

# AXL SE DI16/1

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



Data sheet  
108699\_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 in accordance with EN 61131-2 type 1 and type 3
- 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



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/1088127](https://phoenixcontact.com/product/1088127)

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### 3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Axioline Smart Elements, Digital input module, Digital inputs: 16, 24 V DC, connection technology: 1-conductor, degree of protection: IP20	AXL SE DI16/1	1088127	1

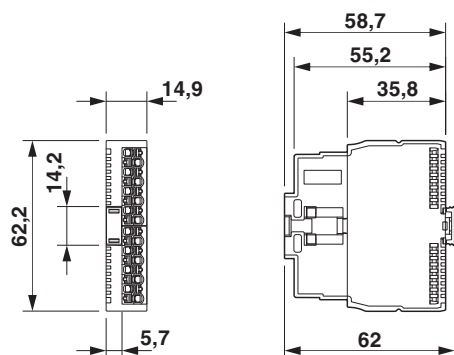
Documentation	Type	Item no.	Pcs./Pkt.
User manual, English, Axioline Smart Elements	UM EN AXL SE SYS INST	-	-
User manual, English, Axioline F: System and installation	UM EN AXL F SYS INST	-	-
User manual, English, Axioline F: Diagnostic registers, and error messages	UM EN AXL F SYS DIAG	-	-

#### Additional ordering data

For additional ordering data (accessories), go to: [www.phoenixcontact.com/product/1088127](http://www.phoenixcontact.com/product/1088127)

### 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	35 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	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 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
Conductor cross section, flexible	0.25 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
Conductor cross section [AWG]	24 ... 16
Conductor cross section flexible, with ferrule with plastic sleeve	0.25 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
Conductor cross section flexible, with ferrule without plastic sleeve	0.25 mm <sup>2</sup> ... 1.5 mm <sup>2</sup>
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<sub>SE</sub>)**

Supply voltage	using card edge connectors
Current draw	See documentation for the system in which the Smart Element is used.

**I/O supply (U<sub>P</sub>)**

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. 14 mA (without connected peripherals) max. 17 mA
Power consumption	min. 340 mW max. 0.5 W
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.

<b>Digital inputs</b>	
Number of inputs	16
Connection method	Push-in connection
Connection technology	1-conductor
Description of the input	EN 61131-2 types 1 and 3
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	-3 V DC ... 5 V DC
Input voltage range "1" signal	11 V DC ... 30 V DC
Input filter time	< 1 ms
Process data update	typ. 340 µs
Polarity reversal protection of the inputs	Diode
<b>Input and output address area</b>	
Input address area	2 Byte
Output address area	0 Byte
<b>Configuration and parameter data in a PROFIBUS system</b>	
Required parameter data	1 Byte
Required configuration data	6 Byte
<b>Electrical isolation/isolation of the voltage areas</b>	
<b>Test section</b>	<b>Test voltage</b>
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.
<b>Mechanical tests</b>	
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 61000-6-2/IEC 61000-6-2**

Electrostatic discharge (ESD) EN 61000-4-2/IEC 61000-4-2	Criterion B, 6 kV contact discharge, 8 kV air discharge
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Electromagnetic fields EN 61000-4-3/IEC 61000-4-3	Criterion A, Field intensity: 10 V/m
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Fast transients (burst) EN 61000-4-4/IEC 61000-4-4	Criterion B, 2 kV
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Transient overvoltage (surge) EN 61000-4-5/IEC 61000-4-5	Criterion B, I/O cables: $\pm 1$ kV asymmetrical
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Conducted interference EN 61000-4-6/IEC 61000-4-6	Criterion A, Test voltage 10 V
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<b>Noise emission test in accordance with EN 61000-6-4/IEC 61000-6-4</b>	Class A
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**Approvals**

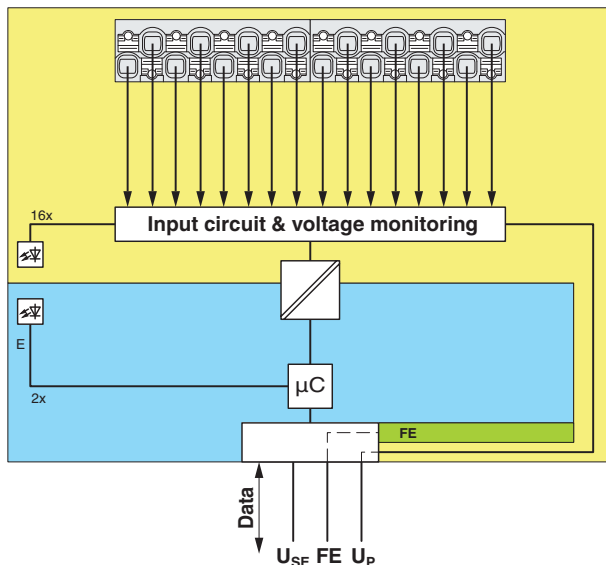
For the current approvals, go to:	<a href="http://www.phoenixcontact.com/product/1088127">www.phoenixcontact.com/product/1088127</a>
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**Manufacturer's declarations**

For the current manufacturer's declarations, go to:	<a href="http://www.phoenixcontact.com/product/1088127">www.phoenixcontact.com/product/1088127</a>
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## 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
$\mu C$	Microcontroller
	Electrical isolation for data or power supply
	LED
	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 "Axoline 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 mm<sup>2</sup>, AWG 26.



##### **UL approval not required**

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** is **not** required when using the Smart Element in combination with a round cable.

#### 6.8 Applications with UL approval



Information:

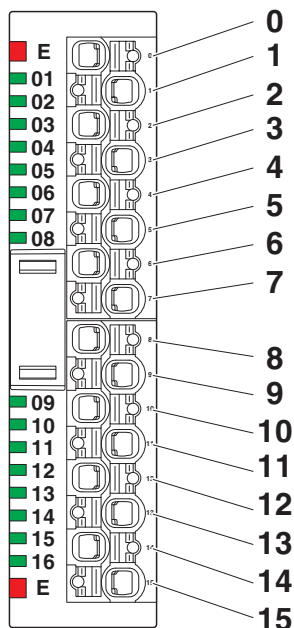
To install the device in accordance with UL/CSA/IEC standard, the following notes must be observed.

- Minimum temperature rating of the cables to be connected to the field wiring terminals:  
105 °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.
01 ... 16	Yellow	On	I/O error Check the connected components and wiring. Remove the error.
		Status of the input	
		On	Input is set.
		Off	Input is not set.

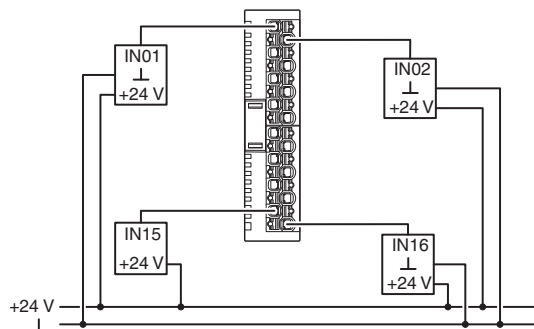
See also "Diagnostic state (0018<sub>hex</sub>: DiagState)" section, "Possible error codes" table.

## 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.

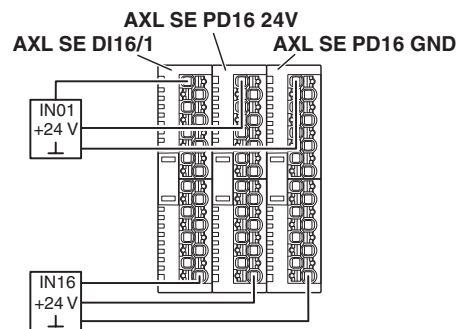
### 8.1 Using equipotential busbars

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 fuses, 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 fuse, 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)

Parameter and diagnostic data as well as other information are transmitted as objects via the PDI channel.

For more detailed information on all possible standard objects for Axioline Smart Elements, please refer to the UM EN AXL SE SYS INST user manual.

The standard objects necessary for operation are described in the following section.

The following applies for the 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

## 11 Standard objects

Index (hex)	Object name	Data type	Length in bytes	Rights	Meaning/contents	Startup parameters	
<b>Device type</b>							
0037	DeviceType	Octet string	8	R	Device type	0080 0002 0000 1D18 <sub>hex</sub>	No
<b>Diagnostics objects</b>							
0018	DiagState	Record [11]	74	R	Diagnostic state		No
0019	ResetDiag	UINT8	1	R/W	Handling diagnostic messages		No
<b>Objects for process data management</b>							
0025	PDIN	Octet string	2	R	Input process data The structure corresponds to the representation in the "Process data" section.		No
0026	PDOUT	Octet string	2	R	Output process data is not available		No

Startup parameters are stored permanently in the 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.

### 11.1 Diagnostics state (0018<sub>hex</sub>: 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 <sub>P</sub> ) is not present.	01	FF	3130	General	Supply missing (U <sub>P</sub> )	●	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 <sub>hex</sub>	No error
	01 <sub>hex</sub>	Error
Channel	00 <sub>hex</sub>	No error
	FF <sub>hex</sub>	Entire device

LED	○	Off
	●	On
	⊗	Flashing (4 Hz)

### 11.2 Handling diagnostic messages (0019<sub>hex</sub>: 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
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

## 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 at [www.phoenixcontact.com/products](http://www.phoenixcontact.com/products) in the download area of the bus coupler installed.