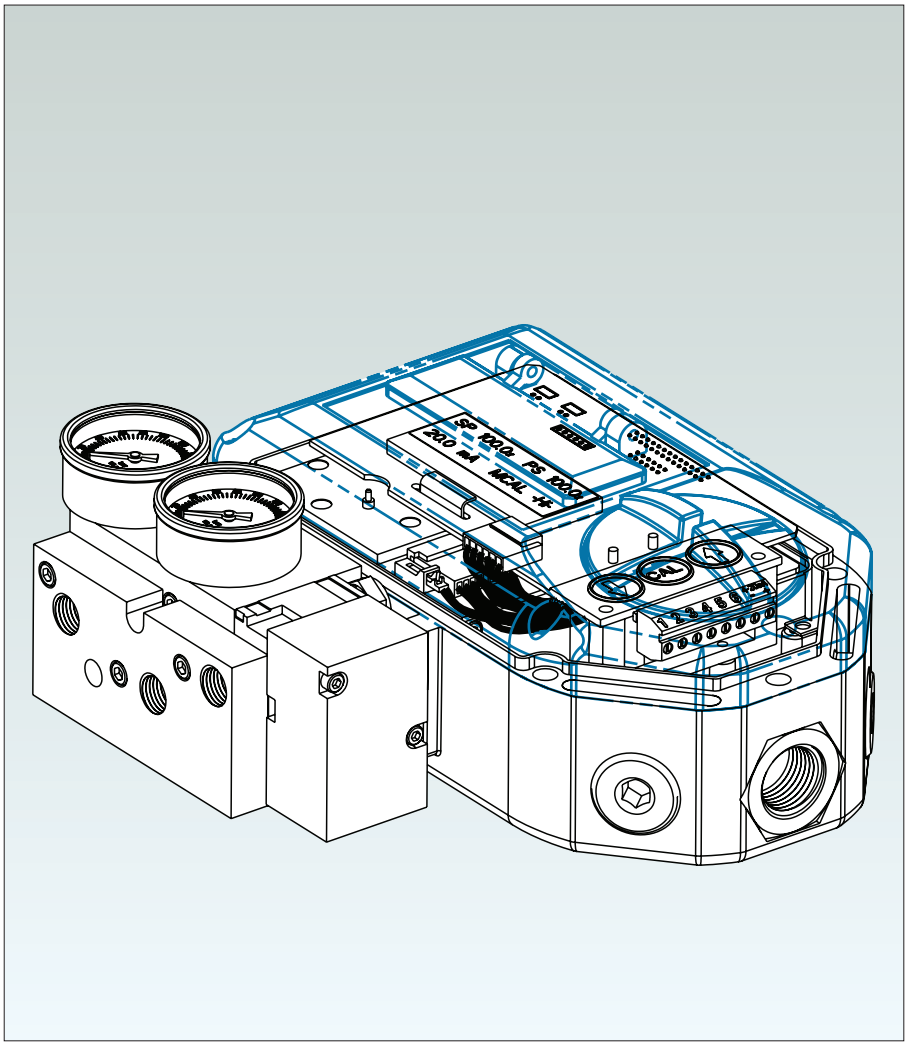
AVID

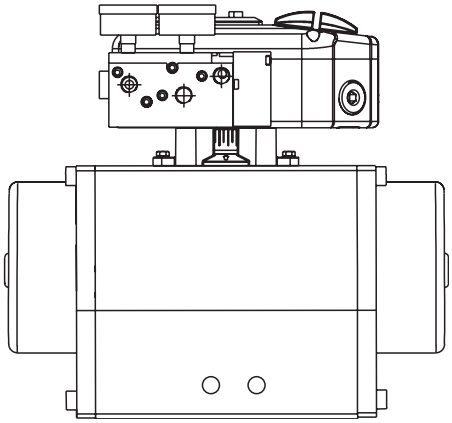
Installation and operating instructions for the AVID SmartCal intelligent valve positioner

Contents



Note: Air supply to the positioner must be clean, dry, oil free instrument air (5 microns) per ISA-S7.3 and ISO 8573-1. Maximum supply pressure is 8.3 bar. All pneumatic connections are 1/4" NPT or G 1/4 ISO 228.

1 Introduction



1.1 Description of SmartCal positioner

The SmartCal 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 SmartCal 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.

Calibration of the SmartCal can transpire by two means. Non-HART® calibration is through an on-board keypad. Communication using HART® protocol allows calibration and access to on-line diagnostics via a Rosemount® 275 hand-held terminal or through FDT/DTM software.

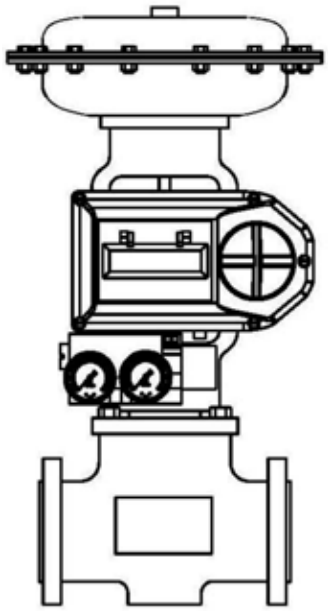
The positioner has a local liquid crystal display which indicates valve position and set-point in percentage open. It also indicates whether the positioner is in calibration mode.

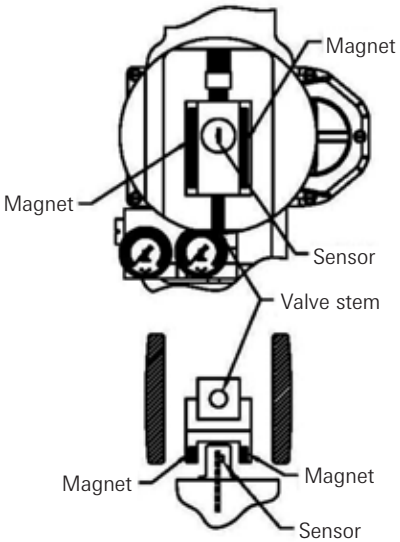
The SmartCal has the capability to monitor operation. If a failure condition occurs, an error message is displayed on the local liquid crystal display.

1.2 Principle of operation

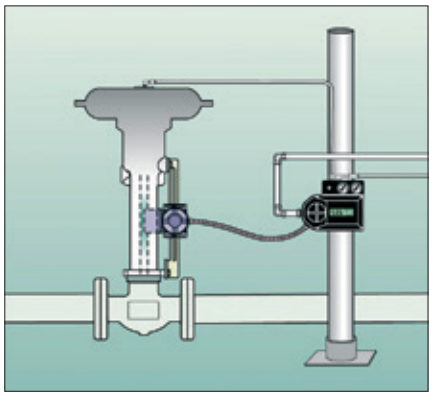
Unlike conventional positioners, the SmartCal positioner feeds back valve position without the need for linkages, levers, or rotary and linear seals. Position sensing is performed totally by non-contacting means, permitting use of advanced control strategies where knowledge of valve position is used 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 SmartCal 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.





LINEAR VALVE

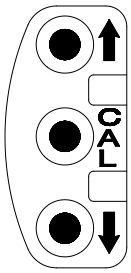


Non-contact position feedback
To provide consistently accurate performance information, all linkages, levers and connecting rods, from the positioner to the control valve have been eliminated from the design. Valve position sensing is performed totally by non-contacting means based upon characterisation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

Remote position control
Since valve position feedback to the SmartCal positioner is accomplished by non-contacting means, the SmartCal has the unique ability to be mounted remotely (up to a distance of 15 m or 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 SmartCal positioner is supplied with HART® interface and a 3-button keypad interface. All SmartCal positioners are furnished with a multi-line LCD, and allow for automated calibration of the positioner. The local LCD provides a multitude of onsite diagnostic information. The displayed information will show the setpoint and position as a percentage. 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 SmartCal positioner has the capability to monitor its operation. If an error or failure condition occurs, it will be displayed on the local LCD, through the HART® interface and displayed on a hand held terminal or at 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 keypad. The keypad is provided for zero and span adjustments, as well as valve characterization and gain adjustments.

Intelligent calibration (HART® protocol)
The SmartCal 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 SmartCal positioner can greatly reduce the air consumption of your process and reduce the demand on instrument air compressors. To increase reliability, the SmartCal employs a patented lapped spool and floating sleeve design. This balanced construction relies on an air bearing which eliminates any metal to metal contact.

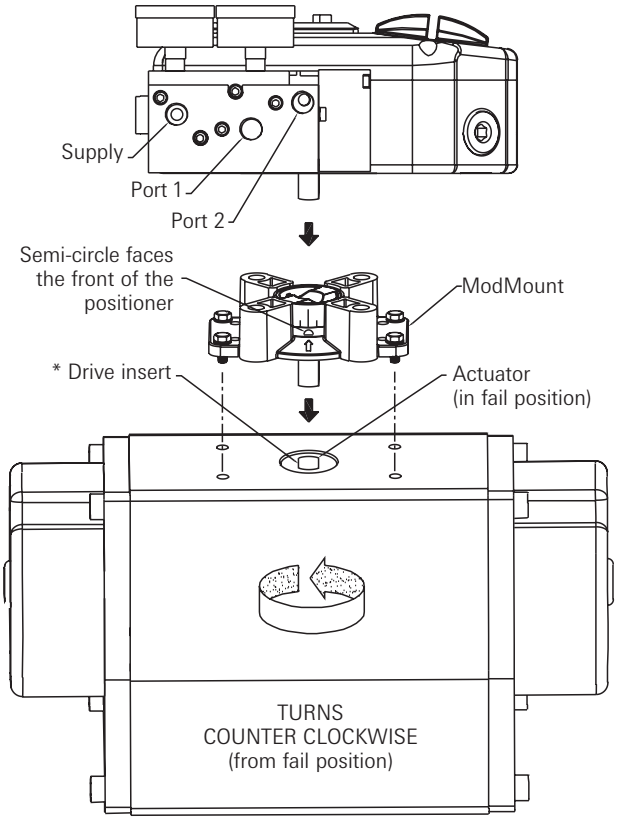
2 Initial setup

2.1 Mounting positioner on a rotary actuator

Condition 1:
Actuator fails in a clockwise direction
(Turns counter clockwise from fail position).

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.



Condition 2:
Actuator fails in a counter clockwise direction
(Turns clockwise from fail position).

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.

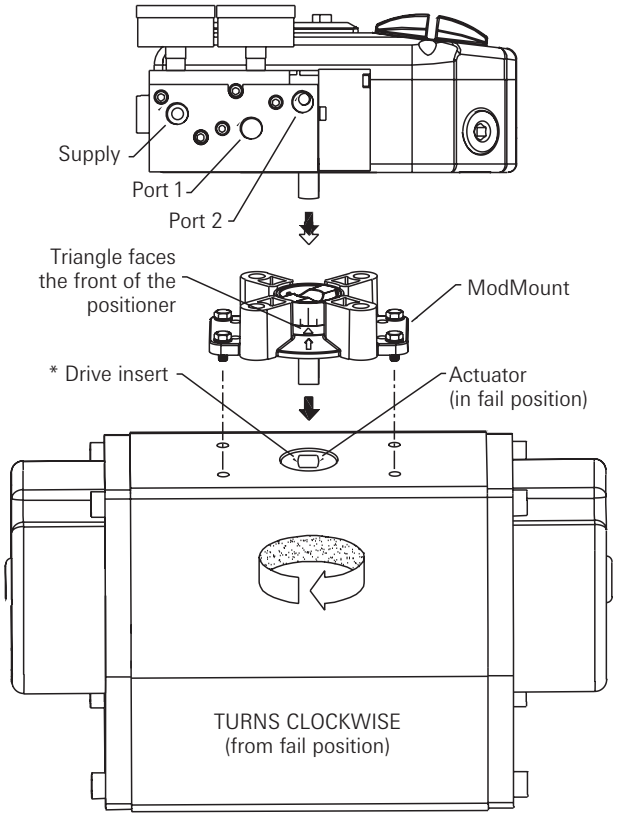
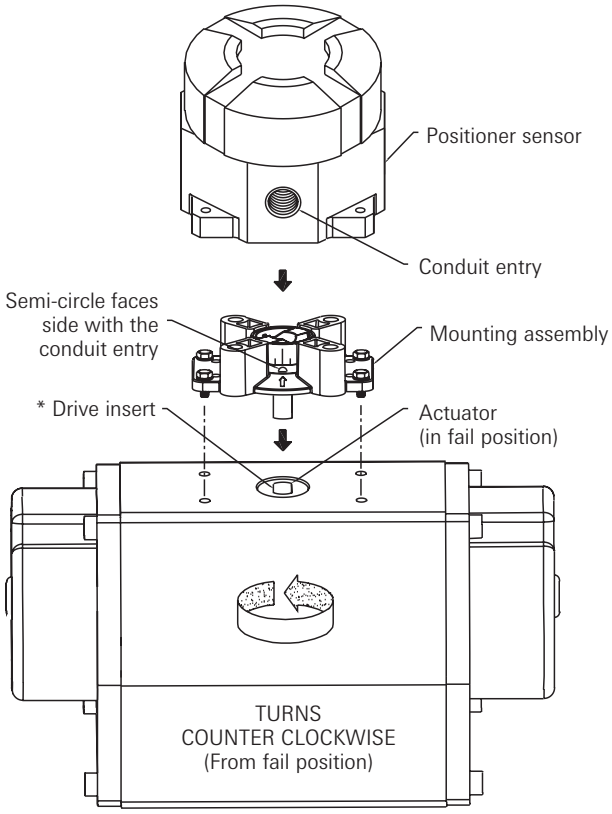


Figure 2-1

*** Note**

1. Drive insert must be provided with Keystone actuators for ModMount installations.
2. Drive insert may need to be disengaged and rotated 90° to allow for proper mounting.



2.2 Mounting remote positioner on a rotary actuator

Condition 1:
Actuator fails in a clockwise direction (Turns counter clockwise from fail position).

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.

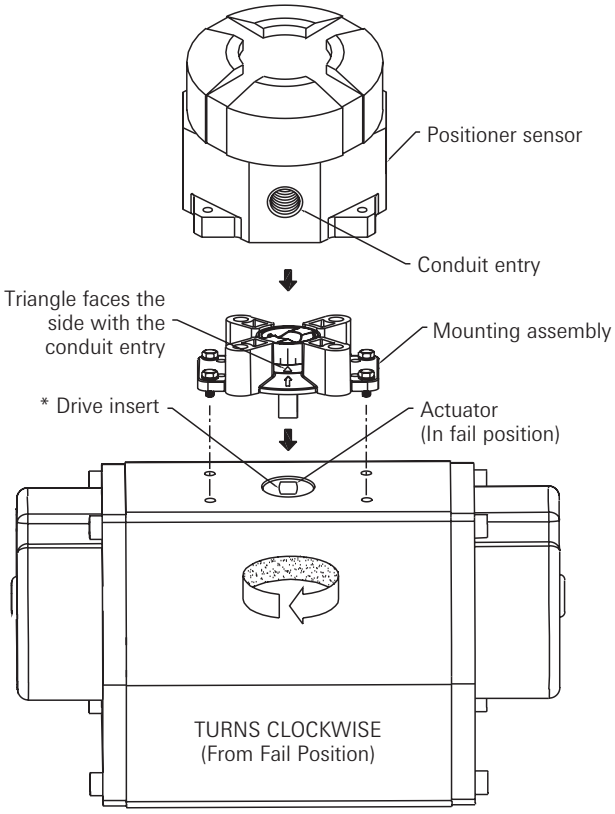


Figure 2-2

Condition 2:
Actuator fails in a counter clockwise direction (Turns clockwise from fail position).

Spring return
Output port 2 is plugged.
Output port 1 is piped to turn the actuator clockwise.

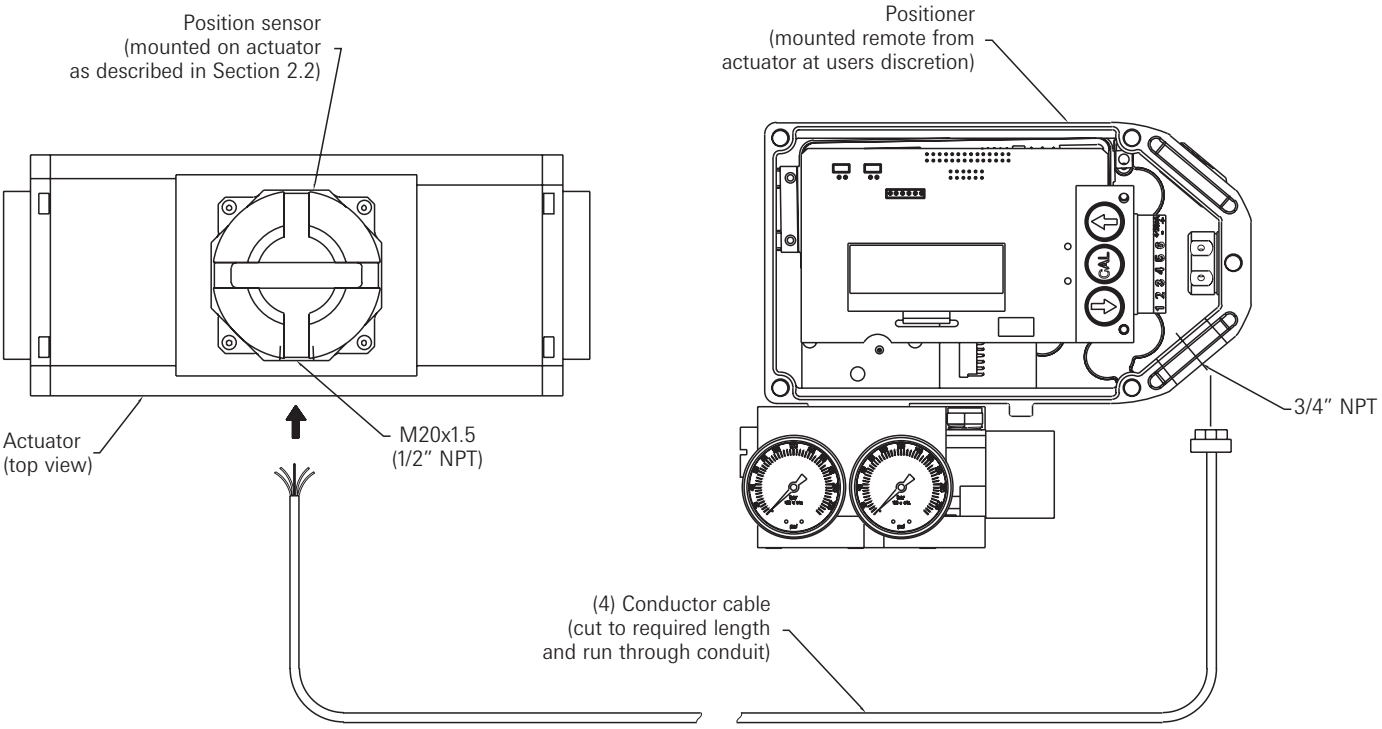
Double acting
Output port 2 is piped to turn the actuator counter clockwise
Output port 1 is piped to turn the actuator clockwise

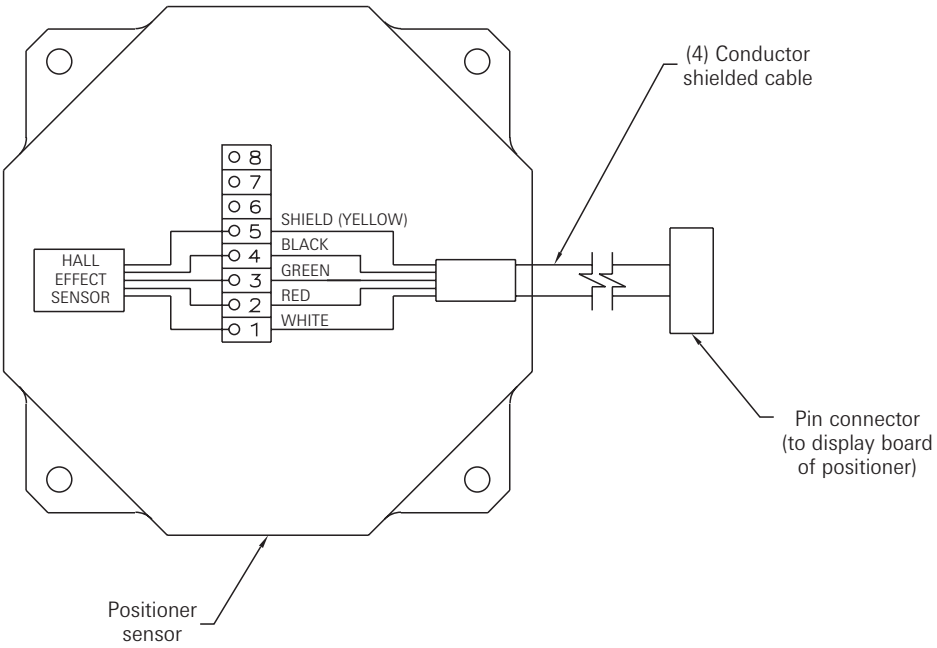
*** Note**

1. Drive insert must be provided with Keystone actuators for ModMount installations.
2. Drive insert may need to be disengaged and rotated 90° to allow for proper mounting.

2.3 Wiring the remote sensors to the positioner

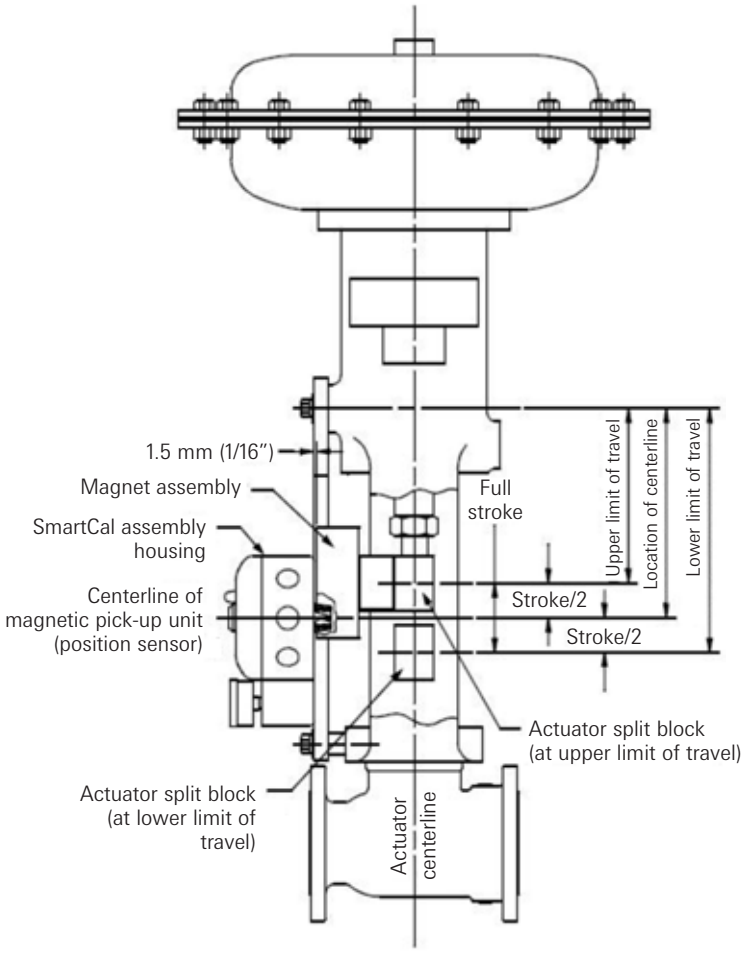
Mount positioner at a remote location. Remove the electronic canister cover by unscrewing 2 mounting screws. Wire the positioner sensors back to the positioner using the cable provided (see Figure 2-3).





Wiring schematic

Figure 2-3



2.4 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 3 mm (1/8") from the back of the positioner (1.5 mm (1/16") is ideal), (See Figure 2-4 A)

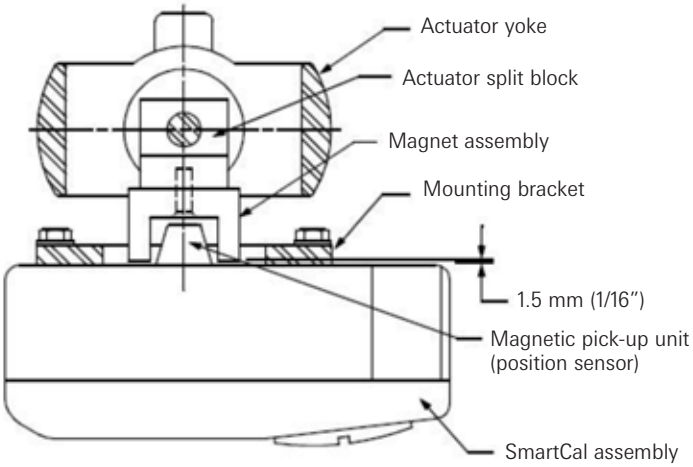


Figure 2-4 A

Note

For Fisher actuators model 657 & 667 sizes 34 thru 70, 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.

2.4.1 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 SmartCal lines up with the midpoint mark. (See Figure 2-4 B)

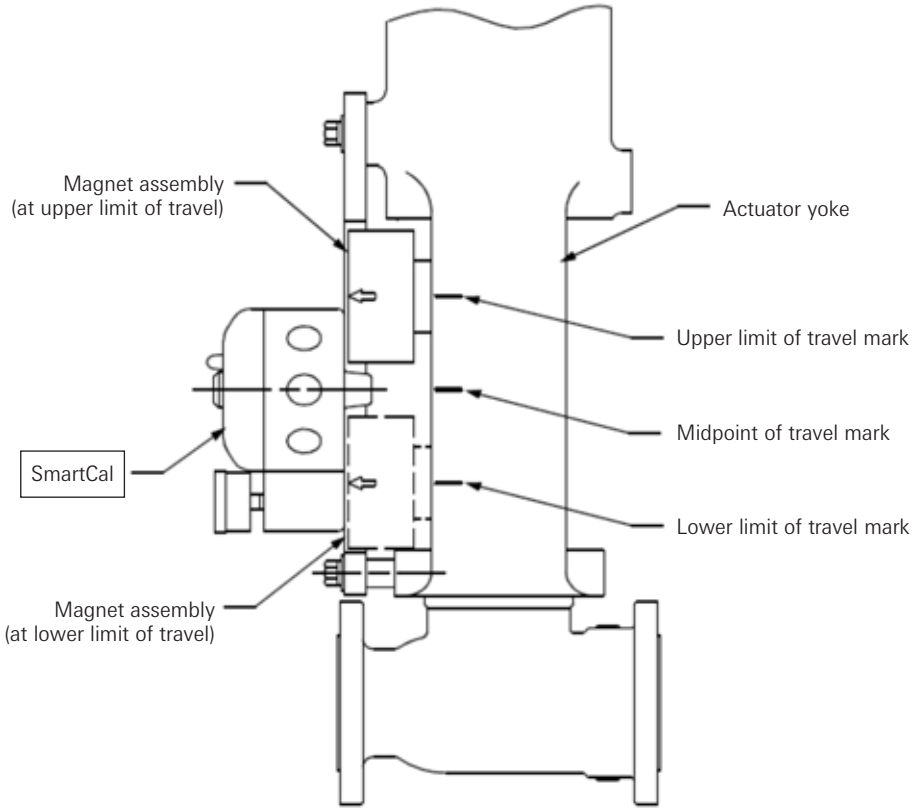


Figure 2-4 B

2.5 Mounting remote positioner on a linear actuator

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 2-5 A)

Step 3. Mount positioner at a remote location.

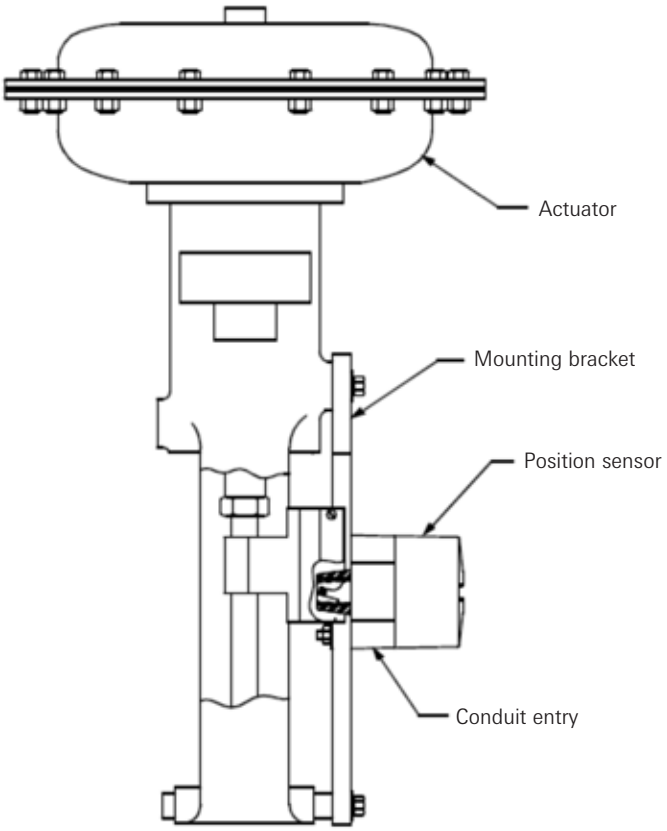


Figure 2-5

Note

For Fisher actuators model 657 & 667 sizes 34 thru 70, 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.

2.6 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 control 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 control 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 (5 microns) per ISA-S7.3 and ISO 8573-1. Maximum supply pressure is 8.3 bar. All pneumatic connections are 1/4" NPT or G 1/4 ISO 228.

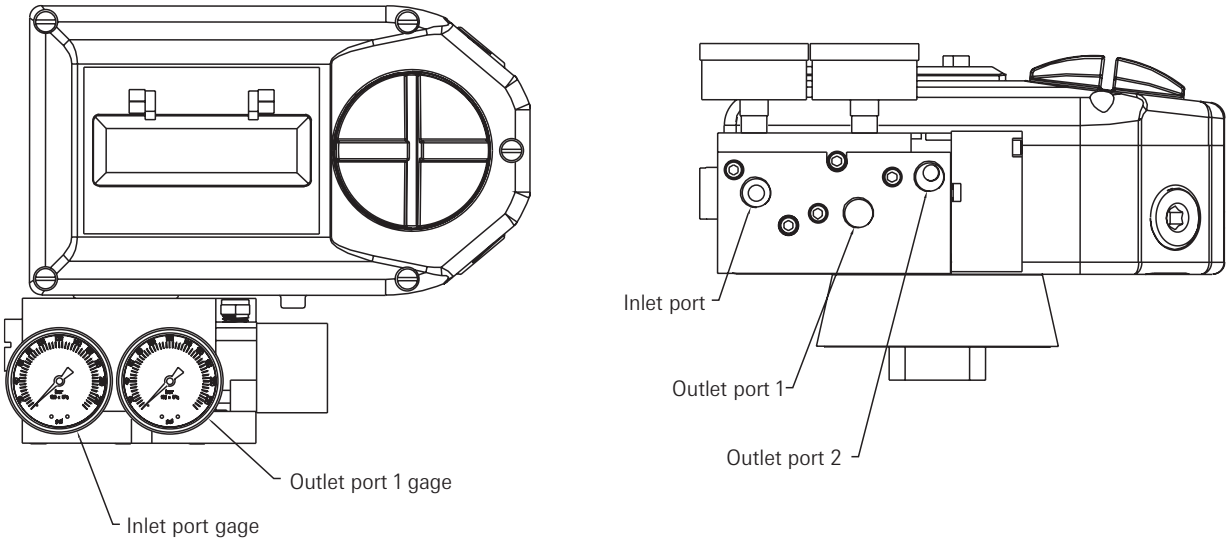


Figure 2-6

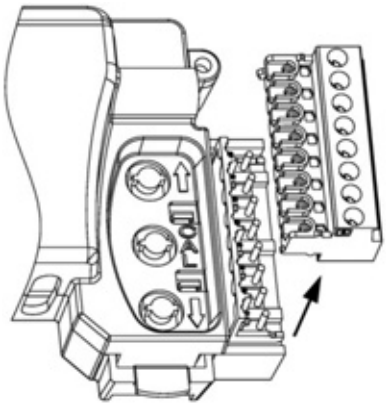
1. Single acting/spring return (plug outlet port 2) increasing control signal causes pressure to increase in outlet port 1.
2. Double acting/double return (pipe outlet port 2 to drive actuator towards the desired failure direction) increasing control signal causes pressure to decrease in outlet port 2 and pressure to increase in outlet port 1.

Notes:
On loss of power pressure fails to outlet port 2.

2.7 Electrical connection

Warning

1. The certification applies to equipment without cable glands. When mounting the enclosure in the hazardous areas, only suitably certified cable glands and blanking elements must be used to maintain ingress protection of IP66.
2. All unused cable entries must be plugged with suitably certified plugs that can maintain an ingress protection level of IP66.
3. The positioner, switches, sensors and coils shall be electrically connected suitable to the rated data via a certified isolating interface/zener barrier placed outside the hazardous areas.
4. For ambient temperatures below -10°C and above +60°C, use field wiring suitable for both minimum and maximum ambient temperatures.



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 2-7 for a wiring schematic.
4. If using the analog transmitter, connect output wiring to terminal points 5 & 6, (Polarities shown below). The 4 to 20 mA analog output requires an external 24 V DC power supply.
5. After all connections have been made reconnect the terminal strip and replace positioner cover.

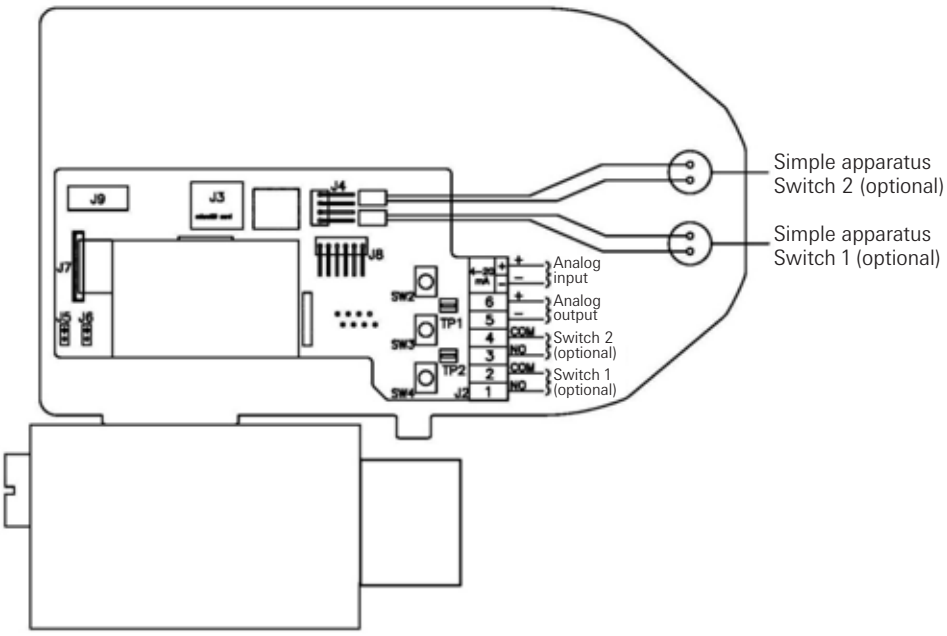


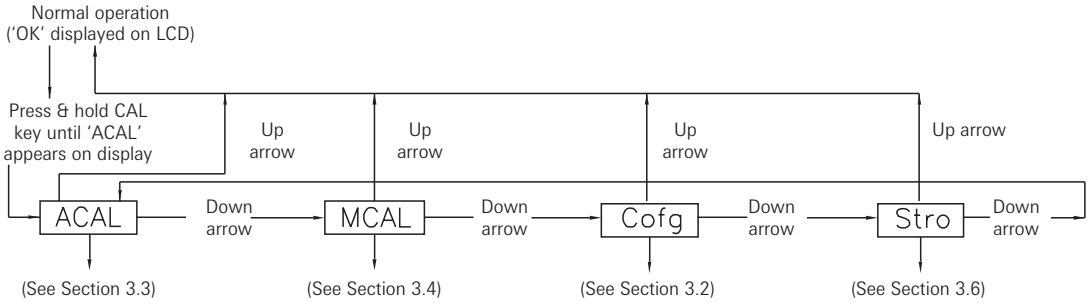
Figure 2-7

3 Calibration with the display

If during the calibration routine you need more information describing any of the menus or functions refer to Sections 3.7 and 3.8. The SmartCal positioners also has an on-board help menu that can be accessed by pressing the Cal button and either arrow button simultaneously, anytime during calibration.

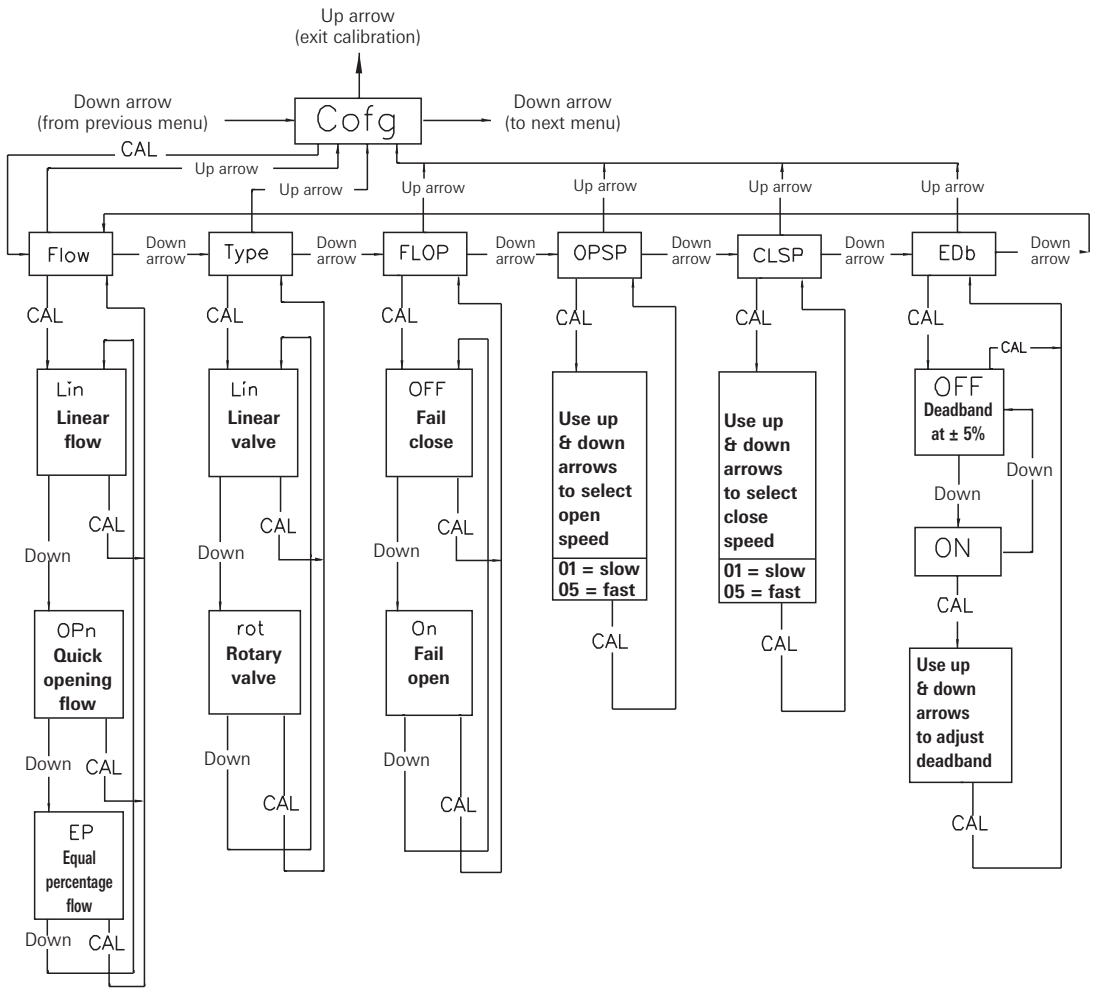
3.1 Enter calibration (Menu level)

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.



3.2 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.



Special note flow capacity

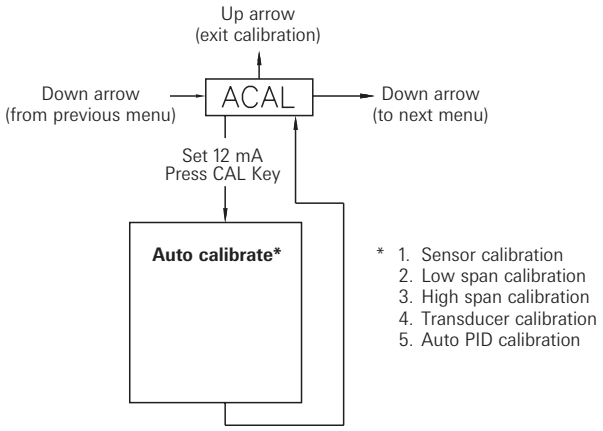
SmartCal standard flow design is suitable for actuator swept volumes of a minimum 40 inch^3 (0.65 liters) to a maximum of 600 inch^3 (9.8 liters) for proper auto calibration functionality. It should also be noted that this is to be used as a general guideline only. The actuator/ valve package dynamics would dictate the success of the auto calibration routine and could be compromised by the following: instrument air supply volume capacity, actuator sizing, tubing size and actuator/valve health.

SmartCal optional high flow design is suitable for actuator swept volumes of a minimum 200 inch^3 (3.3 liters) to a maximum of 1000 inch^3 (16.4 liters) for proper auto calibration functionality. It should also be noted that this is to be used as a general guideline only. The actuator/ valve package dynamics would dictate the success of the auto calibration routine and could be compromised by the following: instrument air supply volume capacity, actuator sizing, tubing size and actuator/valve health.

3.3 Automatic calibration

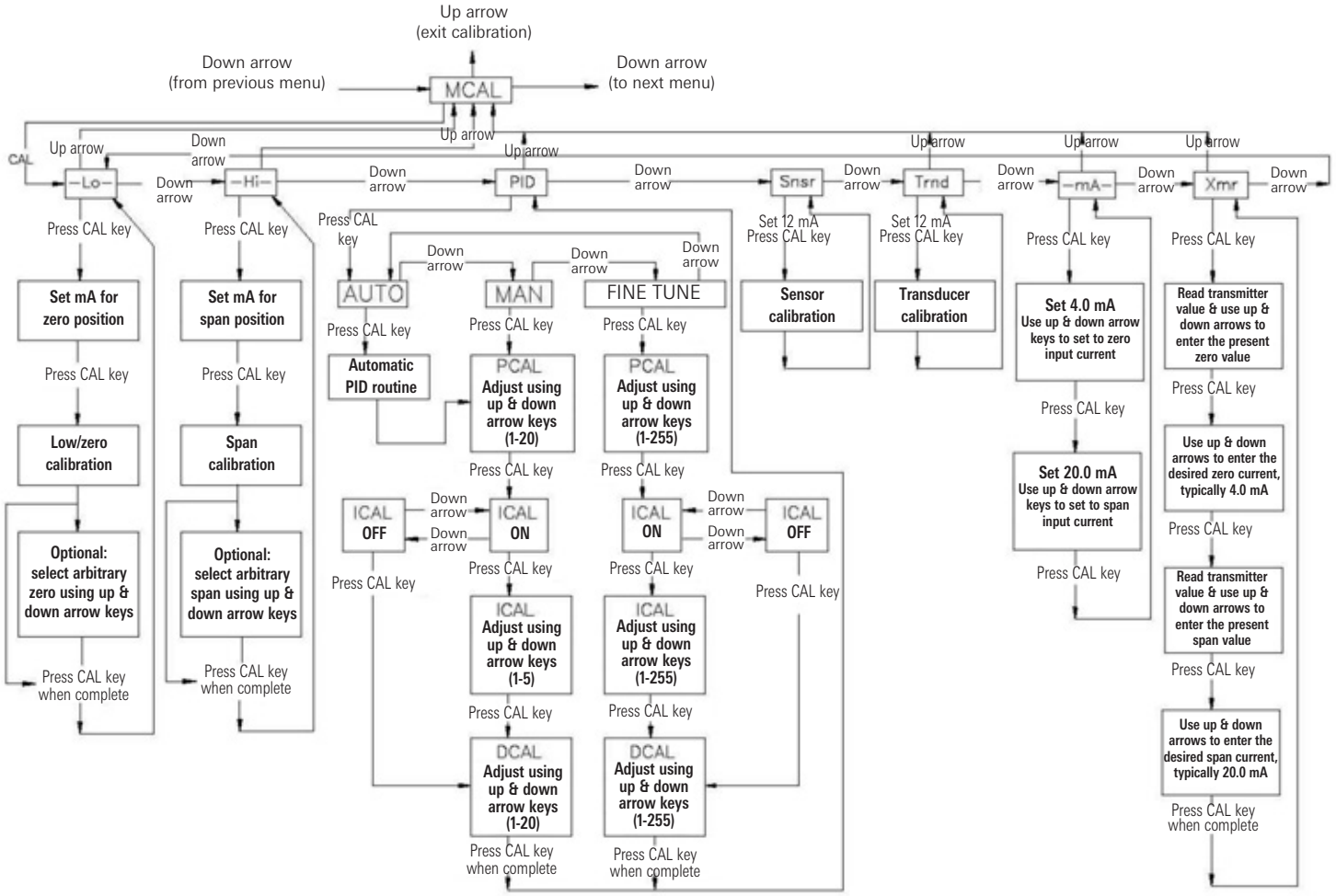
The automatic calibration (ACAL) performs several self-adjustments, as well as a zero calibration, a span calibration, and tunes the positioners PID gain settings. Enter and start the automatic calibration from the menu level. From the menu level press the down arrow button until ACAL is shown on the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

Note: Automatic calibration requires an input current of 12 mA.



3.4 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 3.3 is adequate for most applications. If no advanced calibration is required proceed to Section 3.5 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).



3.5 Exiting calibration

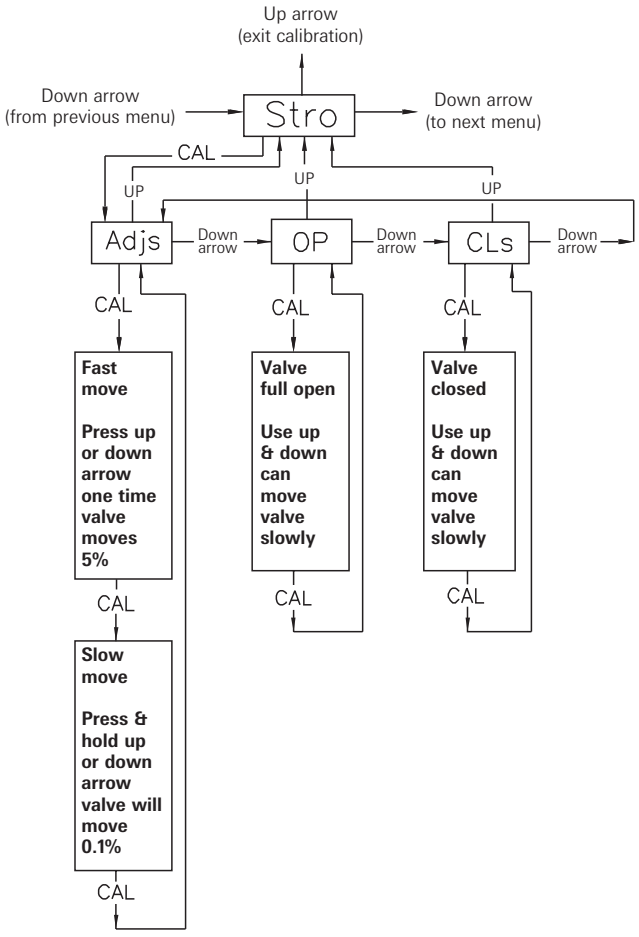
To exit calibration mode and return to normal operation use the up arrow key as follows:

- 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.

3.6 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 of the SmartCal. This is done from the Stro (manual override stroke menu). Enter calibration as described in section 3.1 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.



3.7 Description of menus

The calibration functions of the SmartCal 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 descriptions are as follows:

Menu 1: ACAL (Automatic calibration)
Entering this menu allows you to initiate an approximately seven minute self-calibration function. The SmartCal positioner will automatically enter digital control mode and perform a shallow (input current 12 mA recommended) calibration in the following sequence:

Function	
1 - Snsr -	Sensor calibration
2 - Lo -	Low (zero) calibration
3 - Hi -	High (span) calibration
4 - Trnd -	Transducer calibration
5 - Auto -	Automatic PID tuning

Menu 2: MCAL (manual calibration)
Entering this menu allows you access to the following seven 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 closing speed adjustment
6 - EDb -	Positioner operating deadband adjustment
7 - LCD -	LCD menu timeout 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.

3.8 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 the back to the fail position. 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. 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 fine tune proportional (PCAL) and derivative (DCAL) and integral (ICAL) gain settings can be varied incrementally on a scale from 1-255. The manual 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 manual values are index representations of the fine tune settings that are reported through the HART® communication. The larger the number the higher the gain setting.

Snsr The sensor calibration is a self adjustment that sets the positioners 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, therefore 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	60%
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	60%
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%.

LCD This feature configures LCD timeout. The range is 1 to 60 minutes. Measures the amount of time there is no activity on the keypad and returns the system to the main screen after the configured timeout. The default value is 10 minutes.

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 therefore 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 pressure & outlet port 2 = 0 pressure). This function places the positioner in digital control mode (input current independent) and therefore allows override of the control signal.

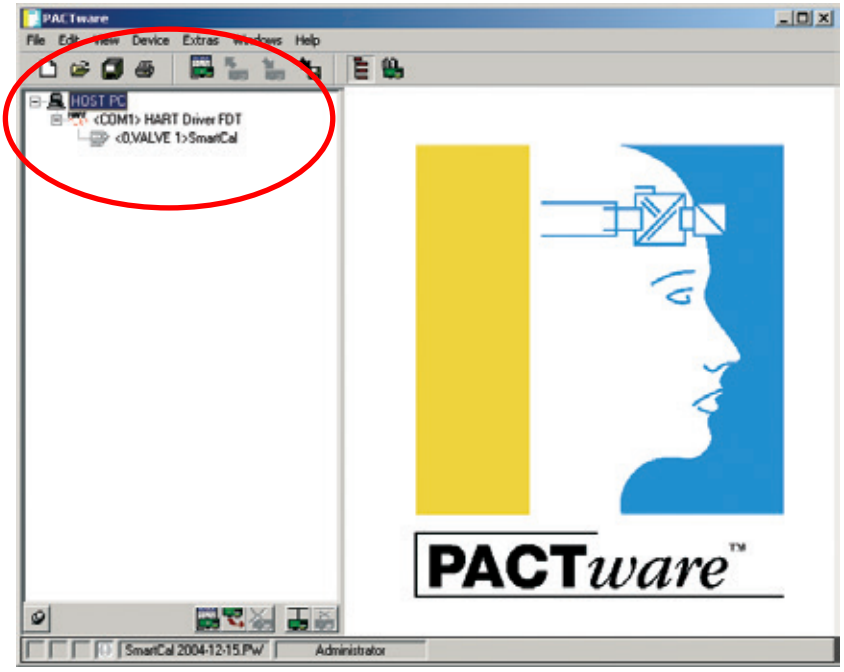
CLs This function sets the valve to the fully de-energized position via the keypad (outlet port 1 = 0 pressure & outlet port 2 = supply pressure). This function places the positioner in digital control mode (input current independent) and therefore allows override of the control signal.

4 Calibration with pc application

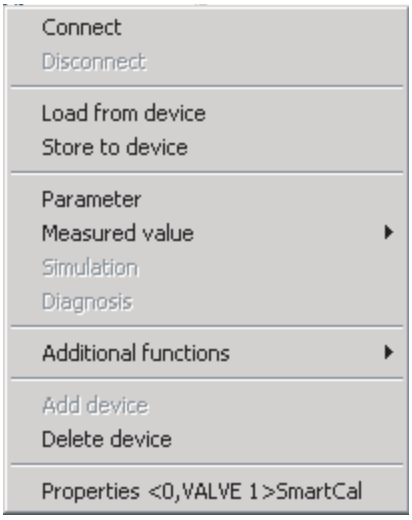
ValveGURU is a collection of software solutions to increase production and reduce failure rates. Using HART® communication and advanced FDT/DTM (Field Device Tool/Device Type Manager) technology, SmartCal can be connected to a pc and configured on-line.

To make the connection, a pc and a HART® interface modem are required (item 9505HG1XX2MXXXX). The HART® interface can be connected either directly to pin TP1 and TP2 of the SmartCal, or parallel to the 4-20 mA controls. For the connection to the 4-20 mA controls, see the schematic in appendix D.

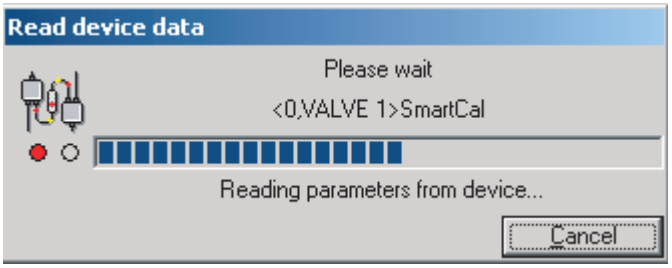
The SmartCal DTM can be used with several FDT frame applications. If you don't have any, you can use the PACTware configuration included on the AVID® SmartCal FDT/DTM CD. After installation of the software, you must create a project as in the following example:



Select the SmartCal with the right-hand mouse button to display the selection menu.



Before starting configuration of the SmartCal, you must download the current configuration. Select <connect> and <load from device>. All parameters are now downloaded from the SmartCal and are available for editing.

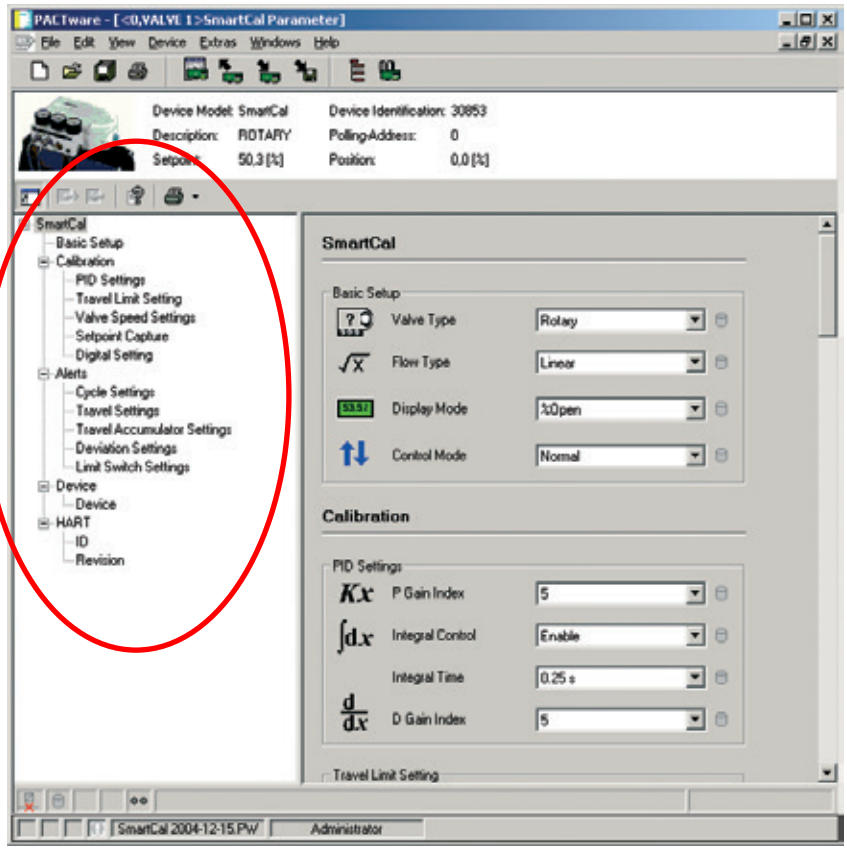


Attention

If you do not upload the existing parameters from the SmartCal prior to configuration, the factory settings will be used. If the command <load to device> is executed, the existing values will be overwritten. This might result in a malfunction of the application.
If this happens, change the parameters accordingly and download the existing parameters once again.

4.1 Configuration of the SmartCal parameters

Selection of the <parameter> button in the selection menu will show the existing configuration (see figure). All parameters are divided in five groups: Basic Setup, Calibration, Alerts, Device and HART®.



With the Basic Setup menu you can configure the settings for Valve Type, Flow Type, Display Mode and Control Mode.

With the 'Calibration' menu you can edit the P, I and D values or tune them after auto calibration.

The positioner is configured for 0-100% control. By changing the parameters in the 'Travel Limit Setting' menu, you can alter the lower and upper limits. Only after activation of 'Limit Control' (enable), the new limits will be used.
Please note that the 'Cutoff Mode' has to be disabled. Otherwise the SmartCal will still open or close the valve at minimum and maximum control signal.
'Valve Speed Setting' is used to control the opening and closing speed of the valve. You can decrease the speed in steps of 20%.

The 'Setpoint Capture' menu defines the lower and upper limits of the control signal. If required, the SmartCal can also be used for split range control. The standard control range of the positioner is 4-20 mA.

With 'Digital Settings' it is possible to control the valve position independent of the mA signal. The digital setpoint is executed after enabling.

The SmartCal has a number of alarms. Malfunctions can easily be detected on the display and it is even possible to prevent downtime. The 'cycle count' function registers how often the SmartCal changes direction. Every time the direction changes and a stroke is made that exceeds the defined 'Cycle DB' (DB is dead band), the number is increased by 1. As soon as the 'Cycle Count' exceeds the 'Cycle Limit' and the 'Cycle Alert' is enabled, the alarm will be activated.

With the 'Cycle Count' you can detect any oscillations in the control loop. The cause could be incorrect parameter values, but also valve wear. If the valve gets stuck, the torque required increases. As soon as the valve begins to move, the torque will be too great and the valve travels beyond the set position. As a result, the positioner will move the valve into the opposite direction. In this way, the control loop becomes unstable (begins to oscillate), which leads to production loss. With the 'Cycle Alert' alarm you will be notified in time.

To verify if the positioner operates in its control range, the functions 'Travel High' and 'Travel Low' have been included. If the position exceeds these limits by more than the 'Travel DB', the 'Travel Alert' alarm will be activated.

In addition to the 'Cycle Count' alarm, the 'Travel Accumulated Count' is also a valve wear indicator. The 'Accum. Count' counts the number of valve movements. The end result is the number of full open/close cycles. The value 'Accum. DB' is the minimum stroke that can be counted. If the counted value exceeds this limit, the alarm will be activated.

The 'Deviation Setting' generates an alarm if the difference between the PV (process value) and the SP (setpoint) exceeds the selected value. The 'Deviation' alarm is activated only if the 'Deviation Alert' is enabled.

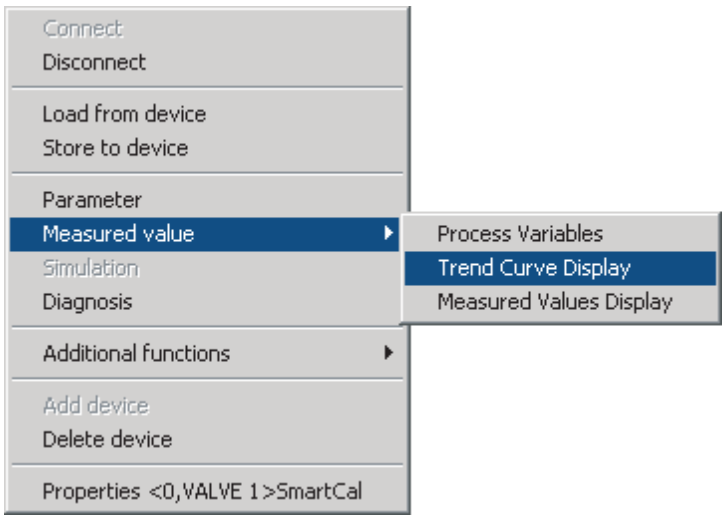
Although mentioned in the software, the 'Limit Switch Settings' are not used.

The 'Device' menu presents supplier and model information and also the hardware and software revision. The 'Description' and 'Date' fields are available for information such as valve number and calibration date. This information is saved in the SmartCal and is available for future reference.

The 'HART®' menu displays specific information of the HART® communication. The 'Tag' field can be used for reference and the 'Polling-Address' can be changed if the SmartCal is connected in a network.

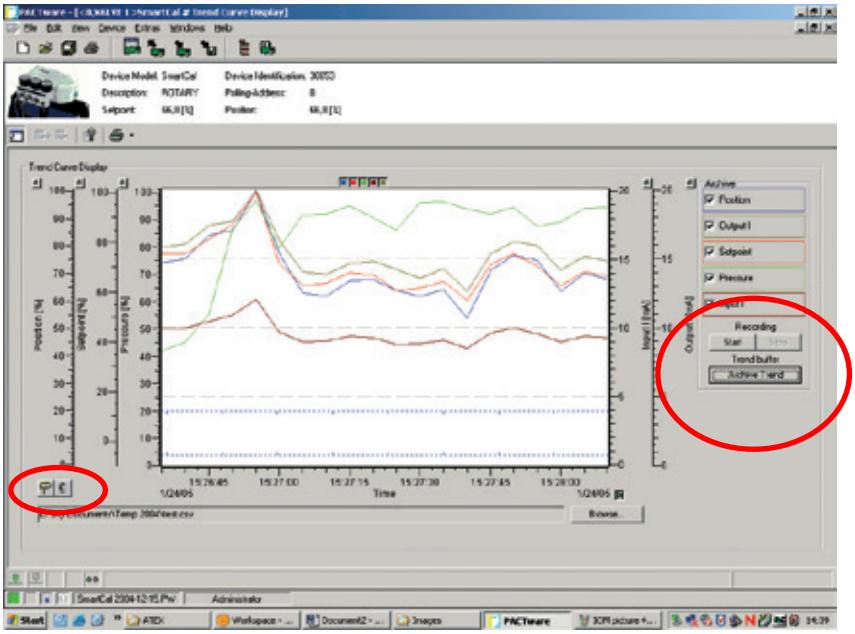
4.2 Measurement data

The HART® communication allows retrieving parameter values during operation. The 'Measured Value' menu presents an overview of all parameters ('Process Variable') and a trend curve or bar graph of the most important parameters.



The 'Process Variables' screen displays all variables as a dashboard. The variables are displayed, but cannot be changed.

The trend curve and bar graph show the most important parameters, i.e. setpoint, valve position, air pressure and 4-20 mA input/output signal of the SmartCal.



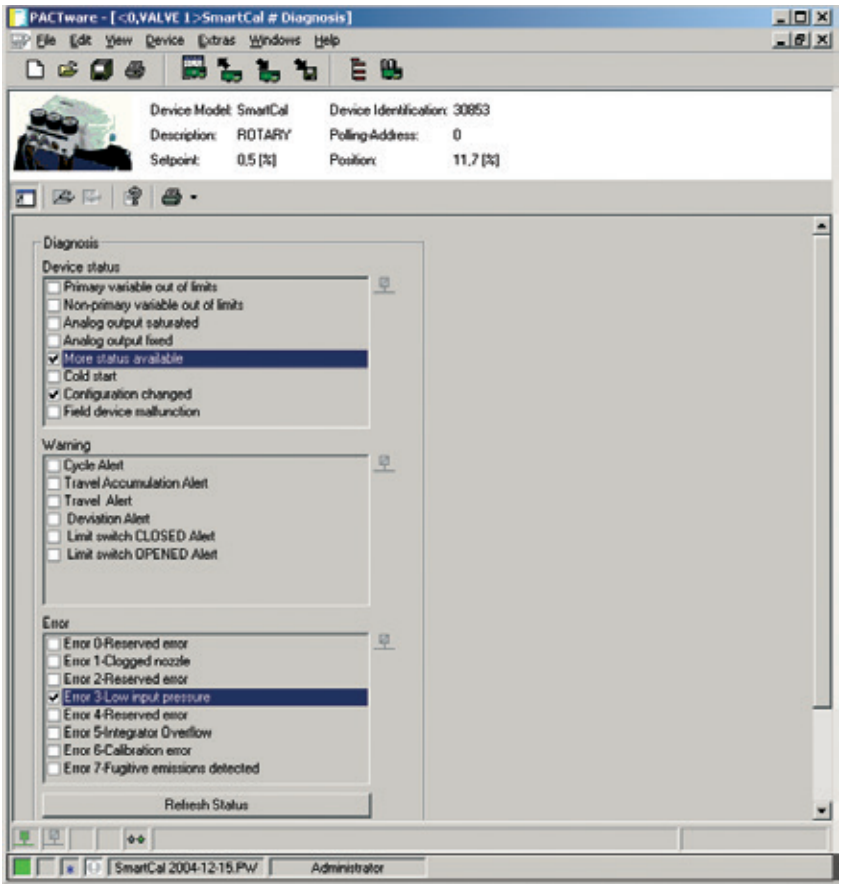
The left-hand and right-hand mouse buttons are used to set the y-axis. The icons on the lower left are used to simply capture the values in the graph.

The recorder functions are on the right-hand side. Clicking the start and stop buttons of the recorder will save the values to a *.csv file. The *.csv files can be imported into Excel or TrendAnalyser software (optional). This facilitates the comparison of curves and the preparation of reports.

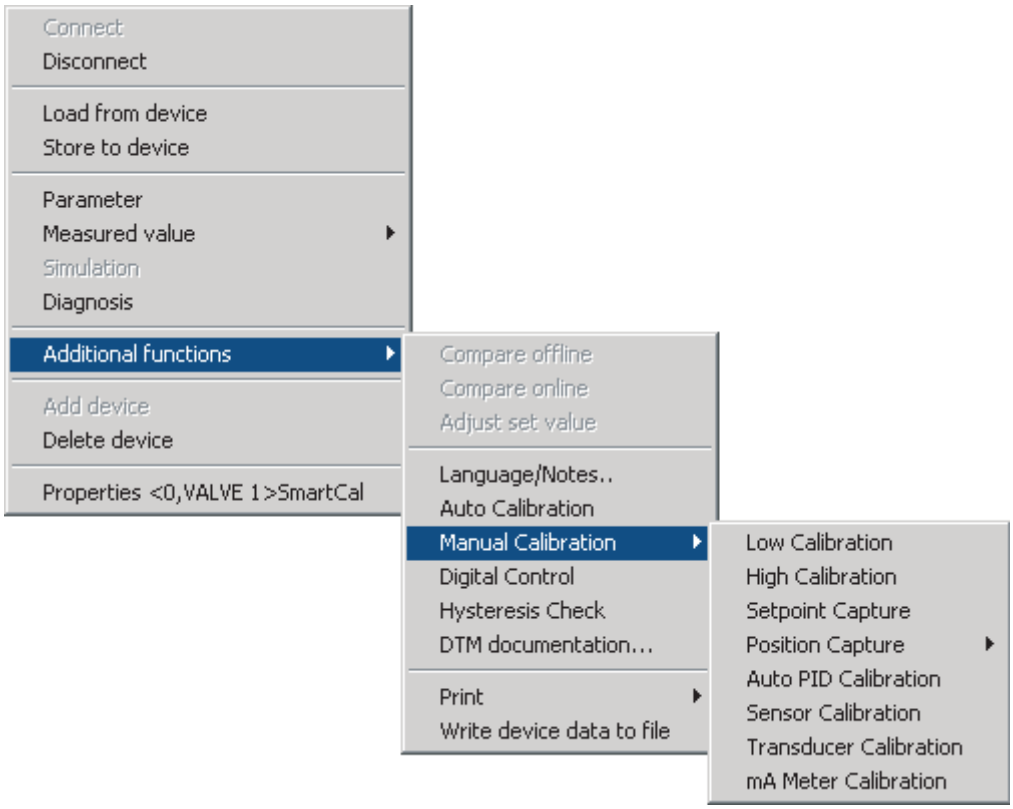
4.3 Diagnosis

Selection of 'Diagnosis' produces an overview of all SmartCal alarms and statuses. It shows proper operation of the SmartCal and informs of any manual configuration changes. Other notifications include Cycle Alert, Travel Accumulation Alert, Travel Alert and Deviation Alert. Error messages 0 to 7 are also available.

Note: the message 'Fugitive emissions detected' is not available.



4.4 Additional functions



The 'Additional functions' offer the possibility to execute a complete auto calibration or any manual calibration. Please note that calibration cannot take place during normal process conditions. If you use a HART® network, be sure to select the correct device.

'Low/High Calibration'
Use 'Low/High Calibration' to calibrate the open and closed position.

'Setpoint Capture'
The 'Setpoint Capture' function allows you to calibrate the SmartCal to the mA signal for open and closed position. The values of 'Setpoint Capture' in the 'Parameter' menu will be changed accordingly.

'Position Capture'
With 'Position Capture' you can define the operating area of the SmartCal. There are three different ways to define the 'Position Capture': 'Analog', 'Digital' and 'Digital tuning'. Each selection has its own menu. Please follow these instructions in order to carry out the appropriate calibration.

The 'Analog' selection uses the mA signal to set the valve to the correct open/close position. Upon confirmation, this position is saved in the SmartCal.
The 'Digital' selection uses a value field to set the positioner to the correct position. For example: if you want the valve to be 15% open at 4 mA, enter the value 15.
After selecting 'Digital tuning', select one of the pre-defined steps to change the valve position (-5, -1, -0.1, OK, +0.1, +1, +5) and confirm. You can adjust the position as often as required.
Select OK to complete the procedure.

'Auto PID Calibration'
The SmartCal positioner has a built-in PID controller to optimize valve control. Use the 'Auto PID Calibration' to recalibrate the control loop.

'Sensor Calibration'
If the sensor has been replaced, it must be calibrated with this function.

'Transducer Calibration'
If the transducer has been replaced, it must be calibrated with this function.

'mA Meter Calibration'
If the standard 4-20 mA position feedback signal is used, it can be calibrated it with this function.

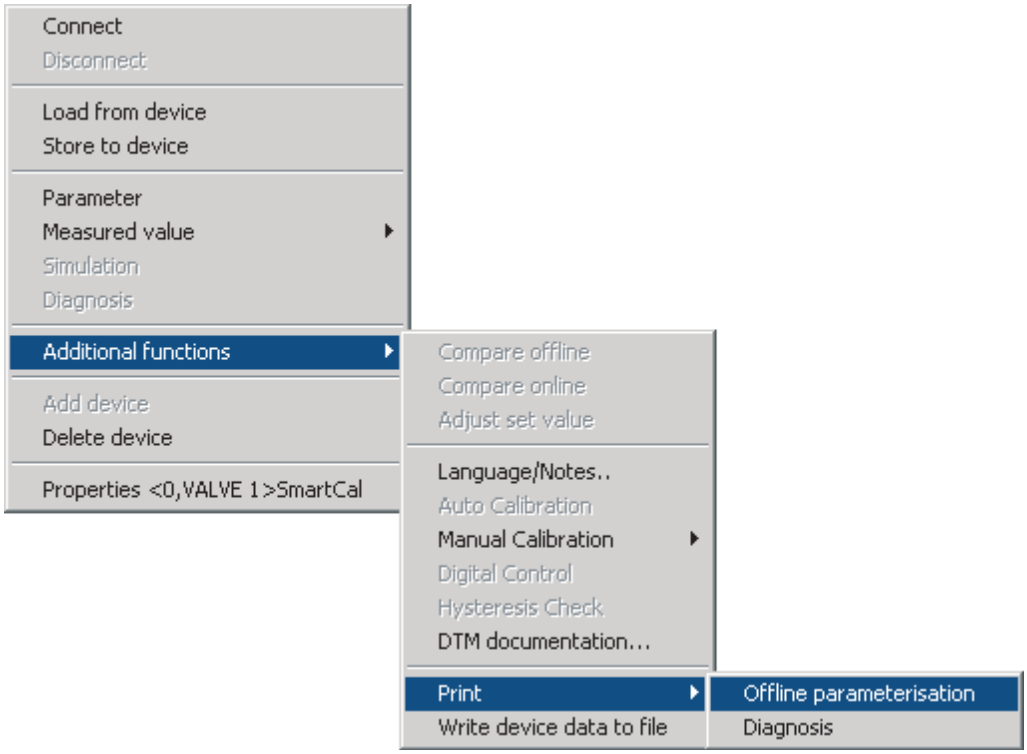
'Digital Control'
'Digital Control' allows control of the valve position independent of the 4-20 mA signal.
Note: a minimum of 4 mA is required to provide the positioner sufficient power to perform this function.

'Hysteresis Check'
The 'Hysteresis Check' is used to verify the correct functionality of the positioner. The positioner verifies the position in 10% steps from the closed to open positions and from the open to closed position. In this way, it is possible to verify if the SmartCal operates within the defined tolerances. If the measured values are not within the defined tolerances, the test procedure will be cancelled and a full auto or manual calibration has to be carried out.

Note: while executing certain functions (e.g. calibration), communication between pc and SmartCal may stop and an error message will be displayed. If this happens, wait until the procedures are finished. The communication will start automatically.

'DTM Documentation'
The 'DTM Documentation' provides you with all information available on the SmartCal DTM. Acrobat Reader is required to use this function.

4.5 Print



If you have completed the full configuration of the SmartCal, recommends making a copy of all parameter values. The parameters are saved in the FDT application. However, a hardcopy can be obtained by the 'Print Offline Parameterization' function. This offers a complete overview of all available parameter values. The print-out can also be saved in Microsoft Word. Select 'Print' and select all values with by <CTRL> + A and paste the selection into a Word file.

The 'Print Diagnosis' function provides in a hardcopy of all the alarm statuses

5 Trouble shooting

5.1 Preliminary checks

Before operating the positioner check the following:

1) Voltage

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

Current range: 3.2 mA to 22 mA, accordingly to the following table (Namur NE43):

Input current (mA)	Electronics	Spool valve	HART® Comm
0.0 ≤ I < 3.2	OFF	OFF	OFF
3.2 ≤ I < 3.5	ON	OFF	OFF
3.5 ≤ I < 3.8	ON	OFF	ON
3.8 ≤ I ≤ 20.5	ON	ON	ON
I > 20.5	ON	ON	ON

2) Electrical connection

Check the polarity of the 4-20 mA current loop. The SmartCal 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 2.6)

Double acting:

Output 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 2.6)

4) Magnetic feedback to the positioner

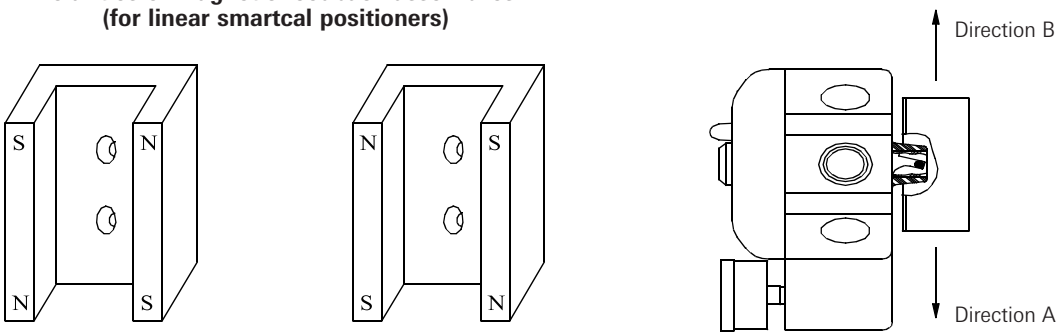
Rotary positioner:

The magnetic beacon should be set in the proper orientation, based on the direction of failure. (See Section 2.1 or 2.2)

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 SmartCal's 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 smartcal positioners)



FAIL-DOWN
(Actuator fails in direction A)

FAIL-UP
(Actuator fails in direction B)

Figure 5-1

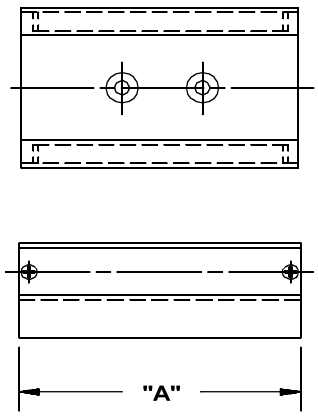


Figure 5-2

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

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.

5.2 FAQ
Listed here are some FAQ encountered with the SmartCal 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 9 V DC. 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 too 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 3).

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.
- The error message indicates a discrepancy between the actual and the controlled position. The error message doesn't automatically disappear when the problem is corrected. Therefore, please perform the following steps:
- Press the CAL button and hold until low is displayed on the screen (a black arrow appears next to the word 'calibration' on the display window).
- The positioner is now in calibration mode. Leave it in this state for about 10-15 seconds.
- After the 10-15 seconds press the 'before' key once, so as to remove the regulator from the calibration mode (the black arrow next to the word 'calibration' disappears).
- The Err 5 should now be deleted.
- If the Err 5 reappears, please make sure that all the aforementioned checks are performed correctly. If you can't find the reason of the Err 5, please contact Pentair.

6 Specifications

Input

Signal:	4 to 20 mA, two wire
Operating voltage:	9 to 30 V DC
Pressure:	2.8 to 8.2 bar (40 to 120 psi)

Output

Flow rate:	458 l/m at 6.2 bar (16.2 scfm at 90 psi)
Pressure:	0 to 8.2 bar (0 to 120 psi)
Actuator:	Single acting or Double acting

Technical

Resolution:	0.2% Full travel
Linearity:	0.5% Full scale (rotary) 1% Full scale (linear)
Hysteresis:	0.2% Full scale
Repeatability:	0.2% Over one hour
Ambient temp:	-40°C to 75°C (-40°F to 167°F)
Thermal coefficient:	2% / 100°C
Air consumption:	0.225 l/m at 6.2 bar (0.08 scfm at 90 psi)
Impedance:	450 Ohm
Hazardous rating:	Non-incendive, Class I, Division 2, Groups A,B,C,D Intrinsically safe Class I, Division 1, Groups A,B,C,D Class II, Division 1, Groups E,F,G Ⓔx II 1G Ex ia IIC T4
Stroke:	0 to 95 degrees (rotary) 6 - 600 mm (linear)
Position feedback:	Magnetic (non-contact)
Diagnostics:	HART® protocol, software utilizing HART® protocol (AMS or FDT/DTM)

Enclosure

Material:	Engineered resin
Class of equipment:	NEMA type 4, 4x or IP66
Weight:	3.3 Kg
Air connections:	1/4" NPT or BSP (Std flow) 3/8" NPT or BSP (High flow)
Conduit connection:	M20 or 1/2" NPT Approvals FM, CSA Kema (Cenelec)

7 Error Codes

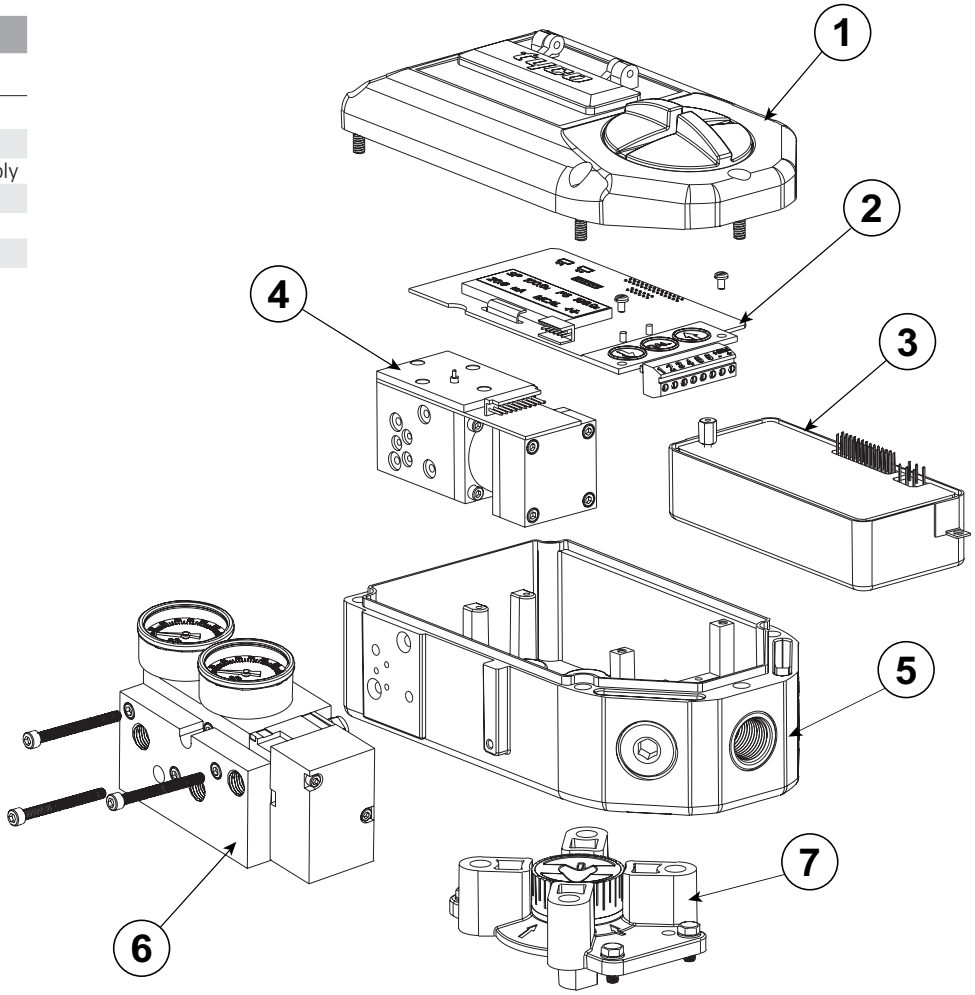
Err 3 (Error 3)	Low input pressure or clogged filter
Err 5 (Error 5)	Intergrator Overflow - Position of actuator does not match setpoint of positioner
Err 6 (Error 6)	Calibration error - Positioner could not successfully perform calibration
ALR (Alert 3)	Valve position is not being maintained within 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

For assistance in diagnosing problems which result in positioner error messages, please see section 4 on trouble shooting or contact the nearest office.

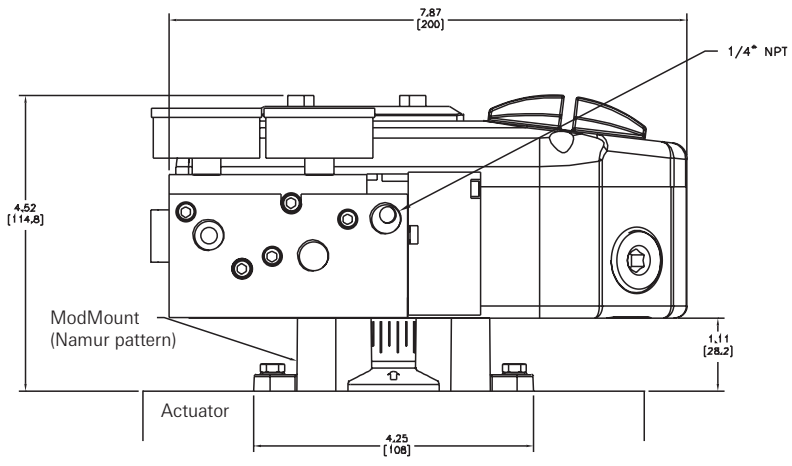
8 Exploded parts list

SmartCal parts description

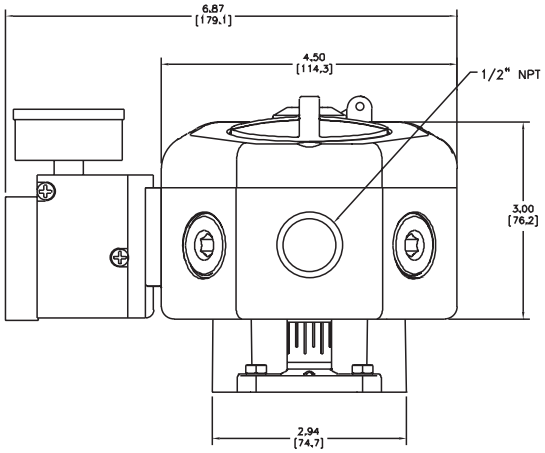
Item #	Qty	Description
1	1	Cover assembly
2	1	Display board assembly
3	1	Electronics module assembly
4	1	Transducer assembly
5	1	Housing assembly
6	1	Manifold assembly
7	1	Direct mount assembly



Dimensions (mm)



Front view



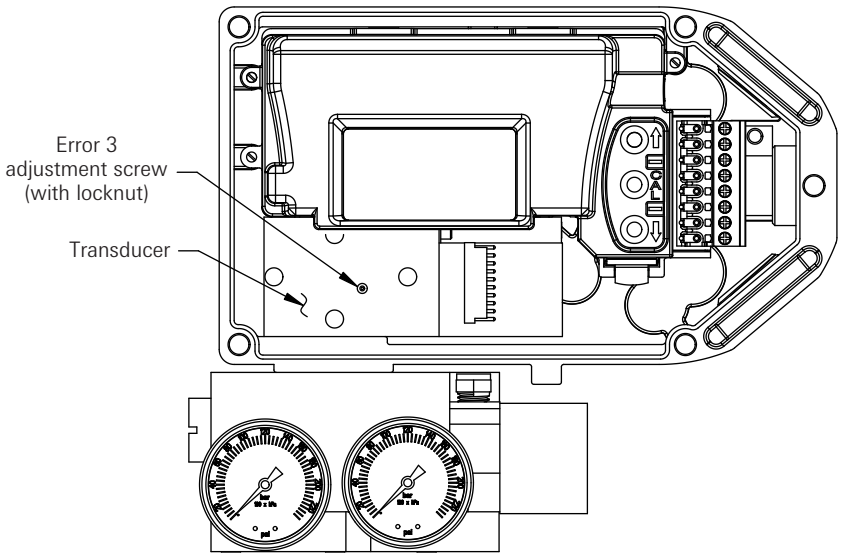
Side view

Appendix A - Procedure to adjust the Error 3 setting

Note

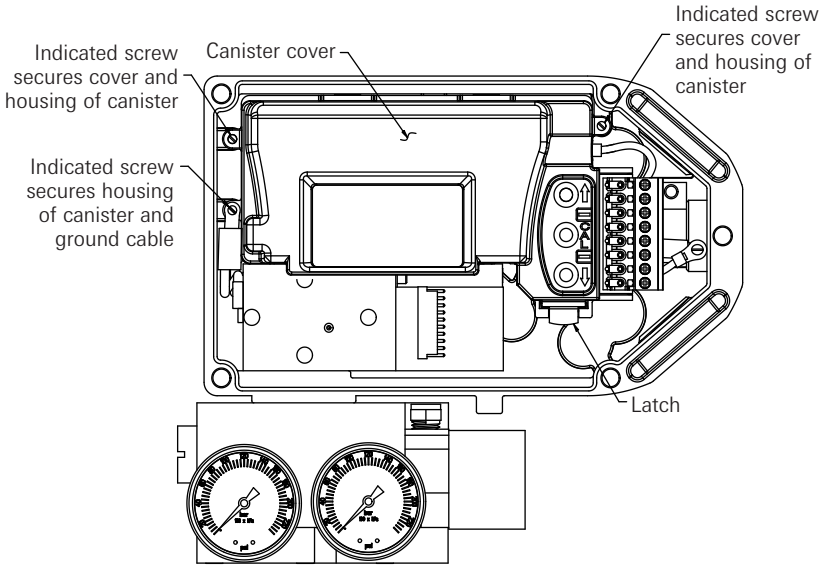
The Error 3 message is pre-set from the factory at 4 bar (55 psi). If the setting comes out of calibration or if it is necessary to change the setting, the following instructions can be followed.

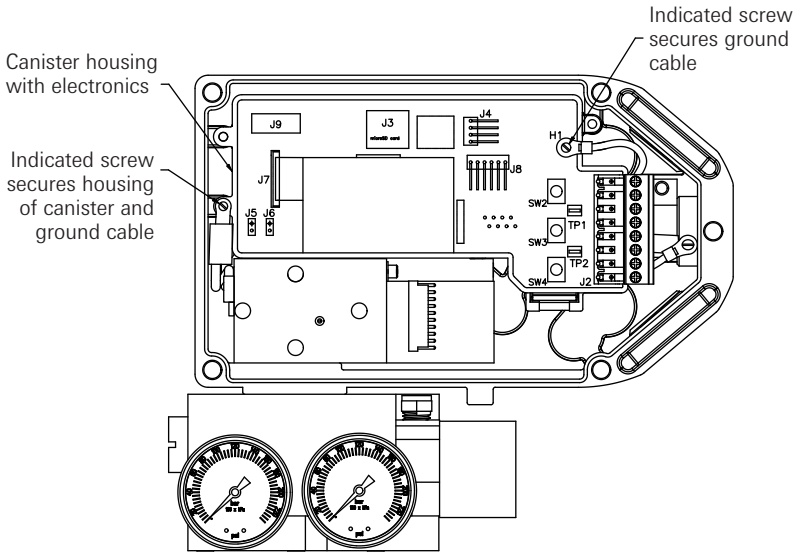
1. Before adjusting the Error 3 setting the positioner must be mounted and set-up. See Section 3 of this manual.
2. To adjust the setting of the Error 3 message to indicate low input pressure, there is an adjustment screw located on the top of the transducer. (See Figure below)
3. To set the Error 3 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 affect the adjustment screw setting.
7. Re-regulate the supply air to the normal operating pressure.



Appendix B - Procedure to remove electronics cover and electronic canister

1. Remove the two screws that secure canister cover, unlock the latch by pulling it up and remove the canister cover. (See Figures below).
2. Disconnect all connectors from electronics canister, make sure to note connector locations. Remove the screw that secures canister housing and ground cable. Remove the screw that secures ground cable. (See Figures below).
3. Remove the canister with electronics from SmartCal enclosure.

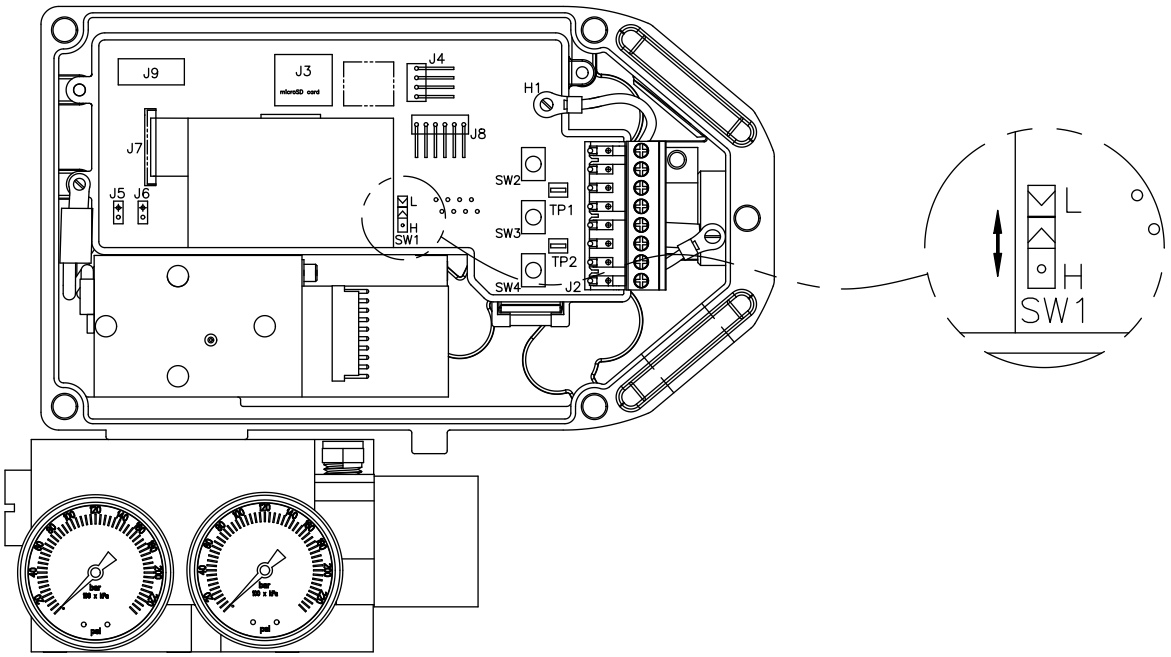




Appendix C - Setting the transmitter output fail current

The SmartCal conforms to Namur NE43 with an operating current of 3.8 mA to 20.5 mA. Input currents between 3.2 mA and 3.5 mA and above 21.0 mA are considered outside the control range and are a current input failure. When the input current is out of range the LCD will display a failure message and the transmitter output (if so equipped) will go to pre-determined current to indicate the failed state. The transmitter output can be configured to go to 3.4 mA or 21.1 mA by the user.

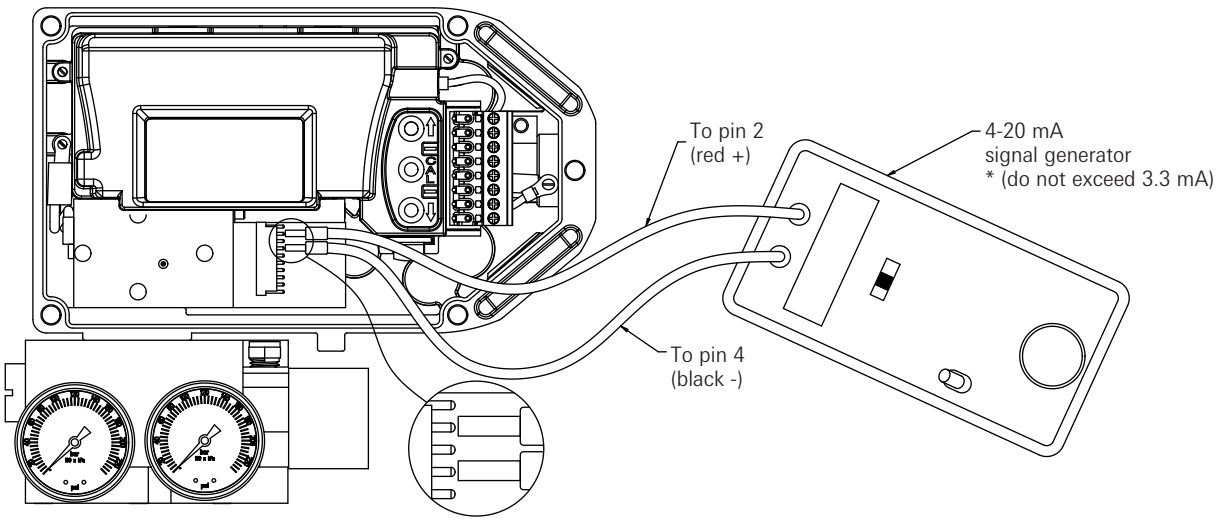
To set the transmitter output:
Step 1: Remove enclosure cover. Follow appendix B to remove the electronics cover.
Step 2: For 3.4 mA fail current place the jumper in the L position on the LCD pcb. Note this is the default factory position. For 21.1 mA fail current place the jumper in the H position on the LCD pcb.
Step 3: Replace electronic canister cover and enclosure cover.



Appendix D - Procedure to check transducer operation

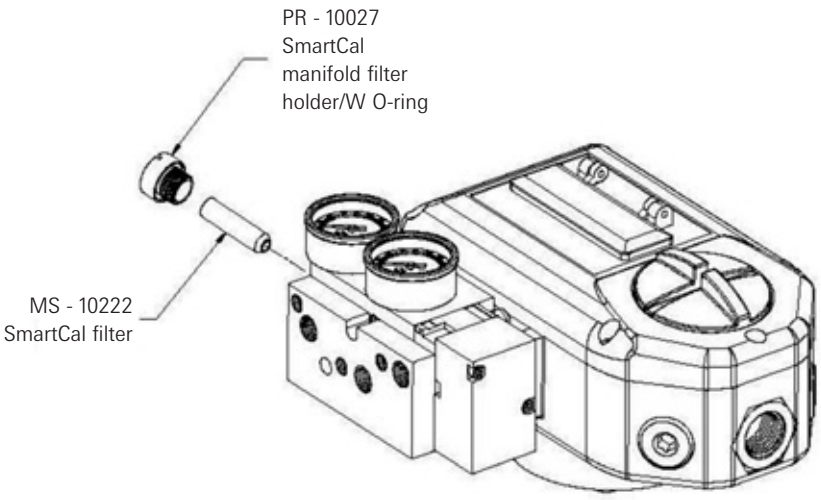
(This procedure should only be used for trouble shooting)

1. Mount the positioner and connect the pneumatics as described in Section 3 of this manual.
2. Remove the electronics cover 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 gauges, pin 10 is nearest to the pressure gauges.
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 E - General maintenance standard flow

The positioner's onboard filter should be replaced regularly. See diagram for location of the filter.
Note: The following instructions are for Standard flow. For High flow please contact the factory.
Important: The positioner's onboard filter is not a substitute for normal instrument air preparation. Supply air to the positioner should conform to ISA Standard S7.3 - Quality for Instrument Air.
Important: The filter's original color is chalk white. If the filter is discolored, its replacement should be performed more often. A discolored filter may also indicate the need for an evaluation of the air-supply quality. A filter/regulator with a 5 micron or better element, just prior to the positioner, is recommended.

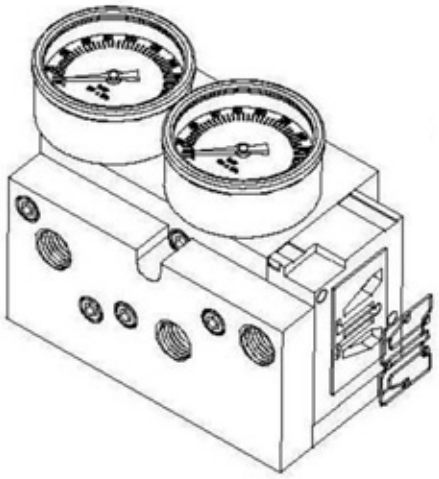


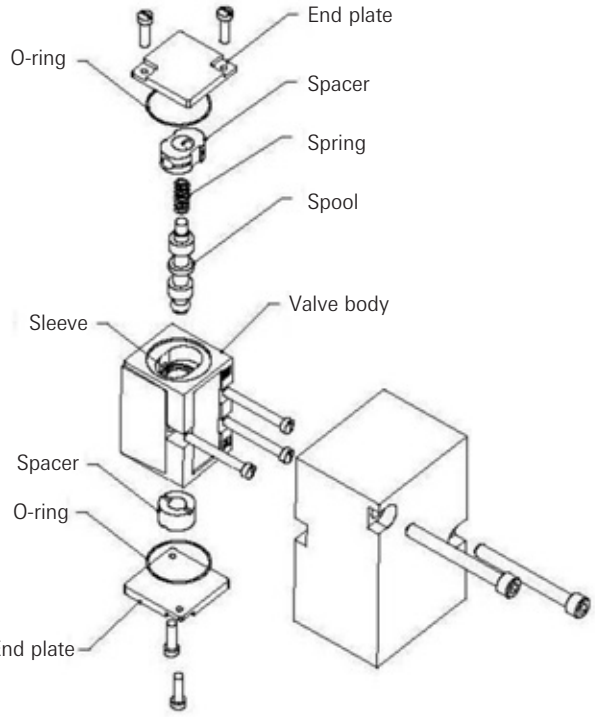
Spool valve
In favorable conditions (i.e. high quality supply air, healthy actuator) there will be minimal if any maintenance necessary on the spool valve.
If unfavorable conditions exist (i.e. Poor supply air quality or if lubrication and sediment from the actuator is being exhausted through the spool valve) it may become necessary to clean the spool valve to avoid operational failures due to valve sticking and to maintain optimum positioner performance.
To clean the spool valve, the spool piece needs to be removed (see diagram below). Prior to removing the spool, make sure the positioner is out of service and all air pressure has been bled-off the positioner and the actuator.
The spool piece and sleeve can be cleaned using any non-chlorinated cleaning solvent (such as Stoddard solution or volatile mineral spirits).
To clean the spool, use a clean lint free cloth. To clean the I.D. of the sleeve, a polyester, lint free clean room swab is recommended. These items can be obtained from most industrial supply companies or catalogs.

Important: Do not use an abrasive cleaner on the spool or sleeve. Never buff the spool or sleeve or use crocus cloth, and never attempt to remove the sharp edges from the spool lands. These practices will damage the spool assembly and will affect the fit and action of the spool sleeve assembly.

Important: The spool and sleeve assembly is sold as a precision matched set. Spools are not interchangeable. To prevent mix-ups it is recommended that only one assembly be cleaned at a time.

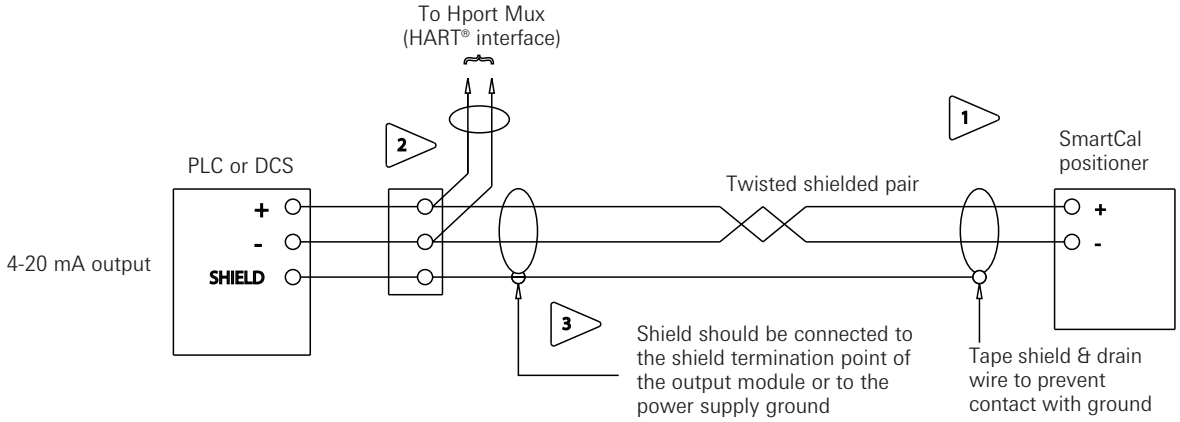
Important: After cleaning, insert the spool, into the sleeve, gently. Insert straight with a slight rotating motion. Do not cock the spool. Make sure the spool spins and moves freely. After the spool valve is cleaned and reassembled it is recommended that the positioner be recalibrated.





SPOOL/VALVE ASSY
PR-30034

Appendix F - Grounding schematic



1 Connection from DCS or PLC to positioner is 20 Gauge shielded twisted pair (Belden 8762 or equivalent). Maximum distance is 1500 m (5000 feet).

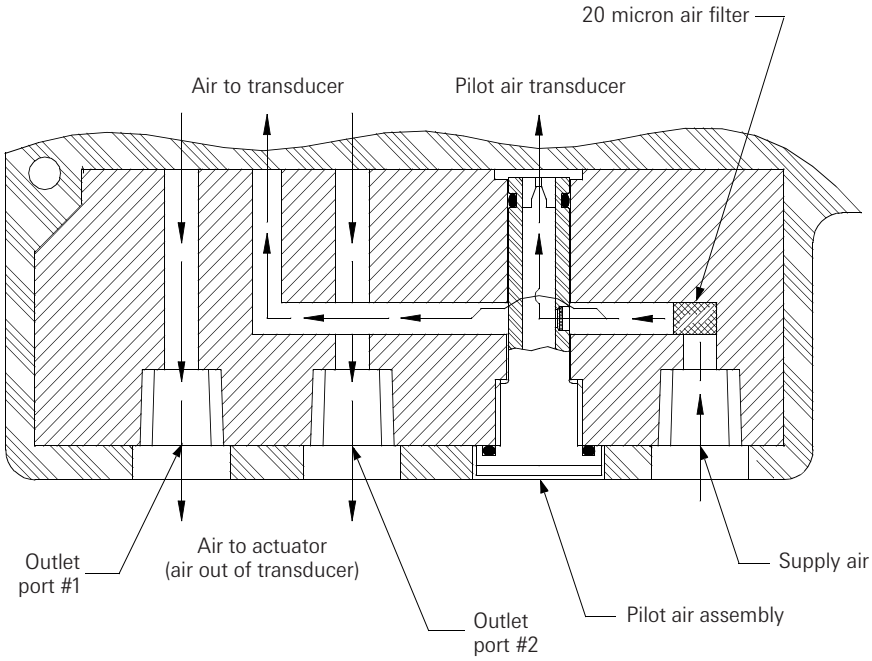
2 Connection from HART® Multiplexer to positioner is 20 Gauge shielded twisted pair (Belden 8762 or equivalent). Maximum distance from HART® Multiplexer to positioner is 1800 m (6000 feet).

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 V AC or 480 V AC, in order to minimize electrical noise interference.

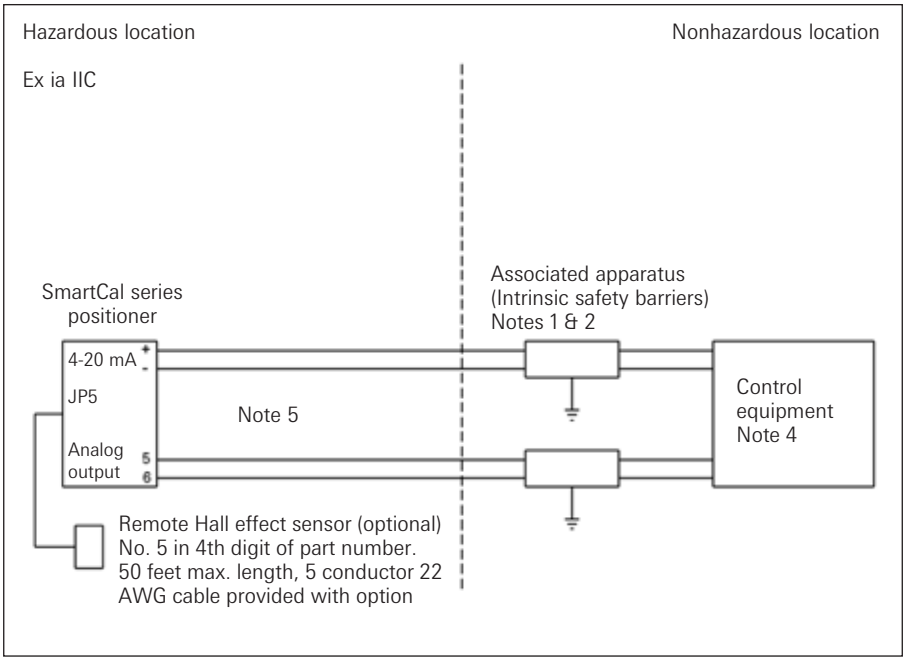
Raceway	480 V AC	120 V AC
Tray	26″	6″
Tray-conduit	18″	4″
Conduit	12″	3″

Appendix G - Pneumatic manifold diagram



Appendix H -
Control schematic for wiring of intrinsically safe SmartCal for ATEX & IECEX

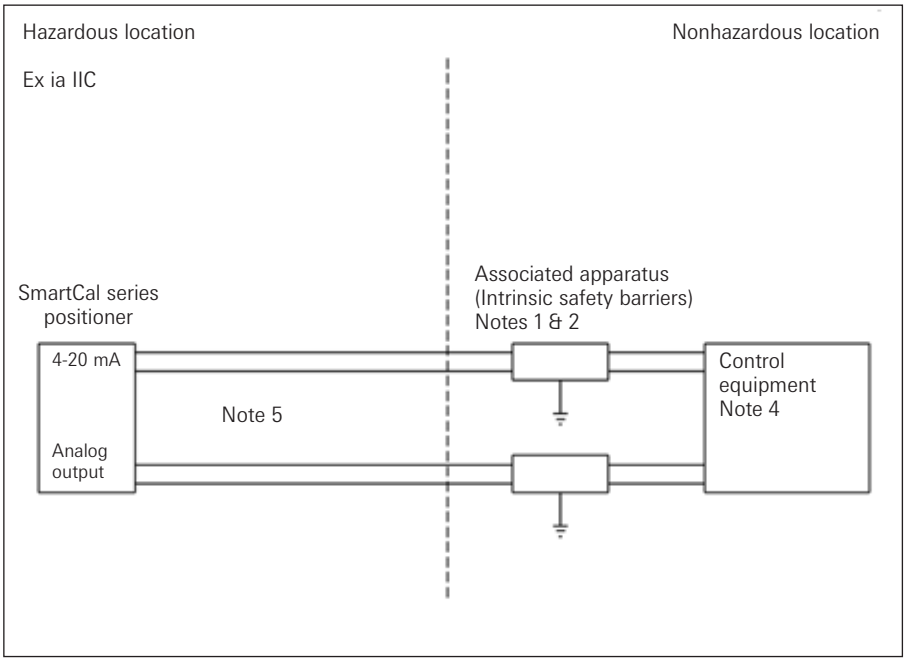
(Sheet 1 of 2)



Entity parameters for each field wiring terminal pair of SmartCal:
Vmax = 30 V Imax = 100 mA Pi = 0.75 Watt
Ci = 0 pF Li = 17.25 µH

1. ATEX Entity approved associated apparatus used in an approved configuration, such that:
   A. SmartCal Vmax ≥ Voc and Vt of associated apparatus.
   B. SmartCal Imax ≥ Isc and It of associated apparatus.
   C. Ci of SmartCal cable capacitance ≤ Ca of associated apparatus.
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 250 V.
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. Where rigid metal conduit is not used, seal SmartCal cable entries against dust and fibers using an appropriate NRTL listed cable gland fitting.
6. Installation should be in accordance with the local / national electrical codes of practice.

Control schematic for wiring of intrinsically safe SmartCal for ATEX & IECEX (Sheet 2 of 2)



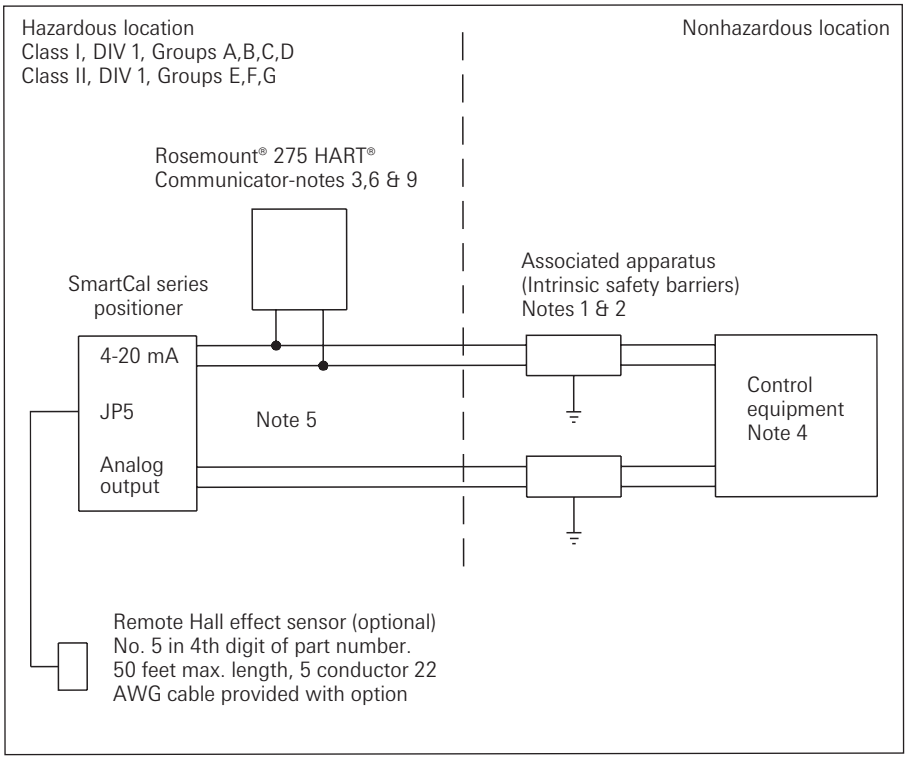
Entity parameters for each field wiring terminal pair of SmartCal:
Vmax = 30 V Imax = 100 mA Pi = 0.75 Watt
Ci = 0 pF Li = 17.25 µH

ATEX notes:

1. Barrier must be a ATEX 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 ≤ Vmax or Ui Ca > Ci + C Cable
   Isc or Io ≤ 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 250 V.
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. Where rigid metal conduit is not used, seal SmartCal cable entries against dust and fibers using an appropriate NRTL listed cable gland fitting.
6. Installation should be in accordance with the local / national electrical codes of practice.

Appendix I - Control schematic for wiring of intrinsically safe SmartCal for US & Canada

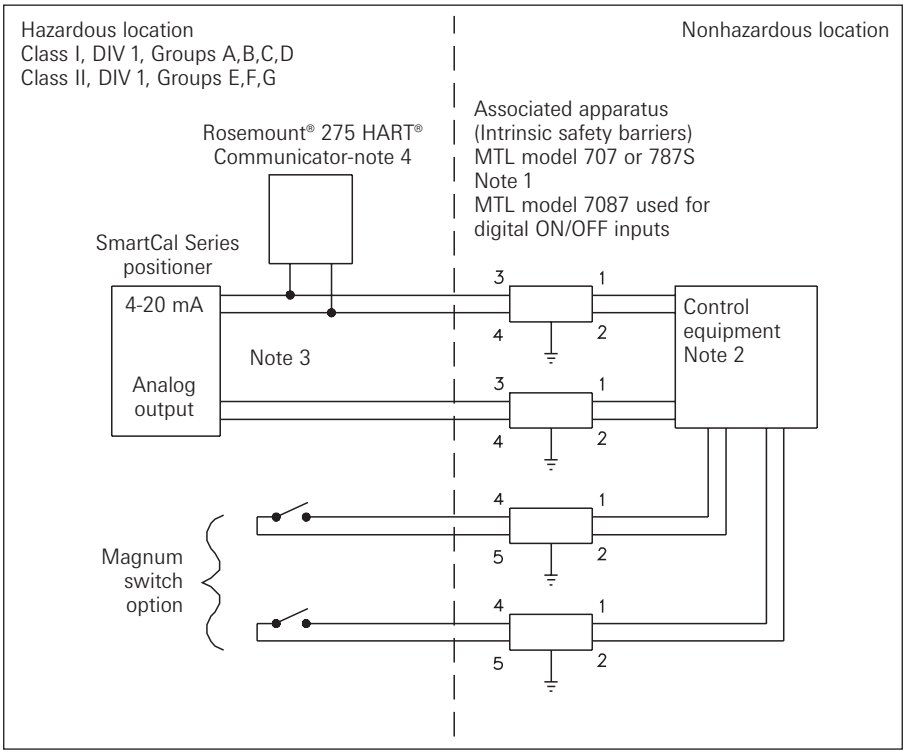
(Sheet 1 of 4)



Entity parameters for each field wiring terminal pair of SmartCal:
Vmax = 30 V Imax = 100 mA Pi = 0.75 Watt
Ci = 0 pF Li = 17.25 µH

1. FMRC Entity approved associated apparatus used in an approved configuration, such that:
   A. SmartCal Vmax ≥ Voc and Vt of associated apparatus.
   B. SmartCal Imax ≥ Isc and It of associated apparatus.
   C. Ci of SmartCal + Ci of Rosemount® 275 HART® Communicator (if used) + cable capacitance ≤ Ca of associated apparatus.
   D. In cases where the Rosemount® 275 HART® Communicator is not connected between the associated apparatus and the SmartCal, Li of SmartCal + cable inductance ≤ La of associated apparatus.
   E. In cases where the Rosemount® 275 HART® Communicator is connected between the associated apparatus and the SmartCal, 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 SmartCal. 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 250 V.
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 SmartCal 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).

Control schematic for wiring of intrinsically safe positioner for US & Canada (Sheet 2 of 4)



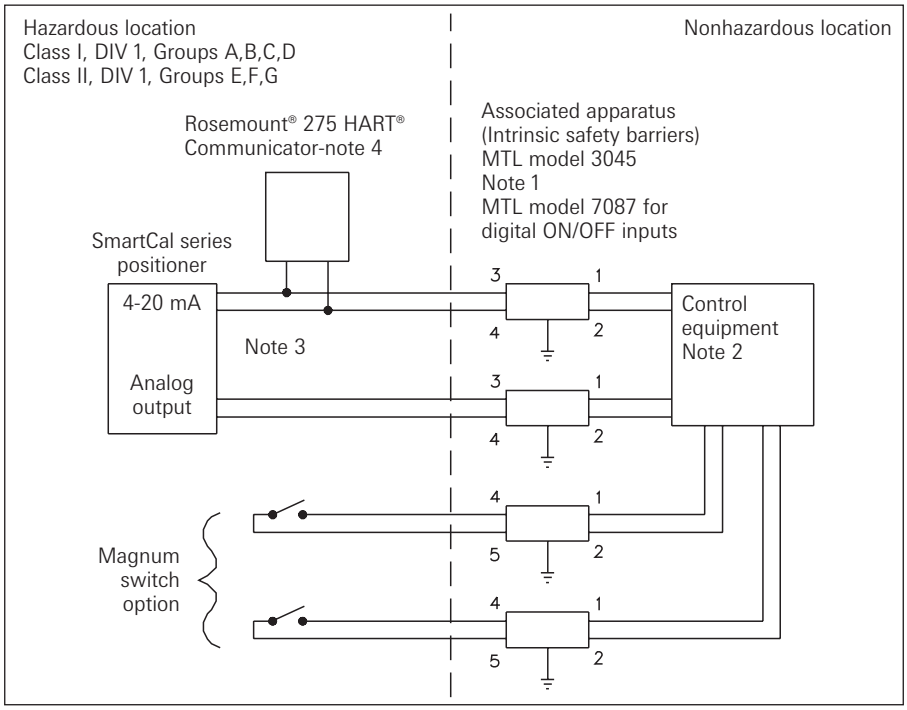
1. Associated apparatus manufacturer's installation drawing must be followed when installing this equipment.
2. Control equipment connected to associated apparatus must not use or generate more than 250 V.
3. To maintain intrinsic safety, each field wiring pair (4-20 mA and analog output) must be run 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 SmartCal 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 allowable 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	30 nF	4,0 mH
GP C,D,E,F,G location W/Communicator	230 nF	16 mH
GP A OR B location W/OUT Communicator*	100 nF	4,0 mH
GP C,D,E,F,G location W/OUT Communicator*	300 nF	16 mH

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

Control schematic for wiring of intrinsically safe positioner for US & Canada (Sheet 3 of 4)



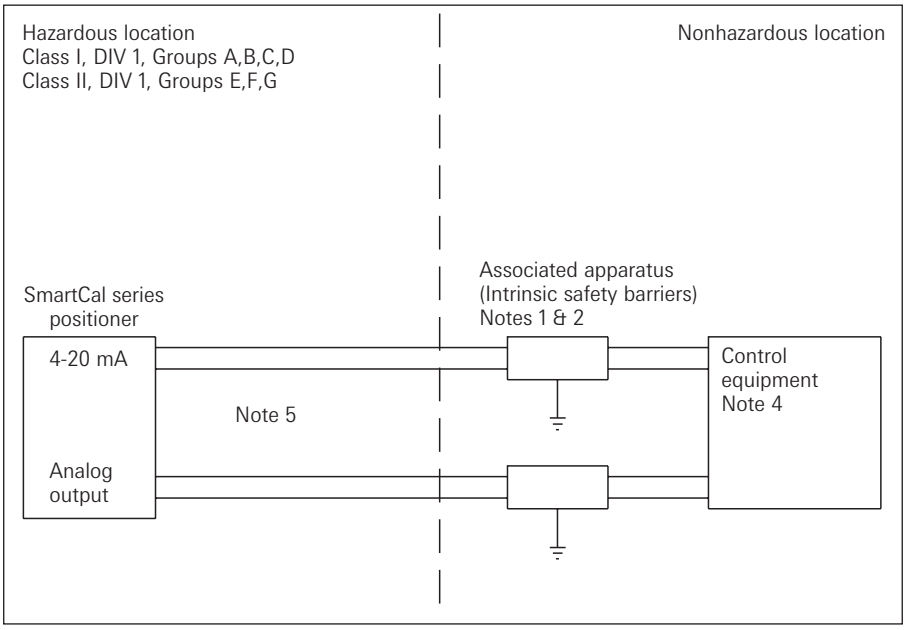
1. Associated apparatus manufacturer's installation drawing must be followed when installing this equipment.
2. Control equipment connected to associated apparatus must not use or generate more than 250 V.
3. To maintain intrinsic safety, each field wiring pair (4-20 mA and analog output) must be run 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 SmartCal 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 allowable 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	30 nF	4,0 mH
GP C,D,E,F,G location W/Communicator	230 nF	16 mH
GP A OR B location W/OUT Communicator*	100 nF	4,0 mH
GP C,D,E,F,G location W/OUT Communicator*	300 nF	16 mH

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

Control schematic for wiring of intrinsically safe positioner for US & Canada (Sheet 4 of 4)



Entity parameters for each field wiring terminal pair of SmartCal:
Vmax = 30 V Imax = 100 mA Pi = 0.75 Watt
Ci = 0 pF Li = 17.25 µH

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 ≤ Vmax or Ui Ca > Ci + C Cable
   Isc or Io ≤ 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 250 V.
4. To maintain intrinsic safety, each field wiring pair (4-20 mA and analog output) must be run in separate cables 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 SmartCal 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 J - Procedure to reset the EEPROM to factory settings

The SmartCal smart 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 recalibrate 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 'Starting Up' for several seconds while holding down the CAL button.

3. Continue to hold the CAL button until the LCD shows 'Factory Default Intialization. No?' When this statement appears release the CAL button. Use the down arrow to change 'No' to 'Yes'. To begin Factory reset procedure press the Cal button.

4. When mA METER CALIBRATION appears release the Up-arrow button.

5. After releasing the Up-arrow 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.

6. 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.

7. The positioner will automatically return to normal operating mode.

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

Appendix K - HART® Communicator menu flow chart

SmartCal series digital valve controller