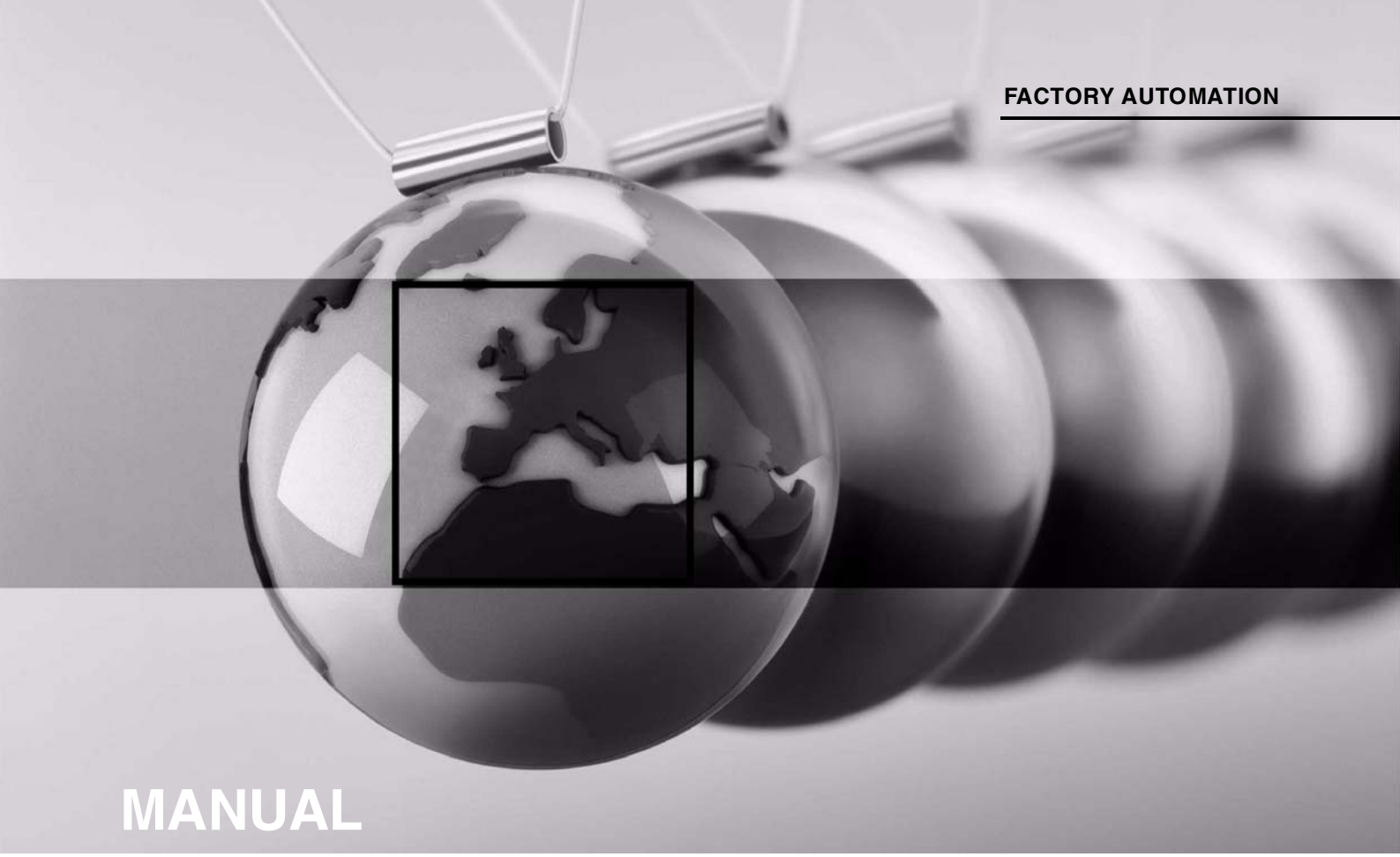

# MANUAL

# VBA-4E-G11-I-F

## AS-Interface analog module

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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

## Congratulations

You have chosen a device manufactured by Pepperl+Fuchs. Pepperl+Fuchs develops, produces and distributes electronic sensors and interface modules for the market of automation technology on a worldwide scale.

Before you install this device and put it into operation, please read the operating instructions thoroughly. The instructions and notes contained in this operating manual will guide you step-by-step through the installation and commissioning procedures to ensure trouble-free use of this product. By doing so, you:

- guarantee safe operation of the device
- can utilize the entire range of device functions
- avoid faulty operation and associated errors
- reduce costs from downtimes and incidental repairs
- increase the effectiveness and operating efficiency of your plant.

Store this operating manual somewhere safe in order to have it available for future work on the device.

After opening the packaging, please ensure that the device is intact and that the package is complete.

## Symbols used

The following symbols are used in this manual:

***Note!***

This symbol draws your attention to important information.

Handling instructions

You will find handling instructions beside this symbol

## Contact

If you have any questions about the device, its functions, or accessories, please contact us at:

Pepperl+Fuchs GmbH
Lilienthalstraße 200
68307 Mannheim
Telephone: +49 621 776-4411
Fax: +49 621 776-274411
E-Mail: fa-info@pepperl-fuchs.com

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# 2 Declaration of Conformity

All products were developed and manufactured under observance of the applicable European standards and guidelines.

***Note!***

A Declaration of Conformity can be requested from the manufacturer.

The product manufacturer, Pepperl+Fuchs GmbH, 68307 Mannheim, has a certified quality assurance system that conforms to ISO 9001.

ISO**9001**

# 3 Safety

## 3.1 Symbols relevant to safety


***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 devices and any connected facilities or systems, or result in their complete failure.

## 3.2 Intended Use

The VBA-4E-G11-I-F is an analog module for connecting up to four 0/4 mA ... 20 mA measurement sensors to the AS-Interface network. Measured values are converted and data transmitted asynchronously as defined by AS-Interface profile 7.3. The measured values are converted internally at a resolution of 16 bits. The analog module features four analog current inputs. The measurement sensors are powered either by the AS-Interface or by the auxiliary power source.

Read through these instructions thoroughly. Familiarize yourself with the device before installing, mounting, or operating.

Always operate the device as described in these instructions to ensure that the device and connected systems function correctly. The protection of operating personnel and plant is only guaranteed if the device is operated in accordance with its intended use.

## 3.3 General Safety Instructions

Only instructed specialist staff may operate the device in accordance with the operating manual.

User modification and or repair are dangerous and will void the warranty and exclude the manufacturer from any liability. If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, return the device to your local Pepperl+Fuchs representative or sales office.

The connection of the device and maintenance work when live may only be carried out by a qualified electrical specialist.

The operating company bears responsibility for observing locally applicable safety regulations.

Store the not used device in the original packaging. This offers the device optimal protection against impact and moisture.

Ensure that the ambient conditions comply with regulations.

***Note!***

***Disposal***

Electronic waste is hazardous waste. When disposing of the equipment, observe the current statutory requirements in the respective country of use, as well as local regulations.

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# 4 Product Description

## 4.1 Displays and Controls

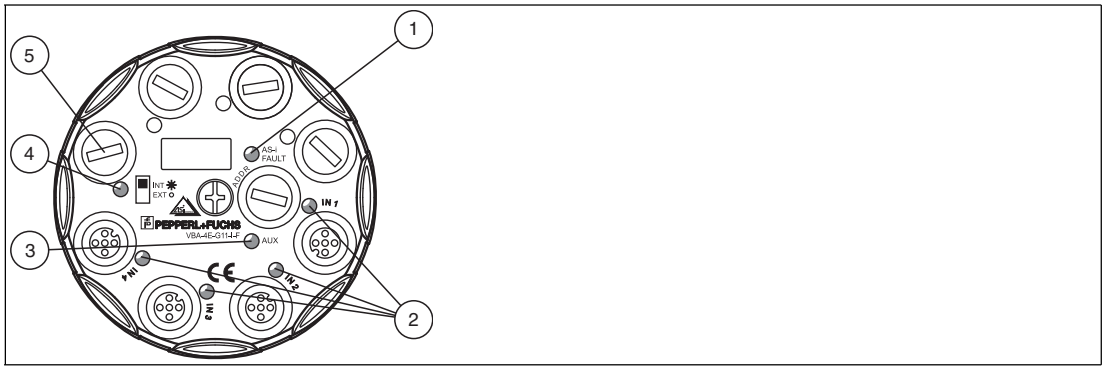



Figure 4.1 Indicators and operating means

The VBA-4E-G11-I-F analog module is equipped with the following displays and controls:

**LED Indicators**

| | | |
|---|---|---|
| ① | AS-i/FAULT LED | Status indication; multicolor LED<br>Green: normal mode<br>Red: communication error<br>Flashing yellow/red: address 0<br>Flashing green/red: peripheral fault |
| ② | IN1 LED<br>IN2 LED<br>IN3 LED<br>IN4 LED | Status of input signal; yellow LED<br>Off: not active<br>On: signal within measuring range<br>Flashing: signal outside measuring range |
| ③ | AUX LED | Ext. auxiliary power source ($U_{AUX}$); dual LED (green/red)<br>Green: voltage OK<br>Red: voltage reversed |
| ④ | INT/EXT LED | Status indication, input supply; green LED<br>Green: input supply from AS-Interface<br>Off: input supply from auxiliary power source |

**Switches**

| | | |
|---|---|---|
| ⑤ | INT/EXT switch | Set to INT: sensors powered via the AS-Interface (max. 140 mA)<br>Set to EXT: sensors powered via auxiliary power source (max. 600 mA) |

To reach the switch, remove the dust cover ⑤.

## 4.2 Connections

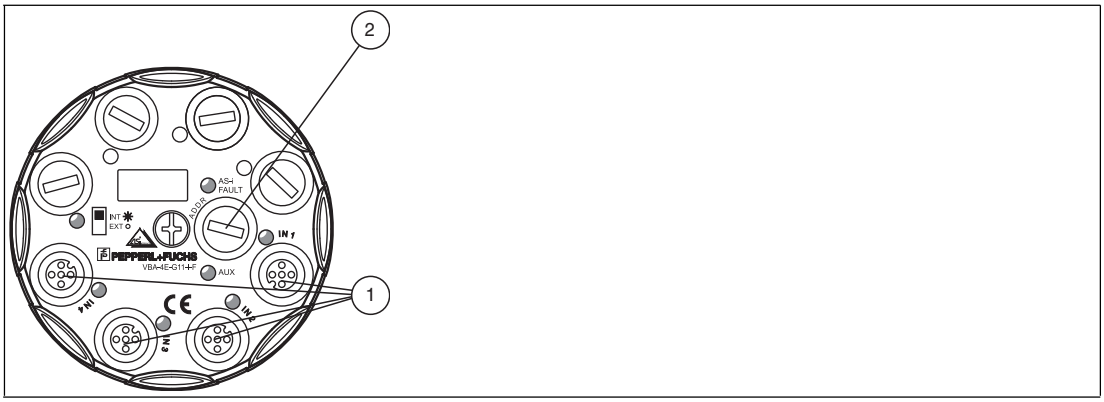



Figure 4.2 Connections

The VBA-4E-G11-I-F analog module is equipped with the following connections:

| | | |
|---|---|---|
| 1 | Current inputs |  5 : functional ground<br>M12 round plug connector |
| 2 | Addressing socket | Low voltage switch socket, ∅ 1.3 mm |

## 4.3 Activating the Input Channels

All input channels on the analog module are deactivated by default. This state is indicated by the four yellow LEDs IN1 to IN4 illuminating in sequence. Wire break detection is activated (parameter bit P3=1). The measuring range is between 4 mA and 20 mA.

### Activating an Input Channel

An input channel is activated if an input signal within a range of 1 mA to 23 mA is present. Any input channels activated remain active after the module is restarted.

### Resetting Activated Input Channels

In order to restore the module to its default status, set parameter bit P3 to P3=0 and then to P3=1. Alternatively, when switching on the module, a signal of < 1 mA must be present at all input channels for a period of 7 seconds.

***Note!***

Where wire break detection is deactivated (parameter bit P3=0), all four input channels are activated. The measuring range is between 0 mA and 20 mA.

# 5 Installation

## 5.1 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.

## 5.2 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 direct them to Pepperl+Fuchs.

## 5.3 Mounting

Align the device as required and secure to a flat mounting surface by screwing it in place with two M4 mounting screws. When the central screw is tightened, the functional ground of the M12 round plug connector connects with the metal insert in the mounting base. Ensure that this metal insert is connected with the protective ground via the mounting screws. The mounting screws are not included.

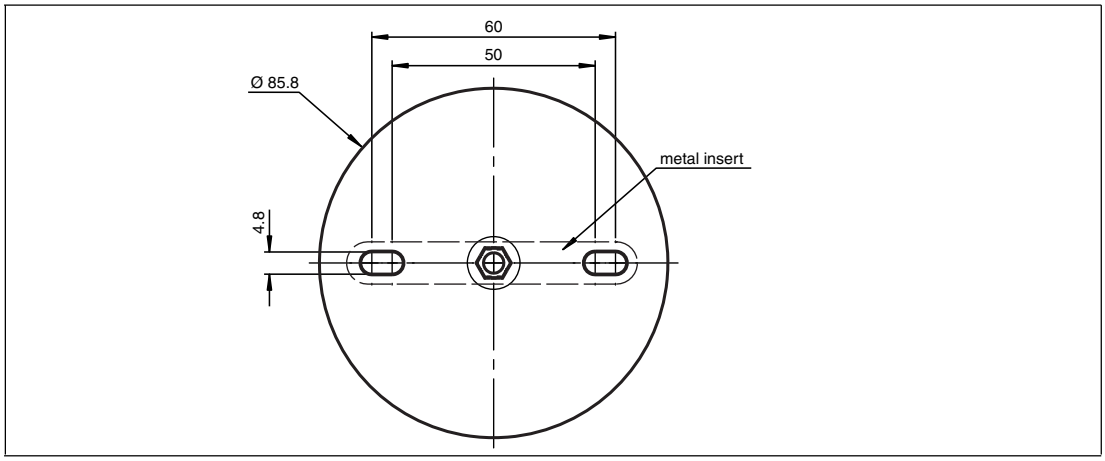



Figure 5.1

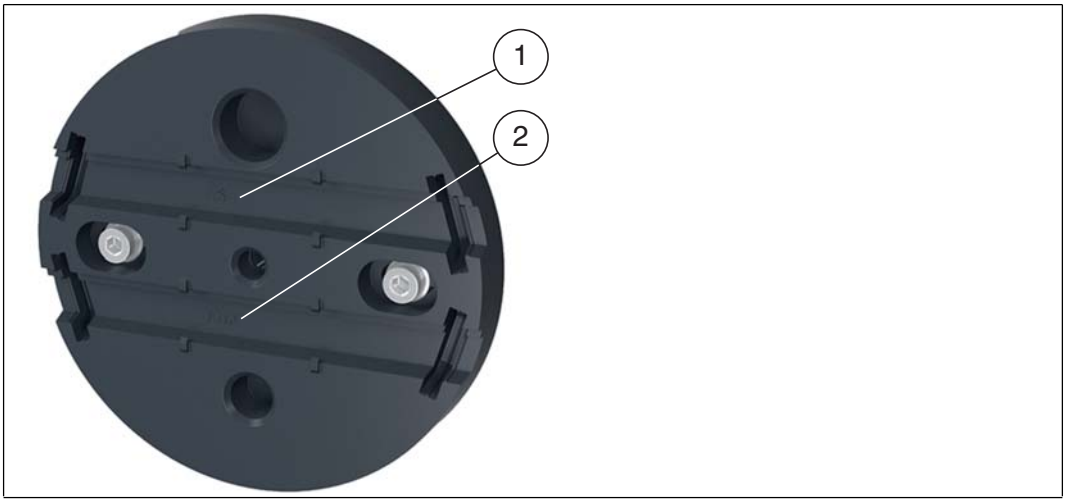
Screw a blind plug onto unused connections to ensure the relevant degree of protection. The recommended tightening torque for securing blind plugs is 0.4 Nm.

## 5.4 Connecting the AS-Interface

The module is connected to the AS-Interface network via the yellow flat cable. The external auxiliary power source $U_{AUX}$ is connected to the module via the black flat cable where required.

### Connecting to the AS-Interface

1. Open the module by unscrewing the central screw.
2. Place the yellow flat cable in the channel labeled AS-i.
3. If the module is to be powered via an external auxiliary power source $U_{AUX}$, place the black flat cable in the channel labeled AUX. Set the INT/EXT switch to EXT.
   If the module is to be powered solely by the AS-Interface, place the flat cable seal (VAZ-FK-S-BK-SEAL) in the channel labeled AUX. The flat cable seal ensures compliance with the degree of protection.




1. AS-i channel (yellow flat cable)
2. AUX channel (black flat cable)

3. Ensure the flat cable is positioned correctly.
4. Reattach the upper part of the module.
5. Tighten the central screw. The recommended tightening torque for this screw is 1.8 Nm.

   ↳ The AUX LED and the AS-i/FAULT LED light up green when the module is connected to the AS-Interface and the external auxiliary power source $U_{AUX}$.

## 5.5 Connecting the Sensors

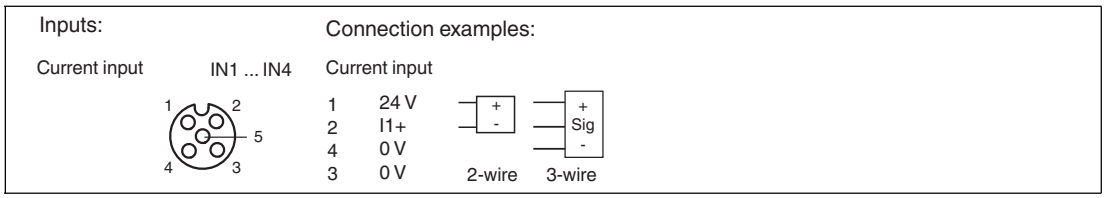



Figure 5.2

You can connect 2- and 3-wire sensors to the VBA-4E-G11-I-F. For various connection options, → see Figure 5.2 on page 11.

***Note!***

***Connection Instructions***

Use shielded cables to connect the sensors.

***Note!***

Pin 5 of the M12 round plug connector is the functional ground. When the central screw is tightened, pin 5 connects with the metal insert in the mounting base. see chapter 5.3. This metal insert then makes contact with the mounting surface via the mounting screws.

# 6 Commissioning

## 6.1 Assigning an Address to the Module

To operate the VBA-4E-G11-I-F within an AS-Interface network, a suitable address must be assigned to the AS-Interface slave. The AS-Interface VBP-HH1-V3.0 handheld device by Pepperl+Fuchs or an AS-Interface master can be used to assign addresses.

The VBA-4E-G11-I-F 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.

## 6.2 Slave Profile

The VBA-4E-G11-I-F has the profile

**S-7.3.E**

| | | |
|---|---|---|
| I/O | = | 7 |
| ID | = | 3 |
| ID1 | = | F (programmable) |
| ID2 | = | E |

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

## 6.3 Parameterization

The following parameters can be set for the VBA-4E-G11-I-F. 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 power frequencies. With an activated filter, power frequency interference is suppressed. In this case, the conversion time is extended (see chapter 9.2).

### Parameter P1: Not Used

### 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 9). If notifications are activated, the AS-i/FAULT LED flashes in the event of a peripheral fault, and a notification is sent to the master.

A peripheral fault is always reported if:

- The power supply is overloaded.
- The external power supply is not available when the INT/EXT switch = EXT.
- No channel is activated.  see chapter 4.3.

### Parameter P3: Wire Break Detection

Default value P3=1, active

Parameter P3 is used to switch wire break detection on or off at the input channels. Where wire break detection is activated, automatic channel detection is also activated (see chapter 4.3). The measuring range is between 4 mA and 20 mA.

Parameter P3=0 is used to switch off wire break detection. All four input channels are then active. The measuring range is between 0 mA and 20 mA.

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# 7 Troubleshooting

## 7.1 Causes and Elimination of Peripheral Faults

A peripheral fault (P fault) is indicated by the color and flashing of the AS-i/FAULT LED. There are various causes of and solutions for correcting peripheral faults.

| Cause | Solution |
|---|---|
| Sensor supply overload | ■ Check sensor supply for short circuit |
| Measured values outside the measuring range | ■ Check the connected measurement sensors for wire break/short circuit |
| Auxiliary power too low (switch set to EXT) | ■ Check the auxiliary power source |
| No input channel activated | Activate input channel (see chapter 4.3) |

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

# 8 Appendix A

## 8.1 Dimensions

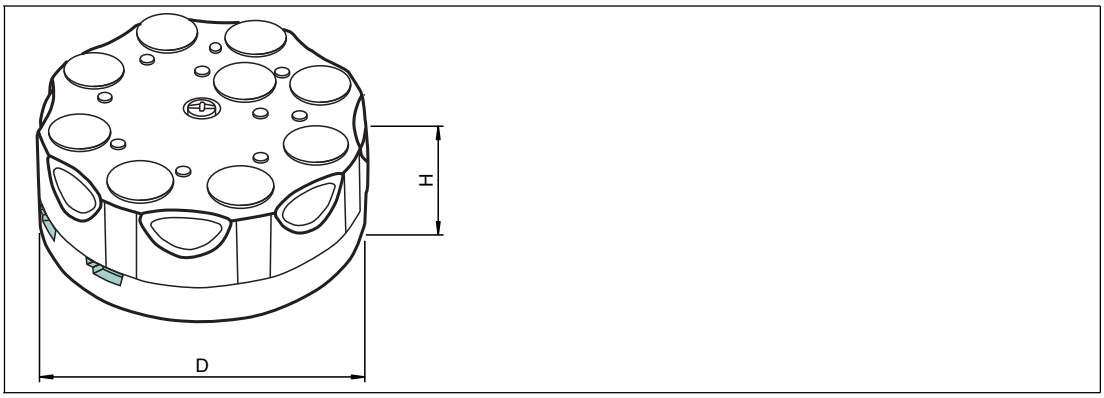


Figure 8.1

| Type | D | H |
|---|---|---|
| VBA-4E-G11-I-F | 85 mm | 35 mm |

## 8.2 Technical Data

**General specifications**

| | |
|---|---|
| Slave type | Standard slave |
| AS-Interface specification | V3.0 |
| Required master specification | ≥ V2.1 |
| UL File Number | E87056 |

**Indicators/operating means**

| | |
|---|---|
| LED AS-i/FAULT | Status display; multi-colour LED<br>Green: normal operation<br>Red: communication fault<br>Flashing yellow/red: address 0<br>Flashing green/red: peripheral fault |
| LED ANALOG | status of input signal; LED yellow<br>off: not active<br>on: signal within measurement range<br>flashing: signal outside of measurement range |
| LED AUX | ext. auxiliary voltage $U_{AUX}$; dual LED green/red<br>green: voltage OK<br>red: reverse voltage |
| LED INT/EXT | status display input supply; LED green<br>green: input supply from AS-Interface<br>off: input supply from auxiliary voltage |

**Electrical specifications**

| | |
|---|---|
| Auxiliary voltage (output) | 20 ... 30 V DC PELV |
| Rated operational voltage | 26.5 ... 31.6 V from AS-Interface |
| Rated operational current | ≤ 60 mA (without sensors) / max. 200 mA |
| Protection class | III |
| Surge protection | $U_{AUX}$, $U_{in}$: Over voltage category III, safe isolated power supplies (PELV) |

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### Input

| | |
|---|---|
| Number/Type | Four analog inputs<br>Current: 0 mA ... 20 mA/4 mA ... 20 mA |
| Supply | from AS-Interface (switch position INT, basic setting) or auxiliary voltage $U_{EXT}$ (switch position EXT) |
| Current loading capacity | ≤ 140 mA from AS-Interface; overload and short-circuit resistant<br>≤ 600 mA from external auxiliary voltage $U_{AUX}$ , overload and short-circuit protected |
| Input resistance | Max. 70 Ω |
| Accuracy | 0.1% of end value |
| Resolution | 16 bits |
| Temperature influence | 0.0025%/K from input signal range |

### Programming instructions

| | |
|---|---|
| Profile | S-7.3.E |
| IO code | 7 |
| ID code | 3 |
| ID2 code | E |
| Data bits (function via AS-Interface) | The transfer of the data value is based on AS-Interface Profile 7.3. |
| Parameter bits (programmable via AS-i) | function |
| P0 | 50/60 Hz filter<br>P0=1, enabled<br>P0=0, disabled |
| P1 | Not used |
| P2 | Indication of the peripheral fault by exceeding measuring range<br>P2=1, peripheral fault is reported<br>P2=0, peripheral fault is not reported |
| P3 | P3=1, wire break detection active, automatic channel detection (at > 1 mA)<br>P3=0, wire break detection deactivated, all four channels active |

### Compliance with standards and directives

| | |
|---|---|
| Directive conformity | |
| EMC Directive 2004/108/EC | EN 50295:1999 |
| Standard conformity | |
| Noise immunity | EN 61000-6-2:2005, EN 61326-1:2006, IEC 62026-2:2008 |
| Emitted interference | EN 61000-6-4:2007 |
| Input | EN 61131-2:2007 |
| Protection degree | EN 60529:2000 |
| Fieldbus standard | EN 50295:1999, IEC 62026-2:2008 |

### Ambient conditions

| | |
|---|---|
| Ambient temperature | -25 ... 70 °C (-13 ... 158 °F) |
| Storage temperature | -25 ... 85 °C (-13 ... 185 °F) |

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**Mechanical specifications**

| | |
|---|---|
| Connection | AS-Interface/$U_{AUX}$: cable piercing method, flat cable yellow/flat cable black<br>Inputs: M12 round connector |
| Protection degree | IP68 / IP69K |
| Material | |
| Housing | PBT PC |
| Mounting screw | Stainless steel 1.4305 / AISI 303 |
| Mass | 200 g |
| Mounting | Mounting base |

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# 9 Appendix B

## 9.1 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 | Flashing[1)] | Above threshold (peripheral fault) |
| 20.001 ... 23 | 20001 ... 23000 | On | Extended range [2)] |
| **4 ... 20** | **4000 ... 20000** | **On** | **Nominal range** |
| 1 ... 3.999 | 1000 ... 3999 | On | Extended range [2)] |
| < 1 | 32767 | Flashing[1)] | Below threshold (peripheral fault) |

Table 9.1 Measuring range 1 mA ... 23 mA

[1)]: When channel is activated

[2)]: Measurement accuracy corresponds to the nominal range

**Current: 0 mA ... 20 mA**

| Input signal [mA] | Display on the master | Input LED | |
|---|---|---|---|
| > 23 | 32767 | Flashes | 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 9.2 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.

## 9.2 Delay Times

The VBA-4E-G11-I-F needs a certain amount of time to convert and transmit the analog measuring signals to the AS-Interface master. This time period (= latency) is mainly composed of the conversion time and the transmission time. The conversion time and the transfer time depend on several 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

**1st**

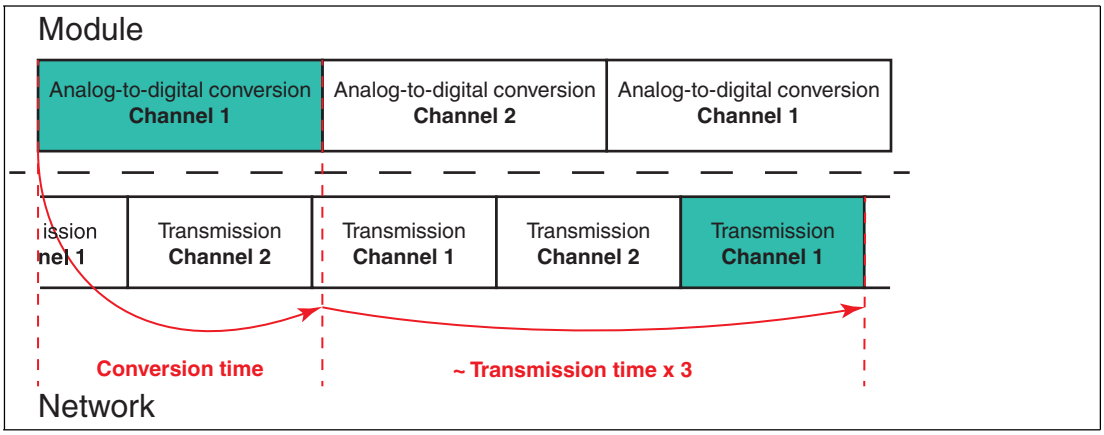


Figure 9.1 Conversion time > Transmission time

**2nd**

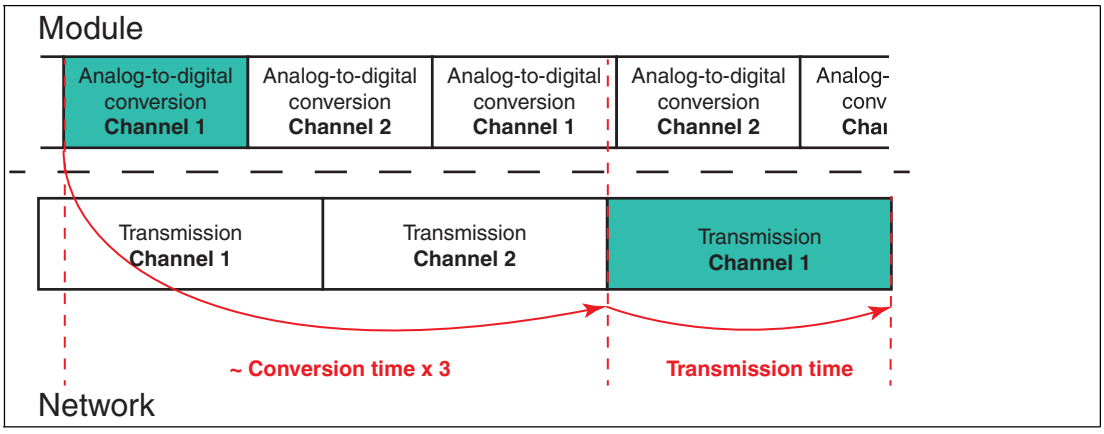


Figure 9.2 Conversion time < Transmission time

## 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 9.3

## 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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