# AXL E ETH DI8 DO4 2A M12 6P

**Axioline E Ethernet device,
plastic housing, 8 inputs, 4 outputs,
24 V DC, M12 fast connection technology**

Data sheet
8553_en_03

## 1      Description

The Axioline E device is designed for use within an Ethernet network (Modbus/TCP).

It is used to acquire and output digital signals.

**Ethernet features**

– 2 Ethernet ports (with integrated switch)
– Supported protocols:
  SNMP v1, HTTP, TFTP, FTP, BootP, DHCP
– Specification: Modbus application protocol V1.1b
– Firmware can be updated
– Integrated web server for web-based management

**Axioline E features**

– Connection to Ethernet network (Modbus/TCP)
  using M12 connectors (D-coded)
– Transmission speed of 10 Mbps and 100 Mbps
– Connection of digital sensors and actuators
  to M12 connectors (A-coded)
– Diagnostic and status indicators
– Short-circuit and overload protection
  of the sensor supply
– IP65/67 degree of protection

| | |
|---|---|
| **i** | This data sheet is only valid in association with the associated user manual. |
| **i** | Make sure you always use the latest documentation.<br>It can be downloaded from the product at phoenixcontact.net/products. |
| **i** | By default upon delivery, the process data watchdog is deactivated. |

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## 2 Table of contents

# 3 Ordering data

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| Axioline E-Ethernet device in a plastic housing with 8 digital inputs and 4 digital outputs, each with a load capacity of 2 A, 24 V DC, M12 fast connection technology | AXL E ETH DI8 DO4 2A M12 6P | 2701535 | 1 |

| Accessories | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| An M12 screw plug for the unoccupied M12 sockets of the sensor/actuator cable, boxes and flush-type connectors (Protection and sealing elements) | PROT-M12 | 1680539 | 5 |
| Snap-in markers, Sheet, white, unlabeled, can be labeled with: THERMOMARK CARD, BLUEMARK CLED, BLUEMARK LED, TOPMARK LASER, Mounting type: snapped into marker carrier, Lettering field: 7 x 10 mm (Marking) | UCT-EM (7X10) | 0830765 | 10 |

| Documentation | Type | Order No. | Pcs. / Pkt. |
|---|---|---|---|
| User manual, English, Axioline E: system and installation | UM EN AXL E SYS INST | - | - |
| Application note, English: Updating the firmware of AXL E devices using the Windows Explorer | AH EN FIRMWARE UPDATE AXL E | - | - |
| Application note, English: Startup of Axioline E Ethernet devices (Modbus/TCP) using the ModScan32 Modbus master tool | AH EN AXL E ETH MODSCAN32 | - | - |

| Additional ordering data |
|---|

For additional accessories, visit phoenixcontact.net/products.

# 4 Technical data

**Dimensions (nominal sizes in mm)**
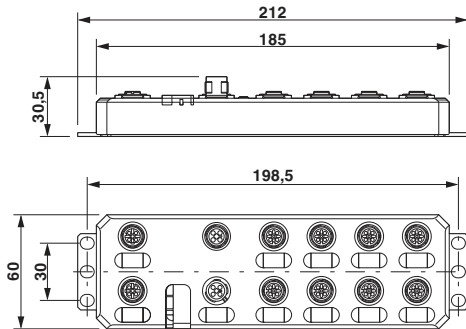


| | |
|---|---|
| Width | 60 mm |
| Height | 185 mm |
| Depth | 30.5 mm |
| Note on dimensions | The height is 212 mm including fixing clips. |

**General data**

| | |
|---|---|
| Housing material | Pocan$^{®}$ |
| Color | anthracite |
| Weight | 480 g |
| Ambient temperature (operation) | -25 °C ... 60 °C |

> ⚠ **CAUTION: Risk of burns**
> If the device is used at an ambient temperature above 50°C, the contact temperature of metal surfaces may exceed 70°C.

| | |
|---|---|
| Ambient temperature (storage/transport) | -25 °C ... 85 °C |
| Permissible humidity (operation) | 5 % ... 95 % |
| Permissible humidity (storage/transport) | 5 % ... 95 % |
| 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 | IP65/IP67 |
| Protection class | III, IEC 61140, EN 61140, VDE 0140-1 |

**Connection data**

| | |
|---|---|
| Connection method | M12 connector |

**Interface Ethernet**

| | |
|---|---|
| Connection method | M12 connectors, D-coded |
| Designation connection point | Copper cable |
| Number of positions | 4 |
| Transmission speed | 10/100 MBit/s (with auto negotiation) |
| Cycle Time | min. 1 ms |

## Modbus/TCP

| | |
|---|---|
| Equipment type | Modbus slave (server) |
| Modbus protocols | Modbus/TCP |
| Additional protocols | SNMP v1, HTTP, TFTP, FTP, BootP, DHCP |
| Specification | Modbus application protocol V1.1b |

## Supply: Module electronics and sensors ($U_S$)

| | |
|---|---|
| Connection method | M12 connector (T-coded) |
| Number of positions | 4 |
| Supply voltage | 24 V DC |
| Nominal supply voltage range | 18 V DC ... 31.2 V DC (including all tolerances, including ripple) |
| Typical current consumption | 140 mA ±15 % (at 24 V DC) |
| Current consumption | max. 12 A |

## Supply: Actuators ($U_A$)

| | |
|---|---|
| Connection method | M12 connector (T-coded) |
| Number of positions | 4 |
| Supply voltage | 24 V DC |
| Nominal supply voltage range | 18 V DC ... 31.2 V DC (including all tolerances, including ripple) |
| Typical current consumption | 30 mA ±15 % (at 24 V DC) |
| Current consumption | max. 12 A |

## Digital inputs

| | |
|---|---|
| Number of inputs | 8 (EN 61131-2 types 1 and 3) |
| Connection method | M12 connector, double occupancy |
| Connection method | 2, 3, 4-wire |
| Nominal input voltage | 24 V DC |
| Nominal input current | typ. 3 mA |
| Sensor current per channel | typ. 0.75 mA (from Us) |
| Total sensor current | max. 0.6 A (per device) |
| Input voltage range "0" signal | -30 V DC... 5 V DC |
| Input voltage range "1" signal | 11 V DC ... 30 V DC |
| Input filter time | < 1000 µs |
| Permissible conductor length to the sensor | 30 m |
| Overload protection, short-circuit protection of sensor supply | Yes |

## Digital outputs

| | |
|---|---|
| Number of outputs | 4 |
| Connection method | M12 connector, (A-coded) |
| Connection method | 2, 3-wire |
| Nominal output voltage | 24 V DC (from voltage $U_A$) |
| Maximum output current per channel | 2 A |
| Nominal load, ohmic | 12 W (48 Ω; with nominal voltage) |
| Nominal load, inductive | 12 VA (1.2 H; 48 Ω; with nominal voltage) |
| Signal delay | max. 150 µs (when switched on)<br>max. 200 µs (when switched off) |
| Switching frequency | max. 5500 per second (with at least 50 mA load current) |
| Switching frequency | max. 1 per second (with inductive load) |
| Limitation of the voltage induced on circuit interruption | -28 V... -17 V |

## Digital outputs

| | |
|---|---|
| Output voltage when switched off | max. 1 V |
| Output current when switched off | max. 20 µA |
| Behavior with overload | Auto restart |
| Reverse voltage resistance to short pulses | Reverse voltage proof |
| Overcurrent shut-down | min. 2.2 A |
| Overload protection, short-circuit protection of outputs | Electronic |

## Electrical isolation/isolation of the voltage areas

| Test section | Test voltage |
|---|---|
| 24 V supply (communications power and sensor supply, digital inputs)/ bus connection (Ethernet 1) | 500 V AC, 50 Hz, 1 min |
| 24 V supply (communications power and sensor supply, digital inputs)/ bus connection (Ethernet 2) | 500 V AC, 50 Hz, 1 min |
| 24 V supply (communications power and sensor supply, digital inputs)/FE | 500 V AC, 50 Hz, 1 min |
| Bus connection (Ethernet 1)/FE | 500 V AC, 50 Hz, 1 min |
| Bus connection (Ethernet 2)/FE | 500 V AC, 50 Hz, 1 min |
| Bus connection (Ethernet 1)/bus connection (Ethernet 2) | 500 V AC, 50 Hz, 1 min |
| 24 V supply (actuator supply, digital outputs)/ 24 V supply (communications power and sensor supply, digital inputs) | 500 V AC, 50 Hz, 1 min |
| 24 V supply (actuator supply, digital outputs)/bus connection (Ethernet 1) | 500 V AC, 50 Hz, 1 min |
| 24 V supply (actuator supply, digital outputs)/bus connection (Ethernet 2) | 500 V AC, 50 Hz, 1 min |
| 24 V supply (actuator supply, digital outputs)/FE | 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, 11 ms period, half-sine shock pulse |
| 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; 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 |

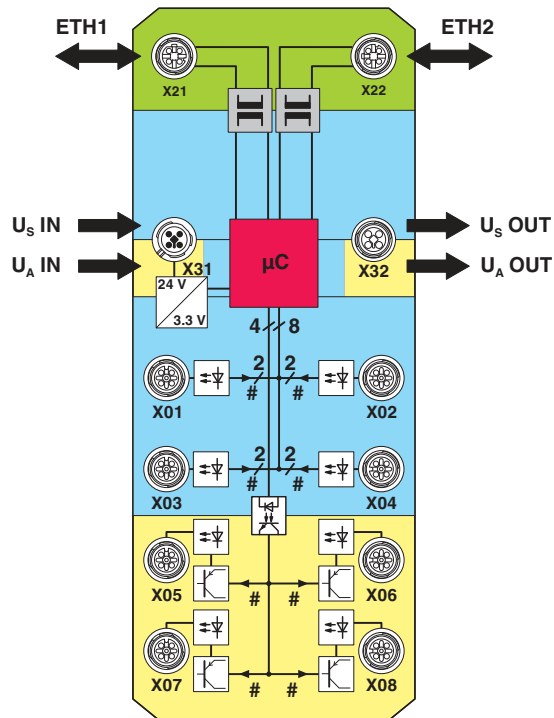**Noise emission test as per EN 61000-6-4**

| | |
|---|---|
| Radio interference properties EN 55022 | Class A |

## Approvals

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

# 5    Internal circuit diagram
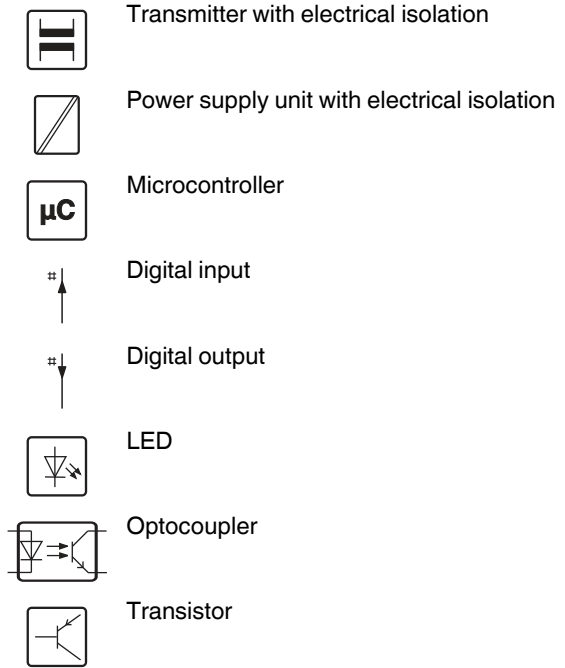


Figure 1        Internal wiring of connections

Key:

| | |
|---|---|
| Green area: | Network |
| Blue area: | $U_S$ |
| Yellow area: | $U_A$ |

# 6 Pin assignment

## 6.1 Ethernet and power supply connection
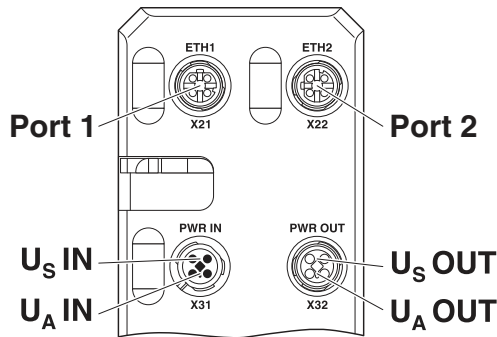


Figure 2    Connections for Ethernet and voltage supply

| Designation | Meaning |
|---|---|
| Port 1 (X21) | Ethernet port 1 |
| Port 2 (X22) | Ethernet port 2 |
| $U_S$ IN (X31) | Power supply IN (logic and sensors) |
| $U_A$ IN (X31) | Power supply IN (actuators) |
| $U_S$ OUT (X32) | Power supply OUT for additional devices |
| $U_A$ OUT (X32) | Power supply OUT for additional devices |

| | |
|---|---|
| ⊘ | Ground the device by means of the mounting screws. |

## 6.2 Ethernet pin assignment
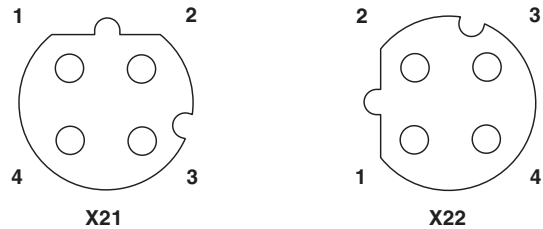


Figure 3    Ethernet pin assignment, D-coded

| Pin | Ethernet port 1 (X21) | Ethernet port 2 (X22) |
|---|---|---|
| 1 | TX+ | TX+ |
| 2 | RX+ | RX+ |
| 3 | TX- | TX- |
| 4 | RX- | RX- |

| | |
|---|---|
| ℹ | The shield is connected to FE in the device. |

| | |
|---|---|
| ℹ | The thread is used for additional shielding. |

## 6.3 Pin assignment of the power supply $U_S/U_A$
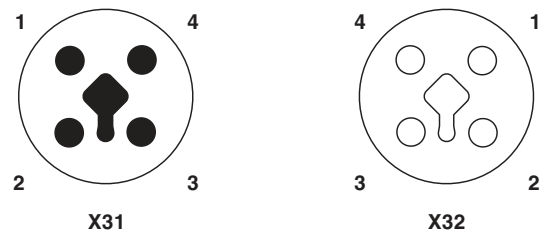


Figure 4    Pin assignment of the power supply, T-coded

| Pin | IN | OUT | Conductor colors |
|---|---|---|---|
| 1 | +24 V DC ($U_S$) | +24 V DC ($U_S$) | Brown |
| 2 | GND ($U_A$) | GND ($U_A$) | White |
| 3 | GND ($U_S$) | GND ($U_S$) | Blue |
| 4 | +24 V DC ($U_A$) | +24 V DC ($U_A$) | Black |

## 6.4 Connecting inputs and outputs
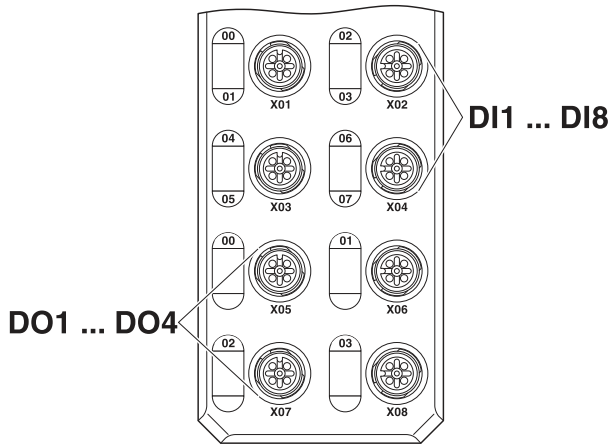


Figure 5     Input and output connections

| Designation | Meaning |
|---|---|
| DI1 ... DI8 (X01 ... X04) | Inputs 1 ... 8 |
| DO1 ... DO4 (X05 ... X08) | Outputs 1 ... 4 |

## 6.5 Pin assignment of the inputs and outputs



**X01, X03, X05, X07**          **X02, X04, X06, X08**
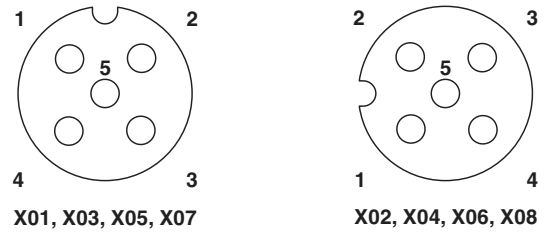
Figure 6     Pin assignment of the inputs and outputs, A-coded

| Pin | Input socket | Output socket |
|---|---|---|
| 1 | +24 V DC ($U_S$) | Not used |
| 2 | Input 2, 4, 6, 8 | Not used |
| 3 | GND | GND |
| 4 | Input 1, 3, 5, 7 | Output 1, 2, 3, 4 |
| 5 | FE | FE |

# 7 Connection example
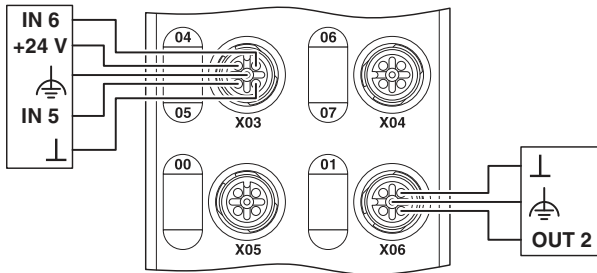


Figure 7 Example of connection of sensors and actua-
tors

# 8 Connection notes

**Note: data corruption or loss**

Implement the FE connection using mounting screws, in order to ensure immunity to interference.

**NOTE: device damage**

To ensure IP65/IP67 protection, cover unused sockets with protective caps.

**NOTE: Damage to the electronics**

Only supply the sensors with the voltage $U_S$ provided at the terminal points.

**NOTE: Damage to the electronics**

Observe the correct polarity of the supply voltages $U_S$ and $U_A$ in order to prevent damage to the device.

**NOTE: Malfunction**

When connecting the sensors and actuators, observe the assignment of the connections to the Ethernet input and output data.

Secure the device to a level surface or to a profile. Do not use this device to bridge gaps, in order to prevent forces being transmitted via the device.

Use standard M5 screws with toothed lock washer and self-locking nuts. Observe the maximum torque of the screws.

# 9    Configuration via rotary encoding switch

You can configure the address assignment and other functions using rotary encoding switches.

After modifying the switch position, restart the device, as the modification to the switch position does not take effect during operation.
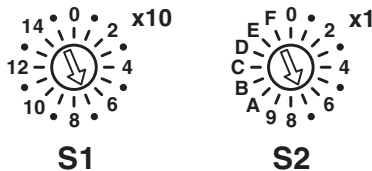


Figure 8        Rotary encoding switch

The code results from the sum of S1 x 10 plus S2 x 1. The image shows code 77 (7 x 10 + 7).

| S1 | S2 | Code | Function |
|---|---|---|---|
| 0 | 0 | 00 | Remote access (default) |
| 0 ... 5 | 1 ... 0 | 01 ... 50 | Manual address assignment |
| 5 ... 15 | 0 ... 9 | 51 ... 159 | DHCP name assignment |
| 0 | A | 0A | Static address |
| 0 | E | 0E | Resetting IP parameters |
| 0 | F | 0F | Resetting to the default settings |
| Other | | | Reserved |

## 9.1    Remote access

**Switch position 00**

At this switch position, it is possible to remotely configure the device using corresponding tools (e.g., Startup+, web-based management (WBM)).

**Behavior during initial startup, after resetting the IP parameters or after resetting to default settings**

**Default: BootP aktiviert, DHCP deaktiviert**

A valid IP address is not assigned (0.0.0.0) and communication is therefore not possible.

The device transmits continuous BootP requests , until a valid IP address has been received.

Valid IP parameters are then automatically saved as configuration data on the device.

**Each additional startup**

**BootP activated**

BootP requests are transmitted even in the case of a valid configuration. If the device receives a BootP reply, the new IP parameters are applied. Otherwise the device starts with the last valid configuration.

**DHCP activated**

For behavior, see switch position 51 ... 159. The station name can be selected in WBM, the default station name is the MAC address with "-" used as the separator.

**Static (BootP and DHCP deactivated)**

The device starts with the last valid assigned IP configuration.

## 9.2    Manual address assignment

**Switch position 01 ... 50**

**Default: BootP deactivated, DHCP activated**

The first three octets in the IP address are preset as 192.168.0.x.
The subnet mask is 255.255.255.0.

Specify the last byte with the switch position.

As such, you can select IP addresses between 192.168.0.**1** and 192.168.0.**50**.

Prior to transferring the IP address, a test is performed to check for any potential IP address conflicts. If a conflict is detected, the device temporarily switches the IP address to 0.0.0.0 (no IP communication). In this case, the NET LED flashes red. Eliminate the conflict and restart the device.

## 9.3    DHCP name assignment

**Switch position 51 ... 159**

This switch position is used to easily specify the DHCP host name for the device.

The host name is provided to the DHCP server via DHCP options. This is therefore able to send a DNS update to the DNS server.

The DNS name consists of one set part, which is based on the order designation, and a variable part, which is determined by the switch position.

The first part of the station name is AXL-E-ETH-.

The set number is added.

This results in the following station names:
AXL-E-ETH-**051** ... AXL-E-ETH-**159**.

**Behavior during initial startup, after resetting the IP parameters or after resetting to default settings**

A valid IP address is not assigned (0.0.0.0) and communication is therefore not possible.

The device transmits continuous DHCP discover messages until a valid IP address has been received.

**Each additional startup**

The device transmits continuous DHCP requests.

There are two possible scenarios:

1. The DHCP server assigns a new IP address.
   ⇒ The device applies the new IP parameters.
2. The DHCP server does not respond.
   ⇒ The device transmits continuous DHCP Discover messages until new IP parameters have been received.

### 9.4 Static address

**Switch position 0A**

**Behavior during initial startup, after resetting the IP parameters or after resetting to default settings**

A valid IP address is not assigned (0.0.0.0) and communication is therefore not possible.

Assign an address initially with another switch position.

**Each additional startup**

After a voltage reset, the device maintains the IP address which was assigned last.

| **i** | With this switch position, modifying the IP address via tools or web-based management is not possible. |
|---|---|

### 9.5 Resetting IP parameters

**Switch position 0E**

The IP parameters stored on the device are reset.

All other settings made on the device are retained.

– BootP is activated for switch position 00.

– IP address, subnet mask: 0.0.0.0

As long as the switch position 0E remains selected, no connection to the device can be established.

IP communication is deactivated (LED NET static yellow).

### 9.6 Resetting to the default settings

**Switch position 0F**

All settings are reset to default settings, including IP parameters.

| **i** | The device is ready for operation after powering up, as soon as the RDY LED lights up green.<br>A connection to the device however cannot be established in this switch position.<br>As soon as the RDY LED lights up green, a new switch position can be selected on the rotary encoding switch and the device can be restarted. |
|---|---|

### 9.7 Reserved/invalid switch position

The device starts with the previous settings, e.g., with the settings that were valid before the device was restarted.

An invalid switch position is indicated by the RDY LED (red on).

# 10 Local status and diagnostic indicators
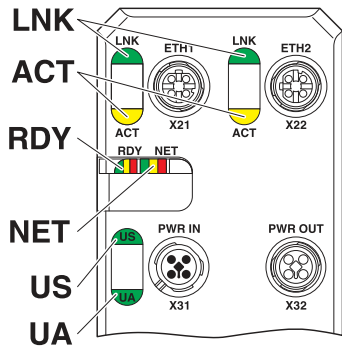
## 10.1 Indicators for Ethernet ports and power supply



Figure 9    Indicators for Ethernet ports and power supply

| Designation | Color | Meaning | State | Description |
|---|---|---|---|---|
| LNK 1/2 | Green | **Link** | Green ON | Connection present at port 1/2. |
| | | | OFF | Connection not present at port 1/2. |
| ACT 1/2 | Yellow | Activity | Yellow ON | Data transmission present at port 1/2. |
| | | | OFF | Data transmission not present at port 1/2. |
| RDY | Green/ yellow/ red | **Ready** | Green ON | Device is ready for operation. |
| | | | Green flashing | Firmware update is being performed. |
| | | | Flashing green/yellow | Over- or undervoltage at $U_S$ |
| | | | | Temperature of the device is in the critical area. |
| | | | | Failure of the actuator supply $U_A$ |
| | | | | Surge voltage/undervoltage of the actuator supply $U_A$ |
| | | | | And red US LED: sensor supply overload |
| | | | Red ON | Rotary encoding switches are set to an invalid/reserved position. |
| | | | OFF | Device is not ready for operation. |
| NET | Green/ yellow/ red | **Net**work status | Green flashing | A connection can be established to the device. |
| | | | Green ON | At least one connection has been established to the device. |
| | | | Yellow flashing | BootP request or DHCP requests/discover messages are being transmitted. |
| | | | Yellow ON | The IP configuration/IP address (0.0.0.0) is invalid. |
| | | | Red flashing | An IP address conflict has occurred during static configuration via rotary coding switches (IP address assigned twice). |
| | | | Red ON | A network error has occurred. The monitoring function detected an error or the process data watchdog was activated. |
| | | | OFF | Device is not ready for operation. |
| US | Green/ red | $U_{\mathbf{S}ensorik}$ | Green ON | Communications power/sensor voltage present |
| | | | OFF | Communications power/sensor voltage not present or too low. |
| | | | Red ON | Sensor voltage overload |
| UA | Green | $U_{\mathbf{A}ktorik}$ | ON | Actuator voltage present. |
| | | | OFF | Actuator voltage not present. |

## 10.2    Input and output indicators
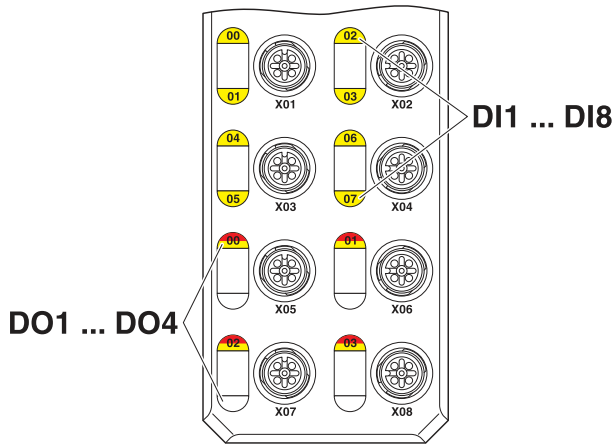


Figure 10      Input and output indicators

| Designation | Color | Meaning | State | Description |
|---|---|---|---|---|
| 00 ... 07 | Yellow | Status of the inputs | ON | Input is set. |
| | | | OFF | Input is not set. |
| 00 ... 03 | Yellow/red | Status of the outputs | Yellow ON | Output is set. |
| | | | Red ON | Output is short circuited or overloaded. |
| | | | OFF | Output is not set. |

The numbering of the LEDs is as follows: the first number specifies the byte, the second number specifies the bit.

# 11 Monitoring

Monitoring functions with different features are available for monitoring Ethernet communication.

– Modbus connection monitoring
– Process data watchdog

By default upon delivery, the process data watchdog is deactivated.

| Mechanism | Monitoring |
|-----------|-----------|
| Modbus connection monitoring | Client application |
| | Modbus channels |
| | Ethernet connection |
| Process data watchdog | Client application |
| | Ethernet connection |
| | Process data exchange |

By default upon delivery, the process data watchdog is deactivated.

If the timeout period expires for one or both mechanisms, the OUT process data is blocked. The parameterized substitute value behavior of the outputs is performed.

The error is indicated by the NET LED (red on). During the Net Fail state, the OUT process data can continue to be updated by the application.
Following a Net Fail reset, substitute values are then replaced by the latest process data.
Function of the process data watchdog

A process data watchdog is integrated into the device to avoid uncontrolled setting/resetting of outputs in the event of an error.

If outputs are set, the controlling process must be able to access the device.

In the event of an error, e.g., network cable interrupted or function error in the controlling process, the device can respond appropriately via the process data watchdog.

> **i** By default upon delivery, the process data watchdog is deactivated; timeout period = 0 ms.

When activating the process data watchdog, it is started by the first write process and the next write process is expected within the timeout period. During error-free operation, the write process is performed during the timeout period and the watchdog is restarted (triggered).

> **(!)** Reading calls do not trigger the process data watchdog.

## 11.1 Net fail

If there is no triggering during the timeout period, an error occurred. Two responses follow:

– All outputs are set to the configured substitute value.
– The Net Fail signal is set (NET LED is red and bit 1 in status register 7996 is set).

For safety reasons, the user cannot stop the watchdog once it has been activated.

If the user terminates the controlling application, the watchdog is not triggered. When the timeout period elapses, the Net Fail signal is set, and the parameterized substitute value behavior is performed.

After the watchdog has performed its task, the outputs are only enabled again after acknowledgment.

> **(!)** When the error is acknowledged, the watchdog is restarted. This means that it must be triggered during the timeout period, otherwise an error is detected again.

## 11.2 Configuring the process data watchdog

To activate the watchdog, specify the desired timeout period in the range of 200 ms and 65,000 ms.

In order to deactivate the watchdog, specify the 0 ms timeout period.

You have the following options for changing the timeout period:

– Web-based management
– Modbus register 2000

### 11.3    Acknowledge error message

There are two options to acknowledge a network error:

The following options are available:

– Auto (default)
– Manual

This confirmation mode can be configured in the WBM only.

**Auto (default)**

The error is acknowledged "automatically" with the next valid write access to the output process data. (Net Fail in register 7996 is deleted and the NET LED changes to green).

**Manual**

In "manual" mode the error must be acknowledged via register 2006 or the web-based management.

## 12    Substitute value behavior

If Ethernet communication fails, all device outputs are set to the previous parameterized substitute values.

**Set the desired substitute value behavior**

To set the desired substitute value behavior, the following options are available:

– Web-based management
– Modbus register 2002

For further information, please refer to the "Fault response mode" section.

## 13    Modbus protocols and registers

The device supports a Modbus/TCP server.

As such, the Modbus protocol can be used in a connection-related (TCP) manner.

### 13.1    Modbus connections

The device supports up to eight Modbus/TCP connections at the same time.

The connection can access different addresses simultaneously.

Since eight connections are supported, a connection can quickly be restored. This means that the client can successfully restore an interrupted Modbus connection.

### 13.2    Modbus conformity classes

The device supports Modbus conformity classes 0 and 1 as well as parts of class 2.

### 13.3    Modbus function codes

The following function codes are supported:

| Function code | Function | Description |
|---|---|---|
| FC1 | Read coils | Read output and input bits |
| FC2 | Read input discretes | Read multiple input bits |
| FC3 | Read holding registers | Read words from outputs and inputs |
| FC4 | Read input registers | Read words from inputs |
| FC5 | Write coil | Write an output bit |
| FC6 | Write single registers | Write word for output data |
| FC15 | Write multiple coils | Write multiple output bits |
| FC16 | Write multiple registers | Write several output words |
| FC23 | Read/write multiple registers | Read and write several process data for inputs and outputs |

## 13.4    Modbus register

| Modbus register (16-bit word) | Access | Function | Access with function code |
|---|---|---|---|
| **Special register** | | | |
| 1280 | R/W | Modbus timeout monitoring | FC3, FC4, FC6, FC16, FC23 |
| 2000 | R/W | Timeout for process data watchdog | FC3, FC4, FC6, FC16, FC23 |
| 2002 | R/W | Substitute value behavior (fault response mode) | FC3, FC4, FC6, FC16, FC23 |
| 2004 | R | Net Fail reason | FC3, FC4, FC23 |
| 2006 | W | Command register | FC6, FC16, FC23 |
| **Diagnostics** | | | |
| 7996 | R | Status register | FC3, FC4, FC23 |
| 7997 | R | Diagnostic status register | FC3, FC4, FC23 |
| 7998 | R | Diagnostic parameter register | FC3, FC4, FC23 |
| **Process data** | | | |
| 8000 | R | Input process data | FC1, FC2, FC3, FC4, FC23 |
| 9000 | R/W | Output process data | FC1, FC2, FC3, FC4, FC5, FC6, FC15, FC16, FC23 |

R        Read
W        Write

| i | In write access to the Modbus/TCP clients on the "Read only" register, the data is not transferred and is answered with exception code 02. |
|---|---|

### 13.5 Modbus timeout monitoring (1280)

Modbus monitoring means setting or reading the timeout value for the Modbus connection monitoring.

A timeout value of 0 ms deactivates monitoring.

Enter the time in milliseconds in the range from 200 ms to 65000 ms, converted to hexadecimal.

| **i** | Connection monitoring with the new timeout values is only activated after a Modbus/TCP function has been executed on the relevant TCP connection. |
|---|---|

### 13.6 Timeout OUT process data monitoring (process data watchdog) (2000)

Timeout OUT process data monitoring means setting or reading the timeout value for the process data watchdog.

Enter the time in milliseconds in the range from 200 ms to 65000 ms, converted to hexadecimal.

A timeout value of 0 ms deactivates the watchdog.

### 13.7 Fault response mode (2002)

The required fault response mode can be set via web-based management or by writing to Modbus register 2002.

| Code (bin) | Code (hex) | Meaning |
|---|---|---|
| 00 | 0000 | All outputs are set to "0". |
| 01 | 0001 | All outputs are set to "1". |
| 10 | 0002 | All outputs keep their last value. |

### 13.8 Net Fail reason (2002)

The reasons for a Fault Response and a set Net Fail signal can be accessed via web-based management or via the Modbus register 2004.

| Code (hex) | Meaning |
|---|---|
| 0001 ... 0006 | Reserved |
| 0007 | DTI timeout occurred |
| 0008 | Host timeout occurred |
| 0009 | Set by user. |
| 000A | Connection aborted |
| 000B | Initialization error |
| 000C | Process data watchdog triggered |
| 000D | Modbus timeout occurred |

### 13.9 Command register (2006)

Only set one bit for the command register, otherwise an error message is output. Only write access is enabled for the register.

| Bit | Code (hex) | Meaning |
|---|---|---|
| 0 | 0001 | Reserved |
| 1 | 0002 | Reserved |
| 2 | 0004 | Reserved |
| 3 | 0008 | Reserved |
| 4 | 0010 | Set Net Fail |
| 5 | 0020 | Acknowledge Net Fail |
| 6 | 0040 | Reserved |
| 7 | 0080 | Delete a detected I/O warning/malfunction |
| 8 | 0100 | Reserved |
| 9 | 0200 | Reserved |
| 10 | 0400 | Reserved |
| 11 | 0800 | Reserved |
| 12 | 1000 | Reserved |
| 13 | 2000 | Reserved |
| 14 | 4000 | Reserved |
| 15 | 8000 | Reserved |

## 13.10 Status register (7996)

| Bit | Code (hex) | Meaning | |
|---|---|---|---|
| 0 | 0001 | 1 | An error occurred (e.g., a bit in the diagnostic register is set). For additional information, please refer to register 2004. |
| | | 0 | No error |
| 1 | 0002 | 1 | A Net Fail occurred, active substitute values. For additional information, please refer to register 2004. |
| | | 0 | No error |
| 2 | 0004 | Reserved | |
| 3 | 0008 | Reserved | |
| 4 | 0010 | Reserved | |
| 5 | 0020 | Reserved | |
| 6 | 0040 | Reserved | |
| 7 | 0080 | Reserved | |
| 8 | 0100 | Reserved | |
| 9 | 0200 | Reserved | |
| 10 | 0400 | Reserved | |
| 11 | 0800 | Reserved | |
| 12 | 1000 | Reserved | |
| 13 | 2000 | Reserved | |
| 14 | 4000 | Reserved | |
| 15 | 8000 | Reserved | |

## 13.11 Diagnostic status register (7997)

| Bit | Code (hex) | Meaning |
|---|---|---|
| 0 | 0001 | Short circuit or overload of outputs, for additional information please refer to register 7998. |
| 1 | 0002 | Reserved |
| 2 | 0004 | Undervoltage of sensor supply |
| 3 | 0008 | Surge voltage of sensor supply |
| 4 | 0010 | Short circuit or overload of the sensor supply |
| 5 | 0020 | Reserved |
| 6 | 0040 | Undervoltage of actuator supply |
| 7 | 0080 | Surge voltage of actuator supply |
| 8 | 0100 | Short circuit or overload of the actuator supply |
| 9 | 0200 | Reserved |
| 10 | 0400 | Overtemperature of the device |
| 11 | 0800 | Reserved |
| 12 | 1000 | Reserved |
| 13 | 2000 | Reserved |
| 14 | 4000 | Reserved |
| 15 | 8000 | Reserved |

## 13.12 Diagnostic parameter register (7998)

This register sends the fault location (channel number) to where the fault has occurred. The fault location is sent in group format.

| Code (hex) | Meaning |
|---|---|
| 0000 | A short circuit has not occurred. |
| 0001 | Short circuit at one output or several outputs 1 ... 4 |
| 0002 | Reserved |
| 0003 | Reserved |
| 0004 | Reserved |

### 13.13 Figure of process data on Modbus registers 8000 and 9000

| Process data input word 8000 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Byte | Byte 0 | | | | | | | |
| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| IN | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
| Connection | X04 | | X03 | | X02 | | X01 | |
| Pin | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 |
| DI | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

Key:

Bit:        Process data assignment

IN:        LED marking

DI:        Device input

| Process data output word 9000 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Byte | Byte 0 | | | | | | | |
| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| OUT | - | - | - | - | 03 | 02 | 01 | 00 |
| Connection | - | - | - | - | X08 | X07 | X06 | X05 |
| Pin | - | - | - | - | 4 | 4 | 4 | 4 |
| DO | - | - | - | - | 4 | 3 | 2 | 1 |

Key:

Bit:        Process data assignment

OUT:      LED marking

DO:        Device output

# 14 Startup

## 14.1 Delivery state/default settings

By default upon delivery, the following functions and features are available:

**IP settings**

| | |
|---|---|
| IP parameters: | 0.0.0.0 |
| Subnet mask: | 0.0.0.0 |
| Default Gateway: | 0.0.0.0 |
| BootP: | activated |

**Process data watchdog**

| | |
|---|---|
| Fault response mode: | Reset fault mode: |
| Process data watchdog timeout: | 0 (deactivated) |
| Confirmation mode: | Auto |

**Firmware update**

| | |
|---|---|
| Firmware update on next restart: | deactivated |
| TFTP server IP address: | 192.168.210.211 |
| Firmware file name: | FIRMWARE.NXF |

**System identification**

| | |
|---|---|
| Device name: | No name assigned |
| Description: | No description assigned |
| Device location: | No location assigned |
| Contact: | No contact assigned |

**Web-based Management (WBM)**

| | |
|---|---|
| User name: | admin |
| Password: | private |

## 14.2 Restoring the default settings

There are two options for resetting the default settings:
– Via web-based management, go to the Administration web page > default settings and follow the instructions.
– Via the rotary coding switch, switch position 0F

## 14.3 Starting the firmware

Once you have connected the power, the firmware is started.

After completion of the firmware boot process, the NET LED either lights up or flashes green.

## 15 SNMP - Simple Network Management Protocol

The device supports SNMP v1.

**Management Information Base - MIB**

> ℹ️ The corresponding latest MIBs are available on the Internet at phoenixcontact.net/products.

For the object descriptions, please refer to the ASN1 descriptions for this product.

The password for read access is "public" and cannot be changed.
By default upon delivery, the password for write/read access is "private" and can be modified at any time.

## 16 WBM - Web-based management

The device has a web server, which generates the required pages for web-based management and, depending on the requirements of the user, sends them to a standard web browser. Web-based management can be used to access static information (e.g., technical data, MAC address) or dynamic information (e.g., IP address, status information).

**Calling web-based management**

The device web server can be addressed using the IP address if configured accordingly. The homepage (web page) of the device is accessed by entering the
URL "http://ip-address".
Example: http://172.16.113.38
The default user name is "admin", the default password is "private".

> ℹ️ If you cannot access the WBM pages, check the connection settings in your browser and deactivate the proxy, if set.

## 17 Firmware update

In order to update the firmware of the device, the device must be provided with a firmware container via a TFTP server or it must be loaded onto the device via FTP. Any FTP client or TFTP server can be used for this. The update must always be initiated by the web-based management. When carrying out the firmware update, the RDY LED flashes yellow.

## 18 Quick Connect

The device supports Quick Connect Class A.

After switching on the mains voltage, it is ready to operate in under 350 ms in order to process a connection request.

A cyclic process data connection can be established in under 500 ms.

## 19 Endianness

The Modbus specification stipulates Big Endian format; words (16-bit) are mapped 1:1.

Individual bytes (modules with a process data width of 1 byte) are mapped to the lower byte (low byte) of a register.

In the read direction, the upper byte (high byte) contains $00_{hex}$ and is ignored in the write direction.