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Bus system AS-interface

Catalogue 2008/2009

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fluid sensors and diagnostic systems

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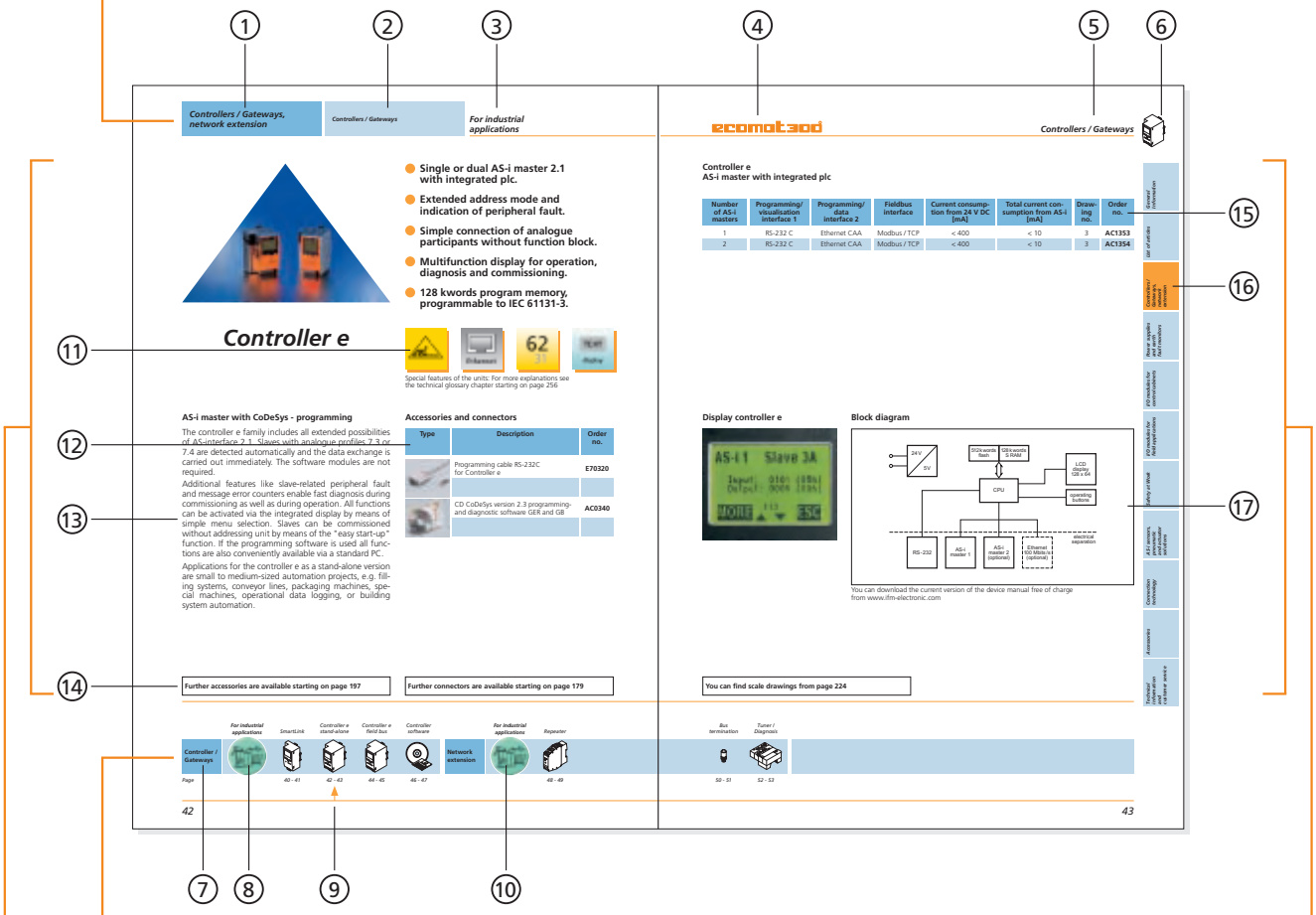
The easy way to find what you're looking for

Header

1. *Section*
2. *Heading*
3. *Product*
4. *Product group name*
5. *Heading repeated*
6. *Illustration*



Navigation bar

7. *Current heading*
8. *Current environment*
9. *Arrow = You are here*
10. *Other headings*

Right

15. *Technical data*
16. *Current section*
17. *Block diagram, wiring diagrams of the units or common technical data*

Left

11. *Special features of the units*
12. *Recommended accessories and connectors*
13. *Product description*
14. *Notes for further details*

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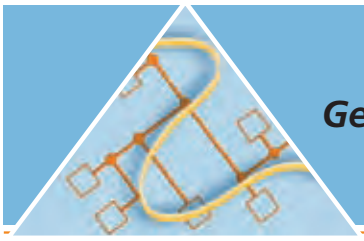
You will find a list of the abbreviations on the inside back cover.



General information

Notes and explanations

For industrial applications

Industrial applications require robust and uncomplicated electronic units but with a high level of technology. ifm makes sensors and evaluation electronics in accordance with quality standards which are far above average.
The production materials employed are subjected to demanding tests and have been selected for a maximum long-term stability in universal applications. The result of this production philosophy is an optimum resistance and reliability of all products used in industrial applications.

For hygienic and wet areas

In all areas of process technology, especially in the food and pharmaceutical industry special regulations must be adhered to. Special materials are required for the components.
Important features for the sensors in these installations are a long life and good resistance even where there is frequent and aggressive cleaning. Sensors from ifm meet these requirements due to the use of stainless steels, gold-plated contacts and selected plastics.

For hazardous areas

Sensors and switching amplifiers to 94/9/EC (ATEX):

Inductive and capacitive sensors are available for hazardous areas (ATEX). The requirements of the applicable installation regulations must be strictly followed by the user. Intrinsically safe sensors are only allowed to be operated with suitable amplifiers holding an EC type test certificate. There are also special requirements for the sensor wiring which must also be strictly adhered to. This is the user's responsibility. Also note the EC type test certificate, operating instructions and the technical data sheet.

For safety applications

In industrial automation applications safety-related areas are safeguarded for the protection of persons. The units developed for this purpose meet the current EN 954-1 and IEC 61508 standards. Previously safety-related sensors had to be wired separately. With the development of Safety at Work it is possible to transfer safety-related and "standard" signals via one bus system, in this case AS-interface.

CE	With the CE marking the manufacturer documents that the units sold by him adhere to the European directives for specified electrical equipment.
Ecolab	The company Ecolab, formerly Henkel ecolab, is the market leader in the area of industrial cleaning agents. In a test laboratory the product manufacturers for the food industry can have their products tested for resistance to cleaning agents. ifm has obtained ecolab test certificates for sensors and AS-i components.
Ex	The units of the categories 1 and 2 have been tested and approved by a notified European body (e.g. PTB, EXAM) for use in hazardous areas.
UL / CSA or cULus / cЯUus	Units with this marking meet the requirements of UL (Underwriters Laboratories Inc.) and CSA (Canadian Standards Association). In many cases this approval is necessary to access the North American market. cULus is a combined approval and corresponds to the two individual approvals CSA and UL.

The AS-interface (AS-i)

The actuator-sensor interface (AS-i) sets new technological standards in the design and automation of installations. This leads to economic advantages for the OEM and the user for project management, commissioning and maintenance of machines. In contrast to conventional fieldbuses AS-i has a finely granulated structure and can therefore be integrated even into proximity switches.

AS-i considerably reduces wiring complexity since conventional parallel wiring of each sensor or actuator to the controller is no longer necessary. This saves the user a great number of terminals, splitter boxes, input / output cards and cable lines.

Wide selection of connection options

Via its field connections AS-i allows low-cost connection of conventional devices. Up to 248 binary sensors and 186 actuators can be connected per AS-i line. It is also possible to integrate sensors with bus capability into the system at any time. These sensors with integrated AS-interface supply more information to the controller without the need of additional wiring. Therefore this latest sensor generation is also referred to as intelligent sensors.

Voltage supply and data via one cable

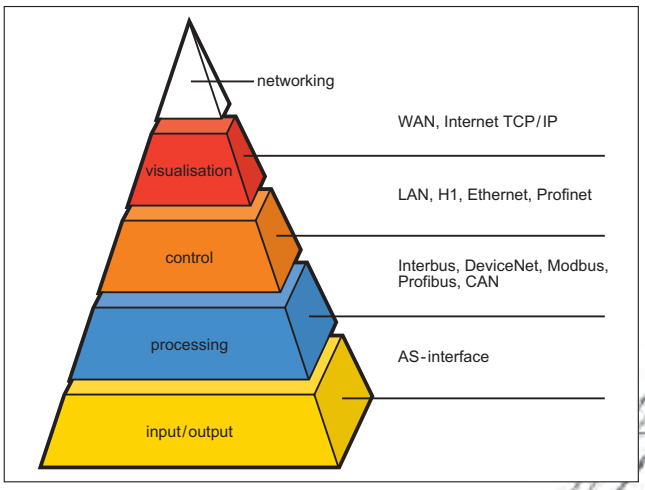
Voltage supply and data communication of all sensors are normally performed via a (yellow) AS-i cable. For some modules actuators can also be supplied via this cable. If a higher output current or emergency stop switch-off is required, actuators are supplied via a second black flat cable with a separate 24 V auxiliary voltage.

AS-i in the automation pyramid

AS-interface has established itself at the lowest automation level, it is located below the fieldbuses. The strengths of AS-i are its simple structure, speed, quick wiring and price / performance ratio. It can be used as a feeder bus for higher bus systems, they in turn then ensure a non time critical transmission of the data over longer distances to the host controller.

At the Ford plant in Düren AS-i controls the production process at a bolt jointing machine. Valves and proximity sensors are connected via the conventional modules. There are special requirements for laying the AS-i cable as a drag chain. Cost savings compared to conventional wiring: approx. 25%.

AS-i is designed for the lowest fieldbus level, i.e. for direct connection of sensors and actuators.



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Master

Master as the central part

The AS-i operation, i.e. the communication with the slaves is continuously monitored and controlled in the master. These management functions are directly carried out at the hardware level of the master without a higher level of input being required from the user via programming. At the same time the binary information of the actuators / sensors is supplied to the higher-level control system (plc, PC, NC) via an interface. The data from the system's inputs and outputs are presented in exactly the same way from the AS-i system as it would be from standard I/O modules thus programming in the control system remains unchanged allowing existing programs to be further used. Here the practical conception of AS-i can be clearly seen.

Single-master system

AS-i allows exactly one master per system. This master polls all participants cyclically. Its location in the AS-i tree is unimportant because every participant has its individual address. This address is stored non-volatilely in an EEPROM in every slave. The single-master system ensures constant defined cycle times which depend on the number of the participants and are 5 to 10 ms with the maximum capacity of the system.

Depending on the application there are different options for connecting the actuator-sensor interface to the higher-level control system (host):

plc master

Using the AS-i plc master card the controller CPU can directly access the AS-i periphery. The AS-i master and CPU normally communicate via the internal plc bus which is also used for the exchange of data by other interface connections, e.g. the input / output modules. This ensures a quick exchange of data and compatibility with existing plc programs. So the user can further use his existing software.

Gateway to higher systems

AS-i is designed as actuator-sensor-interface for binary participants. Therefore, couplers (so-called gateways) to higher-level bus systems (e.g. Profibus-DP) specially designed for larger data volumes are available. On the one hand, the gateway consists of an AS-i master which establishes the connection to AS-i and on the other hand of a connection to the higher-level system to which the AS-i data are transferred. Concerning programming the AS-i master is treated like a participant of the higher-level bus. Examples of gateways are the ***controller*** family.

PC master

The AS-i master card for the PC provides the full functionality of the PC (visualisation, process control, collection of data) in combination with the actuator-sensor-interface. The PC in its industrially compatible design and due to falling prices is increasingly used in automation technology as part of the machine control. Here the advantages of AS-i can be directly integrated into the system. The user can program in a high-level language by using the specific AS-i driver which ensures communication with the master card.

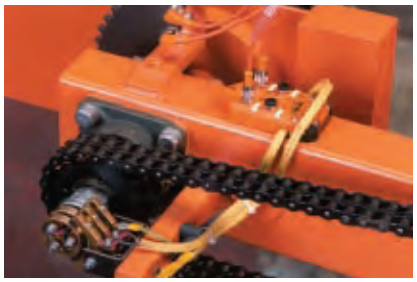
At the Deutsche Shell AG in the plant Grasbrook over 2,000 valve actuators are networked via the AS-interface.

Master profiles

Different profiles characterising performance have been defined for AS-i masters.
For the further development of the slave functions the "new" functions have also been integrated in the master profiles. The following table shows the compatibility between master and slaves. The master profiles can be found in the data sheet.

Profile	Functionality
M0	cyclical data exchange, only binary data, no extended addressing mode
M1	like M0, in addition analogue data and acyclical AS-i parameters
M2	cyclical data exchange and acyclical AS-i parameters
M3	like M1, complemented by the extended addressing mode (62 slaves), analogue protocols S-7.3x and S7.4 x.
M4	like M3, complemented by data protocols for byte transmission

AS-i characteristics	
Topology (wiring)	tree structure, line, line with spurs, ring, star
Medium	unscreened two-wire cable (e.g. H05VV-F2 x 1.5; AS-i flat cable)
Signals	data and energy via one cable, max. 8 A
Cable length	100 m, expansion via repeaters possible
Number of the slaves per line	up to 62 slaves
Useful data per slave	4-bit data (cyclical, 4-bit parameters (acyclical), 4 bits with data protocol (multiplex)
Number of the binary I/O (cyclical)	124 I/O (single slaves), 248 I + 186 O (A/B slaves)
Analogue value processing	channels possible via the slave profile S 7.3
Number of the analogue I/O (acyclical)	124 words
Data transmission, parameter setting	several bytes, unidirectional / bidirectional
Number of the masters / lines	optional via multimaster, controller or gateway
Cycle time	5...10 ms
Access method	cyclical polling, single-master system
Addressing	permanent, clear address in the slave
Fault detection	identification and repetition of corrupted messages



Due to the safe unscreened data transmission AS-i can transfer signals even via slip rings.

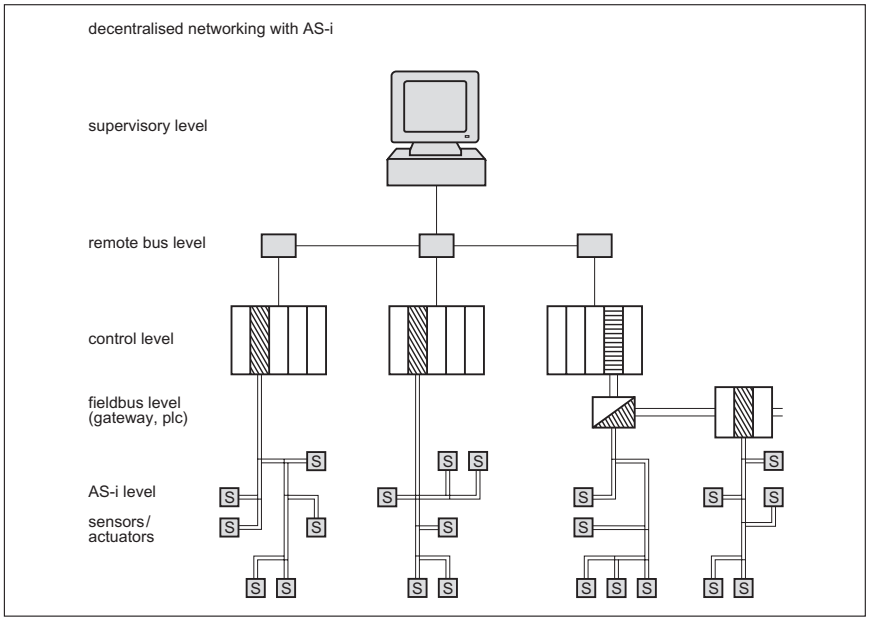
Decentralised automation

Practical people have long since seen the advantages of decentralised automation. Whereas a few years ago the tendency was to controllers becoming bigger and bigger and more and more powerful for the central control of an installation, the tendency is now to distributed solutions. Important functions are immediately processed locally in a small decentralised controller. Only important information is then transmitted to a central processor.

The advantages of such solutions are obvious:

- Shorter and clearer programs, thus easier commissioning of plant sections.
- Less downtime because if individual stations fail the installation continues to operate on a restricted scale.
- Reduced cabling, exchange of data between the controllers via bus systems.
- Easier, quicker mounting and expansion options.
- Consistent project management and programming due to the common standard of the "Automation Alliance".

Due to its easy structure AS-i is an excellent choice for being used between sensors / actuators and decentralised controllers.



Decentralised networking with AS-i.

Possibilities of slave addressing

In addition to the tried and tested conventional (offline) addressing method of the AS-i slaves there are further technologies which allow addressing of the units after mounting:

1. via a mechanical addressing socket or
2. via an infrared addressing interface.

Thus all AS-i components can be mechanically preinstalled without special preliminary knowledge. Addressing can then be carried out later on as described in the documentation.

Using the addressing unit the slaves can be easily programmed via cable.

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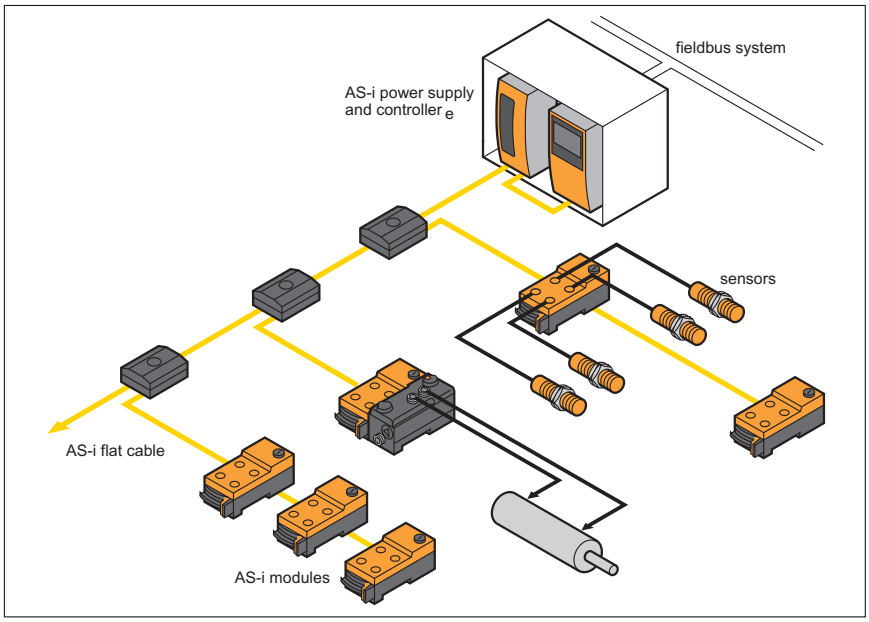
Basic system structure

The minimum configuration of an AS-i system consists of the master, an AS-i power supply and the slaves. If needed, the user can also connect safety monitors, repeaters, earth fault monitors or other diagnostic tools to the AS-i network.



Basic structure of an AS-i system.

AS-interface version 2.1

2.1 + 3.0

In 1999 the AS-International Association improved its tried and tested industrial standard AS-Interface by some important features. This is called version 2.1. As the designation suggests, these features are downward compatible. For the user this means the investments he made are protected since all existing AS-i slaves can be further used under version 2.1. So the physical bus structure and the protocol have remained unchanged since 1992. At the end of 2004 a downward compatible extension, AS-i 3.0, was agreed. This new version describes a new slave generation with serial data transmission and other special applications. The AS-i specification 3.0 comprises all former specifications (2.0 and 2.1).

The most important new features of the version 2.1:

- Qualified diagnostic options, peripheral fault bit
- "plug & play" for analogue participants
- Increase of the number of participants from 31 to 62
- Extended ID code in the slave.

The most important additions of the version 3.0:

- asynchronous, serial protocol
- A/B slaves with 4 inputs and 4 outputs
- several slaves in one unit
- parameter setting possible

A master compatible with AS-i 2.1 and / or AS-i 3.0 is required to utilize the new features. At ifm this is the ***controller e***. The slaves must also support these functions. More details are given on the product pages.

Peripheral faults

The master distinguishes between communication errors and peripheral faults. Peripheral faults are indicated with a red LED at the module. A peripheral fault can for example be a short circuit in the sensor cable. In addition, a list is automatically generated in the master, the LFS (List of Faulted Slaves) so that it is also possible to evaluate faults via the user program. The advantage is an exact location of faults and easy maintenance of the installation. The slave signals communication errors by the red fault LED – e.g. if the slave was not addressed.

Analogue slaves

Until now software blocks have been necessary in the application program to enable the exchange of data of for example 12-bit analogue signals via the 4-bit AS-i data channel. To do this required some specialist knowledge and software for the controller environment used. A further disadvantage was a slower data transmission due to the plc cycle time.

Because of this and at the request of many customers AS-International entrusted a study group with the task of making the integration of analogue slaves more user friendly. The result is now available in the version 2.1. It allows real "plug & play" also for analogue modules.

62 participants at AS-i

Two slaves can now share one address. This can be seen with the ID code "A". The addresses for A and B slaves are then for example 10A and 10B. In the first AS-i cycle all A slaves are called, in the following cycle all B slaves. For the selection of the B slaves the 4th data bit is used so that the following configurations of A/B slaves are technically feasible: 4DI, 2DI / 2DO, 3DI / 1DO, 1DI / 3DO, 4DI / 3DO.

Furthermore, "single slaves" can be used in the addressing area 1 to 31. A version 2.1 slave can be programmed with the hand-held addressing unit as A, B or single slave by the user. The slave selection is done by the master via an output (select) bit. Version 2.1 slaves with extended addressing mode can also communicate with the older version 2.0 masters if they are programmed as A slaves.

Extended ID code

The existing slave profiles consisting of ID code and I/O configuration remain unchanged. The ID_Code_1 and ID_Code_2 have been added. Two additional 4-bit registers are available. The ID_Code is used, for example, to indicate whether there is an A/B slave or analogue module.

The ID_1 register can be used in a customer-specific manner. The user can for example code the current rating of motor starters to ensure that, in case of a failure, only an identical replacement unit is fitted.

Depending on the slave profile the ID_2 has different meanings.

Example of the ID code 2 for analogue slaves

Bit 3	Bit 2	Bit 1	Bit 0	Meaning
–	–	0	0	one-channel slave
–	–	0	1	two-channel slave
–	–	1	0	four-channel slave
–	–	1	1	four-channel slave (for slaves without ext. ID code)
–	0	–	–	transparent exchange of data
–	1	–	–	analogue value transmission
0	–	–	–	output slave
1	–	–	–	input slave

AS-i slave profile

The profiles mainly decide on the compatibility of the AS-i components. The profile consists of two figures separated by a dot. The first figure indicates the I/O configuration, the second the identification code (ID code). This profile must be specified in the data sheet.

Both configuration and ID code are permanently stored in the slave by the manufacturer. To do so, 4 bits each are available. These bits can be read via corresponding commands.

It would of course be conceivable to assign all 16 possible combinations. But to ensure that the AS-i system remains open for further developments in the future the combinations are used sparingly.

It is important that when the information is defined the measuring method or operating principle is not restricted. So it is possible at any time to replace for example an inductive proximity sensor by a photoelectric sensor.

The I/O configuration describes the direction of the data bits as input or output or bidirectional.

The profiles are made from the I/O configuration (1st position) and ID code (2nd position). They also supplement the I/O configuration by defined contents of the data and parameter bits, if any.

The contents of the profiles are determined by the AS-i association if necessary. There is for example a standard sensor profile (S-1.1) or an analogue value profile S-7.3.

The introduction of AS-Interface 2.1 extended the profile by a third digit, the ID_2_Code. It indicates for example whether a slave supports the peripheral fault.

AS-i 2.1 and 3.0 profiles of type S-7.3.E serve the master as support of units of similar design when exchanged.

They can also be read by the addressing unit.

The current profiles can be found on the official website of AS-International: http://www.as-interface.net.

I/O configuration (for the ID code = 0):

I = input O = output B = bidirectional

Bin	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Dec	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Used	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–
D0	I	I	I	I	I	I	I	B	O	O	O	O	O	O	O	–
D1	I	I	I	I	I	O	B	B	O	O	O	O	O	I	B	–
D2	I	I	I	O	B	O	B	B	O	O	O	I	B	I	B	–
D3	I	O	B	O	B	O	B	B	O	I	B	I	B	I	B	–

ID-Code

The ID code shows whether a slave has no profile (F hex), whether there are decentralised peripheral modules (0 hex) or defined intelligent sensors, actuators or modules (1 hex).

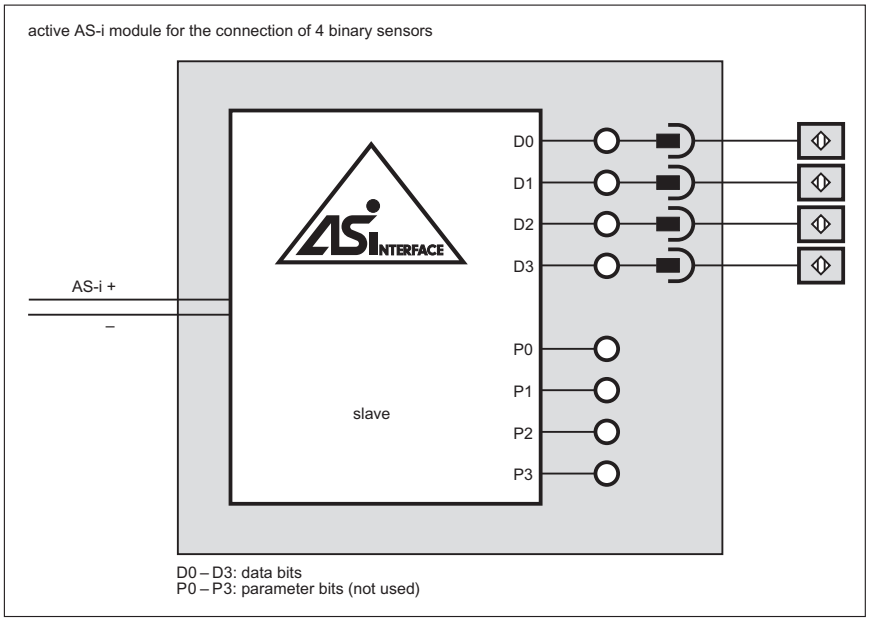
Bin	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Dec	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Used	•	•	•	•	•											•

AS-i as a practical system

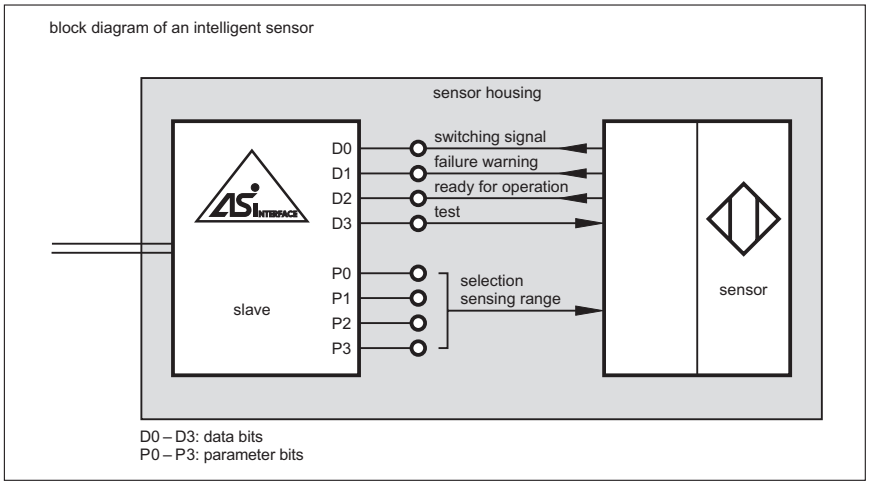
AS-interface offers new methods for implementing a system. On the one hand there are conventional I/O modules much like other bus systems, however one difference with AS-i is that it works in much smaller blocks of I/O due to its structure being dividable by 4. This offers the chance to implement a decentralised system where the bus connection comes to the sensor and not vice versa.

On the other hand due to each AS-i slave being only 4 bits, direct integration of the AS-i connection into the sensor or actuator is possible without high redundancy of I/O. This certainly is the future. Thus only the bus cable, here the AS-i flat cable, and the energy cable, e.g. 400 V three-phase current and compressed air, if any, are laid through the machine. Specially in the special machine construction and conveying this flexible installation is an excellent choice because the control cabinets can be considerably reduced and no space must be reserved any more.

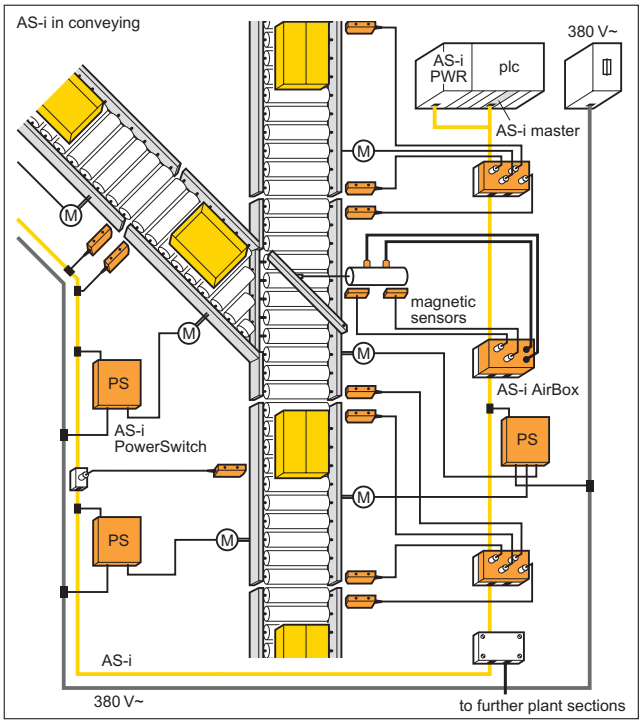
In the ifm logistics centre in Essen all sensors in the conveyor are connected to the higher-level controller via AS-i.



Active AS-i module for the connection of four binary sensors.



Block diagram of an intelligent sensor.



AS-i in conveying.

The AS-i message

The AS-i master uses a very simple message to communicate with the connected slaves. Due to an overhead restricted to what is necessary AS-i achieves short cycle times of e.g. 5 ms for 248 inputs and outputs to be scanned. Per cycle the AS-i message is repeated 31 times, in the extended mode 62 times.

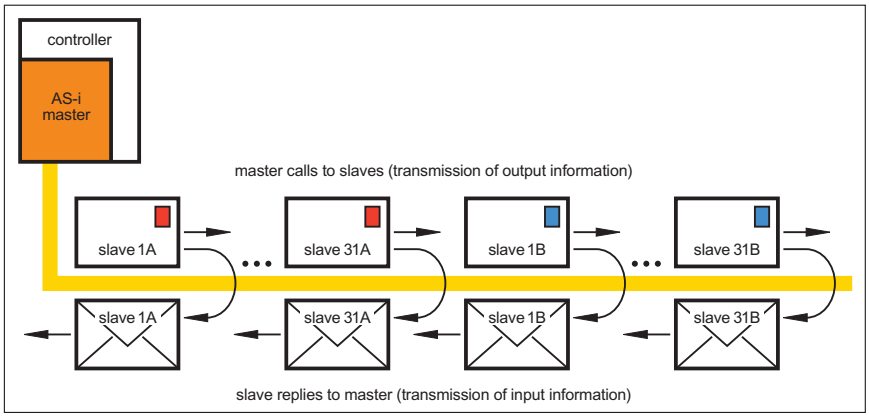
Master call:

ST	SB	A4	A3	A2	A1	A0	I4	I3	I2	I1	I0	PB	EB

Slave reply:

ST	I3	I2	I1	I0	PB	EB

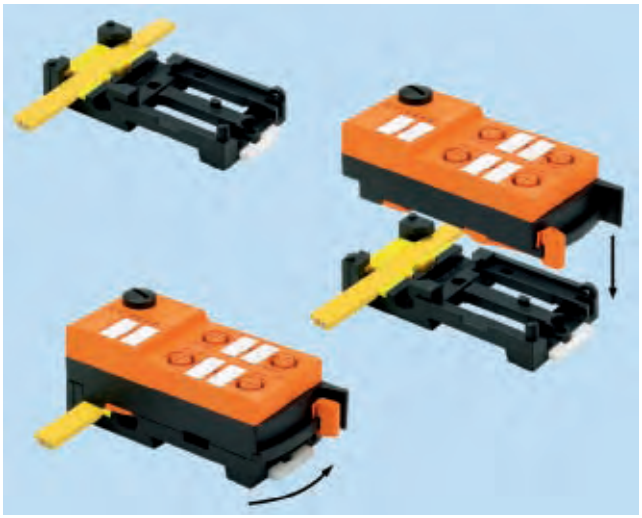
A4...A0 = address of the slave
I4...I0 = information part
ST = start bit
SB = control bit
PB = parity bit
EB = end bit



AS-i cycle with A/B slaves.

The AS-i flat cable concept

AS-i is the only bus system which has been developed for unscreened two-wire cables. Due to the standardised yellow flat cable installation can be carried out without cutting, stripping and wiring the cable. Branches and spurs can be made at any point, also subsequently.



Quick mounting technology: This technology guarantees fast, toolless and at the same time very secure mounting.

One AS-i flat cable instead of many parallel cables: In a brewery the interface serves to transfer the sensor signals to the higher-level controller.

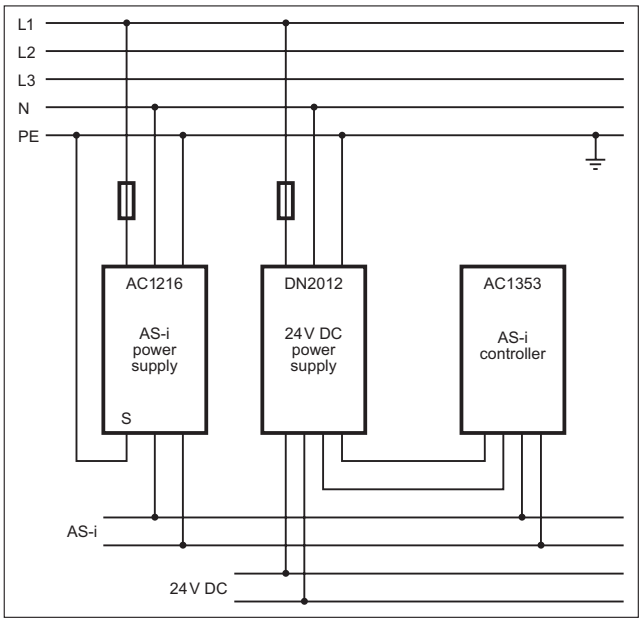
Project management, planning, documentation

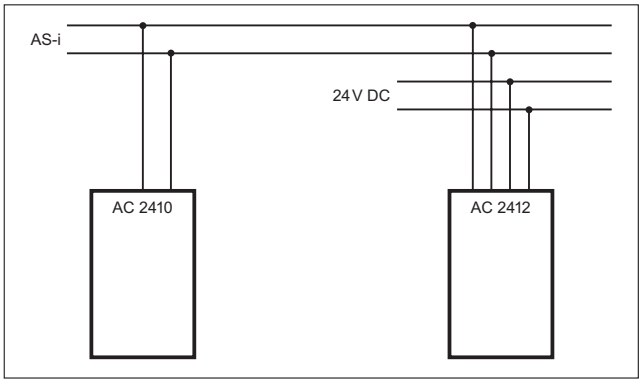
For planning and project management of installations using AS-i the following conditions must be adhered to:

- Slave addresses of 1...31 per master.
- More slaves due to further AS-i networks or fieldbus gateways (e.g. controller e).
- Cable length 100 m, another 100 m per repeater.
- Binary devices can "share" one address, 1A...31A and 1B...31B, this results in up to 248 inputs and 186 outputs per master.
- Up to 4 analogue channels per slave, inputs or outputs.
- Keep addresses free when safety monitors are used.
- One or two safe sensors (e.g. E-stop) per slave, depending on the category.
- Cycle time 5 ms for single addresses, 10 ms for A plus B address.
- Intelligent sensors at places where extended diagnosis is needed.

A rule of thumb to calculate the power supply rating is given on the next page.

Safety at work is designed for safety-related applications. Here an E-stop implemented with AS-i.





Example of a plant documentation.

In 4 steps to the AS-i network

Step 1: Selection of the suitable power supplies.

AS-i power supply

For the voltage supply a special AS-i power supply must be used. In contrast to conventional power supplies it includes the necessary data decoupling. ifm supplies the units in different power classes. The required rating can be determined as follows:

$I_{AS\text{-}i\ total}$ =

number of slaves x current consumption per slave (typ. 35 mA)
+ number of module inputs x max. input current typ. 5 mA
+ number of sensors x individual current consumption
(e.g. 10 mA / inductive sensor, 35 mA / photoelectric sensor)
+ current for master analogue part (typ. 60 mA)
+ 10% safety margin (e.g. for heating)

The current consumption for each slave is stated on the product pages:

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input current / module [mA]	Total output current / channel [A]	AS-i profile S -	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
4 DI	–	yes	–	200	–	0.A.E	<250	1	**AC2250**
4 DI	4 DOT	yes	yes	200	1 (4)	7.0.E	<250	1	**AC2251**

The current output of the power supplies is also stated on the product pages:

Output current 1 [A]	Output voltage 1 AS-i [V]	Output current 2 [A]	Output voltage 2 [V]	Output voltage 2 AS-i [V]	Nominal voltage [V]	Draw-ing no.	Order no.
AS-i switched mode power supplies							
4	28.5...31.6 DC	4	–	28.5...31.6 DC	115 / 230 AC	4	**AC1224**
2.8	28.5...31.6 DC	6	24 DC	–	115 / 230 AC	8	**AC1209**

Here is an example calculation to determine the suitable power supply:
(25 modules 4I/4O, per module two inductive and two photoelectric sensors)

$I_{AS\text{-}i\ total}$ = (25 x 35 mA) + (25 x 4 x 5 mA) + (25 x 2 x 10 mA) + (25 x 2 x 35 mA)

$I_{AS\text{-}i\ total}$ = 3,625 mA x 1.10 = 3.987 A

-> selected AS-i power supply: 4A.

Or the rule of thumb is used:

$I_{AS\text{-}i\ total}$ ⊕number of modules x 150 mA

24 V power supply to supply the actuators

The actuators are supplied via a separate 24 V power supply with current (black auxiliary power cable). To calculate the required power supply rating simply add the current consumption values of the actuators:

Sum of the load currents (actuators):

(e.g. 10 valves with 5 W each, 5 valves with 3 W each, 10 lamps with 45 mA each)

$I_{24\ V\ total}$ = 10 x 5 W / 24 V + 5 x 3 W / 24 V + 10 x 0.045 A = 3.16 A

-> selected 24 V power supply: 4A.

Step 2: Addressing of the slaves.

The addresses are best assigned using the hand-held addressing unit AC1144. The order of the devices at the AS-i cable is independent of the address assignment. However for a simplified fault location addresses should be spatially arranged according to their functionality in the application (functional units). Normally addressing is performed before mounting.

The AS-i slaves (modules, intelligent components) receive an address from 1 to 31 (or 1A to 31A and 1B to 31B in the extended addressing mode). The AS-i master does not have an address. When addressing special care must be taken to avoid double addressing.

In principle slave addressing can be done in four ways:

1. Lower parts with addressing socket (and SmartLine modules)
This technology is suitable for addressing after mounting the modules. Later, even while voltage is applied to the yellow cable, an addressing cable is inserted into the addressing socket which interrupts the communication between the AS-i slave and the master and establishes a direct connection to the addressing unit.

2. Infrared addressing
Some modules can be addressed using a special infrared adapter – also without removing the slaves. To do so, the master must be switched "offline" so that no data are exchanged via the bus. This can be done by disconnecting the master from the AS-i line or by inserting the addressing jumper at the AS-i power supply into the position "IR Addr. on".

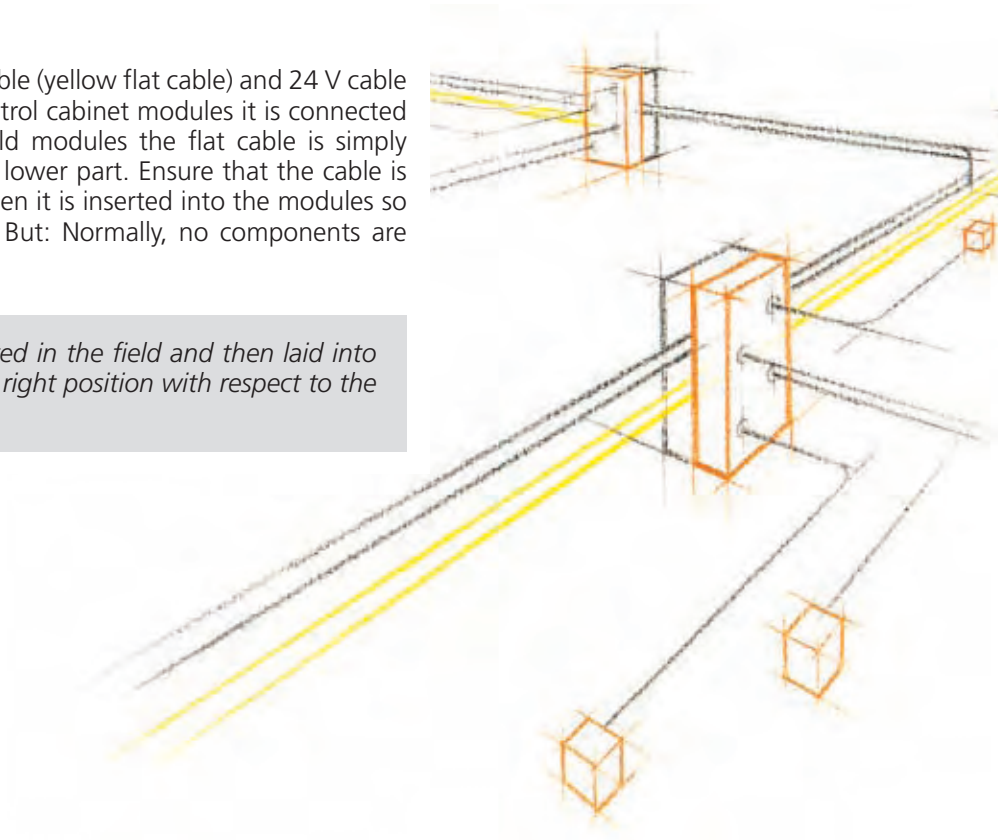
3. "Conventional" addressing before mounting
Using this conventional method all slaves are addressed with the hand-held unit AC1144 before mounting, labelled and then mounted according to the plant layout. This method requires special care because it is absolutely necessary to adhere to the mounting location of the modules in the AS-i network.

4. Addressing with the ifm *controller*
It is also possible to address the slaves directly from the controller. How to do this is detailed in the operating instructions of the controller.

Step 3: Mounting, installation.

After mounting the modules the AS-i cable (yellow flat cable) and 24 V cable (black flat cable) are connected. For control cabinet modules it is connected to the corresponding terminals, for field modules the flat cable is simply inserted into the cut-out in the module lower part. Ensure that the cable is correctly placed (mechanical coding) when it is inserted into the modules so that everything works fine afterwards. But: Normally, no components are damaged when the polarity is reversed.

Tip: The flat cable should first be wired in the field and then laid into the control cabinet so that it is in the right position with respect to the modules!



Special care must be taken to place the cable into the carriages for the lower parts to ensure a good contact. The carriages have the same colour code as the flat cable (yellow = AS-i, black = 24 V DC).

Core colours

Yellow AS-i cable:

A+	AS-i plus pole brown
A–	AS-i minus pole blue

Black auxiliary voltage cable:

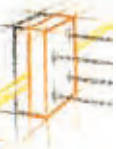
E+	24 V plus pole brown
E–	24 V minus pole blue

In the control cabinet the yellow AS-i cable should be laid uninterrupted to the AS-i power supply. The master is connected in parallel (blue = AS-i–, brown = AS-i+). If further input / output modules are to be used in the control cabinet, separate wiring (spurs) is recommended, starting from the AS-i power supply.

Caution: The AS-i minus or plus poles must not be connected to ground at any point. Only the shield / GND connection at the AS-i power supply must be grounded! Input and output potentials have reference to the related AS-i module. Mixing reference potentials over several modules is not allowed.

Step 4: Configure the master automatically.

After all slaves are correctly connected and addressed, the last step is carried out. The master must be informed which slaves must be present for a system to operate (list of the projected slaves LPS). This is done by the automatic configuration (for the plc master for example by pressing a button, for ifm controllers conveniently via the menu). In this process the AS-i master briefly passes to the projection mode, reads the current projection of all connected slaves and saves it permanently.



Projection mode = master communicates with all slaves, e.g. during commissioning. Missing slaves are not indicated.

Normal operating mode = master only communicates with slaves from the LPS. Missing slaves are indicated.

Finished – that's all!

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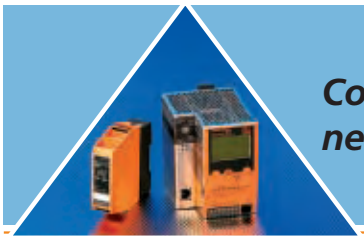


Controllers / Gateways, network extension

ecomat300

Controllers / Gateways · Introduction

AS-i controllers, gateways, masters and repeaters are elementary components of AS-i networks. These components are most of the time placed in the control cabinet and ensure data communication, extension and power supply of the connected slaves, sensors and actuators.

AS-i master

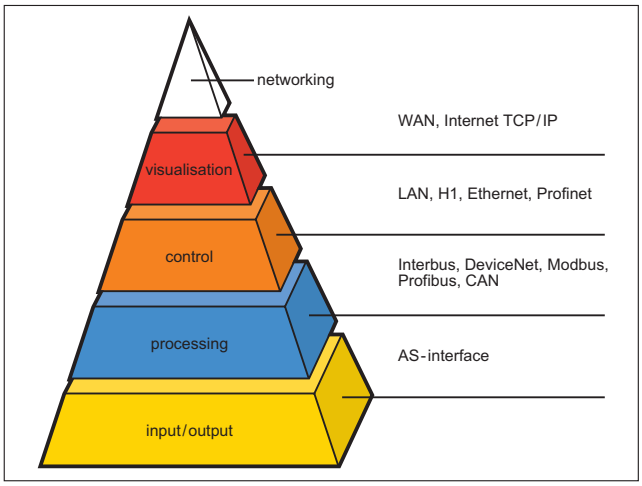
The master, as its name suggests, performs the most important function in every AS-interface network. It is responsible for the control of the complete communication. AS-i is a single master system. This means that max. one master is permitted at a time. The master controls the cyclical data transfer with the connected slaves, monitors the replies and makes the data available to the host. The host most of the time consists of a plc or an equivalent controller processing the AS-i data.

Gateways

AS-i gateways, also called couplers, connect the AS-interface to a higher-level bus system. Thus, the advantages of both systems can be combined. The advantages of AS-i as the bus of the first automation level are its easy handling, fast data transmission, low costs and quick mounting technology.

Via fieldbus gateways, e.g. to the Profibus DP, several AS-i installations can be connected to a control room over greater distances, e.g. in a mounting hall. As the fieldbus is most of the time considerably slower, decentralised data preprocessing in the gateway is often required. Here ifm electronic offers the AS-i ***controller*** family as gateways with integrated plc.

The automation pyramid.



Controller family

In the ifm ***controller e*** family the components AS-i master, controller and fieldbus or serial interface are integrated into one unit. This high integration density enables very short cycle times between the AS-i master and the plc. The optionally mounted fieldbus slave can be configured in such a way that only the required AS-i data are transmitted, so that the fieldbus is not strained unnecessarily. In addition to the AS-i data, parameters and error messages all analogue values can also be gradually transmitted via a command channel.

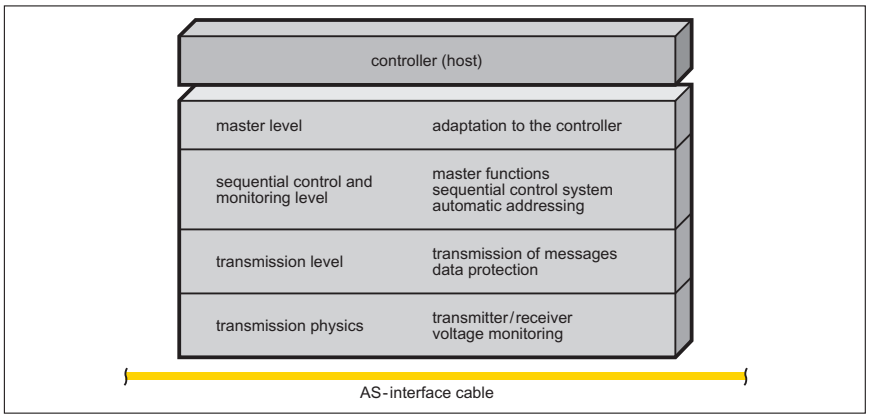
Controller e family.

Structure of the AS-i master

In principle the AS-i master consists of four levels (see figure "Structure of the AS-i master"). The lowest transmission level includes the analogue part responsible for the quality of the data messages and the pulse shape on the yellow cable. This analogue part is supplied with current from the AS-i cable. This current is considered in the total calculation of the AS-i power supply.

The transmission level is responsible for the exchange of individual messages with the slaves. The master cyclically detects all AS-i slaves in a rising addressing order. Detection takes 5 ms for 31 slaves or max. 10 ms for 62 slaves. The order of calls cannot be changed by the user.

Via the master level data are directly available for the programmer, most of the time in a common memory area (DP-RAM). In general no further software calls or function blocks are necessary.

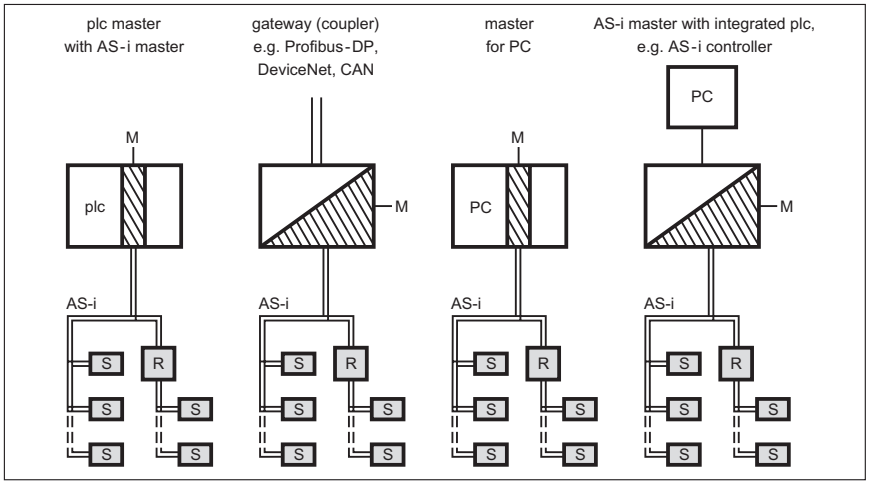


Structure of the AS-i master.

Examples of AS-i masters

AS-i masters are available in different versions depending on the used controller:

- Master as PC plug-in card
- Master as plc plug-in card
- Master as fieldbus gateway
- Master with integrated plc



Different master variants.

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Master according to the AS-i specification 2.1

By now there are masters in addition to the tried and tested AS-i specification 2.0 masters, e.g. the ***Controller e*** family with AS-i 2.1. The most important common feature of these two variants is their full compatibility. New AS-i functions have been implemented in version 2.1, these can however only be used with 2.1 slaves. All 2.0 slaves can be perfectly operated from 2.1 masters. Vice versa, pure data communication is only downward compatible. All other functions can however not be evaluated by the 2.0 master. The correlation is demonstrated in the following table.

The slave profile of the AS-i specification 2.0 consisted of 2 positions (e.g. S.7.0). In specification 2.1 these have been complemented by further ID codes (e.g. S-7.A.E). These codes can also only be evaluated by masters type 2.1. The "missing" third position in older slaves is filled up with the value "F" (hex).

Compatibility of master and slaves.

AS-i slave-specification	Function	Master 2.0 M0, M1, M2 profiles	Master 2.1 M3 profile	Master 3.0 M4 profile
2.0	slaves without extended addressing mode	31 slaves	31 slaves	31 slaves
2.0	analogue slaves with the profile S-7.1 or S-7.2	with function block	with function block	with function block
2.1 + 3.0	slaves without extended addressing mode	31 slaves	31 slaves	31 slaves
2.1 + 3.0	slaves with extended addressing mode	31 slaves (A slaves)	62 slaves (A and B slaves)	62 slaves
2.1 + 3.0	peripheral faults	not evaluated	yes	yes
2.1 + 3.0	analogue slaves with the profile S-7.3.x or S-7.4.x	possibly with function block	directly connectable, without function block	directly connectable, without function block
3.0	slaves with special functions, e.g. serial data transmission	possibly with function block	possibly with function block	directly connectable, without function block

Commissioning of the master

The AS-i system is designed as a self configuring system, it can thus be commissioned without software. As the data quantity is fixed to 4 bits per AS-i slave the master can read a connected network and permanently save it as preset configuration (LPS, list of projected slaves). This can be done without any software. For this reason a lot of masters feature only one pushbutton "Config all" or a convenient display which also allows addressing of the slaves.

Diagnosis

For extended AS-i diagnosis the controller e family has a full graphic display with four operating keys. In addition some software tools are integrated. These allow local diagnosis at the plant in addition to the centralised error message sent via the fieldbus for evaluation in the control room.

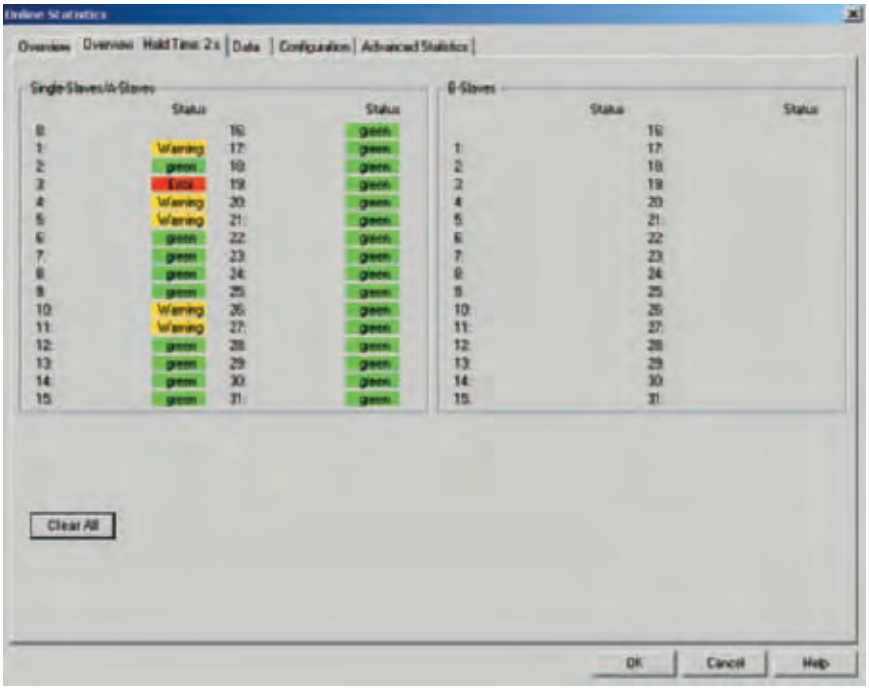
The display indicates:

- Slave lists (detected, projected, activated slaves)
- Peripheral faults
- Configuration faults
- Faulty messages
- Safety slaves
- Slave addresses

The full graphic controller e display.

A detailed diagnosis of the AS-i bus is also possible by using an external unit, the **eASi tester**. This unit is optimised for the needs of service, commissioning and maintenance staff. It is connected to the bus cable in parallel without stopping production. The supplied software enables assessment of the quality of the data messages of all connected slaves on a connected PC or notebook. The ratio between all messages and the number of repeat messages is shown clearly.

When inverters are earthed for example, success can be checked when the bus system is running.



Screenshot "Software eASi tester"

Network extension · Introduction

The classic AS-i bus is designed for a cable length of 100 metres. Experienced users have found out that often systems with 130 metres and more function without any problems. However, AS-i has a free topology so that there is no general installation rule for these 100 plus "x" metres. In many cases long , non-terminated cables cause reflections which overlay the AS-i messages and cause faults and message repetitions.

There are several solutions for an extension by a further 100 metres:

1. The **termination plug** at the end of the long cable minimises reflections. In case of only few participants it should be connected at the end of the cable since the voltage drop there increases with the connected load. Another advantage of the bus termination is the improvement of the AS-i message quality for long cables and the use of Safety at Work components.

2. AS-Interface **repeaters** allow the cable length to be extended by a further 100 metres. The number of possible participants remains unchanged. Each repeater has a galvanic separation which divides the network into two segments. Each segment has its own voltage supply. The master segment can thus be supplied with voltage via AS-i power supply 1 and the segment after the repeater via AS-i power supply 2. This principle allows an increase in total current per AS-i network and improves the voltage drop.

A repeater can also be used for safety reasons. A repeater is used to ensure that a short circuit on the secondary circuit has no influence on the primary circuit. AS-i networks can thus be divided into electrically separated segments.

Each repeater has an internal propagation time which adds for series connection. This limits the number of repeaters to be used, see table below.

3. **Dual masters** in the centre of the machine allow an extension of the AS-i cable by a further 100 metres in opposite directions. Distances of 200 metres can thus be linked. One of the advantages is that twice the number of AS-i participants can be connected.

Comparison of network extension methods

There are different ways to extend the AS-i cable. The specified one hundred metres can be extended up to 600 metres in extreme cases. The following table shows the different possibilities and the different methods of cable extension.

Measure	Extension by	Additional power supply = more current from AS-i	Electrical separation	Voltage drop	Max. no. of slaves:	Cost / benefit* per slave (ranking)	Comment
Repeaters	100 m	yes	yes	uncritical	62	6.2 (4)	max. 2 repeaters in series and max. 1 repeater for Safety at Work
Dual masters	100 m	yes	yes	uncritical	124	2.8 (2)	master in the centre
Termination plug	100 m	no	no	critical	62	0.95 (1)	check total current from AS-i and message quality
Tuner	100...150 m	no	no	critical	62	6.13 (3)	check total current from AS-i and message quality

* Formula: (Unit cost / max. number of slaves)

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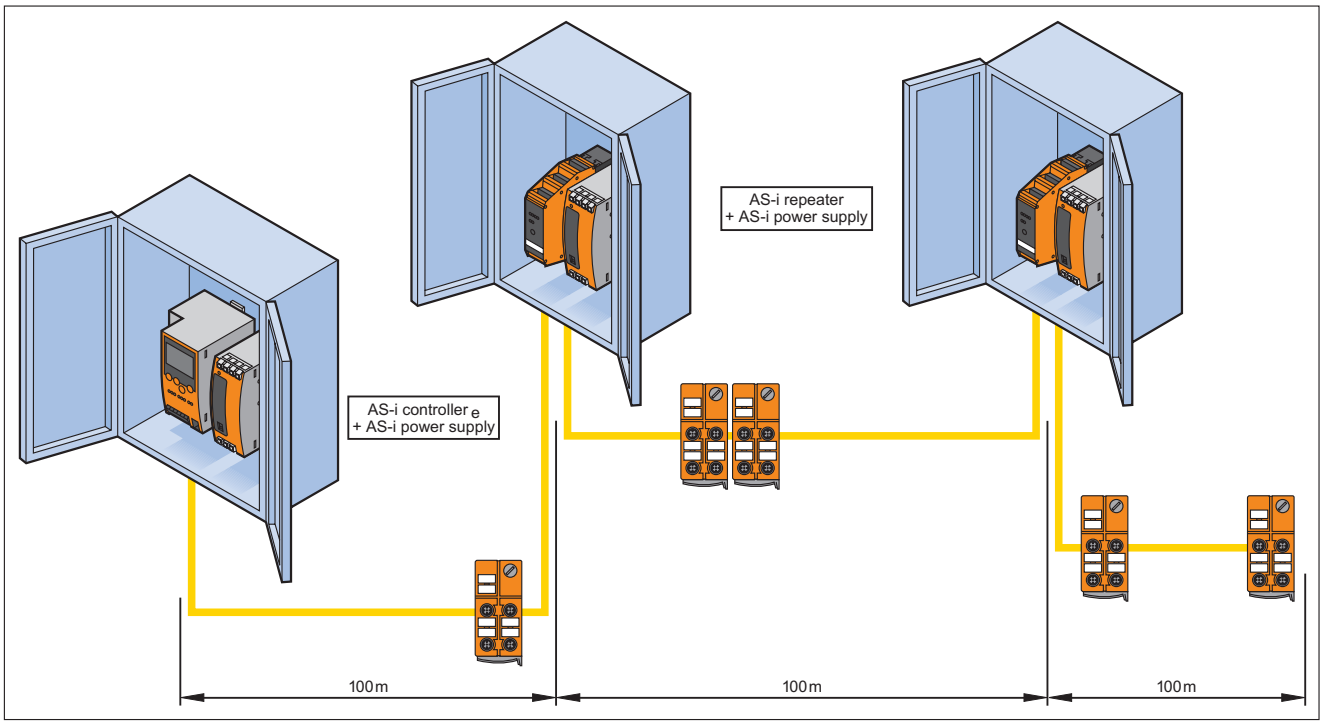
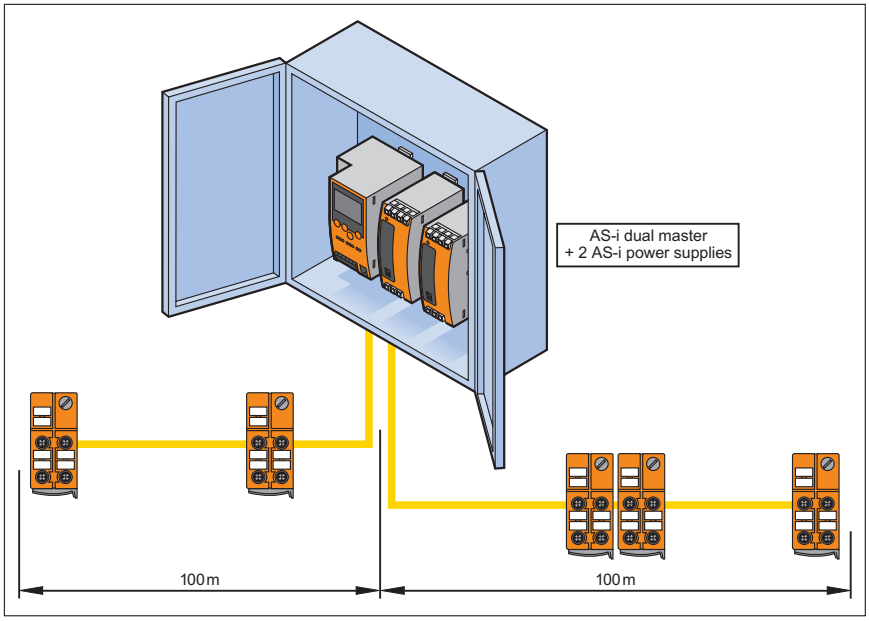
AS-i example 1: Network extension using repeaters

AS-i repeaters can be used in local control cabinets to extend cable lengths and increase the total current. A parallel connection of AS-i power supplies is not possible without repeater. Up to two repeaters can be connected in series.



AS-i example 2: Network extension using dual masters

Instead of repeaters an AS-i dual master can be mounted at the centre. It allows one line of 100 metres in one direction and a second line of 100 metres in the opposite direction. One advantage is that twice the number of slaves can be connected compared to a one master solution.



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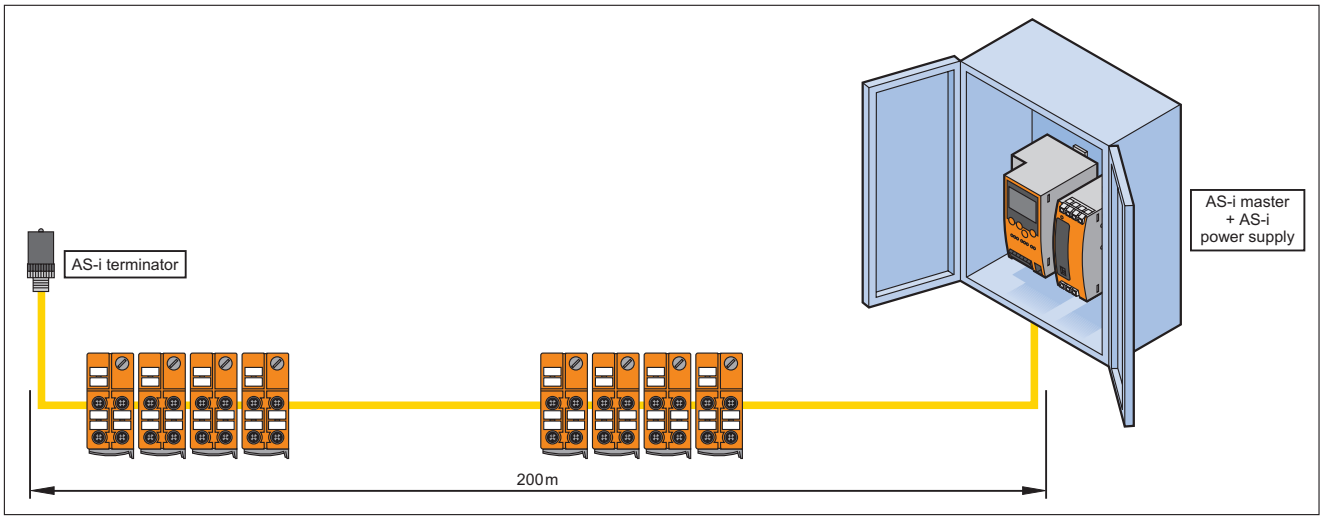
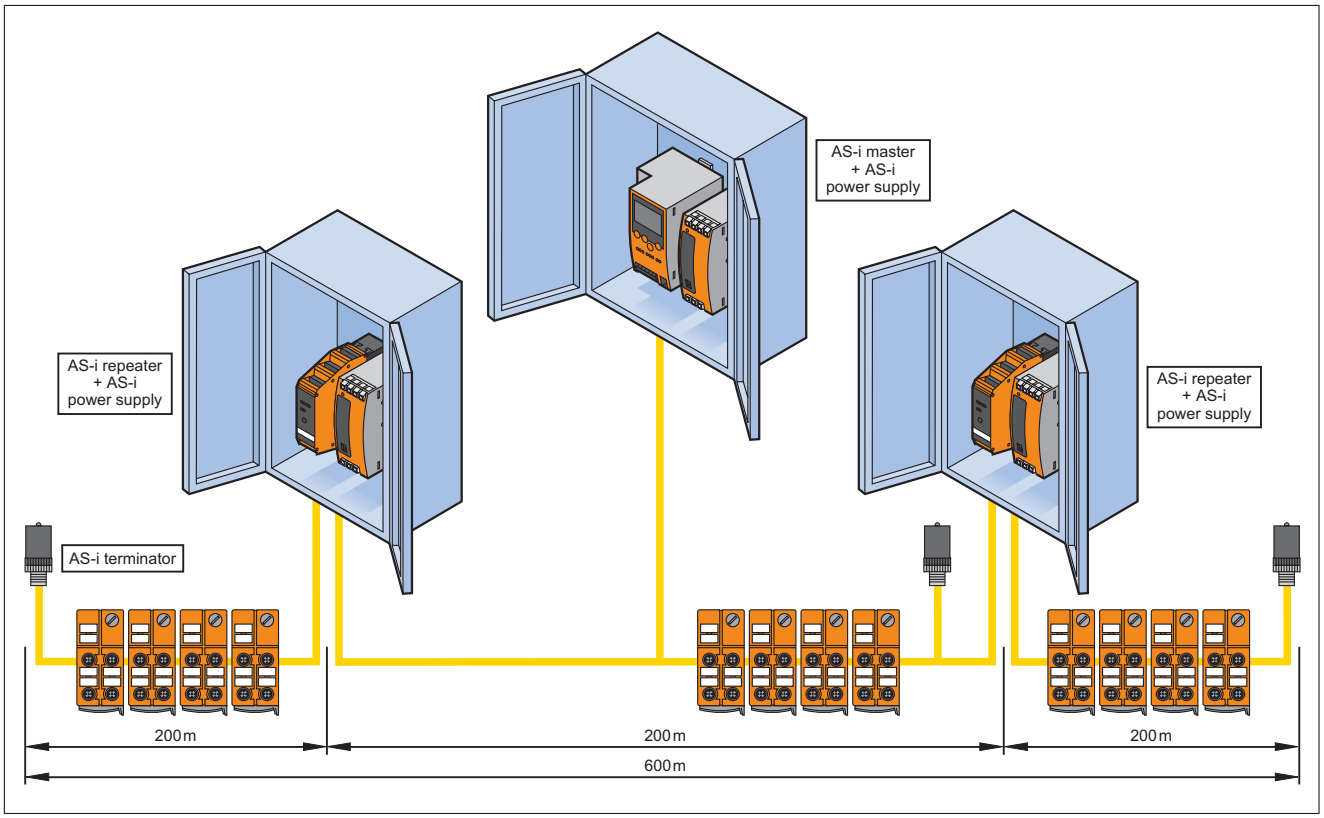
AS-i example 3: Network extension with termination plug

At best the bus termination doubles the length of the AS-i bus cable. However, the number of repeated messages has to be tested by a suitable service unit or via the *Controller* display before and after mounting of the bus termination. This is the only way to document an improvement of the transmission quality.



AS-i example 4: Maximum possible network extension with repeaters and bus termination

The maximum bus length is reached using 2 repeaters and 3 termination plugs. Restrictions can result from the way the cables are laid and the topology. The above-mentioned cable extension configuration is not suited for Safety at Work applications!



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Service units

Introduction

Powerful analysis and service units are available for service, troubleshooting and set-up.

Set-up

The **AS-i addressing unit** can be used for set-up. If only one slave is connected, it is supplied from the unit. In addition to the most important function, the addressing function, AS-i profiles and digital inputs can be read and parameters and outputs can be written. The addressing unit can also be used for an AS-i system with several slaves. The slave to be tested can then be selected. An AS-i power supply has to be used. During the test stage no additional master can be in operation.

Service, maintenance

With the analysis unit, the **eASi tester**, a complete AS-i line can be analysed without stopping the installation. The unit is connected in parallel to the yellow cable and can monitor all AS-i messages for a certain period.

Permanent diagnosis

The **masters with display menu** (***Controller e*** and SmartLink) of ifm electronic can be used for permanent AS-i diagnosis during operation. These units work as stand-alone controllers or gateways and have individual message error counters for each slave. The extended diagnosis of the safe AS-i slaves shows the status of all bus participants to the Safety at Work specification.

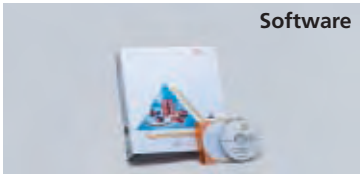
The **AS-i tuner** in the ClassicLine housing can also be permanently connected to the installation. It has two basic functions. The first function allows the setting of an optimum matching resistor for the extension of the cable by a further 100 metres, similar to the passive termination plug. The second function is the bus diagnosis and analysis of the messages. The quality of the data communication is permanently displayed via three coloured LEDs (red / yellow / green) like a traffic light. The worst measured state remains stored until a manual reset has been performed.

AS-i tuner.

Addressing unit.

eASi tester.

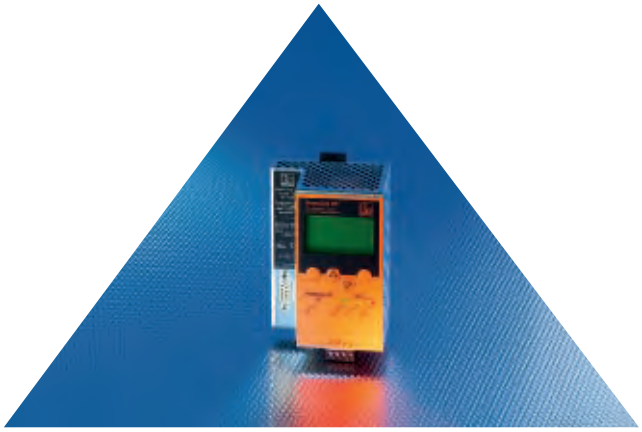
Controller e display.

Type	Interfaces	Program memory	Applications		Number of AS-i masters	Applica-tion	Page
			Control cabinet	Field			
SmartLink · Use as fieldbus gateway							
SmartLink 	Profibus DP	–	•	–	1 or 2	●	40
Controller e · Use as stand-alone controller							
Controller e 	RS-232 C	128 kwords	•	–	1 or 2	●	42
	Ethernet CAA Modbus / TCP	128 kwords	•	–	1 or 2	●	42
Controller e · Use as fieldbus gateway with preprocessing							
Controller e 	Profibus DP	128 kwords	•	–	1 or 2	●	44
	DeviceNet	128 kwords	•	–	1 or 2	●	44
	CANopen	128 kwords	•	–	1 or 2	●	44
	Ethernet IP	128 kwords	•	–	1 or 2	●	44
System software for ifm controllers							
Software 	Download via RS-232 C or Ethernet	–	–	–	–	●	46

For industrial applications

Type	Interfaces	Program memory	Applications		Number of AS-i masters	Applica-tion	Page
			Control cabinet	Field			
Cable extension, signal improvement, diagnosis							
Repeater IP 20 	2 x AS-i electrically separated	–	•	–	–	●	48
Bus termination 	1 x AS-i	–	–	•	–	●	50
Tuner 	2 x AS-i	–	–	•	–	●	52
eASi tester 	1 x AS-i 1 x RS-232 C	–	–	–	–	●	52

For industrial applications



- **AS-i SmartLink DP – AS-i Profibus gateway with display and diagnosics.**
- **AS-i master with Safety at Work support, analogue and data protocols.**
- **Profibus-DP slave, easy integration with GSD file, without programming.**
- **Integrated message error counter, display of inputs / outputs, status bits.**
- **Robust DIN rail mounting, metal housing.**

SmartLink

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

High functionality at a low price

The SmartLink complements the current master range. They have the same diagnostic and AS-i master functions as the controller e family but are operating as pure gateways to the higher level field bus without plc function.There is bidirectional exchange of AS-i data with Profibus, with the data in the same address range as for the controller e. All settings are made via the GSD file in the Profibus configurator, therefore a serial interface and separate software is not required. The display with four operating keys can be used intuitively. The state of all the AS-i data can be checked on-line with analogue data directly displayed as decimal values. During commissioning the AS-i participants can be addressed via the display. An error message counter is available to assist fault finding. The diagnosis of Safety at Work slaves is also integrated. Up to 62 A/B slaves can be connected to one master.

Accessories and connectors

Type	Description	Order no.
	AS-i power supply SilverLine 2,8 A	**AC1216**
	AS-i power supply SilverLine 4 A with integrated earth fault monitor	**AC1224**
	AS-i power supply SilverLine 8 A	**AC1218**
	Combicon connector with screw terminals	**E70230**

Further accessories are available starting on page 197

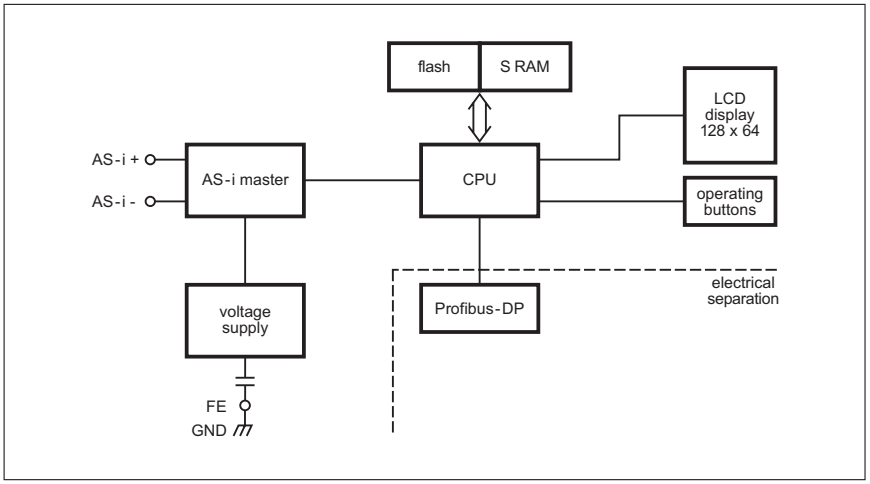
Further connectors are available starting on page 179

AS-interface SmartLink
1 or 2 AS-i masters, supply from AS-i or 24 V

Number of AS-i masters	Programming/ visualisation interface 1	Programming/ data interface 2	Fieldbus interface	Current consumption from 24 V DC [mA]	Total current consumption from AS-i [mA]	Drawing no.	Order no.
SmartLink · 1 Profibus DP slave · supply via AS-i							
1	–	–	Profibus-DP	–	< 200	1	**AC1335**
AS-i / Profibus DP-gateway · 1 Profibus DP slave · supply via 24 V							
2	–	–	Profibus-DP	< 400	< 10	2	**AC1326**

Display AC1335

Block diagram AC1335



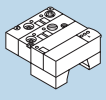
You can download the current version of the GDS file free of charge from www.ifm-electronic.com.

Common technical data

AC1335
AS-i / Profibus-DP gateway
Fixing data via GSD-file
Graphic LC display, backlit
1 AS-i master integrated
4 function keys, 4 LEDs
Operating temperature : 0...60 °C
Robust DIN rail mounting
Operating voltage: 26,5...31,6 V DC
Housing material: aluminium / steel
Combicon screw clamps

You can find scale drawings from page 224

Bus termination
Tuner / Diagnosis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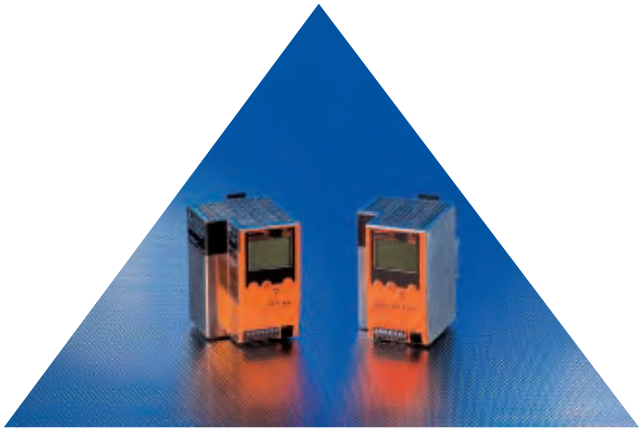


- **Single or dual AS-i master 2.1 with integrated plc.**
- **Extended address mode and indication of peripheral fault.**
- **Simple connection of analogue participants without function block.**
- **Multifunction display for operation, diagnosis and commissioning.**
- **128 kwords program memory, programmable to IEC 61131-3.**

Controller e

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

AS-i master with CoDeSys – programming

The controller e family includes all extended possibilities of AS-interface 2.1. Slaves with analogue profiles 7.3 or 7.4 are detected automatically and the data exchange is carried out immediately. The software modules are not required.

Additional features like slave-related peripheral fault and message error counters enable fast diagnosis during commissioning as well as during operation. All functions can be activated via the integrated display by means of simple menu selection. Slaves can be commissioned without addressing unit by means of the "easy start-up" function. If the programming software is used all functions are also conveniently available via a standard PC.

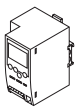
Applications for the controller e as a stand-alone version are small to medium-sized automation projects, e.g. filling systems, conveyor lines, packaging machines, special machines, operational data logging, or building system automation.

Accessories and connectors

Type	Description	Order no.
	Programming cable RS-232C for Controller e	**E70320**
	CD CoDeSys version 2.3 programming- and diagnostic software GER and GB	**AC0340**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

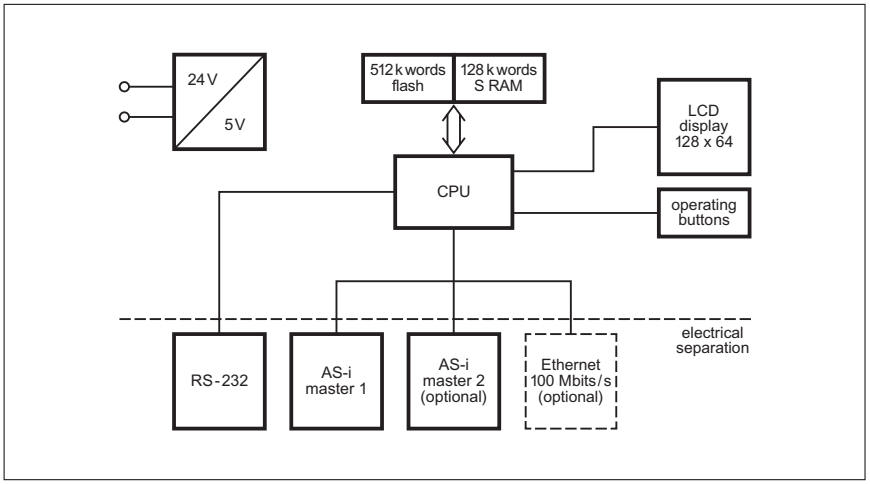


Controller e
AS-i master with integrated plc

Number of AS-i masters	Programming/ visualisation interface 1	Programming/ data interface 2	Fieldbus interface	Current consumption from 24 V DC [mA]	Total current consumption from AS-i [mA]	Drawing no.	Order no.
1	RS-232 C	Ethernet CAA	Modbus / TCP	< 400	< 10	3	**AC1353**
2	RS-232 C	Ethernet CAA	Modbus / TCP	< 400	< 10	3	**AC1354**

Display controller e

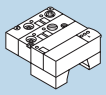
Block diagram



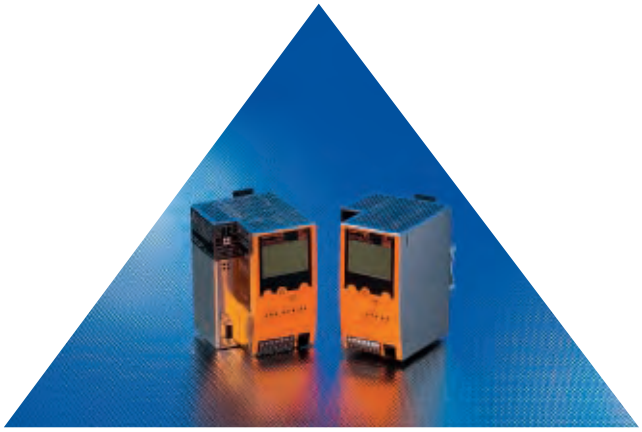
You can download the current version of the device manual free of charge from www.ifm-electronic.com

You can find scale drawings from page 224

Bus termination
Tuner / Diagnosis

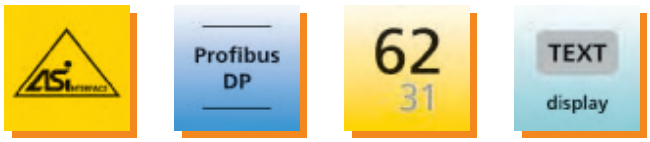



50 - 51
52 - 53



- **Single or dual AS-i master 2.1 with integrated plc.**
- **Extended address mode and indication of peripheral fault.**
- **Simple connection of analogue participants without function block.**
- **Multifunction display for operation, diagnosis and commissioning.**
- **Profibus-DP, DeviceNet, CANopen or Ethernet / IP-gateway.**

Controller e



Special features of the units: For more explanations see the technical glossary chapter starting on page 256

AS-i gateway with extended functionality

The Controller e family includes all extended possibilities of AS-interface 2.1. Slaves with analogue profiles 7.3 or 7.4. are detected automatically and the data exchange is carried out immediately. The software modules are not required.

Additional features like slave-related peripheral fault and message error counters enable fast diagnosis during commissioning as well as during operation. All functions can be activated via the integrated display by means of simple menu selection. Slaves can be commissioned without addressing unit by means of the "easy start-up" function. If the programming software is used all functions are also conveniently available via a standard PC.

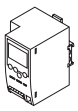
Applications for the Controller e as fieldbus gateway are for example filling systems, conveyor lines, packaging machines, special machines, process data logging or building system automation. The fieldbus interfaces enable structured data acquisition of the digital and analogue inputs and outputs of the connected AS-i system as well as an extensive system diagnosis down to the peripheral monitoring of each individual slave.

Accessories and connectors

Type	Description	Order no.
	Programming cable RS-232C for Controller e	E70320
	CD CoDeSys version 2.3 programming- and diagnostic software GER and GB	AC0340

Further accessories are available starting on page 197

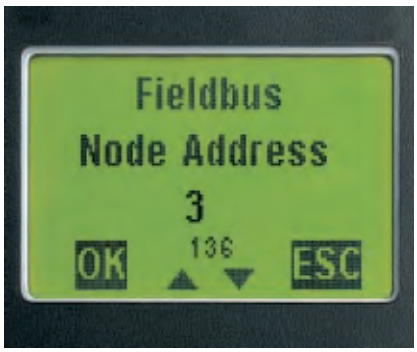
Further connectors are available starting on page 179



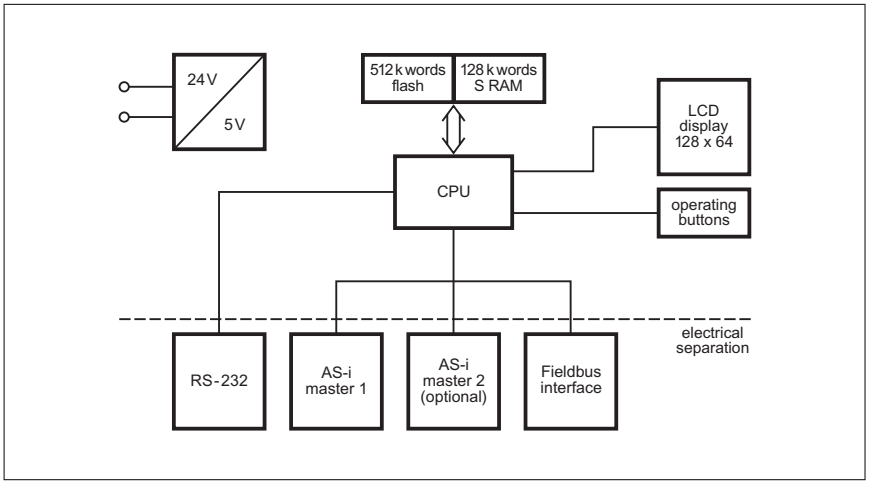
Controller e as Profibus-DP, DeviceNet, CANopen or Ethernet IP-gateway AS-i master with integrated plc

Number of AS-i masters	Programming/ visualisation interface 1	Programming/ data interface 2	Fieldbus interface	Current consumption from 24 V DC [mA]	Total current consumption from AS-i [mA]	Drawing no.	Order no.
1	RS-232 C	–	Profibus-DP	< 500	< 10	2	**AC1345**
2	RS-232 C	–	Profibus-DP	< 500	< 10	2	**AC1346**
1	RS-232 C	–	DeviceNet	< 500	< 10	4	**AC1308**
2	RS-232 C	–	DeviceNet	< 500	< 10	4	**AC1314**
1	RS-232 C	–	CANopen	< 500	< 10	4	**AC1321**
2	RS-232 C	–	CANopen	< 500	< 10	4	**AC1322**
1	RS-232 C	–	Ethernet / IP	< 400	< 10	5	**AC1307**
2	RS-232 C	–	Ethernet / IP	< 400	< 10	5	**AC1317**

Display controller e



Block diagram



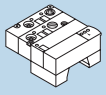
You can download the current version of the device manual as well as GDS / EDS files free of charge from www.ifm-electronic.com.

You can find scale drawings from page 224

Bus termination

50 - 51

Tuner / Diagnosis



52 - 53

- **Software “CoDeSys for Automation Alliance”.**
- **Programming and configuration system to IEC 61131-3.**
- **5 programming languages: LD, FBD, IL, ST, SFC.**
- **Commissioning, diagnosis and service tool.**
- **Integrated visualisation with free design.**

CoDeSys

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Programming software for AS-i controllers

The software “CoDeSys for Automation Alliance” is based on its successful predecessor “ecolog asi”. Due to the integration into the Automation Alliance which consists of leading automation companies a universal programming and configuration software has been created which in future will combine projects with manufacturer-independent hardware in one tool.

A new configuration tree for AS-i is introduced as an operating platform for the ifm controller e family. Programming to IEC 61131-3 is of course also possible. Similar to the Windows file manager all detected and projected slaves are shown clearly. By clicking on “slave” a window with all relevant status indications, parameters, binary and analogue values and the AS-i profile is opened. With a further click output bits can be set or analogue values can be written. For the documentation of the plant further units like masters, power supplies, earth fault monitors, or repeaters can be integrated into the configuration.

Accessories and connectors

Type	Description	Order no.
	Programming cable RS-232C for Controller e	E70320

Further accessories are available starting on page 197

Further connectors are available starting on page 179

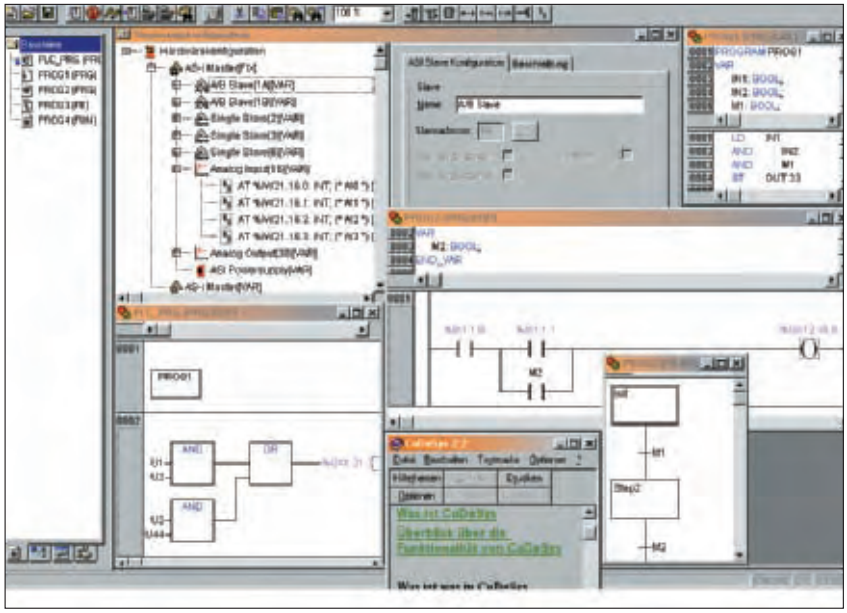
For industrial applications | SmartLink | Controller e stand-alone | Controller e field bus | Controller software | For industrial applications | Repeater
Controller / Gateways | Network extension
Page 40 - 41 | 42 - 43 | 44 - 45 | 46 - 47 | 48 - 49

CoDeSys for Automation - Alliance programming / diagnostic software and documentation for Controller e

Version D = demo	Language	Application for controller e	Application for controllers, SmartLogic	PC interface	Program on 3.5" disk / CD-ROM	OPC server	Order no.
2.3	Ger. / Engl.	yes	–	RS-232C / Ethernet	CD	yes	**AC0340**
2.3	German	yes	–	–	manual	–	**AC0346**
2.3	English	yes	–	–	manual	–	**AC0347**

AC0340: The CD contains the device manual and the CoDeSys documentation as PDF file. You can download the current versions of the device manual / software manual free of charge from www.ifm-electronic.com.

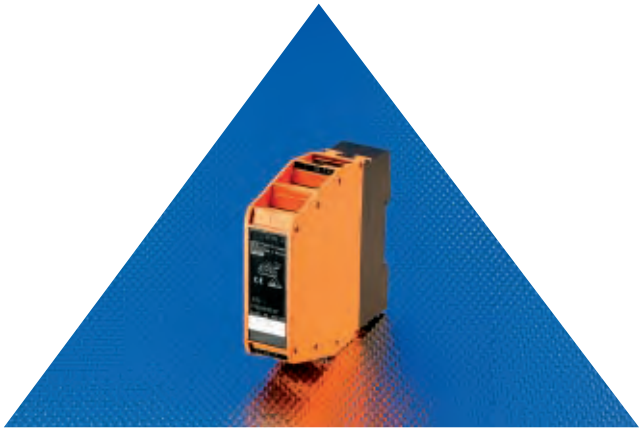
Screenshot



You can find scale drawings from page 224

Bus termination
50 - 51

Tuner / Diagnosis
52 - 53



Repeater

- **Repeater for extension of the cable.**
- **Extension of an AS-i network by a further 100 metres.**
- **Electrical separation, therefore additional AS-i power supply required.**
- **Increased plant safety due to separation into segments.**
- **For universal use: Control cabinet or field module.**

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Long distances–no problem thanks to the repeater

AS-i repeaters are used in order to extend the standard cable length of 100 metres by a further 100 metres. When calculating the length of the AS-i cable the total of the yellow flat cable as well as all directly connected spurs via FC isolation displacement connectors or passive splitters have to be taken into account. AS-i cable in the control cabinet, e.g. for the connection of slaves, counts as well. Thus no "reserve loops" should be laid if possible. With AS-i a later extension is possible without any problems.

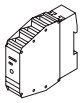
Several repeaters can be connected in the system, however, only a maximum of two repeaters may be connected in series. It is possible, however, to install several repeaters in the system in a star topology, starting from the master. In the case of Safety at Work components only one repeater max. is allowed. Repeaters are available as SmartLine modules for installation in the control cabinet. An additional AS-i power supply is required, as the repeaters are electrically separated.

Accessories and connectors

Type	Description	Order no.
	Combicon connector QIC with insulation displacement terminals	E70236
	Combicon connector with screw terminals	E70230
	Combicon connector with cage clamps	E70232

Further accessories are available starting on page 197

Further connectors are available starting on page 179



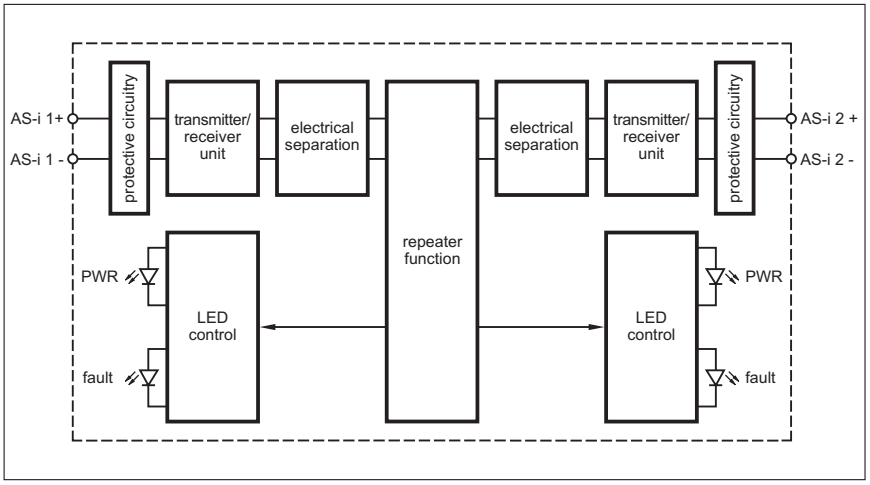
AS-i repeater
for extension of the AS-i cable

Nominal voltage [V]	Under-voltage monitoring	AS-i connection	Electrical separation	Slave address	Total current consumption from AS-i [mA]	Drawing no.	Order no.
26.5...31.6 DC	no	terminals	yes	no	2 x 60	1	**AC2225**

Please order the Combicon plug separately!

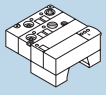
Front view AC2225

Block diagram AC2225



You can find scale drawings from page 225

Bus termination
Tuner / Diagnosis

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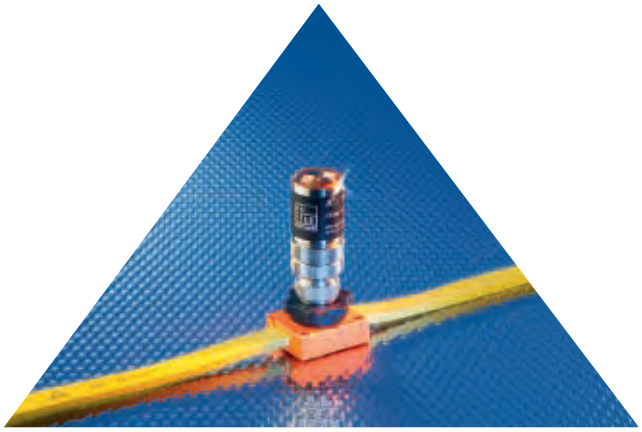
52 - 53



- AS-i bus termination.
- Use at the end of the bus cable.
- Extends the cable length by a further 100 meters.
- Improves the AS-i messages by reducing reflections.
- One bus termination possible per master, one per repeater.

Bus termination

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Safe data transmission for extended installations

AS-i is easy to use. This principle also applies to the bus termination. It can be mounted wherever the AS-i communication is affected by reflections. Reflections can occur when the yellow AS-i cable is considerably longer than 100 meters. A bus termination can be used to prevent these reflections. The optimum mounting position is the point as far as possible away from the AS-i power supply.

With the bus termination cable lengths of up to 200 m can be achieved. There are two possibilities to check the signal quality before and after installation of the bus termination:

1. via the diagnostic menu on the controller e. All repeat messages are analysed and represented there, separately for each slave.

2. with the eASi tester, a service unit which is connected to the AS-i cable in parallel and evaluates the disturbed messages by PC and software.

Accessories and connectors

Type	Description	Order no.
	FC-insulation displacement connector M12, 2-pole	E70096
	FC-insulation displacement connector M12, 2-pole, with mounting link	AC5005

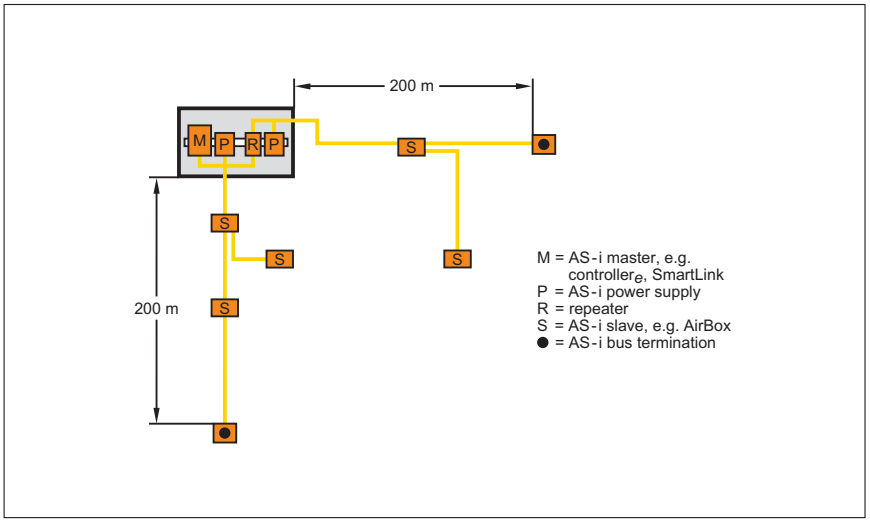
Further accessories are available starting on page 197

Further connectors are available starting on page 179

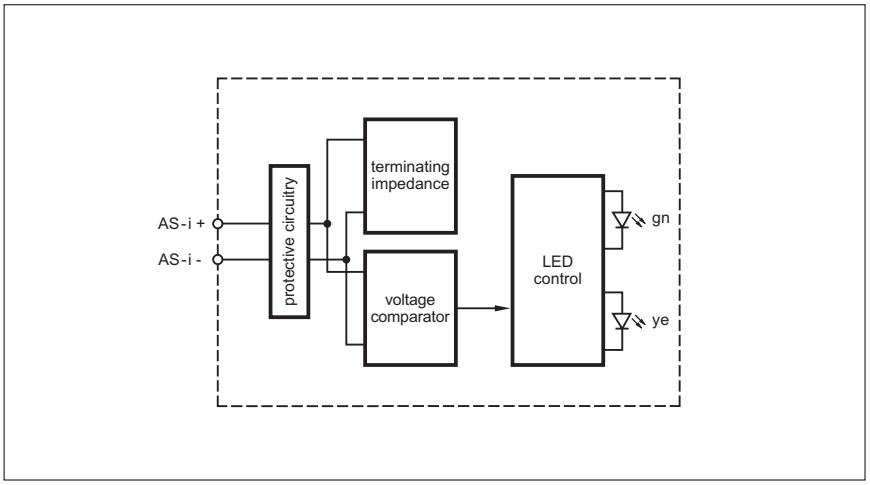
AS-i termination:
Bus termination for AS-i networks

Nominal voltage [V]	Under-voltage monitoring	AS-i connection	Electrical separation	Slave address	Total current consumption from AS-i [mA]	Drawing no.	Order no.
26.5...31.6 DC	yes	M12	no	no	< 10	–	**AC1147**

Application



Block diagram



You can find scale drawings from page 225

Bus termination *Tuner / Diagnosis*

50 - 51 *52 - 53*

- **AS-i tuner in the ClassicLine module, eASi-tester for bus diagnosis.**
- **Three diagnostic LEDs for assessment of the AS-i message quality.**
- **Microprocessor for adaptation of the bus termination to the AS-i network.**
- **Service tools to eliminate reflections for long AS-i cables.**

Tuner

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Permanent bus diagnosis / extended cable lengths

The AS-i tuner module is a service unit in the tried-and-tested ClassicLine housing. The integrated microprocessor analyses the bus messages and the three traffic light LEDs indicate continuously whether the number of message repetitions is in the good, medium or critical range. This reflects the quality of the AS-interface communication.

If the message repetitions are caused by reflections, when the bus cable is for example too long, the tuner can adapt its integrated variable bus termination to the network until the communication is in the good range. For safety reasons the number of repetition messages should be checked with the eASi tester or directly on the Controller e or SmartLink diagnostic display. This ensures that the cause of the distorted messages is really removed and that there is no other reason such as EMC radiation of a frequency converter.

Accessories and connectors

Type	Description	Order no.
	FC lower part ye/ye	**AC5000**
	FC lower part ye/ye with addressing-socket	**AC5010**
	FC insulation displacemant connector with 2 m cable (eASi-tester to AS-i cable)	**E70098**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

Controller / Gateways: For industrial applications (Page) | SmartLink (40 - 41) | Controller e stand-alone (42 - 43) | Controller e field bus (44 - 45) | Controller software (46 - 47)

Network extension: For industrial applications | Repeater (48 - 49)

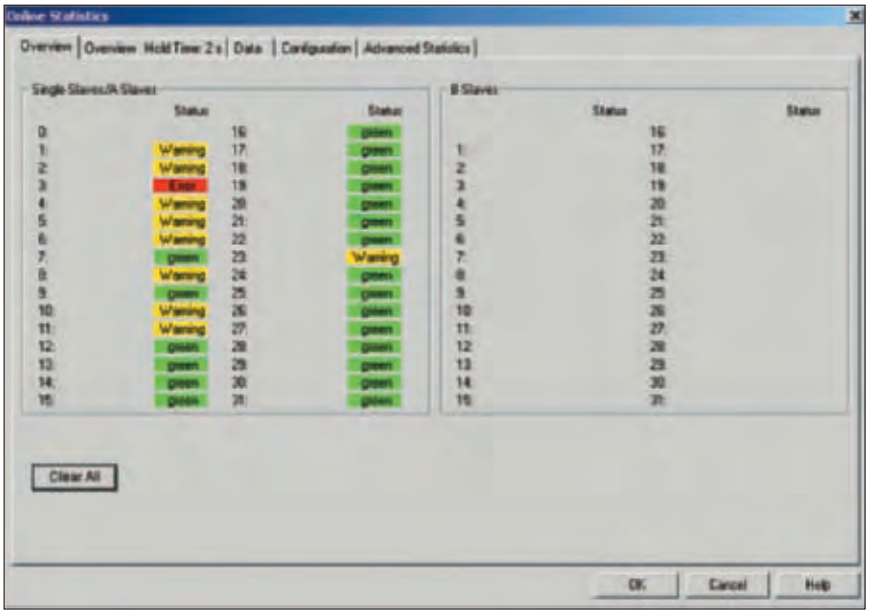
AS-i tuner – the diagnostic module for long cables
eASi-tester – the bus analyser

Nominal voltage [V]	Under-voltage monitoring	AS-i connection	Electrical separation	Slave address	Total current con-sumption from AS-i [mA]	Draw-ing no.	Order no.
eASi-tester · local diagnosis of the AS-i network							
26.5...31.6 DC	yes	terminals	yes	no	< 70	2	**AC1145**
AS-i tuner diagnostic module							
26.5...31.6 DC	yes	EMS	no	no	< 60	3	**AC1146**

AC1146: Please order the lower part AC5000 separately!

Front view eASi-tester

PC diagnosis with eASi-tester



Front view AS-i tuner

You can find scale drawings from page 225

Bus termination *Tuner / Diagnosis*

50 - 51 *52 - 53*

Power supplies and earth fault monitors

ecomat200®

Universal application

Power supplies, earth fault monitors

Power supplies for industrial applications

Earth fault monitors for industrial applications

Power supplies · Introduction

AS-i switched-mode power supplies are a necessary and essential part of an AS-interface network. They generate a regulated DC output voltage between 29.5 V and 31.6 V according to the AS-i specification. All power supplies comply with the PELV requirements of EN 50178 and EN 60204 (PELV: "protective extra low voltage" meaning "functional extra low voltage" with safe separation). The PELV protective measure also includes the safe separation of the DC output voltage from the input voltage. Therefore there is no need for a protective conductor (PE) in the AS-i circuit. The auxiliary circuits can also be executed without PE conductor to comply with the regulations concerning protection of persons when a power supply to PELV is used.

Operating principle

Thanks to the integrated data decoupling in the AS-i power supply, data as well as the required supply voltage of the sensors can be transmitted via one two-wire cable. The AS-i power supply assumes the function of energy provision, data decoupling and balancing of both output wires (AS-i "+" and AS-i "-") with respect to the machine ground (shielded connection). It is designed as a primary switched-mode power supply, the advantages with this technology compared to transformer power supplies are that it is significantly smaller, has a better control and is electronically protected against overload. The degree of efficiency of a switched-mode power supply is higher, too, so that the development of heat and / or power loss are considerably reduced. Degrees of efficiency of up to 92 percent are in fact common. All AS-i power supplies are protected against no load, overload and permanent short-circuit on the output.

To ensure optimum noise immunity against symmetrical interference injection, a well-balanced design of the AS-i system is required. Therefore the "shield terminal" of the AS-i power supply always needs to be connected to machine ground.

Variants

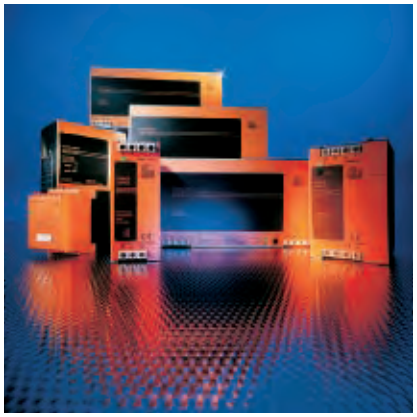
In case an auxiliary current supply is needed in addition to the AS-i voltage, the very compact combined power supply with 1 x 26 V DC / 6 A and 1 x AS-i / 2.8 A is suitable. If so-called dual masters are used, ifm offers the dual power supply with 2 x AS-i / 4 A. A special DC / DC power supply also ensures the primary supply from 24 V DC mains, on the secondary side the AS-i voltage with 2.8 A output current is available.

SilverLine AS-i power supplies

The AS-i power supplies of the type SL feature special additional functions which in particular simplify the set-up of AS-i networks. So it is possible to switch off bus communication via the "IR addressing mode" shunt on the power supply to address slaves via an infrared interface.

The convenient and robust DIN rail mounting allows easy installation and removal of the power supplies without any additional tools. This prevents the power supplies on the DIN rail from moving sidewards. Robust screw terminals for core cross-sections of up to 4 mm^2 are available for the connection of the cores.

AS-i and 24 V standard power supplies.



AS-i SilverLine switched-mode power supplies.

All controls and indicators are located on the front panel. A green LED indicates that secondary voltage is present. It goes out in case of any overload operation of the power supply. One red LED is lit if communication is shut off on the yellow AS-i cable via the "IR addressing mode" shunt. A voltage selector switch allows use in European 230 V mains as well as in American 115 V mains.

Infrared shunt allows easy installation and set-up.

3-phase AS-i power supply

ifm electronic also offers a 3-phase AS-i power supply with a wide-range input of 340 V...576 V AC and an output current of 8 A. Since according to the EN 60204 Machine Directive use of the neutral conductor is only permitted with the approval of the plant operator, this power supply was designed without the neutral conductor. Even if one phase fails the power supply permanently supplies an output current of 8 A. A phase-failure protection to protect the power supply against destruction is not required.

Furthermore this power supply has only one so-called "fuse mode" just like the one-phase 8 A AS-i SL power supply. It ensures that the unit is switched off on the output after approx. 4 to 10 seconds if there is a short-circuit on the AS-i cable. When the short-circuit is rectified and the reset button has been pressed, the power supply is automatically started again. The IR addressing mode shunt to switch off AS-i communication is of course also available for this power supply.

3-phase power supply with 8A output current.

Earth fault monitor integrated

Within the framework of unintentional start-up of a machine according to EN 60204 a hazardous condition such as unintentional starting or failure to stop the machine caused by earth faults or incorrect input signals is to be safely prevented. Without any protective measure this hazardous state can arise if two earth faults occur in the control circuit at the same time.

To solve this problem the standard suggests as one of the possibilities to safely detect earth faults the connection to an earth fault monitoring device. Therefore the power supply of type SL features an integrated earth fault monitor. The latter signals the occurrence of an asymmetrical earth fault via a red LED and a signal-free normally-closed contact allows another evaluation. In addition wire break can also be monitored by the PLC via this NC contact.

To ensure protection against direct and indirect contact with the primary connection terminals all AS-i power supplies of type SL are supplied with a so-called contact protection for the primary circuit.

Protection against accidental contact.

Earth fault monitor · Introduction

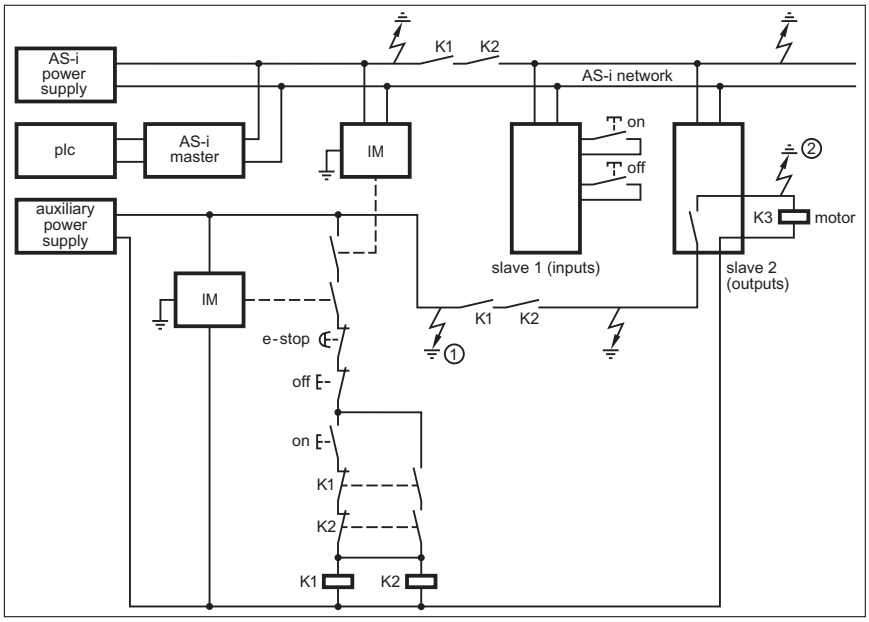
In the field of machine automation safety for persons and machinery is of high importance, and rightly so. The protection of persons (protection against electrical shock) or protection against direct and indirect contact with hazardous voltages is complied with in the AS-i network by the specification as a PELV system (Protective Extra Low Voltage).

All power supplies comply with the PELV requirements of EN 50178 and EN 60204 (PELV: "protective extra low voltage" meaning "functional extra low voltage" with safe separation). The PELV protective measure includes the safe separation of the DC output voltage from the input voltage of the power supply. The auxiliary circuits can also be executed without PE conductor to comply with the regulations concerning protection of persons when a power supply to PELV is used.

Within the framework of unintentional start-up of a machine according to EN 60204 a hazardous condition such as unintentional starting or "failure to stop" a machine caused by earth faults or incorrect input signals is to be safely prevented. Without any protective measure this hazardous state can arise if two earth faults occur in the control circuit at the same time.

One of the solutions suggested by EN 60204 is the connection of the control circuit to the protective bonding circuit. An insulation fault to earth is the same as a short circuit at the power supply output and results in either a triggering of the fuse of the auxiliary supply or a reduction in the output voltage through electronic overload limitation. This latter method is used in all 24 V switched-mode power supplies from ifm electronic. For protection of machinery monitoring the PE conductor should be avoided due to the long response time of the fuse, as during this time a control system can malfunction.

Another possibility indicated in the standard is an insulation monitoring device (IM) which either indicates an earth fault or automatically switches off the control circuit following an earth fault (see diagram).



Principle of earth fault monitoring in AS-interface networks with external auxiliary energy.

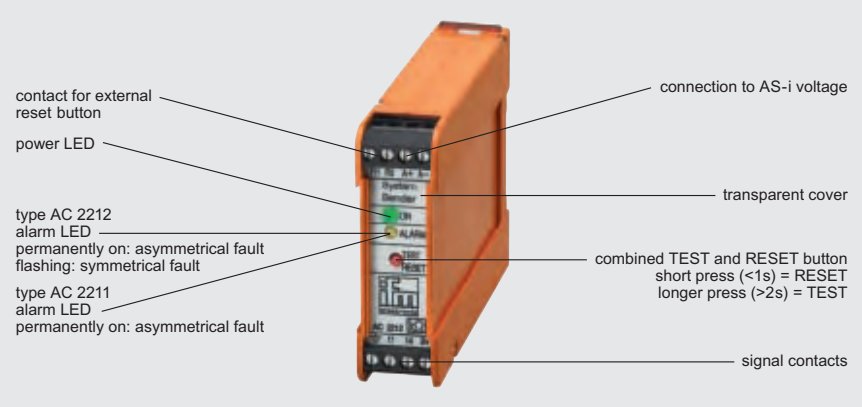
Without earth fault / insulation monitoring device (IM) it would be impossible to switch off a running engine by the EMERGENCY STOP function for example in the event of an earth fault on positions 1 and 2.

The earth fault / insulation monitoring device which can be installed in the existing AS-i system without any problems is available from ifm in two designs: The earth fault monitor uses a passive measuring procedure and measures the displacement voltage between phase conductors and plant ground (earth).

The occurrence of an asymmetrical earth fault is directly signalled on the unit by means of the permanently lit yellow LED. A potential-free signalling contact is available for further processing. The response time for detecting an asymmetrical earth fault is 5 ms.

The insulation monitoring device detects symmetrical as well as asymmetrical earth fault or insulation faults by means of an active measuring method. A flashing yellow LED signals symmetrical, a permanently lit LED asymmetrical faults. The evaluation "earth fault / insulation fault present" can be executed via two volt-free signal contacts.

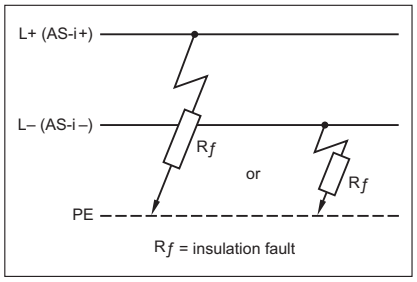
The response time for asymmetrical earth faults is 5 milliseconds, for symmetrical earth faults it is 2 seconds.

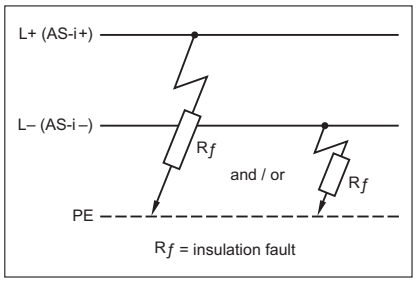


On both units a combined test and reset button allows simulation of an earth fault as well as reset of the earth fault once it has been rectified.

Another possibility to safely detect earth faults is given by the special AS-i power supply with integrated earth fault monitoring and 4 A output current. The occurrence of an asymmetrical earth fault is indicated by a red LED. A volt-free normally-closed contact allows further processing for example via a standard module for control cabinets. In addition wire break can also be monitored by the PLC via this relay contact.

Detection of asymmetrical earth faults.





Detection of asymmetrical and symmetrical earth faults.

Selection chart

Type	Nominal voltage [V]	Output voltage 1 [V]	Output current 1 [A]	Output voltage 2 [V]	Output current 2 [A]	Application	Page
AS-i switched-mode power supplies SilverLine							
single phase 	115 / 230 AC selectable	29.5...31.6 AS-i	2.8	–	–	●	64
single phase 	115 / 230 AC selectable	29.5...31.6 AS-i	4	–	–	●	64
single phase 	115 / 230 AC selectable	29.5...31.6 AS-i	8	–	–	●	64
three phases 	400...500 AC	29.5...31.6 AS-i	8	–	–	●	64
AS-i switched-mode power supplies							
single phase 	24 DC	29.5...31.6 AS-i	2.8	–	–	●	64
single phase 	115 / 230 AC selectable	29.5...31.6 AS-i	4	29.5...31.6 AS-i	4	●	64
single phase 	115 / 230 AC selectable	29.5...31.6 AS-i	2.8	24 DC	6	●	64

For industrial applications

Type	Nominal voltage [V]	Output voltage 1 [V]	Output current 1 [A]	Output voltage 2 [V]	Output current 2 [A]	Application	Page
24 V DC switched-mode power supplies, single phase							
single phase 	115 / 230 AC selectable	24 DC	2.5	–	–	●	66
	115 / 230 AC selectable	12...15 DC	3	–	–	●	66
single phase 	115 / 230 AC selectable	24 DC	4	–	–	●	66
	115 / 230 AC selectable	24 DC	5	–	–	●	66
single phase 	115 / 230 AC selectable	24...28 DC adjustable	10	–	–	●	66
single phase 	230 AC	24...28 DC adjustable	20	–	–	●	66

For industrial applications

Selection chart

Type	Nominal voltage [V]	Output voltage 1 [V]	Output current 1 [A]	Output voltage 2 [V]	Output current 2 [A]	Application	Page
24 V DC switched-mode power supplies, three phases							
three phases 	3 x 400...500 AC	24...28 DC adjustable	5	–	–	●	66
three phases 	3 x 400...500 AC	24...28 DC adjustable	10	–	–	●	66
three phases 	3 x 400 AC	24...28 DC adjustable	20	–	–	●	66
	3 x 500 AC	24...28 DC adjustable	20	–	–	●	66
three phases 	3 x 400...500 AC	24...28 DC adjustable	30	–	–	●	66
	3 x 400...500 AC	24...28 DC adjustable	40	–	–	●	66
Earth fault monitors							
active 	21...36 DC	–	–	–	–	●	68
passive 	21...36 DC	–	–	–	–	●	68

For industrial applications

- Regulated AS-i output voltage.
- Power supply for AS-i networks.
- Different power classes up to 8 amperes.
- Robust connection terminals.
- Design matching ifm controllers.

AS-i power supplies

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Power for the yellow AS-i cable

AS-i power supplies supply all participants connected to the yellow AS-i cable. These are usually slaves, connected sensors, intelligent actuators, the analogue part of the master, and the repeaters. They provide an increased voltage of approx. 30 volts which is converted by the slaves into 24 V required for input devices.

AS-i is an unshielded bus system which transports data and supply energy on the same pair of cores. In order to ensure the decoupling between AS-i data and the supply only approved AS-i power supplies may be used. The transmitting current for the signal modulation is also generated in the AS-i power supply. Thus it forms the virtual terminating resistor of an AS-i network. The AS-i voltage is a PELV voltage and must not be earthed for reasons of symmetry. The shield / GND terminal, however, must be earthed.

Common 24 V power supplies cannot be used instead of AS-i power supplies.

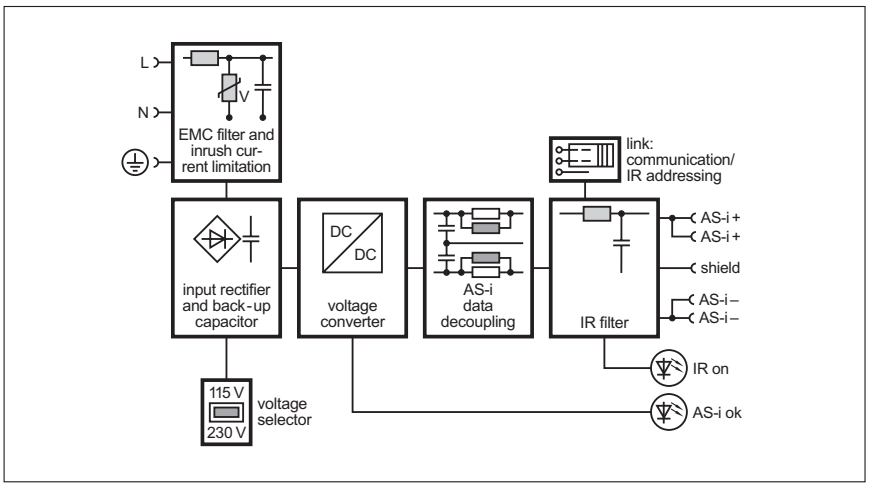
Power supplies	For industrial applications	AS-i power supplies	24 V DC power supplies	Earth fault monitors	For industrial applications	Earth fault monitor, insulation monitor
Page		64 - 65	66 - 67			68 - 69

AS-i switched-mode power supplies SilverLine and standard power supplies for AS-i networks

Output current AS-i [A]	Output voltage AS-i [V]	Output current DC [A]	Output voltage DC [V]	Nominal voltage [V]	Draw-ing no.	Order no.
AS-i switched-mode power supplies SilverLine						
2.8	29.5...31.6 DC	–	–	115 / 230 AC	1	**AC1216**
8	29.5...31.6 DC	–	–	115 / 230 AC	2	**AC1218**
8	29.5...31.6 DC	–	–	400...500 AC	3	**AC1223**
AS-i switched-mode power supplies SilverLine with earth fault monitor						
4	29.5...31.6 DC	–	–	115 / 230 AC	4	**AC1224**
AS-i switched-mode power supply SilverLine with cage clamps						
2.8	29.5...31.6 DC	–	–	115 / 230 AC	5	**AC1226**
Double-switched-mode power supply						
2 x 4	2 x 29.5...31.6 DC	–	–	115 / 230 AC	6	**AC1212**
Switched-mode power supply with output voltage AS-i and output voltage 26 V DC						
2.8	29.5...31.6 DC	6	26 DC (± 2%)	115 / 230 AC	7	**AC1209**
DC convertor 24 V DC to AS-i system voltage						
2.8	29.5...31.6 DC	–	–	24 DC	8	**AC1207**

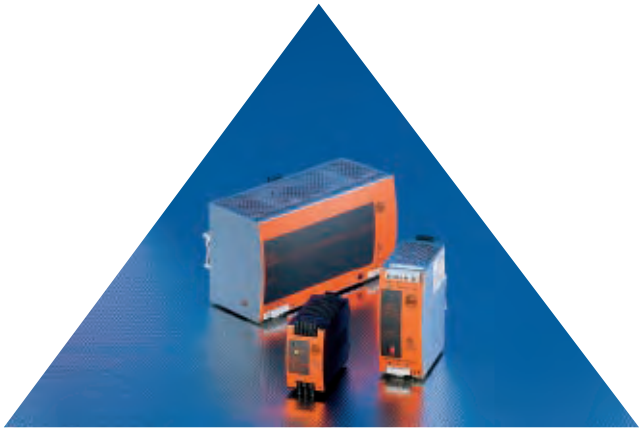
Front view AC1216

Block diagram AC1216



For further block diagrams and terminal connections see www. ifm-electronic.com

You can find scale drawings from page 226



- Regulated 24 V DC output voltage.
- Wide input voltage range.
- High efficiency.
- Output short-circuit and overload protected.
- Robust metal housing, secure fixing.

24 V DC power supplies

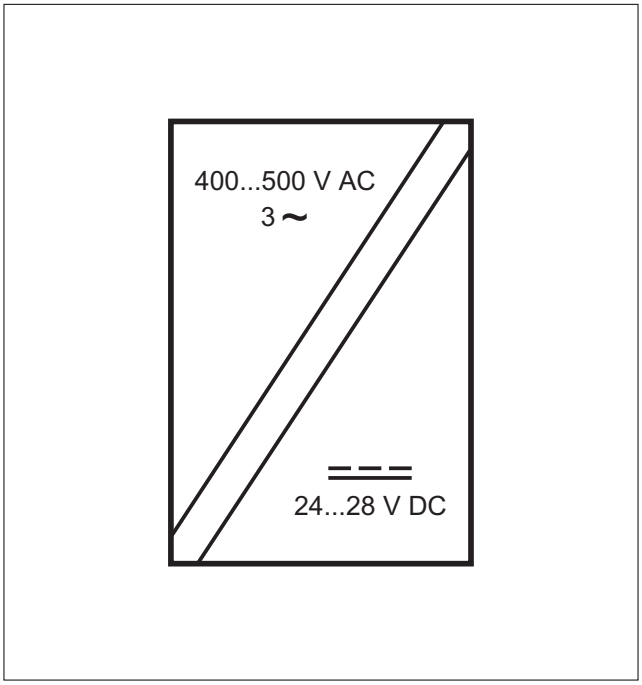
Special features of the units: For more explanations see the technical glossary chapter starting on page 256

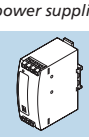
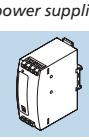
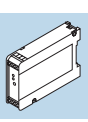
Switched-mode power supplies

Primary switched-mode power supplies are a compact and economical solution to supply sensors, actuators and sensitive electronic components. As opposed to conventional transformer power supplies with regulated output voltage primary switched-mode power supplies need no heavy 50 Hz transformers so that there are fewer iron and copper losses – just a small high frequency power transmitter is needed.

Between no load and full load switched-mode power supplies ensure a stable supply voltage and thus operational reliability even in case of voltage fluctuations, for mains fluctuations up to ± 15 % and mains interference are compensated for and not passed on to the load. Even mains voltage dips of a few milliseconds are compensated for. All types are electronically protected against overvoltage (OVP) and permanent short circuit. The electrical structure is equivalent to that of safety transformers according to VDE 0551. Their low weight and the compact dimensions allow quick mounting without problem on TS 35 rails according to DIN.

Schematics



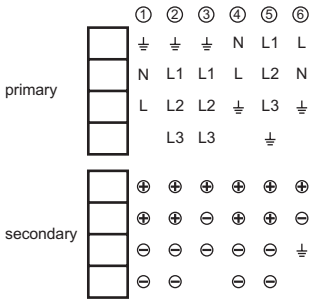
	For industrial applications	AS-i power supplies	24 V DC power supplies		For industrial applications	Earth fault monitor, insulation monitor
Power supplies				Earth fault monitors		
Page		64 - 65	66 - 67			68 - 69

Power supplies single-phase
Power supplies three-phase
Class 2: DN2112

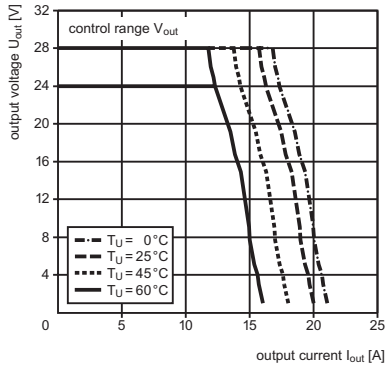
Current [A]	Output voltage [V]	Nominal voltage [V]	Degree of efficiency typ. [%]	Terminal connection no.	Drawing no.	Order no.
1,3	24...28 DC (±2%)	115 / 230 AC	87,5	1	9	**DN1020**
2,1	24...28 DC (±2%)	115 / 230 AC	88,5	1	9	**DN1021**
4,1	24...28 DC (±2%)	115 / 230 AC	90	1	10	**DN1022**
2,5	24 DC (+5% / -1%)	115 / 230 AC	87,5	4	11	**DN2011**
3	12...15 DC (±2%)	115 / 230 AC	87	4	12	**DN2021**
4	24 DC (+5% / -1%)	115 / 230 AC	90	4	13	**DN2112**
5	24 DC (+5% / -1%)	115 / 230 AC	90	4	13	**DN2012**
10	24...28 DC (±2%)	115 / 230 AC	90	4	14	**DN2013**
20	24...28 DC (±2%)	230 AC	91	1	15	**DN2014**
5	24...28 DC (±2%)	3 x 400...500 AC	89	5	16	**DN2032**
10	24...28 DC (±2%)	3 x 400...500 AC	90	5	17	**DN2033**
20	24...28 DC (±2%)	3 x 400 AC	92	2	18	**DN2034**
20	24...28 DC (±2%)	3 x 400...500 AC; ±15%	92	2	19	**DN2134**
30	24...28 DC (±2%)	3 x 400...500 AC	93	2	20	**DN2036**
40	24...28 DC (±2%)	3 x 400...500 AC	92,5	3	21	**DN2035**

Front view DN1020

Terminal connection



Typ. output characteristics



You can find scale drawings from page 226

- **Earth fault monitor for non-earthed PELV voltages.**
- **Suitable for AS-i and 24 V power supplies.**
- **Detection of symmetrical and asymmetrical earth faults.**
- **Volt-free signal contact and reset input.**
- **Does not use an AS-i address.**

Earth fault monitors

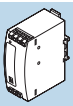
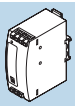
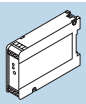
Special features of the units: For more explanations see the technical glossary chapter starting on page 256

More safety for the network

Earth fault and insulation fault monitors detect earth faults in a non-earthed PELV or SELV system. They can be used for AS-i and 24 V networks. They are mounted at any place parallel to the voltage to be monitored. In most cases an earth fault does not lead to a problem immediately. A second earth fault, however, can lead to a ground loop which makes it impossible to switch off actuators via an AS-i output. The risk assessment must be carried out by the planner of the plant before commissioning.

Insulation fault monitors function according to an active measuring principle which applies test pulses to the cable. This enables the detection of symmetrical and asymmetrical earth faults.

Earth fault monitors use a passive measuring principle which only signals asymmetrical earth faults.

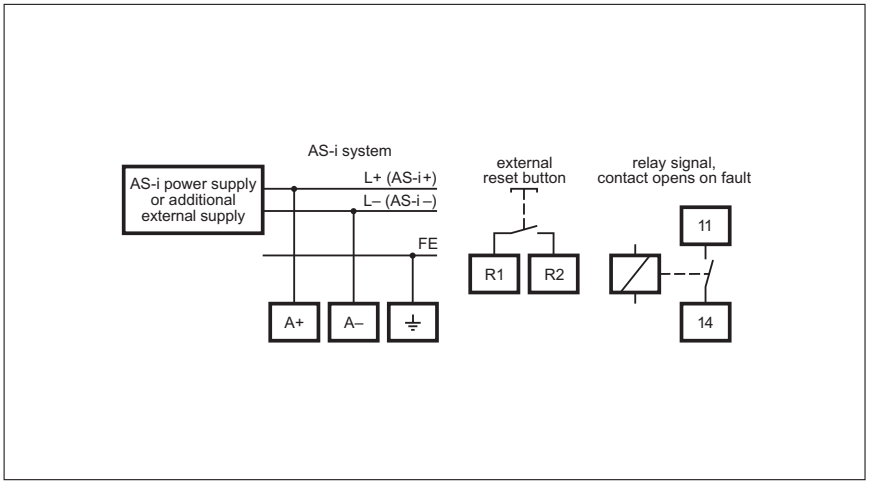
	For industrial applications	AS-i power supplies	24 V DC power supplies		For industrial applications	Earth fault monitor, insulation monitor
Power supplies				Earth fault monitors		
Page		64 - 65	66 - 67			68 - 69

AS-i and 24 V earth fault monitors for non-earthed PELV voltages

Nominal voltage [V]	Measuring method	Signal contacts	Slave address	Total current consumption from AS-i [mA]	Drawing no.	Order no.
Earth fault monitor						
21...36 DC	passive	1	no	< 40	1	**AC2211**
AS-i insulation monitor						
21...36 DC	active	2	no	< 40	1	**AC2212**

Front view AC2211

Block diagram AC2211



For further block diagrams and terminal connections see www. ifm-electronic.com

You can find scale drawings from page 230

I/O modules for control cabinets

ecomat300

Universal application

Digital modules control cabinet · Introduction

From conception AS-interface was designed as a decentralised system, thus allowing the conventional plc with its large rack and high number of input / output cards to become a thing of the past. Thanks to bus technology the previously widespread centralised wiring structure with a central control cabinet and star connection of all units was no longer state-of-the-art technology. This concept of parallel wiring had in fact several disadvantages: Many terminals made fault finding very difficult, large plc racks consumed a lot of energy, generated a lot of heat and generally had poor long-term stability. Once the capacity of a rack (locations) was depleted, another more expensive rack had to be installed which in turn took up more space and entailed costs.

The AS-i modules for use in control cabinets offer a useful alternative to the conventional I/O rack. The units are compact in size and offer up to 4 inputs and 4 outputs allowing expansion to take place but keeps unused I/O down to a minimum. Communication to the plc is handled in the usual way via an AS-i master.

PCB solution in the extended addressing mode.

SmartLine modules for electrical separation

Centralised control cabinets usually contain the power distribution of the plant, the fuses as well as the power supplies and components of the power electronics. AS-i coupling modules are available which electrically separate non AS-i voltages from AS-i voltages. The outputs are relay outputs. The AS-i inputs are electrically separated from the AS-i supply and can be operated with any 24V voltage according to PELV.

SmartLine module with electrical separation and relay output.

SmartLine modules for universal use in control cabinets

Due to their slim-line design and the latest AS-i technology the SmartLine modules are suitable for universal use. Thanks to AS-i 2.1 specification up to 62 digital modules or 31 analogue modules can be connected to the AS-i master.

Further characteristics are:

- Robust DIN rail mounting
- Addressing socket on the front
- Combicon terminals for quick replacement
- Screw terminals, insulation displacement terminals or cage clamps
- AS-i Quix for uninterrupted bus wiring
- All status LEDs clearly visible on the front
- Peripheral fault indication

The SmartLine modules are especially slim.

Analogue modules for the control cabinet · Introduction

In addition to binary signals analogue control signals often have to be processed in industrial process automation, e.g. temperature or pressure values. In the fields of conveyor technology, machinery and plants are speed-adjusted via the transmission of continuous signals.

In principle it does not matter whether the analogue values represent a temperature, a speed, a pressure or another continuous quantity required for the process. In general the analogue value is translated into a voltage or current value by a suitable sensor and thus it is available for the process. By means of the analogue I/O modules these values can then be digitally transmitted to the controller via the standard AS-i cable.

Analogue value detection of system pressure.

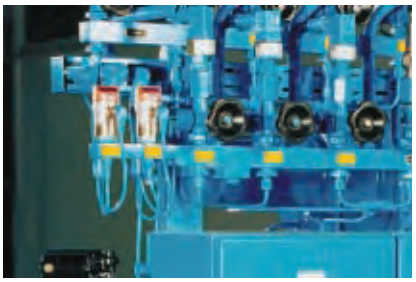
Visit our website: www.ifm-electronic.com

Operating principle

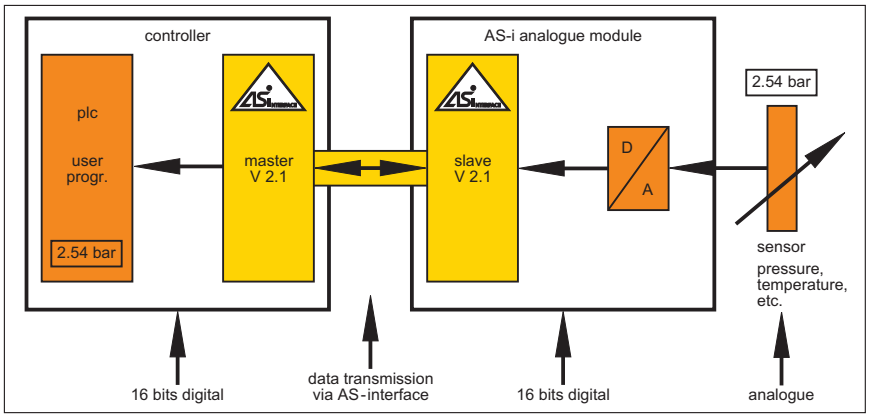
Since each slave was allotted 4 bits for information when the fundamental characteristics of AS-i slaves were defined, the transmission of analogue values which generally consist of more than 4 bits is slightly more complex.

At first certain manufacturer-independent slave profiles were defined, controlling the data exchange between the analogue slaves and the AS-i master. These are the profiles S-7.3 and S-7.4 (according to the AS-i specification V2.1).

If slaves with the profiles S-7.1 or S-7.2 are used, a function block has to be processed in the software of the higher-level controller implementing data communication with the analogue slave. This procedure however becomes less and less important as these drivers are no longer required due to the availability of analogue slaves with the profiles S-7.3 and S-7.4. The new generation AS-i masters available on the market can clearly identify these slaves by their profiles and then they in turn start data exchange. The effort required is virtually reduced to "plug & play". An additional software module is not necessary as it is integrated into the firmware of the AS-i master.



Imperative: Temperature detection in plant and machinery.



Example of an analogue value transmission.

The analogue values are transmitted in the form of data fragments in several AS-i cycles and "reassembled" into one complete analogue value by the driver module processed in the AS-i master. In the user program access to an analogue value is limited to reading it at a defined address.

4-channel SmartLine analogue module with flexible connection technology and profile S-7.3.

SmartLine analogue modules

The SmartLine analogue modules can be connected to all AS-i 2.1 masters without any additional function blocks or software functions. This is a case of real "plug & play". By means of the ID2 (see table) the master automatically recognises what module type is connected and exchanges the analogue data independently. This is done, like before, by multiplexing across several AS-i cycles. This means that a master can process up to 124 analogue values.

The user can read the analogue values directly on the display of ifm's *controller e* to ensure correctness of data transfer during installation and set-up.

Analogue profiles S-7.3x and S-7.4x	x = ID-code 2				
	Bit 3	Bit 2	Bit 1	Bit 0	Hex
One channel	•	•	0	0	
Two channels	•	•	0	1	
Four channels	•	•	1	0	
Transparent mode	•	0	•	•	
Analogue transmission	•	1	•	•	
Output module	0	•	•	•	
Input module	1	•	•	•	
Four channels without peripheral fault	1	1	1	1	F

Examples

Four analogue inputs with peripheral fault indication	1	1	1	0	E
Two analogue output channels with peripheral fault indication	0	1	0	1	5

In spite of the SmartLine's compact dimensions 4 analogue inputs, 4 analogue outputs or 4 Pt100 inputs are available. Status LEDs for inputs and outputs as well as for the indication of AS-i voltage, external 24 V or peripheral and communication faults complete the features of these modules.

The use of Combicon connectors (to be ordered separately) with either screw terminals, insulation displacement terminals or cage clamps provides different connection technologies. The implemented mechanical addressing interface allows SmartLine analogue modules to be addressed when they are mounted and wired.

SmartLine QUIX connection technology

The AS-i QUIX technology developed by PhoenixContact ensures simple bus wiring via insulation displacement terminals into which up to 4 individual wires (2 for AS-i and 2 for external voltage supply) can be connected. The AS-i QUIX plugs match the Combicon connections of the SmartLine family. These pin outs on the plugs are the same for all SmartLine types. Advantages of this connection technology are the quick replacement of individual modules without disconnecting the bus and the external energy supply so that all other bus participants remain active.

QUIX wiring allows replacement of modules during operation.

Addressing of several modules by means of the addressing unit AC1144

With the introduction of AC1144 AS-i addressing unit it is now possible to connect a whole series of modules apart from the known point-to-point connection to one module. Due to the increased power required to supply multiple modules it is not possible to use the built-in battery of the addressing unit, therefore an external AS-i power supply is required. The display indicates all detected AS-i slaves. Individual profiles can be read, parameters and data can be written.

For cabinet modules AS-i communication can be deactivated via an addressing link (factory setting) so that AC1144 does not detect them at once. By gradually connecting the slaves they are detected one after the other, they can be addressed and set up until eventually the whole network has been completely configured. Thus the dreaded double addressing is avoided.

For SmartLine modules we recommend addressing to the point-to-point principle via the integrated jack socket after installation. This process automatically separates the module from the master when the addressing plug is connected and then allows addressing via AC1144. Since communication is switched off on the module, the absence of slaves from the master can be simulated. The user can verify, for example, if the slave was correctly detected and projected.

Addressing unit incl. power supply and addressing cable (optional).

Application addressing unit AC1144	Connection to	External AS-i power supply
Addressing of individual modules	Slave (point-to-point)	Not required (accumulator operation)
Addressing / diagnostics of several modules (bus wiring)	AS-i network	Required

Application

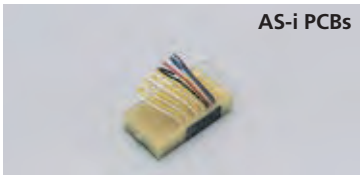
The AS-i SmartLine modules are installed in large control cabinets as well as in small local boxes and customer-specific units.

For use in control cabinets SmartLine modules are often used as coupling modules to external electronic modules such as weighing electronics, frequency converters, controllers and other evaluation units. Since these electronic components do not usually have AS-i potentials we recommend modules with electrically separated inputs for any 24 V voltages and relay outputs.

In small boxes which are usually decentralised across the plant a large number of inputs / outputs are required for connection of sensors and valves or other actuators. Here SmartLine modules with extended addressing range can be used, 62 of which can be connected to one AS-i master. This means an amount of 248 inputs and 186 outputs.

For integration into customer-specific units there is a choice of AS-i slaves from the cabinet or SmartLine families. Depending on the base and height available the user can select the appropriate type. Therefore it is very easy to integrate each non-AS-i component in conjunction with a certified slave from ifm electronic into the bus.

Selection chart

Type	Digital inputs	Digital outputs		Analogue inputs (AI) Analogue outputs (AO)			Application	Page
		Transistor	Relay	I	U	Pt100		
Control cabinet modules with digital inputs and outputs								
 **SmartLine**	4	–	–	–	–	–	●	78
	–	4	–	–	–	–	●	78
	4	4	–	–	–	–	●	78
	4	–	2	–	–	–	●	78
	4	3	–	–	–	–	●	78
 **SmartLine**	4	–	4	–	–	–	●	78
Control cabinet modules with analogue inputs and outputs								
 **SmartLine**	–	–	–	4 (AI)	–	–	●	80
	–	–	–	–	4(AI)	–	●	80
	–	–	–	–	–	4	●	80
	–	–	–	4 (AO)	–	–	●	80
	–	–	–	–	4 (AO)	–	●	80
PCB solutions								
 **AS-i PCBs**	4	4	–	–	–	–	●	82
	4	3	–	–	–	–	●	82
	2	1 LED	–	–	–	–	●	82

For industrial applications

- **Control cabinet modules as single slave with extended address mode.**
- **Digital inputs and outputs.**
- **Transistor and relay output stage.**
- **Electrical connections via Combicon terminals.**
- **Robust DIN rail mounting.**

SmartLine

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Space-saving modules for DIN rail mounting

SmartLine modules can be mounted in any local box, panel, control panel, or control cabinet. The installation is made by means of a robust DIN rail fixing on standard rails. The small design with a width of only 25 mm can contain up to 4 inputs and 4 outputs. Modules with the double width are available for more performance with 230 V relay.

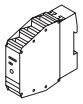
Addressing is carried out via the jack socket on the front panel which is directly connected to the addressing unit by means of the corresponding cable. Thus addressing is possible at any time, before or after mounting. The powerful LEDs are also located on the front panel. The supply voltage(s) and the peripheral signals are connected at the top and at the bottom in the direction of the cable ducts by means of plug-in Combicon terminals. These can be equipped either with screw terminals, cage clamps, or insulation displacement terminals by the customer.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable	**E70213**
	Combicon connector QIC with insulation displacement terminals	**E70236**
	Combicon connector with screw terminals	**E70230**

Further accessories are available starting on page 197

Further connectors are available starting on page 179



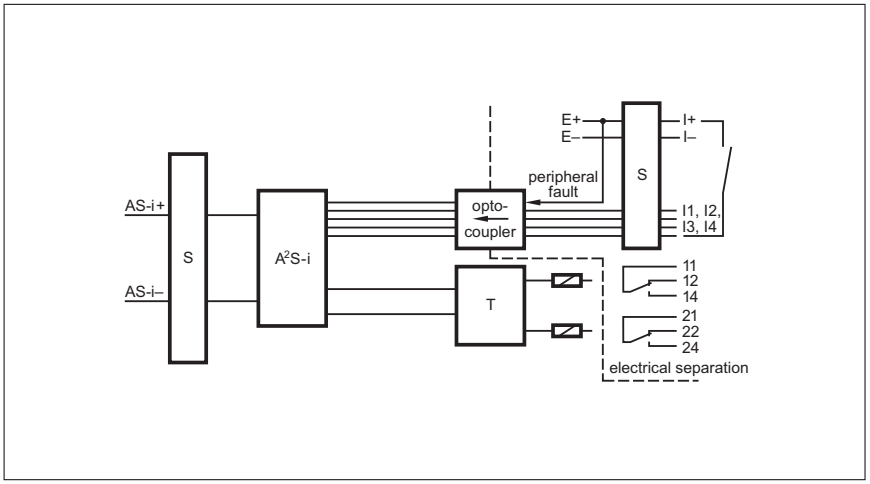
SmartLine
Digital inputs and outputs
A/B-Slave: AC2250, AC2254, AC2255, AC2256, AC2264

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
4 DI	–	yes	–	200	–	S-0.A.E	< 250	1	**AC2250**
4 DI	4 DOT	yes	yes	200	1 (4)	S-7.0.E	< 250	1	**AC2251**
–	4 DOT	–	yes	–	1 (4)	S-8.0.E	< 50	1	**AC2252**
4 DI	–	–	–	500	–	S-0.A.E	< 50	1	**AC2254**
4 DI	2 DOR	–	–	500	1.5 (6)	S-7.A.E	< 50	1	**AC2255**
4 DI	2 DOR	yes	–	200	1.5 (6)	S-7.A.E	< 50	1	**AC2256**
4 DI	4 DOT	–	yes	500	1 (4)	S-7.0.E	< 50	1	**AC2257**
4 DI	4 DOR	yes	–	200	6 (6)	S-7.0.E	< 250	2	**AC2258**
4 DI	4 DOR	–	–	500	6 (6)	S-7.0.E	< 50	2	**AC2259**
4 DI	3 DOT	yes	yes	200	1 (3)	S-7.A.E	< 50	1	**AC2264**

Please order the Combicon plug separately!

Front view AC2255

Block diagram AC2255



For further block diagrams and terminal connections see www. ifm-electronic.com

You can find scale drawings from page 232

SmartLine

- **Control cabinet modules with analogue inputs and outputs.**
- **Standard signals 0/4 to 20 mA, 0 to 10 V.**
- **Temperature modules 4-channel, Pt100.**
- **Channels which are not used can be switched off.**
- **AS-i analogue profiles 7.3 for "plug & play" on masters 2.1.**

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Analogue modules for DIN rail mounting

SmartLine modules can be mounted in any local box, panel, control panel, or control cabinet. The installation is made by means of a robust DIN rail fixing on standard rails. The small design with a width of only 25 mm can contain up to 4 analogue inputs or 4 analogue outputs. The Pt100 module additionally contains a linearisation so that the measured value is directly available in the temperature unit degrees Celsius.

Addressing is carried out via the jack socket on the front panel which is directly connected to the addressing unit by means of the corresponding cable. Thus addressing is possible at any time, before or after mounting. The powerful LEDs are also located on the front panel. The supply voltage(s) and the peripheral signals are connected at the top and at the bottom in the direction of the cable ducts by means of plug-in Combicon terminals. These can be equipped either with screw terminals, cage clamps, or insulation displacement terminals by the customer.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable	**E70213**
	Combicon connector QIC with insulation displacement terminals	**E70236**
	Combicon connector with screw terminals	**E70230**

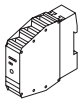
Further accessories are available starting on page 197

Further connectors are available starting on page 179

For industrial applications *SmartLine digital* *SmartLine analogue* *For industrial applications* *AS-i PCBs*

SmartLine **PCB module solutions**

Page *78 - 79* *80 - 81* *82 - 83*



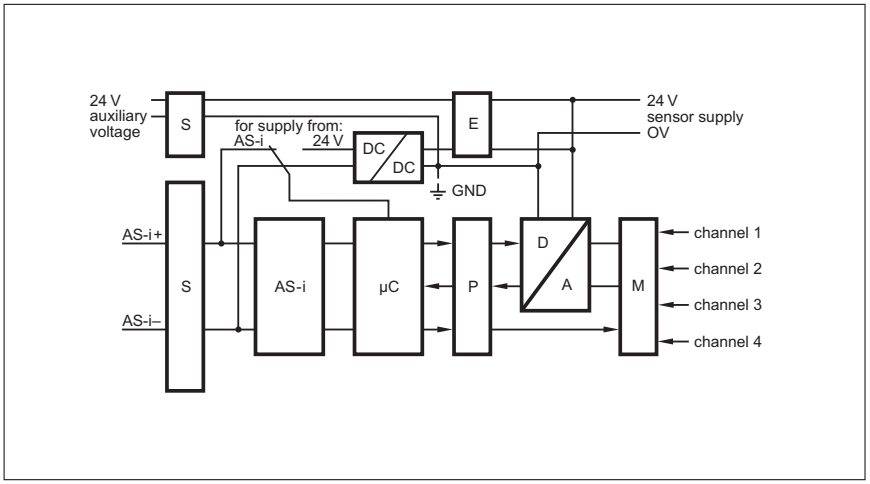
SmartLine
Analogue inputs and outputs

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
4 AI C	–	yes	–	< 500	–	S-7.3.E	< 180	1	**AC2216**
4 AI V	–	yes	–	< 500	–	S-7.3.E	< 180	1	**AC2217**
–	4 AO C	–	yes	–	< 500	S-7.3.6	< 180	1	**AC2218**
–	4 AO V	–	yes	–	< 500	S-7.3.6	< 180	1	**AC2219**
4 Pt 100	–	yes	–	< 80	–	S-7.3.E	< 80	1	**AC2220**

Please order the Combicon plug separately!

Front view AC2216

Block diagram AC2216 / 2217



For further block diagrams and terminal connections see www. ifm-electronic.com

You can find scale drawings from page 232

- AS-i PCBs as single slave or with extended addressing mode.
- Digital inputs and outputs
- Connection wires / screw terminals.
- Some PCBs fully potted
- PCB for RMQ-Titan housing.

PCB module solutions

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

PCB module solutions

The AS-i PCBs can be installed in any on-site housing, panel, control cabinet or in individual housings. Some of the PCBs are fully potted and have either connection wires or screw terminal connections. They are available in the AS-i version 2.1 as single slaves or in the extended address mode.

The AS-i PCB with 2 inputs and one LED output is designed for the connection of mechanical contacts and due to its dimensions of 44 x 32 mm it is very small and compact. The operating voltage or also peripheral faults signal states are indicated by LEDs of high luminosity. A watchdog function switches the outputs off if there is no communication between the AS-i slave and the controller. The AC2709 AS-i PCB is suitable for the Moeller RMQ-Titan housing (I3M, I4M, I6M).

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	AS-i-flat cable	**AC4000**
	FC insulation displacement connector	**E70454**
	Adapter plug plastic M12-M20	**E7006S**

Further accessories are available starting on page 197

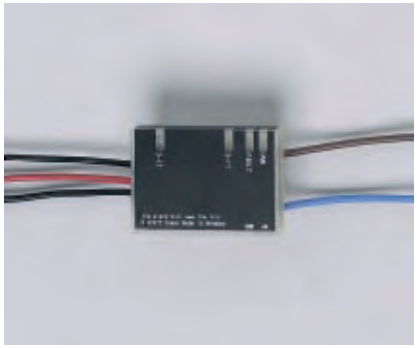
Further connectors are available starting on page 179

Digital inputs and outputs
A/B-slave: AC2728, AC2730, AC2731, AC2729

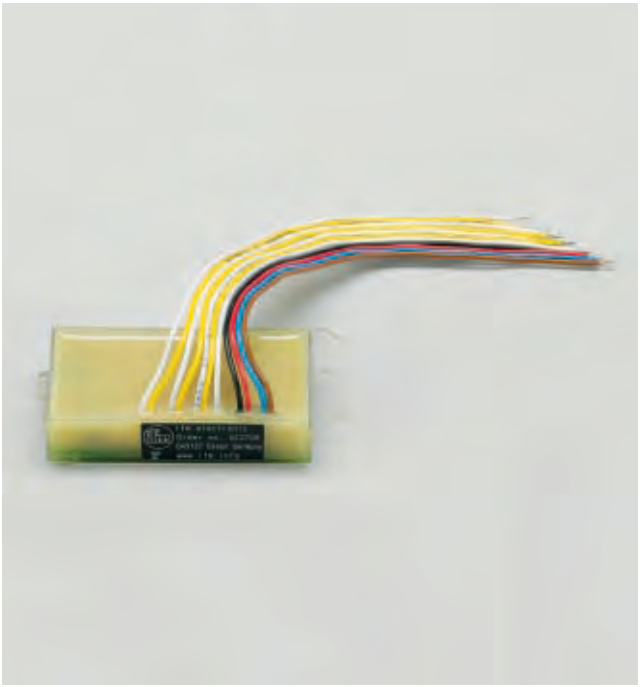
Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
4 DI	4 DO	yes	AS-i	200	0,05 (0,2)	S.7.0.E	< 250	1	**AC2709**
4 DI	4 DO	yes	AS-i	180	0,1 (0,18)	S.7.0.F	< 200	2	**AC2726**
2 DI	1 LO	yes	AS-i	5	0,01	S.7.A.E	< 50	3	**AC2729**
3 DI	3 DO	yes	AS-i	180	0,18 (0,18)	S.7.A.E	< 200	4	**AC2731**
With 10 cm connection wires									
4 DI	3 DO	yes	AS-i	180	0,1 (0,18)	S.7.A.F	< 200	5	**AC2728**
With 20 cm connection wires									
4 DI	3 DO	yes	AS-i	180	0,1 (0,18)	S.7.A.F	< 200	5	**AC2730**

AC2709: Total current rating in- and outputs = 200 mA, for AC2726, AC2728, AC2730 and AC2731: 180 mA

AS-i PCB AC2729



AS-i PCB AC2730 with 20 cm connection wires



You can find scale drawings from page 233

I/O modules for field applications

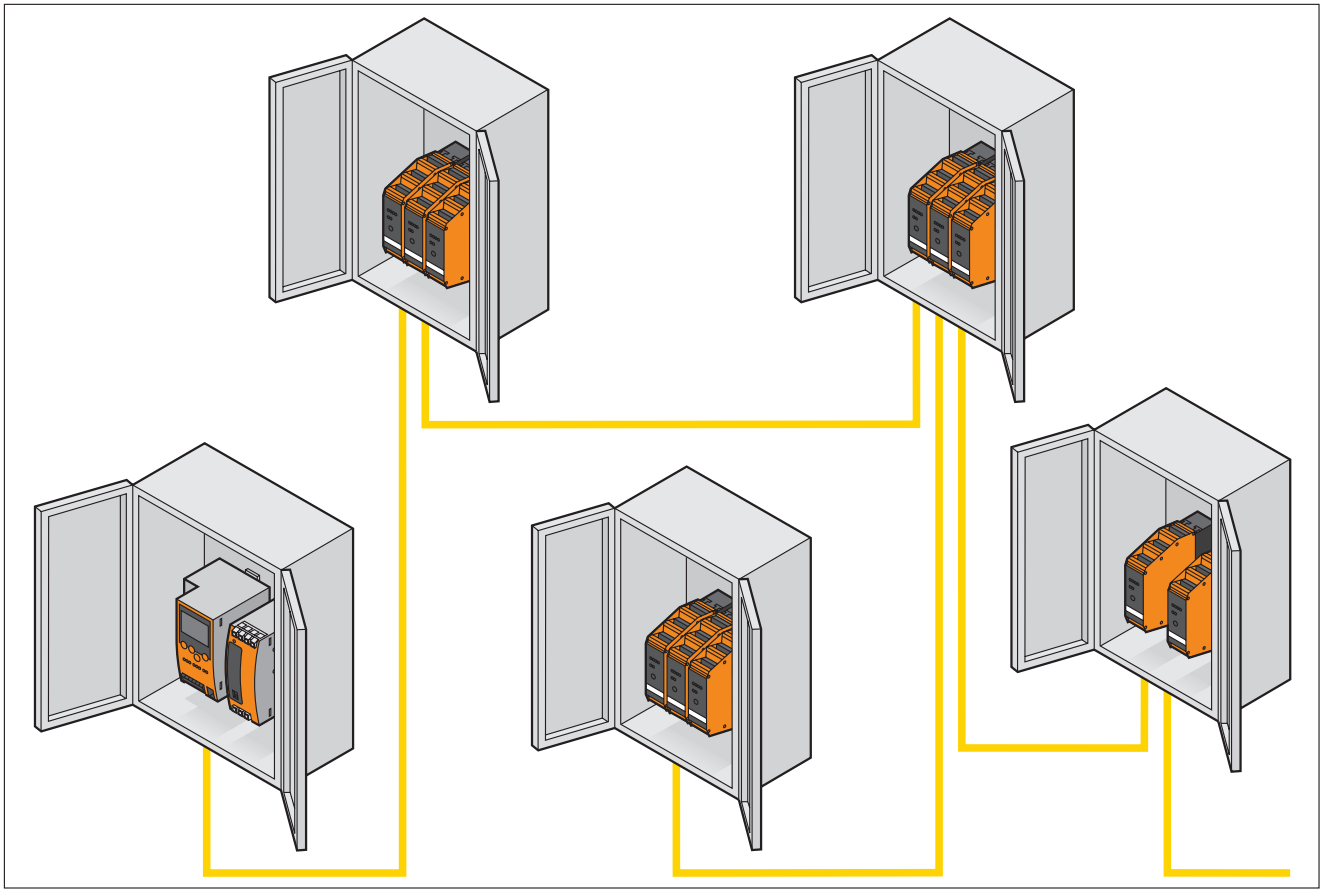
ecomat300

ProcessLine · Introduction

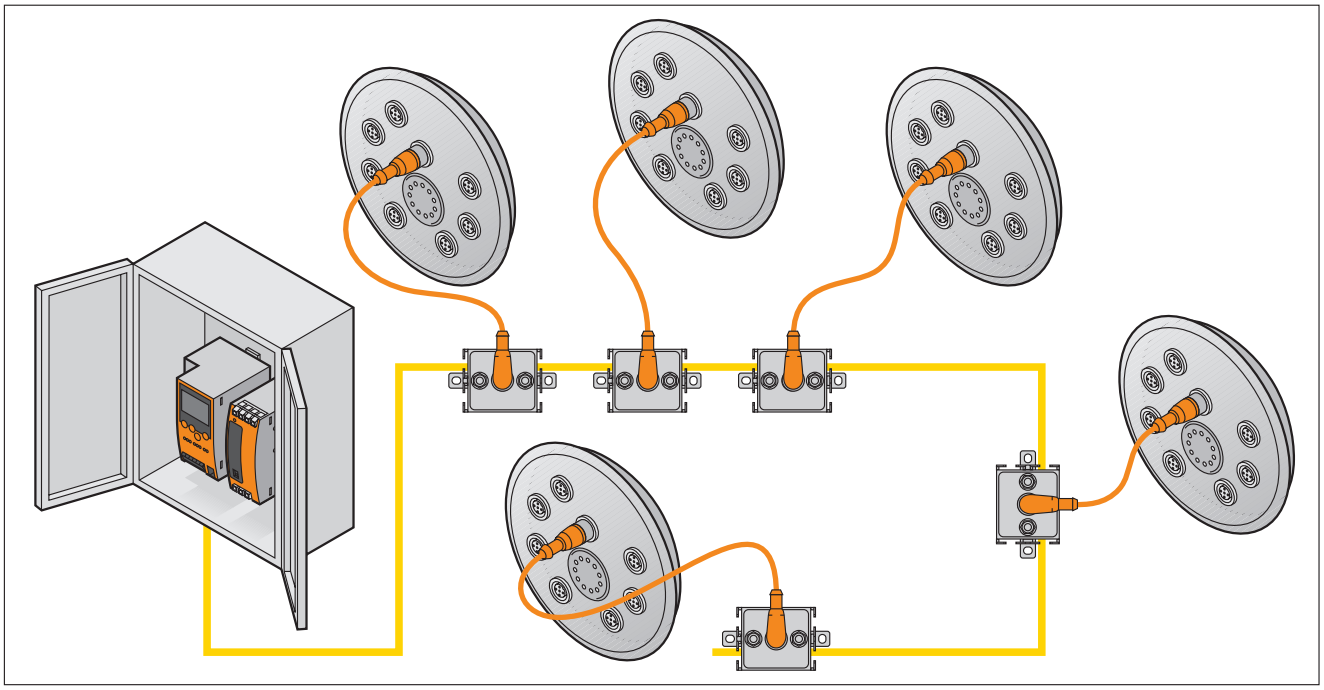
AS-Interface has become established as standard in traditional mechanical engineering. Some machine and plant builders of the bottling and brewery industries have surged ahead and thus opened the door for an application with completely new requirements. First the traditional control cabinets are equipped with AS-i control cabinet modules. The easy AS-i bus technology for the distribution of binary and analogue signals reduces the so far usual high number of parallel cables. However, the expensive stainless steel switch boxes required on site undo part of the cost saved for wiring. This is where the concept of ifm ProcessLine comes in: Modules completely made of stainless steel that can replace many switch boxes.

AS-i in the food industry

In the AS-i applications in the food industry so far the used modules for field applications or control cabinets are located in switch boxes to protect the units against humidity and cleaning agents. The boxes must be made from high-grade stainless steel since normal steel boxes would corrode within short time. The ProcessLine modules are the first high-grade stainless steel AS-i modules for direct installation in the field. All process connections are M12 connections with radial sealing. That means: Never again necessary to mount cable exits, remove the external cable sheath, strip the individual cores and connect them to terminals. Prewired cables prevent wiring faults and loose connections. All components have protection rating IP 69 K.



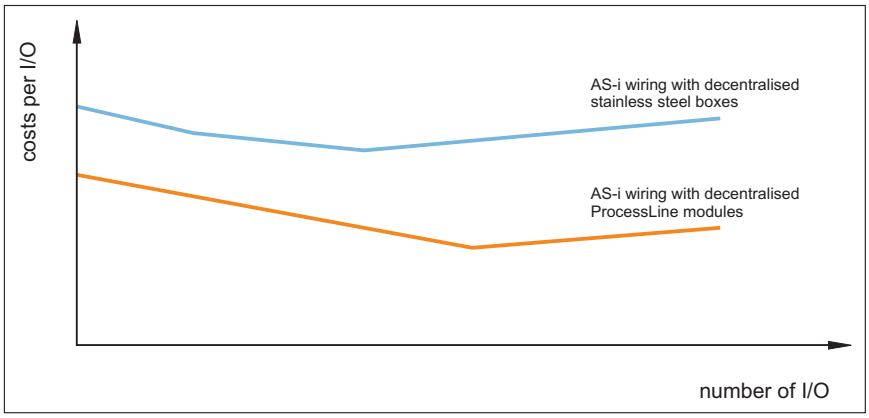
Conventional wiring: Decentralised switch boxes.



Decentralised wiring with ProcessLine modules.

Cost comparison

The costs for the use of conventional decentralised installation boxes are mainly caused by the mounting time, the relatively expensive stainless steel boxes, the complex cable preparation and the electrical connection. Compared to this the costs for the AS-i modules for control cabinets are relatively low. If it is possible to replace a number of these field splitter boxes by ProcessLine modules, the many manual activities described in the beginning are no longer necessary. The machine builder can thus work more effectively with the same team, that is they can install more machines in the same time.



Cost comparison of an example installation.

Award-winning technology

ProcessLine is certainly one of the most exceptional, completely round housings that have ever existed in automation technology. The application is in the foreground here. Our engineers and designers developed this extraordinary design on the basis of the requirements for stainless steel surface, hygienic cleaning, high ingress resistance and bacteria inhibition. It is for these reasons that ifm electronic obtained the renowned "reddot design award" from the design centre Essen.

ProcessLine module front and rear view.

reddot design award
winner 2004

Applications

The ProcessLine modules can be used where high ingress resistance, robustness and good cleanability are important.

This especially concerns the following industries:

- breweries
- dairies
- beverage bottling systems
- fish processing
- butcheries, meat and sausage production
- can factories
- wine and sparkling wine production
- fruit juice processing
- pizza and pastries production
- frozen food production
- convenient food production
- pharmaceutical factories
- margarine, grease and oil production
- chemical industry

The units have been tested and approved by the Ecolab institute (formerly Henkel ecolab) for use in hygienic applications. The resistance to common cleaning agents and the ingress resistance was tested IP 68 and IP 69 K. This guarantees that no liquid can penetrate the module and that the bacteria growth is harmless. In most cases the modules are mounted laterally so that no deposits or drops can form on the housing front.

ProcessLine in use.

Technical details

The ProcessLine modules are optimised for use in the food industry. Many details are exceptional at first glance such as the central LED window displaying both operating voltages and signal states. Another highlight is the round housing without rough edges which can be accessed and cleaned from all sides with latest AS-Interface technology, with extended addressing range and peripheral fault evaluation. The AS-i interface is protected against reverse polarity and overload, the supply of the sensors and actuators is protected against short circuits. The modules are maintenance-free, the one-screw mounting guarantees a fast exchange in case of service. A range of connection cables with the same protection rating and with stainless steel nuts are available as accessories.

Digital modules CompactLine · Introduction

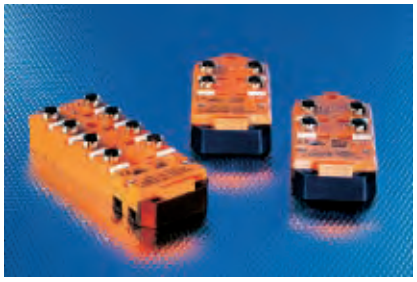
By means of the digital I/O modules binary signals of standard sensors can be transmitted to the controller via the AS-i cable. The controller can however also transmit binary switched signals to the actuators on site via the outputs of the I/O modules.

The tried and tested compact modules have been modified in the framework of the additions according to specification 2.1 and now find their place on the market of AS-i field modules as CompactLine modules. The A^2S-i chip manufactured by the company AMI is used.

Thus, new functionalities are available. The extended addressing mode allows communication with up to 62 slaves. Peripheral faults are displayed and transmitted to the AS-i master (according to the specification V2.1, e.g. *Controller e*). What is also new is the option of infrared addressing.

When the modules were modified, well-tried features such as full potting and compact housing remained. The slaves are connected to the AS-interface via the classic flat cable and feature protection rating

The LEDs on the front panel indicate the input / output states, the voltage supply and possible faults of the module.



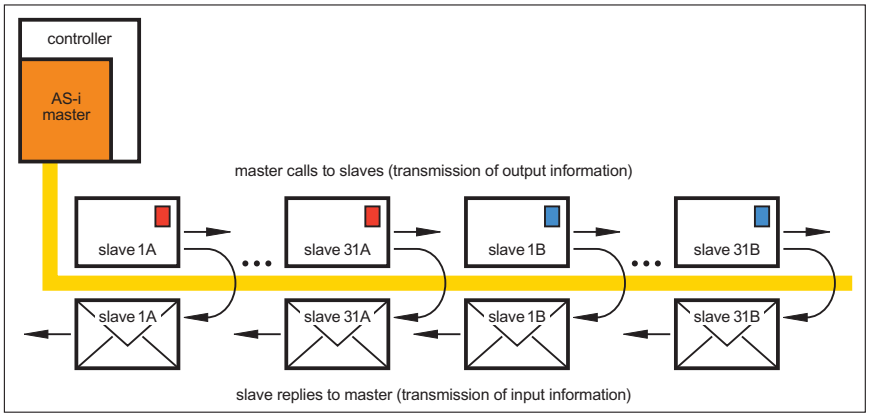
CompactLine M12 – the robust field modules.

Operating principle

When the master and the slaves communicate, the AS-i master transmits information to the AS-i network. This information comprises for example the slave address and the output information for the connected actuators of the called slave. The slave replies to the AS-i master with the input information of the connected sensors. If a slave provides inputs and outputs, bidirectional data exchange is used.

Slaves which only have outputs receive output signals from the master. The reply of the called slave however does not contain input information, it merely contains "empty" bits.

If a slave is designed as an input slave, the information bits are not used when the slave is called – the called slave however replies with the input information of the connected sensors. In this way 4 inputs and 4 outputs per slave can be realised with only four information bits.



Data communication via the AS-interface.

Variants

The CompactLine M12 modules are available with two different housings:

The modules with 4 locations (4 inputs, 2 inputs / 2 outputs, 4 outputs or the passive splitter box with 4 connections for intelligent sensors) have a housing length of 118 mm.

Modules with 4 inputs and 4 outputs have a housing length of 152 mm. The housing width, housing height and the fixing holes for the modules are identical for both housings. Thus, a universal drilling template can be used for mounting.

In order to meet the requirements of different applications CompactLine M12 modules are available as both standard units with a nickel-plated brass thread and with high-grade stainless steel threaded inserts. All variants use Viton O-rings as seals in the M12 sockets. The CompactLine modules are fully potted allowing them to meet the highest requirement for their protection rating as regards ingress of water and dust. Another advantage with potting the unit is that it makes the module resistant to high vibration.

In addition to the CompactLine modules, using the tried and tested yellow and black flat cables for the connection of the AS-i voltage and the external 24 V supply, further modules with integral round cable and M12 plug are available, so that different branching technologies can be used according to the customers' wishes when building an AS-i network.

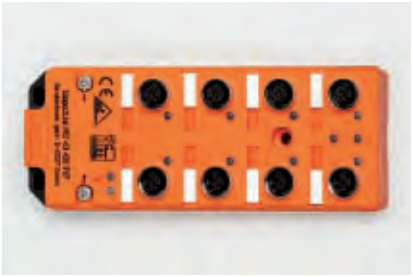
All modules using the flat cable technology and the insulation displacement technology with blade contacts have an infrared addressing interface. These modules can thus be allocated their address by using the respective addressing adapter (accessories) either before mounting or when connected. The red fault LED enables local fault diagnosis for these modules as well, giving the possibility to distinguish between communication and peripheral faults.

Some variants moreover include a "Y connection" for the input sockets. Here, pin 2 of socket 1 is connected to pin 4 of socket 2 (the same applies to sockets 3 and 4 – if available). Thus, a sensor with two outputs (e.g. one switching output and one function check output) can be connected to socket 1 (in this case socket 2 must not be used in addition) or one sensor each with only one switching output can be connected to socket 1 and socket 2. Modules having two sockets with two inputs each are thus eliminated, which simplifies stock management.

The CompactLine modules partly have further special functions like the extended addressing mode (addressing of up to 62 AS-i slaves) or an external input supply. It is thus possible to connect an output via a switching or auxiliary contact directly to an input without causing a mixing of AS-i potentials and external 24 V supply.

Furthermore there are CompactLine modules for which the AS-i / 24 V supply is not provided via the flat cable lower part but via an M12 connector.

CompactLine M12 4I module.



CompactLine M12 4I / 4O module.

CompactLine M12 supply.

Digital modules ClassicLine · Introduction

By means of the digital I/O modules binary signals of standard sensors can be transmitted to the controller via the AS-i cable. Vice versa, the controller can also transmit binary switched signals to the actuators on site via the outputs of the I/O modules.

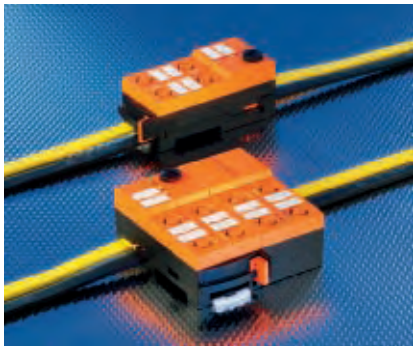
The ClassicLine modules for field applications convince by their flat design, the quick mounting technology and many other features. Electrical characteristics such as "extended addressing mode" (communication with up to 62 slaves) as well as peripheral fault and communication error indication with the possibility of transfer to and evaluation by an AS-i master of the specification 2.1, e.g. ***controller e***, are also available.

In addition to the already known LEDs the logic state of the PLC outputs is also indicated by an LED by the digital output modules.

The ClassicLine modules enable precise fault location. They are excellently suited for installation in the field due to their compact design and their protection rating. Special characteristics enabling quick set-up for the user are, among others:

- quick mounting of upper and lower parts (quick mounting technology)
- very safe mounting
- insertion of the flat cable from three directions

ClassicLine modules for field applications.

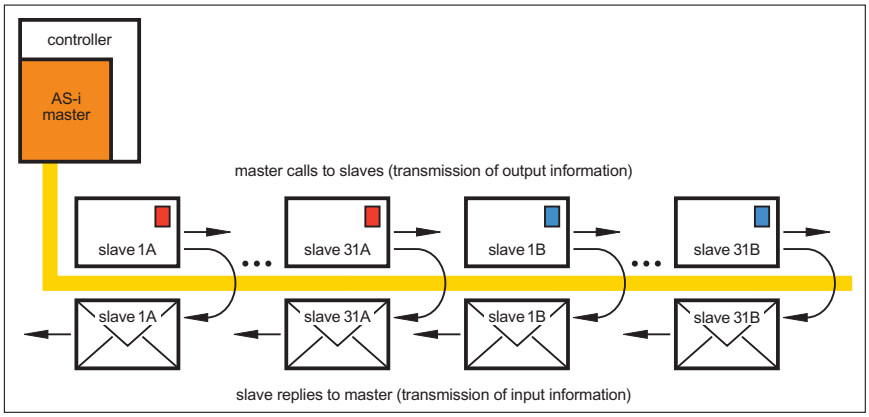


Operating principle

When the master and the slaves communicate, the AS-i master transmits information to the AS-i network. This information comprises for example the slave address and the output information for the connected actuators of the called slave. The slave replies to the AS-i master with the input information of the connected sensors. If a slave provides inputs and outputs, bidirectional data exchange is used.

Slaves which only have outputs receive output signals from the master. The reply of the called slave however does not contain input information, it merely contains "empty" bits.

If a slave is designed as an input slave, the information bits are not used when the slave is called – the called slave however replies with the input information of the connected sensors. In this way 4 inputs and 4 outputs per slave can be realised with only four information bits.



Data communication via the AS-interface.

Versions

The ClassicLine modules for field applications are available in the most common electrical versions. ifm moreover offers ClassicLine modules with 2 ampere outputs, in order to also enable the connection of powerful solenoid valves with increased current consumption. All ClassicLine modules with extended addressing mode have a so-called Y-circuit for the inputs, which for example enable the connection of dual sensors to an M12 socket of the module. All digital outputs also have a Y-circuit.

The ClassicLine modules are available with a width of 45 or 90 mm. Mounting can be done using the supplied flat cable lower part on a DIN rail or with two screws on a mounting plate.

Addressing

The modules can be addressed either prior to installation without voltage or when connected and wired via the implemented addressing socket. Only the addressing unit and the corresponding addressing cable with a jack plug are required.

All these features make commissioning and maintenance easier for the user and increase the uptime of the complete AS-interface system.

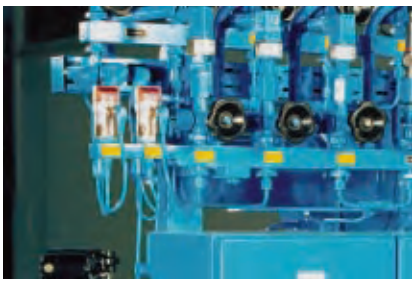
Convenient addressing of the ClassicLine modules via the the addressing socket.

Analogue modules · Introduction

In addition to binary signals analogue control signals often have to be processed in industrial process automation, e.g. temperature or pressure values. In conveying, machines and plants are speed-adjusted via the transmission of continuous signals.

In principle it does not matter whether the analogue values represent a temperature, a speed, a pressure or another continuous quantity necessary for the process. In general the analogue value is converted into a voltage value or current value via a suitable sensor and is thus available for the process. By means of the analogue I/O modules these values can then be digitally transmitted to the controller, e.g. ***controller e***, via the standard AS-i cable.

Analogue value detection of system pressure.



Imperative: Temperature detection in plants and machines.

Operating principle

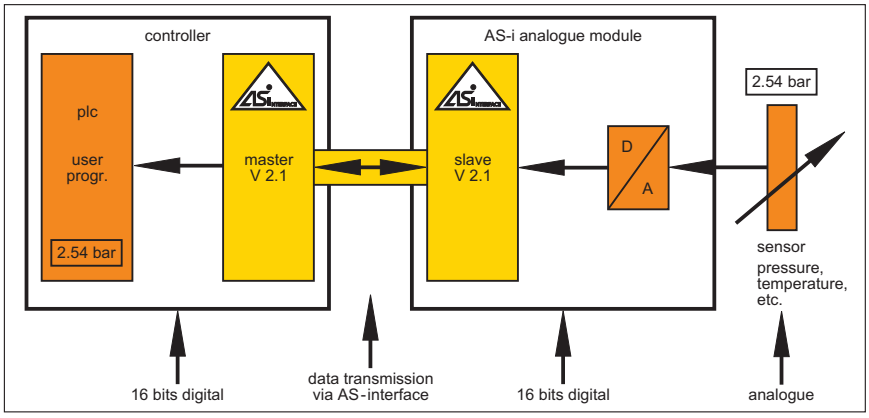
When the fundamental characteristics of AS-i were defined, an information share was defined at 4 bits for each slave. A little more time is necessary for the transmission of analogue values which generally consist of more than 4 bits.

Practically, the analogue values are transmitted in the form of data fragments in several AS-i cycles and "reassembled" to a complete analogue value by the driver module in the AS-i master. In the user program, access to an analogue value is limited in such a way that the value can be read at a defined address.

First, certain manufacturer-independent slave profiles were defined, regulating the data exchange of the analogue slaves with the AS-i master. These are the profiles S-7.1 and S-7.2 (according to the AS-i specification V2.0) and the profiles S-7.3 and S-7.4 (according to the AS-i specification V2.1).

If slaves with the profiles S-7.1 or S-7.2 are used, a function block has to be processed in the software of the higher-level controller, realising data communication with the analogue slave. This procedure however becomes less important, as these drivers are no longer necessary due to the availability of analogue slaves with the profiles S-7.3 and S-7.4. The AS-i masters available on the market can clearly recognise these slaves by their profile and then start data exchange themselves. The necessary effort is practically reduced to "plug & play". An additional software module is not necessary, as it is integrated into the firmware of the AS-i master.

The transmission of analogue data takes more time when using slaves with the profiles S-7.1 and S-7.2, compared to slaves with the profiles S-7.3 or S-7.4, because data communication here depends on the cycle time of the higher-level plc.



Data communication via the AS-interface.

Visit our website: www.ifm-electronic.com

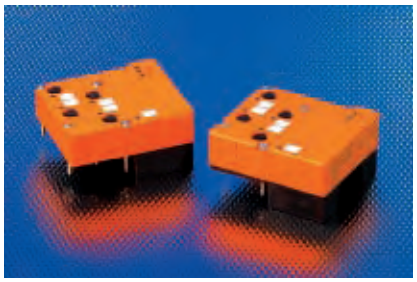
Analogue modules with quick mounting technology

The analogue modules for field applications are as convincing as the digital ClassicLine modules with the quick mounting technology as well as their easy and safe handling. The user inserts the flat cable into the supplied flat cable guide (lower part) as usual, mounts the module and locks it by means of the slide. So, considerable timesaving during installation of these modules is an additional customer benefit.

The module now is safely locked, complies with the protection rating IP67 and can be unlocked, for example for removal, by means of a screwdriver.

Addressing can be carried out directly after mounting via the implemented addressing socket.

In addition to the ClassicLine modules with quick mounting technology other analogue modules for field applications are offered, too.



4-channel analogue module with M12 connectors.

Standard ClassicLine modules

The modules with the standard ClassicLine housing, developed according to the slave profile S-7.3, feature protection rating IP 67. With a housing width of 90 mm 4 analogue inputs, 4 analogue outputs or 4 Pt100 inputs are available. Status LEDs for inputs and outputs and for the display of AS-i voltage, external 24 V voltage or peripheral and communication faults complete the features of these modules.

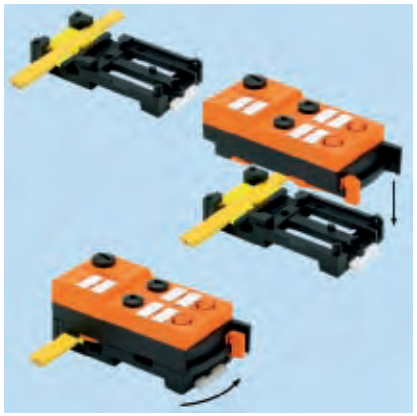
2-channel analogue module with cage clamps.

Universal modules

The universal analogue modules with an IP 65 housing have also been developed according to the profile S-7.3 and thus do not require a software driver. These analogue modules have either 2 inputs, 2 outputs or 4 Pt100 inputs. For the connection to the AS-interface and to the external 24 V supply the tried and tested flat cable lower parts are also used here. The connection cables of the sensors / actuators are inserted into the module via PG cable glands and connected via cage clamps.

LEDs in the module indicate the status of the analogue channels and communication or peripheral faults.

Addressing of the analogue modules in the universal housing is either done prior to installation via the addressing adapter integrated into the addressing unit or after by using the lower part of the module with an addressing socket (as an option) and an addressing cable with a jack plug (accessories).



Active ClassicLine module for field applications.

Digital module ClassicLine ATEX

The standard AS-i bus system so far exclusively used in non-hazardous areas, can now also be used for zone 2 and zone 22 (non-conductive dusts). The AS-i ATEX modules can be directly mounted in the corresponding environments. This eliminates the need for complex control cabinets with conventional wiring. The remaining AS-i system consisting of AS-i master, power supply, cable, etc. can be used unchanged.

Within the framework of the extension of the AS-Interface according to specification 2.1 the product range for field applications is considerably complemented by the ClassicLine family. The use of the A^2SI chip enables a range of additional functions. Peripheral and communication fault indication (which can be transferred to and analysed by an AS-i master of specification 2.1 such as ***Controllere***) are available.

These modules also feature an infrared addressing interface to allow addressing after mounting.
The ClassicLine modules enable exact fault location and their compact design and high protection rating make them perfectly suitable for installation in the field.
The connection of the ClassicLine modules to the flat cable is done via the tried and tested conventional flat cable lower parts and enables fast and reverse polarity protected mounting for the user.
The LEDs indicate the signal states of the inputs and outputs, the operating voltage and possible faults.
The variety of types of the ClassicLine family enables the user to compile the optimum configuration for the required number of inputs / outputs.

ClassicLine modules for field applications in hazardous areas.

Definitions and marking of ATEX units

ATEX stands for "**at**mosphère **ex**plosible".

The EU directives 94/9/EC and 1999/92/EC are commonly **also called "ATEX directives"**.

What does 94/9/EC mean?

These are the directives which harmonise the legal provisions of the member states of the European Union for equipment and protection systems for intended use in hazardous areas.

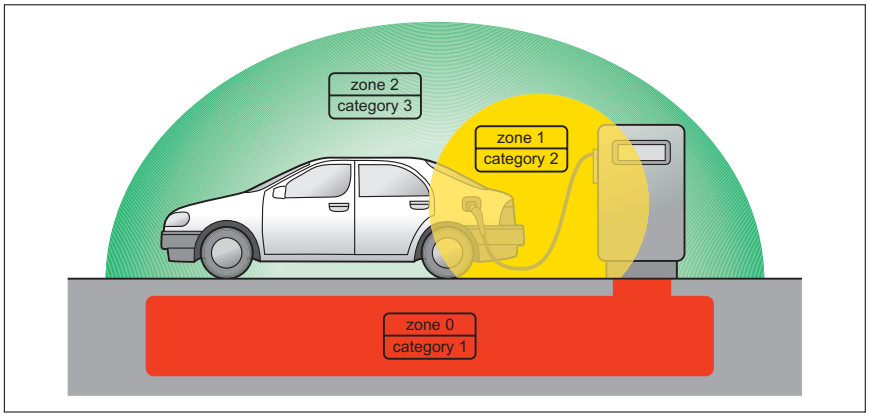
▶ concerns the manufacturers of electrical equipment

What does 1999/92/EC mean?

These are minimum provisions to improve the protection of health and safety of the employees who can be jeopardised by hazardous atmospheres.

▶ concerns the users

Note: The user or the operator of an installation is responsible for the division into zones.



Example of the division into hazardous areas.

Explosions may arise where combustible gases, vapours, mists, liquids or dusts are produced, stored, filled or transported and when exposed to air may form an explosive mixture under certain conditions. Hot surfaces of electrical equipment can also act as ignition source.

Division into equipment categories and zones for equipment group II			
Equipment category	Zone		Presence of explosive atmospheres
	Gas	Dust	
1	0	20	continuously or for long periods
2	1	21 22 (conductive dust)	occasionally in normal operation
3	2	22 (non-conductive dust)	explosive atmospheres are not likely to occur in normal operation and if they occur they will exist only rarely and for a short time

Division into equipment groups

Equipment group I: for mines

Equipment group II: for other explosive atmospheres

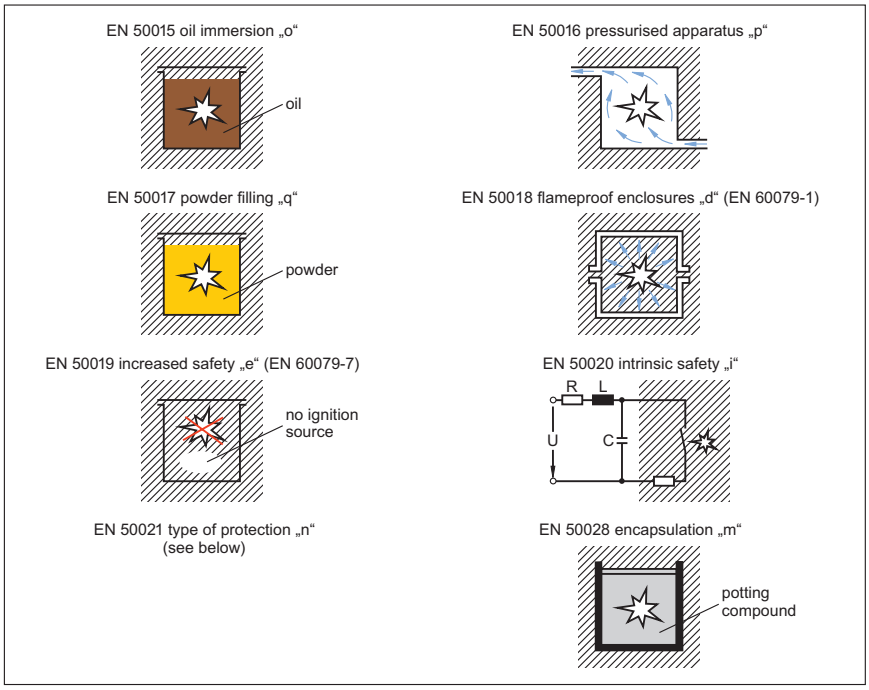
Substance groups

G: Explosive atmospheres: gas, mist, vapours

D: Explosive atmospheres: dust

Protection groups

No matter which protection group, the parts to which the explosive atmosphere has free access must not have non-permissible temperatures.



EN 50281-1-1:

Electrical equipment for use in areas with combustible dust with protection by enclosure. Part 1-1: Protection by enclosure.

EN 50014 (EN 60079-0):

Electrical equipment for explosive atmospheres, general conditions.

Protection group "n" (EN 60079-15):

nA non-sparking equipment

nC sparking equipment with the contacts being protected in an appropriate way, however not by mist-proof enclosure, energy limitation or pressurised enclosure

nR mist-proof equipment

nL energy-limited equipment

nZ equipment with n pressurised enclosure

Temperature classes (EN 50014)

T1: 450 °C

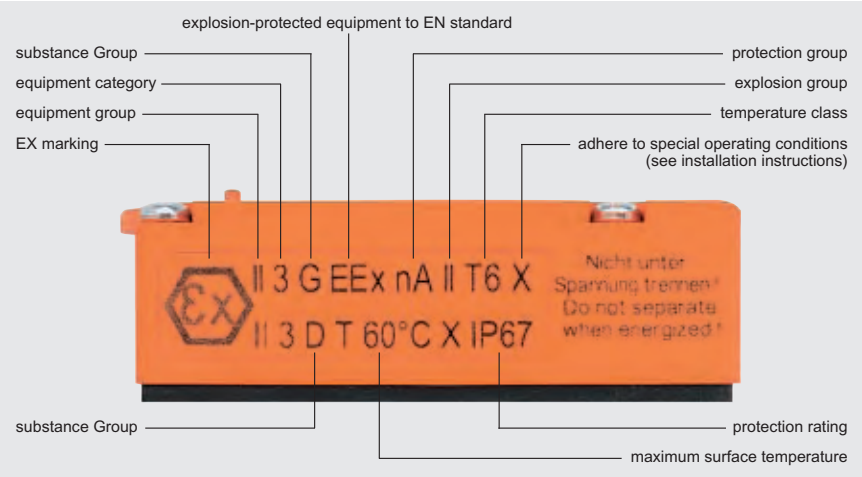
T2: 300 °C

T3: 200 °C

T4: 135 °C

T5: 100 °C

T6: 85 °C



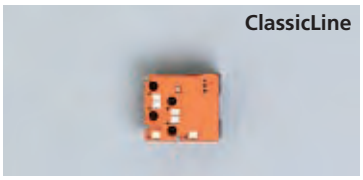
Example of equipment marking.

Type	Digital inputs	Digital outputs		Analogue inputs (AI) Analogue outputs (AO)			Applica-tion	Page
		Tran-sistor	Relay	I	U	Pt100		
ProcessLine · Stainless steel module with digital inputs and outputs								
ProcessLine 	4	3	–	–	–	–	●	104
	8	–	–	–	–	–	●	104
CompactLine · Robust field modules with digital inputs and outputs								
CompactLine M12 	4	–	–	–	–	–	●	106
	2 x 2	–	–	–	–	–	●	106
	2	2	–	–	–	–	●	106
	–	4	–	–	–	–	●	106
CompactLine M12 	4	4	–	–	–	–	●	106
CompactLine M12 	4	4	–	–	–	–	●	106
	4	–	–	–	–	–	●	106
CompactLine M8 	4	–	–	–	–	–	●	106
ClassicLine · Robust field modules with digital inputs and outputs (quick mounting technology)								
ClassicLine 	4-way splitter	–	–	–	–	–	●	112
	4	–	–	–	–	–	●	112
	4	4	–	–	–	–	●	112
	2	2	–	–	–	–	●	112
	–	4	–	–	–	–	●	112
ClassicLine 2.1 	4	–	–	–	–	–	●	114
	2	2	–	–	–	–	●	114
	–	3	–	–	–	–	●	114

For industrial applications

For hygienic and wet areas

For hazardous areas

Type	Digital inputs	Digital outputs		Analogue inputs (AI) Analogue outputs (AO)			Applica-tion	Page
		Tran-sistor	Relay	I	U	Pt100		
ClassicLine · Robust field modules with digital inputs and outputs (quick mounting technology)								
 ClassicLine	4	4	–	–	–	–	●	112
	4	3	–	–	–	–	●	114
	8	–	–	–	–	–	●	114
ClassicLine ATEX · Field modules for use in hazardous areas								
 ClassicLine ATEX	4	–	–	–	–	–	●	122
	2	2	–	–	–	–	●	122
	–	4	–	–	–	–	●	122
Field modules with digital inputs and outputs								
 Universal	4	–	–	–	–	–	●	108
 Universal	4	4	–	–	–	–	●	108
Field modules with analogue inputs and outputs								
 ClassicLine	–	–	–	2 AI	–	–	●	120
 ClassicLine	–	–	–	4 AI, AO	–	–	●	118
	–	–	–	–	4 AI, AO	–	●	118
	–	–	–	–	–	4	●	118
 Universal	–	–	–	2 AI, AO	–	–	●	110
	–	–	–	–	2 AI, AO	–	●	110
	–	–	–	–	–	4	●	110

For industrial applications

For hygienic and wet areas

For hazardous areas

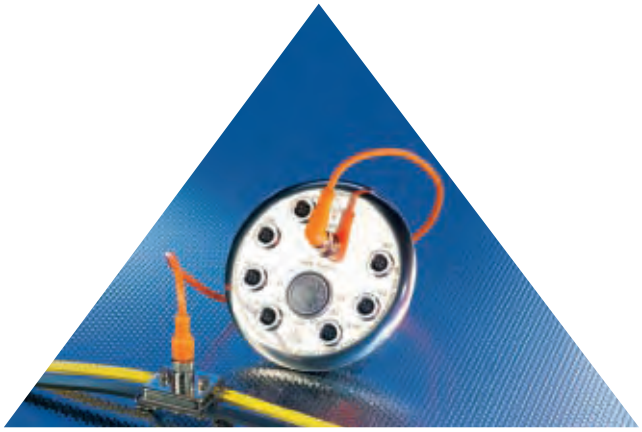
Selection chart

Type	Digital inputs	Digital outputs		Analogue inputs (AI) Analogue outputs (AO)			Applica-tion	Page
		Tran-sistor	Relay	I	U	Pt100		
Illuminated pushbutton module								
Illuminated pushbutton module 	2	2	–	–	–	–	●	116
Module lower parts								
Type 1 	–	–	–	–	–	–	●	124
Type 2 	–	–	–	–	–	–	●	124

For industrial applications

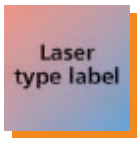
For hygienic and wet areas

For hazardous areas



- **AS-i ProcessLine – stainless steel modules with high protection ratings.**
- **Digital inputs and outputs. Extended AS-i addressing range 1...62.**
- **M12 connection technology with radial O-ring.**
- **Quick mounting with only one screw.**
- **ECOLAB tested, resistant to common cleaning agents.**

ProcessLine



Special features of the units: For more explanations see the technical glossary chapter starting on page 256

AS-i ProcessLine modules – hygienic and robust

All units in the ProcessLine family feature award winning design, high protection rating, robust stainless steel housing and one screw mounting. It has been specially designed for frequent high pressure cleaning. The laser type label enables permanent legibility.

The electrical functioning of the ProcessLine I/O module is the same as for the modules in other housing types. The addressing is made via the M12 plug on the front panel. The M12 sockets allow connection of common 2- or 3-wire sensors such as the inductive T-series efector m of ifm electronic. 2-wire actuators such as solenoid valves can be connected to the outputs.

The passive AS-i splitter enables connection of active AS-i slaves such as the T4 / T5 / T6 dual sensors or AS-i valve heads. It distributes AS-i and separate 24 V voltage. Pin 5 allows screening or connection of functional earth.

Accessories and connectors

Type	Description	Order no.
	ProcessLine FC insulation displacement connector, V4A, IP 69 K	E70354
	Protective cover M12	E70297
	AS-i flat cable for food applications, colour: yellow	AC4007
	AS-i flat cable for food applications, colour: black	AC4008
	Jumper M12-M12, group 22 5-pole, 1 m, st. steel, IP 69 K	E11642
	Jumper M12-M12, group 22 5-pole, 2 m, st. steel, IP 69 K	E11643

Further accessories are available starting on page 197

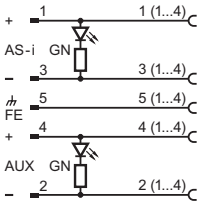
Further connectors are available starting on page 179

AS-i ProcessLine
Modules for food and process industry

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
ProcessLine module active									
4 DI	3 DOT	yes	yes	200	0.7 (2.1)	S-7.A.E	< 240	1	**AC2904**
8 DI	–	yes	–	400	–	S-0.A.E	< 500	2	**AC2910**
ProcessLine passive splitter box									
8 S	–	yes	yes	–	4 (4)	–	–	3	**AC2900**
Flat cable insulation displacement connectors / flat cable splitter boxes									
–	–	–	–	–	2	–	–	4	**E70354**
–	–	–	–	–	2	–	–	5	**E70454**
–	–	–	–	–	8	–	–	6	**E70377**

Front view AC2904

Socket pin layout AC2900

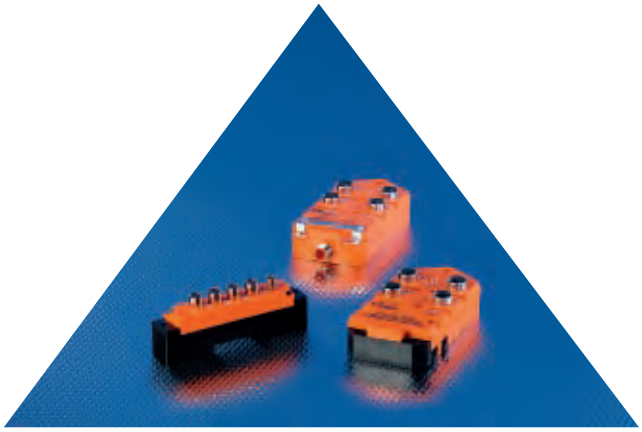


FC-connections

From left: E70377, E70454 and E70354

You can find scale drawings from page 234

ClassicLine digital 112 - 115
Illuminated pushbutton modules 116 - 117
ClassicLine analogue 118 - 121
For hazardous areas 122 - 123
Module lower parts
For industrial applications
Module lower parts 124 - 125



- **Field modules with digital inputs and outputs.**
- **Modules with full potting for robust applications.**
- **Indication of peripheral fault and communication error.**
- **LED status and switching status indication on the front panel.**
- **Connection of the unit by means of M12 sockets.**

CompactLine

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Robust I/O modules

Distinctive features of the ifm CompactLine family include high ingress-resistance and an increased resistance to vibration and shock. This is achieved by fully potting the unit. Due to the especially flat, compact design it can be used when only a restricted mounting space is available. The sockets are made of nickel-plated brass as a standard, but they are also available in stainless steel. Addressing is made either via the AS-i interface or via infrared adapter. In the latter case, however, the unit must be connected to the AS-i voltage. The connection of the yellow (AS-i) and black (24 V) flat cables is made by means of the lower part supplied with the unit.

The CompactLine M8-module is ideal for handling systems. Due to the M8 connections it is very small and can also be mounted on movable parts. The holes at the top and at the sides enable horizontal or vertical mounting, by means of slot nuts, on aluminium system sections without any problems.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable	**E70123**
	Jumper, M12 / M8 group 13, PPU, 2 m	**E70027**
	Addressing cable with infrared head, 1 m	**E70211**

Further accessories are available starting on page 197

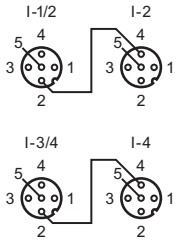
Further connectors are available starting on page 179

CompactLine M8 and M12
Digital inputs and outputs
A/B-slave: AC2457, AC2480

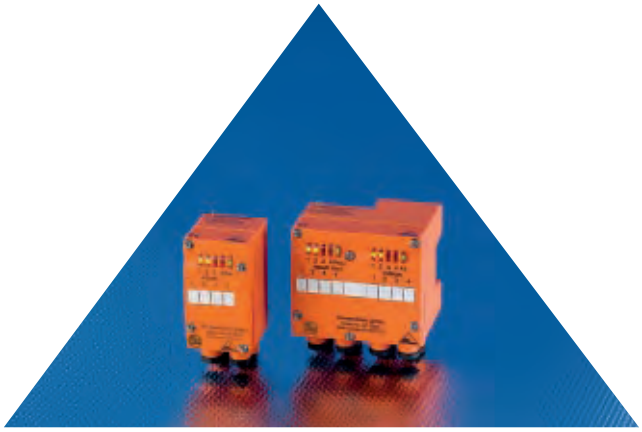
Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
CompactLine M12 · digital inputs and outputs									
4 V	–	yes	–	–	(4)	–	–	1	**AC2413**
4 DI	–	yes	–	200	–	S-0.0.E	< 250	1	**AC2410**
4 DI-Y	–	yes	–	200	–	S-0.A.E	< 250	1	**AC2457**
8 DI-Y	–	yes	–	2 x (200)	–	S-0.1.E	2 x 250	2	**AC2463**
–	4 DOT	–	yes	–	2 (4)	S-8.0	< 75	1	**AC2417**
2 DI	2 DOT	yes	yes	100	2 (4)	S-3.0.E	< 150	1	**AC2411**
4 DI	4 DOT	yes	yes	200	2 (4)	S-7.0.E	< 250	2	**AC2412**
2 DI-Y	2 DOT	yes	yes	200	2 (4)	S-3.F.E	< 250	1	**AC2458**
4 DI-Y	4 DOT	yes	yes	200	2 (4)	S-7.F.E	< 250	2	**AC2459**
CompactLine M12 · digital inputs and outputs · supply inputs via 24V									
4 DI	4 DOT	–	yes	500	2 (4)	S-7.0.E	< 30	2	**AC2466**
CompactLine M12 · digital inputs and outputs · high-grade stainless steel									
4 DI	–	yes	–	200	–	S-0.0.E	< 250	1	**AC2451**
4 DI	4 DOT	yes	yes	200	2 (4)	S-7.0.E	< 250	2	**AC2452**
CompactLine M8 · digital inputs and outputs									
4 DI	–	yes	–	100	–	S-0.A.E	< 120	3	**AC2480**
CompactLine M12 · digital inputs and outputs · AS-i / AUX external power supply via M12 connector									
4 DI	–	yes	–	200	–	S-0.0.E	< 250	4	**AC2464**
4 DI	4 DO	yes	yes	200	2(4)	S-7.0.E	< 250	5	**AC2465**

Front view AC2464

Socket pin layout AC2457 (Y-circuit)



You can find scale drawings from page 235



Universal

- **Field modules with digital inputs and outputs.**
- **Standardised EMS interface for AS-i and 24 V.**
- **Indication of peripheral fault and communication error.**
- **Unit connection via lateral cable glands and cage clamps.**
- **Robust DIN rail mounting via FC lower parts.**

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Universal I/O modules

The universal module concept is based on the first universal AS-i interface. It ensures compatibility of different products like I/O modules, AirBoxes, or illuminated pushbutton modules which are all connected via the same lower parts. Thus the mounting holes can be standardised, the cabling is easier and the possibility of side-by-side mounting is ensured. Depending on the AS-i cable flat cable (FC) or round cable (RC) lower parts can be used. The biggest saving is achieved with the FC lower parts as the flat cable is only inserted and does not have to be cut, stripped and wired any more. The lower parts are not included in the delivery of the Classic Line, as there are different versions. In the case of input-only modules lower parts for the yellow cable are required (type 1). In the case of modules that have outputs lower parts that allow connection to both yellow (AS-i) and black (external 24 V) (type 2) are required. Type 1 units always fit onto type 2 lower parts. All unit connections are made via cage clamps in the housing and are accessible under the removable cover.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable for AS-i slaves via addressing socket in the lower part	**E70213**
	FC lower part (yellow / yellow)	**AC5000**
	FC lower part (yellow / yellow) with addressing socket	**AC5010**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

Universal modules
Digital inputs and outputs

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
4 DI	–	yes	–	160	–	S-0.0	< 200	1	**AC2032**
4 DI	4 DOT	yes	yes	200	2 (4)	S-7.F	< 260	2	**AC2035**

Please order the lower part separately !

Front view AC2032

Terminal connection

terminal designation	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3
data bit	D0			D1			D2			D3		
order no.												
AC 2032	input 1			input 2			input 3			input 4		
	+	IN	–	+	IN	–	+	IN	–	+	IN	–
AC 2035	input 1			input 2			input 3			input 4		
	+	IN	–	+	IN	–	+	IN	–	+	IN	–
	output 1			output 2			output 3			output 4		
	nc	OUT	–	nc	OUT	–	nc	OUT	–	nc	OUT	–

You can find scale drawings from page 236

Universal

- **Field modules with 2 analogue inputs or outputs.**
- **Slave profile S-7.3 for simple data transmission.**
- **Indication of peripheral fault and communication error.**
- **0/4...20 mA, Pt100 and 0...10 V standard signals.**
- **Robust DIN rail mounting via FC lower parts.**

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Universal modules analogue

The universal module concept is based on the first universal AS-i interface. It ensures compatibility of different products like I/O modules, AirBoxes, or illuminated pushbutton modules which are all connected via the same lower parts. Thus the mounting holes can be standardised, the cabling is easier and the possibility of side-by-side mounting is ensured.

Universal modules with analogue inputs and outputs exchange their data directly with AS-i 2.1 masters. This is done automatically after detection and identification of the modules. An additional function block is not required. In case of the controller e e.g. the analogue values can be indicated directly on the display.

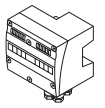
All unit connections are made via cage clamps in the housing and are accessible under the removable cover. The unit cables are inserted by means of cable glands on the side. The status and diagnostic LEDs can be seen on the front panel.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable for AS-i slaves	**E70213**
	FC lower part (yellow / yellow)	**AC5000**
	FC lower part (yellow / yellow) with addressing socket	**AC5010**

Further accessories are available starting on page 197

Further connectors are available starting on page 179



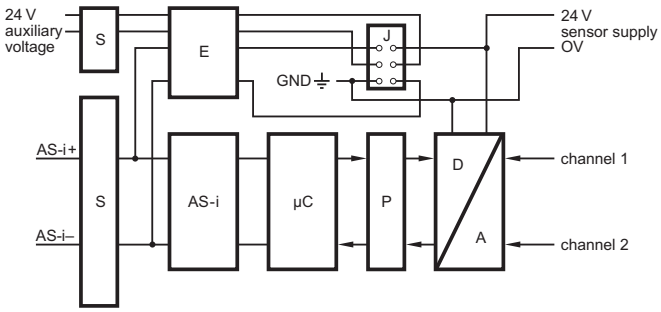
Universal modules
Analogue inputs and outputs

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
2 AI C	–	yes	yes	80	–	S-7.3.D	< 170	3	**AC2616**
2 AI V	–	yes	yes	80	–	S-7.3.D	< 170	3	**AC2617**
–	2 AO C	–	yes	–	80 (80)	S-7.3.5	< 170	3	**AC2618**
–	2 AO V	–	yes	–	80 (80)	S-7.3.5	< 170	3	**AC2619**
4 Pt100	–	yes	–	20	–	S-7.3.E	< 80	2	**AC2620**

Please order the lower part separately !

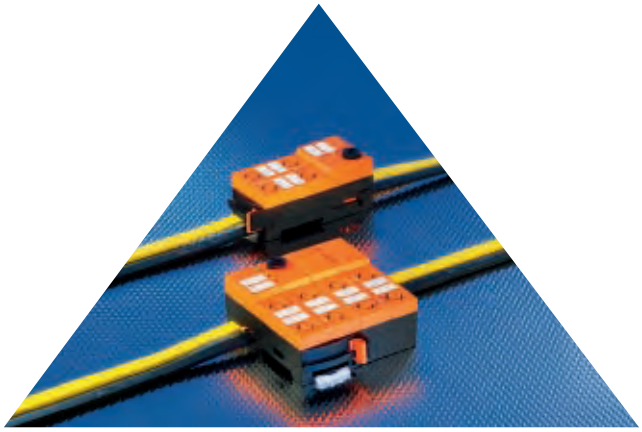
Front view AC2616

Block diagram AC2616



For other block diagrams see www. ifm-electronic.com

You can find scale drawings from page 236



- **Quick toolless mounting of upper and lower parts.**
- **Very safe mounting.**
- **3 freely selectable directions of the flat cable.**
- **Digital field modules with high protection rating.**
- **Easy addressing.**

ClassicLine

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Quick mounting technology

The ClassicLine modules for field applications are now easier to use with their novel slider technology which ensures toolless and safe mounting of upper and lower parts. For removal a tool is needed, e.g. a screwdriver. The modules can be addressed either without voltage before mounting or when mounted and wired via the implemented addressing socket.

Moreover, the user can insert the flat cable according to its concept in three different, freely selectable directions to the module. In addition to the conventional LEDs such as operating voltage, signal states of the periphery indication the logic state of the PLC is also displayed with digital output modules.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable for AS-i slaves	**E70213**
	Flat cable splitter box	**E70381**
	Flat cable seal	**E70413**

Further accessories are available starting on page 197

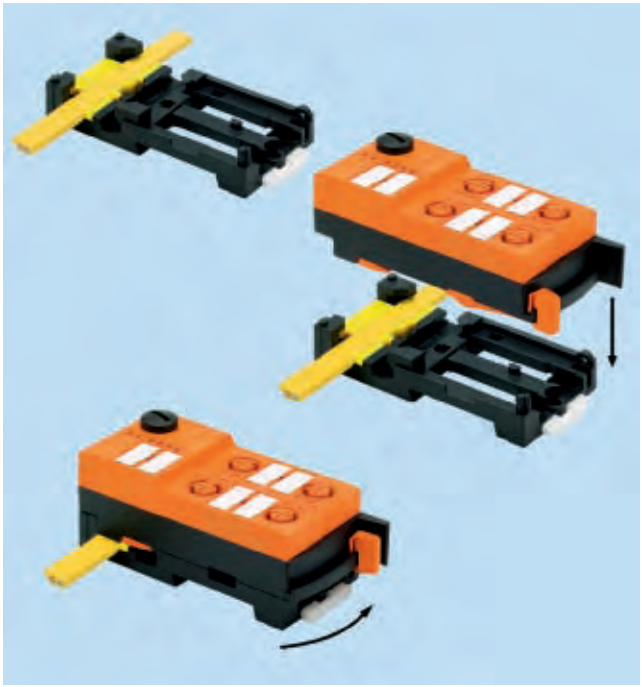
Further connectors are available starting on page 179

ClassicLine, single-slaves
Digital in- and outputs

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
ClassicLine · digital in- and outputs									
4 S	–	–	–	–	(2)	–	–	4	**AC5200**
4 DI	–	yes	–	200	–	S-0.0.E	< 250	4	**AC5205**
–	4 DO-Y	–	yes	–	1 (2)	S-8.0.E	< 50	4	**AC5208**
–	4 DO-Y	–	yes	–	2 (4)	S-8.0.E	< 50	4	**AC5213**
4 DI	4 DO-Y	yes	yes	200	1 (2)	S-7.0.E	< 250	5	**AC5209**
4 DI	4 DO-Y	yes	yes	200	2 (4)	S-7.0.E	< 250	5	**AC5212**
2 DI	2 DO-Y	yes	yes	100	2 (4)	S-3.0.E	< 150	4	**AC5211**

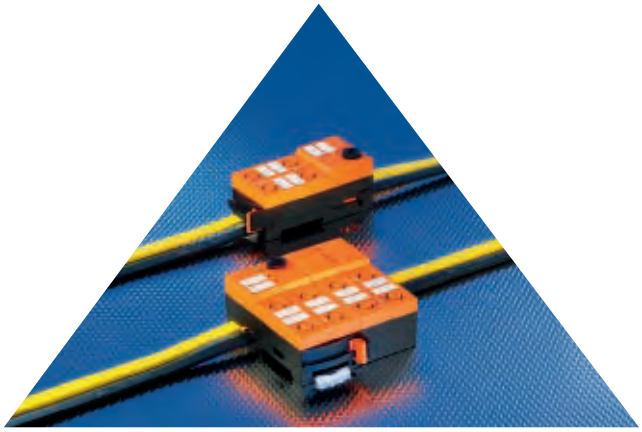
Lower part supplied with the device!
Protective caps for M12 sockets to be ordered separately (E73004).

Quick mounting of upper and lower parts



You can find scale drawings from page 236

ClassicLine digital 112 - 115
Illuminated pushbutton modules 116 - 117
ClassicLine analogue 118 - 121
For hazardous areas 122 - 123
Module lower parts
For industrial applications
Module lower parts 124 - 125



- **Quick toolless mounting of upper and lower parts.**
- **Very safe mounting.**
- **3 freely selectable directions of the flat cable.**
- **Digital field modules with high protection rating.**
- **Easy addressing.**

ClassicLine

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Quick mounting technology

The ClassicLine modules for field applications are now easier to use with their novel slider technology which ensures toolless and safe mounting of upper and lower parts. For removal a tool is needed, e.g. a screwdriver. The modules can be addressed either without voltage before mounting or when mounted and wired via the implemented addressing socket.

Moreover, the user can insert the flat cable according to its concept in three different, freely selectable directions to the module. In addition to the conventional LEDs such as operating voltage, signal states of the periphery indication the logic state of the PLC is also displayed with digital output modules.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable for AS-i slaves	**E70213**
	Flat cable splitter box	**E70381**
	Flat cable seal	**E70413**

Further accessories are available starting on page 197

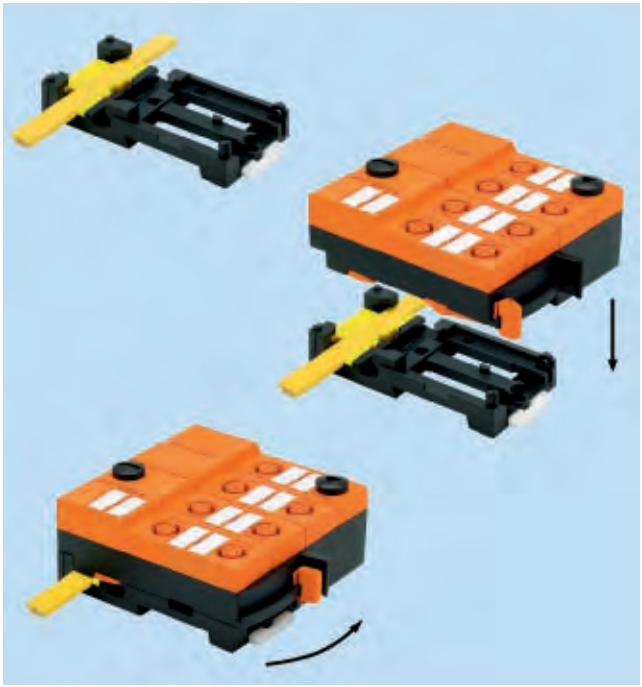
Further connectors are available starting on page 179

ClassicLine 2.1, A/B-slaves
Digital in- and outputs

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
ClassicLine 2.1 · digital in- and outputs									
8 DI-Y	–	yes	–	250	–	S-0.A.E	< 300	5	**AC5210**
4 DI-Y	–	yes	–	200	–	S-0.A.E	< 250	4	**AC5215**
4 DI-Y	3 DO-Y	yes	yes	200	1 (3)	S-7.A.E	< 250	5	**AC5204**
2 DI-Y	2 DO-Y	yes	yes	100	1 (2)	S-B.A.E	< 150	4	**AC5214**
–	3 DO-Y	–	yes	–	2 (4)	S-8.A.E	< 50	4	**AC5203**

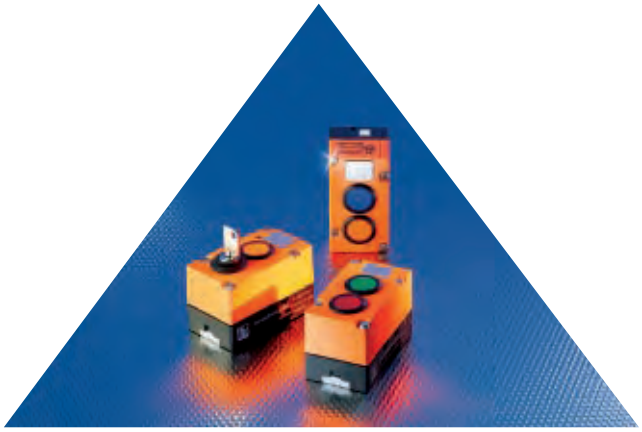
Lower part supplied with the device!
Protective caps for M12 sockets to be ordered separately (E73004).

Quick mounting of upper and lower parts



You can find scale drawings from page 236

ClassicLine digital 112 - 115
Illuminated pushbutton modules 116 - 117
ClassicLine analogue 118 - 121
For hazardous areas 122 - 123
Module lower parts
For industrial applications
Module lower parts 124 - 125



- **Illuminated pushbutton modules in conventional ClassicLine housing.**
- **2 pushbuttons and 2 LEDs, ready to use.**
- **Fixed or selectable illuminated pushbutton colour.**
- **Supply from the AS-i line, no additional 24V required.**
- **Robust DIN rail mounting via FC lower parts.**

Pushbutton

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Illuminated pushbutton modules

The illuminated AS-i pushbutton modules are based on the EMS standard and can be used in combination with all FC lower parts. The modules are exclusively supplied with voltage from the AS-i line. The maximum current consumption is less than 60 mA. The two pushbuttons operate as normally open contacts and are completely wired to the LEDs below. They can be evaluated by means of AS-i data bits.

Addressing is carried out in the same way as with all other I/O modules. A red / green dual LED on the master indicates that the AS-i voltage has been applied and that the communication functions correctly (green) or that there is a communication error (red) due to non-addressing or non-projection.

The powerful LEDs are available in red / green combination and with exchangeable colour caps in red, green, yellow, blue and white. The pushbuttons can be labelled and provide protection against unintentional actuation.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable for AS-i slaves	**E70213**
	FC lower part	**AC5000**
	FC lower part with addressing socket	**AC5010**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

Illuminated push-button modules
A/B slave: AC2086, AC2087 and AC2088 (normally open / normally closed)

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
Illuminated push-button module · Digital inputs and outputs · red/green									
2 BI	2 LO	yes	–	–	–	S-3.F.F	< 55	6	**AC2018**
2 BI	2 LO	yes	–	–	–	S-B.A.E	< 55	6	**AC2088**
Illuminated push-button module · Digital inputs and outputs · Colour inserts changeable									
2 BI	2 LO	yes	–	–	–	S-3.F.F	< 55	6	**AC2026**
2 BI	2 LO	yes	–	–	–	S-B.A.E	< 55	6	**AC2086**
Illuminated push-button module · Digital inputs and outputs · key-operated switch									
2 BI	1 LO	yes	–	–	–	S-B.A.E	< 55	6	**AC2087**

Please order the lower part separately !

Front view AC2086

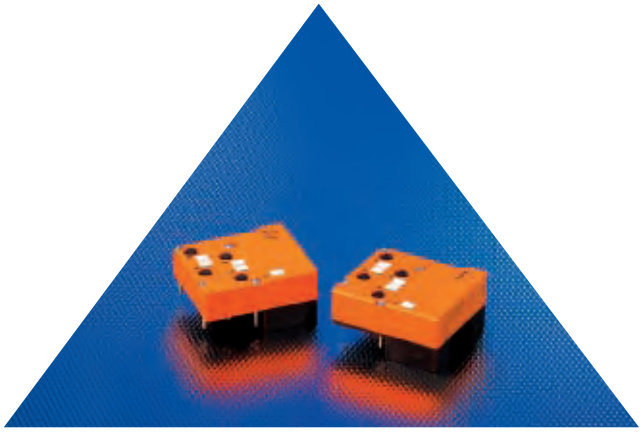
Data bits AC2086

data bit	D0	D1	D2	D3
push button 1	–	–	I-3	–
push button 2	–	–	–	I-4
LED 1	O-1	–	–	–
LED 2	–	O-2	–	–

For other wiring diagrams see www. ifm-electronic.com

You can find scale drawings from page 236

ClassicLine digital 112 - 115
Illuminated pushbutton modules 116 - 117
ClassicLine analogue 118 - 121
For hazardous areas 122 - 123
Module lower parts
For industrial applications
Module lower parts 124 - 125



- **Field modules with 4 analogue inputs or outputs.**
- **Slave profile S-7.3 for simple data transmission.**
- **Indication of peripheral fault and communication error.**
- **0/4...20 mA, Pt100 or 0...10 V standard signals.**
- **Robust DIN rail mounting via FC lower parts.**

ClassicLine

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Standard analogue modules

The ClassicLine module concept is based on the first universal AS-i interface. It ensures compatibility of different products like I/O modules, AirBoxes, or illuminated pushbutton modules which are all connected via the same lower parts. Thus the mounting holes can be standardised, the cabling is easier and the possibility of side-by-side mounting is ensured.

ClassicLine modules with analogue inputs and outputs exchange their data directly with AS-i 2.1 masters. This is done automatically after detection and identification of the modules. An additional function block is not required. In case of the controller e e.g. the analogue values can be indicated directly on the display.

For the connection of 2-wire, 3-wire, or 4-wire sensors the parameters of the modules can be set accordingly.

All units have M12 sockets with standard pin connection. The status and diagnostic LEDs can be seen on the front panel.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable with infrared head, 1 m	**E70211**
	Addressing cable for AS-i slaves	**E70213**
	FC lower part with earthing lead	**AC5020**

Further accessories are available starting on page 197

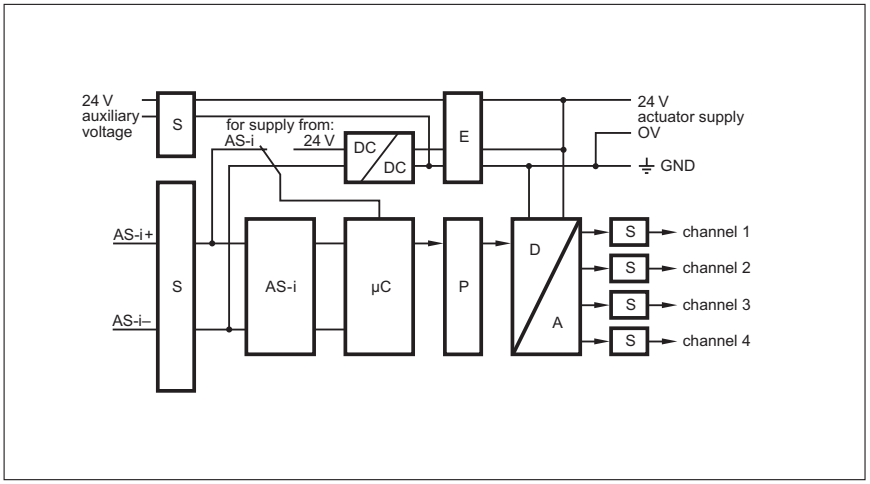
Further connectors are available starting on page 179

ClassicLine
Analogue inputs and outputs

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
4 AI C	–	yes	–	–	–	S-7.3.E	< 180	7	**AC2516**
4 AI V	–	yes	–	< 500	–	S-7.3.E	< 180	7	**AC2517**
–	4 AO C	–	yes	–	–	S-7.3.6	< 180	7	**AC2518**
–	4 AO V	–	yes	–	–	S-7.3.6	< 180	7	**AC2519**
4 Pt100	–	yes	–	< 80	–	S-7.3.E	< 80	7	**AC2520**

Please order the lower part separately !

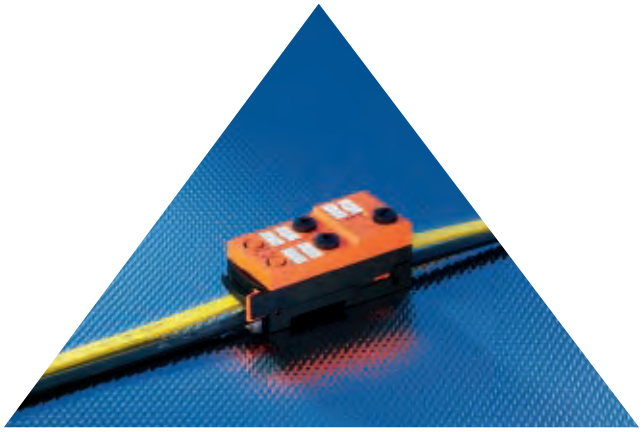
Block diagram AC2518



For other block diagrams see www. ifm-electronic.com

You can find scale drawings from page 236

ClassicLine digital *112 - 115*
Illuminated pushbutton modules *116 - 117*
ClassicLine analogue *118 - 121*
For hazardous areas *122 - 123*
Module lower parts
For industrial applications
Module lower parts *124 - 125*



- **Quick toolless mounting of upper and lower parts.**
- **Very safe mounting.**
- **3 freely selectable directions of the flat cable.**
- **Analogue input 4...20 mA.**
- **Easy addressing.**

ClassicLine

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Quick mounting technology

The ClassicLine modules for field applications are now easier to use with their novel slider technology which ensures toolless and safe mounting of upper and lower parts. For removal a tool is needed, e.g. a screwdriver. The modules can be addressed either without voltage before mounting or when mounted and wired via the implemented addressing socket.

Moreover, the user can insert the flat cable according to its concept in three different, freely selectable directions to the module. In addition to the conventional LEDs such as operating voltage, signal states of the periphery indication the logic state of the PLC is also displayed with digital output modules.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable for AS-i slaves	**E70213**
	Flat cable splitter box	**E70381**
	Flat cable seal	**E70413**

Further accessories are available starting on page 197

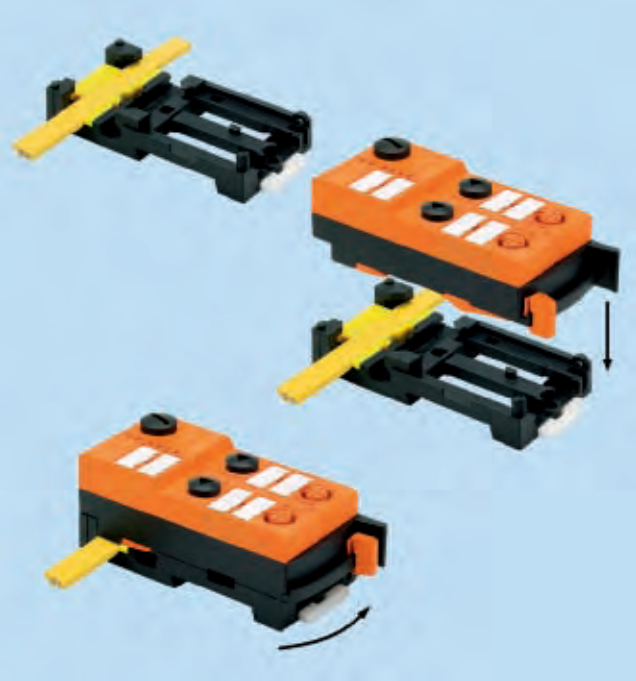
Further connectors are available starting on page 179

ClassicLine analogue input modules 4...20 mA
AC5222: for 2 and 3-wire sensors, no electrical separation
AC5223: for 2, and 4-wire sensors, electrical separation between analogue inputs and AS-i

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
2 AI C	–	yes	–	< 200	–	S.7.3.D	< 250	4	**AC5222**
2 AI C	–	yes	–	< 200	–	S.7.3.D	< 250	4	**AC5223**

AC5223: 3-wire connection possible via external link

Quick mounting of upper and lower parts



You can find scale drawings from page 236

ClassicLine digital 112 - 115
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ClassicLine analogue 118 - 121
For hazardous areas 122 - 123
Module lower parts
For industrial applications
Module lower parts 124 - 125

- **Digital inputs and outputs for the hazardous area II 3D/G.**
- **Modules for field use to EU directive 94/9/EC (ATEX).**
- **Modules with standardised EMS interface for AS-i and 24 V.**
- **Indication of peripheral fault and communication error.**
- **Robust DIN rail mounting via FC lower parts.**

ATEX ClassicLine

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

ATEX I/O modules

Like the standard modules the ATEX ClassicLine modules are based on the standardised AS-i interface. The ATEX modules can be directly mounted in the corresponding environments. This eliminates the need of complex control cabinets with conventional wiring. The remaining AS-i system consisting of AS-i master, power supply, cable, etc. can be used unchanged. Due to a combined peripheral fault and communication error LED the user is provided with two important signals during set-up and operation.

A "permanent red" light signals a communication error, e.g. the address is still set to "0".

A "flashing red" light indicates a problem with the connected periphery, e.g. overload.

Accessories and connectors

Type	Description	Order no.
	AS-i flat cable	**AC4000**
	FC insulation displacement connector AS-i / 24V on M12, ATEX II 3 D/G	**E7354A**
	FC insulation displacement connector AS-i on M12, ATEX II 3 D/G	**E7454A**
	Flat cable splitter box ATEX II 3 D/G	**E7377A**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

ATEX ClassicLine, single slaves
Digital inputs and outputs

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
ClassicLine · digital inputs and outputs									
4 DI	–	yes	–	200	–	S-0.0.E	< 240	8	**AC005A**
–	4 DOT	–	yes	–	1 (2)	S-8.0.E	< 50	8	**AC008A**
2 DI	2 DOT	yes	yes	100	1 (2)	S-3.0.E	< 150	8	**AC007A**
2 DI	2 DOT	yes	yes	100	1 (2)	S-B.A.E	< 150	8	**AC014A**

Please order the lower part separately !

Front view AC005A

Application

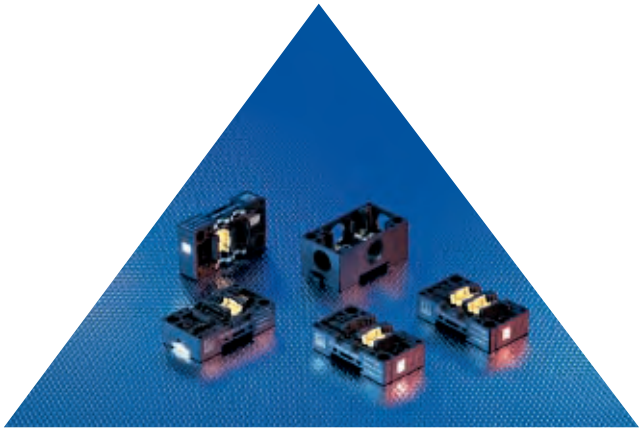
Common technical data

Operating temperature: ...40 °C
Version 2.1, single slaves

Note:
Adressing via adressing unit
AC1144 or controller e
Always use flat cable AC4000 or 4002,
for FC lower parts AC5000 or 5003
Always use M12 connectors with hexagon
knurled nut (tightening torque 0.8 Nm)

You can find scale drawings from page 236

ClassicLine digital 112 - 115
Illuminated pushbutton modules 116 - 117
ClassicLine analogue 118 - 121
For hazardous areas 122 - 123
Module lower parts
For industrial applications
Module lower parts 124 - 125



- **Module lower parts for ClassicLine and all modules with EMS interface.**
- **Standardised AS-i / 24 V interfaces "yellow / yellow" or "yellow / black".**
- **Connection to AS-i flat cable remains after the module has been removed.**
- **Versions with or without addressing socket available.**
- **Robust DIN rail mounting, can be loosened with screw driver.**

Lower parts

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Universal module lower parts

The Classic module lower parts are based on the electro-mechanical structure (EMS) as defined by the AS-i association (AS-International). They are compatible with all modules which comply with this standard interface. This is indicated by the EMS symbol next to the photo on the product double page in this catalogue.

There are two basic principles of power supply: Type 1 is only for yellow cable (AS-i), both channels are connected in parallel (yellow / yellow). Therefore this lower part can also serve as simple splitter box. Type 2 is rated for the yellow (AS-i) and the black (24 V DC) cable. In this case AS-i and 24 V are transmitted separately to the upper part via four contact pins.

Possible applications for Classic lower parts are e.g. ClassicLine, universal and illuminated pushbutton modules, PowerBoxes, and AirBoxes. The module lower parts are not supplied with the modules and have to be ordered separately.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable for AS-i slaves	**E70213**
	Seals, NBR pack quantity = 50 pieces	**E70351**
	Seals, Viton pack quantity = 50 pieces	**E70353**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

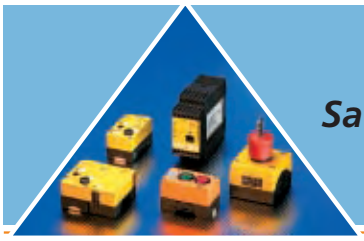
Module lower parts Classic

Lower part type	Cable	Addressing socket	Stainless steel threaded inserts	Version yellow/yellow 2 x AS-i	Version yellow/black 2 x 24 V	Max. protection rating which can be reached	Drawing no.	Order no.
Module lower part flat cable								
type 1	flat cable	–	–	yes	–	IP 67	1	**AC5000**
type 2	flat cable	–	–	–	yes	IP 67	1	**AC5003**
type 1	flat cable	yes	–	yes	–	IP 67	2	**AC5010**
type 2	flat cable	yes	–	–	yes	IP 67	2	**AC5011**
type 1	flat cable	–	yes	ja	–	IP 67	1	**AC5014**
type 2	flat cable	–	yes	–	yes	IP 67	1	**AC5015**
Module for the transistion from round cable to flat cable (only AS-i) or round cable to round cable								
type 1	round cable	–	–	–	yes	IP 65	–	**AC5031**
Screw terminal insert for AC5031 for additional 24 V supply								
type 2	round cable	–	–	–	yes	–	–	**AC5007**

Lower parts type 1 (ye / ye) and type 2 (ye / bk)

You can find scale drawings from page 238

ClassicLine digital 112 - 115
Illuminated pushbutton modules 116 - 117
ClassicLine analogue 118 - 121
For hazardous areas 122 - 123
Module lower parts
For industrial applications
Module lower parts 124 - 125



Safety at Work

ecomat300

Special application

Introduction

AS-interface has become the standard for binary units in automation. Due to standardisation in IEC 62026-2 and its easy handling this system has established itself worldwide. So far, the only signals still conventionally wired have been the safety-related signals. With the AS-i extension "Safety at Work" this has now come to an end.

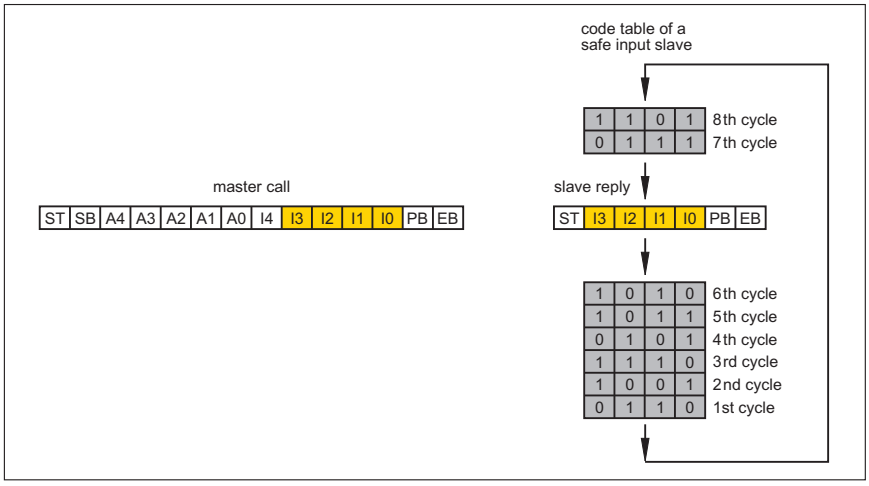
Safety at Work reaches the highest control category 4 according to EN 954-1 and can thus even be used for emergency-stop applications with the stop category 0 or 1. Safety at Work has been granted approval by BIA and TÜV.

AS-i Safety at Work can be used for both new installations and for retrofitting of existing AS-i installations because it works with all standard masters. It must only be ensured that, when using repeaters, max. one repeater may be used.

Basics

The ordinary AS-i 4-bit protocol is a prerequisite for the use of Safety at Work components. As standard masters and controllers are to be used, a safety protocol is generated by the safe slaves and monitored by a new AS-i component, the safety monitor.

Each safe slave has a 8 x 4-bit code table, which is as individual as a fingerprint, thus making sure that each safe slave transmits a different code. This code is inserted into the normal data message during the 8 AS-i cycles (see figure "safety code sequence in the AS-i message").



Safety code sequence in the AS-i message.

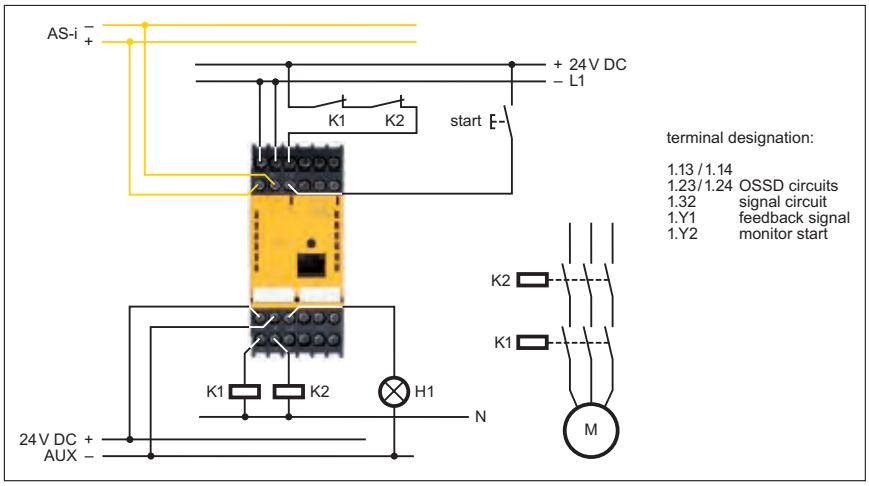
Safety monitor

The safety monitor monitors all connected safety slaves and ensures switch-off or the triggering of the safety system in the case of any disturbance. It thus replaces the safety relay, so far common in systems with parallel wiring.

The safety monitor evaluates the AS-i communication, however it cannot be operated independently without an AS-i master. The states can be evaluated in the master via the data bits. The output relays feature positively driven contacts. There are safety monitors with 1 or 2 channels, which are operated independently from each other. The safe slaves can be combined into groups and assigned to the OSSDs. These groups can be freely chosen, irrespective of the slave addresses. It is also possible to set up overlapping groups. Finally, several safety monitors connected to one AS-i network can be operated at the same time.

The safety monitor can be operated with or without AS-i address. Addressing is however recommended, because only addressing makes a diagnosis by the AS-i master possible.

AS-i safety monitor for safety-related AS-i applications.



Circuit example 1-channel safety monitor.

As its name suggests, the safety monitor works as a monitoring device, monitoring the once "learned" code sequences of the safe slaves and triggering in the case of a fault. This analysis of code sequences is checked for conformity in each AS-i cycle. If a wrong code sequence or the code "0 0 0 0" (trigger code) is transmitted, the monitor ensures switch-off within max. 40 ms.

By means of the muting operation safety systems can be intentionally bypassed. This makes sense when a safety door has to be opened in order to exchange a tool.

Configuration software

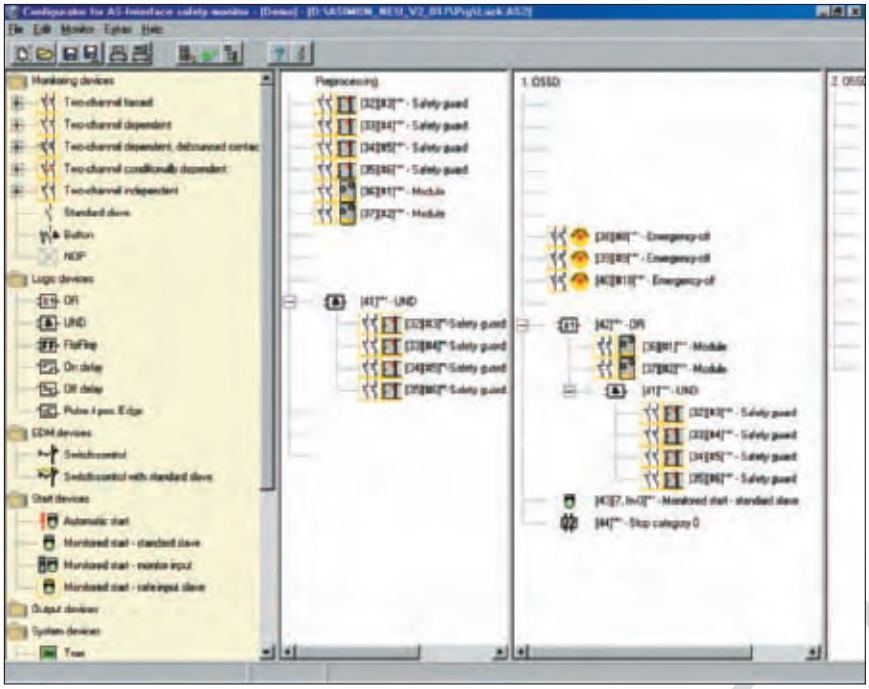
The assignment of the OSSDs (switch-off relays) to the inputs of the safe slaves is done conveniently via the parameter-setting software. This software runs on any Windows-compatible PC and is transmitted to the monitor via the serial RS-232 interface, where it is stored in a non-volatile memory.

Among others, the following functions can be set via the configuration software:

- Assignment of the safe inputs to the monitoring devices
- Functions such as emergency-stop, light curtains, safe input modules etc.
- Assignment of hardware or AS-i inputs to the start devices
- Selection of output devices, for example stop category 0 or 1

The program download and upload is password protected in order to avoid unauthorised modifications. After completion of the configuration, a test report is printed, which has to be added to the documentation of the machinery.

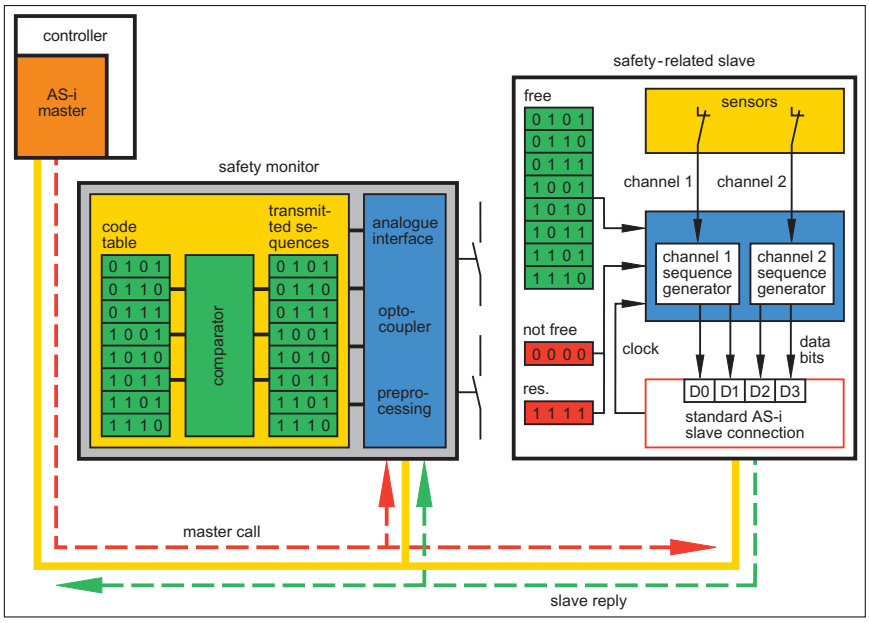
When commissioning, it is possible to directly display the status of the parameterised slaves in the diagnostic operation via the serial interface.



Using the configuration software, the user can easily handle all settings via the system.

Safe slaves

In principle there are two types of safe slaves: intelligent slaves, integrated directly into the sensor, or in a conventional input module with up to two safe inputs. Safe slaves can be identified by the AS-i ID code B. This is the second position in the AS-i profile. Max. 31 safe slaves can be connected to one master. The extended address mode can thus not be technically implemented with these slaves. Safe slaves consist of the standard AS-i slave, the code sequence generator and the individual code sequence itself. Note that the codes "0 0 0 0 " and "1 1 1 1" are blocked for normal data exchange. The sequence "0 0 0 0" leads to the immediate triggering of the safety monitor.



Block diagram of a safe slave.

Intelligent safe slaves are for example integrated into a classic emergency stop housing. This AS-i emergency stop can be directly connected to the yellow cable. The slave is completely prewired and features an M12 connector for the connection of the yellow cable via a flat cable insulation displacement connector.

Any safety switch can be connected to the safe AS-i input module. These can be mechanical switches, as for example safety switchgear, door switches or conventional emergency stop switches.

Intelligent AS-i slave: Emergency stop switch.

Any switchgear can be connected to the safe AS-i input module.

Visit our website: www.ifm-electronic.com

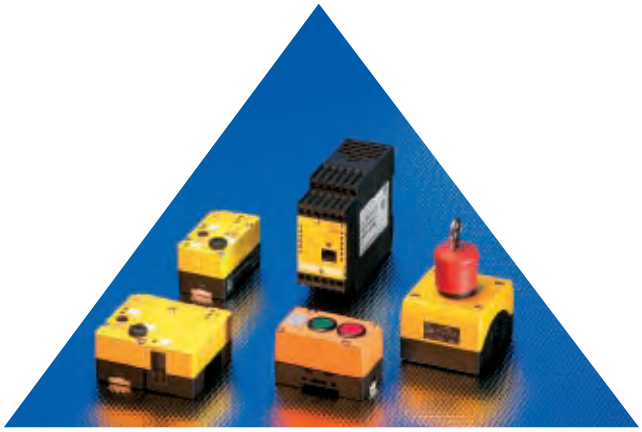
Selection chart

Type	Applications		Safe inputs	Safe outputs	Conventional outputs	Application	Page
	Control cabinet	Field					
Safety monitors							
single channel 	•	–	–	1 x 2	1	●	134
dual channel 	•	–	–	2 x 2	2	●	134
ASIMON parameter setting software							
ASIMON software 	–	–	–	–	–	●	–
Safety slaves							
SmartLine 	•	–	2	–	2	●	136
ClassicLine 	–	•	2	–	–	●	138
ClassicLine 	–	•	1	–	1	●	138
	–	•	2	–	2	●	138
E-stop 	–	•	2	–	–	●	138

For safety applications

Type	Applications		Safe inputs	Safe outputs	Conventional outputs	Application	Page
	Control cabinet	Field					
Safety slaves							
Safety PCB 	•	–	2	–	1	●	140
Electronic fail-safe sensors							
Fail-safe sensor 	–	•	–	1	–	●	142

For safety applications



- **AS-i safety monitor, 1-channel or 2-channel.**
- **Safety function freely configurable.**
- **Positively driven relay contacts for the enabling of drives, etc.**
- **Replacement of the conventional safety relay.**
- **Robust DIN rail mounting, no tools needed.**

Safety at Work

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Safety monitor

The AS-i safety monitor functions according to the Safety at Work specification. It monitors the data exchange between safe slaves and the AS-i master. Should data transmission be disrupted, the slave fail or a wire break occur the monitor passes into the safe state and ensures switch-off. The same happens when the safety system is triggered. The safety monitor receives a slave address to enable direct diagnosis via the AS-i master. It can be mounted anywhere in the bus.

The safety monitor incorporates one or two independent output signal switching devices that can be configured via PC software. The parameter setting includes functions like emergency stop, start button, stop category 0 or 1, two-hand operation, enable switch, or set-up operation (muting). Thus the safety monitor replaces a variety of different units.

Accessories and connectors

Type	Description	Order no.
	Configuration software ASIMON V2.12 for safety monitors	E7030S
	Serial interface cable for the connection of the safety monitor to a PC	E7001S
	Download cable for the connection between safety monitors	E7002S

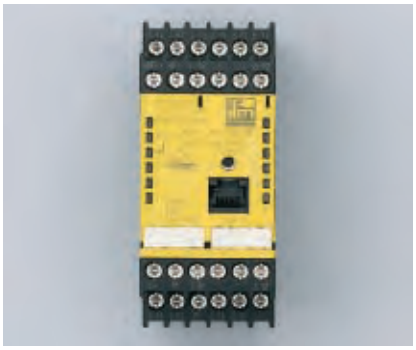
Further accessories are available starting on page 197

Further connectors are available starting on page 179

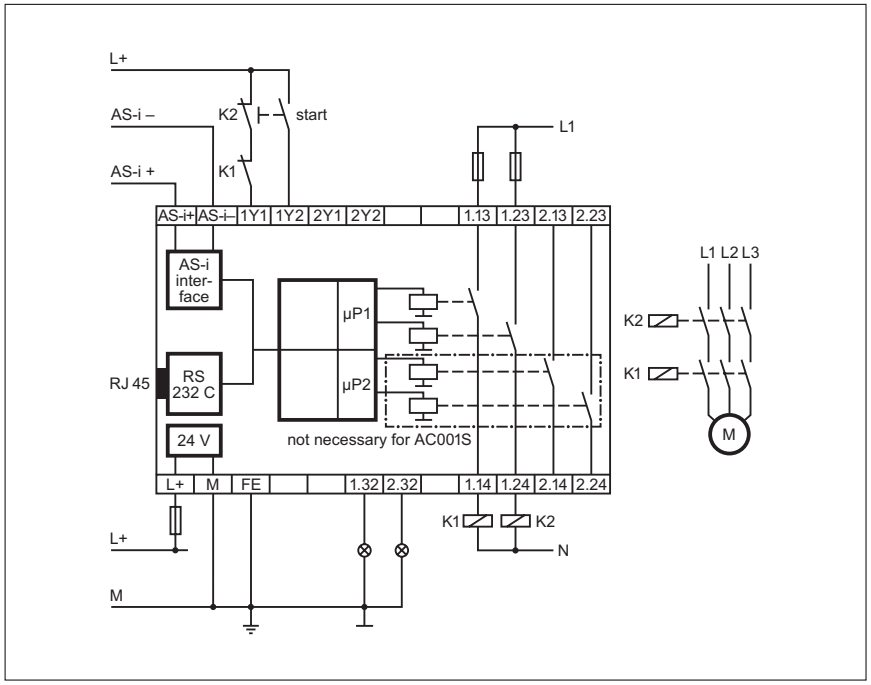
Safety monitors IP 20 · EN 954-1 / Cat. 4; IEC 61508 / SIL 3
Safe relay outputs

Number of inputs	Number of outputs	U_b [V]	Output voltage acc. to PELV	Max. input curr. / module [mA]	Total output current / channel [A]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
AS-i safety monitor · standard									
1 + 1 DI	1 DOR	24	–	–	1...3	S-7.F	< 45	1	**AC001S**
1 + 1 DI	2 DOR	24	–	–	1...3	S-7.F	< 45	1	**AC002S**
AS-i safety monitor · with extended functions V 2.X									
1 + 1 DI	1 DOR	24	–	–	1...3	S-7.F	< 45	1	**AC003S**
1 + 1 DI	2 DOR	24	–	–	1...3	S-7.F	< 45	1	**AC004S**

Front view AC004S



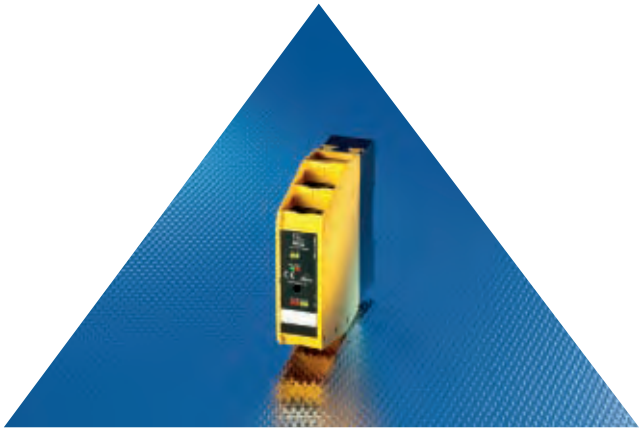
Circuit example 1-channel



Common technical data

Operating temperature:
-20...60°C
Approvals:
TÜV, UL, CSA

You can find scale drawings from page 240



- **AS-i SmartLine – safe input module for the control cabinet.**
- **Two safe inputs with cross-monitoring.**
- **Two standard relay outputs with potential-free changeover contacts.**
- **Robust DIN rail mounting.**
- **TÜV approval to safety standard IEC 61508.**

SmartLine

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

AS-i SmartLine safety module – for all applications

The SmartLine Safety at Work module connects mechanical switches to AS-interface. Evaluation to the Safety at Work protocol is carried out with one of the four available safety monitors.

Powerful LEDs on the front panel indicate switching states of the inputs and outputs, voltage supply and faults in the module, if any. All kinds of mechanical safety switches with two positively-driven contacts and two independent switches with one contact each can be connected to the two inputs. Due to the integrated cross-monitoring the two contact signals can be laid in one cable as possible faults by damaging the cable sheath, shearing or crushing are detected and signalled.

Two red alarm LEDs which are freely programmable by the user like normal AS-i outputs can indicate the triggering switching inputs, furthermore the status can be stored permanently.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Addressing cable	**E70213**
	Combicon connector QIC with insulation displacement terminals	**E70236**
	Combicon connector with screw terminals	**E70230**
	Combicon connector with cage clamps	**E70232**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

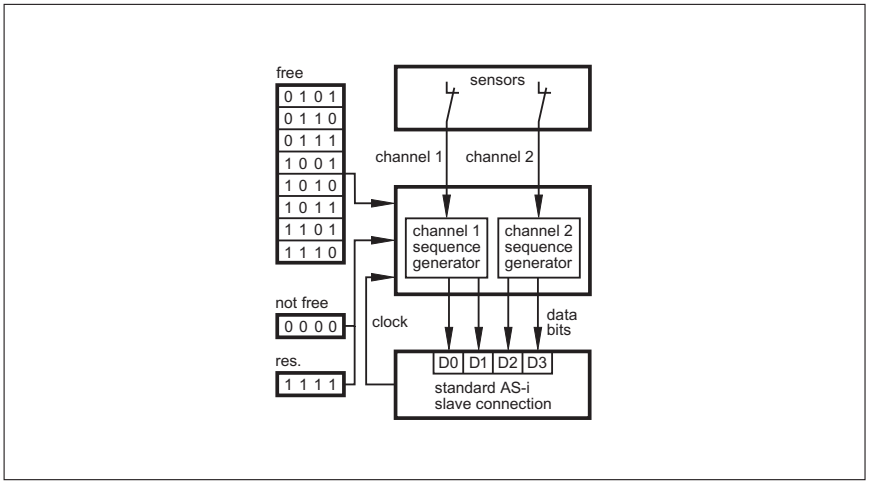
SmartLine · EN 954-1 / Cat. 4; IEC 61508 / SIL 3
2 safe inputs

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
SmartLine · safe inputs · relay outputs									
2 SI	2 DOR	yes	–	100	6 (6)	S-7.B.E	< 250	1	**AC009S**

Please order the Combicon plug separately!

Front view AC009S

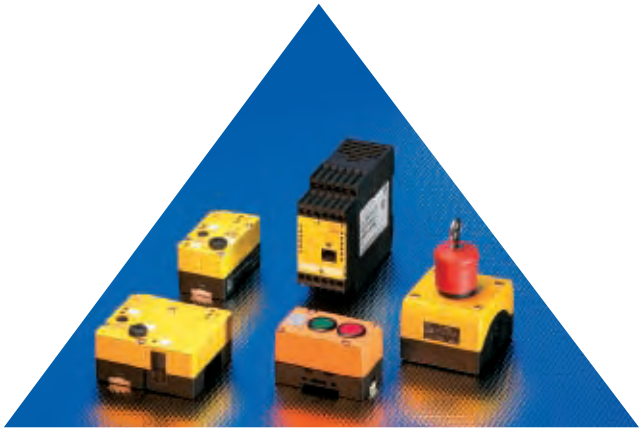
Block diagram AC009S



Common technical data

Operating temperature:
-25...50°C
Approvals:
AS-i, TÜV, UL, CSA

You can find scale drawings from page 241



Safety at Work

- Safe input slaves for Safety at Work.
- E-stop with integrated AS-i slave.
- Safe input module ClassicLine with 2 inputs.
- Connection of mechanical safety switches, e.g. door switches, contact mats.
- Robust DIN rail mounting via FC lower part or screw mounting.

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Slaves for safety-related applications

The safe AS-i slaves communicate with the AS-i master in the usual way. In principle all masters can be used. As opposed to "normal" binary slaves safe slaves transmit a series of 4-bit code sequences which are different for each safe slave. The safety monitor monitors the correct transmission of these codes. In the case of a faulty transmission or manual triggering of the safety system (e.g. by means of an E-stop) the monitor passes into the safe (switch-off) state.

At the moment safe slaves are only available as input slaves. The safe slaves can be placed anywhere in the network, but only two repeater max. may be installed in the AS-i system.

As the safe input modules are also AS-i slaves the query "Which switch has triggered?" is directly integrated. Thus there is no need for additional wiring of an auxiliary contact to a separate plc input.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	AC1144
	Emergency stop label IP66 for AC010S / AC011S	E7003S
	Bridging plug for AC005S/AC006S	E7005S
	Configuration software ASIMON V2.12 for safety monitors	E7030S

Further accessories are available starting on page 197

Further connectors are available starting on page 179

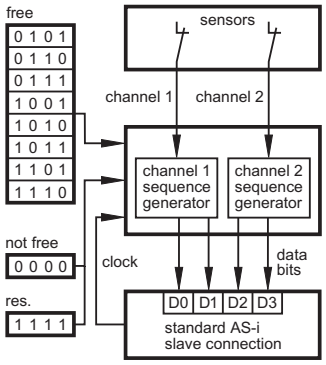
Safety monitors	Safety slaves	Electronic fail-safe sensors
Page 134 - 135	136 - 141	142 - 143

ClassicLine / E-stops · EN 954-1 / Cat. 4; IEC 61508 / SIL 3
2 safe inputs

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
Active ClassicLine module · control category 4 according to EN954-1 for the connection of mechanical contacts									
2 SI	1 LO	yes	–	typ. 10	–	S-7.B.0	< 60	2	**AC005S**
Activate ClassicLine module for the connection of mechanical contacts and non-safe actuators									
2 SI	2 DO	yes	yes	150	1000	S-7.B.E	< 250	3	**AC006S**
E-stop illuminated with integrated AS-i connection									
2 SI	1 LO	yes	–	typ. 4	8	S-7.B.E	< 40	4	**AC010S**
Key-release emergency-stop switch with integrated AS-i connection									
2 SI	–	yes	–	typ. 4	–	S-7.B.E	< 40	4	**AC011S**
Active ClassicLine module · evaluation unit for fail-safe switches									
1 SI	1 DO	yes	yes	150	500	S-7.B.E	< 250	5	**AC016S**

Front view AC005S

Block diagram AC005S



For further block diagrams see www. ifm-electronic.com

Common technical data

Approvals:
AS-i, TÜV, UL, CSA

You can find scale drawings from page 241

- **Connection of mechanical contacts and LED elements.**
- **Connection of an e-stop to ISO 13850 and EN 418.**
- **Certification to EN 954-1, category 4 and IEC 61508, SIL 3.**
- **Integration of the AS-i slaves in a housing.**
- **Quick and easy to mount**

Safety at Work

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Safety AS-i PCB

The new AS-interface slave allows easy connection of mechanical switching elements to the AS-interface system. The safety AS-interface PCB serves for the connection of an e-stop mushroom pushbutton switch in compliance with ISO 13850 and EN 418 to the bus system AS-interface. In this version, two inputs (normally closed) and one output are available for the user to trigger an LED light indicator. Using the safe AS-interface slave, the highest category 4 to EN 954-1 (SIL 3 / IEC 61508) is achieved.

Exact fault location is possible for the user via different LEDs on the PCB. A red FAULT LED signals communication errors, indicated by a permanent red light. A green POWER LED indicates the supply via the AS-interface. In addition to these common LEDs, the logic input states are also indicated by means of LEDs.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Configuration software ASIMON V2.12 for safety monitors	**E7030S**
	Adapter plug plastic M12-M20	**E7006S**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

PCB · EN 954-1 / Kat. 4; IEC 61508 / SIL 3
2 safe inputs

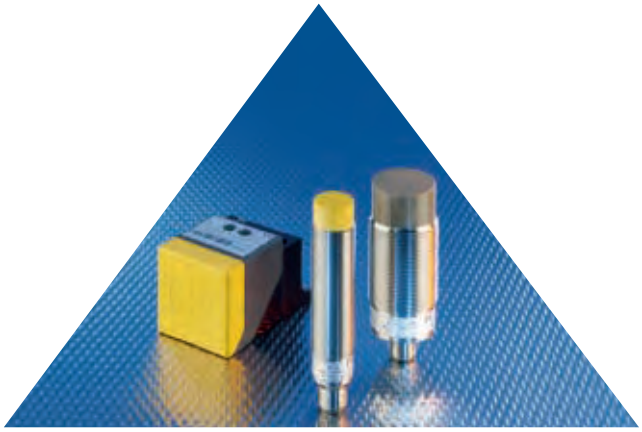
Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [mA]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
Safety PCB for the connection of mechanical contacts									
2 SI	1 LO	yes	AS-i	typ. 5	10	S-7.B.E	< 50	6	**AC015S**

PCB AC015S

Common technical data

Operating temperature:
-25...60°C
Approvals:
AS-i, TÜV, UL, CSA

You can find scale drawings from page 241



- **Certified to EN 954-1, category 4 PDF-M to EN 60947-5-3.**
- **Safety monitoring of persons and machines.**
- **No coded target required.**
- **Connection of the sensors to safety plc or AS-i module AC016S.**
- **Series connection of sensors and contacts.**

Category 4 fail-safe sensors

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Features

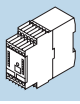
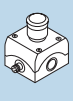
A special counterpart such as a magnet or coded target is not necessary for the function of the sensor. The fail-safe inductive sensor detects metals like stainless steel or mild steel. The sensor operates with an enable zone which is monitored for target position and dwell time. An adjustment mode facilitates mounting. With reduced mounting input up to 10 fail-safe sensors can be connected in series in combination with mechanical contacts. Wear-free, non-contact selfmonitoring operation and high protection rating ensure high uptime of the machines and installations. Non-contact fail-safe product or position detection is now possible, for applications in conveying processes roller lever switches or counterparts such as magnets are no longer necessary. The input and output signals of the sensors correspond to DIN EN 61131 and are therefore fully compatible with the inputs and outputs of a plc. It is possible to connect them to ifm evaluation relays, AS-i Safety at Work, PROFIsafe, Interbus Safety, safe logic modules and safe PLC with TÜV-certified software modules.

Accessories and connectors

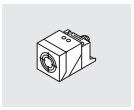
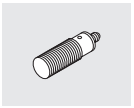
Type	Description	Order no.
	Socket M12 2 m black, PUR cable	EVC001
	Socket M12 5 m black, PUR cable	EVC002
	Socket M12 10 m black, PUR cable	EVC003
	Socket M12 2 m black, PUR cable	EVC004
	Socket M12 5 m black, PUR cable	EVC005
	T-piece for the pseudo-serial connection of fail-safe technology	E11569

Further accessories are available starting on page 197

Further connectors are available starting on page 179

	For safety applications	Safety monitors	For safety applications	Safety slaves	For safety applications	Electronic fail-safe sensors
Safety monitors						
Safety slaves						
Electronic fail-safe sensors						
Page		134 - 135		136 - 141		142 - 143

Electronic fail-safe sensor category 4 for continuous operation (maintenance-free)
Response time on safety request (moving out of the enable zone): < 20 ms
Response time when approaching the enable zone (enable time): typ. < 100 ms, < 200 ms

Housing	Length [mm]	Enable zone [mm]	Housing material	U_b [V]	Protection	Category to EN 954-1	Response time for moving out / approaching [ms]	Wiring diagram no.	Drawing no.	Order no.
Rectangular type 40 x 40 mm										
	66	10...15 b	PPE / diec. zinc	19.2...30	IP 67	4	< 20 / < 200	1	1	**GM504S**
	66	10...20 nb	PPE / diec. zinc	19.2...30	IP 67	4	< 20 / < 200	1	1	**GM505S**
Type M18										
	91	3...6 nb	st. steel / PBT	19.2...30	IP 69 K	4	< 20 / < 200	1	2	**GG505S**
Type M30										
	80	6...12 nb	st. steel / PEEK	19.2...30	IP 69 K	4	< 20 / < 200	1	3	**GI505S**

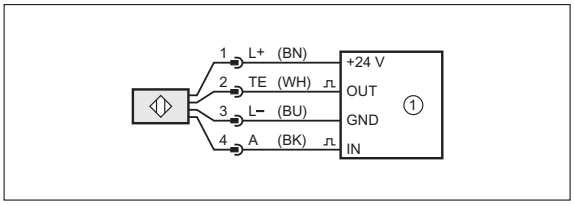
f = flush mountable,
nf = non flush mountable

Evaluation unit AC016S

Common technical data

Power-on delay time: 5 s
Input and output signals to DIN EN 61131-2
Operating temperature
GM504S, GM505S, GG505S: -25...70 °C
GI505S: 0...70 °C
Impact resistance to EN 60439-6
GG505S, GI505S: IK04
GM504S, GM505S: IK06
More information:
www.ifm-electronic.com/sicher

Wiring diagrams of the units



Wiring diagram no. 1

You can find scale drawings from page 242

AS-i sensors, pneumatic and actuator solutions

ecomat300

Universal application

AS-i sensors, AirBoxes, valve control, motor starters, RF identification

AS-i sensors for industrial applications

AirBoxes for industrial applications

Valve control for industrial applications

Motor starters for industrial applications

RF identification for industrial applications

Intelligent sensors · introduction

In 1994 ifm electronic presented the first intelligent AS-i sensors worldwide at the Hanover Trade Fair. Remote parameter setting via the bus was already possible and diagnostic messages could be sent to the controller. On the basis of this experience and due to new innovative sensor technologies it was possible to make AS-i sensors with a built-in interface smaller and more efficient. From the point of view of the housing types there is no difference any more to simple units with a binary switching output. Thus when mounting the sensors you have to take into account if it is a binary, analogue or an AS-i sensor – the information is on the type label.

Basic information

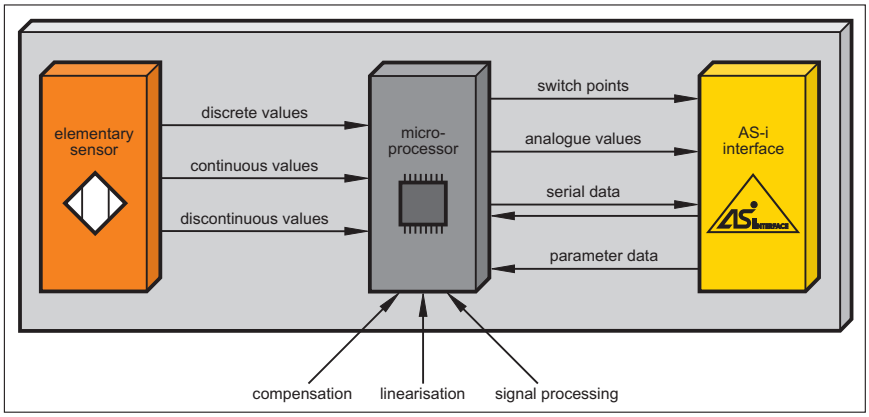
When defining sensors with a built-in interface three levels are differentiated:

- Sensors without a built-in interface
- Sensors with diagnostic information
- Sensors with a built-in interface

On the first level the sensors are connected via bus modules with standard signals (24 V switching signal, 0...10 V or 4...20 mA analogue signal). The advantage of this method is the large range of sensors without a built-in interface on the market and many I/O modules for all kinds of application. A disadvantage is certainly the restricted monitoring of the sensor function.

On level 2 there are sensors with serial interfaces or bidirectional function check pins which can also be connected to specialised bus modules. Advantages are extended diagnostic possibilities, disadvantages are the interfaces which have to be specially adapted on the sensor side as well as on the controller side.

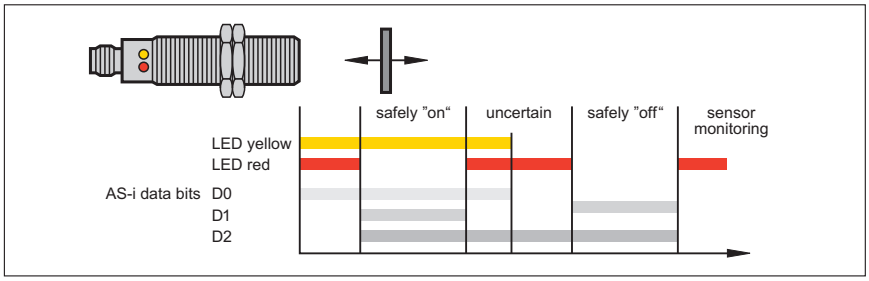
The optimum solution are AS-i sensors with a built-in interface on the third level of development. The AS-i sensors can transmit either digital or analogue values. The AS-i sensor interface is standardised to IEC 62026-2. Importantly the sensor profiles are defined in the AS-i specification thus ensuring interoperability.



Intelligent sensor with a built-in interface.

Intelligent inductive sensors

Inductive AS-i sensors transmit the switching status as well as a signal for readiness for operation and a failure warning. All three evaluated together can give important maintenance information, i.e. if the target is still correctly adjusted or if the sensing face has been destroyed. All diagnostic bits can be scanned permanently without interruption of the machine function. A yellow and a red LED are available as a setting aid for sensor mounting.



Inductive sensors on a traversing slide.

Detection areas of optical AS-i sensors.

Intelligent pressure sensors

AS-i pressure sensors type PPA from ifm are equipped with a ceramic pressure measuring cell which can measure a medium pressure of up to 600 bar and which is overload-resistant up to 800 bar. They are suited for hydraulic water and oil systems for direct measuring in the medium. AS-i pressure sensors transmit the pressure value according to the AS-i profile S-7.3.C directly in the unit "bar" so that the measured value is available in the plc without having to be converted.

Software diagnosis

From Ethernet to the sensor – continuous communication from the control level to the binary machine function. Generations of automation engineers have dreamt of this, as it allows central configuration and commissioning from one point over several control and bus levels. This dream has now come true. Data communication from the central control level or from the HMI to the sensor is only possible if all software and hardware interfaces are matched. In 2001 ifm electronic cleared the way to this continuity by joining the Automation Alliance, an open programming and visualisation platform with a variety of well-known automation companies. Contrary to the proprietary systems manufacturer-independent communication from the control level to the sensor / actuator level can be handled as easily as it was in the past with point-to-point connection with only one plc. The ***controller*** family serves as connecting link between AS-i sensors and fieldbus or Ethernet. For further details please refer to the chapter "Controllers / Gateways, network extension".

AS-i pressure sensors on a valve unit.

AirBox · introduction

Decentralisation by means of the AS-interface has also considerably marked and changed the area of pneumatics. For example in process technology there is a large variety of pneumatically driven ball valves and butterfly valves (quarter-turn actuators) which are often still controlled conventionally, i.e. by means of solenoid valves and in the case of AS-interface by means of input and output modules.

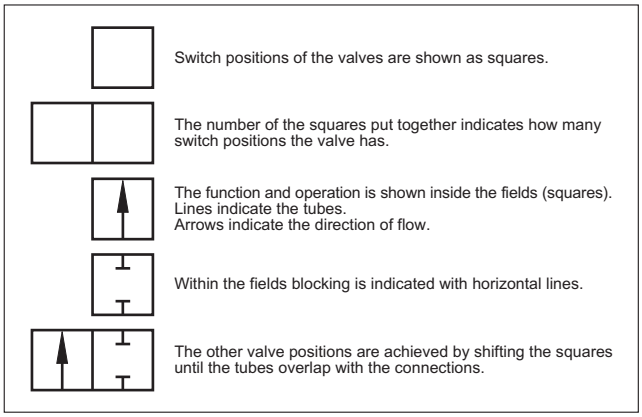
This conventional solution is also still often found in the conveyor and storage technology where linear movements, e.g. on lifting platforms, stoppers, shunts, and grippers take place. Pneumatic cylinders are used as drive elements and cylinder switches give feedback to the controller.

This is where the AirBoxes come in. They combine electrically controlled pneumatic valves in a compact form. They are controlled via the AS-Interface.

AirBox: Intelligent system solution due to integration of electronics and pneumatics.

Valves in general

In pneumatics, valves are used depending on their design for blocking, as shunts for the deviation of an airflow or as restrictor elements. The graphic symbols for valves used in circuit diagrams do not give any information about the construction, but only show the function of the valve.



Pneumatic symbols.

	ISO 559	Designation (old)
Compressed air connection	1	P
Operating connections	2, 4	A, B
Exhausts	3, 5	R, S

3/2-way valve

The 3/2-way valve enables triggering of single-acting actuators, like e.g. cylinders with return spring (single-acting cylinders).

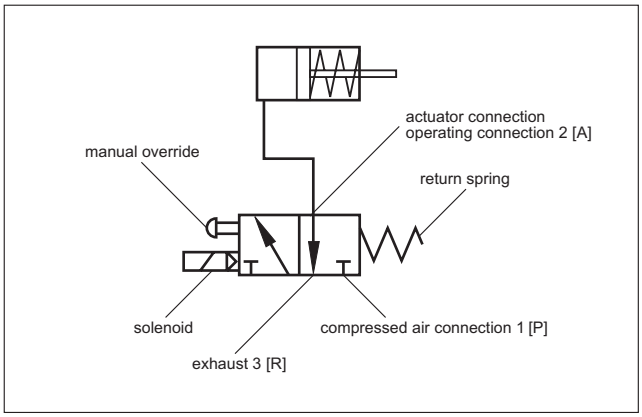


Diagram of a 3/2-way valve with connection of a single-acting cylinder.

The designation of a valve depends on the number of the controlled connections and on the number of possible valve positions.

Example:

***3** controlled connections (1[P], 3[R], 2[A])*

***2** switching positions (2 squares).*

Function

Starting from the off position of the 3/2-way valve (see drawing) the feed of compressed air [P] to the single-acting cylinder is blocked when the valve (AirBox) is connected to the compressed air supply. The piston rod of the cylinder can be moved in any direction.

If the respective output of the AirBox is triggered via AS-i and thus the valve is operated (via the pilot valve, solenoid, squares are moved one position to the right, see drawing) the feed of compressed air to the cylinder is released and the piston rod of the cylinder is extended. By resetting the output the valve is pressed back into the off position by means of the return spring. The piston rod of the cylinder retracts.

Very safe mounting and quick connection of the pneumatics.

Time-consuming installation is not necessary any more due to the integrated tube connections (push-in) which enable safe connection and quick insertion and removal without any tools. On the electrical side the AirBox can be integrated very easily into the existing AS-i network by means of the supplied flat cable lower part. The AirBox no longer has to be screwed onto the lower part. Quick mounting technology with a slide ensures reliable connection between the AirBox and the flat cable lower part. The AirBox is supplied as usual via the AS-i cable or in addition by means of the black flat cable in order to be able to separately switch off the pneumatic outputs of the valves via e-stops. All AirBox versions also have a manual override. This allows the user to carry out a pneumatic function test of the AirBox initially, without connection to the AS-i network.

Quick and very secure mounting technology.

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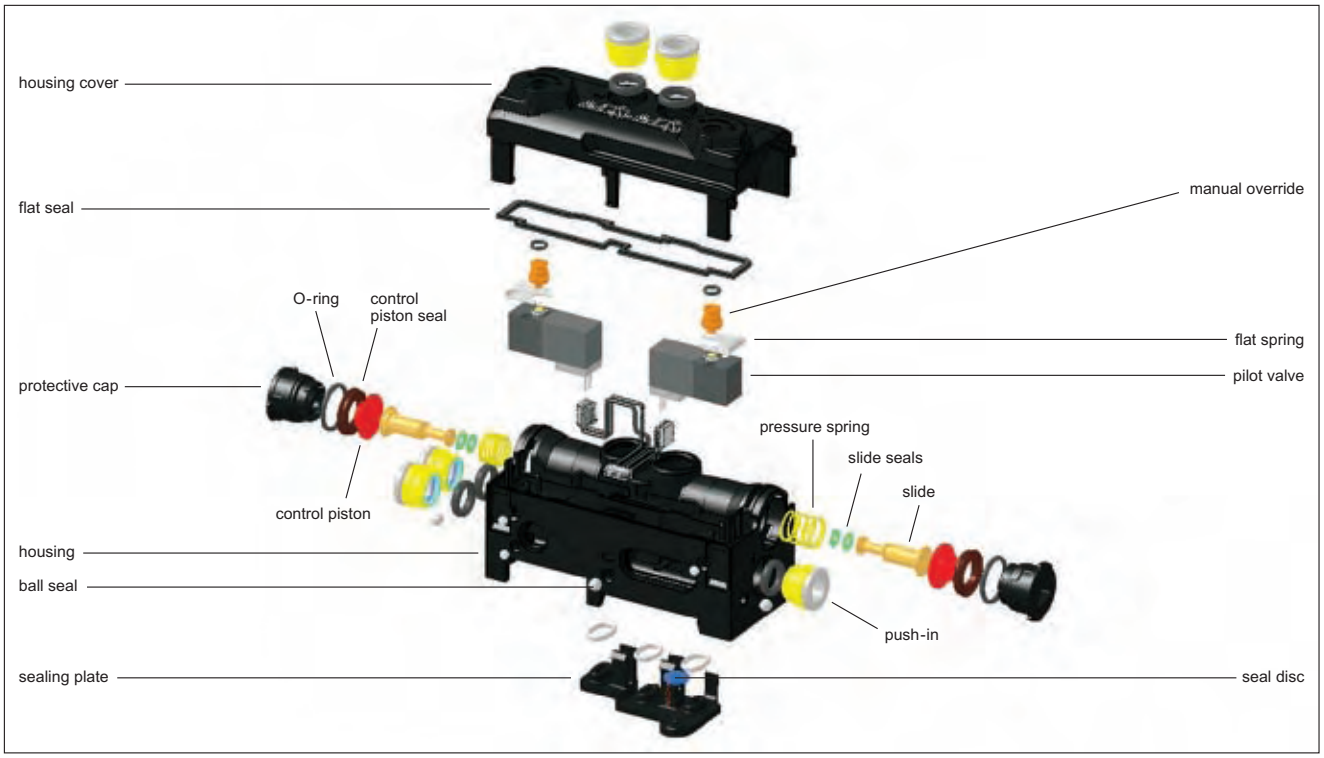
AirBox with 2 x 3/2-way slide valves

This type of AirBox has two independent 3/2-way valves, enabling triggering of single-acting actuators, e.g. cylinders with return springs. The M12 sockets with two or four inputs (Y-circuit) enable feedback via inductive sensors or cylinder sensors. All AirBoxes have a common exhaust (tube connection). So, the user can decide whether the exhaust air is discharged via a tube or via a silencer. The protection rating is IP 65 or IP 67.

The AirBox requires a minimum pressure of 2 bar in order to operate the main valve via the pilot valve. The maximum pressure is 8 bar, the pressure peak resistance 12 bar.

Exploded view of the pneumatic component of the AirBox 2 x 3/2-way.



AirBox with 5/2-way slide valve – monostable

The AirBox has a fully integrated 5/2-way valve in the form of a slide valve. It requires a minimum pressure of 3 bar in order to operate the main valve (5/2-way slide valve) via the pilot valve. The maximum pressure is 8 bar, the pressure peak resistance 12 bar.

The AirBox in monostable design is necessary if the cylinder (piston rod) is to retract into a safe/defined position when the e-stop function is activated.

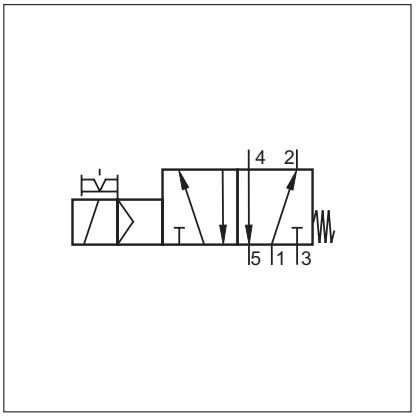


Diagram of the 5/2-way slide valve – mono-stable.

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5/2-way slide valve - bistable (pulse valve)

The 5/2-way function enables triggering of double-acting actuators, e.g. cylinders without return spring.

Compared to the monostable valve 2 defined positions are required for bistable operation. In case of a power failure the valve is held in position.

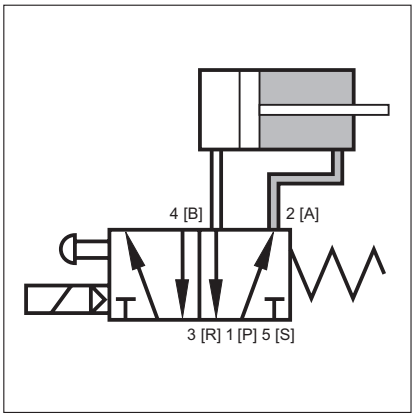


Diagram of the 5/2-way slide valve - bistable.

Addressing

The AirBoxes can be addressed either prior to installation without voltage or when connected and wired via the addressing socket integrated in the module. Only the addressing unit and the corresponding addressing cable with a jack plug are required.

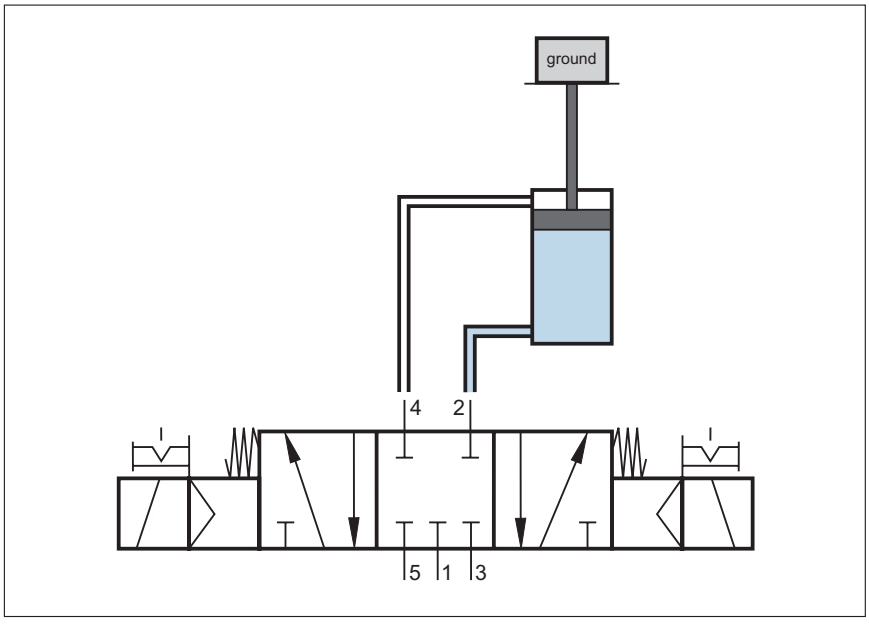
Please note

When AirBoxes are used filters with at least 5 µm pore size must be used in the supply of compressed air. The switching elements in the AirBoxes receive a basic lubrication (initial lubrication) so that they can be operated with compressed air which is not lubricated. Important: If in exceptional cases lubricated compressed air is used you must continue to use it as the oil in the compressed air removes the initial lubrication.

5/3-way slide valve – blocked middle position

The 5/3-way function also enables triggering of double-acting actuators, e.g. cylinders without return spring.

In contrast to all previously mentioned valves the 5/3-way valve, for example, prevents dropping of a load in the event of compressed air failure due to the blocked middle position. The 5/3-way valve with blocked middle position enables moving back into a defined position in case of an e-stop of the pneumatics.



Operating principle of the 5/3-way slide valve.

Valve control · Introduction

In industrial processes where liquids, air or gases are used valves are needed for dosing and control. There is a wide variety of valve types; butterfly or ball valves being the most common quarter-turn types.

These valves are seldom operated manually. Pneumatic valve actuators are normally used for mechanical positioning. The valve position must be monitored electronically. On the one hand to provide a feedback to the controller when a certain position (e.g. "open" or "closed") is reached. On the other hand it is necessary to monitor the valves centrally.

Mechanical switches are still often used for position feedback on the actuator shaft. For other solutions several proximity sensors are used together with a switch target for position detection. Disadvantage of these methods: Mounting is mechanically complex. During switch mounting the signal wires can be reversed when they are connected in the top-mounted junction box. Where there are temperature fluctuations condensing humidity leads to corrosion and thus malfunction.

Feedback: Monitoring of pneumatic and manual valves must be possible.

Industrial process plant: Various media are controlled using valves.

Operating principle

An innovative design eliminates the disadvantages of these conventional solutions. In 1992 ifm electronic developed a standard which is now used by many leading actuator manufacturers. A round switch target, known as a 'puck', with two metal screws offset by 90° is mounted on the actuator shaft. The screws are located at a different height. A compact dual proximity sensor (type IND) with two integral sensors detects the upper or lower metal screw depending on the valve position and thus the two switch positions.

Easy as ABC: Puck with two metal targets offset by 90° and inductive dual sensor for position detection of the shaft.

Advantages

Due to the simple construction the system operates safely with no wear at all. It is virtually resistant to external influence and meets the protection rating IP 67. Under certain conditions the unit can even be self-cleaning. Compared to conventional solutions the sensor weight is low. The sensors are also resistant to mechanical stress such as vibration and shock.

Standardisation

It only takes a few minutes to mount the switches on the quarter-turn actuator. This is ensured by the mechanical interface in accordance with VDI / VDE 3845. This standard exactly defines where the threaded holes for fixing the switches have to be located by the valve manufacturer. The ifm dual sensors conform exactly to this standard. For different actuators the user only has to select one of three puck sizes. Keyed connectors simplify wiring. An additional terminal box is not required.

Because of the standardised connections (mechanical and electrical) the units provide an optimum price / performance ratio, taking mounting and maintenance cost into account, and high operational reliability.

Special design for hazardous areas (T1)

For use in hazardous areas ifm offers a special solution. This consists of two NAMUR sensors for position feedback and triggering of the EX-i solenoid valve. Both sensor and valve are connected to the controller via a 6-pole cable.

Special design AS-i (T5)

An extended design is the series T5. In addition to the inductive dual sensor, the unit provides an integrated connection for the solenoid valve. The connection to the control unit is made via a two-wire AS-i cable. The asset: Up to 61 other units can be connected to this line and separately controlled via the AS-i master. A so-called "preventive monitoring" of the solenoid valve can be implemented easily. Furthermore, ATEX 3G versions are available.

AS-i complete set

As complete solution ifm electronic offers an automation box for pneumatic quarter-turn actuators. In addition to the T5 sensor with AS-i capability it includes puck, solenoid valve, silencer and wired cable. So everything the user needs to provide his actuator with bus capability. If necessary, the optionally available AS-i master gateways serve as an interface with Profibus, DeviceNet, Ethernet and other network topologies.

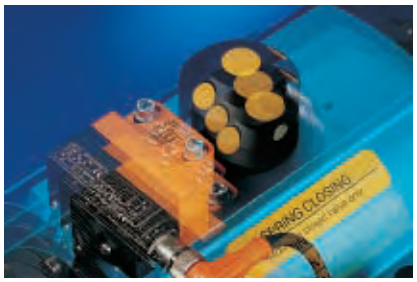
Continuous position detection for linear valves

The **efector *valvis*** has been designed for feedback of the valve positions on linear valves with a stroke of up to 80 mm. The sensor is fitted over the valve spindle and continuously measures the stroke. The actual limits of travel are transmitted to the controller via teachable switch points.

The **efector *valvis*** signals up to three valve positions to the controller: valve open, valve closed and any intermediate position, e.g. seat lifting. Furthermore the resolution of the measuring distance of 0.2 mm allows condition-based maintenance of the valve seals. Maintenance intervals can be adapted to the actual wear, which in turn increases life and uptime.

Using the **efector *valvis*** eliminates the need of mounting several individual position sensors. Convenient programming replaces the time-consuming mechanical adjustment to the respective valve positions. In the analogue transmitter version any number of valve positions can be defined and evaluated in the controller.

Standard fittings: Common dimensions in accordance with VDI / VDE standard.



Hazardous areas: Sensor signals and valve control are carried in one cable.

***efector valvis:** position feedback for single and double seat valves.*

Motor starter PowerSwitch · introduction

Due to the modular design of the AS-interface many components from the formerly centralised control cabinet are relocated into the field. This is now also valid to a larger extent for power electronics and motor branches. With the PowerSwitch family ifm electronic presents a high-performance AS-i motor branch for three-phase loads. Special advantages of this compact design are the high protection rating for direct installation in the field. Furthermore all connections are pluggable for quick replacement. They have additional 24 V sensor inputs, e.g. for the connection of photoelectric sensors.

Motor starter PowerSwitch on a conveyor line.

Design

The AS-i PowerSwitch consists first of all of a reversing contactor circuit for controlling 400 V three-phase standard motors or other three-phase loads. The second component is an AS-i slave with 4 inputs and 4 outputs as well as a SUB-D9 socket for the connection of a manual operating panel. All status LEDs are on the front panel under a transparent plastic cover which can be opened. At the lower long side there are three Harting connectors for the motor branch and the 400 V supply with the possibility of looping through to the next PowerSwitch. Opposite, on the upper side there are four M12 sockets for the connection of external input / output periphery. Mounting is made via four holes at the corners which are accessible from the front. For each power stage of 0.09 to 2.2 kW there is a suitable PowerSwitch with the corresponding motor protection. It can be checked visually from the front or via AS-i as regards triggering and be reset manually if required.

Function

Seen from the AS-i master the PowerSwitch operates bidirectionally with 4-bit information. 2 output bits are used for controlling the motor (left / right). Two further outputs are 24 V DC outputs to the M12 sockets.

The master detects via a data input if the motor protection has been activated. A further input indicates if the handheld operating panel has been connected and thus prevents a restart of the plc. Two further inputs enable the connection of any 2 or 3-wire sensors.

Commissioning

The commissioning of a PowerSwitch is as easy as the commissioning of a normal AS-i module. First the slave can be connected by means of the M12 connector directly to the addressing unit AC1144 and then be addressed. As an alternative, addressing can be carried out online via the master, e.g. the ifm ***controller e***. Next, the PowerSwitch is connected with the AS-i line and the 24 V cable. The easiest way to do this is via a flat cable insulation displacement connector (e.g. E70200) and an M12 / M12 jumper of the required length. After voltage has been applied the hand-held unit can be used. When it is plugged onto the SUB-D9 socket at the front the motor can be switched on / off or moved forwards / backwards as requested. The two external outputs can be switched manually as well. Both options are also possible without AS-i master and without software in the plc. For safety reasons it is only an inching mode which stops as soon as the pushbutton is released. This commissioning can of course also be carried out centrally via the controller with the corresponding software. When the drive has been mechanically adjusted the complete plant function and the controller software can be commissioned.

PowerSwitch power relay to control three-phase drives.

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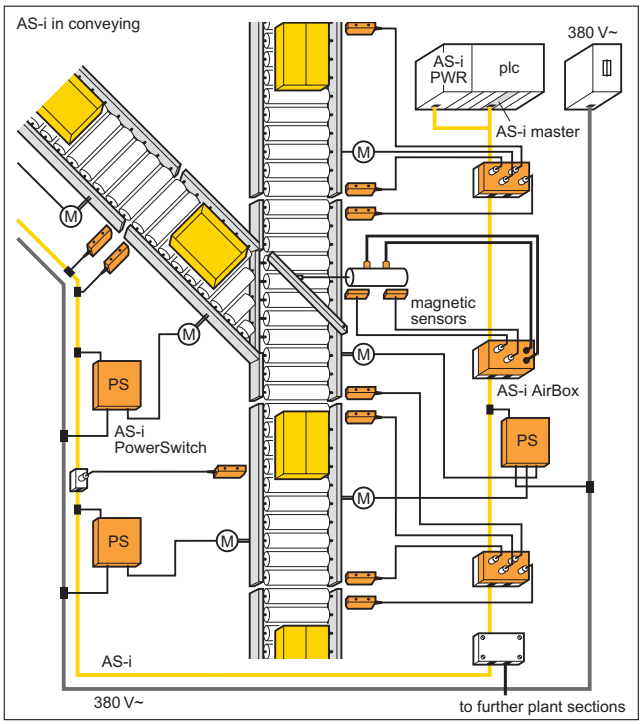
Application

In the large area of conveyor technology for different industries the ifm PowerSwitch has achieved an excellent position. The advantages of the completely wired module which has been tested in the production, the compact design and the quick commissioning speak for themselves.

Often the PowerSwitch is mounted under a conveyor line and connected to the three-phase drive and the further periphery by means of the connectors. The cabling for the bus, for the 24 V as well as the power cabling follow the conveyor line. It is also possible to work with hybrid (flat) cables or to lead all signals in one bus bar. As the units are pluggable and can thus be replaced quickly without any special tools this leads to a high uptime of the plant in case of a fault.

A further advantage is the commissioning of the plant step by step. As the conveyor technology is based on modular construction the plant manufacturers often have the problem that they have to commission individual modules in the plant without the complete plant being available. This is of course possible at any time due to the simple AS-i technology. Partial commissioning of the bus participants and a complete function test of the conveyor modules simplify the complete test at the end user's premises and shortens the expensive commissioning times on site.

Conveyor systems are typical applications of the PowerSwitch.



MOVIMOT · introduction

There is a growing trend in automation towards decentralised, intelligent drives. The frequency converters required for the control of rotational speed are placed directly on the electrical drive instead of being installed centrally in a large control cabinet. SEW as a large supplier in this area offers motors in the product family MOVIMOT with integrated converter electronics on the drive. ifm electronic has developed several matching AS-interfaces for different applications.

These modules are suitable for all cases where different rotational speeds, rotational directions and start / stop functions of the SEW drives are to be controlled via AS-i. It is only necessary to lay the 400 V supply, the AS-i cable and if required the additional black 24 V cable to the drive.

Control of SEW drives via AS-interface.

Variants

The modules communicate via digital inputs and outputs or via a serial RS 485 interface with the frequency converter MOVIMOT and thus carry out the commands transmitted via AS-i.

AS-i module for SEW MOVIMOT

This compact module can be mounted directly on site on the converter of the drive.

The following functions are available to the user for the control of the motor:

- Start / stop
- Clockwise / counterclockwise operation
- 2 speeds

The 24 V supply of the converter electronics comes from the AS-i cable. The external M12 socket provides two inputs for sensor signals.

Connection of the AS-i module to SEW MOVIMOT via digital interface.

Separate AS-i interface for SEW MOVIMOT

This AS-i slave in the universal housing must be mounted separately from the frequency converter. With this module it is also possible to control the rotational direction of the motor via AS-interface. By selecting the operating mode by means of AS-i parameters the rotational speed of the motor can be continuously altered or set in steps. Furthermore motor movement, combined error message and two further digital signals are transmitted.

All this is enabled by coded 4-bit information which is transmitted from the AS-i master to the slave. The slave converts the information into a serial message and provides it to the frequency converter.

Fast diagnosis and high operational reliability

By connecting the SEW drives to the AS-interface via the above-mentioned modules operating status or error messages can be detected. As one participant (slave) is assigned to one drive the fault cause can be located very easily. In case of a service all other participants of the AS-interface can continue to operate due to the free topology.

Connection of the AS-i module to SEW MOVIMOT via serial interface.

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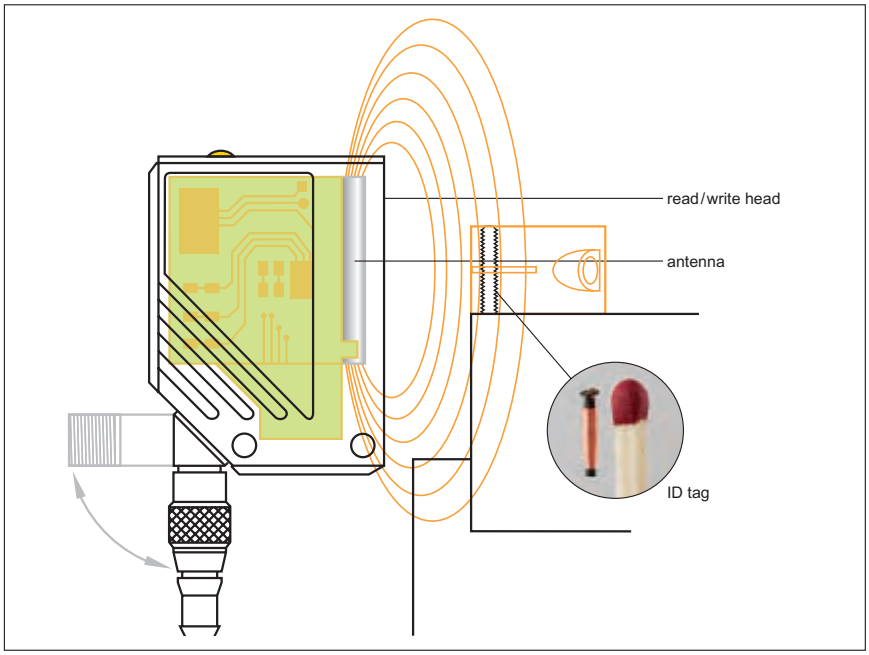
RFID · Introduction

The RFID system (**R**adio **F**requency **ID**entification) from ifm electronic generates a 125 kHz electromagnetic field for reading and writing data. The electromagnetic field emitted by the antenna induces voltage in the passive ID tag (transformer principle). This activates the ID tag (transponder) which returns its code. Processing of the code and transmission to the AS-interface are carried out in the read / write head. Advantage: reliable data transmission in dynamic reading processes.



The RF identification system immediately provides the data from the tag – without programming.

Applications are in conveying for the identification of the workpiece carriers as well as in handling and assembly technology.

Operating principle

DTS 125 is the first RF identification system worldwide for AS-interface and offers real "Plug & Play". From the AS-i master's perspective the system operates like an analogue input slave in the reading mode. The tag values are directly available in the input image of the controller without programming.

Customer benefits

DTS 125 can also be integrated into existing AS-i networks in no time and is ready for operation immediately. So, complex programming is not necessary. Up to 31 of the compact read / write heads can be connected to one AS-i master.

Connection via M12 connector or AS-i splitter box.

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Type / dimensions [mm]		Sensing range [mm]	Range retro-reflective mode [m]	Range diffuse reflection mode [mm]	Measuring range [bar]	AS-i profile	Application	Page
AS-i inductive sensors								
Type IG 	M18 x 1	5 f	–	–	–	S-1.1	●	162
	M18 x 1	10 nf	–	–	–	S-1.1	●	162
Type II 	M30 x 1.5	10 f	–	–	–	S-1.1	●	162
	M30 x 1.5	15 nf	–	–	–	S-1.1	●	162
Type IMC 	40 x 40 x 66	15 f	–	–	–	S-1.1	●	162
AS-i pressure sensors								
Type PPA... 	Ø 20 x 88	–	–	–	0...400	S-7.3.C analogue	●	164

f = flush / nf = non-flush / example dimensions: 30 x 12 (= active face) x 12

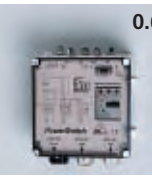
For industrial applications

For hazardous areas

Type	External 24 V voltage	Valve	Digital inputs	Digital outputs	AS-i profile	Application	Page
AS-i pneumatic modules AirBox							
AirBox 2 x 3/2 	•	2 x 3/2-way	2/4	2 (internal)	S-7.A.E S-3.F.F	●	166
AirBox 5/2 	•	5/2-way monostable / bistable	4	1/2 (internal)	S-7.A.E	●	168
AirBox 5/3 	•	5/3-way middle position blocked	4	2 (internal)	S-7.A.E	●	168
AS-i actuator sensors, A / B-slaves							
Type IND 	–	–	2 (integrated dual sensor)	1	S-7.A.E	●	174
Type IND 	–	–	2 (integrated dual sensor)	2	S-7.A.E	●	174
AS-i actuator sensors, ATEX design							
Type IND 	–	–	2 (integrated dual sensor)	1	S-7.A.E	●	170
Type IND 	–	–	2 (integrated dual sensor)	2	S-7.A.E	●	170

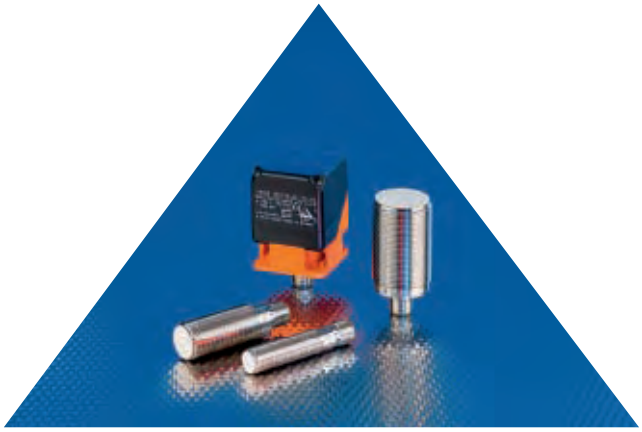
For industrial applications

For hazardous areas

Type	External 24 V voltage	Valve	Digital inputs	Digital outputs	AS-i profile	Applica-tion	Page
Motor starter PowerSwitch							
0.6...2.2 kW 	•	–	2	2	S-7.F	●	172
AS-i slaves for SEW motors							
MOVIMOT 	–	–	3	4	S-7.F	●	174
MOVIMOT 	–	–	2 x 2	–	S-7.4	●	174
RF identification							
Type DTA 	–	–	–	–	S-7.3 / S-7.4	●	176

For industrial applications

For hazardous areas



- **Long life due to protection IP 68 coolant.**
- **Resistant to aggressive oils and coolants.**
- **AS-i specification 2.1: up to 62 slaves possible per master.**
- **Increased sensing range for more plant uptime.**
- **High shock and vibration resistance.**

efector

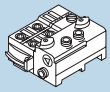
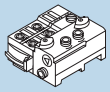
Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Accessories

Type	Description	Order no.
	Angle bracket for type M12 x 1	E10735
	Angle bracket for type M18 x 1	E10736
	Angle bracket for type M30 x 1,5	E10737
	Mounting clamp with end stop for type M12 x 1	E11047
	Mounting clamp with end stop for type M18 x 1	E11048
	Mounting clamp with end stop for type M30 x 1,5	E11049

Connectors and splitter boxes

Type	Description	Order no.
	Jumper, M12 1 m black, PUR cable	EVC012
	Jumper, M12 2 m black, PUR cable	EVC013
	Jumper, M12 1 m black, PUR cable	EVC017
	Jumper, M12 2 m black, PUR cable	EVC018
	Jumper, M12 1 m black, PUR cable	EVC032
	Jumper, M12 2 m black, PUR cable	EVC033

	For industrial applications	AS-i inductive sensors	AS-i pressure sensors		For industrial applications	AirBox 3/2-way	AirBox 5/2-way / AirBox 5/3-way
AS-i sensors				AirBoxes			
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Design cylindrical and rectangular
Connection technology: M12 connector
Integrated AS-i chip

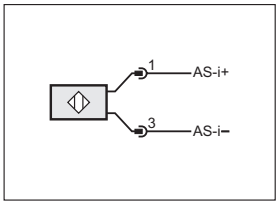
Type	Dimensions [mm]	Sensing range [mm]	Material	U_b [V]	Protection rating	Short-circuit, overload and rev. polarity protection	I_0 [mA]	Wiring diagram no.	Drawing no.	Order no.
	M12 / L = 60	4 f	st. steel	26.5...31.6	IP 68	yes	< 30	1	1	**IFC247**
	M12 / L = 60	7 nf	st. steel	26.5...31.6	IP 68	yes	< 30	1	2	**IFC248**
	M18 / L = 60	8 f	st. steel	26.5...31.6	IP 68	yes	< 20	1	3	**IGC234**
	M18 / L = 60	12 nf	st. steel	26.5...31.6	IP 68	yes	< 20	1	4	**IGC235**
	M30 / L = 60	14 f	st. steel	26.5...31.6	IP 68	yes	< 30	1	5	**IIC220**
	M30 / L = 60	22 nf	st. steel	26.5...31.6	IP 68	yes	< 30	1	6	**IIC221**
	40 x 40 x 66	15 f	PBT / PPE	26,5...31,6	IP 67	yes	< 35	1	7	**IM5118**

f = flush mountable,
nf = non flush mountable

Common technical data

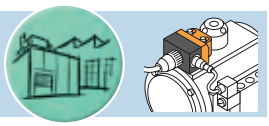
Ub: 26.5...31.6 V DC
Operating temperature: -25.. .70 °C
Protection rating/class: IP 68 III
Switching status indication: LED yellow
Setting display: LED red (uncertain range or error message)
Sr: 0...10 % (...10 Hz)
Sn 80...1150 % (...10 Hz),
Sensor coil wire break / sensor coil short circuit

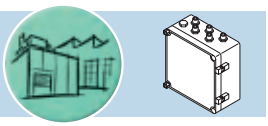
Wiring diagrams of the units

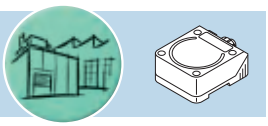


Wiring diagram no. 1

You can find scale drawings from page 244

For industrial applications *Sensors for actuators*
Valve control  *170 - 171*

For industrial applications *Motor starter / Motor controller*
Motor starter  *172 - 175*

For industrial applications *RF identification*
RF identification  *176 - 177*

efector

- Analogue electronic pressure sensor with integrated AS-i slave.
- Fast and simple set-up.
- Protection against unauthorised access / high transmission reliability.
- "Plug & play" with clear identification by ID code.
- 16-bit scaled meas. value incl. sign, transmission to AS-i profile S-7.3.C.

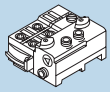
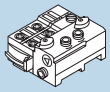
Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Accessories

Type	Description	Order no.
	FC insulation displacement connector	E70096
	Mounting clamp with reducing bush	E10077

Connectors and splitter boxes

Type	Description	Order no.
	Jumper, M12 1 m black, PUR cable	EVC012
	Jumper, M12 2 m black, PUR cable	EVC013
	Jumper, M12 1 m black, PUR cable	EVC017
	Jumper, M12 2 m black, PUR cable	EVC018
	Jumper, M12 1 m black, PUR cable	EVC032
	Jumper, M12 2 m black, PUR cable	EVC033

	For industrial applications	AS-i inductive sensors	AS-i pressure sensors		For industrial applications	AirBox 3/2-way	AirBox 5/2-way / AirBox 5/3-way
AS-i sensors				AirBoxes			
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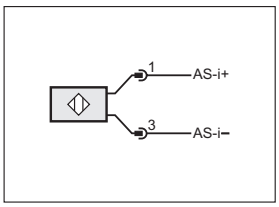
Ceramic measuring cell
Process connection G 1/4 female
AS-i profile / AS-i certificate S-7.3.C applied for

Measuring range [bar]	$P_{overload}$ max. [bar]	$P_{bursting}$ min. [bar]	U_b [V]	Medium temperature [°C]	Operating temperature [°C]	I_0 [mA]	Wiring diagram no.	Drawing no.	Order no.
0...60	800	1200	26,5...31,6	-25...80	-25...70	< 25	1	8	**PPA060**
0...400	600	1000	26.5...31.6	-25...80	-25...70	< 25	1	8	**PPA020**
0...10	50	150	26.5...31.6	-25...80	-25...70	< 25	1	8	**PPA024**

Common technical data

Protection rating: IP 67
Characteristics deviation < ±1,5
Materials (wetted parts):
stainless steel (303S21), ceramics FPM (Viton)
Shock resistance: 50 g
Vibration resistance: 20 g (10...2.000 Hz)
For further data see:
www.ifm-electronic.com

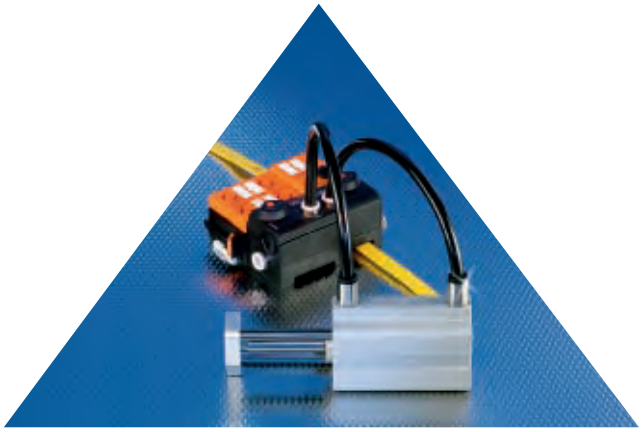
Wiring diagrams of the units



Wiring diagram no. 1

You can find scale drawings from page 244

For industrial applications *Sensors for actuators*
Valve control 170 - 171
For industrial applications *Motor starter / Motor controller*
Motor starter 172 - 175
For industrial applications *RF identification*
RF identification 176 - 177



AirBox

- Two 3/2-way slide valves (free from overlapping).
- Pressure peak resistance up to 12 bar.
- Digital inputs and extended addressing mode.
- Power supply completely from AS-i or via external 24 V.
- 3 freely selectable directions of the flat cable.

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

AS-i pneumatics with quick mounting technology

Integration of different valve functions, quick and tool-less mounting and the other following characteristics are features of the AirBoxes.

Pneumatic:

- slide valves free from overlapping
- Pressure peak resistance up to 12 bar
- higher flow and fast switching times
- 8 mm tube connections
- manual override: pressing / releasing or pressing / turning / locking

Electrical / mechanical:

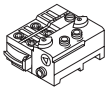
- extended addressing mode
- implemented addressing interface
- communication / peripheral fault indication
- AirBox supply completely from AS-i or via ext. 24 V
- safe mounting of upper and lower parts
- 3 freely selectable directions of the flat cable
- protection rating IP 65 / IP 67

Accessories and connectors

Type	Description	Order no.
	FC splitter	E70381
	T-connector for AirBoxes	E75227
	L-connector for AirBoxes	E75228
	Silencer for AirBox	E75232

Further accessories are available starting on page 197

Further connectors are available starting on page 179



AirBoxes 2 x 3/2 way slide valves
Digital inputs, pneumatic outputs
A/B slave: AC5228 and AC5243

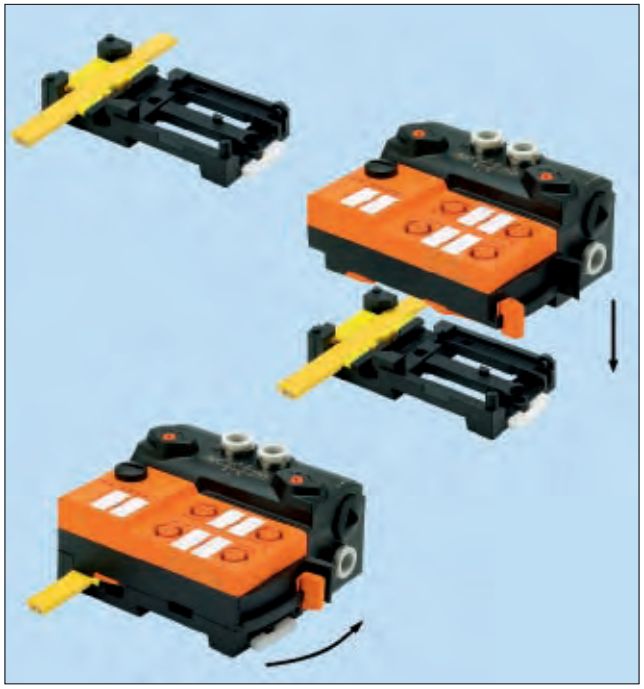
Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input current / module [mA]	Air flow / channel [l/min.]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
AirBox · 2 digital inputs · 2 pneumatic outputs · IP 65 / IP 67									
2 DI	2 PO	yes	–	100	500	S-3.F.F	< 180	1	**AC5227**
AirBox · 4 digital inputs · 2 pneumatic outputs · IP 65 / IP 67									
4 DI-Y	2 PO	yes	–	200	500	S-7.A.E	< 280	1	**AC5228**
4 DI-Y	2 PO	yes	yes	200	500	S-7.A.E	< 280	1	**AC5243**

Lower part supplied with the device!
Addressing via AC1144 and E70213

For information about compressed air and EMC please go to www.ifm-electronic.com

Front view AC5228

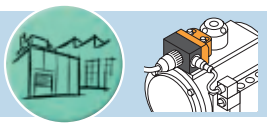
Quick mounting of upper and lower parts

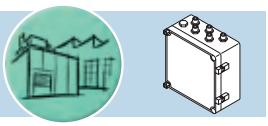


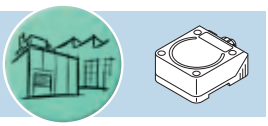
Common technical data

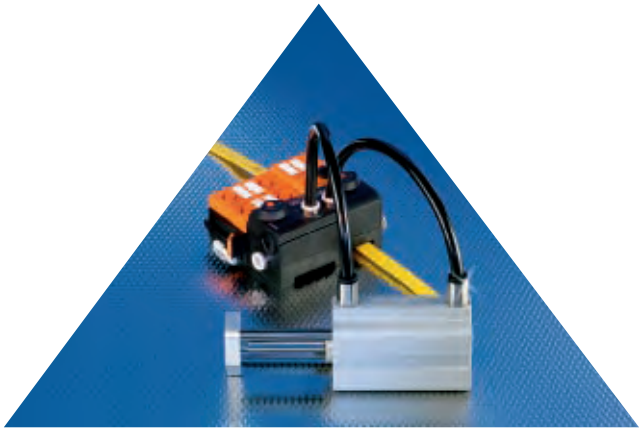
Dimensions: 85 x 108 x 50 mm
Materials: PA / POM
Operating temperature: -10...55 °C
Protection: IP 65 / IP 67
Pressure range: 2...8 bar
Perm. compressed air: filtered (5um); lubricated (class 6-3-4)
or not lubricated (class 6-3-1)
Air flow at 6/5 bar: 500 Nl/min

You can find scale drawings from page 245

For industrial applications *Sensors for actuators*
Valve control 
170 - 171

For industrial applications *Motor starter / Motor controller*
Motor starter 
172 - 175

For industrial applications *RF identification*
RF identification 
176 - 177



AirBox

- 5/2-way slide valves, monostable / bistable (free from overlapping).
- 5/3-way slide valve, middle position blocked (free from overlapping).
- Pressure peak resistance up to 12 bar.
- Digital inputs and extended addressing mode.
- 3 freely selectable directions of the flat cable.

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

AS-i pneumatics with quick mounting technology

Integration of different valve functions, quick and tool-less mounting and the other following characteristics are features of the AirBoxes.

Pneumatic:

- slide valves free from overlapping
- Pressure peak resistance up to 12 bar
- higher flow and fast switching times
- 8 mm tube connections
- manual override by pressing / releasing or pressing / turning / locking

Electrical / mechanical:

- extended addressing mode
- implemented addressing interface
- communication / peripheral fault indication
- AirBox supply completely from AS-i or via ext. 24 V
- safe mounting of upper and lower parts
- 3 freely selectable directions of the flat cable
- protection rating IP 65 / IP 67

Accessories and connectors

Type	Description	Order no.
	FC splitter	E70381
	T-connector for AirBoxes	E75227
	L-connector for AirBoxes	E75228
	Silencer for AirBox	E75232

Further accessories are available starting on page 197

Further connectors are available starting on page 179

5/3-way slide valves (monostable/ bistable), 5/3-way slide valves (middle position blocked)
Digital inputs, pneumatic changeover contacts
All AirBoxes are A/B slaves

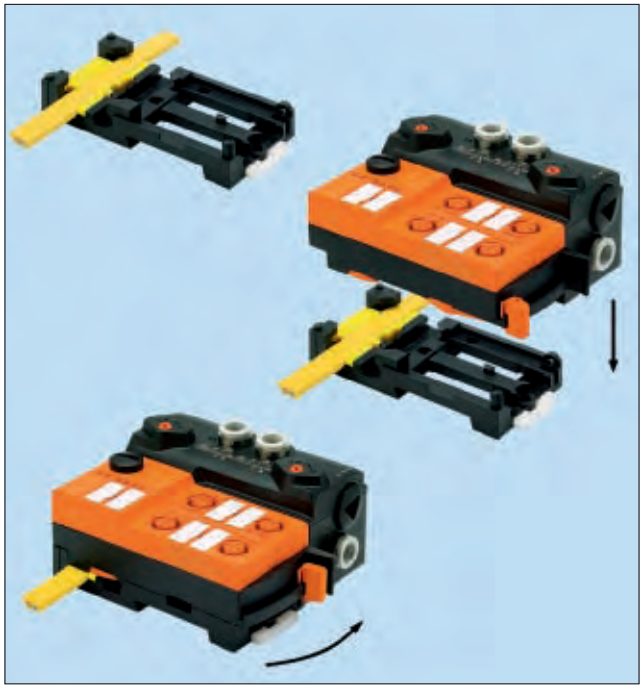
Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input current / module [mA]	Air flow / channel [l/min.]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
AirBox 5/2-way · monostable · 4 digital inputs · 1 pneumatic changeover contact									
4 DI-Y	1 PO	yes	–	200	500	S.-7.A.E	280	2	**AC5246**
4 DI-Y	1 PO	yes	yes	200	500	S.-7.A.E	280	2	**AC5249**
AirBox 5/2-way · bistable (pulse valve)· 4 digital inputs · 1 pneumatic changeover contact									
4 DI-Y	1 PO	yes	–	200	500	S.-7.A.E	280	1	**AC5251**
4 DI-Y	1 PO	yes	yes	200	500	S.-7.A.E	280	1	**AC5253**
AirBox 5/3-way · (middle position blocked)· 4 digital inputs · 1 pneumatic changeover contact									
4 DI-Y	1 PO	yes	–	200	500	S.-7.A.E	280	1	**AC5270**
4 DI-Y	1 PO	yes	yes	200	500	S.-7.A.E	280	1	**AC5271**

Lower part supplied with the device!
Addressing via AC1144 and E70213

For information about compressed air and EMC please go to www.ifm-electronic.com

Front view AC5270

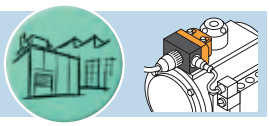
Quick mounting of upper and lower parts

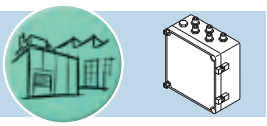


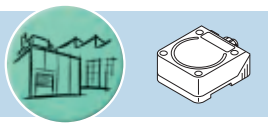
Common technical data

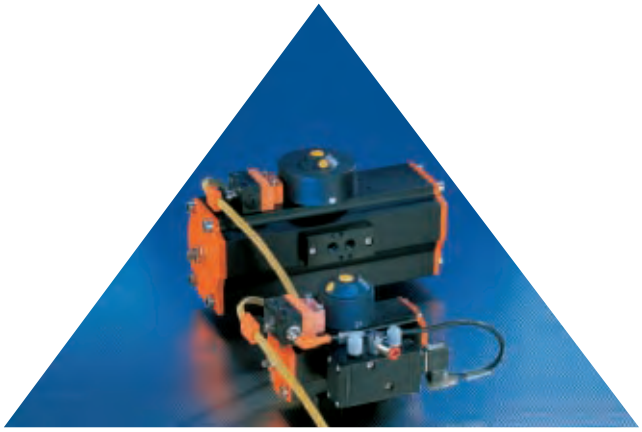
Dimensions: 85 x 108 x 50 mm
Materials: PA / POM
Operating temperature: -10...55 °C
Protection: IP 65 / IP 67
Pressure range:
2...8 bar (5/2 way), 3...8 bar (5/3 way)
Perm. compressed air: filtered (5um);
lubricated (class 6-3-4)
or not lubricated (class 6-3-1)
Air flow at 6/5 bar: 500 Nl/min

You can find scale drawings from page 245

For industrial applications *Sensors for actuators*
Valve control  *170 - 171*

For industrial applications *Motor starter / Motor controller*
Motor starter  *172 - 175*

For industrial applications *RF identification*
RF identification  *176 - 177*



Ask for our complete sets:
T5 with puck, cables and solenoid valve.

T-family

- **Products with integrated AS-i slave – certified.**
- **Quick and safe installation due to “plug & play”.**
- **Monitoring of the solenoid valve for interruption / short circuit.**
- **Up to 62 actuators connectable to a master / controller.**
- **50 % cost reduction compared to parallel wiring.**

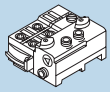
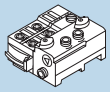
Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Accessories

Type	Description	Order no.
	Target puck Ø 53 mm, PA6	**E17320**
	Target puck Ø 65 mm, PA6	**E17327**
	Target puck Ø 102 mm, PA6	**E17328**
	Target puck Ø 53 mm, angle adjustable	**E10661**

Connectors and splitter boxes

Type	Description	Order no.
	T-splitter, AS-i	**E70271**
	Jumper, 0.3 m, M12 plug / valve plug type A, PUR / PVC cable	**E10817**
	Jumper, 0.6 m, M12 plug / valve plug type A, PUR / PVC cable	**E10818**
	Jumper, 0.3 m, M12 plug / valve plug type C, PUR / PVC cable	**E10844**
	Jumper, 0.6 m, M12 plug / valve plug type C, PUR / PVC cable	**E10845**
	Y-jumper, 1 m, M12 plug / valve plug type A, PUR / PVC cable	**E70203**

	For industrial applications	AS-i inductive sensors	AS-i pressure sensors		For industrial applications	AirBox 3/2-way	AirBox 5/2-way / AirBox 5/3-way
AS-i sensors				**AirBoxes**			
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Dual sensors
Control of quarter-turn actuators or valves with AS-i
Sensing range: 4 mm non flush

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Type	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
Dual sensor for actuator feedback									
2 SI	–	yes	–	T4	–	S-0.A.F	< 40	1	**AC2315**
2 SI	1 DOT	yes	AS-i	T5	0.1	S-7.A.E	< 160	2	**AC2316**
2 SI	2 DOT	yes	AS-i	T6	0.1	S-7.A.E	< 160	2	**AC2317**
Dual sensor for actuator feedback ATEX 3 D									
2 SI	–	yes	–	T4	–	S-0.A.F	< 40	1	**AC315A**
2 SI	1 DOT	yes	–	T5	0,1	S-7.A.E	< 160	2	**AC316A**
2 SI	2 DOT	yes	–	T6	(0,1)	S-7.A.E	< 160	2	**AC317A**

Target puck to actuator manufacturers at www.ifm-electronic.com/ifmde/web/puck_sel.htm

T-sensor AC2317

Terminal connection

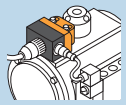
M 12 plug	pin
AS-i +	1
AS-i –	3

M 12 socket for T5	pin
switching output +	4
24 V voltage –	3
not connected	5

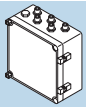
M 12 socket for T6	pin
switching output 1 +	4
switching output 2 +	2
24 V voltage –	3
not connected	5

You can find scale drawings from page 246

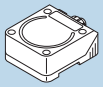
For industrial applications *Sensors for actuators*
Valve control


170 - 171

For industrial applications *Motor starter / Motor controller*
Motor starter


172 - 175

For industrial applications *RF identification*
RF identification


176 - 177

PowerSwitch

- **Motor starter for three-phase drives.**
- **Reversing contactor combination with motor-protective circuit breaker.**
- **Status LEDs and socket for manual operating panel on the front panel.**
- **Inputs and outputs on M12 sockets, power connector for 400 V and motor.**
- **Robust plastic housing with transparent cover.**

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Control of motors by means of AS-i

The AS-i PowerSwitch consists first of all of a reversing contactor circuit for controlling 400 V three-phase standard motors or other three-phase loads. The second component is an AS-i slave with 4 inputs and 4 outputs as well as a SUB-D9 socket for the connection of a manual operating panel. All status LEDs are at the front under a transparent plastic cover which can be opened. At the lower long side there are three Harting connectors for the motor branch and the 400 V supply with the possibility of looping through to the next PowerSwitch. Opposite, on the upper side there are four M12 sockets for the connection of external input / output periphery. Mounting is made via four holes at the corners which are accessible from the front. For each power stage of 0.09 to 2.2 kW there is a suitable PowerSwitch with the corresponding motor protection. It can also be checked visually from the front or via AS-i as regards triggering and be reset if required.

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Jumper, M12 1 m black, PUR cable	**EVC012**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

AS-i sensors

For industrial applications | *AS-i inductive sensors* | *AS-i pressure sensors*



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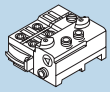
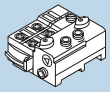
AirBoxes

For industrial applications | *AirBox 3/2-way* | *AirBox 5/2-way / AirBox 5/3-way*

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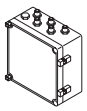


Motor starter PowerSwitch
Digital inputs and outputs

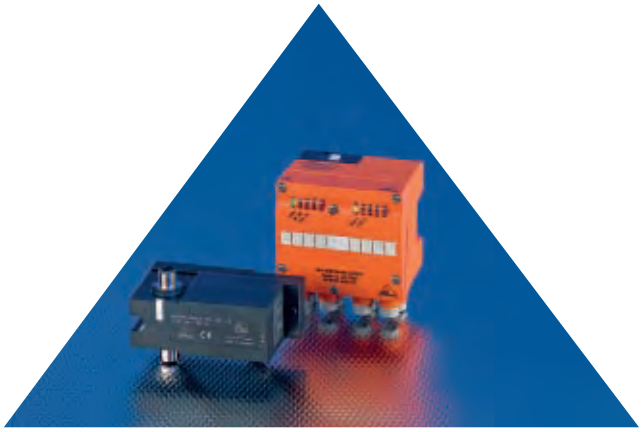
Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output power / channel [kW]	AS-i profile	Total current consumption from AS-i [mA]	Drawing no.	Order no.
4 DI	2 + 2 DO	yes	yes	< 140	0.25	S-7.0	< 250	1	**ZB0032**
4 DI	2 + 2 DO	yes	yes	< 140	0.37	S-7.0	< 250	1	**ZB0033**
4 DI	2 + 2 DO	yes	yes	< 140	0.55	S-7.0	< 250	1	**ZB0034**
4 DI	2 + 2 DO	yes	yes	< 140	0.75	S-7.0	< 250	1	**ZB0035**
4 DI	2 + 2 DO	yes	yes	< 140	0.75	S-7.0	< 250	1	**ZB0036**
4 DI	2 + 2 DO	yes	yes	< 140	1.1	S-7.0	< 250	1	**ZB0037**
4 DI	2 + 2 DO	yes	yes	< 140	1.5	S-7.0	< 250	1	**ZB0039**
4 DI	2 + 2 DO	yes	yes	< 140	2.2	S-7.0	< 250	1	**ZB0040**

Further types which are different from the following standard range are available on request.

Front view ZB0032

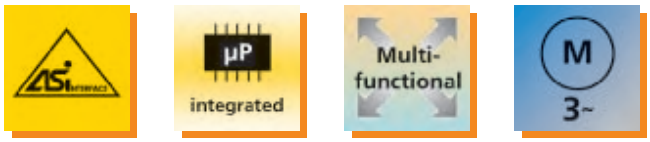
Application

You can find scale drawings from page 247



- **Motor control for SEW Movimot drives.**
- **Digital inputs and outputs.**
- **Robust DIN rail mounting.**

Movimot



Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Intelligent modules

The AS-i field modules with digital inputs / outputs specially developed for SEW drives enable the control of drives with decentralised power electronics (Movimot). This means that the volume of the control cabinet is further reduced. Now the motors are connected directly with 400 V and the AS-i cable. All further power elements and terminal connection points are not required any more. Following functions are available to the user for the control of the motor.

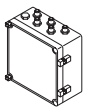
- start / stop
- clockwise / counterclockwise operation
- rotation speed can be controlled in steps

Accessories and connectors

Type	Description	Order no.
	AS-i addressing unit	**AC1144**
	Jumper, M12 1 m black, PUR cable	**EVC012**
	Addressing cable for AS-i slaves	**E70213**

Further accessories are available starting on page 197

Further connectors are available starting on page 179

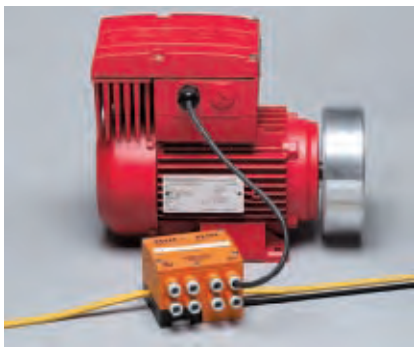


Movimot

Number of inputs	Number of outputs	Input voltage from AS-i	Output voltage acc. to PELV	Max. input curr. / module [mA]	Output current / channel (total) [A]	AS-i profile	Total current consumption from AS-i [mA]	Draw-ing no.	Order no.
Movimot modules for SEW drives · digital inputs and outputs									
3 DI	4 DOT	yes	–	100	0.01	S-7.F	< 420	2	**AC1151**
Movimot module for SEW drives · serial interface									
2 + 2 DI	–	yes	–	26	–	S-7.F	< 80	3	**AC1150**

View AC1151

View AC1150



You can find scale drawings from page 247

- Inductive identification system in 125 kHz technology.
- RFID for assembly/conveying technology and handling automation.
- Quick and easy set-up.
- High reading reliability.
- Compact housing.

RF identification

Special features of the units: For more explanations see the technical glossary chapter starting on page 256

Safety and cost saving with RFID

DTS125 is a compact and low-cost alternative for applications where optical identification cannot be used due to environmental influences.

DTS125 can be integrated into AS-i networks in no time and is ready for operation immediately. In addition to the lower cost for hardware, this also saves time during set-up.

Benefit from the unique selling proposition of ifm sensors: quick and easy to mount with absolute safety

Accessories and connectors

Type	Description	Order no.
	Angle bracket for DTA100, DTA101	E80304
	Mounting set for DTA300	E11121
	Mounting set for DTA300	E11122
	Mounting bracket for DTA300	E10730

Further accessories are available starting on page 197

Further connectors are available starting on page 179

	For industrial applications	AS-i inductive sensors	AS-i pressure sensors
AS-i sensors			
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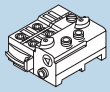
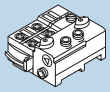
	For industrial applications	AirBox 3/2-way	AirBox 5/2-way / AirBox 5/3-way
AirBoxes			
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RF identification

Dimensions	Type	Connection	Material	Current-consump. [mA]	Reading range [mm]	Protec-tion	AS-i profile	Draw-ing no.	Order no.
55 x 24 x 41	read / write head	M12 connector	PA	″ 50	max. 65	IP 67	7.4	1	**DTA100**
55 x 24 x 41	read head	M12 connector	PA	″ 50	max. 65	IP 67	7.3	1	**DTA101**
92 x 80 x 40	read / write head	M12 connector	PPE	″ 65	max. 100	IP 67	7.4	2	**DTA300**

Applikation

You can find scale drawings from page 248

General information
List of articles
Controllers / Gateways, network extension
Power supplies and earth fault monitors
I/O modules for control cabinets
I/O modules for field applications
Safety at Work
AS-i sensors, pneumatic and actuator solutions
Connection technology
Accessories
Technical information and customer service

Connection technology

ecomat 400

Complete ifm product range

Description	For industrial applications 	For hygienic and wet areas 	For hazardous areas 	For safety applications 
	from page 182	from page 182	from page 191	from page 184
Sockets · Groups				
Socket M12, 4 pole, 4 wires	1 / 5	2		
Socket M12, 4 pole, 4 wires with LED, PNP	3 / 6	4		
Cable plugs · Groups				
M12 connector, 4 pole	7 / 8			7 / 8
M12 connector, 5 pole	9			9
Jumpers · Groups				
Jumper M8 plug, 3 pole / M8 socket, 3 pole	10			
Jumper M8 plug, 3 pole / M8 socket, 3 pole, with LED, PNP	11			
Jumper M8 plug, 3 pole / M8 socket, 4 pole	12			
Jumper M12 plug, 3 pole / M8 socket, 3 pole	13			
Jumper M12 plug, 3 pole / M8 socket, 3 pole, with LED, PNP	14			
Jumper M12 plug, 4 pole / M8 socket, 4 pole	15			
Jumper M12 plug, 3 pole / M12 socket, 3 pole	16			
Jumper M12 plug, 3 pole / M12 socket, 3 pole, with LED, PNP	17			
Jumper M12 plug, 4 pole / M12 socket, 4 pole	18	19	19	18
Jumper M12 plug, 4 pole / M12 socket, 4 pole, with LED, PNP	20			
Jumper M12 plug, 5 pole / M12 socket, 5 pole	21	22	22	21
Jumper M12 plug, 5 pole / valve plug DIN A, 3/4 pole, with LED	23			
Jumper M12 plug, 5 pole / valve plug DIN B, 3/4 pole, with LED	24			
Jumper M12 plug, 5 pole / valve plug DIN C, 3/4 pole, with LED	25			
Jumper M12 plug, 5 pole / valve plug industrial standard B, 3/4 pole, with LED	26			
Jumper M12 plug, 5 pole / valve plug industrial standard C, 3/4 pole, with LED	27			

Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Protection	Gold-contacts	LEDs	Drawing no.	Order no.
Group 1 · Socket M12, 4-pole, 4-wire										
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	1	**EVC001**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	1	**EVC002**
	10 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	1	**EVC003**
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	2	**EVC004**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	2	**EVC005**
	10 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	2	**EVC006**
Group 2 · Socket M12, 4-pole, 4-wire										
	5.3 m orange PVC cable	4 x 0.34 mm² Ø 5 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69 K	•	–	3	**E10662**
	10 m orange PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69 K	•	–	3	**E10663**
	25 m orange PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69 K	•	–	3	**E10899**
	5 m orange PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69 K	•	–	4	**E10700**
	10 m orange PVC cable	4 x 0.25 mm² Ø 5 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69 K	•	–	4	**E10701**
	25 m orange PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69 K	•	–	4	**E10800**
Group 3 · Socket M12, 4-pole, 4-wire, LED, PNP										
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	5	**EVC007**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	5	**EVC008**
	10 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	5	**EVC009**
Group 4 · Socket M12, 4-pole, 4-wire, LED, PNP										
	5.3 m orange PVC cable	4 x 0.34 mm² Ø 5 mm	PVC / stainless steel (316S12)	10...30 DC	-25...100	IP 68	•	green / 2 x yell.	6	**E10702**
	10 m orange PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	10...30 DC	-25...100	IP 68	•	green / 2 x yell.	6	**E10703**
	25 m orange PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	10...30 DC	-25...100	IP 68	•	green / 2 x yell.	6	**E10773**

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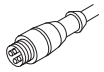
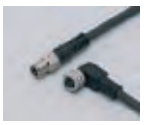
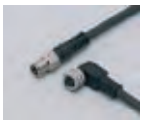
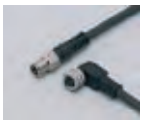
Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Pro-tection	Gold-con-tacts	LEDs	Draw-ing no.	Order no.
Group 5 · Socket M12, 4-pole										
	Wirable	...0.75 mm² (Ø 4...6 mm)	PA / brass	250 AC/DC	-25...100	IP 68	•	–	7	**E11508**
	Wirable	...0.75 mm² (Ø 4...6 mm)	PA / brass	250 AC/DC	-25...100	IP 68	•	–	8	**E11509**
Group 6 · Socket M12, 4-pole, LED, PNP										
	Wirable	...0.75 mm² (Ø 4...6 mm)	PA / brass	10...30 DC	-25...100	IP 68	•	green / yellow	9	**E11510**

Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Pro-tection	Gold-con-tacts	LEDs	Draw-ing no.	Order no.
Group 7 · Plug M12, 4-pole, 4-wire										
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	10	**EVC076**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	10	**EVC077**
	10 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	10	**EVC078**
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	11	**EVC079**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	11	**EVC080**
	10 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	11	**EVC081**
Group 8 · Plug M12, 4-pole										
	Wirable	...0.75 mm² (Ø 4...6 mm)	PA / brass	250 AC/DC	-25...100	IP 68	•	–	12	**E11504**
	Wirable	...0.75 mm² (Ø 4...6 mm)	PA / brass	250 AC/DC	-25...100	IP 68	•	–	13	**E11505**
Group 9 · Plug M12, 5-pole										
	Wirable	...0.75 mm² (Ø 4...6 mm)	PA / brass	125 AC/DC	-25...100	IP 68	•	–	14	**E11506**
	Wirable	...0.75 mm² (Ø 4...6 mm)	PA / brass	125 AC/DC	-25...100	IP 68	•	–	15	**E11507**



Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Protection	Gold-contacts	LEDs	Drawing no.	Order no.
Group 10 · Jumper M8, 3-pole, 3-wire										
	0.3 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	16	**E11319**
	0.6 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	16	**E11320**
	1 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	16	**E11321**
	2 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	16	**E11322**
	5 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	16	**E11323**
	0.3 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	17	**E11324**
	0.6 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	17	**E11325**
	1 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	17	**E11326**
	2 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	17	**E11327**
	5 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	17	**E11328**
Group 11 · Jumper M8, 3-pole, 3-wire, LED										
	0.3 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	18	**E11329**
	0.6 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	18	**E11330**
	1 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	18	**E11331**
	2 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	18	**E11332**
	5 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	18	**E11333**
Group 12 · jumper M8 plug, 3-pole / M8 socket, 4-pole										
	0.3 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	19	**E11334**
	0.6 m black PUR cable	3 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	19	**E11335**
	1 m black PUR cable	3 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	19	**E11202**
	2 m black PUR cable	3 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	19	**E11203**
	5 m black PUR cable	3 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	19	**E11336**

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Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Protection	Gold-contacts	LEDs	Drawing no.	Order no.
Group 12 · jumper M8 plug, 3-pole / M8 socket, 4-pole										
	0.3 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	20	**E11337**
	0.6 m black PUR cable	3 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	20	**E11338**
	1 m black PUR cable	3 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	20	**E11204**
	2 m black PUR cable	3 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	20	**E11205**
	5 m black PUR cable	3 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	20	**E11339**
Group 13 · Jumper M12 / M8, 3-pole, 3-wire										
	0.3 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	21	**E11376**
	0.6 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	21	**E11377**
	1 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	21	**E11378**
	2 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	21	**E11379**
	5 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	21	**E11380**
	0.3 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	22	**E11381**
	0.6 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	22	**E11382**
	1 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	22	**E11383**
	2 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	22	**E11384**
	5 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	22	**E11385**
Group 14 · Jumper M12 / M8, 3-pole, 3-wire, LED										
	0.3 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	23	**E11386**
	0.6 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	23	**E11387**
	1 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	23	**E11388**
	2 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	23	**E11389**
	5 m black PUR cable	3 x 0.34 mm² Ø 5 mm	PUR / brass	10...30 DC	-25...85	IP 68	•	green / yellow	23	**E11390**

Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Protection	Gold-contacts	LEDs	Drawing no.	Order no.
Group 15 · jumper M12 plug, 4-pole / M8 socket, 4-pole										
	0.3 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	24	**E11441**
	0.6 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	24	**E11442**
	1 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	24	**E11210**
	2 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	24	**E11211**
	5 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	24	**E11445**
	0.3 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	25	**E11446**
	0.6 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	25	**E11447**
	1 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	25	**E11212**
	2 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	25	**E11213**
	5 m black PUR cable	4 x 0.25 mm² Ø 5 mm	PUR / brass	60 AC 75 DC	-25...85	IP 68	•	–	25	**E11450**

Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Protection	Gold-contacts	LEDs	Drawing no.	Order no.
Group 16 · Jumper M12, 3-wire										
	0,3 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	26	**EVC040**
	0,6 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	26	**EVC041**
	1 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	26	**EVC042**
	2 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	26	**EVC043**
	5 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	26	**EVC044**
	0,3 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	27	**EVC045**
	0,6 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	27	**EVC046**
	1 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	27	**EVC047**
	2 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	27	**EVC048**
	5 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	27	**EVC049**
Group 17 · Jumper M12, 3-wire, LED										
	0,3 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / yellow	28	**EVC050**
	0,6 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / yellow	28	**EVC051**
	1 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / yellow	28	**EVC052**
	2 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / yellow	28	**EVC053**
	5 m black PUR cable	3 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / yellow	28	**EVC054**
Group 18 · Jumper M12, 4-wire										
	0,3 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	29	**EVC010**
	0,6 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	29	**EVC011**
	1 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	29	**EVC012**
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	29	**EVC013**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	29	**EVC014**

Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Protection	Gold-contacts	LEDs	Drawing no.	Order no.
Group 18 · Jumper M12, 4-wire										
	0,3 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	30	**EVC015**
	0,6 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	30	**EVC016**
	1 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	30	**EVC017**
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	30	**EVC018**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	30	**EVC019**
	0,3 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	31	**EVC025**
	0,6 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	31	**EVC026**
	1 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	31	**EVC027**
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	31	**EVC028**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	31	**EVC029**
	0,3 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	32	**EVC030**
	0,6 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	32	**EVC031**
	1 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	32	**EVC032**
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	32	**EVC033**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	250 AC 300 DC	-25...90	IP 68 / IP 69K	•	–	32	**EVC034**
Group 19 · jumper M12 plug, 4-pole / M12 socket, 4-pole, 4-wire										
	1 m PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69K	•	–	33	**E70204**
	2 m orange PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69K	•	–	33	**E10881**
	5 m orange PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69K	•	–	33	**E10882**
	10 m orange PVC cable	4 x 0.34 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	250 AC 300 DC	-25...100	IP 68 / IP 69K	•	–	33	**E70189**

Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Protection	Gold-contacts	LEDs	Drawing no.	Order no.
Group 20 · Jumper M12, 4-wire, LED										
	0,3 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	34	**EVC020**
	0,6 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	34	**EVC021**
	1 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	34	**EVC022**
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	34	**EVC023**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	34	**EVC024**
	0,3 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	35	**EVC035**
	0,6 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	35	**EVC036**
	1 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	35	**EVC037**
	2 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	35	**EVC038**
	5 m black PUR cable	4 x 0,34 mm² Ø 4,9 mm	TPU / brass	10...36 DC	-25...90	IP 68 / IP 69K	•	green / 2 x yel.	35	**EVC039**
Group 21 · Jumper M12, 5-wire										
	0,3 m black PUR cable	5 x 0,34 mm² Ø 4,9 mm	TPU / brass	30 AC 36 DC	-25...90	IP 68 / IP 69K	•	–	36	**EVC060**
	0,6 m black PUR cable	5 x 0,34 mm² Ø 4,9 mm	TPU / brass	30 AC 36 DC	-25...90	IP 68 / IP 69K	•	–	36	**EVC061**
	1 m black PUR cable	5 x 0,34 mm² Ø 4,9 mm	TPU / brass	30 AC 36 DC	-25...90	IP 68 / IP 69K	•	–	36	**EVC062**
	2 m black PUR cable	5 x 0,34 mm² Ø 4,9 mm	TPU / brass	30 AC 36 DC	-25...90	IP 68 / IP 69K	•	–	36	**EVC063**
	5 m black PUR cable	5 x 0,34 mm² Ø 4,9 mm	TPU / brass	30 AC 36 DC	-25...90	IP 68 / IP 69K	•	–	36	**EVC064**
Group 22 · Jumper M12, 5-wire										
	1 m orange PVC cable	5 x 0.25 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	30 AC 36 DC	-25...100	IP 68 / IP 69 K	•	–	37	**E11642**
	2 m orange PVC cable	5 x 0.25 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	30 AC 36 DC	-25...100	IP 68 / IP 69 K	•	–	37	**E11643**
	5 m orange PVC cable	5 x 0.25 mm² Ø 5.3 mm	PVC / stainless steel (316S12)	30 AC 36 DC	-25...100	IP 68 / IP 69 K	•	–	37	**E11644**
Group 23 · Jumper M12 / DIN A, 3-wire, LED										
	0.3 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	38	**E11416**

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Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Protection	Gold-contacts	LEDs	Drawing no.	Order no.
Group 23 · Jumper M12 / DIN A, 3-wire, LED										
	0.6 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	38	**E11417**
	1 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	38	**E11418**
	2 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	38	**E11419**
	5 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	38	**E11420**
Group 24 · Jumper M12 / DIN B, 3-wire, LED										
	0.3 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	39	**E11421**
	0.6 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	39	**E11422**
	1 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	39	**E11423**
	2 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	39	**E11424**
	5 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	39	**E11425**
Group 25 · Jumper M12 / DIN C, 3-wire, LED										
	0.3 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 65	•	yellow	40	**E11426**
	0.6 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 65	•	yellow	40	**E11427**
	1 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 65	•	yellow	40	**E11428**
	2 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 65	•	yellow	40	**E11429**
	5 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 65	•	yellow	40	**E11430**
Group 26 · Jumper M12 / Indu.Std. B, 3-wire, LED										
	0.3 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	41	**E11431**
	0.6 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	41	**E11432**
	1 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	41	**E11433**
	2 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	41	**E11434**
	5 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	41	**E11435**

Type	Cable	Wire-specification	Material housing/ nut	U [V]	T_a [°C]	Protection	Gold-contacts	LEDs	Drawing no.	Order no.
Group 27 · Jumper M12 / Indu.Std. C, 3-wire, LED										
	0.3 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	42	**E11436**
	0.6 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	42	**E11437**
	1 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	42	**E11438**
	2 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	42	**E11439**
	5 m black PUR cable	3 x 0.5 mm² Ø 5 mm	PUR / brass	24 AC/DC	-25...80	IP 67	•	yellow	42	**E11440**

Accessories

ecomat300

Accessories bus systems

Introduction

In addition to numerous masters, slaves and other components an extensive range of accessories is another strong point of ifm. It comprises addressing units, addressing adapters, flat cable lower parts, flat cable insulation displacement connectors, jumpers, mounting accessories and many other useful small components.

These accessories are not only required to set up an AS-i system (for example addressing units) but also to establish a network topology by taking into consideration the conditions on site (for example flat cable insulation displacement connectors). In addition ifm offers the user products which simply make operation or installation of an AS-i network easier, these include flat cable stripping tools or accessories for branching AS-i cables.

Addressing

In principle AS-i slaves can be addressed in two ways: By means of a separate addressing unit or by means of a software in the AS-i master. No matter which way the user chooses: In the end it is always the same commands that are sent to the slave to allot a fixed address.

In most cases a hand-held addressing unit is used to program slaves. This is not only very convenient but it also simplifies installation and set-up.

The handy, battery-operated unit is suited for various kinds of AS-i slaves. There is also an M12 socket integrated into the hand-held unit where all common addressing adapters can be connected. This includes jack plugs, infrared modules and special adapters for addressing CompactLine modules.

The hand-held addressing unit features the following functionality:

- Addressing standard slaves and slaves supporting the extended addressing mode
- Indicating all AS-i slaves connected to the bus
- Reading and writing slave data and slave parameters
- Indicating peripheral faults of a slave

The unit can be operated intuitively. The functions of the five keys are: “increment address”, “decrement address”, “write address / set”, “read address / switch on unit” and “change operating modes”. The integrated LC display informs the user at any time about the selected operating mode and the data being currently read or written.

AS-i addressing unit for diagnostics and set-up.

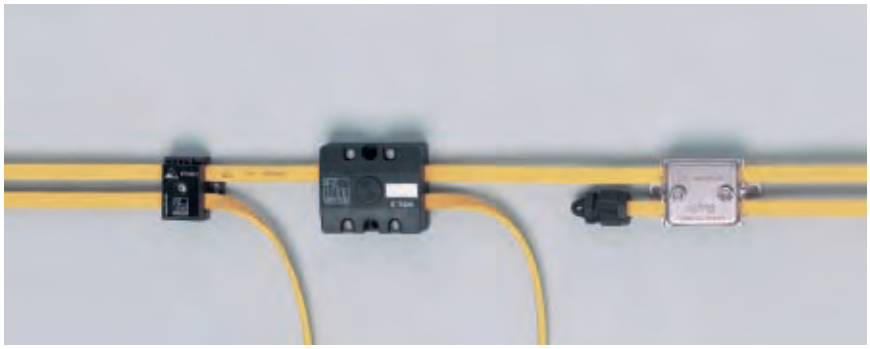
Connection of units to the AS-i flat cable

Since there are no restrictions for the use of the AS-i interface in connection with feasible topologies all conceivable network structures such as star, tree, line and string are possible. On the one hand side this requires components for branching AS-i cables on the network nodepoints and on the other hand connection possibilities for the AS-i slaves.

FC insulation displacement connector for the connection of AS-i participants.

Distribution of the AS-i / AUX voltage

Distribution of the AS-i voltage and the auxiliary voltage (AUX) can be carried out in different – but very simple – ways. The splitters differ, among others, in terms of protection, dimensions, current rating and material.



Different AS-i splitters.

Voltage distribution in the module lower part.

Flat cable insulation displacement connectors

These insulation displacement connectors enable the user the connection of AS-i participants, e.g. intelligent sensors, to the flat cable.

Different flat cable insulation displacement connectors.

Sealing of the flat cable

To prevent short circuits the flat cable end should be protected against humidity and direct machine contact.

Lower part with cover, heat-shrink cap or seal for the flat cable ends.

For further accessories please refer to the following pages.

Selection chart

Type of accessories	Controllers / Gateways, network extension	I/O control cabinet modules	I/O field modules	Safety at Work	Lower parts / Addressing unit AS-i cables	Customer service
	from page	from page	from page	from page	from page	from page
Combicon connectors						
 Combicon connectors	–	202	–	–	–	–
Flat cable splitters / insulation displacement connectors and other accessories						
 FC insulation displacement connectors	–	–	204	–	–	–
T-splitters	–	–	206	–	–	–
Protective caps	–	–	206	–	–	–
Safety at Work						
 Software	–	–	–	208	–	–
Interface cables	–	–	–	208	–	–
Emergency stop label	–	–	–	208	–	–
Protective collar	–	–	–	209	–	–
Link plug	–	–	–	209	–	–

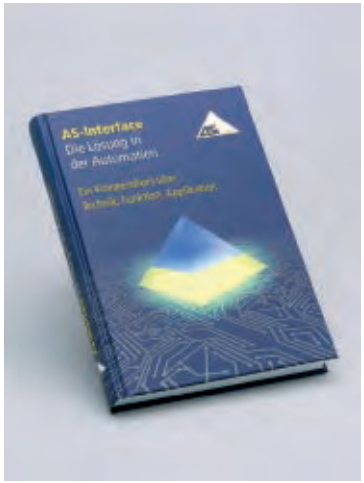
Type of accessories	Controllers / Gateways, network extension	I/O control cabinet modules	I/O field modules	Safety at Work	Lower parts / Addressing unit AS-i cables	Customer service
	from page	from page	from page	from page	from page	from page
Module lower parts, addressing unit, AS-i cables						
						
Addressing unit	–	–	–	–	210	–
Addressing cables	–	–	–	–	210	–
Lower parts	–	–	–	–	211	–
Programming cables	–	–	–	–	211	–
AS-i flat cables	–	–	–	–	213	–
Pneumatics / RFID accessories						
						
Silencers	–	–	–	–	196	–
ID tags	–	–	–	–	198	–
Literature						
						
AS-i automation	–	–	–	–	–	220
AS-i Safety at Work	–	–	–	–	–	220

Illustration	Description	Order no.
	COMBICON connector screw terminals 4-pole for SmartLine modules and SmartLogic pack quantity = 6 pcs.	**E70230**
	COMBICON connector screw terminals 4-pole for SmartLine modules and SmartLogic pack quantity = 100 pcs.	**E70231**
	COMBICON connector cage clamps 4-pole for SmartLine modules and SmartLogic pack quantity = 6 pcs.	**E70232**
	COMBICON connector cage clamps 4-pole for SmartLine modules and SmartLogic pack quantity = 100 pcs.	**E70233**
	COMBICON connector insulation displacement terminals 4-pole for looping through supply for cable cross-sections 0.75 to 1 mm for SmartLine modules and SmartLogic pack quantity = 6 pcs.	**E70236**
	COMBICON connector insulation displacement terminals 4-pole for looping through supply for cable cross-sections 0.75 to 1 mm for SmartLine modules and SmartLogic pack quantity = 100 pcs.	**E70237**

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Illustration	Description	Order no.
	FC insulation displacement connector AS-i / 24 V on M12 socket current rating 4 A M12 socket high-grade stainless steel, screws high-grade stainless steel O-ring M12 socket Viton, seals NBR	**E70188**
	FC splitter AS-i / AS-i, 24 V / 24 V current rating 8 A screws high-grade stainless steel, seals NBR	**E70200**
	FC splitter · Distribution of the AS-i voltage or the external 24 V supply	**E70381**
	FC splitter · AS-i voltage via M12 socket, stainless steel ProcessLine IP68 / IP 69K currrent rating 2 A	**E70454**
	T-splitter stainless steel ProcessLine IP 68 / IP 69 K, metal parts stainless steel, seal blanks Viton, O-ring EPDM	**E70354**

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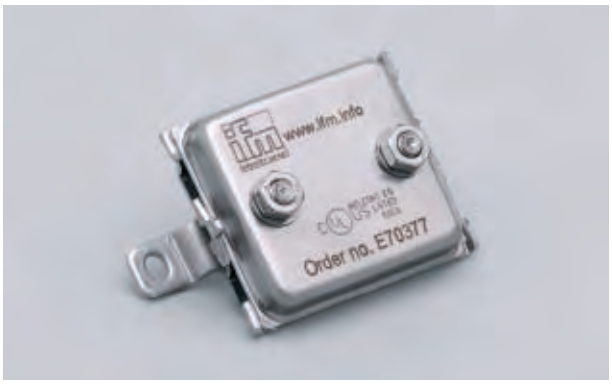
Illustration	Description	Order no.
	FC splitter · Distribution of the AS-i voltage or the external 24 V supply,stainless steel ProcessLine IP68 / IP 69K currrent rating 2 A	**E70377**
	FC insulation displacement connector M12 socket for connection to round cable or unit with M12 connector to flat cable current rating 2 A	**AC5005**
	FC insulation displacement connector M12 socket for connection to round cable or unit with M12 connector to flat cable, metal parts stainless steel, O-ring Viton, flat seal EPR current rating 2 A	**E70271**
	FC insulation displacement connector M12 socket for connection to round cable or unit with M12 connector to flat cable current rating 2 A	**E70096**
	FC insulation displacement connector with 2 m cable, incl. fixture round cable PPU 2 x 1.5 mm current rating 2 A	**E70098**
	FC insulation displacement connector with 5 m cable, incl. fixture round cable PPU 2 x 1.5 mm current rating 2 A	**E70099**

Illustration	Description	Order no.
	FC insulation displacement connector with round cable 1.2 m	E79995
	FC insulation displacement connector with round cable and M12, 1.2 m	E79998
	T-splitter, M12 plug on 2 x M8 socket e.g. for modules having dual connection on M12 socket	E10802
	T-splitter, M12 plug on 2 x M12 socket e.g. for modules having dual connection on M12 socket	E10803
	Protective cap M12, for AirBoxes Classic-and CompactLine modules, pack quantity = 10 pcs.	E73004

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Illustration	Description	Order no.
	protective cover M12, for PocessLine modules pack quantity = 10 pcs.	E70297

Illustration	Description	Order no.
	Parameter setting software for safety monitors 1/2-channel CD for MS-Windows 95, 98, 2000, NT, XP incl. electronic manual	**E7020S**
	Serial interface cable SUB-D9/RJ 45 for connection of the safety monitor to PC	**E7001S**
	Download cable RJ45 / RJ45 crossover for connection safety monitor-safety monitor	**E7002S**
	Emergency-stop label in four languages German, English, French, Italian IP 66 for AC010S / AC011S	**E7003S**

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Illustration	Description	Order no.
	Protective collar for AC010S / AC011S	**E7004S**
	Bridging plug for AC005S / AC006S	**E7005S**

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Illustration	Description	Order no.
	Addressing unit for AS-i version 2.1 incl. plug-in power supply	**AC1144**
	Addressing cable with straight jack plug for lower parts with addressing socket and SmartLine modules	**E70213**
	Addressing adapter for connection of CompactLine M12 modules to AC1144	**E70123**
	Infrared addressing cable for connection of ClassicLine and CompactLine modules to AC1144	**E70211**

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Illustration	Description	Order no.
	Programming cable for controller E · Western connector RJ11 6 poles / D-Sub socket 9 poles	E70320
	FC lower part (yellow / yellow)	AC5000
	FC lower part (yellow / yellow) with addressing socket	AC5010
	FC lower part (yellow / yellow) metal parts stainless steel, seals Viton	AC5014
	FCE lower part (yellow / black)	AC5003
	FCE lower part (yellow / black) with addressing socket	AC5011
	FCE lower part (yellow / black) metal parts stainless steel, seals Viton	AC5015
	FC lower part (yellow / yellow) with earthing lead, e.g. for analogue modules	AC5020
	FC lower part (yellow / yellow) with addressing socket and earthing lead, e.g. for analogue modules	AC5022

Illustration	Description	Order no.
	FCE lower part (yellow / black) with earthing lead, e.g. for analogue modules	**AC5021**
	FCE lower part (yellow / black) with addressing socket and earthing lead, e.g. for analogue modules	**AC5023**
	Seals for FC/ FCE lower parts, NBR pack quantity = 50 pcs.	**E70351**
	Seals for FC/ FCE lower parts, Viton pack quantity = 50 pcs.	**E70353**
	Module lower part screw connection screw terminal	**AC5031**
	Screw terminal block for AC500, for additional 24 V supply	**AC5007**

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Illustration	Description	Order no.
	Module cover for module lower parts	**AC3000**
	AS-i flat cable yellow, PUR, lengths 100 m	**AC4001**
	AS-i flat cable black, PUR, lengths 100 m	**AC4006**
	AS-i flat cable, yellow EPDM (rubber) available in lengths of 25 m, 50 m, 100 m, 1000 m	**AC4000**
	AS-i flat cable, black EPDM (rubber) available in lengths of 25 m, 50 m, 100 m, 1000 m	**AC4002**
	AS-i flat cable, yellow TPE available in lengths of 25 m, 50 m, 100 m, 1000 m	**AC4003**
	AS-i flat cable, black TPE available in lengths of 25 m, 50 m, 100 m, 1000 m	**AC4004**
	AS-i flat cable, yellow for food industry length = 100 m	**AC4007**
	AS-i flat cable, black for food industry length = 100 m	**AC4008**

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Illustration	Description	Order no.
	JOKARI flat cable stripping tool	**E70062**
	Flat cable dummy, e.g. for E70354 length = 60 mm pack quantity = 10 pcs.	**E70299**
	Flat cable dummy, e.g. for CompactLine and ClassicLine, length = 45 mm pack quantity = 10 pcs.	**E70399**
	Shrink wrap pack quantity = 10 pcs. to seal the flat cable ends closed at one side	**E70113**

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Illustration	Description	Order no.
	Flat cable seal, pack quantity = 10 pcs.	**E70413**
	Flat cable clip, pack quantity = 100 pcs. self-adhesive and screw-connectable	**E70067**

Illustration	Description	Order no.
	Silencer for AirBoxes, pack quantity = 10 pcs.	E75232
	T-connector for AirBoxes, pack quantity = 10 pcs.	E75227
	L-connector for AirBoxes, pack quantity = 10 pcs.	E75228

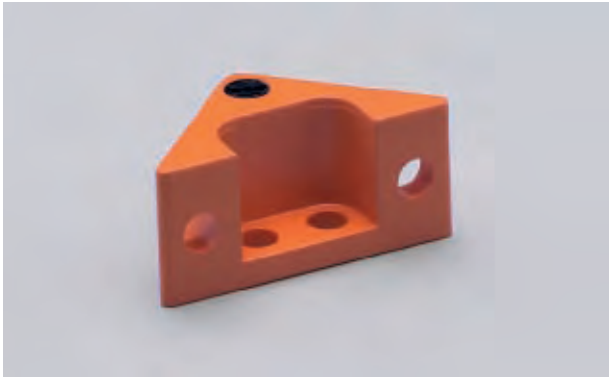
Illustration	Description	Order no.
	ID tag M5x16.5 screw mounting	**E80301**
	Tag fixture for workpiece carriers with ID tag E80301	**E80302**
	ID tag M18x1 screw mounting in metal	**E80311**
	ID tag diameter 12x2mm	**E80312**

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Illustration	Description	Order no.
	ID tag diameter 20 x 2.15 mm	**E80317**
	ID tag diameter 30 x 2.15 mm	**E80318**
	ID tag diameter 50 x 2. 2mm	**E80319**
	ID tag ISO card	**E80320**

Illustration	Description	Order no.
	ecolog asi system AS-Interface Manual (German)	**AC0115**
	ecolog asi system AS-Interface Manual (English)	**AC0116**
	Manual AS-interface Safety at Work (German) Introduction and application examples	**AC115S**
	Manual AS-interface Safety at Work (English) Introduction and application examples	**AC116S**

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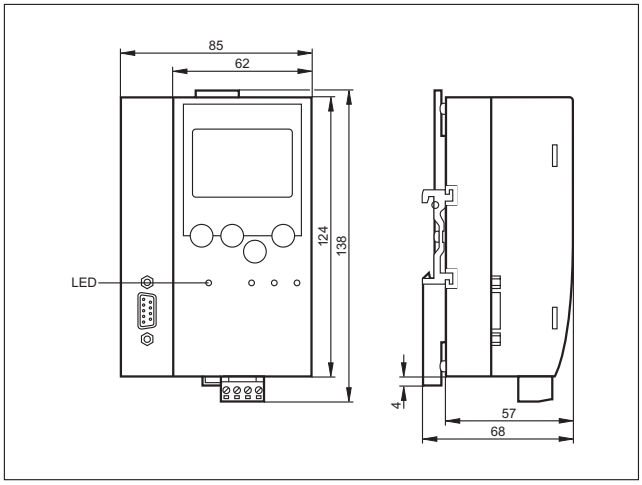
Technical information and customer service

Controller / Gateways

1 **type ....**



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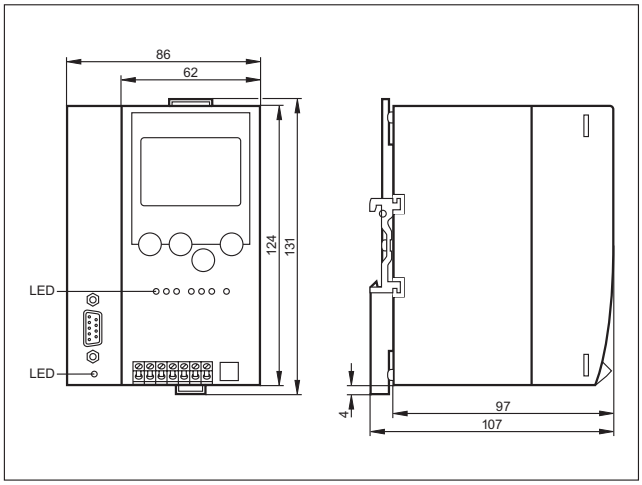
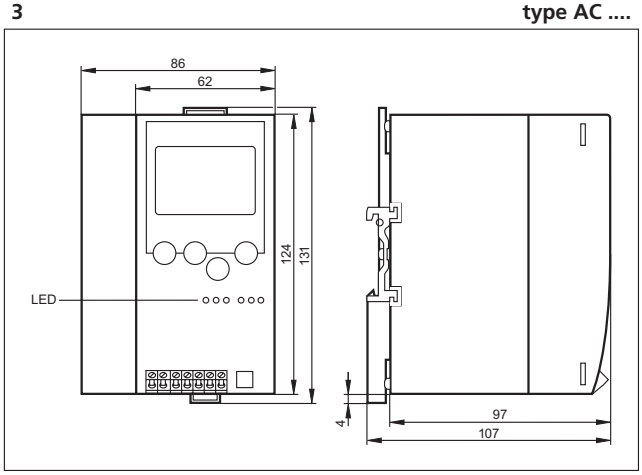
2 **type AC ....**



Page 41, 45

3 **type AC ....**



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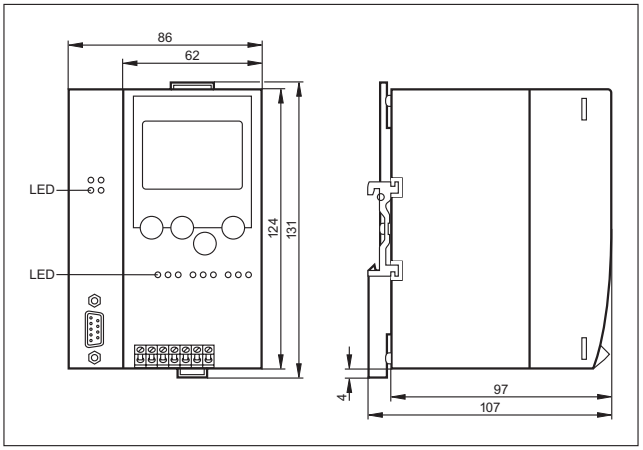
4 **type ....**



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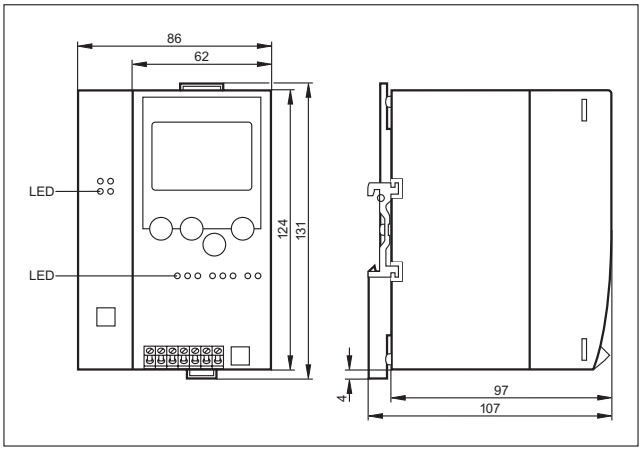
5 **type AC ....**



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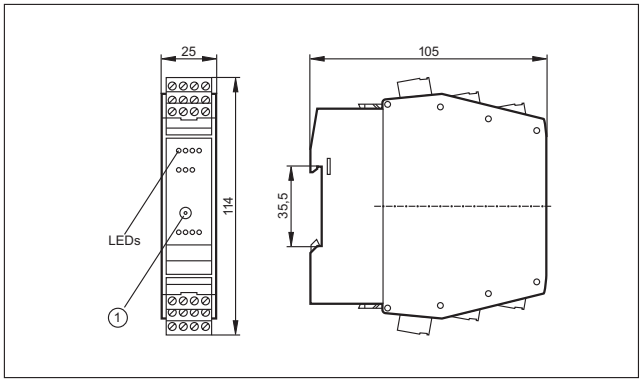
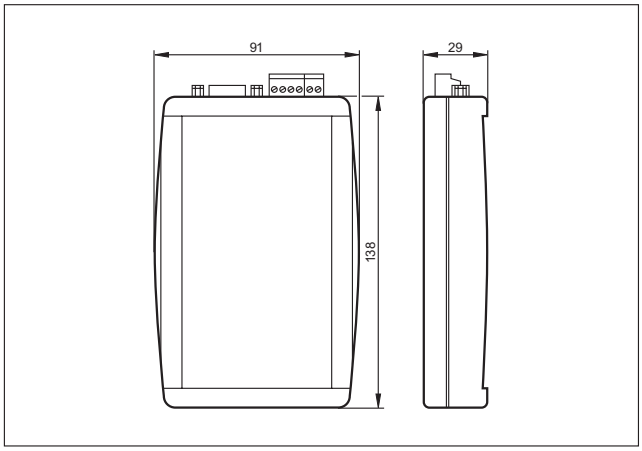
Network extension

1 **type ....**



1: addressing socket, Page 49

2 **type AC ....**



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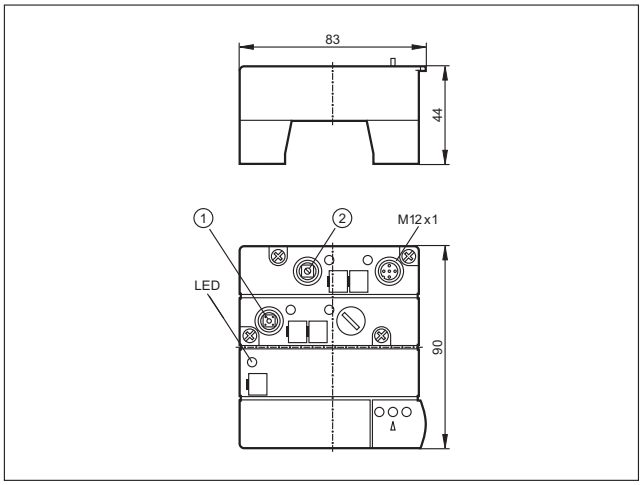
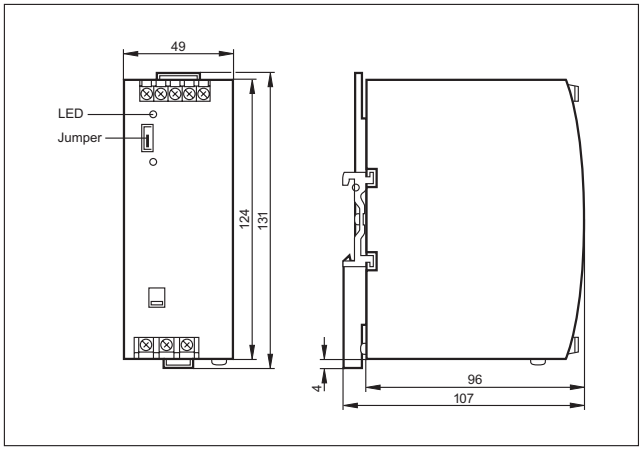
3 **type ....**



1: tune button, 2: mode selector, Page 53

Power supplies

1 **type ....**



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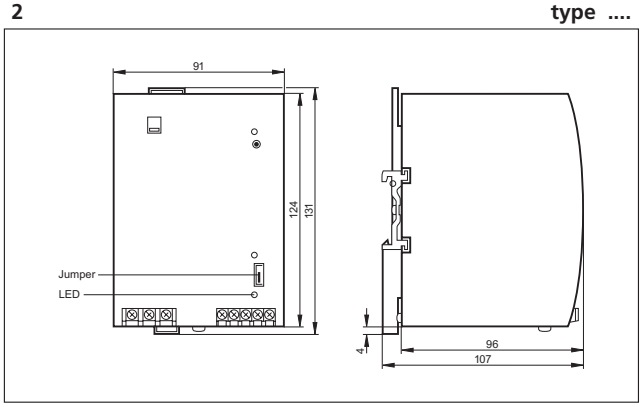
2 **type ....**



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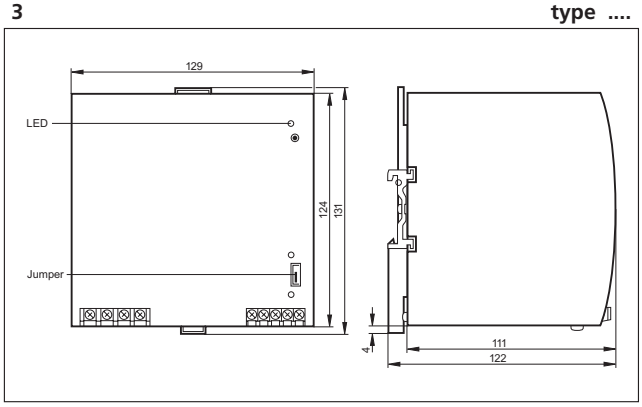
3 **type ....**



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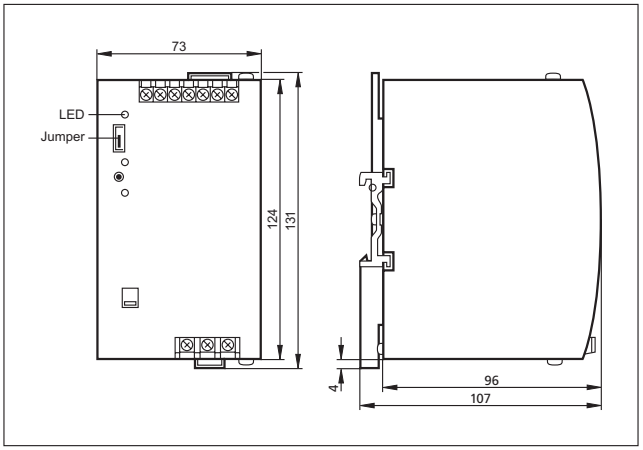
4 **type ....**



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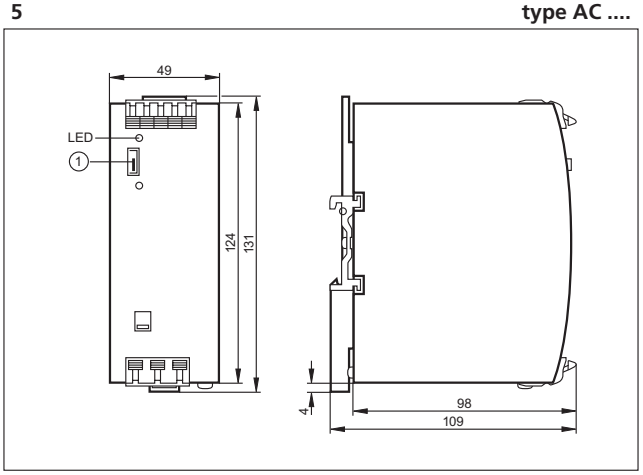
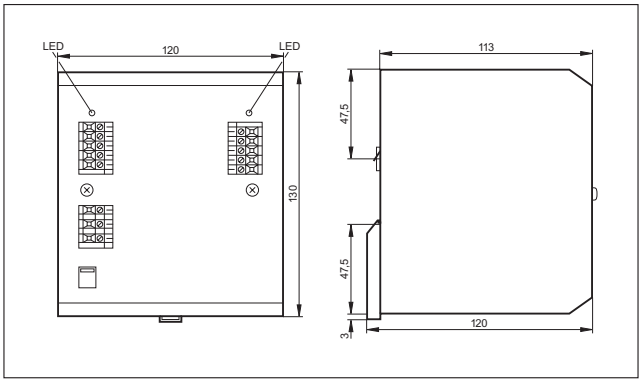
5 **type AC ....**



1: Jumper , Page 65

6 **type AC ....**



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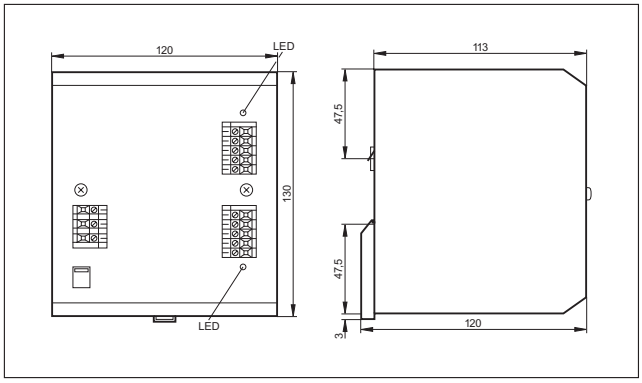
Power supplies

7 **type AC ....**



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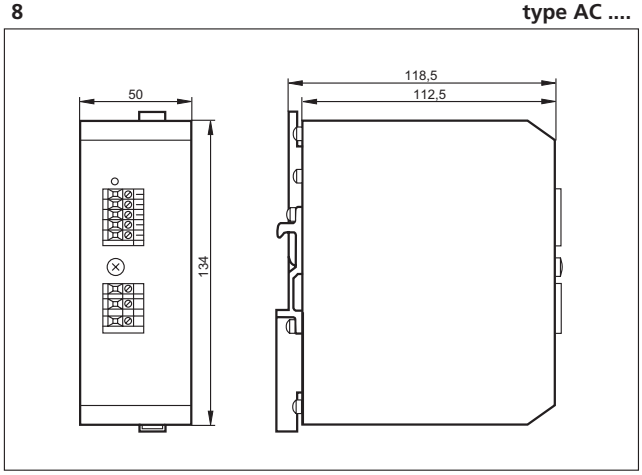
8 **type AC ....**



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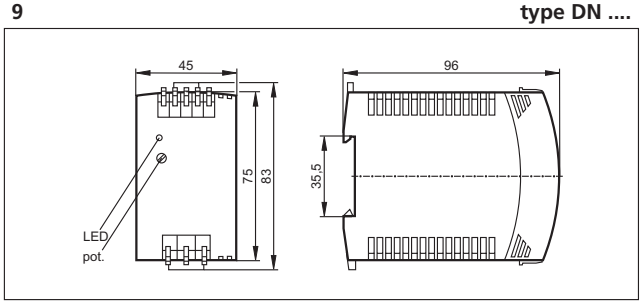
9 **type DN ....**



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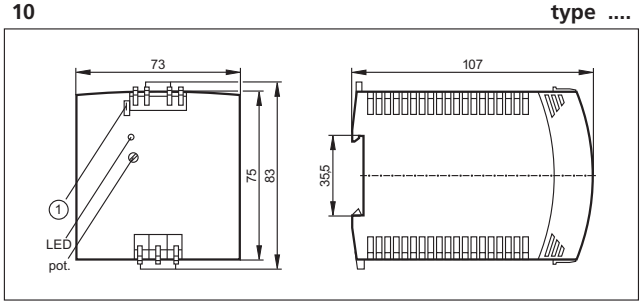
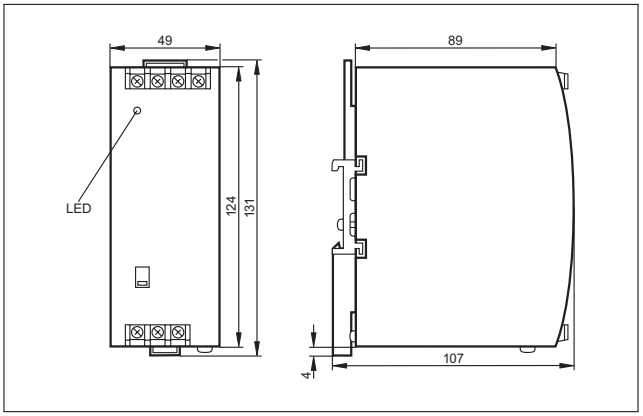
10 **type ....**



1: jumper "single/parallel operation", Page 67

11 **type DN ....**



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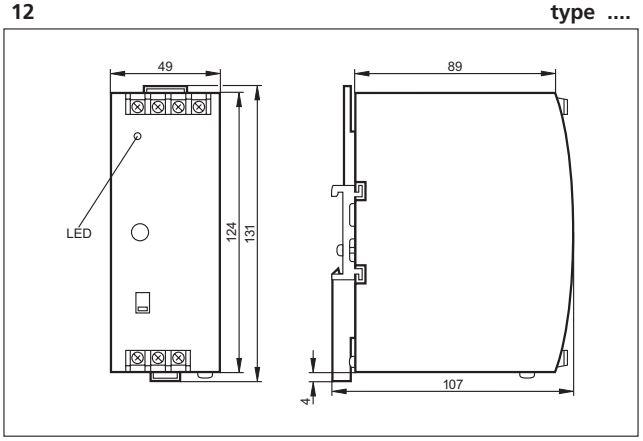
12 **type ....**



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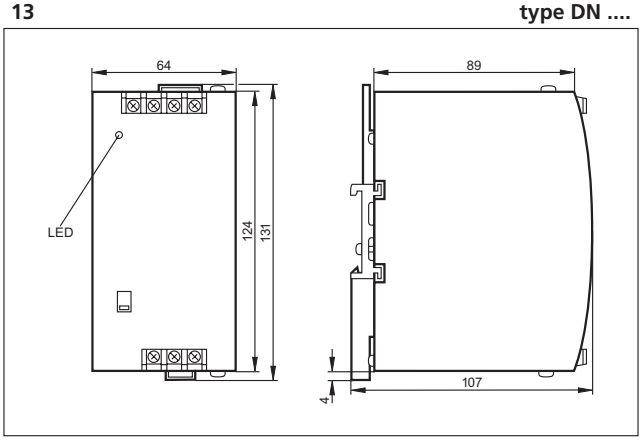
13 **type DN ....**



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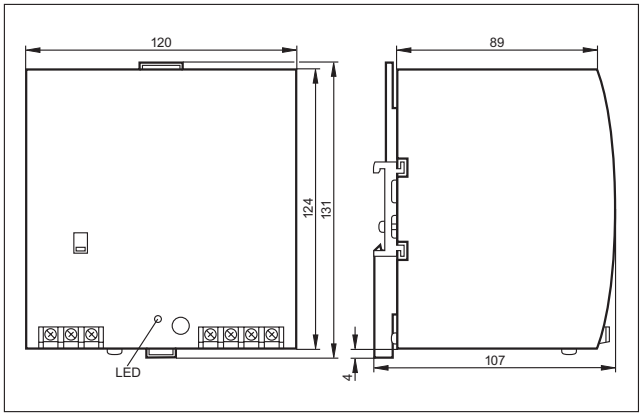
Power supplies

14 **type DN ....**



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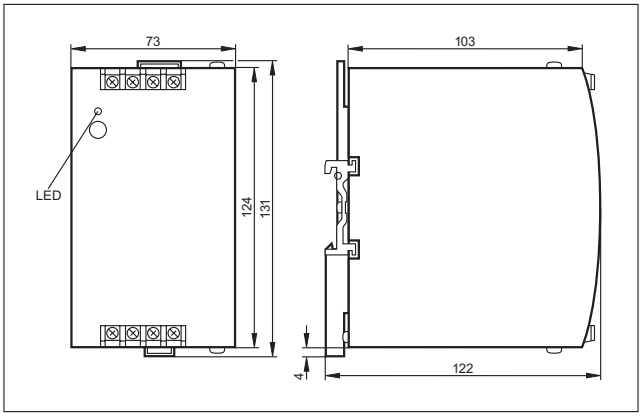
16 **type DN ....**



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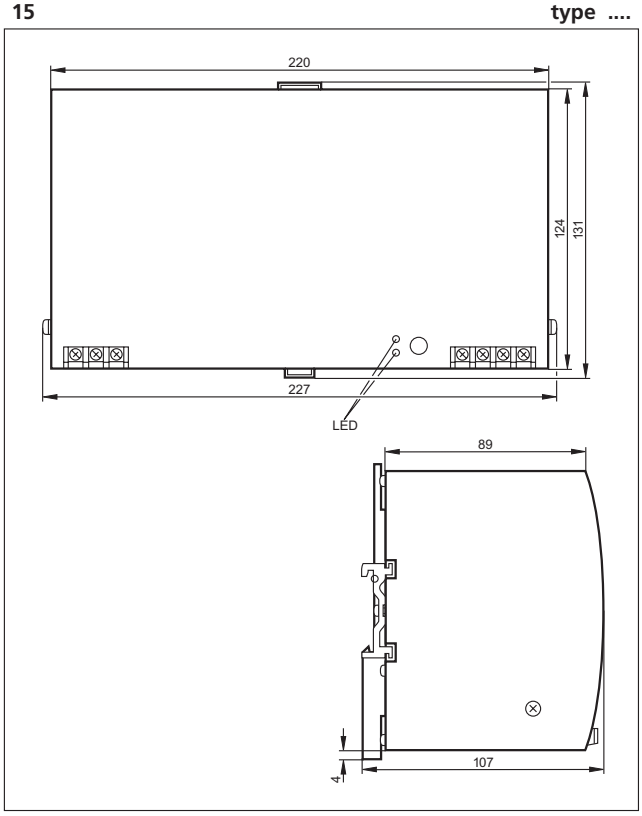
15 **type ....**



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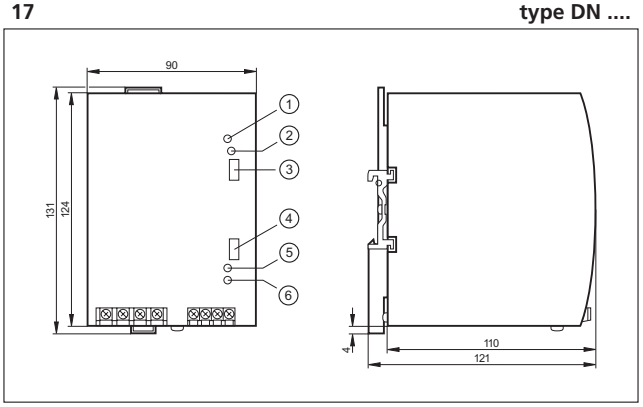
17 **type DN ....**



1: LED red, 2: reset push button, 3: jumper "overload performance", 4: jumper "single/parallel operation", 5: with pot., 6: LED green,
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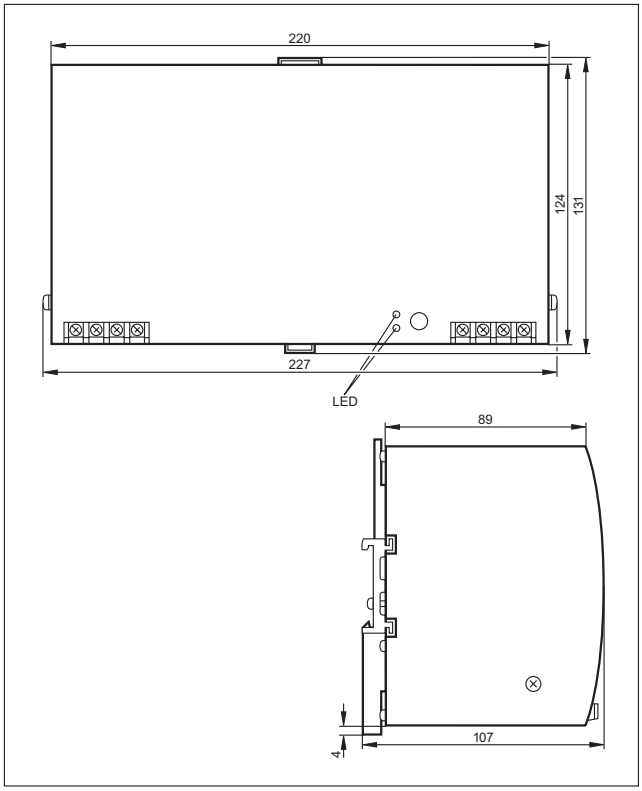
Power supplies

18 **type ....**



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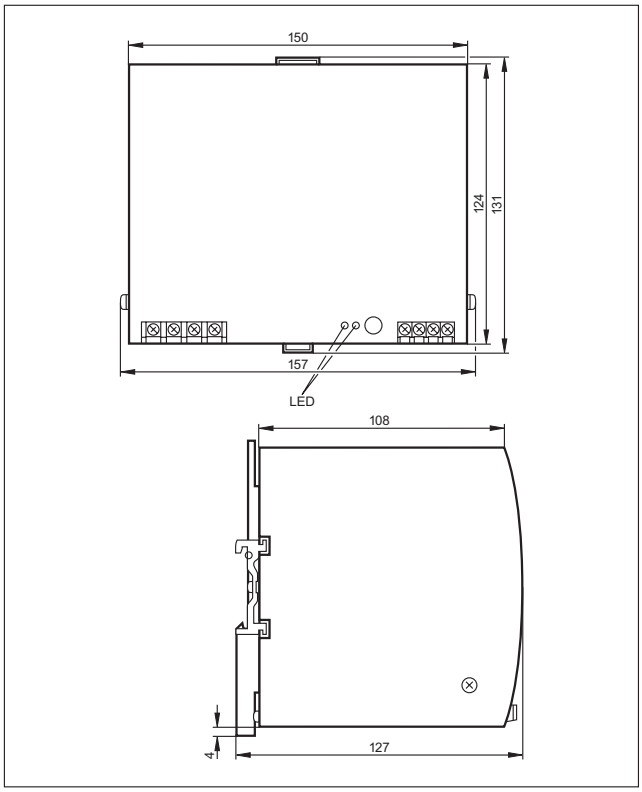
19 **type ....**



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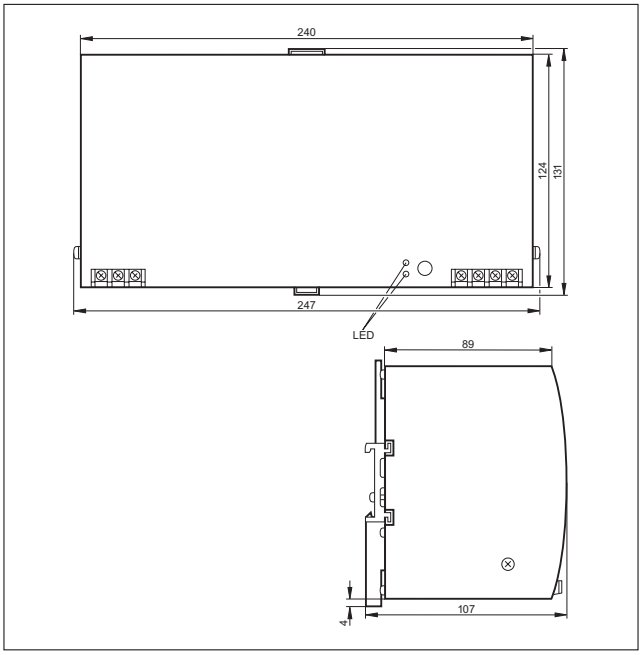
20 **type ....**



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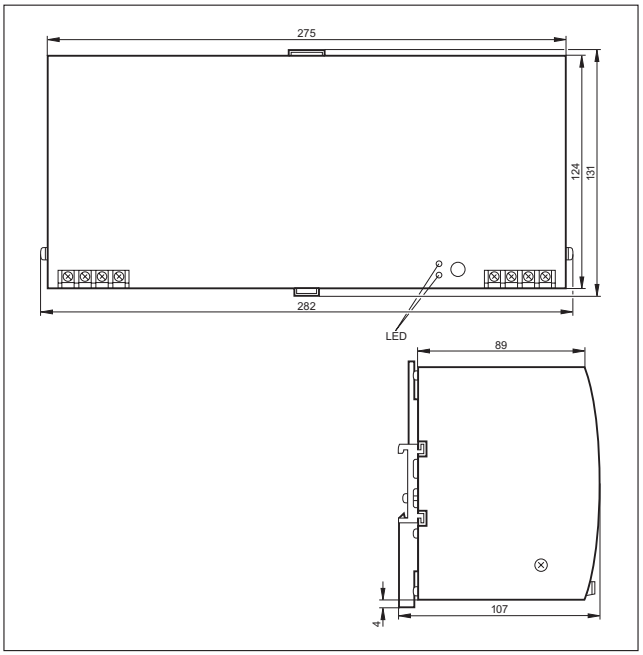
21 **type ....**



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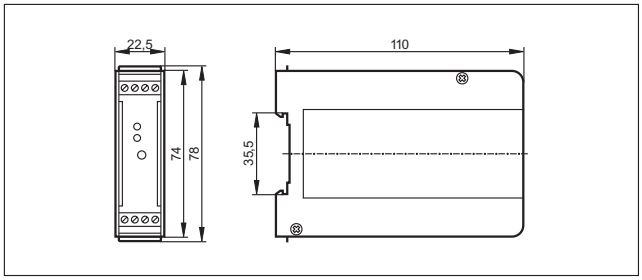
Earth fault monitors

1 **type AC ....**



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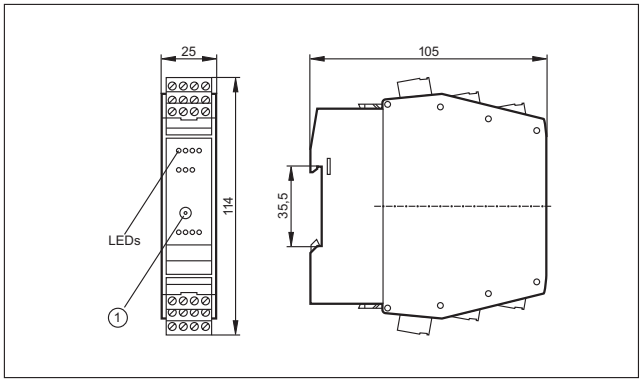
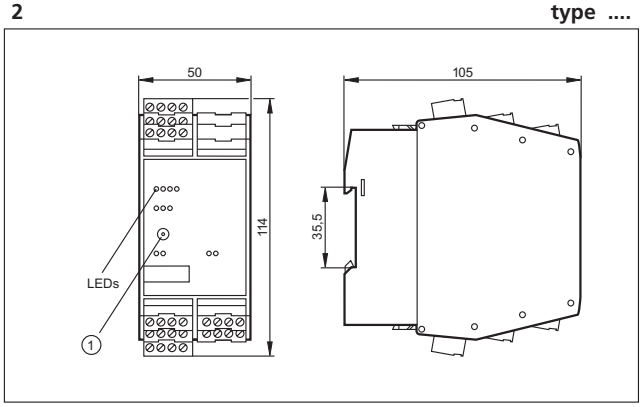
SmartLine

1 **type ....**



1: addressing socket, Page 79, 81

2 **type ....**



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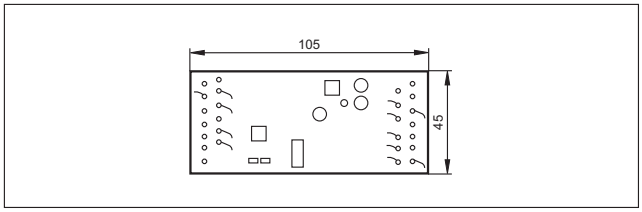
PCB module solutions

1 **Typ AC ....**



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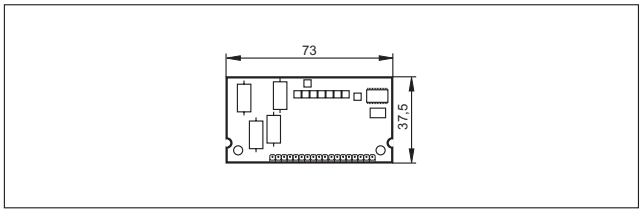
2 **Typ AC ....**



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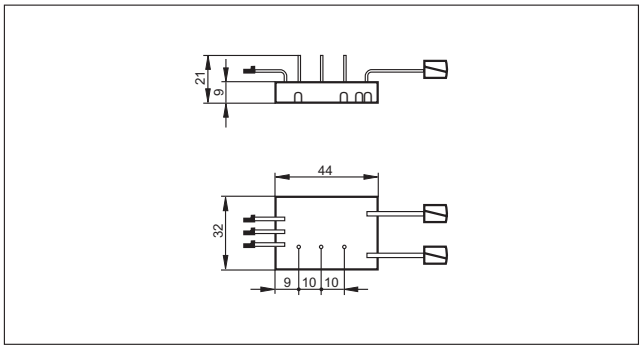
3 **Typ AC ....**



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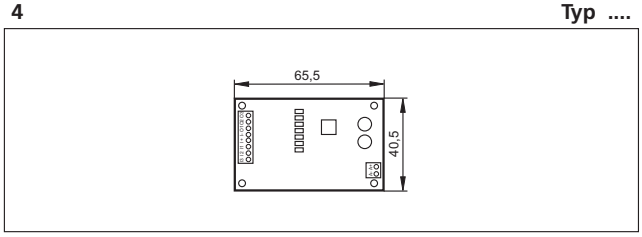
4 **Typ ....**



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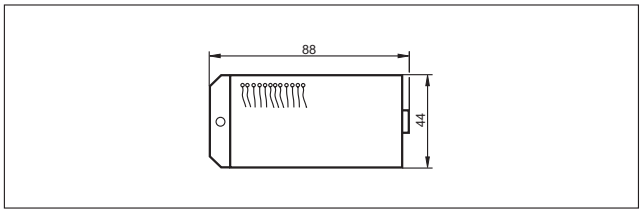
5 **Typ AC ....**



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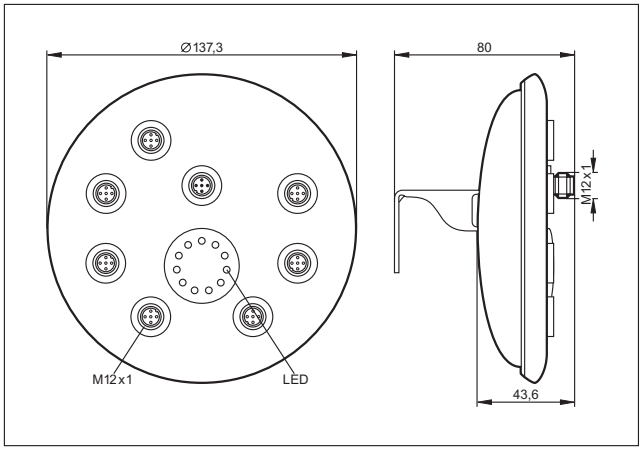
ProcessLine

1 **type AC ....**



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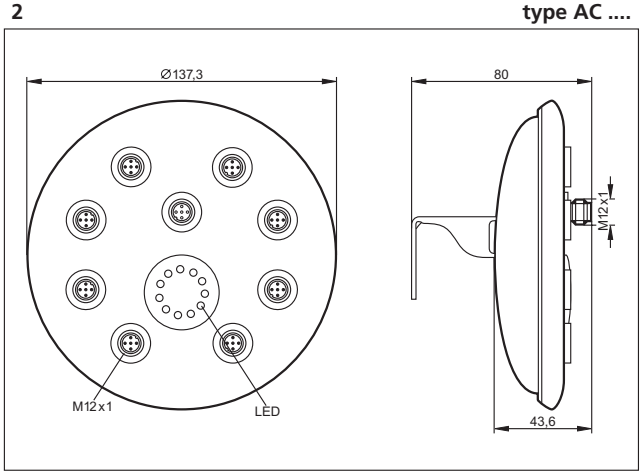
2 **type AC ....**



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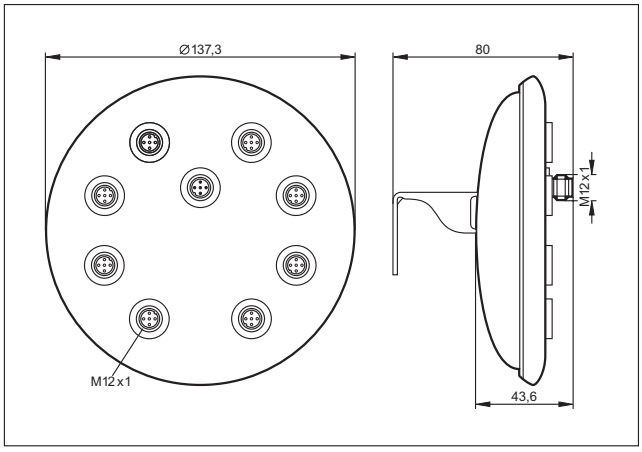
3 **type AC ....**



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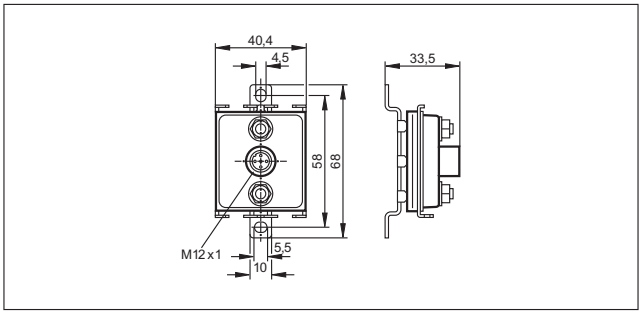
4 **type E7 ....**



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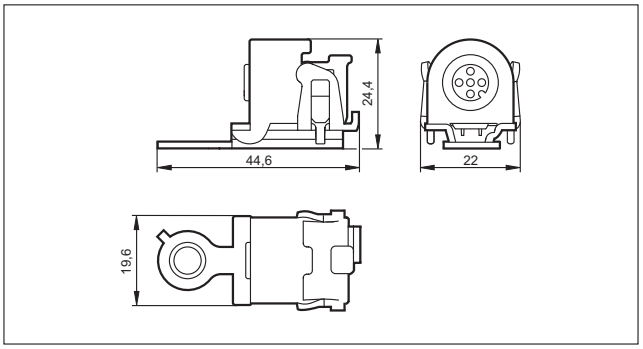
5 **type E7 ....**



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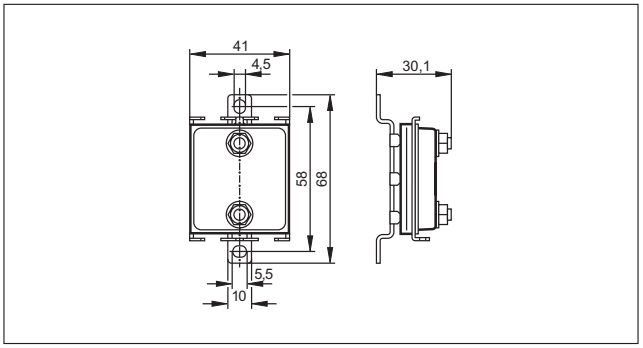
6 **type E7 ....**



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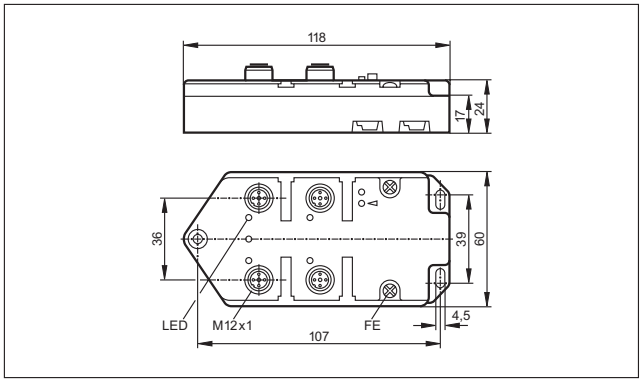
CompactLine

1 **type AC ....**



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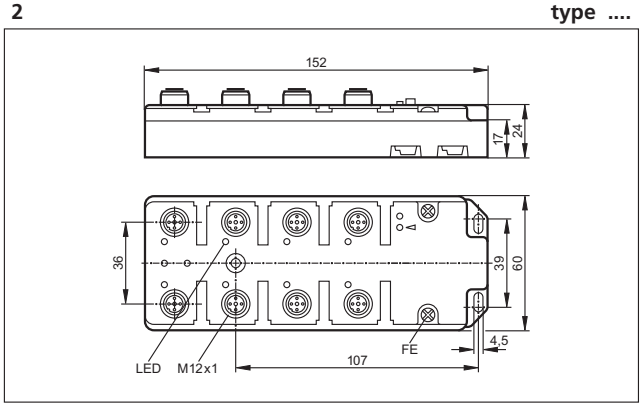
2 **type ....**



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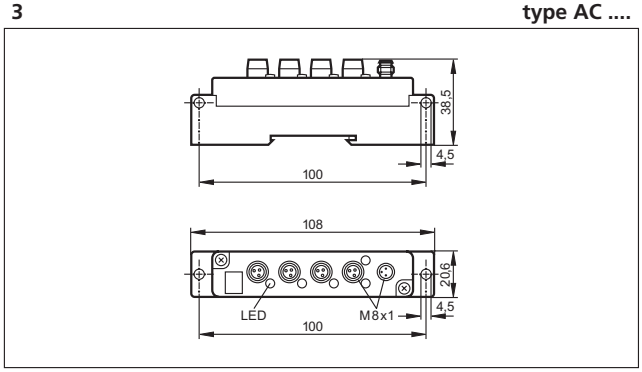
3 **type AC ....**



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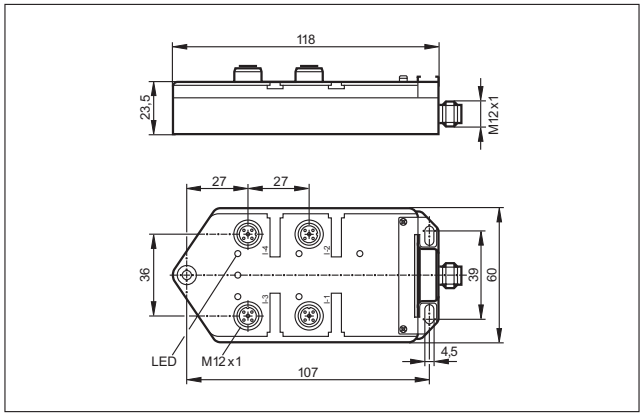
4 **type AC ....**



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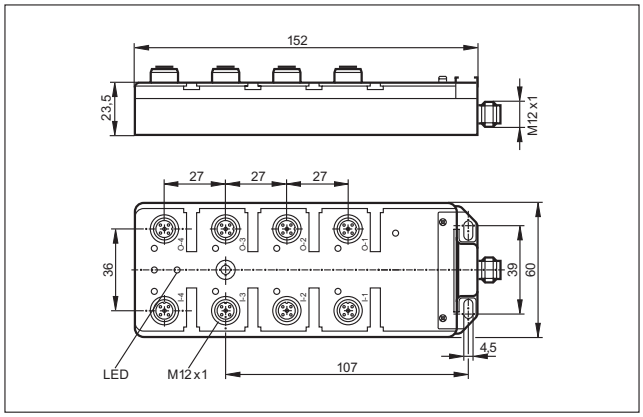
5 **type AC ....**



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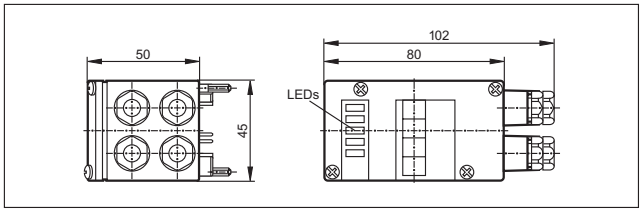
Universal modules, ClassicLine

1 **type ....**



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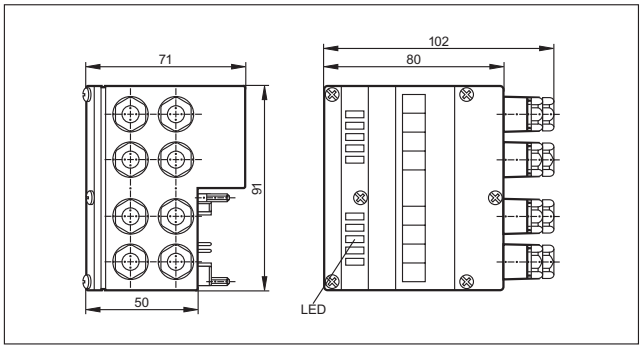
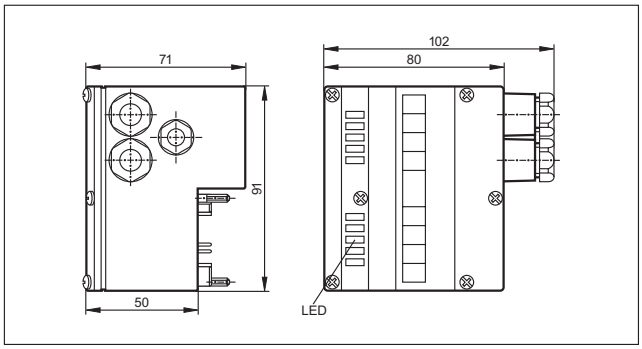
2 **type ....**



Page 109, 111

3 **type ....**



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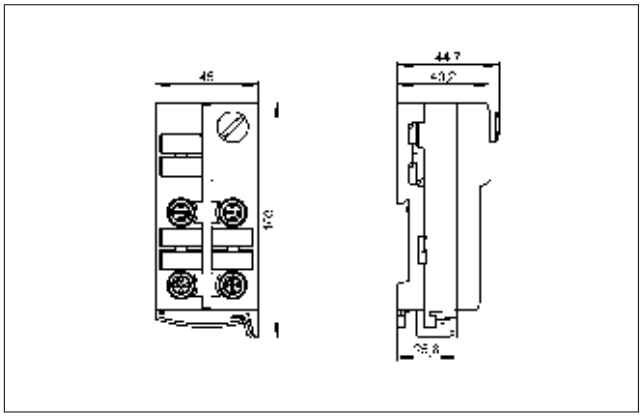
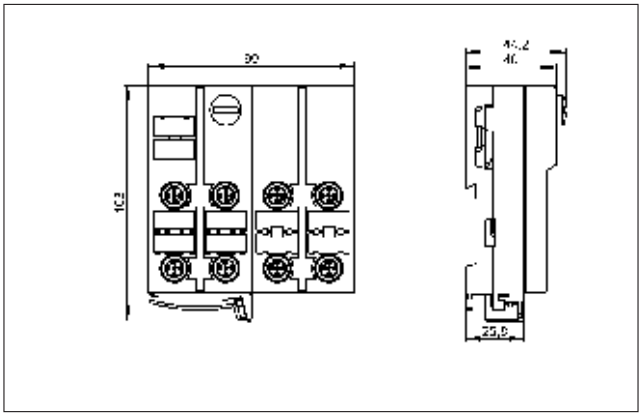
4 **type AC ....**



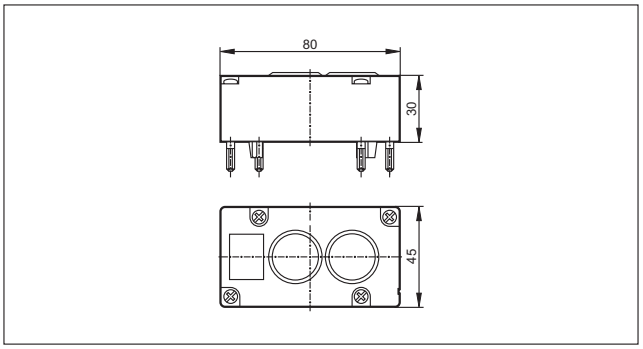
Page 113, 115, 121

5 **type AC ....**



Page 113, 115

6 **type ....**



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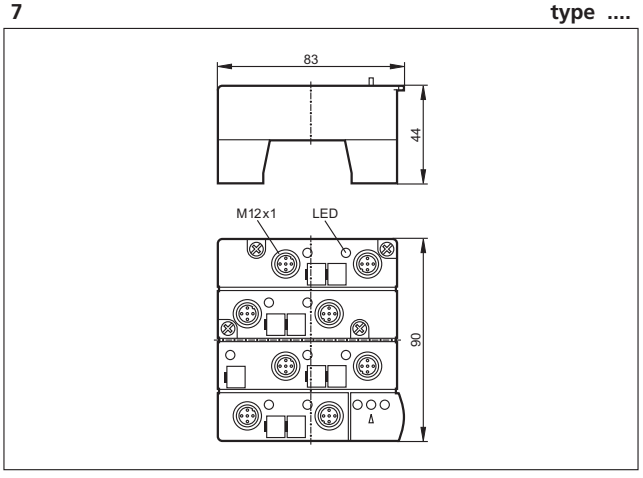
7 **type ....**



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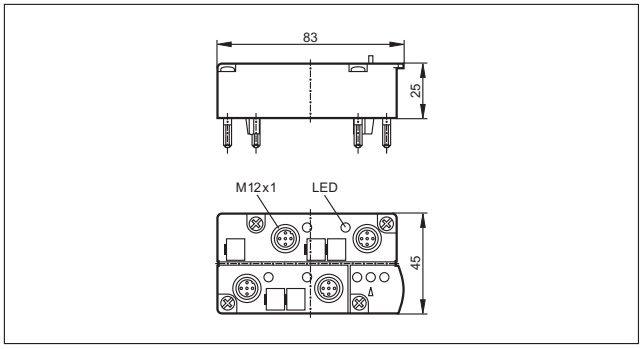
Universal modules, ClassicLine

8 **type ....**



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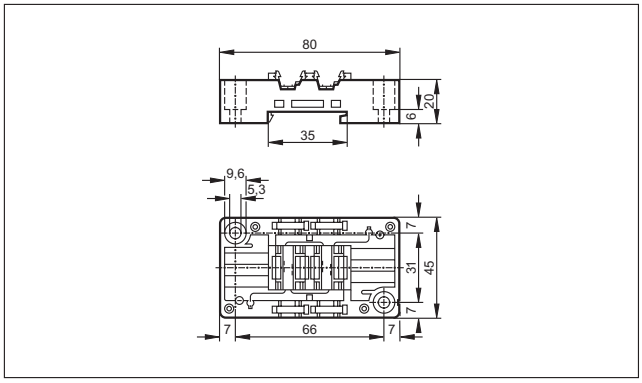
Module lower parts

1 **type ....**



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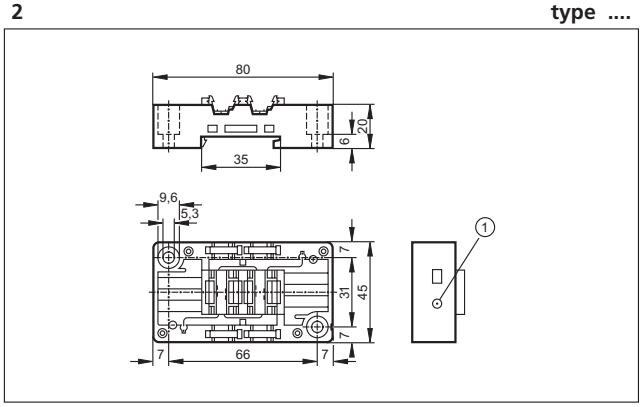
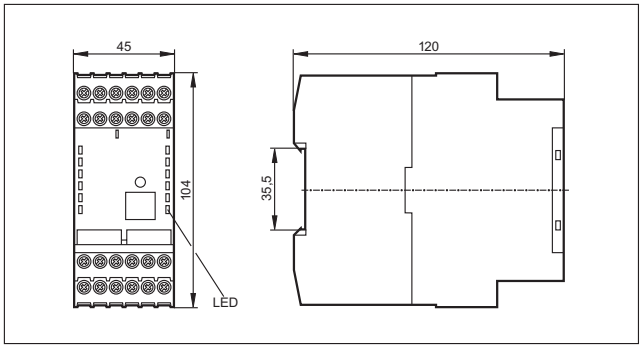
2 **type ....**



1: addressing socket, Page 125

Safety monitors

1 **type AC ....**



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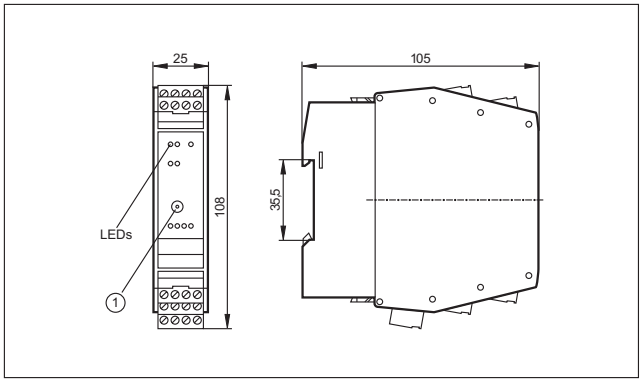
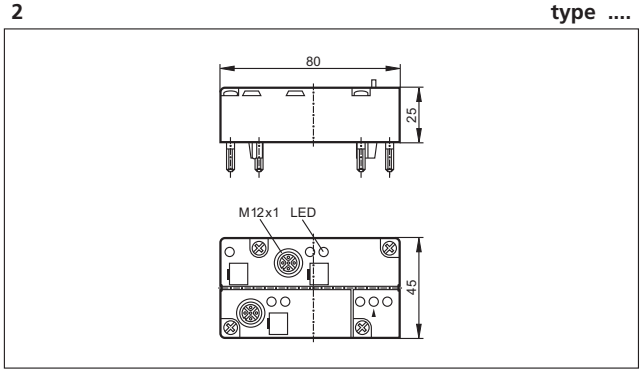
Safety slaves

1 **type ....**



1: addressing socket, Page 137

2 **type ....**



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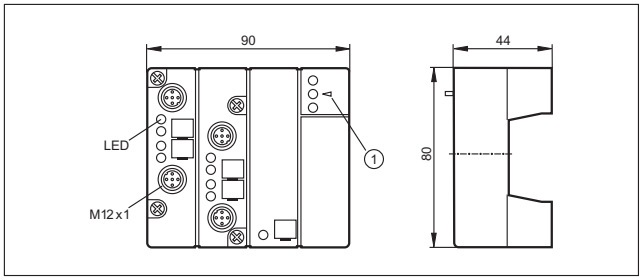
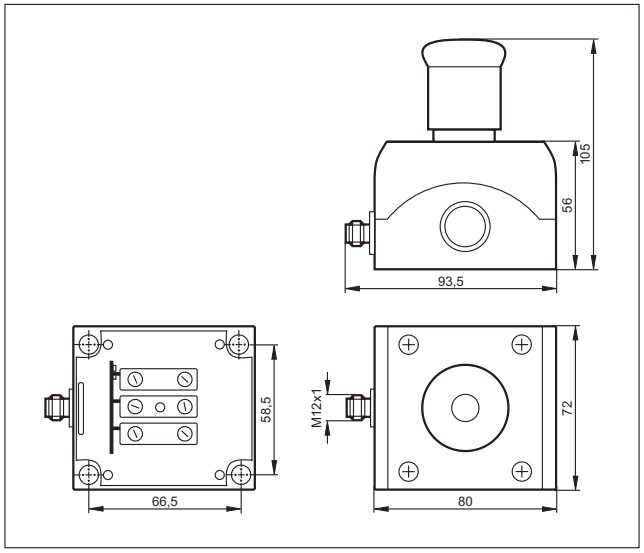
3 **type AC ....**



1: fixture infrared adapter, Page 139

4 **type AC ....**



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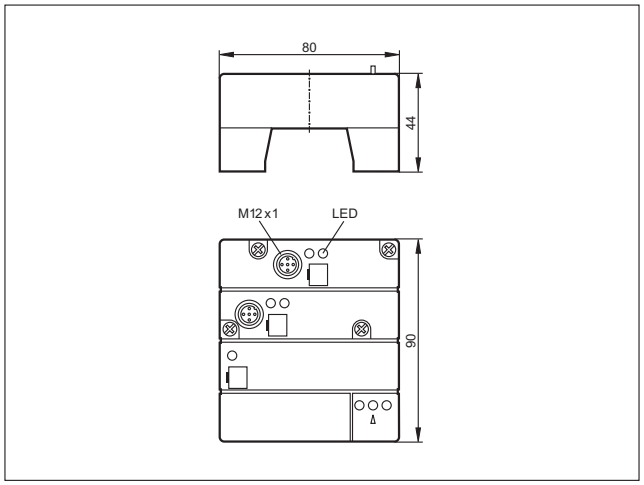
5 **type ....**



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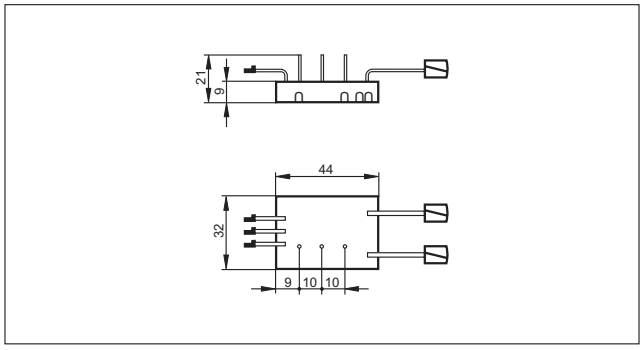
6 **type AC ....**



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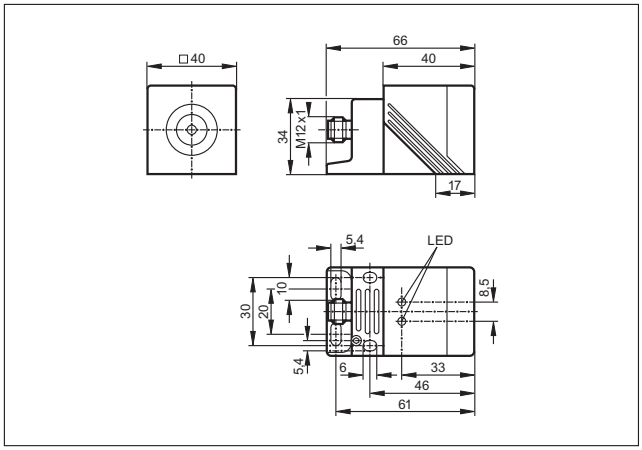
Electronic fail-safe sensors

1 **type GM, IM ....**



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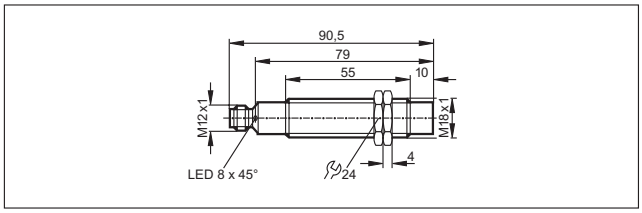
2 **type GG ....**



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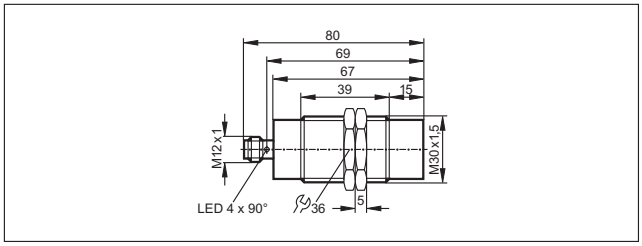
3 **type GI ....**



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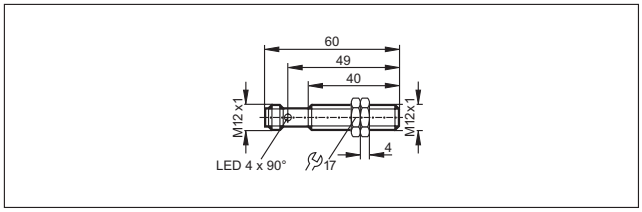
AS-i Sensors

1 **type IF, MF ....**



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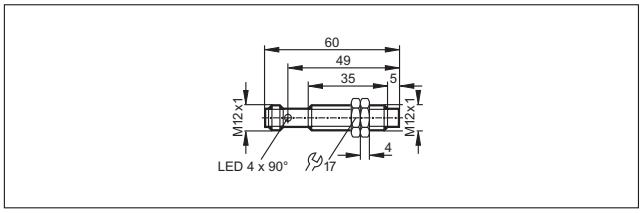
2 **type IF ....**



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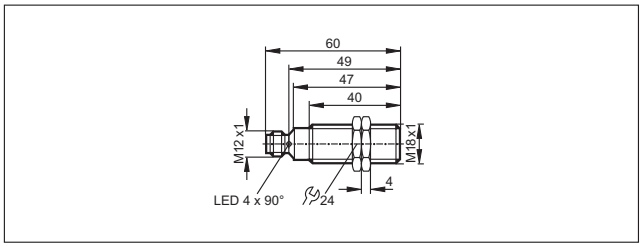
3 **type IG ....**



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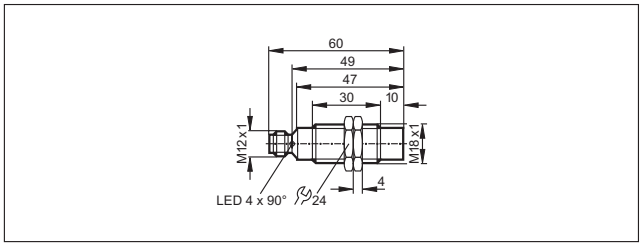
4 **type IG ....**



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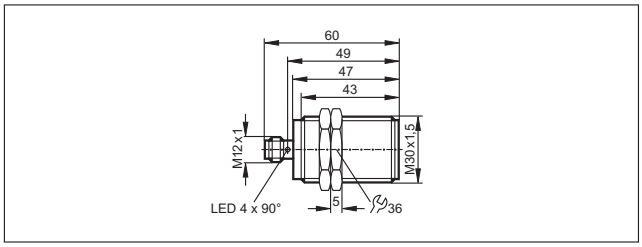
5 **type II ....**



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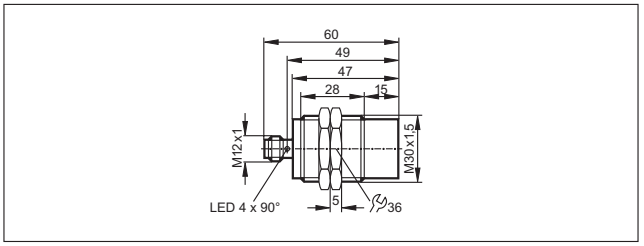
6 **type II ....**



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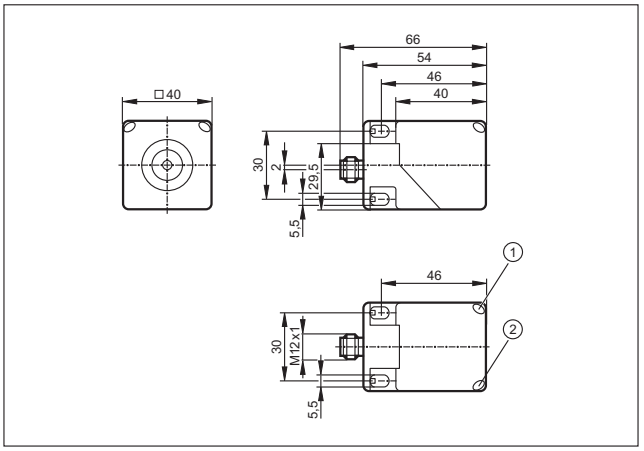
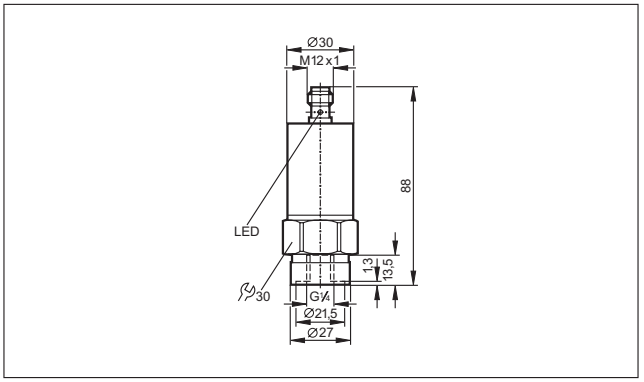
7 **type IM ....**



1: LED yellow, 2: LED green, Page 163

8 **type PP ....**



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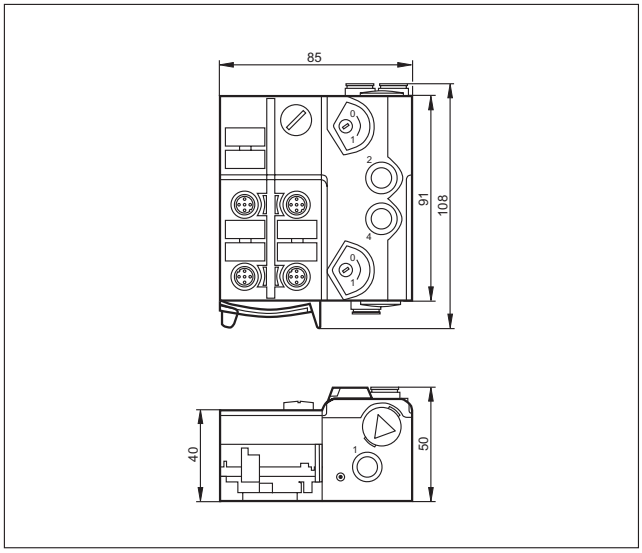
AirBoxes

1 **type AC ....**



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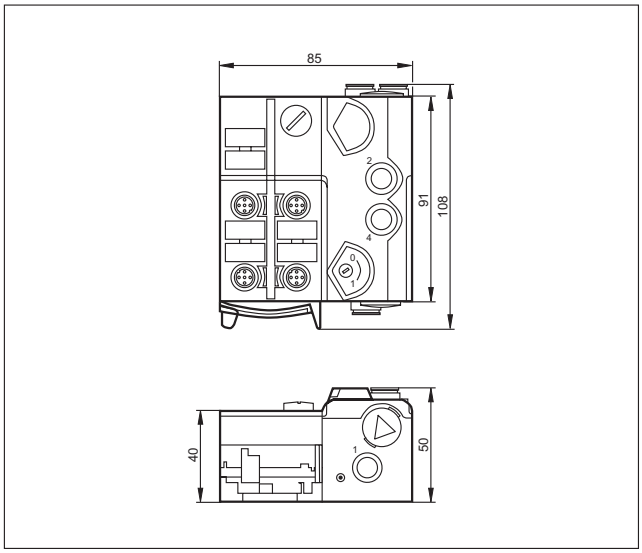
2 **type AC ....**



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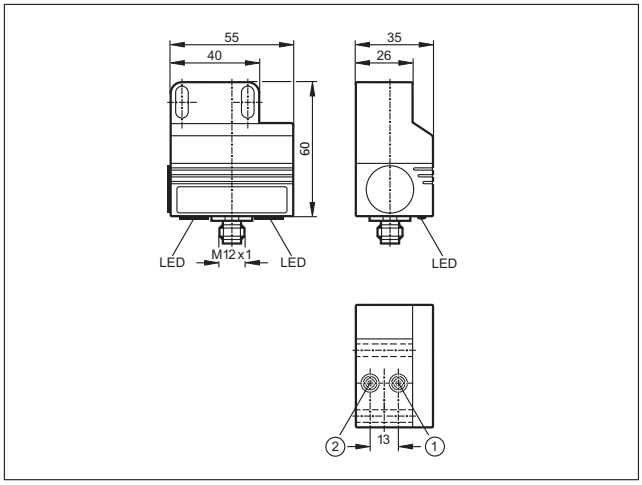
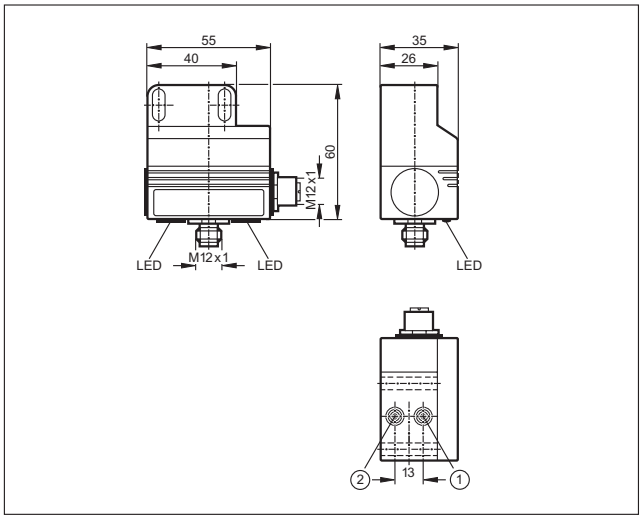
Valve contol

1 **type AC ....**



1: sensor 1, 2: sensor 2, Page 171

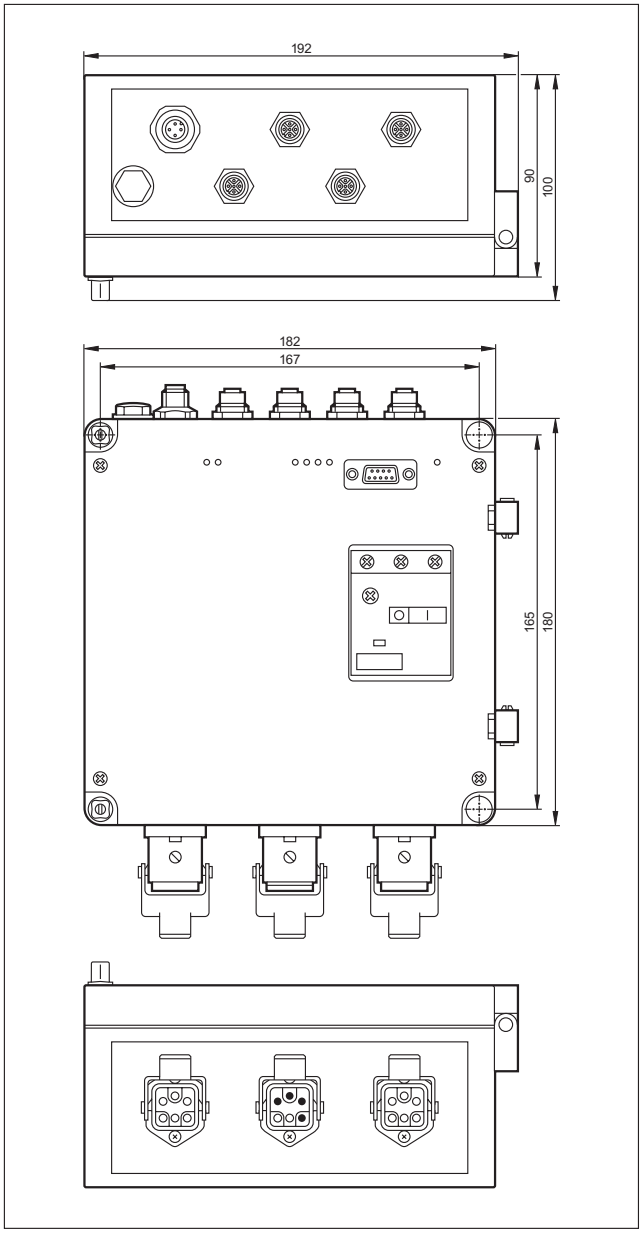
2 **type AC ....**



1: sensor 1, 2: sensor 2, Page 171

Motor starter

1 **type ....**



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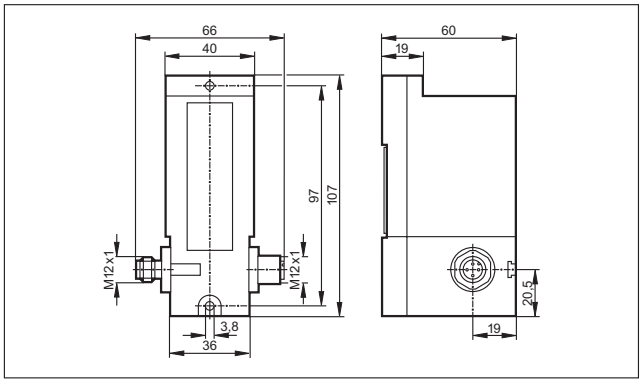
2 **type AC ....**



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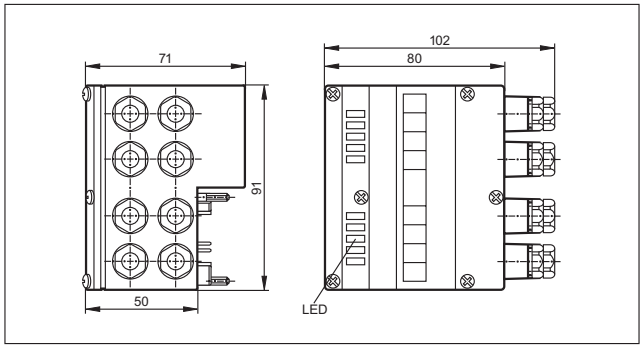
3 **type AC ....**



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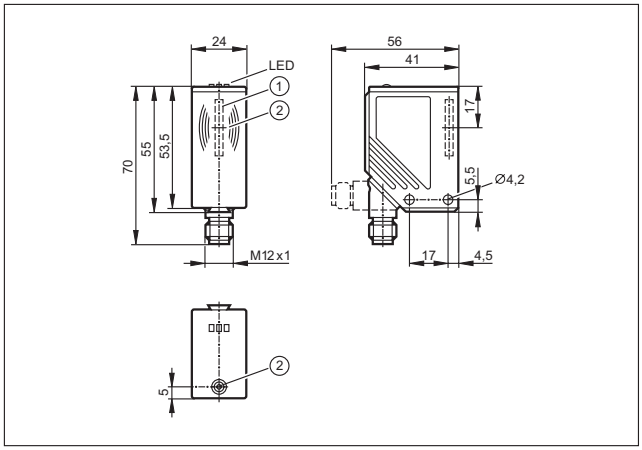
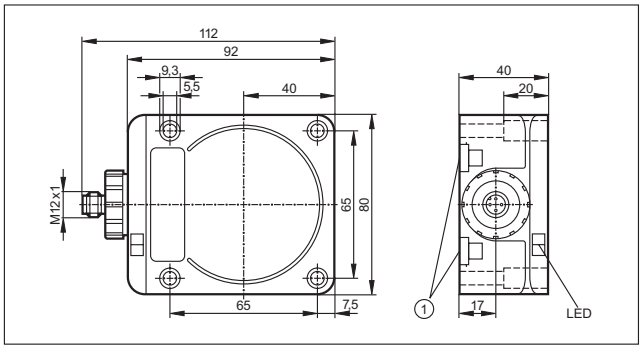
RF identification

1 **Typ DT ....**



1: integr. antenna , 2: tag pos. mark, Page 177

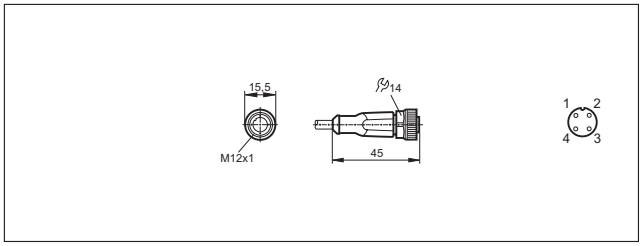
2 **Typ DT, ID ....**



1: mounting on DIN rail, Page 177

ifm product range

1 **Typ EV ....**



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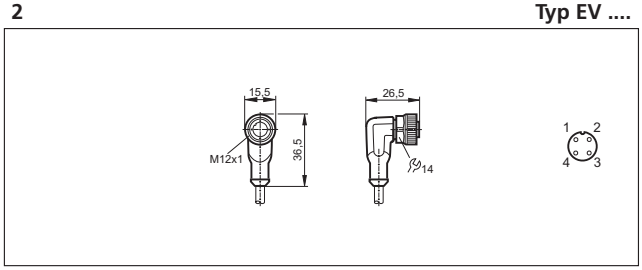
2 **Typ EV ....**



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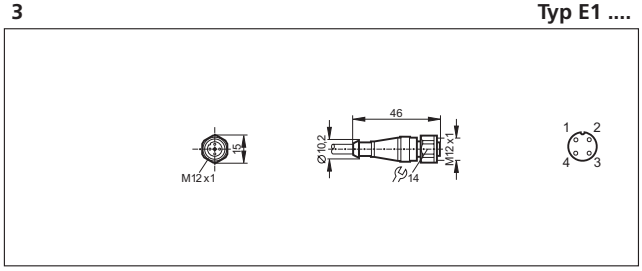
3 **Typ E1 ....**



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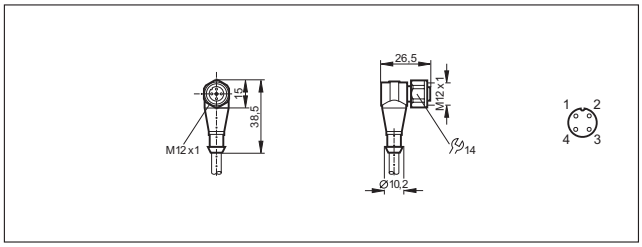
4 **Typ E1 ....**



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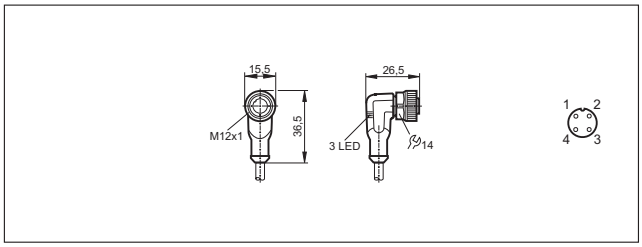
5 **Typ EV ....**



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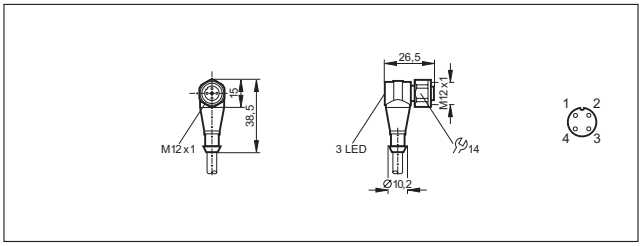
6 **Typ E1 ....**



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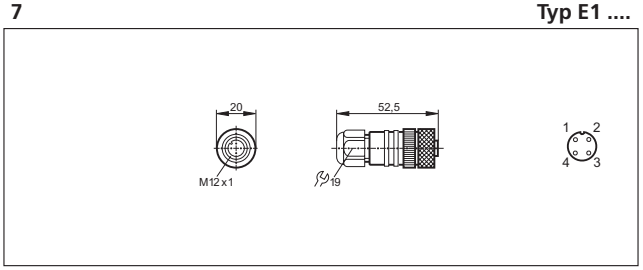
7 **Typ E1 ....**



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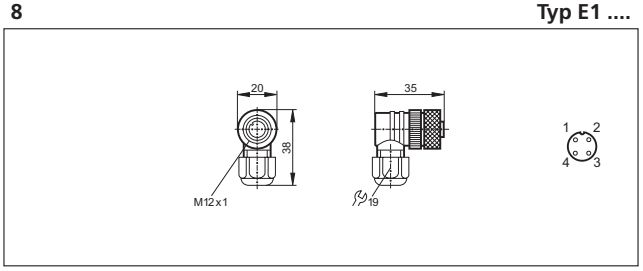
8 **Typ E1 ....**



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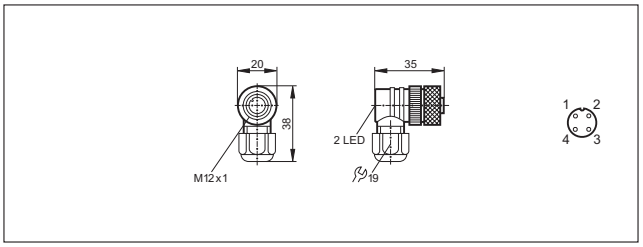
9 **Typ E1 ....**



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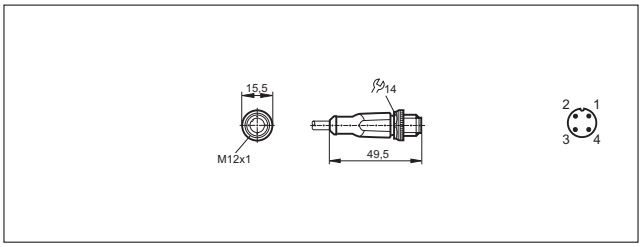
10 **Typ ....**



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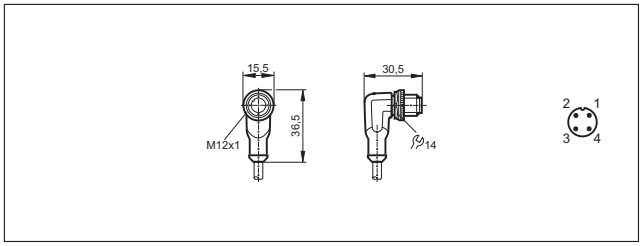
11 **Typ ....**



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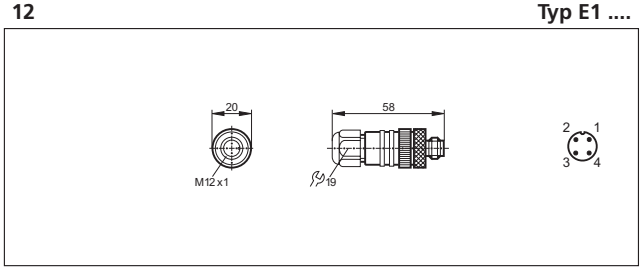
12 **Typ E1 ....**



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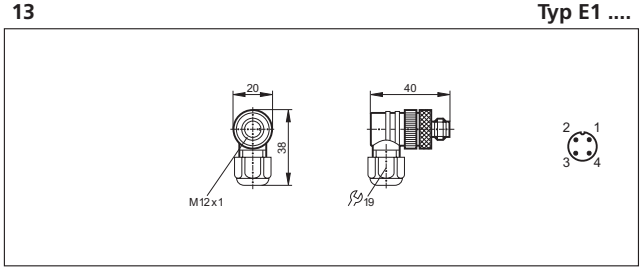
13 **Typ E1 ....**



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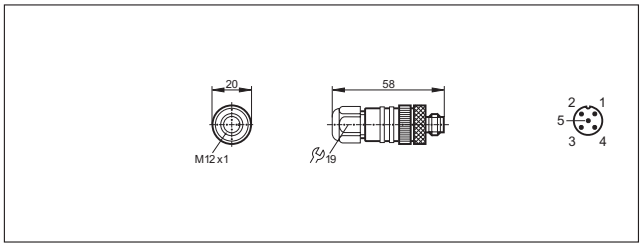
14 **Typ E1 ....**



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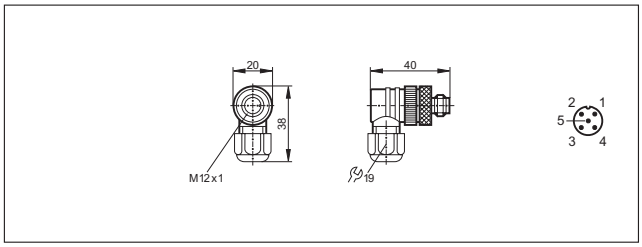
15 **Typ E1 ....**



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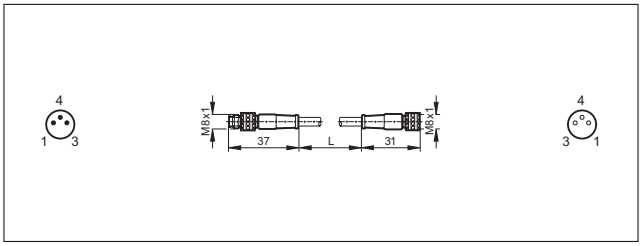
16 **Typ E1 ....**



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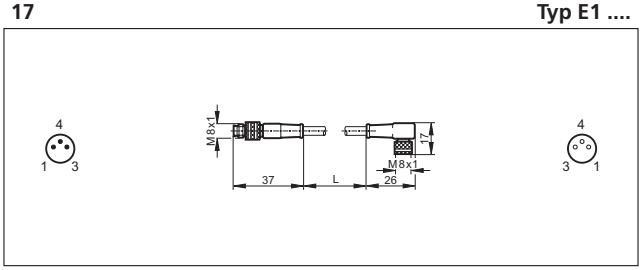
17 **Typ E1 ....**



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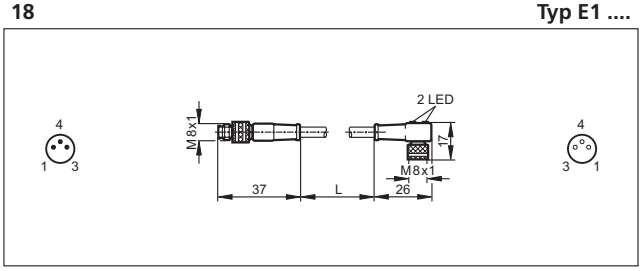
18 **Typ E1 ....**



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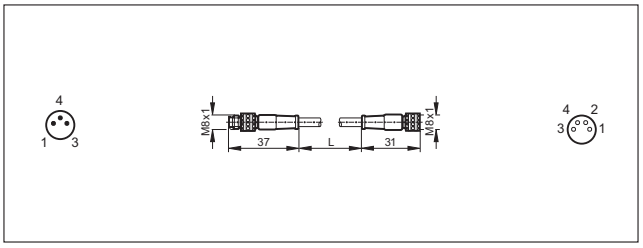
19 **Typ E1 ....**



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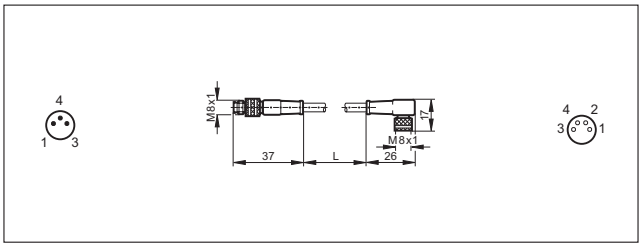

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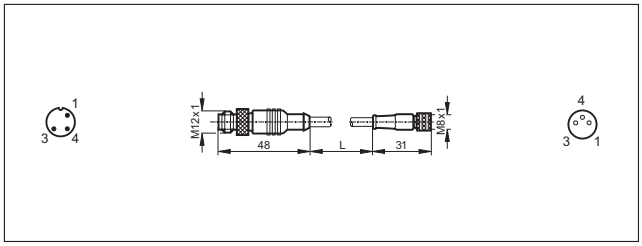

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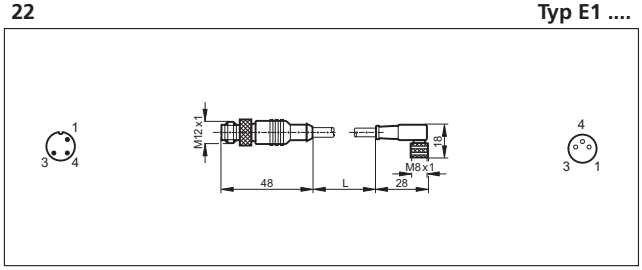

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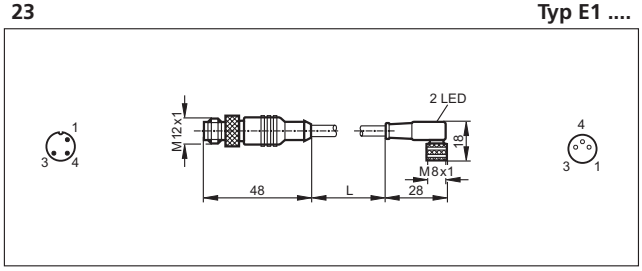

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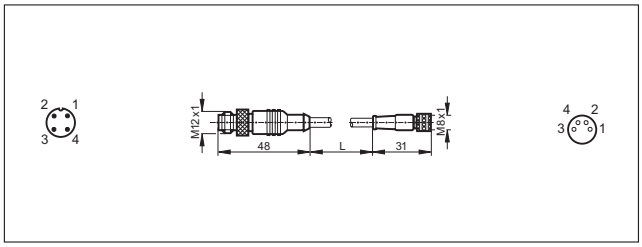

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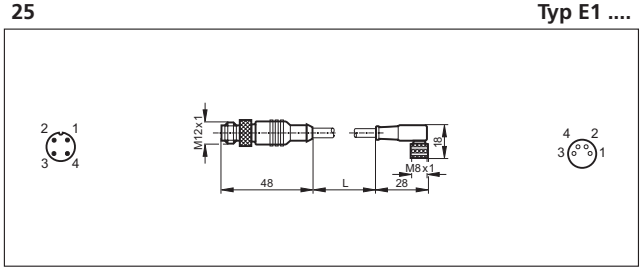

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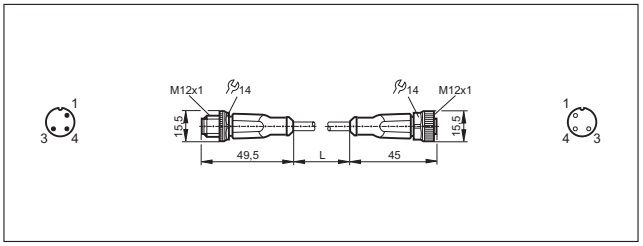

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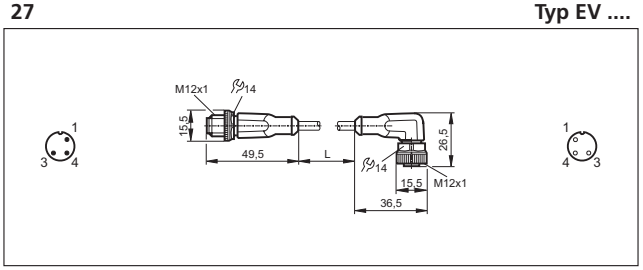

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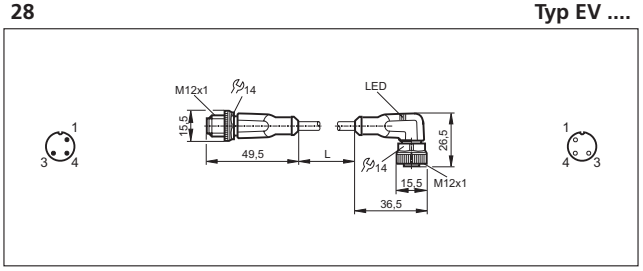

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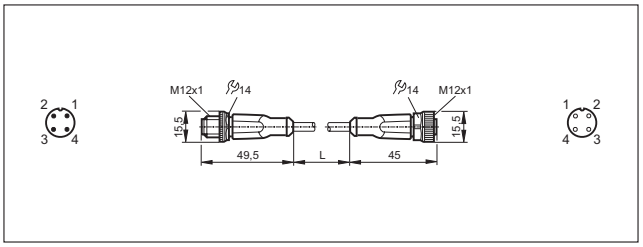

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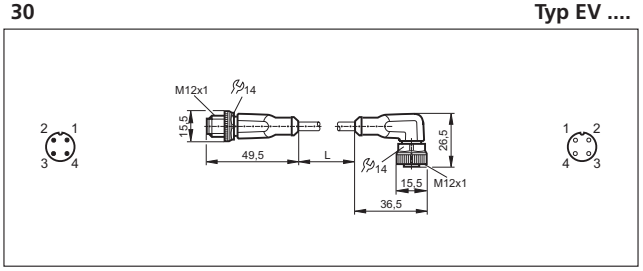

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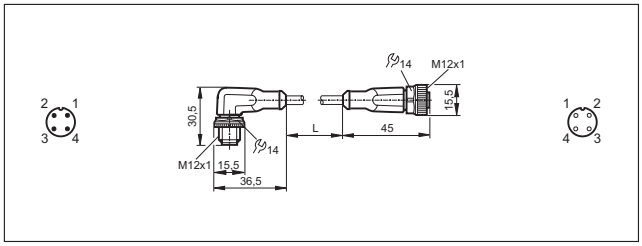

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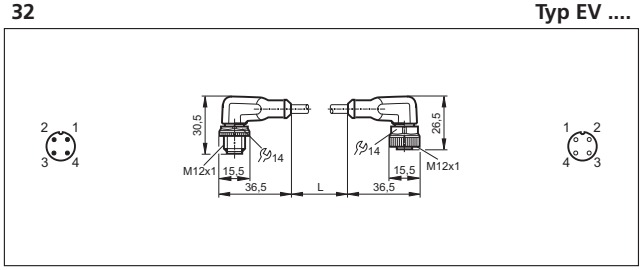

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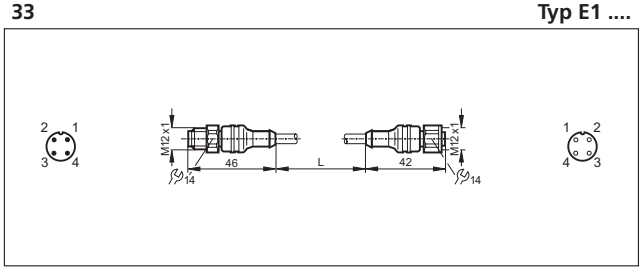

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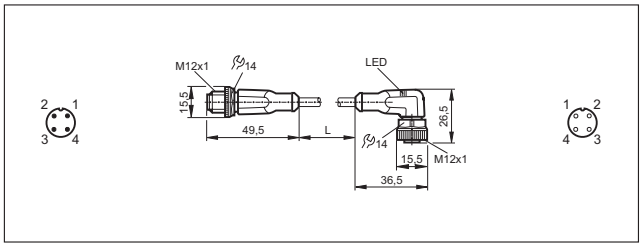

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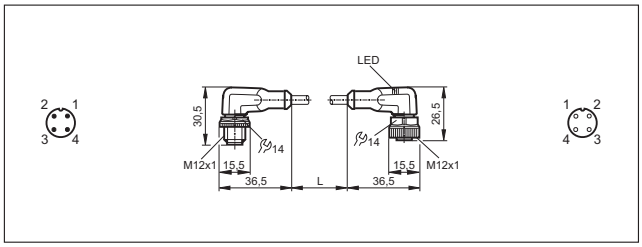

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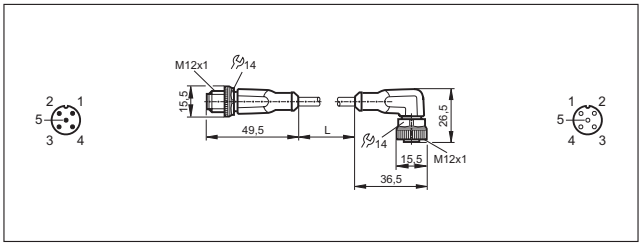

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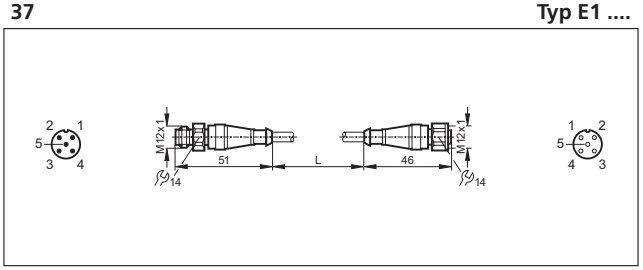

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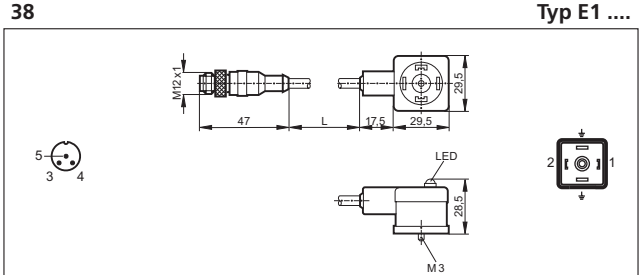

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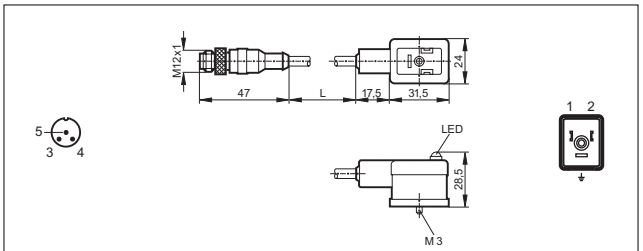

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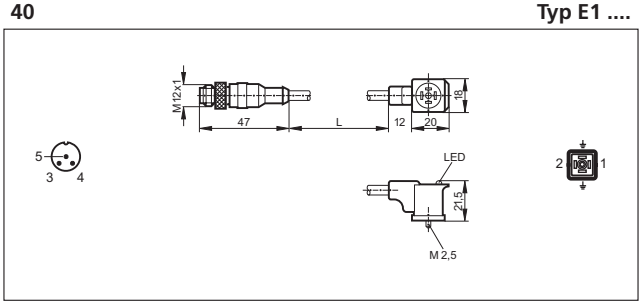

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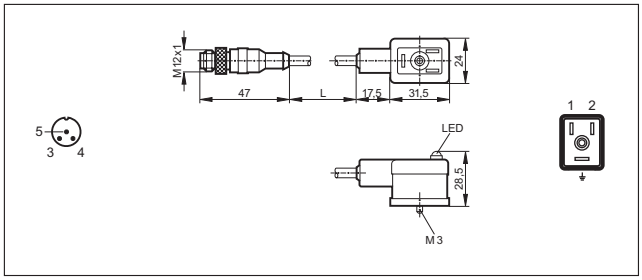
41 **Typ E1 ....**



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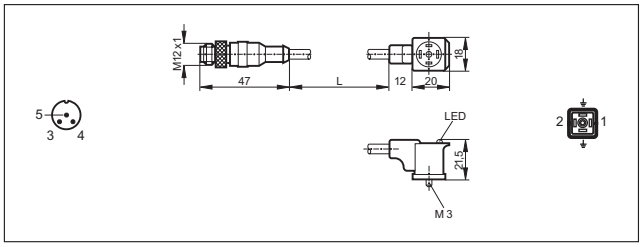

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Acyclic data transmission	Parameters are transmitted to one slave at a time by the master once per cycle. This is done at power on or when the values are changed. This is called acyclic data transmission.
Addressing	Each AS-i slave is assigned an individual address for identification by the master. It lies in the range from 1 to 31. The address "0" has a special function for automatic addressing (-> automatic addressing).
AI	Analogue In, analogue input at an AS-i slave.
AirBox	Integration of pneumatic valves, AS-i connection and electrical feedback inputs in a classic AS-i module. This leads to substantial savings for mounting as the valves no longer have to be mounted separately and connected with tubes. Voltage supply can come from the yellow AS-i cable or the additional black cable (24 V DC). AirBoxes with 3/2-way and 5/2-way, as well as 5/3-way valves in monostable and bistable version are available.
Analogue	In contrast to binary signals these are continuous values such as temperature or pressure. A specific analogue value can be assigned a specific electrical current or voltage value.
Analogue value transmission	Due to the development of a secured analogue value transmission profile AS-i can also transmit non time critical analogue values. The method is compatible with existing masters and slaves.
AO	Analogue Out, analogue output at an AS-i slave.
AS-i	Actuator-Sensor-interface, bus system for the first binary field level.
AS-i 2.1+3.1	Extension of the functionality of the AS-interface with full downward compatibility. Up to 62 slaves can be connected to one line. Diagnosis is facilitated by an additional peripheral fault bit per slave. When new analogue slaves are used with masters according to version 2.1, 16-bit data per channel are automatically exchanged without additional software driver.
AS-i current supply	Serial data and the current for the slaves are simultaneously transferred on the AS-i cable. Therefore special AS-i power supplies with data decoupling are required.
ASIC	Application Specific Integrated Circuit, in this case containing the complete AS-i slave function.

Automatic addressing

A slave can be replaced while the system is in operation. The master immediately detects the missing slave. The new slave with the address "0" is automatically assigned the address of its "predecessor". This function can be deactivated by the user. So no addressing unit is needed to replace a slave.

Automatic configuration (projection)

By means of automatic configuration the user can set up an AS-i network without PC and software. As the AS-i data quantity per slave is fixed the addressed slaves can be read by the master and stored as preset configuration (see "LPS").

Automation Alliance

Association of automation companies to define a joint hardware-independent software standard in accordance with IEC 61131-3.

A/B slave

An A/B slave has an addressing range of 1A to 31A or 1B to 31B. The cycle time is limited to 10 ms. A/B slaves cannot use the 4th output data bit as it is used by the master to change over to B slaves.

A/B slaves can be operated at AS-i 2.0 masters if the following is taken into account:

1. Only A addresses are used

2. The 4th data bit must be permanently "0"

3. The 4th parameter bit must be "1"

Bidirectional

AS-i slave operating mode in which the four data bits are transmitted in both directions with different information. This requires a more complex circuit in the slave.

A typical application is in the 4I/4O module.

Binary

Two possible switching states: On/Off, "1" or "0".

Bit

Digital information carrier, state "0" / "1" corresponds to the switching signal On / Off.

Bus

Serial data transmission of several participants on the same line.

Cable sheath materials

Depending on environment and operating conditions the materials show different resistances. Therefore certain properties or the suitability for a certain application cannot be guaranteed. Concerning the specific resistances we refer you to the explanations under "PUR cable", "PVC cable" and "PPU cable". The notes given there are general and individual application tests may be required.

CAN	CAN (Controller Area Network) is a fieldbus system for important data quantities. It is controlled by priorities. There are different CAN variants such as CANopen, CAN in Automation (CiA) or DeviceNet. CAN can be used over long distances, e.g. as fieldbus for AS-i. Different networks are coupled using -> gateways.
ClassicLine	Field modules based on the EMS standard. The electronics fit onto the FC or SC lower parts. ClassicLine is the implementation of the -> EMS concept with the latest electronics in accordance with -> AS-i 2.1.
CoDeSys	Universal programming and configuration software of the -> Automation Alliance with IEC 61131 programming languages, visualisation, fieldbus and AS-i configurator.
Compact modules	The "compact" types have the electronics and contact pins for connection to the flat cable in one housing. Their advantages are a considerably reduced housing height and, thanks to full potting, suitability for robust applications.
Compatibility	Despite the AS-i 2.1 extensions AS-i has maintained its full downward and upward compatibility. The data messages have not been changed. Binary 2.1 slaves can be operated at 2.0 masters, however only in the standard addressing range 1 to 31. Conversely, all existing 2.0 slaves can be operated at 2.1 masters without any restriction.
Config Error (configuration error)	An AS-i configuration error is given if -> LPS and -> LAS do not match, i.e. slaves are missing or additional slaves are connected. This function only operates in the protected mode of the master. Mismatch of the AS-i profile and the -> ID code "1" also results in a Config Error.
Control cabinet modules	SmartLine modules are available in 25 or 50 mm wide. They are mounted via DIN rails, the electrical connection is established via screw terminals, cage clamps, Combicon or insulation displacement terminals.
Controller e	Extension of the controller gateway family by AS-i 2.1. Additional features: bigger plc memory, -> CoDeSys support, fieldbus and -> Ethernet interface.
Conventional binary sensor	Sensor with switching output for connection to common plc input modules or AS-i user modules.
Current consumption	Current consumption Current for the internal consumption of the unit. The value specified in the data sheet applies to the switched unit without load.
Cycle time	Time the master takes to scan all slaves once.

Cycle time / optimisation

Due to the -> master-slave principle the AS-i cycle time is constant and can be further optimised within limits. The following rules apply:

1. 31 slaves result in a maximum cycle time of 5 ms, for 62 slaves it is 10 ms.
2. Single slaves (binary) always take 5 ms.
3. A without B or B without A slaves always take 5 ms.
4. Analogue slaves take approx. 40 ms per channel. Two one-channel slaves are double as fast as one two-channel slave.

Cyclical data transmission (cyclical polling)

Data of all -> slaves are cyclically transferred (polling). After max. 5 ms they are updated in the master. If A/B slaves are used, the cycle time can be 10 ms.

Data port

4-bit information which is cyclically updated.

Data protection

AS-i is a very safe and maintenance-friendly system. It is more or less insensitive to external interference.

Several independent hardware-oriented mechanisms monitor the safety of the data transmission:

1. Parity bit check
2. Manchester coding
3. Repetition of corrupted messages
4. Monitoring of pulse/break ratio
5. Monitoring of response time
6. Check for correct configuration of participants
7. Coded signal transfer with receiver decoding

Thorough examinations in the laboratory and under practical conditions resulted in the following values for AS-i:

1. Residual error probability $<>10^{-12}$
2. The maximum severity level 3 is achieved

Conclusion: AS-i is very safe even in an industrial environment subject to severe levels of interference!

DeviceNet

Fieldbus system for important data quantities, based on -> CAN technology. It requires special cables and a complex connection technology. DeviceNet can be used over longer distances as fieldbus for AS-i. Suitable -> gateways are available.

DI

Digital In, binary input at an AS-i slave.

Diagnosis	AS-i supplies a wide range of diagnostic information. Intelligent sensors indicate their operating states if for example the sensing range is no longer correct. Modules signal short circuit and overload. Analogue sensors automatically detect measured values outside the nominal range. Missing or faulty slaves as well as wire breaks and short circuits are detected. All diagnostic information is provided in the master / gateway and can be transferred via the fieldbus or Ethernet.
Digital	Digital units can have two states, switched or not switched as opposed to analogue units which provide continuous values.
DO	Digital Out, binary output at an AS-i slave.
Double addressing	A double addressing, i.e. two or more slaves with the same address should be avoided because it makes diagnosis more difficult during setup. If the function -> automatic addressing is used, double addressing is excluded.
E-EMS	Extended electromechancial structure. Advanced definition of -> EMS with two additional contact pins in the module lower and upper part for the connection of the external voltage supply (24 V DC) for the outputs. Module upper parts developed for EMS can also be used for E-EMS module lower parts.
Earth fault	An earth fault can occur if the AS-i voltage or sensor cables connected to it are electrically connected to earth. This is an undesired state which can reduce noise immunity as AS-i is a symmetric, earth-free system in accordance with -> PELV. A second earth fault can lead to earth loops which continuously supply the outputs with current.
Earth fault monitor	A unit which gives a warning if earth faults of an unearthed voltage supply occur.
EMS – electromechanical structure	Structure between module lower parts and module upper parts defined by the AS-i Association. Advantages: It is standardised, reverse-polarity protected and allows quick mounting.
EN standardisation	The AS-interface is defined in the European standard EN 50295 (-> IEC standardisation).
Ethernet	High-speed data bus initially developed for computing communication which is suitable for the transmission of important data quantities. Available media are glass fibres, twisted or coaxial cables. However it is not suitable for real time transmission of signals. Ethernet is increasingly accepted for use in industrial applications between process and higher level (-> fieldbus hierarchies). Moreover Ethernet is the basis for the -> internet and the -> webserver.
Fieldbus	Fieldbuses in automation technology are used to collect data and to serially transfer them to a central controller or a higher-level control system.

Fieldbus hierarchies

When looking at the position of AS-i in the fieldbus pyramid, it can be seen that AS-i is an optimum choice for simple digital and analogue sensors and actuators. AS-i is positioned at the first level and serves as feeder for the classic fieldbuses, e.g. Profibus or DeviceNet.

Gateway (coupler)

Connection between AS-i and higher-level fieldbus systems such as Profibus-DP, DeviceNet, Interbus-S or other interfaces (e.g. RS-485).

The unit includes an AS-i master which is directly coupled to the host interface (e.g. Profibus-DP slave).

Housing materials

Metal housing:

aluminium, stainless steel, galvanised sheet, brass with Optalloy, teflon-coated brass

Rust and acid-resistant steels:

Stainless steel, material no. 303S22 / X8CrNiS 18-9

High-grade stainless steel, material no. 320S31 / X6CrNiMoTi 17-12-2

Plastic housing:

PBTP (polybutyleneterephthalate)

Largely resistant to aliphatic and aromatic hydrocarbons, oils, greases, hydraulic fluids and fuels; no stress cracking when exposed to air.

Not resistant to hot water, hot steam, acetone, halocarbons, concentrated acids and alkalis.

Modified PPO:

Largely resistant to diluted mineral acids, weak alkalis, some alcohols, oils and greases depending on additives; resistant to hydrolysis in hot and cold water.

Not resistant to aromatic hydrocarbons and hydrocarbons containing chlorine, petrol, oils and greases depending on additives.

Chemically resistant fluoroplastics:

PTFE (polytetrafluoroethylene), LCP, PEEK, PEI, PA, mod. PC

Depending on environment and operating conditions plastics show different resistances. Therefore certain properties or the suitability for a certain application cannot be guaranteed.

For frequent or permanent exposure to chemicals testing all housing materials prior to use is recommended.

ID code

The ID code refers to the second position of the -> slave profile. In connection with the -> I/O configuration it describes the properties of slaves. S-1.1 for example stands for an intelligent sensor profile, S-0.0 for a slave with 4 inputs. "A" stands for a slave with -> extended addressing mode.

ID code 1

The ID code 1 is independent of the AS-i profile. Application-specific changes can be made, e.g. using the addressing unit. ID 1 serves to identify further slave properties.

ID code 2	The ID code 2 is the 3rd position of the profile for AS-i 2.1 slaves. For binary slaves it indicates that a transfer of peripheral faults is supported (ID 2 = "E").
IEC standardisation	The IEC (International Electrotechnical Commission) represents an international standard and thus a great challenge worth overcoming. In the meantime AS-interface has been defined in the IEC 62026-2 standard. This gives all OEMs a high investment reliability for future developments.
Infrared interface (IR)	Many slaves are fitted with an IR interface for addressing. This requires an AS-i voltage supply and an IR addressing cable to the addressing unit.
Insulation displacement connector (IDC)	Patented technology to electrically connect the AS-i flat cable to the slaves without terminals or stripping insulation (-> modules).
Intelligent sensor	Sensor with integrated AS-i chip and additional functionality, -> with built-in bus interface. There are for example intelligent inductive, photoelectric and pressure sensors.
Intelligent system solutions	The trend goes to integrated solutions. Therefore the market requires systems with integrated bus connection and intelligence (data preprocessing) in aggregates close to the machines. Examples of this are integrated motor controls, sensors with integrated system diagnosis, SmartLogic or the AirBox family.
Internet	The internet as a worldwide web also provides advantages in automation technology, e.g. for remote service and diagnosis. -> Webservers which are for example integrated into the AS-i master are a better choice to transfer data to the PC at home than modem dialling connections. The machine can send e-mails controlled by events and transfer state variables.
I/O configuration	The I/O configuration (first position of the slave profile) shows the direction of data of the data bits. "0" for example stands for 4 digital inputs and "7" for 4 inputs and 4 outputs.
LAS – List of Activated Slaves	The LAS is automatically updated by the master. It includes all slaves which actively participate in the communication. In the protected mode only slaves are activated which are also entered in the -> LPS. In the projection mode all detected slaves in the -> LDS are activated.
LDS – List of Detected Slaves	The LDS includes all correctly addressed and detected slaves. The list is automatically updated by the master.
LPF – List of Peripheral Faults	This list is only available for AS-i 2.1 masters. It includes the slaves which signalled a peripheral fault.

LPS – List of Projected Slaves

The LPS is stored in the master. It can be generated automatically as an image of the currently connected slaves. To do so, there is in most cases a pushbutton or menu point at the master (-> automatic configuration).

M12 connection

The standard connection for field modules is the M12 socket. Its pin connection is standardised as follows (IEC60947-5-2):

Pin 1: supply (+)

Pin 2: NC input

Pin 3: supply (-)

Pin 4: NO input

For some AS-i modules there is either a bridge between pin 2 and pin 4 to connect NC and NO units or a -> Y-circuit for the connection of a sensor with two outputs.

Master

The master controls the complete organisation in the bus. It decides on the bus access time and polls the -> slaves cyclically.

Master-slave communication

AS-i strictly operates to the master-slave principle. The master polls all slaves one after the other in always the same order. Only one master per network line is allowed (see –> cyclical polling).

Master call

The master call is carried out in the form of a prompting message to the slave. The slave replies with the requested information (see -> message).

Master cycle

A master cycle consists of up to 31 master calls (-> message) and 31 slave replies. If the message is faulty, it is repeated at the end of the cycle.

Master profiles

Master profiles describe the scope of performance of the AS-i master. There are three profiles for AS-i 2.0 masters (M0, M1, M2) and the corresponding profiles for 2.1 masters (M0e, M1e, M2e). M1 masters support the full AS-i functionality in accordance with the specification (incl. analogue data). M0 masters only transfer binary data and M2 masters process data and parameters.

Message

A uniform message structure is used for the different services of the master. The AS-i message has a time-optimised structure. It consists of a 14-bit long master call and the 7-bit long slave reply.

Modules (EMS / E-EMS)

A distinction is made between module upper parts (user modules) and module lower parts (coupling modules). The upper parts can be active or passive. They are the connection between sensor/actuator and coupling module. The coupling modules are available for flat or round cable. They are the electromechanical connection between bus cable and user module. Examples of EMS modules are the ClassicLine and universal modules as well as the AirBoxes.

Noise immunity	To avoid malfunction as a result of too high voltage peaks which can occur in critical applications, we recommend laying the cables of sensors and pulse pick-ups separately from other cables (e.g. motors, solenoid valves). In especially difficult cases it may be necessary to lay screened cables. If in doubt please contact our engineers.
Operating voltage	The given operating voltage defines the permissible operating voltage range inclusive of residual ripple where safe functioning is guaranteed.
Overload protected	The response threshold for the short-circuit protection is above the value specified for the continuous current rating. Units protected against overload are protected against destruction in this range as well.
Parameter (port)	4-bit parameters acyclically transferred as setting value by the -> master
PELV	Protective Extra Low Voltage. One of the protective measures against direct contact according to DIN VDE 0100 T410.
Peripheral fault (PF)	A peripheral fault can be evaluated in every 2.1 slave. Depending on the version overload, function check or overflow is evaluated. Peripheral faults are indicated by a red flashing LED at the master and slave.
Profibus	Fieldbus system for important data quantities. Special cables are required. Compared to AS-i connection technology is more complex. The following versions are available: Profibus FMS, DP or PA. Profibus-DP can be used over longer distances, e.g. as fieldbus for AS-i. Suitable -> gateways are available.
Profile	Definition of certain device parameters to ensure compatibility between different manufacturers (see -> slave profile).
Profile S-7.3.x	This AS-i profile identifies analogue slaves which are just as easily connected as binary slaves. An additional software module is not required.
Protection classes	Protection class 1 (I): units with protective wire connection Protection class 2 (II): units with protective insulation Protection class 3 (III): units for connection to protective low voltage Voltage supply according to EN 50178, PELV, SELV All units marked protection class III or all units without protective wire connection or protective insulation mark must be connected to protective low voltage. For inductive proximity switches this can be SELV or PELV.

Protection rating

The protection rating (according to IEC 529 / DIN 40 050) defines the degree of protection from ingress of dust and moisture.

IP 20

Protection against ingress of solid particles with a diameter greater than 12 mm. No special protection against ingress of water.

IP 40

Protection against ingress of solid particles with a diameter greater than 1 mm. No special protection against ingress of water.

IP 50

Complete protection against contact with live parts or internal moving parts. Protection against harmful dust deposits. The ingress of dust is not completely prevented but dust must not penetrate in such quantity as to impair the operation. No special protection against ingress of water.

IP 61

Complete protection against contact with live parts; protection against ingress of dust.

IP 64

Complete protection against contact with live parts; protection against ingress of dust and splashing water.

IP 65

Complete protection against contact with live parts; protection against ingress of dust and water jets.

IP 66

Complete protection against contact with live parts or internal moving parts. Protection against ingress of dust and powerful water jets. Water must not penetrate the equipment in harmful quantities in case of temporary powerful water jets.

IP 67

Complete protection against contact with live parts, protection against ingress of dust, protection against the effects of immersion under defined conditions:

1 m depth of water for 30 minutes.

IP 68 (ifm specific definition)

Complete protection against contact with live parts, protection against ingress of dust, protection against the effects of immersion under defined conditions:

1 m depth of water for 7 days.

IP 69K

Complete protection against contact with live parts, protection against ingress of dust, protection against ingress of water during high-pressure steam cleaning.

PTB / INERIS	National bodies testing electrical equipment and approving it for hazardous areas. PTB = Physikalisch-Technische Bundesanstalt Braunschweig und Berlin. INERIS = Institut National de L'Environnement Industriel et de Risques (France).
PUR cable	Oil-resistant cable. Not resistant to hydrolysis, therefore not suited for permanent contact with water. In order to avoid breakage the cables must not be moved if the temperature falls below -5 °C.
PUR/PVC cable (PPU cable)	PVC cable with additional PUR sheathing. Oil-resistant cable. It is not resistant to hydrolysis, therefore not suited for permanent contact with water. In order to avoid breakage the cables should not be moved if the temperature falls below -5 °C.
PVC cable	Tried and tested standard cable. In order to avoid breakage the cables must not be moved if the temperature falls below -5 °C. PVC cables are not intended for continuous operation in oily environments. They are neither resistant to ozone nor to ultra-violet light.
Quick mounting	The new ClassicLine modules for field applications are now easier to use with their innovative assembly technology. This technology guarantees fast, toolless and at the same time very secure mounting.
Remote setting (parameter setting)	Via the -> parameter port -> intelligent sensors can be set with the aid of a (plc) program. For some modules individual channels can be switched off via parameters.
Repeater	The repeater is inserted in any bus branch to amplify signals. From the repeater the length of the AS-i line is extended by another 100 m. In principle, any number of repeaters can be used in a network provided that no more than two repeaters are connected in series.
Ring structure	All bus participants are wired one after the other. The beginning and end of the bus cable are connected to each other. A distinction can be made between a logical and physical ring structure. For systems such as the Interbus this is a physical ring. So each participant has two connections: an incoming connection (receiver) and an ongoing connection (transmitter). The bus cable must be stripped and wired to each participant. This is not necessary for a logical ring which can for example be set up with AS-i. Here as usual the yellow flat cable is laid uninterrupted to all participants and at the end led back to the power supply.
Safe inputs	Safe inputs are implemented using special safe slaves in accordance with the Safety at Work standard. They are available integrated into e-stops or as module for the connection of any fail-safe sensors. For the AS-interface safe outputs are at present only implemented in the -> safety monitor.

Safety at Work	Safety at Work is the extension of the AS-interface by safety-related inputs. Thus it is possible to connect safety sensors (e-stops, door switches, etc.) to AS-i up to the highest control category 4 in accordance with EN 954-1.
Safety monitor	The safety monitor is a basic module of -> Safety at work. It replaces the so far usual safety relay. Integration into the existing machine safety concept is made via positively driven relay contacts.
SELV	SELV (Safe Extra Low Voltage) describes an electrical system in which the voltage does not exceed the value of 60 V DC. It includes a protective measure against direct and indirect contact with dangerous voltage, the so-called "safe isolation" from the supply system. In contrast to a PELV system a SELV system must not be grounded.
Short-circuit protection	Most ifm sensors are protected against excessive current by means of a pulsed short-circuit protection.
Single-master system	Only one -> master is available in the AS-i network. This results in defined scanning times. The single-master operation is especially suitable for the field range of automation.
Single slave	A single slave has an addressing range of 1 to 31. The cycle time is limited to 5 ms. -> Analogue slaves are special single slaves with other cycle times. Single slaves can also use the 4th output data bit.
Slave	Passive bus participant, answers only when scanned by the -> master (-> cyclical polling).
Slave profile	For AS-i there are profiles which identify the direction of data and functionality of each slave. The slave profile must be specified in the data sheet. It has the format S-x.y.z. x stands for -> I/O configuration, y for the ID code and z for the extended ID code 2.
Slave reply	Reply of the slave to the master call, contains 4-bit -> user data.
SmartLine	Designation for a family of control cabinet modules in 25 or 50 mm width. Due to the three-line arrangement of terminals these units have the advantage that they require little space in the cabinet. This allows a 4I/4O module to be accommodated on a width of only 25 mm. -> SmartLogic is available as a special version with integrated processor for preprocessing of fast processes.
TCP/IP	The basic protocol for the internet communication. On this basis higher-level industrially compatible extensions, e.g. "Modbus over IP" are available.
Topology	Principle structure of bus systems. The tree structure (AS-i) has the highest flexibility. Further topologies are ring, star and line.

TPR cable	Cable for operating temperatures from -40 °C to 150 °C. Good resistance to oils, fuels, acids and alkalis.
Tree structure	The tree structure of AS-i ensures flexible adaptation to the plant. It is possible to connect extensions and spurs subsequently at any point.
Universal modules	These modules match the classic module lower parts and allow connection of sensors or actuators via cable glands and cage clamps. Thus the cable can be cut to the desired length.
User data	Part of the message consisting of the information to be transferred (4 bits for AS-i).
Utilization categories	The utilization categories serve to classify outputs for direct (DC) and alternating (AC) voltages: DC 12: Control of ohmic load and semiconductor load in input circuits of optocouplers DC 13: Control of electromagnets for direct voltage AC 1: Control of non-inductive or light-inductive load AC 15: Control of electromagnetic load for alternating voltage
Webserver	A webserver provides information which can be called via -> Ethernet and the -> TCP/IP protocol. It can also support e-mail protocols (POP3) or file transfer (FTP). Initially developed for computing communication, automation products (e.g. controller e) are now available with integrated webserver.
With a built-in bus interface	Units (e.g. sensors) which can be directly connected to a bus. The bus connection (here as an AS-i slave) must be integrated into the sensor.
Y-circuit	Two M12 sockets are assigned to each other. Either a 2- or 3-wire sensor is connected to each socket or a 4-wire sensor to the first socket. In the latter case the second socket must not be used.

Position sensors and object recognition

Inductive sensors

Electromagnetic field immune and temperature shock resistant sensors · High-grade stainless steel housings · Protection up to IP 69 K · Versions with increased sensing range · Analogue output · Use e.g. in hazardous areas, in the food industry and in mobile machines · Sensors with correction factor 0 or 1

Capacitive sensors

High operational reliability by increased noise immunity · Adjustable sensing ranges · Variable connection options by cable, connector or terminals · Versions for industrial applications and use in hazardous areas

Magnetic sensors, cylinder sensors

Cylinder sensors: For robust industrial applications · For position detection of pistons in pneumatic cylinders · Versions with ATEX approval · Accessories for all common cylinder types · Magnetic sensors: For position detection · Polarity independent · Ingress resistant to high-pressure cleaning

Safety technology

Sensors in compliance with the machinery directive · All four control categories available · Direct connection to PLCs and logic modules · Sensors operating without coded target · Enable zone monitored for target position and dwell time

Valve sensors

Absolutely safely with no wear at all · Protection rating IP 67 · Resistant to mechanical stress such as shock or vibration · Special versions for AS-interface and hazardous areas · Quick and easy mounting

Photoelectric sensors

Infrared and red light sensors: Through-beam, retro-reflective and retro-reflective sensors with polarisation filter · Diffuse reflection sensors · Fibre optics · Laser sensors · Colour and contrast detection · Glass and film detection· Laser distance sensors with PMD technology: 10 m range · Background suppression

Object recognition

Object recognition for assembly and manufacturing tasks and quality control · Orientation-independent recognition of contour and orientation · Ultra-flat back-lights for 4 times higher luminous power

Encoders

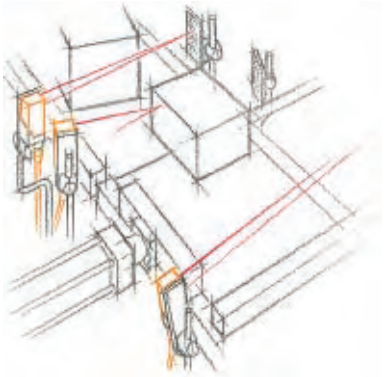
Incremental encoders: Solid shaft encoders · Hollow shaft encoders with integrated stator coupling · Absolute encoders: Singleturn and multiturn · SSI interface · Profibus DP gateway

Evaluation systems, power supplies

Pulse processing and display: Monitors with various pulse evaluation functions · Speed monitors · Programmable counters · Digital displays · Hazardous dust areas · Transformer and switched-mode power supplies: Versions from 1 to 40 A

Connection technology

High-quality connectors · From M8, M12, M18 standard versions to the valve plug · For different applications: Industrial applications, oils and coolants, electromagnetic fields, robotics, hygienic and wet areas as well as explosive atmospheres



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Fluid sensors and diagnostic systems

Level sensors

Capacitive level sensors: For liquids and dry bulk material · Increased noise immunity · Level sensors: Local level indication · Point level sensors: Versions with approvals to the German overspill standard WHG section 19

Flow sensors

Flow sensors with integrated control monitor or external amplifier · Flow sensors for hazardous areas · Flow rate sensor for industrial applications · Airflow sensor · Thermal compressed air meter for leakage monitoring · Consumed quantity meter for special gases

Pressure sensors

High overload resistance · Universal process fitting via adapter · Alphanumeric LED display · Maintenance-free and with longterm stability · Setting of the switch points possible without system pressure · Special versions for process technology and integration into hydraulic / pneumatic networks

Temperature sensors

Control monitors with integrated sensor or for the connection of probe / cable sensors · Pt100 / Pt1000 versions · Universal process connection via adapter · Alphanumeric LED display · Analogue and / or switching outputs

Diagnostic systems

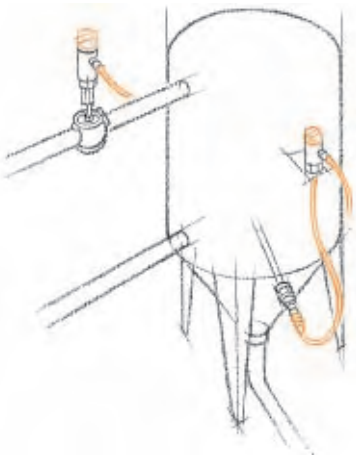
Rolling element bearing diagnosis: Rolling element bearing damage can be detected as it arises · Increased uptime of plants and machines · Real-time maintenance: Sensors with serial or Ethernet interface · Visualisation software · Diagnostic electronics for vibration sensors

Evaluation systems, power supplies

Switching amplifiers: Threshold relay for standard signals with RS-232 interface · Digital displays with LED or LCD display · Transformer / switched-mode power supplies: Transformer power supply with 1 or 2 channels · Integrated sensor supply · Switched-mode power supplies with a stable supply voltage

Connection technology

High-quality connectors · From M8, M12, M18 standard versions to the valve plug · Versions for different applications: Industrial applications, oils and coolants, electro-magnetic fields, hygienic and wet areas as well as explosive atmospheres



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Bus system AS-interface

AS-i controller with integrated PLC · Masters · Gateways to all common bus systems · AS-i repeaters · I/O modules · AS-i Safety at Work · Intelligent sensors with integrated AS-i slave · AS-i actuators · Extensive range of accessories · Software

Power supplies

AS-i switched-mode power supplies · PELV requirements to EN 50178 and EN 60204 · Voltage selector for 230 V or 115 V networks · One-phase or three-phase versions · Regulated DC output voltage between 29.5 V und 31.6 V · Rail mounting

Connection technology

High-quality connectors · From M8, M12, M18 standard versions to the valve plug · For different applications: Industrial applications, oils and coolants, electromagnetic fields, robotics, hygienic and wet areas as well as explosive atmospheres

Bus systems

Identification systems

DataMatrix code-reading systems

Sensors for reading Data Matrix codes · High reading speed and data protection · Small robust design · Direct PLC connection · Quick and easy set-up · Ideal for rough surfaces

RF-identification systems

Industrially compatible identification system for AS-interface · Read / write head or read head requiring little space due to the narrow design · Coding of workpiece carriers in routing conveyors · Quick and easy set-up

Power supplies

AS-i switched-mode power supplies · PELV requirements to EN 50178 and EN 60204 · Voltage selector for 230 V or 115 V networks · One-phase or three-phase versions · Regulated DC output voltage between 29.5 V und 31.6 V · Rail mounting

Connection technology

High-quality connectors · From M8, M12, M18 standard versions to the valve plug · For different applications: Industrial applications, oils and coolants, electromagnetic fields, robotics, hygienic and wet areas as well as explosive atmospheres

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Control systems for mobile vehicles

Controllers and masters with CANopen gateway · Remote maintenance and diagnosis · Displays and operating elements · Decentralised I/O modules to control proportional hydraulic valves · Sensors · Data memory and logger

Connection technology

High-quality connectors · From M8, M12, M18 standard versions to the valve plug · For different applications: Industrial applications, oils and coolants, electromagnetic fields, robotics, hygienic and wet areas as well as explosive atmospheres

Control systems

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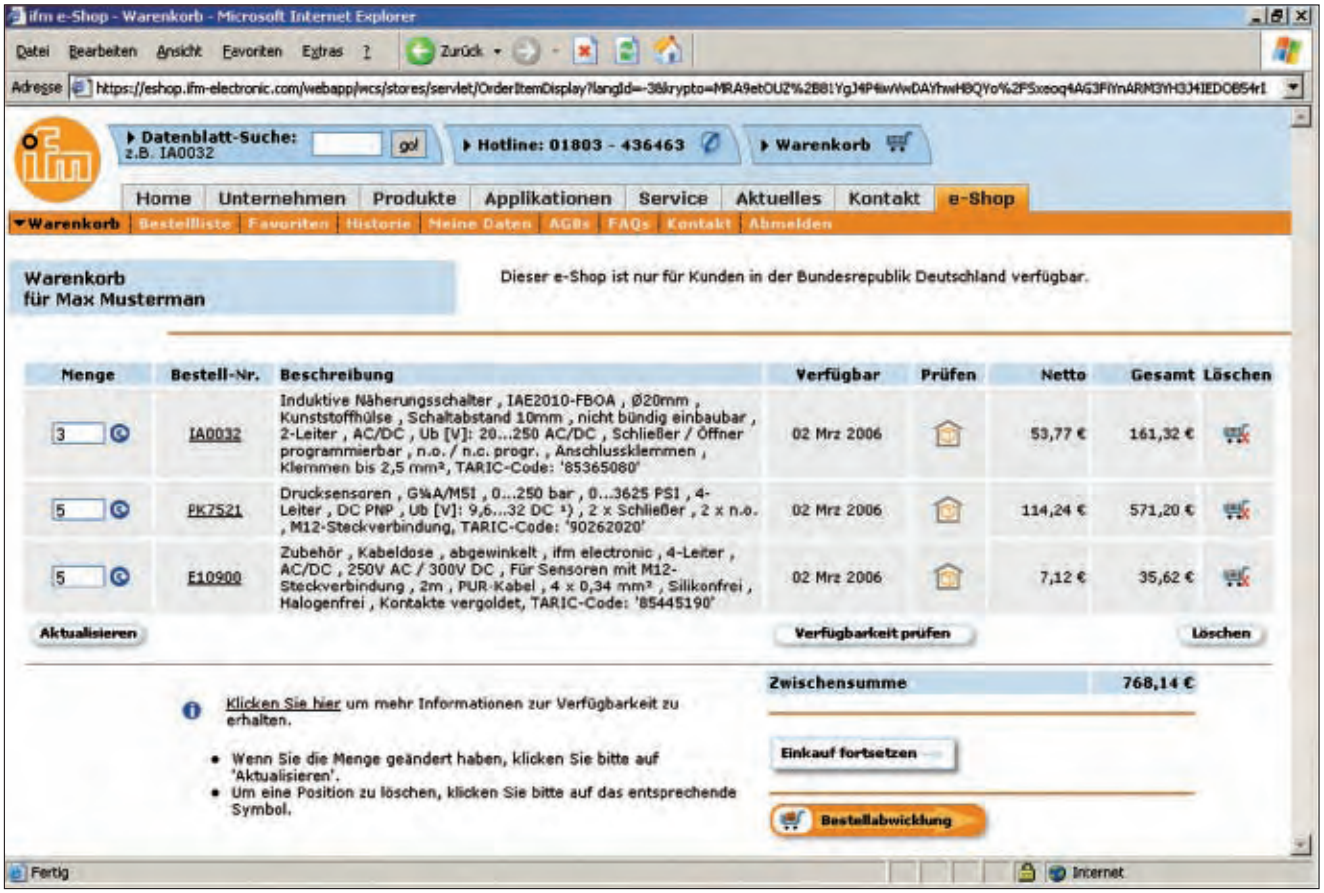

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AS-i slaves

DI	digital inputs
DO	digital outputs
T / R / W	transistor / relay / changeover contact
–Y	Y-circuit
AI	analogue inputs
AO	analogue outputs
C	current 0/4...20 mA
V	voltage 0...10 V
Pt	Pt100 temperature sensors
PO	pneumatic outputs
LO	LED outputs
BI	button inputs

LED functions AS-i slaves

PWR	green	AS-i power
FAULT	red permanently lit red flashing	communication error, e.g. slave address = 0 peripheral fault, e.g. overload
AUX	green	aux. power 24 V DC
I-1...I-4	yellow	input signal
O-1...O-4	yellow	output signal

LED functions AS-i master, controller

ASi PWR	green permanently lit	AS-i power ok
COM MODE	green permanently lit	communication with at least one slave
ALARM CONFIG	red permanently lit	configuration error, e.g. missing slave
NOT AUTO ADDR	red permanently lit off	automatic addressing disabled automatic addressing enabled
CTRL	yellow	controller RUN

LED functions controller e

PWR / COM	green permanently lit green flashing	AS-i power ok communication error, no slave detected
PROJ	yellow permanently lit yellow flashing	projection mode activated slave 0 present
CONF / PF	red permanently lit red flashing	configuration error peripheral fault(s) for slave(s) detected
PLC RUN	yellow	controller RUN
AUX	green	aux. power input 24 V DC ok

LED functions AS-i power supplies

PWR	green	AS-i power output ok
COM ERR	red	no AS-i communication, addressing link "on"

Terminal designations

A+, A– or AS-i+, AS-i–	**AS-i PWR**	AS-i voltage
E+, E–	**AUX PWR**	external 24 V voltage
I+, I– / I1...I4	**input power**	input voltage supply from the module / inputs
O+, O– / O1...O4	**output power**	output voltage supply from the module / outputs
GND, G, FE	**Ground**	ground connection, functional earth
AI, AO or C1...C4 / V1...V4	**analog I/O**	analogue input / output
S+, S1+, S1–, S–	**Sense Pt100**	sense inputs, 4-wire connection for Pt100 sensors
L1, L2, L3, N / L1, N	**Supply**	three-phase, AC supply
11, 12, 14 / 21, 22, 24	**Relais**	relay contacts: common, NC, NO for the outputs O1 / O2
31, 32, 34 / 41, 42, 44	**Relais**	relay contacts: common, NC, NO for the outputs O3 / O4

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