WESTLOCK
CONTROLS CORPORATION

Intellis

Profibus DP Network Monitor

Installation and Operation Manual

PROFI® PROCESS FIELD BUS

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Revision History

Revision 1.0	**20 March, 2002**	**Initial Version**

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1. Bibliography

Profibus Specification (FMS, DP, PA), Version 1.0

Test Specifications for Profibus DP-Slaves, Version 2.0

Profibus-DP Extensions, Version 2.0

Specification for Profibus Device Description and Device Integration, Volume1: GSD Specification, Version 4.1

2. Device Overview

2.1. Introduction

The Profibus Pneumatic Actuator Controller (PPAC) is an actuator control module designed to meet the specific performance requirements of all pneumatic and electric actuators. The module can be an integral part of electric actuators and is installed inside the actuator housings. The PPAC provides actuator Open/Stop/Close control, Emergency Shutdown (ESD), and actuator status information including position feedback via the Profibus DP network protocol.

2.2. About Profibus DP

Started as a joint Fieldbus project in 1987 between several companies (Siemens, Klockner-Moeller, Bosch, and 10 other Manufactures), The Profibus User Organization (PNO) was founded in 1989.

The PNO oversees the Profibus specification and conformance testing of Profibus products. It is open to any manufacturer or user of this protocol with a worldwide membership of over 1100 companies. By the end of 2001, Profibus had more than 5 million installed devices, over 2,000 available products, more than 550,000 applications worth more than $5.8B, and User Groups in 23 countries.

Profibus is a powerful networking solution that reduces the cost and time required to install and wire industrial automation devices. A single Profibus AVID System will accommodate up to 126 stations, typically 124 slaves with 992 discrete I/O points and 124 analog points. Profibus has the capability to interconnect complex and simple devices from multiple vendors on the same network.

2.3. Westlock Profibus DP Module

The EL-40105 module is a six discrete input, single analog resistive input, two-output network monitor. Inputs 0 and 1 are internal Hall effect sensors that are activated by the shaft trigger assembly magnets (south pole). Inputs 2 thru 5 are active low (activated by pulling the input to ground) for use with dry contact type sensors. Outputs are FET (field effect transistor) open drain active low with diode protection. Position feedback is an analog value developed via an external potentiometer returned as a value in the range 0 to 1000, representing the position in 0.1% increments. Current consumption is 120mA with single solenoid activated Operating voltage is 18-30Vdc.

For data exchange to occur, each station, master or slave, connected to the Profibus net work must be programmed with a unique address, numbered between 0 and 125. It is possible to exchange or add devices to the network during normal operations without interfering with communications to other nodes.

2.4. Features

- Open/Close limit switch indication.
- Analog position feed back
- Configurable - Drive Open/Drive Close/Stayput Emergency Shut Down command via the Profibus Network.
- LED status indicators for local diagnostics
- Configurable address via the on-board DIP switch
- Plug in style electrical terminal blocks

2.5. Specifications

Topology	Zero drop/daisy chain, no spurs
Max. Bus Length	1,200m/segment
Max. # of Segments	10
Max. Spur Length	If unavoidable, 0.3m
DATA RATE	9.6, 19.2, 93.75, 187.5, 500, 1500, 12000 kbps
Module Specifications:	
Max. Power Consumption (inputs and outputs energized)	8.4 W
Current Consumption	350mA max, 120 mA typical
Input Voltage (from bus)	11 - 25 Vdc
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-40°C to +90°C
Physical I/O	2 Hall Effect inputs (Close and Open Limit Switches)
	4 Dry Contact Inputs (Auxiliary Inputs)
	2 Open Drain Outputs (Solenoid Outputs)
	Analog Position Feedback
Visual Indication	Module and Network diagnostics
	Closed Limit Switch (CL-LS, Yellow LED)
	Open Limit Switch (OP-LS, Yellow LED)
	Aux Input 2 (IN 2, Yellow LED)
	Aux Input 3 (IN 3, Yellow LED)
	Aux Input 4 (IN 4, Yellow LED)
	Aux Input 5 (IN 5, Yellow LED)
	Output 0 (Out 0, Yellow LED)
	Output 1 (Out 1, Yellow LED)

3. Installation Instructions

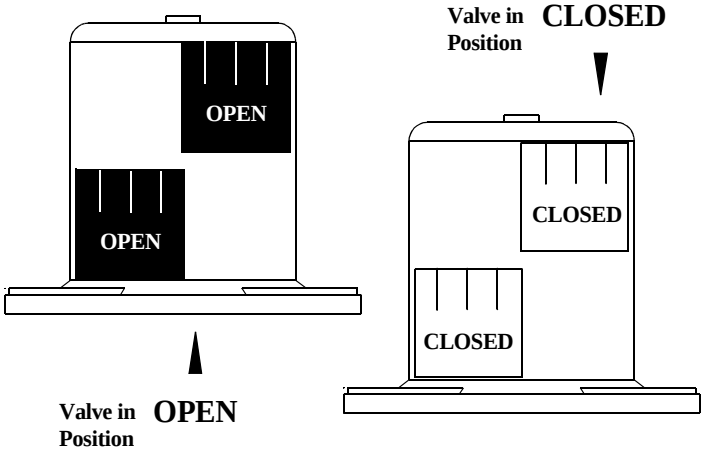
Important: If valve monitor is in the field already mounted on an actuator and valve, please follow the field wiring instructions.
Warning: The valve monitor should always be handled with care when the cover is removed and wired to an electrical power source.

1. Attach the proper mounting bracket and adapter to the valve monitor housing with the hardware provided.

2. Operate the actuator in full closed position.

3. Attach the valve monitor and mounting bracket to the actuator.

4. Note graphic display of the Beacon and circle one of the coinciding drawings shown below.



STANDARD FLOW ARRANGEMENTS

PART NO.	ARRANGEMENT NUMBER
90° ROTATION	
BM3-1	1
BM3-3	3
BM3-5	5
180° ROTATION	
BM3-7	7
BM3-9	9

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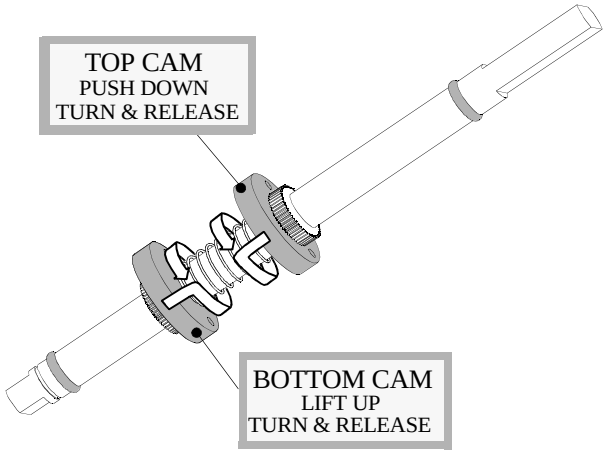
4. Switch Adjustment

Note: Switches are factory set. If you need to adjust for any reason follow instructions below.

1. To set switches, lift bottom cam and turn until switch is activated and then release. Spring will push cam back onto the splined shaft. Operate the actuator to the opposite extreme, push down on the top cam and turn until the open switch is activated.

2. Operate the actuator to the opposite extreme and repeat steps 1 through 3 for the other switch.



5. Westlock Intellis 7244 Wiring Instructions

1. The Wiring options for 7244 & 7279ME or XE are shown in Fig. 1 and 2 below. The proper wiring diagram for your unit is shown on the inside of the 7279ME or XE covers.

2. All wiring must be in accordance with National Electrical Code (ANSI-NFPA-70) for area classifications. The valve monitors are approved as explosion proof for Class I, Division 1, Groups C and D; nonincendive for Class I, Division 2, Groups A,B,C and D; dust-ignition proof for Class II/III, Division 1, Groups E,F and G hazardous (classified) locations; indoor/outdoor (NEMA type 4, 4X).

Always check the nameplate to make sure the agency approval ratings coincide with the application.

Caution: To Prevent Ignition of Hazardous Atmospheres, Replace Cover Before Actuating the Electrical Circuits. Keep Cover Tightly Closed When in Operation.

3. Replace the electronics housing cover or junction housing cover.

4. Unit is now ready for automatic operation. If any assistance is required, please call Westlock Controls at (201) 794-7650

Model 7244

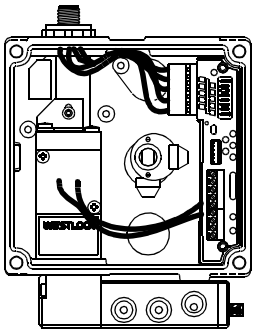


Figure 1

Model 7279

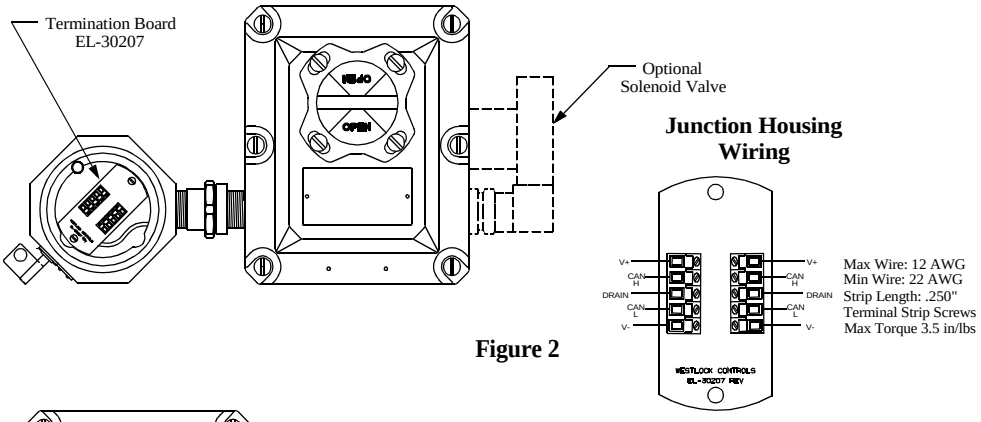
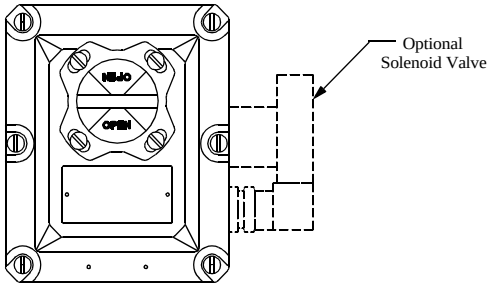


Figure 2



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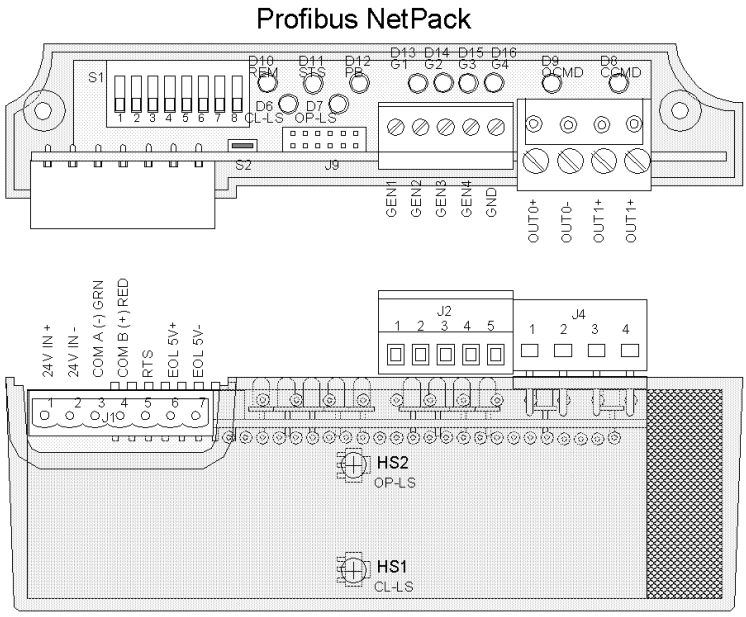
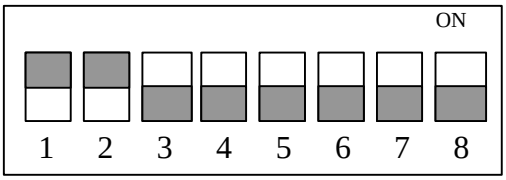
6. Hardware Configuration

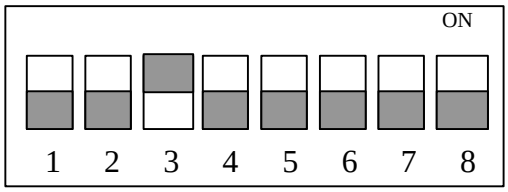


6.1. Setting the Profibus Slave Address

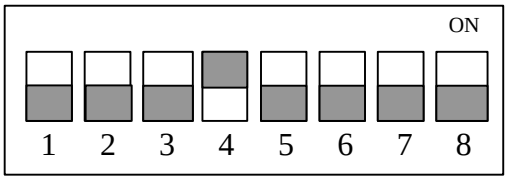
The Profibus slave address is configured by setting the binary address on selector switch S1



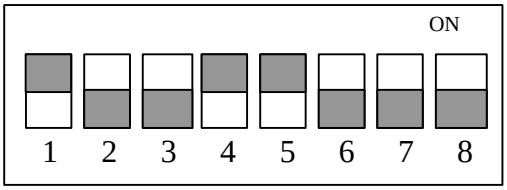
Slave Address 3



Slave Address 4



Slave Address 8



Slave Address 25

(See Fig. 1 above). Examples are shown below.

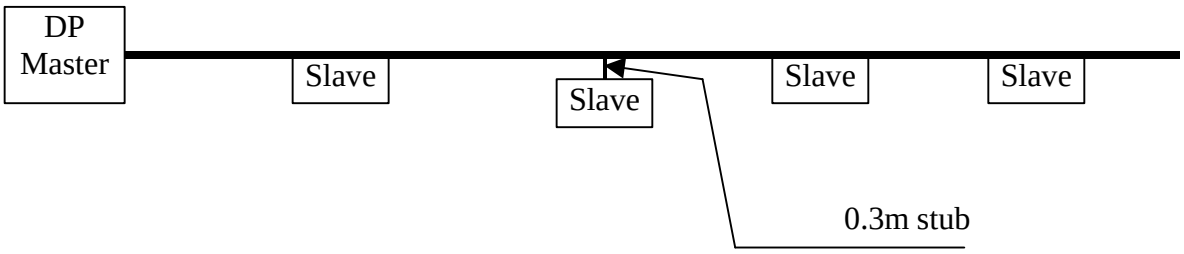
6.2. Potentiometer Calibration

The position feedback potentiometer can be calibrated by either software or hardware. The software procedure is outlined in the following section entitled 'Input Bits"
The calibration can also be performed as follows:

1. Move the actuator to the close limit so that the Close Limit LED is illuminated.
2. To set the close position, press and hold S2 for 3 Seconds.
   a. The Close LED will flash for 3 seconds, and then stop confirming the position has been set.
3. Move the actuator to the open limit, until Open Limit LED is illuminated.
4. To set the open position, press and hold S2 for 3 Seconds.The Open LED will flash for 3 seconds, and then stop confirming the position has been set.

7. Connection Options

Profibus DP supports a zero drop topology. Stubs less than or equal 0.3m are permitted if unavoidable.



8. Module Configuration

The unit can be configured as a 2 byte Input/2 byte Output module standard discrete Output or a 2 byte Input/4 byte Output module for use with analog position feedback.

9. Parameters

The following parameters are configurable using the appropriate network management tools

9.1. Instantaneous Reversal Time (1 Byte)

The **Instantaneous Reversal Time Delay** is configurable from 0.5 to 255 seconds in 100 ms increments. The **Instantaneous Reversal Time** inhibits the action of instantaneously energizing the opposite output.

9.2. Travel Timeout (1 Byte)

The **Travel Timeout** parameter sets the maximum allowable time from a command being received by the actuator and the corresponding limit switch activating. If the time to complete an actuator stroke is greater than the value set for this attribute the appropriate **Fail to Open** or **Fail to Close** alarm will be set.
The **Travel Timeout** value is configurable between 0 to 255 seconds in increments of 1 second. A setting of 0 will disable this feature.
Suggested time-out for pneumatic actuators is 15 seconds.

9.3. Hold Control (1 Byte)

If this parameter is set to 1 the PPAC will hold actuator at the target position i.e. if the actuator has received an Open/Close command, the actuator outputs will remain energized preventing movement from the full open/close position. A **Stop** command will de energize the output.
Setting the **Hold Control** parameter to 0 will cause the actuator to de energize its outputs on completion of a command.
For pneumatic actuators it should be set to 1.
See **DriveOpen**, **DriveClose** and **Stop** commands in the **Input Bit Description** section for more detailed information regarding the interaction with each command.

9.4. ESD Action (1 Byte)

The following values determine the **ESD Action**.

Parameter Value	ESD Action
0	StayPut (De-energized position)
1	Drive Close
2	Drive Open

9.5. Service Count (2 bytes)

The value of this parameter determines the number of cycles x 1000, after which the service request alarm is set (See **Diagnostic Data Bit Description** section). Setting a value greater than the value stored in the cycle counter will reset the alarm; alternatively setting this value to zero will disable the service count alarm.

10. Slave Input Data

The slave will accept two bytes of input data defined in the following table, a more detailed description of each function can be found in the sections to follow.
The Input data consists of two bytes: - Byte 0, Runtime Inputs and Byte 1. Commissioning Inputs. *Under normal operation 0x00 should always be written to Byte 1.*

	Bit	Hex	Description
BYTE 0	0	0x01	Output 0
	1	0x02	Output 1
	2	0x04	Stop
	3	0x08	ESD
	4	0x10	Not Used
	5	0x20	Not Used
	6	0x40	Not Used
	7	0x80	Not Used
BYTE 1	0	0x01	Set Close (0)%
	1	0x02	Set Open (100)%
	2	0x04	Reset
	3	0x08	Set Diagnostic Flag
	4	0x10	Not Used
	5	0x20	Not Used
	6	0x40	Not Used
	7	0x80	Not Used

Only one bit of Byte 0 should be set at any one time. In the case of more than one bit being

set, the following priority of commands will apply:

1. ESD
2. Stop
3. Drive Close
4. Drive Open

11. Input Bit Description

11.1. Output 0 (0 x 00 01)

A transition of this bit from 0 to 1 will cause Output 0 to energize. Clearing the bit while the actuator is moving will have no effect. Only a **Stop** command will halt the actuator. Once the close position is reached, the action is dependent on the value of the parameter **Hold Control** as follows:

11.1.1. Hold Control set to 1

When the end of travel limit is reached, the **Output 0** command will remain active, independent of the value of the **Output 0** bit (i.e. the close output will remain energized if the drive close bit is set or is cleared). A **Stop** command will clear the **DriveClose** command.

11.1.2. Hold Control set to 0

When the end of travel limit is reached the **Output 0** command will be deactivated, independent of the value of the **Output 0** bit. (i.e. the close output will remain de-energized if the **Output 0** bit is set or is cleared). If the actuator is manually moved from the Close Position, only a transition of the **Output 0** bit from 0 to 1 will re-initiate the **Output 0** Command.
To ensure that the actuator will properly respond to the next Close command, it is recommended that this bit be cleared after use.

11.2. DriveOpen (0 x 00 02)

A transition of this bit from 0 to 1 cause Output 1 to energize. Clearing the bit while the actuator is moving will have no effect. Only a **Stop** command will halt the actuator. Once the opened position is reached, the action is dependent on the value of the parameter **Hold Control** as follows:

11.2.1. Output 1 set to 1

When the end of travel limit is reached, the **Output 1** command will remain active, independent of the value of the **Output 1** bit (i.e. the open output will remain energized if the drive open bit is set or is cleared). A **Stop** command will clear the **Output 1** command.

11.2.2. Hold Control set to 0

When the end of travel limit is reached the **Output 1** command will be deactivated, independent of the value of the **Output 1** bit (i.e. the open output will remain de-energized if the **Output 1** bit is set or is cleared). If the actuator is manually moved from the Open Position, only a transition of the **Output 1** bit from 0 to 1 will re-initiate the **Output 1** Command
To ensure that the actuator will properly respond to the next Open command, it is recommended that this bit be cleared after use.

11.3. Stop (0 x 00 04)

Setting this bit stops the actuator at its current position.
Note: *In the case of a pneumatic actuator with a single coil, two-position solenoid, the result of issuing a **Stop** command will be to de-energize the solenoid coil, returning the actuator to the de-energized position*. (See **Parameters** section for more information).

11.4. ESD (0 x 00 08)

When this variable is set to 1 the actuator will move to the **Emergency Shut Down** (**ESD**) position as set via the **ESD** parameter (See **Parameters** section for more information).

11.5. Potentiometer Calibration (0 x 01 00 & 0 x 02 00)

Setting bit 0 & 1 of byte 1 will calibrate the potentiometer feedback.
Whenever a bit is written, the current potentiometer value (Actuator Position) will be recorded as follows:

- 0% set when bit 0 is set
- 100%set when bit 1 is set.

The values will be calibrated on the 0 to 1 transition of the bit. Each bit should be reset to 0 after calibration is completed.
(Continued page 17)

The following procedure can be used to calibrate the potentiometer remotely:

1. Command the actuator to close (dpn_out_slv = 00 01)
2. Wait for Close Limit indication (dpn_in_slv = xx yy 00 21)
3. alibrate close position (dpn_out_slv = 01 00)
4. Confirm set (dpn_in_slv = 00 00 00 21)
5. Clear Calibrate close bit (dpn_out_slv = 00 00)
6. Command the actuator to open (dpn_out_slv = 00 02)
7. Wait for Open Limit indication (dpn_in_slv = xx yy 00 22)
8. Calibrate open position (dpn_out_slv = 02 00)
9. Confirm set (dpn_in_slv = 03 E8 00 22)
10. Clear Calibrate open bit (dpn_out_slv = 00 00)

Notes: xx yy = un-specified value, xx yy, where xx = most significant bits, yy = least significant bits
When confirming limits, the actual value of position may be different from above.

11.6. Reset Counter (0 x 04 00)

The **Reset** function will reset the cycle counter to zero.

11.7. Set Diagnostic Flag (0 x 08 00)

This bit will force the slave state from "Ready" to "Ready+Diagnostics". Under normal operation the slave state changes from "Ready" to "Ready+Diagnostics" only when an alarm bit is set (Byte 0 of the **Diagnostic Data**). Only when the slave state is "Ready+Diagnostics" will the contents of the diagnostics be current (See **Diagnostic Data,** section for further information).

12. Slave Output Data

There are 4 bytes of output data.

	Bit	Description
BYTE 0	0	Open Limit Upper
	1	Open Limit Lower
	2	Output 0 Travel
	3	Output 1 Travel
	4	ESD Active
	5	Reserved
	6	Reserved
	7	Reserved
BYTE 1	0	Aux. Input 0
	1	Aux. Input 1
	2	Aux. Input 2
	3	Aux. Input 3
	4	Reserved
	5	Reserved
	6	Reserved
	7	Reserved
Byte 2 *	0-7	Position Low Byte
Byte 3*	0-7	Position High Byte

13. Output Bit Description

13.1. Upper Limit (0 x 00 00 00 00)

This bit will be set when the Upper limit switch contacts are closed

13.2. Lower Limit (0 x 00 00 00 01)

This bit will be set when the Lower limit switch contacts are closed

13.3. Output 0 Travel (0 x 00 00 00 02)

This bit will be set when a valid Output 0 command has been received.

13.4. Output 1 Travel (0 x 00 00 00 03)

This bit will be set when a valid Output 1 command has been received.

13.5.ESD Active (0 x 00 00 00 04)

This variable reflects the ESD state. When value is 1 the ESD command is active, i.e. the actuator is at the ESD position (or traveling to the ESD position) and all other Runtime Input commands are disabled.

13.6. Auxiliary Inputs (0 x 00 00 00 00 through 0 x 00 00 03 00)

Byte 1, bits 0-3 report the status of the external inputs connected to J2. The corresponding bit will be set to 1 when the dry contact type switch connected to that input is closed.

13.7. Position Feedback (0 x 00 00 00 00)

Bytes 2 and 3 contain the position feedback from the actuator calibrated as per calibration procedure detailed in section 10.5. The value returned is in the range 0 to 1000, representing the position in 0.1% increments.

14. Diagnostic Data

The following diagnostic data is available from the device. Only changes in Byte 0 will result in a DPN_SLV_READY_DIAG being returned. Since the diagnostic data buffer is only updated when DPN_SLV_READY_DIAG state is returned, the state must be forced in order to retrieve bytes 1 through 16. The DPN_SLV_READY_DIAG state can be forced by writing 0x0800 to the slave input.

	Bit	Description
BYTE 0	0	Output 0 Timeout
	1	Output 1 Timeout
	2	Limit Switch Alarm
	3	Service Count Exceeded
	4	Position Sensor Failure
	5	Reserved
	6	Reserved
	7	Reserved
Byte1	0-7	Cycle Counter LSB
Byte 2	0-7	Cycle Counter
Byte 3	0-7	Cycle Counter
Byte 4	0-7	Cycle Counter MSB
Byte 5	0-7	Average Close Time LSB
Byte 6	0-7	Average Close Time MSB
Byte 7	0-7	Average Open Time LSB
Byte 8	0-7	Average Open Time MSB
Byte 9	0-7	Reversal Time
Byte 10	0-7	Travel Time
Byte 11	0-7	Hold Control
Byte 12	0-7	ESD
Byte 13	0-7	Service Count LSB
Byte 14	0-7	Service Count MSB
Byte 15	0-7	Raw Bits 0%
Byte 16	0-7	Raw Bits 100%

15. Diagnostic Data Bit Description

15.1. Fail to Limit Alarm (Byte 0, Bit 0)

The Fail to Close Alarm will be set if the time between an DriveClose command being received and a Close Limit switch closure being detected exceeds the value set by the parameter Travel Timeout. The alarm will be reset after the close cycle completed within the Travel Timeout value.

15.2. Fail to Open Alarm (Byte 0, Bit 1)

The Fail to Open Alarm will be set if the time between an DriveOpen command being received and a Open Limit switch closure being detected exceeds the value set by the parameter Travel Timeout. The alarm will be reset after the open cycle completed within the Travel Timeout value.

15.3. Limit Switch Alarm (Byte 0, Bit 2)

This bit will be set if both limit switches are set. Correcting the fault will clear this alarm.

15.4. Service Count Exceeded (Byte 0, Bit 3)

Should the value of the cycle counter exceed the value of the parameter configured by the Service Count parameter, the Service Count Exceeded bit will be set and the slave state will be changed to DPN_SLV_READY_DIAG. Setting the Service Count Parameter to 0 will disable this feature.

15.5. Position Sensor Failure (Byte 0, Bit 4)

Should the Position Feedback value be out of normal operating values the Position Sensor Failure alarm is set.. Correcting the fault will clear this alarm.

15.6.Cycle counter (Bytes 1, 2, 3 & 4)

The cycle counter is incremented each time the Close or Open outputs are energized. The counter can be cleared by writing to Reset.

15.7. Average Close Time (Bytes 5 & 6)

The average close time is the average time of the last 10 complete close strokes. A complete close stroke time is recorded each time the actuator moves from the full open position, with open limit set, to the full close position, and the close limit is set. Partial strokes are not recorded.

15.8. Average Open Time (Bytes 7 & 8)

The average open time is the average time of the last 10 complete open strokes. A complete open stroke time is recorded each time the actuator moves from the full close position, with close limit set, to the full open position, and the open limit is set. Partial strokes are not recorded.

15.9. Bytes 9 through 14

These bytes reflect the parameter values downloaded from the master at start up

16. Contact Information

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