AS-Interface Overview

The AS-i (Actuator Sensor Interface) protocol was created in Germany in 1994 by a consortium of factory automation suppliers. Originally developed to be a low-cost method for addressing discrete sensors in factory automation applications, AS-i has since gained acceptance in process industries due to its high power capability, simplicity of installation and operation, and low cost adder for devices.

Each AS-i segment can network up to 31 devices. This provides for 124 inputs and 124 outputs, giving a maximum capacity of 248 I/O per network on a v2.0 segment. The AS-i v2.1 specification doubles this to 62 devices per segment, providing 248 inputs and 186 outputs for a total network capacity of 434 I/O points.

Both signal and power are carried on two wires. Up to 8 amps at 30VDC of power are available for field devices such as solenoid valves.

AS-i Network Highlights

Technology Developer AS-i Consortium

Year Introduced 1993

Openness Multiple vendors
800+ products, 150 Vendors

Type of Network Sensor Bus

Physical Media 2-wire cable (flat or round)

Network Topology Bus, Ring, Tree, Star

Maximum Devices
- v2.0 31 nodes (or 248 I/O points)
- v2.1 62 nodes (or 434 I/O points)

Maximum Distance
- Maximum Distance 100 meters
- Maximum Distance with repeaters 300 meters (max. of 2 repeaters can be used)

Communication Methods
- Master/Slave with cyclic polling
- Manchester Bit Encoding implemented via Alternating Pulse Modulation (APM)

Transmission Properties
- 5 mSec latency max. on fully loaded segment

Primary usage
- v2.0 Discrete Signals
- v2.1 Discrete Signals (supports 12 bit analog signals accessed over 5 cycles)

Power and Communications on same twisted pair
- Limited to 200mA per device power consumption
- Requires AS-i specific power supply on communications bus for de-coupling

Device Power Supply
- Devices can be supplied from bus (<200mA)
- Additional power can be supplied by AS-i power bus cable having multiple power supplies (required for higher power outputs)

Wiring Types
Round: Normal 2 wire cable #16AWG (1.5mm)

Flat: 2 wire flat AS-i cable (1.5mm conductors) Yellow for communications Black for additional power

Grounding aspects Ungrounded communications bus

Shielding Unshielded wire

Terminators No terminators required

Hazardous Area Installations Explosion Proof wiring required

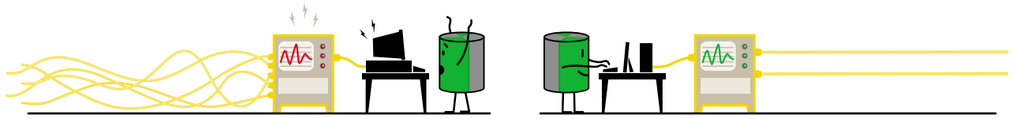
Device Addressing
- Automatic when connected one at a time to the segment or with Handheld Addressing Unit

Governing Body ATO (AS-i Trade Organization)

Web Site **www.as-interface.com**

Conventional I/O System vs. AS-i Bus Network

AS-i is so simple and so inexpensive that it makes using traditional wiring methods difficult to justify.



CONVENTIONAL I/O SYSTEM

Advantages
- Technology is already understood
- Slightly lower device cost
- Independent wiring from devices to the control system means wiring problems with one device don't affect other field devices

Drawbacks
- Higher installed cost
- Point-to-point wiring is expensive
- Many wiring connections:
  - are labor intensive to install
  - create many points of failure
  - increase complexity when troubleshooting
  - require large amounts of cabinet or rack space for installation of terminal blocks
  - create time-consuming initial checkout and startup
- Expansion requires duplicating the entire wiring scheme for each additional point

AS-i BUS NETWORK

Advantages
- Technology is easy to understand
- Very low device cost adder
- Lower installed cost
- High speed network for sensor level devices
- Ability to integrate conventional devices into AS-i network
- Easy addressing for devices; auto-addressing capabilities on most masters
- Many gateways available to integrate AS-i network into higher-level networks, allowing for easy integration of a lower cost, sensor level network with a more sophisticated, higher-cost control level network
- AS-i network provides for use of higher power devices
- Easily expandable with network redesign
- Requires no terminators or special shielding requirements yet still less susceptible to RFI interface than some networks
- Wide variety of masters/gateways available for PLC's, DCS's, PC's
- Power and bus communications are on same pair of wires
- Wide variety of topologies available, including point-to-point, line, tree, and ring

Drawbacks
- Not available for Intrinsically Safe applications
- Wiring runs limited to 100 meters
- v2.0 supports only discrete devices (v2.1 has limited analog support)
- No control in the field
- Limited data quality and status messaging
- Limited analog support
- Requires specific AS-i power supply for bus communications isolation
- Limited redundancy capabilities

AS-i is inexpensive, simple, supplies plenty of power and offers end users a variety of wiring strategies.

TopWorx Comments on AS-i

Strengths
AS-i is inexpensive, especially in general purpose environments.

AS-i is simple. Unlike other communication protocols, AS-i is not designed to bring control system functionality to the field. AS-i is simply a better way to connect field devices to the control system. AS-i offers end users a variety of topologies (wiring strategies). And AS-i's principle of operation makes it easy to install and configure as well as add new devices later.

AS-i supplies plenty of power. AS-i delivers plenty of power to operate virtually all field devices, including solenoid valves.

Limitations
Wiring length
The maximum length of cable run is limited to 100 m per segment. Up to two repeaters can be added to increase this length to 300 m.

Hazardous Areas
Since AS-i is an 8 amp bus, it cannot be intrinsically safe. TopWorx has recognized the difficulties of installing AS-i in hazardous areas and offers a variety of solutions suitable for use in Class I, Div 1 (Zone 1) and Class I, Div 2 (Zone 2) environments.

When to Use AS-i
Generally speaking, TopWorx recommends AS-i when:
- device populations are all discrete
- plants are not intrinsically safe
- cable length limitations are not an issue
- users desire the ultimate in simplicity
- existing discrete devices need to be incorporated into a bussed environment
- conventional discrete devices need to be incorporated into a bus network
- large numbers of discrete devices need to be cost-effectively incorporated into an existing control level network via a gateway device