Epic Hart Enabled Control Transmitter
Model D441, D450, D451
OPERATING MANUAL

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Prepared By: A R Paolini	**Date:** 3/23/16	**Drafting Work Order:** 25188	**ECN:** 13887
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WESTLOCK CONTROLS CORPORATION
280N MIDLAND AVENUE, STE.258, SADDLE BROOK, NJ 07663 TEL: 201-794-7650 FAX: 201-794-0913

www.westlockcontrols.com

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Westlock Controls Offices

USA
Westlock Controls
280 North Midland Ave. Ste. 258, Saddle Brook, NJ 07663
Phone: (201) 794-7650 •Fax: (201) 794-0913
Email: westlockinfo@westlockcontrols.com
Internet http://www.westlockcontrols.com

Europe
Phone: 011-44-189-251-6277 •Fax: 011-441-892-516279

Asia
Phone: +65 676 858 00 •Fax: 011-441-892-516279

Table of Contents

1.1 Product Certification 4

1.1 Warnings 5

1.3 Special Features of the Digital Epic 6

1.4 Description of D441, D450, D451 6

2 Order Guide 8

3 Installation 9

3.1 Mounting the Digital EPIC on a Rotary Actuator 9

3.2 Mounting the EPIC on a Linear Actuator 11

4 Field Wiring 13

5 Calibration 14

6 Maintenance and Repair 14

7 Appendix 15

7.1 Appendix A ESD/PST Menu 15

7.2 Appendix B HART 475 Communicator Quick Calibration 18

1.1Product Certification

*nnnn

FM 08 ATEX 0062X
II 1 G Ex ia IIC T4 Ga Tamb -40°C to +*°C IP66/67
ENTITY PARAMETERS: Ui=30V; Li=100mA; Pi=0.75; Ci=0uF; Li=4uH
FM08 ATEX 0061X
II 3 G Ex ec IIC T4 Gc Tamb -40°C to +*°C IP66/67
*nnnn = Notified Body Number

*= +80°C Customer installed solenoid
*= +65°C Factory installed solenoid

IECEx

IECEX FMG 09.0012X
Ex ia IIC T4 Ga Tamb -40°C to +*°C IP66/67
ENTITY PARAMETERS: Ui=30V; Li=100mA; Pi=0.75; Ci=0uF; Li=4uH
IECEX FMG 09.0012
Ex ec IIC T4 Gc Tamb -40°C to +*°C IP66/67

*= +80°C Customer installed solenoid
*= +65°C Factory installed solenoid

Intrinsically Safe for use in
CLASS I DIVISION 1 Groups A,B,C,D; T4 Tamb -40°C to +*°C
CLASS II, DIVISION 1 GROUPS E,F&G
ENTITY PARAMETERS: Ui=30V; Li=100mA; Pi=0.75; Ci=0uF; Li=4uH
NON-INCENDIVE CLASS I DIVISION 2 Group A, B, C, D T4 TA -40°C to *°C
SUTABLE for CLASS II and III DIVISION 2 Group F and G
TYPE 4X, 6P, IP67

*= +80°C Customer installed solenoid
*= +65°C Factory installed solenoid

Specific Conditions of Use:

Model 441 contains aluminum and is at potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.

Models D450 and D451 equipped with aluminum valve bodies contains aluminum and is at potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.

Similar care must be taken for models D450 and D451 equipped with aluminum valve bodies.

This manual contains installation, configuration, and specification data for the Digital Epic Valve Control/Position Transmitter.

Installing, calibrating, configuring, and operating this device assumes a basic level of familiarity and competence with instrumentation technology and related field wiring and installation practices.

Only qualified personnel should install, operate and maintain this equipment.

Product identification label must be checked with an 'X' in the box next to the protection method used.

For level of protection "ec" transient protection shall be provided that is set at a level not exceeding 140% of the peak rated voltage value at the supply terminals of the equipment.

For level of protection "ec" the equipment shall be used in an area of not less than pollution degree 2, as defined in IEC 60664-1.

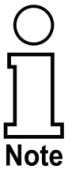
The User shall permanently mark the protection type chosen. Once the try of protection has been marked it shall not be changed.

1.1 Warnings

1.2 Symbols Used In This Document

This symbol warns the user of possible danger. Failure to heed this warning may result in personal injury or death and/or severe damage to property.

This symbol identifies information about operating the equipment in a particular manner that may damage it or result in a system failure. Failure to heed this warning can lead to total failure of the equipment or any other connected equipment.



This symbol draws attention to information that is essential for understanding the operation and/or features of the equipment.

1.3 Special Features of the Digital Epic

- Non-contact position feedback via Hall Effect Sensor technology
- Non-intrusive local calibration possible without opening the device
- HART communications and 4 - 20 mA position signal
- Suitable for rotary and linear valves
- Suitable for use in SIL3 safety integrated functions per Exida FMEDA
- A Type A3 device according to IEC61508 having a hardware fault tolerance of zero
- Integrated SIS ESD/PST functionality

1.4 Description of D441, D450, D451

The DIGITAL EPIC is a "smart" Intrinsically Safe valve position transmitter and ESD (Emergency Shutdown)/PST(Partial Stroke Test) controller with microprocessor-based intelligence providing both a 4-20ma signal for position and digital communications via the HART protocol.

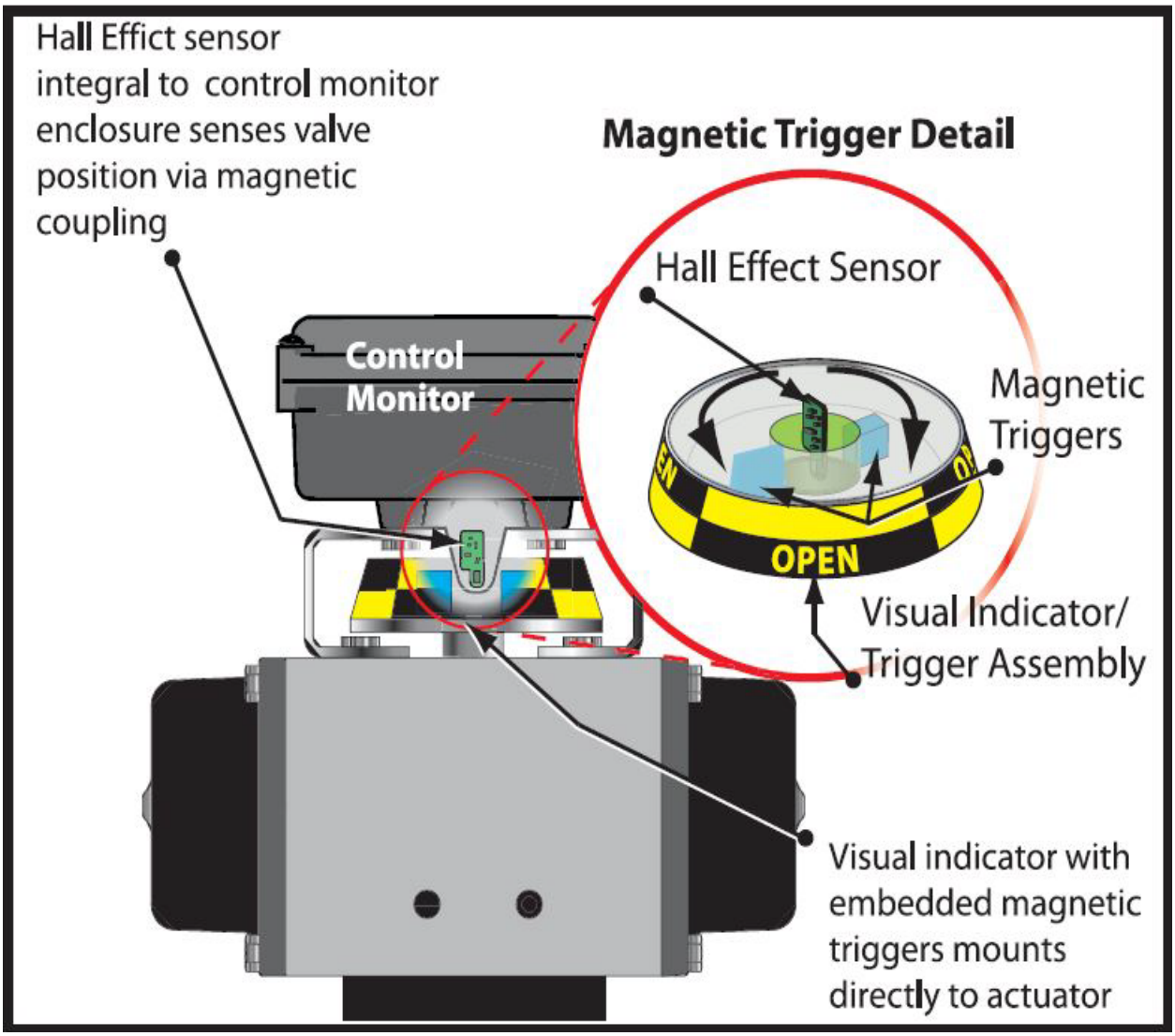
Principles of Operation

Unlike conventional linkage-type valve-position transmitters, the D-EPIC measures valve position without the need for linkages, levers, or rotary or linear seals. Position sensing is performed by non-contacting means via the use of an integral Hall Effect sensor in conjunction with a special magnet assembly that is attached to the valve actuator that also provides visual position indication (rotary applications). Accurate measurement of valve position provides the precision data required for the use of advanced control strategies and predictive maintenance algorithms.

The D-EPIC may be calibrated, configured, and data accessed via a Rosemount 275, 375, or 475 hand-held HART communicator or HART infrastructure.

The range of values displayed is 0.0% to 100.0%. Display resolution is in 0.1% increments, however, internal calculations are maintained at higher precision. The LCD

provides a constant readout of position (0.0 to 100.0 % of full span) and Analog Output Current (3.6 to 23.0 mA). During the Calibration routine the required prompts and values are displayed. The Analog Output signal is a 4 to 20 mA current sink (current is proportional to position) with 10-30VDC across the Output terminals. The Input Terminal block accepts 14 to 22 AWG wire.



2 Order Guide

D441 D-EPIC Transmitter
(Small Aluminum Encl. w/two ¾" NPT (F) or one ¾" NPT (F) when equipped with Falcon Solenoid Valve).

D450 D-EPIC Transmitter
(Large 316 Stainless Steel Encl. w/three ¾" NPT (F) or two ¾" NPT (F) when equipped with Falcon Solenoid Valve).

D451 D-EPIC Transmitter
(Small 316 Stainless Steel Encl. w/two ¾" NPT (F) or one ¾" NPT (F) when equipped with Falcon Solenoid Valve).

Application Type
LV Linear Transmitter (Specify Stroke length and Fail Up or Down ***)
LR Linear Transmitter with Remote Mount Option (Specify Stroke length and Fail Up or Down ***)
RO Rotary Transmitter
RR Rotary Transmitter with Remote Mount Option

ESD/PST
0 None
1 ESD/PST Function
2 PST with Push Button Initiation

Falcon Solenoid Valve Coil Voltage
0 No Solenoid Valve
D 24 VDC (IS Coil)

Falcon Valve Body

2V3 1.4cv 3-way brass	**2VY** 1.4cv dual-coil brass	**580** 3.5cv 4-way 316ss
3V3 1.4cv 3-way aluminum	**5VY** 1.4cv dual-coil 316ss	**3VY** 1.4cv dual-coil Aluminum
5V3 1.4cv 3-way 316ss	**2V7** 1.4cv 4-way brass	**3VZ** 4.3cv dual-coil aluminum
3V4 4.3cv 3-way aluminum	**3V7** 1.4cv 4-way aluminum	**540** 3.5 3-way 316ss
3V8 4.3 4-way aluminum		

Special Valve Features
0 None
V Venting (Available in 1.4 Cv only)
I Non-Venting No indicator (Available in 1.4 Cv only)

Over-ride Option
0 None
M Momentary **
L Locking**
R No-Voltage Release (Non-Latching, available in 1.4 Cv only)
N No-Voltage Release (Latching, available in 1.4 Cv only)
E External Pilot**

Sample Model Number: *D450 RO 1 D 53 0 5V3 L* = MODEL NUMBER **D450RO1D5V3L**

***Dual-Coil valve body options only available with Base Models D430 and D450.**
****Override Options M, L, E are not available with option "5V4" & "5V8" Falcon Valve Bodies. These options are available in 303 SS, contact factory for availability.**
***** Linear magnet assemblies included in price up to 2.5" stroke. For strokes above 2.5" consult factory for price and delivery.**

3 Installation

3.1 *Mounting the Digital EPIC on a Rotary Actuator*

3.1.1 Mount bracket and beacon coupler to actuator.

These components and fasteners must be fabricated of non-magnetic material. Typical Westlock DEPIC mounting kit brackets are 303ss, while standard couplers are aluminum. Kits are also available in all-316ss. Consult Factory for availability.

If actuator shaft has a tapped hole, fasten beacon coupler to actuator shaft using flat head screw provided with Westlock Mounting kit. If actuator does not have a tapped hole, fasten using set screws on sides of coupler.

Orient the unit housing with the valve body facing you, or if no valve is mounted, orient with conduit entry (not shown) to the “back” (away from you.)

3.1.2 Press fit the Beacon to the Beacon coupler.

Orient the beacon using the symbols on the top of the beacon (**Figure 1**) **per Valve Fail Position 1** (**Figure 2**) or **Valve Fail Position 2** (**Figure 3**) below. **Valve Fail Position 1** and **Valve Fail Position 2** show the placement of the beacon with respect to the EPIC housing while the actuator is in its **fail position.**

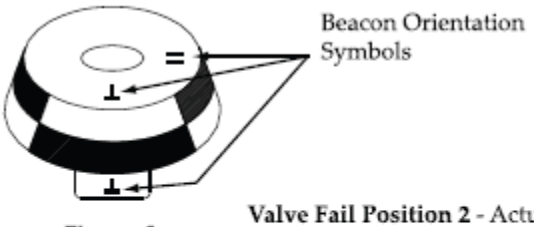


Figure 1

Valve Fail Position 1 - Actuator fails in a clockwise direction

⊥ **Placed at 6:00**

|| **Placed at 3:00**

Valve Fail Position 2 - Actuator fails in a counter-clockwise direction

⊥ **Placed at 9:00**

|| **Placed at 6:00**

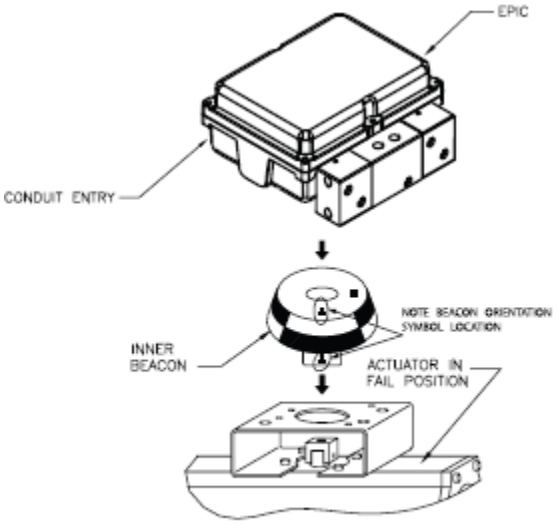


Figure 2

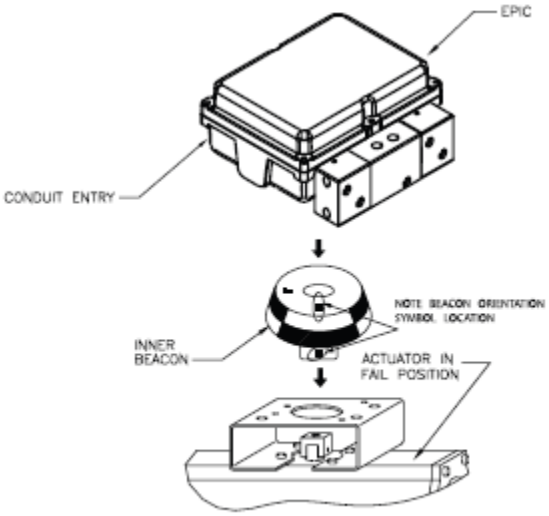


Figure 3

3.2 *Mounting the D-EPIC on a Linear Actuator*

3.2.1 Mount the magnet assembly to the stem of the actuator. A coupler block (provided with Westlock mounting kits) is used to space the magnet assembly outside the yoke area to provide stroke clearance and to position the magnet assembly into the sensing range of the Hall Effect Sensor.

3.2.2 Fasten the mounting bracket to the actuator yoke.

3.2.3 Mount the D-EPIC to the mounting bracket so the Hall Effect Sensor on the bottom of the housing assembly is centered vertically between the limits of the magnetic assembly's stroke (see 3.3.4 below).

3.2.4 After mounting the D-EPIC, the magnet assembly should be 1/6" to 1/8" from the back of the housing. 1/16" is ideal (**Figure 4**).

3.2.5 To align the D-EPIC housing assembly to the center of the actuator's stroke:

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

Mount the D-EPIC to the bracket so that the conduit entry faces away from the diaphragm or cylinder (**Figure 5**) and with the Hall Effect Sensor aligned with the stroke-center mark.

For Fisher actuators model 657 & 667 sizes 34 thru 70, Westlock Controls supplies a slotted mounting bracket to facilitate centering of the Hall Effect Sensor.

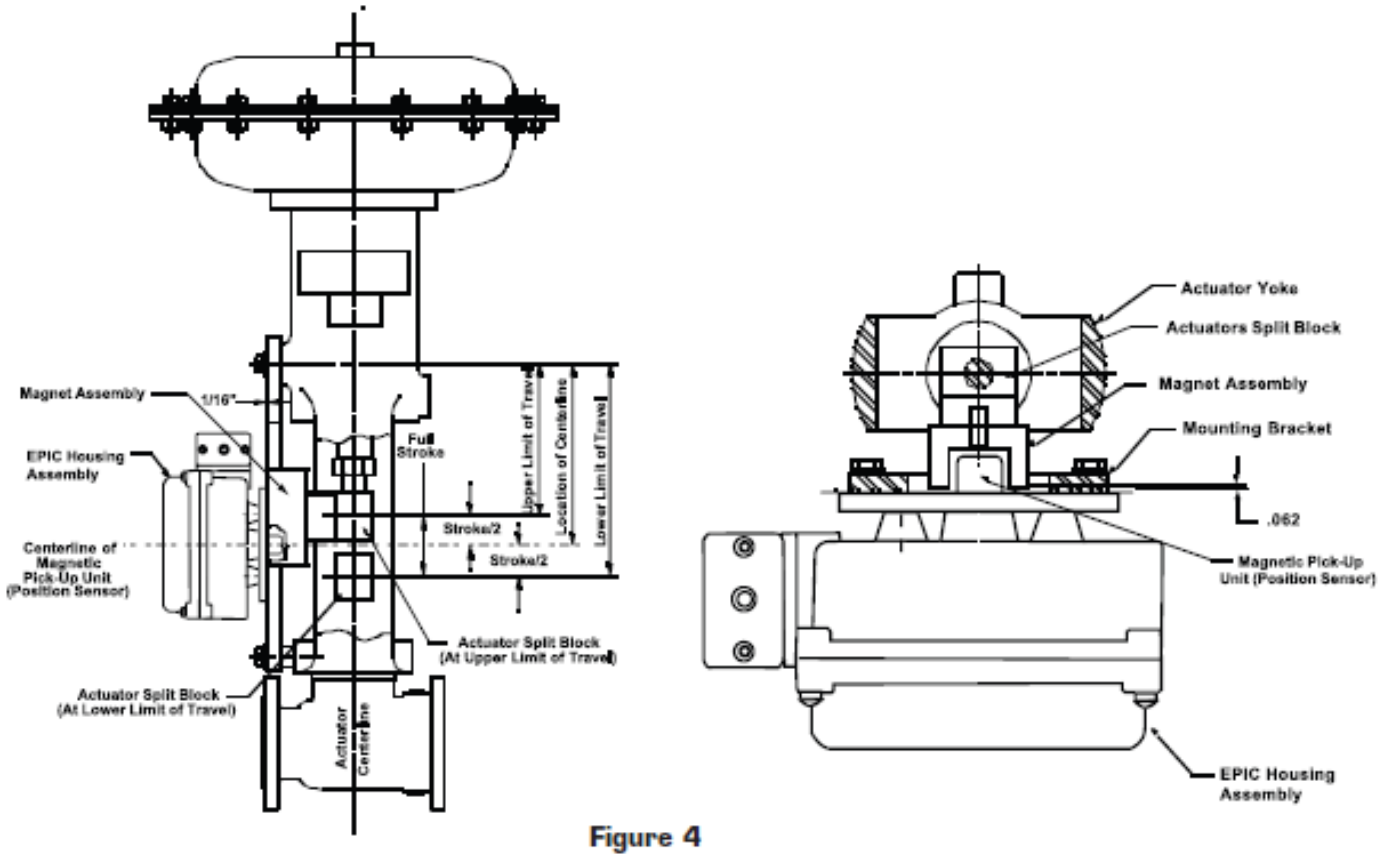


Figure 4

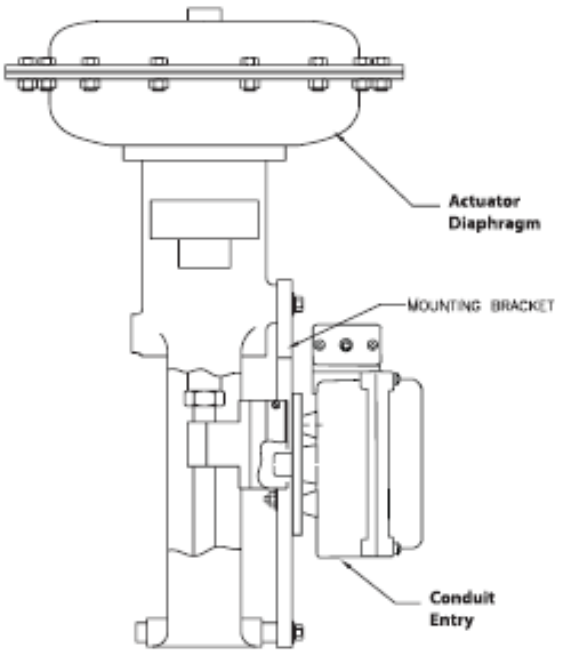


Figure 5

4 Field Wiring

The D-EPIC ingress protection is based on the use of cable glands for all field wiring entrances. When installing the product in hazardous areas, only suitability-certified cable glands and blanking plugs must be used to maintain the ingress protection of IP67.

For ambient temperatures below -40°C and above 80°C, use field wiring suitable for both min and max ambient temperatures. Observe temperature limits of D-Epic as printed on the identification label

Maintain the D-EPIC product within the temperature limits marked on the unit ID label.

4.1 Field Wiring

4.1.1 Remove cover of unit, pull cable(s) into housing, and terminate to points shown in Figure 6. Use twisted pair shielded cable of 18 to 24 AWG.

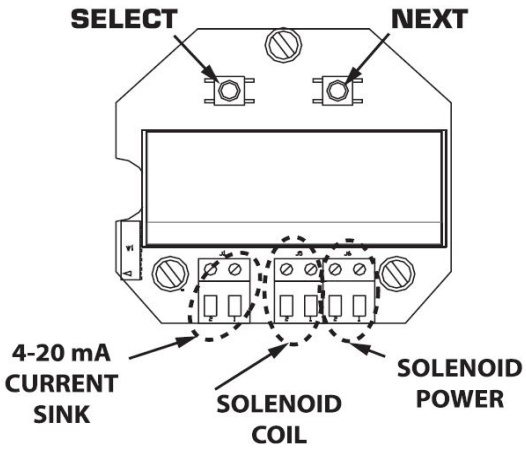


Figure 6

- Terminal Blocks accept wire size range of 6.45mm² to 16.28mm² . Wire must be suitable for ambient temperatures of -40°C to 80°C. Use supply wires suitible for a minimum 10°C above maximum ambient.
- Tighten terminal strip screws to 4.4lb-in. (0.5nM) max.
- 4-20mA connection terminals are polarity insensitive.
- 4-20 mA current sink provides a current output proportional to valve position. Minimum 10 VDC to a Maximum of 30 VDC permissible across Output terminals.

5 Calibration

5.1 Local Calibration Options

Remove the enclosure cover to utilize the **SELECT** and **NEXT** pushbuttons shown in **Figure 7** Below**.**

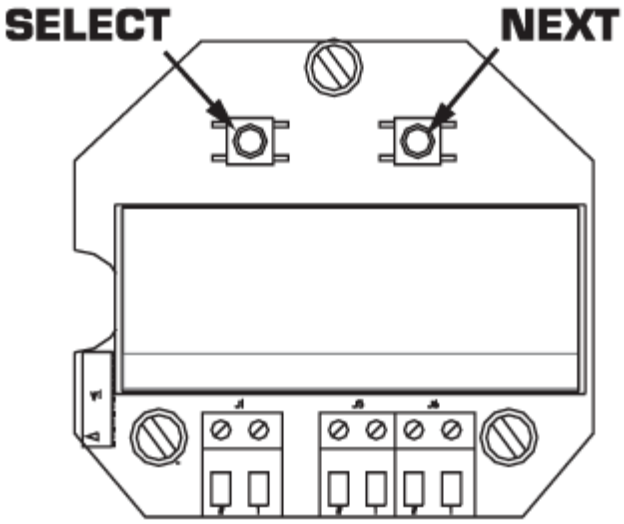


Figure 7

6 Maintenance and Repair

6.1 *Keep area around moving Beacon clean and clear of debris that could interfere with Beacon movement*

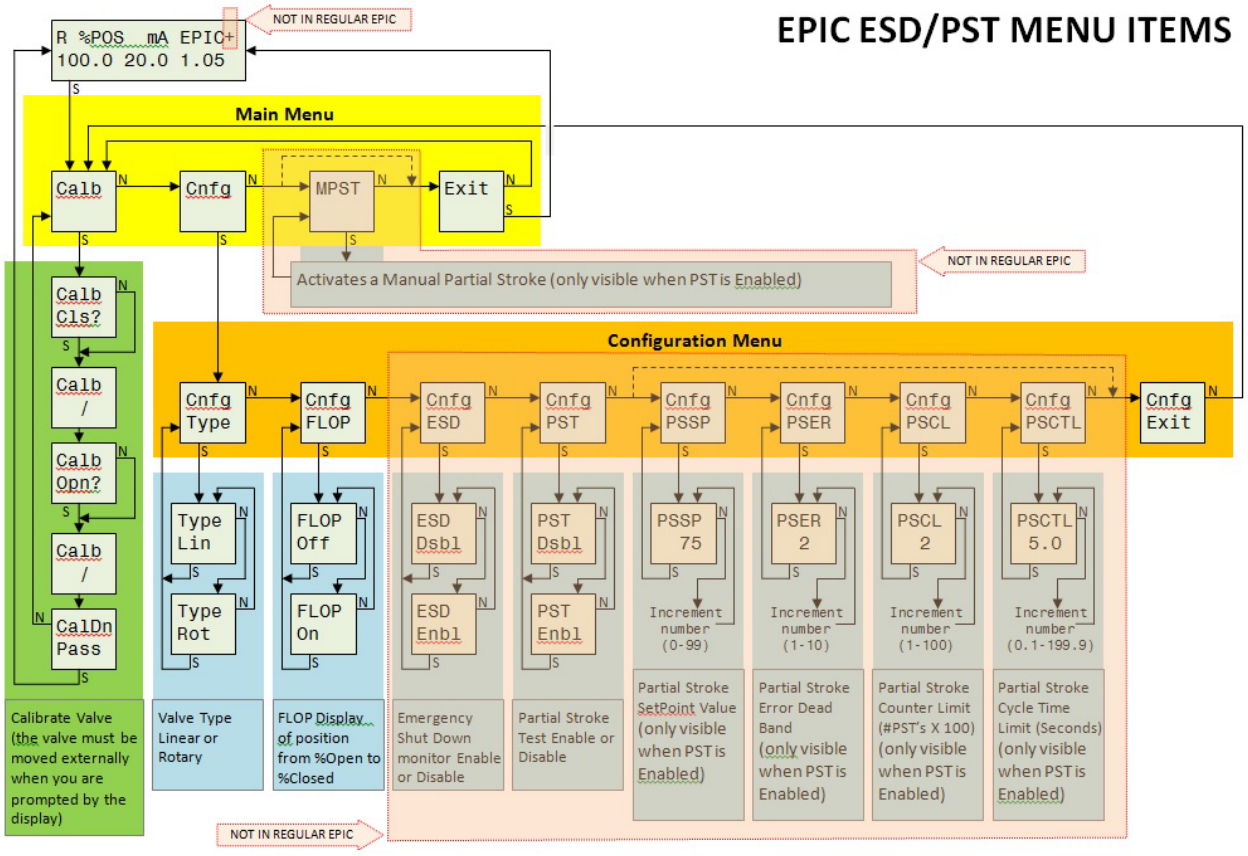
6.2 *install and maintain a filter/regulator close to solenoid valve supply pressure port to prevent debris from entering valve.*

6.3 *Flush new piping prior to operation of solenoid valve.*

6.4 *No periodic maintenance is required.*

7 Appendix

7.1 *Appendix A*



Calibration adjusts the position output signal to match the position measured by the Hall Effect sensor when the valve is in the fully open and fully closed positions. The D-EPIC does not control the valve during the calibration routine, it only monitors the position and registers the Open and Closed position values. The valve must be Opened and Closed by the PLC or by manually applying and removing voltage to the solenoid valve that controls the actuator.

PST (Partial Stroke Test) will test that a safety valve is able to respond to a command to go to the "safe" position from its "normal" (fully open or closed) position. The PST test will drive the valve toward the "safe" position while monitoring the valve position. Once a predetermined PST position set point is reached, the valve is then driven back to the "normal" position. In this way the functionality of the valve can be tested without adversely disturbing the process flow which the valve is controlling.

By reading the Break-time (the time from when the command is issued until the valve begins to move) and the Cycle-time (the time from when the command is issued until the valve returns to the "normal" position) it can be determined if the valve is operating

properly or if performance is deteriorating. The Cycle-count will record how many times the Partial Stroke Test is completed. Partial stroke can be done manually from the auxiliary input of the D-EPIC, or via HART. In PST mode, the D-EPIC controls the valve by opening a normally closed relay contact to remove power from the solenoid valve controlling the safety valve's actuator, then closes the contact again to restore power to the solenoid valve and thereby returns the safety valve to its normal position.

Valve Type can be rotary or linear. Rotary valves open and close by rotating around a shaft, while linear valves open and close by moving in a straight line. The EPIC needs to know this because the Hall Effect position sensor uses a correction factor to display position accurately for rotary valves.

Display Mode will show the current valve position as a percentage of the valve open position or as a percentage of the valve closed position.

PST (Partial Stroke Test) Control is used to enable or disable the Partial Stroke Controller. Partial stroke is initiated by shorting the two pins of the Auxiliary Input (see Fig X). This will either be done via an integral push-button on the D-Epic unit or by a remote switch or relay.

ESD (Emergency Shut Down) Control is used to enable or disable the Emergency Shut-Down Controller. The ESD Controller will monitor the auxiliary input as an indication of the ESD condition which can be displayed with the ESD Alert. ESD is normally a 24V signal from a Safety System which is present during normal operation and is removed in the Emergency Shut-Down condition. A dry-contact closure across the Auxiliary Input pins of the D-Epic (see Fig X) is required to trigger the ESD alarm function on the HART bus. An SPDT relay, whose coil driven by the 24V ESD signal, is required to perform this function. When the ESD signal is present (normal operation) the relay coil is energized and the Normally Closed contacts are open. When the ESD signal is removed or fails (emergency shut-down condition) the relay coil is de-energized and the Normally Closed contacts close, thus shorting the Auxiliary Input pins and initialing an ESD alarm. **When ESD Control is enabled the auxiliary input cannot be used for the PST function.**

Partial Stroke Setpoint will set the position value that the valve is permitted to reach during the Partial Stroke Test. Values are in percentage of valve open position and the choices are 50%, 60%, 65%, 70%, 75%, 80%, 85%, 90% and 95%. Once this position is reached during the Partial Stroke Test the EPIC will begin to open the valve again.

Partial Stroke Cycle Limit is the number of times the Partial Stroke Test is completed before a PST Cycle Alert is triggered.

Partial Stroke Time Limit is the time (in seconds) that is allocated for completion of the Partial Stroke Test. Failure to complete the test in that amount of time will result in a Cycle Time Exceeded error.

Cycle Count is the number of times the valve has finished a complete cycle (close-open-close). The valve must do a full span stroke in order for the counter to increment.

Cycle Limit is the cycle count limit above which a Cycle Count Alert will be generated if Cycle Count Alert is enabled.

Cycle Count Dead-Band is the percentage from the end of travel (fully closed and fully open) that the valve can be and still be counted in the cycle count. For instance if Cycle Count Dead-Band is 2.5% than any position less than 2.5% open is taken as a valve close position and any position greater than 97.5% open is taken as a valve open position as far as the Cycle Count is concerned.

Cycle Count Alert Control is used to enable or disable this alert notification condition.

Accumulated Count is the number of times the valve has finished a complete cycle based on accumulated valve movement. This is useful for monitoring total valve movement on a valve that does not do full span strokes. The incremental travel (independent of direction) is added together and when it reaches the equivalent of one complete cycle the counter is incremented.

Accumulated Cycle Limit is the cycle count limit above which a Accumulated Cycle Count Alert will be generated if Accumulated Cycle Count Alert is enabled.

Accumulated Cycle Count Dead-Band is the percentage of full span that the valve must move before this incremental travel will be added in the accumulated cycle count. For instance if Accumulated Cycle Count Dead-Band is 3.5% than any movement greater than 3.5% of span will be added to the sum of incremental travel.

Accumulated Cycle Count Alert Control is used to enable or disable this alert notification condition.

Travel Overshoot High is the percentage of full span that the valve can go past the fully open position before a Travel Overshoot Alert condition exists. For instance if the Travel Overshoot High is 5.0% then the Travel Overshoot Alert condition exists when the valve position is greater than 105%.

Travel Overshoot Low is the percentage of full span that the valve can go below the fully close position before a Travel Overshoot Alert condition exists. For instance if the Travel Overshoot Low is 4.0% then the Travel Overshoot Alert condition exists when the valve position is lower than -4%.

Travel Overshoot Dead-Band is the percentage of full span that the valve must travel back past the limit condition before the Travel Overshoot Alert condition is cleared. For instance if the
Travel Overshoot High is 5.0% and the Travel Overshoot Dead-Band is 1.0% then the Travel Overshoot Alert condition exists when the valve position is greater than 105% and will be cleared when the valve position goes below 104%. If the Travel Overshoot Low is

4.0% and the Travel Overshoot Dead-Band is 1% then the Travel Overshoot Alert condition exists when the valve position is lower than -4% and is cleared when the valve position goes above -3%.

Travel Overshoot Alert Control is used to enable or disable this alert notification.

PST Cycle Count Alert Control is used to enable or disable the PST Cycle Alert notification.

PST Setpoint Exceeded Alert Control is used to enable or disable the PST Setpoint Exceeded Alert notification.

PST Cycle Time Exceeded Alert Control is used to enable or disable the PST Cycle Time Exceeded Alert notification.

ESD Alert Control is used to enable or disable the ESD Alert notification.

7.2 Appendix B

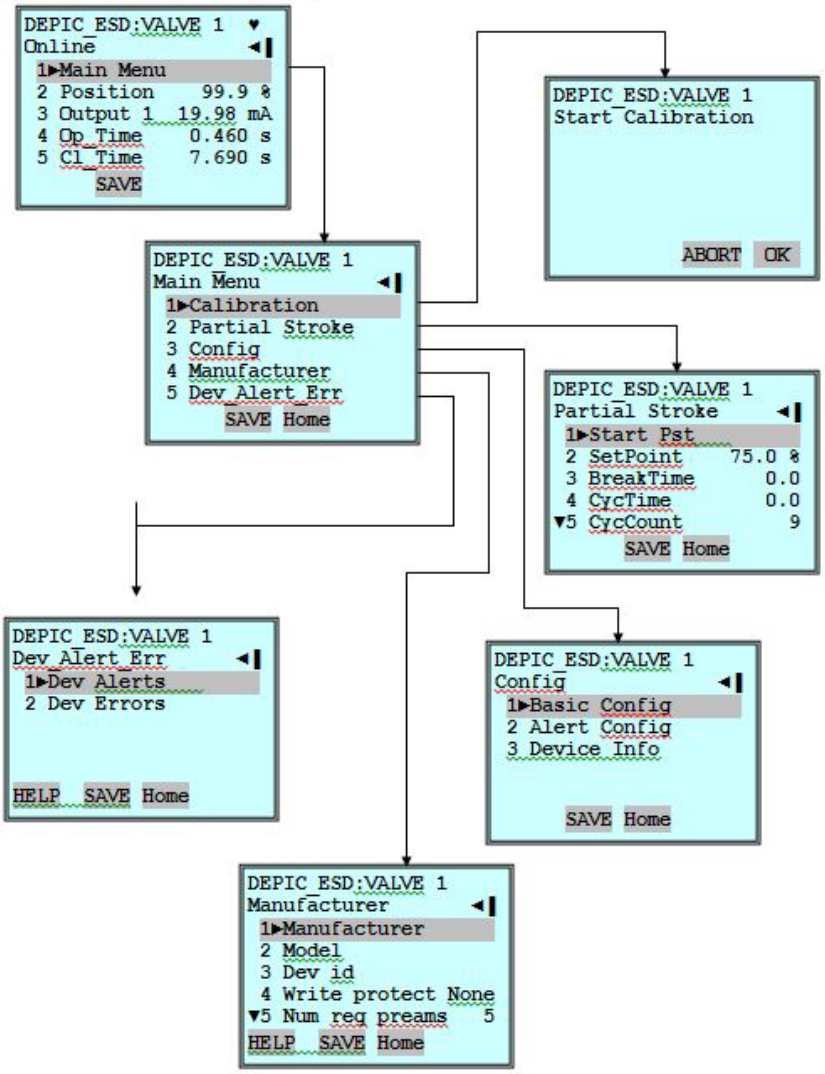
HART 475 Communicator

Quick CAL Procedure

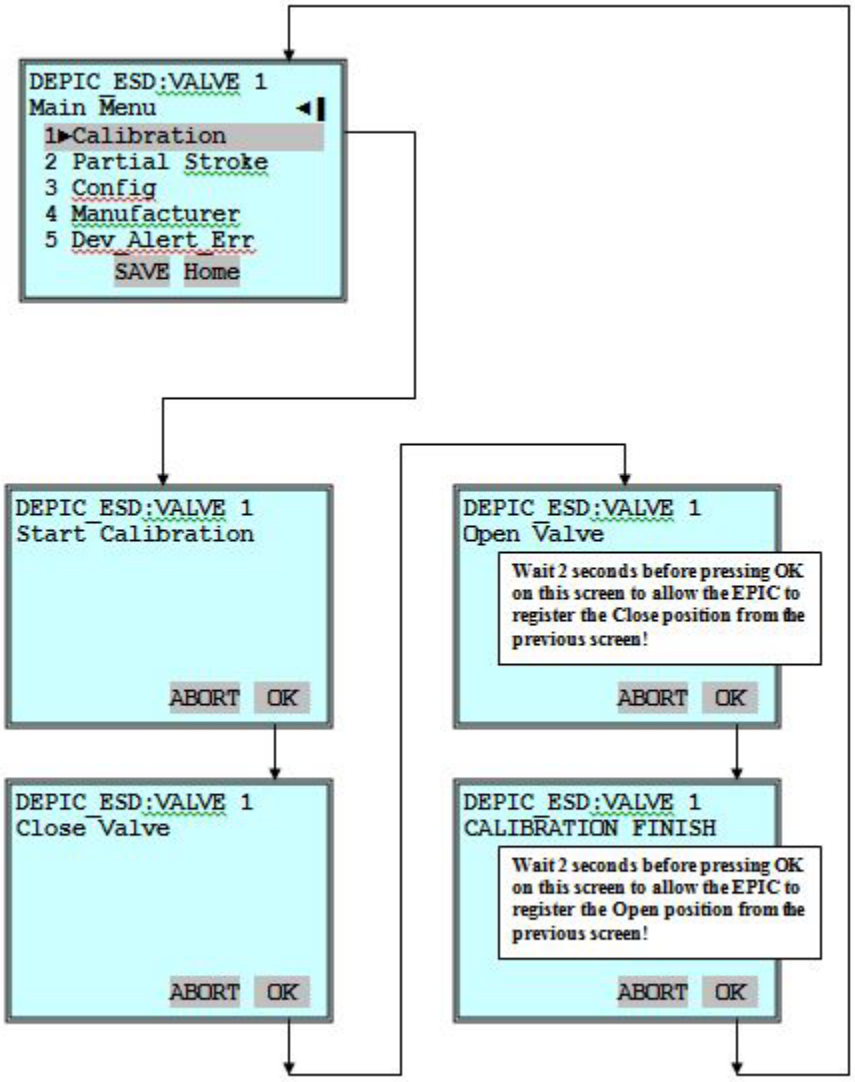
Note: For visual reference of the user interface see APPENDEX A

5.2.1 De-Energized the actuator (typically the “closed” position).
5.2.2 Press the **SELECT** Key once: **Ma Calb** is displayed.
5.2.3 Press the **SELECT** Key again to select **CLS?**
5.2.4 Press **SELECT** key again to calibrate this position as the **CLS (closed)** position.
5.2.5 Display then prompts for **OPN** (open) position
5.2.6 Energize the actuator (typically the “open” position).
5.2.7 Once the actuator has reached the full Energized position, press **SELECT** to calibrate this position as the **OPN** position.
5.2.8 Then Press the **NEXT** Key until **Exit** is displayed on the LCD.
5.2.9 Once **Exit** is displayed press the **SELECT** key to Exit calibration.
5.2.10 It is critical to wait 2 Seconds after the “CALIBRATION FINISH” screen appears before pressing “OK”.
5.2.11 it is critical to return to the “Main Menu” after doing a calibration.

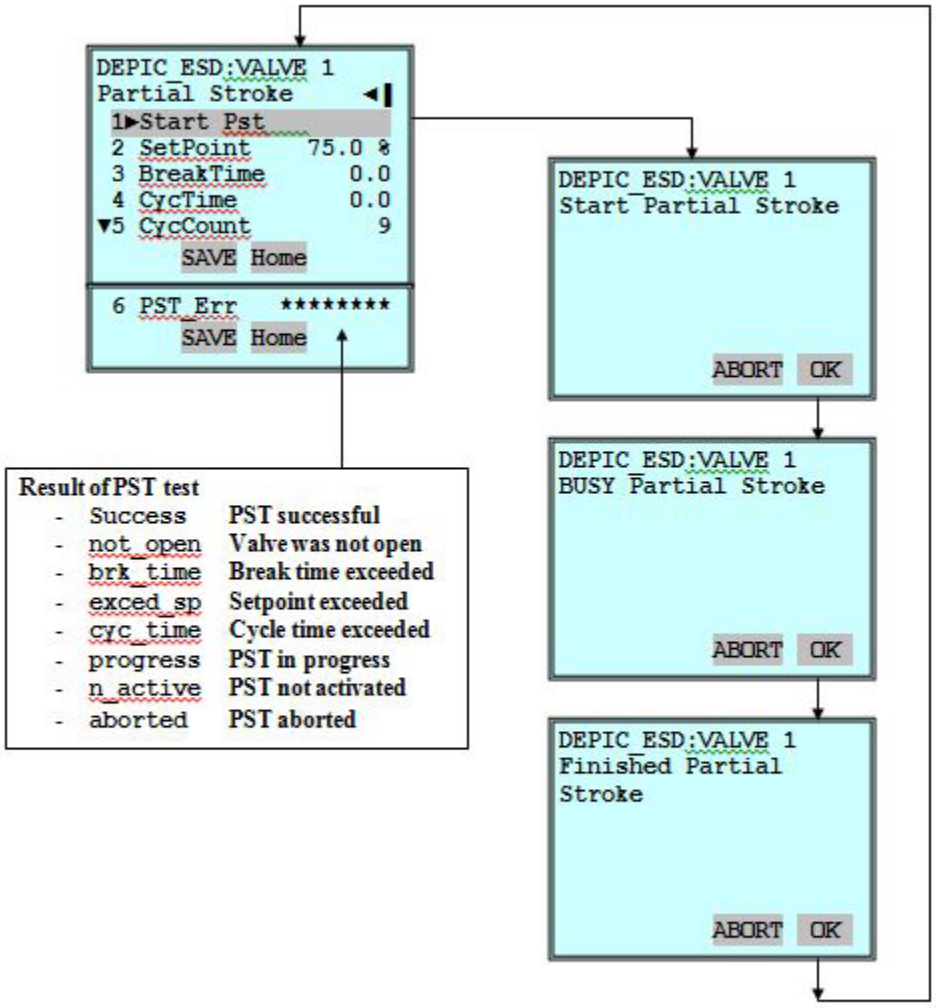
Main Menu from Home Screen item 1,



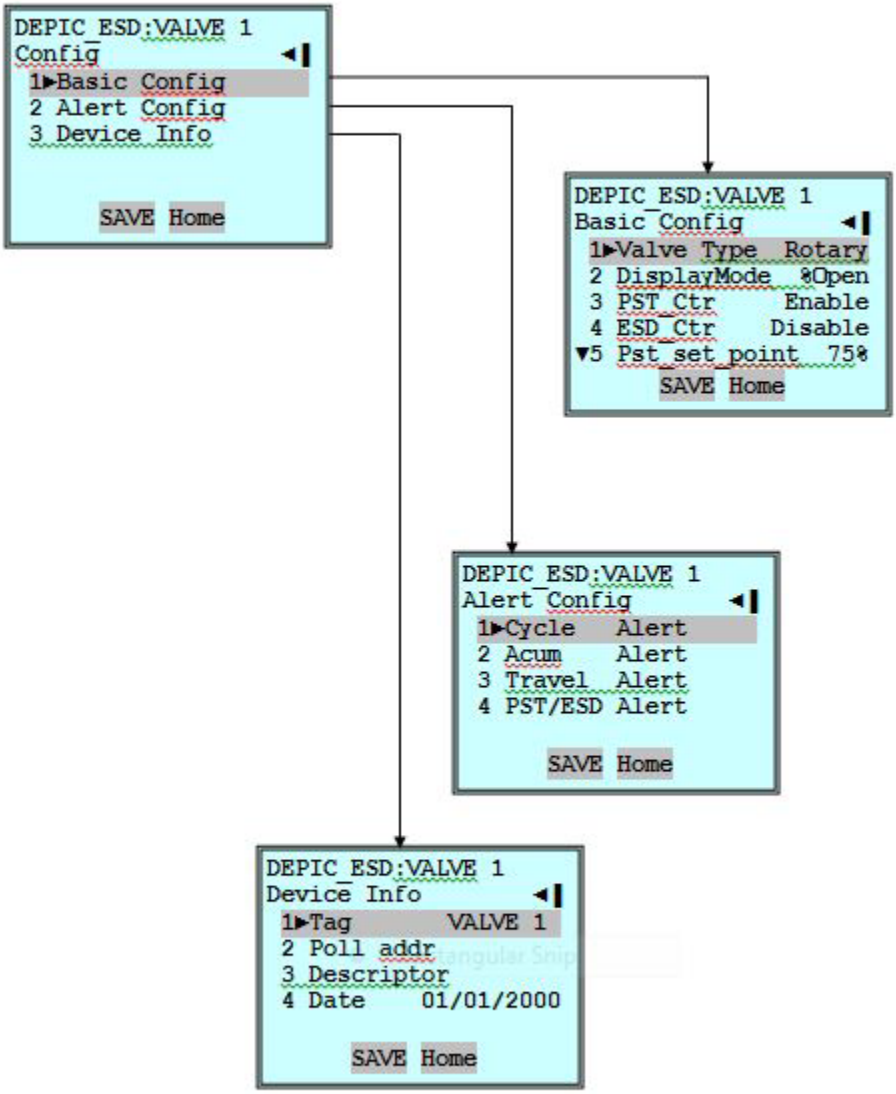
Calibration Menu from Home Screen item 1, Main Menu item 1



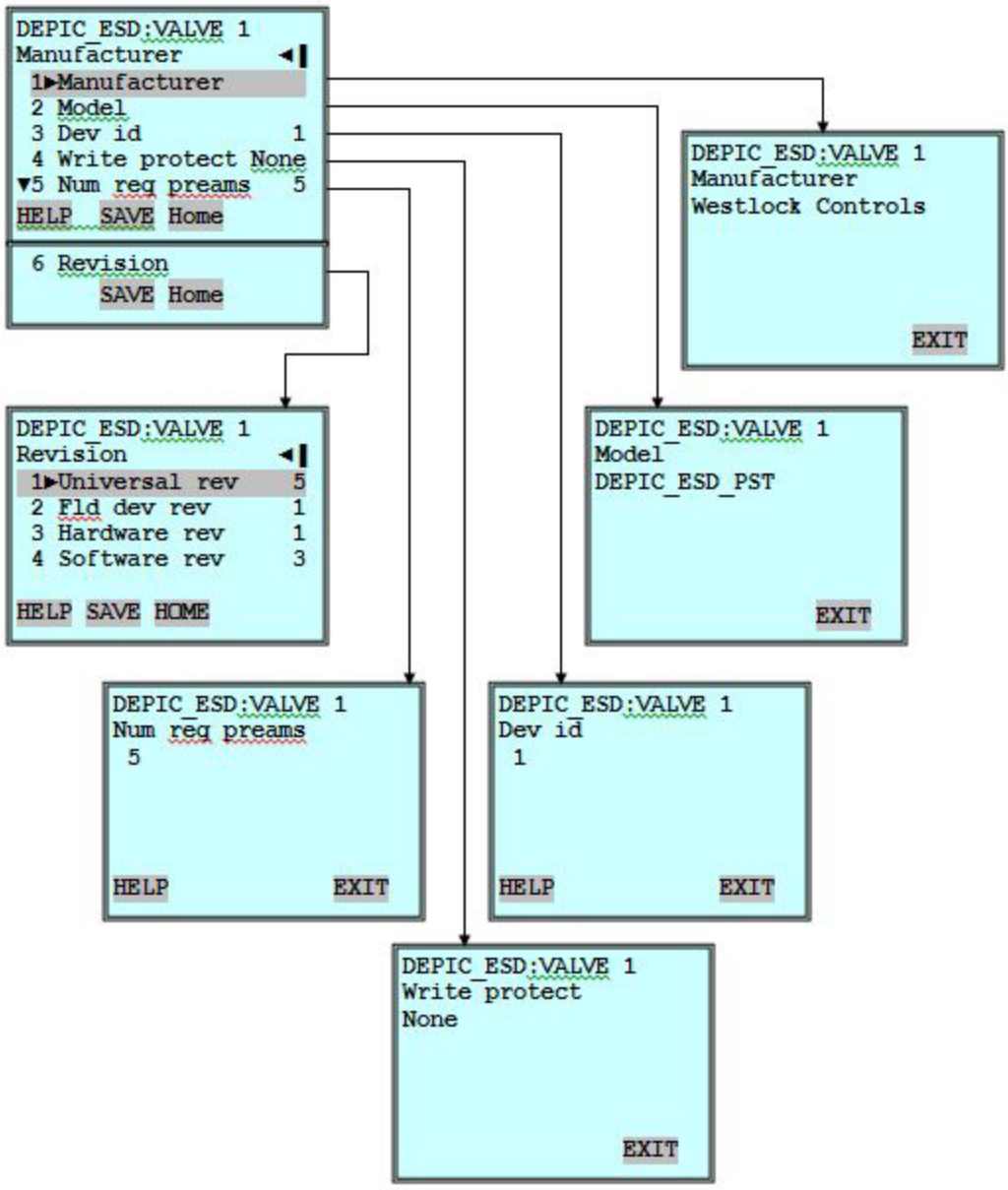
Partial Stroke Menu from Home Screen item 1, Main Menu item 2



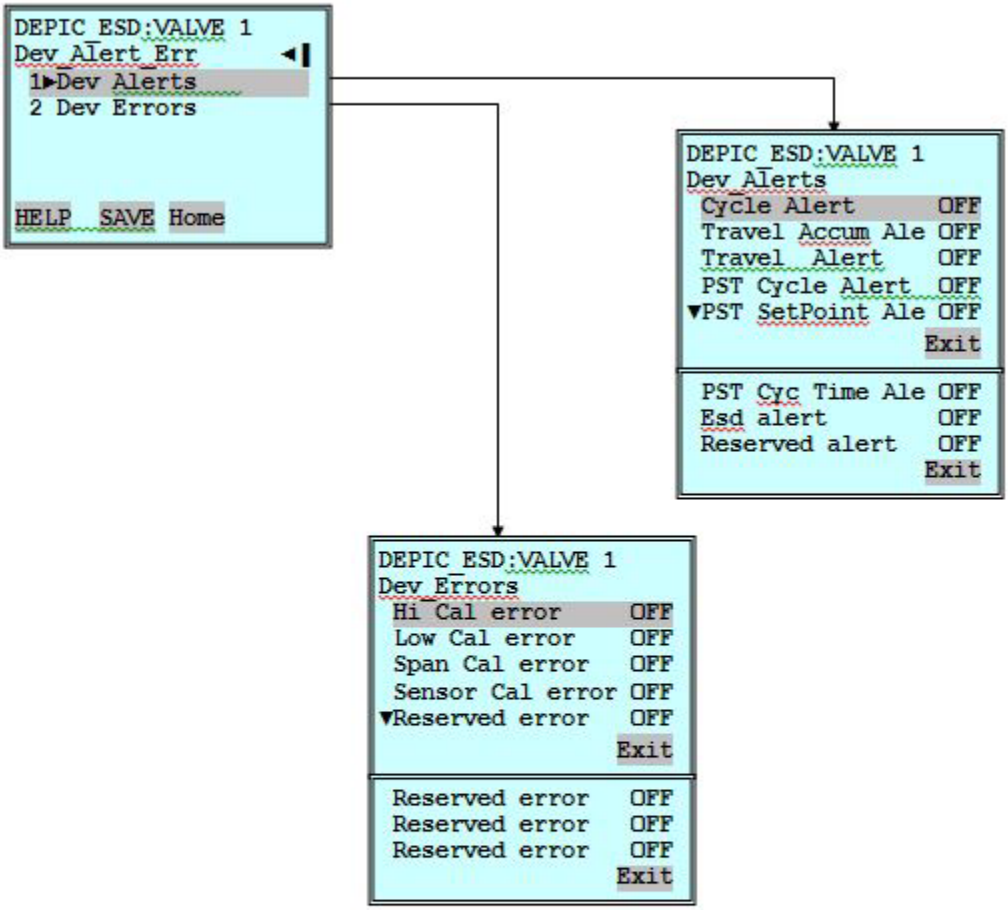
Configuration Menu from Home Screen item 1, Main Menu item 3



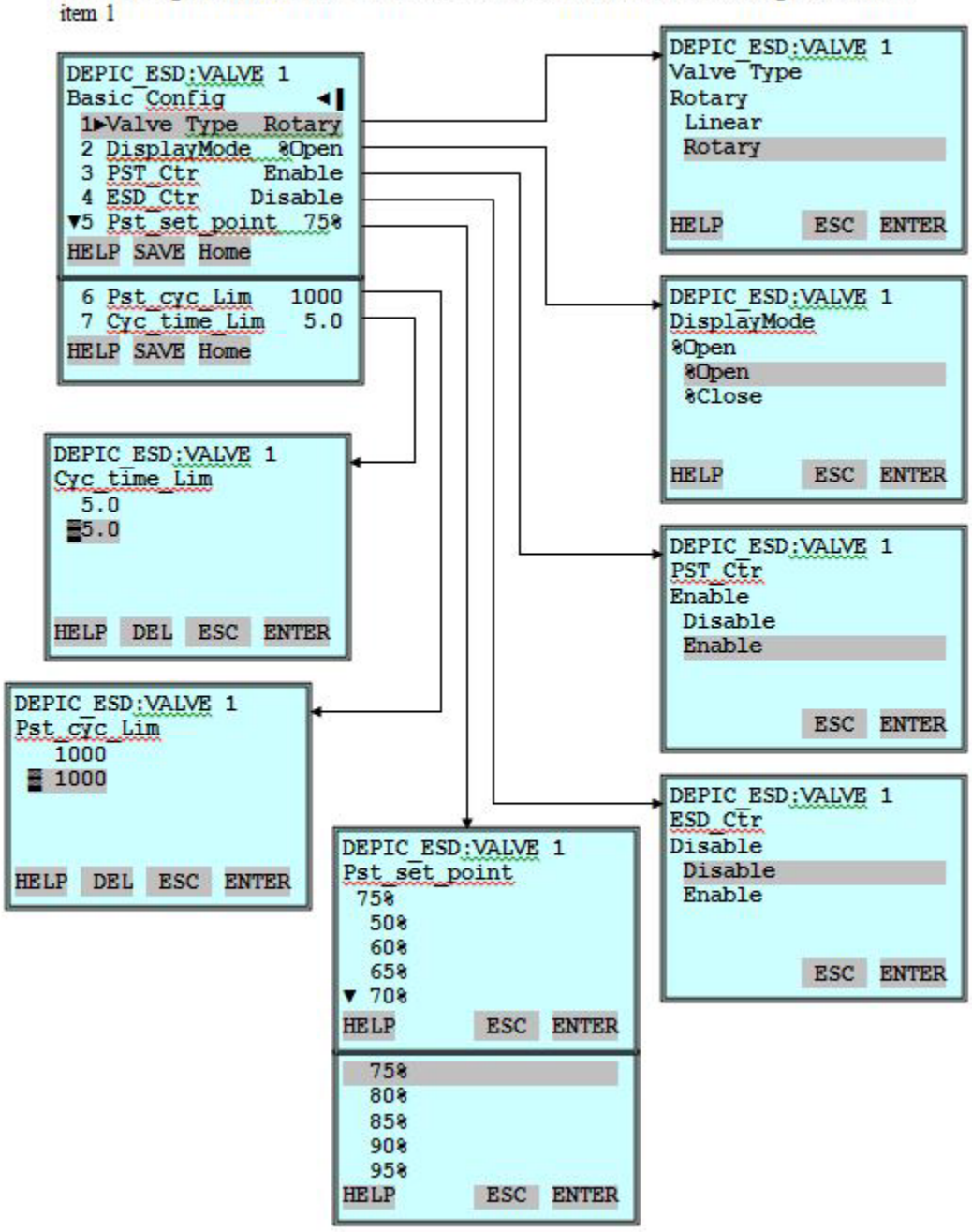
Manufacturer Information Menu from Home Screen item 1, Main Menu item 4



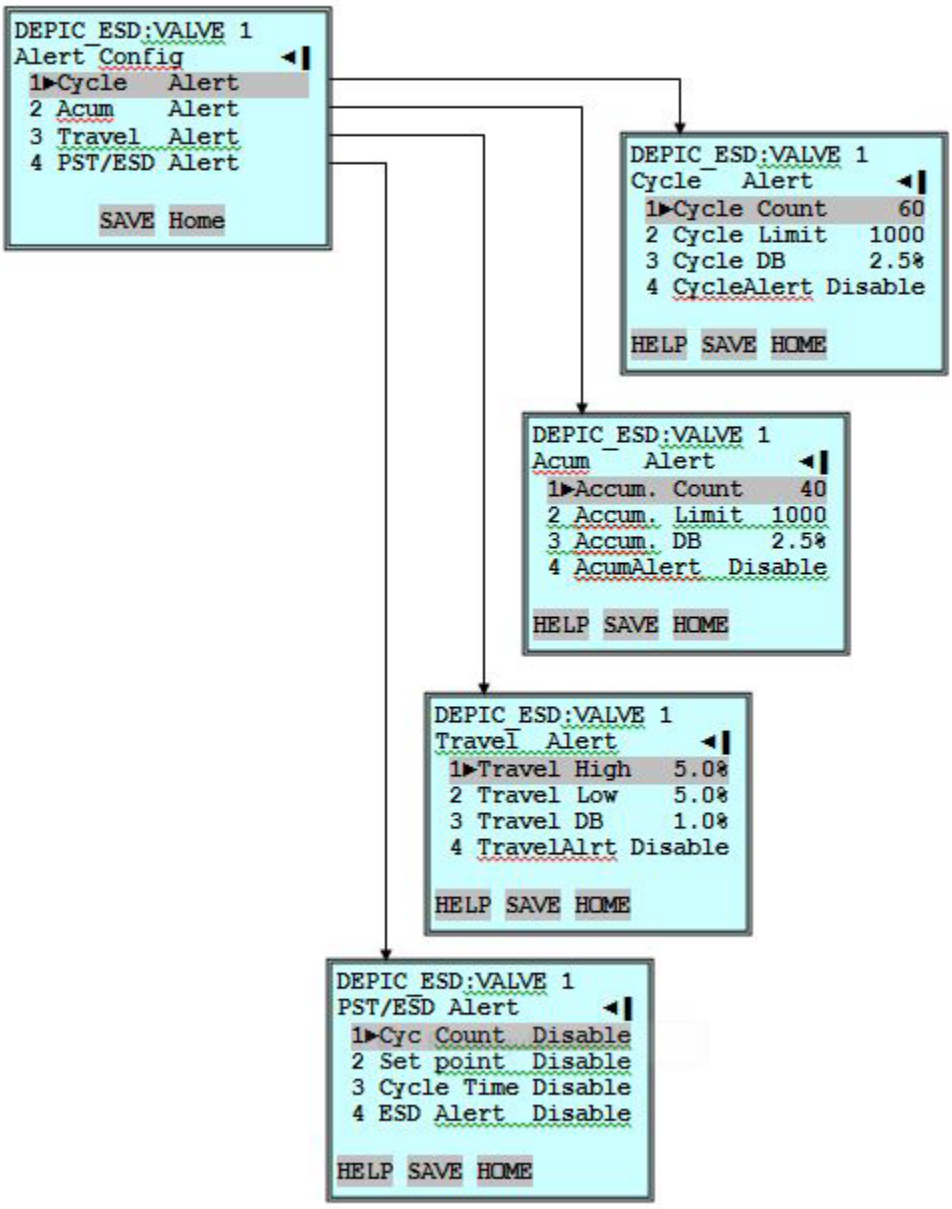
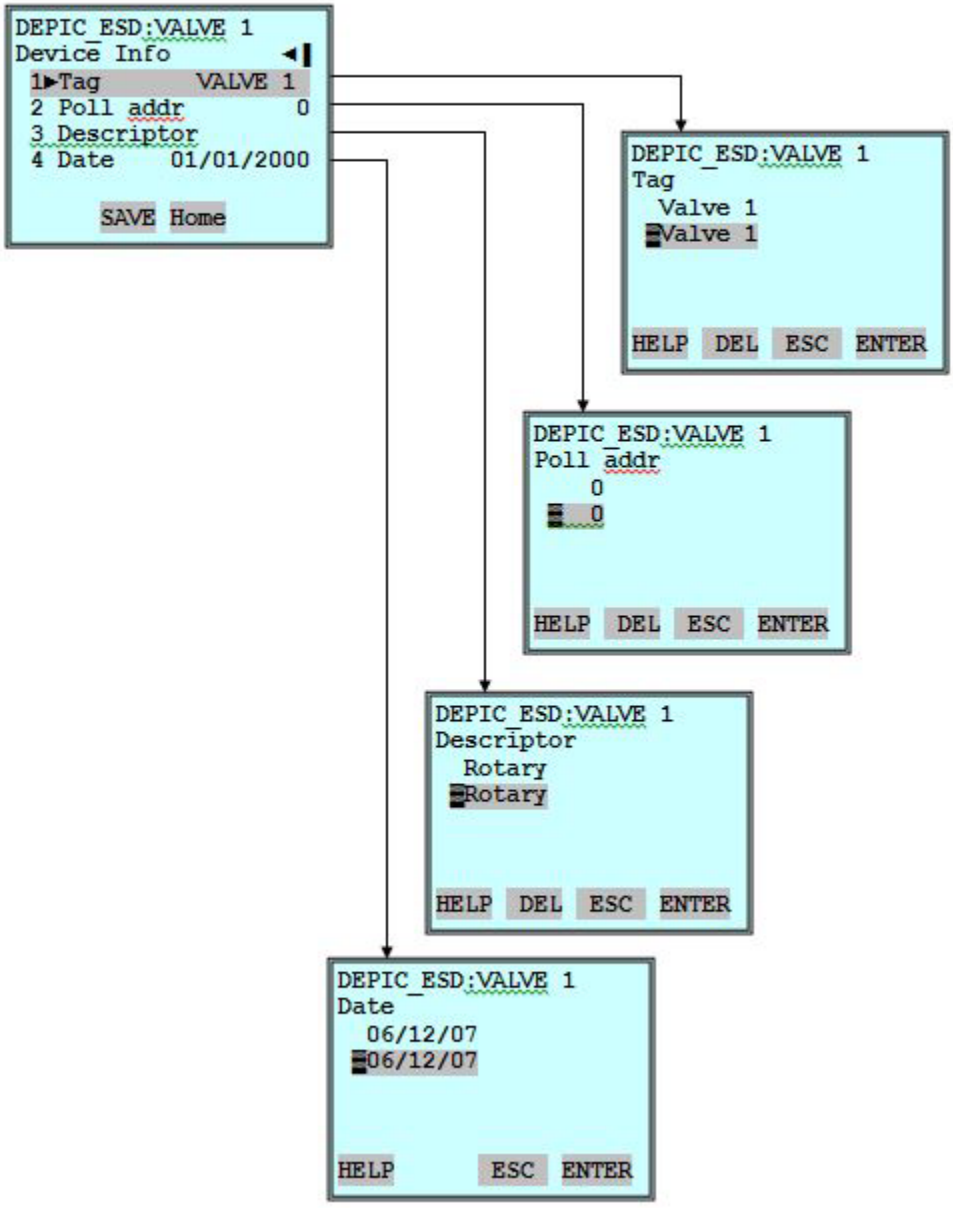
Device Alert and Error Menu from Home Screen item 1, Main Menu item 5



Basic Configuration Menu from Home Screen item 1, Main Menu item 3, Configuration Menu item 1



Alert Configuration Menu from Home Screen item 1, Main Menu item 3, Configuration Menu item 2



Device Information Menu from Home Screen item 1, Main Menu item 3, Configuration Menu item 3