WESTLOCK CONTROLS

INTELLIS 7300 SERIES

INSTALLATION AND OPERATION MANUAL

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1 INTRODUCTION

The Intellis 7300 is a family of industrial discrete valve controllers suited for the demanding applications of today's industry. It connects to any FF compliant control system and is capable of monitoring and controlling up to 2 (two) independent valves with complete diagnostics.
This IOM is valid for FPAC device revision 5 or above (DD 0501 or above). For devices with revision 4 or below (DD 0401 or below), please consult previous versions of this IOM or contact Westlock. This manual is not an introduction on fieldbus technology and is intended for users with previous knowledge on the following subjects:

- Installation and configuration of foundation fieldbus field devices.
- Valve automation, including installation and test of pneumatic valves and actuators.

1.1 Product certification

- **Hazardous ratings[1]**

  The FPAC is designed in accordance with criteria for NI and IS/FISCO devices. It requires the use of an agency approved barrier in IS applications. For information on the barrier used by Westlock Controls to obtain the agency approvals listed above, appropriate network architecture and segment device limits, refer to Control Drawing WD-11835 located in Appendix E of this document. The FPAC is approved for both Entity and FISCO IS applications. Refer to the tables below for more details and Contact Westlock to obtain the certificates.

NOTE

1. Reference only. Contact Westlock for approvals and certificates.

Certification agency	Housing/ type	Rating
FM	73x4 (Resin, Alum, SST) / Intrinsically safe	IS/I/1/ABCD/T4/Ta=80°C
	73x4 (Resin Alum SST) / Non-incendive	NI/I/2/ABCD; S/II,III/2/FG/T4 Ta=60°C TYPE 4X
ATEX	3600 (Resin,Alum,SST) / Intrinsically safe	Pending
IEC	3600 (Resin, Alum, SST) / Intrinsically safe	Pending
INMETRO	73x4 (Resin, Alum) / Intrinsically safe	Ex ia IIC T4 Gb IP66W
	7345 (Resin) / Intrinsically safe	Ex ia IIC T4 Gb IP66W
	73x4 (Resin, Alum) / Non-incendive	Pending
	7345 (Resin) / Non-incendive	Pending
	7379 (Aluminum)/ Explosion proof*	Pending

* Contact Westlock for more information.

Intrinsically safe parameters for bus connector J2 pins 1, 3

Entity	FISCO
Ui = 30 V	Ui = 17.5 V
Ii = 100 mA	Ii = 380 mA
Pi = 0.75 W	5.32 W
Ci = 5 nF	Ci = 5 nF
Li = 10 uH	Li = 10 uH

1.2 Warnings
N/A

1.3 Description
1.3.1 Technical specification

- **Fieldbus information**
  - ITK version: 6.1.1
  - PHY compliance: FF-830 FS2.0
  - MANUFAC_ID: 0x574343
  - DEV_TYPE: 0x0001
  - DEV_REV: 0x05
  - DD_REV: 0x01[2]
  - No of Blocks: 1xRB, 4xTB, 6xDI, 4xDO, 1xAI
  - Block execution time: 30 ms (DI, DO, AI)
  - Device class: BASIC
  - Default address: 234 (0xEA)
  - More at: www.fieldbus.org

- **Fieldbus input**
  - Connector: J2 (pins 1 and 3)
  - Grounding: J3 pin 2 (do not connect cable shield)
  - Operating voltage: 9 to 32 VDC (Max 35 VDC)
  - Bus current: 12 mA (17 mA in high current mode)
  - Non-resettable fuse: 50 mA

- **Discrete inputs TOP and BOTTOM**
  - Internal Hall Effect sensors
  - Indicate CLOSED and OPENED
  - Activated by cam shaft magnets
  - Resolution: ± 2% degrees

- **Discrete inputs AUX1 and AUX2**
  - Connector: J4 (pins 1,2 and 3,4)
  - Maximum cable length: 3 m (10 feet)
  - Suitable for dry-contact switches. See Drawing WD-12059 in the Appendix for inductive sensor and open-drain/collector option)
  - Embedded pull-up 510 k to 3.1 V

- **Discrete outputs OUT0 and OUT1**
  - Connector: J3 (pins 1,2 and 3,4)
  - Maximum cable length: 3 m (10 feet)
  - Current source for up to 2 (two) ultra-low power solenoids powered from the bus
  - Open circuit voltage: 6.5 VDC
  - Maximum operating current: 5.0 mA
  - Output impedance: 320 Ohms
  - Overcurrent limited to 5.2 mA (it indicates short-circuit when the output is active)
  - Minimum load current: 1 mA (it indicates open circuit when the output is active)

- **Real time clock (optional)**
  - Adjusted using diagnostic transducer block
  - Used for automatic PST[3] function
  - Back-up: Lithium battery
  - Back-up life: 10 years at 20°C (68°F)
  - Contact Westlock for this option

- **Temperature sensor**
  - Embedded digital temperature sensor
  - Used for alarm generation
  - Accuracy[4]: ± 2°C

- **Potentiometer input (optional)**
  - Connector: J5
  - Industrial ruggedized pre-installed
  - Angle of rotation: 30 to 110 degrees
  - Maximum wire length: 10 cm (4 inches)
  - Resolution: 0.2% FS
  - Accuracy[5]: ± 1% FS
  - Closed/Opened tolerance: ± 2% FS
  - Contact Westlock for this option

- **Environmental**
  - Operating[6]: -40°C to +85°C (-40°F to +185°F)
  - Storage: -40°C to +85°C (-40°F to +185°F)
  - Relative Humidity: 0 to 95% non-condensed
  - Vibration: 2 g, 10 Hz to 1000 Hz
  - Shock: 18 g, 3 axis, 100 bumps each axis
  - References: IEC61514-2, IEC 60068-2-29/27, IEC 61298-3, IEC 60068-2-1/2

- **Ingress Protection rating (base models)**
  - 7344: IP65
  - 7379: IP65
  - Contact Westlock for other models

- **Reliability data**
  - MTBF (Electronic module): Pending.
  - Reference: MIL-HDBK-217F N1/2.

NOTES

2. For reference only. Check your actual device or consult Westlock for more information.
3. Future implementation, contact Westlock for more information.
4. Combined linearity, hysteresis and repeatability over the operating temperature range.
5. Combined linearity, hysteresis and repeatability over the operating range.
6. Valid for general purpose application only. Contact Westlock for hazardous areas. It does not include pneumatic assembly.

• Electro-Magnetic Compatibility (EMC):

Immunity test	Standard	Level	Class*
Electrostatic Discharge - ESD	IEC 61000-4-2	Direct ±4 kV, air ±8 kV	A
Electric Fast Transient Burst - EFTB	IEC 61000-4-4	±2 kV	A
Lightning Surge - SURGE	IEC 61000-4-5	±1 kV	A
Power Frequency Magnetic Field - PFMF	IEC 61000-4-8	30 A/m 50 Hz and 60 Hz	A
Radiated Immunity - RI	IEC 61000-4-3	10 V/m 80 MHz-1 GHz 3 V/m 1 GHz-2.7 GHz	A
Conducted Immunity - CI	IEC 61000-4-6	10 Vrms 150 kHz-80 MHz	A

NOTE

* Class A: device does not exhibit noticeable interference. Class B: device may exhibit temporary interference with loss of function, but self-recovers. Reference standards: IEC 61514-2, IEC61326, IEC61000-6-4, IEC61000-6-2.

Emissions test	Standard	Level	Class
Radiated Emissions - RE	CISPR 11	Class A QP 3 m	A
Conducted Emissions - CE	CISPR 22	Class A	A

1.4 Principles of operation

1.4.1 Configuration

Now that you have determined your application and wired the bus, limit switches and solenoids, it is time to configure the module in order to control and/or monitor the valve(s). For this you will make use of the resource, transducer, channel and function blocks.

1.4.2 Blocks modes

The MODE_BLK parameter controls the block execution and is comprised of four sub-parameters:

1. Target: determines which mode the user wants the block to assume. Usually it needs to be set to OOS before any configuration parameter can be changed.
2. Actual: set by the block during its execution based on the target and internal diagnostics. Typically it needs to be in AUTO or CAS (cascade) for the block to execute its normal function.
3. Permitted: defines the modes supported by this block.
4. Normal: desired operating mode of the block in normal operation.

When a block is in Out of Service mode (O/S or OOS) it will not run and the associated data will have Bad Status. If the mode is OOS the output of the function block is usually maintained at the last value but can be configured to go to a predefined fail state (See section "Fault State / Fail Safe Configuration". Parameter configurations are usually performed in OOS mode so there is no bump in a running process. Before a particular block will be usable in a configuration, the mode must not be OOS and block specific parameters may need modification (appropriate Channel or ACTION_ELEMENT selected, etc.).

MODE_BLK PARAMETER (VALUES IN HEXDECIMAL)

Value	Enumerations	Notes
0x01	Remote-Output (Rout)	
0x02	Remote-Cascade (RCas)	
0x04	Cascade (CAS)	Typical mode for DO blocks
0x08	Automatic (AUTO)	Typical mode for transducers, DI and AI blocks
0x10	Manual (MAN)	Use this mode to actuate manually
0x20	Local Override (LO)	
0x40	Initialization Manual (IMan)	
0x80	Out of Service (OOS or O/S)	Out of Service, block is not running

1.4.3 Blocks and I/O channels

Throughout this document, all references to blocks are made using factory default tags, but in a real application block tags are different from TB1 or DI_1 (more likely TRANSDUCER482 or FFDI35). Thus, it is useful to know how to find out in your application the block you want to configure or link. The table below shows the pre-instantiated blocks, their VFD indexes (object directory/table index) and the physical I/O that every block can access through the proper configuration of the transducer parameters and function blocks channels.

Default block tag	VFD index	Description	Top hall (open)	Bottom hall (close)	Aux1 J4 1,2 (open)	Aux2 J4 3,4 (close)	Out0 J3 1,2 (valve 1)	Out1 J3 3,4 (valve 2)	Maskable	Aux3 J5 (analog)
RB	407	Resource block	-	-	-	-	-	-	-	-
TB1-STD-VALVE1	482	Standard discrete transducer block valve 1	•	•	•	•	•	•*	•	•
TB2-STD-VALVE2	554	Standard discrete transducer block valve 2	•	•	•	•	•*	•	•	•
TB3-DIAG-VALVE1	626	Diagnostics transducer block valve 1	•	•	•	•	•	•*	•	•
TB4-DIAG-VALVE2	694	Diagnostics transducer block valve 2	•	•	•	•	•*	•	•	•
DI_1	762	Discrete input for general purpose	•	•	•	•	-	-	•	-
DI_2	791	Discrete input for general purpose	•	•	•	•	-	-	•	-
DI_3	820	Discrete input for general purpose	•	•	•	•	-	-	•	-
DI_4	849	Discrete input for general purpose	•	•	•	•	-	-	•	-
DI_5	878	Discrete input for general purpose	•	•	•	•	-	-	•	-
DI_6	907	Discrete input for general purpose	•	•	•	•	-	-	•	-
DO_1	936	Discrete output for general purpose	•	•	•	•	•	•	-	•
DO_2	967	Discrete output for general purpose	•	•	•	•	•	•	-	•
DO_3	998	Discrete output for general purpose	•	•	•	•	•	•	-	•
DO_4	1029	Discrete output for general purpose	•	•	•	•	•	•	-	•
AI	1060	Analog input for potentiometer/temperature	-	-	-	-	-	-	-	•

• available

* Transducer controls both outputs only when configured for Double Action.

Note: the "Maskable" signal is the only virtual I/O in the FPAC. It is generated by the combination of certain conditions configured in the transducer block, typically for advanced diagnostics. See Advanced Valve Diagnostics chapter for further details.

Before the FPAC can be configured it is important to understand which I/O channels and function blocks are available. The following function blocks are pre-instantiated in the device:

- Discrete Input (DI): 6 (six). DI blocks can be used to read position feedback, auxiliary inputs and diagnostic alarms (maskable signal), depending on which channel is configured.
- Discrete Output (DO): 4 (four). DO blocks can be used to control one or two outputs (solenoid) AND to read position feedback.
- Analog Input (AI): 1 (one). AI block can be used to read position feedback when the optional potentiometer is installed, or device's onboard temperature.

The function blocks behavior will depend on which option has been configured in the CHANNEL parameter. See in the next sections a detailed description of all I/O channels available for these function blocks. The I/O channels provide value and status for the function blocks. There are 5 (five) possible values for the position feedback of a valve that can be read from the blocks. The transducer block parameters WORKING_POS_D and FINAL_POSITION_VALUE_D read and pass along to DIs and DOs the following values via the configured CHANNEL.

Value	Description
0: Closed / Not Opened	The transducer block is indicating the valve is closed or not opened, depending on the selected CHANNEL.
1: Opened / Not Closed	The transducer block is indicating the valve is opened or not closed, depending on the selected CHANNEL.
2: Stopped / Intermediate	The transducer block is indicating the valve has been stopped by a DO block, depending on the selected CHANNEL.
3: Opening / Intermediate	The transducer block is indicating the valve is moving from closed to opened position. Both limit switches are not active.
4: Closing / Intermediate	The transducer block is indicating the valve is moving from opened to closed position. Both limit switches are not active.

On the other hand, there are only 3 (three) possible values* to write to a DO block set-point to control the valve position. The DO will pass along these values to the transducer block, via configured CHANNEL, to parameters FINAL_VALUE_D and WORKING_SP_D, which in turn can assume the values:

Value	Description
0: Close	The transducer block is indicating there is a DO commanding the valve to move to the closed position.
1: Open	The transducer block is indicating there is a DO commanding the valve to move to the opened position.
2: Stop	The transducer block is indicating there is a DO commanding the valve to stop at the current position (it removes power from the physical output OUT0, OUT1 or both when in Double Action applications.

* Values > 2 do not affect the DO block.

NOTE
See Appendix I for a diagram of the connections between the transducers and function blocks.

1.4.3.1 Standard transducer block overview
Transducer blocks are responsible for isolating the function blocks from the specificities of the device's I/O subsystem. The following transducer blocks are available:
- Standard Discrete Transducer: 2 (two), used to control up to two valves.
- Diagnostics Transducer: 2 (two), used for the diagnostics of up to two valves.

These transducer blocks work in pairs:
- TB1 and TB3 form a pair of transducers that works for the "local valve" or "valve 1". All configuration and diagnostics related to valve 1 reside in this pair of transducers.
- TB2 and TB4 form the other pair of transducers that work for the "remote valve" or "valve 2". All configuration and diagnostics related to valve 2 reside in this pair of transducers.

	Position feedback indication			Output
	Opened	**Opening/closing/stopped**	**Closed**	**Solenoid***
Local (Valve 1)	TOP Hall sensor: active	Top = Bottom = both active or not active	TOP Hall Effect sensor not active	OUT0 (J3 1,2) active opens the valve
	BOTTOM Hall sensor: not active		BOTTOM Hall Effect sensor active	OUT0 not active closes the valve
Remote (Valve 2)	AUX1 (J4 1,2): pins shorted out	AUX1 = AUX2 = both opened or shorted out	AUX1 (J4 1,2): pins opened	OUT1 (J3 3,4) active opens the valve
	AUX2 (J4 3,4): pins opened		AUX2 (J4 3,4): pins shorted out	OUT1 not active closes the valve

* If the solenoid requires the use of the two outputs, use OUT0 to move the valve to the opened position and OUT1 to move the valve to the closed position.

1.4.3.2 Outstanding parameters

See Appendix B for factory default procedure and Appendix D for a complete list of parameters including default values. The transducer block parameters that determine the normal operation of the device and are mandatory to configure are the following:

- ACTION_ELEMENT: select the type of application, Single Action, Double Action or Monitoring. Single Action means the transducer block will control the valve using only one physical output either OUT0 or OUT1. Double Action means the transducer will control both outputs OUT0 and OUT1. Monitoring tells the transducer just to look at the limit switches and ignore the output. Monitoring applications do not need a Discrete Output block or I/O, while the others need at least one DO.
- IO_ASSIGNMENT: selects the physical I/O used for opened limit switch, closed limit and solenoid output, in this order.
- SIGNAL_ACTION: selects the polarity of the physical output. Default is "0: Increase to Open" which means '1' in the transducer/DO set-point will energize the physical output. If configured to "1: Increase to Close" the same '1' in the transducer/DO set-point will make the physical output de-energize. This can also be seen from the associated output LED. This is useful when configuring fail opened or fail closed valves. Pneumatics have to be installed accordingly to obtain the desired valve position.

There are some optional parameters that can be configured in order to document the application, like ACT_TYPE, which indicates the type of the assembly (rotary, linear etc.). This parameter does not affect the operation of the device though. See Appendix D for the complete list of parameters.

After the transducer block is properly configured it can be used to control the outputs and to read the limit switches. The transducer block mode should be set to MAN. Then, the following parameters can be used to verify the position feedback:

- WORKING_POS_D: the actual measured discrete feedback position. This is the raw value obtained from the limit switches configured with IO_ASSIGNMENT parameter. For example, if the limit switch that indicates valve opened is active, WORKING_POS_D = '1' (OPENED).
- FINAL_POSITION_VALUE_D: the actual valve position and status. This is the value sent to be used for a DI block or as the READBACK_D in a DO block.

The following parameters can be used to control the physical outputs:

- WORKING_SP_D: the final discrete command value to the positioning algorithm. This parameter can be written by the user when the transducer block mode is MAN. This is the raw value that goes to the physical output(s) configured in the IO_ASSIGNMENT parameter depending on the configuration of the ACTION_ELEMENT parameter. For example, if ACTION_ELEMENT = 2: Double Action, and user writes WORKING_SP_D = '1' (OPEN), the transducer will command the 2 outputs to a state where the valve should move to the opened position. In the default configuration is corresponds to OUT1 energized and OUT2 off.
- FINAL_VALUE_D: the requested valve position and status written by a DO Block. This parameter can only be written by a properly configured DO block.

The table below shows the relation between parameters IO_ASSIGNMENT, WORKING_POS_D and the physical inputs. In the table below the value "0,0" or "1,1" means both limit switches not active or both are active, respectively:

	Top, Bottom = 0.0 or 1.1	Top, Bottom = 1.0	Top, Bottom = 0.1
IO_ASSIGNMENT		**WORKING_POS_D**	
0: No selection	0	0	0
1: Top,Bottom,Out0	2	1	0
2: Top,Bottom,Out1	2	1	0
3: Bottom,Top,Out0	2	0	1
4: Bottom,Top,Out1	2	0	1

	Aux1,Aux2 = 0.0 or 1.1	Aux1,Aux2 = 1.0	Aux1,Aux2 = 0.1
IO_ASSIGNMENT		**WORKING_POS_D**	
5: Aux1,Aux2,Out0	2	1	0
6: Aux1,Aux2,Out1	2	1	0
7: Aux2,Aux1,Out0	2	0	1
8: Aux2,Aux1,Out1	2	0	1

	Pot=INTERMEDIATE	Pot=OPENED	Pot=CLOSED
IO_ASSIGNMENT		**WORKING_POS_D**	
9: Analog,Out0	2	1	0
10: Analog,Out1	2	1	0

NOTE

Top = Top hall sensor, Bottom = Bottom hall sensor, '1' = Limit switch active, '0' = Limit switch not active
WORKING_POS_D: 0 = CLOSED, 1 = OPENED, 2 = INTERMEDIATE.

- Example #1: IO_ASSIGNMENT = 1: Top, Bottom, Out0. When magnet activates the Top Hall sensor but not the bottom sensor, WORKING_POS_D = 1 = OPENED.
- Example #2: IO_ASSIGNMENT = 8: Aux2, Aux1, Out1. When the Aux1 input is active (shorted out) but Aux 2 is not, WORKING_POS_D = 0 = CLOSED.
- Example #3: IO_ASSIGNMENT = 9: Analog,Out0. If the shaft is in the middle of the stroke WORKING_POS_D = 2 = INTERMEDIATE.
- Example #4: IO_ASSIGNMENT = 4: Bottom,Top,Out1. If both sensors are active or both sensors are not active, it will indicate WORKING_POS_D = 2 = INTERMEDIATE. This condition maybe a problem and should be fixed if persists.

The following tables show the relationship between the parameters IO_ASSIGNMENT, WORKING_SP_D and the physical outputs OUT0 and OUT1. The result also depends on parameters SIGNAL_ACTION and ACTION_ELEMENT:

- **ACTION_ELEMENT = 1: Single Action**
  - SIGNAL_ACTION = 0: Increase to Open or 1:Increase to Close.
  - WORKING_SP_D > 1 does not affect the outputs.
  - OUT/OUT1: 0 = output not energized; 1 = output energized; NA: Not affected.

	ACTION_ELEMENT = 1: Single Action							
	WORKING_SP_D = 0				**WORKING_SP_D = 1**			
	SIGNAL_ACTION = 0		**SIGNAL_ACTION = 1**		**SIGNAL_ACTION = 0**		**SIGNAL_ACTION = 1**	
IO_ASSIGNMENT	OUT0	OUT1	OUT0	OUT1	OUT0	OUT1	OUT0	OUT1
0: No selection	NA	NA	NA	NA	NA	NA	NA	NA
1: Top,Bottom,Out0	0	NA	1	NA	1	NA	0	NA
2: Top,Bottom,Out1	NA	0	NA	1	NA	1	NA	0
3: Bottom,Top,Out0	0	NA	1	NA	1	NA	0	NA
4: Bottom,Top,Out1	NA	0	NA	1	NA	1	NA	0
5: Aux1,Aux2,Out0	0	NA	1	NA	1	NA	0	NA
6: Aux1,Aux2,Out1	NA	0	NA	1	NA	1	NA	0
7: Aux2,Aux1,Out0	0	NA	1	NA	1	NA	0	NA
8: Aux2,Aux1,Out1	NA	0	NA	1	NA	1	NA	0
9: Analog,Out0	0	NA	1	NA	1	NA	0	NA
10: Analog,Out1	NA	0	NA	1	NA	1	NA	0

- **ACTION_ELEMENT = 2: Double Action**
  - SIGNAL_ACTION = 0: Increase to Open or 1:Increase to Close.
  - WORKING_SP_D > 2 does not affect the outputs.
  - OUT/OUT1: 0 = output not energized; 1 = output energized; NA: Not affected.

1.4.4 DI (Discrete Input) channels

The discrete input channels will reflect the physical I/O depending on the configuration made on the transducer blocks TB1 and TB2. They can be used to read the position feedback as well as some advanced diagnostics. The following channels are available for the DI blocks:

• Typical applications use channels 9, 14, 15 or 29.

DI block - Discrete input channels		OUT_D.Value	Description
0	No Transducer Connection	-	Default value for DI_2 to DI_6.
9	TRD1: 0-Closed / 1-Opened	0 = CLOSED 1 = OPENED 3 = OPENING 4 = CLOSING	OUT_D will indicate '0' when the I/O configured in TB1 indicates closed and '1' for opened. This is the factory default value for DI_1.
10	TRD1: 0-Not Opened / 1-Opened	0 = Any other 1 = OPENED	OUT_D will indicate '1' when TB1 indicates valve OPENED and '0' for any other position (closed, opening, closing, stopped). Typically used in combination with channel 11.
11	TRD1: 0-Not Opened / 1-Opened	0 = Any other 1 = CLOSED	OUT_D will indicate '1' when TB1 indicates valve CLOSED and '0' for any other position (opened, opening, closing, stopped). Typically used in combination with channel 10.
12	TRD1: 0-Closed / 1-Opened / 2-Stopped	0 = CLOSED 1 = OPENED 2 = STOPPED 3 = OPENING 4 = CLOSING	OUT_D will indicate '0' when the I/O configured in TB1 indicates closed, '1' for opened and '2' for stopped. Value 2 = STOPPED is valid only when the FPAC is controlling the valve through a DO block and the transducer is configured as Double Action.
13	TRD1: Maskable Signal	0 = NOT ACTIVE 1 = ACTIVE	It show the state of the maskable signal configured in TB1.
14	Auxiliary Input 1	0 = NOT ACTIVE 1 = ACTIVE	AUX1 input is active when pins 1 and 2 of J4 are shorted out. This channel is connected directly to the physical I/O and does not use the transducer block.
15	Auxiliary Input 2	0 = NOT ACTIVE 1 = ACTIVE	AUX2 input is active when pins 3 and 4 of J4 are shorted out. This channel is connected directly to the physical I/O and does not use the transducer block.
29	TRD2: 0-Closed / 1-Opened	0 = CLOSED 1 = OPENED 3 = OPENING 4 = CLOSING	OUT_D will indicate '0' when the I/O configured in TB2 indicates closed and '1' for opened. This is the factory default value for DI_1.
210	TRD2: 0-Not Opened / 1-Opened	0 = Any other 1 = OPENED	OUT_D will indicate '1' when TB2 indicates valve opened and '0' for any other position (closed, opening, closing, stopped). Typically used in combination with channel 211.
211	TRD2: 0-Not Closed / 1-Closed	0 = Any other 1 = CLOSED	OUT_D will indicate '1' when TB2 indicates valve closed and '0' for any other position (opened, opening, closing, stopped). Typically used in combination with channel 210.
212	TRD2: 0-Closed / 1-Opened / 2-Stopped	0 = CLOSED 1 = OPENED 2 = STOPPED 3 = OPENING 4 = CLOSING	OUT_D will indicate '0' when the I/O configured in TB2 indicates closed, '1' for opened and '2' for stopped. Value 2 = STOPPED is valid only when the FPAC is controlling the valve through a DO block and the transducer is configured as Double Action.
213	TRD2: Maskable Signal	0 = Any other 1 = OPENED	It show the state of the maskable signal configured in TB2.

There are some basic rules to follow when working with DI channels:

1. More than one DI can be configured to use the same channel. For example, DI_1 and DI_3 can be configured with channel 9: TRD1: 0-Closed / 1-Opened.
2. Channels 10, 11 and 210, 211 typically work in pairs requiring two DIs: one DI to indicate the valve is opened and another DI to indicate the valve is closed.
3. The auxiliary inputs can be used for any application where one needs to monitor a dry-contact switch. Just connect the dry-contact switch to one of the auxiliary inputs (J4) and configure the correct channel in the DI block (channels 14 and 15).

- Example #1: one rotary valve (local) with one DI for feedback position using transducer TB1:
  - Configure the DI block channel with 9: TRD1: 0-Closed / 1-Opened.
- Example #2: one rotary valve (local) with double action solenoid, one DI for position feedback using TB1:
  - Configure the DI block channel with 12: TRD1: 0-Closed / 1-Opened / 2-Stopped. The stopped will only be seen when the DO block commands the valve to stop.
- Example #3: one linear valve (remote) with two independent DIs for opened and closed positions, using transducer TB2:
  - Configure the channel of the first DI block (OPENED indication) with 210: TRD2: 0-Not Opened / 1-Opened.
  - Configure the channel of the second DI block (CLOSED indication) with 211: TRD2: 0-Not Closed / 1-Closed.
- Example #4: two valves, one rotary (local) and one linear (remote), with feedback position using TB1 and TB2. Configure one DI for each valve:
  - Configure the channel of the first DI block (local valve) with 9: TRD1: 0-Closed / 1-Opened.
  - Configure the channel of the second DI block (remote valve) with 209: TRD2: 0-Closed / 1-Opened.
- Example #5: one rotary valve (local) with feedback position using one DI, transducer TB1 and one leak detector switch with dry contact output connected to AUX1:
  - Configure the DI block channel with 9: TRD1: 0-Closed / 1-Opened.
  - Configure another DI block channel with 14: Auxiliary Input 1.

1.4.5 DO (Discrete Output) channels

The discrete output channels will control physical outputs and read limit switches depending on the configuration made on the transducer blocks TB1 and TB2. The following channels are available for the DO blocks:

• Typical applications use channels 1 or 21.

DO block - Discrete Output Channels		DO Set-point*	Description
0	No Transducer Connection	-	Default value for DO_2 to DO_4.
1	TRD1: 0-Close / 1-Open	0 = CLOSE 1 = OPEN	Writing '1' to the DO block set-point will make TB1 open the valve while '0' will close the valve.
2	TRD1: 0-Not Open / 1-Open	0 = Other DO 1 = OPEN	Writing '1' to the DO block will make TB1 open the valve, while '0' will release the control to another DO block. Typically used in combination with channel 3 and 4 to control double action solenoid valves.
3	TRD1: 0-Not Close / 1-Close	0 = Other DO 1 = CLOSE	Writing '1' to the DO block will make TB1 CLOSE the valve, while '0' will release the control to another DO block. Typically used in combination with channels 2 and 4 to control double action solenoid valves.
4	TRD1: 0-Not Stop / 1-Stop	0 = Other DO 1 = STOP	Writing '1' to the DO block will make TB1 STOP the valve, while '0' will release the control to another DO block. Typically used in combination with channels 2 and 3 to control double action solenoid valves.
5	TRD1: 0-Close / 1-Open / 2-Stop	0 = CLOSE 1 = OPEN 2 = STOP	Writing '1' to the DO block will make TB1 OPEN the valve, while '0' will make TB1 CLOSE the valve and in the case of a Double Action solenoid, '2' will make TB1 STOP the valve (de-energize both outputs).
21	TRD2: 0-Close / 1-Open	0 = CLOSE 1 = OPEN	Writing '1' to the DO block will make TB2 open the valve while '0' will close the valve.
22	TRD2: 0-Not Open / 1-Open	0 = Other DO 1 = OPEN	Writing '1' to the DO block will make TB2 OPEN the valve, while '0' will release the control to another DO block. Typically used in combination with channel 3 to control double action solenoid valves.
23	TRD2: 0-Not Close / 1-Close	0 = Other DO 1 = CLOSE	Writing '1' to the DO block will make TB2 CLOSE the valve, while '0' will release the control to another DO block. Typically used in combination with channels 23 and 24 to control double action solenoid valves.
24	TRD2: 0-Not Stop / 1-Stop	0 = Other DO 1 = STOP	Writing '1' to the DO block will make TB2 STOP the valve, while '0' will release the control to another DO block. Typically used in combination with channels 22 and 23 to control double action solenoid valves.
25	TRD2: 0-Close / 1-Open / 2-Stop	0 = CLOSE 1 = OPEN 2 = STOP	Writing '1' to the DO block will make TB2 OPEN the valve, while '0' will make TB2 CLOSE the valve and in the case of a Double Action solenoid, '2' will make TB2 STOP the valve (de-energize both outputs).
91	FSTATE - TRD 1 (Valve 1)	TBD	TBD
92	FSTATE - TRD2 (Valve 2)	TBD	TBD

* Set-point can be SP_D or CAS_IN_D depending on the mode and application.

Depending on the channel selected on one DO block, some constraints may apply to the remaining channels:

DO CHANNEL INTERLOCKS

Selected channel	0	1/21	2/22	3/23	4/24	5/25	91/92
1/21	O	X	X	X	X	X	O
2/22	O	X	X	!	O	X	O
3/23	O	X	!	X	O	X	O
4/24	O	X	O	O	X	X	O
5/25	O	X	X	X	X	X	O
91/92	O	O	O	O	O	O	X

! - Required (Two DO blocks are required), X - Not allowed, O - Optional

As indicated in the table above, there are certain rules associated with the DO channels:

1. A channel cannot be used by more than one DO block. If more than one DO is using a channel for the same transducer block, that transducer will not work and the physical inputs and output wills remain frozen until this condition is fixed.
2. Channels 2, 3, 4, 22, 23 and 24 are meant for applications where the solenoid valve employs two coils/piezos (Double Action, one coil to open the valve and another coil to close the valve) AND the user wants to control each coil separately using up to 3 (three) DO blocks and the two physical outputs OUT0 and OUT1. When these channels are used with Single Action solenoid valves (one coil), it means there will be more than one DO block controlling one physical output at the same time. If it happens and the DO blocks force the physical output to different logic levels, the physical output will remain frozen until the condition ceases.
3. The effect of the channels 4 and 24 (STOP) on the physical output is to de-energize the output (Single Action) or both outputs (Double Action).
4. It is important to verify the configuration of the transducer block and to check the output LEDs to make sure the DO is working as expected.

Note: for double action valves it is possible to command the DO to "STOP" the valve at the current position writing value '2' to the DO set-point. The transducer block will deactivate both OUT0 and OUT1 to trap the air in the actuator causing the valve to stay at the current position. Depending on the time to open or close the valve may stop at any intermediate position.
Note: if a value higher than '2' is written to the DO block set-point (or to the transducer block set-point) the device will enter into fault state and remain until this conditions ceases.
When properly configured, the DO blocks can be used to control and monitor the position feedback, usually through BKCAL_OUT_D and READBACK_D. Typically the IO_OPTS parameter will have the bit 9 set (Use PV for BKCAL_OUT). This way BKCAL_OUT_D will indicate the real position of the valve. The values these parameters will show are the same as for the DI blocks, namely:

Possible Values for BKCAL_OUT_D and READBACK_D	
0 = CLOSED	Parameter will indicate '0' when the channel configured in the DO indicates closed, '1' for opened and '2' for stopped. Value 2 = STOPPED is valid only when the FPAC is controlling the valve through a DO block and the transducer is configured as Double Action. Closing and Opening are intermediate states when both limit switches are not active.
1 = OPENED	
2 = STOPPED	
3 = OPENING	
4 = CLOSING	

Note: notice that, although the DO blocks can be used to provide position feedback through BKCAL_OUT_D or READBACK_D, the DI blocks can be used freely in combination with the DOs, depending only on the application and correct configuration of the transducer blocks and channels.

- Example #1: one rotary valve (local) with one DO for control and position feedback, using transducer TB1:
  - Configure the DO block channel with 1: TRD1: 0-Close / 1-Open. The position feedback can be read from BKCAL_OUT_D or READBACK_D.
- Example #2: one rotary valve (local) with Double Action solenoid (two coils/piezos), one DO for control and position feedback using TB1:
  - Configure the DO block with channel 5: TRD1: 0-Close / 1-Open / 2-Stop.
- Example #3: one linear valve (remote) with Double Action solenoid (two coils/piezos) and three independent DOs for opened, closed and stopped positions, using transducer TB2:
  - Configure the channel of the first DO block (OPEN) with 22: TRD2: 0-Not Open / 1-Open.
  - Configure the second DO block (CLOSE) with 23: TRD2: 0-Not Close / 1-Close.
  - Configure the third DO (STOP) to 24: TRD2: 0-Not Stop / 1-Stop.
  - Position feedback can be read from BKCAL_OUT_D or READBACK_D.
- Example #4: two valves, one rotary (local) and one linear (remote), with feedback position using TB1 and TB2. Configure one DO for each valve:
  - Configure the channel of the first DO block (local valve) with 1: TRD1: 0-Close / 1-Open.
  - Configure the second DO block (remote valve) with 21: TRD2: 0-Close / 1-Open.
  - The position feedback can be read from BKCAL_OUT_D or READBACK_D.

1.4.5.1 READBACK_D parameter operating modes

To enable BKCAL_OUT_D parameter report the actual position, the IO_OPTS parameter "Bit 9: Use PV for BKCAL_OUT" must be set to '1'. The DO block mode must be OOS before modifying IO_OPTS. This way BKCAL_OUT_D will publish position feedback according to READBACK_D parameter.

The READBACK_D parameter indicates the actual position of the valve when properly configured. This parameter has some special operating modes configured with the XD_STATE parameter. When the XD_STATE parameter is '0' (default), the READBACK_D can assume the following values:

- XD_STATE = '0' (default):
  0 = CLOSED
  1 = OPENED
  2 = STOPPED
  3 = OPENING
  4 = CLOSING

Changing XD_STATE parameter to other values makes READBACK_D assume different values according to the table below:

READBACK_D	Value	XD_STATE = 64001 (0xFA01)	XD_STATE = 64000 (0xFA00)
Bit0	0	OUT0 NOT active	TB1.FINAL_VALUE_D = 0 (Close)
	1	OUT0 active	TB1.FINAL_VALUE_D = 1 (Open)
Bit1	0	OUT1 NOT active	TB2.FINAL_VALUE_D = 0 (Close)
	1	OUT1 active	TB2.FINAL_VALUE_D = 1 (Open)
Bit2	0	BOTTOM Hall sensor NOT active	TB1.FINAL_POSITION_VALUE_D = 0 (Closed)
	1	BOTTOM Hall sensor active	TB1.FINAL_POSITION_VALUE_D = 1 (Not Closed)
Bit3	0	TOP Hall sensor NOT active	TB1.FINAL_POSITION_VALUE_D = 0 (Opened)
	1	TOP Hall sensor active	TB1.FINAL_POSITION_VALUE_D = 1 (Not Opened)
Bit4	0	AUX1 shorted out	TB1.FINAL_POSITION_VALUE_D = 0 (Stopped)
	1	AUX1 opened	TB1.FINAL_POSITION_VALUE_D = 1 (Not Stopped)
Bit5	0	AUX2 shorted out	TB2.FINAL_POSITION_VALUE_D = 0 (Closed)
	1	AUX2 opened	TB2.FINAL_POSITION_VALUE_D = 1 (Not Closed)
Bit6*	0	Analog = CLOSED	TB2.FINAL_POSITION_VALUE_D = 0 (Opened)
	1	Analog = OPENED	TB2.FINAL_POSITION_VALUE_D = 1 (Not Opened)
Bit7	0	Associated channel NOT in Fault state	TB2.FINAL_POSITION_VALUE_D = 0 (Stopped)
	1	Associated channel in Fault state	TB2.FINAL_POSITION_VALUE_D = 1 (Not Stopped)

* Only valid when transducer is configured to use the analog potentiometer to read position. IO_ASSIGMENT = "Analog,Out1/2"

Note: the status of the READBACK_D parameter is not affected by the XD_STATE parameter.

1.4.6 AI (Analog Input) channels

There are two channels available for the AI block:

AI - Analog Input Channels		Description	XD_SCALE and OUT_SCALE
0	No Transducer Connection	No transducer channel assigned.	Not necessary
1	Actual Position	Default value for the AI block. Outputs the valve position from 0% to 100%.	• EU_100 = 100 • EU_0 = 0 • UNITS_INDEX = % = XDUCER_UNITS (this unit comes from the transducer) • DECIMAL = 3
2	Internal Temperature	Outputs the onboard temperature.	• EU_100 = 200 • EU_0 = -100 • UNITS_INDEX = XDUCER_UNITS (this unit comes from the transducer as °C or °F) • DECIMAL = 3

Before the AI block can be used for position monitoring:
- The optional potentiometer must be installed and calibrated. See section about potentiometer calibration for further detail. Contact Westlock for more information on this option.
- Transducer block TB1 or TB2 must be configured with IO_ASSIGMENT = "9: Analog,Out0" or "10: Analog,Out1"
- AI.CHANNEL = "1: Actual Position"
- XD_SCALE and OUT_SCALE parameters should be configured to match the channel according to the previous table.

Before the AI block can be used for onboard temperature monitoring:
- Transducer block TB1 or TB2 must have INTERNAL_TEMP_UNITS configured to °C or °F
- AI.CHANNEL = "2: Internal Temperature"
- XD_SCALE and OUT_SCALE parameters should be configured to match the channel according to the previous table.

1.4.7 Configuration overview

Configuration of the FPAC module demands full understanding of all blocks involved, including Resource, Transducer and Function blocks. It also requires the reader has previous knowledge on how to install and configure Foundation Fieldbus field devices. Although a myriad of parameters are available in the blocks, just a small number of them needs to be configured in order to make FPAC work as required. The most important parameters that have to be configured are the following:

- RESOURCE BLOCK
  - MODE_BLK
- STANDARD TRANSDUCER BLOCK
  - MODE_BLK
  - SIGNAL_ACTION: controls the polarity of the physical output.
  - ACTION_ELEMENT: indicates the type of device being controlled/monitored:

		TB2.ACTION_ELEMENT			
TB1.ACTION_ELEMENT	**0: No selection**	**1: Single Action**	**2: Double Action**	**3: See other transducer**	**4: Monitoring**
0: No selection	OK	OK	Invalid	OK	OK
1: Single Action	OK	OK*	Invalid	Invalid	OK
2: Double Action	OK	Invalid	Invalid	OK	Invalid
3: See other transducer	Invalid	Invalid	OK	Invalid	Invalid
4: Monitoring	OK	OK	Invalid	Invalid	OK

* Set dipswitch #6 to ON and parameter SET_CURRENT_SINK = 2: Current Level 2.
For all the other configurations the dipswitch #6 must be OFF.
The option "3: See other transducer" is automatically selected when Double Action is selected in the other transducer.

IO_ASSIGNMENT: assigns physical I/O to the transducer. Each transducer must use different I/O even if the transducer is only monitoring. The valid combinations are detailed in the table below:

	TB2.IO_ASSIGNMENT										
TB1.IO_ASSIGNMENT	**0: No selection**	**1: Top,Bottom,Out0**	**2: Top,Bottom,Out1**	**3: Bottom,Top,Out0**	**4: Bottom,Top,Out1**	**5: Aux1,Aux2,Out0**	**6: Aux1,Aux2,Out1**	**7: Aux2,Aux1,Out0**	**8: Aux2,Aux1,Out1**	**9: Analog,Out0**	**10:Analog,Out1**
0: No selection	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
1: Top,Bottom,Out0	OK	X	X	X	X	X	OK	X	OK	X	OK
2: Top,Bottom,Out1	OK	X	X	X	X	OK	X	OK	X	OK	X
3: Bottom,Top,Out0	OK	X	X	X	X	X	OK	X	OK	X	OK
4: Bottom,Top,Out1	OK	X	X	X	X	OK	X	OK	X	OK	X
5: Aux1,Aux2,Out0	OK	X	OK	X	OK	X	X	X	X	X	OK
6: Aux1,Aux2,Out1	OK	OK	X	OK	X	X	X	X	X	OK	X
7: Aux2,Aux1,Out0	OK	X	OK	X	OK	X	X	X	X	X	OK
8: Aux2,Aux1,Out1	OK	OK	X	OK	X	X	X	X	X	OK	X
9: Analog,Out0	OK	X	OK	X	OK	X	OK	X	OK	X	X
10: Analog,Out1	OK	OK	X	OK	X	OK	X	OK	X	X	X

- DISCRETE OUTPUT BLOCK:
  - MODE_BLK
  - CHANNEL
  - IO_OPTS
  - SHED_OPTS
- DISCRETE INPUT BLOCK
  - MODE_BLK
  - CHANNEL
  - L_TYPE
- ANALOG INPUT BLOCK
  - MODE_BLK
  - CHANNEL
  - OUT_SCALE
  - XD_SCALE

The DIAGNOSTIC transducer block does not require any configuration for the basic usage and will be addressed in the section "Advanced Valve Diagnostics".
You will need to identify how to configure each of these parameters on your particular FF Host and for your particular application. The FPAC DD provides a configuration method/wizard to make the basic step-by-step configuration very easy. Some configuration examples will be shown in the following sections.

1.4.8 Fault State Configuration
Three failure scenarios are considered: power failure, communication failure and internal failure:

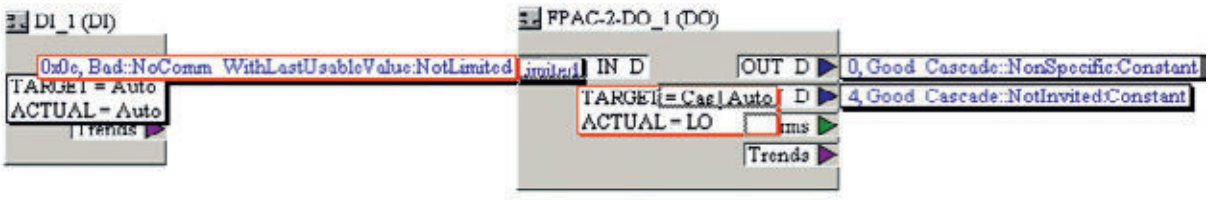
1. During a power failure event, the pneumatics (air supply, solenoid, actuator, tubing etc.) should ensure the fail-safe position is achieved. The FPAC electronic module is out of the loop. Carefully verify the pneumatic installation and simulate this condition before assembly acceptance.
2. When a communication failure event is detected and FPAC has lost the setpoint sent by another block in the application, it can move the valve to a pre-configured fault state / fail safe position. This also happens when there is no LAS in the bus to maintain the FF communication.
3. When an internal block failure occurs, one of the blocks in the FPAC experiments a fault condition, bad status or is forced to Out of Service mode. This condition may also happen in normal situations like when the user is downloading a new configuration, for example. In this case a fault state condition can also be configured.

The configuration made in the transducer block takes precedence over the DO block. In other words, the DO block IFS will only prevail if the transducer block is not forcing the fault state condition.
Note: fail last applications typically require a double coil/piezo solenoid that allows the air to be trapped inside the actuator during failures, including power failures. See wiring example #2 for more details.

1.4.9 Resource block fault state parameters
- FAULT_STATE parameter located in the Resource block indicates if the device is in a fault condition.
- SET_FSTATE and CLR_FSTATE parameters can be used to force and clear this condition for maintenance and test purposes.

1.4.10 Discrete output block fault state (IFS) parameters
The DO block will be present in the application whenever the FPAC is controlling the valve position. The DO block has standard parameters that allow a fault state action to be specified on detection of an input with bad status or uncertain quality. The configuration for these parameters follows the standard IFS specification. The following parameters have to be configured in the DO:

- IO_OPTS: there are 3 bits in this parameter to control the fault state actions:
  - Bit4: Fault State to value. If this bit is set to '0' (Freeze) the output will hold the current value (freeze) if a fault is detected. If this bit is set to '1' (Go to preset value), the output will go to the preset FSTATE_VAL_D value.
  - Bit5: Fault State restart. When this bit is set to '1' the block output will use the value of FSTATE_VAL_D parameter if the device is restarted, otherwise it will use the non-volatile value stored for OUT_D parameter.
  - Bit6: Target to Manual if IFS. This option in IO_OPTS may be used to latch the FAULT_ STATE parameter. Setting this bit value will cause the target mode to automatically change to MAN when a fault is detected. The block will then have to be manually set to its normal target mode when fault conditions are fixed. If the external condition which caused the fault state has not been cleared the device will immediately reenter fault state.
- STATUS_OPTS: options which the user may select in the block processing of status.
  - Bit0: Propagate Fault Backward. If the status of CAS_IN_D parameter is Failure the block will propagate it to BKCAL_OUT_D parameter without generating an alarm. The substatus FaulStateActive indicates the block entered fault state (IFS).
- FSTATE _TIME: the time, in seconds, from the detection of a failure of the output block remote set-point to the output action of the block output if the condition still exists.
- FSTATE_VAL_D: the preset discrete SP_D value to use when a failure occurs. This value will be used if IO_OPTS = "Fault State to value" is selected. The possible values are: 0: Close, 1: Open and 2: Stop.



Typically, a FF alarm will be generated upon transition to a fault state. The alarm should be handled using the standard alarm handling mechanism present in the FF Host system.
A typical situation where the DO blocks goes to fault state is illustrated above. In this case, a communication problem occurred on the DI_1 block that was generating the set-point to the FPAC-2-DO_1 block. The status of the DO set-point changed to Bad-NoComm_ WithLastUsableValue-NotLimited. The DO block automatically switched its mode to LO (Local Override) and initiated the fault state action keeping the output at a constant value.

1.4.11 Standard Transducer block fault state parameters

In addition to the DO standard IFS parameters, there are 3 (three) parameters in the standard transducer blocks TB1 and TB2 that can be used to configure the action the transducer will take in case of a fault state. It is important to understand this configuration do not replace the standard DO fault state configurations as the transducer blocks fault state is device specific.
The standard transducer will enter a fault state in the following situations;

1. Configuration mistake: 2 (two) DO's using the same channel or no DO using the transducer channel (when in Single or Double Action)
2. Bad quality in the FINAL_VALUE_D parameter: example, DO in OOS mode.
3. Forced by a DO configured with channel options "FSTATE - TRD 1 (Valve 1)" or "FSTATE - TRD 2 (Valve 2)" see next section for an example of this configuration.

- PSNR_FSTATE_OPT: whenever the transducer block enters into a fault state (DO sends a BAD status to the FINAL_ VALUE_D parameter, for example) the device will control the valve according to what is defined in this parameter.
  0: Hold Last Value
  1: Fail Closed
  2: Fail Open
  3: PSNR_FSTATE_VAL_D (uses the value configured in this parameter)
- PSNR_OOS_OPT: whenever the transducer block enters into Out of Service (OOS) mode the device will control the valve according to what is defined in this parameter.
  0: Hold Last Value
  1: Fail Closed
  2: Fail Open
  3: PSNR_FSTATE_VAL_D (uses the value configured in this parameter)
- PSNR_FSTATE_VAL_D: if this parameter was chosen in any of the two previous parameters the state assumed by any of the physical outputs will match the value configured in this parameter. Valid values are: 0: Close, 1: Open and 2: Stop.
  Note: see Appendix D for a complete list of blocks and parameters including default values.

1.4.12 Forcing fault state from an auxiliary input

Auxiliary inputs AUX1 and AUX2 can be used to force the transducer into a fault state value and, in turn, move the valve to a fail-safe position (block or vent). This can be accomplished by using one DI and one DO blocks, linked together and properly configured, as in the example below.
Example #1: configure FPAC to go to fault state and command valve 1 (TB1) to open (fail opened) when auxiliary input AUX1 is active (inputs pins are shorted out):

- DI block configuration:
  - CHANNEL = 14: Auxiliary Input 1
  - MODE_BLOCK = AUTO
- DO block configuration:
  - CHANNEL = 91: FSTATE - TRD 1 (Valve 1)
  - MODE_BLOCK = CAS + AUTO
  Note: in the application, DI.OUT_D output has to be linked to the DO.CAS_IN_D input.
- Standard Transducer block configuration:
  - PSNR_FSTATE_OPT = 2: Fail Open
  - MODE_BLK = AUTO
  Short out AUX1 pins. AUX1 LED will turn on. Notice the OUT0 LED will turn on indicating the command to open the valve in fault state. Transducer block mode should go to "LO" (Local Override). BLOCK_ALMS_ACT will set the Device Fault State bit. Resource Block will indicate Fault State in the BLOCK_ERR parameter.

1.4.13 Testing fault state configuration
After transducer and DO blocks have been configured, use Resource block SET_FSTATE parameter to force the fault state in the DO block. Check if FAULT_STATE = ACTIVE. Check that block error should be indicating DeviceFaultState. DO block should immediately transition to fault state, which is indicated by the mode changing to LO (Local Override). Transducer blocks and physical outputs OUT0 and OUT1 must transition to the configured fault state according to the set-point DO block will send to parameter FINAL_VALUE_D.

- Example #1: DO block mode is CAS+AUTO, DO receives a BAD or UNCERTAIN status in its CAS_IN_D input with substatus FaultStateActive, the device will enter fault state defined by the parameters configured in the DO block. Parameters in the transducer block do not take any effect. DO mode goes to LO (Local Override) while in fault state.

To test the transducer block fault state change the DO block mode to OOS. The FINAL_ VALUE_D parameter will receive a BAD status then transducer will switch to fault state.

- Example #2: DO block goes to OOS. In this situation the DO will send a BAD status to the transducer FINAL_VALUE_D parameter, that will command the valve to a state defined in the transducer block parameters. The DO IFS parameters do not take effect. WORKING_ SP_D substatus change to FaultStateActive, indicating the transducer block is in fault state. The configuration in the transducer block parameters determines the valve position.

1.5 Special features
1.5.1 Advanced valve diagnostics
This chapter presents the advanced diagnostic features available in the Intellis 7300 series (the FPAC) of discrete valve controllers. The Diagnostic Transducer block is an outstanding tool to help users anticipate potential problems and prevent unwanted losses and injuries. Some of the available diagnostics can generate standard FF alarms handled by the FF Host system. There is also the maskable signal that allows DI blocks to indicate some alarm status, like cycle counter limit or valve cycle time exceeded. The operational diagnostics and the associated parameters, maskable signals and alarms are summarized in the tables below. Notice the diagnostic transducer must be in AUTO for the diagnostics to work.

		Maskable signal => SIGNAL_MASK bit 0 = Cycle Count 1 exceeds limits		
CYCLE_CNTR		**Alarm => CYCLE_COUNT_ALM**		
What is it?	**What is it used for?**	**How does it work?**	**How to use it?**	**Clear?**
Totalizes cycle counts for the valve controlled or monitored by the transducer.	Depending on the characteristics of the valve assembly it may be required to perform maintenance after a given number of cycles. Contact valve and actuator manufacturer for more information.	It accumulates in non-volatile memory how many times the valve completed a movement from one end to another. If the count limit set in CYCLE_CNTR_LIM is exceeded the CYCLE_COUNT_ALM is generated. Optionally a maskable signal channel can inform a DI this alarm is active. Then the user can schedule a preventive maintenance.	Configure the desired maximum limit in CYCLE_ CNTR_LIM. If required, configure SIGNAL_MASK bit 0 and one DI block channel. Set CYCLE_COUNT_PRI = 1 to enable the alarm.	Write '0' directly to CYCLE_ CNTR or Set bit 9 (0x0100) in the parameter CLEAR_CNTR in the Diagnostics transducer.

- CYCLE_CNTR resides in transducer blocks TB1 and TB2 (Standard Discrete Transducer).
- CYCLE_CNTR_LIM and CYCLE_COUNT_ALM are in the transducer blocks TB3 and TB4 (Diagnostic Transducer).

		Maskable signal => SIGNAL_MASK bit 1 = Cycle Time exceeds limits		
VALVE_CYCLE_TIME		**Alarm => CYCLE_TIME_ALM**		
What is it?	**What is it used for?**	**How does it work?**	**How to use it?**	**Clear?**
The time in seconds (with resolution of 100 ms) the valve took to complete the last two cycles. It is the same as STROKE_TIME_CLOSED + STROKE_TIME_OPEN.	Detect early problems with solenoid valves, air leakage, supply pressure issues, valve shaft/stem or any other mechanic or pneumatic component that may prevent the valve to move properly.	It measures the complete time in seconds between two consecutive strokes and compare with the limit configured in the parameter CYCLE_TIME_LIM. If this limit is exceeded CYCLE_TIME_ALM is triggered.	Configure the maximum time in CYCLE_TIME_LIM. If required, configure SIGNAL_MASK bit 1 and one DI block channel. Set CYCLE_TIME_PRI = 1 to enable the alarm.	Factory default, Power cycle.

- CYCLE_TIME _LIM resides in the transducer blocks TB1 and TB2 (Standard Discrete Transducer).
- VALVE_CYCLE_TIME and CYCLE_TIME_ALM reside in transducer blocks TB3 and TB4 (Diagnostic Transducer).

		Maskable signals => SIGNAL_MASK bits 3 and 4 = Low/Hi Temperature		
INTERNAL_TEMP		**Alarms => HIGH_TEMPERATURE_ALM and LOW_TEMPERATURE_ALM**		
What is it?	**What is it used for?**	**How does it work?**	**How to use it?**	**Clear?**
The electronic module onboard temperature. Units according to parameter INTERNAL_TEMP_UNITS.	Used to discover unexpected temperature conditions. Typically the operating range of most coil/piezo operators is narrower than the FPAC electronic module.	It compares onboard temperature with parameters LOW_TEMPERATURE_LIM and HIGH_TEMPERATURE LIM. If temperature exceeds the limits, alarms LOW_TEMPERATURE_ALM or HIGH_TEMPERATURE_ALM are triggered.	Configure maximum and minimum temperatures LOW_TEMPERATURE_LIM and HIGH_TEMPERATURE LIM. If required, configure SIGNAL_MASK bits 3 and 3 or and one DI block channel. Set HIGH/LOW_TEMPERATURE_PRI = 1 to enable the alarms.	Factory default, Power cycle.

- All parameters in the table are located in the transducer blocks TB1 and TB2 (Standard Discrete Transducer).

The following parameters do not generate FF alarms nor maskable signal but are still useful for general diagnostics. User can monitor them periodically to check some operational conditions:

STROKE_TIME_CLOSED / STROKE_TIME_OPEN			
What is it?	**What is it used for?**	**How does it work?**	**How to use it?**
The time in seconds the valve took in its last movement to go from opened/closed to closed/opened position. It is used to calculate VALVE_CYCLE_TIME.	Detect early problems with solenoid valves, air leakage, supply pressure issues, valve shaft/stem or any other mechanic or pneumatic component that may prevent the valve to move properly.	It measures time between the activation of the valve and the detection of the CLOSED/OPENED limit switch. These times are then summed up to update the parameter VALVE_CYCLE_TIME. It is then compared against the pre-configured limit CYCLE_TIME_LIM. If these limits are exceeded, the CYCLE_TIME_ALM is triggered, then the user can schedule a maintenance. It can also be monitored using a DI block and the corresponding maskable signal.	Although this parameter does no generate any alarm is indirectly monitored though the parameter VALVE_CYCLE_TIME that generates an alarm. The user can also verify this parameter From time to time against some pre-determined limit.

- STROKE_TIME_CLOSED and STROKE_TIME_OPEN are located in blocks TB3 and TB4 (Diagnostic Transducer).

BREAKAWAY_TIME			
What is it?	**What is it used for?**	**How does it work?**	**How to use it?**
The last reported time taken in seconds for valve to begin moving (opening or closing).	Detect early problems with solenoid valves, air leakage, supply pressure issues, valve shaft/stem or any other mechanic or pneumatic component that may prevent the valve to move properly.	It measures for every cycle the time between the activation of the valve and the detection of the associated limit switch.	Although this parameter does no generate any alarm is indirectly monitored though the parameter VALVE_CYCLE_TIME that generates an alarm. The user can also verify this parameter From time to time against some pre-determined limit.

- BREAKAWAY_TIME is located in blocks TB3 and TB4 (Diagnostic Transducer).

The CYCLE_TIME_HISTORY stores up to 400 cycle times for later analysis. To retrieve the collected data configure the CYCLE_TIME_HISTORY parameter as a standard fieldbus trend in your FF Host system. See the following table:

CYCLE_TIME_HISTORY			
What is it?	**What is it used for?**	**How does it work?**	**How to use it?**
An array of up to 400 valve cycle times collected on demand.	It is used for trending the cycle time to detect early problems with solenoid valves, air leakage, supply pressure issues, valve shaft/stem or any other mechanic or pneumatic component that may prevent the valve to move properly.	It collects cycle times in an array for later analysis. Set of up to 400 cycle times can be stored in the device and later retrieved using the standard fieldbus trend system.	Configure the type of collection you want to perform in the parameter CYCLE_TIME_COLLECT_TYPE as Continuous or Stop when full. To initiate the collection the COLLECT_ CYCLE_TIME parameter must be set to Active. Writing Inactive will stop collecting data. To have the report sent, set COLLECT_CYCLE_TIME parameter to Report. The standard trend mechanism should then retrieve the collected data.

1.5.2 The "Maskable signal"

The Maskable Signal is a virtual signal generated from one or more alarms and conditions pre-configured in the transducer blocks using the parameter SIGNAL_MASK. The active conditions can be verified in the parameter MASKABLE_SIGNAL. Some of the diagnostics explained in the previous tables can be linked to a DI block using the maskable signal. The options available for this parameter are:

Bit	SIGNAL_MASK TB1 and TB2	MASKABLE_SIGNAL TB3 and TB4	Description
0	Cycle Count 1 exceeds limits		CYCLE_CNTR exceeded CYCLE_CNTR_LIM
1	Cycle Time exceeds limits		VALVE_CYCLE_TIME exceeded CYCLE_TIME_LIM
2	Bad Xducer Status		The associated transducer (TB1 or TB2) has a BAD status
3	High Temperature		INTERNAL_TEMP exceeded HIGH_TEMPERATURE_LIM
4	Low Temperature		INTERNAL_TEMP exceeded LOW_TEMPERATURE_LIM

The "Maskable Signal" can be used to link some of the diagnostic alarms directly to a DI. This allows the alarms states to be linked directly to another function block for immediate action in the process. Since FPAC can control up to two valves, every transducer pair can generate its own Maskable Signal, creating a multitude of options for the user to report alarms in the application for up to two valves.

For example, maintenance alarms can be generated when the user configured Cycle Count Limit is reached. The CYCLE_CNTR_LIM parameter in the Diagnostic transducer is set during configuration with the limit chosen by the user. The maintenance alarm will be generated when CYCLE_CNTR accumulates a number larger than the associated CYCLE_CNTR_LIM. This condition can trigger a FF alarm on the bus that can be handled via the standard alarm handling, depending on the FF Host System. This condition can also immediately transmit to other function blocks on the application bus using the Maskable Signal channel configured in a DI block.

To use the maskable signal you have to follow the general guidelines below:

1. Set one or more maskable signal bits in the SIGNAL_MASK parameter located in the standard transducer blocks (TB1 for valve 1, TB2 for valve 2). The block can be in any mode.
2. For every condition configured in the SIGNAL_MASK, there is a corresponding status bit in the MASKABLE_SIGNAL parameter located in the diagnostics transducer blocks (TB3 and TB4).
3. Configure the advanced diagnostic parameters as explained in the previous sections with the appropriate limits for your application.
4. Configure the DI block CHANNEL with "13: TRD1: Maskable Signal" or "213: TRD2: Maskable Signal" depending on which transducer block you want to use. If FPAC is controlling or monitoring two valves you may want to use two DI blocks, one for each transducer.
5. Set block modes to AUTO: DIs and TB1 to TB4.
6. When at least one of the conditions enabled in the SIGNAL_MASK parameter occurs the corresponding bit in MASKABLE_SIGNAL parameter will be set and the DI.OUT_D = MASKABLE_SIGNAL.
7. When the conditions cease DI.OUT_D = '0'.
8. This DI output can be used in the application to generate an operator or maintenance alarm, or to trigger preventive actions, like forcing that valve to a fail-safe position. See section about Fault State Configuration for more details.

Note: the Maskable Signal is active only while the condition exists. It does not latch the condition. Example, if a valve takes too long to open and triggers a cycle time exceeded signal, the DI output will indicate '2' only while the VALVE_CYCLE_TIME > CYCLE_TIME_LIM. If in the next valve movement the cycle takes less than the limit the corresponding maskable signal and the DI output will be cleared. In order to latch the maskable signal events it is necessary to configure the associated alarms as indicated in the following examples. Otherwise, the events can go away and the user will not be notified.

1.5.3 Examples of advanced diagnostics usage

- Example #1: configure DI_2 to indicate when the CYCLE_COUNT_ALM an alarm when the valve 1 opens and closes more than 1000 times. This example assumes the transducer block TB1 has been already configured.
  - TB1.MODE_BLK = OOS.
  - TB1.CYCLE_CNTR_LIM = 1000.
  - TB1.CYCLE_CNTR_PRI = 1. (Enables CYCLE_COUNT_ALM)
  - TB1.SIGNAL_MASK = check bit 0 = Cycle Count 1 exceeds limits.
  - TB1.MODE_BLK = AUTO.
  - TB3.MODE_BLK = AUTO.
  - DI_2.MODE_BLK = OOS.
  - DI_2.CHANNEL = 13: TRD1: Maskable Signal.
  - DI_2.MODE_BLK = AUTO.

- Example #2: configure DI_4 to report an alarm if onboard temperature rises above +60°C. In this case it does not matter transducer TB1 or TB2 is used as there is only one onboard temperature sensor and both transducers will show the same onboard temperature.
  - TB1.MODE_BLK = OOS.
  - TB1.HIGH_TEMPERATURE_LIM = 60.
  - TB1.HIGH_TEMPERATURE_PRI = 1. (Enables HIGH_TEMPERATURE_ALM)
  - INTERNAL_TEMP_UNITS = °C.
  - TB1.SIGNAL_MASK = Check bit 3 = High Temperature.
  - TB1.MODE_BLK = AUTO.
  - TB3.MODE_BLK = AUTO.
  - DI_2.MODE_BLK = OOS.
  - DI_2.CHANNEL = 13: TRD1: Maskable Signal.
  - DI_2.MODE_BLK = AUTO.

- Example #3: Configure DI_2 to report the alarms on examples #1 and #2, plus any time the valve 1 (TB1) takes more than 10 seconds to open or close:
  - TB1.MODE_BLK = OOS.
  - TB1.CYCLE_CNTR_LIM = 1000.
  - TB1.CYCLE_COUNT_PRI = 1. (Enables CYCLE_COUNT_ALM)
  - TB1.CYCLE_TIME_LIM = 10.
  - TB1.CYCLE_TIME_PRI = 1. (Enables CYCLE_TIME_ALM)
  - TB1.HIGH_TEMPERATURE_LIM = 60.
  - TB1.HIGH_TEMPERATURE_PRI = 1. (Enables HIGH_TEMPERATURE_ALM)
  - INTERNAL_TEMP_UNITS = oC.
  - TB1.SIGNAL_MASK = Check bits 0, 1 and 3 = Cycle Count 1 exceeds limits | Cycle Time exceeds limits | High Temperature
  - TB1.MODE_BLK = AUTO.
  - TB3.MODE_BLK = AUTO.
  - DI_2.MODE_BLK = OOS.
  - DI_2.CHANNEL = 13: TRD1: Maskable Signal.
  - DI_2.MODE_BLK = AUTO.

- Example #4: configure a DI block to inform if the transducer TB1 as detected a bad status:
  - TB1.MODE_BLK = OOS.
  - TB1.SIGNAL_MASK = Check bit 2 (third bit) = Bad Xducer Status.
  - TB1.MODE_BLK = AUTO.
  - TB3.MODE_BLK = AUTO.
  - DI_2.MODE_BLK = OOS.
  - DI_2.CHANNEL = 13: TRD1: Maskable Signal.
  - DI_2.MODE_BLK = AUTO.

- Example #5: Configure cycle time history to collect valve 1 cycle times until it is full then transfer to the Host:
  - Configure parameter CYCLE_TIME_HISTORY as a trend in your FF Host system.
  - TB1.MODE_BLK = AUTO.
  - TB1. COLLECT_CYCLE_TIME = 2: Stop when full.
  - TB1.CYCLE_TIME_COLLECT_TYPE = 1: Active.
  - Wait until TB1.CYCLE_TIME_COLLECT_TYPE = 0: Inactive, indicating the history is full.
  - TB1.CYCLE_TIME_COLLECT_TYPE = 2: Report
  - The data will be transferred to the FF Host through the standard trend mechanism.

1.5.4 Additional diagnostics

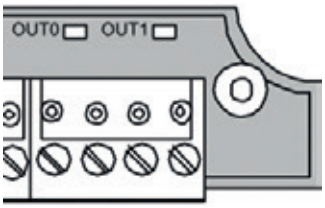
1.5.5 MODULE_IO_SUMMARY parameter

Use the MODULE_IO_SUMMARY parameter located in Diagnostics blocks (TB3/TB4) to check the status of any pin in the module. Both transducers exhibit the same value. It is summarized in the table below:

Bit	Hex	Mnemonic	Description
0	0x0001	WRP	Write protect DIPswitch #1 is ON
1	0x0002	SIM	Simulate enable DIP switch #2 is ON
2	0x0004	FCT	Factory default DIP switch #3 is ON
3	0x0008	CAL	Calibration enable DIP switch #4 is ON
4	0x0010	O/C	Open/Close DIP switch #5 is ON
5	0x0020	AUX	Auxiliary DIP switch #6 is ON
6	0x0040	OUT0	Discrete Output 0 is energized
7	0x0080	OUT1	Discrete Output 1 is energized
8	0x0100	AUX1	Discrete Auxiliary Input 1 pins are shorted out
9	0x0200	AUX2	Discrete Auxiliary Input 2 pins are shorted out
10	0x0400	TOP	Top Hall Effect sensor is active (magnet detected)
11	0x0800	BOT	Bottom Hall Effect sensor is active (magnet detected)
12-15	-	-	Reserved for future use

1.5.6 OUT_LOAD_STATUS parameter
Use OUT_LOAD_STATUS parameter to verify the status of the load connected to outputs OUT0 and OUT1. Whenever the output is active to power the coil/piezo it will indicate whether it is short-circuited or opened. It is helpful to diagnose wiring problems or solenoid faults. In addition, any time the output circuit detects a fault, the corresponding LED will blink. If the output is not active or not used it does not indicate open circuit. As soon as the problem ceases the corresponding bit is cleared. See technical specification page for thresholds.

FIGURE 1
Output LEDs for solenoid diagnostic

Bit	Output status	LEDs will blink
Bit0	Out0 Short	
Bit1	Out0 Open	
Bit2	Out1 Short	
Bit3	Out1 Open	

1.5.7 DIAG_CNTR parameter
For more advanced diagnostics there is the DIAG_CNTR parameter. It is a set of counters that record events.

Element	Mnemonic	Description
0	DIAG_CNTR(0)	Reserved for future use
1	DIAG_CNTR(1)	Number of device resets since last clear
2	DIAG_CNTR(2)	Reserved for future use
3	DIAG_CNTR(3)	Reserved for future use
4	DIAG_CNTR(4)	Reserved for future use
5	DIAG_CNTR(5)	Reserved for future use
6	DIAG_CNTR(6)	Reserved for future use
7	DIAG_CNTR(7)	Reserved for future use

Note: to clear counters in the parameter DIAG_CNTR, one must set the corresponding bit in the parameter DIAG_CLR. For example, to clear the counter DIAG_CNTR(1) set bit DIAG_CLR(1) = '1'. The counter will be cleared and the bits will be automatically set back to '0'.

2 ORDER GUIDE

Please Contact Westlock to get the most recent Ordering Guide.

3 DEFINITIONS

- Single Action: in this document refers to an application where the FPAC uses only one output connected to a single coil to control the main valve. When powered, this coil makes the valve move to one position (typically opened) and when unpowered it moves the valve to the other position (typically closed). The FPAC is able to control up to 2 (two) single action valves simultaneously.
- Double Action: in this document refers to the use of two coils and, in turn, the two FPAC outputs, to control the main valve. Each coil moves the valve to one position, while both coils powered or unpowered stop the valve at the current position.
- Valve cycle or valve stroke: a complete movement from one end to the other. For example, if the valve goes from opened to closed position it represents a cycle; back to opened position it counts another cycle. If the valve starts moving but goes back to the same end it does not count as a cycle.
- Valve opened: it means the valve is at the position the user determined as opened. For the FPAC it means the shaft is in the position where the top cam magnet is facing the canister that activates the top internal Hall Effect limit switch, which turns on LED OPEN. Alternatively, a dry-contact connected to discrete input AUX1 can be used to indicate the opened position when the contact is shorted out, which in turn, makes the LED AUX1 turn on.
- Valve closed: it means the valve is at the position the user determined as closed. For the FPAC it means the shaft is in the position where the bottom cam magnet is facing the canister that activates the bottom internal Hall Effect limit switch, which makes the LED CLSD turn on. Alternatively, a dry-contact connected to discrete input AUX2 can be used to indicate the closed position when the contact is shorted out. This makes the LED AUX2 turn on.
- Valve is opening: the valve is moving from the closed position to the opened position. The FPAC recognizes this state just after the closed limit switch has been deactivated but the opened limit switch is still not activate.
- Valve is closing: the valve is moving from the opened position to the closed position. The FPAC recognizes this state just after the opened limit switch has been deactivated but the closed limit switch is still not activate.
- Intermediate position: the valve can be either opening or closing. This condition always happens when both limit switches are not active. If the optional potentiometers is used the exact position can be determined.
- Valve is stopped: the valve was either opening or closing, then it stopped somewhere along the stroke. For the DI block this condition happens when both position sensors are not active, indicating the valve is not closed and not opened.
- Open: command sent by a DO block to move the valve to the opened position. Typically this command will energize the corresponding output, with the LED turning on.
- Close: command sent by a DO block to move the valve to the closed position. Typically this command will de-energize the corresponding output, with the LED turning off.
- Stop: for the DO block this command turns OFF (de-energizes) both outputs on a Double Action solenoid valve, making it stop at the current position, including anywhere in the middle of the stroke. The operation and position where the valve will stop depends on pneumatic connection and application.
- TB or TRD: Transducer block or simply Transducer, used to insulates function blocks from the specifics of I/O hardware, such as sensors, actuators, and switches. Transducer blocks allow for configuration and perform functions such as calibration. Transducer blocks are defined to decouple function blocks from the local input/output functions required to read sensor hardware and command effector hardware.
  - FPAC provides two ENHANCED STANDARD DISCRETE POSITIONER TRANSDUCER BLOCKS, that allow control and monitoring of up to 2 (two) valves. They are referred in this document as TB1/TB2, TRD1/TRD2 or Std Transducer 1/2.
  - It also provides 2 diagnostics transducer blocks with a variety of diagnostics such as cycle counter, cycle time measurement, open and close times among others. They are referred in this document as TB3/TB4, TRD3/TRD4 or DIAG1/DIAG2.
- Direct action: also known as "increase to open". When the valve set-point = '1' (on the transducer block or DO block) FPAC activates its output and power the solenoid that forces the actuator/valve to the Opened position. This is often referred as a fail closed valve because in the absence of power the pneumatics/actuator spring will force the valve to the closed position.
- Reverse action: also known as "increase to close". When the valve set-point = '1' (on transducer block or DO block) FPAC deactivates its output removing power from the solenoid.

4 INSTALLATION

4.1 Mounting

4.1.1 Intellis 7300 (the FPAC) electronic module overview

The Intellis 7300 electronic module (the FPAC) includes the following physical I/O:

- 1 (one) bus connector for Foundation Fieldbus compliant bus (J2);
- 1 (one) analog input for position sensing potentiometer (J5);
- 2 (two) internal Hall Effect limit switches to be used with the cam shaft magnets;
- 2 (two) dry-contact discrete inputs AUX1 and AUX2 (J4);
- 2 (two) current source outputs for ultra-low power solenoids OUT0 and OUT1 (J3);
- See the technical specification page for more information on electrical characteristics and limits.

The FPAC module can control and/or monitor up to 2 (two) independent valves. The internal Hall Effect sensors read the cam shaft magnets, thus the "valve 1" or "local valve" has to be the one where the housing shaft is attached to and is, in turn, rotary. Typically the solenoid to control valve 1 is wired to OUT0. See Appendix A for more details on how to adjust the cams for internal sensors.

The "valve 2" or "remote valve" can be either rotary or linear depending on the installation. The limit switches for the remote valve are typically connected to auxiliary inputs AUX1 and AUX2, while the solenoid to control valve 2 is wired to OUT1.

- Discrete inputs AUX1 and AUX2, when not used to monitor valve position, can be used as general purpose dry contact inputs to connect leak detectors, tamper proof switches, level or pressure switches and so forth. See technical specification page for characteristics and limits.

FIGURE 1
Example of 7379 internal components and explosion proof junction box

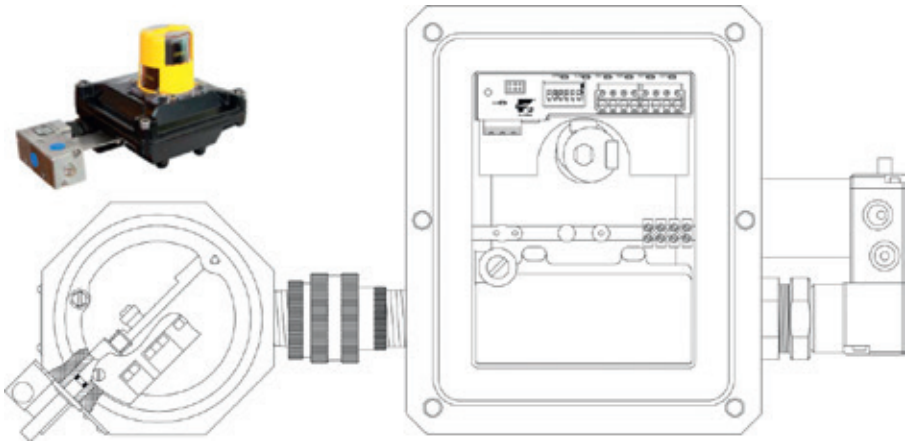
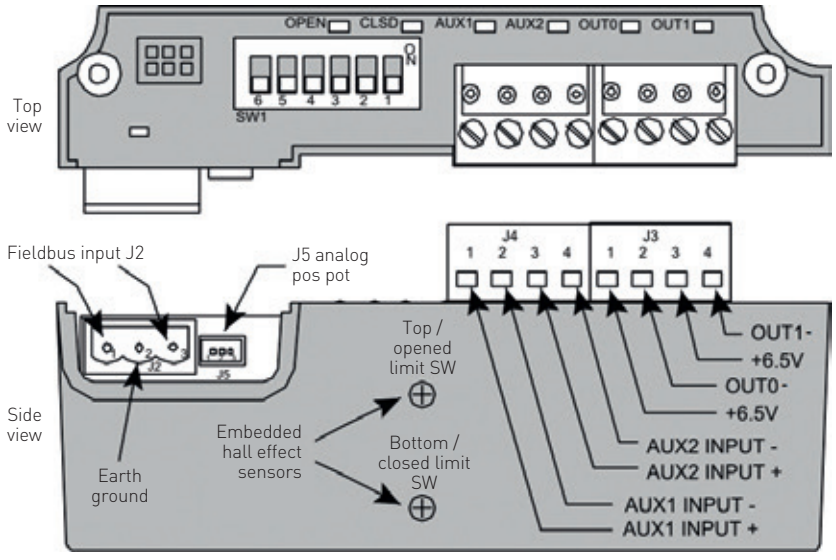


FIGURE 2
FPAC module overview



4.1.2 Description of the DIP switch

For more information on every function of the DIP switches see Appendix B.

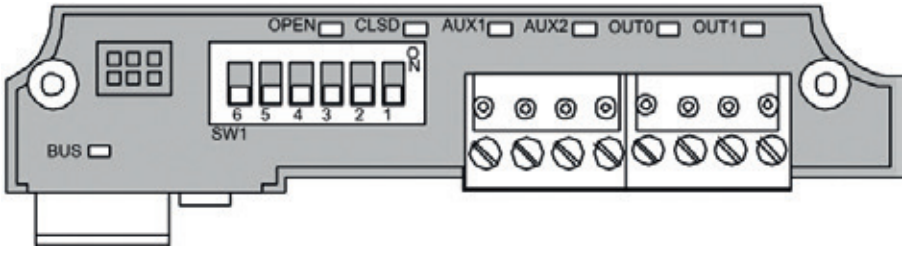
Switch	Name	Function
1	WRP - Write Protect	Disable writing to parameters in the blocks
2	SIM - Simulate Enable	Enable simulation capability for the blocks
3	FCT - Factory Default	Restore factory default values to non-volatile parameters
4	CAL - Calibration Enable	Enable local calibration and Real Time Clock adjustment
5	O/C - Open/Close	Open or close the valve during local calibration
6*	AUX - Auxiliary function	Enable high current mode. See note below

* THIS SWITCH SHOULD ALWAYS BE IN THE OFF POSITION, unless FPAC is configured to control 2 (TWO) SINGLE ACTION VALVES with power coming from the bus. It is NOT necessary to turn switch #6 ON for any other configuration. Use the MODULE_IO_SUMMARY parameter from the Diagnostics transducer block to read the switch status.

4.1.3 Description of the LEDs

On power up, all LEDs blink once for a self-test. Then each LED assumes its normal function as indicated in the table below, except when a factory default is underway. See Appendix B for more information on the factory default procedure using the dip switch and the behavior of the LEDs.

LED	Function	ON	Blinking	OFF
BUS	Bus communication status	There is activity on the bus but the device is not ready	There is activity on the bus and the device is ready to use	There is no activity at all on the bus
OPEN	Top Hall Effect limit switch	TOP Hall sensor is active, magnet detected	Factory default	The TOP switch is not active
CLSD	Bottom Hall Effect limit switch	The BOT Hall sensor is active, magnet detected	Factory default	The BOT switch is not active
AUX1	Auxiliary discrete input 1	AUX1, J4 pins 1,2 are shorted out	Factory default	AUX1 J4 pins 1,2 are opened
AUX2	Auxiliary discrete input 2	AUX2, J4 pins 3,4 are shorted out	Factory default	AUX2 J4 pins 3,4 are opened
OUT0	Discrete output 0	OUT0 (J3 pins 1,2) is energized and there is a normal load connected to it	The output is energized but the load is open or short-circuited (See OUT_LOAD_STATUS parameter in the Diagnostics block for more details)	OUT0 is not energized
OUT1	Discrete output 1	OUT1 (J3 pins 3,4) is energized and there is a normal load connected to it	The output is energized but the load is open or short-circuited (See OUT_LOAD_STATUS parameter in the Diagnostics block for more details)	OUT1 is not energized



4.1.4 Pneumatic connections

WARNING
Personal injury and/or property damage may occur from loss of process control if the supply medium is not clean, dry, oil-free and non-corrosive. Instrument quality air that meets the requirements of ISA S7.3-1975 is recommended for use with pneumatic equipment in process control environments. Westlock Controls recommends the use of a 20 micron filter with all solenoids.

4.1.5 Tubing and fittings
The use of copper, stainless steel, nylon or polyethylene tubing is recommended for piping up air circuits and equipment. As a general rule, pipe threaded fittings should not be assembled to a specific torque because the torque required for a reliable joint varies with thread quality, port and fitting materials, sealant used, and other factors. The suggested method of assembling pipe threaded connections is to assemble them finger tight and then wrench tighten further to a specified number of turns from finger tight. The assembly procedure given below is for reference only; the fitting should not be over tightened for this will lead to distortion and most likely, complete valve failure.

1. Inspect ports and connectors to ensure that the threads on both are free of dirt, burrs and excessive nicks.
2. Apply sealant/lubricant or Teflon tape to the male pipe threads. With any sealant tape, the first one or two threads should be left uncovered to avoid system contamination.
3. Screw the connector into the port to the finger tight position.
4. Wrench tighten the connector approximately 1 - 2 turns (to seal) from finger tight. Again this is only reference - the fitting should NOT be over tightened.

4.1.6 Porting for falcon solenoids

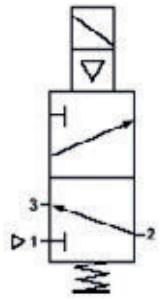
4.1.7 Wiring instructions and examples

WARNING
All wiring must be in accordance with National Electrical Code (ANSI-NFPA-70) for the appropriate area classifications or the local electrical code when applicable.
Always check the nameplate to make sure the agency approval ratings coincide with the application.

NOTE
The proper wiring diagram for your unit is shown on the inside of the enclosure cover.

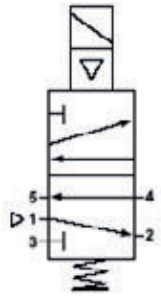
4.1.8 FPAC BUS Connector pin out
See Figure 3.

NOTE
The FF input is polarity insensitive.



3 Way spring return valve
Description of operation:
Solenoid de-energized - air flows from Outlet Port 2 to Exhaust Port 3.

Solenoid energized - air flows from Inlet Port 1 to Outlet Port 2.



4 way spring return valve
Description of operation:

Solenoid de-energized - air flows from Inlet Port 1 to Outlet Port 2 and exhausts from Port 4 to Port 5.

Solenoid energized - air flows from Inlet Port 1 to Outlet Port 4 and exhausts from Port 2 to Port 3.

FIGURE 3
FPAC revision 5 vs. FPAC previous pin style connector

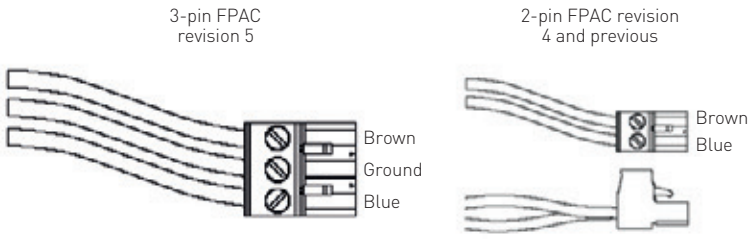
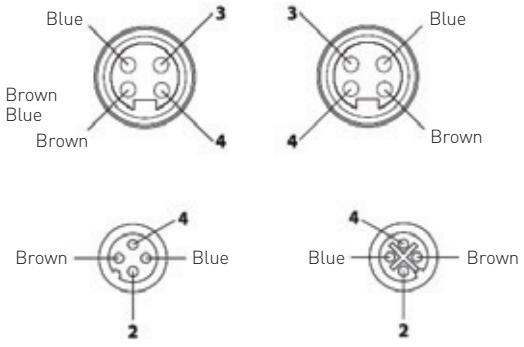


FIGURE 4
FPAC mini and micro connectors pin out



4.2 Calibration

4.2.1 Configuration and operation

4.2.1.1 Configuration overview

This section shows how to configure and operate the FPAC provided it has been properly installed. Basically what you need to operate FPAC is to create a control strategy linking the function blocks in the FPAC with function blocks in the control application/strategy.
The way this is accomplished is particular for control system from different vendors and will not be addressed in this document. Contact Westlock for technical notes regarding your particular FF Host system. This IOM will show a general overview about the possible applications with some examples.
The examples shown hereafter assume the device has been commissioned and is at the factory default configuration. Factory default configuration pre-configures some block parameters for the typical applications. See Appendix B for factory default procedure and Appendix D for a complete list of parameters including default values. The most important parameters used for the configuration and operation of the FPAC are:

- RESOURCE BLOCK
  - MODE_BLK: after factory default goes to AUTO.
- DISCRETE STANDARD TRANSDUCER BLOCK
  - MODE_BLK: normally should be in AUTO. When in MAN it allows direct control of outputs.
  - SIGNAL_ACTION: after factory default TB1 = Increase to Open.
  - ACTION_ELEMENT: after factory default TB1 = Single Action.
  - IO_ASSIGNMENT: after factory default: TB1 = Top,Bot,Out0.
  - SET_CURRENT_SINK: used to increase bus current when FPAC controls 2 (two) single action valves.
  - WORKING_POS_D: this is the raw value obtained from the limit switches configured in the IO_ASSIGNMENT parameter. For example, if the limit switch that indicates valve opened is active, WORKING_POS_D = '1' (OPENED).
  - WORKING_SP_D: this parameter can be written manually when the block mode is MAN. This is the raw value that goes to the physical output(s) configured in the IO_ASSIGNMENT parameter: write '0' to CLOSE, '1' to OPEN and '2' to STOP.
- DIAGNOSTIC TRANSDUCER BLOCK
  - MODE_BLK: normally should be in AUTO.
  - MODULE_IO_SUMMARY: allow user to monitor the raw value for any I/O in the device.
  - OUT_LOAD_STATUS: outputs diagnostics for coil/piezo short or open detection.
- DISCRETE OUTPUT BLOCK:
  - MODE_BLK: normally in CAS+AUTO for automatic control. Can also be used in MAN or AUTO for testing purposes and manual control.
  - CHANNEL: configured for the target transducer block.
  - OUT_D: value and status sent to transducer block via configured channel.
  - SP_D: block set-point, can be written in MAN. When in MAN, write to this parameter to control valve position: write '0' to CLOSE, '1' to OPEN and '2' to STOP.
  - CAS_IN_D: remote set-point, written by another block in the application/control strategy through a fieldbus link.
  - READBACK_D: position feedback taken from the transducer block channel. Typically '0' = CLOSED, '1' = OPENED, '2' = STOPPED, '3' = OPENING and '4' = CLOSING.
  - BKCAL_OUT_D: position feedback sent to another function block in the application/control strategy through a fieldbus link. Typically '0' = CLOSED, '1' = OPENED, '2' = STOPPED, '3' = OPENING and '4' = CLOSING.
- DISCRETE INPUT BLOCK
  - MODE_BLK: typically in AUTO.
  - CHANNEL: configured for the target transducer block.
  - OUT_D: position feedback sent to another function block in the application/control strategy through a fieldbus link. Typically '0' = CLOSED, '1' = OPENED, '2' = STOPPED, '3' = OPENING and '4' = CLOSING.
- ANALOG INPUT BLOCK
  - MODE_BLK: usually in AUTO.
  - CHANNEL: configured for position or temperature.
  - OUT: position feedback in % open sent to another function block in the application/control strategy through a fieldbus link. Alternatively it can be the onboard temperature depending on channel configuration.

4.2.2 Installing DD/CF and handheld support files
Registered DD/CF files can be downloaded from the Fieldbus Foundation registered products website: www.fieldbus.org.
For more information on how to install the files see an example on Appendix G. Contact Westlock in case of any problem.

4.2.3 Configuration examples
Among the many possible applications the examples herein will give you an idea of the flexibility of the Intellis 7300 (the FPAC). The examples shown typically do not depend on the model/housing and can be applied to any FF Host or control system. Contact Westlock in case of any question. Despite of the tremendous flexibility of the FPAC, you will need to configure just a few parameters to get it working. Most of the block parameters are pre-configured at factory default. See Appendix B for factory default instructions and Appendix D for a complete list of blocks and parameters including default values. Look up in the table below the example(s) that is closest to your application. It is easy to adapt the examples for applications that are not listed.

Example #	Number of valves*	TB1/TB2	Type (Valve1/ Valve2)	SOV (number of coil/piezo)	Comments
1A, 1B, 1C	One	Control / not used	Rotary	One	Typical installation for the 7344 model
2	One	Control / not used	Rotary	Two	One SOV with 2 piezos on the same housing (LG2 housing)
3A, 3B	One	Control / not used	Linear	One	Using Silver Bullet/Magnum for the linear actuator
4	Two	Control / control	Rotary/rotary	One	Using 764 for the second valve (second housing has only switches and SOV)
5	Two	Control / monitor	Rotary/linear	Two	Using dual coil/piezo solenoid for the local valve; Silver Bullet/Magnum to monitor position of the remote linear valve
6A, 6B	One	Monitoring and control	Rotary	One	Using potentiometer connected to analog input J5 instead of cam shaft magnets

Note: the examples below use a FF Host system to configure and exemplify some control strategies. You can adapt the examples according to your application.
Note: the examples assume the reader has a good knowledge of the FF Host system, as tasks like device commissioning, I/O assignment, device configuration and setup, control module edition etc. are not covered in detail.

4.2.4 Configuration for example #1: one valve, rotary, simple solenoid

This example assumes the device is at the factory default state. The FPAC is installed on top of the actuator and the internal Hall effect sensors are used as limit switches. It assumes it is wired as illustrated in the previous section "Wiring for Example #1". The tables below show 3 (three) possible realizations for this example:

A. Just monitoring the valve with one DI block. The valve is controlled by some other means (manually or by a separate controller):

Blocks and parameters that need configuration		
Resource	**TB1**	**DI_1**
MODE_BLK = AUTO	ACTION_ELEMENT = 4: Monitoring	MODE_BLK = AUTO
	MODE_BLK = AUTO	

B. The second variant of the example assumes the FPAC is controlling the valve using a DO block (OUT0 is used to power the solenoid) and the position feedback is given by the same DO through BKCAL_OUT_D parameter:

Blocks and parameters that need configuration		
Resource	**TB1**	**DO_1**
MODE_BLK = AUTO	MODE_BLK = AUTO	IO_OPTS = Use PV for BKCAL_OUT
		MODE_BLK = CAS+AUTO*

C. The third variant of the example uses a combination of one DO block to control the valve position (OUT0 is used to power the solenoid) and 2 (two) DI blocks for the position feedback:

Blocks and parameters that need configuration				
Resource	**TB1**	**DO_1**	**DI_1 (CLOSED)**	**DI_2 (OPENED)**
MODE_BLK = AUTO	MODE_BLK = AUTO	IO_OPTS = Use PV for BKCAL_OUT	CHANNEL = 11: TRD1: 0-Not Closed / 1-Closed	CHANNEL = 10: TRD1: 0-Not Opened / 1-Opened
		MODE_BLK = CAS+AUTO*	MODE_BLK = AUTO	MODE_BLK = AUTO

4.2.4.1 Just monitoring one valve with a DI block

The transducer block configuration for this example is going to be shown in two ways: first using the DD method "Basic Device Configuration" to configure the transducer blocks; second writing directly to block parameters. The rest of the example is the same independently of the way you prefer to configure the transducer.

4.2.4.1.1 Transducer configuration using the DD method "Basic Device Configuration"

1. This example assumes the device has been commissioned and is at the factory default configuration. See Appendix B for factory default procedure and Appendix D for complete list of block parameters including default values.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.
3. Right-click on the device you want to configure and chose Configure/Setup. See Figure 5.
4. The Device Identification window will appear after a few seconds. Click on Basic Device Configuration to start the method. A series of warning windows will be shown. Read them carefully and click Next until the method starts making changes to the device. See Figure 6.
5. A series of messages will be displayed, for a few seconds. Wait until the message "Transducer blocks are in OOS (WCON005)" is shown. Then click Next.
6. Configure there is only 1 valve attached to this FPAC and click on Next. Configure the FPAC will be just monitoring the valve and click on Next. See Figure 7.

FIGURE 5

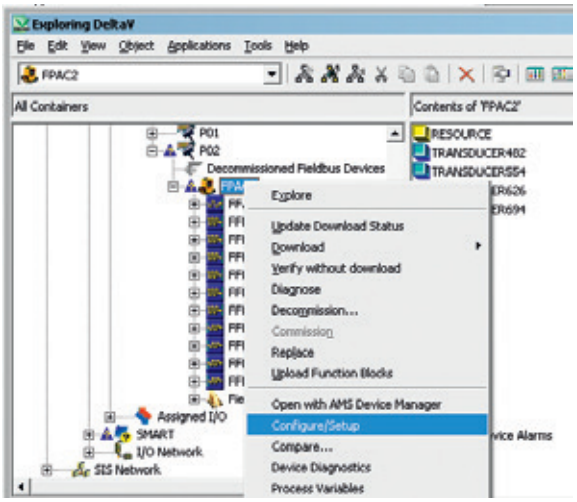


FIGURE 6

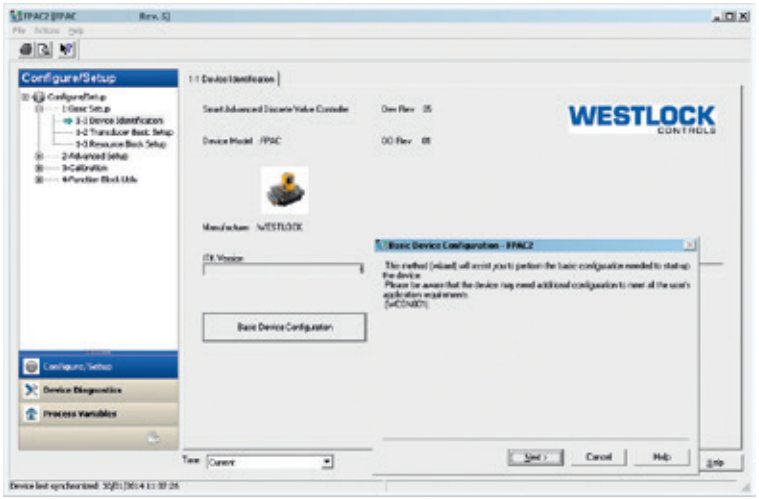
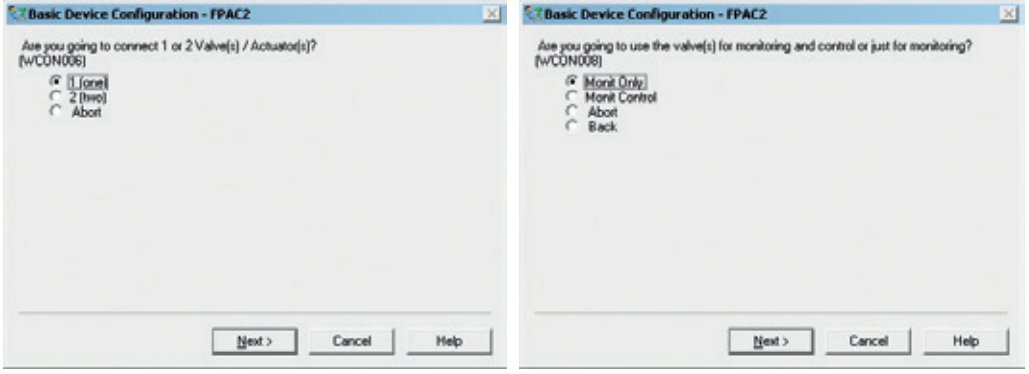


FIGURE 7



7. Choose now the internal sensors and click Next. Configure the valve type is Rotary. This is informative and does not affect any functionality. Click on Next to continue. See Figure 8.
8. A series of messages will follow, for a few seconds. Wait until the message "Configuration finished. Start downloading/ writing...(WCON0019)" appears, then click on Next to continue.
9. Another series of configuration messages will be shown. Wait until the message "Configuration finished. Returning transducers to Auto...(WCON0020)" appears, then click on Finish to close the method window.
10. Close the Configure/Setup window. If you want see how to configure the blocks directly without the method, proceed to the next section. If you want to go directly to control module example, skip the next section.

4.2.4.1.2 Transducer configuration writing directly to block parameters

1. This example assumes the device has been commissioned and is at the factory default configuration. See Appendix B for factory default procedure and Appendix D for complete list of block parameters including default values.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.
3. Right-click on the device you want to configure and chose Configure/Setup. See Figure 9.
4. The Device Identification window will appear after a few seconds. Click on Transducer Basic Setup and wait a few seconds until all parameters are read.
5. In the Std Transducer 1 parameters group, click on the parameter ACTION_ELEMENT drop box and select the option Monitoring. Click on Apply, and then on the screen that opens click on Yes. See Figure 10.

FIGURE 8

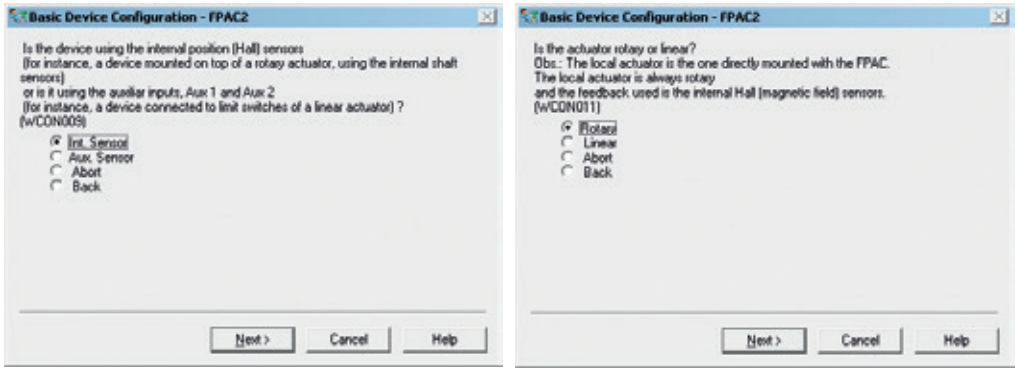


FIGURE 9

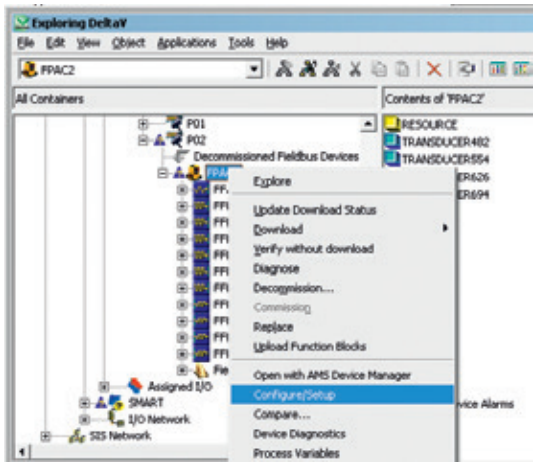
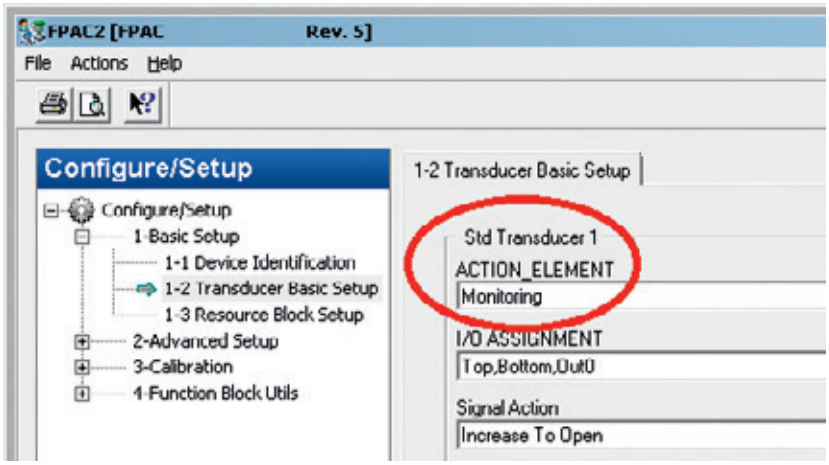


FIGURE 10



6. On the menu tree, select Function Block Utils, then click on Block Modes and finally select the tab Block Mode-Std Transducer. In the Std TRD 1 Target Mode group, select the target mode to Automatic. Make sure to uncheck the Out of Service option. Click on Apply to write the configuration. See Figure 11.
7. After a few seconds, confirm the transducer block changed the mode to Automatic by observing the parameters in the left side of the window, group Std TRD 1 Actual Mode. See Figure 12.
8. Close Configure/Setup window.

4.2.4.1.3 Control module using the DI block

Note: although possible, it is not recommended to use AMS for function block (DI, DO, AI) channel configuration once this configuration is not saved in the persistent database. Use DeltaV explorer or Control Studio for function blocks configuration as illustrated in the next section.

1. Open or create a control module and add one DI block. Assign this DI block to the DI_1 block in the FPAC. If desired, add more blocks and create links from the DI_1. OUT_D.
2. Click on the DI block and make sure that Mode = Auto and Channel = 9 - TRD1: 0-Closed / 1-Opened. See Figure 13.
3. Download the control module configuration the fieldbus network. See Figure 14.

FIGURE 11

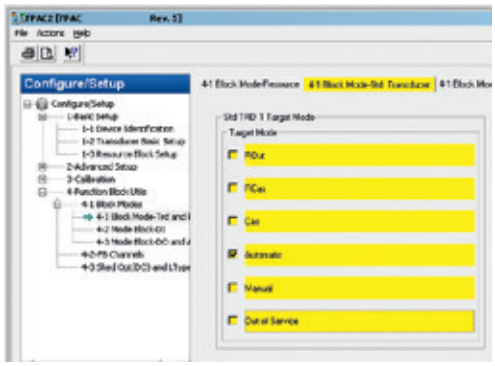


FIGURE 12

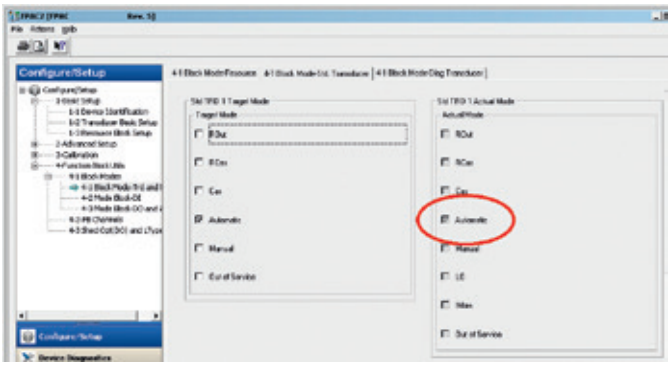
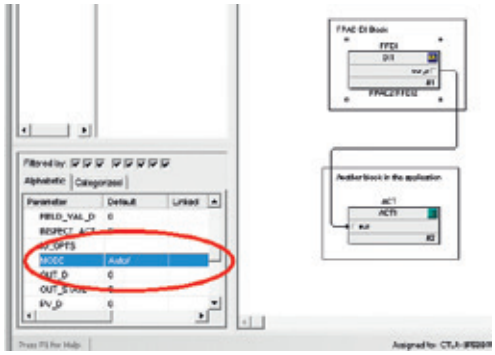


FIGURE 13



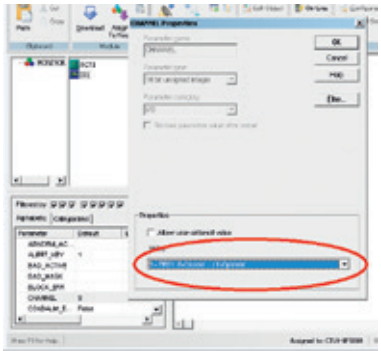
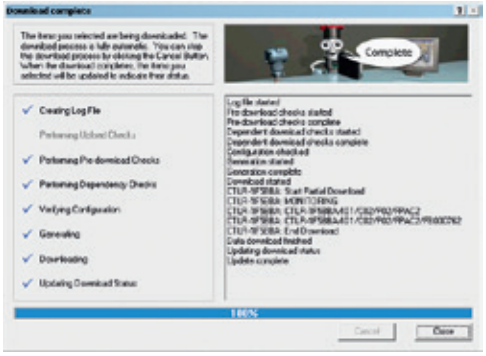


FIGURE 14



4. When the download finishes, open the control module on-line to verify the DI.OUT_D parameter. Move the valve and observe it will show '0' for valve closed, '1' for valve opened and '3' or '4' for opening/closing positions. The LEDs on the module will indicate the position accordingly. Notice the block linked to the DI is also receiving the same values. See Figure 15.

4.2.4.2 Controlling and monitoring one valve with a DO block

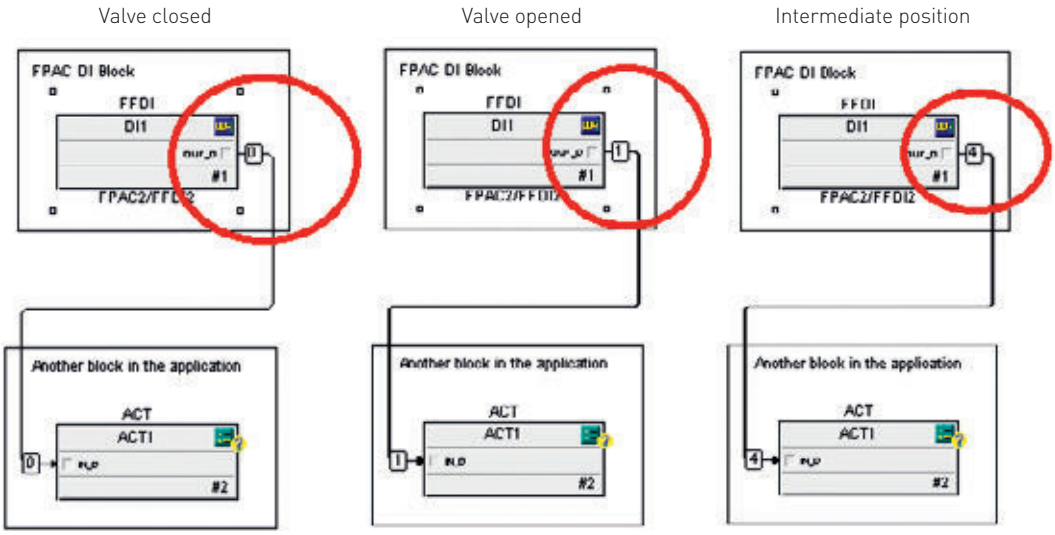
The second variant of the example #1 assumes the FPAC is controlling the same valve assembly using a DO block. The position feedback is given by the same DO through BKCAL_OUT_D parameter:

Blocks and parameters that need configuration		
Resource	**TB1**	**DO_1**
MODE_BLK = AUTO	MODE_BLK = AUTO	IO_OPTS = Use PV for BKCAL_OUT
		MODE_BLK = CAS+AUTO*

* For testing purposes mode can be set to AUTO or MAN.

1. This example assumes the device has been commissioned and is at the factory default configuration. See Appendix B for factory default procedure and Appendix D for complete list of block parameters including default values.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.

FIGURE 15



3. Right-click on the device you want to configure and chose Configure/Setup. See Figure 16.
4. On the menu tree, select Function Block Utils, then click on Block Modes and finally select the tab Block Mode-Std Transducer. In the Std TRD 1 Target Mode group, select the target mode to Automatic. Make sure to uncheck the Out of Service option. Click on Apply to write the configuration. See Figure 17.
5. After a few seconds, confirm the transducer block changed the mode to Automatic by observing the parameters in the left side of the window, group Std TRD 1 Actual Mode. See Figure 18.
6. **Important:** at this point in the configuration, if you check the transducer block 1 diagnostics you will see that BLOCK_ERR parameter will be indicating Block Configuration error and the Resource Block will be indicating Device Fault State. These errors will be cleared once the DO is configured.
7. Close Configure/Setup window.
8. Open or create a control module and add one DO block. Assign this DO block to the DO_1 block in the FPAC. If desired, add more blocks and create links to DO_1. CAS_IN_D and from DO_1.BKCAL_OUT_D.

FIGURE 16

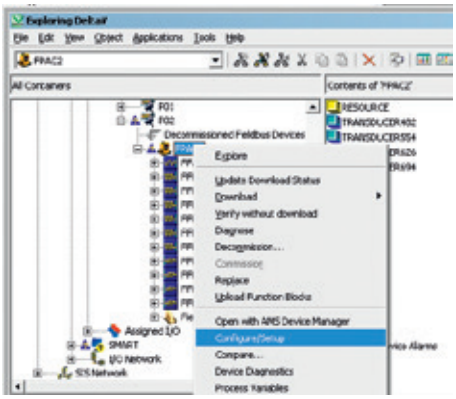


FIGURE 17

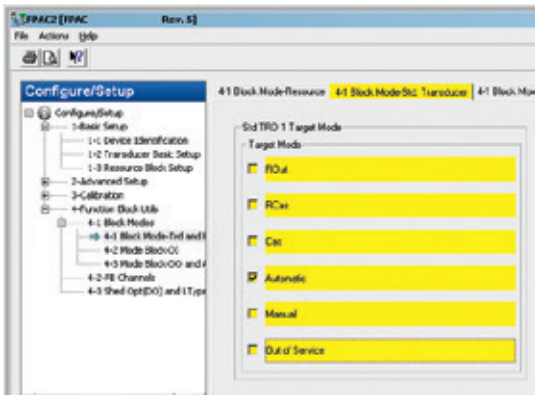
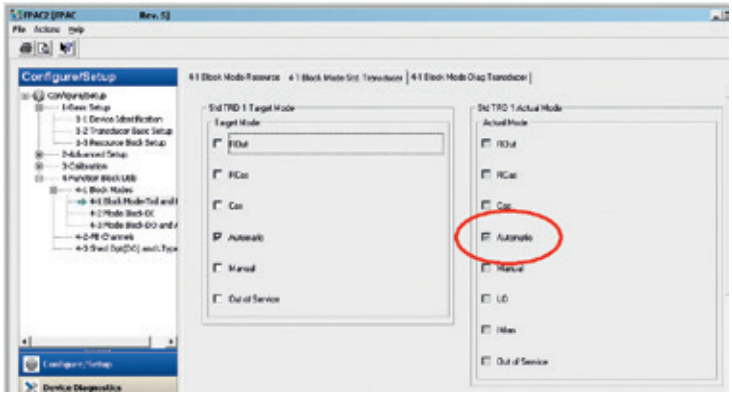


FIGURE 18



9. Click on the DO block and make sure that Mode = Auto, IO_OPTS = Use PV for BKCAL_OUT and Channel = 1 - TRD1: 0-Close / 1-Open. See Figure 19.
10. Download the control module configuration to the fieldbus network. See Figure 20.

FIGURE 19

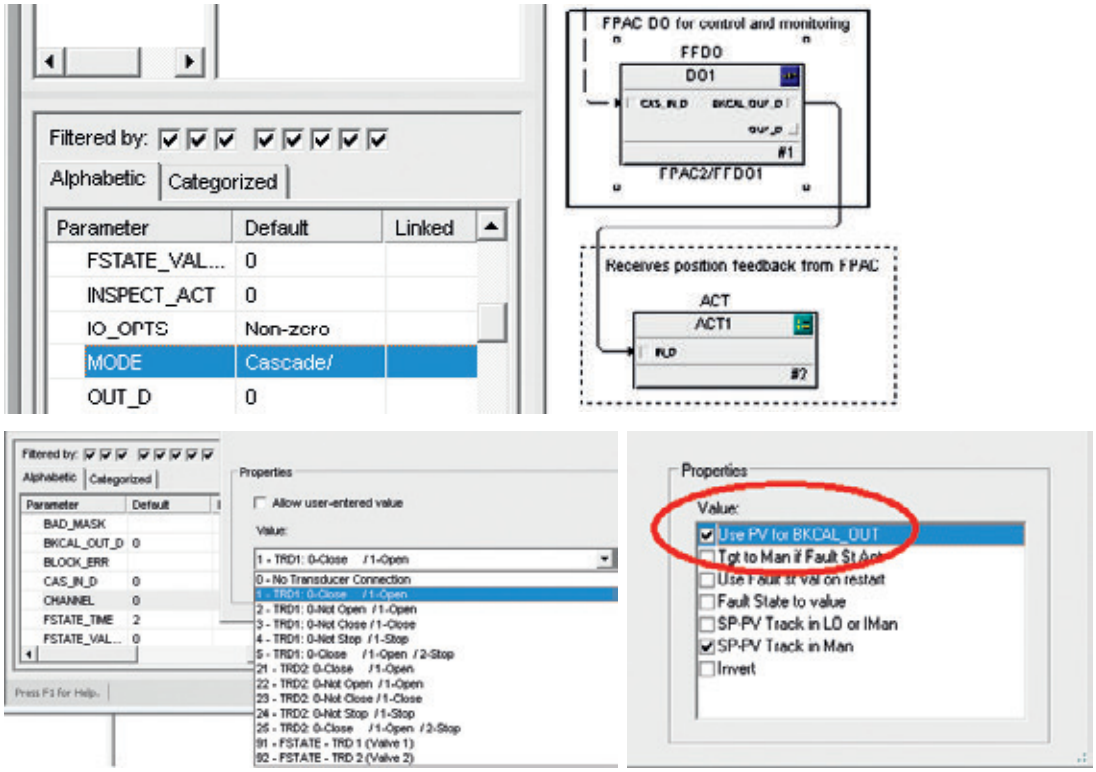
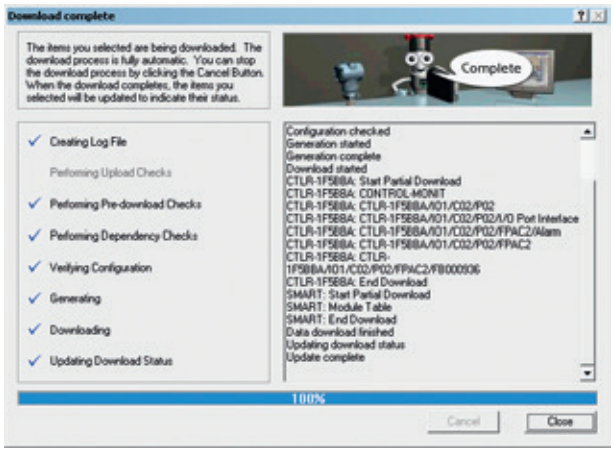


FIGURE 20



11. When the download finishes, open the control module on-line. Move the valve by changing the parameter linked to the DO_1.CAS_IN_D and observe the valve position feedback will show '0' for valve closed, '1' for valve opened, '3' for valve opening or '4' for valve closing. The LEDs on the module will indicate the position accordingly. Notice the block linked to the DI is also receiving the same values. See Figure 21.

4.2.4.3 Controlling and monitoring one valve with one DO block and two DI blocks

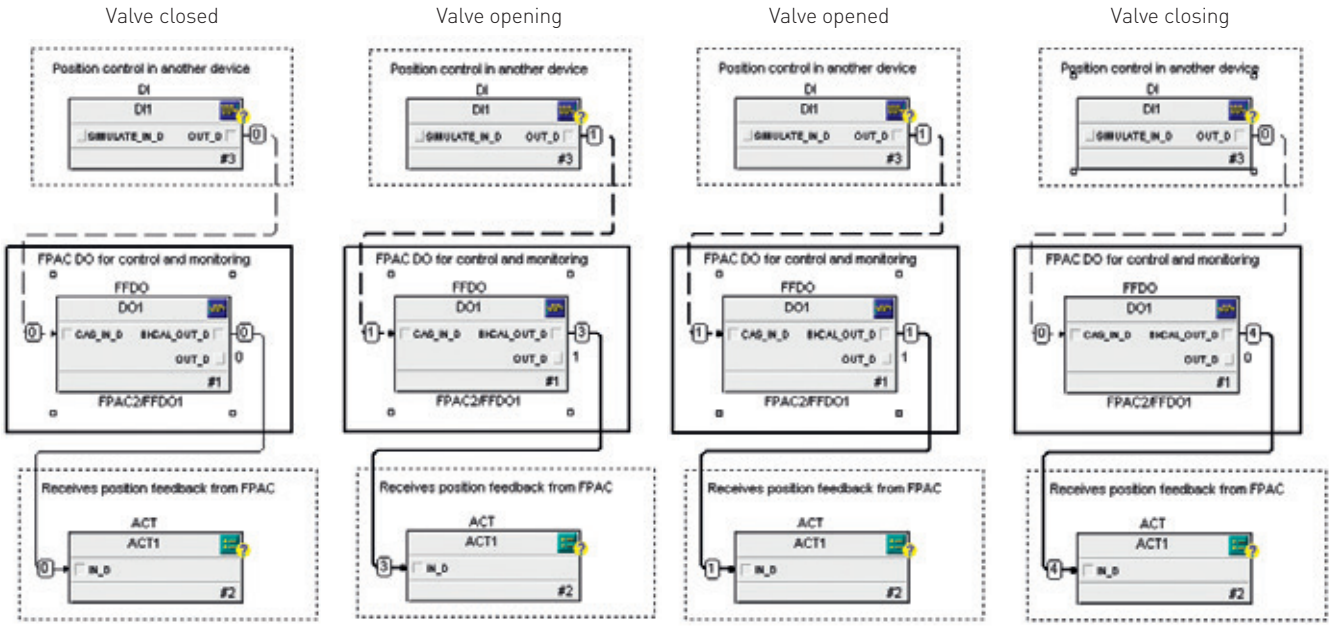
The third variant of the example #1 shows a combination of one DO block to control the valve position and 2 (two) DI blocks for the position feedback.

Blocks and parameters that need configuration				
Resource	**TB1**	**DO_1**	**DI_1 (CLOSED)**	**DI_2 (OPENED)**
MODE_BLK = AUTO	MODE_BLK = AUTO	IO_OPTS = Use PV for BKCAL_OUT	CHANNEL = 11: TRD1: 0-Not Closed / 1-Closed	CHANNEL = 10: TRD1: 0-Not Opened / 1-Opened
		MODE_BLK = CAS+AUTO*	MODE_BLK = AUTO	MODE_BLK = AUTO

* For testing purposes mode can be set to AUTO or MAN.

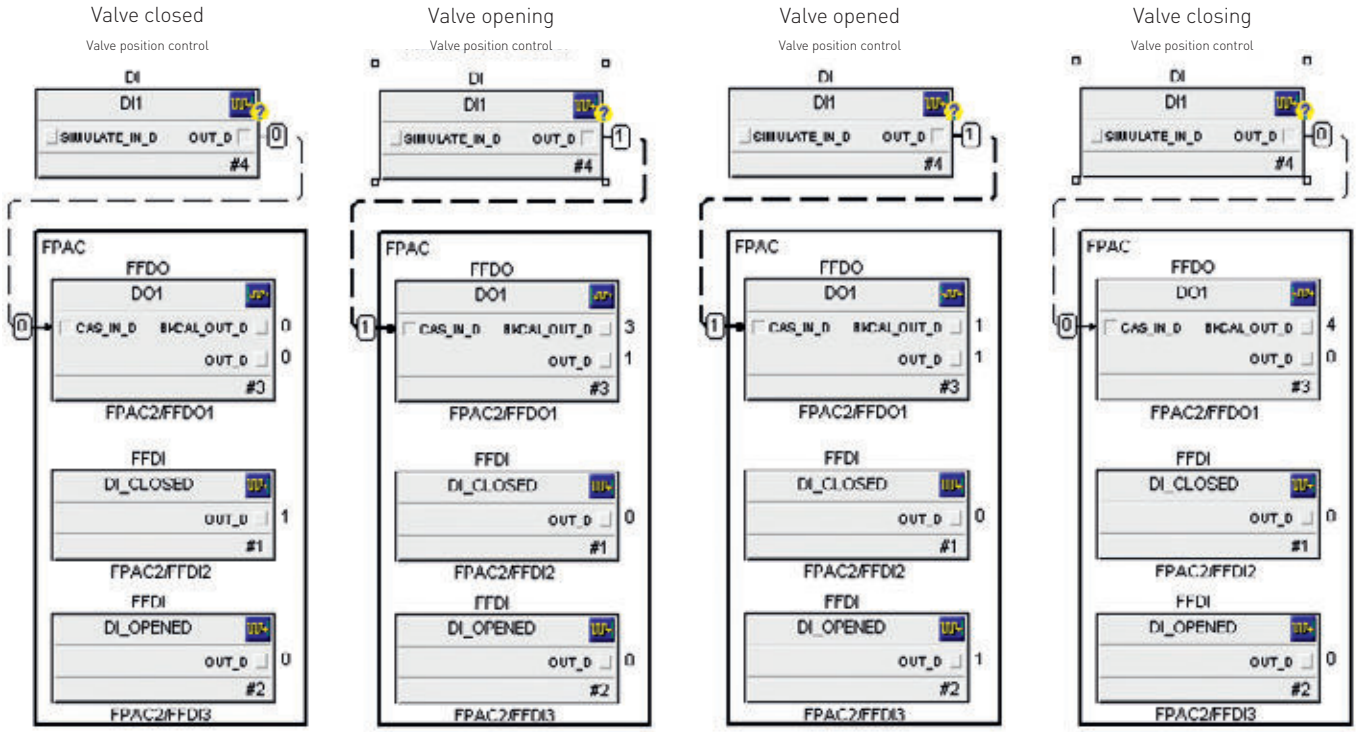
1. This example utilizes the exact same configuration of the previous example for the transducer TB1 and DO_1 blocks. Therefore, we can jump straight to the control module differences that are basically the DI blocks.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.
3. Open or create a control module and add one DO block and two DI blocks: DI_CLOSED and DI_OPENED. Assign the DO and DI blocks in the control module to FPCA's DO_1, DI_1 and DI_2 respectively. If desired, add more blocks and create links from/to these blocks.
4. Click on the DO block and make sure that Mode = Auto, IO_OPTS = Use PV for BKCAL_OUT and Channel = 1 - TRD1: 0-Close / 1-Open, identical to the previous example.

FIGURE 21



5. Click on the DI_CLOSED block and make sure that Mode = Auto and Channel = 11: TRD1: 0-Not Closed / 1-Closed. Notice that '1' in this DI output means the valve is CLOSED, which is not the typical convention but may be useful in some applications.
6. Click on the DI_OPEN block and make sure that Mode = Auto and Channel = 10 - TRD1: 0-Not Opened / 1-Opened.
7. Download the control module configuration to the fieldbus network.
8. When the download finishes, open the control module on-line. Move the valve by changing the parameter linked to the DO_1.CAS_IN_D and observe the valve position feedback will show '0' for valve closed, '1' for valve opened, '3' for valve opening or '4' for valve closing. The LEDs on the module will indicate the position accordingly. Notice the block linked to the DI is also receiving the same values. See Figure 22.
9. Compare the position indication amongst the blocks. Notice the indication "valve opening" or "valve closing" is only present in the DO.BKCAL_OUT_D.

FIGURE 22



4.2.5 Configuration for example #2: one valve, rotary, dual coil/piezo solenoid

This example assumes the device is at the factory default state. It shows control and monitoring of one rotary valve with dual coil/piezo solenoid (Double Action). The FPAC is installed on top of the actuator and the internal Hall effect sensors are used as limit switches. It assumes it is wired as illustrated in the previous section "Wiring for Example #2".OUT0 and OUT1 are used to power the double coil/piezo solenoid valve. The DO_1 block is used for control and feedback. DI_1 is optional and can also be used for position feedback. In addition, DO and DI channels with the option "2-Stop" are chosen to illustrate the usage. The following parameters need to be configured:

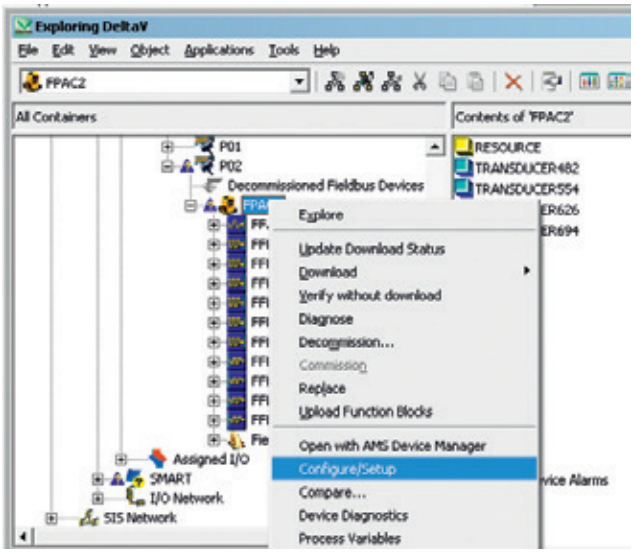
Blocks and parameters that need configuration			
Resource	**TB1**	**DO_1**	**DI_1 (Optional)**
MODE_BLK = AUTO	ACTION_ELEMENT = Double Action	IO_OPTS = Use PV for BKCAL_OUT	CHANNEL = TRD1: 0-Close / 1-Open / 2-Stop
	MODE_BLK = AUTO	CHANNEL = TRD1: 0-Close / 1-Open / 2-Stop	MODE_BLK = AUTO
		MODE_BLK = CAS+AUTO*	

* For testing purposes mode can be set to AUTO or MAN.

Note: for double action valves it is possible to command the DO block to "STOP" the valve at the current position writing value '2' to the set-point. The transducer block will deactivate both OUT0 and OUT1 to trap the air in the actuator causing the valve to stay at the current position. Depending on the time to open or close the valve may stop at any intermediate position.
Note: in this configuration, despite the fact that FPAC is powering two coils/piezos, there is only one coil/piezo powered at a time, so the dipswitch #6 must remain OFF and the power consumption of the module is 12 mA. In the STOP condition both outputs are de-energized.

1. This example assumes the device has been commissioned and is at the factory default configuration. See Appendix B for factory default procedure and Appendix D for complete list of block parameters including default values.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.
3. Right-click on the device you want to configure and chose Configure/Setup. See Figure 23.

FIGURE 23



4. The Device Identification window will appear after a few seconds. Click on Basic Device Configuration to start the method. A series of warning windows will be shown. Read them carefully and click Next until the method starts making changes to the device. See Figure 24.
5. A series of messages will be displayed, for a few seconds. Wait until the message "Transducer blocks are in OOS (WCON005)" is shown. Then click Next.
6. Configure there is only 1 valve attached to this FPAC and click on Next. Select Monit Control and click on Next. See Figure 25.
7. Choose internal sensors option and click Next. Configure for a Double Action (dual coil/piezo solenoid) and click Next. See Figure 26.

FIGURE 24

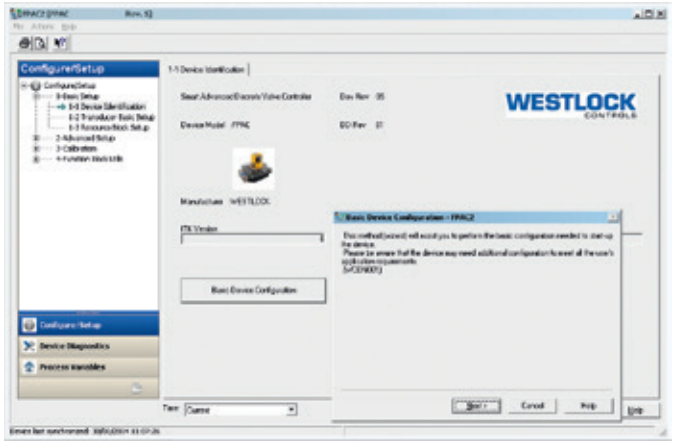


FIGURE 25

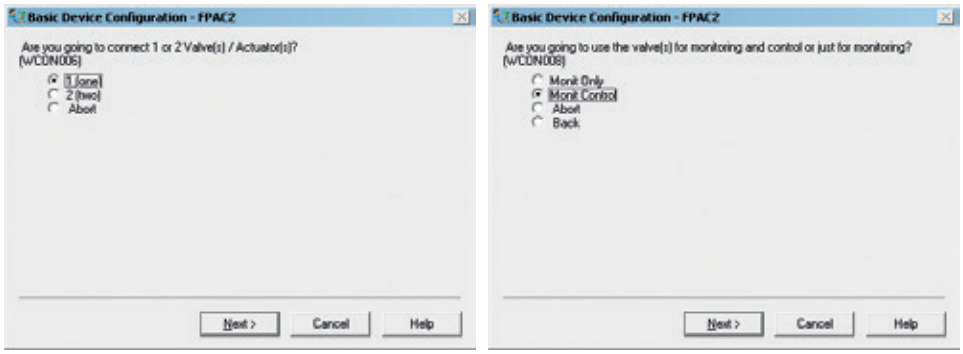
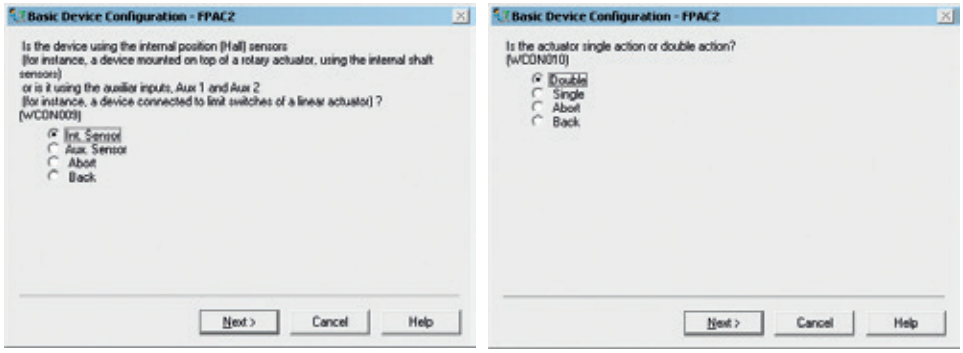


FIGURE 26



8. Configure the valve type is Rotary. This is informative and does not affect any functionality. Click on Next to continue. See Figure 27.
9. A series of messages will follow, for a few seconds. Wait until the message "Configuration finished. Start downloading/ writing...(WCON0019)" appears, then click on Next to continue.
10. Another series of configuration messages will be shown. Wait until the message "Configuration finished. Returning transducers to Auto...(WCON0020)" appears, then click on Finish to close the method window. Close the Configure/Setup window. **Note:** although possible, it is not recommended to use AMS for function block (DI, DO, AI) channel configuration once this configuration is not saved in the persistent database. Use DeltaV explorer or Control Studio for function blocks configuration as illustrated in the next section.
11. Open or create a control module and add one DO block and one DI block. Assign these blocks to FPAC's DO_1 and DI_1 respectively. If desired, add more blocks and create links to DO_1.CAS_IN_D, DI_1.OUT_D and from DO_1.BKCAL_OUT_D.
12. Click on the DO block and make sure that Mode = Auto, IO_OPTS = Use PV for BKCAL_ OUT and Channel = 5 - TRD1: 0-Close / 1-Open / 2-Stop. See Figure 28.
13. Click on the DI block and make sure that Mode = Auto and Channel = 12 - TRD1: 0-Closed / 1-Opened / 2-Stopped. See Figure 29.

FIGURE 27

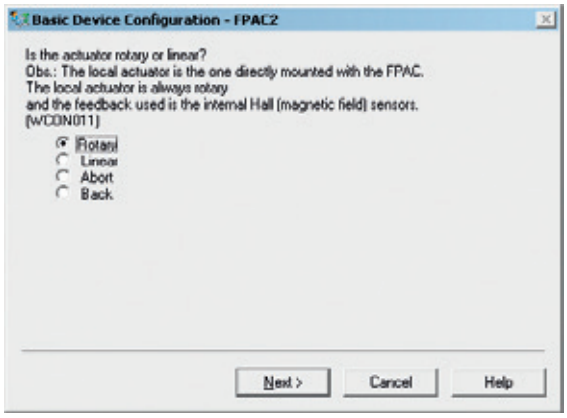


FIGURE 29

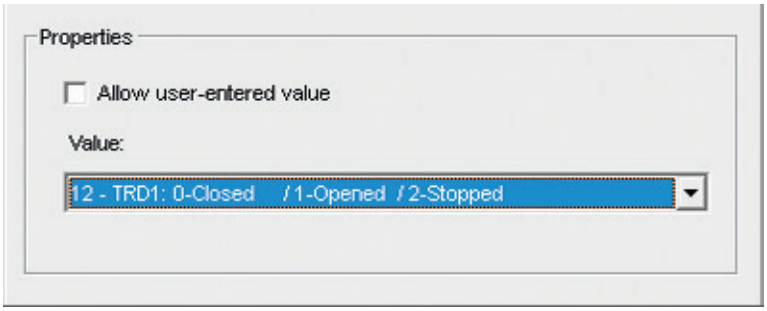
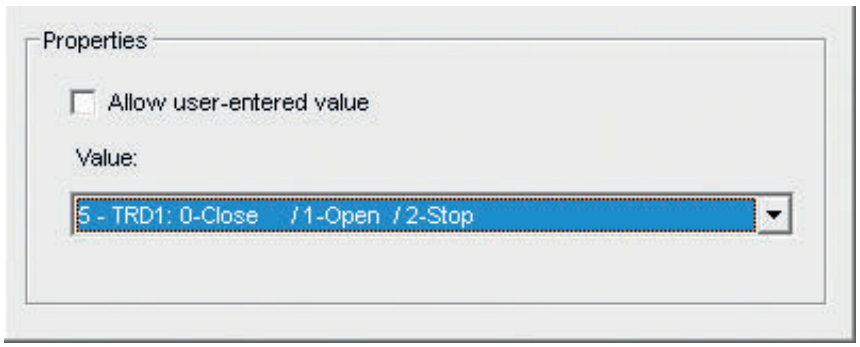
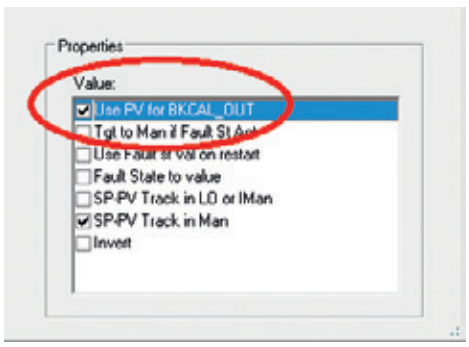


FIGURE 28





14. Download the control module configuration to the fieldbus network.
15. When the download finishes, open the control module on-line. Move the valve by changing the parameter linked to the DO_1. CAS_IN_D and observe the valve position feedback will show '0' for valve closed, '1' for valve opened, '2' for valve stopped, '3' for valve opening and '4' for valve closing. The LEDs on the module will indicate the position accordingly. The values. Notice the block linked to the DI is also receiving the same values. See Figure 30.

Note: values '3' = OPENING and '4' = CLOSING may only be seen for assemblies where the time to open/close is at least a few seconds. Faster valves will make the position feedback switch from '0'=CLOSED to '1' = OPENED and vice-versa.
Note: the feedback value '2' = STOPPED is only seen when the DO commands the valve to stop. If this command is sent right after an open/close command, while the valve is still moving (closing or opening) the valve may stop at an intermediate position. See screenshots below. These conditions can be reproduced manually of using a very slow assembly. See Figure 31.

FIGURE 30

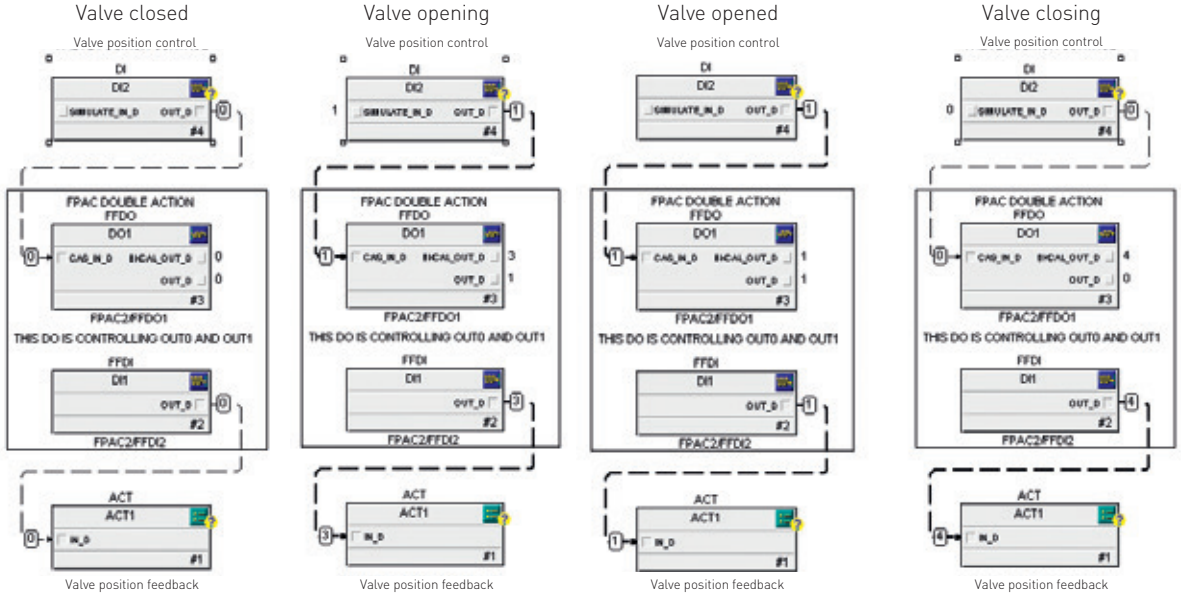
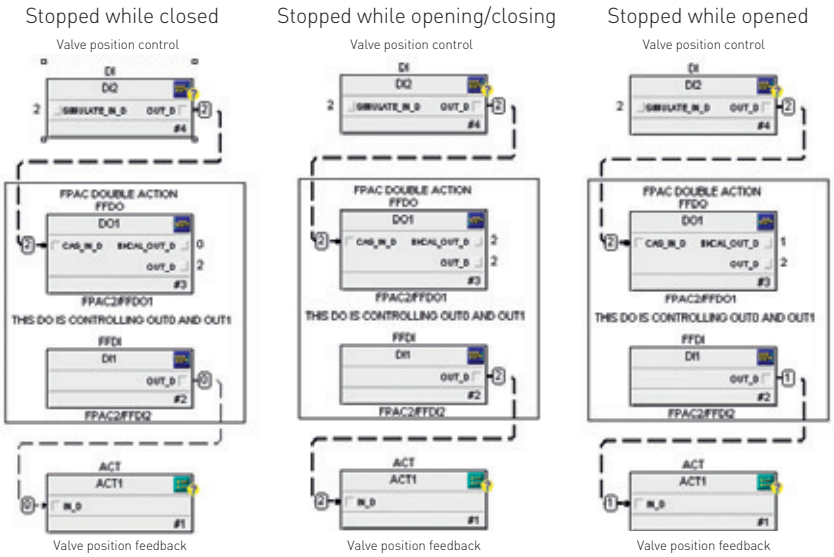


FIGURE 31



4.2.6 Configuration for example #3: one valve, linear, with simple solenoid
This example is similar to example #1. The only difference is that FPAC uses auxiliary inputs AUX1 and AUX2 for the limit switches. Because of DD method convention, this example uses OUT1 to power the solenoid. Position feedback is given by the DO through BKCAL_OUT_D parameter. It assumes it is wired as illustrated in the previous section "Wiring for Example #3".
This example assumes the device is at the factory default state. It shows control and monitoring of one linear valve with simple solenoid (single coil/piezo). The following parameters need to be configured:

A. Just monitoring the valve with one DI block. Transducer block TB2 is used. The valve is controlled by some other means (manually or by a separate controller):

Blocks and parameters that need configuration		
Resource	**TB2**	**DI_1**
MODE_BLK = AUTO	ACTION_ELEMENT = 4: Monitoring	MODE_BLK = AUTO
	IO_ASSIGNMENT = Aux1,Aux2,Out1	
	MODE_BLK = AUTO	

B. The second variant of the example assumes the FPAC is controlling the valve using a DO block (OUT1 is used to power the solenoid) and the position feedback is given by the same DO through BKCAL_OUT_D parameter:

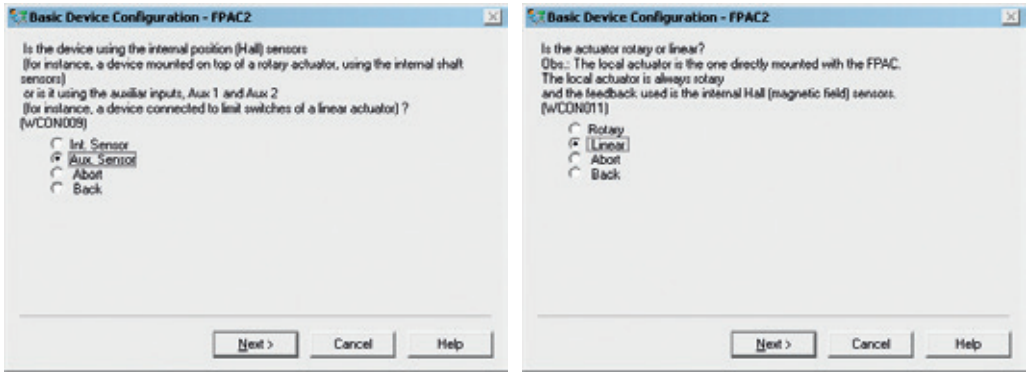
Blocks and parameters that need configuration		
Resource	**TB2**	**DO_1**
MODE_BLK = AUTO	ACTION_ELEMENT = 4: Monitoring	IO_OPTS = Use PV for BKCAL_OUT
	IO_ASSIGNMENT = Aux1,Aux2,Out1	CHANNEL: TRD2: 0-Close / 1-Open
	MODE_BLK = AUTO	MODE_BLK = CAS+AUTO*

* For testing purposes mode can be set to AUTO or MAN.

1. To configure this application using the DD method, follow the same steps illustrated in example #1 except that you should choose Aux sensor for the limit switches and click Next. Configure the valve type for Linear and click on Next to continue. See the screenshots below.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state. See Figure 32.
3. The strategy for the linear valve is exactly the same as for the rotary valve in example #1. The linear valve can be monitored and controlled using a combination of DO and DI blocks depending on the application requirements.

Note: the physical limit switches must be wired to AUX1 and AUX2 at the J4 connector. LEDs AUX1=OPENED and AUX2=CLOSED should be used to verified the limit switches activity. The solenoid coil/piezo must be wired to OUT1.
Note: although possible, it is not recommended to use AMS for function block (DI, DO, AI) channel configuration once this configuration is not saved in the persistent database. Use DeltaV explorer or Control Studio for function blocks configuration as illustrated in the next section.

FIGURE 32



4.2.7 Configuration for example #4: two rotary valves, direct and reverse action

This example shows control and monitoring of two rotary valves with simple solenoids (single coil/ piezo). Position feedback is given by the DO blocks through BKCAL_OUT_D parameter. It assumes it is wired as illustrated in the previous section "Wiring for Example #4".The next sections show 2 (two) possible realizations for this example:

1. Just monitoring the 2 (two) valves with DI blocks (it does not control the solenoids).
2. Controlling and monitoring the 2 (two) valves with DO blocks.

4.2.7.1 Just monitoring two valves using DI blocks

This example assumes the device is at the factory default state. It shows monitoring of two rotary valves. Position feedback is given by DI blocks. Since the valves are controlled by some other means it does not matter if the valve is direct or reverse action.

- Valve 1 uses internal TOP and BOTTOM Hall effect sensors as limit switches.
- Valve 2 uses AUX1 (OPENED) and AUX2 (CLOSED) inputs for the limit switches.

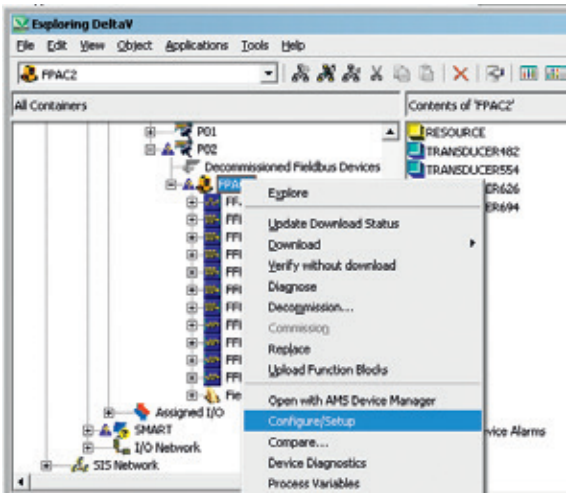
Blocks and parameters that need configuration				
Resource	**TB1**	**DI_1**	**TB2**	**DI_2**
MODE_BLK = AUTO	ACTION_ELEMENT = Monitoring	MODE_BLK = AUTO	ACTION_ELEMENT = Monitoring	CHANNEL = TRD2: 0-Close / 1=Open
	MODE_BLK = AUTO		IO_ASSIGNMENT = Aux1,Aux2,Out1	MODE_BLK = AUTO
			MODE_BLK = AUTO	

* For testing purposes mode can be set to AUTO or MAN.

This example does not use the DD method. It shows how to configure the parameters directly in the transducer blocks.

1. This example assumes the device has been commissioned and is at the factory default configuration. See Appendix B for factory default procedure and Appendix D for complete list of block parameters including default values.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.
3. Right-click on the device you want to configure and chose Configure/Setup. See Figure 33.

FIGURE 33



4. On the menu tree, click on Basic Setup, then click on Transducer Basic Setup. On the Std Transducer 1 group, click on ACTION_ELEMENT parameter drop box and select Monitoring. Repeat this for the Std Transducer 2. Click on Apply. See Figure 34.
5. On the menu tree, click on Function Block Utils, then click on Block Modes and finally select the tab Block Mode-Std Transducer. In the Std TRD 1 Target Mode group, select the target mode to Automatic. Make sure to uncheck the Out of Service option. Scroll down the window and check Automatic also for the Std TRD 2 Target Mode. Click on Apply to write the configuration. See Figure 35.

FIGURE 34

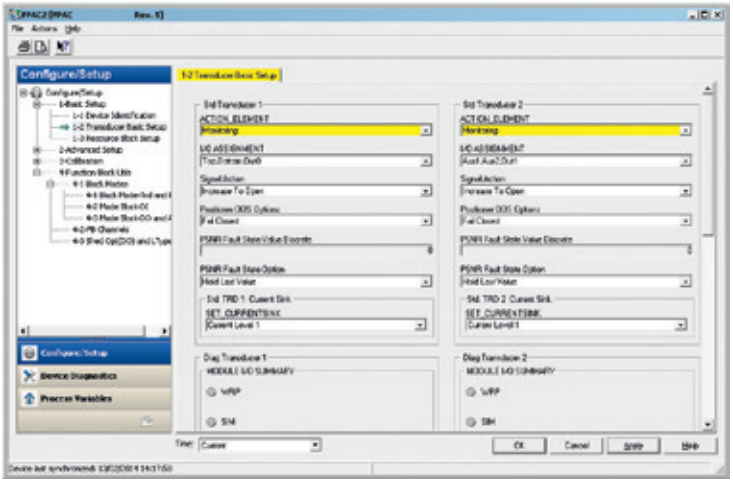
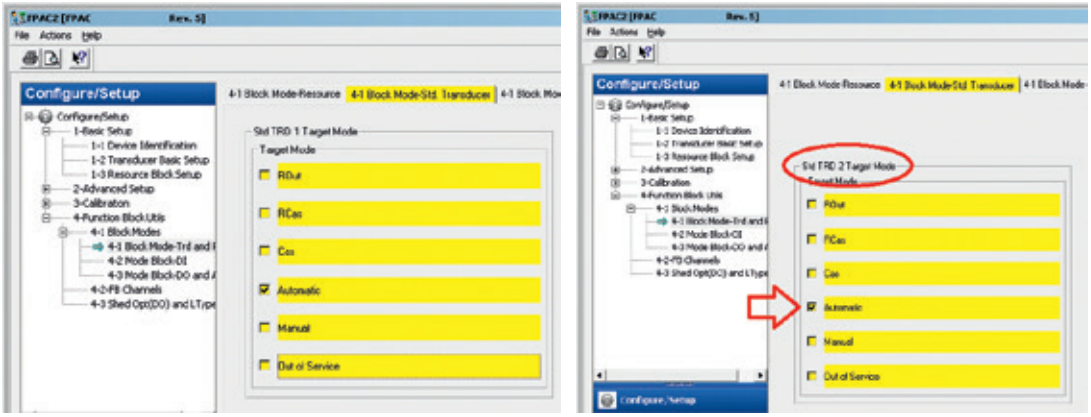


FIGURE 35



6. After a few seconds, confirm both transducer blocks changed the mode to Automatic by observing the parameters in the left side of the window, group Std TRD 1 Actual Mode. Scroll down and check also Std TRD 2 Actual Mode. See Figure 36.

Note: although possible, it is not recommended to use AMS for function block (DI, DO, AI) channel configuration once this configuration is not saved in the persistent database. Use DeltaV explorer or Control Studio for function blocks configuration as illustrated in the next section.

7. Open or create a control module and add two DI blocks. Assign these DI blocks FPAC's DI_1 and DI_2 respectively. Add more blocks and create links from the DI_1. OUT_D and DI_2.OUT_D if you will.
8. Click on the first DI (valve 1) and make sure that Mode = Auto and Channel = 9 - TRD1: 0-Closed / 1-Opened. See Figure 37.

FIGURE 36

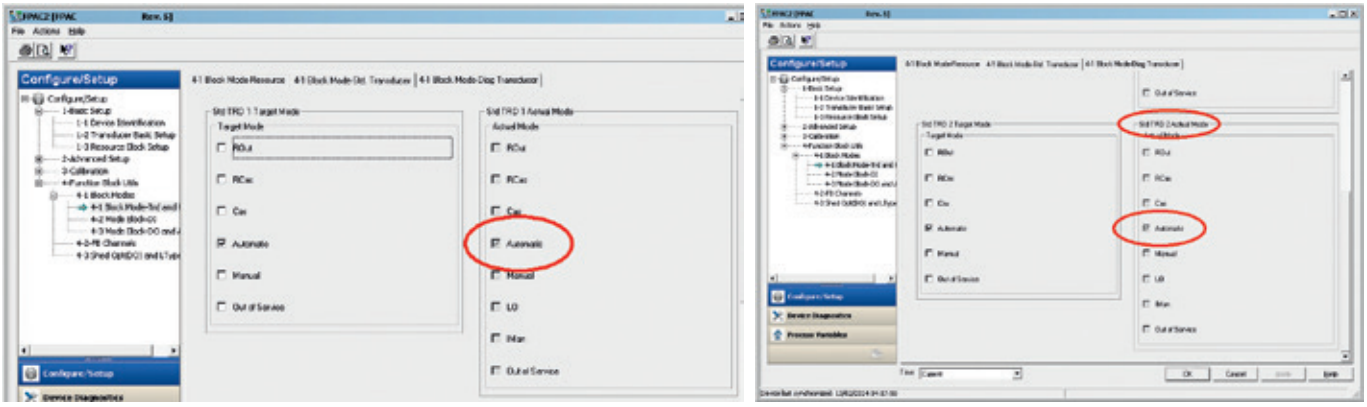
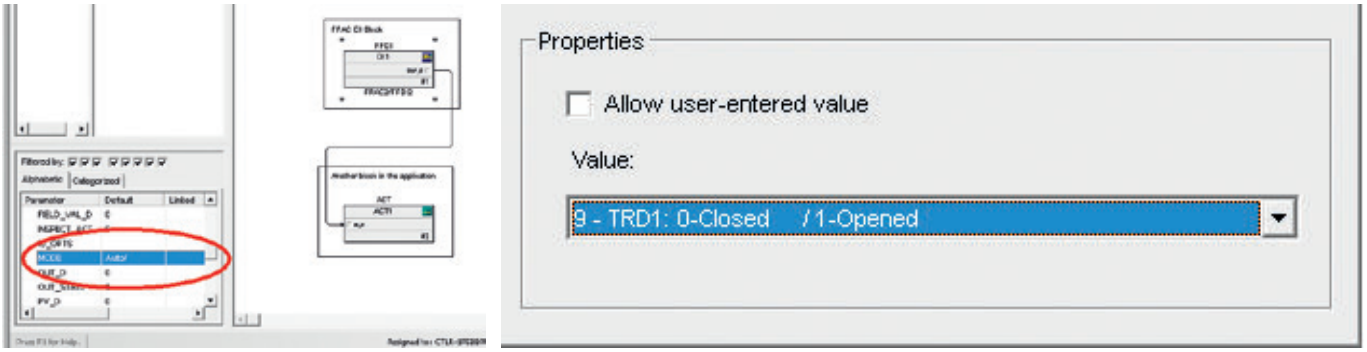


FIGURE 37



9. Click on the second DI (valve 2) and make sure that Mode = Auto and Channel = 29 - TRD2: 0-Closed / 1-Opened. See Figure 38.
10. Download the control module configuration to the fieldbus network. See Figure 39.
11. When the download finishes, open the control module on-line. Move the valves and observe the DI outputs will show '0' for valve closed, '1' for valve opened and '3' or '4' for opening/closing positions. The LEDs on the module will indicate the position accordingly. See Figure 40.

FIGURE 38

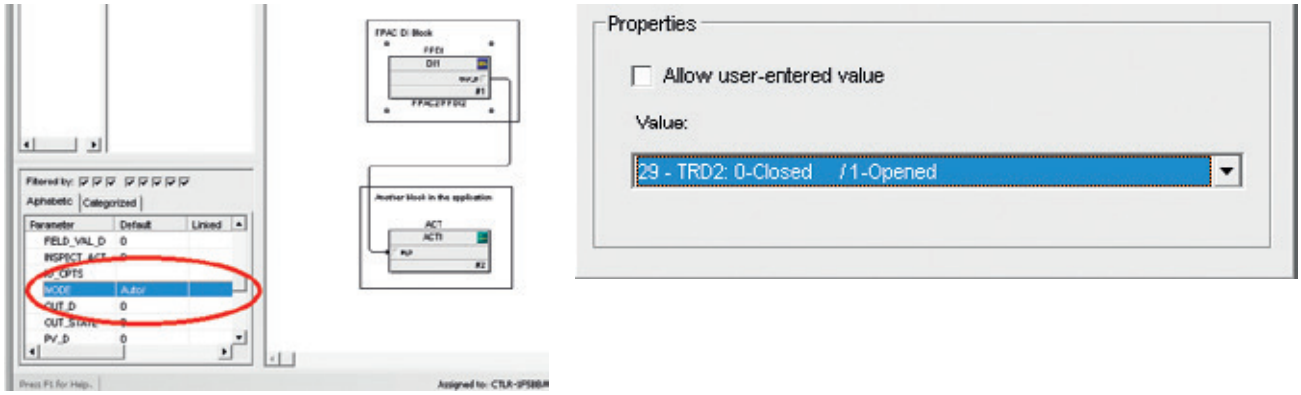
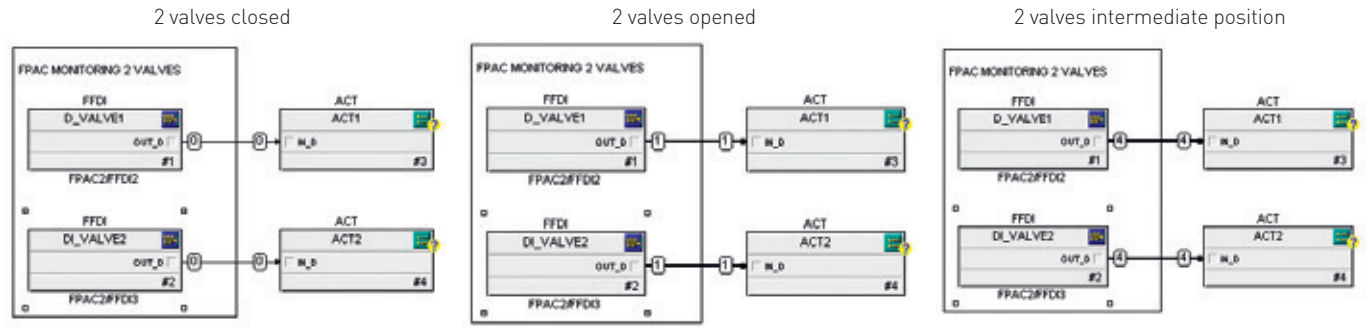


FIGURE 39

FIGURE 40



4.2.7.2 Controlling and monitoring two valves using DO blocks

This example assumes the device is at the factory default state. It shows control and monitoring of two rotary valves with simple solenoids (single coil/piezo). Position feedback is given by the DO blocks through BKCAL_OUT_D parameter.

- Valve 1 uses internal Hall effect sensors as limit switches and OUT0 to power the solenoid. This valve is DIRECT action (increase to open).
- Valve 2 uses AUX1 and AUX2 as limit switches and OUT1 to power the solenoid. This valve is REVERSE action (increase to close).

Blocks and parameters that need configuration				
Resource	**TB1**	**DO_1**	**TB2**	**DO_2**
MODE_BLK = AUTO	MODE_BLK = AUTO	IO_OPTS = Use PV for BKCAL_OUT	ACTION_ELEMENT = Single Action	IO_OPTS = Use PV for BKCAL_OUT
		MODE_BLK = CAS+AUTO*	SIGNAL_ACTION = Increase to Close	CHANNEL = TRD2: 0-Close / 1=Open
			SET_CURRENT_SINK = Current Level 2	MODE_BLK = CAS+AUTO*
			MODE_BLK = AUTO	

* For testing purposes mode can be set to AUTO or MAN.

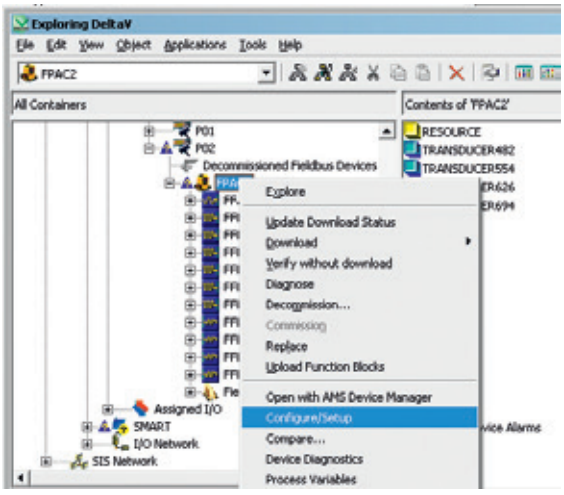
Note: dipswitch #6 MUST BE SET TO ON otherwise the transducer blocks will not go to AUTO. To control 2 single action valves SIMULTANEOUSLY it is necessary that FPAC takes 17 mA from the bus in order to power the 2 solenoids. Therefore it is necessary to configure "SET_CURRENT_SINK = Set Current Level 2" parameter and to turn dip switch 6 (AUX) on. If this is not done the second transducer configured as single action will remain with a block error AND WILL NOT CHANGE MODE TO AUTO.

Note: if after the configuration for two single action valves is done the dip switch 6 (AUX) is turned off, the transducer block will change state from AUTO to OOS and remain until the condition is fixed. Use MODULE_IO_SUMMARY parameter from the Diagnostics transducer block to read the switch status.

This example will make use of the DD method to configure both valves at once.

1. This example assumes the device has been commissioned and is at the factory default configuration. See Appendix B for factory default procedure and Appendix D for complete list of block parameters including default values.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.
3. Right-click on the device you want to configure and chose Configure/Setup. See Figure 41.

FIGURE 41



4. The Device Identification window will appear after a few seconds. Click on Basic Device Configuration to start the method. A series of warning windows will be shown. Read them carefully and click Next until the method starts making changes to the device. See Figure 42.
5. A series of messages will be displayed for a few seconds. Wait until the message "Transducer blocks are in OOS (WCON005)" is shown. Then click Next.
6. Configure there are 2 valves attached to this FPAC and click on Next. Select Monit Control and click on Next. See Figure 43.

FIGURE 42

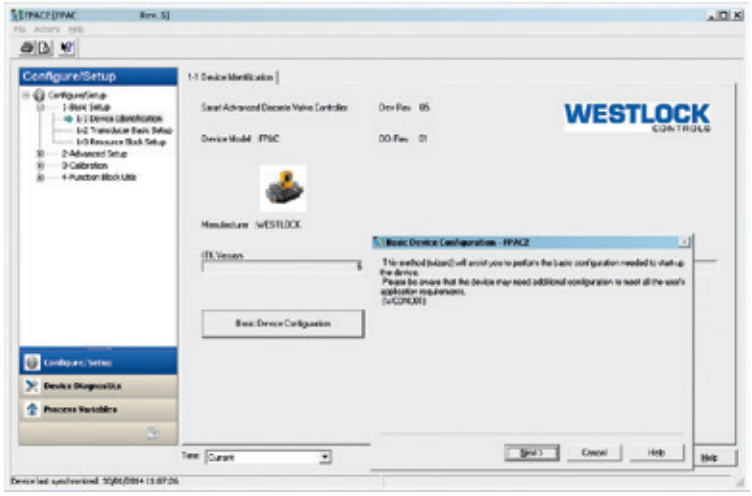
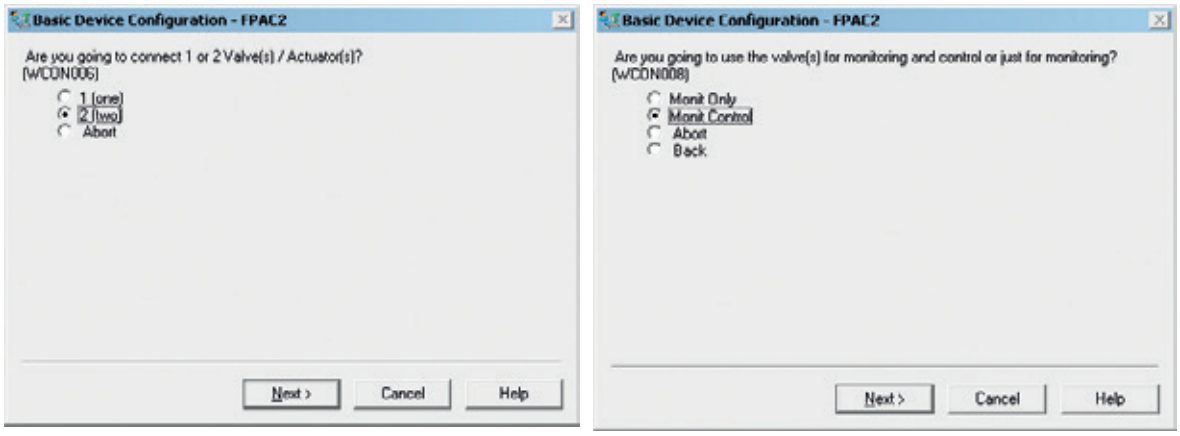
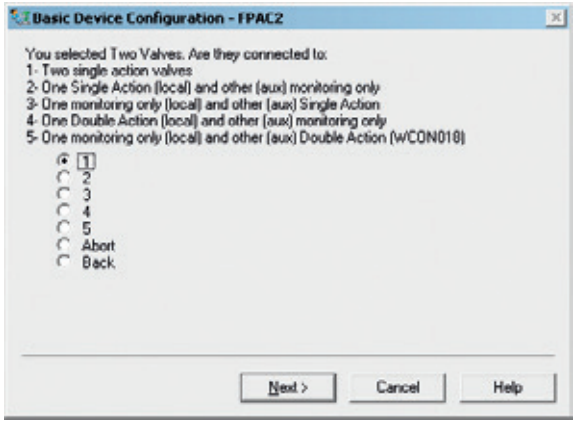


FIGURE 43



7. Inform these 2 valves are Single Action and click on Next. Configure the two valves are Rotary and click on Next to continue. See Figure 44.
8. It is not necessary to select the I/O for the limit switches as the DD method convention for two valves is always the following:
   a. Internal Hall sensors and OUT0 for valve 1
   b. Auxiliary inputs and OUT1 for valve 2.
   c. If you application requires a different configuration you need to change transducers configuration manually.
9. Configure now the valve 1 is direct (increase to open / fail closed) and valve 2 is reverse (increase to close / fail opened). Click Next to continue.
   a. This way, when the DO that controls valve 1 gets '1' in the set-point it will turn the OUT0 on, powering the coil/piezo.
   b. On the other hand, when the DO that controls valve 2 gets '1' in the set-point it will turn the OUT1 off, de-energizing the coil/piezo.
   See Figure 45.
10. A series of messages will follow, for a few seconds. Wait until the message "Configuration finished. Start downloading/ writing...(WCON0019)" appears, then click on Next to continue.
11. The method will take care of setting SET_CURRENT_SINK parameter to "2: Current Level 2". However, you must turn dipswitch #6 ON manually, otherwise the transducer blocks will not change the mode to AUTO and the application will not work as expected.
12. Another series of configuration messages will be shown. Wait until the message "Configuration finished. Returning transducers to Auto...(WCON0020)" appears, then click on Finish to close the method window. Close the Configure/Setup window.
13. Open or create a control module and add two DO blocks. Assign these blocks to FPAC's DO_1 and DO_2 respectively. If desired, add more blocks and create links.

FIGURE 44



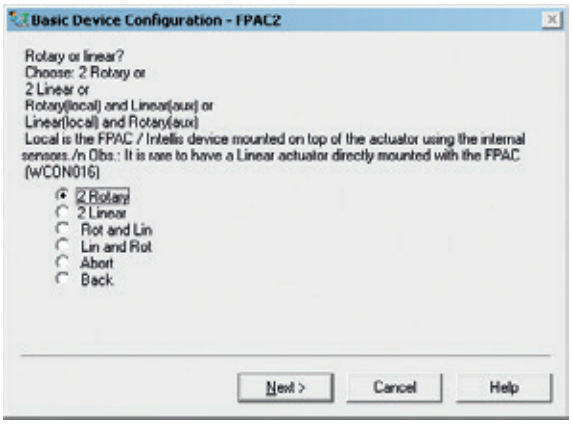
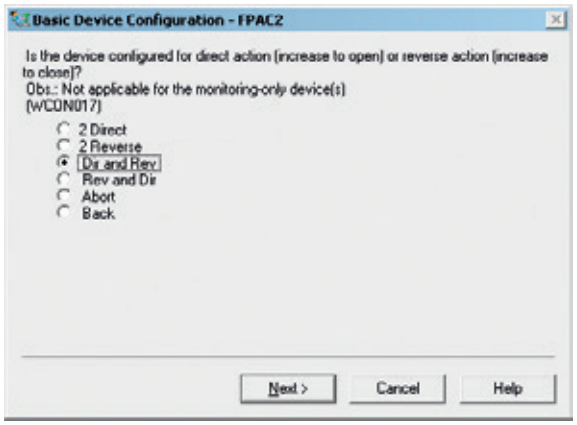


FIGURE 45



14. Click on the first DO block (valve 1) and make sure that Mode = Auto, IO_OPTS = Use PV for BKCAL_OUT and Channel = 1 - TRD1: 0-Close / 1-Open. See Figure 46.
15. Click on the second DO block (valve 2) and make sure that Mode = Auto, IO_OPTS = Use PV for BKCAL_OUT and Channel = 21 - TRD2: 0-Close / 1-Open. See Figure 47.
16. Download the control module configuration to the fieldbus network.

FIGURE 46

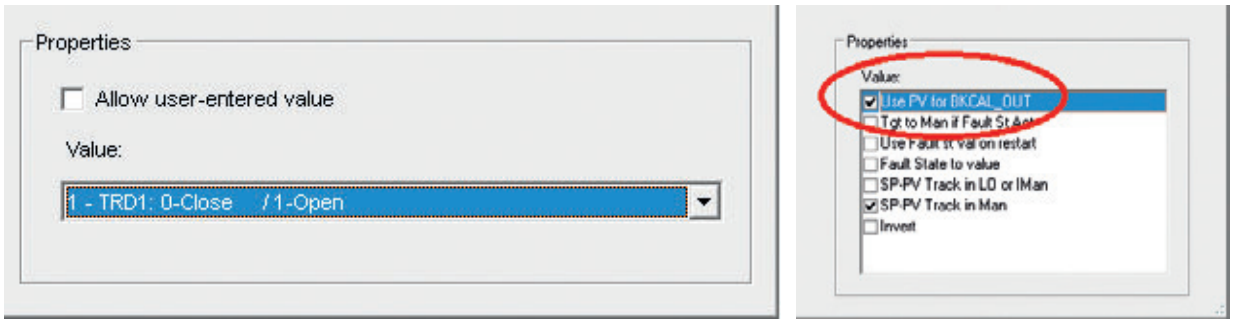
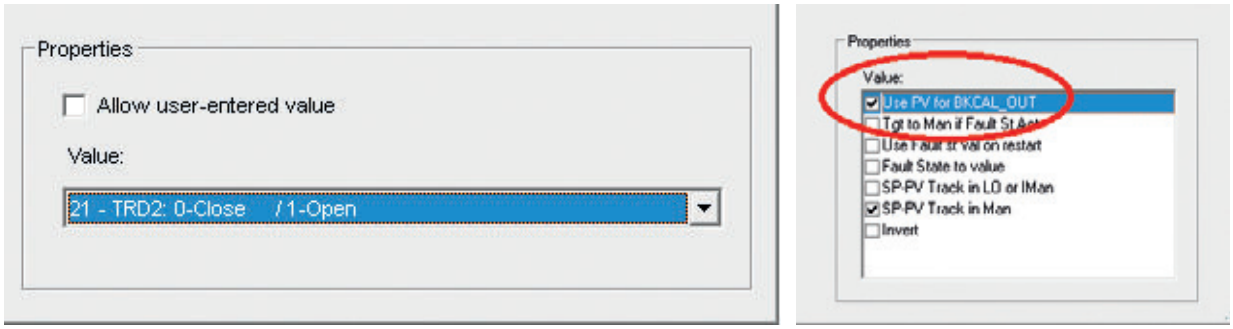


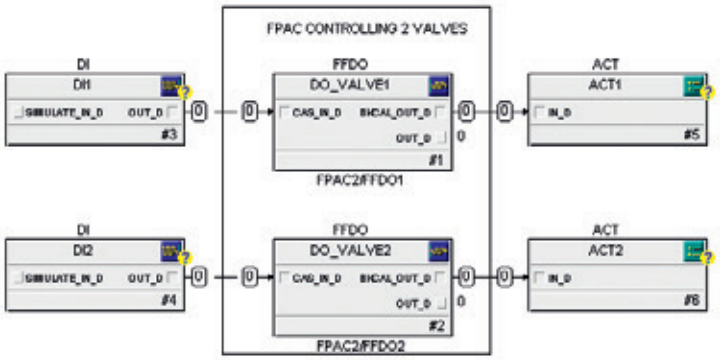
FIGURE 47



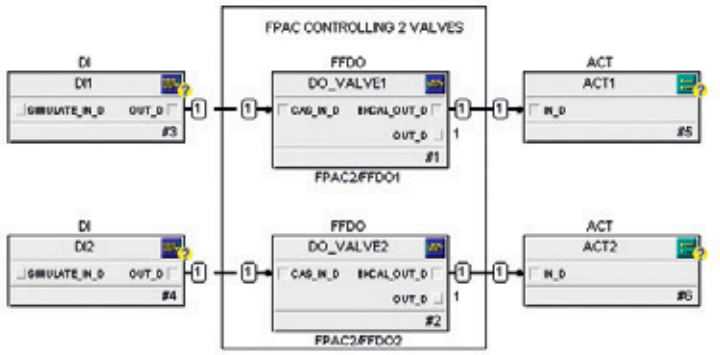
17. When the download finishes, open the control module on-line. Move the valve by changing the parameter linked to the DO_1.CAS_IN_D and observe the valve position feedback will show '0' for valve closed, '1' for valve opened, '2' for valve stopped, '3' for valve opening and '4' for valve closing. The LEDs on the module will indicate the position accordingly. The values. Notice the block linked to the DI is also receiving the same values. See Figure 48.

FIGURE 48

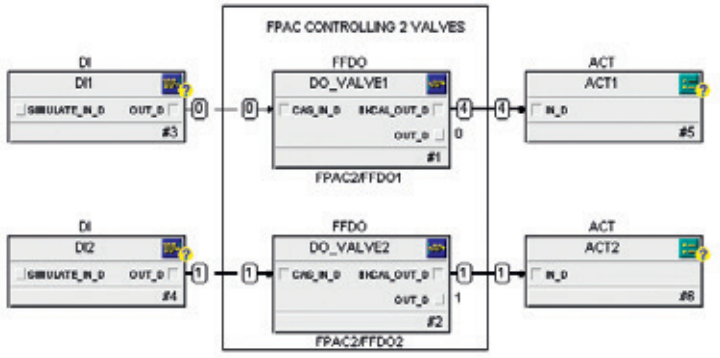
Both valves closed



Both valves opened



Valve 1 closing and Valve 2 opened



Note: values '3' = OPENING and '4' = CLOSING may only be seen for assemblies where the time to open/close is at least a few seconds. Faster valves will make the position feedback switch from '0'=CLOSED to '1' = OPENED and vice-versa.

4.2.8 Configuration for example #5: two valves, rotary/linear, monitoring/control

This example assumes the device is at the factory default state. It assumes it is wired as illustrated in the previous section "Wiring for Example #5".The two valves in this application are as follows:

- Valve 1: rotary valve, monitoring, internal Hall Effect sensors. Valve is controlled by other means. Position feedback is performed by one FPAC DI block.
- Valve 2: linear valve, control, auxiliary inputs and OUT1. Valve is controlled by one FPAC DO which also provides the position feedback.

Blocks and parameters that need configuration				
Resource	**TB1**	**DI_1**	**TB2**	**DO_1**
MODE_BLK = AUTO	ACTION_ELEMENT = Monitoring	MODE_BLK = AUTO	ACTION_ELEMENT = Single Action	IO_OPTS = Use PV for BKCAL_OUT
	MODE_BLK = AUTO		IO_ASSIGNMENT = Aux1,Aux2,Out1	CHANNEL = TRD2: 0-Close / 1=Open
			MODE_BLK = AUTO	MODE_BLK = CAS+AUTO*

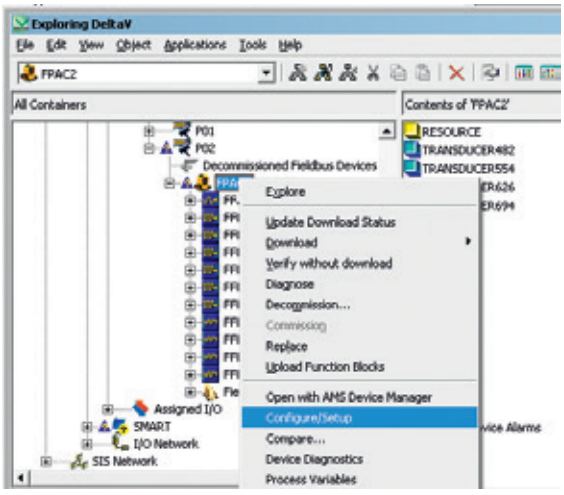
* For testing purposes mode can be set to AUTO or MAN.

Note: in this configuration, despite the fact that FPAC is working with two valves, there is only one solenoid and the dipswitch #6 must remain OFF. Thus, the power consumption of the module is 12 mA.

This example will make use of the DD method to configure both valves at once.

1. This example assumes the device has been commissioned and is at the factory default configuration. See Appendix B for factory default procedure and Appendix D for complete list of block parameters including default values.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.
3. Right-click on the device you want to configure and chose Configure/Setup. See Figure 49.

FIGURE 49



4. The Device Identification window will appear after a few seconds. Click on Basic Device Configuration to start the method. A series of warning windows will be shown. Read them carefully and click Next until the method starts making changes to the device. See Figure 50.
5. A series of messages will be displayed for a few seconds. Wait until the message "Transducer blocks are in OOS (WCON005)" is shown. Then click Next.
6. Configure there are 2 valves attached to this FPAC and click on Next. Select Monit Control and click on Next. See Figure 51.

FIGURE 50

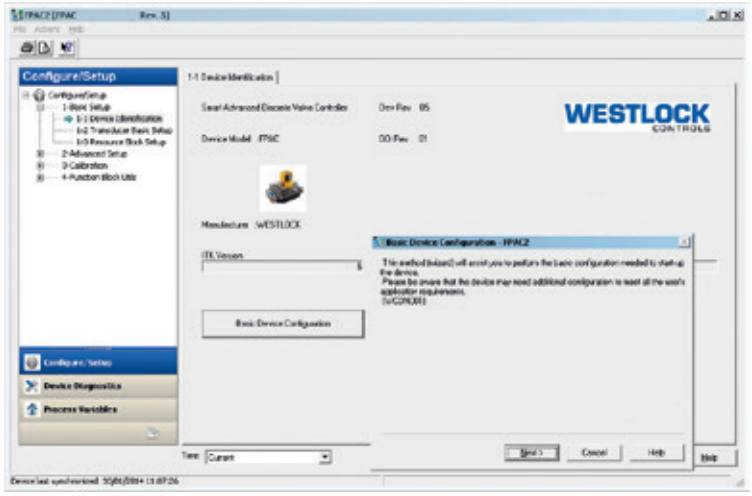
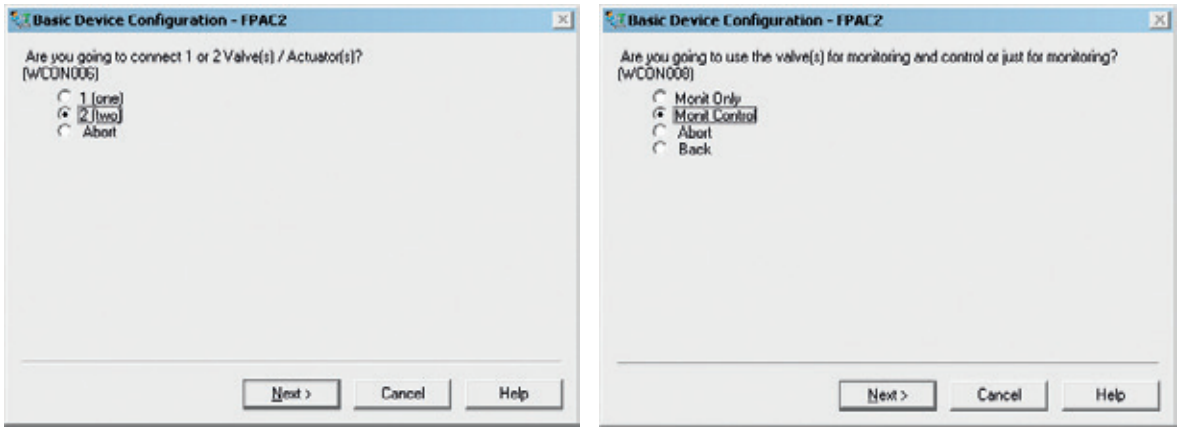


FIGURE 51

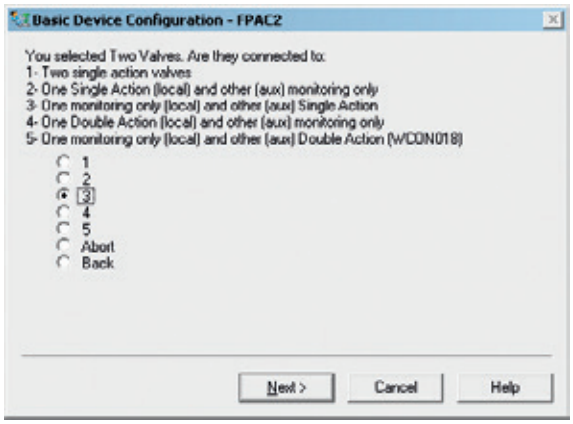


7. Inform to the method now that the valve 1 (local valve) will be just Monitored and valve 2 will be controlled as Single Action choosing option '3' and click on Next. Configure the valves respectively as Rotary and Linear according to the screenshots below. Click on Next to continue. See Figure 52.
8. It is not necessary to select the I/O for the limit switches as the DD method convention for two valves is always the following:
   a. Internal Hall sensors and OUT0 for valve 1 (local valve).
   b. Auxiliary inputs and OUT1 for valve 2 (remote valve).
   c. If you application requires a different configuration you need to change transducers configuration manually.
9. Configure now both valves are Direct (increase to open / fail closed) and click Next. See Figure 53.
10. A series of messages will follow, for a few seconds. Wait until the message "Configuration finished. Start downloading/ writing...(WCON0019)" appears, then click on Next to continue.
11. The method will take care of setting SET_CURRENT_SINK parameter to "2: Current Level 2". However, you must turn dipswitch #6 ON manually, otherwise the transducer blocks will not change the mode to AUTO and the application will not work as expected.
12. Another series of configuration messages will be shown. Wait until the message "Configuration finished. Returning transducers to Auto...(WCON0020)" appears, then click on Finish to close the method window. Close the Configure/Setup window.

Note: although possible, it is not recommended to use AMS for function block (DI, DO, AI) channel configuration once this configuration is not saved in the persistent database. Use DeltaV explorer or Control Studio for function blocks configuration as illustrated in the next section.

13. Open or create a control module and add one DI and one DO blocks. Assign these blocks to FPAC's DI_1 and DO_1 respectively. If desired, add more blocks and create links.

FIGURE 52



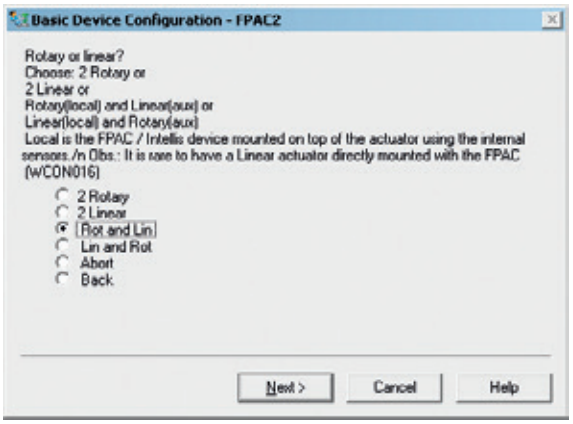
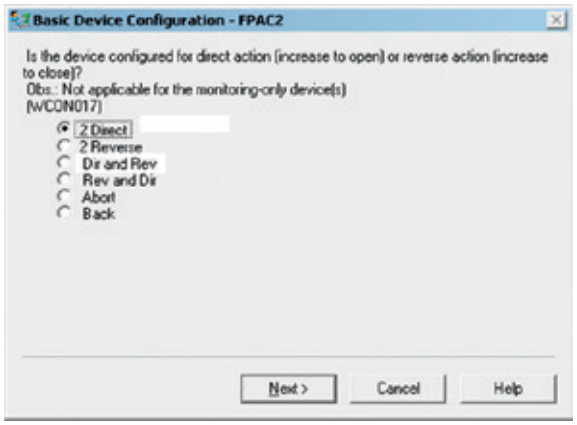


FIGURE 53



14. Click on the DI block (valve 1) and make sure that Mode = Auto, and Channel = 9 - TRD1: 0-Close / 1-Open. See Figure 54.
15. Click on the DO block (valve 2) and make sure that Mode = Auto, IO_OPTS = Use PV for BKCAL_OUT and Channel = 21 - TRD2: 0-Close / 1-Open. See Figure 55.
16. Download the control module configuration to the fieldbus network.
17. When the download finishes, open the control module on-line. Move the valve 1 and verify the position is indicated by the DI block. Observe the valve position feedback will show '0' for valve closed, '1' for valve opened, '2' for valve stopped, '3' for valve opening and '4' for valve closing. The OPEN and CLSD LEDs on the module will indicate the position accordingly.

FIGURE 54

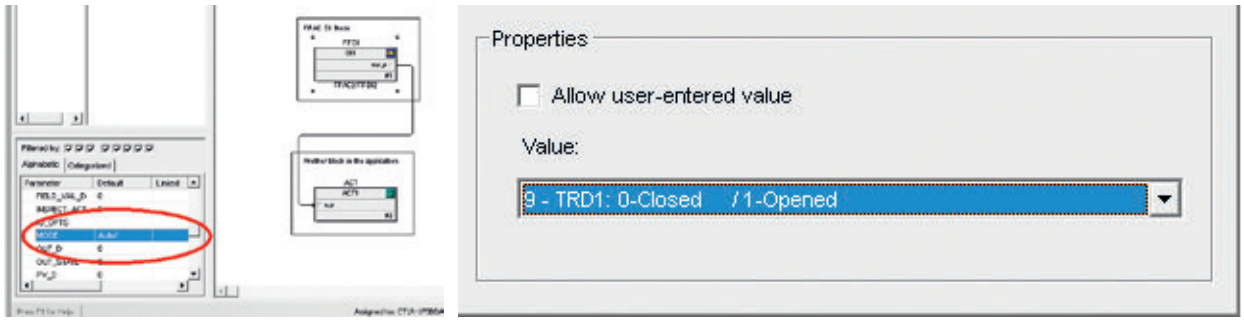
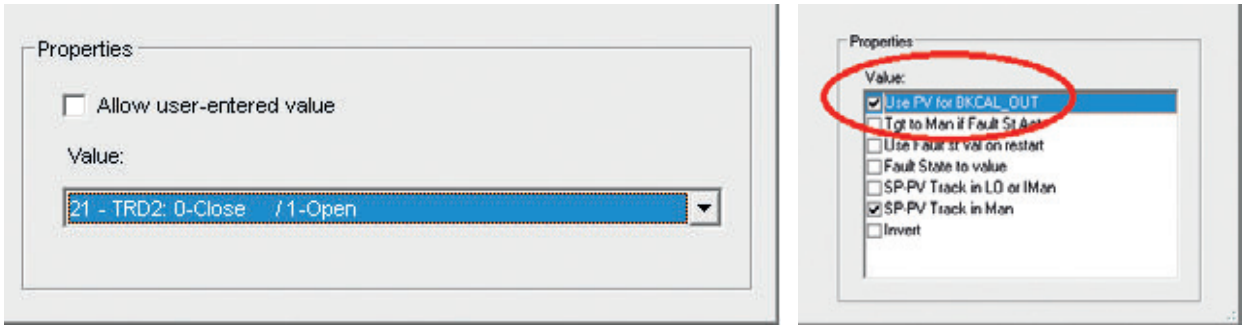


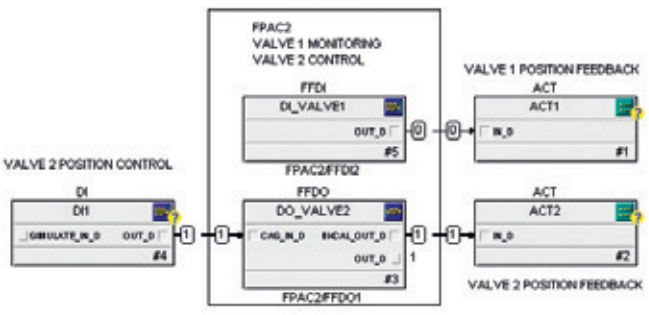
FIGURE 55



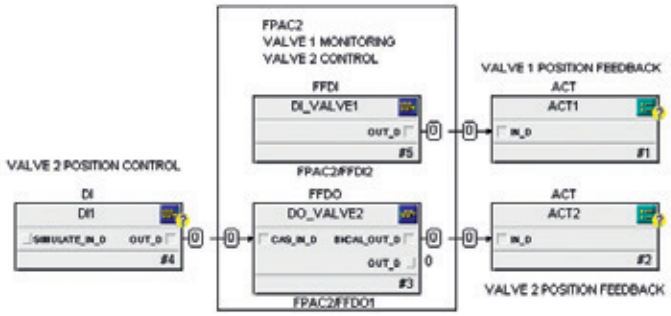
18. Change the parameter linked to the DO_1. CAS_IN_D to cause valve 2 to move. Observe the valve position feedback will show '0' for valve closed, '1' for valve opened, '2' for valve stopped, '3' for valve opening and '4' for valve closing. The AUX1, AUX2 and OUT1 LEDs on the module will light accordingly. See below the screenshots of the control module. See Figure 55.

FIGURE 55

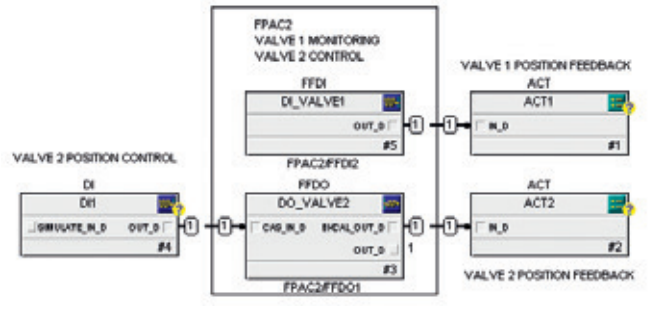
Valve 1 closed and Valve 2 opened



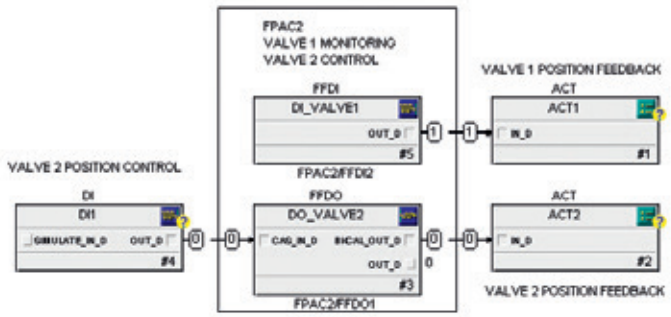
Both valves closed



Both valves opened



Valve 1 opened and Valve 2 closed



4.2.9 Configuration for example #6: one valve, rotary, simple solenoid, potentiometer
This example assumes the device is at the factory default state. This example also assumes the optional potentiometer is installed. Therefore, instead of using the internal Hall Effect limit switches to read the shaft position, the FPAC utilizes the potentiometer assembly connected to the analog output (J5) to deliver 0-100% position indication besides discrete CLOSED and OPENED. It assumes it is wired as illustrated in the previous section "Wiring for Example #6". Two variants of the example will be shown:

A. Monitoring the valve with the AI block and one DI block. This example assumes the valve is controlled by some other means (manual valve or controlled by a separate PLC/DCS):

Blocks and parameters that need configuration			
Resource	**TB1**	**DI_1**	**AI**
MODE_BLK = AUTO	IO_OPTION = 9: Analog,Out0	MODE_BLK = AUTO	MODE_BLK = AUTO
	MODE_BLK = AUTO		

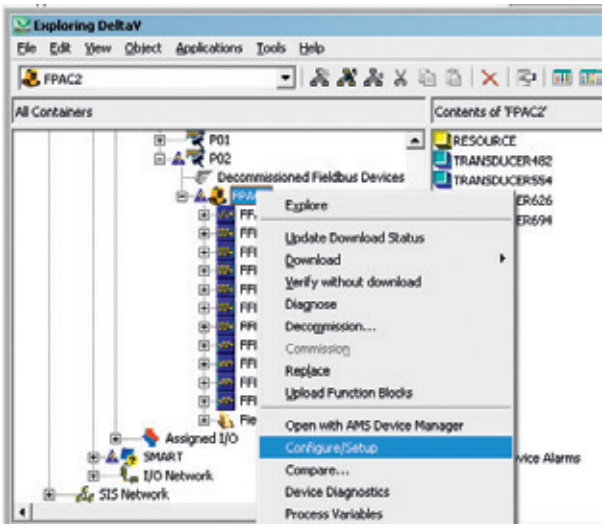
B. The second variant of the example assumes the FPAC is controlling the valve with a DO block and the position feedback is given by the DO block using the BKCAL_OUT_D parameter and the AI block:

Blocks and parameters that need configuration			
Resource	**TB1**	**DO_1**	**AI**
MODE_BLK = AUTO	IO_OPTION = 9: Analog,Out0	MODE_BLK = CAS+AUTO*	MODE_BLK = AUTO
	MODE_BLK = AUTO		

* For testing purposes mode can be set to AUTO or MAN.

4.2.9.1 Valve monitoring using DI and AI blocks: position transmitter
1. This example assumes the device has been commissioned and is at the factory default configuration. See Appendix B for factory default procedure and Appendix D for complete list of block parameters including default values.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.
3. Right-click on the device you want to configure and chose Configure/Setup. See Figure 56.

FIGURE 56



4. The Device Identification window will appear after a few seconds. Click on Transducer Basic Setup and wait a few seconds until all parameters are read.
5. In the Std Transducer 1 parameters group, click on the parameter ACTION_ELEMENT drop box and select the option Monitoring. Click on the IO_ASSIGNMENT parameter and select Analog,Out0. Click on Apply, and then on the screen that opens click on Yes. See Figure 57.
6. On the menu tree, select Function Block Utils, then click on Block Modes and finally select the tab Block Mode-Std Transducer. In the Std TRD 1 Target Mode group, select the target mode to Automatic. Make sure to uncheck the Out of Service option. Click on Apply to write the configuration. See Figure 58.

FIGURE 57

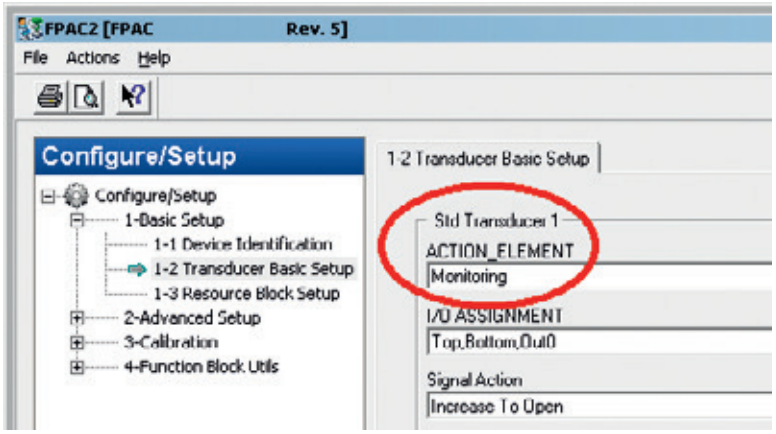
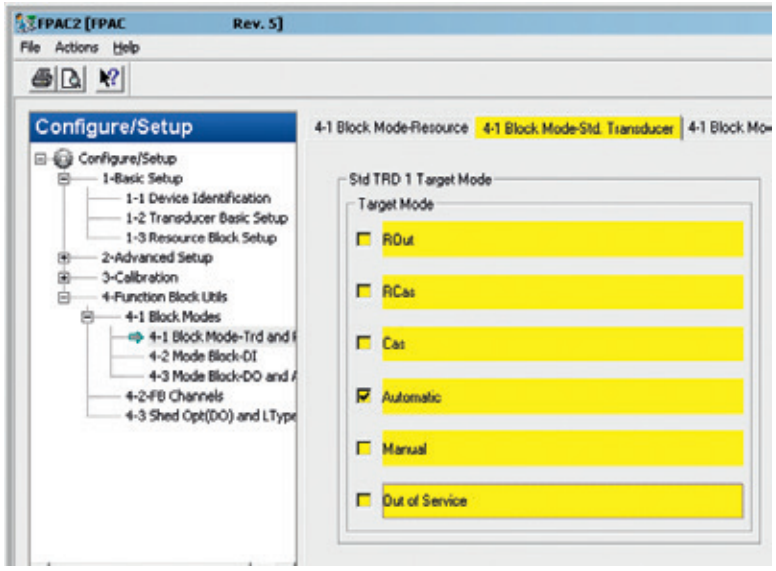


FIGURE 58



7. After a few seconds, confirm the transducer block changed the mode to Automatic by observing the parameters in the left side of the window, group Std TRD 1 Actual Mode. See Figure 59.
8. Close Configure/Setup window.

Note: although possible, it is not recommended to use AMS for function block (DI, DO, AI) channel configuration once this configuration is not saved in the persistent database. Use DeltaV explorer or Control Studio for function blocks configuration as illustrated in the next section.

4.2.9.2 Valve control using DO and AI blocks: position transmitter

1. This example assumes the device has been commissioned and is at the factory default configuration. See Appendix B for factory default procedure and Appendix D for complete list of block parameters including default values.
2. Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.
3. Right-click on the device you want to configure and chose Configure/Setup: See Figure 60.

FIGURE 59

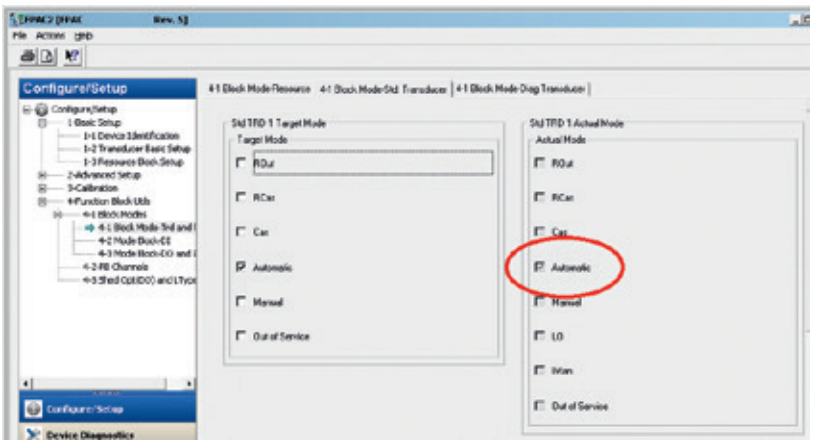
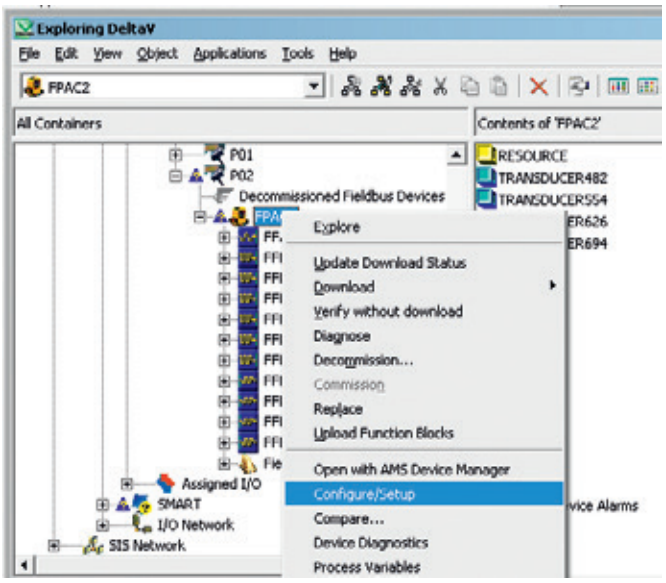


FIGURE 60



4. The Device Identification window will appear after a few seconds. Click on Transducer Basic Setup and wait a few seconds until all parameters are read.
5. In the Std Transducer 1 parameters group, click on the parameter ACTION_ELEMENT drop box and select the option Single Action. Click on the IO_ASSIGNMENT parameter and select Analog,Out0. Click on Apply, and then on the screen that opens click on Yes.
6. On the menu tree, select Function Block Utils, then click on Block Modes and finally select the tab Block Mode-Std Transducer. In the Std TRD 1 Target Mode group, select the target mode to Automatic. Make sure to uncheck the Out of Service option. Click on Apply to write the configuration. See Figure 61.
7. After a few seconds, confirm the transducer block changed the mode to Automatic by observing the parameters in the left side of the window, group Std TRD 1 Actual Mode. See Figure 62.
8. Close Configure/Setup window.

Note: although possible, it is not recommended to use AMS for function block (DI, DO, AI) channel configuration once this configuration is not saved in the persistent database. Use DeltaV explorer or Control Studio for function blocks configuration as illustrated in the next section.

FIGURE 61

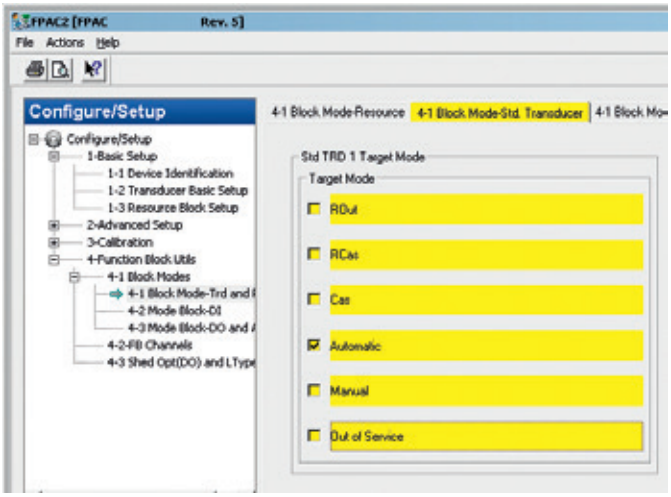
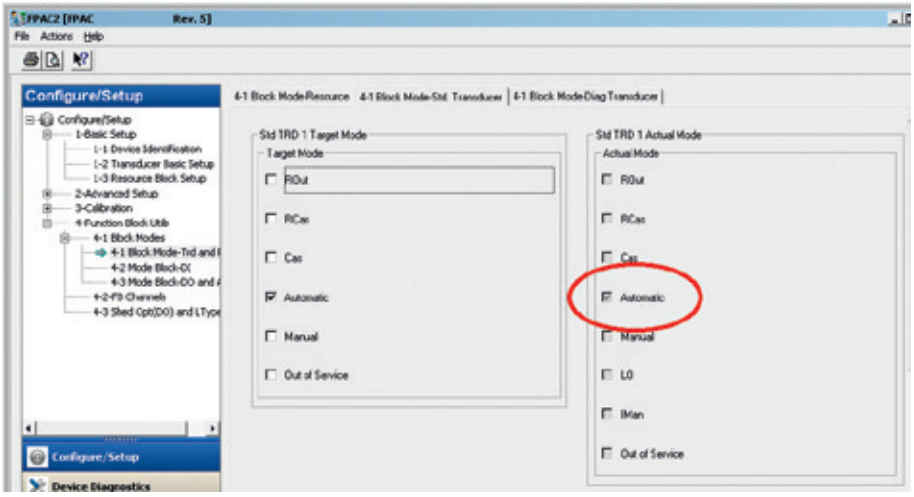


FIGURE 62



4.3 Configuration and operation with a FF handheld or FF bench host

The step-by-step example below illustrates an application where the FPAC is controlling 2 (two) single action valves using a FF Handheld or FF Bench Host. You can adapt the example to your application. If you are using FPAC to control or monitor one valve, just ignore the steps related to valve 2.

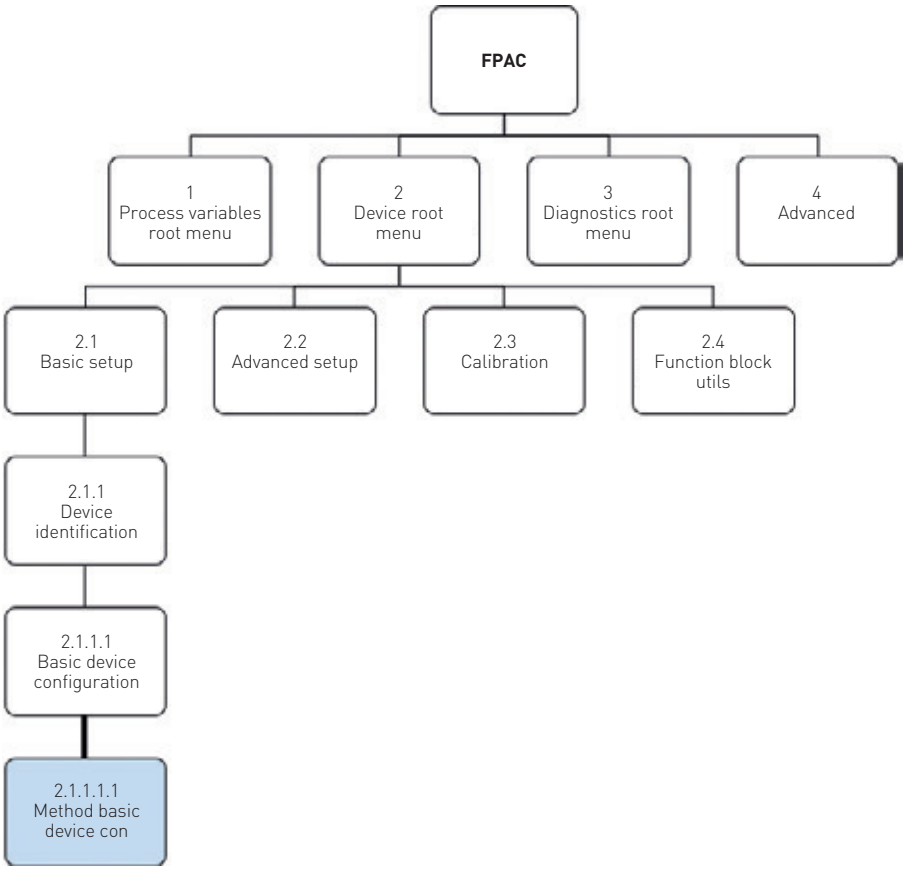
For more information on how to install the files see an example on Appendix G. Contact Westlock in case of any problem.

It is shown how to configure the blocks, actuate on the outputs and monitor the limit switches. In order to configure the FPAC for this application, a DD method (wizard) will be used. The simplified menu tree to access the method "Basic Device Config" is shown below (see Appendix H for the complete menu tree). See Figure 63.

Note: Make sure the handheld or bench host has the necessary support files installed (DD/CF). Contact Westlock in case you need help with the support files. See Technical Note TN-2014-003 "How to install Intellis 7300 (FPAC) support files into 475-375 handheld".

1. Before you start, make sure the FPAC is properly powered with a suitable FF power supply and the proper impedance and bus terminators are in place. As soon as the FPAC is energized all LEDs will blink once. Notice that outputs may change during the configuration steps. Make sure your setup is safe if outputs change state.

FIGURE 63
DD menu tree to access basic configuration method



2. From the Handheld Main Menu select Foundation Fieldbus Application. Up and Down arrow keys scroll through the icon rows; the Right and Left arrow keys scroll through the icon columns; Enter key selects the highlighted item or press the icon on the touch screen. See Figure 64.
3. From the Fieldbus Application Main Menu highlight Online then press the Right Arrow key. If this is not on an active Fieldbus Segment (communicating with a Fieldbus Host or LinkActiveScheduler) then a Warning message will appear saying: "Connection Warning: No Fieldbus communication detected. Press OK to connect to this segment anyway. Press CANCEL to go to the Fieldbus Application Main Menu". Press OK to start communication. A warning message "Fieldbus Library System Management Error. SMERROR: FAILED RESPONDER IDENTIFY" may also appear. Press OK to continue.
4. After the handheld finds all the devices on the Fieldbus network select the FPAC. The FPAC BUS LED should start blinking at a rate around 1 Hz. If the FPAC2 does not appear then hit the Left arrow key, hit OK then continue as in step 3. Otherwise, highlight the FPAC and press the Right Arrow key. See Figure 65.
5. Scroll down to Device Root Menu and select it by hitting the Right arrow key. The warning "This device description may not have been tested with this version of Fieldbus Application. Do you want to proceed with this device anyway?" may appear, hit YES and continue. See Figure 66.

FIGURE 64

FIGURE 65

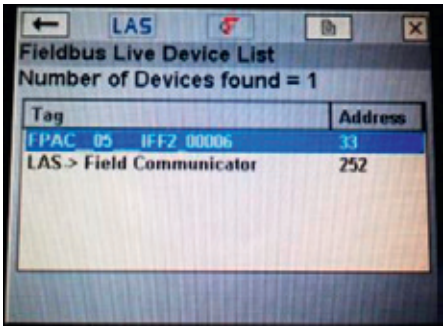
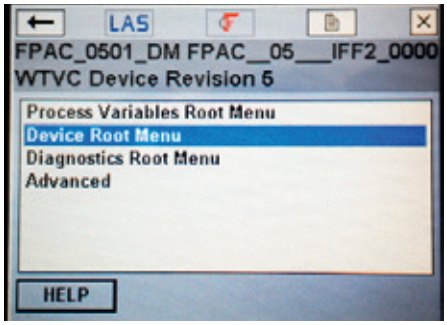
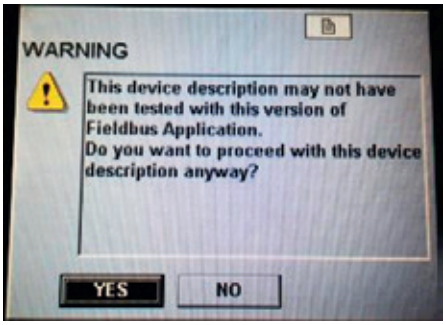


FIGURE 66





6. Highlight Basic Setup then press the Right arrow key. Highlight Device Identification then press the Right arrow key. See Figure 67.
7. Wait for the entire screen to update then scroll down with the Down arrow key until you find the option "Basic Device Configuration" and then press the Right arrow key. See Figure 68.
8. Press NEXT twice to continue, then make sure the "Continue" option is selected. Press NEXT again to continue. See Figure 69.

FIGURE 67

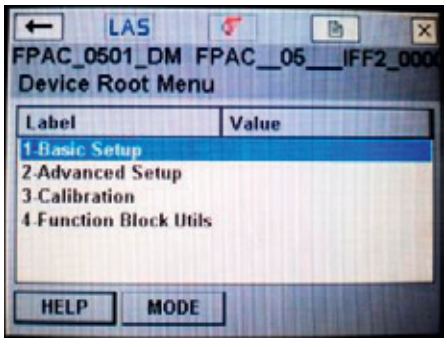


FIGURE 68

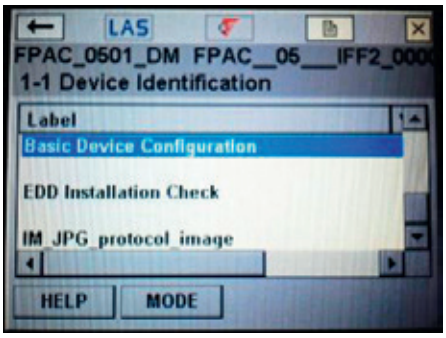
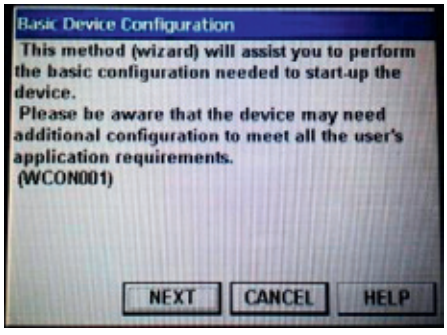
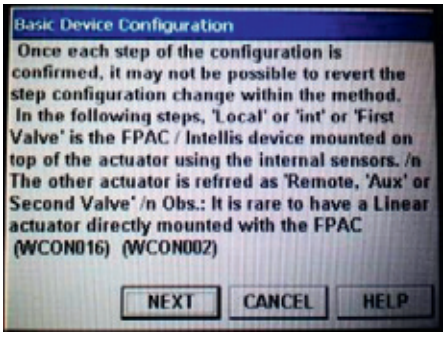


FIGURE 69





9. The display will show a sequence of messages, for a few seconds. When the last message "Transducer Blocks are in OOS (WCON005)" appears press NEXT to continue. See Figure 70.
10. Now you are going to choose the configuration you will be using in a sequence of questions and options. This example will control 2 (two) single action rotary valves. You can adapt the example to match your application. Make sure the appropriate choice is selected (for this example choose "2 (two)") then press NEXT to continue.
    a. Valve 1 uses the cam magnets on the shaft to activate the FPAC internal Hall Effect limit switches and OUT0 to power the solenoid;
    b. Valve 2 uses the auxiliary inputs AUX1 and AUX2 as open/close limit switches and OUT1 to power the solenoid.
    See Figure 71.
11. In this example FPAC inputs are used as Open/Close limit switches and FPAC outputs are used to control the actuator, then select "Monit Control". If you are using FPAC just to monitor the valve(s) position, then select "Monit Only", then press NEXT to continue. See Figure 72.
12. Since both valves are Single action in this example, choose option "1" then press NEXT.
    a. Depending on your application you may choose an option to control one of the valves and just monitor the other one, or even to monitor both.
    b. The DD method always associated valve 1 with transducer block TB1 and channels starting with "TRD1..."
    c. The DD method always associated valve 2 with transducer block TB2 and channels starting with "TRD2..."
    See Figure 73.
13. In this example the two valves are rotary, thus choose option "2 Rotary" then press NEXT. This option is just information and does not change any functionality in the device. See Figure 74.

FIGURE 70

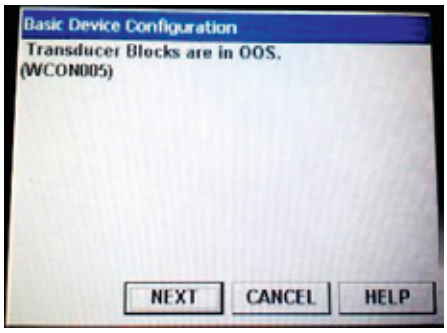


FIGURE 71

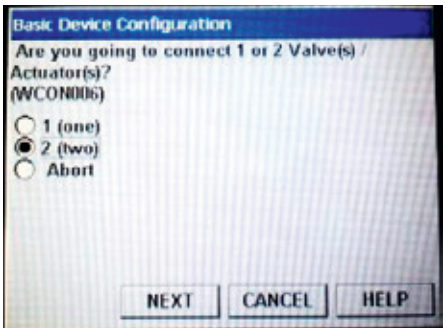


FIGURE 72

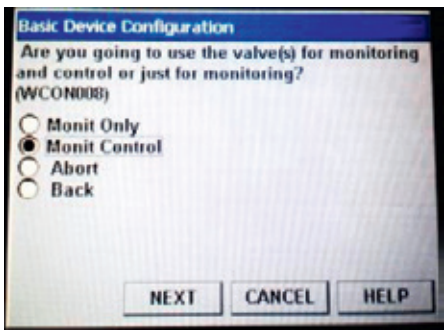


FIGURE 73

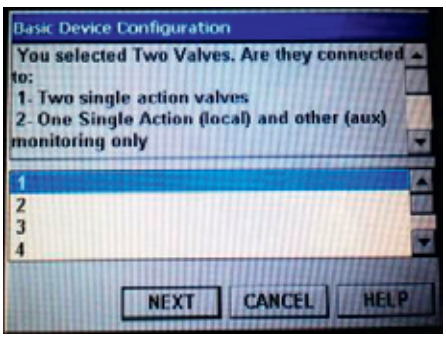
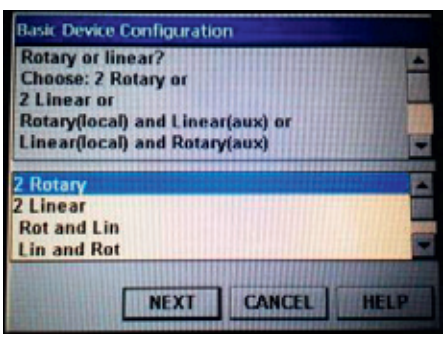


FIGURE 74



14. The display will show the following items (for a few seconds). See Figure 75.
15. Then the following screen will appear. Select the desired configuration: "Direct" action or "Reverse" action. In this example both valves are "Direct". Press NEXT to continue.
    a. Direct: when set-point = '1' = OPEN (on transducer or DO) it activates the FPAC output, powers the solenoid and supply air forces the actuator to the Opened position. This is often referred as a fail closed valve as in the absence of power the pneumatics will force the valve to the closed position.
    b. Reverse: when the set-point = '1' = OPEN (on transducer or DO) it deactivates the FPAC output removing power from the solenoid, but supply air and pneumatics setup still forces the actuator to the Opened position. This is often referred as a fail opened valve as in the absence of power the pneumatics will force the valve to the opened position.

    See Figure 76.
16. The display will show a sequence of messages, about 2 seconds each, while the method is configuring TB1 and TB2 transducer block parameters. Notice that outputs may change at this point. Make sure your setup is safe if outputs change state. Finally when the message "Configuration finished. Returning Transducer to Auto... (WCON020)" appears and the NEXT changes to FINISH, press FINISH to continue. See Figure 77.
17. The menu returns to the Device Identification screen. Press the Left arrow key to go up one level. Press button MODE to check the FPAC Block modes of operation. See Figure 78.

FIGURE 75

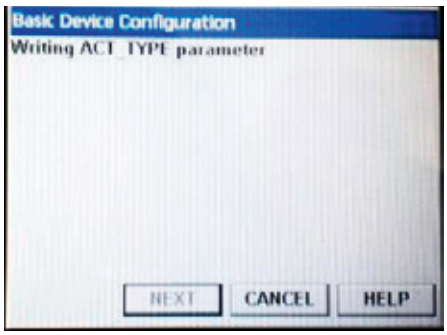


FIGURE 76

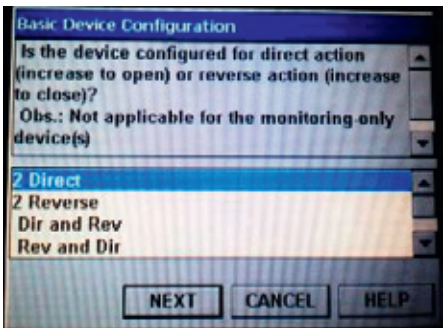


FIGURE 77

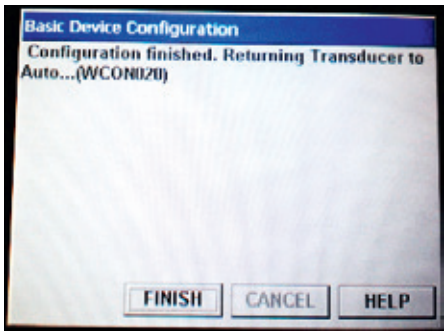
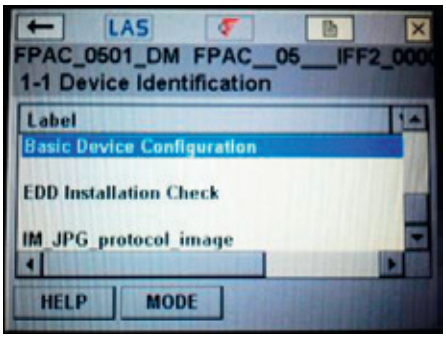


FIGURE 78



18. The Resource Block should be in Auto. If this is already in Auto then hit CANCEL and skip to step 24. If it is not in Auto then perform the next steps. See Figure 79.
19. Hit the Down arrow key to select the Resource Block then press OK. See Figure 80.
20. Select Auto (box checked) and make sure OOS is not selected (box is not checked). The item is toggled from selected to not selected by touching the box on the handheld LCD screen. Then press OK button. See Figure 81.
21. A warning about Mode change affecting the process appears. Press YES to continue and wait a few seconds. See Figure 82.
22. After the Mode changes the screen returns to Basic Setup menu. Press MODE to check the block modes again. Now that the Resource Block has changed to Auto, click OK. See Figure 83.
23. Once the Resource Block is in Auto press the Left arrow button twice to return to the top level menu.

FIGURE 79

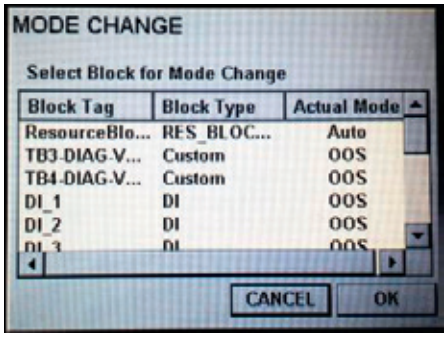


FIGURE 80

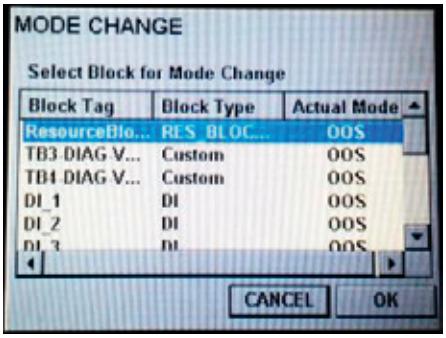


FIGURE 81

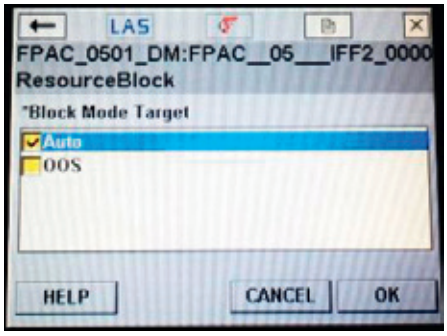
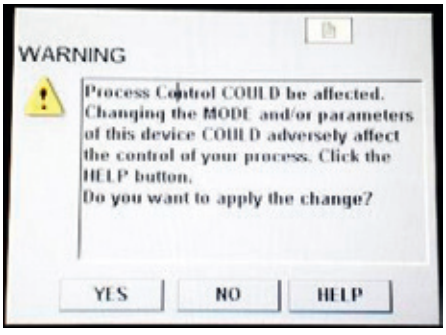


FIGURE 82



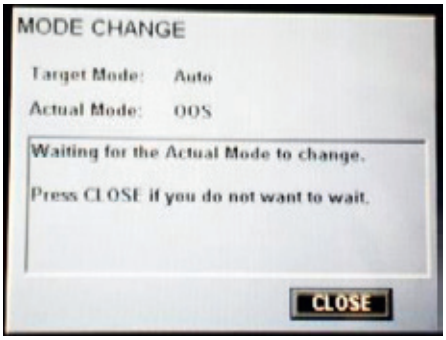
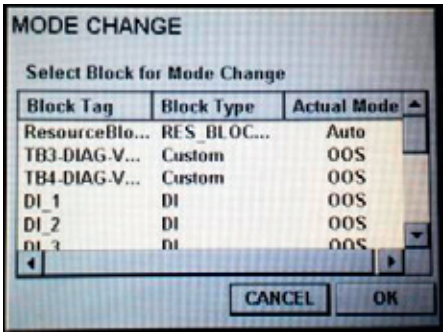


FIGURE 83



24. Now it is necessary to schedule function blocks execution. Press the Down arrow to highlight Advanced, and then press the Right arrow button to select it. See Figure 84.
25. Scroll down to highlight Schedule and then press the Right arrow button to select it. See Figure 85.
26. A warning appears to inform you that, if the device is already commissioned (has blocks scheduled), and is being used in a host system, it cannot not be commissioned by the handheld. Hit YES to allow the handheld to schedule blocks. See Figure 86.
27. With the Down arrow button scroll down to DO_1 and DO_2 blocks and select the on screen check box. Then press OK. A message informing that the block schedule was changed appears. Press OK to continue. See Figure 87.
28. Scroll down to Block List and then press the Right Arrow button to select it. See Figure 88.
29. The next steps are to set DO_1 and DO_2 channels and need to be repeated for each block. Scroll down to Block List and then press the Right arrow button to select DO_1. See Figure 89.

FIGURE 84

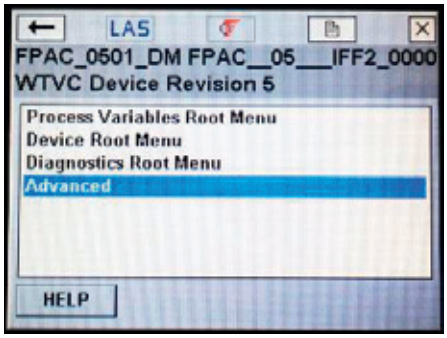


FIGURE 85

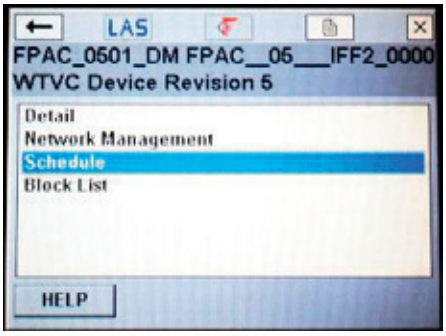


FIGURE 86

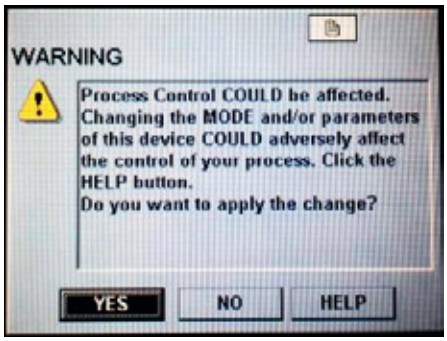
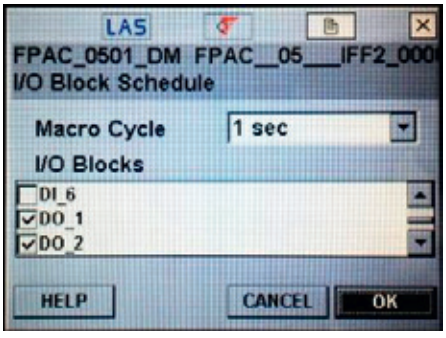


FIGURE 87



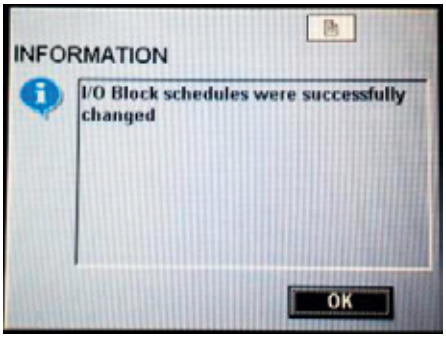


FIGURE 88

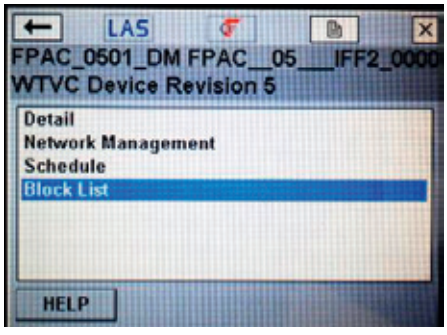
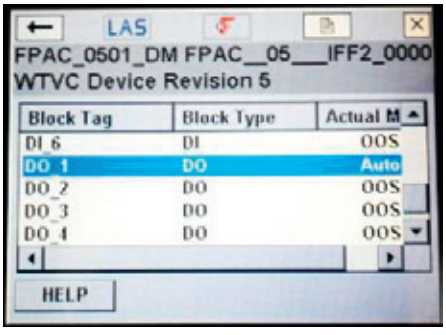
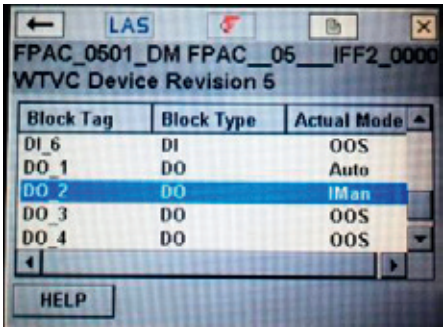


FIGURE 89





30. Highlight I/O References and then press the Right arrow button to select it. See Figure 90.
31. Channel is highlighted; then press the Right arrow button to select it. See Figure 91.
32. From the drop-down of DO_1 menu choose "TRD1:0-Close /1-Open", then press OK twice. There is a similar option for DO_2 but you should use transducer TB2, then choose "TRD2:0-Close /1-Open". See Figure 92.

FIGURE 90

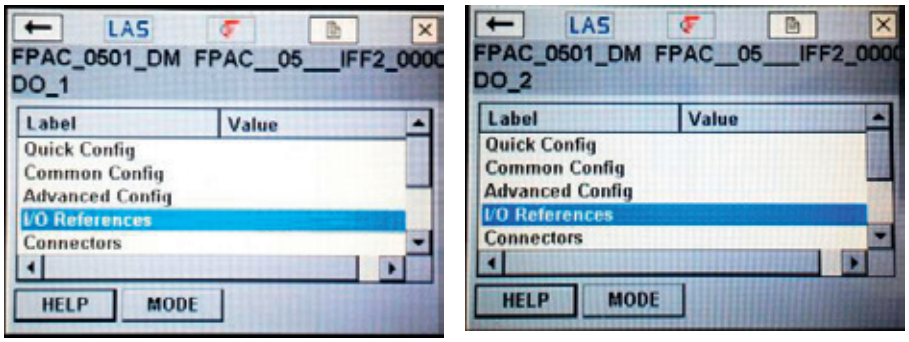


FIGURE 91

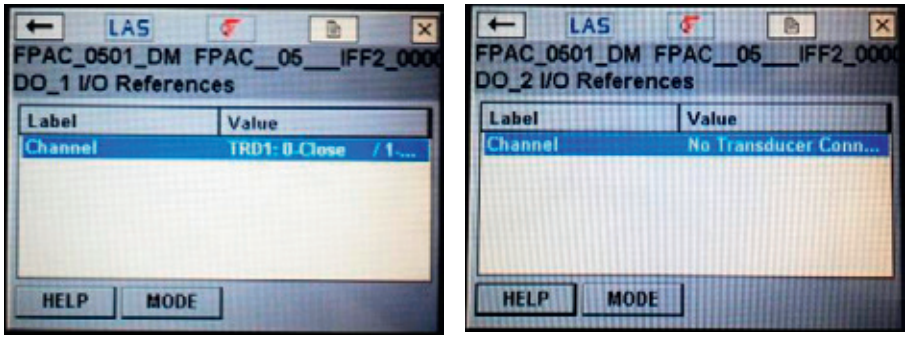
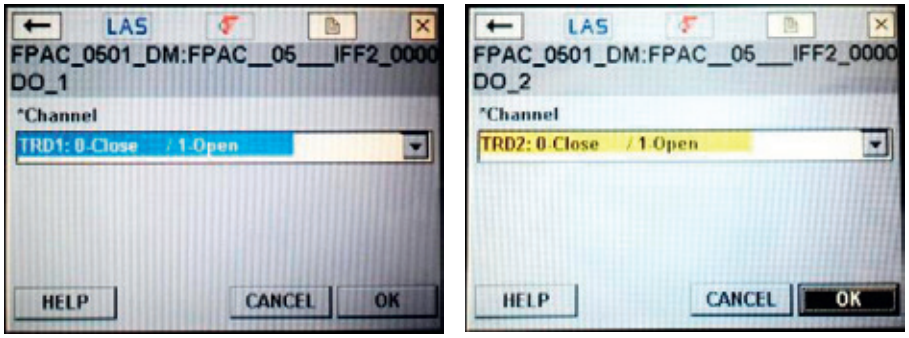


FIGURE 92



33. Press MODE to put both DO_1 and DO_2 blocks in Out Of Service (so that the Channel can be sent to the block). See Figure 93.
34. Select OOS (box checked), make sure Auto is not selected (box is not checked). The item is toggled from selected to not selected by touching the box on the handheld LCD screen. Then press the OK button. See Figure 94.
35. A warning about Mode change affecting the process appears. Notice that outputs may change at this point. Make sure your setup is safe if outputs change state. Press YES to continue. See Figure 95.
36. Now that the blocks are Out Of Service press SEND to change the Channel. See Figure 96.

FIGURE 93

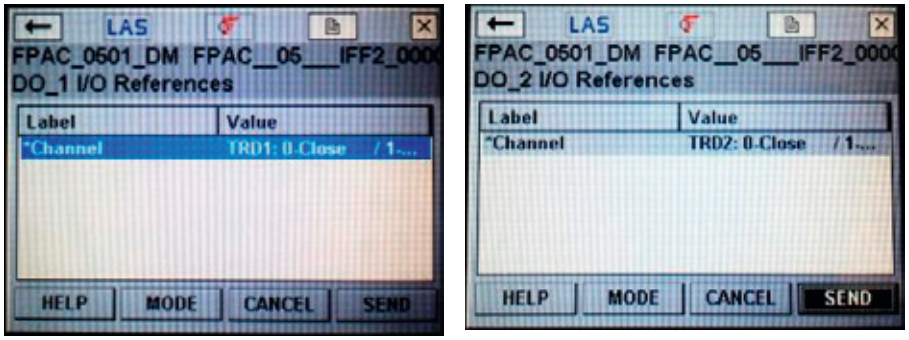


FIGURE 94

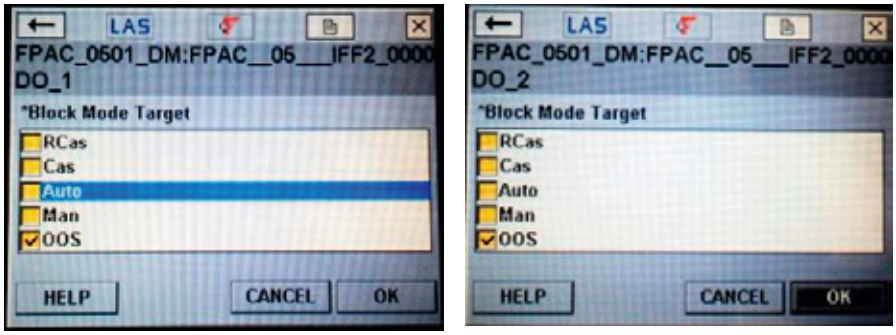


FIGURE 95

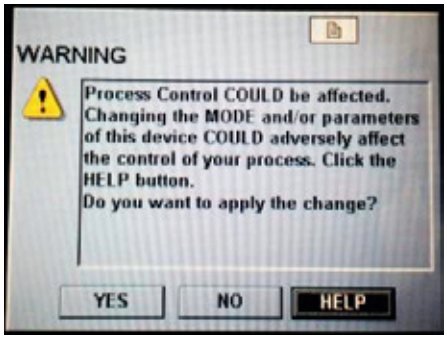
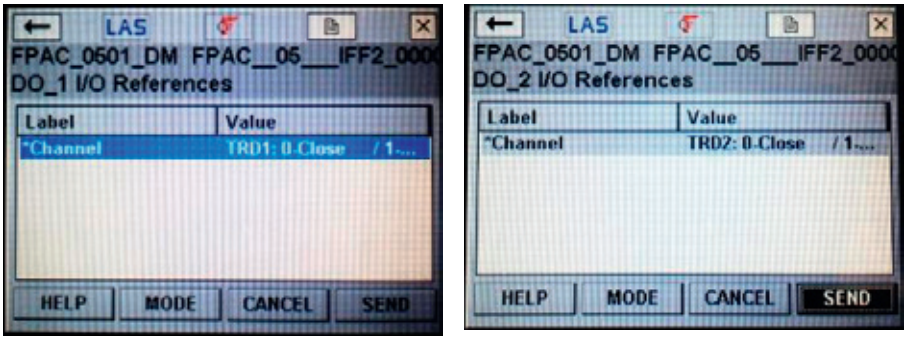


FIGURE 96



37. Press the Left arrow key to go to the previous menu. Highlight Quick Config and then press the Right arrow button to select it. Repeat this for both DO_1 and DO_2. See Figure 97.
38. At this point the OUT0 and OUT1 LEDs should be OFF. Scroll down to "Setpoint Discrete Value" and then press the Right arrow button to select it. See Figure 98.
39. From the drop-down list choose '1' (or use the Up arrow or Down arrow to scroll through the list of values) and then press OK. See Figure 99.

FIGURE 97

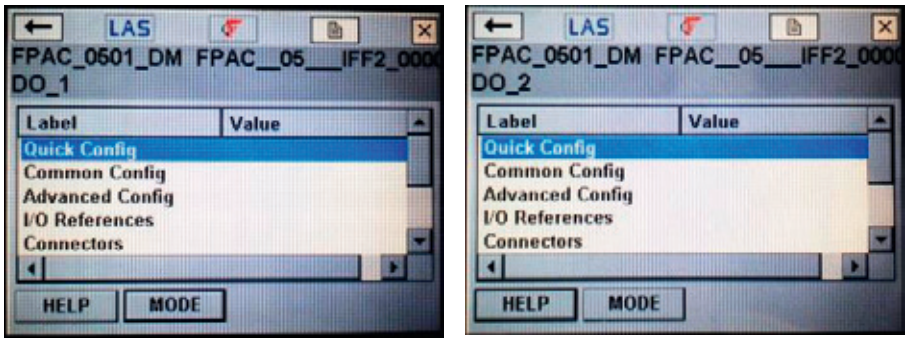


FIGURE 98

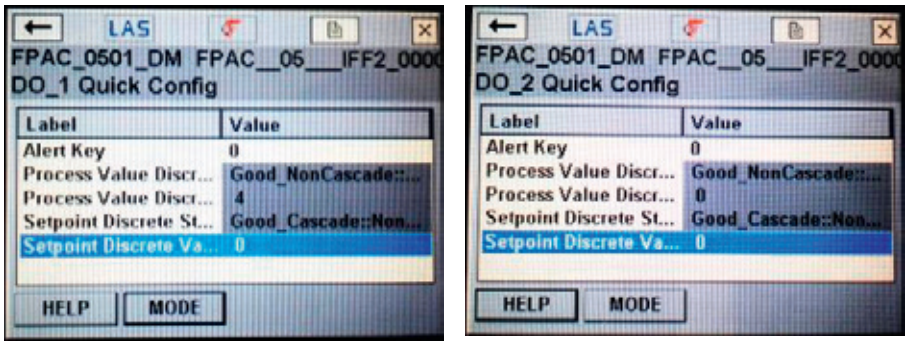
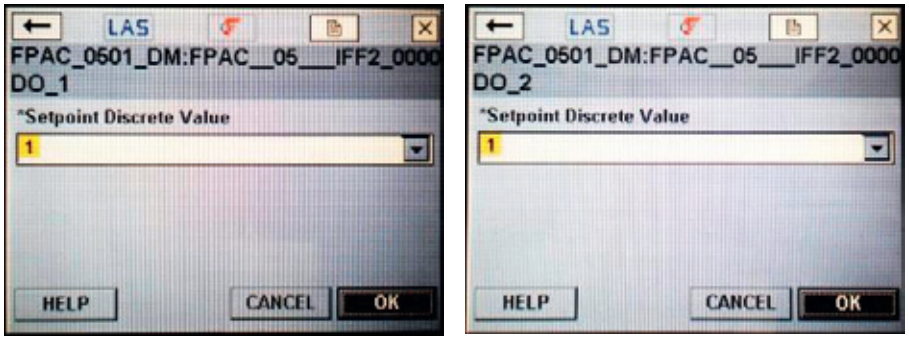
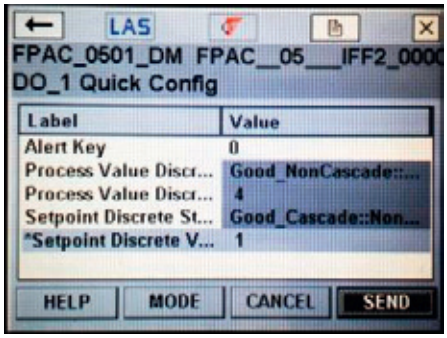


FIGURE 99



40. The asterisk before the set-point Discrete Value means that a change has been made but has not yet been sent to the FPAC. Press SEND to make the new value effective in the output. See Figure 100.
41. If you write '1' to the DO_1 set point the OUT0 LED should be ON (or flashing if no solenoid is connected) and the OUT1 LED should be OFF. If the FPAC is mounted on an actuator, pneumatics and wiring are properly set, the actuator should move to the OPENED position. This would be a good time to set the magnet on the cam for the top limit switch by observing the OPEN LED.
42. If you write '0' to the DO_1 set point the OUT0 LED should be OFF and the OUT1 LED should be OFF. If the FPAC is mounted on an actuator, pneumatics and wiring are properly set, the actuator should move to the CLOSED position. This would be a good time to set the magnet on the cam for the bottom limit switch by observing the CLSD LED.
43. Repeat the previous steps for the DO_2 block, observing the OUT1 will change state. Make sure both limit switches connected to AUX1 and AUX2 are also properly adjusted for opened and closed positions by observing AUX1 and AUX2 LEDs.
44. Press the Left arrow button 4 times to return to the top level menu. Press the Up arrow to highlight Process Variables Root Menu, and then press the Right arrow button to select it. See Figure 101.
45. Highlight option "1- Discrete Position and Status" and then press the Right arrow button to select it. Highlight the "Final Position Value" and then press the Right Arrow button to select it. See Figure 102.

FIGURE 100



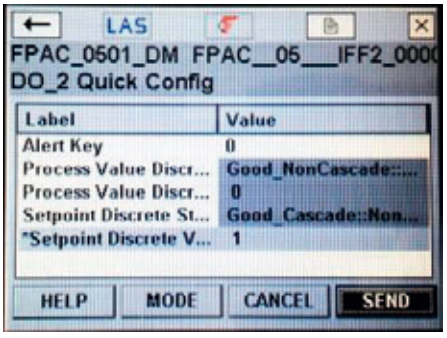


FIGURE 101

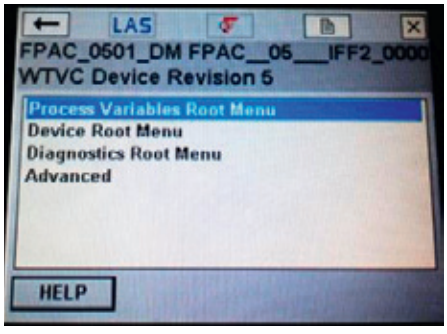
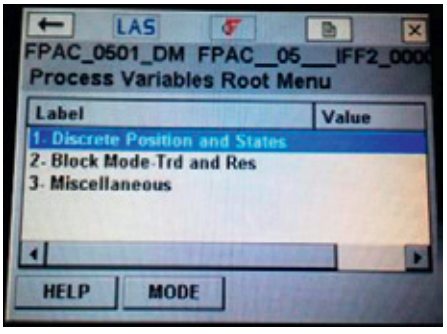
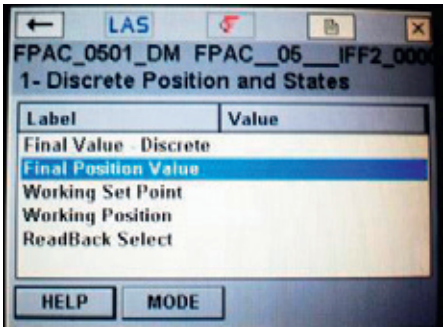


FIGURE 102





46. Put a magnet near the CLOSED Hall sensor limit switch (bottom), the CLSD LED should light. After a few seconds the Std Transducer 1 Final Position Value should change to '0'. Put the magnet near the OPENED Hall sensor limit switch (top), the OPEN LED should light. After a few seconds the Std Transducer 1 Final Position Value should change to '1'. See Figure 103.
47. Now short out AUX1, the AUX1 LED should light. After a few seconds the Std Transducer 2 Final Position Value should change to '0'. Short out AUX2, the AUX2 LED should light. After a few seconds the Std Transducer 2 Final Position Value should change to '1'. See Figure 104.
48. Press the Left Arrow button three times to return to the top level menu. See Figure 105.

FIGURE 103

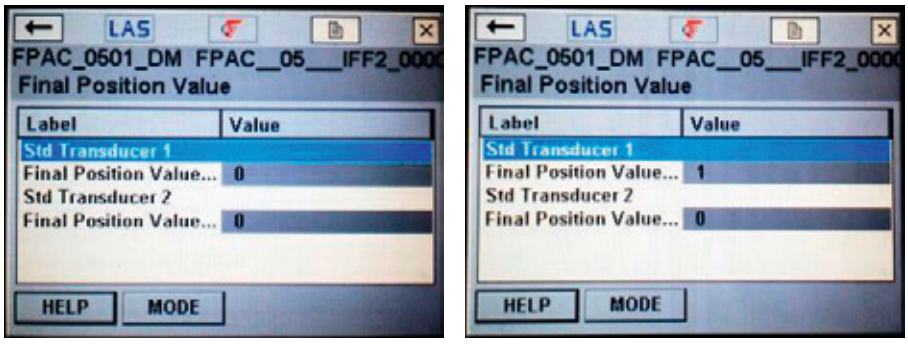


FIGURE 104

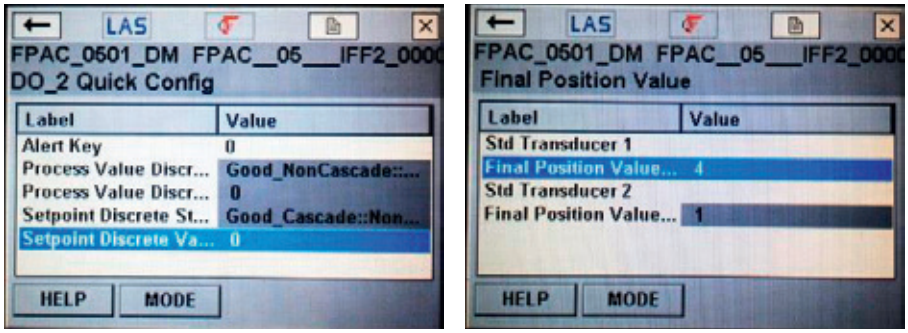
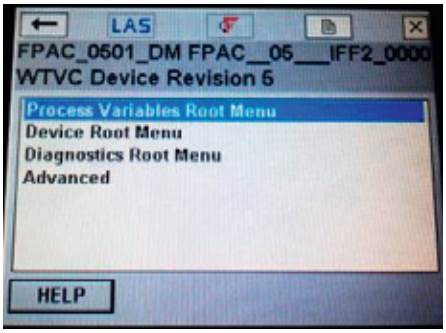


FIGURE 105



5 FIELD WIRING

5.1.1 Wiring examples

This section details the various wiring options available with the FPAC-2. Refer to the wiring diagram supplied with the unit for specific details. Among the many possible applications with the Intellis 7300, the following table manual presents some examples:

Example #	Number of valves*	TB1/TB2	Type (Valve1/ Valve2)	SOV (number of coil/piezo)	Comments
1A, 1B, 1C	One	Control / Not used	Rotary	One	Typical installation for the 7344 model.
2		Control / not used		Two	One SOV with 2 piezos on the same housing (LZ2 housing).
3A, 3B	One	Control / Not used	Linear	One	Using Silver Bullet/Magnum for the linear actuator.
4	Two	Control / control	Rotary/Rotary	One	Using 764 for the second valve (second housing has only switches and SOV).
5	Two	Control / monitor	Rotary/Linear	Two	Using dual coil/piezo solenoid for the local valve; Silver Bullet/ Magnum to monitor position of the remote linear valve.
6A, 6B	One	Control	Rotary	One	Using potentiometer connected to analog input J5 instead of cam shaft magnets.

* FPAC can control or monitor up to two valves. SOV = Solenoid valve.

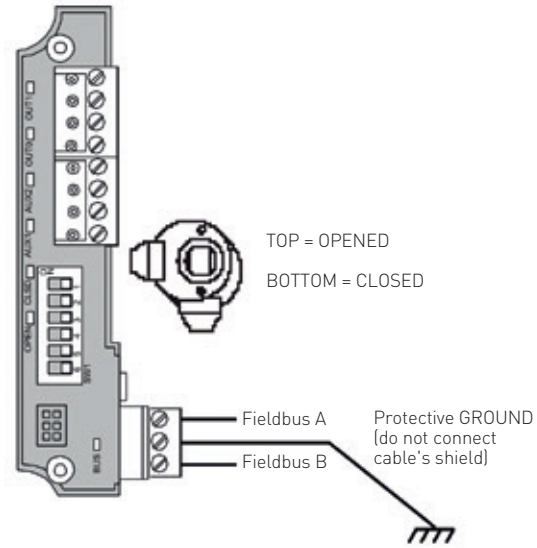
Note: If in your application the valve is not controlled by the FPAC, then just ignore the electrical connections to the solenoid(s). In this case FPAC should be configured as "Monitoring" as explained in the "Configuration" section.

5.1.2 Wiring for example #1: one valve, rotary, with a simple solenoid

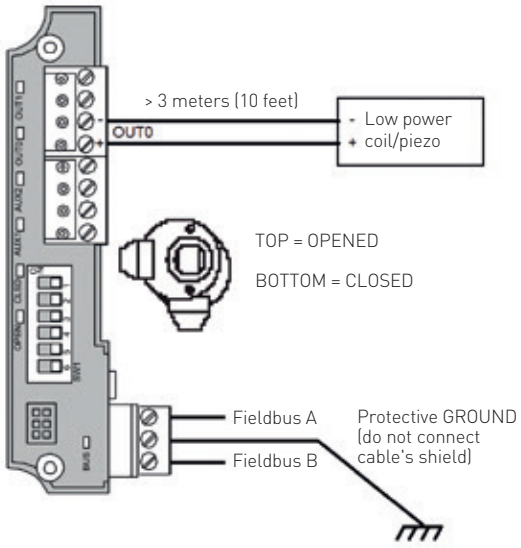
This example can be used for monitoring only applications as well as for control of one valve. One FPAC output is necessary to power the solenoid.

FIGURE 106
Wiring diagram for example #1

Example #1A: one valve, rotary, just monitoring



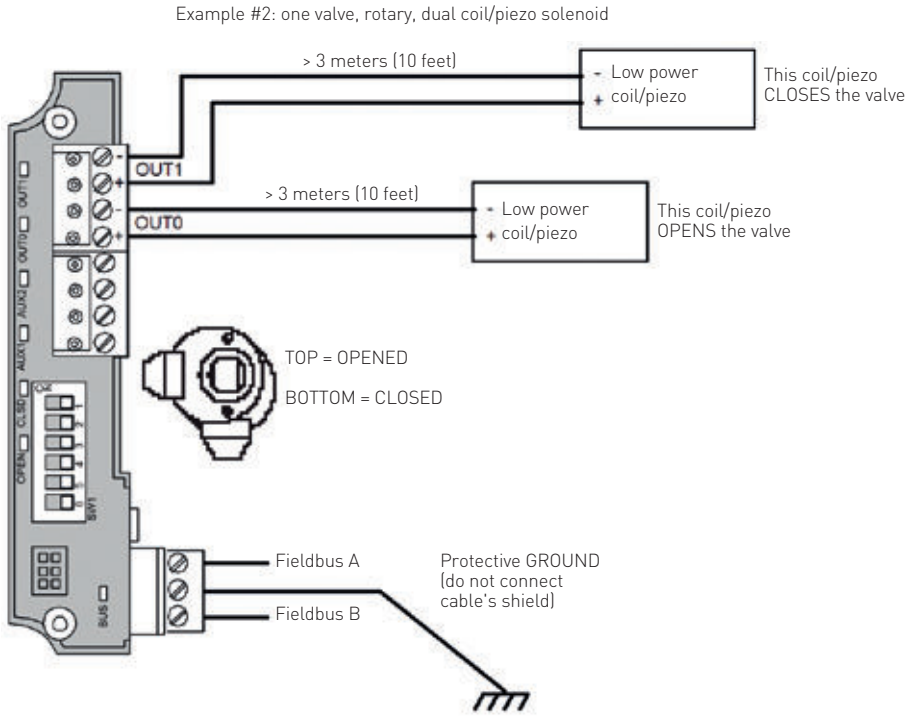
Examples #1B and #1C: one valve, rotary, with a simple solenoid



Note: cams, limit switches and potentiometer are factory set. If for some reason you need to adjust them see Appendix A for more details.
Note: for a configuration example see section "Configuration for example #1".

5.1.3 Wiring for example #2: one valve, rotary, dual coil/piezo solenoid
This example shows a solenoid that has two coils/piezos, each one to move the valve in one direction. There is no spring in the solenoid valve, therefore both outputs OUT0 and OUT1 are used.

FIGURE 107
Wiring diagram for example #2

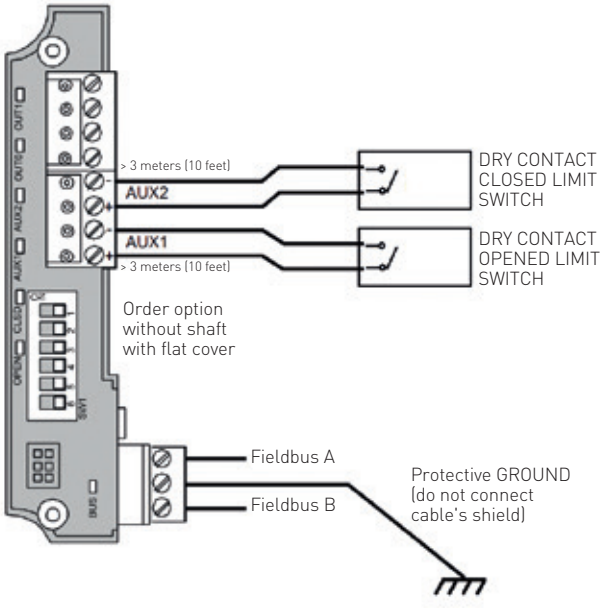


Note: cams, limit switches and potentiometer are factory set. If for some reason you need to adjust them. See Appendix A for more details.
Note: for a configuration example see section "Configuration for example #2".

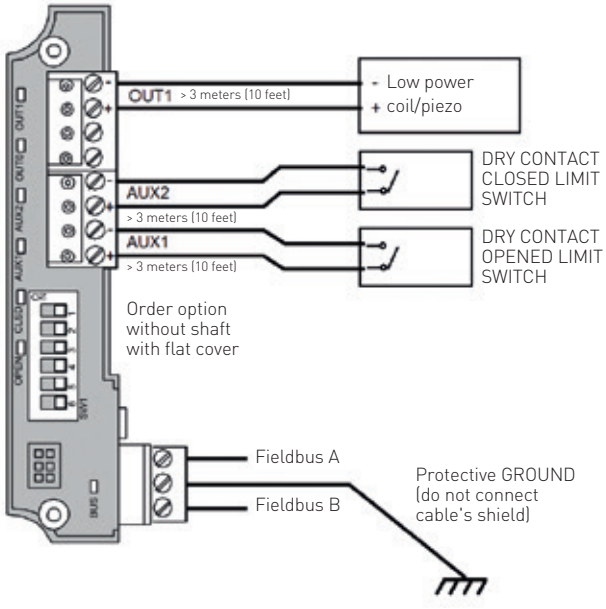
5.1.4 Wiring for example #3: one valve, linear, with simple solenoid
This is for the case where the valve is linear and uses two external sensors connected to AUX1 and AUX2.

FIGURE 108
Wiring diagram for example #3

Example #3: one valve, linear, just monitoring



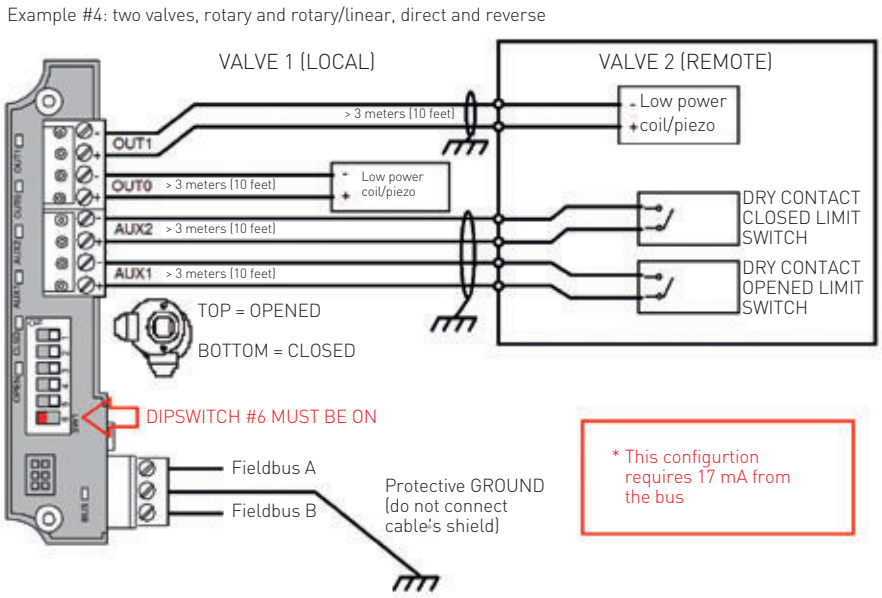
Example #3: one valve, linear, simple solenoid



Note: cams, switches and potentiometer are factory set. If for some reason you need to adjust them see Appendix A.
Note: for a configuration example see section "Configuration for example #3".

5.1.5 Wiring for example #4: two rotary valves, direct and reverse action
In this example FPAC is used to control two valves, one rotary and another rotary or linear. The FPAC housing is installed on top of the "valve 1, local", while an auxiliary housing just containing switches and the solenoid valve is installed on top of the "valve 2, remote".

FIGURE 109
Wiring diagram for example #4

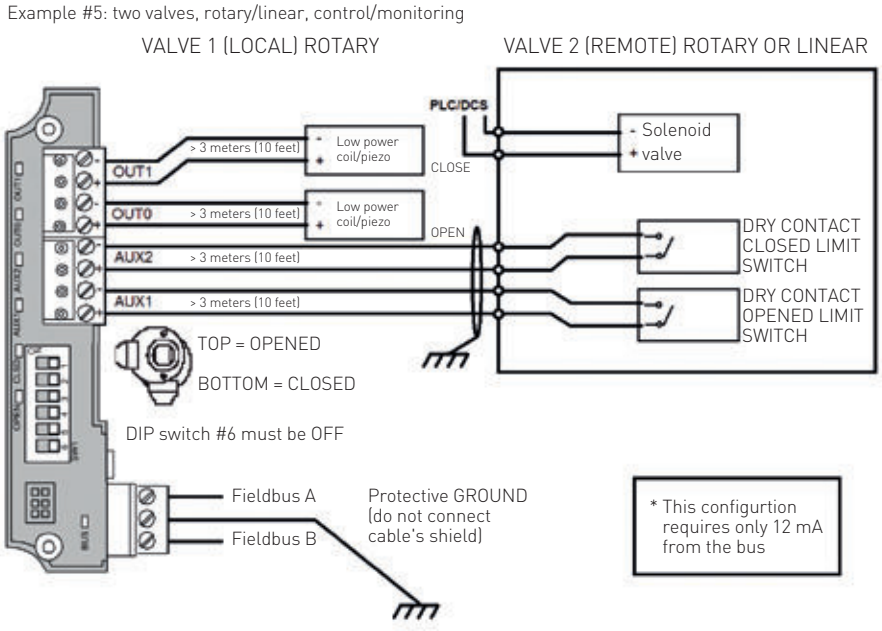


Note: cams, switches and potentiometer are factory set. If for some reason you need to adjust them see Appendix A.
Note: for a configuration example see section "Configuration for example #4".

5.1.6 Wiring for example #5: two valves, rotary/linear, monitoring/control

This is for the case where one FPAC will be used to control one valve and to monitor another one, the two valves being one rotary and another rotary or linear. The FPAC housing is installed on top of the "valve 1, local", while an auxiliary housing just containing switches and the solenoid valve is installed on top of the "valve 2, remote". The valve 2 solenoid is powered and controlled by other means, like a PLC/DCS DO output.

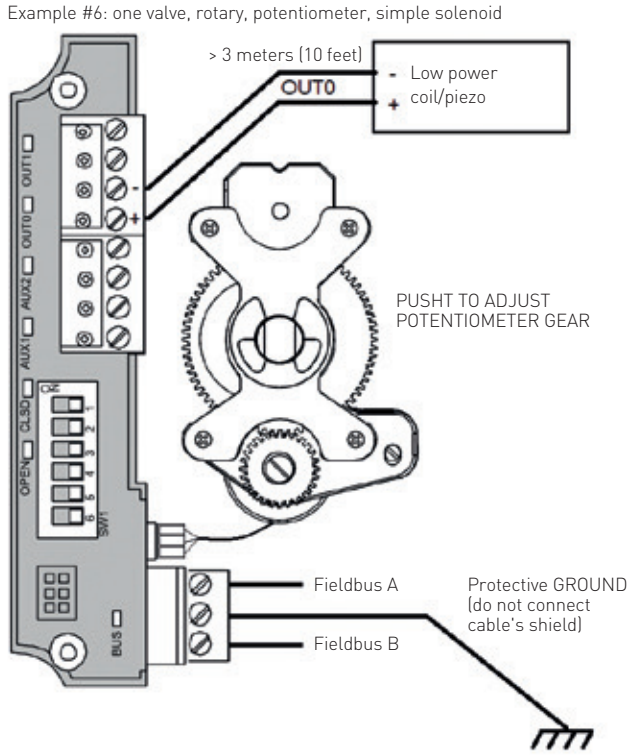
FIGURE 110
Wiring diagram for example #5



Note: cams, switches and potentiometer are factory set. If for some reason you need to adjust them see Appendix A.
Note: for a configuration example see section "Configuration for example #5".

5.1.7 Wiring for example #6: one valve, rotary, simple solenoid, potentiometer option
This example assumes the optional potentiometer is installed and there are no cams or additional switches on the shaft. Therefore, instead of using the internal Hall Effect limit switches to read the shaft position, the FPAC utilizes the potentiometer assembly connected to the analog output. The potentiometer has to be calibrated accordingly before it can be used to monitor position.

FIGURE 111
Wiring diagram for example #6



Note: cams, limit switches and potentiometer are factory set. If for some reason you need to adjust them see Appendix A for more details. If your application is for valve monitoring and the valve position is not controlled by the FPAC just ignore the solenoid connections.
Note: when ACTION_ELEMENT parameter in the transducer block is configured to use the analog option the OPEN and CLSD LEDs will no longer respond to the internal Hall Effect sensors, but to the potentiometer position after proper calibration.

6 MAINTENANCE AND REPAIR

6.1 Troubleshooting

This chapter addresses the most common installation, configuration, and operation problems. It also introduces diagnostic parameters and procedures that help solve these problems.

6.2 FPAC does not turn on, LEDs do not light when powered up

1. Check voltage at connector J2 pins 1 and 3. It should be between 9V and 32V, otherwise there may be a problem with the power supply, barrier, protections, bus terminators or cabling.
2. Disconnect the bus cable from connector J2. Using an Ohmmeter check the resistance between pins 1 and 3 of the bus connector J2. If the resistance is higher than 100 kOhms the internal fuse may be blown. Contact Westlock technical support.

6.3 Where do I find device revision and firmware version?

1. Check the label attached to the module. It should indicate the device version.
2. If you cannot access the device's label, you can use your FF Host system to open the device's Resource Block and look up the parameters listed below:
   a. MANUFAC_ID: manufacturer identification number, example "WESTLOCK" or " WTVC" or "0x574343".
   b. DEV_TYPE: device identification number, example "0x0001".
   c. DEV_REV: device revision, e.g., "0x05".
   d. DD_REV: version of the DD that needs to be used for this device, e.g., "0x01".
   e. ITK_VER: major version number of the ITK this device is registered, example "0x06".
   f. REVISION_ID: version of the firmware installed in the device, example "FPACRev1.0.0".
   g. REVISION_DATE: date of the firmware installed in the device, example "01 Feb 2014".

6.4 Which DD version should I use?

1. First of all, confirm the device revision of your FPAC: it should be between 2 and 5. Then you are going to need DD files for the same device revision. For example, FPAC with device revision 4 needs DD 0401; FPAC device revision 5 needs DD 0501 and so forth. All registered DD files can be downloaded from www.fieldburs.org. Contact Westlock if you have any problem getting the DD.

6.5 How do I perform a factory default?

1. Use dip switch #3 or Resource Block RESTART parameter. See Appendix B for more details.
2. IMPORTANT: the factory default MUST be performed with the device connected to an active bus with proper voltage levels, impedance, and communication. The factory default will not work if the device is connected to a simple DC power supply.

6.6 FPAC2 lost configuration after some time

1. After downloading a new configuration or after performing a factory default the data is stored in a volatile RAM memory. It takes some time to save the data to the non-volatile memory through a low priority task in the real time operating system of the device. Therefore the device must not be powered off before enough time has elapsed. Usually all configuration is saved after 10 minutes.

6.7 The device is not communicating or the Host communication statistics is showing errors

1. Some installation problems can cause communication malfunctions and errors:
   a. Check for loose wires, wire strands, and bad contact on all connectors. Make sure all wires and connectors are firmly attached and all screws are tight. It has been seen in many installations that a bad contact can cause intermittent malfunctions that will not prevent the bus from working but will degraded communication and reduce the performance due to sporadic errors, like DLL retries, Token Pass Time Outs (TPTO's), Missed View List Scan, Live List appearances and so forth.
   b. Check bus terminators, make sure there are only 2 (two) terminators enabled in the bus segment. It is common that power conditioners, junction boxes, barriers, repeaters have embedded terminators. Make sure they are configured in way that only two bus terminators are enabled at a time on the same segment.
   c. Check cabling for shield strands making intermittent shorts in connectors; check for wire splices and junction boxes.
   d. Check bus voltage at the device's terminals and make sure it is in the range 9 VDC to 32 VDC.

6.8 Blocks' tags on my application are different from the references on this manual

1. In a real application the blocks' tags are going to be different from the default tags referenced in this manual. Check the table below to find out the object directory index of each block and then identify the block in your application.

Default block tag	VFD Index
RB	407
TB1-STD-VALVE1	482
TB2-STD-VALVE2	554
TB3-DIAG-VALVE1	626
TB4-DIAG-VALVE2	694
DI_1	762
DI_2	791
DI_3	820

Default block tag	VFD Index
DI_4	849
DI_5	878
DI_6	907
DO_1	936
DO_2	967
DO_3	998
DO_4	1029
AI	1060

2. See below an example of properties window of a FF Host where one can correlate the block tag with the physical block in the device.
   a. FFDI3 in the application is the same as DI_2 in the physical device (block index 791).
   b. FFDO1 in the application is the same as DO_1 in the physical device (block index 936).
   See Figure 112.

6.9 Some parameters are showing "Error: Dictionary String Not Found"

1. FPAC DD has been developed to meet the latest FF specification. If some parameters or enumerations are showing a message, like "Error: Dictionary String Not Found" there is a chance the FF Standard Dictionary installed in your FF Host is outdated. FPAC was tested with FF Standard Dictionary version 3.8. Contact your FF Host supplier to ask for more information on how to update the FF Standard Dictionary.
2. There is method in the DD for checking the version of the dictionary installed in your system. It can be accessed from the Device Identification menu. See Figure 113.

6.10 Transducer MODE_BLK does not go to AUTO

1. Check that parameters ACTION_ELEMENT and IO_ASSIGNMENT are properly configured.
2. In applications where both TB1 and TB2 are configured with ACTION_ELEMENT as Single Action, SET_CURRENT_SINK parameter must be set to "2: Current Level 2" AND dip switch #6 must be ON.

FIGURE 112

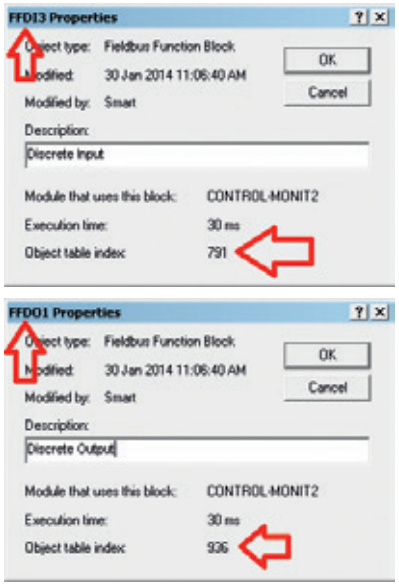
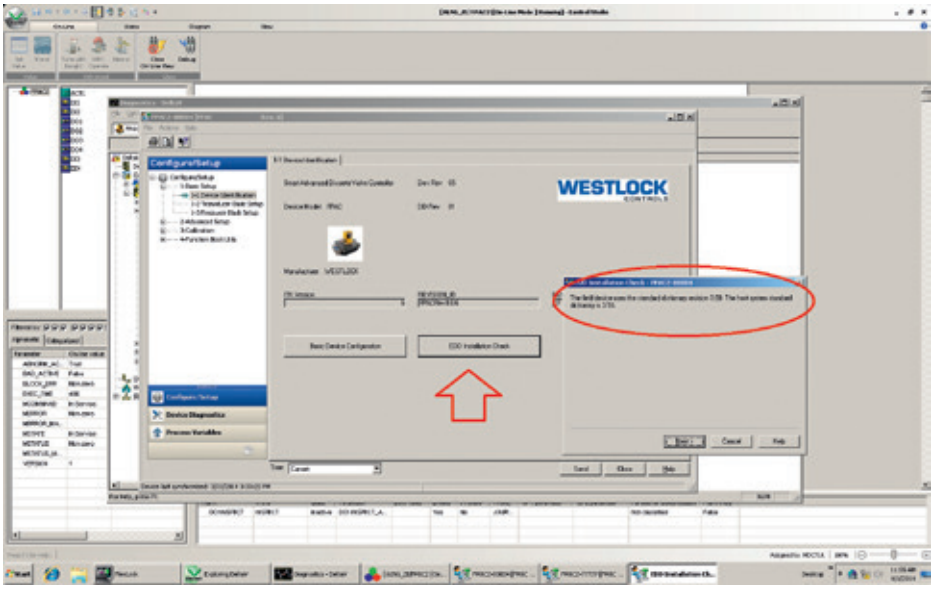


FIGURE 113



6.11 Transducer MODE_BLK = AUTO but BLOCK_ERR = BlockConfiguration

1. If the transducer is configured to control the valve (ACTION_ELEMENT = Single Action or Double Action) it is required to have a DO block feeding this transducer. Configure one DO block with a channel that belongs to this transducer and make sure DO mode is CAS+AUTO (AUTO or MAN only for testing purposes or manual control).
2. If more than one DO is configured to use the same channel of a transducer (TB1 or TB2), that transducer block will indicate a block error and keep the outputs frozen until the channels are fixed even though the mode transitions to AUTO. Make sure DO blocks in the same device use different channels and leave only one (1) DO configured with a given channel. If after the reconfiguration of the DO channels the block error still persists power cycle the device and recheck.

6.12 Can't write to ACTION_ELEMENT parameter

1. Write ACTION_ELEMENT = 0: "No selection" on both transducers and reconfigure.
2. Make sure the configuration is consistent for both transducers, for example, if one transducer is configured for "Double Action", the other can only be configured for "Monitoring" or leave unused. See section "Standard Transducer block overview" for more information.
3. Dipswitch #6 = ON and TBX.SET_CURRENT_SINK = Current Level 2 only when TB1 AND TB2 are configured for Single Action. For all the other combinations the dipswitch #6 = OFF and TBX.SET_CURRENT_SINK = Current Level 1. Use parameter MODULE_IO_SUMMARY from the Diagnostics transducer block to read the switch status.

6.13 Can't write to IO_ASSIGNMENT parameter

4. Make sure TB1 and TB2 are not using the same physical I/O. See section "Standard Transducer block overview" for more information.

6.14 The valve does not go to FAIL position when FPAC is powered off

1. When device is powered off pneumatics and actuator assembly are responsible for moving the valve to the fail position. Check air supply, pneumatics assembly, solenoid valve, and actuator.
2. There are applications where the valve is controlled by another discrete output, not the FPAC. In this case, check if the discrete output that controls the valve position.

6.15 The valve does not go to FAIL position when communication is lost

1. If FPAC is controlling the valve, it is responsible to command the solenoid in a way that the pneumatic assembly moves the valve to the fail position when communication is lost. Check transducer block configuration, in special the following parameters:
   a. PSNR_FSTATE_OPT: whenever the transducer block enters into a fault state (commanded by a DO block) the device will control the valve according to what is defined in this parameter.
   b. PSNR_OOS_OPT: whenever the transducer block enters into Out of Service (OOS) mode the device will control the valve according to what is defined in this parameter.
   c. PSNR_FSTATE_VAL_D: if this parameter was chosen in any of the two previous parameters the state assumed by any of the physical outputs will match the value configured in this parameter.
2. Check DO configuration, in special the following parameters:
   a. IO_OPTS: if IO_OPTS is '0', the value will hold the current value (freeze) if a fault is detected. If IO_OPTS is '1', the output will go to the preset FSTATE_VAL_D value, if a fault is detected.
   b. STATUS_OPTS: options which the user may select in the block processing of status.
   c. FSTATE _TIME: the time, in seconds, from detection of failure of the output block remote set-point to the output action of the block output if the condition still exists.
   d. FSTATE_VAL_D: the preset discrete SP_D value to use when failure occurs. This value will be used if IO_OPTS = "Fault State to value" is selected. The possible values are: 0: Close, 1: Open and 2: Stop.

6.16 The valve does not STOP at last position when communication is lost

1. Fail last applications depend on the pneumatic assembly to keep the air trapped in the actuator in the event of a failure. Check the pneumatic assembly, leakages, tubing etc.
2. When FPAC is controlling the valve, it also depends on the solenoid valve assembly and transducer block configuration. Fail last is typically implemented when FPAC is controlling 2 (two) coils/piezos. In the event of a failure FPAC will de-energize both coils causing the actuator to hold the valve in the current position. Check transducer block ACTION_ELEMENT parameter that should be "Double Action".

6.17 FPAC is not communicating with the FF Host

1. When there is regular communication the BUS LED blinks at a rate around 1 Hz. It means the device has an address in the range 0x10 to 0xF7, is receiving token pass and should be present in the Host live list and ready to use/commission.
   a. BUS LED is on: FPAC detected valid communication on the bus but its address is in the range 0xF8 to 0xFB; or it is not receiving token pass from the bus yet. It is likely the device is not present in the Host live list or it has not been commissioned yet. Check again the FF Host configuration and addressing.
   b. BUS LED is off: FPAC has not detected any valid activity on the bus. Check wiring, connectors, terminators, bus voltage (between 9 V and 32 V), barriers, signal amplitude.

6.18 Indication of valve closed or valve opened is wrong

1. LEDs OPEN, CLSD, AUX1 and AUX2 work independently from any block configuration. This feature can be used to test if the limit switches are working and properly installed or adjusted. Follow the steps below:
   a. All dip switches should be in the off position.
   b. Power up the module. It must blink ALL LEDs once. If the LEDs do not blink, check wiring, connectors, and if bus voltage measured at the device connector is between 9V and 32V.
   c. Move the shaft to the OPENED position. At this position, the cam magnet should be facing the FPAC canister and the OPEN LED should turn on. If you are not able to move the shaft you can also put a magnet near the Top Hall Effect limit switch (see Figure 1 for location). If the LED does not turn on, check the cam alignment and make adjustments if necessary. Rotate the shaft or remove the magnet, the LED should turn off. If the LED does not turn on even when you put a magnet close to it, then the module may have been damaged. Contact Westlock technical support.
   d. Repeat the same procedure for the CLOSED position and the CLSD LED with the Bottom Hall sensor.
   e. Using a wire, clip, tweezers or pliers, short out AUX1 pins (J4 1,2). The AUX1 LED should turn on. Release the short, the LED should turn off. If the LED does not behave as explained the module may have been damaged. Contact Westlock technical support.
   f. Repeat the same procedure for AUX2 input (J4 3,4) and AUX2 LED.
2. If all LEDs are turning on and off properly, then it is likely you have a configuration problem. Review device configuration or see the next sections for more troubleshooting options.

6.19 Valve is not moving when set-point is written to the DO block

1. Check pneumatic connections, air supply pressure, solenoid valve wiring.
2. Check DO BLOCK_ERR parameter for configuration errors and make sure all mandatory parameters are properly configured: MODE_BLK, CHANNEL, SHED_OPT, IO_OPTS.
3. Check associated transducer block actual mode is AUTO.

6.20 DO block entered IMAN or AUTO mode

1. Both limit switches associated to the configured channel are active at the same time. Check limit switches, actuator and valve stops, wiring etc.
2. The block that is publishing the set-point to the DO is sending a BAD status. Check the application.

6.21 BKCAL_OUT_D parameter is not indicating actual valve position

1. Check if parameter IO_OPTS has been configured. Bit "Use PV for BKCAL_OUT" has to be set to indicate actual valve position.
2. Check parameter XD_STATE if you are using the intend option. See section "READBACK parameter operating modes" for more details.
3. Check if the associated transducer block mode is OOS or MAN. Change it to AUTO.

6.22 DI.OUT_D parameter is not indicating actual valve position

1. Check block mode, it should be in AUTO.
2. Check if parameter CHANNEL has been properly configured.
3. Check if the associated transducer block mode is OOS or MAN and change it to AUTO.

6.23 Valve OPENED and CLOSED indications are inverted

1. Check IO_ASSIGMENT parameter in the standard transducer block. The convention for the I/O order is OPENED, CLOSED, OUTPUT.
2. If using auxiliary inputs, check limit switches wiring.
3. If using internal Hall sensors, check cams: TOP cam is for opened position and BOTTOM cam is for closed position.

6.24 Analog Input block is not working

1. Check associated transducer block, MODE_BLK = AUTO and IO_ASSIGNMENT = Analog,Out1/2 parameters.
2. Check mode block, set to AUTO.
3. Check CHANNEL configuration.
4. Check L_TYPE configuration.
5. Check XD_SCALE and OwUT_SCALE configuration match the configured CHANNEL.
   a. For Actual position: 100, 0, %, 3
   b. For Internal Temperature: 200, -100, C or F, 3.

6.25 Diagnostic parameters that measure time are not working

1. If parameters like VALVE_CYCLE_TIME, STROKE_TIME_CLOSED, STROKE_TIME_OPEN or BREAKAWAY_TIME are not updating check if the actual mode block is in AUTO.
2. Close and reopen the parameter window to update the values.

6.26 Transducer block is in "LO" (Local Override) mode

1. It means the device is in fault state, which can be verified in the BLOCK_ERR parameter of the Resource Block.
2. Fault state is also indicated in the BLOCK_ALMS_ACT parameter of the corresponding transducer block.
3. Check transducer block configuration and mode.
4. Check transducer block is receiving a valid set-point in the FINA_VALUE_D or WORKING_SP_D parameters. It only accepts values 0, 1, and 2. Any other value will generate a fault.
5. Check DO block channel configuration and mode.
6. Check if DO block is receiving a valid set-point in the CAS_IN_D and SP_D parameters. It only accepts values 0, 1, and 2. Any other value will generate a fault.

6.27 Where can I see statistics of the FF communication?

1. It depends on the FF Host System. Usually the statistics are grouped by card, port and/or device. See below an example of the statistics collected for the FPAC with the DeltaV system. Usually, after the device has been configured, the statistics are reset and error counters should not increment during normal operation. If counters like NumDllRetryes, NumDllTokenPassTimeouts or NumLiveListAppearances are continuously incrementing it may indicate a misconfiguration, installation problem (power supply, bus terminator, bad contact) or ultimately a defective device. If MissedViewListScan counter is incrementing, the system is not able to read all parameters within the configured scan time. Increase the control module scan time to a suitable value.

6.28 What does MissedViewListScan indicate about system operation (Pentair DeltaV)?

See Figure 114

1. MissedViewListScan is a diagnostic parameter. If it is incrementing, segment communications should not be seen as overloaded. Scheduled data transfers are guaranteed to get through. An incrementing MissedViewListScan parameter simply is an indication that ViewList data to the controller for operator display is not getting updated as frequently as the controller is requesting it. It is difficult to quantify what is acceptable before it is recommended to slow down the controller execution rate. As more devices are added to a segment and, more importantly, as more function blocks per device are configured, MissedViewListScans can start occurring. The general rule of running the controller execution rate at half the speed of the Macrocycle has been found to eliminate MissedViewListScans in most situations. When Control in the Field is used, a controller can execute slowly because the controller is not included in the control loop. Therefore, from the perspective of the loop, there is no need to configure a module such that misses occur, although MissedViewListScan may still occur during heavy communication usage, such as for downloads.

In practice, there is practically no functional difference between a controller running at one second with a high number of MissedViewListScans compared to the same controller running at two seconds with no MissedViewListScans.

Controller execution rate can be set for best operator display update time (faster rate) while minimizing use of processor resources (slower rate). When Hybrid Control is incorporated, the most important criterion to consider is control loop performance. It is generally acceptable to expect some MissedViewListScans to achieve best control loop performance. Experience has shown that, if MissedViewListScans are within 25% of requests sent, display updates are not adversely affected. When doing this calculation make sure to account for counter rollovers.

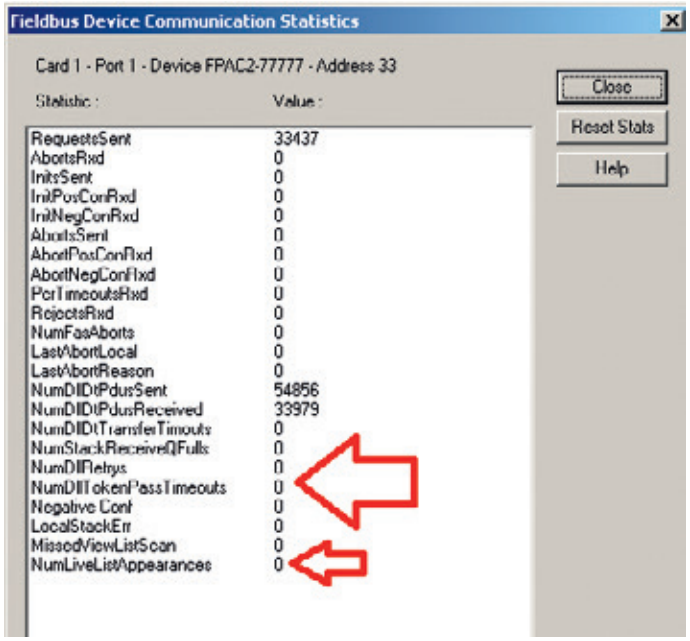
6.29 When configuration is changed from "Double Action" to "Single Action" or vice-versa it does not work properly

1. Check all other configuration parameters in the Transducer and function blocks.
2. Power cycle the device and download the configuration again.

6.30 Resolving problems using Status and Substatus

All function block input and output parameters are composed of two fields: value and status. The status field indicates health and quality of the current value being received or generated. In many cases it can be used for diagnostics and problem solving.

FIGURE 114



See below an explanation on the most important parameters and how to use them depending on the block type:

6.30.1 Discrete output status and substatus
Use the tables below to identify configuration and operation problems related to the DO block.

Parameter	Status: Quality-Substatus-Limit	Possible causes and fixes
OUT_D	Bad-OutOfService-NotLimited	• Block mode is in OOS, check MODE_BLK parameter. • Check Resource block mode in OOS. • Check associated transducer mode in OOS.
	Uncertain-InitialValue-Constant	• CAS_IN_D is receiving a BAD status. Check set-point publisher. • Both limit switches are active at the same time, check limit switches, cam adjustment, wiring. Block mode is IMAN. • Block mode is CAS+AUTO or AUTO but no CHANNEL has been assigned.
	Good-NonSpecific-NotLimited	• This is the expected status when everything is working properly and the block mode is CAS+AUTO, AUTO.

Parameter	Status: Quality-Substatus-Limit	Possible causes and fixes
BKCAL_ OUT_D	Good-FaultStateActive-NotLimited	• Device is in Fault State and STATUS_OPTS = Propagate Fail Bkwd. See Resource block. • Block mode goes to LO (Local Override).
BKCAL_ OUT_D	Bad-OutOfService-NotLimited	• Block mode is in OOS, check MODE_BLK parameter. • Check Resource block mode in OOS.
	Good-NotInvited-NotLimited	• Both limit switches are active at the same time, check limit switches, cam adjustment, wiring. • Block mode is CAS+AUTO or AUTO but no CHANNEL has been assigned. • Check associated transducer block mode in OOS or MAN.
	Good-NonSpecific-SensorFail	• If using the analog input, the potentiometer has not yet been calibrated.
	Good-NonSpecific-LowLimited	• Position reading from potentiometer is below -2%, check potentiometer calibration, mechanical assembly, valve and actuator stops.
	Good-NonSpecific -HighLimited	• Position reading from potentiometer is above +102%, check potentiometer calibration, mechanical assembly, valve and actuator stops.
	Good-NonSpecific-NotLimited	• Normal condition with block in AUTO or CAS+AUTO.

6.30.2 Discrete input status and substatus

Use the table below to identify configuration and operation problems related to the DI block.

Parameter	Status: Quality-Substatus-Limit	Possible causes and fixes
OUT_D	Bad-OutOfService-NotLimited	• Block mode is in OOS, check MODE_BLK parameter. • Check Resource block mode in OOS.
	Bad-NonSpecific-NotLimited	• Both limit switches are active at the same time, check limit switches, cam adjustment, wiring. • Block mode is AUTO but no CHANNEL has been assigned. • Check associated transducer block mode in OOS or MAN.
	Uncertain-NonSpecific-NotLimited	• Normal condition with block in MAN and STATUS_OPTS = Uncertain if Man.
	Good-NonSpecific-SensorFail	• If using the analog input, the potentiometer has not yet been calibrated.
	Good-NonSpecific-LowLimited	• Position reading from potentiometer is below -2%, check potentiometer calibration, mechanical assembly, valve and actuator stops.
	Good-NonSpecific -HighLimited	• Position reading from potentiometer is above +102%, check potentiometer calibration, mechanical assembly, valve and actuator stops.
	Good-NonSpecific-NotLimited	• Normal condition with block in AUTO.
	Good-NonSpecific-Constant	• Actual mode in MAN and STATUS_OPT configured to set Uncertain If MAN.

6.30.3 Analog input status and sub-status

Parameter	Status: Quality-Substatus-Limit	Description
OUT	Bad-OutOfService-NotLimited	• Actual mode in OOS. Check block configuration and associated transducer block.
	Bad-NonSpecific-NotLimited	• Actual mode in OOS. Check block configuration and associated transducer block.
	Uncertain-NonSpecific-NotLimited	• Actual mode in MAN and STATUS_OPT configured to set Uncertain.
	Good-NonSpecific-NotLimited	• Normal condition with block in AUTO.
	Good-NonSpecific-Constant	• Normal condition with block in MAN.

Parameter	Status: Quality-Substatus-Limit	Description
FIELD_ VAL	Bad-OutOfService-NotLimited	• Actual mode in OOS.
	Bad-ConfigurationError-NotLimited	• Check if transducer block IO_ASSIGNMENT parameter is configured for Analog option.
	Good-NonSpecific-NotLimited	• Normal condition with block in AUTO.

6.31 Resolving problems using BLOCK_ERR (Block Error) parameter

NOTE
The BLOCK_ERR parameter gives the user further insight into configuration errors and operational faults that prevent the expected operation of the device. After the error is identified the user must take the appropriate steps to eliminate the error.

Use the BLOCK_ERR (Block Error) parameter to troubleshoot configuration and operation.
See below a table with possible block error indications depending on the block type:

Bit	Hex	Message	RB	TB	DIAG	DI	DO	AI	Description
1	0x0002	BlockConfiguration	•	•	•	•	•	•	There is one or more parameters with invalid values in the block. Refer to the next sections for possible causes and solutions.
5	0x0010	DeviceFaultState	•						Fault state is active. The RB is either forcing this state or there is at least one block with BlockConfiguration. Refer to the next sections for possible causes and solutions.
6	0x0020	DeviceMaintenance	•						There is a transducer block configure to use the optional potentiometer
7	0x0040	SensorFailure		•				•	The analog option (potentiometer) is configured but there is a sensor or calibration failure.
15	0x8000	OutOfService	•	•	•	•	•	•	Block mode is OOS. Check target and actual modes.

See in the following sections the explanation of block error parameter for each block type, possible causes and fixes.

6.31.1 Resource block

1. BLOCK_ERR = BlockConfiguration: check for any inconsistencies in the Resource block configuration.
2. BLOCK_ERR = DeviceFaultState: device fault state is active.
   a. The RB can be forcing this state. Check FAULT_STATE, SET_FSTATE and CLR_FSTATE parameters.
   b. There is at least one transducer or function block with BLOCK_ERR = BlockConfiguration. Check every block to find out where the problem is and take measures to correct the problems. Only after all blocks in the application are clear from block errors this bit in the Resource block will be cleared.
   c. One of the transducer blocks is in "LO" mode (Local Override). This can be caused by an invalid set-point value (higher than '2') or status coming from a DO block, or a DO that is not in the correct mode, or is receiving or sending an invalid set-point value for example.
   d. This can also be caused by a DO block configured with a fault state channel. Check the DO block configuration.
3. BLOCK_ERR = DeviceMaintenance: this bit indicates the position sensor (potentiometer) needs to be calibrated.
   a. This error bit is valid only if the transducer block is configured with IO_ASSIGNMENT parameter = "Analog,Out1/2" AND block mode is in AUTO.
   b. If there is any configuration error in the transducer, the block mode will not go to AUTO, therefore the DeviceMaintenance bit in the Resource block will not be set.
4. BLOCK_ERR = OutOfService: Resource block is not going to AUTO when MODE_BLK.Target = AUTO.
   a. Check MODE_BLK.Target = AUTO.

6.31.2 Transducer blocks TB1 and TB2 (Standard Discrete Transducer)

1. BLOCK_ERR = BlockConfiguration: this bit is the most common error. It is set whenever there is a misconfiguration in the transducer or function blocks. Check the following parameters:
   a. IO_ASSIGNMENT: this parameter should match the I/O used in your application. TB1 and TB2 must use different I/O. If your configuration is wrong, configure both transducers with "0: No Selection" and then reconfigure the desired I/O.
   b. ACTION_ELEMENT parameter is not configured. Configure using a valid option for your application: Single Action, Double Action, Monitoring or leave it as No Selection.
   c. SET_CURRENT_SINK parameter is not properly configured. If FPAC is controlling 2 (two) valves and both transducer blocks are configured with ACTION_ELEMENT = "1: Single Action", this parameter must be set to "2: Current Level 2". This means the two outputs can be powered simultaneously and in this condition the FPAC will consume 17 mA from the bus. Otherwise, the block is not going to change the mode to AUTO. For all other configurations this parameter should be left with "1: Current Level 1". You just need to set this parameter in one transducer, then the value is copied to the other one.
   d. DIPSWITCH #6: this switch must be ON whenever the 2 outputs can be used simultaneously, as in applications with two single action valves. In addition, check the parameter SET_CURRENT_SINK = "2: Current Level 2" in the corresponding transducer block. Use parameter MODULE_IO_SUMMARY from the Diagnostics transducer block to check dip switch #6 status.
   e. The transducer block is configured to control the valve with ACTION_ELEMENT = "1: Single Action" or "2: Double Action", but there is no associated DO block with the CHANNEL parameter configured to use this transducer. Configure a DO channel to use this transducer. For example, if transducer TB1 is used, pick channel TRD1: 0-Close / 1-Open.
   f. There is more than one DO block configured to use the same CHANNEL. Leave only one (1) DO configured with a given channel. If after the reconfiguration of the DO channels the block error still persists power cycle the device.
   g. One or more associated DO block is in OOS mode. Change mode to AUTO.
   h. Block is in "LO" (Local Override) mode. Check parameter BLOCK_ALMS_ACT for the cause of the error.
2. BLOCK_ERR = SensorFailure: an error occurred during analog sensor (potentiometer) calibration. Repeat the calibration procedure.
3. BLOCK_ERR = OutOfService: transducer is not going to AUTO when MODE_BLK. Target = AUTO.
   a. Both transducers TB1 and TB2 are configured for Single Action valves but dipswitch #6 is not ON. Move dipswitch #6 to ON position. Use parameter MODULE_IO_SUMMARY from the Diagnostics transducer block to read the switch status.
   b. Transducers TB1 and TB2 are both configured for Single Action valves but SET_CURRENT_SINK parameter is not configured to "Current Level 2".
   c. Transducer is configured as Single or Double Action but there is no DO assigned to use any of its channels. Configure one DO block to use the transducer channel.

6.31.3 Diagnostic Block (TB3 and TB4)

1. BLOCK_ERR = BlockConfiguration: this bit is set when the configuration is inconsistent. Check the following parameters:
   a.
2. BLOCK_ERR = OutOfService: Diagnostic block is not going to AUTO when MODE_BLK.Target = AUTO.
   a. Check MODE_BLK.Target = AUTO.

6.31.4 Discrete Input

1. BLOCK_ERR = BlockConfiguration: check the following parameters:
   a. CHANNEL: it should be configured with a valid channel associated with TB1 or TB2. See Discrete Input channels table for more details.
2. BLOCK_ERR = OutOfService: DI block is not going to AUTO when MODE_BLK.Target = AUTO.
   a. DI block is not scheduled to execute. Include the DI block in a control strategy or application to schedule its execution.
   b. CHANNEL parameter is not properly configured.

6.31.5 Discrete output

1. BLOCK_ERR = BlockConfiguration: check the following parameters:
   a. CHANNEL: it should be configured with a valid channel associated with TB1 or TB2. See Discrete Output channels table for more details.
   b. SHED_OPT: should be configured with any valid option, like "NormalShed_NormalReturn".
2. BLOCK_ERR = OutOfService: DO block is not going to AUTO when MODE_BLK.Target = AUTO.
   a. DO block is not scheduled to execute. Include the DO block in a control strategy or application to schedule its execution.
   b. CHANNEL is not properly configured.
   c. SHED_OPT is not properly configured.

6.31.6 Analog input

1. BLOCK_ERR = BlockConfiguration: check the following parameters:
   a. If your application uses the potentiometer for analog position measurement, verify that at least one of the transducer blocks TB1 or TB2 has IO_ASSIGNMENT parameter = "Analog,Out1/2", enabling the analog input to read position.
   b. CHANNEL: it should be configured with a valid channel associated with TB1 or TB2. See Analog Input channels table for more details.
   c. XD_SCALE: check this parameter is configured to match the selected channel. See section about Analog Input channels for more information.
   d. OUT_SCALE: check this parameter is configured to match the selected channel. See section about Analog Input channels for more information.
   e. L_TYPE: should be configured with any valid option, like "Direct".
2. BLOCK_ERR = SensorFailure: an error occurred during analog sensor (potentiometer) calibration. Repeat the calibration.
3. BLOCK_ERR = OutOfService: AI block is not going to AUTO when MODE_BLK.Target = AUTO.
   a. AI block is not scheduled to execute. Include the AI block in a control strategy or application to schedule its execution.
   b. CHANNEL is not properly configured.
   c. L_TYPE is not properly configured.
   d. XD_SCALE is not properly configured.
   e. OUT_SCALE is not properly configured.

6.32 Resolving problems using Block Alarms Active parameter

NOTE
The BLOCK_ALMS_ACT parameter, located in the standard transducer blocks TB1 and TB2 gives the user further insight into configuration errors and operational faults that prevent the expected operation of the device.

See in the table below the values, possible causes and solutions.

BLOCK_ALARMS_ACTIVE parameter		
Value	**Message**	**Description**
0x00000000	None Active	No active block alarms.
0x08000000	Fault State Active	Fault State is active in the transducer block due to an invalid input or wrong configuration, like two DO blocks configured with the same channel or a DO in OOS mode. Verify resource, transducer and function blocks configuration.
0x04000000	Invalid Mode	The computed actual mode for the block is not supported, the block's actual mode will go to out of service. Review MODE_BLK.Target parameter.
0x02000000	Bad Output Configuration	Conflicting output channels have been assigned. Please review channels assignments and make appropriate corrections. It is possible that 2 (two) DO blocks are configured with the same channel.
0x01000000	Invalid Input	The target position is not valid for the current device configuration. There is an inconsistency between the position DO is commanding the valve to move and the position effectively detected.
0x00800000	Out Of Service	Transducer block is out of service. Check parameter BLOCK_ERR for any configuration error that may be preventing the block to change the actual mode to AUTO.
0x00400000	No Output Channels	No output channels have been assigned, i.e. there can be no action. Configure the transducer parameters and DO channel accordingly. For example, the transducer is configured for Single Action but there is no DO configured to use the transducer channel.
0x00200000	Open without Close	An Open output channel has been assigned without a Close channel. Confirm DO block's channels configuration.
0x00100000	Conflicting Channels	Conflicting output channels have been assigned, please review and correct. It is possible DO blocks are configured to use the same channel, or there are still blocks without proper channel configuration. Review your configuration.
0x00080000	Both Contacts Closed	Both contacts are closed. OPENED and CLOSED Limits switches configured in the transducer block are both active. This is an invalid condition and should be verified. Check can shaft adjustment and auxiliary inputs.
0x40000000	Mode Error	The mode calculator detected an error. Review block's configuration.

Examples of usage:
- Transducer block TB1 is configured to used internal Hall sensors Top and Bottom. Cam shaft magnets are adjusted in a way that the angle is too small, so there is a position where cams are activating the two sensors simultaneously. In this case the BLOCK_ALARMS_ACTIVE parameter will indicate 0x00080000 = Both Contacts Closed. Fix the cam shaft adjustment.
- After configuring the device it does not respond and does not move the valve. The BLOCK_ ALMS_ACT parameter of the transducer block TB1 is indicating Fault State Active (0x08000000).

7 APPENDIX

7.1 Appendix A - Limit switches and potentiometer calibration

Although the internal limit switches (cams) and potentiometer are factory set, it is common after the installation is done and all wiring completed the cam set needs to be adjusted for the rotary valves (and external limit switches for the linear valves) in order to allow the sensors to properly read OPENED and CLOSED positions. The LEDs on the top of the electronic module can assist in verifying and adjusting the limit switches. When a limit switch is active the corresponding LED lights up, regardless the configuration in the module.

7.1.1 Quick test after factory default

If FPAC is controlling the valve (low power solenoid only) and is at the factory default state there is an easy way to test pneumatic assembly, wiring, solenoid and limit switches. After the factory default (see Appendix B) the dipswitches #4 (CAL) and #5 (O/C) can be used to control the output OUT0. Therefore, if the solenoid is wired to OUT0, it is possible to open and close the valve and check LEDs by following the steps below:

1. Make sure the FPAC is at the factory default state (see Appendix B how to perform the factory default).
2. Make sure the solenoid is wired to OUT0.
3. Make sure dipswitches #4 (CAL) and #5 (O/C) are at the off position.
4. Make sure the FPAC is properly powered from the bus connector (9-32VDC).
5. Check OUT0 LED, it should be off.
6. Move the dipswitch #4 (CAL) to the ON position to enable the local calibration.
7. OUT0 LED should turn ON. OUT0 should energize the solenoid making the valve move to the opened position.
8. OPEN LED should light up. If necessary, adjust the top cam until the OPEN LED lights up.
9. Move the dipswitch #5 (O/C) to the ON position (C = CLOSE).
10. OUT0 LED should turn off. OUT0 should de-energize the solenoid making the valve move to the closed position.
11. CLSD LED should light up. If necessary, adjust the bottom cam until the CLSD LED lights up.
12. While dipswitch #4 (CAL) is on you can control the valve position by moving switch #5 to on and off.
13. When you are finished testing, move the dipswitch #5 to the ON position, dipswitch#4 to off position and then finally dipswitch $ to off position.

NOTE

This quick test only works right after the factory default. If any configuration is download to the device this procedure will not work and the complete local calibration procedure must be used. See the next sections in this appendix for more details.

7.1.2 Cam shaft adjustment when FPAC IS NOT controlling valve position

There are two different ways to perform the limit switches calibration. If FPACs is controlling the valve, there is a special procedure involving block parameters and the dip switch that is explained in the next section. If the FPAC is not controlling the solenoid and is just monitoring the valve, or if you can move the shaft between opened and closed limits, follow the procedure below:

- With the valve OPENED, the TOP can magnet should face the canister and the OPEN LED should light up.
- With the valve CLOSED, the BOTTOM cam magnet should face the canister and, in turn, the CLSD LED should light up.
- If both magnets face the canister, both LEDs will light up.

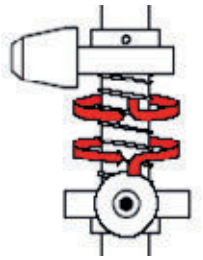
7.1.3 Cam shaft adjustment when FPAC IS controlling valve position

If the FPAC is controlling valve position you need first to configure the transducer block according to your application then follow the procedure henceforth. In the steps below TB1/2 below can be either TB1 or TB2 depending on which transducer is configured to control the valve:

WARNING

Notice that outputs may change during configuration and operation. Make sure your setup is safe if outputs change state.

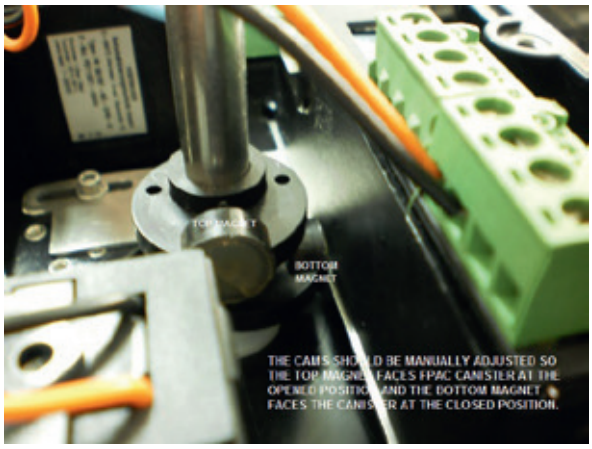
1. Set Resource block mode to OOS.
2. Set Resource block mode to TB1/2 to OOS.
3. Write TB1/1.CALIBRATION_ENABLE = "1: Manual Calibration Enabled".
4. Set dipswitch #4 CAL to ON.
5. Set dipswitch #5 O/C to ON => the valve moves to CLOSED position.
6. Manually adjust the BOTTOM cam shaft until the CLSD LED turns on.
7. Set dipswitch #5 O/C to OFF => the valve moves to OPENED position.
8. Manually adjust the TOP cam shaft until the OPEN LED turns on.
9. Set dipswitch #4 CAL to OFF.
10. Return Resource and Transducer blocks to the previous modes.



Top Cam: with the actuator in the OPENED position, push it down and turn until the magnet faces the canister and the OPEN LED turns on, then release.

Bottom Cam: with the actuator in the CLOSED position, pull it up and turn until the magnet faces the canister and then CLSD LED turns on, then release.

FIGURE 115
Cam shaft adjustment



7.1.4 Potentiometer calibration

An optional potentiometer can be installed (see ordering guide) to read the analog position in % of the open position using an AI block. This way FPAC operates as a position transmitter. The position is transmitted to the control/ monitoring system through an Analog Input (AI) block. It is mandatory to configure the IO_ASSIGNMENT parameter to "Analog,Out0/1" in the transducer block TB1 or TB2. In the case FPAC is just monitoring the valve position (valve is controlled by other means) the output is not used and the valve has to be moved by others means to accomplish the calibration.

Note: until the calibration is performed the Resource Block will keep indicating block error DeviceMaintenance as long as the transducer block mode is AUTO.

Note: this calibration procedure assumes the valve starts at the CLOSED position.

The calibration is done in two phases, as explained below:

1. First phase: prepare for local calibration. These steps are accomplished with the FF Host system or with the use of a FF portable configurator:
   a. This procedure applies for firmware version 5.0.0 and above.
   b. Configure TB1/2.IO_ASSIGNMENT = "Analog,Out0/1".
   c. Set parameter TB1/2.CALIBRATION_ ENABLE = "1: Manual Calibration Enabled" if not yet configured (after factory default it is automatically enabled for the first calibration).
2. Second phase: perform local calibration. These steps are accomplished at the FPAC:
   a. Make sure dipswitches #5 (O/C) and #4 (CAL) are OFF.
   b. With the valve at the CLOSED position perform the initial adjustment of the gears as follows:
      i. Make sure the potentiometer is installed onto the gear restrain with its label facing the main shaft as shown in the picture below. If not, contact the factory for more instructions. See Figure 116.
      ii. If the valve opens counterclockwise (looking from the top of the module):
         1. Make sure the valve remains at the CLOSED position during this adjustment.
         2. Push the big gear to release the clutch.
         3. Rotate it in any direction until the OPEN LED turns solid ON AND the groove on top of the potentiometer shaft points towards the electronic module, as can be seen in the picture below.
         4. Release the big gear.

      See Figure 117.
      iii. If the valve opens clockwise (looking from the top of the module):
         1. Make sure the valve remains at the CLOSED position during this adjustment.
         2. Push the big gear to release the clutch.
         3. Rotate it in any direction until the CLSD LED turns solid ON AND the groove on top of the potentiometer shaft points towards the main shaft, as can be seen in the picture below.
         4. Release the big gear.

      See Figure 118.

FIGURE 116

FIGURE 117

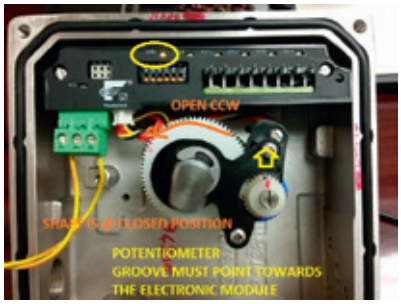
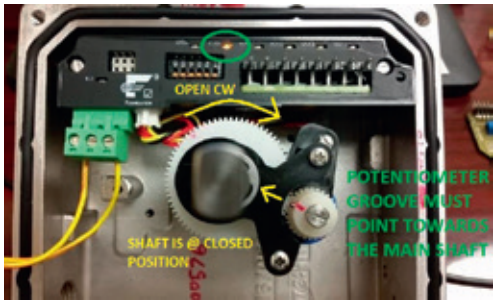


FIGURE 118



c. **Warning:** the valve will move in the next steps. Make sure all safety precautions have been taken.
d. Set switch #4 to ON => OPEN and CLSD LED's will start blinking.
e. If FPAC is controlling the valve it will open. Otherwise, move the valve to the opened position by any other means.
f. After the valve is stable at the opened position, set dipswitch #4 (CAL) to OFF => OPEN LED stops blinking and lights up solid. CLSD LED will still be blinking.
g. Set dipswitch #5 (O/C) switch to ON. If FPAC is controlling the valve it will close. Otherwise, move the valve to the closed position by any other means.
h. After the valve is stable at the closed position, set dipswitch #4 (CAL) to ON => OPEN LED should go OFF while CLSD LED still blinks.
i. Set dipswitch #4 CAL to OFF => CLSD LED stops blinking and lights up solid.
j. Set dipswitch #5 (O/C) to OFF position to finish the calibration.

3. Return Resource and Transducer Blocks to the previous modes.
4. Download the application and verify the AI block now reports position accurately over the calibrated range.

Note: OPENED and CLOSED positions with the potentiometer use a fixed tolerance of ±2% of the full calibrated span.
Note: when FPAC is at factory default state there is a valid default calibration value for the potentiometer assuming a 90 degree stroke. However, in order to match the actual installation the calibration should be performed to adjust for zero, span and direction. While this calibration is not performed, the Resource Block will indicate Device Needs Maintenance in the BLOCK_ERR parameter. After this calibration is performed the data is stored in the non-volatile memory and IS NOT LOST after a regular factory default. In order to erase the calibration values to the default values the device needs to be re-initialized as FPAFC or ZRF using a special default procedure (Deep Default, contact Westlock). See Appendix B for more information.

7.2 Appendix B - Dip switch usage

- Use MODULE_IO_SUMMARY parameter located in diagnostics transducer blocks TB3 and TB4 to check the status of the dipswitches. Both transducers exhibit the same value:

Bit	Hex	Mnemonic	Description
0	0x0001	WRP	Write protect dip switch #1 is ON
1	0x0002	SIM	Simulate enable dip switch #2 is ON
2	0x0004	FCT	Factory default dip switch #3 is ON
3	0x0008	CAL	Calibration enable dip switch #4 is ON
4	0x0010	O/C	Open/Close dip switch #5 is ON
5	0x0020	AUX	Auxiliary dip switch #6 is ON
6	0x0040	OUT0	Discrete Output 0 is energized
7	0x0080	OUT1	Discrete Output 1 is energized
8	0x0100	AUX1	Discrete Auxiliary Input 1 pins are shorted out
9	0x0200	AUX2	Discrete Auxiliary Input 2 pins are shorted out
10	0x0400	TOP	Top Hall Effect sensor is active (magnet detected)
11	0x0800	BOT	Bottom Hall Effect sensor is active (magnet detected)
12-15	-	-	Reserved for future use

7.2.1 Switch #1 write protect

- When this switch is set to ON Resource block parameter WRITE_LOCK = Locked. This prevents any unwanted change in the configuration.

7.2.2 Switch #2 simulate enable

- When this switch is set to ON it enables simulation capability for AI, DI, DO blocks. Simulations is useful for commissioning, test and diagnostic purposes. In these blocks the SIMULATE.ENABLE_DISABLE parameter can only be enable (written to Active) when this switch is ON, otherwise the device will reject the write.

7.2.3 Switch #3 Factory Default procedure

WARNING

Factory default will erase device's configuration stored in the non-volatile memory. Notice that outputs may change during the factory default procedure. Make sure your setup is safe if outputs change state.

- The regular factory default can be performed following the steps below. Bear in mind this process erases device tag, blocks tags, links, device address and block parameters. The configuration will have to be downloaded again. This factory default does not erase the analog input calibration data for the potentiometer though.

1. The procedure below only applies with FF communication on the bus. It will not work if the device is connected to a regular DC power supply.
2. Close any supervision window for this device while the factory default is not completed.
3. Set dip switch 3 to ON.
4. Power cycle the device, all LEDs will start blinking.
5. Set dip switch 3 to OFF.
6. LEDs will stop blinking. LED BUS light up.
7. DO NOT TURN POWER OFF while device is saving non-volatile data.
8. It may take from 1 to 3 minutes.
9. LED BUS will blink when factory default finishes and device will reset.
10. If device does not enter promptly in the FF Host list power cycle it.
11. All LEDs will blink once and turn off.
12. Device is ready for use.

7.2.4 Deep Default

WARNING

This procedure will clear device's configuration and restore potentiometer default calibration. A new download and calibration is necessary to restore device operation.

Step 1: Make sure the device is properly powered and connected to the FF Host System or portable configurator. The procedure below only applies with FF communication on the bus. It will not work if the device is connected to a regular DC power supply. Close any supervision window for this device while the factory default is not completed.
Step 2: Make sure all dipswitches are in the OFF position. See Figure 119.
Step 3: Set dip switches 1, 3 and 5 to ON. Leave all other switches OFF. See Figure 120.
Step 4: Power cycle the device, LEDs OUT0 e OUT1 start blinking.
Step 5: Set only switches 1 and 5 to OFF, leaving switch 3 ON. See Figure 121.

FIGURE 119

FIGURE 120

FIGURE 121

Step 6: Now set dip switch 3 to OFF (this switch must be the last one to be switched OFF). If you don't follow this sequence you may have to repeat the procedure.
Step 7: LEDs will stop blinking. LED BUS light up.
Step 8: DO NOT TURN POWER OFF while device is saving non-volatile data.

Step 9: LED BUS will blink when factory default finishes. It may take from 1 to 3 minutes.
Step 10: Power cycle the device, all LEDs will blink.
Step 11: Device is ready for use and DEVICE ID will show default FPAC information. See Figure 122.
Step 12: Remember to set dipswitch #6 to ON in case the application requires two single action solenoids powered simultaneously by FPAC.

7.2.5 Switch #4 and #5
Local Calibration and Real Time Clock

- Local calibration:
  - When the switch #4 is ON it enables local control of the outputs. This switch works along with CALIBRATION_ENABLE parameter, present in transducers TB1 and TB2. To enable local calibration CALIBRAITON_ENABLE = "1: Manual Calibration Enabled" AND switch #4 = ON.
  - Once the local calibration is enabled, switch #5 is used to move the valve to opened and closed positions in order to adjust the cams.
  - See section about local calibration for more information.
- Real time clock adjustment:
  - When switch #4 is ON it enables Real Time Clock adjustment through PST_INITIAL_START_TIME parameter located in the Diagnostic Transducer block. RTC can be used for operations like event logging and automatic tests like PST and FST.

7.2.6 Switch #6 Auxiliary power, high current mode

- This switch controls the current consumption of the device. It works along with parameter SET_CURRRENT_SINK located in the transducer blocks TB1 and TB2. The switch AND the parameter determine if the FPAC will drain 12 mA or 17 mA from the bus.
- THIS SWITCH SHOULD ALWAYS BE IN THE OFF POSITION unless the FPAC is configured to control 2 (TWO) SINGLE ACTION VALVES with power coming from the bus. It is NOT necessary to turn switch #6 ON for any other configuration. With the switch in the off position FPAC will drain 12 mA from the bus.
- In order to enable FPAC to power 2 coils/ piezos simultaneously, dip switch #6 should be set to the ON position AND SET_CURRRENT_SINK parameter set to "2: Current Level 2". In this situation FPAC will drain 17 mA from the bus.
- Use MODULE_IO_SUMMARY parameter in the Diagnostics transducer block to read the status of the dipswitches. See Figure 123.

FIGURE 122

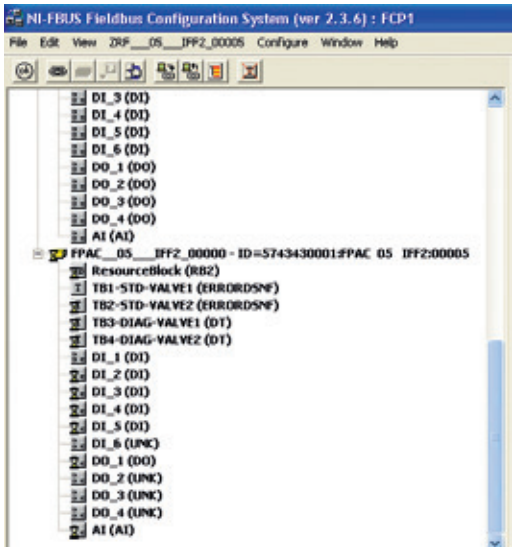
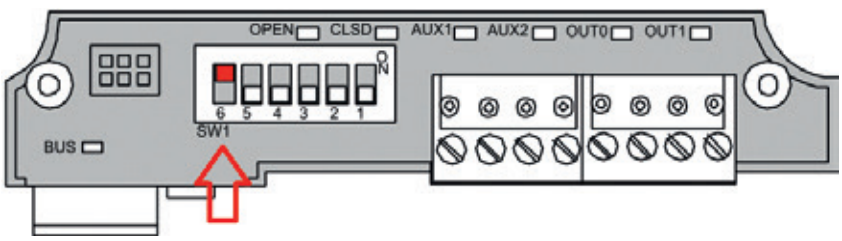


FIGURE 123



7.3 Appendix C - DO.READBACK parameter tables

Westlock Controls manufacturer specific state tables:

• State Table 64000 (0xFA00) Pure bit value:

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Out0	Out1	Bottom	Top	Aux1	Aux2	Analog	Fail

• State Table 64001 (0xFA01) Bit value is channel dependent:

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Cl/Op cmd1	Cl/Op cmd2	Closed1	Opened1	Stopped1	Closed2	Opened2	Stopped2

7.4 Appendix D - Complete list of block parameters

7.4.1 Common definitions and tables

• Factory Default (FCT default) values are obtained after a Resource block RESTART parameter is written to '5', or '11' or dipswitch #3 is used. See Appendix B for more details on the factory default procedure.

• Deep Default values are obtained after a special procedure using the dipswitches. See Appendix B for more details on the factory default and deep procedures.

• BLOCK_ALMS_ACT table (valid for the Standard Transducer block only):

Value	Meaning
0x00000000	None Active => No active block alarms
0x08000000	Fault State Active => Fault State is active in the transducer block due to an invalid input or mis-configuration
0x04000000	Invalid Mode => The computed actual mode for the block is not supported, the blocks actual mode will go to out of service
0x02000000	Bad Output Configuration => Conflicting output channels have been assigned. Please review channels assignments and make appropriate corrections
0x01000000	Invalid Input => The target position is not valid for the current device configuration
0x00800000	Out Of Service => Transducer block is out of service
0x00400000	No Output Channels => No output channels have been assigned, i.e. there can be no action
0x00200000	Open without Close => An Open output channel has been assigned without a channel Close
0x00100000	Conflicting Channels => Conflicting output channels have been assigned, please review and correct
0x00080000	Both Contacts Closed => Both contacts are closed
0x40000000	Mode Error => The mode calculator detected an error

• SIGNAL_MASK and MASKABLE_SIGNAL table:

Value	Meaning
0	No Selection => No signal is selected to generate discrete
1	Cycle Count exceeds limits => Number of valve cycles exceeds the CYCLE_COUNT_LIM
2	Cycle Time exceeds limits => Cycle time exceeds limit set in CYCLE_TIME_LIM
4	Bad Xducer Status => Status of the transducer is not Good
5	Low Temp. Alarm exceeds limits => Threshold configured for this parameter has been exceeded
6	Hi Temp. Alarm exceeds limits => Threshold configured for this parameter has been exceeded

• Function block channels after factory default (dip switch #3):

DEFAULT CHANNEL (FCT DEFAULT DIP SWITCH #3 OR RB.RESTART = 5 OR 11)

Block	CHANNEL
DI_1	9: TRD1: 0-Closed / 1-Opened
DI_2	0: No Transducer Connection
DI_3	0: No Transducer Connection
DI_4	0: No Transducer Connection
DI_5	0: No Transducer Connection
DI_6	0: No Transducer Connection
DO_1	1: TRD1: 0-Close / 1-Open
DO_2	0: No Transducer Connection
DO_3	0: No Transducer Connection
DO_4	0: No Transducer Connection
AI	1: Actual Position

7.4.2 Complete list of discrete standard transducer block parameters

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write	R/W
1	ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.							Read only
2	TAG_DESC	The user description of the intended application of the block.							R/W
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.							R/W
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	1 to 255				None		R/W
5	MODE_BLK	The actual, target, permitted, and normal modes of the block.	See MODE	O/S	O/S	O/S	NA		R/W
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.							Read only
7	UPDATE_EVT	This alert is generated by any change to the static data.							Read only
8	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.							Read only
9	TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the transducers in the transducer block. For further information, please refer to section 3.4.7.	At a minimum is an array of 1 element containing a 0	0	0	0	None		Read only
10	TRANSDUCER_ TYPE	Identifies the transducer that follows.	See Standard Tables (TN-016)	107: Standard Discrete Valve	107: Standard Discrete Valve	107: Standard Discrete Valve	E		Read only
11	TRANSDUCER_ TYPE_VER	The version of the transducer identified by TRANSDUCER_ TYPE in the form 0xAABB where AA is the major revision of the transducer specification on which the transducer is based, and BB is a revision number assigned and controlled by the manufacturer of the device.	See parameter description	0x1100	0x1100	0x1100			Read only
12	XD_ERROR	One of the error codes defined in section 4.4 XD_ERROR and Block Alarm Subcodes below.	See section 4.4 XD_ERROR and Block Alarm Subcodes				E		Read only
13	COLLECTION_ DIRECTORY	A directory that specifies the number, starting indices, and DD Item IDs of the data collections in each transducer within a transducer block. For further information, please refer to section 3.4.8 above.	Legacy, array with one element = 0.	0	0	0	None		Read only
14	FINAL_ VALUE_D	The requested valve position and status written by a discrete Function Block.		0	0	0	None	O/S, Man	R/W

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write	R/W
15	FINAL_ POSITION_ VALUE_D	The actual valve position and status; can be used for a DI block and as the READBACK_ VALUE in a DO block.		0	0	0	None		Read only
16	WORKING_ POS_D	The actual measured discrete feedback position before de-characterization.		0	0	0			Read only
17	WORKING_ SP_D	The final discrete command value to the positioning algorithm after characterization.		0	0	0		O/S, Man	R/W
18	PSNR_ FSTATE_VAL_D	User defined discrete position in case of fault state of transducer.		0	0	0		O/S, Man	R/W
19	DISCRETE_ STATE		See DD enumeration	0	0	0			R/W
20	PSNR_ FSTATE_OPT	Defines an action to be taken on a transducer fault state. Enumerations defined in Standard Tables (TN-016).	0: Hold Last Value 1: Fail Closed 2: Fail Open 3: PSNR_FSTATE_VAL_D 4-7: Reserved 8-255: Mfg Specific						
21	CYCLE_CNTR	Totalized cycle counts since last clear. A cycle is defined as a complete movement from one end to another.							
22	SIGNAL_ ACTION	Defines actuator movement relative to increasing command. Enumerations defined in Standard Tables (TN-016).	0: Increase to Open 1: Increase to Close						
23	READBACK_ SELECT	Selects whether working position or final position value is passed back to connected function block. Enumerations defined in Standard Tables (TN-016).	0: Final Position Value 1: Working Position Value						
24	PSNR_ COMMAND	Command to start device-specific procedure. Command value will reset to zero after execution of procedure regardless of value of PSNR_COMMAND_STATE.	0: Normal Operation 1-7: Reserved 8-65535: Mfg Specific: 8: Arm 9: Verify Open/Close 10: Verify Open Position 11: Verify Closed Position 15: Abort						
25	PSNR_ COMMAND_ STATE	The state of the procedure initiated by PSNR_ COMMAND.	0: Normal Operation 1-7: Reserved 8-65535: Mfg Specific: 8: Arm 9: Verify Open/Close 10: Verify Opened Position 11: Verify Closed Position 15: Abort	0: Normal Operation	0: Normal Operation	0: Normal Operation	E		Read only
26	PSNR_OOS_ OPT	Defines an action to be taken whenever the Transducer Block transitions to Out of Service mode. ***Note:** not all options are required to be supported.	0: Hold Last Value 1: Fail Closed 2: Fail Open 3: PSNR_FSTATE_VAL_D 4-7: Reserved 8-255: Mfg Specific	1: Fail Closed	1: Fail Closed	1: Fail Closed	E	O/S, Man	R/W

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write	R/W
27	POS_ FEATURES	BIT_ENUMERATED parameter indicating the parameter groups supported by this transducer block.	0: Group A 1: Group B 2: Group C 3: Group D 4: Group E 5: Group F 6: Group G 7: Group H 8: Group I 9: Group J 10: Group K 11: Group L 12-15 Reserved	A, C, D, K, L	A, C, D, K, L	A, C, D, K, L	E		Read only
28	ACT_FAIL_ ACTION	Informative parameter, does not affect the block. Specifies the final failure position of the actuator as defined in the Standard Tables (TN-016). It is a recommendation that only the first four enumerations of the table be used.	0: Undefined 1: Self-closing 2: Self-opening 3: Hold last value 4: Maximum value 5: Minimum value 255: Indeterminate	0	0	0	E		R/W
29	ACT_MAN_ID	The actuator manufacturer identification.					None		R/W
30	ACT_MODEL_ NUM	The actuator model number.					None		R/W
31	ACT_SN	The actuator serial number.					None		R/W
32	ACT_TYPE	Actuator type, just and informative parameter.	0: Undefined 1: Linear 2: Rotary 3: Rotary - Multi-turn 4: Rotary - Quarter-turn 5: Linear - Lever 6-32767: Reserved 32768-65534: Manufacturer Specific	4: Rotary - Quarter-turn	4: Rotary - Quarter-turn	4: Rotary - Quarter-turn			R/W
33	VALVE_MAN_ID	The valve manufacturer identification.					None		R/W
34	VALVE_ MODEL_NUM	The valve model number.					None		R/W
35	VALVE_SN	The valve serial number.					None		R/W
36	VALVE_TYPE	The type of the valve as defined in the Standard Tables (TN-016).	0: Globe 1: Gate 2: Butterfly 3: Ball 4: Plug 5: Diaphragm 6: Float 7: Check 8: Triple Offset 255: Other	2: Butterfly	2: Butterfly	2: Butterfly	E		R/W

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write	R/W
37	XD_CAL_LOC	The location of last positioner calibration. This describes the physical location at which the calibration was performed. (ex. "NIST", "Acme Labs").					None		R/W
38	XD_CAL_DATE	The date of the last positioner calibration.		01/01/2013 00:00:00 000	01/01/2013 00:00:00 000	01/01/2013 00:00:00 000	None		R/W
39	XD_CAL_WHO	The name of the person responsible for the last positioner calibration.					None		R/W
40	CHARACTERIZA-TION	Desired characterization operation. Enumerations defined in Standard Tables (TN-016)	0: Linear 1: Percent 2: Quick Opening 3: Custom 4-7: Reserved 8-255: Mfg Specific	0	0	0	E	O/S, Man	R/W
41	STROKE_TIME_ CLOSE_LIM	The user defined time of a full span travel in closing direction in seconds, used to slow down valve movement.		0	0	0	Sec	O/S, Man	R/W
42	STROKE_TIME_ OPEN_LIM	The user defined time of a full span travel in opening direction in seconds, used to slow down valve movement.		0	0	0	Sec	O/S, Man	R/W
43	TRAVEL_ACCUM_ LIM	User defined limit of accumulator value that will trigger alert.					TAU		R/W
44	TRAVEL_ACCUM_ UNITS	Travel units as defined in standard table in TN-016.	See Standard Tables (TN-016)				TAU	O/S, Man	R/W
45	INTERNAL_TEMP	Internal device temperature in user defined temperature units.	-40 to +185				ITU		Read only
46	INTERNAL_ TEMP_MIN	Minimum internal device temperature in user defined temperature units over operation lifetime of device.	-40 to +185			22	ITU		Read only
47	INTERNAL_ TEMP_MAX	Maximum internal device temperature in user defined temperature units over operation lifetime of device.	-40 to +185			22	ITU		Read only
48	INTERNAL_ TEMP_UNITS	Internal temperature units as defined in standard table in (TN-016).	Only accepts °C and °F	°C	°C	°C	ITU		R/W
49	HIGH_ TEMPERATURE_ LIM	Sets the threshold for the HIGH_ TEMPERATURE_ALM. Unit is given by INTERNAL_TEMP_UNITS parameter.	-40 to +185	80	80	80	E		R/W
50	HIGH_ TEMPERATURE_ PRI	Alarm priority for the HIGH_ TEMPERATURE_ALARM.		0	0	0	E		R/W
51	LOW_ TEMPERATURE_ LIM	Sets the threshold for the LOW_ TEMPERATURE_ALARM. Unit is given by INTERNAL_TEMP_UNITS parameter.	-40 to +185	-35	-35	-35	E		R/W
52	LOW_ TEMPERATURE_ PRI	Alarm priority for the LOW_ TEMPERATURE_ALARM.		0	0	0	E		R/W
53	TEMPERATURE_ ALARM_ HYSTERESIS	Amount the TEMPERATURE must return within the alarm limits before the alarm condition clears.	-40 to +185	5	5	5			R/W

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write	R/W
54	ACTION_ ELEMENT	User configurable parameter to determine the type of valve operation needed. It MUST be set before operation. To achieve the same combinations as in the old FPAC the user must also configure the parameter SIGNAL_ACTION.	0: No Selection 1: Single Action 2: Double Action 3: See other transducer 4: Monitoring	0: No Selection	TB1: 1: Single Action TB2: 0: No Selection	TB1: 1: Single Action TB2: 0: No Selection		O/S	R/W
55	IO_ASSIGNMENT	Assign physical I/O to this transducer block. The convention that is used to reflect the physical I/O to the parameters values is: 1, 0, OUT. For example: - If option "1: Top,Bottom,Out0" is selected, when sensor "Top" is active, parameter WORKING_POS_D = 1. - If option "3: Bottom,Top,Out0" is selected, when sensor "Bottom" is active, parameter WORKING_POS_D = 1. When ACTION_ELEMENT is configured as Double Action both physical output are automatically allocated to this transducer. When Analog options is selected the OPEN and CLOSE positions come from the position sensor after proper calibration. - If ACTION_ELEMENT is configured as "4: Monitoring" the output is not used and becomes available for the other transducer block.	0: No selection 1: Top,Bottom,Out0 2: Top,Bottom,Out1 3: Bottom,Top,Out0 4: Bottom,Top,Out1 5: Aux1,Aux2,Out0 6: Aux1,Aux2,Out1 7: Aux2,Aux1,Out0 8: Aux2,Aux1,Out1 9: Analog,Out0 10: Analog,Out1	0: No Selection	TB1 = 1: Top,Bottom, Out0 TB2: 0: No Selection	TB1 = 1: Top,Bottom, Out0 TB2: 0: No Selection		O/S	R/W
56	RESERVED1	Reserved for future use.	0	0	0		O/S, Man	R/W	
57	CYCLE_COUNT_ PRI	Priority of the first cycle count alarm.	0	0	0			R/W	
58	CYCLE_TIME_ LIM	User configurable Floating Point value used as limit to determine cycle time alarm. Unit is in seconds.	0	0	0			R/W	
59	CYCLE_TIME_PRI	User configurable priority of cycle time alarm.		0	0	0			R/W
60	SIGNAL_MASK	Used to select which operational failures will be reflected in MASKABLE_SIGNAL.	See SIGNAL_MASK table	No Selection	No Selection	No Selection			R/W
61	COLLECT_ CYCLE_TIME	Enables the collection of cycle_time in cycle_time_history.	0: Inactive 1: Active 2: Report	0	0	0			R/W
62	CYCLE_TIME_ COLLECT_TYPE	Selects Continuous or stop when full collection of cycle time.	0: No Op 1: Continuous 2: Stop when full	0	0	0			R/W
63	CALIBRATION_ ENABLE	Parameter must be enabled for the Limit Sensor Calibration Switch to be operative.	0: Manual Calibration Disabled 1: Manual Calibration Enabled	0: Manual Calibration Disabled	TB1: 1 TB2: 0	TB1: 1 TB2: 0		O/S, Man	R/W
64	SET_CURRENT_ SINK	Allows user to select Ultra-low Current mode (No power for the solenoids is available through Out0/Out1).		1: Current Level 1	1: Current Level 1	1: Current Level 1		O/S, Man	R/W

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write	R/W
65	RESERVED2	Reserved for future use.		0	0	0			R/W
66	WSN_ PASSWORD	Password needed to write the Serial Number.		0	0	0		O/S, Man	R/W
67	WSN_CONTROL_ FLAG	Status of serial number write command (Disabled,Arm,Fail).	0: Disabled 1: Armed 3: Fail	0	0	0			Read only
68	WSN_SERIAL_ NUMBER	Electronic board's Serial Number used for the DEVICE_ID.		0	0	0		O/S, Man	R/W
69	BLOCK_ERR_ DESC_1	Specific details of a BLOCK_ERR with additional diagnostic information.							Read only
70	BLOCK_ALMS_ ACT	Detailed listing of active block alarms to assist troubleshooting.	See BLOCK_ALMS_ ACT table	0	0	0			Read only
71	SUPPORTED_ MODES	Read only parameter that indicates the modes supported by the block.	0x08: Automatic (Auto) 0x10: Manual (Man) 0x80: Out of Service (O/S)	Auto: Man: Oos	Auto: Man: Oos	Auto: Man: Oos			Read only

7.4.3 Complete list of discrete output block parameters

Index	Parameter mnemonic	Description / DD Help	Valid Range	Default	FCT Default	Deep Default	Units	Write	R/W
1	ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.							Read only
2	TAG_DESC	The user description of the intended application of the block.							R/W
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.							R/W
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	1 to 255				None		R/W
5	MODE_BLK	The actual, target, permitted, and normal modes of the block.	See MODE	O/S	O/S	O/S	NA		R/W
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.					E		Read only
7	PV_D	Either the primary discrete value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK_D value of a DO block.							
8	SP_D	The discrete setpoint of this block.							
9	OUT_D	The primary discrete value calculated as a result of executing the function block.							

Index	Parameter mnemonic	Description / DD Help	Valid Range	Default	FCT Default	Deep Default	Units	Write	R/W
10	SIMULATE_D	Allows the transducer discrete input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.							
11	PV_STATE	Index to the text describing the states of a discrete PV.							
12	XD_STATE	Index to the text describing the states of a discrete PV.							
13	GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.							
14	IO_OPTS	Option which the user may select to alter input and output block processing.							
15	STATUS_OPTS	Option which the user may select to alter input and output block processing.							
16	READBACK_D	This indicates the readback of the actual discrete valve or other actuator position, in the transducer state.							
17	CAS_IN_D	This indicates the readback of the actual discrete valve or other actuator position, in the transducer state.							
18	CHANNEL	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.	See table with complete description of the DO channels	0	DO_1 = 1: TRD1: 0-Close / 1-Open DO_2-4 = 0	DO_1 = 1: TRD1: 0-Close / 1-Open DO_2-4 = 0			
19	FSTATE_TIME	The time in seconds from detection of failure of the output block remote setpoint to the output action of the block output if the condition still exists.							
20	FSTATE_VAL_D	The preset discrete SP_D value to use when failure occurs. This value will be used if the I/O option Fault state to value is selected.							
21	BKCAL_OUT_D	The output value and status provided to an upstream block output tracking when the loop is broken, as determined by the status bits. This information is used to provide bumpless transfer to closed loop control.							
22	RCAS_IN_D	Target setpoint and status provided by a supervisory Host to a discrete control or output block.							
23	SHED_OPT	Defines action to be taken on remote control device timeout.							
24	RCAS_OUT_D	Block setpoint and status provided to a supervisory Host for back calculation and to allow action to be taken under limiting conditions or mode change.							
25	UPDATE_EVT	This alert is generated by any change to the static data.							Read only

Index	Parameter mnemonic	Description / DD Help	Valid Range	Default	FCT Default	Deep Default	Units	Write	R/W
26	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.							Read only
27	XDUCER_VAL_D	The value and status received from the transducer block on the selected channel.							
28	BLOCK_ERR_ DESC_1	Specific details of a BLOCK_ERR.							Read only
29	BLOCK_ALMS_ACT	Reserved for future use.		0	0	0			Read only
30	SUPPORTED_ MODES	Read only parameter that indicates the modes supported by the block.	0x08: Automatic (Auto) 0x10: Manual (Man) 0x80: Out of Service (O/S)						Read only

7.4.4 Complete list of discrete input block parameters

Index	Parameter mnemonic	Description / DD Help	Valid Range	Default	FCT Default	Deep Default	Units	Write	R/W
1	ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.							Read only
2	TAG_DESC	The user description of the intended application of the block.							R/W
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.							R/W
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	1 to 255				None		R/W
5	MODE_BLK	The actual, target, permitted, and normal modes of the block.	See MODE	O/S	O/S	O/S	NA		R/W
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.					E		Read only
7	PV_D	Either the primary discrete value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK_D value of a DO block.							
8	OUT_D	The primary discrete value calculated as a result of executing the function block.							
9	SIMULATE_D	Allows the transducer discrete input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.							

Index	Parameter mnemonic	Description / DD Help	Valid Range	Default	FCT Default	Deep Default	Units	Write	R/W
10	XD_STATE	Index to the text describing the states of a discrete for the value obtained from the transducer.							
11	OUT_STATE	Index to the text describing the states of a discrete output.							
12	GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.							
13	IO_OPTS	Option which the user may select to alter input and output block processing.							
14	STATUS_OPTS	Option which the user may select to alter input and output block processing.							
15	CHANNEL	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.	See table with complete description of the DI channels.	0	DI_1 = 9: TRD1: 0-Closed / 1-Opened DI_2-6 = 0	DI_1 = 9: TRD1: 0-Closed / 1-Opened DI_2-6 = 0			
16	PV_FTIME	Time constant of a single exponential filter for the PV, in seconds.							
17	FIELD_VAL_D	Raw value of the field device discrete input, with a status reflecting the Transducer condition.							
18	UPDATE_EVT	This alert is generated by any change to the static data.							Read only
19	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.							Read only
20	ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.							
21	ACK_OPTION	Selection of whether alarms associated with the function block will be automatically acknowledged.							
22	DISC_PRI	Priority of the discrete alarm.							
23	DISC_LIM	State of discrete input which will generate an alarm.							
24	DISC_ALM	The status and time stamp associated with the discrete alarm.							
25	XDUCER_VAL_D	The value and status received from the transducer block on the selected channel.							
26	BLOCK_ERR_ DESC_1	Specific details of a BLOCK_ERR.							Read only
27	BLOCK_ALMS_ ACT	Reserved for future use.		0	0	0			Read only
28	SUPPORTED_ MODES	Read only parameter that indicates the modes supported by the block.	0x08: Automatic (Auto) 0x10: Manual (Man) 0x80: Out of Service (O/S)						Read only

7.4.5 Complete list of analog input block parameters

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write	R/W
1	ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.							Read only
2	TAG_DESC	The user description of the intended application of the block.							R/W
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.							R/W
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	1 to 255				None		R/W
5	MODE_BLK	The actual, target, permitted, and normal modes of the block.	See MODE	O/S	O/S	O/S	NA		R/W
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.					E		Read only
7	PV	Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block.							
8	OUT	The primary analog value calculated as a result of executing the function block.							
9	SIMULATE	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status.							
10	XD_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.							
11	OUT_SCALE	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT.							
12	GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.							
13	IO_OPTS	Option which the user may select to alter input and output block processing.							
14	STATUS_OPTS	Options which the user may select in the block processing of status.							
15	CHANNEL	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.	See table with complete description of the DI channels.	0	1: Actual Position	1: Actual Position			
16	L_TYPE	Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect) , or with square root (Ind Sqr Root), using the input range defined for the transducer and the associated output range.							

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write	R/W
17	LOW_CUT	Limit used in square root processing. A value of zero percent of scale is used in block processing if the transducer value falls below this limit, in % of scale. This feature may be used to eliminate noise near zero from a flow sensor.							
18	PV_FTIME	Time constant of a single exponential filter for the PV, in seconds.							
19	FIELD_VAL	Raw value of the field device in % of PV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE) or filtering (PV_FTIME).							
20	UPDATE_EVT	This alert is generated by any change to the static data.							Read only
21	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.							Read only
22	ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.							
23	ACK_OPTION	Selection of whether alarms associated with the function block will be automatically acknowledged.							
24	ALARM_HYS	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm hysteresis expressed as a percent of the span of the PV.							
25	HI_HI_PRI	Priority of the high high alarm.							
26	HI_HI_LIM	The setting for high high alarm in engineering units.							
27	HI_PRI	Priority of the high alarm.							
28	HI_LIM	The setting for high alarm in engineering units.							
29	LO_PRI	Priority of the low alarm.							
30	LO_LIM	The setting for the low alarm in engineering units.							
31	LO_LO_PRI	Priority of the low low alarm.							
32	LO_LO_LIM	The setting of the low low alarm in engineering units.							
33	HI_HI_ALM	The status for high high alarm and its associated time stamp.							
34	HI_ALM	The status for high alarm and its associated time stamp.							
35	LO_ALM	The status of the low alarm and its associated time stamp.							
36	LO_LO_ALM	The status of the low low alarm and its associated time stamp.							
37	XDUCER_VAL	The value and status received from the transducer block on the selected channel.							
38	XDUCER_ UNITS	The value and status received from the transducer block on the selected channel.							
39	BLOCK_ERR_ DESC_1	Specific details of a BLOCK_ERR.							Read only
40	BLOCK_ALMS_ ACT	Reserved for future use.		0	0	0			Read only
41	SUPPORTED_ MODES	Read only parameter that indicates the modes supported by the block.	0x08: Automatic (Auto) 0x10: Manual (Man) 0x80: Out of Service (O/S)						Read only

7.4.6 Complete list of diagnostic transducer block parameters

Index	Parameter mnemonic	Description / DD Help	Valid range	Initial value	Units	Write mode	Other R/W
1	ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.		0			Read only
2	TAG_DESC	The user description of the intended application of the block.					R/W
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.		0			R/W
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	1 to 255	0	None		R/W
5	MODE_BLK	The actual, target, permitted, and normal modes of the block.	See MODE	O/S	NA		R/W
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.		0	E		Read only
7	UPDATE_EVT	This alert is generated by any change to the static data.		Uninitialized			Read only
8	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.		Uninitialized			Read only
9	TRANSDUCER_ DIRECTORY	A directory that specifies the number and starting indices of the transducers in the transducer block. For further information, please refer to section 3.4.7.	Which at a minimum is an array of 1 element containing a 0.		None		Read only
10	TRANSDUCER_ TYPE	Identifies the transducer that follows.	See Standard Tables (TN-016)	65535 (0xFFFF): other	E		Read only
11	TRANSDUCER_ TYPE_VER	The version of the transducer identified by TRANSDUCER_TYPE in the form 0xAABB where AA is the major revision of the transducer specification on which the transducer is based, and BB is a revision number assigned and controlled by the manufacturer of the device.	See parameter description				Read only
12	XD_ERROR	One of the error codes defined in section 4.4 XD_ERROR and Block Alarm Subcodes below.	See section 4.4 XD_ERROR and Block Alarm Subcodes		E		Read only
13	COLLECTION_ DIRECTORY	A directory that specifies the number, starting indices, and DD Item IDs of the data collections in each transducer within a transducer block. For further information, please refer to section 3.4.8 above.	Legacy, array of one element = 0.		None		Read only
14	VST_ COMMAND	Command for VST (PST or FST) execution. Enumerations defined in Standard Tables (TN-016).	0: Un-initialized 1: Execute VST (store as reference) 2: Execute VST (store as current) 3: Abort stroke test 4: Reset VST_RESULT to 'no initial result' 5-7: Reserved 8-255: Mfg Specific	0: Un-initialized	E		R/W

Index	Parameter mnemonic	Description / DD Help	Valid range	Initial value	Units	Write mode	Other R/W
15	VST_MODE	Specifies different modes of the valve stroke test (start at normal operating position). Enumerations defined in Standard Tables (TN-016).	0: Disable 1: PST for ESD valves 2: FST for ESD valves 3-7: Reserved 8-255: Mfg Specific	0: Disable	E		R/W
16	VST_PAUSE	Pause time between test ramp and ramp back to start position. Delay once the target position is reached prior to returning to the normal operating position. See FF-906 Figure 7.		0	Sec		R/W
17	VST_RESULT	Result of latest valve stroke test. Enumerations defined in Standard Tables (TN-016).	0: No initial results 1: Last VST successful 2: Last VST failed	0: No initial results	E		Read only
18	VST_ DETAILED_ RESULT	Detailed results of valve stroke test if VST_RESULT indicates failure. Enumerations defined in Standard Tables (TN-016).	0: Test command rejected 1: Time Limit Exceeded 2: Pres Limit Exceeded 3: Friction Limit Exceeded 4: PST Travel Limit Exceeded 5: Overridden (abort due to external event) 6-7: Reserved 8-15: Mfg Specific	0: Test command rejected	E		Read only
19	CLOSED_POS_ DEADBAND	User defined dead band for the closed position.		0			R/W
20	CLOSED_POS_ SHIFT	Closed position change since last calibration.		0			Read only
21	CUSTOM_ CURVE_ DESCRIPTION	Description of the size of the table and the data type used for table.					Read only
22	CUSTOM_ CURVE_XY_ NUM_PTS			0			R/W
23	CUSTOM_ CURVE_ SCALING_ FACTOR	The scaling factor is a divisor value which can be used to obtain fractional values for X and Y.		0			R/W
24	CUSTOM_ CURVE_X			0			R/W
25	CUSTOM_ CURVE_Y			0			R/W
26	CUSTOM_ CURVE_XY_ FLOAT			0			R/W
27	CYCLE_CNTR_ DEADBAND	User defined minimum movement before incrementing cycle counter.		0	%		R/W
28	FRICTION_ UNITS	Friction units as defined in standard table in (TN-016).	See Standard Tables (TN-016)	0	FU	Man	R/W
29	FRICTION	Calculated dynamic friction value.		0	FU		Read only
30	HYSTERISIS	Maximum measured amount of difference between desired and actual position after a signal reversal.		0	%		R/W
31	POS_ DEADBAND	Configurable dead band for the control algorithm.		0		Man	R/W

Index	Parameter mnemonic	Description / DD Help	Valid range	Initial value	Units	Write mode	Other R/W
32	STROKE_TIME_ CLOSED	The measured time in seconds the valve took in its last movement to go from opened to closed position. It is used to calculate VALVE_CYCLE_TIME.		0			Read only
33	STROKE_TIME_ OPEN	The measured time in seconds the valve took in its last movement to go from closed to opened position. It is used to calculate VALVE_CYCLE_TIME.		0			Read only
34	TRAVEL_ ACCUM_ DEADBAND	User defined allowable movement before incrementing travel accumulator.		0	%		R/W
35	TRIP_TIMEOUT	Time in seconds beyond which an alert will be set if the target is not reached during an actual trip event. A trip event is defined as the signal from the Safety Logic Solver to the Safety Instrumented positioner causing the positioner to activate its defined safety function as configured.		0	Sec		R/W
36	PSNR_ COMMAND_ FLAGS	Manufacturer specific enumerated procedures.	0: Normal Operation 1-7: Reserved 8-65535: Mfg Specific: 8: Arm 9: Verify Open/Close 10: Verify Opened Position 11: Verify Closed Position 15: Abort	0: Normal Operation	E	Man	RO
37	CYCLE_CNTR_ LIM	User defined limit of cycle counter value that will trigger alert.		0			R/W
38	PST_BREAKOUT_ TIME	Actual delay until valve movement is detected. See FF-906 Fig 3.		0	Sec		Read only
39	PST_BREAKOUT_ TIMEOUT	Allowable delay at start of test to break the valve out of the seat. See graphical definition in FF-906 Fig 3.		0	Sec		R/W
40	PST_INITIAL_ START_TIME	Date and time scheduled for start of initial PST.		01/01/2013 00:00:000			R/W
41	PST_INTERVAL	Time interval between the periodic execution of the partial stroke test (hours). Setting of 0 indicates no PST.		0	Days		R/W
42	PST_OPTIONS	Options which the user may select to influence block behavior during valve stroke test 1. Enumerations defined in Standard Tables (TN-016).	0: Freeze analog Feedback 1: Freeze discrete Feedback 2-7: Reserved 8-15: Mfg Specific	0	E		R/W
43	PST_RAMP_ RATE	Defined rate of travel (% per second) during the valve stroke test. See FF-906 fig 5.		0	%/s		R/W
44	PST_STRK_TRAV	Target position for valve travel during partial stroke test. (PST Target). See FF-906 fig 5.		0	%		R/W
45	PST_STRK_ TRAV_TIMEOUT	Allowed time to reach the PST Target. See FF-906 fig 6.		0	Sec		R/W
46	PST_ COMPLETION_ TIMEOUT	Allowed time to perform a complete PST. See FF-906 figure 8.		0	Sec		R/W
47	FST_BREAKOUT_ TIME	Actual delay until valve movement is detected. See FF-906 Fig 10.		0	Sec		Read only

Index	Parameter mnemonic	Description / DD Help	Valid range	Initial value	Units	Write mode	Other R/W
48	FST_BREAKOUT_ TIMEOUT	Allowable delay at start of test to break the valve out of the seat. See FF-906 Fig 10.		0	Sec		R/W
49	FST_RAMP_RATE	Defined rate of valve travel (% per second) during the valve test 100% travel target by default during the FST. See FF-906 figure 11.		0	%/s		R/W
50	FST_STRK_ TRAV_TIMEOUT	Allowed time to reach the fully closed position. See FF-906 figure 12.		0	Sec		R/W
51	FST_ COMPLETION_ TIMEOUT	Allowed time to perform a complete FST. See FF-906 figure 13.		0	Sec		R/W
52	BLOCK_ERR_ DESC_1	Specific details of a BLOCK_ERR with additional diagnostic information.					Read only
53	DEVICE_ERR	Errors preventing proper operation of device.		0			Read only
54	DIAG_CNTR	Communication diagnostic counters. Reset with DIAG_ CLEAR.	DIAG_CNTR(0): DIAG_CNTR(1): Number of resets since last clear DIAG_CNTR(2): DIAG_CNTR(3): DIAG_CNTR(4): DIAG_CNTR(5): DIAG_CNTR(6): DIAG_CNTR(7):				Read only
55	DIAG_CLEAR	User writable to clear diagnostics counters and begin counting from 0 again: CYCLE_CNTR, DIAG_CNTR.	0x0001: Clear DIAG_ CNTR(0): 0x0002: Clear DIAG_ CNTR(1): Number of resets since last clear 0x0004: Clear DIAG_CNTR(2) 0x0008: Clear DIAG_CNTR(3) 0x0010: Clear DIAG_CNTR(4) 0x0020: Clear DIAG_CNTR(5) 0x0040: Clear DIAG_CNTR(6) 0x0080: Clear DIAG_CNTR(7) 0x0100: Clear CYCLE_CNTR	0			R/W
56	OUT_LOAD_ STATUS	It indicates the condition of the discrete output load (SOV coil) based on the supply current when the corresponding output is active.	Bit0: Out0 Short Bit1: Out0 Open Bit2: Out1 Short Bit3: Out1 Open	0, no bit set			Read only
57	VALVE_CYCLE_ TIME	The time in seconds the valve took to complete the previous cycle (open + close). It is the same as STROKE_ TIME_CLOSED + STROKE_TIME_OPEN.		0			Read only
58	BREAKAWAY_ TIME	The last reported time taken in seconds for the valve to begin moving (opening or closing). When FPAC is just monitoring the valve (ACTION_ELEMENT = Monitoring) there is no way to measure this time, so it is set to 0.		0			Read only
59	MASKABLE_ SIGNAL	User configurable mask that allows alarms to be linked as discrete parameter.	See MASKABLE_SIGNAL table	0: No Selection			Read only
60	MODULE_IO_ SUMMARY	FPAC generated value indicating whether Dip Switches, Outputs, Auxiliary inputs and sensors are active or not.	See MODULE_IO_SUMMARY table	0			Read only

Index	Parameter mnemonic	Description / DD Help	Valid range	Initial value	Units	Write mode	Other R/W
61	CYCLE_COUNT_ ALM	Alarm generated when the number of cycles on the first valve exceeds the limit.					Read only
62	CYCLE_TIME_ ALM	Alarm generated when valve does not cycle in the desired time.					Read only
63	HIGH_ TEMPERATURE_ ALM	Alarm indicating that the TEMPERATURE has exceeded the HIGH_TEMPERATURE_LIM.					Read only
64	LOW_ TEMPERATURE_ ALM	Alarm indicating that the TEMPERATURE has exceeded the HIGH_TEMPERATURE_LIM.					Read only
65	CYCLE_TIME_ HISTORY	Last cycle_time, used for trending cycle_time.		0	FPAC1	FPAC1	R/W
66	BLOCK_ALMS_ ACT	Reserved for future use.		0			Read only
67	SUPPORTED_ MODES	Read only parameter that indicates the modes supported by the block.	0x08: Automatic (Auto) 0x10: Manual (Man) 0x80: Out of Service (O/S)	Auto: Man:Oos			Read only

7.4.7 Complete list of resource block parameters

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write Mode	Other R/W
1	ST_REV	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.							Read only
2	TAG_DESC	The user description of the intended application of the block.							R/W
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.							R/W
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.	1 to 255				None		R/W
5	MODE_BLK	The actual, target, permitted, and normal modes of the block.	See MODE	O/S	AUTO	AUTO	NA		R/W
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.					E		Read only
7	RS_STATE	State of the function block application state machine.							
8	TEST_RW	Read/write test parameter - used only for conformance testing.							
9	DD_RESOURCE	String identifying the tag of the resource which contains the Device Description for this resource.							

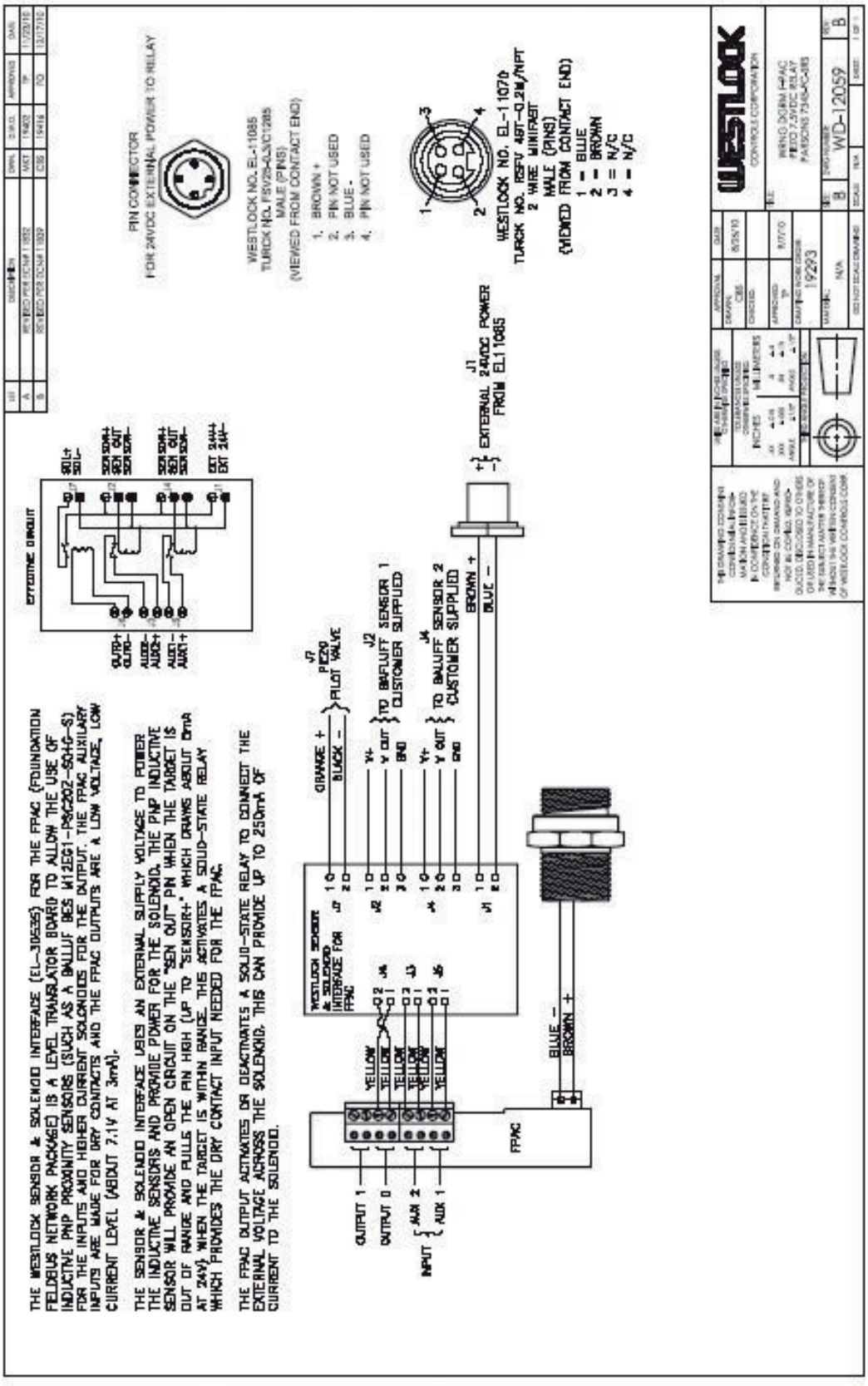
Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write Mode	Other R/W
10	MANUFAC_ID	Manufacturer identification number - used by an interface device to locate the DD file for the resource.		WESTLOCK = WTVC = 0x574343	WESTLOCK = WTVC = 0x574343	WESTLOCK = WTVC = 0x574343			
11	DEV_TYPE	Manufacturer's model number associated with the resource - used by interface devices to locate the DD file for the resource.		FPAC2 = 0x0001	FPAC2 = 0x0001	FPAC2 = 0x0001			
12	DEV_REV	Manufacturer revision number associated with the resource - used by an interface device to locate the DD file for the resource.		FPAC2 = 0x05	FPAC2 = 0x05	FPAC2 = 0x05			
13	DD_REV	Revision of the DD associated with the resource - used by an interface device to locate the DD file for the resource.		FPAC2 = 0x01	FPAC2 = 0x01	FPAC2 = 0x01			
14	GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block.							
15	HARD_TYPES	The types of hardware available as channel numbers.							
16	RESTART	Allows a manual restart to be initiated. Several degrees of restart are possible. They are 1: Run, 2: Restart resource, 3: Restart with defaults, 4: Restart processor, 5: Restart with factory defaults (same as dipswitch #3), 11: Restart with factory defaults (same as dipswitch #3) and 12: Restart Transducer with factory defaults.	See description of the parameter.						
17	FEATURES	Used to shows supported resource block options.							
18	FEATURE_SEL	Used to select resource block options.							
19	CYCLE_TYPE	Identifies the block execution methods available for this resource. FPAC2 = SCHEDULED.							
20	CYCLE_SEL	Used to select the block execution method for this resource.		SCHEDULED					
21	MIN_CYCLE_T	Time duration of the shortest cycle interval of which the resource is capable.							
22	MEMORY_SIZE	Available configuration memory in the empty resource. To be checked before attempting a download.							
23	NV_CYLE_T	Interval between writing copies of NV parameters to non-volatile memory. Zero means never.							
24	FREE_SPACE	Percent of memory available for further configuration. Zero in a preconfigured device.							
25	FREE_TIME	Percent of the block processing time that is free to process additional blocks.							
26	SHED_RCAS	Time duration at which to give up on computer writes to function block RCas locations.							
27	SHED_ROUT	Time duration at which to give up on computer writes to function block ROut locations.							

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write Mode	Other R/W
28	FAULT_ STATE	Condition set by loss of communication to an output block, failure promoted to an output block or a physical contact. When fault state condition is set, then output function blocks will perform their FSTATE actions.							
29	SET_FSTATE	Allows the fault state condition to be manually initiated by selecting Set.							
30	CLR_FSTATE	Writing a Clear to this parameter will clear the device fault state if the field condition, if any, has cleared.							
31	MAX_NOTIFY	Maximum number of unconfirmed alert notify messages possible.							
32	LIM_NOTIFY	Maximum number of unconfirmed alert notify messages allowed.							
33	CONFIRM_ TIME	The minimum time between retries of alert reports.							
34	WRITE_LOCK	If set, no writes from anywhere are allowed, except to clear WRITE_ LOCK. Block inputs will continue to be updated.							
35	UPDATE_EVT	This alert is generated by any change to the static data.							Read only
36	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.							Read only
37	ALARM_SUM	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.							
38	ACK_OPTION	Selection of whether alarms associated with the function block will be automatically acknowledged.							
39	WRITE_PRI	Priority of the alarm generated by clearing the write lock.							
40	WRITE_ALM	This alert is generated if the write lock parameter is cleared.							
41	ITK_VER	This alert is generated if the write lock parameter is cleared.							
42	FD_VER	The major version of the Field Diagnostics specification used for the development of this device.							
43	FD_FAIL_ ACTIVE	This parameter reflects the error conditions that are being detected as active as selected for this category. It is a bit string, so that multiple conditions may be shown.							
44	FD_ OFFSPEC_ ACTIVE	This parameter reflects the error conditions that are being detected as active as selected for this category. It is a bit string, so that multiple conditions may be shown.							
45	FD_MAINT_ ACTIVE	This parameter reflects the error conditions that are being detected as active as selected for this category. It is a bit string, so that multiple conditions may be shown.							
46	FD_CHECK_ ACTIVE	This parameter reflects the error conditions that are being detected as active as selected for this category. It is a bit string, so that multiple conditions may be shown.							
47	FD_FAIL_ MAP	This parameter enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the 3 alarm categories.							
48	FD_ OFFSPEC_ MAP	This parameter enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the 3 alarm categories.							

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write Mode	Other R/W
49	FD_MAINT_ MAP	This parameter enables or disables conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the 3 alarm categories.							
50	FD_CHECK_ MAP	This parameter enables or disables conditions to be detected as active for this alarm category.							
51	FD_FAIL_ MASK	This parameter allows the user to suppress any single or multiple conditions that are active, in this category, from being broadcast to the host through the alarm parameter.							
52	FD_OFFSPEC_ MASK	This parameter allows the user to suppress any single or multiple conditions that are active, in this category, from being broadcast to the host through the alarm parameter.							
53	FD_MAINT_ MASK	This parameter allows the user to suppress any single or multiple conditions that are active, in this category, from being broadcast to the host through the alarm parameter.							
54	FD_CHECK_ MASK	This parameter allows the user to suppress any single or multiple conditions that are active, in this category, from being broadcast to the host through the alarm parameter.							
55	FD_FAIL_ALM	This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.							
56	FD_OFFSPEC_ ALM	This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.							
57	FD_MAINT_ ALM	This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.							
58	FD_CHECK_ ALM	This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.							
59	FD_FAIL_PRI	This parameter allows the user to specify the priority of this alarm category.							
60	FD_OFFSPEC_ PRI	This parameter allows the user to specify the priority of this alarm category.							
61	FD_MAINT_ PRI	This parameter allows the user to specify the priority of this alarm category.							
62	FD_CHECK_ PRI	This parameter allows the user to specify the priority of this alarm category.							
63	FD_SIMULATE	This parameter allows the user to specify the priority of this alarm category.							
64	FD_ RECOMMEN_ ACT	This parameter is a device enumerated summarization of the most severe condition or conditions detected. The DD help should describe by enumerated action, what should be done to alleviate the condition or conditions.							
65	BLOCK_ERR_ DESC_1	New field diagnostics for ITK6.							Read only
66	COMPATILITY_ REV	This parameter is optionally used when replacing field devices. The correct usage of this parameter presumes the DEV_REV value of the replaced device is equal or lower than the COMPATIBILITY_REV value of the replacing device.							

Index	Parameter mnemonic	Description / DD Help	Valid range	Default	FCT default	Deep default	Units	Write Mode	Other R/W
67	REVISION_ID	The revision identifier of the device. It shows firmware version for the FPAC module.							
68	REVISION_ DATE	The revision date of the device. It shown firmware release date for the FPAC2 module.							
69	STACK_ REVISION	Revision ID of the Stack in the device.							
70	STACK_DATE	Date information for the Stack in the device.							
71	FBAPP_ REVISION	Revision ID of the Function Block Application in the device.							
72	FBAPP_DATE	Date information for the Function Block Application in the device.							
73	BLOCK_ ALMS_ACT	Reserved for future use.							
74	SUPPORTED_ MODES	Read only parameter that indicates the modes supported by the block.	0x08: Automatic (Auto) 0x10: Manual (Man) 0x80: Out of Service (O/S)						Read only

7.5 Appendix E - Wiring instructions for 7345-FC-SRS



7.6 Appendix F - Installation in hazardous locations
Refer to TECH-502 for more information.

7.7 Appendix G - Installing DD files
7.7.1 Importing to DeltaV/AMS system
This is a step-by-step guide to import the Intellis 7300 (FPAC revision 5) FF DD files into the DeltaV / AMS system using the Delta V program called "ADD DEVICE TYPE":

Step 1: Contact Westlock to receive the latest DD files or download directly from the Fieldbus Foundation (now incorporated in the FieldGroup organization) registered products website, link below:
http://www.fieldbus.org/index.php?option=com_mtree&task=viewlink&link_id=1836&ffbstatus=Registered&Itemid=324.
See Figure 124.

Step 2: Unzip the file you downloaded from the FF site (or the one you have received from Westlock) in a temporary directory to use in the next steps. IN THIS CASE, IT IS BETTER TO CHOOSE A DIRECTORY YOU USE FOR THE DDs AND CFFs IN THE DELTAV SYSTEM, AND POINT THE DELTAV SYSTEM SOURCE DIRECTORY TO THE LAST FOLDER (0001). Example: C:/AMS/Devices/FF/574343/0001. See Figure 125.
Step 3: Click on Windows' "START" and find the category "AMS Device Manager". Then click on "Add Device Type". See Figure 126.

FIGURE 124

FIGURE 125

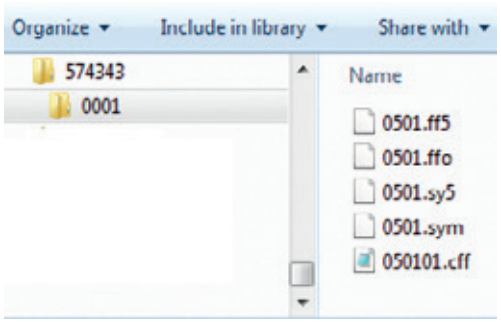
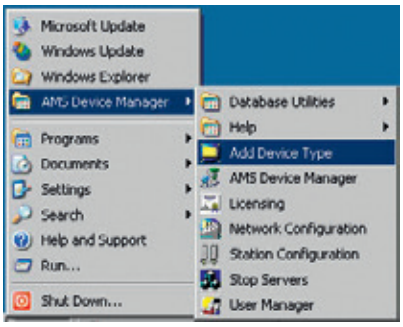


FIGURE 126



Step 4: Click on "Browse" and locate the temporary folder you created in the previous steps to store the DD files. Click on "OK" to proceed. See Figure 127.
Step 5: Follow the on-screen instructions and click on "OK" until importing the device type successfully. See Figure 128.
Step 6: Now your AMS / DeltaV system has installed all the necessary files to support Intellis 7300 (FPAC revision 5).

7.7.2 Importing to 475/375 field communicator
Contact Westlock to get the latest DD support files for field communicators.
Step 1: Click on the Fieldbus icon on the first window. Select and click on Utility. See Figure 129.
Step 2: Select and click on Available Device Description List. Scroll down until you find WTVC (Westlock Valves & Controls) and open the tree to verify the installed DD (Dev Rev 5 DD Rev 1). If the latest DD is not installed follow the next steps, otherwise skip to step 4. See Figure 130.

FIGURE 127

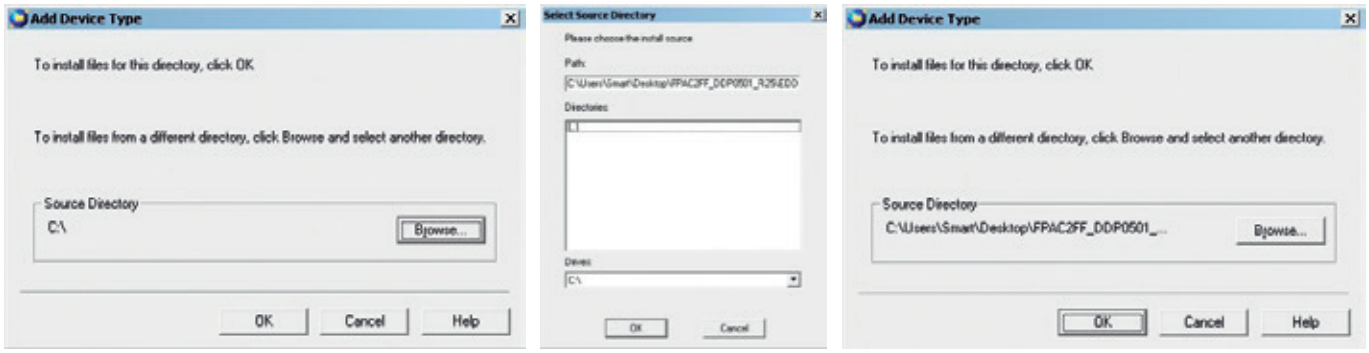


FIGURE 128

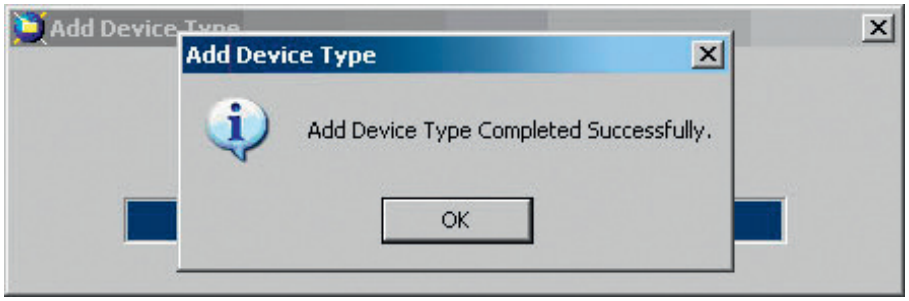
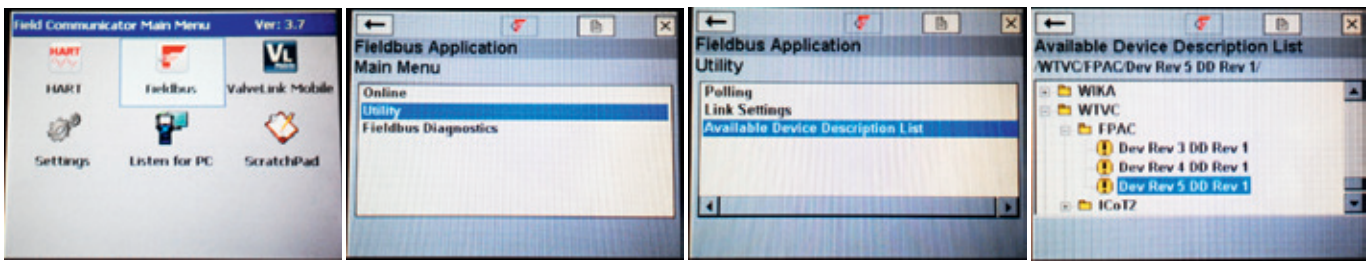


FIGURE 129

FIGURE 130



Step 3: DD INSTALLATION

3.1 Unzip the DD file in a temporary folder as shown in Figure 131.

3.2 Use the Field Communicator Easy Upgrade Utility to get the files in the 475. See Figure 132.

3.3 Follow the 475 Field Communicator instructions to complete the procedure.

Step 4: Power up the 475 Field Communicator, connect the 475 bus leads to the Fieldbus test line. Use the FF connections (not the HART) on the top of the 475 by sliding the connector cover to the right. The FPAC2 is not polarity sensitive but the 475 is, so observe polarity. Make sure the Fieldbus segment has power through a Fieldbus power conditioner. Connect the fieldbus cable to the FPAC2 bus connector (pins 1 and 3). Use suitable FF power supply and bus impedance. Install two bus terminators. The bus voltage should be between 9 V and 32 V. Also make sure all switches on the dipswitch are in the OFF position. See Figure 134.

Step 5: From the 475 Main Menu select Foundation Fieldbus Application. (the Up and Down arrow keys scroll through the icon rows, the Right and Left arrow keys scroll through the icon columns the Enter key selects the highlighted item or press the icon on the touch screen, click YES and make sure the FF communication is running. See Figure 135.

FIGURE 131

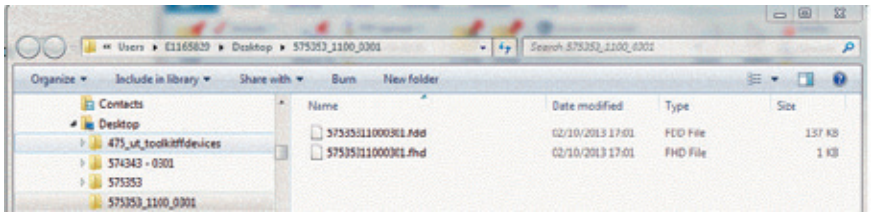


FIGURE 132

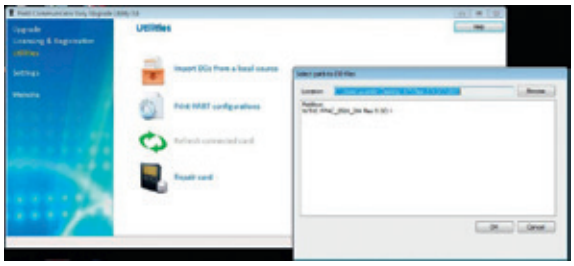


FIGURE 133

FIGURE 134

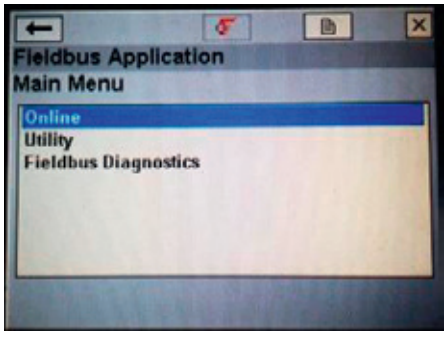
FIGURE 135

Step 6: From the Fieldbus Application Main Menu highlight Online then press the Right Arrow key. If this is not on an active Fieldbus Segment (communicating with a Fieldbus Host or LinkActiveScheduler) then a Warning message will appear saying: "Connection Warning No Fieldbus communication detected. Press OK to connect to this segment anyway. Press CANCEL to go to the Fieldbus Application Main Menu". Press OK to start communication. A warning message "Fieldbus Library System Management Error. SMERROR: FAILED RESPONDER IDENTIFY" may also appear. Press OK to continue. See Figure 136.

Step 7: After the 475 finds all the devices on the Fieldbus network select the FPAC2. As soon as the module is energized all LEDs will blink once. If there is communication on the bus the BUS LED will start blinking at a rate around 1 Hz after a few seconds to indicate that the FPAC has established communication with the 475. If the FPAC2 does not appear then hit the Left Arrow key, hit OK then continue as in step 5 above otherwise highlight the FPAC2 and press the Right Arrow key. See Figure 137.

Step 8: Scroll down to Device Root Menu and select it by hitting the Right Arrow key. The warning "This device description may not have been tested with this version of Fieldbus Application. Do you want to proceed with this device anyway?" may appear, hit YES and continue. See Figure 138.

FIGURE 136



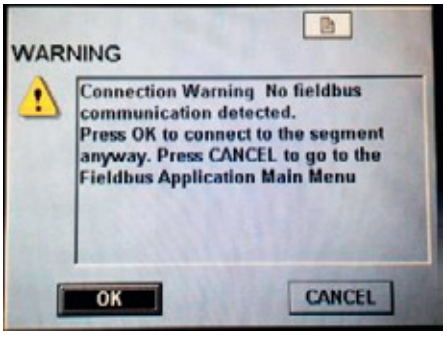


FIGURE 137

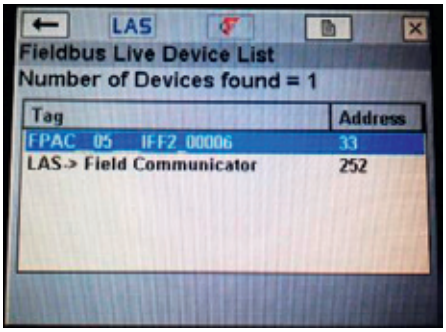
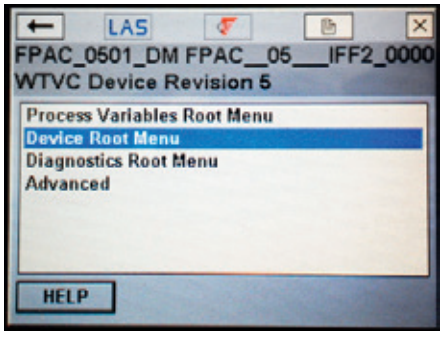
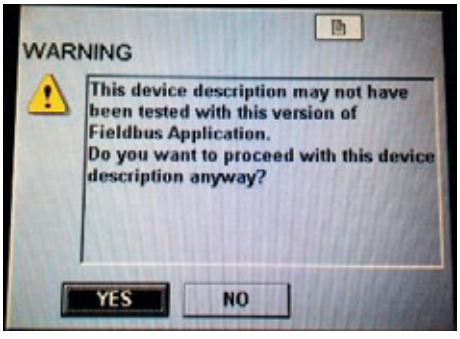
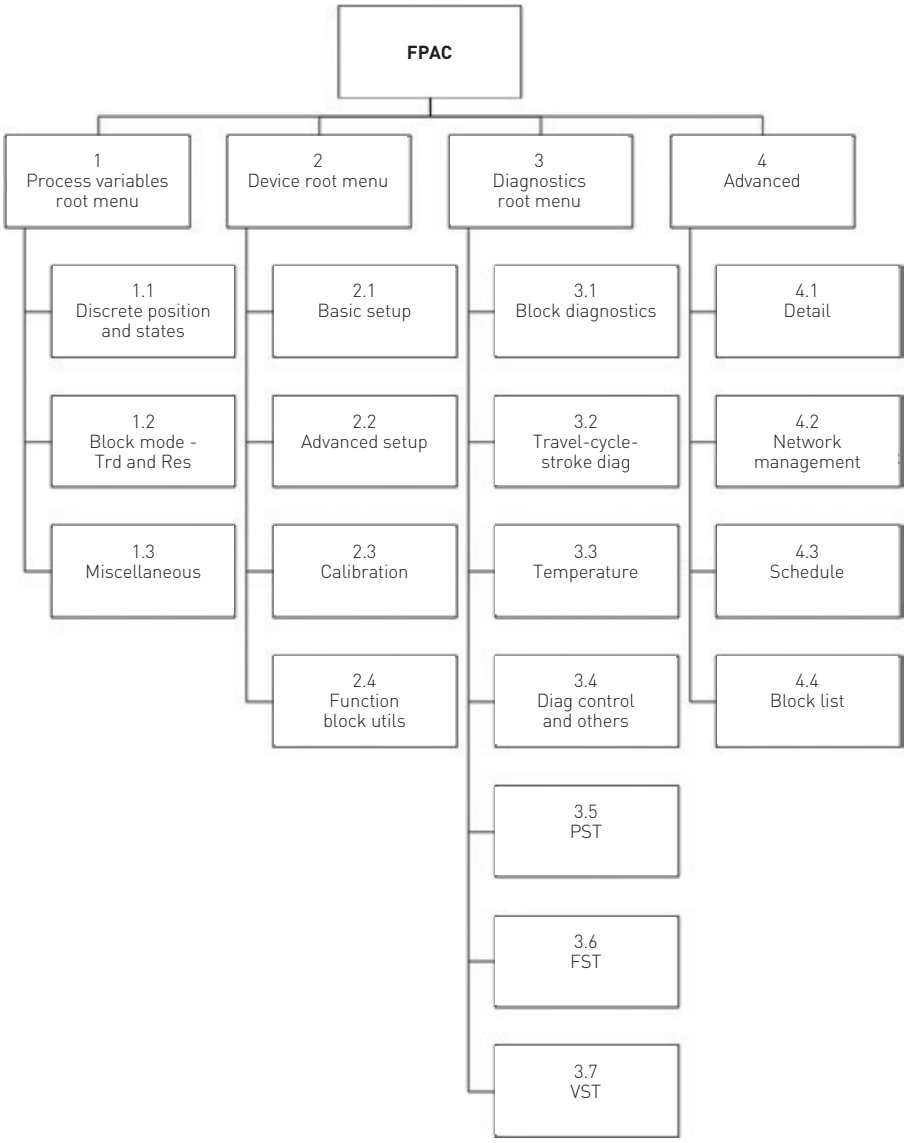


FIGURE 138



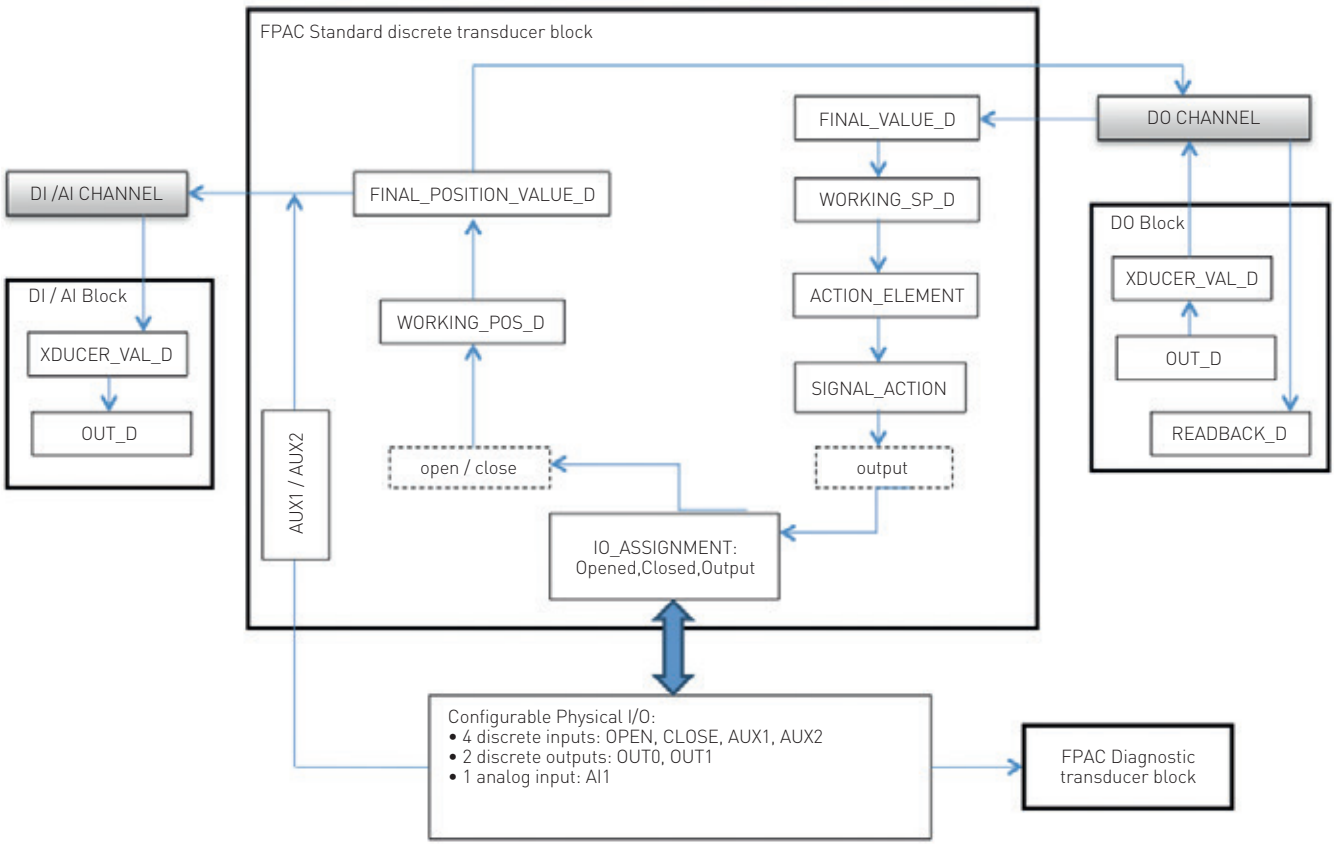


7.8 Appendix H - DD Menu tree



7.9 Appendix I - Blocks relationship diagram

The diagram below show the way the function blocks (DO, DI and AI) connect to the transducer blocks through the I/O channels and the most important parameters involved:

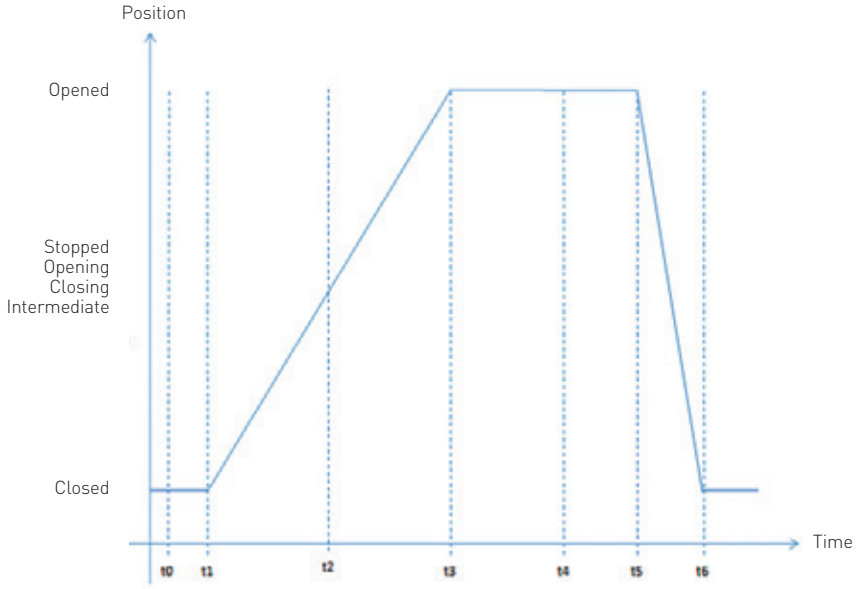


7.10 Appendix J - Cycle time measurement timing diagram

See below a timing diagram that illustrates the way the parameters VALVE_CYCLE_TIME, STROKE_TIME_CLOSE, STROKE_TIME_OPEN and BREAKAWAY_TIME are measured depending on the applications (ACTION_ELEMENT parameter):

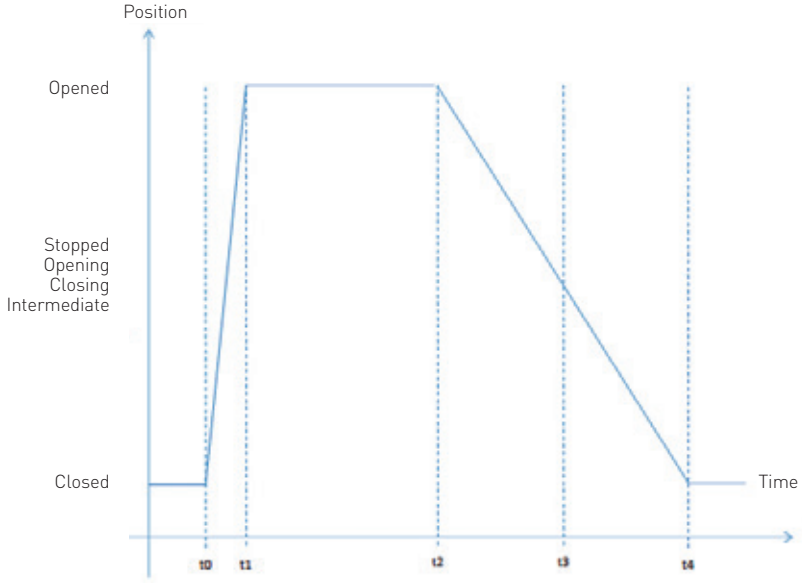
ACTION_ELEMENT = SINGLE ACTION or DOUBLE ACTION (FPAC CONTROLS VALVE POSITION)

T0 = FINAL_VALUE_D receives command to open (STROKE_TIME_OPEN start s counting)
T1 = WORKING_SP_D detects valve started opening (BREAKAWAY_TIME = STROKE_TIME_OPEN)
T2 = VALVE_CYCLE_TIME exceeded CYCLE_TIME_LIM, => MASKABLE_SIGNAL and CYCLE_TIME_ALM triggered
T3 = WORKING_SP_D detects valve is fully opened (STROKE_TIME_OPEN ends, update VALVE_CYCLE_TIME)
T4 = FINAL_VALUE_D receives command to close (STROKE_TIME_CLOSED start s counting)
T5 = WORKING_SP_D detects valve started closing (BREAKAWAY_TIME = STROKE_TIME_CLOSED)
T6 = WORKING_SP_D detects valve is fully closed (STROKE_TIME_CLOSED ends, update VALVE_CYCLE_TIME)



ACTION_ELEMENT = MONITORING (ONLY STARTS AFTER VALVE IS CLOSED OR OPENED)

*BREAKAWAY_TIME = 0 (Solenoid is controlled externally so it is not possible to measure this time)
T0 = WORKING_SP_D detects valve started opening (STROKE_TIME_OPEN starts counting)
T1 = WORKING_SP_D detects valve is fully opened (STROKE_TIME_OPEN ends, update VALVE_CYCLE_TIME)
T2 = WORKING_SP_D detects valve started closing (STROKE_TIME_CLOSED starts counting)
T3 = VALVE_CYCLE_TIME exceeded CYCLE_TIME_LIM, => MASKABLE_SIGNAL and CYCLE_TIME_ALM triggered
T4 = WORKING_SP_D detects valve is fully closed (STROKE_TIME_CLOSED ends, update VALVE_CYCLE_TIME)



7.11 Appendix K - List of useful technical notes

The following Technical Notes are available with more installation and configuration examples as we as solutions for some common problems:

Reference #	Description
TN-2014-001	Importing Intellis 7300 (FPAC) FF DD files into the AMS DeltaV system
VCIOM-05124	How to replace an old FPAC (rev 2, 3 or 4) with a new FPAC2 (rev 5)
TN-2014-003	How to install Intellis 7300 (FPAC) support files into 475-375 handheld
TN-2014-004	Quick configuration for the Intellis 7300 (FPAC2) using NI-FBUS Configurator
TN-2014-005	Intellis 7300 (FPAC2) basic configuration examples
TN-2014-006	Installing NI-FBUS Tools and DD support for FPAC2-ZRF2 device revision 5
TN-2014-007	Quick configuration for the Intellis 7300 (FPAC2) using 475 Field Communicator
TN-2014-011	FPAC2 controlling one single valve using DeltaV-AMS

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