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-Interface Network Highlights

<table>
<thead>
<tr>
<th>Technology Developer</th>
<th>AS-i Consortium</th>
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<tbody>
<tr>
<td>Year Introduced</td>
<td>1993</td>
</tr>
<tr>
<td>Openess</td>
<td>Multiple vendors</td>
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<tr>
<td>Type of Network</td>
<td>Sensor Bus</td>
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<tr>
<td>Physical Media</td>
<td>2-wire cable (flat or round)</td>
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<tr>
<td>Network Topology</td>
<td>Bus, Ring, Tree, Star</td>
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<tr>
<td>Maximum Devices</td>
<td>- v2.0: 31 nodes (or 248 I/O points) - v2.1: 62 nodes (or 434 I/O points)</td>
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<td>Maximum Distance</td>
<td>- Maximum Distance: 100 meters - Maximum Distance with repeaters: 300 meters (max. of 2 repeaters can be used)</td>
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<td>Communication Methods</td>
<td>Master/Slave with cyclic polling - Manchester BiLevel Encoding implemented via Alternating Pulse Modulation (APM)</td>
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<tr>
<td>Wiring Types</td>
<td>- Normal 2 wire cable: #16AWG (1.5mm) - 2 wire flat AS-i cable: (1.5mm conductors)</td>
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<td>Grounding aspects</td>
<td>Ungrounded communications bus</td>
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<td>Shielding</td>
<td>Unshielded wire</td>
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<td>Hazardous Area Installations</td>
<td>Explosion Proof wiring required</td>
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<tr>
<td>Device Addressing</td>
<td>- Automatic when connected one at a time to the segment or with Hardwired Addressing Unit</td>
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<td>Governing Body</td>
<td>ATO (AS-i Trade Organization)</td>
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<tr>
<td>Web Site</td>
<td><a href="http://www.as-interface.com">www.as-interface.com</a></td>
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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 (v2.0)
- Additional power can be supplied by AS-i power bus cable
- Having multiple power supplies (required for higher power outputs)

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

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

Hazardous Areas
- Since AS-i is an 8 amp bus, it cannot be intrinsically safe. TopWorx has recognised 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 bus network
  - large numbers of discrete devices need to be cost-effectively incorporated into an existing control level network via a gateway device

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

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

CONVENTIONAL I/O SYSTEM

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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

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