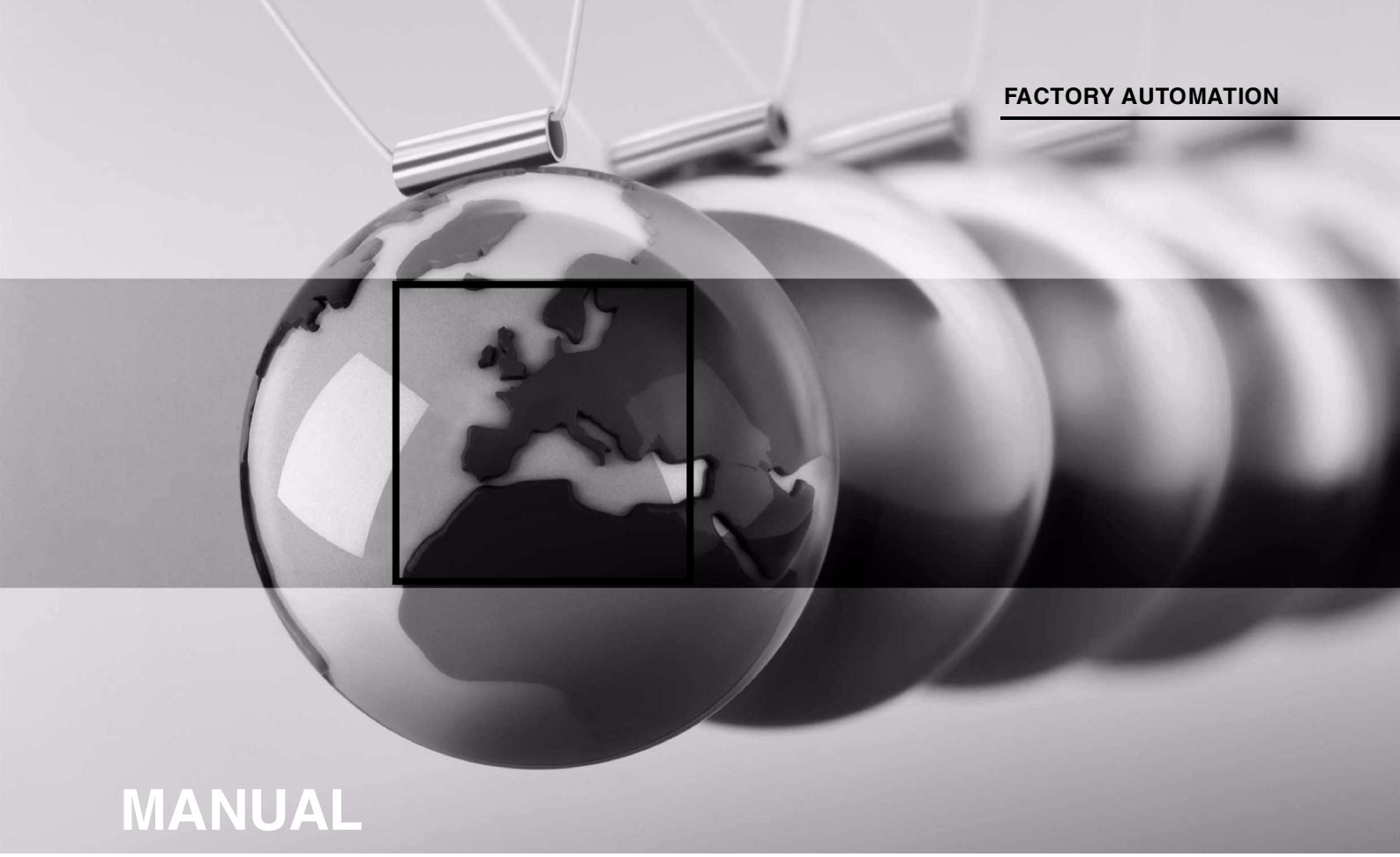
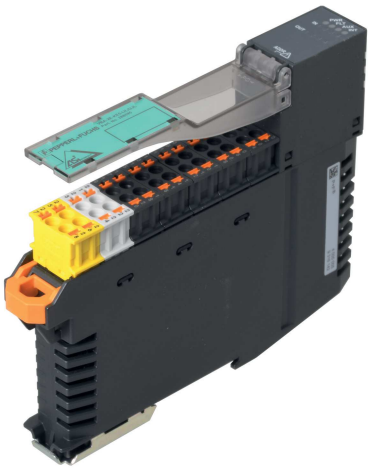


MANUAL

VBA-2E-KE5-IJL/UJL

AS-Interface Analog Module



A/D Spec 2.1

CE

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With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

1 Introduction

1.1 Content of this Document

This document contains information required to use the product in the relevant phases of the product life cycle. This may include information on the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal

Note!

For full information on the product, refer to the further documentation on the Internet at www.pepperl-fuchs.com.

The documentation comprises the following parts:

- This document
- Datasheet

In addition, the documentation may comprise the following parts, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Instruction manual
- Other documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

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1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:

Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

Informative Symbols

Note!

This symbol brings important information to your attention.

Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

2 Certificates and Approvals

2.1 UL Information

Technical Data and Environmental Conditions

This device is for indoor use only.

This device may be operated in altitudes up to 2000 m.

The ambient temperature range is from -25 °C to +70 °C.

The device must be installed in accordance with applicable national laws and regulations.

If the device is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

The device must be installed in a switch cabinet or switch box that meets protection class IP54 as a minimum.

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3 Product Description

3.1 Intended Use

The VBA-2E-KE5-IJL/UJL is an analog module for connecting 0 V … 10 V or 0/4 mA … 20 mA sensors to the AS-Interface network. Data conversion and data transfer are provided asynchronously according to AS-Interface profile 7.3. The data is converted internally at a 16 bit resolution. The analog module features two analog inputs that can be used as either a current or a voltage input. The sensors are supplied with power via the AS-Interface or auxiliary voltage.

3.2 Displays and Operating Elements

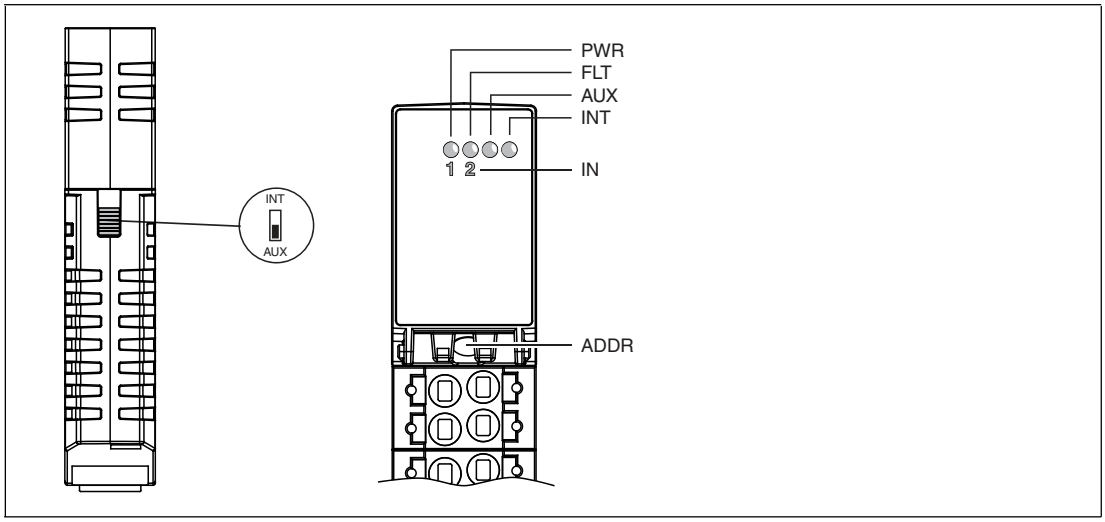

Figure 3.1 Displays and operating elements

The VBA-2E-KE5-IJL/UJL analog module is equipped with the following indicators and operating elements:

LED Indicators

Description	Function
FAULT LED	Fault indication; LED red red: communication fault or address is 0 red, flashing: peripheral fault
INT LED	Internal input voltage active; green LED
PWR LED	AS-Interface voltage; LED green green: voltage OK green, flashing: address 0 or peripheral fault
AUX LED	Ext. auxiliary voltage U_{AUX}; dual green/red LED green: voltage OK red: voltage reversed
IN1 LED IN2 LED	Status of input signal; yellow LED Yellow: input value within measuring range (see note below) Flashing yellow: wire break or input value outside of measuring range Off: channel deactivated

Note!

The IN LED lights up continuously if the corresponding input is configured as a current input. For inputs in voltage mode, the corresponding IN LED flashes, going out briefly and then illuminating for a longer period. See chapter 7.

Switch

Description	Function
INT/AUX switch	Set to INT: inputs powered via the AS-Interface (max. 100 mA) Set to AUX: inputs powered via auxiliary voltage (max. 600 mA)

Warning!

Only use the switch when de-energized

Only adjust the INT/AUX switch if the module is not supplied via the AS-Interface (INT) or the auxiliary voltage (AUX)!

3.3 Connections

Figure 3.2

The analog module has the following connections:

Name	Description
ADDR	Addressing socket, extra-low-voltage switch socket, Ø 1.3 mm
IU+1/IU-1 IU+2/IU-2	Voltage at analog inputs
II1 II2	Current at analog inputs
L+	Sensor supply
GND	Reference potential of inputs + sensors
1CH	Jumper to the input configuration
ASI+ ASI-	AS-Interface; both ASI+ terminals and both ASI- terminals are bridged in the terminal block.
AUX+ AUX-	Auxiliary voltage; both AUX+ terminals and both AUX- terminals are bridged in the terminal block.

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Note!

Switching Off the Second Channel

Figure 3.3 Jumper for switching off input channel 2

Input channel 2 can be deactivated using a jumper between the GND and 1CH connections or using parameter P1. The jumper has priority. If no jumper is set and P1 = 1, then both channels are active.

3.4 Automatic Detection of the Sensor Type

Each of the two input channels can be operated either as a current or a voltage input. The analog input module automatically detects the type of sensor connected. 0 V … 10 V or 0/4 … 20 mA measurement sensors can be connected as sensor types. The automatic detection process occurs after the device is switched on. The detected sensor type is saved in the non-volatile memory and reactivated when the device is switched on again.

The valid signal values that ensure unambiguous detection of the type of sensor connected are:

- Voltage: 1 ... 11.5 V
- Current: 1 ... 23 mA

If the module cannot clearly establish which sensor type is connected, the last detected sensor type is provisionally activated. For example, the module may not detect which sensor type is connected if the signal values are not within the specified thresholds or if two different sensor types are simultaneously applied to one channel.

A specific sensor type is finally activated when the signal values measured are within the specified thresholds.

3.5 Resetting the Automatically Detected Sensor Types

Any sensor types saved through automatic detection are reset when the input configuration of the module is manually changed. For this, there are two available options:

1. Switch off the module power supply. Place or remove the jumper between 1CH and GND, then switch on the supply voltage again.
2. Change the status of parameter P1 or P3 (see chapter 5.3). In this case, it is not necessary to switch the supply voltage off and on.

Repeat this process if necessary to return to the required input configuration.

Note!

Any change made to the input configuration via a jumper between 1CH and GND is only detected once the supply voltage is switched on. Changes made via parameter P1 and P3 can also be implemented during ongoing operation. See chapter 5.3.

Do not connect the 1CH and GND connections to external potentials. The length of the jumpers must not exceed 5 cm.

Note!

If you connect two different sensor types to one channel simultaneously, fault-free operation is not guaranteed. The module will not be damaged by this.

4 Installation

4.1 Storage and Transport

For storage and transport purposes, package the unit using shockproof packaging material and protect it against moisture. The best method of protection is to package the unit using the original packaging. Furthermore, ensure that the ambient conditions are within allowable range.

4.2 Unpacking

Check the product for damage while unpacking. In the event of damage to the product, inform the post office or parcel service and notify the supplier.

Retain the original packaging in case the device must be stored or shipped again at a later date.

Should you have any questions, please contact Pepperl+Fuchs.

4.3 Mounting

Mount the module by snapping it onto a 35 mm DIN rail in compliance with EN 50022.

Unlocking Terminal Blocks

Proceed as follows to unlock and eject terminal blocks:

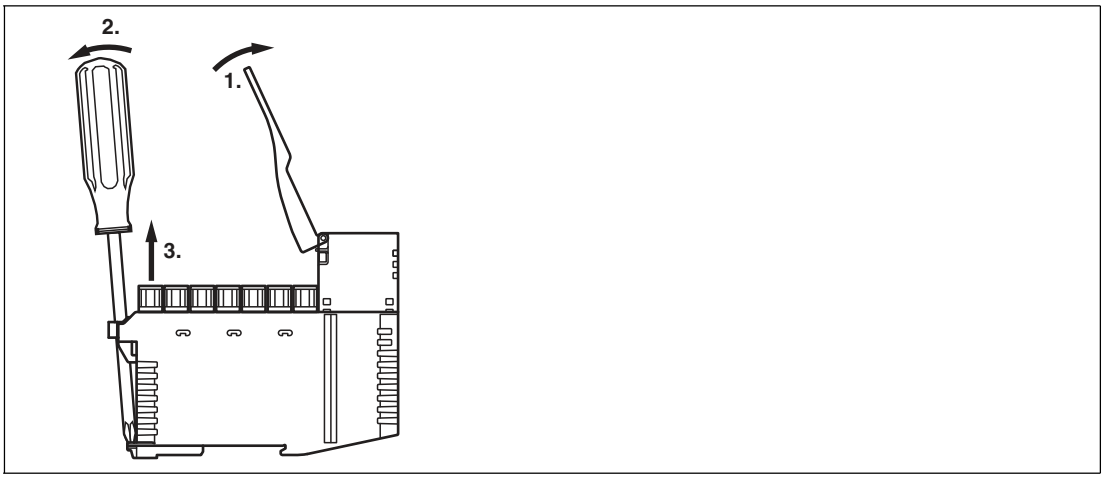

Figure 4.1 Unlocking terminals

1. Lift the label carrier upwards.
2. Guide a suitable screwdriver through the eye on the ejector and then:
   - Insert the blade of the screwdriver on the bottom of the foot bolt.
   - Then pull on the handle of the screwdriver in the direction indicated.
3. Remove the terminal block.

4.4 Connecting AS-Interface/Auxiliary Voltage

2 terminals each are avilable for ASI+, ASI-, AUX+ and AUX- in order to ease the looping of these lines. Each of these terminal pairs is bridged in the terminal block. This is why the connection remains intact even though the terminal block has been separated from the module.

Warning!

Note the permitted operating temperature

The permitted operating temperature of the cables connected to the terminal block must be at least +80 ° C!

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4.5 Connecting the Sensors

You can connect 2-, 3-, and 4-wire sensors to the VBA-2E-KE5-IJL/UJL. For various connection options, see → see Figure 4.2 on page 11 and → see Figure 4.3 on page 11.

The sensors are supplied via the AS-Interface or auxiliary voltage (AUX)

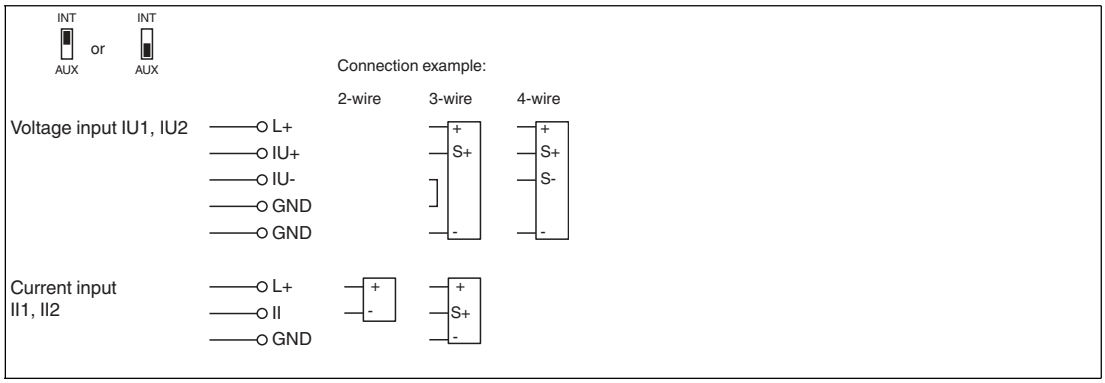

Figure 4.2 Connection of the sensors for sensor supply via the module

Sensor Supply from External PELV EXT Voltage Source

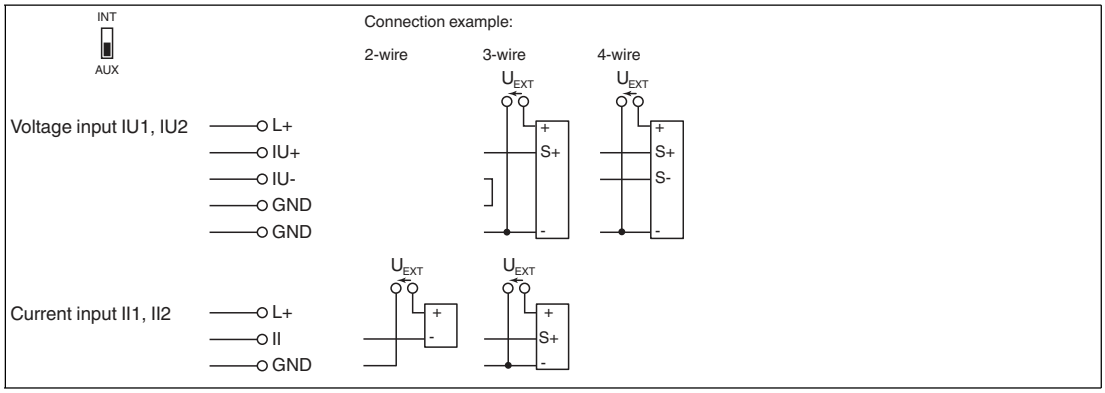

Figure 4.3 Connection of the sensors for sensor supply from external PELV voltage source

Note!

Where the sensor is supplied by an external PELV voltage source (EXT), U_{EXT} should have equal reference potential to the auxiliary voltage (AUX).

Note!

In order to obtain a sound measurement result, the difference in voltage between IU and GND must not exceed 2 V.

Warning!

Note the permitted operating temperature

The permitted operating temperature of the cables connected to the terminal block must be at least +80 °C!

5 Commissioning

5.1 Assigning an Address to the Module

To operate the VBA-2E-KE5-IJL/UJL within an AS-Interface network, a suitable address must be assigned to the AS-Interface slave. The AS-Interface VBP-HH1-V3.0 handheld programming device by Pepperl+Fuchs, for example, or an AS-Interface master can be used to assign addresses.

The VBA-2E-KE5-IJL/UJL is a standard slave as defined by specification 3.0 and requires a master that meets specification 2.1 or higher. You can assign addresses 1 to 31. The default address on delivery is 0.

5.2 Slave Profile

The VBA-2E-KE5-IJL/UJL has the profile

S-7.3.D

I/O	=	7
ID	=	3
ID1	=	F (programmable)
ID2	=	D

The data value is transmitted as defined by AS-Interface profile 7.3.

5.3 Parameterization

The following parameters can be set for the VBA-2E-KE5-IJL/UJL. Program the parameters using an AS-Interface master, with the VAZ-SW-ACT32 AS-i Control Tools from Pepperl+Fuchs, or with the VBP-HH1-V3.0 handheld device.

Parameter P0: 50/60 Hz Filter

Default value P0=1, active

With parameter P0, you activate the filter for 50/60 Hz line frequencies. With an activated filter, line frequency interference is suppressed. In this case, the conversion time is extended (see chapter 7.2).

Parameter P1: Second Channel

Default value P1=1, active

Parameter P1 is used to switch the second measurement channel on or off. If the second channel is switched off, this can considerably reduce the conversion time in the module. (see chapter 7.2)

Alternatively, you can control the second channel via a jumper between terminals 1CH and GND. (see chapter 3.3)

Note!

The jumper between terminals 1CH and GND overrides parameter P1.

Parameter P2: Peripheral Fault

Default value P2=1, active

Parameter P2 is used to switch notification of a peripheral fault in the event of a measuring overrange on or off (see chapter 7). If messages are activated, the PWR LED and FAULT LED flash in the event of a peripheral fault, and a message is sent to the master.

A peripheral fault is always output independently of parameter P2, if:

- The power supply is overloaded.
- The external power supply is not available when the INT/AUX switch = AUX.

Parameter P3: Current input 0 ... 20 mA

Default value P3=1, not active

Parameter P3=0 is used to set both input channels to current mode. Wire break detection is simultaneously deactivated. (see chapter 7.1)

6 Troubleshooting

6.1 Causes and Elimination of a Peripheral Fault

A peripheral fault (P fault) is indicated by the PWR LED and the FAULT LED flashing alternately. There are various causes of and solutions for correcting peripheral faults.

Cause	Solution
Sensor supply overload	■ Check sensor supply for short circuit
Data outside the measuring range	■ Check connected sensors for wire break/short circuit
Wrong sensor type configured	■ A different sensor type has already been configured through automatic detection of sensor type. To reset the sensor configuration, see see chapter 3.5
Auxiliary voltage too low (switch set to AUX)	■ Check the auxiliary voltage

6.2 Cause and Elimination of a Channel Fault

If channel 2 is not transferred and LED IN2 is not illuminated, channel 2 is not activated.

Cause	Solution
Jumper is inserted between 1CH and GND	■ Remove the jumper, then reset the power supply (see chapter 3.3)
Parameter P1=0	■ Change parameter P1 (see chapter 5.3)

6.3 Cause and Elimination of a Sensor Fault

If connected sensors are not recognized or no meaningful data is delivered, this could have been caused by the issues below.

Cause	Solution
Voltage sensor connected to current input (II1, II2)	■ Check the connection of the sensors. See chapter 3.3 and see chapter 4.5
Current sensor connected to voltage input (IU1, IU2)	
Both sensors connected to the same input channel (IU1 and II1 or IU2 and II2)	
Wrong sensor type configured	■ A different sensor type has already been configured through automatic detection of sensor type. To reset the sensor configuration, see see chapter 3.5

If none of these potential solutions correct the fault, please contact Pepperl+Fuchs.

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7 Appendix

7.1 Analog Input Module Measuring Ranges

Current Input Measuring Ranges

The measuring range of the current input can be set via AS-Interface parameter P3:

- P3=1, nominal range 4 mA ... 20 mA
- P3=0, nominal range 0 mA ... 20 mA

Current: 4 mA ... 20 mA

Input signal [mA]	Display on the master	Input LED	
> 23	32767		Above threshold (peripheral fault)
20.001 ... 23	20001 ... 23000	On	Extended range [1)]
4 ... 20	**4000 ... 20000**	**On**	**Nominal range**
1 ... 3999	1000 ... 3999	On	Extended range [1]
< 1	32767		Below threshold (peripheral fault)

Table 7.1 Measuring range 1 mA ... 23 mA

1.Measurement accuracy corresponds to the nominal range

Current: 0 mA ... 20 mA

Input signal [mA]	Display on the master	Input LED	
> 23	32767		Above threshold (peripheral fault)
20.001 ... 23	20001 ... 23000	On	Extended range [1]
0 ... 20	**0000 ... 20000**	**On**	**Nominal range**
< 0	0000	On	Below threshold

Table 7.2 Measuring range 0 mA ... 23 mA

1.Measurement accuracy corresponds to the nominal range

Caution!

Maximum input current

At input currents > 80 mA, fault-free operation of all inputs is not guaranteed.

Voltage Input Measurement Ranges

Voltage: 0 V ... 10 V

Input signal [V]	Display on the master	Input LED	
> 11.5	32767		Above threshold (peripheral fault)
10.001 ... 11.5	10001 ... 11500		Extended range [1]
0 ... 10	**0000 ... 10000**		**Nominal range**
< 0	0000		Below threshold

Table 7.3 Measurement range 0 V ... 11.5 V

1.Measurement accuracy corresponds to the nominal range

Caution!

Maximum input voltage

The input voltage at the voltage input must not exceed 50 V.

7.2 Delay Times

The analog input module requires a certain amount of time to convert and transmit the analog measuring signals to the AS-Interface master. This time span is mainly composed of the conversion time and the transmission time. The conversion time and transmission time depend on a number of factors.

Latency

Latency = delay of a signal under worst case conditions.

The analog-to-digital conversion in the analog module and the transmission via AS-Interface is not in sync. In the worst case, the transmission of a channel via AS-Interface starts just before the conversion of this channel is completed within the module. This gives rise to two scenarios:

1. The conversion time is longer than the transmission time

   Latency = Conversion time + Transmission time * (Number of channels +1)

2. The conversion time is shorter than the transmission time

   Latency = Conversion time * (Number of channels +1) + Transmission time

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1st

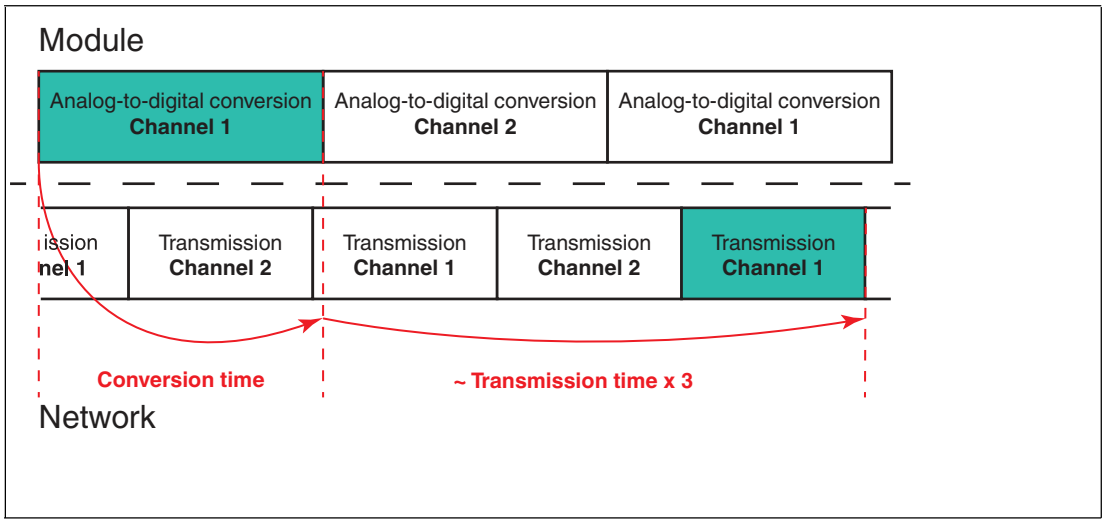

Figure 7.1 Conversion time > Transmission time

2nd

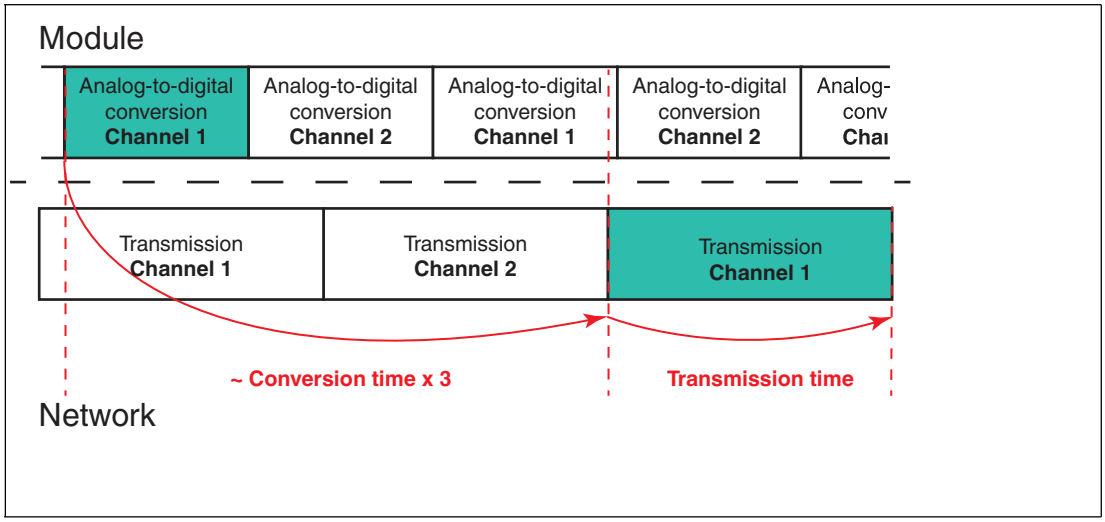

Figure 7.2 Conversion time < Transmission time

Conversion time

The conversion time is the time that the module requires to convert an analog signal into a digital value. The conversion time depends heavily on parameter P0

50/60 Hz filter inactive (P0=0)	10 ms
50/60 Hz filter active (P0=1)	70 ms

Table 7.4

Transmission time

The transmission time is based on the AS-Interface specification. The AS-Interface transmits data in 4-bit packets. At values greater than 4 bits, the quantity of data is divided into smaller values and then transmitted to a com unit over several cycles. If several channels are transmitted per slave, the number of cycles increases. The transmission time is the time required to fully transmit a digital data volume to the com unit. In the profile 7.3, seven frames are required per channel.

The duration of a cycle depends on the number of occupied addresses in the AS-interface network. An address is considered occupied if one of the following configurations apply:

- A standard address is assigned (e. g. **1**)
- An A- or B-Address is assigned (e. g. **1A** or **1B**)
- An A- and a B-Address are assigned (e. g. **1A** and **1B**)

When calculating the cycle time, each of these configurations assumed to be **one** occupied address.

Cycle time = 150µs * ([Number of occupied addresses] +2)

The transmission time is 7 cycles:

Transmission time = 150µs * ([Number of occupied addresses] +2) * 7

Example:

In a network, the addresses of 1A, 1B, 2A and 3 are assigned. For the calculation of the transmission time this corresponds to 3 occupied addresses. Thus we have:

Transmission time = 150µs * (**3** +2) * 7 = 5,25 ms

- 4 occupied addresses: Transmission time = 6,3 ms
- 31 occupied addresses: Transmission time = 35 ms

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