

# **MELSEC STlite Series**

Modular Input/Output System

Installation Manual

**Head Stations**  
**Power Supply Modules**  
**Digital I/O-Modules**  
**Analog I/O-Modules**  
**Special Function Modules**

# About this Manual

The texts, illustrations, diagrams, and examples contained in this manual are intended exclusively as support material for the explanation, handling and operation of the components of the MELSEC ST Series.

If you have any questions concerning the programming and operation of the equipment described in this manual, please contact your relevant sales office or department (refer to back of cover).

Current information and answers to frequently asked questions are also available through the Internet ([www.mitsubishi-automation.com](http://www.mitsubishi-automation.com))

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# Safety Information

## General Safety Information

### For use by qualified staff only

This manual is only intended for use by properly trained and qualified electrical technicians who are fully acquainted with the relevant automation technology safety standards. All work with the hardware described, including system design, installation, configuration, maintenance, service and testing of the equipment, may only be performed by trained electrical technicians with approved qualifications who are fully acquainted with all the applicable automation technology safety standards and regulations. Any operations or modifications to the hardware and/or software of our products not specifically described in this manual may only be performed by authorised Mitsubishi Electric staff.

### Proper use of the products

The devices of the MELSEC STlite series are only intended for the specific applications explicitly described in this manual. All parameters and settings specified in this manual must be observed. The products described have all been designed, manufactured, tested and documented in strict compliance with the relevant safety standards. Unqualified modification of the hardware or software or failure to observe the warnings on the products and in this manual may result in serious personal injury and/or damage to property. Only peripherals and expansion equipment specifically recommended and approved by Mitsubishi Electric may be used with the devices of the MELSEC STlite series.

All and any other uses or application of the products shall be deemed to be improper.

### Relevant safety regulations

All safety and accident prevention regulations relevant to your specific application must be observed in the system design, installation, configuration, maintenance, servicing and testing of these products.

The regulations listed below are particularly important in this regard. This list does not claim to be complete, however; you are responsible for being familiar with and conforming to the regulations applicable to you in your location.

- VDE Standards
  - VDE 0100  
Regulations for the erection of power installations with rated voltages below 1000 V
  - VDE 0105  
Operation of power installations
  - VDE 0113  
Electrical installations with electronic equipment
  - VDE 0160  
Electronic equipment for use in power installations
  - VDE 0550/0551  
Regulations for transformers
  - VDE 0700  
Safety of electrical appliances for household use and similar applications
  - VDE 0860  
Safety regulations for mains-powered electronic appliances and their accessories for household use and similar applications
- Fire safety regulations
- Accident prevention regulations
  - Electrical systems and equipment

**Safety warnings in this manual**

In this manual warnings that are relevant for safety are identified as follows:



**DANGER:**

*Failure to observe the safety warnings identified with this symbol can result in health and injury hazards for the user.*



**CAUTION:**

*Failure to observe the safety warnings identified with this symbol can result in damage to the equipment or other property.*

## General Safety Information and Precautions

The following safety precautions are intended as a general guideline for using PLC systems together with other equipment. These precautions must always be observed in the design, installation and operation of all control systems.



### **DANGER:**

- **Observe all safety and accident prevention regulations applicable to your specific application. Always disconnect all power supplies before performing installation and wiring work or opening any of the assemblies, components and devices.**
- **Assemblies, components and devices must always be installed in a shockproof housing fitted with a proper cover and fuses or circuit breakers.**
- **Devices with a permanent connection to the mains power supply must be integrated in the building installations with an all-pole disconnection switch and a suitable fuse.**
- **Check power cables and lines connected to the equipment regularly for breaks and insulation damage. If cable damage is found immediately disconnect the equipment and the cables from the power supply and replace the defective cabling.**
- **Before using the equipment for the first time check that the power supply rating matches that of the local mains power.**
- **Take appropriate steps to ensure that cable damage or core breaks in the signal lines cannot cause undefined states in the equipment.**
- **You are responsible for taking the necessary precautions to ensure that programs interrupted by brownouts and power failures can be restarted properly and safely. In particular, you must ensure that dangerous conditions cannot occur under any circumstances, even for brief periods. EMERGENCY OFF must be switched forcibly, if necessary.**
- **EMERGENCY OFF facilities conforming to EN 60204/IEC 204 and VDE 0113 must remain fully operative at all times and in all PLC operating modes. The EMERGENCY OFF facility reset function must be designed so that it cannot ever cause an uncontrolled or undefined restart.**
- **You must implement both hardware and software safety precautions to prevent the possibility of undefined control system states caused by signal line cable or core breaks.**
- **When using modules always ensure that all electrical and mechanical specifications and requirements are observed exactly.**

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# Symbols used in the manual

## Use of instructions

Instructions concerning important information are marked separately and are displayed as follows:

### NOTE

| Text of instruction

## Use of numbering in the figures

Numbering within the figures is displayed by white numbers within black circles and is explained in a table following it using the same number, e.g.:

① ② ③ ④

## Use of handling instructions

Handling instructions are steps that must be carried out in their exact sequence during startup, operation, maintenance and similar operations.

They are numbered consecutively (black numbers in white circles):

- ① Text.
- ② Text.
- ③ Text.

## Use of footnotes in tables

Instructions in tables are explained in footnotes underneath the tables (in superscript). There is a footnote character at the appropriate position in the table (in superscript).

If there are several footnotes for one table then these are numbered consecutively underneath the table (black numbers in white circle, in superscript):

- ① Text
- ② Text
- ③ Text

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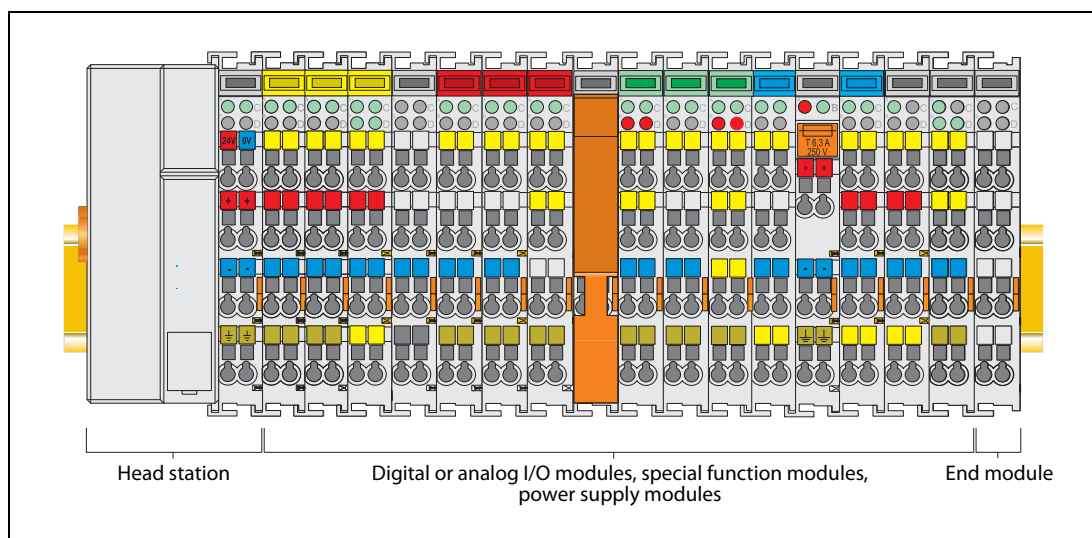


# 1 Introduction

The most important characteristics of the MELSEC STlite series are summarized in this installation description. This description is designed to help the experienced user quickly start-up the modules. Additional information and a detailed mounting and wiring description is in the MELSEC STlite series operating manual. This documentation is provided solely as a quick reference.

## 1.1 System Configuration

STlite is a modular, field bus independent I/O system. It is comprised of a head station and up to 64 connected modules for any type of signal. Together, these make up the field bus node. An end module completes the node.



**Fig. 1-1:** Field bus node

Head stations are available for different field bus systems, such as PROFIBUS/DP, ETHERNET TCP/IP or CC-Link.

The head station contains the field bus interface, electronics and a power supply terminal. The field bus interface connects the node to the relevant field bus. The electronics process the data of the I/O modules or special function modules and make it available for the field bus communication. The 24 V system supply and the 24 V field supply are fed in via the integrated power supply terminal.

Modules for diverse digital and analog I/O functions as well as special functions can be connected to the head station. Populating the nodes with STlite modules is based on the requirements of the application. The communication between the head station and the bus modules is carried out via an internal bus.

STlite has a clear port level with LEDs for status indication, insertable markers and pullout group marker carriers. The 3-wire technology supplemented by a ground wire connection allows for direct sensor/actuator wiring.

“ST” means “Slice Type terminal”, and refers to the narrow width of the modules (only 12 mm!).

### 1.1.1 Components of the STlite Series

Type of module		Name	ID number	Description
Head stations	PROFIBUS/DP	STL-PB1	51247152	Head station for the connection to PROFIBUS/DP
	CC-Link	STL-BT1	51247154	Head station for the connection to CC-Link
	Ethernet	STL-ETH1	51247153	Head station for the connection to Ethernet TCP/IP
Power supply modules		STL-PS	51205036	Power supply modules 24 V DC
		STL-BPS	51244880	
Digital input modules		STL-DI8-V1	51205052	8 inputs for source type sensors, 24 V DC
		STL-DI8-V2	51205053	
Digital output modules		STL-DO4	51205045	4 transistor outputs, 24 V DC, 0.5 A, source type
		STL-DO8	51205043	8 transistor outputs, 24 V DC, 0.5 A, source type
		STL-RO2	51205044	2 relay outputs 230 V AC / 30V DC, 500 VA/60 W
Analog input modules	Voltage	STL-AD2-V	51205046	2 inputs 0 to 10 V
		STL-AD4-V1	51205049	4 inputs 0 to 10 V
		STL-AD4-V2	51205050	4 inputs -10 to 10 V
	Current	STL-AD2-I	51205047	2 inputs 4 to 20 mA
		STL-AD4-I	51205051	4 inputs 4 to 20 mA
	Temperature	STL-TI2	51205048	2 inputs for Pt100 resistance thermometers
Analog output modules	Voltage	STL-DA2-V	51205042	2 outputs 0 to 10 V
		STL-DA4-V1	51205038	4 outputs 0 to 10 V
		STL-DA4-V2	51205039	4 outputs -10 to 10 V
	Current	STL-DA2-I	51205041	2 outputs 4 to 20 mA
		STL-DA4-I	51205040	4 outputs 4 to 20 mA
Encoder module		STL-ENC	51205116	Input module for incremental encoder with RS422 interface
Counter module		STL-C100	51244881	Forward/reverse counter, 24 V DC, max. frequency 100 kHz
Interface module		STL-SSI	51205057	Input module for SSI encoder
Bus end module		STL-ET	51205037	End module for the termination of the internal bus

**Tab. 1-1:** Head stations and modules of the STlite series

## 2 General Specifications

### 2.1 Operating Environment



**CAUTION:**

**Please operate the modules of the MELSEC STlite Series in the listed conditions only. If the modules are used under other conditions, electric shock, fire, malfunction, damages or deterioration may be caused.**

Item		Specifications
Ambient temperature	for operation	0 to +55 °C
	for storage	-20 to +85 °C
Ambient humidity for operation and storage		5 to 95 %, relative humidity, non-condensing
Resistance to harmful substances		acc. to IEC 60068-2-42 and IEC 60068-2-43
Maximum pollutant concentration at relative humidity < 75%		SO <sub>2</sub> ≤ 25 ppm H <sub>2</sub> S ≤ 10 ppm
Special conditions		Ensure that additional measures for components are taken, which are used in an environment involving: <ul style="list-style-type: none"> <li>• dust, caustic vapors or gases</li> <li>• ionization radiation</li> </ul>

**Tab. 2-1:** Operating environment of the STlite series

### 2.2 Mechanic and Connection

Item		Specifications
Material		Polycarbonate, Polyamide 6.6
Dimensions (WxDxH)	Head stations	51 mm x 65* mm x 100 mm
	Modules (except STL-ENC)	12 mm x 64* mm x 100 mm
	Encoder modules STL-ENC	24 mm x 64* mm x 100 mm
Installation		on DIN 35 with interlock
Modular by		double featherkey-dovetail
Mounting position		any position
Maximum length of the entire STlite station		831 mm
Marking		standard marking label type group marking label 8 x 47 mm
Connection of the external wiring	Connection type	CAGE CLAMP®
	Applicable wire size	0.08 mm <sup>2</sup> to 2.5 mm <sup>2</sup> (AWG 28 to AWG 14)
	Stripped length	8 to 9 mm
Power jumpers contacts	Type	blade/spring contact, self-cleaning
	Maximum current via power contacts	10 A
	Voltage drop	< 1 V for 64 modules and maximum current
Data contacts		slide contact, hard gold plated (1.5 μm), self-cleaning

**Tab. 2-2:** Specifications for the mechanic and the connection of the STlite series

\* from upper edge of DIN 35 rail

## 2.3 Mechanical strength

Item	Specifications
Vibration resistance	acc. to IEC 60068-2-6 Note on vibration test: • Type of vibration: Frequency change max. 1 octave/minute 10 Hz ≤ f < 57 Hz, 1.75 mm amplitude (permanent) 57 Hz ≤ f ≤ 150 Hz, constant acceleration: 1 g • Vibration direction: 3 axes
Shock resistance	acc. to IEC 60068-2-27 Note on shock test: • Type of shock: half sine • Shock: 15 g • Shock duration: 11 ms • Shock direction: 3x in positive and 3x in negative direction for each of the three mutually perpendicular axes of the test specimen (18 shocks in all).
Free fall	acc. to IEC 60068-2-32 Fall height ≤ 1m (module in original packing)

**Tab. 2-3:** Specifications for the mechanical strength of the STlite series

## 2.4 Electrical Safety

Item	Specifications
Degree of protection	IP20
Air and creepage distance	acc. to IEC 60664-1
Degree of pollution acc. to IEC 61131-2	2

**Tab. 2-4:** Specifications for the electrical safety of the components of the STlite series

## 2.5 Maximum Power Dissipation of the Components

Components	Maximum power dissipation
Head stations	2.0 W per head station
Modules	0.8 W per module (total power dissipation, system/field)

**Tab. 2-5:** Max. power dissipation of the components of the STlite series



**CAUTION:**

- The power dissipation of all installed components must not exceed the maximum conductible power of the housing (cabinet).
- When dimensioning the housing, care is to be taken that even under high external temperatures, the temperature inside the housing does not exceed the permissible ambient temperature of 55 °C.

## 2.6 Electromagnetic Compatibility

Item			Specifications	
Immunity to interference acc. to EN 50082-2 (96)	Test specification	Test values	Strength class	Evaluation criteria
	EN 61000-4-2	4 kV/8 kV	(2/4)	B
	EN 61000-4-3	10 V/m 80% AM	(3)	A
	EN 61000-4-4	2 kV	(3/4)	B
	EN 61000-4-6	10 V/m 80% AM	(3)	A
Emission of interference acc. to EN 50081-2 (94)	Test specification	Test values	Distance	Class
	EN 55011	30 dB $\mu$ V/m	(30 m)	A
		37 dB $\mu$ V/m		
Emission of interference acc. to EN 50081-1 (93)	EN 55022	30 dB $\mu$ V/m	(10 m)	B
		37 dB $\mu$ V/m		
Requirements on emission of interference			Usage in industrial areas	Usage in residential areas
			EN 50081-2 : 1993	EN 50081-1 : 1993*
Requirements on immunity to interference			EN 50082-2 : 1996	EN 50082-1 : 1992

**Tab. 2-6:** Specifications for the electromagnetic compatibility of the components of the STlite series

\* The system meets the requirements on emission of interference in residential areas with the head station STL-ETH1 (Ethernet). With a special permit, the system can also be implemented with other head stations in residential areas (housing, commercial and business areas, small-scale enterprises). The special permit can be obtained from an authority or inspection office. In Germany, the permit is issued by the Federal Office for Post and Telecommunications and its branch offices.

### NOTE

The specifications in the above table are not valid for the SSI interface module STL-SSI. This module complies to the following EMC regulations:

- CE Immunity to interference: acc. to EN 61000-6-2 (2005)
- CE Emission of interference: acc. to EN 61000-6-4 (2007)

### Ship specific approvals for electromagnetic compatibility

The head stations and the STlite modules comply to the following regulations:

- Immunity to interference: acc. to Germanischer Lloyd (2003)
- Emission of interference: acc. to Germanischer Lloyd (2003)

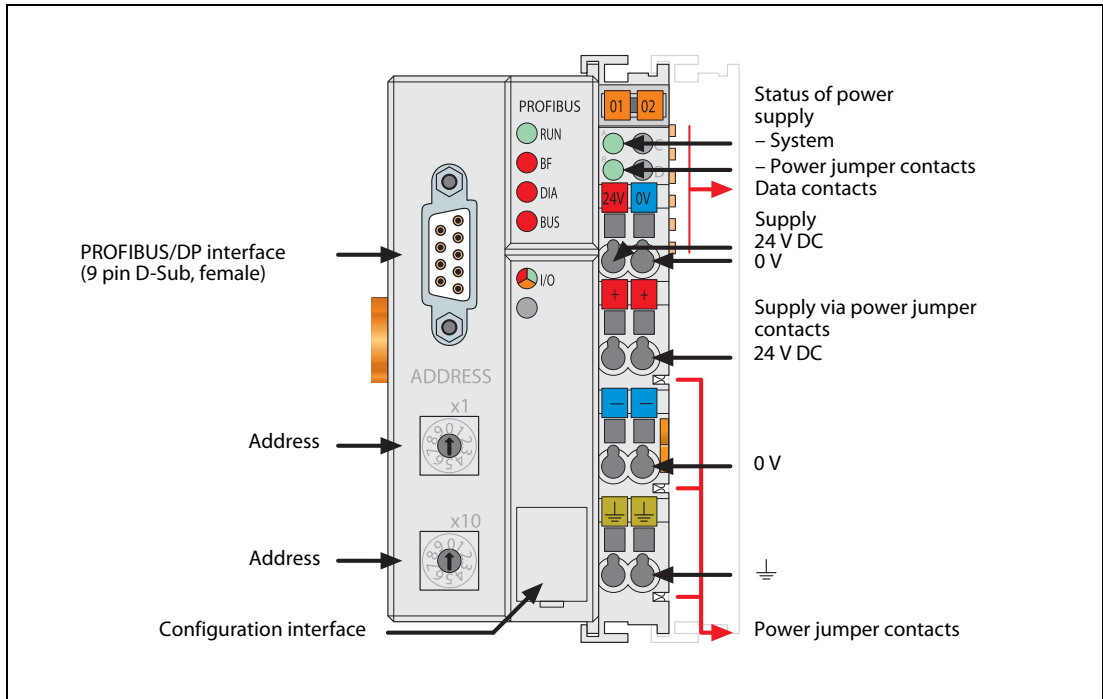




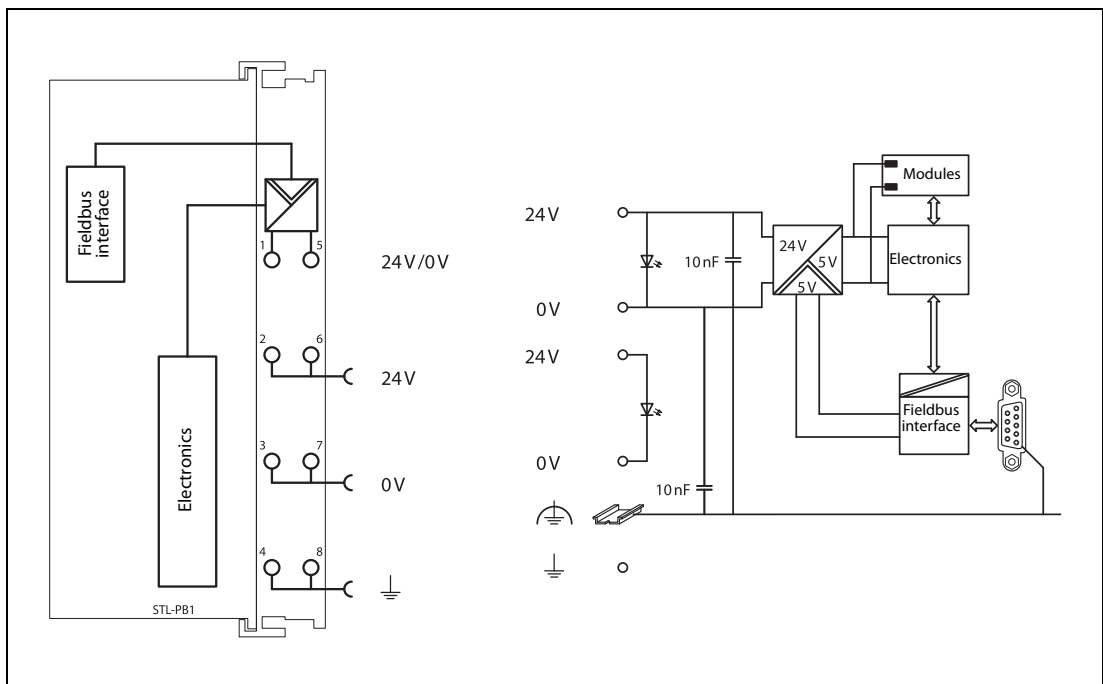
# 3 Description of the Modules

## 3.1 Head Stations

### 3.1.1 STL-PB1 (PROFIBUS/DP)



**Fig. 3-1:** Head station STL-PB1 (PROFIBUS/DP)



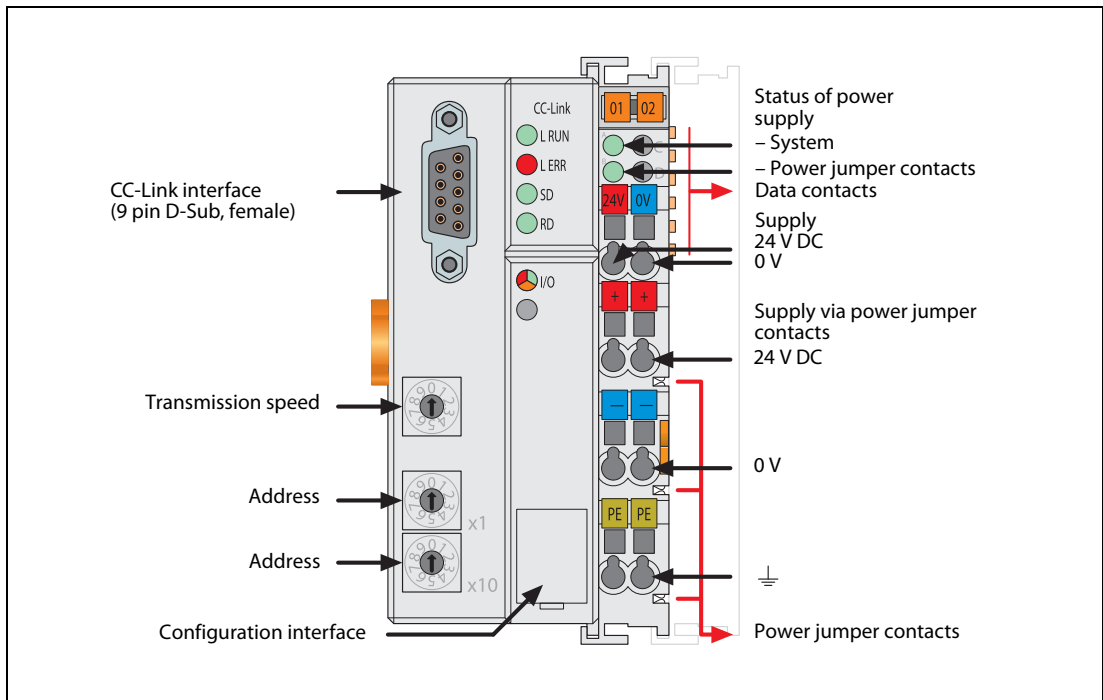
**Fig. 3-2:** Block diagram for the head station STL-PB1 (PROFIBUS/DP)

**Specifications**

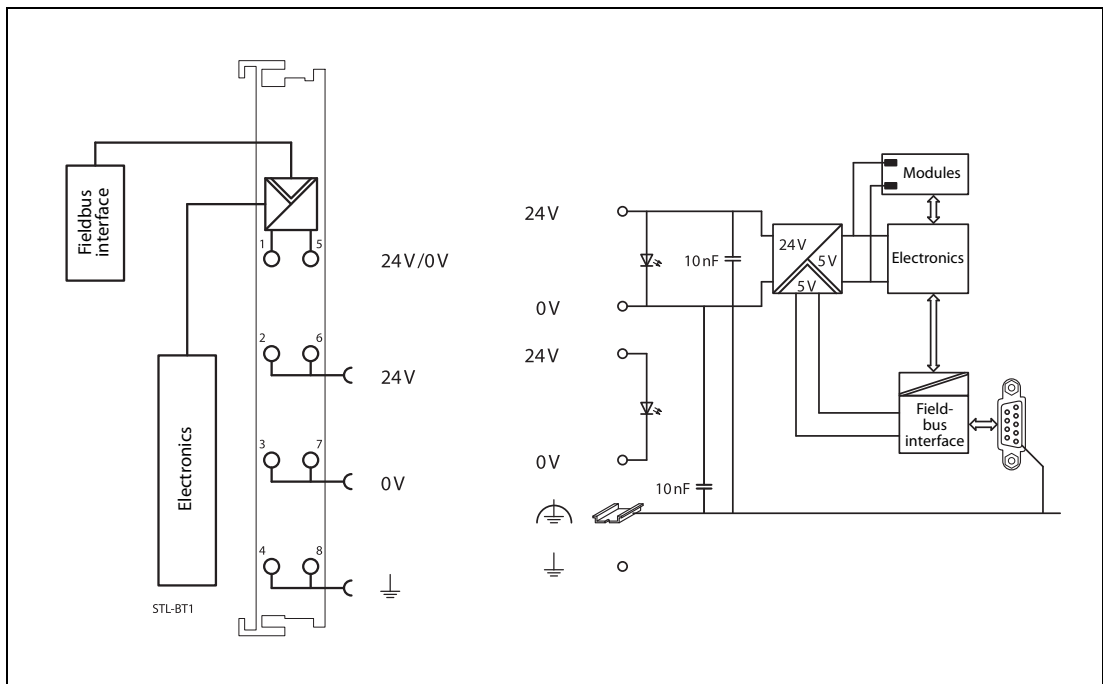
Item		STL-PB1
Fieldbus interface		PROFIBUS/DP V1
Maximum number of head modules connected to master		96 (with repeater)
Maximum number of I/O points		approx. 6000 (depends on master)
Max. length of fieldbus segment		100 m to 1200 m (depends on transmission speed and cable)
Transmission speed		9,6 kbit/s to 12 Mbit/s
Transmission time		typ. 1 ms (10 head stations; 32 digital I/Os per head station; transmission speed 12 Mbit/s) max. 3.3 ms
Maximum number of connectable STLite modules		63
Fieldbus	Max. input process image	244 bytes
	Max. output process image	244 bytes
Configuration		via PC or PLC
External power supply	Voltage	24 V DC (-25 % / +30 %)
	Current	max. 500 mA
	Efficiency of the power supply	87 %
Internal current consumption (5 V)		200 mA
Total current for STLite modules (5 V)		1800 mA
Isolation		500 V system/supply
Weight		182 g

**Tab. 3-1:** Specifications of the head station STL-PB1

### 3.1.2 STL-BT1 (CC-Link)



**Fig. 3-3:** Head station STL-BT1 (CC-Link)



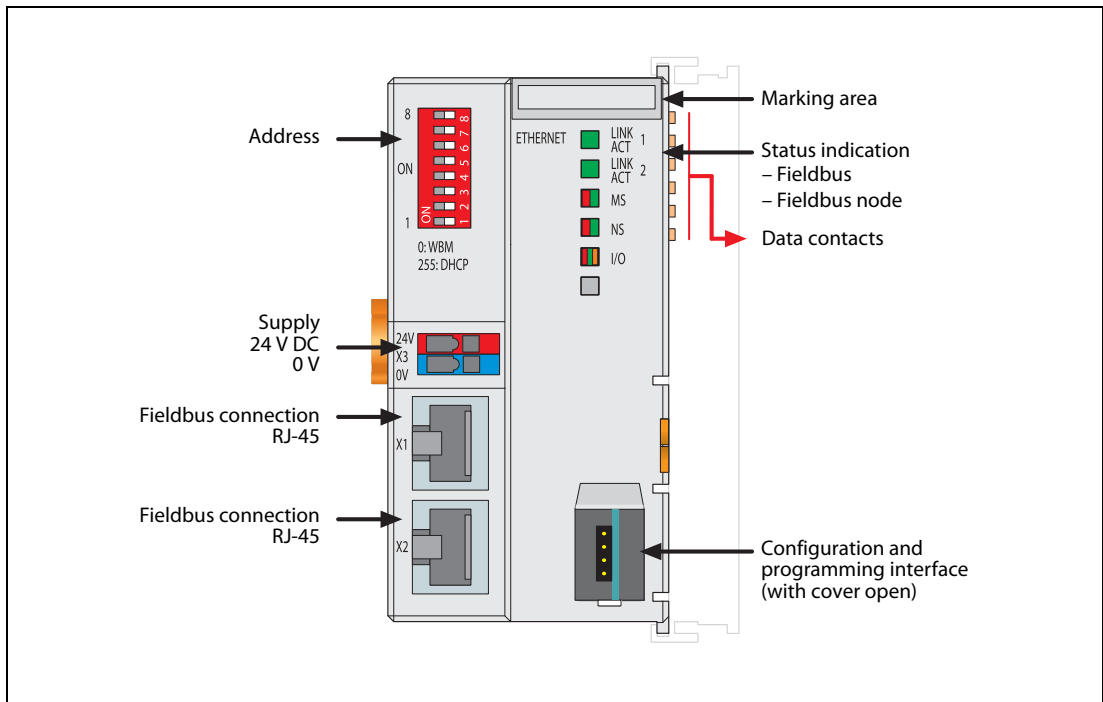
**Fig. 3-4:** Block diagram for the head station STL-BT1 (CC-Link)

**Specifications**

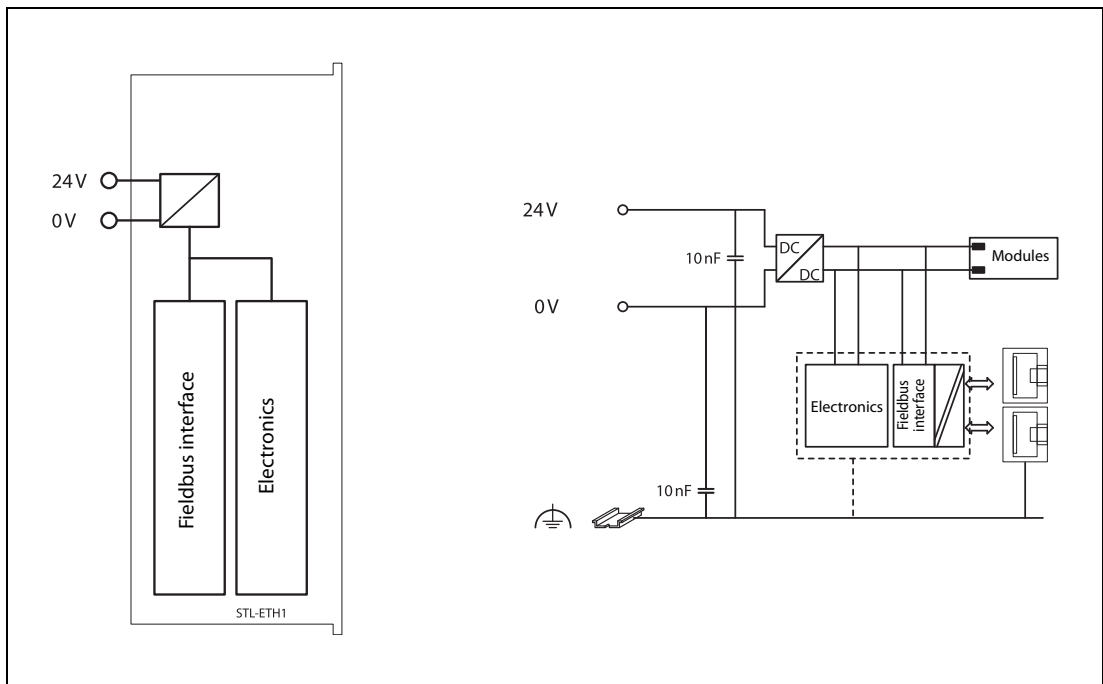
Item		STL-BT1
Fieldbus interface		CC-Link
Maximum number of connectable STLite modules		64
Fieldbus	Max. input process image	14 bytes digital, 2 bytes system, 32 bytes analog
	Max. output process image	14 bytes digital, 2 bytes system, 32 bytes analog
External power supply	Voltage	24 V DC (-25 % / +30 %)
	Current	max. 500 mA
	Efficiency of the power supply	87 %
Internal current consumption (5 V)		300 mA
Total current for STLite modules (5 V)		1700 mA
Isolation		500 V system/supply
Weight		210 g

**Tab. 3-2:** Specifications of the head station STL-BT1 (CC-Link)

### 3.1.3 STL-ETH1 (Ethernet)



**Fig. 3-5:** Head station STL-ETH1 (Ethernet)



**Fig. 3-6:** Block diagram for the head station STL-ETH1 (Ethernet)

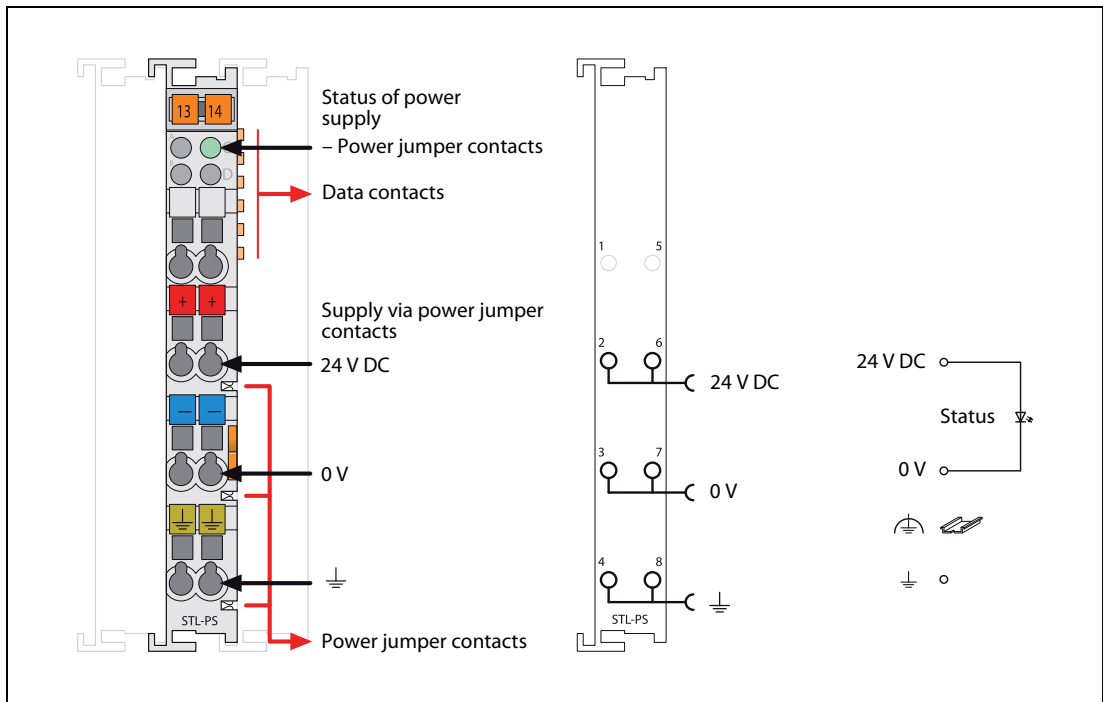
**Specifications**

Item		STL-ETH1
Fieldbus interface		Ethernet TCP/IP
Maximum number of head modules connected to master		limited by Ethernet specification
Transmission medium		Twisted Pair S-UTP; 100 Ω, Cat 5;
Maximum line length		100 m
Transmission speed		10/100 Mbit/s
Transmission performance		Class D acc. to EN 50173
Connection to fieldbus		Two RJ-45 jacks
Protocols		EtherNet/IP, MODBUS/TCP (UDP), HTTP, BootP, DHCP, DNS, FTP, SNMP
Maximum number of connectable STlite modules		64 (250 with bus extension)
Fieldbus	Max. input process image	1020 words
	Max. output process image	1020 words
Configuration		via PC
External power supply	Voltage	24 V DC (-25 % / +30 %)
	Current	typ. 280 mA at rated load (24 V)
	Efficiency of the power supply	90 % at nominal load (24 V)
Internal current consumption (5 V)		450 mA
Total current for STlite modules (5 V)		700 mA
Isolation		500 V system/supply
Weight		110 g

**Tab. 3-3:** Specifications of the head station STL-ETH1

### 3.2 Power supply modules

#### 3.2.1 STL-PS



**Fig. 3-7:** Power supply module STL-PS

#### Specifications

Item	STL-PS
Voltage via power jumper contacts	max 24 V
Current via power jumper contacts	max. 10 A
Weight	44.5 g

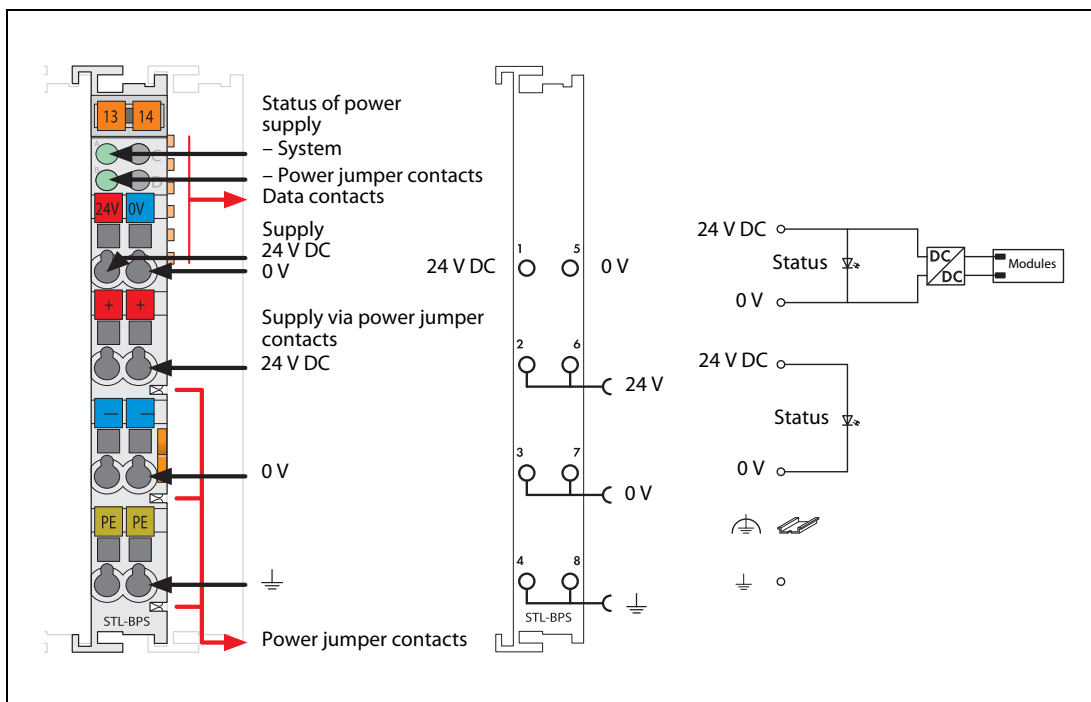
**Tab. 3-4:** Specifications of the power supply module STL-PS



**CAUTION:**

**The maximum current of the supply module is 10 A. When configuring the system it is important not to exceed the maximum/sum current. However, if such a case should occur, another supply module must be added.**

### 3.2.2 STL-BPS



**Fig. 3-8:** Power supply module STL-BPS with bus power supply

#### Specifications

Item		STL-BPS
External power supply	Voltage	24 V DC (-25 % / +30 %)
	Current	max. 500 mA
Total current for STlite modules		2000 mA
Voltage via power jumper contacts		max 24 V
Current via power jumper contacts		max. 10 A
Weight		58.5 g

**Tab. 3-5:** Specifications of the power supply module STL-BPS



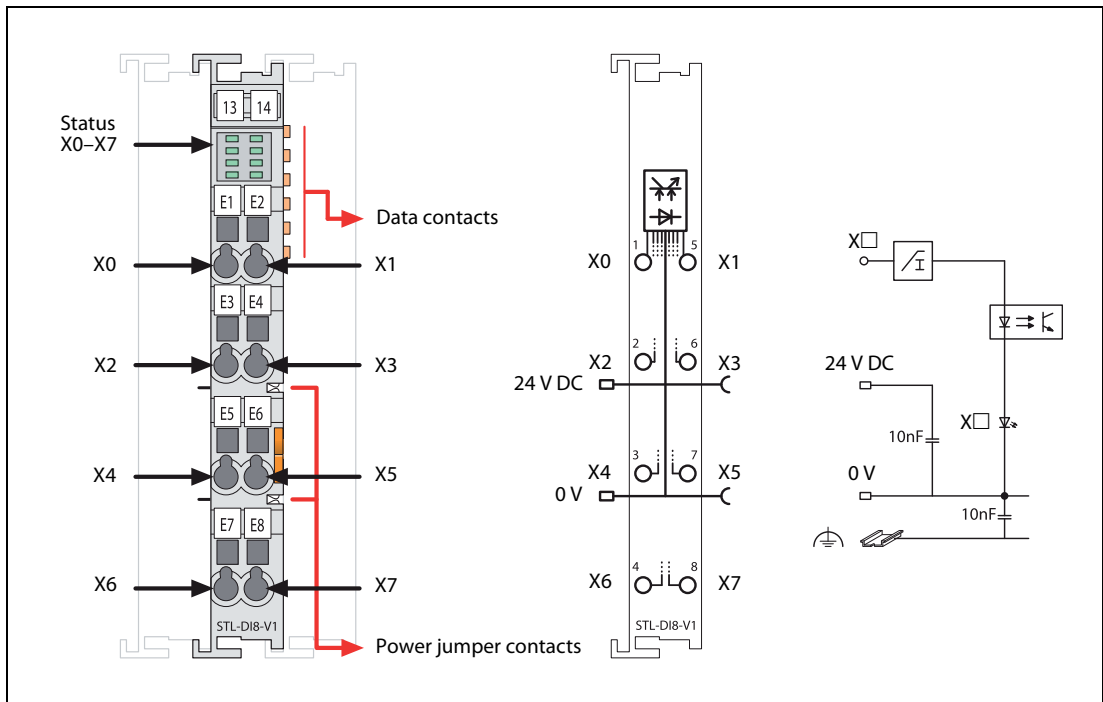
**CAUTION:**

**The maximum current of the supply module is 10 A. When configuring the system it is important not to exceed the maximum/sum current. However, if such a case should occur, another supply module must be added.**



### 3.3 Digital Input Modules

#### 3.3.1 STL-DI8-V1 and STL-DI8-V2



**Fig. 3-9:** Digital input modules STL-DI8-V1 and STL-DI8-V2

#### Specifications

Item	STL-DI8-V1	STL-DI8-V1
Number of inputs	8	
Connectable sensors	source type	
Rated input voltage	24 V DC	
Voltage for „ON“ (1)	15 V to 30 V DC	
Voltage for „OFF“ (0)	-3 V to +5 V DC	
Input current	typ. 2.8 mA	
Response time	0.2 ms	3.0 ms
Current consumption (internal)	17 mA	
Voltage via power jumper contacts	24 V DC (-25 % / +30 %)	
Internal bit width	8 bits	
Isolation	500 V system/supply	
Weight	48.5 g	

**Tab. 3-6:** Specifications of the digital input modules STL-DI8-V1 and STL-DI8-V2

### 3.4 Digital Output Modules

#### 3.4.1 STL-DO4

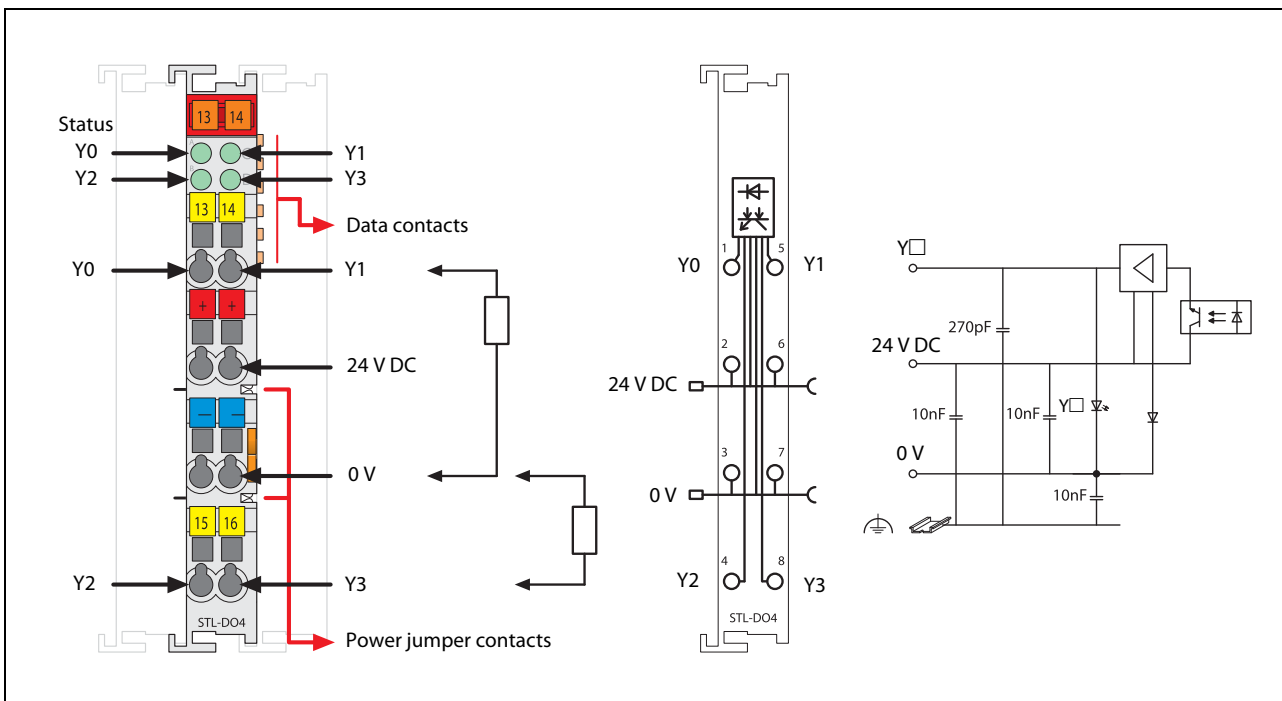


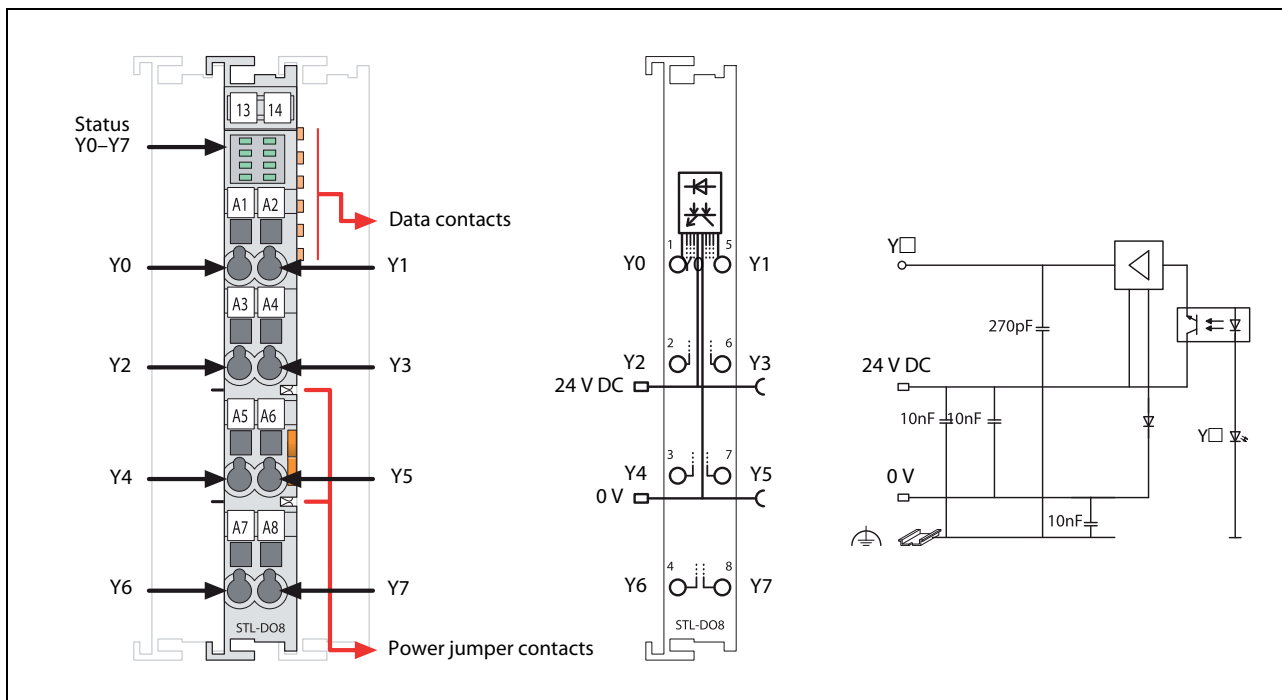
Abb. 3-10: Digital output module STL-DO4

#### Specifications

Item	STL-DO4
Number of outputs	4
Output type	source
Rated output voltage	24 V DC
Output current	0.5 A (short-circuit protected)
Type of load	resistive, inductive, lamps
Switching frequency	max. 1 kHz
Inductive load switch off energy dissipation W (one time switch off)	0.3 J; $L_{max} = 2 \times W_{max.} / I^2$
Current consumption typ. (field side)	typ. 30 mA / module + charge
Current consumption (internal)	7 mA
Voltage via power jumper contacts	24 V DC (-25 % / +30 %)
Internal bit width	4 bits
Isolation	500 V system/supply
Weight	49.5 g

Tab. 3-7: Specifications of the digital output module STL-DO4

### 3.4.2 STL-DO8



**Abb. 3-11:** Digital output module STL-DO8

#### Specifications

Item	STL-DO8
Number of outputs	8
Output type	source
Rated output voltage	24 V DC
Output current	0.5 A (short-circuit protected)
Type of load	resistive, inductive, lamps
Switching frequency	max. 2 kHz
Inductive load switch off energy dissipation W (one time switch off)	0.9 J; $L_{max} = 2 \times W_{max} / I^2$
Current consumption typ. (field side)	typ. 15 mA / module + charge
Current consumption (internal)	25 mA
Voltage via power jumper contacts	24 V DC (-25 % / +30 %)
Internal bit width	8 bits
Isolation	500 V system/supply
Weight	48.5 g

**Tab. 3-8:** Specifications of the digital output module STL-DO8

### 3.4.3 Relay Output Module STL-RO2

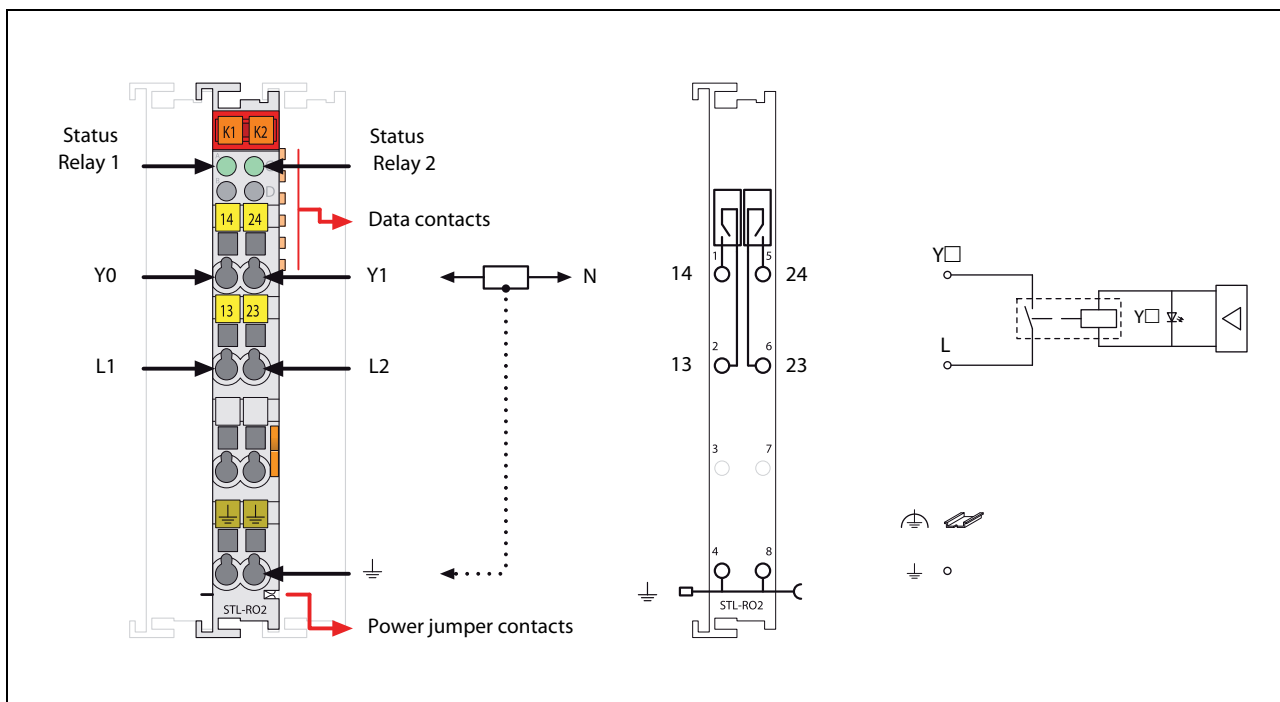


Abb. 3-12: Relay output module STL-RO2

#### Specifications

Item		STL-RO2
Number of outputs		2 normally open contacts
Output type		Relay (potential free)
Switching voltage		max. 250 V AC / 30 V DC
Switching power		500 VA / 60 W cos φ max. = 0.4; L/R max = 7 ms
Switching current	minimal	10 mA (5 V DC)
	maximum	2 A AC / DC
Switching frequency		max. 30 per minute (at nominal load)
Pull-in time		max. 10 ms
Bounce time		typ. 1.2 ms
Drop-out time		max. 10 ms
Contact material		Silver alloy
Life	Mechanical	2 x 10 <sup>7</sup> switching operations
	Electrical	at least 3 x 10 <sup>5</sup> switching operations at 250 V AC, 2 A or 30 V DC, 2 A
Current consumption (internal)		100 mA
Internal bit width		2 bits
Isolation		1.5 kV eff. (field/system)* *2.5 kV rated surge voltage; Overvoltage category III
Weight		53.5 g

Tab. 3-9: Specifications of the relay output module STL-RO2

### 3.5 Analog Input Modules

#### 3.5.1 STL-AD2-V

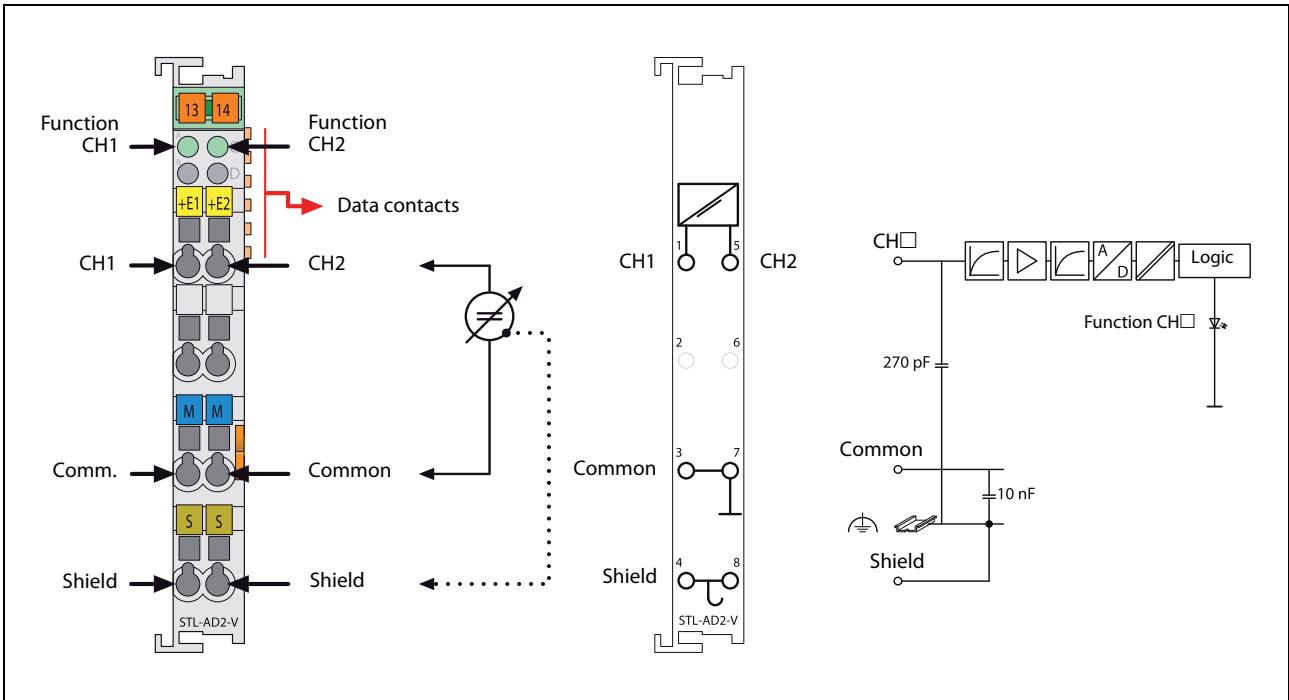


Abb. 3-13: Analog input module STL-AD2-V for voltage acquisition

#### Specifications

Item	STL-AD2-V
Number of input channels	2
Analog input	0 to 10 V
Maximum input	35 V
Input resistance	130 kΩ
Resolution	12 bits
Conversion time	typ. 2 ms
Accuracy	< ± 0.2 % of the full scale value (at 25 °C)
Temperature coefficient	< ± 0.01 %/K of the full scale value
Power supply	via system voltage DC / DC
Current consumption (internal)	typ. 60 mA
Internal bit width	2 x 16 bits data 2 x 8 bits control/status (optional)
Isolation	500 V system/supply
Weight	51.5 g

Tab. 3-10: Specifications of the analog input module STL-AD2-V

### 3.5.2 STL-AD4-V1 and STL-AD4-V2

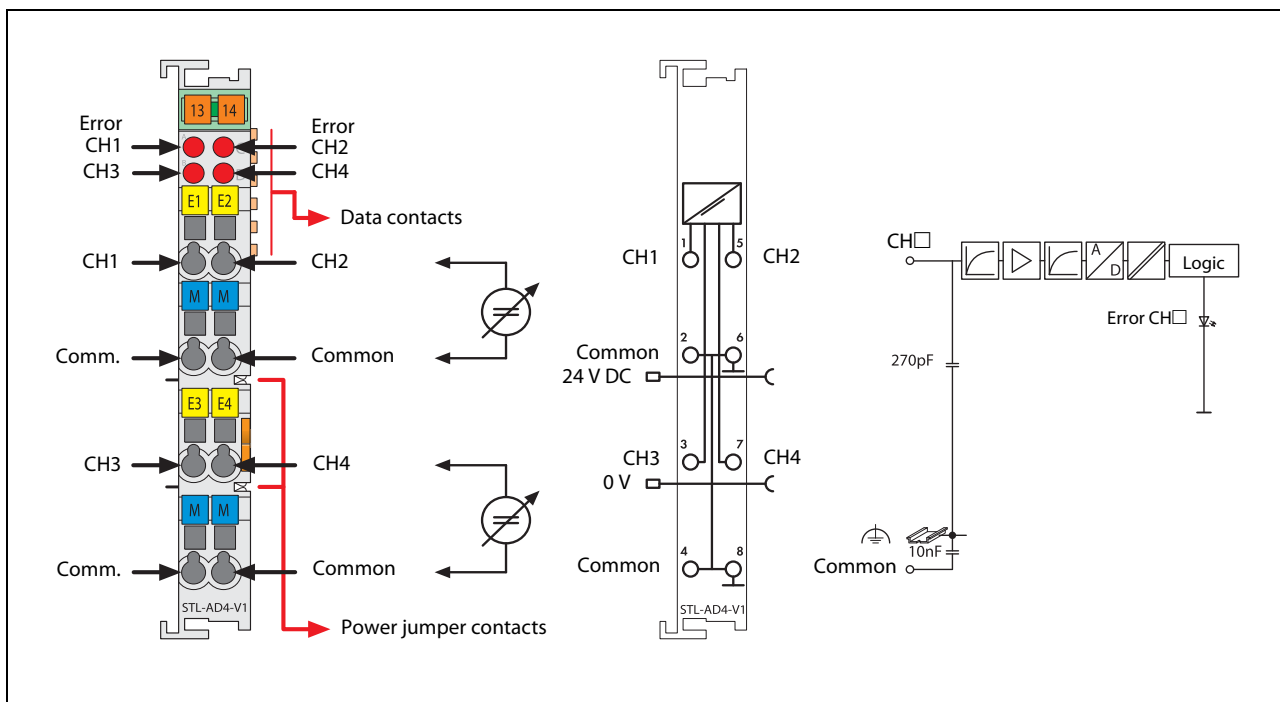


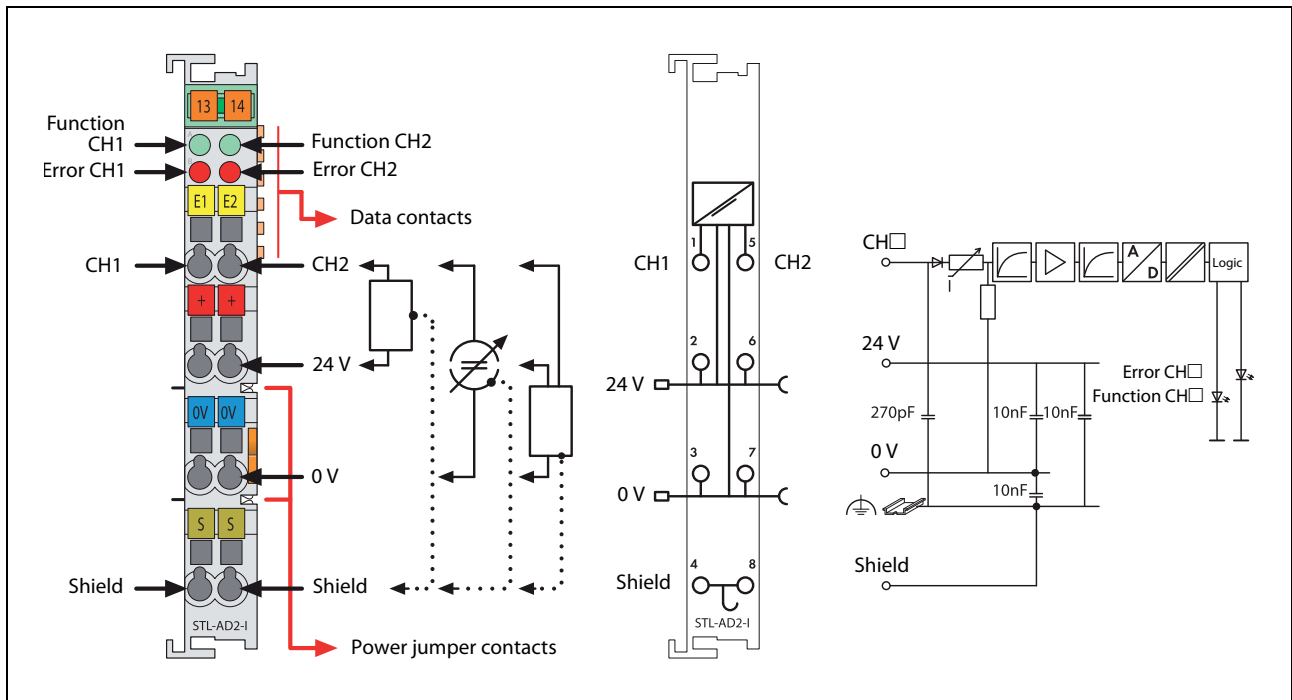
Abb. 3-14: Analog input modules STL-AD4-V1 and STL-AD4-V2 for voltage acquisition

#### Specifications

Item	STL-AD4-V1	STL-AD4-V2
Number of input channels	4	
Analog input	0 to 10 V	-10 V to 10 V
Maximum input	±40 V	
Input resistance	>100 kΩ	
Resolution	12 bits	
Conversion time	typ. 10 ms	
Accuracy	< ± 0.1 % of the full scale value (at 25 °C)	
Temperature coefficient	< ± 0.01 %/K of the full scale value	
Power supply	via system voltage DC / DC	
Current consumption (internal)	65 mA	
Internal bit width	4 x 16 bits data 4 x 8 bits control/status (optional)	
Isolation	500 V system/supply	
Weight	51.0 g	

Tab. 3-11: Specifications of the analog input modules STL-AD4-V1 and STL-AD4-V2

**3.5.3 STL-AD2-I**



**Abb. 3-15:** Analog input module STL-AD2-I for current acquisition

**Specifications**

Item	STL-AD2-I
Number of input channels	2
Analog input	4 to 20 mA
Maximum input voltage	10 V
Input resistance	< 220 Ω / 20 mA
Resolution	12 bits
Conversion time	typ. 2 ms
Accuracy	< ± 0.2 % of the full scale value (at 25 °C)
Temperature coefficient	< ± 0.01 %/K of the full scale value
Power supply	via system voltage DC / DC
Current consumption (internal)	75 mA
Internal bit width	2 x 16 bits data 2 x 8 bits control/status (optional)
Isolation	500 V system/supply
Weight	52.5 g

**Tab. 3-12:** Specifications of the analog input module STL-AD2-I

### 3.5.4 STL-AD4-I

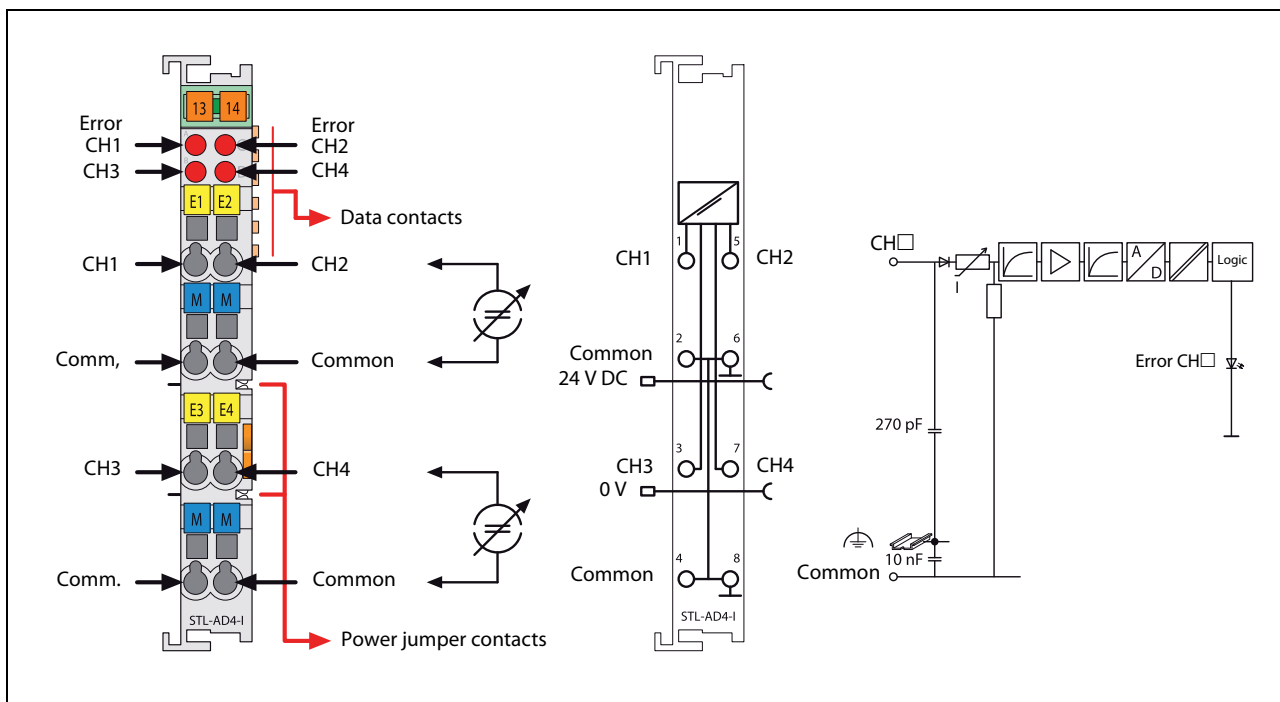


Abb. 3-16: Analog input module STL-AD4-I for current acquisition

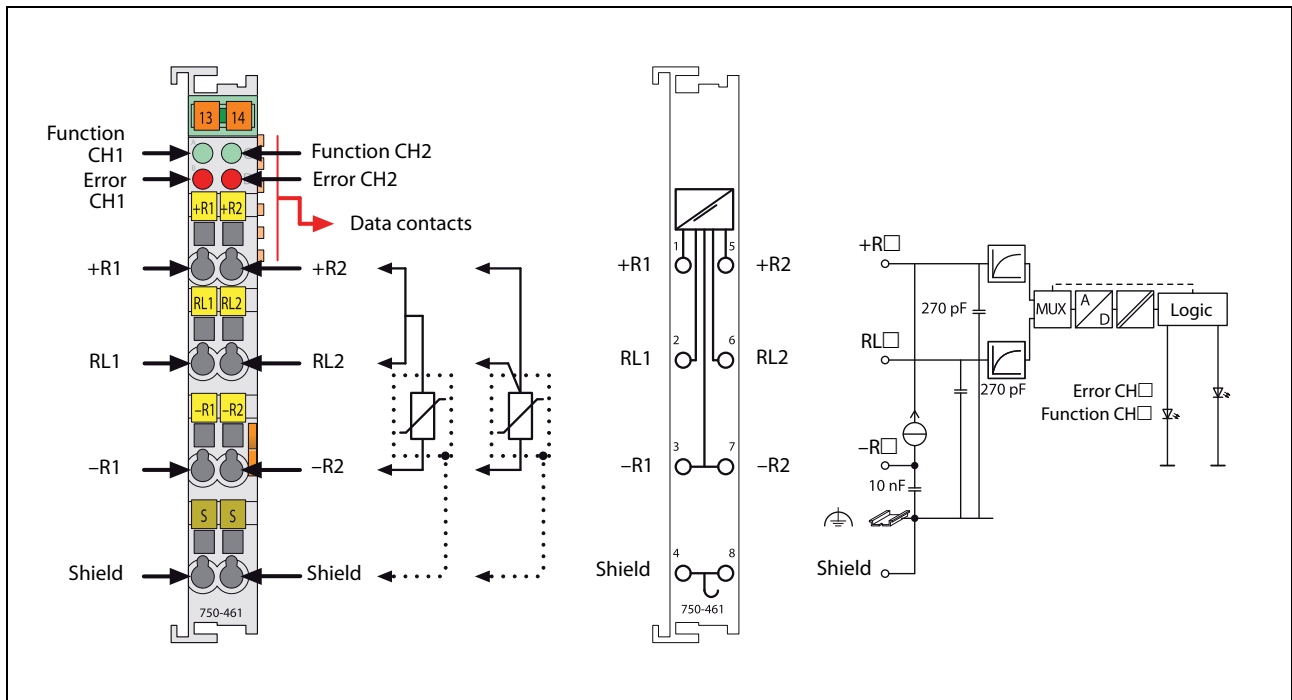
#### Specifications

Item	STL-AD4-I
Number of input channels	4
Analog input	4 to 20 mA
Maximum input voltage	32 V
Input resistance	< 100 Ω / 20 mA
Resolution	12 bits
Conversion time	typ. 10 ms
Accuracy	< ± 0.1 % of the full scale value (at 25 °C)
Temperature coefficient	< ± 0.01 %/K of the full scale value
Power supply	via system voltage DC / DC
Current consumption (internal)	65 mA
Internal bit width	4 x 16 bits data 4 x 8 bits control/status (optional)
Isolation	500 V system/supply
Weight	51.0 g

Tab. 3-13: Specifications of the analog input module STL-AD4-I



**3.5.5 STL-TI2**



**Abb. 3-17:** Analog input module STL-TI2 for temperature acquisition

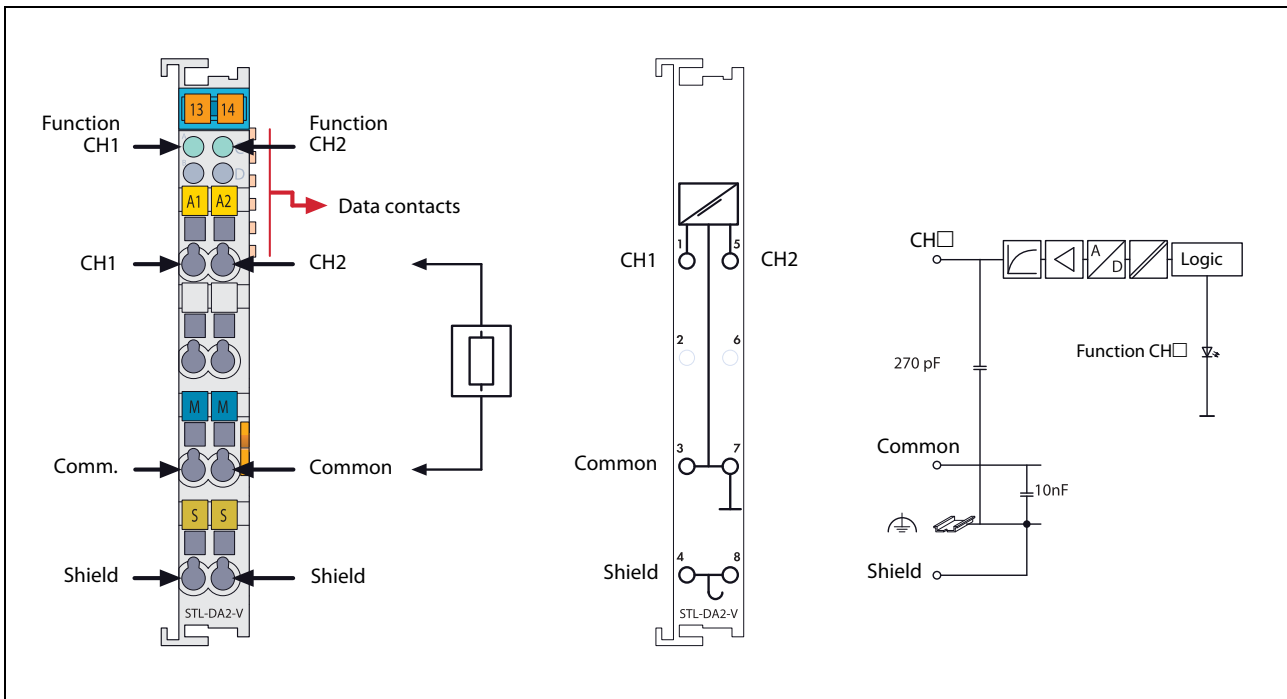
**Specifications**

Item	STL-TI2
Number of input channels	2
Connectable sensors	Pt100 resistance thermometers
Sensor connection	3-wire connection (factory preset) or 2-wire
Temperature range	-200 °C to +850 °C
Resolution	0.1 °C (over whole range)
Conversion time	320 ms (per channel)
Response time	max. 4 s
Measuring current	typ. 0.5 mA
Accuracy	< ± 0.2 % of the full scale value (at 25 °C)
Temperature coefficient	< ± 0.01 %/K of the full scale value
Power supply	via system voltage DC / DC
Current consumption (internal)	80 mA
Internal bit width	2 x 16 bits data 2 x 8 bits control/status (optional)
Isolation	500 V system/supply
Weight	52.5 g

**Tab. 3-14:** Specifications of the temperature acquisition module STL-TI2

## 3.6 Analog Output Modules

### 3.6.1 STL-DA2-V



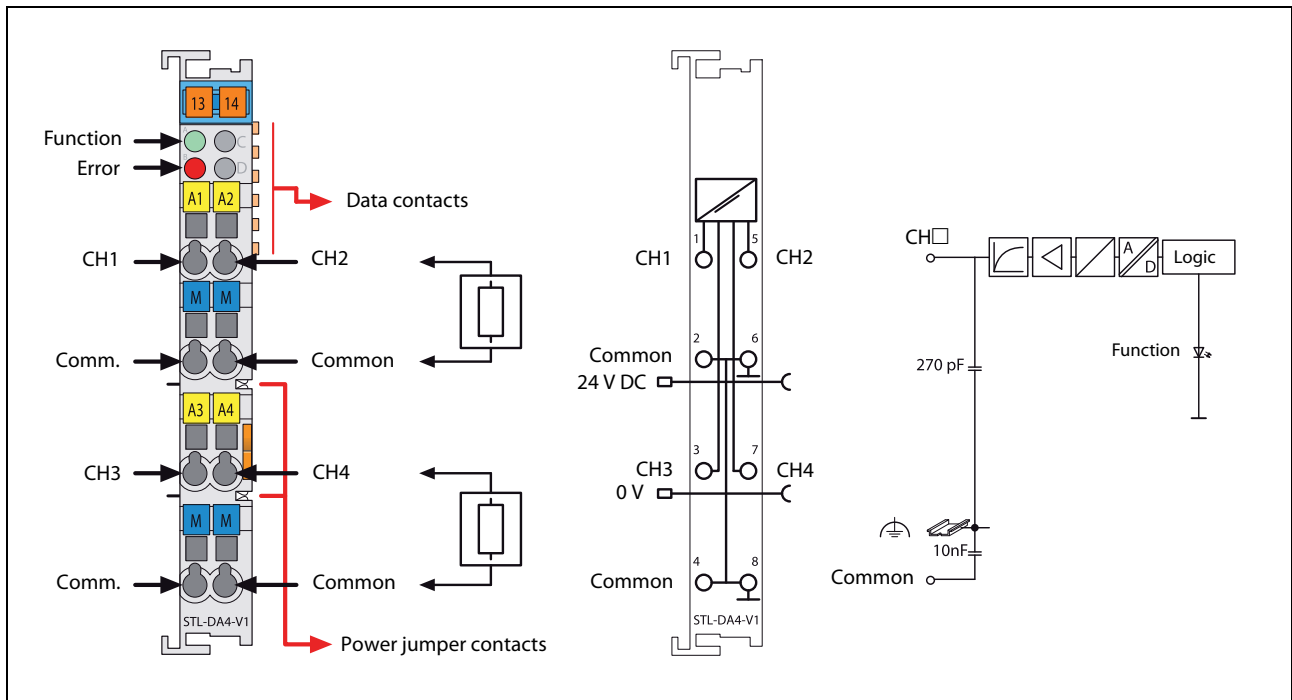
**Abb. 3-18:** Analog output module STL-DA2-V for voltage output

#### Specifications

Item	STL-DA2-V
Number of output channels	2
Analog output	0 to 10 V
Load impedance	>5 k $\Omega$
Linearity	$\pm 10$ mV
Resolution	12 bits
Conversion time	approx. 2 ms
Recovery time	typ. 300 $\mu$ s
Accuracy	< $\pm 0.1$ % of the full scale value (at 25 $^{\circ}$ C)
Temperature coefficient	< $\pm 0.01$ %/K of the full scale value
Power supply	via system voltage DC / DC
Current consumption (internal)	typ. 65 mA
Internal bit width	2 x 16 bits data 2 x 8 bits control/status (optional)
Isolation	500 V system/supply
Weight	50.5 g

**Tab. 3-15:** Specifications of the analog output module STL-DA2-V

### 3.6.2 STL-DA4-V1 and STL-DA4-V2



**Abb. 3-19:** Analog output modules STL-DA4-V1 and STL-DA4-V2 for voltage output

#### Specifications

Item	STL-DA4-V1	STL-DA4-V2
Number of output channels	4	
Analog output	0 to 10 V	-10 V to 10 V
Load impedance	>5 kΩ	
Resolution	12 bits	
Conversion time	typ. 10 ms	
Recovery time	typ. 100 ms	
Accuracy	< ± 0.1 % of the full scale value (at 25 °C)	
Temperature coefficient	< ± 0.01 %/K of the full scale value	
Power supply	via system voltage DC / DC	
Current consumption (internal)	max. 125 mA	
Internal bit width	4 x 16 bits data 4 x 8 bits control/status (optional)	
Isolation	500 V system/supply	
Weight	53.5 g	

**Tab. 3-16:** Specifications of the analog output modules STL-DA4-V1 and STL-DA4-V2

### 3.6.3 STL-DA2-I

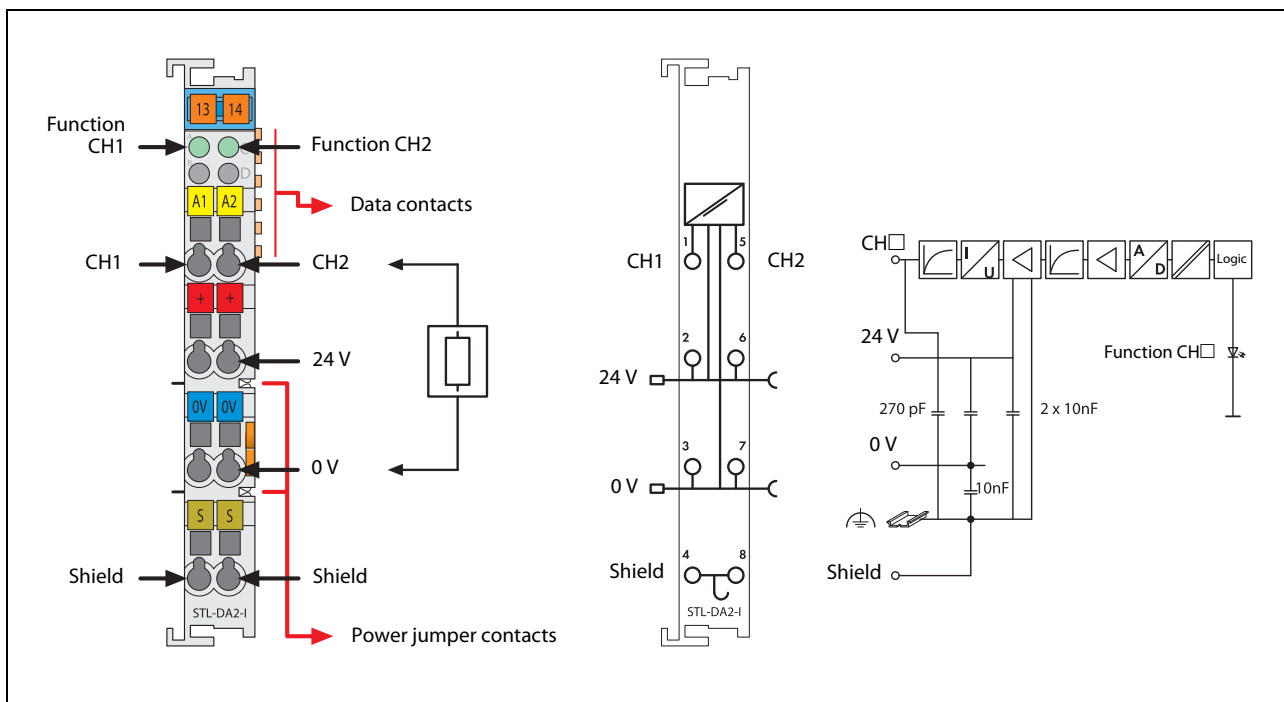


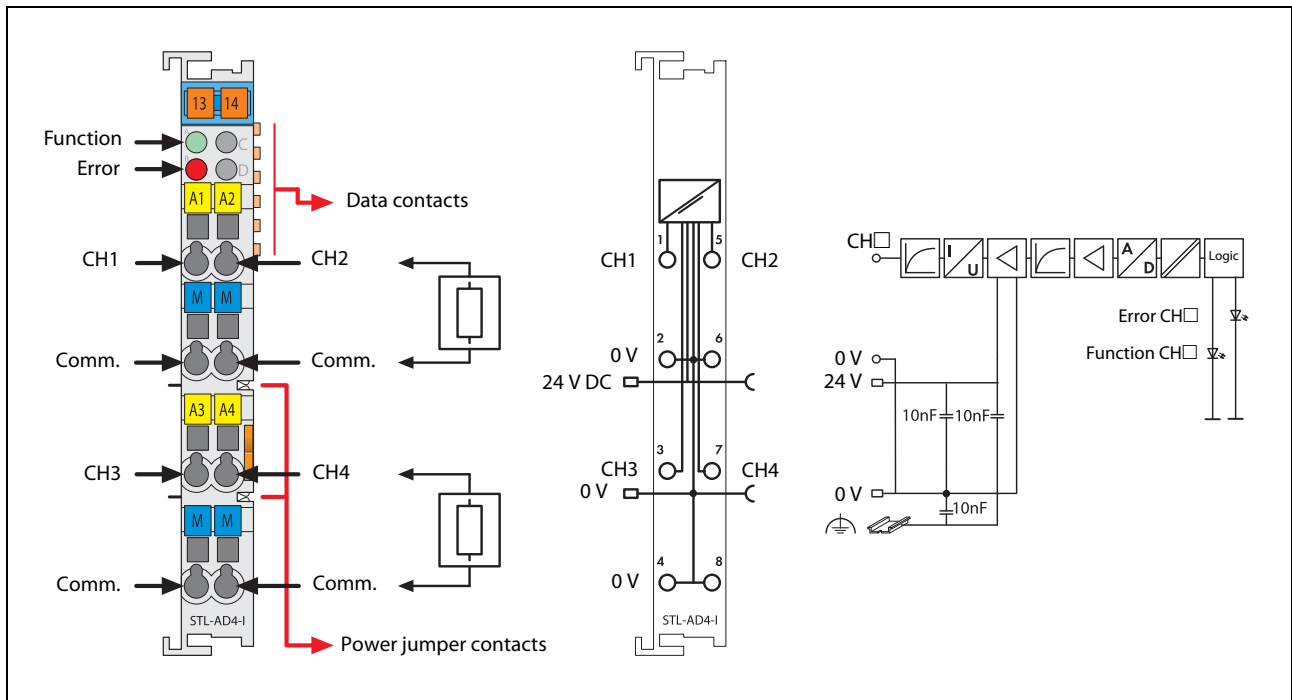
Abb. 3-20: Analog output module STL-DA2-I for current output

#### Specifications

Item	STL-DA2-I
Number of output channels	2
Analog output	4 to 20 mA
Load impedance	>600 Ω
Linearity	±10 μA
Resolution	12 bits
Conversion time	approx. 2 ms
Accuracy	< ± 0.1 % of the full scale value (at 25 °C)
Temperature coefficient	< ± 0.01 %/K of the full scale value
Voltage via power jumper contacts	24 V DC (-25 % / +30 %)
Current consumption (internal)	typ. 70 mA
Internal bit width	2 x 16 bits data 2 x 8 bits control/status (optional)
Isolation	500 V system/supply
Weight	53.5 g

Tab. 3-17: Specifications of the analog output module STL-DA2-I

**3.6.4 STL-DA4-I**



**Abb. 3-21:** Analog output module STL-DA4-I for current output

**Specifications**

Item	STL-DA4-I
Number of output channels	4
Analog output	4 to 20 mA
Load impedance	either 0 to 300 Ω or 300 to 600 Ω (use same range of impedance for all channels)
Resolution	12 bits
Conversion time	typ. 10 ms
Recovery time	typ. 100 ms
Accuracy	< ± 0.1 % of the full scale value (at 25 °C)
Temperature coefficient	< ± 0.01 %/K of the full scale value
Power supply	via system voltage DC / DC
Current consumption (internal)	max. 125 mA
Internal bit width	4 x 16 bits data 4 x 8 bits control/status (optional)
Isolation	500 V system/supply
Weight	53.5 g

**Tab. 3-18:** Specifications of the analog output module STL-DA4-I

### 3.7 Encoder Module STL-ENC

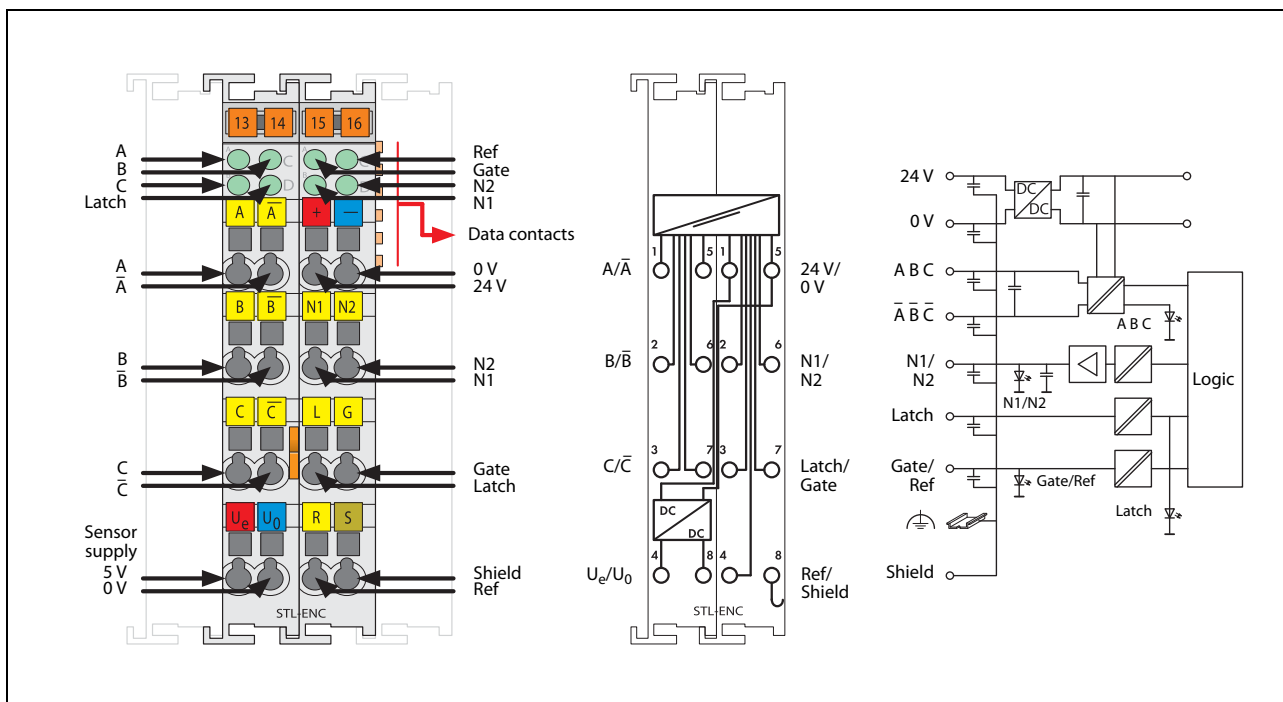


Abb. 3-22: Encoder module STL-ENC for the connection of incremental encoders

#### Specifications

Item		STL-ENC
Sensor	Connection	A, $\bar{A}$ , B, $\bar{B}$ , C, $\bar{C}$
	Operating voltage	5 V DC
	Output current	max. 300 mA
Counter		32 bits binary
Max. operating frequency		250 kHz
Quadrature decoder		4-fold report
Zero impulse latch		32 bits
Commands		read, set, enable
Digital inputs (Latch, Gate, Ref.)	Voltage for „ON“ (1)	15 V to 30 V DC
	Voltage for „OFF“ (0)	-3 V to +5 V DC
	Input current (typ.)	Latch: 5 mA, Gate: 7 mA, Ref.: 7 mA
Digital Outputs (N1, N2)	Output voltage	24 V DC
	Output current	0.5 A (short-circuit protected)
Power supply		24 V DC (-15 % / +20 %)
Current consumption		typ. 35 mA (without load)
Current consumption (internal)		110 mA
Internal bit width		1 x 32 bits data 1 x 8 bits control/status
Weight		100.0 g

Tab. 3-19: Specifications of the encoder module STL-ENC

### 3.8 Counter module STL-C100

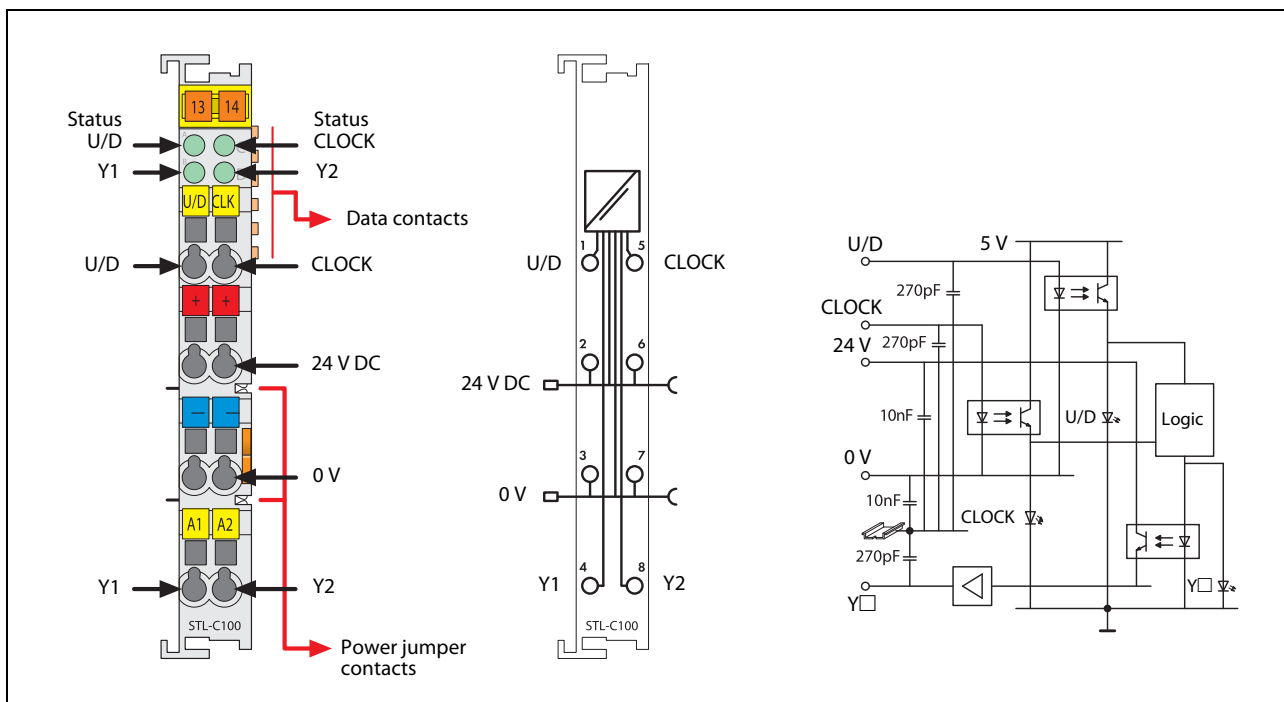


Abb. 3-23: Counter module STL-C100

#### Specifications

Item	STL-C100	
Counter input	Number of counters	1
	Counting frequency	max. 100 kHz
	Counter depth	32 bits
	Voltage for „ON“ (1)	15 V to 30 V DC
	Voltage for „OFF“ (0)	-3 V to +5 V DC
	Input current	typ. 5 mA
Digital outputs (Y1, Y2)	Output voltage	24 V DC
	Output current	0.5 A (short-circuit protected)
Power supply	24 V DC (-15 % / +20 %)	
Current consumption (internal)	70 mA	
Internal bit width	1 x 32 bits data 1 x 8 bits control/status	
Isolation	500 V system/supply	
Weight	60.0 g	

Tab. 3-20: Specifications of the counter module STL-C100

### 3.9 SSI Transmitter Interface STL-SSI

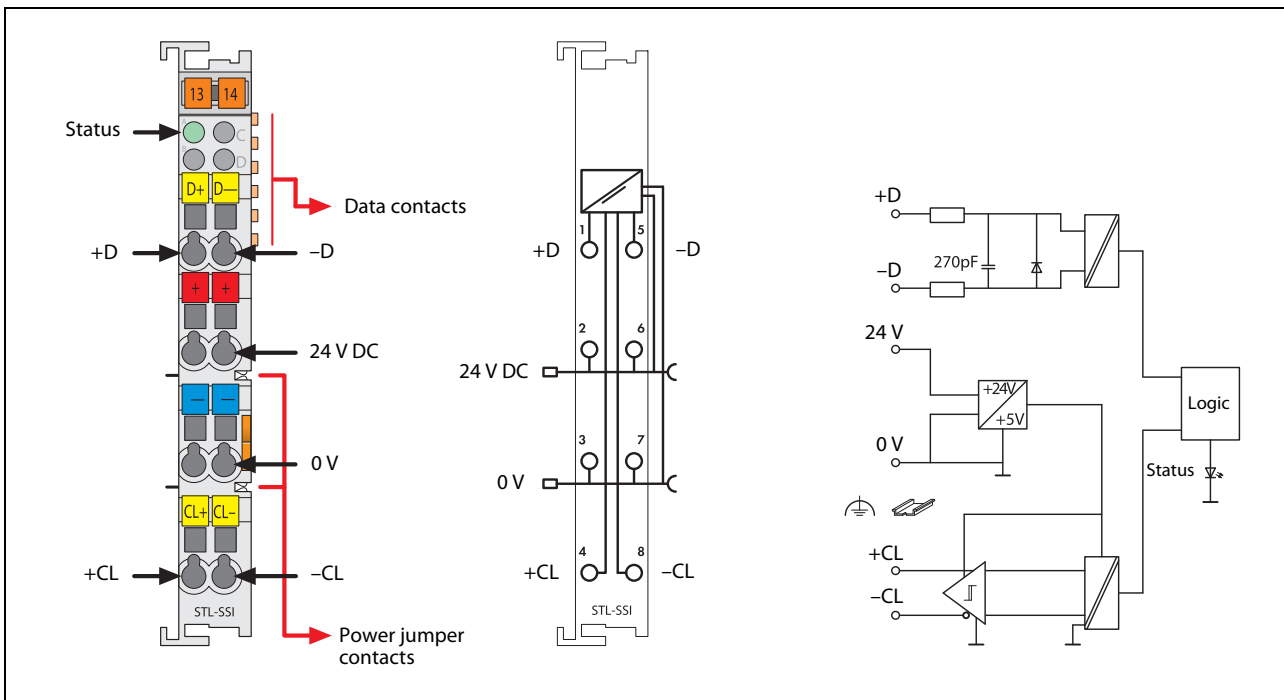


Abb. 3-24: Interface module STL-SSI

#### Specifications

Item	STL-SSI	
Sensor connection	No. of connectable sensors	1
	Inputs	+D, -D
	Outputs	+CL, -CL
Sensor supply	24 V DC via power jumper contacts	
Serial input	32 bits (bit width)	
Transmission rate	125 kHz (max. 1 MHz)	
Code	Gray code	
Signal input	Differential signal (RS-422)	
Signal output	Differential signal (RS-422)	
Voltage via power jumper contacts	24 V DC (-15 % / +20 %)	
Current consumption (internal)	85 mA	
Internal bit width	1 x 32 bits data 1 x 8 bits control/status (optional) (24 bits data, 8 bits reserved)	
Isolation	500 V system/supply	
Weight	46.5 g	

Tab. 3-21: Specifications of the interface module STL-SSI



# 4 Installation

## 4.1 Mounting Notes

### 4.1.1 Assembly Guidelines and Standards

- DIN 60204           Electrical equipping of machines
- DIN EN 50178       Equipping of high-voltage systems with electronic components (replacement for VDE 0160)
- EN 60439           Low-voltage switchgear and controlgear assemblies

### 4.1.2 Installation Position

A fieldbus node, consisting of a head station and modules of the MELSEC STlite series, can be mounted in any installation position.



**CAUTION:**

*In the case of vertical assembly, an end stop has to be mounted as an additional safeguard against slipping.*

### 4.1.3 Total Expansion

The total expansion of a node can be calculated thus:

Component	Number	Width
Head station	1	51 mm
STlite modules	64	12 mm*
Bus end module	1	12 mm
Total		<u>831 mm</u>

\* An encoder interface module STL-ENC is 24 mm width.



**CAUTION:**

*The maximum total length of a STlite node must not exceed 831 mm.*

## 4.2 Mounting onto Carrier Rail

### 4.2.1 Carrier Rail Properties

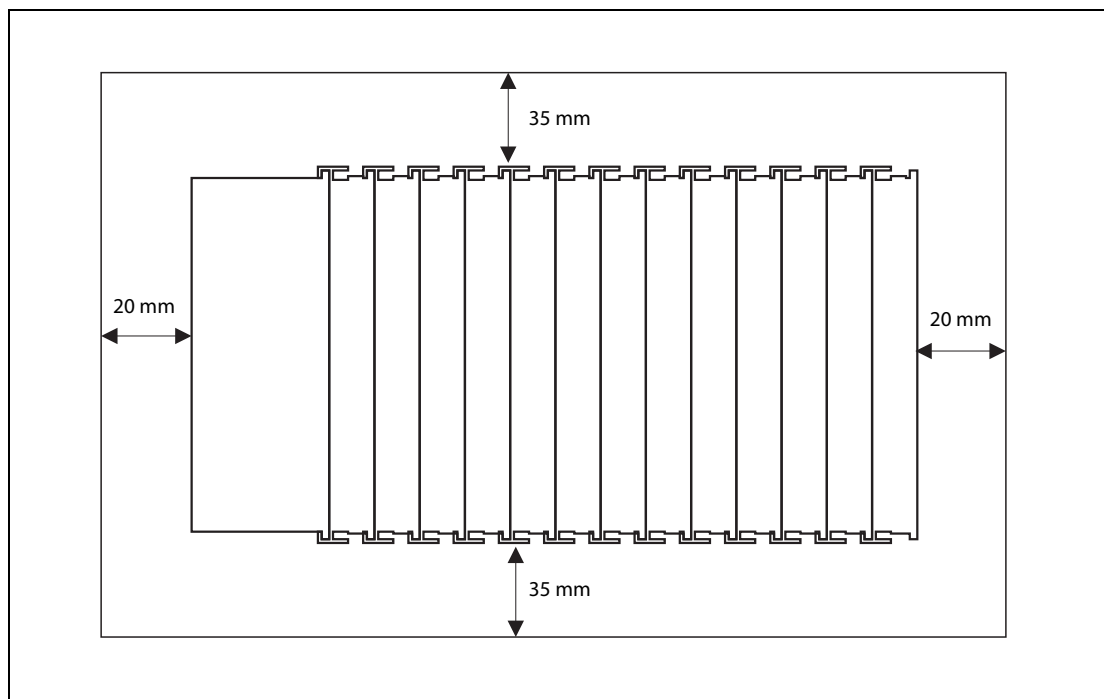
All system components of the MELSEC STlite series can be snapped directly onto a 35 mm width carrier rail in accordance with the European standard EN 50022 (DIN 35).

Carrier rails have different mechanical and electrical properties. For the optimal system setup on a carrier rail, certain guidelines must be observed:

- The material must be non-corrosive.
- Most STlite components have a contact to the carrier rail to ground electromagnetic disturbances. In order to avoid corrosion, this tin-plated carrier rail contact must not form a galvanic cell with the material of the carrier rail which generates a differential voltage above 0.5 V (saline solution of 0.3% at 20°C)
- The carrier rail must optimally support the EMC measures integrated into the system and the shielding of the STlite module connections.
- A sufficiently stable carrier rail should be selected and, if necessary, several mounting points (every 20 cm) should be used in order to prevent bending and twisting (torsion).
- The geometry of the carrier rail must not be altered in order to secure the safe hold of the components. In particular, when shortening or mounting the carrier rail, it must not be crushed or bent.
- The base of the I/O components extends into the profile of the carrier rail. For carrier rails with a height of 7.5 mm, mounting points are to be riveted under the node in the carrier rail (slotted head captive screws or blind rivets).


### 4.2.2 Spacing

To ensure proper ventilation and to facilitate module replacement, the following clearances should be maintained around an STlite node.



**Fig. 4-1:** Clearances to other components, cable conduits, casing and frame sides

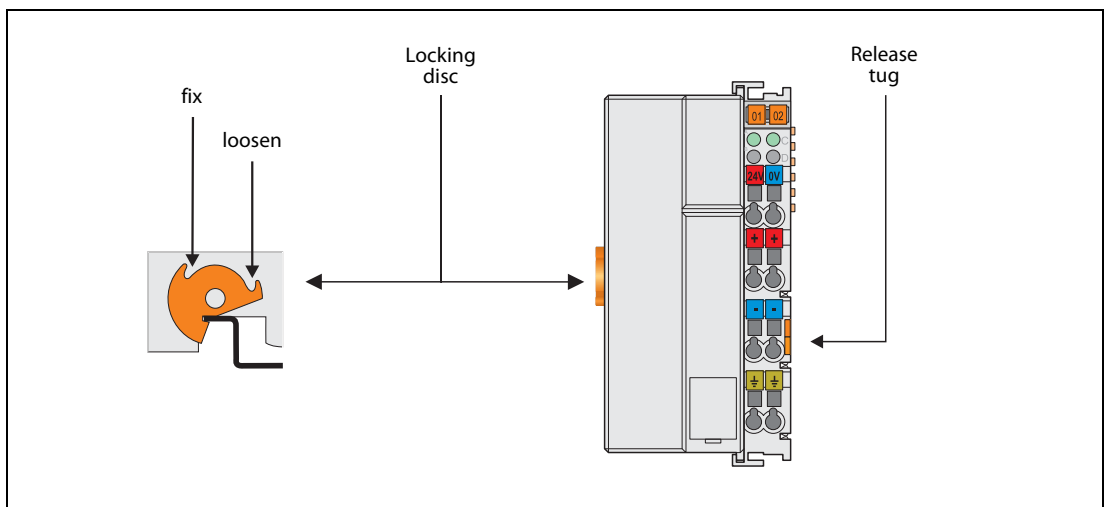
### 4.3 Installation and Deinstallation of the Modules



**CAUTION:**  
*Before installation or deinstallation of the components of the STlite series and during wiring work switch off the power supply for the fieldbus node and other external voltages.*

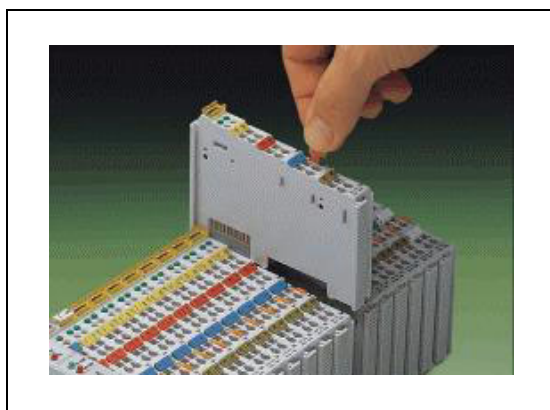
In order to safeguard the head station from jamming, it should be fixed onto the carrier rail with the locking disc. To do so, push on the upper groove of the locking disc using a screwdriver.

To pull out the head station, release the locking disc by pressing on the bottom groove with a screwdriver and then pulling the orange colored unlocking lug.




**Fig. 4-2:** Locking disc of the head station

It is also possible to release an individual STlite module from the unit by pulling an unlocking lug.



**Fig. 4-3:** Removal of a STlite module



**DANGER:**  
*Ensure that an interruption of the ground wire will not result in a condition which could endanger a person or equipment!*  
*For planning the ring feeding of the ground wire, please refer to section 4.7.3 .*

### 4.3.1 Mounting Sequence

All system components can be snapped directly on a carrier rail in accordance with the European standard EN 50022 (DIN 35).

The reliable positioning and connection is made using a tongue and groove system. Due to the automatic locking, the individual components are securely seated on the rail after installing.

Starting with the head station, the modules are mounted adjacent to each other according to the project planning. Errors in the planning of the node in terms of the potential groups (connection via the power contacts) are recognized, as the STlite modules with power contacts (male contacts) cannot be linked to bus modules with fewer power contacts.

**NOTE**

Always link the modules with the head station, and always plug from above.

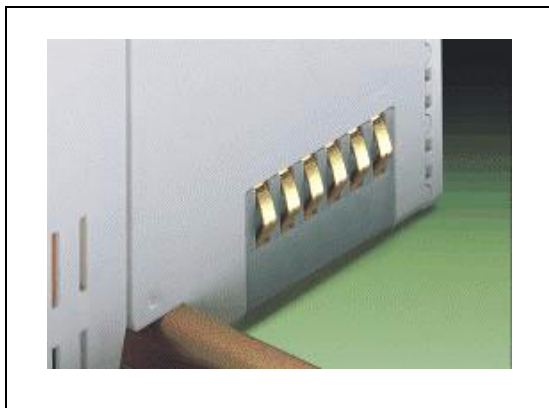
**CAUTION:**

- *Never plug modules from the direction of the end terminal. A ground wire power contact, which is inserted into a terminal without contacts, e.g. a digital input module with 4 inputs, has a decreased air and creepage distance to the neighboring contact, in this example X4.*
- *Always terminate the field bus node with an end module STL-ET.*

## 4.4 Power and Data Contacts of the Modules

### 4.4.1 Internal Bus/Data Contacts

Communication between the head station and the modules as well as the system supply of the bus modules is carried out via the internal bus. It is comprised of 6 data spring contacts, which are gold plated and self-cleaning.



**Fig. 4-4:**  
Data contacts of a STlite module



**CAUTION:**

- *Do not touch the gold spring contacts on the components of the STlite series in order to avoid soiling or scratching.*
- *The head station and the modules are equipped with electronic components that may be destroyed by electrostatic discharge. When handling the components of the STlite series, ensure that the environment (persons, workplace and packing) is well grounded. Avoid touching conductive components, e.g. data contacts.*

### 4.4.2 Power Contacts

Self-cleaning power contacts, are situated on the side of the components which further conduct the supply voltage for the field side. These contacts come as touchproof spring contacts on the right side of the head module and the other modules. As fitting counterparts the module has male contacts on the left side.



**DANGER:**

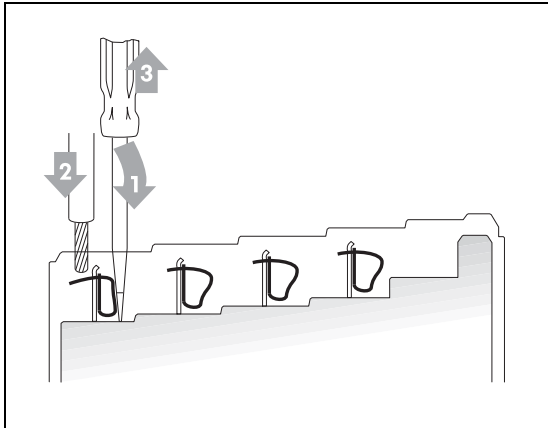
*The power contacts are sharp-edged. Handle the module carefully to prevent injury.*

**NOTE**

Please take into consideration that some modules have no or only a few power jumper contacts. The design of some modules does not allow them to be physically assembled in rows, as the grooves for the male contacts are closed at the top.

## 4.5 Wire Connection

All components have CAGE CLAMP® connections. The CAGE CLAMP® connection is appropriate for solid, stranded and finely stranded conductors. Each clamping unit accommodates one conductor.



**Fig. 4-5:**  
CAGE CLAMP® Connection

- ① The operating tool is inserted into the opening above the connection. This opens the CAGE CLAMP®.
- ② Subsequently the conductor can be inserted into the opening.
- ③ After removing the operating tool, the conductor is safely clamped.

More than one conductor per connection is not permissible. If several conductors have to be made at one connection point, then they should be made away from the connection point using terminal blocks. The terminal blocks may be jumpered together and a single wire brought back to the STlite module connection point.

### NOTE

If it is unavoidable to jointly connect 2 conductors, then a ferrule must be used to join the wires together.

Specification for the ferrule

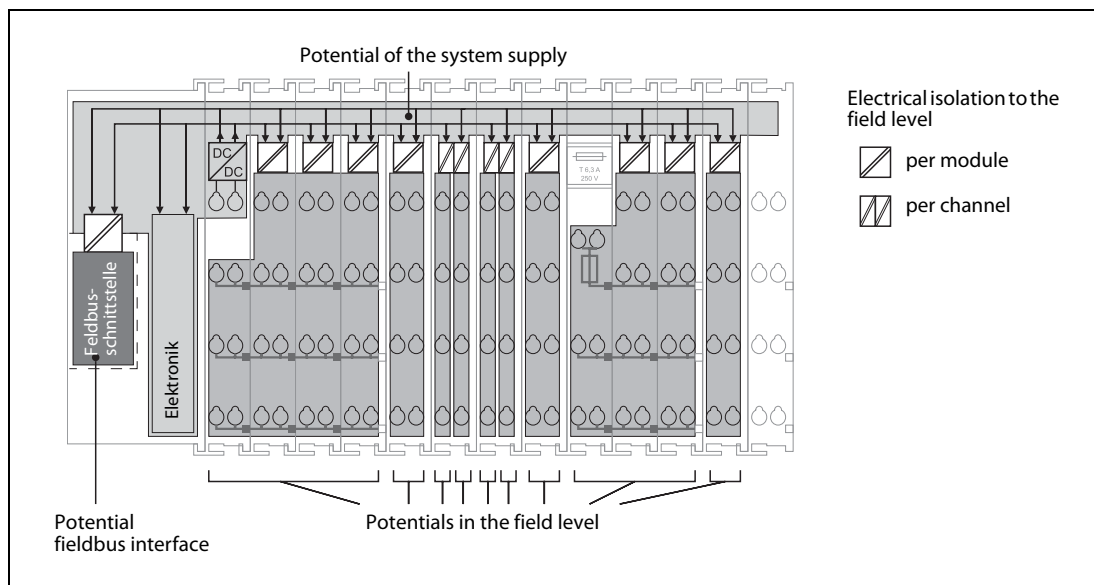
- Length: 8 mm
- Nominal cross section max. 1 mm<sup>2</sup> for 2 conductors with 0.5 mm<sup>2</sup> each

## 4.6 Connection of the Power Supply

### 4.6.1 Isolation

Within the field bus node, there are three electrically isolated potentials:

- Operational voltage for the field bus interface.
- Electronics of the head station and the modules (internal bus).
- All modules have an electrical isolation between the electronics (internal bus, logic) and the field electronics. Some analog input modules have each channel electrically isolated (see section 3.5).



**Fig. 4-6:** Isolation

#### NOTES

The ground wire connection must be present in each group. In order that all protective conductor functions are maintained under all circumstances, it is recommended that a ground wire be connected at the beginning and end of a potential group. (ring format, please see section 4.7.3). Thus, if a module comes loose from a composite during servicing, then the protective conductor connection is still guaranteed for all connected field devices.

When using a joint power supply unit for the 24 V system supply and the 24 V field supply, the electrical isolation between the internal bus and the field level is eliminated for the potential group.

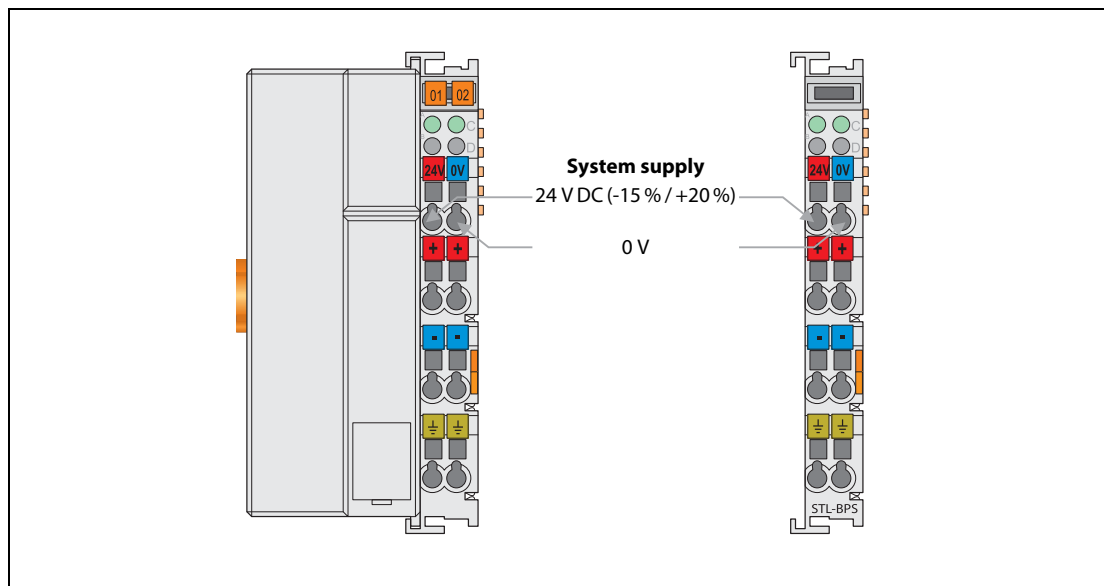
## 4.6.2 System Supply

The STlite series requires a 24 V direct current system supply (-15 % or +20 %). The power supply is provided via the head station and, if necessary, in addition via the internal system supply modules (STL-BPS). The voltage supply is reverse voltage protected.



**CAUTION:**

*The use of an incorrect supply voltage or frequency can cause severe damage to the component.*



**Fig. 4-7:** Connection of the system supply to head stations and the power supply module STL-BPS

The direct current supplies all internal system components, e.g. head station electronics, field bus interface and modules via the internal bus (5 V system voltage). The 5 V system voltage is electrically connected to the 24 V system supply.

**NOTE**

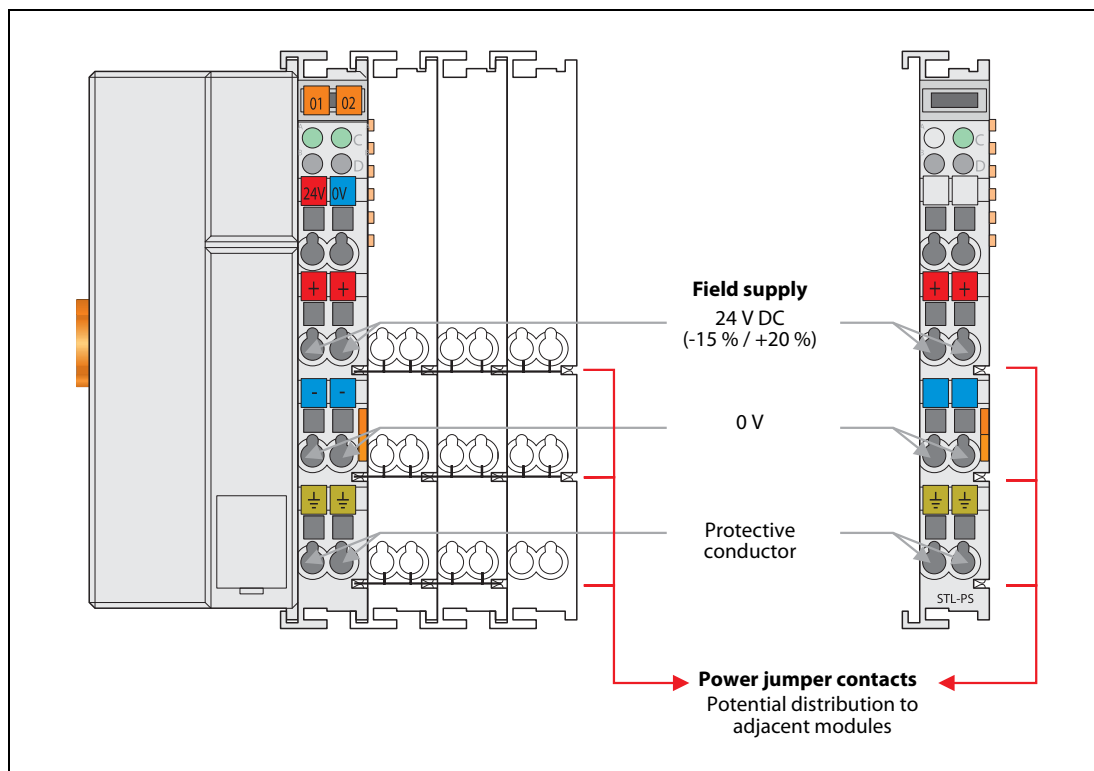
Resetting the system by switching on and off the system supply, must take place simultaneously for all supply modules (head station and power supply module STL-BPS).



### 4.6.3 Field Supply

Sensors and actuators can be directly connected to the relevant channel of the STlite module in 1/4 conductor connection technology. The module supplies power to the sensors and actuators. The input and output drivers of some modules require the field side supply voltage.

The head station provides field side power (24 V DC). In this case it is a passive power supply without protection equipment. With the aid of the power supply modules, various potentials can be set up. The connections are linked in pairs with a power contact.



**Fig. 4-8:** Connection of the field supply to head stations and power supply modules

The supply voltage for the field side is automatically passed to the next module via the power jumper contacts when mounting the modules.

The current load of the power contacts must not exceed 10 A on a continual basis. The current load capacity between two connection terminals is identical to the load capacity of the connection wires.

By inserting an additional power supply module, the field supply via the power contacts is disrupted. From there a new power supply occurs which may also contain a new voltage potential.

**NOTE**

Some STlite modules have no or very few power contacts (depending on the I/O function). Due to this, the passing through of the relevant potential is disrupted. If a field supply is required for subsequent modules, then a power supply module must be used. Note the specifications of the modules in chapter 3.

#### 4.6.4 Power Supply Unit

The STlite series requires a 24 V direct current system supply with a maximum deviation of -15 % or +20 %.

**NOTE**

A stable network supply cannot be taken for granted always and everywhere. Therefore, regulated power supply units should be used in order to guarantee the quality of the supply voltage.

A buffer (200  $\mu$ F per 1 A current load) should be provided for brief voltage dips. The STlite system buffers for approx 1 ms.

The electrical requirement for the field supply is to be determined individually for each power supply point. Thereby all loads through the field devices and STlite modules should be considered. The field supply as well influences the STlite modules, as the inputs and outputs of some modules require the voltage of the field supply.

**NOTE**

The system supply and the field supply should be isolated from the power supplies in order to ensure bus operation in the event of short circuits on the actuator side.

## 4.7 Grounding

### 4.7.1 Grounding the DIN Rail

#### Framework Assembly

When setting up the framework, the carrier rail must be screwed together with the electrically conducting cabinet or housing frame. The framework or the housing must be grounded. The electronic connection is established via the screw. Thus, the carrier rail is grounded.

**NOTE**

Care must be taken to ensure the flawless electrical connection between the carrier rail and the frame or housing in order to guarantee sufficient grounding.

#### Insulated Assembly

Insulated assembly has been achieved when there is constructively no direct conduction connection between the cabinet frame or machine parts and the carrier rail. Here the earth must be set up via an electrical conductor.

The connected grounding conductor should have a cross section of at least 4 mm<sup>2</sup>.

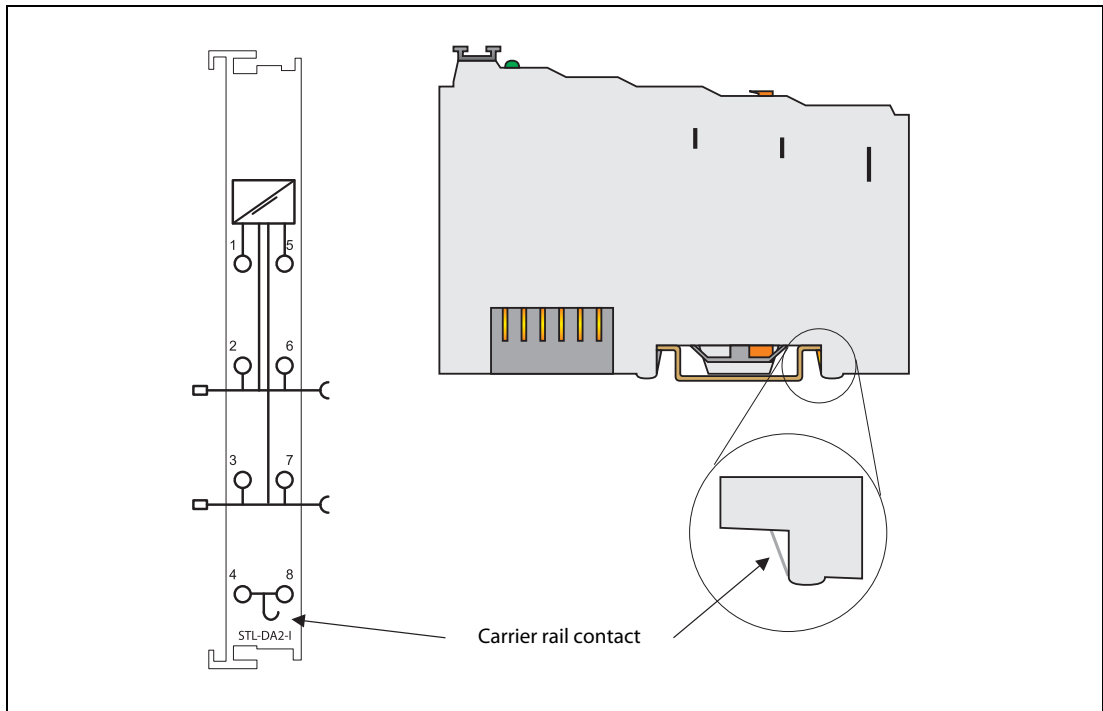
**NOTE**

The optimal insulated setup is a metallic assembly plate with grounding connection with an electrical conductive link with the carrier rail.

The separate grounding of the carrier rail can be easily set up with the aid of ground wire terminals.

## 4.7.2 Grounding Function

The grounding function increases the resistance against disturbances from electro-magnetic interferences. Some components in the STlite series have a carrier rail contact that dissipates electro-magnetic disturbances to the carrier rail.



**Fig. 4-9:** Position of the carrier rail contact

### NOTES

- Care must be taken to ensure the direct electrical connection between the carrier rail contact and the carrier rail.
- The carrier rail must be grounded
- For information on carrier rail properties, please refer to section 4.2.1

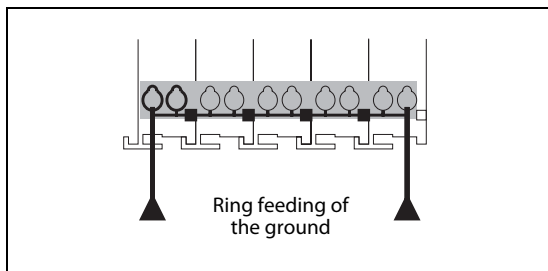
### 4.7.3 Grounding Protection

For the field side, the ground wire is connected to the lowest connection terminals of the power supply module. The ground connection is then connected to the next module via the power jumper contact. If the module has the lower power jumper contact, then the ground wire connection of the field devices can be directly connected to the lower connection terminals of the module.

**NOTE**

Should the ground conductor connection of the power jumper contacts within the node become disrupted, e. g. due to a 4-channel STlite module, the ground connection will need to be re-established.

The ring feeding of the grounding potential will increase the system safety. When one STlite module is removed from the group, the grounding connection will remain intact. The ring feeding method has the grounding conductor connected to the beginning and end of each potential group.

**Fig. 4-10:**

*The ring feeding of the ground prevents an disconnection of the grounding potential.*

**NOTE**

The regulations relating to the place of assembly as well as the national regulations for maintenance and inspection of the grounding protection must be observed.

## 4.8 Shielding

### General

The shielding of the data and signal conductors reduces electromagnetic interferences thereby increasing the signal quality. Measurement errors, data transmission errors and even disturbances caused by overvoltage can be avoided.

#### NOTES

Constant shielding is absolutely required in order to ensure the technical specifications in terms of the measurement accuracy.

The data and signal conductors should be separated from all high-voltage cables.

The cable shield should be potential. With this, incoming disturbances can be easily diverted

The shielding should be placed over the entrance of the cabinet or housing in order to already repel disturbances at the entrance

### Bus Conductors

For the shielding of the bus conductor please observe the assembly guidelines and standards of the relevant bus system.

### Signal Conductors

STlite modules for analog signals include a connection for the shield.

#### NOTE

For a better shield performance, the shield should have previously been placed over a large area. This suggestion is especially applicable if the equipment can have even current or high impulse formed currents running through (for example initiated by atmospheric discharge).



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