AXL F EX IS AI8 P HART XC 1F

Axioline F, analog input module, passive analog inputs: 8 (HART), HART functionality, intrinsically safe

Data sheet
111710_en_00

 2024-12-20

1 Description

The module is an Axioline F I/O module for use in the Axioline F modular I/O system.
The module is a modular I/O device that can be affixed to the Axioline F local bus, to communicate I/O data up to the Axioline F controller or bus coupler, which forms the head of the station.
As an intrinsic safety I/O module, this device allows direct connection from intrinsically safe field I/Os to the terminals of the module.
The analog input I/O module with HART capabilities collects analog input and HART data from the field I/O terminals and makes this information available to the controller / bus coupler through the Axioline F local bus.
The passive analog input module allows the connection of up to eight HART enabled, active analog input signals.

Features

- Passive analog input module
- Sinks power from up to eight HART enabled, active analog input signals
- Cyclic access to PV, SV, TV, QV, and Loop Current
- Current ranges: 0 mA ... 20 mA, 4 mA ... 20 mA
- Intrinsically safe analog inputs with connection to Zone 1, Zone 0 or Division 1
- Can be used under extreme ambient conditions
- Extended temperature range of -40 °C ... +70 °C (see “Tested successfully: use under extreme ambient conditions” in the data sheet)

Observe these notes

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 at: phoenixcontact.com/product/1215393

2 Table of contents

3 Ordering data

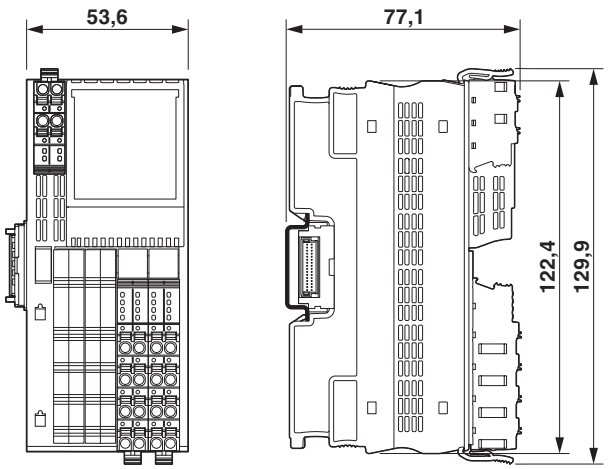
Description	Type	Item no.	Pcs./Pkt.
Axioline F, Analog input module, Passive analog inputs: 8 (HART), 0 mA ... 20 mA, 4 mA ... 20 mA, connection technology: 2-conductor, transmission speed in the local bus: 100 Mbps, Extreme conditions version, intrinsically safe, HART functionality, degree of protection: IP20, including bus base module and Axioline F connectors	AXL F EX IS AI8 P HART XC 1F	1215393	1

Documentation	Type	Item 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	-	-

Additional ordering data	
For additional ordering data (accessories), go to:	www.phoenixcontact.com/product/1215393

4 Technical data

Dimensions (nominal sizes in mm)



Width	53.6 mm
Height	129.9 mm
Depth	77.1 mm
Note on dimensions	The depth applies when a TH 35-7.5 DIN rail is used (in accordance with EN 60715).

General data	
Color	Housing: traffic grey A (RAL 7042)
Weight	267 g (with connectors and bus base module)
Ambient temperature (operation)	-25 °C … 60 °C (Standard) -40 °C … 70 °C (Extended, see section “Tested successfully: use under extreme ambient conditions” in the data sheet.)
Ambient temperature (storage/transport)	-40 °C … 85 °C
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
Maximum altitude	3000 m
Protection class	III (IEC 61140, EN 61140, VDE 0140-1)
Overvoltage category	II (IEC 60664-1, EN 60664-1)
Degree of pollution	2 (IEC 60664-1, EN 60664-1)
Mounting type	DIN rail mounting
Mounting position	any (no temperature derating)

Connection data: Axioline F connector	
Connection method	Push-in connection
Conductor cross section, rigid	0.2 mm² … 1.5 mm²
Conductor cross section, flexible	0.2 mm² … 1.5 mm²
Conductor cross section [AWG]	24 … 16
Stripping length	8 mm

Please observe the information provided on conductor cross sections in the “Axioline F: system and installation” user manual.

Interface: Axioline F local bus	
Number of interfaces	2
Connection method	Bus base module
Transmission speed	100 Mbps

Axioline F local bus supply (U_{Bus})	
Supply voltage	5 V DC (via bus base module)
Current consumption	typ. 40 mA max. 60 mA

Supply for analog modules (U_A)	
Supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	max. 27 mA
Surge protection	electronic (35 V, 0.5 s)
Reverse polarity protection	Polarity protection diode
Transient protection	Suppressor diode
Power dissipation	
Maximum power dissipation for nominal condition	2.15 W
Passive analog inputs	
Number of inputs	8 (HART)
Description of the input	HART enabled passive analog input signals
Connection method	Push-in connection
Connection technology	2-conductor, shielded, twisted pair
Current input signal	0 mA ... 20 mA, 4 mA ... 20 mA
A/D converter resolution	12 bit
A/D conversion time	500 µs
Measured value representation	16 bits (15 bits + sign bit)
Data formats	Inline, S7-compatible, standard formatting
Process data update	1.9 ms (Analog input latency) 400 ms (HART latency per channel)
Tolerance, relative	typ. 0.1 % (of measuring range final value for active mean-value generation and 30 Hz filter)
Limit frequency (3 dB)	25 Hz 10 Hz
Polarity reversal protection of the inputs	yes
Input and output address area	
Input address area	48 Byte
Output address area	0 Byte
Configuration and parameter data in a PROFIBUS system	
Required parameter data	27 Byte
Required configuration data	6 Byte

Electrical isolation/isolation of the voltage areas	
Test section	**Test voltage**
5 V supply of the local bus (U_{Bus}) / 24 V supply (I/Os)	500 V AC, 60 Hz, 1 min
5 V supply of the local bus (U_{Bus}) / functional ground	500 V AC, 60 Hz, 1 min
5 V supply of the local bus (U_{Bus}) / analog inputs	1500 V AC, 60 Hz, 1 min
24 V supply (I/O) / functional ground	500 V AC, 60 Hz, 1 min
24 V supply (I/O) / analog inputs	1500 V AC, 60 Hz, 1 min
Analog inputs / functional ground	500 V AC, 60 Hz, 1 min

Mechanical tests	
Vibration resistance in accordance with EN 60068-2-6/IEC 60068-2-6	5g
Shock in accordance with EN 60068-2-27/IEC 60068-2-27	30g
Continuous shock in accordance with EN 60068-2-27/IEC 60068-2-27	10g

Conformance with EMC Directive 2014/30/EU	
Immunity test in accordance with EN IEC 61000-6-2	
Electrostatic discharge (ESD) IEC 61000-4-2	Criterion A, ±6 kV contact discharge, ±8 kV air discharge
Electromagnetic fields IEC 61000-4-3	Criterion A, Field intensity: 10 V/m
Fast transients (burst) IEC 61000-4-4	Criterion A, supply lines: ±2 kV Criterion A, signal/data lines: ±1 kV Criterion B, signal/data lines: ±2 kV
Transient overvoltage (surge) IEC 61000-4-5	Criterion A, supply lines DC: ±0.5 kV/±1.0 kV (symmetrical/ asymmetrical) Criterion B, ±1 kV to shielded I/O cables
Conducted interference IEC 61000-4-6	Criterion A, Test voltage 10 V
Noise emission test in accordance with EN IEC 61000-6-4	Class A

Safety data	
Max. external inductivity L_o / Max. external capacitance C_o	0 mH / 0 µF (A, B / IIC) 0 mH / 0 µF (C/IIB, IIIC) 0 mH / 0 µF (D/IIA, E, F, G, Class III)
Max. voltage U_i	30 V
Max. current I_i	115 mA
Input power P_i	863 mW
Safety-related maximum voltage U_m	250 V

Approvals	
For the current approvals, go to:	www.phoenixcontact.com/product/1215393
ATEX (DEMKO 20 ATEX 2370X)	II 3(1) G Ex ec [ia Ga] IIC T4 Gc II (1) D [Ex ia Da] IIIC
IECEx (IECEx UL 20.0044X)	Ex ec [ia Ga] IIC T4 Gc [Ex ia Da] IIIC
UKCA Ex (UKEX) (UL22UKEX2508X)	II 3(1) G Ex ec [ia Ga] IIC T4 Gc II (1) D [Ex ia Da] IIIC
UL, USA/Canada (E238705)	cULus
UL Ex, USA / Canada (E196811)	Class I, Division 2, Groups A, B, C, D, T4 Intrinsically safe connections to: Class I, Groups A, B, C, D; Class II, Groups E, F, G; Class III; [Ex ia] Haz loc Class I, Zone 2, AEx ec [ia Ga] IIC T4 Gc [AEx ia Da] IIIC Ex ec [ia Ga] IIC T4 Gc [Ex ia Da] IIIC
CCC / China-Ex	Ex ec [ia Ga] IIC T4 Gc [Ex ia Da] IIIC

Manufacturer's declarations	
For the current manufacturer’s declarations, go to:	www.phoenixcontact.com/product/1215393

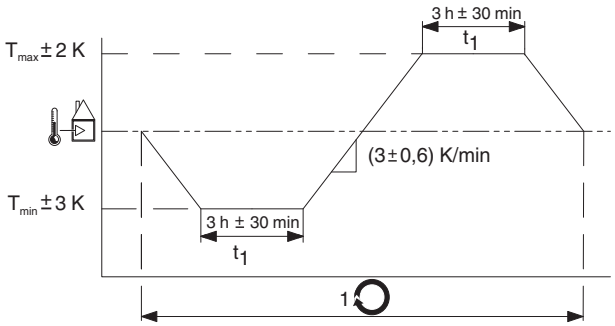
5 Tested successfully: Use under extreme ambient conditions

XC modules have been tested successfully over 250 temperature change cycles according to IEC 61131-2 in the range from -40°C to +70°C.

The following conditions were observed:

- The Axioline F devices for all connecting cables were connected with a minimum conductor cross section of 0.5 mm²
- The Axioline F station was installed on a wall-mounted horizontal DIN rail
- Fans were used to ensure continuous movement of air in the control cabinet
- The Axioline F station was not exposed to vibration or shock
- The Axioline F station was operated with a maximum of 24.5 V (ensured by using electronically regulated power supply units)

Figure 1 Temperature change cycle



Temperature in the control cabinet/ambient temperature

Cycle

WARNING:

The module is not approved for use in safety technology.

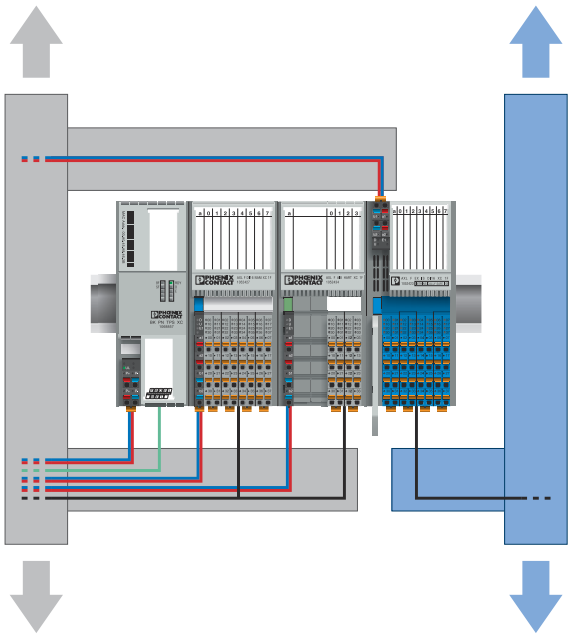
6 Intrinsic safety

Connect the module to any Axioline F system, providing the module is installed with intrinsic safety installation practices. This module has intrinsically safe I/O terminals with connection to Zone 1, Zone 0, or Division 1 with the use of intrinsically safe sensors.

Install the module together with all other intrinsically safe AXL F modules at the end of the local bus. Install an AXL F/P IO EX PP partition plate (item no.: 1100201) between the non-intrinsically safe and intrinsically safe sections of the system.

The figure below shows a typical installation for handling non-intrinsically safe and intrinsically safe modules.

Figure 2 Handling of non-intrinsically safe and intrinsically safe modules



For more detailed information, please refer to the UM EN AXL F SYS INST user manual.

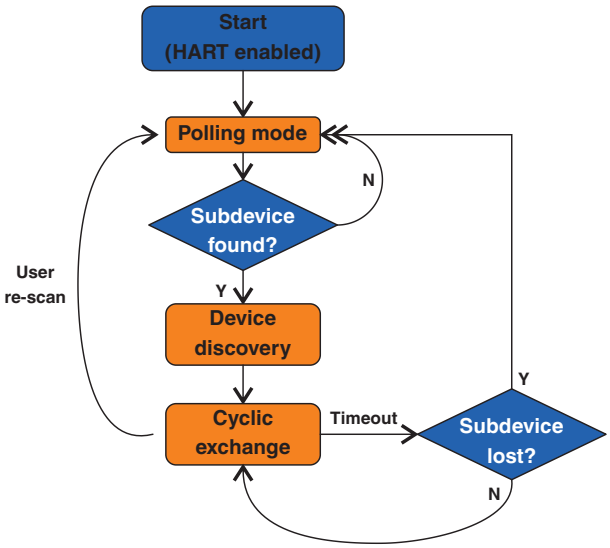
7 HART functionality

The module allows an easy-to-setup connection to HART devices. While this module does not support multi-drop, there are two HART modems embedded in the module that connect up to 8 HART devices.

Once added to the Axioline F local bus, this module will start its HART loop scan until a device is found.

The figure below shows, how the module polls HART devices.

Figure 3 Polling HART devices



For each HART channel 1 to 8, parameterize whether it is enabled or disabled.

In addition, enable or disable “HART, High Priority Polling”. If you specify HART high-priority polling for some channels, these channels will be polled more often than the others.

Select the cyclic process data for each channel of the module.

Available HART data includes loop current, PV, SV, TV, and QV.

The process data for the analog input values and the HART process values is specified in the following data structure.

Process data structure

AI8 process data			HART process data		
[0]	...	[15]	[16]	...	[47]

HART process data

The block of HART process data provides all HART data of the module through eight slots. To populate each of the eight slots with values, select Loop Current, PV, SV, TV, or QV from the HART values of the field device. Each of these five HART values uses just one slot. This allows for a modular configuration approach in accordance with your requirements.

Examples

Example 1: A HART device is connected to any channel of the module. It is desired to receive the Loop Current, PV, and SV from the device. In this scenario, these three HART variables would use three of the eight available HART slots. These three HART variables may be placed anywhere in the eight slots. The module can configure HART devices for polling with different priorities. To do this, activate high-priority polling at the desired channel of the module.

Example 2: Eight different HART devices are connected to all eight channels of the module. It is desired to receive one HART variable from each device. These eight HART variables in total can be assigned to the eight slots of the HART process data in any order and with any polling priority.

8 For your safety

8.1 Intended use

Use the Axioline F modules exclusively in accordance with the specifications in the accompanying data sheet and the “Axioline F: System and Installation” user manual.

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

8.2 Qualification of users

The use of products described in this data sheet is oriented exclusively to electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

8.3 Electrical safety

WARNING: loss of electrical safety

If used incorrectly, device safety may be impaired.

The instructions given in this data sheet as well as the UM EN AXL F SYS INST user manual must be observed during installation, startup, and operation.

8.4 Installation

Only install the Axioline F modules in a control cabinet or junction box.

Mount and install the device in such a way that the disconnecting device can be operated without restriction.

NOTE: Fire hazard

– The device must be installed in the final protective housing, which provides sufficient resistance to mechanical strain and protection against the spreading of fire in accordance with the standards UL/IEC/EN 61010-1 and UL/IEC/EN 61010-2-201.
– The supply and external circuits intended to be connected to this device shall be galvanically separated from the mains supply or hazardous live voltage by reinforced or double insulation and meet the requirements of SELV/PELV (Class III) circuits of UL/CSA/IEC/EN 61010-1, UL/CSA/IEC/EN 61010-2-201.

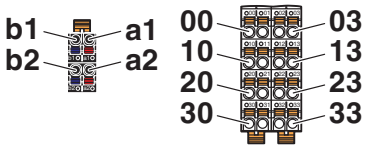
NOTE: Damage to the contacts

Physical overloads can result in damage to the terminal points.

- Relieve strain in the connected cables.

9 Terminal point assignment

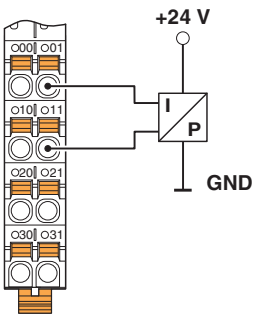
Figure 4 Terminal point assignment



Terminal point	Color	Assignment	
Supply voltage input			
b1, b2	Blue	GND	Reference potential of the supply voltage (bridged internally)
a1, a2	Red	24 V DC (U_A)	Supply for analog modules (bridged internally)
Analog inputs			
00 ... 03	Orange	I01+ ... I04+	Positive current connection for channel 1 ... 4
10 ... 13	Orange	I01- ... I04-	Negative current connection for channel 1 ... 4
20 ... 23	Orange	I05+ ... I08+	Positive current connection for channels 5 ... 8
30 ... 33	Orange	I05- ... I08-	Negative current connection for channels 5 ... 8

10 Connection examples

Figure 5 Passive pressure sensor (HART sensor) at a differential current input



11 Connection notes

Observe the connection notes by the sensor manufacturer.

Shielding

Always connect the analog sensors using shielded, twisted pair cables.

Use of shielded, twisted connecting cables (e.g. LiYCY (TP) 2 x 2 x 0.5 mm²) is required in environments prone to interference as well as for sensor cables which are longer than 1 m.

In environments with high levels of interference, unshielded cables may cause values to be outside the specified tolerance limits.

For installation in a control cabinet: Connect the cable shield to the functional ground at a suitable point immediately after entry into the control cabinet. Route the cable in the control cabinet in a shielded manner.

If a closed control cabinet is not available, connect the shield to a shield bus.

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

In general, you can use Phoenix Contact products for shielding, see www.phoenixcontact.com/webcode/#0845.

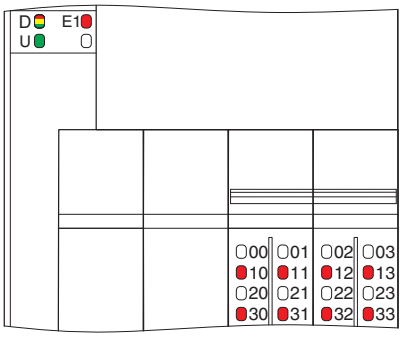
For further information on shielding, please refer to the user manual UM EN AXL F SYS INST.

Strain relief

Do not use the shield contact as a strain relief. Carry out the shielding and the strain relief separately.

12 Local diagnostic and status indicators

Figure 6 Local diagnostic and status indicators



Channel errors are errors that can be associated with a channel.
I/O errors are errors that affect the entire module.

Designation	Color	Meaning	State	Description
D	Red/ yellow/ green	Diagnostics of local bus communication		
		Run	Green on	The device is ready for operation, communication within the station is OK. All data is valid. An error has not occurred.
		Active	Flashing green	The device is ready to operate, communication within the station is OK. The data is **not** valid. The controller or higher-level network is not delivering valid data. There is no error on the module.
		Device application not active	Flashing green/ yellow	The device is ready for operation, communication within the station is OK. Output data **cannot** be outputted and/or input data **cannot** be read. There is a fault on the periphery side of the module.
		Ready	Yellow on	The device is ready for operation but did not detect a valid cycle after power-up.
		Connected	Flashing yellow	The device is not (yet) part of the active configuration.
		Reset	Red on	The device is ready for operation but has lost the connection to the bus head.
		Not connected	Red flashing	The device is ready for operation but there is no connection to the previously existing device.
		Power down	Off	Device is in (power) reset.
U	Green	U_A	On	Supply for analog modules (U_A) present.
			Off	Supply for analog modules (U_A) not present.
E1	Red	Supply voltage error	On	Supply for analog modules (U_A) is faulty.
			Off	Supply for analog modules (U_A) is OK.
10 ... 13, 30 ... 33	Red	Diagnostics of the input	On	Short-circuit/open-circuit/overrange/underrange of the input.
			Off	No error

Error code and status of the E1 LED

Error	LED E1
No error	off
Underrange	off
Overrange	off
Wire break	off
Supply voltage faulty (supply for analog modules (U_A))	on
Parameter table invalid	off
Device error	off
Flash format error	off

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.

13 Process data

The module uses 24 input process data words.

Each channel to which an analog sensor is connected is mapped to one word.

Each channel to which a HART sensor is connected is mapped to two words.

The process data is mapped in Motorola format (Big Endian).

Example of process data visualization in PLCnext Engineer

Process data element	I/Q	Type	Offset
ai-1 / ~AI384	I	OctetString[48]	0.0
ai-1 / IN01	I	BitString16	2.0
ai-1 / IN02	I	BitString16	4.0
...	...	...	...
ai-1 / IN08	I	BitString16	14.0
ai-1 / HART_IN01	I	Float32	16.0
ai-1 / HART_IN02	I	Float32	20.0
...	...	...	...
ai-1 / HART_IN08	I	Float32	44.0

Input words IN01 to IN08

The measured values are transmitted to the higher-level system via the input process data words.

The measured values are depicted in Inline format, in S7-compatible format, or in the standard format.

In all formats, the measured value is represented in 16-bit format.

INxx															
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	Wire break
8004	Measured value invalid or no valid measured value available
8040	Device faulty
8080	Below measuring range (underrange)

Input words (32 bit) HART_IN01 to HART_IN08

The HART process values are transmitted to the controller board or the computer via the 32-bit words HART_IN01 to HART_IN08 in the input process data.

Channel 1 ... channel 8 measured value

Element	Data type	Length in bytes	Meaning
1	FLOAT32	4	Measured value in float format according to IEEE 754

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

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

14 Significant values in various formats

14.1 Significant values in Inline format

Input data		0 mA ... 20 mA	4 mA ... 20 mA
hex	dec	mA	mA
8001	Overrange	> +21.6747	> +21.3397
7F00	32512	+21.6747	+21.3397
7530	30000	+20.0	+20.0
0001	1	+0.0006667	+4.0005333
0000	0	0	+4.0
FFFF	-1	-	+3.999
FD10	-752	-	+3.6 ... +3.2
8002	Wire break	-	< +3.2

14.2 Significant values in S7-compatible format

Input data		0 mA ... 20 mA	4 mA ... 20 mA
hex	dec	mA	mA
7FFF	Overrange	> +23.5157	> +22.8142
7EFF	32511	+23.5157	+22.8142
6C00	27648	+20.0	+20.0
0001	1	+0:0007234	+4.0005787
0000	0	0	+4.0
FFFF	-1	-	+3.9994
F940	-1728	-	+3.0
8000	Underrange/ wire break	-	< +1.1852

14.3 Significant values in standard format

Input data		0 mA ... 20 mA	4 mA ... 20 mA
hex	dec	mA	mA
8001	Overrange	> +21.674	> +21.339
54AA	21674	+21.674	-
4E20	20000	+20.0	-
43BB	17339	+17.339	+21.339
3E80	16000	+16.0	+20.0
0001	1	+0.001	+4.001
0000	0	0	+4.0
FFFF	-1	-	+3.999
FE70	-400	-	+3.6 ... +3.2
8002	Wire break	-	< +3.2

15 Parameter, diagnostics and information (PDI)

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

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

You will find an explanation of the data types in the user manual UM EN AXL F SYS INST.

The following applies to all tables below:

Abbreviation	Meaning
Length in bytes	Maximum length of the elements in bytes
R	Read
W	Write
[x]	Number of elements in an array or record

Each visible string is terminated with a null terminator (00_{hex}). The length of a visible-string-type element is therefore at least one byte larger than the number of user data items.
If the number of user data items plus null terminator is smaller than the specified length of the element, the visible string will be populated with a null character (00_{hex}).

You will find detailed information on the PDI objects in the user manual UM EN AXL F SYS INST.

16 Standard objects

16.1 Objects for identification (device rating plate)

Index (hex)	Object name	Data type	Length in bytes	Rights	Meaning	Contents
Manufacturer						
0001	VendorName	Visible String	32	R	Vendor name	Phoenix Contact
0002	VendorID	Visible String	7	R	Vendor ID	00A045
0003	VendorText	Visible String	58	R	Vendor text	Components and systems for industrial automation
0012	VendorURL	Visible String	58	R	Vendor URL	www.phoenixcontact.com/qr/1215393
Module - general						
0004	DeviceFamily	Visible String	58	R	Device family	I/O analog IN
0006	ProductFamily	Visible String	32	R	Product family	AXL F XC
000E	CommProfile	Visible String	5	R	Communication profile	633
000F	DeviceProfile	Visible String	5	R	Device profile	0010
0011	ProfileVersion	Record [2] of Visible Strings	51	R	Profile version	2011-12-07; Basic - Profile V2.0
0017	Language	Record [2] of Visible Strings	56	R	Language	en-us; English
Module - special						
0005	Capabilities	Octet string	8	R	Capabilities	FwUpdt0
0007	ProductName	Visible String	32	R	Product name	AXL F EX IS AI8 P HART XC 1F
0008	SerialNo	Visible String	22	R	Serial number	e. g., 1234512345
0009	ProductText	Visible String	58	R	Product text	8 analog passive I.S. inputs with HART
000A	OrderNumber	Visible String	32	R	Item No.	1215393
000B	HardwareVersion	Record [2] of Visible Strings	22	R	Hardware version	e. g., 2010-06-21; 01
000C	FirmwareVersion	Record [2] of Visible Strings	22	R	Firmware version	e. g., 2010-06-21; V1.10
000D	PChVersion	Record [2] of Visible Strings	51	R	PDI version	2016-12-01; PDI V1.10
0037	DeviceType	Octet string	8	R	Device type	0422 0430 000B 0CA4$_{hex}$
003A	VersionCount	Array [4] of UINT16	8	R	Version counter	e. g., 0007 0001 0001 0001$_{hex}$
Use of the device						
0014	Location	Visible String	58	R/W	Location	Can be completed by the user.
0015	EquipmentIdent	Visible String	58	R/W	Equipment identifier	Can be completed by the user.
0016	ApplDeviceAddr	UINT16	2	R/W	Application-specific device address	Can be completed by the user.

16.2 Miscellaneous standard objects

Index (hex)	Object name	Data type	Length in bytes	Rights	Meaning/contents	Startup parameters	
Diagnostics objects							
0018	DiagState	Record [6]	57	R	Diagnostic state	No	*
0019	ResetDiag	UINT8	1	R/W	Handling diagnostic messages	Yes	*
Objects for process data management							
0025	PDIN	Octet string	48	R	Input process data The structure corresponds to the representation in the "Process data" section.	No	
0026	PDOUT	Octet string	48	R	OUT process data, not applicable	No	
003B	PDIN_Descr	Array [3] of Records	24	R	Description of the IN process data	No	
003C	PDOUT_Descr	Array [3] of Records	12	R	Description of the output process data	No	
Objects for device management							
002D	ResetParam	UINT8	1	R/W	Reset parameterization	No	*

Startup parameters are stored in the non-volatile flash memory.

The objects identified with * in the last column are described in more detail in the following sections.

The description of the other objects is to be found in the user manual UM EN AXL F SYS INST.

The objects $003B_{hex}$ and $003C_{hex}$ are only applicable to tools.

16.3 Diagnostics state (0018_{hex}: DiagState)

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

Read off all information via subindex 00 to receive all information on an error number. Access to individual elements of the object is not permitted.

0018_{hex}: Diagnostics state (read)					
Element	**Data type**	**Length in bytes**	**Meaning**	**Contents**	
0	Record [6]	57	Diagnostic state	Complete diagnostics information	
1	UINT16	2	Error number	0 ... 65535_{dec}	
2	UINT8	1	Priority	00_{hex}	No error
				01_{hex}	Error
				02_{hex}	Warning
				81_{hex}	Error removed
				82_{hex}	Warning eliminated
3	UINT8	1	Channel/group/module	00_{hex}	No error
				01_{hex}	Channel 1
				:	:
				08_{hex}	Channel 8
				FF_{hex}	Entire device
4	UINT16	2	Error code	See table below	
5	UINT8	1	Additional information	00_{hex}	
6	Visible String	50	Text	See table below	

The message with priority 81_{hex} or 82_{hex} is a one-off, internal message to the bus coupler. The bus coupler transfers this error message to the error mechanisms of the higher-level system.

Once the cause of the fault has been removed, the message is automatically reset.

Error and status of the local diagnostics and status indicators

Element	2	3	4	6				
Error	Priority	Channel/ group/ module	Error code	Text	LED			
	hex	hex	hex		D	U	E1	10 ... 13, 30 ... 33
No error	00	00	0000	Status OK	◐	●	○	X
Supply voltage faulty (supply for analog modules (U_A))	01	FF	5160	Supply fail	☼	○	●	X
Device error	01	FF	6301	CS FLASH	◐	●	○	○
Flash format error	01	FF	6302	FO FLASH	◐	●	○	○
Wire break	01	01 ... 08	7710	Open circuit	◐	●	○	●
Overrange	02	01 ... 08	8910	Overrange	◐	●	○	●
Underrange	02	01 ... 08	8920	Underrange	◐	●	○	●
No HART subdevice present	01	01 ... 08	A001	Device missing	◐	●	○	○
HART subdevice replaced	02	01 ... 08	A003	Dev replaced	◐	●	○	○
HART communication error	01	01 ... 08	A020	Comm error	◐	●	○	●
HART Timeout	01	01 ... 08	A021	Timeout	◐	●	○	●

X The LED is not affected by this error.

○ Off ◐ Green on

● On ☼ Flashing green/yellow

An error at a channel (channel = 01 ... 08) is indicated via the corresponding LEDs 10 ... 13 or LEDs 30 ... 33. An error which affects the entire device (channel = FF) is only indicated on active channels via LEDs 10 ... 13 and 30 ... 33. The corresponding LED is off for inactive channels.

16.4 Handling diagnostic messages (0019_{hex}: ResetDiag)

You can use this object to specify how the module should handle diagnostic messages.

0019_{hex}: Handling diagnostic messages (read, write)				
Subindex	Data type	Length in bytes	Code (hex)	Meaning/contents
0	UINT8	1	00	Permit all diagnostic messages (default)
			02	Delete and acknowledge all diagnostic messages that are still pending
			06	Delete and acknowledge all diagnostic messages and do not permit new diagnostic messages
			Other	Reserved

16.5 Reset parameterization ($002D_{hex}$: ResetParam)

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

To reset the parameters, value 01_{hex} must be transferred during write access. All other values are invalid and will be acknowledged with an error.

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

17 Analog input objects

Index (hex)	Subindex (hex)	Object name	Data type	Length in bytes	Rights	Meaning/contents	Startup parameters
0100	Per module: 00	Data_Format	UINT8	1	R/W	Data format	Yes
0200	Per channel: 00, 01 ... 08, FF	AI_Range	Array [8] of UINT8	8	R/W	Measuring range	Yes
0201	Per channel: 00, 01 ... 08, FF	AI_Average	Array [8] of UINT8	8	R/W	Sliding average	Yes
0203	Per channel: 00, 01 ... 08	AI_MeasuredValueFloat	Array [8] of 32-bit FLOAT	32	R	Measured value	No
0204	Per channel: 00, 01 ... 08, FF	AI_NE43_Alarm	UINT8	8	R/W	NE43 Alarm	Yes

Startup parameters are stored in the non-volatile flash memory.

Structure of objects

Use these objects to parameterize either the entire module or each channel individually.

The objects are structured as follows:

Index $02xx_{hex}$	
Subindex	**Meaning/contents**
00	Read and/or write complete information (depending on privileges)
01	Channel 1
:	:
08	Channel 8
FF	Apply identical value for all channels (write only)

Example

0200_{hex}: Measuring range (AI_Range) (read/write)			
Subindex (hex)	**Data type**	**Length in bytes**	**Meaning/contents**
00	Array [8] of UINT8	8	Read and/or write the measuring range for all channels
01	UINT8	1	Measuring range, channel 1
:	:	:	:
08	UINT8	1	Measuring range, channel 8
FF	UINT8	1	Apply identical value for all channels (write only)

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

17.1 Data format (0100_{hex}: Data_Format)

Use this object to parameterize the data format for the module.

Code (hex)	Data format
00	**Inline (default)**
02	S7-compatible
06	Standard formatting

17.2 Measuring range (0200_{hex}: AI_Mode)

Use this object to parameterize the measuring range for each channel.

Code (hex)	Measuring range
04	0 mA ... 20 mA
06	4 mA ... 20 mA
FF	**Channel inactive (default)**

Parameterize unused channels as “Channel inactive”.

17.3 Sliding average (0201_{hex}: Average)

A sliding average is useful for determining relatively static positions that change gradually. Use this object to parameterize the number of measured values that are used to generate the sliding average.

Code (hex)	Mean-value
00	**Without mean value (default)**
04	4-sample
08	8-sample
10	16-sample
20	32-sample

17.4 Measured value (0203_{hex}: AI_MeasuredValueFloat)

Use this object to read the 32-bit measured value in float format for each channel.

17.5 NE43 Alarm (0204_{hex}: AI_NE43_Alarm)

Use this object to enable or disable the NE43 alarm for each channel.

Code (hex)	NE43 Alarm
00	Disabled
01	**Enabled (default)**

18 HART objects

Index (hex)	Subindex (hex)	Object name	Data type	Length in bytes	Rights	Meaning/contents	Startup parameters
07A0	Per channel: 00, 01 ... 08, FF	HART_ScanSubDevices	Array [8] of UINT8	8	R/W	Scan subdevices	No
07A1	Per channel: 00, 01 ... 08, FF	HART_ChannelEnable	Array [8] of UINT8	8	R/W	HART channel enable	Yes
07A2	Per channel: 00, 01 ... 08, FF	HART_HighPriority_Polling	Array [8] of UINT8	8	R/W	HART high priority polling	Yes
07A3	Per channel: 00, 01 ... 08, FF	HART_Channel	Array [8] of UINT8	8	R/W	HART channel	Yes
07A4	Per channel: 00, 01 ... 08, FF	HART_Variable	Array [8] of UINT8	8	R/W	HART variable	Yes
07A5	Per channel: 00, 01 ... 08, FF	HART_DiagValue	Array [8] of UINT8	8	R/W	HART diagnostic value	No
07A6	Per channel: 00, 01 ... 08	HART_SubDeviceInfo	Array [8] of Records [6]	80	R	HART subdevice information	No
07A7	Per channel: 01 ... 08	HART_SubDeviceTag	STRING	33	R	HART subdevice tag	No
07A8	Per channel: 00, 01 ... 08	HART_SubDevicePV	Array [8] of 32-bit FLOAT	32	R	HART subdevice PV	No
07A9	Per channel: 00, 01 ... 08	HART_ChannelState	Array [8] of ENUM	8	R	HART channel state	No
07AA	Per channel: 01 ... 08	HART_ExternalCommand	Domain variable	Dynamic	R/W	HART external command	No

18.1 Scan HART subdevices ($07A0_{hex}$: HART_ScanSubDevices)

Use this object to send a request to scan the HART channels to find HART subdevices.

Only use this object in a DTM or WBM configuration (Modbus/TCP).

Code (hex)	Scanning of subdevices
00	**Auto Scan (default)**
01	Restart scan

18.2 HART channel enable ($07A1_{hex}$: HART_ChannelEnable)

Use this object to enable or disable HART with or without alarms per channel.

With this method, you can only enable or disable HART communication. Parameterization has no effect on the 0 mA/4 mA … 20 mA signal of the channel.

Code (hex)	HART channel enable
00	Disabled
01	Enabled
02	**Enabled, no alarms (default)**

18.3 HART high priority polling ($07A2_{hex}$: HART_HighPriority_Polling)

Use this object to parameterize for each channel whether the channel should be polled with high priority or not.

Code (hex)	HART high priority polling
00	**Off (default)**
01	On

18.4 HART channel ($07A3_{hex}$: HART_Channel)

Use this object to assign a channel of the module to each HART process data item (HART_INxx).

Code (hex)	HART channel
00	Disabled
01	Channel 1
…	
08	Channel 8

Default values:

HART process data item	HART channel
HART_IN01	Channel 1
…	…
HART_IN08	Channel 8

18.5 HART variable ($07A4_{hex}$: HART_Variable)

Use this object to assign a HART variable to each HART process data item (HART_INxx).

Code (hex)	HART variable
00	Loop current
01	**PV (default)**
02	SV
03	TV
04	QV

18.6 HART diagnostic value ($07A5_{hex}$: HART_DiagValue)

Use this object to delete the HART status byte for each channel.

Code (hex)	Clear HART status byte
01	**Clear HART status byte**

HART status byte:

Code (hex)	Meaning
00	No error
01	Faulty or no subdevice
02	Communication error
04	New subdevice detected
08	I/O module error
10	Subdevice lost from loop
20	Intermittent communication

18.7 HART subdevice information (07A6$_{hex}$: HART_SubDeviceInfo)

Use this object to read the information on the connected HART subdevice for each channel.

07A6hex: HART subdevice information (read)						
Subindex	**Element**	**Name**	**Data type**	**Length in bytes**	**Rights**	**Meaning/contents**
00		HART_SubDeviceInfo	Array [8] of Records [6]	80	R	Read HART subdevice information for all channels
01	00	HART_SubDeviceInfo	Record [6]	10	R	Read HART subdevice information for channel 1
	01	SubDeviceAddress	UINT8	1	R	Subdevice address
	02	SubDeviceType	ENUM	2	R	Subdevice type
	03	SubDeviceId	Octet string	3	R	Subdevice ID
	04	SubDeviceHart Revision	UINT8	1	R	Subdevice HART revision
	05	SubDevice Manufacturer	ENUM	2	R	Subdevice manufacturer
	06	SubDeviceStatus	UINT8	1	R	Subdevice status
02	00	HART_SubDeviceInfo	Record [6]	10	R	Read HART subdevice information for channel 2
...	...	...	...	...	...	...
08	00	HART_SubDeviceInfo	Record [6]	10	R	Read HART subdevice information for channel 8

18.8 HART subdevice tag (07A7$_{hex}$: HART_SubDeviceTag)

This object can be used to read the identification (Long TAG) within the HART subdevice for each channel.

Due to the length restriction, only subindices 01 ... 08 are permitted.

18.9 HART subdevice PV (07A8$_{hex}$: HART_SubDevicePV)

This object can be used to read the current PV of the HART subdevice for each channel.

18.10 HART channel state (07A9$_{hex}$: HART_ChannelState)

Use this object to read the HART channel state for each channel.

Code (hex)	HART channel state
00	Idle
01	Starting
02	Polling
03	Getting name
04	Bursting
05	External command
FF	Error state

18.11 HART external command (07AA$_{hex}$: HART_ExternalCommand)

This object can be used to read or write external HART commands for each channel.

This enables other software tools such as DTM or the AXL_HART library to tunnel into the connected HART subdevice and communicate acyclic HART data with the device.

Due to the length restriction, only subindices 01 ... 08 are permitted.

19 Device descriptions

The device is described in the device description files.
For Phoenix Contact controllers, the device descriptions are included in PLCnext Engineer.
The device description files for other systems are available for download in the download area of the installed bus coupler at the following address:
www.phoenixcontact.com/products.