

IB IL EX-IS AIO 4/EF-PAC

Intrinsically safe Inline analog I/O terminal for hazardous locations



Data sheet
2764_en_C

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1 Description

The IB IL EX-IS AIO 4/EF-PAC terminal is an intrinsically safe analog input/output module for sensor or actuator connection right into Zone 1 or 0. The terminal and accompanying intrinsically safe power supply (IB IL EX-IS PWR IN-PAC) is installed in Zone 2 or safe area.

The terminal provides four independently configurable analog channels for standard voltage and current signals.

2 Features

- Four single-ended analog signal inputs for the connection of either voltage or current signals
- Connection of sensors in 2- or 3-wire technology
- Two current measuring ranges:
0 mA to 20 mA, 4 mA to 20 mA
- Voltage measuring range: 0 V to 10 V
- Measured values can be represented in three different formats
- Mean-value generation of measured values
- Diagnostic indicators
- Communication via either process data or parameter channel (PCP)
- Channels are independently configurable
- Resolution up to 16-bits (depends on the representation format and the measuring range)
- -25... +60°C operating range
- Shield termination



This data sheet is only valid in association with the IB IL SYS PRO UM E user manual or the Inline system manual for your bus system.



Make sure you always use the latest documentation.
It can be downloaded at phoenixcontact.com.



This data sheet is valid for all products listed on the following page:

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3 Ordering data

Products

| Description | Type | Order No. | Pcs. / Pkt. |
|--|--------------------------|-----------|-------------|
| Terminal with four analog input channels; 500 kbps transmission speed; includes accessories (connectors and labeling fields) | IB IL EX-IS AIO 4/EF-PAC | 2869912 | 1 |

Documentation

| Description | Type | Order No. | Pcs. / Pkt. |
|--|--------------------|-----------|-------------|
| User manual: "Configuring and Installing the INTERBUS Inline Product Range" | IB IL SYS PRO UM E | 2743048 | 1 |
| User manual: "Automation Terminals of the Inline Product Range" | IL SYS INST UM E | 2698737 | 1 |

4 Technical data

General data

| | |
|--|--|
| Housing dimensions (width x height x depth) | 48.8 mm x 136.8 mm x 71.5 mm |
| Weight | 222 g (without connectors) |
| Operating mode | Process data mode with 5 words/1 word PCP |
| Transmission speed | 500 kbps |
| Connection method for sensors | 2- and 3-wire technology (shielded) |
| Permissible temperature (operation) | -25°C to +60°C |
| Permissible temperature (storage/transport) | -25°C to +85°C |
| Permissible humidity (operation/storage/transport) | 10% to 95%, according to DIN EN 61131-2 |
| Permissible air pressure (operation/storage/transport) | 70 kPa to 106 kPa (up to 3000 m above sea level) |
| Degree of protection | IP20 according to IEC 60529 |
| Protection class | Class 3 according to VDE 0106, IEC 60536 |
| Connection data for connector | |
| Connection method | Spring-cage terminals |
| Conductor cross section | 0.2 mm ² - 1.5 mm ² (solid or stranded), 24 - 16 AWG |

Interface

| | |
|-----------|--------------|
| Local bus | Data routing |
|-----------|--------------|

Power consumption

| | |
|---------------------------------|-------------------------------------|
| Communications power U_L | 5 V |
| Current consumption from U_L | 100 mA (typical)/120 mA (maximum) |
| I/O supply voltage U_{EX} | 28 V DC |
| Current consumption at U_{EX} | 90 mA (typical)/187 mA (maximum) |
| Total power consumption | 1500 mW (typical)/2200 mW (maximum) |

Hazardous location ratings

| | Output | | |
|----------------------------------|---------------|---------------|---------------|
| Module supply voltage U_{EX}^1 | 28 V DC | | |
| Voltage input U_i | 0 V DC | | |
| Voltage output U_o | 28 V DC | | |
| Current output I_o | 108 mA | | |
| Power output P_o | 750 mW | | |
| | IIC | IIB | IIA |
| Capacitance C_o^2 | 0.082 μ F | 0.649 μ F | 2.149 μ F |
| Inductance L_o^2 | 1.015 mH | 3.045 mH | 8.12 mH |

¹ $U_{EX} = U_m$ as listed in the SIRA Certification

² The quoted entity parameters of C_o and L_o are applicable for the distributed capacitance and inductance in cable. Where there is circuit capacitance or inductance in the connected equipment (represented by C_i and L_i respectively), then these values shall not exceed 50% of the quoted C_o and L_o .

Supply of the module electronics and I/O through the bus coupler/power terminal

| | |
|-------------------|-------------------|
| Connection method | Potential routing |
|-------------------|-------------------|

Sensor supply voltage U_{IS}

| | |
|--------------------------------------|---|
| Nominal value U_{IS} | 24 V |
| Nominal current I_{IS} per channel | 20 mA |
| Nominal source resistance R_{IS} | 300 Ω |
| Protection | Internal, channel-specific electronic fuse, short-circuit-proof with single-channel diagnostics |

Analog inputs

| | |
|--|--|
| Number | 4 analog inputs (can also be configured as outputs) |
| Signals/resolution in the process data word (quantization) | See tables on page 19 and onwards |
| Measured value representation | In the following formats: IB IL (15 bits with sign bit) S7-compatible (15 bits with sign bit) Standardized representation (15 bits with sign bit) |



Please read the notes on page 19 and page 22 on measured value representation in "IB IL" and "standardized representation" format.

| | |
|--|--|
| Digital filtering (mean-value generation) | First order lag filter (tau) selectable as 100 or 1000 ms None or over 4, 16 or 32 measured values Default setting: 16 measured values |
| Nominal conversion time of the A/D converter | 50 μ s |
| Process data update of the channels | < 1 ms |
| Limit frequency (-3 dB) of the input filters | < 30 Hz |
| Bus synchronism | Yes |
| Transient protection | Yes |

Analog voltage inputs

| | |
|---|-------------|
| Number | 4 |
| Input range | 0 V to 10 V |
| Input resistance | 10 kΩ ±1% |
| Maximum permissible voltage between analog voltage inputs and analog return | ±30 V DC |

Analog current inputs

| | |
|--|------------------------------|
| Number | 4 |
| Input range | 0 mA to 20 mA; 4 mA to 20 mA |
| Input resistance | 51 Ω ±2% |
| Open circuit detect | Yes |
| Maximum permissible current per current input | 40 mA |
| Maximum permissible voltage at the analog current inputs | ±1.5 V DC |

Analog outputs

| | |
|--|--|
| Number | 4 analog outputs (can also be configured as inputs) |
| Signals/resolution in the process data word (quantization) | See tables on page 19 and onwards |
| Measured value representation | In the following formats: IB IL (15 bits with sign bit) S7-compatible (15 bits with sign bit) Standardized representation (15 bits with sign bit) |



Please read the notes on page 19 and page 22 on measured value representation in "IB IL" and "standardized representation" format.

| | |
|--|--------------------|
| Conversion time of the D/A converter | 10 μs |
| Process data update of the channels (configurable) | 10 ms ... 200 ms |
| Bus synchronism | Yes |
| Transient protection | Yes, via arresters |

Analog current outputs

| | |
|--------------------------|------------------------------|
| Number | 4 |
| Input range | 0 mA to 20 mA; 4 mA to 20 mA |
| Open circuit detect | Yes |
| Short circuit protection | Yes |

Tolerance and temperature response

T_A = 25°C

| | Measuring range | Tolerance | Error |
|----------------|-----------------|-----------|--------|
| Current input | 4... 20 mA | ±0.5% | 0.1 mA |
| Voltage input | 0 V to 10 V | ±0.5% | 0.05 V |
| Current output | 4 mA to 20 mA | ±0.5% | 0.1 mA |

T_A = -25°C... +25°C

| | Measuring range | Temperature coefficient (typical) | Error (typical) | Temperature coefficient (maximum) | Error (maximum) |
|----------------|-----------------|-----------------------------------|-----------------|-----------------------------------|-----------------|
| Current input | 4... 20 mA | 50 ppm/°C | 0.05 mA | 100 | 0.1 mA |
| Voltage input | 0 V to 10 V | 50 ppm/°C | 25 mV | 100 | 50 mV |
| Current output | 4 mA to 20 mA | 50 ppm/°C | 0.05 mA | 100 | 0.1 mA |

T_A = -25°C... +60°C

| | Measuring range | Temperature coefficient (typical) | Error (typical) | Temperature coefficient (maximum) | Error (maximum) |
|----------------|-----------------|-----------------------------------|-----------------|-----------------------------------|-----------------|
| Current input | 4... 20 mA | 50 ppm/°C | 0.035 mA | 100 | 0.07 mA |
| Voltage input | 0 V to 10 V | 50 ppm/°C | 17.5 mV | 100 | 35 mV |
| Current output | 4 mA to 20 mA | 50 ppm/°C | 0.035 mA | 100 | 0.07 mA |



All percentage values refer to the relevant measuring range final value.
The values refer to nominal operation in the recommended mounting position (horizontal wall mounting).

Additional tolerances influenced by electromagnetic fields

| Type of electromagnetic interference | Typical deviation from the measuring range final value (voltage input) | Typical deviation of the measuring range final value (current input) |
|--|--|--|
| | Relative | Relative |
| Electromagnetic fields; field strength 10 V/m according to EN 61000-4-3/IEC 61000-4-3 | < ±1% | < ±1% |
| Conducted interference Class 3 (test voltage 10 V) according to EN 61000-4-6/IEC 61000-4-6 | < ±1% | < ±1% |
| Fast transients (burst) 4 kV supply, 2 kV input according to EN 61000-4-4/IEC 61000-4-4 | < ±1% | < ±1% |

Safety equipment

| | |
|-----------------------|---|
| Inputs | Transient surge protection via arresters |
| Sensor supply voltage | Short-circuit protection with electronic fuse |

Electrical isolation/isolation of the voltage areas



NOTE:

To provide electrical isolation between the logic level and the I/O area, it is necessary to supply the station bus coupler and the sensors connected to the analog input terminal described here from separate power supply units. Interconnection of the power supply units in the 24 V area is not permitted. (See also user manual.)

Common potentials

The 4 analog channels have the same potential. The 24 V U_{EX} and 5 V U_L are separate potential areas. The FE and shield have the same potential.

Separate potentials in the system consisting of bus coupler/power terminal and I/O terminal

- Test distance

5 V supply (bus logic), 24 V supply U_{ANA} /analog I/O
 5 V supply (bus logic), 24 V supply U_{ANA} /functional earth ground
 Analog I/O/functional earth ground

- Test voltage

500 V AC, 50 Hz, 1 min.
 500 V AC, 50 Hz, 1 min.
 500 V AC, 50 Hz, 1 min.

Error messages to the higher-level control or computer system

| | |
|---|--|
| Failure of the internal I/O voltage supply | Yes, I/O error message sent to the bus coupler |
| Failure of or insufficient communications power U_L | Yes, I/O error message sent to the bus coupler |
| Peripheral fault/user error | Yes, error message via the IN process data (see page 17) |

Conformance/approvals

| | |
|--------|--|
| CE | 94/9/EC EN 60079-0:2009 EN 60079-11:2007 EN 60079-15:2010 |
| ATEX | Sira 09ATEX2339X; Ex nA [ia Ga Da] IIC T4 Gc |
| IECEX | IECEX SIR 10.0033X; Ex nA [ia Ga Da] IIC T4 Gc |
| | Ⓔ II 3(1)GD |
| UL/cUL | Class I, Division 2, Groups A, B, C, D |
| FM | Class I, II, Division 2, Group A-G; Class I, Zone 2 AEx nA [ia] IIC T4 |

For the latest approvals, please visit phoenixcontact.com.

5 Local diagnostic and status indicators and terminal point assignment

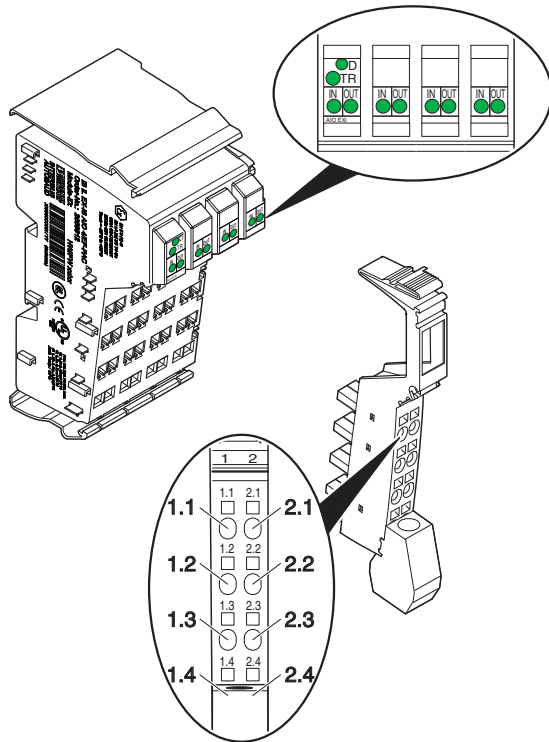


Figure 1 IB IL EX-IS AIO 4/EF-PAC terminal with an appropriate connector

5.1 Local diagnostic and status indicators

| Des. | Color | Meaning |
|------------|------------|---|
| D | Green | Diagnostics |
| | 0.5 Hz | Local bus stop |
| | 2 Hz | Peripheral fault or U_{EX} low or off |
| | 4 Hz | Local bus failure |
| TR | Green | PCP communication active |
| IN | Green (on) | Input on and OK |
| | Red (on) | Broken wire or under/over range |
| OUT | Green (on) | Output on |

5.2 Terminal point assignment for each connector

| Terminal points | Signal | Assignment |
|-----------------|-----------------|--------------------------------|
| 1.1 | U_{Vx} (24 V) | Initiator supply for channel x |
| 1.2 | AI_{Ix} | Current input for channel x |
| 1.3 | AI_{Ux} | Voltage input for channel x |
| 1.4 | Shield | Shield connection |
| 2.1 | AO_{Ix} | Current output for channel x |
| 2.2 | $-AO_{Ix}$ | Return for channel x (GND) |
| 2.3 | $-AO_{Ix}$ | Return for channel x (GND) |
| 2.4 | Shield | Shield connection |

x = 1 to 4

6 Internal circuit diagram

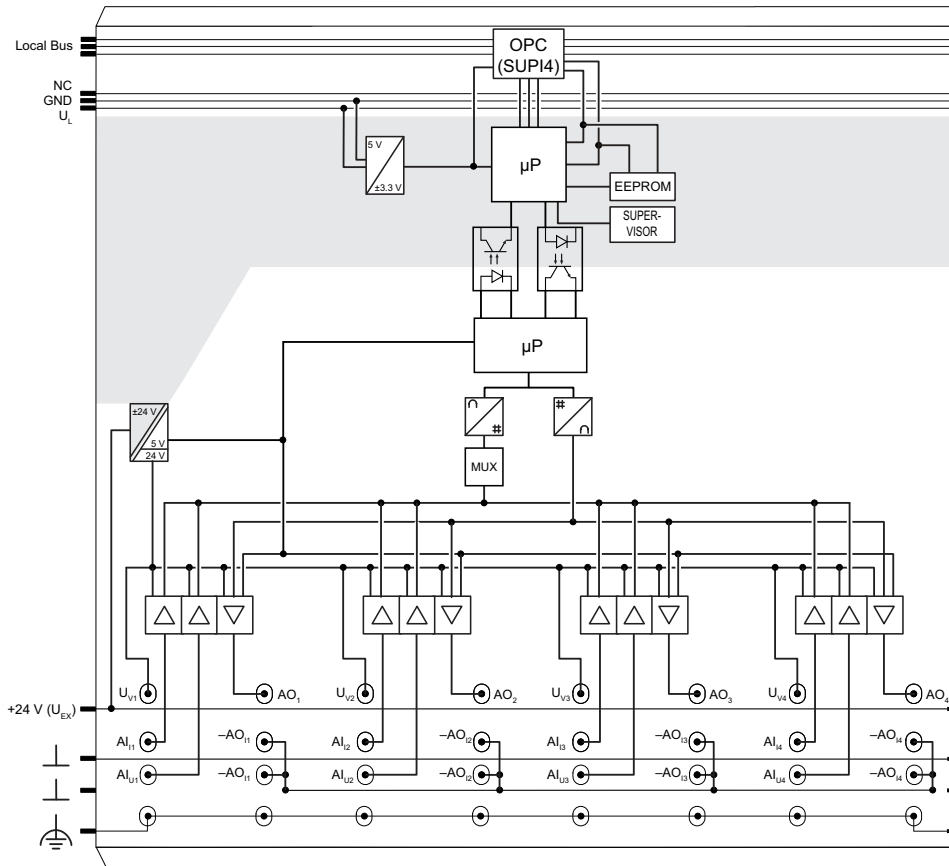












Figure 2 Internal wiring of the terminal points

Key:

| | | | |
|---|---|---|---------------------------|
|  | Protocol chip |  | Digital/analog converter |
|  | Power supply unit with electrical isolation |  | Analog/digital converter |
|  | Optocoupler |  | Amplifier |
|  | Microprocessor |  | Multiplexer |
|  | Electrically erasable programmable read-only memory |  | Microprocessor monitoring |



Other symbols used are explained in the IB IL SYS PRO UM E user manual or in the Inline system manual for your bus system.

7 Safety regulations installation notes



For a list of terminals that are approved for the potentially explosive areas of Zone 2, please refer to the AH EN IL EX ZONE 2 application note. Verify use by checking the label on the Inline terminal and the packaging.



WARNING: Explosion hazard

The following conditions must be observed to adhere to the ATEX 94/9/EC directive.

7.1 Special conditions for safe use

The module shall only be supplied from the IB IL EX-IS PWR IN-PAC module.

If the module is installed in a zone 2 hazardous area, it shall be housed in an enclosure that is coded Ex nA, Ex e, Ex d or Ex p. If the module is installed in a zone 22 or 21 hazardous area, it shall be housed in an enclosure that is coded Ex tD or Ex t. For some types of enclosure, additional certification is required to permit the installation of the module within the enclosure. Reference should be made to the enclosure certificate. The installer shall ensure that the maximum ambient temperature of the module, when installed, is not exceeded.

If the module is installed in a non-hazardous area, the enclosure or location shall provide suitable protection. This may be either by the use of an enclosure approved for use in zones 1, 2, 21, or 22 or otherwise meet the following requirements:

- Non-metallic enclosures must be capable of withstanding the thermal endurance requirements of IEC 60079-0 prior to impact and IP54 testing.
- Any enclosure must be capable of withstanding an impact of 7J or the module is otherwise protected from impact.
- The enclosure or location must provide an ingress protection of at least IP54.
- If exposed to sunlight, non-metallic enclosures must be capable of meeting the requirements of IEC 60079-0 clause 26.10 regarding resistance to light.

The installer is responsible for ensuring that the mounting of the module does not reduce the segregation distances between different modules. There shall be a minimum of 6 mm between any intrinsically safe terminals and other conductors or earthed metal, in accordance with IEC 60079-14:2007 clause 12.2.3. In addition, there shall be a minimum of 50 mm between the intrinsically safe terminals of the module and any non-intrinsically safe terminals.

When the module is mounted in a zoned area, live connection and disconnection of the module from the rail is only permitted if the potentially explosive atmosphere is shown to be absent.

The four channels of the IB IL EX-IS AIO 4/EF-PAC shall be treated as separate, intrinsically safe circuits.

Each channel shares a common zero volts with the other channels in the IB IL EX-IS AIO 4/EF-PAC module as well as other IB IL EX-IS AIO 4/EF-PAC modules and non-isolated IB IL EX-IS...IO... modules connected to the same IB IL EX-IS PWR IN-PAC (power supply) module. If the field devices do not maintain 500 V AC isolation from earth/ground, then all the non-isolated devices from the same IB IL EX-IS PWR IN-PAC module shall be installed in a location (such as the same vessel) where a difference in earth/ground potential is unlikely to occur. If the field devices maintain 500 V AC isolation from earth/ground, there is no such limitation.

The quoted entity parameters of C_o and L_o are applicable for the distributed capacitance and inductance in cable. Where there is circuit capacitance or inductance in the connected equipment (represented by C_i and L_c respectively), these values shall not exceed 50% of the quoted C_o and L_o .

7.2 Safety instructions

Installation instructions

The device is an associated equipment of the “intrinsically safe” protection type and suitable for installation in zone 2.

Follow the installation instructions.

Installation, operation and maintenance may only be carried out by qualified personnel.

Always remove power from Inline station before installing or removing any Inline terminal.

Comply with the valid safety regulations (including national safety regulations) for the installation and operation, accident prevention regulations, and the general rules and regulations pertaining to technology. The safety relevant data may be derived from the operating instructions and the certificates (EC type examination certificate, possibly additional ratings).

Access to the circuits within the device is prohibited. Do not repair the device yourself, but replace it with an equivalent device. Repairs may only be carried out by the manufacturer.

The IP20 degree of protection (IEC 60529/EN 60529) is intended for a clean and dry environment. Do not expose the device to any mechanical or thermal influences that exceed the limits described.

Intrinsic safety

When carrying out measurements on the intrinsically safe side, it is imperative that you observe the relevant regulations regarding connecting intrinsically safe electrical equipment. Only use equipment approved for intrinsically safe circuits.

If the device was used in circuits that are not intrinsically safe, it is forbidden to use it again in intrinsically safe circuits. Label the device clearly as being not intrinsically safe.

Installation in Zone 2

Observe the specified conditions for use in potentially explosive areas! Use a suitable housing of the minimum protection IP54 for the installation. Within this context observe the requirements of IEC 60079-14/EN 60079-14, i.e., steel housing with a wall thickness of 3 mm.

Do not connect any live cables/lines within the potentially explosive area.

Only use IB IL EX-IS...IO... modules of category 3G (ATEX 94/9EG).

Potentially dust-explosive areas

The device is not designed for use in environments capable of dust explosions.

Only make the connection to the intrinsically safe circuit in potentially dust-explosive areas of zones 20, 21 and 22 if the equipment connected to this circuit is certified for this zone (e.g., category 1D, 2D or 3D).

7.3 FM compliance

In addition to the previous statements, FM compliance requires that the module is mounted in an enclosure that meets the requirements of ANSI/ISA 601010 and is installed in compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application.

8 Electrical isolation

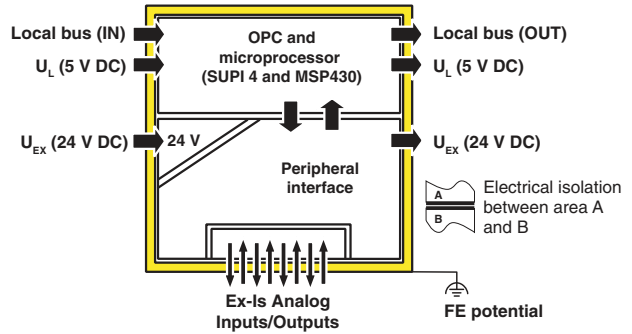


Figure 3 Electrical isolation of the individual function areas

9 Connection notes



NOTE:

Always connect the analog sensors using shielded, twisted-pair cables. Connect the shielding to the terminal using the shield connection clamp. The clamp connects the shield to FE on the module side. Avoid connection to FE from both sides.

9.1 Power budget

The IB IL EX-IS PWR IN-PAC provides power to the IB IL EX-IS AIO 4/EF-PAC terminal in two ways:

- 1000 mA is available for the logic functions (U_L).
- 1000 mA is available for the I/O functions (U_{EX}).

The number of terminals that can be powered by the IB IL EX-IS PWR IN-PAC varies according to the type of terminal and the number and type of I/O connections.

Based on the logic functions, the maximum number of terminals that can be connected is 10.

The IB IL EX-IS AIO 4/EF-PAC terminal draws different power depending on the type of connection. To determine the number of I/O points that can be connected, refer to Table 1.

Table 1 U_{EX} Current Draw

| | IB IL EX-IS AIO 4/EF-PAC |
|-------------------|--------------------------|
| Terminal overhead | 45 mA |
| Output | 25 mA |
| Input | 25 mA |

To calculate the power requirements of a system, list the number and type of each connected point. From this list, determine the number and type of terminals required. Multiply

the number of each I/O point by the appropriate current draw listed in Table 1.

head current draw determines the total current draw from the IB IL EX-IS PWR IN-PAC. The maximum current draw is 1000 mA.

Add the terminal overhead current for each terminal used. The sum of the I/O point current draw and the terminal over-

10 Connection examples



Use a connector with shield connection when installing the sensors. Figure 4 shows the connection schematically.

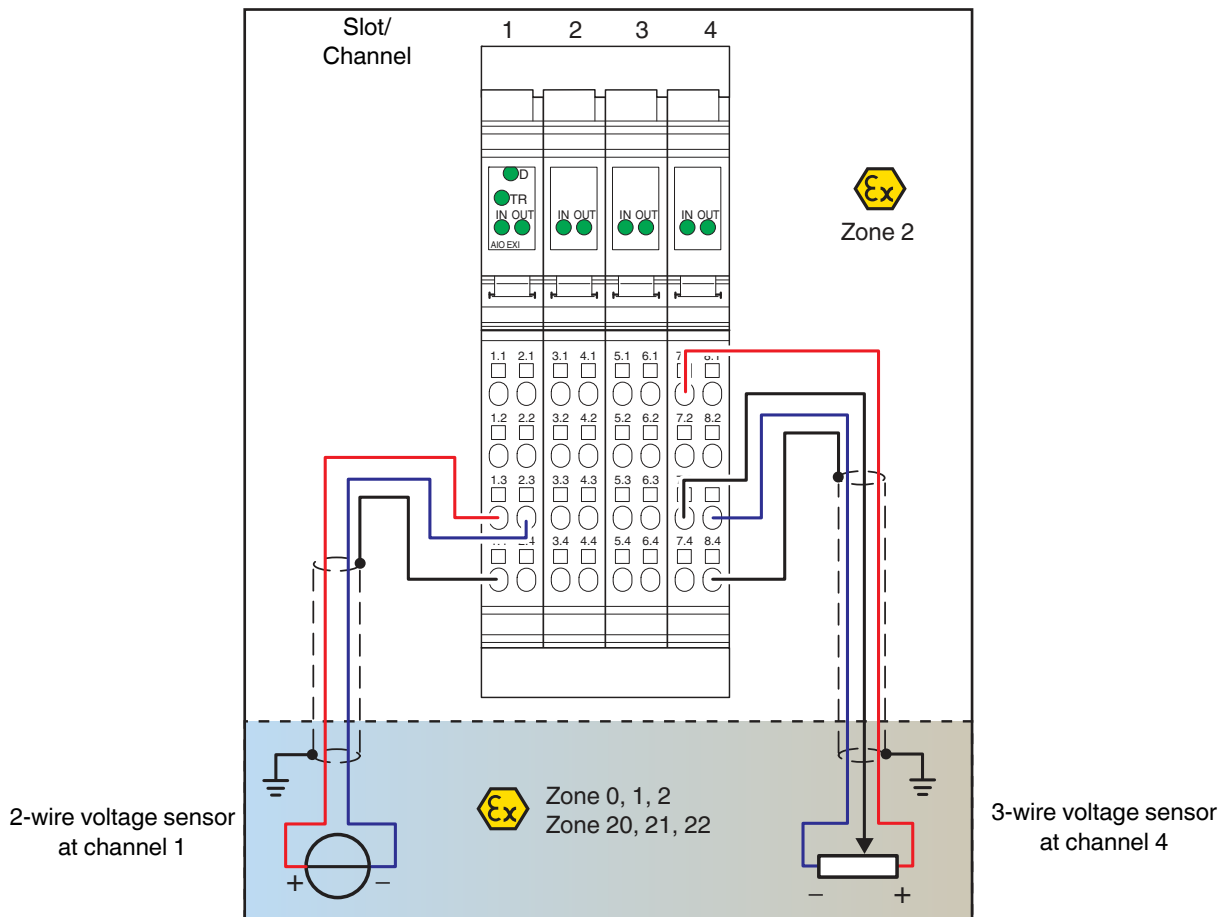


Figure 4 Connection of voltage sensors with shield connection

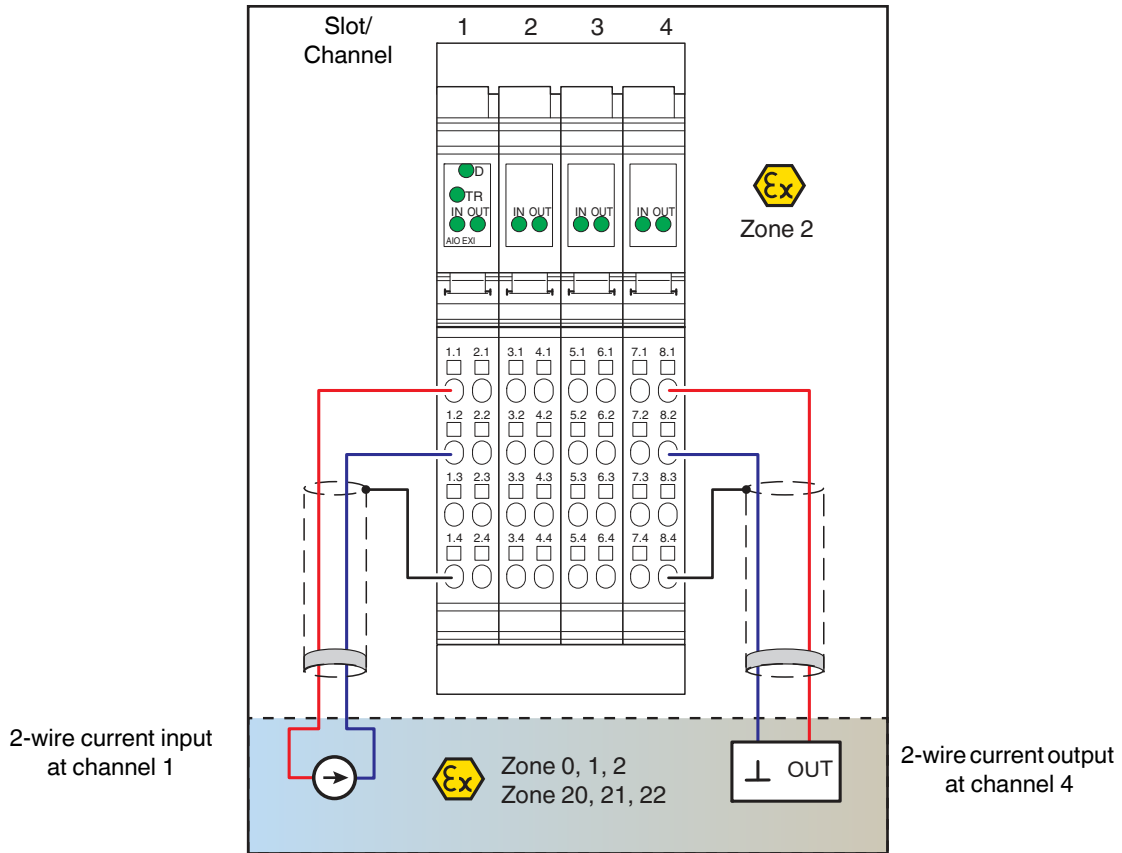


Figure 5 Connection of current devices with shield connection

11 Configuration and analog values

You can either configure the device via process data or via PCP and transmit analog values accordingly.

If the device was configured via PCP, the configuration can no longer be modified the via process data.

12 Programming data/configuration data

12.1 INTERBUS

| | |
|-------------------------|---------|
| ID code | 0xDF |
| Length code | 05 |
| Input address area | 5 words |
| Output address area | 5 words |
| Parameter channel (PCP) | 1 word |
| Register length (bus) | 6 words |

12.2 Other bus systems



For the programming data/configuration data of other bus systems, please refer to the corresponding electronic device data sheet (e.g., GSD, EDS).

13 Assignment of the process data to the terminal points for the “Read Analog Value” and “Configure Device and Read Analog Value” commands

| | | | | | | | | | | | | | | | | | |
|---|------------------|--|----|----|----|----|----|---|---|--------|---|---|---|---|---|---|---|
| (Word.bit) view | Word | Word x | | | | | | | | | | | | | | | |
| | Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| (Byte.bit) view | Byte | Byte 0 | | | | | | | | Byte 1 | | | | | | | |
| | Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| AI Word 2: Channel 1 (connector 1) Word 3: Channel 2 (connector 2) Word 4: Channel 3 (connector 3) Word 5: Channel 4 (connector 4) | 24 V | Terminal point 1.1: Sensor supply | | | | | | | | | | | | | | | |
| | GND | Terminal point 2.1: Ground | | | | | | | | | | | | | | | |
| | Signal | Terminal point 1.2: Positive voltage input Terminal point 1.3: Positive current input | | | | | | | | | | | | | | | |
| | Signal reference | Terminal point 2.2: Negative voltage input Terminal point 2.3: Negative current input | | | | | | | | | | | | | | | |
| | Shielding (FE) | Terminal point 1.4, 2.4 | | | | | | | | | | | | | | | |

14 Process data

The device has 5 process data words and 1 PCP word. The first output word represents the control word because the assignment of the following words depends on the configuration. As confirmation for a control word action, the first input word contains a partial copy of the control word.

For the device configuration, channel-specific configuration data is set in the relevant channel output words. Once configuration has been completed, and depending on the format set, the measured values in the corresponding input words are either transmitted to the controller board or to the computer.

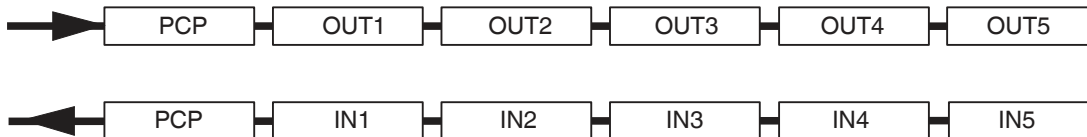


Figure 6 Order of the process data words

15 OUT process data words

15.1 Output word OUT1 (control word)

- For command code 400x_{hex}

| | | | | | | | | | | | | | | | | | |
|------------|--|-------------------|----|----|----|----|----|---|---|--------|---|----|----|-----------|-----------|---|---|
| | | OUT1 | | | | | | | | | | | | | | | |
| | | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | Command code 0x40 | | | | | | | | 0 | 0 | RR | PF | AO Format | AI Format | | |

| Field | Value (Binary) | Description |
|----------------------------------|----------------|---|
| AI format | 00 | IB IL (default) |
| | 01 | Reserved |
| | 10 | S7 compatible |
| | 11 | Standardized representation |
| AO format | 00 | IB IL (default) |
| | 01 | Reserved |
| | 10 | S7 compatible |
| | 11 | Standardized representation |
| RR (Refresh rate input channels) | 0 | 200 ms (default) |
| | 1 | 10 ms |
| PF (Peripheral fault) | 0 | Not permitted (default) |
| | 1 | Permitted: Flag the StatErr bit on any error condition on input |

- For all other command codes

| | | OUT1 | | | | | | | | | | | | | | | |
|-----|------------|--------------|----|----|----|----|----|---|--------|---|---|---|---|---|---|---|---|
| | | Byte 1 | | | | | | | Byte 0 | | | | | | | | |
| Bit | Assignment | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| | | Command code | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

| OUT1 | Command description |
|--------|--|
| 0x40xx | Configure device. The configuration parameters are sent on OUT2 to OUT5 |
| 0x1000 | Read configuration one channel at a time Configuration for selected channel is displayed in IN2 |
| 0x1100 | Read configuration for channel 1 |
| 0x1200 | Read configuration for channel 2 |
| 0x1300 | Read configuration for channel 3 |
| 0x1300 | Read configuration for channel 4 |
| 0x0000 | Read analog values for all channels. Values are displayed on IN2 to IN5 |
| 0x0100 | Write analog values for all channels. Values are sent on OUT2 to OUT5 |
| 0x3C00 | Read device info – Firmware version and 4-bit device |

15.2 Output words OUT2 to OUT5 (configuration)

Each channel can be configured independently of the other channels. The first channel is configured via the second output word, the second channel via the third output word, etc.

If the configuration changes, the corresponding channel is re-initialized. If the format "IB IL" is set, the error code "Measured value invalid" is output.

If the configuration is invalid, a corresponding error message is output in the status word. The configuration is stored in a volatile memory.

For command 40xx_{hex}, specify the parameters for the appropriate channels 1 to 4 in OUT2 to OUT5. The parameter words are only evaluated by this command.

| | | OUT2 to OUT5 | | | | | | | | | | | | | | | |
|-----|------------|--------------|----|-------------------|----|----|-----------------|---|---|----|-----------|------|---|---|--------------------|---|---|
| Bit | Assignment | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| | | CO | | AO reset behavior | | | AO output range | | | CI | AI filter | Wire | | | AI measuring range | | |

| Field | Value (binary) | Description |
|---------------------|----------------|---|
| AI measuring range | 0000 | 0... 10 V |
| | 00xx | Reserved |
| | 0100 | 0... 20 mA |
| | 0101 | Reserved |
| | 0110 | 4... 20 mA (Default) |
| | 0111 | Reserved |
| | 0xxx | Reserved |
| Wire | 0 | 2 wire (default) |
| | 1 | 3 wire |
| AI Filter | 0 | No filter |
| | 1 | First order lag filter; 100 ms for 10 ms update rate, 1 s for 200 ms update |
| CI (Channel input) | 0 | Input mode disabled |
| | 1 | Input mode enabled |
| AO Output range | 0xx | Reserved |
| | 100 | 0... 20 mA |
| | 101 | Reserved |
| | 110 | 4... 20 mA (default) |
| | 111 | Reserved |
| AO Reset behavior | 00 | Hold (default) |
| | 01 | Reset |
| | 10 | Fail safe |
| | 11 | Reserved |
| CO (Channel output) | 0 | Output mode disabled |
| | 1 | Output mode enabled |

Default configuration: all channels are disabled.

Either of CI or CO has to be set for enabling the channel in input or output mode. If both CI and CO are reset, the channel is disabled. If both CI and CO are set, error is returned.

For output channel, device supports only 2 wire technology.

Selection of any reserved value in any field results in an error.

Refresh rate of 10 ms is supported only for 4-20 mA range on input channels.

The selected refresh rate will apply to all input channels.

The output channels will have a fixed refresh rate of 200 ms.

16 IN Process Data Words

16.1 Input word IN1 (Status word)

| | | OUT1 | | | | | | | | | | | | | | | |
|------------|--|-------------------------------------|----|----|----|----|----|---|---|--------|---|---|---|---|---|---|---|
| | | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | Command code 0x10, 0x11, 0x12, 0x13 | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

16.2 Input word IN1 (Status word)

| | | IN1 | | | | | | | | | | | | | | | |
|------------|----|-----------------------|----|----|----|----|----|---|---|--------|---|---|---|---|---|---|---|
| | | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | EB | Mirrored command code | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Error bit:

EB = 0 No error has occurred.

EB = 1 An error has occurred.

The error bit indicates incorrect or unrecognized command entered.

16.3 Input words IN2 to IN5

The measured values, firmware version or configuration are transmitted to the controller board or the computer via IN process data words IN2 to IN5 according to the configuration.

For control words **0000_{hex}** (error-free standard operation) the measured values are transmitted in IN2 to IN5. For control word **1x00_{hex}**, the configuration of the selected channel is indicated in IN2. For control word **3C00_{hex}**, IN2 supplies the firmware version and the device ID.

Example:

| | | IN2 | | | | | | | | | | | | | | | |
|---------|--|-----------------------|----|----|----|----|----|---|---|---|---|---|---|---------------|---|---|---|
| | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Meaning | | Firmware Version 1.00 | | | | | | | | | | | | Device ID 0x3 | | | |

For control word **4000_{hex}** (configuration mode), the configuration data is mirrored in the input words after transfer.

17 OUT process data words

17.1 Read analog values via process data

| | | OUT1 | | | | | | | | | | | | | | | |
|------------|--|-------------------|----|----|----|----|----|---|---|--------|---|---|---|---|---|---|---|
| | | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | Command code 0x00 | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

17.2 Input word IN1 (Status Word)

| | | IN1 | | | | | | | | | | | | | | | |
|------------|--|--------|----------------------------|----|----|----|----|---|---|--------|---|---|---|---|---|---|---|
| | | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | ERR | Mirrored command code 0x00 | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Error bit:

EB = 0 No error has occurred.

EB = 1 An error has occurred.

The error bit is available as a group error message. Possible errors and their effects are listed in “Supported error codes for the “IB IL” and “Standardized Display” formats” on page 23.

Only an analog value corresponding to a configured input channel is processed.

In case of a read analog value on an unconfigured channel, the return value will be in accordance with representation format (IB IL and Standard Representation: 0x8004; S7-compatible: 0x8000).

17.3 Write analog values via process data

| | | OUT1 | | | | | | | | | | | | | | | |
|------------|--|-------------------|----|----|----|----|----|---|---|--------|---|---|---|---|---|---|---|
| | | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | Command code 0x01 | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | OUT2 to OUT5 for channel 1 to channel 4 | | | | | | | | | | | | | | | |
|------------|--|---|-------------------|----|----|----|----|---|---|--------|---|---|---|---|---|---|---|
| | | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | SB | Command code 0x01 | | | | | | | | | | | | | | |

17.4 Input word IN1 (Status word)

| | | IN1 | | | | | | | | | | | | | | | |
|------------|--|--------|----------------------------|----|----|----|----|---|---|--------|---|---|---|---|---|---|---|
| | | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | SB | Mirrored command code 0x01 | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Only the analog value corresponding to a configured output channel is processed.

In case of a write analog value on an unconfigured channel, the value will be ignored without any error returned.

If any channels are configured as inputs, the corresponding input values appear on IN2 to IN5 for channel 1 to channel 4.

17.5 Read device information via process data

| | | | | | | | | | | | | | | | | | |
|------------|--|-------------------|----|----|----|----|----|---|--------|---|---|---|---|---|---|---|---|
| | | OUT1 | | | | | | | | | | | | | | | |
| | | Byte 1 | | | | | | | Byte 0 | | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | Command code 0x3C | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

| | | | | | | | | | | | | | | | | | |
|------------|--|----------------------------|----|----|----|----|----|---|--------|---|---|---|---|---|---|---|---|
| | | IN1 | | | | | | | | | | | | | | | |
| | | Byte 1 | | | | | | | Byte 0 | | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | Mirrored command code 0x3C | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

| | | | | | | | | | | | | | | | | | |
|------------|--|-----------------------|----|----|----|----|----|---|---------------|---|---|---|---|---|---|---|---|
| | | IN2 | | | | | | | | | | | | | | | |
| | | Byte 1 | | | | | | | Byte 0 | | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | | Firmware version 1.00 | | | | | | | Device ID 0x3 | | | | | | | | |

18 Formats for the representation of measured values (IN2 to IN5)

18.1 Format: "IB IL" (Default Setting)

The measured value is represented in bits 14 to 0. An additional bit (bit 15) is available as a sign bit.

This format supports extended diagnostics. Values > 8000_{hex} and < 8100_{hex} indicate an error. The error codes are listed on page 23.

| | | | | | | | | | | | | | | | | | |
|------------|----|---------------------------------------|----|----|----|----|----|---|--------|---|---|---|---|---|---|---|---|
| | | IN2 to IN5 for channel 1 to channel 4 | | | | | | | | | | | | | | | |
| | | Byte 1 | | | | | | | Byte 0 | | | | | | | | |
| Bit | | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | SB | Analog value in IB IL format | | | | | | | | | | | | | | | |

Significant measured values

Input measuring range 0 mA to 20 mA/4 mA to 20 mA/0 V to 10 V

| IB Input Word hex | 0 mA to 20 mA I_{Input} mA | 4 mA to 20 mA I_{Input} mA | 0 V to 10 V U_{Input} V |
|----------------------|------------------------------------|------------------------------------|---------------------------------|
| 8001 over range | > +21.6747 | > +21.339733 | > +10.837 |
| 7F00 | +21.6747 | +21.339733 | +10.837 |
| 7530 | +20.0 | +20.0 | +10.0 |
| 0001 | +0.6667 μ A | +4.0005333 | +333.33 μ V |
| 0000 | \leq 0 | +3.2 to +4.0 | 0 |
| 8002 open circuit | - | < +3.2 | - |

Output measuring range 0 mA to +20 mA/4 mA to 20 mA

| OutputData Word | 0 mA to +20 mA I_{Output} | 4 mA to 20 mA U_{Output} |
|---|---------------------------------------|--------------------------------------|
| hex | mA | mA |
| 8001 over range | > +21.6747 | > +21.3397 |
| 7FFF - 7F01 | +21.6747 | +21.3397 |
| 7F00 | +21.6747 | +21.3397 |
| 7530 | +20.0 | +20.0 |
| 3A98 | +10.0 | +12.0 |
| 0001 | +0.6667 μA | +4.000533 |
| 0000 | 0 | +4.0 |
| FFFF | 0 | +4.0 |
| C568 | 0 | +4.0 |
| 8AD0 | 0 | +4.0 |
| 8100 | 0 | +4.0 |
| 80FF - 8000 (excluding 8001, 8002, 8080) | Hold | Hold |
| 8080 under range | 0 | Hold |
| 8002 open circuit | Hold | 0 |

18.2 Format: "S7-compatible"

The measured value is represented in bits 14 to 0. An additional bit (bit 15) is available as a sign bit.

Measured value representation in "S7-compatible" format

| | | | | | | | | | | | | | | | | | |
|-----|---------------------------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|-----|
| MSB | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | LSB |
| SB | Analog value in S7 format | | | | | | | | | | | | | | | | |

Significant measured values

Measuring range 0 mA to 20 mA/4 mA to 20 mA/0 V to 10 V

| Input Data Word | 0 mA to 20 mA I_{Input} | 4 mA to 20 mA I_{Input} | 0 V to 10 V U_{Input} |
|-----------------|------------------------------|------------------------------|----------------------------|
| hex | mA | mA | V |
| 7FFF over range | > +23.5157 | > +22.8142 | > +11.759 |
| 7EFF | +23.5157 | +22.8142 | +11.759 |
| 6C00 | +20.0 | +20.0 | +10.00 |
| 0001 | +0.7234 μ A | +4.0005787 | +361.39 μ V |
| 0000 | \leq 0 | +4.0 | \leq 0 |
| F940 | - | +3.0 | - |
| 8000 Line break | - | < +1.11852 | - |

Output measuring range 0 mA to +20 mA/4 mA to 20 mA

| Output Data Word | 0 mA to +20 mA I_{Output} | 4 mA to 20 mA U_{Output} |
|-------------------------|--------------------------------|-------------------------------|
| hex | mA | mA |
| 7FFF - 7F01 over range | 0 | 0 |
| 7EFF | +23.5150 | +23.8100 |
| 6C00 | +20.0 | +20.0 |
| 5100 | +15.0 | +16.0 |
| 0001 | +0.7234 μ A | +4.000578 |
| 0000 | 0 | +4.0 |
| FFFF | 0 | +3.99942 |
| E501 | 0 | +0.578 μ A |
| E500 | 0 | 0 |
| EF00 | 0 | 0 |
| 9400 | 0 | 0 |
| 8100 | 0 | 0 |
| 80FF - 8000 under range | 0 | 0 |

Formula for calculating the measured value from the process data input value for the 4 ma to 20 ma measuring range

$$\text{Measured value} = \text{Process data input value} \times 0.0005787 \text{ mA} + 4 \text{ mA}$$

| | Example 1 | Example 2 |
|--------------------------|--|---|
| Process data input value | 6C00 _{hex} = 27648 _{dec} | F940 _{hex} -> FFFF _{hex} - F940 _{hex} + 1 = -1728 _{dec} |
| Value x resolution | 27648 x 0.0005787 mA = 16 mA | -1728 x 0.0005787 mA = -1 mA |
| + 4 mA | 16 mA + 4 mA = 20 mA | -1 mA + 4 mA = 3 mA |
| Measured value | 20 mA | 3 mA |

18.3 Format: "Standardized Representation"

The data is represented in bits 14 to 0. An additional bit (bit 15) is available as a sign bit.

Measured value representation in "standardized representation" format

| | | | | | | | | | | | | | | | |
|-----|--------------|----|----|----|----|---|---|---|---|---|---|---|---|---|-----|
| MSB | | | | | | | | | | | | | | | LSB |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| SB | Analog value | | | | | | | | | | | | | | |

Significant measured values

Measuring range 0 mA to 20 mA/4 mA to 20 mA/0 V to 10 V

| Input data word | 0 mA to 20 mA | 4 mA to 20 mA | 0 V to 10 V |
|-------------------|--------------------------|--------------------------|-------------------------|
| hex | I _{Input} mA | I _{Input} mA | U _{Input} V |
| 8001 over range | > +21.6747 | > +21.339 | > +10.837 |
| 4E20 | +20.0 | - | - |
| 2710 | +10.0 | +14.0 | +10.0 |
| 1388 | +5.0 | +9.0 | +5.0 |
| 0001 | +0.001 | +4.001 | +0.001 |
| 0000 | ≤ 0 | +4.0 to +3.2 | ≤ 0 |
| 8002 open circuit | - | < +3.2 | - |

Output measuring range 0 mA to +20 mA/4 mA to 20 mA

| Output Data word | 0 mA to +20 mA | 4 mA to 20 mA |
|------------------|---------------------------|---------------------------|
| hex | I _{Output} mA | U _{Output} mA |
| 8001 over range | > +21.674 | > +21.3397 |
| 7FFF - 54AB | +21.674 | +21.3397 |
| 54AA | +21.674 | +21.3397 |
| 4E20 | +20.0 | +21.3397 |
| 2710 | +10.0 | +14.0 |
| 1388 | +5.0 | +9.0 |
| 0001 | +1.0 μA | +4.001 |
| 0000 | 0 | +4.0 |
| FFFF | 0 | +4.0 |

| Output Data word | 0 mA to +20 mA I_{Output} | 4 mA to 20 mA U_{Output} |
|---|--------------------------------|-------------------------------|
| hex | mA | mA |
| EC78 | 0 | +4.0 |
| D8F0 | 0 | +4.0 |
| B1E0 | 0 | +4.0 |
| AB56 | 0 | +4.0 |
| AB55 - 8100 | 0 | +4.0 |
| 80FF - 8000 (excluding 8001, 8002, 8080) | Hold | Hold |
| 8080 under range | 0 | Hold |
| 8002 open circuit | Hold | 0 |

18.4 Supported error codes for the “IB IL” and “Standardized Display” formats

After an error message, the following errors/messages for “IB IL” and “standardized representation” format are displayed in words IN2 to IN5 in the status word (error bit):

Supported error codes in “IB IL” format

| Input data word (hex) | Error |
|-----------------------|--|
| 8001 | Overrange (input only) |
| 8002 | Open circuit/broken wire (4-20 mA input, 4-20 mA output) |
| 8004 | Measured value invalid/channel disabled |
| 8040 | Device fault |
| 8080 | Underrange (input only) |

19 PCP communication



For information on PCP communication, please refer to the IBS SYS PCP G4 UM E (Order No. 2745169) and IBS PCP COMPACT UM E (Order No. 9015349) user manuals.

By default, the IB IL EX-IS AIO 4/EF-PAC is configured to the default settings. The module can be configured via process data or PCP to adapt to a particular application. In PCP mode, the device is configured with the “Config Table” object.



The IBS CMD (for standard controller boards) and PC WorX (for Field Controllers (FC) and Remote Field Controllers (RFC)) programs are available for the configuration and parameterization of your INTERBUS system. For additional information, please refer to the “IBS CMD SWT G4 UM E” (Order No. 2722250) user manual and the documentation for your applied PC WorX version.

PCP can be used to

- identify the device.
- configure the device.
- read/write analog values to channels.
- get diagnostic information.

19.1 Object dictionary

| Index | Data Type | Length | Meaning | Object Name | Rights |
|-------|---------------------------|---------------|---------------------------------------|-------------------|--------|
| 01 | Visible string | 58 max. bytes | Phoenix Contact GmbH & Co. Kg | VendorName | R |
| 02 | Visible string | 6 bytes | Vendor ID 000A45 | VendorID | R |
| 04 | Visible string | 58 max. bytes | Device family | DeviceFamily | R |
| 06 | Visible string | 58 max. bytes | Product family "INLINE" | ProductFamily | R |
| 07 | Visible string | 58 max. bytes | IB IL EX-IS AIO 4/EF-PAC | ProductName | R |
| 09 | Visible string | 58 max. bytes | Intrinsically safe Analog IO module | ProductText | R |
| 0A | Visible string | 58 max. bytes | 2869912 | OrderNumber | R |
| 0B | Visible string | 58 max. bytes | YYYY-MM-DD Hardware Version | HardwareVersion | R |
| 0C | Visible string | 58 max. bytes | YYYY-MM-DD Firmware Version | FirmwareVersion | R |
| 0D | Record | 2 fields | YYYY-MM-DD PCP Compact Version | PCPVersion | R |
| 0E | Visible string | 3 bytes | 633 | CommProfile | R |
| 11 | Record | 2 fields | YYYY-MM-DD Basic Profile Version | ProfileVersion | R |
| 12 | Visible string | 58 max. bytes | URL http:// www.phoenixcontact.com | VendorURL[] | R |
| 17 | Record | 2 fields | Language English | Language | R |
| 25 | Octet string | 5 units | IN Process Data | PDIN | R |
| 26 | Octet String | 5 units | OUT Process Data | PDOOUT | R |
| 32 | Record | 2 fields | ID_code and PD length | IBS_ID | R |
| 3A | Array | 4 fields | VersionCount | VersionCount | R |
| 80 | Visible string | 58 max. bytes | Hardware Version | Config table | R/W |
| 81 | 16-bit array, unsigned | | Input data | Analog IN values | R |
| 85 | 16-bit array, unsigned | | Output data | Analog OUT values | R/W |

19.2 Configuration via PCP

Config Table object

The Configuration Table object can be used for configuring the module using PCP compact. Following are the Index and Subindex fields along with their respective descriptions.

| | | |
|----------------|------------------------|-------------------------------------|
| Object | Config table | |
| Access | Read, write | |
| Data type | 16-bit array, unsigned | |
| Index (hex) | 0080 | |
| Subindex (hex) | 00 | Configure device all channels |
| | 01 | Configure channel 1 |
| | 02 | Configure channel 2 |
| | 03 | Configure channel 3 |
| | 04 | Configure channel 4 |
| | 05 | AO format AI format |
| | 06 | Output failsafe value for channel 1 |
| | 07 | Output failsafe value for channel 2 |
| | 08 | Output failsafe value for channel 3 |
| | 09 | Output failsafe value for channel 4 |
| Length | 08 | Subindex 00 |
| | 02 | Subindex 01 to 09 |
| Data | Configuration data | |

Configuration data

For subindex 00 to 04, configuration data is per channel, the same as that explained in configuration via process data (see “Output words OUT2 to OUT5 (configuration)” on page 15).

| Bit | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
|------------|--------|----|-------------------|----|-----------------|----|---|----|-----------|------|--------------------|---|---|---|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | CO | | AO reset behavior | | AO output range | | | CI | AI filter | Wire | AI measuring range | | | | | |

For subindex 05, configuration data is

| Bit | Byte 1 | | | | | | | | Byte 0 | | | | | | | |
|------------|-------------------|----|----|----|----|----|---|---|--------|---|----|----|-----------|-----------|---|---|
| | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Assignment | Command code 0x40 | | | | | | | | 0 | 0 | RR | PF | AO format | AI format | | |

For subindex 06 to 09, data is a 16-bit value contained in 2 bytes. This value is valid only if the **AO Reset Behavior** (bits 13 and 12) are set to **Failsafe** in the process dat comand 0x40. This failsafe value is loaded to the outputs in case of Interbus failure.

19.3 Analog IN values object

This object can be used for reading 16-bit analog values from the configured input channels.

| | | |
|---------------------|------------------------|-----------------------------|
| Object | Analog IN values | |
| Access | Read | |
| Data type | 16-bit array, unsigned | |
| Index (hex) | 0081 | |
| Subindex (hex) | 00 | Read all channels |
| | 01 | Read analog value channel 1 |
| | 02 | Read analog value channel 2 |
| | 03 | Read analog value channel 3 |
| | 04 | Read analog value channel 4 |
| Length (bytes, hex) | 08 | Subindex 00 |
| | 02 | Subindex 01 to 04 |
| Data | Channel analog values | |

Channel analog values

| | | | | | | | | | | | | | | | |
|-----|---------------------------------|----|----|----|----|---|---|---|---|---|---|---|---|---|-----|
| MSB | | | | | | | | | | | | | | | LSB |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| SB | Analog value in selected format | | | | | | | | | | | | | | |



Channel analog value of 2 bytes per channel. SB is error bit. For details, refer to “Formats for the representation of measured values (IN2 to IN5)” on page 19.

19.4 Analog Out values object

This object can be used for writing analog values on configured output channels.

| | | |
|---------------------|------------------------|------------------------------|
| Object | Analog OUTvalues | |
| Access | Read, write | |
| Data type | 16-bit array, unsigned | |
| Index (hex) | 0085 | |
| Subindex (hex) | 00 | Write to all channels |
| | 01 | Write analog value channel 1 |
| | 02 | Write analog value channel 2 |
| | 03 | Write analog value channel 3 |
| | 04 | Write analog value channel 4 |
| Length (bytes, hex) | 08 | Subindex 00 |
| | 02 | Subindex 01 to 04 |
| Data | Channel analog values | |

Channel analog values

| | | | | | | | | | | | | | | | |
|-----|---------------------------------|----|----|----|----|---|---|---|---|---|---|---|---|---|-----|
| MSB | | | | | | | | | | | | | | | LSB |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| SB | Analog value in selected format | | | | | | | | | | | | | | |



Channel analog value of 2 bytes per channel. SB causes the output to be clipped. For details, refer to “Formats for the representation of measured values (IN2 to IN5)” on page 19.

19.5 DiagState object

This object can be used to obtain the diagnostics from the IB IL EX-IS AIO 4/EF-PAC module in the standard format. Useful information, like the number of errors occurred, brief description text, channel number, etc., for the error and error code can be obtained using this object.

| | | |
|---------------------|--------------------|--|
| Object | DiagState | |
| Access | Read | |
| Data type | Record | |
| Index (hex) | 0018 | |
| Subindex (hex) | 00 | Read all channels |
| | 01 | Total count of number of errors occurred Resets to 0 when full |
| | 02 | Priority U8 0x00 - no error occurred 0x02 - any error |
| | 03 | Channel U8 channel number for last occurred error |
| | 04 | Error code U16 error code from basic profile Always shows last error code |
| | 05 | More follows U8 always 0x00 |
| | 06 | Text 10 bytes text equivalent of supported error codes |
| Length (bytes, hex) | 11 | Subindex 00 length |
| | 02 | Subindex 01 length |
| | 01 | Subindex 02 length |
| | 01 | Subindex 03 length |
| | 02 | Subindex 04 length |
| | 01 | Subindex 05 length |
| | 0A | Subindex 06 length |
| Data | As specified above | |

Supported error codes

| Error code (hex) | Error |
|------------------|--|
| 0x0000 | OK |
| 0x6330 | Invalid data |
| 0x8910 | Overrange (input only) |
| 0x8920 | Underrange (input only) |
| 0x7790 | Open circuit/broken wire (4-20 mA input, 4-20 mA output) |
| 0x5010 | Hardware failure - note - code checksum |