

### AS-I Bus Card for BUSwitch and UltraSwitch Enclosures

#### Introduction

Flowserve's BUSwitch™ uses the AS-I Bus® communication protocol to operate pneumatic valve actuators and monitor/report their position. The AS-I card may be provided in Flowserve's Aviator enclosure with integrated solenoid valve or in our UltraSwitch™ enclosures for use with external solenoid valves.

#### Principles of Operation

BUSwitch™ utilizes two discrete outputs to energize solenoid valves, which operate rotary pneumatic actuators. For spring return and double acting applications with a desired fail position (open or closed). Output one (1) is used to operate a single pilot. For applications requiring fail in last position, both output one (1) and output two (2) are used with a "dual coil" pilot configuration.

Actuator position is sensed with two limit switches. BUSwitch™ communicates the state of these limits into the master as input one (1) and input two (2)

A 2-wire cable using the AS-I (166 kb/s) protocol provides communication and power to the AS-I Communication Board. This card operates from 29.5 to 31.6 VDC.

#### Printed Circuit Board Specifications

Power requirements	
XA0244 Communications Card	29.5 to 31.6 VDC
Temperature	
Operational	-55 °F to +185 °F (-48 °C to +85 °C)
Storage	-55 °F to +250 °F (-48 °C to +120 °C)

#### AS-I Bus Information

ID Code (describes device behavior)	
ID	0001 Binary This code is specific to Flowserve's AS-I board and is stored in non-volatile memory
I/O Code (describes type of I/O implemented)	
Type	OUT OUT IN IN
I/D	1011 Binary This code is also stored in non-volatile memory.

#### Start-up Guide

- Following the instructions in "Mechanical Installation," install the BUSwitch™ onto a pneumatic actuator and turn supply air on.
- Following the instructions in "Electrical connections," connect AS-I bus.
- Bring up control software used for AS-I implementation.
- Turn power onto AS-I bus.
- Using output 1 value parameter (and output 2 for dual coil mode), stroke the valve (Discrete 0 = de-energized; Discrete 1 = energized) and set limit switches, referring to "Adjustment of Switch Cams" section. Circuit board mounted LED's light when switches are tripped.
- This is the minimum configuration to operate the actuator and read valve position

#### Mechanical Installation

Installation is best performed with Flowserve NAMUR mounting kits. These kits allow direct mounting of the BUSwitch™ shaft to the actuator pinion without a coupler. The NAMUR mounting kits will work with any actuator conforming to the instructions, NAMUR standard for accessory mounting hole locations and pinion dimensions. Simply attach the bracket to actuator and BUSwitch™ to the bracket with the included fasteners. The BUSwitch™ shaft features an integral alignment pin that engages the tapped pinion hole. Flowserve also offers a full line of non-NAMUR mounting kits.

#### Spool and Tubing Configuration

- For external solenoid valves, refer to solenoid valve operating instructions for piping and tubing configuration. For integrated solenoid valve, a four-way spool valve is provided. Plug port #2 for 3-way applications (Figure 1). Make sure the plug is properly configured before installing tubing.
- Make sure all air pressure is removed before installing tubing.
- Attach tubing according to solenoid valve manufacturer's instructions. For integrated solenoid valve configuration, refer to Figure 1 for

spring return or Figure 2 for double acting applications. Attach supply tubing to Port 1 and use 3 and 5 for exhaust.

- To prolong actuator life use only clean, dry plant air. Lubricated air is not required, although it is recommended, particularly for high cycle applications.

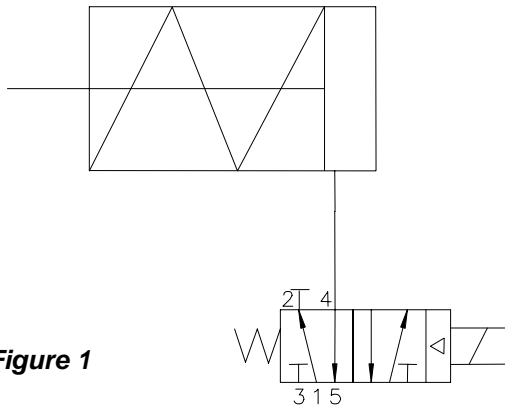


Figure 1

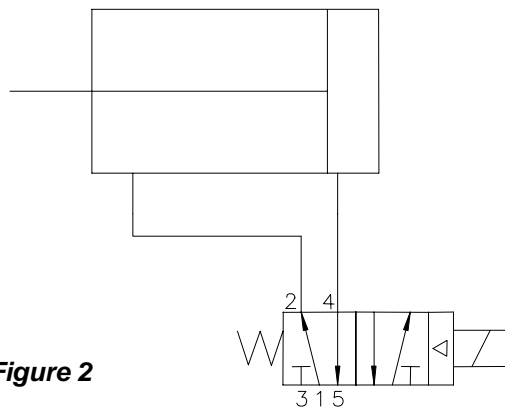


Figure 2

### Lubrication

All BUSwitch™ integrated spool valves are pre-lubricated and will operate dry (with no additional lubrication). The use of lubricated air will not interfere with the functioning of the BUSwitch™. If air lubrication is used, the oils listed below are popular, easily obtainable, fluids that are recommended for use with the BUSwitch™ integrated spool valve: Gulf Harmony 47, Mobil DTE Medium, Shell Tellus 29, Texaco Rondo B, Sohivis 47 and Sunnis 921. Many other lubricants are acceptable providing they do not contain detergents that will attack Buna N or Viton Seals.

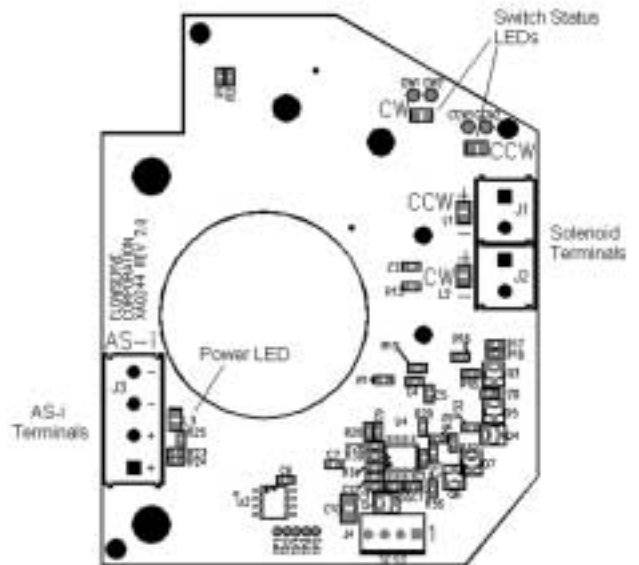
### Electrical Connections

#### CAUTION

**To prevent ignition of hazardous atmospheres, keep cover bolts tight while circuits are live. Disconnect supply circuit before opening.**

Entry into the BUSwitch™ integrated solenoid housing is made through three ½" NPT conduit entries. UltraSwitch enclosures feature two entries: ¾" NPT for XL and PL series and ½" NPT for GL series. Figure 3 provides terminal locations on the XA0244 interface card.

Connection of the data cable is made to connector P3 - observing polarity. Incorrect polarity will not damage the electronics, but it will prevent communication. **Caution: make sure power is turned off when making electrical connection.** For hazardous locations, Underwriters Laboratories (UL) and the National Electric Code (NEC) require an approved sealing fitting within eighteen inches of the switch enclosure.



**Solenoid to AS-1 Interface Card (XA0244 rev 2.0)**  
Figure 3

Open conduit entries must be closed after installation using a close-up plug approved for hazardous locations. Conduit and plugs must fully engage five threads.

### Special Notes on AS-I cabling

Minimum voltage requirement for the BUSwitch™ is 29.5 VDC supply. The output voltage of the fieldbus power supply, the current drawn and the electrical characteristics of the data cable determine the maximum distance that a particular segment can span. With data cable that conforms to the AS-I cable specified in section 5.5.3 of AS-I specification V2.0 distances of 100 m are guaranteed. If a shielded cable is used, connect the shield to ground at **one** point only. Multiple grounds can lead to ground loops which can impair the proper operation of the segment. For this reason, a shield connection has not been provided inside the BUSwitch™ housing. Radio frequency grounding at multiple points through the use of capacitors is not allowed by the AS-I protocols. For a more thorough treatment of data cable wiring and aspects of installation refer to the AS-I specification V 2.0.

### Device Initialization

Each new device that is connected to the AS-I network is recognized within 10ms. Devices are immediately ready for use when an address is assigned. Make sure each device to be connected to a bus segment has a unique address prior to starting configuration software. This will ensure that each device is recognized by the system. Duplicate addresses can result in devices not being recognized.

### Adjustment of Switch Cams

1. Loosen five captive cover screws and remove lid, turning slightly while lifting.
2. Place the actuator in the clock-wise (CW) position and connect to the AS-I bus segment.
3. Push down on the top cam until it clears the splined coupler, rotating clockwise until the CW LED is illuminated (figure 4).
4. Release the cam and insure that it fully engages the spline.
5. Place the actuator in the counter-clockwise (CCW) position.
6. Pull up on the lower cam until it clears its splined coupler, rotating counter-clockwise until the CCW LED is illuminated (figure 4).

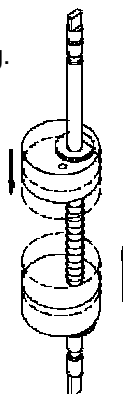


Figure 4

### Pneumatic Actuator Operation – Single Coil, Fail Open or Fail Closed

For operation requiring a consistent fail position (either open or closed), One output is used as shown in the Single Coil Truth Table. To reverse the actuator fail mode for double acting actuators, reverse actuator ports. To reverse spring-return actuators, actuator modification is necessary.

#### Single Coil Truth Table

Output 1	OPEN/CLOSE
0	De-energized
1	Energized

### Pneumatic Actuator Operation – Dual Coil, Fail in Last Position

Dual Coil Operation uses both output 1 and output 2 as shown in the Dual Coil Truth Table. *For valve movement to take place, the Output parameters must take on opposite values as shown below.*

#### Dual Coil Truth Table

Output 1	Output 2	OPEN	CLOSE
0	0	No Change	No Change
1	0	Energized	De-energized
1	1	No Change	No Change
0	1	De-energized	Energized

### Valve Position Monitoring and Reporting

The BUSwitch™ monitors the status of two limit switches. SW1 is the upper switch and is set to trip when the valve reaches the closed position. SW2 is the lower switch and is set to trip when the valve is open.

#### Truth Table for Switch Values

SW1	SW2	Input 1	Input 2	Meaning
A	A	1	1	Improper switch adj.
A	O	1	0	Actuator CLOSED
O	A	0	1	Actuator OPENED
O	O	0	0	Actuator is moving

A = Activated or Tripped, O = Open or Not Tripped



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