

# 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.

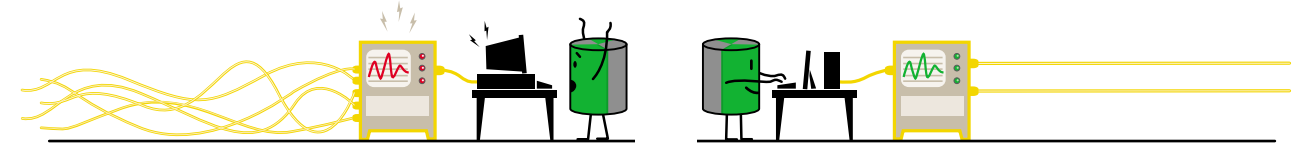
## AS-i Network Highlights

<b>Technology Developer</b>	AS-i Consortium
<b>Year Introduced</b>	1993
<b>Openness</b>	Multiple vendors 800+ products, 150 Vendors
<b>Type of Network</b>	Sensor Bus
<b>Physical Media</b>	2-wire cable (flat or round)
<b>Network Topology</b>	Bus, Ring, Tree, Star
<b>Maximum Devices</b>	31 nodes (or 248 I/O points) - v2.0 62 nodes (or 434 I/O points) - v2.1
<b>Maximum Distance</b>	100 meters - Maximum Distance 300 meters - Maximum Distance with repeaters (max. of 2 repeaters can be used)
<b>Communication Methods</b>	- Master/Slave with cyclic polling - Manchester Bit Encoding implemented via Alternating Pulse Modulation (APM)
<b>Transmission Properties</b>	- 5 mSec latency max. on fully loaded segment
<b>Primary usage</b>	Discrete Signals - v2.0 Discrete Signals (supports 12 bit analog signals accessed over 5 cycles) - v2.1

<b>Power and Communications on same twisted pair</b>	- Limited to 200mA per device power consumption - Requires AS-i specific power supply on communications bus for de-coupling
<b>Device Power Supply</b>	- 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)
<b>Wiring Types</b>	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
<b>Grounding aspects</b>	Ungrounded communications bus
<b>Shielding</b>	Unshielded wire
<b>Terminators</b>	No terminators required
<b>Hazardous Area Installations</b>	Explosion Proof wiring required
<b>Device Addressing</b>	- Automatic when connected one at a time to the segment or with Handheld Addressing Unit
<b>Governing Body</b>	ATO (AS-i Trade Organization)
<b>Web Site</b>	<a href="http://www.as-interface.com">www.as-interface.com</a>

## 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