

AXL F DO16/3 2F

**Axioline F digital output module, 16 outputs,
24 V DC, 500 mA, 2-, 3-wire connection method**

Data sheet
7988_en_03

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1 Description

The module is designed for use within an Axioline F station.

It is used to output digital signals.

Actuators with up to three wires can be connected.

The outputs are short-circuit and overload-protected .

Features

- 16 digital outputs
- 24 V DC, 500 mA
- Connection of actuators in 2 and 3-wire technology
- Minimum update time < 100 µs
- Device type label stored
- Diagnostic and status indicators
- Approved for use in applications which meet functional safety requirements



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.



Observe the corresponding notes when using the module in applications which meet functional safety requirements.

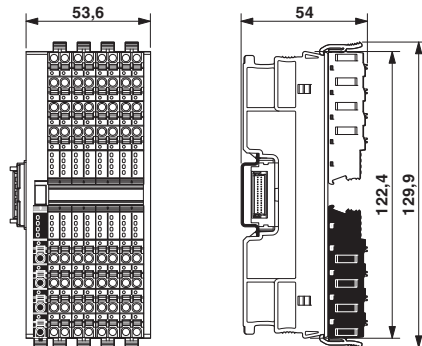
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3 Ordering data

Description	Type	Order No.	Pcs. / Pkt.
Axioline F digital output module, 16 outputs, 24 V DC, 500 mA, 2 or 3-wire connection method (including bus base module and connectors)	AXL F DO16/3 2F	2688048	1
Accessories	Type	Order No.	Pcs. / Pkt.
Axioline F bus base module for housing type F (Replacement item)	AXL F BS F	2688129	5
Axioline F connector set (for e.g., AXL F DO16/3 2F) (Replacement item)	AXL CNS 8L-OBBG/D/UO/E1	2700981	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
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	-	-
Application note, English, Using devices of the Axioline F product range in safety applications	AH EN AXL F SAFE	-	-

4 Technical data

Dimensions (nominal sizes in mm)



Width	53.6 mm
Height	129.9 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	234 g (with connectors and bus base module)
Ambient temperature (operation)	-25 °C ... 60 °C
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)

General data

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}	max. 120 mA
Power consumption at U_{Bus}	max. 600 mW

I/O supply

Supply of digital output modules U_O	24 V DC
Maximum permissible voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption from U_O	max. 8 A (external fuse)
Power consumption at U_O	typ. 320 mW (Without actuators), max. 240 W (Of which 560 mW with internal losses)
Surge protection of the supply voltage	Electronic (35 V, 0.5 s)
Polarity reversal protection of the supply voltage	Parallel diode; with external 5 A fuse (for startup only)
Protection	max. 8 A (polarity reversal protection up to 5 A)



When using for the first time, protect the module with a 5 A fuse. If all the modules are correctly connected in the system, the 5 A fuse can be replaced by an 8 A fuse. you can now load the module up to 8 A.
Loads over 8 A are not permitted.



NOTE: Damage to the electronics

Provide the module with an external fuse to protect it against polarity reversal. The power supply unit must be able to supply four times the nominal current of the external fuse, to ensure that it trips in the event of an error.

Digital outputs

Number of outputs	16
Connection method	Push-in technology
Connection method	2, 3-wire
Nominal output voltage	24 V DC
Maximum output current per channel	500 mA
Maximum output current per device	8 A (external fuse)
Nominal load, ohmic	max. 12 W (48 Ω ; with nominal voltage)
Nominal load, inductive	max. 12 VA (1.2 H; 48 Ω ; with nominal voltage)
Nominal load, lamp	max. 12 W (at nominal voltage)
Signal delay	max. 100 μ s (when switched on)
Signal delay	max. 100 μ s (when switched off; with at least 50 mA load current)
Switching frequency	max. 10000 per second (with at least 50 mA load current)
Switching frequency	max. 1 per second (with inductive load)
Switching frequency	max. 16 per second (with nominal lamp load)

Digital outputs

Load min.	10 k Ω
Energy consumption	see diagram
Limitation of the voltage induced on circuit interruption	-25.8 V ... -15 V
Output voltage when switched off	max. 1 V
Output current when switched off	max. 300 μ A
Behavior with overload	Shutdown with automatic restart
Behavior with inductive overload	Output can be destroyed
Reverse voltage resistance to short pulses	Limited protection up to 0.5 A for 1 s

**NOTE: Damage to the electronics**

If there is a faulty external voltage (reverse voltage) at one of the outputs, the output may be destroyed. This may cause unintentional setting of further outputs.

Overcurrent shut-down	as of 0.7 A
Output current with ground connection interrupt when switched off	< 1 mA
Short-circuit protection, overload protection of the outputs	Electronic

Fieldbus data telegram

Fieldbus system	PROFIBUS DP
Required parameter data	3 Byte
Need for configuration data	6 Byte

Error messages to the higher level control or computer system

I/O supply failure	configurable
Short-circuit / overload of the digital outputs	Yes

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)/functional earth ground	500 V AC, 50 Hz, 1 min
24 V supply (I/O) / 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	5 g
Shock in acc. with EN 60068-2-27/IEC 60068-2-27	30 g
Continuous shock according to EN 60068-2-27/IEC 60068-2-27	10 g

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; DC supply lines: ± 0.5 kV/ ± 0.5 kV (symmetrical/asymmetrical)
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
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Approvals

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

5 Maximum outputs power consumption when inductive loads are switched off



NOTE: Damage to the electronics
 When you use an external freewheel limit, the free-wheeling voltage to a maximum of -15 V. The external freewheel limit has no function with a higher negative voltage.

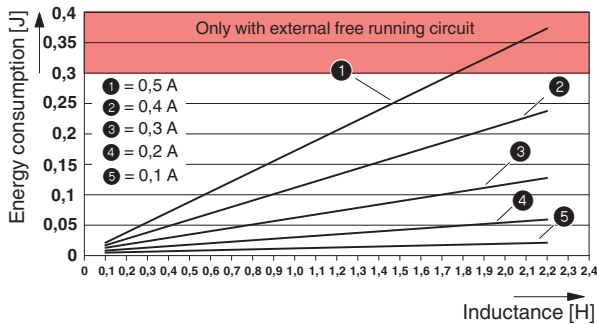


Figure 1 Maximum outputs power consumption when inductive loads are switched off

The diagram shows the maximum power that can be fed back for every switch-off operation in the respective output groups (outputs 1 to 4, 5 to 8, 9 to 12, 13 to 16) when an inductive load is switched off without an external freewheel. The current data refers to the ohmic DC voltage component of the inductive load.

6 Internal circuit diagram

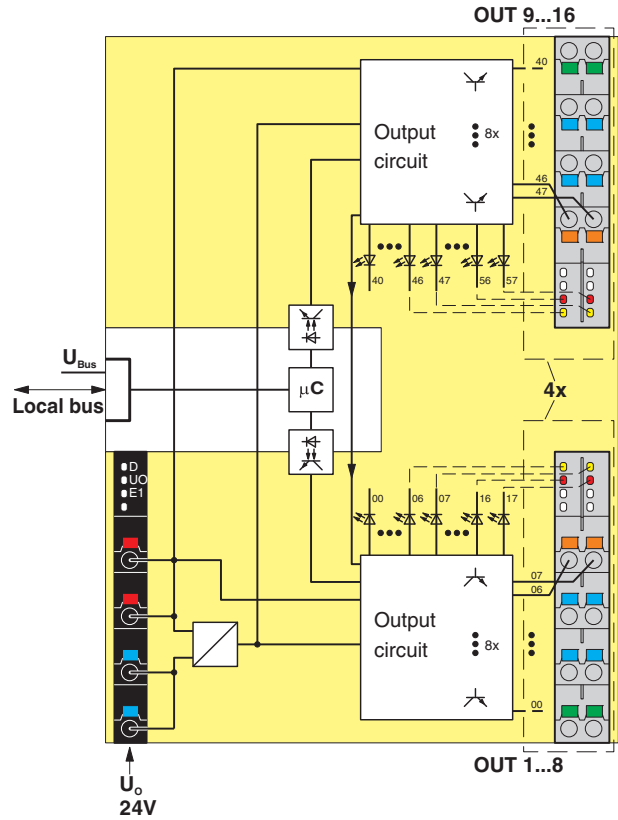


Figure 2 Internal wiring of the terminal points

Key:

- Local bus Axioline F local bus (hereinafter referred to as local bus)
- Microcontroller
- Optocoupler
- LED
- Power supply unit
- Electrically isolated areas
- Output circuit Output configuration

7 Terminal point assignment

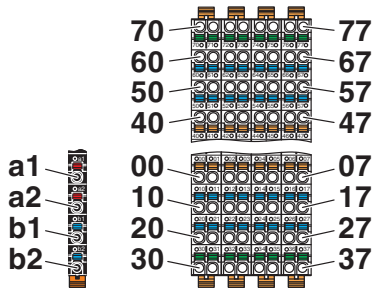


Figure 3 Terminal point assignment

8 Connection example

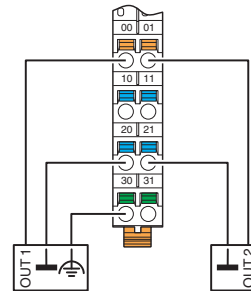


Figure 4 Connection using 3 and 2-wire technology

Terminal point	Color	Assignment	
Supply voltage input			
a1, a2	Red	24 V DC (U _O)	Supply to digital output modules (internally jumpered)
b1, b2	Blue	GND	Reference potential of the supply voltage (internally jumpered)
Digital outputs			
00 ... 07	Orange	OUT1 ... OUT8	Digital outputs 1 ... 8
40 ... 47	Orange	OUT9 ... OUT16	Digital outputs 9 ... 16
10 ... 17, 50 ... 57	Blue	GND	Reference potential for all channels
20 ... 27, 60 ... 67	Blue	GND	Reference potential for all channels
30 ... 37, 70 ... 77	Green	FE	Functional earth ground (FE)



For more information on the meaning of local diagnostic and status indicators, please refer to the UM EN AXL F SYS INST user manual.

10 Notes on using the module in applications which meet Functional Safety requirements

As of the specified hardware version, the modules listed below are approved for use in applications which meet functional safety requirements (safety applications).

Order No.	Type	Hardware revision
Old type designation		
2688048	AXL DO 16/3	04
2688161	AXL DO 16/3-ME	04
New type designation		
2688048	AXL F DO16/3 2F	04



The hardware and firmware version is printed on the left-hand side of the housing on each module.



When using the module in safety applications, also observe the requirements in the AH DE AXL F SAFE / AH EN AXL F SAFE application notes.
The documentation can be found on the Internet at phoenixcontact.net/products.

12 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
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.

11 Process data

The I/O data is displayed in S7-compatible format.

Byte	0							
Bit	7	6	5	4	3	2	1	0
Channel	8	7	6	5	4	3	2	1
Terminal point	07	06	05	04	03	02	01	00

Byte	1							
Bit	7	6	5	4	3	2	1	0
Channel	16	15	14	13	12	11	10	9
Terminal point	47	46	45	44	43	42	41	40

13 Standard objects

13.1 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	Manufacturer name	Phoenix Contact
0002	VendorID	Var	Visible String	1	7	R	Manufacturer identification	00A045
0003	VendorText	Var	Visible String	1	49	R	Comment on the manufacturer	Components and systems for industrial automation
0012	VendorURL	Var	Visible String	1	30	R	URL of the manufacturer	http://www.phoenix-contact.com
Module - general								
0004	DeviceFamily	Var	Visible String	1	16	R	Device family	I/O digital OUT
0006	ProductFamily	Var	Visible String	1	33	R	Product family	Axioline - High speed I/O system
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	Device profile version	2011-12-07; Basic Profile V2.0
003A	VersionCount	Array	Unsigned 16	4	4 * 2	R	Version counter	0006 0001 0000 0000 _{hex}
Module - special								
0005	Capabilities	Array	Visible String	1	8	R	Properties	Nothing
0007	ProductName	Var	Visible String	1	16	R	Product designation	AXL F DO16/3 2F
0008	SerialNo	Var	Visible String	1	11	R	Serial number	xxxxxxxxxx (e. g., 1234512345)
0009	ProductText	Var	Visible String	1	19	R	Product text	16 digital outputs
000A	OrderNumber	Var	Visible String	1	8	R	Order No.	2688048
000B	HardwareVersion	Record	Visible String	2	11; 3	R	Hardware version	e. g., 2011-02-04; 00
000C	FirmwareVersion	Record	Visible String	2	11; 3	R	Firmware version	0000-00-00; --
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 40 00 02 00 00 00 D1 _{hex}
Use of the device								
0014	Location	Var	Visible String	1	59	R/W	Installation 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	User-defined device number	Can be filled out by the user.

13.2 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

13.3 Diagnostics objects

Index (hex)	Object name	Object type	Data type	A	L	Rights	Assignment/content
0018	DiagState	Record		6	2; 1; 1; 2; 1; 1	R	Diagnostics state; see below

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	8	Diagnostic state	Complete diagnostics information
1	Unsigned 16	2	Error number	0 ... 65535 _{dec}
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	Group	00 _{hex} No error
				FF _{hex} entire device
4	Unsigned 16	2	Error code	See table below
5	Unsigned 8	1	More information follows	00 _{hex} (not supported)
6	Visible String	1	Text	00 _{hex} (not supported)



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 code and status of the local status and diagnostics indicators

Error code	Error	Priority	Group	LED			
				D	U _O	E1	xx
0000 _{hex}	No error	00 _{hex}	00 _{hex}	Green ON	ON	OFF	OFF
2344 _{hex}	Short-circuit/overload of an output.	02 _{hex}	FF _{hex}	Green ON	ON	Red on	Red on
3422 _{hex}	Actuator supply not present	01 _{hex}	FF _{hex}	flashing green or green/yellow	OFF	OFF	

xx LED Diagnostics of the output
 xx 10 ... 17, 50 ... 57

The behavior of LED D during an "Actuator supply not present" error depends on whether you have switched error reporting via the FF8F_{hex} object on or off.



After all errors have been eliminated, it is automatically reset.

Parameterization in FF8F _{hex}	D LED
Error is not reported to the controller	green
Error is reported to the controller	Flashing green/yellow

13.4 Objects for process data management

Index (hex)	Object name	Object type	Data type	A	L	Rights	Assignment
0026	PDOOUT	Var	Octet string	1	2	R	Output process data
003B	PDIN_Descr	Array of Records		3	8; 2; 2	R	Description of the IN process data
003C	PDOOUT_Descr	Array of Records		3	8; 2; 2	R	Description of the output process data

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

OUT process data (0026_{hex}: PDOOUT)

You can write the output process data of the module with this object.

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

0026 _{hex} : PDOOUT (Read)			
Subindex	Data type	Length in bytes	Meaning
0	Octet string	2	Output process data

14 Application objects

Index (hex)	Object name	Object type	Data type	A	L	Rights	Assignment
FF8D	PD Output Substitute Configuration	Var	Unsigned 8	1	1	R/W	Substitute value
FF8F	DiagOut	Var	Unsigned 8	1	1	R/W	Turn on/off reporting of "actuator supply not present" message

14.1 Substitute value (FF8D_{hex}: PD Output Substitute Configuration)

Configure the substitute value with which the module is to be operated with an application reset using this object.

FF8D _{hex} : PD Output Substitute Configuration (Read, write)				
Subindex	Data type	Length in bytes	Contents	
0	Var	1	00 _{hex} (Default)	"0" output to all output bits
			01 _{hex}	Hold last value

14.2 Turn on/off reporting of "actuator supply not present" message (FF8F_{hex}: DiagOut)

With this object, you configure whether the "actuator supply not present" error is reported to the controller or not.

If you parameterize the module so that the error is not reported to the controller, the corresponding indicator in LED D (flashing green/yellow) is suppressed and the LED lights up green.

FF8F _{hex} : DiagOut (Read, write)				
Subindex	Data type	Length in bytes	Contents	
0	Var	1	00 _{hex} (Default)	Error is not reported to the controller
			01 _{hex}	Error is reported to the controller

15 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.