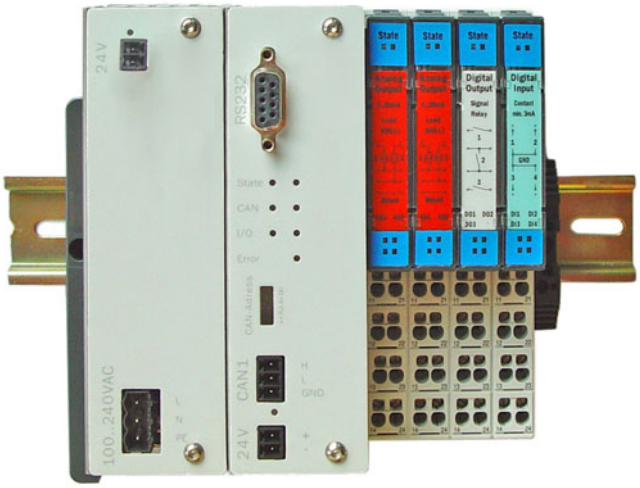
Operating Instructions
Modular I/O System

Analog and Digital Interface Modules



Endress+Hauser
People for Process Automation

Described product
Product name: Modular I/O System Analog and Digital Interface Modules

Manufacturer
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Legal information

Original document
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Warning Symbols

Hazard (general)

Hazard by voltage

Warning Levels / Signal Words

HAZARD
Risk or hazardous situation which *will* result in severe personal injury or death.

WARNING
Risk or hazardous situation which *could* result in severe personal injury or death.

CAUTION
Hazard or unsafe practice which *could* result in less severe or minor injuries *and/or* property damage.

NOTICE
Hazard which *could* result in property damage.

Information Symbols

Important technical information for this device

Important information on electric or electronic functions

Nice to know

Supplementary information

Link to information at another place

Modular I/O System

1 Description

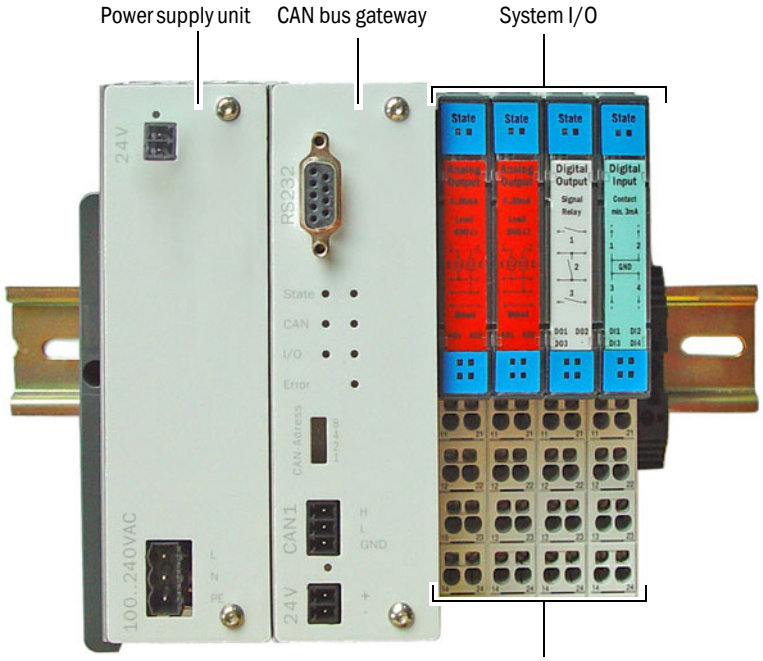
Overview
Assembly
Connections
Technical Data

1.1 Overview

The modular I/O system serves for the input and output of analog and digital signals. It can be used as single component or as extension for the SCU (System Control Unit).

Connection or control of the I/O module with the SCU (System Control Unit) → “Operating Instructions SCU-P100”

Fig. 1 Modular I/O system (example)



Basic modules into which the electronic modules (analog inputs/outputs and digital inputs/outputs) are plugged

1.1.1 Single components

- Modular I/O system
  - Contains different I/O modules such as analog inputs/outputs, digital inputs/outputs
  - Communicates with the CAN bus gateway via an internal module bus
  - Independent of higher level field bus
  - No address setting required
  - Type-specific color coding
  - Mechanic coding ensures the assignment of the I/O modules and the basic modules in groups. This prevents incorrect module insertion, for example when modules are replaced.→ page 11, Fig. 5
- Basic modules:
  - Serve to connect the field wiring
  - Terminal strip; production units equipped with tension spring connection

1.1.2 I/O Modules

I/O modules	
Analog output	2 channels, 0/4 ... 22 mA
Analog input	2 channels, 0/4 ... 22 mA
Digital output	3, 4 relays, make-contact
Digital output	2 relays, changeover contact
Digital input	4 channels, potential-free contacts

Modular I/O System

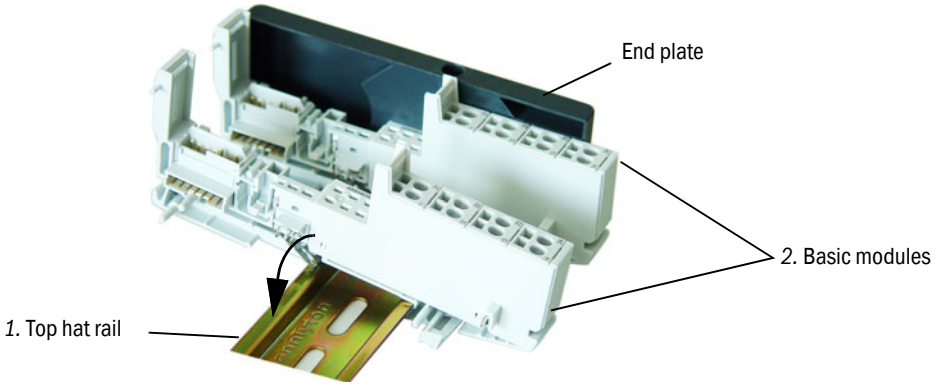
2 Assembly

Assembly

2.1 Assembly

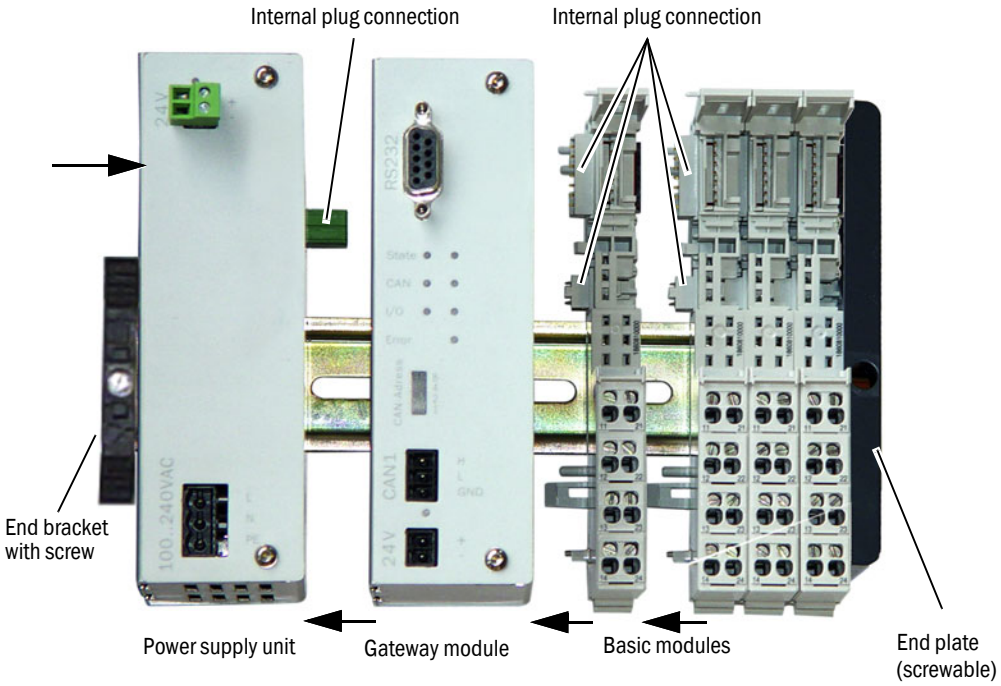
1 Provide a top hat rail for assembling the modules.
2 Install the end bracket and attach it to the screw.
3 Install one basic module after the other on the rail.

Fig. 2 Installation of basic modules



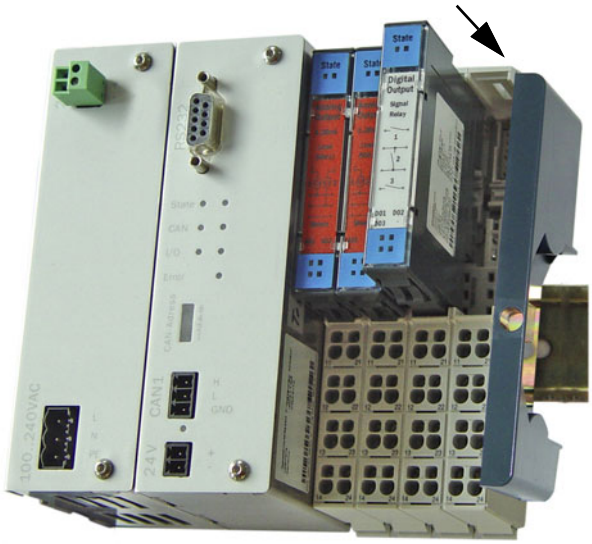
4 Install further subassemblies, for example, a power supply unit and a CAN bus gateway and push them together.
5 Firmly press the subassemblies together and screw them to the end plates. Ensure that the internal plug-in connectors match correctly.

Fig. 3 Assembly of the I/O modules on the CAN gateway as single components



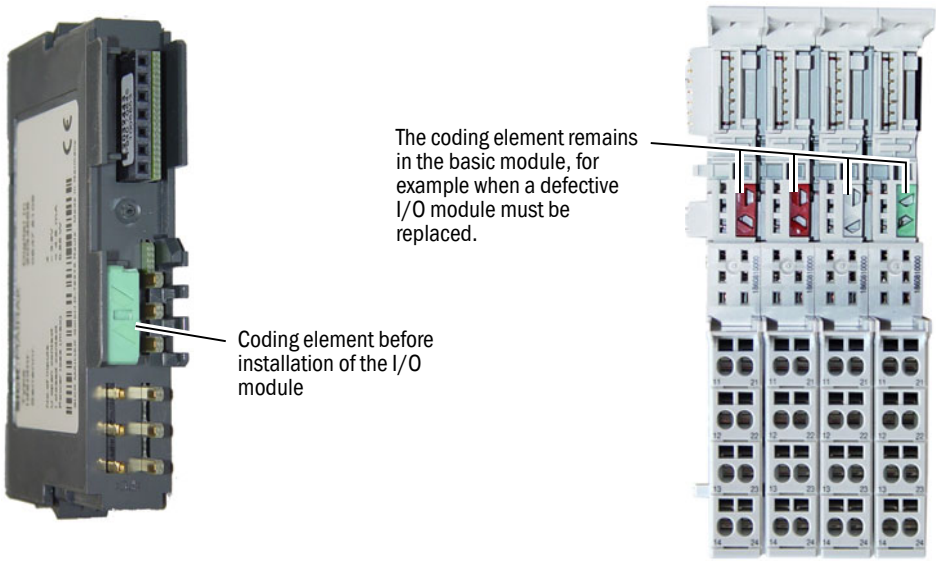
6 Plug the respective I/O modules onto the basic modules.

Fig. 4 Insertion of the I/O modules



The basic modules are mechanically coded when I/O modules are plugged, i.e. a coding element remains in the basic module. This prevents mistakes when replacing a defective module.

Fig. 5 Mechanical coding of I/O modules



Modular I/O System

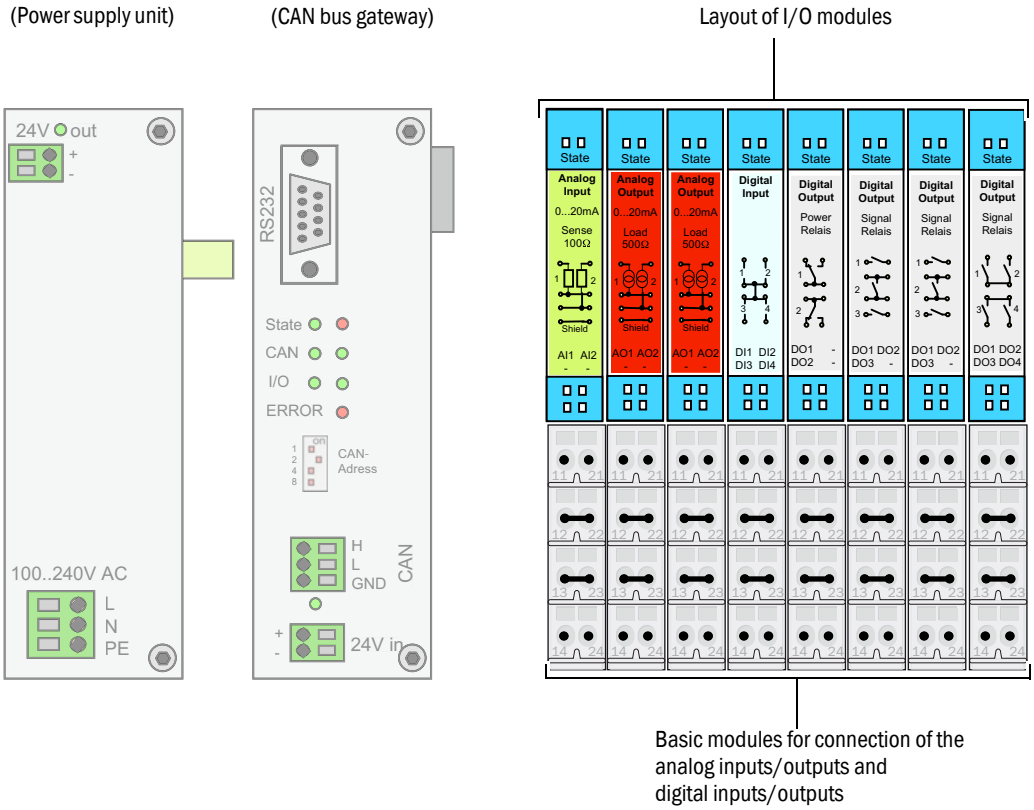
3 Configuration

Configuration

3.1 Configuration

3.1.1 Overview of single components

Fig. 6 Layout of I/O modules (example)



Always use lines that are shielded and twisted in pairs!
Establish area contact of the cable shields (e.g. via suitable PGs).
Always switch off the energy supply before exchanging modules; no hot plug-in.

The wiring of the power supply unit and CAN bus gateway module components is described individually in the SCU-P100 Operating Instructions.

3.1.1.1 Maximum configuration of the I/O modules

- When using the Gateway module and 15 W power supply unit:
- ► Up to 13 modules of any type can be installed.

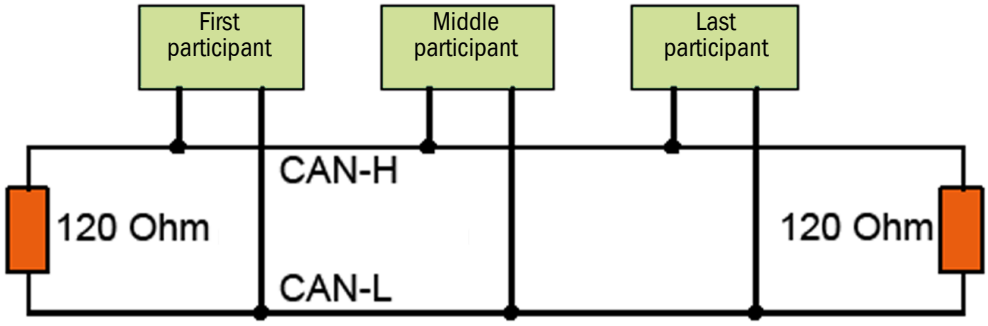
If more than 13 modules are to be installed, check whether the output of the power supply unit is adequate or whether a different power supply unit is to be used!

3.2 Connecting the CAN bus

The CAN bus is a 2-wire bus system to which all bus participants are connected parallel (i.e. with short stub lines).

- Each end of the CAN bus must be closed off with a 120 ±10% Ohm terminating resistor (prevents reflections).
  This is also required for very short line lengths.

Fig. 7 CAN bus principle



Terminating resistors must be activated for first and last bus participants.

The terminating resistor must be deactivated for middle bus participants.

► Activating or deactivating terminating resistors → Operating Instructions of bus participants.

► For Endress+Hauser gateway → page 19, §3.2.1.2.

Stub lines lead to reflections on the bus, therefore:

► Avoid stub lines whenever possible, otherwise limit these to max. 10 m.

CAN wiring:

► Maximum length of the CAN bus: 1000 m

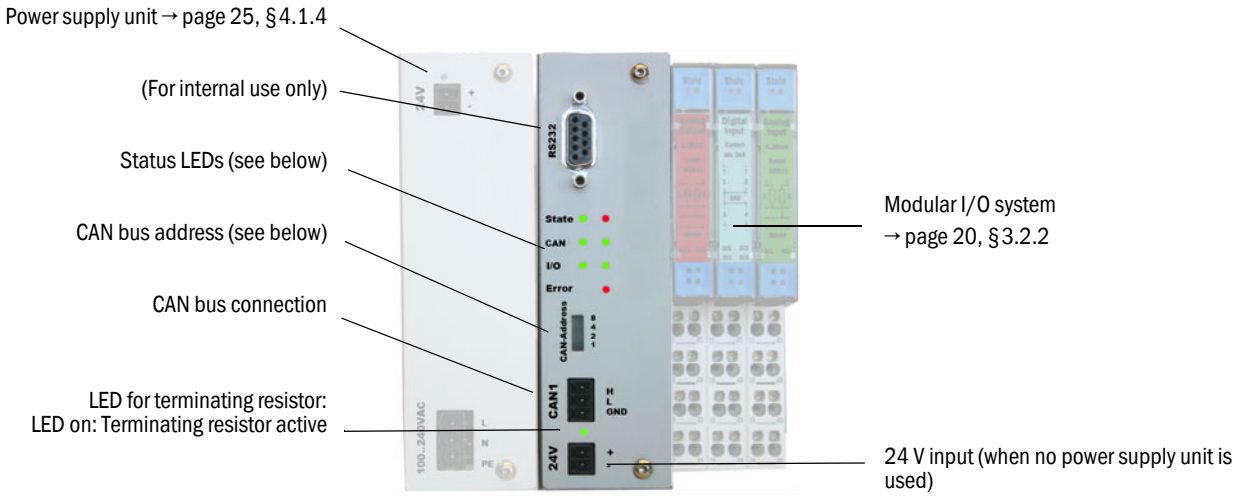
► Cable twisted in pairs and shielded

- Surge impedance: 120 Ohm
- Capacity: ≤ 60 pF/m.

Connect the shield across the complete bus and only ground galvanically at one location (prevents ground loops).

3.2.1 CAN bus gateway

Fig. 8 CAN bus gateway



The CAN bus gateway provides a remote modular I/O system and integrates the connection line from the SCU (→ page 10, § 2.1).

Maximum distance between SCU and CAN bus gateway: 1000 m.

The modular I/O system (→ page 6, § 1.1) is directly plugged into the CAN bus gateway (→ page 10, § 2.1). The CAN bus gateway automatically recognizes the position and function of the connected I/O modules.

Status LEDs significance

- State
  - Left LED blinks *green*: Normal operation.
  - Right LED lights *red*: Error in gateway.
    An error message is displayed on the screen.
- CAN
  - Both LEDs blink *green* during data transfer on the system bus.
    (Permanent green light = no communication)
- I/O
  - Both LEDs blink *green* during data transfer on the internal data bus.
    (Permanent green light = no communication)
- Error
  - LED lights *red*: Error message from SCU.
    An error message is displayed on the console.

Significance of the "CAN address LEDs"

The "CAN address" LEDs indicate the set CAN bus address.

Table 1 Indication of CAN bus address

LED 8	LED 4	LED 2	LED 1	Set address
Off	Off	Off	Off	0
Off	Off	Off	On	1
Off	Off	On	Off	2
Off	Off	On	On	3
Off	On	Off	Off	4
				etc.
On	On	On	On	15

When only 1 CAN bus gateway exists: The default address is address "0" (no LED lights).

3.2.1.1 **Setting the CAN bus address**

1 The CAN bus gateway must be disconnected from the mains and be potential-free.

2 Unscrew the cover of the CAN bus gateway (2 Allen screws SW 2.0).

> Screws and washers fall off easily and may get lost.
> ► Use a suitable container to collect the screws and washers.

3 Pull the cover off to the front.

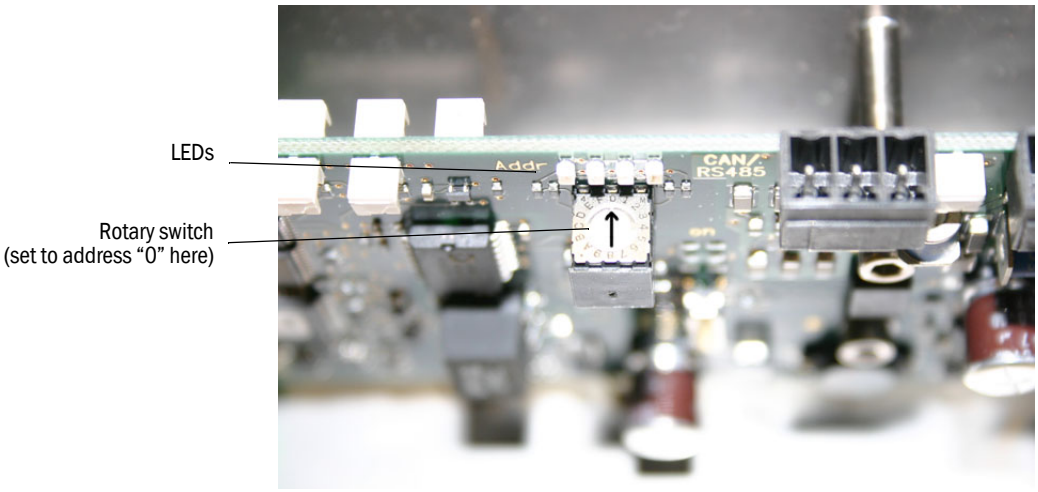
4 Set the CAN bus address of the gateway on the rotary switch with a small screwdriver.
- If there is only one gateway on the CAN bus: Address 0.
- If there are more gateways: Address 1 ... 15

Addresses must be unique (only assign once) (and assigned when setting parameters in the SCU menus).

Recommendation: Assign addresses as consecutive values.

The set address is shown BCD-coded with 4 LEDs (→ page 17, Table 1)

Fig. 9 Rotary switch and LEDs of CAN address



5 Place cover on and screw tight.

Technical data and connector pin assignment → page 25, § 4.1.3

3.2.1.2 **Setting the CAN bus termination**

A DIP switch on the CAN bus gateway determines the bus termination (terminating resistor).

The terminating resistor must be *set* (default) when the CAN bus gateway is positioned *at the end* of the bus system.

A LED (→ page 16, Fig. 8) shows that the terminating resistor is set.

Setting the terminating resistor

1 The CAN bus gateway must be disconnected from the mains and be potential-free.

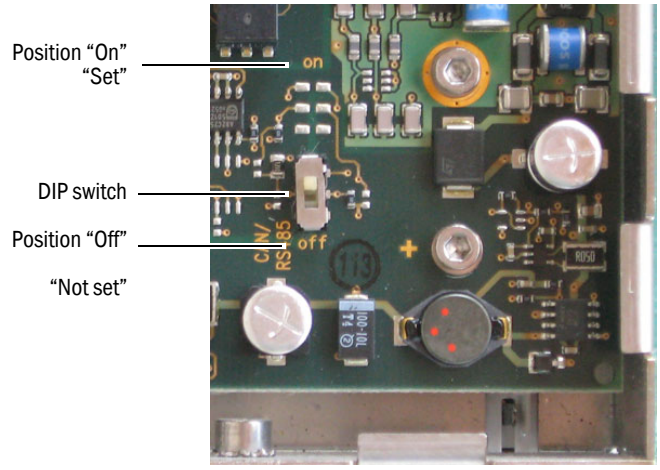
2 Unscrew the cover of the CAN bus gateway (2 Allen screws SW 2.0).

> Screws and washers fall off easily and may get lost.
> ► Use a suitable container to collect the screws and washers.

3 Pull the cover off to the front.

4 Set the DIP switch.

Fig. 10 DIP switch of the terminating resistor



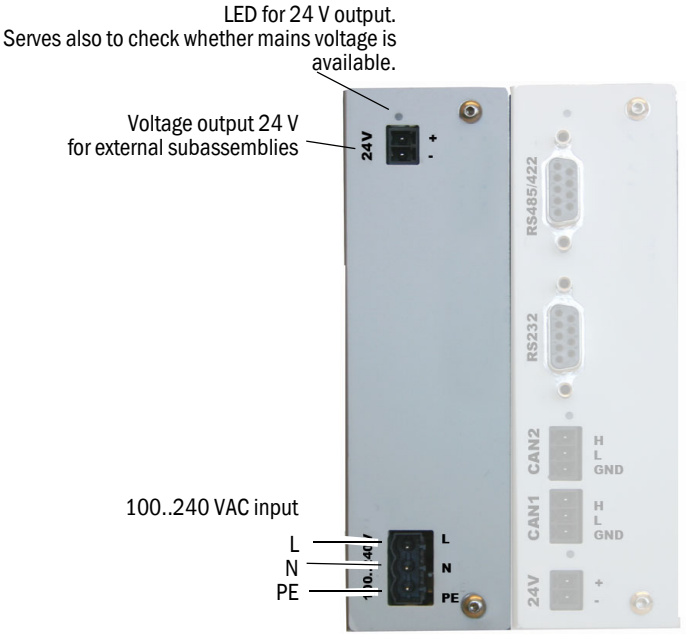
Location in bus system	DIP switch direction	Terminating resistor	LED[1]
At the end	On (default setting)	Set, active	On
In the middle	Off	Not set	Off

[1] LED location, see → page 16, Fig. 8

5 Place cover on and screw tight.

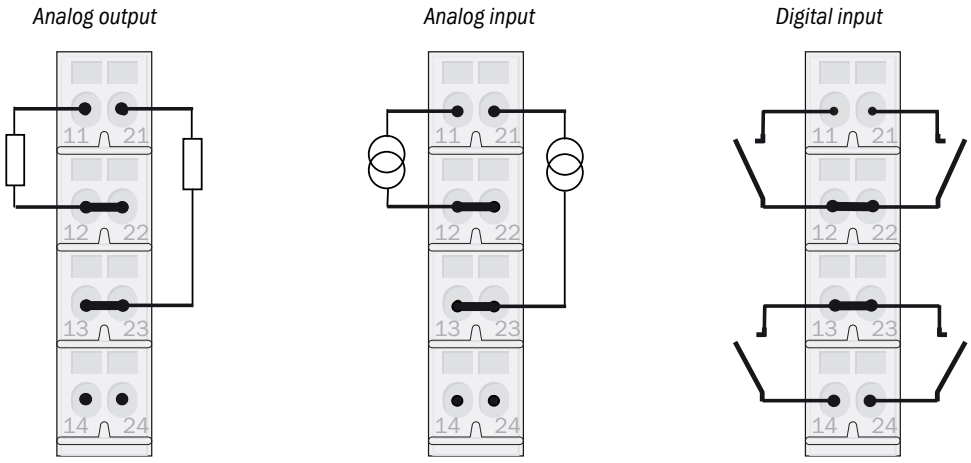
3.2.2 Power supply unit

Fig. 11 Voltage input on power supply unit



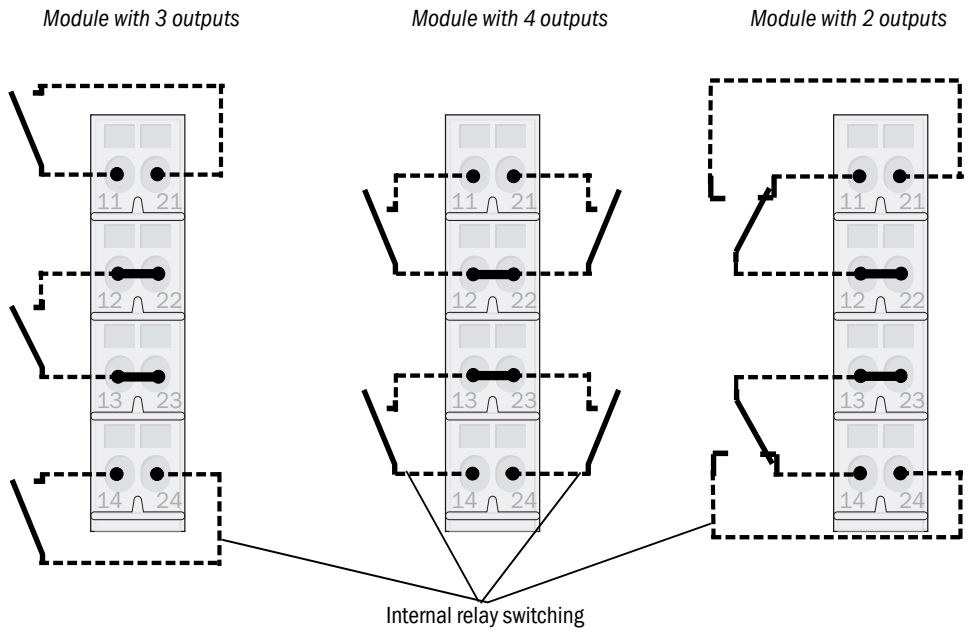
3.2.3 Connections of analog and digital I/O modules

Fig. 12 Connections of analog outputs, analog inputs and digital inputs



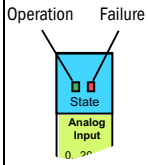
Terminals 12/22 and 13/23 are each bridged internally in the basic module

Fig. 13 Connections of digital outputs



Terminals 12/22 and 13/23 are each bridged internally in the basic module

3.2.3.1 Status indicator of I/O modules

	Operation (Green)	Failure (Red)	Cause/Condition
	On	Off	Processor is running, module was recognized and addressed
	On	On	Processor is running, incorrect addressing
	Off	On	Voltage is applied, processor did not start
	Off	Off	Module is not supplied with voltage
	Blinks	Off	Signals communication between gateway and I/O module

Modular I/O System

4 Technical Data

Technical Data
Part Nos.

4.1 Technical Data

4.1.1 Analog input modules, analog output modules and digital input modules

Modules	Analog output (AO)	Analog input (AI)	Digital input (DI)
Channels	2	2	4
Signal	Output current: 0/4 ... 22 mA	Input current: 0/4 ... 22 mA	Voltage at open contact: Approx. 3.9 V Current at closed contact for < 4.5 mA
Maximum load resistance	500 Ohm	100 Ohm (input resistance)	
Maximum power dissipation	1.10 W (with +24 V)	0.25 W (with +24 V)	0.55 W (with +24 V)
Accuracy	0.25 %		
Temperature range	0 ... 55 °C		
Dimensions (WxLxH)	12.6 x 74.1 x 55.4 mm		
Dimensions of basic module (W x L x H)	12.6 x 128.9 x 49.9 mm		
Characteristics	• Analog outputs are electrically isolated for each module • LEDs for status and diagnostic indication	• LEDs for status and diagnostic indication (reverse polarity protection diode in input circuit)	• Read-in from potential-free relay contacts • LEDs for status and diagnostic indication

4.1.2 Data for digital output modules

Modules	Digital output (DO2)	Digital output (DO3)	Digital output (DO4)
Channels	2 (changeover contact)	3 (make-contact)	4 (make-contact)
Power dissipation (with +24 V)	0.5 W	0.75 W	1.0 W
Nominal load voltage	48 V AC/48 V DC		
Maximum switching capacity	340 VA	35 VA/24 W	35 VA/24 W
Maximum continuous current	5 A	0.5 A	
Minimum load current (recommended)	≥100mA with 12 V	≥0.1mA with 20 mV	
Temperature range	0 ... 55 °C		
Dimensions (WxLxH)	12.6 x 74.1 x 55.4 mm		
Dimensions of basic module (W x L x H)	12.6 x 128.9 x 49.9 mm		
Characteristics	• Contacts for 24..48 V DC/AC • LEDs for status and diagnostic indication		

4.1.3 CAN bus gateway

Part No.:	2 031 144
Operating temperature:	0 °C ... +50 °C
Storage temperature:	-25 °C ... +85 °C
Degree of protection:	IP 20 (higher degree of protection depending on installation)
Weight:	Approx. 300 g
Power input:	1 W maximum

4.1.4 Power supply unit

Part No.:	2 031 142
Operating temperature:	-10 °C ... +70 °C
Storage temperature:	-25 °C ... +85 °C
Degree of protection:	IP 20 (higher degree of protection depending on installation)
Weight:	Approx. 500 g
Input voltage range:	100 ... 240 V AC (allowed: 85 ... 264 V AC), 47 ... 440 Hz
Output voltage:	24 V ± 2 %
Current consumption:	100 V AC: < 400 mA 230 V AC: < 200 mA
Mains buffering:	100 V AC: > 25 ms 230 V AC: > 100 ms
No-load dissipation:	100 V AC: < 300 mW 230 V AC: < 400 mW
Short circuit and no-load test:	Yes
Overtemperature cut-off:	Yes, self-resetting

4.1.5 CAN bus

Surge impedance:	135 ... 165 Ohm (3 ... 20 MHz)
Impedance:	120 Ohm ±15%
Loop resistance:	<100 Ohm/km
Capacitance per unit length:	< 10 pF/m
Type:	Twisted pairs, shielded
Terminating resistor:	120 Ohm ± 10%

4.1.6 Spare parts Part Nos. for I/O modules

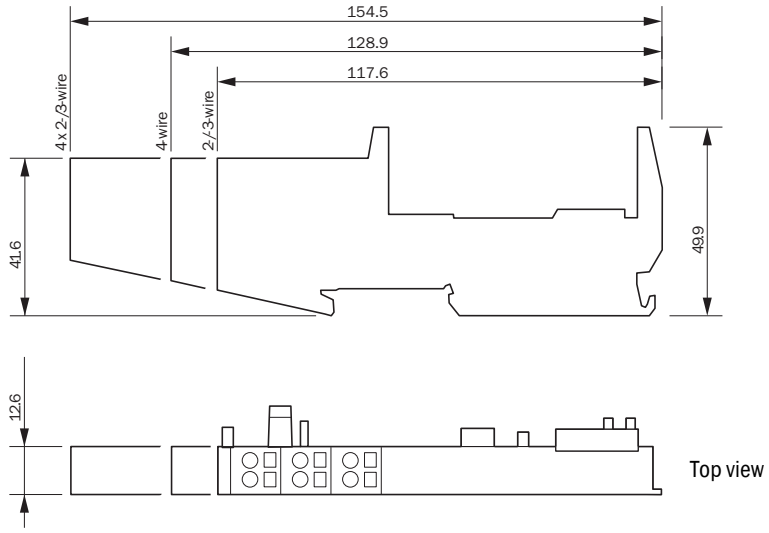
Designation	Part No.
Analog input module: 2 channels, 100 Ohm, 0 ... 22 mA	2034656
Analog output module: 2 channels, 500 Ohm, 0 ... 22 mA, each module electrically isolated	2034657
Digital input module: 4 channels for potential-free contacts, max. 4.5 mA	2034658
Digital output module: 2 channels (changeover contact), contact load 48 V AC/DC, 5 A	2034659
Digital output module: 3 channels (make-contact), contact load 48 V AC/DC, 0.5 A	2034660
Digital output module: 4 channels (make-contact), contact load 48 V AC/DC, 0.5 A	2034661
Basic module to accommodate one I/O module each, with tension spring connections	6033578
Module end plate (1 required)	6028672
End bracket (2 required)	6028673
Cable, 6 poles, 0.2 m [1]	2033863

[1]Also for direct connection of the I/O modules to a console

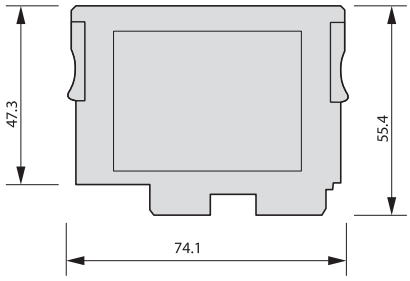
4.1.7 Dimensions of I/O modules

Fig. 14 Dimensions of basic module

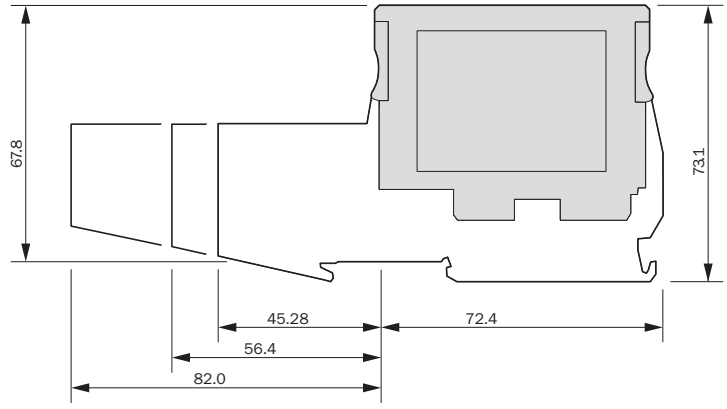
Basic module (with tension spring connection)



I/O module



Basic module equipped with I/O module



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