

# AS-Interface Safety at Work

## Why AS-Interface?

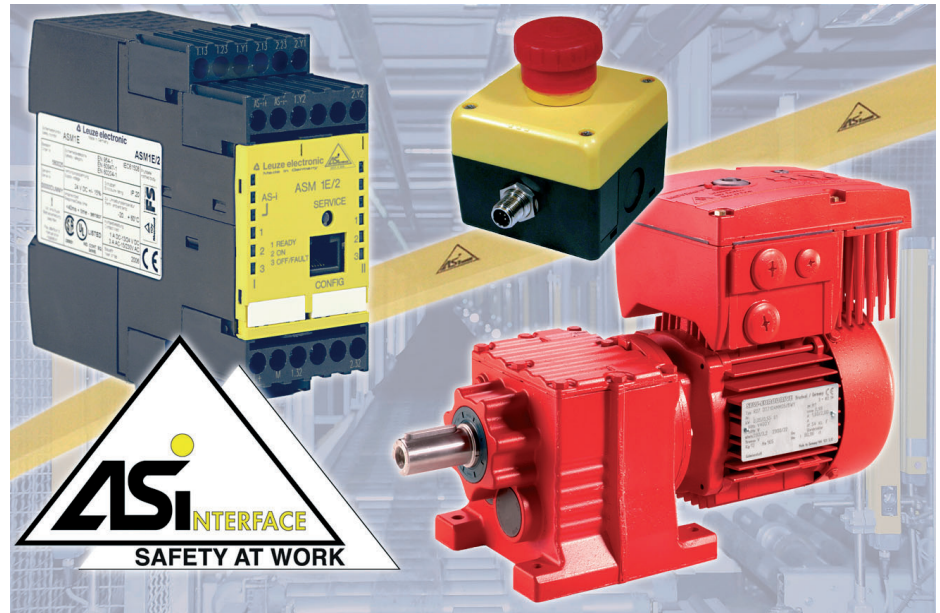
The Actuator Sensor Interface, as it is known in full, is a cost-effective alternative to conventional wiring technologies, which is easy to use, extend and can be connected without having to power off. The unmistakable two-wire “yellow cable” for transferring both power and data, the easy connection to penetration technology, control with the PLC as I/O module and the extensive diagnostics options, are just some of the impressive AS-Interface features. These result in significant savings with project planning, installation, documentation and maintenance, as well as short downtimes if a fault occurs. The original number of 11 founding members in 1992 has now swelled to approximately 300 member companies around the world, which support the manufacturer-independent AS-Interface system, and have helped to make it an established standard.

## Network hierarchy

AS-Interface is designed for the lowest level of automation and provides quick, simple and safe transmission of switching signals with an optimum price/performance ratio. It can be flexibly extended and operated in independently working sub-areas. The AS-Interface significantly reduces the data volumes for higher level field busses that it can be connected to via existing gateway solutions.

## Basic AS-Interface components

The AS-Interface logo identifies the devices of various manufacturers that are certified by the independent AS-Interface test center and can be easily operated on an AS-Interface strand. The AS-Interface master or



the AS-Interface gateway with corresponding diagnostics options is the central unit. It controls and monitors the data exchange with the modules and the AS-Interface sensors/actuators in the master-slave setup. Special AS-Interface power supplies with data isolation are used for the power supply.

The “yellow cable” can be laid star-shaped, as a strand, a curve or in a tree-shaped structure. Repeaters are provided if the application requires cable lengths of more than 100 m.

## Additional component: Safety Monitor

“Safety at Work” is a safety concept that is based on the AS-Interface standard and enables applications for machine and system safety. To enable this one or more safety monitors and safety sensors, such as EMERGENCY STOP buttons, optical safety devices and/or safety switches, must be installed on the strand. A mixed operation of safe and unsafe AS-Interface slaves is absolutely no problem. The safety

monitor monitors the data communication of the master with the safe slaves. Each safe slave receives an unmistakable code table consisting of 8 x 4 bits. The code tables are “read in” during the safety monitor’s start-up as a target sequence and compared with every bus cycle line-by-line with the actual sequence. With code sequence transmission faults the safety monitor switches the corresponding release circuit off within 40 ms.

The system can be used up to control category 4 in accordance with EN 954-1, up to Performance Level “e” in accordance with EN 13849-1 and up to SIL 3 in accordance with IEC 61508.

## Safety sensors as AS-Interface bus participants

Just as with the AS-Interface power supply, the master or the safety monitor, the AS-Interface safety sensors of the AS-Interface Association must also be tested and identified with the AS-Interface logo.

All currently recognized types of switching safety sensors, such as laser scanners, light curtains, light beam safety devices, PS mats, EMERGENCY STOP buttons or safety door switches of various manufacturers are available for connection to the AS-Interface. Safety sensors with integrated AS-Interface are ideal for direct M12 connection to the “yellow cable”. Aptly named “coupling modules” are provided for sensors that don’t have this kind of interface – either for contact-related switching signals or for safety semiconductor outputs.

It must be noted here that the achievable level of a specific control circuit does not depend here on the safety monitor alone – it depends also on the design type, arrangement and logical integration of these safety sensors. If the risk assessment requires, for example, category 3 or 4, a light curtain that also has a higher level of safety, i.e. type 4, must be used.

The safety sensors receive one bus address from 1 to 31 each, which can only be assigned once in a network. A maximum of 31 safety sensors can therefore be connected to one AS-Interface strand if standard A/B sensors are to be dispensed with.

### **Logical linking modules**

If several safety sensors are linked in a safety circuit, this is performed by default with the “AND” function. The ASIMON software allows further logical links, such as OR gates, FLIP-FLOP and switch on/off delays, to be flexibly implemented, and therefore complex safety tasks to be performed.

With the logical system modules of the safety monitor, additional statuses, e.g. of the output switching elements and/or the release circuits, can be included in positive logic or

included inverted in the signal processing.

### **Safety monitor release circuits**

Each safety monitor can be equipped with one or two switch-off circuits, each of which can be assigned a safety circuit with stop category “0” in acc. with EN 60204. To activate a braking process while live, for example, for stop category “1” the second switch-off circuit can take over the delayed switch-off of the same safety circuit, which causes an immediate switch-off in the first switch-off circuit. The delay of the second switch-off circuit is configured and monitored via the ASIMON software.

Each switch-off circuit is equipped with a contactor monitoring function (EDM), which becomes effective with the use of positive-guided feedback contacts when it has been configured in ASIMON.

### **Forecast**

The integration of safe sensors into the AS-Interface has significantly improved its cost-effectiveness and acceptance, as separate conventional wiring is no longer required for such sensors. In a further step it will be possible in the near future to not only switch off safe actuators directly via the safety monitor’s switch-off circuits – it will also be possible to safely switch them off via the “yellow cable” as an alternative.

This will be ensured by a further developed safety monitor that continuously communicates with the safe actuator or the safe actuator group via AS-Interface. The planned safe actuator can also be controlled via standard A/B address with commands from the control unit, e.g. for clockwise/anti-clockwise rotation and/or slow/fast mode. The safe actuator will also be able to locally analyze feedback signals from safety

valves or positive-guided contactors (EDM). Expensive cable routing back to the safety monitor is no longer required.

The new safety monitor generation also allows for the coupling of AS-Interface networks, so that, for example, EMERGENCY STOP or start commands can be sent via several AS-Interface networks. This opens up new options with applications that have to be provided with more than 31 AS-Interface addresses and for which higher level field busses are not planned.