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9

O & M MANUALS WITH MSD

Operating Manual

Petro make valves have proven themselves with long-term, trouble-free service in a wide variety of application.

Applied within their pressure and temperature limitations, properly installed, adjusted, and operated, these valves should require minimum attention.

General
Ball Valves are bidirectional valves. Controlling flow either direction. They can be installed in any position, horizontally or vertically.

Storage Instruction
Ball Valves ball, seats and end connections should be adequately protected against damage. The protective end covers should not be removed until ready for installation.

Rang:
Ball Valves
½" to 8"
2p/c Full/Reducel Bore
Flange Ends
Class 150 &300
Lever Operated

Maintenance.

All Petro Make Ball Valves are factory tested for tight shutoff. Standard valves with a stem packing adjustment nut are live loaded/tighted and normally no further adjustment is necessary.
If leakage should occur along the stem, follow the simple adjustment instructions.

Stem Seal Adjustment.

To adjust for leakage along the valve stem, open handle and remove lock plate form stem. Turn the stem nut clockwise in approximately 1/3- turn to increments to compress the gland packing. Do not over tight. Replace lock plat and handle with handle lock nut before tern valves. If a tight seal cannot be obtained, continue with the instructions for valve repair.

Repair of Valves

It is important that leakage be attended to promptly. If leakage is allowed to persist, the valve top works could be damaged by corrosive media.
Before Disassembly.

1. Open the valve to the 45-degree position. This will allow any trapped pressure within the valve to escape.
2. Remove the valve from the pipeline.
3. If the valve has been used with hazardous fluids, make certain the valve is thoroughly cleaned and decontaminated before disassembly.

Disassembly.

1. Separate the body &side p/c by unscrewing the body stud nuts or bolts.
2. Remove the body joint body gasket.
3. Remove stem ball from body: open handle and remove lock plate form stem. Remove the stem nut by turning it counter-clockwise. Rotate the ball to the closed position and remove it from the valve body. Remove the stem by pressing it down into the body cavity. Remove the Gland packing; stem ring from the body.
4. Remove seat holder& spring holder from the body by using puller/proper fixture, remove seat ring, spring and "O"rings

Caution: For remove ball ,soft seal,"O"ring and stem care should be taken do not damage on ball surface if required us soft headed tools.

Inspection.

Inspect the valve components for wear or damage. Be sure to carefully inspect the following components for nicks, cracks, breaks, or other defects:

- Ball &Stem
- Seat Ring, Seat holder,& Stem Ring
- Gland Packing rings
- Body Gasket

The parts listed above, are the only components that should require replacement. Also carefully inspect the Body and Side p/c, Inspect both the seat pockets,O rings and body gasket areas. Clean all areas thoroughly to remove all signs of corrosion and media build-up.

Reassembly.

When reassembling valves, it is recommended that new seal components be used to minimize the chance of internal and external leakage.

1.Properlly insert O ring ,insert spring holder and seat holder on body and side p/c, Place the spherical stem ring over the stem.

Note: Use lubricant if required for inserting Seat Holders in body and side p/c

Caution: Before using of lubrication please check nature of services.

2. Insert the stem through the valve body cavity. Make sure the anti-static Spring and ball are located properly in the stem.
3. Install the gland packing ring sets over the stem with the concave side down, pushing the rings into the body packing chamber.

Note: For the PTFE packing, orientation is important. For the graphite packing, it is important to firmly compress each graphite ring independently as it is installed

4. Place the gland bush over the valve stem.
5 Place the locking nut over the stem. Thread the stem nut over the stem. Do not tighten at this time.
6. Insert the replacement seats with the conical surface (which is adjust with ball surface) facing the ball.
7. Insert the ball into the body cavity with the port opening in the closed position. With the stem drive tab Positioned in the ball stem slot, turn the ball to the open position.
8 Install body gaskets in the body.
9 Join the body &side p/c, making sure the end flange drilling is meet require position Install and tighten the body stud nuts in the crossing pattern.
10.Tighten the nuts to the proper torque value. When tightening in the crossing pattern, cycle through the pattern at least three (3) times to assure proper and uniform. Torque. When the 2-piece valve is reassembled, be sure the studs protrude through the nut a minimum of one (1) thread.
11.Tighten the gland nut clockwise to compress gland packing. Replace lock plat and handle with handle lock nut before tern valves.
12. Open and close the valve two (3) or three (4) times to be sure the valve operates properly.

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OPERATION, INSTALLATION & MAINTENANCE MANUAL

STEELSTRONG

VALVES (I) PVT. LTD.

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STORAGE, INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTION FOR CAST STEEL GATE, GLOBE AND CHECK VALVES

❖ STORAGE

Check the Valves and its accessories to ensure that all are intact and the Valve is in fully closed position.

End protectors on either side of the Valves should be kept intact and should be removed only at the time of installation.

Valves should be stored in a covered area. In case covered area is not available, waterproof covering material should be used to product the Valve. Valves should be stored minimum of 6” above the ground preferably on a wooden pallet.

Do not apply tar, paint, grease or any other material inside the Valve as this may impair its performance.

❖ CONSTRUCTION:

All Gate, Globe and Check Valves are of sturdy design and give tight sealing against varied pressure and temperature of the lime fluid.

All Gate and Globe Valves are of outside screw and yoke (OS & Y) type. Check Valves are of swing type & lift type.

Gate Valves :

All Gate Valves are of bolted type body bonnet joint, with a flexible or solid wedge type Gate.

Globe Valves :

All Globe Valves are of bolted type body bonnet joint, with a plug type disc.

Check Valves :

All Check Valves are of bolted cover joint.

❖ INSTALLATION

1. Preparation for Installation

The Valves should be moved as close as possible to the installation site before removing packaging and end protectors. After removing end protectors, the inside of the Valves should be Checked and any rust inhibitor or dirt should be removed. If the Valves had been stored for a long period of time the protective paper should be removed and fresh coat of grease applied.

2. Pre-Commissioning tests:

All Valves are tested in factory in accordance with the relevant testing standards. Wherever Valves are required to be re tested prior to installation, ensure that the proper test rig is available at the side. Valves should be tested as per relevant testing standards. If water is used for testing, it is recommended that the internals be dried. It is advisable to add corrosion inhibitor in the water.

3. Installation Configuration:

For best performance, it is recommended that Gate and Globe Valves are installed in vertical position with the stem operating end at the top, horizontal or at any angle in between.

Swing Check Valves can be installed either in horizontal or vertical pipe lines. However in vertical pipelines the flow should always be in the upward direction. Swig Check Valves should never be installed at the outlet of a reciprocating pump as the pulsating flow is likely to damage the internals of the Valve.

Gate Valves have bi-directional sealing capabilities, and therefore can be installed in any direction. However if the Valves are with the pressure relieving features, they have to be installed only in the direction of the arrow.

Globe Valves have to be installed in the direction of the arrow that is, the direction of the flow is influenced by the operation conditions.

Check Valves are uni-directional and are installed such that the arrow mark is in line with the flow direction. If this is not ensured, Check Valve will not stop the flow altogether.

4. Lifting to position:

Valves should be lifted using suitable mechanical equipment. Chains, Slings and other Lifting equipment should be regularly inspected. Do not attempt to Lift the Valves by applying load on the hand wheel, Gear unit, Actuator or by pass piping. Chains and slings should be fixed around the Valve body.

5. Making end connections:

Gate, Globe and Check Valves with flanged and butt welded ends. The ends are machined in accordance with the relevant standards specified.

5.1) Flanged connections :

Gaskets and flanged boltings are not supplied with the Valves. They should meet the requirements of the end flanges of the Valve. Flanges should be pulled together evenly by tightening opposite pairs of bolts.

5.2) Welded connections :

All-weldings should be performed by qualified welders using approved procedures. It is advised that good engineering practices are followed to ensure that the heat from the welding does not affect the internals. Though there are no soft seats in the Gate, Globe and Check Valves, it is recommended that proper care be taken to prevent weld splatter does not affect or damage the metal to metal seating.

Gate and Globe Valves are to be in the fully closed condition while welding on the pipe line to prevent weld splatters affecting the seating surfaces and sparking between the body and the Gate.

Local post weld heat treatment of the heat-affected zone can be safe but it is not recommended for the entire Valve. Excessive direct heat may affect the stem packing and other operating equipments.

6. Installation of Valve operators:

As a standard Gate and Globe are supplied with hand wheel or gear unit for manual operation. Check Valves do not require any operators as they open and close automatically depending on the flow condition.

Whenever Gate and Globe Valves ordered with actuators, they are fitted at factory itself. All Valves are set and tested at the factory before despatch.

It is strongly recommended that the actuator setting should not be disturbed/altered at site.

7. Start up:

All Valves should be checked for operation before startup. For a motor operated Valve, check the working direction by keeping the Gate stroke disc in mid position. If not Check the wiring connections.

The pipeline should be furnished, cleaned thoroughly with water or air. The Valves should be either fully closed or fully opened during the cleaning operations. They should not be kept partially open or close a the Gate/disc seating may get damaged by the debris being flushed out. Some pipelines are required to be flushed out at very high speed and in such cases particles in the pipeline might damage even the body seating. In such cases use of metal protectors around the body seating to prevent damage is recommended.

8. Commissioning test:

Valves are tested as per the relevant testing standards.

If there are operational requirement to test the Valves at higher pressures temperatures, or duration, these test parameters should be specified and Checked with factory prior to subjecting the Valves to such tests.

❖ OPERATION:

1. Gate Valves:

Gate Valves are multi turn Valves with rising stem i.e., they require number of turns of rotation of hand wheel for full opening and closing of the Valve. All Gate Valves should be either in fully open or in fully closed position only. Gate Valves are not to be used in slight or half open position as the Gate may vibrate/chatter and also cause wire drawing at the seating area. Therefore Gate Valves should not be used for regulation.

All Valves close by the rotation of the hand wheel. Clock wise rotation close the Valve and anti clock wise open the same.

For Hand wheel operated Valves the projection of the stem above the hand wheel indicates whether the Valves is in the open or closed position. In gate operated Valves the stem top will not be visible and a separate indicator can be provided if required.

Wedge Gate Valves:

The Valve is closed by driving the wedge into the corresponding taper in the body. The wedge and body seat ring are matched perfectly and lapped for good sealing. When the Valve is fully opened the stem back seats into the bonnet bush. However in the case of actuator valves the stem is not allowed to fully back seat to avoid damage. Wedge Gate Valves fully close by torque limit and fully open (back seat) by travel limit.

2. Globe Valves:

All Globe Valves are multi turn Valves with rotating stem and rising hand wheel. Globe Valves can be used for normal flow regulation. However if it is used in slightly opened position when the differential pressure is very high the seating may erode. It is advisable not to use Globe Valves for flow control below 10% of full opening.

All Valves close by rotating the hand wheel clock wise and open by rotating it anti-clock wise.

As the stem travel is very small in Globe Valve when compared to a same size Gate Valve it is difficult to make out whether the Valve is in open or close position from the stem position.
Generally Globe Valves are hand wheel operated. However in case if it is required to be gear operated the Valve will be modified to non-rotating stem.

3. Check Valves:

All Check Valves are Swing type which automatically open by the velocity pressure of the flow and close by the gravitational force when the flow reverses or stops.

❖ IN LINE MAINTENANCE

Gate and Globe Valves require only a minimum in - line maintenance for satisfactory performance.

1. Check the gland eye bolts for tightness at regular intervals. If loose, tighten them.
2. Grease the stem threads in Gate and Globe Valves as and when required.
3. Apply a drop of oil into the stem packing area to reduce the friction between the stem and the packing.
4. Grease the yoke sleeve in Gate Valve through the grease nipple regularly.

❖ ROUTINE MAINTENANCE:

1. Gland Leak:

Check the tightness of the gland eye bolts and tighten evenly if required. If the leak persists, the packing should be renewed. For this the Valve must be either in fully open position (back seated) or the pipeline must be shut off so that there is no pressure inside the Valve before the gland eye bolts are loosened.

Caution:

For certain applications like high-pressure steam, toxic, chemicals, etc., it is not safer to remove the gland even with Valves fully back seated. It is advisable to shut off the pipeline before attempting to renew the packing.

Most of the packing rings are already cut so that they can be inserted around the stem. Incase of solid moulded packing like graphite rings, use a sharp knife and cut the ring at 45^0 angle. Then slightly twist the ring and insert it around the steam. Do not open up the ring as it could break.

2. Body-Bonnet Joint Leak:

Since the body-bonnet joint is bolted Check the tightness of the bolting and tighten the bolts at the vicinity of the leak. If leak persists, renew the bonnet gasket. The pipeline must be shut off before dismantling the bonnet.

3. Gear units:

Gear operated Valves are fitted with enclosed water tight bevel gears. The gears are designed to function without maintenance for many years. The gear units are lubricated with the heavy bearing grease and may be refilled as required.

4. Actuators:

For operational details and maintenance instructions refer the actuator manufacturer's instruction manual. Ensure that proper electrical connections are given as indicated in the wiring diagram for specific actuator.

❖ PERIODIC MAINTENANCE:

1. **Dismantling:** All Valves are designed permit inspection without removing the body from the pipeline. The section of the pipe should be shut off before dismantling the Valve for inspection.
2. Gate and Globe Valves can be inspected by removing the bonnet assembly.
3. In the case of Check Valves there is no stem and only the cover is to be removed for inspection. The disc is hinged inside the body.
4. **Bolted Bonnet / Cover Valves**
   - 4.1.) Keep the Valve in mid position and remove the hand wheel/gear unit/actuator from the top of the Valve.
   - 4.2.) Loosen the body/bonnet bolting and remove the studs and nuts.
   - 4.3.) Lift the bonnet assembly including the stem and Gate/disc out of the body. Care should be taken not to drop the Gate/disc while Lifting out. Mark the matching surfaces of the Gate and the body seat rings of the Gate Valves so that they are not interchanged during re-assembly.

5. Inspection:

5.1) Check the seating of the body seat ring and the Gate/disc for wear or damage.
5.2) Check the stem and back seat for damage.
5.3) Lap the seating of Gate/disc if required.

6. Re-assembly:

6.1) Lower the bonnet assembly including the Gate/disc smoothly into the body keeping the Gate/disc in open position. Remember to match the markings done earlier on Gate and body seat rings. A blue bearing test will confirm if there is a uniform contact between the Gate/disc and body seat rings.
6.2) Replace the gland packing if necessary and tighten the eye bolts on to the glands.

6.3) Place the gasket on the body in the correct position.
6.4) Fit the bonnet studs and tighten the nuts every working at diagonally opposite pairs. Do not over tighten as the gasket may get damage. Apply moly grease for the Studs & Nuts during re-assembly.
6.5) Assembly the hand wheel/gear unit/actuator.
6.6) Operate the Valve from fully closed to fully open position manually and ensure free operation.

7. Actuator setting:

Limit switches are required to be set to trip on travel limit or torque limit for full open/close position depending on the design of the Valve.

The following chart provides the setting parameters. 'Torque' indicates that the actuator shall trip by torque limit switch.
'Position' indicates that the actuator shall trip by travel limit switch.

Type of Valve	Close	Open
Wedge Gate	Torque	Position
Globe	Torque	Position

7.1) How to set the limit switches?

7.2) To set close on torque?

The limit switch is set at the factory to the required torque for zero leak. Normally when the Valve is dismantled for servicing it may not be required to adjust the torque setting. While testing after servicing, if it is found that the Valve is not fully closed at the initial setting, close the Valve manually. If the leakage stops, increase the torque setting of the actuator.

7.3) To set open on position:

Open the Valve manually till it gets back seated. Then close the Valve by rotating the handwheel by 1/2 revolution or by 3 or 4 mm. At this position set the limit switch.

7.4) To set close on position :

Close the Valve manually till the stopper touches the actuator bush. Then open the Valve by rotating the hand wheel 1/2 revolution or by 2 to 3 mm. At this position set the limit switch. Check the operation so that the closing is by the limit switch and not by the stopper.

7.5) For detailed procedure on periodic maintenance, dismantling and actuator settings refer to actuator manufacturer's instruction manual.

TROUBLE SHOOTING GUIDE FOR GATE, GLOBE & CHECK VALVES

Trouble	Probable Cause	Remedy
Leaks across the Gate / disc	a. Valve not closed fully	a. Re-tighten the handwheel
	b. Limit/torque setting of the actuator disturbed	b. Reset the switches as required
	c. Valve seating damaged	c. Dismantle and lap the seating
	d. By - pass Valve not closed fully	d. Close the Valve fully
	e. By - pass Valve seat may be damaged	e. Check the seating of the by-pass Valve
Leaks through gland	a. Packing loosened	a. Tighten the gland eye-bolts
	b. Packing worn out	b. Replace the packing
Leaks though Bonnet / Cover Joint	a. Bonnet/cover bolting loose. If this does not seal then suspect	a. Tighten the bolting
	b. Gasket damage	b. Dismantle and replace the gasket
Not closing fully	a. Debris inside the Valve	a. Clean the pipeline
	b. Limit/Torque settings of the actuator disturbed	b. Reset the switches as required

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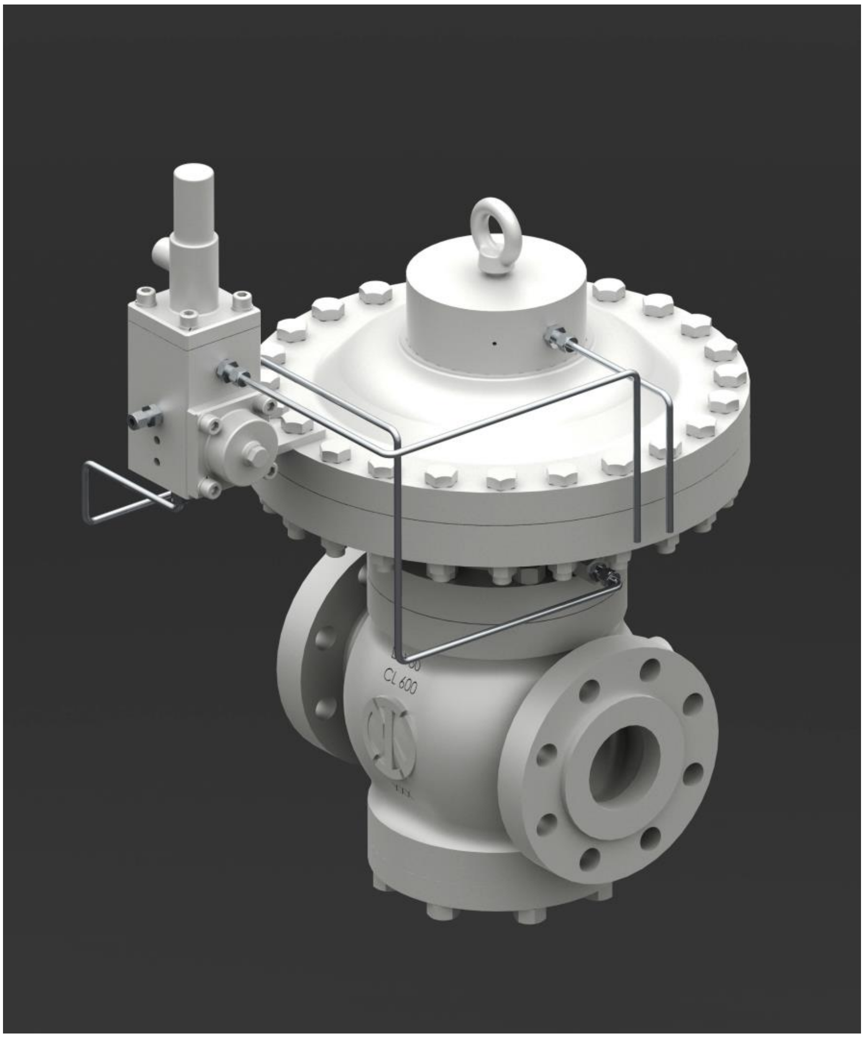
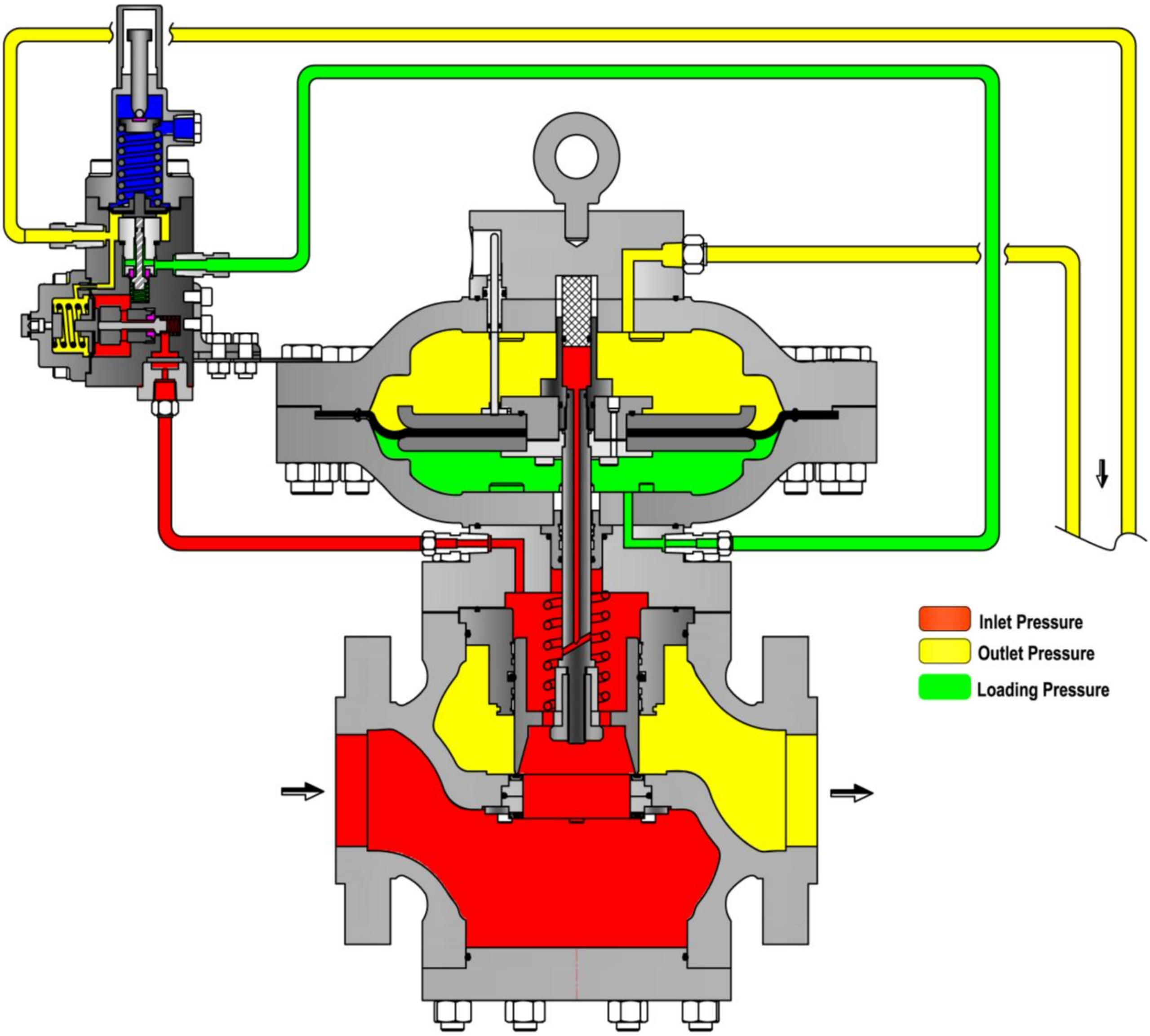
GAS PRESSURE REGULATOR



SERIES D53

TECHNICAL MANUAL

User's Guide



SERIES D53
GAS PRESSURE REGULATOR

MODEL OF DECLARATION OF CONFORMITY
(Module H of the pressure equipment directive)

NIRMAL INDUSTRIAL CONTROLS PVT.LTD. with registered office at 4, Nahur Industrial Estate, L.B.S.Marg, Mulund (W), Mumbai – 400 080. INDIA

certifies under its sole responsibility that the item of equipment specified below has been designed, manufactured, inspected and tested as required by the relevant provisions of the Pressure Equipment Directive 2014/68/EU, transposed in the French law by the modified decree n° 99-1046 of 13 December 1999.

The item or equipment identified below has been subject to EC Unit verification (Module H of the pressure equipment directive) by Bureau Veritas - SA (notified body number 0062) which has issued the certificate of conformity

EQUIPMENT: GAS PRESSURE REGULATOR

Serial number(s) : XXXXXX

Technical standards and specifications used : EN 334

NIRMAL INDUSTRIAL CONTROLS PVT. LTD.

Place: MUMBAI

PRECAUTIONS

A. GENERAL PRECAUTIONS

- The apparatus described in this manual is a device subject to pressure installed in systems under pressure.
- The apparatus in question is normally installed in systems for transporting flammable gases (natural gas, for example).
- The apparatus be installed, operated and maintained in accordance with international and applicable codes and regulations, and Technical Manual instructions hereunder.

CAUTION !!!

NICPL will not be responsible for any untoward eventualities during the use of the apparatus if the apparatus is used or handled without

a) going through this manual and/or

b) Not following the specified instructions

CAUTION !!!

Person injury, equipment damage, or leakage due to escaping fluid or bursting of pressure containing parts may result if this regulator is over pressurized or is installed where service conditions could exceed the limits given in the specifications section, or where conditions exceed any ratings of the adjacent piping or piping components.

B. PRECAUTIONS FOR THE OPERATORS

Before proceeding with installation, commissioning or maintenance, operators must:

- Examine the **Safety Provisions** applicable to the installation in which they must work;
- Obtain the **authorizations** necessary for working when so required;
- Use the necessary means of **individual protection** (helmet, goggles, etc.);
- Ensure that the area in which they operate is fitted with the means of **collective protection** envisaged and with the necessary **Safety indications.**

CAUTION!!!

Only qualified personnel shall install or service a regulator.
To avoid injury and damage, install the regulator in a safe location.

C. HANDLING

The handling of the apparatus and of its components must only be carried out after ensuring that the lifting device is adequate for the **loads to lift** (lifting capacity and functionality). The apparatus must be handled using the **lifting points** provided on the apparatus itself.
Motorized means must only be used by the persons in charge of them.

CAUTION!!!

Appropriate care should be taken while handling to avoid damage to mounted accessories, pilots, tubing etc.

D. PACKING

The packing for transportation of equipment and of relevant spare parts are designed and shaped to avoid damage to any part during transportation, warehousing and handling activities. Therefore the equipment and spare parts shall be kept into their packing until their installation in the final site. After packing is open, check that no damage occurred to any goods. If damage occurred inform the supplier and keep packing for any verification.

E. INSTALLATION

If the installation of the apparatus requires the application of **compression fittings** in the field, these must be installed following the **instructions of the manufacturer** of the fittings themselves. The choice of the fitting must be compatible with use specified for the apparatus and with specifications of the system when envisaged.

CAUTION !!!

Flush out all the pipelines before installation of regulator and check to be sure that the regulator has not been damaged or collected foreign material, during shipping.

F. COMMISSIONING

While commissioning, the risks associated with any discharges into the atmosphere of flammable or noxious gases must be assessed. In case of installations in natural gas distribution networks, the risk of the formation of explosive mixtures (gas/air) inside the piping must be considered.

CONFORMITY TO DIRECTIVE 2014/68/EU (PED)

Gas Pressure regulators SERIES D53 according to the EN 334 are categorized as **pressure accessory** according to directive 2014/68/EU (PED).

The regulator SERIES D53/S… when incorporating safety-shut (according to EN 14382) is categorized as **safety accessory** according to PED.

CAUTION!!!

The regulator with incorporated safety shut off should be used for all equipments / piping system which are classified in Category III and below in accordance with 2014/68/EU (PED)

CONTENTS

1. 0 INTRODUCTION

This manual proposes to provide the essential information for the installation, start-up, disassembly, reassembly and maintenance of the Regulators Series D53.
This is also appropriate, however, to provide a brief illustration of the main features of the regulator and of its components.

These are available in the followings versions

- D53C : Pressure Regulator
- D53M : Monitor Regulator to be installed at upstream of Active Regulator
- D53S : Pressure Regulator and Slam Shut Device combined in one unit
- D53MS : Monitor Regulator and Slam Shut Device combined in one unit

1. 1 MAIN FEATURES

The Series D53 pressure regulator is a pilot operated regulator for medium and high pressure.

1. 2 SPECIFICATIONS

- Design pressure: up to 100 bar;
- Design temperature: -20 °C to +60 °C;
- Range of the inlet pressure bpu: 0.5 to 100 bar;
- Possible regulation range Wd: 0.5 to 50.0 bar (depending on the pilot installed)
- Minimum differential pressure: 0.5 bar;
- Accuracy class AC : up to 1.0 (according to EN 334)
- Lock-up pressure zone class SZ: up to 2.5.

Available Sizes & End connections :

Size	:	DN 25, 50, 80, 100, 150 , 200 , 250
End Connection	:	Flanged end - PN 16, PN25, ANSI 150, ANSI 300, and ANSI 600

Maximum Operating Inlet Pressure at average ambient temperature is, for

PN 16	:	16 bar
PN 25	:	25 bar
ANSI 150	:	19 bar
ANSI 300	:	48 bar
ANSI 600	:	99 bar

CAUTION!!!

The pressure / temperature limits in this manual and other relevant applicable standard or code Limitation should not be exceeded.

1.3 OPERATION

The regulator is operated by two stage pilot. The pilot reduces the inlet pressure Pe in two stages and provides constant motorization pressure Pm to operate the main regulator, **Refer Fig. 1.**

In the absence of pressure, the plug (05) remains in the closed position by the spring (16), and rests on the molded seat (04). The upstream pressure, even if variable, does not change this position as the plug is balanced and is therefore subject to equal pressures, even if the sections are different. The plug rod (18) is also between two equal pressures, as the pressure upstream is also passed through the hole in plug rod (18) to the top piston chamber (H).

The plug movement is controlled by the diaphragm (10) by the following forces acting on it:

- Downwards: The force of the spring (16), the thrust deriving from the regulated pressure Pa in the top diaphragm chamber (E) and the weight of the diaphragm assembly & plug assembly.
- Upwards: The thrust deriving from the motorization pressure Pm in the bottom diaphragm chamber (F), supplied by the pilot.

The motorization pressure is obtained by drawing gas from the regulator at the upstream pressure. The gas is filtered through the Filter (41) and is subjected to initial reduction in the first Stage pilot, **Refer Fig. 2** composed essentially of a plug (37), a spring (28A) and a diaphragm (34A) to a value, which depends on the pressure set-point of the regulator. The pressure then passes to second stage pilot that controls pressure by means of a plug (35), a main spring (28B) and a diaphragm (34B) to the motorization pressure, Pm, which is supplied to bottom diaphragm chamber (F) of the main regulator. The regulation of Pm is obtained by the comparison of the force exerted by setting spring 28B of the pilot and the action of the regulated pressure, Pa, acting in the chamber below the diaphragm 34B.

The set point can be changed by turning the adjustment set screw (31B); clockwise rotation increases Pm and therefore the regulated pressure, Pa; the opposite occurs when the set screw is turned anticlockwise.

If, for example, the downstream pressure, Pa, drops during operation (because of an increase in the consumption or flow rate or a drop in the upstream pressure) an imbalance occurs at the diaphragm (34B) of the pilot, which is displaced to increase the opening by pressing the plug (35) downward. As a result, the motorization pressure value, Pm, increases and, by acting in the bottom chamber (F) of diaphragm (10) (fig.1) causes the plug (05) to move upwards and therefore an increase in the opening of the regulator until the set point of the regulated pressure, Pa, is restored.

Vice versa, when the regulated pressure begins to increase, the force it exerts on the diaphragm (34B) of the pilot that moves the diaphragm (34B) upward displacing the plug (35), towards the closed position. The pressure, Pm, then drops because of the pressure transfer from bottom chamber (F) to top chamber (E) through the orifice (N), and the force exerted by the spring (16) causes the downward displacement of the plug (05), to restore the regulated pressure to the set point. In normal working conditions, the plug (35) of the pilot positions itself so that the motorization pressure value, Pm, is such as to maintain the downstream pressure value, Pa, around the set point.

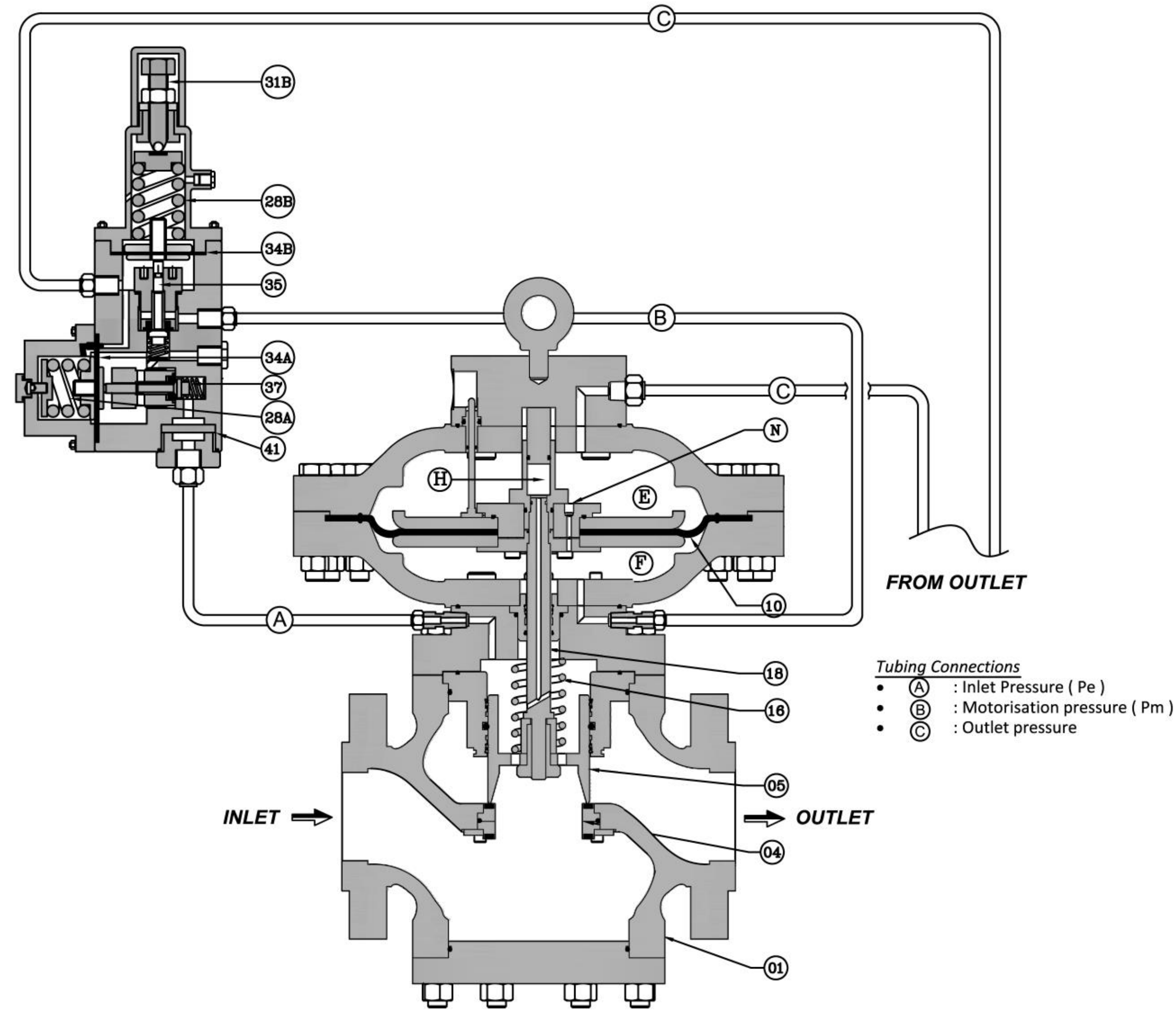


Figure 1 : TYPICAL D53 SERIES PRESSURE REGULATOR WITH PILOT VALVE

Note: Tubing Connections C & D are to be made by Customer/User

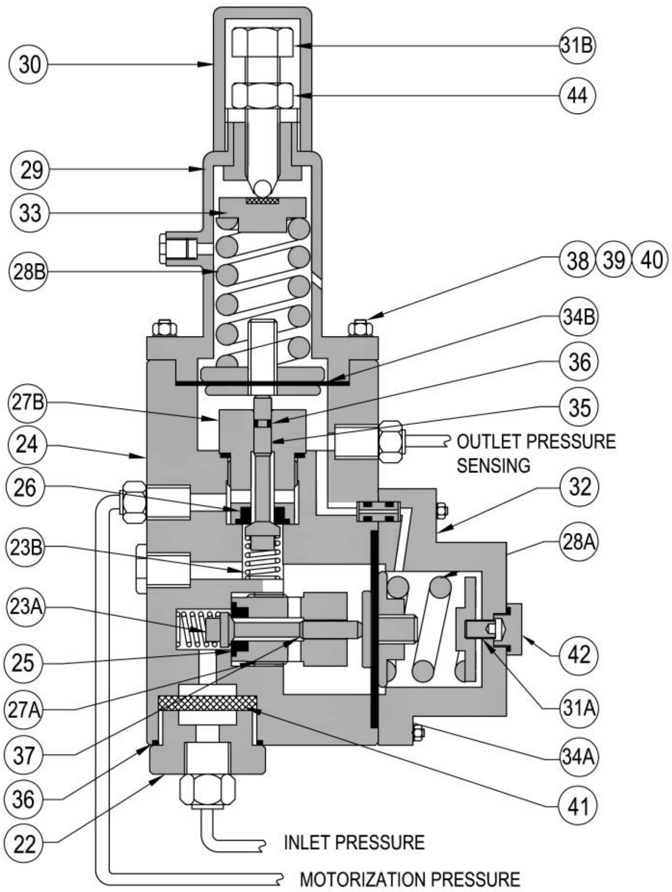


Figure 2 : PILOT VALVE - TYPE DNP1

SLAM SHUT-OFF VALVE OPERATION (REFER FIG.3)

The Regulator having Slam Shut Device (Refer Fig. 3) attached to the main body .The control mechanism (E) i.e. Pilot-DNP12having linkage mechanism (B) which is connected to latching mechanism (F) that hold the plug rod (14S) in open position. The sensing element is diaphragm (31S) which continuously monitors the line pressure which is to be safeguarded. This pilot is spring-cum-diaphragm type valve with under & over pressure shut-off arrangement and in case of over-pressurization or under-pressurization takes place, it gives signal pressure to pilot € which in turn trips off the main valve.

In normal condition the main valve remains in open position by holding the plug rod (14S) by latching arrangement (F) provided in device unit.

Whenever the pressure monitored by (Pilot-DNP12) exceeds above its set intervention value, this pressure acts on below the diaphragm area (G) , this results in diaphragm (31S) to move upward displacing the latching mechanism (F). Thus the upward movement of plug rod (14S) releases the ball (18S) from the plug rod (14S) , this results in upward movement of plug assembly (A) which closes the valve by the action of spring (9S).

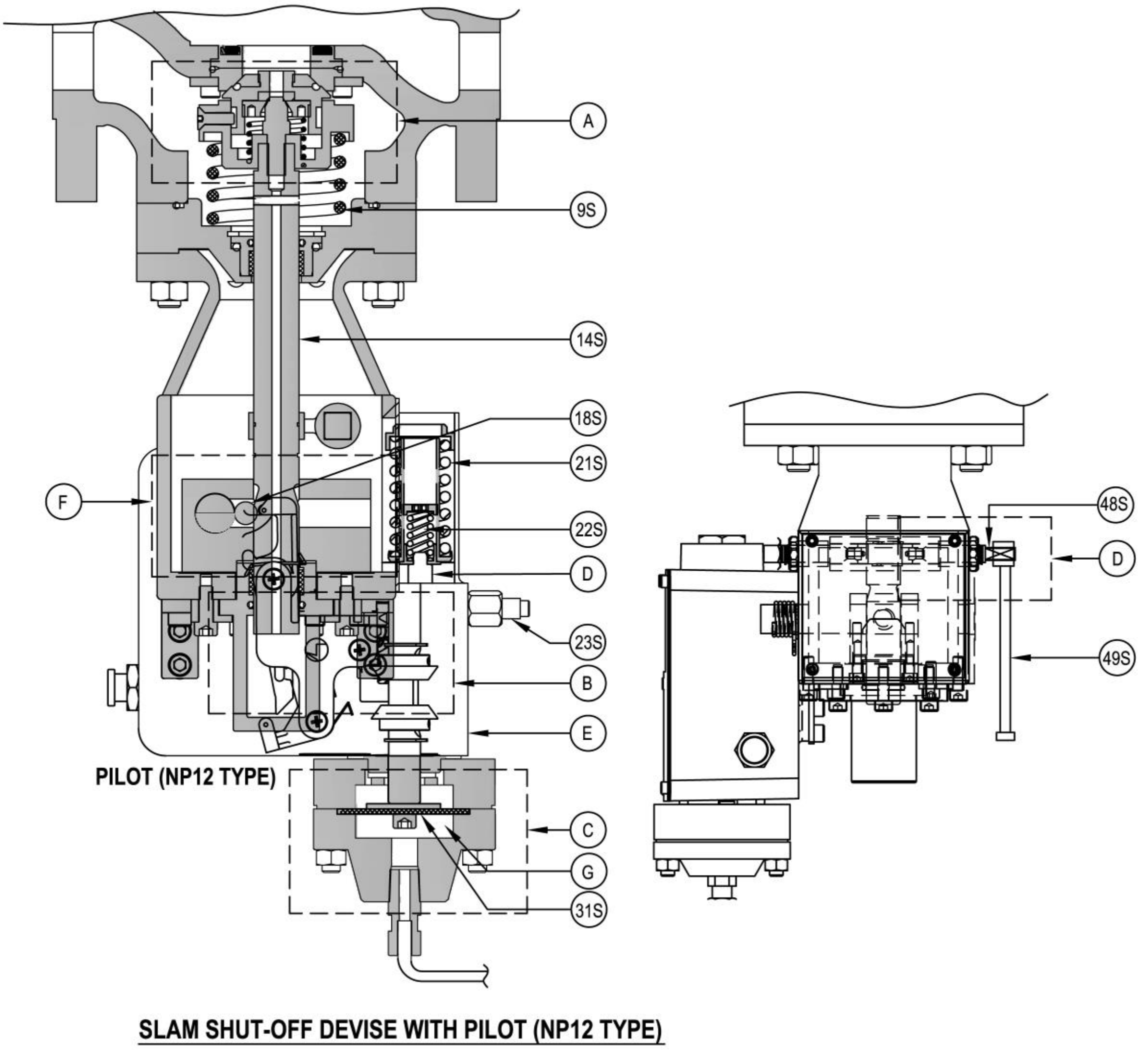


Figure 3: SLAM SHUT VALVE WITH PILOT VALVE – TYPE DN12

RE-SETTING PROCEDURE (REFER FIG.3)

To reset the device,

1) Engage the reset lever (49S) slot in reset square head of connector rod (48S).
2) Turn the reset lever (49S) slightly; this will open the pressure equalizing orifice in the plug rod (14S).
3) Allow the pressure at inlet and outlet to equalize.
4) Now turn the reset lever (49S) to fully towards open position i.e. in downward direction. After reaching the extreme position, press the push button (23S) to engage the latching mechanism (F). This can assured by hearing a latching sound before latching .With this it can be ensured that the latching mechanism has correctly latched in-place of plug rod (14S) which in turn is connected to plug assembly (A).
5) Now remove the reset lever (49S)from the connector rod (48S).
   Regulator is ready for operation

CAUTION!!!
The valve can be re-opened only by manual resetting. Before resetting the valve ensure that the cause for over-pressurization is found and rectified.

1.4 START-UP SETTINGS

The Regulator Series D53 with pilots is having following regulation range.

Table : 1

Configuration. No.	Regulator Set Pressure Range	Safety Shut Off Device Set Pressure Range	Pilot Type.
1	0.5 TO 2.0 Barg	1.6 TO 4.0 Barg	DNP1
2	1.5 TO 6.0 Barg	2.8 TO 5.4 Barg	DNP1
3	4.0 TO 18.0 Barg	4.6 TO 8.0 Barg	DNP1
4	10.0 TO 30.0 Barg	12.0 TO 22.0 Barg	DNP1
5	25.0 TO 50.0 Barg	26.0 TO 44.0 Barg	DNP9 & DNP10

Refer Figure 2

The regulator is factory set at the pressure requested or ordered and normally, no setting is again required. However, if, due to unpredicted or unanticipated changes in the planned parameters, the regulator may required to set at different set point, this can be done by turning the set screw 31B of pilot DNP1.

- For increasing the regulated pressure: Turn the set screw (31B) in clockwise direction.
- For decreasing the regulated pressure: Turn the set screw (31B) in anti-clockwise direction.

When desired setting has been set, the set screw shall be locked by tightening the lock nut provided and cap shall be placed over it.

Refer Figure 2 & Figure 3

Similarly, the Safety shut off device may required to set at different set point, this can be done by turning the set screw 51 (fig.3) of Pilot-TYPE DNP12.
FOR OPSO ;

- For increasing the regulated pressure: Turn the set screw (19S) in clockwise direction.
- For decreasing the regulated pressure: Turn the set screw (19S) in anti-clockwise direction.

FOR UPSO ;

- For increasing the regulated pressure: Turn the set screw (20S) in clockwise direction.
- For decreasing the regulated pressure: Turn the set screw (20S) in anti-clockwise direction.

2.0 INSTALLATION

2.1 GENERAL

Pressure regulator does not require any supplementary upstream safety accessory for protection against overpressure compared with its design pressure PS, when upstream reducing station is sized for a max downstream incidental pressure MIPd $\leq$ 1.1 PS.

2.2 PRE-INSTALLATION CHECKS

Before installing the regulator it is necessary to ensure that:

a. The regulator has been installed in vertical position, but be sure flow through the body is in the direction indicated by the arrow on the body
b. The use of suitable gaskets and approved piping and bolting practices has been done;
c. The regulator can be inserted in the space provided and that subsequent maintenance operations will be sufficiently practicable;
d. The upstream and downstream piping is at the same level and capable of supporting the weight of the regulator;
e. The inlet/outlet flanges of the piping are parallel;
f. The inlet/outlet flanges of the regulator are clean and the regulator itself has not been subject to damage during transport;
g. The gas supply to regulator has been cleaned by means of proper Filters / Separators / Scrubbers to avoid any technical failure & reasonable hazard of erosion or abrasion for pressure containing parts;
h. The piping upstream has been cleaned or flushed for removal of residual impurities such as welding scale, sand, paint residues, water, etc;
i. The regulator has been installed in non-seismic area and hasn't to under go fire and thunderbolt action;
j. The vent & drain arrangements has been provided adequately at upstream and downstream of the regulator.

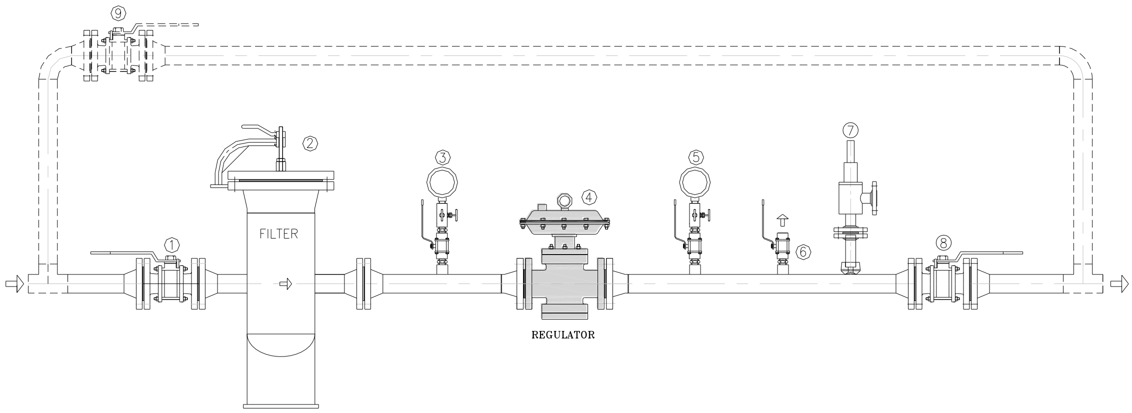


Figure 4: Typical Installation of D53 SERIES Regulator
(For sensing connections refer details under 2.3)

2.3 CONNECTING THE REGULATOR

The connections between the apparatus and the main piping must be made using stainless steel pipe with minimum internal diameter of 8 mm.

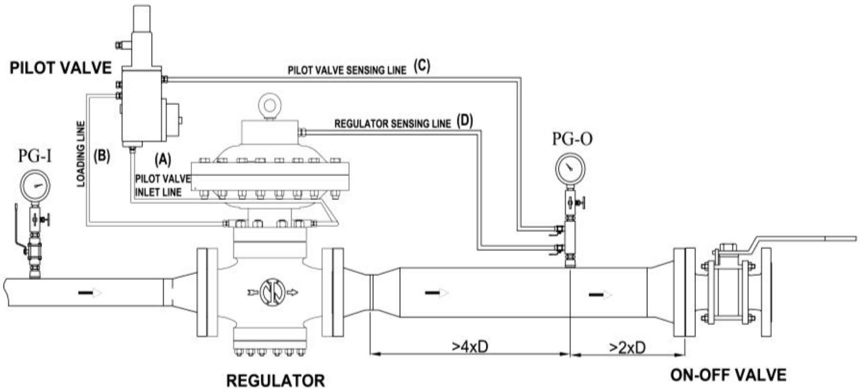


Figure 5A Installation in straight line

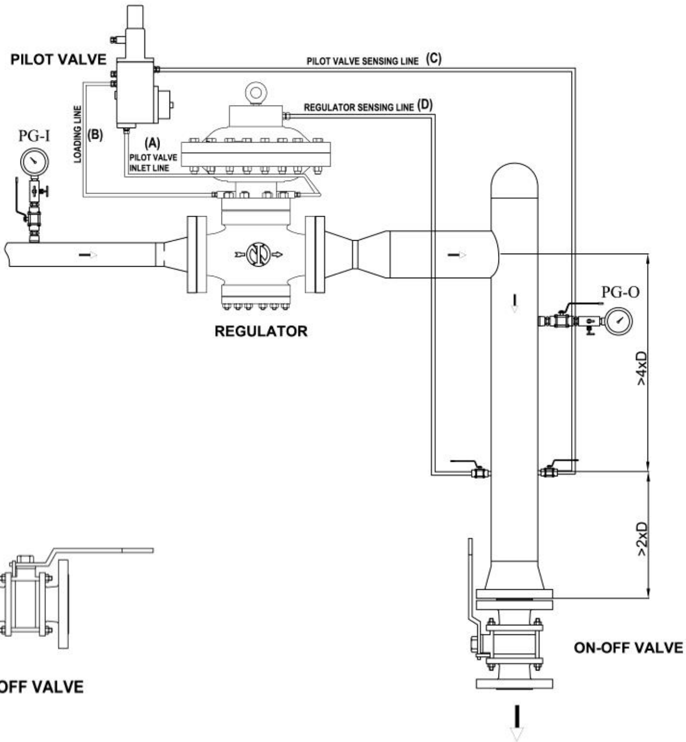


Figure 5B Installation with outlet header at 90°

Tube & Fitting Sizes: FOR DNP1 Pilot Valve

Tubing conn.	Tube size	Start Fitting size	End fitting size	Remarks
A	3/8" OD	1/4" NPTM x 3/8" OD	3/8" NPTM x 3/8" OD	Supply Pr. to Pilot
B	3/8" OD	3/8" NPTM x 3/8" OD	1/4" NPTM x 3/8" OD	Motorization pressure, Pm
C	3/8" OD	3/8" NPTM x 3/8" OD	1/2" NPTM x 3/8" OD	Downstream signal to Pilot
D	3/8" OD	1/2" NPTM x 3/8" OD	1/2" NPTM x 3/8" OD	Downstream signal to Main Regulator

Note: Tubing Connections C & D are to be done by Piping contractor as per installation requirements.

The regulator must be so installed that the flow is in the direction of the arrow on the body.

Tube & Fitting Sizes: FOR DNP9 & DNP10 Pilot Valve

Tube size	Start Fitting size	End fitting size	Remarks
3/8" OD	1/4" NPTM x 3/8" OD	3/8" NPTM x 3/8" OD	Supply Pr. to 1st Stage Pilot
3/8" OD	1/4" NPTM x 3/8" OD	1/2" NPTM x 3/8" OD	Motorization pressure, Pm
3/8" OD	1/4" NPTM x 3/8" OD	3/8" NPTM x 3/8" OD	1st Stage outlet to 2nd Stage Inlet
3/8" OD	1/4" NPTM x 3/8" OD	1/4" NPTM x 3/8" OD	Downstream signal to Pilot
3/8" OD	1/2" NPTM x 3/8" OD	1/2" NPTM x 3/8" OD	Downstream signal to Main Regulator
	3/8" x 3/8" x 3/8" OD.	Ferrule Tee	
	3/8" x 3/8" OD.	Elbow	

For better performance of the regulator it is important that the downstream pressure sensing connections are taken from the distance shown in Fig. 5A & 5B and the gas velocity at the take offs must not exceed the values below.

For Downstream Pressure Pa $\geq$ 1 bar; Vmax = 40 m/s
For Downstream Pressure Pa < 1 bar; Vmax = 25 m/s

CAUTION !!!
The gas velocity at any point must not exceed the following values in the piping :
Unfiltered Gas : Vmax = 20 m/s
Filtered Gas : Vmax = 40 m/s

3. 0 ACCESSORIES & CONFIGURATIONS

3.1 RELIEF VALVE

The relief valve is a safety device which releases a certain small quantity of gas to the atmosphere when the pressure at the control point exceeds the set-point as a result of short-lasting events such as, the very fast closing of the on/off valves and/or overheating of the gas with zero flow rate demand. The release of the gas to atmosphere can, for example, delay or block intervention of the slam-shut valve for transitory reasons deriving from damage to the regulator.

The quantity of gas released depends on the extent of the over pressure with respect to the set point. The different models of the relief valve are available.

3.2 SLAM SHUT DEVICE (Series SH4)

Slam Shut off is a device which immediately blocks the gas flow by intervention if due to some failure, the downstream pressure reaches the set point.

When the slam shut incorporated into pressure regulator it is also to be considered as safety accessory according to Directive PED, cuts off the feeding of gas both to pressure regulator and to its pilots when the pressure increases / decreases.

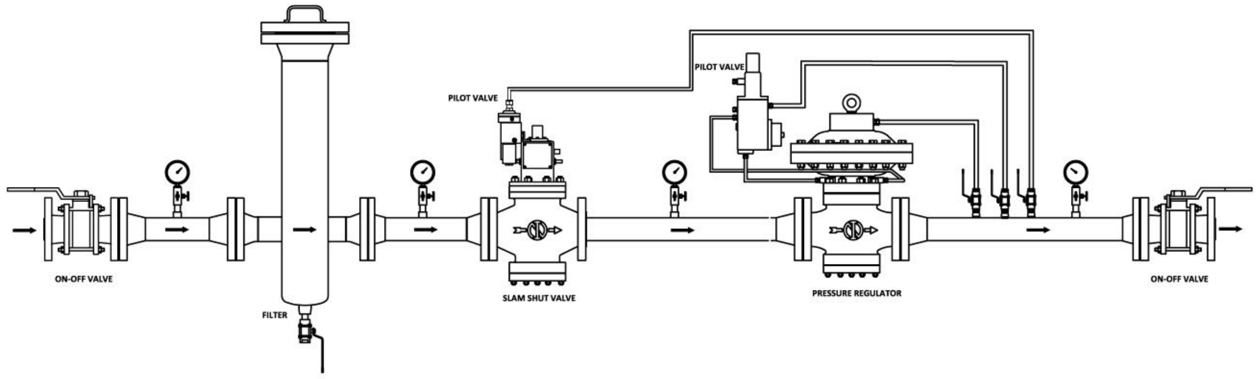


Figure 6: Typical Installation with Slam Shut Device SERIES SH4

3.3 IN-LINE MONITOR

In this configuration the monitor regulator is installed upstream of the main (active) regulator (refer Fig. 7 & 8)

Although their roles are different, the two regulators are virtually identical from the point of view of their mechanical construction. The only difference is that the monitor is set at a higher pressure than the main active regulator.

The in-line monitor is an emergency regulator which comes into operation to replace the active regulator if for any reason the down line pressure rise up to the value set for its intervention.

Normally, Monitor remains wide open and Active regulator regulates the outlet pressure at the set value. If, in case of contingency, controlled pressure tends to rise, Monitor regulator takes over and regulates the controlled pressure at its set value, which is marginally higher than that of Active regulator.

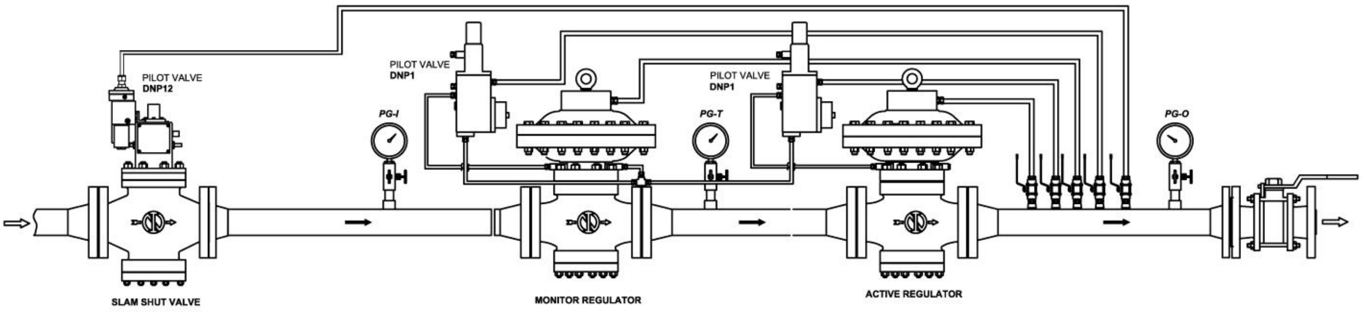


Figure 7: Typical Installation Active Monitor Configuration with DNP1 Pilot

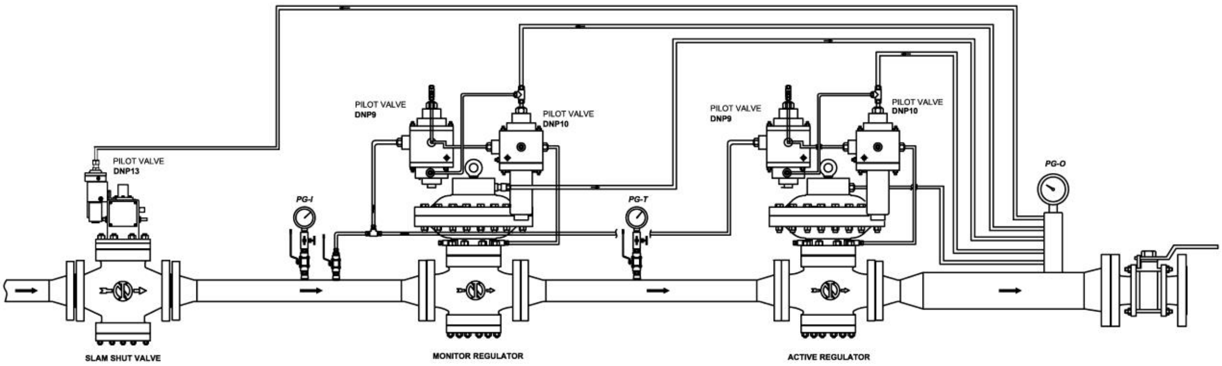


Figure 7A: Typical Installation Active Monitor Configuration with DNP9 & DNP10 Pilot

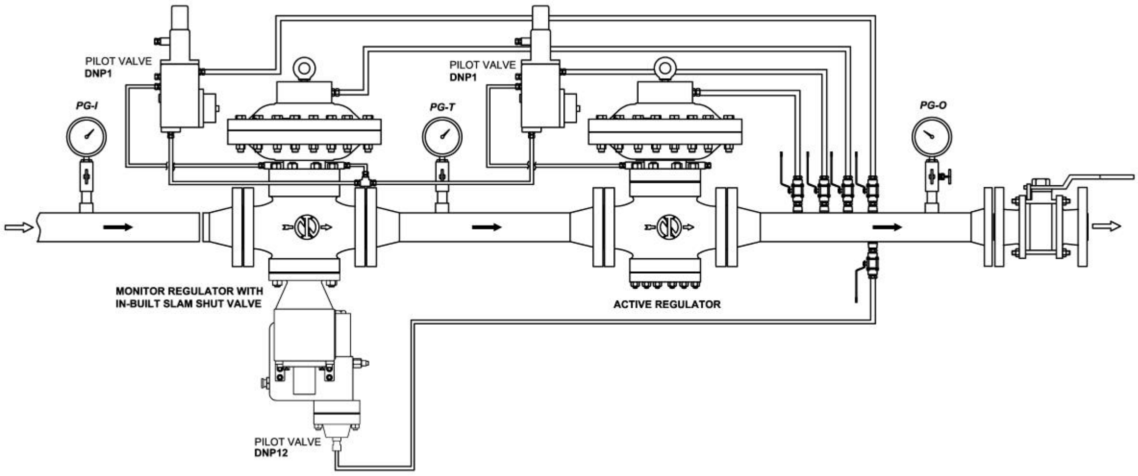


Figure 8 : Typical Installation Active Monitor Configuration with DNP1 Pilot (Monitor with in-built Slam Shut)

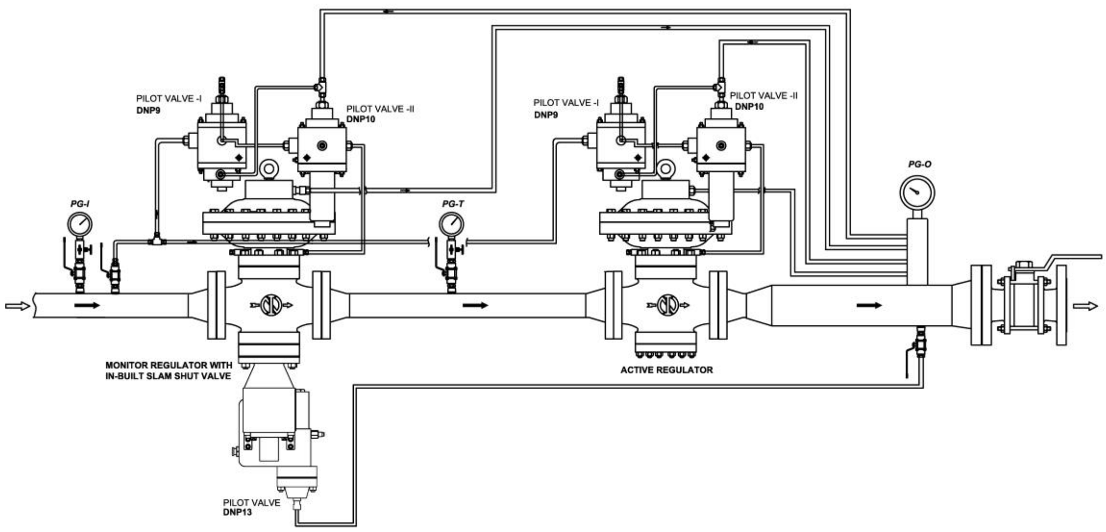


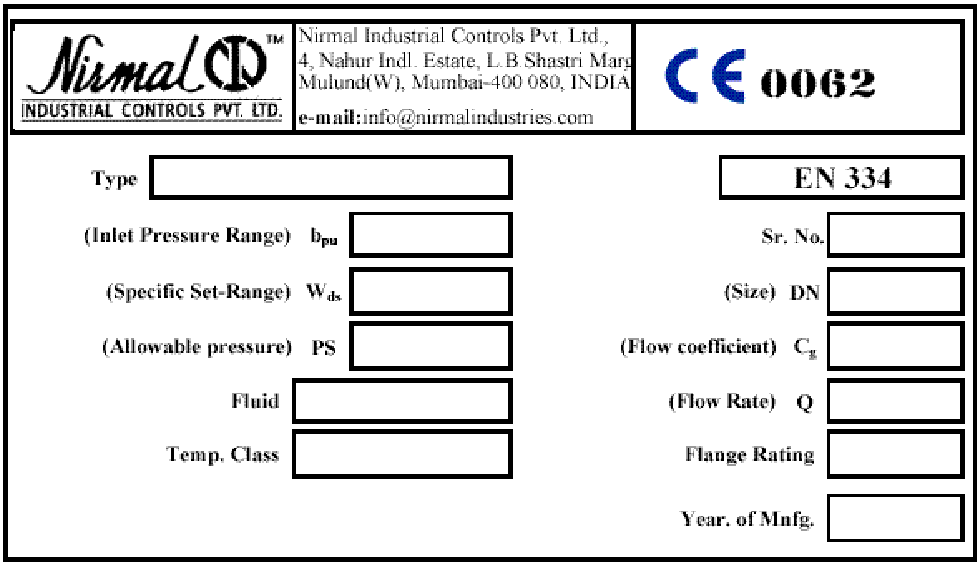
Figure 8A: Typical Installation Active Monitor Configuration with DNP9 & DNP10 Pilot (Monitor with in-built Slam Shut)

4.0 START UP INSTRUCTIONS

4.1 GENERAL

After installation, check that the inlet/outlet on-off valves, any by-pass and the bleed cock are closed. Before starting up, checking is recommended to ascertain that the conditions of use are in conformity with the specifications of the equipment. These specifications are recalled with the symbols on the plate fitted on the Regulator (Refer fig. 9).

REGULATOR NAME PLATE SPECIMEN



SAFETY SHUT OFF DEVICE NAME PLATE SPECIMEN

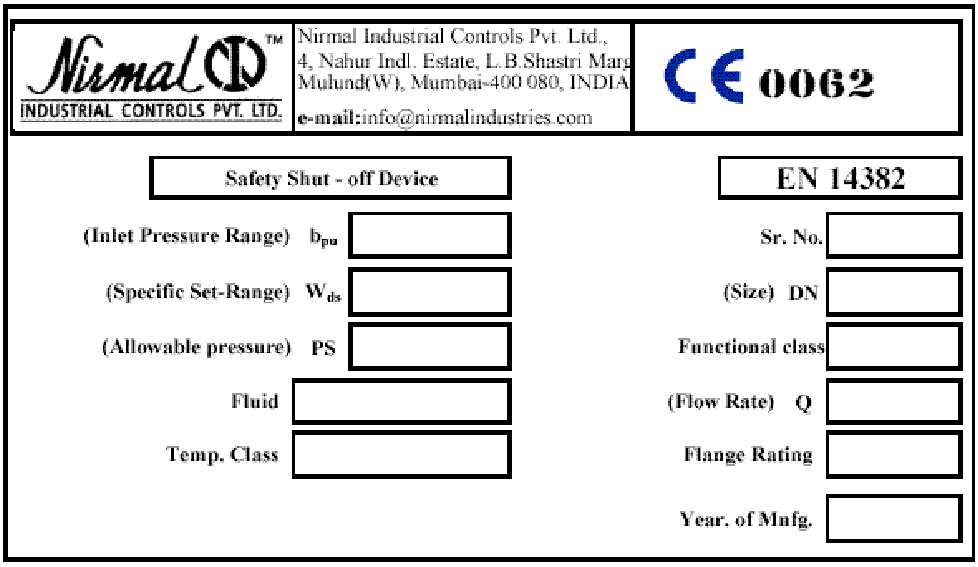


Figure 9

CAUTION !!!

> Do not use the Equipment for the parameters other than those for which it is ordered for.

4.2 CHARGING THE GAS & LEAK TEST

The charging of the gas must be carried out very gradually. Also to protect the regulator from possible damage, following operations must be avoided:

- **Pressuring the line through isolation valve located downstream of regulator.**
- **De-pressuring the line through isolation valve located upstream of regulator.**

External leak tightness is assured if no bubbles form when a foam medium is applied on the pressurized component.

The regulator and other devices (slam-shut, monitor) are normally supplied for the desired set-point. It is possible that the settings may have changed for various reasons (e.g., vibration during transport) while remaining within the values permitted by the springs used.

We therefore recommend checking the settings using the procedures illustrated below. Table 2 gives the recommended set-points for the equipments in the various installation arrangements. The figures in these tables can be useful both when checking existing set-points and for modifying them if necessary later on.

The installations consisting of two streams, we suggest testing one stream at a time, starting from the one with the lower set-point, known as the "stand-by" stream. **The set-points of the equipments in this stream will obviously deviate from those specified in the Table 2.**

4.3 SET POINT SELECTION

Before commissioning the regulator it must be checked that all the on/off valves (inlet, outlet, any by-pass) are closed and that the gas is at a temperature which will not lead to malfunctioning.

Table : 2

Recommended Set points of line equipments consisting of Regulator Active + Monitor + Slam-shut (Over Pressure & Under Pressure) + Relief Valve				
Set-point Regulator (Pas) bar	**Set-point MONITOR**	**Set-point RELIEF-VALVE**	**Set-point SLAM-SHUT (OPSO [a])**	**Set-point SLAM-SHUT (UPSO [b])**
0.5<Pas>2.1	Pas x 1.1	Pas x 1.3	Pas x 1.5	Pas x 0.75 bar [c]
2.1<Pas>5	Pas x 1.1	Pas x 1.3	Pas x 1.4	Pas x 0.75 bar
5<Pas>25	Pas x 1.05	Pas x 1.15	Pas x 1.3	Pas x 0.75 bar
25<Pas>50	Pas x 1.05	Pas x 1.15	Pas x 1.3	Pas x 0.75 bar

[a] OPSO : Over Pressure Shut Off
[b] UPSO : Under Pressure Shut Off

[c] Difference between Regulator set point (Pas) & UPSO shall be 0.3 bar minimum

5.0 COMMISSIONING

5.1 COMMISSIONING THE REGULATOR

If there is a relief valve 8 in the line, refer to point 3.1.

Refer Figure 10.

1) Keeping the bleed valve 7 partially open, gradually open the inlet isolation valve 1, to pressurize the complete pipe line.
2) Check reading on the pressure gauge 6 that pressure does not exceed the setting of the regulator. If necessary, suspend the operation by closing inlet valve 1, opening the cap (30) of pilot 5 and completely reducing the load on the spring by turning the adjustment screw (31) appropriately.
3) Close the bleed cock 7 and check that the downstream pressure, after increasing, settles at a value lower or equal to that of setting of the pilot / regulator assembly. If it does not settle, remedy the causes of the seat leakage.
4) After taking remedial action, by using a foaming agent, check the tightness of all the joints between the on-off valves 1 and 9.
5) Very slowly open the downstream isolation valve 9 until the line gets completely filled. If, at the beginning of this operation, the pressure in the line is much lower than the set-point, the opening of this valve 9 should be done very gradually so as to avoid excess flow through the regulator installation.
6)

Figure 10

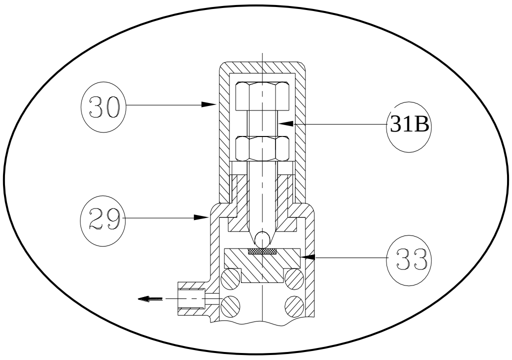
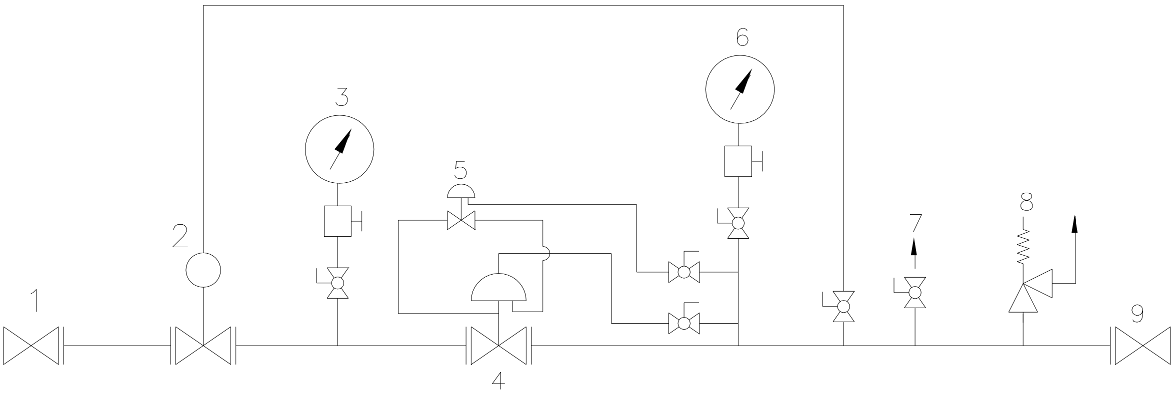


Figure 10A



5.2 COMMISSIONING THE REGULATOR WITH IN-BUILT SLAM-SHUT OFF

If there is a relief valve 8 in the line, refer to point 3.1.

5.2.1 To Check and adjust the intervention of the slam-shut as follows: (Refer Fig.11)

- Keeping both the inlet & outlet isolation valves 1 & 9 closed, open the slam shut device by means of the lever provided with the equipment;
- To operate slam shut device it is recommended to provide a controlled auxiliary pressure to pilot 5 externally;
  - **Over Pressure Shut Off** (Safety devices, which shut off if pressure exceeds the regulator setting) : slowly increase the auxiliary pressure and check the intervention value. If necessary, increase the intervention value by turning the adjustment screw clockwise, or anticlockwise to reduce the intervention value.
  - **Over & Under Pressure Shut Off** (Safety devices, which shut off if pressure exceeds or falls down the regulator setting) : slowly increase the auxiliary pressure and record the intervention value. Restore the pressure to the set-point established for the regulator, and carry out the slam-shut reset operation. Check intervention for pressure reduction by slowly reducing the auxiliary pressure. If necessary increase the intervention values for OPSO or UPSO by respectively turning the OPSO or UPSO adjusting screws clockwise and vice versa to reduce the intervention values.
- Operate the shut off device at least 2-3 times and ensure proper functioning.

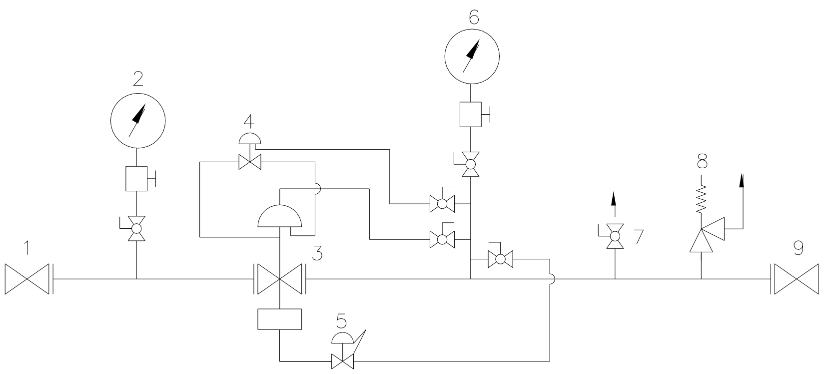


Figure 11

> **CAUTION !!!**
> After checking the slam shut operation, re-connect the sensing line to the take-off point.

N.B.: It is recommended to carry out the intervention tests atleast every 3 months.

5.2.2 Commissioning Procedure for Regulator with safety shut off (Refer Fig.11)

At the end of the slam-shut operation check, proceed as follows:

1) Ensure that the slam-shut is in closed position.
2) Gradually open the inlet isolation valve 1, to pressurize the complete pipe line.
3) Then slowly reset the slam-shut device by operating the provided lever.
   - In case of OPSO safety shut off device, the device will get suddenly engaged in the open position.
   - In case of OPSO & UPSO safety shut off device; keep the lever turned and increase the outlet pressure to the desired regulator set-point. At this point, the lever can be released and slam-shut will stay in the open position;
4) Partially open the bleed cock 7.
5) Check reading on the pressure gauge 6 that pressure does not exceed the setting of the regulator. If necessary, suspend the operation by closing inlet valve 1, opening the cap (30) [Refer Fig. 10] of pilot -

TYPE DNP1 and completely reducing the load on the spring by turning the adjustment screw (31B) appropriately.

6) If necessary, open the cap (30) of pilot –TYPE DNP1 & adjust the setting by turning the adjustment screw (31B).
7) Close the bleed cock 7 and check that the downstream pressure, after increasing, settles at a value lower or equal to that of setting of the pilot / regulator assembly. If it does not settle, remedy the causes of the seat leakage.
8) After taking remedial action, by using a foaming agent, check the tightness of all the joints between the on-off valves 1

9) Very slowly open the downstream isolation valve 9 until the line gets completely filled. If, at the beginning of this operation, the pressure in the line is much lower than the set-point, the opening of this valve 9 should be done very gradually so as to avoid excess flow through the regulator installation.
10) It is recommended to check that when the slam-shut is operated manually, the flow in the line stops completely.

The procedure same as above should be followed even if separate shut off device Series SH4 mounted at regulator upstream.

5.3 COMMISSIONING THE REGULATOR (ACTIVE) HAVING IN-LINE MONITOR WITH SAFETY SHUT OFF

If there is a relief valve 8 in the line, refer to point 3.1.

5.3.1 To Check and adjust the intervention of the slam-shut refer point 5.2.1

N.B.: It is recommended to carry out the intervention tests at least every 3 months.

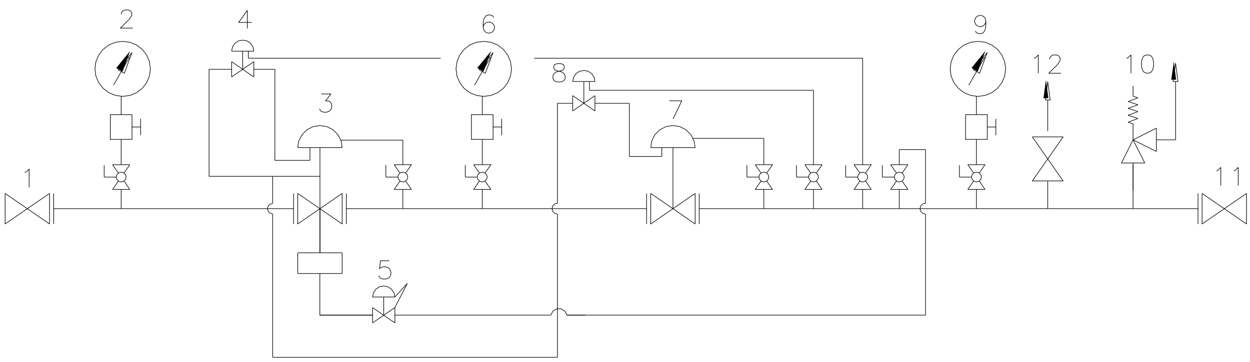


Figure 12.

5.3.2 Commissioning Procedure for Regulator having in-line monitor with safety shut off

Refer Fig. 12.

At the end of the slam-shut check, proceed as follows:

1) Ensure that the slam-shut is in closed position.
2) Gradually open the inlet isolation valve 1, to pressurize the complete pipe line.

3) Then slowly reset the slam-shut device by operating the provided lever.
   - In case of OPSO safety shut off device, the device will get suddenly engaged in the open position.
   - In case of OPSO & UPSO safety shut off device; keep the lever turned and increase the outlet pressure to the desired regulator set-point. At this point, the lever can be released and slam-shut will stay in the open position;

4) Partially open the bleed cock 12.

5) Completely increase the setting of the pilot 8 by turning the adjustment screw clockwise to make the active regulator 7 fully open.
6) Check that the setting of the pilot 4 corresponds to the selected set value of the monitor and adjust it to the desired if necessary.
7) Reduce the setting of the pilot 8 to the selected set value of the active regulator.
8) The monitor will remain fully open during operation.
9) Close the bleed cock 12 and check that the downstream pressure, after increasing, settles at a value lower or equal to that of setting of the pilot / regulator assembly. If it does not settle, remedy the causes of the seat leakage.
10) After taking remedial action, by using a foaming agent, check the tightness of all the joints between the on-off valves 1 and 11.
11) Very slowly open the downstream isolation valve 11 until the line gets completely filled. If, at the beginning of this operation, the pressure in the line is much lower than the set-point, the opening of this valve 11 should be done very gradually so as to avoid excess flow through the regulator installation.
12) It is recommended to check that when the slam-shut is operated manually, the flow in the line stops completely.

The procedure same as above should be followed even if separate shut off device SERIES SH4 mounted at regulator upstream.

6.0 TROUBLE-SHOOTING

Various kinds of problems could come across with the Regulators, same are stated here under with the possible remedies advised.

The foremost reasons developing that can give rise to the various problems depends upon
- the conditions of the gas;
- The natural ageing and wear of the materials.

CAUTION !!!
Only qualified personnel with appropriate knowledge about the subject should carry out installation or servicing of a regulator and handling only after reading the manual

Unsuitable person should not be permitted or allowed to fiddle with the regulator. The maintenance personnel should be trained officially by our authorized representative, whenever necessary.

6.1 REGULATOR

Table. 3 (Refer Fig. 14,14A , 14B & 15)

PROBLEM	PROBABLE CAUSES	REMEDY
Seat leakage i.e. Increase in downstream pressure during no flow (Q = 0)	**PILOT** IInd Stage Disc [26] worned or damaged Ist Stage Diaphragm [34A] rupture	Replace the disc Replace the diaphragm
	MAIN REGULATOR Molded seat [03] damaged Plug guide [07] O-rings [8.13] damaged Ice formation between the seat [03] and the plug [05]	Replace the Molded seat Replace the O-rings Increase the gas temp. to the regulator.
Increase in downstream pressure during flowing condition (Q > 0)	**PILOT** IInd Stage Disc [26] worned or damaged IInd Stage Plug [35] stucked in the open position IInd stage Spring [23B] given up	Replace disc Clean & check free movement Replace with new spring
	MAIN REGULATOR Molded seat [03] damaged Ice formation between the seat [03] and the plug [05] Deposition of Dirt on molded seat [03] Plug [05] jammed Diaphragm [10] fitted incorrectly Downstream sensing line chocked Plug guide [07] O-rings [8.13] damaged Set Pressure disturbed	Replace the Molded seat Increase the gas inlet temp. to the Regulator Clean & Check gas quality & filtration Clean & Check free movement Fit the diaphragm properly Clean the sensing line Replace O-Rings Adjust set point referring start-up settings pt. 1.4

Drop in downstream pressure	PILOT Ist stage setting low Pilot Filter element [41] clogged IInd Stage Diaphragm [34B] ruptured Leakage from Pilot feed line	Increase setting by turning Ist stage adjusting screw [31A] clockwise Replace the filter mesh Replace the diaphragm Tighten the compression fittings or replace
	MAIN REGULATOR Plug [05] jammed Diaphragm [10] ruptured Insufficient supply from upstream	Clean and check free movement Replace the diaphragm Increase inlet pressure or clean line filter cartridges
Functional inconsistency (Vibration, Pressure hunting, No Pressure at outlet)	PILOT Friction in diaphragm [34B] and plug [35] or mis-alignment Worn diaphragm [34B] Spring [23A & 23B] slackened or un-balanced	Align the diaphragm and plug Replace diaphragm Replace or align the spring
	MAIN REGULATOR Plug guide [07] O-ring worn Friction between the Plug [05] and Plug guide [07] Friction in plug rod [18] or O-ring worn Spring [16] slackened or un-balance Active regulator and monitor set-points too close	Replace the O-rings Align the Plug and check the O-rings Replace O-rings Replace or align the spring Increase the difference between two set-points

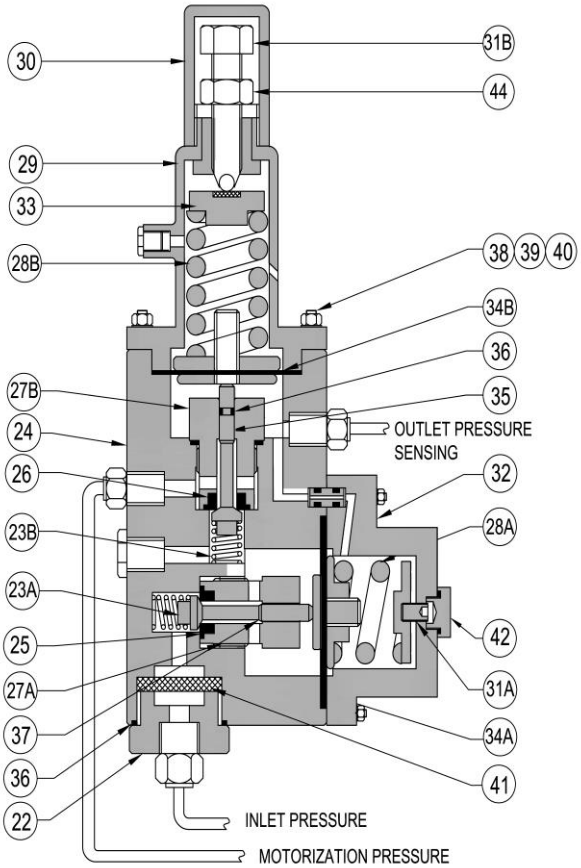


Figure 13A : Pilot Valve – TYPE DNP

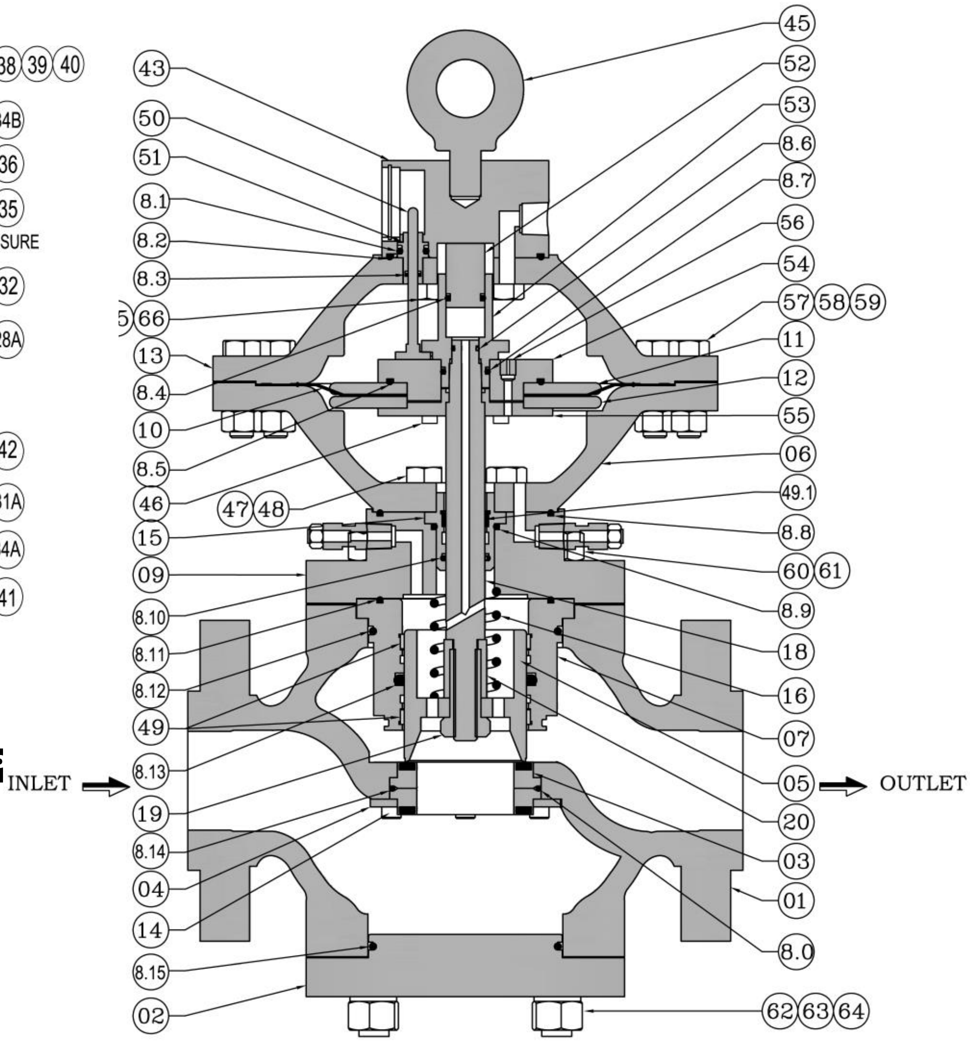


Figure 13A : Main Regulator

SERIES D53 Regulator Main & Pilot Assemblies

SLAM SHUT OFF DEVICE

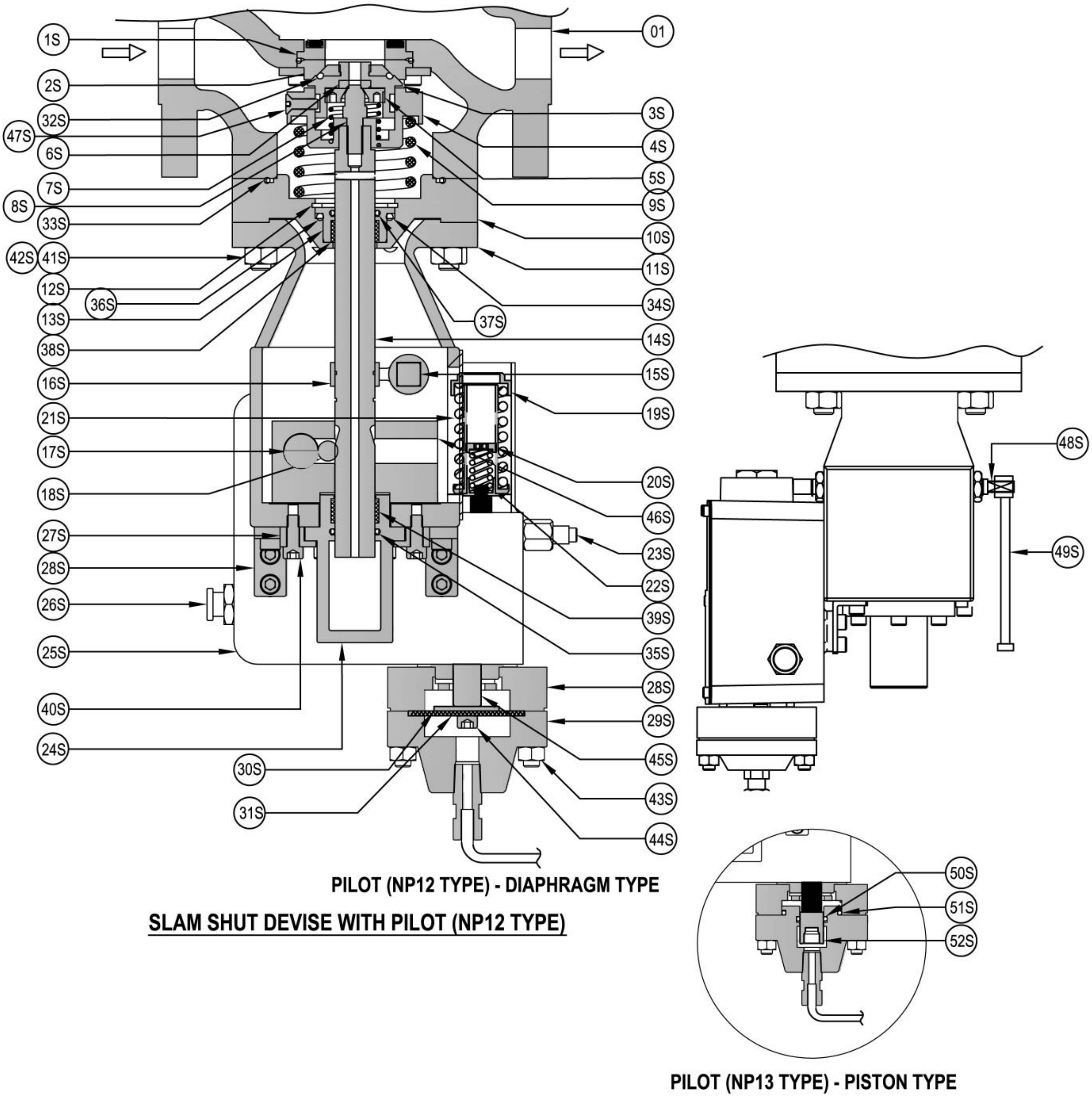


Figure 14*:* SERIES D53 Regulator with Slam shut off Device combined in one unit

6.2 SLAM SHUT OFF DEVICE

Table. 4 **(Refer Fig. 14)**

PROBLEM	POSSIBLE CAUSES	REMEDY
Not intervening in case of controlled pressure rise	Setting of slam shut disturbed Insufficient sensing pressure Blockage of sensing line from Regulator outlet to Pilot-DNP12 Pilot diaphragm rupture [31S]	Set the set screw [19S] or [20S] to suitable pressure (refer Table. 2) Open the root isolation valve completely Clean the sensing line for possible blockage or choking Replace the ruptured diaphragm
Seat Leakage in trip down condition	'O' ring [32S] in the plug worn out	Change the 'O' ring
Resetting not possible	The cause for rise or fall of the controlled pressure not attended Setting of slam shut disturbed Misalignment of latching arrangement	Check & attend the cause for intervention Set the set screw [19S] or [20S] to suitable pressure (refer Table. 2) Re-align the arrangement

CAUTION !!!

If the slam-shut has intervened, close the inlet & outlet isolation valves in the line and discharge the pressure before carrying out any operation. Eliminate the causes which gave rise to Intervention before reactivating it.

7.0 MAINTENANCE

7.1 GENERAL

The periodic inspection & maintenance shall be carried out according to the national or statutory regulations in addition to the instructions given herein.

The maintenance frequency and nature depends mainly on the following attributes;

- the quality of the gas (impurities, humidity, condensate, corrosive substances);
- the efficiency of the filtration unit & liquid separator;
- the cleanliness and conservation of the piping upstream from the regulator;
- the level of reliability required from the regulating system;
- the significance of regulating system functioning to the application.

As a preventive maintenance practice , it is recommended to carry out preventive maintenance at-least once a year, leak test as per 4.2 & set point check as per 5.1 and incase of any problem carry out necessary maintenance as given hereunder.

CAUTION !!!
While starting the equipment for the first time, more frequent maintenance is required due to possibility of residual impurities such as welding scale, sand, paint residues, water inside the piping.

The dismantling of the regulator should be started after ensuring the listed points:

- a regulator is isolated from both upstream & downstream and regulator is totally de-pressurized;
- a set of recommended original spares are available consisting the important ones such as diaphragms & soft seatings;
- a set of wrenches is available.

For easy traceability of the spare kits it is recommended to store the spares with identification tags giving reference of:

- The Sr.No. & Tag No. of the regulator for which the spare parts are intended;
- The part no. or position of parts in the assembly drawing.

In case the maintenance is carried out by your own authorized & qualified personnel, we recommend putting reference markings, before the disassembly, especially on those parts which could have directional or reciprocal positioning problems while reassembling. The O-Rings and sliding mechanical components (stem, plug, etc.) must be lubricated, before the re-assembly, with a fine layer of silicone grease. Before re-commissioning of equipment, internal sealing (seat leakage) shall be verified at appropriate pressure to assure the internal sealing at the maximum expected operating pressure. Both verifications are essential to assure safe use at foreseen operating conditions; they have, anyhow, to comply with the national regulations in force.

SERIES D53 MAIN REGULATOR

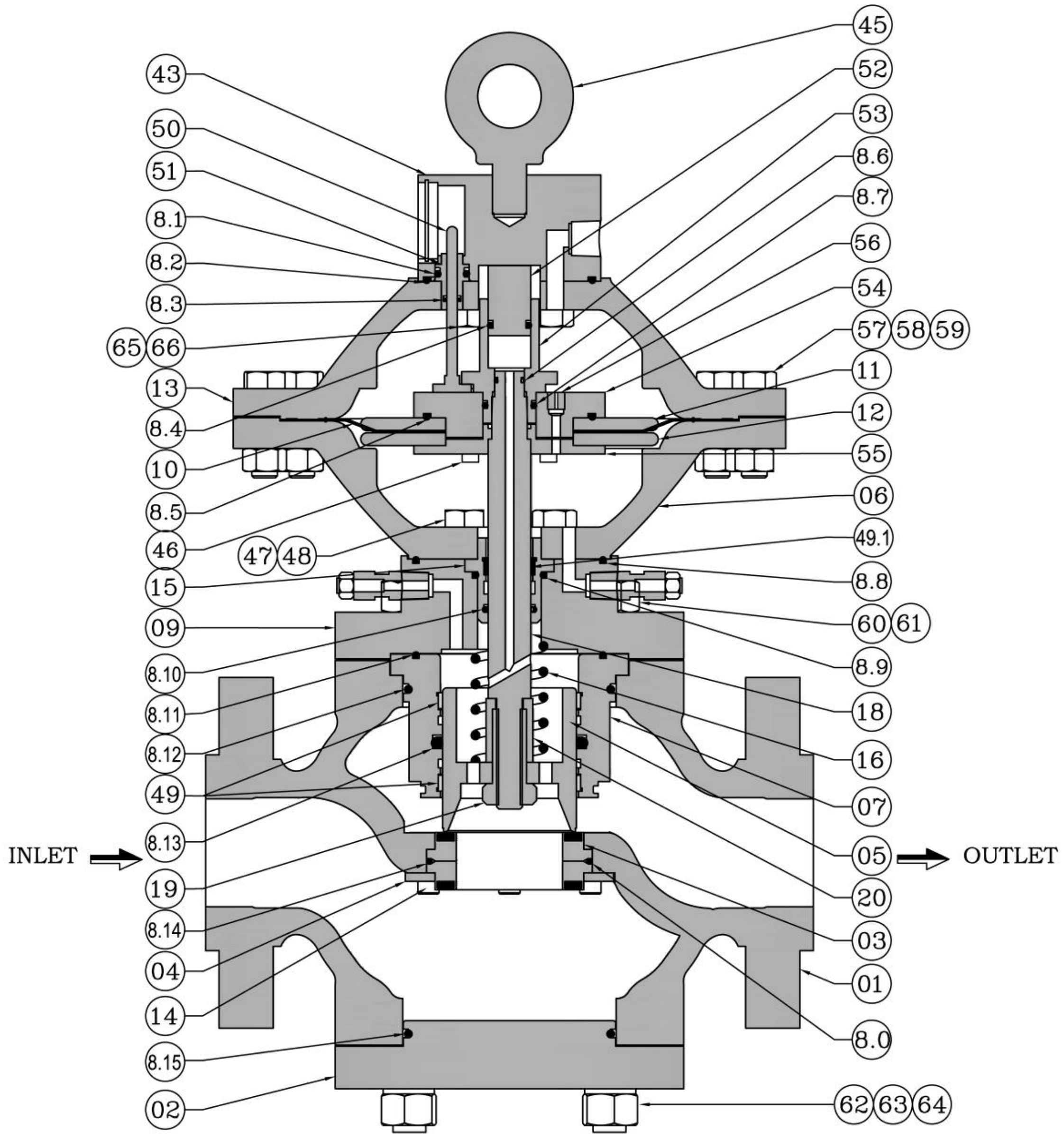


Figure 14A : Valve Size : DN 25 (1") & DN 50 (2")

SERIES D53 MAIN REGULATOR

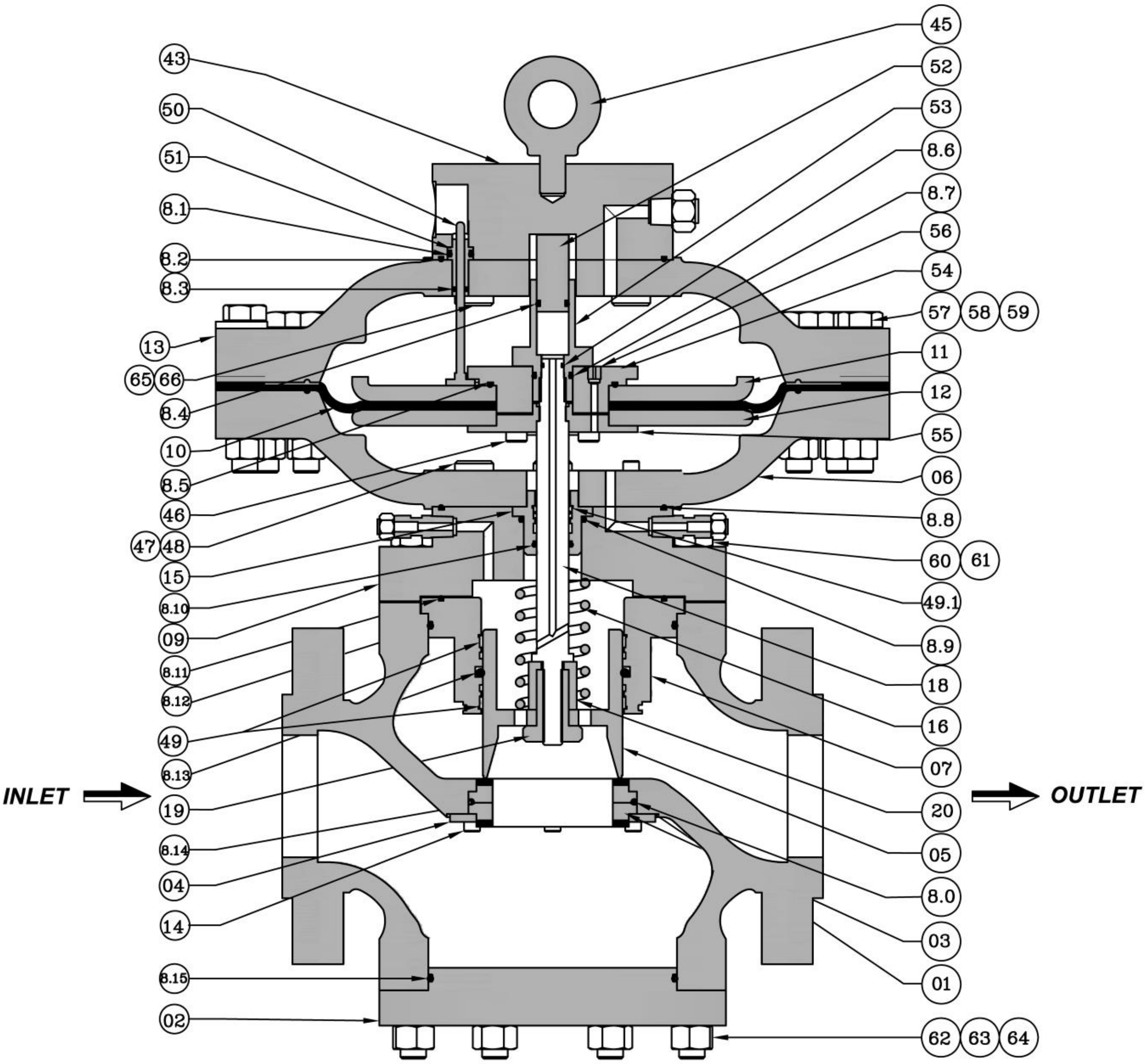


Figure 14B : Valve Size : DN 80 (3") & DN 200 (8")

SERIES D53 PILOT VALVE

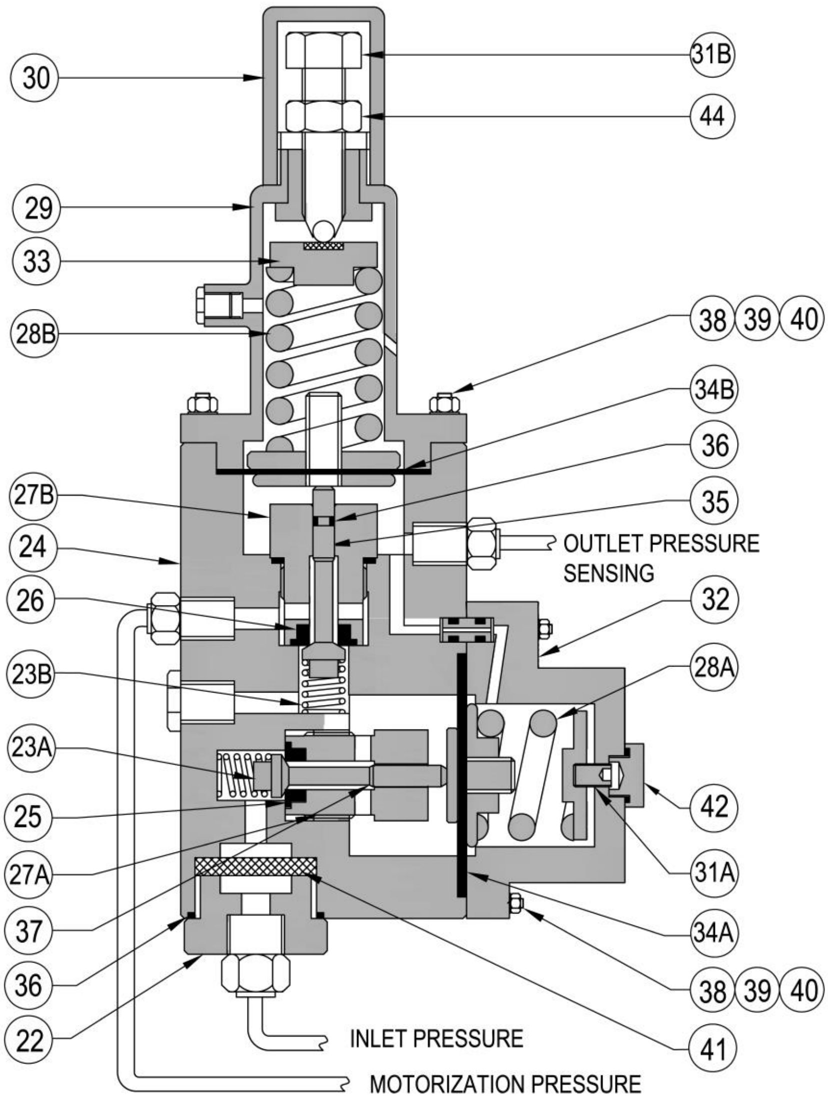


Figure 15 : TYPE : DNP1 - FOR SET PRESSURE 0.5 BARG. – 30.0 BARG

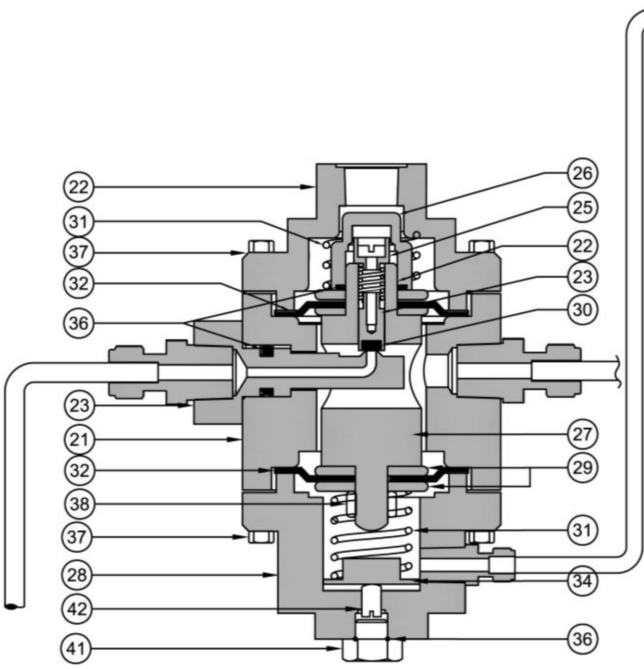
PART LIST (SERIES D53 REGULATOR)

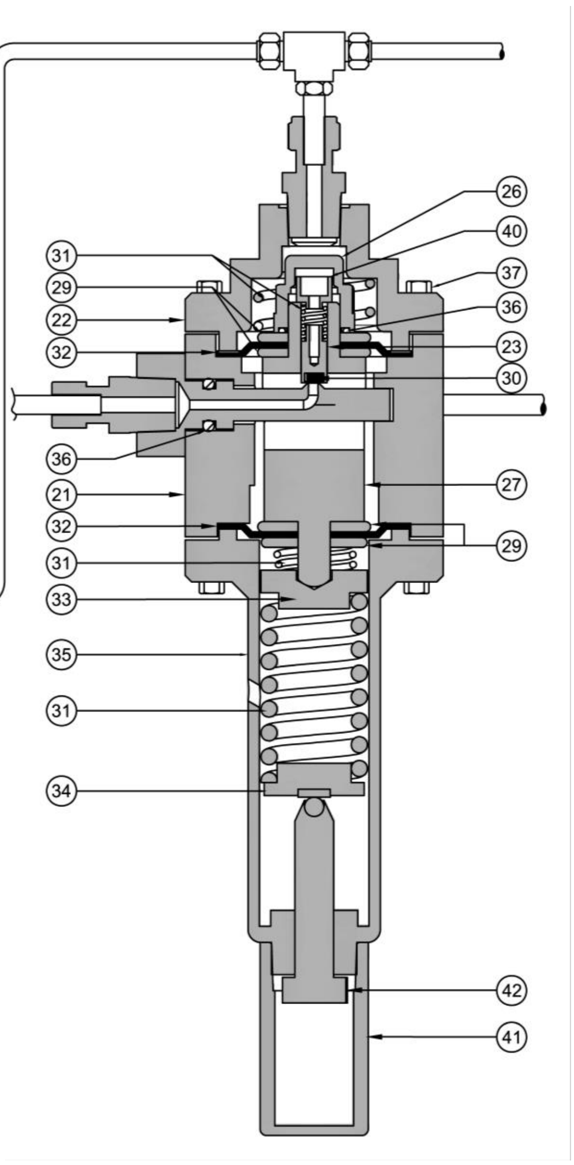
Table 5: Refer Figure 14A, 14B & 15

SR. NO.	DESCRIPTION	QTY.	SR. NO.	DESCRIPTION	QTY.
47	Bolts	--			
46	Allen bolts	--			
45	Eye Bolt	1			
44	Lock Nut	1			
43	Indicator Boss	1			
42	Cap – Ist Stage	1			
* 41	Filter Mesh	1			
40	Tension Washer	--			
39	Nuts	--			
38	Stud / Bolt	--			
37	Plug – Ist Stage	1			
* 36	"O" Ring	4			
35	Plug – IInd Stage	1			
* 34A & 34B	Diaphragm (Ist & IInd Stage)	1 + 1			
33	Top Spring Washer	1			
32	Spring Casing – Ist Stage	1			
31A & 31B	Set Screw (Ist & IInd Stage)	1 + 1			
30	Cap – IInd Stage	1			
29	Spring Casing – II Stage	1			
28A & 28B	Main Spring (Ist & IInd Stage)	1 + 1			
27A & 27B	Seat (Ist & IInd Stage)	1 + 1			
* 26	Disc – II Stage	1			
* 25	Disc – I Stage	1			
24	Pilot Body	1			
23A & 23B	Bottom Spring (Ist & IInd Stage)	1 + 1			
22	Inlet Adaptor	1			
20	Plug Rod Guide Piece	1	66	Tension washer	---
19	Bolt	1	65	Bolts	---
18	Plug Rod	1	64	Tension washer	---
16	Spring	1	63	Nuts	---
15	Guide piece	1	62	Studs	---
14	Allen bolts	-----	61	Nut s	---
13	Top Casing	1	60	Stud	---
12	Diaphragm Washer	1	59	Tension washer	---
11	Diaphragm Plate	1	58	Nut	---
* 10	Diaphragm	1	57	Bolt	---
9	Bonnet	1	56	Nozzle	1
* 8.0 – 8.15	'O' rings	1	55	Diaphragm plate holder - II	1
7	Plug Guide	1	54	Diaphragm plate holder - I	1
6	Bottom Casing	1	53	Piston guide	1
5	Plug	1	52	Piston	1
4	Support plate	1	51	Indicator guide	1
* 3	Molded Seat	1	50	Indicator rod	1
2	Bottom	1	*49	Teflon ring	2
1	Body	1	48	Tension washer	-----
SR. NO.	**DESCRIPTION**	**QTY.**	**SR. NO.**	**DESCRIPTION**	**QTY.**
BILL OF MATERIAL (Regulator & Pilot Valve –I)					

(*) Marked parts are included in "Spare part kit" recommended as stock.

SERIES D53 PILOT VALVE





ITEM	DESCRIPTION	MATERIAL	QTY.
21	PILOT BODY	STAINLESS STEEL	01
22	TOP COVER	STAINLESS STEEL	01
*23	PISTON	STAINLESS STEEL	01
26	LOCKING CAP	STAINLESS STEEL	01
27	UNION PIECE	STAINLESS STEEL	01
28	BOTTOM	STAINLESS STEEL	01
29	DIAPHRAGM PLATE I & II	STAINLESS STEEL	01
*30	SOFT SEAT DISC	NITRILE	01
31	SPRING	SPRING STEEL	01
*32	DIAPHRAGM I & II	NITRILE	01
33	BOTTOM SPRING WASHER	STAINLESS STEEL	01
34	TOP SPRING WASHER	STAINLESS STEEL	01
35	ACTUATOR	STAINLESS STEEL	01
*36	'O' RING	NITRILE	01
37	BOLTS	STAINLESS STEEL	--
37A	BOLTS	STAINLESS STEEL	--
38	LOCK NUT	STAINLESS STEEL	01
39	TENSION WASHER	STAINLESS STEEL	01
41	CAP	STAINLESS STEEL	01
42	SET SCREW	STAINLESS STEEL	01

(*) Marked parts are included in "Spare part kit" recommended as stock.

Figure 15A: TYPE : DNP9 & DNP10 - FOR SET PRESSURE 25.0 BARG. – 50.0 BARG.

Maintenance Procedure is laid down for changing the spare parts, assembly and reassembly of the SERIES D53 Regulator & Pilot. Preventative Maintenance recommended to be carried out during plant shut down.

CAUTION !!!
Before maintenance depressurize the Regulator assembly completely;
Ensure that the upstream and downstream lines are isolated & pressure is zero.

INITIAL OPERATIONS

Following steps should be carried before proceeding with any maintenance procedure.

1) Disconnect all the sensing lines connected to the pilot and main regulator by unscrewing the compression fittings.
2) It is recommended to put reference markings on the tubing and fittings before disassembly, to prevent positioning problems while reassembling.
3) Separate out the pilot from main regulator by loosening the bolts of the bracket.

7.2 REGULATOR MAINTENANCE

(Refer Fig.14A.)

7.2.1. Disassembly of Diaphragm Unit

a. Loosen the fasteners (57,58,59) fixing the diaphragm top casing (13) with bottom casing (6)
b. Separate the top casing (13) from bottom casing (6) and ensure indicator rod doesn't get damaged.
c. Next carefully remove the indicator rod (50) from indicator guide (51).
d. Remove piston (52) from piston guide (53).
e. Next loosen the piston guide (53) from plug rod (18) and unscrew it completely.
f. Remove whole diaphragm assembly from plug rod (18).
g. Remove the Allen screws (46) holding the diaphragm plate holder I & II (54,55) .
h. Separate the diaphragm plate holder I & II, (54,55) with removing diaphragm plate (11) and diaphragm washer (12).
i. Remove the diaphragm (10).
j. Clean all the disassembled metal parts followed by flushing the casing with dry compressed air.
k. Replace the polymer parts via; diaphragm,(10) O- Rings (8.4 , 8.5 , 8.6, 8.7) from the spare parts kit.
l. The O-Ring and sliding mechanism must be lubricated with a fine layer of silicon greases before reassembly, the polymer parts required greases to hold them in their position or slots and also make them softer.

7.2.2. Reassembly of Diaphragm Unit

a. Replace the 'O'-Ring (8.5, 8.6, 8.7) on top of plug rod (18), top piston (52), piston guide (53).
b. Reassemble the diaphragm (10) between diaphragm plate holder I & II, (54,55) with diaphragm plate (11) and diaphragm washer (12).
c. Tighten diaphragm plate holder I & II with Allen bolts (46) and ensure nozzle hole is aligned properly.
d. Insert the diaphragm assembly in plug rod (18) and tighten with piston guide (53).
e. Carefully reassembly the indicator rod (50) with indicator guide (51).
f. Reassembly the top cover (13) with bottom casing (6) and ensure that the diaphragm is correctly positioned with respect to the bottom casing (6).

g. Resemble and fix the hex bolt and nut (57,58,59)

7.2.3. Disassembly of Regulation unit (Plug assembly)

a. Loosen the Nuts (60) fixing bonnet (9) with main regulator body (1).
b. Lift up the diaphragm assembly from body appropriately by means of lifting arrangement on top casing (13).
c. Carefully remove the plug assembly from body (1).
d. Now loosen the Bolt (19) gradually till the spring (16) tension is fully released.
e. Remove the plug (5) from plug guide (7).
f. Next remove the plug guide (7) from the body (1) and remove the 'O' ring (8.13) & Teflon rings (49) form the respective groove.
g. Clean all the disassembled metal parts followed by flushing the body with dry compressed air.
h. Replace the molded seat (3) , if damaged.
i. Replace the polymer parts i.e. O-Rings (8.0, 8.11, 8.12, and 8.13) & Teflon rings (49) from the spare parts kit.

7.2.4. Reassembly of Regulation unit (Plug assembly)

a. Position the plug guide (07), plug (5) ,spring (16) and plug rod guide (20) correctly with plug rod (18).
b. Ensure the free movement of plug (5) within the plug guide (07).
c. Tighten the bolt (19) ensuring the correct initial compression of spring (16).
d. Place the plug guide (7) on body (9) by positioning the O-rings (8.11, 8.12).
e. Reassemble the bonnet (9) with plug assembly to body (01), by tightening the Nuts (60).

To check the **STEM SEALING,** follow; both the disassembly procedure 7.2.1 & 7.2.3 above. Remove the push rod (18) from bonnet (09) and guide piece (20). Change the O-ring (8.6, 8.10) from the push rod (18) . Place the push rod (18) in the guide piece (20) and ensure proper movement of push rod in guide. For reassembly follow the procedure 7.2.2 & 7.2.4 above.

7.2.5. Disassembly of Molded Seat from Body

a. Loosen & remove the nuts (63) from the body (01).
b. Now separate the bottom (02) from the body (01).
c. Next with the means of Allen key , unscrew the Allen screws (14) from the body (01) in criss-cross pattern , this will result in separation of support plate (04) from body (01).
d. Carefully remove the molded seats (03) from the body (01).
e. Clean all the disassembled metal parts followed by flushing with dry compresses air.
f. Replace the polymer parts i.e. 'O' rings (8.0, 8.15) from the spare part list.

7.2.6. Reassembly of Molded Seat

a. Lubricate and replace the 'O' ring (8.0) from the molded seat and (8.15) from the bottom (02).
b. Insert molded seat (03) on the recess provided on the body (01) and position the 'O' ring (8.0). Again insert another molded seat (03) in the way as shown in figure 14A / 14B.
c. Next clamp the molded seats (03) by means of support plate (04) and fix them by tightening the Allen screws (14) in criss-cross pattern.
d. Next align bottom (02) with body (01) and reassemble them by tightening the nuts (63) in criss-cross pattern.

7.3 PILOT MAINTENANCE

(Refer Figure 15 – TYPE DNP1)

7.3.1. Disassembly of I st Stage assembly

a. Loosen the fasteners (39,40) fixing spring casing (32) to pilot body (24).
b. Remove the spring casing (32) carefully ensuring that spring tension is released completely while loosening the fixing bolts. DO NOT DISTURB THE FACTORY SETTING OF SET SCREW (31A) DURING DISASSEMBLY.
c. Remove the diaphragm (34A) assembly along with spring (28A).
d. Loosen the seat (27A) using box type spanner.
e. Remove the seat (27A) carefully releasing the spring (23A) tension.
f. Remove the plug (37), disc (25), and spring (23A).
g. Clean all the disassembled metal parts followed by flushing the pilot body with dry compressed air.

7.3.2. Reassembly of Ist Stage assembly

a. Replace the polymer parts viz; disc (25), diaphragm (34A) from the spare part kit.
b. Place the disc (25), spring (23) & plug (37) in the position and tighten the seat (27A) gently using box spanner.
c. Ensure the movement of plug (37) inside the seat (27A) by pressing it.
d. Positioning the diaphragm (34A) assembly correctly with a pin ascertaining that hole in the diaphragm (34A) matching with hole in pilot body (24) and casing (32).
e. Reassemble the spring (28A) and spring casing (32).
f. Tighten the fasteners fixing the spring casing (32) to pilot body (24).

7.3.3. Disassembly of IInd Stage assembly

a. Unscrew & remove the cap (30) from the spring casing(29)
b. Turn the set screw (31B) anticlockwise and loosen it completely and ensure spring tension (28B) is released.
c. Loosen the fasteners (39) fixing spring casing (29) to pilot body (24).
d. Remove the spring casing (29) along with spring (28B) and spring washer (33).
e. Remove the diaphragm (34B) assembly.
f. Loosen the seat (27B) using pliers fitted in the slots provided on seat.
g. Remove the seat (27B) carefully until the spring (23) tension is released.
h. Remove the plug (35), disc (26), and spring (23A).
i. Clean all the disassembled metal parts followed by flushing the pilot body with dry compressed air.

7.3.4. Reassembly of II nd Stage assembly

a. Replace the polymer parts i.e. disc (26), diaphragm (34B), O-rings (36) from the spare part kit.
b. Place the disc (26), spring (23) & plug (35) in the position and tighten the seat (27B) gently using pliers.
c. Ensure the movement of plug (35) inside the seat (27B) by pressing it.
d. Reassemble the diaphragm (34B) assembly, spring (28B), spring washer (33) and spring casing (29).
e. Tighten the fasteners fixing the spring casing (29) to pilot body (24).
f. Put the set screw (31B) in place and adjusting the set screw for the required pressure and tighten the lock nut (44) also refer start-up settings 1.4.
g. Place the cap (30) at its position

To clean or replace the Filter Mesh (41) in the pilot, unscrew inlet adaptor (22) from the body (24). Remove the filter, clean it with compressed air or replace it and tighten the adaptor (22) by properly positioning the filter inside the body.

7.3.5. Refer Figure 15A: DNP9 Type Pilot valve

1st stage - Replacing Diaphragm & Soft seat

a. Disconnect all feed and sensing line connections from the Pilot & Regulator by unscrewing the fittings.
b. Separate the Pilot assembly from the regulator by slackening the fittings.
c. Unscrew cap (41) and loosen screw (42) until all the spring tension is released.
d. Loosen the fasteners (37) and remove Bottom (28) along with spring (31) and top spring washer (34).
e. Unscrew the lock nut (38) and remove diaphragm (32) along with diaphragm plate (29) from union piece (27).
f. Next , loosen the fasteners (37A) and remove top cover (22) from the pilot body (21) along with spring (31)
g. Unscrew the locking cap (26) , remove diaphragm plate (29) along with diaphragm (32) from the union piece (27)
h. Next by unscrewing, remove piston assembly, comprising of piston (23) & spring (31).
i. Replace piston assembly, diaphragm (32), if necessary.
j. Replace 'O' ring (36)
For re-assembly, reverse the above sequence.

7.3.6. Refer Figure : DNP10 Type Pilot valve

2nd stage – Replacing Diaphragm & Soft seat

k. Disconnect all feed and sensing line connections from the Pilot & Regulator by unscrewing the fittings.
l. Separate the Pilot assembly from the regulator by slackening the fittings.
m. Unscrew cap (41) and loosen screw (42) until all the spring tension is released.
n. Loosen the fasteners (37) and remove Actuator (35) along with spring (31) and top spring washer (34) & Bottom spring washer (33).
o. Unscrew the lock nut (38) and remove diaphragm (32) along with diaphragm plate (29) from union piece (27).
p. Next , loosen the fasteners (37A) and remove top cover (22) from the pilot body (21) along with spring (31)
q. Unscrew the locking cap (26) , remove diaphragm plate (29) along with diaphragm (32) from the union piece (27)
r. Next by unscrewing, remove piston assembly, comprising of piston (23) & spring (31).
s. Replace piston assembly, diaphragm (32), if necessary.
t. Replace 'O' ring (36)
For re-assembly, reverse the above sequence.

SLAM SHUT OFF DEVICE

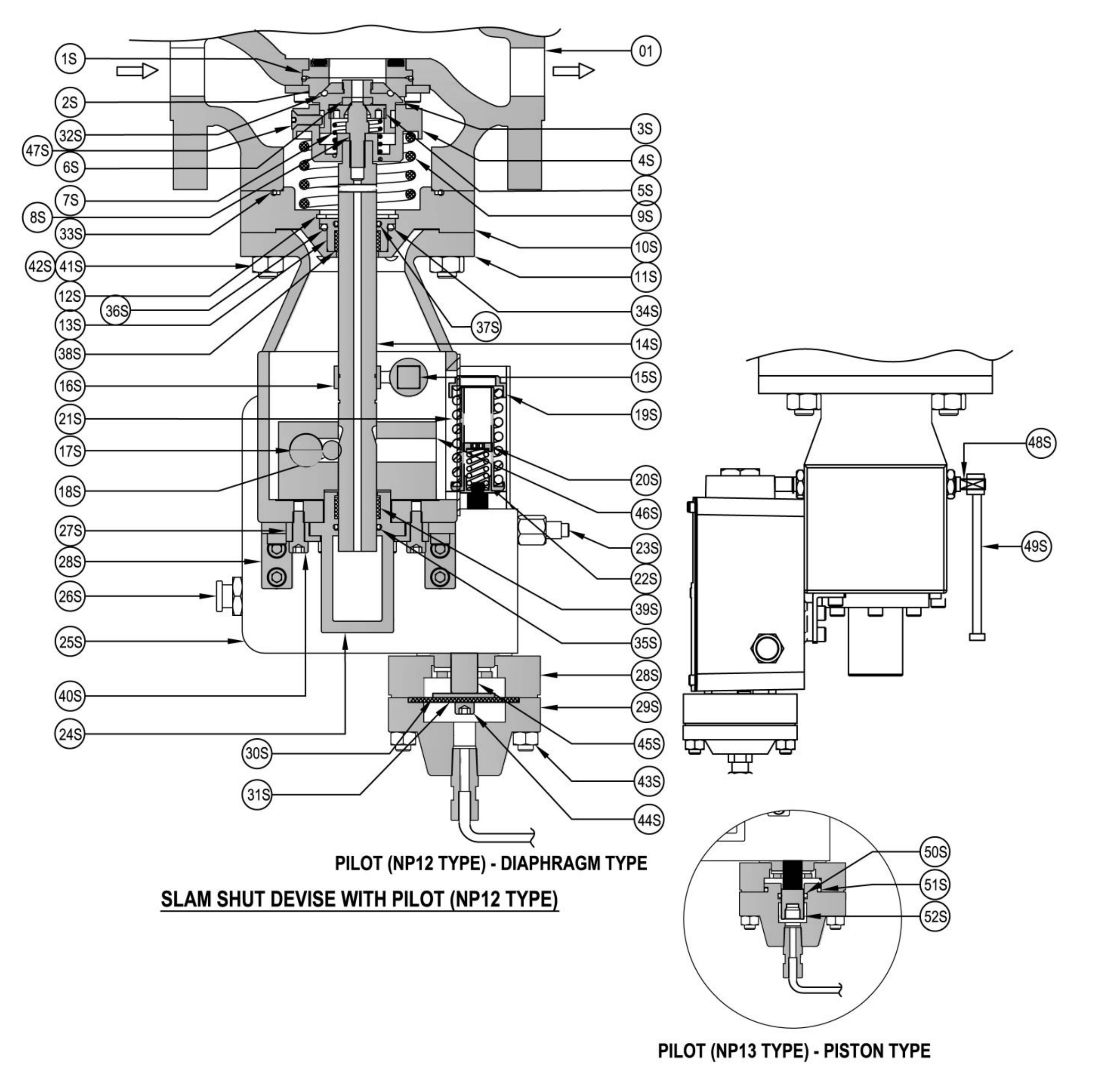


Figure 16

PART LIST (SLAM SHUT OFF DEVICE)

52S	**PISTON**	**1**
51S	O-RING	**1**
50S	O-RING	**1**
49S	RESETTING LEVER	1
48S	CONNECTOR ROD	1
47S	COUNTERSINK SCREWs	1
46S	CONNECTOR BODY	1
45S	SHAFT ROD	1
44S	ALLEN BOLT	1
43S	NUTS	1
42S	NUTS	1
41S	STUDS	1

40S	ALLEN BOLT	1
39S	TEFLON RING	6
38S	TEFLON RING	1
37S	O-RING	1
36S	O-RING	1
35S	O-RING	2
34S	O-RING	8
33S	O-RING	8
32S	O-RING	10
31S	DIAPHRAGM - PILOT	10
30S	DIAPHRAGM PLATE	8
29S	TOP COVER	8
28S	BOTTOM CASING	4
27S	TOP GUIDE PIECE	1
26S	RESER MECHANISM	1
25S	PILOT - CASING BOX	1
24S	GUIDE TUBE	1
23S	PUSH BUTTON	1
22S	UPSO SPRING	1
21S	OPSO SPRING	1
20S	UPSO SET SCREW	1
19S	OPSO SET SCREW	1
18S	BALL	2
17S	SHAFT ROD	2
16S	CONNECTOR BUSH	1
15S	CONNECTOR GUIDE	1
14S	PLUG ROD	1
13S	GUIDE PIECE	1
12S	CIRCLIP	1
11S	TOP CASING	1
10S	TOP COVER	1
9S	MAIN SPRING -SSV SIDE	1
8S	BALANCING PLUG	1
7S	BOTTOM SPRING	1
6S	DISC	1
5S	BALANCING SEAT	1
4S	PLUG HOLDER	1
3S	PLUG	1
2S	PLUG CAP	1
1S	SSV SEAT	1

(*) Marked parts are included in ”Spare part kit” recommended as stock.

7.4 SLAM SHUT OFF DEVICE MAINTENANCE

(Refer Fig.16.)

7.4.1. Disassembly of Main Valve unit (Plug assembly)

a. Loosen the nuts (42S) fixing the top cover (10S) with body (01).
b. Carefully separate the top cover (10S) with SSV assembly from body (01).
c. Unscrew the plug cap (2S) from the plug assembly by turning it in the anti-clockwise direction.
d. Next remove the 'O'ring (32S) from the plug holder (4S).
e. Now unscrew & remove the countersunk screws (47S) from the plug assembly unit.
f. Gradually remove the plug holder (4S) from plug (3S) , this will result in removal of disc (6S) , balancing seat (5S) , spring (7S).
g. Clean all the disassembled metal parts followed by flushing the body & top cover with dry compressed air.
h. Replace the polymer parts i.e.; Disc (6S), O-ring (32S) from the spare parts kit.

The O-Rings and sliding parts must be lubricated with a fine layer of silicone grease before reassembly, the polymer parts require grease to hold them in their positions or slots and also make them softer.

7.4.2. Reassembly of Main Valve unit (Plug assembly)

a. Re-fit the spring (7S) on the plug (3S)and lock-in position by screwing the balancing seat (5S).
b. Place the disc (6S) on the plug holder groove and insert it in the plug (3S) and fix in position by tightening the countersunk screws (47S).
c. Next place the 'O' ring (32S) on the plug (3S) and tighten it by screwing the plug cap (2S)
d. Replace the 'O ring (32S) between the top cover (10S) and body (01),if required from the spare kit.
e. Reassemble the top cover (10S) with SSV assembly to body (01) by tightening the nuts uniformly (42S) in a criss-cross pattern.

7.4.3. Disassembly of Pilot NP12 (Diaphragm Type - Diaphragm replacement)

a. Turn the set screw (19S) & (20S) anticlockwise and loosen it completely to ensure the release of spring (21S, 22S) tension.
b. Loosen the nuts (43S) uniformly and remove the Top cover (29S) attached to Bottom casing (28S).
c. Loosen the Allen bolt (44S) and remove it from the push rod (45S)
d. Now remove the existing diaphragm (31S) from the Top cover (29S).
e. Next remove the diaphragm plate (30S).
i. Clean all the disassembled metal parts followed by flushing the diaphragm casing with dry compressed air.
f. Replace the polymer parts i.e. Diaphragm (31S) from the spare parts kit.

For reassembly reverse the above sequence from steps 'e' to 'a'.

7.4.4. Disassembly of Pilot NP13 (Piston Type - O-ring replacement) – Refer figure

g. Turn the set screw (19S) & (20S) anticlockwise and loosen it completely to ensure the release of spring (21S, 22S) tension.
h. Loosen the nuts (43S) uniformly and remove the Top cover (29S) attached to Bottom casing (28S).
i. Next remove the Piston (52S) from the Top cover (29S).
j. Now remove the existing O-rings (51S & 52S) from the Top cover (29S).
k. Clean all the disassembled metal parts followed by flushing the casing with dry compressed air.
l. Replace the polymer parts i.e. O-rings (51S,52S) from the spare parts kit.

(Refer Fig.16.)

7.4.1. Disassembly of Main Valve unit (Plug assembly)

j. Loosen the nuts (83) fixing the top cover (76) with body (01).
k. Carefully separate the top cover (76) from body (01).
l. Unscrew the plug cap (73) from the plug assembly by turning it in the anti-clockwise direction.
m. Next remove the 'O'ring (8.17) from the plug holder (70)
n. Now unscrew & remove the countersunk screws from the plug assembly.
o. Gradually remove the plug holder (70) from plug (71) , this will result in removal of disc (8.19) , balancing seat (69) , spring (74)
p. Clean all the disassembled metal parts followed by flushing the body & top cover with dry compressed air.
q. Replace the polymer parts i.e.; Disc (8.19), O-ring (8.16,8.17) from the spare parts kit.

The O-Rings and sliding parts must be lubricated with a fine layer of silicone grease before reassembly, the polymer parts require grease to hold them in their positions or slots and also make them softer.

7.4.2. Reassembly of Main Valve unit (Plug assembly)

f. Re-fit the spring (74) on the plug (71)and lock in position by screwing the balancing seat (69).
g. Place the disc (8.19) on the plug holder groove and insert it in the plug (71) and fix in position by tightening the countersunk screws.
h. Next place the 'O' ring (8.17) on the plug holder (70) and tighten it by screwing the plug cap (73)
i. Replace the 'O ring (8.16) between the top cover (76) and body (01).
j. Reassemble the top cover (76) to body (01) by tightening the fasteners (83,84)

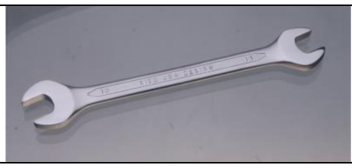
Following are the minimum Tools required to carry out maintenance and operation of unit.

7.5. LIST OF RECOMMENDED TOOLS

7.5.1 FOR MAIN VALVE.

SR. NO.	MODEL	TOOL	PICTURE	SPANNER SIZE
1		Allen Key		M4
2		Allen Key		M3
3		Open Spanner		16 – 17
4	MAIN VALVE	Box Spanner		M19
5		Open Spanner		18 - 19
6		Open Spanner		24 – 27
7		Open Spanner		20 - 22

7.5.2 FOR PILOT VALVE.

FOR USE PILOT VALVE					
SR. NO.	**VALVE SIZE**	**FASTNERS**	**SIZE**	**PICTURE**	**SPANNER SIZE**
1	D53 -PILOT	SEAT	HEX32		BOX SPANNER-32
2		CAP	M10		16-17
3		SET SCREW	M12		18-19
4		GRUB SCREW	M6		ALLEN KEY-3
5		LOCK NUT	M8		12-13
6		LOCK NUT	M12		18-19
7		BOLT	M10		16-17

FINAL OPERATIONS

Following steps should be carried after carrying out the maintenance.

1) Mount the pilot on main regulator by fixing the bolts of the bracket.
2) Reconnect all the sensing lines connected to the pilot and main regulator by screwing in the compression fittings.
3) Lastly follow the procedure detailed in 4.2 for charging the gas and leak test.

CAUTION !!!
The vent connection provided in the pilot valve spring casing should be free from blockages.

After adjusting the set pressure lock the set screw by lock nut and put the cap over set screw.

8.0 LIST OF RECOMMENDED SPARES

8.1 REGULATOR UNIT

Table 7. (Refer Fig. 14 & 15.)

MAIN REGULATOR			PILOT TYPE : DNP1		
PART NO.	DESCRIPTION	QTY.	PART NO.	DESCRIPTION	QTY.
3	Molded seat	1	25	Disc (Ist Stage)	1
8	'O' ring	14	26	Disc (IInd Stage)	1
10	Diaphragm	1	34A & 34B	Diaphragms	2
49	Teflon Rings	14	36	O-Rings	4
			41	Filter Mesh	1

Table 8 (Refer Fig. 15)

MAIN REGULATOR			PILOT TYPE : DNP9 & DNP10		
PART NO.	DESCRIPTION	QTY.	PART NO.	DESCRIPTION	QTY.
3	Molded seat	1	23	Piston	1
8	'O' ring	14	30	Soft seat disc	1
10	Diaphragm	1	32	Diaphragms (Ist & IInd Stage)	2
49	Teflon Rings	14	36	O-Rings	4

8.2 SLAM SHUT OFF DEVICE

Table 9 ***(Refer Fig.16.)***

MAIN UNIT			PILOT		
PART NO.	DESCRIPTION	QTY.	PART NO.	DESCRIPTION	QTY.
6S	Soft seating Disc	1	31S	Pilot DNP12 - Diaphragm	1
32S,34S,35s,36S,37S	Set of "O" Rings	5			
51S , 52S	Pilot DNP13 - Set of "O" Rings	1			

WHILE INQUIRING FOR SPARE PARTS, PROVIDE FOLLOWING DETAILS:
Type of regulator
Unit no. (Serial no.) **& Year of manufacture**
Slam-shut (if assembled)
Part no.
Quantity desired
Technical Manual (this document) reference i.e. MD53(FC)/05/2017/R2

***Note* : Disposal of Products / Parts**

"The products or parts thereof are to be disposed–off in accordance with existing Government / Federal / State & local environment control regulations at authorized recycler regulations prevailing at location of use / disposal."

ANNOTATIONS

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For any assistance please contact us; our contact details are given under.

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Nirmal
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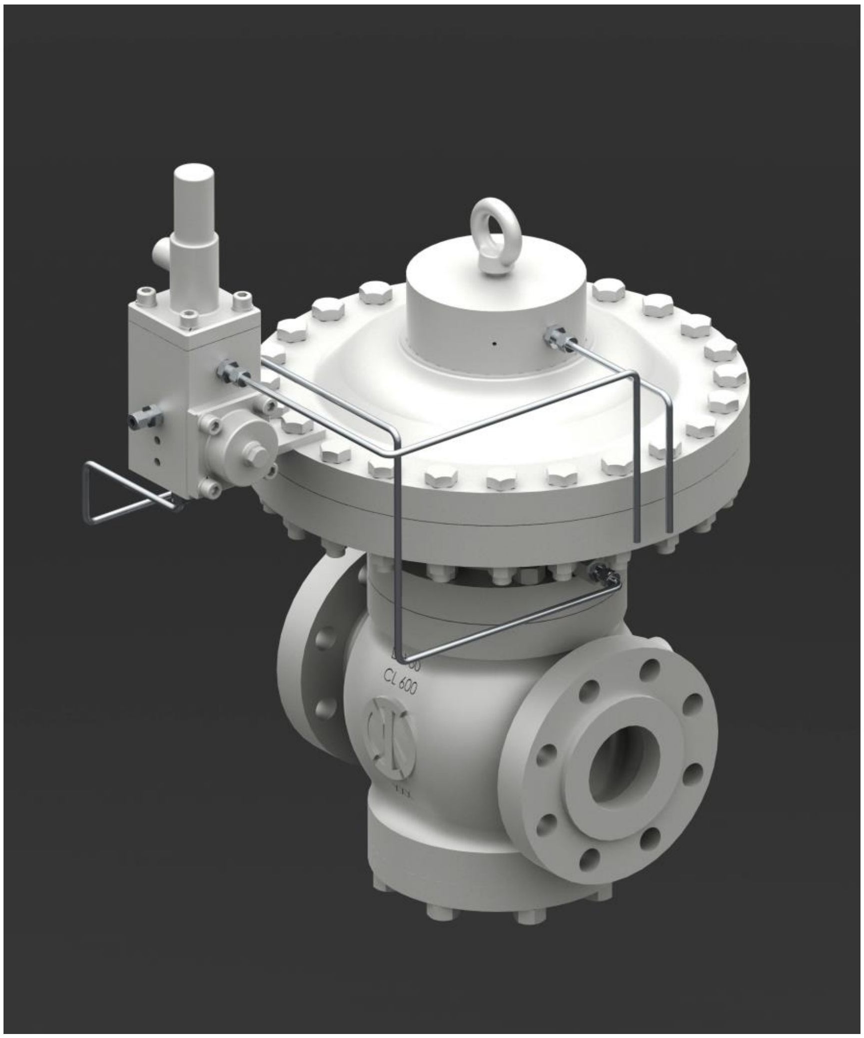
Expertise that delivers

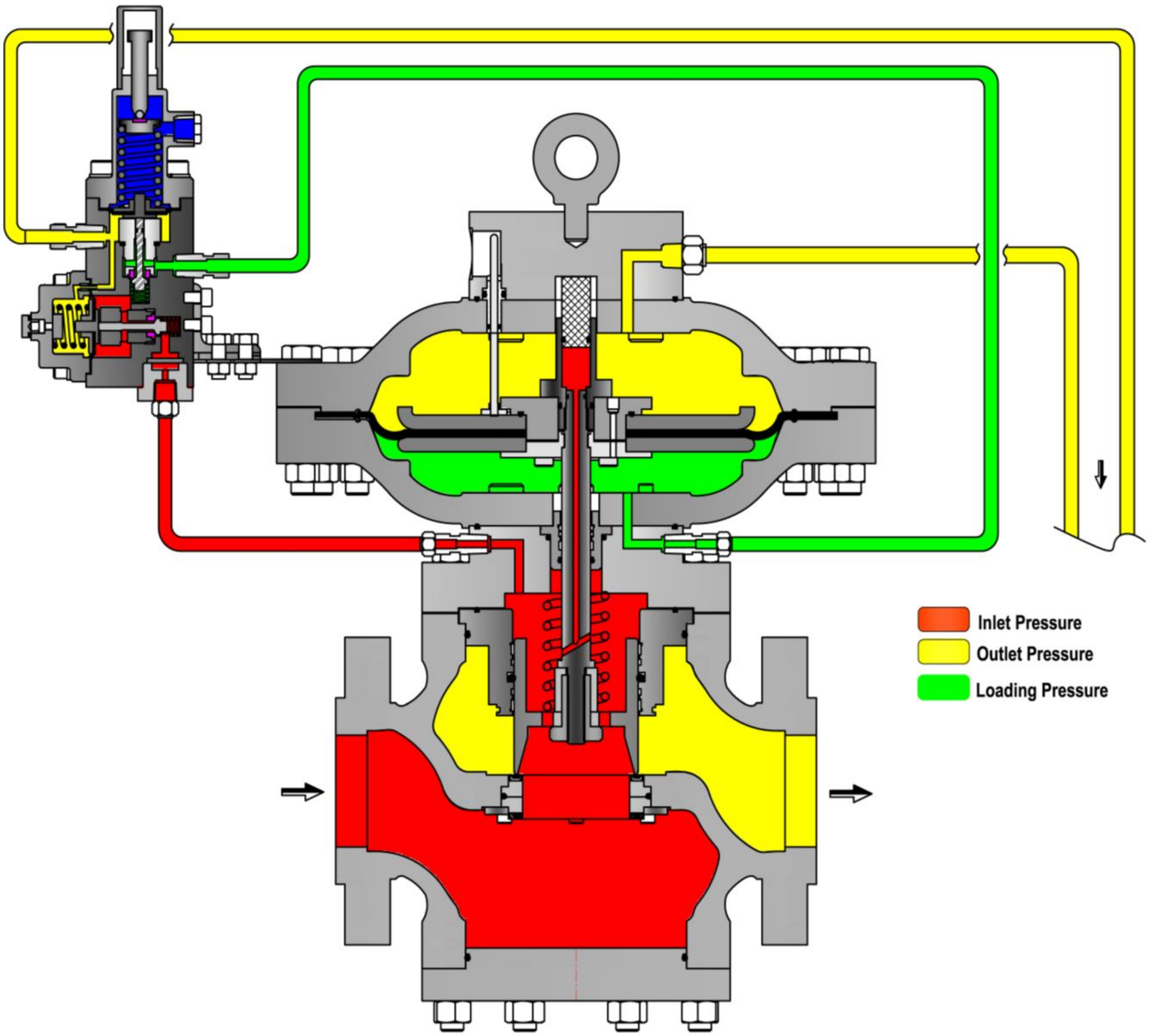
GAS PRESSURE REGULATOR



SERIES D53 (FAIL-CLOSE TYPE)

TECHNICAL MANUAL

User's Guide



SERIES D53

GAS PRESSURE REGULATOR

MODEL OF DECLARATION OF CONFORMITY
(Module H of the pressure equipment directive)

NIRMAL INDUSTRIAL CONTROLS PVT.LTD. with registered office at 4, Nahur Industrial Estate, L.B.S.Marg, Mulund (W), Mumbai – 400 080. INDIA

certifies under its sole responsibility that the item of equipment specified below has been designed, manufactured, inspected and tested as required by the relevant provisions of the Pressure Equipment Directive 2014/68/EU, transposed in the French law by the modified decree n° 99-1046 of 13 December 1999.

The item or equipment identified below has been subject to EC Unit verification (Module H of the pressure equipment directive) by Bureau Veritas - SA (notified body number 0062) which has issued the certificate of conformity

EQUIPMENT: GAS PRESSURE REGULATOR

Serial number(s) : XXXXXX

Technical standards and specifications used : EN 334

NIRMAL INDUSTRIAL CONTROLS PVT. LTD.

Place: MUMBAI

PRECAUTIONS

A. GENERAL PRECAUTIONS

- The apparatus described in this manual is a device subject to pressure installed in systems under pressure.
- The apparatus in question is normally installed in systems for transporting flammable gases (natural gas, for example).
- The apparatus be installed, operated and maintained in accordance with international and applicable codes and regulations, and Technical Manual instructions hereunder.

CAUTION !!!

NICPL will not be responsible for any untoward eventualities during the use of the apparatus if the apparatus is used or handled without

a) going through this manual and/or

b) Not following the specified instructions

CAUTION !!!

Person injury, equipment damage, or leakage due to escaping fluid or bursting of pressure containing parts may result if this regulator is over pressurized or is installed where service conditions could exceed the limits given in the specifications section, or where conditions exceed any ratings of the adjacent piping or piping components.

B. PRECAUTIONS FOR THE OPERATORS

Before proceeding with installation, commissioning or maintenance, operators must:

- Examine the **Safety Provisions** applicable to the installation in which they must work;
- Obtain the **authorizations** necessary for working when so required;
- Use the necessary means of **individual protection** (helmet, goggles, etc.);
- Ensure that the area in which they operate is fitted with the means of **collective protection** envisaged and with the necessary **Safety indications.**

CAUTION!!!

Only qualified personnel shall install or service a regulator.
To avoid injury and damage, install the regulator in a safe location.

C. HANDLING

The handling of the apparatus and of its components must only be carried out after ensuring that the lifting device is adequate for the **loads to lift** (lifting capacity and functionality). The apparatus must be handled using the **lifting points** provided on the apparatus itself.
Motorized means must only be used by the persons in charge of them.

CAUTION!!!

Appropriate care should be taken while handling to avoid damage to mounted accessories, pilots, tubing etc.

D. PACKING

The packing for transportation of equipment and of relevant spare parts are designed and shaped to avoid damage to any part during transportation, warehousing and handling activities. Therefore the equipment and spare parts shall be kept into their packing until their installation in the final site. After packing is open, check that no damage occurred to any goods. If damage occurred inform the supplier and keep packing for any verification.

E. INSTALLATION

If the installation of the apparatus requires the application of **compression fittings** in the field, these must be installed following the **instructions of the manufacturer** of the fittings themselves. The choice of the fitting must be compatible with use specified for the apparatus and with specifications of the system when envisaged.

CAUTION !!!

Flush out all the pipelines before installation of regulator and check to be sure that the regulator has not been damaged or collected foreign material, during shipping.

F. COMMISSIONING

While commissioning, the risks associated with any discharges into the atmosphere of flammable or noxious gases must be assessed. In case of installations in natural gas distribution networks, the risk of the formation of explosive mixtures (gas/air) inside the piping must be considered.

CONFORMITY TO DIRECTIVE 2014/68/EU (PED)

Gas Pressure regulators SERIES D53 according to the EN 334 are categorized as **pressure accessory** according to directive 2014/68/EU (PED).

The regulator SERIES D53/S… when incorporating safety-shut (according to EN 14382) is categorized as **safety accessory** according to PED.

CAUTION!!!

The regulator with incorporated safety shut off should be used for all equipments / piping system which are classified in Category III and below in accordance with 2014/68/EU (PED)

CONTENTS

1. 0 INTRODUCTION

This manual proposes to provide the essential information for the installation, start-up, disassembly, reassembly and maintenance of the Regulators Series D53.
This is also appropriate, however, to provide a brief illustration of the main features of the regulator and of its components.

These are available in the followings versions

- D53/E… : Pressure Regulator
- D53/F…: Monitor Regulator to be installed at upstream of Active Regulator
- D53/S… : Pressure Regulator and Slam Shut Device combined in one unit
- D53/H… : Monitor Regulator and Slam Shut Device combined in one unit

1. 1 MAIN FEATURES

The Series D53 pressure regulator is a pilot operated regulator for medium and high pressure.

1. 2 SPECIFICATIONS

- Design pressure: up to 100 bar;
- Design temperature: -20 °C to +60 °C;
- Range of the inlet pressure bpu: 0.5 to 100 bar;
- Possible regulation range Wd: 0.5 to 50.0 bar (depending on the pilot installed)
- Minimum differential pressure: 0.5 bar;
- Accuracy class AC : up to 1.0 (according to EN 334)
- Lock-up pressure zone class SZ: up to 2.5.

Available Sizes & End connections :

Size	:	DN 25, 50, 80, 100, 150
End Connection	:	Flanged end - PN 16, PN25, ANSI 150, ANSI 300, and ANSI 600

Maximum Operating Inlet Pressure at average ambient temperature is, for

PN 16	:	16 bar
PN 25	:	25 bar
ANSI 150	:	19 bar
ANSI 300	:	48 bar
ANSI 600	:	99 bar

CAUTION!!!

The pressure / temperature limits in this manual and other relevant applicable standard or code Limitation should not be exceeded.

1.3 OPERATION

The regulator is operated by two stage pilot. The pilot reduces the inlet pressure Pe in two stages and provides constant motorization pressure Pm to operate the main regulator, **Refer Fig. 1.**

In the absence of pressure, the plug (05) remains in the closed position by the spring (16), and rests on the molded seat (04). The upstream pressure, even if variable, does not change this position as the plug is balanced and is therefore subject to equal pressures, even if the sections are different. The plug rod (18) is also between two equal pressures, as the pressure upstream is also passed through the hole in plug rod (18) to the top piston chamber (H).

The plug movement is controlled by the diaphragm (10) by the following forces acting on it:

- Downwards: The force of the spring (16), the thrust deriving from the regulated pressure Pa in the top diaphragm chamber (E) and the weight of the diaphragm assembly & plug assembly.
- Upwards: The thrust deriving from the motorization pressure Pm in the bottom diaphragm chamber (F), supplied by the pilot.

The motorization pressure is obtained by drawing gas from the regulator at the upstream pressure. The gas is filtered through the Filter (41) and is subjected to initial reduction in the first Stage pilot, **Refer Fig. 2** composed essentially of a plug (37), a spring (28A) and a diaphragm (34A) to a value, which depends on the pressure set-point of the regulator. The pressure then passes to second stage pilot that controls pressure by means of a plug (35), a main spring (28B) and a diaphragm (34B) to the motorization pressure, Pm, which is supplied to bottom diaphragm chamber (F) of the main regulator. The regulation of Pm is obtained by the comparison of the force exerted by setting spring 28B of the pilot and the action of the regulated pressure, Pa, acting in the chamber below the diaphragm 34B.

The set point can be changed by turning the adjustment set screw (31B); clockwise rotation increases Pm and therefore the regulated pressure, Pa; the opposite occurs when the set screw is turned anticlockwise.

If, for example, the downstream pressure, Pa, drops during operation (because of an increase in the consumption or flow rate or a drop in the upstream pressure) an imbalance occurs at the diaphragm (34B) of the pilot, which is displaced to increase the opening by pressing the plug (35) downward. As a result, the motorization pressure value, Pm, increases and, by acting in the bottom chamber (F) of diaphragm (10) (fig.1) causes the plug (05) to move upwards and therefore an increase in the opening of the regulator until the set point of the regulated pressure, Pa, is restored.

Vice versa, when the regulated pressure begins to increase, the force it exerts on the diaphragm (34B) of the pilot that moves the diaphragm (34B) upward displacing the plug (35), towards the closed position. The pressure, Pm, then drops because of the pressure transfer from bottom chamber (F) to top chamber (E) through the orifice (N), and the force exerted by the spring (16) causes the downward displacement of the plug (05), to restore the regulated pressure to the set point. In normal working conditions, the plug (35) of the pilot positions itself so that the motorization pressure value, Pm, is such as to maintain the downstream pressure value, Pa, around the set point.

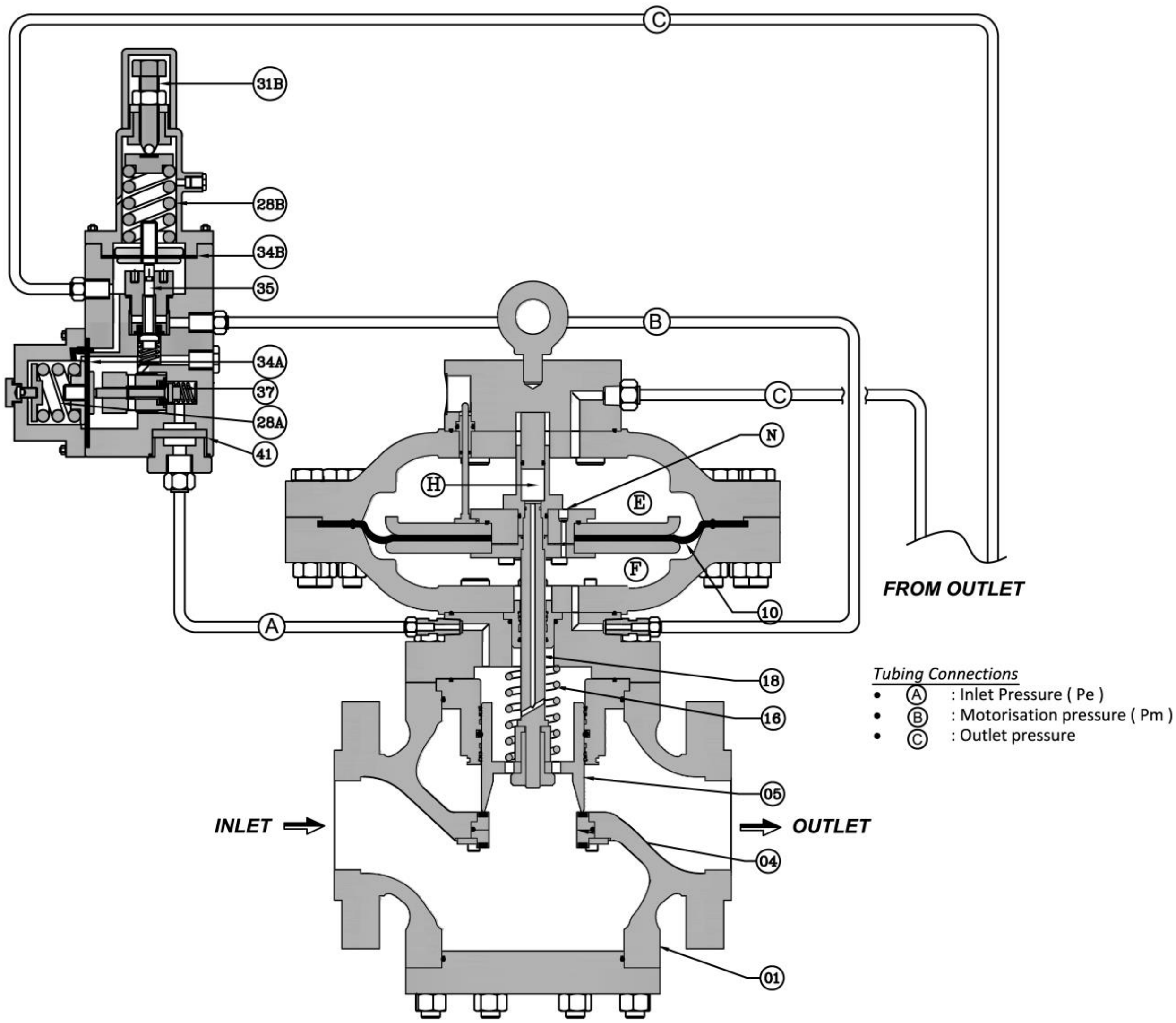


Figure 1 : TYPICAL D53 SERIES PRESSURE REGULATOR WITH PILOT VALVE

Note: Tubing Connections C & D are to be made by Customer/User

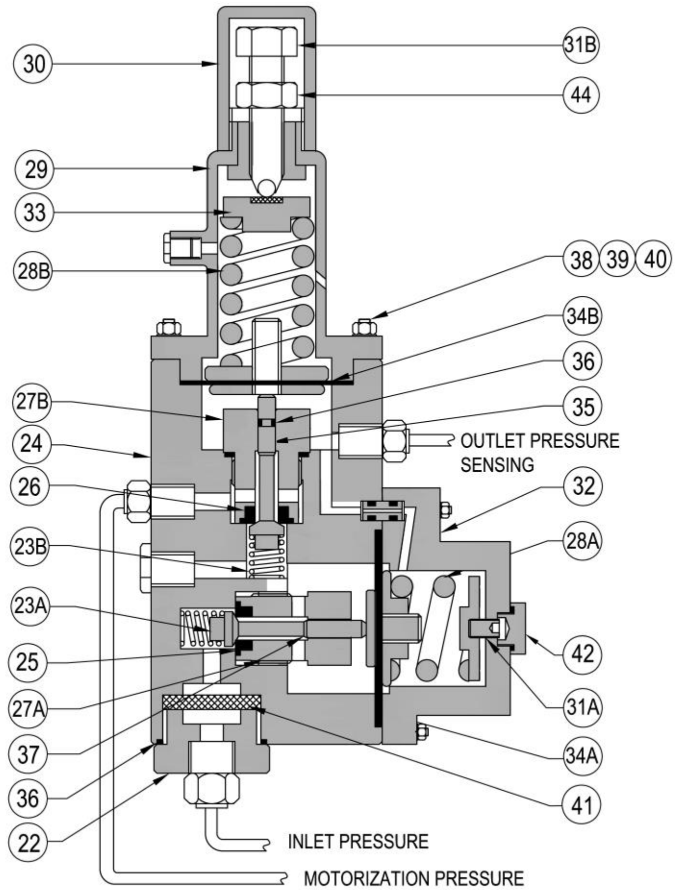


Figure 2 : PILOT VALVE - TYPE DNP1

The Regulator having Slam Shut Device (Refer Fig. 3) attached to the main body is common for both. The control mechanism (Pilot-DNP4) is having latching arrangement that hold the main valve stem in open position. The sensing element is pilot regulator (Pilot-DNP5) which continuously monitors the line pressure which is to be safeguarded. This pilot is spring diaphragm type valve and in case of over-pressurization it gives signal pressure to control mechanism which in turn trips off the main valve.

In normal condition the (Pilot-DNP4) remains in close position. The main valve remains in open position by holding the plug rod 14 by rack 21 through ball catch arrangement in Pilot-DNP5.

Whenever the pressure monitored by (Pilot-DNP5) exceeds above its set intervention value the diaphragm 48 move upward displacing the plug 47. Thus the pressure passes to (Pilot-DNP4) diaphragm 27 pressing it along with push rod 25, pressing the ball 41. The rack 21 latched by the ball gets released resulting in downward movement of plug 7 and plug rod 14 by closing the valve. The visual indicator 32 will indicate the position as CLOSE. The valve can also be shut off manually by pushing the knob 33 on (Pilot-DNP4).

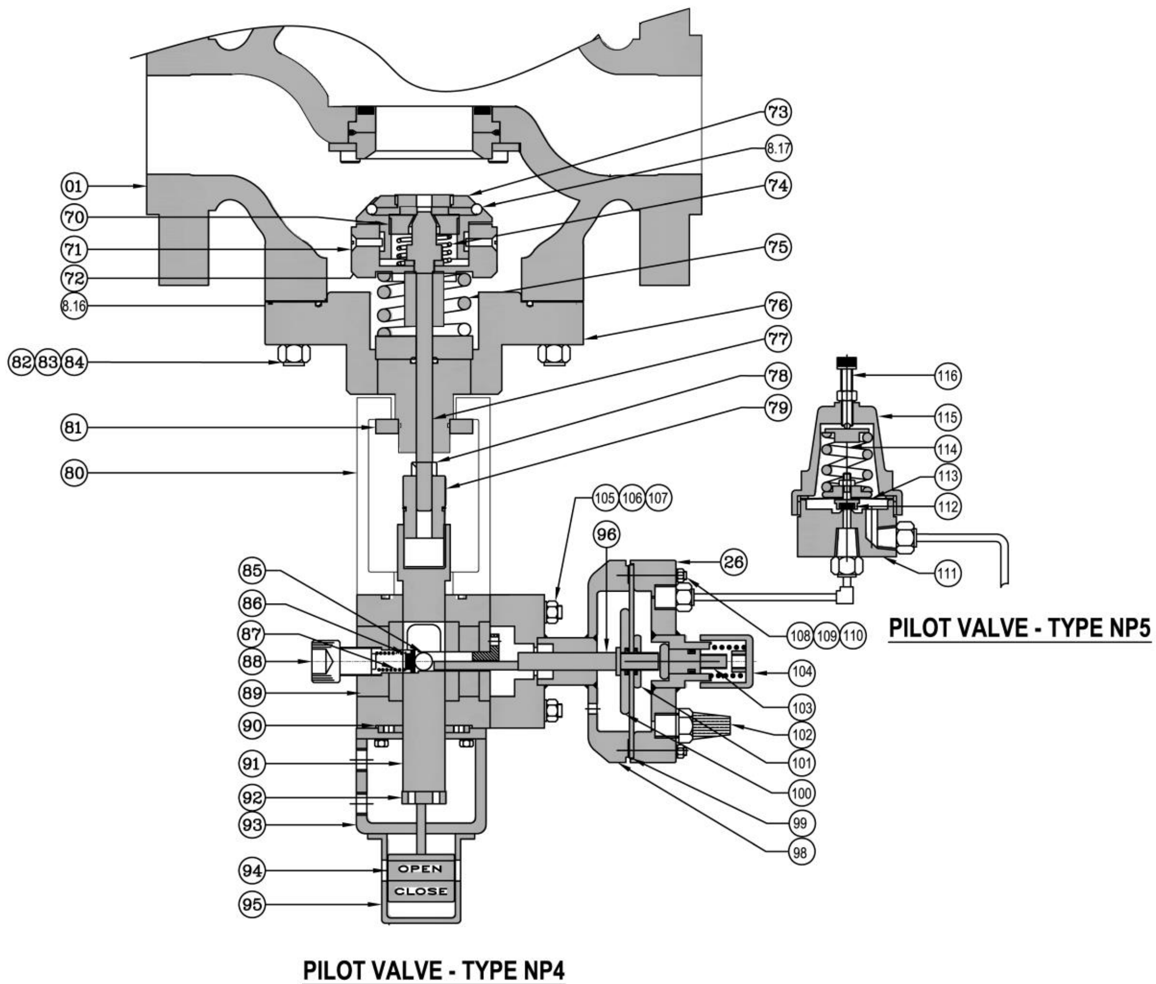


Figure 3: SLAM SHUT VALVE WITH PILOT VALVE – TYPE DNP4 & TYPE DNP5

RESETTING OF SLAM SHUT OFF DEVICE (REFER FIG.3)

To reset the valve to open position first engage the reset lever (handle provided with device) in the reset square slot of pinion 88. Turn the reset shaft slightly, this opens the pressure equalizing orifice in the plug rod 77. Allow the pressure at the inlet & outlet to equalize. Now, the reset lever can be swung easily to open position. Once the shaft reaches to fully open position, it is automatically latched in that position. The visual indicator 94 will indicate the position as OPEN.

CAUTION!!!

The valve can be re-opened only by manual resetting. Before resetting the valve ensure that the cause for over-pressurization is found and rectified.

1.4 START-UP SETTINGS

The Regulator Series D53 with pilots is having following regulation range.

Table : 1

Configuration. No.	Regulator Set Pressure Range	Safety Shut Off Device Set Pressure Range	Pilot Type.
1	0.5 TO 2.0 Barg	1.0 TO 5.0 Barg	DNP1
2	1.5 TO 6.0 Barg	5.0 TO 10.0 Barg	DNP1
3	4.0 TO 18.0 Barg	6.0 TO 15.0 Barg	DNP1
4	10.0 TO 30.0 Barg	10.0 TO 25.0 Barg	DNP1
5	25.0 TO 50.0 Barg	24.0 TO 55.0 Barg	DNP9 & DNP10

Refer Figure 2

The regulator is factory set at the pressure requested or ordered and normally, no setting is again required. However, if, due to unpredicted or unanticipated changes in the planned parameters, the regulator may required to set at different set point, this can be done by turning the set screw 31B of pilot DNP1.

- For increasing the regulated pressure: Turn the set screw (31B) in clockwise direction.
- For decreasing the regulated pressure: Turn the set screw (31B) in anti-clockwise direction.

Refer Figure 2 & Figure 3

Similarly, the Safety shut off device may required to set at different set point, this can be done by turning the set screw 51 (fig.3) of Pilot-TYPE DNP5.

- For increasing the regulated pressure: Turn the set screw (116) in clockwise direction.
- For decreasing the regulated pressure: Turn the set screw (116) in anti-clockwise direction.

When desired setting has been set, the set screw shall be locked by tightening the lock nut provided and cap shall be placed over it.

2.0 INSTALLATION

2.1 GENERAL

Pressure regulator does not require any supplementary upstream safety accessory for protection against overpressure compared with its design pressure PS, when upstream reducing station is sized for a max downstream incidental pressure MIPd $\leq$ 1.1 PS.

2.2 PRE-INSTALLATION CHECKS

Before installing the regulator it is necessary to ensure that:

a. The regulator has been installed in vertical position, but be sure flow through the body is in the direction indicated by the arrow on the body
b. The use of suitable gaskets and approved piping and bolting practices has been done;
c. The regulator can be inserted in the space provided and that subsequent maintenance operations will be sufficiently practicable;
d. The upstream and downstream piping is at the same level and capable of supporting the weight of the regulator;
e. The inlet/outlet flanges of the piping are parallel;
f. The inlet/outlet flanges of the regulator are clean and the regulator itself has not been subject to damage during transport;
g. The gas supply to regulator has been cleaned by means of proper Filters / Separators / Scrubbers to avoid any technical failure & reasonable hazard of erosion or abrasion for pressure containing parts;
h. The piping upstream has been cleaned or flushed for removal of residual impurities such as welding scale, sand, paint residues, water, etc;
i. The regulator has been installed in non-seismic area and hasn't to under go fire and thunderbolt action;
j. The vent & drain arrangements has been provided adequately at upstream and downstream of the regulator.

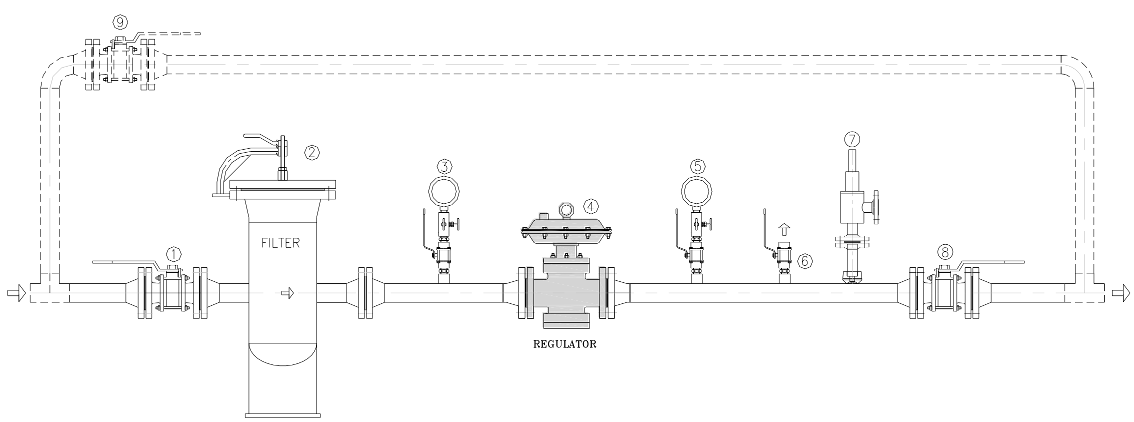
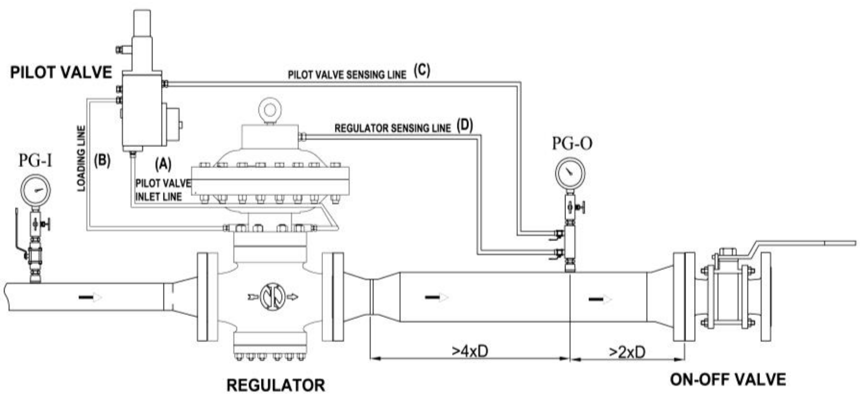


Figure 4: Typical Installation of D53 SERIES Regulator
(For sensing connections refer details under 2.3)

2.3 CONNECTING THE REGULATOR

The connections between the apparatus and the main piping must be made using stainless steel pipe with minimum internal diameter of 8 mm.



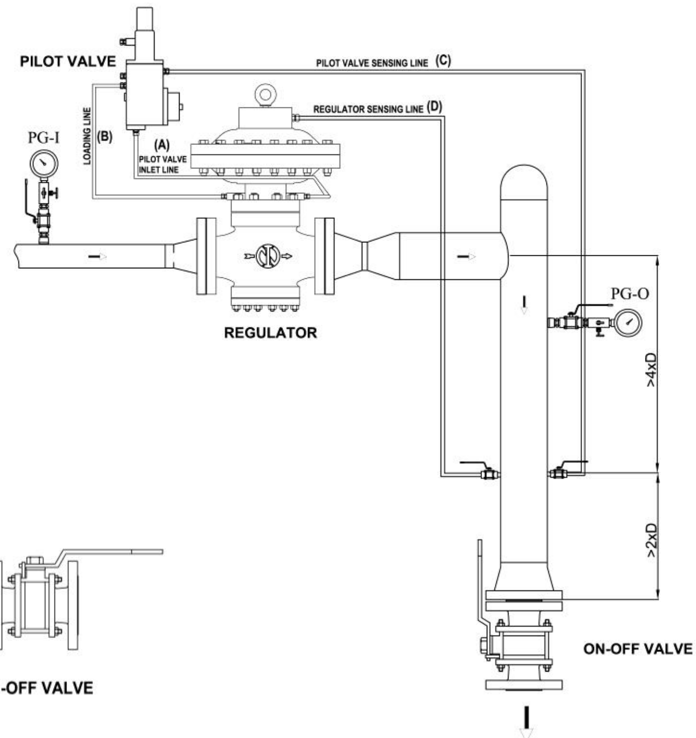


Figure 5A Installation in straight line

Figure 5B Installation with outlet header at 90°

Tube & Fitting Sizes: FOR DNP1 Pilot Valve

Tubing conn.	Tube size	Start Fitting size	End fitting size	Remarks
A	3/8" OD	1/4" NPTM x 3/8" OD	3/8" NPTM x 3/8" OD	Supply Pr. to Pilot
B	3/8" OD	3/8" NPTM x 3/8" OD	1/4" NPTM x 3/8" OD	Motorization pressure, Pm
C	3/8" OD	3/8" NPTM x 3/8" OD	1/2" NPTM x 3/8" OD	Downstream signal to Pilot
D	3/8" OD	1/2" NPTM x 3/8" OD	1/2" NPTM x 3/8" OD	Downstream signal to Main Regulator

Note: Tubing Connections C & D are to be done by Piping contractor as per installation requirements.

The regulator must be so installed that the flow is in the direction of the arrow on the body.

Tube & Fitting Sizes: FOR DNP9 & DNP10 Pilot Valve

Tube size	Start Fitting size	End fitting size	Remarks
3/8" OD	1/4" NPTM x 3/8" OD	3/8" NPTM x 3/8" OD	Supply Pr. to 1st Stage Pilot
3/8" OD	1/4" NPTM x 3/8" OD	1/2" NPTM x 3/8" OD	Motorization pressure, Pm
3/8" OD	1/4" NPTM x 3/8" OD	3/8" NPTM x 3/8" OD	1st Stage outlet to 2nd Stage Inlet
3/8" OD	1/4" NPTM x 3/8" OD	1/4" NPTM x 3/8" OD	Downstream signal to Pilot
3/8" OD	1/2" NPTM x 3/8" OD	1/2" NPTM x 3/8" OD	Downstream signal to Main Regulator
	3/8" x 3/8" x 3/8" OD.	Ferrule Tee	
	3/8" x 3/8" OD.	Elbow	

For better performance of the regulator it is important that the downstream pressure sensing connections are taken from the distance shown in Fig. 5A & 5B and the gas velocity at the take offs must not exceed the values below.

For Downstream Pressure Pa $\geq$ 1 bar; Vmax = 40 m/s
For Downstream Pressure Pa < 1 bar; Vmax = 25 m/s

CAUTION !!!
The gas velocity at any point must not exceed the following values in the piping :
Unfiltered Gas : Vmax = 20 m/s
Filtered Gas : Vmax = 40 m/s

3. 0 ACCESSORIES & CONFIGURATIONS

3.1 RELIEF VALVE

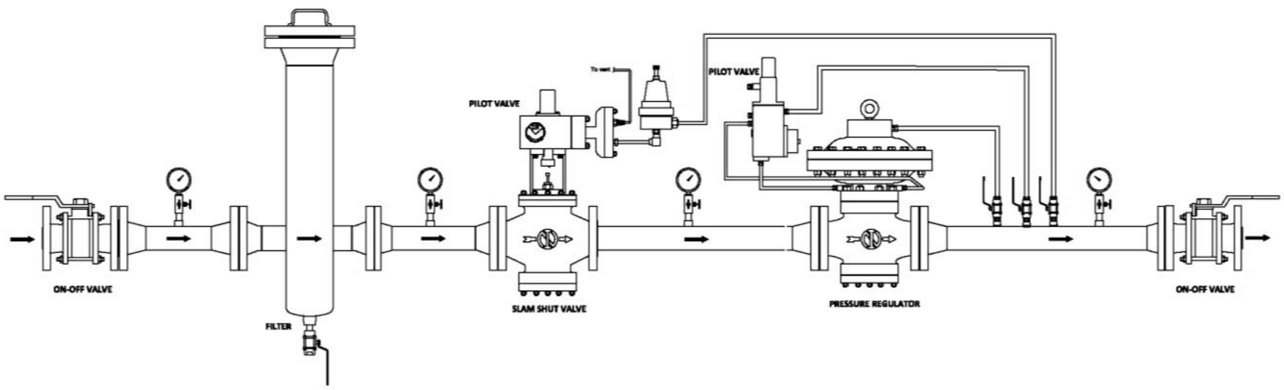
The relief valve is a safety device which releases a certain small quantity of gas to the atmosphere when the pressure at the control point exceeds the set-point as a result of short-lasting events such as, the very fast closing of the on/off valves and/or overheating of the gas with zero flow rate demand. The release of the gas to atmosphere can, for example, delay or block intervention of the slam-shut valve for transitory reasons deriving from damage to the regulator.

The quantity of gas released depends on the extent of the over pressure with respect to the set point. The different models of the relief valve are available.

3.2 SLAM SHUT DEVICE (Series SH4)

Slam Shut off is a device which immediately blocks the gas flow by intervention if due to some failure, the downstream pressure reaches the set point .

When the slam shut incorporated into pressure regulator it is also to be considered as safety accessory according to Directive PED, cuts off the feeding of gas both to pressure regulator and to its pilots when the pressure increases / decreases.



3.3 IN-LINE MONITOR

In this configuration the monitor regulator is installed upstream of the main (active) regulator (refer Fig. 7 & 8)

Although their roles are different, the two regulators are virtually identical from the point of view of their mechanical construction. The only difference is that the monitor is set at a higher pressure than the main active regulator.

The in-line monitor is an emergency regulator which comes into operation to replace the active regulator if for any reason the down line pressure rise up to the value set for its intervention.

Normally, Monitor remains wide open and Active regulator regulates the outlet pressure at the set value. If, in case of contingency, controlled pressure tends to rise, Monitor regulator takes over and regulates the controlled pressure at its set value, which is marginally higher than that of Active regulator.

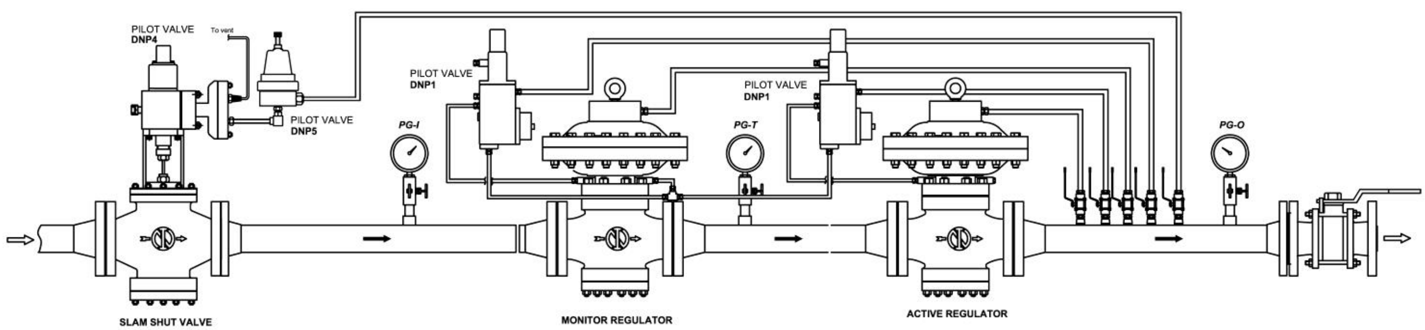


Figure 7: Typical Installation Active Monitor Configuration with DNP1 Pilot

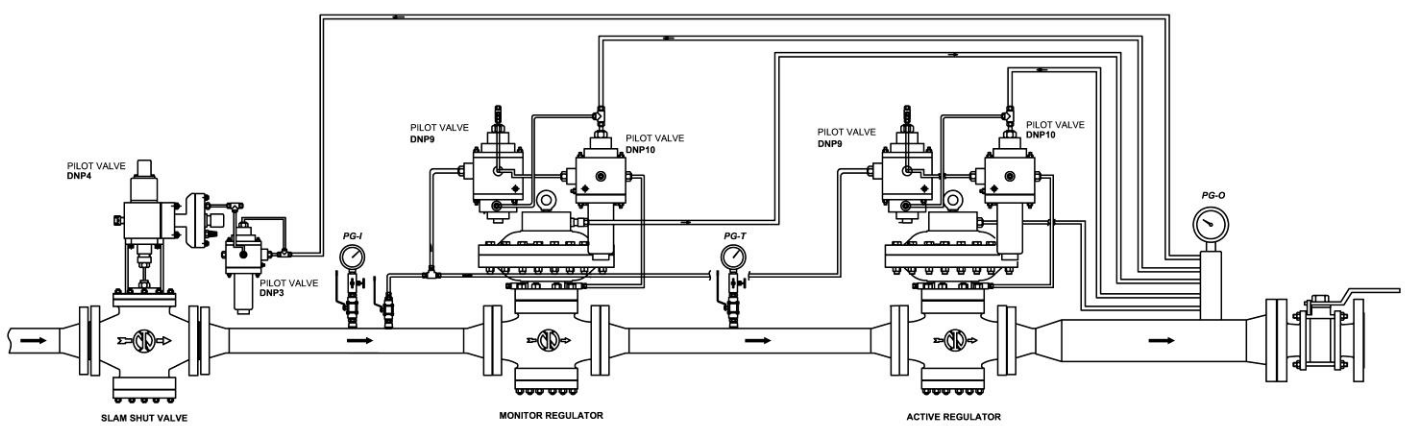


Figure 7A: Typical Installation Active Monitor Configuration with DNP9 & DNP10 Pilot

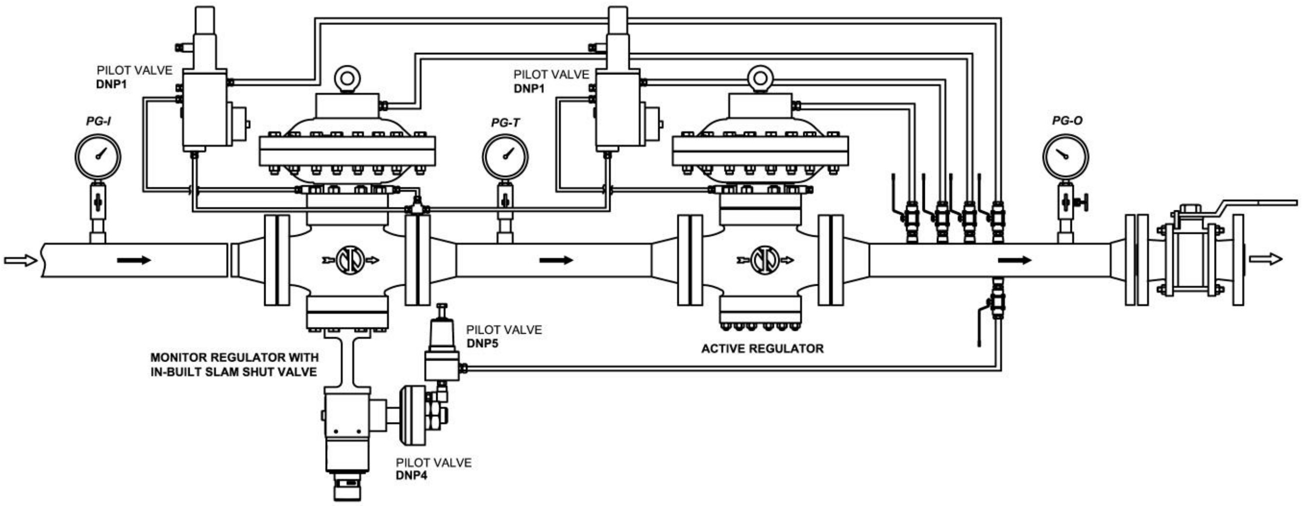


Figure 8 : Typical Installation Active Monitor Configuration with DNP1 Pilot (Monitor with in-built Slam Shut)

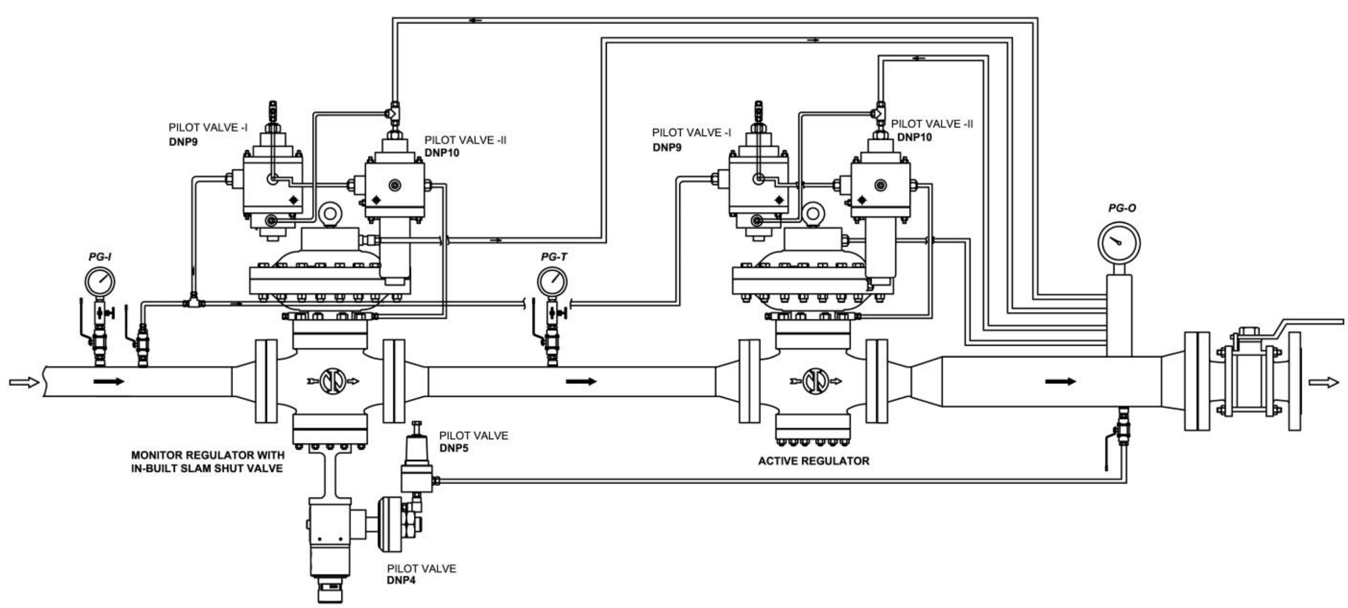


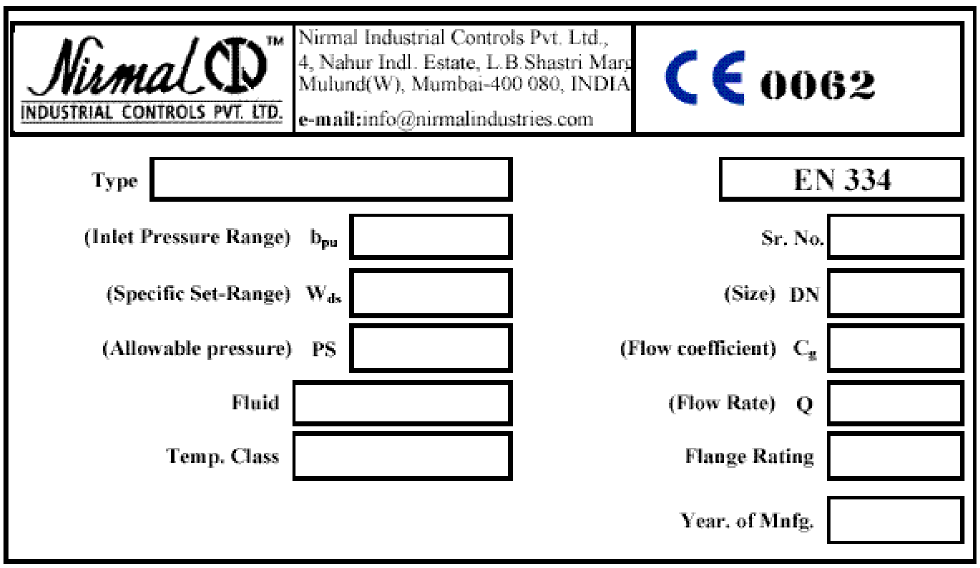
Figure 8A: Typical Installation Active Monitor Configuration with DNP9 & DNP10 Pilot (Monitor with in-built Slam Shut)

4.0 START UP INSTRUCTIONS

4.1 GENERAL

After installation, check that the inlet/outlet on-off valves, any by-pass and the bleed cock are closed. Before starting up, checking is recommended to ascertain that the conditions of use are in conformity with the specifications of the equipment. These specifications are recalled with the symbols on the plate fitted on the Regulator (Refer fig. 9).

REGULATOR NAME PLATE SPECIMEN



SAFETY SHUT OFF DEVICE NAME PLATE SPECIMEN

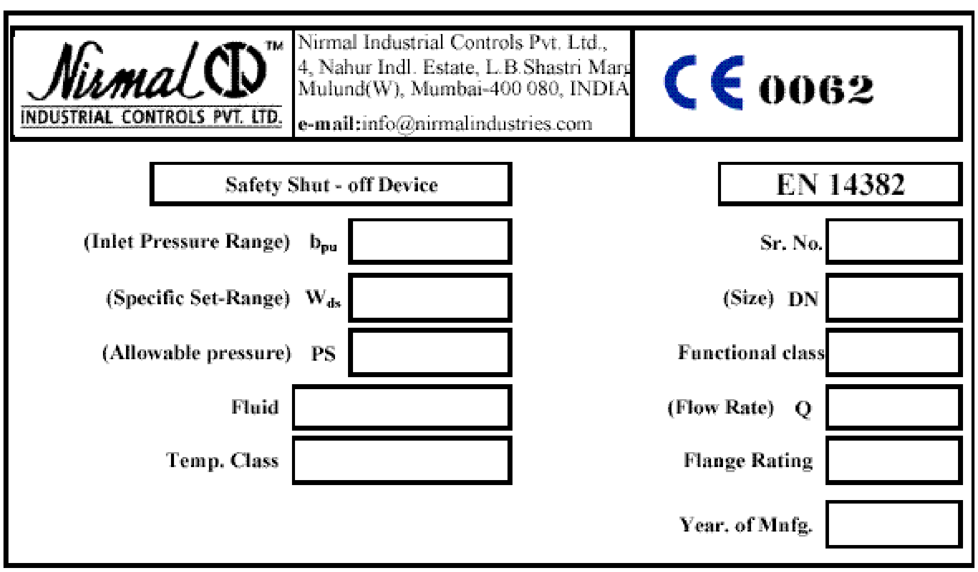


Figure 9

CAUTION !!!

Do not use the Equipment for the parameters other than those for which it is ordered for.

4.2 CHARGING THE GAS & LEAK TEST

The charging of the gas must be carried out very gradually. Also to protect the regulator from possible damage, following operations must be avoided:

- **Pressuring the line through isolation valve located downstream of regulator.**
- **De-pressuring the line through isolation valve located upstream of regulator.**

External leak tightness is assured if no bubbles form when a foam medium is applied on the pressurized component.

The regulator and other devices (slam-shut, monitor) are normally supplied for the desired set-point. It is possible that the settings may have changed for various reasons (e.g., vibration during transport) while remaining within the values permitted by the springs used.

We therefore recommend checking the settings using the procedures illustrated below. Table 2 gives the recommended set-points for the equipments in the various installation arrangements. The figures in these tables can be useful both when checking existing set-points and for modifying them if necessary later on.

The installations consisting of two streams, we suggest testing one stream at a time, starting from the one with the lower set-point, known as the "stand-by" stream. **The set-points of the equipments in this stream will obviously deviate from those specified in the Table 2.**

4.3 SET POINT SELECTION

Before commissioning the regulator it must be checked that all the on/off valves (inlet, outlet, any by-pass) are closed and that the gas is at a temperature which will not lead to malfunctioning.

Table : 2

Recommended Set points of line equipments consisting of Regulator Active + Monitor + Slam-shut (Over Pressure & Under Pressure) + Relief Valve				
Set-point Regulator (Pas) bar	**Set-point MONITOR**	**Set-point RELIEF-VALVE**	**Set-point SLAM-SHUT (OPSO [a])**	**Set-point SLAM-SHUT (UPSO [b])**
0.5<Pas>2.1	Pas x 1.1	Pas x 1.3	Pas x 1.5	Pas x 0.75 bar [c]
2.1<Pas>5	Pas x 1.1	Pas x 1.3	Pas x 1.4	Pas x 0.75 bar
5<Pas>25	Pas x 1.05	Pas x 1.15	Pas x 1.3	Pas x 0.75 bar
25<Pas>50	Pas x 1.05	Pas x 1.15	Pas x 1.3	Pas x 0.75 bar

[a] OPSO : Over Pressure Shut Off
[b] UPSO : Under Pressure Shut Off

[c] Difference between Regulator set point (Pas) & UPSO shall be 0.3 bar minimum

5.0 COMMISSIONING

5.1 COMMISSIONING THE REGULATOR

If there is a relief valve 8 in the line, refer to point 3.1.

<u>Refer Figure 10.</u>

1) Keeping the bleed valve 7 partially open, gradually open the inlet isolation valve 1, to pressurize the complete pipe line.
2) Check reading on the pressure gauge 6 that pressure does not exceed the setting of the regulator. If necessary, suspend the operation by closing inlet valve 1, opening the cap (30) of pilot 5 and completely reducing the load on the spring by turning the adjustment screw (31) appropriately.
3) Close the bleed cock 7 and check that the downstream pressure, after increasing, settles at a value lower or equal to that of setting of the pilot / regulator assembly. If it does not settle, remedy the causes of the seat leakage.
4) After taking remedial action, by using a foaming agent, check the tightness of all the joints between the on-off valves 1 and 9.
5) Very slowly open the downstream isolation valve 9 until the line gets completely filled. If, at the beginning of this operation, the pressure in the line is much lower than the set-point, the opening of this valve 9 should be done very gradually so as to avoid excess flow through the regulator installation.

6)

Figure 10

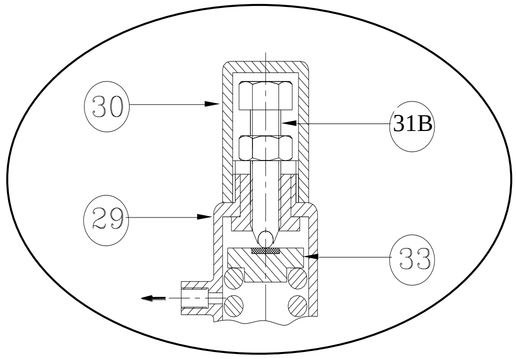
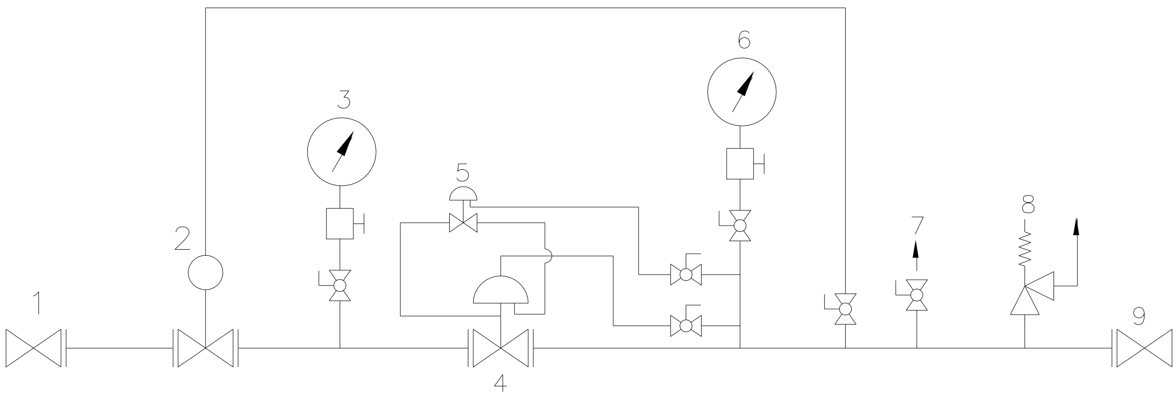


Figure 10A



5.2 COMMISSIONING THE REGULATOR WITH IN-BUILT SLAM-SHUT OFF

If there is a relief valve 8 in the line, refer to point 3.1.

5.2.1 To Check and adjust the intervention of the slam-shut as follows: (Refer Fig.11)

- Keeping both the inlet & outlet isolation valves 1 & 9 closed, open the slam shut device by means of the lever provided with the equipment;
- To operate slam shut device it is recommended to provide a controlled auxiliary pressure to pilot 5 externally;
  - **Over Pressure Shut Off** (Safety devices, which shut off if pressure exceeds the regulator setting) : slowly increase the auxiliary pressure and check the intervention value. If necessary, increase the intervention value by turning the adjustment screw clockwise, or anticlockwise to reduce the intervention value.
  - **Over & Under Pressure Shut Off** (Safety devices, which shut off if pressure exceeds or falls down the regulator setting) : slowly increase the auxiliary pressure and record the intervention value. Restore the pressure to the set-point established for the regulator, and carry out the slam-shut reset operation. Check intervention for pressure reduction by slowly reducing the auxiliary pressure. If necessary increase the intervention values for OPSO or UPSO by respectively turning the OPSO or UPSO adjusting screws clockwise and vice versa to reduce the intervention values.
- Operate the shut off device at least 2-3 times and ensure proper functioning.

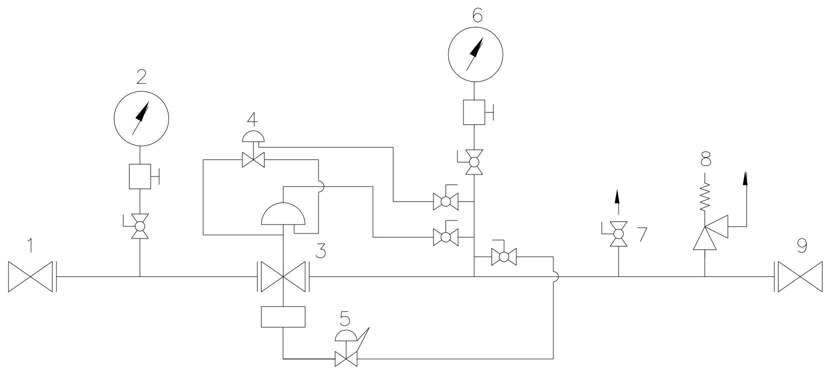


Figure 11

> **CAUTION !!!**
> After checking the slam shut operation, re-connect the sensing line to the take-off point.

N.B.: It is recommended to carry out the intervention tests atleast every 3 months.

5.2.2 Commissioning Procedure for Regulator with safety shut off (Refer Fig.11)

At the end of the slam-shut operation check, proceed as follows:

1) Ensure that the slam-shut is in closed position.
2) Gradually open the inlet isolation valve 1, to pressurize the complete pipe line.
3) Then slowly reset the slam-shut device by operating the provided lever.
   – In case of OPSO safety shut off device, the device will get suddenly engaged in the open position.
   – In case of OPSO & UPSO safety shut off device; keep the lever turned and increase the outlet pressure to the desired regulator set-point. At this point, the lever can be released and slam-shut will stay in the open position;
4) Partially open the bleed cock 7.
5) Check reading on the pressure gauge 6 that pressure does not exceed the setting of the regulator. If necessary, suspend the operation by closing inlet valve 1, opening the cap (30) [Refer Fig. 10] of pilot - TYPE DNP1 and completely reducing the load on the spring by turning the adjustment screw (31B) appropriately.
6) If necessary, open the cap (30) of pilot –TYPE DNP1 & adjust the setting by turning the adjustment screw (31B).
7) Close the bleed cock 7 and check that the downstream pressure, after increasing, settles at a value lower or equal to that of setting of the pilot / regulator assembly. If it does not settle, remedy the causes of the seat leakage.
8) After taking remedial action, by using a foaming agent, check the tightness of all the joints between the on-off valves 1

9) Very slowly open the downstream isolation valve 9 until the line gets completely filled. If, at the beginning of this operation, the pressure in the line is much lower than the set-point, the opening of this valve 9 should be done very gradually so as to avoid excess flow through the regulator installation.
10) It is recommended to check that when the slam-shut is operated manually, the flow in the line stops completely.

The procedure same as above should be followed even if separate shut off device Series SH4 mounted at regulator upstream.

5.3 COMMISSIONING THE REGULATOR (ACTIVE) HAVING IN-LINE MONITOR WITH SAFETY SHUT OFF

If there is a relief valve 8 in the line, refer to point 3.1.

5.3.1 To Check and adjust the intervention of the slam-shut refer point 5.2.1

N.B.: It is recommended to carry out the intervention tests at least every 3 months.

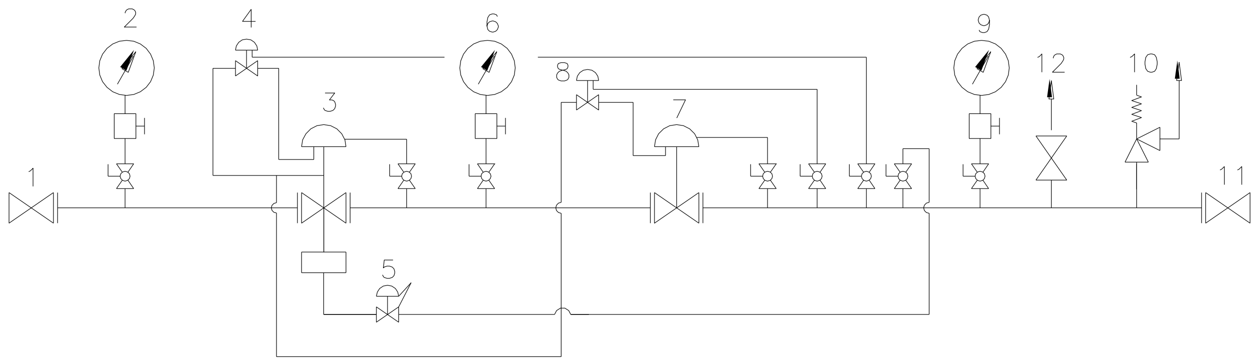


Figure 12.

5.3.2 Commissioning Procedure for Regulator having in-line monitor with safety shut off

Refer Fig. 12.

At the end of the slam-shut check, proceed as follows:

1) Ensure that the slam-shut is in closed position.
2) Gradually open the inlet isolation valve 1, to pressurize the complete pipe line.
3) Then slowly reset the slam-shut device by operating the provided lever.
   – In case of OPSO safety shut off device, the device will get suddenly engaged in the open position.
   – In case of OPSO & UPSO safety shut off device; keep the lever turned and increase the outlet pressure to the desired regulator set-point. At this point, the lever can be released and slam-shut will stay in the open position;

4) Partially open the bleed cock 12.

5) Completely increase the setting of the pilot 8 by turning the adjustment screw clockwise to make the active regulator 7 fully open.
6) Check that the setting of the pilot 4 corresponds to the selected set value of the monitor and adjust it to the desired if necessary.
7) Reduce the setting of the pilot 8 to the selected set value of the active regulator.
8) The monitor will remain fully open during operation.
9) Close the bleed cock 12 and check that the downstream pressure, after increasing, settles at a value lower or equal to that of setting of the pilot / regulator assembly. If it does not settle, remedy the causes of the seat leakage.
10) After taking remedial action, by using a foaming agent, check the tightness of all the joints between the on-off valves 1 and 11.
11) Very slowly open the downstream isolation valve 11 until the line gets completely filled. If, at the beginning of this operation, the pressure in the line is much lower than the set-point, the opening of this valve 11 should be done very gradually so as to avoid excess flow through the regulator installation.
12) It is recommended to check that when the slam-shut is operated manually, the flow in the line stops completely.

The procedure same as above should be followed even if separate shut off device SERIES SH4 mounted at regulator upstream.

6.0 TROUBLE-SHOOTING

Various kinds of problems could come across with the Regulators, same are stated here under with the possible remedies advised.

The foremost reasons developing that can give rise to the various problems depends upon

- the conditions of the gas;
- The natural ageing and wear of the materials.

CAUTION !!!
Only qualified personnel with appropriate knowledge about the subject should carry out installation or servicing of a regulator and handling only after reading the manual

Unsuitable person should not be permitted or allowed to fiddle with the regulator. The maintenance personnel should be trained officially by our authorized representative, whenever necessary.

6.1 REGULATOR

Table. 3 (Refer Fig. 14,14A , 14B & 15)

PROBLEM	PROBABLE CAUSES	REMEDY
Seat leakage i.e. Increase in downstream pressure during no flow (Q = 0)	**PILOT** IInd Stage Disc [26] worned or damaged Ist Stage Diaphragm [34A] rupture	Replace the disc Replace the diaphragm
	MAIN REGULATOR Molded seat [03] damaged Plug guide [07] O-rings [8.13] damaged Ice formation between the seat [03] and the plug [05]	Replace the Molded seat Replace the O-rings Increase the gas temp. to the regulator.
Increase in downstream pressure during flowing condition (Q > 0)	**PILOT** IInd Stage Disc [26] worned or damaged IInd Stage Plug [35] stucked in the open position IInd stage Spring [23B] given up	Replace disc Clean & check free movement Replace with new spring
	MAIN REGULATOR Molded seat [03] damaged Ice formation between the seat [03] and the plug [05] Deposition of Dirt on molded seat [03] Plug [05] jammed Diaphragm [10] fitted incorrectly Downstream sensing line chocked Plug guide [07] O-rings [8.13] damaged Set Pressure disturbed	Replace the Molded seat Increase the gas inlet temp. to the Regulator Clean & Check gas quality & filtration Clean & Check free movement Fit the diaphragm properly Clean the sensing line Replace O-Rings Adjust set point referring start-up settings pt. 1.4

Drop in downstream pressure	PILOT Ist stage setting low Pilot Filter element [41] clogged IInd Stage Diaphragm [34B] ruptured Leakage from Pilot feed line	Increase setting by turning Ist stage adjusting screw [31A] clockwise Replace the filter mesh Replace the diaphragm Tighten the compression fittings or replace
	MAIN REGULATOR Plug [05] jammed Diaphragm [10] ruptured Insufficient supply from upstream	Clean and check free movement Replace the diaphragm Increase inlet pressure or clean line filter cartridges
Functional inconsistency (Vibration, Pressure hunting, No Pressure at outlet)	PILOT Friction in diaphragm [34B] and plug [35] or mis-alignment Worn diaphragm [34B] Spring [23A & 23B] slackened or un-balanced	Align the diaphragm and plug Replace diaphragm Replace or align the spring
	MAIN REGULATOR Plug guide [07] O-ring worn Friction between the Plug [05] and Plug guide [07] Friction in plug rod [18] or O-ring worn Spring [16] slackened or un-balance Active regulator and monitor set-points too close	Replace the O-rings Align the Plug and check the O-rings Replace O-rings Replace or align the spring Increase the difference between two set-points

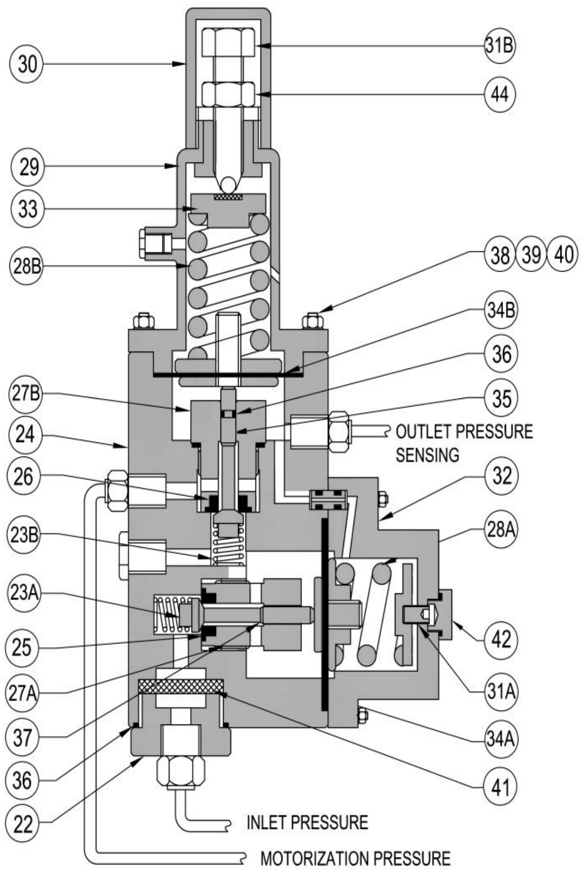


Figure 13A : Pilot Valve – TYPE DNP1

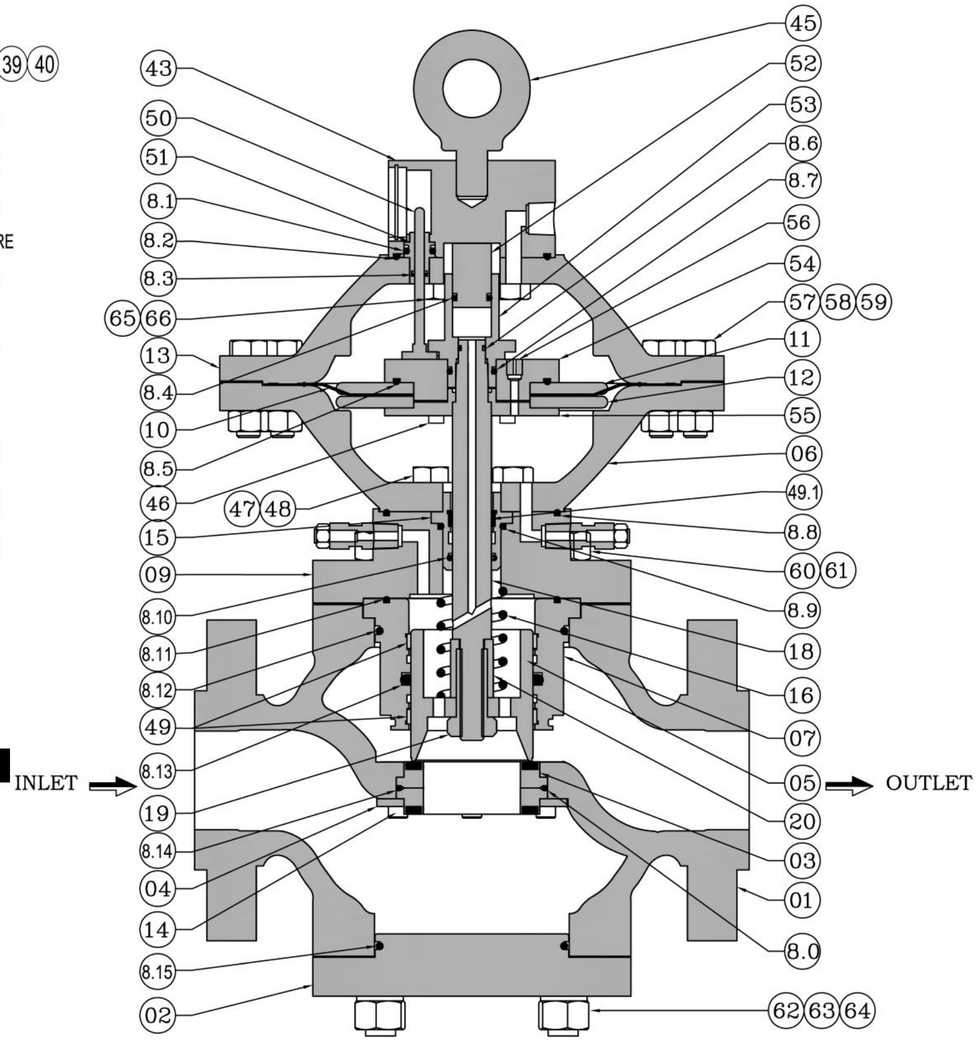


Figure 13A : Main Regulator

SERIES D53 Regulator Main & Pilot Assemblies

SLAM SHUT OFF DEVICE

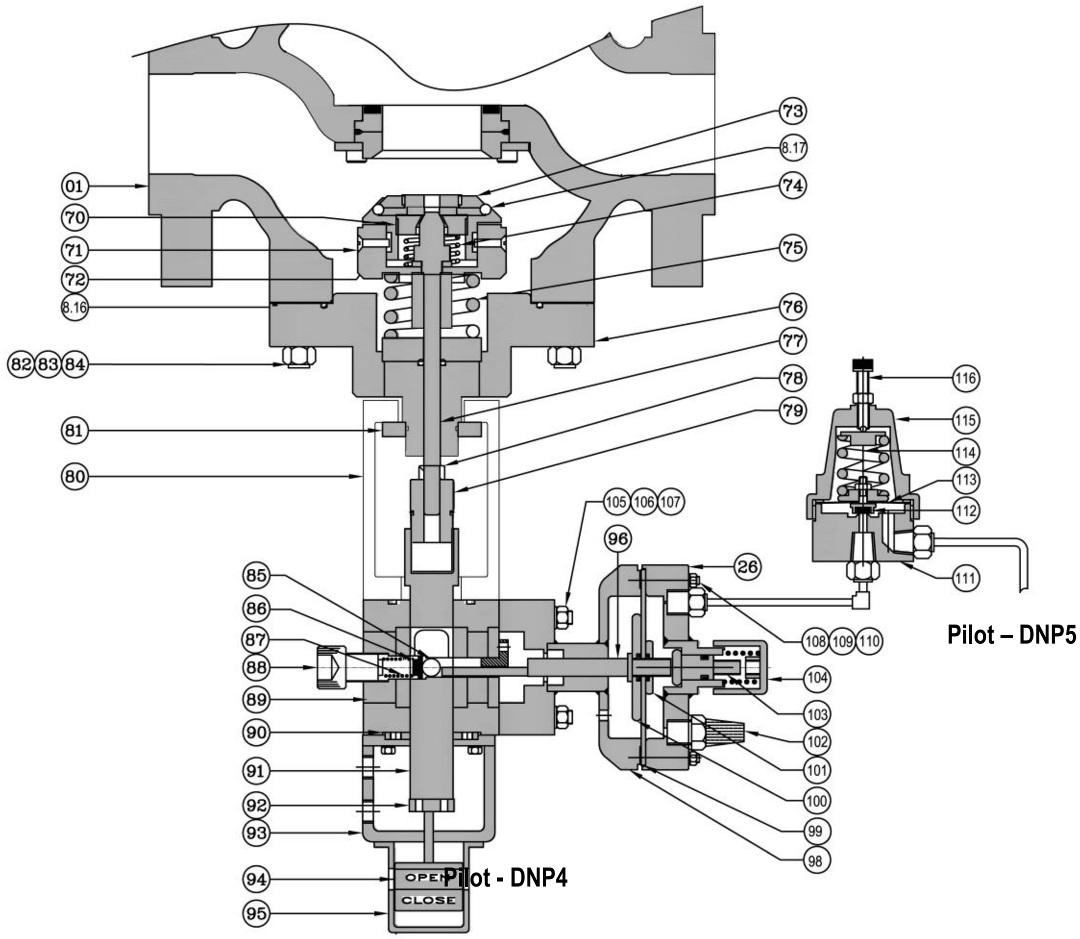


Figure 14: SERIES D53 Regulator with Slam shut off Device combined in one unit

6.2 SLAM SHUT OFF DEVICE

Table. 4 **(Refer Fig. 14)**

PROBLEM	POSSIBLE CAUSES	REMEDY
Not intervening in case of controlled pressure rise	Setting of slam shut disturbed	Set the set screw [116] to suitable pressure (refer Table. 2)
	Insufficient sensing pressure	Open the root isolation valve completely
	Blockage of sensing line from Regulator outlet to Pilot-DNP4	Clean the sensing line for possible blockage or chocking
	Pilot diaphragm rupture [113]	Replace the ruptured diaphragm
Seat Leakage in trip down condition	'O' ring [8.17] in the plug worn out	Change the 'O' ring
Resetting not possible	The cause for rise or fall of the controlled pressure not attended	Check & attend the cause for intervention
	Setting of slam shut disturbed	Set the set screw [116] to suitable pressure (refer Table. 2)
	Misalignment of latching arrangement	Re-align the arrangement

CAUTION !!!

If the slam-shut has intervened, close the inlet & outlet isolation valves in the line and discharge the pressure before carrying out any operation. Eliminate the causes which gave rise to Intervention before reactivating it.

7.0 MAINTENANCE

7.1 GENERAL

The periodic inspection & maintenance shall be carried out according to the national or statutory regulations in addition to the instructions given herein.

The maintenance frequency and nature depends mainly on the following attributes;

– the quality of the gas (impurities, humidity, condensate, corrosive substances);
– the efficiency of the filtration unit & liquid separator;
– the cleanliness and conservation of the piping upstream from the regulator;
– the level of reliability required from the regulating system;
– the significance of regulating system functioning to the application.

As a preventive maintenance practice , it is recommended to carry out preventive maintenance at-least once a year, leak test as per 4.2 & set point check as per 5.1 and incase of any problem carry out necessary maintenance as given hereunder.

CAUTION !!!
While starting the equipment for the first time, more frequent maintenance is required due to possibility of residual impurities such as welding scale, sand, paint residues, water inside the piping.

The dismantling of the regulator should be started after ensuring the listed points:

– a regulator is isolated from both upstream & downstream and regulator is totally de-pressurized;
– a set of recommended original spares are available consisting the important ones such as diaphragms & soft seatings;
– a set of wrenches is available.

For easy traceability of the spare kits it is recommended to store the spares with identification tags giving reference of:

- The Sr.No. & Tag No. of the regulator for which the spare parts are intended;
- The part no. or position of parts in the assembly drawing.

In case the maintenance is carried out by your own authorized & qualified personnel, we recommend putting reference markings, before the disassembly, especially on those parts which could have directional or reciprocal positioning problems while reassembling. The O-Rings and sliding mechanical components (stem, plug, etc.) must be lubricated, before the re-assembly, with a fine layer of silicone grease. Before re-commissioning of equipment, internal sealing (seat leakage) shall be verified at appropriate pressure to assure the internal sealing at the maximum expected operating pressure. Both verifications are essential to assure safe use at foreseen operating conditions; they have, anyhow, to comply with the national regulations in force.

SERIES D53 MAIN REGULATOR

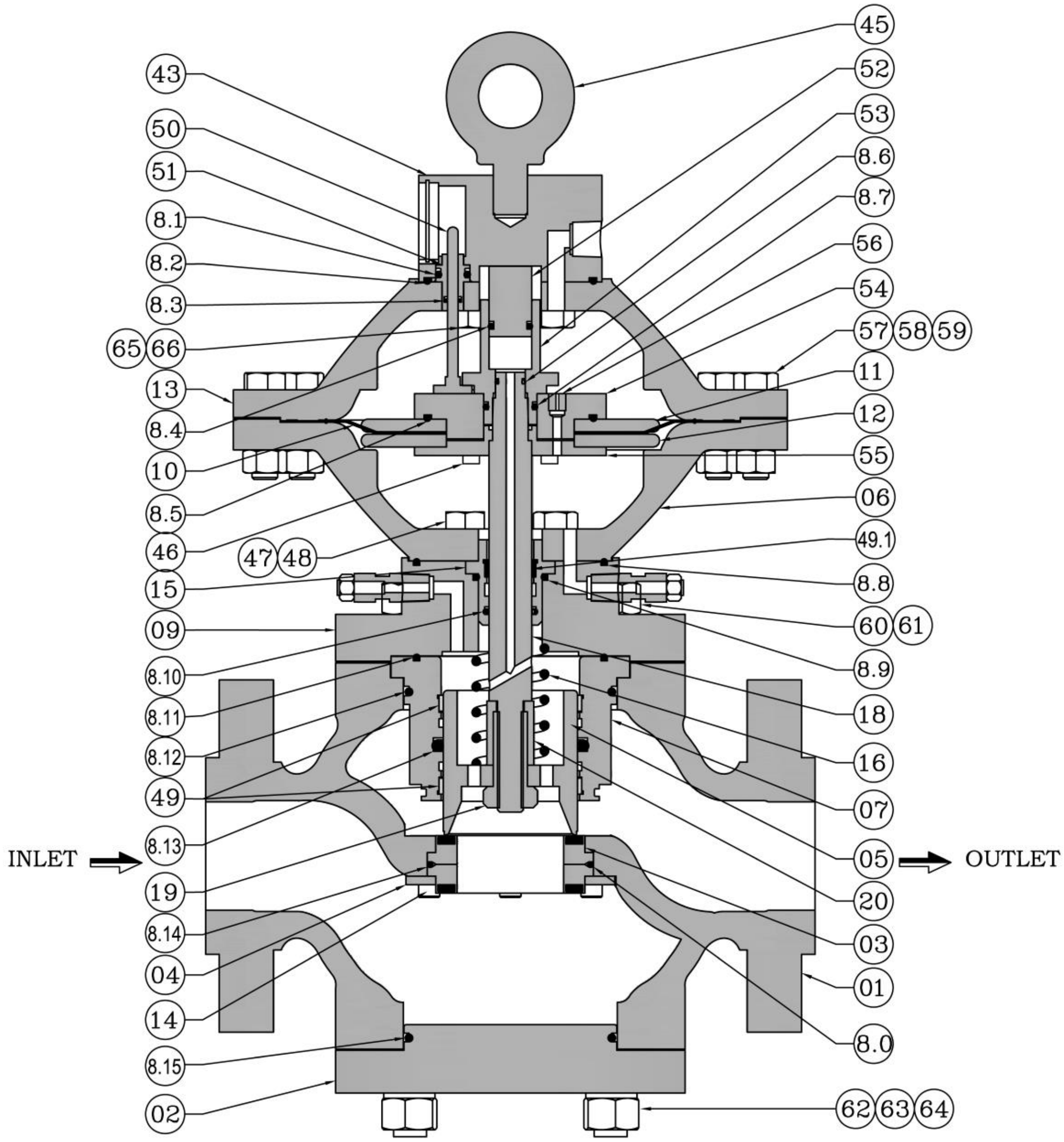


Figure 14A : Valve Size : DN 25 (1") & DN 50 (2")

SERIES D53 MAIN REGULATOR

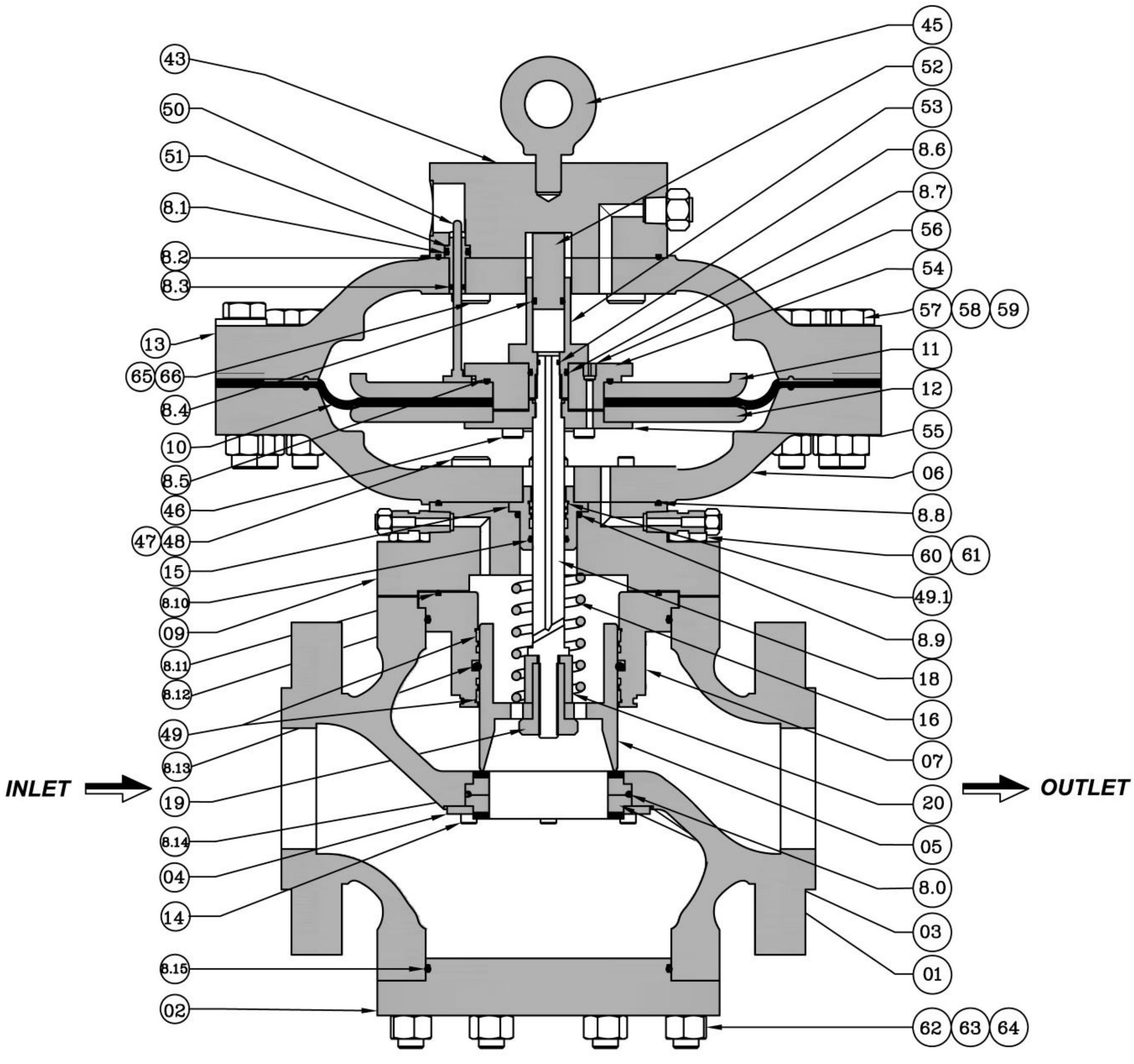


Figure 14B : Valve Size : DN 80 (3") & DN 200 (8")

SERIES D53 PILOT VALVE

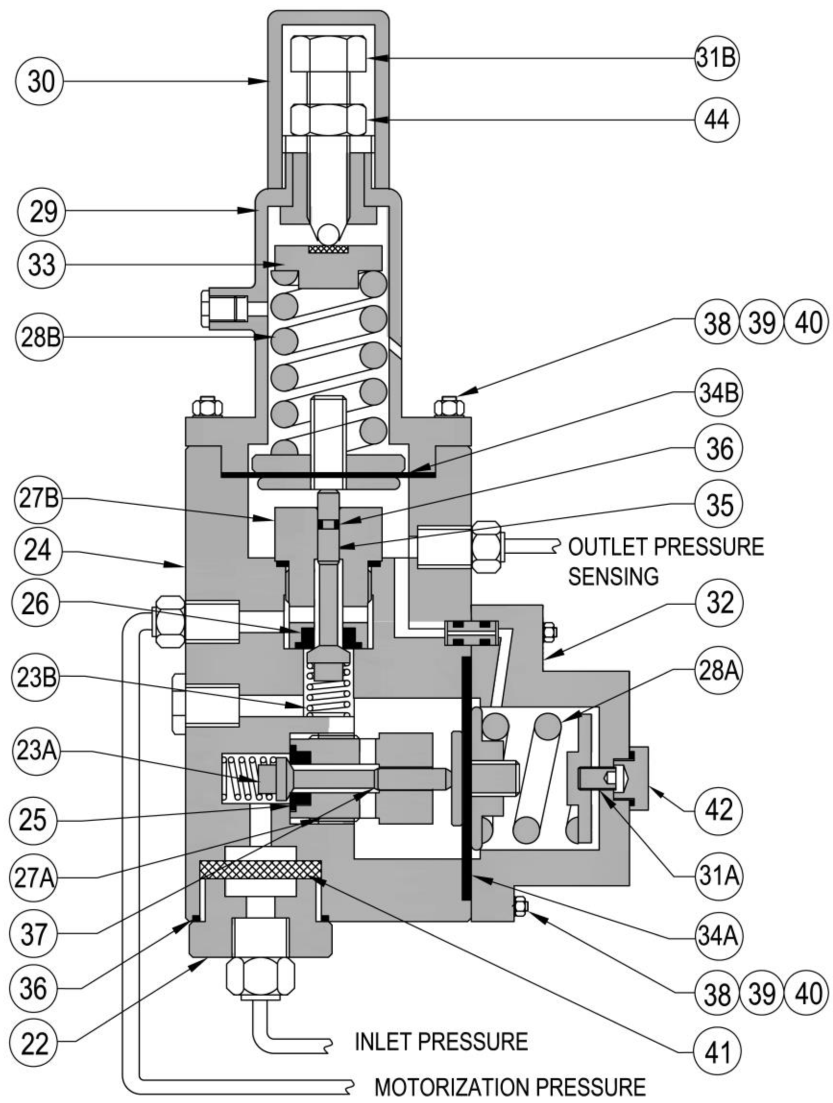


Figure 15 : TYPE : DNP1 - FOR SET PRESSURE 0.5 BARG. – 30.0 BARG

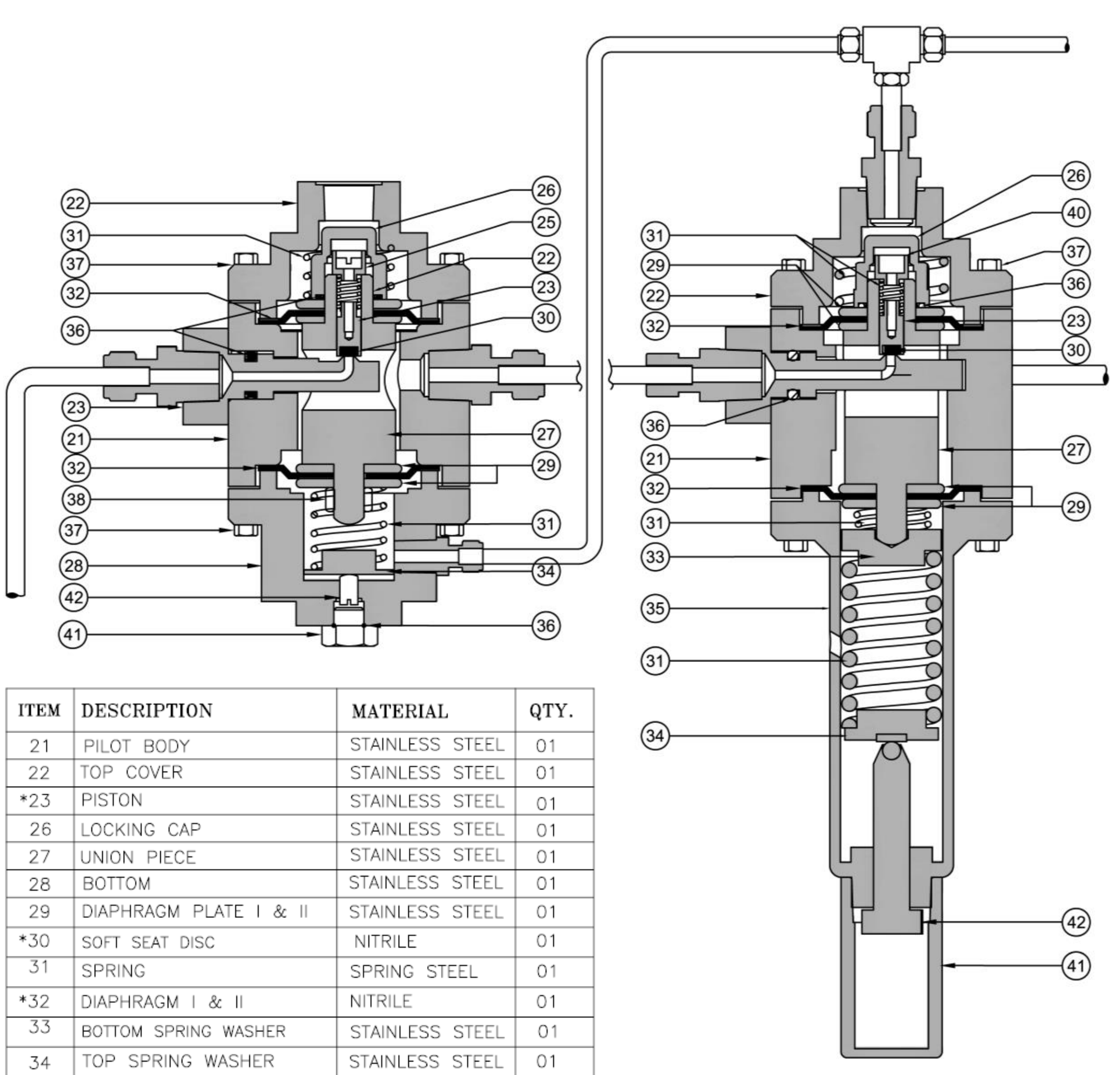
PART LIST (SERIES D53 REGULATOR)

Table 5: Refer Figure 14A, 14B & 15

SR. NO.	DESCRIPTION	QTY.	SR. NO.	DESCRIPTION	QTY.
47	Bolts	--			
46	Allen bolts	--			
45	Eye Bolt	1			
44	Lock Nut	1			
43	Indicator Boss	1			
42	Cap – Ist Stage	1			
* 41	Filter Mesh	1			
40	Tension Washer	--			
39	Nuts	--			
38	Stud / Bolt	--			
37	Plug – Ist Stage	1			
* 36	"O" Ring	4			
35	Plug – IInd Stage	1			
* 34A & 34B	Diaphragm (Ist & IInd Stage)	1 + 1			
33	Top Spring Washer	1			
32	Spring Casing – Ist Stage	1			
31A & 31B	Set Screw (Ist & IInd Stage)	1 + 1			
30	Cap – IInd Stage	1			
29	Spring Casing – II Stage	1			
28A & 28B	Main Spring (Ist & IInd Stage)	1 + 1			
27A & 27B	Seat (Ist & IInd Stage)	1 + 1			
* 26	Disc – II Stage	1			
* 25	Disc – I Stage	1			
24	Pilot Body	1			
23A & 23B	Bottom Spring (Ist & IInd Stage)	1 + 1			
22	Inlet Adaptor	1			
20	Plug Rod Guide Piece	1	66	Tension washer	---
19	Bolt	1	65	Bolts	---
18	Plug Rod	1	64	Tension washer	---
16	Spring	1	63	Nuts	---
15	Guide piece	1	62	Studs	---
14	Allen bolts	-----	61	Nut s	---
13	Top Casing	1	60	Stud	---
12	Diaphragm Washer	1	59	Tension washer	---
11	Diaphragm Plate	1	58	Nut	---
* 10	Diaphragm	1	57	Bolt	---
9	Bonnet	1	56	Nozzle	1
* 8.0 – 8.15	'O' rings	1	55	Diaphragm plate holder - II	1
7	Plug Guide	1	54	Diaphragm plate holder - I	1
6	Bottom Casing	1	53	Piston guide	1
5	Plug	1	52	Piston	1
4	Support plate	1	51	Indicator guide	1
* 3	Molded Seat	1	50	Indicator rod	1
2	Bottom	1	*49	Teflon ring	2
1	Body	1	48	Tension washer	-----
SR. NO.	**DESCRIPTION**	**QTY.**	**SR. NO.**	**DESCRIPTION**	**QTY.**
BILL OF MATERIAL (Regulator & Pilot Valve –I)					

(*) Marked parts are included in "Spare part kit" recommended as stock.

SERIES D53 PILOT VALVE



ITEM	DESCRIPTION	MATERIAL	QTY.
21	PILOT BODY	STAINLESS STEEL	01
22	TOP COVER	STAINLESS STEEL	01
*23	PISTON	STAINLESS STEEL	01
26	LOCKING CAP	STAINLESS STEEL	01
27	UNION PIECE	STAINLESS STEEL	01
28	BOTTOM	STAINLESS STEEL	01
29	DIAPHRAGM PLATE I & II	STAINLESS STEEL	01
*30	SOFT SEAT DISC	NITRILE	01
31	SPRING	SPRING STEEL	01
*32	DIAPHRAGM I & II	NITRILE	01
33	BOTTOM SPRING WASHER	STAINLESS STEEL	01
34	TOP SPRING WASHER	STAINLESS STEEL	01
35	ACTUATOR	STAINLESS STEEL	01
*36	'O' RING	NITRILE	01
37	BOLTS	STAINLESS STEEL	--
37A	BOLTS	STAINLESS STEEL	--
38	LOCK NUT	STAINLESS STEEL	01
39	TENSION WASHER	STAINLESS STEEL	01
41	CAP	STAINLESS STEEL	01
42	SET SCREW	STAINLESS STEEL	01

(*) Marked parts are included in "Spare part kit" recommended as stock.

Figure 15A: TYPE : DNP9 & DNP10 - FOR SET PRESSURE 25.0 BARG. – 50.0 BARG.

Maintenance Procedure is laid down for changing the spare parts, assembly and reassembly of the SERIES D53 Regulator & Pilot. Preventative Maintenance recommended to be carried out during plant shut down.

CAUTION !!!
Before maintenance depressurize the Regulator assembly completely;
Ensure that the upstream and downstream lines are isolated & pressure is zero.

INITIAL OPERATIONS

Following steps should be carried before proceeding with any maintenance procedure.

1) Disconnect all the sensing lines connected to the pilot and main regulator by unscrewing the compression fittings.
2) It is recommended to put reference markings on the tubing and fittings before disassembly, to prevent positioning problems while reassembling.
3) Separate out the pilot from main regulator by loosening the bolts of the bracket.

7.2 REGULATOR MAINTENANCE

(Refer Fig.14A.)

7.2.1. Disassembly of Diaphragm Unit

a. Loosen the fasteners (57,58,59) fixing the diaphragm top casing (13) with bottom casing (6)
b. Separate the top casing (13) from bottom casing (6) and ensure indicator rod doesn't get damaged.
c. Next carefully remove the indicator rod (50) from indicator guide (51).
d. Remove piston (52) from piston guide (53).
e. Next loosen the piston guide (53) from plug rod (18) and unscrew it completely.
f. Remove whole diaphragm assembly from plug rod (18).
g. Remove the Allen screws (46) holding the diaphragm plate holder I & II (54,55) .
h. Separate the diaphragm plate holder I & II, (54,55) with removing diaphragm plate (11) and diaphragm washer (12).
i. Remove the diaphragm (10).
j. Clean all the disassembled metal parts followed by flushing the casing with dry compressed air.
k. Replace the polymer parts via; diaphragm,(10) O- Rings (8.4 , 8.5 , 8.6, 8.7) from the spare parts kit.
l. The O-Ring and sliding mechanism must be lubricated with a fine layer of silicon greases before reassembly, the polymer parts required greases to hold them in their position or slots and also make them softer.

7.2.2. Reassembly of Diaphragm Unit

a. Replace the 'O'-Ring (8.5, 8.6, 8.7) on top of plug rod (18), top piston (52), piston guide (53).
b. Reassemble the diaphragm (10) between diaphragm plate holder I & II, (54,55) with diaphragm plate (11) and diaphragm washer (12).
c. Tighten diaphragm plate holder I & II with Allen bolts (46) and ensure nozzle hole is aligned properly.
d. Insert the diaphragm assembly in plug rod (18) and tighten with piston guide (53).
e. Carefully reassembly the indicator rod (50) with indicator guide (51).

f. Reassembly the top cover (13) with bottom casing (6) and ensure that the diaphragm is correctly positioned with respect to the bottom casing (6).
g. Resemble and fix the hex bolt and nut (57,58,59)

7.2.3. Disassembly of Regulation unit (Plug assembly)

a. Loosen the Nuts (60) fixing bonnet (9) with main regulator body (1).
b. Lift up the diaphragm assembly from body appropriately by means of lifting arrangement on top casing (13).
c. Carefully remove the plug assembly from body (1).
d. Now loosen the Bolt (19) gradually till the spring (16) tension is fully released.
e. Remove the plug (5) from plug guide (7).
f. Next remove the plug guide (7) from the body (1) and remove the 'O' ring (8.13) & Teflon rings (49) form the respective groove.
g. Clean all the disassembled metal parts followed by flushing the body with dry compressed air.
h. Replace the molded seat (3) , if damaged.
i. Replace the polymer parts i.e. O-Rings (8.0, 8.11, 8.12, and 8.13) & Teflon rings (49) from the spare parts kit.

7.2.4. Reassembly of Regulation unit (Plug assembly)

a. Position the plug guide (07), plug (5) ,spring (16) and plug rod guide (20) correctly with plug rod (18).
b. Ensure the free movement of plug (5) within the plug guide (07).
c. Tighten the bolt (19) ensuring the correct initial compression of spring (16).
d. Place the plug guide (7) on body (9) by positioning the O-rings (8.11, 8.12).
e. Reassemble the bonnet (9) with plug assembly to body (01), by tightening the Nuts (60).

To check the **STEM SEALING,** follow; both the disassembly procedure 7.2.1 & 7.2.3 above. Remove the push rod (18) from bonnet (09) and guide piece (20). Change the O-ring (8.6, 8.10) from the push rod (18) . Place the push rod (18) in the guide piece (20) and ensure proper movement of push rod in guide. For reassembly follow the procedure 7.2.2 & 7.2.4 above.

7.2.5. Disassembly of Molded Seat from Body

a. Loosen & remove the nuts (63) from the body (01).
b. Now separate the bottom (02) from the body (01).
c. Next with the means of Allen key , unscrew the Allen screws (14) from the body (01) in criss-cross pattern , this will result in separation of support plate (04) from body (01).
d. Carefully remove the molded seats (03) from the body (01).
e. Clean all the disassembled metal parts followed by flushing with dry compresses air.
f. Replace the polymer parts i.e. 'O' rings (8.0, 8.15) from the spare part list.

7.2.6. Reassembly of Molded Seat

a. Lubricate and replace the 'O' ring (8.0) from the molded seat and (8.15) from the bottom (02).
b. Insert molded seat (03) on the recess provided on the body (01) and position the 'O' ring (8.0). Again insert another molded seat (03) in the way as shown in figure 14A / 14B.
c. Next clamp the molded seats (03) by means of support plate (04) and fix them by tightening the Allen screws (14) in criss-cross pattern.
d. Next align bottom (02) with body (01) and reassemble them by tightening the nuts (63) in criss-cross pattern.

7.3 PILOT MAINTENANCE

(Refer Figure 15 – TYPE DNP1)

7.3.1. Disassembly of I st Stage assembly

a. Loosen the fasteners (39,40) fixing spring casing (32) to pilot body (24).
b. Remove the spring casing (32) carefully ensuring that spring tension is released completely while loosening the fixing bolts. DO NOT DISTURB THE FACTORY SETTING OF SET SCREW (31A) DURING DISASSEMBLY.
c. Remove the diaphragm (34A) assembly along with spring (28A).
d. Loosen the seat (27A) using box type spanner.
e. Remove the seat (27A) carefully releasing the spring (23A) tension.
f. Remove the plug (37), disc (25), and spring (23A).
g. Clean all the disassembled metal parts followed by flushing the pilot body with dry compressed air.

7.3.2. Reassembly of Ist Stage assembly

a. Replace the polymer parts viz; disc (25), diaphragm (34A) from the spare part kit.
b. Place the disc (25), spring (23) & plug (37) in the position and tighten the seat (27A) gently using box spanner.
c. Ensure the movement of plug (37) inside the seat (27A) by pressing it.
d. Positioning the diaphragm (34A) assembly correctly with a pin ascertaining that hole in the diaphragm (34A) matching with hole in pilot body (24) and casing (32).
e. Reassemble the spring (28A) and spring casing (32).
f. Tighten the fasteners fixing the spring casing (32) to pilot body (24).

7.3.3. Disassembly of IInd Stage assembly

a. Unscrew & remove the cap (30) from the spring casing(29)
b. Turn the set screw (31B) anticlockwise and loosen it completely and ensure spring tension (28B) is released.
c. Loosen the fasteners (39) fixing spring casing (29) to pilot body (24).
d. Remove the spring casing (29) along with spring (28B) and spring washer (33).
e. Remove the diaphragm (34B) assembly.
f. Loosen the seat (27B) using pliers fitted in the slots provided on seat.
g. Remove the seat (27B) carefully until the spring (23) tension is released.
h. Remove the plug (35), disc (26), and spring (23A).
i. Clean all the disassembled metal parts followed by flushing the pilot body with dry compressed air.

7.3.4. Reassembly of II nd Stage assembly

a. Replace the polymer parts i.e. disc (26), diaphragm (34B), O-rings (36) from the spare part kit.
b. Place the disc (26), spring (23) & plug (35) in the position and tighten the seat (27B) gently using pliers.
c. Ensure the movement of plug (35) inside the seat (27B) by pressing it.
d. Reassemble the diaphragm (34B) assembly, spring (28B), spring washer (33) and spring casing (29).
e. Tighten the fasteners fixing the spring casing (29) to pilot body (24).
f. Put the set screw (31B) in place and adjusting the set screw for the required pressure and tighten the lock nut (44) also refer start-up settings 1.4.
g. Place the cap (30) at its position

To clean or replace the Filter Mesh (41) in the pilot, unscrew inlet adaptor (22) from the body (24). Remove the filter, clean it with compressed air or replace it and tighten the adaptor (22) by properly positioning the filter inside the body.

7.3.5. Refer Figure 15A: DNP9 Type Pilot valve

1st stage - Replacing Diaphragm & Soft seat

a. Disconnect all feed and sensing line connections from the Pilot & Regulator by unscrewing the fittings.
b. Separate the Pilot assembly from the regulator by slackening the fittings.
c. Unscrew cap (41) and loosen screw (42) until all the spring tension is released.
d. Loosen the fasteners (37) and remove Bottom (28) along with spring (31) and top spring washer (34).
e. Unscrew the lock nut (38) and remove diaphragm (32) along with diaphragm plate (29) from union piece (27).
f. Next , loosen the fasteners (37A) and remove top cover (22) from the pilot body (21) along with spring (31)
g. Unscrew the locking cap (26) , remove diaphragm plate (29) along with diaphragm (32) from the union piece (27)
h. Next by unscrewing, remove piston assembly, comprising of piston (23) & spring (31).
i. Replace piston assembly, diaphragm (32), if necessary.
j. Replace 'O' ring (36)
For re-assembly, reverse the above sequence.

7.3.6. Refer Figure : DNP10 Type Pilot valve

2nd stage – Replacing Diaphragm & Soft seat

k. Disconnect all feed and sensing line connections from the Pilot & Regulator by unscrewing the fittings.
l. Separate the Pilot assembly from the regulator by slackening the fittings.
m. Unscrew cap (41) and loosen screw (42) until all the spring tension is released.
n. Loosen the fasteners (37) and remove Actuator (35) along with spring (31) and top spring washer (34) & Bottom spring washer (33).
o. Unscrew the lock nut (38) and remove diaphragm (32) along with diaphragm plate (29) from union piece (27).
p. Next , loosen the fasteners (37A) and remove top cover (22) from the pilot body (21) along with spring (31)
q. Unscrew the locking cap (26) , remove diaphragm plate (29) along with diaphragm (32) from the union piece (27)
r. Next by unscrewing, remove piston assembly, comprising of piston (23) & spring (31).
s. Replace piston assembly, diaphragm (32), if necessary.
t. Replace 'O' ring (36)
For re-assembly, reverse the above sequence.

SLAM SHUT OFF DEVICE

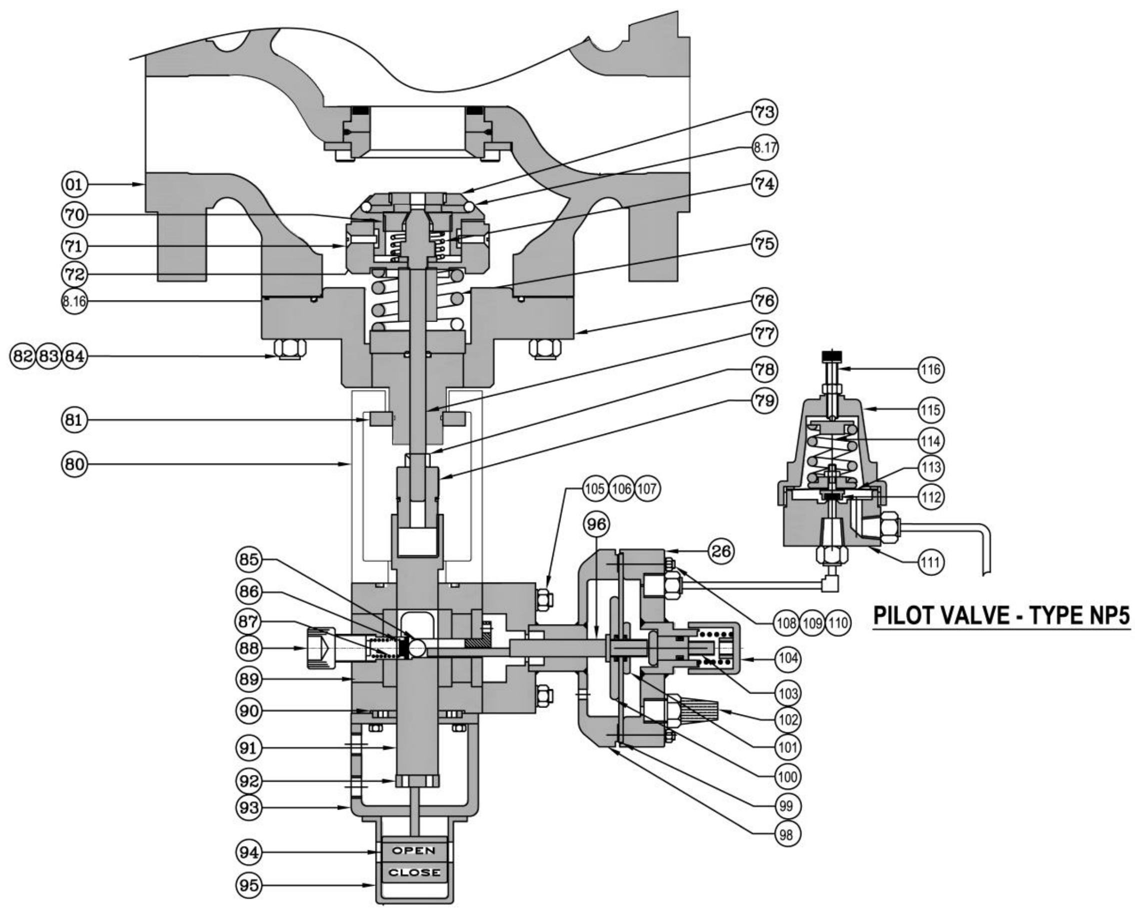


Figure 16

PART LIST (SLAM SHUT OFF DEVICE)

116	Set screw	1
115	Spring casing	1
114	Spring	1
* 113	Diaphragm	1
* 112	Plug	1
111	Pilot – DNP5 body	1
110	Tension washer	--
109	Nuts	--
108	Studs	-----
107	Tension washer	-----
106	Nuts	-----
105	Studs	-----

104	Knob	1
103	Push Button rod	1
102	Silencer	1
101	Diaphragm washer	1
100	Diaphragm plate	1
99	Diaphragm	1
98	Bonnet	1
97	Top casing	1
96	Push rod	1
95	Indicator Cap	1
94	Indicator	1
93	Cap	1
92	Support plate	1
91	Rack	1
90	Support piece –I	1
89	Pilot- DNP4 Body	1
88	Allen bolt	----
87	Spring	1
86	Spring washer	1
85	Ball	1
84	Tension washer	-----
83	Nuts	-----
82	Studs	----
81	Lock Nut	1
80	Yoke	1
79	Connector	1
78	Lock nut	1
77	Plug rod	1
76	Top cover	1
75	Main Plug Spring	1
74	Spring	1
73	Plug Cap	1
72	Countersunk Screw	1
71	Plug	1
70	Balancing Seat	1
* 8.19	Disc	1
* 8.17	'O' ring	1
* 8.16	'O' ring	1
01	Body	1
SR. NO.	**DESCRIPTION**	**QTY.**
BILL OF MATERIAL (Slam Shut Off Device Assembly)		

(*) Marked parts are included in "Spare part kit" recommended as stock.

7.4 SLAM SHUT OFF DEVICE MAINTENANCE

(Refer Fig.16.)

7.4.1. Disassembly of Main Valve unit (Plug assembly)

a. Loosen the nuts (83) fixing the top cover (76) with body (01).
b. Carefully separate the top cover (76) from body (01).
c. Unscrew the plug cap (73) from the plug assembly by turning it in the anti-clockwise direction.
d. Next remove the 'O'ring (8.17) from the plug holder (70)
e. Now unscrew & remove the countersunk screws from the plug assembly.
f. Gradually remove the plug holder (70) from plug (71) , this will result in removal of disc (8.19) , balancing seat (69) , spring (74)
g. Clean all the disassembled metal parts followed by flushing the body & top cover with dry compressed air.
h. Replace the polymer parts i.e.; Disc (8.19), O-ring (8.16,8.17) from the spare parts kit.

The O-Rings and sliding parts must be lubricated with a fine layer of silicone grease before reassembly, the polymer parts require grease to hold them in their positions or slots and also make them softer.

7.4.2. Reassembly of Main Valve unit (Plug assembly)

a. Re-fit the spring (74) on the plug (71)and lock in position by screwing the balancing seat (69).
b. Place the disc (8.19) on the plug holder groove and insert it in the plug (71) and fix in position by tightening the countersunk screws.
c. Next place the 'O' ring (8.17) on the plug holder (70) and tighten it by screwing the plug cap (73)
d. Replace the 'O ring (8.16) between the top cover (76) and body (01).
e. Reassemble the top cover (76) to body (01) by tightening the fasteners (83,84)

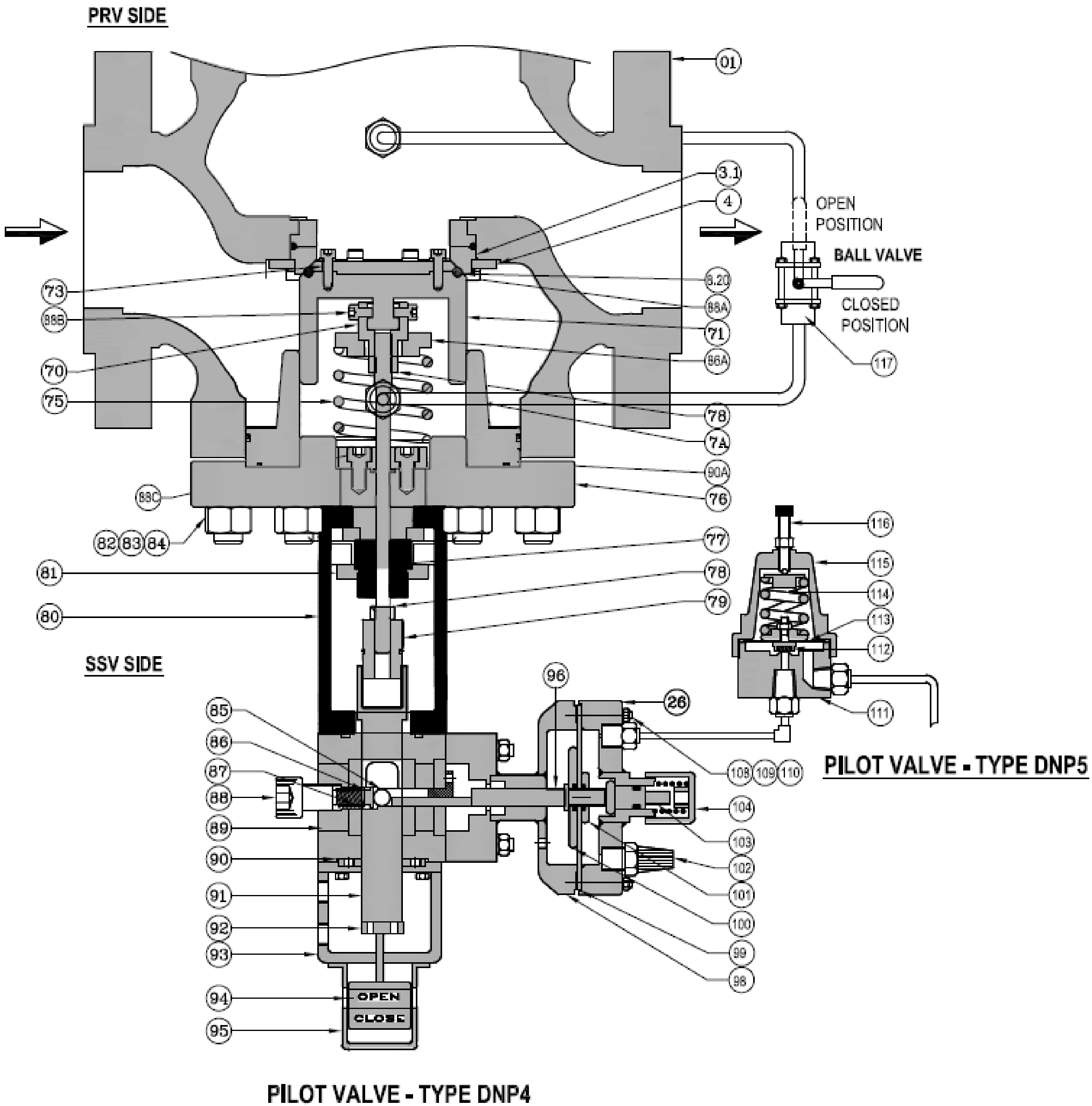
7.4.3. Disassembly of sensing element (Pilot-III assembly)

a. Turn the set screw (116) anticlockwise and loosen it completely to ensure the release of spring (114) tension.
b. Unscrew the spring casing (115) to detach it from body (111).
c. Remove the spring (114) and diaphragm (113) assembly.
d. Loosen the nut fixing diaphragm (113) with plug (112).
e. Remove the washer on diaphragm (113).
i. Clean all the disassembled metal parts followed by flushing the pilot body & casing with dry compressed air.
f. Replace the polymer parts i.e. Diaphragm (113) & plug (112) from the spare parts kit.

7.4.4. Reassembly of sensing element (Pilot-III assembly)

a. Reassemble the plug (112) & diaphragm (113) fixing with washer & nut.
b. Position the plug (112), diaphragm (113) assembly inside the body (111) correctly.
c. Place the spring (114) over the diaphragm assembly.
d. Tighten the spring casing (115) by screwing it to body (111).
e. Put the set screw (116) in place for adjusting the pressure.

SLAM SHUT OFF DEVICE



	116	Set screw	1
	115	Spring casing	1
	114	Spring	1
*	113	Diaphragm	1
*	112	Plug	1
	111	Pilot – DNP5 body	1
	110	Tension washer	--
	109	Nuts	--
	108	Studs	-----
	107	Tension washer	-----
	106	Nuts	-----
	105	Studs	-----
	104	Knob	1
	103	Push Button rod	1
	102	Silencer	1
	101	Diaphragm washer	1
	100	Diaphragm plate	1
	99	Diaphragm	1
	98	Bonnet	1
	97	Top casing	1
	96	Push rod	1
	95	Indicator Cap	1
	94	Indicator	1
	93	Cap	1
	92	Support plate	1
	91	Rack	1
	90A	Support piece –I	1
	89	Pilot- DNP4 Body	1
	88A,88B,88C	Allen bolt	----
	87	Spring	1
	86,86A	Spring washer	1
	85	Ball	1
	84	Tension washer	-----
	83	Nuts	-----
	82	Studs	----
	81	Lock Nut	1
	80	Yoke	1
	79	Connector	1
	78,78A	Lock nut	1
	77	Plug rod	1
	76	Top cover	1
	75	Main Plug Spring (SSV Side)	1
	74	Spring	1
	73	Plug Cap	1
	72	Countersunk Screw	1
	71	Plug	1
	70	Balancing Seat	1
*	8.19	Disc	1
*	8.17	'O' ring	1
*	8.16	'O' ring	1

7A	Plug guide	
4.0	Support plate	
3.1	Seat (SSV seat)	
3.0	Seat (PRV Molded seat)	
01	Body	1
SR. NO.	**DESCRIPTION**	**QTY.**
BILL OF MATERIAL (Slam Shut Off Device Assembly)		

(Refer Fig.16.)

7.4.1. Disassembly of Main Valve unit (Plug assembly)

j. Loosen the nuts (83) fixing the top cover (76) with body (01).
k. Carefully separate the top cover (76) from body (01).
l. Unscrew the plug cap (73) from the plug assembly by turning it in the anti-clockwise direction.
m. Next remove the 'O'ring (8.17) from the plug holder (70)
n. Now unscrew & remove the countersunk screws from the plug assembly.
o. Gradually remove the plug holder (70) from plug (71) , this will result in removal of disc (8.19) , balancing seat (69) , spring (74)
p. Clean all the disassembled metal parts followed by flushing the body & top cover with dry compressed air.
q. Replace the polymer parts i.e.; Disc (8.19), O-ring (8.16,8.17) from the spare parts kit.

The O-Rings and sliding parts must be lubricated with a fine layer of silicone grease before reassembly, the polymer parts require grease to hold them in their positions or slots and also make them softer.

7.4.2. Reassembly of Main Valve unit (Plug assembly)

f. Re-fit the spring (74) on the plug (71)and lock in position by screwing the balancing seat (69).
g. Place the disc (8.19) on the plug holder groove and insert it in the plug (71) and fix in position by tightening the countersunk screws.
h. Next place the 'O' ring (8.17) on the plug holder (70) and tighten it by screwing the plug cap (73)
i. Replace the 'O ring (8.16) between the top cover (76) and body (01).
j. Reassemble the top cover (76) to body (01) by tightening the fasteners (83,84)

Following are the minimum Tools required to carry out maintenance and operation of unit.

7.5. LIST OF RECOMMENDED TOOLS

7.5.1 FOR MAIN VALVE.

SR. NO.	MODEL	TOOL	PICTURE	SPANNER SIZE
1		Allen Key		M4
2		Allen Key		M3
3		Open Spanner		16 – 17
4	**MAIN VALVE**	Box Spanner		M19
5		Open Spanner		18 - 19
6		Open Spanner		24 – 27
7		Open Spanner		20 - 22

7.5.2 FOR PILOT VALVE.

FOR USE PILOT VALVE					
SR. NO.	**VALVE SIZE**	**FASTNERS**	**SIZE**	**PICTURE**	**SPANNER SIZE**
1		SEAT	HEX32		BOX SPANNER-32
2		CAP	M10		16-17
3		SET SCREW	M12		18-19
4	D53 -PILOT	GRUB SCREW	M6		ALLEN KEY-3
5		LOCK NUT	M8		12-13
6		LOCK NUT	M12		18-19
7		BOLT	M10		16-17

FINAL OPERATIONS

Following steps should be carried after carrying out the maintenance.

1) Mount the pilot on main regulator by fixing the bolts of the bracket.
2) Reconnect all the sensing lines connected to the pilot and main regulator by screwing in the compression fittings.
3) Lastly follow the procedure detailed in 4.2 for charging the gas and leak test.

CAUTION !!!
The vent connection provided in the pilot valve spring casing should be free from blockages.

After adjusting the set pressure lock the set screw by lock nut and put the cap over set screw.

8.0 LIST OF RECOMMENDED SPARES

8.1 REGULATOR UNIT

Table 7. (Refer Fig. 14 & 15.)

MAIN REGULATOR			PILOT TYPE : DNP1		
PART NO.	DESCRIPTION	QTY.	PART NO.	DESCRIPTION	QTY.
3	Molded seat	1	25	Disc (Ist Stage)	1
8	'O' ring	14	26	Disc (IInd Stage)	1
10	Diaphragm	1	34A & 34B	Diaphragms	2
49	Teflon Rings	14	36	O-Rings	4
			41	Filter Mesh	1

Table 8 (Refer Fig. 15)

MAIN REGULATOR			PILOT TYPE : DNP9 & DNP10		
PART NO.	DESCRIPTION	QTY.	PART NO.	DESCRIPTION	QTY.
3	Molded seat	1	23	Piston	1
8	'O' ring	14	30	Soft seat disc	1
10	Diaphragm	1	32	Diaphragms (Ist & IInd Stage)	2
49	Teflon Rings	14	36	O-Rings	4

8.2 SLAM SHUT OFF DEVICE

Table 9 ***(Refer Fig.16.)***

MAIN UNIT			PILOT		
PART NO.	DESCRIPTION	QTY.	PART NO.	DESCRIPTION	QTY.
10	Soft seating Disc	1	27	Pilot-I Diaphragm	1
15	Set of "O" Rings	6	47	Pilot-II Plug	1
			48	Pilot-II Diaphragm	1

WHILE INQUIRING FOR SPARE PARTS, PROVIDE FOLLOWING DETAILS:
Type of regulator
Unit no. (Serial no.) **& Year of manufacture**
Slam-shut (if assembled)
Part no.
Quantity desired
Technical Manual (this document) reference i.e. MD53(FC)/05/2017/R2

***Note* : Disposal of Products / Parts**

"The products or parts thereof are to be disposed–off in accordance with existing Government / Federal / State & local environment control regulations at authorized recycler regulations prevailing at location of use / disposal."

ANNOTATIONS

The contents of this publication are presented for informational purpose and while every care has been taken to ensure their accuracy, they are not be constructed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. We reserve the right to modify the designs or specifications of the products at any time without notice.

For any assistance please contact us; our contact details are given under.

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CR-02, CREEP RELIEF VALVE

Instruction Manual

FIGURE 1: CR-02, CREEP RELIEF VALVE

PRODUCT DESCRIPTION

Designed for Pressure regulators control, this Creep Relief valve is a single staged, diaphragm operated for gas pressure regulator.

TECHNICAL SPECIFICATION

- **Valve size**: 1/4" and 1/2"
- **Body Rating**: Up to Class 300#
- **End connection:** Screwed (NPT)
- **Set pressure range**: 1.0 – 5.0 barg.
  5.0 – 10.0 barg.
  6.0 – 15.0 barg.
  10.0 – 25.0 barg.
- **Temperature capabilities** : -20°C to 60°C

STANDARD MATERIAL OF CONSTRUCTION

- **Pilot valve Body** : Stainless Steel
- **Actuator** : Stainless steel
- **Diaphragm** : Nitrile
- **Valve disc** : Nitrile
- **Spring** : Spring steel
- **Diaphragm plate** : Stainless steel
- **Set screw** : Stainless Steel

Note: - Other M.O.C and Polymer on request.

INSTALLATION

a. Check the data on the Name plate and verify the parameters are compatible with actual working conditions.

b. Install in regulation with regulator instruction manual

c. Before servicing, cut-off valve inlet and outlet and release any trapped pressurized gas. Use suds to check that there are no leaks.

MAINTENANCE

Replacing Diaphragm & Plug

SR.NO	DESCRIPTION	MATERAIL	QTY
1	BODY	STAINLESS STEEL	1
2	ACTUATOR	STAINLESS STEEL	1
3	PLUG	NITRILE	1
4	DIAPHRAGM PLATE	STAINLESS STEEL	1
5	SPRING WASHER	STAINLESS STEEL	1
6	SET SCREW	STAINLESS STEEL	1
7	SPACER	BRASS	1
8	LOCKNUT	STAINLESS STEEL	1
9	SPRING	SPRING STEEL	1
10	DIAPHRAGM	NITRILE	1
11	NYLON LOCK NUT	STAINLESS STEEL	1
12	PLUG HOLDER	STAINLESS STEEL	1
13	SPLIT PIN	STAINLESS STEEL	1

a. De – Pressurize the valve & unscrew the Set screw (06) along with lock Nut (08) to de-energize spring (09) tension.
b. Separate Actuator (02) from Body (01) by rotating Actuator (02) in anti-clock wise direction.
c. Remove Spring washer (05), spring (09) from Diaphragm plate (04).
d. Separate Diaphragm assembly along with Plug with assembly from body (01) along with Spacer (07).
e. Loosen Nylon locknut (11), and remove Diaphragm Plate (04) and Diaphragm (10) from Plug Holder (12) and replace new Diaphragm.
f. Remove Plug (03) from Plug Holder (12) by removing Split Pin (13) and replace new Plug from spares.
   For Re-assembly, reverse the above sequence.

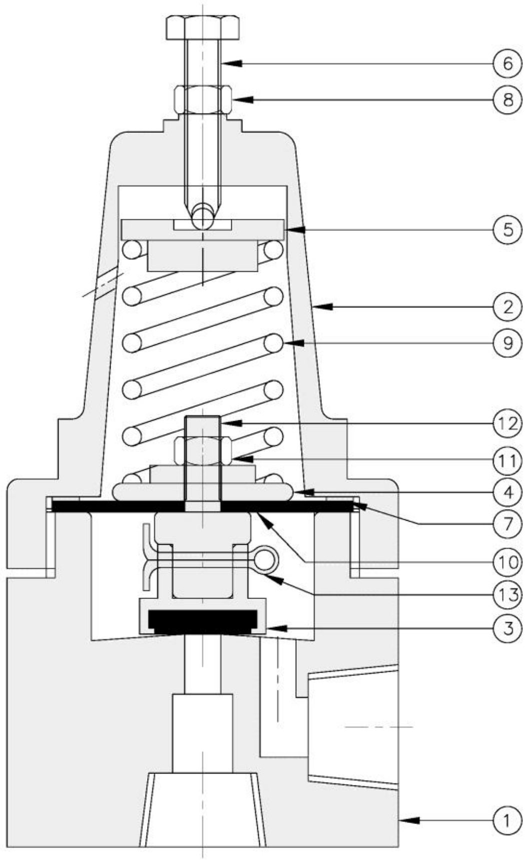

FIGURE 2: CR-02, CREEP RELIEF VALVE

DIMENSIONS

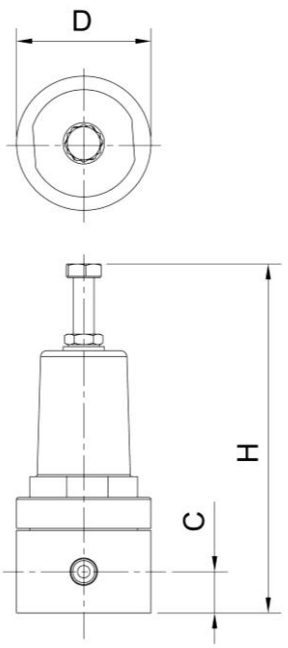

FIGURE: 3

Note: Dimensions are in "mm"

CR – 02, Creep Relief Valve	
C	20.0
D	65.0
H	170.0
Weight	1.9 kg

***Note** : Disposal of Products / Parts*

"The products or parts thereof are to be disposed–off in accordance with existing Government / Federal / State & local environment control regulations at authorized recycler regulations prevailing at location of use / disposal."

For any assistance contact us, on details as given under,

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Crosby Style JOS-E, JBS-E, JLT*-JBS-E, JLT*-JOS-E Valves
Installation and Maintenance Instructions

CROSBY

These instructions must be fully read and understood before beginning maintenance.

Attention

The safety of lives and property often depends on the proper operation of the pressure relief valves. Consequently, the valves should be kept clean and should be periodically tested and reconditioned to make sure they function properly.

Warning

Suitability of the material and product for the use contemplated by the buyer is the sole responsibility of the buyer. Also storage, installation and proper use and application are the sole responsibility of the purchaser. Tyco Valves & Controls disclaims any and all liability arising out of same.

Any installation, maintenance, adjustment, repair and testing performed on pressure relief valves should be done in accordance with the requirements of all applicable Codes and Standards under which those performing such work should maintain proper authorization through appropriate governing authorities.

No repair, assembly and test work done by other than Tyco Valves & Controls shall be covered by the warranty extended by Crosby to its customers. You assume full responsibility for your work. In maintaining and repairing Crosby products you should use only parts manufactured by Tyco Valves & Controls. Call your nearest TV&C regional sales office or representative for a Crosby service engineer should you wish assistance with your field needs.

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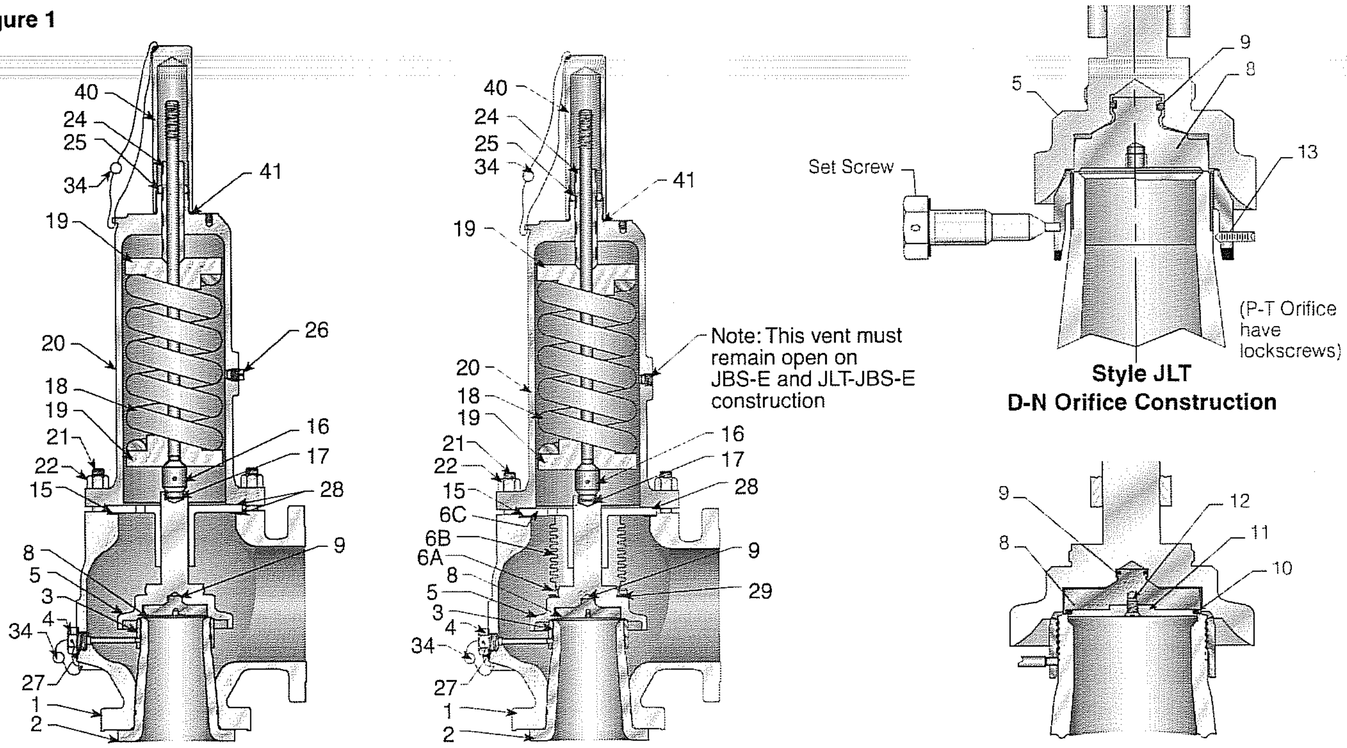
tyco Flow Control

Engineering Doc. #ISV3137B

Figure 1



Style JOS-E

Style JBS-E

Soft Seat

Parts List

No.	Part Name	Notes
1	Body	
2	Nozzle	
3	Nozzle Ring	3
4	Set screw	3, except P-T Orifice JLT
4A	Set Screw	3, (M-T Orifice)
4B	Set Screw Rod	3, (M-T Orifice)
4C	Set Screw Pin	3, (M-T Orifice)
5	Disc Holder	2
6A	Bellows Tailpiece	2
6B	Bellows	2
6C	Bellows Flange	2
8	Disc Insert	1
9	Retention Clip	1
10	O-ring	1
11	O-ring Retainer	2
12	Retainer Screw(s)	2
13	Nozzle Ring Lockscrew	P-T Orifice JLT
14	Set Screw Plug	P-T Orifice JLT (not shown)
15	Guide	3
16	Spindle	3
17	Spindle Cotter Pin	1 (L-T Orifice)
18	Spring	3
19	Spring Washers	3
20	Bonnet	
21	Bonnet Stud	
22	Bonnet Stud Nut	
24	Adjusting Bolt	
25	Adjusting Bolt Nut	
26	Pipe Plug	
27	Set Screw Gasket	1
28	Guide Gasket	2
29	Tailpiece Gasket	1
34	Seal and Wire	
35	Seal Clip (not shown)	
36	Nameplate (not shown)	
40	Screwed Cap	
41	Cap Gasket	1
	Gasket Kit	1, 4

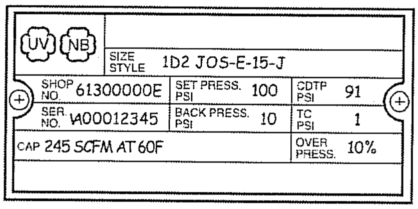
Notes:

1. Consumable Spare Parts: Valve parts which should be replaced as part of any disassembly, and discs and disc inserts which must be replaced if seats are damaged.
2. Repair Spare Parts: Valve parts exposed to wear and/or corrosion during normal operation. They are in fluid flow paths and may require replacement as part of any repair.
3. Insurance Spare Parts: Valve parts exposed to process or environmental wear and/or corrosion and may require replacement as part of a major repair. Tyco Valves & Controls recommends that sufficient inventory of spare parts be maintained to support process requirements. Always be sure to use genuine Crosby parts to ensure continued product performance and warranty.
4. Contains complete set of gaskets for all style of valves.

Engineering Doc. #ISV3137B

Figure 2

Sample Nameplate



Ordering Spare Parts

When ordering spare parts, the valve size, style and assembly number and/or serial number should be given together with set pressure, part name and reference number from page 2. The valve assembly number is shown on the valve nameplate as, "Shop Number." Spare parts may be ordered from any Tyco Valves & Controls Regional Sales Office or Representative.

Safety Precautions

Proper handling, storage, installation, maintenance and operation is essential to the safe and reliable functioning of any pressure relief product.

Precautionary statements in the form of warnings, cautions and notes are used throughout this instruction to emphasize important and critical factors where applicable.

Examples:

WARNING: An operating procedure or practice which if not strictly observed may result in injury to personnel or loss of life.

CAUTION: An operating procedure or practice which if not strictly observed may result in damage to or destruction of equipment.

These precautionary statements are by no means exhaustive.

Tyco Valves & Controls cannot be expected to know, evaluate, and advise customers of all the possible applications and operating conditions for its products or of the possible hazardous consequences which may result from the misapplication or misuse of such products.

Consequently, the improper handling, storage, installation, use or maintenance of any Tyco Valves & Controls Product by a non Tyco Valves & Controls employee may void any Tyco Valves & Controls guarantees or warranties with respect to such Product.

All personnel working with Tyco Valves & Controls products should be adequately trained and thoroughly familiar with the contents of the appropriate instruction manual(s).

Tyco Valves & Controls cannot evaluate all conditions in which the products may be used.

However, Tyco Valves & Controls offers the following general safety suggestions:

- Never subject valves to sharp impact loads.
  Rough handling (striking, bumping, dropping, etc.) may alter the pressure setting, deform valve parts and adversely affect seat tightness and valve performance. Striking a valve which is under pressure can cause premature actuation.
- Always lower the system pressure to the pressure level specified in the instruction before making any adjustment to the valve. Furthermore, always install a proper test rod to gag an installed valve before making any ring adjustments on the valve.
- Ear and eye protection should be used when working on a valve which has pressure.
- Never stand in front of the discharge outlet of a pressure relief valve which is under pressure.
- Always stand to the side of and at a safe distance from the valve discharge and use extreme care when observing a valve for leakage.

The above precautions and suggestions are by no means exhaustive and the user should always approach and use any pressure relief valve with great care.

Operation, Installation and Safety Instructions are available at www.tycovalves.com or from your local Tyco Valves & Controls regional sales office or representative.

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1.0 Introduction

1.1 Crosby Style JOS-E/JBS-E pressure relief valves have been selected for installation because of their performance features, reliability and ease of maintenance.

Adherence to the installation and maintenance procedures specified herein will provide the utmost in safety, a minimum of maintenance, and a long service life. Crosby Style JOS-E, JBS-E and JLT-E Valves are manufactured in accordance with the requirements of Section VIII Pressure Vessels, ASME Boiler and Pressure Vessel Code. Style JOS-E is a conventional closed bonnet valve. Style JBS-E has a balanced bellows for minimizing the effect of back pressure.

Style JLT-E is a high performance valve designed specifically for liquid service. The JLT-E features patented contoured liquid trim in a standard JOS-E/JBS-E envelope.

2.0 Storage and Handling

2.1 Valves are often on hand at the job site months before they are installed. Unless properly stored and protected, valve performance may be adversely affected.

Rough handling and dirt may damage or cause misalignment of the valve parts. It is recommended that the valves be left in their original shipping containers and that they be stored in a warehouse or at a minimum on a dry surface with a protective covering until they are used.

3.0 Installation

3.1 Care in Handling

Pressure relief valves must be handled carefully and never subjected to sharp impact loads. They should not be struck, bumped or dropped. Rough handling may alter the pressure setting, deform valve parts and adversely affect seat tightness and valve performance.

When it is necessary to use a hoist, the chain or sling should be placed around the valve body and bonnet in a manner that will ensure that the valve is in a vertical position to facilitate installation. The valve should never be lifted or handled using the lifting lever inlet and outlet protectors should remain in place until the valve is ready to be installed on the system.

3.2 Inspection

Pressure relief valves should be visually inspected before they are installed to ensure that no damage has occurred during shipment or while in storage.

All protective material, sealing plugs and any extraneous material inside the valve body or nozzle must be removed.

The valve nameplate and other identifying tags should be checked to ensure that the particular valve is being installed at the location for which it was intended.

The valve seals protecting the spring setting and ring adjustments should be intact. If seals are not intact, the valve should be inspected, tested and seals properly installed before use.

3.3 Inlet Piping

Pressure relief valves should be mounted vertically in an upright position either directly on a nozzle from the pressure vessel or on a short connecting fitting that provides direct and unobstructed flow between the vessel and the valve. Installing a pressure relief valve in other than this recommended position might adversely affect its operation. Where rounded or beveled approaches cannot be provided ahead of the valve it is recommended that one size larger nozzle or fitting be used. A valve should never be installed on a fitting having a smaller inside diameter than the inlet connection of the valve.

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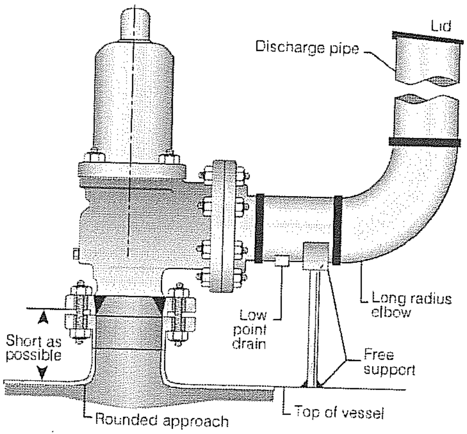
Figure 3
Recommended Installation
Discharging to Atmosphere



Inlet piping (nozzles) must be designed to withstand the total resultant forces due to the valve discharging at the maximum accumulated pressure and the expected piping loads. The magnitudes of the bending moment exerted on the inlet piping will depend on the configuration and method of supporting the outlet piping.

Many valves are damaged when first placed in service because of failure to clean the connections properly when installed. Both the valve inlet and the vessel and/or line on which the valve is mounted must be thoroughly cleaned of all foreign material. The inlet connection bolts or studs should be drawn down evenly to avoid straining the valve body with possible distortion of the nozzle flange or base.

3.4 Outlet Piping

Outlet piping should be simple and direct. Where possible, for non-hazardous fluids, a short discharge pipe or vertical riser connected through a long radius elbow venting directly to atmosphere is recommended. Such discharge piping should be at least the same size as the valve outlet.

All discharge piping should be run as direct as is practicable to the point of final release for disposal. Valve effluent must discharge to a safe disposal area.

Where discharge piping is long, due consideration shall be given to the use of long radius elbows, and the reduction of excessive line strains through the use of expansion joints and proper means of support to minimize line sway and vibration under operating conditions. Adequate drainage is required to prevent corrosive media from collecting in the discharge side of the pressure relief valve. When required, low point drains shall be provided in the discharge pipe. Particular care must be observed to ensure that the drains are directed or piped to a safe disposal area. In installations where the pressure relief valve discharges into a closed system, care must be taken to ensure that built up and superimposed back pressure has been properly calculated, specified, and accounted for when sizing and selecting the valve.

Where built up back pressure is expected to exceed 10% of set pressure or if superimposed back pressure is variable, a bellows valve is required.

4.0 Hydrostatic Pressure Tests

4.1 Hydrostatic Test of Vessel or System

When a pressure vessel or system is to be hydrostatically tested, it is recommended that the pressure relief valve be removed and a blank flange be installed in its place. This practice precludes the possibility of any damage to the pressure relief valve. Bent spindles and damaged valve seats are problems that can be caused by improper hydrostatic test procedures.

Blank flanges must be removed and the pressure relief valve reinstalled before the vessel is placed in service.

When the hydrostatic test must be performed with the valve in place, a test gag may be used. Crosby Style JOS-E/JBS-E valves are designed to accommodate test gags for use with each type of cap. In the case of the Type C cap with lifting lever, the lifting lever assembly must be replaced with a hydrostatic test cap and test rod prior to hydrostatic testing. When test rods are used, care must be exercised to prevent overtightening that could damage the valve spindle and valve seats. A test rod which is hand tight will generally provide sufficient force to hold the valve closed.

After the hydrostatic test, the test rod (gag) must be removed and replaced by either a cap plug or a cap not fitted with a test rod.

4.2 Hydrostatic Test of Outlet System

When a hydrostatic test must be conducted on the outlet piping system, with the valve in place, special consideration must be given not to exceed the design pressure limits of the downstream side of the pressure relief valve. The outlet side of a pressure relief valve is known as the secondary pressure zone. This zone is normally designed to a lower pressure rating than the inlet and frequently is designed to a lower pressure rating than the outlet flange. This is particularly true in the case of balanced bellows designs and in the larger valve sizes.

Consult Crosby products specifications for the back pressure design limits of the Style JOSE/JBS-E or JLT-E valves.

5.0 Setting, Testing and Adjustments

5.1 New Valves

Every new Crosby J series Pressure Relief Valve is fully tested and sealed prior to shipment. The external adjustment points of each valve are sealed to ensure that no changes have been made to the valve after shipment and that the valve has not been disassembled or tampered with. The seals and nameplates are your assurance that the valve has been built and tested to the applicable Codes and Standards and are the physical evidence of our product warranty.

All new Crosby J series valves are fully tested prior to shipment on the appropriate testing medium, so there is no need to pre-test the valve prior to installation. If pre-testing is required, in order to maintain the product warranty, a Crosby authorized service organization should be contacted to perform the testing. Contact your local sales representative or visit our website to locate the authorized service organization closest to your location. By choosing an authorized service organization to perform testing you can be assured that the correct testing procedure is followed which will save time and cost by avoiding possible valve damage caused by improper testing methods.

In any event, if pre-testing is to be performed, several important cautions should be observed.

First it is vital that the appropriate test fluid is used to test any valve. See Section 5.5. this will insure accuracy of the test results as well as avoid possible damage to the valve.

All Crosby J series valves are tested for seat tightness after the final set point test and shipment from the factory. If further seat tightness testing is required before installation, it is recommended that the test be performed prior to any set point verification testing. Repeated pressure testing of a metal seated valve can cause damage to the sealing surfaces leading to seat leakage

Testing on a low volume test stand requires specific testing techniques in order to ensure accurate test results and to avoid damage to the sealing surfaces of the valve. In many cases this requires temporary adjustment of the nozzle ring during the test as described in Section 5.8 and specifically in Section 5.8.1. For valves with set points in excess of 500 psig, it is recommended that when testing on a low volume test bench, the lift be temporarily restricted by use of a gag or other suitable device.

However, it is good practice to inspect the valve prior to installation.

This inspection determines any damage which may have occurred due to rough handling in transit or storage and initiates appropriate service records.

5.2 Reconditioned Valves

Valves which have not been in service for extended periods due to plant shutdown or long term storage, or valves which have been repaired or reconditioned, should also be tested before being put into operation.

5.3 Valves Removed From Service

Valves being removed from service should be tested on a shop test bench before being disassembled to determine the set pressure and seat tightness. This is an important phase of the maintenance routine and the test results should be recorded for review and determination of necessary corrective action.

CAUTION: Improper testing may cause valve damage and seat leakage.

The "as received from service" condition of a pressure relief valve is a most useful tool in establishing the proper time interval between inspections.

5.4 The Test Bench

The quality and condition of the shop test bench is paramount to obtaining proper test results. The test bench must be free of leaks and the test fluid must be clean. Solids or other foreign material in the test medium will damage the seating surfaces of the pressure relief valve being tested.

The test pressure gage must be calibrated and have a range proper to the pressure level of the valve setting. Set pressure should fall within the middle third of the dial range of the test gage. The test bench provides an accurate and convenient facility for determining valve set pressure and seat tightness. It does not duplicate all of the field conditions to which a pressure relief valve will be exposed while in service. It is not practical to attempt to measure relieving capacity or blowdown using a test bench.

5.5 Test Fluids – Set Pressure Test

The test fluid should be air or nitrogen for valves used on gas and vapor service and water for valves used on liquid service. Valves for steam service should be tested on steam. It may be necessary to make a correction to the adjusted set pressure to compensate for the difference in temperature of the test fluids (see appropriate instruction).

5.6 Valve Operation

Crosby Style JOS-E/JBS-E valves intended for compressible fluid service and tested with air or steam will open with a sharp clear popping action at the set point. Valves for liquid service tested with water are considered open when there is a continuous unbroken stream of liquid flowing from the valve.

5.7 Set Pressure Changes

Set pressure changes beyond the Crosby specified spring range will necessitate a change in the valve spring assembly consisting of the spring and two fitted spring washers. The new spring and washers must be obtained from Crosby and the valve must be reset and the nameplate restamped by an authorized valve repair facility.

5.8 Set Pressure Adjustment

Before making any adjustments, reduce the pressure under the valve seat to at least 10% below the stamped opening pressure. This will prevent seat damage due to turning of the disc on the nozzle seat and minimize the chance of an inadvertent valve opening. A strong (high) ring position is necessary to obtain a good clean popping action of the valve on air or gas with the limited volume available on the test bench.

5.8.1 (Not required for testing on liquid.) Remove the nozzle ring set screw and raise the nozzle ring until it touches the disc holder, then back it down two (2) notches. Exercise care in counting the number of notches moved so that the ring can be returned to its proper position following testing.

Moving the notches on the nozzle ring to the left will lower the nozzle ring.

Replace the nozzle ring set screw before each set pressure test. The set screw must engage one of the ring notches, being careful that it does not bear on the top of a tooth.

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5.8.2 Remove the cap or lifting lever following the instruction for valve disassembly. (See paragraph 6)

5.8.3 Loosen the adjusting bolt nut and turn the adjusting bolt clockwise to increase set pressure or counterclockwise to reduce set pressure.

5.8.4 Retighten the adjusting bolt nut following each adjustment.

5.8.5 Two or three consecutive valve openings at the same pressure are necessary to accurately verify the opening pressure.

5.8.6 Once the set pressure has been established, lower the nozzle ring to the installed ring position as indicated in Table 1 and replace the nozzle ring set screw as described above. Seal wire the adjusting bolt and adjusting ring set screw with identifying seals.

Table 1

Service	Orifice Size	Nozzle Ring Setting (Below highest lock position)
Styles JOS-E/JBS-E Pressure Relief Valve Recommended Nozzle Ring Settings		
Vapor and Gases	D through J	-5
	K through N	-10
	P through T	-15
Styles JLT-E Pressure Relief Valve Recommended Nozzle Ring Settings		
Liquids and Gases	D, E, and F	-2
	G, H, and J	-3
	K and L	-5
	M and N	-10
	P and Q (See Table 2)	
	R and T (See Table 2)	

Minus sign: indicates number of ring notches below starting position of nozzle ring which is the highest position with the valve closed (contact with disc holder)

5.9 Nozzle Ring Settings

The nozzle ring adjustment is made at the factory and resetting in service is seldom necessary. Should it be necessary to change blowdown or reduce valve simmer, the nozzle ring may be adjusted as follows: (See the next paragraph for P, Q, R and T Orifice Style JLT)

CAUTION: Should any adjustments be made while the valve is installed on a pressurized system, the valve should be gagged while ring adjustments are made.

5.9.1 Remove the nozzle ring set screw and insert a screwdriver to engage the ring notches.

5.9.2 Turning the ring to the right raises the ring, thereby increasing blowdown. Turning the ring to the left lowers the ring, thereby decreasing the blowdown.

5.9.3 Do not lower the nozzle ring to the point where the valve begins to have excessive simmer. Raising of the ring will reduce simmer.

5.9.4 The nozzle ring should not be moved more than two notches before retesting. When making adjustments, always keep count of the number of notches and the direction in which the nozzle ring is moved. This will permit returning to the original setting in case of error.

5.9.5 Style JLT
The Style JLT in the P, Q, R and T Orifice sizes is preset at the factory and cannot be externally adjusted in the field, since the special

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contoured skirt on the disc holder prevents engagement of the set screw with the nozzle ring. As a result the nozzle ring is not slotted and is held in place by three set screws. The position of the nozzle ring must be set prior to valve assembly as follows:

5.9.5.1 Screw the nozzle ring (3) on to the nozzle. The top of the nozzle ring should be below the nozzle seating surface.

5.9.5.2 Install the disc insert retention clip (9) onto the disc insert. Assemble the disc insert (8) and disc holder (5). The disc insert should snap into place using hand force only.

5.9.5.3 Lower the disc holder and disc insert carefully onto the nozzle.

5.9.5.4 Reach through the valve body outlet and turn the nozzle ring until it lightly touches the disc holder. This is the highest lock position.

5.9.5.5 Carefully remove the disc holder and disc insert from the valve.

5.9.5.6 Lower the nozzle ring (turn to the left) the total number of revolutions shown in Table 2.

5.9.5.7 Carefully tighten each of the set screws on the nozzle ring to hold the ring in position.

Table 2

JLT-E Orifice Size	Nozzle Ring Setting Total revolutions below highest lock position
P and Q	3/4 Revolution
R and T	1 Revolution

5.10 Cold Differential Test Pressure Adjustments

When a pressure relief valve is on a test bench at room temperature and atmospheric pressure, and is to be installed on a system operating at a higher temperature and/or a higher back pressure, a compensating adjustment is necessary. The test pressure required to have the valve open at the desired set pressure under actual service conditions is known as the cold differential test pressure.

5.10.1 Temperature Correction

When a Crosby Style JOS-E/JBS-E or JLT-E valve is set on air or water at room temperature and then used at a higher service temperature, the test pressure shall be corrected to exceed the set pressure using the temperature correction shown in Table 3.

Note: this table is not applicable to steam service valves.

Table 3

Relieving Temperature	% Excess Pressure
0-150°F	None
151-600°F	1%
601-800°F	2%
801-1000°F	3%

5.10.2 Back Pressure Correction

Conventional valves without balancing bellows set with atmospheric pressure at the outlet and intended for use under elevated constant back pressure conditions shall be adjusted so that the test pressure is equal to the set pressure minus the expected back pressure. See example below:

Set Pressure	100 psi
Constant Back Pressure	10 psi
Cold Differential Test Pressure	90 psi

In all instances, the spring should be selected based on the cold differential test pressure; in the example above, 90 psi. See sample nameplate on page 3 which shows how temperature and back pressure is indicated.

Table 4 – (JOS/JOS-E Style Only)

Orifice Size	Saturated Steam Set Pressure (max)
D, E, F, G, H, J, K, L	1500 psig
M	1100 psig
N, P	1000 psig
Q	600 psig
R, T, T_2	300 psig

5.10.3 Saturated Steam Correction Factors

Crosby Style JOS and JOS-E pressure relief valves that are used for saturated steam service and are within the set pressure limits established in Table 4 may be set on air at ambient temperature, provided the correction factors in Table 5 are applied to the valve set pressure.

Table 5 – Saturated Steam Service

Air Set Pressure Correction Factors at Ambient Temperature

Set Pressure (psig)	% Increase in Spring Set Pressure
15-400	3%
401-1000	4%
1001-1500	5%

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5.11 Seat Leakage Tests

Ambiguous terms such as "bubble-tight," "drop tight," "zero leakage" and "commercial tightness" are sometimes used to describe seat tightness. These terms, however, lack uniform definition and true practical meaning.

- Test Procedure
  API Standard 527 provides a standard for "commercial" tightness and has been adopted by industry and users in order to clarify testing methods and tightness criteria. This standard applies to flanged inlet nozzle type pressure relief valves.
- Test Apparatus
  A typical test arrangement for determining seat tightness for pressure relief valves per API Standard 527 is shown in Figure 4. Leakage is measured using a 5/16 inch OD tube with 0.035 inch wall. The tube end is cut square and smooth, is parallel to and 1/2 inch below the surface of the water. A snap-on type test clamp shown in Figure 5 is available.

Figure 4

Typical Test Arrangement

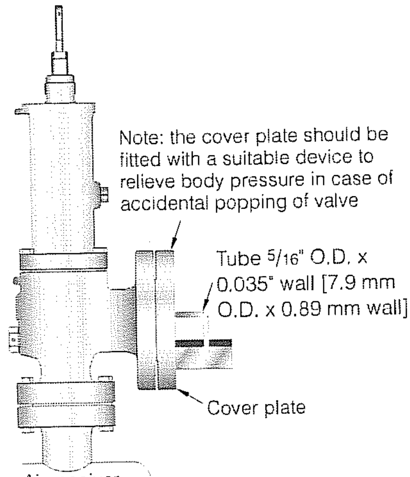
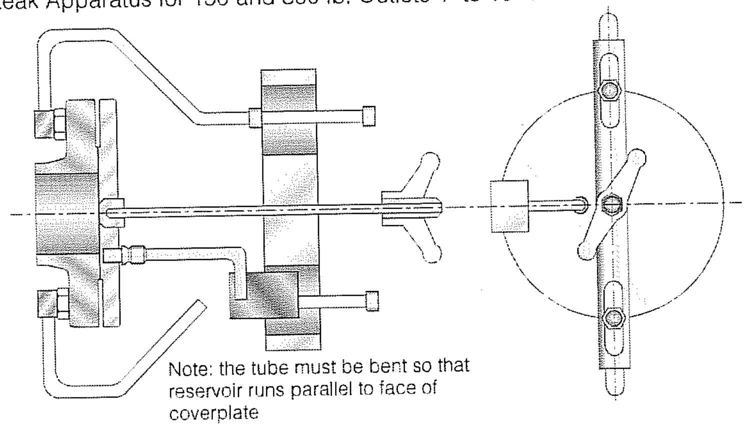


Figure 5

Seat Leak Apparatus for 150 and 300 lb. Outlets 1" to 10" Sizes



- Procedure
  With the valve mounted vertically, the leakage rate in bubbles per minute shall be determined with pressure at the pressure relief valve inlet raised up to and held at 90 percent of the set pressure (or cold differential test pressure – CDTP) immediately after popping. This applies except for valves set at 50 psig or below, in which case the pressure shall be held at 5 psig below the set pressure immediately after popping. The test pressure shall be applied for a minimum of one minute for valves of inlet sizes through 2"; two minutes for sizes 21/2", 3" and 4"; five minutes for sizes 6" and 8". Air (or nitrogen) at approximately ambient temperature shall be used as the pressure medium.
- Tightness Standard
  Metal-to-Metal Seated Valves. The leakage rate in bubbles per minute shall be observed for at least one minute and shall not exceed the values indicated in Table 6.

  Soft Seated Valves. For soft seated valves there shall be no leakage for one minute (zero bubbles for one minute).
- Crosby Seat Tightness Standard-Liquid Service Valves (Style JLT-E)

  Crosby liquid service pressure relief valves are checked for seat tightness by a quantitative seat leakage test.

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Table 6 – Maximum Seat Leakage Rate – Metal Seated Pressure Relief Valves

Set Pressure psig [barg]	Effective Orifice Sizes 0.307 In² and Smaller D, E & F			Effective Orifice Sizes Larger than 0.307 In² G Orifice and Larger		
	Max. Bubbles per Minute	Approximate Leakage Rate Per 24 Hours		Max. Bubbles per Minute	Approximate Leakage Rate Per 24 Hours	
		Standard Cubic Feet	Standard Cubic Meters		Standard Cubic Feet	Standard Cubic Meters
15-1000 [1.03-68.9]	40	0.6	0.017	20	0.3	0.0085
1500 [103.4]	60	0.9	0.026	30	0.45	0.013
2000 [137.9]	80	1.2	0.034	40	0.6	0.017
2500 [172.4]	100	1.5	0.043	50	0.75	0.021
3000 [206.8]	100	1.5	0.043	60	0.9	0.026
4000 [275.8]	100	1.5	0.043	80	1.2	0.034
5000 [344.8]	100	1.5	0.043	100	1.5	0.043
6000 [413.7]	100	1.5	0.043	100	1.5	0.043

All of the test fluid passing through an assembled valve is collected and measured per the following test procedure:

1. The inlet pressure is adjusted to a test pressure which is 90% of the Cold Differential Test Pressure. Valves set below 50 psig are tested at 5 psig below the cold differential test pressure.
2. The test pressure is maintained for a period of not less than ten minutes.

- Allowable Leak Rate
  The maximum allowable leakage rate should not exceed 10 cubic centimeters per hour per inch of diameter of nominal valve inlet size. For nominal valve sizes of 1 inch or less, the leakage rate shall not exceed 10 cubic centimeters per hour. For soft seated valves there shall be no leakage for one minute.
- Soft Seated Valves
  For exceptional seat tightness, Crosby offers an O-ring soft seat design. Refer to Figure 13.

  The Crosby soft seat design will provide a valve that has no visible leakage at a test pressure of 90 percent of the set pressure or cold differential test pressure. Soft seated valves are tested using the same test procedure used for metal-to-metal seated valves.

6.0 Valve Maintenance

CAUTION: Valves in hazardous fluid service and any other materials classified as dangerous must be neutralized immediately after removal from service.

6.1 Visual Inspection and Neutralizing

A visual inspection shall be made when valves are first removed from service. The presence of deposits or corrosion products in the valve and in the piping should be recorded and valves should be cleaned to the extent possible prior to disassembly. Check the condition of external surfaces for any indication of corrosive atmospheric attack or evidence of mechanical damage.

6.2 Disassembly

Crosby JOS-E/JBS-E valves should be disassembled as described below. Parts identification may be found in Figure 1 on page 2. The parts from each valve should be properly marked and segregated to keep them separate from parts used in other valves.

6.2.1 Remove the cap (40) and cap gasket (41). If the valve has a lifting lever device follow the instructions in Section 6.7.

6.2.2 Remove the nozzle ring set screw (4) and set screw gasket (27). Record the position of the nozzle ring (3) with respect to the disc holder (5) by counting the number of notches required to raise the ring until it just touches the disc holder. This information will be needed again when reassembling the valve. (Measure the revolutions for P, Q, R and T Orifice Style JLT. See Table 2)

6.2.3 Loosen the adjusting bolt nut (25). Before releasing the spring load, make note of the depth of the adjusting bolt in the bonnet and count the number of turns required to remove the spring load. This information will help when reassembling the valve to its approximate original setting.

6.2.4 Release all of the spring load by rotating the adjusting bolt (24) in a counterclockwise direction.

6.2.5 Remove the bonnet stud nuts (22).

6.2.6 Lift the bonnet (20) straight up to clear the spindle (16) and valve spring (18). Exercise care when lifting the bonnet as the spring and spindle will then be free to fall aside.

6.2.7 The spring and spring washers (19) can now be lifted off the spindle (16). The spring and spring washers are fitted together and must be kept together as a subassembly. Spring washers are not interchangeable between ends of the spring.

6.2.8 Remove the spindle, guide (15), disc holder and disc insert (8). For balanced bellows valves (Style JBS-E and JLT-JBS-E) special care must be taken not to damage the bellows subassembly (6). If parts are difficult to remove, due to the presence of corrosive or foreign materials, soaking in a suitable solvent may be required.

6.2.9 Remove the spindle from the disc holder.

6.2.10 Lift the guide off the disc holder.

6.2.11 Disc Insert Removal

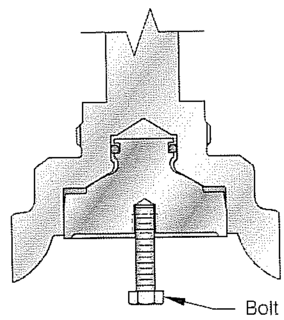
Note: For removal of threaded inserts supplied with JOS/JBS valves, see IS-V3137A.

- Orifice Sizes D through M (Metal Seats)
  Screw a standard bolt into the tapped hole (see Table 7) in the face of the disc insert. Using hand force pull the bolt straight out. The disc insert with the retention clip (9) should come out with moderate force. If the valve has been in dirty service, it may be necessary to use a suitable solvent to aid in removal. If additional pullout force is required, a bolt with a T handle may be used. The method described below for Orifice sizes N through T may be used if necessary.
- Orifice Sizes N through T (Metal Seats)
  Safety precautions should be followed whenever heavy parts are being lifted or transported. Dropping disc holder assembly may dislodge the insert. The removal of the insert is accomplished by the use of a tool as shown in Figure 6. This tool consists of a rectangular steel bar which spans the outside diameter of the disc holder with a center hole through which the standard bolt can be inserted before screwing into the disc insert. A nut and washer is also required as shown. Tightening the nut with a wrench will exert a pulling force on the disc insert and cause it to be removed from the disc holder.
- Orifice Sizes D through K (O-ring Seats)
  The O-ring seat design for Orifice sizes D through K has a retaining screw in the center of the disc insert. A drilled and tapped hole (4-40 UNC) is provided in the center of the retaining screw for removal of the disc insert (Figure 7). Screw a standard bolt into the hole in the retaining screw. Using hand force pull the bolt straight out. The disc insert with the retention spring should come out with moderate force.

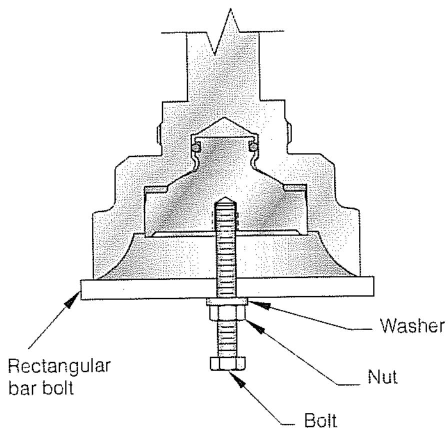
Table 7 – JOS-E/JBS-E Disc Insert Threaded Hole Sizes

Orifice Size	Thread Size
D & E	#10 - 24 UNC
F, G H	1/4 - 20 UNC
J, K, L	1/4 - 20 UNC
M, N, P, Q, R, T	3/8 - 16 UNC

Figure 6

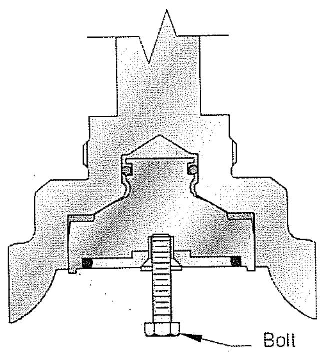


Remove Disc Insert by Pulling on Bolt



Remove Disc Insert by Turning Nut with Wrench

Figure 7



Remove Disc Insert by Pulling on Bolt

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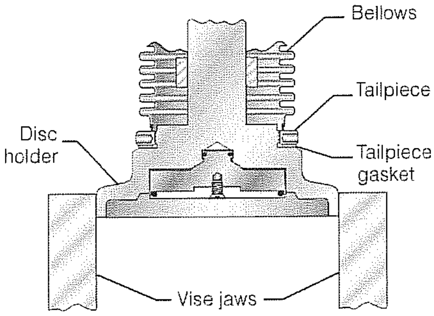
Figure 8



- Orifice Sizes L through T (O-ring Seats)
  Safety precautions should be followed whenever heavy parts are being lifted or transported. Dropping the disc holder may dislodge the insert. Remove the three retaining screws from the insert. Remove the retainer and O-ring seat. A tapped hole (refer to Table 7) is provided in the disc insert for insertion of a removal bolt. Follow instructions for metal seated insert removal.

6.2.12 For bellows valves only, place the disc holder in a vise (the larger sizes may require a 3-jaw vise) as shown in Figure 8. Using a suitable wrench unscrew the tailpiece and bellows from the disc holder.

6.2.13 Remove the nozzle ring (3) from the nozzle (2).

6.2.14 Remove the nozzle (2) from the valve body (1) if necessary. Unless the valve seat on the nozzle has been mechanically damaged or shows signs of corrosive attack, it will not be necessary to remove the nozzle. In most cases the nozzle can be reconditioned without removal from the valve body. To remove the nozzle, turn the valve body over taking care not to damage the bonnet studs (21). Turn the nozzle counterclockwise by using the wrench flats on the nozzle flange or a nozzle wrench designed to clamp onto the nozzle flange.

6.3 Cleaning

External parts such as the valve body, bonnet and cap should be cleaned by immersion in a bath such as hot Oakite solution or equivalent. These external parts may be cleaned by wire brushing, provided the brushes used do not damage nor contaminate the base metals. Only clean stainless steel brushes should be used on stainless steel components.

The internal parts such as the guide, disc holder, disc insert, nozzle ring and spindle should be cleaned by immersion in a commercial high alkaline detergent.

Guiding surfaces on the disc holder and guide may be polished using a fine emery cloth. The bellows and other metal parts may be cleaned using acetone or alcohol, then rinsed with clean tap water and dried.

6.4 Inspection

Check all valve parts for wear and corrosion. The valve seats on both the nozzle and disc insert must be examined to determine if they have been damaged. Most often, lapping the valve seats is all that is necessary to restore them to their original condition.

If the inspection shows that the valve seats are badly damaged, remachining will be necessary or it may be advisable to replace these parts. When the time element is a factor, it may be advantageous to replace damaged parts from spare parts stock, thereby permitting the replaced part to be checked and reworked at leisure. (See Figure 10 and Table 8 for critical dimensions.) The valve spring (18) should be inspected for evidence of cracking, pitting or deformation. The bellows (6B) in a Style JBS-E and JLT-JBS-E valve should be inspected for evidence of cracking, pitting or deformation that might develop into a leak.

The bearing surfaces on the guide and disc holder should be checked for residual product build up and any evidence of scoring. Inspection of valve components is important to ensure proper valve performance. Damaged valve parts must be repaired or replaced.

Spindle assemlies should be checked for excessive runout. For D to K orifice the total runout between the spindle point to top of the spindle rod should be less than 0.015 inch. For L orifice and larger it should be less than 0.030 inch.

Check and inspect all gaskets for evidence of damage (creases, gouges, cuts) or corrosion. Metal gaskets may be re-used if found to be undamaged. All organic fiber or soft gaskets should be replaced.

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6.5 Reconditioning of Valve Seats

The tightness of a valve and its proper operation depend directly on the condition of the seats. Many pressure relief valve problems are due to eroded or damaged seats.

The standard Crosby Style JOS-E/JBS-E/JLT-E valve is constructed with a flat metal-to-metal seat. It is important that seating surfaces be properly refurbished by lapping with a flat cast iron lap coated with the correct lapping compound.

6.5.1 Lapping Procedures

Unless the seats have been badly damaged by dirt or scale, lapping the seating surfaces should restore them to their original condition. Never lap the disc insert against the nozzle. Lap each part separately against a cast-iron lapping block of the proper size. These blocks hold the lapping compound in their surface pores and must be recharged frequently. Lap the block against the seat. Never rotate the block continuously, but use an oscillating motion. Extreme care should be taken throughout to make certain that the seats are kept perfectly flat. If considerable lapping is required, spread a thin coat of medium coarse lapping compound on the block. After lapping with the medium coarse compound, lap again with a medium grade compound. Unless much lapping is called for, the first step can be omitted. Next, lap again using a fine grade compound. When all nicks and marks have disappeared, remove all the compound from the block and seat. Apply polish compound to another block and lap the seat.

As the lapping nears completion, only the compound left in the pores of the block should be present. This should give a very smooth finish. If scratches appear, the cause is probably dirty lapping compound. These scratches should be removed by using compound free from foreign material.

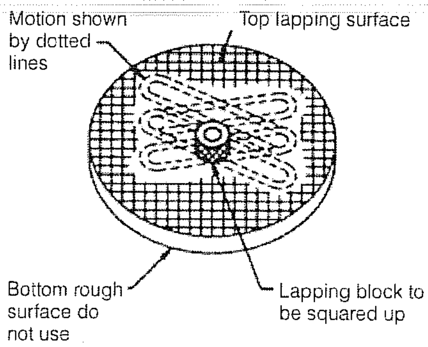
Disc inserts should be lapped in the same way as nozzles. The disc insert must be removed from the holder before lapping. Before the disc insert is placed back in the holder all foreign material should be removed from both parts. The insert must be free when in the holder. If the disc insert is damaged too badly to be reconditioned by lapping, it should be replaced.

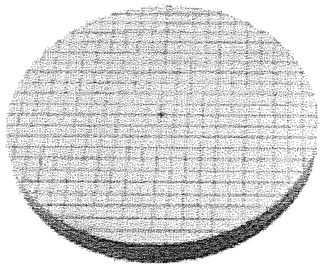
Remachining the insert will change critical dimensions, affect the action of the valve and is not recommended.

- Lapping Blocks
  Lapping blocks are made of a special grade of annealed cast iron. There is a block for each orifice size. Each block has two perfectly flat working sides and it is essential that they retain this high degree of flatness to produce a truly flat seating surface on either the disc insert or the nozzle. Before a lapping block is used, it should be checked for flatness and reconditioned after use on a lapping plate. The block should be lapped in a figure eight motion, applying uniform pressure while rotating the lapping block against the plate as shown in Figure 9.
- Lapping Compounds
  Experience has proven that medium coarse, medium fine, and polish lapping compounds will properly condition any damaged pressure relief valve seat except where the damage requires remachining. The following lapping compounds, or their commercial equivalents are suggested:

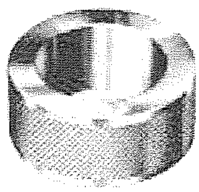
Grit Compound No.	Description
320	Medium Coarse
400	Medium
600	Fine
900	Polish

Figure 9





Lapping Block Resurfacing Plate



Lapping Block

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6.5.2 Machining of Nozzle Seats

If machining of the nozzle seat or other major repairs are necessary, it is recommended that the valve be returned to a Tyco Valves & Controls facility for repair. All parts must be accurately machined per Crosby specifications.

No pressure relief valve will be tight, nor will it operate properly unless all parts are correctly machined. The most satisfactory way to machine a nozzle is to remove it from the valve body. However, it may also be machined while assembled within the valve body. In any event, it is vitally important that the seating surfaces run absolutely true before machining.

Machining dimensions for Crosby Style JOS-E/JBS-E valves with metal-to-metal nozzle seats are shown in Figure 10 and Table 8. Remove only enough metal to restore the surface to its original condition. Turning to the smoothest possible finish will facilitate lapping.

The nozzle must be replaced when minimum face to seat dimension is reached. This critical dimension is shown in Table 8.

Figure 10

Nozzle Seat Critical Dimensions

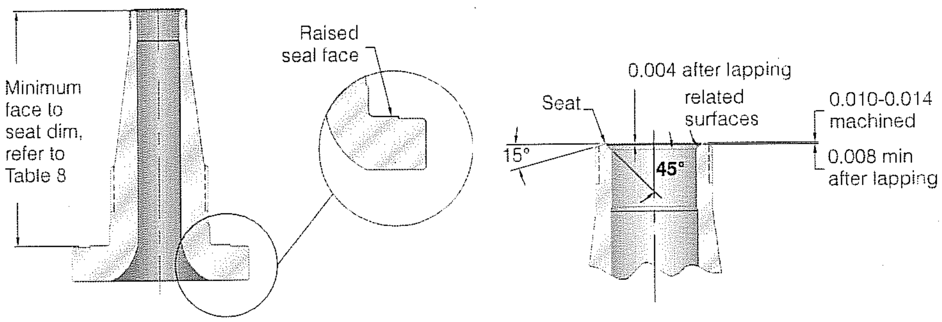


Table 8 – Minimum Nozzle Face to Seat Dimensions (See Figure 10)

Valve Type Orifice	12, 14, 15, 16	22, 24, 25, 26	34, 35, 36, 37	47	42, 44, 45, 46	57	55, 56	64, 65, 66, 67	75, 76, 77
D	3.453	3.453	3.453	3.453	3.453	3.675	3.675	3.675	4.796
E	3.453	3.453	3.453	3.453	3.453	3.675	3.675	3.675	4.796
F	4.013	4.013	4.013	4.013	4.013	4.013	4.013	4.013	4.633
G	3.763	3.763	3.763	3.763	3.763	3.763	3.763	4.763	4.763
H	3.889	3.889	3.889	3.889	4.826	4.826	4.826	4.826	–
2J3	4.326	4.326	–	–	–	–	–	–	–
2½J4	–	–	4.357	4.357	5.107	5.107	–	–	–
3J4	–	–	6.232	6.232	6.232	6.232	6.441	6.441	–
K	4.701	4.701	4.701	4.701	5.826	5.826	7.013	7.013	–
L	5.045	5.045	5.263	5.263	5.263	6.236	6.236	6.236	–
M	5.576	5.576	5.576	5.576	5.576	6.389	6.389	–	–
N	6.117	6.117	6.117	6.117	6.117	–	–	–	–
P	5.857	5.857	7.607	7.607	7.607	–	–	–	–
Q	7.732	7.732	7.732	7.732	7.732	–	–	–	–
R	8.117	8.117	8.117	8.117	8.117	–	–	–	–
T, T2	9.576	9.576	9.576	–	9.576	–	–	–	–

* Type 42, 44 not available

6.5.3 Machining of Disc Insert Seats
When the damage to the disc insert seat is too severe to be removed by lapping, the disc insert may be machined and lapped provided that minimum seat height is maintained (Figure 11 and Table 9).

Figure 11
Disc Insert Minimum Seat Height (Table 9)

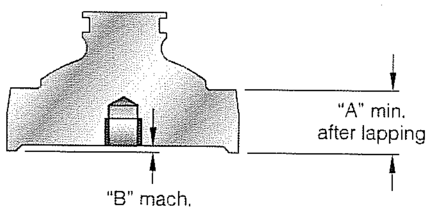


Table 9 – Disc Insert Minimum Seat Heights

Orifice	D & E	F	G	H	J	K	L	M	N	P	Q	R	T
"A"	0.332	0.370	0.369	0.398	0.429	0.531	0.546	0.605	0.632	0.692	0.783	0.781	0.839
"B"	0.021	0.025	0.030	0.036	0.044	0.051	0.063	0.070	0.076	0.091	0.118	0.139	0.176
	0.023	0.027	0.032	0.038	0.046	0.053	0.065	0.072	0.078	0.093	0.120	0.141	0.178

6.6 Assembly

All components should be clean. Before assembling the following parts, lubricate with pure nickel "Never-Seez."

- Nozzle and body threads
- Nozzle and body sealing surface
- All studs and nut threads
- Spindle and threads
- Set screw threads
- Spring washer bevels
- Adjusting bolt and bonnet threads
- Bonnet pipe plug
- Cap threads
- All metal gaskets
- Dog shaft bearing threads
- Disc holder threads (bellows valves only)

Lubricate the spindle point thrust bearing and disc insert bearing with pure nickel "Never-Seez." Special attention should be given to the guiding surfaces, bearing surfaces and gasket surfaces to ensure that they are clean, undamaged and ready for assembly. (Figure 12)

For parts identification, refer to Figure 1.

6.6.1 Before installing the nozzle (2) apply lubricant to the flange surface in contact with the valve body (1) and on the body to nozzle threads. Screw the nozzle (2) into the valve body (1) and tighten with a nozzle wrench.

6.6.2 Screw the nozzle ring (3) onto the nozzle (2).

Note: The top of the nozzle ring should be above the nozzle seating surface. For P, Q, R and T Orifice Style JLT, position the nozzle ring per Table 2.

6.6.3 For bellows valves only, place the disc holder in a vise (larger sizes may require a 3 jaw vise) as shown in Figure 8. Install the tailpiece gasket (29).

Screw the bellows assembly onto the disc holder. Tighten with a suitable wrench.

6.6.4 Assemble the disc insert (8) and the disc holder (5).

(See Figure 14 for O-ring soft seat assembly)

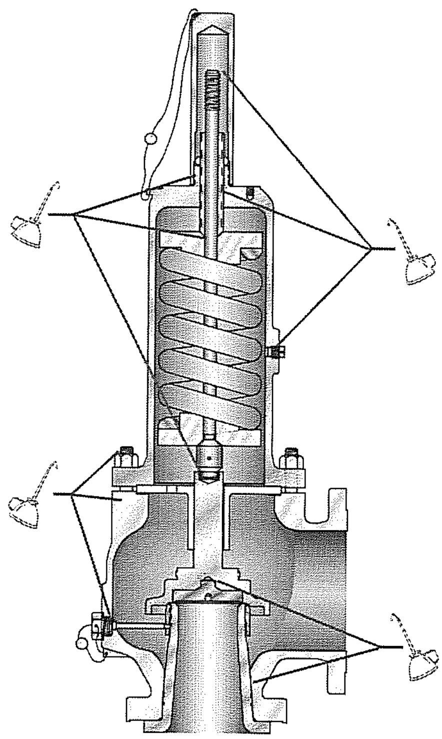
Install the disc insert retention clip (9) onto the disc insert.

Install the disc insert into the disc holder. The disc insert should snap into place using handforce only.

Safety precautions should be followed whenever heavy parts are being lifted or transported.

Dropping disc holder assembly may dislodge the insert.

Figure 12
Recommended Lubrication Points



6.6.5 Assemble the disc holder (5) and guide (15) by sliding the guide over the disc holder.

Note: The guide for D and E orifice valves protrudes up into the valve bonnet.

6.6.6 Install the two guide gaskets (28), one above and one below the guide.

Note: When assembling bellows valves, the bellows flange eliminates the need for a bottom guide gasket.

6.6.7 While holding the top of the disc holder, install the guide into the body. Align the hole of the guide with the body outlet. Once the guide is seated, the disc holder and disc insert can be lowered onto the nozzle.

Note: Lower the nozzle ring below the seats so that it moves freely.

6.6.8 Place the spring (18) and washers (19) onto the spindle (16) and assemble the spindle to the disc holder (5) with the spindle cotter pins.

Note: No cotter pins are required in D through K orifice sizes all other orifice sizes use two cotter pins.

6.6.9 Lower the bonnet (20) over the spindle and spring assembly onto the bonnet studs (21) in the body. Position the bonnet counter bore on the O.D. of the guide and lower the bonnet onto the guide.

6.6.10 Screw the bonnet nuts (22) onto the bonnet studs and tighten down evenly to prevent unnecessary strain and possible misalignment.

6.6.11 Screw the adjusting bolt (24) and nut (25) into the top of the bonnet to apply force on the spring. (The original set pressure can be approximated by screwing the adjusting bolt down to the predetermined measurement.)

6.6.12 Move the nozzle ring up until it touches the disc holder, then lower it two notches. This is a test stand setting only.

6.6.13 Place the set screw gasket (27) onto the set screw (4) and screw the set screw into the body engaging the nozzle ring. The nozzle ring should move back and forth slightly after the set screw is tightened.

6.6.14 The valve is now ready for testing.

After testing, the following measures should be taken:

- Be sure that adjusting bolt nut (25) is locked.
- Return the nozzle ring to either the original recorded position or to the recommended position shown in Table 1.
- Install the cap or lifting device. See Figure 13 for lifting lever assembly.
- Seal the cap or lifting lever device and nozzle ring set screw to prevent tampering.

6.7 Assembly of Cap and Lifting Lever Devices

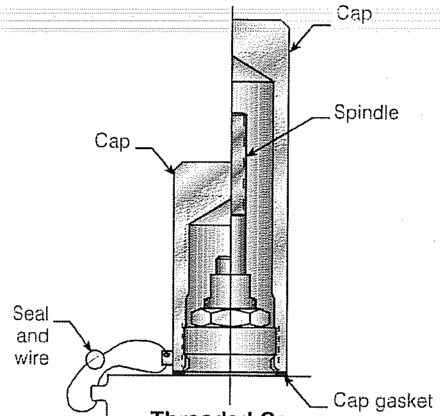
Styles JOS-E, JBS-E and JLT-E pressure relief valves are furnished with several different caps and lifting lever devices. The following describes assembly of the available types of cap construction.

(Disassembly is the reverse of assembly). For part identification refer to Figure 13.

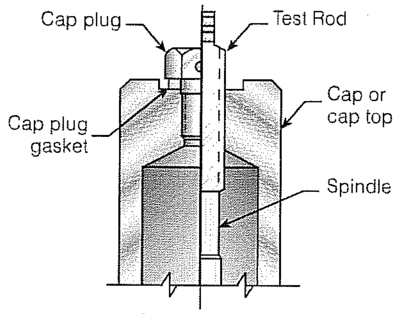
- Type A and J
  Install the cap gasket and screw the cap onto the top of the bonnet. Tighten the cap with a strap wrench.
- Type B and K
  Install the cap gasket and screw the cap onto the top of the bonnet. Tighten the cap with a strap wrench. Install the cap plug gasket and screw cap plug into the cap. The test rod is installed only during system hydrostatic testing. Never install the test rod unless performing system hydrostatic testing.

Figure 13

Cap and Lifting Levers

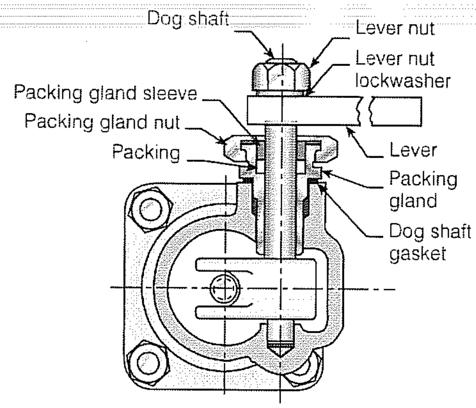


Threaded Cap
Type A | ***Type J (Standard)***

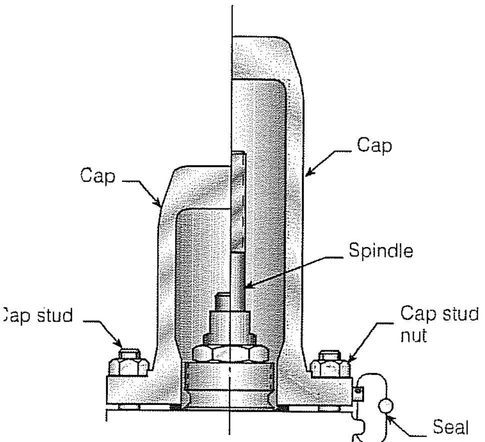


Cap and Test Rod

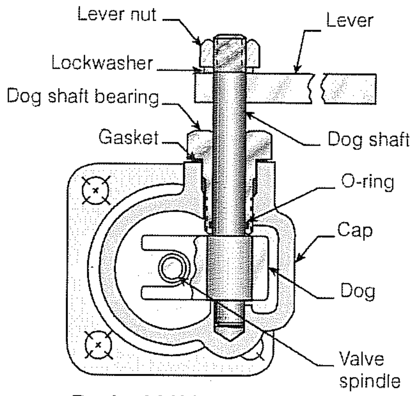
Type B – screwed cap
Type E – packed lifting lever
Type H – bolted cap
Type K – screwed cap (standard)
Type M – bolted cap (standard)



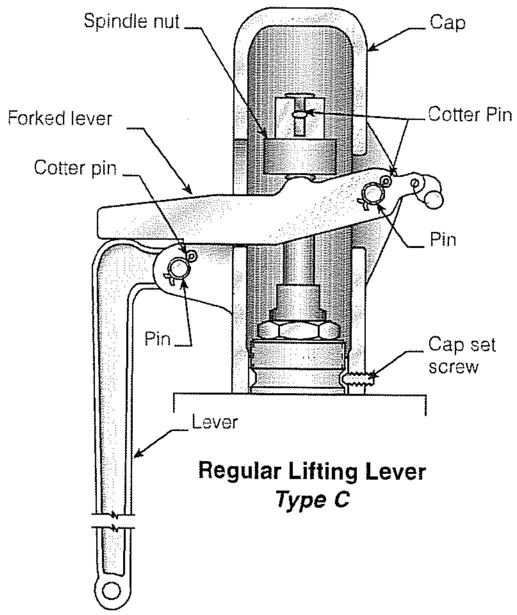
Packed Lifting Lever
Type D
(Top view of packing gland construction used for special materials)



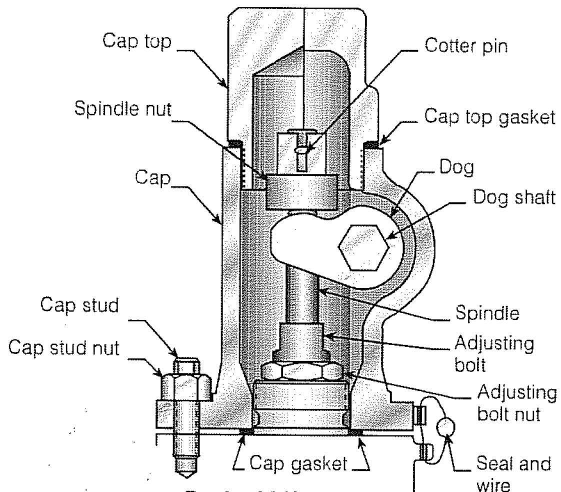
Bolted Cap
Type G | ***Type L (Standard)***



Packed Lifting Lever
Type D
(Top View)



Regular Lifting Lever
Type C



Packed Lifting Lever
Type D

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- Type C
  Screw the spindle nut onto the spindle.

  Place the cap on the bonnet. Install the forked lever and forked lever pin. Attach the lever to the cap using the lever pin and secure with the lever pin cotter.

  Adjust the spindle nut until the forked lever rests on the lever and there is a 1/16 inch minimum of play between the forked lever and the spindle nut. The spindle nut may be adjusted by removing the forked lever pin, forked lever and cap. When the spindle nut is in proper adjustment, install the spindle nut cotter pin. Replace the cap and forked lever and install the forked lever pin and forked lever pin cotter.

  Position the lever opposite the valve outlet and install the four (4) cap set screws and tighten them against the groove in the top of the bonnet.

- Type D
  Install the cap gasket on the bonnet. Screw the spindle nut onto the spindle. Place the dog in the cap and install the dog shaft so that the dog is horizontal and the square on the end of the dog shaft has a corner on top. With the dog shaft in the position above, scribe a horizontal line on the end of the dog shaft. This line must be horizontal when the lifting gear is finally installed on the valve. Install the dog shaft O-ring in the dog shaft bearing and place the dog shaft bearing gasket on the dog shaft bearing.

  Screw the dog shaft bearing into the cap. Rotate the dog shaft so that the dog is pointing down and install the cap assembly onto the bonnet. Rotate the dog shaft so that the dog contacts the spindle nut. With the scribed line horizontal, remove the assembly and adjust the position of the spindle nut. Repeat the operation until the scribed line is horizontal when the dog contacts the spindle. Remove the assembly and install the spindle nut cotter pin.

  Install the lifting gear assembly onto the bonnet and secure it with cap studs and nuts.

  For Type D lifting levers that have two part caps (cap and cap top) the above procedure is more easily accomplished. After the cap is screwed to the bonnet, the positioning of the dog shaft is the same as above except that the positioning of the spindle nut is performed last through the open end of the cap.

  With the dog in the horizontal position, screw the spindle nut onto the spindle until it contacts the dog. Install the spindle nut cotter, cap top gasket and screw the cap top into the cap.

- Type E
  Assembly of Type E lifting lever is identical to Type D with the addition of the cap plug gasket and cap plug. The test rod is installed only during system hydrostatic testing. Never install the test rod unless performing system hydrostatic test.

- Type G and L
  Install the cap studs to the bonnet top. Place the cap gasket onto the bonnet and the cap onto the cap studs. Install and tighten cap stud nuts.

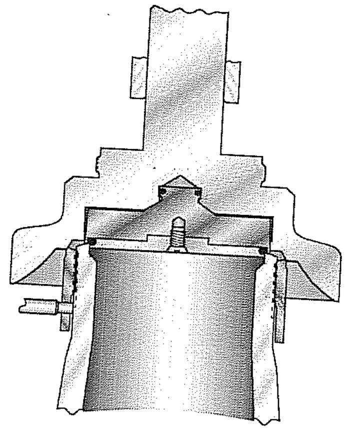
- Type H and M
  Assembly of Type H and M is identical to Type G and L with the addition of the cap plug gasket and cap plug. The test rod is installed only during system hydrostatic testing. Never install the test rod unless performing system hydrostatic test.

6.8 Soft Seat Construction

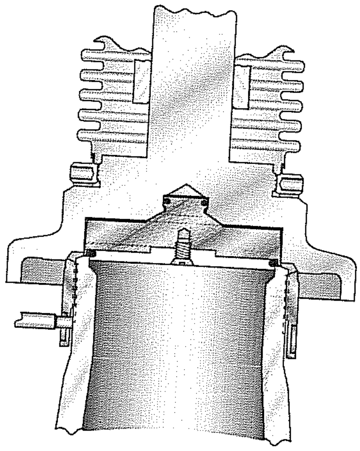
Coat O-ring with Parker Super O-Lube and place a small amount of Loctite 242 (or equivalent removable thread lock) onto retainer screw before assembly. Securely tighten retainer screw(s).

- O-ring Soft Seats
  Crosby Style JOS-E/JBS-E metal-to-metal seated pressure relief valves may be converted to an O-ring soft seat by replacing the standard disc insert and nozzle with those parts designed to house the O-ring soft seat or vice versa.

Figure 14



JLT-E O-ring Soft Seat



JOS-E/JBS-E O-ring Soft Seat

7.0 Style Variations

The Crosby Style JOS-E pressure relief valve was designed with flexibility and interchangeability in mind. Retrofitting from conventional to balanced bellows high performance liquid trim or soft seat design is accomplished with a minimum number of new parts. These style retrofits can be accomplished at lowest possible cost.

- Balanced Bellows
  A Crosby JOS-E conventional non-bellows pressure relief valve may be converted to a Style JBS-E balanced bellows valve simply by adding the bellows assembly and tailpiece gasket.
- JLT Liquid Trim
  Crosby Style JOS-E/JBS-E pressure relief valves in D to N orifice sizes may be converted to high performance JLT liquid service design simply by replacing the standard disc holder with a JLT disc holder, or vice versa. For P to T orifice sizes, a new nozzle ring is also required.
- O-ring Soft Seat Design
  Crosby Style JOS-E and JBS-E pressure relief valves in all orifice sizes may be converted from the standard metal-to-metal seats to an exceptionally tight soft seat design. This style conversion can be accomplished by replacing the standard disc insert and nozzle with parts adapted to accommodate the soft seat design.

The Crosby soft seat design uses standard size O-rings and is capable of handling pressures to 1480 psig. Standard O-ring materials include BUNA-N, EPR, Viton®, Kalrez®, Silicone and Teflon®. (See Figure 14 and Table 10).

Table 10 – Soft Seat O-ring Sizes

Orifice	O-ring Size
D & E	2-013 All Elastomers 2-014 Teflon® Only
F	2-113
G	2-116
H	2-120
J	2-125
K	2-130
L	2-226
M	2-228
N	2-230
P	2-337
Q	2-346
R	2-352
T, T2	2-438

8.0 Service Records

Service records should be completed before a valve is returned to service. These records are important and will provide guidance on establishing time intervals between repairs as well as providing the historical record of repairs and service conditions. Well kept records will be useful in predicting when to retire a valve and which spare parts should be maintained in inventory to ensure uninterrupted plant operation.

9.0 Spare Parts

When ordering spare parts, the valve shop number, assembly number, or serial number should be given together with set pressure, part name and item number, valve size and style. On the valve nameplate, the valve assembly number is shown as shop number.

Spare parts may be ordered from any Tyco Valves & Controls Regional Sales Office or Representative.

10. Trouble Shooting Pressure Relief Valves

Troubles encountered with pressure relief valves can vitally affect the life and performance of the valve and must be corrected at the first possible opportunity.

Failure of a pressure relief valve to function properly could result in the rupture of a line or vessel jeopardizing the safety of personnel and causing damage to property and equipment. Some of the most common troubles and the recommended correction measures are discussed in the following paragraphs.

10.1 Seat Leakage

Of all the problems encountered with pressure relief valves, seat leakage is the most common and the most detrimental. A leaking valve allows fluids to circulate into the secondary pressure zone of the valve where it can cause corrosion of the guide and valve spring.

When a leaking valve problem is not immediately addressed, the leakage itself will further contribute to seat damage through erosion (wire-drawing).

10.1.1 Seats Damaged by Foreign Matter

Seating surfaces may be damaged when hard foreign particles such as mill scale, welding spatter, coke and dirt are trapped between the seats. While this type of damage usually occurs while the valve is in service, it may also happen in the maintenance shop. Every precaution should be taken to clean the process system before installing a pressure relief valve and to test the valve using only clean fluids.

Damaged seating surfaces are generally reconditioned by lapping. Most often small pits and scratches may be removed by lapping alone. More extensive damage will also require remachining prior to lapping.

In some instances, valve construction can be changed to reduce the effects of seat leakage. The use of an O-ring soft seat when applicable will minimize leakage and thus eliminate the associated corrosion and erosion problems. If it is not possible to use a soft seated valve, or if the corrosive media is present in the exhaust system, conversion to a Style JBS bellows seated valve will isolate and protect the guides and valve spring from any corrosive fluids.

10.1.2 Distortion from Piping Strains

Valve bodies can be distorted by excessive piping loads causing seat leakage. Both inlet and discharge piping must be properly supported and anchored so that high bending loads are not transmitted to the valve body.

10.1.3 Operating Pressure too Close to Set Pressure

A carefully lapped metal-to-metal seated valve will be commercially tight at a pressure approximately ten percent under the set pressure or 5 psi, whichever is greater. Consequently, this minimum pressure differential should be maintained between set and operating pressure to avoid seat leakage problems.

10.1.4 Chatter

Oversized valves, excessive pressure drop in the inlet lines, restrictions in the inlet line, too great a build up of back pressure or pulsating inlet pressure will cause instability to the pressure relief valve. In such installations, the pressure under the valve disc may be great enough to cause the valve to open, but as soon as flow is established, the pressure drops allowing the valve to immediately close. This cycle of opening and closing sometimes occurs at very high frequency causing severe seat damage, sometimes beyond repair.

Proper valve selection and installation techniques are paramount to reliable valve performance.

10.1.5 Incorrectly Adjusting Lifting Gear

A space of 1/16 inch minimum should always be provided between the lifting device and the spindle lift nut. Failure to provide sufficient clearance may result in inadvertent contact causing a slight shift in the opening pressure.

10.1.6 Other Causes of Seat Leakage

Improper alignment of the spindle, too much clearance between the valve spring and the spring washers, or improper bearing contact between the adjusting bolt and the spring washers, spindle and disc holder or spindle and lower spring washer may cause seat leakage problems. Spindles should be checked for straightness and springs and spring washers should be properly fitted and kept together as a spring assembly.

10.1.7 Corrosion

Corrosion may result in pitting of valve parts, failure of various valve parts, build up of corrosive products and general deterioration of the valve materials.

Corrosive attack is generally controlled through selection of suitable materials or by employing a bellows seal to isolate the valve spring, adjusting bolt, spindle and guiding surfaces from the corrosive attack of the process fluid.

Environmental corrosion attacks all exposed surfaces, including studs and nuts. In general, the materials required for a particular service are dictated by the temperature, pressure and the degree of corrosion resistance required.

11.0 Tyco Valves & Controls Field Service and Repair Programs Field Service

Tyco Valves & Controls Field Service provides on-site, in line testing and repair capability for all types of pressure relief devices.

11.1 Parts

Tyco Valves & Controls will help you establish the right mix of on-site spares with Tyco Valves & Controls' own distribution and manufacturing support.

11.2 Training

Crosby offers intensive factory or on-site seminars to improve maintenance and application skills.

11.3 Testing

Tyco Valves & Controls has the capability to evaluate pressure relief valve operability either in the field or at various Tyco Valves & Controls facilities. Special qualifications programs may also be conducted in our laboratories.

11.4 Contract Management

Tyco Valves & Controls will combine a group of services to satisfy your special maintenance needs.

⚠ WARNING

The Product is a safety related component intended for use in critical applications. The improper application, installation or maintenance of the Product or the use of parts or components not manufactured by Crosby may result in failure of the Product. The advice of a qualified engineer should be sought prior to any use of the Product.

Any installation, maintenance, adjustment, repair or test performed on the Product must be done in accordance with the requirements of all applicable Codes and Standards.

The information, specifications and technical data (the "Specifications") contained in this document are subject to change without notice. Crosby does not warrant that the Specifications are current and assumes no responsibility for the use or misuse thereof.

The Purchaser should verify that there have been no changes to the Specifications prior to use.

General INSTRUMENTS CONSORTIUM

Factory : 4,5,6 Jawahar Co-op, Industrial Estate, Kamothe, Panvel - 410 209 Tel : 00 91 22 2743 1903 / 2743 1095 Fax · 00 91 22 742 1901

Regd.Office : 194/195, Gopi Tank Road, Mumbai-40016. Tel : 24454387,24449177 Fax : 91-22-24463507

Installation,Operation&Maintenance Manual for Pressure Gauges

Models :-

1) Bourdon Sensing Pressure Gauges - BSPG & SFBSPG
2) Liquid Filled Bourdon Sensing Pressure Gauges - LFBSPG & LFSFBSPG
3) Master Pressure Gauges (MPG)
4) Receiver Gauges (RG)

1) Unpacking :

The GIC Pressure Gauges are inspected during manufacture and prior to shipping . However visual inspection should be made at the time of unpacking to detect any damage that may have occurred during shipment.

2) Mounting :

Bottom entry local mounting pressure gauges to be mounted dial vertically.
Bottom entry surface mounting pressure gauges to be mounted dial vertically .
with sequence as shown below:
Do the assembly of surface mounting.
Connect threaded connection with nozel.

Back entry local mounting pressure gauges to be mounted vertically.
Back entry panel mounting pressure gauges to be mounted vertically
with sequence as shown below:
Do the assembly of panel mounting.
Connect threaded connection with nozel, ensure that center line of nozel and pressure gauge coincides.

3) Thread Fixing :

1) Parallel Thread : Fix Gasket between the end of thread & around spigot
2) Taper Thread :Use of Tefelon tape around the thread provide better tightness

While doing thread connections , ensure that proper spanners are used only
Avoid use of hands to rotate case while tightening threads.

4) Factors Consideration :

Following factors need to be ensured before installation.
Proper selection of gauge like - Range , Connection size, Dial size etc.
Proper wetted parts compatible to process media.
Preferabally fix the pressure gauge on rigid support on which vibration do not influence.
If rigid support is not available use LFBSPG type pressure gauges.
(NOTE : Filled oil should be replaced by 2 to 3 years operation period)
Appropriate pressure gauges for hazardous media such as oxygen ,
Acetylene, flammable or toxic gases.

QUALITY ASSURANCE PANVEL

5) Steam Service / Hot Service

For this service connect syphon between the gauge & Process pipe
The syphon should be filled with water before the gauge is put into service
Cooling tower may be used if space is a problem.

6) Pressure Pulsations:

In pulsation case of fluid Snubber (dampener) should be fitted between Pressure Gauge & Pipe
Adjustment of Snubber to be carried on line where gauge is used according to pulsation of fluid

7) Gauge Saver :

The Gauge Saver is used where design Pressure is very high than that of operating Pressure .
Range of Gauge saver is clearely engraved on Gauge Saver .

8)Storage :

Do not remove gauges from box until installation.
Protect gauge form external damage ,humidity & dust.
Storage Temperature range is -20 Deg C to +80 Deg.C

9) Permissible Ambient and Operating Temperature :

When mounting the Pressure Gauge it must be ensured that the influence of convection and heat radiation must be considered , no deviation above or below the permissible ambient and medium temperature can occur .

10) Maintenance /Repair:

The instruments are maintenance free& check should be carried on regular intervals.While doing calibration hold the gauge in vertical position only .
The checks or recalibration must be carried out by skilled person with proper equipment . While dismounting ,close the isolation valve if any .

In case of any difficulty , kindly contact
M/s. General Instruments Consortium Factory

Honeywell

SmartLine Pressure Transmitters
ST 700 User's Manual

34-ST-25-44
Revision 8.0
December 2016

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Honeywell Process Solutions
1250 W Sam Houston Pkwy S
Houston, TX 77042

About This Manual

This manual is a detailed *how to* reference for installing, piping, wiring, configuring, starting up, operating, maintaining, calibrating, and servicing Honeywell's family of ST 700 SmartLine Pressure Transmitters, Standard and Basic models.
Users who have a Honeywell ST 700 SmartLine Pressure Transmitter configured for HART protocol or Honeywell's Digitally Enhanced (DE) are referred to the *ST 700 Series HART/DE Option User's Manual*, Document # 34-ST-25-47.
Users who have a Honeywell ST 700 SmartLine Pressure Transmitter configured for Fieldbus operation are referred to the *ST 700 Series Fieldbus Option User's Manual*, Document # 34-ST-25-48.

The configuration of your Transmitter depends on the mode of operation and the options selected for it with respect to operating controls, displays and mechanical installation. This manual provides detailed procedures to assist first-time users, and it further includes keystroke summaries, where appropriate, as quick reference or refreshers for experienced personnel.

To digitally integrate a Transmitter with one of the following systems:

- For the Experion PKS, you will need to supplement the information in this document with the data and procedures in the *Experion Knowledge Builder.*
- For Honeywell's TotalPlant Solutions (TPS), you will need to supplement the information in this document with the data in the *PM/APM SmartLine Transmitter Integration Manual*, which is supplied with the TDC 3000 book set. (TPS is the evolution of the TDC 3000).

Release Information

ST 700 SmartLine Pressure Transmitter User Manual, Document # 34-ST-25-44,
Revision 1, February, 2013

Revision 2, May, 2013 – Updates to Parts list, Explosionproof Seal class, Fail Safe and Comms Module procedures.

Revision 3, July 2013 – Control Drawing updated to Rev.D

Revision 4, December 2013 – STG73P Flush Mount

Revision 5, December 2014 – MID and MARINE Approvals added

Revision 6, March 2016 – Standard Display added

Revision 7, May 2016 – Approval updates and EU cert.

Revision 8, December 2016 – Basic models added.

References

The following list identifies publications that may contain information relevant to the information in this document.

SmartLine Pressure Transmitter ST 800/ST700 Standard Quick Start Guide, Document # 34-ST-25-36

SmartLine Pressure Transmitter ST 700 Basic Quick Start Guide, Document # 34-ST-25-57

ST 800 & ST 700 Pressure Transmitter with HART Safety Manual, # 34-ST-25-37

ST 700 SmartLine Pressure Transmitter HART/DE Option User's Manual, Document # 34-ST-25-47

ST 700 FF Transmitter with FOUNDATION Fieldbus Option Installation & Device Reference Guide, Document # 34-ST-25-48

MC Tookit User Manual, for 400 or later, Document # 34-ST-25-20

PM/APM Smartline Transmitter Integration Manual, Document # PM 12-410

ST 800 & ST 700 Series Pressure, Analog, HART and DE Communications form, Honeywell drawing 50049892

Smart Field Communicator Model STS 103 Operating Guide, Document # 34-ST-11-14

Patent Notice

The Honeywell ST 700 SmartLine Pressure Transmitter family is covered by one or more of the following U. S. Patents: 5,485,753; 5,811,690; 6,041,659; 6,055,633; 7,786,878; 8,073,098; and other patents pending.

Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, refer to the back page of this manual or the appropriate Honeywell Solution Support web site:

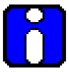
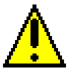
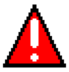
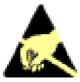
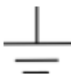
Honeywell Corporate	www.honeywellprocess.com
Honeywell Process Solutions	www.honeywellprocess.com/pressue-transmitters/
Training Classes	http://www.honeywellprocess.com/en-US/training

Telephone and Email Contacts

Area	Organization	Phone Number
United States and Canada	Honeywell Inc.	1-800-343-0228 Customer Service 1-800-423-9883 Global Technical Support
Global Email Support	Honeywell Process Solutions	hfs-tac-support@honeywell.com

Symbol Descriptions and Definitions

The symbols identified and defined in the following table may appear in this document.

Symbol	Definition
	**ATTENTION: Identifies information that requires special consideration.**
	**TIP: Identifies advice or hints for the user, often in terms of performing a task.**
CAUTION	**Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.**
	**CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.** **CAUTION symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.**
	**WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death.** **WARNING symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.**
	**WARNING, Risk of electrical shock: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.**
	**ESD HAZARD: Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.**
	**Protective Earth (PE) terminal: Provided for connection of the protective earth (green or green/yellow) supply system conductor.**
	**Functional earth terminal: Used for non-safety purposes such as noise immunity improvement. Note: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.**
	**Earth Ground: Functional earth connection. Note: This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.**
	**Chassis Ground: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.**
continued	

Symbol	Description
	The Factory Mutual®: Approval mark means the equipment has been rigorously tested and certified to be reliable.
	The Canadian Standards mark means the equipment has been tested and meets applicable standards for safety and/or performance.
	The Ex mark means the equipment complies with the requirements of the European standards that are harmonised with the 94/9/EC Directive (ATEX Directive, named after the French "ATmosphere EXplosible").

Contents

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List of Tables

1. ST 700 Transmitter Series

1.1 Overview

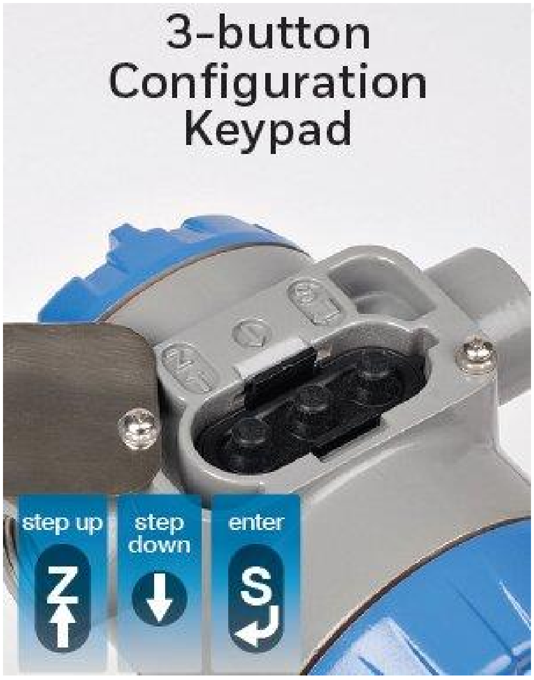
SmartLine Pressure Transmitter ST 700 family conists of a series of ST 700 Standard Transmitter models and a series of ST 700 Basic Transmitter models.

The entire manual is broadly classified in two sections.
The first half of this manual, Sections **2** through **9**, are for ST 700 Standard Transmitter model series and the second half, Sections **10** through **17**, are applicable only to ST 700 Basic Transmitter model series.

Which type of transmitter do I have?
To determine which version you have:
Look at the nameplate on top of the unit shown in Figure 3. Refer to the Model number
If you have a ST 700 Standard Transmitter use Sections **2** through **9**.
If you have a ST 700 Basic Transmitter go straight to Sections **10** through **17.**
Appendix A - PRODUCT CERTIFICATIONS is applicable for both ST 700 Standard and Basic Transmitters.

Table 1 below to identify which type of Transmitter you have; Standard or Basic.

The Standard transmitter will have a three button assembly (see Figure 17), the basic Transmitter with have two button assembly (see Figure 18)



3-button Standard ST 700 Transmitter

2-button Basic ST 700 Transmitter

Table 1 – ST 700 Standard andf Basic model types

Transmitter Configuration	Smart Line Pressure ST700	
	Standard Models	Basic Models
Dual head DP	STD720/730/770	STD725/735/775
Dual head GP	STG730/740/770	STG735/745/775
Inline GP	STG73L/74L/77L/78L/79L	STG73S/74S/77S/78S/79S
Inline flush GP	STG73P	STG73SP
Dual head AP	STA722/740	STA725/745
Inline AP	STA72L/74L/77L	STA72S/74S/77S
Flush flanged level	STF724/732	STF725/735
Pseudo flanged level	STF72F/73F	STF72P/73P
Remote seal DP/GP	STR73D/74G	STR735D/745G

,

2. Introduction to the ST 700 Standard Transmitter

This section is an introduction to the physical and functional characteristics Honeywell's family of the ST 700 Standard Transmitters.

2.1 Features and Options

The ST 700 Standard Transmitter is available in a variety of models for measuring Differential Pressure (DP), Gauge Pressure (GP), and Absolute Pressure (AP). Table 2 lists the protocols, human interface (HMI), materials, approvals, and mounting bracket options.

Table 2 – Features and Options_ST 700 Standard transmitter

Feature/Option	Standard/Available Options
Communication Protocols	HART® version 7, Digitally Enhanced (DE), Fieldbus
Human-Machine Interface (HMI) Options (Basic Display/Standard Display)	**Basic Digital Display:** • Three-button programming (optional) • Basic display language: English only
	Standard Display (HART® only): • Two-button programming (optional) • Standard display language: English only • Two-mode operations: PV display and Menu Navigation
Calibration	Single
Approvals for details go to page 130	FM, CSA, ATEX, IECEx, SAEx, INMETRO, NEPSI, GOST and MARINE
Mounting Brackets	Angle/flat carbon steel/304 and 316 stainless steel, Marine 304 stainless steel, 316 Stainless Steel
Integration Tools	Experion

The three-button option is available for the Basic Display.

The two-button option is available for the Standard Display.

Also, for the Basic Display, the three button reed switch is used only for span & zero correction and not for the Display navigation.

2.1.1 Physical Characteristics

As shown in Figure 1, the ST 700 Standard is packaged in two major assemblies: the Electronics Housing and the Meter Body. The elements in the Electronic Housing respond to setup commands and execute the software and protocol for the different pressure measurement types. Figure 2 shows the assemblies in the Electronics Housing with available options.

The Meter Body provides connection to a process system. Several physical interface configurations are available, as determined by the mounting and mechanical connections, all of which are described in the **Installation** section of this manual.

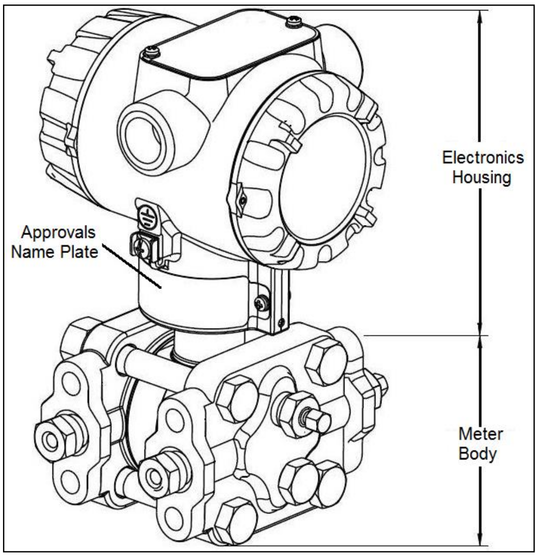


Figure 1 – ST 700 Standard Transmitter Major Assemblies

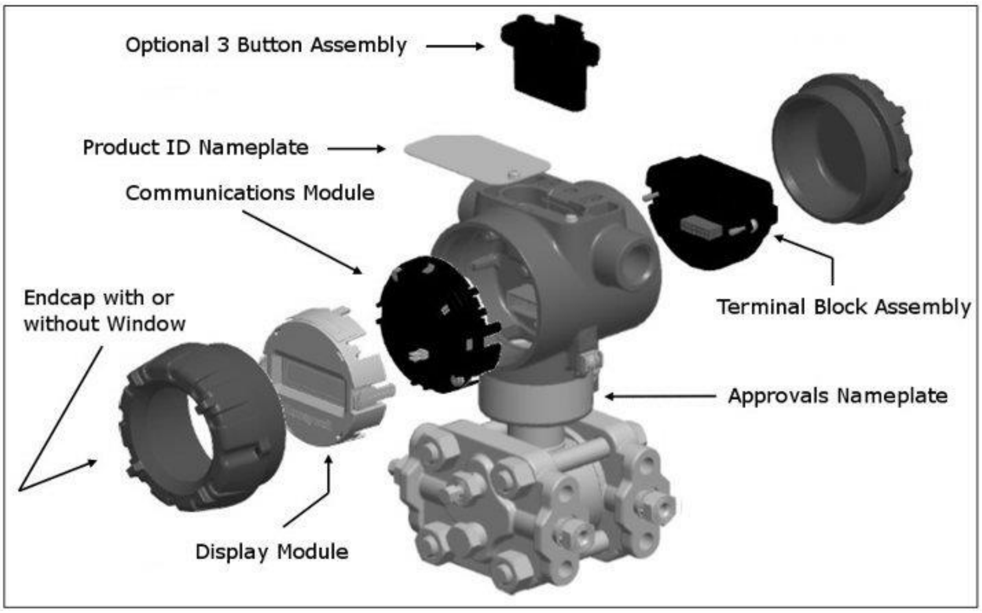


Figure 2 – ST 700 Standard Transmitter Electronics Housing Components

2.1.2 Functional Characteristics

The ST 700 Standard Transmitter measures process pressure and provides a proportional analog 4 to 20mA output to the measured process variable (PV). Available output communication protocols include Honeywell Digitally Enhanced (DE), HART®, and FOUNDATION™ Fieldbus.

The Standard display is only available on HART transmitters.

An optional 3-button assembly is available to set up and make adjustments to the Transmitter. In addition, a Honeywell Multi-Communication (MC) Toolkit (not supplied with the Transmitter) can facilitate setup and adjustment procedures. Certain adjustments can be made through an Experion Station or a Universal Station if the Transmitter is digitally integrated with Honeywell's Experion or TPS/TDC 3000 control system.

The Standard Display Menu is implemented as one long single-level menu and will "wrap around" when it reaches the start or end of the menu. The Standard Display uses an optional two-button assembly to set up and make adjustments to the Transmitter.

2.2 ST 700 Standard Transmitter Nameplate

The Transmitter nameplate mounted on the bottom of the electronics housing (see Figure 1) lists its model number, physical configuration, electronics options, accessories, certifications, and manufacturing specialties. Figure 3 is an example of a typical Gauge Pressure (GP) or Atmospheric Pressure (AP) Transmitter name plate. The model number format consists of a Key Number with several table selections. The Differential Pressure (DP), Absolute Pressure (AP), and Gauge Pressure (GP) name plates are essentially the same. The DP model provides one additional entry (7 vs. 6) in the Meter Body Selections (Table I) to accommodate the static pressure rating.

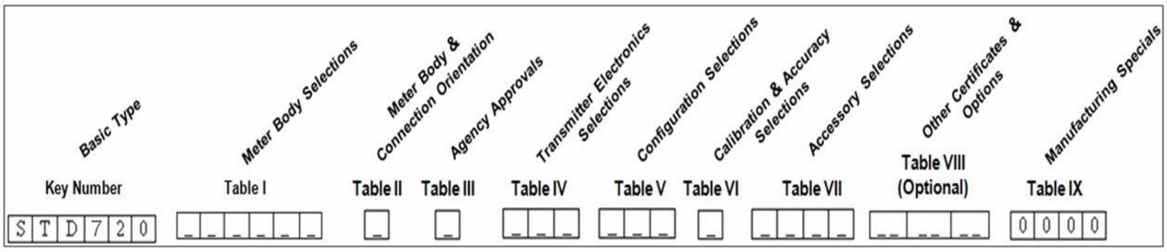


Figure 3 –ST 700 Standard Transmitter - Typical Name Plate

You can readily identify the series and basic Transmitter type from the third and fourth digits in the key number. The letter in the third digit represents one of these basic transmitter types:

- A = Absolute Pressure
- G = Gauge Pressure
- D = Differential Pressure
- R = Remote Seals
- F = Flange Mounted

For a complete selection breakdown, refer to the appropriate Specification and Model Selection Guide provided as a separate document.

2.3 Safety Certification Information

An “approvals” name plate is located on the bottom of the Electronics Assembly; see Figure 1for exact location. The approvals name plate contains information and service marks that disclose the Transmitter compliance information.
Refer to Section Appendix A in this document for safety certification requirements and details.

2.4 Transmitter Adjustments

Zero and Span adjustments are possible in ST 700 Standard Transmitter with the optional 3 button and two-button assemblies.

You can also use the Honeywell MC Toolkit or other third-party hand-held configurator to make adjustments to the ST 700 Standard Transmitter. Alternately, certain adjustments can be made through the Experion or Universal Station, if the Transmitter is digitally integrated with a Honeywell Experion or TPS system.

2.5 Display Options –Standard Display

Table 3 – Available Display Characteristics

Basic Display	• Suitable for basic process needs • 360º rotation in 90º Increments • 2 lines, 16 characters • Standard units of measurement: Pa, KPa, MPa, KGcm2, TORR, ATM, inH2O, mH2O, bar, mbar, inHg, FTH2O, mmH2O, MMHG, & PSI • Diagnostic messaging • Square root output indications
Standard Display	• 360º rotation in 90º Increments • 2 lines, 8 characters • Standard units of measurement: Pa, KPa, MPa, KGcm2, TORR, ATM, inH2O, mH2O, bar, mbar, inHg, FTH2O, mmH2O, MMHG, Flow Units (DP models only) ,PSI , cmH2O and mH2O • Diagnostic messaging

2.6 Optional Integrated Two-Button Assembly (Standard Display)

The Standard Display does not support all the transmitter configuration parameters and has limited features.
The optional Integrated two-Button Assembly for the Standard Display provides the following features and capabilities:

- Menu and enter key functionality.
- With the menu-driven display:
    - Comprehensive on-screen menu for navigation.
    - Transmitter configuration: enter LRV, enter URV and Loop Test.
    - Transmitter calibration
    - Display configuration (contrast only)
    - Set zero and span parameters.

	If you are using the optional external two-button assembly with the Standard Display then you can perform all the above operations without removing external glass cap using the external buttons

	Lower range value (LRV): A display parameter (Standard display), which allows users to enter the measuring value for which the analog output will be scaled to 4mA. **Upper range value (URV):** A display parameter (Standard display), which allows users to enter the measuring value for which the analog output will be scaled to 20mA.

3. Application Design for the ST 700 Standard Transmitter

3.1 Overview

This section discusses the considerations involved with deploying a Honeywell ST 700 Standard Transmitter in a process system. The following areas are covered:

- Safety
- Input and output data
- Reliability
- Environmental limits
- Installation considerations
- Operation and maintenance\
- Repair and replacement

3.2 Accuracy

The ST 700 Standard Transmitter measures the gauge, differential, or absolute pressure of a process and reports the measurement to a receiving device.

3.2.1 Diagnostic Messages

Transmitter standard diagnostics are reported in the two basic categories listed in Table 4. Problems detected as critical diagnostics drive the analog output to the programmed burnout level. Problems detected as non-critical diagnostics may affect performance without driving the analog output to the programmed burnout level. Informational messages (not listed in Table 4) report various Transmitter status or setting conditions. The messages listed in Table 4 are specific to the Transmitter, exclusive of those associated with HART and DE protocols. HART and DE diagnostic messages are listed and described in the *ST 700 SmartLine Pressure Transmitter HART/DE Option User Manual*, Document # 34-ST-25-47.

	The Standard Display is only available on HART transmitters

	The Standard Display only displays critical diagnostics (Meter Body Fault, Electronics Module Fault and Meter Body Communication Fault). Non-critical diagnostics are not displayed.

Table 4 – ST 700 Standard transmitter - Basic Display Diagnostics Messages

Critical Diagnostics (Failure Conditions)	Non-Critical Diagnostics (Warning Conditions)	
Sensor Comm Timeout	No DAC Compensation	No DAC Calibration
Meter Body Critical Failure	No Factory Calibration	Tamper Alarm
Electronic Module Diag Failure	PV Out of Range	Meter Body Unreliable Comm
Config Data Corrupt	Fixed Current Mode	Loop Current Noise
Meter Body NVM Corrupt	Sensor Over Temperature	AO Out of Range
Electronic Module DAC Failure	Meter Body Excess Correct	URV Set Error – Span Config Button
	Local Display	LRV Set Error – Span Config Button
	Low Supply Voltage	

3.3 Safety

3.3.1 Safety Integrity Level (SIL)

The ST 700 Standard transmitter has met manufacturer design process requirements of Safety Integrity Level (SIL) 3. These are intended to achieve sufficient integrity against systematic errors of design by the manufacturer.

A Safety Instrumented Function (SIF) designed with this product must not be used at a SIL level higher than the statement, without “prior use” justification by the end user or diverse technology redundancy in the design.

Refer to the *Honeywell SmartLine Safety Manual*, Document # 34-ST-25-37, for additional information.

4. Installation and Startupfor the ST 700 Standard Transmitter

4.1 Installation Site Evaluation

Evaluate the site selected for the ST 700 Standard Transmitter installation with respect to the process system design specifications and Honeywell's published performance characteristics for your particular model. Some parameters that you may want to include in your site evaluation are:

- Environmental Conditions:
  - Ambient Temperature
  - Relative Humidity
- Potential Noise Sources:
  - Radio Frequency Interference (RFI)
  - Electromagnetic Interference (EMI)
- Vibration Sources
  - Pumps
  - Motorized System Devices (e.g., pumps)
  - Valve Cavitation
- Process Parameters
  - Temperature
  - Maximum Pressure Rating

4.2 Honeywell MC Toolkit

In preparation for post-installation processes, refer to the *MC Tookit User Manual,* Document # 34-ST-25-20, for battery conditioning and device operation and maintenance information.

4.3 Display Installation Precautions

Temperature extremes can affect display quality. The display can become unreadable at temperature extremes; however, this is only a temporary condition. The display will again be readable when temperatures return to within operable limits.

The display update rate may become slower at cold temperature extremes, but as with readability, normal updating resumes when temperatures are within limits for full operability.

	The ST 700 Standard Transmitter should not be operated without the endcap covers on. Covers can be removed temporarily for configuration with buttons or during maintenance/wiring. The static voltage must be discharged before removing the cover.

4.4 Mounting ST 700 Standard Transmitters

4.4.1 Summary

The ST 700 Standard transmitter models, except flush mounts and those with integral flanges, can be attached to a two-inch (50 millimeters) vertical or horizontal pipe using Honeywell's optional angle or flat mounting bracket; alternately you can use your own bracket. Flush-mount models are attached directly to a process pipe or tank by a one-inch weld nipple. Models with integral flanges are supported by the flange connection.

Figure 4 shows a typical bracket-mounted and flange-mounted transmitter installations.

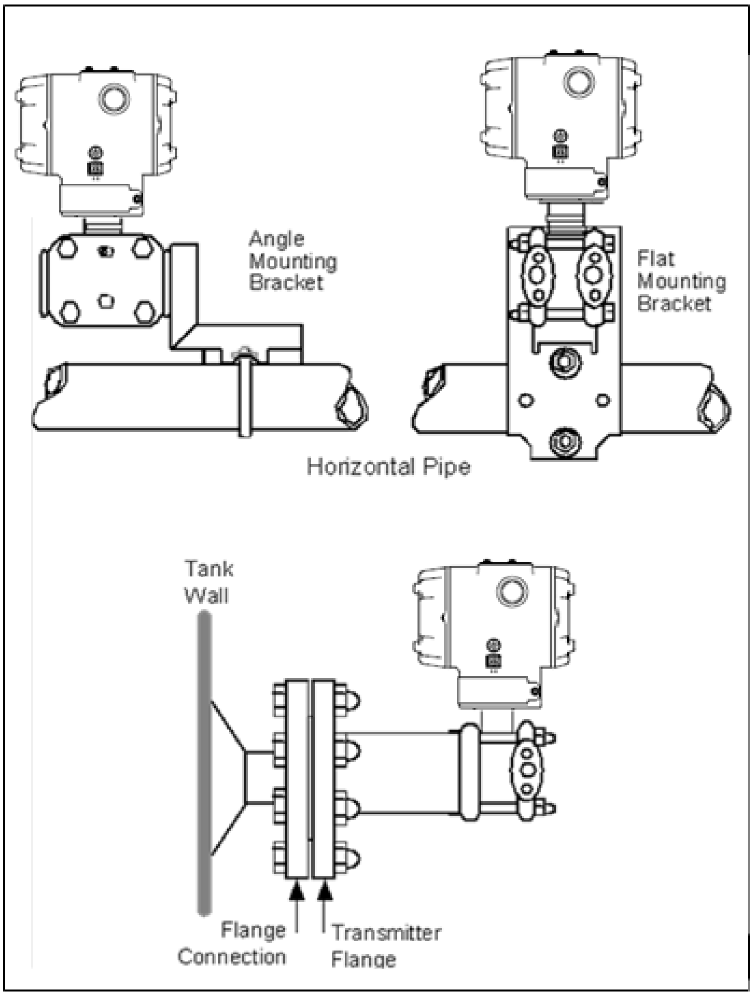


Figure 4 – ST 700 Standard Transmitter - Typical Bracket and Flange Mounted Installations

4.4.2 Flush mounting - ST 700 Standard Transmitter

To mount a flush mounted model, cut a hole for a 1" standard pipe in the tank or pipe where the transmitter is to be mounted. Weld the 1" mounting sleeve to the wall of the tank or to the hole cut on the pipe. Insert the meter body of the transmitter into the mounting sleeve and secure with the locking bolt. Tighten the bolt to a torque of 6,4 Nm +/- 0,30 Nm (4.7 ft-lbs +/- 0.2 ft.-lbs.). Figure 5 shows a typical installation for a transmitter with a flush mount on a pipe.

Once the transmitter is mounted, the electronics housing can be rotated to the desired position. See Figure 8 for details.

ATTENTION: On insulated tanks, remove enough insulation to accommodate the mounting sleeve.

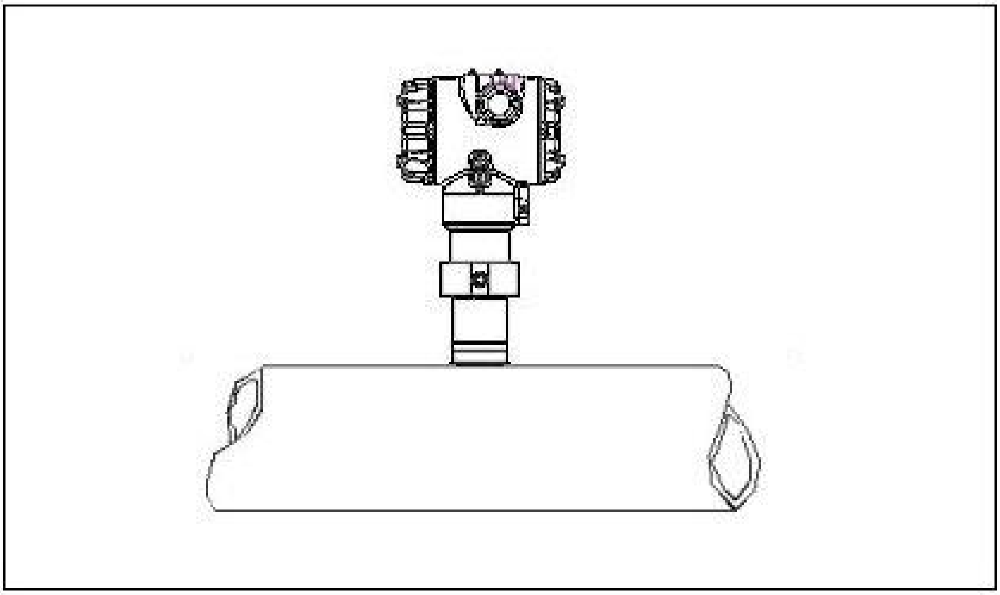


Figure 5 - ST 700 Standard Transmitter - Typical Flush Mounted Installation

4.4.3 Mounting Dimensions

Refer to Honeywell drawing number 50049930 (Dual Head), 50049931 (In-Line), 50049932 (Flange Mount) 50049933 (Extended Flange), 50049934 (Remote Seal) and 50049936 (Flush Mount Pressure Transmitter) for detailed dimensions. Abbreviated overall dimensions are also shown on the Specification Sheets for the transmitter models. This section assumes that the mounting dimensions have already been taken into account and the mounting area can accommodate the Transmitter.

4.4.4 Bracket Mounting Procedure

If you are using an optional bracket, start with Step 1. For an existing bracket, start with Step 2.

1. Refer to Figure 6. Position the bracket on a 2-inch (50.8mm nominal diameter, 2.38" (60.4mm) actual OD) for a horizontal or vertical pipe, and install a "U" bolt around the pipe and through the holes in the bracket. Secure the bracket with the nuts and lock washers provided.

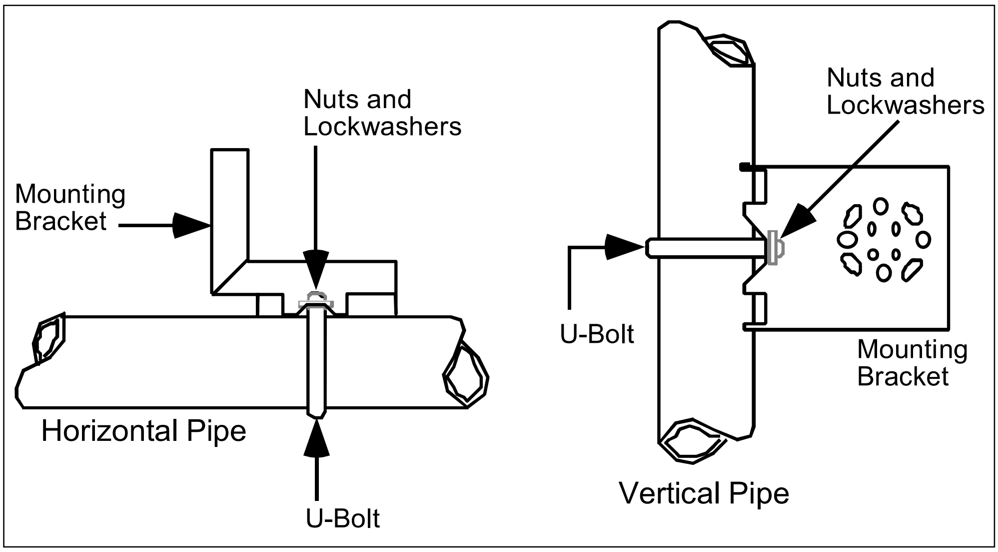


Figure 6 – ST 700 Standard Transmitter - Angle Mounting Bracket Secured to a Horizontal or Vertical Pipe

2. Align the appropriate mounting holes in the Transmitter with the holes in the bracket. Use the bolts and washers provided to secure the Transmitter to the bracket; see the following variations.

Table 5 - ST 700 Standard Transmitter - Mounting Bracket procedure

Transmitter Type	Use Hardware
DP with double-ended process heads and/or remote seals	Alternate mounting holes in the ends of the heads
ST 700 Standard transmitter models only. In-line GP: STG7x0 and STG7xL AP models: STA7xL and STA72x, STA740	The smaller "U" bolt provided to attach the meter body to the bracket. See the following example.
Dual-head GP and AP	Mounting holes in the end of the process head.

Example: Inline model mounted to an optional angle bracket. See Figure 7**.**

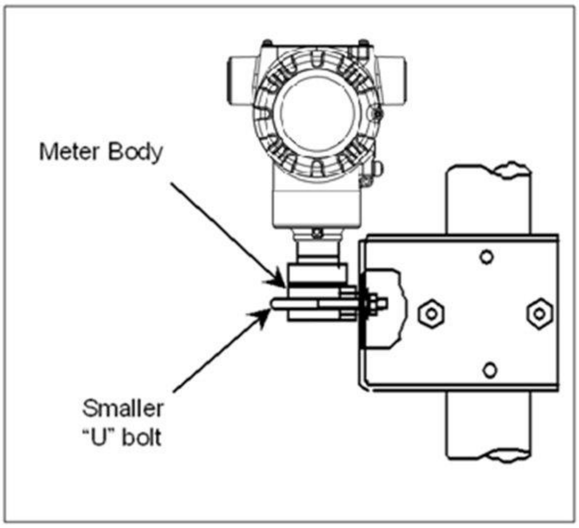


Figure 7 – ST 700 Standard Transmitter - Inline Model Mounted to an Optional Bracket

3. Loosen the set screw on the outside neck of the Transmitter one (1) full turn.

4. Rotate the Electronics housing a maximum of 180º left or right from the center to the position you require, and tighten the set screw using a 4mm metric socket head wrench. See the following example and Figure 8.

   Example: Rotating the Electronics Housing

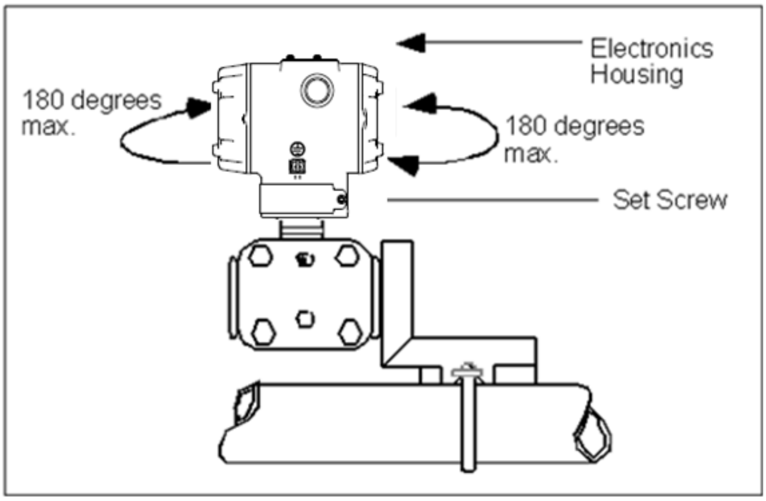


Figure 8 – ST 700 Standard Transmitter - Rotating the Electronics Housing

The mounting position of AP models STA722 and STA72L becomes critical as the Transmitter spans become smaller. A maximum zero shift of 2.5mmHg for these models can result from a mounting position that is rotated 90o from the vertical.
A typical zero-shift of 0.12mmHg or 0.20 inH_2O can occur for a five (5)-degree rotation from the vertical.

4.4.5 Mounting Transmitters with Small Absolute or Differential Pressure Spans

To minimize positional effects on calibration (zero shift), take the appropriate mounting precautions for the respective Transmitter model. Ensure that the Transmitter is vertical when mounting models STA722 and STA72L. You do this by leveling the Transmitter side-to-side and front-to-back. **Figure 9** shows how to level a Transmitter using a spirit level.

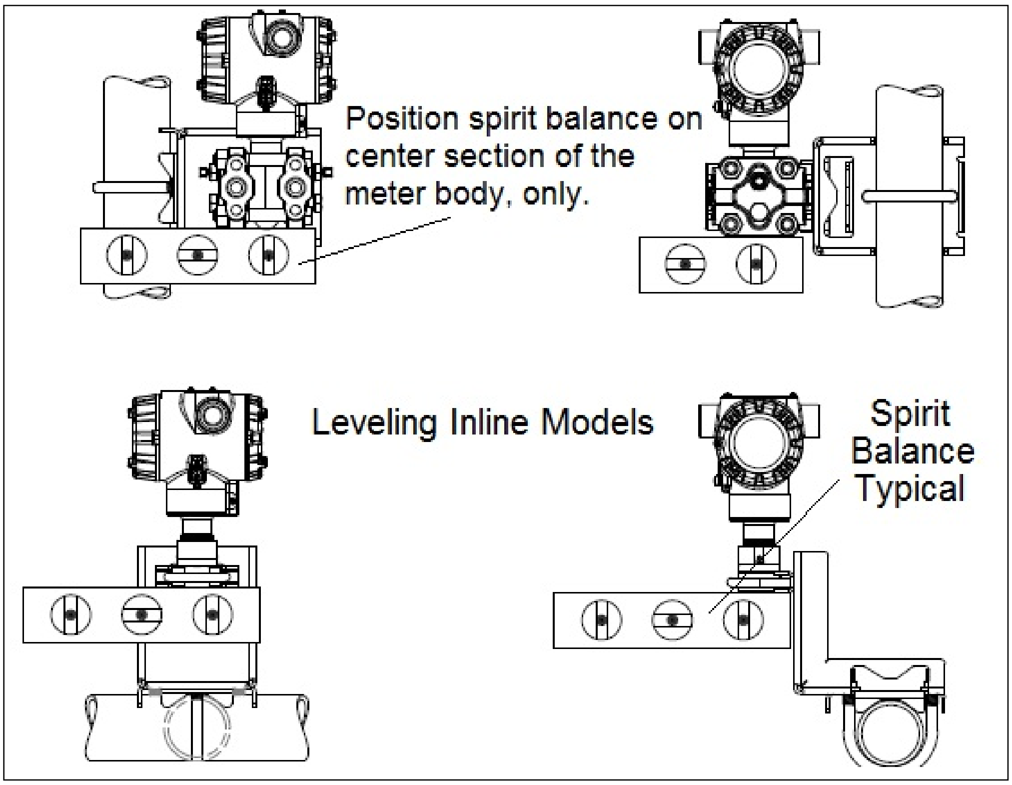


Figure 9 – ST 700 Standard Transmitter - Using a Spirit Balance to Level a Transmitter

4.4.6 Flange Mounting

Figure 10 shows a typical tank-flange mount installation, with the Transmitter flange mounted to the pipe on the wall of the tank.

On insulated tanks, remove enough insulaiton to accommodate the flange extension.

When flange-mounting to a tank, note the following:

- The End User is responsible for providing a flange gasket and mounting hardware suitable for the Transmitter service conditions.
- To avoid degrading performance in flush-mounted flanged Transmitters, exercise care to ensure that the internal diameter of the flange gasket does not obstruct the sensing diaphragm.
- To prevent performance degradation in extended-mount flanged Transmitters, ensure that sufficient clearance exists in front of the sensing diaphragm body.

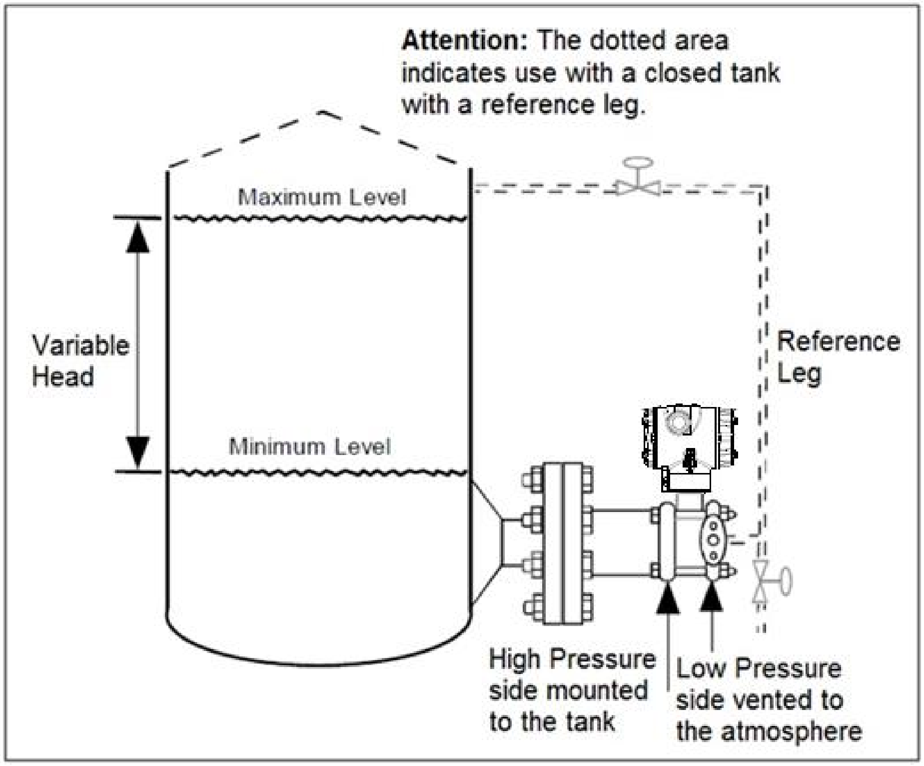


Figure 10 – ST 700 Standard Transmitter - Tank-Flange Mounted Transmitter

4.4.7 Remote Diaphragm Seal Mounting Information

The combination of tank vacuum and high pressure capillary head effect should not exceed nine (9) psi (300mmHg) absolute. For insulated tanks, be sure to remove enough insulation to accommodate the flange extension. The end user is responsible for supplying a flange gasket and mounting hardware suitable for the service condition of the Transmitter.

Mount the Transmitter flanges within the limits in **Table 6** for the fill fluid in the capillary tubes, with a tank at one (1) atmosphere.

Table 6 – ST 700 Standard Transmitter - Flange Mounting Guidelines

Fill Fluid	Mount the Flange…
Silicone 200 Oil	≤22 feet (6.7 meters) below the Transmitter
Chlorotrifluorethylene (CTFE)	≤11 feet (3.4 meters) below the Transmitter

Refer to Figure 11 for a representative remote diaphragm seal installation. Mount the Transmitter at a remote distance determined by the length of the capillary tubing.

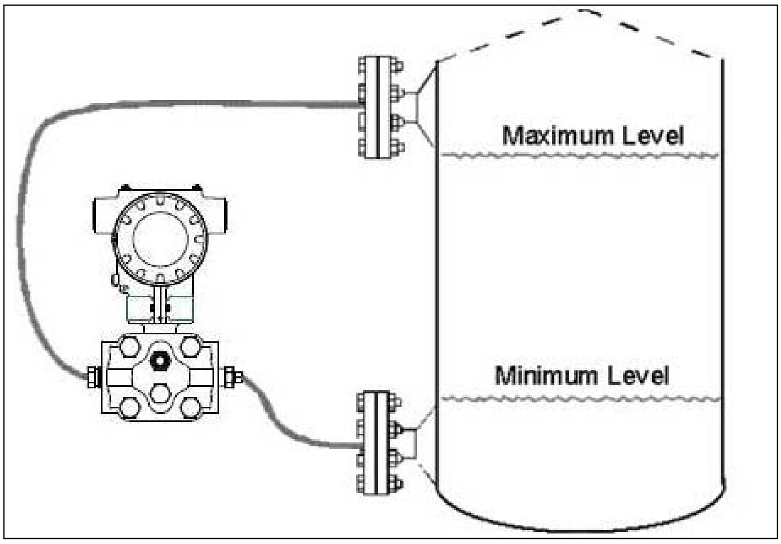


Figure 11 – ST 700 Standard Transmitter - Representative Remote Diaphragm Seal Transmitter Installation

Depending on Transmitter model, connect the remote seal to the tank according to Table 7.

Table 7 – ST 700 Standard Transmitter - Remote Diaphragm Mounting Details

Transmitter Model	Connect the Remote Seal on ….	
	Variable Head	Fixed or Constant Head
STR73D	Transmitter High Pressure (HP) Side to tank wall lower flange mounting.	Transmitter Low Pressure (LP) side to tank wall upper flange.

4.5 Piping the ST 700 Standard Transmitter

4.5.1 Piping Arrangements

Piping arrangements vary depending upon process measurement requirements and the Transmitter model. For example, a differential pressure transmitter comes with double-ended process heads with ¼-inch NPT connections, which can be modified to accept ½-inch NPT through optional flange adapters. Gauge pressure transmitters are available with various connections for direct mounting to a process pipe.

A ½-inch, schedule 80, steel pipe is commonly used for Transmitter integration into a process system. Many piping arrangements use a three-valve manifold to connect the process piping to the Transmitter. A manifold makes it easy to install and remove or re-zero a Transmitter without interrupting the process. A manifold also accommodates the installation of blow-down valves to clear debris from pressure lines. Figure 12 represents a typical piping arrangement using a three-valve manifold and blow-down lines for a differential pressure transmitter being used to measure flow.

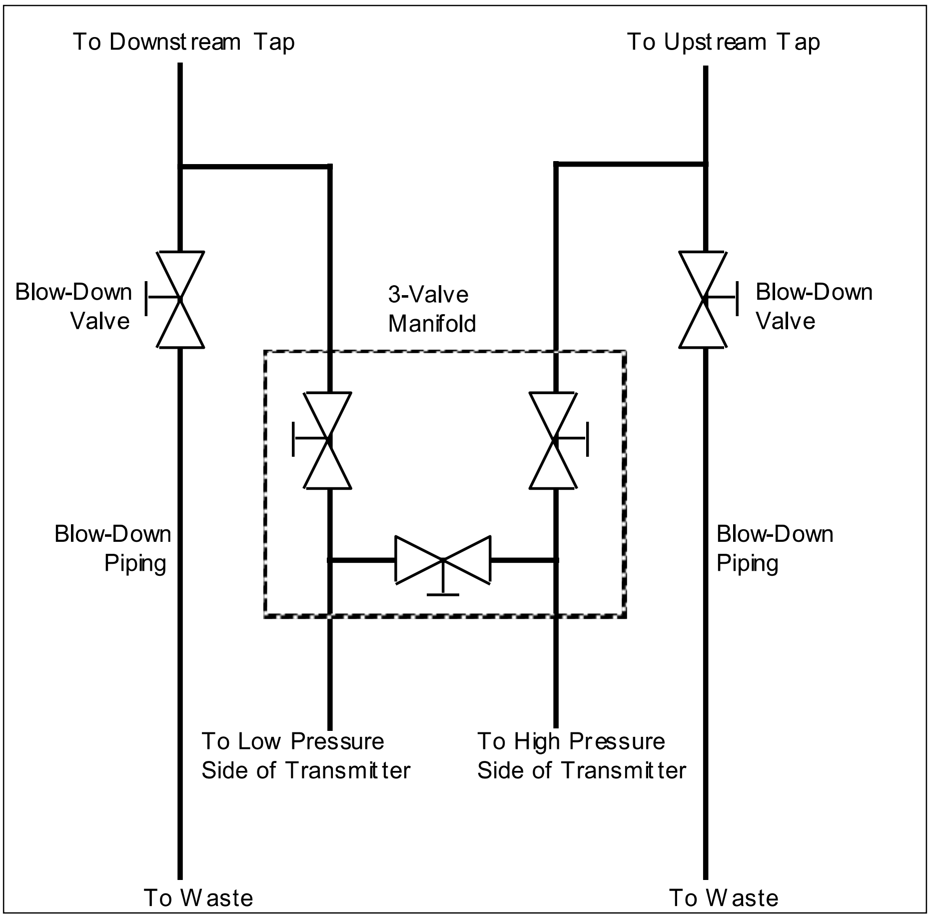


Figure 12 – ST 700 Standard Transmitter - Typical 3-Valve Manifold with Blow-Down Piping

4.5.2 Transmitter Location

The following are suggested connections based on what is being processed by the system.

Table 8 – ST 700 Standard Transmitter - Suggested Connection Locations

Process	Suggested Location	Description
Gases	Above the gas line.	The condensate drains away from the Transmitter.
Liquids	Below but near the elevation of the process connection.	This minimizes that static head effect of the condensate.
	Level with or above the process connection.	This requires a siphon to protect theTransmitter from process steam. The siphon retains water as a *fill fluid*.

1. For liquid or steam, the piping should slope a minimum of 25.4mm (1 inch) per 305mm (1 foot).
2. Slope the piping down toward the Transmitter if it is below the process connection to allow the bubbles to rise back into the piping through the liquid.
3. If the transmitter is located above the process connection, the piping should rise vertically above the Transmitter. In this case, slope down toward the flow line with a vent valve at the high point.
4. For gas measurement, use a condensate leg and drain at the low point (freeze protection may be required here).

ATTENTION Care must be taken when installing transmitters on hot processes. The operating temperature limits for the device (as outlined in Table 5) must not be exceeded. Impulse piping may be used to reduce the temperature of the process that comes into contact with the transmitter meter body. As a general rule there is a 56°C drop (100°F) in the temperature of the process for every foot of ½ inch uninsulated piping.

4.5.3 General Piping Guidelines

- When measuring fluids that contain suspended solids, install permanent valves at regular intervals to blow-down piping.
- Blow-down all lines on new installations with compressed air or steam, and flush them with process fluids (where possible) before connecting these lines to the Transmitter Meter body.
- Verify that the valves in the blow-down lines are closed tightly after the initial blow-down procedure and each maintenance procedure thereafter.

4.5.4 Procedure to Install Flange Adapters

The following procedure provides the steps for removing and replacing an optional flange adapter on the process head. Refer to Figure 13.

This procedure does not require that the Meter body be removed from the Electronics Housing. If flange adapters are being replaced with parts from other kits (for example, process heads), follow the procedures for the kits and incorporate the following procedure.

The threaded hole in each Flange Adapter is offset from center. To ensure proper orientation for re-assembly, note the orientation of the offset relative to each Process Head **before removing the adapter.**

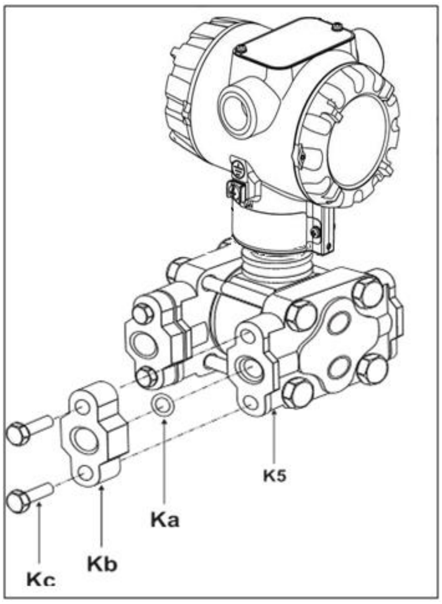


Figure 13 – ST 700 Standard Transmitter - Flange Adapter Removal and Replacement

Refer to the instructions included with the kit for removal and replacement procedures.

4.6 Wiring the ST 700 Standard Transmitter

4.6.1 Overview

The transmitter is designed to operate in a two-wire power/current loop with loop resistance and power supply voltage within the operating range shown in Figure 14.

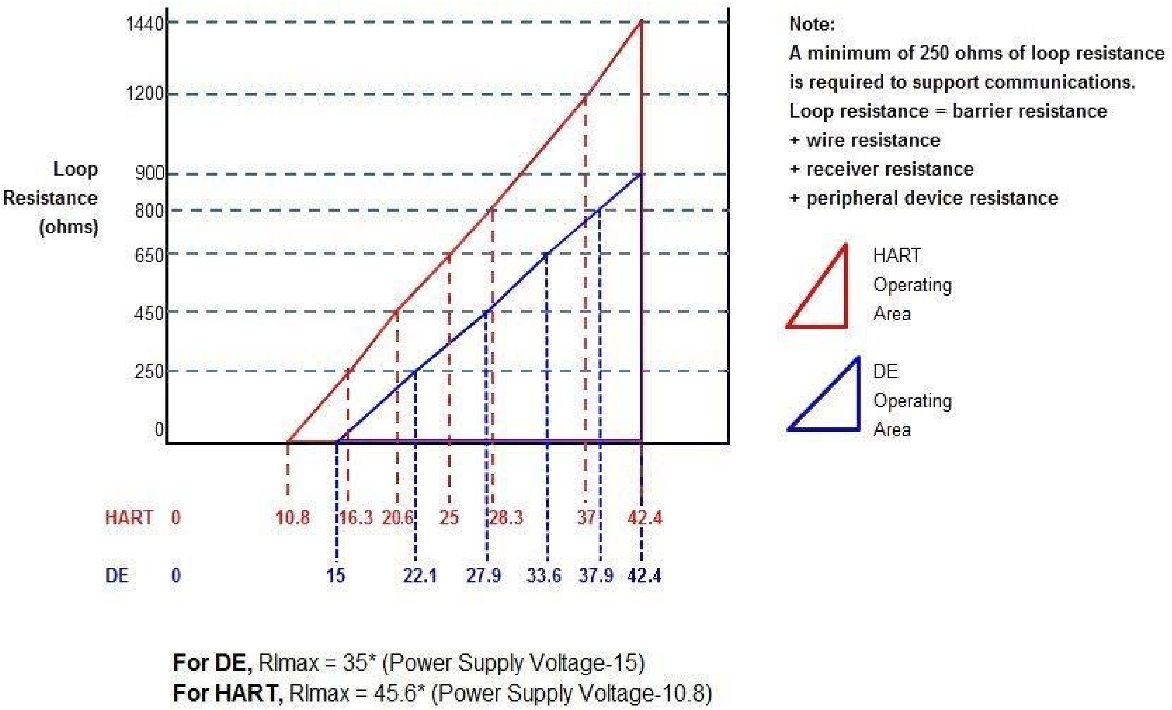


Figure 14 – ST 700 Standard Transmitter - Operating Ranges

Loop wiring is connected to the Transmitter by simply attaching the positive (+) and negative (–) loop wires to the positive (+) and negative (–) terminals on the Transmitter terminal block in the Electronics Housing shown in Figure 15.

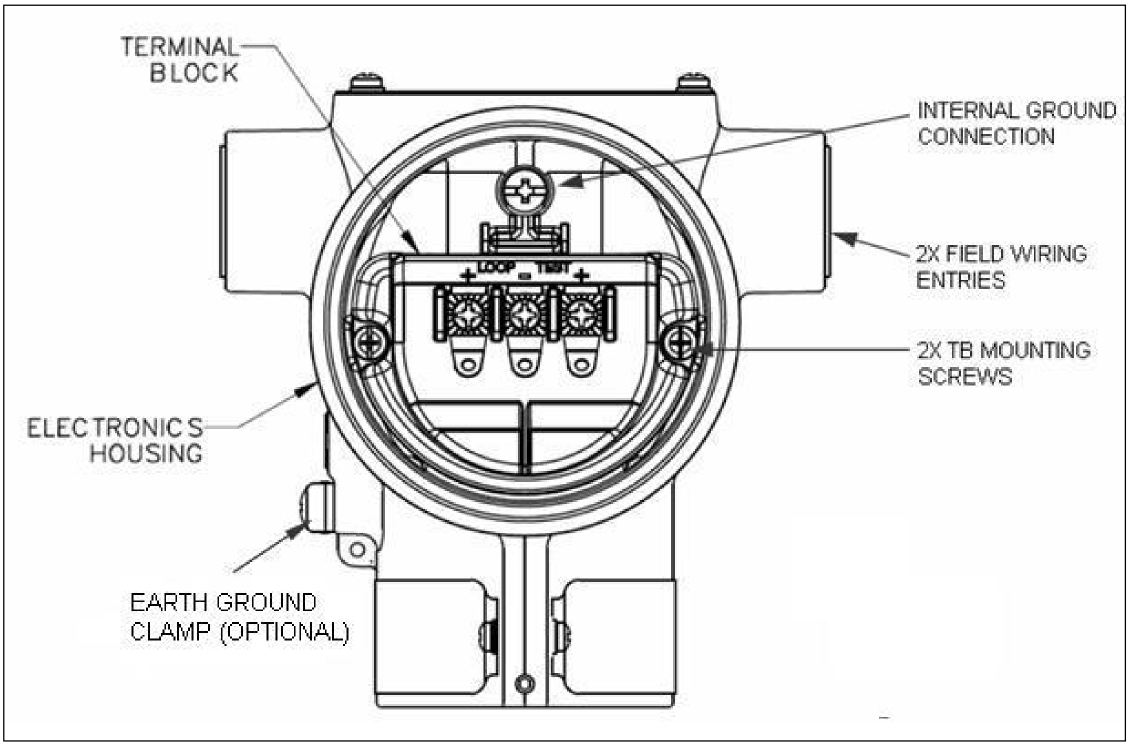


Figure 15 – ST 700 Standard Transmitter - 3-Screw Terminal Board and Grounding Screw

As shown in Figure 15, each Transmitter has an internal terminal to connect it to earth ground. Optionally, a ground terminal can be added to the outside of the Electronics Housing. While it is not necessary to ground the Transmitter for proper operation, doing so tends to minimize the possible effects of noise on the output signal and affords protection against lightning and static discharge. An optional lightning terminal block can be installed in place of the non-lightning terminal block for Transmitters that will be installed in an area that is highly susceptible to lightning strikes.

Wiring must comply with local codes, regulations and ordinances. Grounding may be required to meet various approval body certification, for example CE conformity. Refer to Appendix A of this document for details.

Note: The right hand terminal is for loop test and is not applicable for the Fieldbus option.

The Transmitter is designed to operate in a two-wire power/current loop with loop resistance and power supply voltage within the operating range; see

Figure 14. With optional lightning protection and/or a remote meter, the voltage drop for these options must be added to the basic 10.8-volt supply requirements to determine the required Transmitter voltage (V_{XMTR}) and maximum loop resistance ($R_{LOOP\ MAX}$). Additional consideration is required when selecting intrinsic safety barriers to ensure that they will supply at least minimum

Transmitter voltage ($V_{XMTR\ MIN}$), including the required 250 ohms of resistance (typically within the barriers) needed for digital communications.

Transmitter loop parameters are as follows:
$R_{LOOP\ MAX}$ = maximum loop resistance (barriers plus wiring) that will allow proper Transmitter operation and is calculated as $R_{LOOP\ MAX} = (V_{SUPPLY\ MIN} - V_{XMTR\ MIN}) \div 21.8mA$.

In this calculation:

$V_{XMTR\ MIN} = 10.8V + V_{LP} + V_{SM}$

$V_{LP} = 1.1V$, lightning protection option, LP

$V_{SM} = 2.3V$, remote meter

Note that V_{SM} should only be considered if a remote meter will be connected to the transmitter.

The positive and negative loop wires are connected to the positive (+) and negative (–) terminals on the terminal block in the Transmitter Electronics Housing.

Barriers can be installed per Honeywell's instructions for Transmitters to be used in intrinsically safe applications.

4.6.2 Digital System Integration Information

Transmitters that are to be digitally integrated to Honeywell's Total Plant Solution (TPS) system will be connected to the Pressure Transmitter Interface Module in the Process Manager, Advanced Process Manager or High Performance Process Manager through a Field Termination Assembly. Details about the TPS system connections are given in the *PM/APM SmartLine Transmitter Integration Manual*, PM12-410, which is part of the TDC 3000^X system bookset.

If you are digitally integrating a Transmitter in an Allen Bradley Programmable Logic Controller (PLC) process system, the same Field Terminal Assembly (FTA) and wiring procedures used with Honeywell's TPS system are also used with the Allen-Bradley 1771 and 1746 platforms.

4.6.3 Wiring Variations

The above procedures are used to connect power to a Transmitter. For loop wiring and external wiring, detailed drawings are provided for Transmitter installation in non-intrinsically safe areas and for intrinsically safe loops in hazardous area locations.

If you are using the Transmitter with Honeywell's TPS system, see *PM/APM Smartline Transmitter Integration Manual*, PM12-410, which is part of the TDC 3000^X system bookset.

4.6.4 Wiring Procedure

1. See Figure 15, above, for parts locations. Loosen the end cap lock using a 1.5mm Allen wrench.
2. Remove the end cap cover from the terminal block end of the Electronics Housing.
3. Feed loop power leads through one end of the conduit entrances on either side of the Electronics Housing. The Transmitter accepts up to 16AWG wire.
4. Plug the unused conduit entrance with the appropriate plug for the environment.
5. Connect the positive loop power lead to the positive (+) terminal and the negative loop power lead to the negative (-) terminal. Note that the Transmitter is <u>not</u> polarity-sensitive.
6. Replace the end cap, and secure it in place.

4.6.5 Lightning Protection

If your Transmitter includes the optional lightning protection, connect a wire from the Earth Ground Clamp (see Figure 15) to Earth Ground to make the protection effective. Use a size 8 AWG or (8.37mm^2) bare or green covered wire for this connection.

4.6.6 Supply Voltage Limiting Requirements

If your Transmitter complies with the ATEX 4 directive for self-declared approval per 94/9EC, the power supply has to include a voltage-limiting device. Voltage must be limited such that it does not exceed 42V DC. Consult the process design system documentation for specifics.

4.6.7 Process Sealing

The ST 700 SmartLine Pressure Transmitter is CSA-certified as a Dual Seal device in accordance with ANSI/ISA–12.27.01–2003, "Requirements for Process Sealing Between Electrical Systems and Flammable, or Combustible Process Fluids."

4.6.8 Explosion-Proof Conduit Seal

When installed as explosion proof in a Division 1 Hazardous Location, keep covers tight while the Transmitter is energized. Disconnect power to the Transmitter in the non-hazardous area prior to removing end caps for service.

When installed as non-incendive equipment in a Division 2 hazardous location, disconnect power to the Transmitter in the non-hazardous area, or determine that the location is non-hazardous before disconnecting or connecting the Transmitter wires.

Transmitters installed as explosion proof in Class I, Division 1, Group A Hazardous (classified) locations in accordance with ANSI/NFPA 70, the US National Electrical Code, with 1/2 inch conduit do not require an explosion-proof seal for installation. If 3/4 inch conduit is used, a LISTED explosion-proof seal to be installed in the conduit, within 18 inches (457.2mm) of the Transmitter.

4.7 Startup – ST 700 Standard Transmitter

4.7.1 Overview

This section identifies typical start up tasks associated with several generic pressure measurement applications. It also includes the procedure for running an optional analog output check.

4.7.2 Startup Tasks

After completing the installation and configuration tasks for a Transmitter, you are ready to start up the process loop. Startup usually includes:

- Checking zero input
- Reading inputs and outputs
- Applying process pressure to the transmitter.

You can also run an optional output check to *wring out* an analog loop and check out individual Process Variable (PV) outputs in Digitally Enhanced (DE) mode before startup.

The actual steps in a startup procedure vary based on the type of Transmitter and the measurement application. In general, the procedures in this section are based on using Honeywell MC Toolkit to check the Transmitter input and output under static process conditions, and make adjustments as required initiating full operation with the running process. Note that similar checks can be made using the optional three-button assembly, where the Transmitter is equipped. Operation with the three-button assembly is discussed in the Operation section.

When the Standard Display is connected, the two-button assembly for the Standard Display is present. The buttons will function 1 second after powering up.

4.7.3 Output Check Procedures

The Output Check comprises the following procedures:

- The Loop Test procedure checks for continuity and the condition of components in the output current loop.
- The Trim DAC Current procedure calibrates the output of the Digital-to-Analog converter for minimum (0%) and maximum (100%) values of 4mA and 20mA, respectively. This procedure is used for Transmitters operating online in analog mode to ensure proper operation with associated circuit components (for example, wiring, power supply, control equipment). Precision test equipment (an ammeter or a voltmeter in parallel with precision resistor) is required for the Trim DAC Current procedure.
- The Apply Values procedure uses actual Process Variable (PV) input levels for calibrating the range of a Transmitter. To measure a liquid level for example, a sight-glass can be used to determine the minimum (0%) and maximum (100%) level in a vessel. The PV is carefully adjusted to stable minimum and maximum levels, and the LRV and URV are then set by commands from the MC Toolkit.

The Transmitter does not measure the given PV input or update the PV output while it operates in the Output mode.

4.7.4 Constant Current Source Mode Procedure

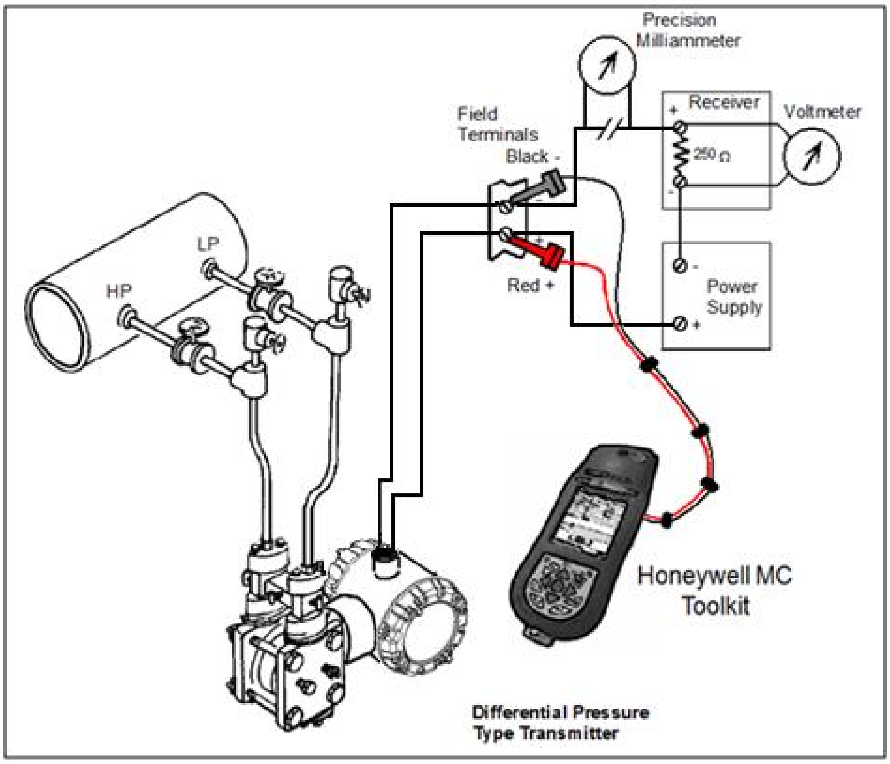


Figure 16 – ST 700 Standard Transmitter - Current Loop Test Connections

1. Refer to Figure 16 for test connections. Verify the integrity of electrical components in the output current loop.
2. Establish communication with the Transmitter. For these procedures, the values of components in the current loop are not critical if they support reliable communication between the Transmitter and the Toolkit.
3. On the Toolkit, display the **Output Calibration** box.
4. In the Output Calibration box, select the **Loop Test** button; the **LOOP TEST** box will be displayed.
5. Select the desired constant-level Output: 0%, 100%, or Other (any between 0% - 100%).
6. Select the Set button. A box will be displayed asking **Are you sure you want to place the transmitter in output mode?**

With the Transmitter in Analog mode, you can observe the output on an externally-connected meter or on a local meter. In DE mode, you can observe the output on the local meter or on the Toolkit Monitor display.

7. Select the **Yes** button. Observe the output current at the percentage you selected in Step 5.
8. To view the monitor display, navigate back from the **LOOP TEST** display, and select the **MONITOR** display. A **Confirm** popup will be displayed.
9. Select **Yes** to continue. This concludes the Startup procedure.

5. Operation_ST 700 Standard Transmitter

5.1 Overview

This section provides the information and processes involved for both Digitally Enhanced (DE) and HART operation using the three-button Basic and two-button Standard options for the ST 700 Standard transmitter.

5.2 Three-Button Operation

The ST 700 Standrad transmitter has optional three-button interface that provides a user interface and operation capability without opening the transmitter. Figure 17 shows the location of the three-button option and the labels for each button.

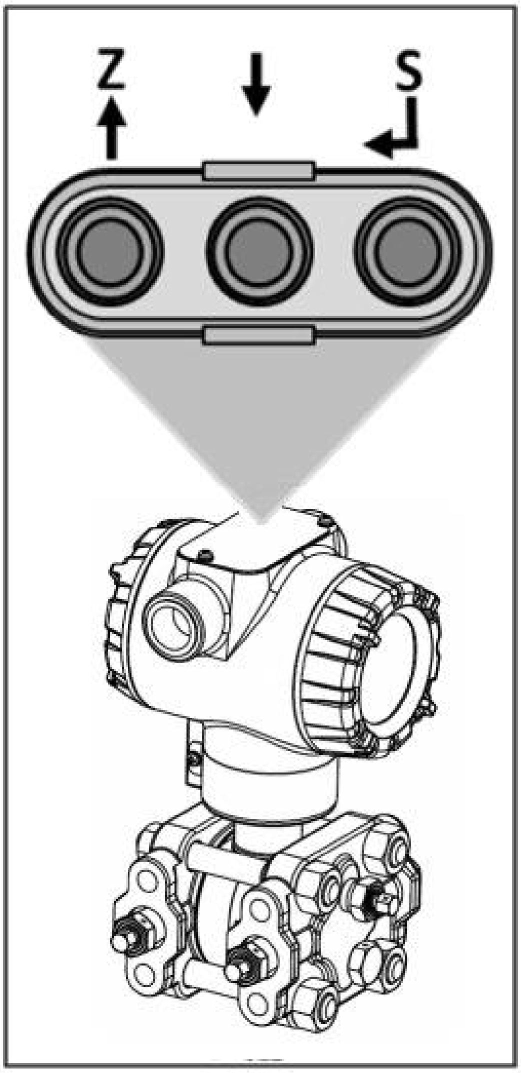


Figure 17 – ST 700 Standard Transmitter - Three-Button Option

Table 9 – Three-Button Option Functions

Physical Button	Basic Display	Action
Left ↑	Increment Previous Menu Item	Scroll to previous menu item in an active list. Scroll through alphanumeric list to desired character (ex. for entering Tag names or numeric values)
Center ↓	Decrement Next Menu Item	Scroll to next menu item in an active list. Scroll through alphanumeric list to desired character (ex. for entering Tag names or numeric values)
Right ↵	Select displayed menu item for activation or editing	Call up the Main Menu. Select an item for data entry. Confirm a data entry operation Activate the service associated with a selected menu item.

5.2.1 The Basic Display Menu

The Basic Display Menu is implemented as one long single-level menu and will “wrap around” when it reaches the start or end of the menu. Operation is as follows:

Press the ↵ button to call up the Menu.

1. Select **<Exit Menu>** and press ↵ to exit the Menu.
2. Use the ↑ and ↓ buttons to scroll through the list of menu items.
3. Press the ↵ button to select an item for data entry or activation. When an item is selected for data entry or activation, the cursor will jump to the lower line of the LCD to allow editing of the value. No action is taken against a menu item until the user presses the ↵ button.
4. If you want to abort a data entry operation, simply refrain from pushing any buttons for 10 seconds; the data entry operation will time out and the original value of the selected item will be preserved.

Table 10 – The Basic Display Menus

LCD Contrast	»»»»»	Adjust the LCD contrast level. Range from » (1) to »»»»»»»»» (9) Default: »»»»»»»(7)		Press ↵ to enter menu selection ↑ and ↓ to select level. ↵ to enter
PV Display	Pressure	Pressure Units	Select Process Variable (PV) to be shown on the display from list.	
	Percent Output	%		
	Loop Output	mA		
PV Decimal	None X.X X.XX X.XXX	Select the PV decimal resolution to be shown on selected screen from list.		
Pressure Units	atm, bar ftH2O @ 68ºF gf/cm2 inH2O @ 39ºF inH2O @ 60ºF inH2O @ 68ºF inHg @ 0ºC kgf/cm2, kPa mbar, mmH2O @ 4ºC, mmH2O @ 68ºF, mmHg @ 0ºC, MPa, Pa, psi Torr, mHg @ 0ºC	Choose appropriate engineering units from list		Press ↵ to enter menu selection ↑ and ↓ to select from list ↵ to enter
Zero Correct	Do Correct	Executing this selection corrects the Zero based on the input pressure		Press ↵ to enter menu selection Press ↵ to initiate action
LRV Correct	Do Correct	Executing this selection corrects the LRV based on the input pressure		
URV Correct	Do Correct	Executing this selection corrects the LRV based on the input pressure		
Reset Corrects	Do Correct	Executing this selection Resets the Zero, LRV, and URV Corrects back to Factory values		
DAC Zero Trim Note: Loop must be removed from Automatic Control	DAC Zero Trim	This selection allows the loop zero output 4mA value to be trimmed. Note: You must connect a current meter to the transmitter to monitor the loop output.		Press ↵ to enter menu selection ↑ and ↓ to select number. ↵ to enter and shift to the next digit to the right
DAC Span Trim Note: Loop must be removed from Automatic Control	DAC Span Trim	This selection allows the loop span output 20mA value to be trimmed. Note: You must connect a current meter to the transmitter to monitor the loop output.		

Loop Test Note: Loop must be removed from Automatic Control	Loop Test 12.000	This selection allows the user to force the DAC output to any value between 3.8 and 20.8 mA. Note: This selection will put the DAC into Fixed Output Mode, as indicated by the flashing output value. Navigation away from this menu item will return the loop to Normal (Automatic) Mode.	
LRV URV	#. ## #. ##	The limits are: 2X the Lower Range Limit (LRL) of the Meter body and 2X the Upper Range Limit (URL) of the Meter body	Press ↵ to enter menu selection ↑ and ↓ to select number. ↵ to enter and shift to the next digit to the right
Damping	#. ##	Selection applies digital filtering to suppress noise effects on the PV. The limits for this value are 0.0 to 32.0 seconds	
NAMUR	Enabled Disabled	Disabling sets the loop output and burnout levels to the Honeywell levels	Press ↵ to enter menu selection ↑ and ↓ to select from list ↵ to enter
Filter Perf	Fast SOR Standard SOR	Fast Speed of Response Standard Speed of Response	
Transfer Function (only available for DP Transmitters)	Linear	The loop output of the transmitter is a linear representation of the differential pressure	Press ↵ to enter menu selection ↑ and ↓ to select Alphanumeric ↵ to enter and shift to next character to the right.
	Square Root	The loop output of the transmitter represents %Flow as defined by the DP Square Root flow equation.	
Flow Cutoff	Single Breakpt	Allows the user to specify a single breakpoint as the low flow cutoff point. This item is only available when the Transfer Function is set to Square Root.	
	Dual Slope	Uses a dual slope formula to determine the low flow cutoff point. This item is only available when the Transfer Function is set to Square Root.	

Flow Breakpoint	##. #%	Enter the low flow cutoff point when Single Breakpt is selected. Range: 0 to 25.0 %Flow.	
Tag ID	▯▯▯▯▯▯▯▯	Enter Tag ID name up to 8 characters long. ▯ = any Alphanumeric value	Press ↵ to enter menu selection ↑ and ↓ to select Alphanumeric ↵ to enter and shift to next character to the right.
Device ID	Unique for each device		Read Only
PV Units	Units of transmitted PV		
Install Date	DD MM YYYY	This selection allows the user to enter the date a transmitter is installed. The Install Date is entered in sequence of Day, Month, and Year, followed by the new date and the prompt Write Date to confirm the entry. **CAUTION**: The Install Date can only be written once in the life of the Transmitter. You cannot erase or overwrite the Install Date once it has been written.	Press ↵ to enter menu selection ↑ and ↓ to select number ↵ to enter and shift to next digit to the right. Read Only after entered
Firmware	Display Electronics Meterbody	Menu item shows the current Firmware versions of the Display, Electronics Module and the Meter body	Read Only Parameter
Protocol	HART DE	Menu item shows the communications protocol	
Model Key		Identifies the type and range of the transmitter	Read Only Parameter
<Exit Menu>			

5.2.2 Data Entry

Data entry is performed from left to right. Select a character / digit by pressing 🠅 or 🠇 buttons, and then press ↵ to advance to the next character position to the right. Select the cross-hatch character ▒ to terminate the entry or if the final character is already a space character, just press **<<** again.

All numeric entries are clamped at the low or high limit if needed. You can determine the low and high limit for a parameter by selecting either the **H** or **L** character while the cursor is positioned over the left-most digit and press ↵ button. The Display will show the selected limit.

Table 11 – Three-Button Data Entry

Screen Symbol	Numeric data entry	Text entry
H	Display the high limit for this parameter. This symbol only appears in the left-most position of the data entry field.	Not Available
L	Display the low limit for this parameter. This symbol only appears in the left-most position of the data entry field.	Not Available
<<	Terminate the numeric entry	Terminate the text entry
0 thru 9, Minus, Decimal	These characters are used to enter numeric values. The minus sign only appears in the left-most digit.	These characters can be used to enter the Tag ID

5.2.3 Editing a Numeric value

Editing of a numeric value is a digit-by-digit process, starting with the left-most digit.

1. Press ↵ to begin the edit process.
2. The Basic Display will show the current value of the item on the lower line, left justified. The
3. Press the 🠅 or 🠇 buttons to select the desired digit, and then press ↵ to advance to the next digit to the right.
4. After the last digit has been entered, press ↵ one more time to write the new value to the transmitter.

5.2.4 Selecting a new setting from a list of choices

Use the procedure described below to select a new setting for parameters that present a list of choices (e.g., PV Display, Pressure Units, etc.).

1. Press ↵ to begin the edit process.
    a. The Basic Display will show the current setting of the item on the lower line, left justified.
2. Press the 🠅 or 🠇 buttons to scroll through the list of choices.

Press ↵ to make your selection. The new selection will be stored in the transmitter and will be displayed on the lower line, right justified.

5.3 Two-Button Operation

The ST 700 Standrad transmitter has an optional two-button interface that provides a user interface and operation capability without opening the transmitter. Figure 18 shows the location of the two-button option and the labels for the buttons.

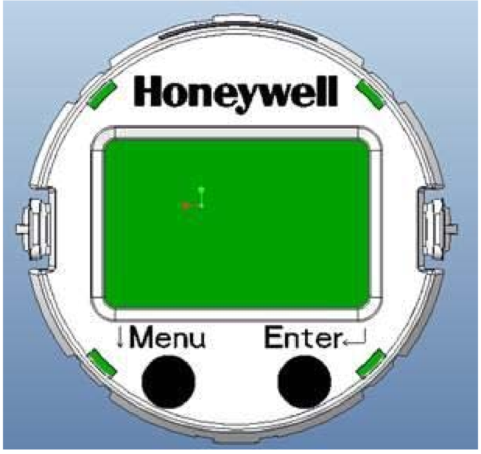


Figure 18 – ST 700 Standard Transmitter - Two-Button Option

5.3.1 The Standard Display Menu

The ST 700 Standard Display Menu is implemented as one long single-level menu and will "wrap around" when it reaches the end of the menu. Operation is as follows:

1. Select **<Exit Menu>** and press ↵ to exit the Menu.
2. Use the ↓ buttons to scroll through the list of menu items.
3. Press the ↵ button to select an item for data entry or activation. When an item is selected for data entry or activation, the cursor will jump to the lower line of the LCD to allow editing of the value. No action is taken against a menu item until the user presses the ↵ button.
4. If you want to abort a data entry operation, simply refrain from pushing any buttons for 10 seconds; the data entry operation will time out and the original value of the selected item will be preserved.
5. If you want to abort a menu operation, simply refrain from pushing any buttons for 60 seconds; the menu operation will time out and the exit from menu & it will show PV value.

Note: The abort option is not available for Loop test parameter.

Table 12 – The Standard Display Menus

<table>
<tr><td rowspan="4">PV Display [SEL PV]</td><td>Pressure (PRESURE)</td><td>Pressure Units</td><td rowspan="4">Select Process Variable (PV) to be shown on the display from list.</td><td rowspan="5">Press ↵ to enter menu selection

↓Menu to select from list
↵ to enter</td></tr>
<tr><td>Percent Output (% OUT)</td><td>%</td></tr>
<tr><td>Loop Output (LOOPOUT)</td><td>mA</td></tr>
<tr><td>Flow (FLOW)
Note: Before selecting PV type as Flow, please ensure the LRV/URV values in (pressure unit) are as per application. For PV type Flow the pressure unit will not be visible.</td><td>Flow unit</td></tr>
<tr><td>Pressure Units [UNITS]
(Visible for all PV except Flow)</td><td>atm, bar
ftH2O @ 68ºF
gf/cm2
inH2O @ 39ºF
inH2O @ 60ºF
inH2O @ 68ºF
inHg @ 0ºC
kgf/cm2, kPa
mbar,
mmH2O @ 4ºC,
mmH2O @ 68ºF,
mmHg @ 0ºC,
MPa, Pa,
psi
Torr,
mHg @ 0ºC</td><td colspan="2">Choose appropriate engineering units from list</td></tr>
<tr><td>Flow Units [FLUNIT]
(Visible if PV is Flow)</td><td>Cubic meter/hour[m3/hr] Kg/hour [Kg/hr]
Metric Ton/Hour [MT/hr]
Liter per second [L/sec]
Liters/hour [L/hr]
Standard Cubic feet per hour[SCFH]
Cubic feet per hour[CFH]
Gallons/hour[gal/hr]
Barrel/hours [bbl/hr]
Imperial Gallons/hours[Igal/hr]
Percentage[%]</td><td colspan="2">Choose appropriate engineering units from list</td><td>Press ↵ to enter menu selection

↓Menu to select from list
↵ to enter</td></tr>
</table>

Scaling Low [SCLLOW] Scaling High [SCLHIG] (Visible if PV is Flow)	#. ## #. ##	The limits are: -999999 to 999999	Press ↵ to enter menu selection ↓ Menu to select number. ↵ to enter and shift to the next digit to the right
Enter LRV [ENTLRV] Enter URV [ENTURV]	#. ## #. ##	The limits are: 2X the Lower Range Limit (LRL) of the Meter body and 2X the Upper Range Limit (URL) of the Meter body. The LRV/URV value will be available in Pressure Units (Standard Display pressure unit)	Press ↵ to enter menu selection ↓ Menu to select number. ↵ to enter and shift to the next digit to the right
DAC Zero Trim [ZEROTR] Note: Loop must be removed from Automatic Control	DAC Zero Trim	This selection allows the loop zero output 4mA value to be trimmed. Note: You must connect a current meter to the transmitter to monitor the loop output.	Press ↵ to enter menu selection ↓ Menu to select number. ↵ to enter and shift to the next digit to the right
DAC Span Trim [SPANTR] Note: Loop must be removed from Automatic Control	DAC Span Trim	This selection allows the loop span output 20mA value to be trimmed. Note: You must connect a current meter to the transmitter to monitor the loop output.	
Loop Test [LPTEST] Note: Loop must be removed from Automatic Control	Loop Test 12.000	This selection allows the user to force the DAC output to any value between 3.8 and 20.8 mA. Note: This selection will put the DAC into Fixed Output Mode, as indicated by the flashing output value. Navigation away from this menu item will return the loop to Normal (Automatic) Mode.	Press ↵ to enter menu selection ↓ to select number. ↵ to enter and shift to the next digit to the right

<table>
<tr><td>Set LRV [SETLRV]</td><td>Set LRV</td><td>Executing this selection performing for Zero operation.</td><td rowspan="2">Press ↵ to enter menu selection

Press ↵ to initiate action</td></tr>
<tr><td>Set URV [SETURV]</td><td>Set URV</td><td>Executing this selection for Span operation</td></tr>
<tr><td>Contrast [CNTRST]</td><td>»»»»»</td><td>Adjust the LCD contrast level.
Range from » (1)   to
»»»»»»»»» (7)
Default: »»»»»»»(7)</td><td>Press ↵ to enter Menu selection

Menu to select level.
↵ to Enter</td></tr>
<tr><td colspan="4"><Exit Menu></td></tr>
</table>

5.3.2 Standard Display Abbreviations:

Table 13 – The Standard Display abbreviations

Abbreviation	Meaning
OOR	Out of Range
PRSPAN	Push reduce span
Wrng Mo	Wrong Mode
Illegal	Illegal Value
Wrt Err	NVM write error
Too Hi	Value/Parameter Too High
Too Lo	Value/Parameter Too Low
LRV Hi	LRV too High
LRV Lo	LRV too Low
LargeSP	Span too large
SmallSP	Span too small
Locked	Device is locked
Multidr	Device in multidrop mode
Wrt Prt	Device in write protect mode
NotSprt	Not supported
Hi LMT	Value is greater than high Limit value
Low LMT	Value is less than low Limit value

5.3.3 Data Entry

Data entry is performed from left to right. Select a character / digit by pressing ↓ buttons, and then press ↵ to advance to the next character position to the right. Select the cross-hatch character ▒ to terminate the entry or if the final character is already a space character, just press **<<** again.

All numeric entries are clamped at the low or high limit if needed. You can determine the low and high limit for a parameter by selecting either the **H** or **L** character while the cursor is positioned over the left-most digit and press ↵ button. The Display will show the selected limit.
For numeric entry sign is required to be entered only for negative numbers. For positive number, select space and move ahead.

Table 14 –Two-Button Data Entry

Screen Symbol	Numeric data entry
H	Display the high limit for this parameter. This symbol only appears in the left-most position of the data entry field.
L	Display the low limit for this parameter. This symbol only appears in the left-most position of the data entry field.
<<	Terminate the numeric entry
0 thru 9, Minus, Decimal	These characters are used to enter numeric values. The minus sign only appears in the left-most digit.

5.3.4 Editing a Numeric value

Editing a numeric value is a digit-by-digit process, starting with the left-most digit.

1. Press ↵ to begin the edit process.
2. The Standard Display will show the current value of the item on the lower line, left justified.
3. Press the ↓ buttons to select the desired digit, and then press ↵ to advance to the next digit to the right.
4. After the last digit has been entered, press ↵ one more time to write the new value to the transmitter.

5.3.5 Selecting a new setting from a list of choices

Use the procedure described below to select a new setting for parameters that present a list of choices (e.g. PV Display, Pressure Units, and so forth.).

1. Press ↵ to begin the edit process.
    a. The Standard Display will show the current setting of the item on the lower line
2. Press the ↓ buttons to scroll through the list of choices.
3. Press ↵ to make your selection. The new selection will be stored in the transmitter and will be displayed on the lower line

5.4 Basic and Standard Display Operations

5.4.1 Editing a Numeric value

Editing of a numeric value is a digit-by-digit process, starting with the left-most digit.

1. Press ↵ to begin the edit process:
   - The Basic and Standard Display will display the current value of the item on the lower line, left justified.
   - **Basic Display:** Press the ↑ or ↓ buttons to select the relevant digit, and then press ↵ to advance to the next digit to the right.
   - **Standard Display:** Press the ↓ button to select the relevant digit, and then press ↵ (both button simultaneously) to advance to the next digit on the right.
2. Basic and Simply Displays: After the last digit has been entered, press ↵ one more time to write the new value to the transmitter.

5.4.2 Selecting a new setting from a list of choices

Use the procedure described below to select a new setting for parameters that present a list of choices (e.g. PV Display, Pressure Units, etc.).

1. Press ↵ to begin the edit process.
   a. The Basic Display will show the current setting of the item on the lower line, left justified.
2. Press the ↑ or ↓ buttons to scroll through the list of choices.

   Press ↵ to make your selection. The new selection will be stored in the transmitter and will be displayed on the lower line, right justified.

5.5 Three Button Operation with no Display Installed

When there is no Display installed, the buttons can be used to perform a Zero or Span adjustment of the ST 700 Standard Transmitter. Caution should be taken to insure these adjustments are only made when the correct input pressures are applied.

5.5.1 Zero Adjustment

This adjustment is the same as performing a Set LRV using the Display.

1. Connect a current meter or voltmeter as shown in Figure 16 to monitor the PV output of the Transmitter.
2. Using an accurate pressure source, apply pressure equivalent to the Transmitter LRV.
3. Press the Down (↓) and Zero (↑) buttons together to set the Zero.
4. Verify that the output is now 4 mA.

5.5.2 Span Adjustment

This adjustment is the same as performing a Set URV using the Display.

1. Connect a current meter or voltmeter as shown in Figure 16 to monitor the PV output of the Transmitter.
2. Using an accurate pressure source, apply pressure equivalent to the desired Upper Range Value of the transmitter.
3. Press the **Down (↓)** and **Span** (↵) buttons together to set the span.
4. Verify that the PV output is now 20mA.

You can also use the MCT 202 Toolkit to make any adjustments to an ST 700 SmartLine Pressure Transmitter. Alternately, certain adjustments are possible through an Experion Station or Universal Station, if the ST 700 is digitally integrated with either of these stations.

5.6 Changing the Default Failsafe Direction

Transmitters are shipped with a default failsafe direction of upscale. This means that the Transmitter output will set the current output to upscale failsafe (maximum output) upon detection of a critical status. You can change the direction from upscale failsafe to downscale failsafe (minimum output) by moving the top jumper located in the Electronics module.

5.6.1 DE and Analog Differences

Failsafe operation is different between DE and analog operation:

- **Analog operation** – Upscale failsafe drives the Transmitter output to 21.8mA. Downscale failsafe drives the Transmitter output to 3.8mA.
- **DE operation** – Upscale failsafe causes the Transmitter to generate a **+ infinity** digital signal. Downscale failsafe causes the Transmitter to generate a **– infinity** digital signal.

The Transmitter electronics module interprets either signal as *not-a-number* and initiates its own configured failsafe action for the control system.

5.6.2 Procedure to Establish Failsafe Operation

The failsafe direction display accessible via the Toolkit shows only the state of the jumper as it correlates to analog Transmitter operation. Failsafe action for the DE control system may be configured to operate in a manner different from analog, as indicated by the state of the Transmitter jumper.

The integrated circuits in the Transmitter PWA are vunerable to damage by stray static discharges when removed from the Electronics Housing. Minimize the possibility of static discharge damage when handling the PWA as follows:

Do not touch terminals, connectors, component leads, or circuits when handling the PWA.

When removing or installing the PWA, handle it by its edges or bracket section only. If you need to touch the PWA circuits, be sure you are grounded by staying in contact with a grounded surface or by wearing a grounded wrist strap.

When the PWA is removed from the Transmitter, put it in an electrically conductive bag, or wrap it in aluminum foil to protect it.

The following procedure outlines the steps for positioning the write protect and failsafe jumpers on the electronics module. See Figure 19 for the locations of the failsafe and write protect jumpers.

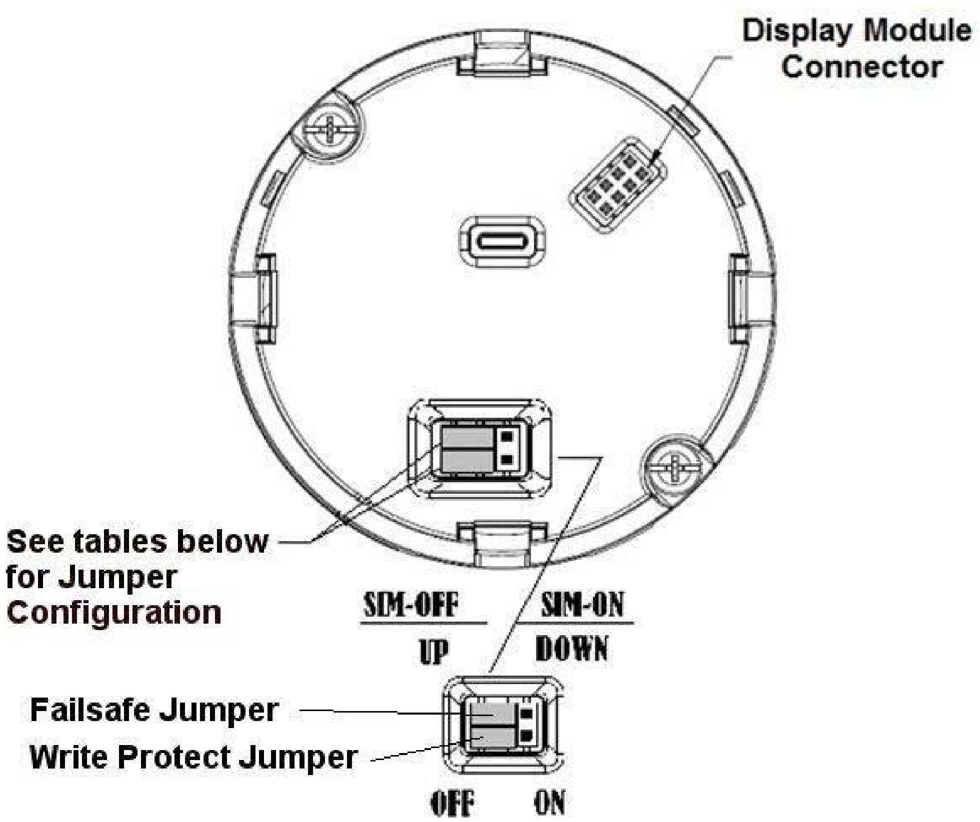


Figure 19 – ST 700 Standard Transmitter - Locating the Failsafe and Write Protect Jumpers

Table 15 – ST 700 Standard Transmitter - Hart and DE Failsafe and Write Protect Jumpers

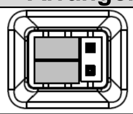
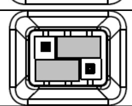
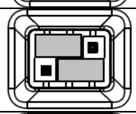
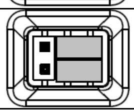
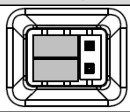
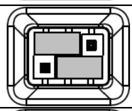
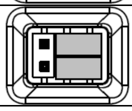
Jumper Arrangements	Description
	Failsafe = UP (High) Write Protect = OFF (Not Protected)
	Failsafe = DOWN (Low) Write Protect = OFF (Not Protected)
	Failsafe = UP (High) Write Protect = ON (Protected)
	Failsafe = Down (Low) Write Protect = On (Protected)

Table 16 – ST 700 Standard Transmitter - Fieldbus Simulation and Write Protect Jumpers

Image	Description
	Fieldbus Simulation Mode = OFF Write Protect = OFF (Not Protected)
	Fieldbus Simulation Mode = OFF Write Protect = ON (Protected)
	Fieldbus SIM Mode = ON Write Protect = OFF (Not Protected)

1. Turn OFF Transmitter power (Power removal is only required in accordance with area safety approvals. Power removal is only required in Class 1 Div 1 Explosionproof and Class 1 Div 2 environments).

2. Loosen the end cap lock, and unscrew the end cap from the electronics side of the Transmitter housing.

3. If equipped with a Display module, carefully depress the two tabs on the sides of the Display Module, and pull it off.

4. If necessary, unplug the interface connector from the Communication module. Do not discard the connector.

5. Set the Failsafe Jumper (top jumper) to the desired position (UP or DOWN). See Table 15 and Table 16 for jumper positioning.

6. If applicable, re-install the Display module as follows:
    - Orient the display as desired.
    - Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.
    - Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

   Note: Installing a Display Module into a powered transmitter may cause a temporary upset to the loop output value.

   Orient the Display for proper viewing through the end cap window. You can rotate the meter mounting orientation in 90° increments.

7. Restore transmitter power if removed.

5.7 Monitoring the Basic and Standard Displays for the ST 700 Standard Transmitter

This section describes the information shown on the operator screens of the Basic and Standard Displays.

5.7.1 Basic Display_ST 700 Standard Transmitter -

Figure 20 illustrates the Basic Display format with Process Variable (PV).

- The PV value is user-configurable. This field has 7 characters. The maximum allowable numeric value is 9999999 or -999999. If fractional decimals are configured, the fractional positions will be dropped, as required. If the PV value exceeds the above limits, it is divided by 1000 and "K" is appended to the result, allowing a maximum value with multiplier of 999999K or -99999K.
- Process Variable Tag is user-configurable from a HART Host. This field has 14 characters.
- Engineering Units, this field is user-configurable. This field has 8 characters.

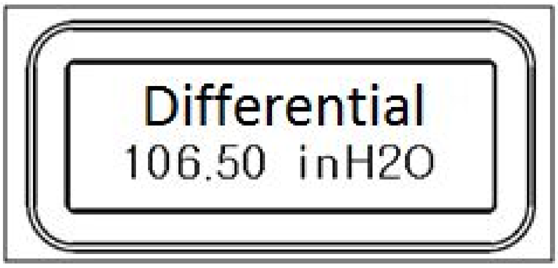


Figure 20 – ST 700 Standard Transmitter - Basic Display with Process Variable Format

5.7.2 Standard Display_ST 700 Standard Transmitter -

- The PV value is user-configurable. This field has 6 characters. The maximum allowable numeric value is 999999 or -999999.
  - If fractional decimals are configured, the fractional positions will be dropped, as required.
  - If the PV value exceeds the above limits, it is divided by 1000 and "K" is appended to the result, allowing a maximum value with multiplier of 99999K or -99999K.

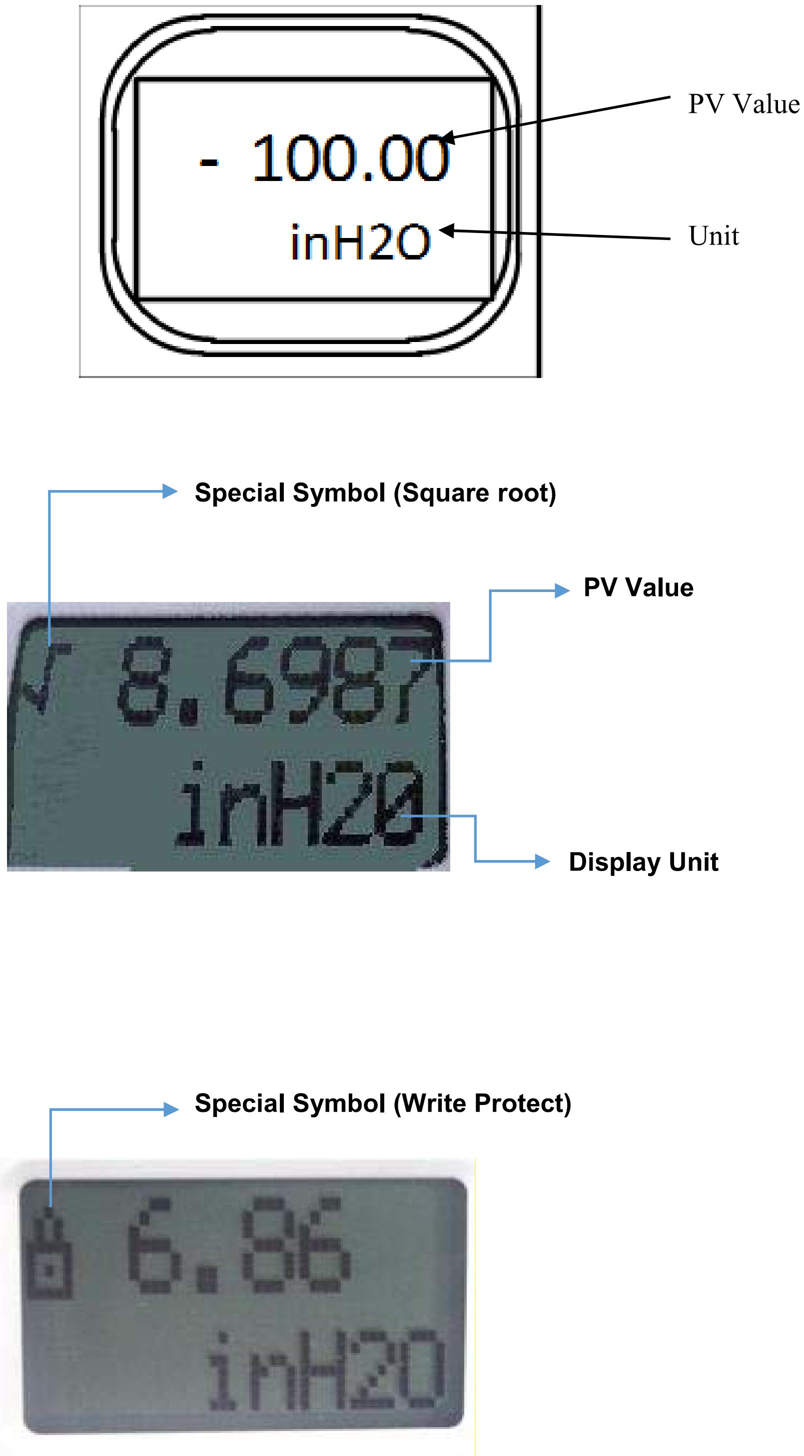


Figure 21 – ST 700 Standard Transmitter - Standard Display with Process Variable Format

6. Maintenance_ST 700 Standard Transmitter

6.1 Overview

This section provides information about preventive maintenance and replacing damaged parts. The topics covered in this section are:

- Preventive maintenance of the meter body barrier diaphragms and process piping to the Transmitter.
- Replacement of damaged parts such as the Transmitter Printed Wiring Assembly (PWA) and meter body

6.2 Preventive Maintenance Practices and Schedules

The ST 700 Transmitter does not require any specific maintenance at regularly scheduled intervals. However, it is recommended that you perform these typical inspection and maintenance routines on a schedule that is dictated by the characteristics of the process medium and if blow-down facilities or purge systems are being used.

- Check piping for leaks.
- Clear piping of sediment or other foreign matter.
- Clean the Transmitter process heads, including the barrier diaphragms.

6.3 Inspecting and Cleaning Barrier Diaphragms

Depending on the characteristics of the process medium, sediment or other foreign particles may collect in the process head cavity/chamber and cause faulty measurement. In addition, the barrier diaphragm(s) in the Transmitter meter body may become coated with residue from the process medium. The latter is also true for external diaphragms on flange-mount and remote seal type Transmitters.

In many cases, you can readily remove the process head(s) from the Transmitter meter body to clean the process head cavity and inspect the barrier diaphragm(s). For flange-mount and remote seal diaphragms, you may only need to run a purge line in the tank to rinse off the face of the diaphragm(s).

The following procedure comprises the general steps for inspecting and cleaning barrier diaphragms. You may have to modify these steps to meet your particular process or transmitter model requirements. Figure 22 shows an exploded view of a Differential Pressure (DP) Transmitter meter body for reference. For disassembly/reassembly purposes, Gauge Pressure (GP) and Absolute Pressure (AP) Transmitters are similar.

It is recommended that you remove the Transmitter from service and move it to a clean area before disassembling it.

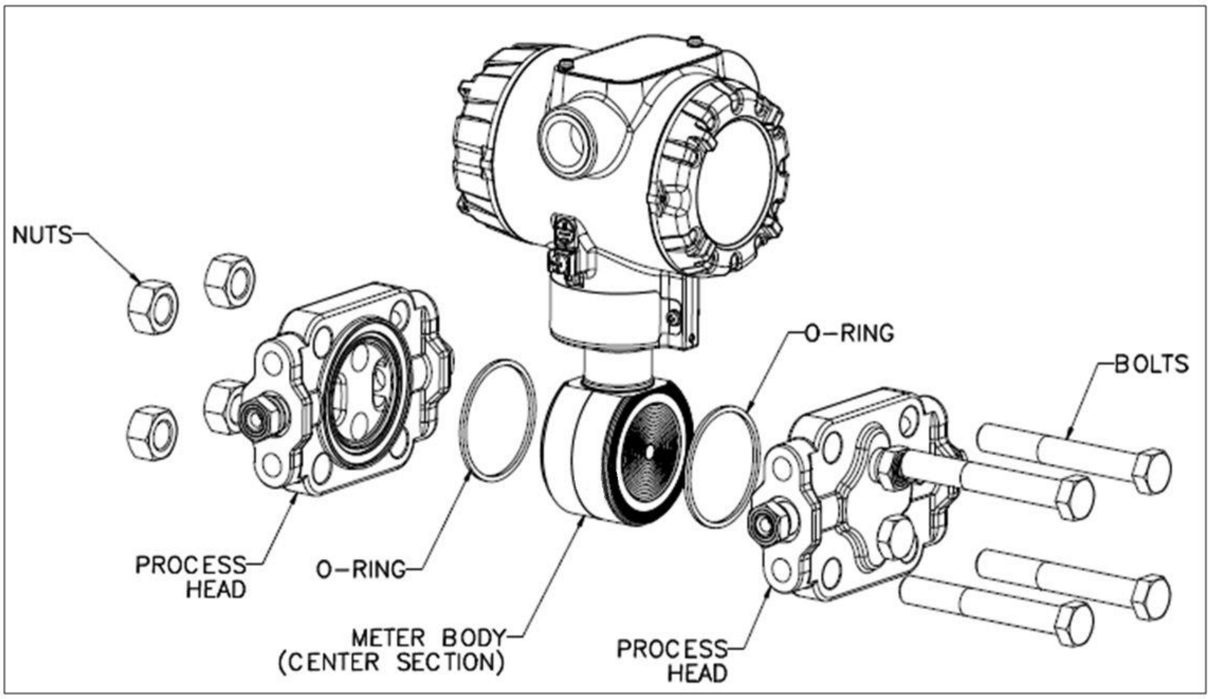


Figure 22 – ST 700 Standard Transmitter - DP Transmitter Head Disassembly

1. Close all valves to isolate the Transmitter from the process.
2. Open the vent in the process head to drain fluid from the Transmitter meter body, as necessary.
3. Remove the Transmitter from the process.
4. Loosen the nuts in the sequence shown in Figure 23.
5. Remove the nuts from the bolts that hold the process head(s) to the meter body.
6. Remove the process heads and bolts.
7. Remove the gasket/ O-ring, and clean the interior of the process head using a soft bristle brush and an approved solvent.
8. Inspect the barrier diaphragm for signs of deterioration, corrosion, and distortion.
9. If the diaphragm is distorted contact Honeywell for assistance.
10. Install a new gasket/O-ring in each process head.
11. Coat threads on the process head bolts with a suitable anti-seize compound, such as “Neverseize,” or equivalent.
12. Using a torque wrench, gradually tighten the nuts in the sequence shown in Figure 23. Tighten head bolts in stages of 1/3-full torque, 2/3-full torque, and full torque. Refer to the values in Table 17 for torque requirements versus Transmitter type and model.

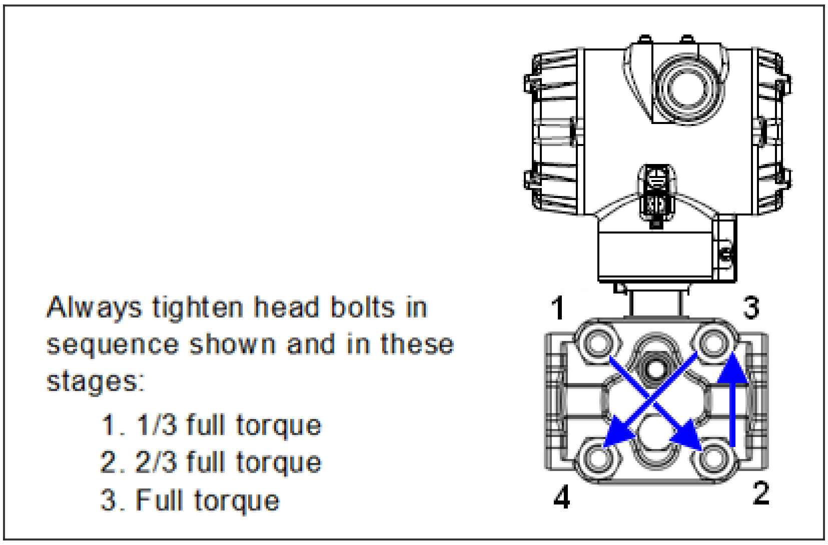


Figure 23 – ST 700 Standard Transmitter - Head Bolt Tightening Sequence

Table 17 – Head Bolt Torque Values

BOLTING TYPE	B7M BOLTING TABLE III B7 OPTION BOLT 51452557-004 NUT 51452559-003	PTFE COATED B7M BOLTING Y SPECIAL OPTION BOLT 51452557-007 NUT 51452559-007	MONEL K 500 BOLTING Y SPECIAL OPTION BOLT 51452557-005 NUT 51452559-005	25% CHROMIUM SUPER DUPLEX BOLTING Y SPECIAL OPTION BOLT 51452557-006 NUT 51452559-006	316 STAINLESS STEEL BOLTING TABLE III SS OPTION BOLT 51452557-003 NUT 51452557-003 BOLT 51452559-004	NACE CR BOLTING TABLE III CR OPTION BOLT 51452557-002 NUT 51452559-02	ALL GRADE 660 CLASS D BOLTING Y SPECIAL OPTION BOLT 51452557-001 NUT 51452559-008	CARBON STEEL BOLTING STANDARD OPTION BOLT 51452557-001 NUT 51452559-001	ALL GRADE 660 CLASS D BOLTING Y SPECIAL 6 KPSI OPTION BOLT 51452557-202 NUT 51452559-008
50049713XXXX, EXCEPT XXX5 ALL TRANSMITTERS EXCEPT DRAFT RANGE	48,8 N•M +/- 2,4 N•M (36.0 Lb-Ft +/- 1.8 Lb-Ft)				56,9 N•M +/- 2,8 N•M (42.0 Lb-Ft +/- 2.1 Lb-Ft)			67,8 N•M +/- 3,4 N•M (50.0 Lb-Ft +/- 2.5 Lb-Ft)	
50049713XXX5 DRAFT RANGE TRANSMITTER ONLY	20,3 N•M +/- 1,0 N•M (15.0 Lb-Ft +/- 0.8 Lb-Ft)								

6.4 Replacing the Communication Module

The Communication module includes a connector to the sensor ribbon cable and a connector to the optional Display module. This section includes the procedure to replace the Communication module.

The transmitter does not have to be removed from service to replace the Comm Module

Please take appropriate steps to avoid ESD damage when handling the Communication and Display Module assemblies

Refer to Figure 24 for parts locations.

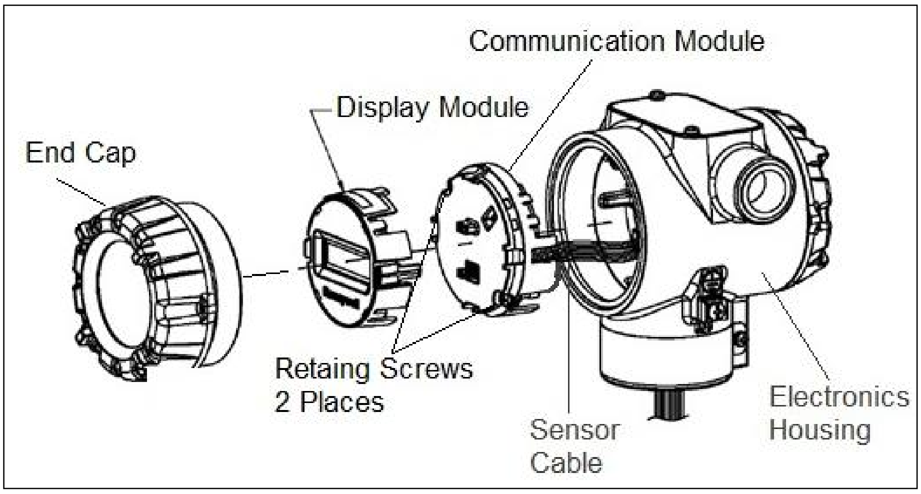


Figure 24 – ST 700 Standard Transmitter - PWA Replacement

1. Turn OFF Transmitter power (Power removal is only required in accordance with area safety approvals. Power removal is only required in Class 1 Div 1 Explosion-proof and Class 1 Div 2 environments).
   - When removing the Communications Module with power applied, the loop will go to 0V. Likewise, installing a Communications Module into a transmitter with power applied will cause the loop output value to go to 12ma for several seconds then the loop output value will go to the configured value based on the PV input.
   - Installing a Display Module into a powered transmitter may cause a temporary upset to the loop output value.
2. Loosen the end cap lock, and unscrew the end cap from the electronics side of the Transmitter housing.
3. If equipped with a Display module, carefully depress the two tabs on the sides of the Display Module, and pull it off.
4. If necessary, unplug the interface connector from the Communication module. **Do not discard the connector**.
5. Loosen the two retaining screws, and carefully pull the Communication module from the Electronics compartment.

6. Carefully align and connect the Sensor Ribbon Cable to the connector “J4” at the bottom of the Communication module. When installing the Communication module in the next step, be careful not to pinch the Sensor Ribbon Cable.

7. Carefully, insert the Communication module into the Electronics compartment. Ensure that the Sensor Ribbon Cable is not pinched.

8. Tighten the two Communication module retaining screws.

9. Refer to the SmartLine User's Manual to change the FAILSAFE, READ/WRITE, and SIM-OFF/SIM-ON (Fieldbus Only) configuration settings.

10. If applicable, re-install the Display module as follows:

    a. Orient the display as desired.

    b. Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.

    c. Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

Orient the Display for proper viewing through the end cap window. You can rotate the meter mounting orientation in 90 ° increments.

11. Apply Parker Super O-ring Lubricant or equivalent to the end cap O-ring before installing the end cap. Reinstall the End Cap and tighten the End Cap locking screw.

12. Installing Optional External Configuration Button Assembly.

    a. Loosen (Do Not Remove) both top nameplate screws and pivot nameplate 90°.

    b. Align the protrusion on the button assembly with the matching opening in the housing and snap the button assembly into the housing.

    c. Rotate the nameplate back to the original position, and tighten the nameplate screws.

(Steps 13 - 16 required for Field Upgrades Only)

13. Loosen the End Cap locking screw and unscrew the End Cap from the Field Wiring side of the transmitter housing.

14. Select the proper Communication/External Configuration upgrade kit label from the label strip provided and adhere to the inside of the Field Wiring compartment End Cap.

15. Apply Parker Super O-ring Lubricant or equivalent to the end cap o-ring before installing the end cap. Reinstall the End Cap and tighten the end cap locking screw.

16. Install external upgrade label (e.g. DEVICE MODIFIED…..) provided on outside of housing as shown in Figure 24.

17. Restore power if removed.

18. Check the settings of the Transmitter Setup and Display Setup parameters to make sure that the transmitter is configured correctly for your application. See the HART/DE User's Manual (ST 800 #34-ST-25-38, ST 700 #34-ST-25-44) for details on HART and DE transmitters. Refer to manual #34-ST-25-39 for additional information about Fieldbus transmitters.

19. If applicable, verify External Button Configuration operation. The transmitter is now available for use.

6.5 Replacing the Meter Body

You can replace the complete meter body, including the process heads, or the meter body only on certain Differential Pressure (DP), Gauge Pressure (GP), and Atmospheric Pressure (AP) Transmitters by using the existing process head(s). Use the following procedure for meter body-only replacement.

1. Save or record device configuration data.
2. Turn off Transmitter power.
3. Remove the Transmitter from service, and move it to a clean area before disassembling it.
4. Refer to Figure 25. Loosen the End Cap Lock, and unscrew the End Cap from the electronics side of the Transmitter housing.

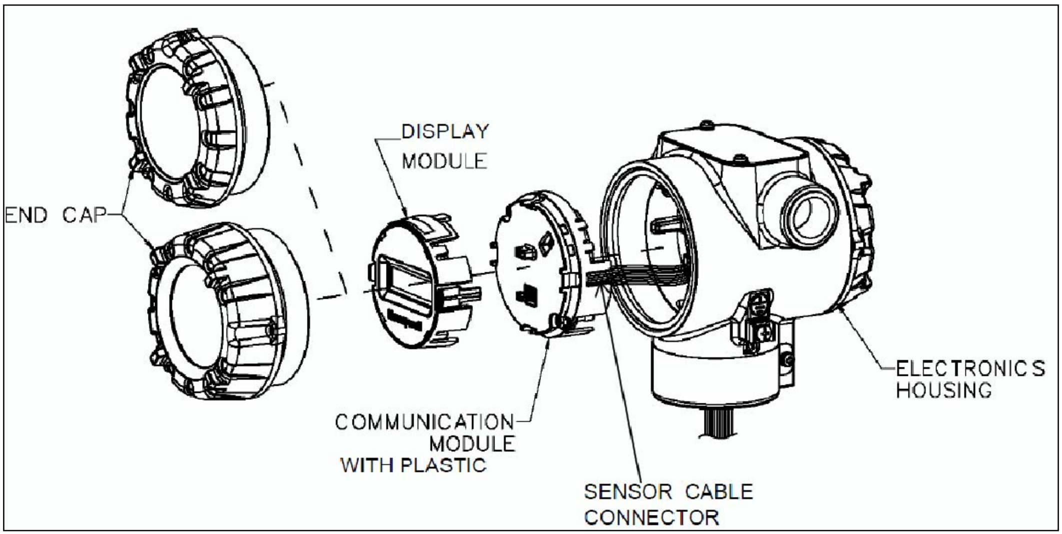


Figure 25 – ST 700 Standard Transmitter - Disassembly for Meter Body Replacement

Please take appropriate steps to avoid ESD damage when handling the Communication and Display Module assemblies

5. If a display is present, press the two snaps along the side, and remove it from the communication module assembly.
   Note: Do not discard or misplace the Display/Communication connector, it will be required to reassemble the Display Module
6. Loosen the two retaining screws, and remove the Communications Module assembly, and remove the Communication Module assembly from the electronics housing.

7. Disconnect the Sensor Cable from the Communications Board.
8. Refer to Figure 26. Use a 2mm hex wrench to completely loosen the set screw on the outside of the housing to permit rotating the meter body.

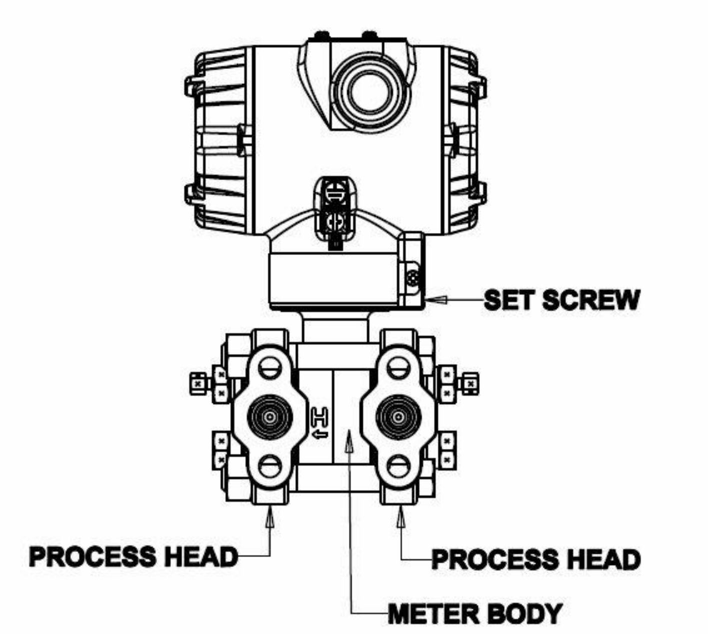


Figure 26 – ST 700 Standard Transmitter - Hardware Location to Remove the Meter Assembly

9. Carefully turn the complete meter body counterclockwise to unscrew it from the electronics housing.
10. Remove the nuts from bolts that hold the process head(s) to the Meter Body.
11. Remove process heads and bolts.
12. Remove the gaskets or O-rings from the process heads.
13. Clean the interior of the process head(s) with a soft bristle brush and suitable solvent.

CAUTION: To prevent damage to the diaphragm in the Meter Body, use extreme care when handling or placing the Meter Body on any surface. Carefully assemble gaskets or O-rings to the meter body. If installing O-rings, lubricate with water or leave dry.

14. Coat threads on process head bolts with anti-seize compound such as “Neverseize” or equivalent.
15. Refer to Figure 27. Apply Dow Corning #33 silicone grease to the meter body adapter O-ring and carefully assemble the O-ring to the meter body. Assemble the process head(s) and bolts to the new meter body. For now, make the bolts only finger-tight.

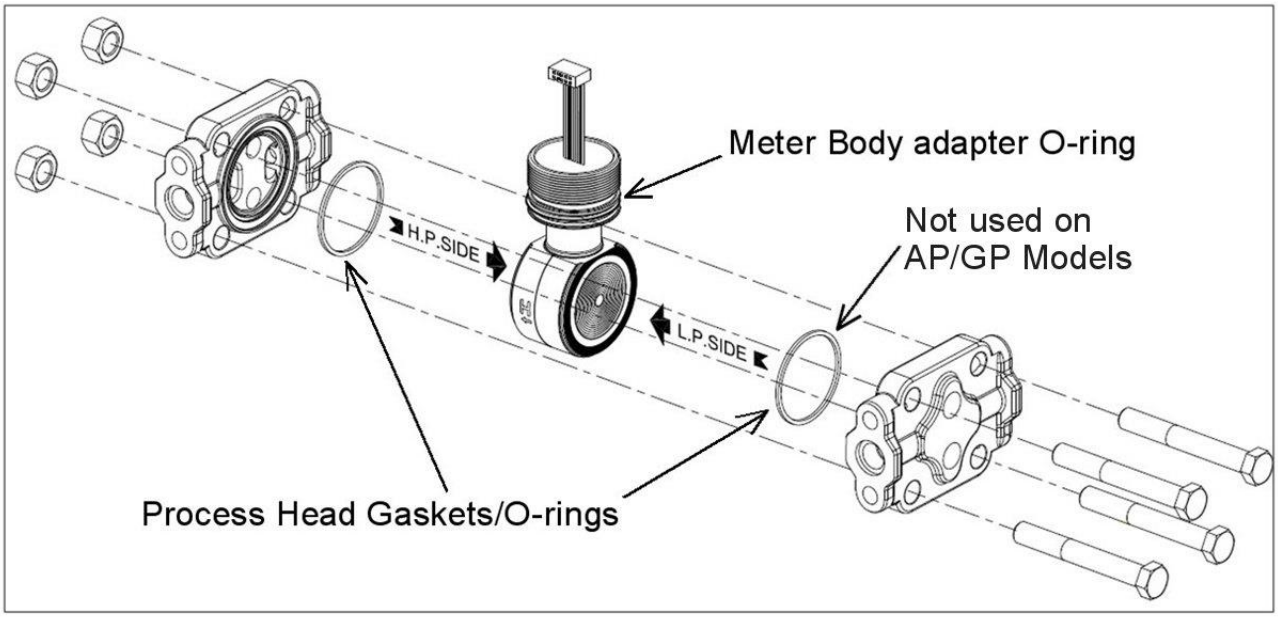


Figure 27 – ST 700 Standard Transmitter - Meter Body Reassembly

16. Use a torque wrench to gradually tighten nuts to torque rating in sequence shown in Figure 28. Tighten head bolts in stages of 1/3 full torque, 2/3 full torque, and then full torque.

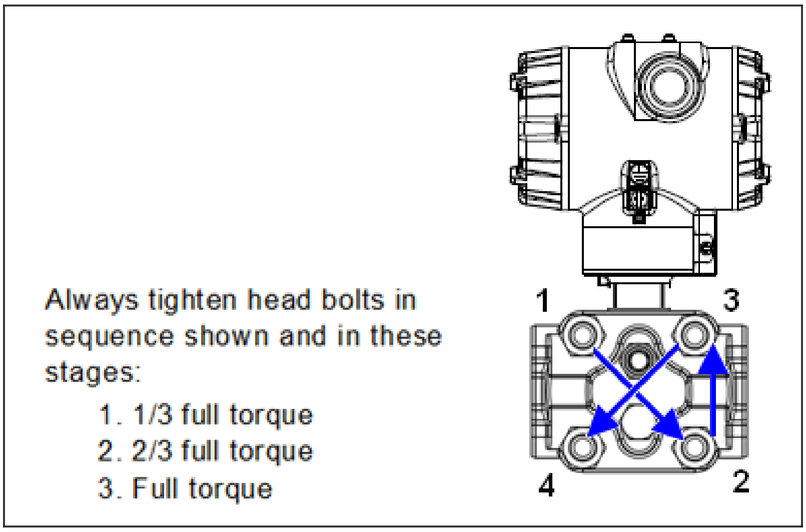


Figure 28 – ST 700 Standard Transmitter - Head Bolt Tightening Sequence

17. Feed the ribbon cable on the new meter body through the neck of the housing.

CAUTION: To prevent damage to the ribbon cable, use care when assembling the Meter Body to the electronics housing.

18. Screw the new meter body into the housing until the bottom of the Meter Body adapter is flush with the neck of the electronics housing.
19. Tighten the outside set screw to be sure it is fully seated in the slot in the header.

20. Loosen the set screw ½- turn.
21. Rotate the housing to the desired position (Max. 180^{o} in either direction), and tighten the set screw.
22. Carefully align and connect the Sensor Ribbon Cable to connector "J4" at the bottom of the Communication module board. When installing the Communication module in the next step, be careful not to pinch the Sensor Ribbon Cable.
23. Carefully, insert the Communication module into the Electronics compartment. Ensure that the Sensor Ribbon Cable is not pinched.
24. Tighten the two Communication module retaining screws.
25. If applicable, re-install the Display module as follows:
    a. Orient the display as desired.
    b. Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.
    c. Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

Orient the Display for proper viewing through the end cap window.
You can rotate the meter mounting orientation in 90 o increments.

26. Connect the bracket to the Transmitter housing.
27. Recalibrate the Transmitter per section 7 Calibration, of this document.
28. Return the Transmitter to service, and turn ON power
29. Verify the Transmitter configuration data. Restore the saved database if necessary.
30. Lubricate the end-cap O-ring with Parker Super O-ring silicone lubricant or equivalent before replacing the end caps.

7. Calibration for the ST 700 Standard Transmitter

7.1 Recommendations for Transmitter Calibration

The ST 700 Standard Transmitter does not require periodic calibration to maintain accuracy. Typically, calibration of a process-connected Transmitter will degrade, rather than augment the capability of a smart Transmitter. For this reason, it is recommended that a Transmitter be removed from service before calibration. Moreover, calibration will be accomplished in a controlled, laboratory-type environment, using certified precision equipment.

7.2 Calibration Procedures

For a Transmitter operating in analog mode, you must calibrate its output signal measurement range using any compatible hand-held communicator or a local display.

One calibration option is to use the Honeywell Smart Field Communicator (SFC). Refer to the *Smart Field Communicator Operating Guide,* Document # 34-ST-11-14 for calibration procedures.

Calibration information and procedures for a Transmitter operating in the HART/DE mode are provided in the *ST 700 Series HART/DE Option User's Manual*, Document # 34-25-25-47.

8. Troubleshooting on the ST 700 Standard Transmitter

8.1 Overview

Troubleshooting involves responding to error messages, primarily displayed by the MC Toolkit. Error messages that may occur on the Transmitter's local display are fairly self-explanatory and intuitive. However, this section covers the diagnostic messages that indicate critical conditions. Other than the critical conditions, additional detail is not provided. If you require assistance, contact your distributor or Honeywell Technical Support. All other messages are covered by the MC Toolkit Users' Manual.

8.2 Critical Diagnostics Screens

The Basic Display will display the message CRITCAL FAULT on the top line of the LCD and the appropriate diagnostic text on the lower line.

A description of the diagnostic conditions is given in Table 18 and Table 19 along with suggested actions for resolving the problem.

8.2.1 Fault Conditions and Recommended Corrective Actions – Basic Display

Table 18 – ST 700 Standard Transmitter - Fault Conditions and Recommended Corrective Actions.

Condtion	Analysis	Recommended Corrective Action
Fault. A critical failure has been detected in the Meter body	Use a HART, DE, or FF communicator to read the detailed status information from the transmitter. Refer to the appropriate communicator manual to get more information about the possible causes of the failure.	Cycle power to the Transmitter. If the problem continues to occur, replace the Meter body.
Electronics Module Fault. A critical failure has been detected on the HART, DE, or FF Electronics Module.	Use a HART, DE, or FF communicator to read the detailed status information from the transmitter. Refer to the appropriate communicator manual for more information about the possible failure causes.	Cycle power to the transmitter. If the problem continues to occur replace the Electronics Module.
Meter body Comm fault. Communications between the Meter body and the Electronics Module has failed.	This could be the result of a failure on either of these modules or the cable that connects them. Use a HART, DE, or FF communicator to read the detailed status information from the transmitter. Refer to the appropriate communicator manual to get more information about the possible causes of the failure.	Check the ribbon cable that connects the Meter body to the Electronics Module. Make sure that the cable is securely plugged into the Electronics Module. Make sure that all pins are plugged into the connector (e.g., make sure that the connector is not offset in a way that leaves some pins unconnected). Cycle power to the transmitter. If the problem continues to occur replace the Electronics Module. If

Condtion	Analysis	Recommended Corrective Action
		this does not fix the problem, replace the Meter body.

8.2.2 Fault Conditions and Recommended Corrective Actions – Standard Display

The Standard Display will display the message FAULT on the top line of the LCD and the appropriate diagnostic text on the lower line.

Table 19 – ST 700 Standard Transmitter - Fault Conditions and Recommended Corrective Actions.

Condtion	Analysis	Recommended Corrective Action
Mbd Com (Meter body Comm fault)	Communications between the Meter body and the Electronics Module has failed.	Check the ribbon cable that connects the Meter body to the Electronics Module. Ensure that the cable is securely plugged into the Electronics Module. Ensure that all pins are plugged into the connector (e.g. ensure that the connector is not offset in a way that leaves some pins unconnected). Cycle power to the transmitter. If the problem continues to occur replace the Electronics Module. If this does not fix the problem, replace the Meter body.
Comm El (Communication Board fault)	A critical failure has been detected on the HART Electronics Module.	Cycle power to the transmitter. If the problem continues to occur replace the Electronics Module.
Mtrbody (Sensor Board Fault)	A critical failure has been detected in the Meter body	Cycle power to the transmitter. If the problem continues to occur replace the Electronics Module.

9. Parts List_ST 700 Standard Transmitter

9.1 Overview

Individually saleable parts for the various Transmitter models are listed in this section. Some parts are illustrated for identification. Parts are identified and listed in the corresponding tables as follows:

- Individually saleable parts are indicated in each figure by key number callout.
- Parts that are supplied in kits are indicated in each illustration by key number callout with the letter K prefix.

Table 20 is a list of recommended spare parts.

Table 20 – ST 700 Standard Transmitter - Summary List of Recommended Spare Parts

Part Number	Description	Figure No.	Key No.	1-10 Units	10-100 Units	100-1000 Units
	Electronics Housing Assembly					
50049849-501 50049849-502 50049849-503 50049849-504 50049849-509 50049849-510	HART Electronics Module Without REED Sensor PWA HART Electronics Module With REED Sensor PWA DE Electronics Module Without REED Sensor PWA DE Electronics Module With REED Sensor PWA Fieldbus Electronics Module Without REED Sensor PWA FIeldbus Electronics Module With REED Sensor PWA	Figure 31	5	1	1-2	2-4
 51452865-201 51452865-202 51452865-203 51462865-204	**Meter Body Seal kit (includes O-rings)** Glass Filled PTFE VITON 100% PTFE GRAPHITE	Figure 33	K1	1	1-2	2-4
50075472-531 50075472-532 50075472-533 50075472-534	HART/DE Terminal Block Assy Without Lightning Protection HART/DE Terminal Block Assy With Lightning Protection FieldBus Terminal Block Assy Without Lightning Protection FieldBus Terminal Block Assy With Lightning Protection	Figure 31	3	1	1-2	2-4

Process head gasket kit		Figure No.	Key No.	1-10 Units	10-100 Units	100-1000 Units
51452868-501	Gasket only, Process Head (12 PTFE packs)	Figure 33	Ka	12	12-24	24-48
51452868-502	Gasket only, Process Head (6 Viton Head O'Rings)			6	6-12	12-24
51452868-507	Gasket only, Process Head Graphite Gasket (replacement only for existing graphite gasket)			6	6-12	12-24
Meter Body						
Specify complete model number from nameplate	DP Models GP/AP HEAD Models LGP/LAP Models Flush Mount Models Flange Mount Models	Figure 32		1	1-2	2-4

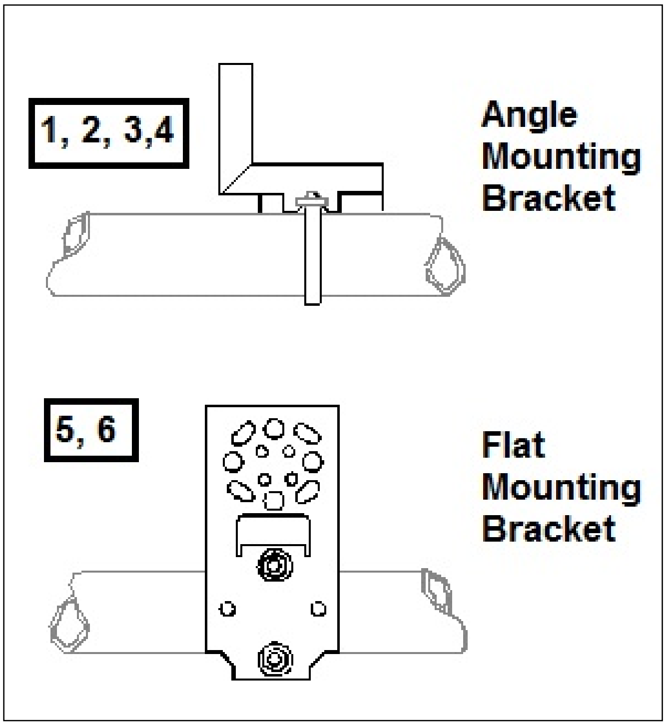


Figure 29 – ST 700 Standard Transmitter - Angle and Flat Bracket Parts

Table 21 – ST 700 Standard Transmitter - Angle and Flat Bracket Parts

(Refer to Figure 29)

Key No.	Part Number	Description	Quantity Per Unit
1	30752770-103	SS 304 Angle Bracket Mounting kit for all models except In-line and Flush mount transmitters	1
2	30752770-104	SS 304 Angle Bracket Mounting kit for all In-Line and Flush mount transmitters	1
3	30752770-303	Marine Approved Angle Bracket for all models except In-line and Flush mount transmitters	1
4	30752770-304	Marine Approved Angle Bracket for all In-line and Flush mount transmitters	1
5	51196557-005	SS 304 Flat Bracket Mounting kit for all models except In-line and Flush mount transmitters	1
6	51196557-006	SS 304 Flat Bracket Mounting kit for all In-line transmitters and Flush mount transmitters	1
7	30752770-403	SS 316 Angle Bracket Mounting kit for all In-line transmitters except In-Line and Flush mount transmitters	1
8	30752770-404	SS 316 Angle Bracket Mounting kit for all In-Line and Flush mount transmitters	1
9	51196557-008	SS 316 Flat Bracket Mounting kit for all In-line transmitters except In-Line and Flush mount transmitters	1
10	51196557-009	SS 316 Flat Bracket Mounting kit for all In-Line and Flush mount transmitters	1

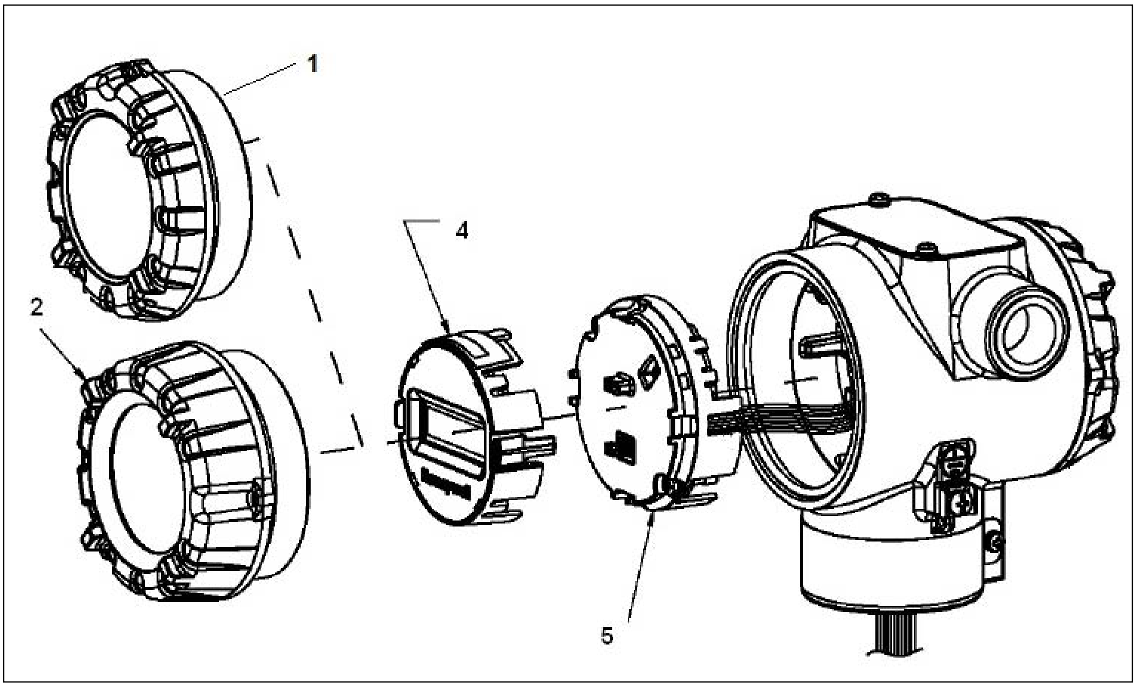


Figure 30 – ST 700 Standard Transmitter - Electronic Housing, Display End

Table 22 – ST 700 Standard Transmitter Major Assemblies

(Refer to Figure 29, Figure 31 and Figure 32)

Key No.	Part Number	Description	Quantity Per Unit
1	50049858-501 50049858-521	End Cap (Aluminum) End Cap (Stainless Steel)	1
2	50049832-501 50049832-521	End Cap, Display (Aluminum) End Cap, Display (Stainless Steel)	1
3	50075472-531 50075472-532 50075472-533 50075472-534	Terminal Assy HART/DE without Lightning protection Terminal Assy HART/DE with Lightning protection Terminal Assy FF/PB without Lightning protection Terminal Assy FF/PB with Lightning protection	1
4	50049911-501 50126003-501	Basic Display Standard Display	1
5	50049849-501 50049849-502 50049849-503 50049849-504 50049849-509 50049849-510	HART Electronics Module Assembly (PWA) without Reed sensor HART Electronics Module Assembly (PWA) with Reed sensor DE Electronics Module Assembly (PWA) without Reed sensor DE Electronics Module Assembly (PWA) with Reed sensor FF Electronics Module Assembly (PWA) without Reed sensor FF Electronics Module Assembly (PWA) with Reed sensor	1
6	50049915-501 50131077-501	External Zero, Span & Config Buttons (3- button Assembly) External Zero, Span & Config Buttons (2- button Assembly)	1
K1	30757503-005	Electronics housing seals kit (includes O-rings)	2

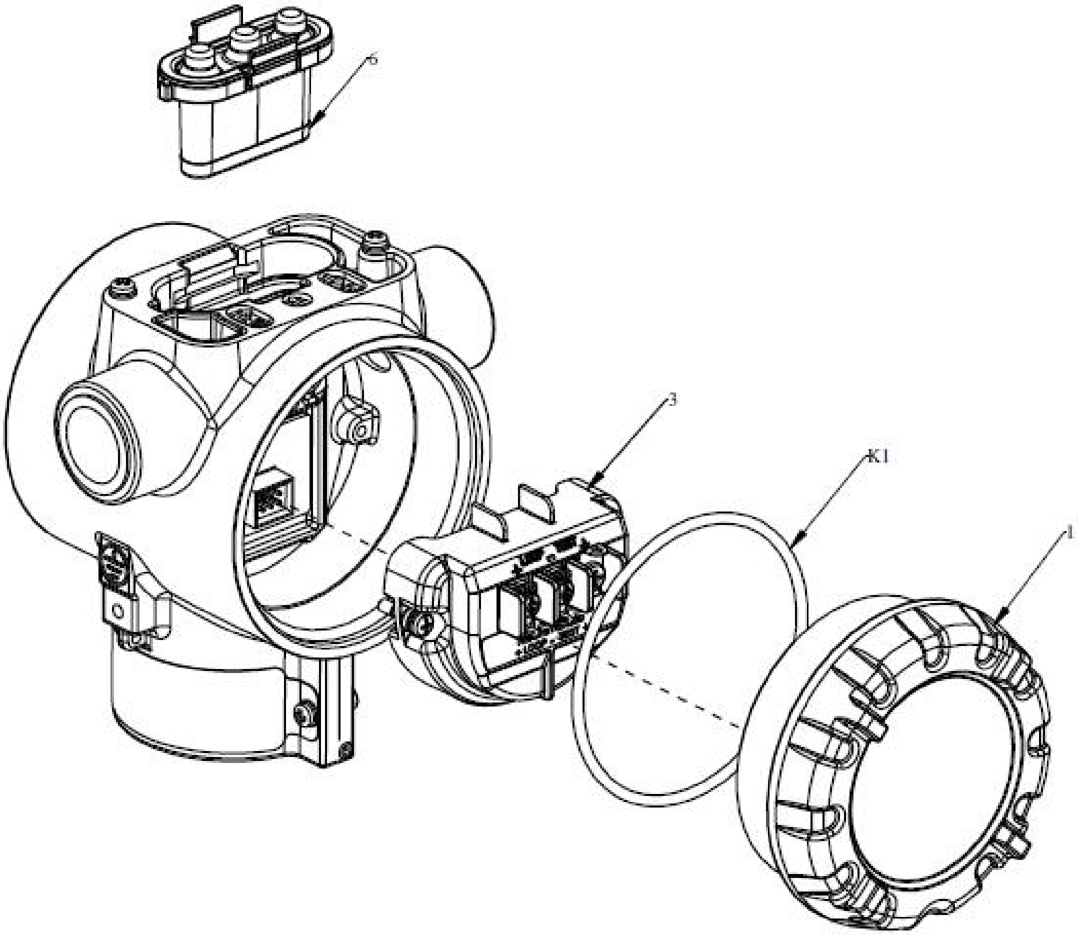


Figure 31 – ST 700 Standard Transmitter - Electronic Housing, Terminal Block End

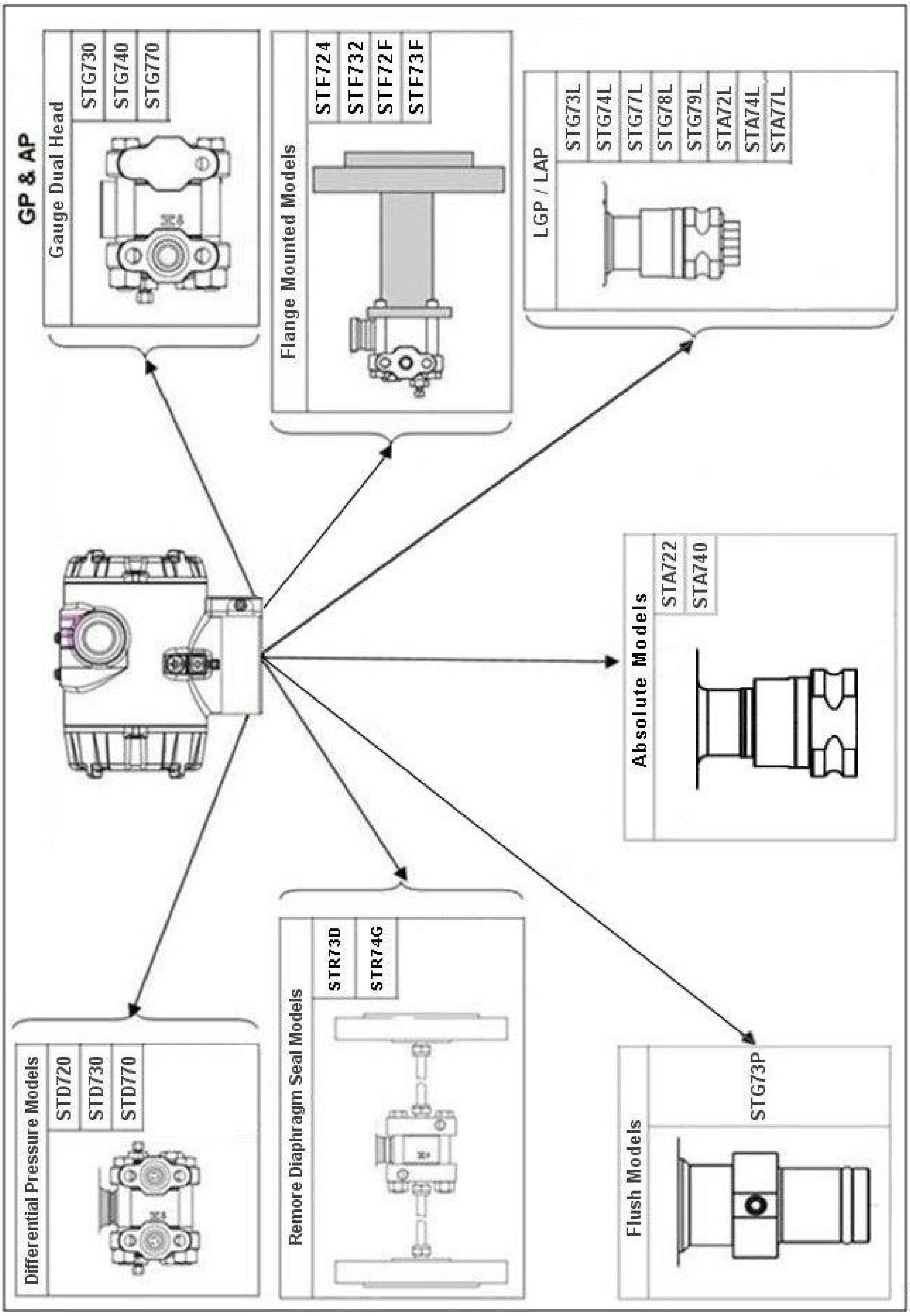


Figure 32 – ST 700 Standard Transmitter - Major Assemblies

Table 23 – ST 700 Standard Transmitter Models STD720, 730 & 770

(Refer to Figure 33)

Key No.	Part Number	Description	Qty/ Unit
		Vent and Plug Kits	
	30753785-001 30753787-001 30753786-001	Drain and Plug Kit, stainless steel Drain and Plug Kit, Monel Drain and Plug Kit, Hastelloy C **Each Drain and Plug Kit includes:**	
K1		Pipe Plug	4
K2		Vent Plug	2
K3		Vent Bushing	2
		Meter Body Gasket Kits	
	 51452865-201 51452865-202 51452865-203 51452865-204	Each Meter Body Gasket Kit includes: Glass Filled PTFE VITON 100% PTFE GRAPHITE	
K6		Gasket, Process Head	6
Ka		Gasket, Flange Adapter	6
K7		O-Ring, Meter Body to Electronics Housing	3
		K7 Process Head Gasket Kits	
K6 K6 K6	51452868-501 51452868-502 51452868-507	Gasket only, Process Head (12 PTFE Gaskets/pack) Gasket only, Process Head (6 Viton Head O-Rings) Gasket only, Process Head Graphite Gasket (use only as replacement of existing graphite gasket)	12 6 6
		Flange Adapter Gasket Kits	
Ka Ka Ka	51452868-504 51452868-505 51452868-508	Gasket only, Flange Adapter, 6 PTFE Adapter Gaskets Gasket only, Flange Adapter, 6 VITON Adapter O-Rings Gasket only, Flange Adapter Graphite Gasket (use only as replacement of existing graphite gasket)	6 6 6
		½-inch NPT Flange Adapter Kits	
	 51452867-110 51452867-210 51452867-310 51452867-410 51452867-150 51452867-350 51452867-130 51452867-330	Flange Adapter Kit, with: SS Flange Adapters and with carbon steel bolts SS Flange Adapters and with A286 SS (NACE) bolts SS Flange Adapters and with 316 SS (non-NACE) bolts SS Flange Adapters and with B7M alloy steel bolts Monel Flange Adapters and with carbon steel bolts Monel Flange Adapters and with 316 SS (non-NACE) bolts Hastelloy C Flange Adapters and with carbon steel bolts Hastelloy C Flange Adapters and with 316 SS (non-NACE) bolts	
		Each ½-inch NPT Flange Adapter Kit includes:	
Ka		Gasket, Flange Adapter	2
Kb		½-inch NPT Flange Adapter	2
Kc		Bolt, hex head, 7/16-20 UNF, 1.50 inches long	4

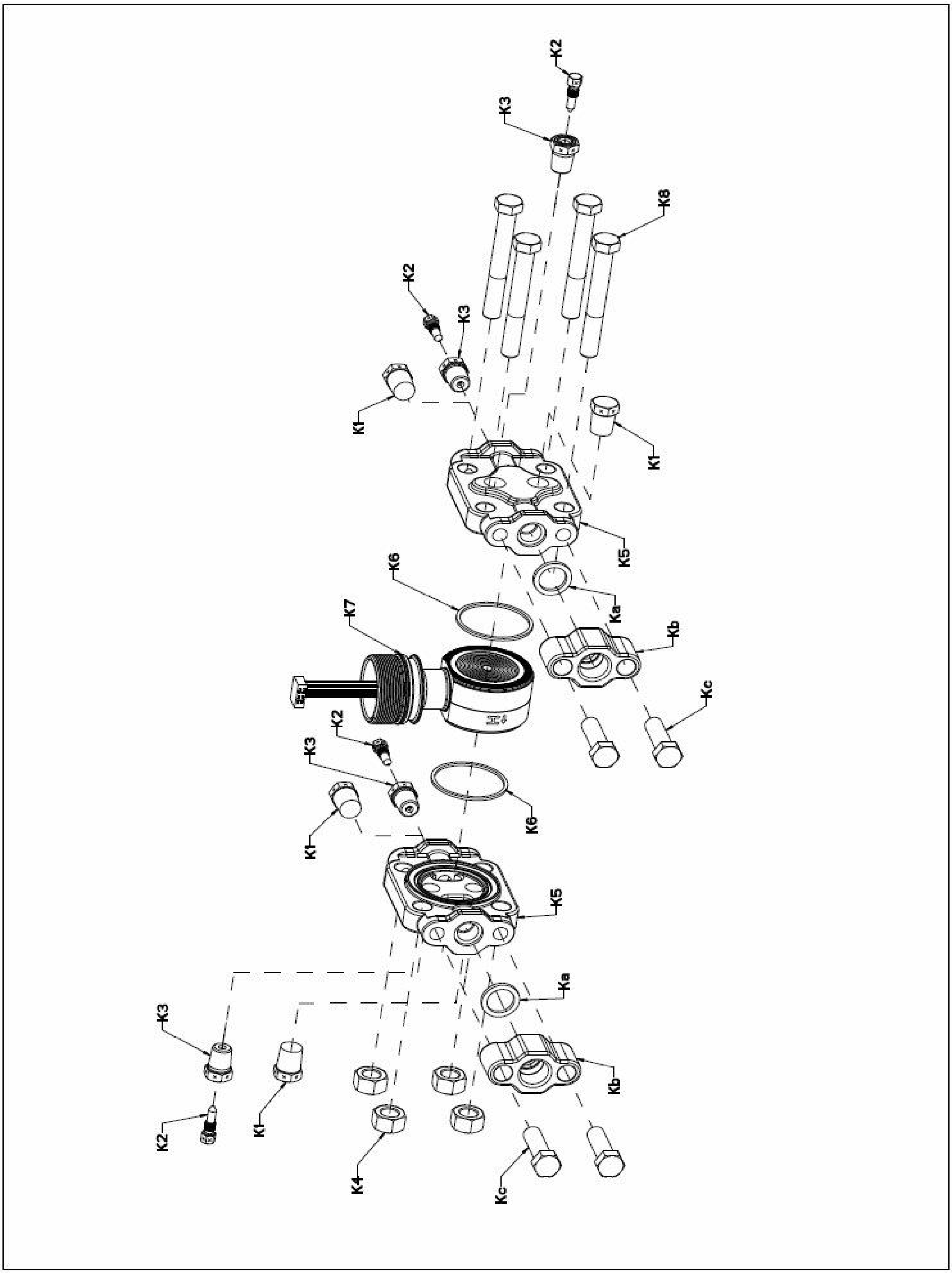


Figure 33 - ST 700 Standard Transmitter - ST 700 Models STD720, 730, 770

(Refer to Table 23)

Table 24 – ST 700 Standard Transmitter - Parts for STG730, 740, 770 and STA722, 740 Transmitter Body

(Refer to Figure 34)

Key No.	Part Number	Description	Qty/Unit
Process Head Assembly Kits with PTFE Gaskets			
	51452864-010 51452864-012 51452864-020 51452864-022 51452864-030 51452864-032 51452864-040 51452864-042 51452864-050 51452864-052	Carbon steel head (zinc plated) without side vent/drain Carbon steel head (zinc plated) with side vent/drain Stainless steel head without side vent/drain Stainless steel head with side vent/drain Hastelloy C head without side vent/drain Hastelloy C head with side vent/drain Monel head without side vent/drain Monel head with side vent/drain Carbon steel head (nickel plated) without side vent/drain Carbon steel head (nickel plated) with side vent/drain	
Process Head Assembly Kits with PTFE Gaskets			
	51452864-110 51452864-112 51452864-120 51452864-122 51452864-130 51452864-132 51452864-140 51452864-142 51452864-150 51452864-152	Carbon steel head (zinc plated) without side vent/drain Carbon steel head (zinc plated) with side vent/drain Stainless steel head without side vent/drain Stainless steel head with side vent/drain Hastelloy C head without side vent/drain Hastelloy C head with side vent/drain Monel head without side vent/drain Monel head with side vent/drain Carbon steel head (nickel plated) without side vent/drain Carbon steel head (nickel plated) with side vent/drain	
Each process head assembly kit includes:			
K1		Pipe Plug (See notes 1 & 2)	1
K2		Vent Plug (See note 1)	1
K3		Vent Bushing (See note 1.)	1
K5		Process Head	1
K6		Gasket (PTFE), Process Head	1
Ka		Gasket (PTFE), Flange Adapter	1
	Notes		
	Note 1: This item is made of the same material as the Process Heads, except for Kits with carbon steel Process Heads, which include stainless steel Pipe Plug, Vent Plug, and Vent Bushing. Note 2: The Kit for Process Heads without side vent/drain does not include Pipe Plugs (K1).		
Reference Head			
K9	51452951-201	Carbon Steel Blind Reference Head	1
K9	51452951-101	316 SS Blind Reference Head	1

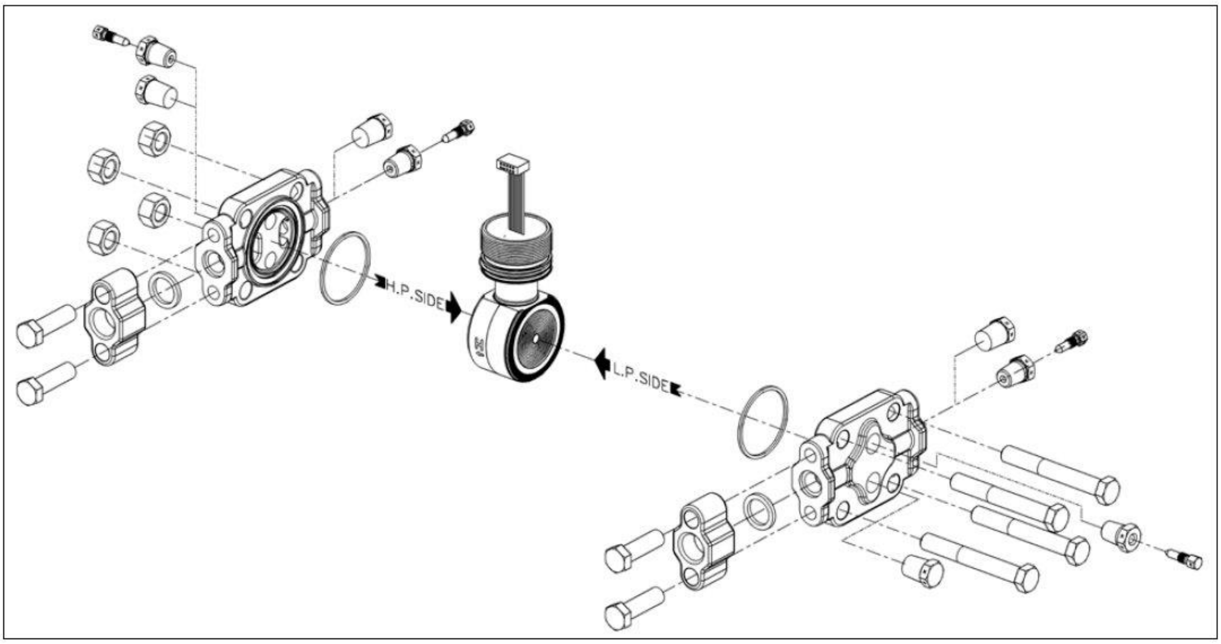


Figure 34 – ST 700 Standard Transmitter - STG730, 740, 770 and STA722, 740 Transmitter Body

Table 25 - ST 700 Standard Transmitter - Inline Gauge and Inline Atmospheric Meter Body Parts

(See Figure 35)

Key No.	Part Number	Description	Qty/Unit
	Specify complete model number from nameplate	ST Series replacement meter body (LAP/LGP model)	1

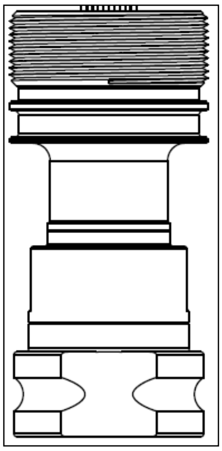


Figure 35 – ST 700 Standard Transmitter - Inline Gauge and Inline Atmospheric Meter Body Bodies

Table 26 – ST 700 Standard Transmitter - Flange-Mounted Meter Body Parts – STF724, 732

(Refer to Figure 36 and Figure 37)

Key No.	Part Number	Description	Qty/Unit
1	Specify complete model number from nameplate	ST Series 700 replacement meter body	1
	30749372-005	O-ring seal	1
	30749372-001	O-ring seal	1
Optional Flange Adapter - Not Shown			
	30754419-006	Flange adapter kit (st. steel flange adapter with carbon steel bolts)	
	30754419-008	Flange adapter kit (Monel flange adapter with carbon steel bolts)	
	30754419-022	Flange adapter kit (st. steel flange adapter with 316 st. steel bolts)	
	30754419-024	Flange adapter kit (Monel with 316 st. steel bolts)	
		Bolt, hex head, 7/16-20 UNF, 1.375 inches lg.	2
		Flange adapter	1
		Gasket	1
		Filter screen	1
	30754419-007	Flange adapter kit (Hastelloy C flange adapter with carbon steel bolts)	
	30754419-023	Flange adapter kit (Hastelloy C flange adapter with 316 st. steel bolts)	
		Bolt, hex head, 7/16-20 UNF, 1.375 inches lg.	2
		Flange adapter	1
		Gasket	1
	30757503-005	Housing seal kit	1

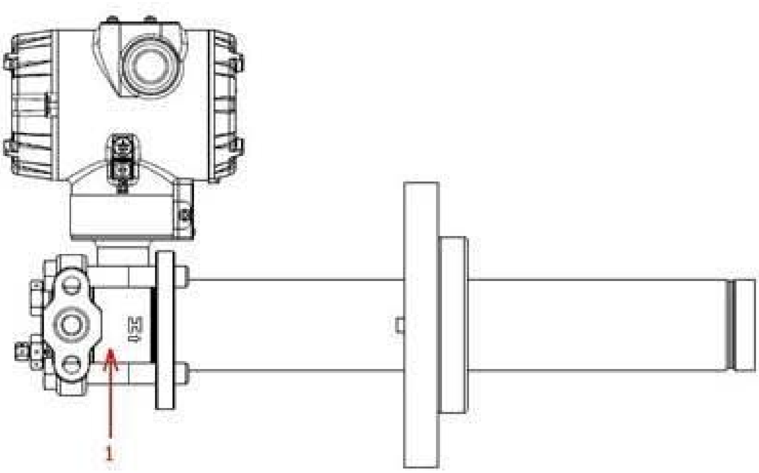


Figure 36 – ST 700 Standard Transmitter - Extended Flange Design

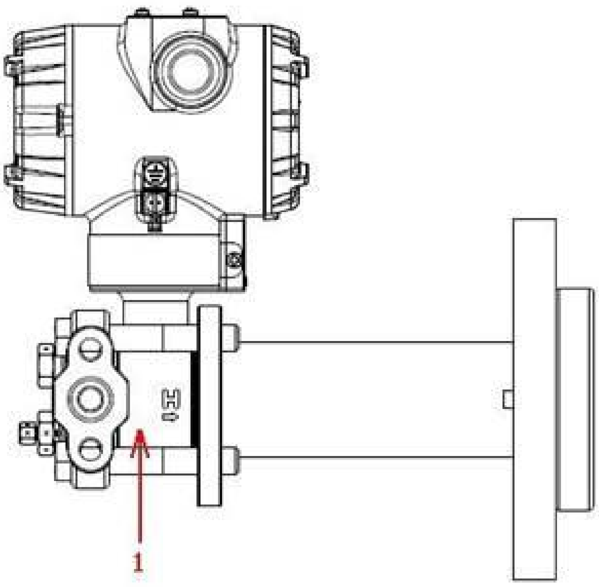


Figure 37 - ST 700 Standard Transmitter - Flush Flange Design

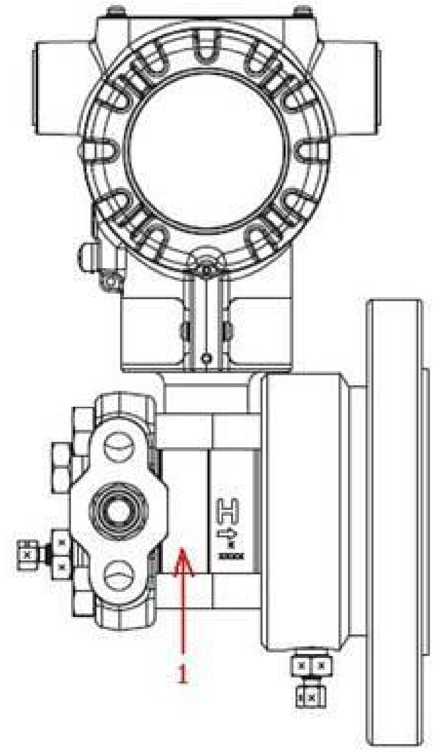


Figure 38 - ST 700 Standard Transmitter - Pseudo Flange Design

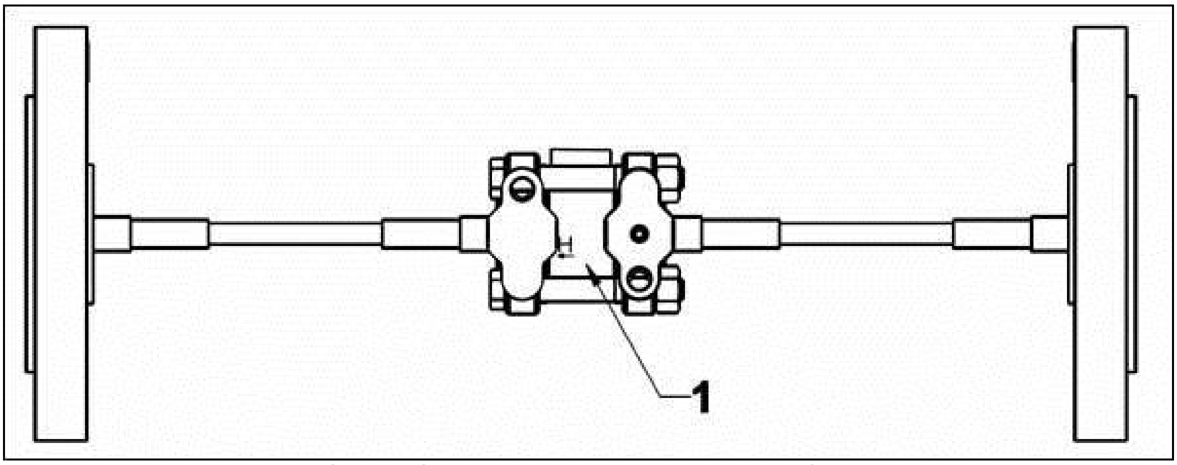


Figure 39 – ST 700 Standard Transmitter - Remote Seal Diaphragm

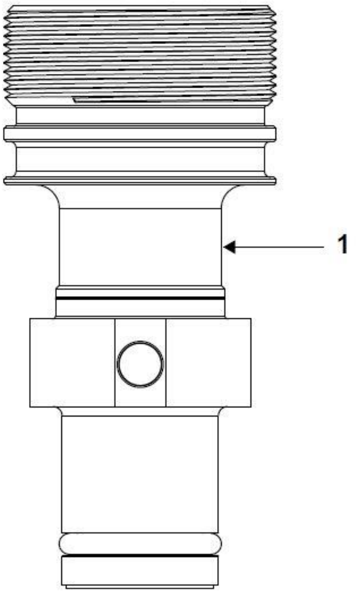


Figure 40 - ST 700 Standard Transmitter - Flush Mount Meter Body.

Table 27 – ST 700 Standard Transmitter - Flush Mount Meter Body Parts
(Refer to Figure 40)

Key No.	Part Number	Description	Qty/Unit
1	Specify complete model number from nameplate	Replacement meter body (Flush Mount model)	1
	30756445-508	Gasket Kit (0-rings)	
	51204496-001	316L SS Mounting Sleeve Kit	
	51204497-001	Calibration Sleeve Kit	

Refer to Appendix A for Product Certifications and Approvals for the ST 700 Standard and Basic Transmitter.

10. Introduction_ST 700 Basic Transmitter

10.1 Overview

This section is an introduction to the physical and functional characteristics Honeywell's family of the ST 700 Basic SmartLine Pressure Transmitters.

If you are not sure which type of ST 700 you have, Standrad or Basic, please refer to Section 1 of this manual

If you have a ST 700 Standard Transmitter use Sections **2** through **9**.
If you have a ST 700 Basic Transmitter go straight to Section **10** through **17.**

10.2 Features and Options

The ST 700 Basic transmitter is available in a variety of models for measuring Differential Pressure (DP), Gauge Pressure (GP), and Absolute Pressure (AP). Table 28 lists the protocols, human interface (HMI), materials, approvals, and mounting bracket options for the ST 700.

Table 28 – ST 700 Basic Transmitter - Features and Options

Feature/Option	Basic/Available Options
Communication Protocols	HART® version 7
Human-Machine Interface (HMI) Options (Standard Display/External Two buttons)	
	Standard Display (HART® only): • Two-button programming (optional) • Standard display language: English only • Two-mode operations: PV display and Menu Navigation
Calibration	Single
Approvals See section 0 for details.	FM, CSA, ATEX, IECEx, SAEx, INMETRO, NEPSI, GOST
Mounting Brackets	Angle/flat carbon steel/304 and 316 stainless steel,
Integration Tools	Experion

The 2-button option is available for the Standard Display.

The External 2-buttons option is available in this model.This is used for navigation of standard display or for setting zero, span and zero correct where standard display is not connected.

10.2.1 Physical Characteristics

As shown in Figure 41 the ST 700 Basic transmitter is packaged in two major assemblies: the Electronics Housing and the Meter Body. The elements in the Electronic Housing respond to setup commands and execute the software and protocol for the different pressure measurement types. Figure 42 shows the assemblies in the Electronics Housing with available options.

The Meter Body provides connection to a process system. Several physical interface configurations are available, as determined by the mounting and mechanical connections, all of which are described in the **Installation** section of this manual.

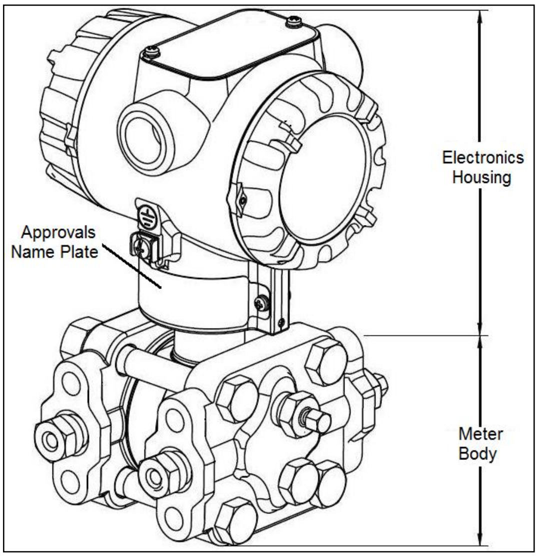


Figure 41 – ST 700 Basic Transmitter - Major Assemblies

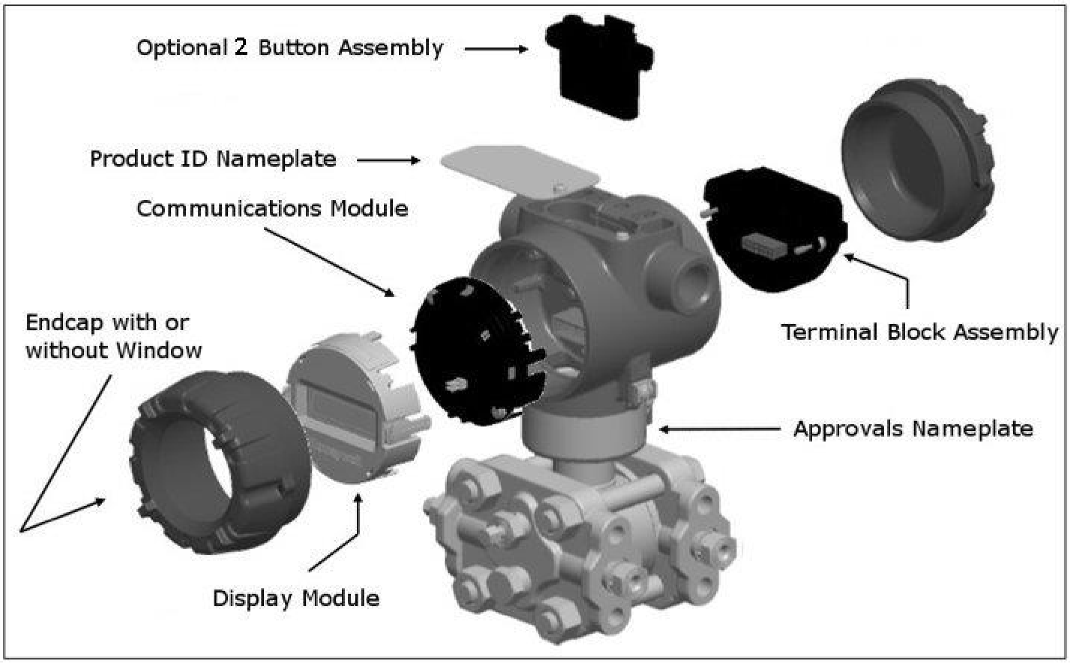


Figure 42 – ST 700 Basic transmitter Electronics Housing Components

10.2.2 Functional Characteristics

The Transmitter measures process pressure and provides a proportional analog
4 to 20mA output to the measured process variable (PV). Available output communication protocols include HART®.

The Standard display is only available on HART transmitters.

An optional external 2-button assembly is available to set up and make adjustments to the Transmitter. In addition, a Honeywell Multi-Communication (MC) Toolkit (not supplied with the Transmitter) can facilitate setup and adjustment procedures. Certain adjustments can be made through an Experion Station if the Transmitter is digitally integrated with Honeywell's Experion.

The Standard Display Menu is implemented as one long single-level menu and will "wrap around" when it reaches the start or end of the menu. The Standard Display uses an optional 2-button assembly to set up and make adjustments to the Transmitter.

10.3 ST 700 Transmitter Nameplate

The Transmitter nameplate mounted on the bottom of the electronics housing (see Figure 42) lists its model number, physical configuration, electronics options, accessories, certifications, and manufacturing specialties. Figure 43 is an example of a typical Gauge Pressure (GP) or Atmospheric Pressure (AP) Transmitter name plate. The model number format consists of a Key Number with several table selections. The Differential Pressure (DP), Absolute Pressure (AP), and Gauge Pressure (GP) name plates are essentially the same. The DP model provides one additional entry (7 vs. 6) in the Meter Body Selections (Table I) to accommodate the static pressure rating.

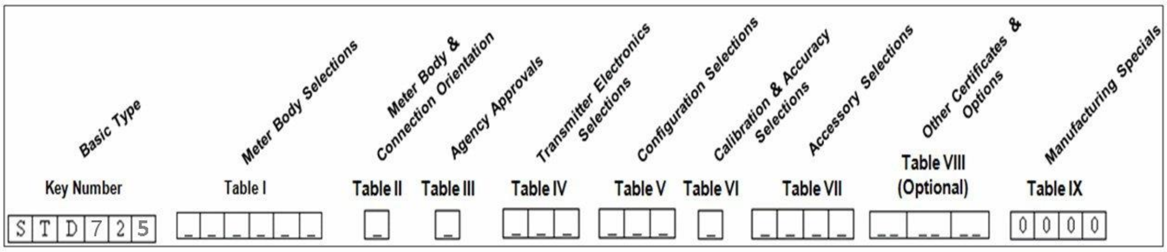


Figure 43 – ST 700 Basic Transmitter - Name Plate

You can readily identify the series and basic Transmitter type from the third and fourth digits in the key number. The letter in the third digit represents one of these basic transmitter types:

- A = Absolute Pressure
- D = Differential Pressure
- F = Flange Mounted
- G = Gauge Pressure
- R = Remote Seals

For a complete selection breakdown, refer to the appropriate Specification and Model Selection Guide provided as a separate document.

10.4 Safety Certification Information

An “approvals” name plate is located on the bottom of the Electronics Assembly; see Figure 42 exact location. The approvals name plate contains information and service marks that disclose the Transmitter compliance information.
See section 0 of this document for safety certification requirements and details.

10.5 Transmitter Adjustments

Zero and Span adjustments are possible in ST 700 Basic Transmitter with the optional external 2-button and integrated two-button assemblies. See Figure 42 for the external 2-button assembly.

You can also use the Honeywell MC Toolkit or other third-party hand-held configurator to make adjustments to the ST 700 Basic Transmitter. Alternately, certain adjustments can be made through the Experion or Universal Station, if the Transmitter is digitally integrated with a Honeywell Experion or TPS system.

10.6 Display Options –Standard Display

Table 29 – ST 700 Basic Transmitter - Available Display Characteristics

Standard Display	• 360° rotation in 90° Increments • 2 lines, 8 characters • Standard units of measurement: Pa, KPa, MPa, KGcm2, TORR, ATM, inH2O, mH2O, bar, mbar, inHg, FTH2O, mmH2O, MMHG, Flow Units (DP models only) ,PSI , cmH2O and mH2O • Diagnostic messaging

10.7 Optional Integrated two-Button Assembly (Standard Display)

The Standard Display does not support all the transmitter configuration parameters and has limited features. The optional Integrated Two-Button Assembly for the Standard Display provides the following features and capabilities:

- Menu and enter key functionality.
- With the menu-driven display:
    - Comprehensive on-screen menu for navigation.
    - Transmitter configuration: enter LRV, enter URV and Loop Test.
    - Transmitter calibration
    - Display configuration (contrast only)
    - Set zero and span parameters.

	If you are using the optional external 2-button assembly with the Standard Display then you can perform all the above operations without removing external glass cap using the external buttons

	Lower range value (LRV): A display parameter (Standard display), which allows users to enter the measuring value for which the analog output will be scaled to 4mA. **Upper range value (URV):** A display parameter (Standard display), which allows users to enter the measuring value for which the analog output will be scaled to 20mA.

11. Application Design_ST 700 Basic Transmitter

11.1 Overview

This section discusses the considerations involved with deploying a Honeywell ST 700 Basic Transmitter in a process system. The following areas are covered:

- Safety
- Input and output data
- Reliability
- Environmental limits
- Installation considerations
- Operation and maintenance
- Repair and replacement

11.2 Accuracy

The ST 700 Basic Transmitter measures the gauge, differential, or absolute pressure of a process and reports the measurement to a receiving device.

11.2.1 Diagnostic Messages

Transmitter standard diagnostics are reported in the two basic categories listed in Table 4. Problems detected as critical diagnostics drive the analog output to the programmed burnout level. Problems detected as non-critical diagnostics may affect performance without driving the analog output to the programmed burnout level. Informational messages (not listed in Table 4 report various Transmitter status or setting conditions.

	The Standard Display is only available on HART transmitters

	The Standard Display only displays critical diagnostics (Meter Body Fault, Electronics Module Fault and Meter Body Communication Fault). Non-critical diagnostics are not displayed.

11.3 Safety

11.3.1 Safety Integrity Level (SIL)

The ST 700 Basic Transmitter has met manufacturer design process requirements of Safety Integrity Level (SIL) 3. These are intended to achieve sufficient integrity against systematic errors of design by the manufacturer.

A Safety Instrumented Function (SIF) designed with this product must not be used at a SIL level higher than the statement, without "prior use" justification by the end user or diverse technology redundancy in the design.

Refer to the *Honeywell SmartLine Safety Manual*, Document # 34-ST-25-37, for additional information.

12. Installation and Startup_ST 700 Basic Transmitter

12.1 Installation Site Evaluation

Evaluate the site selected for the ST 700 Basic Transmitter installation with respect to the process system design specifications and Honeywell's published performance characteristics for your particular model. Some parameters that you may want to include in your site evaluation are:

- Environmental Conditions:
  - Ambient Temperature
  - Relative Humidity
- Potential Noise Sources:
  - Radio Frequency Interference (RFI)
  - Electromagnetic Interference (EMI)
- Vibration Sources
  - Pumps
  - Motorized System Devices (e.g., pumps)
  - Valve Cavitation
- Process Parameters
  - Temperature
  - Maximum Pressure Rating

12.2 Honeywell MC Toolkit

In preparation for post-installation processes, refer to the *MC Tookit User Manual,* Document # 34-ST-25-20, for battery conditioning and device operation and maintenance information.

12.3 Display Installation Precautions

Temperature extremes can affect display quality. The display can become unreadable at temperature extremes; however, this is only a temporary condition. The display will again be readable when temperatures return to within operable limits.

The display update rate may become slower at cold temperature extremes, but as with readability, normal updating resumes when temperatures are within limits for full operability.

	The Transmitter should not be operated without the endcap covers on. Covers can be removed temporarily for configuration with buttons or during maintenance/wiring. The static voltage must be discharged before removing the cover.

12.4 Mounting_ST 700 Basic Transmitter

12.4.1 Summary

ST 700 Basic Transmitter models, except flush mounts and those with integral flanges, can be attached to a two-inch (50 millimeters) vertical or horizontal pipe using Honeywell's optional angle or flat mounting bracket; alternately you can use your own bracket. Flush-mount models are attached directly to a process pipe or tank by a one-inch weld nipple. Models with integral flanges are supported by the flange connection.

Figure 44 shows a typical bracket-mounted and flange-mounted transmitter installations.

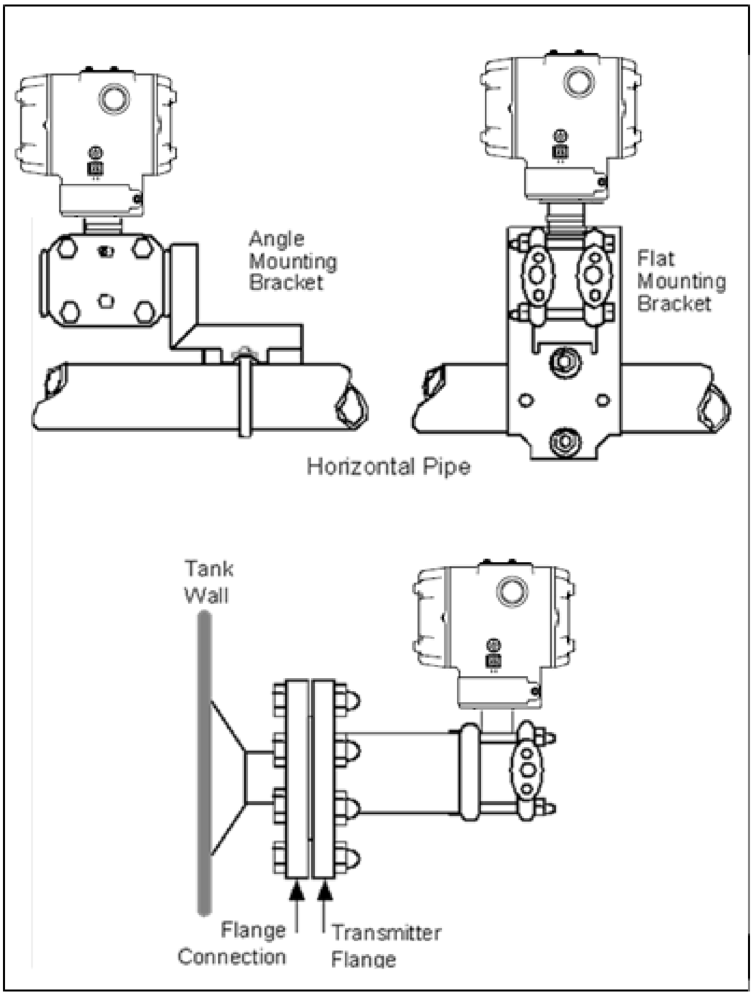


Figure 44 – ST 700 Basic Transmitter - Typical Bracket Mounted and Flange Mounted Installations

12.5 Flush mounting_ST 700 Basic Transmitter

To mount a flush mounted model, cut a hole for a 1” standard pipe in the tank or pipe where the transmitter is to be mounted. Weld the 1” mounting sleeve to the wall of the tank or to the hole cut on the pipe. Insert the meter body of the transmitter into the mounting sleeve and secure with the locking bolt. Tighten the bolt to a torque of 6,4 Nm +/- 0,30 Nm (4.7 ft-lbs +/- 0.2 ft.-lbs.). Figure 45 shows a typical installation for a transmitter with a flush mount on a pipe.

Once the transmitter is mounted, the electronics housing can be rotated to the desired position. See Figure 48 for details.

ATTENTION: On insulated tanks, remove enough insulation to accommodate the mounting sleeve.

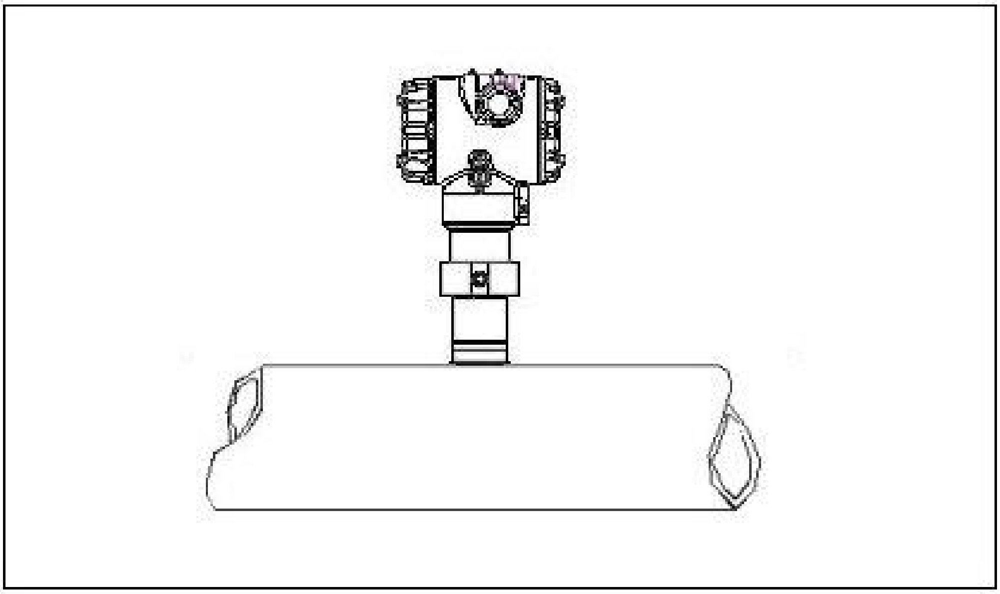


Figure 45 - ST 700 Basic Transmitter - Typical Flush Mounted Transmitter Installation

12.5.1 Mounting Dimensions, ST 700 Basic Transmitter

Refer to Honeywell drawing number 50049930 (Dual Head), 50049931 (In-Line), 50049932 (Flange Mount) 50049933 (Extended Flange), 50049934 (Remote Seal) and 50049936 (Flush Mount Pressure Transmitter) for detailed dimensions. Abbreviated overall dimensions are also shown on the Specification Sheets for the transmitter models. This section assumes that the mounting dimensions have already been taken into account and the mounting area can accommodate the Transmitter.

12.5.2 Bracket Mounting Procedure for ST 700 Basic Transmitter,

If you are using an optional bracket, start with Step 1. For an existing bracket, start with Step 2.

5. Refer to Figure 46 for position of the bracket on a 2-inch (50.8mm) nominal, 2.38-inch (60.4mm) actual, horizontal or vertical pipe, and install a "U" bolt around the pipe and through the holes in the bracket. Secure the bracket with the nuts and lock washers provided.

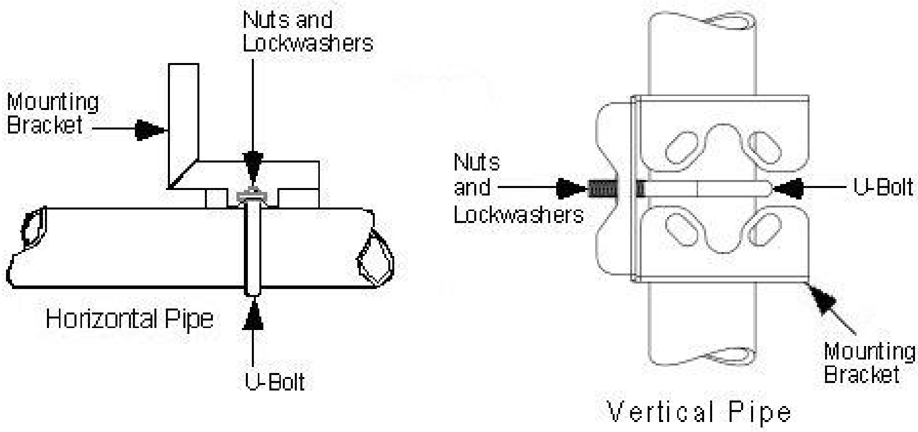


Figure 46 – ST 700 Basic Transmitter - Angle Mounting Bracket Secured to a Horizontal or Vertical Pipe

6. Align the appropriate mounting holes in the Transmitter with the holes in the bracket. Use the bolts and washers provided to secure the Transmitter to the bracket; see the following variations.

Table 30 - ST 700 Basic Transmitter - Mounting Bracket procedure

Transmitter Type	Use Hardware
DP with double-ended process heads and/or remote seals	Alternate mounting holes in the ends of the heads
In-line GP and AP models (STG7xS and STA7xS)	The smaller "U" bolt provided to attach the meter body to the bracket. See the following example.
Dual-head GP and AP	Mounting holes in the end of the process head.

Example: Inline model mounted to an optional angle bracket. See Figure 47.

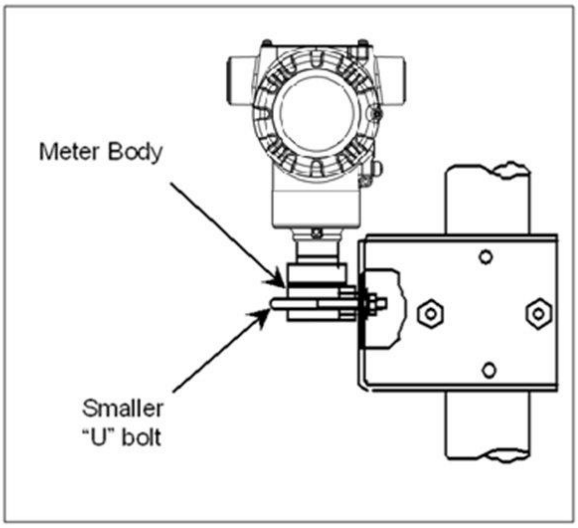


Figure 47 – ST 700 Basic Transmitter - Inline Model Mounted to an Optional Bracket

7. Loosen the set screw on the outside neck of the Transmitter one (1) full turn.

8. Rotate the Electronics housing a maximum of 180º left or right from the center to the position you require, and tighten the set screw using a 4mm metric socket head wrench. See the following example and Figure 48.

   Example: Rotating the Electronics Housing

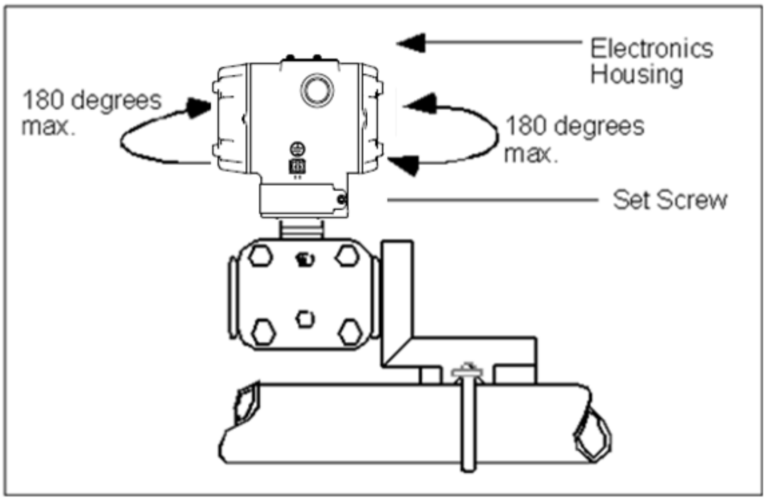


Figure 48 – ST 700 Basic Transmitter - Rotating the Electronics Housing

The mounting position of AP models STA725, STA745, STA72S, STA74S and STA77S becomes critical as the Transmitter spans become smaller. A maximum zero shift of 2.5mmHg for these models can result from a mounting position that is rotated 90o from the vertical.
A typical zero-shift of 0.12mmHg or 0.20 inH_2O can occur for a five (5)-degree rotation from the vertical.

12.5.3 Mounting Transmitters with Small Absolute or Differential Pressure Spans

To minimize positional effects on calibration (zero shift), take the appropriate mounting precautions for the respective Transmitter model. Ensure that the Transmitter is vertical when mounting models STA725, STA745, STA72S, STA74S and STA77S . You do this by leveling the Transmitter side-to-side and front-to-back.

Figure 49 shows how to level a Transmitter using a spirit level.

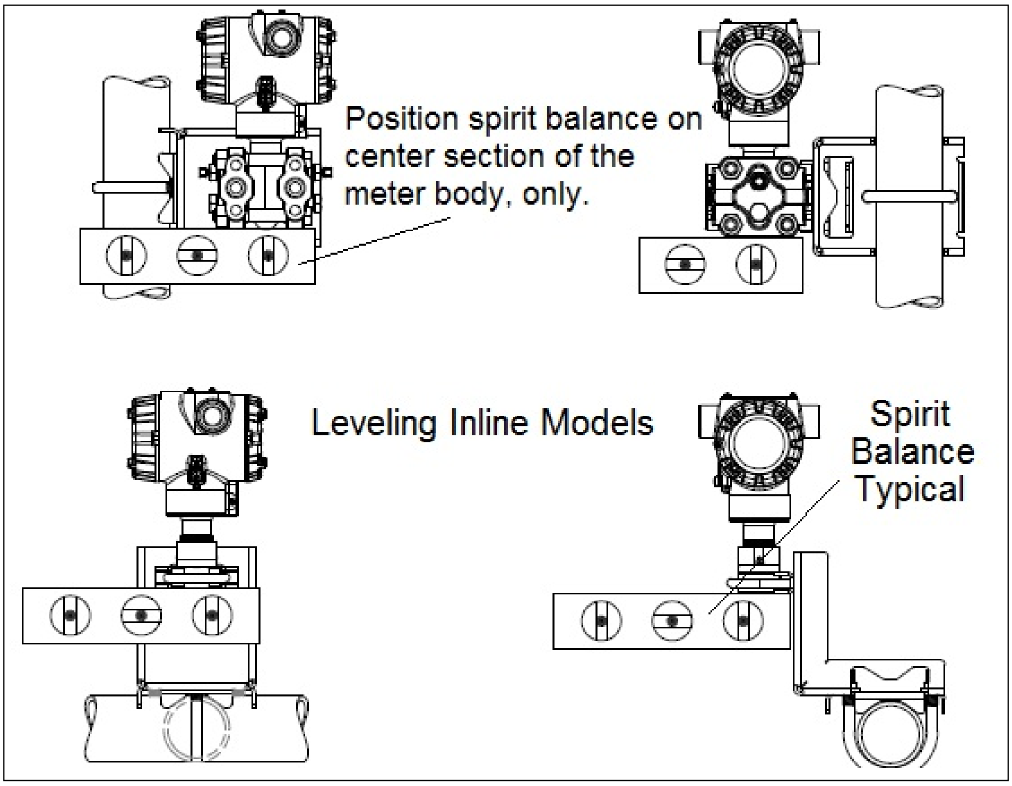


Figure 49 – ST 700 Basic Transmitter, using a Spirit Balance to Level a Transmitter

12.5.4 Flange Mounting_ST 700 Basic Transmitter

Figure 50 shows a typical tank-flange mount installation, with the Transmitter flange mounted to the pipe on the wall of the tank.

On insulated tanks, remove enough insulaiton to accommodate the flange extension.

When flange-mounting to a tank, note the following:

- The End User is responsible for providing a flange gasket and mounting hardware suitable for the Transmitter service conditions.
- To avoid degrading performance in flush-mounted flanged Transmitters, exercise care to ensure that the internal diameter of the flange gasket does not obstruct the sensing diaphragm.
- To prevent performance degradation in extended-mount flanged Transmitters, ensure that sufficient clearance exists in front of the sensing diaphragm body.

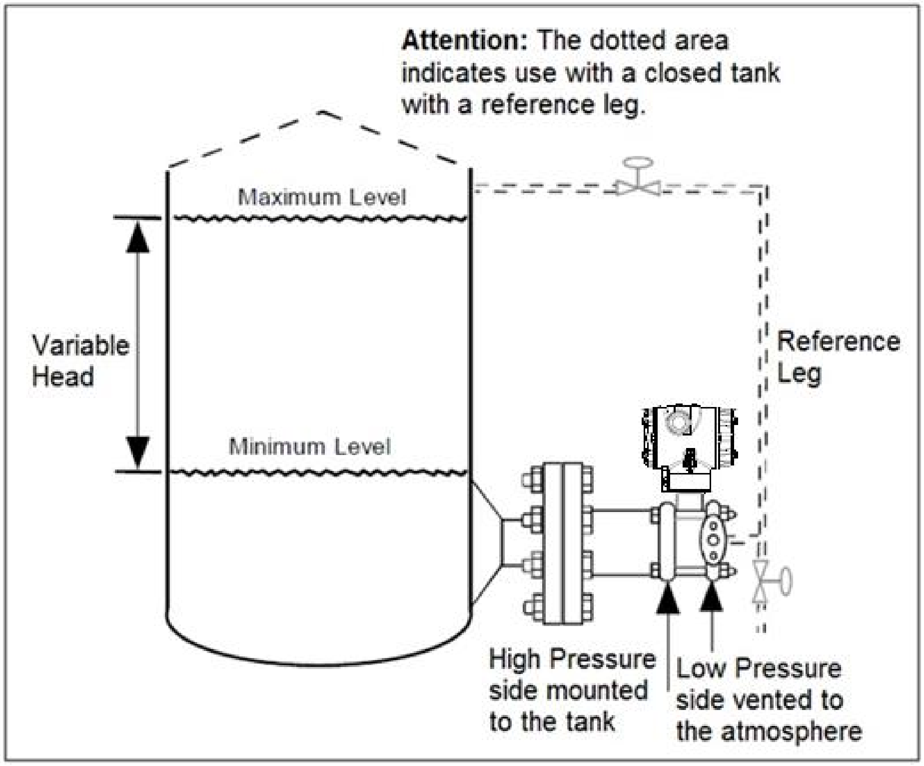


Figure 50 – ST 700 Basic Transmitter, Tank-Flange Mounted Transmitter

12.5.5 Remote Diaphragm Seal Mounting Information_ST 700 Basic Transmitter,

The combination of tank vacuum and high pressure capillary head effect should not exceed nine (9) psi (300mmHg) absolute. For insulated tanks, be sure to remove enough insulation to accommodate the flange extension. The end user is responsible for supplying a flange gasket and mounting hardware suitable for the service condition of the Transmitter.

Mount the Transmitter flanges within the limits in **Table 31**Table 6 for the fill fluid in the capillary tubes, with a tank at one (1) atmosphere.

Table 31 – ST 700 Basic Transmitter, Flange Mounting Guidelines

Fill Fluid	Mount the Flange…
Silicone 200 Oil	≤22 feet (6.7 meters) below the Transmitter
Chlorotrifluorethylene (CTFE)	≤11 feet (3.4 meters) below the Transmitter

Refer to Figure 51 for a representative remote diaphragm seal installation. Mount the Transmitter at a remote distance determined by the length of the capillary tubing.

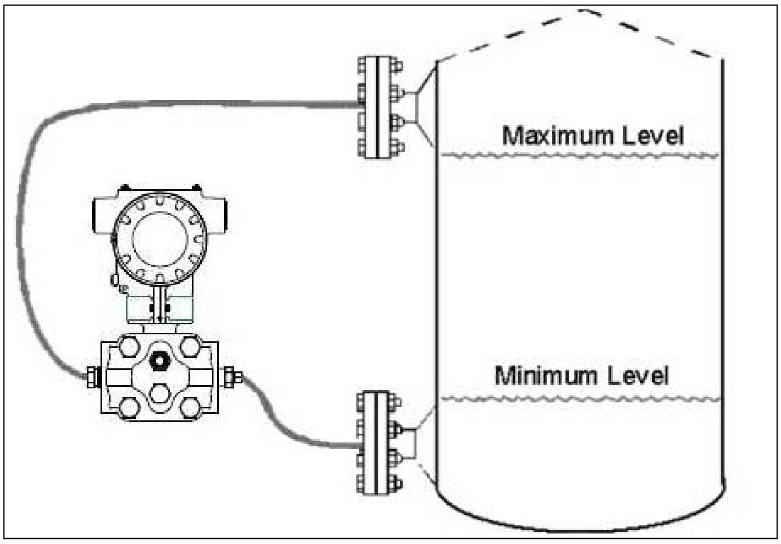


Figure 51 – ST 700 Basic Transmitter - Representative Remote Diaphragm Seal Transmitter Installation

Depending on Transmitter model, connect the remote seal to the tank according to Table 32

Table 32 – ST 700 Basic Transmitter - Remote Diaphragm Mounting Details

Transmitter Model	Connect the Remote Seal on ….	
	Variable Head	Fixed or Constant Head
STR735D	Transmitter High Pressure (HP) Side to tank wall lower flange mounting.	Transmitter Low Pressure (LP) side to tank wall upper flange.

12.6 Piping the ST 700 Basic Transmitter

12.6.1 Piping Arrangements

Piping arrangements vary depending upon process measurement requirements and the Transmitter model. For example, a differential pressure transmitter comes with double-ended process heads with ¼-inch NPT connections, which can be modified to accept ½-inch NPT through optional flange adapters. Gauge pressure transmitters are available with various connections for direct mounting to a process pipe.

A ½-inch, schedule 80, steel pipe is commonly used for Transmitter integration into a process system. Many piping arrangements use a three-valve manifold to connect the process piping to the Transmitter. A manifold makes it easy to install and remove or re-zero a Transmitter without interrupting the process. A manifold also accommodates the installation of blow-down valves to clear debris from pressure lines. Figure 52 represents a typical piping arrangement using a three-valve manifold and blow-down lines for a differential pressure transmitter being used to measure flow.

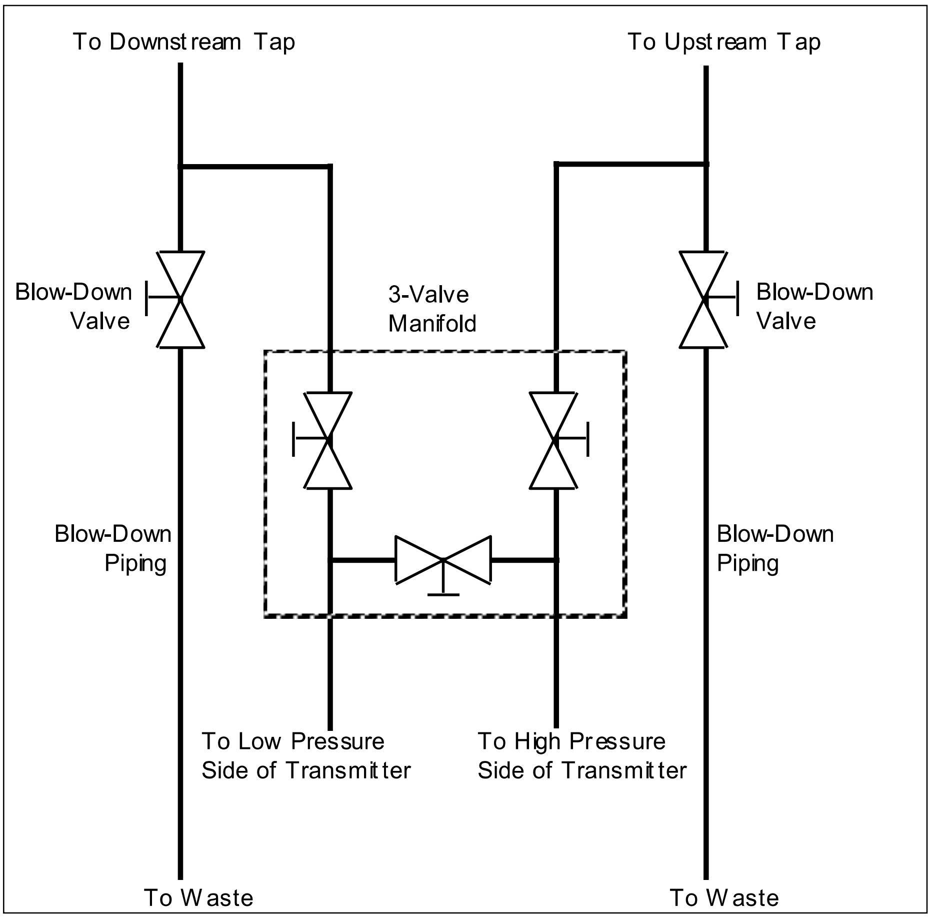


Figure 52– ST 700 Basic Transmitter - Typical 3-Valve Manifold with Blow-Down Piping

12.6.2 Suggestions for Transmitter Location

The following are suggested connections based on what is being processed by the system.

Table 33 – ST 700 Basic Transmitter - Suggested Connection Locations

Process	Suggested Location	Description
Gases	Above the gas line.	The condensate drains away from the Transmitter.
Liquids	Below but near the elevation of the process connection.	This minimizes that static head effect of the condensate.
	Level with or above the process connection.	This requires a siphon to protect theTransmitter from process steam. The siphon retains water as a *fill fluid*.

5. For liquid or steam, the piping should slope a minimum of 25.4mm (1 inch) per 305mm (1 foot).
6. Slope the piping down toward the Transmitter if it is below the process connection to allow the bubbles to rise back into the piping through the liquid.
7. If the transmitter is located above the process connection, the piping should rise vertically above the Transmitter. In this case, slope down toward the flow line with a vent valve at the high point.
8. For gas measurement, use a condensate leg and drain at the low point (freeze protection may be required here).

ATTENTION Care must be taken when installing transmitters on hot processes. The operating temperature limits for the device (as outlined in Table 5) must not be exceeded. Impulse piping may be used to reduce the temperature of the process that comes into contact with the transmitter meter body. As a general rule there is a 56°C drop (100°F) in the temperature of the process for every foot of ½ inch uninsulated piping.

12.6.3 General Piping Guidelines

- When measuring fluids that contain suspended solids, install permanent valves at regular intervals to blow-down piping.
- Blow-down all lines on new installations with compressed air or steam, and flush them with process fluids (where possible) before connecting these lines to the Transmitter Meter body.
- Verify that the valves in the blow-down lines are closed tightly after the initial blow-down procedure and each maintenance procedure thereafter.

12.6.4 Procedure to Install Flange Adapters

The following procedure provides the steps for removing and replacing an optional flange adapter on the process head. Refer to Figure 53.

This procedure does not require that the Meter body be removed from the Electronics Housing. If flange adapters are being replaced with parts from other kits (for example, process heads), follow the procedures for the kits and incorporate the following procedure.

The threaded hole in each Flange Adapter is offset from center. To ensure proper orientation for re-assembly, note the orientation of the offset relative to each Process Head **before removing the adapter.**

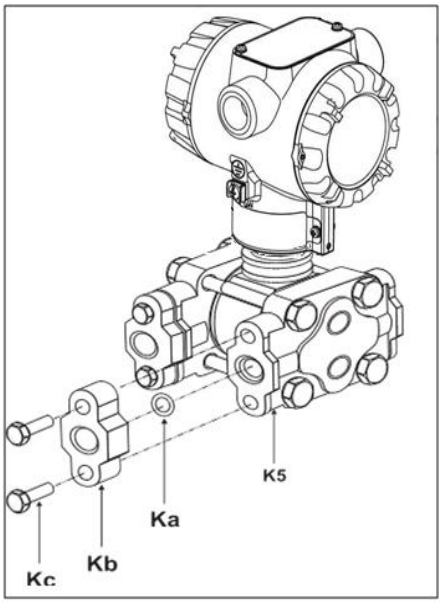


Figure 53 – ST 700 Basic Transmitter - Flange Adapter Removal and Replacement

Refer to the instructions included with the kit for removal and replacement procedures.

12.7 Wiring an ST 700 Basic Transmitter

12.7.1 Overview

The ST 700 basic transmitter is designed to operate in a two-wire power/current loop with loop resistance and power supply voltage within the operating range shown in Figure 54

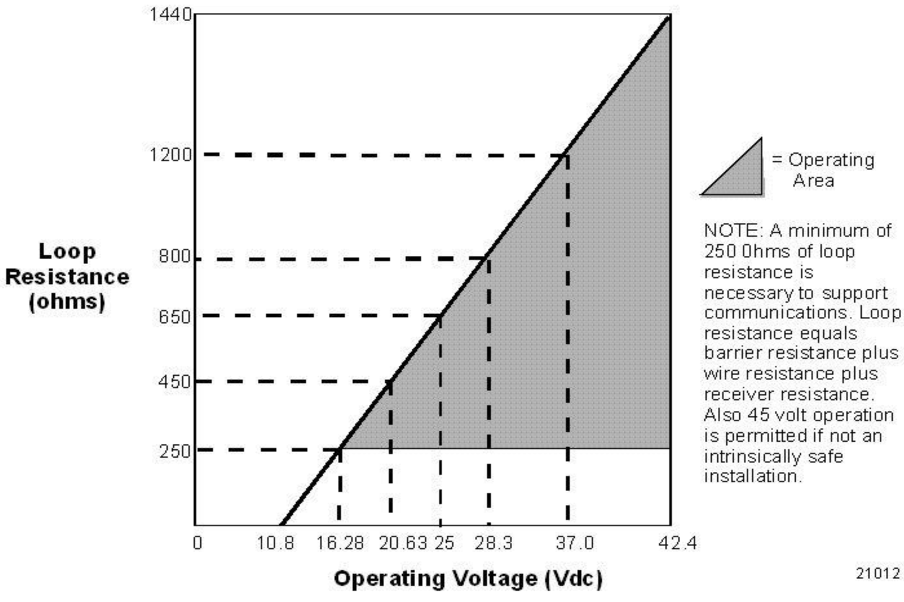


Figure 54 – ST 700 Basic Transmitter - Operating Ranges

Loop wiring is connected to the Transmitter by simply attaching the positive (+) and negative (–) loop wires to the positive (+) and negative (–) terminals on the Transmitter terminal block in the Electronics Housing shown in Figure 55

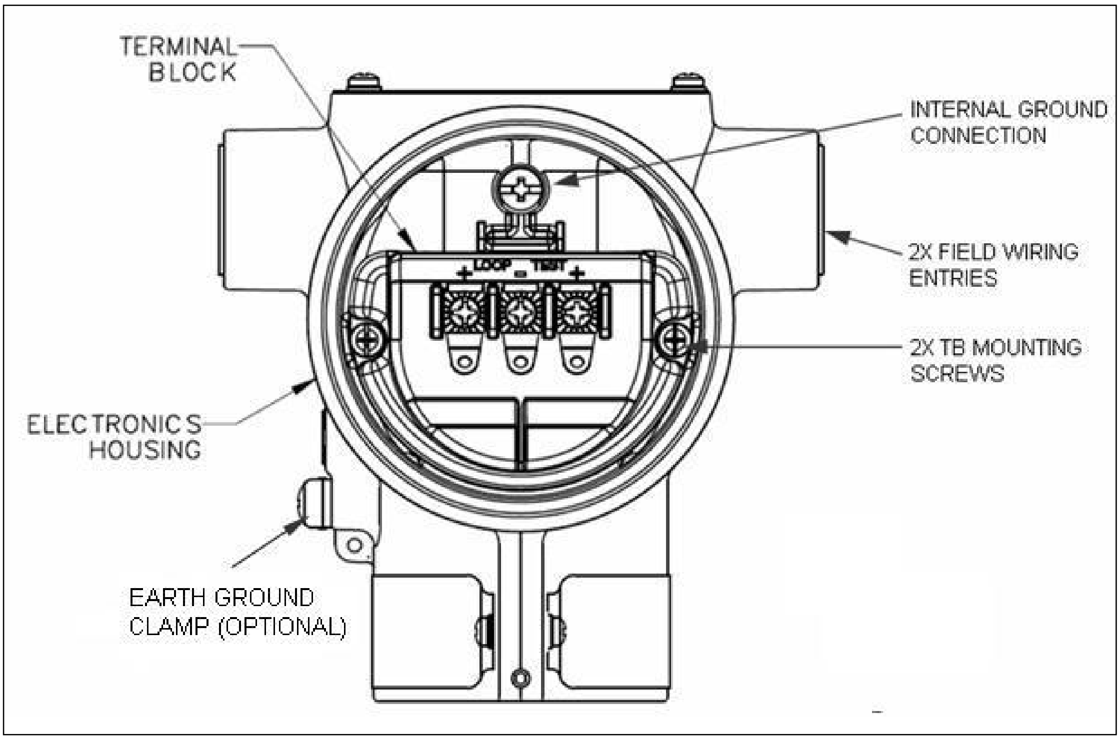


Figure 55 – ST 700 Basic Transmitter - 3-Screw Terminal Board and Grounding Screw

As shown in Figure 55 each Transmitter has an internal terminal to connect it to earth ground. Optionally, a ground terminal can be added to the outside of the Electronics Housing. While it is not necessary to ground the Transmitter for proper operation, doing so tends to minimize the possible effects of noise on the output signal and affords protection against lightning and static discharge. An optional lightning terminal block can be installed in place of the non-lightning terminal block for Transmitters that will be installed in an area that is highly susceptible to lightning strikes.

Wiring must comply with local codes, regulations and ordinances. Grounding may be required to meet various approval body certification, for example CE conformity. Refer to Appendix A of this document for details.

The Transmitter is designed to operate in a two-wire power/current loop with loop resistance and power supply voltage within the operating range; see Figure 54. With optional devices such as remote meter, the voltage drop for these options must be added to the basic 10.8-volt supply requirements to determine the required Transmitter voltage (V_{XMTR}) and maximum loop resistance ($R_{LOOP\ MAX}$). Additional consideration is required when sel*ecting* intrinsic safety barriers to ensure that they will supply at least minimum Transmitter voltage ($V_{XMTR\ MIN}$), including the required 250 ohms of resistance (typically within the barriers) needed for digital communications.

Transmitter loop parameters are as follows:
$R_{LOOP\ MAX}$ = maximum loop resistance (barriers plus wiring) that will allow proper Transmitter operation and is calculated as $R_{LOOP\ MAX} = (V_{SUPPLY\ MIN} - V_{XMTR\ MIN}) \div 21.8mA$.

In this calculation:

$V_{XMTR\ MIN} = 10.8V + V_{LP} + V_{SM}$

$V_{LP} = 0V$ for Honeywell supplied lightning protection option, LP

$V_{SM} = 2.3V$, remote meter

Note that V_{SM} should only be considered if a remote meter will be connected to the transmitter.

The positive and negative loop wires are connected to the positive (+) and negative (–) terminals on the terminal block in the Transmitter Electronics Housing.

Barriers can be installed per Honeywell's instructions for Transmitters to be used in intrinsically safe applications.

12.7.2 Digital System Integration Information

Transmitters that are to be digitally integrated to Honeywell's Total Plant Solution (TPS) system will be connected to the Pressure Transmitter Interface Module in the Process Manager, Advanced Process Manager or High Performance Process Manager through a Field Termination Assembly. Details about the TPS system connections are given in the *PM/APM SmartLine Transmitter Integration Manual*, PM12-410, which is part of the TDC 3000^X system bookset.

If you are digitally integrating a Transmitter in an Allen Bradley Programmable Logic Controller (PLC) process system, the same Field Terminal Assembly (FTA) and wiring procedures used with Honeywell's TPS system are also used with the Allen-Bradley 1771 and 1746 platforms.

12.7.3 Wiring Variations

The above procedures are used to connect power to a Transmitter. For loop wiring and external wiring, detailed drawings are provided for Transmitter installation in non-intrinsically safe areas and for intrinsically safe loops in hazardous area locations.

If you are using the Transmitter with Honeywell's TPS system, see *PM/APM Smartline Transmitter Integration Manual*, PM12-410, which is part of the TDC 3000^X system bookset.

12.7.4 Wiring Procedure

7. See Figure 55 above, for parts locations. Loosen the end cap lock using a 1.5mm Allen wrench.
8. Remove the end cap cover from the terminal block end of the Electronics Housing.
9. Feed loop power leads through one end of the conduit entrances on either side of the Electronics Housing. The Transmitter accepts up to 16AWG wire.
10. Plug the unused conduit entrance with the appropriate plug for the environment.
11. Connect the positive loop power lead to the positive (+) terminal and the negative loop power lead to the negative (-) terminal. Note that the Transmitter is <u>not</u> polarity-sensitive.
12. Replace the end cap, and secure it in place.

12.7.5 Lightning Protection

If your Transmitter includes the optional lightning protection, connect a wire from the Earth Ground Clamp (see Figure 15) to Earth Ground to make the protection effective. Use a size 8 AWG or ($8.37mm^2$) bare or green covered wire for this connection.

12.7.6 Supply Voltage Limiting Requirements

If your Transmitter complies with the ATEX 4 directive for self-declared approval per 94/9EC, the power supply has to include a voltage-limiting device. Voltage must be limited such that it does not exceed 42V DC. Consult the process design system documentation for specifics.

12.7.7 Process Sealing

The ST 700 SmartLine Pressure Transmitter is CSA-certified as a Dual Seal device in accordance with ANSI/ISA–12.27.01–2003, "Requirements for Process Sealing Between Electrical Systems and Flammable, or Combustible Process Fluids."

12.7.8 Explosion-Proof Conduit Seal

When installed as explosion proof in a Division 1 Hazardous Location, keep covers tight while the Transmitter is energized. Disconnect power to the Transmitter in the non-hazardous area prior to removing end caps for service.

When installed as non-incendive equipment in a Division 2 hazardous location, disconnect power to the Transmitter in the non-hazardous area, or determine that the location is non-hazardous before disconnecting or connecting the Transmitter wires.

Transmitters installed as explosion proof in Class I, Division 1, Group A Hazardous (classified) locations in accordance with ANSI/NFPA 70, the US National Electrical Code, with 1/2 inch conduit do not require an explosion-proof seal for installation. If 3/4 inch conduit is used, a LISTED explosion-proof seal to be installed in the conduit, within 18 inches (457.2mm) of the Transmitter.

12.8 Startup

12.8.1 Overview

This section identifies typical start up tasks associated with several generic pressure measurement applications. It also includes the procedure for running an optional analog output check.

12.8.2 Startup Tasks

After completing the installation and configuration tasks for a Transmitter, you are ready to start up the process loop. Startup usually includes:

- Checking zero input
- Reading inputs and outputs
- Applying process pressure to the transmitter.

The actual steps in a startup procedure vary based on the type of Transmitter and the measurement application. In general, the procedures in this section are based on using Honeywell MC Toolkit to check the Transmitter input and output under static process conditions, and make adjustments as required initiating full operation with the running process. Note that similar checks can be made using the optional external 2-button assembly, where the Transmitter is equipped. Operation with the 2-button assembly is discussed in the Operation section.

When the Standard Display is connected, the two-button assembly for the Standard Display is present. The buttons will function 1 second after powering up.

12.8.3 Output Check Procedures

The Output Check comprises the following procedures:

- The Loop Test procedure checks for continuity and the condition of components in the output current loop.
- The Trim DAC Current procedure calibrates the output of the Digital-to-Analog converter for minimum (0%) and maximum (100%) values of 4mA and 20mA, respectively. This procedure is used for Transmitters operating online in analog mode to ensure proper operation with associated circuit components (for example, wiring, power supply, control equipment). Precision test equipment (an ammeter or a voltmeter in parallel with precision resistor) is required for the Trim DAC Current procedure.
- The Apply Values procedure uses actual Process Variable (PV) input levels for calibrating the range of a Transmitter. To measure a liquid level for example, a sight-glass can be used to determine the minimum (0%) and maximum (100%) level in a vessel. The PV is carefully adjusted to stable minimum and maximum levels, and the LRV and URV are then set by commands from the MC Toolkit.

The Transmitter does not measure the given PV input or update the PV output while it operates in the Output mode.

12.8.4 Constant Current Source Mode Procedure

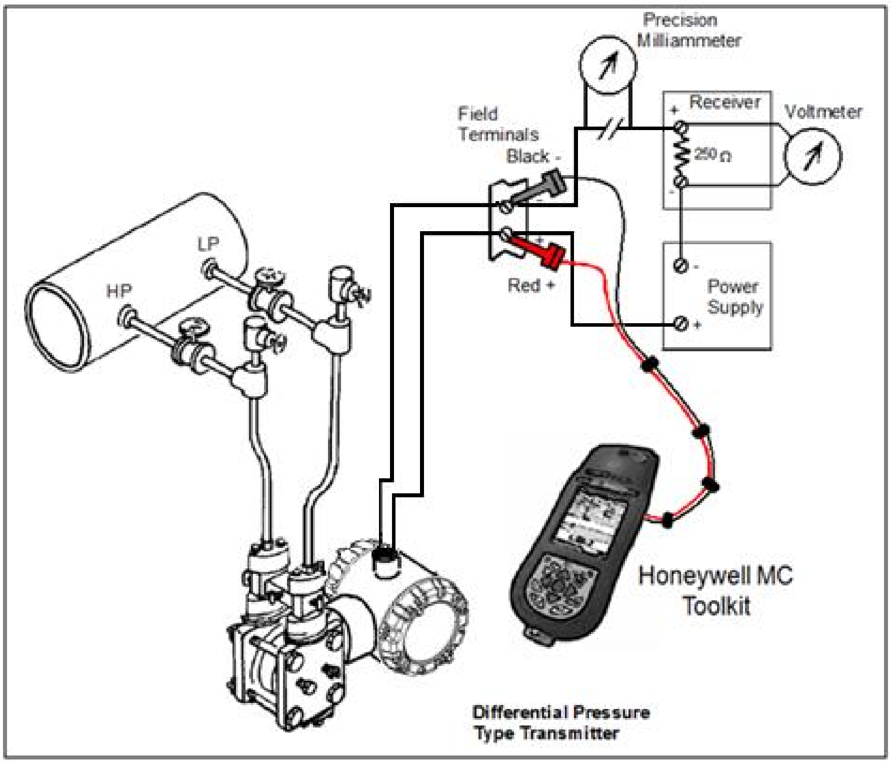


Figure 56 – ST 700 Basic Transmitter - Current Loop Test Connections

10. Refer to Figure 56 for test connections. Verify the integrity of electrical components in the output current loop.
11. Establish communication with the Transmitter. For these procedures, the values of components in the current loop are not critical if they support reliable communication between the Transmitter and the Toolkit.
12. On the Toolkit, display the **Output Calibration** box.
13. In the Output Calibration box, select the **Loop Test** button; the **LOOP TEST** box will be displayed.
14. Select the desired constant-level Output: 0%, 100%, or Other (any between 0% - 100%).
15. Select the Set button. A box will be displayed asking **Are you sure you want to place the transmitter in output mode?**

With the Transmitter in Analog mode, you can observe the output on an externally-connected meter or on a local meter. In DE mode, you can observe the output on the local meter or on the Toolkit Monitor display.

16. Select the **Yes** button. Observe the output current at the percentage you selected in Step 5.
17. To view the monitor display, navigate back from the **LOOP TEST** display, and select the **MONITOR** display. A **Confirm** popup will be displayed.
18. Select **Yes** to continue. This concludes the Startup procedure.

13. Operation_ST 700 Basic Transmitter

13.1 Overview

This section provides the information and processes involved for operation of ST 700 Basic Transmitter using the external two-button options.

13.2 External Two-Button Operation

The ST 700 Basic Transmitter optional external two-button interface provides a user interface and operation capability without opening the transmitter. Figure 57 shows the location of the two-button option and the labels for each button. See Table 37 for button operation.

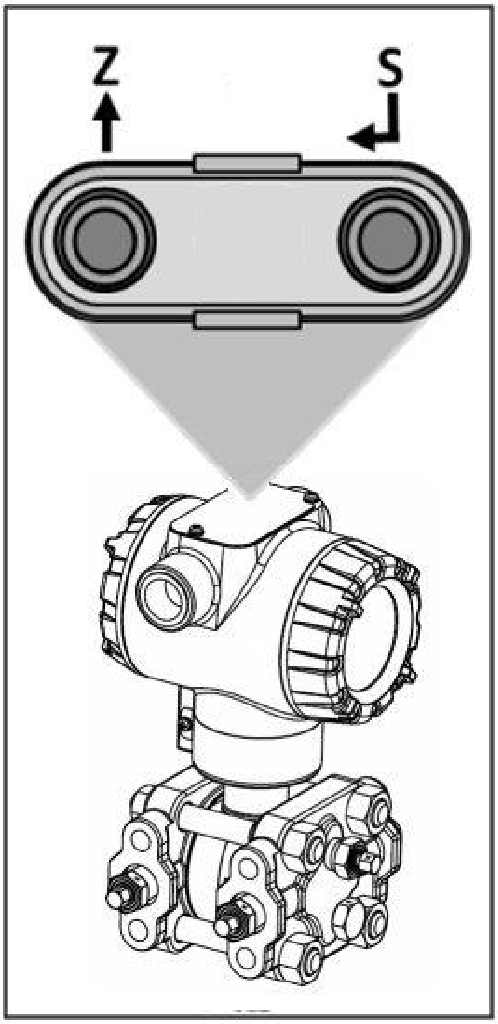


Figure 57 – ST 700 Basic Transmitter - Two-Button Option

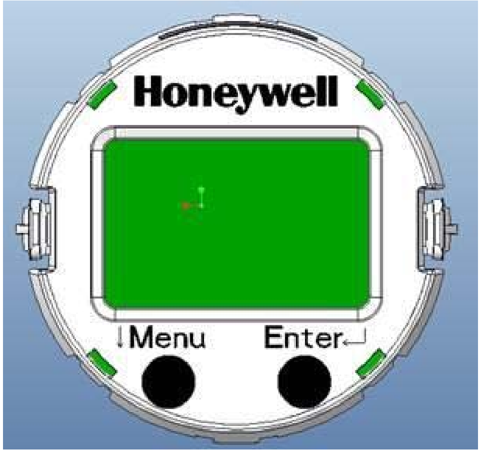


Figure 58 – ST 700 Basic Transmitter - Two-Button Option

13.2.1 The Standard Display Menu

The Standard Display Menu is implemented as one long single-level menu, after entering into Menu mode, and will “wrap around” when it reaches the end of the menu. To enter Menu mode select ↵ in PV display mode. Operation is as follows:

6. Select **<Exit Menu>** and press ↵ to exit the Menu.
7. Use the ↓ buttons to scroll through the list of menu items.
8. Press the ↵ button to select an item in Menu mode for data entry or activation. When an item is selected for data entry or activation, the cursor will jump to the lower line of the LCD to allow editing of the value. No action is taken against a menu item until the user presses the ↵ button.
9. If you want to abort a data entry operation, simply refrain from pushing any buttons for more than 10 seconds; the data entry operation will time out and the original value of the selected item will be preserved.
10. If you want to abort a menu operation, simply refrain from pushing any buttons for more than 60 seconds; the menu operation will time out and the exit from menu & it will show PV value.

The menu is divided into Standard Menu and Extended menu which can be enabled and disabled by Extended Menu Enable/Disable operation.

Note: The abort option is not available for Loop test parameter. The timeout for the DAC trim operation is more to enable user to calculate the loop current value to enter.

Table 34 – ST 700 Basic Transmitter: Standard Display Menus

<table>
<tr><td rowspan="4">PV Display [1SEL PV]</td><td>Pressure (PRESURE)</td><td>Pressure Units</td><td rowspan="4">Select Process Variable (PV) to be shown on the display from list.</td><td rowspan="6">Press ↵ to enter Menu Mode

Press ↵ to enter menu selection

Press ↵ to initiate action

Press ↓Menu to Exit to Menu</td></tr>
<tr><td>Percent Output (% OUT)</td><td>%</td></tr>
<tr><td>Loop Output (LOOPOUT)</td><td>mA</td></tr>
<tr><td>Flow (FLOW)
Note: Before seleting PV type as Flow, please ensure the LRV/URV values in (pressure unit) are as per application. For PV type Flow the pressure unit will not be visible.</td><td>Flow unit</td></tr>
<tr><td>Pressure Units [2UNITS]
(Visible for all PV except Flow)</td><td>atm, bar
ftH2O @ 68ºF
gf/cm2
inH2O @ 39ºF
inH2O @ 60ºF
inH2O @ 68ºF
inHg @ 0ºC
kgf/cm2, kPa
mbar,
mmH2O @ 4ºC,
mmH2O @ 68ºF,
mmHg @ 0ºC,
MPa, Pa,
psi
Torr,
mH2O @ 4ºC
cmH2O @ 4ºC
mHg @ 0ºC</td><td colspan="2">Choose appropriate engineering units from list</td></tr>
<tr><td>Flow Units [3FLUNIT]</td><td>Cubic meter/hour[m3/hr] Kg/hour [Kg/hr]
Metric Ton/Hour [MT/hr]
Liter per second [L/sec]
Liters/hour [L/hr]
Standard Cubic feet per hour[SCFH]
Cubic feet per hour[CFH]
Gallons/hour[gal/hr]
Barrel/hours [bbl/hr]
Imperial Gallons/hours[Igal/hr]
Percentage[%]</td><td colspan="2">Choose appropriate engineering units from list</td></tr>
</table>

<table>
<tr>
<td>Scaling Low
[4SCLLOW]
Scaling High
[5SCLHIG]</td>
<td>#. ##
#. ##</td>
<td>The limits are:
-999999 to 999999</td>
<td rowspan="2">Press ↵ to enter Menu Mode

Press ↵ to enter menu selection

↓ Menu to select number.
↵ to enter and shift to the next digit to the right

After complete value is Entered Press ↓Menu to Exit to Menu</td>
</tr>
<tr>
<td>Enter LRV
[6ENTLRV]
Enter URV
[7ENTURV]</td>
<td>#. ##
#. ##</td>
<td>The limits are:
2X the Lower Range Limit (LRL) of the Meter body and 2X the Upper Range Limit (URL) of the Meter body.
The LRV/URV value will be available in Pressure Units (Standard Display pressure unit)</td>
</tr>
<tr>
<td>Zero Correct
[8SETZRO]</td>
<td>Zero Correct</td>
<td>Executing this selection performing for Zero Correct operation</td>
<td>Press ↵ to enter Menu Mode

Press ↵ to enter menu selection

Press ↵ to initiate action

Press ↓Menu to Exit to Menu</td>
</tr>
</table>

Table 35 – ST 700 Basic Transmitter - Extended Display Menu

DAC Zero Trim [9ZEROTR] Note: Loop must be removed from Automatic Control	DAC Zero Trim	This selection allows the loop zero output 4mA value to be trimmed. Note: You must connect a current meter to the transmitter to monitor the loop output.	Press ↵ to enter Menu Mode Press ↵ to enter menu selection ↓ Menu to select number. ↵ to enter and shift to the next digit to the right After complete value is Entered Press ↓Menu to Exit to Menu
DAC Span Trim [10SPANTR] Note: Loop must be removed from Automatic Control	DAC Span Trim	This selection allows the loop span output 20mA value to be trimmed. Note: You must connect a current meter to the transmitter to monitor the loop output.	
Loop Test [11LPTEST] Note: Loop must be removed from Automatic Control	Loop Test 12.000	This selection allows the user to force the DAC output to any value between 3.8 and 20.8 mA. Note: This selection will put the DAC into Fixed Output Mode, as indicated by the flashing output value. Navigation away from this menu item will return the loop to Normal (Automatic) Mode.	
Set LRV [12SETLRV]	Set LRV	Executing this selection performing for Zero operation.	Press ↵ to enter Menu Mode Press ↵ to enter menu selection Press ↵ to initiate action
Set URV [13SETURV]	Set URV	Executing this selection for Span operation	
Contrast [14CNTRST]	»»»»»	Adjust the LCD contrast level. Range from » (1) to »»»»»»»»» (7) Default: »»»»»»»(7)	
Enable Extended Menu [EXDMNU]	Enable/Disable	Enable the extended Menu.The default is disabled	Press ↵ toto Enter the Menu Mode Press ↵ to enter Menu selection Menu to Enable or disable the Extended Menu ↵ to Enter Press ↓Menu to Exit to Menu
	Exit Menu		

13.2.2 Standard Display Abbreviations:

Table 36 – ST 700 Basic Transmitter - The Standard Display abbreviations

Abbreviation	Meaning
OOR	Out of Range
PRSPAN	Push reduce span
Wrng Mo	Wrong Mode
Illegal	Illegal Value
Wrt Err	NVM write error
Too Hi	Value/Parameter Too High
Too Lo	Value/Parameter Too Low
LRV Hi	LRV too High
LRV Lo	LRV too Low
LargeSP	Span too large
SmallSP	Span too small
Locked	Device is locked
Multidr	Device in multidrop mode
Wrt Prt	Device in write protect mode
NotSprt	Not supported
Hi LMT	Value is greater than high Limit value
Low LMT	Value is less than low Limit value

13.2.3 Data Entry

Data entry is performed from left to right. Select a character / digit by pressing ↓ buttons, and then press ↵ to advance to the next character position to the right. Select the cross-hatch character ▒ to terminate the entry or if the final character is already a space character, just press **<<** again.

All numeric entries are clamped at the low or high limit if needed. You can determine the low and high limit for a parameter by selecting either the **H** or **L** character while the cursor is positioned over the left-most digit and press ↵ button. The Display will show the selected limit.
For numeric entry sign is required to be entered only for negative numbers. For positive number, select space and move ahead.

Table 37 – ST 700 Basic Transmitter - Two-Button Data Entry

Screen Symbol	Numeric data entry
H	Display the high limit for this parameter. This symbol only appears in the left-most position of the data entry field.
L	Display the low limit for this parameter. This symbol only appears in the left-most position of the data entry field.
<<	Terminate the numeric entry
0 thru 9, Minus, Decimal	These characters are used to enter numeric values. The minus sign only appears in the left-most digit.

13.2.4 Editing a Numeric value

Editing a numeric value is a digit-by-digit process, starting with the left-most digit.

1. Press ↵ to begin the edit process.
2. The Standard Display will show the current value of the item on the lower line, left justified.
3. Press the ↓ buttons to select the desired digit, and then press ↵ to advance to the next digit to the right.
4. After the last digit has been entered, press ↵ one more time to write the new value to the transmitter.

13.2.5 Selecting a new setting from a list of choices

Use the procedure described below to select a new setting for parameters that present a list of choices (e.g. PV Display, Pressure Units, and so forth.).

1. Press ↵ to begin the edit process.
    a. The Standard Display will show the current setting of the item on the lower line
2. Press the ↓ buttons to scroll through the list of choices.
3. Press ↵ to make your selection. The new selection will be stored in the transmitter and will be displayed on the lower line

13.3 Two Button Operation with no Display Installed

When there is no Display installed, the buttons can be used to perform a Zero or Span adjustment and zero correction of the ST 700 Basic Transmitter. Caution should be taken to insure these adjustments are only made when the correct input pressures are applied.

13.3.1 Zero Adjustment

This adjustment is the same as performing a Set LRV using the Display.

1. Connect a current meter or voltmeter as shown in Figure 56 to monitor the PV output of the Transmitter.
2. Using an accurate pressure source, apply pressure equivalent to the Transmitter LRV.
3. Press the Zero (↑) button for more than 2 seconds to set the Zero.
4. Verify that the output is now 4 mA.

Note: Pressing the zero button for more than 5 seconds will ignore the button press.

13.3.2 Span Adjustment

This adjustment is the same as performing a Set URV using the Display.

1. Connect a current meter or voltmeter as shown in Figure 56 to monitor the PV output of the Transmitter.
2. Using an accurate pressure source, apply pressure equivalent to the desired Upper Range Value of the transmitter.
3. Press the **Span** (↵) button for more than 2 secondsr to set the span.
4. Verify that the PV output is now 20mA.

Note: Pressing the zero button for more than 5 seconds will ignore the button press.

13.3.3 Zero Correction

This adjustment is the same as performing a Zero correct using the Display.

1. Connect a current meter or voltmeter as shown in Figure 56 to monitor the PV output of the Transmitter.
2. Using an accurate pressure source, apply pressure equivalent to the zero Value of the transmitter.
3. Press the Zero (↑) and **Span** (↵) buttons together for more than 5 sec to set the span.
4. Verify that the PV is set to 0 value.

Note: Pressing the SPAN button for more than 10 seconds will ignore the button press

You can also use the MCT Toolkit to make any adjustments to an ST 700 SmartLine Pressure Transmitter. Alternately, certain adjustments are possible through an Experion Station , if the ST 700 is digitally integrated with either of these stations.

13.4 Changing the Default Failsafe Direction

ST 700 Basic Transmitters are shipped with a default failsafe direction of upscale. This means that the Transmitter output will set the current output to upscale failsafe (maximum output) upon detection of a critical status. You can change the direction from upscale failsafe to downscale failsafe (minimum output) by moving the top jumper located in the Electronics module.

13.4.1 Procedure to Establish Failsafe Operation

The failsafe direction display accessible via the Toolkit shows only the state of the jumper as it correlates to analog Transmitter operation.

The integrated circuits in the Transmitter PWA are vunerable to damage by stray static discharges when removed from the Electronics Housing. Minimize the possibility of static discharge damage when handling the PWA as follows:

Do not touch terminals, connectors, component leads, or circuits when handling the PWA.

When removing or installing the PWA, handle it by its edges or bracket section only. If you need to touch the PWA circuits, be sure you are grounded by staying in contact with a grounded surface or by wearing a grounded wrist strap.

When the PWA is removed from the Transmitter, put it in an electrically conductive bag, or wrap it in aluminum foil to protect it.

The following procedure outlines the steps for positioning the write protect and failsafe jumpers on the electronics module. See Figure 59 for the locations of the failsafe and write protect jumpers.

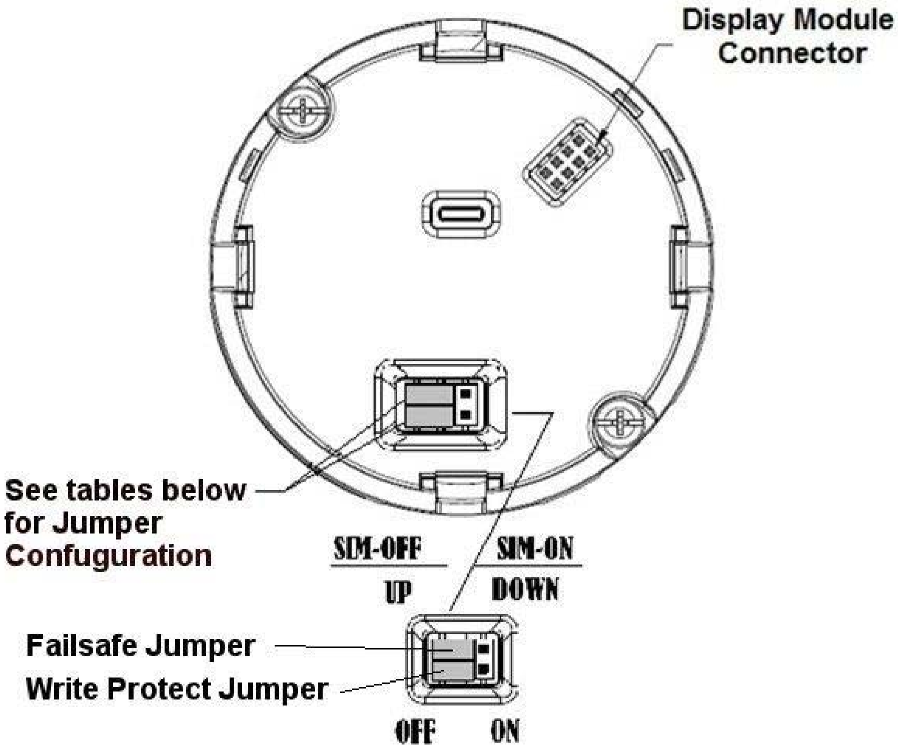
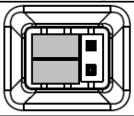
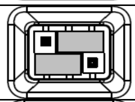
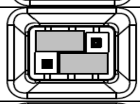
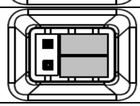


Figure 59 – ST 700 Basic Transmitter - Locating the Failsafe and Write Protect Jumpers

Table 38 – ST 700 Basic Transmitter - HART Failsafe and Write Protect Jumpers

Jumper Arrangements	Description
	Failsafe = UP (High) Write Protect = OFF (Not Protected)
	Failsafe = DOWN (Low) Write Protect = OFF (Not Protected)
	Failsafe = UP (High) Write Protect = ON (Protected)
	Failsafe = Down (Low) Write Protect = On (Protected)

1. Turn OFF Transmitter power (Power removal is only required in accordance with area safety approvals. Power removal is only required in Class 1 Div 1 Explosionproof and Class 1 Div 2 environments).

2. Loosen the end cap lock, and unscrew the end cap from the electronics side of the Transmitter housing.

3. If equipped with a Display module, carefully depress the two tabs on the sides of the Display Module, and pull it off.

4. If necessary, unplug the interface connector from the Communication module. Do not discard the connector.

5. Set the Failsafe Jumper (top jumper) to the desired position (UP or DOWN). See Figure 59? and Table 38 for jumper positioning.

6. If applicable, re-install the Display module as follows:
   - Orient the display as desired.
   - Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.
   - Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

   Note: Installing a Display Module into a powered transmitter may cause a temporary upset to the loop output value.

   Orient the Display for proper viewing through the end cap window. You can rotate the meter mounting orientation in 90° increments.

7. Restore transmitter power if removed.

13.5 Monitoring the Standard Displays

This section describes the information shown on the operator screens of the Standard Display.

13.5.1 Standard Display

- The PV value is user-configurable. This field has 6 characters. The maximum allowable numeric value is 999999 or -999999.
  - If fractional decimals are configured, the fractional positions will be dropped, as required.
  - If the PV value exceeds the above limits, it is divided by 1000 and “K” is appended to the result, allowing a maximum value with multiplier of 99999K or -99999K.

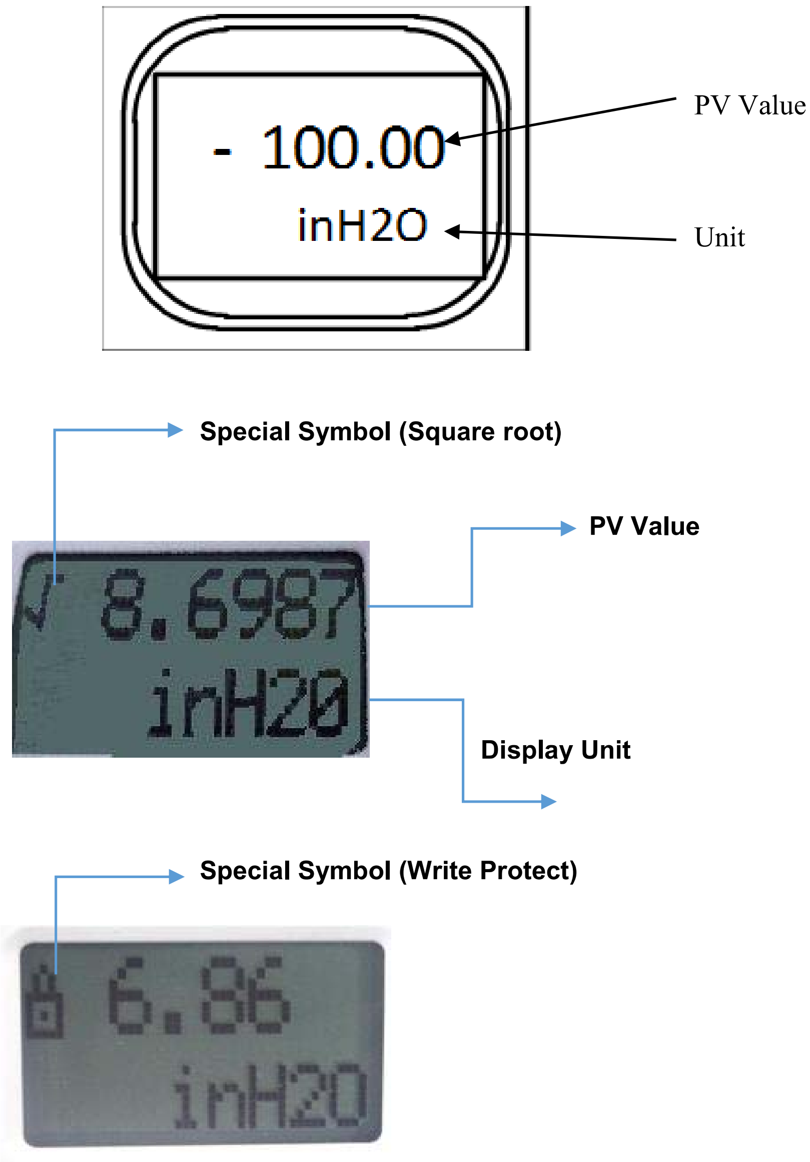


Figure 60 – ST 700 Basic Transmitter - Standard Display with Process Variable Format

14. Maintenance_ST 700 Basic Transmitter

14.1 Overview

This section provides information about preventive maintenance and replacing damaged parts. The topics covered in this section are:

- Preventive maintenance of the meter body barrier diaphragms and process piping to the Transmitter.
- Replacement of damaged parts such as the Transmitter Printed Wiring Assembly (PWA) and meter body

14.2 Preventive Maintenance Practices and Schedules

The ST 700 Basic Transmitter does not require any specific maintenance at regularly scheduled intervals. However, it is recommended that you perform these typical inspection and maintenance routines on a schedule that is dictated by the characteristics of the process medium and if blow-down facilities or purge systems are being used.

- Check piping for leaks.
- Clear piping of sediment or other foreign matter.
- Clean the Transmitter process heads, including the barrier diaphragms.

14.3 Inspecting and Cleaning Barrier Diaphragms

Depending on the characteristics of the process medium, sediment or other foreign particles may collect in the process head cavity/chamber and cause faulty measurement. In addition, the barrier diaphragm(s) in the Transmitter meter body may become coated with residue from the process medium. The latter is also true for external diaphragms on flange-mount and remote seal type Transmitters.

In many cases, you can readily remove the process head(s) from the Transmitter meter body to clean the process head cavity and inspect the barrier diaphragm(s). For flange-mount and remote seal diaphragms, you may only need to run a purge line in the tank to rinse off the face of the diaphragm(s).

The following procedure comprises the general steps for inspecting and cleaning barrier diaphragms. You may have to modify these steps to meet your particular process or transmitter model requirements. Figure 61 shows an exploded view of a Differential Pressure (DP) Transmitter meter body for reference. For disassembly/reassembly purposes, Gauge Pressure (GP) and Absolute Pressure (AP) Transmitters are similar.

It is recommended that you remove the Transmitter from service and move it to a clean area before disassembling it.

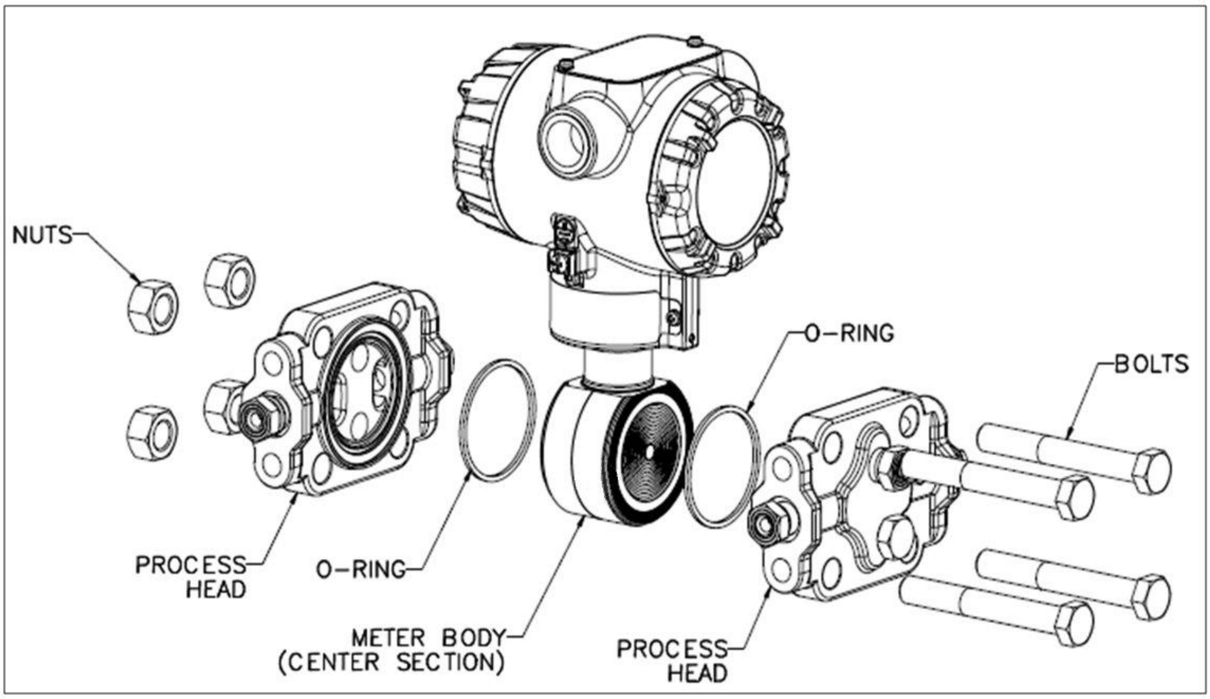


Figure 61 – ST 700 Basic Transmitter - DP Transmitter Head Disassembly

13. Close all valves to isolate the Transmitter from the process.
14. Open the vent in the process head to drain fluid from the Transmitter meter body, as necessary.
15. Remove the Transmitter from the process.
16. Loosen the nuts in the sequence shown in Figure 62
17. Remove the nuts from the bolts that hold the process head(s) to the meter body.
18. Remove the process heads and bolts.
19. Remove the gasket/ O-ring, and clean the interior of the process head using a soft bristle brush and an approved solvent.
20. Inspect the barrier diaphragm for signs of deterioration, corrosion, and distortion.
21. If the diaphragm is distorted contact Honeywell for assistance.
22. Install a new gasket/O-ring in each process head.
23. Coat threads on the process head bolts with a suitable anti-seize compound, such as “Neverseize,” or equivalent.
24. Using a torque wrench, gradually tighten the nuts in the sequence shown in Figure 62
25. Tighten head bolts in stages of 1/3-full torque, 2/3-full torque, and full torque. See Table 39 or torque requirements versus Transmitter type and model.

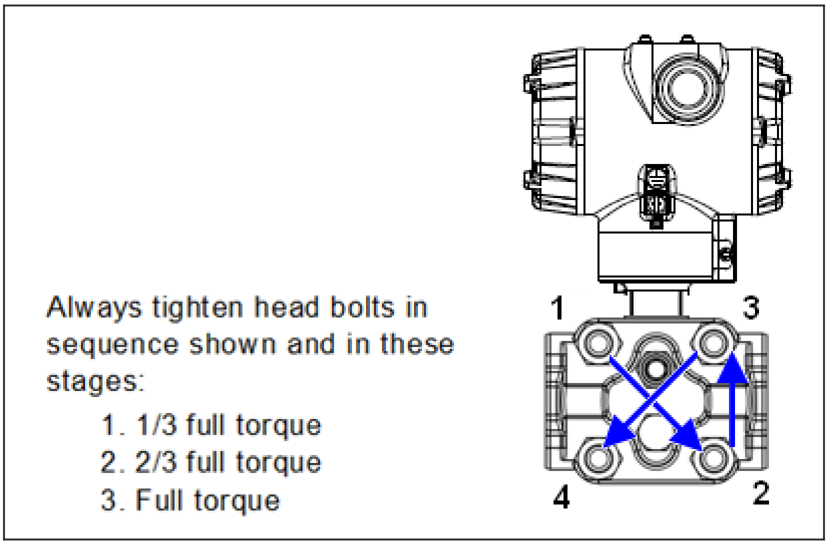


Figure 62 – ST 700 Basic Transmitter - Head Bolt Tightening Sequence

Table 39 – Head Bolt Torque Values

Bolting Type	**50049713XXXX all transmitters except draft range (XXX5)**	**50049713XXX5 Draft Range Transmitter only**
Super Duplex Bolting Option Bolt 514452557-006 Nut 51452559-006	48,8 N-M +/- 2,4 N-M (36.0 Lb-Ft +/- 1.8 Lb-Ft)	20,3 N-M (16.0 Lb-Ft +/- 0.8 Lb-Ft)
316 Stainless Steel Bolting Option Bolt 51452557-003 Nut 51452559-004	56,9 N-M +/- 2,8 N-M (42.0 Lb-Ft +/- 2.1 Lb-Ft)	
Grade 660 NACE Bolts/NACE 304 Nuts Option Bolt 51452557-002 Nut 51452559-002		
Grade 660 NACE Bolting Option Bolt 51452557-002 Nut 51452559-008	67,8 N-M +/- 3,4 N-M (50.0 Lb-Ft +/- 2.5 Lb-Ft)	
Carbon Steel Bolting Option Bolt 51452557-001 Nut 51452559-001		

14.4 Replacing the Communication Module

The Communication module includes a connector to the sensor ribbon cable and a connector to the optional Display module. This section includes the procedure to replace the Communication module.

The transmitter does not have to be removed from service to replace the Comm Module

Please take appropriate steps to avoid ESD damage when handling the Communication and Display Module assemblies

Refer to Figure 63 for parts locations.

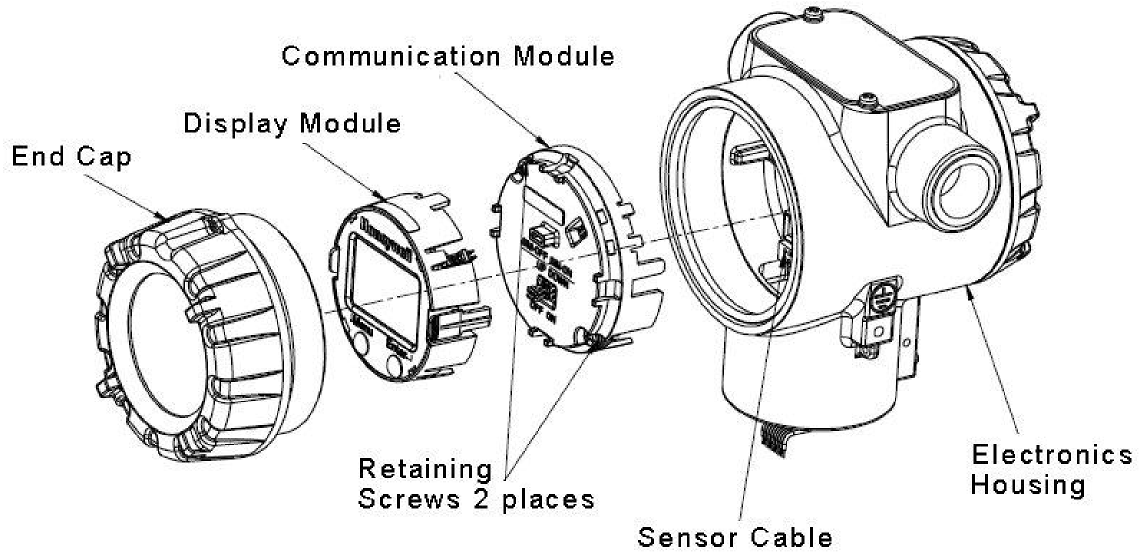


Figure 63 – ST 700 Basic Transmitter - PWA Replacement

1. Turn OFF Transmitter power (Power removal is only required in accordance with area safety approvals. Power removal is only required in Class 1 Div 1 Explosion-proof and Class 1 Div 2 environments).
    - When removing the Communications Module with power applied, the loop will go to 0V. Likewise, installing a Communications Module into a transmitter with power applied will cause the loop output value to go to 12ma for several seconds then the loop output value will go to the configured value based on the PV input.
    - Installing a Display Module into a powered transmitter may cause a temporary upset to the loop output value.
2. Loosen the end cap lock, and unscrew the end cap from the electronics side of the Transmitter housing.
3. If equipped with a Display module, carefully depress the two tabs on the sides of the Display Module, and pull it off.

4. If necessary, unplug the interface connector from the Communication module. **Do not discard the connector**.
5. Loosen the two retaining screws, and carefully pull the Communication module from the Electronics compartment.

6. Carefully align and connect the Sensor Ribbon Cable to the connector “J4” at the bottom of the Communication module. When installing the Communication module in the next step, be careful not to pinch the Sensor Ribbon Cable.

7. Carefully, insert the Communication module into the Electronics compartment. Ensure that the Sensor Ribbon Cable is not pinched.

8. Tighten the two Communication module retaining screws.

9. Refer to the SmartLine User's Manual to change the FAILSAFE, READ/WRITE configuration settings.

10. If applicable, re-install the Display module as follows:

    d. Orient the display as desired.

    e. Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.

    f. Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

Orient the Display for proper viewing through the end cap window. You can rotate the meter mounting orientation in 90 ° increments.

11. Apply Parker Super O-ring Lubricant or equivalent to the end cap O-ring before installing the end cap. Reinstall the End Cap and tighten the End Cap locking screw.

12. Installing Optional External Configuration Button Assembly.

    d. Loosen (Do Not Remove) both top nameplate screws and pivot nameplate 90°.

    e. Align the protrusion on the button assembly with the matching opening in the housing and snap the button assembly into the housing.

    f. Rotate the nameplate back to the original position, and tighten the nameplate screws.

14.5 Replacing the Meter Body

You can replace the complete meter body, including the process heads, or the meter body only on certain Differential Pressure (DP), Gauge Pressure (GP), and Atmospheric Pressure (AP) Transmitters by using the existing process head(s). Use the following procedure for meter body-only replacement.

1. Save or record device configuration data.
2. Turn off Transmitter power.
3. Remove the Transmitter from service, and move it to a clean area before disassembling it.
4. Refer to Figure 64. Loosen the End Cap Lock, and unscrew the End Cap from the electronics side of the Transmitter housing.

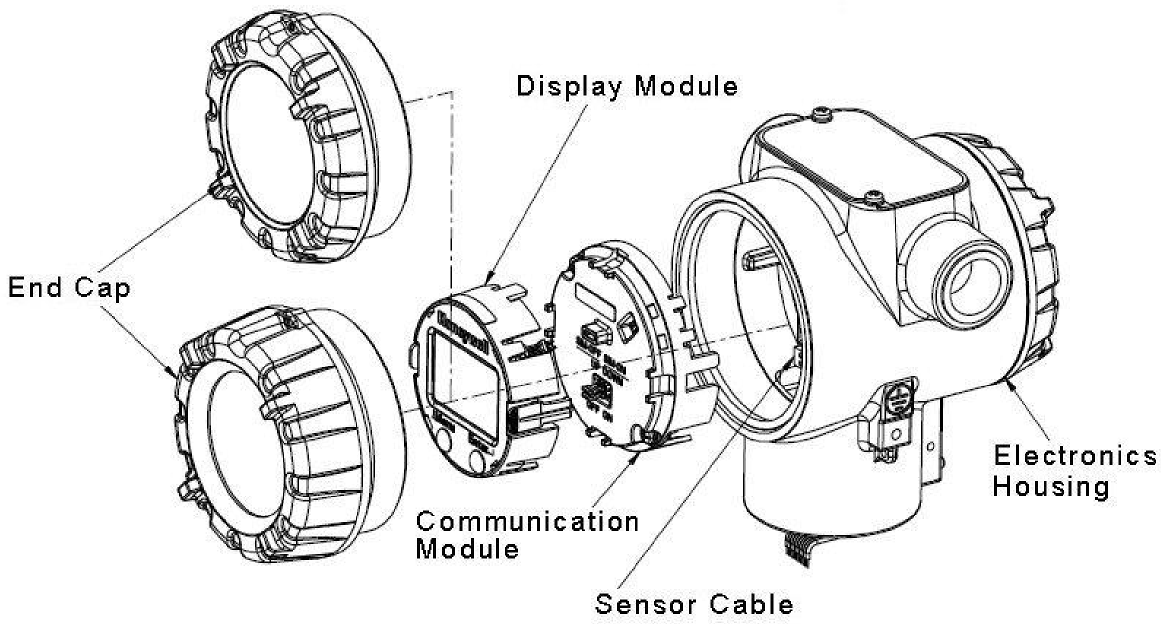


Figure 64 – ST 700 Basic Transmitter - Disassembly for Meter Body Replacement

Please take appropriate steps to avoid ESD damage when handling the Communication and Display Module assemblies

5. If a display is present, press the two snaps along the side, and remove it from the communication module assembly.
   Note: Do not discard or misplace the Display/Communication connector, it will be required to reassemble the Display Module
6. Loosen the two retaining screws, and remove the Communications Module assembly, and remove the Communication Module assembly from the electronics housing.
7. Disconnect the Sensor Cable from the Communications Board.
8. Refer to Figure 66. Use a 2mm hex wrench to completely loosen the set screw on the outside of the housing to permit rotating the meter body.

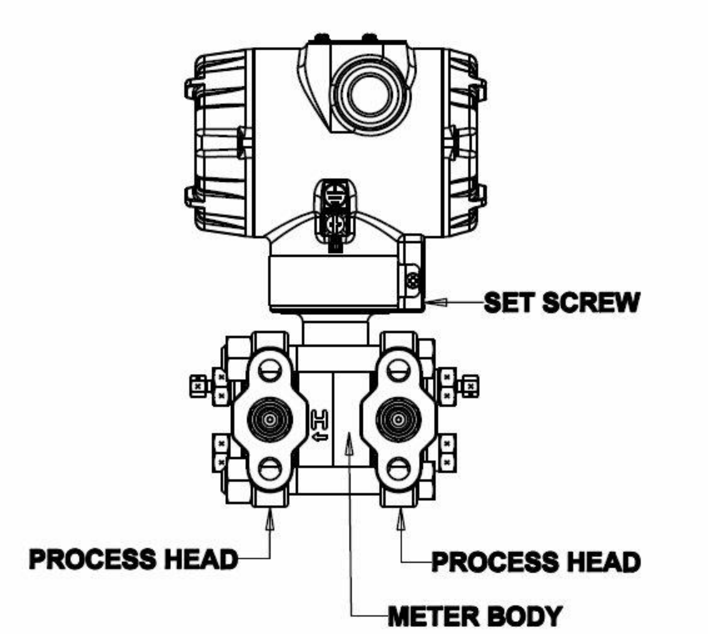


Figure 65 – ST 700 Basic Transmitter - Hardware Location to Remove the Meter Assembly

9. Carefully turn the complete meter body counterclockwise to unscrew it from the electronics housing.
10. Remove the nuts from bolts that hold the process head(s) to the Meter Body.
11. Remove process heads and bolts.
12. Remove the gaskets or O-rings from the process heads.
13. Clean the interior of the process head(s) with a soft bristle brush and suitable solvent.

CAUTION: To prevent damage to the diaphragm in the Meter Body, use extreme care when handling or placing the Meter Body on any surface. Carefully assemble gaskets or O-rings to the meter body. If installing O-rings, lubricate with water or leave dry.

14. Coat threads on process head bolts with anti-seize compound such as "Neverseize" or equivalent.
15. Refer to Figure 66. Apply Dow Corning #33 silicone grease to the meter body adapter O-ring and carefully assemble the O-ring to the meter body. Assemble the process head(s) and bolts to the new meter body. For now, make the bolts only finger-tight.

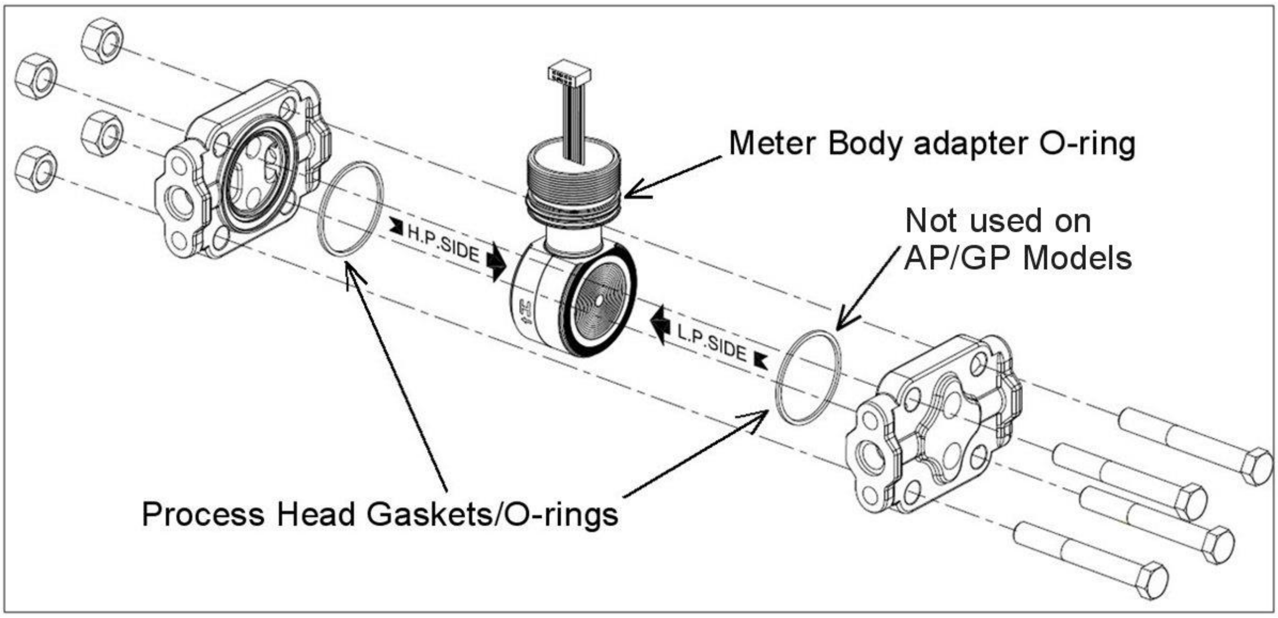


Figure 66 – ST 700 Basic Transmitter - Meter Body Reassembly

16. Use a torque wrench to gradually tighten nuts to torque rating in sequence shown in Figure 67. Tighten head bolts in stages of 1/3 full torque, 2/3 full torque, and then full torque as per Table 39.

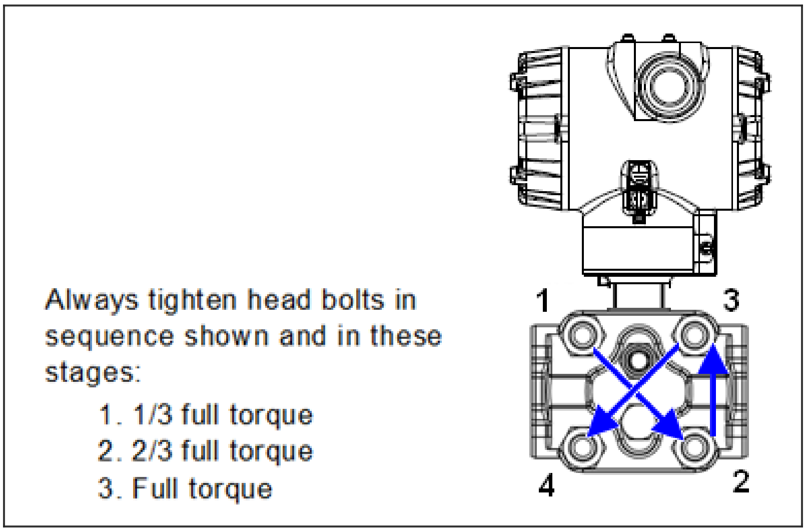


Figure 67 – ST 700 Basic Transmitter - Head Bolt Tightening Sequence

17. Feed the ribbon cable on the new meter body through the neck of the housing.

CAUTION: To prevent damage to the ribbon cable, use care when assembling the Meter Body to the electronics housing.

18. Screw the new meter body into the housing until the bottom of the Meter Body adapter is flush with the neck of the electronics housing.

19. Tighten the outside set screw to be sure it is fully seated in the slot in the header.

20. Loosen the set screw ½- turn.

21. Rotate the housing to the desired position (Max. 180° in either direction), and tighten the set screw.

22. Carefully align and connect the Sensor Ribbon Cable to connector “J4” at the bottom of the Communication module board. When installing the Communication module in the next step, be careful not to pinch the Sensor Ribbon Cable.

23. Carefully, insert the Communication module into the Electronics compartment. Ensure that the Sensor Ribbon Cable is not pinched.

24. Tighten the two Communication module retaining screws.

25. If applicable, re-install the Display module as follows:

    d. Orient the display as desired.

    e. Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.

    f. Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

Orient the Display for proper viewing through the end cap window. You can rotate the meter mounting orientation in 90 o increments.

26. Connect the bracket to the Transmitter housing.

27. Recalibrate the Transmitter per section Calibration_ST 700 Basic Transmitter, of this document.

28. Return the Transmitter to service, and turn ON power

29. Verify the Transmitter configuration data. Restore the saved database if necessary.

30. Lubricate the end-cap O-ring with Parker Super O-ring silicone lubricant or equivalent before replacing the end caps.

15. Calibration_ST 700 Basic Transmitter

15.1 Recommendations for Transmitter Calibration

The ST 700 Basic Transmitter does not require periodic calibration to maintain accuracy. Typically, calibration of a process-connected Transmitter will degrade, rather than augment the capability of a smart Transmitter. For this reason, it is recommended that a Transmitter be removed from service before calibration. Moreover, calibration will be accomplished in a controlled, laboratory-type environment, using certified precision equipment.

15.2 Calibration Procedures

For a transmitter operating in analog mode, you must calibrate its output signal measurement range using any compatible hand-held communicator or a local display.

One calibration option is to use the Honeywell Smart Field Communicator (SFC). Refer to the *Smart Field Communicator Operating Guide,* Document # 34-ST-11-14 for calibration procedures.

Calibration information and procedures for a Transmitter operating in the HART/DE mode are provided in the *ST 700 Series HART/DE Option User's Manual*, Document # 34-25-25-47.

16. Troubleshooting_ST 700 Basic Transmitter

16.1 Overview

Troubleshooting involves responding to error messages, primarily displayed by the MC Toolkit. Error messages that may occur on the Transmitter's local display are fairly self-explanatory and intuitive. However, this section covers the diagnostic messages that indicate critical conditions. Other than the critical conditions, additional detail is not provided. If you require assistance, contact your distributor or Honeywell Technical Support. All other messages are covered by the MC Toolkit Users' Manual.

16.2 Critical Diagnostics Screens

The Standard Display will display the fault message on the top line of the LCD .

16.2.1 Fault Conditions and Recommended Corrective Actions – Standard Display

The Standard Display will display the message FAULT on the top line of the LCD and the appropriate diagnostic text on the lower line.

Table 40 – ST 700 Basic Transmitter - Fault Conditions and Recommended Corrective Actions.

Condtion	Analysis	Recommended Corrective Action
Mbd Com (Meter body Comm fault)	Communications between the Meter body and the Electronics Module has failed.	Check the ribbon cable that connects the Meter body to the Electronics Module. Ensure that the cable is securely plugged into the Electronics Module. Ensure that all pins are plugged into the connector (e.g. ensure that the connector is not offset in a way that leaves some pins unconnected). Cycle power to the transmitter. If the problem continues to occur replace the Electronics Module. If this does not fix the problem, replace the Meter body.
Comm El (Communication Board fault)	A critical failure has been detected on the HART Electronics Module.	Cycle power to the transmitter. If the problem continues to occur replace the Electronics Module.
Mtrbody (Sensor Board Fault)	A critical failure has been detected in the Meter body	Cycle power to the transmitter. If the problem continues to occur replace the Electronics Module.

17. Parts List_ST 700 Basic Transmitter

17.1 Overview

Individually saleable parts for the various Transmitter models are listed in this section. Some parts are illustrated for identification. Parts are identified and listed in the corresponding tables as follows:

- Individually saleable parts are indicated in each figure by key number callout.
- Parts that are supplied in kits are indicated in each illustration by key number callout with the letter K prefix.

Table 41 is a list of recommended spare parts.

Table 41 – ST 700 Basic Transmitter - Summary List of Recommended Spare Parts

Part Number	Description	Figure No.	Key No.	1-10 Units	10-100 Units	100-1000 Units
Electronics Assembly						
50129828-501 50129828-502	HART Comm Assembly without external 2 button support HART Comm Assembly with external 2 button support	Figure 69	5	1	1-2	2-4
51452865-201 51452865-202 51452865-203 51462865-204	Meter Body Seal kit (includes O-rings) Glass Filled PTFE VITON 100% PTFE GRAPHITE	Figure 72	K1	1	1-2	2-4
50129832-501 50129832-502	HART Terminal Block Assy Without Lightning Protection HART Terminal Block Assy With Lightning Protection	Figure 69	3	1	1-2	2-4

Process head gasket kit		Figure No.	Key No.	1-10 Units	10-100 Units	100-1000 Units
51452868-501	Gasket only, Process Head (12 PTFE packs)	Figure 72	Ka	12	12-24	24-48
51452868-502	Gasket only, Process Head (6 Viton Head O'Rings)			6	6-12	12-24
51452868-507	Gasket only, Process Head Graphite Gasket (replacement only for existing graphite gasket)			6	6-12	12-24
Meter Body						
Specify complete model number from nameplate	DP Models GP/AP HEAD Models LGP/LAP Models Flush Mount Models Flange Mount Models	Figure 71		1	1-2	2-4

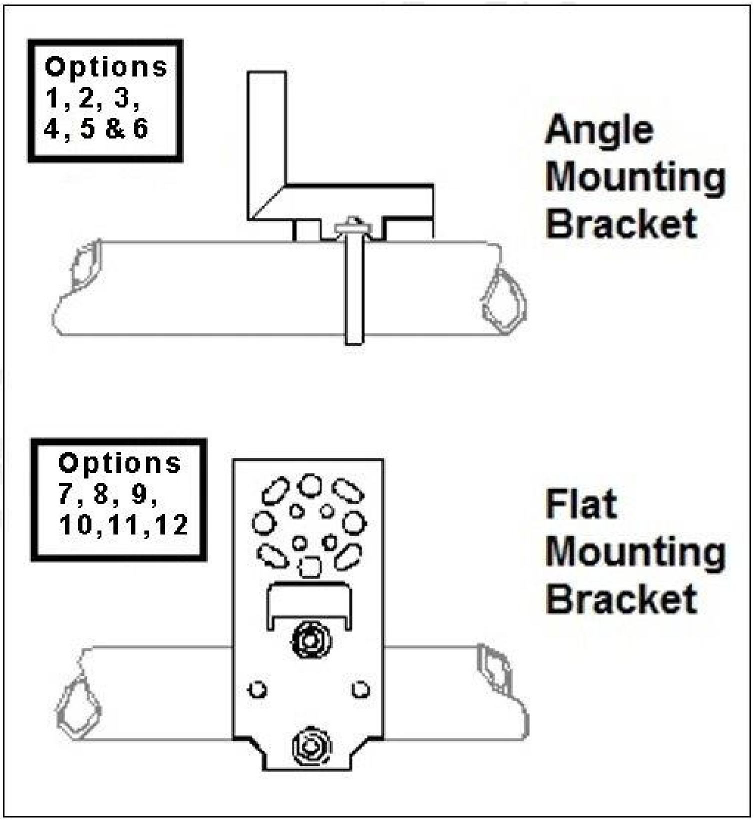


Figure 68 – ST 700 Basic Transmitter - Angle and Flat Bracket Parts (refer to Table 42)

Table 42 – ST 700 Basic Transmitter - Angle and Flat Bracket Parts

(Refer to Figure 68)

Key No.	Part Number	Description	Quantity Per Unit
1	50132311-511	Carbon Steel Angle Bracket for all models **except** In-line and Flush mount transmitters (CHINA MARKET ONLY)	1
2	50132311-521	Carbon Steel Angle Bracket for all In-line and Flush mount transmitters (CHINA MARKET ONLY)	1
3	51196557-001	Carbon Steel Flat Bracket Mounting kit for all models **except** In-line and Flush mount transmitters	1
4	51196557-002	Carbon Steel Flat Bracket Mounting kit for all In-line transmitters and Flush mount transmitters	1
5	30752770-103	SS 304 Angle Bracket Mounting kit for all models **except** In-line and Flush mount transmitters	1
6	30752770-104	SS 304 Angle Bracket Mounting kit for all In-Line and Flush mount transmitters	1
7	51196557-005	SS 304 Flat Bracket Mounting kit for all models **except** In-line and Flush mount transmitters	1
8	51196557-006	SS 304 Flat Bracket Mounting kit for all In-line transmitters and Flush mount transmitters	1
9	50132311-513	SS 316 Angle Bracket Mounting kit for all In-line transmitters and Flush mount transmitters (CHINA MARKET ONLY)	1
10	50132311-523	SS 316 Angle Bracket Mounting kit for all models **except** In-line and Flush mount transmitters (CHINA MARKET ONLY)	1
11	51196557-008	SS 316 Flat Bracket Mounting kit for all In-line transmitters **except** In-Line and Flush mount transmitters	1
12	51196557-009	SS 316 Flat Bracket Mounting kit for all In-Line and Flush mount transmitters	1
1	50132311-511	Carbon Steel Angle Bracket for all models **except** In-line and Flush mount transmitters (CHINA MARKET ONLY)	1
2	50132311-521	Carbon Steel Angle Bracket for all In-line and Flush mount transmitters (CHINA MARKET ONLY)	1

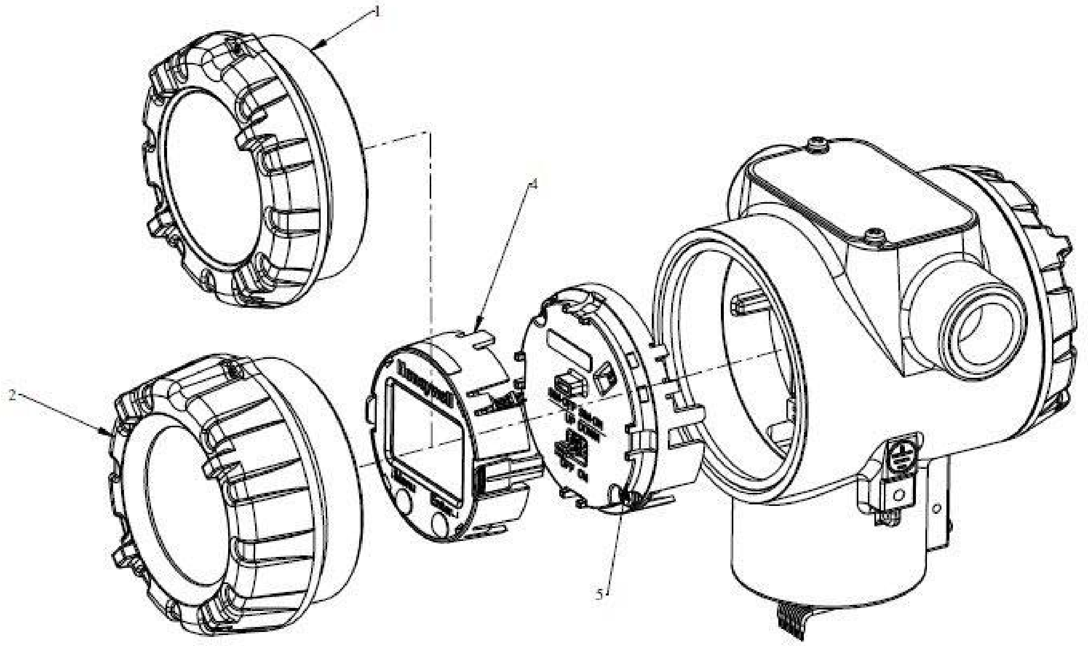


Figure 69 – ST 700 Basic Transmitter - Electronic Housing, Display End

Table 43 – ST 700 Basic Transmitter - Major Assemblies

(Refer to Figure 69, Figure 70 and Figure 72)

Key No.	Part Number	Description	Quantity Per Unit
1	50049858-501 50049858-521	End Cap (Aluminum) End Cap (Stainless Steel)	1
2	50049832-501 50049832-521	End Cap, Display (Aluminum) End Cap, Display (Stainless Steel)	1
3	50129832-501 50129832-502	Terminal Assy HART without Lightning protection Terminal Assy HART with Lightning protection	1
4	50049911-501 50126003-501	Basic Display Standard Display	1
5	50129828-501 50129828-502	HART Electronics Module Assembly (PWA) without MR sensor HART Electronics Module Assembly (PWA) with MR sensor	1
6	50131077-501	External Zero, Span & Config Buttons (2- button Assembly)	1
K1	30757503-005	Electronics housing seals kit (includes O-rings)	2

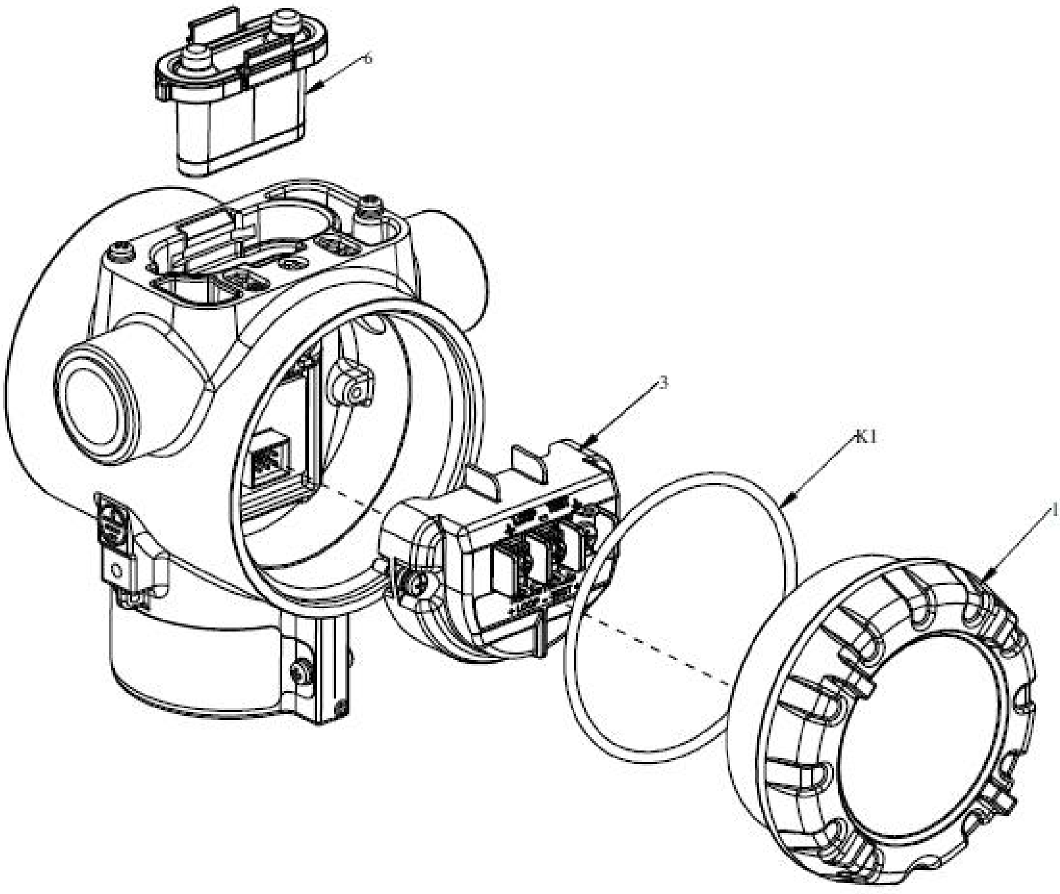


Figure 70 – ST 700 Basic Transmitter - Electronic Housing, Terminal Block End

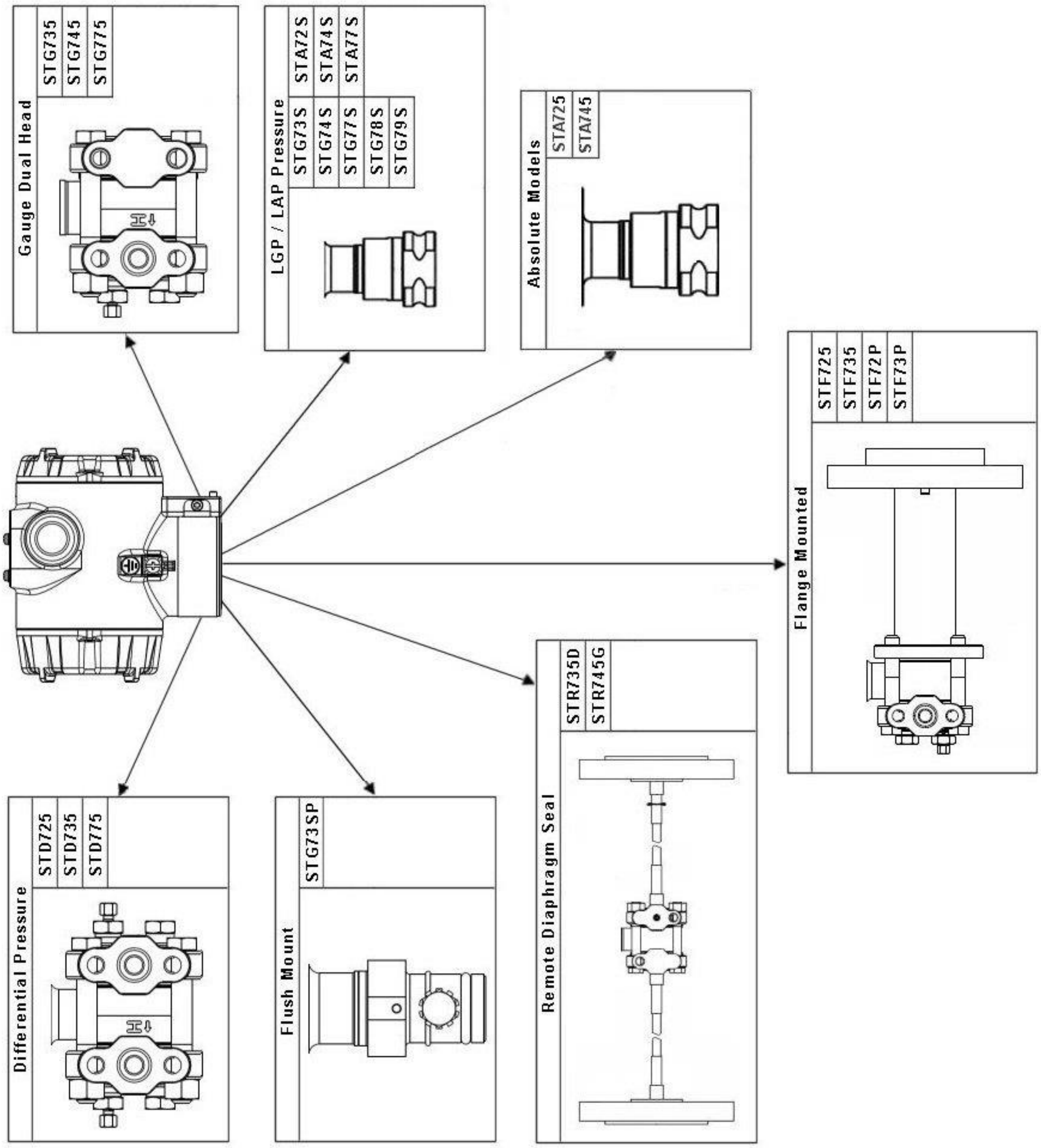


Figure 71 – ST 700 Basic Transmitter - Major Assemblies

Table 44 – ST 700 Basic Transmitter Models STD720, 725, 730, 735, 770, 775 & STG774

(Refer to Figure 72)

Key No.	Part Number	Description	Qty/ Unit
		Vent and Plug Kits	
	30753785-001 30753787-001 30753786-001	Drain and Plug Kit, stainless steel Drain and Plug Kit, Monel Drain and Plug Kit, Hastelloy C **Each Drain and Plug Kit includes:**	
K1		Pipe Plug	4
K2		Vent Plug	2
K3		Vent Bushing	2
		Meter Body Gasket Kits	
	 51452865-201 51452865-202 51452865-203 51452865-204	Each Meter Body Gasket Kit includes: Glass Filled PTFE VITON 100% PTFE GRAPHITE	
K6		Gasket, Process Head	6
Ka		Gasket, Flange Adapter	6
K7		O-Ring, Meter Body to Electronics Housing	3
		K7 Process Head Gasket Kits	
K6 K6 K6	51452868-501 51452868-502 51452868-507	Gasket only, Process Head (12 PTFE Gaskets/pack) Gasket only, Process Head (6 Viton Head O-Rings) Gasket only, Process Head Graphite Gasket (use only as replacement of existing graphite gasket)	12 6 6
		Flange Adapter Gasket Kits	
Ka Ka Ka	51452868-504 51452868-505 51452868-508	Gasket only, Flange Adapter, 6 PTFE Adapter Gaskets Gasket only, Flange Adapter, 6 VITON Adapter O-Rings Gasket only, Flange Adapter Graphite Gasket (use only as replacement of existing graphite gasket)	6 6 6
		½-inch NPT Flange Adapter Kits	
	 51452867-110 51452867-210 51452867-310 51452867-410 51452867-150 51452867-350 51452867-130 51452867-330	Flange Adapter Kit, with: SS Flange Adapters and with carbon steel bolts SS Flange Adapters and with A286 SS (NACE) bolts SS Flange Adapters and with 316 SS (non-NACE) bolts SS Flange Adapters and with B7M alloy steel bolts Monel Flange Adapters and with carbon steel bolts Monel Flange Adapters and with 316 SS (non-NACE) bolts Hastelloy C Flange Adapters and with carbon steel bolts Hastelloy C Flange Adapters and with 316 SS (non-NACE) bolts	
		Each ½-inch NPT Flange Adapter Kit includes:	
Ka		Gasket, Flange Adapter	2
Kb		½-inch NPT Flange Adapter	2
Kc		Bolt, hex head, 7/16-20 UNF, 1.50 inches long	4

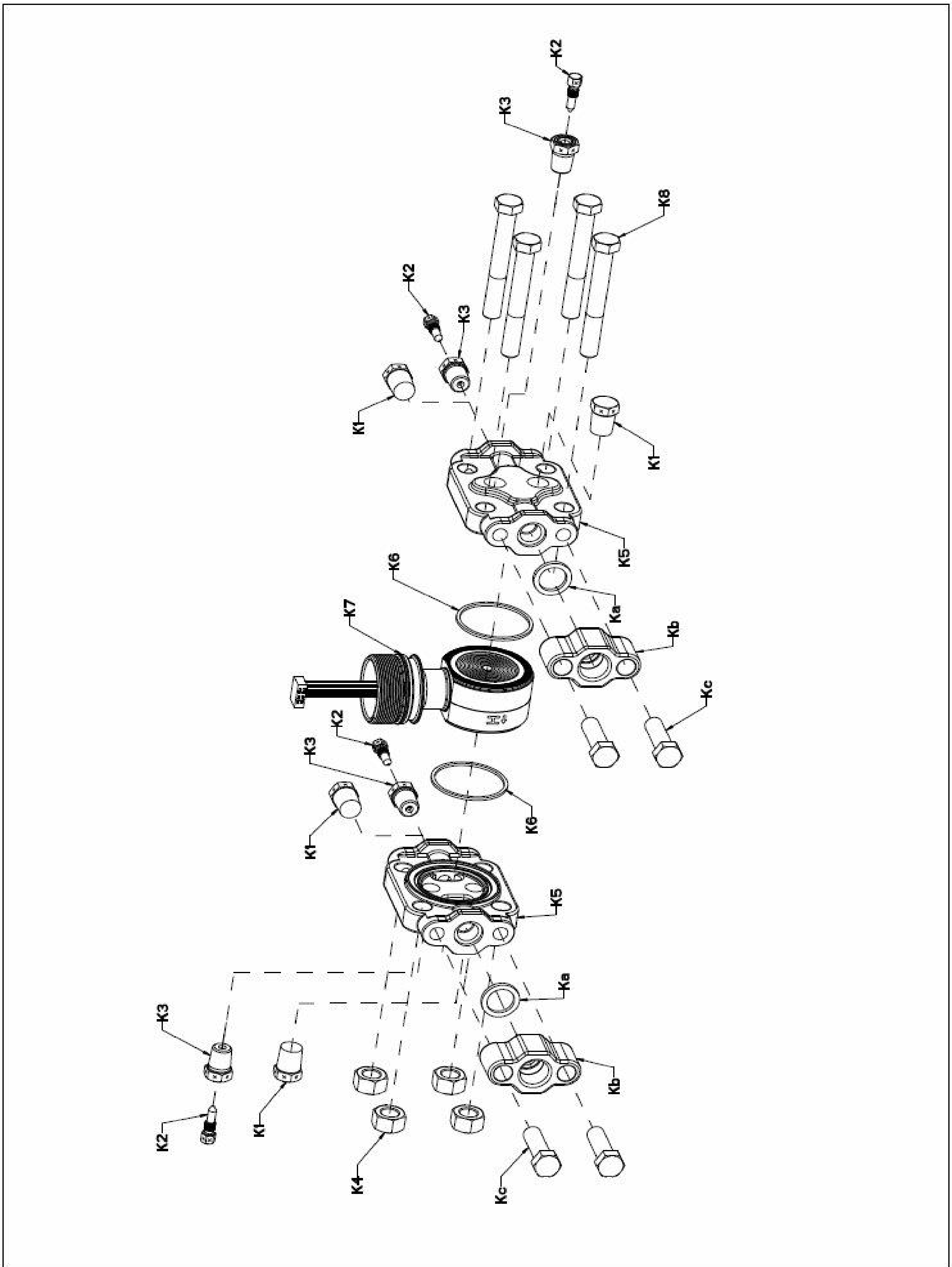


Figure 72 - ST 700 Basic Transmitter Models STD725, 735, 775

(Refer to

Table 44)

Table 45 – ST 700 Basic Transmitter - Parts for STG725, 735, 745, 775, 745 Transmitter Body

(Refer to Figure 73)

Key No.	Part Number	Description	Qty/Unit
Process Head Assembly Kits with PTFE Gaskets			
	51452864-010 51452864-012 51452864-020 51452864-022 51452864-030 51452864-032	Carbon steel head (zinc plated) without side vent/drain Carbon steel head (zinc plated) with side vent/drain Stainless steel head without side vent/drain Stainless steel head with side vent/drain Hastelloy C head without side vent/drain Hastelloy C head with side vent/drain	
Process Head Assembly Kits with Viton® or Fluorocarbon Elastomer Gaskets			
	51452864-110 51452864-112 51452864-120 51452864-122 51452864-130 51452864-132	Carbon steel head (zinc plated) without side vent/drain Carbon steel head (zinc plated) with side vent/drain Stainless steel head without side vent/drain Stainless steel head with side vent/drain Hastelloy C head without side vent/drain Hastelloy C head with side vent/drain	
Each process head assembly kit includes:			
K1		Pipe Plug (See notes 1 & 2)	1
K2		Vent Plug (See note 1)	1
K3		Vent Bushing (See note 1.)	1
K5		Process Head	1
K6		Gasket (PTFE), Process Head	1
Ka		Gasket (PTFE), Flange Adapter	1
	Notes		
	Note 1: This item is made of the same material as the Process Heads, except for Kits with carbon steel Process Heads, which include stainless steel Pipe Plug, Vent Plug, and Vent Bushing. Note 2: The Kit for Process Heads without side vent/drain does not include Pipe Plugs (K1).		
Reference Head			
K9 K9	51452951-201 51452951-101	Carbon Steel Blind Reference Head 316 SS Blind Reference Head	1 1

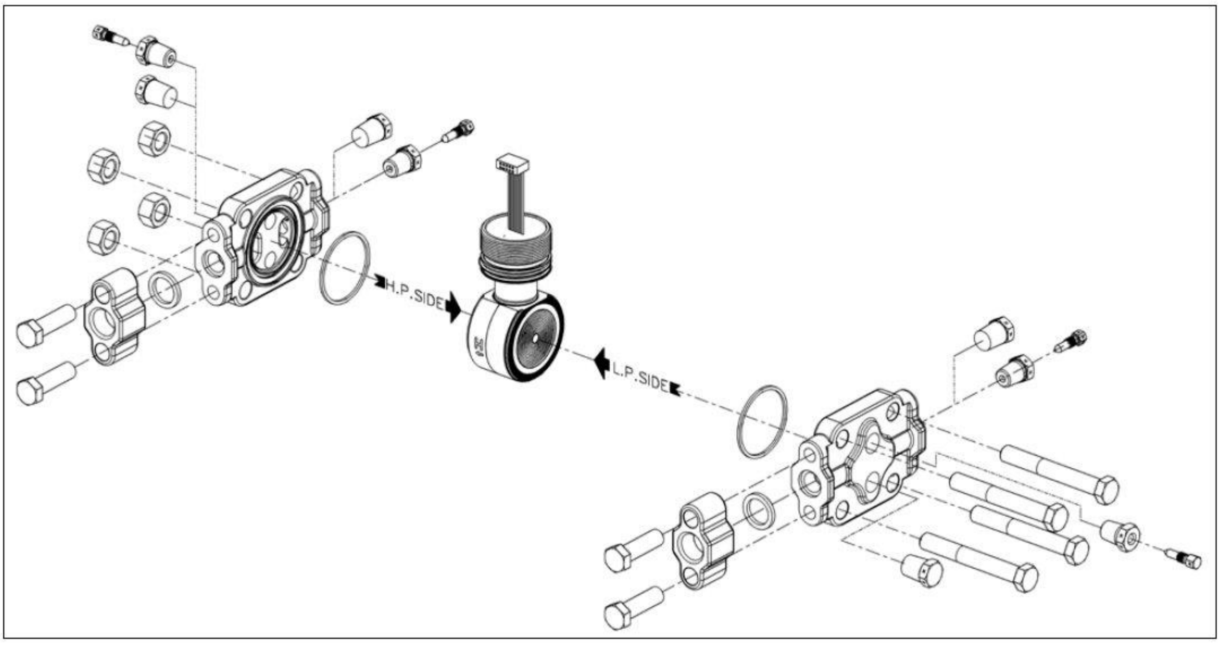


Figure 73 – ST 700 Basic Transmitter - STG730, 735, 740, 745, 770, 775 and STA722, 725, 745 Transmitter Body

Table 46 - ST 700 Basic Transmitter - Inline Gauge and Inline Atmospheric Meter Body Parts

(Figure 74)

Key No.	Part Number	Description	Qty/Unit
	Specify complete model number from nameplate	ST Series replacement meter body (LAP/LGP model)	1

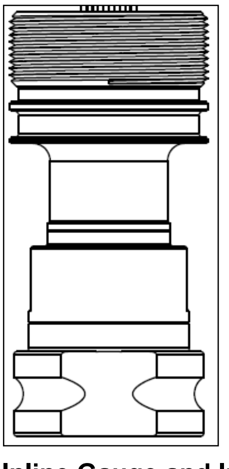


Figure 74 – ST 700 Basic Transmitter - Inline Gauge and Inline Atmospheric Meter Body Bodies

Table 47 – ST 700 Basic Transmitter - Flange-Mounted Meter Body Parts

(Refer to Figure 75 and Figure 76)

Key No.	Part Number	Description	Qty/Unit
1	Specify complete model number from nameplate	ST Series 700 replacement meter body	1
	30749372-005	O-ring seal	1
	30749372-001	O-ring seal	1
Optional Flange Adapter - Not Shown			
	30754419-006	Flange adapter kit (st. steel flange adapter with carbon steel bolts)	
	30754419-022	Flange adapter kit (st. steel flange adapter with 316 st. steel bolts)	
		Bolt, hex head, 7/16-20 UNF, 1.375 inches lg.	2
		Flange adapter	1
		Gasket	1
		Filter screen	1
	30754419-007	Flange adapter kit (Hastelloy C flange adapter with carbon steel bolts)	
	30754419-023	Flange adapter kit (Hastelloy C flange adapter with 316 st. steel bolts)	
		Bolt, hex head, 7/16-20 UNF, 1.375 inches lg.	2
		Flange adapter	1
		Gasket	1
	30757503-005	Housing seal kit	1

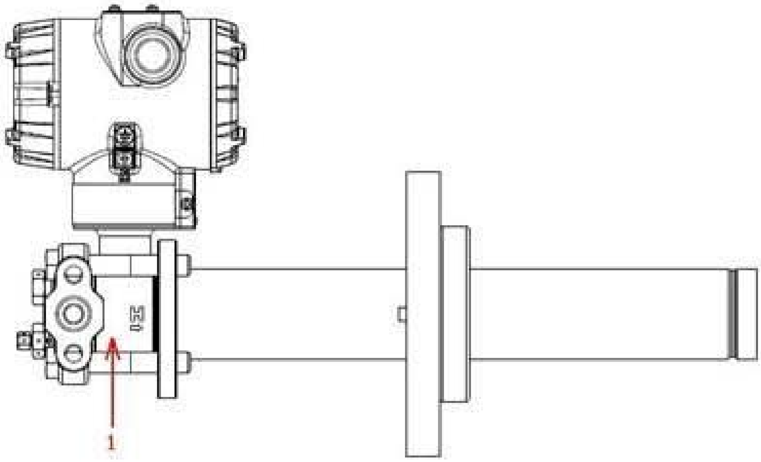


Figure 75 – ST 700 Basic Transmitter - Extended Flange Design

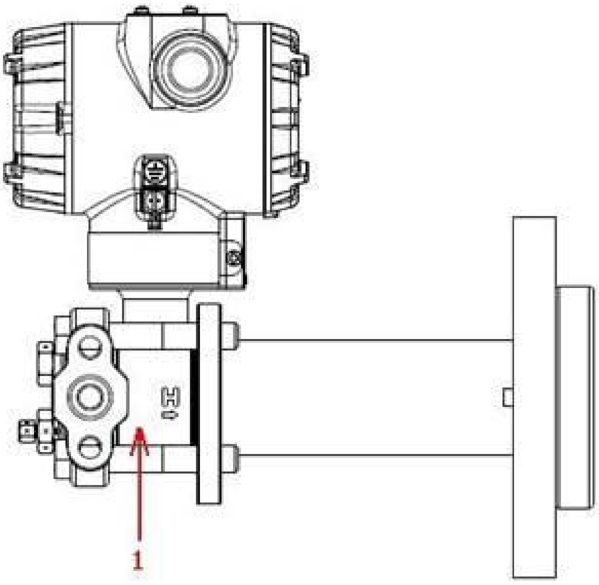


Figure 76 - ST 700 Basic Transmitter - Flush Flange Design

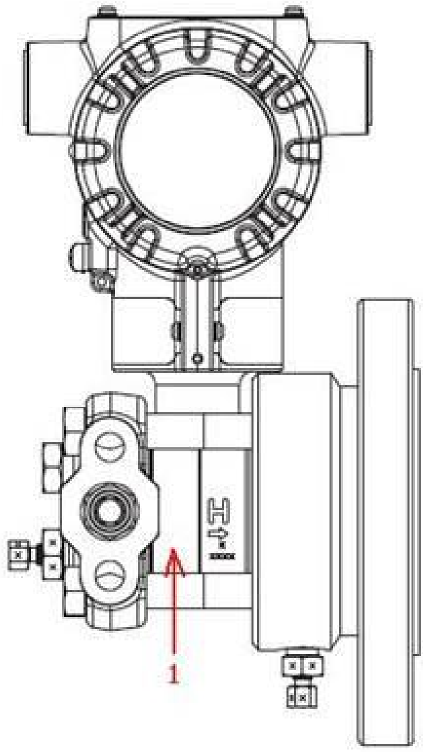


Figure 77 - ST 700 Basic Transmitter - Pseudo Flange Design

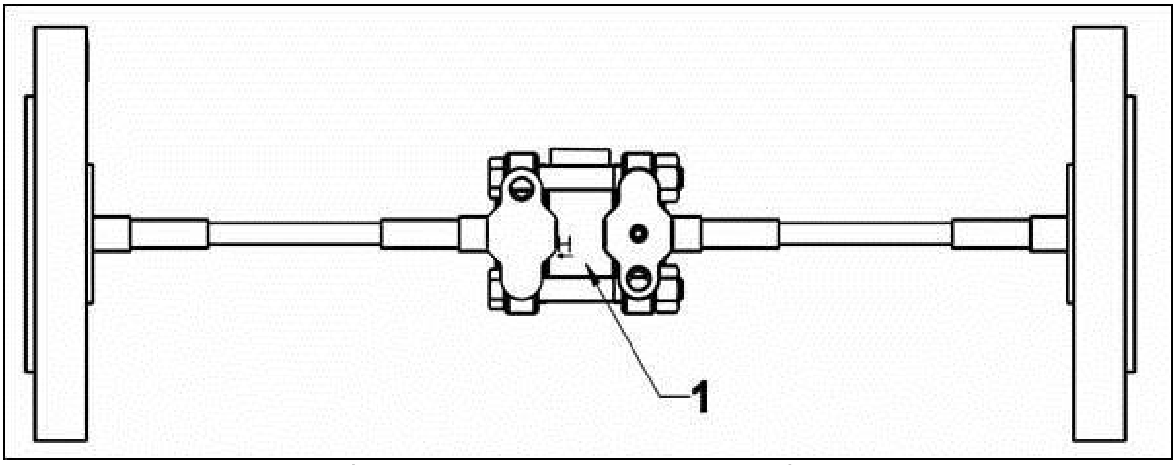


Figure 78 – ST 700 Basic Transmitter - Remote Seal Diaphragm

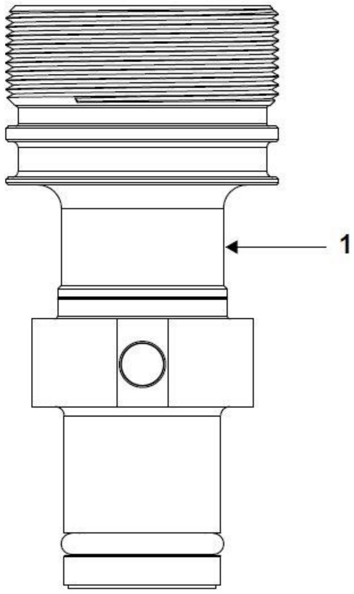


Figure 79 - ST 700 Basic Transmitter - Series 700 Flush Mount Meter Body.

Table 48 – ST 700 Basic Transmitter - Flush Mount Meter Body Parts

(Refer to Figure 79**)**

Key No.	Part Number	Description	Qty/Unit
1	Specify complete model number from nameplate	Replacement meter body (Flush Mount model)	1
	30756445-508	Gasket Kit (0-rings)	
	51204496-001	316L SS Mounting Sleeve Kit	
	51204497-001	Calibration Sleeve Kit	

Appendix A - PRODUCT CERTIFICATIONS for the ST 700 Standard and Basic Transmitter

A.1 Safety Instrumented Systems (SIS) Installations

For Safety Certified Installations, please refer to the ST 800 and ST 700 Safety Manual 34-ST-25-37 for installation procedure and system requirements.

SIL 2/3 Certification	IEC 61508 SIL 2 for non-redundant use and SIL 3 for redundant use under the following standards: IEC61508-1: 2010; IEC 61508-2: 2010; IEC61508-3: 2010.

A.2 European Directive Information (CE Mark)

CE Honeywell

50080030
Revision: Q

EU DECLARATION OF CONFORMITY

We,
Honeywell International Inc.
Honeywell Field Solutions
512 Virginia Drive
Fort Washington, PA 19034 USA

declare under our sole responsibility that the following products,

ST 800 – Smart Series Pressure Transmitter
And
ST 700- Smart Series Pressure Transmitter

to which this declaration relates, is in conformity with the provisions of the European Community Directives, including the latest amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of the harmonized standards and when applicable or required, a European Community notified body certification, as shown in the attached schedule.

The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person is identified below.

Owen J. Murphy
Product Safety & Approvals Engineering
Issue Date: 2 December 2016
Fort Washington, PA 19034, USA

Honeywell

SCHEDULE
50080030
Revision: Q

EMC Directive (2014/30/EU)

EN 61326-1:2013 Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements.

IEC 61326-3-1:2008 Electrical Equipment for Measurement, Control and Laboratory Use- Part 3-1: Immunity Requirements for safety related systems and equipment intended to perform safety-related functions.

Summary of Tests Performed:

PORT	TEST	STANDARD	CRITERIA (IEC 61326-1)	CRITERIA (IEC 61326-3-1)	RESULTS
Enclosure	Radiated Emission	CISPR 11	Group1, Class A 30 – 230 MHz: 40 dB 230 – 1000 MHz: 47 dB	Group1, Class A 30 – 230 MHz: 40 dB 230 – 1000 MHz: 47 dB	PASS
	ESD Immunity	IEC61000-4-2	+/- 4KV Contact +/- 8KV Air	+/- 6KV Contact +/- 8KV Air	PASS
	EM Field- RF Radiated Susceptibility	IEC61000-4-3	10 V/m- 80 MHz to 1GHz 3 V/m - 1.4 GHz to 2.0 GHz 1 V/m- 2.0 GHz to 2.7 GHz	20 V/m- 80MHz to 1GHz 10 V/m - 1.4GHz to 2.0 GHz 3 V/m- 2.0GHz to 2.7GHz	PASS PASS PASS
	50Hz/60Hz Magnetic Field Immunity	IEC 6100-4-8	30 A/m	30 A/m	N/A 1
DC Power	EFT(B) Immunity	IEC61000-4-4	+/- 1KV	+/- 2KV	PASS
	Surge Immunity	IEC61000-4-5	+/- 1KV	+/- 2KV	PASS
	RF Conducted Susceptibility	IEC61000-4-6	3V	3 V Except the following: 10 V 3.39 to 3.410MHz 10 V 6.765 to 6.795MHz 10 V 13.553 to 13.567MHz 10 V 26.957 to 27.283MHz 10 V 40.66 to 40.70MHz	PASS
I/O Signal/ Control (Including Earth Lines)	EFT(Burst) Immunity	IEC61000-4-4	+/- 1KV	+/- 2KV	2
	Surge Immunity	IEC61000-4-5	+/- 1KV	+/- 2KV	2
	RF Conducted Susceptibility	IEC61000-4-6	3V	3 V Except the following: 10 V 3.39 to 3.410MHz	2

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Revision: Q

PORT	TEST	STANDARD	CRITERIA (IEC 61326-1)	CRITERIA (IEC 61326-3-1)	RESULTS
				10 V 6.765 to 6.795MHz 10 V 13.553 to 13.567MHz 10 V 26.957 to 27.283MHz 10 V 40.66 to 40.70MHz	
AC Power	Voltage Dip	IEC61000-4-11	0% during 1 Cycle 40% during 10-12 Cycles 70% during 25-30 Cycles		N/A[3]
	Short Interruptions	IEC61000-4-11	0% during 250-300 Cycles		N/A[3]
	EFT(Burst) Immunity	IEC61000-4-4	2KV		N/A[3]
	Surge Immunity	IEC61000-4-5	1KV/ 2KV		N/A[3]
	RF Conducted Susceptibility	IEC61000-4-6	3V		N/A[3]

1. There is no magnetic sensitive circuitry.
2. Done as part of the DC Power Testing.
3. Product is DC Powered.

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50080030
Revision: Q

ATEX Directive (2014/34/EU)

EC-Type Examination Certificate No: FM12ATEX0029X Protection : Flameproof and Dust
Equipment Group II Category 1/ 2 G and Group II Caegrory 2 D
Ex db IIC T5 Ga/Gb (Ta= -50°C TO 85°C)
Ex db IIC T6 Ga/Gb (Ta= -50°C TO 65°C)
Ex tb IIIC T95°C Db (Ta= -50°C TO 85°C)

Standards:
EN 60079-0: 2012+A11 : 2013 EN 60079-1: 2014
EN 60079-26: 2015 EN 60079-31: 2014 EN 60529: 1991 + A1:2000

EC-Type Examination Certificate No: Sira12ATEX2233X Protection: Intrinsically Safe
Equipment Group II Category 1 G
Ex ia IIC T4 Ga (Ta= -50°C TO 70°C)
Ex ia IIC T4 Ga (Ta= -50°C TO 70°C)
FISCO Field Device

Standards:
EN 60079-0: 2012+A11 : 2013 EN 60079-11: 2012

Type Examination Certificate No: Sira12ATEX4234X Protection : Non Sparking
Equipment Group II Category 3 G
Ex nA IIC T4 Gc (Ta= -50°C TO 70°C)
Ex ic IIC T4 Ga (Ta= -50°C TO 70°C)
FISCO Field Device

Standards:
EN 60079-0: 2012+A11 : 2013 EN 60079-11: 2012
EN 60079-15: 2010

ATEX Notified Body for EC Type Certificates
FM Approvals Ltd. [Notified Body Number: 1725]
1 Windsor Dials,
Windsor, Berkshire, SL4 1RS
England

Sira Certifcation Service [Notified Body Number: 0518]
Unit 6, Hawarden Industrial Park,
Hawarden, CH5 3US
United Kingdom

ATEX Notified Body for Quality Assurance
DEKRA Certification B.V. [Notified Body Number: 0344]
Meander 1051
6825 MJ Arnhem
The Netherlands

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SCHEDULE
50080030
Revision: Q

Pressure Equipment Directive (PED) (2014/68/EU)

ASME Boiler and Pressure Vessel Code Section VIII 'Rules for Construction of Pressure Vessels: 2000

Pressure Transmitter	**PED Module**
Absolute Pressure	
STA822/ STA722/ STA725	Sound Engineering Practice (SEP)
STA 82L/ STA72L/ STA72S	
STA 840/ STA740/ STA745	
STA 84L/ STA74L/ STA74S	
STA87L/ STA77L/ STA77S	Module A
Differential Pressure	
STD 810	Module A
STD820/ STD720/ STD725	
STD825	
STD830/ STD730/ STD735	
STD870/ STD770/ STD775	
Gauge Pressure	
STG830/ STG730/ STG735	Sound Engineering Practice (SEP)
STG840/ STG740/ STG745	
STG83L/ STG73L/ STG73S	
STG84L/ STG74L/ STG74S	
STG870/ STG770/ STG77S	Module A
STG87L/ STG77L/ STG78S	
STG88L/ STG78L/ STG78S	
STG89L/ STG79L/ STG79S	
Flange Mounted	
STF828/ STF728/ STF725	Sound Engineering Practice (SEP)
STF832/ STF732/ STF735	
STF82F/ STF72F/ STF72P	
STF83F/ STF73F/ STF72P	
Remote Diaphragm	
STR82D/ STR73D/ STR735D	Sound Engineering Practice (SEP)
STR83D	
STR84G/ STR74G/ STR745G	
STR87G	
STR84A	

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SCHEDULE
50080030
Revision: Q

Measuring Instruments Directive (MID) (2014/32/EU)

NMI Evaluation Certificate: TC7948

Model	Range
STA 84L	1 to 35 Bara
STA87L	1 to 100 Bara
STG 84L	1 to 35 Barg
STG87L	1 to 100 Barg
STD 820	0 to 1Barg
STD830	0 to 7 Barg
STD870	0 to 100 Barg

WELMEC Guide 8.8 OIML R117-1: 2007(E) EN 12405-1/A1: 2006

MID Notified Body for Parts Certificates

NMi Certin B.V.
Hugo de Grootplein 1
3300 AJ Dordrecht
The Netherlands

A3. Hazardous Locations Certifications

<table>
<tr><th>MSG CODE</th><th>AGENCY</th><th>TYPE OF PROTECTION</th><th>COMM OPTION</th><th>Electrical Parameters</th><th>Ambient Temperature</th></tr>
<tr><td rowspan="5">A</td><td rowspan="5">FM-USA</td><td>Explosion proof:
Class I, Division 1, Groups A, B, C, D
Dust Ignition Proof:
Class II, III, Division 1, Groups E, F, G
Class I, Zone 0/1, AEx db IIC Ga/Gb
Class II, Zone 21, AEx tb IIIC T 95ºC Db</td><td>DE/HART /FF</td><td>Note 1</td><td>T5: -50 ºC to 85ºC
T6: -50 ºC to 65ºC</td></tr>
<tr><td>Intrinsically Safe:
Class I, II, III, Division 1, Groups A, B, C, D, E, F, G
Class I Zone 0 AEx ia IIC Ga
FISCO Field Device (Only for FF Option)
Ex ia IIC Ga</td><td>DE/HART /FF</td><td>Note 2</td><td>T4: -50ºC to 70ºC</td></tr>
<tr><td>Non-Incendive
Class I, Division 2, Groups A, B, C, D
Class I Zone 2 AEx nA IIC Gc
Class I Zone 2 AEx ic IIC Gc</td><td>DE/HART /FF</td><td>Note 1</td><td>T4: -50ºC to 85ºC</td></tr>
<tr><td>Enclosure: Type 4X/ IP66/ IP67</td><td>ALL</td><td>ALL</td><td>ALL</td></tr>
<tr><td colspan="4">Standards: FM 3600:2011; ANSI/ ISA 60079-0: 2009
FM 3615:2006; ANSI/ ISA 60079-1 : 2009
FM 3616 : 2011 ; ANSI/ ISA 60079-31 : 2009
FM 3610:2010; ANSI/ ISA 60079-11 : 2011
FM 3810 : 2005 ; ANSI/ ISA 60079-26 : 2008
FM 3611:2004; ANSI/ ISA 60079-15 : 2009 ; FM 3810 : 2005 ;
NEMA 250 : 2003 ; ANSI/ IEC 60529 : 2004</td></tr>
<tr><td rowspan="4">B</td><td rowspan="4">CSA-Canada</td><td>Explosion proof:
Class I, Division 1, Groups A, B, C, D
Dust Ignition Proof:
Class II, III, Division 1, Groups E, F, G
Zone 0/1, Ex db IIC Ga/Gb
Ex tb IIIC T 95ºC Db</td><td>DE/HART /FF</td><td>Note 1</td><td>T5: -50 ºC to 85ºC
T6: -50 ºC to 65ºC</td></tr>
<tr><td>Intrinsically Safe:
Class I, II, III, Division 1, Groups A, B, C, D, E, F, G;

Ex ia IIC Ga
FISCO Field Device (Only for FF Option)
Ex ia IIC Ga</td><td>DE/HART /FF</td><td>Note 2</td><td>T4: -50ºC to 70ºC</td></tr>
<tr><td>Non-Incendive
Class I, Division 2, Groups A, B, C, D

Ex nA IIC Gc
Ex ic IIC Gc</td><td>DE/HART /FF</td><td>Note 1</td><td>T4: -50ºC to 85ºC</td></tr>
<tr><td>Enclosure: Type 4X/ IP66/ IP67</td><td>ALL</td><td>ALL</td><td>ALL</td></tr>
</table>

MSG CODE	AGENCY	TYPE OF PROTECTION	COMM OPTION	Electrical Parameters	Ambient Temperature
		Standards: ANSI/ ISA 60079-0: 2009 ; CAN/ CSA-C22.2 No. 0-M91:2006; CAN/ CSAE60079-0:2002; ANSI/ UL 913 : 2010 ; ANSI/ ISA 60079-11 : 2009; CAN/ CSA-C22.2 No.157-92: 1992; CAN/CSA-E 60079-11: 2002; ANSI/ ISA 60079-26 : 2008; ANSI/ ISA 12.12.01 : 2007 ; ANSI/ ISA 60079-15 : 2009 ; C22.2 No. 213-M1987; CAN/CSA-E60079-15: 2002; ANSI/ UL 50 : 2007 ; ANSI/ IEC 60529 : 2004			
C	ATEX	**Flameproof:** FM12ATEX0029X II 1/2 G Ex d IIC Ga/Gb II 2 D Ex tb IIIC T 95°C Db	DE/HART /FF	Note 1	T5: -50 °C to 85°C T6: -50 °C to 65°C
		Standards: EN 60079-0: 2012+A11: 2013 EN 60079-1 : 2014 EN 60079-31 : 2014 EN 60079-26 : 2015 EN 60529 : 2000 + A1			
		Intrinsically Safe: **Sira12ATEX2233X** II 1 G Ex ia IIC Ga FISCO Field Device (Only for FF Option) Ex ia IIC	DE/HART /FF	Note 2	T4: -50°C to 70°C
		Non Sparking: Sira12ATEX4234X II 3 G Ex nA IIC Gc II 3 G Ex ic IIC Gc	DE/HART /FF	Note 1	T4: -50°C to 85°C
		Standards: EN 60079-0: 2012+A11: 2013 EN 60079-11 : 2012 EN 60079-15 : 2010 IEC 60529 : 2009 with Corr 3			
		Enclosure: IP66/ IP67	ALL	ALL	ALL
D	IECEx	**Intrinsically Safe:** SIRA 12.0100 Ex ia IIC Ga FISCO Field Device (Only for FF Option) Ex ia IIC Ga	DE/HART /FF	Note 2	T4: -50°C to 70°C
		Non Sparking: SIRA 12.0100 Ex nA IIC Gc Ex ic IIC Gc	DE/HART /FF	Note 1	T4: -50°C to 85°C
		Standards: IEC 60079-0: 2011 IEC 60079-11 : 2011 IEC 60079-15 : 2011 IEC 60529 : 2009 with Corr 3			
		Flameproof: Ex d IIC Ga/Gb Ex tb IIIC Db T 95°C	DE/HART /FF	Note 1	T5: -50 °C to 85°C T6: -50 °C to 65°C
		Standards: IEC 60079-0: 2011 IEC 60079-1 : 2007 IEC 60079-31 : 2008 IEC 60079-26 : 2006 IEC 60529 : 2009 with Corr 3			
		Enclosure: IP66/ IP67	ALL	ALL	ALL
E	SAEx (South Africa)	**Intrinsically Safe:** Ex ia IIC Ga FISCO Field Device (Only for FF Option) Ex ia IIC Ga	DE/HART /FF	Note 2	T4: -50°C to 70°C
		Non Sparking: Ex nA IIC Gc	DE/HART /FF	Note 1	T4: -50°C to 85°C
		Flameproof: Ex d IIC Ga/Gb Ex tb IIIC T 95°C Db	DE/HART /FF	Note 1	T4: -50°C to 85°C
		Enclosure: IP66/ IP67	ALL	ALL	ALL

MSG CODE	AGENCY	TYPE OF PROTECTION	COMM OPTION	Electrical Parameters	Ambient Temperature
F	INMETRO	**Intrinsically Safe:** Ex ia IIC Ga FISCO Field Device (Only for FF Option) Ex ia IIC Ga	DE/HART /FF	Note 2	T4: -50ºC to 70ºC
		Non Sparking: Ex nA IIC Gc	DE/HART /FF	Note 1	T4: -50ºC to 85ºC
		Flameproof: Ex d IIC Ga/Gb Ex tb IIIC T 95ºC Db	DE/HART /FF	Note 1	T4: -50ºC to 85ºC
		Enclosure: IP66/ IP67	ALL	ALL	ALL
G	NEPSI (CHINA)	**Intrinsically Safe:** Ex ia IIC Ga FISCO Field Device (Only for FF Option) Ex ia IIC Gc	DE/HART /FF	Note 2	T4: -50ºC to 70ºC
		Non Sparking: Ex nA IIC Ga	DE/HART /FF	Note 1	T4: -50ºC to 85ºC
		Flameproof: 1 Ex d IIC Ga/Gb Ex tb IIIC Db T 95ºC Db	All	Note 1	T4: -50 ºC to 85ºC
		Enclosure: IP66/ IP67	ALL	ALL	ALL
-------	GOST	**Intrinsically Safe:** 0 Ex ia IIC Ga FISCO Field Device (Only for FF Option) Ex ia IIC	DE/ HART/ FF	Note 2	T4: -50 ºC to 70ºC
		Enclosure : IP 66/67	All	All	

Notes

1. Operating Parameters:

DE/HART	Voltage= 11 to 42 V	Current= 4-20 mA Normal (3.8 – 23 mA Faults)
Foundation Fieldbus	Voltages = 9 to 23 V	Current = 25 mA

2. Intrinsically Safe Entity Parameters

For details see Control Drawing on page 140.

3. Marking ATEX Directive

General:

The following information is provided as part of the labeling of the transmitter:

- Name and Address of the manufacturer
- Notified Body identification: DEKRA Quality B.V., Arnhem, the Netherlands
- For complete model number, see the Model Selection Guide for the particular model of pressure transmitter.
- The serial number of the transmitter is located on the Meter Body data-plate. The first two digits of the serial number identify the year (02) and the second two digits identify the week of the year (23); for example, 0223xxxxxxxx indicates that the product was manufactured in 2002, in the 23 rd week.

Apparatus Marked with Multiple Types of Protection
The user must determine the type of protection required for installation the equipment. The user shall then check the box [ ] adjacent to the type of protection used on the equipment certification nameplate. Once a type of protection has been checked on the nameplate, the equipment shall not then be reinstalled using any of the other certification types.

4. WARNINGS and Cautions:

Intrinsically Safe and Non-Incendive Equipment:
WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN HAZARDOUS LOCATIONS.
Explosion-Proof/ Flameproof:
WARNING: DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT
Non-Incendive Equipment:
WARNING: DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAYBE PRESENT
WARNING: FOR CONNECTION IN AMBIENTS ABOVE 60°C USE WIRE RATED 105oC

5. Conditions of Use for Ex Equipment, “Hazardous Location Equipment” or “Schedule of Limitations”:

Painted surface of the ST800 may store electrostatic charge and become a source of ignition in applications with a low relative humidity less than approximately30% relative humidity where the painted surface is relatively free of surface contamination such as dirt, dust or oil. Cleaning of the painted surface should only be done with a damp cloth.

Flame-proof Installations: The Transmitter can installed in the boundary wall between an area of EPL Ga/ Class I Zone 0/ Category 1 and the less hazardous area, EPL Gb/ Class I Zone 1/ Category 2. In this configuration, the process connection is installed in EPL Ga/ Class I Zone 0/ Category 1, while the transmitter housing is located in EPL Gb/ Class I Zone 1/ Category 2.

The applicable temperature class, ambient temperature range and maximum process temperature of the equipment is as follows;
T5 for -50°C < Ta < 85°C
T6 for -50°C < Ta < 65°C
Maximum process temperature = 125°C

Consult the manufacturer for dimensional information on the flameproof joints for repair.

The Transmitter can be installed in the boundary wall between an area of Category 1 and the less hazardous area, Category 2. In this configuration, the process connection is installed in Category 1 while the transmitter housing is installed in Category 2.

Intrinsically Safe: Must be installed per drawing 50049892

Division 2: This equipment is suitable for use in a Class I, Division 2, Groups A, B, C, D; T4 or Non-Hazardous Locations Only.

The enclosure is manufactured from low copper aluminum alloy. In rare cases, ignition sources due to impact and friction sparks could occur. This shall be considered during Installation, particularly if equipment is installed a Zone 0 location.
If a charge-generating mechanism is present, the exposed metallic part on the enclosure is capable of storing a level of electrostatic that could become incendive for IIC gases. Therefore, the user/ installer shall implement precautions to prevent the buildup of electrostatic charge, e.g. earthing the metallic part. This is particularly important if equipment is installed a Zone 0 location.

A4. Control Drawing

PRE REL							
ISS	REVISION & DATE					APPD	
G	06/20/2016 ECN 2016-3397					DGG	

ST 800/ ST 700 Series Pressure, ANALOG, HART/DE and FF/ PA Communications

1. Intrinsically safe installation shall be in accordance with
   a. FM (USA): ANSI/NFPA 70, NEC* Articles 504 and 505.
   b. CSA (Canada): Canadian Electrical Code (CEC), part I, section 18.
   c. ATEX: Requirements of EN 60079-14, 12.3 (See also 5.2.4).
   d. IECEx: Requirements of IEC 60079-14, 12.3 (See also 5.2.4).
2. ENTITY approved equipment shall be installed in accordance with the manufacturer's Intrinsic Safety Control Drawing.
3. The Intrinsic Safety ENTITY concept allows the interconnection of two ENTITY Approved Intrinsically safe devices with ENTITY parameters not specifically examined in combination as a system when:

   Uo, Voc, or Vt ≤ Ui or Vmax; Io, Isc, or It ≤ Ii or Imax; Ca or Co ≥ Ci + Ccable, La or Lo ≥ Li + Lcable, Po ≤ Pi.
   Where two separate barrier channels are required, one dual-channel or two single-channel barriers may be used, where in either case, both channels have been Certified for use together with combined entity parameters that meet the above equations.
4. System Entity Parameters:
   ST 800/ ST 700 Transmitter: Vmax Voc or Uo, Imax Isc or Io;
   ST 800/ ST 700 Transmitter: Ci + Ccable ≤ Control Apparatus Ca,
   ST 800/ ST 700 Transmitter: Li + Lcable ≤ Control Apparatus La.
5. When the electrical parameters of the cable are unknown, the following values may be used:
   Capacitance: 197pF/m (60 pF/ft)
   Inductance: 0.66µH/m (0.020µH/ft).
6. Control equipment that is connected to Associated Equipment must not use or generate more than 250 V.
7. Associated equipment must be FM, CSA ATEX or IECEx (depending on location) listed. Associated equipment may be installed in a Class I, Division 2 or Zone 2 Hazardous (Classified) location if so approved.
8. Non-Galvanically isolated equipment (grounded Zener Barriers) must be connected to a suitable ground electrode per:
   a. FM (USA): NFPA 70, Article 504 and 505. The resistance of the ground path must be less than 1.0 ohm.
   b. CSA (Canada): Canadian Electrical Code (CEC), part I, section 10.
   c. ATEX: Requirements of EN 60079-14, 12.2.4.
   d. IECEx: Requirements of IEC 60079-14, 12.2.4.
9. Intrinsically Safe DIVISION 1/ Zone 0 WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN HAZARDOUS LOCATIONS.
10. Division 2/ Zone 2: WARNING: DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT.
11. NO REVISION OF THIS CONTROL DRAWING IS PERMITTED WITHOUT AUTHORIZATION FROM THE AGENCIES listed.
12. For release approvals see ECO # 0094464.

DRAWN	KP	1/9/2015	Honeywell	
CHECKED			CONTROL DRAWING ST 800/ ST 700 SERIES PRESSURE TRANSMITTER DIVISIONS 1 & 2 / ZONE 0 & 2	
DEV ENG				
MFG ENG				
QA ENG				
TOLERANCE UNLESS NOTED			A ~~A4~~	50049892
ANGULAR DIMENSION			SCALE: None	USED ON / SH. 1 OF 5

MASTER FILE TYPE: MS WORD

Output Protocol: H=HART or D=DE

All Models of ST800 and the following Models of the ST700: STA722, STA740, STA72L, STA74L, STA77L, STD720, STD730, STD770, STG730, STG740, STG770, STG73L, STG74L, STG77L, STG78L, STG79L, STF724, STF732, STF72F, STF73F, STR73D, STR74G, STR73D, and STR74G

ENTITY PARAMETERS	Associated Apparatus
Ui or Vmax ≤ 30V	Uo, Voc or Vt ≤ 30V
Ii or Imax ≤ 105 mA	Io (Isc or It) ≤ 105 mA
Pi or Pmax = 0.9W	Po ≤ 0.9 W
Ci= 3.9 nF	Ca or Co ≥ C_{cable} + $C_{ST\ 800/\ ST\ 700}$
Li= 984 µH	La or Lo ≥ L_{cable} + $L_{ST\ 800/\ ST\ 700}$

After 9/27/2013 (TERMINAL MODULE REVISION E OR LATER)

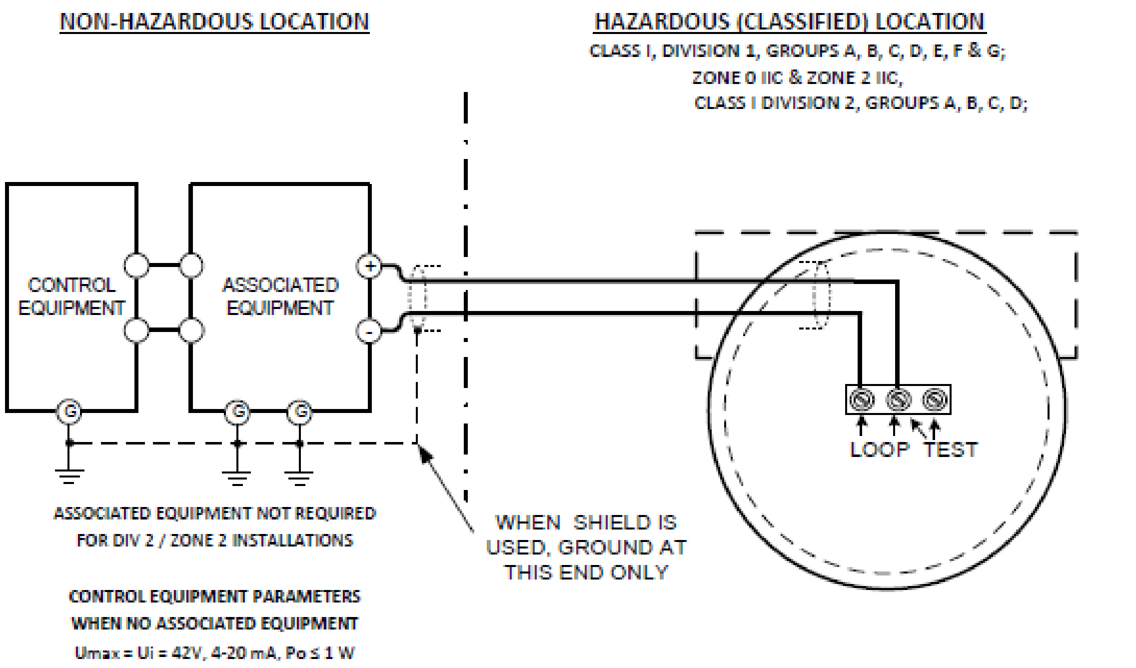
NOTE: THE REVISION IS ON THE LABEL THAT IS ON THE MODULE. THERE WILL BE TWO LINES OF TEXT ON THE LABEL:

- FIRST IS THE MODULE PART #: 50049839-001 OR 50049839-002
- SECOND LINE HAS THE SUPPLIER INFORMATION, ALONG WITH THE REVISION: XXXXXXX-EXXXX, THE "X" IS PRODUCTION RELATED, THE POSITION OF THE "E" IS THE REVISION.

Additionally for the ST700 Models: STA725, STA745, STA72S, STA74S, STA77S, STD725, STD735, STD775, STG735, STG745, STG775, STG73S, STG74S, STG77S, STG78S, STG79S, STF725, STF735, STF72P, STF73P, STR735D, and STR745G

ENTITY PARAMETERS (Divisions and Zones Ex ia and Ex ic)	Associated Apparatus
Ui or Vmax ≤ 30V	Uo, Voc or Vt ≤ 30V
Ii or Imax ≤ 225 mA	Io (Isc or It) ≤ 225 mA
Pi or Pmax = 0.9W	Po ≤ 0.9 W
Ci= 3.9 nF	Ca or Co ≥ C_{cable} + $C_{ST\ 800/\ ST\ 700}$
Li= 0 µH	La or Lo ≥ L_{cable} + $L_{ST\ 800/\ ST\ 700}$

Honeywell	A/A4	50049892		
	SCALE: None	REV G	DATE 06/20/16	SH. 2 of 5



Honeywell	A/A4	50049892		
	SCALE: None	REV G	DATE 06/20/16	SH. 3 of 5

Output Protocol: F=Foundation Fieldbus or P= PROFIBUS

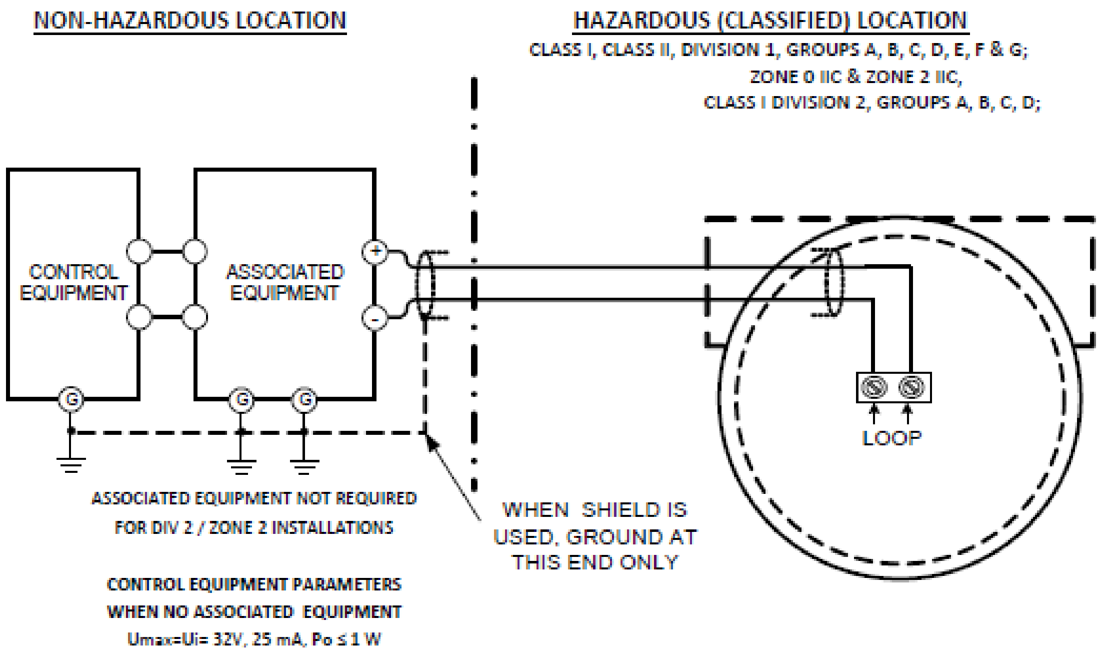
All Models of ST800 and the following Models of the ST700: STA722, STA740, STA72L, STA74L, STA77L, STD720, STD730, STD770, STG730, STG740, STG770, STG73L, STG74L, STG77L, STG78L, STG79L, STF724, STF732, STF72F, STF73F, STR73D, STR74G, STR73D, and STR74G

ENTITY PARAMETERS	Associated Apparatus
Ui or Vmax $\leq$ 30V	Uo, Voc or Vt $\leq$ 30V
Ii or Imax $\leq$ 180 mA	Io (Isc or It) $\leq$ 180 mA
Pi or Pmax = 1W	Po $\leq$ 1 W
Ci= 0 nF	Ca or Co $\geq C_{cable} + C_{ST\ 800/\ ST\ 700}$
Li= 984 µH	La or Lo $\geq L_{cable} + L_{ST\ 800/\ ST\ 700}$

Terminal Module Revision F or Later

NOTE: THE REVISION IS ON THE LABEL THAT IS ON THE MODULE. THERE WILL BE TWO LINES OF TEXT ON THE LABEL:
- FIRST IS THE MODULE PART #: 50049839-003 OR 50049839-004
- SECOND LINE HAS THE SUPPLIER INFORMATION, ALONG WITH THE REVISION: XXXXXXX-FXXXX, THE "X" IS PRODUCTION RELATED; THE POSITION OF THE "F" IS THE REVISION.

ENTITY PARAMETERS	Associated Apparatus
Ui or Vmax $\leq$ 30V	Uo, Voc or Vt $\leq$ 30V
Ii or Imax $\leq$ 225 mA	Io (Isc or It) $\leq$ 225 mA
Pi or Pmax = 1W	Po $\leq$ 1 W
Ci= 0 nF	Ca or Co $\geq C_{Cable} + C_{ST\ 800/\ ST\ 700}$
Li= 0 µH	La or Lo $\geq L_{cable} + L_{ST\ 800/\ ST\ 700}$



Honeywell	A/A4	50049892		
	SCALE: None	REV G	DATE 06/20/16	SH. 4 of 5

Output Protocol: F=Foundation Fieldbus

All Models of ST800 and the following Models of the ST700: STA722, STA740, STA72L, STA74L, STA77L, STD720, STD730, STD770, STG730, STG740, STG770, STG73L, STG74L, STG77L, STG78L, STG79L, STF724, STF732, STF72F, STF73F, STR73D, STR74G, STR73D, and STR74G

FISCO Terminal Module Revision F or Later

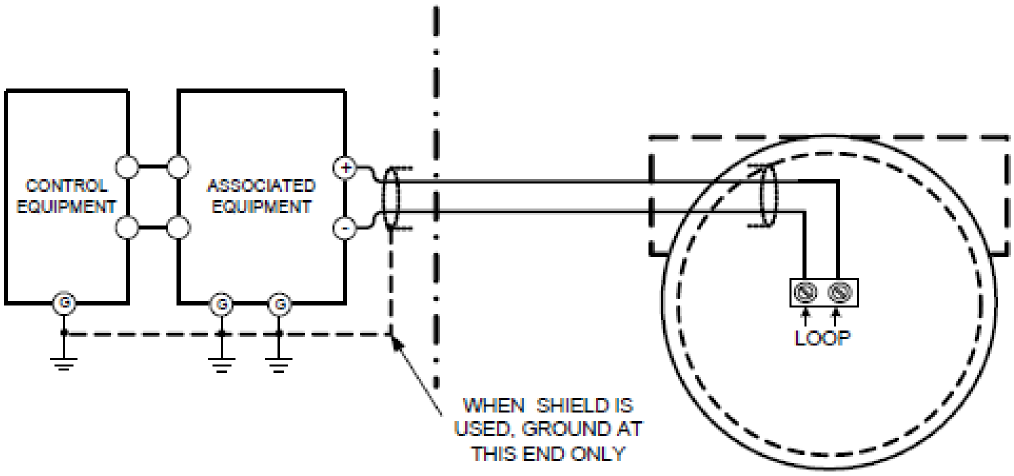
NOTE: THE REVISION IS ON THE LABEL THAT IS ON THE MODULE. THERE WILL BE TWO LINES OF TEXT ON THE LABEL:

- FIRST IS THE MODULE PART #: 50049839-003 OR 50049839-004
- SECOND LINE HAS THE SUPPLIER INFORMATION, ALONG WITH THE REVISION: XXXXXXX-FXXXX, THE "X" IS PRODUCTION RELATED, THE POSITION OF THE "F" IS THE REVISION.

ENTITY PARAMETERS (Ex ia and Ex ic)	Associated Apparatus
Ui or Vmax ≤ 18	Uo, Voc or Vt ≤ 18V
Ii or Imax ≤ 380 mA	Io (Isc or It) ≤ 380 mA
Pi or Pmax = 5.32W	Po ≤ 5.32 W
Ci= 0 nF	Ca or Co ≥ C_{cable} + $C_{ST\ 800/\ ST\ 700}$
Li= 0 µH	La or Lo ≥ L_{cable} + $L_{ST\ 800/\ ST\ 700}$

NON-HAZARDOUS LOCATION

HAZARDOUS (CLASSIFIED) LOCATION
ZONE 0 IIC & ZONE 2 IIC,



Honeywell	A/A4	50049892		
	SCALE: None	REV G	DATE 08/20/16	SH. 5 of 5

A5. Marine Approvals

American Bureau of Shipping (ABS) **Certificate Number:** 14-HS1265317 **ABS Rules:** Rules for Conditions of Classification, Part 1 - 2014 Steel Vessel Rules 1-1-4/7.7, 1-1-A3, 1-1-A4 which Covers the following: Steel Vessels 4-6-2/5.15, 4-8-3/13, 4-8-4/27.5.1, 4-9-8/13; Offshore Support Vessels 4-8-3/13, 4-8-4/29.5.1, 4-9-8/13; High Speed Craft 4-6-3/9.1.1(a), 4-7-9/15.1; Rules for Conditions of Classification, Part 1 - 2014 Offshore Units and Structures 1-1-4/9.7, 1-1-A2, 1-1-A3
Bureau Veritas (BV) **Certificate Number**: 39542/A0 BV **Requirements:** Bureau Veritas Rules for the Classification of Steel Ships EC Code: 41S
Det Norske Veritas (DNV) **Certificate Number:** A-13982 **Application/ Location Classes:** Temperature D Humidity: B Vibration: A EMC: B Enclosure: C For salt spray exposure; enclosure of 316 SST or 2-part epoxy protection with 316 SST bolts to be applied.
Korean Register of Shipping (KR) **Appl. No**: DLN-T0044-14
Lloyd's Register (LR) **Certificate Number:** 14/60017 **Application:** For use in environmental categories ENV1, ENV2, ENV3 adn ENV5 as defined by Lloyd's Register Test specification No. 1, 2013

Glossary

AP	Absolute Pressure
AWG	American Wire Gauge
DE	Digital Enhanced Communications Mode
DP	Differential Pressure
d1	Inside diameter of pipe
d2	Orifice plate bore diameter at flowing temperature
do	Inside diameter of orifice
EMI	Electromagnetic Interference
FTA	Field Termination Assembly
GP	Gauge Pressure
HP	High Pressure (also, High Pressure side of a Differential Pressure Transmitter)
Hz	Hertz
inH_2O	Inches of Water
LGP	In-Line Gauge Pressure
LP	Low Pressure (also, Low Pressure side of a Differential Pressure Transmitter)
LRL	Lower Range Limit
LRV	Lower Range Value
mAdc	Milliamperes Direct Current
mmHg	Millimeters of Mercury
mV	Millivolts
Nm	Newton·meters
NPT	National Pipe Thread
NVM	Non-Volatile Memory
Pa	Measured static pressure in PV4 algorithm
Pc	Absolute critical pressure of the gas
Pd	Static pressure at downstream point
Pdp	Measured differential pressure in Pascals in PV4 algorithm
Pf	Absolute pressure of flowing gas
Pr	Reduced pressure
Pu	Static pressure at upstream point
PM	Process Manger
PSI	Pounds per Square Inch
PSIA	Pounds per Square Inch Absolute
PV	Process Variable
PWA	Printed Wiring Assembly
RFI	Radio Frequency Interference
RTD	Resistance Temperature Detector
SFC	Smart Field Communicator
STIM	Pressure Transmitter Interface Module
STIMV IOP	Pressure Transmitter Interface Multivariable Input/Output Processor
T/C	Thermocouple
URL	Upper Range Limit
URV	Upper Range Value
US	Universal Station
Vac	Volts Alternating Current
Vdc	Volts Direct Current

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INDEX

Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

Honeywell Process Solutions,
(TAC) hfs-tac-support@honeywell.com

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Honeywell Limited
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FAX: +(61) 7-3840 6481
Toll Free 1300-36-39-36
Toll Free Fax:
1300-36-04-70

China – PRC - Shanghai
Honeywell China Inc.
Phone: (86-21) 5257-4568
Fax: (86-21) 6237-2826

Singapore
Honeywell Pte Ltd.
Phone: +(65) 6580 3278
Fax: +(65) 6445-3033

South Korea
Honeywell Korea Co Ltd
Phone: +(822) 799 6114
Fax: +(822) 792 9015

EMEA

Honeywell Process Solutions,
Phone: + 80012026455 or
+44 (0)1344 656000

Email: (Sales)
FP-Sales-Apps@Honeywell.com
or
(TAC)
hfs-tac-support@honeywell.com

AMERICAS

Honeywell Process Solutions,
Phone: (TAC) 1-800-423-9883 or
215/641-3610
(Sales) 1-800-343-0228

Email: (Sales)
FP-Sales-Apps@Honeywell.com
or
(TAC)
hfs-tac-support@honeywell.com

Specifications are subject to change without notice.

For more information
To learn more about SmartLine Transmitters,
visit www.honeywellprocess.com
Or contact your Honeywell Account Manager

Process Solutions
Honeywell
1250 W Sam Houston Pkwy S
Houston, TX 77042

Honeywell Control Systems Ltd
Honeywell House, Skimped Hill Lane
Bracknell, England, RG12 1EB

Shanghai City Centre, 100 Jungi Road
Shanghai, China 20061

Honeywell

34-ST-25-44 Rev.8.0
December 2016

STT850 SMARTLINE Temperature Transmitter User's Manual

34-TT-25-03
Revision 3
March 2016

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Revision 3, March 2016

Honeywell Process Solutions
1250 W Sam Houston Pkwy S
Houston, TX 77042

About This Manual

This manual is a detailed *how to* reference for installing, piping, wiring, configuring, starting up, operating, maintaining, calibrating, and servicing Honeywell's family of STT850 Temperature Transmitters. Users who have a Honeywell STT850 SmartLine Temperature Transmitter configured for HART protocol or Honeywell's Digitally Enhanced (DE) are referred to the *STT850 SmartLine Series HART/DE Option User's Manual*, document number 34-TT-25-06. Users who have a Honeywell STT850 SmartLine Temperature Transmitter configured for Fieldbus operation are referred to the *STT850 SmartLine Series Fieldbus Option User's Manual*, document number (34-TT-25-07).

The configuration of your Transmitter depends on the mode of operation and the options selected for it with respect to operating controls, displays and mechanical installation. This manual provides detailed procedures to assist first-time users, and it further includes keystroke summaries, where appropriate, as quick reference or refreshers for experienced personnel.

To digitally integrate a Transmitter with one of the following systems:

- For the Experion PKS, you will need to supplement the information in this document with the data and procedures in the *Experion Knowledge Builder*.
- For Honeywell's TotalPlant Solutions (TPS), you will need to supplement the information in this document with the data in the *PM/APM SmartLine Transmitter Integration Manual*, which is supplied with the TDC 3000 book set. (TPS is the evolution of the TDC 3000).

Release Information:

STT850 SmartLine Temperature Transmitter User Manual, Document # 34-TT-25-03,

Rev 1,	March 2014	1st Release
Rev, 2	November 2014	Foundation Fieldbus features added
Rev, 3	March 2016	CVD, Digital Output, W5W26, Housing w/o plug, angle Brackets, NAMUR 89 Approval and Nic 120 & Cu 10 inputs added. Advanced diagnostics and Display menus updated.

References

The following list identifies publications that may contain information relevant to the information in this document.

STT850 SmartLine Temperature Transmitter Quick Start Installation Guide, Document # 34-TT-25-04

STT850 SmartLine Temperature Transmitter with HART Communications Options Safety Manual, # 34-TT-25-05

STT850 SmartLine Temperature Transmitter HART/DE Option User's Manual, Document # 34-TT-25-06

STT850 Transmitter with FOUNDATION Fieldbus Option Installation & Device Reference Guide, Document # 34-TT-25-07

MC Toolkit User Manual, for 400 or later, Document # 34-ST-25-20

PM/APM SmartLine Transmitter Integration Manual, Document # PM 12-410

*STT850 Series Temperature, Transmitter, Agency IS Control Drawing*50091227

Smart Field Communicator Model STS 103 Operating Guide, Document # 34-ST-11-14

Patent Notice

The Honeywell STT850 SmartLine Temperature Transmitter family is covered by one or more of the following U. S. Patents: 5,485,753; 5,811,690; 6,041,659; 6,055,633; 7,786,878; 8,073,098; and other patents pending.

Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, refer to the back page of this manual or the appropriate Honeywell Solution Support web site:

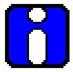
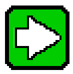
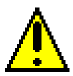
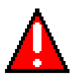
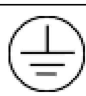
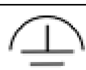
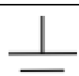
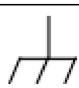
Honeywell Corporate	www.honeywellprocess.com
Honeywell Process Solutions	https://www.honeywellprocess.com/smartline-temperature/
Training Classes	http://www.automationccollege.com

Telephone and Email Contacts

Area	Organization	Phone Number
United States and Canada	Honeywell Inc.	1-800-343-0228 Customer Service 1-800-423-9883 Global Technical Support
Global Email Support	Honeywell Process Solutions	ask-ssc@honeywell.com

Symbol Descriptions and Definitions

The symbols identified and defined in the following table may appear in this document.

Symbol	Definition
	**ATTENTION: Identifies information that requires special consideration.**
	**TIP: Identifies advice or hints for the user, often in terms of performing a task.**
CAUTION	**Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.**
	**CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.** **CAUTION symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.**
	**WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death.** **WARNING symbol on the equipment refers the user to the product manual for additional information. The symbol appears next to required information in the manual.**
	**WARNING, Risk of electrical shock: Potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible.**
	**ESD HAZARD: Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices.**
	**Protective Earth (PE) terminal: Provided for connection of the protective earth (green or green/yellow) supply system conductor.**
	**Functional earth terminal: Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national local electrical code requirements.**
	**Earth Ground: Functional earth connection. NOTE: This connection shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.**
	**Chassis Ground: Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.**
continued	

Symbol	Description
	The Factory Mutual® Approval mark means the equipment has been rigorously tested and certified to be reliable.
	The Canadian Standards mark means the equipment has been tested and meets applicable standards for safety and/or performance.
	The Ex mark means the equipment complies with the requirements of the European standards that are harmonized with the 94/9/EC Directive (ATEX Directive, named after the French "ATmosphere EXplosible").

Contents

List of Figures

List of Tables

1 Introduction

1.1. Overview

This section is an introduction to the physical and functional characteristics Honeywell's family of STT850 SmartLine Temperature Transmitters.

1.2. Features and Options

The STT850 SmartLine Temperature Transmitter is available in a variety of models for measuring Thermocouples, RTD, Millivolts, and Volt or ohm sensor types. Table 1 lists the protocols, Human-Machine Interface (HMI), materials, approvals, and mounting bracket options for the STT850.

Table 1 – Features and Options

Feature/Option	Standard/Available Options
Communication Protocols	HART version 7, Digitally Enhanced (DE), Fieldbus
Human-Machine Interface (HMI) Options (Basic and Advanced Display)	Basic and Advanced Digital Display
	Three-button programming (optional)
	Basic display language: English only
	Advanced display languages: English, German, French, Spanish, Turkish, Italian, Chinese, Japanese and Russian
Calibration	Single
Approvals (See Appendix C for details.)	ATEX, CSA, FM, IECx, NEPSI
Mounting Brackets	Pipe mounting and wall mounting brackets in carbon steel and 316 stainless steel.
Integration Tools	Experion

1.1.1 Physical Characteristics

As shown in Figure 1, the STT850 is packaged in one major assembly: the Electronics Housing. The elements in the Electronic Housing are connected to the process sensors, measure the process variables, respond to setup commands and execute the software and protocol for the different temperature measurement types. Figure 2 shows the assemblies in the Electronics Housing with available options.

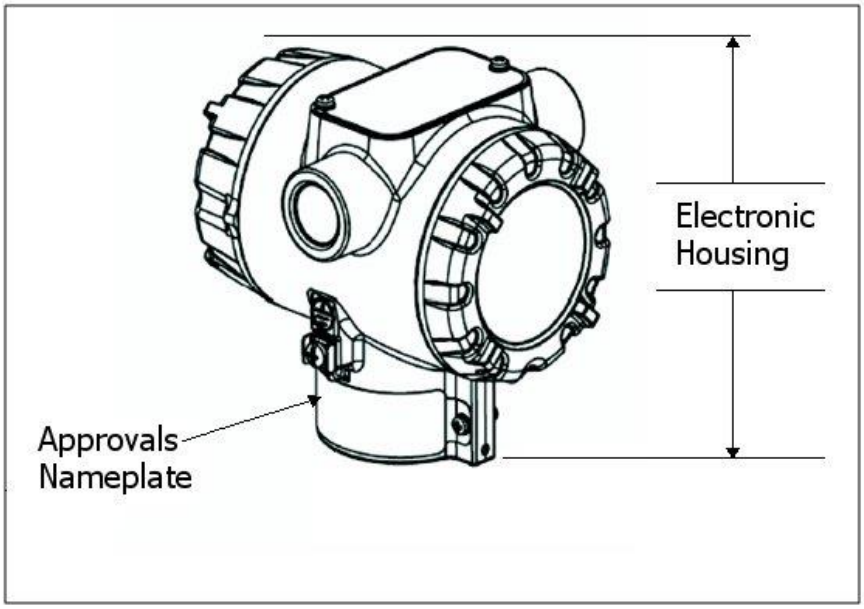


Figure 1 – STT850 Major Assemblies

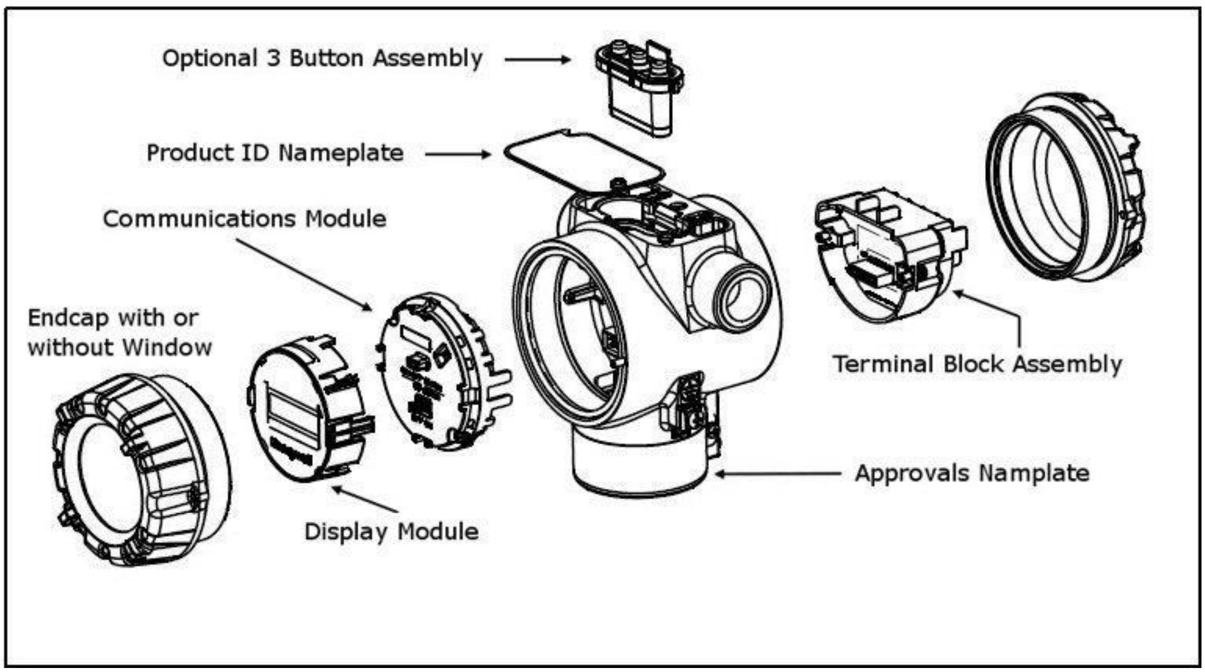


Figure 2 – Electronics Housing Components

1.1.2 Functional Characteristics

The Transmitter measures process Temperature and outputs a signal proportional to the measured process variable (PV). Available output communication protocols include 4 to 20mA, Honeywell Digitally Enhanced (DE), HART, and FOUNDATION Fieldbus.

An optional 3-button assembly is available to set up and make adjustments to the Transmitter. In addition, a Honeywell Multi-Communication (MC) Toolkit (not supplied with the Transmitter) can facilitate setup and adjustment procedures in the case of HART and DE. Certain adjustments can be made through an Experion Station or a Universal Station if the Transmitter is digitally integrated with Honeywell's Experion or TPS/TDC 3000 control system for HART and DE transmitters.

1.3. STT850 SmartLine Transmitter NamePlate

The Transmitter nameplate mounted on the bottom of the electronics housing (see Figure 1) lists its model number, physical configuration, electronics options, accessories, certifications, and manufacturing specialties. Figure 3 is an example of a typical Temperature Transmitter nameplate. The model number format consists of a Key Number with several table selections.

Key		I		II		III		IV		V		VI		VII		VIII		IX
STT850	-	_	-	_	-	_	-	_ _ _	-	_ _ _	-	_	-	_ _ _ _	-	_ _, _ _, _ _	-	XXXX

Figure 3 –Typical STT850 NamePlate

You can readily identify the series and basic Transmitter type from the key number. The letter in the third digit represents one of these basic transmitter types:

- T = Temperature

For a complete selection breakdown, refer to the appropriate Specification and Model Selection Guide provided as a separate document.

1.4. Safety Certification Information

An "approvals" nameplate is located on the bottom of the Electronics Assembly; see Figure 1for exact location. The approvals nameplate contains information and service marks that disclose the Transmitter compliance information. Refer to Appendix C of this document for safety certification requirements and details.

1.5. Transmitter Adjustments

For HART and DE variants, Span adjustments are possible in STT850 SmartLine Temperature Transmitters with the optional three-button assembly located at the top of the Electronic Housing (see Figure 2).

For HART and DE you can also use the Honeywell MC Toolkit or other third-party hand-held to make any adjustments to an STT850 SmartLine Temperature Transmitter. Alternately, certain adjustments can be made through the Experion or Universal Station, if the Transmitter is digitally integrated with a Honeywell Experion or TPS system. In case of Fieldbus (FF) variants, adjustments can be made using any Fieldbus compliant DCS or Asset management system including Honeywell Experion PKS and Honeywell FDM. Any Fieldbus compliant third party handheld configuration may also be used.

1.6. Display Options

The STT850 SmartLine Temperature Transmitter has two display options: Basic and Advanced; see Table 2.

Table 2 – Available Display Characteristics

Basic Display	• Suitable for basic process needs • 360º rotation in 90º increments • 8 configurable screens • 2 lines,16 characters • Standard units of measurement: °F, °C, °R, K, Ω, mV & % (Custom Units available for Fieldbus variant) • Diagnostic messaging
Advanced Display	• Suitable for custom and complex process needs • 360° rotation in 90° increments • Three (3) configurable screen formats with configurable rotation timing o Large process variable (PV) o PV with bar graph o PV with trend (1-999 hours (allows 31 days), configurable) • Eight (8) screens with 3-30 seconds rotation timing • Standard engineering units (Custom Units available for Fieldbus variant) • Diagnostic alerts and diagnostic messaging • Multiple language support: o EN, FR, DE, ES, RU, IT, TR o EN, CH (Kanji), JP • Supports 3-button configuration and calibration • Supports transmitter messaging, and maintenance mode indications

1.7. Optional 3-Button Assembly

The optional 3-Button Assembly provides the following features and capabilities:

- Increment, decrement, and enter key functions.
- With the menu-driven display:
  - Comprehensive on-screen menu for navigation.
  - Transmitter configuration (for HART and DE).
  - Transmitter calibration (for HART and DE).
  - Display configuration.
  - Set span parameters (for HART and DE).
  - Viewing transmitter parameters

2 Application Design

1.8. Overview

This section discusses the considerations involved with deploying a Honeywell STT850 SmartLine Temperature Transmitter in a process system. The following areas are covered:

- Safety
- Input and output data
- Reliability
- Environmental limits
- Installation considerations
- Operation and maintenance
- Repair and replacement

1.9. Safety

2.1.1 Accuracy

The STT850 SmartLine Temperature Transmitter (Transmitter) measures the temperature of a process and reports the measurement to a receiving device. Refer to STT850 Specification, 34-TT-03-14.

2.1.2 Diagnostic Messages

Transmitter standard diagnostics are reported in the two basic categories listed in Table 3. Problems detected as critical diagnostics drive the analog output to the programmed burnout level for HART and DE. Problems detected as non-critical diagnostics may affect performance without driving the analog output to the programmed burnout level (for HART and DE only). Informational messages (not listed in Table 3) report various Transmitter status or setting conditions. The messages listed in Table 3 are specific to the Transmitter, exclusive of those associated with HART and DE protocols. HART and DE diagnostic messages are listed and described in the *STT850 SmartLine Temperature Transmitter HART/DE Option User Manual*, document number 34-TT-25-06.

Table 3 – STT850 Standard Diagnostics Messages

Critical Diagnostics (Failure Conditions)	Non-Critical Diagnostics (Warning Conditions)
Temperature Sensor Module Failure	Excess Cal 1 Correct (Excess LRV Correct and/or Span correct for Sensor Input 1)
Sensor Input 1 Failure	Excess Cal 2 correct (Excess LRV Correct and/or Span correct for Sensor Input 2)
Sensor Input 2 Failure	Input 1 Out of Range (Sensor Input 1 Under Range or Over Range)
Communication Module Failure	Input 2 Out of Range (Sensor Input 2 Under Range or Over Range)
Sensor Comm. Timeout	Sensor Module Over Temperature
	Cold Junction Out of Range Error
	Sensor Input 1 Open
	Sensor Input 1 TB5 Open
	Sensor Input 1 TB6 Open
	Sensor Input 1 TB7 Open
	Sensor Input 1 TB9 Open
	Sensor Input 2 Open
	Sensor Input 2 TB8 Open
	No Factory Calibration
	Supply voltage Fault (External Supply voltage Fail)
	Communication Module Over Temperature
	No DAC compensation
	Unreliable communication between Sensor and Comm Modules
	Display NVM fault
	Excess Delta
	Internal Power failure for Communication Module

2.1.3 Safety Integrity Level (SIL)

The STT850 is intended to achieve sufficient integrity against systematic errors by the manufacturer's design. A Safety Instrumented Function (SIF) designed with this product must not be used at a SIL level higher than the statement, without "prior use" justification by the end user or diverse technology redundancy in the design. Refer to the *STT850 Safety Manual*, 34-TT-25-05, for additional information. The Fieldbus variant of STT850 is not SIL certified.

3 Installation and Startup

1.10. Installation Site Evaluation

Evaluate the site selected for the STT850 SmartLine Transmitter installation with respect to the process system design specifications and Honeywell's published performance characteristics for your particular model. Some parameters that you may want to include in your site evaluation are:

- Environmental Conditions:
  - Ambient Temperature
  - Relative Humidity
- Potential Noise Sources:
  - Radio Frequency Interference (RFI)
  - Electromagnetic Interference (EMI)
- Vibration Sources
  - Pumps
  - Motorized System Devices (e.g., pumps)
  - Valve Cavitation
- Process Parameters
  - Temperature
  - Maximum Sensor Input Ratings

1.11. Honeywell MC Toolkit

In preparation for post-installation processes, refer to the *MC Toolkit User Manual*, Document # 34-ST-25-20, for battery conditioning and device operation and maintenance information.

1.12. Display Installation Precautions

Temperature extremes can affect display quality. The display can become unreadable at temperature extremes; however, this is only a temporary condition. The display will again be readable when temperatures return to within operable limits.

The display update rate may increase at cold temperature extremes, but as with readability, normal updating resumes when temperatures are within limits for full operability.

1.13. Mounting STT850 SmartLine Temperature Transmitters

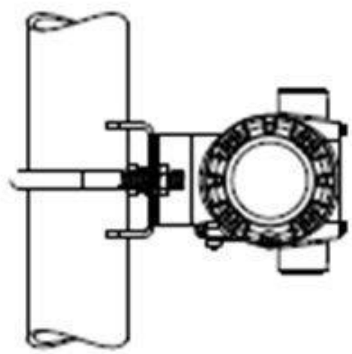
3.1.1 Summary

Transmitter models can be attached to a two-inch (50 millimeter) vertical or horizontal pipe using Honeywell's optional angle. Honeywell's optional wall mounting bracket is also shown below:

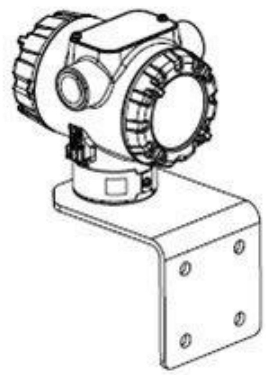
For Housing with Adaptor refer to Honeywell drawings 50095917 (Pipe mount), 50095918 (Wall mount) and 50124813 (Angle pipe mount) for detailed mounting specifications.
For Housing without adaptor refer to Honeywell drawings 32306827 (No-Adaptor, Pipe mount), 32306828 (No-adaptor, Wall mount) and 50124813 (No-adaptor angle pipe mount).

Figure 4 shows typical bracket-mounted installations.

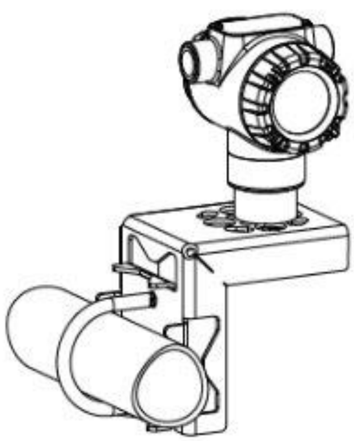
HORIZONTAL PIPE MOUNTING



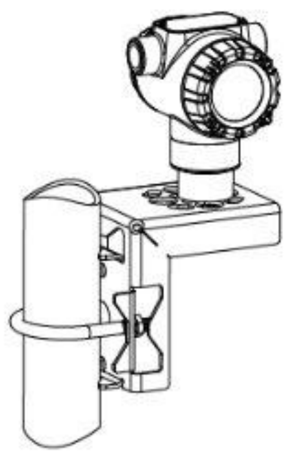
VERTICAL PIPE MOUNTING



WALL PIPE MOUNTING



HORIZONTAL ANGLE PIPE MOUNTING



VERTICAL ANGLE PIPE MOUNTING

Figure 4 – Typical Bracket Mounted Installations

3.1.2 Mounting Dimensions

Refer to Honeywell drawing number 50094836 for detailed dimensions of the transmitter assembly. Abbreviated overall dimensions are also shown on the Specification Sheets for the transmitter models. This section assumes that the mounting dimensions have already been taken into account and the mounting area can accommodate the Transmitter.
Refer to Honeywell drawing numbers 50095917 (Pipe Mount) and 50095918 (Wall Mount) for detailed mounting specifications.

3.1.3 Bracket Mounting Procedure

1. Align the two mounting holes in the transmitter with the two slots in the mounting bracket and assemble the (2) M8 hex cap screws, (2) lockwashers and (2) flat washers provided. Rotate transmitter assembly to the desired position and torque the M8 hex cap screws to 27,0 Nm/20,0 Lb-ft maximum.
2. Pipe Mount Option: Refer to Figure 5. Position the bracket on a 2-inch (50.8 mm) horizontal or vertical pipe, and install a “U” bolt around the pipe and through the holes in the bracket. Secure the bracket with the nuts, flat washers and lock washers provided.
3. Wall Mount Option: Position the bracket on the mounting surface at the desired location and secure the bracket to the mounting surface using the appropriate hardware (Wall mounting hardware requirements to be determined and supplied by the end user).

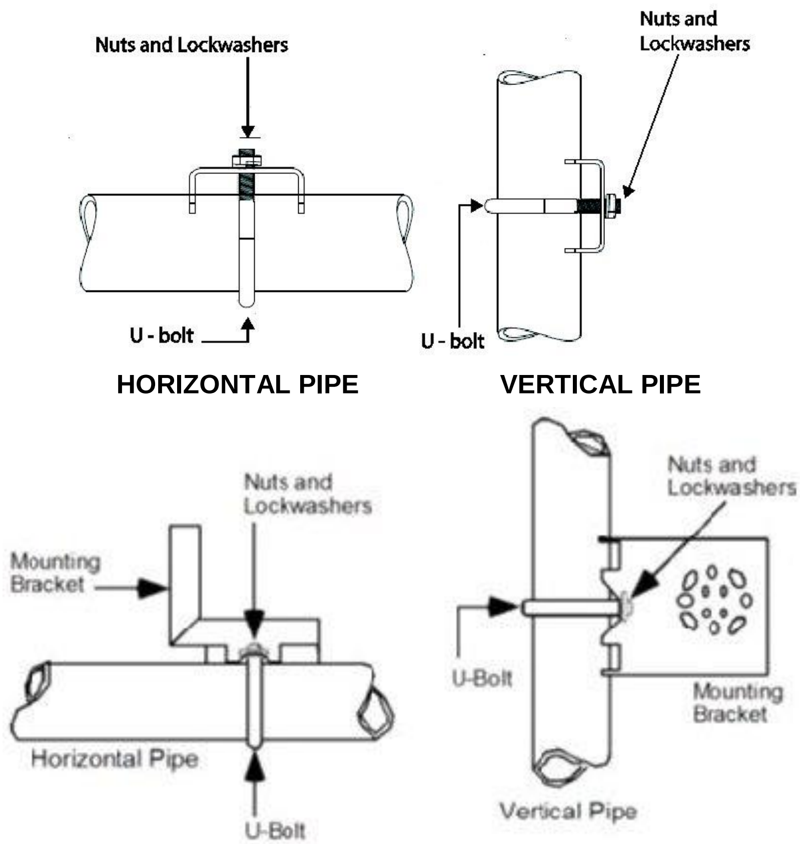


Figure 5 – Pipe Mounting Bracket Secured to a Horizontal or Vertical Pipe

1.14. Wiring a Transmitter

3.1.4 Loop Power Overview

The transmitter is designed to operate in a two-wire power/current loop with loop resistance and power supply voltage within the HART or DE operating range shown in Figure 6.

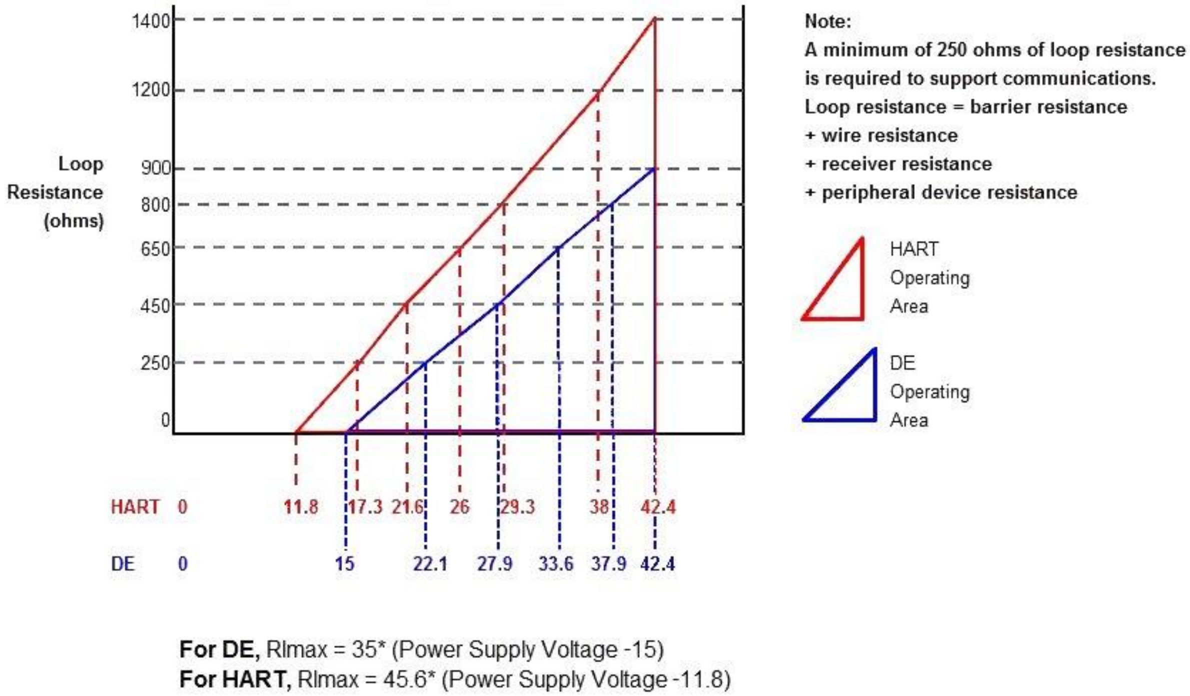


Figure 6 – HART and DE Transmitter Operating Ranges

For DE operation, add 2.0 V to these values. The Fieldbus transmitter operates from 9-32 V and does not require a loop resistance.
Loop wiring is connected to the Transmitter by simply attaching the positive (+) and negative (–) loop wires to the positive (+) and negative (–) terminals on the Transmitter terminal block in the Electronics Housing. Connect the Loop Power wiring shield to earth ground only at the power supply end. **Note** that the Transmitter is not polarity-sensitive.

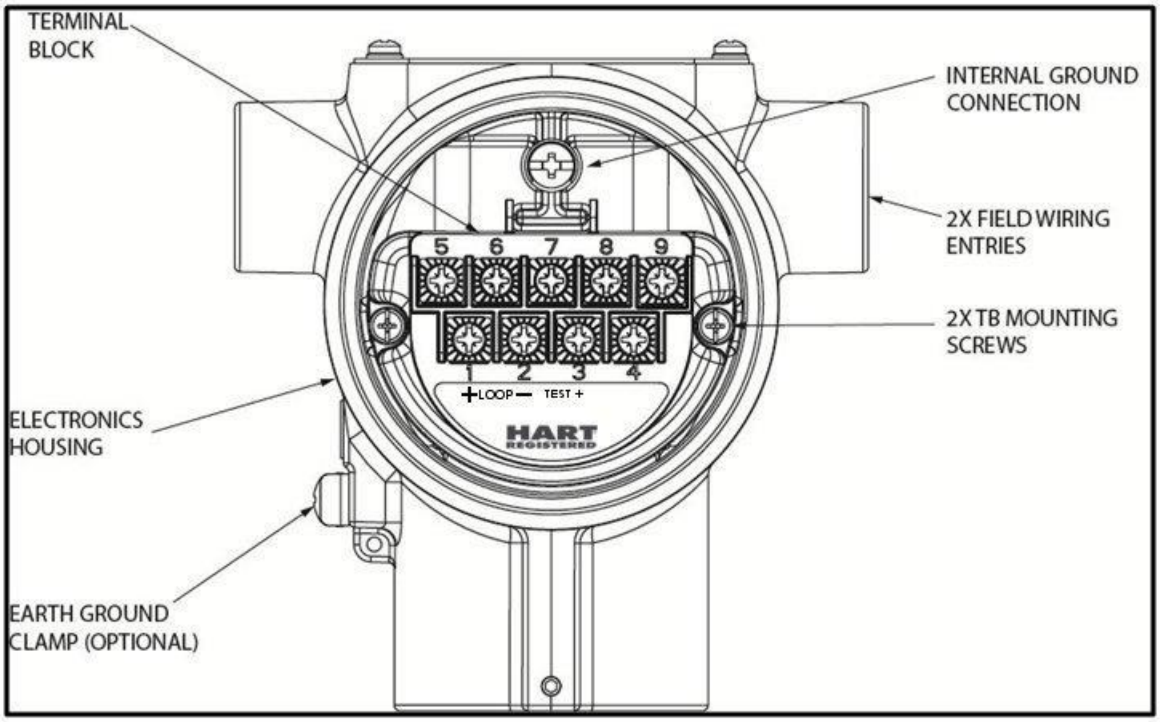


Figure 7 – Transmitter 9-Screw Terminal Board and Grounding Screw

As shown in Figure 7, each Transmitter has an internal terminal to connect it to earth ground. Optionally, a ground terminal can be added to the outside of the Electronics Housing. Grounding the Transmitter for proper operation is required, as doing so tends to minimize the possible effects of noise on the output signal and affords protection against lightning and static discharge. An optional lightning terminal block can be installed in place of the non-lightning terminal block for Transmitters that will be installed in areas that are highly susceptible to lightning strikes. As noted above, the Loop Power wiring shield should only be connected to earth ground at the power supply end.

Wiring must comply with local codes, regulations and ordinances. Grounding may be required to meet various approval body certification, for example CE conformity. Refer to Appendix A of this document for details.

Note: Terminal #3 is for loop test and is not applicable for Fieldbus option.
Terminal #4 is for Digital Output and is not applicable for Fieldbus option.

For HART and DE the Transmitter is designed to operate in a two-wire power/current loop with loop resistance and power supply voltage within the operating range; see Figure 6. With an optional remote meter, the voltage drop for this must be added to the basic power supply voltage requirements to determine the required Transmitter voltage (V_{XMTR}) and maximum loop resistance ($R_{LOOP\ MAX}$).

Additional consideration is required when selecting intrinsic safety barriers to ensure that they will supply at least minimum Transmitter voltage ($V_{XMTR\ MIN}$), including the required 250 ohms of resistance (typically within the barriers) needed for digital communications.

Transmitter loop parameters are as follows:
$R_{LOOP\ MAX}$ = maximum loop resistance (barriers plus wiring) that will allow proper Transmitter operation and is calculated as $R_{LOOP\ MAX} = (V_{SUPPLY\ MIN} - V_{XMTR\ MIN} - V_{SM}) \div 21.8$ mA.

In this calculation:

$V_{XMTR\ MIN}$ = 11.8 V (HART) or 13.8V (DE) V_{SM} = 2.3 V, remote meter

Note that V_{SM} should only be considered if a remote meter will be connected to the transmitter.

The positive and negative loop wires are connected to the positive (+) and negative (–) terminals on the terminal block in the Transmitter Electronics Housing.

Barriers can be installed per Honeywell's instructions for Transmitters to be used in intrinsically safe applications.

3.1.5 Digital System Integration Information

DE transmitters that are to be digitally integrated to Honeywell's Total Plant Solution (TPS) system will be connected to the Temperature Transmitter Interface Module in the Process Manager, Advanced Process Manager or High Performance Process Manager through a Field Termination Assembly. Details about the TPS system connections are given in the *PM/APM SmartLine Transmitter Integration Manual*, PM12-410, which is part of the TDC 3000^X system bookset.

If you are digitally integrating a Transmitter in an Allen Bradley Programmable Logic Controller (PLC) process system, the same Field Terminal Assembly (FTA) and wiring procedures used with Honeywell's TPS system are also used with the Allen-Bradley 1771 and 1746 platforms.

3.1.6 Wiring Variations

The above procedures are used to connect power to a Transmitter. For loop wiring, sensor wiring and external wiring, detailed drawings are provided for Transmitter installation in non-intrinsically safe areas and for intrinsically safe loops in hazardous area locations.
If you are using the Transmitter with Honeywell's TPS system, see *PM/APM Smartline Transmitter Integration Manual*, PM12-410, which is part of the TDC 3000^X system bookset.

3.1.7 Loop Wiring Procedure

1. See Figure 7, above, for parts locations. Loosen the end cap lock using a 1.5 mm Allen wrench.
2. Remove the end cap cover from the terminal block end of the Electronics Housing.
3. Feed loop power leads through one end of the conduit entrances on either side of the Electronics Housing. The Transmitter accepts up to 16 AWG wire.
4. Plug the unused conduit entrance with a conduit plug appropriate for the environment.
5. Connect the positive loop power lead to the positive (+) terminal #1 and the negative loop power lead to the negative (-) terminal #2. Note that the Transmitter is <u>not</u> polarity-sensitive.
6. Replace the end cap, and secure it in place.

3.1.8 Grounding and Lightning Protection

Connect a wire from the Earth Ground Clamp or to the Internal Ground Connection (see Figure 7) to Earth Ground to make the protection effective. Use a size 8 AWG or (8.37mm^2) bare or green covered wire for this connection.
For ungrounded Thermocouple, mV, RTD or ohm inputs connect the input wiring shield(s) to the Internal Ground Connection shown in Figure 7.

For grounded Thermocouple inputs, connect the Internal Ground Connection shown in Figure 7 to the same earth ground as used by the thermocouple.

As noted above, the Loop Power wiring shield should only be connected to earth ground at the power supply end.

3.1.9 Supply Voltage Limiting Requirements

If your Transmitter complies with the ATEX 4 directive for self-declared approval per 94/9EC, the power supply has to include a voltage-limiting device. Voltage must be limited such that it does not exceed 42 V DC. Consult the process design system documentation for specifics.

3.1.10 Process Sealing

The STT850 SmartLine Temperature Transmitter is CSA-certified as a Dual Seal device in accordance with ANSI/ISA–12.27.01–2003, “Requirements for Process Sealing Between Electrical Systems and Flammable, or Combustible Process Fluids.”

3.1.11 Explosion-Proof Conduit Seal

When installed as explosion proof in a Division 1 Hazardous Location, keep covers tight while the Transmitter is energized. Disconnect power to the Transmitter in the non-hazardous area prior to removing end caps for service.

When installed as non-incendive equipment in a Division 2 hazardous location, disconnect power to the Transmitter in the non-hazardous area, or determine that the location is non-hazardous before disconnecting or connecting the Transmitter wires.

Transmitters installed as explosion proof in Class I, Division 1, Group A Hazardous (classified) locations in accordance with ANSI/NFPA 70, the US National Electrical Code, with 1/2 inch conduit do not require an explosion-proof seal for installation. If 3/4 inch conduit is used, a LISTED explosion proof seal to be installed in the conduit, within 18 inches (457.2 mm) of the transmitter.

3.1.12 Input Sensor Wiring

Connect the input sensors as shown in Figures below:

Figure 8 – HART/DE/FF Single Input Wiring Diagram.

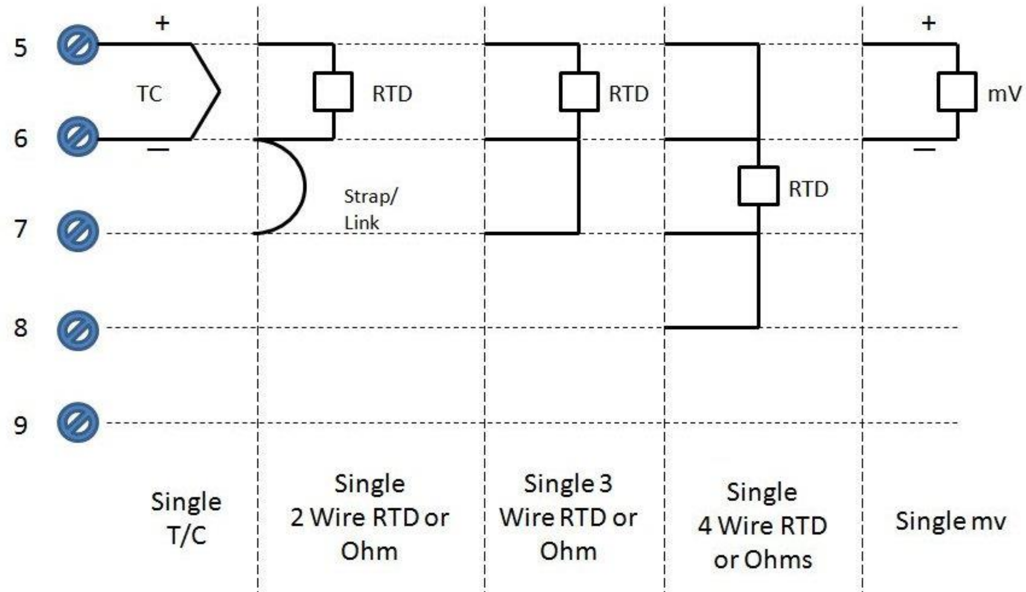


Figure 8 – HART/DE/FF Single Input Wiring Diagram

RTD Thermocouple, mV and Ohm Connections

Figure 9 – DE Dual Input Wiring Diagram

- Resistance temperature detector (RTD) measurements use the 3 or 4 wire approach.
- Dual-input units wired for a 4-wire RTD will automatically disable Input 2.
- To minimize common noise problems in the application, a strap/jumper should be wired between terminals 6 and 8.

For differential T/C operation on DE Models, a second strap/jumper should be wired between terminals 6 and 7. Do not install this strap for Non-DE models. The output for differential operation is calculated as T/C 1 - T/C 2.

-

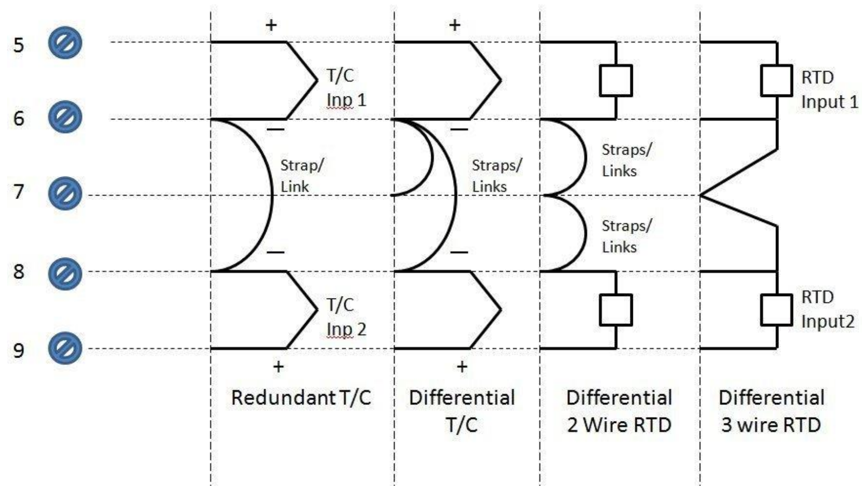


Figure 9 – DE Dual Input Wiring Diagram

Thermocouple and RTD Connections (not applicable to single input sensor)

Figure 10 - HART/FF Dual Input Wiring Diagram

- For External C/J compensation, the first input is a thermocouple type and the second input is a 3-wire PT100 ohm RTD
- The STT850 can have different sensor types on its inputs for split range or averaging applications

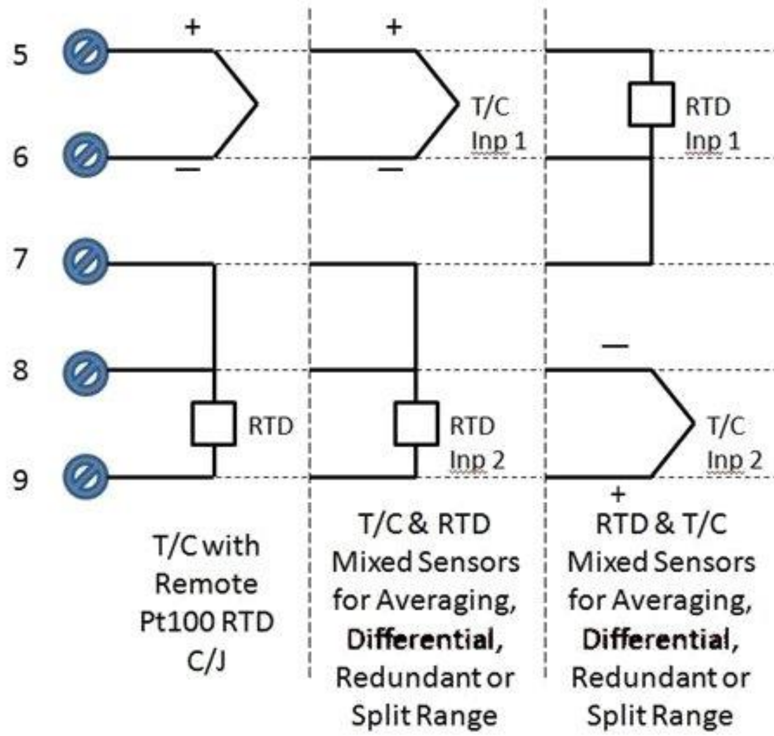


Figure 10 - HART/FF Dual Input Wiring Diagram
Remote C/J and Mixed Sensors Connections

Digital Output is available only on HART transmitters. The Digital Output should not use the same power supply as used to support the 4-20mA transmitter output. See Figure 11 and Figure 12. For Intrinsically Safe (IS) applications, the 4-20mA and the Digital Output must use separate IS Barriers.

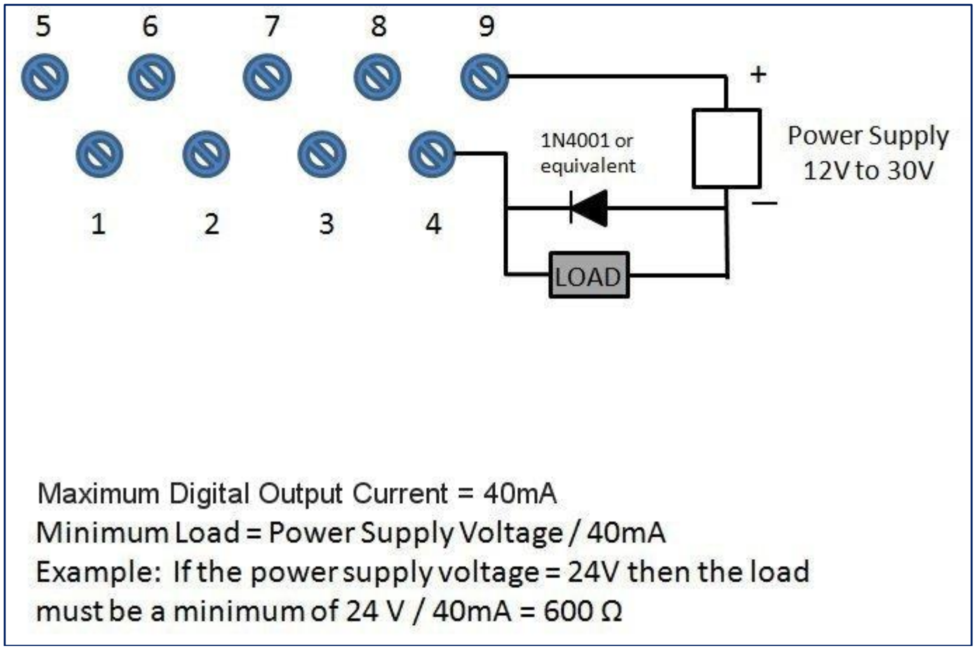


Figure 11 – Digital Output Connections for mA Load (HART only)

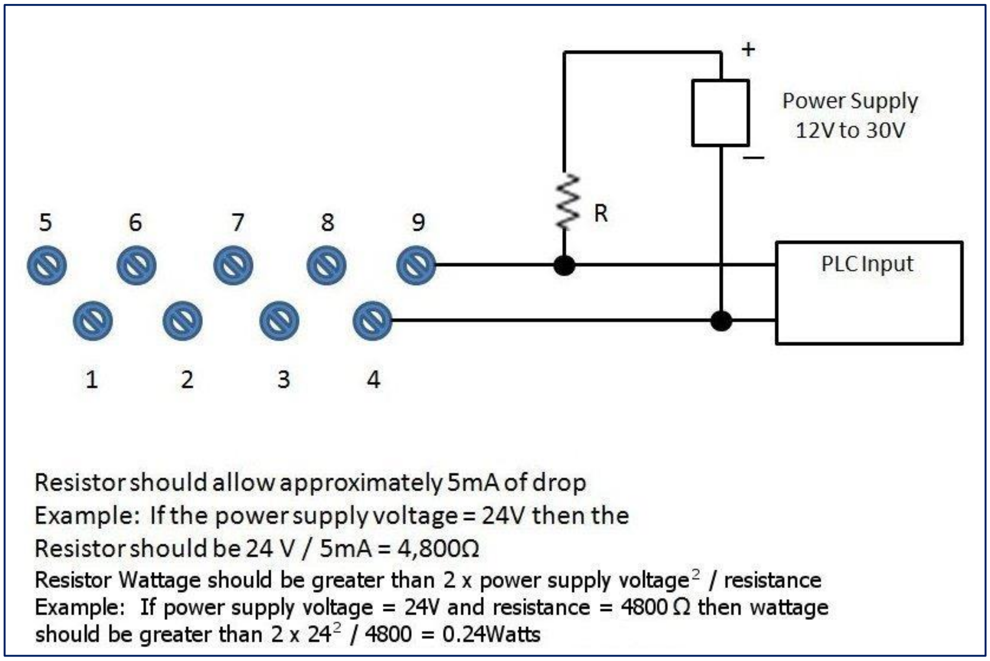


Figure 12 – Digital Output Connections for PLC Counting Pulse (HART only)

1.15. Startup

3.1.13 Overview

This section identifies typical start up tasks associated with several generic temperature measurement applications. It also includes the procedure for running an optional analog output check.

3.1.14 Startup Tasks

After completing the installation and configuration tasks for a Transmitter, you are ready to start up the process loop. Startup usually includes:

- Setting initial resistance (RTD sensor types only)
- Reading inputs and outputs
- Applying process inputs to the transmitter.

You can also run an optional output check to *wring out* an analog loop and check out individual Process Variable (PV) outputs in Digitally Enhanced (DE) mode before startup.
The actual steps in a startup procedure vary based on the type of Transmitter and the measurement application. In general, the procedures in this section are based on using Honeywell MC Toolkit, with a HART or DE variant, to check the Transmitter input and output under static process conditions, and make adjustments as required initiating full operation with the running process.
Note: Checks can be made using the optional three-button assembly, if your Transmitter is so equipped. Operation with the three-button assembly is discussed in the "Operation" section of this manual.

3.1.15 Output Check Procedures

The Output Check comprises the following procedures:

- The Loop Test procedure checks for continuity and the condition of components in the output current loop.
- The Trim DAC Current procedure calibrates the output of the Digital-to-Analog converter for minimum (0%) and maximum (100%) values of 4 mA and 20 mA, respectively. This procedure is used for Transmitters operating online in analog mode to ensure proper operation with associated circuit components (for example, wiring, power supply, control equipment). Precision test equipment (an ammeter or a voltmeter in parallel with precision resistor) is required for the Trim DAC Current procedure.
- The Apply Values procedure uses actual Process Variable (PV) input levels for calibrating the range of a Transmitter. The PV is carefully adjusted to stable minimum and maximum levels, and the Lower Range Limit Value (LRV) and Upper Range Limit Value (URV) are then set by commands from the MC Toolkit.

The Transmitter does not measure the given PV input or update the PV output while it operates in the Output mode.

3.1.16 Constant Current Source Mode Procedure

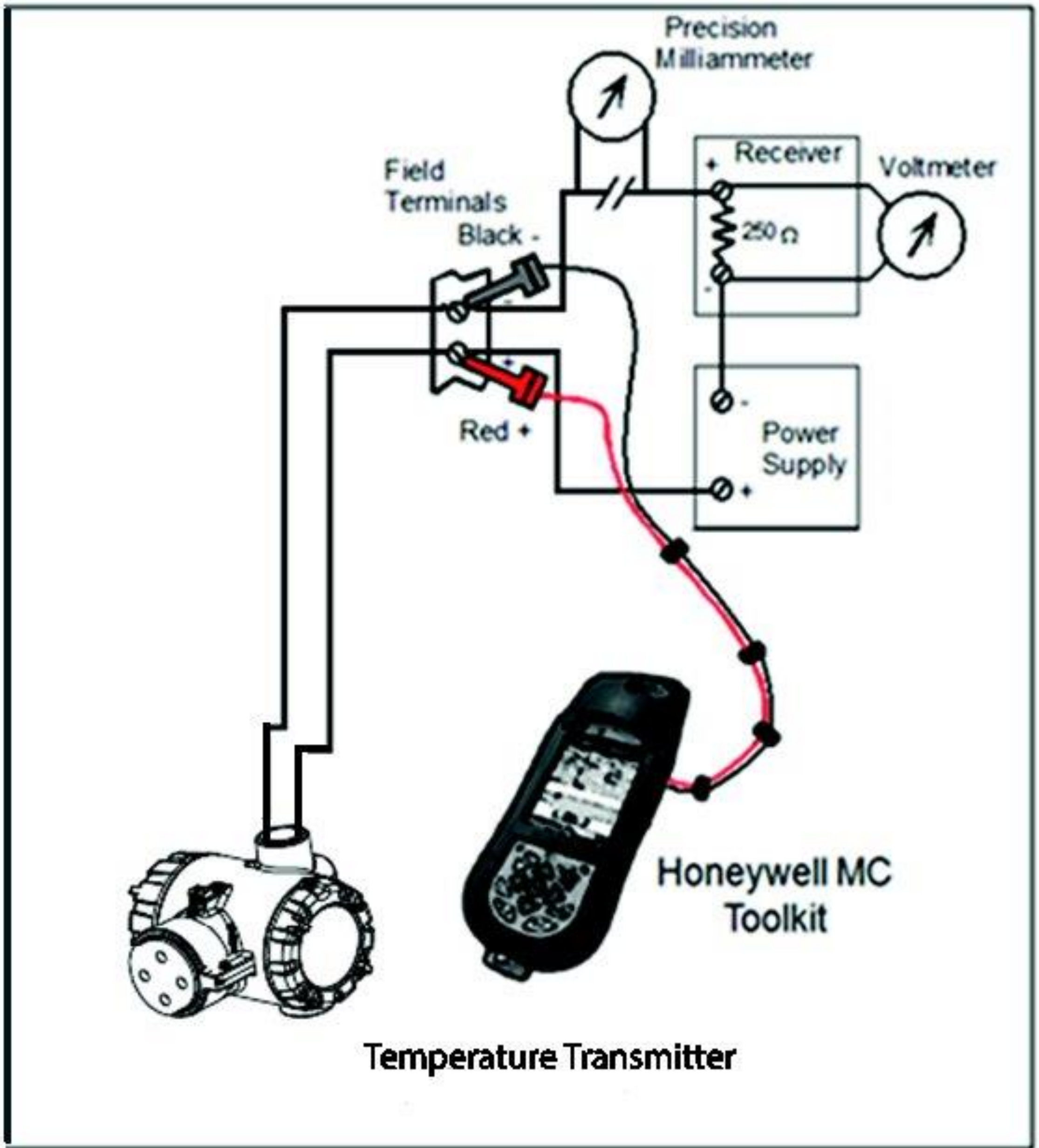


Figure 13 – Current Loop Test Connections

1. Refer to Figure 13 for test connections. Verify the integrity of electrical components in the output current loop.
2. Establish communication with the Transmitter. For these procedures, the values of components in the current loop are not critical if they support reliable communication between the Transmitter and the Toolkit.
3. On the Toolkit, display the **Output Calibration** box.
4. In the Output Calibration box, select the **Loop Test** button; the **LOOP TEST** box will be displayed.
5. Select the desired constant-level Output: 0 %, 100 %, or Other (any between 0 % - 100 %).

6. Select the Set button. A box will be displayed asking **Are you sure you want to place the transmitter in output mode?**

   With the Transmitter in Analog mode, you can observe the output on an externally-connected meter or on a local meter.

7. Select the **Yes** button. Observe the output current at the percentage you selected in Step 5.
8. To view the monitor display, navigate back from the **LOOP TEST** display, and select the **MONITOR** display. A **Confirm** popup will be displayed.
9. Select **Yes** to continue. This concludes the Startup procedure.

4 Operation

1.16. Overview

This section provides the information and processes involved for both Digitally Enhanced (DE) and HART and Foundation Fieldbus (FF) operation using the 3-button option.

1.17. Three-Button Operation

The STT850 optional three-button interface provides a user interface and operation capability without opening the transmitter.
Figure 14 shows the location of the three-button option and the labels for each button.

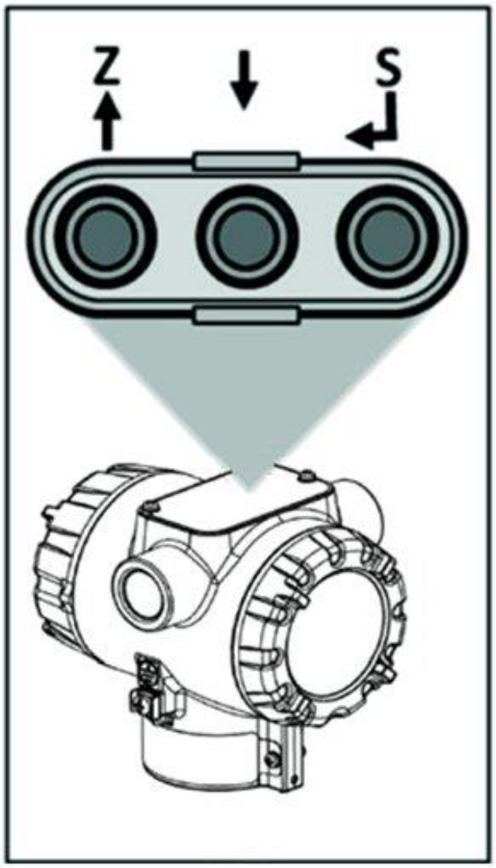


Figure 14 – Three-Button Option

Table 4 – Three-Button Option Functions

Physical Button	Basic Display	Advanced Display	Action
Left ↑	Increment Previous Menu Item	Increment Move cursor Up	Scroll to previous menu item in an active list. Scroll through alphanumeric list to desired character (ex. for entering Tag names or numeric values)
Center ↓	Decrement Next Menu Item	Decrement Move cursor Down	Scroll to next menu item in an active list. Scroll through alphanumeric list to desired character (ex. for entering Tag names or numeric values)
Right ↵	Select displayed menu item for activation or editing	Enter	Call up the Main Menu. Call up a lower-level menu. Select an item for data entry. Confirm a data entry operation Activate the service associated with a selected menu item.

4.1.1 Menu Navigation

The behavior of the buttons is the same for both the Basic and Advanced Displays. The user must press ↵ button to call up the Main Menu. To exit the Main Menu and return to the PV display screen, select **<EXIT>**.

When on a lower level menu, return to the menu above by selecting <Return>. Alternately, the (up symbol) and (down symbol) buttons can be pressed simultaneously to return to the menu above. When on the highest level menu, or when using the basic display menu, pressing the (up symbol) and (down symbol) buttons simultaneously will exit the menu and return to the PV display. Use the ↑ and ↓ buttons to scroll through the list of menu items. Press the ↵ button to select an item for data entry or activation. When an item is selected for data entry or activation, the cursor will jump to the lower line of the LCD (Basic Display) or call up a pop-up window (Advanced Display) to allow editing of the value. No action is taken against a menu item until the ↵ button is pressed.

If a user presses the ↵ button to begin a data entry operation, they must press another button within 10 seconds or the transmitter firmware will assume that the user wants to abort the operation or has walked away from the transmitter. After 10 seconds with no action, the data entry will time out and the original value of the parameter will be preserved.

If no button presses occur within 60 seconds, menu access will time out and the transmitter will exit the menu and return to the PV display.

4.1.2 Data Entry

Data entry is performed from left to right. Select a character / digit by pressing ↑ or ↓ buttons, and then press ↵ to advance to the next character position to the right. Select the cross-hatch character ▒ to terminate the entry or if the final character is already a space character, just press ↵ again.

All numeric entries are clamped at the low or high limit if needed. You can determine the low and high limit for a parameter by selecting either the ▲ or ▼ character while the cursor is positioned over the left-most digit and press ↵ button. The Display will show the selected limit.

Table 5 – Three-Button Data Entry

Screen Symbol	Numeric data entry	Text entry
▲	Display the high limit for this parameter. This symbol only appears in the left-most position of the data entry field.	Not Available
▼	Display the low limit for this parameter. This symbol only appears in the left-most position of the data entry field.	Not Available
▒	Terminate the numeric entry	Terminate the text entry
0 thru 9, Minus, Decimal	These characters are used to enter numeric values. The minus sign only appears in the left-most digit.	These characters can be used to create custom tags and unit labels
A thru Z, 0 thru 9 special symbols	Not Available	These characters can be used to create custom tags and unit labels

4.1.3 Editing a Numeric Value

Editing a Numeric Value
Editing of a numeric value is a digit-by-digit process, starting with the left-most digit.

1. Press ↵ to begin the edit process.
2. The Basic Display will show the current value of the item on the lower line, left justified. The Advanced Display will show the current value of the item in a pop-up window in the middle of the screen
3. Press the ↑ or ↓ buttons to select the desired digit, and then press ↵ to advance to the next digit to the right.
4. After the last digit has been entered, press ↵ one more time to write the new value to the transmitter.

4.1.4 Selecting a new setting from a list of choices

Use the procedure described below to select a new setting for parameters that present a list of choices (e.g., Screen Format, Display Units, etc.).

1. Press ↵ to begin the edit process.
    a. The Basic Display will show the current setting of the item on the lower line, left justified.
    b. The Advanced Display will show the current setting of the item in a pop-up window.
2. Press the ↑ or ↓ buttons to scroll through the list of choices.
3. Press ↵ to make your selection. The new selection will be stored in the transmitter and will be displayed on the lower line, right justified.

4.1.5 The Advanced Display Menus

The Advanced Display menus are organized into three levels, as shown by Table 6. There is a **<Return>** menu item at each level that allows the user to return to the previous level.

Table 6 – Advanced Display Main Menu Structure

Level 1	Level 2	Level 3
<Exit>	n/a	n/a
Diagnostics	Critical Non-Critical	For details go to the Diagnostics Menu table
Display Setup	LCD Contrast Common Setup Screen 1 Screen 2 … Screen 8	For details go to the Display Setup Menu table. Note that the Advanced Display supports the configuration of up to 8 different screens.
Calibration	Cal Points Set Time Stamp S1 CVD Cal Pts S2 CVD Cal Pts S1 Cal Hi/Lo (HART only) S2 Cal Hi/Lo (HART only) Reset Cal 1&2 Corr (HART only) LRV/URV Reset Correct (DE only) DAC Trim (HART/DE) Loop Test (HART/DE)	For details go to the Calibration Menu table.
Transmtr Setup	Device Setup HART Setup HART Date Sensor Setup Sensor 1 CVD (HART/FF) Sensor 2 CVD (HART/FF) Digital Output (HART only) Range values (FF only) LRV (HART/DE) URV (HART/DE) MRV (HART only) Set LRV (HART/DE) Set URV (HART/DE) Dev Install Date (HART/FF) S1 Install Date (HART/FF) S2 Install Date (HART/FF)	For details go to the Transmitter Setup Menu table.
Information	Display Comm Module Sensor Module	For details go to the Information Menu table.

Table 7 –Diagnostics Menu

All Diagnostics menu items are Read Only.
All instances of #2 reference Dual Inputs

Critical	<Return>		
	Active Diags	# #	Description
	Sensor Module	OK FAULT	FAULT: There is a problem with the Sensor Module
	Comm Module	OK FAULT	FAULT: There is a problem with the Electronics Module (HART, DE, or Fieldbus)
	Sensor Comm	OK FAULT	FAULT: There is a problem with the interface between the Sensor Module and the Electronics Module.
	Input 1	OK FAULT	FAULT: There is a problem with the Input 1 sensor
	Input 2 (Dual Inputs only)	OK FAULT	FAULT: There is a problem with the Input 2 sensor
Non-Critical	<Return>		
	Active Diags	# #	Shows the number of Non-Critical Diagnostics that are currently active
	Cal 1 Correct	OK EXCESSIVE	EXCESSIVE: Input applied exceeds 5% of expected value
	Cal 2 Correct (Dual Inputs only) (HART/FF only)	OK EXCESSIVE	EXCESSIVE: Input applied exceeds 5% of expected value
	Sensor Temp	OK OUT OF RANGE	Electronics temperature is greater than 85 °C
	Input 1 Range	OK OUT OF RANGE	OUT OF RANGE: Input 1 temperature is greater than Sensor 1 URL or less than Sensor 1 LRL
	Input 2 Range (Dual Inputs only)	OK OUT OF RANGE	OUT OF RANGE: Input 2 temperature is greater than Sensor 2 URL or less than Sensor 2 LRL
	CJ Range	OK OUT OF RANGE	OUT OF RANGE: Cold Junction temperature is greater than 85C or less than -40C.
	Input 1	OK OPEN	OPEN: Input 1 is open.
	Input 2 (Dual Inputs only)	OK OPEN	OPEN: Input 2 is open.
	Input 1 TB5	OK OPEN	OPEN: Input 1 Terminal TB5 is open.

Non-Critical	Input 1 TB6	OK OPEN	OPEN: Input 1 terminal TB6 is open
	Input TB7	OK OPEN	OPEN: Input 2 Terminal TB7 is open (RTD and Ohm sensors only)
	Input 1 TB8	OK OPEN	OPEN: Input 1 terminal TB8 is open Applicable to RTD 4 wire configuration for Sensor 1 RTD or Sensor 1 Ohm input
	Input 2 TB8	OK OPEN	OPEN: Input 2 terminal TB8 is open Applicable to dual input model
	Input 2 TB9	OK OPEN	OPEN: Input 2 terminal TB9 is open Applicable to dual input model
	Factory Cal	OK NO FACTORY CAL	The transmitter has not been calibrated by the factory.
	Supply Voltage	OK LOW OR HIGH	LOW: Supply voltage is below the low specification limit. HIGH: Supply voltage is above the high specification limit.
	Comm Module Temp	OK OVER TEMP	OVER TEMP: Electronics temperature is greater than 85°C or less than -40°C.
	DAC Temp Comp HART/DE only	OK NO COMPENSATION	The DAC has not been compensated for temperature effects. This is a factory operation.
	Sensor Comm	OK SUSPECT	SUSPECT: The interface between the Temperature Sensor Module and the Electronics Module is experiencing intermittent communication failures.
	Display Setup HART only	OK NVM Corrupt	NVM Corrupt: The Display memory is corrupt.
	Excess: Delta (Dual Inputs only) (HART/FF only)	OK EXCESSIVE	EXCESSIVE: Delta value exceeds Delta Limit
	Internal Power (HART only)	OK LOW OR HIGH	LOW: Internal power is below 2.9V" and "HIGH: Internal power is above 3.2V.
	Digital Output	ON OFF	State of Digital Output

Table 8 –Display Setup Menus

<Return> Return to the Level 1 menu				
LCD Contrast	<Return>			
	Set Contrast	# #	Adjust the LCD contrast level. Range from 0 to 9. Default: 5	Press ↵ to enter menu selection ↑ and ↓ to select number. ↵ to enter and shift to next digit
Common Setup	<Return>			
	Set Password	####	Enter Display configuration password. Default: 0000. This value disables the password. All other values enable the password. When enabled, a prompt to enter the password is presented only on the first parameter successfully accessed to change after entering the menu.	
	Language	English, French, German, Spanish, Italian, Turkish, Russian	Select the language for the Display. Default: English	
	Rotation Time	# #	Time duration, in seconds, that each configured screen is shown before moving to the next screen. Range: 3 to 30 seconds Default: 10 seconds	
	Screen Rotate	Yes No	Select to enable or disable the automatic rotation of Screens	
	Units	°C, °F, °R, K	Select the ranging and calibration temperature units	
Screens 1 through 8	<Return>			
	Screen Format	None PV PV & Bar Graph PV & Trend	Select the Screen format from the list.	
	Trend Hours	##	Select the amount of historic data visible on the Trendscreen. Range: 1 to 999 hours (allows 31 days). Applies to the “PV & Trend” format only	
	PV Selection (HART/DE only)	Loop PV Sensor 1 Sensor 2 CJ Temperature Sensor 1 Resistance Sensor 2 Resistance Loop Output Percent Output	Select the Process Variable (PV) that will be shown on the screen. Sensor Resistance is only available for RTDs and will read 0 for thermocouples.	

Screens 1 through 8 *(continued ..)*	Display Units	ºR, K, ºC, ºF	Select the Display Units for the selected PV.	Press ↵ to enter menu selection ↑ and ↓ to select number. ↵ to enter and shift to next digit
	Custom Units DE/FF only	□□□□□□□□□□□□	Enter Custom Units using any alphanumeric value up to 14 characters long.	
	Decimals	None	Select the decimal resolution for the PV.	
		X.X		
		X.XX		
		X.XXX		
	Disp Low Limit	#########	Enter the lower limit shown on the Bar Graph or Trend screen	
	Disp High Limit	#########	Enter the upper limit shown on the Bar Graph or Trend screen.	
	Custom Tag	□□□□□□□□□□□□	Enter Custom Tag using any alphanumeric value up to 14 characters long.	

Table 9 –Calibration Menus

<Return> Return to the Level 1 menu				
Cal Points (HART/FF only)	**<Return>**			
	S1 Cal Lo Pt		Calibration low point for Sensor 1	
	S1 Cal Hi Pt		Calibration high point for Sensor 1	
	S2 Cal Lo Pt (Dual Inputs only)		Calibration low point for Sensor 2	
	S2 Cal Hi Pt (Dual Inputs only)		Calibration high point for Sensor 2	
Set Time Stamp (HART only)	**<Return>**			
	Hour	# #	These selections allow the user to enter a time stamp for the Zero Correct, LRV Correct, URV Correct, and Reset Corrects. This time stamp can be read via HART and Fieldbus communications.	Press ↵ to enter menu selection ↑ and ↓ to select number. ↑ and ↓ to select from list. ↵ to enter
	Minute	# #		
	Year	# # # #		
	Month	January thru December		
	Day	# #		
S1 CVD Cal Points (HART or FF) Applicable for Pt100, Pt200, Pt500 and Pt1000 RTDs only.	**<Return>**			
	S1 Cal Lo (Ω)		CVD Calibration low point for Sensor 1 (Ohms)	
	S1 Cal Hi (Ω)		CVD Calibration high point for Sensor 1 (Ohms)	
S2 CVD Cal Points (HART or FF) Applicable for Pt100, Pt200, Pt500 and Pt1000 RTDs only.	**<Return>**			
	S2 Cal Lo (Ω)		CVD Calibration low point for Sensor 2 (Ohms)	
	S2 Cal Hi (Ω)		CVD Calibration high point for Sensor 2 (Ohms)	

S1 Cal Lo Corr (HART only)	**<Return>**		
	Do S1 Cal Lo	Executing this selection corrects the Input 1 Calibration Low Point based on the input measurement. The current live value of the Input 1 Sensor is shown on this display so the user can easily see the effect of the correction.	Press ↲ to enter menu selection Scroll to Do Cal Press ↲ to initiate
S1 Cal Hi Corr (HART only)	**<Return>**		
	Do S1 Cal Hi	Executing this selection corrects the Input 1 Calibration High Point based on the input measurement. The current live value of the Input 1 Sensor is shown on this display so the user can easily see the effect of the correction.	Press ↲ to enter menu selection Scroll to Do Cal Press ↲ to initiate
S2 Cal Lo Corr (Dual Inputs only) (HART only)	**<Return>**		
	Do S2 Cal Lo	Executing this selection corrects the Input 2 Calibration Low Point based on the input measurement. The current live value of the Input 2 sensor is shown on this display so the user can easily see the effect of the correction.	Press ↲ to enter menu selection Scroll to Do Cal Press ↲ to initiate
S2 Cal Hi Corr (Dual Inputs only) (HART only)	**<Return>**		
	Do S2 Cal Hi	Executing this selection corrects the Input 2 Calibration High Point based on the input measurement. The current live value of the Input 2 sensor is shown on this display so the user can easily see the effect of the correction.	Press ↲ to enter menu selection Scroll to Do Cal Press ↲ to initiate
Reset Cal 1 Corr (HART only)	**<Return>**		
	Reset S1 Corr	Executing this selection resets the Sensor 1 and calibrations back to Factory values.	Press ↲ to enter menu selection Scroll to Reset Cals Press ↲ to initiate
Reset Cal 2 Corr (Dual Inputs only) (HART only)	**<Return>**		
	Reset S2 Corr	Executing this selection resets the Sensor 2 calibrations back to Factory values.	Press ↲ to enter menu selection Scroll to Reset Corrects Press ↲ to initiate
LRV Correct (DE only)	**<Return>**		
	Do LRV Correct	Executing this selection corrects the LRV based on the input pressure. The current live value of the primary pressure input is shown on this display so the user can easily see the effect of the LRV correction.	Press ↲ to enter menu selection Scroll to Do LRV Correct Press ↲ to initiate
URV Correct (DE only)	**<Return>**		
	Do URV Correct	Executing this selection corrects the URV based on the input pressure. The current live value of the primary pressure input is shown on this display so the user can easily see the effect of the URV correction.	Press ↲ to enter menu selection Scroll to Do URV Correct Press ↲ to initiate

Reset Corrects (DE only)	**<Return>**		
	Reset Corrects	Executing this selection Resets the Zero, LRV, and URV Corrects back to Factory values	Press ↵ to enter menu selection Scroll to Reset Corrects Press ↵ to initiate
DAC Trim Note: Loop must be removed from Automatic Control (HART/DE only)	**<Return>**		
	Trim Zero	This selection will calibrate the loop zero output to 4.000 mA Connect a current meter to the transmitter to monitor the loop output. When you press Enter, the transmitter will set the loop output to 4 mA. When the prompt “Enter reading” appears, enter the value shown on the current meter (in milliamps) and press Enter again. The transmitter will adjust the DAC output to 4mA.	Press ↵ to enter menu selection Scroll to Trim Zero or Trim Span Press ↵ to initiate ↑ and ↓ to select number. ↵ to enter and shift to next digit
	Trim Span	This selection will calibrate the loop span output to 20.000 mA Connect a current meter to the transmitter to monitor the loop output. When you press Enter, the transmitter will set the loop output to 20 mA. When the prompt “Enter reading” appears, enter the value shown on the current meter (in milliamps) and press Enter again. The transmitter will adjust the DAC output to 20 mA.	
	Set DAC Normal	This selection allows the loop to be returned to its Normal mode (Automatic Control) after performing the Trim operation.	Press ↵ to enter menu selection Scroll to Set DAC Normal Press ↵ to initiate
Loop Test Note: Loop must be removed from Automatic Control (HART/DE only)	**<Return>**		
	Set DAC Output	This selection allows the user to force the DAC output to any value between 3.8 and 20.8 mA. Note: This selection will put the DAC into Fixed Output Mode.	Press ↵ to enter menu selection Scroll to Set DAC Output Press ↵ to initiate ↑ and ↓ to select number. ↵ to enter and shift to next digit
	Set DAC Normal	This selection allows the loop to be returned to its Normal mode (Automatic Control) after performing the Set DAC Output operation	Press ↵ to enter menu selection Scroll to Set DAC Normal Press ↵ to initiate

Table 10 –Transmitter Setup Menus

<Return> Return to the Level 1 menu				
	<Return>			
Device Setup	Tag ID (HART/DE only)	□□□□□□□□	Enter Tag ID name up to 8 characters long. □ = any Alphanumeric value	Press ↵ to enter menu selection ↑ and ↓ to select Alphanumeric ↵ to enter and shift to next character to the right.
	Damping (sec) (HART/DE only)	##. #	Selection applies digital filtering to suppress noise effects on the PV. The limits for this value are 0.0 to 32.0 seconds	
	NAMUR Output (HART/DE only)	Disabled	Disabling sets the loop output and burnout levels to the Honeywell levels	
		Enabled	Enabling sets the loop output and burnout levels to the NAMUR levels	
	Loop Ctrl Mode (Dual Inputs only) (HART/DE only) (Read only for DE)	Average, Differential, Sensor 1, Sensor 2, Split-Range, Redundant	Mode of Loop control	
	Loop Ctrl Src (HART only)	Sensor 1, Sensor 2	Input sensor currently controlling the Loop	
	Delta Limit (Dual Inputs only) (HART/FF only)	####.##	User can configure the Delta Limit. If the Critical Excess Delta Detection has also been enabled, the critical fault will be set when the PV Delta (Sensor 1-Sensor 2 value) exceeds the Delta Limit."	
	Bumpless Damping (HART/FF only)	##.#	Damping value for the transition of Loop Control between Sensors when Loop Ctrl Mode is Split-Range or Redundant	
	Hysteresis (Dual Inputs only) (HART/FF only)	###.##	Hysteresis value relative to the MRV for the transition of Loop Control between Sensors when Loop Ctrl Mode is Split-Range	
	Break Detect*	Enable, Disable	When enabled, adds a constant bias value to the Sensor 2 measured value to equate it to the Sensor 1 measured value at the moment selected.	

* Spurious readings may occur if Break Detect is off in delta mode

<table>
<tr><td rowspan="7">Device Setup</td><td>Match PVs (Dual Inputs only) (HART/FF only)</td><td></td><td>Match PVs value for when Loop Ctrl Mode is in Redundant mode</td><td rowspan="7">Press ↵ to enter menu selection
↑ and ↓ to select Alphanumeric
↵ to enter and shift to next character to the right.</td></tr>
<tr><td>Latching</td><td>Enabled, Disabled</td><td>When enabled, causes all critical sensor input failures to latch to the Critical Fault state. The fault may only be cleared by device reset. When disabled, the critical sensor input failure will be cleared if the input recovers.</td></tr>
<tr><td rowspan="4">CJ Source</td><td colspan="2">Determines the source of the Cold Junction compensation for Thermocouple Sensor types. Valid range of -40 to +85°C. Out of Range warning generated for temperatures between -45 and -50°C and between +85 and +90°C. Suspect Input failure generated for temperatures below -50°C and above +90°C</td></tr>
<tr><td>Internal</td><td>Uses internal CJ sensor.</td></tr>
<tr><td>External</td><td>Uses a Pt100 RTD on Input 2 as the CJ source.</td></tr>
<tr><td>Fixed</td><td>User configurable value for CJ temperature.</td></tr>
<tr><td>Fixed CJ Value</td><td>####.##</td><td>When CJ Type is Fixed, specifies the Cold Junction temperature value for thermocouple Sensor types. Degrees Celsius. Range of -50.0°C to 90.0°C</td></tr>
<tr><td rowspan="10">HART Setup (HART only)</td><td colspan="4"><Return></td></tr>
<tr><td colspan="4">Disabled when Loop Control Mode is disabled</td></tr>
<tr><td>Device ID</td><td colspan="2">Unique for each device</td><td>Read Only</td></tr>
<tr><td>Universal Rev</td><td colspan="2">HART Revision</td><td>Read Only</td></tr>
<tr><td>Field Device Rev</td><td colspan="2">For DD/DTM compatibility</td><td>Read Only</td></tr>
<tr><td>Final Assy Num</td><td colspan="2">Asset tracking number</td><td></td></tr>
<tr><td>Loop mA</td><td colspan="2">Disabled for Multidrop</td><td></td></tr>
<tr><td>Poll Address</td><td colspan="2">0 (default) to 63</td><td></td></tr>
<tr><td>PV Units</td><td colspan="2">Units of transmitted PV</td><td></td></tr>
<tr><td>SV Units</td><td colspan="2">Units of transmitted SV</td><td></td></tr>
<tr><td rowspan="5">HART Date (HART only)</td><td colspan="4"><Return></td></tr>
<tr><td>Year # # # #</td><td colspan="2">Enter the current year</td><td></td></tr>
<tr><td>Month</td><td>January through December</td><td>Select the current month</td><td></td></tr>
<tr><td>Day # #</td><td>Enter the day of the month</td><td>Select the current day</td><td></td></tr>
<tr><td>Write Date</td><td>Press ENTER to write the HART Date to the Transmitter</td><td></td><td></td></tr>
</table>

Sensor Setup	**<Return>**			
	Sensor 1 Type	mV, TC, RTD, Ohm	Select Sensor Type1. Database updates take 30 seconds to complete. Do not interrupt power.	Press ↵ to enter menu selection ↑ and ↓ to select entry. ↵ to enter
	Sensor 1 ID (HART/FF only)	Sensor ID for Input 1	Select Sensor ID for Input n for selected Sensor Type. (Input 1 selection or dual input model). See Note 1. Database updates take 30 seconds to complete. Do not interrupt power.	
	Sensor 2 Type (Dual Inputs only) (HART/FF only)	mV, TC, RTD, Ohm	Select Sensor Type. Database updates take 30 seconds to complete. Do not interrupt power.	
	Sensor 2 ID (Dual Inputs only) (HART/FF only)	Sensor ID for Input 2	Select Sensor ID for Input n for selected Sensor Type. (Input 1 selection or dual input model) See Note 1. Database updates take 30 seconds to complete. Do not interrupt power.	
	S1 Type (HART/FF only)	2-Wire, 3-Wire, 4-Wire	Select the number of lead wires for Sensor 1	
	S1 Lead Res (HART/FF only)	####.##	Sensor 1 lead wire resistance valve	
	Sensor 1 Bias (HART/FF only)	####.##	Bias on the measured value for Sensor 1	
	S2 Type (Dual Inputs only) (HART/FF only)	2-Wire, 3-Wire, 4-Wire	Select the number of lead wires for Sensor 2	
	S2 Lead Res (Dual Inputs only) (HART/FF only)	####.##	Sensor 2 lead wire resistance valve. (only if RTD type is 2 wire)	
	Sensor 2 Bias (Dual Inputs only) (HART/FF only)	####.##	Bias on the measured value for Sensor 2	
Sensor 1 CVD (HART or FF) Applicable for Pt100, Pt200, Pt500 and Pt1000 RTDs only.	Sensor 1 CVD	Enabled, Disabled	Callendar - van Dusen RTD coefficients for Sensor 1. See Note 1	
	Sensor 1 R0	####.####	Resistance at 0°C CVD coefficient. See Note 1	Press ↵ to enter menu selection ↑ and ↓ to select entry. ↵ to enter
	Sensor 1 Alpha	#.#########	Alpha CVD coefficient	
	Sensor 1 Delta	#.######	Delta CVD coefficient	
	Sensor 1 Beta	#.#######	Beta CVD coefficient	
	Write S1 CVD	Press ENTER to write all Sensor 1 CVD coefficients to the transmitter		

Sensor 2 CVD (HART or FF) Applicable for Pt100, Pt200, Pt500 and Pt1000 RTDs only.	Sensor 2 CVD	Enabled, Disabled	Callendar - van Dusen RTD coefficients for Sensor 2. See Note 1	
	Sensor 2 R0	####.####	Resistance at 0°C CVD coefficient	Press ↵ to enter menu selection ↑ and ↓ to select entry. ↵ to enter
	Sensor 2 Alpha	#.#########	Alpha CVD coefficient	
	Sensor 2 Delta	#.######	Delta CVD coefficient	
	Sensor 2 Beta	#.#######	Beta CVD coefficient	
	Write S2 CVD	Press ENTER to write all Sensor 2 CVD coefficients to the transmitter		
Digital Output (HART only)	**<Return>**			
	Physical DO	Yes, No	Presence of physical DO	Read Only
	Alarm Type 1	None	Type of Alarm • None • PV High • PV Low • Critical Diagnostic • Redundant Input Active • Rate of Change* • Deviation*	*Available only with Advanced Diagnostics Option. See Note 2 below
	Alarm Type 2	None	Type of Alarm • None • PV High • PV Low • Critical Diagnostic • Redundant Input Active • Rate of Change* • Deviation*	*Available only with Advanced Diagnostics Option. See Note 2 below
	Setpoint 1	####.#	Setpoint for PV High/Low Alarm Type 1.	Press ↵ to enter menu selection ↑ and ↓ to select Alphanumeric ↵ to enter and shift to next character to the right.
	Setpoint 2	####.#	Setpoint for PV High/Low Alarm Type 2.	
	Alarm Hysteresis	###.##	Hysteresis in percent of PV range where alarm activates. Applies to PV High/Low, Rate of Change and Deviation alarm types.	
	Deviation	###.#	Deviation above or below setpoint. Available only with Advanced Diagnostics Option.	
	Alarm Latching	Enable, Disable, Clear	Latching state of active alarm. Clear is a momentary selection that clears a latched alarm if the alarm condition no longer exists.	
	Alarm Blocking	Enable, Disable	Suppresses alarm until after the first occurrence of any alarm condition after power on. Applies to PV High/Low, Rate of Change and Deviation alarm types.	

Range Values (FF only)	Type (Dual Inputs only)	Sensor 1, Sensor 2, Average, Differential, Redundant, Split Range	The range for the selected type is shown	Press ↵ to enter menu selection ↑ and ↓ to select entry. ↵ to enter
	LRV	####.##	Lower Range value for Type selected	
	URV	####.##	Upper Range value for Type selected	
	MRV (Dual Inputs only)	####.##	Middle Range value (Applicable for Split Range type only)	
	Units	°C, °F, °R, K		Read only
LRV (HART/DE only)	**<Return>**			
	###. ##	The limit for the Lower Range Value is the Lower Range Limit (LRL) of the selected Sensor ID.		Press ↵ to enter menu selection ↵ to execute
URV (HART/DE only)	**<Return>**			
	###. ##	The limit for the Upper Range Value is the Upper Range Limit (URL) of the selected Sensor ID.		Press ↵ to enter menu selection ↵ to execute
MRV (Dual Inputs only) HART only	**<Return>**			
	###.##	Limits are the minimum URL and maximum LRL of the selected Sensor 1 and Sensor 2 IDs. Determines the point of transition of Loop Control between Sensor 1 and Sensor 2 for Split-Range Loop Control Mode.		Press ↵ to enter menu selection ↵ to execute
Set LRV (HART/DE only)	**<Return>**			
	ATTENTION: Executing this service will set the Lower Range Value (LRV) equal to the Input 1 measurement			Press ↵ to enter menu selection ↵ to execute
Set URV (HART/DE only)	**<Return>**			
	ATTENTION: Executing this service will set the Upper Range Value (URV) equal to the Input 1 measurement			Press ↵ to enter menu selection ↵ to execute

Note 1: Changing the RTD ID (Pt100, Pt200, Pt500, Pt1000) will automatically disable CVD and set the CVD coefficients to their default values for the RTD type selected.

Note 2: The Setpoint for the Rate of Change Alarm is configured in terms of PV change per minute. The STT850 monitors the PV change as a rolling window two seconds long and pro-rates this value in terms of PV change per minute. If the rate of change measured during any two second window exceeds the configured Setpoint value then the alarm will turn on. If Alarm Latching is disabled, then once the rate of change value falls below the configured Setpoint and Hysteresis values, the alarm will turn off. If latching is enabled, then the alarm will not turn off until the unit is reset or the alarm is cleared via the Alarm Latching Clear function.

<table>
<tr><td rowspan="7">Dev Install Date
(HART/FF only)</td><td colspan="4"><Return></td></tr>
<tr><td>Year
HART only</td><td># # # #</td><td>Enter the current year.
This item will only be visible if no Install Date has been written to the transmitter.</td><td></td></tr>
<tr><td>Month
HART only</td><td>January through December</td><td>Select the current month.
This item will only be visible if no Install Date has been written to the transmitter.</td><td></td></tr>
<tr><td>Day HART only</td><td># #</td><td>Enter the day of the month.
This item will only be visible if no Install Date has been written to the transmitter.</td><td></td></tr>
<tr><td>Install Date</td><td>dd-mm-yyyy</td><td>If no Install Date has been set in the transmitter, this value is a preview of the Year, Month, and Day entered above. Otherwise, this is the Install Date that was previously written to the transmitter.</td><td></td></tr>
<tr><td>Write Date
HART only</td><td colspan="2">Press ENTER to write the Install Date to the transmitter.

<u>CAUTION</u>: The Install Date can only be written once in the life of the transmitter. You cannot erase or overwrite the Install Date once it has been written.</td><td></td></tr>
<tr></tr>
<tr><td rowspan="5">S1 Install Date
(HART/FF only)</td><td colspan="4"><Return></td></tr>
<tr><td>Year</td><td># # # #</td><td>Enter the current year.
This item will only be visible if no Install Date has been written to the transmitter.</td><td></td></tr>
<tr><td>Month</td><td>January thru December</td><td>Select the current month.
This item will only be visible if no Install Date has been written to the transmitter.</td><td></td></tr>
<tr><td>Day</td><td># #</td><td>Enter the day of the month.
This item will only be visible if no Install Date has been written to the transmitter.</td><td></td></tr>
<tr><td>Write Date</td><td colspan="2">Press ENTER to write the Install Date to the transmitter.</td><td></td></tr>
<tr><td rowspan="5">S2 Install Date
(Dual Inputs only)
(HART/FF only)</td><td colspan="4"><Return></td></tr>
<tr><td>Year</td><td># # # #</td><td>Enter the current year.
This item will only be visible if no Install Date has been written to the transmitter.</td><td></td></tr>
<tr><td>Month</td><td>January thru December</td><td>Select the current month.
This item will only be visible if no Install Date has been written to the transmitter.</td><td></td></tr>
<tr><td>Day</td><td># #</td><td>Enter the day of the month.
This item will only be visible if no Install Date has been written to the transmitter.</td><td></td></tr>
<tr><td>Write Date</td><td colspan="2">Press ENTER to write the Install Date to the transmitter.</td><td></td></tr>
</table>

Table 11 –**Information Menus**

<Return> Return to the Level 1 menu			
Display	**<Return>**		
	Firmware Version	The firmware version of the Display Module	Read Only
Comm Module	**<Return>**		
	Firmware Version	The firmware version of the Electronics Module	Read Only
	Software Rev (HART/DE only)	The firmware version number of the Electronics Module as displayed via the HART and DE protocols	Read Only
	Protocol	The communications protocol of the transmitter: • HART: HART protocol • DE: Honeywell DE protocol • FF: Foundation Fieldbus	Read Only
	Serial Number (FF only)	Serial number of the Fieldbus Comms module	Read Only
Sensor Module	**<Return>**		
	Firmware Version	The firmware version of the Sensor Module	Read Only
	Model Key	Identifies the type and range of the transmitter	Read Only
	Units	The Engineering Units for the LRL and URL. Note that you can change these Units from the Transmitter Setup menu, if desired (Transmitter Setup\Parameters\Units)	Read Only
	S1 LRL	The Lower Range Limit of the Input 1 Sensor	Read Only
	S1 URL	The Upper Range Limit of the Input 1 Sensor	Read Only
	S2 LRL (Dual Inputs only) (HART/FF only)	The Lower Range Limit of the Input 2 Sensor	Read Only
	S2 URL (Dual Inputs only) (HART /FF only)	The Upper Range Limit of the Input 2 Sensor	Read Only

4.1.6 The Basic Display Menu

The Basic Display Menu is implemented as one long single-level menu and will “wrap around” when it reaches the start or end of the menu. Operation is as follows:

Press the ↵ button to call up the Menu.

1. Select <**Exit Menu**> and press ↵ to exit the Menu.
2. Use the ↑ and ↓ buttons to scroll through the list of menu items.
3. Press the ↵ button to select an item for data entry or activation. When an item is selected for data entry or activation, the cursor will jump to the lower line of the LCD to allow editing of the value. No action is taken against a menu item until the user presses the ↵ button.
4. If you want to abort a data entry operation, simply refrain from pushing any buttons for 10 seconds; the data entry operation will time out and the original value of the selected item will be preserved.

Table 12 – The Basic Display Menus

'#' in "Screen #" indicates the screen numbers 1, 2, 3, 4, 5, 6, 7, 8
'n' in "Sensor n" indicates the Input numbers 1, 2

<table>
<tr><td>LCD Contrast</td><td>»»»»»</td><td>Adjust the LCD contrast level.
Range from » (1) to »»»»»»»»» (9)
Default: »»»»»»» (7)</td><td rowspan="12">Press ↵ to enter menu selection

↑ and ↓ to select entry.
↵ to enter</td></tr>
<tr><td>Rotation Time</td><td></td><td></td></tr>
<tr><td>Screen Rotate</td><td>Enabled
Disabled</td><td>Select to enable or disable the automatic rotation of Screens</td></tr>
<tr><td>Select Screen (HART/DE)</td><td>1 through 8</td><td>Select Screen to configure.</td></tr>
<tr><td>Screen # (HART/DE)</td><td>Enabled/Disabled</td><td>Select to enable or disable the screen for display and configuration</td></tr>
<tr><td>Screen # PV (HART/DE)</td><td>Loop PV
Sensor 1
Sensor 2
CJ Temperature
Sensor 1 Resistance
Sensor 2 Resistance
Loop Output
Percent Output</td><td>Select the Process Variable (PV) that will be shown on the screen.
Sensor Resistance is only available for RTDs and will read 0 for thermocouples</td></tr>
<tr><td rowspan="4">Screen Decimal (HART/DE)</td><td>None</td><td rowspan="4">Select the PV decimal resolution to be shown on selected screen from list.</td></tr>
<tr><td>X.X</td></tr>
<tr><td>X.XX</td></tr>
<tr><td>X.XXX</td></tr>
<tr><td>Screen Units (HART/DE) (Writable only for TC/RTD inputs)</td><td>°C, °F,°R, K</td><td>Choose appropriate engineering units from list</td></tr>
<tr><td>Range/Cal Units (HART/DE/FF) (Visible for TC and RTD inputs only)</td><td>°C, °F, °R, K</td><td>Select the ranging and calibration temperature units</td></tr>
</table>

Select Input (HART/FF) (Dual input only)	1, 2	Select Input number to configure, referred to as "n" in subsequent menu items	Press ↵ to enter menu selection ↑ and ↓ to select entry. ↵ to enter
Sensor n Type (FF read only)	mV, TC, RTD, Ohm	Select Sensor Type. Database updates take 30 seconds to complete. Do not interrupt power.	
Sensor n ID (HART/FF) (FF read only)	Sensor Identifier	Select Sensor ID for Input n for selected Sensor Type. (Input 1 selection or dual input model). Database updates take 30 seconds to complete. Do not interrupt power.	
Sens n Wire Type (HART/FF) (FF read only)	2-Wire, 3-Wire, 4-Wire	Select the number of lead wires for RTD and Ohm sensors.	
Sens nLead (HART/FF) (FF read only)	####.##	Sensor lead wire resistance value. (only if RTD type is 2 wire)	
Sensor n Bias (HART/FF) (FF read only)	####.##	Bias on the measured value	
Sens n Cal Lo Pt (HART/FF) (FF read only)	####.##	Calibration low point for Sensor n	
Sens n Cal Hi Pt (HART/FF) (FF read only)	####.##	Calibration high point for Sensor n	
Do Sens n Cal Lo (HART/DE)	Confirm	Executing this selection corrects the Cal Low Point based on the input measurement	
Do Sens n Cal Hi (HART/DE)	Confirm	Executing this selection corrects the Cal High Point based on the input measurement	
Sensor n LRV (FF only)	####.##	Lower Range Value representing 0% output	Read Only Parameter
Sensor n URV (FF only)	####.##	Upper Range Value representing 100% output	Read Only Parameter
Reset Sens n Cal (HART/DE)	Confirm	Executing this selection Resets the LRV, and URV Corrects back to Factory values	Press ↵ to enter menu selection ↑ and ↓ to select entry. ↵ to enter
Sensor n CVD (HART or FF) Applicable for Pt100, Pt200, Pt500 and Pt1000 RTDs only.	Enabled, Disabled	Callendar - van Dusen RTD coefficients for Sensor n	
Match PVs (HART only)	Enabled, Disabled	For Redundant Loop Control Mode. When enabled, adds a constant bias value to the Sensor 2 measured value to equate it to the Sensor 1 measured value at the moment selected.	

Break Detect (FF read only)	Enabled, Disabled	Enable or disable detection of Input wire break	Press ↵ to enter menu selection ↑ and ↓ to select entry. ↵ to enter
Latching (FF read only)	Enabled, Disabled	When enabled, causes all critical sensor input failures to latch to the Critical Fault state. The fault may only be cleared by device reset. When disabled, the critical sensor input failure will be cleared if the input recovers.	
CJ Type (FF read only)	Internal, External, Fixed	Determines the source of the Cold Junction compensation for thermocouple Sensor types.	
Fixed CJ Value (FF read only)	####.##	When CJ Type is Fixed, specifies the Cold Junction temperature value for thermocouple Sensor types. Degrees Celsius. Fixed CJ temperatures below -50 degrees have no effect on measured values.	
Loop Ctrl Mode (HART/DE) (DE read only) (Dual input only)	Average, Difference, Sensor 1, Sensor 2, Split-Range, Redundant	Mode of Loop control	
Loop Source (HART/DE) (Dual input only)	Sensor 1, Sensor 2	Input sensor currently controlling the Loop	Read Only Parameter
LRV (HART/DE) URV (HART/DE)	#. ## #. ##	The limits are: the Lower Range Limit (LRL) and the Upper Range Limit (URL) of the selected Sensor 1 ID	Press ↵ to enter menu selection ↑ and ↓ to select digit. ↵ to enter
Set LRV (HART/DE)	Set Lower Range Value	ATTENTION: Executing this service will set the Lower Range Value (LRV) equal to the input pressure	
Set URV (HART/DE)	Set Upper Range Value	ATTENTION: Executing this service will set the Upper Range Value (URV) equal to the input pressure	
MRV (HART/FF) (FF read only)	Set Middle Range Value	Limits are the minimum URL and maximum LRL of the selected Sensor 1 and Sensor 2 IDs. Determines the point of transition of Loop Control between Sensor 1 and Sensor 2 for Split-Range Loop Control Mode.	
Hysteresis (HART/FF) (FF read only)	###.##	Hysteresis value relative to the MRV for the transition of Loop Control between Sensors when Loop Ctrl Mode is Split-Range	
Bumpless Damping (HART/FF) (FF read only)	##.#	Damping value for the transition of Loop Control between Sensors when Loop Ctrl Mode is Split-Range or Redundant	
Damping (HART/DE)	#. ##	Selection applies digital filtering to suppress noise effects on the PV. The limits for this value are 0.0 to 32.0 seconds	

NAMUR Output (HART/DE)	Enabled Disabled	Disabling sets the loop output and burnout levels to the Honeywell levels	Press ↵ to enter menu selection ↑ and ↓ to select entry. ↵ to enter
DAC Zero Trim (HART/DE) Note: Loop must be removed from Automatic Control	DAC Zero Trim	This selection allows the loop zero output 4mA value to be trimmed. Note: You must connect a current meter to the transmitter to monitor the loop output.	
DAC Span Trim (HART/DE) Note: Loop must be removed from Automatic Control	DAC Span Trim	This selection allows the loop span output 20mA value to be trimmed. Note: You must connect a current meter to the transmitter to monitor the loop output.	
Loop Test (HART/DE) Note: Loop must be removed from Automatic Control	Loop Test 12.000	This selection allows the user to force the DAC output to any value between 3.8 and 20.8 mA. Note: This selection will put the DAC into Fixed Output Mode, as indicated by the flashing output value. Navigation away from this menu item will return the loop to Normal (Automatic) Mode.	
Alarm Type 1	None PV High PV Low Critical Diagnostic Redundant Input Active Rate of Change* Deviation* (*Available only with Advanced Diagnostics Option).	Type of alarm.	Read Only Parameter
Alarm Type 2			
Tag ID (HART/DE)	□□□□□□□□	Enter Tag ID name up to 8 characters long. □ = any Alphanumeric value	Press ↵ to enter menu selection ↑ and ↓ to select entry. ↵ to enter
HART Device ID (HART only)	Unique for each device	Unique ID for device	Read Only Parameter
HART PV Units (HART only)	Units of transmitted PV	Units for the Primary Variable (Writable - for TC/RTD inputs Read only - mV and Ohm)	Press ↵ to enter menu selection
HART SV Units (HART only)	Units of transmitted SV	Units for the Secondary Variable	

Install Date (HART only)	DD MM YYYY	This selection allows the user to enter the date a transmitter is installed. The Install Date is entered in sequence of Day, Month, and Year, followed by the new date and the prompt Write Date to confirm the entry. CAUTION: The Install Date can only be written once in the life of the Transmitter. You cannot erase or overwrite the Install Date once it has been written.	↑ and ↓ to select entry. ↲ to enter
Firmware	Display Electronics Sensor	Menu item shows the current Firmware versions of the Display, Electronics Module and the Sensor Module	Read Only Parameter
Protocol	HART, DE, FF	Menu item shows the communications protocol	Read Only Parameter
Model Key (HART/FF)		Identifies the type and range of the transmitter	Read Only Parameter
<Exit Menu>			

4.1.7 Selecting a new setting from a list of choices

Use the procedure described below to select a new setting for parameters that present a list of choices (e.g., PV Display, Temperature Units, etc.)

1. Press ↲ to begin the edit process. The Basic Display will show the current setting of the item on the lower line, left justified.
2. Press the ↑ or ↓ buttons to scroll through the list of choices.
3. Press ↲ to make your selection. The new selection will be stored in the transmitter and displayed on the lower line, right justified.

1.18. Three Button Operation with no Display Installed

When there is no Display installed, the buttons can be used to perform a Zero or Span adjustment of the Transmitter. Caution should be taken to insure these adjustments are only made when the correct input values are applied. This feature is not available in the Fieldbus transmitter variant.

4.1.8 Zero Adjustment

This adjustment is the same as performing a Set LRV using the Display.

1. Connect a current meter or voltmeter as shown in Figure 13 to monitor the PV output of the Transmitter.
2. Using an accurate input source, apply a signal equivalent to the Transmitter LRV.
3. Press the Down (↓) and Zero (↑) buttons together to set the Zero.
4. Verify that the output is now 4 mA.

4.1.9 Span Adjustment

This adjustment is the same as performing a Set URV using the Display.

1. Connect a current meter or voltmeter as shown in Figure 13 to monitor the PV output of the Transmitter.
2. Using an accurate input source, apply a signal equivalent to the desired Upper Range Value of the transmitter.
3. Press the **Down (↓)** and **Span** (↵) buttons together to set the span.
4. Verify that the PV output is now 20 mA.

You can also use the MCT 202 Toolkit to make any adjustments to an STT850 SmartLine Temperature Transmitter. Alternately, certain adjustments are possible through an Experion Station or Universal Station, if the STT850 is digitally integrated with either of these stations.

1.19. Changing the Default Failsafe Direction

For HART or DE the transmitters are shipped with a default failsafe direction of upscale. This means that the Transmitter output will set the current output to upscale failsafe (maximum output) upon detection of a critical status. You can change the direction from upscale failsafe to downscale failsafe (minimum output) by moving the top jumper located in the Electronics module.

4.1.10 DE and Analog Differences

Failsafe operation is somewhat different between DE and analog operation:

- **Analog operation** – Upscale failsafe drives the Transmitter output to 21.8 mA. Downscale failsafe drives the Transmitter output to 3.6 mA.
- **DE operation** – Upscale failsafe causes the Transmitter to generate a **+ infinity** digital signal. Downscale failsafe causes the Transmitter to generate a **– infinity** digital signal.

The Transmitter electronics module interprets either signal as *not-a-number* and initiates its own configured failsafe action for the control system.

4.1.11 Procedure to Establish Failsafe Operation

The failsafe direction display accessible via the Toolkit shows only the state of the jumper as it correlates to analog Transmitter operation. Failsafe action for the DE control system may be configured to operate in a manner different from analog, as indicated by the state of the Transmitter jumper.

The integrated circuits in the Transmitter PWA are vunerable to damage by stray static discharges when removed from the Electronics Housing. Minimize the possibility of static discharge damage when handling the PWA as follows:

Do not touch terminals, connectors, component leads, or circuits when handling the PWA.

When removing or installing the PWA, handle it by its edges or bracket section only. If you need to touch the PWA circuits, be sure you are grounded by staying in contact with a grounded surface or by wearing a grounded wrist strap.

When the PWA is removed from the Transmitter, put it in an electrically conductive bag, or wrap it in aluminum foil to protect it.

The following procedure outlines the steps for positioning the write protect and failsafe jumpers on the electronics module. See Figure 15 for the locations of the failsafe and write protect jumpers.

Note: The Fieldbus variant has simulation and write protect jumpers in the same location and their positions are described in Table 14**Error! Reference source not found.**. See Section 4.1.12, Write Protect Jumper on Foundation Fieldbus (FF)

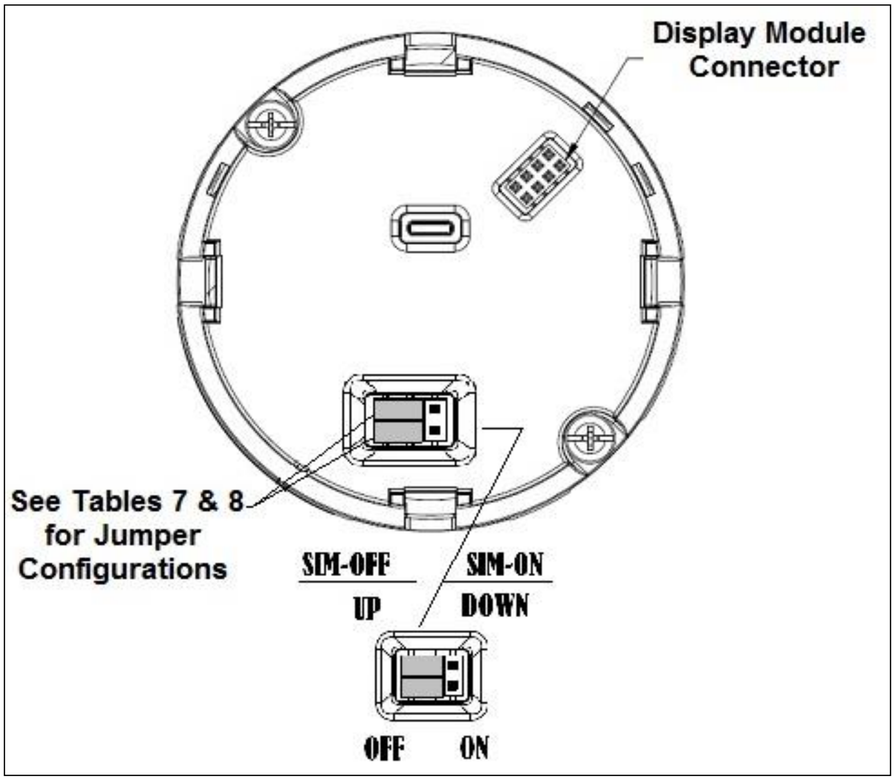
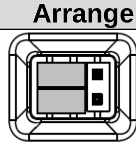
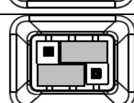
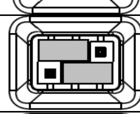
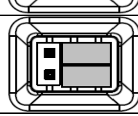


Figure 15 – Locating the Failsafe and Write Protect Jumpers

Table 13 – HART and DE Failsafe and Write Protect Jumpers

Jumper Arrangements	Description
	Failsafe = UP (High) Write Protect = OFF (Not Protected)
	Failsafe = DOWN (Low) Write Protect = OFF (Not Protected)
	Failsafe = UP (High) Write Protect = ON (Protected)
	Failsafe = Down (Low) Write Protect = On (Protected)

1. Turn OFF Transmitter power (Power removal is only required in accordance with area safety approvals. Power removal is only required in Class 1 Div 1 Explosionproof and Class 1 Div 2 environments).
2. Loosen the end cap lock, and unscrew the end cap from the electronics side of the Transmitter housing.
3. If equipped with a Display module, carefully depress the two tabs on the sides of the Display Module, and pull it off.

4. If necessary, unplug the interface connector from the Communication module. Do not discard the connector.

5. Set the Failsafe Jumper (top jumper) to the desired position (UP or DOWN). See Table 13 and Figure 15 for jumper positioning.

6. If applicable, re-install the Display module as follows:

    - Orient the display as desired.
    - Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.
    - Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

NOTE: Installing a Display Module into a powered transmitter may cause a temporary upset to the loop output value.

Orient the Display for proper viewing through the end cap window. You can rotate the meter mounting orientation in 90 º increments.

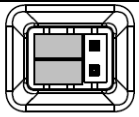
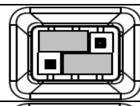
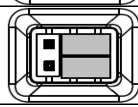
7. Restore transmitter power if removed.

4.1.12 Write Protect Jumper on Foundation Fieldbus (FF)

On Foundation Fieldbus transmitters there is no Failsafe jumper selection but there is a Write Protect jumper. The bottom jumper sets the Write Protect. The default setting is OFF (Un-protected). When set to the On (Protected) position, Changed configuration parameters cannot be written to the transmitter. When set to the OFF (Un-protected) position, Changed configuration parameters can be written to the transmitter.

	ATTENTION: Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices.
	WARNING! PERSONAL INJURY: Risk of electrical shock. Disconnect power before proceeding. HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible. Failure to comply with these instructions could result in death or serious injury.
Step	Action
1	Turn OFF Transmitter power.
2	Loosen the end-cap lock, and unscrew the end cap from the Electronics side of the Transmitter housing.
3	If applicable, carefully depress the tabs on the sides of the Display Module and pull it off. If necessary, move the interface connector from the Communication Module to the display module to provide the preferred orientation of the display module in the window.
4	Set the Write Protect jumper (Bottom jumper) to the desired behavior (Protected or Unprotected). See Table 14**Error! Reference source not found.** for jumper positioning.
5	Screw on the end cap and tighten the end-cap lock.
6	Turn ON Transmitter power.

Table 14 – Fieldbus Simulation and Write Protect Jumpers

Image	Description
	Fieldbus Simulation Mode = OFF Write Protect = OFF (Not Protected)
	Fieldbus Simulation Mode = OFF Write Protect = ON (Protected)
	Fieldbus SIM Mode = ON Write Protect = OFF (Not Protected)

1.20. Monitoring the Basic and Advanced Displays

This section describes the information shown on the operator screens of the Advanced and Basic Displays.

4.1.13 Basic Display

Figure 16 illustrates the Basic Display format with Process Variable (PV).

- The PV value is user-configurable. This field has 7 characters. The maximum allowable numeric value is 9999999 or -999999. If fractional decimals are configured, the fractional positions will be dropped, as required. If the PV value exceeds the above limits, it is divided by 1000 and “K” is appended to the result, allowing a maximum value with multiplier of 999999K or -99999K.
- Process Variable Tag is user-configurable from a HART Host. This field has 14 characters.
- Engineering Units. This field is user-configurable when measuring temperature. (Custom Units option is available for Fieldbus only)

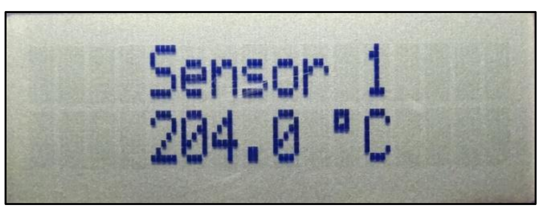


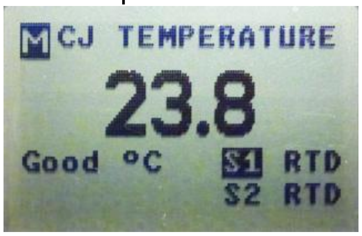
Figure 16 – Basic Display with Process Variable Format

4.1.14 Advanced Displays

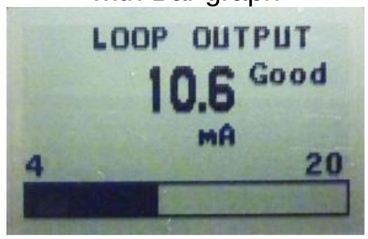
As shown in Figure 17 , the Advanced Display provides three formats. Table 15 lists and describes the fields in each of the three Advanced Display formats. Essentially, all three formats provide the same information, but with the following differences:

- Bar Graph. User Configurable 126 segment Bar Graph with range settings. The Bar Graph displays the current value of the configured PV.
- PV Trend. User-configurable display period from one hour to 999 hours (allowing 31 days). The chart displays minimum, maximum, and average of the configured PV over the selected trend period.

Advanced Display
with process variable



Advanced Display
with Bar graph



Advanced Display
with Trending

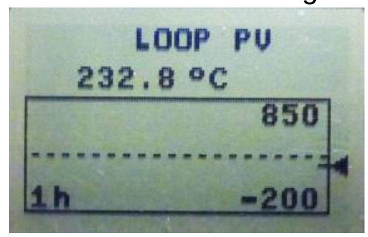
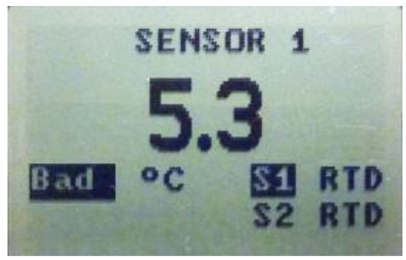


Figure 17 – Advanced Display Formats with the Process Variable

Table 15 – Advanced Displays with PV Format Display Indications

Display Indicator	What It Means
Diagnostic / Maintenance These indicators are displayed in the upper left corner of the screen when the associated conditions are present in the transmitter.	D Diagnostic condition present This indicator is displayed any time a diagnostic is present in the transmitter, either Critical or Non-Critical. If a Critical Diagnostic is present, the message "Critical Diag" will flash at the top of the screen and the appropriate Diagnostic screen will be inserted into the normal screen rotation.  To determine which Non-Critical diagnostics are active, use the local buttons to call up the Non-Critical diagnostics menu (Main Menu\Diagnostics\Non-Critical. Refer to Table 10Table 10 for details concerning the Non-Critical diagnostics. M Maintenance Mode is active For HART and DE, this indicator is set by the Experion DCS. For Fieldbus, the transmitter internally sets this mode. When this Mode is active, a screen with the text "Available for Maintenance" will be inserted into the normal screen rotation to make it easy to identify transmitters that are available for maintenance. 

PV Value	User Configurable. This field has 7 characters. Maximum allowable numeric value of 9999999 or -999999. If fractional decimals are configured, the fractional positions will be dropped as required. If the PV exceeds the values above limits, the PV is divided by 1000 and "K" is appended to the result, allowing a maximum value with multiplier of 999999K or -99999K
PV Status:	Good The transmitter is operating normally Bad The transmitter has detected a fault condition. The PV Status field will flash when this condition is present and the PV Value will be displayed on a black background as shown below:  Unc Uncertain (this status is only available for Fieldbus transmitters) The PV Value is outside of normal limits.

<table>
<tr><td rowspan="2">PV Function Block Mode</td><td colspan="2">The Function Block Mode is only displayed for Foundation Fieldbus transmitters. The eight possible Modes are shown below.</td></tr>
<tr><td>OOS Out Of Service
Auto Automatic
Man Manual
Cas Cascade</td><td>RCas Remote Cascade
Rout Remote Output
IMan Initialization Manual
LO Local Override</td></tr>
<tr><td>Process Variable Tag</td><td colspan="2">User Configurable. This field has 14 characters</td></tr>
<tr><td rowspan="2">Engineering Units</td><td colspan="2">User Configurable. This field has 2 characters in case of HART and DE
Note: In case of Fieldbus, this field has 8 characters to configure Custom Units , which is applicable when Units configured to “Custom” from host)</td></tr>
<tr><td>Temperature
^{o}C
^{o}F
^{o}R
K (Kelvin)</td><td>Other:
(%) percent
(mV) millivolt
mA (milliampere)
Custom - applicable to FF only</td></tr>
<tr><td>Bar Graph</td><td colspan="2">The limits of the bar graph are user-configurable for each screen.</td></tr>
<tr><td>Trend graph</td><td colspan="2">The limits of the trend graph are user-configurable for each screen.
The amount of time visible on the Trend graph is also configurable.</td></tr>
</table>

4.1.15 Button operation during monitoring

When the operator screens are active on the Advanced Display, the Increment and Decrement buttons (**↑** and **↓**) can be used to move to the next or previous operator screen without waiting for the rotation time to expire. Pressing the Enter button (**↵**) will call up the Main Menu.

5 Maintenance

1.21. Overview

This section provides information about preventive maintenance and replacing damaged parts. The topics covered in this section are:

- Replacement of damaged parts such as the Electronics Modules.

1.22. Preventive Maintenance Practices and Schedules

The STT850 SmartLine Transmitter does not require any specific maintenance at regularly scheduled intervals.
Maintenance of the STT850 is limited to ensuring that connections, seals and mounting are tight and secure. There are no moving parts or adjustments and hence no reason to open the field housing except to inspect for corrosion or conductive dust entry which could later affect reliable operation. The transmitter modules themselves should never be opened.

1.23. Replacing the Communication Module

The Communication module includes a connector to the optional Display module. This section includes the procedure to replace the Communication module.

The transmitter does not have to be removed from service to replace the Comm Module

Please take appropriate steps to avoid ESD damage when handling the Communication and Display Module assemblies

Refer to Figure 18 for parts locations.

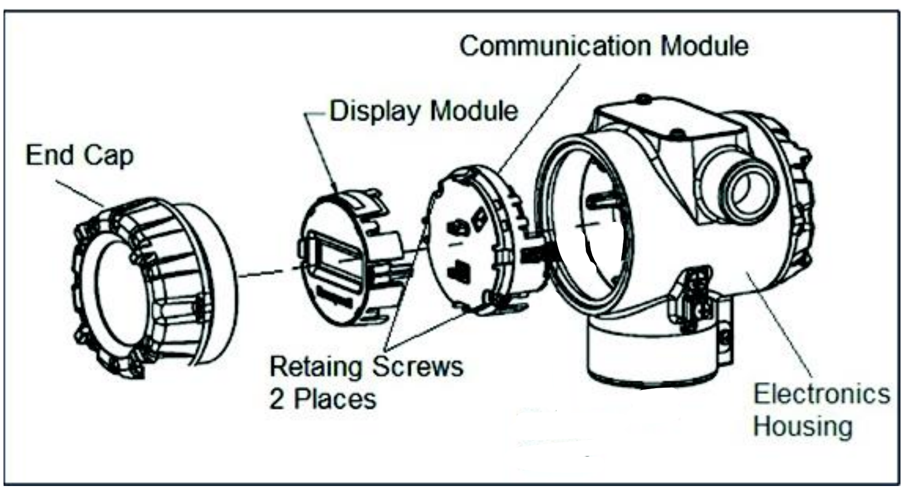


Figure 18 – PWA Replacement

1. Turn OFF Transmitter power (Power removal is only required in accordance with area safety approvals. Power removal is only required in Class 1 Div 1 Explosionproof and Class 1 Div 2 environments).

   - When removing the Communications Module with power applied, the loop will go to 0V. Likewise, installing a Communications Module into a transmitter with power applied will cause the loop output value to go to 12 ma for several seconds then the loop output value will go to the configured value based on the PV input.
   - Installing a Display Module into a powered transmitter may cause a temporary upset to the loop output value.

2. Loosen the end cap lock, and unscrew the end cap from the electronics side of the Transmitter housing.

3. If equipped with a Display module, carefully depress the two tabs on the sides of the Display Module, and pull it off.

4. If necessary, unplug the Display interface connector from the Communication module. **Do not discard the connector**.

5. Loosen the two retaining screws, and carefully pull the Communication module from the Electronics compartment.

6. Carefully, insert the Communication module into the Electronics compartment.

7. Tighten the two Communication module retaining screws.

8. Refer to the SmartLine User's Manual to change the FAILSAFE (HART and DE only), READ/WRITE, and SIM-OFF/SIM-ON configuration settings.

9. If applicable, re-install the Display module as follows:

a) Orient the display as desired.

b) Install the Interface Connector in the Display module such that it will mate with the socket for the display in the Communication module.

c) Carefully line up the display, and snap it into place. Verify that the two tabs on the sides of the display latch.

Orient the Display for proper viewing through the end cap window. You can rotate the meter mounting orientation in 90 ^{o} increments.

10. Apply Parker Super O-ring Lubricant or equivalent to the end cap O-ring before installing the end cap. Reinstall the End Cap and tighten the End Cap locking screw.

11. Installing Optional External Configuration Button Assembly.

a) Loosen (Do Not Remove) both top nameplate screws and pivot nameplate 90°.

b) Align the protrusion on the button assembly with the matching opening in the housing and snap the button assembly into the housing.

c) Rotate the nameplate back to the original position, and tighten the nameplate screws.

(Steps 13 - 16 required for Field Upgrades Only)

12. Loosen the End Cap locking screw and unscrew the End Cap from the Field Wiring side of the transmitter housing.
13. Select the proper Communication/External Configuration upgrade kit label from the label strip provided and adhere to the inside of the Field Wiring compartment End Cap.
14. Apply Parker Super O-ring Lubricant or equivalent to the end cap o-ring before installing the end cap. Reinstall the End Cap and tighten the end cap locking screw
15. Install external upgrade label (i.e. DEVICE MODIFIED…..) provided on outside of housing as shown in Figure 18.
16. Restore power if removed.
17. Check the settings of the Transmitter Setup and Display Setup parameters to make sure that the transmitter is configured correctly for your application. Refer to the STT850 HART/DE manual (34-TT-25-06) for details on HART and DE transmitters. Refer to STT850 Fieldbus manual (34-TT-25-07) for additional information about Fieldbus transmitters.
18. If applicable, verify External Button Configuration operation.

Installation is complete.

6 Calibration

1.24. Recommendations for Transmitter Calibration

The STT850 SmartLine Temperature Transmitter does not require periodic calibration to maintain accuracy. Typically, calibration of a process-connected Transmitter will degrade, rather than augment the capability of a smart Transmitter. For this reason, it is recommended that a Transmitter be removed from service before calibration. Moreover, calibration must be accomplished in a controlled, laboratory-type environment, using certified precision equipment.

1.25. Calibration Procedures

For a Transmitter operating in analog mode, you must calibrate its output signal measurement range using any compatible hand-held communicator or a local display.

One calibration option is to use the Honeywell MC Toolkit (MCT). Refer to the *MC Toolkit User Manual*, Document # 34-ST-25-20.

Calibration information and procedures for a Transmitter operating in the HART/DE mode are provided in the *STT850 Series HART/DE Option User's Manual*, document number 34-TT-25-06, Section on "Calibration." For Foundation Fieldbus calibration information refer to Foundation Fieldbus STT850 Temperature Transmitter User's Guide, 34-TT-25-07

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7 Troubleshooting

1.26. Overview

Troubleshooting involves responding to error messages, primarily displayed by the MC Toolkit. Error messages that may occur on the Transmitter's local display are fairly self-explanatory and intuitive. However, this section covers the diagnostic messages that indicate critical conditions. Other than the critical conditions, additional detail is not provided. If you require assistance, contact your distributor or Honeywell Technical Support. All other messages are covered by the MC Toolkit Users' Manual.

1.27. Critical Diagnostics Screens

When a Critical Diagnostic is present in the Transmitter, the Advanced Display will show one or more of the screens pictured in Figure 19. These screens will be inserted into the normal screen rotation and displayed between the user-defined operator screens. A description of the diagnostic conditions is given Table 16, along with suggested actions for resolving the problem.

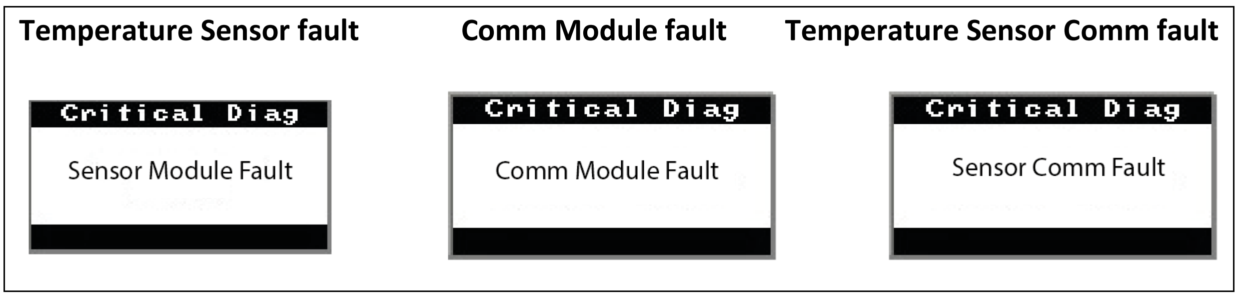


Figure 19 – Local Display Fault Diagnostic Conditions

The Basic Display will display the message CRITICAL FAULT on the top line of the LCD and the appropriate diagnostic text on the lower line.

7.1.1 Fault Conditions and Recommended Corrective Actions

Table 16 – Fault Conditions and Recommended Corrective Actions.

Condtion	Analysis	Recommended Corrective Action
Electronics Module Fault. A critical failure has been detected on the HART, DE, or Fieldbus Electronics Module.	Use a HART, DE, or Fieldbus communicator to read the detailed status information from the transmitter. Refer to the appropriate communicator manual for more information about the possible failure causes.	Cycle power to the transmitter. If the problem continues to occur replace the Electronics Module.
Temperature Sensor Module Fault. A critical failure has been detected on the Temperature Sensor Module.	Use a HART, DE, or Fieldbus communicator to read the detailed status information from the transmitter. Refer to the appropriate communicator manual for more information about the possible failure causes.	If the diagnostic status indicates an input problem (burnout, out of range, etc.), correct the root error and then cycle power to the transmitter. If the problem continues to occur replace the Temperature Sensor Module.
Temperature Sensor Comm Fault. Cannot communicate with the Temperature Sensor Module.	Use a HART, DE, or Fieldbus communicator to read the detailed status information from the transmitter. Refer to the appropriate communicator manual for more information about the possible failure causes.	Cycle power to the transmitter. If the problem continues to occur replace the Temperature Sensor Module

8 Parts List

1.28. Overview

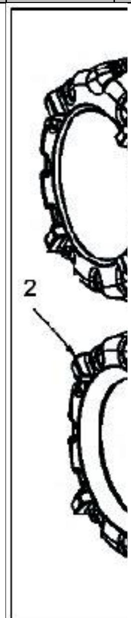
Individually saleable parts for the various Transmitter models are listed in this section. Some parts are illustrated for identification. Parts are identified and listed in the corresponding tables as follows:

- Individually saleable parts are indicated in each figure by key number callout.
- Parts that are supplied in kits are indicated in each illustration by key number callout with the letter K prefix.

Table 17 is a summarized list of recommended spare parts.

Table 17 – Summary List of Recommended Spare Parts

Part Number	Description	Figure No.	Key No.	1-10 Units	10-100 Units	100-1000 Units
Electronics Housing Assembly						
50086423-501 50086423-502 50086423-503 50086423-504 50086423-505 50086423-506	HART Electronics Module Without REED Sensor PWA HART Electronics Module With REED Sensor PWA DE Electronics Module Without REED Sensor PWA DE Electronics Module With REED Sensor PWA FieldBus Electronics Module Without REED Sensor PWA FieldBus Electronics Module With REED Sensor PWA	 Figure 21	5	1	1-2	2-4

Part Number	Description	Figure No.	Key No.	1-10 Units	10-100 Units	100-1000 Units
50049911-502 50049846-503 50087087-503	Basic Display Module Advanced Display Module Advanced Display Module, East Asia (CH, JP)	 Figure 21	4	1	1-2	2-4
50086421-501 50086421-502 50086421-503 50086421-504 50086421-505 50086421-506	HART/DE Temperature/Terminal Block Assy Without Lightning Protection, Single Input HART/DE Temperature/Terminal Block Assy Without Lightning Protection, Dual Input HART/DE Temperature/Terminal Block Assy With Lightning Protection, Single Input HART/DE Temperature/Terminal Block Assy With Lightning Protection, Dual Input HART/DE Temperature/Terminal Block Assy Without Lightning Protection, Single Input w/Digital Output HART/DE Temperature/Terminal Block Assy With Lightning Protection, Single Input,w/Digital Output	Figure 22	3	1	1	1-2
50086421-507 50086421-508 50086421-509 50086421-510	FieldBus Temperature/Terminal Block Assy Without Lightning Protection, Single Input FieldBus Temperature/Terminal Block Assy Without Lightning Protection, Dual Input Temperature/Terminal Block Assy With Lightning Protection, Single Input FieldBus Temperature/Terminal Block Assy With Lightning Protection, Dual Input	Figure 22	3	1	1	1-2

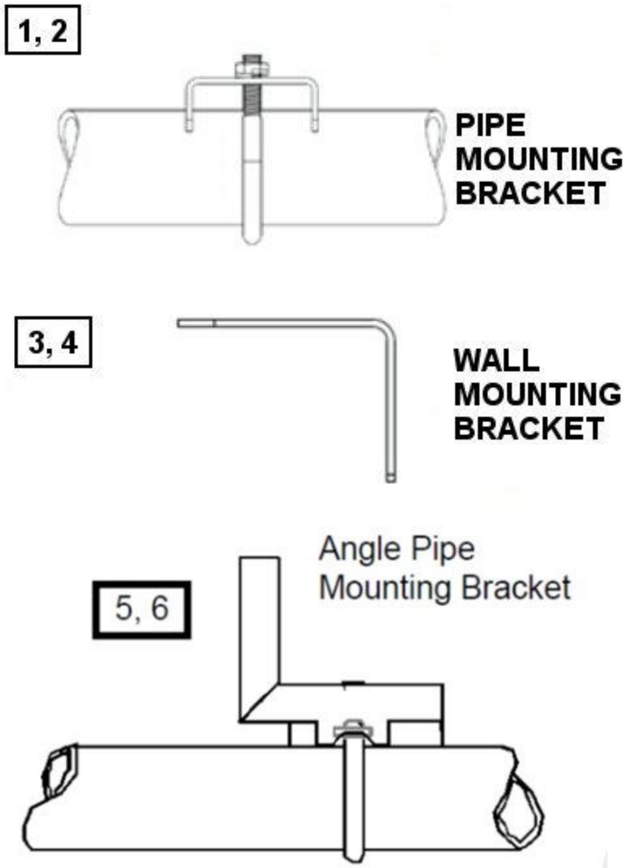


Figure 20 – Pipe and Wall Bracket Parts

Pipe Mounting Bracket	Carbon Steel
Pipe Mounting Bracket	316 SS
Angle Pipe Mounting Bracket	Carbon Steel
Angle Pipe Mounting Bracket	316 SS
Marine Approved Mounting Bracket	316 SS
Wall Mounting Bracket	Carbon Steel
Wall Mounting Bracket	316 SS

Table 18 – Pipe, Wall and Angle Bracket Parts

(Refer to Figure 20)

Key No.	Part Number	Description	Quantity Per Unit
1	50090524-501	Carbon Steel Pipe Bracket Mounting kit for all models	1
2	50090524-503	316 Stainless Steel Pipe Bracket Mounting kit for all models	1
3	50092363-501	Carbon Steel Wall Bracket Mounting kit for all models	1
4	50092363-503	316 Stainless Steel Wall Bracket Mounting kit for all models	1
5	30752770-007	Carbon Steel Angle Pipe Bracket Mounting kit for all models	1
6	30752770-407	316 Stainless Steel Angle Pipe Bracket Mounting kit for all models	1

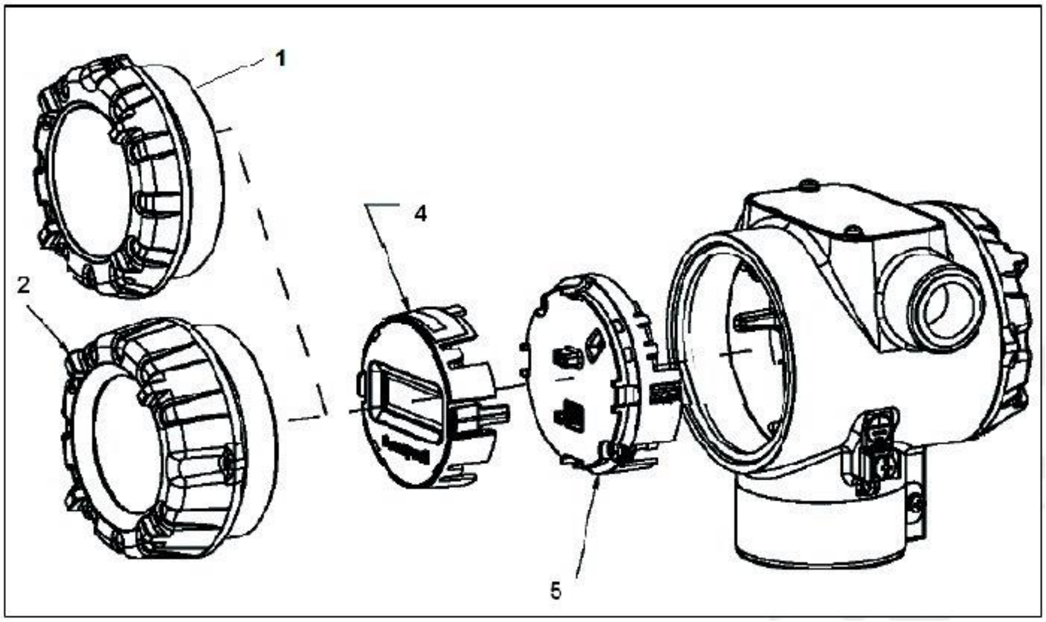


Figure 21 – Electronic Housing, Display End

Table 19 – Transmitter Major Assemblies

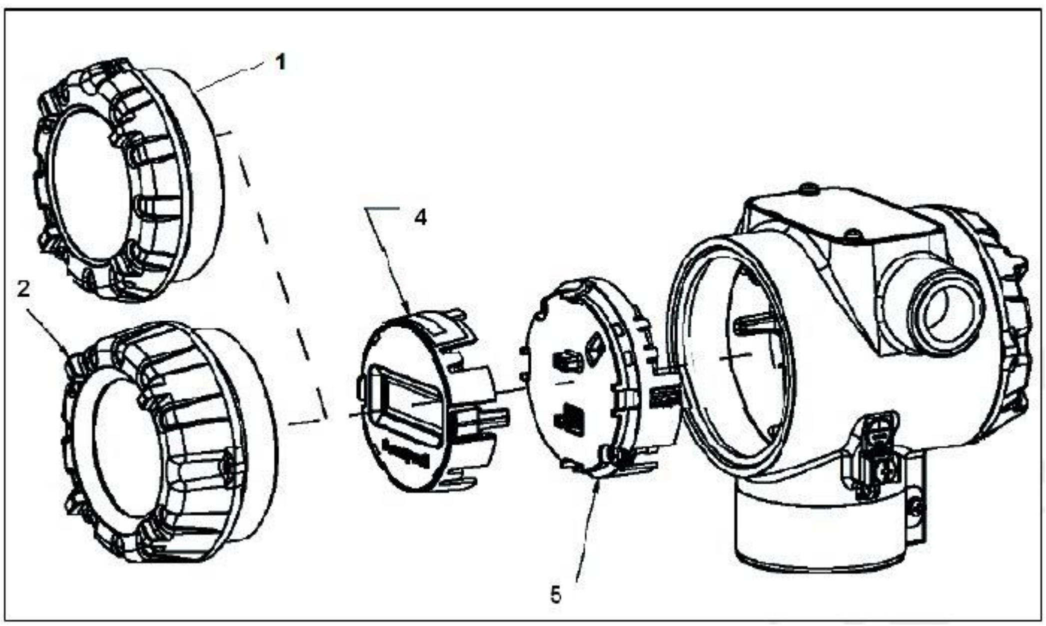
(Refer to 

Figure 21**,** Figure 22**)**

Key No.	Part Number	Description	Quantity Per Unit
1	50049858-501 50049858-521	End Cap (Aluminum) End Cap (Stainless Steel)	1
2	50049832-501 50049832-521	End Cap, Display (Aluminum) End Cap, Display (Stainless Steel)	1

3	50086421-501 50086421-502 50086421-503 50086421-504 50086421-505 50086421-506 50086421-507 50086421-508 50086421-509 50086421-510	HART/DE Temperature/Terminal Block Assy Without Lightning Protection, Single Input HART/DE Temperature/Terminal Block Assy Without Lightning Protection, Dual Input HART/DE Temperature/Terminal Block Assy With Lightning Protection, Single Input HART/DE Temperature/Terminal Block Assy With Lightning Protection, Dual Input HART/DE Temperature/Terminal Block Assy Without Lightning Protection, Single Input w/Digital Output HART/DE Temperature/Terminal Block Assy With Lightning Protection, Single Input,w/Digital Output FieldBus Temperature/Terminal Block Assy Without Lightning Protection, Single Input FieldBus Temperature/Terminal Block Assy Without Lightning Protection, Dual Input FieldBus Temperature/Terminal Block Assy With Lightning Protection,Single Input FieldBus Temperature/Terminal Block Assy With Lightning Protection,Dual Input	1
4	50049911-502 50049846-503	Basic Display for Temperature Advanced Display for Temperature	1
5	50086423--501 50086423--502 50086423--503 50086423--504 50086423--505 50086423--506	HART Electronics Module Assembly (PWA) without Reed sensor HART Electronics Module Assembly (PWA) with Reed sensor DE Electronics Module Assembly (PWA) without Reed sensor DE Electronics Module Assembly (PWA) with Reed sensor FF Electronics Module Assembly (PWA) without Reed sensor FF Electronics Module Assembly (PWA) with Reed sensor	1
6	50049915-501	External Zero, Span & Config Buttons (HART and DE)	1
K1	30757503-005	Electronics housing seals kit (includes O-rings)	

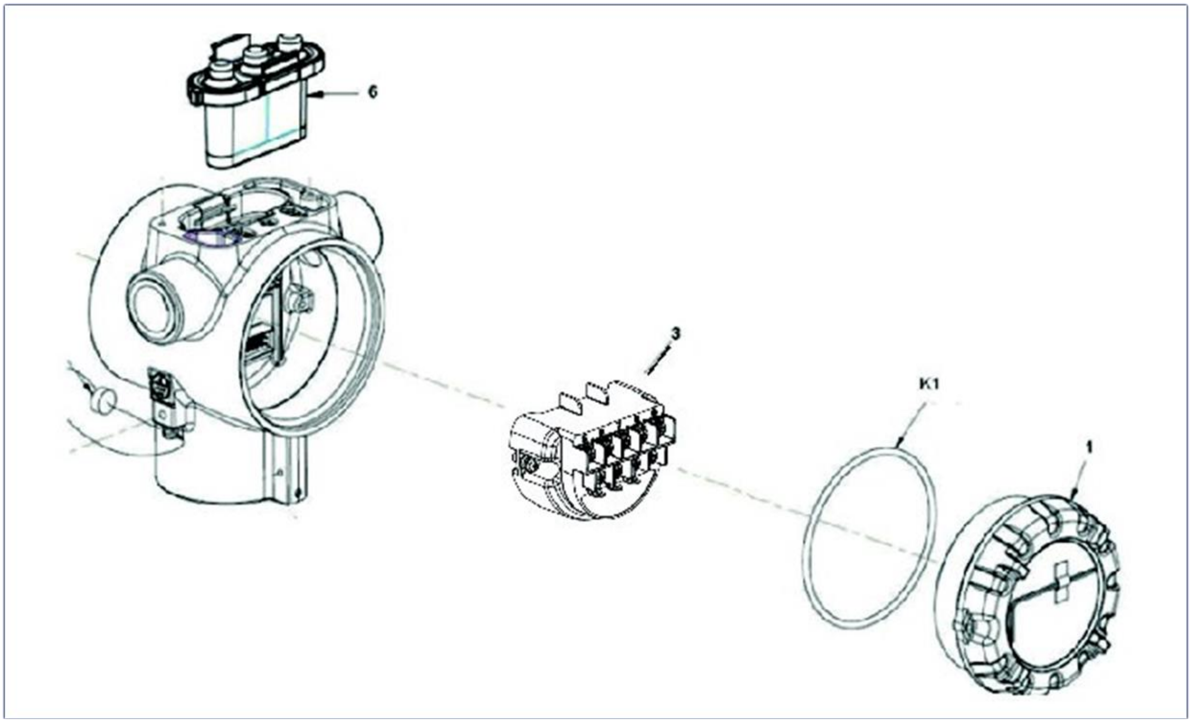


Figure 22 – Electronic Housing, Terminal Block End

Appendix A. PRODUCT CERTIFICATIONS

A1. Safety Instrumented Systems (SIS) Installations

For Safety Certified Installations, please refer to STT850 Safety Manual 34-TT-25-05 for installation procedure and system requirements.

A2. European Directive Information (CE Mark)

CE Honeywell

50094560 Revision: D

EC DECLARATION OF CONFORMITY

We,

Honeywell International Inc.
Honeywell Field Solutions
512 Virginia Drive
Fort Washington, PA 19034 USA

declare under our sole responsibility that the following products,

STT 850 – Smart Series Temperature Transmitter

to which this declaration relates, is in conformity with the provisions of the European Community Directives, including the latest amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of the harmonized standards and when applicable or required, a European Community notified body certification, as shown in the attached schedule.

The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person is identified below.

Owen J. Murphy
Product Safety & Approvals Engineering
Issue Date: 11 November 2014

SCHEDULE

50094560 Revision: D

EMC Directive (2004/108/EC)

IEC 61326-1:2005	Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements.
IEC 61326-3-1:2008	Electrical Equipment for Measurement, Control and Laboratory Use- Part 3-1: Immunity Requirements for safety related systems and equipment intended to perform safety-related functions.

Overview of EMC Testing

Equipment Tested (EUT): ST 850 TRANSMITTER

Summary of Tests Performed:

PORT	TEST	STANDARD	CRITERIA (IEC 61326-1)	CRITERIA (IEC 61326-3-1)	RESULTS
Enclosure	Radiated Emission	CISPR 11	Group1, Class A 30 – 230 MHz: 40 dB 230 – 1000 MHz: 47 dB	Group1, Class A 30 – 230 MHz: 40 dB 230 – 1000 MHz: 47 dB	PASS
	ESD Immunity	IEC61000-4-2	+/- 4KV Contact +/- 8KV Air	+/- 6KV Contact +/- 8KV Air	PASS
	EM Field- RF Radiated Susceptibility	IEC61000-4-3	10 V/m- 80 MHz to 1GHz 3 V/m - 1.4 GHz to 2.0 GHz 1 V/m- 2.0 GHz to 2.7 GHz	20 V/m- 80MHz to 1GHz 10 V/m - 1.4GHz to 2.0 GHz 3 V/m- 2.0GHz to 2.7GHz	PASS PASS PASS
	50Hz/60Hz Magnetic Field Immunity	IEC 6100-4-8	30 A/m	30 A/m	N/A 1
DC Power	EFT(B) Immunity	IEC61000-4-4	+/- 1KV	+/- 2KV	PASS
	Surge Immunity	IEC61000-4-5	+/- 1KV	+/- 2KV	PASS
	RF Conducted Susceptibility	IEC61000-4-6	3V	3 V Except the following: 10 V 3.39 to 3.410MHz 10 V 6.765 to 6.795MHz 10 V 13.553 to 13.567MHz 10 V 26.957 to 27.283MHz 10 V 40.66 to 40.70MHz	PASS

Honeywell

SCHEDULE

50094560 Revision: D

PORT	TEST	STANDARD	CRITERIA (IEC 61326-1)	CRITERIA (IEC 61326-3-1)	RESULTS
I/O Signal/ Control (Including Earth Lines)	EFT(Burst) Immunity	IEC61000-4-4	+/- 1KV	+/- 2KV	2
	Surge Immunity	IEC61000-4-5	+/- 1KV	+/- 2KV	2
	RF Conducted Susceptibility	IEC61000-4-6	3V	3 V Except the following: 10 V 3.39 to 3.410MHz 10 V 6.765 to 6.795MHz 10 V 13.553 to 13.567MHz 10 V 26.957 to 27.283MHz 10 V 40.66 to 40.70MHz	2
AC Power	Voltage Dip	IEC61000-4-11	0% during 1 Cycle 40% during 10-12 Cycles 70% during 25-30 Cycles		N/A[3]
	Short Interruptions	IEC61000-4-11	0% during 250-300 Cycles		N/A[3]
	EFT(Burst) Immunity	IEC61000-4-4	2KV		N/A[3]
	Surge Immunity	IEC61000-4-5	1KV/ 2KV		N/A[3]
	RF Conducted Susceptibility	IEC61000-4-6	3V		N/A[3]

1. There is no magnetic sensitive circuitry.
2. Done as part of the DC Power Testing.
3. Product is DC Powered.

3 of 4

SCHEDULE

50094560 Revision: D

ATEX Directive (94/9/EC)

EC-Type Examination Certificate No: SIRA 14ATEX0020X- **Flameproof "d" and Intrinsically Safe "ia" Certificate**

EN 60079-0: 2012 EN 60079-1: 2007 **EN 60079-11: 2011**

EN 60079-26: 2006 EN 60079-31: 2009

Type Examination Certificate No: SIRA 14ATEX4052X **Non Sparking "n" Certificate**

EN 60079-0: 2012 EN 60079-15: 2010

ATEX Notified Body for EC Type Certificates

SIRA Certification Service
Rake Lane, Eccleston
Chester, CH4 9JN
England

ATEX Notified Body for Quality Assurance

DEKRA Certification B.V. [Notified Body Number: 0344]
Maender 1051
6825 MJ Arnhem
The Netherlands

A3. Hazardous Locations Certifications

MSG CODE	AGENCY	TYPE OF PROTECTION	COMM OPTION	Electrical Parameters	Ambient Temperature
A	FM Approvals ™ (USA)	**Explosion proof,** Certificate: 3051269: Class I, Division 1, Groups A, B, C, D; **Dust Ignition Proof:** Class II, III, Division 1, Groups E, F, G; T4 Class 1, Zone 1, AEx d IIC T4 Gb Class 2, Zone 21, AEx tb IIIC T 95°C IP 66 Db	4-20 mA/ DE/HART/ FF/ PROFIBUS	Note 1	-50°C to 85°C With Display: -20°C to 70°C
		Intrinsically Safe, Certificate: 3051269: Class I, II, III, Division 1, Groups A, B, C, D, E, F, G; T4 Class I Zone 0 AEx ia IIC T4 Ga FISCO Field Device (Only for FF Option) Ex ia IIC T4	4-20 mA/ DE/HART /FF/ PROFIBUS	Note 2	-50°C to 70°C With Display: -20°C to 70°C
		Non-Incendive, Certificate: 3051269: Class I, Division 2, Groups A, B, C, D; T4 Class I Zone 2 AEx nA IIC T4 Gc AEx nA IIC T4	4-20 mA/ DE/HART /FF/ PROFIBUS	Note 1	-50°C to 85°C With Display: -20°C to 70°C
		Standards: FM 3600:2011; ANSI/ ISA 60079-0: 2013 FM 3615:2006; ANSI/ ISA 60079-1 : 2009 FM 3616 : 2011 ; ANSI/ ISA 60079-31 : 2009 FM 3610:2010; ANSI/ ISA 60079-11 : 2013 FM 3810 : 2005 ; FM 3611:2004; ANSI/ ISA 60079-15 : 2012 ; FM 3810 : 2005 ; NEMA 250 : 2003 ; ANSI/ IEC 60529 : 2004			
		Enclosure: Type 4X/ IP66/ IP67	ALL	ALL	ALL
B	CSA-Canada	**Explosion proof,** Certificate: 2689056: Class I, Division 1, Groups A, B, C, D; **Dust Ignition Proof:** Class II, III, Division 1, Groups E, F, G; T4 Zone 1 Ex d IIC T4 Gb Ex tb IIIC T 95°C IP 66 Db DIP A21 Class II, III	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C

		Intrinsically Safe, Certificate: 2689056: Class I, II, III, Division 1, Groups A, B, C, D, E, F, G; T4 Ex ia IIC T4 Ga FISCO Field Device (Only for FF Option) Ex ia IIC T4	4-20 mA/ DE/HART/FF	Note 2	-50°C to 70°C
		Non-Incendive, Certificate: 2689056: Class I, Division 2, Groups A, B, C, D; T4 Class I Zone 2 Ex nA IIC T4 Gc Ex nA IIC T4 Gc	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C
		Enclosure: Type 4X/ IP66/ IP67	ALL	ALL	ALL
		Standards: CSA C22.2 No. 0-10; CSA 22.2 No. 25-1966 (reaffirmed 2009); CSA C22.2 No. 30-M1986 (reaffirmed 2012); CSA C22.2 No. 94-M91; CSA C22.2 No. 142-M1987 (reaffirmed 2009); CSA-C22.2No.157-92 (reaffirmed 2012); C22.2 No. 213-M1987(reaffirmed 2012); C22.2 No. 60529-05 C22.2 No. CSA 60079-0:2011; C22.2 No. 60079-1: 2011; C22.2 No. 60079-11: 2011; C22.2 No. 60079-15: 2012; C22.2 No. 60079-31: 2012; ANSI/ ISA12.12.01-2012; ANSI/ ISA 60079-0 (12.00.01): 2009 ; ANSI/ ISA 60079-1 (12.22.01): 2009 ; ANSI/ ISA 60079-11(12.02.01) : 2012; ANSI/ ISA 60079-26 (12.00.03) : 2011; ANSI/ ISA 60079-15(12.12.02) : 2012 ; ANSI/ ISA 60079-27 (12.02.04) : 2006; ANSI/ ISA 60079-31(12.10.03) : 2009 ; FM Class 3615: Aug 2006; FM Class 3616: Dec 2011; ANSI/ IEC 60529 : Edition 2.1 ANSI/ UL 913: Edition 7; ANSI/ UL 916 : Edition 4 ;			
C	ATEX	**Flameproof,** Sira 14ATEX2046X: II 2 G Ex d IIC T4 Gb II 2 D Ex tb IIIC T 95°C Db IP 66/ IP67	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C
		Intrinsically Safe, Sira 14ATEX2046X: II 1 G Ex ia IIC T4 Ga FISCO Field Device (Only for FF Option) Ex ia IIC T4	4-20 mA/ DE/HART/FF	Note 2	-50°C to 70°C FISCO: -50°C to 45°C
		Enclosure: IP66/ IP67	ALL	ALL	ALL
		Standards: EN 60079-0: 2012; EN 60079-1 : 2007; EN 60079-31 : 2009 EN 60079-11: 2011; EN 60079-26 : 2006; EN 60529 : 2000 + A1			
		Non Sparking, Sira 14ATEX4052X: II 3 G Ex nA IIC T4 Gc	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C
		Enclosure: IP66/ IP67	ALL	ALL	ALL
		Standards: EN 60079-0: 2012; EN 60079-15 : 2010; IEC 60529 : 2009 with Corr 3			

D	IECEx	**Flameproof,** SIR 14.0020X Ex d IIC T4 Gb Ex tb IIIC T 95°C IP 66/ IP67	4-20 mA/ DE/HART/ FF	Note 1	-50°C to 85°C
		Intrinsically Safe, SIR 14.0020X Ex ia IIC T4 Ga FISCO Field Device (Only for FF Option) Ex ia IIC T4	4-20 mA/ DE/HART/ FF	Note 2	-50°C to 70°C FISCO: -50°C to 45°C
		Non Sparking, SIR 14.0020X Ex nA IIC T4 Gc	4-20 mA/ DE/HART/ FF	Note 1	-50°C to 85°C
		Enclosure: IP66/ IP67	ALL	ALL	ALL
		Standards: IEC 60079-0: 2011, Edition 6; IEC 60079-1 : 2007-04, Edition 6; IEC 60079-11 : 2011, Edition 6; IEC 60079-15 : 2010, Edition 4 IEC 60079-26 : 2006, Edition 2; IEC 60079-31 : 2008, Edition 1 IEC 60529 : 2009 with Corr 3			
E	SAEx (South Africa)	**Flameproof**: Ex d IIC T4 Gb Ex tb IIIC T 85°C IP 66 Db	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C
		Intrinsically Safe: Ex ia IIC T4 Ga FISCO Field Device (Only for FF Option) Ex ia IIC T4	4-20 mA/ DE/HART/FF	Note 2	-50°C to 70°C
		Non Sparking: Ex nA IIC T4 Gc	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C
		Enclosure: IP66/ IP67	ALL	ALL	ALL
F	INMETRO	**Flameproof**: Ex d IIC T4 Gb Ex tb IIIC T 95°C IP 66 Db	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C
		Intrinsically Safe: Ex ia IIC T4 Ga FISCO Field Device (Only for FF Option) Ex ia IIC T4	4-20 mA/ DE/HART/FF	Note 2	-50°C to 70°C
		Non Sparking: Ex nA IIC T4 Gc	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C
		Enclosure: IP66/ IP67	ALL	ALL	ALL
G	NEPSI (CHINA)	**Flameproof**: Ex d IIC T4 Gb Ex tb IIIC T 85°C IP 66	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C
		Intrinsically Safe: Ex ia IIC T4 FISCO Field Device (Only for FF Option) Ex ia IIC T4	4-20 mA/ DE/HART/FF	Note 2	-50°C to 70°C
		Non Sparking: Ex nA IIC T4	4-20 mA/ DE/HART/FF	Note 1	-50°C to 85°C
		Enclosure: IP66/ IP67	ALL	ALL	ALL

Notes

1. **Operating Parameters:**

4-20 mA/DE/HART (Loop Terminal)
Terminals 1, 2: Voltage= 11 to 42 V Current= 4-20 mA Normal (3.8 – 23 mA Faults)
OPTIONAL DIGITAL OUTPUT:
Terminals 4 and 9: Voltage 4 to 30 V Current 40 ma max

FF (Loop Terminal)
Voltage= 9 to 32 V Current= 25 mA

2. Intrinsically Safe Entity Parameters

For details see Control Drawing on page 67.

A4. Marking ATEX Directive

General:

The following information is provided as part of the labeling of the transmitter:
• Name and Address of the manufacturer
• Notified Body identification: DEKRA Quality B.V., Arnhem, the Netherlands

• For complete model number, see the Model Selection Guide for the particular model of Temperature Transmitter.
• The serial number of the transmitter is located on the Housing data-plate. The first two digits of the serial number identify the year (02) and the second two digits identify the week of the year (23); for example, 0223xxxxxxxx indicates that the product was manufactured in 2002, in the 23 rd week.

Apparatus Marked with Multiple Types of Protection

The user must determine the type of protection required for installation the equipment. The user shall then check the box [?] adjacent to the type of protection used on the equipment certification nameplate. Once a type of protection has been checked on the nameplate, the equipment shall not then be reinstalled using any of the other certification types.

WARNINGS and Cautions:

Intrinsically Safe and Non-Incendive Equipment:

WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN HAZARDOUS LOCATIONS.

Explosion-Proof/ Flameproof:

WARNING: DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT

Non-Incendive Equipment:

WARNING: DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAYBE PRESENT

All Protective Measures:

WARNING: FOR CONNECTION IN AMBIENTS ABOVE 60ºC USE WIRE RATED 105ºC

A.5 Conditions of Use" for Ex Equipment", Hazardous Location Equipment or "Schedule of Limitations":

Consult the manufacturer for dimensional information on the flameproof joints for repair.

Painted surface of the STT850 may store electrostatic charge and become a source of ignition in applications with a low relative humidity less than approximately30% relative humidity where the painted surface is relatively free of surface contamination such as dirt, dust or oil. Cleaning of the painted surface should only be done with a damp cloth.

Intrinsically Safe: Must be installed per drawing 50091227

Division 2: This equipment is suitable for use in a Class I, Division 2, Groups A, B, C, D; T4 or Non-Hazardous Locations Only.

The installer shall provide transient over-voltage protection external to the equipment such that the voltage at the supply terminal of the equipment does not exceed 140% of the voltage rating of the equipment.

The enclosure is manufactured from low copper aluminium alloy. In rare cases, ignition sources due to impact and friction sparks could occur. This shall be considered during Installation, particularly if equipment is installed a Zone 0 location.

If a charge-generating mechanism is present, the exposed metallic part on the enclosure is capable of storing a level of electrostatic that could become incendive for IIC gases. Therefore, the user/ installer shall implement precautions to prevent the buildup of electrostatic charge, e.g. earthing the metallic part. This is particularly important if equipment is installed a Zone 0 location.

A.6 Control Drawing

PRE REL		
ISS	REVISION & DATE	APPD
C	04-21-2015 ECN 2015-1801	OJM

STT 850 Series Temperature Transmitter
ANALOG, HART/DE and FF/ PA Communications

1. Intrinsically safe installation shall be in accordance with
   a. FM (USA): ANSI/NFPA 70, NEC® Articles 504 and 505.
   b. CSA (Canada): Canadian Electrical Code (CEC), part I, section 18.
   c. ATEX: Requirements of EN 60079-14, 12.3 (See also 5.2.4).
   d. IECEx: Requirements of IEC 60079-14, 12.3 (See also 5.2.4).
2. ENTITY approved equipment shall be installed in accordance with the manufacturer's Intrinsic Safety Control Drawing.
3. The Intrinsic Safety ENTITY concept allows the interconnection of two ENTITY Approved Intrinsically safe devices with ENTITY parameters not specifically examined in combination as a system when:

   Uo, Voc, or Vt $\leq$ Ui or Vmax; Io, Isc, or It $\leq$ Ii or Imax; Ca or Co $\geq$ Ci + Ccable, La or Lo $\geq$ Li + Lcable, Po $\leq$ Pi.
   Where two separate barrier channels are required, one dual-channel or two single-channel barriers may be used, where in either case, both channels have been Certified for use together with combined entity parameters that meet the above equations.
4. System Entity Parameters:

   STT 850 Transmitter: Vmax Voc or Uo, Imax Isc or Io;
   STT 850 Transmitter: Ci + Ccable $\leq$ Control Apparatus Ca,
   STT 850 Transmitter: Li + Lcable $\leq$ Control Apparatus La.
5. When the electrical parameters of the cable are unknown, the following values may be used:

   Capacitance: 197pF/m (60 pF/ft)
   Inductance: 0.66µH/m (0.020µH/ft).
6. Control equipment that is connected to Associated Equipment must not use or generate more than 250 V.
7. Associated equipment must be FM, CSA ATEX or IECEx (depending on location) listed. Associated equipment may be installed in a Class I, Division 2 or Zone 2 Hazardous (Classified) location if so approved.
8. Non-Galvanically isolated equipment (grounded Zener Barriers) must be connected to a suitable ground electrode per:
   a. FM (USA): NFPA 70, Article 504 and 505. The resistance of the ground path must be less than 1.0 ohm.
   b. CSA (Canada): Canadian Electrical Code (CEC), part I, section 10.
   c. ATEX: Requirements of EN 60079-14, 12.2.4.
   d. IECEx: Requirements of IEC 60079-14, 12.2.4.
9. Intrinsically Safe DIVISION 1/ Zone 0 WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN HAZARDOUS LOCATIONS.
10. Division 2/ Zone 2: WARNING: DO NOT OPEN WHEN AN EXPLOSIVE GAS ATMOSPHERE IS PRESENT.
11. NO REVISION OF THIS CONTROL DRAWING IS PERMITTED WITHOUT AUTHORIZATION FROM THE AGENCIES listed.
12. For release approvals see ECO-0110873.

	DRAWN	OJM	03/28/14	Honeywell
	CHECKED			CONTROL DRAWING ST 850 SERIES TEMPERATURE TRANSMITTER DIVISIONS 1 & 2 / ZONE 0 & 2
	DEV ENG			
	MFG ENG			
	QA ENG			
	TOLERANCE UNLESS NOTED			A/A4 — 50091227
MASTER FILE TYPE: MS WORD	ANGULAR DIMENSION			SCALE: None — USED ON — SH. 1 OF 6

INSTRUCTIONS FOR INMETRO

1. Instalação de segurança intrínseca devem estar de acordo com
   Requisitos de IEC 60079-14, 12.3 (See also 5.2.4).
2. ENTIDADE equipamento aprovado deve ser instalado de acordo com a segurança intrínseca Desenho de Controle do fabricante.
3. O conceito de Segurança Intrínseca ENTIDADE permite a interligação de dois entidade credenciada dispositivos de segurança intrínseca com parâmetros de entidade não examinados especificamente em combinação como um sistema quando:
   Uo, Voc, or Vt ≤ Ui or Vmax; Io, Isc, or It ≤ Ii or Imax; Ca or Co ≥ Ci + Ccable, La or Lo ≥ Li + Lcable, Po ≤ Pi.
   Quando forem necessários dois canais separados de barreira, um dual-channel ou duas barreiras de canal único pode ser usado, onde em ambos os casos, ambos os canais foram certificados para uso em conjunto com os parâmetros entidade combinada que atendam as equações acima.
4. Parâmetros da Entidade de sistema::
   Vmax Voc or Uo, Imax Isc or Io;
   Ci + Ccable ≤ Control Apparatus Ca,
   Li + Lcable ≤ Control Apparatus La.
5. Quando os parâmetros eléctricos do cabo não são conhecidos, podem ser utilizados os seguintes valores::
   Capacidade: 197pF/m (60 pF/ft)
   Indutância: 0.66µH/m (0.020µH/ft).
6. Os equipamentos de controle que está ligado à Associated Equipment não deve usar ou gerar mais de 250 V.
7. Equipamentos associados devem ser IECEx (dependendo da localização) listados. Equipamentos associados podem ser instalados em uma perigosos (classificados) local Classe I, Divisão 2 ou Zona 2 se for aprovado.
8. O equipamento não Galvanicamente isolado (Barreiras Zener aterradas) deve ser conectado a um eletrodo de aterramento adequado por IECEx: Requisitos de IEC 60079-14, 12.2.4.
9. Intrinsecamente seguro Divisão 1 / Zona 0 AVISO: substituição de componentes pode prejudicar a adequação para uso em locais perigosos.
10. Divisão 2 / Zona 2: AVISO: NÃO aberto quando uma atmosfera de gás explosiva.
11. Nenhuma revisão deste desenho CONTROL é permitida sem autorização dos órgãos listados.
12. Para aprovações de libertação ver ECO # 0094464.

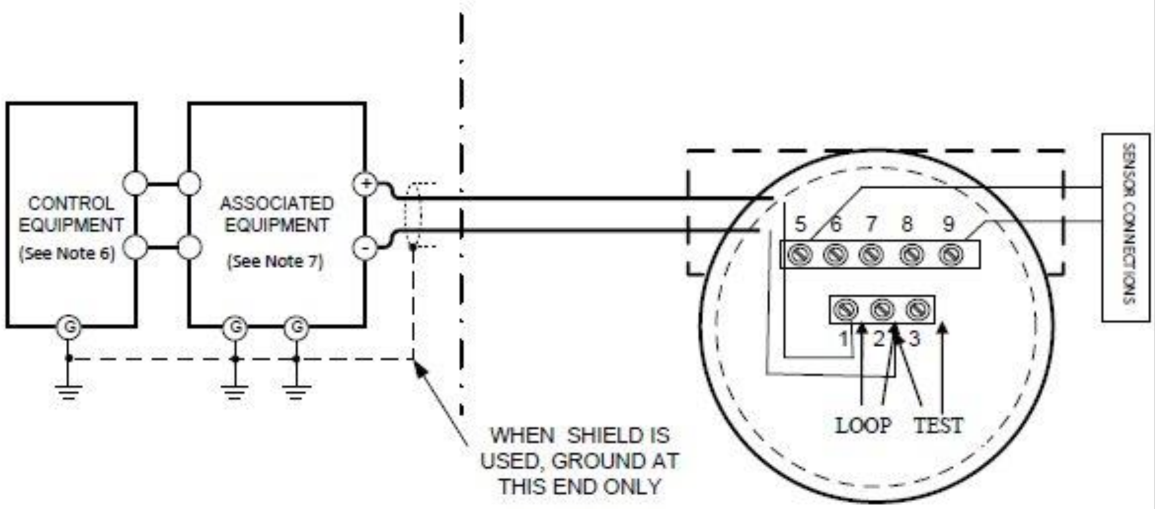
Honeywell	A/A4	50091227	
	SCALE: None	REV C DATE 04-21-2015	SH. 2 of 6

HART/DE

TERMINAL	ENTITY PARAMETERS	ASSOCIATED APPARATUS
1,2 (LOOP)	Ui or Vmax $\leq$ 30V	Uo, Voc or Vt $\leq$ 30V
	Ii or Imax $\leq$ 225 mA	Io (Isc or It) $\leq$ 225 mA
	Pi or Pmax = 0.9W	Po $\leq$ 0.9 W
	Ci= 4 nF	Ca or Co $\geq C_{cable} + C_{STT\ 850}$
	Li= 0 µH	La or Lo $\geq L_{cable} + L_{STT\ 850}$
5, 6, 7, 8, 9 (SENSOR- SEE Page 6)	Co= 39 uF	-----
	Lo= 4.99 H	-----

NON-HAZARDOUS LOCATION

HAZARDOUS (CLASSIFIED) LOCATION
CLASS I, DIVISION 1, GROUPS A, B, C, D, E, F & G;
ZONE 0 IIC & ZONE 2 IIC,
CLASS I DIVISION 2, GROUPS A, B, C, D;



FOR DIV 2 / ZONE 2 INSTALLATIONS

CONTROL EQUIPMENT PARAMETERS
Umax = Ui = 42V, 4-20 mA, Po $\leq$ 1 W
NOTE : ASSOCIATED EQUIPMENT NOT REQUIRED

Honeywell	A/A4	50091227	
	SCALE: None	REV C DATE 04-21-2015	SH. 3 of 6

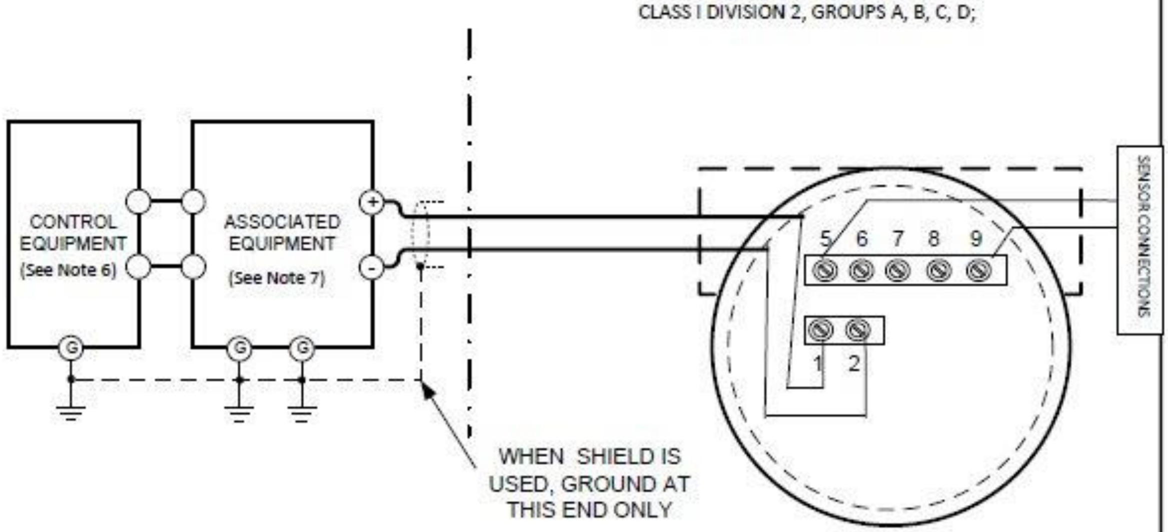
FOUNDATION FIELDBUS/ PROFIBUS

TERMINALS	NON FISCO		FISCO	
	ENTITY PARAMETERS	Associated Apparatus	ENTITY PARAMETERS	Associated Apparatus
1,2 (FF CONNECTION)	Ui or Vmax $\leq$ 30V	Uo, Voc or Vt $\leq$ 30V	Ui or Vmax $\leq$ 17.5	Uo, Voc or Vt $\leq$ 18V
	Ii or Imax $\leq$ 225 mA	Io (Isc or It) $\leq$ 225 mA	Ii or Imax $\leq$ 380 mA	Io (Isc or It) $\leq$ 380 mA
	Pi or Pmax = 1W	Po $\leq$ 1 W	Pi or Pmax = 5.32W	Po $\leq$ 5.32 W
	Ci= 0 nF	Ca or Co $\geq C_{cable} + C_{STT\ 850}$	Ci= 0 nF	Ca or Co $\geq C_{cable} + C_{STT\ 850}$
	Li= 0 µH	La or Lo $\geq L_{cable} + L_{STT\ 850}$	Li= 0 µH	La or Lo $\geq L_{cable} + L_{STT\ 850}$
5, 6, 7, 8, 9 (SENSOR- SEE PAGE 6)	Co= 39 uF	-----	Co= 39 uF	-----
	Lo= 4.99 H	-----	Lo= 4.99 H	-----

NON-HAZARDOUS LOCATION

HAZARDOUS (CLASSIFIED) LOCATION

CLASS I, CLASS II, DIVISION 1, GROUPS A, B, C, D, E, F & G;
ZONE 0 IIC & ZONE 2 IIC,
CLASS I DIVISION 2, GROUPS A, B, C, D;



DIV 2 / ZONE 2 INSTALLATIONS

CONTROL EQUIPMENT PARAMETERS

Umax=Ui= 32V, 25 mA, Po $\leq$ 1 W

NOTE : ASSOCIATED EQUIPMENT NOT REQUIRED

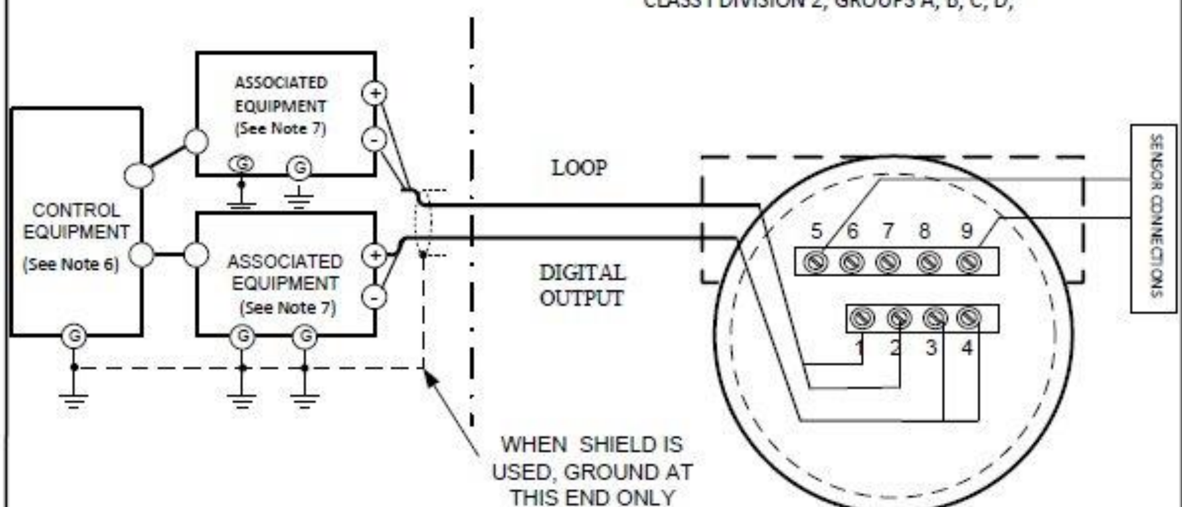
Honeywell	A/A4	50091227	
	SCALE: None	REV C DATE 04-21-2015	SH. 4 of 6

HART/DE WITH DIGITAL OUTPUT OPTION

TERMINAL	ENTITY	Associated Apparatus
1,2 (LOOP)	Ui or Vmax $\leq$ 30V	Uo, Voc or Vt $\leq$ 30V
	Ii or Imax $\leq$ 225 mA	Io (Isc or It) $\leq$ 225 mA
	Pi or Pmax = 0.9W	Po $\leq$ 0.9 W
	Ci= 4 nF	Ca or Co $\geq C_{cable} + C_{STT\,850}$
	Li= 0 µH	La or Lo $\geq L_{cable} + L_{STT\,850}$
4, 9 (DO OPTION)	Ui or Vmax $\leq$ 30V	Uo, Voc or Vt $\leq$ 30V
	Ii or Imax $\leq$ 40 mA	Io (Isc or It) $\leq$ 225 mA
	Pi or Pmax = 0.5W	Po $\leq$ 0.5 W
	Ci= 0 nF	Ca or Co $\geq C_{cable} + C_{STT\,850\_DO}$
	Li= 24 µH	La or Lo $\geq L_{cable} + L_{STT\,850\_DO}$
5,6,7,8 (SENSOR- SEE Page 6)	Co= 39 uF	----
	Lo= 4.99 H	----

NON-HAZARDOUS LOCATION

HAZARDOUS (CLASSIFIED) LOCATION
CLASS I, DIVISION 1, GROUPS A, B, C, D, E, F & G;
ZONE 0 IIC & ZONE 2 IIC,
CLASS I DIVISION 2, GROUPS A, B, C, D;

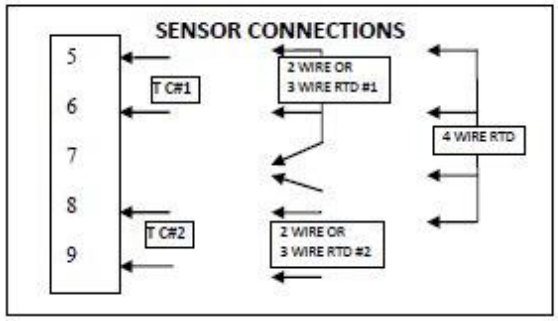


FOR DIV 2 / ZONE 2 INSTALLATIONS

CONTROL EQUIPMENT PARAMETERS
Umax = Ui = 42V, 4-20 mA, Po $\leq$ 1 W
NOTE : ASSOCIATED EQUIPMENT NOT REQUIRED

Honeywell	A/A4	50091227	
	SCALE: None	REV C DATE 04-21-2015	SH. 5 of 6

SENSOR CONNECTIONS



Note:
1. DO OPTION IS ONLY AVAILABLE WITH HART/ DE COMMUNICATIONS
2. WITH DO OPTION, ONLY ONE RTD/ THERMAL COUPLE CONNECTION IS AVAILABLE.

Honeywell	A/A4	50091227
	SCALE: None	REV C DATE 04-21-2015	SH. 6 of 6

Glossary

AWG	American Wire Gauge
CVD	Callendar Van Duesen is an equation that describe the relationship between resistance (R) and temperature (t) of platinum resistance thermometers (RTD)
DE	Digital Enhanced Communications Mode
EMI	Electromagnetic Interference
FF	Foundation Fieldbus
FTA	Field Termination Assembly
Hz	Hertz
LRL	Lower Range Limit
LRV	Lower Range Value
mAdc	Milliamperes Direct Current
mV	Millivolts
Nm	Newton·meters
NVM	Non-Volatile Memory
PM	Process Manager
PV	Process Variable
PWA	Printed Wiring Assembly
RFI	Radio Frequency Interference
RTD	Resistance Temperature Detector
T/C	Thermocouple
URL	Upper Range Limit
URV	Upper Range Value
US	Universal Station
Vac	Volts Alternating Current
Vdc	Volts Direct Current

Index

S

T

W

Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

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(TAC) hfs-tac-support@honeywell.com

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Honeywell Limited
Phone: +(61) 7-3846 1255
FAX: +(61) 7-3840 6481
Toll Free 1300-36-39-36
Toll Free Fax:
1300-36-04-70

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Honeywell China Inc.
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Fax: (86-21) 6237-2826

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Honeywell Pte Ltd.
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Honeywell Korea Co Ltd
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FP-Sales-Apps@Honeywell.com
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hfs-tac-support@honeywell.com

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(Sales) 1-800-343-0228

Email: (Sales)
FP-Sales-Apps@Honeywell.com
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hfs-tac-support@honeywell.com

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Shanghai City Centre, 100 Jungi Road
Shanghai, China 20061

www.honeywellprocess.com

34-TT-25-03 Rev.3
March 2016

Quick Start Guide
00825-0100-4530, Rev FB
June 2016

Rosemount™ 5300 Series

Superior Performance Guided Wave Radar Level and Interface Transmitter

IEC

HART COMMUNICATION PROTOCOL WirelessHART FOUNDATION Modbus

EMERSON
Process Management

1.0 About this guide

This Quick Start Guide provides basic guidelines for Rosemount 5300 Series Transmitters. Refer to the Rosemount 5300 Reference Manual for more instructions. Manuals are available electronically on EmersonProcess\Rosemount.com.

⚠ WARNING

Failure to follow safe installation and service guidelines could result in death or serious injury.

- Make sure the transmitter is installed by qualified personnel and in accordance with applicable code of practice.
- Use the equipment only as specified in this Quick Start Guide and the Reference Manual. Failure to do so may impair the protection provided by the equipment.
- Any substitution of non-authorized parts or repair, other than exchanging the complete transmitter head or probe assembly, may jeopardize safety and is prohibited.

Explosions could result in death or serious injury.

- Verify that the operating environment of the transmitter is consistent with the appropriate hazardous locations specifications. See "Product certifications" on page 23.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.
- Before connecting a HART®, FOUNDATION™ Fieldbus, or Modbus® based communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- To avoid process leaks, only use O-rings designed to seal with the corresponding flange adapter.

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals. High voltage that may be present on leads can cause electrical shock.
- Make sure the main power to the Rosemount 5300 Series Transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the transmitter.
- Ground device on non-metallic tanks (e.g. fiberglass tanks) to prevent electrostatic charge build-up.

Probes with non-conducting surfaces
Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

Eliminate the risk of ESD discharge prior to dismounting the transmitter head from the probe.
Probes may generate an ignition- capable level of electrostatic charge under extreme conditions. During any type of installation or maintenance in a potentially explosive atmosphere the responsible person should make sure that any ESD risks are eliminated before attempting to separate the probe from the transmitter head.

Contents

2.0 Confirm system readiness (4-20 mA only)

2.1 Confirm HART revision capability

If using HART-based control or asset management systems, confirm the HART 7 capability of such systems prior to commissioning and installation. Not all systems are capable of communicating with the HART Revision 7 protocol. This transmitter can be configured for either HART Revision 5 or 7.

2.2 Confirm correct Device Driver

- Verify that the correct Device Driver (DD/DTM™) is loaded on your systems to ensure proper communication. See Table 1.
- Download the Device Driver from www.rosemount.com/LevelSoftware

Table 1. Rosemount 5300 Device Revisions and Files

Firmware version[1]	Find Device Driver	
	HART universal revision	Device revision[2]
2F0 and later	7	4
	5	3
2A2 - 2D2	5	3

1.Firmware version is printed on the transmitter head label, e.g. SW 2E0.

2.Device revision is printed on the transmitter head label, e.g. HART Dev Rev 4.

2.3 Switch HART revision mode

If the HART configuration tool is not capable of communicating with HART Revision 7, the device will load a generic menu with limited capability.

To switch the HART revision mode from the Generic Menu:

1. Go to **Manual Setup** > **Device Information** > **Identification** > **Message**.
2. In the *Message* field, enter “HART5” or “HART7”.

3.0 Mount transmitter on tank

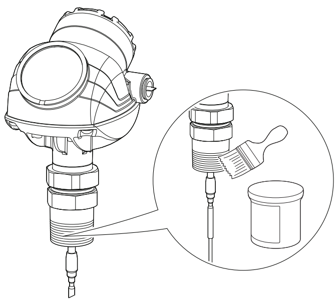
For flexible single lead probes ordered with weight unmounted (option code WU), refer to section "Adjust probe length" on page 20 before mounting the transmitter.

3.1 Threaded / flange / Tri Clamp tank connection

Step 1: Seal and protect the threads

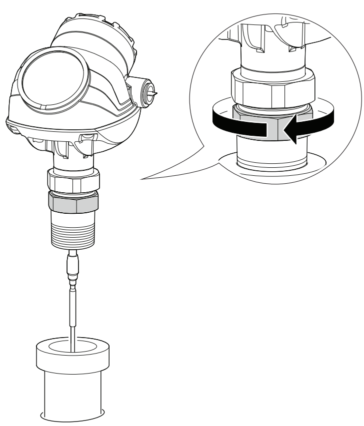
Use anti-seize paste or PTFE tape according to your site procedures.

⚠ Only for NPT threaded tank connection.

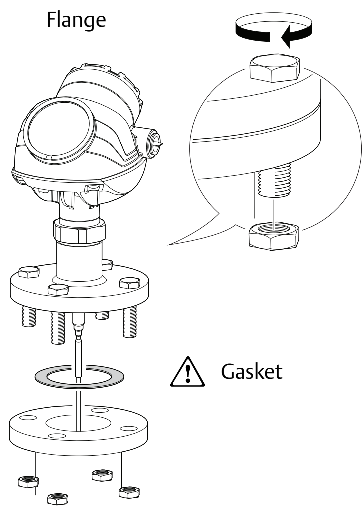


Step 2: Mount the device on tank

NPT

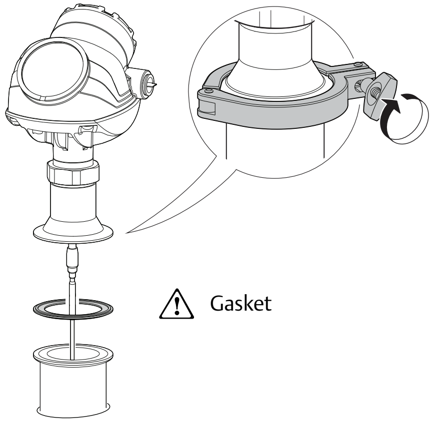


Flange

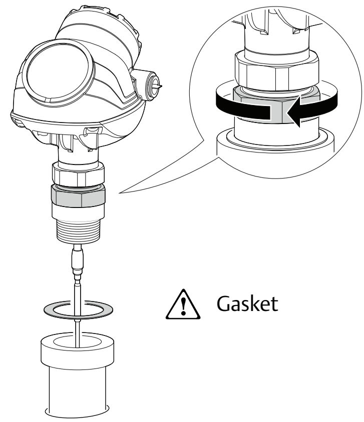


Step 2: Continued...

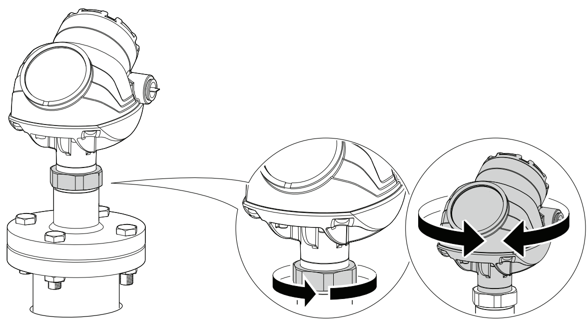
Tri Clamp



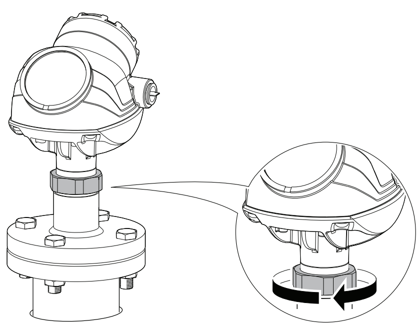
BSP/G



Step 3: Adjust display orientation (optional)



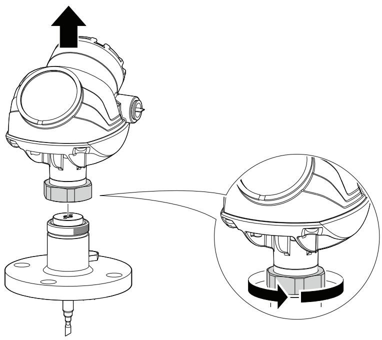
Step 4: Tighten the nut



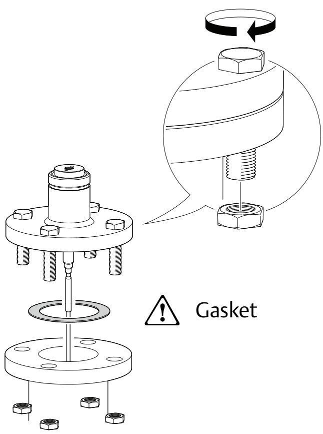
Torque 30 Lbft (40 Nm)

3.2 Remote housing

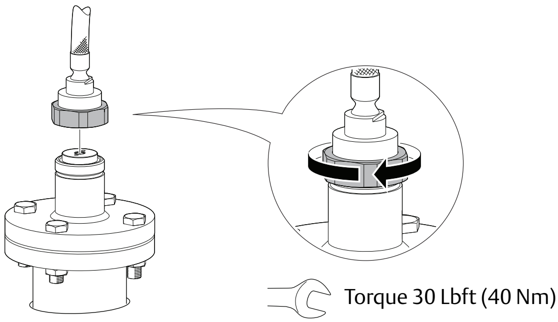
Step 1: Carefully remove the transmitter



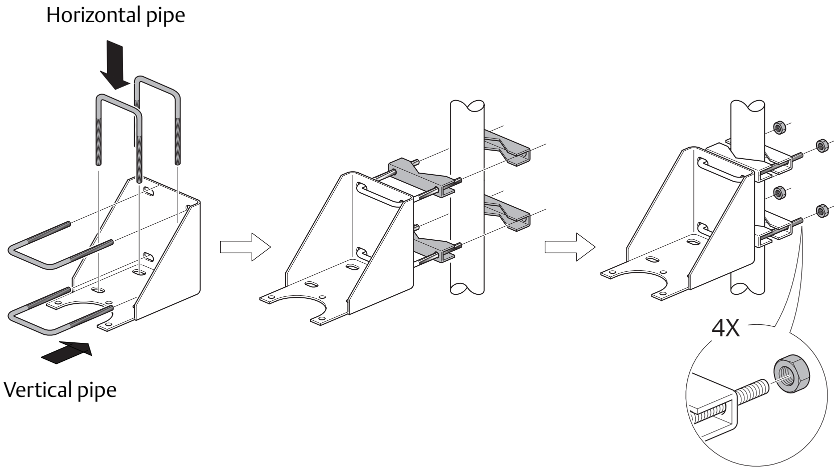
Step 2: Mount the probe on tank



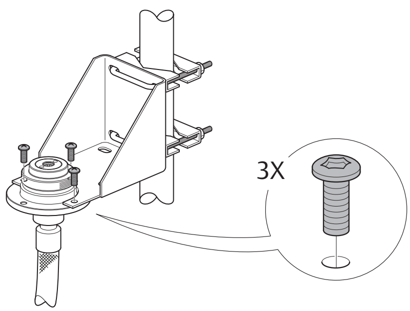
Step 3: Mount the remote connection on the probe



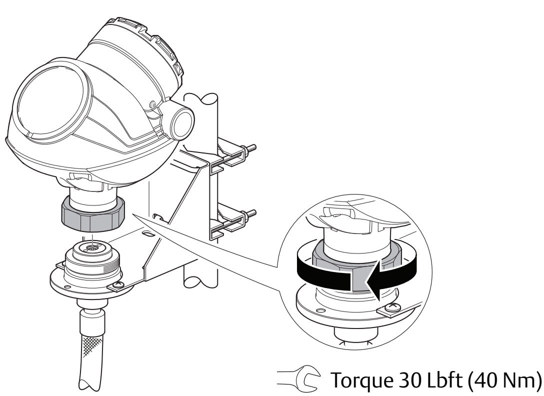
Step 4: Mount the bracket to the pipe



Step 5: Fasten the housing support



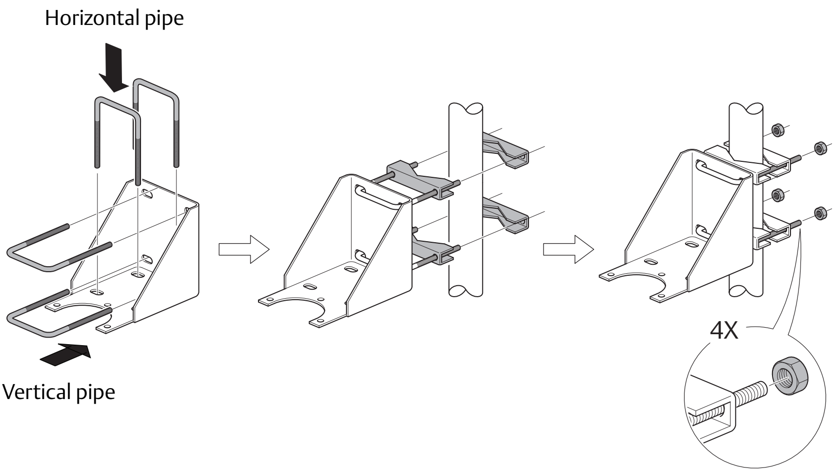
Step 6: Mount the transmitter head



3.3 Bracket mounting

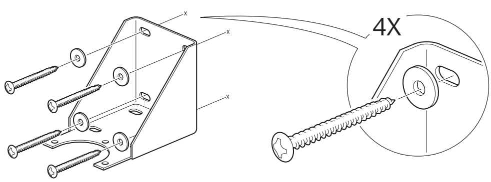
Step 1: Mount the bracket to the pipe/wall

On pipe

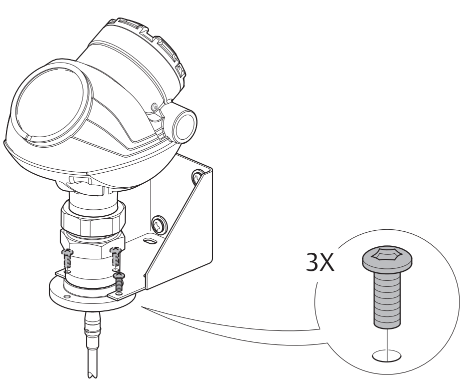


On wall

Use screws suitable for the purpose.



Step 2: Mount the transmitter with probe to the bracket



4.0 Connect the wiring

4.1 Cable selection

Use shielded twisted pair wiring (18-12 AWG).

For the RS-485 bus, use shielded twisted pair wiring, preferably with an impedance of 120 Ω (typically 24 AWG).

4.2 Cable gland/conduit

For explosion-proof/flameproof installations, only use cable glands or conduit entry devices certified explosion-proof or flameproof.

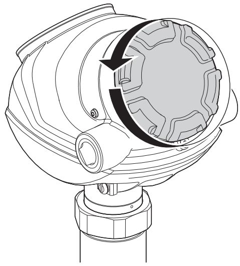
4.3 Power supply (Vdc)

Approval type	HART	FOUNDATION Fieldbus	RS-485 with Modbus
None	16 - 42.4	9 - 32	8-30 (max. rating)
Non-sparking/energy limited	16 - 42.4	9 - 32	N/A
Intrinsically safe	16 - 30	9 - 30	N/A
FISCO	N/A	9 - 17.5	N/A
Explosion-proof/Flameproof	20 - 42.4	16 - 32	8-30 (max. rating)

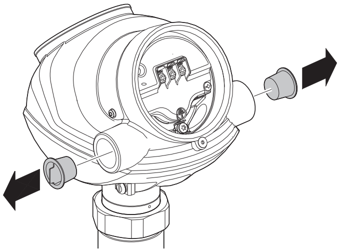
4.4 Procedure

Step 1: Verify that the power supply is disconnected

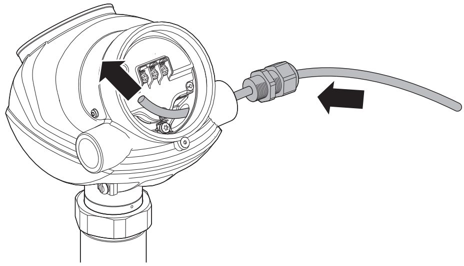
Step 2: Remove the cover



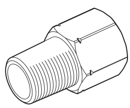
Step 3: Remove the plastic plugs



Step 4: Pull the cable through cable gland/conduit



Adapters are required if M20 glands are used.



Step 5: Connect the cable wires

See the wiring diagrams on page 13-16.

Step 6: Ensure proper grounding

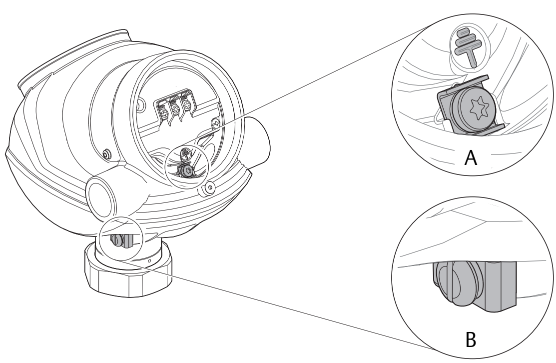
Make sure grounding is done (including IS ground inside Terminal compartment) according to Hazardous Locations Certifications, national and local electrical codes.

Transmitter housing grounding

The most effective transmitter housing grounding method is a direct connection to earth ground with minimal (< 1 Ω) impedance.

There are two grounding screw connections provided (see Figure 1).

Figure 1. Ground Screws



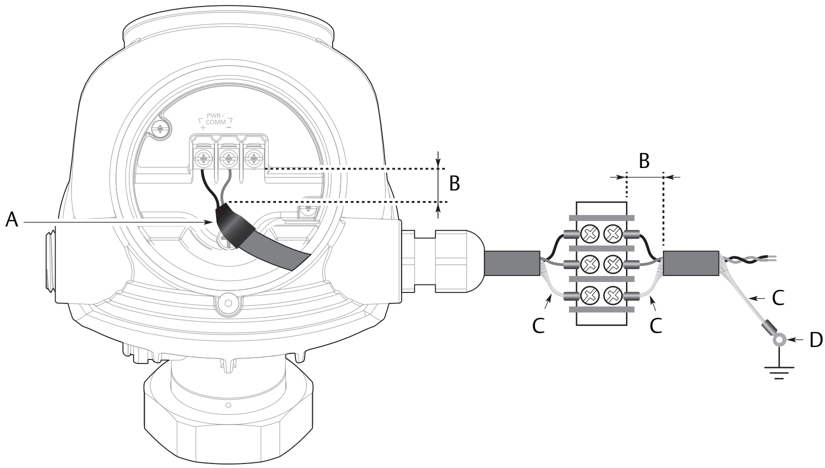
A. Internal ground screw
B. External ground screw

Signal cable shield grounding

Make sure the instrument cable shield is:

- trimmed close and insulated from touching the transmitter housing.
- continuously connected throughout the segment.
- connected to a good earth ground at the power supply end.

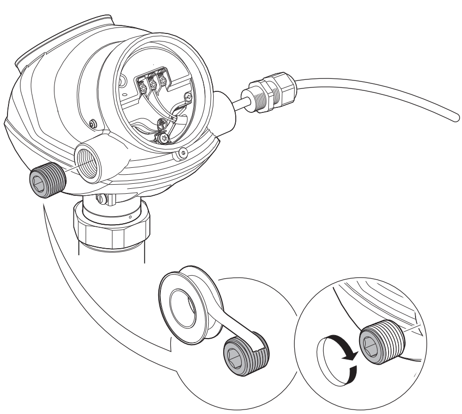
Figure 2. Cable Shield



A. Insulate shield
B. Minimize distance
C. Trim shield and insulate
D. Connect shield back to the power supply ground

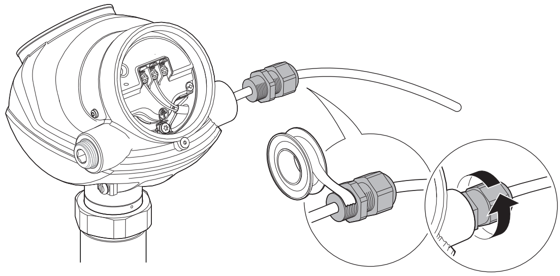
Step 7: Seal any unused port with the enclosed metal plug

Apply PTFE tape or other sealant to the threads.

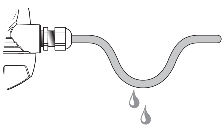


Step 8: Tighten the cable gland

Apply PTFE tape or other sealant to the threads.

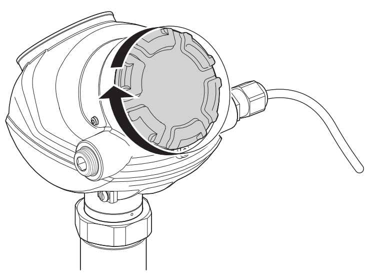


Note
Make sure to arrange the wiring with a drip loop.



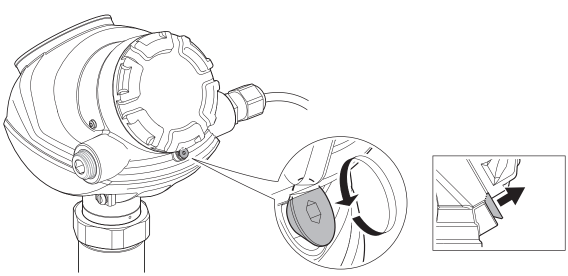
Step 9: Mount the cover

Make sure the cover is fully engaged to meet Explosion-proof requirements.



Step 10: Lock the cover with the locking screw

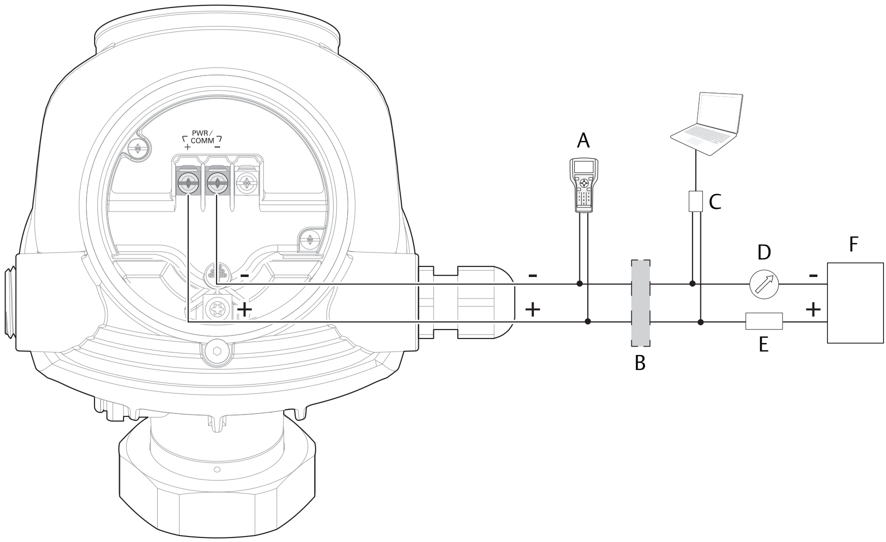
Required for ATEX, IECEx, NEPSI, INMETRO, and TIIS installations only.



Step 11: Connect the power supply

4.5 4-20 mA/HART communication

Figure 3. Wiring Diagram



A. Field Communicator
B. Approved IS barrier (for Intrinsically Safe installations only)
C. HART modem
D. Current meter
E. Load resistance (≥250 Ω)
F. Power supply

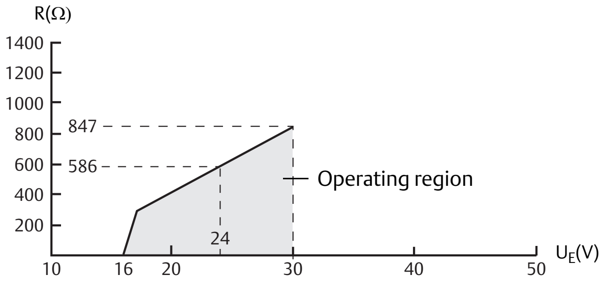
Note
Rosemount 5300 Series Transmitters with Flameproof/explosion-proof output have a built-in barrier; no external barrier needed.

Load limitations

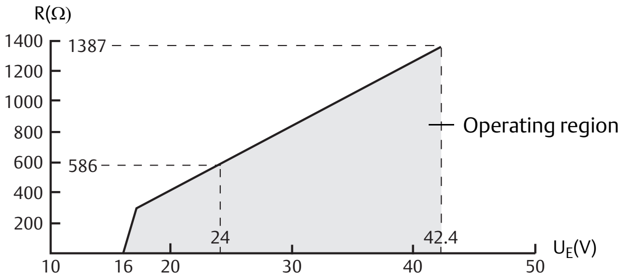
For HART communication, a minimum loop resistance of 250 Ω is required. For maximum loop resistance, see Figure 4.

Figure 4. Maximum Loop Resistance

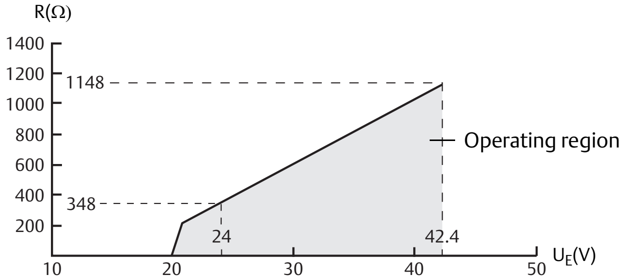
Intrinsically safe installations



Non-hazardous and Non-sparking/energy limited installations



Explosion-proof/flameproof (Ex d) installations



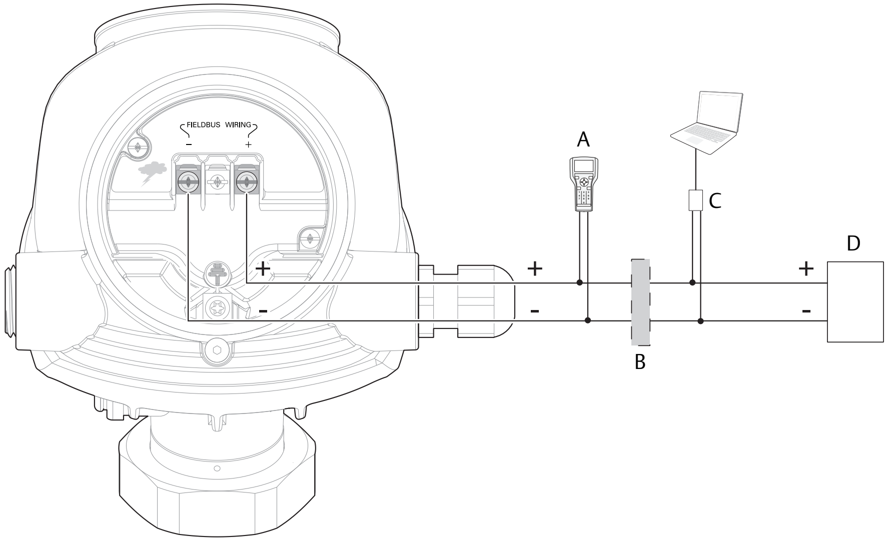
R(Ω): Maximum Loop Resistance
U_E(V): External Power Supply Voltage

Note

For the Ex d case, the diagram is only valid if the HART load resistance is at the + side and if the - side is grounded, otherwise the load resistance value is limited to 435 Ω.

4.6 FOUNDATION Fieldbus

Figure 5. Wiring Diagram



A. Field Communicator
B. Approved IS barrier (for Intrinsically Safe installations only)
C. FOUNDATION Fieldbus modem
D. Power supply

Note
Rosemount 5300 Series Transmitters with Flameproof/explosion-proof output have a built-in barrier; no external barrier needed.

4.7 RS-485 with Modbus communication

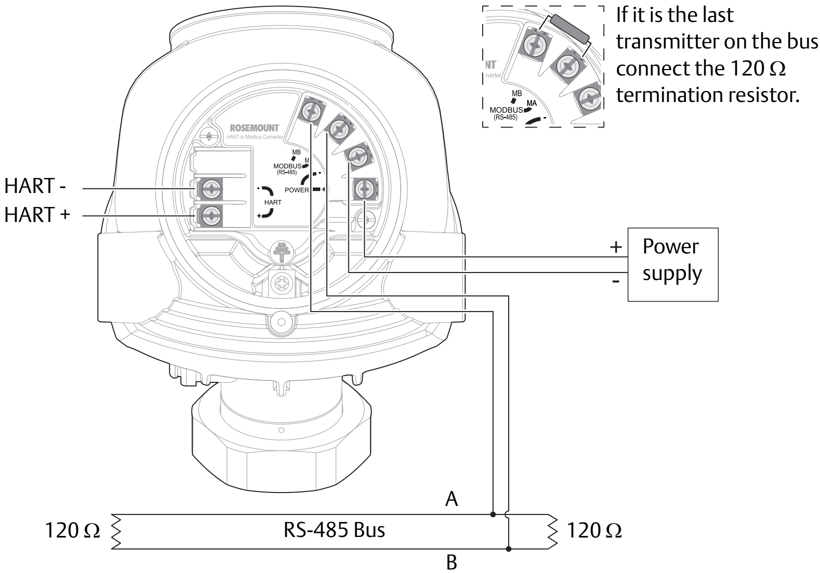
See the Rosemount 5300 Series Reference Manual for details.

Power consumption

< 0.5 W (with HART address = 1)

< 1.2 W (including four HART slaves)

Figure 6. Wiring Diagram



Note

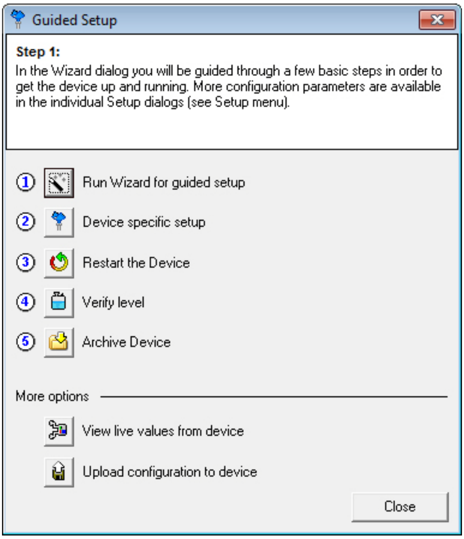
Rosemount 5300 Series Transmitters with Flameproof/Explosion-proof output have a built-in barrier; no external barrier needed.

5.0 Configure

Basic configuration can easily be done either with Rosemount Radar Master, a Field Communicator, the AMS™ Suite, DeltaV™, or any other DD (Device Description) or DTM compatible host system. For advanced configuration features, Rosemount Radar Master is recommended.

5.1 Rosemount Radar Master

1. Start Rosemount Radar Master (RRM).
2. Connect to the desired transmitter.
3. In the *Guided Setup* window, click **Run Wizard for guided setup** and follow the instructions.



4. Continue with steps 2 to 5 in the Guided Setup.
5. Click **View live values from device** to verify that the transmitter works correctly.

5.2 AMS Device Manager or Field Communicator

Step 1: Connect to device

AMS Device Manager

1. Start AMS Device manager.
2. Select **View** > **Device Connection View**.
3. In the *Device Connection View*, double-click the modem icon.
4. Double-click the device icon.

Field Communicator

1. Turn on the Field Communicator.
2. From the *Main Menu*, tap the HART or Fieldbus symbol.
   The Field Communicator now connects to the device.

Step 2: Configure device

HART Device Revision 3

1. Select **Configure/Setup** > **Basic Setup**.
2. Configure steps 1- 6 in the Basic Setup.
   (Variable Mapping, Probe, Geometry, Environment, Volume, and Analog Out)
3. Select **Finish**.
4. Select **Device Specific Setup**.
5. Select **Restart Device**.

HART Device Revision 4

1. Select **Configure** > **Guided Setup**.
2. Select **Level Measurement Setup** and follow the instructions.
3. Select **Device Specific Setup**.
4. Run **Verify Level** to check your level measurement.
5. Consider optional setup, such as **Volume** and **Display**.

FOUNDATION Fieldbus

1. Select **Configure** > **Guided Setup**.
2. Select **Level Measurement Setup** and follow the instructions.
3. Optional: Select **Volume Calculation Setup**.
4. Select **Device Specific Setup**.
5. Select **Restart Measurement**.

Table 2. FOUNDATION Fieldbus Parameters

Function	Parameter
Probe type	TRANSDUCER_1100 > PROBE_TYPE
Probe length	TRANSDUCER_1100 > PROBE_LENGTH
Hold off distance/Upper null zone	TRANSDUCER_1100 > GEOM_HOLD_OFF_DIST
Tank height	TRANSDUCER_1100 > GEOM_TANK_HEIGHT
Mounting type	TRANSDUCER_1100 > MOUNTING_TYPE
Pipe/chamber/nozzle inner diameter	TRANSDUCER_1100 > PIPE_DIAMETER
Nozzle height	TRANSDUCER_1100 > NOZZLE_HEIGHT
Measurement mode	TRANSDUCER_1100 > MEAS_MODE
Product dielectric range(1)	TRANSDUCER 1100 > PRODUCT_DIELEC_RANGE
Upper product dielectric constant(2)	TRANSDUCER 1100 > UPPER_PRODUCT_DC
Process condition (rapid level changes)	TRANSDUCER_1100 > ENV_ENVIRONMENT
Volume calculation method	TRANSDUCER 1300 > VOL_VOLUME_CALC_METHOD
Tank diameter (only for ideal tank shapes)	TRANSDUCER 1300 > VOL_IDEAL_DIAMETER
Tank length/height (only for ideal tank shapes)	TRANSDUCER_1300 > VOL_IDEAL_LENGTH
Volume offset	TRANSDUCER_1300 > VOL_VOLUME_OFFSET

1. Applicable to “Liquid Product Level” and “Solid Product Level” measurement modes.
2. Applicable to “Interface Level with submerged” and “Product Level and Interface Level” measurement modes.

6.0 Safety Instrumented Systems (4-20 mA only)

For Safety Certified installations, refer to the Rosemount 5300 Series Reference Manual.

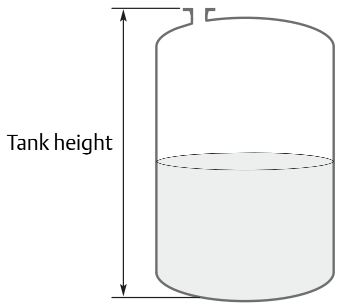
7.0 Adjust probe length

This section describes how to adjust the length of flexible single lead probes with weight unmounted (option code WU).

For other probe types, refer to Section 3 in the Rosemount 5300 Reference Manual.

Step 1: Measure tank height

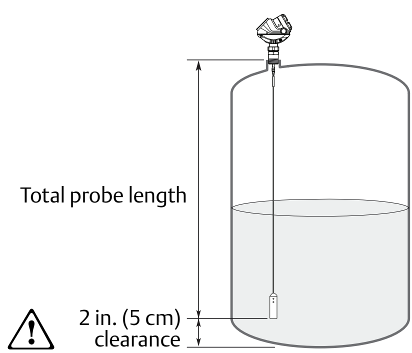
Tank height:



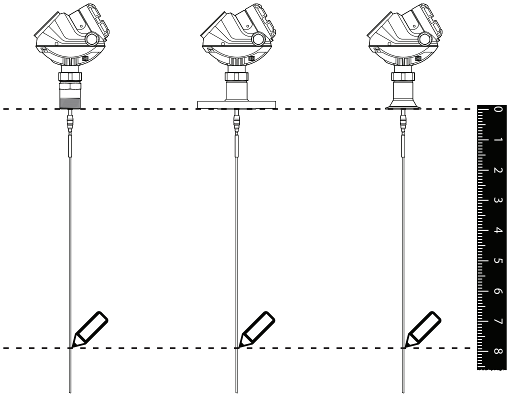
Step 2: Calculate total probe length

Total probe length = Tank height – 2 in. (5 cm)

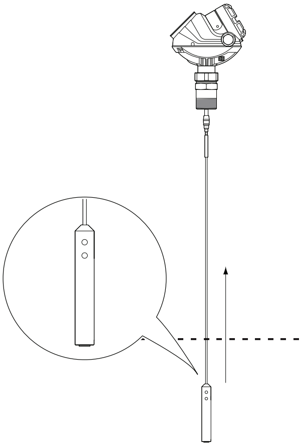
Total probe length:



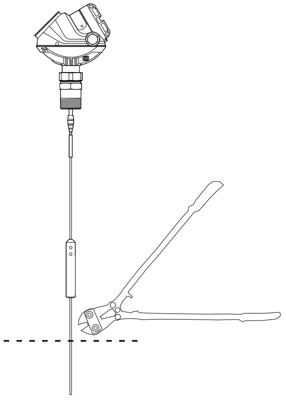
Step 3: Mark where to cut the probe



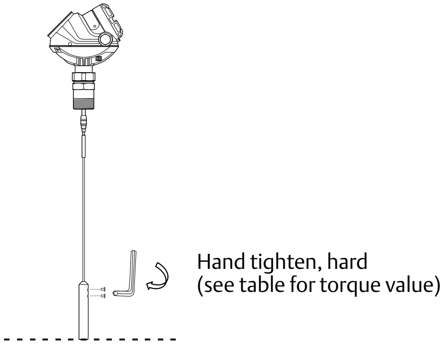
Step 4: Slide the weight up



Step 5: Cut the probe at the mark



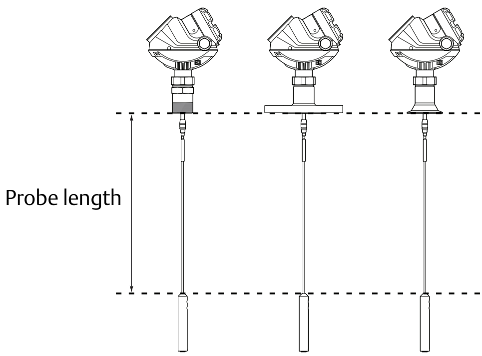
Step 6: Fasten the weight



Weight material	Torque (Nm)
Stainless steel	5
Alloy C-276	2.5
Alloy 400	2.5
Duplex 2205	2.5

Step 7: Update transmitter configuration to the new probe length

Probe length:



8.0 Product certifications

Rev 2.0

8.1 EU conformity

The EU declaration of conformity can be found on page 35. The most recent revision of the EU declaration of conformity can be found at EmersonProcess.com/Rosemount.

8.2 Ordinary Location Certification

As standard, the transmitter has been examined and tested to determine that the design meets the basic electrical, mechanical, and fire protection requirements by a nationally recognized test laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

8.3 Installing Equipment in North America

The US National Electrical Code (NEC®) and the Canadian Electrical Code (CEC) permit the use of Division marked equipment in Zones and Zone marked equipment in Divisions. The markings must be suitable for the area classification, gas, and temperature class. This information is clearly defined in the respective codes.

8.4 USA

E5 Explosionproof (XP), Dust-Ignitionproof (DIP)

Certificate: FM 3020497

Standards: FM Class 3600 - 2011; FM Class 3610 - 2010; FM Class 3611 - 2004; FM Class 3615 - 2006; FM Class 3810 - 2005; ANSI/ISA 60079-0 - 2013; ANSI/ISA 60079-11 - 2012; ANSI/NEMA 250 - 2003

Markings: XP CL I, DIV 1, GP B, C, D; DIP CLII/III, DIV 1, GP E, F, G; T4 Ta=60°C and 70°C; Type 4X

Special Conditions for Safe Use (X):

1. Potential Electrostatic Charging Hazard - The enclosure contains non-metallic material. To prevent the risk for electrostatic sparking the plastic surface should only be cleaned with a damp cloth.
2. WARNING - The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

I5 Intrinsic Safety (IS), Nonincendive (NI)

Certificate: FM 3020497

Standards: FM Class 3600 – 2011; FM Class 3610 – 2010; FM Class 3611 – 2004; FM Class 3615 – 2006; FM Class 3810 – 2005; ANSI/ISA 60079-0 – 2013; ANSI/ISA 60079-11 – 2012; ANSI/NEMA 250 – 2003;

Markings: IS CL I, II, III, DIV 1, GP A, B, C, D, E, F, G in accordance with control drawing 9240030-936; IS (Entity) CL I, Zone 0, AEx ia IIC T4 in accordance with control drawing 9240030-936, NI CL I, II, DIV 2, GP A, B, C, D, F, G; Suitable for use in CL III DIV 2, indoor and outdoor, T4 Ta=60 °C and 70°C; Type 4X

Special Conditions for Safe Use (X):

1. Potential Electrostatic Charging Hazard - The enclosure contains non-metallic material. To prevent the risk for electrostatic sparking the plastic surface should only be cleaned with a damp cloth.
2. WARNING - The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

	Ui	Ii	Pi	Ci	Li
Entity parameters HART	30 V	130 mA	1 W	7.26 nF	0
Entity parameters Fieldbus	30 V	300 mA	1.3 W	0	0

IE FISCO

Certificate: FM 3020497

Standards: FM Class 3600 – 2011; FM Class 3610 – 2010; FM Class 3611 – 2004; FM Class 3615 – 2006; FM Class 3810 – 2005; ANSI/ISA 60079-0 – 2013; ANSI/ISA 60079-11 – 2012; ANSI/NEMA 250 – 2003;

Markings: IS CL I, II, III, DIV 1, GP A, B, C, D, E, F, G in accordance with control drawing 9240030-936; IS (Entity) CL I, Zone 0, AEx ia IIC T4 in accordance with control drawing 9240030-936, NI CL I, II, DIV 2, GP A, B, C, D, F, G; Suitable for use in CL III DIV 2, indoor and outdoor, T4 Ta=60 °C and 70°C; Type 4X

Special Conditions for Safe Use (X):

1. Potential Electrostatic Charging Hazard - The enclosure contains non-metallic material. To prevent the risk for electrostatic sparking the plastic surface should only be cleaned with a damp cloth.
2. WARNING - The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Care must be taken into account during installation and use to prevent impact or friction.

	Ui	Ii	Pi	Ci	Li
FISCO parameters	17.5 V	380 mA	5.32 W	0	0

8.5 Canada

E6 Explosionproof, Dust-Ignitionproof

Certificate: 1514653

Standards: CSA C22.2 No.0-M91, CSA C22.2 No.25-1966, CSA C22.2 No.30-M1986, CSA C22.2 No.94-M91, CSA C22.2 No.142-M1987, CSA C22.2 157-92, CAN/CSA C22.2 No. 60529:05, ANSI/ISA 12.27.01-2003

Markings: Explosionproof CL I, DIV 1, GP B, C, D; Dust-Ignitionproof CL II, DIV 1 and 2, GP E, F, G and coal dust, CL III, DIV 1, Type 4X/IP66/IP67

I6 Intrinsically Safe and Non-Incendive Systems

Certificate: 1514653

Standards: CSA C22.2 No.0-M91, CSA C22.2 No.25-1966, CSA C22.2 No.30-M1986, CSA C22.2 No.94-M91, CSA C22.2 No.142-M1987, CSA C22.2 157-92, CAN/CSA C22.2 No. 60529:05, ANSI/ISA 12.27.01-2003

Markings: CL I, DIV 1, GP A, B, C, D, T4 see installation drawing 9150079-906; Non-Incendive Class III, DIV 1, Haz-loc CL I DIV 2, GP A, B, C, D, Maximum Ambient Temperature +60°C for Fieldbus and FISCO and +70 °C for HART, T4, Type 4X/IP66/IP67, Maximum Working Pressure 5000 psi, Dual Seal.

	Ui	Ii	Pi	Ci	Li
Entity parameters HART	30 V	130 mA	1 W	7.26 nF	0
Entity parameters Fieldbus	30 V	300 mA	1.3 W	0	0

IF FISCO

Certificate: 1514653

Standards: CSA C22.2 No.0-M91, CSA C22.2 No.25-1966, CSA C22.2 No.30-M1986, CSA C22.2 No.94-M91, CSA C22.2 No.142-M1987, CSA C22.2 157-92, CAN/CSA C22.2 No. 60529:05, ANSI/ISA 12.27.01-2003

Markings: CL I, DIV 1, GP A, B, C, D, T4 see installation drawing 9150079-906; Non-Incendive Class III, DIV 1, Haz-loc CL I DIV 2, GP A, B, C, D, Maximum Ambient Temperature +60°C for Fieldbus and FISCO and +70 °C for HART, T4, Type 4X/IP66/IP67, Maximum Working Pressure 5000 psi, Dual Seal.

	Ui	Ii	Pi	Ci	Li
FISCO parameters	17.5 V	380 mA	5.32 W	0	0

8.6 Europe

E1 ATEX Flameproof

Certificate: Nemko 04ATEX1073X

Standards: EN 60079-0:2012, EN 60079-1:2014, EN 60079-11:2012, EN 60079-26:2015, EN 60079-31:2014

Markings: Ex II 1/2G Ex db ia IIC T4 Ga/Gb, (-40°C ≤ Ta ≤ +60°C /+70°C)
II 1D Ex ta IIIC T69°C/T79°C Da, (-40°C/-50°C ≤ Ta ≤ +60°C /+70°C)
Um = 250 V

Special Conditions for Safe Use (X):

1. The intrinsically safe circuits do not withstand the 500V AB test as specified in EN 60079-11:2012 clause 6.4.13.
2. Potential ignition hazards by impact or friction need to be considered according to EN 60079-0:2012 clause 8.3 (for EPL Ga and EPG Gb), when the transmitter enclosure and antennas exposed to the exterior atmosphere of the tank, is made with light metals containing aluminium or titanium.
   The end user shall determine the suitability with regard to avoid hazards from impact and friction.
3. The Ex ia version of model 5300 FISCO field device may be supplied by an "Ex ib" FISCO power supply, when the power supply is certified with three separate safety current limiting devices and voltage limitation which meets the requirements for type Ex ia.
4. 1/2" NPT threads need to e sealed for dust and water ingress protection, IP 66, IP 67 or "Ex t", EPL Da or Db is required.

I1 ATEX Intrinsic Safety

Certificate: Nemko 04ATEX1073X

Standards: EN 60079-0:2012, EN 60079-1:2014, EN 60079-11:2012, EN 60079-26:2015, EN 60079-31:2014

Markings: Ex II 1G Ex ia IIC T4 Ga (-50°C ≤ Ta ≤ +70°C)
II 1/2G Ex ib IIC T4 Ga/Gb (-50°C ≤ Ta ≤ +70°C)
II 1D Ex ia IIIC T69°C/T79°C Da, (-50°C ≤ Ta ≤ +60°C /+70°C)
II 1/2D Ex ib IIIC T69°C/T79°C Da/Db, (-50°C ≤ Ta ≤ +60°C /+70°C)

Special Conditions for Safe Use (X):

1. The intrinsically safe circuits do not withstand the 500V AB test as specified in EN 60079-11:2012 clause 6.4.13.
2. Potential ignition hazards by impact or friction need to be considered according to EN 60079-0:2012 clause 8.3 (for EPL Ga and EPG Gb), when the transmitter enclosure and antennas exposed to the exterior atmosphere of the tank, is made with light metals containing aluminium or titanium.
   The end user shall determine the suitability with regard to avoid hazards from impact and friction.
3. The Ex ia version of model 5300 FISCO field device may be supplied by an "Ex ib" FISCO power supply, when the power supply is certified with three separate safety current limiting devices and voltage limitation which meets the requirements for type Ex ia.
4. 1/2" NPT threads need to e sealed for dust and water ingress protection, IP 66, IP 67 or "Ex t", EPL Da or Db is required.

	Ui	Ii	Pi	Ci	Li
Entity parameters HART	30 V	130 mA	1 W	7.26 nF	0
Entity parameters Fieldbus	30 V	300 mA	1.5 W	4.95 nF	0

IA ATEX FISCO

Certificate: Nemko 04ATEX1073X

Standards: EN 60079-0:2012, EN 60079-1:2014, EN 60079-11:2012, EN 60079-26:2015, EN 60079-31:2014

Markings: Ⓔx II 1G Ex ia IIC T4 Ga (-50°C ≤ Ta ≤ +60°C) or
II 1/2G Ex ia/ib IIC T4 Ga/Gb (-50°C ≤ Ta ≤ +60°C)
II 1D Ex ia IIIC T69°C Da, (-50°C ≤ Ta ≤ +60°C)
II 1D Ex ia/ib IIIC T69°C Da/Db, (-50°C ≤ Ta ≤ +60°C)

Special Conditions for Safe Use (X):

1. The intrinsically safe circuits do not withstand the 500V AB test as specified in EN 60079-11:2012 clause 6.4.13.2.
2. Potential ignition hazards by impact or friction need to be considered according to EN 60079-0:2012 clause 8.3 (for EPL Ga and EPG Gb), when the transmitter enclosure and antennas exposed to the exterior atmosphere of the tank, is made with light metals containing aluminium or titanium.
   The end user shall determine the suitability with regard to avoid hazards from impact and friction.
3. The Ex ia version of model 5300 FISCO device may be supplied by an "Ex ib" FISCO power supply, when the power supply is certified with three separate safety current limiting devices and voltage limitation which meets the requirements for type Ex ia.
4. 1/2" NPT threads need to e sealed for dust and water ingress protection, IP 66, IP 67 or "Ex t", EPL Da or Db is required.

	Ui	Ii	Pi	Ci	Li
FISCO parameters	17.5 V	380 mA	5.32 W	4.95 nF	<1 µH

N1 ATEX Type N

Certificate: Nemko 10ATEX1072X

Standards: EN 60079-0:2012, EN 60079-11:2012, EN 60079-15:2010, EN 60079-21:2013

Markings: Ⓔx II 3G Ex nA ic IIC T4 Gc (-50°C ≤ Ta ≤ +60°C /+70°C)
II 3G Ex ic IIC T4 Gc (-50°C ≤ Ta ≤ +60°C /+70°C)
II 3D Ex tc IIIC T69°C/T79°C Dc (-50°C ≤ Ta ≤ +60°C /+70°C)

Special Conditions for Safe Use (X):

1. The transmitter circuits does not withstand 500V AC dielectric strength test according to EN 60079-11 clause 6.3.13 due to earth connected transient suppressing devices. Appropriate measures have to be considered by installation.

	Ui	Ii	Pi	Ci	Li
Safety parameters HART	42.4 V	23 mA	1 W	7.25 nF	Negligible
Safety parameters Fieldbus	32 V	21 mA	0.7 W	4.95 nF	Negligible

8.7 International

E7 IECEx Flameproof

Certificate: IECEx NEM 06.0001X

Standards: IEC 60079-0:2011, IEC 60079-1:2014-06, IEC 60079-11:2011; IEC 60079-26:2014, IEC 60079-31:2013

Markings: Ex db ia IIC T4 Ga/Gb (-40°C ≤ Ta ≤ +60°C /+70°C)
Ex ta IIIC T69 °C/T79 °C Da (-40°C ≤ Ta ≤ +60°C /+70°C)
Um=250 VAC, IP66/IP67

Special Conditions for Safe Use (X):

1. The Intrinsically safe circuits do not withstand the 500 V AC test as specified in IEC 60079-11 clause 6.4.13
2. Potential ignition hazards by impact or friction need to be considered according to IEC 60079-0:2011 clause 8.3 (for EPL Ga and EPL Gb9, when the transmitter enclosure and antenna exposed to the exterior atmosphere of the tank, is made with light metals containing aluminum or titanium.
   The end used shall determine the suitability with regard to avoid hazards from impact and friction.
3. The Ex ia version of model 5300 FISCO device may be supplied by an “Ex ib” FISCO power supply, when the power supply is certified with three separate safety current limiting devices and voltage limitation which meets the requirements for type Ex ia.
4. ½” NPT threads need to be sealed for dust and water ingress protection, IP 66, IP 67 or “Ex t”, EPL Da or Db is required.

I7 IECEx Intrinsic Safety

Certificate: IECEx NEM 06.0001X

Standards: IEC 60079-0:2011, IEC 60079-1:2014-06, IEC 60079-11:2011; IEC 60079-26:2014, IEC 60079-31:2013

Markings: Ex ia IIC T4 Ga (-50°C ≤ Ta ≤ +70°C)
Ex ia IIIC T4 T69°C/T79°C Da (-50°C ≤ Ta ≤ +60°C/+70°C)

Special Conditions for Safe Use (X):

1. The Intrinsically safe circuits do not withstand the 500 V AC test as specified in IEC 60079-11 clause 6.4.13
2. Potential ignition hazards by impact or friction need to be considered according to IEC 60079-0:2011 clause 8.3 (for EPL Ga and EPL Gb9, when the transmitter enclosure and antenna exposed to the exterior atmosphere of the tank, is made with light metals containing aluminum or titanium.
   The end used shall determine the suitability with regard to avoid hazards from impact and friction.
3. The Ex ia version of model 5300 FISCO device may be supplied by an “Ex ib” FISCO power supply, when the power supply is certified with three separate safety current limiting devices and voltage limitation which meets the requirements for type Ex ia.
4. ½” NPT threads need to be sealed for dust and water ingress protection, IP 66, IP 67 or “Ex t”, EPL Da or Db is required.

	Ui	Ii	Pi	Ci	Li
Entity parameters HART	30 V	130 mA	1 W	0 µF	Negligible
Entity parameters Fieldbus	30 V	300 mA	1.5 W	4.95 nF	Negligible

IG IECEx FISCO

Certificate: IECEx NEM 06.0001X

Standards: IEC 60079-0:2011, IEC 60079-1:2014-06, IEC 60079-11:2011; IEC 60079-26:2014, IEC 60079-31:2013

Markings: Ex ia IIC T4 Ga (-50°C ≤ Ta ≤ +60°C)
Ex ia/ib IIC T4 Ga/Gb (-50°C ≤ Ta ≤ +60°C)
Ex ia IIIC T69°C Da (-50°C ≤ Ta ≤ +60°C)
Ex ia/ib IIIC T69°C Da/Db (-50°C ≤ Ta ≤ +60°C)

Special Conditions for Safe Use (X):

1. The Intrinsically safe circuits do not withstand the 500 V AC test as specified in IEC 60079-11 clause 6.4.13
2. Potential ignition hazards by impact or friction need to be considered according to IEC 60079-0:2011 clause 8.3 (for EPL Ga and EPL Gb9, when the transmitter enclosure and antenna exposed to the exterior atmosphere of the tank, is made with light metals containing aluminum or titanium.
   The end used shall determine the suitability with regard to avoid hazards from impact and friction.
3. The Ex ia version of model 5300 FISCO field device may be supplied by an [Ex ib] FISCO power supply when the power supply is certified with three separate safety current limiting devices and voltage limitation which meets the requirements for type Ex ia.
4. ½" NPT threads need to be sealed for dust and water ingress protection, IP 66, IP 67 or "Ex t", EPL Da or Db is required.

	Ui	Ii	Pi	Ci	Li
FISCO parameters	17.5 V	380 mA	5.32 W	4.95 nF	<1 µH

N7 IECEx Type N

Certificate: IECEx NEM 10.0005X

Standards: IEC 60079-0:2011, IEC 60079-11:2011, IEC 60079-15:2010, IEC 60079-31:2010

Markings: Ex nA ic IIC T4 Gc (-50°C ≤ Ta ≤ +60°C /+70°C)
Ex ic IIC T4 Gc (-50°C ≤ Ta ≤ +60°C /+70°C)
Ex tc IIIC T69°C/T79°C Dc (-50°C ≤ Ta ≤ +60°C /+70°C)

Special Conditions for Safe Use (X):

1. The transmitter circuits does not withstand 500V AC dielectric strength test according to EN 60079-11 clause 6.3.13 due to earth connected transient suppressing devices. Appropriate measures have to be considered by installation.

	Ui	Ii	Pi	Ci	Li
Safety parameters HART	42.4 V	23 mA	1 W	7.25 nF	Negligible
Safety parameters Fieldbus	32 V	21 mA	0.7 W	4.95 nF	Negligible

8.8 Brazil

E2 INMETRO Flameproof

Certificate: NCC 14.2258 X

Standards: ABNT NBR IEC 60079-0:2013, ABNT NBR IEC 60079-1:2009 + Errata 1:2011, ABNT NBR IEC 60079-11:2013, ABNT NBR IEC 60079-26:2008 + Errata 1:2009, ABNT NBR IEC 60079-31:2011

Markings: Ex d ia IIC T4 Gb/Ga (-40 °C ≤ T_{amb} ≤ +60 °C /+70 °C)
Ex ta IIIC T69 °C/T79 °C (-40 °C ≤ T_{amb} ≤ +60 °C /+70 °C)
Um=250 V_{CA}, IP66/67

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

I2 INMETRO Intrinsic Safety

Certificate: NCC 14.2258 X

Standards: ABNT NBR IEC 60079-0:2013, ABNT NBR IEC 60079-1:2009 + Errata 1:2011, ABNT NBR IEC 60079-11:2013, ABNT NBR IEC 60079-26:2008 + Errata 1:2009, ABNT NBR IEC 60079-31:2011

Markings: Ex ia IIC T4 Ga (- 50 °C ≤ T_{amb} ≤ +60 °C /+70 °C)
Ex ta IIIC T69 °C/T79 °C (- 50 °C ≤ T_{amb} ≤ +60 °C /+70 °C)

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

	Ui	Ii	Pi	Ci	Li
Entity parameters HART	30 V_{CC}	130 mA	1.0 W	7.26 nF	Negligible
Entity parameters Fieldbus	30 V_{CC}	300 mA	1.5 W	4.95 nF	Negligible

IB INMETRO FISCO

Certificate: NCC 14.2258 X

Standards: ABNT NBR IEC 60079-0:2013, ABNT NBR IEC 60079-1:2009 + Errata 1:2011, ABNT NBR IEC 60079-11:2013, ABNT NBR IEC 60079-26:2008 + Errata 1:2009, ABNT NBR IEC 60079-31:2011

Markings: Ex ia IIC T4 Ga
Ex ia/ib IIC T4 Ga/Gb
Ex ta IIIC T69 °C
(- 50 °C ≤ T_{amb} ≤ +60 °C /+70 °C)

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

	Ui	Ii	Pi	Ci	Li
FISCO parameters	17.5 V_{CC}	380 mA	5.32 W	4.95 nF	<1 µH

8.9 China

E3 China Flameproof

Certificate: GYJ16.1095X

Standards: GB 3836.1/2/4/20-2010, GB 12476.1/5-2013, GB 12476.4-2010

Markings: Ex d ia IIC T4 Ga/Gb (-40°C ≤ Ta ≤ +60°C/+70°C)
Ex tD A20 IP 66/67 T69°C /T79°C (-40°C ≤ Ta ≤ +60°C/+70°C)

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

I3 China Intrinsic Safety

Certificate: GYJ16.1095X

Standards: GB 3836.1/2/4/20-2010, GB 12476.1/5-2013, GB 12476.4-2010

Markings: Ex ia IIC T4 Ga (-50°C ≤ Ta ≤ +60°C/+70°C)
Ex iaD 20 T69°C /T79°C
Ex iaD/ibD 20/21 T69°C (-50°C ≤ Ta ≤ +60°C

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

	Ui	Ii	Pi	Ci	Li
Entity parameters HART	30 V	130 mA	1 W	7.26 nF	0 mH
Entity parameters Fieldbus	30 V	300 mA	1.5 W	4.95 nF	0 mH

IC China FISCO

Certificate: GYJ16.1095X

Standards: GB 3836.1/2/4/20-2000, GB 12476.4/5-2013, GB 12476.1-2010

Markings: Ex ia IIC T4 Ga (-50°C ≤ Ta ≤ +60°C)
Ex ia/ib IIC T4 Ga/Gb (-50°C ≤ Ta ≤ +60°C)
Ex iaD 20 T69 (-50°C ≤ Ta ≤ +60°C)
Ex iaD/ibD 20/21 T69°C (-50°C ≤ Ta ≤ +60°C)

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

	Ui	Ii	Pi	Ci	Li
FISCO parameters	17.5 V	380 mA	5.32 W	4.95 nF	<0.001 mH

N3 China Type N

Certificate: GYJ13.1387X

Standards: GB 3836.1-2010, GB 3836.8-2003

Markings: Ex nA nL IIC T4 Gc, (-50 °C ≤ Ta ≤ +60 °C/+70 °C)

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

8.10 Technical Regulations Customs Union (EAC)

EM Technical Regulations Customs Union (EAC) Flameproof
Certificate: RU C-SE.AA87.B.00108
Markings: Ga/Gb Ex d ia IIC T1....T4 X, (-40°C ≤ Ta ≤ +60°C/+70°C)

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

IM Technical Regulations Customs Union (EAC) Intrinsic Safety
Certificate: RU C-SE.AA87.B.00108
Markings: 0Ex ia IIC T1...T4 Ga X, (-50°C ≤ Ta ≤ +60°C/+70°C)
Ga/Gb Ex ib IIC T4 X, (-50°C ≤ Ta ≤ +60°C/+70°C)
Ga/Gb Ex ia/ib IIC T1...T4 X, (-50°C ≤ Ta ≤ +60°C)

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

	Ui	Ii	Pi	Ci	Li
Entity parameters HART	30 V	130 mA	1 W	7.26 nF	0 mH
Entity parameters Fieldbus	30 V	300 mA	1.5 W	4.95 nF	0 mH

8.11 Japan

E4 Flameproof HART
Certificate: TC20104
Markings: Ex d [ia] IIC T4 X
Ex ia IIC T4 X

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

E4 Flameproof FOUNDATION Fieldbus
Certificate: TC20192
Markings: Ex d [ia] IIC T4 X
Ex ia IIC T4 X

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

8.12 Republic of Korea

EP Flameproof HART
Certificate: 13-KB4BO-0019X
Markings: Ex ia/d ia IIC T4 Ga/Gb

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

EP Flameproof Fieldbus
Certificate: 12-KB4BO-0179X
Markings: Ex ia/d ia IIC T4

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

8.13 India

Flameproof
Certificate: P333021/1
Markings: Ex ia d IIC T4

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

Intrinsically safe
Certificate: P314493/1
Markings: Ex ia IIC T4 Ga/Gb
Ex ia/ib IIC T4

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

8.14 Ukraine

Flameproof, Intrinsically Safe
Certificate: UA.TR.047.C.0352-13
Markings: 0 Ex ia IIC T4X,
1 Ex d ia IIC T4 X

Special Conditions for Safe Use (X):

1. See certificate for special conditions.

8.15 Combinations

KA Combination of E1, E5 and E6
KB Combination of E1, E5 and E7
KC Combination of E1, E6 and E7
KD Combination of E5, E6 and E7
KE Combination of I1, I5 and I6
KF Combination of I1, I5 and I7
KG Combination of I1, I6 and I7
KH Combination of I5, I6 and I7
KI Combination of IA, IE and IF
KJ Combination of IA, IE and IG
KK Combination of IA, IF and IG
KL Combination of IE, IF and IG

8.16 Additional Certifications

SBS American Bureau of Shipping (ABS) Type Approval
Certificate: 15-LD1340199
Intended Use: For use on ABS Classed Vessels and Offshore Facilities in accordance with ABS rules and International Standards.

SBV Bureau Veritas (BV) Type Approval
Certificate: 22378_B0 BV
Requirements: Bureau Veritas rules for classification of steel ships.
Application: Class Notations: AUT-UMS, AUT-CCS, AUT-PORT and AUT-IMS.

SDN Det Norske Veritas (DNV) Type Approval
Certificate: A-14107
Intended Use: Det Norske Veritas´ Rules for Classification of Steel Ships, High Speed & Light Craft and Det Norske Veritas´ Offshore Standards.
Application:

Location Classes	
Temperature	D
Humidity	B
Vibration	A
EMC	B
Enclosure	C

SLL Lloyds Register (LR) Type Approval
Certificate: 15/20053
Application: Marine applications for use in environmental categories ENV1, ENV2, ENV3 and ENV5.

U1 Overfill prevention
Certificate: Z-65.16-476
Application: TÜV tested and approved by DIBt for overfill prevention according to the German WHG regulations.

QT Safety-certified to IEC 61508 with certificate of FMEDA data.
Certificate: ROS 13-06-005 C001 R1.2

8.17 Pattern Approval

GOST Belarus
Certificate: RB-03 07 2765 10

GOST Kazakhstan
Certificate: KZ.02.02.03473-2013

GOST Russia
Certificate: SE.C.29.010.A

GOST Uzbekistan
Certificate: 02.2977-14

China Pattern Approval
Certificate: CPA 2012-L135

8.18 Conduit plugs and adapters

IECEx Flameproof and Increased Safety

Certificate: IECEx FMG 13.0032X
Standards: IEC60079-0:2011, IEC60079-1:2007, IEC60079-7:2006-2007
Markings: Ex de IIC Gb

ATEX Flameproof and Increased Safety

Certificate: FM13ATEX0076X
Standards: EN60079-0:2012, EN60079-1:2007, IEC60079-7:2007
Markings: Ex II 2 G Ex de IIC Gb

Table 3. Conduit Plug Thread Sizes

Thread	Identification Mark
M20 x 1.5	M20
½ - 14 NPT	½ NPT

Table 4. Thread Adapter Thread Sizes

Male Thread	Identification Mark
M20 x 1.5 – 6g	M20
½- 14 NPT	½ - 14 NPT
¾ - 14 NPT	¾- 14 NPT
Female Thread	**Identification Mark**
M20 x 1.5 - 6H	M20
½ - 14 NPT	½ - 14 NPT
G1/2	G1/2

Special Conditions for Safe Use (X):

1. When the thread adapter or blanking plug is used with an enclosure in type of protection increased safety "e" the entry thread shall be suitably sealed in order to maintain the ingress protection rating (IP) of the enclosure.See certificate for special conditions.
2. The blanking plug shall not be used with an adapter.
3. Blanking Plug and Threaded Adapter shall be either NPT or Metric thread forms. G½ thread forms are only acceptable for existing (legacy) equipment installations.

8.19 EU Declaration of Conformity

Figure 7. Rosemount 5300 EU Declaration of Conformity

ROSEMOUNT

CE

EU Declaration of Conformity

No: 5300

We,

Rosemount Tank Radar AB
Layoutvägen 1
S-435 33 MÖLNLYCKE
Sweden

declare under our sole responsibility that the product,

Rosemount 5300 Series Level and Interface Transmitter

manufactured by,

Rosemount Tank Radar AB
Layoutvägen 1
S-435 33 MÖLNLYCKE
Sweden

to which this declaration relates, is in conformity with the provisions of the European Community Directives, including amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community notified body certification, as shown in the attached schedule.

(signature)	Manager Product Approvals (function name - printed)
Dajana Prastalo (name - printed)	2016-05-06 (date of issue)

EMERSON. Process Management

ROSEMOUNT

EU Declaration of Conformity
No: 5300

EMC Directive (2014/30/EU)

EN 61326-1:2013

ATEX Directive (2014/34/EU)

Nemko 04ATEX1073X

Intrinsic Safety (Hart@ 4-20mA):
Equipment Group II, Category 1G, Ex ia IIC T4 Ga
Equipment Group II, Category 1D, Ex ia IIIC T79° Da

Intrinsic Safety (Foundation ® Fieldbus):
Equipment Group II, Category 1G, Ex ia IIC T4 Ga
Equipment Group II, Category 1D, Ex ia IIIC T69° Da

Intrinsic Safety (Foundation ® Fieldbus FISCO):
Equipment Group II, Category 1G, Ex ia IIC T4 Ga
Equipment Group II, Category 1/2G, Ex ia/ib IIC T4 Ga/Gb
Equipment Group II, Category 1D, Ex ia IIIC T69° Da
Equipment Group II, Category 1/2D, Ex ia/ib IIIC T69° Da/Db

Flameproof (Hart@ 4-20mA, Modbus RS-485):
Equipment Group II, Category 1/2G, Ex db ia IIC T4 Ga/Gb
Equipment Group II, Category 1D, Ex ta IIIC T79° Da

Flameproof (Foundation ® Fieldbus):
Equipment Group II, Category 1/2G, Ex db ia IIC T4 Ga/Gb
Equipment Group II, Category 1D, Ex ta IIIC T69° Da

EN 60079-0:2012; EN 60079-1:2014; EN 60079-11:2012; EN 60079-26:2015;
EN 60079-31:2014

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No: 5300

Nemko 10ATEX1072

Type of protection N, Non-sparking (Hart@ 4-20mA):
Equipment Group II, Category 3G, Ex nA ic IIC T4 Gc
Equipment Group II, Category 3D, Ex tc IIIC T79° Dc

Type of protection N, Non-sparking (Foundation ® Fieldbus):
Equipment Group II, Category 3G, Ex nA ic IIC T4 Gc
Equipment Group II, Category 3D, Ex tc IIIC T69° Dc

Intrinsic Safety (Hart@ 4-20mA):
Equipment Group II, Category 3G, Ex ic IIC T4 Gc
Equipment Group II, Category 3D, Ex tc IIIC T79° Dc

Intrinsic Safety (Foundation ® Fieldbus):
Equipment Group II, Category 3G, Ex ic IIC T4 Gc
Equipment Group II, Category 3D, Ex tc IIIC T69° Dc

EN60079-0:2012; EN60079-11:2012; EN60079-15:2010; EN60079-31:2013

EMERSON. Process Management

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EU Declaration of Conformity

No: 5300

ATEX Notified Body for EU Type Examination Certificates and Type Examination Certificates

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ATEX Notified Body for Quality Assurance

DNV Nemko Presafe AS [Notified Body Number: 2460]
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Page 4 of 4

List of Model Parts with China RoHS Concentration above MCVs
含有China RoHS管控物质超过最大浓度限值的部件型号列表

Part Name 部件名称	Hazardous Substances / 有害物质					
	Lead 铅 (Pb)	**Mercury 汞 (Hg)**	**Cadmium 镉 (Cd)**	**Hexavalent Chromium 六价铬 (Cr +6)**	**Polybrominated biphenyls 多溴联苯 (PBB)**	**Polybrominated diphenyl ethers 多溴联苯醚(PBDE)**
Electronics Assembly 电子组件	X	O	O	O	O	O
Housing Assembly 壳体组件	O	O	O	X	O	O

This table is proposed in accordance with the provision of SJ/T11364
本表格系依据SJ/T11364的规定而制作.
O: Indicate that said hazardous substance in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.
O: 意为该部件的所有均质材料中该有害物质的含量均低于GB/T 26572所规定的限量要求.
X: Indicate that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.
X: 意为在该部件所使用的所有均质材料里，至少有一类均质材料中该有害物质的含量高于GB/T 26572所规定的限量要求.

Quick Start Guide
00825-0100-4530, Rev FB
June 2016

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ROSEMOUNT

EMERSON
Process Management

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IOM/TW/001/R

ERECTION ,INSTALLATION , PRE-COMMISSIONING & COMMISSINING PROCEDURE FOR BI METAL &GAS FILLED DIAL THERMOMETER WITH / WITHOUT CAPILLARY & THERMOWELLS

(OPERATING & MAINTENANCE MANUAL)

"GENERAL" Dial Thermometers (Temperature Gauge) employ a closed system, with its moving parts enclosed in a weather & shatterproof glass. They are for local mounting installation, either back entry or bottom entry or every angle

1. Physical Check of both Types :

Following checks are necessary before installation

a) Pointer dislocation
b) Glass broken
c) Adjustable Gland loose
d) Capillary winding joints.

2. Remedies for above

2.1) Fault: - Pointer dislocation

Remedy

Remove the instrument cover loosening (anticlockwise rotation) and adjust the micro pointer with the help of adjusting screw Provided on the pointer /if external zero is provided , adjust external screw. (external zero is provided only if specified in P.O.)

2.2) Fault :- Glass Broken

Remedy

Ask factory or our nearest branch office for replacement spares. Provide P.O. No. and instrument No. so that correct spare glass can be provided.

Email : exports@general-gauges.com Website : www.generalinstruments.co.in

2.3 Fault :-Adjustable Gland Loose

Remedy
Tighten the same firmly along with the asbestos thread by first holding the instrument nipple on a rigid vice.

2.4 Capillary Winding Joints :
After receipt of the gauge kindly cut the capillary winding joints so capillary get loose & install accordingly at your site

3. Calibration Test

3.1 Test:- Check the Dial Thermometer under test for ambient temp, which should be measured by comparison with standard thermometer. (Standard Thermometer may be glass/RTD/Digital). Also in calibration always check by holding dial at vertical plane.

Observation:-

The dial thermometer under test must read the temperature within ± 1% FSD.

Remedy :-

If the dial thermometer under test deviates from desired value carry out following adjustment can be done :

a) All the instruments are provided with micrometer pointer & external zero if specified. Set the instrument to standard reference temperature by rotating the reset nut/ screw clockwise or anticlockwise with the help of spanner/ small screw driver.

Caution : We recommend that maximum Zero reset should be ± 10°C angular.

b) The instrument is provided with micrometer pointer, dismantle the inst. Cover after loosening the same and with the help of small screw driver, rotate the reset screw of the micrometer pointer clockwise or anti-clockwise, as required to set the instrument to correct temp.

Caution : Hold other end of the micro pointer firmly between the thumb and finger.

3.2) **Test :**Check the instrument at two different temp. 2/3rd of the temp. span by immersing the sensing length "D" in a wall stirred and controlled temperature bath and thus compare the temperature shown by the gauge under test, with standard thermometer.(Standard Dial Thermometer may be glass/RTD/Digital) .

Observation :
Accuracy should within stipulated limits, as above.

Instruments do not respond.

Remedy:

Contact our nearest branch office or dispatch the instrument to factory for repair if Dial Thermometer does not respond.

FOLLOW THE FOLLOWING INSTRUCTIONS GIVEN BELOW CAREFULLY FOR CHANGES THE ORIENTATION/BENDING EVERY ANGLE DIAL THERMOMETER

1. First loosen the two nos. end screws for orientation
2. Then loosen the two nos. centre screws for bending
3. Tighten all, after positioning in the required plane.
4. For Back Entry Model Above is not applicable.

Note :- '**Caution**' Instruction label carrying above instruction is provided on each and every BDT/EA Model Bimetallic Dial thermometer, at the back of the case.

4. THERMOMETERS (For Gas filled Capillary Thermometer)

4.1. MAXIMUM WORKING TEMPERATURE.

4.1.1 It is recommended that the maximum working temperature does not exceed 70% of the full scale reading.

4.1.2 Instruments are designed to operate in ambient temperatures of -20 to + 60 Deg. C. The instrument head and capillary should be protected from localized heat or cold sources as this can lead to indicating errors.

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Email : exports@general-gauges.com Website : www.generalinstruments.co.in

5.THERMOWELL :

➢ These operating instructions contain important information for handling the Thermowell. Working safely requires that all safety instructions and work instructions are strictly observed/Followed

➢ The operating instructions are part of the instruments and must be made available and readily accessible to skilled personnel prior to installation & during installation.

➢ Skilled personnel must have carefully read and understood the operating instruction manual prior to beginning of the mounting.

➢ Observe the relevant local accident prevention regulations and general safety regulations for the Thermowell's range of use.

➢ Manufacturer's liability is void in the case of any damage caused by using the product contrary to its intended use, non-compliance with these operating instructions, assignment of insufficient qualified skilled personnel or unauthorized modifications to the Thermowell.

➢ This instruction manual is subject to change without notice and the manufacturer reserves all rights.

WARNING! / CAUTION!

.....indicates potentially dangerous situations.

INFORMATIONS!

.....indicates recommendations and information for efficient and trouble-free operation.

6 SAFETY

WARNING!

Before installation, commissioning and operation ensure that the appropriate Thermowell has been selected in terms of measuring range, design and specific measuring conditions.

Before installation, commissioning and operation ensure that the Thermowell material used is chemically resistant / neutral to the medium being measured and that it withstands the mechanical stresses and Temperature from the process.

Non-observance can result in serious injury and or damage to equipment.

For hazardous media such as oxygen, acetylene, flammable or toxic gases or liquids, and refrigeration plants, compressors, etc., in addition to all standard regulations, the appropriate existing codes or regulations must also be followed.

Make sure that the Thermowell is sufficiently earthed.

Residual media on dismounted Thermowell can result in a risk to persons, the environment and the equipment. Take sufficient precautionary measures during and after dismounting.

7. INTENDED USE

CAUTION!

Thermowell are used to protect temperature sensors from the process conditions. Furthermore, Thermowell enable the removal of the temperature sensor without having to shut down the process and they guard against damage to either the environment or to personnel, which might be caused by escaping process media.

The Thermowell has been designed and built solely for the intended use described in technical specification, and may only be used accordingly.

The technical specifications contained in these operating instructions must be observed. Should the Thermowell be improperly handled or operated outside of its technical specifications, it has to be inspected immediately.

The manufacturer shall not be liable for claims of any type based on operation contrary to the intended use.

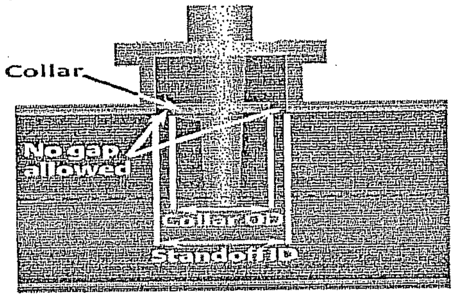
8. INSTALLATION & OPERATION

MOUNTING

Insert the Thermowell into the process adapter without forcing or damaging it. The Thermowell must not be bent or altered in order to mount it.

During Mounting (especially with ceramic Thermowell) the Thermowell should not be subjected to thermal shocks or mechanical impacts.

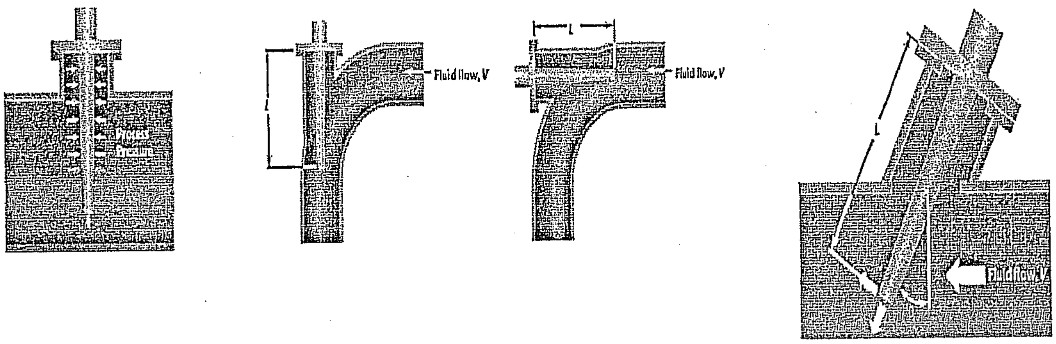
The exception is the retrospective machining of the velocity collar in order that the Thermowell is supported free of play within the nozzle ("interference fit"). The retrospective adjustment of a velocity collar with a loose fit is not permissible. In general,Thermowell with a velocity collar are not recommended within ASME PTC 19.3 TW 2010 and are outside of the scope of the standard.



Note
No gap is allowed between the collar and the pipe standoff ID.

Three mounting positions in the system are possible. These are independent from the process connection type:

Vertical installationElbow installation Angle Installation

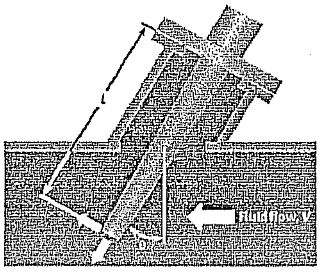


It is recommended to mount the temperature measuring instrument into the Thermowell using a suitable sealing material to avoid, for example, humidity ingress.

In general, the tip of the Thermowell should be placed in the middle third of the pipe, though the position may differ in special cases. It must be ensured that the measuring element (Pt100, thermocouple, bimetal, etc.) i.e. Insertion part of Thermowell is completely exposed to the medium and is not shielded by the flange stubs. If, as a result of a small pipe diameter, this cannot be ensured, a pipe expansion can be inserted around the measuring point.

Threaded Thermowells: When using a parallel threads, a suitable seal should be used when mounting. Tapered threads can be sealed directly on the thread. For the correct tightness it is recommended to apply a PTFE tape on the male parallel thread compatible with the process temperature (200C°max).

The correct tightening torques and suitable tools (e.g. spanner) should be used.



Weld-in Thermowell: Weld-in Thermowell can be mounted into the process directly (pipe or vessel wall) or by using a welding socket. Make sure that the weld seam is clean and that suitable equipment is used. If necessary, heat-treat the weld seams.

Flanged Thermowells : The flange dimensions of the Thermowell must match those of the mating flange on the process side. The seals used must be suitable for the process and the flange geometries (cross-check the project specification). The correct tightening torques and suitable tools (e.g. spanner) should be used for installation. For Thermowell with a collar, make sure that it matches the inner diameter of the coupling and is supported by it. In the case of an interference collar, they should be adapted to the inner diameter of the coupling.

The insertion length and the diameter of the Thermowell are dependent on the process conditions, especially on the flow rate of the measured medium.

9. MAINTENANCE

WARNING!

Dismounting

Only disconnect Thermowells once the system has been depressurised!

Risk of burns!

Let the instrument cool down sufficiently before dismounting it!

When dismounting it, there is a risk that dangerously hot pressure media may escape.

Residual media on dismounted Thermowells can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

Maintenance

In general, Thermowells are maintenance-free.

However following should be carefully observed.

After opening the consignment, please check the well visually for any transit damage.

Clean with soft duster.

Unscrew the threaded protection cap in case of female threads and male threads, which are usually covered with protective tape.

Thermowell now is ready for installation. Tag number is punched on each well and adequate position of each well can be fixed with the help of Tag No.

In case of flanged well, the gasket surface should be cleaned with deoling solution before installation. It is recommended to tighten all the stud bolts to be tightened in a sequence.

If the well is removed from the process after shutdown following is recommended.

Clean the Thermowell from inside and outside.

Check if it is damaged due to wear and tear on corrosion. If affirmative then replace it.

Before installation subject the well to hydro test as per the data sheets. Normally screwed wells are tested at 200Kg/Cm2 and flanged wells as per the flange rating.

If there is any heat or wear and tear then do not repair the well it should be replaced.

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OPERATION AND MAINTENANCE MANUAL FOR RTD

- Make sure the sensor with mounting

Installation of sensor will be done by screws or flanges , In case of screwing thread seal or sealing agent to be applied on taper threads, in case of parallel threads 'O' ring should be provided , For flanges suitable gasket to be provided with nut & bolts, Ensure the flanges are air tightened.

- Please note bending portion or bending radius of the MI cables for TC & RTD

MI cable can be bent to a radius of 3 times the sheath dia, but becoming as before will results fracture in sheath,please bend the sheath 5 times the sheath dia at site. In case of RTD do not bend 100mm portion at tip when the same is installing.

- Do not handled temperature sensor roughly

There are many types of sensors by constructions, If they drop from installation point, It may cause damage to person.RTD sensor have very fine elements & extremely delicate, It may cause error in reading .Ceramic insulated sensors special attention require due to brittleness of material.

- Do not connect Extension /compensating cable leads to power supply Terminals Extension /compensating cable leads must be connected to sensor terminals or receiving instruments. If by mistake extension/compensating cable connected to power supply it may cause high temperature, short circuit & that might cause fire or explosion.

- Do not locate the temperature sensor in a hazardous location at surrounding temperature over 60°C

Temperature sensors are approved for hazardous area providing that the surrounding temperature will not exceeds the 60 °C .Please confirm the same before installation of the sensor.

- Make sure the closing enclosure cover after wiring.

  After wiring please ensure the enclosure cover is tightly fitted, by using screw driver or by Allen screw 'O'ring or gasket should be properly tightened in order to prevent ingress of dust or Water.

- Do not expose the terminals or leads of compensating cable, extension cables at 80 °C and above.

  In case of leads or terminals exposed to high temperature, IR might becomes poor, & measuring error might caused. Unless stated, the surrounding temperature should be below 80°C

- Make sure the polarity of the connections.

  In case of wrong connection big measurement error might caused, Special attention is required to colour coding of compensating cable.

- Do not use installation tester when plant operated.

  When plant is operated, it might be danger of leakage or explosive gases. Therefore checking of performance of sensor, please do not use installation tester. There's possibility of causing sparking, It might be ignition source of explosive gases.

- Do not dissemble or repair the sensor located at hazardous area.

  The construction of the flameproof area is approved by national institutes & not allowed to repair or dissemble the temperature sensor in that area due to safety purpose.

- Please check shutdown, Normal pressure, temperature on maintenance, Inspection& replacement.

  It is dangerous to start inspection in operating condition or just after shut down the plant .Always confirm the pressure, temperature is normal (Ambient). Then start inspection & replacement work.

- Do not touch the sensing probe of the temperature sensor

Sensor's are used for high or low temperature, therefore temperature sensor pooled out from installation point may be still hot or cold, hence touching with bare hand might be burnt or Cold burn, do not touch the sensor unless temperature comes to ambient temperature.

- Do not pool the cable leads or cable lead type sensor.

If pulled by force lead wire connection might brake at connection point. as temperature sensor bottom Portion has no mechanical strength, therefore it may cause wire break.

- Storage- Please store the sensor in dry clean place.

Sensors should be stored in dry & clean area. In high humidity area might cause low insulation resistance.

- Disposal- Scrap the temperature sensor as Industrial waste.

In case of disposal of temperature sensor, please handle it as a industrial waste, if it is difficult please ask industrial waste treatment agency approved by appropriate authority.

- All provisions are subject to change without notice
- Manual is prepared with greatest possible care, if you have any query, please do not hesitate to contact us.

ATTENTION TO SAFETY

Before using the product, please read carefully the points on **"Attention to safety"**

Safety warnings show's to prevent harm & Injury to yourself & the people working Vicinity when operating temperature sensor.

- WARNING

  If the device is improperly used,
  People may be severely fatal or killed.

- CAUTION
  If the device is improperly used,
  People may suffer light to medium injuries
  and or material damage may occur.

Even item bear "caution" lable may, under certain conditions leads to serious accident. Hence always observe safety procedures.

The term "Serious Injury, Light injury& Material damage meaning as below.

Serious Injury	Long term symptoms results eyesight injury,burns(high Temperature & low temperature),Electric Shocks, broken bones injuries will require long period hospitalisation followed by repeated hospital visits.
Light Injury	Light injuries results burns(high&low temp.)Electric shocks which will not require long hospital stay or visits
Material Damage	Direct or indirect losses associated with inventory loss & damage to plant & equipment

SAFETY MANUAL

Maintenance:-

Maintenance is the key factor for safe & sure measurement for temperature measurement.

We recommend following method of Maintenance.

- Systemization of Maintenance work
- Training to maintenance personnel
- Security of maintenance personnel
- Standardization of Maintenance
- Accuracy control of inspection Equipments(recalibration)
- Preparation & management of maintenance data

Maintenance & Inspection:

Since the maintenance/inspection of the installed sensor is dependant upon installation, the methods of inspection also varies depending upon the place & purpose. General methods are as below.

- Daily maintenance & inspection: Indicated temperature to be compared with other sensor by inserting near to the first sensor.

- Confirmation of working condition: The sensor selection is dependant upon the working condition of installation, temperature, pressure, velocity, etc. make sure that the sensor shall be suitable for these conditions, If not suitable, replace the sensor to suit above condition

- Confirmation of insertion length: If insertion length of sensor changes it will affect on heat conduction & error may occur.

- Confirmation of Normal current value: In case of RTD if normal current changes it will affect on self-heating error. Which will affect the accuracy of the element. Hence make sure that the normal current should maintained.

- Cleaning & inspection of protection tube / thermowells: Dust particles, sludge etc. when accumulated on protection tube, which may cause the erratic reading, clean them periodically, Make sure that oxidization & corrosion should not take place on protection tube. Ensure that water will not enter during the installation in protection tube, which may create various problems.

- Inspection of installation area &operating conditions: In some cases sensor, flanged protection tubes were installed with screw & flanged. Depending upon the installation some sensor may be subjected to mechanical vibration, these external forces may loosen the parts & when conditions are severe welded or brazed section's may be damaged, & allowed to enter air/ fluid or gases to leak out, Care must be taken & can be checked visually.

- Inspection of insulation resistance: Please note decrease in insulation resistance can cause in error in indication.

- Inspection of connections: Ensure the connection of RTD indication system & extension leads are properly connected. Ensure polarity of the sensor is properly connected to indicating system.

- Periodic check: Even if the sensor is functioning properly, Remove it & compare with master/another sensor once a year.

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Techtrol
PUNE TECHTROL PVT LTD

INSTRUCTION & MAINTENANCE MANUAL FOR REFLEX FLAT GLASS LEVEL GAUGE ' RFG '.

Introduction & Working :

This gauge is used for safe and positive indication of liquid levels in vessels under high temperatures and pressures. It consists of thick, flat glass (Reflex Type) having prismatic grooves on inside. The refraction of light due to the prismatic grooves results in to showing the liquid portion as dark and balance portion as silvery white. Reflex gauge glass, gaskets, cover plates and liquid chamber are held together with ‘ U ’ bolts. Gauge glass is sandwiched between recesses provided in the body and cover plate.

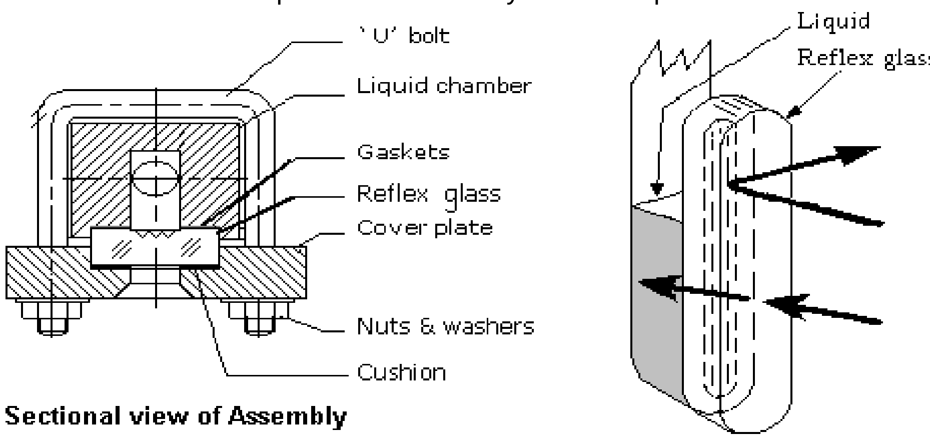


FIG. 1

UNPACKING & CHECKING :

CAUTION : FRAGILE MATERIAL. PLEASE TAKE CARE WHILE UNPACKING.

We are glad to know that you are using a reliable ' Techtrol ' product. This product contains fragile parts like glass tube and hence we suggest that you go through this manual carefully before installation.

1. Unpack carefully & ensure that the product has not been damaged in transit.
2. Ensure that the fasteners / screws have not loosened in transit. Tighten them adequately, if found loose.
3. Identify that the product received is in line with approved Drawing.
4. If the material is found damaged in transit, take further action as per transit insurance clause.

Installation :

* * Please ensure that operating conditions are within limits as per TECHTROL Test Report.

1. Select a suitable location on tank, where vibrations if any, are minimal.
2. Ensure that the Process connections of the level gauge, match the counter connections provided on tank.
   Flange connection -- Flanges on the level gauge should match the counter flanges on the tank & their PCD orientation should be identical.
   Screwed / SMS Union -- The threads and size should match.

3. The level gauge is installed vertically, parallel to the tank side. Ensure its vertical positioning through a `plumb line’. Also ensure that “Vent” is at the “Top” and “Drain” is at the “Bottom”.

4. Provide suitable gaskets between the flanges or appropriate thread sealant between threads before bolting, to ensure zero leakage through the joint.

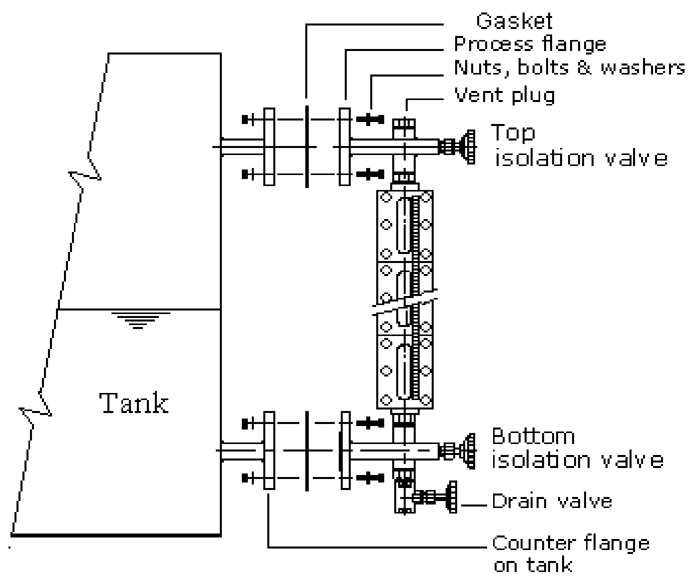
5. Ensure that vent / drain plug / valve are closed properly.

Operation :

a) Open " Top isolation valve" gradually to equalise the pressure in the tank and gauge.

b) Now open bottom isolation valve gradually to allow tank liquid to enter the gauge glass and seek its level.

Installation diagram.



Note: * Counter flange should match Process flange

FIG - 2

c) Allow liquid level in gauge glass to stabilize. This visual indication will be the liquid level in the tank.

Function of Auto Ball Check :
Auto ball check facility is provided to prevent " Liquid loss' from the vessel and Safety during breakage of gauge glass. It consists of a capsule located along the ' neck ' of the gauge and contains a ball which moves freely along its inner race, between the stopper and orifice. During breakage, the pressure on the ball from gauge side will be atmospheric,

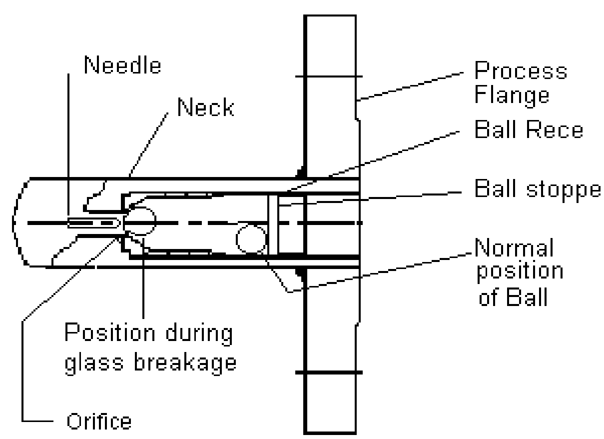


FIG - 3

where as higher pressure from the vessel side (Operating Pressure + Liquid Column) will cause the ball to move and block the orifice where by liquid loss will be minimized.

Maintenance :

Normally `Reflex Level Gauge requires no maintenance. However, gauge glass may become dirty and require an occasional cleaning with a soft brush, trichlorothylene or compressed air.

It is advisable to replace the gaskets at least once in a year.

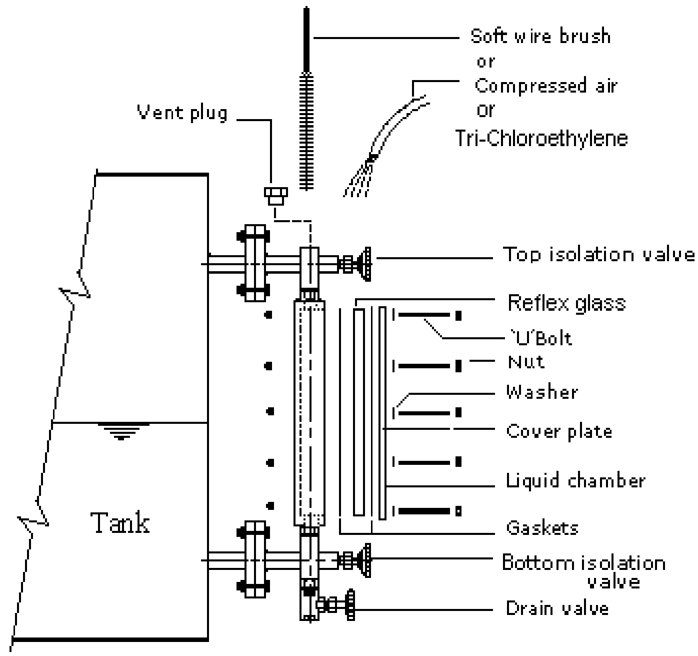


FIG - 4

<u>Cleaning of gauge glass</u> :

The gauge glass can be cleaned without its removal as follows,

i) Close both isolation valves.
ii) Open the drain plug / valve and drain the liquid from the liquid chamber.
iii) Open vent plug / valve.
iv) Clean the gauge glass with a soft wire brush or by passing compressed air or water from top (vent). If dirt still persists, then employ trichlorothylene.

<u>Gauge glass removal</u> :

i) Close both isolation valves.
ii) Open the drain plug / valve and drain the liquid from the liquid chamber.
iii) Open vent plug / valve.
iv) Close bottom isolation valve.
v) Unscrew the nuts over U-bolts on cover plate uniformly.
vi) Remove mid section U-bolts initially and there after remove U-bolts on upper and lower side and separate the cover plate carefully.
vii) Remove gauge glass, gasket and cushion.
viii) Clean the gauge glass and liquid chamber.

<u>Gauge glass refitting</u> :

i) Replace old gaskets with new.
ii) Locate the gasket in the recess.
iii) Place the gauge glass over the gasket.
iv) Fit the U-bolts on the cover plate and tighten the nuts on them starting with upper and lower end bolts of cover plate so that the gauge glass is sandwiched between cushion. the gasket and
v) Ensure that U-bolts and nuts are tightened uniformly with appropriate torque.

Trouble shooting :

Symptom	Probable Cause	Remedy
1. Leakage through gasket.	a) U-bolts not tightened uniformly. b) Gaskets damaged or hardened.	a) Tighten uniformly. b) Replace gaskets.
2. Shows correct reading initially and faulty readings after some period.	a) Gases entrapped within the liquid. b) Scaling / deposition of dirt / foreign particles inside the liquid chamber, gauge glass and orifice of Auto Ball Check if provided.	a) Effect venting. b) Clean gauge glass, liquid chamber & Orifice.
3. Autoball check is not working.	a) Scaling / deposition of foreign particles on autoball and its seat. b) Autoball damaged.	a) Remove & clean autoball and its seat. b) Replace autoball.
4. Leakage through Isolation valve.	Wear out of packing bush in Isolation valve assembly due to frequent operations.	Replace packing bush (teflon) .
5. Breakage of glass.	High operating pressure / temp. Excessive / Uneven tightening of 'U' bolts.	Maintain rated temp & pressure. Tighten uniformly with appropriate torque.

End Block Assembly :

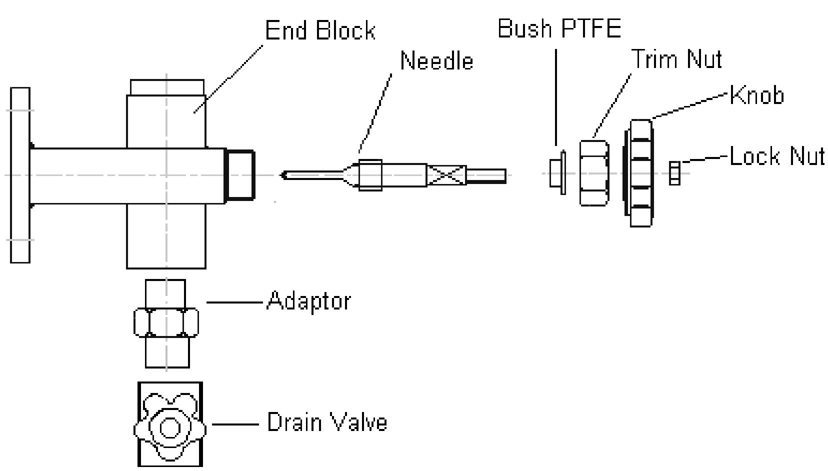


FIG. - 5

CONTENTS

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1. COMPOSITION / PHYSICAL DATA

Chemical Name: Natural Gas
Other Names: Methane

Composition	Maximum	Minimum	Typical
Methane	92.8%	79.0%	87.3%
Ethane	10.3%	3.8%	7.1%
Propane	3.3%	0.4%	1.8%
Butanes	1.2%	0.1%	0.7%
Nitrogen	8.7%	0.5%	2.2%
Carbon Dioxide	2.5%	0.2%	0.9%

Boiling Point: Approx. 100 °F (37.78 °C)
Vapor Density (Air=1): 0.61 to 0.69
Appearance and Odor: Colorless, odorless, tasteless gas without odorants. Addition of odorants makes leaking gas detectable at ½% to 1% in air. Odor similar to heavy skunk odor.

2. HAZARD IDENTIFICATION

Natural gas is non-toxic. However, it can act as a simple asphyxiant by displacing or partially displacing the oxygen required to support life. Victims exposed to oxygen-deficient atmospheres become cyanotic, experiences diminished mental alertness and impaired muscular coordination. Collapse and death can occur at very low oxygen levels.

3. FIRST AID MEASURES

Emergency and First Aid Procedures:
Inhalation: Remove victim to fresh air. Quickly restore and/or support breathing as required. Have trained person administer oxygen, if available. Keep victim quiet and maintain normal body temperature. (Mouth-to-mouth resuscitation should be used immediately for victim if breathing has stopped because of natural gas asphyxiation.) Obtain medical help.

4. FIRE FIGHTING MEASURES

NFPA Rating:
Health: 1 (Slight Hazard)
Fire: 4 (Very Flammable)
Reactivity: 0 (Stable)

Extinguishing Media:
Flame can be extinguished with CO2, dry chemical or halocarbon gas. **A hazard of Re-Ignition or explosion exists if flame is extinguished without stopping flow of gas and/or cooling the surroundings and eliminating ignition source.** Use water spray to cool surroundings and exposures.

Flammable Limits in Air % by Volume:
LFL: 5.0% UFL: 15%

Autoignition Temperature: 1100 °F – 1200 °F (593 °C – 648 °C)

Fire and Explosion Hazards:
Dangerous fire and explosion hazard when exposed to heat, sparks or flame. Natural gas is lighter than air and may travel long distances to a point of ignition and flash back. Container may explode in heat or fire.

5. ACCIDENTAL RELEASE MEASURES

Natural gas is lighter than air and, unless trapped, will rise and dissipate rapidly into the atmosphere.

When gas is escaping in quantity, evacuate and clear a safe area. Shut off gas supply.
Extinguish all open flames, prohibit smoking, and make certain that electrical switches or other possible ignition sources are not operated. Ventilate enclosed areas by opening doors and windows. Minor leaks can be detected with a soap solution applied at suspected leak points.
NEVER use a flame to detect leaks.

6. HANDLING AND STORAGE

Ground all lines and equipment used with natural gas to prevent static sparks. Use non-sparking tools. NO SMOKING where natural gas is used or stored.

Other Precautions:
Incompleted combustion of natural gas may create carbon monoxide as a waste product. Assure that natural gas appliances are properly adjusted, maintained and used to assure complete combustion of natural gas.

7. EXPOSURE CONTROLS, PERSONAL PROTECTION

Provide adequate general and local exhaust ventilation (explosion-proof) to prevent workplace atmospheres from reaching 20% of lower explosive limit. Thoroughly test natural gas lines for leakage. Give special attention to ventilation for enclosed areas. Provide air-supplied or self-contained breathing equipment for emergency or non-routine situations where natural gas level contributes to oxygen deficiency.
(The use of cartridge or cannister respirators may result in suffocation if used in an oxygen-deficient environment)

8. STABILITY AND REACTIVITY

When suitably contained and kept unmixed with air or other oxidizing agents, natural gas is stable under normal storage and handling conditions. It does not polymerize. It readily forms flammable/explosive mixtures with air (see Section 4) in the presence of catalysts or sources of ignition. Violent or explosive reactions can occur between natural gas and oxidizing agents, such as chlorine, bromine pentafluoride, oxygen difluoride, and nitrogen trifluoride. It explodes spontaneously when mixed with chlorine dioxide.

9. TOXICOLOGICAL INFORMATION

N/A

10. GLOSSARY

NFPA.. National Fire Protection Associations
N/A...Not Available
LFL.... Lower flammable limit
UFL.... Upper flammable limit

11. OTHER INFORMATION