

Background

The SVF AS-Interface products are part of the NetWork Solutions program to complement our full line of "Process-Quality" ball valves and controls and are fully compliant with AS-Interface bus specifications. The AS-Interface will network up to 31 field devices/automated valves onto a single pair of wires that carry both signal and power.

Actuator Sensor Interface, or AS-Interface, is a simple and elegant solution for the integration of on/off valves in a process control system. This field proven system provides many features.

AS-Interface Features

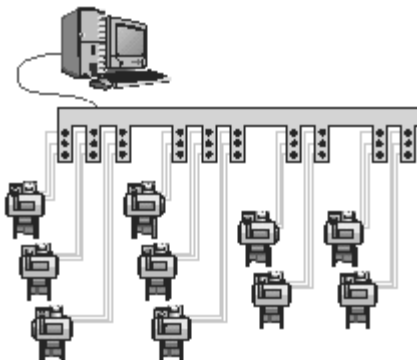
- Ideally suited for on/off process valves and other discrete applications.
- 31 field devices may be networked with a single master.
- Economical system is simple and robust for rugged performance.
- Unshielded two-wire cable carries both data and power supply.
- Signal transmission has high tolerance EMI (interference).
- Easy installation providing the greatest cost savings in a simple, intuitive system design.
- Wide choice of network topology allows optimized wiring network.
- Variety of gateways available to seamlessly tie into high level bus networks.

AS-Interface vs Conventional System

AS-Interface is a versatile, low cost alternative to traditional hard wired I/O. It can replace traditional point-to-point wiring with a better, more flexible solution that is easier to install, operate and maintain and easier to re-configure.

Conventional System

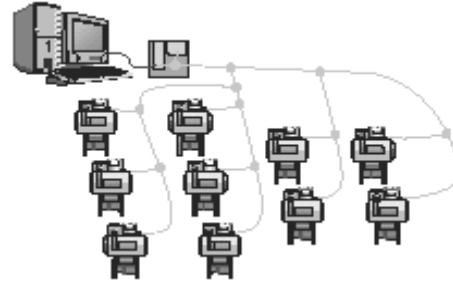
Typical batching valve wiring networks attach each of the inputs and outputs (I/O) to a central location resulting in multiple wire runs for each field device. Large expenditures are needed for cabling conduit, installation and I/O points. Space for I/O racks and cabling must be accommodated in order to attach only a few field devices.



AS-Interface Network

With the AS-Interface Network, a simple gateway interfaces the network into the field communication bus. Data and power are transferred over the two-wire network to each of the AS-Interface compatible field devices.

Each valve communication module contains an AS-Interface ASIC and other electronics to gather open or closed position status and power solenoid or other ancillary devices on or off. Other AS-Interface modules are available to gather inputs and switch power outputs.



AS-Interface Economic Analysis

Using the valve communication networks described earlier, the following economic analysis may be performed (costs are listed in the amount per automated valve system):

	Conventional	AS-Interface
Valve Monitor & Solenoid	\$ 525	\$ 555
Conduit & Wiring	\$ 600	\$ 250
I/O (Conv); Gateway (AS-i)	\$ 100	\$ 100
Power Supply	\$ 10	\$ 35
Protected Drop	\$ 0	\$ 80
Installation Labor	\$ 300	\$ 100
Total Installed Cost	\$1,535	\$1,120
Savings per automated valve system		\$ 415

There is a net savings of \$415 per automated valve system with AS-Interface communication over the conventional system (27% reduction in installed cost). This savings does not include other cost reductions due to less space consumption for wiring, conduit and I/O racks, as well as greater flexibility in adding field devices or reconfiguring later.



AS-Interface Offers An Easy Path For Network Upgrades

AS-Interface gateways may be easily replaced for new upgrades in your plant fieldbus network. For example, you may network your current AS-Interface bus into a Modbus network. However, if you migrate to an Ethernet backbone later, you may install a new gateway and conveniently tie your entire AS-Interface network into the Ethernet network.

AS-Interface Is Reliable

The AS-Interface Alternating Pulse Modulation (APM) with Manchester II coding and decoding minimizes electromagnetic emissions and is highly tolerant of electromagnetic interference. AS-Interface has a very high level of data integrity and is classified as I3 according to DIN 19244.

These networks are robust and perform reliably under the most strenuous environments. AS-Interface networks are recommended for "mission critical" applications.

AS-Interface System Specifications

- Topology Linear, Star, Tree or Ring
- Number Field Devices Maximum of 31 per Master
- Addressing By AS-Interface Master or Hand Held
- Cabling Unshielded 2-wire for Data & Power (30VDC up to 8Amps) Standard Round or AS-Interface Flat Cable Length 100 meters per master or 300 meters with two repeaters
- Transmission Rate 167 kbits/second
- Signal Coding Manchester type with Alternating Pulse Modulation Cycle Time 5 msec. (max) with 31 Devices
- Data Per Message 4 bit bi-directional
- Access Procedure Master/Slave
- Error Detection 1 parity bit + signal quality Monitoring

Other Technical Information

Power and Data

In an AS-Interface network, data and power are carried over a single two-wire cable that links up to 31 field devices. Each of the field devices may have up to 4 inputs and 4 outputs for a total of 248 binary inputs and outputs per string. SVF AS-Interface I/O modules have 4 inputs and 4 outputs (power output for up to four solenoids or other power consuming accessories).

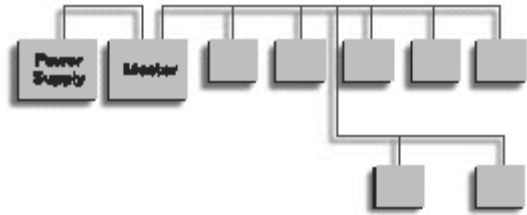
Transmission Media

Two-wire unshielded, untwisted cable, 2 x 1.5 mm2 (16 AWG) is recommended for data and power in the process environment.

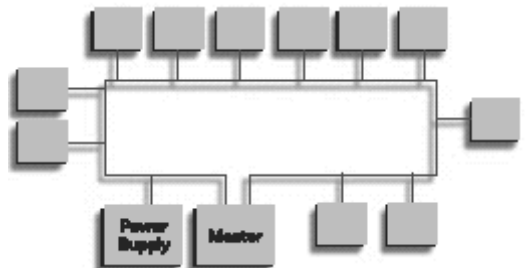
Conductor Length And Topologies

100 meters (328 feet) total length of cabling may be used for each master/gateway. Additional length of 100 meters for each repeater with up to two repeaters. Total length with repeaters may be up to 300 meters (984 feet). Total number of field devices must remain at 31 regardless of number of repeaters for each master.

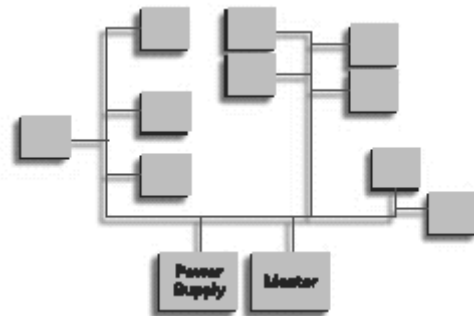
Linear With Spur Topology



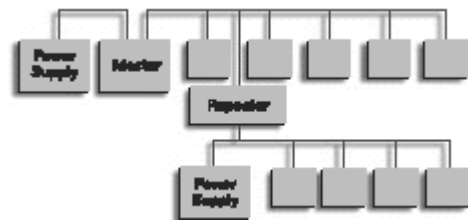
Ring Topology



Tree Topology



Linear with Repeater





Data Integrity

When classifying the bus in terms of data integrity (according to EN608 70-5-4-DIN), the AS-Interface network falls into the highest data integrity class even with a bit error rate of 10-3. Such accuracy is suitable for the transmission of mission critical information.

Standards And User Groups

AS-Interface technology has been submitted for approval under the proposed IEC 947 standard. There are over 400 different products available from 50+ vendors. And, as of this writing, there are estimated to be over 2,000,000 installed nodes (field devices) throughout the world.

AS-Interface Master/Gateway Functions

The AS-Interface Master/Gateway controls and operates the sensor bus network. All of the slaves (field devices) respond to the master and rely on the master for control of the network. Gateways perform all of the same functions as the master and, additionally, interface with higher level bus networks. Common functions of masters/gateways include the following:

- Initialization of the network
- Identification of field devices
- Diagnosis of bus and AS-i field devices
- Sends error messages to the host
- Automatically assigns active addresses to replaced field devices

Addressing

Each field device has a defined address. The address is set offline by the master/gateway or by a hand held addressing device. Automatic on-line addressing is available for field device replacements.

Error Detection and Correction

Single bit parity check and bit repetition is used for error detection. Incorrect messages are identified and repeat requested by the master/gateway.

SVF AS-Interface Gateways

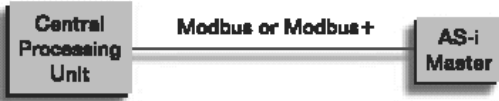
AS-Interface gateways seamlessly interface the AS-Interface network to a higher level fieldbus. For communication, the protocol of the respective fieldbus (Modbus, PROFIBUS, DeviceNet, etc.) will be used. To configure a gateway using an RS485 interface, only a simple RS232C/RS485 converter is needed. In this fashion, the gateway can be operated with a notebook PC via the respective fieldbus interface without need for additional hardware or software.

The operation of all SVF AS-Interface gateways is identical. Complete configuration and debugging of the network can be accomplished with the included pushbuttons, LED and display. Slave addresses can be programmed, faulty AS-Interface field devices can be detected and actual configuration of the AS-Interface network can be stored.

AS-Interface is NOT a competitor to higher-level fieldbuses. AS-Interface is a complementary system to them.
Gateways are readily available to:
MODBUS (RS232C, RS422, RS485)
MODBUS+
PROFIBUS (DP, FMS)
DeviceNet
Ethernet (TCP/IP)
LONWORKS
CAN
Interbus-S
Please contact SVF for availability since new gateways are becoming available regularly.

Host Computer Interface

AS-Interface can be easily interfaced with standard PC, PLC and DCS platforms. Variations are as follows:



DCS

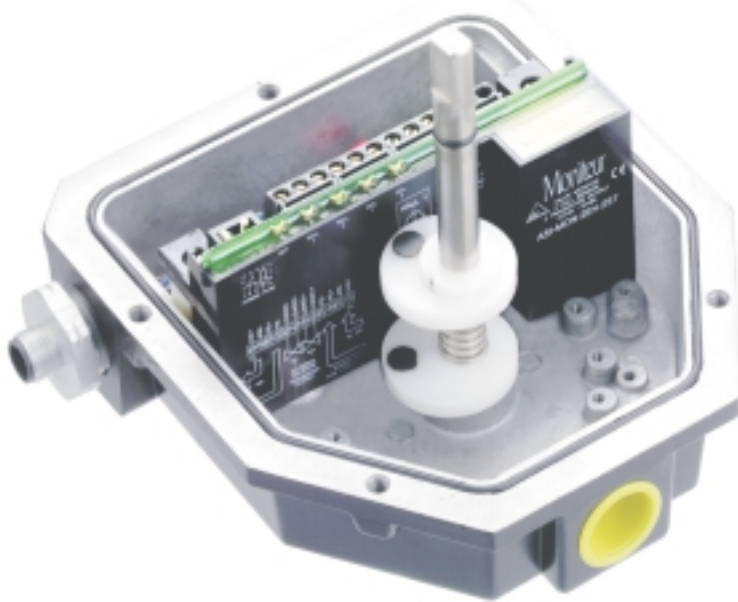
DCS sees the AS-Interface network as a Modbus slave node.

PLC

Many PLCs have AS-Interface scanners available, which enable direct connection without an AS-Interface gateway. Most other PLCs have communication cards available that utilize protocols such as DeviceNet, Modbus, Modbus+, Interbus-S, etc. The appropriate AS-Interface gateway would simply act as a node on the higher level network.

PC

An AS-Interface ISA card may be installed directly into the PC, which acts as the AS-Interface master. Or, a gateway can be used if the PC has the ability to communicate via Modbus, Modbus+, DeviceNet, PROFIBUS, etc.



SVF ASi Valve Position Controllers

ASi makes it simple. SVF's VPCs with encapsulated ASi interface cards adapt your on/off automated valves to an advanced 2-wire ASi valve network. Money and time will be saved as installation and maintenance are streamlined with reduced wiring and improved system diagnostics.

The ASi network protocol was developed to provide industry with a simple and cost effective method of networking on/off sensors and devices. An ASi network can interface directly with your plant's PLCs or through other protocols such as DeviceNet, Foundation Fieldbus, Profibus or Modbus with a gateway. SVF supplies total ASi packages including power supplies, gateways, held-hand programmers, cable and quick disconnect connectors.



SVF's ASi Platform Is Simply Better

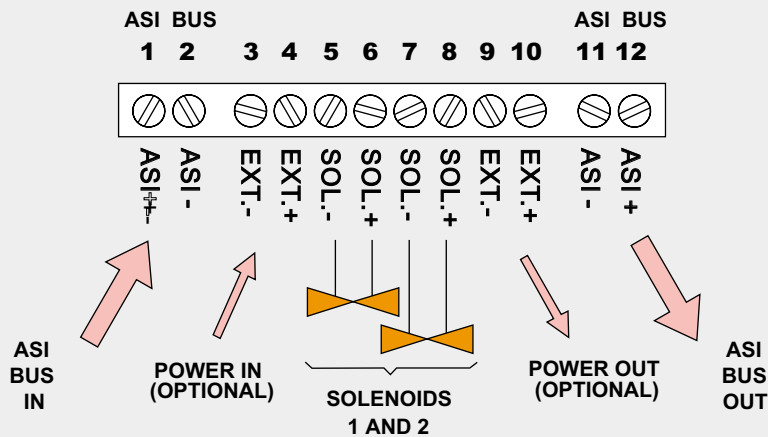
- 1) **The Network Card.** A full function encapsulated network card for the ASi protocol optimized for the functions of the VPC is included in the housing. The cards offer the following benefits:
 - A) Encapsulation of the electronics insures component reliability in corrosive, humid and dirty environments.
 - B) Solid State position sensors are encapsulated on board, protecting them from the environment. These sensors are optimized for the card and are more stable than mechanical or reed switches in areas of high vibration.
 - C) Up to two transistor outputs for 24VDC on-board power, or up to two optional relays for control of devices requiring separate DC or AC power supplies, such as specialty high power AC solenoids using hydraulic fluid.
 - D) The option to "daisy chain" the network or separate power supply through the VPC, if space constraints require it.
 - E) Separate addressing plug located on board, allowing addressing of the units with your ASi hand-held programmer after the VPCs have been fully installed & wired.
 - F) High visibility LEDs are located on-board for local indication of on-board sensors, auxiliary inputs, outputs and network state.
 - G) Two additional inputs are optional for local pressure or temperature switches.
- 2) **The Enclosure.** SVF's platform is available in a wide variety of enclosure materials to match your hazardous or corrosive environment and provide long-term reliability.
 - A) Housings in Aluminum, SuperTough Zytel Thermoplastic or Cast CF-8M Stainless Steel for General Purpose or Hazardous Areas
 - B) SVF's Engineered Loc-Ring Cam and Shaft Retention System assures stable output signals in difficult environments
 - C) Optional Junction boxes to facilitate maintenance of the automated valve without shutting the network down are available for general purpose or hazardous areas.
 - D) Optional DIN 4-pin Female Micro plug connectors can be fitted to the conduit entries of the enclosures to speed installation in general purpose areas.
- 3) **The Visual Indicator.** SVF's High Visibility Valve Position Indication preferred by users worldwide, available in a wide variety of colors and flow patterns.
- 4) **The Solenoid Valve.** Low power solenoid valves optimized for the network card output, available pre-wired with the VPC or with direct NAMUR actuator mounting.

SVF Flow Controls **ASi VALVE NETWORKING**

ASi Technical Information

- Supports up to 124 inputs and 124 outputs over 31 nodes or addresses
- Baud rate at 167Kbit (No termination required)
- Scan time < 5ms for a fully loaded system
- Deterministic - each slave adds 150 μ s to the scan time
- Can be installed in any topology
- Bus power and communications share the same 2 wire cable
- Standard 16AWG or special AS-interface flat cable can be used
- 990 ft. total bus length (with maximum 2 repeaters)
- High level of noise and temperature immunity make ASi an excellent choice for the process plant environment.
- Each AS-interface node requires its own unique address (master/slave)
- No configuration software required
- Nodes can be addressed using buttons on master, hand-held programmer, or through serial communications

Wiring Diagram



Standard ASi Network Card Specifications

Power

voltage	30Vdc (ASi standard)
current	<30mA
local indication	green LEDs

Communication

type	slave
addressing	1 to 31 (0 from factory)
cycle time	less than 5ms

ASi configuration

Bit D0	proximity switch #2
Bit D1	proximity switch #1
Bit D2	ready signal
Bit D3	output relay
Bits P0, P1 P2, P3	not used
IO code	IO = 1H
ID code	ID = FH

On Board Sensor Inputs

type	(2) Hall effect solid-state sensors, (1) for each valve position
local indication	green LEDs

Auxiliary Inputs

type	Namur (DIN 19234) or mechanical switch
voltage	8Vdc \pm 5% - ripple 5%
current	active <1mA, inactive >3mA
local indication	green led (each input)
protection	reverse polarized

Output

type	(2) transistor or relay
transistor rating	2w @ 24 VDC
relay contact	programmable NO or NC
relay voltage	120VAC, 220 VAC, 24 VDC
current	1A

Introduction To Valve Networking

Traditional plant installation requires each device to be connected and wired directly to a central control location and power supply. With a valve network, all of the valve accessories (limit switches, solenoid valve, etc.) sharing communication and power on 2 wires. This method greatly simplifies the installation and maintenance of these devices.

This technology is no longer future speak - it is being implemented now in plants worldwide. End users are realizing the benefits of this new technology that have been documented time and time again. At SVF we believe it is time to become comfortable with the technology now by using it on your next job.



Main Advantages of Valve Networking

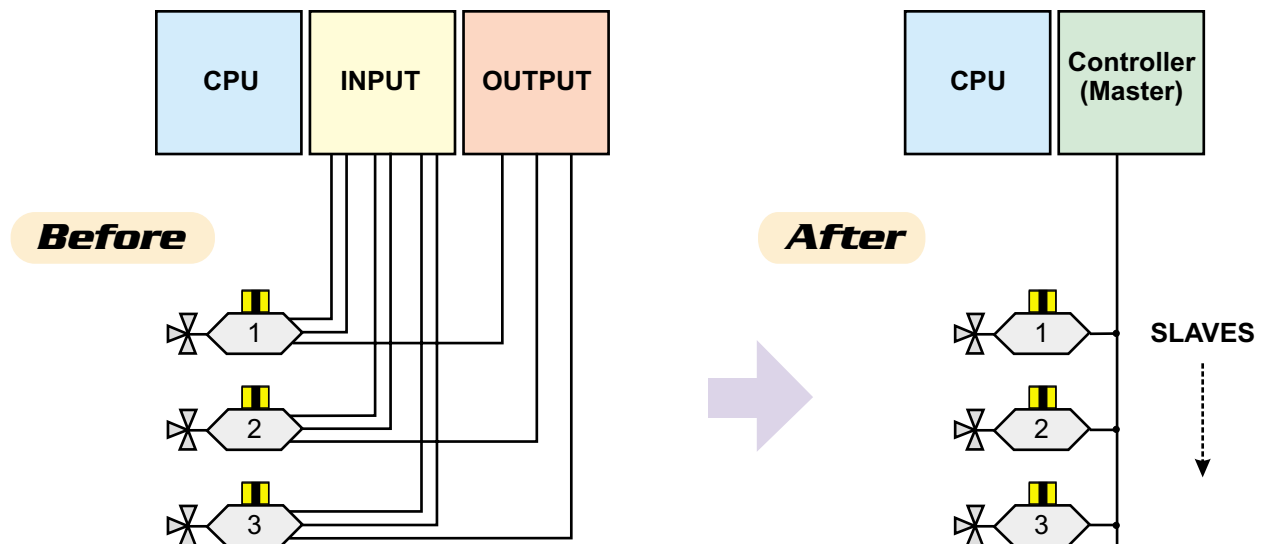
- 1) **Simplified Plant Wiring** - Automated valves can be wired in any configuration to suit physical needs Utilizing only 2 or 4 wires for all the valves in the network eliminates the wiring "spaghetti" of traditional methods.
- 2) **Reduced Installation Costs** - Wiring and installation time can be reduced even further utilizing quick-disconnect pin-style connectors. Set-up is simpler and diagnostic functions speed troubleshooting.
- 3) **Increased System Reliability** - Components are designed to require less maintenance and work "one-way" only while built-in diagnostic functions continuously monitor the equipment during operation
- 4) **Standardized, Proven Technology** - Bus Technology has evolved to simple, standardized protocols that are supported by almost all leading manufacturers of process equipment.

The ASi (Actuator - Sensor Interface)

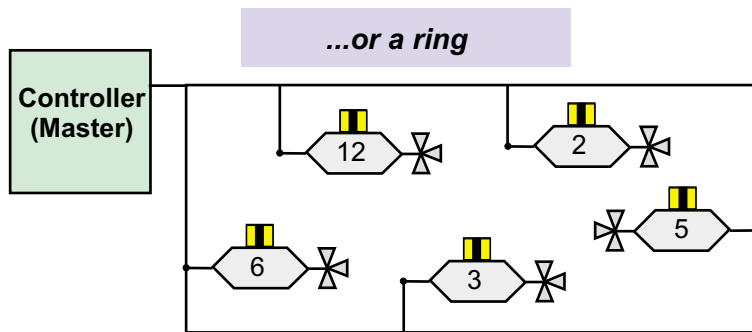
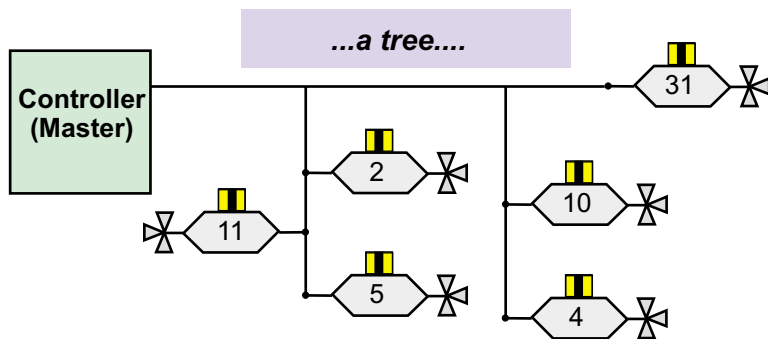
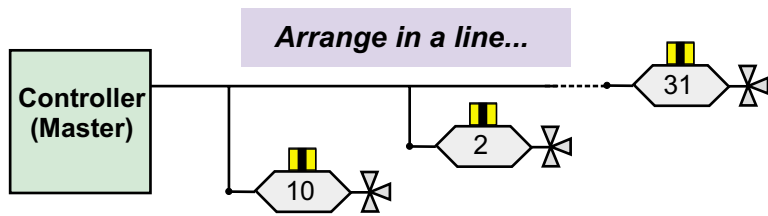
The ASi protocol was specifically developed for applications which require on-off or "binary" feedback. It was designed to be a low cost complement to more sophisticated protocols (such as DeviceNet, Profibus, Modbus and Foundation Fieldbus) for lower levels of plant automation. It is the digital replacement for traditional parallel wiring. This technology was developed by a consortium of 11 European companies with the intention of creating a standard. Today, over 100 companies worldwide offer products that are ASi compatible.

ASi Can Work In Your Plant!

SVF offers a full range of gateways, power supplies, cabling and connector solutions for your application. Contact SVF for your project and our team of specialists will help you configure your next valve network.



SVF Flow Controls **ASi VALVE NETWORKING**



Flexible Network Configuration

An ASi network allows the wiring structure to match the physical needs of your system layout. A network can be branched in a line, tree or ring (see figures at left), allowing new slaves or valve monitors to be placed in any position.

Cable

This network does not require special cabling, although dedicated ASi cabling is available to simplify installation. Total cable length must be less than 300 ft. (100m) *including* all branches. When a longer wiring length is necessary, the cable can be extended for another 300 ft. (100m) using a repeater. Up to two repeaters are allowed for a total cable length of 900 ft. (300m).

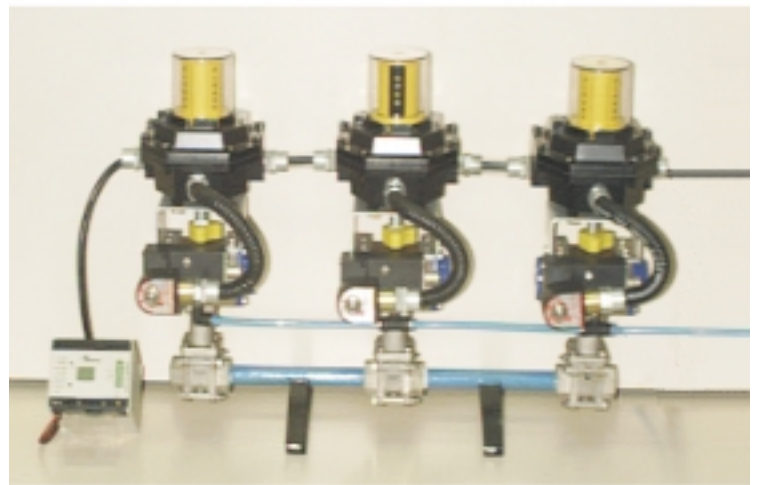
Automated Valves - The Slaves

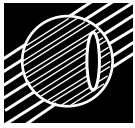
Each valve monitor includes two position sensors or switches, an ASi module and a solenoid valve. Both limit switches and the solenoid valve connect to the ASi module inside the unit. The ASi module controls the solenoid valve and the feedback of the position sensors through the network.

Addressing the Valves

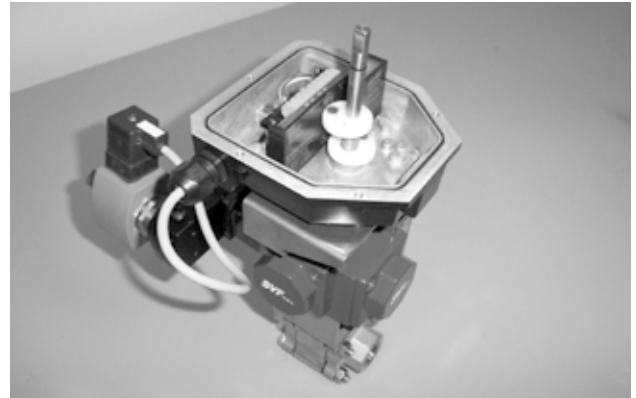
An ASi network can operate with a maximum of 31 valve monitors or "slaves". The node or address is stored in memory on the board once it has been programmed by the master or handheld programmer. The master calls the slaves in series and receives their responses. When all the slaves have been called, the master repeats the cycle again. Total cycle time for the system to address all 31 slaves is 5 ms.

SVF Devices can assist you in implementing an ASi valve network. Contact your local SVF representative for details and find out how easy ASi is.





The ASi network protocol was developed to provide industry with a simple and cost effective method of networking on/off automated valves. A SVF network card can interface directly with your plant's PLCs or through other protocols such as ASi, DeviceNet, Foundation Fieldbus, Profibus or Modbus utilizing a gateway.



SVF's ASi Platform is Simply Better

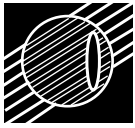
ASi Technical Information

- ▲ Supports up to 124 inputs and 124 outputs over 31 nodes or addresses
- ▲ Baud rate at 167Kbit (no termination required)
- ▲ Scan time <5ms for a fully loaded system
- ▲ Can be installed in any topology
- ▲ Bus power and communications share the same 2 wire cable
- ▲ Standard 16AWG or special AS-interface flat cable can be used
- ▲ 990 ft. total bus length (with minimum 2 repeaters)
- ▲ High level noise and temperature immunity make ASi an excellent choice for the process plant environment.
- ▲ Each AS-interface node requires its own unique address (master/slave)
- ▲ No configuration software required
- ▲ Nodes can be addressed using buttons on master, hand-held programmer, or through serial communications

Standard ASi Network Card Specifications

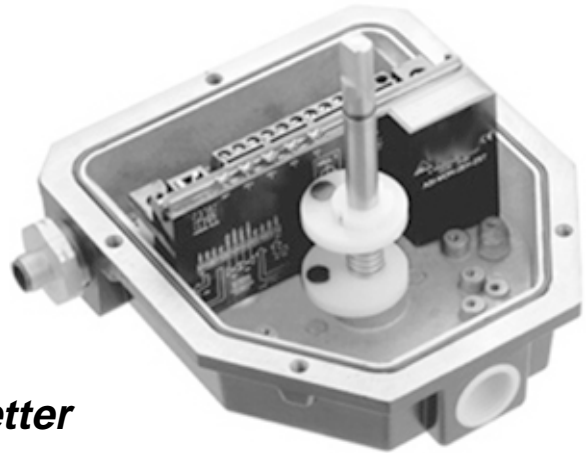
Power	
voltage	30Vdc (ASi standard)
current	<30mA
local indication	green LEDs
Communication	
type	slave
addressing	1 to 31 (0 from factory)
cycle time	less than 5ms
ASi Configuration	
Bit D0	proximity switch #2
Bit D1	proximity switch #1
Bit D3	ready signal
Bits P0, P1, P2, P3	not used
IO code	IO = 1H
ID code	ID = FH

On Board Sensor Inputs	
Type	(2) Hall effect solid-state sensors, (1) for each valve position
local indication	Green LEDs
Auxiliary Inputs	
type	NAMUR (DIN 19234) or mechanical switch
voltage	8Vdc +/- 5% - ripple 5%
current	active <1mA, inactive >3mA
local indication	green LED (each input)
protection	reverse polarized
Output	
type	(2) transistor or relay
transistor rating	2W @ 24 VDC
relay contact	programmable NO or NC
relay voltage	120 VAC, 220 VAC, 24 VDC
current	1A



SVF's "Network Solutions" with encapsulated DeviceNet interface cards adapt your on/off automated valves to an advanced DeviceNet valve network. Money and time will be saved as installation and maintenance are streamlined with reduced wiring and improved system diagnostics.

Based on the CAN protocol, the DeviceNet protocol was developed by Allen Bradley to provide industry with a simple and cost effective method of networking field devices. SVF supplies a full range of accessories including cable and quick-disconnect connectors to simplify installation.



SVF's DeviceNet Platform is Simply Better

DeviceNet Technical Information

- ▲ Each network supports up to 64 nodes or addresses
- ▲ 125K, 250K, and 500K bit/sec
- ▲ 1640 ft. maximum trunk length
- ▲ Thick and Thin cable types
- ▲ Trunkline / Dropline topology
- ▲ Supports online node insertion and removal

Standard DeviceNet Network Card Specifications

Power	
voltage	24Vdc +/-15%
current	<70mA
Communication	
type	slave
communication	polled
word	1 byte TX e 1 byte RX
addressing	0 to 63 set by dipswitch
transmission rate	125-250-500 KBAud set by dipswitch
digital filter	25ms
Configuration	
input - byte 1	bit 0 - sensor 1 bit 1 - sensor 2
output - byte 1	bit 0 - output 1 (sol. 1) bit 1 - output 2 (sol. 2)
Local Indication	
green (light)	active and allocated
green (flashing)	active and allocated
red (flashing)	wrong baud rate or lost communication
red (light)	double address or lost communication

On Board Sensor Inputs	
Type	(2) Hall effect solid-state sensors, (1) for each valve position
local indication	red LEDs
Auxiliary Inputs	
type	(2) NAMUR (DIN 19234) or mechanical switch
voltage	8Vdc +/- 5% - ripple 5%
current	active <1mA, inactive >3mA
indicator	(2) red LEDs
protection	reverse polarized
Output	
type	(2) transistor or relay programmable to NO or NC
transistor rating	24 VDC / 400mA
relay voltage	120 VAC, 220 VAC, 24 VDC
relay power	1A
indicator	(2) red LEDs