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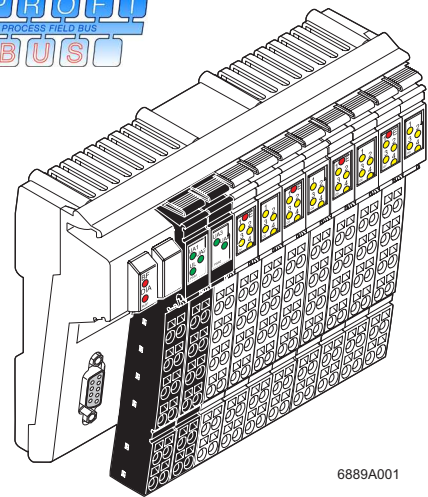


## Contact us

# ILB PB 24 DO32

## Inline Block IO Module
## for PROFIBUS With 32 Digital Outputs

### AUTOMATIONWORX

Data Sheet
6889_en_04

6889A001

## Description

The ILB PB 24 DO32 module is designed for use within a PROFIBUS network. It is used to output digital signals.

**PROFIBUS-DP Features**

– Bus connection via D-SUB connectors
– Rotary encoding switches for address setting
– Supported PROFIBUS addresses 1 to 99
– Transmission speed 9.6 kbaud to 12 Mbaud (autobaud)
– Diagnostic and status indicators
– Device description via GSD file

**Output Features**

– Connections for 32 digital actuators
– Connection of actuators in 2 and 3-wire technology
– Nominal current per output: 0.5 A
– Total current of all outputs: 16 A (4 x 4 A)
– Short-circuit and overload protected outputs
– Diagnostic and status indicators

| | |
|---|---|
| | Please refer to the "Mounting and Removing Inline Block IO Modules" application note (see "Ordering Data" on page 2). |
| | Make sure you always use the latest documentation. It can be downloaded at www.download.phoenixcontact.com. A conversion table is available on the Internet at www.download.phoenixcontact.com/general/7000_en_00.pdf. |

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# Ordering Data

### Product

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| Inline Block IO module for PROFIBUS with 32 digital outputs | ILB PB 24 DO32 | 2862408 | 1 |

### Accessories: Connector

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| 9-pos. D-SUB connector for connecting PROFIBUS | SUBCON-PLUS-PROFIB | 2744348 | 1 |

### Accessories: Connectors as Replacement Item

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| Connector for the supply (color print) | ILB SCN-12-PWR IN-CP | 2863164 | 10 |
| Connector, with color print, for digital 4-channel or 16-channel Inline output terminals | IB IL SCN-12-OCP | 2727624 | 10 |

### Accessories: Other

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| Recommended end clamp; placed both to the right and left of the module to secure it on the DIN rail | CLIPFIX 35-5 | 3022276 | 50 |

### Documentation

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| "Mounting and Removing Inline Block IO Modules" application note | AH ILB INSTALLATION | 9014931 | 1 |
| "Addressing of 32-Channel ILB Modules" application note | AH ILB 24 DI/DO 32 ADDRESS | 9014963 | 1 |

# Technical Data

## General Data

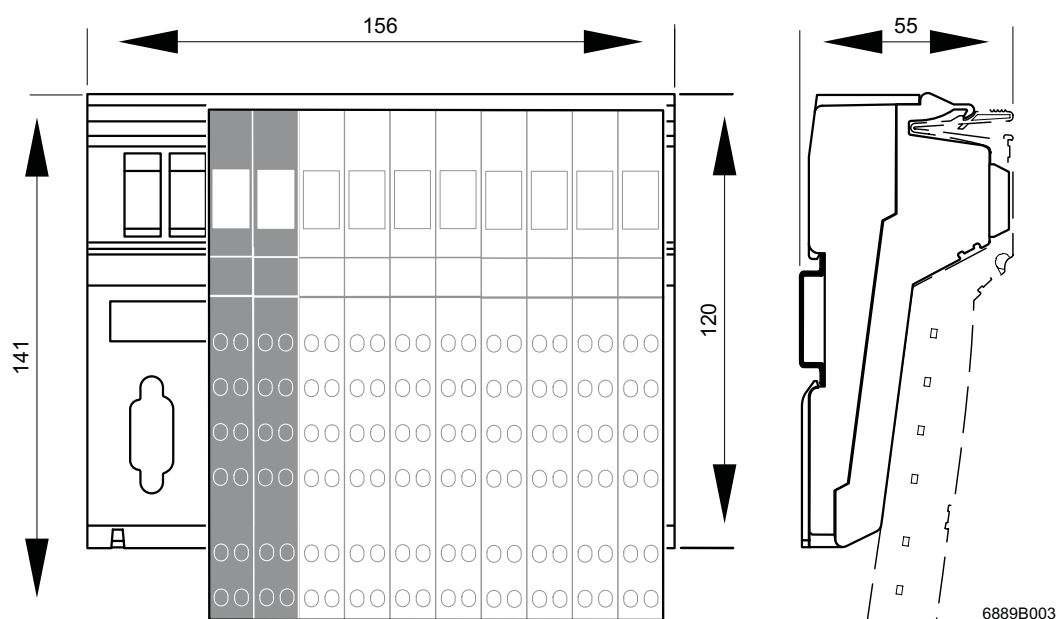| | |
|---|---|
| Housing dimensions with connectors (width x height x depth) | 156 mm x 55 mm x 141 mm |
| Weight | 510 g (with connectors) |
| Operating mode | Process data mode with 4 bytes |
| Transmission speed | 9.6 kbaud to 12 Mbaud (autobaud) |
| Connection method for actuators | 2 and 3-wire technology |

## Housing Dimensions



Figure 1    Housing dimensions of the module (dimensions in mm)

## Ambient Conditions

| | |
|---|---|
| Regulations | Developed according to VDE 0160/EN 50178/IEC 62103, UL 508 |
| Ambient temperature (operation) | -25°C to +60°C |
| Ambient temperature (storage/transport) | -25°C to +85°C |
| Humidity (operation/storage/transport) | 10% to 95% according to EN 61131-2 |
| Air pressure (operation) | 80 kPa to 108 kPa (up to 2000 m above sea level) |
| Air pressure (storage/transport) | 66 kPa to 108 kPa (up to 3500 m above sea level) |
| Degree of protection according to IEC 60529 | IP20 |
| Class of protection | Class 3 according to VDE 0106/IEC 60536 |
| Air and creepage distances | According to DIN VDE 0110/IEC 60664, IEC 60664A, DIN VDE 0160/EN 50178/IEC 62103 |
| Housing material | Plastic, PVC-free, PBT, self-extinguishing (V0) |
| Pollution degree according to EN 60664-1/IEC 60664-1, EN 61131-2/IEC 61131-2 | 2; condensation not permitted during operation |
| Surge voltage class | II |

## Electrical Isolation/Isolation of the Voltage Areas

| Test Distance | Test Voltage |
|---|---|
| PROFIBUS / I/O | 500 V AC, 50 Hz, 1 min |
| PROFIBUS / functional earth ground | 500 V AC, 50 Hz, 1 min |
| I/O / functional earth ground | 500 V AC, 50 Hz, 1 min |

## Mechanical Requirements

| | |
|---|---|
| Vibration test, sinusoidal vibrations according to EN 60068-2-6/IEC 60068-2-6 | 5g load, 2.5 hours in each space direction |
| Shock test according to EN 60068-2-27/IEC 60068-2-27 | 25g load for 11 ms, half sinusoidal wave, 3 shocks in each space direction and orientation |
| Broadband noise according to EN 60068-2-64/IEC 60068-2-64 | 0.78g load, 2.5 hours in each space direction |

## Conformance With EMC Directive 89/336/EEC

### Noise Immunity Test According to EN 61000-6-2

| | | |
|---|---|---|
| Electrostatic discharge (ESD) | EN 61000-4-2 IEC 61000-4-2 | Criterion B<br>6 kV contact discharge<br>8 kV air discharge |
| Electromagnetic fields | EN 61000-4-3 IEC 61000-4-3 | Criterion A<br>Field strength: 10 V/m |
| Fast transients (burst) | EN 61000-4-4/ IEC 61000-4-4 | Criterion B<br>Remote bus: 2 kV<br>Power supply: 2 kV<br>I/O cables: 2 kV<br>Criterion A<br>All interfaces: 1 kV |
| Surge voltage | EN 61000-4-5 IEC 61000-4-5 | Criterion B<br>DC supply lines: ±0.5 kV/±1.0 kV (symmetrical/asymmetrical)<br>Signal cables: ±0.5 kV/±0.5 kV (symmetrical/asymmetrical) |
| Conducted interference | EN 61000-4-6 IEC 61000-4-6 | Criterion A<br>Test voltage 10 V |

### Noise Emission Test According to EN 61000-6-4

| | | |
|---|---|---|
| Noise emission of housing | EN 55011 | Class A |

## Interface

| | |
|---|---|
| PROFIBUS interface | Copper cable (RS-485); connected via D-SUB connector; shielding directly connected with functional earth ground |

## 24 V Module Supply (Communications Power and Actuator Supply; $U_L$ and $U_A$)

| | |
|---|---|
| Nominal value | 24 V DC |
| Tolerance | -15%/+20% according to EN 61131-2 |
| Ripple | ±5% according to EN 61131-2 |
| Permissible range | 19.2 V DC to 30.0 V DC |
| Current consumption at $U_L$ | 70 mA |
| Current consumption at $U_{A1}$ and $U_{A2}$ | 8 A each |
| Safety equipment for communications power | Surge protection and protection against polarity reversal |
| Safety equipment for the actuator supply | Surge protection |
| Connection | Via power connectors |

## Digital Outputs

| | |
|---|---|
| Number | 32 |
| Connection method for actuators | 2 and 3-wire technology |
| Nominal output voltage $U_{OUT}$ | 24 V DC |
| Differential voltage at $I_{nom}$ | $\leq 1$ V |
| Nominal current $I_{nom}$ per channel | 0.5 A |
| Total current | 4 x 4 A |
| Protection | Short-circuit and overload protection |
| Nominal load | |
|    Ohmic | 48 $\Omega$/12 W |
|    Lamp | 12 W |
|    Inductive | 12 VA (1.2 H, 50 $\Omega$) |
| Switching frequency with nominal inductive load | 0.5 Hz (1.2 H, 50 $\Omega$), maximum |
| Overload response | Auto restart |
| Response with inductive overload | Output may be damaged |
| Reverse voltage protection against short pulses | Protected against reverse voltages |
| Resistance to permanently applied reverse voltages | Protected against reverse voltages, permissible current 2 A, maximum |
| Validity of output data after connecting the 24 V supply voltage (power up) | 1 ms, typical |
| Response upon power down | The output follows the supply voltage without delay. |
| Limitation of the voltage induced on circuit interruption | -41.0 V |
| One-time unsolicited energy | 1 J, maximum |
| Protective circuit type | Integrated free running circuit in the output chip |
| Overcurrent shutdown | 0.7 A, minimum |
| Maximum output current when switched off | 10 µA |

☞ When not loaded, a voltage can be measured even at an output that is not set.

## Typical Power Dissipation With 24 V Supply Voltage

### Formula to Calculate the Power Dissipation of the Electronics

$$P_{TOT} = 1.45\ W + \sum_{i=1}^{n} (0.11\ W + I_{Li}^2 \times 0.28\ \Omega)$$

Where
| | |
|---|---|
| $P_{TOT}$ | Total power dissipation of the module |
| i | Index |
| n | Number of set outputs (n = 1 to 32) |
| $I_{Li}$ | Load current of the output i |

## Limitation of Simultaneity, Derating

| Ambient Temperature (TA) | Maximum Load Current (I) at 100% Simultaneity | Maximum Load Current (I) at 50% Simultaneity |
|---|---|---|
| -25°C to +45°C | 32 x 0.5 A | 16 x 0.5 A |
| +46°C to +60°C | 32 x 0.4 A | 16 x 0.5 A |

## Approvals

For the latest approvals, please visit www.download.phoenixcontact.com.

## Internal Circuit Diagram
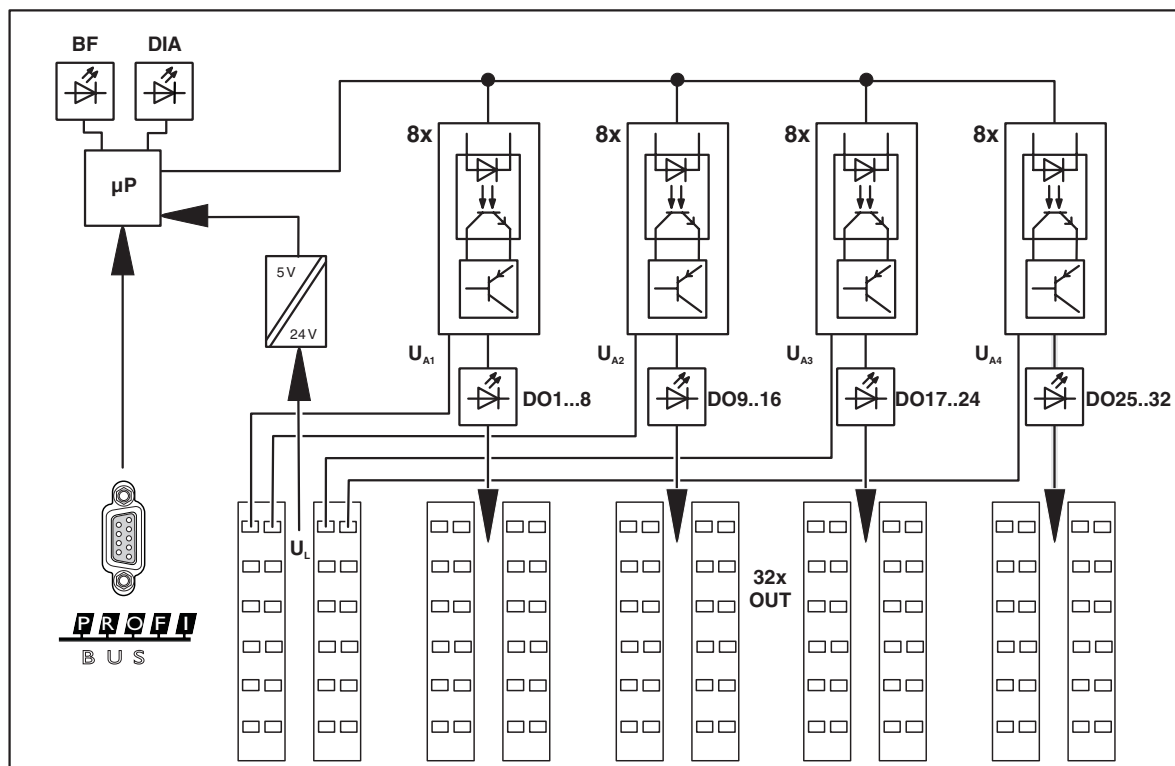


Figure 2    Internal wiring of the terminal points

6889B002

Key:

| | |
|---|---|
|  | LED |
|  | Protocol chip (bus logic) |
|  | Power supply unit with electrical isolation |
|  | Optocoupler |
|  | Short-circuit-proof output |

## Local Diagnostic and Status Indicators
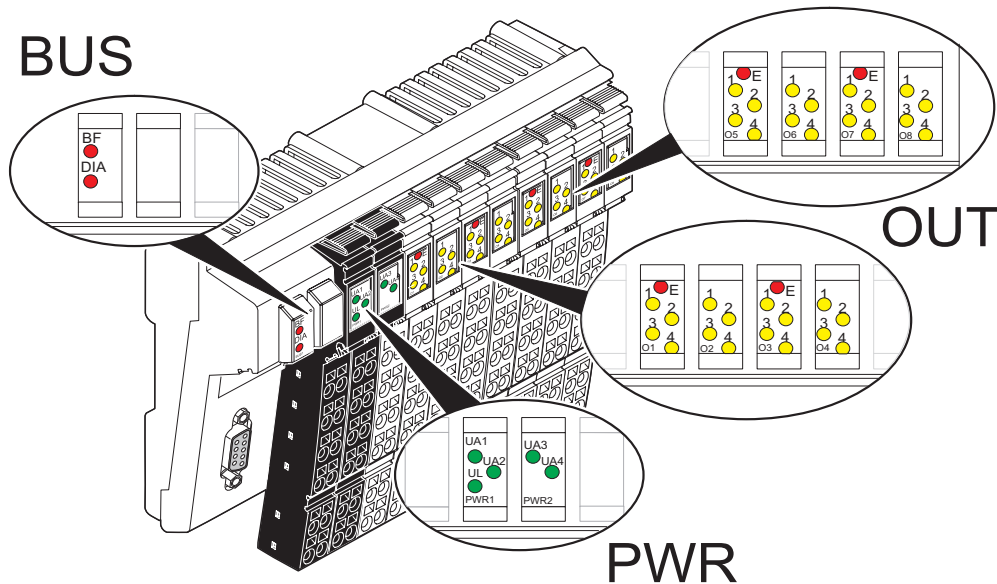


Figure 3    Diagnostic and status indicators of the ILB PB 24 DO32 module

| Designation | Color | Meaning |
|---|---|---|
| **PROFIBUS** | | |
| **BF** | Red | No cyclic data exchange via PROFIBUS, synchronization or parameterization running, timeout elapsed, incorrect setting |
| | OFF | The module is addressed by PROFIBUS and is in the "cyclic process data exchange" state. |
| **DIA** | Red | Module diagnostics |
| **PWR** | | |
| **UL** | Green | Communications power |
| **UA1** | Green | Actuator supply 1 (connector 3 and connector 4 for actuators) |
| **UA2** | Green | Actuator supply 2 (connector 5 and connector 6 for actuators) |
| **UA3** | Green | Actuator supply 3 (connector 7 and connector 8 for actuators) |
| **UA4** | Green | Actuator supply 4 (connector 9 and connector 10 for actuators) |
| **OUT** | | |
| **E** | Red | Short circuit or overload of the actuator supply |
| **1 - 4** | Yellow | Status indicators of the outputs |

☞ If the error LED (E) of a group of eight outputs lights up (e.g., connector 3 and connector 4), this indicates that a short circuit or overload is present at one or more of the outputs in this group.

## Address Setting

Addresses are set using two rotary encoding switches. The left switch is used to set the position in tens and the right switch is used to set the position in units. Addresses can be set between 1 and 99. Figure 4 shows how to set the address "74".
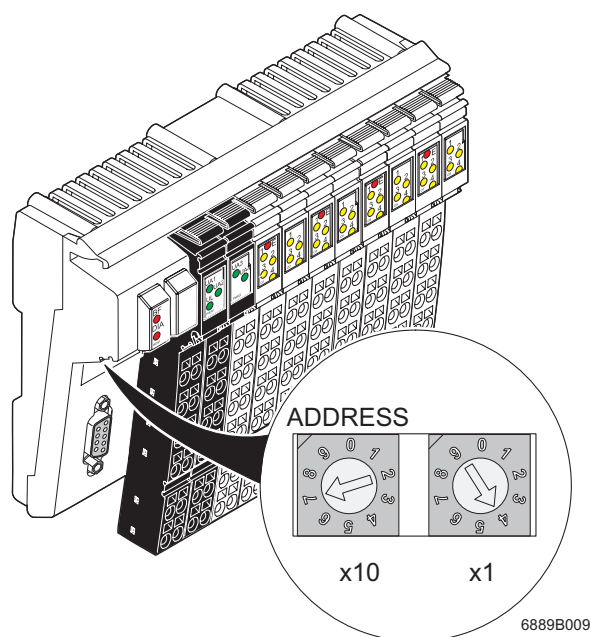


Figure 4        PROFIBUS rotary encoding switches

☞        Any change to an address setting is only accepted after a voltage reset.

## Connecting PROFIBUS, the Supply, and Actuators

### Connecting PROFIBUS
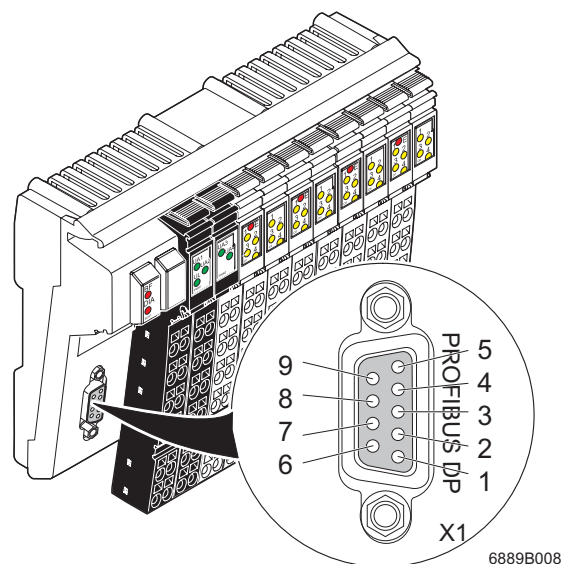


Figure 5        Pin assignment of the 9-pos. D-SUB female connector

Connect PROFIBUS to the module using a 9-pos. D-SUB connector (e.g., SUBCON-PLUS-PROFIB). For the pin assignment, please refer to the following table:

| Pin | Assignment |
|-----|------------|
| 1 | Reserved |
| 2 | Reserved |
| 3 | RxD/TxD-P (receive/transmit data +), cable B |
| 4 | CNTR-P (control signal for repeater), direction control |
| 5 | DGND (reference potential to +5 V) |
| 6 | VP (supply voltage +5 V for termination resistors) |
| 7 | Reserved |
| 8 | RxD/TxD-N (receive/transmit data –), cable A |
| 9 | Reserved |

**Connecting the Supply and Actuators**
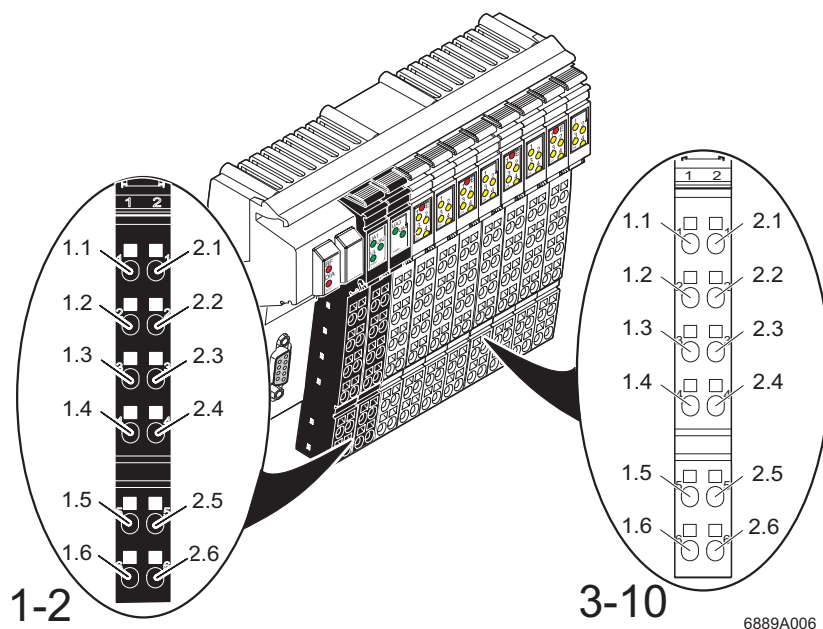


Figure 6    Terminal point assignment of Inline connectors

**Terminal Point Assignment of Power Connectors**
**(Connectors 1 and 2 in Figure 6)**

| Terminal Point | Assignment |
|---|---|
| **Connector 1 (PWR 1)** | |
| **1.1, 2.1** | 24 V actuator supply |
| **1.1** | $U_{A1}$ |
| **2.1** | $U_{A2}$ |
| **1.2, 2.2** | 24 V communications power $U_L$ |
| **1.3, 2.3** | GND |
| **1.4, 2.4** | FE |
| **1.5, 2.5** | 24 V communications power $U_L$ |
| **1.6, 2.6** | GND |
| **Connector 2 (PWR 2)** | |
| **1.1, 2.1** | 24 V actuator supply |
| **1.1** | $U_{A3}$ |
| **1.2** | $U_{A4}$ |
| **1.2, 2.2** | 24 V communications power $U_L$ |
| **1.3, 2.3** | GND |
| **1.4, 2.4** | FE |
| **1.5, 2.5** | 24 V communications power $U_L$ |
| **1.6, 2.6** | GND |

The terminal points can have a total current of 8 A per terminal point. The maximum current carrying capacity of 8 A must not be exceeded. If the total output current in your application is > 8 A, supply the module via a minimum of two terminal points connected in parallel.

The supply points have the same ground potential. All ground supplies on a module are electrically connected with one another. The communications power is also electrically connected via all contacts. In this way, it can supply all potentials with just one supply without the need for additional terminals, see "Connection example" on page 11.

**Terminal Point Assignment of Output Connectors (Connectors 3 to 10 in Figure 6 on page 9)**

| Terminal Point | | | | Assignment |
|---|---|---|---|---|
| **Connector 3 (O1)** | **Connector 4 (O2)** | **Connector 5 (O3)** | **Connector 6 (O4)** | |
| **1.1, 2.1** | **1.1, 2.1** | **1.1, 2.1** | **1.1, 2.1** | Signal output (OUT) |
| **1.2, 2.2** | **1.2, 2.2** | **1.2, 2.2** | **1.2, 2.2** | Ground contact (GND) for 2 and 3-wire termination |
| **1.3, 2.3** | **1.3, 2.3** | **1.3, 2.3** | **1.3, 2.3** | FE connection for 3-wire termination |
| **1.4, 2.4** | **1.4, 2.4** | **1.4, 2.4** | **1.4, 2.4** | Signal output (OUT) |
| **1.5, 2.5** | **1.5, 2.5** | **1.5, 2.5** | **1.5, 2.5** | Ground contact (GND) for 2 and 3-wire termination |
| **1.6, 2.6** | **1.6, 2.6** | **1.6, 2.6** | **1.6, 2.6** | FE connection for 3-wire termination |
| **Connector 7 (O5)** | **Connector 8 (O6)** | **Connector 9 (O7)** | **Connector 10 (O8)** | |
| **1.1, 2.1** | **1.1, 2.1** | **1.1, 2.1** | **1.1, 2.1** | Signal output (OUT) |
| **1.2, 2.2** | **1.2, 2.2** | **1.2, 2.2** | **1.2, 2.2** | Ground contact (GND) for 2 and 3-wire termination |
| **1.3, 2.3** | **1.3, 2.3** | **1.3, 2.3** | **1.3, 2.3** | FE connection for 3-wire termination |
| **1.4, 2.4** | **1.4, 2.4** | **1.4, 2.4** | **1.4, 2.4** | Signal output (OUT) |
| **1.5, 2.5** | **1.5, 2.5** | **1.5, 2.5** | **1.5, 2.5** | Ground contact (GND) for 2 and 3-wire termination |
| **1.6, 2.6** | **1.6, 2.6** | **1.6, 2.6** | **1.6, 2.6** | FE connection for 3-wire termination |

## Connection Example
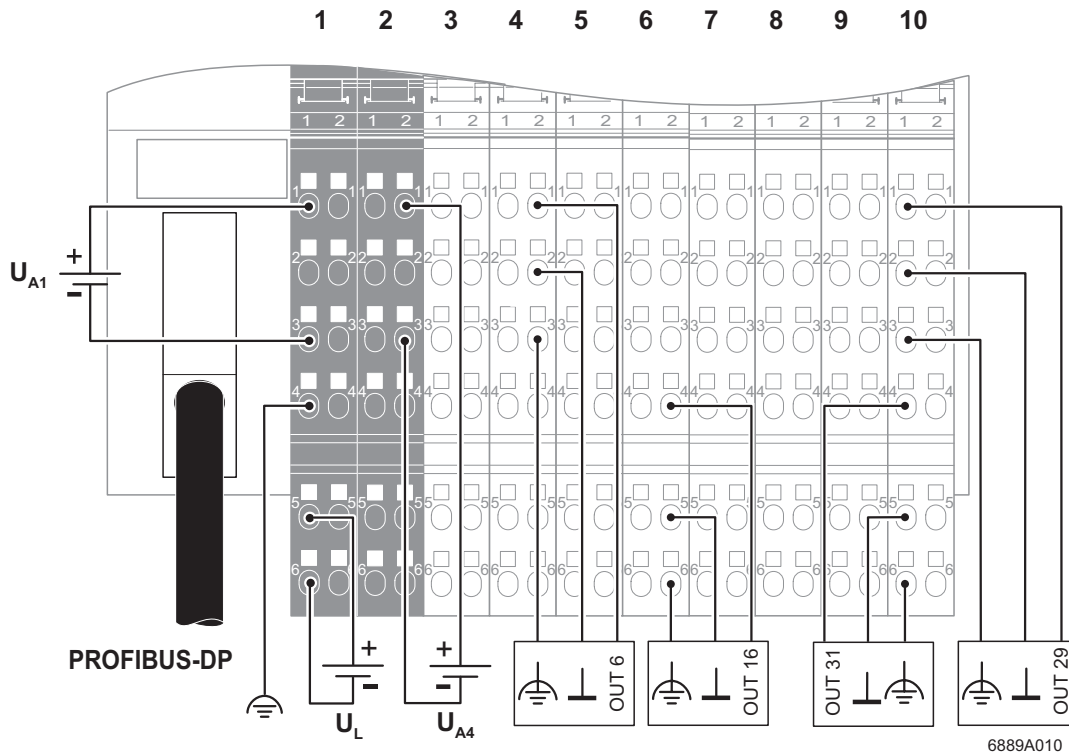


Figure 7    Connection example

☞ The numbers above the module illustration identify the connector slots.

⚠ When connecting the actuators, observe the assignment of the terminal points to the process data (see "Process Data" on page 12).

☞ The module has an FE spring (metal clip) on the bottom of the electronics base. This spring creates an electrical connection to the DIN rail. Use grounding terminals to connect the DIN rail to protective earth ground. The module is grounded when it is snapped onto the DIN rail.
To ensure reliable functional earth grounding of the module even when the DIN rail is dirty or the metal clip is damaged, Phoenix Contact also recommends grounding the module via one of the FE terminal points.

## Device Data

| ID number | 06BD |
|---|---|
| Output address area | 4 bytes |

# Process Data

| | |
|---|---|
| 📄 | Please refer to the application note for addressing 32-channel ILB modules.<br>Documentation and the current GSD file can be downloaded at www.download.phoenixcontact.com. |

**Assignment of Terminal Points to the OUT Process Data Word (Slots 3 to 6)**

| (Word.bit) view | Word | Word 0 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| (Byte.bit) view | Byte | Byte 0 | | | | | | | | Byte 1 | | | | | | | |
| | Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Module | Slot | 4 (O2) | | | | 3 (O1) | | | | 6 (O4) | | | | 5 (O3) | | | |
| | Terminal point (signal) | 2.4 | 1.4 | 2.1 | 1.1 | 2.4 | 1.4 | 2.1 | 1.1 | 2.4 | 1.4 | 2.1 | 1.1 | 2.4 | 1.4 | 2.1 | 1.1 |
| | Terminal point (ground) | 2.5 | 1.5 | 2.2 | 1.2 | 2.5 | 1.5 | 2.2 | 1.2 | 2.5 | 1.5 | 2.2 | 1.2 | 2.5 | 1.5 | 2.2 | 1.2 |
| | Terminal point (FE) | 2.6 | 1.6 | 2.3 | 1.3 | 2.6 | 1.6 | 2.3 | 1.3 | 2.6 | 1.6 | 2.3 | 1.3 | 2.6 | 1.6 | 2.3 | 1.3 |
| Status indicator | Slot | 4 (O2) | | | | 3 (O1) | | | | 6 (O4) | | | | 5 (O3) | | | |
| | LED | 4 | 3 | 2 | 1 | 4 | 3 | 2 | 1 | 4 | 3 | 2 | 1 | 4 | 3 | 2 | 1 |

**Assignment of Terminal Points to the OUT Process Data Word (Slots 7 to 10)**

| (Word.bit) view | Word | Word 1 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| (Byte.bit) view | Byte | Byte 2 | | | | | | | | Byte 3 | | | | | | | |
| | Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Module | Slot | 8 (O6) | | | | 7 (O5) | | | | 10 (O8) | | | | 9 (O7) | | | |
| | Terminal point (signal) | 2.4 | 1.4 | 2.1 | 1.1 | 2.4 | 1.4 | 2.1 | 1.1 | 2.4 | 1.4 | 2.1 | 1.1 | 2.4 | 1.4 | 2.1 | 1.1 |
| | Terminal point (ground) | 2.5 | 1.5 | 2.2 | 1.2 | 2.5 | 1.5 | 2.2 | 1.2 | 2.5 | 1.5 | 2.2 | 1.2 | 2.5 | 1.5 | 2.2 | 1.2 |
| | Terminal point (FE) | 2.6 | 1.6 | 2.3 | 1.3 | 2.6 | 1.6 | 2.3 | 1.3 | 2.6 | 1.6 | 2.3 | 1.3 | 2.6 | 1.6 | 2.3 | 1.3 |
| Status indicator | Slot | 8 (O6) | | | | 7 (O5) | | | | 10 (O8) | | | | 9 (O7) | | | |
| | LED | 4 | 3 | 2 | 1 | 4 | 3 | 2 | 1 | 4 | 3 | 2 | 1 | 4 | 3 | 2 | 1 |

## Diagnostic Data

**Mapping of Diagnostic Data in PROFIBUS**

| Diagnostic Data | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 | Remark |
|---|---|---|---|---|---|---|---|---|---|
| Byte 0 | X | X | X | X | X | X | X | X | Station status 1 |
| Byte 1 | X | X | X | X | X | X | X | X | Station status 2 |
| Byte 2 | X | X | X | X | X | X | X | X | Station status 3 |
| Byte 3 | X | X | X | X | X | X | X | X | Master address diagnostics |
| Byte 4 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | High ID number |
| Byte 5 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | Low ID number |
| Byte 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | Diagnostic header |
| Byte 7 | M.7 | M.6 | M.5 | M.4 | M.3 | M.2 | M.1 | M.0 | Device diagnostics |
| Byte 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Reserved |
| Byte 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Reserved |
| Byte 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Reserved |
| Byte 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Reserved |
| Byte 12 | X | X | 0 | 0 | 0 | 0 | 0 | 0 | Reserved |

> Bytes 0 to 6 are PROFIBUS standard. Bytes 7 to 12 are device-specific.

**Diagnostic Data for Device Diagnostics**

| Bit | Remark | Assignment |
|---|---|---|
| M.0 | Short-circuit/overload status of at least one output | 1, if output is overloaded/short circuited |
| M.1- M.7 | Reserved | 0 |

> If a diagnostic event occurs, the diagnostic data is always sent to the master by means of a diagnostic telegram generated once by the device.
> The current status of the diagnostic data can be read by the device at any time.

**Error Table With Diagnostic Data and Status Indicators**

| Error Type | Diagnostic Data | Status Indicators |
|---|---|---|
| Actuator supply UA1 to UA4 too low | No response | UA1 to UA4 LEDs are off |
| Short circuit of a digital output | Diagnostic register bit 0 is set to "1" | E LED of the affected output group is red DIA LED is red |

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