

# **MELSEC ST Series**

Modular Input/Output System

Installation Manual

**Head Station**  
**Power Feeding Modules**  
**Digital I/O-Modules**  
**Analog I/O-Modules**

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# 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

## For qualified staff only

This manual is only intended for use by properly trained and qualified electrical technicians who are fully acquainted with automation technology safety standards. All work with the hardware described, including system design, installation, setup, maintenance, service and testing, may only be performed by trained electrical technicians with approved qualifications who are fully acquainted with the applicable automation technology safety standards and regulations.

## Proper use of equipment

The moduls of the MELSEC ST Series are only intended for the specific applications explicitly described in this manual. Please take care to observe all the installation and operating parameters specified in the manual. All products are designed, manufactured, tested and documented in agreement with the safety regulations. Any modification of the hardware or software or disregarding of the safety warnings given in this manual or printed on the product can cause injury to persons or damage to equipment or other property. Only accessories and peripherals specifically approved by MITSUBISHI ELECTRIC may be used. Any other use or application of the products is 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, setup, maintenance, servicing and testing of these products. The regulations listed below are particularly important. This list does not claim to be complete; however, you are responsible for knowing and applying the regulations applicable to you.

- VDE Standards
  - VDE 0100  
(Regulations for electrical installations with rated voltages up to 1,000V)
  - VDE 0105  
(Operation of electrical installations)
  - VDE 0113  
(Electrical systems with electronic equipment)
  - VDE 0160  
(Configuration of electrical systems and electrical equipment)
  - 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 prevention regulations
- Accident prevention regulations
  - VBG No. 4 (Electrical systems and equipment)

### Safety warnings in this manual

In this manual special warnings that are important for the proper and safe use of the products are clearly identified as follows:



**DANGER:**

*Personnel health and injury warnings. Failure to observe the precautions described here can result in serious health and injury hazards.*



**CAUTION:**

*Equipment and property damage warnings. Failure to observe the precautions described here can result in serious damage to the equipment or other property.*

### General safety information and precautions

The following safety precautions are intended as a general guideline for using the PLC 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. Installation, wiring and opening of the assemblies, components and devices may only be performed with all power supplies disconnected.*
- *Assemblies, components and devices must always be installed in a shock-proof housing fitted with a proper cover and protective equipment.*
- *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.*
- *Residual current protective devices pursuant to DIN VDE Standard 0641 Parts 1-3 are not adequate on their own as protection against indirect contact for installations with positioning drive systems. Additional and/or other protection facilities are essential for such installations.*
- *EMERGENCY OFF facilities pursuant to EN 60204/IEC 204 VDE 0113 must remain fully operative at all times and in all control system operating modes. The EMERGENCY OFF facility reset function must be designed so that it cannot cause an uncontrolled or undefined restart.*
- *You must also implement hardware and software safety precautions to prevent the possibility of undefined control system states caused by signal line cable or core breaks.*
- *All relevant electrical and physical specifications must be strictly observed and maintained for all the modules in the installation.*

# 1 Introduction

The most important characteristics of the MELSEC ST 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 ST series operating manual. This documentation is provided solely as a quick reference.

## 1.1 General Description

The MELSEC ST series is a modular input and output system which is connected as slave station to a PROFIBUS/DP network. An ST series station consists of

- a head station to which the PROFIBUS is connected.
- Power supply modules.
- Digital and analog I/O modules.

The I/O modules can be combined as desired according to the requirements.

## 1.2 Special Features

### Reduced wiring effort

- External voltages  
for supplying sensors and actuators are connected to the power distribution modules of the ST series only. The other system modules are supplied with power via internal connections. Wiring requirements are significantly reduced because the supply voltage does not need to be connected to each individual module.
- PROFIBUS connection  
Only the head station is connected to the PROFIBUS/DP network.
- Connection of the I/O modules  
Peripherals are connected either via spring clamp terminals, (into which the wires are just inserted), or via conventional screw clamp terminals.

### Flexible System Set-up

The number of inputs and outputs can be adapted easily to the application. Digital modules with 2, 4, and 16 inputs, and with 2 and 16 outputs are available. Up to 63 I/O modules (max. 26 analog I/O modules) can be connected to one head module.

### Simple Service

The electronics modules are plugged into a base module to which the peripheral signals are connected. The base module is mounted on a DIN rail. Electronic modules can be replaced in operation. No tool is required to do this. The GX Configurator DP is available to configure the system.

## 1.3 System Configuration

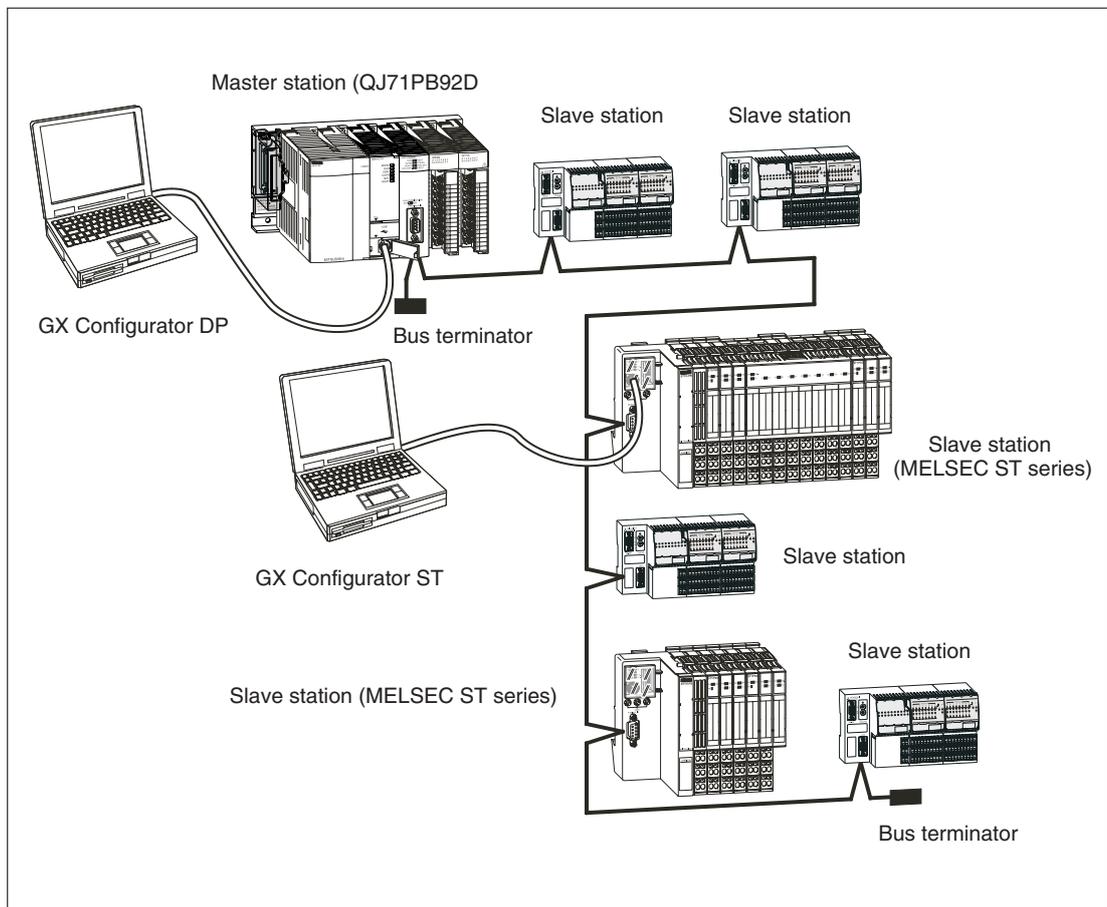
### 1.3.1 Overview

A slave station set-up with the MELSEC ST series is connected to a PROFIBUS/DP network. Use is not limited to networks with a MELSEC PLC as master station, but is also possible in networks with devices from “third-party” manufacturers.

Populating the stations with ST modules is based on the requirements of the application. Analog modules for capture or output of voltages or currents are available, in addition to digital input and output modules.

“ST” means “Slice Type terminal”, and refers to the narrow width of the modules (only 12.6 mm!). In addition to the narrow modules, cost-saving modules with 16 digital inputs or outputs are also available.

An ST series slave station always consists of a head station, which establishes the connection to the PROFIBUS/DP network. At least one power distribution module, and the digital and/or analog I/O modules are connected to the head station.



The I/O modules consist of an electronics module and a base module, which establishes the connection to the head station via screw clamp terminals, or spring clamp terminals. The electronics modules are simply plugged onto the base module, which in turn is mounted on a DIN rail. It is not necessary to disconnect the wiring when swapping out a module because the signals are connected to the base module.

### 1.3.2 Components of the MELSEC ST Series

**NOTE**

A base module is required for mounting each ST series electronics module, except for the head station.

| Product                      |                                      | Electronic module | Description  | Applicable base modules* |                       |
|------------------------------|--------------------------------------|-------------------|--|--------------------------|-----------------------|
|                              |                                      |                   |  | Spring clamp terminals   | Screw clamp terminals |
| Head station                 |                                      | ST1H-PB           | For connection to the PROFIBUS   | Not necessary            | Not necessary         |
| Power distribution modules   | Bus refreshing module                | ST1PSD            | For powering the head station (Supply of 5 V DC and distribution of 24 V DC) | ST1B-S4P2-H-SET          | ST1B-E4P2-H-SET       |
|                              |                                      |                   | For increasing the capacity of the 5 V DC supply                             | ST1B-S4P2-R-SET          | ST1B-E4P2-R-SET       |
|                              | Power feeding module                 | ST1PDD            | Distribution of 24 V DC to the I/O modules                                   | ST1B-S4P2-D              | ST1B-E4P2-D           |
| Digital I/O modules          | Input modules (Negative common type) | ST1X2-DE1         | 2 inputs, 24 V DC  | ST1B-S4X2                | ST1B-E4X2             |
|                              |                                      | ST1X4-DE1         | 4 inputs, 24 V DC  | ST1B-S6X4                | ST1B-E6X4             |
|                              |                                      | ST1X16-DE1        | 16 inputs, 24 V DC   | ST1B-S4X16               | ST1B-E4X16            |
|                              | Output modules                       | ST1Y2-TE2         | 2 transistor outputs, 24 V DC, 0,5 A, source type                            | ST1B-S3Y2                | ST1B-E3Y2             |
|                              |                                      | ST1Y16-TE2        | 16 transistor outputs, 24 V DC, 0,5 A, source type                           | ST1B-S3Y16               | ST1B-E3Y16            |
|                              |                                      | ST1Y2-TPE3        | 2 transistor outputs, 24 V DC, 1 A, source type, short circuit protected     | ST1B-S3Y2                | ST1B-E3Y2             |
|                              |                                      | ST1Y16-TPE3       | 16 transistor outputs, 24 V DC, 1 A, source type, short circuit protected    | ST1B-S3Y16               | ST1B-E3Y16            |
|                              |                                      | ST1Y2-R2          | 2 contact outputs 240 V AC / 24 V DC, 2 A                                    | ST1B-S4IR2               | ST1B-E4IR2            |
|                              |                                      |                   |  |                          |                       |
| Intelligent function modules | Analog input modules                 | ST1AD2-V          | 2 voltage inputs   | ST1B-S4IR2               | ST1B-E4IR2            |
|                              |                                      | ST1AD2-I          | 2 current inputs   |                          |                       |
|                              | Analog output modules                | ST1DA2-V          | 2 voltage outputs  |                          |                       |
|                              |                                      | ST1DA1-I          | 1 current output   |                          |                       |

\* Base modules with screw clamp terminals and base modules with spring clamp terminals cannot be used together in one system. Use either one of them.

### 1.3.3 Notes on System Setup

Operation of the **ST1PSD** power distribution module is possible in two different modes: In “H” mode, 24 V DC is made available to supply the head station and the I/O modules, as well as 5 V DC for the backplane bus. In “R” mode only the internal backplane bus is supplied with 5 V DC. The mode (H or R) is selected by using different base modules that are identified by the letters “H” or “R” in the type designation.

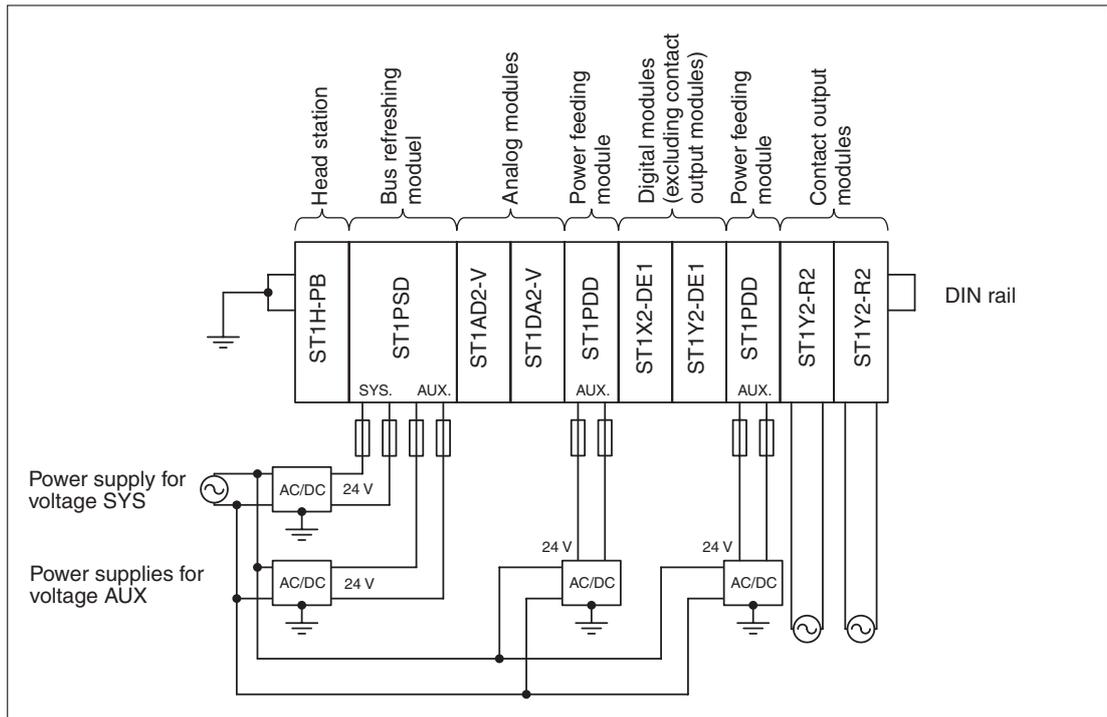
At least one ST1PSD is required in “H” mode in order to operate an ST series station. This is installed on the right side of the head station. Additional power supplies ( with the “R” base module) are only required if power consumption of the installed ST modules exceeds the capacity a single power distribution module.

The **ST1PDD** power feeding module supplies the connected actuators and sensors with a 24 V direct current.

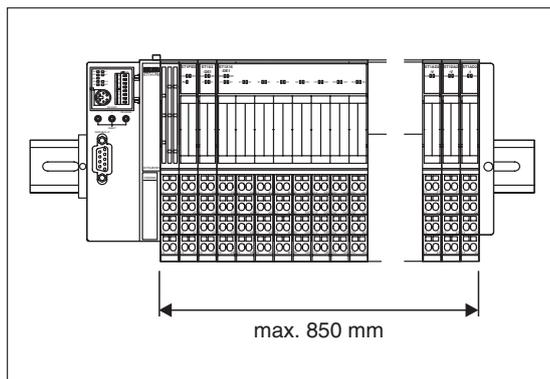
Use voltages from different sources to connect to the module's "SYS" and "AUX" terminals. If multiple ST1PDD are used, then all "SYS" voltage inputs must be supplied by the same power source.

The power distribution modules and power feeding modules are not overload-protected. It is strictly required to provide fuses between power supply and module.

Analog modules must be separately supplied with power. Use an ST1PDD to separate the power supply of digital and analog modules. The ST1PDD is mounted on the DIN rail to the left of the modules that it will supply.



The DIN rail on which the modules are mounted must be conductive.



The maximum width of a station consisting of modules of the MELSEC ST series is 850 mm. Please note that the width of the head station is not counted.

## 2 Specifications

### 2.1 General Specifications


**CAUTION:**

*Please operate the modules of the MELSEC ST 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   |                        |                            |                  |  |
|--|--|------------------------|----------------------------|------------------|--|
| Operating ambient temperature              | 0 to +55 °C  |                        |                            |                  |  |
| Storage ambient temperature                | -25 to +75 °C  |                        |                            |                  |  |
| Ambient humidity for operation and storage | 5 to 95 %, relative humidity, non-condensing   |                        |                            |                  |  |
| Vibration resistance                       | Conforms to JISB3501 and IEC61131-2  | Intermittent Vibration |                            |                  | Sweep count for X, Y, Z<br><br>10 times (80 minutes in each direction) |
|  |  | Frequency              | Acceleration               | Amplitude (half) |  |
|  |  | 10 to 57 Hz            | —                          | 0.075 mm         |  |
|  |  | 57 to 150 Hz           | 9.8 m/s <sup>2</sup> (1 g) | —                |  |
|  |  | Continuous Vibration   |                            |                  |  |
|  |  | 10 to 57 Hz            | —                          | 0.035 mm         |  |
| 57 to 150 Hz                               | 9.8 m/s <sup>2</sup> (1 g)   | —                      |                            |                  |  |
| Shock resistance                           | Conforms to JIS B3501 and IEC61131-2: 15 g, 3 times in each direction X, Y and Z   |                        |                            |                  |  |
| Operating environment                      | No dust, soot, corrosive or conductive dust, corrosive or flammable gas  |                        |                            |                  |  |
| Operating altitude                         | max. 2000 m above MSL (Main Sea Level)<br>(Do not use or store the PLC under pressure higher than the atmospheric pressure at MSL (0 m). Doing so can cause malfunction. When using the PLC under pressure, please contact your local representative.) |                        |                            |                  |  |
| Installation location                      | Inside control panel   |                        |                            |                  |  |
| Overvoltage category <sup>①</sup>          | II max.  |                        |                            |                  |  |
| Pollution level <sup>②</sup>               | 2 max.   |                        |                            |                  |  |

<sup>①</sup> This indicates the section of the power supply to which the equipment is assumed to be connected between the public electrical power distribution network and the machinery within premises. Category II applies to equipment for which electrical power is supplied from fixed facilities. The surge voltage withstand level for up to the rated voltage of 300 V is 2500 V.

<sup>②</sup> This index indicates the degree to which conductive material is generated in the environment where the equipment is used. Pollution level 2 is when only non-conductive pollution occurs but temporary conductivity may be produced due to condensation.

## 2.2 Specifications of the Modules

### 2.2.1 Head Station

| Item                                |   | ST1H-PB   |                                       |  |      |      |
|-------------------------------------|---|---|---------------------------------------|--|------|------|
| PROFIBUS/DP station type            |   | Slave station   |                                       |  |      |      |
| Applicable FDL address              |   | 0 to 99 (Factory-set to FDL address 0)                                    |                                       |  |      |      |
| Maximum I/O points                  |   | Depends on the chosen mode: 32, 64, 128 or 256                            |                                       |  |      |      |
| I/O data size                       |   | Varies depending on the maximum I/O points (Refer to the following table) |                                       |  |      |      |
| Number of connectable slice modules | 32-point mode   | maximum 14 modules  |                                       |  |      |      |
|                                     | 64-point mode   | maximum 30 modules  |                                       |  |      |      |
|                                     | 128-point mode  | maximum 62 modules  |                                       |  |      |      |
|                                     | 256-point mode  | maximum 63 modules  |                                       |  |      |      |
| Transmission specification          | Electrical standards and characteristics                          | EIA-RS485 compliant   |                                       |  |      |      |
|                                     | Applicable cable  | Shielded twisted pair cable   |                                       |  |      |      |
|                                     | Network configuration   | Bus type (tree type when repeaters are used)                              |                                       |  |      |      |
|                                     | Data link method  | Polling   |                                       |  |      |      |
|                                     | Transmission encoding method                                      | NRZ   |                                       |  |      |      |
|                                     | Transmission speed and maximum transmission distance <sup>①</sup> | Transmission speed  | Transmission distance [m per segment] | Max. transmission distance when 3 repeaters are used [m] |      |      |
|                                     |   |   | 9.6 kbps                              | 1200   | 4800 |      |
|                                     |   |   | 19.2 kbps                             |  |      |      |
|                                     |   |   | 45.45 kbps                            |  |      |      |
|                                     |   | 93.75 kbps  | 1000                                  | 4000   |      |      |
|                                     |   | 187.5 kbps  |                                       |  | 400  | 1600 |
|                                     |   | 500 kbps  |                                       |  |      |      |
|                                     |   | 1.5 Mbps  | 200                                   | 800  |      |      |
|                                     |   | 3 Mbps  |                                       |  |      |      |
| 6 Mbps                              |   | 100   | 400                                   |  |      |      |
| 12 Mbps                             |   |   |                                       |  |      |      |
| Repeater per network                | Maximum 3 <sup>①</sup>  |   |                                       |  |      |      |
| Number of stations                  | Maximum 32 (including repeater)                                   |   |                                       |  |      |      |
| Number of connectable nodes         | 32 nodes per segment  |   |                                       |  |      |      |
| Programming interface               |   | RS232 Mini-DIN socket for diagnostics and configuration                   |                                       |  |      |      |
| Diagnostics LEDs                    |   | RUN, ERR, REL, DIA, BF, SYN., FRE., M0, M1                                |                                       |  |      |      |
| Number of occupied slices (Width)   |   | 2 slots (25.2 mm)   |                                       |  |      |      |
| Number of occupied I/O points       | Inputs  | 4   |                                       |  |      |      |
|                                     | Outputs   | 4   |                                       |  |      |      |
| Internal power consumption (5 V DC) |   | 530 mA  |                                       |  |      |      |
| Weight                              |   | 0.1 kg  |                                       |  |      |      |

<sup>①</sup> Calculation of the transmission distance [m per network], when repeaters are used:

$$\text{transmission distance [m per network]} = (\text{Number of repeaters} + 1) \times \text{transmission distance [m per segment]}$$

The volume of data that is exchanged between slave and master station depends on the mode that has been set:

| Item                       | 32-point mode  |                | 64-point mode  |                | 128-point mode |                | 256-point mode |                |
|----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                            | Input          | Output         | Input          | Output         | Input          | Output         | Input          | Output         |
| Bit I/O points             | 32 bits        | 32 bits        | 64 bits        | 64 bits        | 128 bits       | 128 bits       | 256 bits       | 256 bits       |
| Word I/O points (variable) | max. 52 words  | max. 32 words  | max. 32 words  |
| Request/Information area   | 14 bytes       | 14 bytes       | 20 bytes       | 20 bytes       | 32 bytes       | 32 bytes       | 56 bytes       | 56 bytes       |
| Total                      | max. 122 bytes | max. 122 bytes | max. 132 bytes | max. 132 bytes | max. 152 bytes | max. 152 bytes | max. 152 bytes | max. 152 bytes |

## 2.2.2 Power Distribution Modules

| Item                                |                                     | ST1PSD  | ST1PDD           |
|-------------------------------------|-------------------------------------|---|------------------|
| SYS.                                | Rated input voltage                 | 24 V DC   | —                |
|                                     | Rated allowable voltage             | 24 V DC $\pm$ 20 %, ripple ratio within 5 %   |                  |
|                                     | Max. rated input current at 24 V DC | 0.7 A   |                  |
|                                     | Output                              | 5 V DC, maximum 2.0 A   |                  |
|                                     | Efficiency                          | $\geq$ 80 %   |                  |
| AUX.                                | Rated input voltage                 | 24 V DC   |                  |
|                                     | Rated allowable voltage             | 24 V DC +20/ -15 %, ripple ratio within 5 %   |                  |
|                                     | Max. rated input current at 24 V DC | 0.7 A   | —                |
|                                     | Output                              | 24 V DC, max. 8.0 A   |                  |
| Dielectric withstand voltage        |                                     | 500 V AC for 1 minute,<br>600 V AC for 1 s across SYS. inputs and AUX. inputs   |                  |
| Insulation resistance               |                                     | $\geq$ 10 M $\Omega$ across SYS. inputs and AUX. inputs<br>(Checked with 500 V DC insulation resistance tester)         |                  |
| Noise durability                    |                                     | Checked with noise simulator (Peak-to-peak noise voltage: 500 V,<br>noise width/noise frequency: 1 $\mu$ s/25 to 60 Hz) |                  |
|                                     |                                     | First transient noise compliant to IEC61000-4-4: 2 kV   |                  |
| Indication of operating status      |                                     | LED "SYS": Indicates that<br>5 V DC are output  | —                |
|                                     |                                     | LED "AUX": Indicates that 24 V DC are output  |                  |
| Number of occupied slices (Width)   |                                     | 2 slots (25.2 mm)   | 1 slot (12.6 mm) |
| Number of occupied I/O points       |                                     | 2 inputs and 2 outputs  |                  |
| Internal power consumption (5 V DC) |                                     | —   | 0.06 A           |
| Weight                              |                                     | 0.06 kg   | 0.03 kg          |

### 2.2.3 Digital Input Modules

| Item                                |          | ST1X2-DE1  | ST1X4-DE1         | ST1X16-DE1         |
|-------------------------------------|----------|--|-------------------|--------------------|
| Number of inputs                    |          | 2  | 4                 | 16                 |
| Isolation method                    |          | Photocoupler   |                   |                    |
| Rated input voltage                 |          | 24 V DC  |                   |                    |
| Rated allowable voltage             |          | 20.4 to 28.8 V, ripple ratio within 5 %  |                   |                    |
| Rated input current                 |          | 4 mA   |                   |                    |
| Voltage for ON                      |          | ≥ 19 V   |                   |                    |
| Current for ON                      |          | ≥ 3 mA   |                   |                    |
| Voltage for OFF                     |          | ≤ 11 V   |                   |                    |
| Current for OFF                     |          | ≤ 1.7 mA   |                   |                    |
| Input resistance                    |          | 5.6 kΩ   |                   |                    |
| Response time                       | OFF → ON | 0.5 ms/1.5 ms or less at 24 V DC<br>Factory setting: 1.5 ms<br>The response time of the input module can be set by using the configuration software of the master station. When the master station is a Mitsubishi Electric PLC, use GX Configurator-DP. |                   |                    |
|                                     | ON → OFF |  |                   |                    |
| Maximum current at 24 V DC          |          | 2 A<br>(During online module change, the maximum inrush current is 2A per input for approx. 5 ms.)   |                   |                    |
| Inputs per group                    |          | 2  | 4                 | 16                 |
| Dielectric withstand voltage        |          | 500 V AC for 1 minute across DC external terminals and FG  |                   |                    |
| Insulation resistance               |          | ≥ 10 MΩ (across DC external terminals and FG, checked with insulation resistance tester)   |                   |                    |
| Noise durability                    |          | Tested with noise simulator (Peak-to-peak noise voltage: 500 V, noise width/noise frequency: 1 μs/25 to 60 Hz)   |                   |                    |
|                                     |          | First transient noise compliant to IEC61000-4-4: 2 kV  |                   |                    |
| Protection of degree                |          | IP20   |                   |                    |
| Indication of operating status      |          | With LEDs RUN, ERR and 1 LED for each input  |                   |                    |
| Number of occupied slices (Width)   |          | 1 slot (12.6 mm)   | 1 slots (12.6 mm) | 8 slots (100.8 mm) |
| Number of occupied I/O points       | Inputs   | 2  | 4                 | 16                 |
|                                     | Outputs  | 2  | 4                 | 16                 |
| Internal power consumption (5 V DC) |          | 85 mA  | 95 mA             | 120 mA             |
| Weight                              |          | 0.03 kg  | 0.03 kg           | 0.11 kg            |

## 2.2.4 Transistor Output Modules (Source Type)

| Item   |             | ST1Y2-TE2   | ST1Y16-TE2                                    | ST1Y2-TPE3   | ST1Y16-TPE3                  |
|--|-------------|---|---|--|------------------------------|
| Number of outputs                                      |             | 2   | 16  | 2  | 16                           |
| Isolation method                                       |             | Photocoupler  |   |  |                              |
| Rated load voltage                                     |             | 24 V DC   |   |  |                              |
| Rated allowable voltage                                |             | 20.4 to 28.8 V, ripple ratio within 5 %   |   |  |                              |
| Maximum load current                                   |             | 0.5 A/output<br>1.0 A/group   | 0.5 A/output,<br>4.0 A/group                  | 1.0 A/output,<br>2.0 A/group   | 1.0 A/output,<br>4.0 A/group |
| Maximum inrush current                                 |             | 4 A, ≤ 10 ms  |   | 2 A, ≤ 10 ms   |                              |
| Leakage current at OFF                                 |             | ≤ 0.1 mA  |   | ≤ 0.3 mA   |                              |
| Maximum voltage drop at ON                             |             | typ. 0.2 V DC; max. 0.5 V DC<br>(at a load current of 0.5 A)  |   | typ. 0.15 V DC; max. 0.25 V DC<br>(at a load current of 1.0 A)   |                              |
| Response time  | OFF →<br>ON | ≤ 1 ms  |   | ≤ 0.5 ms   |                              |
|  | OFF →<br>ON | ≤ 1 ms (with rated and resistive load)  |   | ≤ 1 ms (with rated and resistive load)   |                              |
| Surge suppressor                                       |             | Zener diode   |   |  |                              |
| Protection   |             | One 4.0 A fuse<br>(unchangeable) <sup>①</sup>   | One 6.7 A fuse<br>(unchangeable) <sup>①</sup> | Thermal protection and short circuit<br>protection<br>After cooling down resp. elimination<br>of the short circuit the operation will<br>continue automatically. |                              |
| Indication of activated protective<br>function         |             | When a fuse blows, the ERR. LED is<br>switched on and a signal is output to<br>the head station. <sup>②</sup>     |   | When a protective function is acti-<br>vated, the ERR. LED is switched on<br>and a signal is output to the<br>head station.                                      |                              |
| Outputs per group                                      |             | 2   | 16  | 2  | 16                           |
| Dielectric withstand voltage                           |             | 500 V AC for 1 minute across DC external terminals and FG   |   |  |                              |
| Insulation resistance                                  |             | ≥ 10 MΩ (across DC external terminals and FG, checked with insulation<br>resistance tester)                       |   |  |                              |
| Noise durability                                       |             | Tested with noise simulator (Peak-to-peak noise voltage: 500 V,<br>noise width/noise frequency: 1 μs/25 to 60 Hz) |   |  |                              |
|  |             | First transient noise compliant to IEC61000-4-4: 2 kV   |   |  |                              |
| Protection of degree                                   |             | IP20  |   |  |                              |
| Indication of operating status                         |             | With LEDs RUN, ERR and 1 LED for each output  |   |  |                              |
| Number of occupied slices (Width)                      |             | 1 slot (12.6 mm)  | 8 slots<br>(100.8 mm)                         | 1 slots (12.6 mm)  | 8 slots<br>(100.8 mm)        |
| Number of occupied<br>I/O points                       | Inputs      | 2   | 16  | 2  | 16                           |
|  | Outputs     | 2   | 16  | 2  | 16                           |
| Internal power consumption<br>(5 V DC), all outputs ON |             | 90 mA   | 150 mA  | 95 mA  | 160 mA                       |
| Weight   |             | 0.03 kg   | 0.11 kg                                       | 0.03 kg  | 0.11 kg                      |

① The fuse is provided to prevent the external wiring from burning when the output of the output module is shorted. Therefore, the output module may not be protected. The fuse may not operate if the output module is damaged due to other failure than short circuit.

② A blown fuse is not detected when the external supply power is off.

## 2.2.5 Contact Output Module

| Item  |   | ST1Y2-R2  |
|---|---|---|
| Number of outputs                                   |   | 2   |
| Isolation method                                    |   | Photocoupler  |
| Rated load voltage                                  |   | 24 V DC/<br>240 V AC  |
| Rated switching current                             |   | At 24 V DC: 2 A (resistive load) per output<br>At 240 V AC: 2 A (cosφ = 1) per output<br>4 A max. per group |
| Minimum switching load                              |   | 5 V DC (1 mA)   |
| Maximum switching voltage                           |   | 125 V DC/264 V AC   |
| Response time                                       | OFF →<br>ON   | ≤ 10 ms   |
|   | ON →<br>OFF   | ≤ 12 ms   |
| Outputs per group                                   |   | 2   |
| Life of the contacts                                | Mechanical  | ≥ 20 million times  |
|   | Elektrical  | ≥ 100000 times at the rated switching voltage/current load  |
|   |   | ≥ 100000 times at 200 V AC, 1.5 A; 240 V AC, 1 A (cosφ = 0.7)   |
|   |   | ≥ 100000 times at 200 V AC, 1 A; 240 V AC, 0.5 A (cosφ = 0.35)  |
|   | ≥ 100000 times at 24 V DC, 1 A; 100 V DC, 0.1 A (L/R = 7 ms)  |   |
| Maximum switching frequency                         |   | 3600 times/hour   |
| Surge suppressor                                    |   | Not provided  |
| Fuse  |   | Not provided  |
| Dielectric withstand voltage                        |   | 2830 V AC rms for 3 cycles (operation altitude 2000 m)  |
| Insulation resistance                               |   | ≥ 10 MΩ (across external terminals and FG,<br>checked with insulation resistance tester)                    |
| Noise durability                                    | Tested with noise simulator (Peak-to-peak noise voltage: 500 V,<br>noise width/noise frequency: 1 μs/25 to 60 Hz) |   |
|   | First transient noise compliant to IEC61000-4-4: 2 kV   |   |
| Protection of degree                                |   | IP20  |
| Indication of operating status                      |   | With LEDs RUN, ERR and 1 LED for each output  |
| Number of occupied slices (Width)                   |   | 1 slot (12.6 mm)  |
| Number of occupied I/O points                       | Inputs  | 2   |
|   | Outputs   | 2   |
| Max. current consumption (24 V DC)                  |   | 35 mA (when both relays are switched on)  |
| Internal power consumption (5 V DC), all outputs ON |   | 90 mA   |
| Weight  |   | 0.04 kg   |

## 2.2.6 Analog Input Modules

| Item                                |                 | ST1AD2-V  | ST1AD2-I                 |
|-------------------------------------|-----------------|---|--------------------------|
| Number of input channels            |                 | 2 (1 when differential input signals are used)  |                          |
| Input characteristics               |                 | Single-End or differential connection   |                          |
| Analog input                        |                 | -10 to +10 V<br>0 to 10 V<br>0 to 5 V<br>1 to 5 V   | 0 to 20 mA<br>4 to 20 mA |
| Input resistance                    | at Single-End   | 1.0 M $\Omega$  | 125 $\Omega$             |
|                                     | at differential | 2.0 M $\Omega$  | 250 $\Omega$             |
| Resolution                          |                 | 12 bit + sign   |                          |
| Conversion time                     |                 | max. 0.1 ms per channel   |                          |
| Maximum input                       |                 | $\pm 15$ V  | $\pm 30$ mA              |
| Total error                         |                 | $\pm 0.2$ % (ambient temperature: 20 °C to 30 °C),<br>$\pm 0.4$ % (ambient temperature: 0 °C to 20 °C and 30 °C to 55 °C) |                          |
| Digital output                      |                 | 16 bit  |                          |
| Isolation method                    |                 | The input channels are isolated against the backplane bus by photocouplers. There is no isolation between the channels.   |                          |
| Dielectric withstand voltage        |                 | 500 V AC for 1 minute across the external DC terminals and FG   |                          |
| Insulation resistance               |                 | $\geq 10$ M $\Omega$ ( across external DC terminals and FG,<br>checked with insulation resistance tester)                 |                          |
| Noise durability                    |                 | Tested with noise simulator (Peak-to-peak noise voltage: 500 V,<br>noise width/noise frequency: 1 $\mu$ s/25 to 60 Hz)    |                          |
|                                     |                 | First transient noise compliant to IEC61000-4-4: 2 kV   |                          |
| Indication of operating status      |                 | With LEDs RUN and ERR   |                          |
| Number of occupied slices (Width)   |                 | 1 slot (12.6 mm)  |                          |
| Number of occupied I/O points       | Inputs          | 2   |                          |
|                                     | Outputs         | 2   |                          |
| Internal power consumption (5 V DC) |                 | 110 mA  | 110 mA                   |
| Weight                              |                 | 0.03 kg   |                          |

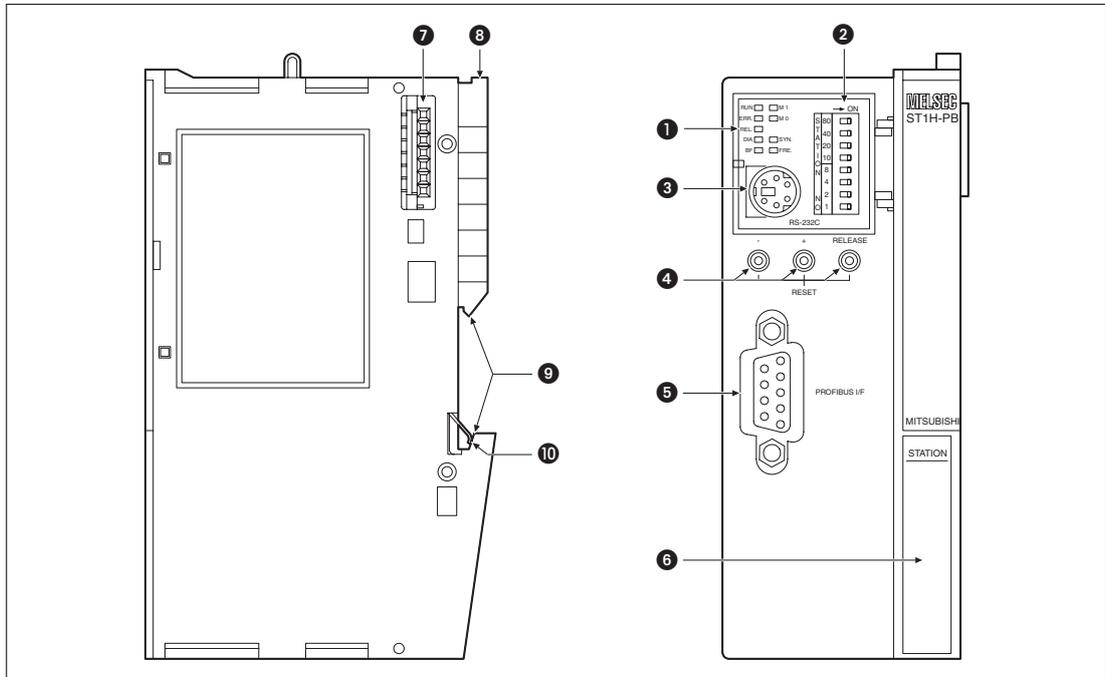
## 2.2.7 Analog Output Modules

| Item                                | ST1DA2-V   | ST1DA1-I                 |
|-------------------------------------|--|--------------------------|
| Number of input channels            | 2  | 1                        |
| Analog output                       | -10 to +10 V<br>0 to 10 V<br>0 to 5 V<br>1 to 5 V  | 0 to 20 mA<br>4 to 20 mA |
| Resolution                          | 12 bit + sign  |                          |
| Conversion time                     | max. 0.1 ms per channel  |                          |
| Maximum output                      | ±12 V  | ±21 mA                   |
| Total error                         | ±0.2 % (ambient temperature: 20 °C to 30 °C),<br>±0.4 % (ambient temperature: 0 °C to 20 °C and 30 °C to 55 °C)          |                          |
| Resistance of the connected load    | > 1 kΩ (-10 to +10 V and 0 to 10 V)<br>> 500 Ω (0 to +5 V and 1 to 5 V)  | < 500 Ω                  |
| Isolation method                    | The output channels are isolated against the backplane bus by photocouplers. There is no isolation between the channels. |                          |
| Dielectric withstand voltage        | 500 V AC for 1 minute across the external DC terminals and FG  |                          |
| Insulation resistance               | ≥ 10 MΩ ( across external DC terminals and FG,<br>checked with insulation resistance tester)                             |                          |
| Noise durability                    | Tested with noise simulator (Peak-to-peak noise voltage: 500 V,<br>noise width/noise frequency: 1 μs/25 to 60 Hz)        |                          |
|                                     | First transient noise compliant to IEC61000-4-4: 2 kV  |                          |
| Indication of operating status      | With LEDs RUN and ERR  |                          |
| Number of occupied slices (Width)   | 1 slot (12.6 mm)   |                          |
| Number of occupied I/O points       | Inputs   | 2                        |
|                                     | Outputs  | 2                        |
| Internal power consumption (5 V DC) | 95 mA  | 95 mA                    |
| Weight                              | 0.03 kg  |                          |

## 3 Description of the Modules

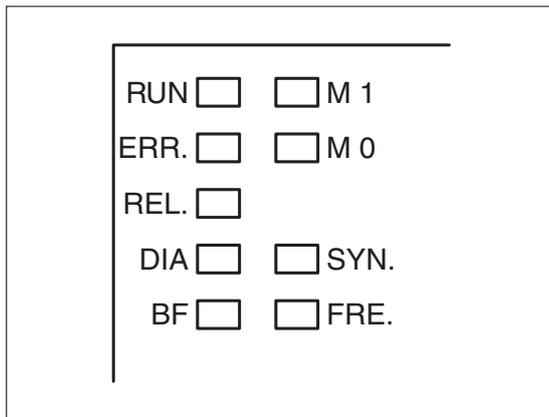
### 3.1 Head Station

#### 3.1.1 Overview



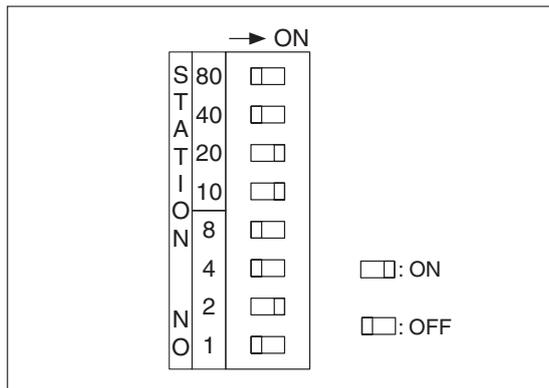
| Number | Meaning                                 | Description   |
|--------|---|---|
| ①      | LEDs                                    | The LEDs show the operating status of the head station. (refer to the next page)  |
| ②      | Switches for setting the station number | These switches are used to set the station number and to activate the self-diagnostics.<br>Range for the station number: 0 to 99 (factory setting: 0)<br>Selection of self-diagnostics: 150<br>Refer to chapter 3.1.3 for a detailed description. |
| ③      | RS232 interface                         | For diagnostics and configuration a personal computer with the software GX Configurator DP installed (version 6.0 or later) is connected with this Mini-DIN socket.   |
| ④      | Buttons ("-", "+" and "RELEASE")        | Used to make online module change and to reset the head station..   |
| ⑤      | PROFIBUS/DP interface                   | Connects the PROFIBUS/DP cable to the head module.  |
| ⑥      | Display plate                           | Write the station number of the head station on this plate  |
| ⑦      | Base module connector                   | Connects the next module (always a power distribution module) to the right of the head station.   |
| ⑧      | Lock lever                              | To remove the head station from the DIN rail, a screwdriver is inserted in this lever from the front of the module and then pulled downward.  |
| ⑨      | DIN rail mounting groove                | Mounts the head station to the DIN rail.  |
| ⑩      | FG contact                              | Grounding metal spring on the back of the head station.<br>FG of all mounted modules ist connected via the conductive DIN rail.   |

### 3.1.2 LEDs of the Head Station



| LED                | LED status | Meaning   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|--------------------|------------|---|--------------------|------------|--|----|----|----|-----|-----|----|-----|----|-----|----|-----|-----|----|----|
| RUN                | ON         | Normally operating  |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | Flickering | <ul style="list-style-type: none"> <li>● Self-diagnostics are being executed</li> <li>● Forced output test mode is being executed</li> </ul>  |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | OFF        | <ul style="list-style-type: none"> <li>● The external power is off.</li> <li>● A watchdog timer error has been occurred.</li> </ul>   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| ERR.               | ON         | A error occurred in the head station or in a slice module.  |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | Flickering | <ul style="list-style-type: none"> <li>● Communication error</li> <li>● The station number has been changed after the head station was powered on.</li> </ul>   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | OFF        | Normally operating (no error)   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| REL.               | ON         | During online module change the settings of the selected slice module were saved and the module can now be remounted.   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | Flickering | After changing a slice module the settings are loaded to the new module.  |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | OFF        | Online module change has been completed or is not selected.   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| DIA                | ON         | Extended diagnostic information being sent to master station  |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | Flickering | Self-diagnostics of head module being executed.   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | OFF        | No extended diagnostic information.   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| BF                 | ON         | PROFIBUS/DP data communication is stopped.  |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | OFF        | PROFIBUS/DP data communication normal   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| M1                 | —          | The LEDs M0 and M1 indicate the maximum input/output points setting status of the head module: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th rowspan="2">Maximum I/O points</th> <th colspan="2">LED status</th> </tr> <tr> <th>M1</th> <th>M0</th> </tr> </thead> <tbody> <tr> <td>32</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>64</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>128</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>256</td> <td>ON</td> <td>ON</td> </tr> </tbody> </table> | Maximum I/O points | LED status |  | M1 | M0 | 32 | OFF | OFF | 64 | OFF | ON | 128 | ON | OFF | 256 | ON | ON |
| Maximum I/O points |            |   |                    | LED status |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    |            |   | M1                 | M0         |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| 32                 |            |   | OFF                | OFF        |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| 64                 |            |   | OFF                | ON         |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| 128                | ON         | OFF   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| 256                | ON         | ON  |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| M0                 |            |   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| SYN.               | ON         | SYNC mode is activated.   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | OFF        | Normally operating  |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
| FRE.               | ON         | FREEZE mode is activated.   |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |
|                    | OFF        | Normally operating  |                    |            |  |    |    |    |     |     |    |     |    |     |    |     |     |    |    |

### 3.1.3 Switches



Use the head station switches to set the station number for addressing this slave station in the PROFIBUS/DP.

The station number can be set in a range between 0 and 99. If the value “150” is set, then the head module executes a self diagnosis.

Each of the 8 switches has a certain value. The total set value is a result of the sum of the values of all switches that are in the “ON” position.

| Station number          | Settings  |           |           |           |          |          |          |          |
|-------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|
|                         | 10s place |           |           |           | 1s place |          |          |          |
|                         | 80        | 40        | 20        | 10        | 8        | 4        | 2        | 1        |
| 0                       | OFF       | OFF       | OFF       | OFF       | OFF      | OFF      | OFF      | OFF      |
| 1                       | OFF       | OFF       | OFF       | OFF       | OFF      | OFF      | OFF      | ON       |
| 2                       | OFF       | OFF       | OFF       | OFF       | OFF      | OFF      | ON       | OFF      |
| 3                       | OFF       | OFF       | OFF       | OFF       | OFF      | OFF      | OFF      | ON       |
| 4                       | OFF       | OFF       | OFF       | OFF       | OFF      | ON       | OFF      | OFF      |
| •                       | •         | •         | •         | •         | •        | •        | •        | •        |
| •                       | •         | •         | •         | •         | •        | •        | •        | •        |
| 10                      | OFF       | OFF       | OFF       | ON        | OFF      | OFF      | OFF      | OFF      |
| 11                      | OFF       | OFF       | OFF       | ON        | OFF      | OFF      | OFF      | ON       |
| •                       | •         | •         | •         | •         | •        | •        | •        | •        |
| •                       | •         | •         | •         | •         | •        | •        | •        | •        |
| 98                      | ON        | OFF       | OFF       | ON        | ON       | OFF      | OFF      | OFF      |
| 99                      | ON        | OFF       | OFF       | ON        | ON       | OFF      | OFF      | ON       |
| <b>Self-diagnostics</b> | <b>80</b> | <b>40</b> | <b>20</b> | <b>10</b> | <b>8</b> | <b>4</b> | <b>2</b> | <b>1</b> |
| 150                     | ON        | ON        | ON        | ON        | OFF      | OFF      | OFF      | OFF      |

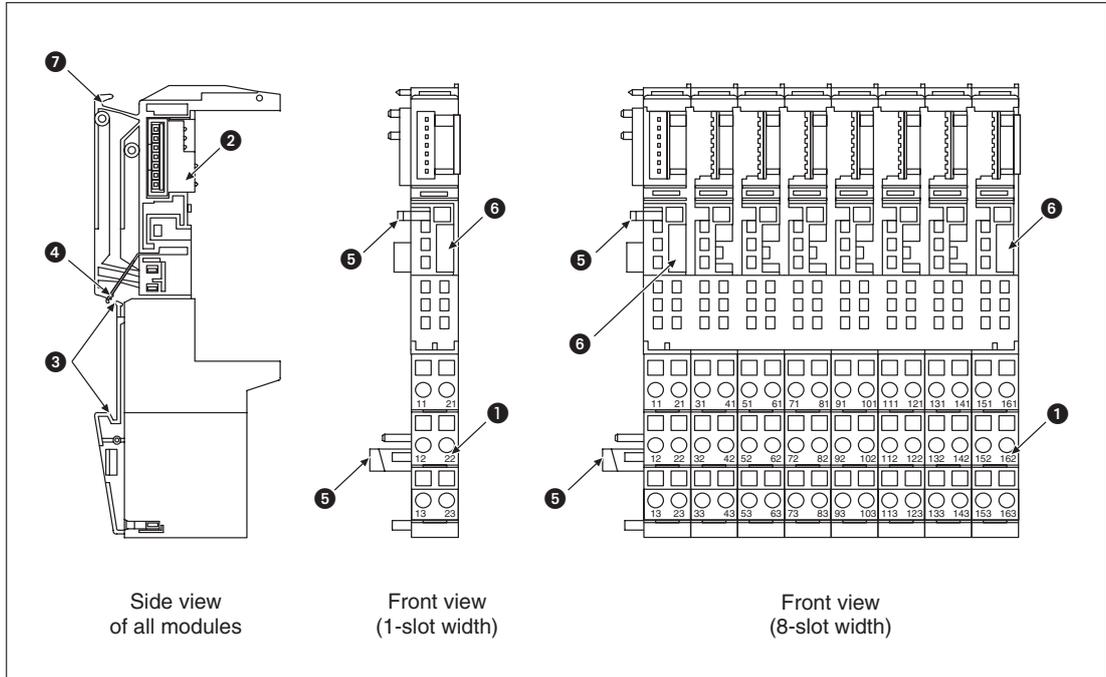
For example, in the illustration above station number 32 is set.

#### NOTES

Only set station numbers in the range of 0 to 99, and set the value “150” for self-diagnostics. If other values are set, then an error will occur after switching on or resetting the head module.

The sum resulting from the switch settings for the single digits (8, 4, 2, and 1) may not exceed the value of “9”.

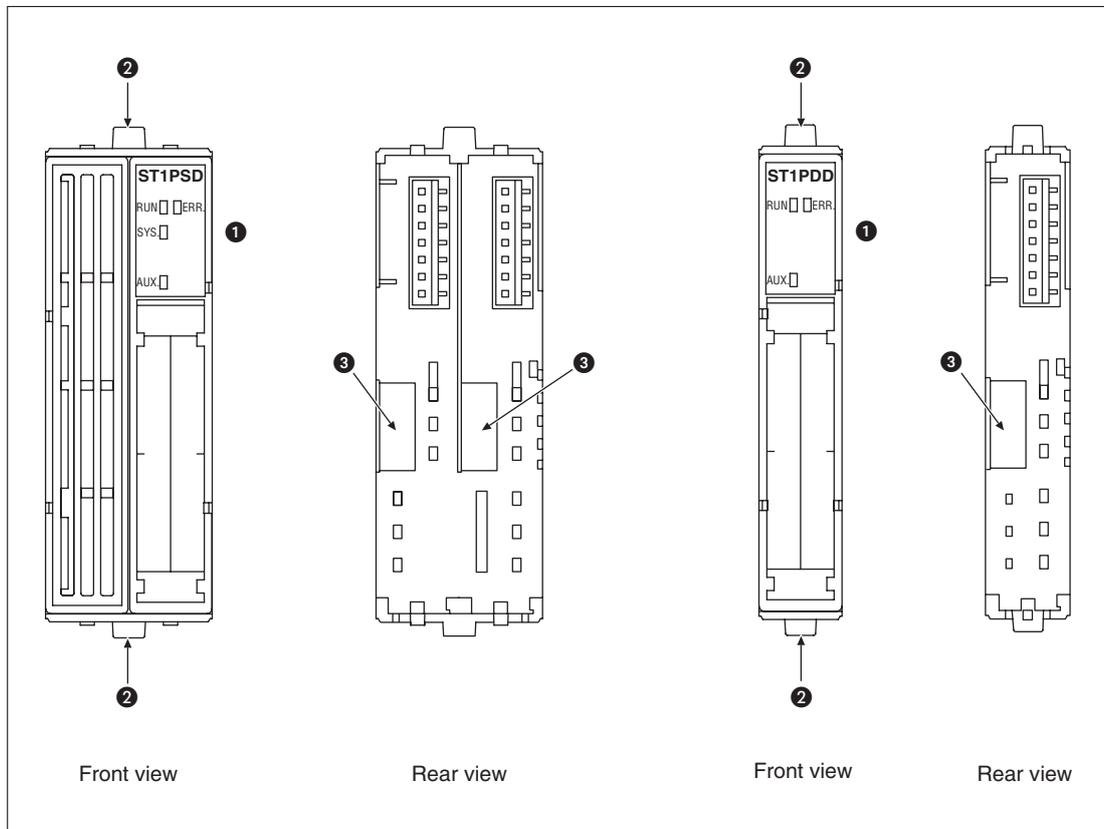
### 3.2 Base Modules



| Number | Meaning                        | Description  |
|--------|--------------------------------|--|
| 1      | External wiring terminal block | Terminal block for connection of external wiring.<br>The terminal block color changes depending on the slice module type.<br><ul style="list-style-type: none"> <li>● Dark grey: I/O modules</li> <li>● Red: Power distribution modules</li> </ul> The terminal block for shield has light gray stripes.   |
| 2      | Base module connector          | Connector for electrical connection between base modules. The connector color changes depending on the base module type.<br><ul style="list-style-type: none"> <li>● Dark gray: For bus refresh module (for powering the head module), power feeding modules and I/O modules.</li> <li>● Yellow: For bus refresh module (for extension)</li> </ul> |
| 3      | DIN rail mounting groove       | Mounts the head station to the DIN rail.   |
| 4      | FG contact                     | Grounding metal spring on the back of the head station.<br>FG of all mounted modules ist connected via the conductive DIN rail.  |
| 5      | Fixing hook                    | Hook for coupling with an adjacent base module.  |
| 6      | Coding element mounting holes  | The coding element is fixed in this hole automatically while mounting a slice module for the first time.   |
| 7      | Lock lever                     | To remove the base module from the DIN rail, insert a screwdriver in this lever from the front of the module and then pulled the screwdriver downward.   |

## 3.3 Power Distribution Modules

### 3.3.1 Overview



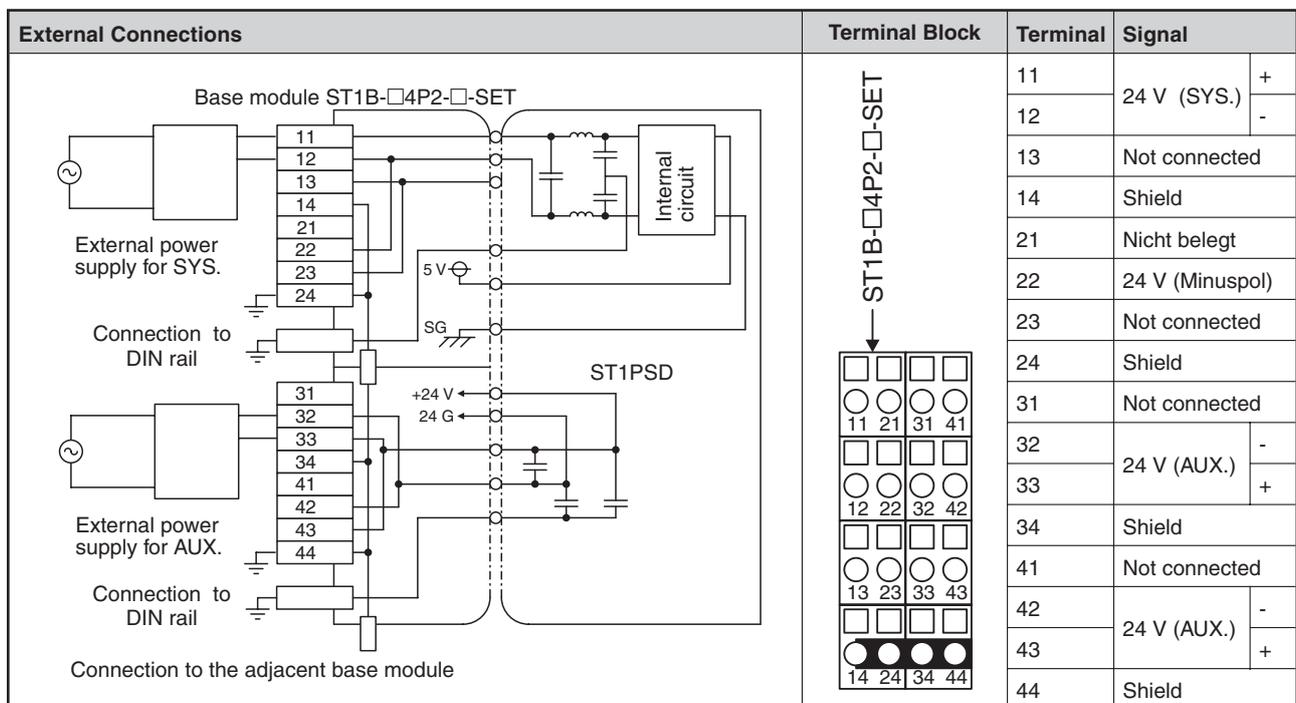
| Number | Meaning                               | Description   |
|--------|---------------------------------------|---|
| ①      | LEDs                                  | The LEDs show the operating status of the module. (refer to chapter 3.3.2)  |
| ②      | Slice module fixing hooks (both ends) | Hooks for mounting/removing the slice module to/from the base module.<br>Hold down the hooks at both ends, and remove the module.   |
| ③      | Coding elements                       | Provided to prevent a wrong slice module from being inserted into the base module. The slice module can be inserted only when the coding element of the base module matches that of the slice module. |

### 3.3.2 LEDs of the Power Distribution Modules

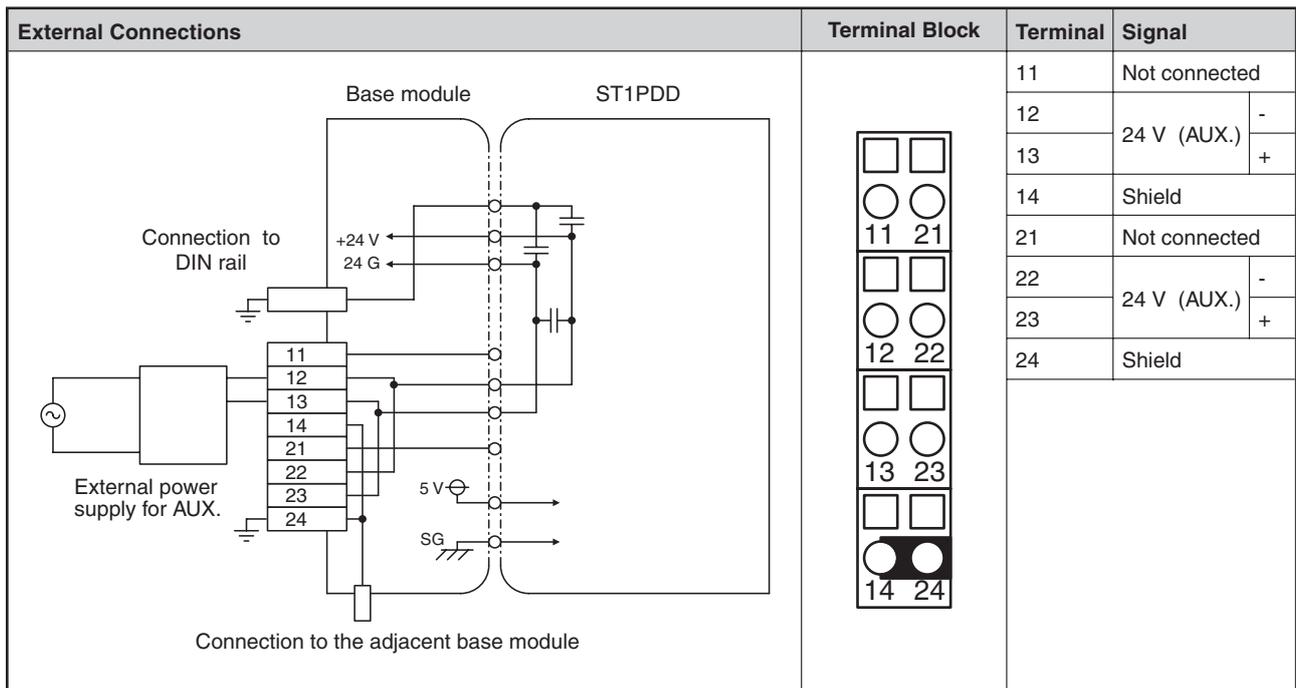
| LED  | LED status   | Meaning  |
|------|--|--|
| RUN  | ON   | Normally operating   |
|      | Flickering   | Flickering in 0.25 s intervals<br>Selected as a module to be replaced online. Power distribution modules cannot be changed while the station is operating. Continue the selection until the RUN LED on the desired module is flickering.         |
|      |  | Flickering in 1 s intervals<br><ul style="list-style-type: none"> <li>● Communication with the master station has stopped.</li> <li>● Slave parameter setting error</li> <li>● Other slice module fault</li> <li>● Internal bus error</li> </ul> |
| OFF  | <ul style="list-style-type: none"> <li>● The external power is off.</li> <li>● Hardware fault</li> <li>● Internal bus error</li> </ul> |  |
| ERR. | ON   | Hardware fault   |
|      | Flickering   | The external power supply voltage (24 V DC) is too low.  |
|      | OFF  | Normally operating   |
| SYS. | ON   | The module provides both the 24 V DC and the 5 V DC voltage.   |
|      | OFF  | 24 V DC voltage low and 5 V DC voltage low.  |
| AUX. | ON   | The 24 V DC voltage is output.   |
|      | OFF  | 24 V DC voltage low  |

### 3.3.3 Terminal Layout and External Connections

#### Bus Refreshing Module ST1PSD

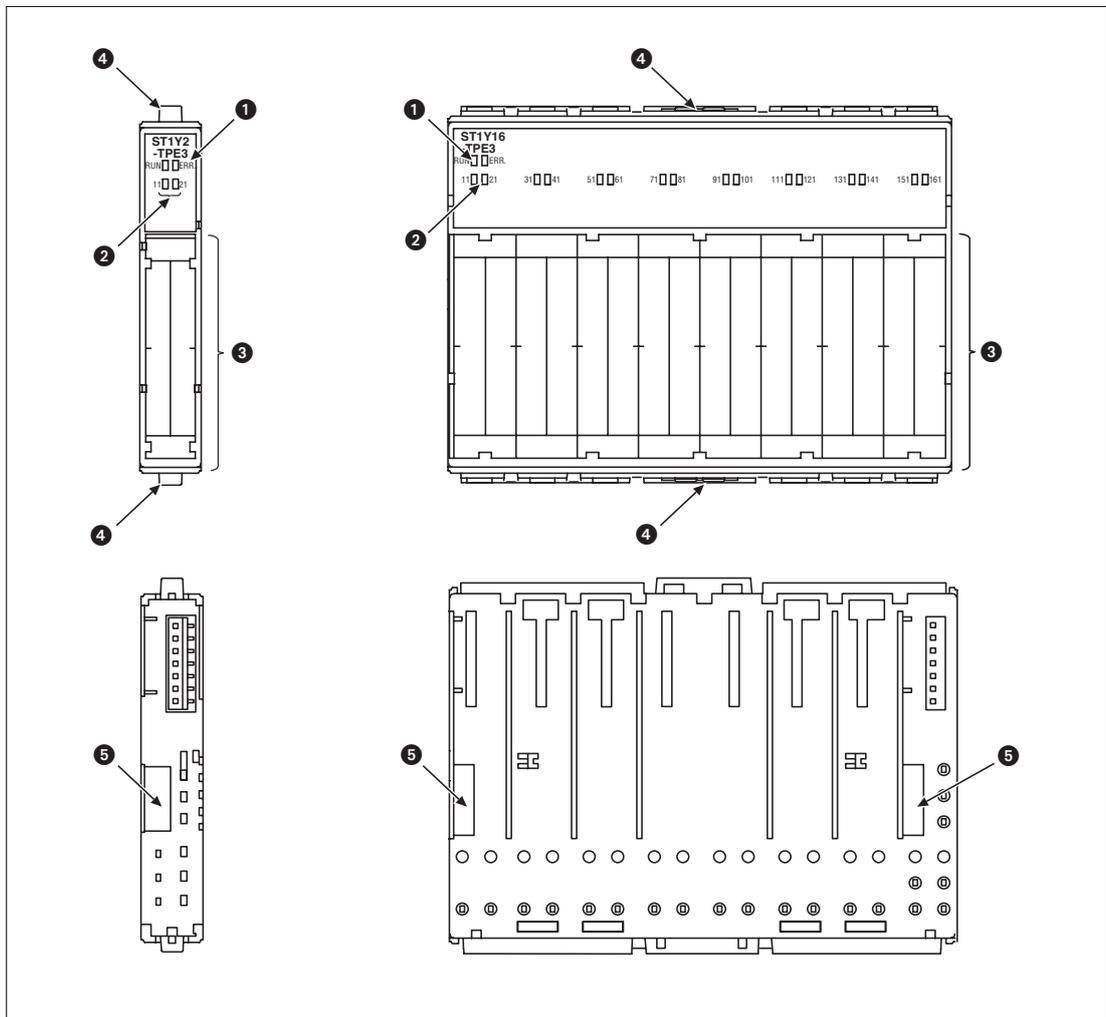


## Power Feeding Module ST1PDD



## 3.4 I/O Modules

### 3.4.1 Overview



| Number | Meaning                               | Description   |
|--------|---------------------------------------|---|
| ①      | RUN LED and ERR. LED                  | <p>The LEDs show the operating status of the module. (refer to page 27)<br/>The background colour of the LEDs is an indicator for the type of module:</p> <ul style="list-style-type: none"> <li>● Light grey: Digital input modules</li> <li>● Orange: Digital output modules (transistor output)</li> <li>● Brown: Digital output modules (contact output)</li> <li>● Green: Analog input modules</li> <li>● Blue: Analog output modules</li> </ul> |
| ②      | I/O status LEDs                       | Indicate whether the inputs/outputs are ON or OFF. The LED is lit when the corresponding input/output is ON.  |
| ③      | Face plate                            | Use the symbol label to note the names of external connections. A diagram of the wiring to the base module is printed on the surface. When checking the wiring diagram, remove the symbol label.  |
| ④      | Slice module fixing hooks (both ends) | Hooks for mounting/removing the slice module to/from the base module. Hold down the hooks at both ends, and remove the module.  |
| ⑤      | Coding element                        | Provided to prevent a wrong slice module from being inserted into the base module. The slice module can be inserted only when the coding element of the base module matches that of the slice module.   |

### 3.4.2 LEDs of the I/O Modules

| LED  | LED  | Meaning   |
|------|--|---|
| RUN  | ON   | Normally operating  |
|      | Flickering   | Flickering in 0.25 s intervals<br>Selected as a module to be replaced online.   |
|      |  | Flickering in 1 s intervals <ul style="list-style-type: none"> <li>● Communication with the master station has stopped.</li> <li>● Slave parameter setting error</li> <li>● Other slice module fault</li> <li>● Internal bus error</li> </ul> |
| OFF  | <ul style="list-style-type: none"> <li>● The external power is off.</li> <li>● Hardware fault</li> <li>● Internal bus error</li> </ul> |   |
| ERR. | ON   | Hardware fault<br>For output modules ST1Y2-TE2 and ST1Y16-TE2 only: The fuse has blown.   |
|      | Flickering   | For output modules ST1Y2-TPE3 und ST1Y16-TPE3 only:<br>Thermal protection or short circuit protection is activated  |
|      | OFF  | Normally operating  |

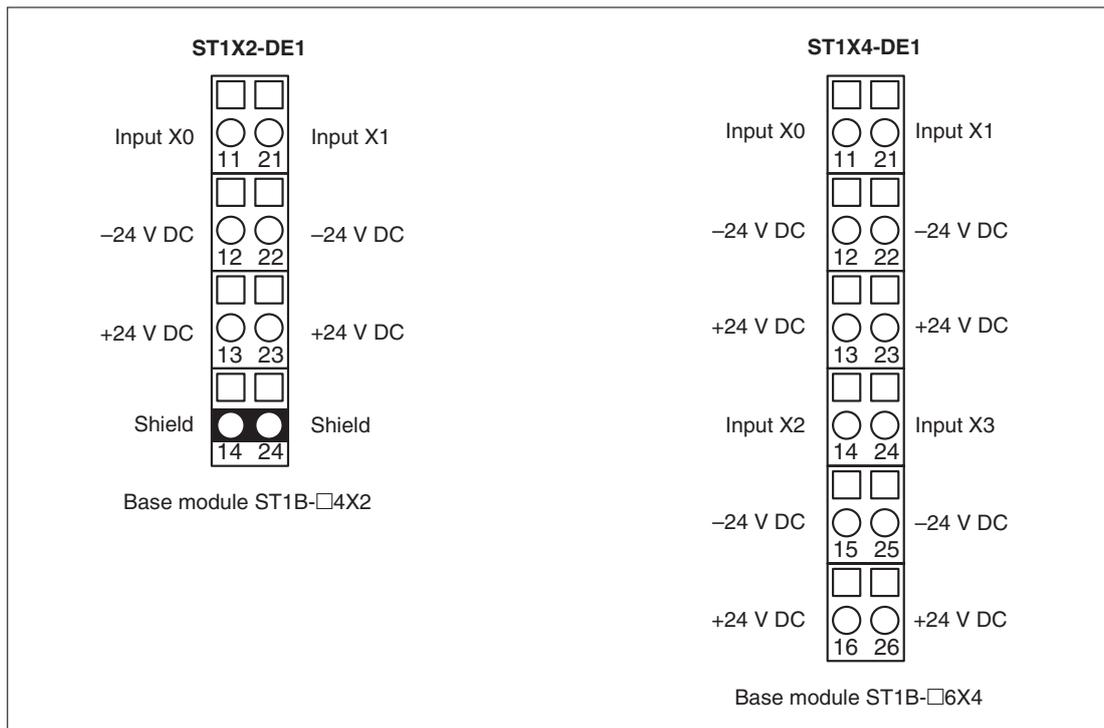
### 3.4.3 Terminal Layout

The following illustrations show the signals that are assigned to the base module terminals, when the corresponding electronics modules is mounted.

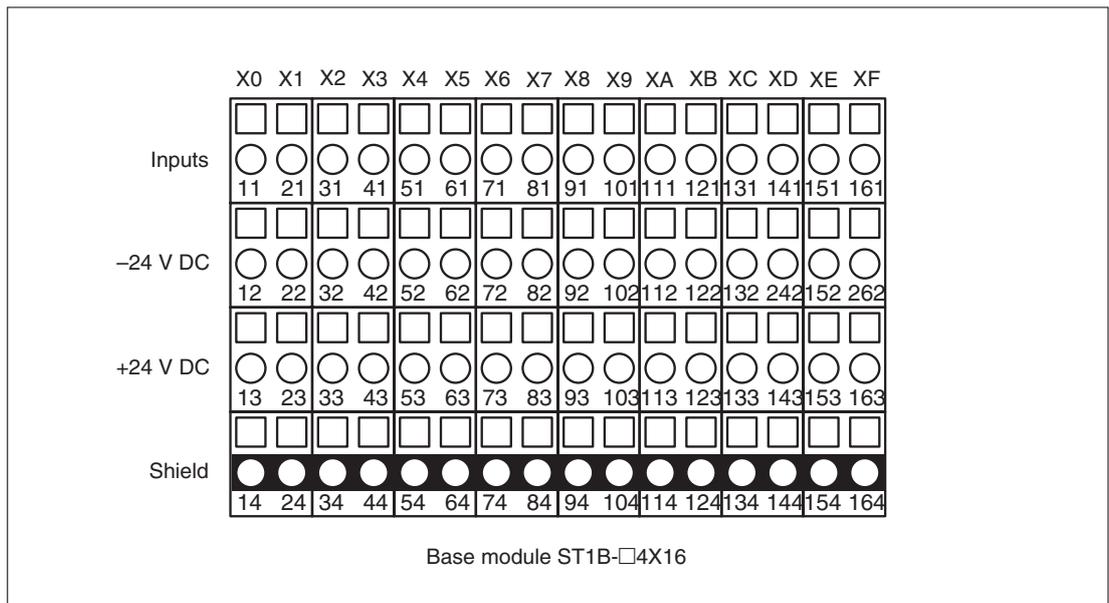
In the base module designations, the place holder "□" stands for the letters "S" (spring clamp terminal) or "E" (screw clamp terminal).

With the input modules the terminals supply the 24 V DC power for the connected switches or sensors. Terminals with the same designations (for example "COM") are connected together internally.

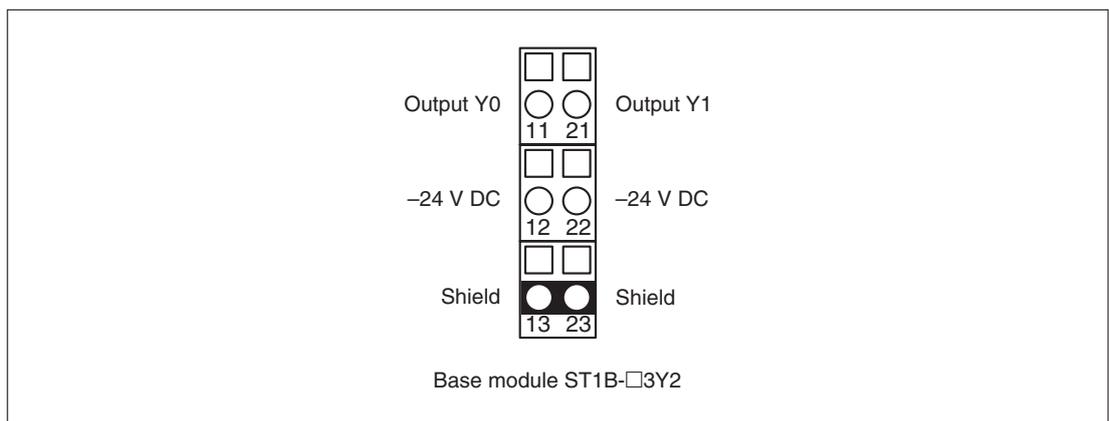
#### Digital Input Modules ST1X2-DE1 and ST1X4-DE1



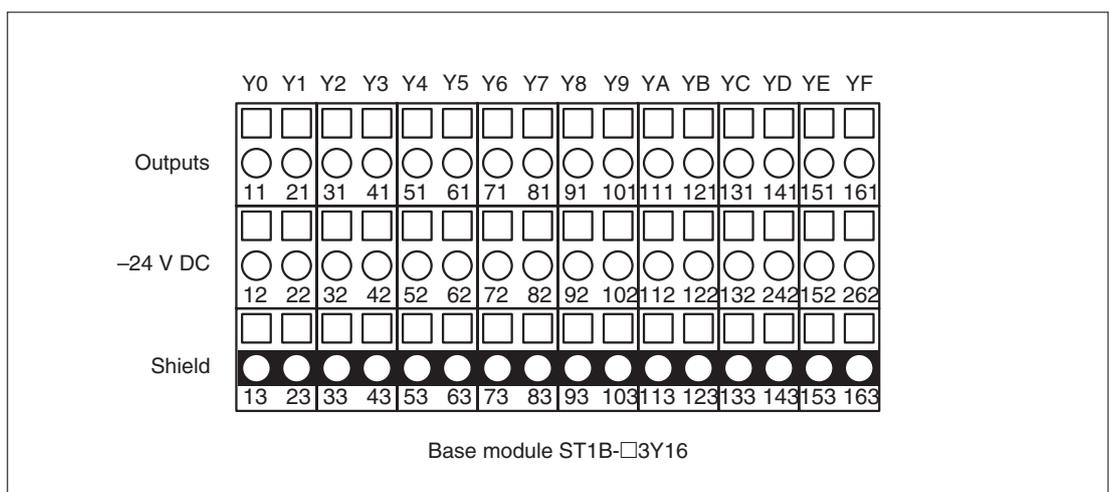
### Digital Input Module ST1X16-DE1

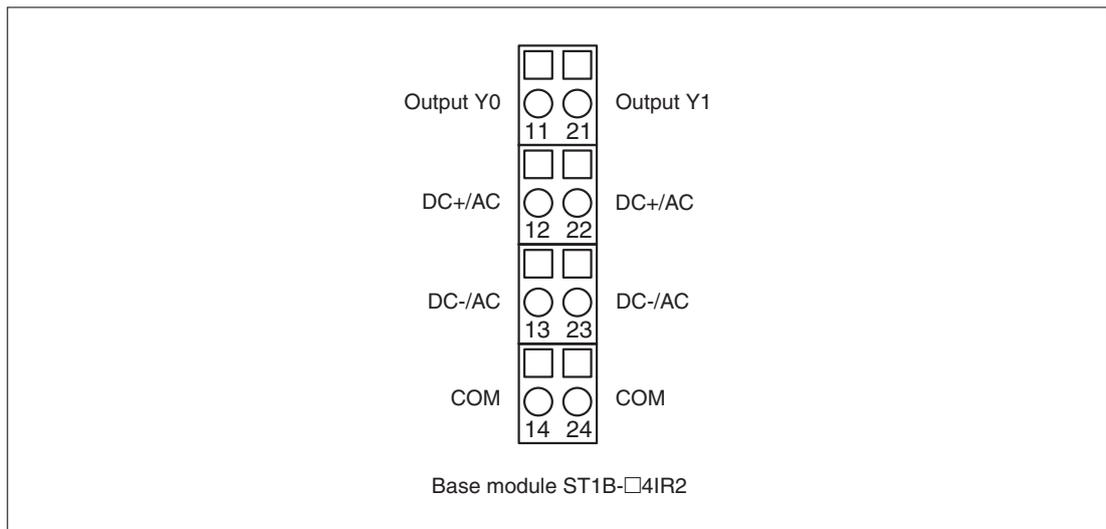
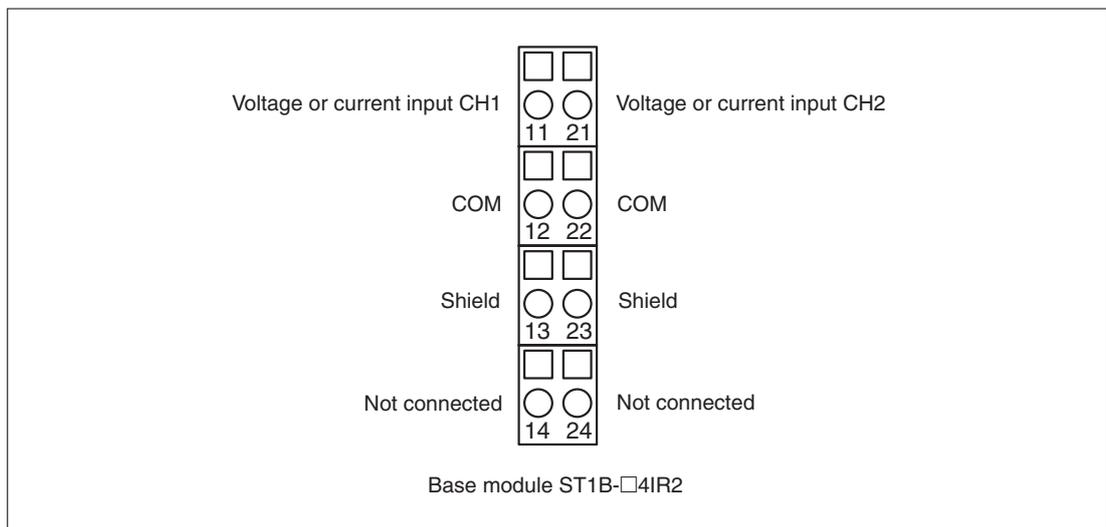
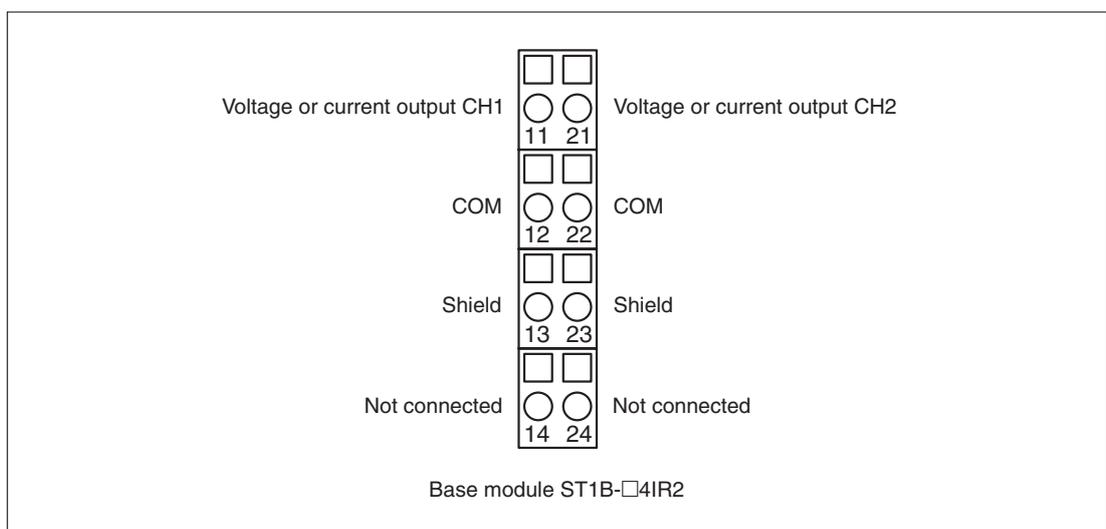


### Digital Output Modules ST1Y2-TE2 and ST1Y2-TPE3



### Digital Output Modules ST1Y16-TE2 and ST1Y16-TPE3



**Contact Output Module ST1Y2-R2****Analog Input Modules****Analog Output Modules**

## 4 Installation

### 4.1 Handling Instructions

#### Precautionary measures

Because the casings and the terminal cover are made of plastic, ensure that the modules are not subjected to mechanical stresses or strong jolts. Under no circumstances may the circuit boards be removed from the device. During the installation ensure that no wires or metal shavings penetrate into the casing.

Tighten the terminal screws and the anchoring screw of the end plate to the torques specified in the following table:

| Screw                            | Tightening torque range |
|----------------------------------|-------------------------|
| Base module terminal block screw | 0.27–0.80 Nm            |
| End bracket screw                | 0.50–0.60 Nm            |



#### ATTENTION:

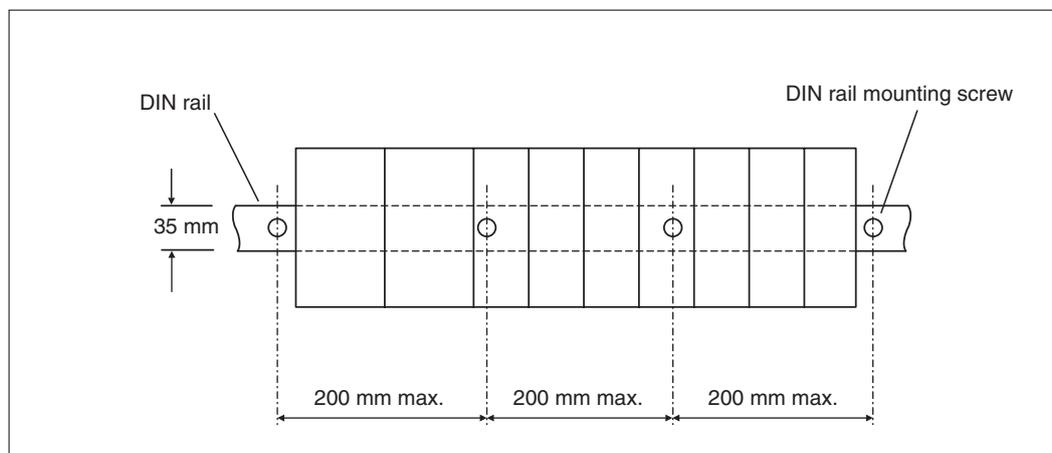
***Do not open the module casing. Do not modify the module. Malfunctions, injury and/or fire can result.***

***The ST modules are designed for mounting on a DIN rail. If the modules are not operated on a DIN rail, then malfunctions can occur.***

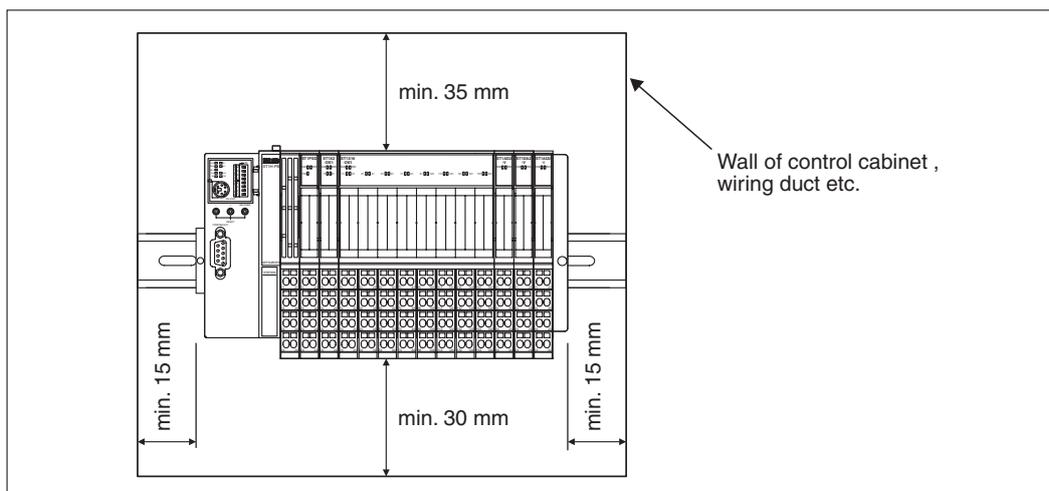
### 4.2 Mounting the DIN Rail

- Use a rail in accordance with DIN 50022 with a width of 35 mm to mount the modules. In addition to anchoring the modules the DIN rail is also used to connect the device grounding of the individual modules. For this reason, the DIN rail must be conductive (made of metal and non-insulated).

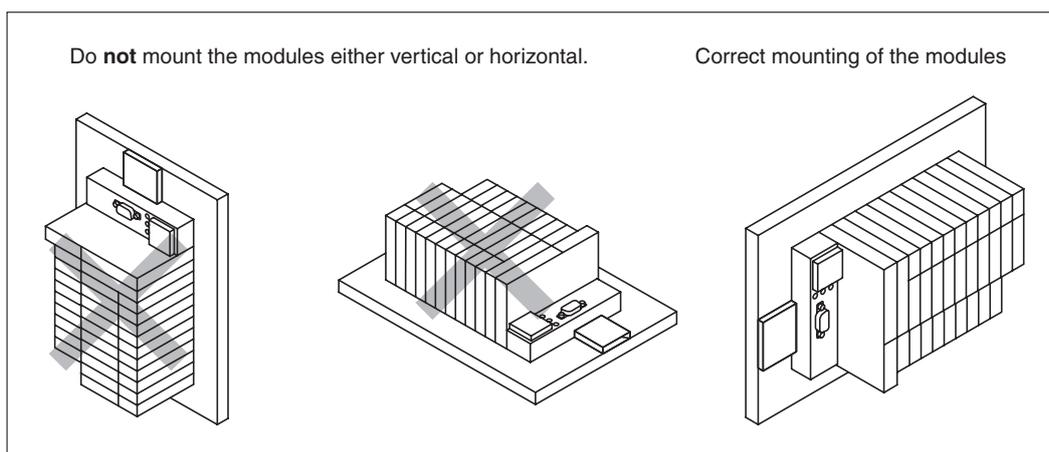
To ensure secure mounting, the screws for anchoring the rail may not be spaced more than 200 mm from each other:



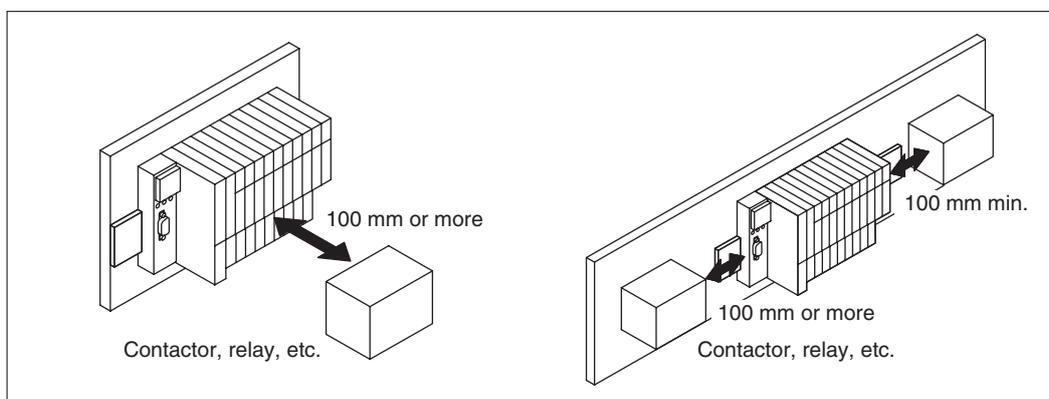
- To ensure proper ventilation and to facilitate module replacement, the following clearances should be maintained around an ST station:



- When mounting, please pay attention to alignment of the modules to ensure adequate ventilation:

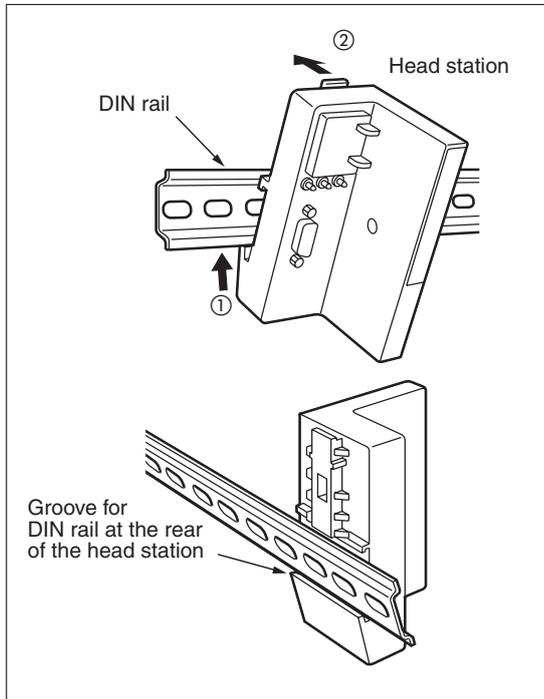


- The DIN rail should be mounted on a level substrate to avoid torsion.
- Mount the ST modules in a separate control cabinet or at a sufficient distance away from electromagnetic switching devices that cause vibrations and emissions. There must be clearance of at least 100 mm between ST modules and such devices.



## 4.3 Mounting the Modules

### 4.3.1 Mounting of the Head Station

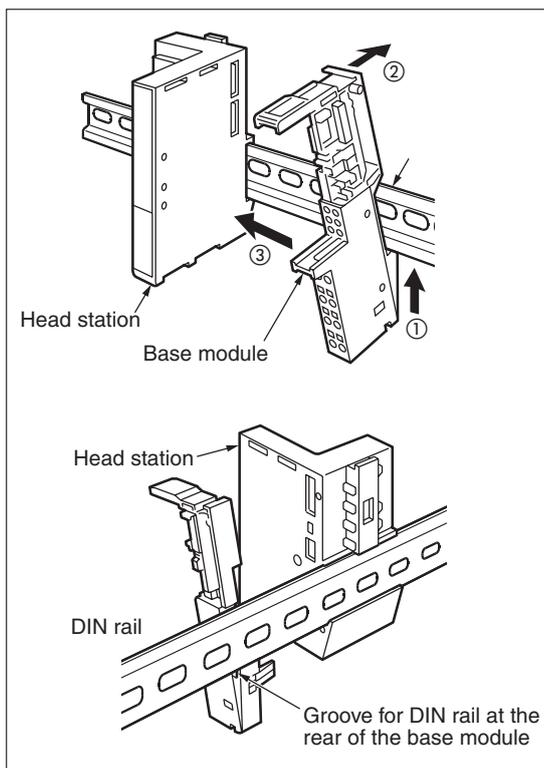


- ① Lightly tip the head module forwards and hook the module under the rail with the lower limit of the DIN rail cutout.
- ② Now press the head module in the direction of the DIN rail until the module clicks into the place and is securely anchored on the DIN rail.  
Allow sufficient space to the left of the head module for the anchoring clips (see page 34).

### 4.3.2 Mounting of the Base Modules

**NOTE**

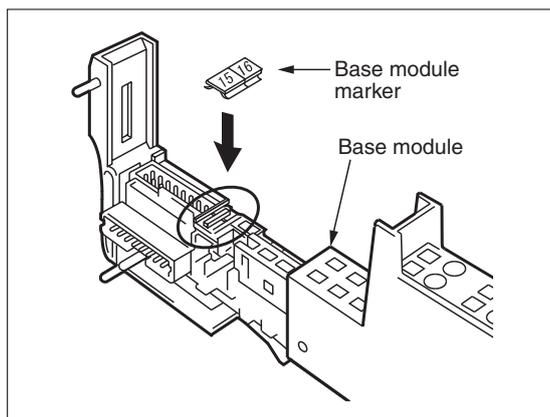
Base modules with spring clamp terminals and base modules with screw clamp terminals may not be used in the same station.



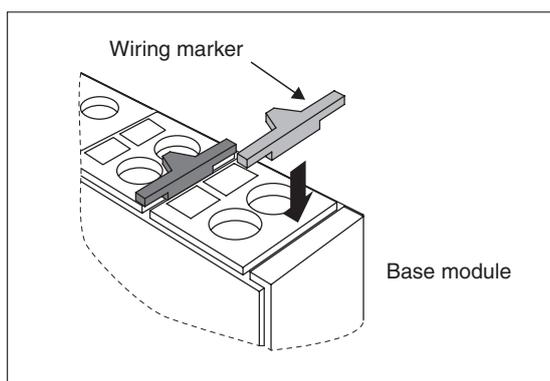
- ① Lightly tilt the base module forwards lightly and hook it under the DIN rail with the lower limit of rail.
- ② Now press the base module in the direction of the DIN rail, until the module clicks into place and is securely anchored on the DIN rail.
- ③ Push the base module on the DIN rail to the left to establish the electrical connection with the head station or with another base module.

Mount the other base modules in the same manner. In this process pay attention to a secure anchoring on the DIN rail. There cannot be any gap between the head module and the first base module, and between the base modules.

### Mounting the Base Module Markers and Wiring Markers



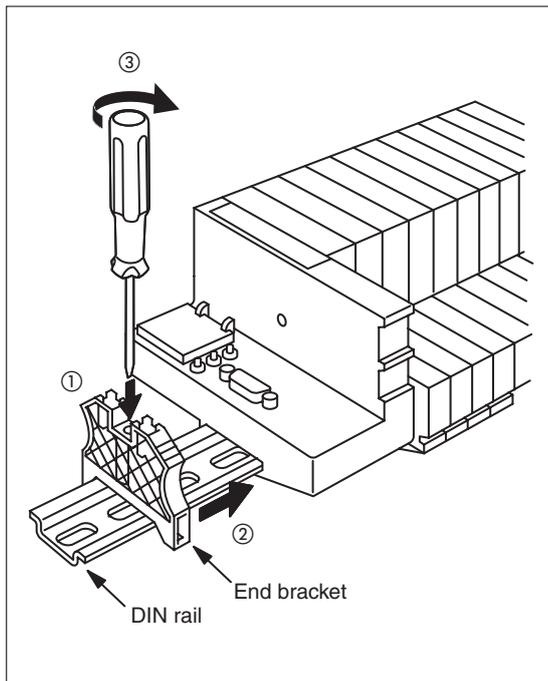
Place the base module markers in the apertures provided underneath the connection for an electronics module.



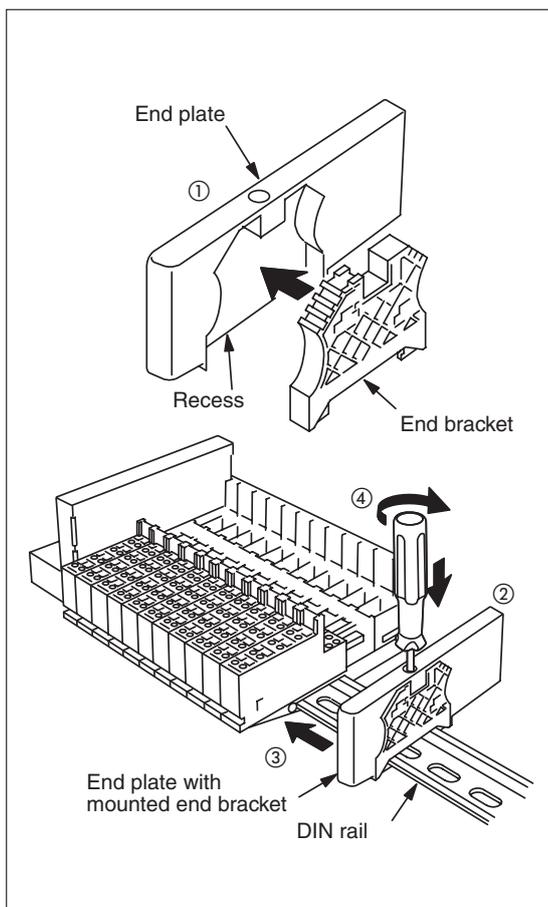
The wiring is identified and diagnostics are simplified with the colored wiring markers. Color coding is listed in the following table. Plug each wiring marker in the slots underneath the terminals.

| Colour of wiring marker | Meaning   |
|-------------------------|---|
| Black                   | Signal wires  |
| Red                     | Positive pole of a DC voltage (24 V DC, 5 V DC)                                 |
| Blue                    | Positive pole of a DC voltage (24 V DC, 5 V DC)<br>N conductor of an AC voltage |
| Red/Blue                | System power supply   |
| Yellow/Green            | Protective earth  |
| Green                   | Shield  |
| Brown                   | Phase of an AC voltage (L1)   |

### 4.3.3 Mounting the End plate and the End Bracket



- ① Place an end bracket on the left side of the head module on the DIN rail.
- ② Push the end bracket until it reaches the head station.
- ③ Firmly tighten the end bracket's screw.



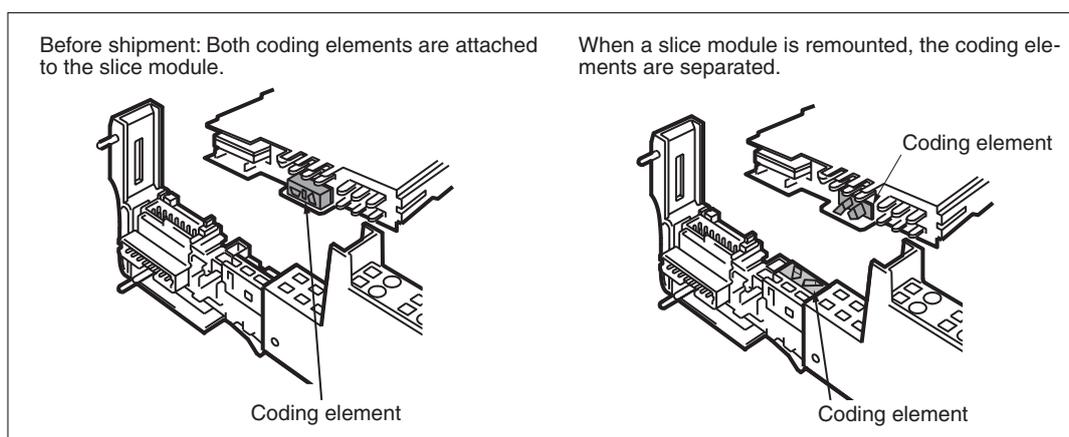
- ① Guide an end bracket into the cutout of the end plate.
- ② Place the end plate next to the last base module on the DIN rail.
- ③ Push the end plate with the end bracket to the left until it reaches the base module.
- ④ Firmly tighten the screw of the end bracket through the hole in the end plate.

### 4.3.4 Mounting the Electronics Modules

#### NOTES

Wire the base modules prior to mounting the electronics modules.

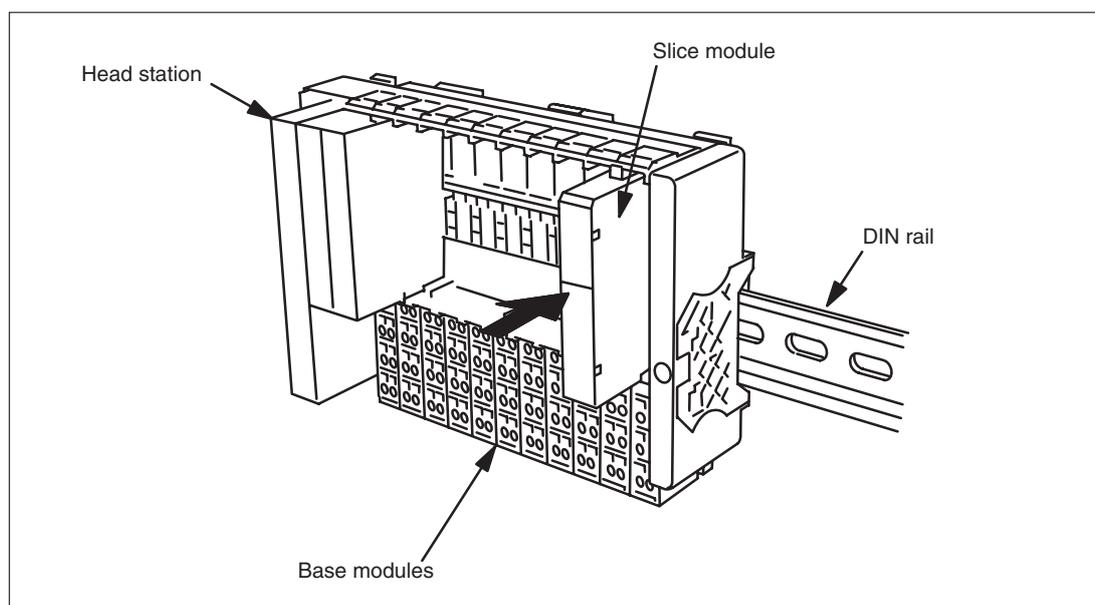
The electronics modules are fitted with two-piece mechanical module coding. When the modules are delivered, both parts of the coding are anchored to the module. When mounting an electronics modules for the first time in a base modules, a part of the coding is automatically anchored in the base module. When removing the electronics module this part remains in the base module. This ensures that when replacing an electronics modules only a module of the same type can be inserted in the base module. When you install an electronics modules in a base module for the first time, you will feel light resistance, while the coding element is anchored in the base module. Nevertheless push the electronics modules all the way into the base module until it clicks into place.



Do not use excessive force if an electronics module cannot be inserted in a base module. In this case, check whether a code element is already installed in the base module.

Prior to mounting the electronics modules the head station, the base modules, the end bracket and the end plate must be anchored onto the DIN rail.

Check whether the correct base module is installed for the electronics module (see chapter 1.3.2). Push the electronics modules into the base module until it clicks into place.



## 4.4 Wiring



### DANGER:

*To avoid electronic shocks and damages to the power distribution of the PLC, for wiring work switch off the PLC on all poles.*

Rigid wires with a cross-section of 0.5 to 2.5 mm<sup>2</sup> and flexible wires with a cross-section of 0.5 to 1.5 mm<sup>2</sup> can be connected to the terminal blocks of the base modules. Flexible wires must be equipped with wire end-sleeves.

### 4.4.1 Connecting the Supply Voltage



### ATTENTION:

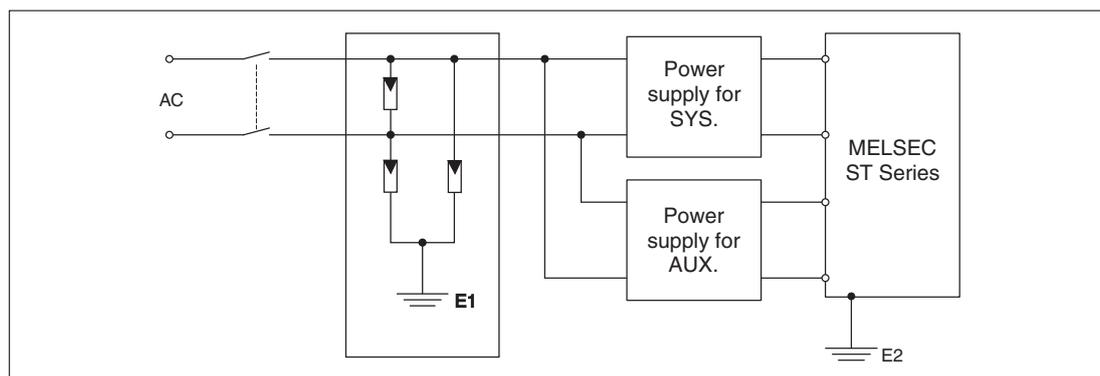
*Check before connecting the ST modules whether the supply voltage from an external power supply is within the range permissible for the ST module.*

The supply voltage of the ST modules should be separated from the supply of the inputs and outputs and the supply of the other devices. If there are strong emissions use a separate power supply which provides 24 V DC for the "SYS" and "AUX" voltages of the ST modules.

The wires with the supply voltage (24 V DC) should be twisted together and laid out in the shortest possible path. Use the maximum possible cross section for these wires (2.5 mm<sup>2</sup>).

The lines for direct current voltage supply (24 V DC) may not be laid out together with lines that conduct high voltages, high currents, or I/O signals. To the extent possible a minimum clearance of 100 mm should be maintained between the lines.

Surge suppressors should be used to protect against over-voltage (for example due to lightning):



### NOTES

*The earthing of the surge protector (E1) and that of the MELSEC ST system (E2) must be executed separately from each other.*

*Lay out the surge protector in such a manner that it is not tripped by permissible voltage fluctuations.*

Also note the instructions for system set-up in chapter 1.3.3.

## 4.4.2 Connecting the I/O Signals

Assignment of base module terminal blocks is described in section 3.4.3.

The lines to the inputs and outputs should always be laid out separately.

Use insulated lines, if the lines with input and output signals cannot be laid out at a sufficient distance from network lines, or from lines that conduct high currents. Analog signals should always be connected via insulated lines. Connect the shielding of the line on one side to the terminals provided on the MELSEC ST station. The terminals, ST1A-SLD-S (for spring clamp terminals) and ST1A-SLD-E (for screw clamp terminals) are available for this purpose.

Metal conduit or cable channels that the wiring runs through, must be earthed.

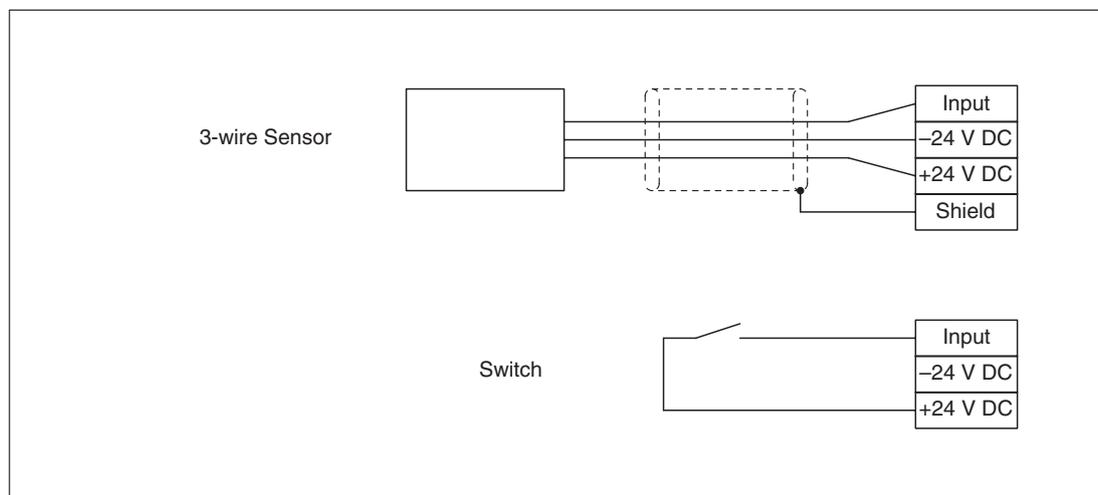
Lines that conduct input or output signals (24 V DC) must be laid out separately from lines that conduct alternating current 110 / 230 V).

**NOTE**

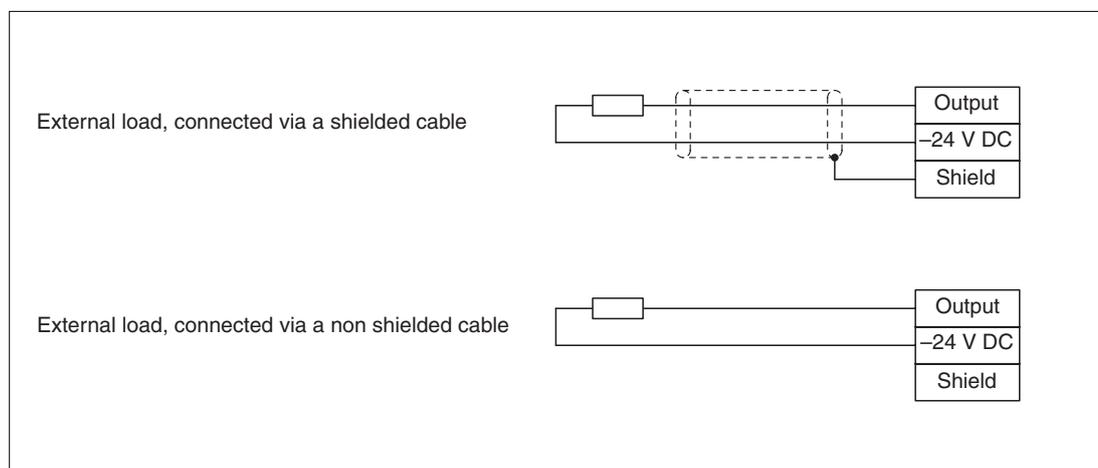
For line lengths over 200 m, capacity losses may occur which can corrupt the input signals.

The following illustrations show the connection of the I/O signals.

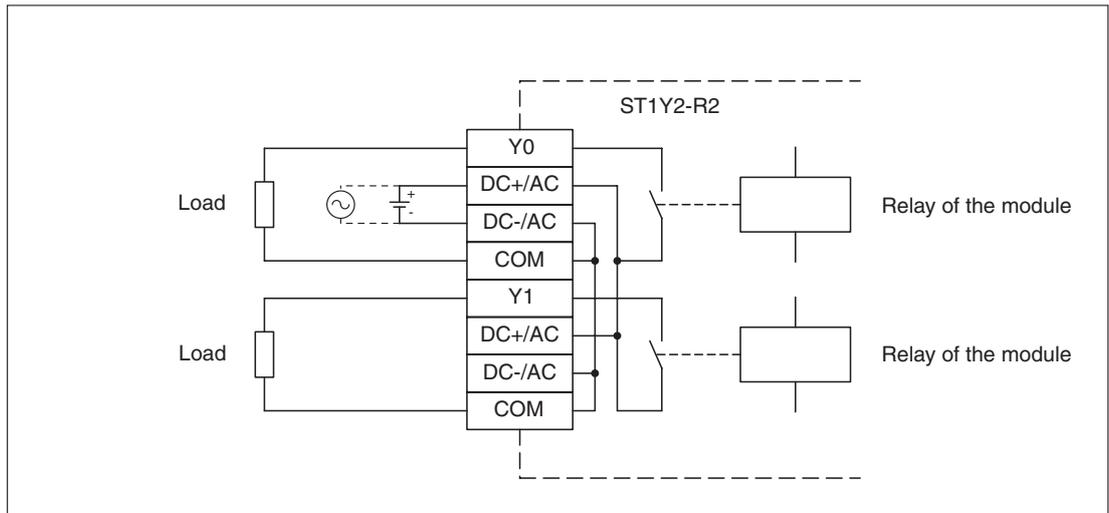
### Digital Input Modules



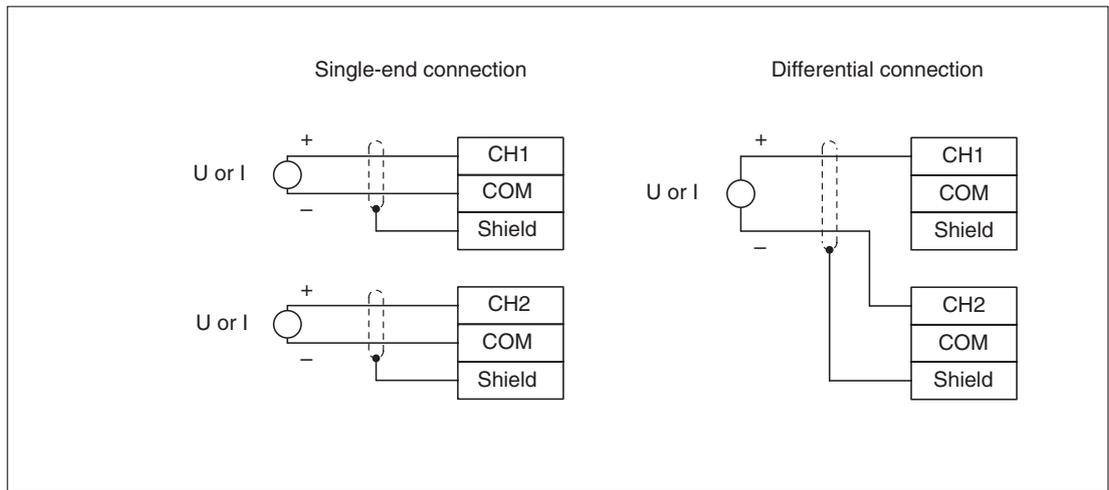
### Transistor Output Modules (Source Type)



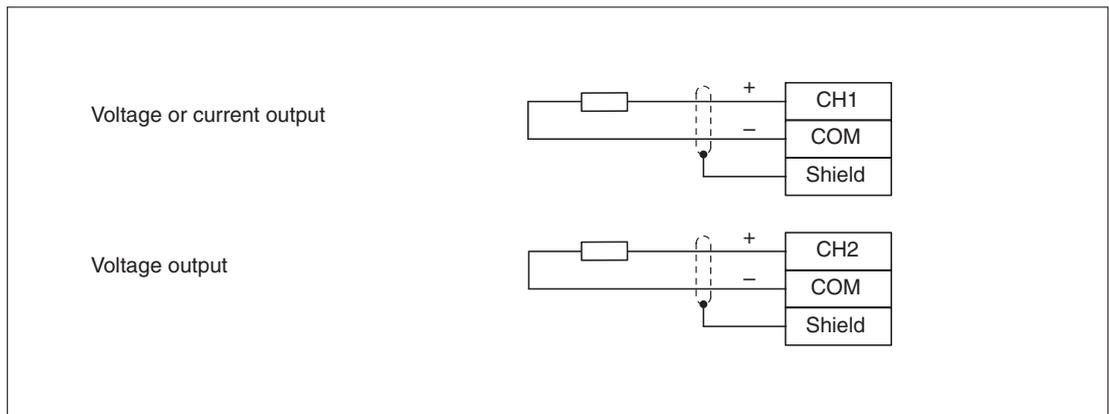
### Contactor Output Module



### Analog Input Modules

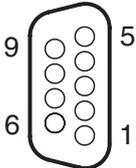


### Analog Output Modules

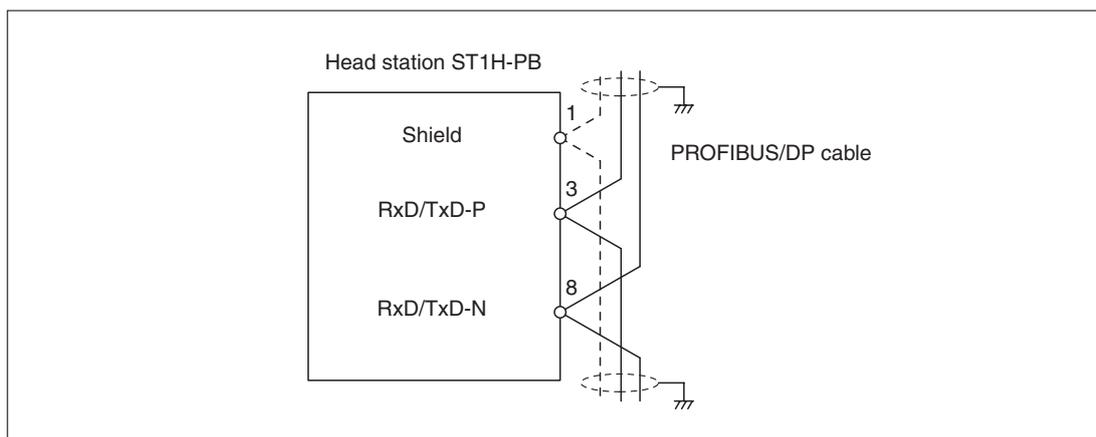


## 4.5 Connection of the PROFIBUS/DP Cable

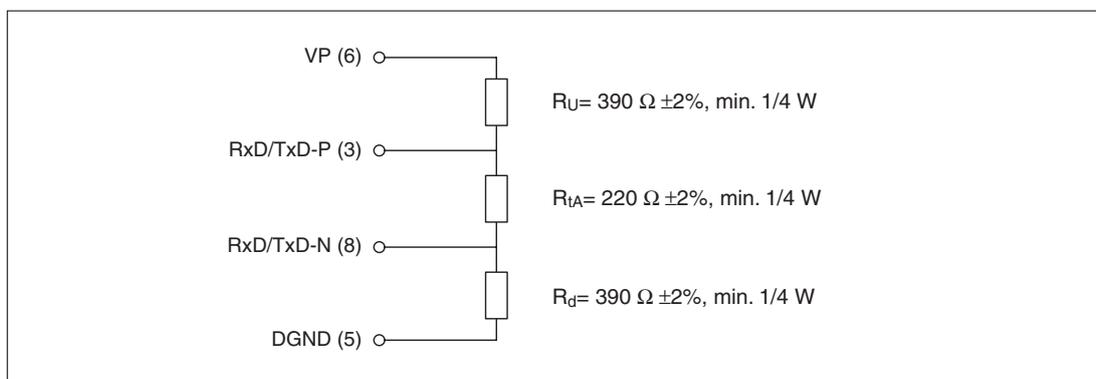
The shielded two-wire PROFIBUS/DP line is connected to the 9-pin D-SUB socket of the head station. The socket has the following pin assignment:

| Pin Layout of the socket  | PIN | Symbol | Name      | Meaning                    |
|---|-----|--------|-----------|----------------------------|
|  | 1   | —      | SHIELD    | Shield, protective earth   |
|   | 2   | —      | M24V      | Not used                   |
|   | 3   | B/B'   | RxD/TxD-P | Sent and received data (P) |
|   | 4   | —      | CNTR-P    | Not used                   |
|   | 5   | C/C'   | DGND      | Data Ground, Datenmasse    |
|   | 6   | —      | VP        | Voltage +                  |
|   | 7   | —      | P24V      | Not used                   |
|   | 8   | A/A'   | RxD/TxD-N | Sent and received data (N) |
|   | 9   | —      | CNTR-N    | Not used                   |

To connect to the PROFIBUS use a 9-pin D-SUB plug like the PROFICON-PLUS plugs and PROFICON PLUS PG plugs from the MELSEC line of accessories. The two wires of the PROFIBUS line and the shielding are connected to pins 1, 3, and 8.



If the head module is the last station in a branch, then the PROFIBUS/DP line must be terminated with resistors. For the PROFICON-PLUS and PROFICON-PLUS PG plugs the resistances are already installed and can be switched on. For a plug without integrated resistors, three resistors must be connected according to the following circuit diagram. The resistors are not included in the module's scope of delivery.



## 4.6 Start-Up

Adhere to the following sequence for installation and start-up of a slave station comprised of MELSEC ST modules.

- ① Mount the DIN rail, and then mount the head station and the base modules on it (see pages 30 and 32).
- ② Connect the supply voltages and the input and output signals to the base modules (see page 36).
- ③ Mount the electronics module (see page 35).
- ④ Set the station numbers on the head module switches (see page 21).
- ⑤ Connect the head station to the PROFIBUS (see page 39).
- ⑥ Set the parameters of the head station as slave on the PROFIBUS using the GX Configurator DP software.
- ⑦ Use the GX Configurator DP software to set the parameters of the individual ST modules.
- ⑧ Set the parameters of the master station of the PROFIBUS/DP network.
- ⑨ Start the data transfer with the ST station via the PROFIBUS.

If all of the RUN LEDs are not illuminated, or if data transfer is not possible, then refer to the instructions for trouble shooting in the following chapter.

## 5 Trouble Shooting

If you cannot communicate with the head station via PROFIBUS, or if all RUN LEDs of the modules are not illuminated, or if an ERR LED is switched on, then there is an error. Detailed instructions for trouble shooting and error resolution are included in the manuals of the individual modules. The steps listed in this chapter are provided as a general guide for trouble shooting.

### 5.1 Checking the System Set-Up

When trouble shooting, first check the system set-up:

- Is the correct number of ST modules connected to a head station?  
A maximum of 63 modules (26 analog modules) can be connected to one head module. For those modules that exceed this range, the RUN LED remains switched off.
- Is the number of assigned I/O addresses within the permissible range?  
A maximum 256 I/O addresses can be assigned by one ST station. If the permissible number is exceeded, then the RUN LED does not light up on the modules that are outside of the range.
- Are electronic modules plugged onto all base modules?  
All electronics modules must be installed before switching on the supply voltage.
- Are the electronics modules mounted on the correct base module?  
There is an appropriate base module for each electronics module (see page 9). Check whether the correct combination is used.
- Is the system shorter than 85 cm?  
The total width of the ST Module connected to a head module may not exceed 85 cm (see page 9).
- Is the power consumption of the modules within the capacity of the power supply?  
It may be that the connected ST modules exceed the capacity of the internal 5 V supply. The capacity of the 24 V supply can be exceeded by the ST modules and connected devices. Instructions for calculating power consumption are included in the operating manual of the ST modules.

### 5.2 Head Station Self-Diagnostics

This self-diagnostics check only the head station:

- ① Switch-off the supply voltage of the ST station:
- ② Unplug the plug of the PROFIBUS/DP line from the head station.
- ③ Set the value "150" on the switches of the head station (see page ).
- ④ Switch-off the supply voltage of the ST station: The self-diagnostics start automatically and the LEDs "RUN" and "DIA" start flashing.
- ⑤ After concluding the self diagnostics the LED "RUN" gives an indication of the result:
  - If the "RUN" LED is illuminated: No error was determined. Reset the switch setting on the head station to the station number.
  - If the "RUN" LED is not lit up: Execute the self-diagnostics again. If the "RUN" LED is still not illuminated, then there is a hardware error. Check the status of the LEDs "REL", "DIA" and "BF" and contact the MITSUBISHI service.

## 5.3 Error Diagnostics using the LEDs

In chapter 3 there are additional instructions for ST module LEDs

### Head station

- If the “RUN” LED of the head station is not lit up check whether
  - the correct station number has been set on the head station switches.
  - the LEDs “SYS” and “AUX” of all power distribution modules are illuminated.
  - a power distribution module is installed to the right of the head station.
  - the correct base module is used for the power distribution modules to the right of the head module. Pay attention to the modes “H” and “R”!
  - the capacity of the power supply is sufficient.
- If the “BF” LED of the head module is illuminated, check whether
  - the station number set on the switches is identical with the station number that is used in the slave parameters.
  - the set parameters correspond to the actual system set-up.
  - the master station works without problem.
  - the wiring of the PROFIBUS/DP network is error-free and terminating resistors are present.
- If the “ERR” LED of the head module is lit up, then an error code can be read out.

### I/O modules

- If the “RUN” LED of an I/O module is not illuminated, then check whether the LEDs “RUN”, “SYS” and “AUX”, of the power distribution modules are illuminated.
- If only the “RUN” LED of an ST module flashes slowly, then replace the electronics module or base module.
- If the “RUN” LEDs of multiple ST modules, arranged directly next to each other, flash slowly, then replace the base module that is installed to the left of the malfunctioning modules. If afterwards the “RUN” LEDs continue to blink, then replace at the first malfunctioning module (to the left of the malfunctioning module) first the electronics modules and then the base module.
- If the “ERR” LED of an I/O module is illuminated, then replace this module.
- If the “ERR” LED flashes for the ST1Y2-TE2 and ST1Y16-TE2 output modules, then excess voltage or the excess temperature monitoring has tripped. Resolve the cause (for example a short circuit).

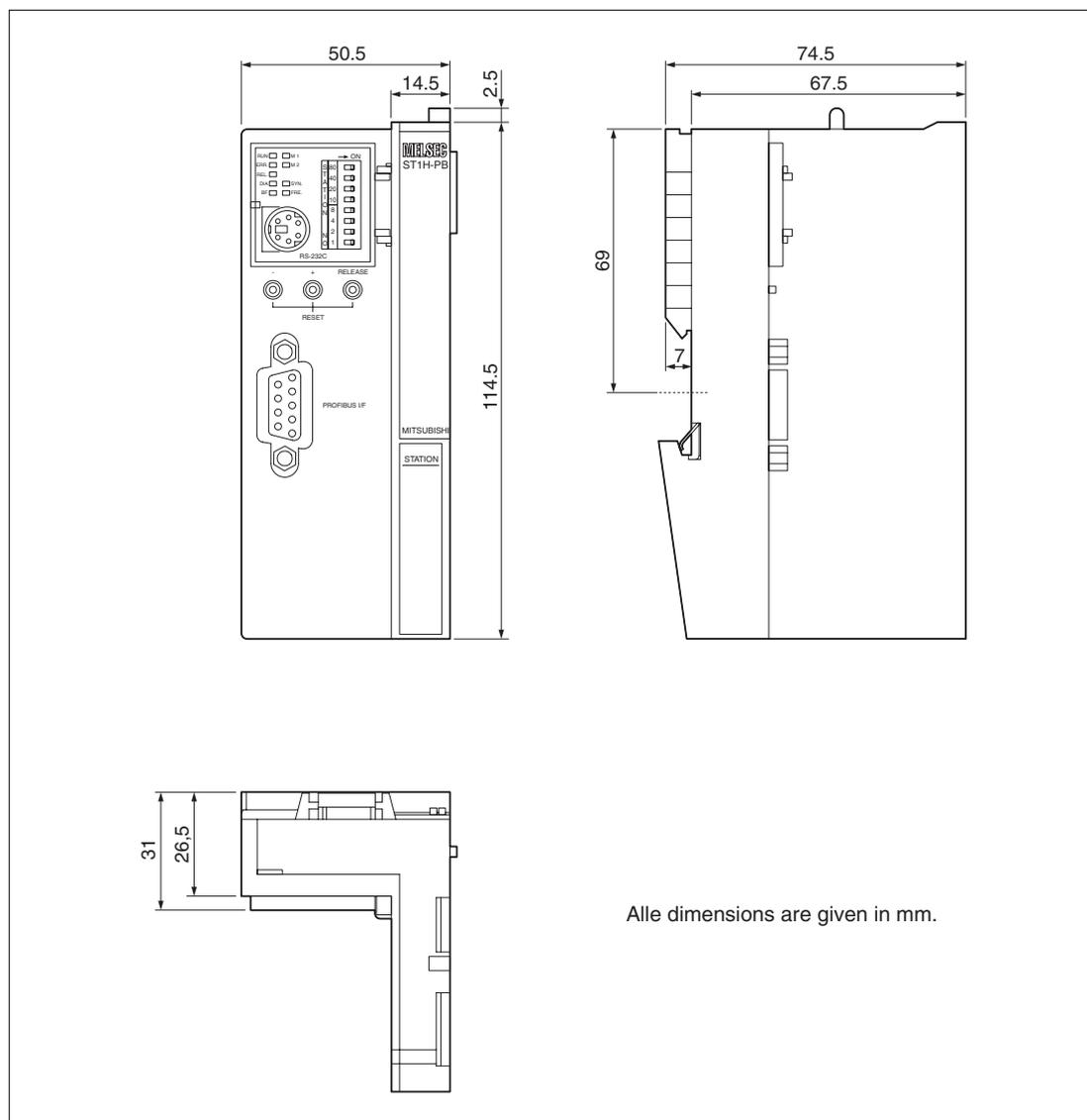
### Power distribution modules and power feeding modules.

- If the “ERR” LED of an I/O module is illuminated, then replace this module.
- If the “ERR” LED flashes, and if the “SYS” LED is switched off at the same time, then the feed for the “SYS” voltage is too low.
- If the “ERR” LED flashes, and if the “AUX” LED is switched off at the same time, then the feed for the “AUX” voltage is too low.

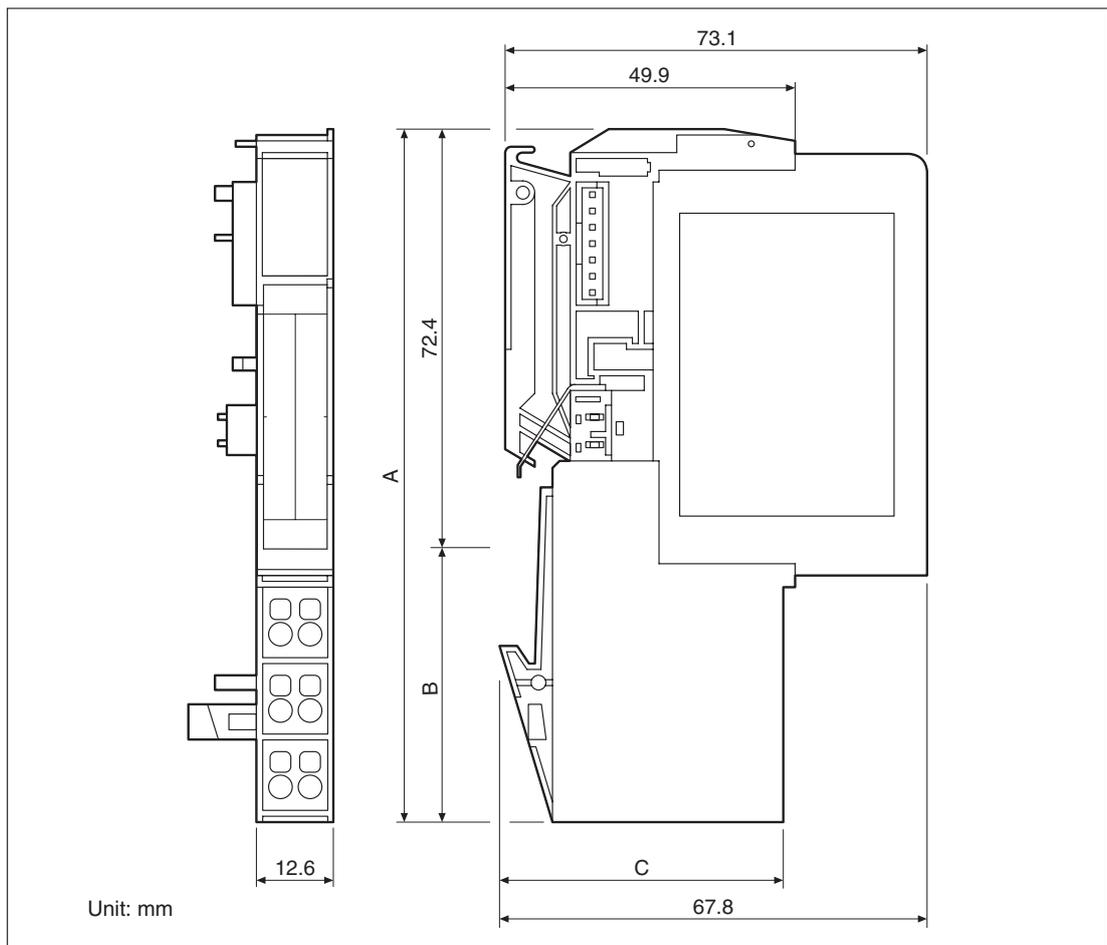
# A Appendix

## A.1 External Dimensions of the Modules

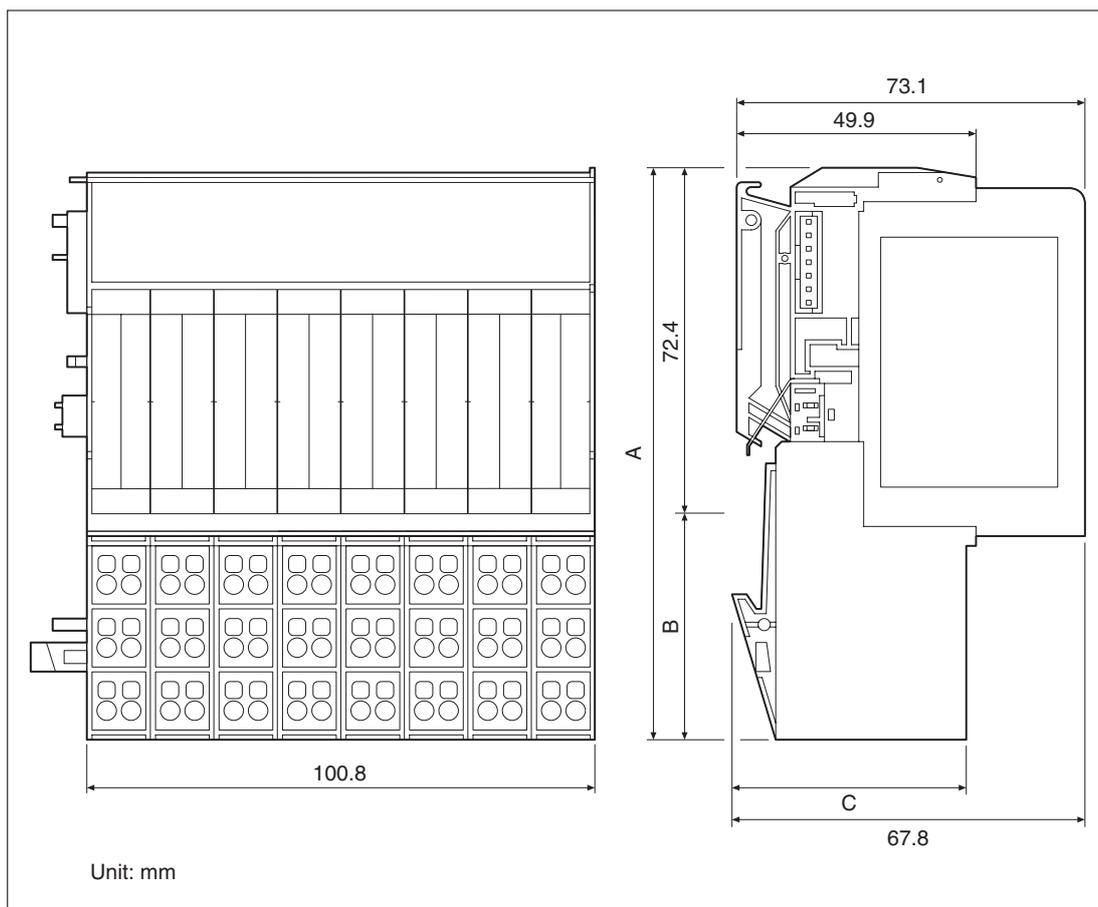
### A.1.1 Head station ST1H-PB



## A.1.2 Base Modules



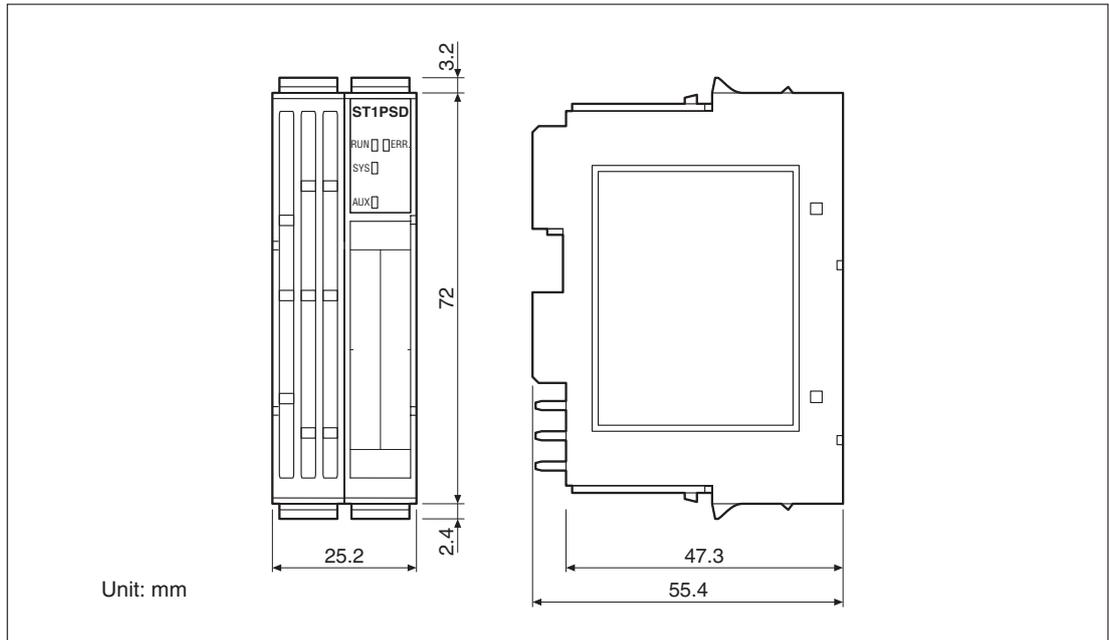
| Base Modules           |             | Dimensions (mm) |      |      |
|------------------------|-------------|-----------------|------|------|
|                        |             | A               | B    | C    |
| Screw clamp terminals  | ST1B-E3Y2   | 117.6           | 45.2 | 48.3 |
|                        | ST1B-E4X2   |                 |      |      |
|                        | ST1B-E4IR2  |                 |      |      |
|                        | ST1B-E4P2-H | 128.8           | 56.4 |      |
|                        | ST1B-E4P2-R |                 |      |      |
|                        | ST1B-E4P2-D |                 |      |      |
| ST1B-E6X4              | 154.4       | 82.0            |      |      |
| Spring clamp terminals | ST1B-S3Y2   | 117.6           | 45.2 | 41.6 |
|                        | ST1B-S4X2   |                 |      |      |
|                        | ST1B-S4IR2  |                 |      |      |
|                        | ST1B-S4P2-H | 128.8           | 56.4 |      |
|                        | ST1B-S4P2-R |                 |      |      |
|                        | ST1B-S4P2-D |                 |      |      |
|                        | ST1B-S6X4   | 154.4           | 82.0 |      |



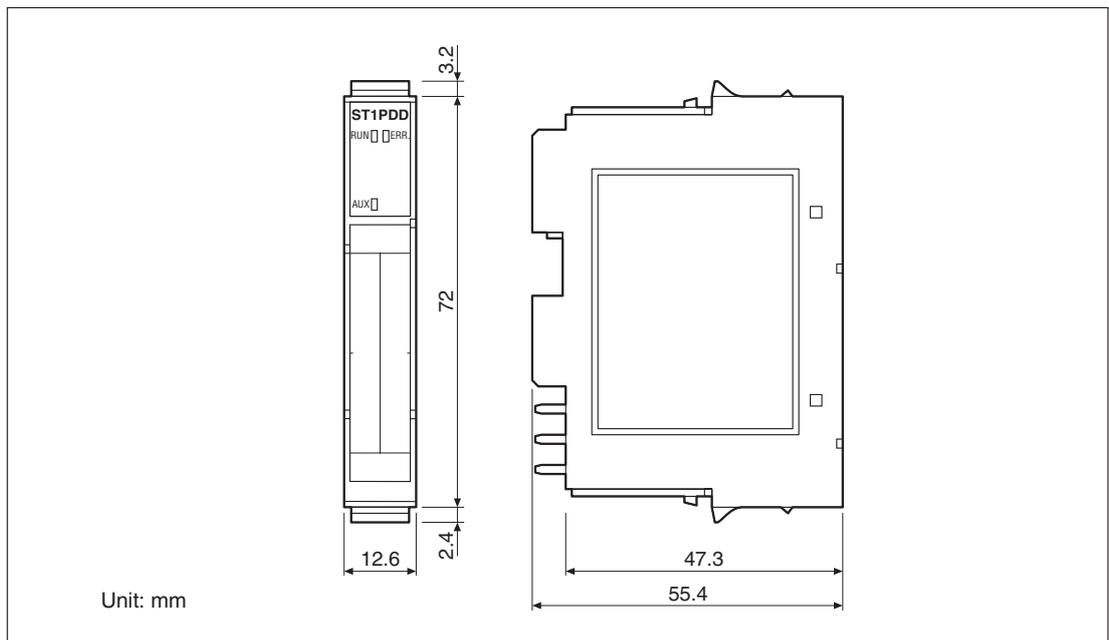
| Base Modules           |            | Dimensions (mm) |      |      |
|------------------------|------------|-----------------|------|------|
|                        |            | A               | B    | C    |
| Screw clamp terminals  | ST1B-E3Y16 | 117.6           | 45.2 | 48.3 |
|                        | ST1B-E4X16 | 128.8           | 56.4 |      |
| Spring clamp terminals | ST1B-S3Y16 | 117.6           | 45.2 | 41.6 |
|                        | ST1B-S4X16 | 128.8           | 56.4 |      |

### A.1.3 Power Distribution Modules

#### ST1PSD

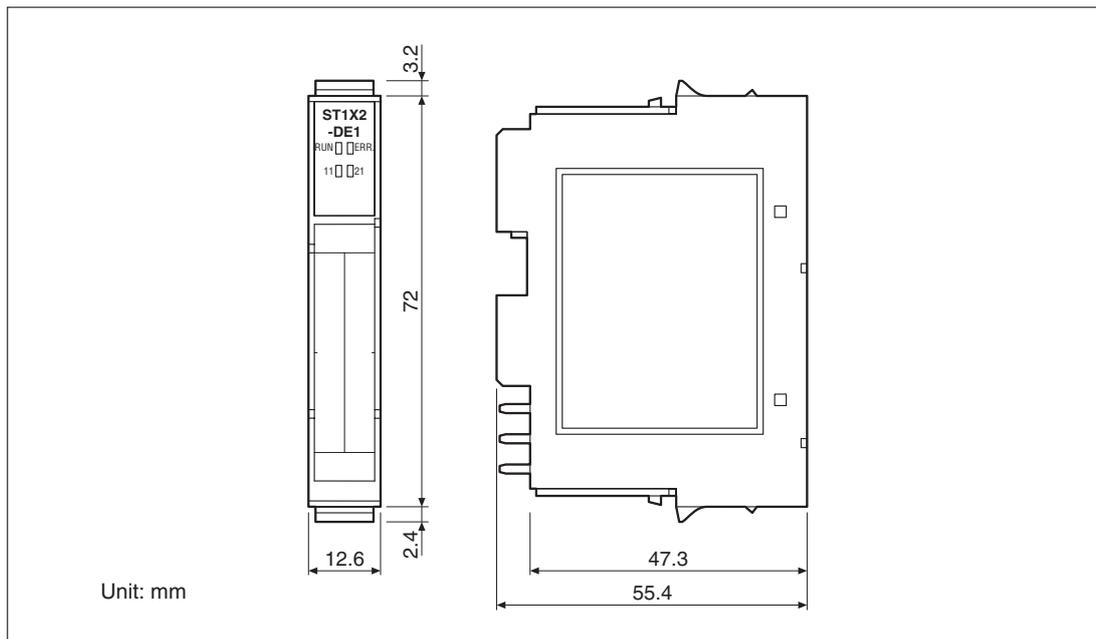


#### ST1PDD

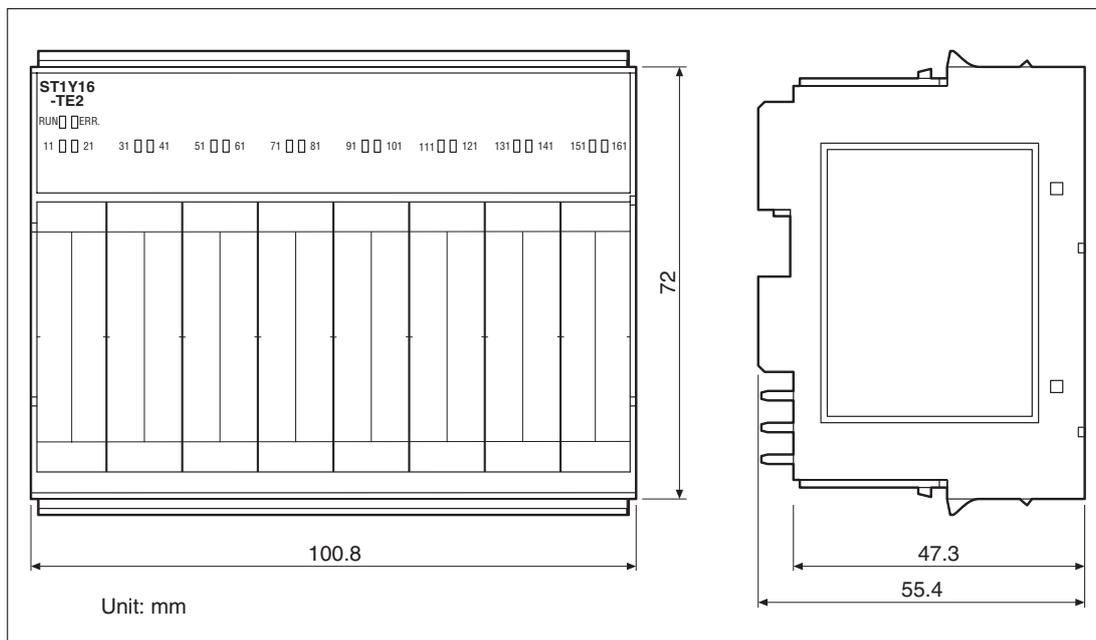


## A.1.4 I/O Modules

### Modules with a wide of one slot (12.6 mm)



### Modules with a wide of eight slots (100.8 mm)



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