

Model APT3100  
Smart Pressure Transmitter  
Operating Manual



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This manual can be change and revised for quality upgrade without an advance notice.

## **APT3100 Smart Pressure Transmitter**

This manual is made so that general user can help to install and operate APT3100 Smart Pressure Transmitter efficiently.

Before handling APT3100 transmitter, all users have to be fully aware of it.

Information on this manual can be changed without an advance notice.



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# Chapter 1 Introduction

The APT3100 Smart Pressure Transmitter are correctly calibrated at the factory before shipment. To ensure correct and efficient use of the instrument, please read this manual thoroughly and fully understand how to operate the instrument before operating it

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- ② All rights reserved. No part of this manual may be reproduced in any form without DUON System's written permission.
- ③ If any question arises or errors are found, or if any information is missing from this manual, please inform the nearest DUON System sales office.
- ④ The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made instrument.
- ⑤ Please note that changes in the specifications, construction, or component parts of the instrument may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.

## 1.1 Using This Manual

The Chapters in this operating manual provide information on installing, operating, and maintaining devices from the AUTROL Model APT3100 Smart Pressure Transmitter. The Chapters are organized as follows.

### Chapter 2 Handling Cautions

This chapter consists of core information for installing APT3100 on operating place after buying it. Chapter 2 provides instruction on commissioning and operating Model APT-3100 Smart Pressure Transmitters. Information on software functions, configuration parameters, and on-line variables is also included.

### Chapter 3 Transmitter Functions

Chapter 3 contains information on handling Model APT3100 Smart Pressure Transmitters.

### Chapter 4 Installation

Chapter 4 contains mechanical, environment consideration and electrical installation instructions on the Model APT3100 Smart Pressure Transmitters.

### Chapter 5 On-line Operation

Chapter 5 describes the configuration parameter how to use variety of the Model APT3100 Smart Pressure Transmitters' software function and configuration. See the following list for the details.

- ① Regulations of circuit's Input/Output characteristics; Sensor or Output Trim
- ② Changed of output characteristic; Range Configuration, Output Type, Damping, Unit
- ③ Changed of general data; Tag No., Date, Message etc.

### Chapter 6 Maintenance

Chapter 6 contains hardware diagnostics ,troubleshooting and maintenace task.

## 1.2 Overview of Transmitter

Autrol® Smart Pressure Transmitter based in a microprocessor is the pressure transmitter, has a designed capacitance sensor optimized for draft measurement. APT-3100 has a true draft analog range from 0 to 20mA offering that feature that a pressure range or after convert analog range to HART (Communication) digital signal transmit for control systems like DCS, PLC. This Model has explosion protected type (Intrinsically Safety) and high precision, better reliabilty and is available on digital commuication for the use remotes communication system.

This transmitter is enabled in HART commmunication with Host, HHT (HART Hand-Held Terminal), PC Configurator, or PDA Configurator. Thus, transmitter various variables in host is enable to be changed, configured and tested calibrated by users. For the HART Communication between DC Power Supply of 24 Vdc and Transmitter has to terminate 250~ 550 Ohm as loop resistance by series connection. But, there is no additional loop resistance when transmitter is connected with analog input port or output port of control system, because transmitter has self resistance 250 Ohm.

## 1.3 Software Compatibility

Autrol® Smart Pressure Transmitter's software is implemented and complemented if necessary. Uses of the transmitter will not be a compatibility software is contained in the host of the HHT(Model 275 HART Communicator). In this case contact us for software DD(Device Descriptor) to be able to use with the transmitter, you must to use loading in HHT, etc.

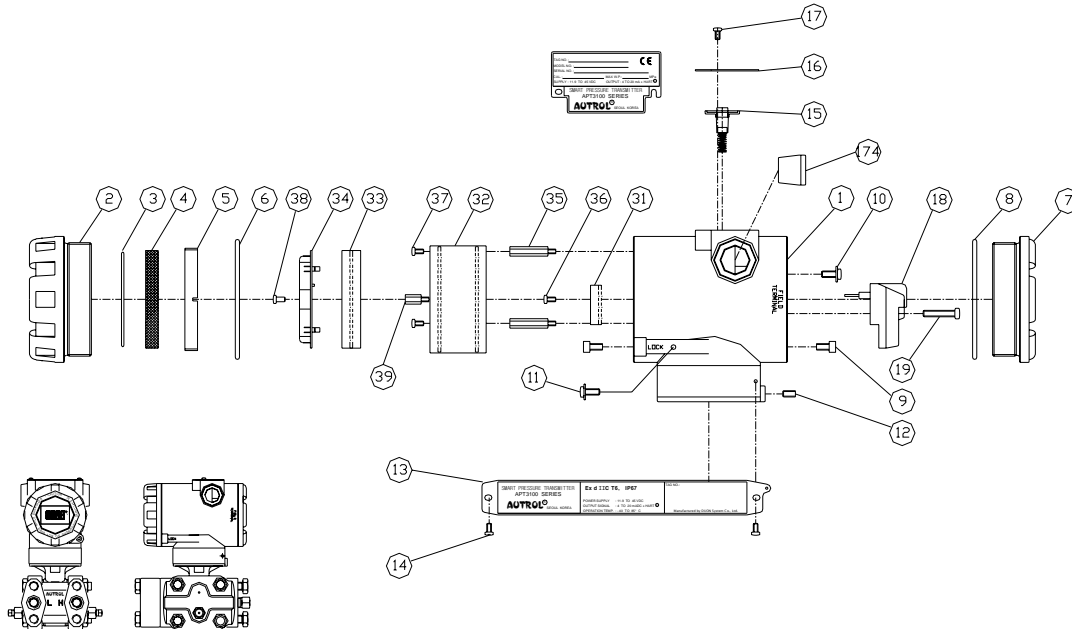
There can be deviations on fuctions as to Firmware Revision of transmitter. This manual is based on Firmware Revision 22. For upgrading Firmware Revision 17 for Revision 22, or Firmware Revision 22 for Revision 23, EEPROM of MCU Board should be changed.

Function deviations as to Firmware Revision are same as under box.

| No   | Functions                                   | Function Supports<br>(OK=possible, NA=impossible) |     |     |  |
|--|---|---|-----|-----|--|
|  |   | R17   | R22 | R23 |  |
| 1  | Sensor Zero Trim with Zero/Span button      | NA  | OK  | OK  |  |
| 2  | Zero Point Adjustment with Zero/Span button | NA  | NA  | OK  |  |
| 3  | Zero Point Adjustment with HART command     | NA  | NA  | OK  |  |
| [NOTE] Revision 23 will be applied to the goods produced from 1 <sup>st</sup> of July,2004 |   |   |     |     |  |

### 1.4 Transmitter Components

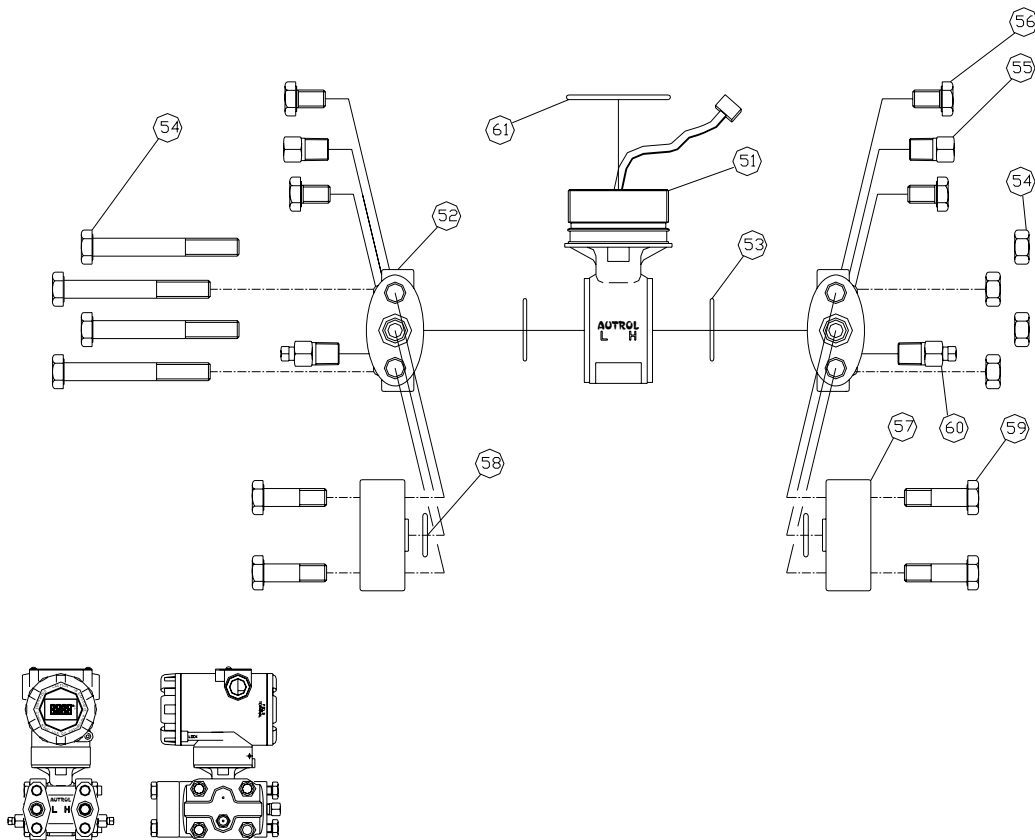
The components and figure of Autrol® Smart Pressure Transmitter is suggested on the next page. Follow the procedure described on figure 1-1, 1-2 and 1-3.



NOTE :

|      |                             |      |                       |
|------|-----------------------------|------|-----------------------|
| 1    | HOUSING-POLYURETHANE PLANT  | 16   | NAME PLATE/ CERTI.    |
| 2    | FRONT COVER                 | 17   | SCREW/ CERTIF. PLATE  |
| 3    | O-RING/ GLASS               | 18   | TERMINAL BLOCK        |
| 4    | GLASS-TEMPERED              | 18-1 | BODT/ T.B             |
| 5    | GLASS RING NUT              | 18-2 | SCREW/ TERMINAL       |
| 6    | O-RING/ FRONT COVER         | 18-3 | PIN/ T.B              |
| 7    | REAR COVER                  | 18-1 | COMM. TEST PIN/ T.B   |
| 8    | O-RING/ REAR COVER          | 19   | SCREW/ TERMINAL BLOCK |
| 9    | SCREW/ COVER LOCK           | 31   | ELECTRONICS/ IN-OUT   |
| 10   | SCREW/ INTERNAL GROUND      | 32   | ELECTRONICS/ MCU      |
| 11   | SCREW/ EXTERNAL GROUND      | 33   | ELECTRONICS/ LCD      |
| 12   | SCREW/ HOUSING ROTATION SET | 34   | LCD COVER             |
| 13   | NAME PLATE/ DATA & TAG      | 35   | POST/ ELECTRONICS     |
| 14   | SCREW/ NAMR PLATE           | 36   | SCREW/ IN-OUT BOARD   |
| 15   | SERO/ SPAN ADJ. SWITCH      | 37   | SCREW/ ELECTRONICS    |
| 15-1 | SWITCH/ SPRING              | 38   | SCREW/ LCD METER      |
| 15-2 | SWITCH/ MACNET              | 39   | SCREW/ LCD METER      |
| 15-3 | SWITCH/ BUTTON              | 74   | PLUG, 1/2 NPT         |
| 15-4 | SWITCH/ COVER               |      |                       |

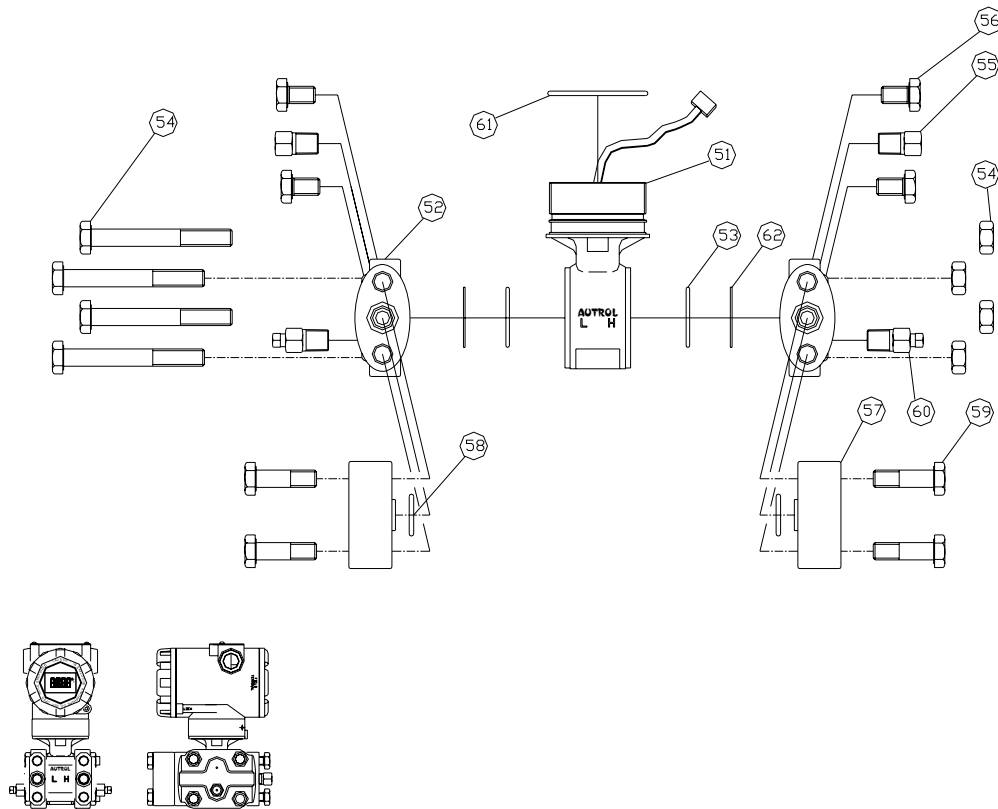
[Figure 1-1 Transmitter HOUSING Exposed View and Components]



| NOTE : |                    |      |                        |
|--------|--------------------|------|------------------------|
| 51     | SENSOR MODULE      | 51-1 | SENSOR                 |
| 51-13  | RANGE 3, 7.5 KPa   | 51-2 | SENSOR BODY            |
| 51-14  | RANGE 4, 37.3 KPa  | 51-3 | SENSOR RING            |
| 51-15  | RANGE 5, 186.5 KPa | 51-4 | SENSOR BOARD           |
| 51-16  | RANGE 6, 690 KPa   | 51-5 | MOLD SOLUTION          |
| 51-17  | RANGE 7, 2068 KPa  | 52   | FLANGE/ PROCESS        |
| 51-18  | RANGE 8, 6895 KPa  | 53-1 | C-RING/ FLANGE         |
| 51-19  | RANGE 9, 20680 KPa | 53-2 | O-RING/ FLANGE         |
|        |                    | 54   | BOLT & NUT / FLANGE    |
|        |                    | 55   | FLANGE PLUG            |
|        |                    | 56   | BOLT / BRACKET         |
|        |                    | 57   | FLANGE ADAPTER         |
|        |                    | 58-1 | C-RING/ FLANGE ADAPTER |
|        |                    | 58-2 | O-RING/ FLANGE ADAPTER |
|        |                    | 59   | BOLT / FLANGE ADAPTER  |
|        |                    | 60   | VENT / DRAIN PLUG      |
|        |                    | 61   | C-RING/ SENSOR MODULE  |

[Figure 1-2 Transmitter SENSOR MODULE - D, G, L Exposed View and Components]





NOTE :

|       |                                       |      |                        |
|-------|---------------------------------------|------|------------------------|
| 51    | SENSOR MODULE<br>(HIGH LINE PRESSURE) | 51-1 | SENSOR                 |
|       |                                       | 51-2 | SENSOR BODY            |
| 51-H4 | RANGE 4, 37.3 KPa                     | 51-3 | SENSOR RING            |
| 51-H5 | RANGE 5, 186.5 KPa                    | 51-4 | SENSOR BOARD           |
| 51-H6 | RANGE 6, 690 KPa                      | 51-5 | MOLD SOLUTION          |
| 51-H7 | RANGE 7, 2068 KPa                     | 52   | FLANGE/ PROCESS        |
|       |                                       | 53-1 | C-RING/ FLANGE         |
|       |                                       | 53-2 | O-RING/ FLANGE         |
|       |                                       | 54   | BOLT & NUT / FLANGE    |
|       |                                       | 55   | FLANGE PLUG            |
|       |                                       | 56   | BOLT / BRACKET         |
|       |                                       | 57   | FLANGE ADAPTER         |
|       |                                       | 58-1 | C-RING/ FLANGE ADAPTER |
|       |                                       | 58-2 | O-RING/ FLANGE ADAPTER |
|       |                                       | 59   | BOLT / FLANGE ADAPTER  |
|       |                                       | 60   | VENT / DRAIN PLUG      |
|       |                                       | 61   | C-RING/ SENSOR MODULE  |

[Figure 1-3 Transmitter SENSOR MODULE - H Exposed View and Components]

## Chapter 2 Handling Cautions

This chapter consists of cautions for transmitter handling and storage, selection of installation locations, insulation and explosion structure, etc.

### [Quick Reference Manual]

| Step | Job                               | Job Details   | Instrument   |
|------|-----------------------------------|---|--|
| 1    | Unpacking                         | - Unpack transmitter packing  |  |
| 2    | Model and Specifications Check    | - Make sure whether the delivered transmitter is same as options attached on its nameplate  |  |
| 3    | Storage                           | - Places not exposed to water, non-vibration and non-impact area<br>- Ambient temperature 25 deg C and relative humidity 65% RH   |  |
| 4    | Calibration on a Calibration Room | - Configuration of Range, Zero/Span, Unit, Tag, Damping Time, Transfer Function, DA Trim and other parameters   | - HHT<br>- Pressure Source (requested)<br>- Galvanometer |
| 5    | Installation Locations            | - Where ambient temperature is not fluctuated<br>- Where corrosion happens by chemical materials, etc.<br>- Where vibration and impact is not severe<br>- Where non-explosion area is matched on explosionproof regulations<br>- Where maintenance is very easy | (Engineering)  |
| 6    | Mechanical Considerations         | - Where transmitter can be handled easily<br>- Be cautious not leaking the pressure.  | (Engineering)  |
| 7    | Electrical Considerations         | - Connect 24 Vdc (Power Supply is 11.9 Vdc – 45 Vdc)<br>- For HART communication, total resistance on transmitter terminal loop should be 250 – 550 Ohm.  | (Engineering)  |
| 8    | Mounting and Installation         | - For mounting transmitter, an appropriate bracket should be used.<br>- Transmitter should be fixed well against swing.   | (Mounting and Installation)                              |
| 9    | Calibration on Spot               | - Sensor Zero Trim has to be done after ten seconds, namely, differential pressure become zero and stabilized.<br>- Make sure that PV value of transmitter is zero and current is 4 mA.   | HHT or Zero/Span button                                  |
| 10   | Pressure                          | - Do not apply the regulated differential and line pressure.<br>- Close equalizing valve of 3 valve manifold, Then, open stop valve on high and low side slowly and simultaneously.   | (Applying pressure)                                      |
| 11   | Operation                         | - Make sure whether transmitter operates well or not  | Eye or HHT   |

## 2.1 Unpacking

When moving the transmitter to the installation site, keep it in its original packaging. Then, unpack the transmitter there to avoid damage on the way.

## 2.2 Models and Specifications Check

The model name and specifications are indicated on the nameplate to the case. Please check your specification and wanted model.

## 2.3 Storage

The following precautions must be observed when storing the instrument, especially for a long period.

- (1) Select a storage area that meets the following conditions:
  - (a) It is not exposed to rain or water.
  - (b) It suffers minimum vibration and shock.
  - (c) If possible, it is preferable at normal temperature and humidity (approx. 25°C, 65% RH).

However, it has an ambient temperature and relative humidity within the following ranges.

- Ambient Temperature: -40 ~ 85°C (without LCD module)  
-30 ~ 80°C (with LCD module)
  - \* General Use -20 ~ 60°C (CSA Explosionproof)
- Relative Humidity: 5% ~ 98% RH (at 40°C)

- (2) When storing the transmitter, repack it as nearly as possible to the way it was packed when delivered from the factory.
- (3) If storing a transmitter that has been used, thoroughly clean diaphragm surfaces (the pressure-detector sections) of the diaphragm seals, so that no measured fluid remains on them. In addition, make sure before storing that the pressure-detector and transmitter assemblies are securely mounted.

## 2.4 Selecting Installation Locations

The transmitter is designed to withstand severe environmental conditions. However, to ensure stable and accurate operation for many years, the following precautions must be observed when selecting an installation location.

- (1) Ambient Temperature  
Avoid locations subject to wide temperature variations or a significant temperature gradient. If the location is exposed to radiant heat from plant equipment, provide adequate insulation or ventilation.
- (2) Ambient Atmosphere  
Avoid installing the transmitter in a corrosive atmosphere. If the transmitter must be installed in a corrosive atmosphere, there must be adequate ventilation as well as measures to prevent intrusion or stagnation of rainwater in conduits. Moreover, there should be appropriate ventilation preventing corrosion by rain gathered on conduit.

- (3) Shock and Vibration  
Select an installation site suffering minimum shock and vibration (although the transmitter is designed to be relatively resistant to shock and vibration)
- (4) Installation of Explosion-protected Transmitters  
Explosion-protected transmitters can be installed in hazardous areas according to the gas types for which they are certified.
- (5) Select a place that transmitter maintenance is very easy.

## 2.5 Calibration on Spot after Installation

- (1) Sensor Zero Trim should be done after transmitter is installed on spot, because zero point is not accurate as to mounting status.
- (2) For Sensor Zero Trim, make differential pressure of transmitter for zero in advance. Then, make Sensor Zero Trim after pressure is sufficiently stabilized (after approximately 10 seconds).
- (3) There are two ways for making differential pressure for zero. One is to apply zero differential pressure (making same pressure both high and low side pressure). The other is to close High and Low side of stop valve of 3 valve manifold and to open its equalizing valve.
- (4) Sensor Zero Trimming is to use HHT (275 calibrator), PC or PDA configurator, and to use Zero/Span button. Make sure all details on this manual.
- (5) Refer to On-line Operation for configuring another parameters except Sensor Zero Trim

## 2.6 Pressure Connections

### ▲ Warning

- ◆ Instrument installed in the process is under pressure. Never loosen or tighten the flange bolts as it may cause dangerous spouting of process fluid.
- ◆ If the accumulated process fluid may be toxic or otherwise harmful, take appropriate care to avoid contact with the body of inhalation of vapors even after dismounting the instrument from process line for maintenance.

The following precautions must be observed in order to safely operate the transmitter under pressure.

- (1) Never apply a pressure higher than the specified maximum working pressure.
- (2) Confirm the option of pressure connection of transmitter. Necessarily use standardized and quality-approved parts.
- (3) In case of being needed by hard circumstances and regulations, there should be seal equipment for leakage.

## 2.7 Waterproofing of Cable Conduit Connections

Apply a non-hardening sealant (silicone or tape, etc.) to the threads to waterproof the transmitter cable conduit connections.

## 2.8 Restrictions on Use of Radio Transceivers

### ▲ Warning

- ◆ Although the transmitter has been designed to resist high frequency electrical noise, if a radio transeiver is used near the transmitter or its external wiring, the transmitter may be affected by high frequency noise pickup. To test for such effects, bring the transeiver in use slowly from a distance of several meters from the transmitter, and observe the measurement loop for noise effects. Thereafter, always use the transeiver outside the area affected by noise.

## 2.9 Insulation Resistance Test and Dielectric Strength Test

Since the transmitter has undergone insulation resistance and dielectric strength tests at the factory before shipment, normally these tests are not required. However, if required, observe the following precautions in the test procedures.

- (1) Do not perform such tests more frequently than is absolutely necessary. Even test voltages that do not cause visible damage to the insulation may degrade the insulation and reduce safety margins.
- (2) Never apply a voltage exceeding 500 Vdc (100 Vdc with an internal lightning protector) for the insulation resistance test, nor a voltage exceeding 500V AC (100V AC with an internal lightning protector) for the dielectric strength test.
- (3) Before conducting these tests, disconnect all signal lines from the transmitter terminals. Perform the tests in the following procedure.
- (4) Insulation Resistance test
  - (a) Short-circuit the + and - SUPPLY terminals in the terminal box.
  - (b) Turn OFF the insulation tester. Then connect the insulation tester plus (+) lead wire to the shorted SUPPLY terminals and the minus (-) lead wire to the grounding terminal.
  - (c) Turn ON the insulation tester power and measure the insulation resistance. The voltage should be applied short as possible to verify that insulation resistance is at least 20M $\Omega$ .
  - (d) After completing the test and being very careful not to touch exposed conductors disconnect the insulation tester and connect a 100kW resistor between the grounding terminal and the short-circuiting SUPPLY terminals. Leave this resistor connected at least three second to discharge any static potential. Do not touch the terminal while it is discharging.
- (5) Dielectric Strength Test
  - (a) Short-circuit the + and - SUPPLY terminals in the terminal box.
  - (b) Turn OFF the dielectric strength tester. Then connect the tester between th shorted SUPPLY terminal and the grounding terminal. Be sure to connect the grounding lead of the dielectric strength tester to the ground terminal.
  - (c) Set the current limit on the dielectric strength tester to 10mA, then turn ON the power and gradually increase the tester voltage from '0' to the specified voltage.
  - (d) When the specified voltage is reached, hold it for one minute.
  - (e) After completing this test, slowly decrease the voltage to avoid any voltage surges.

## 2.10 Installation of Explosion Protected Type Transmitters

### 2.10.1 KOSHA Certification

Caution for KOSHA Flameproof is following type.

[Note1] Model APT3100 diaphragm sealed for potentially explosive atmosphere:

- Type of Protection and Marking Code: Ex d II C T6
- Temperature Class: T6
- Ambient Temperature: -20 ~ 60°C
- Process Temperature: Max. 80°C

## [Note2] Electrical Data

- Supply Voltage: Maximum 45 Vdc
- Output signal: 4 ~ 20mA, maximum 22mA

## [Note3] Installation

- All wiring shall comply with local installation requirement.
- The cable entry devices shall be of a certified flameproof type, suitable for conditions of use.

## [Note4] Operation

- Wait one minute after power -disconnection, before opening the enclosure.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous location.

## [Note5] Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of DUON System is prohibited and will void KOSHA Flameproof.

## 2.10.2 KTL Certification

Caution for KTL intrinsic safety type is following type.

## [Note1] Model APT3200 for potentially explosive atmosphere:

- Type of Protection and Marking Code: Ex ia II C T5
- Temperature Class: T5
- Ambient Temperature: -20 ~ 60°C
- Process Temperature: Max. 80°C

## [Note2] Entity Parameter

- $U_{max}$  = 40 Vdc
- $I_{max}$  = 165 mA
- $P_{max}$  = 0.9 W
- $C_i$  = 1.102  $\mu$ F
- $L_i$  = 0.94 mH

**CAUTION** Necessarily use an appropriate barrier matched on the above Entity Parameter.

## [Note3] Installation

- All wiring shall comply with local installation requirement.

## [Note5] Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of DUON System is prohibited and will void KTL Intrinsic Safety Type.

## 2.10.3 CSA Certification

Caution for CSA Explosionproof / Flameproof is following type.

## [Note1] Hazardous Area for APT3100 Process Transmitter

- Explosionproof for Class I, Division 1, Group A, B, C and D
- Dust-ignitionproof for Class II, Division 1, Group E, F and G ; Class III
- Flameproof for Class I, Zone 1 : Ex d II C
- Temperature Class : T6 T5 T4
- Process Temperature : 85 C 100 C 120 C
- Nonsparking Equipment for class I, Zone 2 : Ex nA IIC T4
- Enclosure : Type 4X, IP66
- Ambient Temperature : -20 to 60 C
- Supply Voltage : 42V dc max.
- Output Signal : 4 to 20mA + HART
- Electrical Connection : 1/2" – 14 npt Female
- List of standards that product compiles with, specifically E60079-1 end E60079-15.
- The warning: ***"WARNING-EXPLOSION HAZARD-SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2"*** or equivalent

## [Note2] Installation

- All wirings have to be installed by the final revision of Canadian Electrical Code.
- Input equipment of cable should be certified by explosionproof and be adjusted to using conditions.
- Wire connection that is no use has blocked by available plugs.
- All screws of cable tube have to be set the 5 teeth.
- Method of cable connection has to be followed by Class I, Division 1 in spite of its length.
- All cable tubes have to be sealed with 50 cm from housing.
- Installation in Division 2 zone does not need to be sealed.
- In assembly of sensor module and housing, over 7 screws have to be set the teeth and be fixed in order not to spin.

## [Note4] Operation

- Be cautious of the CAUTION attached to transmitter.
- **CAUTION** IN EXPLOSIVE ATMOSPHERE DO NOT OPEN WHILE ENERGIZED
- Wait one minute after power-disconnection, before opening the enclosure.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous location.

## [Note5] Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of DUON System is prohibited and will void CSA Explosionproof / Flameproof.

## 2.10 EMC Conformity Standards

EMI (Emission): EN55011  
 EMS (Immunity): EN50082-2

DUON System recommends customer to apply the Metal Conduit Wiring or to upset he twisted pair Shield Cable for signal wiring to conform the requirement of EMC Regulation, when customer installs AUTROL Series Transmitters to the plant.

## Chapter 3 Transmitter Functions

### 3.1 Overview

This Chapter contains information on operating Model APT3100. Tasks that should be performed on the bench priori to installation are explained in this chapter.

### 3.2 Safety Message

Procedures and instructions in this chapter may require special precautions to ensure the safety of the personal performing the operations. Information that raises potential safety issues is indicated by warning symbol(▲). Refer to the following safety messages before performing an operation preceded by this symbol.

### 3.3 Warning

|   |
|---|
| <b>▲ Warning</b>  |
| <p><b>Explosion can result in death or serious injury:</b></p> <ul style="list-style-type: none"> <li>◆ Do not remove the transmitter covers in explosion environments when the circuit is alive.</li> <li>◆ Transmitter covers must be fully engaged to meet explosionproof requirements.</li> </ul> |

|  |
|--|
| <b>▲ Warning</b>   |
| <p><b>Electrical can result in death serious injury:</b></p> <ul style="list-style-type: none"> <li>◆ The qualification which is educated only the person whom it prepares will be able to establish the transmitter.</li> </ul> |

|  |
|--|
| <b>▲ Warning</b>   |
| <p><b>Electrical can result in death serious injury:</b></p> <ul style="list-style-type: none"> <li>◆ Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.</li> </ul> |

### 3.4 Fail Mode Alarm

AUTROL® Smart Pressure Transmitter automatically and continuously performs self-diagnostic routines. If the self-diagnostic routines detect a failure, the transmitter drives its output outside of the normal saturation values. The transmitter will drive its output low(down) or high(up) based on the position of the failure mode alarm jumper . See Table 3.1 for Output values.

| Level    | 4~20mA Saturation | 4~20mA Alarm |
|----------|-------------------|--------------|
| Low/Down | 3.9mA             | ≤ 3.75mA     |
| High/Up  | 20.8mA            | ≥ 21.75mA    |

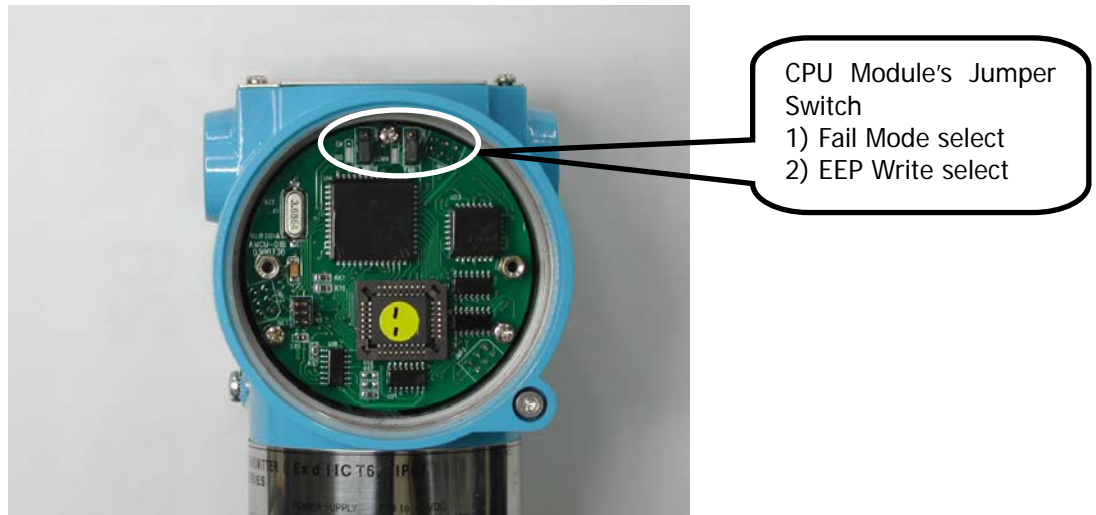
[Table 3-1 Standard Alarm and Saturation Value]

Fail Mode Select Jumper Switch has in LCD Module and Main CPU Module and Jumper Switch Line is connected circuital. In case of Not LCD Module, we can use CPU Module's Fail Mode Select Jumper Switch and In case of LCD Module we can use LCD Module's Jumper Switch. In this case, CPU Module





There is the EEPROM (Electrically Erasable Programmable ROM) restoring various configuration variables in Transmitter. For protect to change configuration variable data in software, hardware side there is Write-Protect Mode and Jumper Switch selected it segmented "EEP-Write DIS / EN " in Main CPU Module. Thus if you connect Jumper to DIS you can't change configuration data in EEPROM, when you connect Jumper to EN you can change configuration data in EEPROM. No connected Jumper, it is classified EN. At the factory before shipment, it is configured "EN". (Following figure 3-3)



[Figure 3-3 CPU Module's Fail-mode, EEP-Write Select Jumper Switch]

There are two security methods in APT3100. Following this.

- (1) Security Jumper: protect to writing configuration parameters of transmitter.
- (2) Physical removing Zero and Span Magnetic Buttons of Transmitter: you are not able to regulate Zero and Span in Local.

[Notification] If EEP-Write is not connected, it is classified Security Off state.

### 3.5.1 Security Jumper (EEPROM Write Protect)

Protect to change Configuration Parameter of transmitter to Write Protect Jumper.

### 3.5.2 Zero and Span Magnetic Button

To remove Magnetic Button, you can't configure Zero and Span in Local.

## 3.6 Configuration of Alarm and Security Jumper Procedures

To change Jumper's position, follow this.

- (1) If install the transmitter, cutoff power.
- (2) Open the housing front side covers. In case Power Supply, don't open the covers of transmitter
- (3) After turn off Jumper, turn on at wanted position.
- (4) Close the housing covers. You must fully engage to meet explosion proof requirements.

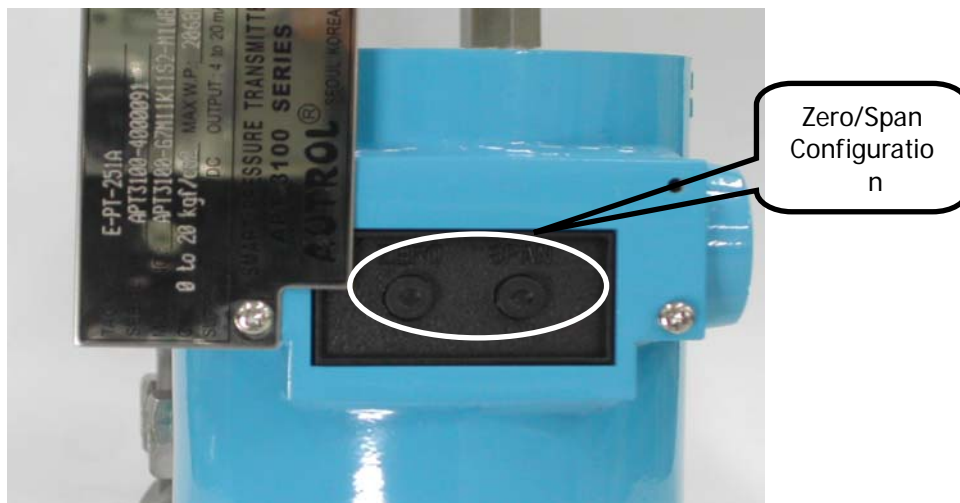
## 3.7 Configuration of Zero and Span Procedures

There are two method configuring Zero and Span's Range. Follow this.

- (1) Zero/Span Button mounted in Transmitter.
- (2) HHT Configurator by HART Communication (following chapter 4)
- \*\* Refer to "275 Hart Communicator User Guide" on Appendix II for details.

Zero/Span configuration process by Zero/Span Button of transmitter is following this.

- (1) Release to both sides bolts of Name Plate in the upper part of transmitter and if push down right of Name Plate, appear to Zero/Span Button (following figure 3-4)
- (2) Zero Configurations
  - Set the current process value for Lower Range Value (4 mA).
  - Put purposed pressure for zero over 10 seconds and push Zero Button over 5 seconds. Then show "Zero" in LCD window. After checking this message, take off the finger from the button. Push the button over 3 seconds after 1 second passes. Then show "-ZE-" in LCD window. By this message, all zero configurations have finished. If the works has failed, show "SPeR" or "SEtE" in LCD window.
- (3) Span Configurations
  - Set the current process value for Upperr Range Value (20 mA).
  - Put purposed pressure for zero over 10 seconds and push Span Button over 5 seconds. Then show "SPAn" in LCD window. After checking this message, take off the finger from the button. Push the button over 3 seconds after 1 second passes. Then show "-SP-" in LCD window. By this message, all zero configurations have finished. If the works has failed, show "SPeR" or "SEtE" in LCD window.
- (4) Zero Trim Configurations.
  - This work is to trim Primary Value in order to let current process value to know Zero. This work makes indication value in LCD for zero "0".
  - Pushing Zero Button and Span Button over 5 seconds simultaneously after zero configurations, "Z-tr" shows in LCD window. After checking this message, take off the finger from both buttons. Push only zero button over 3 seconds after 1 second passes. Then show "-tr-" in LCD window. By this message, all zero trim configurations have finished. If the works has failed, show "ZtEr" or "SEtE" in LCD window. These configurations can be available within Max. 10% of Sensor Maximum Span.
- (5) Close the opened name plate and lock it up.



[Figure 3-4 Transmitter's Zero/Span configuration Button]

**[Error Messages]**

|      |  |
|------|--|
| SPEr | When a purposed value passes over Sensor Limit Range, or is smaller than minimum Span  |
| SEtE | In case that configured value is not registered in memory  |
| ZtEr | In case that configured value is over 10% of Sensor Maximum Span   |
| bEr1 | In case that current work would stop during Zero/Span or Zero Trim configurations<br>In case that button would be pushed at one time, oir be pushed continuously |

### 3.8 Configuration of Sensor Zero Trim

Sensor Zero Trim means to configure deviations as to transmitter mounting status when transmitter reads sensor value. When sensor trimming is done, transmitter read its applied pressure for zero during trimming process. Namely, PV becomes zero. If mounting status would be changed, Sensor Zero Trim has to be done after process pressure makes zero by draining process pressure. And Sensor Zero Trim should be needed when transmitter installed on a spot after it is calibrated in calibration room or shop.

Sensor Zero Trim means that PV (Primary Value, which is displayed in LCD Indicator) is made for zero. But Zero and Span means that optional PV is indicated to 4 mA and 20 mA output for converting analog output.

Even though Sensor Zero Trim of general smart transmitters is done with HHT, etc., APT3100 is able to make Sensor Zero Trim using only Sensor/Zero button.

There are two ways for Sensor Zero Trim of APT3100.

- Using Zero/Span button attached on transmitter
- Using HART communicator, HHT, etc.

For more information and details, please refer to 275 User Guide.

The under guide is a Sensor Zero Trim procedure using Zero/Span button.

- (1) Loosen both bolts of Name Plate on upside transmitter and push the right end of Name Plate back a little bit. (Figure 3-4)
- (2) Apply necessary pressure and push Zero and Span button simultaneously over 3 seconds. Then show "**Z-tr**" in LCD window (Z-tr means Zero Trim). Remove finger on the buttons after seeing the message. After one second, push only Zero button over 3 seconds. You can see "**-tr-**". By this, all procedures finish. If this procedure is failed, show "**ZtEr**" or "**SEtE**".  
Range for Sensor Zero Trim is within 10% of Sensor Maximum Span. In case that value over 10% is done for Sensor Zero Trim, this has to make Zero Trim after modulating transmitter horizon status.
- (3) Close cover of Name Plate and lock both bolts.

### 3.9 Configuration of Zero Point Adjustment

Zero Point Adjustment means to configure PV value which output after Zero Trim. At last, Zero Point Adjustment is to configure a current PV value for another value, which is not zero, by configuring Offset value of zero point. This is for configuring a current displayed value for a desiring process value without making process value zero. Especially, in case of configuring level value is very difficult to make Sensor Zero Trim, this adjustment is very convenient to configuring a current value for a desiring value.

PV\_raw : Value that transmitter calculates signal from sensor  
 PV : Value that transmitter finishes Sensor Zero Trim or Zero Point Adjustment  
 Offset : Value calculated when Sensor Zero Trim or Zero Point Adjustment is done

$$PV = PV\_raw + Offset$$

(A) Sensor Zero Trim case :

$$PV = 0 = PV\_raw + Offset,$$

(In result, Offset = -PV\_raw)

(B) Zero Point Adjustment :

$$PV = PV\_raw + Offset,$$

(Offset is variable. Therefore, PV value and Zero point can be configured by changing Offset value)

There are two ways for Zero Point Adjustment of APT3100.

- Using Zero/Span button attached on transmitter
- Using HART communicator, HHT, etc.

For more information and details, please refer to 275 User Guide.

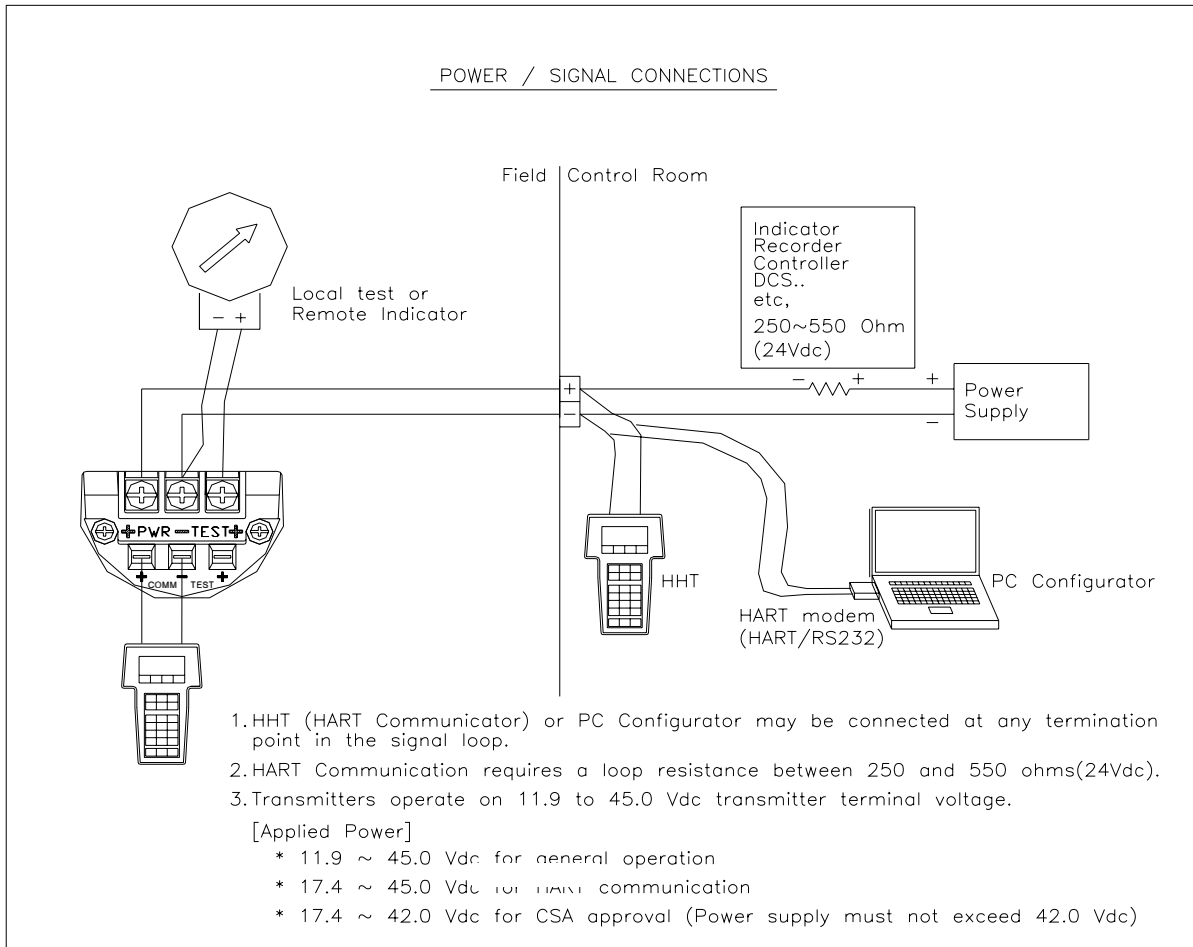
The under guide is a Zero Point Adjustment procedure using Zero/Span button.

- (1) Loosen both bolts of Name Plate on upside transmitter and push the right end of Name Plate back a little bit. (Figure 3-4)
- (2) Apply necessary pressure and push Zero and Span button simultaneously over 3 seconds. Then show "Z-tr" in LCD window. And continuously push Zero and Span button over 3 seconds again. Then show "Z-Ad" in LCD window. After making sure this message, 0.01% diminishes whenever Zero button is pushed, and 0.01% increases whenever Span button is pushed. Pushing button continuously makes speed fast or slow. If you push Zero/Span button over 3 seconds or do not push any button over 10 seconds, "-Zo-" message shows in LCD window. By this message, all procedures finish.  
 Range for Zero Point Adjustment is permitted within 100% of Sensor Maximum Span.
- (3) Close cover of Name Plate and lock both bolts.

### 3.10 Shop Commissioning using HHT

Commissioning consists of testing the transmitter, testing the loop, and verifying transmitter configuration data. APT-3100 Pressure Transmitter may be commissioned using HHT of HART supported either before of after installation.

▲ If you connect "TEST" pin, it's not communicated. If it doesn't exposed electronics circuits after install, you must connect all Jumper of transmitter in the shop commissioning level. Analog output of transmitter is 4~20 mA, thus it requires Power Supply at 11.9 V ~ 45 Vdc and Ampere meter for measuring output current. You must connect 250~550 ohm resistor in Power Loop for HART Communication and HHT or PC Configurator.



[Figure 3-5 Connection the transmitter to HHT]

## Chapter 4 Installation

### 4.1 Overview

The information in this chapter 4 covers installation considerations. Dimensional drawings for Model APT-3100 variation and mounting configuration are included in this chapter.

### 4.2 Safety Message

Procedures and instructions in this chapter may require special precautions ensure the safety of the personnel performing the operation. Information that raises potential safety issues is indicated by a warning symbol(▲). Refer to the following safety messages before performing an operation proceeded by this symbol.

### 4.3 Warning

#### ▲ Warning

**Explosion can result in death or serious injury :**

- ◆ Do not remove the transmitter covers in explosion environments when the circuit is alive.
- ◆ Both transmitter covers must be fully engaged to meet explosionproof requirements

#### ▲ Warning

**Electrical can result in death serious injury:**

- ◆ The qualification which is educated only the person whom it prepares will be able to establish the transmitter.

#### ▲ Warning

**Process leaks can cause death or serious injury:**

- ◆ Install and tighten before applying pressure. If you don't like this, it can cause process leaks.

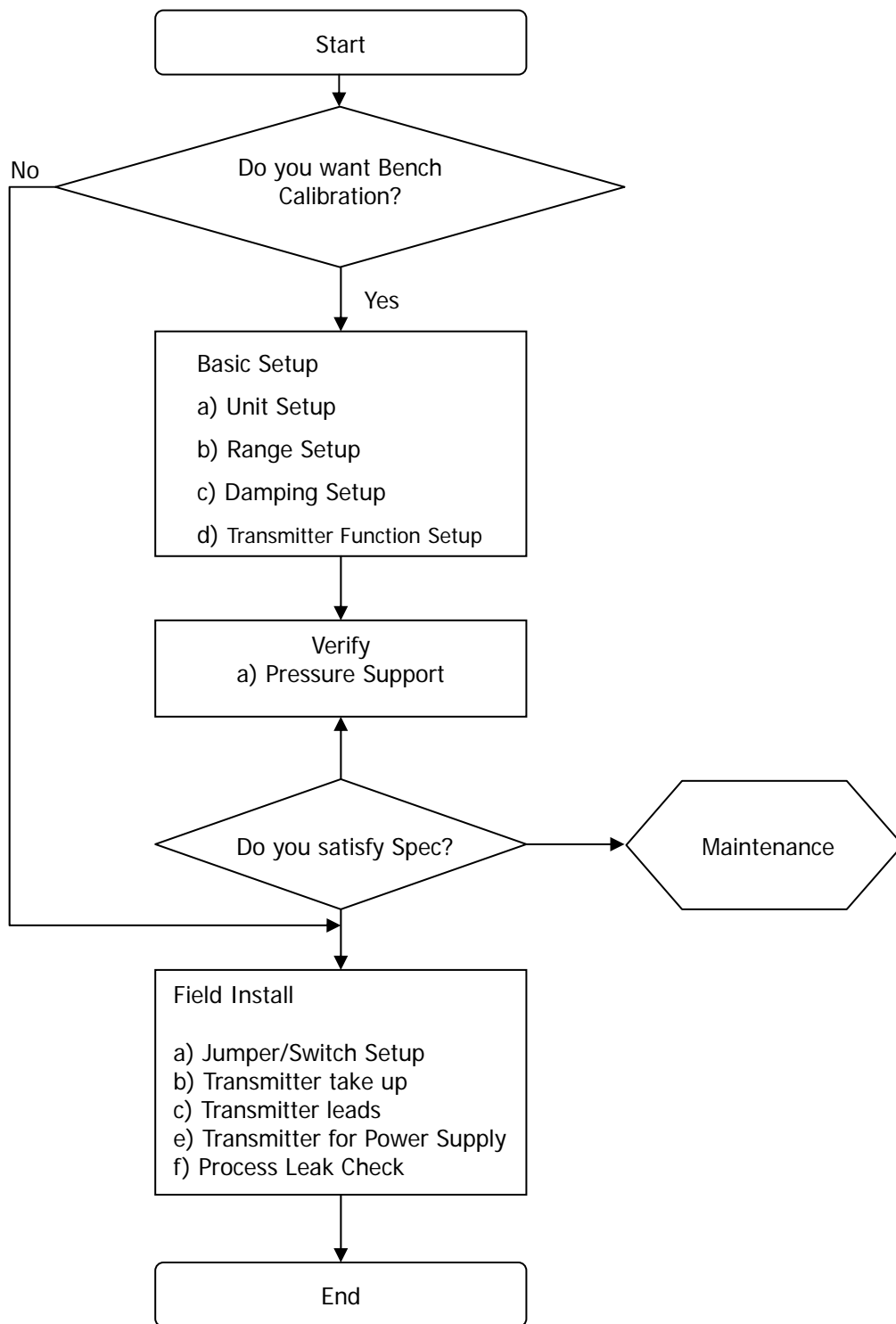
#### ▲ Warning

**Electrical shock can result in death or serious injury. If you install high voltage environment or false condition, power line and lead will be appered high voltages.**

- ◆ Avoid contact with the leads and terminals.

### 4.4 Commissioning on the bench with Hand-Held Terminal

After and before installation, You can handle upon commissioning. However, for correctly handling and knowing the function, before installation you have to handle upon commissioning on the bench with Hand-Held Terminal.



[Figure 4-1 Installation Flow Chart]



## 4.5 General Considerations

This transmitter uses the capacitive pressure sensor. If it changes the pressure sensor, capacitive pressure is changed minutely.

It transfer electrical signal minutely to 4~20mA analog signal. Thus mount the transmitter close to the process and use a minimum of piping to achieve best accuracy. However keep in mind the need for easy access, safety of personnel, practical field calibration, and a suitable transmitter environment.

In general, install the transmitter so as to minimize vibration, shock, and temperature fluctuations.

## 4.6. Electrical Considerations (Power Supply)

The transmitter housing composes of two parts. One side is electronics circuit, and other side is Terminal Block. Terminal Block side is transmitter's frontside and is indicated " Field Terminal" in transmitter housing external. Open this side's housing cover, there is Terminal Block in housing inside. Consider to this Terminal Block polarity, connect to Transmitter's Power Supply. Configurator supported HART connects to "COMM" pin in Power Supply downside. In the field Indicator connects to "TEST" pin.

### 4.6.1 Power Supply

In the transmitter's power supply Input Current Voltage is currently DC voltage between DC 11.9 volt ~ 45 volt and power supply's ripple is not up to 2%. Loop resistance means all resistor sums in loop.

In case of using Intrinsic Safety Barrier, same includes resistor of barrier.

$$\text{Max. Loop Resistance } [\Omega] = (E-11.9) [\text{vdc}] / 0.022 [\text{mA}]$$

Here, loop resistance is preferable at 250 ~ 550 $\Omega$  (24 Vdc) for the HART communication.

## 4.7. Wiring

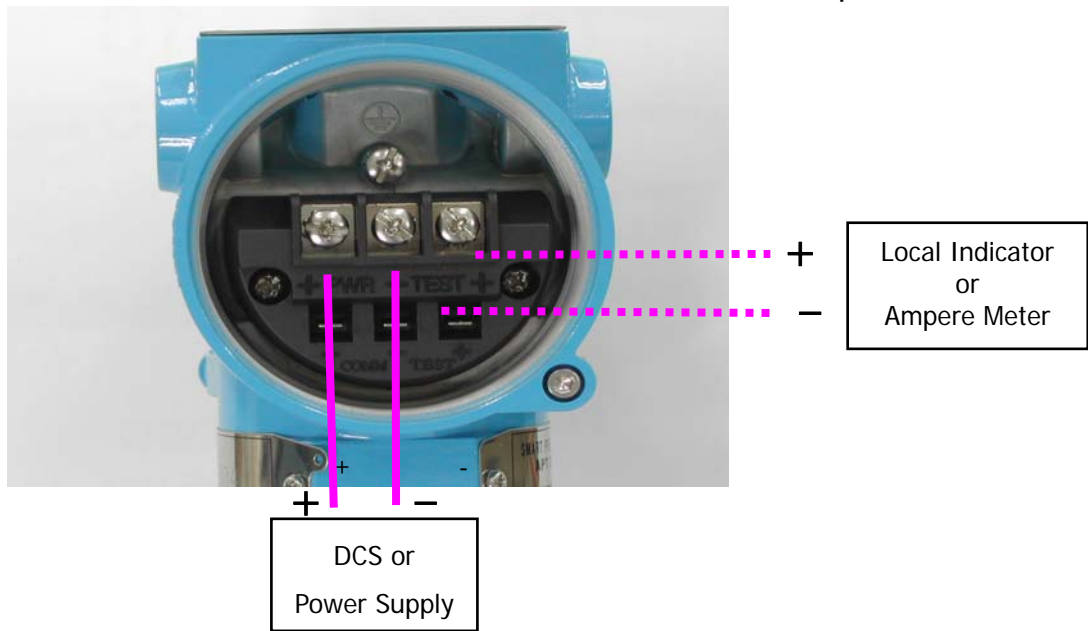
### 4.7.1 Caution of Wiring

- (1) Install cable in the far from electrical noise resources like capacitive transformer, motors power supply as soon as possible.
- (2) Before wiring put out electrical lead connect cap.
- (3) All screw-lined portions paste suture for waterproof. (It promotes the silicon type that is not hardened.)
- (4) Don't lead signal line to power line in same duct for no received noise signal.
- (5) The explosion-proof transmitter in order to maintain the explosion-proof quality of the corresponding transmitter effectively follows in the demand explosion-proof specification that is provided and must be lead.

### 4.7.2 Selecting the Wiring Materials

- (1) Use over 600V PVC shielded wire or standard lead line of same class or cable. (In order to ensure proper communication use 24 AWG or lager wire, and do not exceed 1500 meters.)
- (2) Use the shielded wire in electrical noise effected area.
- (3) At the higher or lower temperature area than ambient temperature it uses the wire or the





### 4.7.4 Wiring

**▲ Warning**

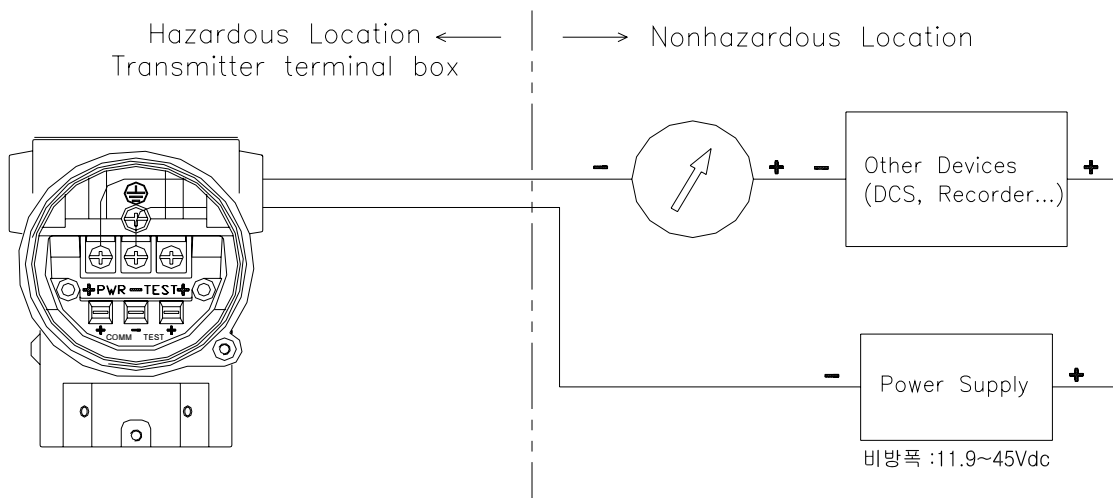
Explosion can result in death or serious injury:

- ◆ Do not remove the transmitter covers in explosion environments when the circuit is alive.
- ◆ Both transmitter covers must be fully engaged to meet explosion proof requirements

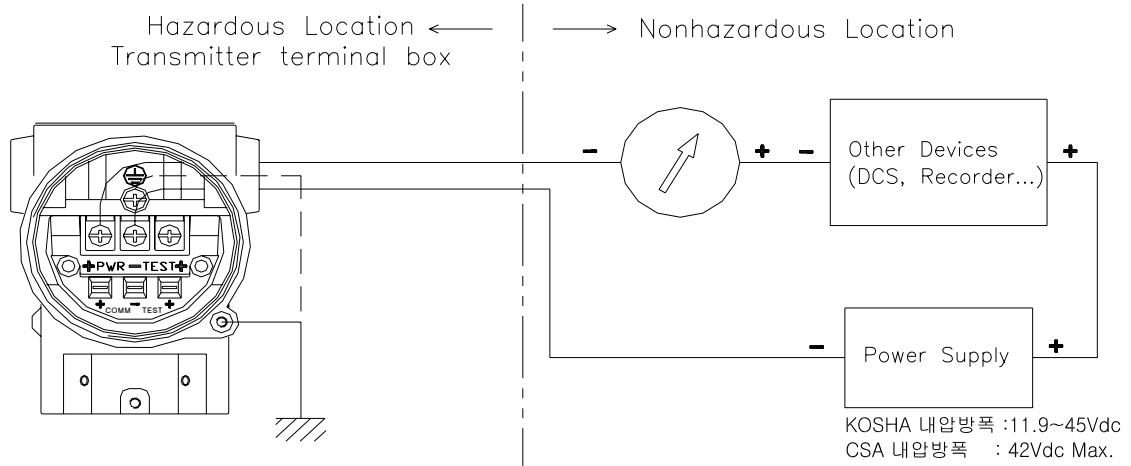
#### 4.7.4.1 Loop Configuration

AUTROL Series Transmitters use a two-wire system for power supply, 4~20mA analog signal transmission and HART digital transmission. DC Power Supply is required for the transmitter loop. The Transmitter and distributor are connected as shown below.

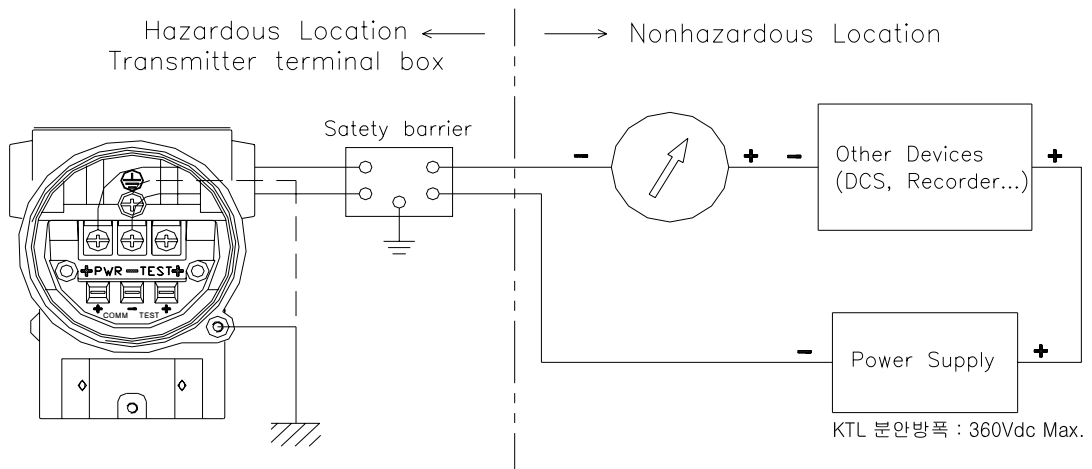
(1) Non-Explosionproof / Flameproof Type



(2) Explosionproof Type



(3) Intrinsic Safety Type

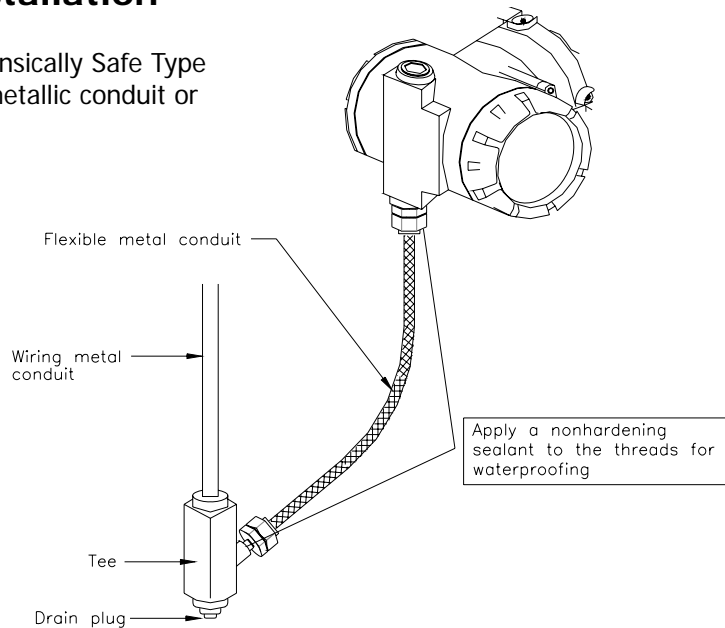


[Figure 4-3 Connection between Transmitter and Power Supply]

### 4.7.4.2 Wiring Installation

(1) General-use Type and intrinsically Safe Type  
 Make cable wiring using metallic conduit or Waterproof cable glands.

o. Apply a non-hardening sealant to the terminal box connection port and the threads on the flexible metal conduit for the waterproofing.



[Figure 4-4a  
 Typical Wiring using Flexible Metal Conduit]

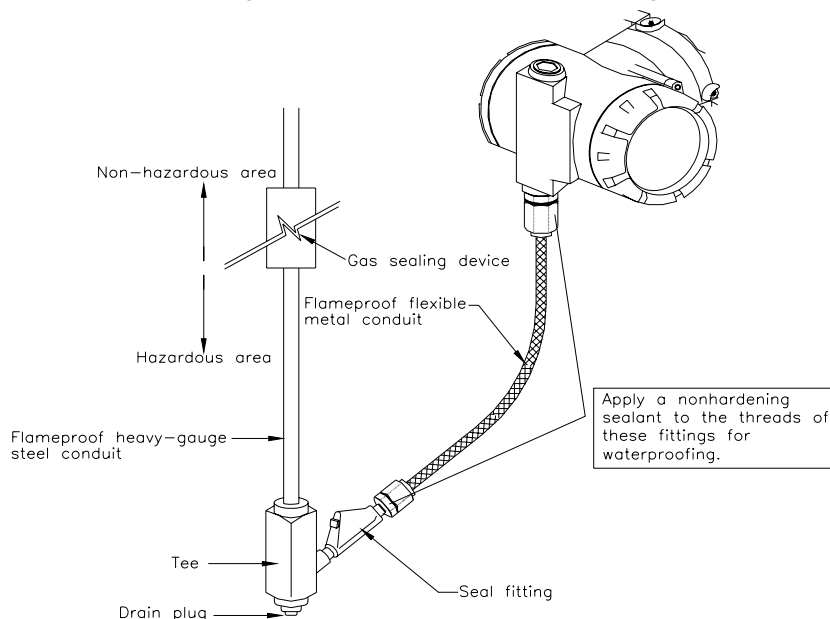
(2) KOSHA Flameproof Type

Wire cables through a flameproof packing adapter, or using a flameproof metal conduit.

(a) Wiring cable through flameproof packing adapter for KOSHA flameproof type (see Figure 4-4b)

- ◇ Use only flameproof packing adapter by KOSHA.
- ◇ Apply a non-hardening sealant to the terminal box connection port and to the threads on the flameproof packing adapter for waterproofing
- ◇ Mounting flameproof packing adapter to the terminal box.

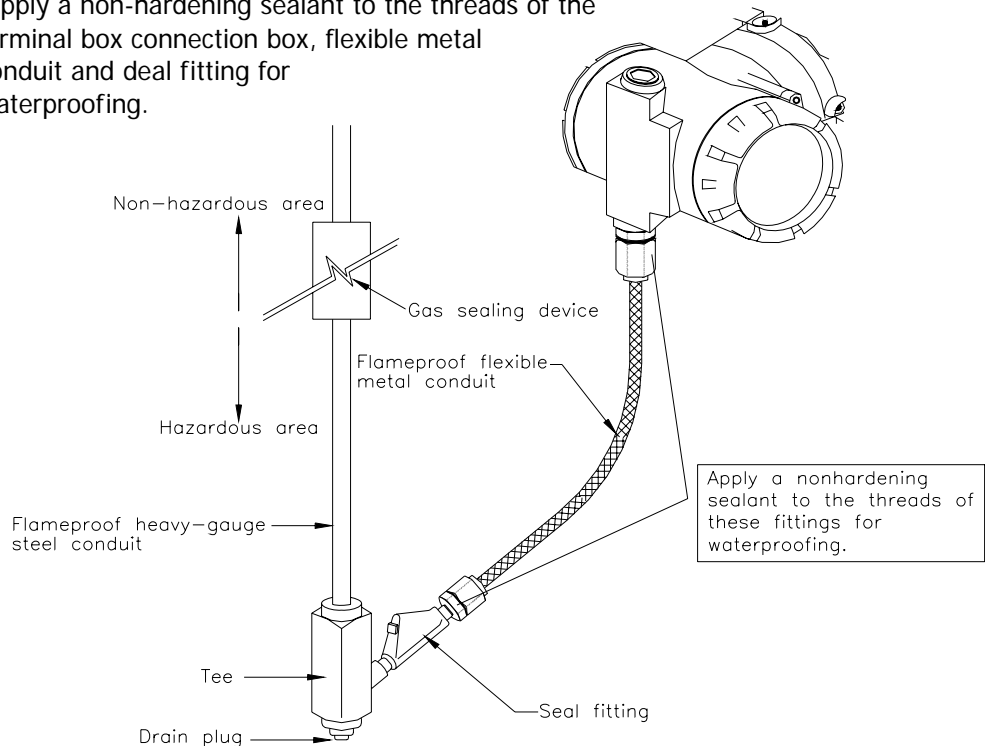
o. Screw the flameproof packing adapter into the terminal box until the O-ring touches the terminal box wiring port (at least 5 full turns), and tighten the lock net.



[Figure 4-4b  
 Typical Wiring using Flameproof Packing Adapter]

After wiring, impregnate the fitting with a compound to seal tubing.

- (b) Flameproof metal conduit wiring (Figure 4-4c)
  - ◇ A seal fitting must be installed near the terminal box connections port for a sealed construction.
  - ◇ Apply a non-hardening sealant to the threads of the terminal box connection box, flexible metal conduit and deal fitting for waterproofing.



[Figure 4-4c  
Typical Wiring using Flameproof Metal Conduit]

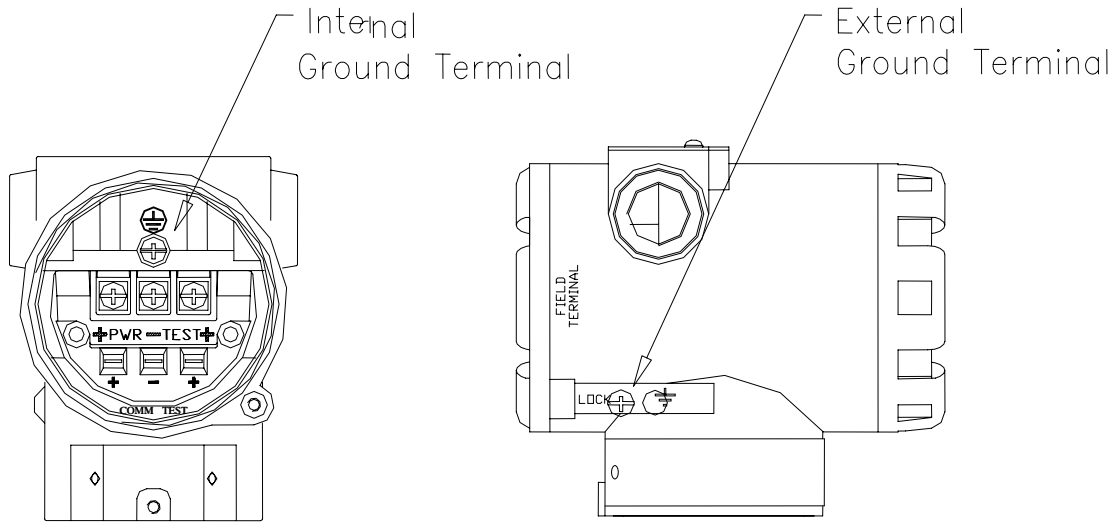
After wiring, impregnate the fitting with a compound to seal tubing.

### 4.7.5 Grounding

- (a) Grounding should satisfy KS requirements (grounding resistance, 10 Ohm or less). Grounding is required below 10 Ohm for explosionproof and intrinsic safety.

[Note] In case of with Built-in Lightning Protector, Grounding should satisfy Special KS requirements (grounding resistance, 10 Ohm or less)

- (b) There are ground terminal on the inside and outside of the terminal box. Either of these terminals may be used.
- (c) Use 600V grade PVC insulated wire for grounding.



APT3100 Smart Pressure Transmitter  
Internal and External Ground Terminal

### 4.7.5 Power Supply Voltage and Load Resistance

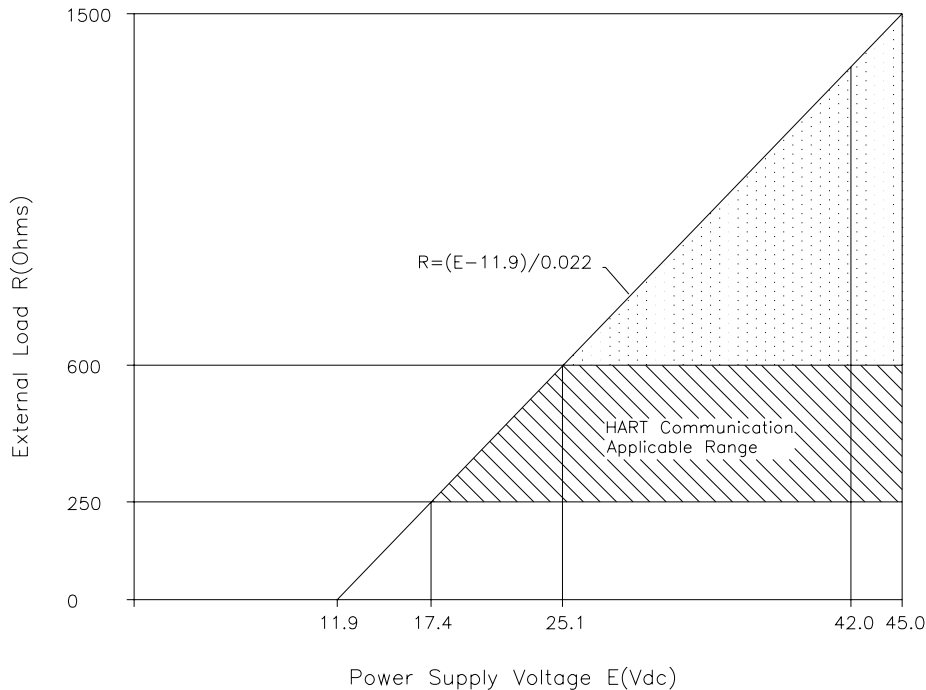
When configuring the loop, make sure that the external load resistance is within the range in the figure below. Since the voltage of transmitter terminal input is same as follows.

- General Standard : 11.9 to 45 Vdc
- Hart Communication : 17.4 to 45 Vdc
- KOSHA Explosionproof: 11.9 to 45 Vdc
- CSA Explosionproof : 17.4 to 42 Vdc max.

And maximum loop current is 24mA, Load resistance R:

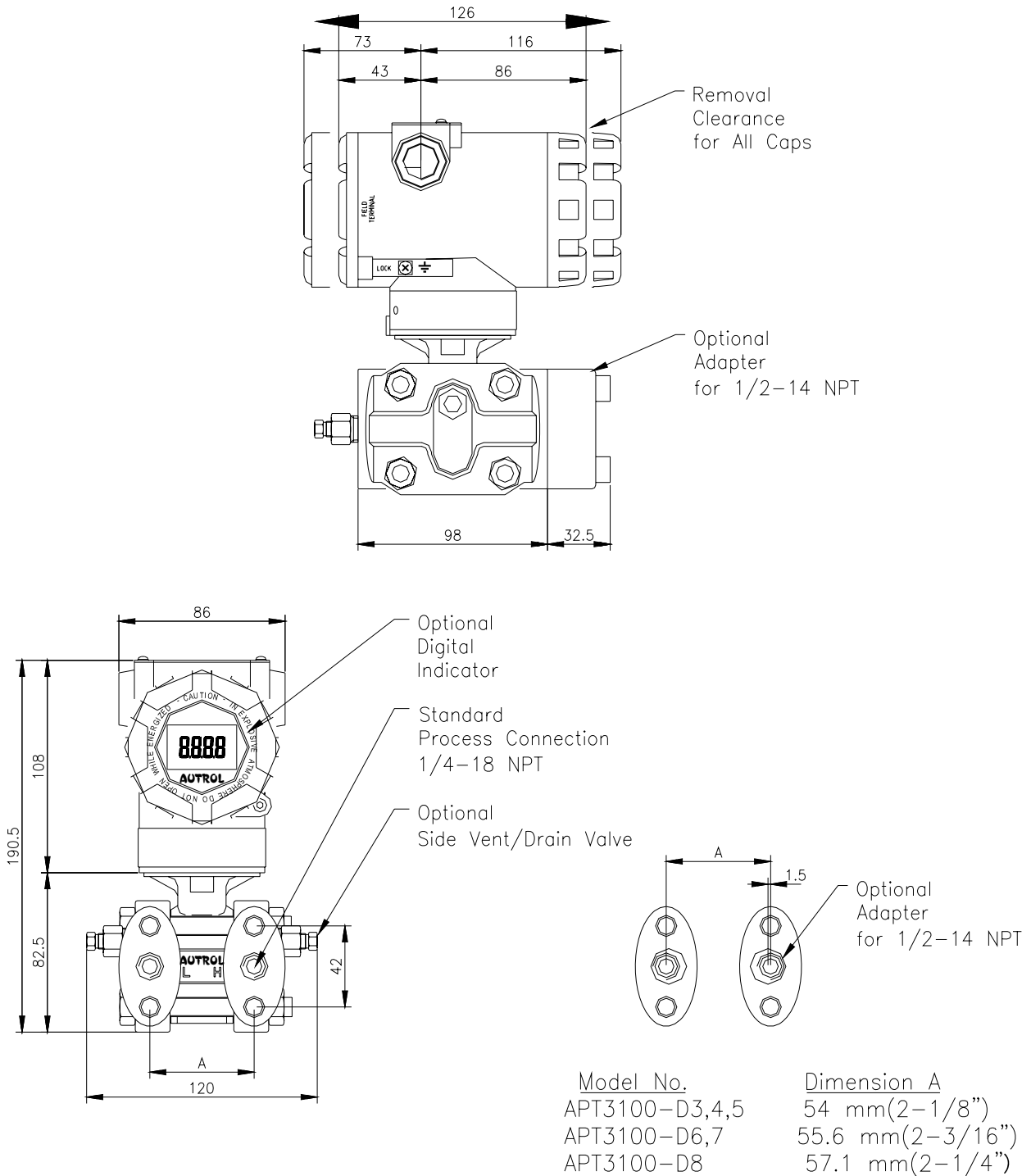
$$R = (E - 11.9) / 0.022 \quad (E = \text{Power Supply Voltage})$$

[Note] In case of an intrinsically safe transmitter, external load resistance includes safety barrier resistance.



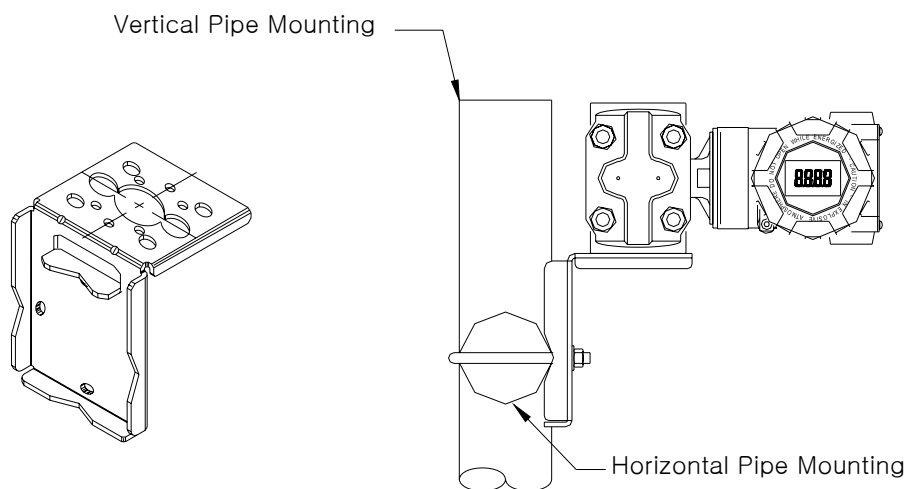
## 4.8 Mechanical Considerations

Figure 4-3 is transmitter dimensional drawings of APT3100. A mounting example and dimensional drawings is shown in Figure 4-4.

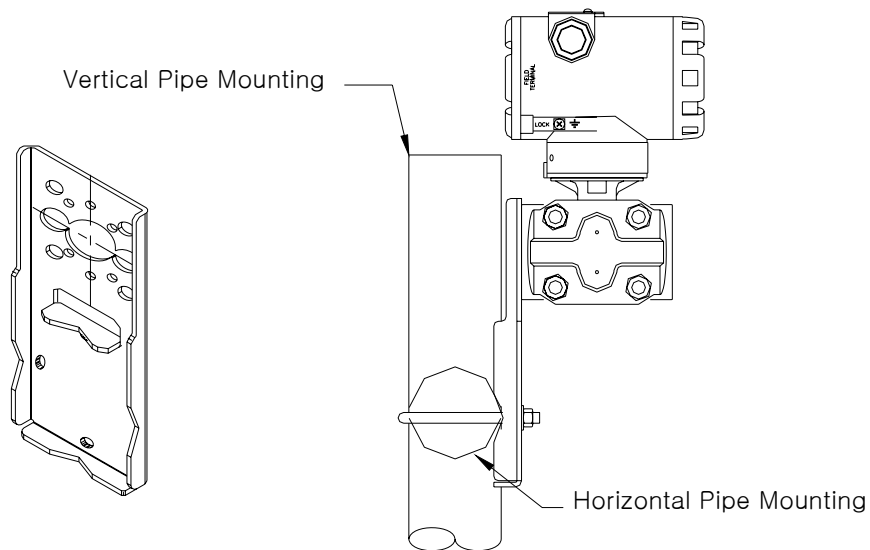


[Figure 4-3 Transmitter Outline Dimensional Drawings]





Vertical Mounting Type  
2" Pipe Mounting Bracket  
Model: Angle Type



Horizontal Mounting Type  
2" Pipe Mounting Bracket  
Model: Flat Type

[Figure 4-4 Typical Bracket Mounting Example]

### 4.8.1 Mounting

To use the cadence carrier from the environment where the vibration is heavy and must install the transmitter. In the environment where the vibration is heavy you will have to install the transmitter by using an assistant support. In the case of severe vibration, promote to mount on pipe using a mounting bracket as option.

### 4.8.2 Consideration of Transmitter Access

When selecting the establishment location or a place of the transmitter, it treats the transmitter it probably is a location that is convenient must consider.

- ① Rotation of housing: housing can be rotated up to 90°.
- ② Terminal sides of transmitter: location ease us terminal space where be able to pull out transmitter cover
- ③ Circuits side of transmitter: the space where there is a possibility of treating a electronic circuit / the space where be able to pull out transmitter cover / If LCD meter is installed, it requires extra space.

## 4.9 Environmental Considerations

### 4.9.1 Effect of Ambient Temperature

You have to install at  $-20^{\circ}\text{C} \sim 60^{\circ}\text{C}$  ( $-4 \sim 180^{\circ}\text{F}$ ), operating ambient temperature range. If predicted heat seems to exceed or equivalent to ambient temperature range limit, you have to consider additional method to cutoff the process heat.

- Ambient Temperature:  $-40 \sim 85^{\circ}\text{C}$  (without LCD module)  
 $-30 \sim 80^{\circ}\text{C}$  (with LCD module)
- \* General Use  $-20 \sim 60^{\circ}\text{C}$  (CSA Explosionproof)

### 4.9.2 Environment of toxic, moisture

Housing of APT-3100 can be protected to moisture or toxic material. Electronic circuit side is separating from terminal side. When O-ring Seal cover covers, it is intrinsic safety. But, some drip could penetrate to the housing of transmitter through conduit pipeline. Therefore, transmitter should be set up over the position of conduit pipe for preventing drip.

### 4.9.3 Installation of dangerous place

Transmitter is designed to explosion-proof housing. Installation environment of transmitter must be confirmed explosion-proof specification.

# Chapter 5 On-line Operation

## 5.1 Overview

This chapter describes to configure function of APT3100 SMART Pressure Transmitter. Transmitter can be configured to On-Line or Off-Line mode. In On-Line Configuration Mode, you must connect configuration such as HHT (Hand Held Terminal), etc. Configuration data inputs in Working Register of HHT and this data is sent to corresponding transmitter.

## 5.2 Safety Message

Send operation. Do specially notice for safety of operator. In damage and place required specially safety, We indicate Warning symbol(▲). When you operate work of Warning symbol, follow Safety Message.

### 5.2.1 Warning

|   |
|---|
| <b>▲ Warning</b>  |
| <p><b>Explosion can result in death or serious injury:</b></p> <ul style="list-style-type: none"> <li>◆ Do not remove the transmitter covers in explosion environments when the circuit is alive.</li> <li>◆ Before connecting HHT in explosion zone, confirm that the configure device has to be installed by intrinsic safety regulations.</li> <li>◆ Both transmitter covers must be fully engaged to meet explosion-proof requirements</li> </ul> |

|   |
|---|
| <b>▲ Warning</b>  |
| <p><b>Electrical shock can result in death or serious injury.</b> If you install high voltage environment or false condition, power line and lead will be appeared high voltages.</p> <ul style="list-style-type: none"> <li>◆ Avoid contact with the leads and terminals.</li> </ul> |

### 5.2.2 Configuration current to passive mode

In the case of short Current Loop, send or request data to change transmitter output you must configure Current Loop to passive mode. Don't believe in message indicating HHT, must configure Current Loop to passive mode with other operation.

## 5.3 Configuration Data Review

In case of install transmitter in fact site, before operate transmitter reexamine and certify whether configuration data correspond with fact application environment.

## 5.4 Check Output

Before other handle transmitter to on-line, you must examine and confirm whether transmitter currently operate and suitably configure progress variable.

### 5.4.1 Process Variable

We use two progress variable in APT-3100 SMART Pressure Transmitter pressure value is Primary Variable and temperature value of pressure value configure SV(Secondary Variable) with fixed value.

Moreover this PV value ouputs with 4~20mA analog value.

## 5.5 Basic Setup

You must configure correlation variable for operating currently transmitter.

### 5.5.1 Select Sensor Range

Pressure range to measure is depended Range Code of sensor. This value is classified from pressure sensor module automatically.

### 5.5.2 Set Output Units

Select from the following engineering units:

Unit: kPa, kg/cm<sup>2</sup>, bar, psi, mmH<sub>2</sub>O etc

### 5.5.3 Rerange

Set the Zero and Span of 4~20mA analog output.

## 5.6 Detailed Setup

### 5.6.1 Set Fail Mode

When sensor is wrong or microprocessor of transmitter doesn't operate normally in order to outputs current value of High or Low.

### 5.6.2 Set Damping Time

The sensor input value changes the response time of the transmitter to smooth variations in output readings caused by rapid changes in input. Determine the appropriate damping setting based on the necessary response time, signal stability, and other requirements of the loop dynamics of your system. The default damping value is 5.0 seconds, and can be reset to damping values between 0 and 32 seconds.

## 5.7 Configuration of Information Variable

### 5.7.1 Set Tag

Tag variable is better easy method to classify to transmitter in multi transmitter install environment. Tag Character can be used to 8 word of English/number.

### 5.7.2 Set Messages

When use several transmitter, user can define for classification each transmitter and use 32 words

of English/number. This message is saved in EEPROM of transmitter.

## 5.8 Configuration of Breakdown Diagnostic Function

### 5.8.1 Loop Test

The Loop Test verifies the output of the transmitter, the integrity of the loop, and the operations of any recorders or similar devices installed loop. Perform the following procedure for a loop test.

- ① Connect a reference meter to the transmitter.
- ② Select the Loop Test of HHT and operate the Loop Test.
- ③ Select output current ( 4mA/20mA/etc )
- ④ If the readings match, then the transmitter and the loop are configured and functioning properly. If the readings do not match, then you may have the current meter attached to the wrong loop, there maybe a fault in the wiring, the transmitter may require an output trim, or the electrical current meter may be malfunctioning.

## 5.9 Calibration

Scaled system implement by calibrating the transmitter. Trim function have several function for the calibration. Smart transmitters operate differently than analog transmitter. A Smart transmitter uses a microprocessor that contains information about the sensor's specific characteristics in response to pressure and temperature inputs for calculating Process Variable. The trim and rerange functions also differ. Reranging sets the transmitter analog output to the selected upper and lower range points and can be done with or without an applied pressure. Reranging does not change the factory characterization curve stored in the microprocessor. Sensor trimming requires an accurate pressure input and adds additional compensation that adjusts the position of the factory characterization curve to optimize transmitter performance over a specific pressure range. Rerange functions provides ability to readjust the 4~20mA points sensor inputs.

### 5.9.1 Sensor Trim

The Sensor Trim the transmitter sensor input signal convert A/D to lead and how it interprets the values which it inputs with digital the contents of such interpretation and it is regarding to change is connected actually in the sensor which in order to correspond.

### 5.9.2 DA (Digital to Analog) Trim

When the D/A trim convert sensor input signal to 4~20mA output, this ouput value scale minuteness. Cyclic you recommend to scale analog output for maintain scale.

## Chapter 6 Maintenance

### 6.1 Overview

This chapter describes breakdown diagnostic and maintenance.

### 6.2 Safety Message

When operation, it requires specially notice for the safety of operator. Information that raises potential safety issues is indicated by a warning symbol(▲). Refer to the following safety messages before performing an operation proceeded by this symbol.

#### 6.2.1 Warning

| ▲ Warning  |
|--|
| <p><b>Explosion can result in death or serious injury:</b></p> <ul style="list-style-type: none"> <li>◆ Do not remove the transmitter covers in explosion environments when the circuit is alive.</li> <li>◆ Both transmitter covers must be fully engaged to meet explosion-proof requirements</li> </ul> |

| ▲ Warning  |
|--|
| <p><b>Electrical shock can result in death or serious injury.</b> If you install high voltage environment or false condition, power line and lead will be appered high voltages.</p> <ul style="list-style-type: none"> <li>◆ Avoid contact with the leads and terminals.</li> </ul> |

| ▲ Warning  |
|--|
| <p><b>Electrical can result in death serious injury:</b></p> <ul style="list-style-type: none"> <li>◆ The qualification which is educated only the person whom it prepares will be able to establish the transmitter.</li> </ul> |

| ▲ Warning   |
|---|
| <p><b>Process leak can result in death serious injury:</b></p> <ul style="list-style-type: none"> <li>◆ Before approval pressure install Thermowell or sensor and then close completely. If don't this, it cause process leak.</li> <li>◆ when operating, don't take out Thermowell.</li> </ul> |

### 6.3 Hardware Diagnostics

If you suspect a malfunction despite the absence of any diagnostic messages on the HHT follow Table 6-1 described here to verify that transmitter hardware and process connections are in good working order.

If you suspect a malfunction despite the absence of any diagnostic messages on the HHT follow Table 6-1 described here to verify that transmitter hardware and process connections are in good working order.

[Table 6-1 Troubleshooting]

| Symptom   | Potential Source     | Corrective Action  |
|---|----------------------|--|
| Transmitter Does not Communicate With HART Communicator | Loop Wiring          | <ul style="list-style-type: none"> <li>• Check for a minimum of 250 ohms resistance between the power supply and HHT.</li> <li>• Check for adequate voltage to the transmitter. The transmitter always requires 11.9 ~ 45 Vdc.</li> <li>• Check for intermittent shorts, open circuits, and multiple grounds.</li> </ul> |
| High Output   | Sensor Input Failure | <ul style="list-style-type: none"> <li>• Connect HHT and enter the Transmitter test mode to isolate a sensor failure.</li> </ul>   |
|   | Loop Wiring          | <ul style="list-style-type: none"> <li>• Check for dirty or defective terminals, interconnecting pins, or receptacles.</li> </ul>  |
|   | Power Supply         | <ul style="list-style-type: none"> <li>• Check the output voltage of the power supply at the transmitter terminals. It should be 11.9 to 45 Vdc in spite of loop scale.</li> </ul>   |
|   | Electronics Module   | <ul style="list-style-type: none"> <li>• Connect HHT and enter the Transmitter test mode to isolate module failure. Check the sensor limits to ensure calibration adjustments are within the sensor range.</li> </ul>  |
| Erratic Output  | Loop Wiring          | <ul style="list-style-type: none"> <li>• Check the output voltage of the power supply at the transmitter terminals. It should be 11.9 to 45 Vdc.</li> <li>• Check for intermittent shorts, open circuits, and multiple grounds.</li> <li>• Check for proper polarity at the signal terminals.</li> </ul>                 |
|   | Electronics Module   | <ul style="list-style-type: none"> <li>• Connect HHT and enter the Transmitter test mode to isolate an electronics mode failure.</li> </ul>  |
| Low Output or No Output                                 | Sensor Element       | <ul style="list-style-type: none"> <li>• Connect HHT and enter the Transmitter test mode to isolate a sensor failure.</li> <li>• Check the PV to see if it is out of range.</li> </ul>   |
|   | Loop Wiring          | <ul style="list-style-type: none"> <li>• Check for adequate voltage to the transmitter. The transmitter always requires 11.9 ~ 45 Vdc.</li> <li>• Check for intermittent shorts, open circuits, and multiple grounds.</li> <li>• Check the loop impedance.</li> </ul>  |
|   | Electronics Module   | <ul style="list-style-type: none"> <li>• Connect HHT and check the sensor limits to ensure calibration adjustments are within the sensor range.</li> </ul>   |

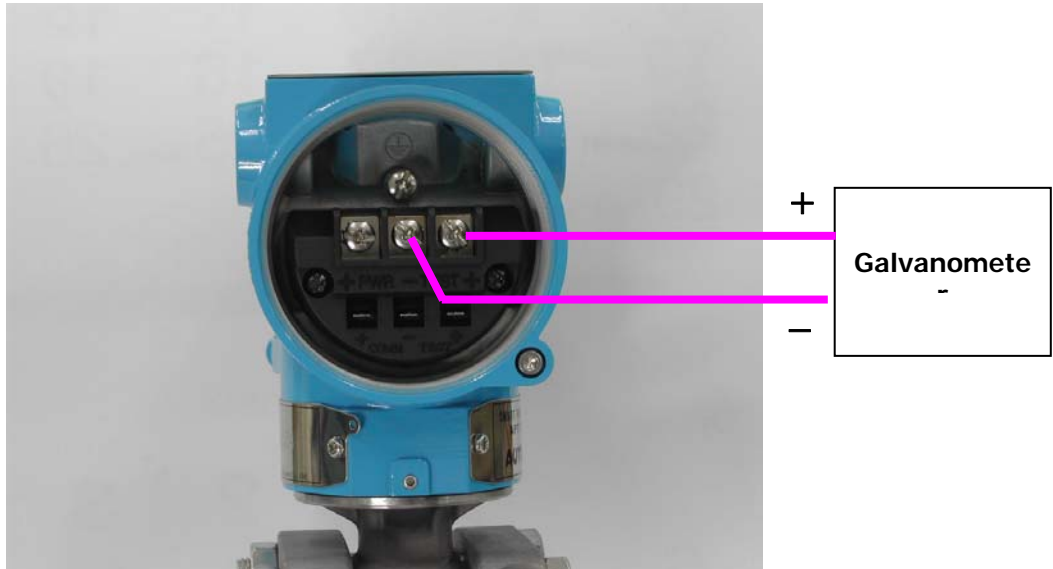
## 6.4 Hardware Maintenance

Autrol APT3100 Smart Transmitters have no moving parts and require a minimum of scheduled maintenance. Both transmitters feature modular design for easy maintenance. If you suspect a malfunction, check for an external cause before performing the diagnostics as discussed later in this section. If you must return failed transmitters or parts, send them to DUON System Co., Ltd. for inspection, repair, or replacement.

### 6.4.1 Test Terminals

The test terminal, marked as TEST on the terminal block. The test and negative terminals are connected to the test terminals; so long as the voltage across the receptacles is kept below the

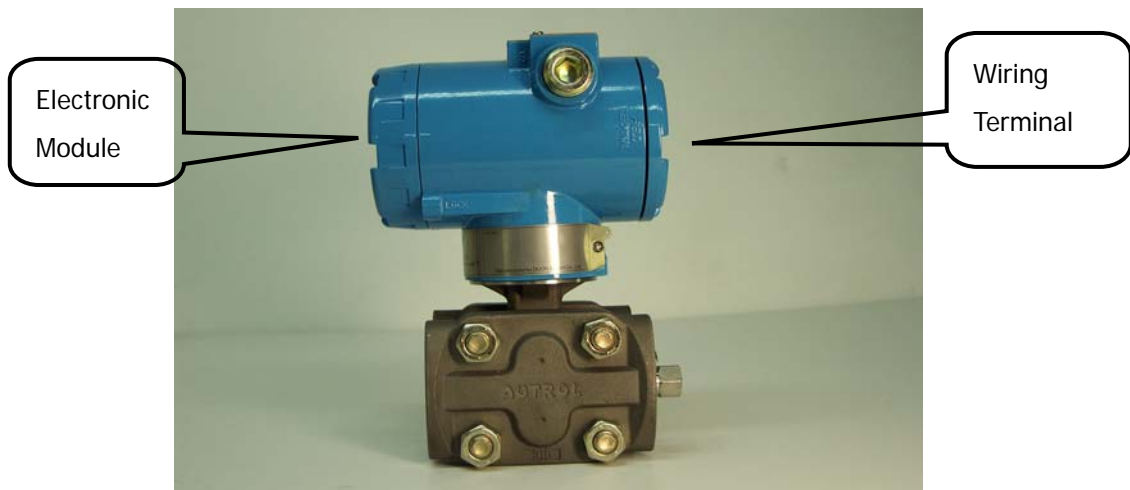
diode threshold voltage, no current passes through the diode. To ensure that there is no leakage current through the diode while making a test reading, or while an indicating meter is connected, the resistance of the test connection or meter should not exceed 10 ohms. A resistance value of 30 ohms will cause an error of approximately 10 percent of reading.



[Figure 6.1 Test Terminals]

### 6.4.2 Disassembling the Electronics Housing

The transmitter is designed with dual-compartment housing; one contains the electronics module, and the other contains all wiring terminals and the communication receptacles.



[Figure 6.2 Structure of Housing]



### 6.4.2.1 Disassembling Electronics Module

Use the following procedure to remove the electronics module.

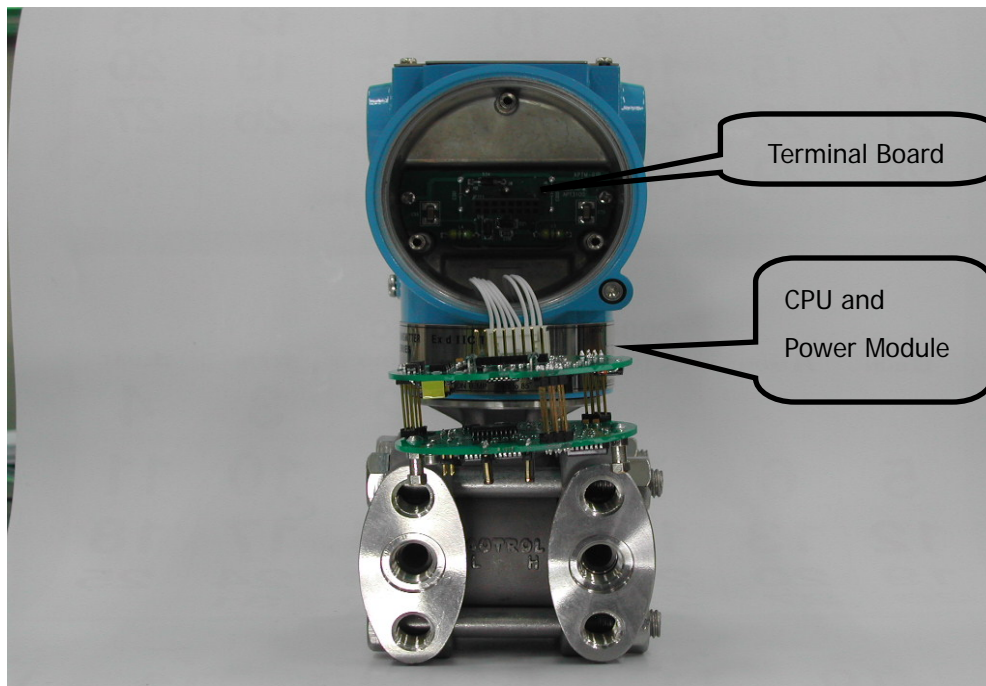
[Note1]

The electronics are sealed in a moisture-proof plastic enclosure referred to as the electronics module. The module is a non-repairable unit; if a malfunction occurs the entire unit must be replaced.

1. Disconnect the power to the transmitter.
2. Remove the cover from the electronics side of the transmitter housing (Figure 6.2). Do not remove the instrument cover in explosive atmospheres when the circuit is alive. Remove the LCD meter, if applicable.
3. Remove the two screws that anchor the electronics module to the transmitter housing.
4. Firmly grasp the electronics module and pull it straight out of the housing, taking care not to damage the interconnecting pins.

[Note2]

The transmitter EEPROM-Write Jumpers and failure mode are located on the front of the electronics module. When it will be replaced for a new one, make a same jumper location.



[Figure 6.3 Structure of Electronics Module inner Transmitter]

### 6.4.2.2 Fail Mode and Jumper Switch of EEPROM-write

Fail-mode and jumper switch of EEPROM-write is located front of electronics module.

### 6.4.3 Assembling the Electronics Housing

Re-assembling procedure is same as follows.

1. Make sure that Fail-mode and Jumper Switch are set exactly.
2. Insert electronics module in housing.
3. Fix electronics module with 3 screws..
4. Close the cover of housing..

## Appendix I

### LCS DISPLAY CODE of APT3100

| No. | CODE | Contents  |
|-----|------|---|
| 1   | e-rd | . Read Analog EEPROM for MCU EEPROM                   |
| 2   | -00- | . Finish to read Analog EEPROM for MCU EEPROM         |
| 3   | r-22 | . LCD stat Message (Transmitter Version "r-22")       |
| 4   | S-FL | . Sensor Fail   |
| 5   | s-op | . Sensor Input Over Pressure                          |
| 6   | e-tt | . Write MCU EEPROM for Analog EEPROM                  |
| 7   | end  | . Finish to write MCU EEPROM for Analog EEPROM        |
| 8   | Zero | . Initial message in using Zero button                |
| 9   | Span | . Initial message in using Span button                |
| 10  | 2-tr | . Initial message of Sensor Zero Trim in using button |
| 11  | -tr- | . Good job of Sensor Zero Trim in using button        |
| 12  | 2ter | . Over 10% of Sensor Zero Trim limit in using button  |
| 13  | -2e- | . Finish Zero configurations in using Zero button     |
| 14  | -sp- | . Finish Span configurations in using Span button     |
| 15  | Sete | . Fail EEPROM-write in using button                   |
| 16  | Sper | . Min/Max span Over in using Zero/Span Button         |
| 17  | Beri | . Wrong button in using button                        |
| 18  | a-cl | . Clear all MCU EEPROM                                |
| 19  | Cp-0 | . Verify Data Message                                 |
| 20  | -cp- | . EEPROM SETTING UP TERMINATION MESSAGE               |
| 21  | e-fa | . MCU data set error                                  |
| 22  | ---- | . Clear MCU EEPROM in User area                       |
| 23  | atrl | . Finish to clear MCU EEPROM in User area             |