the relay out and mains power input each have their own access hole although this is not mandatory. Dress all mains carrying conductors away from signal wiring.

For reliable operation, a mains power source with the following requirements is required:

120 or 240 Vac
Single Phase, 50/60 Hz
12VA

Mains higher than 240 Vac will require the use of a stepdown transformer. DC voltages will require use of a voltage inverter.

(refer to fig 6, loc 2)

Mains power is connected to TB1.

For 120 Vac operation: H is "hot", N is "neutral". A fuse should be installed at F1. Connect the ground wire to the ground lug (refer to fig 6, loc 1) in the upper left hand corner of the board.

For 240 Vac operation: Line 1 is connected to H and Line 2 is connected to N. A fuse should be installed at F1. Connect the ground wire to the ground lug (refer to fig 6, loc 1) in the upper left hand corner of the board.

Mains power is MOV protected. Although the Model 2A uses a jumper set primary transformer, do not attempt to change factory set mains voltage level unless the MOV is also changed to the proper value.

2.8.3 Control Output (steam fail-safe) (refer to fig 6, loc 4, 5 & 6)

Two SPDT Form-C contacts are provided for the control output of each channel, as well as two latching relays. These outputs are designated as shown in the following table:

Relay	Output for:
RY-3 / RY-3A	Latching
RY-2 / RY-2A	Probe 2
RY-1 / RY-1A	Probe 1

Contact Rating:

10 A @ 28 VDC (N.C.)	20 A @ 28 VDC (N.O.)
10 A @ 120 Vac (N.C.)	20 A @ 120 Vac (N.O.)
10 A @ 240 Vac (N.C.)	20 A @ 240 Vac (N.O.)

The latching relays energize only when BOTH associated probes indicate water detection and de-energize only when BOTH associated probes indicate steam detection. For example – when the water level rises to probe #1, RY-1 & RY-1A will energize. When the water level continues to rise to probe #2, RY-2 & RY-2A will energize AND RY-3 & RY-3A will energize. When the water level then drops below probe #2, RY-2 & RY-2A will de-energize, but RY-3 & RY-3A will remain energized. When the water level falls below probe #1, BOTH RY-1 & RY-1A AND RY-3 & RY-3A will de-energize. Or, in logical terminology -

Water high-high = latch
Water low-low = release

3.0 Startup and Operation

3.1 Water Column

Please refer to the Water Column manual for details on Water Column Startup and Operation.

3.2 Electronic Module Sensitivity Control

Inspect the module to ensure that all electrical connections are made and properly protected. The sensitivity required for the water conductivity range to be detected should have been specified when the system was ordered, if not, the default sensitivity of 10 – 100 μ S was supplied. If the sensitivity is not correct, proper replacement resistors should be obtained by contacting TV&C – Prophetstown with the conductivity of water used. The proper resistors are placed into sockets at R5 - for probe #1 & R6 - for probe #2 (refer to fig 6).

Note: All channels will be set to the same conductivity range.

The factory default setting is: Conductivity 10 - 100 μ S nominal.

After setting the sensitivity, power may be supplied to the unit by use of the external circuit breaker. The unit is now operational.

3.3 Probe Installation

Please refer to the Water Column manual for details on Probe Installation.

4.0 Detection Circuitry

A low-voltage square wave is generated in the Model 2A System. This signal is connected through a resistor to the probe field terminal blocks. (ref: fig 6, loc 7)

When the probe tip is immersed in water a signal current bleed path to ground is completed by the conductivity of the water. Current flow through the circuit causes a voltage drop to appear across a sensitivity resistor. When the voltage drop exceeds the turn-on voltage a voltage sensitive latch switches into conduction state, indicating the

presence of water. When the probe is submerged, the voltage should be ≈ 0 , when in air or steam the voltage should be approximately 7.5Vac RMS.

5.0 Maintenance

Each boiler installation is subject to varying operating and water conditions. Generally, the higher operating pressure units (>1800 psi [125 bar]) have improved water treatment and, as such, maintenance is minimized.

5.1 Water Column

A specific maintenance program is difficult to detail but the following outlines the minimum required:

- (1) The water column should be blown down periodically and visually inspected for leaks every 3 months.
- (2) The operating range of the Model 2A should be verified at this time by allowing the water column to fill with condensate (see Water Column manual: Startup and Operation).

5.2 Probes

Please refer to the Water Column manual for details on Probe Maintenance.




WARNING




Before servicing the probes, ensure that the water column is properly isolated from the system, all pressure has been relieved and the unit cooled to an acceptable level, otherwise severe personal injury and property damage may occur.

5.3 Electronic Module and Display

No maintenance is required.



CAUTION



Any malfunction of the equipment should be attended to immediately. Although any single channel will fail safe, the overall package is designed for continued operation. Compounding faults, however, could defeat the internal self-diagnostic logic, providing misinformation to the operator and possibly subjecting the boiler to potential hazard or nuisance trips.

6.0 Spare Parts

The following spare parts are recommended as a minimum set for stocking by the user:

- 1 Probe
- 1 Motherboard
- A copy of this I.O.M.

Probes are available only as complete new assemblies. Consult your Tyco or Penberthy distributor or TV&C-Prophetstown for repair Modules.

7.0 Model 2A Specifications *

Standard Sensitivity:	≥ 10 μSiemens (10 – 100 μS default)
Input Voltage:	105-130 Vac or optional 210-260 Vac – MOV protected
Frequency:	50-60 Hz
Power (max):	12 VA
Output Voltage:	7.5 Vac RMS maximum, resistor isolated
Relay Contact:	10 A @ 28 VDC (N.C.) / 20 A @ 28 VDC (N.O.) 10 A @ 120 Vac (N.C.) / 20 A @ 120 Vac (N.O.) 10 A @ 240 Vac (N.C.) / 20 A @ 240 Vac (N.O.)
Operating Temperature:	
Electronics:	32 – 160°F [0°C –70°C] FOR USE IN 121°F [50°C] MAXIMUM AMBIENT (without local display) FOR USE IN 104°F [40°C] MAXIMUM AMBIENT (with local display)
Standard Column:	850°F [455°C] maximum
Standard Enclosure Rating:	NEMA 4X [IP66]
Wiring Specification:	
Junction Box to	300V, 221°F [105°C]
Electronic Module:	18-24 AWG or larger shielded PVC, 3 conductor minimum
Dimensions/Weights:	Electronic Module 12.0" [30.5 cm] H x 9.2" [23.4 cm] W x 7.0" [17.8 cm] D 7 lbs [2.6 kg]
Manufacturing Standards:	
Column:	ASME Section 1, ASME B31.1
Electronics:	CSA 22.2 NFPA - 70 (NEC)

Standard Options:

Metallic enclosure for EMI/RFI control – Stainless Steel or Carbon Steel
12 VDC battery backup - contact factory for details
Power loss contacts - contact factory for details

*Specifications and descriptions are subject to change without notice.

8.0 Troubleshooting

Water Column:	Refer to section 2.4 & 5.1
Sensitivity/Conductivity:	Refer to sections 2.2 and 3.2
Probes:	Refer to sections 2.5, 3.3 and 5.2
Probe Wiring:	Refer to sections 2.2, 2.8.1, 2.8.2 and fig 4
Line Power/Fuses:	Refer to section 2.8.2

S/W discrimination: Refer to section 4.0

Control Relay: Refer to section 2.8.4

The electronics module is constructed with surface mounted electronics. Field repair is not practical except for replacement of relays.

9.0 Disposal at End of Useful Life

The Model 2A may be used in a variety of fluid applications. By following the appropriate national and industry regulations, the user must determine the extent of preparation and treatment the Model 2A must incur before its disposal. A Material Safety Data Sheet (MSDS) may be required before disposal services accept certain components.

Metal, glass and polymers should be recycled whenever possible. Refer to order and TV&C - Prophetstown Material Specification sheets for materials of construction.

RIGHT TO KNOW LAWS AND OSHA STANDARD 29CFR (1910.1200)
Material Safety Data Sheets on the following Penberthy product:
Model 2A

The OSHA Hazard Communication Standard 29CFR 1910.1200, states that the standard does not apply to "articles". The standard defines an article as:

A manufactured item formed to a specific shape or design for a particular use which does not release or otherwise expose an employee to a hazardous chemical under normal conditions of use.

The above named products fall within the definition of an 'article', no Material Safety Data Sheets are available or are required. Our product is manufactured as an "end product".

If the product is a weld end the following applies.

WARNING: Materials used in manufacture of Penberthy products are considered in a stable condition when shipped. However, under certain conditions purchasers could create potential hazardous conditions by their future operations.

Caution: Welding, cutting, burning, machining or grinding of this product can generate toxic dust and fumes of potentially hazardous ingredients. The dust or fumes can cause irritation of the respiratory tract, nose, throat, skin and eyes. It may cause temporary or permanent respiratory disease in a small percentage of exposed individuals. Use moderate ventilation when grinding or welding. Avoid breathing dust, fumes or mist. Avoid prolonged skin contact with dust or mist. Maintain dust levels below OSHA and ACGIH levels. Use protective devices. Wash hands thoroughly after contact with dust before eating or smoking.

For emergency information contact:
Tyco Valves & Controls, L.P. Prophetstown
320 Locust St., Prophetstown, Illinois 61277
Phone: 815-537-2311
Fax: 815-537-5365
E-mail:boilertrimteam@tycovalves.com

10.0 Telephone Assistance / Factory Repair

If you are having difficulty with your Model 2A, contact your local Tyco / Penberthy distributor. You may also contact the factory direct at (815) 537-2311 and ask for an applications engineer. So that we may assist you more effectively, please have as much of the following information available when you call:

- Model #
- Serial #
- Name of the company from whom you purchased the Model 2A
- Invoice # and date
- Process conditions (pressure, temperature, cycle rate, etc.)
- A brief description of the problem
- Troubleshooting procedures that failed

If attempts to solve your problem fail, you may request to return your Model 2A to the factory for intensive testing. You must obtain a Return Authorization (R.A.) number from TV&C - Prophetstown before returning anything. Failure to do so will result in the unit being returned to you without being tested, freight collect. To obtain an R.A. number, the following information (in addition to that above) is needed:

- Reason for return
- Person to contact at your company
- "Ship To" address

There is a minimum charge of \$75.00 for evaluation of non-warranty units. You will be contacted before any repairs are initiated should the cost exceed the minimum charge. If you return a unit under warranty, but is not defective, the minimum charge will apply.

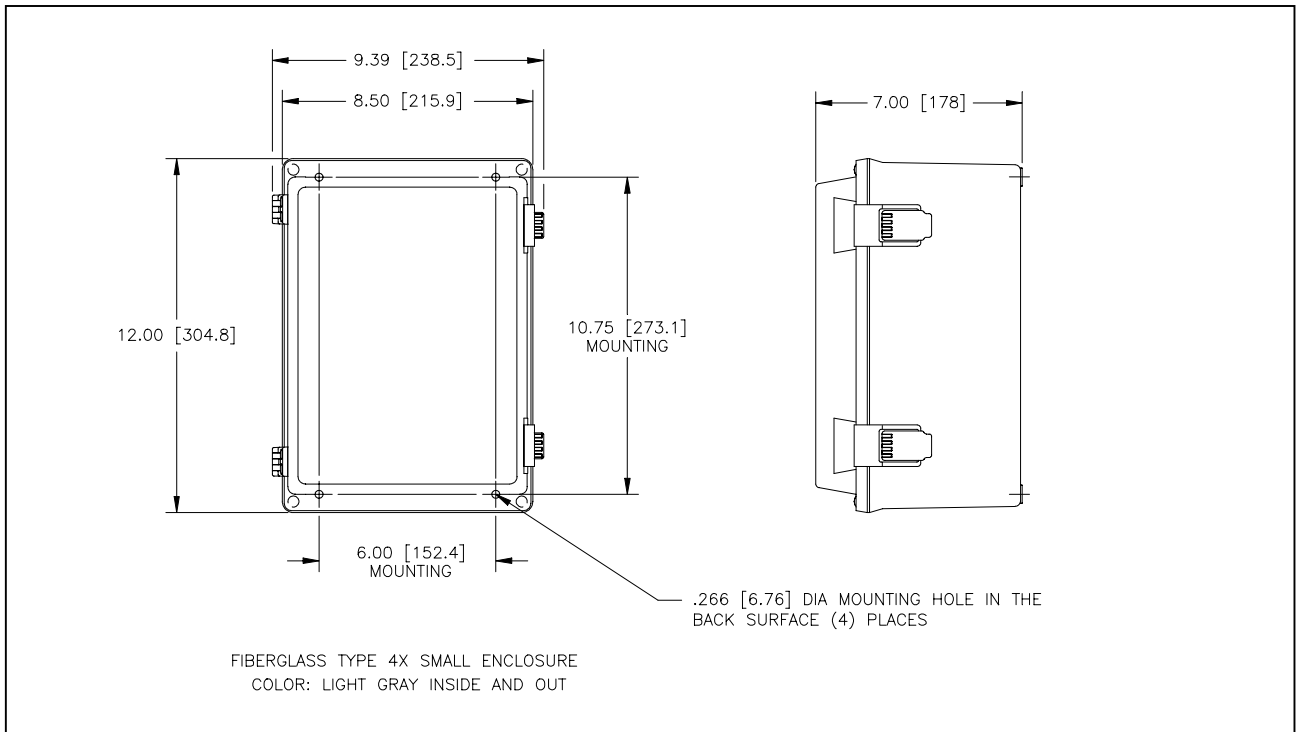


Figure 3 - Standard Fiberglass Enclosure

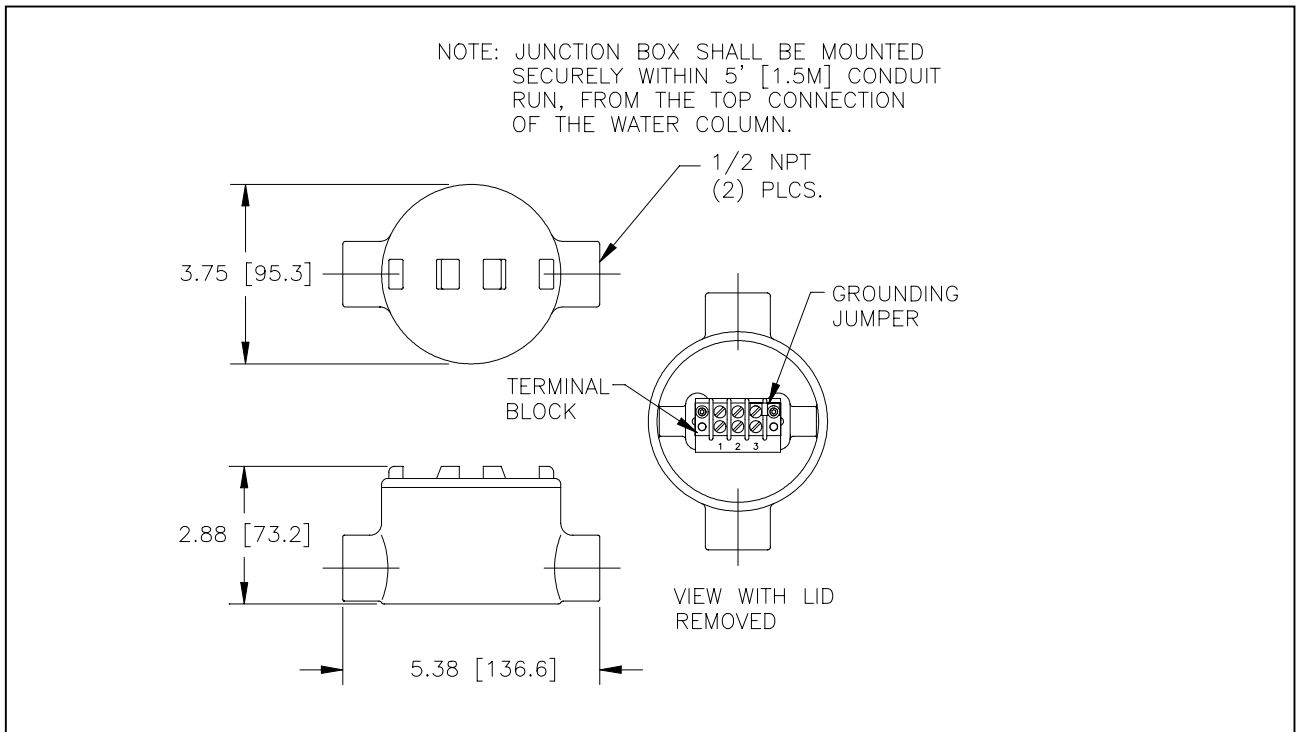


Figure 4 - Probe Wiring Junction Box

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