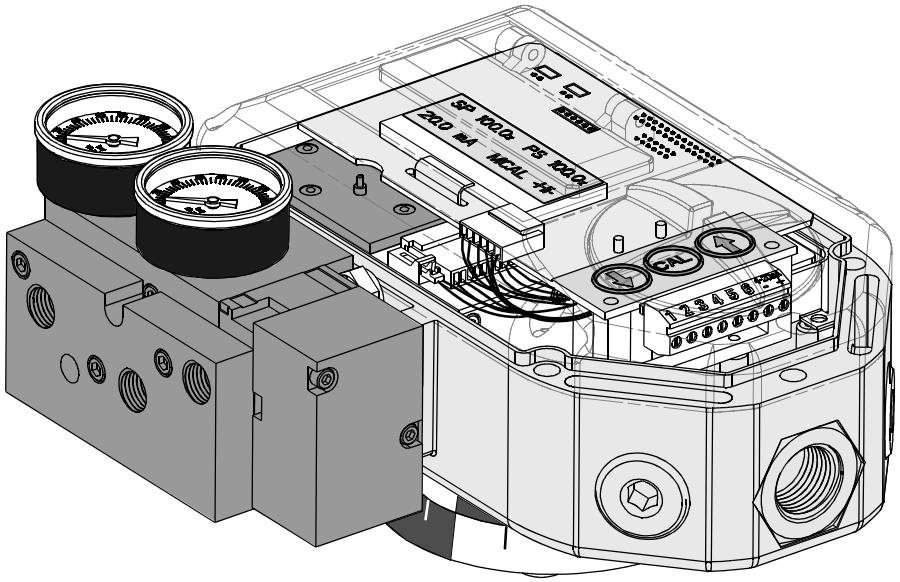
ICoT 5000
Smart Valve Positioner
Operating Manual



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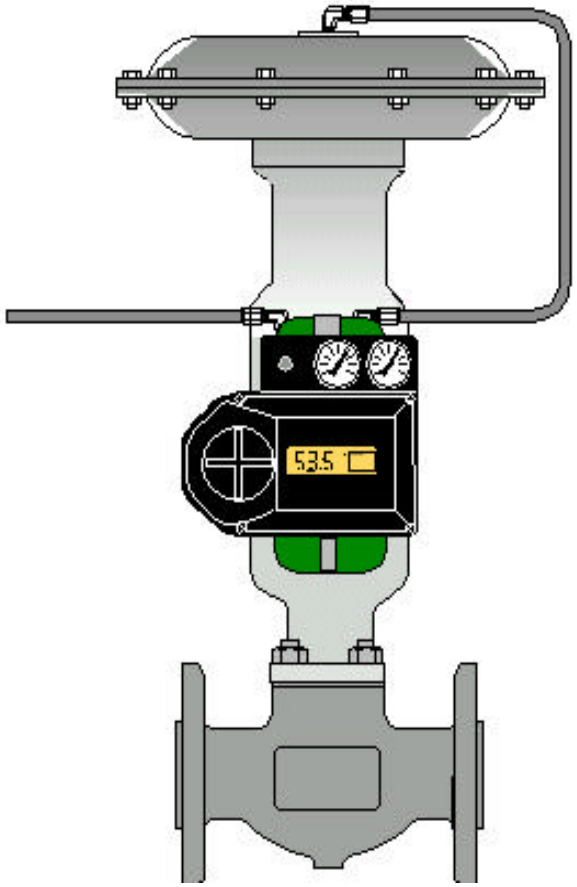
Section 1- Introduction

1.1 Description of ICoT Positioner

The ICoT Smart Valve Positioner is an electro-pneumatic servo system that continuously controls the position of a valve based on a 4 to 20 mA input signal. The ICoT is an instrument that derives its power directly from a control systems current loop. The instrument senses valve position via a non-contact Hall effect sensor and controls valve position through a current to pressure transducer.



The ICoT is available in two versions, HART® and non-HART. The non-HART version allows calibration of the instrument through an on board keypad. The HART® version allows calibration and access to on-line diagnostic information via Rosemount 275 hand-held terminal or through software.

The positioner has a local liquid crystal display which indicates valve position and set-point in percentage open. It also indicates whether the positioner is in calibration mode.

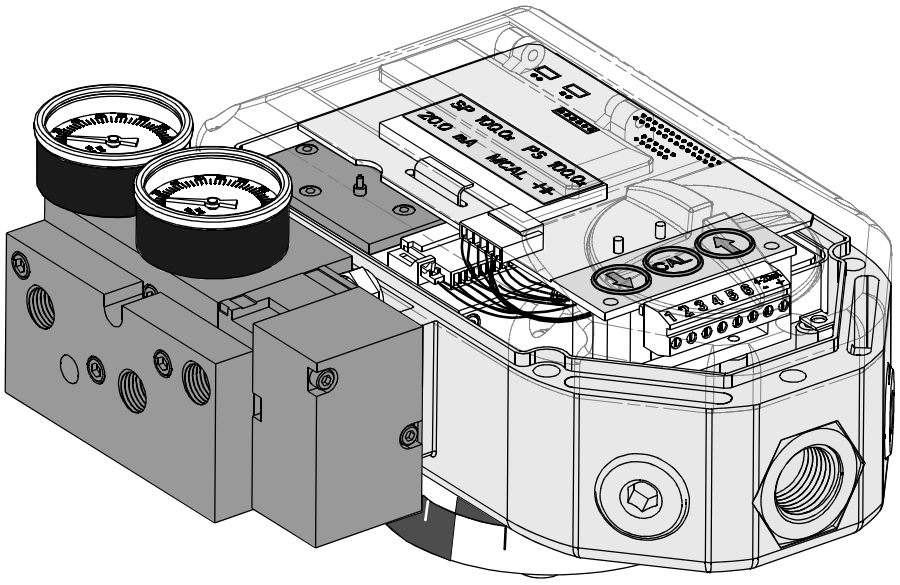
The ICoT has the capability to monitor operation. If a failure condition occurs, an error message is displayed on the local liquid crystal display.

There are several accessories that can be integrally supplied with the ICoT. Among these are a 4 to 20 mA analog output, hermetically sealed non-contact switches and a fugitive emissions monitor.

1.2 Principal of Operation

Unlike conventional positioners, the ICoT Smart Positioner feeds back valve position without the need for linkages, levers, or rotary and linear seals. Position sensing is performed totally by non-contacting means, permitting use of advanced control strategies where knowledge of valve position is used in predictive and other algorithms. By the integration of multiple components into a singular, cost efficient unit, microprocessor-based intelligence can now be used to implement advanced functions such as early warning diagnostics and fugitive emissions monitoring.

The ICoT positioner provides intelligence for the control valve through a microprocessor-based diagnostic system utilizing the HART® protocol. Accurate measurement of valve stem position, input signal, actuator pressure and travel time can be recorded during normal operation, thereby providing information for control valve signature generation.

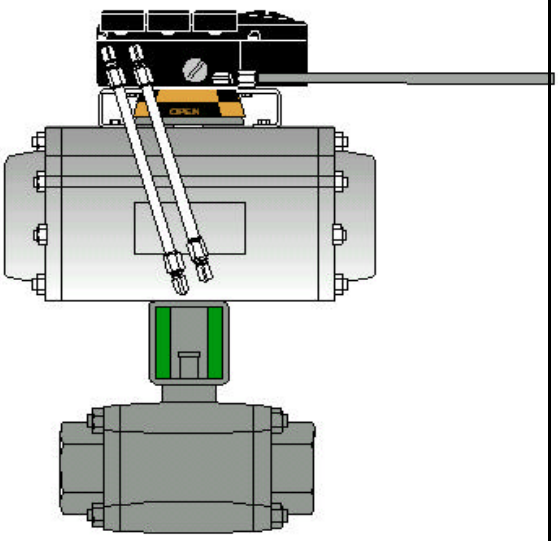


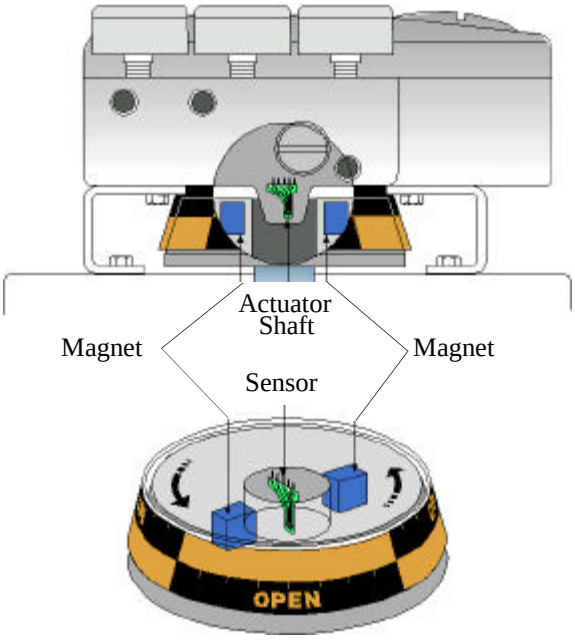
1.3 Special Features

Non-Contact Position Feedback

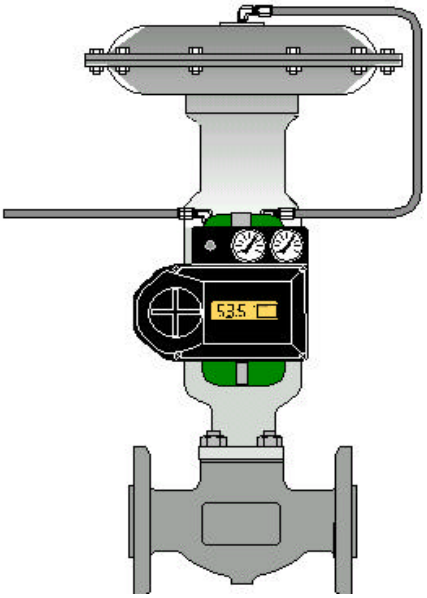
To provide consistently accurate performance information, all linkages, levers and connecting rods, from the positioner to the control valve have been eliminated from the design. Valve position sensing is performed totally by non-contacting means based upon characterization of flux strength as a function of position.

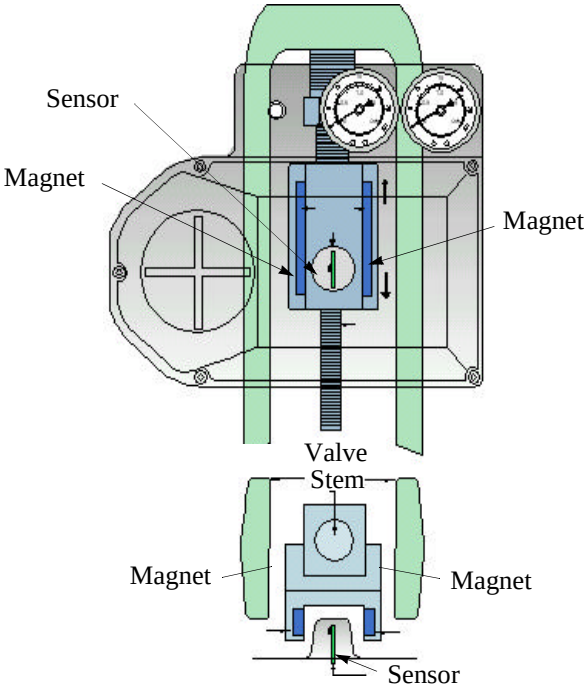
Rotary Valves



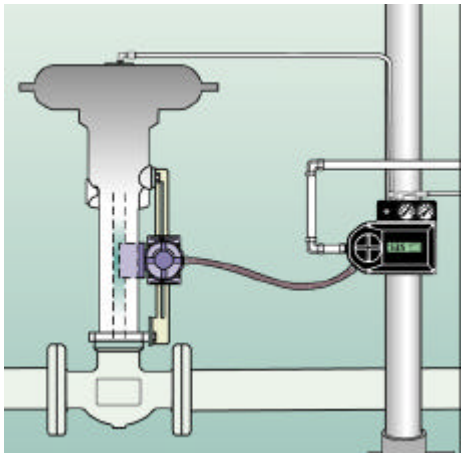


Linear Valves





Remote Position Control



Since valve position feedback to the ICoT positioner is accomplished by non-contacting means, the ICoT has the unique ability to be mounted remotely (up to a distance of 50 feet) from the device it is controlling. In the event the control valve is located in either a high vibration or extremely corrosive environment, the non-contact position feedback feature allows for isolated placement of the positioner.

Local LCD

The ICoT positioner is supplied with HART® interface or a 3-button keypad interface. Both versions are furnished with a 4-digit,.5" tall LCD, and allow for automated calibration of the positioner. The local LCD provides a multitude of onsite diagnostic information. While the valve is being controlled by the positioner, and the error signal is not zero, the displayed information will alternate between setpoint and position as a percentage. Each value is displayed for a period of two seconds. Once the setpoint and valve position agree to within less than 0.5%, the display will only show position. The range of values displayed are from 0.0% to 100.0%. Displayed resolution is in 0.1% increments, however, internal calculations are maintained at higher precision.

On-Board Sensors

The ICoT positioner has the capability to monitor its operation. If an error or failure condition occurs, it will be displayed on the local LCD, or if the positioner is supplied with a HART® interface, the error codes will be displayed on a hand held terminal or a PC maintenance station. Note: Error codes are denoted on a label affixed to the LCD flip-up protective cover.

Local Keypad

All positioners are provided with a 3-button membrane keypad.The keypad is provided for zero and span adjustments, as well as valve characterization and gain adjustments.

Intelligent Calibration (HART® Protocol)

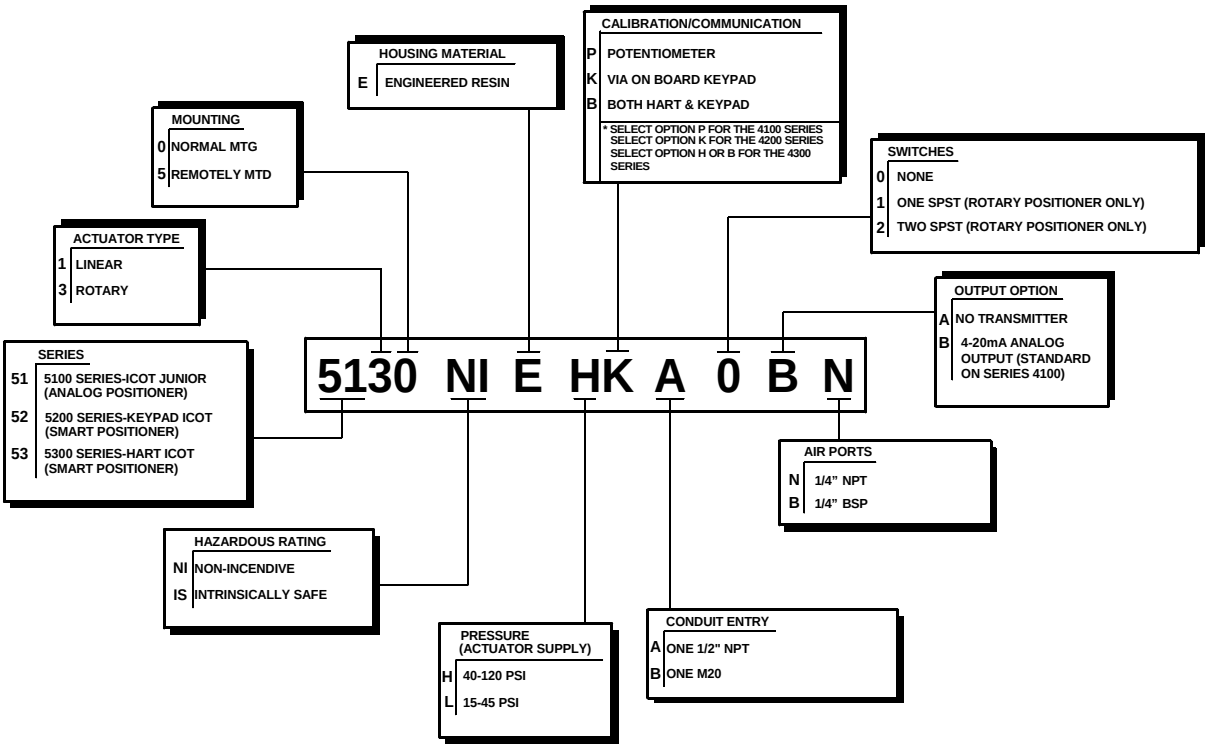
The ICoT positioner responds to HART® commands for seeking the "valve closed" position and assigns an instrument signal of 4 mA to this position. The counterpart of the operation for a full open state is implemented next by setting the span value. Action reversal is also configured. Additionally, provisions are made for altering internal servo loop tuning via the HART® link. In this manner, positioner performance may be optimized with a wide combination of valves and actuators.

Negligible Bleed
Designed to consume the least possible amount of control air at steady state, the ICoT 5000 Series positioner can greatly reduce the air consumption of your process and reduce the demand on instrument air compressors. To increase reliability, the ICoT employs a patented lapped spool and floating sleeve design. This balanced construction relies on an air bearing which eliminates any metal to metal contact.

Section 2 - Ordering

The ICoT positioner is designed to handle a wide range of control valve applications. Please use the following ordering guide to help choose the ICoT positioner that best suits the application.

2.1 ICoT 5000 Positioner Ordering Guide



Note: When ordering a liner ICoT positioner, (option “1” for the third digit in the part number) be prepared to supply the exact stroke length and fail direction of the application.

Section 3 Initial Setup

3.1 Mounting Positioner on a Rotary Actuator

Step 1. Mount bracket and inner beacon coupler to actuator. If actuator shaft has a tapped hole, fasten using proper flat head screw. If actuator does not have a tapped hole, fasten using set screws on side of coupler. (See Figure 3-1)

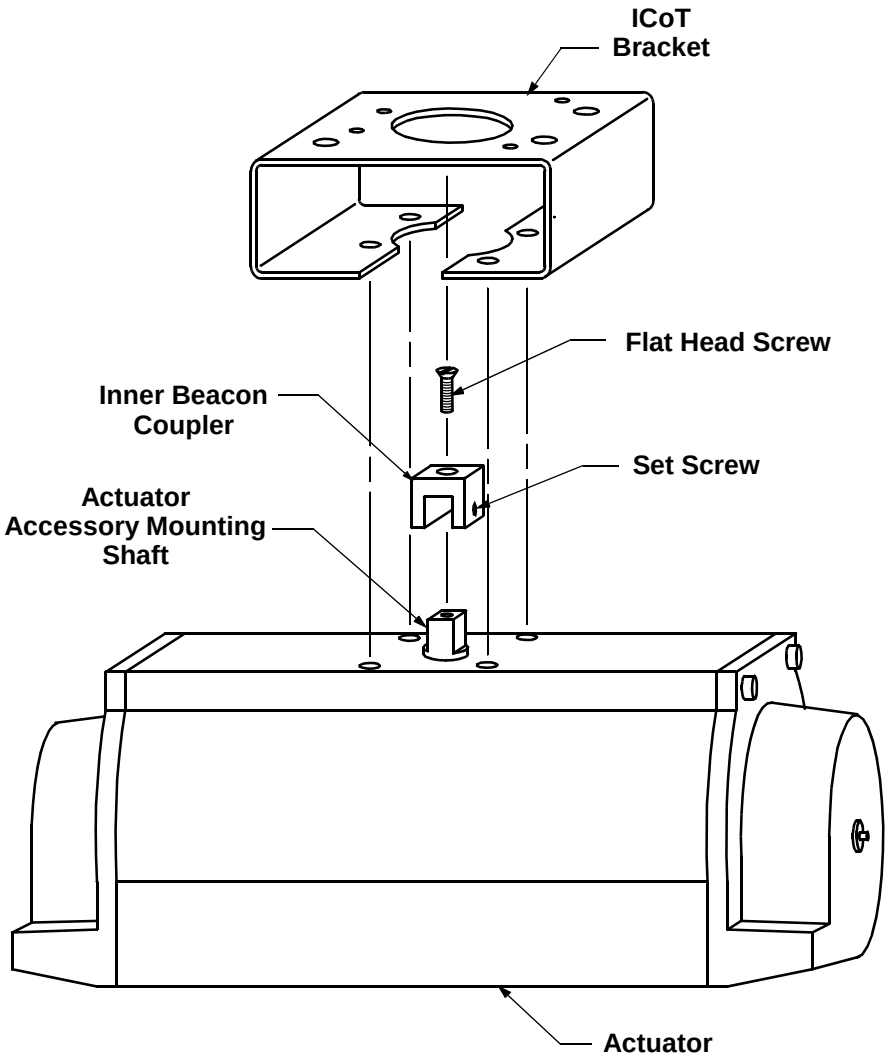


Figure 3-1

Step 2. Press fit the inner beacon to the inner beacon coupler. The inner beacon needs to be properly oriented. Use the symbols on the top of the inner beacon to mount as shown in Condition 1 or Condition 2. (See Figure 3-2). Condition 1 and Condition 2 show the placement of the inner beacon with respect to the positioner housing while the actuator is in the fail position.

Step 3. Mount the positioner to the bracket. As stated in Step 2 make sure that the positioner is mounted in a fashion that properly orients it with respect to the inner beacon.

Condition 1: Actuator fails in a clockwise direction.

Spring Return

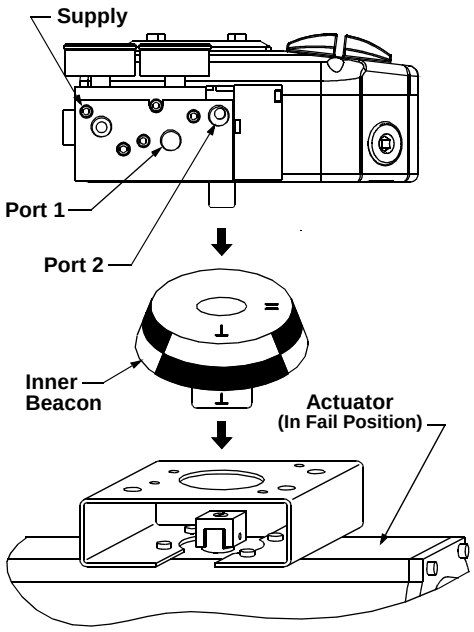
Output Port 2 is plugged
Output Port 1 is piped to turn the actuator counter clockwise

Double Acting

Output Port 2 is piped to turn the actuator clockwise
Output Port 1 is piped to turn the actuator counter clockwise

⊥ **Placed at 6:00**

|| **Placed at 3:00**



Condition 2: Actuator fails in a counter clockwise direction.

Spring Return

Output Port 2 is plugged
Output Port 1 is piped to turn the actuator clockwise

Double Acting

Output Port 2 is piped to turn the actuator counter clockwise
Output Port 1 is piped to turn the actuator clockwise

⊥ **Placed at 9:00**

|| **Placed at 6:00**

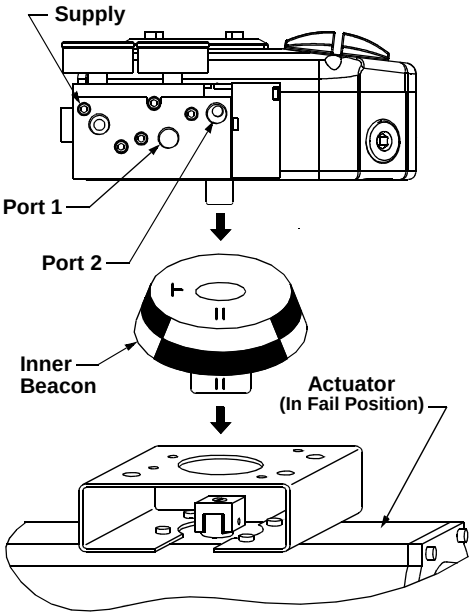


Figure 3-2

3.2 Mounting Remote Positioner on a Rotary Actuator (Models 4235 & 4335)

Step 1. Mount bracket and inner beacon coupler to actuator as described in Section 3.1 Step 1.

Step 2. Press fit the inner beacon to the inner beacon coupler. The inner beacon needs to be properly oriented. Use the symbols on the top of the inner beacon to mount as shown in Condition 1 or Condition 2. (See Figure 3-3). Condition 1 and Condition 2 show the placement of the inner beacon with respect to the position sensor housing while the actuator is in the fail position.

Step 3. Mount the position sensor to the bracket. As stated in Step 2 make sure that the position sensor is mounted in a fashion that properly orients it with respect to the inner beacon.

Condition 1: Actuator fails in a clockwise direction.

Spring Return

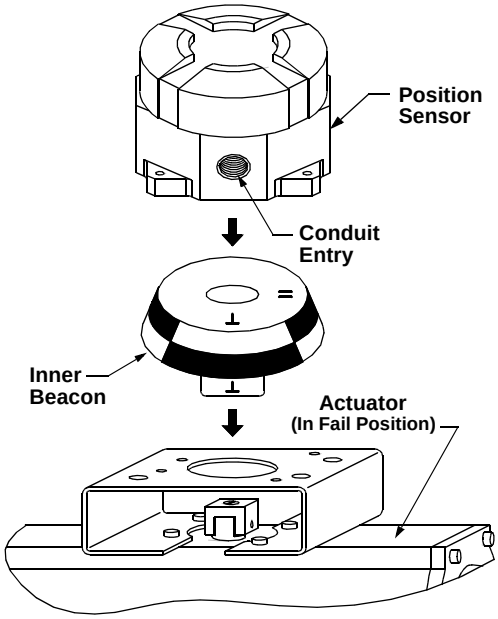
Output Port 2 is plugged
Output Port 1 is piped to turn the actuator counter clockwise

Double Acting

Output Port 2 is piped to turn the actuator clockwise
Output Port 1 is piped to turn the actuator counter clockwise

⊥ **Placed at 6:00**

|| **Placed at 3:00**



Condition 2: Actuator fails in a counter clockwise direction.

Spring Return

Output Port 2 is plugged
Output Port 1 is piped to turn the actuator clockwise

Double Acting

Output Port 2 is piped to turn the actuator counter clockwise
Output Port 1 is piped to turn the actuator clockwise

⊥ **Placed at 9:00**

|| **Placed at 6:00**

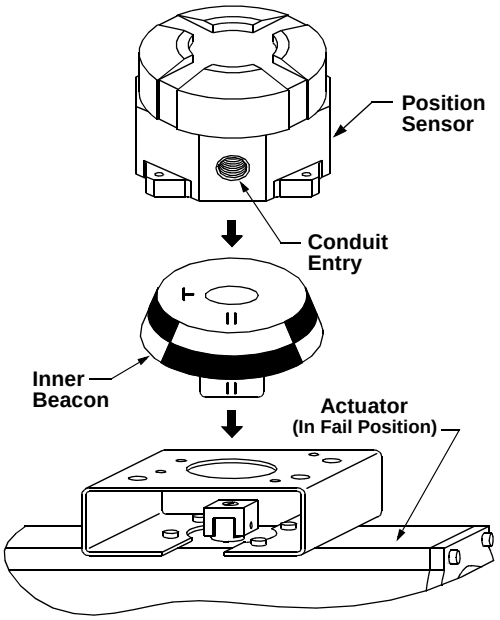
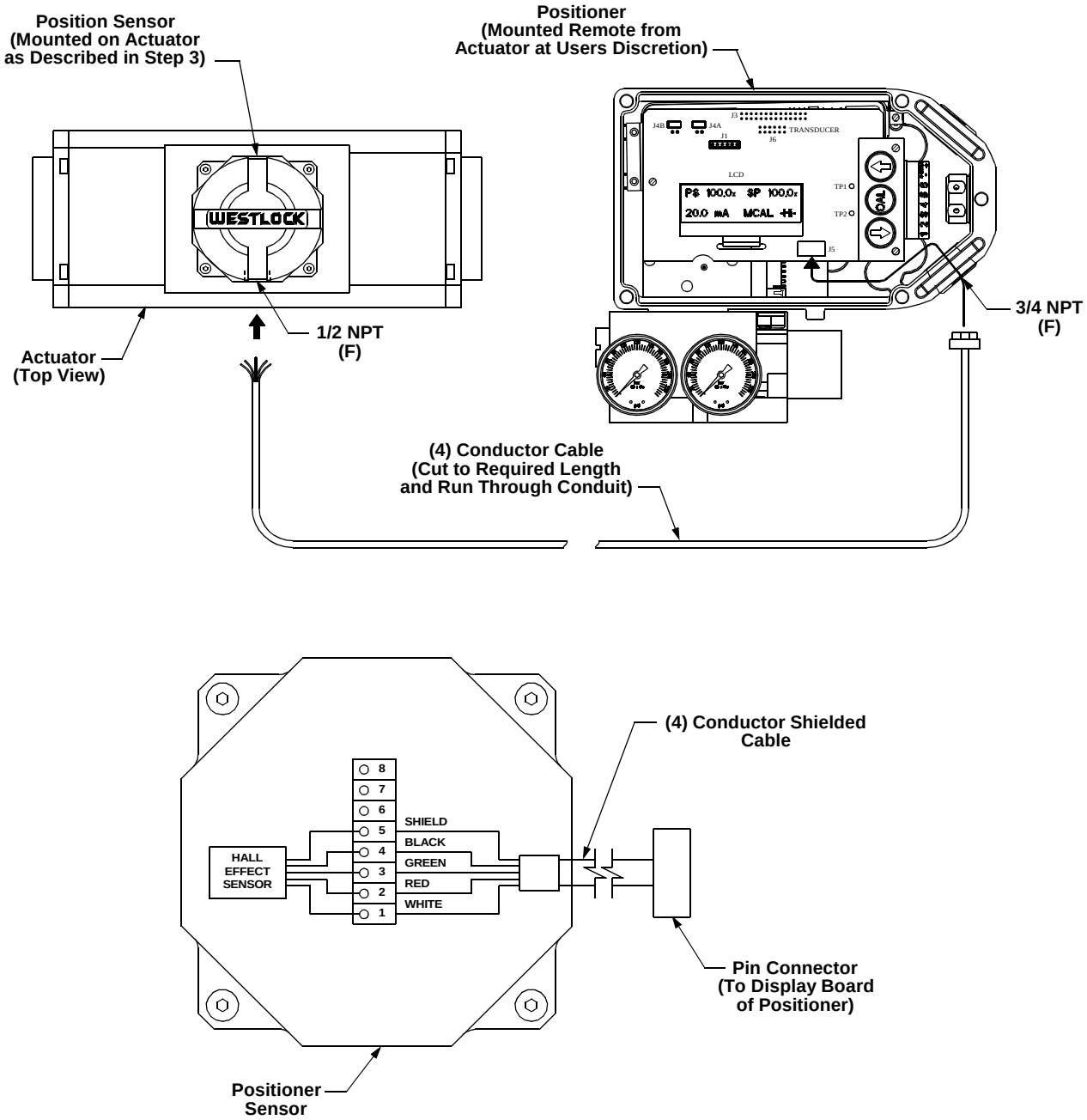


Figure 3-3

Step 4. Mount positioner at a remote location, wire the positioner sensor back to the positioner using the cable provided (See Figure 3-4).



Wiring Schematic

Figure 3-4

3.3 Mounting Positioner on a Linear Actuator

Step 1. Mount the magnet assembly to the stem of the actuator. A coupler block normally is needed to extend the magnet assembly outside the yoke area and into the sensing range of the magnetic pick-up unit.

Step 2. Fasten the mounting bracket to the actuator.

Step 3. Mount the positioner to the mounting bracket. The positioner should be mounted so the magnetic pick-up unit of the positioner is centered between the limits of the magnetic assembly's stroke. After mounting the positioner, the magnet assembly should be within 1/8" from the back of the positioner (1/16" is ideal), (See Figure 3-5).

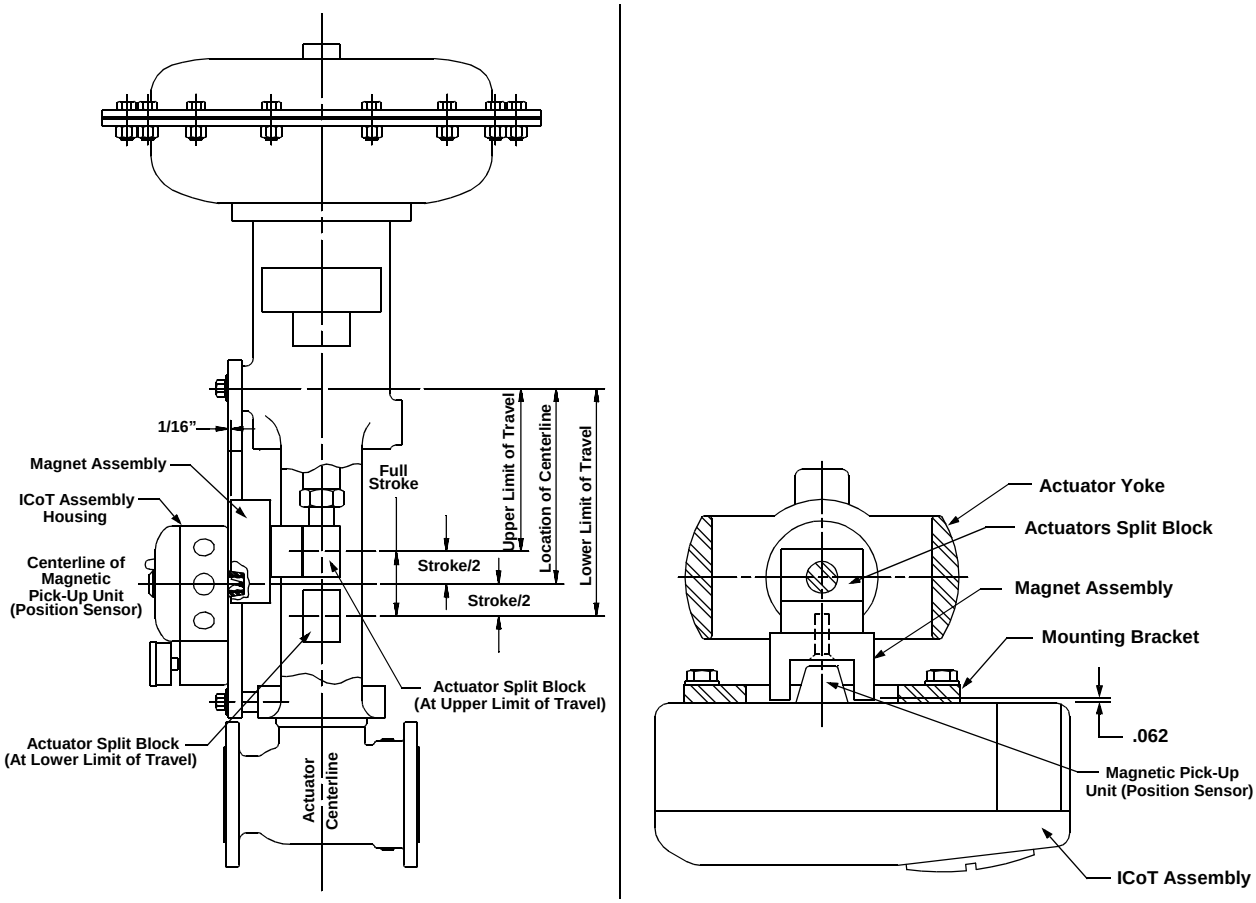


Figure 3-5

Note: For Fisher actuators model 657 & 667 sizes 34 thru 70, Westlock Controls can supply a slotted mounting kit design. This will allow the user to easily center the positioner sensor between the limits of the magnet assembly's stroke.

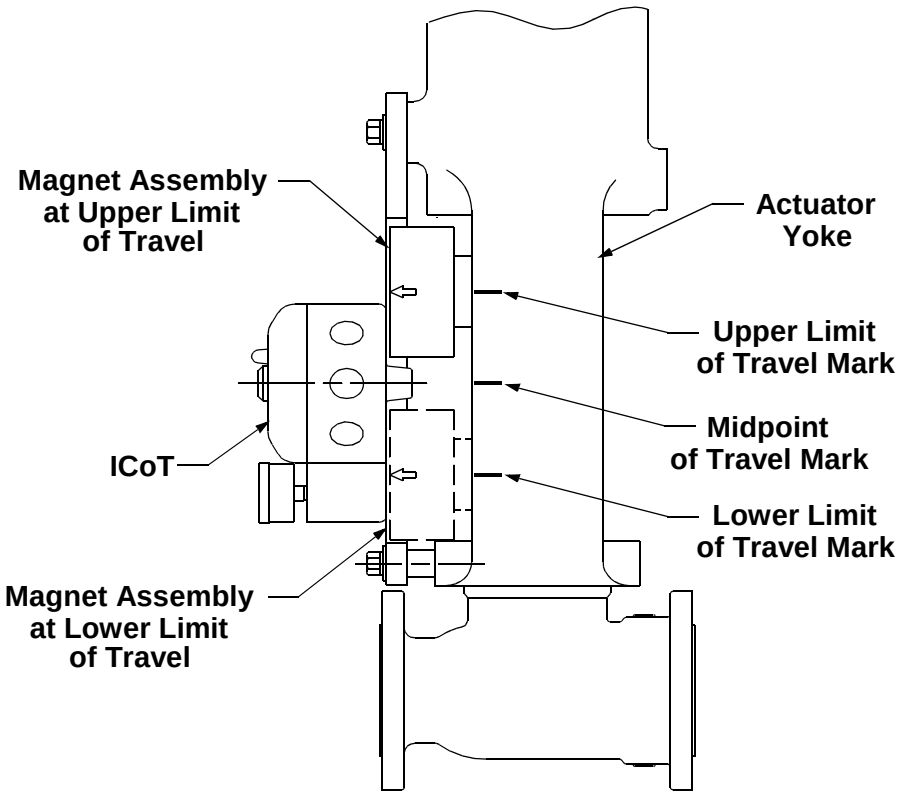


Figure 3-6

To Center the Positioner

1. Stroke the actuator to its upper limit and place a mark on the actuator's yoke that lines up with the red arrow on the magnet assembly.

2. Stroke the actuator to its lower limit and place a mark on the actuator's yoke that lines up with the red arrow on the magnet assembly.

3. Place a third mark on the yoke centered between the upper and lower limit marks.

4. Lastly, mount the positioner to the bracket so that the positioner sensor (nose) of the ICoT lines up with the midpoint mark. (See Figure 3-6).

3.4 Mounting Remote Positioner on a Linear Actuator (Models 4215 & 4315)

Step 1. Mount the magnet assembly and bracket to the actuator as described in Section 3.3 Step 1.

Step 2. Mount the position sensor housing so that the conduit entry faces away from the diaphragm or cylinder. (See Figure 3-7)

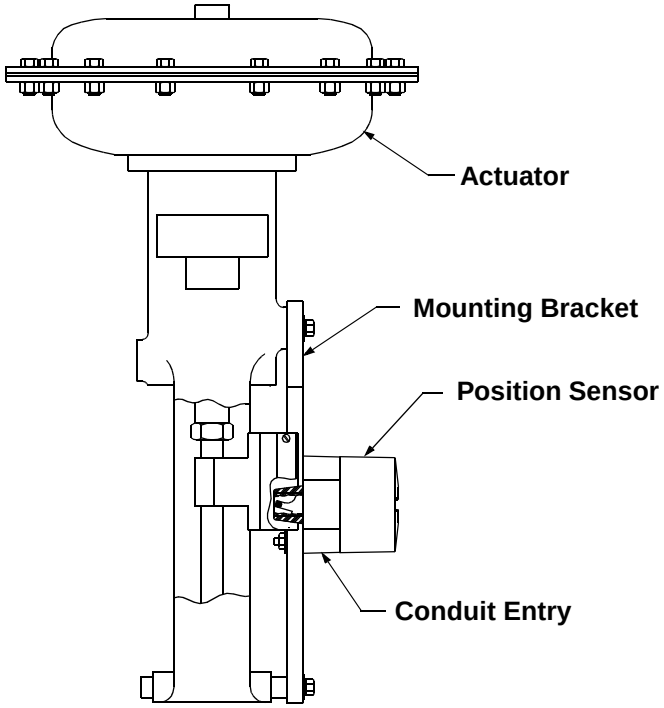
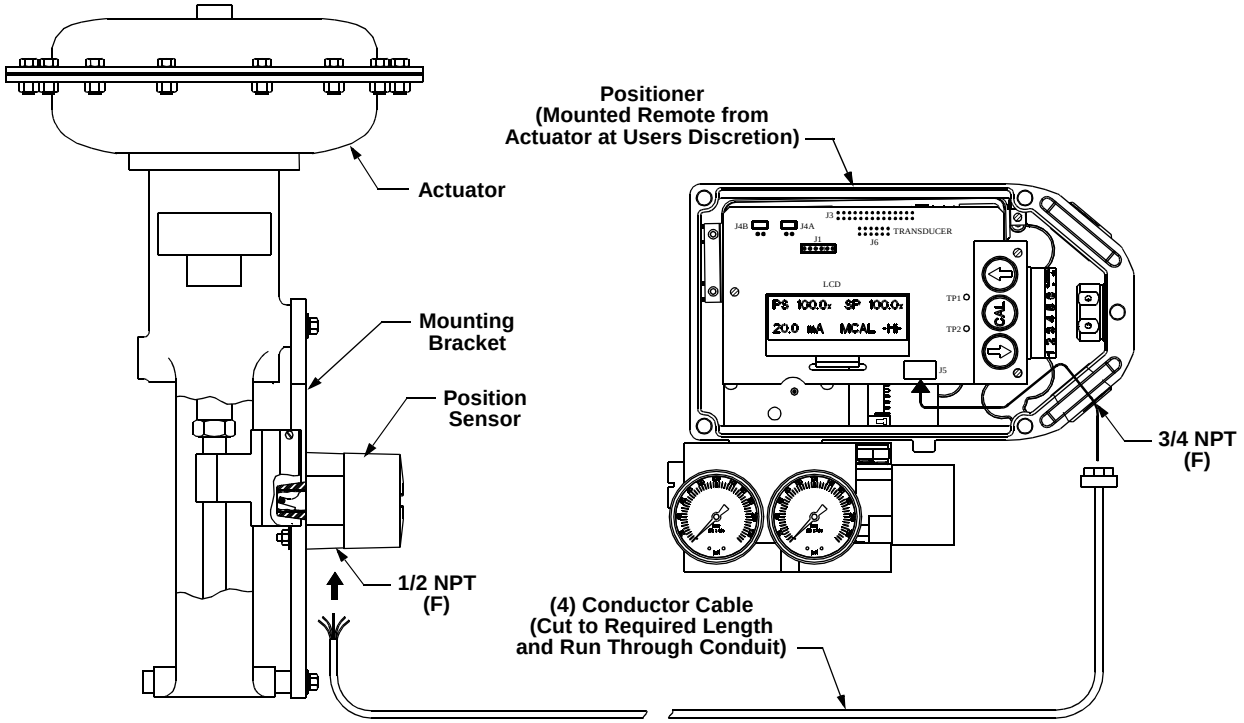
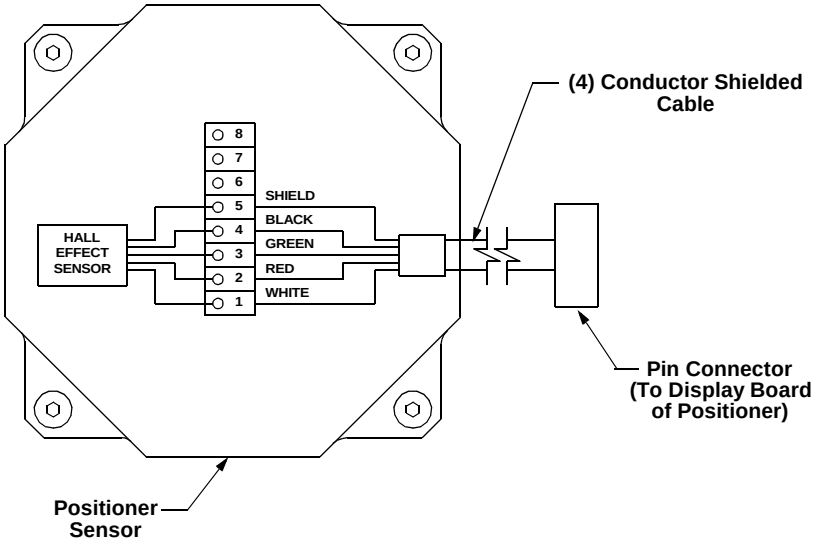


Figure 3-7

Note: For Fisher actuators model 657 & 667 sizes 34 thru 70, Westlock Controls supplies a slotted mounting kit design, to ease the mounting process. This will allow the user to easily center the positioner sensor between the limits of the magnet assembly's stroke.

Step 2. Mount positioner at a remote location, wire the positioner sensor back to the positioner using the cable provided (See Figure 3-8).





Wiring Schematic

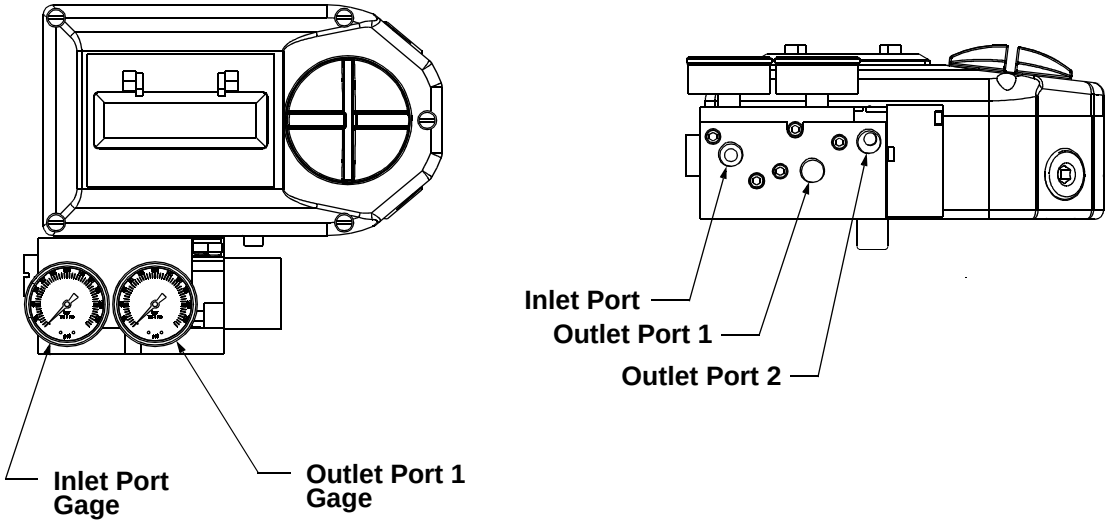
Figure 3-8

3.5 Pneumatic Connection

Single Acting Actuator (Spring Return): For single acting actuators Outlet Port 2 is to be plugged. Outlet Port 1 is to be piped to the actuator inlet port that acts against the spring. (Increasing signal causes pressure to increase in Outlet Port 1 of the positioner).

Double Acting Actuator (Double Return): For double acting actuators Outlet Port 2 is piped to drive the actuator towards the fail position. Outlet Port 1 is piped to drive the actuator away from the fail position. (Increasing signal causes pressure to increase in Outlet Port 1 of the positioner and pressure to decrease in Outlet Port 2 of the positioner).

Note: Air supply to the positioner must be clean, dry, oil free instrument air per ISA-S7.3. Maximum supply pressure is 120 psi. All pneumatic connections are 1/4" NPT.

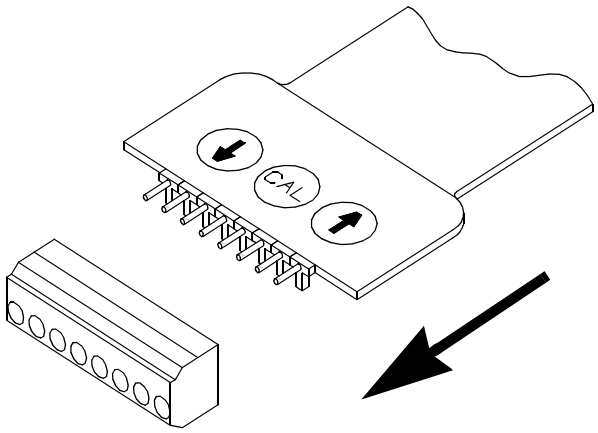


1. Single Acting/Spring Return (Plug Outlet Port 2) increasing signal causes pressure to increase in Outlet Port 1.
2. Double Acting/Double Return (Pipe Outlet Port 2 to drive actuator towards the desired failure direction) increasing signal causes pressure to decrease in Outlet Port 2 and pressure to increase in Outlet Port 1.

Notes:
1. On loss of power pressure fails to Outlet Port 2.

Figure 3-9

3.6 Electrical Connection



Slide Off Terminal Strip
from Keypad assembly

1. Remove positioner cover.
2. Locate terminal strip and carefully disconnect (slide off).
3. Connect the 4 to 20 mA loop signal to terminal points marked (+) and (-). See figure 3-10 for a wiring schematic.
4. If the positioner was ordered with an analog output, connect output wiring to terminal points 5 & 6, (Polarities Shown Below). The 4 to 20mA analog output requires an external 24 volt DC power supply.
5. If the positioner was ordered with switches, connect to the switches at terminal points 1 thru 4, as shown in Figure 3-10.
6. After all connections have been made reconnect the terminal strip and replace positioner cover.

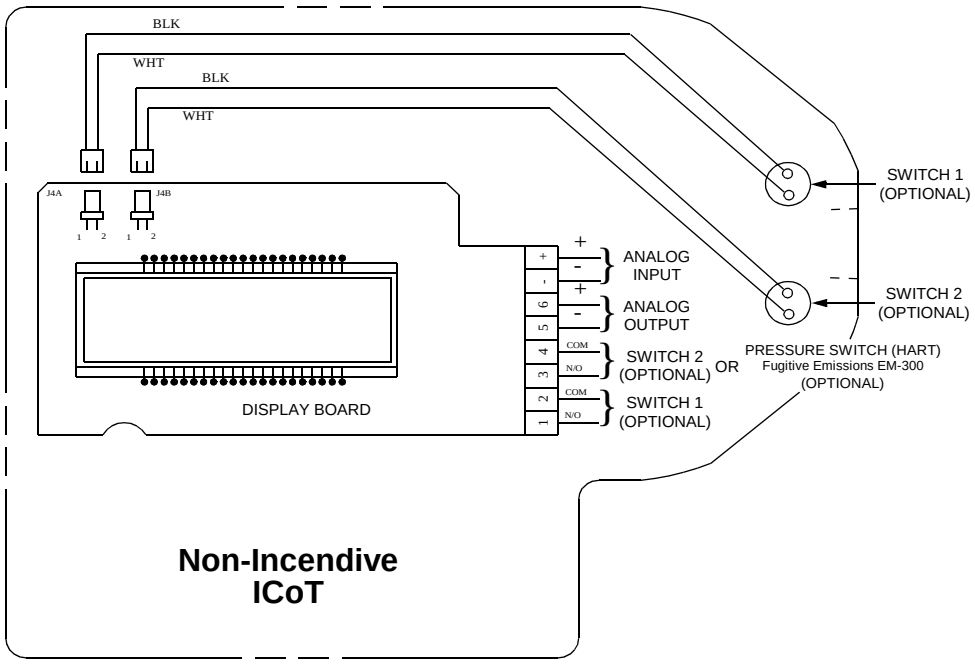


Figure 3-10

3.7 Setting of switches on a rotary ICoT

1. Operate the actuator to the desired extreme.
2. Loosen magnetic trigger bolt #1. (See Figure 3-12)
3. Slide trigger bolt #1 beneath the first switch and tighten with wrench.
4. Operate the actuator to the opposite extreme.
5. Loosen magnetic trigger bolt #2.
6. Slide trigger bolt #2 beneath the second switch and tighten with wrench.

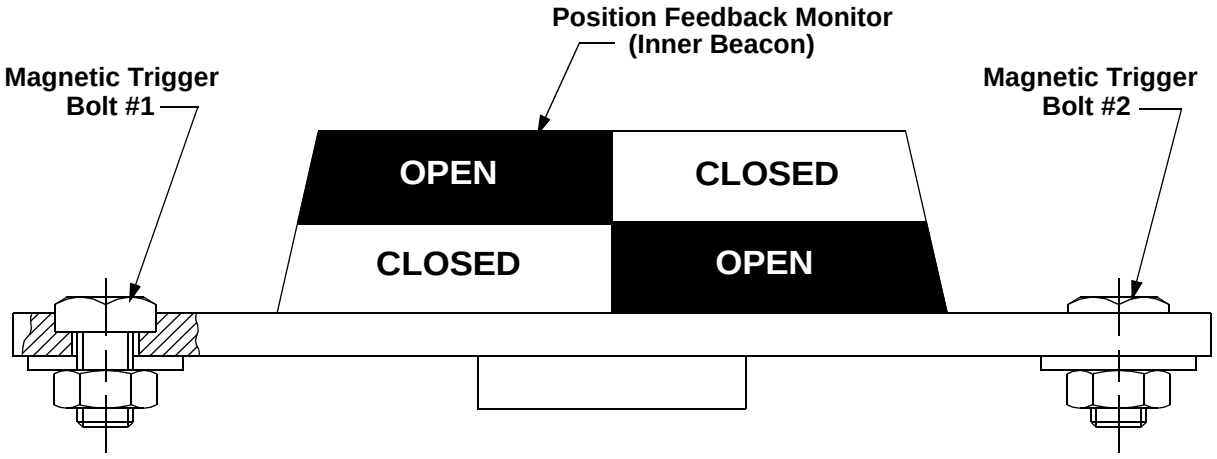


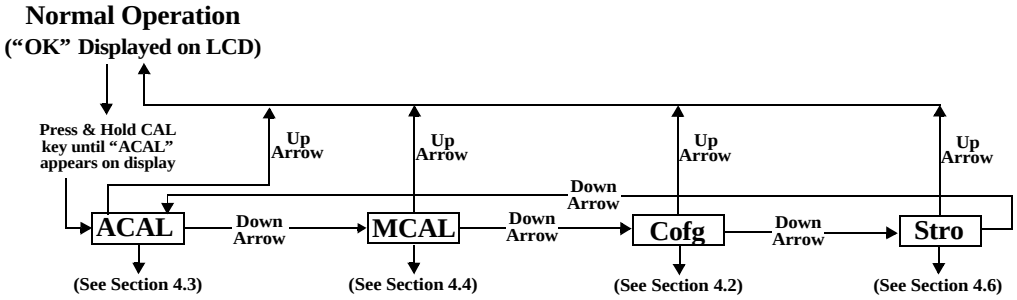
Figure 3-12

Section 4 - Calibration

The ICoT positioner has an on-board help menu that can be accessed by pressing the Cal button and either arrow button simultaneously, anytime during calibration.

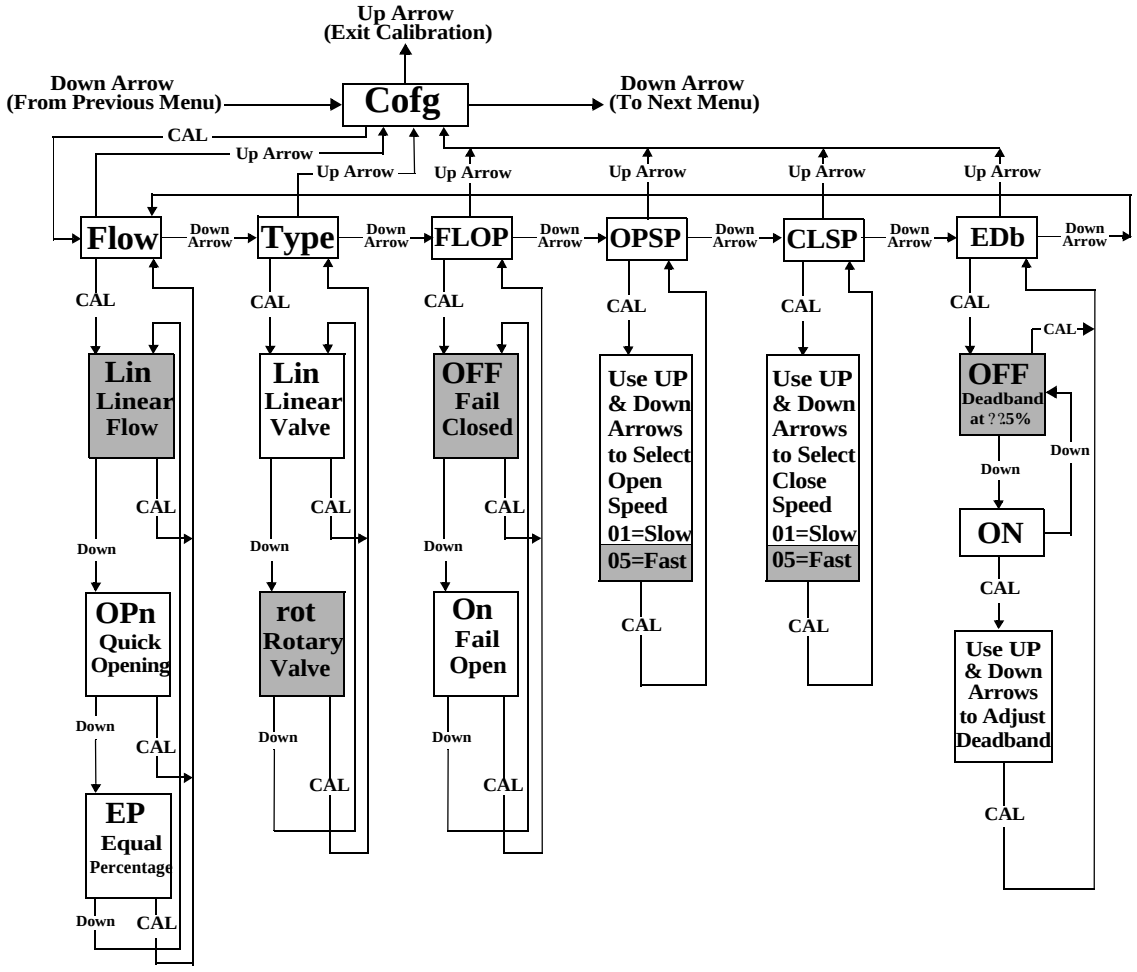
4.1 Enter Calibration (Menu Level)

Enter the calibration routine by pressing and holding the CAL button. Continue to hold the CAL button until ACAL appears on the LCD. ACAL (Auto Cal Menu) is the first of four menus. By pressing the down arrow button you can cycle through the four menus. The remaining three menus are MCAL (Manual Cal Menu), Cofg (Configuration Menu), Stro (Manual Position Override Menu). The menu level is shown below.



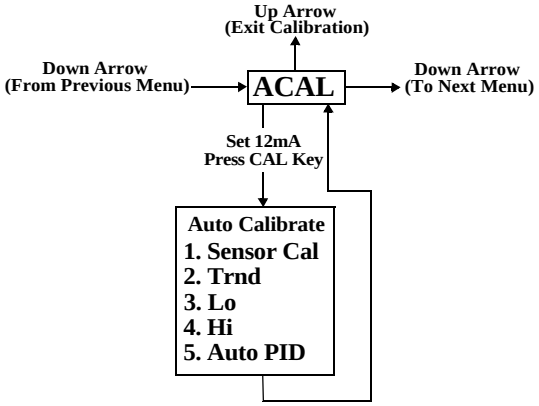
4.2 Configure the Positioners Parameters

From the menu level press the down arrow button until the Cofg (Configuration Menu) is shown on the display (Configuration Routine Shown Below). Enter this menu and change any of the parameters, if other than the factory settings are needed. The factory settings are highlighted.



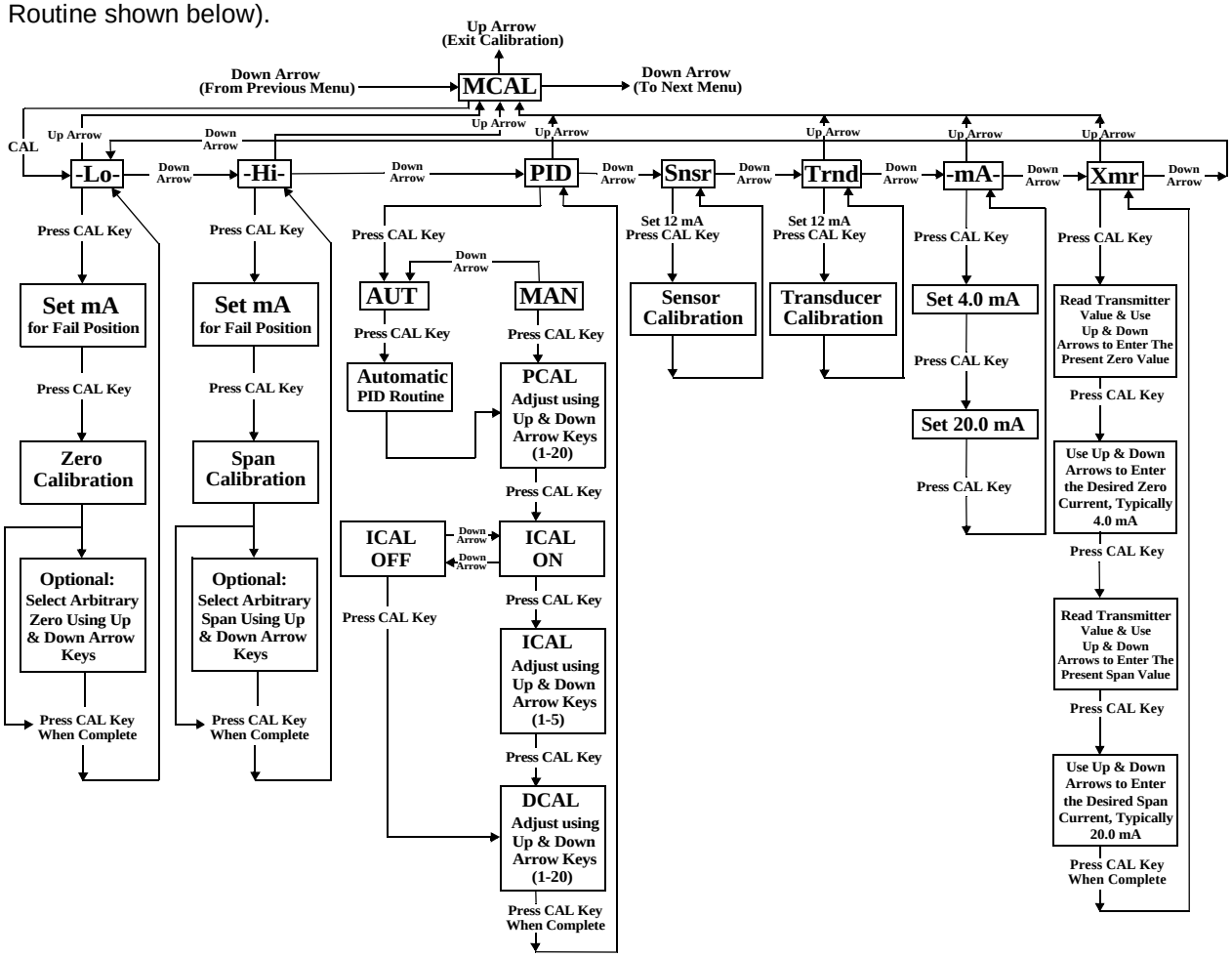
4.3 Automatic Calibration

The Automatic Calibration (ACAL) performs several self-adjustments, as well as a zero calibration, a span calibration, and tunes the positioners PID gain settings. Enter and start the Automatic Calibration from the Menu level. From the menu level press the down arrow button until ACAL is shown on the display (ACAL Routine Shown Below).



4.4 Proceed to Exiting Calibration or Perform Advanced Calibration

At this point the calibration of the positioner is complete. The Automatic Calibration that was performed in Section 3 is adequate for most applications. If no advanced calibration is required proceed to Section 5 to exit calibration. If the user requires to use the advanced settings to fine tune the positioner he may proceed with the remainder of this step and perform adjustments and calibrations in the Manual Calibration Menu (MCAL). From the menu level press the down arrow button until MCAL is shown on the display (MCAL Routine shown below).



4.5 Exiting Calibration

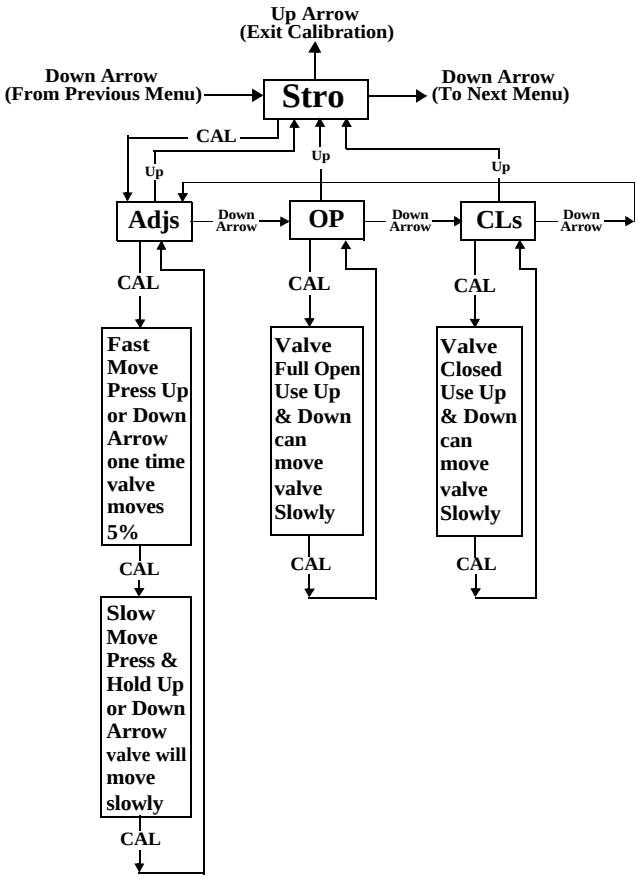
To exit calibration mode and return to normal operation use the **up arrow** key as follows:

- If the positioner is at **Menu level** in the calibration, as determined by LCD displaying a Menu name only (**MCAL**, etc.), press the **up arrow** key once to exit **CAL** mode.
- If the positioner is at **function level** in the calibration, as determined by LCD displaying a function and Menu name only (**MCAL Lo**, etc.), press the **up arrow** key once to enter the Menu level and once more to exit **CAL** mode.
- When the calibration mode is exited the Menu and function names will no longer be displayed by the LCD. The LCD will be displayed “OK”.

Exiting can not be done during a calibration procedure. When a calibration function is initiated, the user must wait until the function’s calibration is complete before being able to exit calibration. The **up arrow** key can be used, as described above, to move to the Menu level and then to exit **CAL** mode.

4.6 Manual Override of Input Signal (Via On-Board Keypad)

The positioner has a feature which allows the operator to override the analog signal and change valve position from the keypad. This is done from the **Stro (Manual Override-Stroke Menu).** Enter calibration as described in section 4.1 and use the down arrow button to cycle to the **Stro** menu. Enter this menu and control the position of the valve as shown below.



4.7 Description of Menu's

The calibration functions of the positioner is organized into the following four menus:

Menus

- Menu 1: **ACAL (Automatic Calibration)**
- Menu 2: **MCAL (Manual Calibration)**
- Menu 3: **Cofg (Configuration)**
- Menu 4: **Stro (Manual Override of Input Signal)**

Menu desciptions are as follows:

Menu 1: ACAL (Automatic Calibration)

Entering this menu allows you to initiate an approximately seven minute self-calibration function. The positioner will automatically enter digital control mode and perform a shallow **(input current independent)** calibration in the following sequence:

Function

1. **-Snsr-** Sensor Calibration
2. **-Trnd-** Transducer Calibration
3. **-Lo-** Low (Zero) Calibration
4. **-Hi-** High (Span) Calibration
5. **-Auto-** Automatic PID Tuning

Menu 2: MCAL (Manual Calibration)

Entering this menu allows you access to the following four calibration functions via the keypad:

1. **-Lo-** Low (Zero) Calibration
2. **-Hi-** High (Span) Calibration
3. **-PID-** Proportional, Integral and Derivative Gain Adjustment
4. **-Snsr-** Sensor Calibration
5. **-Trnd-** Transducer Calibration
6. **-mA-** Milliampere Calibration
7. **-Xmr-** Transmitter Calibration

Menu 3: Cofg (Configuration)

Entering this menu allows you access to the following five configuration functions via the keypad:

1. **-Flow-** Positioner Output Flow Characteristics
2. **-Type-** Positioner Recognition of Magnetic Feedback, Rotary or Linear
3. **-Flop-** Positioner Fail Position, Open or Closed
4. **-OPSP-** Positioner Opening Speed Adjustment
5. **-CLSP-** Positioner Opening Speed Adjustment

These functions allow display, speed and valve characteristic changes from standard factory settings.

Menu 4: Stro (Manual Override of Input Signal)

Entering this menu allows you access to the following three stroking functions via the keypad:

1. **-Adjs-** Adjustment of Positioner to Any Position Using Keypad Arrows
2. **-OP-** Open, Sets the Valve to the Full Open Position
3. **-CLs-** Close, Sets the Valve to the Full Closed Position

These functions set the positioner to digital control mode (**input current independent**) and therefore allow override of the control signal.

4.8 Description of Functions

LO This function serves to set the fail position of the actuator/valve. Initially during this calibration the valve is driven to the fail position (hard stop). The user will notice full pressure to Outlet Port 2 and zero pressure to Outlet Port 1. After a short period of time pressure will increase in Outlet Port 1 and the valve will be driven to the fully energized position and then back to the fail position. After approximately 30 seconds pressure will again increase in Outlet Port 1 and the valve will be driven off of the hard stop (approx. 10% of full travel), and then driven back to the hard stop. The calibration is making note of the torques required to fully seat and un-seat the valve from the hard stop. At this point the user has the option to select the hard stop as low (zero) position or to select an arbitrary position as low (zero) position.

HI This function serves to set the fully energized (full travel) position of the actuator/valve. initially during this calibration the valve is driven to the fully energized (full travel) position (hard stop). The user will notice full pressure to Outlet Port 1 and zero pressure to Outlet Port 2. After a short period of time pressure will increase in Outlet Port 2 and will be driven off of the hard stop (approx. 10% of full travel), and then driven back to the hard stop. The calibration is making note of the torques required to fully seat and un-seat the valve from a hard stop. At this point the user has the option to select the hard stop as the high (span) position. or to select an arbitrary position as the high (span) position.

PID The PID function allows the user to enter or change the PID settings of the positioner. This function is most often used to fine tune the PID values obtained from the automatic calibration function (**ACAL**). This function will allow the user to optimize the dynamic response of the positioner with respect to speed of response, overshoot and percent error by varying the appropriate gain settings.The **Proportional (PCAL)** and **Derivative (DCAL)** gain settings can be varied incrementally on a scale from 1-20. The **Integral (ICAL)** gain setting can be varied incrementally on a scale from 1-5. The larger the number the higher the gain setting.

Snsr The sensor calibration is a self adjustment that sets the positoners Hall-Effect circuitry. This is automatically done during the **ACAL (Automatic Calibration)** routine. The sensor calibration also shows up under the **MCAL** menu. This calibration only needs to be performed under the **MCAL** routine when the positioner is set-up on a new application and only if the **ACAL** routine is not performed.

trnd The purpose of this function is to calibrate the positioner's transducer. The transducer is calibrated on all new positioners at the factory, therefor this procedure does not need to be performed for a new positioner. Perform this calibration function only if a replacement transducer or electronic canister was installed in the positioner.

-mA- This routine calibrates the positioner's electronics to recognizing input current. This is done using 4.0 mA and 20.0 mA as reference points. If exactly 4.0 mA or 20.0 mA can not be given as inputs, the user can adjust the positioners values to the input using the arrow buttons.

Xmr This routine calibrates the positioner's transmitter. The transmitter calibration does not require the user to change the input current, although it does require the user to be able to read the transmitter's value in mA. For each, the zero and span, the user is first prompted to enter the value that the transmitter is presently at. This is done by using the up and down arrow buttons. The user is then prompted to enter the desired transmitter output (typically 4.0 mA for zero and 20.0 mA for span). The positioner then calculates the difference between the present and the desired output currents (for zero and span) and uses the differential to adjust the transmitter accordingly.

Flow This function allows for the setting of the flow characteristic of the positioner (not to be confused with the flow characteristic of the valve). The options are **Lin (Linear)**, **EP (Equal Percentage)** and **Opn (Quick Opening)**. A **Lin (Linear)** positioner characteristic duplicates the inherent characteristic of the valve and is the most often used setting.

Type This function configures the positioner for the type of valve. The options are **rot (Rotary)** and **lin (Linear)**. This setting needs to be done in order to configure the positioner to recognize the type of magnetic feedback being given to the positioner.

FLOP This function allows the user to configure the positioner to match the failure method of the valve/actuator. The options are **"off"** or **"on"**. The **"off"** option is for fail closed applications and the "on" option is for fail open application. When **"off"** is chosen the LCD will read 0% at the **zero (Lo Calibration)** and 100% at the **span (Hi Calibration)**. When **"on"** is chosen the LCD will read 100% at the **zero (Lo Calibration)** and 0% at the **span (Hi Calibration)**.

OPSP This function allows for the setting of the opening speed of the actuator/valve. The range is 1 thru 5. Setting 5 is the fastest opening speed and setting 1 is the slowest opening speed.

Setting	Approx.% Dynamic Speed
5	100%
4	80%
3	60%
2	40%
1	20%

CLSP This function allows for the setting of the closing speed of the actuator/valve. The range is 1 thru 5. Setting 5 is the fastest closing speed and setting 1 is the slowest closing speed.

Setting	Approx.% Dynamic Speed
5	100%
4	80%
3	60%
2	40%
1	20%

EDb This feature configures the positioner's operating deadband. The configuration options are **"off"** and **"on"**. The positioner is factory set as **"off"**. When the deadband feature is **"off"** it operates with nominal value of ± 0.3% of full scale for deadband. When the feature is turned **"on"**, the deadband can be set using the up and down arrow buttons to a value from 1 to 20. The value 1 **(lowest deadband when turned "on")** has a deadband range of 1%, which is equivalent to a deadband of ± 0.5%. The value 20 **(highest deadband value)** has a range of 20%, which is equivalent to a deadband of ± 10%.

Adjs This function allows for the adjustment of the positioner to any position via the keypad. This function places the positioner in digital control mode **(input current independent)** and therefor allows override of the control signal. Within this function there are **Fast** and **Slow move** modes. In **Fast move** mode the valve is opened or closed in 5% increments via the keypad. In **Slow move** mode the valve is opened or closed slowly via the keypad.

OP This function sets the valve to the fully energized position via the keypad **(Outlet Port 1 = Supply psi & Outlet Port 2 = 0 psi)**. This function places the positioner in digital control mode **(input current independent)** and therefor allows override of the control signal.

CLs This function sets the valve to the fully denergized position via the keypad **(Outlet Port 1 = 0 psi & Outlet Port 2 = Supply psi).** This function places the positioner in digital control mode **(input current independent)** and therefor allows override of the control signal.

Section 5 - Trouble Shooting

5.1 Preliminary Checks

Before operating the positioner check the following:

1. Voltage

The positioner requires a 24 volt DC (nominal), 4-20 mA current loop.

2. Electrical Connection

Check the polarity of the 4-20 mA current loop. The ICoT terminal strip visually designates the positive and negative terminal points for connection with a "+" and "-", respectively.

3. Pneumatic Connection

Single Acting: Output port 1 should be piped to drive the actuator away from the valves fail position. Output port 2 should be plugged. (See Section 3.3)

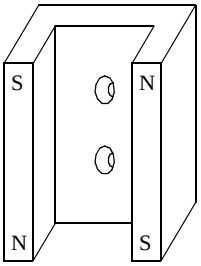
Double Acting: Outport port 1 should be piped to drive the actuator away from the valves fail position. Output port 2 should be piped to drive the actuator towards the valves fail position. (See Section 3.3)

4. Magnetic feedback to the Positioner

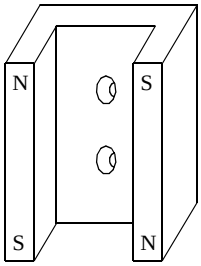
Rotary Positioner: The magnetic beacon should be set in the proper orientation, based on the direction of failure. (See Section 3.1)

Linear Positioner: The magnetic assembly supplied with the positioner should correspond to the stroke length and failure direction of the actuator. To make sure you have the appropriate magnet assembly, check the part. The stroke length and failure direction should be printed on the part. On older ICoTs the magnet assembly is not printed with this information, although there should be a serial number. Contact the factory with the serial number to verify that it is correctly matched to the actuator. (See Figure 5-1 & Figure 5-2).

Polarities of Magnetic Feedback Assemblies (For Linear ICoT Positioners)



FAIL-DOWN
(Actuator Fails in Direction A)



FAIL-UP
(Actuator Fails in Direction B)

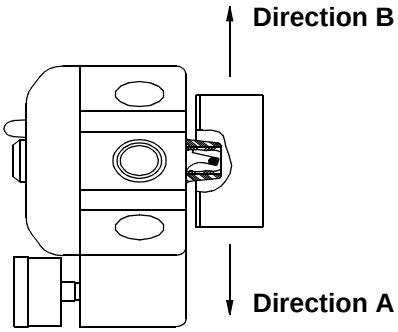
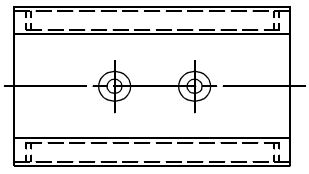
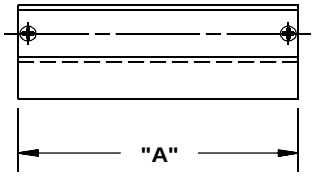


Figure 5-1





STROKE LENGTH OF ACTUATOR/VALVE	DIM "A"	MAGNET ASSY' PART#
GREATER THAN 0.5" UP TO 1.0"	2.5	SW-30057
GREATER THAN 1.0" UP TO 1.5"	3.0	SW-30056
GREATER THAN 1.5" UP TO 2.0"	3.5	SW-30055
GREATER THAN 2.0" UP TO 2.5"	4.0	SW-30054
GREATER THAN 2.5" UP TO 3.0"	4.5	SW-30053

Figure 5-2

5. Supply Pressure
The supply pressure should be regulated appropriately with regard to the actuator. If there is question as to the proper supply pressure, the actuator manufacturer should be contacted.

6. Positioner Pressure Rating
If the supply pressure is above 40 PSI a high pressure ICoT positioner must be used. If the supply pressure is below 40 PSI a low pressure ICoT positioner must be used.
(See Ordering Guide - Section 2.1)

5.2 Common Problems

Listed here are some common problems encountered with the ICoT positioner. Possible causes are given and steps to help rectify the problem are offered.

1. The LCD remains blank even after power is applied to the positioner.
- The positioner should be given a minimum of 14 VDC. The voltage across the positioner can be checked by removing the cover and connecting a voltmeter across TP1 and TP2 on the display board.

2. The positioner has power but the position as shown on the LCD does not seem to match the actual position of the actuator/ valve.
- May need to be calibrated.
- Beacon may be mis-oriented.

3. The positioner is properly set-up, and air is applied to the positioner. When powering up the positioner, the actuator goes into a state of constant oscillation.
- The gain settings are to high for the actuator/valve assembly. Enter the calibration mode and reduce the **PCAL**, **ICAL** and **DCAL** settings.

4. After a successful calibration, position and set point as shown on the LCD does not match the input signal.
- The flow characteristic during calibration was set to equal percentage or quick opening, not linear. If linear is desired enter calibration and make this change (See Calibration Instructions section 4.1 & 4.2).

5. After removing power to the positioner there is full pressure to output port 1 and zero pressure to output port 2.
- On loss of power the positioner fails full air pressure to output port 2. If this does not happen the positioner is damaged. Contact factory.

6. An Err 6 (Calibration Error) is returned during a Lo or Hi Calibration.
- In the case of a rotary application, the beacon may be mis-oriented.
- In the case of a rotary application, the actuator may not have enough rotation. The positioner requires the actuator to stroke a minimum of 45 degrees.
- In the case of a linear application, the feedback magnet assembly needs to be ordered specific to the stroke of the actuator and the fail direction of the actuator. (See figure 5-1 & 5-2).

7. An Err 5 (Integrator Overflow) message is shown on the display.
- This messages indicates a deviation between position and set-point. This error message does not clear itself after the problem ceases, therefore, try clearing the message. See Appendix A.1 “Procedure to Clear Err 5”
- If the Err 5 returns, make sure all the preliminary checks, as described earlier in this section, have been made. If still the cause for the Err 5 can not be diagnosed, call the factory for help.

Section 6 - Specifications

Input

Signal:	4 to 20 mA, two wire
Voltage:	12.3 Volts DC
Pressure:	15 - 45 psi (Low) 40 - 120 psi: (High)

Output

Flow Rate:	8.0 scfm @ 25 psi (Low) 16.2 scfm @ 90 psi (High)
Pressure:	0 to 45 psi (Low) 0 to 120 psi (High)
Actuator:	Single Acting or Double Acting

Technical

Resolution:	.2% Full Travel
Linearity:	.5% Full Scale (Rotary) 1% Full Scale (Linear)
Hysteresis:	.2% Full Scale
Repeatability:	.2% Over One Hour
Operating Temp:	-40°C to 85°C (-40°F to 185°F)
Thermal Coefficient:	2% / 100°C
Air Consumption:	.003 scfm @ 25 psi (Low) .008 scfm @ 90 psi (High)

Hazardous Rating:	Non-Incendive, Class I, Division 2, Groups A,B,C,D Class II, Division 2, Groups F,G Class III, Division 2 Intrinsically Safe Class I, Division 1, Groups A,B,C,D Class II, Division 1, Groups E,F,G Class III, Division 1
Stroke:	.25 to 24 inches (Linear) 0 to 95 Degrees (Rotary)
Position Feedback:	Magnetic (Non-Contact)
Diagnostics:	HART Protocol, Software Utilizing HART Protocol

Enclosure

Material:	Engineered Resin
Class of Equipment:	NEMA type 4
Weight:	7.2 Pounds
Air Connections:	1/4” NPT
Conduit Connection:	1/2” NPT (Standard) M20 (Optional)

Approvals	FM, CSA (Standard) Cenelec (Special Label Req.) Kema (Special Label Req.)

Section 7 - Error Codes

Err 3 (Error 3)	Low Input Pressure or Clogged Filter
Err 5 (Error 5)	Intergrator Overflow - Position of actuator does not match setpoint of positioner
Err 6 (Error 6)	Calibration Error - Positioner could not successfully perform calibration
ALR (Alert 3)	Valve position is not being maintained within the deadband range. The deadband range (EDb) is set from the configuration menu during calibration (Section 4). The EDb must be set to other then zero (0) to enable the Alert 3 message.

Appendix A

Procedure to Adjust the Error 3 Setting

Note: The error 3 message is pre-set from the factory. For a low pressure positioner it is set to 15 psi and for a high pressure positioner it is set at 55 psi. If these settings come out of calibration or if it is necessary to change these settings, the following instructions can be followed.

1. Before adjusting the Error 3 setting the positioner must be mounted and set-up. See section 3 of this manual.

2. To adjust the setting of the Error 3 message to indicate low input pressure, there is an adjustment screw located on the top of the transducer. (See Figure Below)

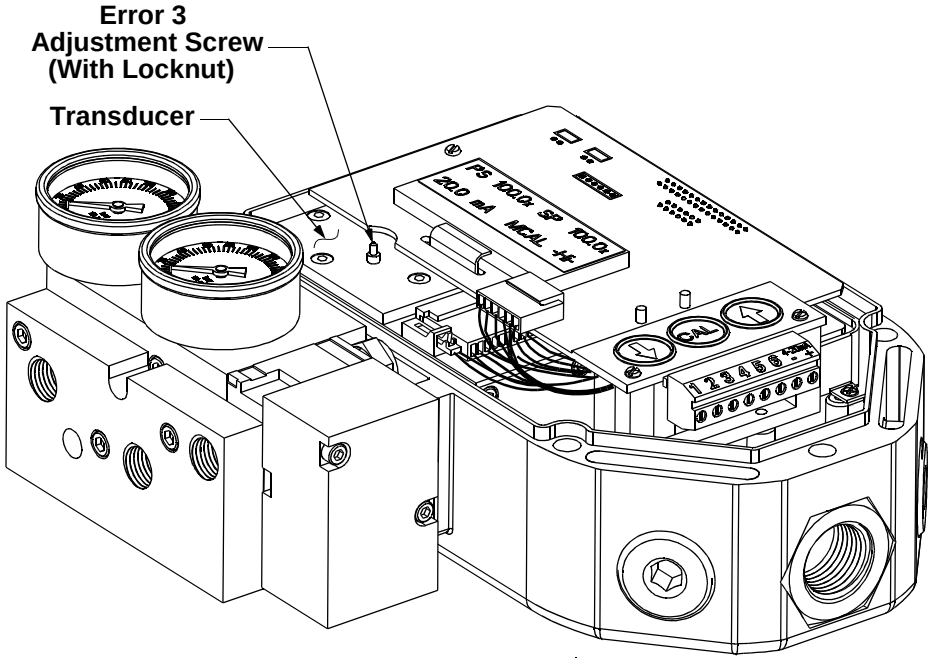
3. To set the Error 3 for an explicit pressure value, loosen the lock nut on the adjustment screw and **gently** turn the screw clockwise as far as it will go. Do not force the screw past its limit or the Error 3 diaphragm assembly may be damaged.

4. Regulate the supply pressure to the pressure you would like to set as a low input pressure flag.

5. Turn the adjustment screw slowly counter-clockwise to the point where the Err 3 message appears on from the display.

6. Set this point by tightening the lock nut. Be careful not to effect the adjustment screw setting.

7. Re-regulate the supply air to the normal operating pressure.



Appendix B

Procedure to Remove Display Board and Electronic Canister

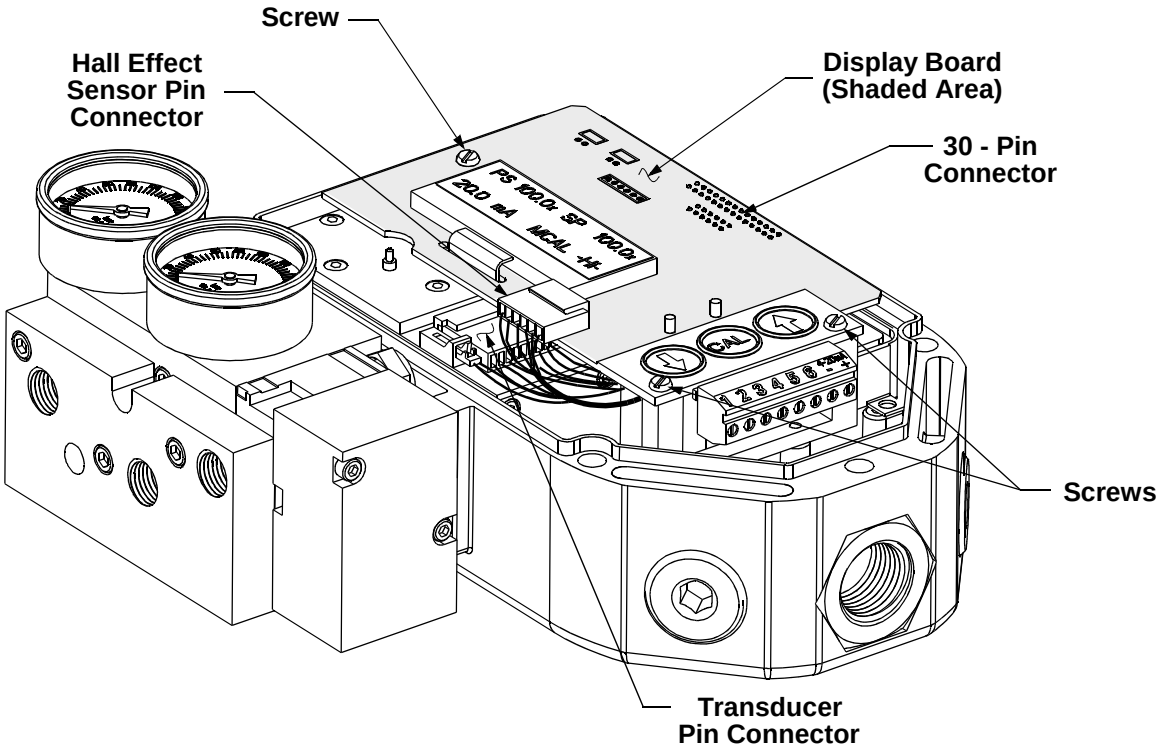
1. Remove the three screws that fasten the display board. (See Figure Below).

2. Gently pull up the display board disconnecting the board from the 30-pin connector on the upper right corner of the display board.

3. Gently remove the transducer pin connector. Be careful not to pull any of the wires out of the connector.

4. Gently remove the hall effect sensor pin connector. Be careful not to pull any of the wires out of the connector.

5. At this point the display board is completely disconnected. If the electronic canister is to be removed, it can be done so by removing the three screws that fasten it to the housing.

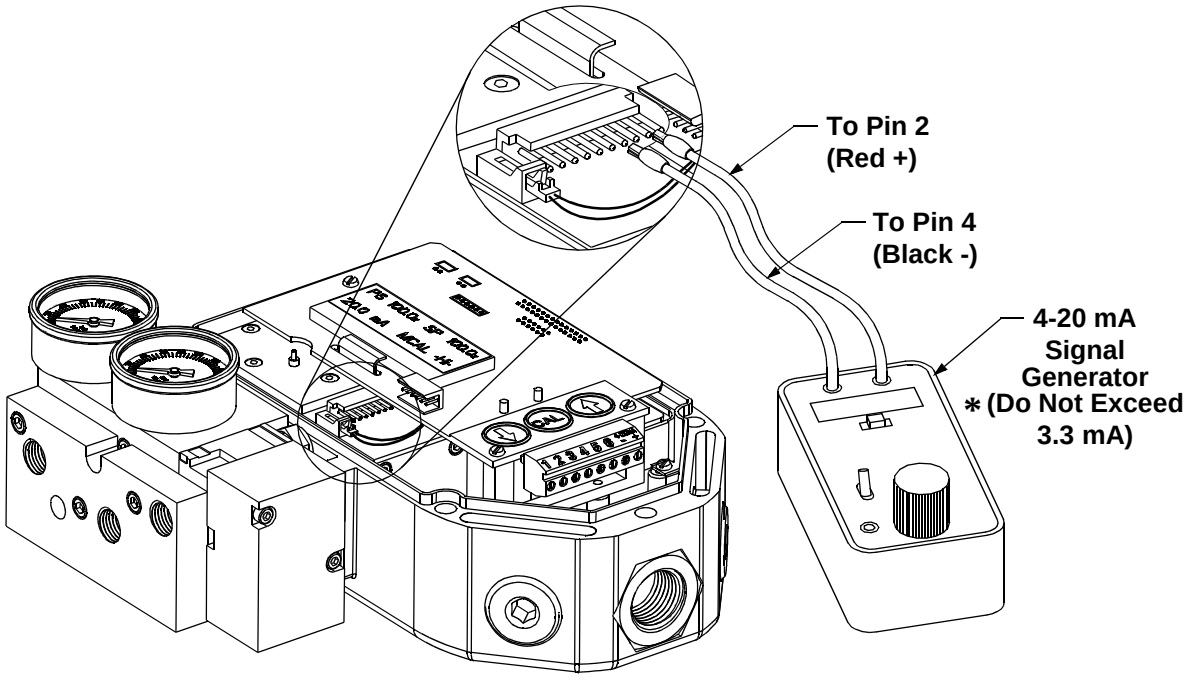


Appendix C

Procedure to Check Transducer Operation

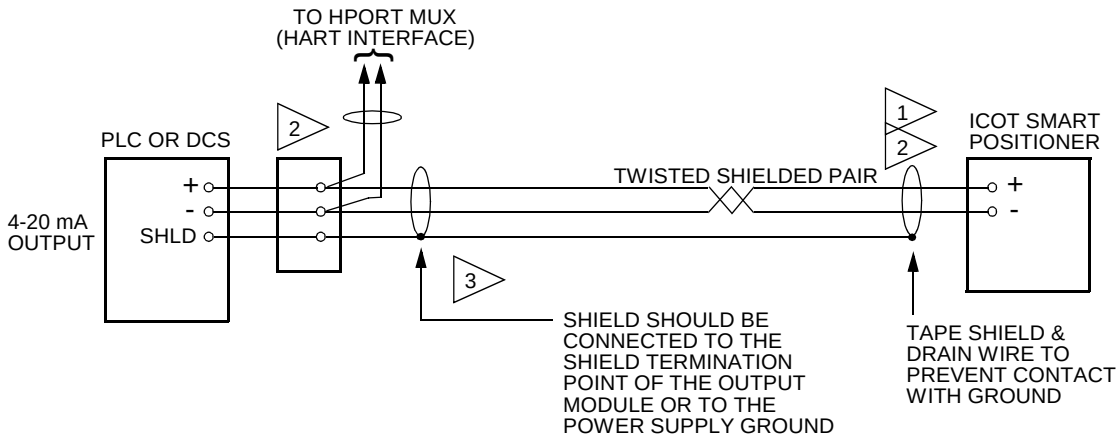
(This procedure should only be used for trouble shooting)

1. Mount the positioner and connect the pneumatics as described in section 3 of this manual.
2. Remove the Display Board as described in Appendix B of this manual. The electronic canister does not need to be removed.
3. Locate Pin 2 & Pin 4 on transducer pin connector. (See Figure Below)
   Ref.: Pin 1 is furthest from the pressure gages, Pin 10 is nearest to the to the pressure gages.
4. Connect positive lead of the signal generator to Pin 2 and connect negative lead to Pin 4.
   Note: Make sure power on the signal generator is turned off before connecting it to the pins.
   Note: Make sure the two leads are not shorting by both coming in contact with Pin 3.
5. Turn on the 4-20 mA signal generator.
   Note: The transducer operates between 0 and 3.3 mA. Therefore, make sure when turning on the current supply's power the current is turned down within this range. Applying a current greater then 3.3 mA can damage the transducer.
6. Apply the supply air to the positioner.
7. The transducer consists of a spool that will channel air between the two output ports of the positioner. As the current is raised air is removed from Output Port 2 and applied to Output Port 1 of the positioner.
8. To check the operation of the positioner, raise and lower the current between 0 and 4 mA. This should allow you to open and close the actuator. You should also be able to control the position of the actuator by adjusting the current supply at an intermediary (idle) current somewhere between 0 and 3.3 mA.



Appendix D

Grounding Schematic



1 CONNECTION FROM DCS OR PLC TO POSITIONER IS 20 GAUGE SHIELDED TWISTED PAIR (BELDEN 8762 OR EQUIVALENT). MAXIMUM DISTANCE IS 5000 FEET.

2 CONNECTION FROM HART MULTIPLEXER TO POSITIONER IS 20 GAUGE SHIELDED TWISTED PAIR (BELDEN 8762 OR EQUIVALENT). MAXIMUM DISTANCE FROM HART MULTIPLEXER TO POSITIONER IS 6000 FEET.

3 SHIELD SHALL BE CONNECTED TO GROUND AT ONE POINT ONLY IN ORDER TO AVOID GROUND LOOPS AND NOISE INTERFERENCE.

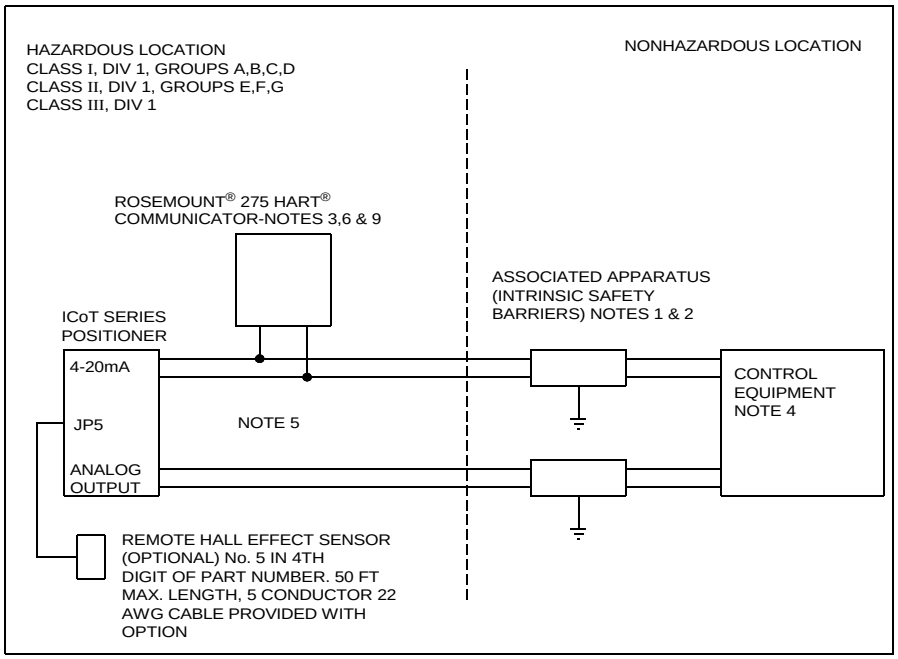
4. THE FOLLOWING TABLE, PER IEEE STD 518-1982, INDICATES THE MINIMUM DISTANCE BETWEEN CABLE TRAYS AND CONDUITS CONTAINING LEVEL 1 (THIS INCLUDES 4-20 mA SIGNALS) AND 120 VAC OR 480 VAC, IN ORDER TO MINIMIZE ELECTRICAL NOISE INTERFERENCE.

RACEWAY	480 VAC	120 VAC
TRAY	26”	6”
TRAY-CONDUIT	18”	4”
CONDUIT	12”	3”

Appendix E

Control Schematic for Wiring of Intrinsically safe ICoT (WD-10836)

(Sheet 1 of 4)



Entity parameters for each field wiring terminal pair of ICoT: Vmax = 30V Imax = 100mA
Ci = 120 pF Li = OmH

1. FMRC Entity approved associated apparatus used in an approved configuration, such that:

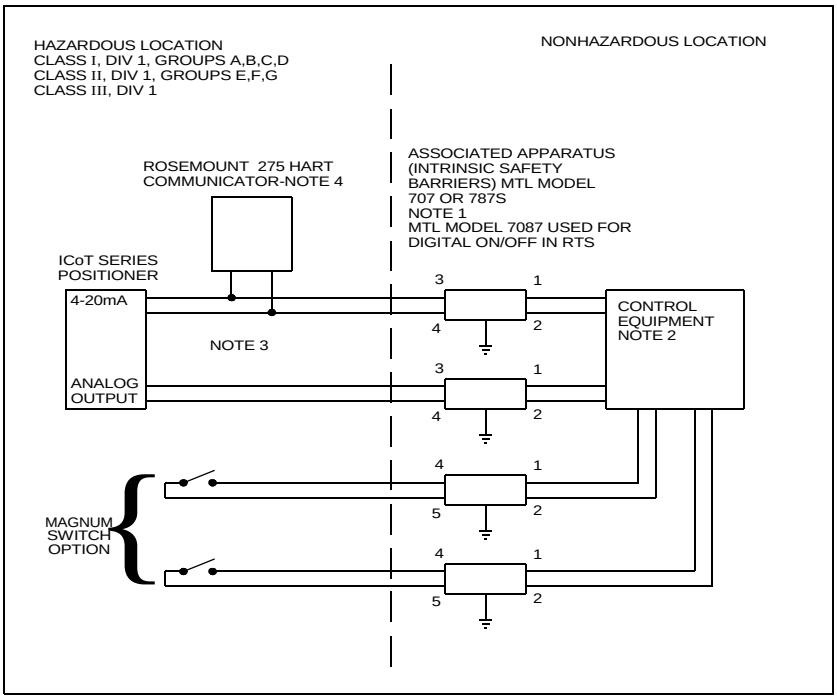
   A. ICoT Vmax greater than or equal to Voc and Vt of associated apparatus.
   B. ICoT Imax greater than or equal to Isc and It of associated apparatus.
   C. Ci of ICoT + Ci of ROSEMOUNT® 275 HART® COMMUNICATOR (if used) + cable capacitance less than or equal to Ca of associated apparatus.
   D. In cases where the ROSEMOUNT® 275 HART® COMMUNICATOR is not connected between the associated apparatus and the ICoT, Li of ICoT + cable inductance less than or equal to La of associated apparatus.
   E. In cases where the ROSEMOUNT® 275 HART® COMMUNICATOR is connected between the associated apparatus and the ICoT, cable inductance should be determined in accordance with ROSEMOUNT® installation drawing 00275-0081.

2. Associated apparatus manufacturer's installation drawing must be followed when installing this equipment.
3. In cases where the ROSEMOUNT® 275 HART® COMMUNICATOR is connected between the associated apparatus and the ICoT. ROSEMOUNT® installation drawing 00275-0081 must be followed when installing this equipment.
4. Control equipment connected to associated apparatus must not use or generate more than 250V.
5. To maintain intrinsic safety, each field wiring pair (4-20 mA and Analog Output) must be run in separate cables or separate shields connected to intrinsically safe (Associated Apparatus) ground.
6. ROSEMOUNT® 275 HART® COMMUNICATOR is NOT FMRC approved for use in Class II and III Hazardous Locations.
7. For Class II and III locations where rigid metal conduit is not used, seal ICoT cable entries against dust and fibers using an appropriate NRTL listed cable gland fitting.
8. Installation should be in accordance with ANSI/ISA RP12.6 and the National Electrical Code (ANSI/NFPA 70).
9. ROSEMOUNT® 275 HART® COMMUNICATOR not used with Model 4100.

Appendix E

Control Schematic for Wiring of Intrinsically safe ICoT (WD-10836)

(Sheet of 2 of 4)



1. Associated apparatus manufacturer's installation drawing must be followed when installing this equipment.
2. Control equipment connected to associated apparatus must not use or generate more than 250V.
3. To maintain intrinsic safety, each field wiring pair (4-20 mA and Analog Output) must be run in separate cables or separate shields connected to intrinsically safe (Associated Apparatus) ground.
4. ROSEMOUNT® 275 HART® COMMUNICATOR is NOT FMRC approved for use in Class II and III Hazardous Locations.
5. For Class II and III locations where rigid metal conduit is not used, seal ICoT cable entries against dust and fibers using an appropriate NRTL listed cable gland fitting.
6. Installation should be in accordance with ANSI/ISA RP12.6 and the National Electrical Code (ANSI/NFPA 70).

MAXIMUM FIELD WIRING CAPACITANCE AND INDUCTANCE

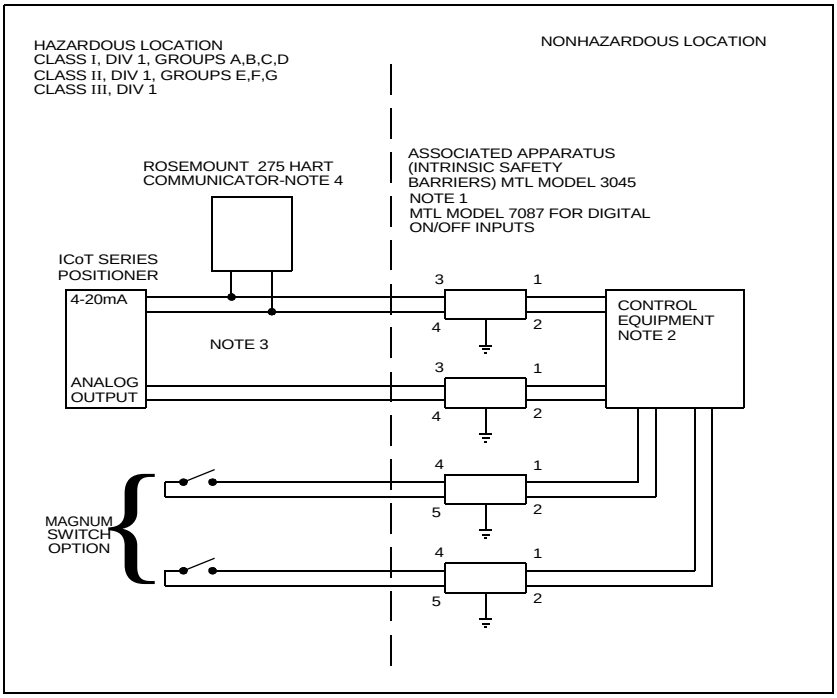
HAZARDOUS LOCATION & CONFIGURATION	MAXIMUM ALLOWABLE FIELD WIRING CAPACITANCE	MAXIMUM ALLOWABLE FIELD WIRING INDUCTANCE
GP A OR B LOCATION W/ COMMUNICATOR	30nF	4.0mH
GP C,D,E,F,G LOCATION W/ COMMUNICATOR	230nF	16mH
GP A OR B LOCATION W/OUT COMMUNICATOR*	100nF	4.0mH
GP C,D,E,F,G LOCATION W/OUT COMMUNICATOR*	300nF	16mH

* ROSEMOUNT® 275 HART® COMMUNICATOR not used or used only on the INPUT side of associated apparatus.

Appendix E

Control Schematic for Wiring of Intrinsically safe ICoT (WD-10836)

(Sheet of 3 of 4)



1. Associated apparatus manufacturer's installation drawing must be followed when installing this equipment.
2. Control equipment connected to associated apparatus must not use or generate more than 250V.
3. To maintain intrinsic safety, each field wiring pair (4-20 mA and Analog Output) must be run in separate cables or separate shields connected to intrinsically safe (Associated Apparatus) ground.
4. ROSEMOUNT® 275 HART® COMMUNICATOR is NOT FMRC approved for use in Class II and III Hazardous Locations.
5. For Class II and III locations where rigid metal conduit is not used, seal ICoT cable entries against dust and fibers using an appropriate NRTL listed cable gland fitting.
6. Installation should be in accordance with ANSI/ISA RP12.6 and the National Electrical Code (ANSI/NFPA 70).

MAXIMUM FIELD WIRING CAPACITANCE AND INDUCTANCE

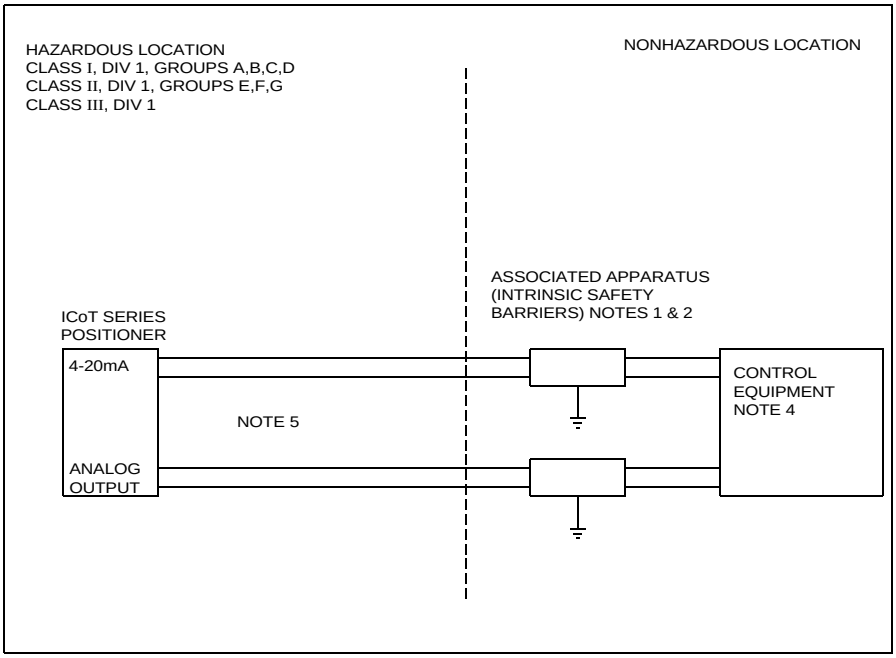
HAZARDOUS LOCATION & CONFIGURATION	MAXIMUM ALLOWABLE FIELD WIRING CAPACITANCE	MAXIMUM ALLOWABLE FIELD WIRING INDUCTANCE
GP A OR B LOCATION W/ COMMUNICATOR	30nF	4.0mH
GP C,D,E,F,G LOCATION W/ COMMUNICATOR	230nF	16mH
GP A OR B LOCATION W/OUT COMMUNICATOR*	100nF	4.0mH
GP C,D,E,F,G LOCATION W/OUT COMMUNICATOR*	300nF	16mH

* ROSEMOUNT® 275 HART® COMMUNICATOR not used or used only on the INPUT side of associated appara-

Appendix E

Control Schematic for Wiring of Intrinsically safe ICoT (WD-10836)

(Sheet of 4 of 4)



Entity parameters for each field wiring terminal pair of ICoT: Vmax = 30V Imax = 100mA
Ci = 120 pF Li = OmH

CSA Notes:

1. Barrier must be a CSA certified, single channel grounded shunt-diode zener barrier or single channel isolating barrier or one dual channel or two single channel barriers may be used where both channels have been certified for use together with combined entity parameters.

   The following conditions must be satisfied:
   Voc or Vo less than or equal to Vmax or Ui Ca > Ci + C Cable
   Isc or Io less than or equal to Imax or Ii La > Li + L Cable

2. Associated apparatus manufacturer's installation drawing must be followed when installing this equipment.
3. Control equipment connected to associated apparatus must not use or generate more than 250V.
4. To maintain intrinsic safety, each field wiring pair (4-20 mA and Analog Output) must be run in separate cables or separate shields connected to intrinsically safe (Associated Apparatus) ground.
5. ROSEMOUNT® 275 HART® COMMUNICATOR is NOT FMRC approved for use in Class II and III Hazardous Locations.
6. For Class II and III locations where rigid metal conduit is not used, seal ICoT cable entries against dust and fibers using an appropriate NRTL listed cable gland fitting.
7. Installation should be in accordance with ANSI/ISA RP12.6 and the National Electrical Code (ANSI/NFPA 70).
8. Install in accordance with Canadian Electrical Code Part 1.

Appendix F

Procedure to Reset the EEprom to Factory Settings

The ICoT Positioner is a digital device. Positioner operation relies on data that is stored in the positioner's EEprom chip. Calibration and configuration data that has been established during the positioner's calibration is stored in the EEprom. Under abnormal conditions this stored information can become corrupted. If this occurs it is necessary to reset the chip and re-calibrate the positioner.

1.) Remove power to the positioner. This can be done by removing the plug-in style terminal strip.

2.) Press and hold the CAL button while replacing the terminal strip (returning power). The LCD will show ICoT Positioner-Rev " for several seconds while holding down the CAL button.

3.) Continue to hold the CAL button until the LCD shows "reset EEprom values to Mfg values. When this statement appears release the CAL button.

4.) After releasing the CAL button you will be prompted to enter 4.0 mA. Change your input to the positioner to exactly 4.0 mA and press the CAL button. If your zero position signal is other than exactly 4.0 mA then use the Up/Down arrow buttons to adjust the value shown on the positioner's LCD to match the zero position mA and press the CAL button.

5.) You will then be prompted to enter 20 mA. Change your input to the positioner to exactly 20.0 mA and press the CAL button. If your full-scale position signal is other then exactly 20.0 mA then use the Up/Down arrow buttons to adjust the value shown on the positioner's LCD to match the full-scale position mA and press the CAL button.

6.) The positioner will automatically return to normal operating mode.

7.) If desired, follow the normal calibration procedure as described in the manual.

Appendix G

Hart® Communicator Menu Flow Chart