AXL SE DI16/1 NPN



Axioline Smart Elements, digital input module, digital inputs: 16 (NPN), 24 V DC, connection technology: 1-conductor

Data sheet
109550_en_04

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1 Description

You can integrate Axioline Smart Elements into systems with the Smart Element interface.
This Smart Element detects digital signals.

Features

- 16 digital inputs, NPN-wired
- Nominal voltage: 24 V DC
- Nominal current: 2.4 mA
- Connection of sensors in 1-conductor technology
- Filter time of < 1 ms
- Device rating plate stored

Observe these notes

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

Make sure you always use the latest documentation.
It can be downloaded at: phoenixcontact.com/product/1105559

2 Table of contents

1 Description 1
2 Table of contents 2
3 Ordering data 3
4 Technical data 3
5 Internal circuit diagram 7
6 For your safety 8
6.1 Intended use 8
6.2 Qualification of users 8
6.3 Installation 8
6.4 Disconnecting or plugging in a Smart Element 8
6.5 Strain relief 8
6.6 Locking a Smart Element 8
6.7 Using round cables CABLE-FLK14/AXIO/OE/0,14/... 8
6.8 Applications with UL approval 9
7 Terminal point assignment as well as diagnostics and status indicators 10
7.1 Terminal point assignment 10
7.2 Local diagnostics and status indicators 10
8 Connection examples 11
8.1 Using equipotential busbars 11
8.2 Using AXL SE PD 11
9 Process data 12
10 Parameter, diagnostics and information (PDI) 13
10.1 PDI objects 13
10.2 Retentive storage 13
11 Standard objects 14
11.1 Diagnostics state (0018hex: DiagState) 15
11.2 Handling diagnostic messages (0019hex: ResetDiag) 15
12 Device descriptions 16

3 Ordering data

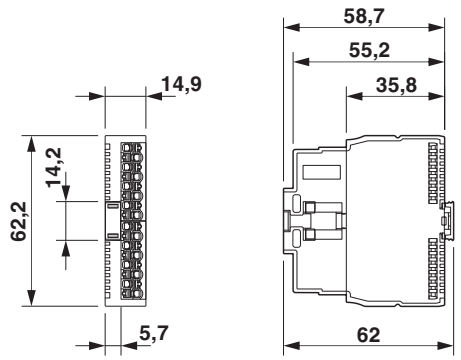
Description	Type	Item no.	Pcs./Pkt.
Axioline Smart Elements, Digital input module, Digital inputs: 16 (NPN), 24 V DC, connection technology: 1-conductor, degree of protection: IP20	AXL SE DI16/1 NPN	1105559	1

Documentation	Type	Item no.	Pcs./Pkt.
User manual, English, Axioline Smart Elements	UM EN AXL SE SYS INST	-	-
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/1105559

4 Technical data

Dimensions (nominal sizes in mm)



Width	14.9 mm
Height	62.2 mm
Depth	62 mm

General data	
Color	Housing: traffic grey A (RAL 7042)
Weight	34 g
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)
Overvoltage category	II (IEC 60664-1, EN 60664-1)
Degree of pollution	2 (IEC 60664-1, EN 60664-1)
Mounting type	Plug-in mounting (Smart Element slot)
Mounting position	See the system in which the Smart Element is used.

Do not use the Smart Element in an atmosphere that contains corrosive gas.

Connection data: I/O	
Connection method	Push-in connection
Conductor cross-section, rigid	0.25 mm² ... 1.5 mm²
Conductor cross-section, flexible	0.25 mm² ... 1.5 mm²
Conductor cross-section [AWG]	24 ... 16
Conductor cross-section flexible, with ferrule with plastic sleeve	0.25 mm² ... 1.5 mm²
Conductor cross-section flexible, with ferrule without plastic sleeve	0.25 mm² ... 1.5 mm²
Stripping length	8 mm

Please observe the information provided on conductor cross-sections in the “Axioline Smart Elements” user manual.

Interface: Smart Element interface	
Number of interfaces	1
Connection method	Card edge connector
Start time until ready to operate	< 500 ms

Communications power supply of the Smart Elements (U_{SE})	
Supply voltage	using card edge connectors
Current draw	See documentation for the system in which the Smart Element is used.

I/O supply (U_P)	
Nominal supply voltage	24 V DC (using card edge connectors)
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current consumption	min. 15 mA (without connected peripherals) max. 40 mA
Surge protection	See the system in which the Smart Element is used.
Reverse polarity protection	Polarity protection diode
Protection	See the system in which the Smart Element is used.

Power dissipation	
Maximum power dissipation for nominal condition	1.3 W

Digital inputs	
Number of inputs	16 (NPN)
Connection method	Push-in connection
Connection technology	1-conductor
Description of the input	Based on EN 61131-2 type 3 for PNP inputs
Nominal input voltage	24 V DC
Nominal input current	2.4 mA
Current flow	linear until nominal current is reached, then constantly approx. 2.4 mA
Input voltage range "0" signal	19 V DC ... 30 V DC (At U_P = 24 V DC)
Input voltage range "1" signal	0 V DC ... 13 V DC (At U_P = 24 V DC)
Input filter time	< 1 ms
Process data update	typ. 330 µs
Polarity reversal protection of the inputs	Diode

Input and output address area	
Input address area	2 Byte
Output address area	0 Byte

Configuration and parameter data in a PROFIBUS system	
Required parameter data	1 Byte
Required configuration data	6 Byte

Electrical isolation/isolation of the voltage areas	
Test section	**Test voltage**
Communications supply / 24 V supply (I/O)	500 V AC, 50 Hz, 1 min
Communications supply / functional ground	500 V AC, 50 Hz, 1 min
24 V supply (I/O) / functional ground	500 V AC, 50 Hz, 1 min

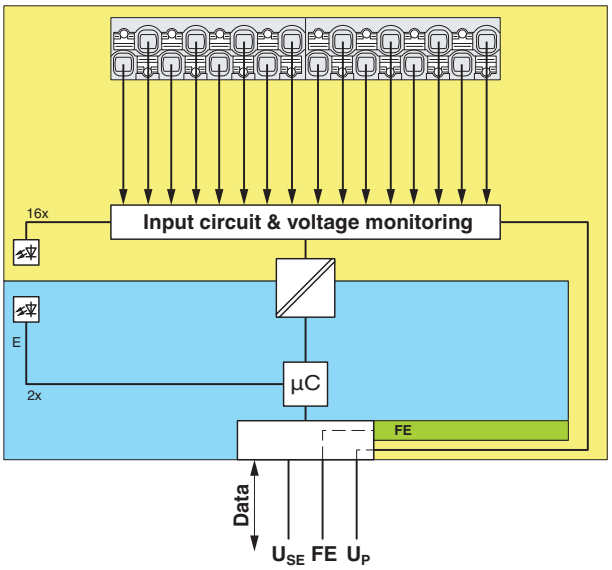
Mechanical tests	
Vibration resistance in accordance with EN 60068-2-6/IEC 60068-2-6	5g
Shock in accordance with EN 60068-2-27/IEC 60068-2-27	30g
Continuous shock in accordance with EN 60068-2-27/IEC 60068-2-27	10g

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 B, ±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 B, ±2 kV
Transient overvoltage (surge) IEC 61000-4-5	Criterion B, I/O cables: ±1 kV asymmetrical
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

Approvals and manufacturer's declarations	
The latest documents can be found at:	www.phoenixcontact.com/product/1105559

5 Internal circuit diagram

Figure 1 Internal wiring of the terminal points



Key:

Data	Data transmission
U_{SE}	Communications power supply of the Smart Element
FE	Functional ground
U_P	I/O supply of the Smart Element
µC	Microcontroller
	Electrical isolation for data or power supply
	LED
Input circuit ...	Input circuit and voltage monitoring
	Electrically isolated areas

6 For your safety

6.1 Intended use

Use Smart Elements exclusively in accordance with the specifications in the data sheet and the “Axioline Smart Elements” user manual.
Please also refer to the documentation for the system in which the Smart Elements are used.

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

6.2 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.

6.3 Installation

CAUTION: 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 external circuits intended to be connected to this device must be galvanically separated from mains supply or hazardous live voltage by reinforced or double insulation and meet the requirements of SELV/PELV (Class III) circuits in accordance with UL/CSA/IEC/EN 61010-1, UL/CSA/IEC/EN 61010-2-201.

6.4 Disconnecting or plugging in a Smart Element

NOTE: Damage to contacts or malfunction

Before performing work on a Smart Element, disconnect the power to the Smart Element.

This means:

- Disconnect the connected I/O devices from the power.
- Switch off the I/O supply voltage U_P!
- Switch off the communications power U_{SE}. For the system in which the Smart Element is used, this means the following: Switch off the voltage that generates the U_{SE}.

6.5 Strain relief

NOTE: Damage to the contacts

Physical overloads can result in damage to the terminal points.

- Relieve strain in the connected cables.

6.6 Locking a Smart Element

Make sure that each Smart Element is locked in its slot. This is only ensured if the unlocking mechanism has been pushed into the guide as far as it will go.

See “Axioline Smart Elements” user manual.

6.7 Using round cables CABLE-FLK14/AXIO/OE/0,14/...

For this Smart Element, the use of assembled round cables CABLE-FLK14/AXIO/OE/0,14/... is permitted. The conductors of these cables are fitted with ferrules and have a conductor cross-section of 0.14 mm², AWG 26.

UL approval does not apply

For applications with UL approvals, the AWG 24-16 conductor cross-section is certified.

Due to the smaller conductor cross-section of AWG 26, **UL approval** does **not** apply when using the Smart Element in combination with a round cable.

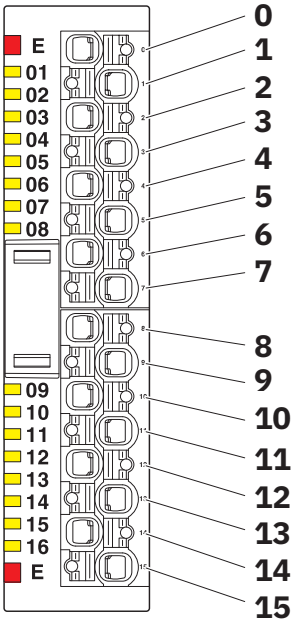
6.8 Applications with UL approval

Information:
To install the device in accordance with UL/CSA/IEC standard, the following notes must be observed.

– Minimum temperature rating of the cables to be connected to the field wiring terminals:
  95 °C, AWG 24 ... 16
– Use copper conductors only.

7 Terminal point assignment as well as diagnostics and status indicators

Figure 2 Terminal point assignment as well as diagnostics and status indicators



7.1 Terminal point assignment

Terminal point	Assignment	Channel	Signal
0	Digital input	1	IN01
...	...	...	...
15	Digital input	16	IN16

7.2 Local diagnostics and status indicators

Designation	Color	Description	
E	Red	Error	
		Off	No error
		Flashing (0.5 Hz)	Error in Smart Element Replace the Smart Element.
		Flashing (4 Hz)	Communication error Check whether the Smart Element has been plugged in correctly.
		On	I/O error Check the connected components and wiring. Remove the error.
01 ... 16	Yellow	Status of the input	
		On	Input is set.
		Off	Input is not set.

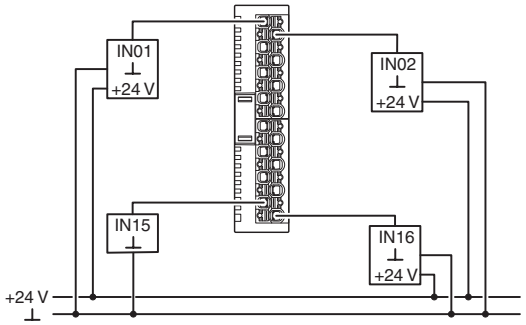
See also “Diagnostic state (0018_{hex}: DiagState)” section, “Possible error codes” table.

8 Connection examples

Ensure that GND of the sensors and actuators and GND for the I/O supply voltage U_P have the same potential.

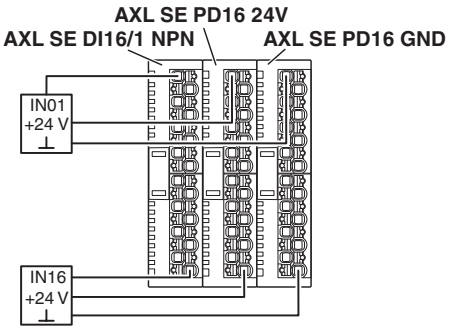
8.1 Using equipotential busbars

Figure 3 Connection in 1-conductor technology



8.2 Using AXL SE PD ...

Figure 4 Connection in 3-conductor technology



To implement the connections of this Smart Element in multi-conductor technology on Smart Elements, you can use the following Smart Elements for potential distribution:

Item No.	Type	Features
1337223	AXL SE PD16 24V	16 x 24 V (U_P)
		2 electronic switches, 2 A each
1337224	AXL SE PD16 GND	16 x GND (U_P)
1337225	AXL SE PD8/8 24V/ GND	8 x 24 V (U_P)
		8 x GND (U_P)
		1 electronic switch, 4 A

Detailed information on the Smart Elements for potential distribution can be found in the associated data sheets. There you will also find instructions for use and examples.

9 Process data

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

Byte	0							
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Signal	IN08	IN07	IN06	IN05	IN04	IN03	IN02	IN01
Terminal point	07	06	05	04	03	02	01	00

Byte	1							
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Signal	IN16	IN15	IN14	IN13	IN12	IN11	IN10	IN09
Terminal point	15	14	13	12	11	10	9	8

10 Parameter, diagnostics and information (PDI)

10.1 PDI objects

The module has PDI objects. They are used to map parameters, diagnostic data, and information about the module. The PDI objects can be read and/or written acyclically.

You can find out how to access the PDI objects in the documentation for the bus coupler or the controller used.

The PDI objects necessary for operation 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.

10.2 Retentive storage

Axioline Smart Elements can have retentively (non-volatilely) and volatilely stored parameters.

Retentively stored parameters retain their values even after the module voltage is reset.

For writeable parameters, the following tables indicate whether they are stored retentively or volatilely.

A write operation to the module memory is only triggered if the value of at least one retentive parameter has been changed.

Due to the storage technology used, parameters that are stored retentively only allow a certain number of write access operations (typ. 100,000 to 1,000,000 times). **They are not suitable for being changed cyclically.**

NOTE: Damage to the Flash memory during cyclic write access

The flash memory is only designed for a limited number of write access operations.

- Make sure that write access operations are not performed too often and, in particular, are not performed cyclically.
- Note this behavior when programming function blocks.
- For systems with initial parameterization (e.g., PROFINET), avoid parameterization from the application program.

11 Standard objects

Index (hex)	Object name	Data type	Length in bytes	Rights	Meaning/contents		Retentive storage	
Device type								
0037	DeviceType	Octet string	8	R	Device type	0080 0002 004E 1D20$_{hex}$		
Diagnostics objects								
0018	DiagState	Record [11]	74	R	Diagnostic state			*
0019	ResetDiag	UINT8	1	R/W	Handling diagnostic messages		No	*
Objects for process data management								
0025	PDIN	Octet string	2	R	Input process data The structure corresponds to the representation in the "Process data" section.			
0026	PDOUT	Octet string	2	R	Output process data is not available			

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.

11.1 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.

A detailed description of the object is provided in user manual UM EN AXL F SYS INST.

Possible error codes

Element	02	03	04	08	0B		
Error	**Priority**	**Channel**	**Error code**	**Function group**	**Text**	**E LED**	**Corrective**
	hex	**hex**	**hex**				
No error	00	00	0000	General	Status OK	○	
I/O supply voltage (U_P) is not present.	01	FF	3130	General	Supply missing (U_P)	●	Check the supply voltage.
Error in the Smart Element firmware	01	FF	6100	General	Firmware error, update required	●	Replace the Smart Element.
Problem communicating with the Smart Element	01	FF	6130	General	Smart Element missing	✹	Check whether the Smart Element has been plugged in correctly. If the error is still present, replace the Smart Element.
Error in the parameter memory	01	FF	6320	General	Parameter error, repeat parameterization	●	Error in the parameter memory. Parameterize the Smart Element.

Key

Priority	00_{hex}	No error
	01_{hex}	Error
Channel	00_{hex}	No error
	FF_{hex}	Entire device

LED	○	Off
	●	On
	✹	Flashing (4 Hz)

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

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

Handling diagnostic messages	
Value (hex)	**Meaning**
00	Permit all diagnostic messages (default)
02	Delete all diagnostic messages that are still pending
06	Delete all diagnostic messages and do not permit new ones
Other	Reserved

12 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 PLCnext Engineer, as well as in the corresponding service packs.

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.