EL40234 and EL40237 FPAC 2
INSTALLATION MANUAL
For use in
WESTLOCK CONTROLS HAZARDOUS LOCATIONS APPROVED ENCLOSURES

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Revision History

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1. *Introduction*

1.1 Product Certification

IECEx IECEx FMG 14.0014U Ex ia IIC T4 II 1 G IP20	 Ex ia IIC T4 II 1G FM14 ATEX 0006U IP20 CE nnnn

- **Hazardous ratings:**
  The FPAC is designed to meet national and international standards for NI/IS/FISCO entity 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-11704 & WD-11835 available at www.westlockcontrols.com. The FPAC is approved for both Entity and FISCO IS applications. Refer to the table below for details.

  This product is designed for use with intrinsically safe systems when connected through the approved barriers.

  * 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	Pi = 5.32 W
Ci = 5 nF	Ci = 5 nF
Li = 10 uH	Li = 10 uH

  WARNING: Devices connected to the outputs listed below must be properly rated:
  For devices such as Solenoids, Potentiometers, and Auxiliary devices
  Ui > Uo;
  Ii > Io;
  (Ci + Ccable) < Co;
  (Li + Lcable) < Lo;
  Pi > Po
  Or for devices such as Potentiometers and Auxiliary devices, they can be a Simple Apparatus (a Simple apparatus is a device which neither generates nor stores more than 1.5 V; 0.1 A; 25 mW; or 20 µJ such as switches; RTDs, TC or LEDs.)

Output Entity Parameters:
Analog Pos Pot: J5-1, J5-2, and J5-3
Uo = 5.9 V,
Io = 4 mA,
Po = 6 mW
Zone 0, Group IIC
Co = 1.5 µF
Lo = 100 mH
Zone 0, Group IIB & IIA
Co = 7.4 µF
Lo = 100 mH

AUX INPUT 1 and 2: J4-1, J4-2, J4-3 and J4-4
Uo = 5.9 V,
Io = 1.2 mA,
Po = 2 mW
Zone 0, Group IIC
Co = 1.6 µF
Lo = 100 mH
Zone 0, Group IIB & IIA
Co = 7.5 µF
Lo = 100 mH

Solenoid Output 1 and 2: J3-1, J3-2, J3-3 and J3-4
Uo = 6.9 V,
Io (Isc) = 91 mA,
Po = 296 mW
Zone 0, Group IIC
Co = 0.52 µF
Lo = 5.8 mH
Zone 0, Group IIB & IIA
Co = 3.1 µF
Lo = 40 mH

1.2 Warnings

- Specific Conditions of Use: The modules shall be installed in Westlock/Pentair enclosure with a minimum ingress protection rating of IP20.
- Perform all wiring in accordance with country of jurisdiction.
- Confirm that the model being installed is approved for the hazardous area (consult unit identification label).
- Confirm that power supplied to F-PAC (EL-40234 and EL-40237) and solenoid is within rated specifications listed on the unit identification label.
- Protect the unit from exposure to aggressive substances or atmospheres to ensure that hazard rating is not compromised.

- Disconnect power to solenoids and the inlet air supply before conducting any valve service or maintenance. Avoid the introduction of any contaminants into the valve.

1.3 Description

The Foundation Fieldbus FPACs P/N's EL-40234 and EL-40237rev 5 are well suited and recommended for use in the Series 3400 / 7300 family of industrial discrete valve controllers. It connects to any Foundation Fieldbus compliant control system and is capable of monitoring and controlling up to 2 (two) independent valves with complete diagnostics.
This IOM is valid for FPACs EL-40234 and EL-40237 revision 5 or (DD 0501 or above) as replacements. For devices with revision 4 or below (DD 0401 or below), please consult previous versions of this IOM or contact Westlock Controls. 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.

1.4 Principles of Operation

- **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[1]
  - 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: J2 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 Appendix for inductive sensor and open-drain/collector option)
  - Embedded pull-up 510k to 3.1V

- **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)

- **Temperature sensor:**
  - Embedded digital temperature sensor
  - Used for alarm generation
  - Accuracy[2] : ± 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[3] : ± 1% FS
  - Closed/Opened tolerance: ± 2% FS
  - Contact Westlock for this option

- **Environmental:**
  - Operating[4] : -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, 10Hz 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

- **Electro-Magnetic Compatibility (EMC):**

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

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

*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.

1.5 Special Features

N/A

2. Order Guide

Ordering guides for all Foundation Fieldbus product series 3400/7300 which use these modules are covered in TECH-482 and are available through a local Westlock distributor, the current Westlock Controls catalog literature or the Westlock Controls website at www.westlockcontrols.com. Spare parts lists for refurbishments or repairs are also available for common AS-i models.

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**: 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 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 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 what 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 opened position when the contact is shorted out, which in turn, makes the LED AUX1 turn on.

- **Valve closed**: it means the valve is 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 what 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 closed position when the contact is shorted out. This makes the LED AUX2 turn on.
- **Valve is opening**: the valve is moving from de closed position to the opened position. The FPAC recognizes this state just after the closed limit switch has been deactivated while both limit switches are still deactivated.
- **Valve is closing**: the valve is moving from de closed position to the opened position. The FPAC recognizes this state just after the closed limit switch has been deactivated while both limit switches are still deactivated.
- **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 opened 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 allows for configuration and also 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 called “increase to open”. It means when the valve set-point = ‘1’ (on transducer block or DO block) FPAC activates its output to power the

solenoid. This way the supply air and pneumatics force the actuator to the **Opened** position. This is often referred as a fail closed valve because in the absence of power the pneumatics will force the valve to the closed position.

- **Reverse action**: also called “increase to close”. When the valve set-point = ‘1’ (on transducer block or DO block) FPAC deactivates its output removing power from the solenoid. It is responsibility of the supply air and pneumatics setup to move the actuator to the **Opened** position without power applied to the solenoid. 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. In order to close the valve FPAC output will “increase” and power the solenoid.

4. Installation

Required tools: Screw driver instrument type .125 in. (3.18mm) straight blade; 4mm Allen Wrench.
For EL-40234:
CAUTION: Tighten terminal screws at J2 to a MAX 0.6Nm, MIN 0.5Nm, J3A1, J4A1, to a MAX 0.4Nm.

1. Remove all power from device if located in hazardous are.
2. Use Allen key to disengage covers screws and remove cover.
3. Unplug J2 connector from old PAC.
4. Use Instrument screw driver to loosen the two screws on the mating J2 connecter and remove wires.
5. Unscrew and remove wires from the input and output terminals if equipped.
6. Remove but ***do not discard*** the two 4-40 slotted head screws that hold the FPAC to the housing and remove the old FPAC.
7. Install the new FPAC using the two 4-40 screws from the old assembly.
8. Re-install the BLUE network wire to J2-1, GREEN wire to J2-2 from earth bus in enclosure, BROWN network wire to J2-3.

Required tools: Screw driver instrument type .125 in. (3.18mm) straight blade; 4mm Allen Wrench.
For EL-40237: This FPAC can only replace an existing product using this part number.
CAUTION: Tighten terminal screws at TS1 and TS2 to a max torque of 0.4Nm/3.5 lb.-in. wire strip length 5mm/.20in.

1. Remove all power from device if located in hazardous are.
2. Use Allen key to disengage covers screws and remove cover.
3. Using the instrument screw driver remove all wires from the two 8 position terminal strips.
4. Remove the two 4-40 screws (do not discard).
5. Remove the FPAC.
6. Re-install the new FPAC using the existing 4-40 screws.
7. Follow the wiring instructions in APPENDIX.

5. Field Wiring

N/A

6. Maintenance and Repair

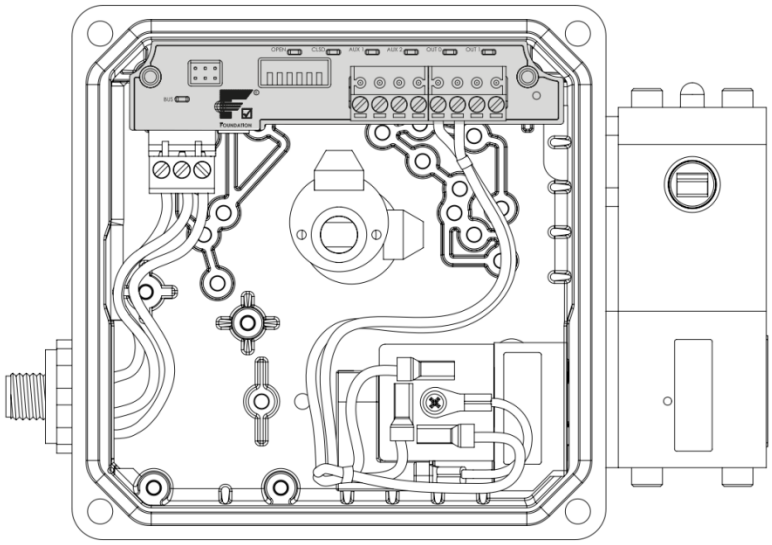
See TECH-482 available at www.westlockcontrols.com.

7. Appendix

EL-40234 FPAC electronic module overview

The EL-40234 FPAC module 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 Principles of Operation section for more information on electrical characteristics and limits.

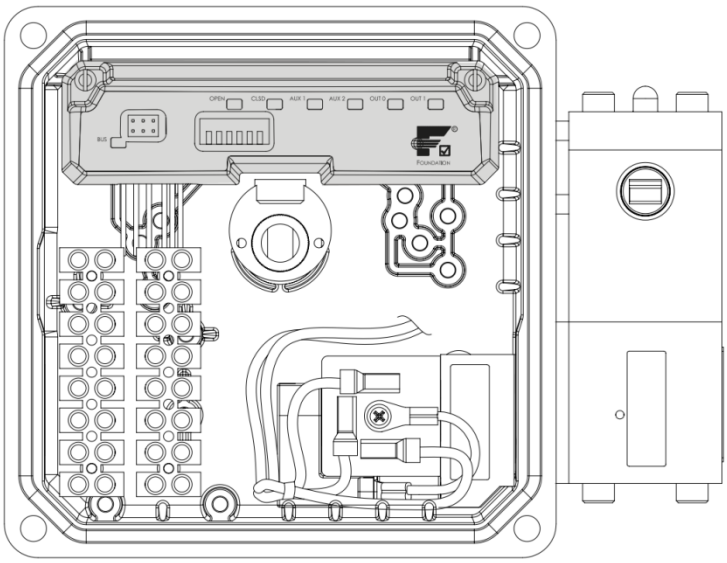


Example of 3400/7300 Series Internal components and wiring using EL-40234

EL-40237 FPAC electronic module overview

The EL-40237 FPAC module includes the following physical I/O:

- 1 (one) bus connector for Foundation Fieldbus compliant bus TS1-1(blu), TS1-2(grn), TS1-3(brn).
- 1 (one) analog input for position sensing potentiometer TS1-4(blk),TS1-5(gry), TS1-6(rd)
- 2 (two) internal Hall Effect limit switches to be used with the cam shaft magnets;
- 2 (two) dry-contact discrete inputs AUX1 TS1-7(wht/brn), TS1-8(wht/org) and AUX 2 TS2-1(wht/vio), TS2-2(wht).
- 2 (two) current source outputs for ultra-low power solenoids OUT0 TS2-3(org), TS2-4(pk) , and OUT1 TS2-5(vio), TS2-6(yel).
- See the Principles of Operation section for more information on electrical characteristics and limits.



Example of 3400/7300 Series
Internal components and wiring
using EL-40237

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.
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 the Principles of Operation section for characteristics and limits.

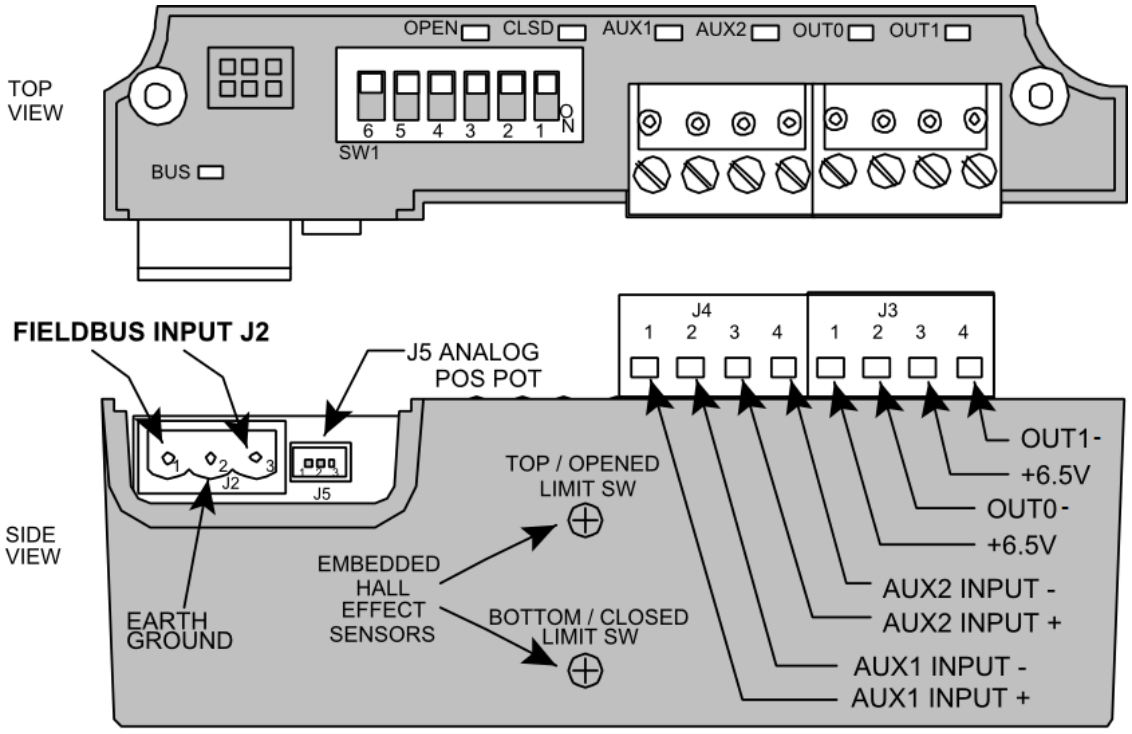


Figure 1 - FPAC module overview

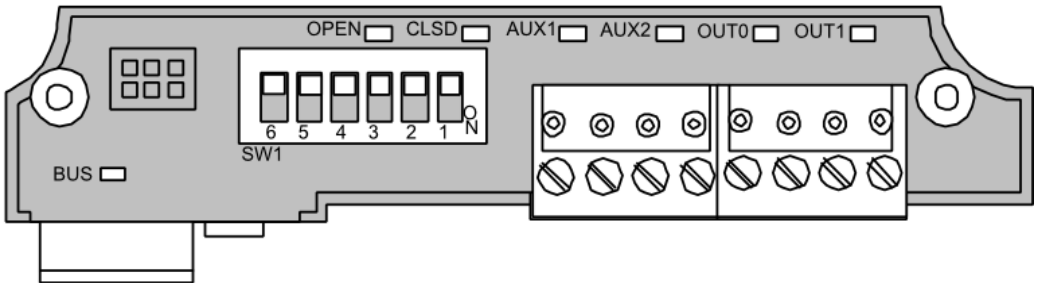
Description of the dipswitch

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.

*Note on switch #6: 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.

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.



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

*Confirm with your vendor or contact Westlock to confirm the exact specification as it may not match this table.