

AXL F AI4 I 1H

Axioline F analog input module, 4 current inputs, integrated sensor supply

Data sheet
8658_en_02

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1 Description

The module is designed for use within an Axioline F station. It is used to acquire analog current signals.

Features

- 4 analog differential input channels for connecting current signals
- Connection of sensors in 2, 3, and 4-wire technology
- Current ranges: 0 mA ... 20 mA, 4 mA ... 20 mA, ± 20 mA
- Simultaneous scanning of all channels by means of simultaneous sampling
- High crosstalk attenuation between the channels, thanks to separate signal paths
- Particularly robust against electromagnetic interference
- Device type label stored
- Diagnostic and status indicators



This data sheet is only valid in association with the UM EN AXL F SYS INST user manual.



Make sure you always use the latest documentation. It can be downloaded from the product at phoenixcontact.net/products.

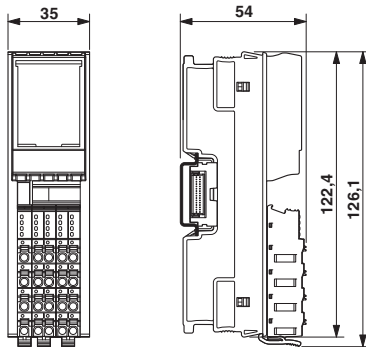
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3 Ordering data

| Description | Type | Order No. | Pcs. / Pkt. |
|--|--------------------------|-----------|-------------|
| Axioline F analog input module, 4 inputs: 0 - 20 mA, 4 - 20 mA, ±20 mA, 2, 3, and 4-conductor connection technology, integrated sensor supply (including bus base module and connectors) | AXL F AI4 I 1H | 2688491 | 1 |
| Accessories | Type | Order No. | Pcs. / Pkt. |
| Axioline F bus base module for housing type H (Replacement item) | AXL F BS H | 2700992 | 5 |
| Axioline shield connection set (contains 2 busbar holders and 2 SK 5 shield connection clamps) | AXL SHIELD SET | 2700518 | 1 |
| Zack marker strip for Axioline F (device labeling), in 2 x 20.3 mm pitch, unprinted, 25-section, for individual labeling with B-STIFT 0.8, X-PEN, or CMS-P1-PLOTTER (Marking) | ZB 20,3 AXL UNPRINTED | 0829579 | 25 |
| Zack marker strip, flat, in 10 mm pitch, unprinted, 10-section, for individual labeling with M-PEN 0,8, X-PEN, or CMS-P1-PLOTTER (Marking) | ZBF 10/5,8 AXL UNPRINTED | 0829580 | 50 |
| Insert label, Roll, white, unlabeled, can be labeled with: THERMOMARK ROLL, THERMOMARK ROLL X1, THERMOMARK X, THERMOMARK S1.1, Mounting type: snapped into marker carrier, Lettering field: 35 x 28 mm (Marking) | EMT (35X28)R | 0801602 | 1 |
| Documentation | Type | Order No. | Pcs. / Pkt. |
| User manual, English, Axioline F: System and installation | UM EN AXL F SYS INST | - | - |
| User manual, English, Axioline F: Diagnostic registers, and error messages | UM EN AXL F SYS DIAG | - | - |

4 Technical data

Dimensions (nominal sizes in mm)



| | |
|--------------------|---|
| Width | 35 mm |
| Height | 126.1 mm |
| Depth | 54 mm |
| Note on dimensions | The depth is valid when a TH 35-7.5 DIN rail is used (according to EN 60715). |

General data

| | |
|---|---|
| Color | traffic grey A RAL 7042 |
| Weight | 145 g (with connectors and bus base module) |
| Ambient temperature (operation) | -25 °C ... 60 °C |
| Ambient temperature (storage/transport) | -40 °C ... 85 °C |

General data

| | |
|--|---|
| Permissible humidity (operation) | 5 % ... 95 % (non-condensing) |
| Permissible humidity (storage/transport) | 5 % ... 95 % (non-condensing) |
| Air pressure (operation) | 70 kPa ... 106 kPa (up to 3000 m above sea level) |
| Air pressure (storage/transport) | 70 kPa ... 106 kPa (up to 3000 m above sea level) |
| Degree of protection | IP20 |
| Protection class | III, IEC 61140, EN 61140, VDE 0140-1 |
| Mounting position | Any (no temperature derating) |

Connection data

| | |
|--|---|
| Designation | Axioline F connector |
| Connection method | Push-in technology |
| Conductor cross section solid / stranded | 0.2 mm ² ... 1.5 mm ² / 0.2 mm ² ... 1.5 mm ² |
| Conductor cross section [AWG] | 24 ... 16 |
| Stripping length | 8 mm |

Interface Axioline F local bus

| | |
|--------------------|-----------------|
| Connection method | Bus base module |
| Transmission speed | 100 MBit/s |

Communications power

| | |
|------------------------------------|------------------------------|
| Communications power U_{BUS} | 5 V DC (via bus base module) |
| Current consumption from U_{BUS} | typ. 120 mA, max. 150 mA |

I/O supply

| | |
|--------------------------------------|--|
| Supply of analog modules U_A | 24 V DC (I/O supply and sensor supply) |
| Maximum permissible voltage range | 19.2 V DC ... 30 V DC (including all tolerances, including ripple) |
| Current consumption from U_A | typ. 38 mA ($I_{IS} = 0$ mA) max. 45 mA ($I_{IS} = 0$ mA) typ. 118 mA ($I_{IS} = 4 \times 20$ mA (nominal load)) max. 125 mA ($I_{IS} = 4 \times 20$ mA (nominal load)) typ. 238 mA ($I_{IS} = 4 \times 50$ mA (full load)) max. 245 mA ($I_{IS} = 4 \times 50$ mA (full load)) |
| Surge protection | Electronic (35 V, 0.5 s) |
| Protection against polarity reversal | Polarity protection diode |
| Transient protection | Suppressor diode |

Total power consumption of the module

| | |
|-------------------|---|
| Power consumption | typ. 1.5 W (at U_{BUS} and U_A), max. 1.83 W (at U_{BUS} and U_A) |
|-------------------|---|

Analog inputs

| | |
|-------------------------------|--|
| Number of inputs | max. 4 (differential inputs, current) |
| Connection method | Push-in technology |
| Connection method | 2, 3, 4-wire (shielded) |
| Current input signal | 0 mA ... 20 mA, 4 mA ... 20 mA, -20 mA ... 20 mA |
| Resolution A/D | 16 bit |
| A/D conversion time | 31.25 μ s |
| Limit frequency (3 dB) | 30 Hz, 12 kHz |
| Measured value representation | 16 bits (15 bits + sign bit) |
| Data formats | IB IL, S7-compatible |
| Process data update | 160 μ s |
| Input filter | 30 Hz, 12 kHz and mean-value generation (can be parameterized) |
| Precision | 0.1 % (of measuring range final value for active mean-value generation and 30 Hz filter) |

Analog inputs

| | |
|--------------------------------|---|
| Transient protection of inputs | Suppressor diode |
| Input resistance current input | 104 Ω (typical) |
| Open circuit response | Going to 0 mA; open-circuit detection from 4 mA ... 20 mA |
| Overload protection | No; ±5.2 V DC, maximum, $I_{max} = 50 \text{ mA}$ |

Configuration and parameter data in a PROFIBUS system

| | |
|-----------------------------|--------|
| Required parameter data | 7 Byte |
| Need for configuration data | 6 Byte |

Electrical isolation/isolation of the voltage areas

| Test section | Test voltage |
|---|------------------------|
| 5 V communications power (logic), 24 V supply (I/O) | 500 V AC, 50 Hz, 1 min |
| 5 V supply (logic)/analog inputs | 500 V AC, 50 Hz, 1 min |
| 5 V supply (logic)/functional earth ground | 500 V AC, 50 Hz, 1 min |
| 24 V supply (I/O)/analog inputs | 500 V AC, 50 Hz, 1 min |
| 24 V supply (I/O) / functional earth ground | 500 V AC, 50 Hz, 1 min |
| Analog inputs/functional earth ground | 500 V AC, 50 Hz, 1 min |

Mechanical tests

| | |
|--|-----|
| Vibration resistance in acc. with EN 60068-2-6/IEC 60068-2-6 | 5g |
| Shock in acc. with EN 60068-2-27/IEC 60068-2-27 | 30g |
| Continuous shock according to EN 60068-2-27/IEC 60068-2-27 | 10g |

Conformance with EMC Directive 2004/108/EC

Noise immunity test in accordance with EN 61000-6-2

| | |
|--|--|
| Electrostatic discharge (ESD) EN 61000-4-2/IEC 61000-4-2 | Criterion B; 6 kV contact discharge, 8 kV air discharge |
| Electromagnetic fields EN 61000-4-3/IEC 61000-4-3 | Criterion A; Field intensity: 10 V/m |
| Fast transients (burst) EN 61000-4-4/IEC 61000-4-4 | Criterion B, 2 kV |
| Transient surge voltage (surge) EN 61000-4-5/IEC 61000-4-5 | Criterion B; supply lines DC: ±0.5 kV/±0.5 kV (symmetrical/asymmetrical); ±1 kV to shielded I/O cables |
| Conducted interference EN 61000-4-6/IEC 61000-4-6 | Criterion A; Test voltage 10 V |

Noise emission test according to EN 61000-6-3

| | |
|--|---------|
| Radio interference properties EN 55022 | Class B |
|--|---------|

Approvals

For the latest approvals, please visit phoenixcontact.net/products.

5 Tolerance data

The following applies for tolerance values:

The data is valid for nominal operation ($U_A = 24\text{ V}$ in the default configuration (unless documented otherwise).

Default configuration: Filter with 30 Hz, 16-sample mean-value, IB IL format.

160 μs update time (12 kHz filter, without mean-value generation)

| Tolerances at $T_A = 25^\circ\text{C}$ | | | | |
|--|------------------------|------------------------|-------------|-------------|
| Measuring range | Absolute | | Relative | |
| | Typ. | Max. | Typ. | Max. |
| 0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20\text{ mA}$ | $\pm 100\ \mu\text{A}$ | $\pm 160\ \mu\text{A}$ | $\pm 0.5\%$ | $\pm 0.8\%$ |

160 μs update time, default (30 Hz filter, 16-sample average value)

| Tolerances at $T_A = 25^\circ\text{C}$ | | | | |
|--|-----------------------|-----------------------|--------------|--------------|
| Measuring range | Absolute | | Relative | |
| | Typ. | Max. | Typ. | Max. |
| 0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20\text{ mA}$ | $\pm 20\ \mu\text{A}$ | $\pm 60\ \mu\text{A}$ | $\pm 0.10\%$ | $\pm 0.30\%$ |

Typical data contains offset error, gain error, and linearity error in the respective default setting.

All tolerances indicated as a percentage are related to the positive measuring range final value.

Please also observe the values for temperature drift and the tolerances under influences of electromagnetic interferences.

| Tolerance and temperature response at $T_A = -25^\circ\text{C}$ to $+60^\circ\text{C}$ | | |
|--|-------------------------|-------------------------|
| Measuring range | Drift | |
| | Typical | Maximum |
| 0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20\text{ mA}$ | $\pm 100\ \text{ppm/K}$ | $\pm 150\ \text{ppm/K}$ |

The drift values refer to the relevant measuring range final value.

| Tolerances influenced by electromagnetic interference | | |
|---|--------------------------------|---------------|
| Electromagnetic fields | EN 61000-4-3/ IEC 61000-4-3 | $< \pm 0.1\%$ |
| Fast transients (burst) | EN 61000-4-4/ IEC 61000-4-4 | $< \pm 0.1\%$ |
| Conducted interference | EN 61000-4-6/ IEC 61000-4-6 | $< \pm 0.1\%$ |

Additional tolerances may occur due to the influence of high-frequency electromagnetic interference caused by wireless transmission systems in the near vicinity. The values specified refer to nominal operation in the event of direct interference to components without additional shielding such as a steel cabinet, etc.

The above mentioned tolerances can be reduced by providing further shielding measures for the I/O module (e.g., use of a shielded control box/control cabinet, etc.).

6 Internal circuit diagram

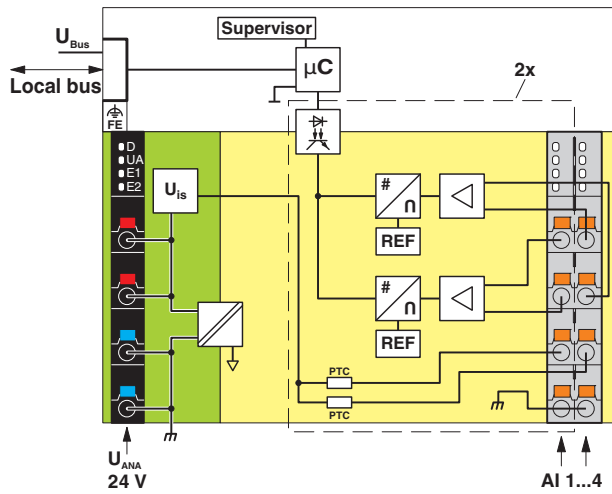


Figure 1 Internal wiring of the terminal points

Key:

Local bus

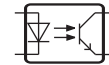
Axioline F local bus
(hereinafter referred to as local bus)
Hardware monitoring



Microcontroller



Optocoupler with bipolar buffer



Power supply unit with electrical isolation



Analog/digital converter



Input amplifier



Reference voltage source



Electrically isolated areas



Noiseless ground



Reference ground of analog voltage



Reference ground for communications power



Reference ground of sensor supply U_{IS}



7 Terminal point assignment

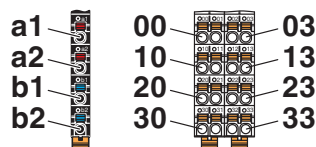


Figure 2 Terminal point assignment

| Terminal point | Color | Assignment |
|-----------------------------|--------|---|
| Supply voltage input | | |
| a1, a2 | Red | 24 V DC (U _A) Analog module supply (internally jumpered) |
| b1, b2 | Blue | GND Reference potential of the supply voltage (internally jumpered) |
| Analog inputs | | |
| 00 ... 03 | Orange | I1+ ... I4+ Positive current connection for channel 1 ... 4 |
| 10 ... 13 | Orange | I1- ... I4- Negative current connection for channel 1 ... 4 |
| 20 ... 23 | Orange | U _{IS1} ... U _{IS4} 24 V sensor supply for channel 1 ... 4 |
| 30 ... 33 | Orange | GND Reference potential of sensor supply |

8 Connection examples

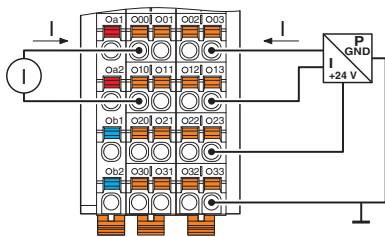


Figure 3 Connection for current measurement

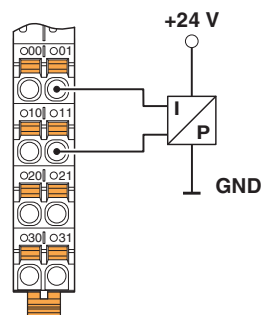


Figure 4 Passive pressure sensor at a differential current input

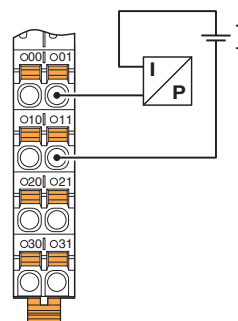


Figure 5 Differential current input with passive 2-wire transmitter (current loop)

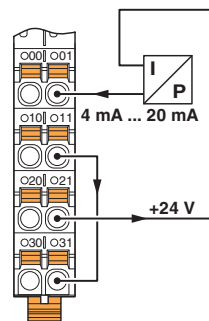


Figure 6 Differential current input with passive 2-wire transmitter (current loop)

9 Connection notes

**NOTE: Damage to the electronics/measuring errors**

Always connect the analog actuators using shielded twisted-pair cables.

Unshielded cables may lead to values outside the specified tolerance limits in environments subject to heavy noise.

Connect the cable shield to functional earth immediately after the cables enter the control cabinet.

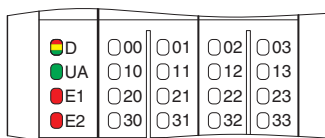
If there is no closed control cabinet, connect the shield to a shield bus.

Use the AXL SHIELD SET Axiline shield connection set for an optimized connection directly in front of the module.



For further information on shielding, please refer to the UM EN AXL SYS INST user manual.

10 Local status and diagnostic indicators



Channel errors are errors that can be associated with a channel.
Periphery errors are errors that affect the entire module.

Figure 7 Local status and diagnostic indicators

| Designation | Color | Meaning | State | Description |
|-------------|------------------|--|--------------------------|---|
| D | Red/yellow/green | Diagnostics of local bus communication | | |
| | | Power down | OFF | Device in (power) reset. |
| | | Not connected | Red flashing | Device operating, but there is no connection to previous device. |
| | | Reset | Red ON | Application reset Device operating, but there is still a connection to the previous device, the application is reset. |
| | | Ready | Yellow ON | Device operating, there is still a connection to the previous device, but the device has not yet detected a valid cycle after power on. |
| | | Connected | Yellow flashing | Valid data cycles have been detected, but the device is (not) yet part of the current configuration. |
| | | Device application not active | Green/yellow alternating | Valid data cycles are being detected. The master application set the output data to valid, however, the slave application has not set the input data to valid as yet. |
| | | Active | Green flashing | Device operating, communications within the station is OK. The master application does not read the input data. (The connection to the controller has not yet been established, for example.) |
| | | Run | Green ON | Valid data cycles are being detected. All data is valid |
| UA | Green | U _{Analog} | ON | Supply of analog modules present |
| | | | OFF | Supply of analog modules not present |
| E1 | Red | Supply voltage error | ON | Supply voltage is faulty. |
| | | | OFF | Supply voltage is present. |
| E2 | Red | Error | ON | I/O or channel error has occurred. |
| | | | OFF | No error |

Error code and status of the E1 and E2 LEDs

| Error | E1 LED | E2 LED |
|-------------------------|--------|--------|
| No error | OFF | OFF |
| Underrange | OFF | ON |
| Overrange | OFF | ON |
| Open circuit | OFF | ON |
| Faulty supply voltage | ON | ON |
| Parameter table invalid | OFF | ON |
| Device error | OFF | ON |
| Flash format error | OFF | ON |



The error that can actually be reported depends on the measuring range. For additional information please refer to the tables with significant measured values in various formats.

11 Process data

The module uses four words of IN process data. Each channel is mapped to a word.

Input words IN1 to IN4

The measured values are transmitted to the controller board or the computer using process data input words IN1 to IN4.

The measured values are depicted in IB IL or S7-compatible format. In both cases, the measured value is displayed in 16 bit format. The data type is Integer 16 from a technical programming point of view.

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

In the IB IL format a diagnostic code is mapped to the input data in the event of an error.

| Code (hex) | Cause |
|------------|--|
| 8001 | Measuring range exceeded (overrange) |
| 8002 | Open circuit |
| 8004 | Measured value invalid/no valid measured value available |
| 8020 | Faulty supply voltage |
| 8040 | Device faulty |
| 8080 | Below measuring range (underrange) |

12 Significant values in various formats

12.1 Significant values in IB IL format

| Input data | | 0 mA ... 20 mA | ± 20 mA | 4 mA ... 20 mA |
|------------|--------------|----------------|------------|----------------|
| hex | dec | mA | mA | mA |
| 8001 | Overrange | > +21.6747 | > +21.6747 | > +21.3397 |
| 7F00 | 32512 | +21.6747 | +21.6747 | +21.3397 |
| 7530 | 30000 | +20.0 | +20.0 | +20.0 |
| 0001 | 1 | +0.6667 µA | +0.6667 µA | +4.0005333 |
| 0000 | 0 | ≤ 0 | 0 | +4.0 ... +3.2 |
| FFFF | -1 | | -0.6667 µA | |
| 8AD0 | -30000 | | -20.0 | |
| 8100 | -32512 | | -21.6747 | |
| 8080 | Underrange | | < -21.6747 | |
| 8002 | Open circuit | | | < +3.2 |

The maximum measured value is 7F00_{hex}.

Depending on the measuring range, the minimum measured value is either 0000_{hex} or 8100_{hex}.

12.2 Significant values in S7-compatible format

| Input data | | 0 mA ... 20 mA | ± 20 mA | 4 mA ... 20 mA |
|------------|-------------------------|----------------|------------|----------------|
| hex | dec | mA | mA | mA |
| 7FFF | Overrange | > +23.5157 | > +23.5157 | > +22.8142 |
| 7EFF | 32511 | +23.5157 | +23.5157 | +22.8142 |
| 6C00 | 27648 | +20.0 | +20.0 | +20.0 |
| 0001 | 1 | +0.7234 µA | +0.7234 µA | +4.0005787 |
| 0000 | 0 | ≤ 0 | 0 | +4.0 |
| FFFF | -1 | | -0.7234 µA | +3.9994 |
| F940 | -1728 | | -1.25 | +3.0 |
| 9400 | -27648 | | -20.0 | |
| 8100 | -32512 | | -23.5157 | |
| 8000 | Underrange/open circuit | | < -23.5157 | < +1.1852 |

The maximum measured value is 7EFF_{hex}.

Depending on the measuring range, the minimum measured value is either 0000_{hex} or 8100_{hex}.

12.3 Calculation of the measured value from the process data input value

The following examples explain the calculation of the measured value from the process data input value for the measuring range 4 mA to 20 mA.

PD IW = Process data input word = input data

IB IL format

Resolution = $(20 \text{ mA} - 4 \text{ mA}) / 30000 = 0.0005333$

Measured value = PD-EW x 0.0005333 mA + 4 mA

Example 1

PD IW 493F_{hex} = 18751_{dec}
 Value x resolution 18751 x 0.000533 mA = 10 mA
 + 4 mA 10 mA + 4 mA = 14 mA
 Measured value 14 mA

S7-compatible format

Resolution = $(20 \text{ mA} - 4 \text{ mA}) / 27648 = 0.0005787$

Measured value = PD IW x 0.0005787 mA + 4 mA

Example 1

PD IW 6C00_{hex} = 27648_{dec}
 Value x resolution 27648 x 0.0005787 mA = 16 mA
 + 4 mA 16 mA + 4 mA = 20 mA
 Measured value 20 mA

Example 2

PD IW F940_{hex} -> FFFF_{hex} - F940_{hex} + 1
 = -1728_{dec}
 Value x resolution -1728 x 0.0005787 mA = -1 mA
 + 4 mA -1 mA + 4 mA = 3 mA
 Measured value 3 mA

13 Parameter, diagnostics and information (PDI)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel of the Axioline F station.

The standard and application objects stored in the module are described in the following section.

The following applies to all tables below:

Please refer to the UM EN AXL F SYS INST for an explanation of the object codes and data types.

| Abbreviation | Meaning |
|--------------|---------------------------------|
| A | Number of elements |
| L | Length of the elements in bytes |
| R | Read |
| W | Write |



Every visible string is terminated with a zero terminator (00_{hex}). The length of a visible string element is therefore one byte larger than the amount of user data.



For detailed information on PDI and the objects, please refer to the UM EN AXL F SYS INST user manual.

14 Standard objects

14.1 Objects for identification (device rating plate)

| Index (hex) | Object name | Object type | Data type | A | L | Rights | Meaning | Contents |
|--------------------------|-----------------|-------------|----------------|---|--------|--------|----------------------------|--|
| Manufacturer | | | | | | | | |
| 0001 | VendorName | Var | Visible String | 1 | 16 | R | Vendor name | Phoenix Contact |
| 0002 | VendorID | Var | Visible String | 1 | 7 | R | Vendor ID | 00A045 |
| 0003 | VendorText | Var | Visible String | 1 | 49 | R | Vendor text | Components and systems for industrial automation |
| 0012 | VendorURL | Var | Visible String | 1 | 30 | R | Vendor URL | http://www.phoenix-contact.com |
| Module - general | | | | | | | | |
| 0004 | DeviceFamily | Var | Visible String | 1 | 14 | R | Device family | I/O analog IN |
| 0006 | ProductFamily | Var | Visible String | 1 | 6 | R | Product family | AXL F |
| 000E | CommProfile | Var | Visible String | 1 | 4 | R | Communication profile | 633 |
| 000F | DeviceProfile | Var | Visible String | 1 | 5 | R | Device profile | 0010 |
| 0011 | ProfileVersion | Record | Visible String | 2 | 11; 20 | R | Profile version | 2011-12-07; Basic Profile V2.0 |
| 003A | VersionCount | Array | Unsigned 16 | 4 | 4 * 2 | R | Version counter | e. g., 0007 0001 0001 0001 _{hex} |
| Module - special | | | | | | | | |
| 0005 | Capabilities | Array | Visible String | 1 | 8 | R | Features | Energ_0 |
| 0007 | ProductName | Var | Visible String | 1 | 15 | R | Product name | AXL F AI4 I 1H |
| 0008 | SerialNo | Var | Visible String | 1 | 11 | R | Serial number | xxxxxxxx (e. g., 1234512345) |
| 0009 | ProductText | Var | Visible String | 1 | 24 | R | Product text | 4 analog input channels |
| 000A | OrderNumber | Var | Visible String | 1 | 8 | R | Order No. | 2688491 |
| 000B | HardwareVersion | Record | Visible String | 2 | 11; 3 | R | Hardware version | e. g., 2010-06-21; 01 |
| 000C | FirmwareVersion | Record | Visible String | 2 | 11; 6 | R | Firmware version | e. g., 2010-06-21; V1.10 |
| 000D | PChVersion | Record | Visible String | 2 | 11; 6 | R | Parameter channel version | 2010-01-08; V1.00 |
| 0037 | DeviceType | Var | Octet string | 1 | 8 | R | Module identification | 00 20 00 08 00 00 00 A6 _{hex} |
| Use of the device | | | | | | | | |
| 0014 | Location | Var | Visible String | 1 | 59 | R/W | Location | Can be filled out by the user. |
| 0015 | EquipmentIdent | Var | Visible String | 1 | 59 | R/W | Equipment identifier | Can be filled out by the user. |
| 0016 | AppIDeviceAddr | Var | Unsigned 16 | 1 | 2 | R/W | Application device address | Can be filled out by the user. |

14.2 Object for multilingual capacity

| Index (hex) | Object name | Object type | Data type | A | L | Rights | Meaning | Contents |
|-------------|-------------|-------------|----------------|---|------|--------|----------|----------------|
| 0017 | Language | Record | Visible String | 2 | 6; 8 | R | Language | en-us; English |

14.3 Object descriptions

| Index (hex) | Object name | Object type | Data type | A | L | Rights | Meaning |
|-------------|--------------|-------------|-----------|----|----------------|-------------|--|
| 0038 | ObjDescrReq | Record | | 2 | 3 | Read, write | Object description request |
| 0039 | ObjDescr | Record | | 16 | See subindices | Read | Object description |
| 003B | PDIN_Descr | Record | | 3 | 12 | R | Description of the IN process data |
| 003C | PDOOUT_Descr | Record | | 3 | 12 | R | Description of the output process data |



These objects are only important for tools and are therefore not described in more detail here.
Please refer to the basic profile for comprehensive information.

14.4 Diagnostics objects

| Index (hex) | Object name | Object type | Data type | A | L | Rights | Assignment |
|-------------|-------------|-------------|------------|---|-------------------|--------|-------------------|
| 0018 | DiagState | Record | | 6 | 2; 1; 1; 2; 1; 14 | R | Diagnostic state |
| 0019 | ResetDiag | Var | Unsigned 8 | 1 | 1 | W | Reset diagnostics |

Diagnostics state (0018_{hex}: DiagState)

This object is used for a structured message of an error.

| 0018 _{hex} : DiagState (Read) | | | | |
|--|----------------|-----------------|----------------------|--------------------------------------|
| Subindex | Data type | Length in bytes | Meaning | Contents |
| 0 | Record | 21 | Diagnostic state | Complete diagnostics information |
| 1 | Unsigned 16 | 2 | Error number | 0 ... 65535 _{dez} |
| 2 | Unsigned 8 | 1 | Priority | 00 _{hex} No error |
| | | | | 01 _{hex} Error |
| | | | | 02 _{hex} Warning |
| | | | | 81 _{hex} Error removed |
| | | | | 82 _{hex} Warning eliminated |
| 3 | Unsigned 8 | 1 | Channel/group/module | 00 _{hex} No error |
| | | | | 01 _{hex} Channel 1 |
| | | | | : : |
| | | | | 04 _{hex} Channel 4 |
| | | | | FF _{hex} entire device |
| 4 | Unsigned 16 | 2 | Error code | See table below |
| 5 | Unsigned 8 | 1 | More follows | 00 _{hex} |
| 6 | Visible String | 14 | Text (14 characters) | See table below |



The message with the priority 81_{hex} or 82_{hex} is a one-time internal message to the bus coupler that is implemented onto the error mechanisms of the higher-level system by the bus coupler.

Error and status of the local status and diagnostics indicators

| Subindex | 2 | 3 | 4 | | 6 | Process data | LED | | | |
|-------------------------|----------|----------------------|------------|-------|--------------|--------------|-----------------------|-----|-----|-----|
| | Priority | Channel/group/module | Error code | | Text | | D | UA | E1 | E2 |
| Error | hex | hex | hex | dec | | | | | | |
| No error | 00 | 00 | 0000 | 0 | Status OK | xxxx | Green ON | ON | OFF | OFF |
| Faulty supply voltage | 01 | FF | 5160 | 20832 | Supply fail | 8020 | Flashing green/yellow | OFF | ON | ON |
| Device error | 01 | FF | 6301 | 25345 | CS FLASH | 8040 | Green ON | ON | OFF | ON |
| Flash format error | 01 | FF | 6302 | 25346 | FO FLASH | 8040 | Green ON | ON | OFF | ON |
| Parameter table invalid | 01 | FF | 6320 | 25376 | Invalid para | 8010 | Green ON | ON | OFF | ON |
| Open circuit | 01 | 01 ... 04 | 7710 | 30480 | Open circuit | 8002 | Green ON | ON | OFF | ON |
| Overrange | 02 | 01 ... 04 | 8910 | 35088 | Overrange | 8001 | Green ON | ON | OFF | ON |
| Underrange | 02 | 01 ... 04 | 8920 | 35104 | Underrange | 8080 | Green ON | ON | OFF | ON |

Reset diagnostic messages (0019_{hex}: ResetDiag)

You can delete the diagnostics memory and acknowledge the diagnostic messages with this object.

| 0019 _{hex} : ResetDiag (Write) | | | | | |
|---|------------|-----------------|-------------------|-------------------|--|
| Subindex | Data type | Length in bytes | Meaning | Contents | |
| 0 | Unsigned 8 | 1 | Reset diagnostics | 00 _{hex} | All diagnostic messages approved |
| | | | | 02 _{hex} | Deletes and acknowledges all pending diagnostic messages that have not been read out |
| | | | | 06 _{hex} | Deletes and acknowledges all the diagnostic messages and allows no further diagnostic messages |
| | | | | Other | Reserved |

14.5 Objects for process data management

| Index (hex) | Object name | Object type | Data type | A | L | Rights | Assignment |
|-------------|-------------|-------------|--------------|---|---|--------|----------------------------------|
| 0025 | PDIN | Var | Octet string | 1 | 8 | R | Input process data |
| 0026 | PDOU | Var | Octet string | 1 | 8 | R | OUT process data; not applicable |

IN process data (0025_{hex}: PDIN)

You can read the IN process data of the module with this object.

The structure corresponds to the representation in the "Process data" section.

| 0025 _{hex} : PDIN (Read) | | | |
|-----------------------------------|--------------|-----------------|--------------------|
| Subindex | Data type | Length in bytes | Meaning |
| 0 | Octet string | 8 | Input process data |

14.6 Objects for device management

These objects are available as of firmware 1.10.

| Index (hex) | Object name | Object type | Data type | A | L | Rights | Meaning |
|-------------|-------------|-----------------|-------------|---|---|--------|------------------------|
| 002D | ResetParam | Simple variable | Unsigned 8 | 1 | 1 | R/W | Reset parameterization |
| 002E | Checksum | Simple variable | Unsigned 32 | 1 | 4 | R | Checksum |

Reset parameterization (002D_{hex}: ResetParam)

This object is used to reset the module to the default settings.

To reset the module value 01_{hex} must be transferred during write access. Any other values are not permissible and will be acknowledged with an error.

Then the default settings of the channels are loaded and all the user-set parameters are reset.

Checksum (002E_{hex}: Checksum)

The data of the startup objects is verified with this CRC32 checksum.

Checksum for the default setting: 44 3E 71 DC_{hex}

15 Application objects

| Index (hex) | Object name | Object type | Data type | A | L | Rights | Assignment |
|-------------|----------------------|-------------|--------------|---|-------|--------|--|
| 0080 | ParaTable | Array | Unsigned 16 | 6 | 6 * 2 | R/W | Parameter table |
| 0082 | Measured Value Float | Array | Octet string | 4 | 4 * 6 | R | Measured values in the extended float format |
| 0083 | PD Min | Array | Integer 16 | 4 | 4 * 2 | R | Minimum process data value |
| 0084 | PD Max | Array | Integer 16 | 4 | 4 * 2 | R | Maximum process data value |

15.1 Parameter table (0080_{hex}: ParaTable)

Parameterize the module using this object.

In the case of valid parameters, the parameterization is stored in the module permanently.

After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

| 0080 _{hex} : ParaTable (read, write) | | | | |
|---|----------------------|-----------------|-------------------------------|---------------------|
| Subindex | Data type | Length in bytes | Meaning | Default value |
| 0 | Array of Unsigned 16 | 6 * 2 | Read/write all elements | See subindices |
| 1 | Unsigned 16 | 2 | Parameterization of channel 1 | 0004 _{hex} |
| : | Unsigned 16 | 2 | : | 0004 _{hex} |
| 4 | Unsigned 16 | 2 | Parameterization of channel 4 | 0004 _{hex} |
| 5 | Unsigned 16 | 2 | Data format | 0000 _{hex} |
| 6 | Unsigned 16 | 2 | Reserved | 0000 _{hex} |

Parameterization channel 1 ... channel 4

Parameterization word

| | | | | | | | | | | | | | | | |
|----|----|----|--------|----|----|------------|---|---|---|---|-----------------|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0 | 0 | 0 | Filter | 0 | 0 | Mean-value | 0 | 0 | 0 | 0 | Measuring range | | | | |

| Filter | Code (bin) | Code (hex) |
|-----------------|------------|------------|
| 30 Hz (default) | 0 | 0 |
| 12 kHz | 1 | 1 |

| Measuring range | Code (bin) | Code (hex) |
|--------------------------|------------|------------|
| 0 mA ... 20 mA (default) | 0100 | 4 |
| ±20 mA | 0101 | 5 |
| 4 mA ... 20 mA | 0110 | 6 |
| Channel inactive | 1111 | F |
| Reserved | Other | |

| Mean-value | Code (bin) | Code (hex) |
|---------------------|------------|------------|
| 16-sample (default) | 00 | 0 |
| No mean-value | 01 | 1 |
| 4-sample | 10 | 2 |
| 32-sample | 11 | 3 |

Data format

| | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|-------------|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | Data format | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Data format | Code (bin) | Code (hex) |
|-------------------------|------------|------------|
| IB IL (default setting) | 00 | 0 |
| Reserved | 01 | 1 |
| S7-compatible | 10 | 2 |
| Reserved | 11 | 3 |

15.2 Measured value in extended float format (0082_{hex}: Measured Value Float)

You can read the IN process data in IB IL or S7-compatible format with the 0025_{hex} object.

The 0082_{hex} object is also available.

This object provides the measured value in the highest internal accuracy of the terminal in the float format.

| 0082 _{hex} : Measured Value Float (Read) | | | |
|---|------------------|-----------------|------------------------------|
| Subindex | Data type | Length in bytes | Meaning |
| 0 | Array of Records | 4 * 6 | Read all elements |
| 1 | Record | 6 | Measured value for channel 1 |
| : | : | : | : |
| 4 | Record | 6 | Measured value channel 4 |

Measured value channel 1 ... channel 4

| Element | Data type | Length in bytes | Meaning |
|---------|------------|-----------------|--|
| 1 | Float 32 | 4 | Measured value in float format according to IEEE 754 |
| 2 | Unsigned 8 | 1 | Status |
| 3 | Unsigned 8 | 1 | Unit |

Structure of the float format according to IEEE 754 in the bit representation:

| | | | |
|-----------|--------------|--------------|--------------|
| VEEE EEEE | EMMM MMMM | MMMM MMMM | MMMM MMMM |
|-----------|--------------|--------------|--------------|

- V 1 sign bit, 0: positive, 1: negative
- E 8 bits exponent with offset 7F_{hex}
- M 23 bits mantissa

Some example values for conversion from floating point to hexadecimal representation:

| Floating point | Hexadecimal representation |
|----------------|----------------------------|
| 1.0 | 3F 80 00 00 |
| 10.0 | 41 20 00 00 |
| 1.03965528 | 3F 85 13 6D |
| - 1.0 | BF 80 00 00 |

Extended Float Format

Extended Float Format is a specially defined format. It consists of the measured value in float format, a status, and a unit.

Status is necessary because the float format defines no patterns providing information on the status of the numerical value.

The status corresponds to the LSB of the diagnostic code in IB IL format (e.g., overrange: status = 01, diagnostic code = 8001_{hex}). If status = 0, the measured value is valid.

| Unit | Code |
|------------------|-------------------------|
| Milliampere (mA) | 39 (27 _{hex}) |

| Status | Code |
|---------------------------|-------------------|
| Measured value is valid | 00 _{hex} |
| Measured value is invalid | Other |

15.3 Minimum process data value (0083_{hex}: PD Min)

Object 0083_{hex} can be used to read the minimum process data values.

The values are initialized after each parameterization. The highest value is assigned for the minimum process data value.

PD Min = 7FFF 7FFF 7FFF 7FFF_{hex}

On every analog conversion, the PD Min value is compared with the current measured values and overwritten if necessary.

| 0083 _{hex} : PD Min (Read) | | | |
|-------------------------------------|---------------------|-----------------|--------------------------------------|
| Subindex | Data type | Length in bytes | Meaning |
| 0 | Array of Integer 16 | 4 * 2 | Read all elements |
| 1 | Integer 16 | 2 | Minimum process data value channel 1 |
| : | : | : | : |
| 4 | Integer 16 | 2 | Minimum process data value channel 4 |

15.4 Maximum process data value (0084_{hex}: PD Max)

Object 0084_{hex} can be used to read the maximum process data values.

The values are initialized after each parameterization. The lowest value is assigned for the maximum process data value.

PD Max = 8000 8000 8000 8000_{hex}

On every analog conversion, the PD Max value is compared with the current measured values and overwritten if necessary.

| 0084 _{hex} : PD Max (Read) | | | |
|-------------------------------------|---------------------|-----------------|--------------------------------------|
| Subindex | Data type | Length in bytes | Meaning |
| 0 | Array of Integer 16 | 4 * 2 | Read all elements |
| 1 | Integer 16 | 2 | Maximum process data value channel 1 |
| : | : | : | : |
| 4 | Integer 16 | 2 | Maximum process data value channel 4 |

16 Device descriptions

The device is described in the device description files.

The device descriptions for controllers from Phoenix Contact are included in PC Worx and the corresponding service packs.

The device description files for other systems are available for download at phoenixcontact.net/products in the download area of the bus coupler used.



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