# AXL SE DI16/1

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

Data sheet
108699_en_02



## 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 according to EN 61131-2 type 1 and type 3
- Nominal voltage: 24 V DC
- Nominal current: 2.4 mA
- Connection of sensors in single-wire 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.net/product/1088127

## 2 Table of contents

## 3 Ordering data

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

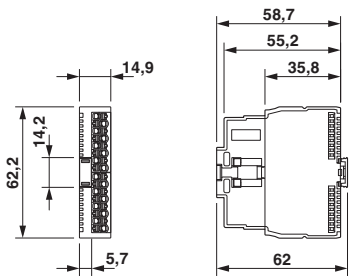
| Documentation | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| User manual, English, Axioline Smart Elements | UM EN AXL SE SYS INST | - | - |

**Additional ordering data**

For additional ordering data (accessories), please refer to user manual UM EN AXL SE SYS INST or go to phoenixcontact.net/products.

## 4 Technical data

**Dimensions (nominal sizes in mm)**




| | |
|---|---|
| Width | 14.9 mm |
| Height | 62.2 mm |
| Depth | 62 mm |

| General data | |
|---|---|
| Color | 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) |
| Degree of protection | IP20 |
| Protection class | III (IEC 61140, EN 61140, VDE 0140-1) |
| Overvoltage category | II (IEC 60664-1) |

| General data | |
|---|---|
| Degree of pollution | 2 (EN 60664-1) |
| 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 solid / stranded | 0.25 mm² ... 1.5 mm² / 0.25 mm² ... 1.5 mm² |
| Conductor cross section [AWG] | 24 ... 16 |
| Stripping length | 8 mm |

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

| Interface: Smart Element interface | |
|---|---|
| Number | 1 |
| Connection method | Card edge connector |
| Start time until ready to operate | < 500 ms (after switching on the supply voltage (object $003D_{hex}$: WakeUpTime)) |

| 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. 14 mA (without connected peripherals)<br>max. 17 mA |
| Power consumption | min. 340 mW<br>max. 1.64 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. |

| Digital inputs | |
|---|---|
| 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 |

| Digital inputs | |
|---|---|
| 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 |

| 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 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 |

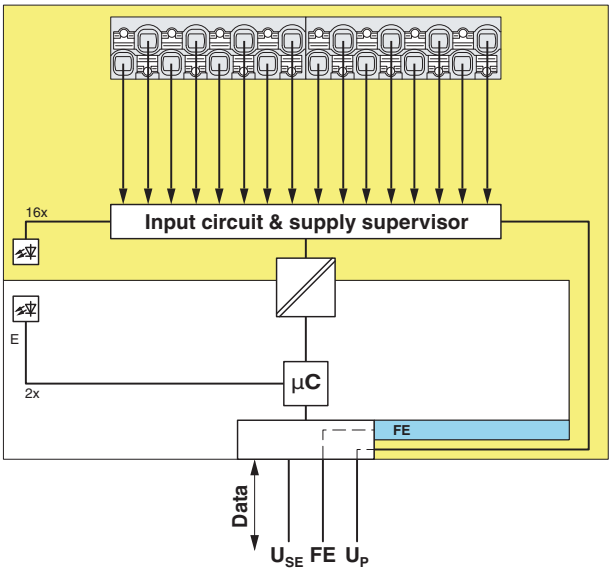
| Conformance with EMC Directive 2014/30/EU | |
|---|---|
| **Noise immunity test in accordance with EN 61000-6-2** | |
| Electrostatic discharge (ESD) EN 61000-4-2/ IEC 61000-4-2 | Criterion B, 6 kV contact discharge, 8 kV air discharge |
| Electromagnetic fields EN 61000-4-3/IEC 61000-4-3 | Criterion A, Field intensity: 10 V/m |
| Fast transients (burst) EN 61000-4-4/IEC 61000-4-4 | Criterion B, 2 kV |
| Transient overvoltage (surge) EN 61000-4-5/ IEC 61000-4-5 | Criterion B, I/O cables: ±1 kV asymmetrical |
| Conducted interference EN 61000-4-6/IEC 61000-4-6 | Criterion A, Test voltage 10 V |
| **Noise emission test as per EN 61000-6-4** | Class A |

**Approvals**

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

# 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.

## 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 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 $U_{SE}$.

## 6.4 Strain relief

**NOTE: damage to the contacts**

Physical overloads can result in damage to the terminal points.

- Relieve strain in the connected cables.

## 6.5 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 also “Axioline Smart Elements” user manual.

## 6.6 Applications with UL approval

**CAUTION!**

– The external circuits intended to be connected to this device shall 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 of UL/CSA/IEC 61010-1, -2-201.
– The device has to be built-in the final safety enclosure, which has adequate rigidity according to UL 61010-1, -2-201 and meets the requirements with respect to spread of fire.

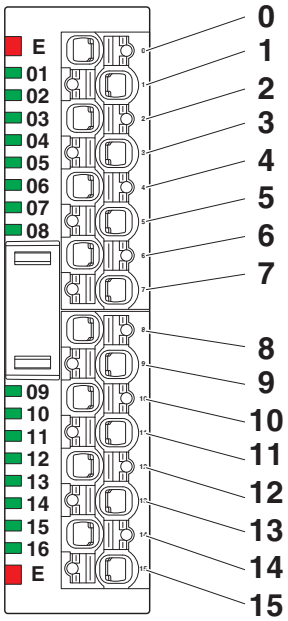
Information:

To install the device according to the UL/CSA/IEC standard, the following rules must be observed.

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

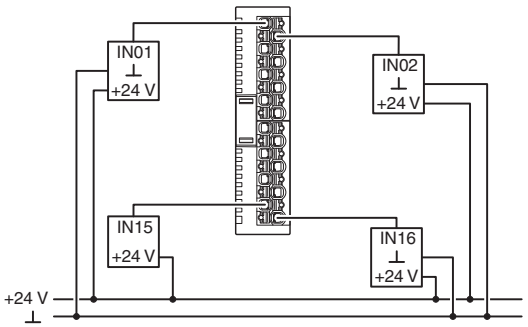
## 7.2 Local diagnostics and status indicators

| 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 example

Figure 3 Connection in 1-conductor technology




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

## 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 |
|---|---|
| A | Number of elements |
| L | Length of the elements in bytes |
| R | Read |
| W | Write |

## 11 Standard objects

| Index (hex) | Object name | Data type | A | L | Rights | Meaning/contents | | Startup parameters | |
|---|---|---|---|---|---|---|---|---|---|
| **Device type** | | | | | | | | | |
| 0037 | DeviceType | Octet string | 1 | 8 | R | Device type | 0080 0002 0000 1D18$_{hex}$ | No | |
| **Diagnostics objects** | | | | | | | | | |
| 0018 | DiagState | Record | 11 | 74 | R | Diagnostic state | | No | * |
| 0019 | ResetDiag | UINT8 | 1 | 1 | R/W | Acknowledge diagnostic messages | | No | * |
| **Objects for process data management** | | | | | | | | | |
| 0025 | PDIN | Octet string | 1 | 2 | R | Input process data<br>The structure corresponds to the representation in the "Process data" section. | | No | |
| 0026 | PDOUT | Octet string | 1 | 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 SE SYS INST.

### 11.1 Diagnostics state ($0018_{hex}$: DiagState)

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

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

Possible error codes

| Subindex | 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 Acknowledge diagnostic messages ($0019_{hex}$: ResetDiag)

You can delete the diagnostic memory of the Smart Element and acknowledge the diagnostic messages with this object.

| Acknowledge 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 phoenixcontact.net/products in the download area of the bus coupler installed.