Technical Description **FBP FieldBusPlug**

V5

AS-Interface Bus

AS-Interface

AS-Interface Bus

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Special terms

FieldBusPlug:	Field bus plug with attached cable (varying for the different bus systems)
Terminal device:	General term for actors and sensors (switching devices, combinations of switching devices, converters, soft starters, proximity switches, etc.). "Device" = "Terminal device"
Terminal device interface:	Neutral interface between FieldBusPlug and terminal device. "Device interface" = "Terminal device interface"
Application function:	Function of a terminal device, e.g. Y-D start, reverse start. Some terminal devices allow selection of the application function (e.g. UMC22 or MFI21).

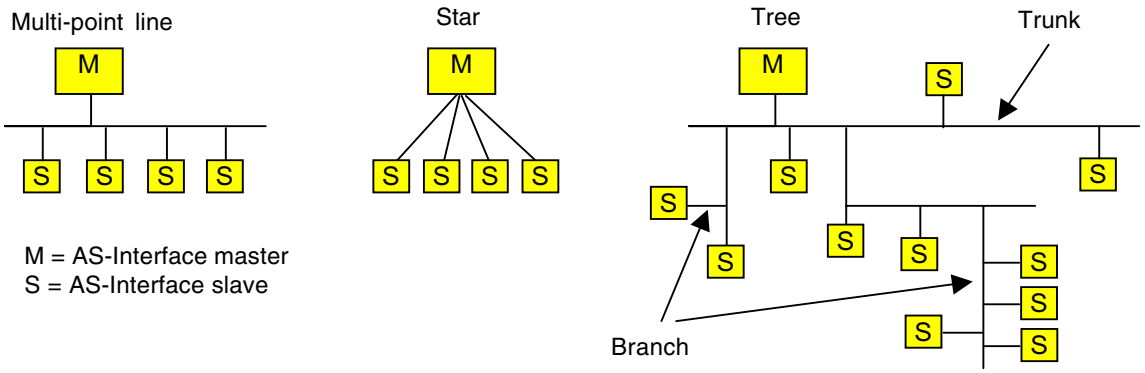
Bus structures and power supply

AS-Interface = Actor-Sensor interface: EN 50295 and IEC 62026-2

Although it is often discussed whether the AS-Interface bus actually represents a real bus system, it is called a bus in this documentation because the AS-Interface bus owns all characteristics of a bus or a field bus even though it carries only a small amount of data.

Network structures

One of the most important advantages of the AS-Interface bus is that it allows any network structure.



M = AS-Interface master
S = AS-Interface slave

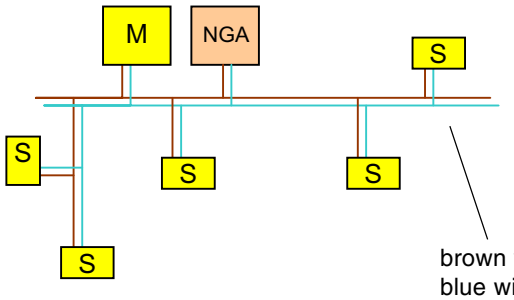
Important: The AS-Interface bus does not require terminating resistors.

Fig. 1: AS-i network structures

Bus lines with integrated power supply

Another important advantage of the AS-Interface bus is that one pair of wires is simultaneously used

- for the transport of telegrams between the master and the slave devices as well as
- for the power supply of the slave devices from the power supply unit (this is why a AS-Interface power supply unit is always required).



For information about the permitted line lengths, please refer to the chapter "Bus length".

M = AS-Interface master
S = AS-Interface slave
NG = Power supply
NGA = AS-Interface power supply

brown wire = AS-Interface +
blue wire = AS-Interface –

Fig. 2: AS-Interface bus lines

Notes:

- The standard AS-Interface cable is a yellow flat cable. Connection is performed by using the penetration method. The cross section is 1.5 mm² (0.024 Ω/m total resistance for both wires).
- The FieldBusPlug cable is a round cable which carries at the same time the additional power supply using another two wires (refer to chapter "Power supply for terminal devices"). The connection is immediately established when inserting the connector. The cross section is 0.5 mm² (0.07 Ω/m total resistance for both wires).
- The maximum current on the FieldBusPlug cables is limited to 4 A, especially due to the usage of M12 connectors. Consequently the load current must be limited to 4 A by the power supply units.

Bus length

The length of an AS-Interface bus line is limited by the following:

- Maximum permitted line loss (attenuation) for the data telegrams.
- Maximum permitted voltage drop for the power supply of the slaves.

For an AS-Interface bus the total bus length determining the line loss must be calculated from the trunk length plus the lengths of the individual branches.

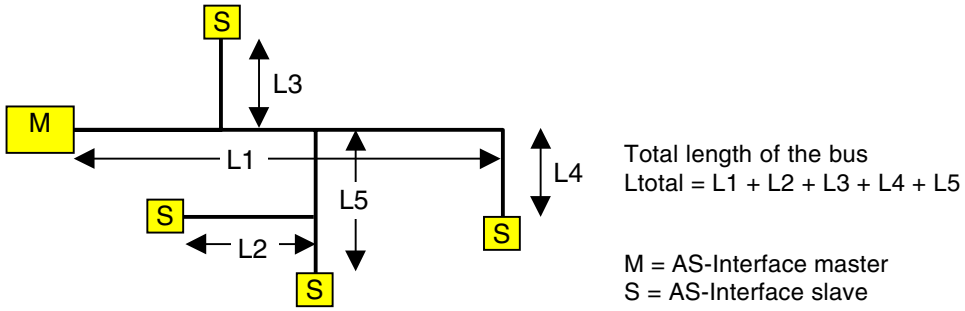


Fig. 3: Total length of the AS-Interface bus

For the power supply of the slaves via the bus line the following must be taken into account:

- For the power supply of the AS-Interface slaves (and the FieldBusPlugs) always a power supply unit (NG-AS-Interface) is required which is especially designed for connection to the AS-Interface bus line. For a better overview, the power supply unit is placed near the AS-Interface master.
  Required output voltage: 29.5...31.6 V DC
- According to the standard the operating voltage range of AS-Interface slave devices is: 18.5...31.6 V DC
- The current consumption of one FieldBusPlug without any devices on the load side is approximately: 0.03 A
- The total current consumption of 62 FieldBusPlugs is approximately: 1.86 A

For simplification:
In the following cases no further calculations are required for the AS-Interface bus line:

- - Basic configuration (refer to chapter "Basic configuration")
  - used only with AS-Interface FieldBusPlugs (no other AS-i slaves)
  - and the maximum total line length (sum) is 80 m
- - Extended configuration (refer to chapter "Extended configuration")
  - used with a total of max. 62 AS-Interface FieldBusPlugs (no other AS-Interface slaves)
  - where max. 50 AS-Interface FieldBusPlugs per branch are used
  - and the maximum total line length (sum) is 100 m
- - Any configuration (basic or extended configuration)
  - used with a total of max. 50 AS-Interface FieldBusPlugs (no other AS-Interface slaves)
  - and the maximum total line length (sum) is 100 m
- Connection of other AS-Interface slaves can cause an increased voltage drop on the bus line. In this case the power supply situation must be checked.
- When determining the total AS-Interface bus length, all cables belonging to the AS-Interface FieldBusPlugs must also be taken into account.

Repeaters

In order to obtain a higher bus length, up to 2 repeaters can be used to refresh the data telegrams.

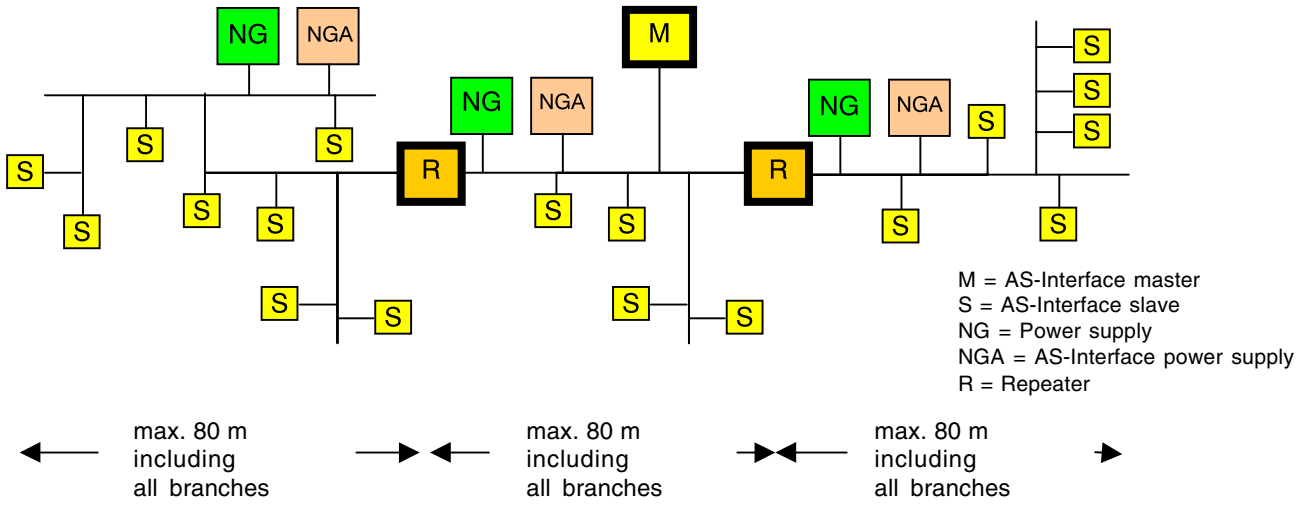


Fig. 4: AS-Interface with repeaters

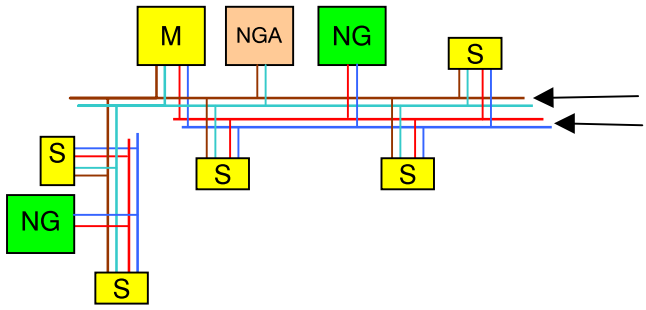
The AS-Interface master can be located at any place (only one master per network). For each segment of the network one AS-Interface power supply unit and, if necessary, one additional power supply unit is required.

Power supply for terminal devices (switching devices, actors, sensors)

Most of the terminal devices, particularly if they contain contactors, require considerably higher currents than the FieldBusPlugs. This is why two supply variants are possible:

1. Power supply for AS-Interface via bus-parallel wires

For this purpose, another pair of wires is available.



When using the flat cables:

- The yellow flat cable is the bus line.
- The black flat cable is for the additional power supply.

For the FieldBusPlug, both wire pairs are integrated in one round cable.

M = AS-Interface master
S = AS-Interface slave
NG = Power supply
NGA = AS-Interface power supply

Fig. 5: Power supply for AS-Interface via wires lead in parallel to the bus

Notes:

- Fig. 5 shows how the power supply can be established in sections in order to control voltage drop.
- The standard AS-Interface cable for the power supply of the terminal devices is a black flat cable. Connection is performed by using the penetration method. The cross section is 1.5 mm² (0.024 Ω/m total resistance for both wires). In an extended configuration (Fig. 8) the yellow and the black cable are used as a trunk.

- The FieldBusPlug cable is a round cable which carries at the same time the additional power supply using another two wires. The connection is immediately established when inserting the connector. The cross section is 0.5 mm² (0.07 Ω/m total resistance for both wires).
- The maximum current on the FieldBusPlug cables is limited to 4 A, especially due to the usage of M12 connectors. Consequently the load current must be limited to 4 A by the power supply units.

The terminal devices MSD11, MSR22, MFI21 and UMC22 work with an operating voltage range of 19.2 ... 31.2 VDC. This voltage range is also valid for inductive sensors and for IP65 I/O devices. For the connection of remote switching devices to the terminal devices refer to Fig. 6.

Basically any 24 V DC power supply unit can be used for the supply of the terminal devices (black cable). However, power supply units with a high stabilized voltage (e.g. AS-i power supply units with 29.5 V DC) allow higher voltage drops. In any case, it is necessary to check the power supply situation of the terminal devices.

2. Local power supply for AS-Interface (external supply)

The terminal devices MSD11, MSR22, MFI21 and UMC22 also allow an external power supply. For this, on the devices MSD11, MSR22 and UMC22 a switch must be toggled. For the MFI21 the external wiring determines whether the device is supplied from the bus or from an external power supply.

Some terminal devices (e.g. the MFI21 and UMC22) allow the connection of external switching devices or sensors. Then, the following conditions must be fulfilled:

- At the slave, the power supply from the bus may only be used for potential-free elements.
- If the power supply from the bus is used, only switching devices which are located right next to the slave may be connected (see S1 in Fig. 6).
- If switching devices or sensors which are located far-off the slave are connected, an external power supply must be used (see S4 in Fig. 6). Otherwise an unclear and susceptible supply network will result where possibly occurring errors can no longer be localized (see S3 in Fig. 6).

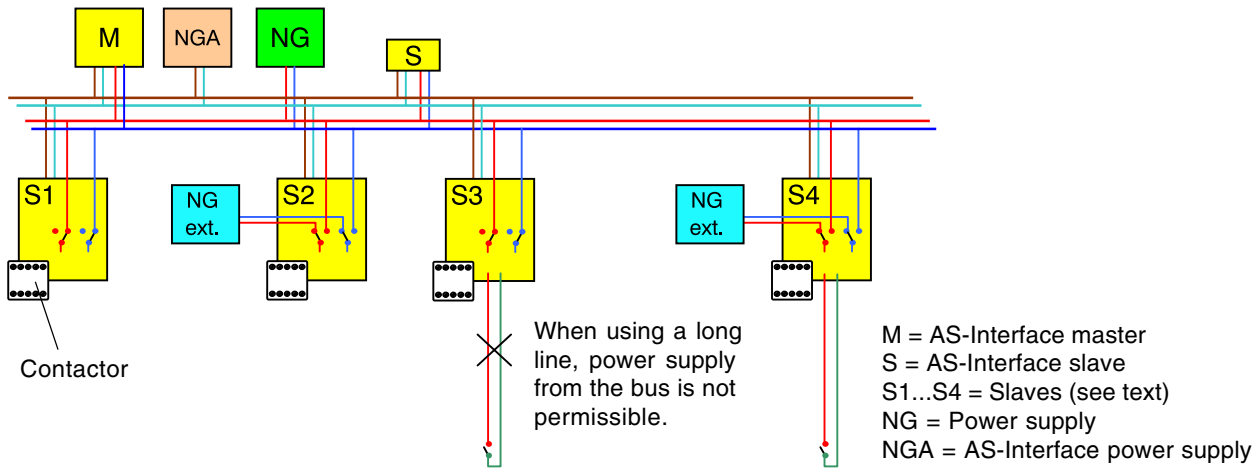


Fig. 6: Power supply of the terminal devices from the bus vs. external power supply

Master and slave devices

Only one master is permitted per network. The following devices can be used as a master:

- A coupler at a CPU of a PLC or inside of a PC.
- Or a gateway to another field bus or a network.

FieldBusPlugs are slaves on the AS-Interface Bus. The maximum number of slaves on the AS-Interface bus is limited and depends on the amounts of data of the slaves.

- **Slave with 4 DIs** (digital inputs) **and 3 DOs** (digital outputs): **max. 62 slaves.**
  The fourth digital output is used as an address extension bit.
  Used for the FieldBusPlug.
  The possible slave addresses divide into 1...31 A and 1...31 B. Here, it is assumed that the AS-Interface master (coupler, gateway, etc.) supports this type of addressing (A and B). Otherwise only the addresses 1...31 are available which are then set on the FieldBusPlug as 1 A to 31 A.
- Slave with 4 DIs and 4 DOs: max. 31 slaves. Not used for the FieldBusPlug.
- Slave with 1 AI (analog input) or 1 AO (analog output): max. 31 slaves.
  Not used for the FieldBusPlug.

Reaction times

The reaction time of an automation system is the time period between the occurrence of a signal change at an input and the issue of an output signal which is derived from the input signal.
The reaction time consists of the following times:

- Input delay and internal processing time at the input devices, sensors, etc.
- Hand-over time between the input device, sensor, etc. and the FieldBusPlug (comparatively short).
- AS-Interface bus cycle time: AS-Interface with 31 slaves $\leq$ 5 ms
  AS-Interface with 62 slaves $\leq$ 10 ms
- Processing time and internal transmission times inside the automation unit.
- AS-Interface bus cycle time.
- Hand-over time between the FieldBusPlug and the actor (short, compared to the bus cycle time).
- Output delay (e.g. pull-in time of the contactor). Usually in the range of 0...10 ms.

The cycle time of the field bus is the time needed to interrogate and write each slave at least one time. It is assumed that the master interrogates the slaves and writes to the slaves one after the other without any delay.

Basic configuration

Configuration for applications where

- the total length of the bus is not higher than 80 m and where
- the current consumption of the slaves is not very high, so that the voltage drop is not relevant.

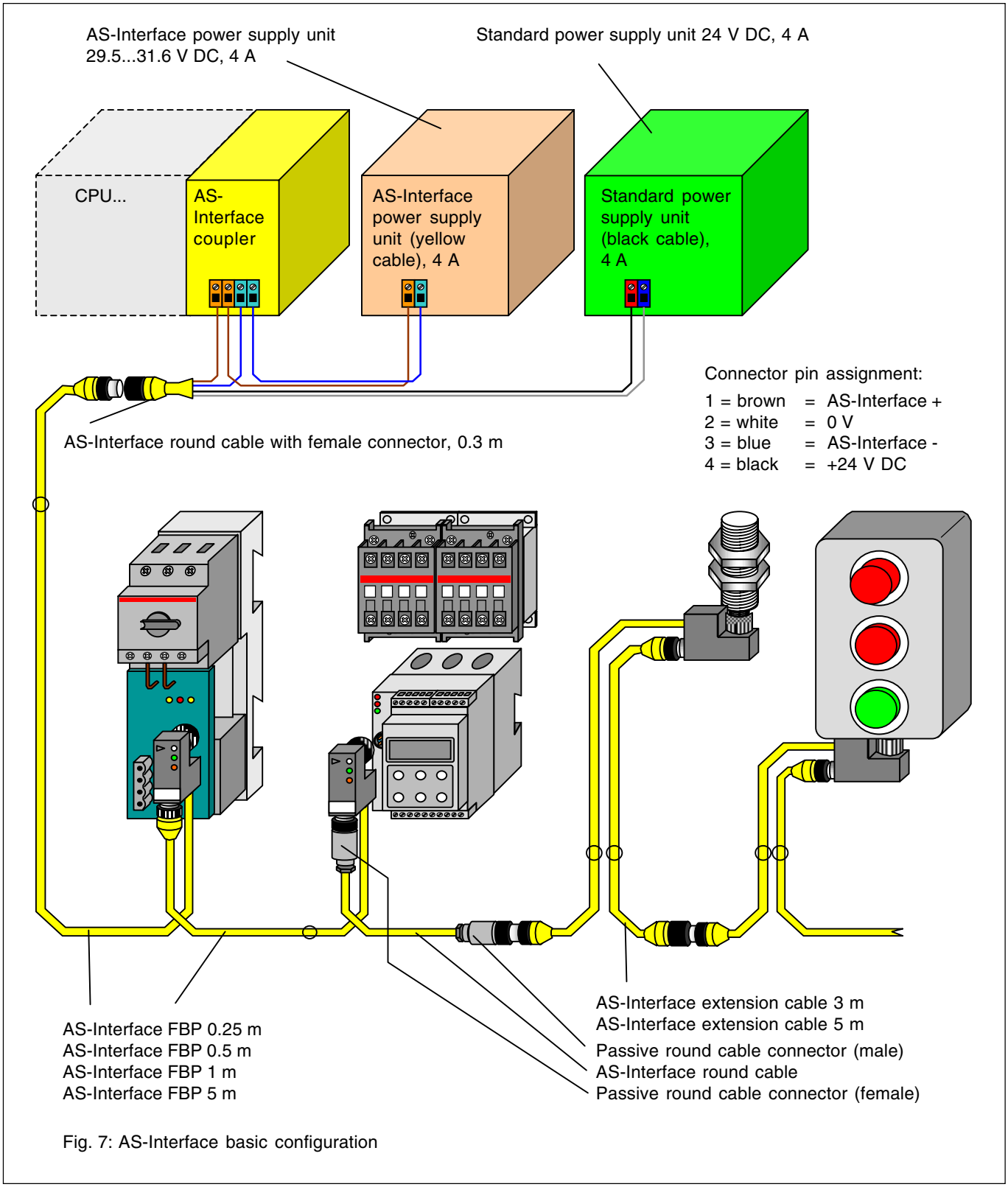


Fig. 7: AS-Interface basic configuration

Extended configuration

An extended configuration can be necessary for several reasons:

- The total length of the bus is higher than 80 m or 100 m.
- The current consumption is high and causes a high voltage drop.
- The field bus structure shall reflect the structure of the machine/system.
- The slaves shall be partitioned to the segments according to the control cabinets.
- Others.

Example with 3 control cabinets:

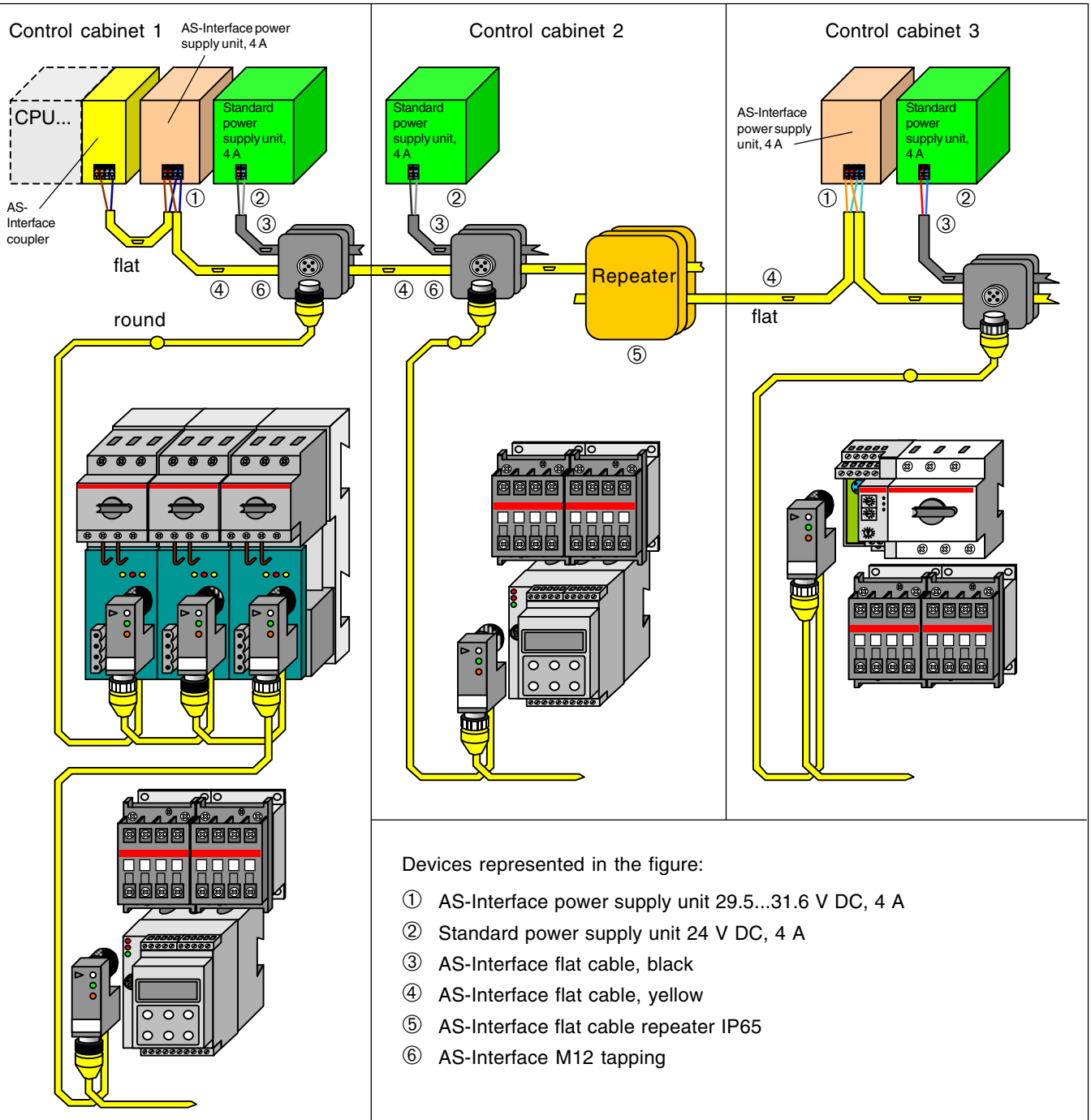


Fig. 8: AS-Interface, extended configuration

Profiles of available FieldBusPlugs

AS-Interface FieldBusPlug types

The available FieldBusPlugs have an address range of 1...31 with the sub-addresses A and B.

Two types of AS-Interface FieldBusPlug are available (both types are completely compatible with AS-Interface):

- **AS-Interface FieldBusPlug Performance**
  - The AS-Interface FieldBusPlug Performance has 4 digital inputs (DI) and 3 digital outputs (DO) and can be used for all devices, even for simple devices.
  - Transmission of parameters is possible using 3 bits.
  - The AS-Interface FieldBusPlug Direct can be replaced at any time by the AS-Interface FieldBusPlug Performance.
  - The diagnosis messages of the terminal device are transmitted to the AS-Interface bus.
  - Generally the following applies:
    The amount of data as well as the types of data which can be exchanged with the terminal devices are limited by the AS-Interface bus itself and not by the AS-Interface FieldBusPlug (with a few exceptions). This particularly also applies to the parameters.
- **AS-Interface FieldBusPlug Direct**
  - The AS-Interface FieldBusPlug Direct has 2 digital inputs (DI) and 1 digital output (DO) and can only be used for simple devices.
  - Transmission of parameters is not possible.
  - Diagnosis messages from the terminal device are not collected.

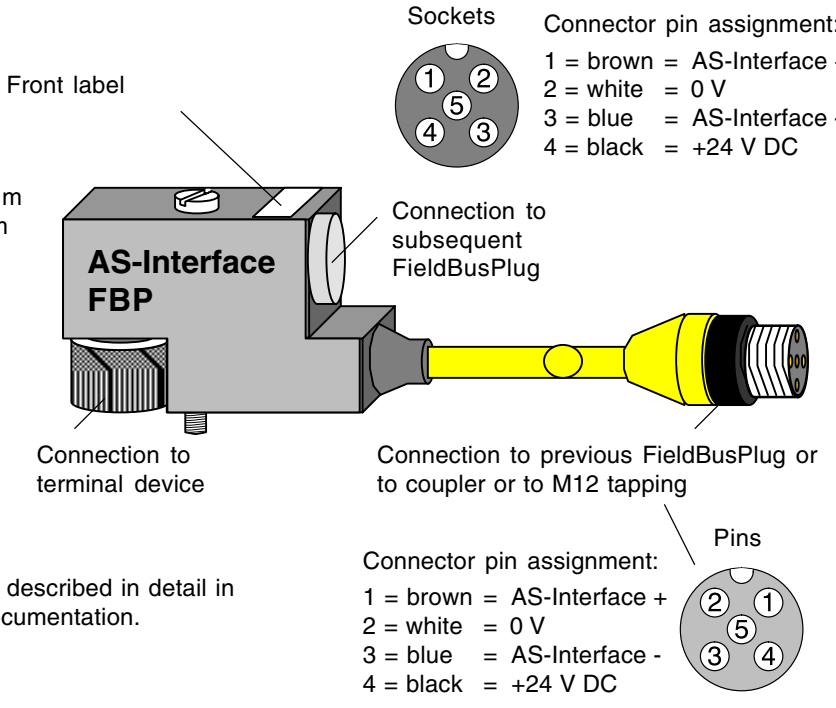
A mix of both FieldBusPlug types can be used in one network without any limitation.
Both types are available with various cable lengths attached.

Performance:

AS-Interface FBP Performance 0.25 m
AS-Interface FBP Performance 0.5 m
AS-Interface FBP Performance 1 m
AS-Interface FBP Performance 5 m

Direct:

AS-Interface FBP Direct 0.25 m
AS-Interface FBP Direct 0.5 m
AS-Interface FBP Direct 1 m
AS-Interface FBP Direct 5 m



The AS-Interface FieldBusPlugs are described in detail in the "AS-Interface FieldBusPlugs" documentation.

Fig. 9: AS-Interface FieldBusPlugs with various cable lengths

I/O configuration and profile (ID code)

In the AS-Interface specification the I/O code and the profile (ID code) describe the type of device connected to the bus as it is seen by the automation. Here, the diversity of variants is limited by the low number of available bits. For example, also the following definition was made:
Motor Control Devices (I/O=7, ID=E_{hex}), without giving further details.

The I/O and ID codes of the FieldBusPlug are programmed ex works and can not be changed any more afterwards.

Since the FieldBusPlug is connected to various devices, the following applies:

- I/O code = 7 (4 DIs, 4 DOs, even though only 4 DIs and 3 DOs can be used)
- ID code = 15 (free profile)

This applies to all AS-Interface FieldBusPlugs. The user cannot change anything and he is also not allowed to.

The AS-Interface FieldBusPlugs are slaves on the AS-Interface bus. The 62 possible slave addresses divide into 1...31 A and 1...31 B. Here it is assumed that the AS-Interface master (coupler, gateway, etc.) supports this type of addressing (A and B). Otherwise only the addresses 1...31 are available which are then set on the FieldBusPlug as 1 A to 31 A.

Usability of FieldBusPlugs for terminal devices

The following applies in general:

- The AS-Interface FieldBusPlug Direct can be replaced at any time by the AS-Interface FieldBusPlug Performance.
- The AS-Interface FieldBusPlug Performance supports parameter transmission.
- The amount of data as well as the types of data which can be exchanged with the terminal devices are limited by the AS-Interface field bus itself and not by the AS-Interface FieldBusPlug Performance (with a few exceptions). This particularly also applies to parameters.
- For terminal devices with selectable application functions it is possible that the AS-Interface FieldBusPlug does not permit the usage of all application functions and that application functions can only be partially parameterized, even though they are permitted.

Application overview

Terminal device	Application (mode)	Signals from and to AS-Interface bus (DI, DO), Terminal device signals (G-DI, G-DO)	AS-Interface FieldBusPlug Performance supports:			AS-Interface FBP Direct applicable?
			Commands, messages	Para-meters	Dia-gnostics	Commands, messages
Proximity switch	indication	DI 0 = 1 sensor detects metal (standard sensor output: p-n-p transistor, NO; standard M12 pin assignment)	yes	no	no	yes
MSD11	direct starter	DO 0 = 1 activate contactor DI 1 = 1 contactor is in position ON DI 0 = 1 motor prot. switch is in pos. ON	yes	no	no	yes
MSR22	reversing starter	DO 0 = 1 activate contactor 1 DO 1 = 1 activate contactor 2 DI 1 = 1 contactor 1 is in position ON DI 2 = 1 contactor 2 is in position ON DI 0 = 1 motor prot. switch is in pos. ON When switching over the contactors a minimum wait time of 50 ms applies.	yes	yes	yes	no
MFI21	transparent	The 4 G-DIs and the 3 G-DOs of the device are inserted to the AS-Interface telegram without any changes.	no	no	no	no
	direct starter	DO 0 = 1 activate contactor DI 0 = 1 contactor is in position ON DI 3 = 1 motor prot. switch is in pos. ON Further G-DIs and G-DOs are transparent.	yes	yes	yes	no
	reversing starter	DO 0 = 1 activate contactor 1 DO 1 = 1 activate contactor 2 DI 0 = 1 contactor 1 is in position ON DI 1 = 1 contactor 2 is in position ON DI 3 = 1 motor prot. switch is in pos. ON Further G-DIs and G-DOs are transparent. The minimum wait time when switching over the contactors is 50 ms. Longer wait times can be set with potentiometer.	yes	yes	yes	no
	star-delta starter, one direction of rotation	DO 0 = 1 start motor DI 0 = 1 mains contactor is in pos. ON DI 1 = 1 star contactor is in pos. ON DI 2 = 1 delta contactor is in pos. ON DI 3 = 1 motor prot. switch is in pos. ON The starting period in star connection can be set by means of a potentiometer. The switch-over time (star contactor is de-activated and delta contactor is activated) is fixed to 50 ms.	yes	yes	yes	no
	others		no	no	no	no

Application overview

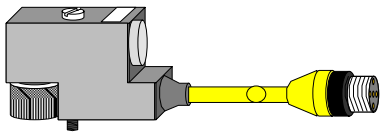
Terminal device	Application (mode)	Signals from and to AS-Interface bus (DI, DO), Terminal device signals (G-DI, G-DO)	AS-Interface FieldBusPlug Performance supports:			AS-Interface FBP Direct applicable?
			Commands, messages	Para-meters	Dia-gnostics	Commands, messages
UMC22	transparent	4 of the 6 G-DIs and the 3 G-DOs of the device are inserted to the AS-Interface telegram without any changes.	no	no	no	no
	direct starter	DO 0 = 1 activate contactor DI 0 = 1 contactor is in position ON DI 3 = 1 motor prot. switch is in pos. ON Further G-DIs and G-DOs are transparent.	yes	yes	yes	no
	reversing starter	DO 0 = 1 activate contactor 1 DO 1 = 1 activate contactor 2 DI 0 = 1 contactor 1 is in position ON DI 1 = 1 contactor 2 is in position ON DI 3 = 1 motor prot. switch is in pos. ON Further G-DIs and G-DOs are transparent. The minimum wait time when switching over the contactors is 50 ms. Longer wait times can be set with potentiometer.	yes	yes	yes	no
	star-delta starter, one direction of rotation	DO 0 = 1 start motor DI 0 = 1 mains contactor is in pos. ON DI 1 = 1 star contactor is in pos. ON DI 2 = 1 delta contactor is in pos. ON DI 3 = 1 motor prot. switch is in pos. ON The starting period in star connection can be set by means of a potentiometer. The switch-over time (star contactor is de-activated and delta contactor is activated) is fixed to 50 ms.	yes	yes	yes	no
	other applications (approx. 10)	e.g. reversing starter with detection of end position	no	no	no	no

Available parts

Types of FieldBusPlugs

AS-Interface FieldBusPlugs Direct

Type	Designation	ABB No.
ASD11-FBP.025	AS-Interface FBP Direct 0.25 m	1SAJ 2100 00 R0003
ASD11-FBP.050	AS-Interface FBP Direct 0.5 m	1SAJ 2100 00 R0005
ASD11-FBP.100	AS-Interface FBP Direct 1 m	1SAJ 2100 00 R0010
ASD11-FBP.500	AS-Interface FBP Direct 5 m	1SAJ 2100 00 R0050

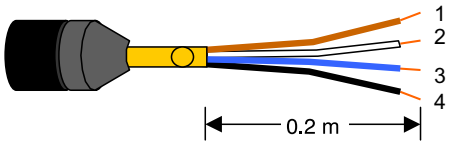


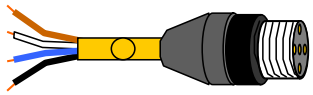
AS-Interface FieldBusPlugs Performance

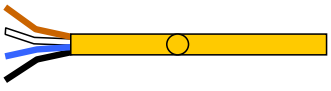
Type	Designation	ABB No.
ASP22-FBP.025	AS-Interface FBP Performance 0.25 m	1SAJ 2200 00 R0003
ASP22-FBP.050	AS-Interface FBP Performance 0.5 m	1SAJ 2200 00 R0005
ASP22-FBP.100	AS-Interface FBP Performance 1 m	1SAJ 2200 00 R0010
ASP22-FBP.500	AS-Interface FBP Performance 5 m	1SAJ 2200 00 R0050

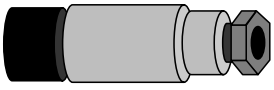
Cables, plug connectors

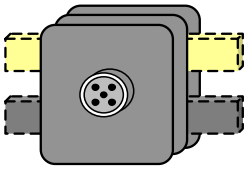
Type	Designation	ABB No.
	AS-Interface extension cables	
ASX11-FBP.100	1 m	1SAJ 9220 01 R0010
ASX11-FBP.300	3 m	1SAJ 9220 01 R0030
ASX11-FBP.500	5 m	1SAJ 9220 01 R0050
ASF11-FBP.030	AS-Interface round cable with female connector 0.3 m, sheath partially removed, wire-end ferrules attached No. Color Signal 1 brown AS-Interface + 2 white 0 V 3 blue AS-Interface - 4 black +24 V DC	1SAJ 9220 02 R0003
ASM11-FBP.030	AS-Interface round cable with male connector 0.3 m, sheath partially removed, wire-end ferrules attached	1SAJ 9220 03 R0003
ASC11-FBP.999	AS-Interface round cable, coil 100 m, 4 x 0.5 mm², not dismantled	1SAJ 9220 04 R1000
ASM11-FBP.0	AS-Interface male connector for round cable, for clamp connection	1SAJ 9220 05 R0001
ASF11-FBP.0	AS-Interface female connector for round cable, for clamp connection	1SAJ 9220 06 R0001
AST11-FBP.0	AS-Interface flat cable junction with female M12 connector	1SAJ 9220 07 R0001







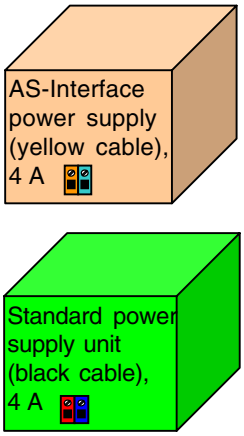




Further AS-Interface materials (parts not supplied by ABB)

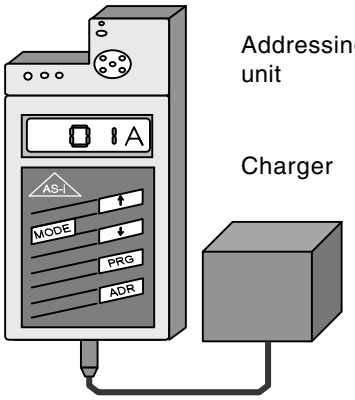
Power supply units

Type	Designation	Supplier
	AS-Interface power supply, IP 20, 29.5...31.6 V DC, for connection to AS-Interface bus (signal wires)	PULS (D-München)
	Standard power supply unit, IP 20, 24 V DC, for power supply of the terminal devices (second pair of wires)	



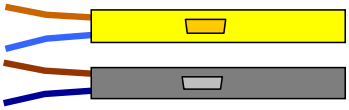
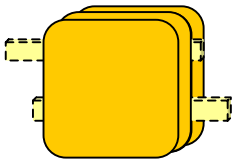
Addressing units

Type	Designation	Supplier
	AS-Interface addressing unit incl. standard cable and charger	Pepperl & Fuchs (D-Mannheim)
	AS-Interface infrared addressing cable, power supply from addressing unit	Hirschmann (D-Neckartenzlingen)



Further AS-Interface materials (parts not supplied by ABB)

Accessories

Type	Designation	Supplier	
	AS-Interface flat cable, yellow, 100 m	Lapp (D-Stuttgart)	
	AS-Interface flat cable, black, 100 m	Lapp (D-Stuttgart)	
	AS-Interface flat cable repeater IP65	Siemens (D-Erlangen)	
	AS-Interface flat cable extender, special repeater, required - if the bus length exceeds 100 m or/and - if there is a large distance between the master and the first slave. Saves one AS-Interface power supply unit, if the master is supplied by an own power supply.	Siemens (D-Erlangen)	not illustrated

Addressing

Master and slave devices

Only one master is permitted per network. The following devices can be used as a master:

- A coupler at a CPU of a PLC or inside of a PC.
- Or a gateway to another field bus or a network.
- The AS-Interface FieldBusPlugs are slaves on the AS-Interface bus. The maximum number of slaves on the AS-Interface bus is limited. The 62 possible slave addresses divide into 1...31 A and 1...31 B. Here, it is assumed that the AS-Interface master (coupler, gateway, etc.) supports this type of addressing (A and B). Otherwise only the addresses 1...31 are available which are then set on the FieldBusPlug as 1 A to 31 A.
- The AS-Interface FieldBusPlugs transmit a maximum of 4 digital inputs and 3 digital outputs as well as parameter data. Analog signals are not transmitted.

Address setting

Generally the following applies: Due to the characteristics of the integrated AS-Interface circuits, the slave address is stored in the FieldBusPlug. Exchanging the FieldBusPlugs mutually will cause serious errors.

The AS-Interface circuits allow only an "electronic" setting of the address. In "principle", the desired address is read via the AS-Interface field bus where the bus master uses a special telegram.
If an addressing unit is used, the AS-Interface master must be temporarily replaced by the addressing unit. This also applies to the FieldBusPlug. On delivery, the address of the FieldBusPlug is 0 A. However, this address is invalid. Due to this, a valid address must be set.

The AS-Interface FieldBusPlug cannot read its address from the terminal device, even though the terminal device is equipped with an address switch.

The AS-Interface provides the following possibilities for setting the address:

1. Setting the address directly by means of an addressing unit

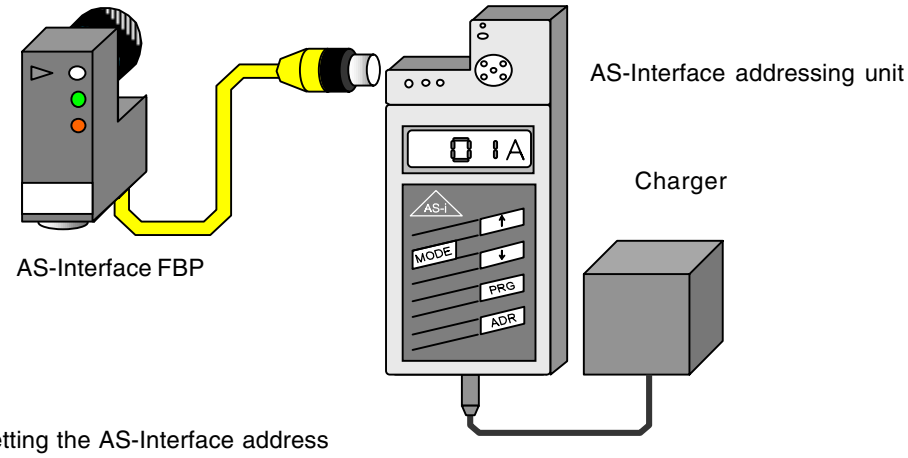


Fig. 10: Setting the AS-Interface address directly by means of an addressing unit

Procedure for setting the slave address in the FieldBusPlug:

- Connect the cable of the FieldBusPlug to the addressing unit and switch on the addressing unit (ADR key). The address is displayed on the addressing unit.
- Change the address setting (up/down arrow key).
- Press the PRG key to program the FieldBusPlug with the desired address.
- Write the address to the address label of the FBP.

2. Setting the address by means of an addressing unit with an infrared cable

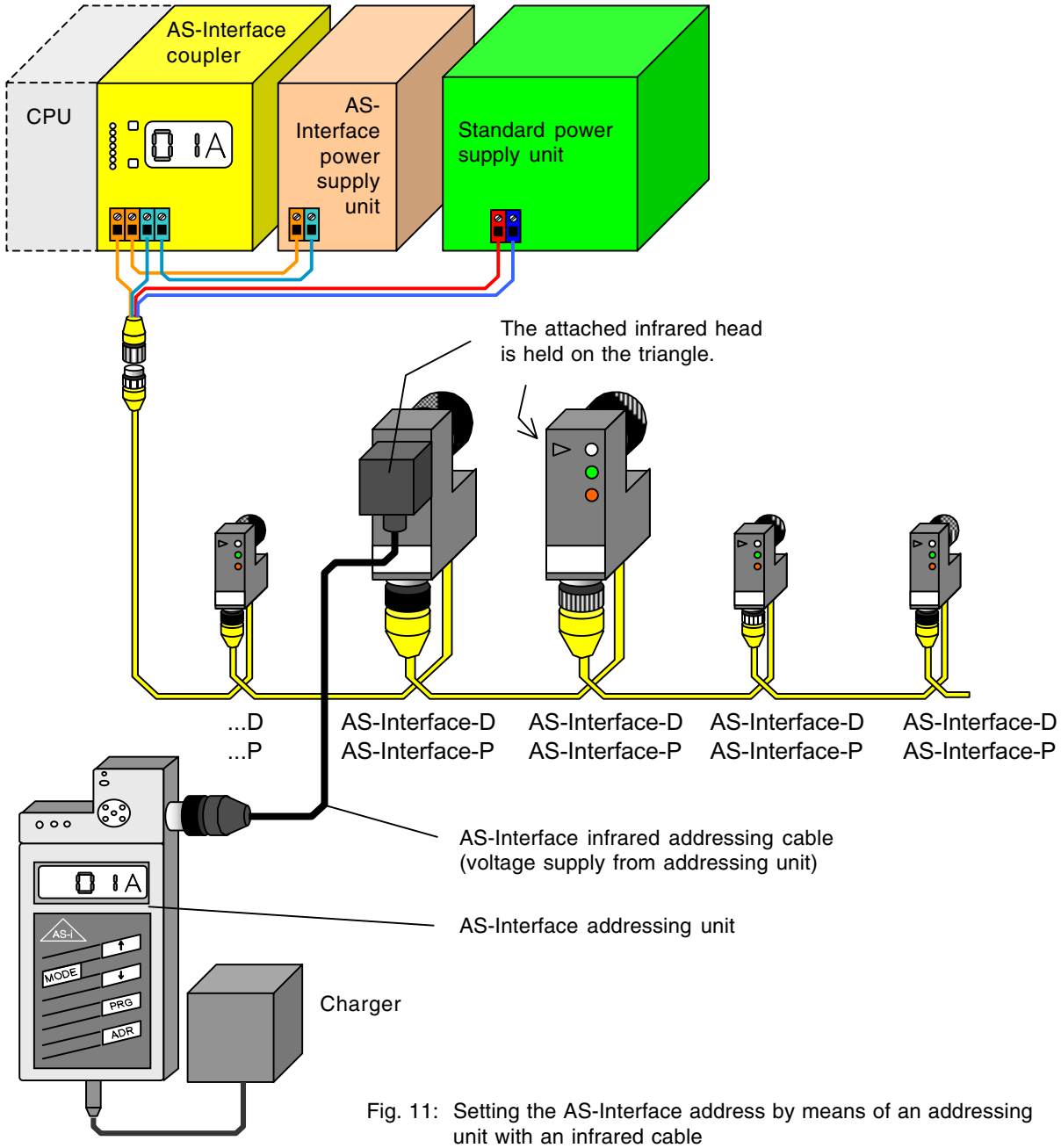


Fig. 11: Setting the AS-Interface address by means of an addressing unit with an infrared cable

Procedure for setting the slave address in the FieldBusPlug:

- Set the AS-Interface master to "offline" or disconnect it and then switch the AS-Interface master and the power supply unit off and on again.
- Connect the infrared cable and switch on the addressing unit (ADR key).
  The address is displayed on the addressing unit.
- Change the address setting (up/down arrow keys).
- Press the PRG key to program the FieldBusPlug with the desired address.
- Write the address to the address label of the FBP.
- Disconnect and detach the infrared cable and then activate or connect the AS-Interface master.

3. Address setting via the AS-Interface bus master (coupler / gateway)

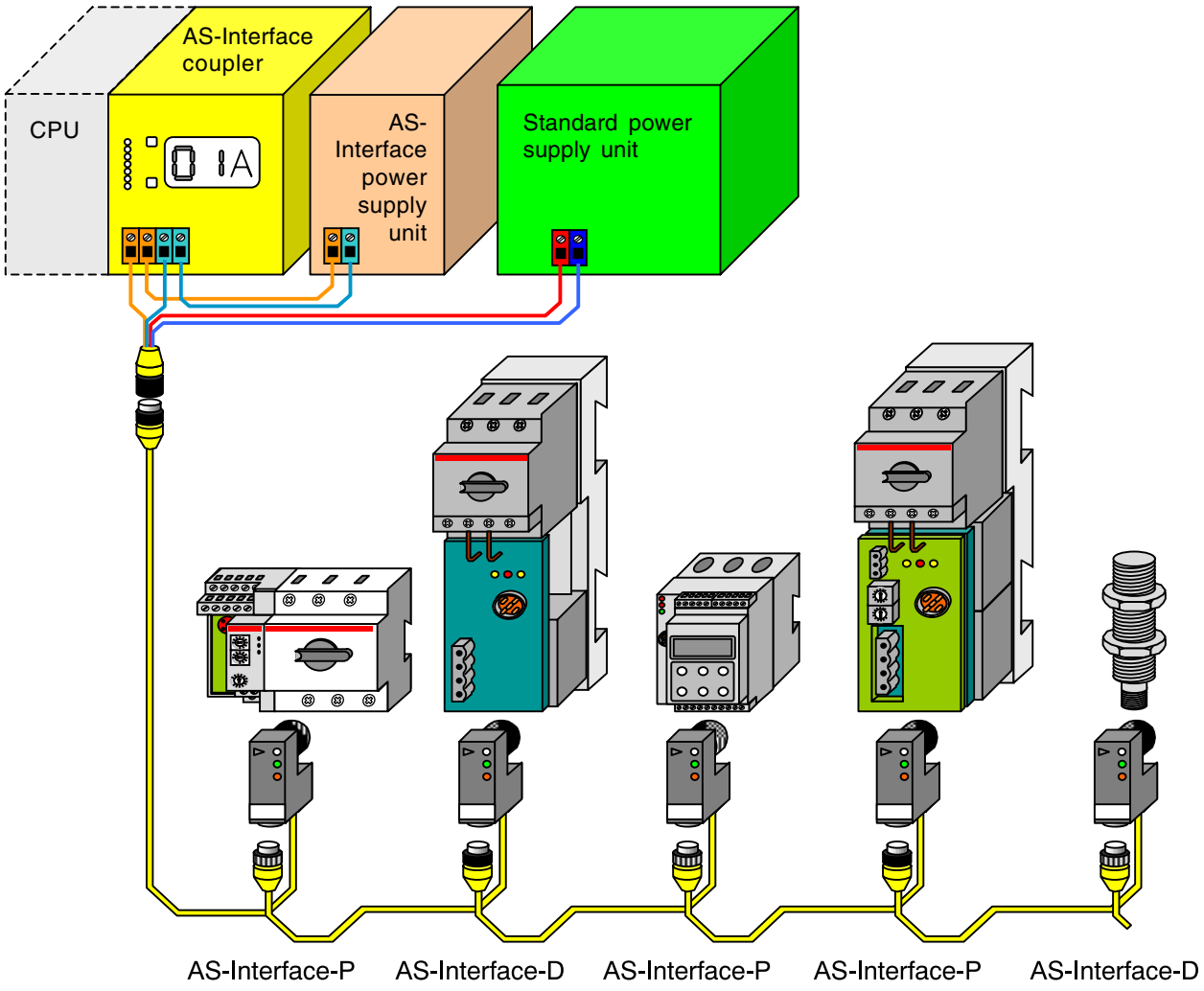


Fig. 12: AS-Interface address setting via the AS-Interface bus master (coupler / gateway)

Procedure (shown using an AS-Interface PROFIBUS gateway as an example)

- Switch on the AS-Interface master (coupler, gateway) and the power supply unit and then change to the project mode.
- Connect the cable of the first FieldBusPlug (needs not to be connected to the terminal device). On delivery, all slaves are set to address 0 A.
- If the address is 0, the bus master now offers the first free address:
  - Acknowledge the setting by pressing the key, if the address is o.k.
  - If you want to set another address, select the desired address using the keys and then confirm the setting.
- Write the address on the address label of the FBP.
- Connect the next FieldBusPlug and proceed as described, etc.

Commissioning information and fault clearance

Faults during commissioning	
● Correct:	All requested FieldBusPlugs reply to the master as required.
Situation:	One or more FieldBusPlugs are missing.
Result:	Due to a previously programmed information the bus master detects that one or more FieldBusPlugs are missing.
Measure:	Inquiry of the actual situation on the bus master (coupler).
● Correct:	One terminal device (switching device, actor, sensor) is connected to the field bus.
Situation:	Terminal device defective, not connected or no power supply.
Result:	The FieldBusPlug cannot detect the error. It remains in parallel mode with 2 DIs and 1 DO.
Measure:	Simple terminal devices must be tested at their mounting place.
● Correct:	The installed FieldBusPlug is an AS-Interface P (Performance). It is plugged to an "intelligent" terminal device which logs on correctly.
Situation:	The currently installed FieldBusPlug is an AS-Interface D (Direct).
Result:	The AS-Interface FieldBusPlug Direct cannot detect the error.
Measure:	Observing the plausibility of the function of the "intelligent" terminal device, e.g. response of an activated contactor.

Faults during operation	
● Correct:	All requested FieldBusPlugs reply to the master as required.
Situation:	Exactly one FieldBusPlug has failed.
Result:	The bus master detects the slave address of the failed FieldBusPlug. The error is displayed by LEDs on the FieldBusPlug.
Measure:	Installation of a new FieldBusPlug and confirmation of the slave address. The entire bus comes back into operation.
● Correct:	All requested FieldBusPlugs reply to the master as required.
Situation:	More than one FieldBusPlug has failed. This can be caused by e.g. an interruption of the AS-Interface field bus due to a faulty plug connection.
Result:	The bus master as well as the LEDs of the affected FieldBusPlugs indicate errors.
Measure:	Searching the location of interruption with the help of the slave addresses and the corresponding terminal devices, for instance. Observation of the error LEDs.
● Correct:	A simple switching device, an actor or a sensor is connected as the FieldBusPlug. The AS-Interface P remains in parallel mode.
Situation:	The switching device, actor or sensor is defective (the connection to the terminal device can most likely be excluded as an error source).
Result:	The FieldBusPlug cannot detect the error.
Measure:	Plausibility check: Does the equipment react to commands of the automation system? Local testing required.
● Correct:	The installed FieldBusPlug is an AS-Interface FieldBusPlug Performance. It is plugged to an "intelligent" terminal device which logged on correctly.
Situation:	The "intelligent" terminal device has failed or its connection is interrupted.
Result:	The FieldBusPlug detects the error and sends it to the automation system. The error LED on the FieldBusPlug lights up.
Measure:	Observing the function of the "intelligent" terminal device, observing the messages in the automation system, replacing the terminal device, if necessary.

Programming

The software development is described in detail in the software documentation. Here we only want to point out the task which is directly connected with the AS-Interface.

General data transmission inside the field area

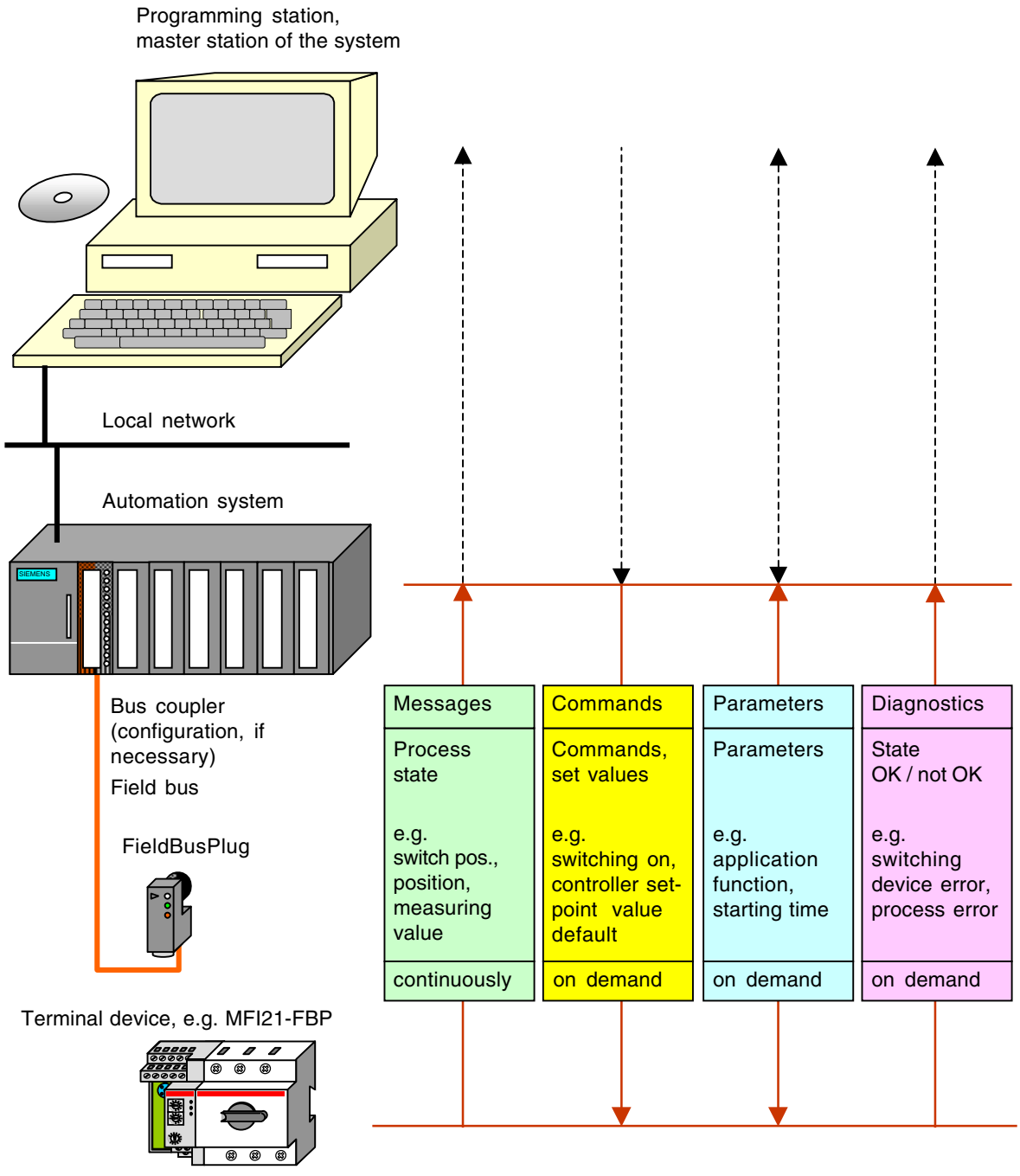


Fig. 13: General data transmission inside the field area

Assumptions for application

It is assumed that the user has already decided for

- the terminal devices and the application functions he wants to perform using these devices,
- the automation system and
- the used field bus type, here: AS-Interface.

Furthermore it is assumed that the user is familiar to the automation system and the tools provided by the manufacturer.

In order to enable the automation system to work with the terminal device, appropriate program parts are required in the automation system. Here, two cases are to be distinguished:

1. **No specific support provided**

   In this case, the user receives:

   - Information about how the terminal device data are contained in the telegrams. Having appropriate knowledge of the automation system and the field bus coupler, the user is able to create the corresponding linking by himself.

2. **Linking of the terminal device to the automation system and the field bus is supported in an optimal way** (at the moment, this applies to S7-300)

   In this case, the user receives:

   - Programming utilities, e.g. **functions** for editing the terminal device (and its application functions) in the user-defined program. Using these utilities the user is able to quickly and effectively develop his program.
   - Installation guide which shows for instance, how the functions are to be integrated into the library of the manufacturer-specific programming system.

Example: Data in the telegrams

MFI21-FBP, application function reversing starter

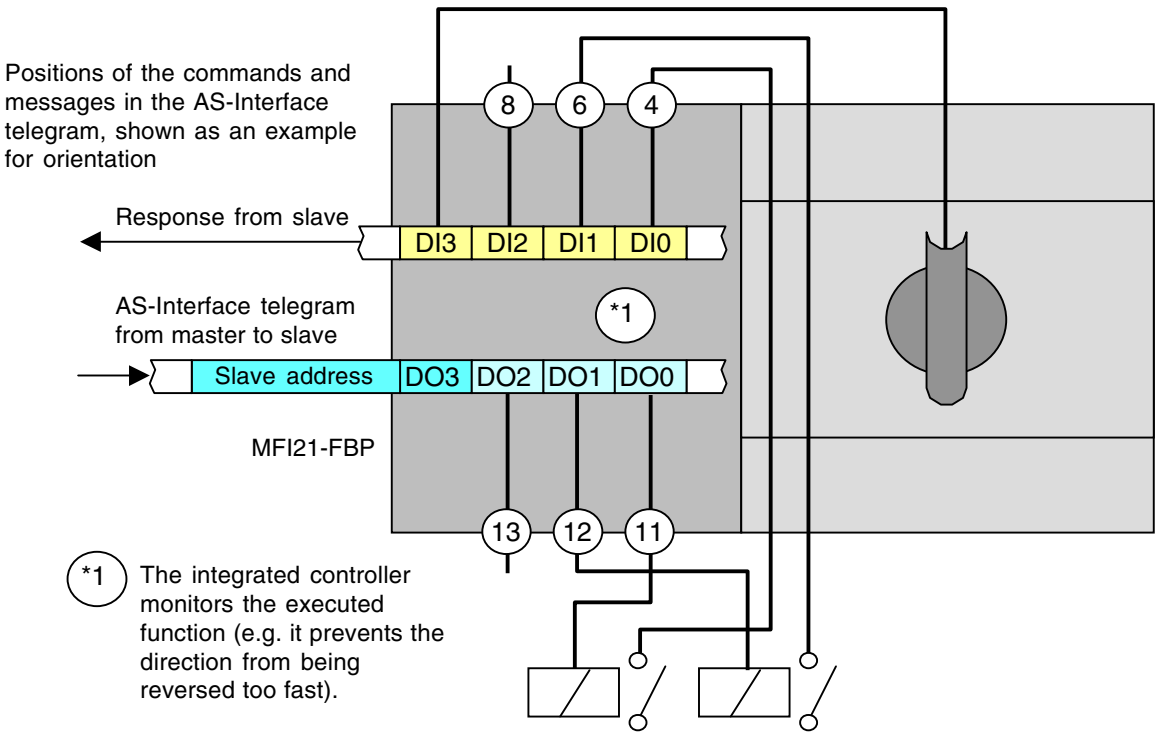


Fig. 14: Data in the telegram; example shown: MFI21, reversing starter

Terminal device	Application (mode) (mode)	Signals from and to AS-Interface bus (DI, DO), Terminal device signals (G-DI, G-DO)	Conn. terminal on MFI21	AS-Interface FieldBusPlug Performance supports:		
				Commands, messages	Para-meters	Dia-gnostics
MFI21	reversing starter	DO 0 = 1 activate contactor 1 DO 1 = 1 activate contactor 2 DI 0 = 1 feedback: contactor 1 is ON DI 1 = 1 feedback: contactor 2 is ON DI 3 = 1 motor prot. switch is in pos. ON DO 2 unused output DI 2 unused input DO 3 address extension A / B P0...P2 parameter values (refer to table on next page) The minimun wait time when switching over the contactors is 50 ms. Longer wait times can be set with potentiometer.	11 (output) 12 (output) 4 (input) 6 (input) mechanically 13 (output) 8 (input)	yes	yes	yes

Example: Assigning the application functions in the MFI21-FBP

Setting the application functions in the MFI21-FBP as well as its behaviour if the bus connection is lost (fall-back behaviour) is performed via the parameter telegram.

Without valid parameters, the MFI21-FBP has no function. None of the outputs will be switched and none of the inputs will be processed.

In order to use an application function, it is necessary, to load the parameters of the desired application function **before** its first processing.

The loaded data are lost from the MFI21-FBP with power-off. When the MFI21-FBP is switched to the bus again, the bus master will load the parameters to the slave automatically.

Possible application functions for the MFI are:

- **Direct starter** (1 motor, 1 direction of rotation)
- **Reversing starter** (1 motor, left or right)
- **Star-delta starter** (1 motor with star-delta starting)
- **Transparent** (MFI21 only used as I/O device), **not possible on AS-Interface bus**

The following parameter values apply to the application functions in the MFI21-FBP used on the AS-Interface bus (used coupler AS-Interface master CP 343-2).

Parameter value	Application function
0	No valid operating mode (default setting)
1	Direct starter. Fallback behavior: MFI21 outputs are switched off
2	Direct starter. Fallback behavior: MFI21 outputs remain in previous state
3	Reversing starter. Fallback behavior: MFI21 outputs are switched off
4	Reversing starter. Fallback behavior: MFI21 outputs remain in previous state
5	Star-delta starter. Fallback behavior: MFI21 outputs are switched off
6	Star-delta starter. Fallback behavior: MFI21 outputs remain in previous state
7	Transparent mode, **not possible for AS-Interface bus**

The assignment of the application function parameters gives the MFI21-FBP a specific behavior concerning

- the processing of bus commands,
- the generation of the relay output signals,
- the evaluation of the feedback via the digital inputs and
- the generation of signals which are transmitted back to the bus.

Setting the parameters is described in the bus-specific software description (e.g. AS-Interface Functions).

Example: Function

MFI21-FBP, reversing starter, used with Siemens S7

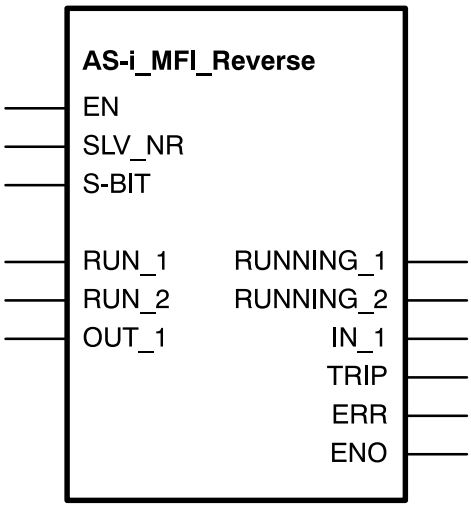


Fig. 15: Function AS-i_MFI_Reverse

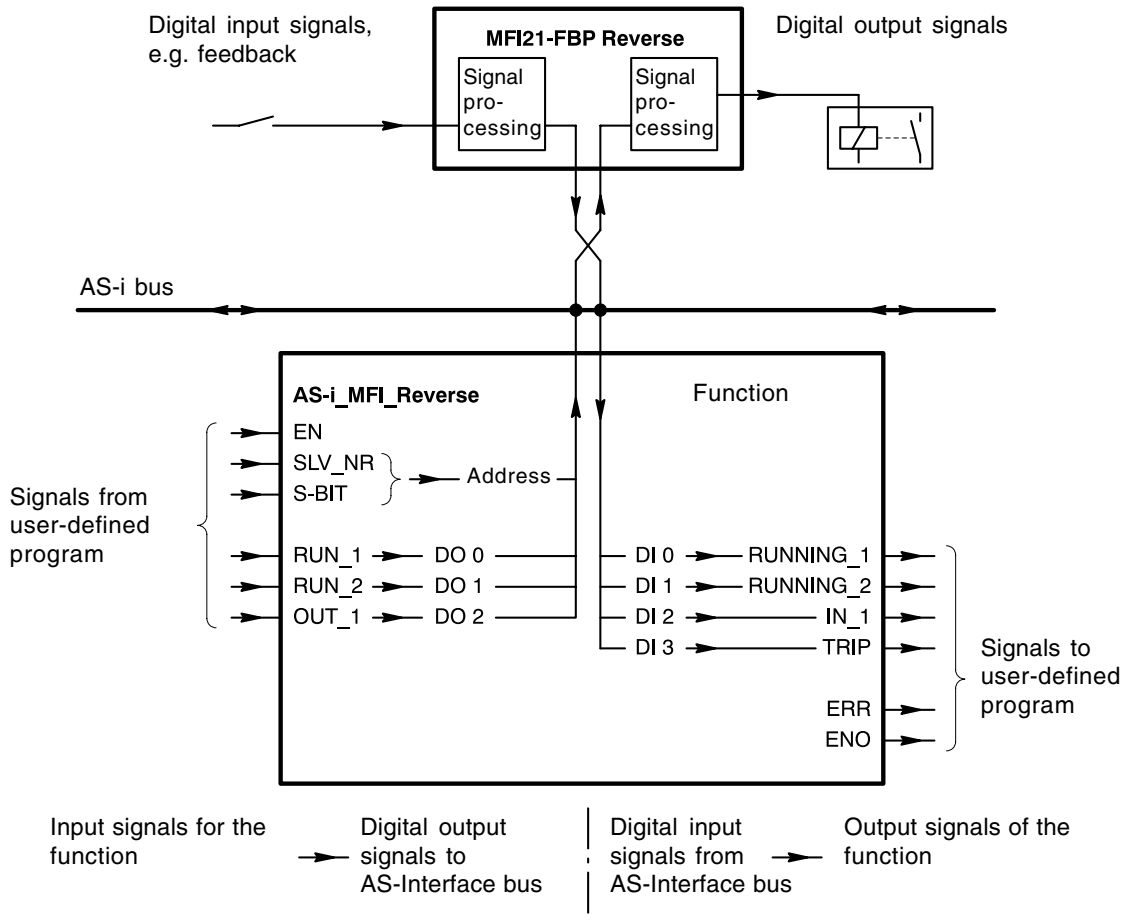


Fig. 16: Function AS-i_MFI_Reverse integrated in a user-defined program

Description

MFI21-FBP, reversing starter, used with Siemens S7

Meanings of the inputs and outputs of the function:

EN	General release for the block (usage not mandatory)
SLV_NR	Slave number 1...31
S-BIT	Slave A or Slave B. 0 = standard or Slave A, 1 = Slave B
RUN_1	Start = 1 / stop = 0 for rotational direction 1
RUN_2	Start = 1 / stop = 0 for rotational direction 2
OUT_1	Free output, can be used for any output signal
RUNNING_1	Input signal (feedback), rotational direction 1
RUNNING_2	Input signal (feedback), rotational direction 2
IN_1	Free input, can be used for any input signal
TRIP	Input signal, motor protecting switch MS325 has tripped or was manually switched off
ERR	Error: Value for SLV_NR is not in the range of 1...31. (The signal is generated in the FC, it is not transmitted via the bus).
ENO	Block was edited (usage not mandatory).

The MFI21 can only be used together with the motor protecting switch MS 325.
All three outputs RUN_1, RUN_2 and OUT_1 are simultaneously switched off, if the motor protecting switch MS 325 trips or is manually switched off.

This block is designed for reversing drives (right/left, up/down, forwards/backwards, etc.). The rotational directions are mutually locked, i.e. if one direction is switched on, the other direction is locked. When the direction is changed, one direction must be first switched off before the other direction can be switched on.

If both directions are switched on at the same time, an error message appears.

Resetting the 1st direction and setting the 2nd direction can be executed within the same PLC cycle. The only assumption is that the reset command is placed **before** the set command in the PLC program.

The change of the direction is executed with a time delay. This delay is at least 50 ms, if the potentiometer is fully turned to the left stop. Otherwise the actual value set with the potentiometer on the MFI is valid.

The dependence between the potentiometer setting and the time delay calculates from a square function. The maximum value is 260 seconds.

This block monitors whether the feedback signal "RUNNING_1 / _2" arrives within a checkout time of 50 ms after the control signal "RUN_1 / _2" was output.

If an error trip event occurred, both control signals "RUN_1 / _2" must be first set to zero before a new switching event can be initiated after the error was cleared.

The inputs and outputs "IN_1" and "OUT_1" are not monitored; they can be used independent from the other in- and outputs.

Please refer to the software documentation for a full description of the functions.

Manual No. 2CDC 191 002 D0203

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