



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



AXL F AI2 AO2 1H

Axioline F analog input and output module, 2 inputs, 2 outputs

Data sheet
106048_en_02

© PHOENIX CONTACT 2015-10-12



1 Description

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

Input features

- 2 analog differential input channels
- Connection of sensors in 2-wire technology
- Current ranges: 0 mA ... 20 mA, 4 mA ... 20 mA, ± 20 mA
- Voltage ranges: 0 V ... 10 V, ± 10 V, 0 V ... 5 V, ± 5 V

Output features

- 2 analog outputs
- Connection of actuators in 2-wire technology
- Current ranges: 0 mA ... 20 mA, 4 mA ... 20 mA, ± 20 mA
- Voltage ranges: 0 V ... 10 V, ± 10 V, 0 V ... 5 V, ± 5 V

General features

- Process data update < 150 μ s
- 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.

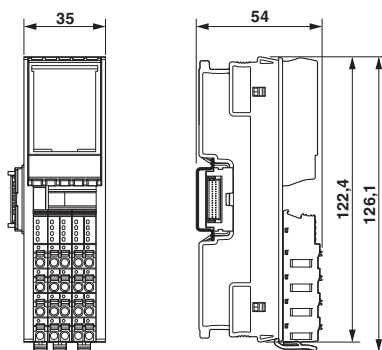
2	Table of contents	
1	Description	1
2	Table of contents	2
3	Ordering data	3
4	Technical data	3
5	Tolerance data.....	7
6	Signal rise times	8
7	Internal circuit diagram	9
8	Terminal point assignment.....	10
9	Connection examples	10
	9.1 Analog inputs.....	10
	9.2 Analog outputs.....	11
10	Connection notes	11
11	Local status and diagnostic indicators	12
12	Process data.....	13
13	Significant values in various formats.....	14
	13.1 Significant values in IB IL format	14
	13.2 Significant values in S7-compatible format	15
	13.3 Significant values in standardized representation format.....	16
	13.4 Calculation of the measured value from the process data input value.....	17
14	Parameter, diagnostics and information (PDI)	17
15	Standard objects	18
	15.1 Objects for identification (device rating plate).....	18
	15.2 Object for multilingual capacity	19
	15.3 Object descriptions	19
	15.4 Diagnostics objects	20
	15.5 Objects for process data management.....	22
	15.6 Objects for device management	26
16	Application objects	28
	16.1 Parameter table (0080hex: ParaTable).....	28
	16.2 Measured value in extended float format (0082hex: Measured Value Float)	30
	16.3 Minimum process data value (0083hex: PD Min).....	31
	16.4 Maximum process data value (0084hex: PD Max)	31
17	Device descriptions	31

3 Ordering data

Description	Type	Order No.	Pcs./Pkt.
Axioline F analog input and output module, 2 inputs, 2 outputs, 0 - 10 V, ±10 V, 0 - 5 V, ±5 V, 0 - 20 mA, 4 - 20 mA, ±20 mA, 2-conductor connection technology (including bus base module and connectors)	AXL F AI2 AO2 1H	2702072	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	200 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 connection
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



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

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
Power consumption at U_{BUS}	typ. 0.6 W, max. 0.75 W

I/O supply

Supply for analog modules U_A	24 V DC
Maximum permissible voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption from U_A	typ. 40 mA max. 80 mA
Power consumption at U_A	typ. 0.96 W, max. 1.92 W
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. 1.56 W (at U_{BUS} and U_A), max. 2.67 W (at U_{BUS} and U_A)
-------------------	--

Analog inputs

Number of inputs	max. 2 (Differential inputs, voltage or current can be chosen separately)
Connection method	Push-in connection
Connection method	2-wire (shielded)
Resolution A/D	16 bit
A/D conversion time	2 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, standardized representation
Process data update	150 μ s

Analog inputs	
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)
Transient protection of inputs	Suppressor diode

Differential inputs, voltage	
Number of inputs	2
Voltage input signal	0 V ... 5 V, -5 V ... 5 V, 0 V ... 10 V, -10 V ... 10 V
Input resistance of voltage input	268 kΩ (typical)
Open circuit response	Goes to 0 V
Common mode voltage range signal - ground	-50 V DC ... 50 V DC
Overload protection	±30 V DC, maximum

Differential inputs, current	
Number of inputs	2
Current input signal	0 mA ... 20 mA, 4 mA ... 20 mA, -20 mA ... 20 mA
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, $I_{max} = 50$ mA

Analog outputs	
Number of outputs	2
Connection method	Push-in connection
Connection method	2-wire (shielded, twisted pair)
D/A resolution	16 bit
Representation of output values	16 bits (15 bits + sign)
Data formats	IB IL, S7-compatible, standardized representation
Process data update	150 μs
Short-circuit and overload protection	Electronic
Transient protection	Suppressor diode

Analog outputs, Current	
Current output signal	0 mA ... 20 mA, 4 mA ... 20 mA, -20 mA ... 20 mA
Load/output load current output	≤ 500 Ω
Precision	typ. 0.1 % (of output range final value)

Analog outputs, Voltage	
Voltage output signal	0 V ... 5 V, -5 V ... 5 V, 0 V ... 10 V, -10 V ... 10 V
Load/output load voltage output	> 2 kΩ
Precision	typ. 0.1 % (of output range final value)

Configuration and parameter data in a PROFIBUS system	
Required parameter data	11 Byte
Need for configuration data	7 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 and outputs	500 V AC, 50 Hz, 1 min
5 V supply (logic)/functional earth ground	500 V AC, 50 Hz, 1 min

Electrical isolation/isolation of the voltage areas

Test section	Test voltage
24 V supply (I/O)/analog inputs and outputs	500 V AC, 50 Hz, 1 min
24 V supply (I/O) / functional earth ground	500 V AC, 50 Hz, 1 min
Analog inputs and outputs/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:

Analog inputs:

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

Default parameterization: filter with 30 Hz, 16-sample mean value, IB IL format.

Analog outputs:

The data is valid irrespective of the parameterization.

Tolerances at $T_A = 25^\circ\text{C}$				
	Absolute		Relative	
	Typ.	Max.	Typ.	Max.
Analog inputs				
0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20\text{ mA}$	$\pm 20\ \mu\text{A}$	$\pm 60\ \mu\text{A}$	$\pm 0.10\%$	$\pm 0.30\%$
0 V ... 5 V, $\pm 5\text{ V}$, 0 V ... 10 V, $\pm 10\text{ V}$	$\pm 10\text{ mV}$	$\pm 30\text{ mV}$	$\pm 0.10\%$	$\pm 0.30\%$
Analog outputs				
0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20\text{ mA}$	$\pm 20\ \mu\text{A}$	$\pm 60\ \mu\text{A}$	$\pm 0.10\%$	$\pm 0.30\%$
0 V ... 5 V, $\pm 5\text{ V}$, 0 V ... 10 V, $\pm 10\text{ V}$	$\pm 10\text{ mV}$	$\pm 30\text{ mV}$	$\pm 0.10\%$	$\pm 0.30\%$

300 μs update time, 12 kHz filter, without mean-value generation

Tolerances at $T_A = 25^\circ\text{C}$				
	Absolute		Relative	
	Typ.	Max.	Typ.	Max.
Analog inputs				
0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20\text{ mA}$	$\pm 100\ \mu\text{A}$	$\pm 160\ \mu\text{A}$	$\pm 0.5\%$	$\pm 0.8\%$
0 V ... 5 V, $\pm 5\text{ V}$, 0 V ... 10 V, $\pm 10\text{ V}$	$\pm 50\text{ mV}$	$\pm 80\text{ mV}$	$\pm 0.5\%$	$\pm 0.8\%$

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 $+60^\circ\text{C}$		
	Drift	
	Typical	Maximum
Analog inputs		
0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20\text{ mA}$	$\pm 45\text{ ppm/K}$	$\pm 65\text{ ppm/K}$
0 V ... 5 V, $\pm 5\text{ V}$, 0 V ... 10 V, $\pm 10\text{ V}$	$\pm 40\text{ ppm/K}$	$\pm 55\text{ ppm/K}$
Analog outputs		
0 mA ... 20 mA, 4 mA ... 20 mA, $\pm 20\text{ mA}$	$\pm 65\text{ ppm/K}$	$\pm 80\text{ ppm/K}$
0 V ... 5 V, $\pm 5\text{ V}$, 0 V ... 10 V, $\pm 10\text{ V}$	$\pm 30\text{ ppm/K}$	$\pm 40\text{ ppm/K}$

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	$< \pm 0.3\%$
Fast transients (burst)	EN 61000-4-4/ IEC 61000-4-4	$< \pm 1.2\%$
Conducted interference	EN 61000-4-6/ IEC 61000-4-6	$< \pm 1.0\%$

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 Signal rise times

Voltage step 0 V ... 10 V (typical values)

Load	Time for 0 % ... 99 %
$R_L = 2 \text{ k}\Omega$	7.5 μs
$R_L = 2 \text{ k}\Omega \parallel C_L = 10 \text{ nF}$	15 μs
$R_L = 2 \text{ k}\Omega \parallel C_L = 220 \text{ nF}$	140 μs
$R_L = 2 \text{ k}\Omega + L_L = 3.3 \text{ mH}$	20 μs

Current step 0 mA ... 20 mA (typical values)

Load	Time for 0 % ... 99 %
$R_L = 500 \Omega$	20 μs
$R_L = 500 \Omega \parallel C_L = 10 \text{ nF}$	20 μs
$R_L = 500 \Omega \parallel C_L = 220 \text{ nF}$	240 μs
$R_L = 500 \Omega + L_L = 3.3 \text{ mH}$	90 μs

Key to the tables

R_L	Ohmic load
C_L	Capacitive load
L_L	Inductive load
\parallel	Parallel connection
$+$	Serial connection

7 Internal circuit diagram

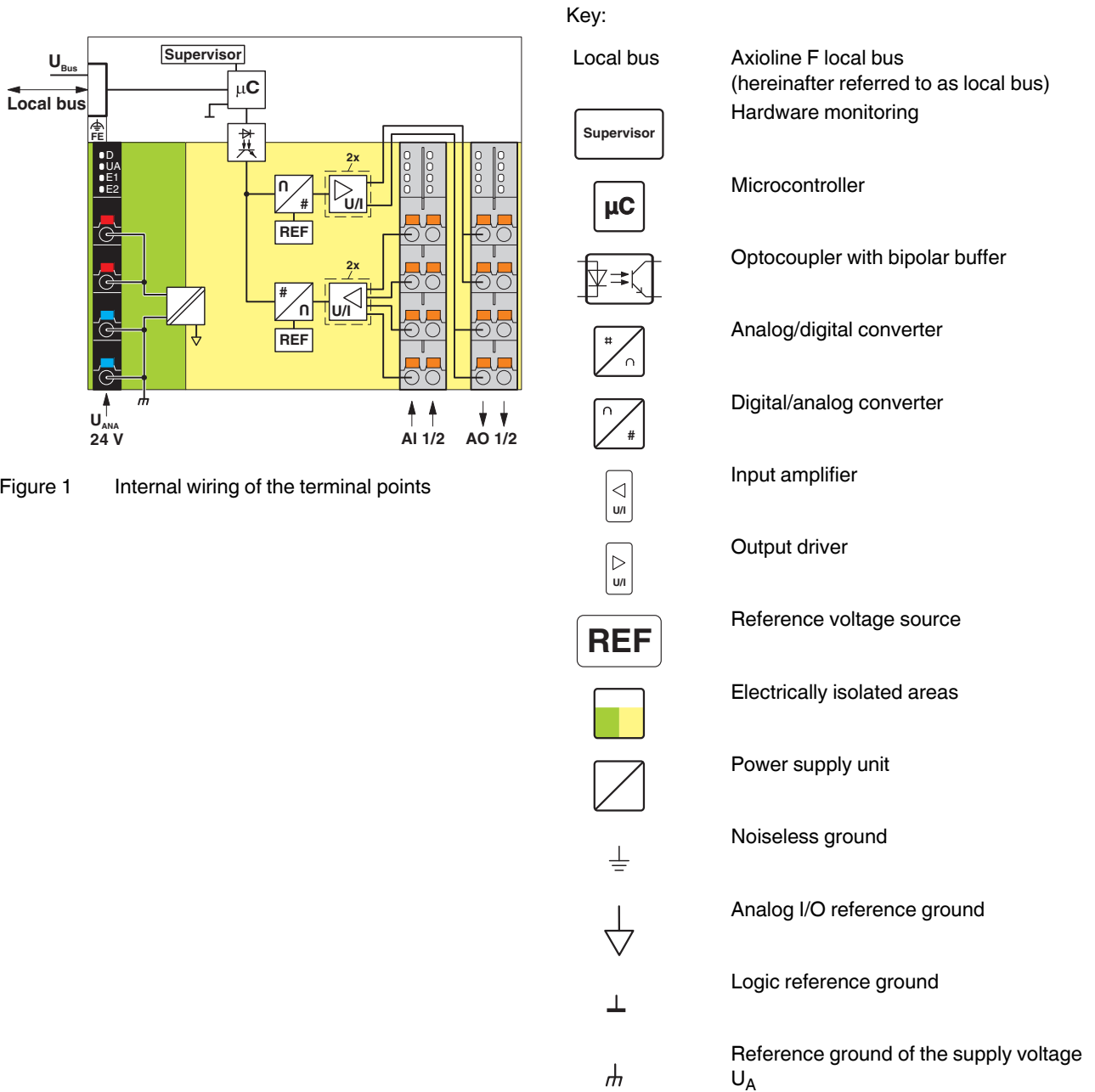


Figure 1 Internal wiring of the terminal points

8 Terminal point assignment

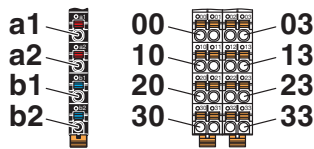


Figure 2 Terminal point assignment

Terminal point	Color	Assignment
Supply voltage input		
a1, a2	Red	24 V DC (U _A) Supply for analog modules (bridged internally)
b1, b2	Blue	GND Reference potential of the supply voltage (internally jumpered)
Analog inputs		
00, 01	Orange	U1+, U2+ Positive voltage connection for channel 1 and 2
10, 11	Orange	U1-, U2- Negative voltage connection for channel 1 and 2
20, 21	Orange	I1+, I2+ Positive current connection for channel 1 and 2
30, 31	Orange	I1-, I2- Negative current connection for channel 1 and 2
Analog outputs		
02, 03	Orange	U1, U2 Voltage connection for channel 1 and 2
12, 13	Orange	I1, I2 Current connection for channel 1 and 2
22, 23	Orange	GND Reference potential for all AO channels
32, 33	Orange	GND Reference potential for all AO channels

9 Connection examples

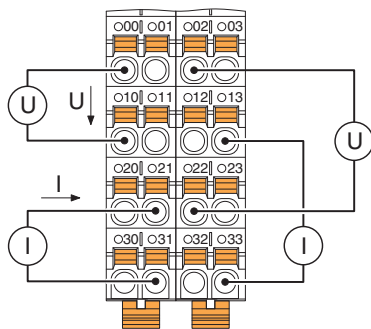


Figure 3 Connection for measuring voltage and current as well as voltage and current output

9.1 Analog inputs

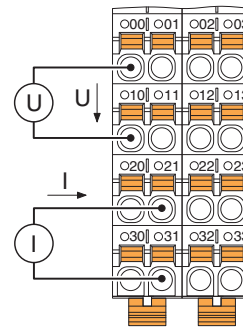


Figure 4 Connection for voltage and current measurement

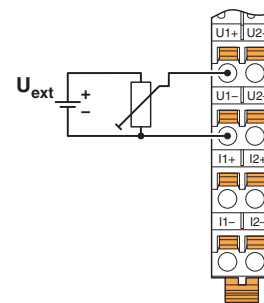


Figure 5 Connection of potentiometric position sensors

The values of potentiometric position sensors can be acquired with voltage measurement. Supply the potentiometer via an external power supply unit ($U_{ext} = 10\text{ V}$).

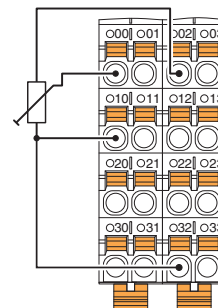


Figure 6 Connection of potentiometers for detecting the position (OUT1 channel is used for supplying the potentiometer)

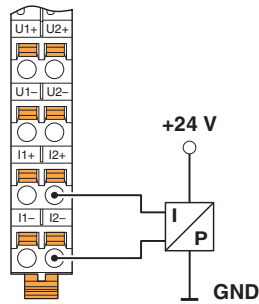


Figure 7 Passive pressure sensor at a differential current input

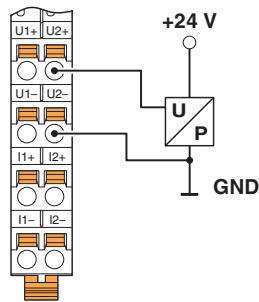


Figure 8 Differential voltage input with active 3-wire transmitter

9.2 Analog outputs

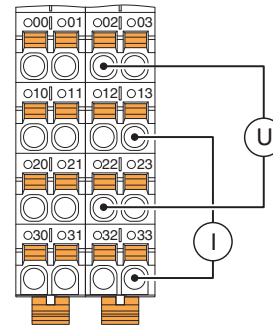


Figure 9 Connection for voltage and current output

10 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 Axioline 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.

11 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 10 Local status and diagnostic indicators

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. There are no faults.
		Active	Green flashing	The device is ready for operation, communication within the station is OK. The data is not valid. Valid data from the controller/higher-level network not available. There is no fault in 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-on.
		Connected	Yellow flashing	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 in (power) reset.
UA	Green	U _{Analog}	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.
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.

12 Process data

The module uses two words of IN process data and two words of OUT process data.

The measured values are transmitted to the controller board or the computer using process data input words IN1 and IN2.

The output values are transmitted from the controller board or the computer to the module using process data output words OUT1 and OUT2.

Output value OUT1	Output value OUT2
-------------------	-------------------

Measured value IN1	Measured value IN2
--------------------	--------------------

Each channel is mapped to a word.

The output values and measured values are depicted in IB IL, S7-compatible or standardized representation format. For all formats, 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 IB IL and standardized representation 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
8010	Parameter table invalid
8020	Faulty supply voltage
8040	Device faulty
8080	Below measuring range (underrange)

13 Significant values in various formats

13.1 Significant values in IB IL format



The measured values and output values are identical for input and output data, except in the event of overrange or underrange. Therefore, in these special cases, the values for the inputs and outputs are specified in the tables.

I/O data		0 V ... 10 V	± 10 V	0 V ... 5 V	± 5 V	0 mA ... 20 mA	± 20 mA	4 mA ... 20 mA
hex	dec	V	V	V	V	mA	mA	mA
8001	Ovrange (output)	+10.837	+10.837	+5.419	+5.419	+21.6764	+21.6764	+21.3397
8001	Ovrange (input)	> +10.837	> +10.837	> +5.419	> +5.419	> +21.6764	> +21.6764	> +21.3397
7FFF ... 7F01		+10.837	+10.837	+5.419	+5.419	+21.6764	+21.6764	+21.3397
7F00	32512	+10.837	+10.837	+5.419	+5.419	+21.6764	+21.6764	+21.3397
7530	30000	+10.0	+10.0	+5.0	+5.0	+20.0	+20.0	+20.0
3A98	15000	+5.0	+5.0	+2.5	+2.5	+10.0	+10.0	+12.0
0001	1	+333.33 µV	+333.33 µV	+166.67 µV	+166.67 µV	+0.6667 µA	+0.6667 µA	+4.0005333
0000	0	0	0	0	0	0	0	+4.0
FFFF	-1	0	-333.33 µV	0	-166.67 µV	0	-0.6667 µA	+4.0
C568	-15000	0	-5.0	0	-2.5	0	-10.0	+4.0
8AD0	-30000	0	-10.0	0	-5.0	0	-20.0	+4.0
8100	-32512	0	-10.837	0	-5.419	0	-21.6764	+4.0
80FF ... 8000*	(Output)	Hold last value	Hold last value	Hold last value	Hold last value	Hold last value	Hold last value	Hold last value
8080	Under-range (output)	0	-10.837	0	-5.419	0	-21.6764	Hold last value
8080	Under-range (input)	0	< -10.837	0	< -5.419	0	< -21.6764	

* without 8001, 8080

The maximum output value or measured value is 7F00_{hex}.

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

13.2 Significant values in S7-compatible format

I/O data		0 V ... 10 V	± 10 V	0 V ... 5 V	± 5 V	0 mA ... 20 mA	± 20 mA
hex	dec	V	V	V	V	mA	mA
7FFF ... 7F00	Overrange	0	0	0	0	0	0
7EFF	32511	+11.7589	+11.7589	+5.8800	+5.8800	+23.5150	+23.5150
6C00	27648	+10.0	+10.0	+5.0	+5.0	+20.0	+20.0
5100	20736	+7.5	+7.5	+3.75	+3.75	+15.0	+15.0
0001	1	+361.69 µV	+361.69 µV	+180.845 µV	+180.845 µV	+0.7234 µA	+0.7234 µA
0000	0	0	0	0	0	0	0
FFFF	-1	0	-361.69 µV	0	-180.845 µV	0	-0.7234 µA
9400	-27648	0	-10.0	0	-5.0	0	-20.0
8100	-32512	0	-11.7589	0	-5.8800	0	-23.5157
80FF ... 8000	Underrange	0	0	0	0	0	0

Output data		4 mA ... 20 mA
hex	dec	mA
7FFF ... 7F00	Overrange	0
7EFF	32511	+22.8100
6C00	27648	+20.0
5100	20736	+16.0
0001	1	+4.000578
0000	0	+4.0
FFFF	-1	+3.99942
F940	-1728	+3.0
E501	-6911	0.578 µA
E500	-6912	0
8100	-32512	0
80FF ... 8000	Underrange	0

Input data		4 mA ... 20 mA
hex	dec	mA
7EFF	32511	+22.8100
6C00	27648	+20.0
5100	20736	+16.0
0001	1	+4.000578
0000	0	+4.0
FFFF	-1	+3.99942
F940	-1728	+3.0
8000	Open circuit	<1.1852

The maximum output value or measured value is 7EFF_{hex}.

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

13.3 Significant values in standardized representation format



The measured values and output values are identical for input and output data, except in the event of overrange or underrange. Therefore, in these special cases, the values for the inputs and outputs are specified in the tables.

I/O data		0 V ... 10 V	± 10 V	0 V ... 5 V	± 5 V	0 mA ... 20 mA	± 20 mA	4 mA ... 20 mA
hex	dec	V	V	V	V	mA	mA	mA
8001	Overrange (output)	+10.837	+10.837	+5.419	+5.419	+21.674	+21.674	+21.339
8001	Overrange (input)	> +10.837	> +10.837	> +5.419	> +5.419	> +21.674	> +21.674	> +21.339
54AA	21674					+21.674	+21.674	
4E20	20000					+20.0	+20.0	
43BB	17339							21.339
2A55	10837	+10.837	+10.837					
2710	10000	+10.0	+10.0			+10.0	+10.0	+14.0
152B	5419			+5.419	+5.419			
1388	5000	+5.0	+5.0	+5.0	+5.0	+5.0	+5.0	+9.0
0001	1	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+4.001
0000	0	0	0	0	0	0	0	+4.0 ... +3.2
FFFF	-1		-0.001		-0.001		-0.001	
EC78	-5000		-5.0		-5.0		-5.0	
EAD5	-5419				-5.419			
D8F0	-10000		-10.0				-10.0	
D5AB	-10837		-10.837					
B1E0	-20000						-20.0	
AB56	-21674		-21.674					
8080	Under-range (output)		-10.837		-5.419		-21.674	
8080	Under-range (input)	< -10.837		< -5.419		< -21.674		

Depending on the output range or measuring range, the maximum output value or measured value is 54AA_{hex}, 43BB_{hex} or 152B_{hex}.

Depending on the output range or measuring range, the minimum output value or measured value is EAD5_{hex}, D5AB_{hex} or AB56_{hex}.

13.4 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 mA - 4 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 mA - 4 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

14 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.

15 Standard objects

15.1 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	20	R	Device family	I/O analog IN / OUT
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; Basis - Profil V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	e. g., 0007 0001 0001 0001 _{hex}
Module - special								
0005	Capabilities	Var	Visible String	1	8	R	Features	Energ_0
0007	ProductName	Var	Visible String	1	17	R	Product name	AXL F AI2 AO2 1H
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxx (e. g., 1234512345)
0009	ProductText	Var	Visible String	1	36	R	Product text	2 input and 2 output analog channels
000A	OrderNumber	Var	Visible String	1	8	R	Order No.	2702072
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 30 00 08 00 00 00 A9 _{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	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	Application device address	Can be filled out by the user.

15.2 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

15.3 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



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.

15.4 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

15.4.1 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					
Error	Priority	Channel/ group/ module	Error code	Text	Process data	LED			
	hex	hex	hex			D	UA	E1	E2
No error	00	00	0000	Status OK	xxxx	Green ON	ON	OFF	OFF
Short-circuit	01	03 ... 04	2130	Short-circuit	--	Green ON	ON	OFF	ON
Supply voltage faulty (supply for analog modules U _A)	01	FF	5160	Supply fail	8020	Flashing green/yellow	OFF	ON	ON
Device error	01	FF	6301	CS FLASH	8040	Green ON	ON	OFF	ON
Flash format error	01	FF	6302	FO FLASH	8040	Green ON	ON	OFF	ON
Parameter table invalid	01	FF	6320	Invalid para	8010	Green ON	ON	OFF	ON
Open circuit	01	01 ... 04	7710	Open circuit	8002	Green ON	ON	OFF	ON
Overrange	02	01 ... 02	8910	Overrange	8001	Green ON	ON	OFF	ON
Underrange	02	01 ... 02	8920	Underrange	8080	Green ON	ON	OFF	ON

Special notes for the analog outputs

In the event of errors at the outputs, no process data codes are written to the input data, only a message is generated via the DiagState object.

The following two error messages are supported:

Open circuit: current output, but open terminal blocks

Short circuit: voltage output, but short circuit between the terminal points

An open circuit or short circuit is only indicated when the process data value of the channel is $> 512_{dec}$, corresponding to 1.7% of the output range final value.

15.4.2 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, resets the error counter, and allows no further diagnostic messages
				Other	Reserved

15.5 Objects for process data management

Index (hex)	Object name	Object type	Data type	A	L	Rights	Assignment
0024	ResetCode	Array	Unsigned 16	2	2	R/W	Substitute value behavior when process data is missing
0025	PDIN	Var	Octet string	1	4	R	Input process data
0026	PDOOUT	Var	Octet string	1	4	R/W	Output process data
0027	GetExRight	Simple variable	Unsigned 8	1	1	R/W (access-protected)	Get exclusive process data write rights
002F	PDOOUT_Subst	Array	Unsigned 16	2	2	R/W	Substitute value for the OUT process data
003B	PDIN_Descr	Record		6	12	R	Description of the IN process data
003C	PDOOUT_Descr	Record		6	12	R	Description of the output process data



Objects 003B_{hex} and 003C_{hex} are only applicable to tools and are therefore not described in more detail here.
Please refer to the basic profile for comprehensive information.

15.5.1 Substitute value behavior when process data is missing (0024_{hex}: ResetCode)

With this object, you parameterize the behavior of the module in the event that process data is missing.

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

0024 _{hex} : BusResetCode (Read, write)					
Subindex	Data type	Length in bytes	Meaning	Contents	Default value
0	Array	2 * 2	Substitute value behavior when process data is missing		

Element	Data type	Length in bytes	Meaning	Contents	Default value
1	Unsigned 16	2	Behavior of channel OUT1	0000 ... 0003 _{hex}	0002 _{hex}
2	Unsigned 16	2	Behavior of channel OUT2	0000 ... 0003 _{hex}	0002 _{hex}

Value range:

Code (hex)	Behavior
0000	Output of zero values (0 V/0 mA/4 mA) at output
0001	Output of final values (10 V/5 V/20 mA) at output
0002	Hold last value
0003	Transfer the substitute values from the "Replace output process data" (002F _{hex}) object

Behavior of the outputs when the supply voltage fails

U _A	U _{Bus}	Behavior of the outputs
Available	Available	Nominal operation or see object 0024 _{hex}
Missing	Available	Outputs to 0 V/0 mA
Available	Missing	Hold the last values (as with object 0024 _{hex} , code 0002)

Special features

- You can only access this object via subindex 0, i. e., you access the entire object.
- In the case of valid parameters, the object is stored permanently.
- After resetting, the module works with the last permanently stored data. Upon delivery, the module works with the default data (default settings).

For error message, see object 0080_{hex}.

15.5.2 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	4	Input process data

15.5.3 OUT process data (0026_{hex}: PDOUT)

You can read or write the OUT process data of the module with this object.

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

0026 _{hex} : PDOUT (Read)			
Subindex	Data type	Length in bytes	Meaning
0	Octet string	4	Output process data

There are 2 bytes available for each channel, starting with channel 1.

Observe the notes in the section "Writing the analog values via the PDI channel".

15.5.4 Request exclusive write access (0027_{hex}: GetExRight)

This object allows you to determine which channel (process data channel or PDI channel) gets the rights for writing the outputs.

0027 _{hex} : GetExRight (read, write)					
Subindex	Data type	Length in bytes	Meaning	Contents	
0	Simple variable	1	Get exclusive process data write rights	00 _{hex}	Rights for writing output data over the PD channel (process data channel)
				01 _{hex}	Rights for writing output data via the PDI channel

All other values are invalid and will be acknowledged with an error.



Please note the following for your process:
 The parameterization in object 0027_{hex} "Rights for writing the output data via the PDI channel" overwrites the OUT process data transmitted via the process data channel with the values from object 0026_{hex} PDOOUT. From now, the OUT process data can only be changed using the PDI object. Changes on the process data channel will have no effect. If the value from the process data channel is to be used again, write access must be changed to "Rights for writing the output data via the PD channel (process data channel)" via the GetExRight object. After a power reset, the values transmitted via the process data channel are always valid.

15.5.5 Substitute value for the OUT process data (002F_{hex}: PDOUT_Subst)

This object is used to parameterize the substitute values that are to be output at the analog outputs in the event that process data is missing. The condition is that option 0003 is selected in the “Substitute value behavior when process data is missing” object (0024_{hex}).

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).

002F _{hex} : PDOUT_Subst (Read, write)			
Subindex	Data type	Length in bytes	Meaning
0	Array of Unsigned 16	2 * 2	Replace output process data

There are 2 bytes available for each channel, starting with channel 1.

The values are used in the parameterized format.

Example:

Channel 1: 1 V, channel 2: 2 V, IB IL format
 0B B8 17 70

Special features

- You can only access this object via subindex 0, i. e., you access the entire object.
- In the case of valid parameters, the object is stored permanently.
- The parameterized values are compared with the selected output range. If the substitute value does not correspond to the output range, an error message is issued.

For error message, see object 0080_{hex}.