While AS-Interface may still be the simplest network for the lowest and most important level of automation, new features make it a more attractive networking option than ever before—including the recent adoption of Specification 3.0, which adds many advanced capabilities. In 2001 AS-Interface Safety at Work (SaW) was released in Europe, with North America following in 2002. A core requirement for SaW was to be compatible with all applications in the field, irrespective of how old the installation is.

Helmut Hornis, Ph.D.
Intelligent Systems Manager
Actuator Sensor Interface (AS-Interface) was introduced in the early 90s as a highly distributed network geared to simplify interfacing sensors (inputs) and actuators (outputs). It was specifically designed to alleviate the problems associated with high installation cost and difficult trouble-shooting offered by other solutions available at the time. While AS-Interface may still be the simplest network for the lowest and most important level of automation, new features make it a more attractive networking option than ever before – including the recent adoption of Specification 3.0, which adds many advanced capabilities.

Because of its initial success as an industrial networking solution, AS-Interface was identified as an ideal candidate for the next paradigm shift in automation. Users were ready to apply AS-Interface to safety applications. In 2001 AS-Interface Safety at Work (SaW) was released in Europe, with North America following in 2002. A core requirement for SaW was to be compatible with all applications in the field, irrespective of how old the installation is. Only two new components are needed to bring functional safety to ANY existing AS-Interface system - the SafetyNodes and the SafetyMonitor.

SafetyNodes are I/O nodes constructed to satisfy the strict rules set forth by safety regulations, and offer inputs for typical safety device like safety light curtains, e-stops, pressure mats, key switches, and door interlocks. The SafetyMonitor is a monitoring device that contains the OSSDs, replacing safety relays in traditional hard-wired installations. As the name “monitor” implies, it is only monitoring the SafetyNodes. To understand how a SafetyNode interacts with the SafetyMonitor requires one additional concept: the dynamic SafetyCode.

All safety systems, including SaW, transmit data over a wire; an inherently unsafe medium. As a result, additional steps must be taken to guarantee that the safety data of safety rated input devices will result in reliable and fast opening of the OSSDs. Each AS-Interface node receives 4 bits of output data from the gateway/scanner and replies with 4 bits of input data. Standard nodes (i.e., non-safe nodes) transmit four bits representing the states of four connected sensors. As long as the states of the sensors do not change, the data from such a node is “static” over time. Not so with SafetyNodes. SafetyNodes do not transmit “e-stop pushed” but rather “e-stop NOT pushed.” This seemingly trivial difference is quite important. So long as a safety input connected to the SafetyNode has not been pushed to indicate a STOP, it transmits a unique SafetyCode sequence for evaluation by the SafetyMonitor. As long as safe inputs on the SafetyNodes are indicating RUN, the SafetyCode sequence is transmitted. The SafetyMonitor compares the received code sequence with an expected sequence and when no difference exists the OSSDs remain closed. Once a difference is detected the SafetyMonitor opens the OSSDs and enters a safe state.

Putting all this together, it becomes apparent that SaW is 100% compatible with any existing AS-Interface installation, irrespective of how old, how new, or what kind of additional nodes are used.
**The Benefits**
In the case of AS-Interface Safety at Work, the list of advantages over conventional hard-wire and other bus-based solutions is plentiful and significant.

- No safety PLC needed
- Approved for Category 4 and SIL 3 safety
- Monitor the state of any safety input and the state of the OSSDs
- Field and enclosure mountable safe inputs
- Quickly configure a safety system, offering the benefits as standard AS-Interface installations
- Further reduce the total number of wires needed for any given installation - this allows machines to be truly modularized
- Install safety input devices and OSSDs anywhere along the network, modifying setup anytime during the project
- Print the safety log, thus reducing the time necessary to create system documentation while limiting possible documentation errors
- Use a powerful visualization tool to check the behavior of the safety hardware
- Add SafetyNodes wherever needed, even during the final phases of the project - since no additional wiring back to the safety relays is needed, this takes only minutes
- Add OSSDs anytime, anywhere, which can be read via AS-Interface
- Compatible with existing, old or new, AS-Interface installations
- Monitor state (activated/not activates) of any safe input without wiring auxiliary contacts
- Safe inputs and normal outputs on one SafetyNode
- Easy configuration with MS-Windows drag & drop tool; Also supports graphical configuration monitoring
- Place SafetyMonitor wherever convenient
- Automatic single node replacement

**Specification 3.0**
AS-Interface Safety at Work users clearly desire to solve new and more demanding applications. The market is demanding I/O nodes with 8 or even 16 inputs. Certain applications call for high speed analog I/O and the connection of ‘complex’ field devices that need configuration data and parameter information.

In September 2004 AS-International ratified specification 3.0, designed to address those and other needs allowing AS-Interface to become an even more robust safety networking solution and to be used in even more demanding applications. The following enhancements of specification 3.0 will be of great interest to users:

- 4 In/4 Out nodes with extended addressing (up to 62 nodes per network)
- 8 In/8 Out nodes with extended addressing (up to 62 nodes per network)
- 16 In nodes with extended addressing (up to 62 nodes per network)
- 2-channel analog modules with extended addressing (up to 62 nodes per network)
- Full-duplex, high-speed devices with 8, 12 or 16 In/Out

**SafetyNodes are I/O modules designed and constructed to satisfy the rules and regulations necessary to obtain desired safety ratings**

Utilizing these new abilities, AS-Interface vendors have already started developing new products such as LED displays and high speed, configurable counters. Given enough interest from the user community, HMI units, robot controllers, complex valve control units and other more enhanced products will be offered in the future.
Pepperl+Fuchs sets the standard in quality and innovative technology for the world of automation. Our expertise, dedication, and heritage of innovation have driven us to develop the largest and most versatile line of industrial sensor technologies and interface components in the world. With our global presence, reliable service, and flexible production facilities, Pepperl+Fuchs delivers complete solutions for your automation requirements— wherever you need us.