

AS-INTERFACE MASTER NEWS

THE BIHL+WIEDEMANN MAGAZINE

INTERVIEW

“The total is more than
the sum of its parts”

safe link

EtherNet/IP

sercos
the automation bus

TCP/IP

Modbus

PROFINET

SYSTEM COMPARISON: SAFE COUPLING

Simply simpler

System comparison: Safe coupling

Simply simpler

The more complex the applications, the more complex the machine safety? Wrong – just the opposite in fact: modular constructed production systems especially lend themselves to as simple a safety concept as possible. There are a number of options for safe coupling of the components: conventional parallel wiring, common safe Ethernet systems or maximum flexibility using Safe Link from Bihl+Wiedemann. But which one wins the system comparison?

At first it was considered a vision of the future, soon thereafter a megatrend, and then even as a driver of the fourth industrial revolution. In the meantime the intelligent factory has become reality – and with it the ever more complex, widely distributed production systems, all of which work together optimally across all segments. For standard

signals the various automation systems have long offered all the possibilities for perfect networking. Coupling of the safety components likewise reveals multiple options: the ancient method using conventional wiring of each individual switching device, the modern version using Ethernet over whichever fieldbus is employed in the

respective system – or simply and flexibly using Safe Link, the safe approach to cross-communication from Bihl+Wiedemann.

All these possibilities have by now been exhaustively tested in a wide variety of applications: in those where the sheer number of safety-relevant signals requires

safe coupling of the networks as well as in distributed systems modularly constructed of autonomous segments for achieving a higher degree of flexibility and standardization. In actual practice of course there are many additional requirements which lend themselves to safe coupling: when for example one machine is located within visual range of another and the E-STOP button needs to affect both of them. Or when stopping one piece of equipment requires that the upstream unit bringing it material also needs to be turned off.

And so by now we have sufficient empirical data to answer all the user questions revolving around a detailed system comparison: all things considered, which type of safe coupling of signals from multiple systems, machines or segments is the most efficient – both with respect to cost and installation effort and in terms of implementation flexibility?

Safe coupling using conventional wiring: flexible, but unnecessarily cumbersome and extremely complicated

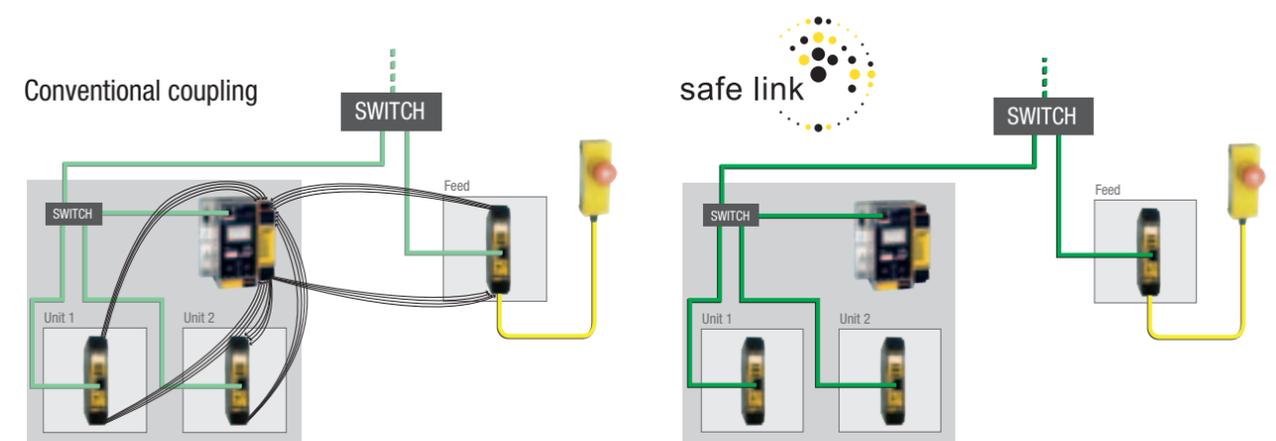
It's really no surprise that good old conventional wiring comes out by far the worst. Here four conductors are required just to connect a single safe two-channel input. Coupling in both directions now brings the total to eight wires that have to be connected on both machines or system components. Even in mini-applications, where for example only the signals from a handful of safety sensors need to be brought together, a perversely impressive cable forest springs up. And with the functionality becomes even somewhat more complex, the jungle becomes even denser. This makes

the whole thing not just unnecessarily expensive, but also extremely confusing.

Amazingly enough, many users are still resorting to this technologically long-since outdated method. Asked why, the answer is always the same: because this way machines or system components can be coupled which work with different automation systems. Until recently this was doubtless a valid argument. But no longer: Safe Link from Bihl+Wiedemann offers the same level of freedom, but also with all the advantages of an efficient safety bus. More about that later.

Safe coupling over the common safe Ethernet systems: rather inflexible and often relatively expensive

Comparison of Safe Link and conventional coupling



Conventional coupling: potential-free contacts

- High wiring effort
- Confusing and error-prone

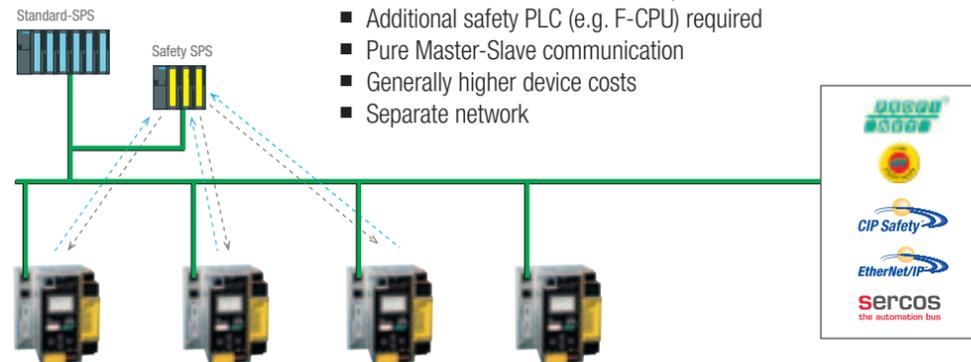
Safe Link from Bihl+Wiedemann: safe coupling over Ethernet

- Simple way of safely coupling many signals
- Each safe signal is available to every device without restriction

Comparison of Safe Link and other safe Ethernet systems

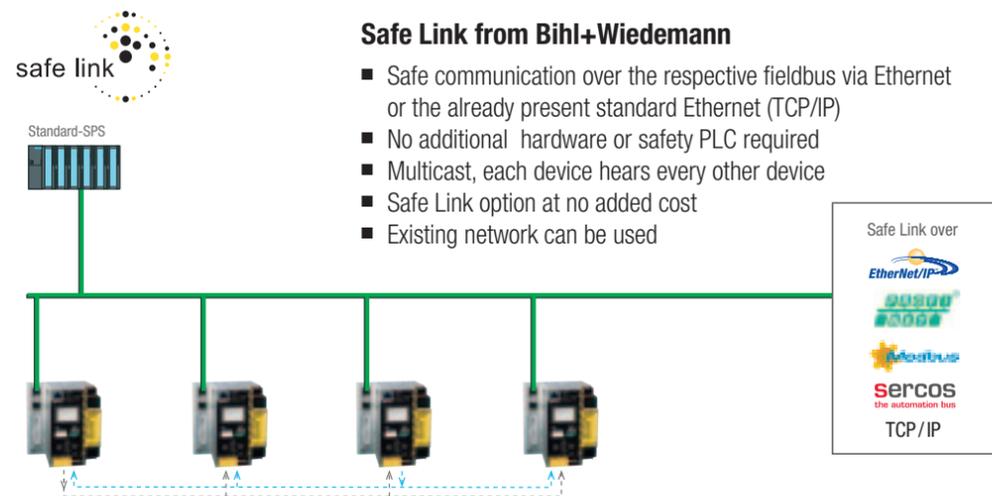
Conventional safe Ethernet systems

- Safe communication over the respective fieldbus via Ethernet
- Additional safety PLC (e.g. F-CPU) required
- Pure Master-Slave communication
- Generally higher device costs
- Separate network



Safe Link from Bihl+Wiedemann

- Safe communication over the respective fieldbus via Ethernet or the already present standard Ethernet (TCP/IP)
- No additional hardware or safety PLC required
- Multicast, each device hears every other device
- Safe Link option at no added cost
- Existing network can be used



First let us take a look at the second option for safe coupling: connecting via Ethernet over the fieldbus used in the respective system. Compared with antiquated parallel wiring, this is of course a much more modern variant, but here also there are at least two significant downsides. For one, it doesn't permit coupling machines that are running in different automation systems.

In addition, it doesn't allow direct coupling between the individual devices: the slaves can only communicate with each other through an additional controller. But this isn't the only thing that affects the calculation: the often significant hardware costs for the devices have a negative impact.

Here the flexible but indisputably inefficient

method of parallel wiring, there the more modern but system-bound and generally more expensive variant using Ethernet on the respective fieldbus: not exactly an attractive alternative for users who are facing the task of safely coupling equipment, machines or segments. It's precisely this unsatisfactory situation that prompted the safety specialists at Bihl+Wiedemann to find a better solution.

Safe coupling using Safe Link from Bihl+Wiedemann: utterly simple, highly flexible and unbeatably efficient

The result is Safe Link, a technology that allows safety controllers to be connected to each other simply, efficiently and with the greatest possible flexibility. If both machines or system components to be coupled run on the same Ethernet-based fieldbus – great, then the Safe Link connection is made through the fieldbus interfaces of the safety controllers. If not, no problem: then the connection is made instead through the Ethernet diagnostic interface of the safety controllers and the standard

Ethernet network already present in every company. It goes without saying that communication over a WLAN is also possible. Safe Link consistently uses the already existing peripherals in any constellation. In all situations an Ethernet cable is all that is needed for the coupling. Nor are additional devices necessary – in the newest generation of compact safety controllers from Bihl+Wiedemann the Safe Link function comes standard. Or to put it in more technical terms: the Safe Link protocol has been integrated into the existing hardware of the safety controllers. But Safe Link is in a league of its own not only when it comes to versatility and from a monetary point of view, it also boasts functional efficiency and expandability. This is because communication is based on so-called multicasts.

Here one safety controller "talks" and all the others "listen." The devices in the coupled networks have all the safety-relevant information all the time. And the number of such devices is virtually limitless: up to 31 Gateways with integrated Safety Monitors and Safety Basic Monitors can be coupled to each other through the Ethernet interface. For those who like impressive numbers, this adds up to 1922 safety components.

Seen objectively and from a purely factual consideration, there can be only one winner in this system comparison: Safe Link from Bihl+Wiedemann. And the numerous AS-i-specific advantages, from the simple installation technique to the comprehensive diagnostic capabilities, are icing on the cake at no added cost.

Safe Link compared with other systems

	safe link	Conventional coupling	PROFIsafe	CIP Safety
Supported Ethernet systems	PROFINET EtherNet/IP Modbus TCP Sercos Standard Ethernet (TCP/IP)	-	PROFINET	EtherNet/IP Sercos
Coupling between different systems	With Safe Link over standard Ethernet	With safe I/O modules	-	-
Communication principle	Multicast, each device hears every other device	Fixed wired	Master-Slave	Master-Slave
Flexibility	Very high	Very low	Medium	Medium
Additional components	-	Safe I/O modules	Safety controller	Safety controller
Cost	Safe Link option at no extra cost	High costs for I/O modules and wiring	Generally higher device costs	

Installation comparison: Profile cable vs. round cable

Just a matter of form?

The familiar yellow cable is not just a symbol for the legendary efficiency of AS-Interface, it is also one of the reasons for it. Even its basic geometry offers significant advantages. In contrast to the round cables used in conventional automation systems, no plugs or tees are needed for connecting modules to the AS-i flat cable. This saves not only material but also a great amount of time in installation and documentation – while at the same time providing virtually limitless topological freedom.

When installing an automation system using round cables the user first has to choose the lesser of two evils: either he assembles everything himself and manages to attach all the plugs and tees to the individual cables – or he reaches into his wallet and has the round cables supplied already assembled. The second option even brings a further drawback with it: now he has to stock round cable pieces in various lengths so as not to waste material.

When installing an AS-Interface network, you don't have to swallow either of these bitter pills. The familiar yellow AS-i flat cable is simply cut to the desired length from the spool and fed directly through the module – the special profile of the cable

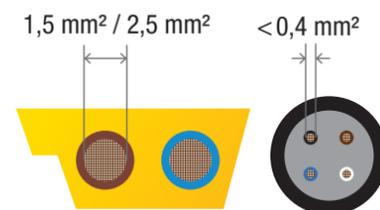
precludes any mistakes. The actual connection is made without a plug, using the unique AS-Interface penetration technique. The contact pins of the device are pushed through the wires of the cable to result in a secure connection. Two gold plated – turned, not punched – pins are used per cable for each contact point, thereby achieving optimal contacting. The cable does not have to be cut, nor do the conductors or jacket require stripping. And if the module is no longer needed, the contact can be easily removed and the slits close back up to form a gas-tight seal again depending on the cable material.

But material and time savings for the installation itself and for documentation does

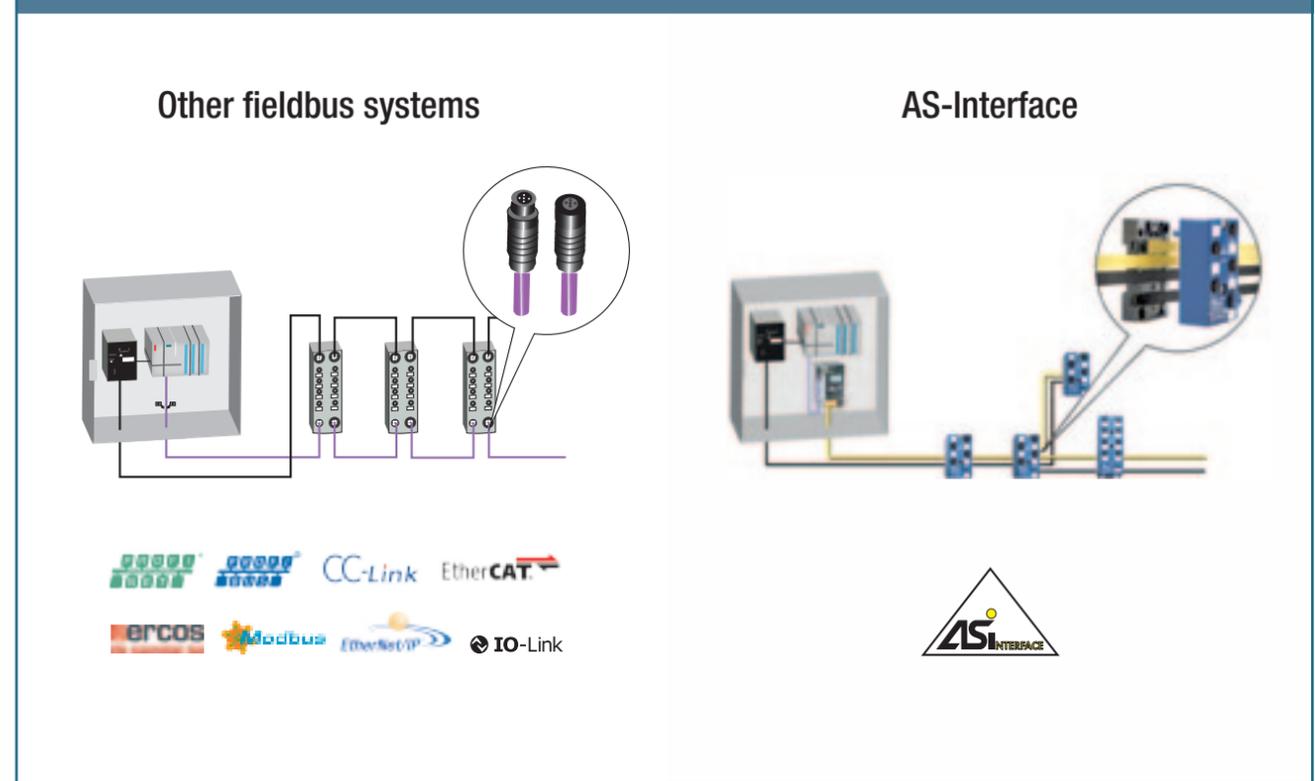
not begin to exhaust all the advantages associated with the combination of flat cable geometry and the clever connection technique. Add to this the enormous flexibility with respect to layout of the networks. As opposed to round cable systems, stub cables and any desired tree structures are possible with the yellow AS-i cable – there are hardly any limits to freedom of topology. Circuits created using the yellow flat cable even score points when it comes to protection from short circuits. Many of the modern AS-Interface masters and gateways already have a 4 A fuse onboard which is more than sufficient even for the smaller of the two available cables, which has a cross-section of 1.5 mm². No additional protection is required.

AS-i also has a place at the round table

In practice there are always some machines or system segments where round cable is preferred. Here again AS-Interface offers an especially convenient option. So-called passive distributors can be used wherever it makes sense to branch round cables off from the actual flat cable run and connect AS-i modules using the normal M12 connectors. Since M12 cable has a lower current rating due to its smaller cross-section, additional fusing may be necessary in some cases. But here again AS-Interface has thought of everything: this fuse is already integrated into many passive distributors.



Comparison between AS-i Installation and other IP67 fieldbus systems



Mostly line structure	Any structure: tree, line, star or mixed
No stub cables	Any stub cables
Shielded, twisted cables (exception: IO-Link)	Unshielded, non-twisted cable
Data and power separate (for IO-Link partially in the same round cable)	Data and power on the same cable
Installation only via plug/socket	Installation using flat cable, M12 plugs or mixed
Many cables of various lengths usually needed	Simply cut flat cable to the required length from the spool
IP67	IP67
Coarser granularity, generally at least 8 in-/outputs per module	Fine granularity: Modules with 1, 2, 4, 8, 16 I/Os available; the more modules or the finer the granularity, the greater the cost advantage when using penetration technique
24 Volt power distribution: M12 (Ø < 0.4 mm ²) usually with many fuses and single leads from the control cabinet or through ¾ inch plugs	24 Volt power distribution: With centralized feed over black flat cable (Ø 1.5/2.5 mm ²); if needed, passive distributors in IP67 for changing to round cable with smaller conductor cross-section are available
No special power supply needed	Up to 50 m cable length no special power supply needed (24V AS-i)

Interview with Thomas Müller, CFO at Bihl+Wiedemann

“The total is more than the sum of its parts”

AS-Interface has long been the epitome of efficiency in production operations around the world. Now the simplest bus system in the world is also playing an ever increasing role in building automation as well. Naturally the AS-Interface masters from Bihl+Wiedemann are implementing their solutions in their own new spaces. CFO Thomas Müller reveals in a conversation with AS-i Master News what he foresees as a numbers guy.

AS-i MASTER NEWS: Mr. Müller, when we talk about automation, in most cases we're referring to the manufacture of products and less often about buildings. Is this also reflected in new orders at Bihl+Wiedemann?

Thomas Müller: Of course. The entire field of building automation still represents for us a fairly modest share of overall sales. But the trend is clearly upward. Today two of our people are currently involved in this area, but we are in the process of expanding our activities – not least because in the meantime there is significantly more information available about the highly interesting cost savings potential that can be realized using intelligent solutions.

AS-i MASTER NEWS: In September of last year you moved into a new building at your Mannheim headquarters which provides

1400 m² of production space and around 600 m² of office space for production-related areas such as quality assurance and purchasing. How much exactly are you saving there using AS-i automation?

Thomas Müller: I can't give you an exact figure yet. We are in the process of measuring all the key parameters. To do this we have installed counters everywhere in the custom converted building to precisely measure for example how much energy is consumed when, where and for what purpose.

We will meticulously and in good time evaluate these results to decide which programming parameters achieve the greatest benefit.

AS-i MASTER NEWS: But didn't you know in advance that you would later fully automate the building?

Thomas Müller: Yes, and we are looking forward to seeing how much money can be saved with an AS-Interface network optimally adapted to the requirements of a production facility. Not only in terms of electric power, where clever circuits are able to achieve much, for example with the outside lighting and interior wall sockets. Intelligent control of the heating system and air conditioning also delivers significant results. With conventional solutions, experience has shown that a building is always overheated, and that even in winter the air conditioning has to be turned on.

That can no longer happen when using networked temperature sensors and actuators to control such things as windows and skylights. Of course these and many other measures represent only minimal savings when seen individually, but in total and projected over an entire year the savings is

significant. And you profit from some building automation benefits even before the system goes live.

AS-i MASTER NEWS: How does that work?

Thomas Müller: It's quite simple: as almost always is the case with new construction or renovations, there were repeated delays, for example when tradesman schedules and delivery dates were pushed back on short notice. But thanks to the flexible installation with AS-Interface we didn't have to completely postpone our moving and occupancy plans, rather we were able to use those building parts which were finished. And we were also much more flexible when it came to short-notice planning changes: for example, only when the walls were already painted and the ceilings enclosed did we have the idea to use a rocker to switch multiple lighting groups. With conventional construction this would

have resulted in significant added cost. In our case all we had to do is change the programming accordingly.

AS-i MASTER NEWS: Some of your customers have already been taking advantage of the plus points of building automation with AS-Interface for some time. To what extent can you refer to their empirical results in the development of your own future concepts?

Thomas Müller: Naturally the best practice examples from our partners provide much important information. But at the end of the day every building is different, and there are of course great individual differences in how the concepts are utilized. This is why with respect to the programming of individual components we want to rely mainly on our own very concrete measurements. It will certainly be quite some time until we have found our way, step-by-step, to an optimum overall solu-

tion. And later our customers can in turn profit from what we have learned in the course of this approach.

AS-i MASTER NEWS: Does this mean you see the automation of your new building also as a kind of reference project for the as yet not so familiar talents of AS-Interface?

Thomas Müller: In the first place we decided to undertake this because we wanted to take advantage of the strengths of AS-Interface – simplicity and flexibility combined with considerable savings potential – for ourselves.

The fact that we are introducing the advantages of this technology to our customers in the future in the form of a living object so to speak and are then in an even better position to advise them, is certainly a highly welcome side effect.

AS-i MASTER NEWS: Mr. Müller, we thank you for the conversation.



AS-INTERFACE HIGHLIGHT

AS-i Safety Output Module now also in IP67 (BWU3064)

Safe switching in the field

- Safe outputs, safe inputs and standard inputs in one module:
 - ✓ 4 x electronic safe outputs (24 V / 2 A)
 - ✓ 2 x 2-channel safe inputs, configurable as potential-free contacts, OSSDs, antivalent or standard inputs
 - ✓ 2 (up to 6) standard inputs
- Chip Card for storing configuration data and for ease of device replacement
- Housing type: 8 x M12
- Protection rating IP67
- Input voltage (sensor power) and output voltage (actuator power) provided by AUX (24 V auxiliary power)
- No cumbersome wiring of the safe outputs from the control cabinet to the field
- Safely control valves in the field



Other Bihl+Wiedemann news at HMI



Analog Modules in new, compact IP67 housing

- Expand the range of AS-i Analog Modules in IP67, M12 ■ Available as: ✓ Analog Output Module with 2 outputs 0 ... 20 mA (BWU3105, BWU3106) ✓ Analog Input Module with 2 inputs Pt100 (BWU3104) and with 2 inputs 4 ... 20 mA (BWU3100)
- Input voltage provided from AS-i and output voltage from AUX (24 V auxiliary power)



Safety Basic Monitor with Ethernet interface and Safe Link, now with Modbus TCP capability (BWU2852)

- Modbus over Ethernet for linking to visualization or displays
- 2 fast electronic safe outputs
- Up to 3 x 2-channel local safe inputs
- Safe AS-i outputs are supported
- Chip Card for storing configuration data
- Protection rating IP20

Update to AS-i/IO-Link Modules, IO-Link Master with 4 IO-Link Ports, IP67



- Improved interoperability with IO-Link products from many manufacturers
- 4 x IO-Link Master
- 2 single slaves in one housing
- IO-Link Class A (BWU2853) or IO-Link Class B (BWU3020)
- IO-Link ports powered from AUX (BWU2853) or AS-i (BWU3020)



ASIMON 3 G2 Safety Software for configuration, diagnostics and programming with new functions

- Available since February 2015
- Supports the Safe Analog Modules (BWU2692), the new Speed Monitor functions, the Safe Output Module in IP67 (BWU3064) and much more
- Improved software stability and functionality



Counter Module in IP20 (BWU3097)

- Expands the range of Counter Modules
- 1 x 2-channel input
- Protection rating IP20
- Special configurations on request



Safe Electronic Output 20 A, IP20 (BW3016)

- Supports applications up to SIL3 / Cat.4 / PLe
- Enables wear-free, safe switching of a high-current 24 V DC device with a load of up to 20 A
- Shorter response time than traditional relays



AS-i Passive Distributor, IP67, M12 (BW3087)

- 2 x M12 plugs to 2 x flat cable for AS-i and/or AUX connection
- 2 x AS-i / AUX to M12 females
- 6 x LED status indicators for status of AS-i / AUX power and M12 connections
- Compact design
- High IP67 protection rating
- Gold plated contacts
- Special configurations on request
- Reliable protection from short circuits: ✓ Optional with 4 x 4 A replaceable fuses or with 4 x 1 A self-resetting fuses
- ✓ Additional protection for connected devices

IMPRINT

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No longer miss a bus with our Safety Gateways

Safety Basic Monitor with switchable AS-i Master – the new cost brake for 3 safe signals or more

Safe Link over Ethernet



Safety Technology by Bihl+Wiedemann

- > Safe Link over Ethernet: The simplest way of coupling many safe signals
- > Optimal PLC connection via fieldbus, all diagnostic data in the controller, safety and standard signals mixed
- > Universally expandable with Safety I/O Modules + Standard I/O Modules in IP20 or IP67, Speed Monitors for up to 40 axis, Safety Relay Output Modules



More information on your application safety at: www.bihl-wiedemann.com

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