

MELSEC ST Series

Programmable Logic Controllers

User's Manual

Profibus/DP Base, Power and I/O Modules

● SAFETY PRECAUTIONS ●

(Read these precautions before using.)

When using Mitsubishi equipment, thoroughly read this manual and the associated manuals introduced in this manual. Also pay careful attention to safety and handle the module properly.

The precautions given in this manual are concerned with this product. Refer to the user's manual of the network system to use for a description of the network system safety precautions.

These SAFETY PRECAUTIONS classify the safety precautions into two categories: "DANGER" and "CAUTION".




DANGER

Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.



CAUTION

Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Depending on circumstances, procedures indicated by  CAUTION may also be linked to serious results.

In any case, it is important to follow the directions for usage.

Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

[DESIGN PRECAUTIONS]



DANGER

- Create an interlock circuit on the program so that the system will operate safety based on the communication status information. Failure to do so may cause an accident due to an erroneous output or malfunction.

When an error occurs, all outputs are turned OFF in the MELSEC-ST system (at default).

However, I/O operations of the head module and respective slice modules can be selected for the errors described below.

Select the status for each module for the entire system safety.

- (1) Communication error (Head Module User's Manual)
- (2) Slice module error

The output status for the case of an error can be set to Clear, Hold or Preset with a command parameter of each slice module. (For setting availability, refer to the manual for each slice module.)

Since the parameter is defaulted to Clear, outputs will be turned off if an error occurs.

This parameter setting can be changed to Hold or Preset when the system safety is more ensured by holding or presetting the output.

[DESIGN PRECAUTIONS]

DANGER

- Create an external fail safe circuit that will ensure the MELSEC-ST system operates safely, even when the external power supply or the system fails.
Accident may occur due to output error or malfunctioning.
 - (1) The status of output changes depending on the setting of various functions that control the output. Take sufficient caution when setting for those functions.
 - (2) Output may be kept ON or OFF due to malfunctions of an output element or its internal circuits.
For signals which may cause a serious accident, configure an external monitoring.

CAUTION

- Make sure to initialize the network system after changing parameters of the MELSEC-ST system or the network system. If unchanged data remain in the network system, this may cause malfunctions.
- Do not install the control wires or communication cables together with the main circuit or power wires. Keep a distance of 100 mm (3.94 inch) or more between them. Not doing so could result in malfunctions due to noise.

[INSTALLATION PRECAUTIONS]

CAUTION

- Use the MELSEC-ST system in the general environment specified in the MELSEC-ST system users manual. Using this MELSEC-ST system in an environment outside the range of the general specifications could result in electric shock, fire, erroneous operation, and damage to or deterioration of the product.
- Mount the head module and base module on the DIN rail securely (one rail for one module) referring to the MELSEC-ST system users manual and then fix them with end brackets. Incorrect mounting may result in a drop of the module, short circuits or malfunctions.
- Secure the module with several end brackets when using it in an environment of frequent vibration. Tighten the screws of the end brackets within the specified torque range. Undertightening can cause a drop, short circuit or malfunction. Overtightening can cause a drop, short circuit or malfunction due to damage to the screw or module.

[INSTALLATION PRECAUTIONS]

CAUTION

- Make sure to externally shut off all phases of the power supply for the whole system before mounting or removing a module. Failure to do so may damage the module.
 - (1) Online replacement of the power distribution module and/or the base module is not available. When replacing either of the modules, shut off all phases of the external power supply.

Failure to do so may result in damage to all devices of the MELSEC-ST system.
 - (2) The I/O modules and the intelligent function modules can be replaced online.

Since online replacement procedures differ depending on the module type, be sure to make replacement as instructed.

For details, refer to the chapter describing the online module change in the user's manual of the head module (for the I/O module) or the corresponding intelligent function module.
- Do not directly touch the module's conductive parts or electronic components. Doing so may cause malfunctions or failure of the module.
- Make sure to securely connect each cable connector. Failure to do so may cause malfunctions due to poor contact.
- DIN rail must be conductive; make sure to ground it prior to use. Failure to do so may cause electric shocks or malfunctions. Undertightening can cause a drop, short circuit or malfunction. Overtightening can cause a drop, short circuit or malfunction due to damage to the screw or module.

[WIRING PRECAUTIONS]

DANGER

- Completely turn off the external power supply when installing or placing wiring. Not completely turning off all power could result in electric shock or damage to the product.

CAUTION

- Make sure to ground the control panel where the MELSEC-ST system is installed in the manner specified for the MELSEC-ST system. Failure to do so may cause electric shocks or malfunctions.
- Check the rated voltage and the terminal layout and wire the system correctly. Connecting an inappropriate power supply or incorrect wiring could result in fire or damage.
- Tighten the terminal screws within the specified torque. If the terminal screws are loose, it could result in short circuits, fire, or erroneous operation. Overtightening may cause damages to the screws and/or the module, resulting in short circuits or malfunction.

[WIRING PRECAUTIONS]

CAUTION

- Prevent foreign matter such as chips or wiring debris from entering the module. Failure to do so may cause fires, damage or erroneous operation.
- When connecting the communication and power supply cables to the module, always run them in conduits or clamp them. Not doing so can damage the module and cables by pulling a dangling cable accidentally or can cause a malfunction due to a cable connection fault.
- When disconnecting the communication and power supply cables from the module, do not hold and pull the cable part. Disconnect the cables after loosening the screws in the portions connected to the module. Pulling the cables connected to the module can damage the module and cables or can cause a malfunction due to a cable connection fault.

[STARTUP AND MAINTENANCE PRECAUTIONS]

DANGER

- Do not touch the terminals while power is on.
Doing so could cause shock or erroneous operation.
- Make sure to shut off all phases of the external power supply for the system before cleaning the module or tightening screws.
Not doing so can cause the module to fail or malfunction.

CAUTION

- Do not disassemble or modify the modules.
Doing so could cause failure, erroneous operation, injury or fire.
- Do not drop or give a strong impact to the module since its case is made of resin. Doing so can damage the module.
- Make sure to shut off all phases of the external power supply for the system before mounting/removing the module onto/from the control panel. Not doing so can cause the module to fail or malfunction.
- The number of terminal block installations/removals is limited to 50 times or less.
(Compliant with JIS B 3502)
Exceeding the count of 50 may cause malfunctions.

[STARTUP AND MAINTENANCE PRECAUTIONS]

CAUTION

- Before handling the module, make sure to touch a grounded metal object to discharge the static electricity from the human body.
Failure to do so may cause a failure or malfunctions of the module.
- When using any radio communication device such as a cellular phone, keep a distance of at least 25cm (9.85 inch) away from the MELSEC-ST system.
Not doing so can cause a malfunction.

[DISPOSAL PRECAUTIONS]

CAUTION

- When disposing of this product, treat it as industrial waste.

REVISIONS

* The manual number is given on the bottom left of the back cover.

Print Date	* Manual Number	Revision
Dec., 2003	SH(NA)-080456ENG-A	First edition
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Apr., 2008	SH(NA)-080456ENG-G	<p>Additional functions</p> <p>ST1H-BT, ST1DA1-1-F01, ST1DA2-V-F01</p> <p>Partial addition</p> <p>SAFETY PRECAUTIONS, CONTENTS, About Manuals, How to Read Manual, About the Generic Terms and Abbreviations, Term definition, Chapter 1, Section 1.1, Chapter 2, Section 3.2, 3.3, 3.4, 4.1, 5.1, 5.2.1, 5.3.1, 7.1, 7.1.1, 7.1.2, 7.1.3, 7.2, 7.2.1, 7.2.2, 7.2.3, 7.2.4, 7.2.5, 7.2.6, 7.3, 7.4, 8.1, 8.3, Chapter 9, Section 9.2, 10.1, 10.3, 10.4.2, 10.5, 11.1.3, 11.2.3, 12.1.1, 12.4</p> <p>Addition</p> <p>Section 3.1.1, 3.1.2, 9.1, Appendix 2</p> <p>Section No. Change</p> <p>Section 9.1 → Section 9.2.1 Section 9.2 → Section 9.2.2 Appendix 2 → Appendix 3 Appendix 3 → Appendix 3.2</p>

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Japanese Manual Version SH-080455-I

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INTRODUCTION

Thank you for choosing the MELSEC-ST series.

Before using the module, please read this manual carefully to fully understand the functions and performance of the MELSEC-ST series and use it correctly.

CONTENTS

SAFETY PRECAUTIONS.....	A- 1
REVISIONS	A- 6
CONTENTS.....	A- 8
About Manuals	A-11
How to Read Manual (FOR CC-LINK)	A-13
How to Read Manual (FOR PROFIBUS-DP).....	A-15
Generic Terms and Abbreviations	A-17
Term definition for CC-Link	A-18
Term definition for PROFIBUS-DP	A-20
1 OVERVIEW	1- 1 to 1- 3
1.1 Features	1- 2
2 HOW TO IDENTIFY MODULE NAMES	2- 1 to 2- 2
3 SYSTEM CONFIGURATION	3- 1 to 3-15
3.1 System Configuration.....	3- 1
3.1.1 CC-Link.....	3- 1
3.1.2 PROFIBUS-DP	3- 2
3.2 System Configuration Outline	3- 3
3.3 Device Configuration.....	3- 5
3.4 Precautions for System Configuration.....	3- 7
4 GENERAL SPECIFICATIONS	4- 1 to 4- 2
4.1 General Specifications	4- 1
4.2 Other System Specifications.....	4- 2
5 POWER DISTRIBUTION MODULES	5- 1 to 5-12
5.1 Specifications	5- 1
5.2 Selection of Power Distribution Modules.....	5- 3
5.2.1 Current consumption calculation	5- 3
5.3 Part Names	5-11
5.3.1 Operating Status LEDs	5-12
6 BASE MODULE	6- 1 to 6- 3
6.1 Base Module Specifications.....	6- 1
6.2 Base module selection.....	6- 2
A - 8	A - 8

6.3 Part Names	6- 3
----------------------	------

7 I/O MODULES	7- 1 to 7-23
----------------------	---------------------

7.1 Input Module Specifications	7- 1
7.1.1 ST1X2-DE1 DC input module (negative common type)	7- 1
7.1.2 ST1X4-DE1 DC input module (negative common type)	7- 2
7.1.3 ST1X16-DE1 DC input module (negative common type)	7- 3
7.2 Output Module Specifications	7- 5
7.2.1 ST1Y2-TE2 transistor output module (source type)	7- 5
7.2.2 ST1Y16-TE2 transistor output module (source type)	7- 6
7.2.3 ST1Y2-TE8 transistor output module (source type)	7- 8
7.2.4 ST1Y2-TPE3 transistor output module (source type)	7- 9
7.2.5 ST1Y16-TPE3 transistor output module with protective functions (source type)	7-10
7.2.6 ST1Y2-R2 Contact Output Module	7-12
7.3 Precautions for Use	7-13
7.3.1 Input module	7-13
7.3.2 Output module	7-13
7.3.3 Module with protection function	7-21
7.4 Part Names	7-22

8 ACCESSORIES	8- 1 to 8- 2
----------------------	---------------------

8.1 End Plate, End brackets	8- 1
8.2 Markers	8- 1
8.3 Coding Elements	8- 2

9 FUNCTIONS AVAILABLE BY USE OF SOFTWARE	9- 1 to 9- 7
---	---------------------

9.1 For CC-Link	9- 1
9.1.1 Functions available by use of GX Configurator-ST	9- 1
9.2 For PROFIBUS-DP	9- 4
9.2.1 Functions Available by Use of Configuration Software	9- 4
9.2.2 Functions Available by Use of GX Configurator-ST	9- 5

10 MOUNTING AND INSTALLATION	10- 1 to 10-22
-------------------------------------	-----------------------

10.1 Handling Precautions	10- 1
10.2 Mounting the Modules	10- 4
10.3 Removing the Modules	10-11
10.4 Wiring	10-14
10.4.1 Wiring precautions	10-14
10.4.2 Wiring the power distribution modules	10-18
10.5 Calculating Heat Generation by unit	10-19

11 EMC AND LOW VOLTAGE DIRECTIVE	11- 1 to 11- 9
---	-----------------------

11.1 Requirements for Compliance with EMC Directive	11- 1
11.1.1 EMC Directive standards	11- 1
11.1.2 Instructions for installing into control panel	11- 2
11.1.3 Cables	11- 3

11.1.4 External power supply module.....	11- 5
11.1.5 Others	11- 6
11.2 Requirement for Compliance with the Low Voltage Directive	11- 7
11.2.1 Standard applied for MELSEC-ST series.....	11- 7
11.2.2 MELSEC-ST series selection	11- 7
11.2.3 Power supply.....	11- 8
11.2.4 Control box	11- 8
11.2.5 Grounding.....	11- 9
11.2.6 External wiring.....	11- 9

12 TROUBLESHOOTING	12- 1 to 12-16
---------------------------	-----------------------

12.1 MELSEC-ST System Troubleshooting.....	12- 1
12.1.1 MELSEC-ST system checkup	12- 2
12.1.2 When RUN LED of slice module is off.....	12- 3
12.1.3 When RUN LED of slice module (excluding intelligent function module) is flickering (1s interval).....	12- 4
12.2 Power Distribution Module Troubleshooting	12- 6
12.2.1 When RUN LED is flickering or off (Common to bus refreshing module and power feeding module).....	12- 6
12.2.2 When ERR. LED is on or flickering.....	12- 6
12.3 I/O Module Troubleshooting	12- 8
12.3.1 When RUN LED is flickering or off	12- 8
12.3.2 When ERR. LED is on or flickering.....	12- 8
12.3.3 Troubleshooting examples.....	12-12
12.4 Error Code List.....	12-15

APPENDICES	App- 1 to App-20
-------------------	-------------------------

Appendix 1 Outer Dimension Drawings	App- 1
Appendix 1.1 Power distribution modules	App- 1
Appendix 1.2 I/O modules.....	App- 3
Appendix 1.3 Base modules	App- 5
Appendix 1.4 Accessory.....	App- 8
Appendix 2 CC-Link	App- 9
Appendix 2.1 I/O data.....	App- 9
Appendix 2.1.1 Power distribution modules	App- 9
Appendix 2.1.2 Input modules	App- 9
Appendix 2.1.3 Output modules	App-10
Appendix 2.2 I/O points sheet.....	App-11
Appendix 3 PROFIBUS-DP	App-12
Appendix 3.1 Input/Output Data.....	App-12
Appendix 3.1.1 Power distribution modules	App-12
Appendix 3.1.2 Input modules	App-15
Appendix 3.1.3 Output modules	App-17
Appendix 3.2 Maximum input/output points setting sheet	App-19
Appendix 4 Recommended Screwdriver	App-20

INDEX	Index- 1 to Index- 2
--------------	-----------------------------

About Manuals

The following manuals are related to this product.
Referring to this list, please request the necessary manuals.

Relevant Manuals For CC-Link

Manual Name	Manual Number (Model Code)
MELSEC-ST CC-Link Head Module User's Manual ST1H-BT Describes the specifications, functions, pre-operational procedure and troubleshooting of the ST1H-BT MELSEC-ST CC-Link head module. (Sold separately)	SH-080754ENG (13JZ11)
CC-Link System Master/Local Module User's Manual QJ61BT11N Describes the system configurations, performance specifications, functions, handlings, wiring, and troubleshooting of QJ61BT11N (Sold separately)	SH-080394E (13JR64)
MELSEC-ST Analog-Digital Converter Module User's Manual ST1AD2-V/ST1AD2-I (CC-Link) Describes the specifications, handling, programming methods, etc. of the MELSEC-ST CC-Link analog-digital converter module. (Sold separately)	SH-080755ENG (13JZ12)
MELSEC-ST CC-Link Digital-Analog Converter Module User's Manual ST1DA2-V/ ST1DA2-V-F01/ST1DA1-I/ST1DA1-I-F01 (CC-Link) Describes the specifications, handling, programming methods, etc. of the MELSEC-ST CC-Link digital-analog converter module. (Sold separately)	SH-080756ENG (13JZ13)
MELSEC-ST CC-Link Thermocouple Input Module User's Manual ST1TD2 (CC-Link) Describes the specifications, handling, programming methods, etc. of the thermocouple input module. (Sold separately)	SH-080757ENG (13JZ14)
MELSEC-ST Platinum RTD Input Module User's Manual ST1RD2 (CC-Link) Describes the specifications, handling, programming methods, etc. of the platinum resistance temperature input module. (Sold separately)	SH-080758ENG (13JZ15)
MELSEC-ST SSI Absolute Encoder Input Module User's Manual ST1SS1 (CC-Link) Describes the specifications, handling, programming methods, etc. of the SSI absolute encoder input module. (Sold separately)	SH-080759ENG (13JZ16)

Relevant Manuals For PROFIBUS-DP

Manual Name	Manual Number (Model Code)
MELSEC-ST PROFIBUS-DP Head Module User's Manual ST1H-PB Describes the specifications, functions, pre-operational procedure and troubleshooting of the ST1H-PB MELSEC-ST PROFIBUS-DP head module. (Sold separately)	SH-080436ENG (13JR68)
MELSEC-ST Analog-Digital Converter Module User's Manual ST1AD2-V/ST1AD2-I (PROFIBUS-DP) Describes the specifications, handling, programming methods, etc. of the MELSEC-ST PROFIBUS-DP analog-digital converter module. (Sold separately)	SH-080442ENG (13JR69)
MELSEC-ST Digital-Analog Converter Module User's Manual ST1DA2-V/ ST1DA2-V-F01/ST1DA1-I/ST1DA1-I-F01 (PROFIBUS-DP) Describes the specifications, handling, programming methods, etc. of the MELSEC-ST PROFIBUS-DP digital-analog converter module. (Sold separately)	SH-080444ENG (13JR70)
MELSEC-ST Thermocouple Input Module User's Manual ST1TD2 (PROFIBUS-DP) Describes the specifications, handling, programming methods, etc. of the thermocouple input module. (Sold separately)	SH-080539ENG (13JR78)
MELSEC-ST Platinum RTD Input Module User's Manual ST1RD2 (PROFIBUS-DP) Describes the specifications, handling, programming methods, etc. of the platinum resistance temperature input module. (Sold separately)	SH-080591ENG (13JR87)
MELSEC-ST SSI Absolute Encoder Input Module User's Manual ST1SS1 (PROFIBUS-DP) Describes the specifications, handling, programming methods, etc. of the SSI absolute encoder input module. (Sold separately)	SH-080630ENG (13JR94)

Relevant Manuals For common

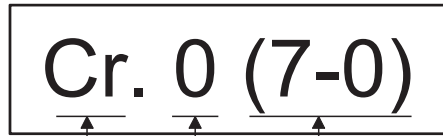
Manual Name	Manual Number (Model Code)
GX Configurator-ST Version 1 Operating Manual Describes how to operate GX Configurator-ST, how to set the intelligent function parameters, and how to monitor the MELSEC-ST system. (Sold separately)	SH-080439ENG (13JU47)

How to Read Manual (FOR CC-LINK)

In this manual, remote I/O, remote registers, and message transmission areas for CC-Link are represented with Br, Wr, Cr, Bw, Ww, Cw.

(1) Data symbol

<Example: Cr Command result area>



Range
In the case of 1-word (16 bit) data, this shows the corresponding range.
(0) : Shows 0 bit position
(7-0): Shows 0-7 bit range

Detail data No.
Abbreviated data symbol
For details of detail data No. and abbreviated data symbol, refer to (2) and (3)

(2) Head module → Master station

(a) Remote input (RX)

Data symbol	Area name	Unit	Detail data No. notation
Br	Br.0 to Br.n	Bit input area	Hexadecimal

(b) Remote register (RWr)

Data symbol	Area name	Unit	Detail data No. notation
Wr	Wr.0 to Wr.n	Word input area	Hexadecimal

(c) Message transmission

Data symbol	Area name	Unit	Detail data No. notation
Cr	Cr.0 to Cr.n	Command result area	Decimal

(3) Master station → Head module

(a) Remote input (RX)

Data symbol		Area name	Unit	Detail data No. notation
<input type="checkbox"/> Bw	<input type="checkbox"/> Bw.0 to <input type="checkbox"/> Bw.n	Bit output area	1 bit/symbol	Hexadecimal

(b) Remote register (RWr)

Data symbol		Area name	Unit	Detail data No. notation
<input type="checkbox"/> Ww	<input type="checkbox"/> Ww.0 to <input type="checkbox"/> Ww.n	Word input area	1 word/symbol	Hexadecimal

(c) Message transmission

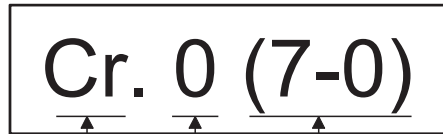
Data symbol		Area name	Unit	Detail data No. notation
<input type="checkbox"/> Cw	<input type="checkbox"/> Cw.0 to <input type="checkbox"/> Cw.n	Command execution area	1 word/symbol	Decimal

How to Read Manual (FOR PROFIBUS-DP)

For PROFIBUS-DP, this manual explains each area for input data and output data using the following symbols.

(1) Data symbol

<Example: Cr Command result area>



Range
In the case of 1-word (16 bit) data, this shows the corresponding range.
(0) : Shows 0 bit position
(7-0): Shows 0-7 bit range

Detail data No.

Abbreviated data symbol

For details of detail data No. and abbreviated data symbol, refer to (2) and (3)

(2) Input send data

Data symbol		Area	Unit	Detail data No. notation
Br	Br.00 to Br.FF	Bit input area	1 bit/symbol	Hexadecimal
Er	Er.00 to Er.FF	Error information area	1 bit/symbol	Hexadecimal
Mr	Mr.0 to Mr.127	Module status area	1 bit/symbol	Decimal
Cr	*1	Command result area	1 word/symbol	Decimal
Wr	Wr.00 to Wr.33	Word input area	1 word/symbol	Hexadecimal

*1: Following shows the data symbols and the corresponding detail areas within the command result area.

Data symbol		Area
Cr.0	Cr.0 (15 - 8)	Command Execution Area
	Cr.0 (7 - 0)	Start Slice No. of Execution Target
Cr.1		Executed Command No.
Cr.2		Response Data 1
Cr.3		Response Data 2

(3) Output receive data

Data symbol		Area name	Unit	Detail data No. notation
<input type="checkbox"/> Bw	<input type="checkbox"/> Bw.00 to <input type="checkbox"/> Bw.FF	Bit output area	1 bit/symbol	Hexadecimal
<input type="checkbox"/> Ew	<input type="checkbox"/> Ew.00 to <input type="checkbox"/> Ew.FF	Error clear area	1 bit/symbol	Hexadecimal
<input type="checkbox"/> Sw	<input type="checkbox"/> Sw.0 to <input type="checkbox"/> Sw.7	System area	1 bit/symbol	Decimal
<input type="checkbox"/> Cw	*1	Command execution area	1 bit/symbol	Decimal
<input type="checkbox"/> Ww	<input type="checkbox"/> Ww.00 to <input type="checkbox"/> Ww.33	Word output area	1 bit/symbol	Hexadecimal

*1: Following shows the data symbols and the corresponding detail areas within the command execution area.

Data symbol	Area name
<input type="checkbox"/> Cw.0	Start slice No. of execution target
<input type="checkbox"/> Cw.1	Command No. to be executed
<input type="checkbox"/> Cw.2	Argument 1
<input type="checkbox"/> Cw.3	Argument 2

Generic Terms and Abbreviations

Unless otherwise specified, this manual uses the following generic terms and abbreviations to explain the head module.

Generic Term/Abbreviation	Description
Head module	ST1H-BT MELSEC-ST CC-Link head module, ST1H-PB MELSEC-ST PROFIBUS-DP Compatible head module.
CC-Link	Abbreviation for Control & Communication Link system.
PROFIBUS-DP	PROFIBUS-DP network.
Master module	Abbreviation for the QJ61BT11N used as a master station.
Bus refreshing module	Module that distributes external system power and auxiliary power to the head module and slice modules.
Power feeding module	Module that distributes external auxiliary power to slice modules.
Power distribution module	Bus refreshing module and Power feeding module.
Base module	Module that transfers data between the head module and slice module, and between the slice module and external devices (including wiring).
Input module	Modules that handle input data in units of bits.
Output module	Modules that handle output data in units of bits.
Intelligent function module	Modules that handle input/output data in units of words.
I/O module	Input modules and output modules.
Slice module	Power distribution modules, I/O modules, and intelligent function modules that can be mounted on a base module.
MELSEC-ST system	System that is composed of a head module, slice modules, an end plate and end brackets.
External power supply	External SYS. power supply and external AUX. power supply.
GX Configurator-ST	Configuration software dedicated to the MELSEC-ST system. The general name of SWnD5C-STPB-E type products. (n=1 or later)
Configuration software	Software used to set slave parameters for head module and slice modules in PROFIBUS-DP. (e.g., GX Configurator-DP)

Term definition for CC-Link

The following explains the meanings and definitions of the terms used in this manual when using CC-Link.

Term	Definition
Cyclic transmission	A communication method by which remote I/O data and remote register data are transferred periodically.
Master station	This station controls the entire data link system. One master station is required for one system.
Local station	A station that has a programmable controller CPU and can communicate with the master station and other local stations.
Remote I/O station	A remote station that can only use bit data. (Input from or output to external devices) (AJ65BTB1-16D, AJ65SBTB1-16D or others)
Remote device station	A remote station that can use both bit and word data. (Input from or output to external devices, analog data conversion) (AJ65BT-64AD, AJ65BT-64DAV, AJ65BT-64DAI or others)
Remote station	Generic term for remote I/O stations and remote device stations. Controlled by the master station.
SB	Link special relay (for CC-Link). Bit data that indicate the module operating status and data link status of the master/local station.
SW	Link special relay (for CC-Link). Data in units of 16 bits, which indicate the module operating status and data link status of master/local station.
RX	Remote input (for CC-Link). Bit data that are input from remote stations to the master station.
RY	Remote output (for CC-Link). Bit data that are output from the master station to remote stations.
RWr	Remote register (Read area for CC-Link). Data in units of 16 bits, which are input from remote device stations to the master stations.
RWw	Remote register (Write area for CC-Link). Data in units of 16 bits, which are output from the master station to remote device stations.
Remote net Ver. 1 mode	Select this mode when extended cyclic setting is not needed or when the QJ61BT11 is replaced with the QJ61BT11N.
Remote net Ver. 2 mode	Select this mode when creating a new system with extended cyclic setting.
I/O data	Data transferred between the head module and the master station.
Br.n Bit input area	Bit input data of each module. Input data are sent from the head module to the master station through remote input (RX).
Bw.n Bit output area	Bit output data of each module. Output data are received from the master station to the head module through remote output (RY).
Wr.n Word input area	Word (16-bit) input data of an intelligent function module. Input data are sent from the head module to the master station through remote register (RWr).
Ww.n Word output area	Word (16-bit) output data of an intelligent function module. Output data are received from the master station to the head module through remote register (RWw).
Number of occupied I/O points	The area, which is equivalent to the occupied I/O points, is occupied in Br Bit input area/ Bw Bit output area.

Term	Definition
Slice No.	<p>The number assigned to every 2 occupied I/O points of each module.</p> <p>The numbers are assigned in ascending order, starting from "0" of the head module. (The maximum value is 127.)</p> <p>This is used for specifying a command execution target.</p>
Slice position No.	<p>The number that shows where the slice module is physically installed.</p> <p>The numbers are assigned in ascending order, starting from "0" of the head module. (The maximum value is 63.)</p> <p>This is used for specifying a command execution target.</p>
Start slice No.	<p>The start slice No. assigned to the head module and slice modules.</p>
Command	<p>Generic term for requests that are executed by the master station for reading each module's operation status, setting intelligent function module command parameters or various controls.</p>
Command parameter	<p>Generic term for parameter set in commands or GX Configurator-ST.</p> <p>All of the parameters set for the head module and slice modules are command parameters.</p>
ST bus cycle time	<p>Processing time for the head module to refresh the input or output status of each slice module.</p>

Term definition for PROFIBUS-DP

The following explains the meanings and definitions of the terms used in this manual when using PROFIBUS-DP.

Term	Definition
Master station	Class 1 master station that communicates I/O data with slave stations.
Slave station	Device that communicates I/O data with the master station.
Repeater	Device that connects PROFIBUS-DP segments.
Bus terminator	Terminator that is connected to both ends of each PROFIBUS-DP segment
FDL address	Address assigned to the master station/slave station.
Extended diagnostic information	Information that is notified from the slave station to the master station when an error occurs at a slave station.
Slave parameter	The slave station parameter (including user parameter) set by the master station. The setting items are described in the GSD file.
GSD file	The electronic file that includes description of the slave station parameter. The file is used to set slave parameters by the master station.
Input data	Data sent from the head module to the master station. The data consists of the following areas. <ul style="list-style-type: none"> ▪ Br Bit Input Area ▪ Information Area <ul style="list-style-type: none"> Er Error Information Area Mr Module Status Area Cr Command Result Area ▪ Wr Word Input Area
Output data	Data that the head module receives from the master station. The data consists of the following areas. <ul style="list-style-type: none"> ▪ Bw Bit Output Area ▪ Request Area <ul style="list-style-type: none"> Ew Error Clear Area Sw System Area Cw Command Execution Area ▪ Ww Word Output Area
I/O data	Data (input data, output data) transferred between the head module and the master station.
Br.n bit input	Bit input data of each module.
Bw.n bit output	Bit output data of each module
Wr.n word input	Word (16-bit) output data of an intelligent function module. In the case of analog input module, the digital output data value is stored.
Ww.n word output	Word (16-bit) input data of an intelligent function module. In the case of analog output module, the digital setting data value is stored.
Information area	Bit/Word input data for checking each module status and command execution results.
Request area	Bit/Word output data for requesting each module to clear errors/to execute commands.
Number of occupied I/O points	The area, that is equivalent to the occupied I/O points is occupied in Br Bit Input Area/ Bw Bit Output Area.
Slice No.	No. assigned to every 2 occupied I/O points of each module. This numbering starts by assigning "0" to the head module and then proceeds in ascending order. (The maximum value No. is 127). The No. is used for specifying the execution target.
Command	Requesting from the master station in order to read the module status, to set/control the intelligent function module command parameters.
ST bus cycle time	Processing time for the head module to refresh the input/output status of each slice module.
Bus cycle time	PROFIBUS-DP processing time for the master station to perform cyclic transfer with each slave station.

1 OVERVIEW

1

This user's manual provides the specifications and handling guidelines of the following MELSEC-ST system devices: power distribution modules, I/O modules, base modules and accessories.

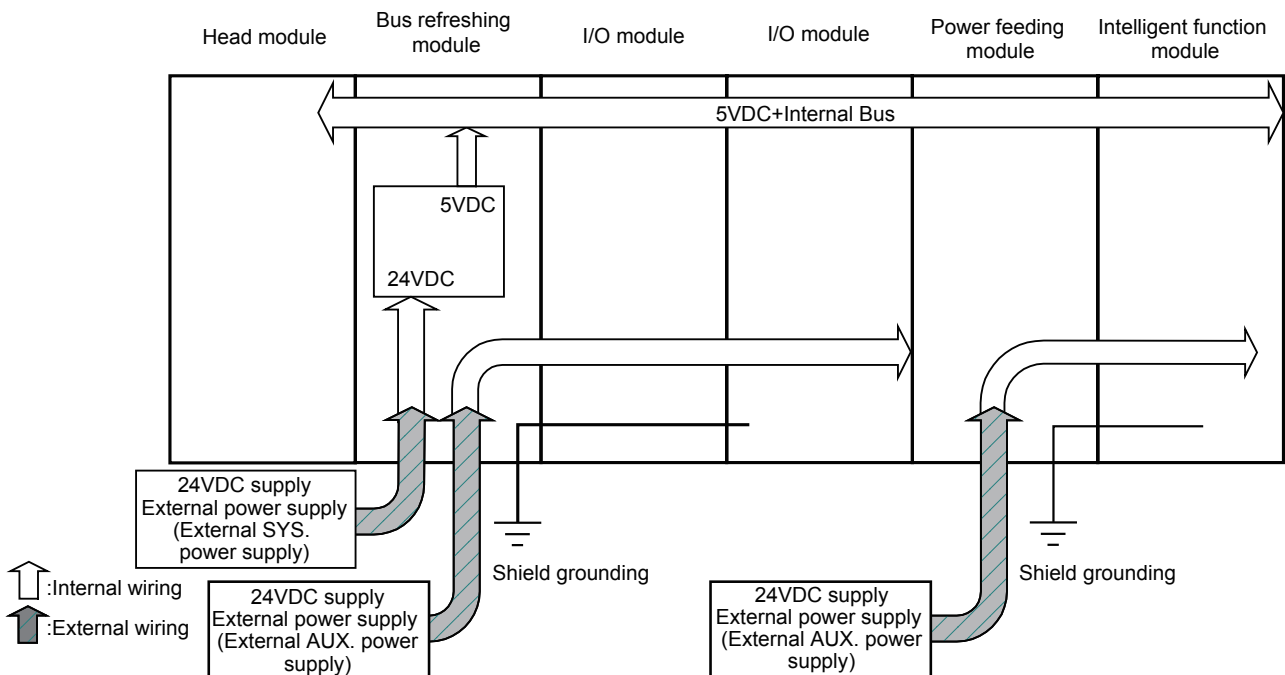
For details of the MELSEC-ST system head module and intelligent function modules, please refer to the Head Module User's Manual and the manual of the corresponding intelligent function modules.

1.1 Features

(1) Wiring reduction

(a) External Power supply wiring

By connecting load power supply cables to the power distribution modules (bus refreshing module, power feeding module), load power can be supplied to all I/O modules and intelligent function modules, resulting in wiring reduction, i.e., the power supply wiring is required only for the power distribution modules.



(b) Wiring in field

Only the head module needs to be wired in the field. The I/O modules and intelligent function modules need not be wired.

(c) Wiring the base modules

Screw clamp type and spring clamp type terminal blocks in base modules are available. The spring clamp type does not need retightening. Note that the screw clamp type and spring clamp type cannot be used together in the system.

(2) Flexible system configuration

- (a) The number of input/output points of each I/O module can be increased in units of minimum two points. Therefore, the efficient system can be configured according to the needs.
- (b) A single head module accepts up to 63 slice modules (up to 26 intelligent function modules*¹). The number of head modules mountable on a field network changes depending on the total input/output points of slice modules. For details, refer to the Head Module User's Manual.

*1: The number of mountable modules varies depending on the intelligent function modules. For the number of mountable modules, refer to the Intelligent Function Module User's Manuals.

(3) Easy maintenance**(a) Online module change**

The I/O module or intelligent function module can be replaced. Also, the modules are front-detachable for easy replacement.

(b) Special tools unnecessary**1) Wiring the terminal block**

The screw clamp/spring clamp type terminal block can be wired with a flat-blade screwdriver and needs no special tools.

2) Mounting and removing the modules

The base module can be mounted directly to a DIN rail without tools. It can be removed from the DIN rail with a flat-blade screwdriver. The slice module can be mounted to and removed from the base module without tools.

(4) Various settings of I/O modules can be changed

The input module's response time and the output module's output status (CLEAR, HOLD) can be changed.

For details, refer to the Head Module User's Manual.

(5) Failsafe function of output module

The transistor output module with short protection and thermal protection functions is available.

(6) GX Configurator-ST available

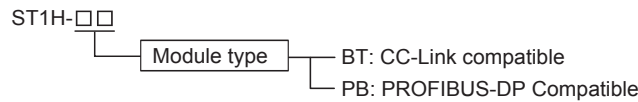
Using the personal computer preinstalled with optional GX Configurator-ST and connected to the head module, parameter setting, system monitor, forced output test, online module change and other operations can be easily performed for the MELSEC-ST system. For details, refer to the GX Configurator-ST Operation Manual.

2 HOW TO IDENTIFY MODULE NAMES

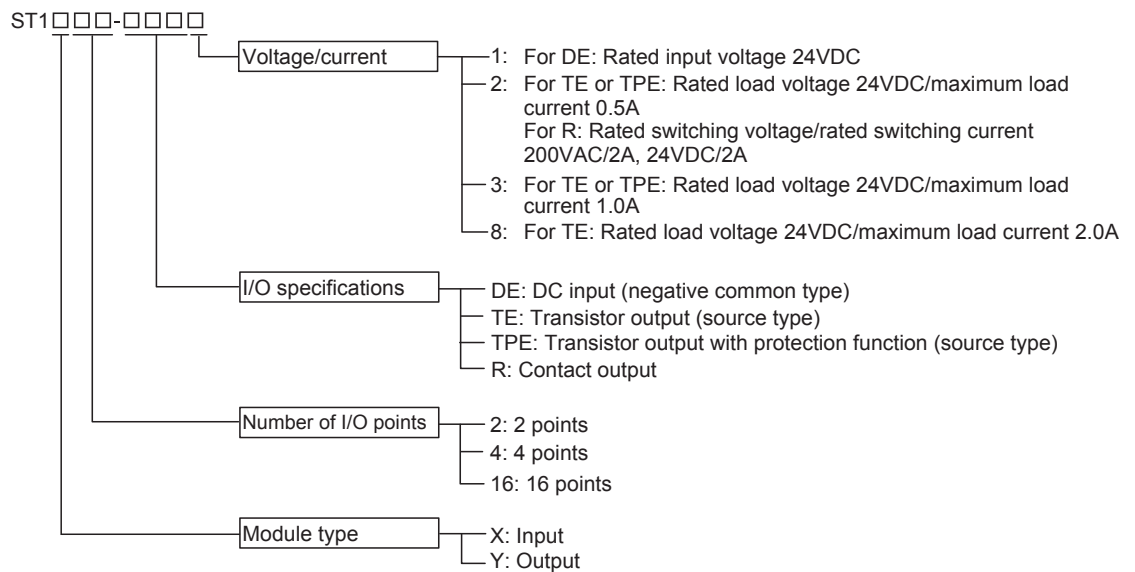
The following shows how to identify the model names of the MELSEC-ST series, head modules, I/O modules, intelligent function modules, power distribution modules and base modules.



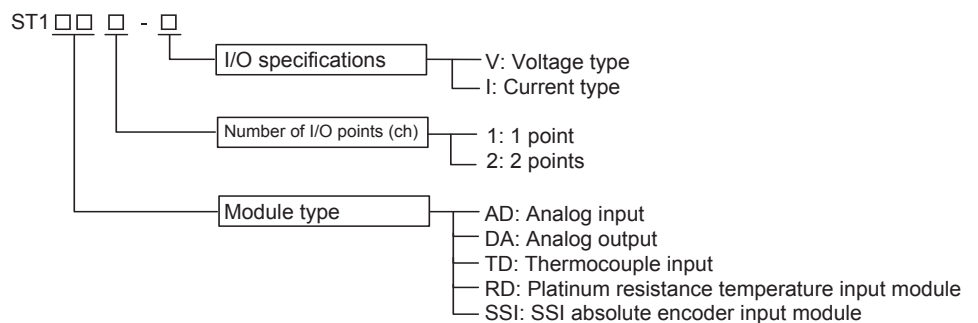
(1) Head modules



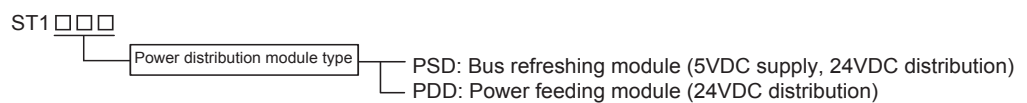
(2) I/O modules



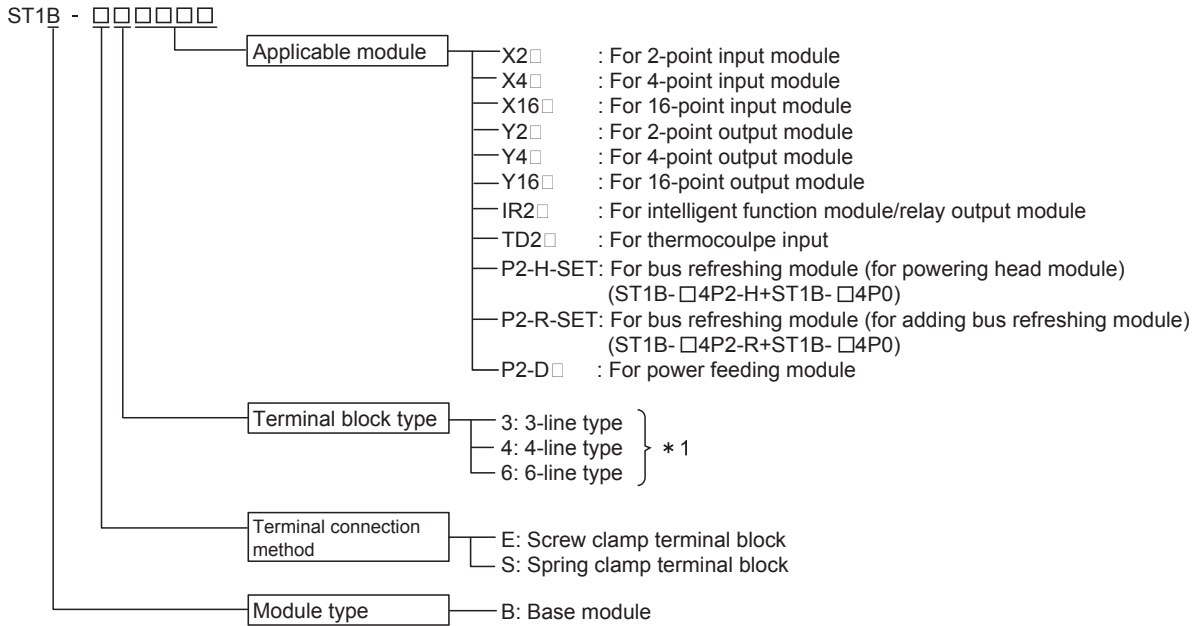
(3) Intelligent function modules



(4) Power distribution modules



(5) Base modules



* 1 On the assumption that the base module has 1-slot width.



3-line type



4-line type



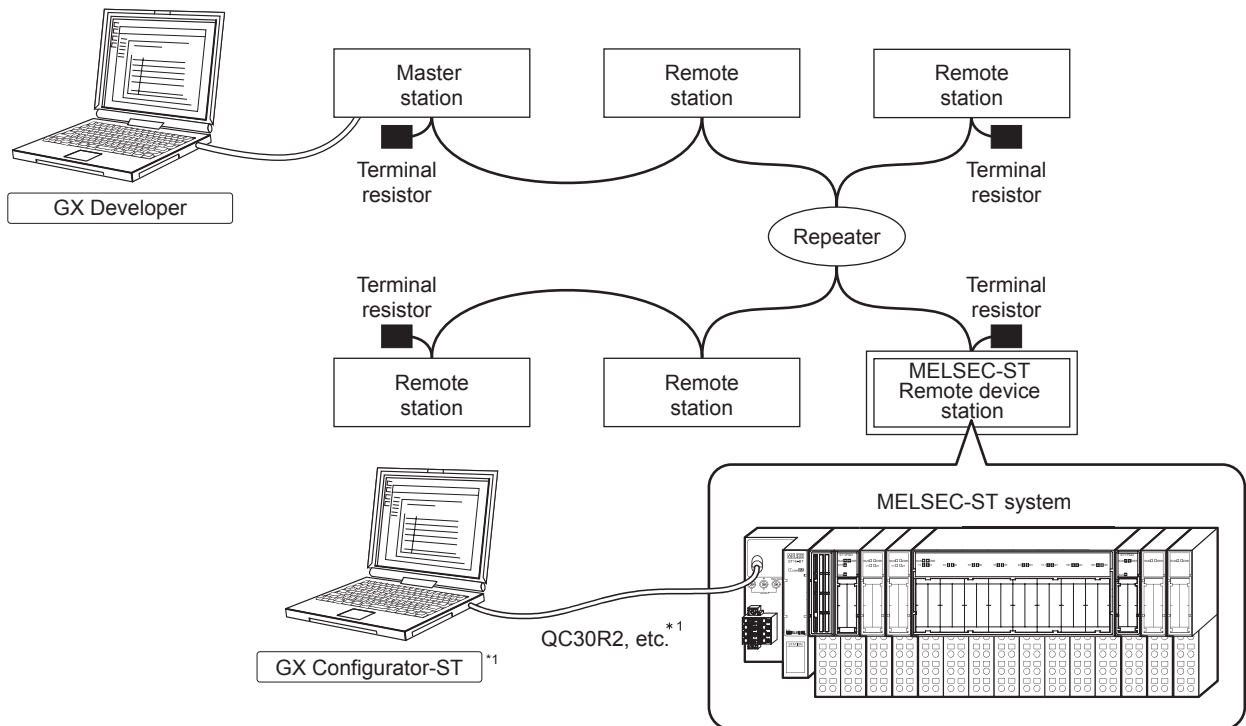
6-line type

3 SYSTEM CONFIGURATION

3.1 System Configuration

3.1.1 CC-Link

This section explains a general system configuration when the system is connected to CC-Link.



*1: Refer to the GX Configurator-ST Manual for the system configuration when GX Configurator is used.

POINT

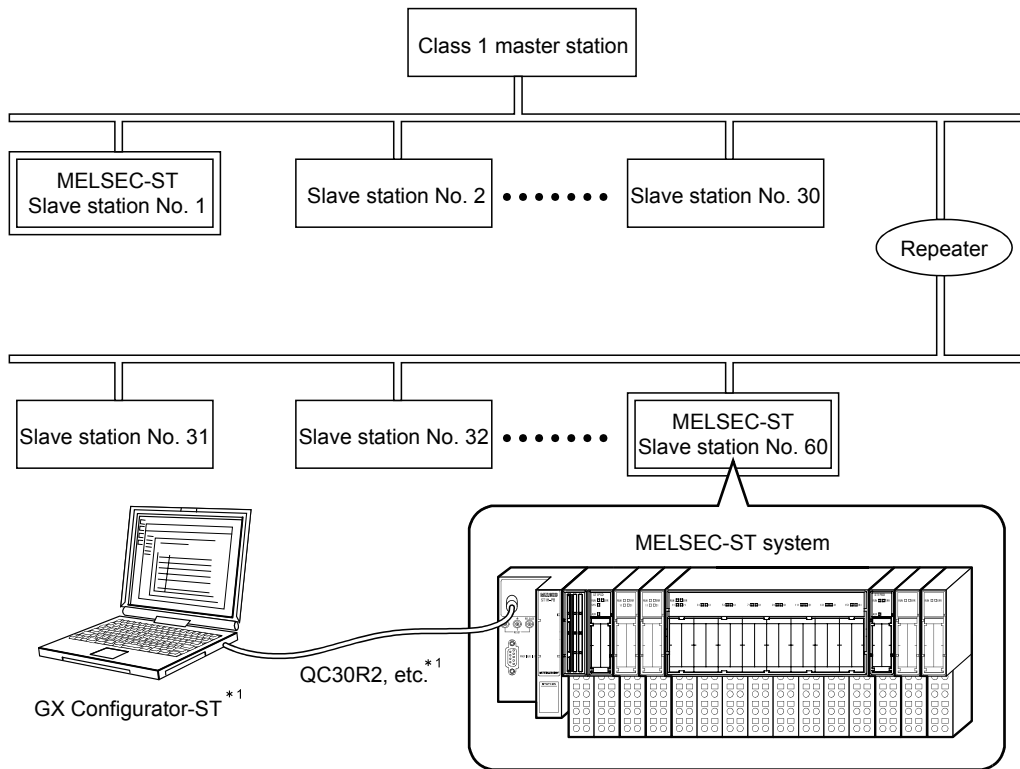
To use the head module as a Ver.1 remote device station, consider and modify the points of slice modules so that the extended cyclic setting is set to single. According to the points of the mounted slice modules, the head module automatically optimizes cyclic setting. For details, refer to the MELSEC-ST CC-Link Head Module User's Manual.

REMARK

For the CC-Link cable wiring and bus terminators, refer to the MELSEC-ST CC-Link Head Module User's Manual.

3.1.2 PROFIBUS-DP

This section explains a general system configuration when the system is connected to PROFIBUS-DP.



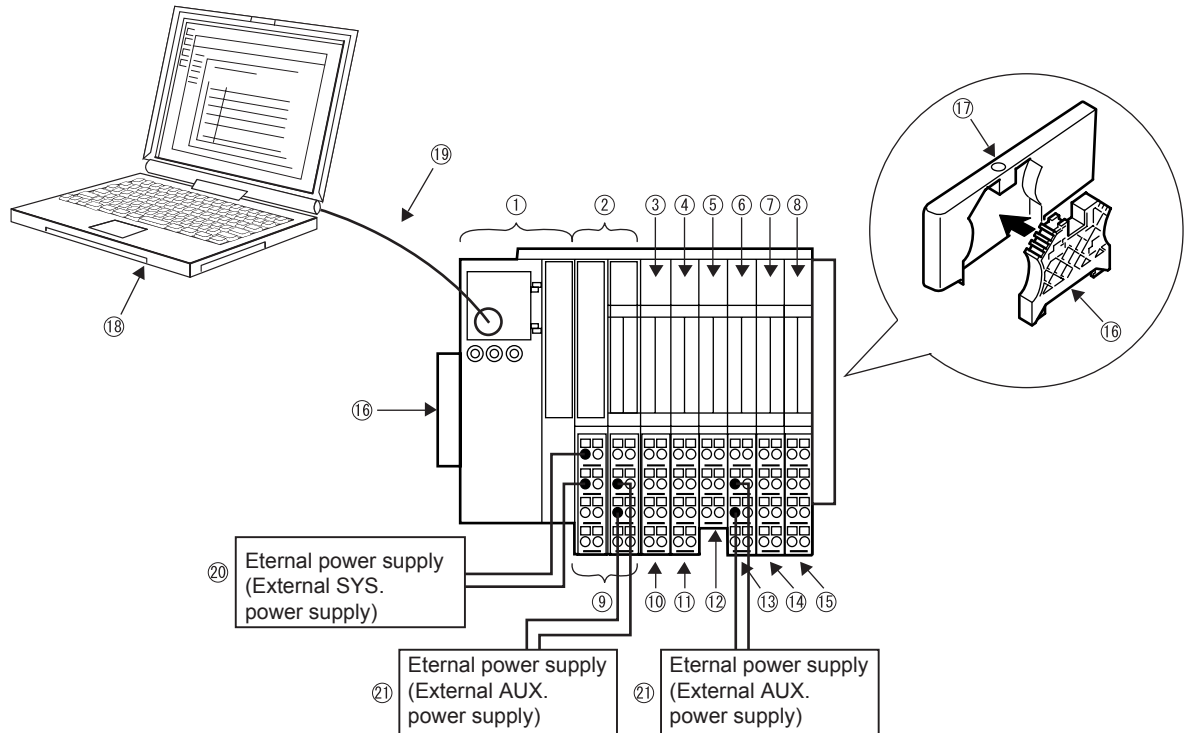
* 1 : Refer to the GX Configurator-ST Manual for the system configuration when GX Configurator is used.

REMARK

For the PROFIBUS cable wiring and bus terminators, refer to the MELSEC-ST PROFIBUS-DP Head Module User's Manual.

3.2 System Configuration Outline

This section outlines the system configuration when the input modules, output module, intelligent function modules, bus refreshing module and power feeding module are used.



System configuration details

①	②	③	④	⑤	⑥	⑦	⑧
Head module	Bus refreshing module	Input module	Input module	Output module	Power feeding module	Intelligent function module	Intelligent function module
ST1H-BT or ST1H-PB	ST1PSD	ST1X2-DE1	ST1X2-DE1	ST1Y2-TE2	ST1PDD	ST1AD2-V	ST1DA2-V

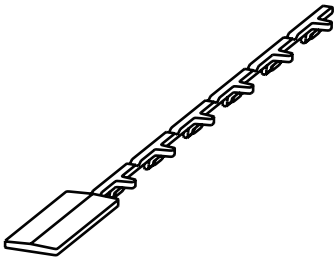

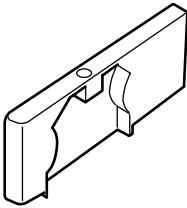
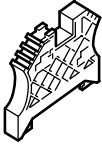
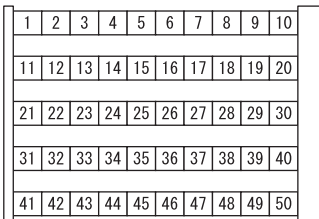
Device name		Description	Configuration condition
①	Head module	ST1H-BT This module acts as a remote device station of a CC-Link network to communicate with master station.	Required (1 module must be mounted)
		ST1H-PB This module acts as a slave station of a PROFIBUS-DP network to communicate with the master station.	
②	Bus refreshing module	This module distributes 5VDC power necessary for the head module and slice modules and 24VDC power necessary for slice modules.	Required (1 module must be mounted) Must be increased when power supply capacity is insufficient.
③④	Input module	Refer to Chapter 7 for details.	Used according to the system configuration.
⑤	Output module	Refer to Chapter 7 for details.	Used according to the system configuration.
⑥	Power feeding module	This module supplies 24VDC power necessary for slice modules. It does not supply 5VDC power necessary for the head module and slice modules.	Necessary when power supply capacity is insufficient.
⑦⑧	Intelligent function module	Various different intelligent function modules are available: digital-analog conversion module, analog-digital conversion module and thermocouple input module, platinum resistance temperature input module and SSI absolute encoder input module.	Used according to the system configuration.
⑨	Base module for bus refreshing module	Used as base modules for the above slice modules. Refer to Chapter 6 and Chapter 7 for details.	Required (1 module must be mounted)
⑩⑪	Base module for input module		Necessary when the input module is mounted.
⑫	Base module for output module		Necessary when the output module is mounted.
⑬	Base module for power feeding module		Necessary when the power feeding module is mounted.
⑭⑮	Base module for intelligent function module		Necessary when the intelligent function module is mounted.
⑯	End bracket	The end brackets are installed on the left side of the head module and on the right side of the last end slice module (installed into the end plate) to fix the slice modules between them. The end brackets are used to make the base modules unmovable under vibration, etc. • For fixing the left side of the head module: 1 pc. • For fixing the right end of the slice module: 1 pc. (Used with the end plate)	Required (2 end brackets are necessary: included with the head module)
⑰	End plate	The end plate is installed to protect the terminals of the rightmost base module from exposure.	Required (1 end plate is necessary: included with the head module)
⑱	GX Configurator-ST	Dedicated software for the MELSEC-ST system. (Slice module status monitor, intelligent function module parameter setting, online module change, etc. can be performed easily.)	Used as necessary.
⑲	RS-232 cable	Used to connect the personal computer installed with GX Configurator-ST and the head module. Model: QC30R2 (Mitsubishi Electric product) or SC-Q (Beijers)	Necessary when GX Configurator-ST is used.
⑳	External power supply (External SYS. power supply)	User-prepared product: Use an external isolated power supply. Refer to Section 11.1.4 for the recommended product.	Required
㉑	External power supply (External AUX. power supply)	User-prepared product Refer to Section 11.1.4 for the recommended product.	Required

3.3 Device Configuration

This section explains the device configuration of the MELSEC-ST system. The following lists the devices that can be configured.

Product	Model	Specifications	Applicable base module*1	
Head module	ST1H-BT	CC-Link compatible (Communicates with the master station as a remote device station)	Base module is unnecessary.	
	ST1H-PB	PROFIBUS-DP network compatible (Communicates with the master station as a slave station)		
Power distribution module	ST1PSD	5VDC supply, 24VDC distribution	For powering the head module. ST1B-□4P2-H-SET For increasing the power distribution module. ST1B-□4P2-R-SET	
	ST1PDD	24VDC distribution	ST1B-□4P2	
I/O module	Input module	ST1X2-DE1	2-point 24VDC input module (Negative common type)	ST1B-□4X2
		ST1X4-DE1	4-point 24VDC input module (Negative common type)	ST1B-□6X4
		ST1X16-DE1	16-point 24VDC input module (Negative common type)	ST1B-□4X16
	Output module	ST1Y2-TE2	2-point 0.5A transistor output module with fuse (Source type)	ST1B-□3Y2
		ST1Y16-TE2	16-point 0.5A transistor output module with fuse (Source type)	ST1B-□3Y16
		ST1Y2-TE8	2-point 2.0A transistor output module (Source type)	ST1B-□3Y2
		ST1Y2-TPE3	2-point 1.0A transistor output module with protection function (Source type)	ST1B-□3Y2
		ST1Y16-TPE3	16-point 1.0A transistor output module with protection function (Source type)	ST1B-□3Y16
		ST1Y2-R2	2-point, 24VDC/200VAC, 2A contact output module	ST1B-□IR2
Intelligent function module	Analog-digital conversion module	ST1AD2-V	2-channel, voltage input	ST1B-□4IR2
		ST1AD2-I	2-channel, current input	ST1B-□4IR2
	Digital-analog conversion module	ST1DA2-V (-F01)	2-channel, voltage output	ST1B-□4IR2
		ST1DA1-I (-F01)	1-channel, current output	ST1B-□4IR2
	Thermocouple input module	ST1TD2	2-channel, thermocouple input	ST1B-□4TD2
	Platinum RTD input module	ST1RD2	2-channel, platinum RTD input	ST1B-□4IR2
	SSI absolute encoder input module	ST1SS1	1-channel, SSI absolute encoder input	ST1B-□4IR2

*1: □ indicates S: Spring clamp type or E: Screw clamp type. Note that the screw clamp type and spring clamp type base modules cannot be used together in the same system. Use either one of them.

	Product	Model	Description
Accessory (Options)	Wiring marker 	ST1A-WMK-BL	Terminal mark, blue (-, 0V, N)
		ST1A-WMK-RD	Terminal mark, red (24VDC, 5VDC)
		ST1A-WMK-GN	Terminal mark, green (Shield)
		ST1A-WMK-BK	Terminal mark, black (Signal wire)
		ST1A-WMK-BR	Terminal mark, brown (L1)
		ST1A-WMK-RD/BL	Terminal mark, red/blue (Module driving power supply)
		ST1A-WMK-GN/YL	Terminal mark, green/yellow (FG (PE))
		ST1A-WMK-WH	Terminal mark, white
	Coding element *1 	ST1A-CKY-02	For input module 24VDC
		ST1A-CKY-06	For power supply module 24VDC
		ST1A-CKY-08	For output module 24VDC
		ST1A-CKY-11	For Digital-analog conversion module (Voltage output)
		ST1A-CKY-12	For Digital-analog conversion module (Current output)
		ST1A-CKY-13	For Analog-digital conversion module (Voltage output)
		ST1A-CKY-14	For Analog-digital conversion module (Current output)
		ST1A-CKY-15	Platinum resistance temperature input module
		ST1A-CKY-16	For thermocouple input module
		ST1A-CKY-17	For contact output module
	ST1A-CKY-18	SSI absolute encoder input module	
	End plate *2 	ST1A-EPL	Included with the head module (1 pc.)
End bracket *3 	ST1A-EBR	Included with the head module (2 pcs.)	
Base module marker 	ST1A-BMK-50	For No. 1 to 50	
	ST1A-BMK-100	For No. 51 to 100	
	ST1A-BMK-150	For No. 101 to 150	
	ST1A-BMK-200	For No. 151 to 200	

*1: The coding element is factory-fitted to each slice module. Refer to Chapter 8 for details.

*2: One end plate is factory-packed with the head module. Refer to Chapter 8 for details.

*3: Two brackets are factory-packed with the head module. Refer to Chapter 8 for details.

3.4 Precautions for System Configuration

The system configuration changes depending on the following conditions: whether intelligent function modules (shown in section 3.3) are used or not, whether online module change will be executed or not, whether contact output modules are used or not.

Be sure to configure the system referring to the figures (configuration examples) and conditions given in the following table.

For the conditions in (1) to (6) common to all system configurations, confirm whether they are satisfied in advance.

System configuration example		1) Whether intelligent function modules are used or not				
		Not used		Used		
		2) Whether contact output modules are used or not				
		Not used	Used	Not used	Used	
		—		—	DC power supply *1	AC power supply *2
		—		3) Whether I/O modules are used or not		
		—		Not used	Used	
Online module change	N/A	Refer to Fig. 3.1		Refer to Fig. 3.2 Condition: (8)(a)(b)	Refer to Fig. 3.3 Condition: (8)(a)(b)(c)	
	Available	Refer to Fig. 3.4 Condition: (7)		Refer to Fig. 3.5 Condition: (7)	Refer to Fig. 3.6 Condition: (7), (8)(c)	

*1: DC power supply (60VDC or less) is used as an external power supply connected to the contacts of the contact output modules.

*2: AC power supply is used as an external power supply connected to the contacts of the contact output modules.

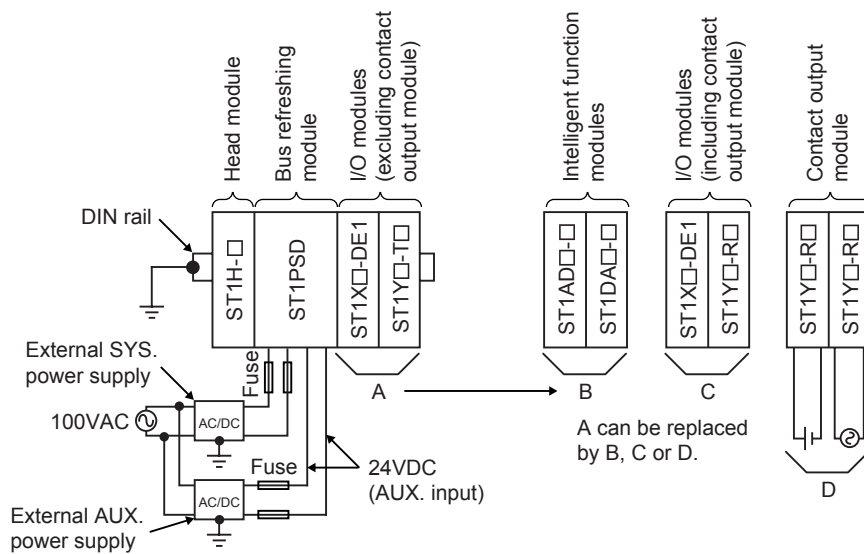


Fig. 3.1 Example of configuration where I/O Modules and intelligent function Modules Are Not Used Together

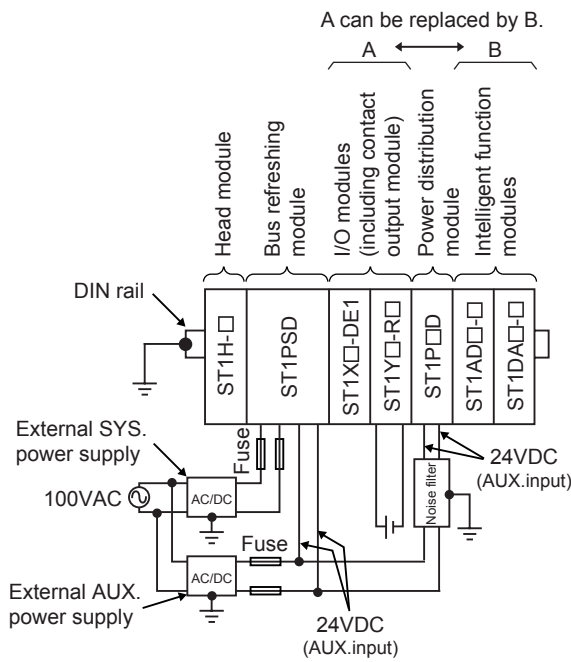


Fig. 3.2 Example of configuration where intelligent function Modules and I/O Module (Including Contact Output Module *1) Are Used Together (Online mode change not executed)

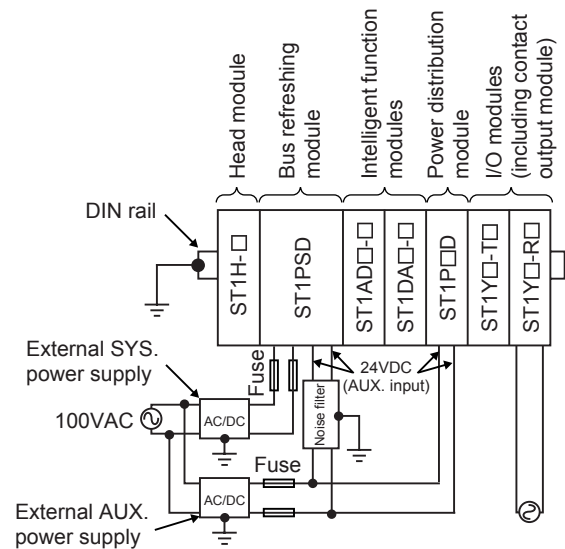


Fig. 3.3 Example of configuration where intelligent function Modules and Contact Output Module *2 Are Used Together (Online mode change not executed)

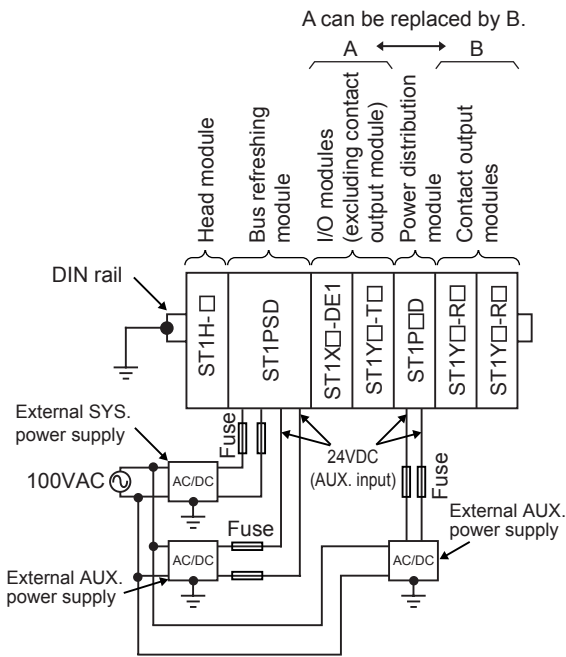


Fig. 3.4 Example of configuration where I/O Modules *3 and Contact Output Modules Are Used Together (Online module change to be executed)

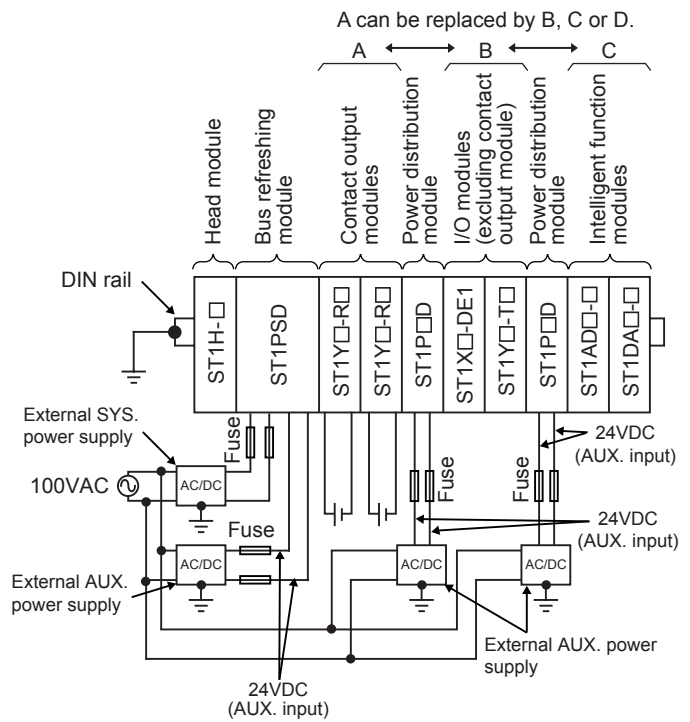


Fig. 3.5 Example of configuration where I/O Modules *3, Contact Output Modules *1 and intelligent function Modules Are Used Together (Online module change to be executed)

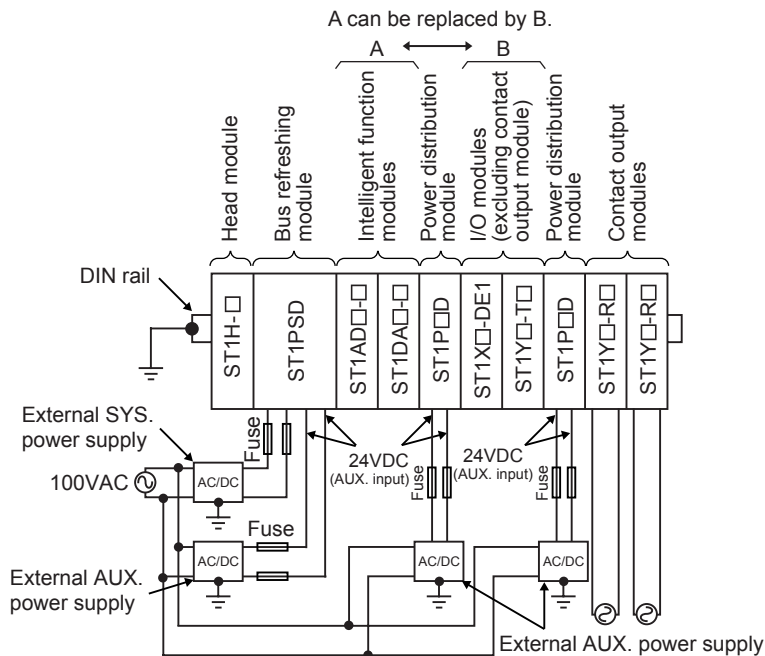


Fig. 3.6 Example of configuration where intelligent function Modules, I/O Modules *3 and Contact Output Modules *2 Are Used Together (Online module change to be executed)

- *1: DC power supply (60VDC or less) is used as external power supply connected to contacts
- *2: AC power supply is used as external power supply connected to contacts
- *3: Excluding contact output modules

(1) Maximum number of connectable modules

The maximum number of slice modules that can be connected to one head module is 63 (except the head module).

The number of head modules mountable on a field network changes depending on the total input/output points of slice modules.

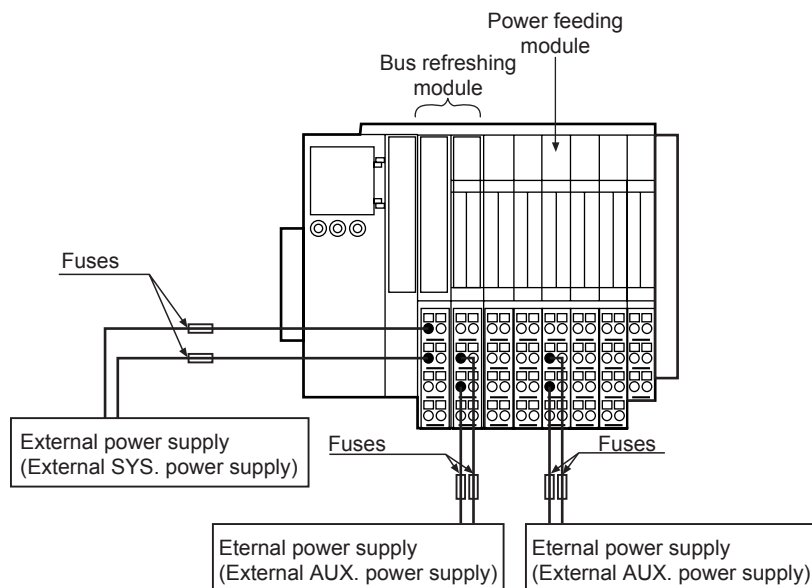
For details, refer to the Head Module User's Manual.

(2) Restrictions on power distribution modules

- (a) Non-isolation type power distribution modules are used. Use an isolation type external SYS. power supply. Use different external power supplies for the external SYS. power supply and external AUX. power supply.

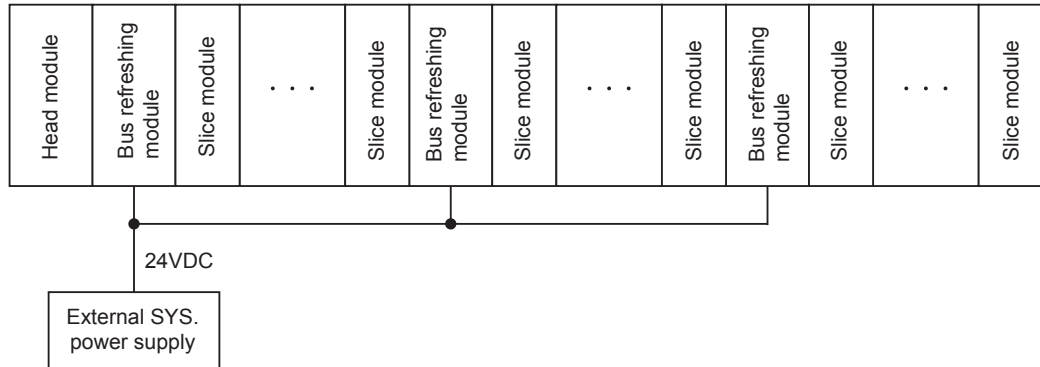
The power distribution modules do not have an overcurrent protection function. If the load current is higher than the rated current (e.g. short circuit) or the overcurrent continues to flow in the power distribution module for a long time, this may cause smoke or ignition. To prevent this trouble, provide fail-safe circuits, i.e., attach fuses outside the system. External power supply must be turned ON/OFF externally.

When turning ON/OFF external power supply, an inrush current may run during the power ON, which comes the external power supply to fail or shut down. Refer to Section 11.1.4 for the recommended products (external power supplies).



- (b) On the right side of the head module, make sure to mount the bus refreshing module to power the head module. The bus refreshing module must be mounted on the base module designed for power supply to the head module.
- (c) Select the power distribution module by calculating the total current consumption of the head module, I/O modules, Intelligent function modules and others powered by the power distribution module. Refer to Chapter 5 for the selection and addition of the power distribution modules.

- (d) In a system configuration using multiple bus refreshing modules, supply 24VDC power from one external SYS. power supply to the multiple bus refreshing modules (SYS. input).



- (e) When configuring a system that includes external AUX. power supplies and power distribution modules, make sure to meet the conditions below.

1) When using an intelligent function module

When configuring a system that includes an intelligent function module, use a power distribution module to separate the 24VDC power supply (AUX. Input) for I/O module and that for intelligent function module.

For details, refer to Section (8) (a).

2) When performing online module change

When configuring a system, separate the power distribution module and external AUX. power supply for each kind of modules, i.e., intelligent function module, contact output module and I/O module (except contact output module).

For details, refer to Section (7) (a).

(3) Restrictions on base modules

The screw clamp type and spring clamp type base modules cannot be used together in the system. Use either one of them.

(4) Restrictions on DIN rail

The function ground (FG) is connected between the slice modules by a conductive DIN rail.

Use a IEC-60715-compliant 35mm DIN rail, which is conductive (of which surface is not insulated).

Recommended product: Weidmuller make DIN rail 35 × 7.5mm (steel type)

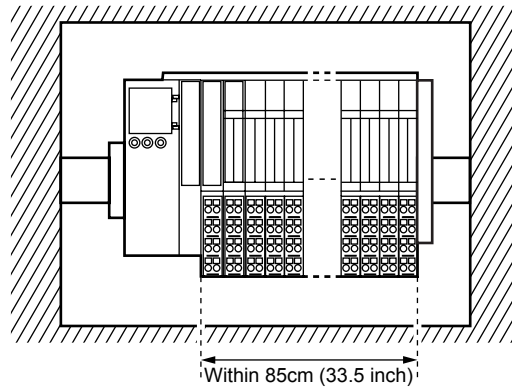
(5) Installing end brackets and end plate

To prevent the base module connection from being loose due to vibration or other be sure to install the end brackets and end plate.

(6) Restrictions on slot width

Configure the system so that the total slot width of the MELSEC-ST system (except the head module) is within 85cm.

Calculate the total slot width using the maximum input/output points setting sheet given in Appendix 2 and 3. (Refer to Appendix 1 for dimensions.)



(7) Precautions for online module change

Configure the system as described in (a), (b), and then execute an online module change according to the procedures given in (c), (d).

Executing an online module change without following the precautions in (a) to (d) will cause a malfunction or failure.

For details of an online module change, refer to the Head Module User's Manual.

- (a) Separate the power distribution module and external AUX. power supply for each kind of the following slice modules

When constructing the system, separate the power distribution module and external AUX. power supply for each kind of the following slice modules.

For details, refer to the system configuration example Fig. 3.4, Fig. 3.5 or Fig. 3.6.

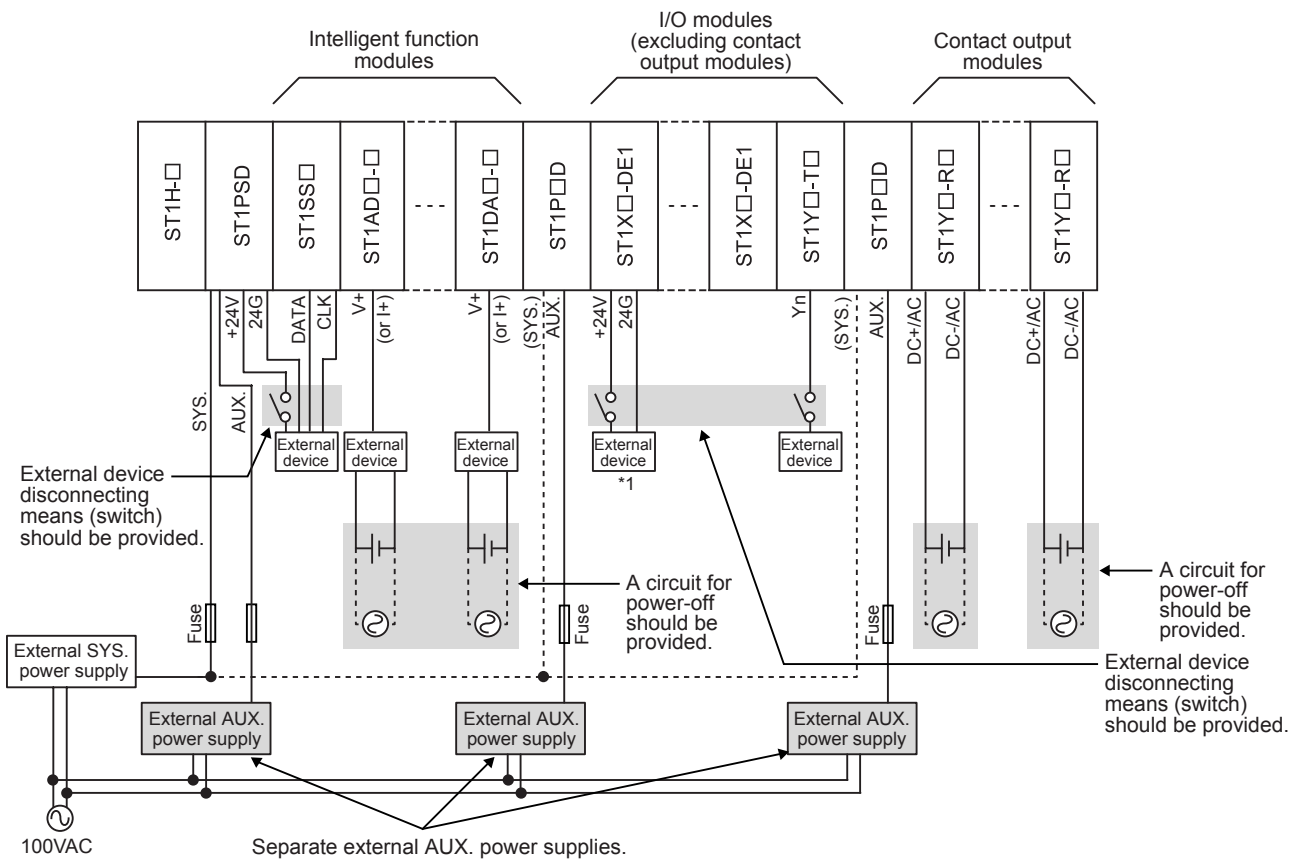
<Separation category>

- Intelligent function module
ST1AD□-□, ST1DA□-□, ST1TD□, ST1RD□, ST1SS□
- Contact output module
ST1Y□-R□
- I/O module (excluding contact output module)
Module other than above

- (b) Create a circuit that disconnects the external device

To ensure safety, a slice module must be replaced after an external device has been disconnected.

Install a circuit that disconnects an external device using a switch or similar as the following diagram shows.



(c) External device connection and disconnection

Module	Model	External device disconnection (before module change)	External device connection (after online module change)
Input module *1	ST1X□-DE1	(1) When external device (3-wire type) is connected to signals +24V, 24G, Xn (n = 0 to F) Disconnect the wiring of +24V. (2) When external device (2-wire type) is connected to signals +24V, Xn (n = 0 to F) No need to disconnect.	(1) When external device (3-wire type) is connected to signals +24V, 24G, Xn (n = 0 to F) <u>Connect the wiring of signal +24V at each point.</u> (2) When external device (2-wire type) is connected to signals +24V, Xn (n = 0 to F) No need to connect.
Transistor output module	ST1Y□-T□	Disconnect the signal Yn (n = 0 to F).	Connect the wiring of Yn (n = 0 to F) and external device.
Contact output module	ST1Y□-R□	Switch off external power supply connected to signals DC+/AC and DC-/AC.	Switch on the external power supply connected to signals DC+/AC and DC-/AC.
Intelligent function module	ST1AD□-□	Switch off the power of the external device connected to signal V+ (or I+).	Switch on the power of the external device connected to signal V+ (or I+).
	ST1TD□	Switch off the power of the external device connected of signal TC+ and TC-.	Switch on the power of the external device connected of signal TC+ and TC-.
	ST1RD□	Switch off the power of the external device connected to signals A, B and b.	Switch on the power of the external device connected to signals A, B and b.
SSI absolute encoder input module	ST1SS□	Disconnect the connection between the external device and signal +24V of ST1P□D.	Connect the external device to signal +24V of ST1P□D.

*1: The maximum inrush current of signal +24V should be 2A/point (5ms). Also provide in addition a disconnection circuit for each external connection.
A disconnecting circuit needs not be installed for the external device (2-wire type) that is not connected to 24G of the input module.

- (d) Multiple I/O modules and intelligent function modules cannot be replaced at a time.
Change the I/O modules and intelligent function modules one by one.

POINT
<p>Only I/O modules and intelligent function modules can be replaced online. Power distribution modules and base modules cannot be replaced online. Before replacing the power distribution module or base module, be sure to shut off all phases of the external power supply. Failure to do so may damage all products of the MELSEC-ST system.</p>

(8) Precautions for use of intelligent function modules

The system should be configured as described below when the intelligent function modules (ST1AD□-□, ST1DA□-□, ST1TD□, ST1RD□, ST1SS□) are used together with the I/O modules (ST1X□-DE1, ST1Y□-T□) and contact output modules (ST1Y□-R□).

If the intelligent function modules are used without the following precautions being observed, the accuracy of the intelligent function modules may not be satisfied.

- (a) Separate 24VDC power supply (AUX. input) for each kind of the following slice modules

For the I/O modules or intelligent function modules, separate the 24VDC power supply (AUX. input) using another power distribution module (ST1P□D).

For details, refer to the system configuration example Fig. 3.2, Fig. 3.3, Fig. 3.5 or Fig. 3.6.

<Separation category>

- Intelligent function module
ST1AD□-□, ST1DA□-□, ST1TD□, ST1RD□, ST1SS□
- Contact output module
ST1Y□-R□
- I/O module (excluding contact output module)
ST1X□-DE1, ST1Y□-T□, ST1Y□-R□

When modules will not be replaced online, contact output modules and I/O modules can be set in the same section.

- (b) Noise filter connection

Connect a noise filter to the 24VDC power supply (AUX. input) of the power distribution module (for intelligent function module distribution).

For details, refer to the system configuration example Fig. 3.2 or Fig. 3.3.

A noise filter need not be connected when the 24VDC power supply (AUX. input) is separated using another external AUX. power supply.

For details, refer to the system configuration example Fig. 3.5 or Fig. 3.6.

The following noise filters are recommended.

Recommended products

Noise filter Model		MXB-1210-33	MXB-1230-33
Maker		LAMBDA	
Rated output	Voltage	250VAC, 250VDC	
	Current	10A	30A

- (c) Precautions for use of contact output modules
 When AC power supply is used as an external power supply connected to the contacts of the contact output modules, the intelligent function modules should be mounted on the left side *1 of the contact output modules. For details, refer to the system configuration example Fig. 3.6.
 When DC power supply (60VDC or less) is used as an external power supply connected to the contacts of the contact output modules, the intelligent function modules need not be mounted on the left side of the contact output modules.

*1: The start slice No. of the intelligent function modules should be lower than that of the contact output modules.

POINT
When a new intelligent function module is added to the system that uses contact output modules (AC power supply is used as the external power supply connected to the contacts), be sure to reconfigure the system so that the start slice No. of the intelligent function modules is lower than that of the contact output modules. However, the system need not be reconfigured when DC power supply (60VDC or less) is used as the external power supply connected to the contacts of the contact output modules.

- (d) When using the SSI absolute encoder input module (ST1SS1)
 - 1) Mount the power distribution module on the immediate left of the ST1SS1.
 - 2) When using multiple ST1SS1s, mount one power distribution module per ST1SS1.
 - 3) When installing the ST1SS1 together with another intelligent function module in the same power supply section, mount the ST1SS1 in the leftmost position.
- (9) Precaution for module addition (For PROFIBUS-DP)
 Using configuration software on the master station, create a new project by a GSD file compatible with the module to be added.
 If the project is created with a GSD file incompatible with the module, the module cannot be added to the system.

(10) UL certification-relevant restrictions

In order to make the MELSEC-ST series compliant with UL, use the class2 external power supply.*

*: Class2 external power supply is the external power supply that satisfies the following specifications described in National Electrical Code.

- Output voltage: 30V
- Output current: 8A or less
- Power supply: Less than 100VA

The following shows the applicable products of class2 external power supply.

Recommended products

Power supply model		DLP75-24-1	DLP100-24-1
Manufacturer name		LAMBDA	
Rated input voltage		100 to 240VAC	
Rated output	Voltage	24VDC	
	Current	3.1A	4.1A

4 GENERAL SPECIFICATIONS

Performance specification of MELSEC-ST series is as follows:

4.1 General Specifications

Item	Specifications					
Operating ambient temperature	0 to 55°C *3					
Storage ambient temperature	-25 to 75°C					
Operating ambient humidity	5 to 95%RH, non-condensing					
Storage ambient humidity	5 to 95%RH, non-condensing					
Vibration resistance	Complying with Conforming to JIS B 3502, IEC 61131-2	Under intermittent vibration	Frequency	Acceleration	Amplitude	Sweep count
			5 to 9Hz	—	3.5mm (0.14inch)	
		Under continuous vibration	9 to 150Hz	9.8m/s ²	—	10 times each in X, Y, Z directions
			5 to 9Hz	—	1.75mm (0.069inch)	—
		9 to 150Hz	4.9m/s ²	—		
Shock resistance	Conforming to JIS B 3502, IEC 61131-2 (147 m/s ² , 3 times in each of 3 directions X, Y, Z)					
Operating ambience	No corrosive gases, dust, dirt and oil mist					
Operating altitude	2000m (6562ft.) max. *4					
Installation location	Inside control panel					
Overvoltage category *1	II max.					
Pollution level *2	2 max.					

*1 : 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.

*2 : 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.

*3 : Install the module in the orientation that satisfies the condition of the module installation orientation in Section 10.1 (6).

*4 : Do not use or store the PLC under pressure higher than the atmospheric pressure of altitude 0m. Doing so can cause a malfunction.

When using the PLC under pressure, please contact your local representative.

4.2 Other System Specifications

Item	Specifications
Insulation resistance *	Across external SYS. power supply inputs and external AUX. power supply inputs 10M Ω or larger by 500VDC insulation resistance tester
Noise durability *	By noise simulator of 500Vp-p noise voltage, 1 μ s noise width and 25 to 60Hz noise frequency First transient noise IEC61000-4-4: 2kV

*: Refer to Chapter 7 for the insulation resistance and noise immunity of the I/O modules.

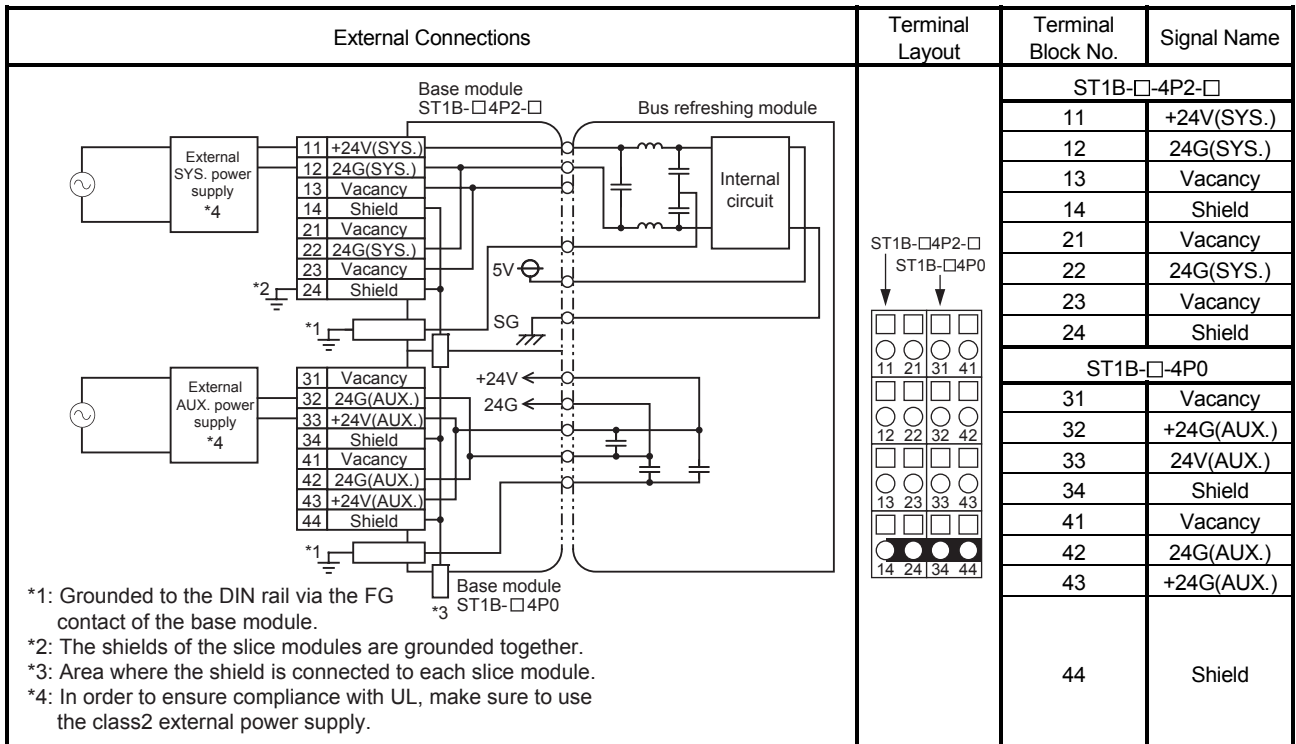
5 POWER DISTRIBUTION MODULES

5.1 Specifications

(1) Bus refreshing module

Specifications		Type	Bus refreshing module	
			ST1PSD	
Number of occupied slices			1	
Number of occupied I/O points			CC-Link: 0 point for each of input and output PROFIBUS-DP: 2 points for each of input and output	
SYS.	Rated input voltage		24VDC	
	Rated allowable voltage (24VDC)		24VDC (±20%, ripple ratio within 5%)	
	Maximum rated input current (24VDC)		0.7A	
	5VDC maximum rated output current		2.0A	
	Efficiency		80% or more	
AUX.	Rated input voltage		24VDC	
	Rated allowable voltage (24VDC)		24VDC (+20/-15%, ripple ratio within 5%)	
	Maximum rated current (24VDC)		Supplying power to I/O modules	8.0A
			Supplying power to intelligent function modules	3.0A
Dielectric withstand voltage			500VAC 1 min/600VAC 1s across SYS. inputs and AUX. inputs	
Operating status			LED indication (at 5VDC output: SYS. turns on, at AUX. (24VDC) output: AUX. turns on)	
Applicable base module	For powering head module	Spring clamp type	ST1B-S4P2-H-SET (ST1B-S4P2-H+ST1B-S4P0) 2-wire type + shield	
		Screw clamp type	ST1B-S4P2-H-SET (ST1B-E4P2-H+ST1B-E4P0) 2-wire type + shield	
	For adding bus refreshing module	Spring clamp type	ST1B-S4P2-H-SET (ST1B-S4P2-H+ST1B-S4P0) 2-wire type + shield	
		Screw clamp type	ST1B-S4P2-H-SET (ST1B-E4P2-H+ST1B-E4P0) 2-wire type + shield	
Weight			0.06 kg	

5



(2) Power feeding module

Type	Power feeding module	
Specifications	ST1PDD	
Number of occupied slices	1	
Number of occupied I/O points	CC-Link: 0 point for each of input and output PROFIBUS-DP: 2 points for each of input and output	
Rated input voltage	24VDC	
Rated allowable voltage	24VDC (+20/-15%, ripple ratio within 5%)	
5VDC internal current consumption	0.06A	
Maximum rated current (24VDC)	Supplying power to I/O modules	8.0A
	Supplying power to intelligent function modules	3.0A
Dielectric withstand voltage	500VAC 1 min/600VAC 1s across SYS. inputs and AUX. inputs	
Operating status	LED indication (at AUX. (24VDC) output: AUX. turns on)	
Applicable base module	Spring clamp type	ST1B-S4P2-D 2-wire type + shield
	Screw clamp type	ST1B-S4P2-D 2-wire type + shield
Weight	0.03 kg	

External Connections	Terminal Layout	Terminal Block No.	Signal Name
<p>*1: Grounded to the DIN rail via the FG contact of the base module. *2: The shields of the slice modules are grounded together. *3: Area where the shield is connected to each slice module. □ *4: In order to ensure compliance with UL, make sure to use the class2 external power supply.</p>		11	Vacancy
		12	24V(AUX.)
		13	+24V(AUX.)
		14	Shield
		21	Vacancy
		22	24V(AUX.)
		23	+24V(AUX.)
		24	Shield

5.2 Selection of Power Distribution Modules

5.2.1 Current consumption calculation

Select the power distribution modules by calculating the total current consumption of the head module, I/O modules, external load devices and intelligent function modules supplied by the power distribution modules.

Refer to Chapter 7 for the 5VDC internal current consumption of the I/O modules.

For the 5VDC internal current consumption of the head module and intelligent function modules, refer to the manuals of the corresponding modules.

For user-prepared products, refer to the manuals of the corresponding devices.

(1) Bus refreshing module and power feeding module

The power distribution modules are classified into the bus refreshing module and power feeding module.

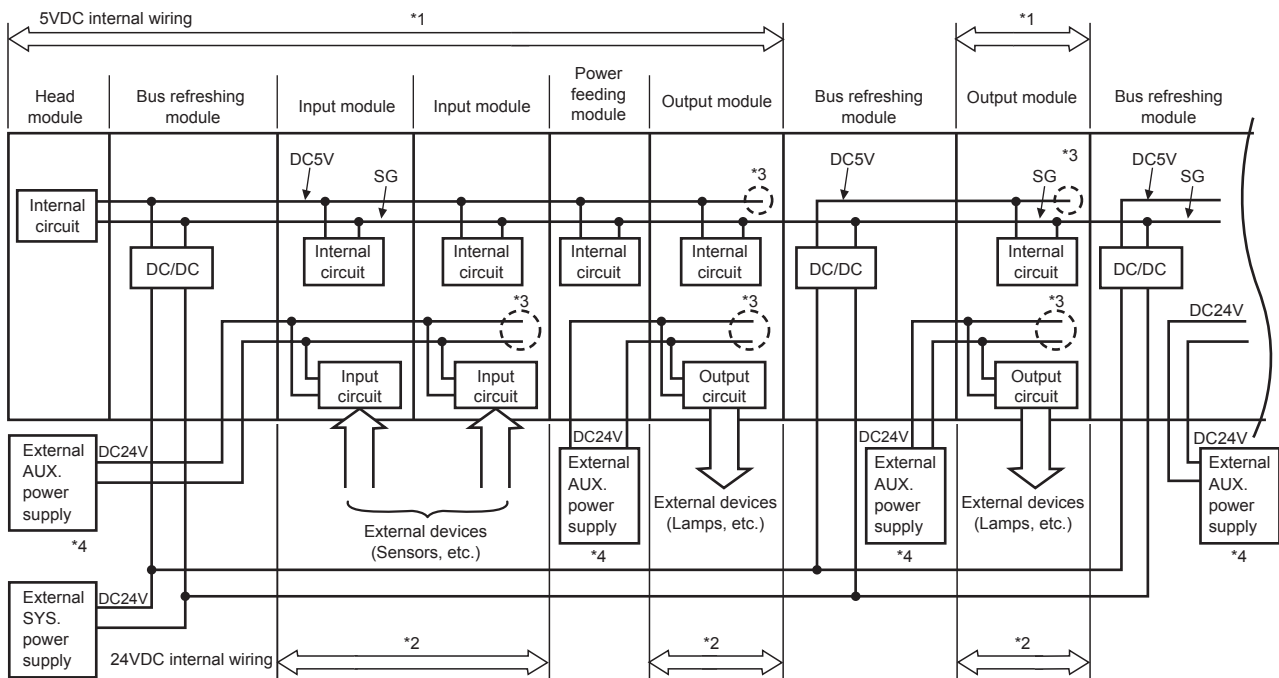
The bus refreshing module is used to supply 5VDC and distribute 24VDC. The power feeding module is designed to distribute 24VDC. Therefore, it cannot be used to supply 5VDC.

Make sure to mount the bus refreshing module (ST1PSD) on the right side of the head module. Then, make sure to attach that bus refreshing module onto the base module (ST1B-□4P2-H-SET) for powering head module.

When mounting a new bus refreshing module (ST1PSD), be sure to use the base module (ST1B-□4P2-R-SET) for adding bus refreshing module.

A malfunction will result if the base module (ST1B-□4P2-H-SET) for powering head module is used when a new bus refreshing module is mounted.

(2) 5VDC, 24VDC internal wiring



*1: 5VDC is supplied to the modules mounted between the bus refreshing module (or head module) and the next bus refreshing module by the internal wiring of the base modules.
 The total 5VDC internal current consumption of the slice modules mounted between the bus refreshing module and the next bus refreshing module should not exceed the maximum rated output current 2.0A.

*2: 24VDC is distributed to the slice modules mounted between the power feeding module (or bus refreshing module) and the next power feeding module (or bus refreshing module) by the internal wiring.
 The total 24VDC current of the slice modules mounted between the power feeding module (or bus refreshing module) and the next power feeding module (or bus refreshing module) should not exceed the maximum rated current (I/O modules: 8.0A, Intelligent function modules: 3.0A).

*3: Indicates the portion where the 5VDC or 24VDC internal wiring is disconnected by the power distribution module.

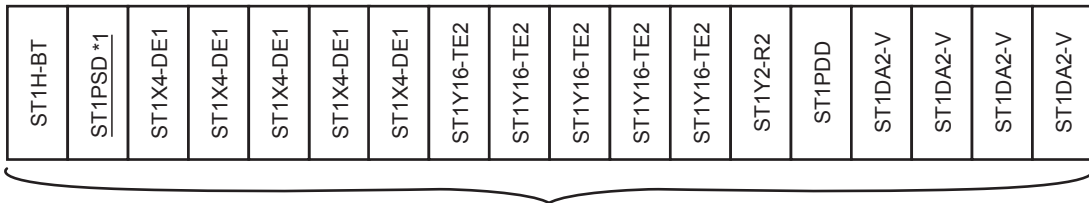
*4: When a contact output module is used as an output module, an external AUX. power supply (for relay load) must be prepared separately.

(3) Example of 5VDC internal current consumption and 24VDC current calculation

(a) Example of 5VDC internal current consumption calculation

If the total 5VDC internal current consumption exceeds the maximum rated output current 2.0A, mount a new bus refreshing module (ST1PSD). Attach the bus refreshing module onto the base module for extension bus refreshing module (ST1B-□4P2-R-SET).

System configuration example



Total current consumption = 2.165(A)

*1: Bus refreshing module (for powering head module)

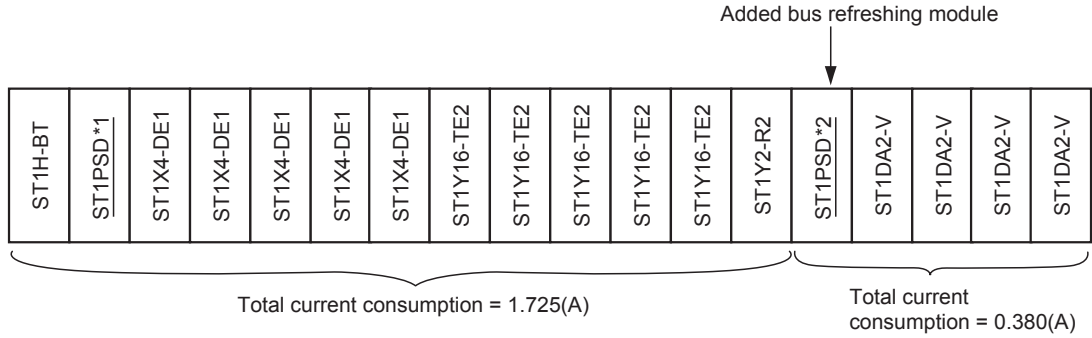
Calculate the total 5VDC internal current consumption using the maximum I/O point setting sheet given in Appendix 2 and 3. (Refer to Section 5.1, Section 7.1 and Section 7.2 for the current values of 5VDC internal current consumption.)

Slice position No.	Start slice No. (Number of occupied slices)	Module name	Br.n	Bw.n	Wr.n	Ww.n	5VDC internal current consumption (Total value)	24VDC current (Total value)	Slot width (Total value)
0	0(2)	ST1H-BT	-	-	-	-	0.410A(0.410A)	0A(0A)	-
1	2(1)	ST1PSD	-	-	-	-	-	-	25.2mm(25.2mm)
2	3(2)	ST1X4-DE1	4	-	-	-	0.095A(0.505A)	-	12.6mm(37.8mm)
3	5(2)	ST1X4-DE1	4	-	-	-	0.095A(0.600A)	-	12.6mm(50.4mm)
4	7(2)	ST1X4-DE1	4	-	-	-	0.095A(0.695A)	-	12.6mm(63.0mm)
5	9(2)	ST1X4-DE1	4	-	-	-	0.095A(0.790A)	-	12.6mm(75.6mm)
6	11(2)	ST1X4-DE1	4	-	-	-	0.095A(0.885A)	-	12.6mm(88.2mm)
7	13(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.035A)	-	100.8mm(189.0mm)
8	21(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.185A)	-	100.8mm(289.8mm)
9	29(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.335A)	-	100.8mm(390.6mm)
10	37(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.485A)	-	100.8mm(491.4mm)
11	45(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.635A)	-	100.8mm(592.2mm)
12	53(1)	ST1Y2-R2	-	2	-	-	0.090A(1.725A)	-	12.6mm(604.8mm)
13	54(1)	ST1PDD	-	-	-	-	0.060A(1.785A)	-	12.6mm(617.4mm)
14	55(2)	ST1DA2-V	4	4	-	2	0.095A(1.880A)	-	12.6mm(630.0mm)
15	57(2)	ST1DA2-V	4	4	-	2	0.095A(1.975A)	-	12.6mm(642.6mm)
16	59(2)	ST1DA2-V	4	4	-	2	0.095A(2.070A)	-	12.6mm(655.2mm)
17	61(2)	ST1DA2-V	4	4	-	2	0.095A(2.165A)	-	12.6mm(667.8mm)
Total			36	98	-	8	-	-	-

$$I = 0.41 + (0.095 \times 5) + (0.15 \times 5) + 0.09 + 0.06 + (0.095 \times 4) = 2.165 \text{ (A)}$$

As the maximum rated output current 2.0A of the bus refreshing module is less than the total 5VDC internal current consumption, the following bus refreshing module must be mounted newly.

In this system configuration, replace the ST1PPD with the ST1PSD.



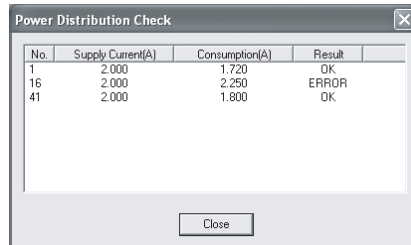
*1: Bus refreshing module (for powering head module)

*2: Bus refreshing module (for extension)

REMARK

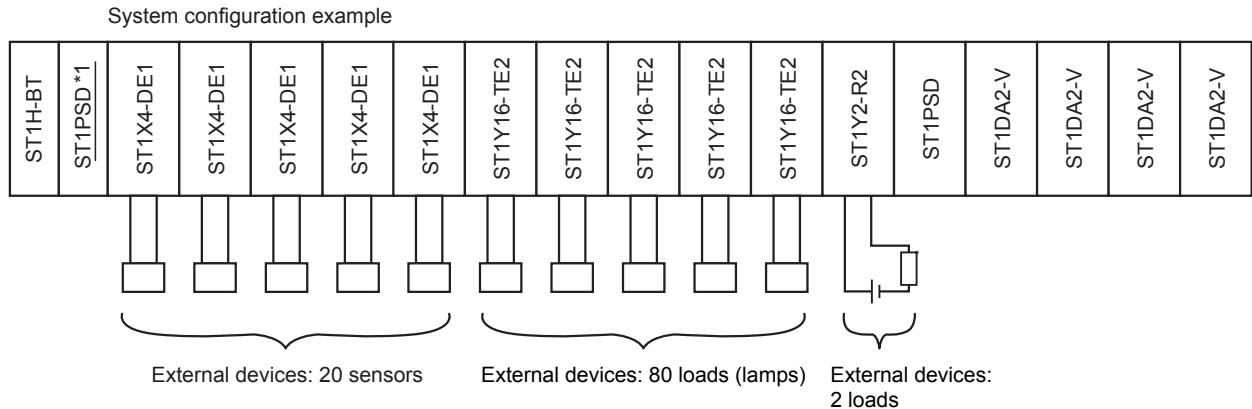
Using optional GX Configurator-ST, whether the power capacity is sufficient for the total 5VDC internal current consumption or not can be checked on the following monitor screen.

For details, refer to the GX Configurator-ST Operating Manual.



(b) Example of 24VDC current calculation

If the total 24VDC current exceeds the maximum rated current (I/O modules: 8.0A, Intelligent function modules: 3.0A) of the bus refreshing module, mount a new power feeding module (or bus refreshing module).



In the above system configuration, consider the following 24VDC currents for calculation.

The 24VDC currents of the output circuits of the transistor output modules (ST1Y16-TE2) need not be included in this calculation since they can be ignored.

Consider inrush currents when inductive loads, lamp loads or capacitive loads are connected to the contact output modules.

Item	Description
Load current of external device	Indicates the load current of an external device (sensor, lamp, etc.). For the current consumption of a user-prepared device, refer to the manual of the corresponding device.
Rated input current	Indicates the input current of the input module (ST1X4-DE1). Refer to Chapter 7 for the rated input current of the corresponding input module.
External AUX. power supply (for relay load) current	Indicates the current flowing in the relay coil of the contact output module (ST1Y2-R2). The current flowing in the relay contact need not be considered. Refer to Chapter 7 for the external AUX. power supply (for driving relay) current.
24VDC current consumption	Indicates the 24VDC current of the intelligent function module (ST1DA2-V). For the current value, refer to the manual of the corresponding intelligent function module.

Calculate the total 24VDC current using the maximum I/O point setting sheet given in Appendix 2 and 3.

Slice position No.	Start slice No. (Number of occupied slices)	Module name	Br.n	Bw.n	Wr.n	Ww.n	5VDC internal current consumption (Total value)	24VDC current (Total value)	Slot width (Total value)
0	0(2)	ST1H-BT	-	-	-	-	0.410A(0.410A)	0A(0A)	-
1	2(1)	ST1PSD	-	-	-	-	-	-	25.2mm(25.2mm)
2	3(2)	ST1X4-DE1	4	-	-	-	0.095A(0.505A)	0.616A(0.616A) * 1	12.6mm(37.8mm)
3	5(2)	ST1X4-DE1	4	-	-	-	0.095A(0.600A)	0.616A(1.232A) * 1	12.6mm(50.4mm)
4	7(2)	ST1X4-DE1	4	-	-	-	0.095A(0.695A)	0.616A(1.848A) * 1	12.6mm(63.0mm)
5	9(2)	ST1X4-DE1	4	-	-	-	0.095A(0.790A)	0.616A(2.464A) * 1	12.6mm(75.6mm)
6	11(2)	ST1X4-DE1	4	-	-	-	0.095A(0.885A)	0.616A(3.080A) * 1	12.6mm(88.2mm)
7	13(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.035A)	3.360A(6.440A) * 2	100.8mm(189.0mm)
8	21(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.185A)	3.360A(9.800A) * 2	100.8mm(289.8mm)
9	29(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.335A)	3.360A(13.160A) * 2	100.8mm(390.6mm)
10	37(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.485A)	3.360A(16.520A) * 2	100.8mm(491.4mm)
11	45(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.635A)	3.360A(19.880A) * 2	100.8mm(592.2mm)
12	53(1)	ST1Y2-R2	-	2	-	-	0.090A(1.725A)	0.035A(19.915A) * 3	12.6mm(604.8mm)
13	54(1)	ST1PSD	-	-	-	-	-	-	25.2mm(630.0mm)
14	55(2)	ST1DA2-V	4	4	-	2	0.095A(0.095A)	0.065A(0.065A) * 4	12.6mm(642.6mm)
15	57(2)	ST1DA2-V	4	4	-	2	0.095A(0.190A)	0.065A(0.130A) * 4	12.6mm(655.2mm)
16	59(2)	ST1DA2-V	4	4	-	2	0.095A(0.285A)	0.065A(0.195A) * 4	12.6mm(667.8mm)
17	61(2)	ST1DA2-V	4	4	-	2	0.095A(0.380A)	0.065A(0.260A) * 4	12.6mm(680.4mm)
Total			36	98	-	8	-	-	-

*1: Rated input current (4 input points) of the ST1X4-DE1 + load current of the external devices (4 sensors) connected to the ST1X4-DE1

$$24\text{VDC current} = 0.004 \times 4 + 0.15 \times 4 = 0.616(\text{A})$$

*2: Load current of the external devices (16 lamps) connected to the ST1Y16-TE2

$$24\text{VDC current} = 0.21 \times 16 = 3.36(\text{A})$$

*3: Current flowing in the relay coil of the ST1Y2-R2

$$24\text{VDC current} = 0.035(\text{A})$$

*4: 24VDC current of the ST1DA2-V = 0.2(A)

< In case of the ST1PSD listed as No.1 in the above table >

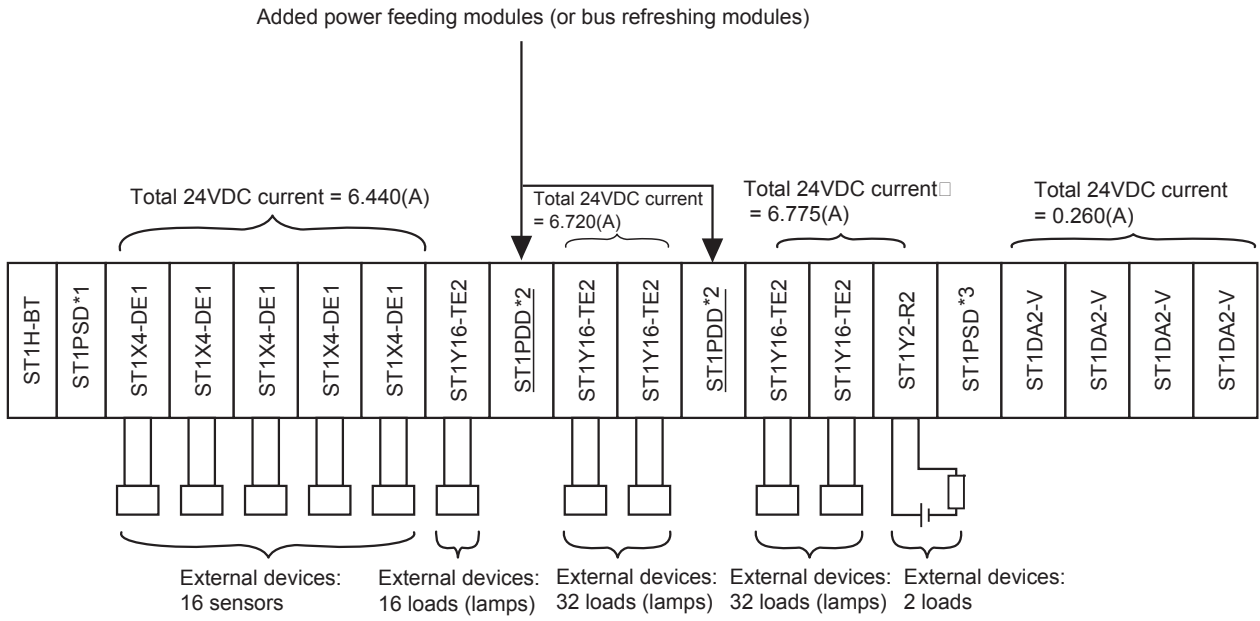
$$I = 0.616 \times 5 + 3.36 \times 5 + 0.035 = 19.915(\text{A})$$

If power is supplied to I/O modules, the total 24VDC current is greater than the maximum rated current 8.0A. Therefore, it is required to add the power feeding modules (or bus refreshing modules).

< In case of the ST1PSD listed as No.13 in the above table >

$$I = 0.065 \times 4 = 0.260(\text{A})$$

If power is supplied to intelligent function modules, the total 24VDC current is less than the maximum rated current 3.0A. Therefore, it is not required to add the power feeding modules (or bus refreshing modules).



- *1: Bus refreshing module (for powering head module)
- *2: Power feeding module (or bus refreshing module)
- *3: Bus refreshing module (for addition)

(c) Last check of 5VDC internal current consumption and 24VDC current calculation

Make a last check of the total 5VDC internal current consumption*¹ and 24VDC current*^{2*3} using the maximum I/O point setting sheet given in Appendix 2 and 3.

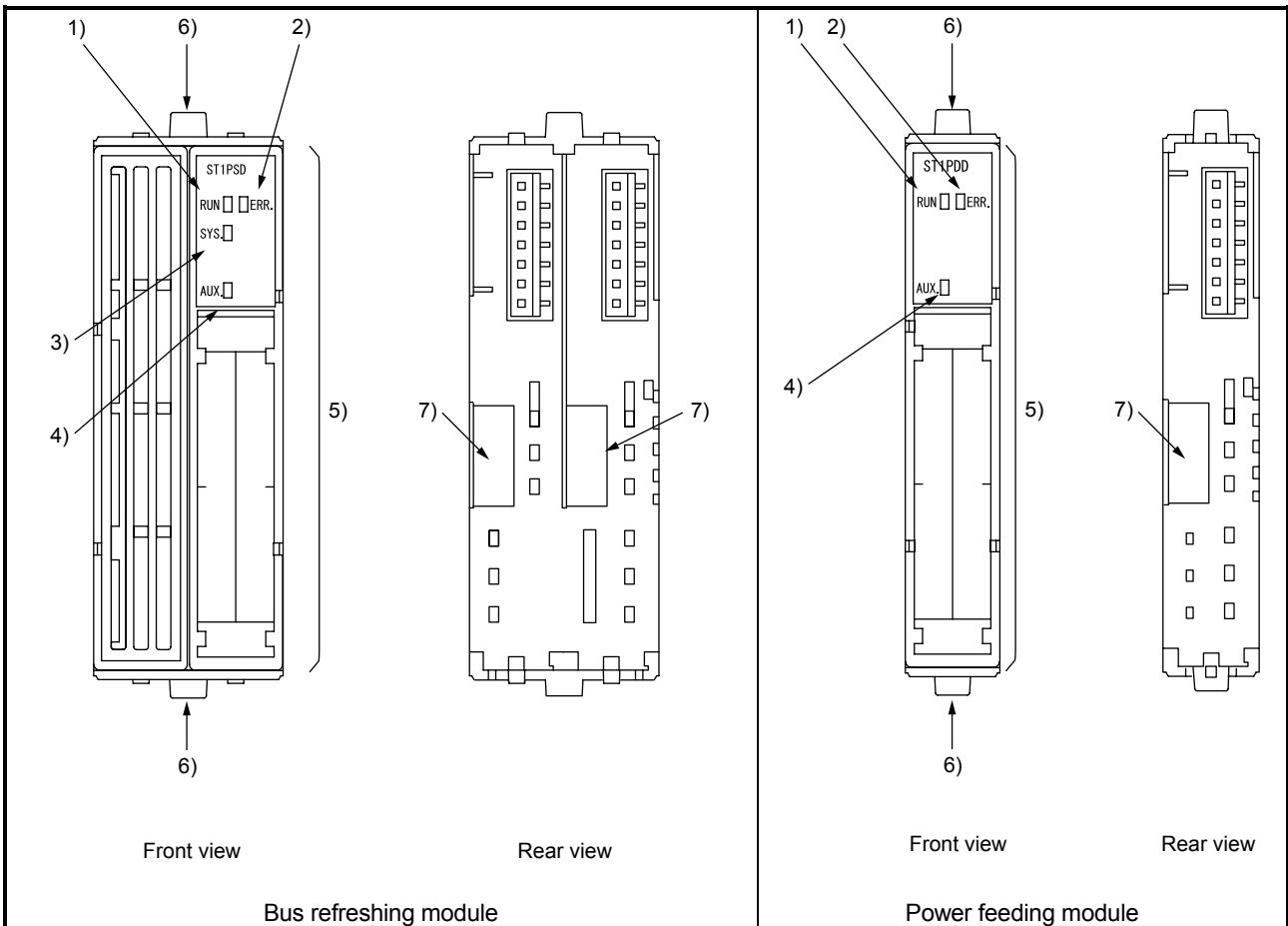
Slice position No.	Start slice No. (Number of occupied slices)	Module name	Br.n	Bw.n	Wr.n	Ww.n	5VDC internal current consumption (Total value)	24VDC current (Total value)	Slot width (Total value)	
0	0(2)	ST1H-BT	-	-	-	-	0.410A(0.410A)	0A(0A)	-	
1	2(1)	ST1PSD	-	-	-	-	-	-	25.2mm(25.2mm)	
2	3(2)	ST1X4-DE1	4	-	-	-	0.095A(0.505A)	0.616A(0.616A)	12.6mm(37.8mm)	
3	5(2)	ST1X4-DE1	4	-	-	-	0.095A(0.600A)	0.616A(1.232A)	12.6mm(50.4mm)	
4	7(2)	ST1X4-DE1	4	-	-	-	0.095A(0.695A)	0.616A(1.848A)	12.6mm(63.0mm)	Total 6.440A
5	9(2)	ST1X4-DE1	4	-	-	-	0.095A(0.790A)	0.616A(2.464A)	12.6mm(75.6mm)	
6	11(2)	ST1X4-DE1	4	-	-	-	0.095A(0.885A)	0.616A(3.080A)	12.6mm(88.2mm)	
7	13(8)	ST1Y16-TE2	-	16	Total *1 1.845A		0.150A(1.035A)	3.360A(6.440A)	100.8mm(189.0mm)	
8	54(1)	ST1PDD	-	-	-	-	0.060A(1.095A)	-	12.6mm(201.6mm)	
9	55(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.245A)	3.360A(3.360A)	100.8mm(289.8mm)	Total *2 6.720A
10	63(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.395A)	3.360A(6.720A)	100.8mm(390.6mm)	
11	71(1)	ST1PDD	-	-	-	-	0.060A(1.455A)	-	12.6mm(201.6mm)	
12	72(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.605A)	3.360A(3.360A)	100.8mm(491.4mm)	Total *2 6.755A
13	80(8)	ST1Y16-TE2	-	16	-	-	0.150A(1.755A)	3.360A(6.720A)	100.8mm(592.2mm)	
14	88(1)	ST1Y2-R2	-	2	-	-	0.090A(1.845A)	0.035A(6.755A)	12.6mm(604.8mm)	
15	89(1)	ST1PSD	-	-	-	-	-	-	25.2mm(630.0mm)	
16	90(2)	ST1DA2-V	4	4	-	2	0.095A(0.095A)	0.065A(0.065A)	12.6mm(642.6mm)	
17	92(2)	ST1DA2-V	4	4	Total *1 0.380A		0.095A(0.190A)	0.065A(0.130A)	12.6mm(655.2mm)	Total *3 0.260A
18	94(2)	ST1DA2-V	4	4	-	-	0.095A(0.285A)	0.065A(0.195A)	12.6mm(667.8mm)	
19	96(2)	ST1DA2-V	4	4	-	2	0.095A(0.380A)	0.065A(0.260A)	12.6mm(680.4mm)	
Total			36	98	-	8	-	-	-	

*1: Check to see if the total 5VDC internal current consumption of the I/O modules mounted between the ST1PSD (including ST1H-BT) and the next ST1PSD is greater than the maximum rated output current 2.0A.

*2: Check to see if the total 24VDC current of the slice modules mounted between the ST1PDD (or ST1PSD) and the next ST1PDD (or ST1PSD) is greater than the maximum rated current 8.0A.

*3: Check to see if the total 24VDC current of the intelligent function modules mounted between the ST1PDD (or ST1PSD) and the next ST1PDD (or ST1PSD) is greater than maximum rated current 3.0 A.

5.3 Part Names



No.	Name	Application
1)	RUN LED	Refer to Section 5.3.1.
2)	ERR. LED	
3)	SYS. LED	
4)	AUX. LED	
5)	Faceplate	<ul style="list-style-type: none"> Indicates the I/O module status with the above LEDs 1) to 3). The diagram of wiring to base module is printed on the surface. When checking the wiring diagram, remove the symbol label.
6)	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.
7)	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. Refer to Chapter 8 for details.

5.3.1 Operating status LEDs

LED indication	LED status	Operating status
RUN	On	Normal
	Flickering (0.25s intervals)	Selected as a module to be replaced online.*1
	Flickering (1s intervals)	Communication with the master station has stopped.*2 Parameter setting error *2 Other slice module fault Internal bus error occurring
	Off	External power supply off, hardware fault, internal bus error occurring
ERR.	On	Hardware fault
	On (0.5s intervals)	24VDC voltage low
	Off	Normal
SYS.	On	Normal
	Off	24VDC voltage low, 5VDC voltage low
AUX.	On	Normal
	Off	24VDC voltage low

*1: The LED flickers when the module is selected as the target of online module change.

Do not replace the power distribution module as it cannot be the target of online module change.

*2: Refer to the head module manual for details.

6 BASE MODULE

6.1 Base Module Specifications

The base module specifications are indicated below.

Item	Specifications			
	Spring clamp type		Screw clamp type	
	1-slot width	8-slot width	1-slot width	8-slot width
Applicable wire size	Solid wire: 0.5 to 2.5mm ² (AWG 20 to AWG 12) Twisted wire: 0.5 to 1.5mm ² (AWG 20 to AWG 16) When bar crimping terminal is used: 0.5 to 1.5mm ² (AWG 20 to AWG 16)			
Wire type	2 to 4-wire type			
Installation	Direct installation to DIN rail			
Weight	Refer to following table			

Terminal block type	Model	Weight
Spring clamp type	ST1B-S4X2	0.04kg
	ST1B-S6X4	0.05kg
	ST1B-S3Y2	0.03kg
	ST1B-S4IR2	0.04kg
	ST1B-S4X16	0.23kg
	ST1B-S3Y16	0.21kg
	ST1B-S4P2-H-SET	0.07kg
	ST1B-S4P2-R-SET	0.07kg
	ST1B-S4P2-D	0.04kg
Screw clamp type	ST1B-E4X2	0.05kg
	ST1B-E6X4	0.07kg
	ST1B-E3Y2	0.04kg
	ST1B-E4IR2	0.06kg
	ST1B-E4X16	0.33kg
	ST1B-E3Y16	0.29kg
	ST1B-E4P2-H-SET	0.10kg
	ST1B-E4P2-R-SET	0.10kg
	ST1B-E4P2-D	0.05kg

Use the ST1B-□4P2-H-SET or ST1B-□4P2-R-SET by combining two base modules of 1-slot width. The specifications are the same as those of the 1-slot width.

6.2 Base module selection

(1) Selection of base module corresponding to slice module

After selecting the slice module, select the base module that corresponds to that slice module. Refer to Chapter 5 and 7 for the base module applied to each slice module.

As the base modules, the 1-slot type (power distribution module, intelligent function module, 2/4-point I/O module) and 8-slot width (16-point I/O module) are available.

Carefully select the base module that corresponds to the slice module.

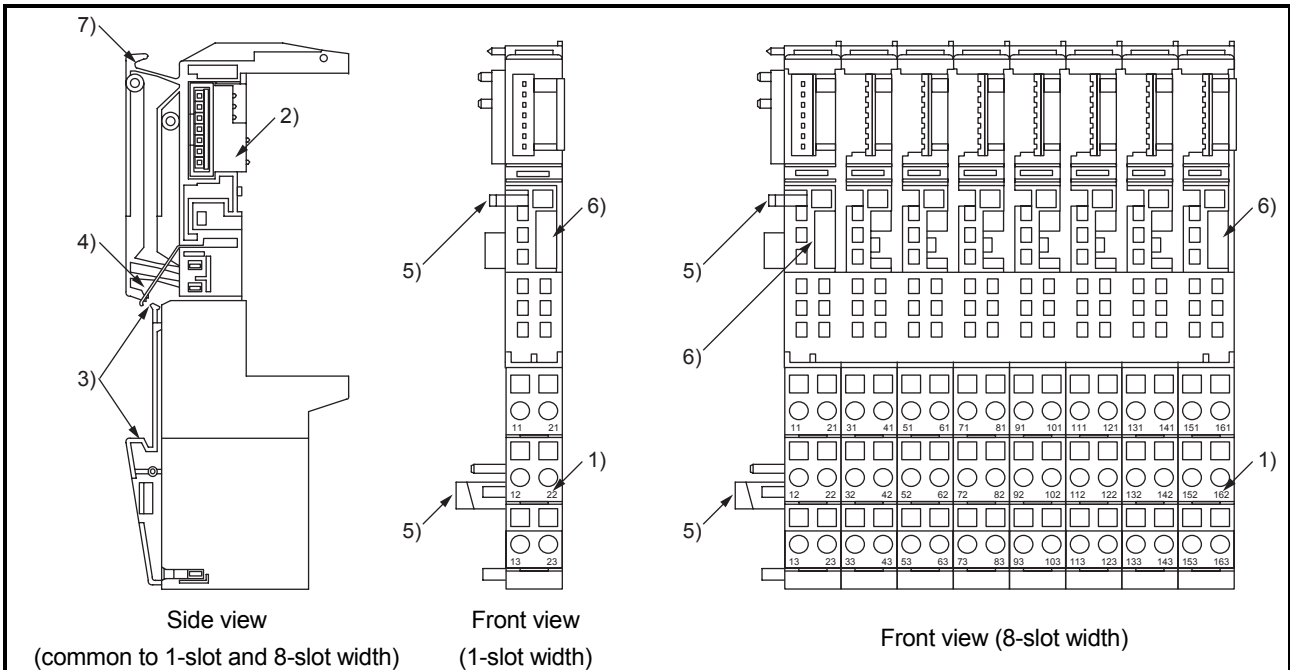
(2) Terminal block type selection

Two different terminal blocks are available for the base modules: spring clamp type and screw clamp type.

In the system, the spring clamp type and screw clamp type cannot be used together. Select either terminal block type.

6.3 Part Names

This section explains the part names of the base modules.



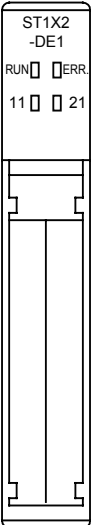
No.	Name	Application
1)	External wiring terminal block	Terminal block for connection of external wiring. The terminal block color changes depending on the slice module type. • Terminal block of I/O module or intelligent function module: Dark gray • Terminal block of base module for power distribution module: Red (The terminal block for shield has light gray stripes.) Insert a screwdriver into the top hole (square), and insert a wire into the bottom hole (circular).
2)	Base module connector cover	Connector for electrical connection between base modules. The connector color changes depending on the base module type. • For bus refresh module (for powering the head module): Dark gray • For bus refresh module (for extension): Yellow • For power feeding module, I/O module, intelligent function module: Dark gray
3)	Installation groove for DIN rail	Groove for installation on a DIN rail.
4)	FG contact	Grounding metal spring on the rear side of the base module. When the base module is installed on a DIN rail, the function ground (FG1) of the base module is connected via the DIN rail.
5)	Fixing hook	Hook for coupling with an adjacent base module.
6)	Coding element mounting holes	Holes for mounting the coding element. (Refer to Chapter 8 for the coding element.)
7)	Base module removing hook	Hook used for inserting a screwdriver when removing the base module from the DIN rail. (Refer to Section 10.3.)

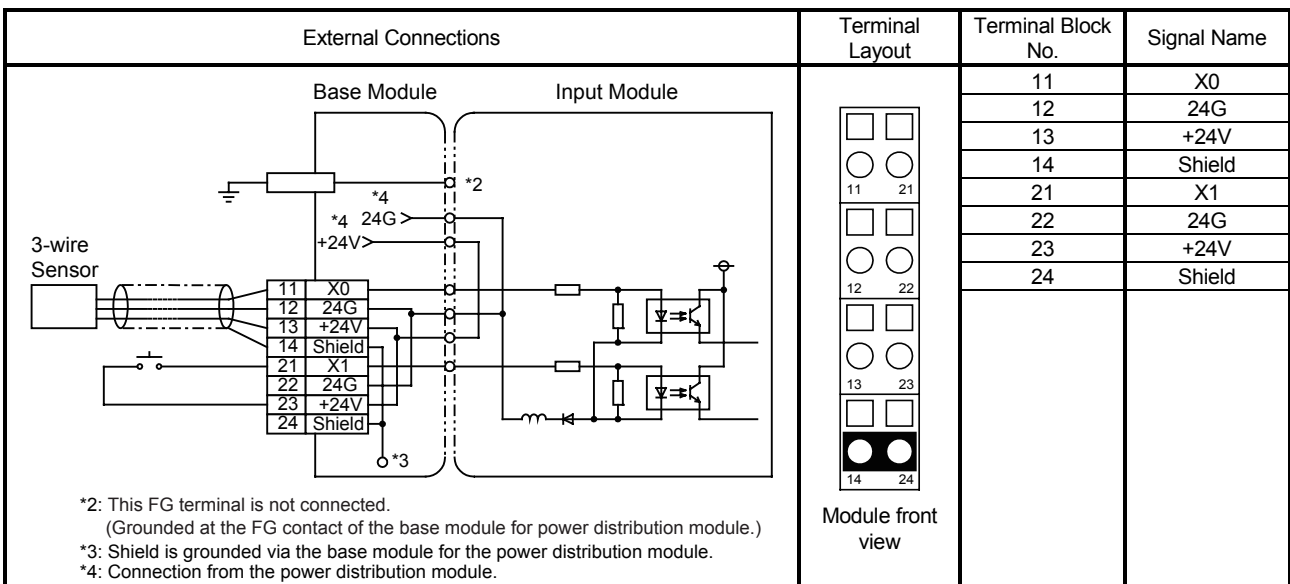
7 I/O MODULES

7.1 Input Module Specifications

This section indicates the input module specifications.
Refer to Appendix 2 and 3 for I/O data of each module.

7.1.1 ST1X2-DE1 DC input module (negative common type)

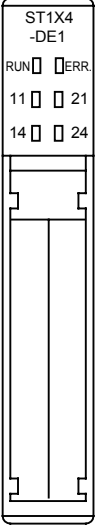
Specifications	Type	DC Input Module (negative common type)		Appearance
		ST1X2-DE1		
Number of occupied slice modules		1		
Number of occupied I/O points		CC-Link: 2 points for input, 0 point for output PROFIBUS-DP: 2 points for each of input and output		
Number of input points		2 points		
Isolation method		Photocoupler		
Rated input voltage		24VDC (+20/-15%, ripple ratio within 5%)		
Rated input current		Approx. 4mA		
Input derating		None		
ON voltage/ON current		19V or higher/3mA or higher		
OFF voltage/OFF current		11V or lower/1.7mA or lower		
Input resistance		Approx. 5.6kΩ		
Response time	OFF to ON	0.5ms/1.5ms or less (24VDC) Initial setting is 1.5ms. *1		
	ON to OFF	0.5ms/1.5ms or less (24VDC) Initial setting is 1.5ms. *1		
24VDC maximum current		2A (total current of signal "+24V") (During online module change, maximum inrush current is 2A/point (5ms))		
Wiring method for common		2 points/common		
Dielectric withstand voltage		500VAC for 1 minute across DC external terminals and FG		
Insulation resistance		10MΩ or larger by insulation resistance tester across DC external terminals and FG		
Noise durability		By noise simulator of 500Vp-p noise voltage, 1μs noise width and 25 to 60Hz noise frequency		
		First transient noise IEC61000-4-4: 1kV (bundle)		
Protection of degree		IP20		
Operating status		ON indication (LED)		
Available base module	Spring clamp type	ST1B-S4X2 2 to 3-wire type + shield		
	Screw clamp type	ST1B-S4X2 2 to 3-wire type + shield		
Available coding element		ST1A-CKY-02 (light gray) (factory-fit) Refer to Chapter 8 for details.		
5VDC internal current consumption		0.085A (TYP. all points ON) (0.09A is shown on the rating plate of the module.)		
Weight		0.03kg		

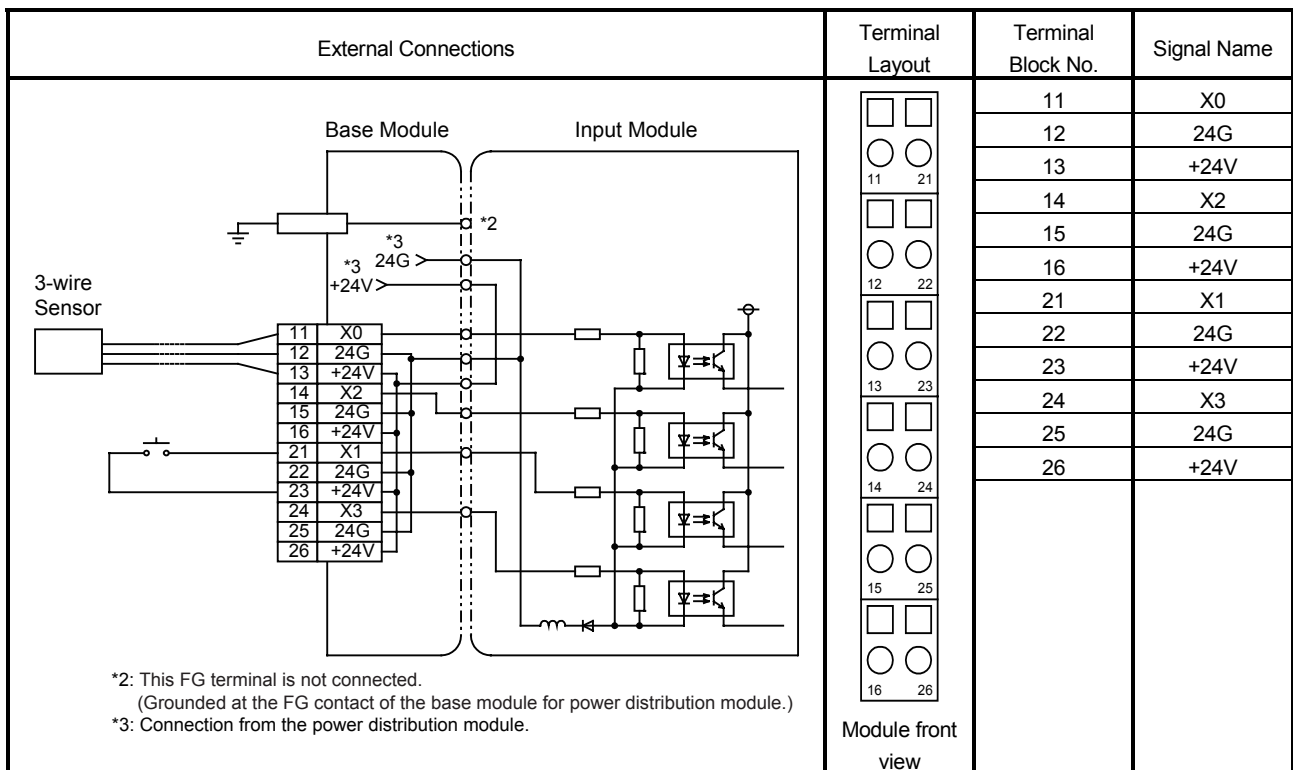


*1: For response time of an input module, refer to Chapter 9.



7.1.2 ST1X4-DE1 DC input module (negative common type)

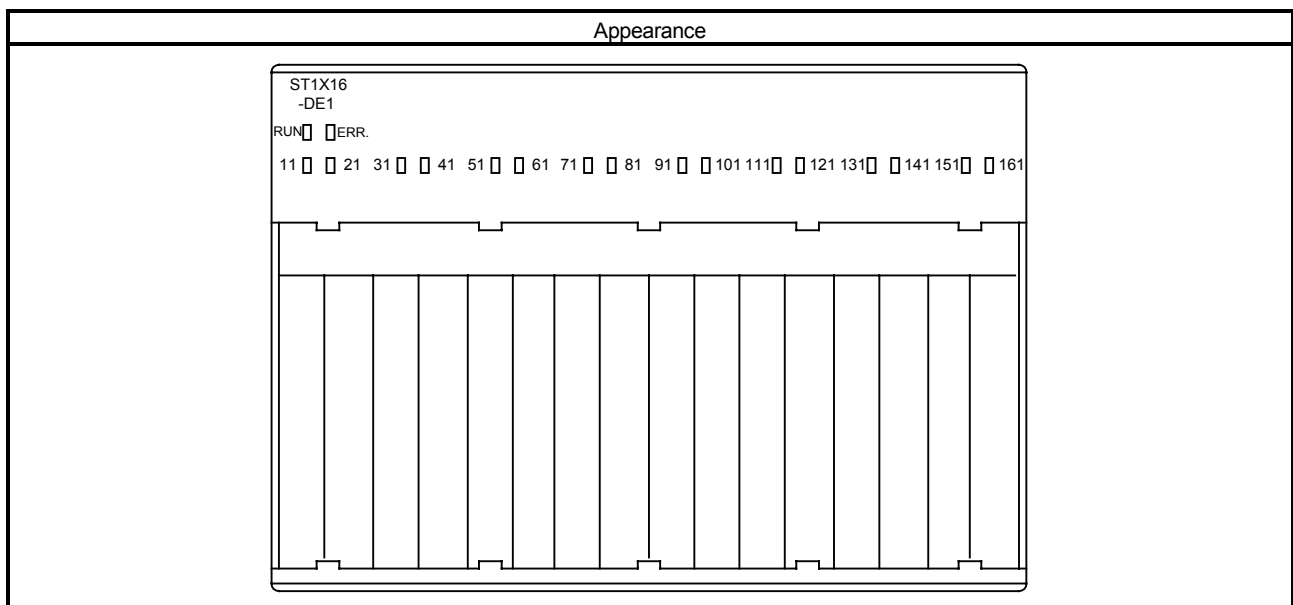
Specifications		Type	DC Input Module (negative common type)	
			ST1X4-DE1	Appearance
Number of occupied slice modules		2		
Number of occupied I/O points		CC-Link: 4 points for input, 0 point for output PROFIBUS-DP: 4 points for each of input and output		
Number of input points		4 points		
Isolation method		Photocoupler		
Rated input voltage		24VDC (+20/-15%, ripple ratio within 5%)		
Rated input current		Approx. 4mA		
Input derating		None		
ON voltage/ON current		19V or higher/3mA or higher		
OFF voltage/OFF current		11V or lower/1.7mA or lower		
Input resistance		Approx. 5.6k Ω		
Response time	OFF to ON	0.5ms/1.5ms or less (24VDC) Initial setting is 1.5ms. *1		
	ON to OFF	0.5ms/1.5ms or less (24VDC) Initial setting is 1.5ms. *1		
24VDC maximum current		2A (total current of signal "+24V") (During online module change, maximum inrush current is 2A/point (5ms))		
Wiring method for common		4 points/common		
Dielectric withstand voltage		500VAC for 1 minute across DC external terminals and FG		
Insulation resistance		10M Ω or larger by insulation resistance tester across DC external terminals and FG		
Noise durability		By noise simulator of 500Vp-p noise voltage, 1 μs noise width and 25 to 60Hz noise frequency		
		First transient noise IEC61000-4-4: 1kV (bundle)		
Protection of degree		IP20		
Operating status		ON indication (LED)		
Available base module	Spring clamp type	ST1B-S6X4 2 to 3-wire type		
	Screw clamp type	ST1B-E6X4 2 to 3-wire type		
Available coding element		ST1A-CKY-02 (light gray) (factory-fit) Refer to Chapter 8 for details.		
5VDC internal current consumption		0.095A (TYP. all points ON) (0.10A is shown on the rating plate of the module.)		
Weight		0.03kg		



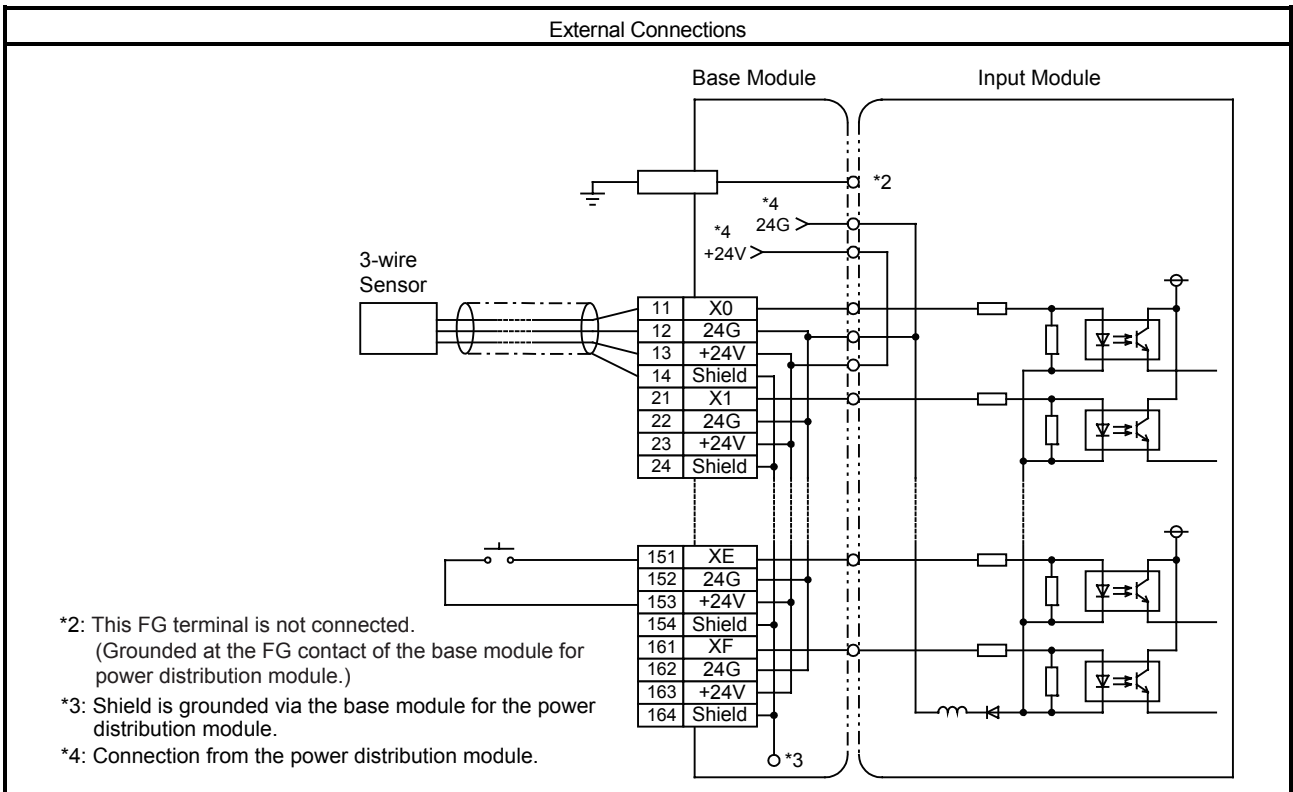
*1: For response time of an input module, refer to Chapter 9.

7.1.3 ST1X16-DE1 DC input module (negative common type)

Specifications		Type	DC Input Module (negative common type)
		ST1X16-DE1	
Number of occupied slice modules		8	
Number of occupied I/O points		CC-Link: 16 points for input, 0 point for output PROFIBUS-DP: 16 points for each of input and output	
Number of input points		16 points	
Isolation method		Photocoupler	
Rated input voltage		24VDC (+20/-15%, ripple ratio within 5%)	
Rated input current		Approx. 4mA	
Input derating		None	
ON voltage/ON current		19V or higher/3mA or higher	
OFF voltage/OFF current		11V or lower/1.7mA or lower	
Input resistance		Approx. 5.6kΩ	
Response time	OFF to ON	0.5ms/1.5ms or less (24VDC) Initial setting is 1.5ms. *1	
	ON to OFF	0.5ms/1.5ms or less (24VDC) Initial setting is 1.5ms. *1	
24VDC maximum current		2A (total current of signal "+24V") (During online module change, maximum inrush current is 2A/point (5ms))	
Wiring method for common		16 points/common	
Dielectric withstand voltage		500VAC for 1 minute across DC external terminals and FG	
Insulation resistance		10MΩ or larger by insulation resistance tester across DC external terminals and FG	
Noise durability		By noise simulator of 500Vp-p noise voltage, 1 μs noise width and 25 to 60Hz noise frequency First transient noise IEC61000-4-4: 1kV (bundle)	
Protection of degree		IP20	
Operating status		ON indication (LED)	
Available base module	Spring clamp type	ST1B-S4X16 2 to 4-wire type	
	Screw clamp type	ST1B-E4X16 2 to 4-wire type	
Available coding element		ST1A-CKY-02 (light gray) (factory-fit) Refer to Chapter 8 for details.	
5VDC internal current consumption		0.120A (TYP. all points ON)	
Weight		0.11kg	



*1: For response time of an input module, refer to Chapter 9.



Terminal Layout	Terminal Block No.	Signal Name	Terminal Block No.	Signal Name
	11	X0	91	X8
	12	24G	92	24G
	13	+24V	93	+24V
	14	Shield	94	Shield
	21	X1	101	X9
	22	24G	102	24G
	23	+24V	103	+24V
	24	Shield	104	Shield
	31	X2	111	XA
	32	24G	112	24G
	33	+24V	113	+24V
	34	Shield	114	Shield
	41	X3	121	XB
	42	24G	122	24G
	43	+24V	123	+24V
	44	Shield	124	Shield
	51	X4	131	XC
	52	24G	132	24G
	53	+24V	133	+24V
	54	Shield	134	Shield
	61	X5	141	XD
	62	24G	142	24G
	63	+24V	143	+24V
	64	Shield	144	Shield
	71	X6	151	XE
	72	24G	152	24G
	73	+24V	153	+24V
	74	Shield	154	Shield
	81	X7	161	XF
	82	24G	162	24G
	83	+24V	163	+24V
	84	Shield	164	Shield

□	□	□	□	□	□	□	□	□	□
○	○	○	○	○	○	○	○	○	○
11	21	31	41	51	61	71	81	91	101
111	121	131	141	151	161				
□	□	□	□	□	□	□	□	□	□
○	○	○	○	○	○	○	○	○	○
12	22	32	42	52	62	72	82	92	102
112	122	132	142	152	162				
□	□	□	□	□	□	□	□	□	□
○	○	○	○	○	○	○	○	○	○
13	23	33	43	53	63	73	83	93	103
113	123	133	143	153	163				
□	□	□	□	□	□	□	□	□	□
○	○	○	○	○	○	○	○	○	○
14	24	34	44	54	64	74	84	94	104
114	124	134	144	154	164				

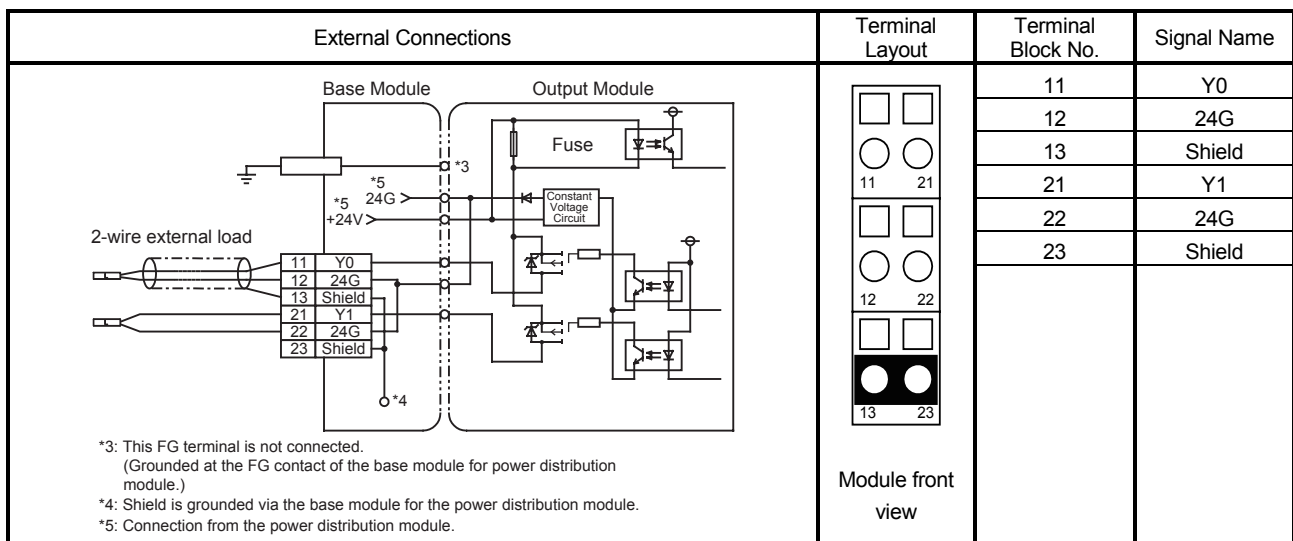
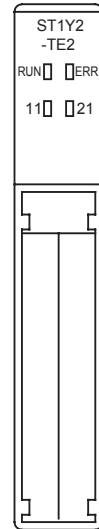
Module front view

7.2 Output Module Specifications

This section indicates the output module specifications.
Refer to Appendix 2 and 3 for the I/O data of each module.

7.2.1 ST1Y2-TE2 transistor output module (source type)

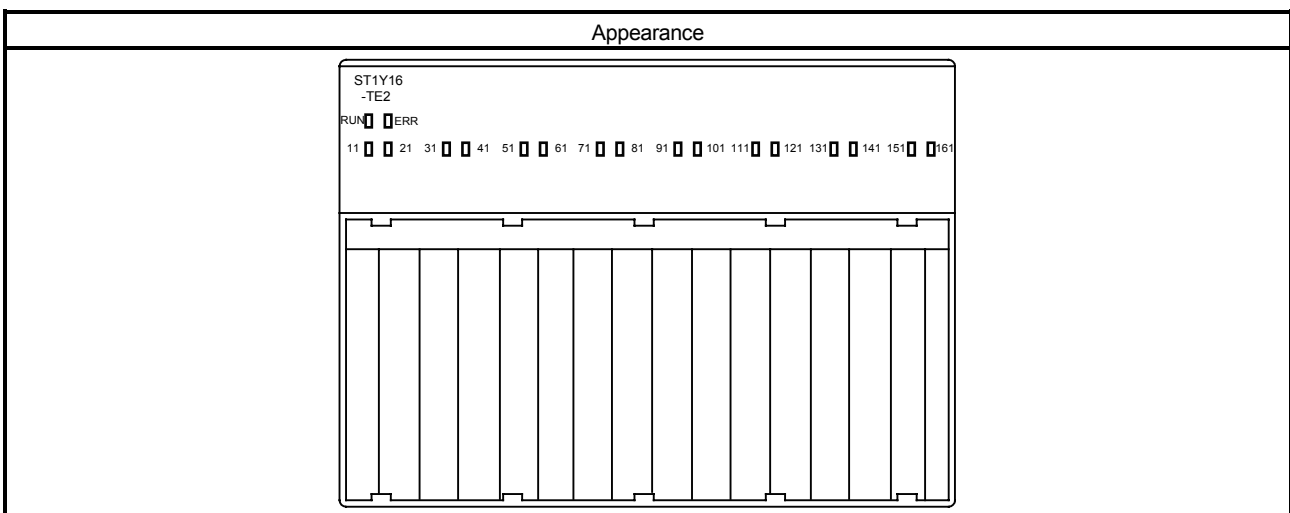
Specifications	Type	Transistor Output Module (source type)	
		ST1Y2-TE2	Appearance
Number of occupied slice modules		1	
Number of occupied I/O points		CC-Link: 0 point for input, 2 points for output PROFIBUS-DP: 2 points for each of input and output	
Number of output points		2 points	
Isolation method		Photocoupler	
Rated load voltage		24VDC (+20/-15%, ripple ratio within 5%)	
Maximum load current		0.5A/point, 1A/common	
Maximum inrush current		4A, 10ms or less	
Leakage current at OFF		0.1mA or less	
Maximum voltage drop at ON		0.2VDC (TYP.) 0.5A, 0.3VDC (MAX.) 0.5A	
Response time	OFF to ON	1ms or less	
	ON to OFF	1ms or less (rated load, resistive load)	
Surge suppressor		Zener diode	
Fuse		4.0A (unchangeable) (fuse blown capacity: 50A) *1	
Fuse blown indication		Yes (Fuse blown indicated by ERR. LED, signal output to head module)*2	
Wiring method for common		2 points/common	
Dielectric withstand voltage		500VAC for 1 minute across DC external terminals and FG	
Insulation resistance		10MΩ or larger by insulation resistance tester across DC external terminals and FG	
Noise durability		By noise simulator of 500Vp-p noise voltage, 1μs noise width and 25 to 60Hz noise frequency	
		First transient noise IEC61000-4-4: 1kV (bundle)	
Protection of degree		IP20	
Operating status		ON indication (LED)	
Available base module	Spring clamp type	ST1B-S3Y2 2-wire type + shield	
	Screw clamp type	ST1B-E3X2 2-wire type + shield	
Available coding element		ST1A-CKY-08 (orange) (factory-fit) Refer to Chapter 8 for details.	
5VDC internal current consumption		0.090A (TYP. all points ON)	
Weight		0.03kg	



*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 fuse blown is not detected when external supply power is off.

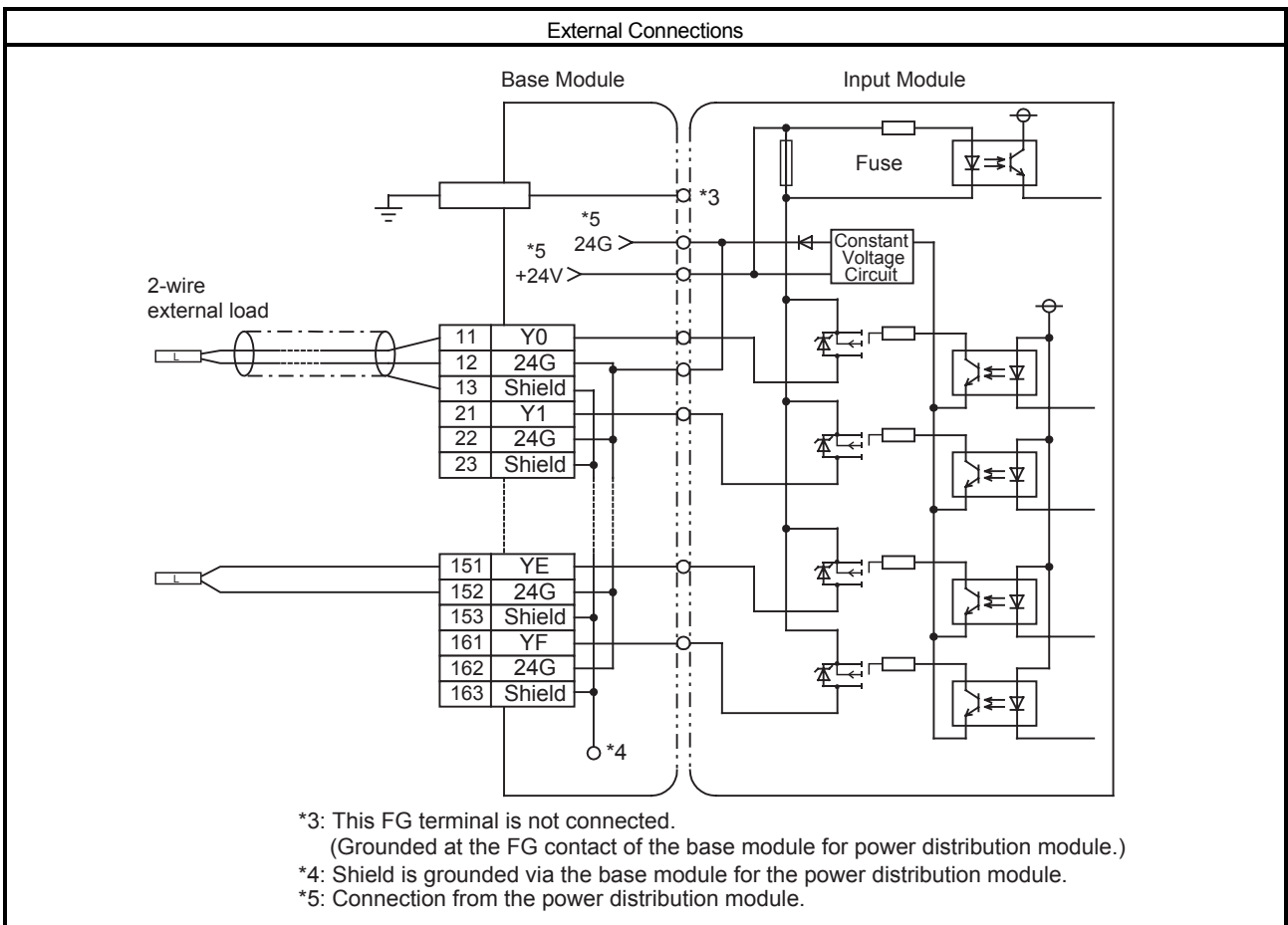
7.2.2 ST1Y16-TE2 transistor output module (source type)

Type		Transistor Output Module (source type)
Specifications		ST1Y16-TE2
Number of occupied slice modules		8
Number of occupied I/O points		CC-Link: 0 point for input, 16 points for output PROFIBUS-DP: 16 points for each of input and output
Number of output points		16 points
Isolation method		Photocoupler
Rated load voltage		24VDC (+20/-15%, ripple ration within 5%)
Maximum load current		0.5A/point, 4A/common
Maximum inrush current		4A, 10ms or less
Leakage current at OFF		0.1mA or less
Maximum voltage drop at ON		0.2VDC (TYP.) 0.5A, 0.3VDC (MAX.) 0.5A
Response time	OFF to ON	1ms or less
	ON to OFF	1ms or less (rated load, resistive load)
Surge suppressor		Zener diode
Fuse		6.7A (unchangeable) (fuse blown capacity: 50A) *1
Fuse blown indication		Yes (Fuse blown indicated by ERR. LED, signal output to head module) *2
Wiring method for common		16 points/common
Dielectric withstand voltage		500VAC for 1 minute across DC external terminals and FG
Insulation resistance		10M Ω or larger by insulation resistance tester across DC external terminals and FG
Noise durability		By noise simulator of 500Vp-p noise voltage, 1 μs noise width and 25 to 60Hz noise frequency First transient noise IEC61000-4-4: 1kV (bundle)
Protection of degree		IP20
Operating status		ON indication (LED)
Available base module	Spring clamp type	ST1B-S3Y16 2-wire type + shield
	Screw clamp type	ST1B-E3X16 2-wire type + shield
Available coding element		ST1A-CKY-08 (orange) (factory-fit) Refer to Chapter 8 for details.
5VDC internal current consumption		0.150A (TYP. all points ON)
Weight		0.11kg



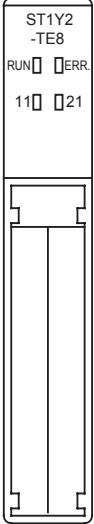
*1: The fuse is provided to prevent the external wiring from burning when the output of the output module is shorted. Therefore, the output module may not be protected. The fuse may not operate if the output module is damaged in the failure mode other than a short circuit.

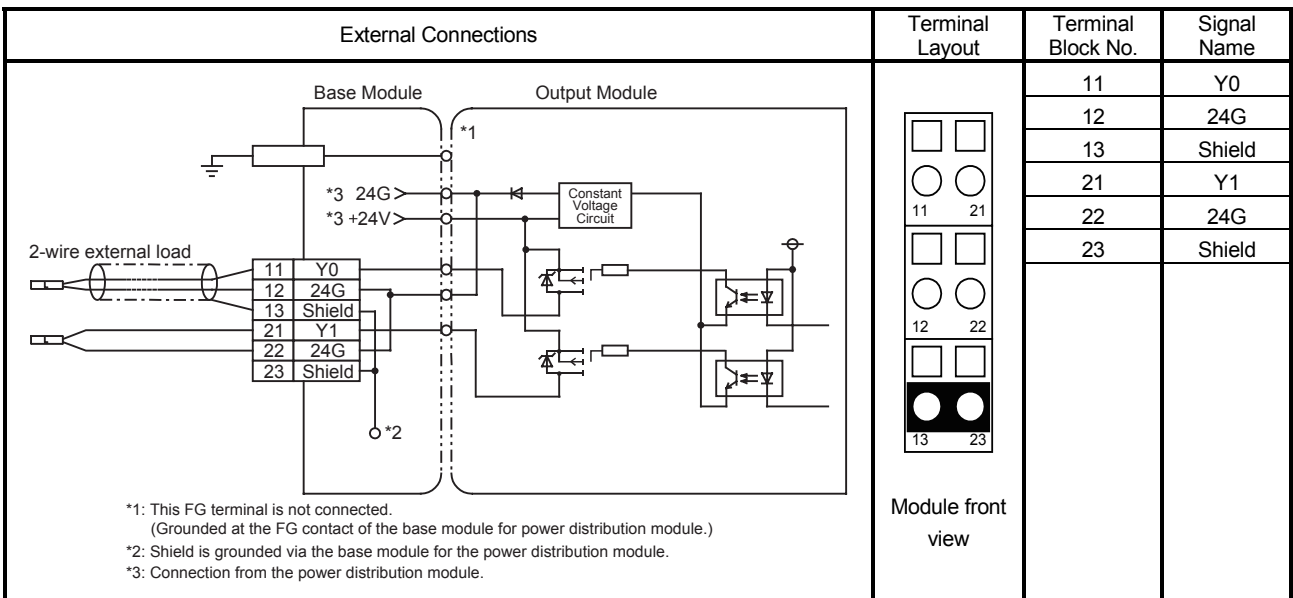
*2: A fuse blown is not detected when external supply power is off.



Terminal Layout	Terminal No.	Signal Name	Terminal No.	Signal Name
	11	Y0	91	Y8
	12	24G	92	24G
	13	Shield	93	Shield
	21	Y1	101	Y9
	22	24G	102	24G
	23	Shield	103	Shield
	31	Y2	111	YA
	32	24G	112	24G
	33	Shield	113	Shield
	41	Y3	121	YB
	42	24G	122	24G
	43	Shield	123	Shield
	51	Y4	131	YC
	52	24G	132	24G
	53	Shield	133	Shield
	61	Y5	141	YD
	62	24G	142	24G
	63	Shield	143	Shield
	71	Y6	151	YE
	72	24G	152	24G
	73	Shield	153	Shield
	81	Y7	161	YF
	82	24G	162	24G
	83	Shield	163	Shield

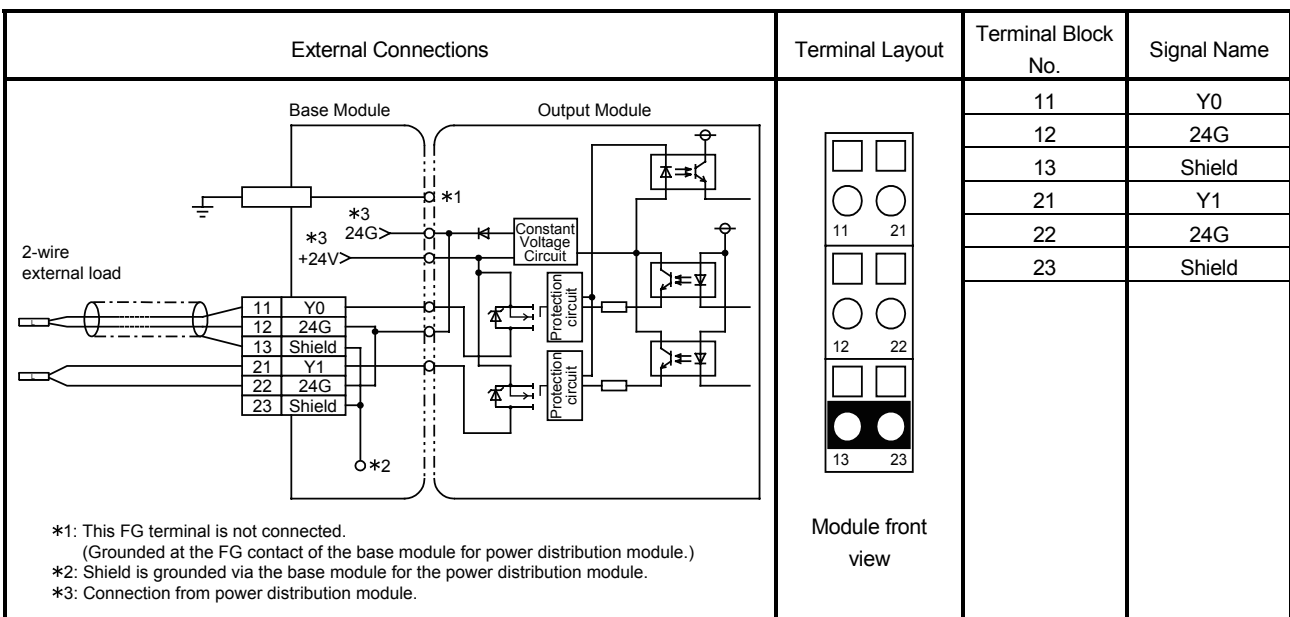
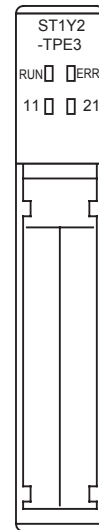
7.2.3 ST1Y2-TE8 transistor output module (source type)

Specifications	Type	Transistor Output Module (source type)		
		ST1Y2-TE8	Appearance	
Number of occupied slice modules	1			
Number of occupied I/O points	CC-Link: 0 point for input, 2 points for output PROFIBUS-DP: 2 points for each of input and output			
Number of output points	2 points			
Isolation method	Photocoupler			
Rated load voltage	24VDC (+20/-15%, ripple ratio within 5%)			
Maximum load current	2A/point, 4A/common			
Maximum inrush current	8A, 10ms or less			
Leakage current at OFF	0.1mA or less			
Maximum voltage drop at ON	0.2VDC (TYP.) 2A, 0.3VDC (MAX.) 2A			
Response time	OFF to ON	1ms or less		
	ON to OFF	1ms or less (rated load, resistive load)		
Surge suppressor	Zener diode			
Fuse	None (Attaching a fuse to external wiring is recommended. Refer to Section 7.3(4))			
Wiring method for common	2 points/common			
Dielectric withstand voltage	500VAC for 1 minute across DC external terminals and FG			
Insulation resistance	10MΩ or larger by insulation resistance tester across DC external terminals and FG			
Noise durability	By noise simulator of 500Vp-p noise voltage, 1μs noise width and 25 to 60Hz noise frequency			
	First transient noise IEC61000-4-4: 1kV (bundle)			
Protection of degree	IP20			
Operating status	ON indication (LED)			
Available base module	Spring clamp type	ST1B-S3Y2 2-wire type + shield		
	Screw clamp type	ST1B-E3X2 2-wire type + shield		
Available coding element	ST1A-CKY-08 (orange) (factory-fit) Refer to Chapter 8 for details.			
5VDC internal current consumption	0.095A (TYP. all points ON) (0.10A is shown on the rating plate of the module.)			
Weight	0.04kg			



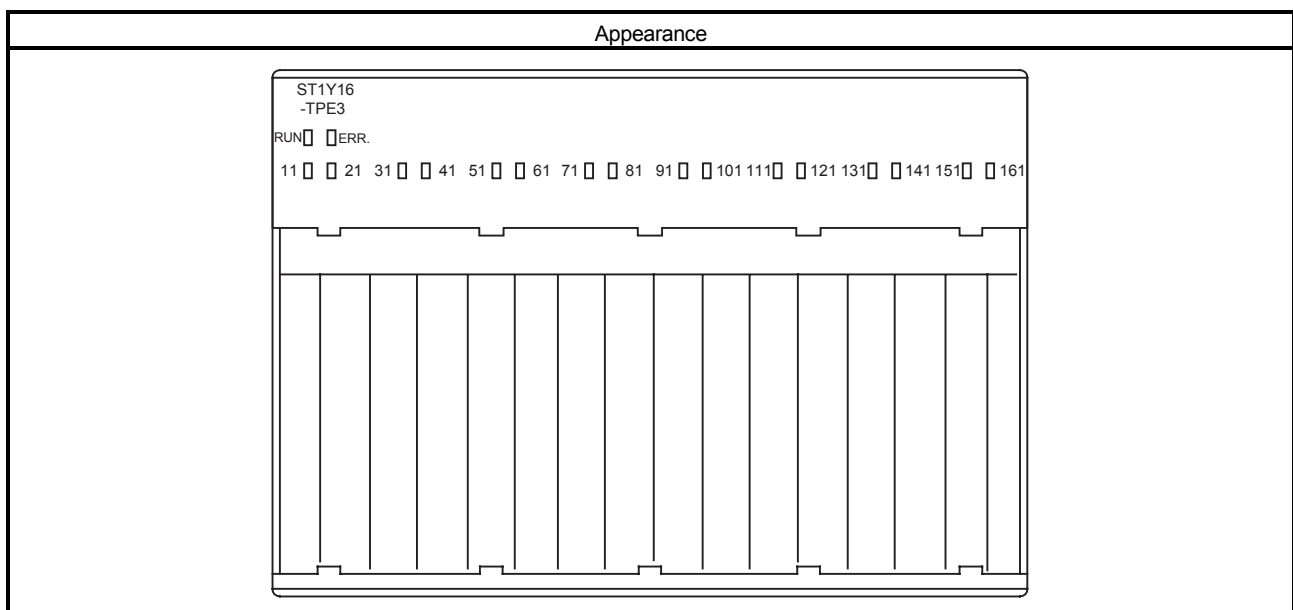
7.2.4 ST1Y2-TPE3 transistor output module (source type)

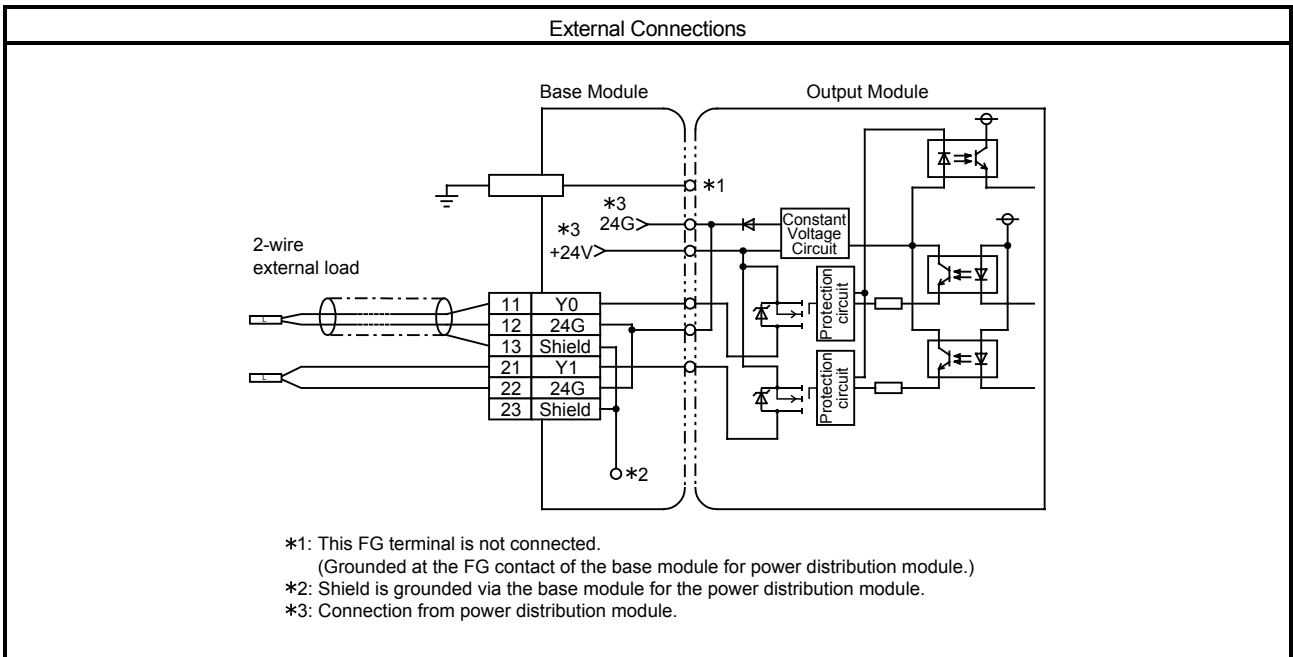
Specifications		Type	Transistor Output Module (source type)	
			ST1Y2-TPE3	Appearance
Number of occupied slice modules		1		
Number of occupied I/O points		CC-Link: 0 point for input, 2 points for output PROFIBUS-DP: 2 points for each of input and output		
Number of output points		2 points		
Isolation method		Photocoupler		
Rated load voltage		24VDC (+20/-15%, ripple ration within 5%)		
Maximum load current		1.0A/point, 2.0A/common		
Maximum inrush current		2.0A, 10ms or less		
Leakage current at OFF		0.3mA or less		
Maximum voltage drop at ON		0.15VDC (TYP.) 1.0A, 0.2VDC (MAX.) 1.0A		
Response time	OFF to ON	0.5ms or less		
	ON to OFF	1.5ms or less (rated load, resistive load)		
Surge suppressor		Zener diode		
Protection function		<ul style="list-style-type: none"> • Yes (thermal protection, short circuit protection) • Indicated by LED (When protective function is activated, ERR. LED turns on and signal is output to head module) • Automatic recovery 		
Wiring method for common		2 points/common		
Dielectric withstand voltage		500VAC for 1 minute across DC external terminals and FG		
Insulation resistance		10MΩ or larger by insulation resistance tester across DC external terminals and FG		
Noise durability		By noise simulator of 500Vp-p noise voltage, 1μs noise width and 25 to 60Hz noise frequency First transient noise IEC61000-4-4: 1kV (bundle)		
Protection of degree		IP20		
Operating status		ON indication (LED)		
Available base module	Spring clamp type	ST1B-S3Y2 2-wire type + shield		
	Screw clamp type	ST1B-E3X2 2-wire type + shield		
Available coding element		ST1A-CKY-08 (orange) (factory-fit) Refer to Chapter 8 for details.		
5VDC internal current consumption		0.095A (TYP. all points ON) (0.10A is shown on the rating plate of the module.)		
Weight		0.03kg		



7.2.5 ST1Y16-TPE3 transistor output module with protective functions (source type)

Specifications		Type	Transistor Output Module (source type)
		ST1Y16-TPE3	
Number of occupied slice modules		8	
Number of occupied I/O points		CC-Link: 0 point for input, 16 points for output PROFIBUS-DP: 16 points for each of input and output	
Number of output points		16 points	
Isolation method		Photocoupler	
Rated load voltage		24VDC (+20/-15%, ripple ratio within 5%)	
Maximum load current		1.0A/point, 4A/common	
Maximum inrush current		2A, 10ms or less	
Leakage current at OFF		0.3mA or less	
Maximum voltage drop at ON		0.15VDC (TYP.) 1.0A, 0.25VDC (MAX.) 1.0A	
Response time	OFF to ON	0.5ms or less	
	ON to OFF	1.5ms or less (rated load, resistive load)	
Surge suppressor		Zener diode	
Protection function		<ul style="list-style-type: none"> • Yes (thermal protection, short circuit protection) • Indicated by LED (When protective function is activated, ERR. LED turns on and signal is output to head module) • Automatic recovery 	
Wiring method for common		2 points/common	
Dielectric withstand voltage		560VAC rms/3 cycles (altitude 2000m (6557.38ft.))	
Insulation resistance		10M Ω or larger by insulation resistance tester across DC external terminals and FG	
Noise durability		By noise simulator of 500Vp-p noise voltage, 1 μs noise width and 25 to 60Hz noise frequency First transient noise IEC61000-4-4: 1kV (bundle)	
Protection of degree		IP20	
Operating status		ON indication (LED)	
Available base module	Spring clamp type	ST1B-S3Y16 2-wire type + shield	
	Screw clamp type	ST1B-E3X16 2-wire type + shield	
Available coding element		ST1A-CKY-08 (orange) (factory-fit) Refer to Chapter 8 for details.	
5VDC internal current consumption		0.160A (TYP. all points ON)	
Weight		0.11kg	



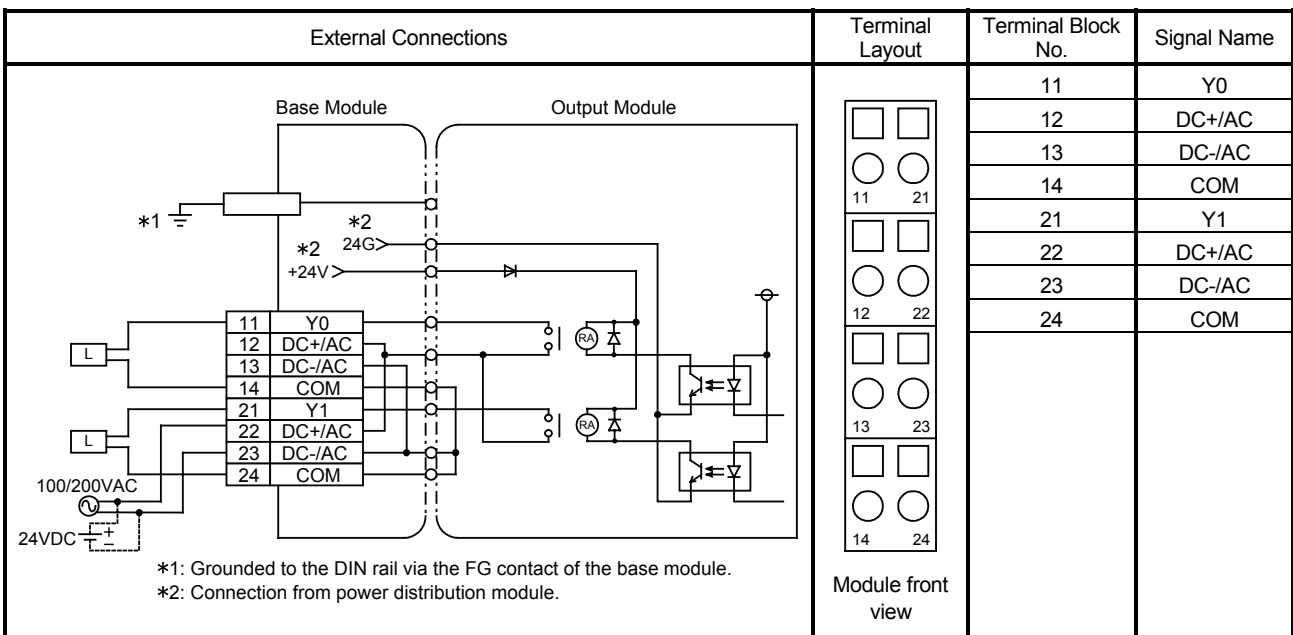
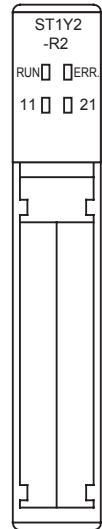


Terminal Layout	Terminal Block No.	Signal Name	Terminal Block No.	Signal Name
	11	Y0	91	Y8
	12	24G	92	24G
	13	Shield	93	Shield
	21	Y1	101	Y9
	22	24G	102	24G
	23	Shield	103	Shield
	31	Y2	111	YA
	32	24G	112	24G
	33	Shield	113	Shield
	41	Y3	121	YB
	42	24G	122	24G
	43	Shield	123	Shield
	51	Y4	131	YC
	52	24G	132	24G
	53	Shield	133	Shield
	61	Y5	141	YD
	62	24G	142	24G
	63	Shield	143	Shield
	71	Y6	151	YE
	72	24G	152	24G
	73	Shield	153	Shield
	81	Y7	161	YF
	82	24G	162	24G
	83	Shield	163	Shield

Module front view

7.2.6 ST1Y2-R2 Contact Output Module

Type		Contact Output Module	
Specifications		ST1Y2-R2	
Number of occupied slice modules		1	
Number of occupied I/O points		CC-Link: 0 point for input, 2 points for output PROFIBUS-DP: 2 points for each of input and output	
Number of output points		2 points	
Isolation method		Photocoupler	
Rated switching voltage, current		24VDC 2A (resistive load) /point, 4A/common 240VAC 2A (cos $\phi = 1$)	
Minimum switching load		5VDC 1mA	
Maximum switching load		264VAC 125VDC	
Response time	OFF to ON	10ms or less	
	ON to OFF	12ms or less	
Wiring method for common		2 points/common	
Life	Mechanical	20 million times or more	
	Electrical	Rated switching voltage/current load More than 100 thousand times or more 200VAC 1.5A, 240VAC 1A (cos $\phi = 0.7$) 100 thousand times or more 200VAC 1A, 240VAC 0.5A (cos $\phi = 0.35$) 100 thousand times or more 24VDC 1A, 100VDC 0.1A (L/R = 7ms) 100 thousand times or more	
Maximum switching frequency		3600 times/hour	
Surge suppressor		No	
External power supply for driving relay	Voltage	24VDC (+20/-15%, ripple ratio within 5%)	
	Current	35mA or less (24VDC, when all points are ON)	
Fuse		No	
Dielectric withstand voltage		2830VAC rms/3 cycles (altitude 2000m (6557.38ft.))	
Insulation resistance		10M Ω or larger by insulation resistance tester across external terminals and FG	
Noise durability		By noise simulator of 1500Vp-p noise voltage, 1 μ s noise width and 25 to 60Hz noise frequency First transient noise IEC61000-4-4: 1kV (bundle)	
Protection of degree		IP20	
Operating status		ON indication (LED)	
Available base module	Spring clamp type	ST1B-S4IR2 2-wire type	
	Screw clamp type	ST1B-E4IR2 2-wire type	
Available coding element		ST1A-CKY-17 (brown) (factory-fit) Refer to Section 8 for details.	
5VDC internal current consumption		0.090A (TYP. all points ON)	
Weight		0.04kg	



7.3 Precautions for Use

- (1) Do not use I/O modules under pressure higher than the atmospheric pressure of 0m (0ft.) altitude. Doing so can cause a malfunction.
When using I/O modules under pressure, please consult your local representative.

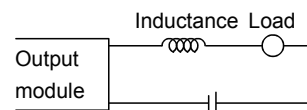
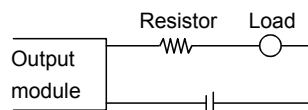
7.3.1 Input module

- (1) Input modules may import noise or similar as an input depending on the pulse width of a signal.
This pulse width changes as shown below depending on the parameter-set response time. The operating environment should be fully considered when making the response time setting.

Response Time Setting	Minimum Value of Pulse Width That May Be Imported
0.5ms	0.02ms
0.5ms	0.8ms

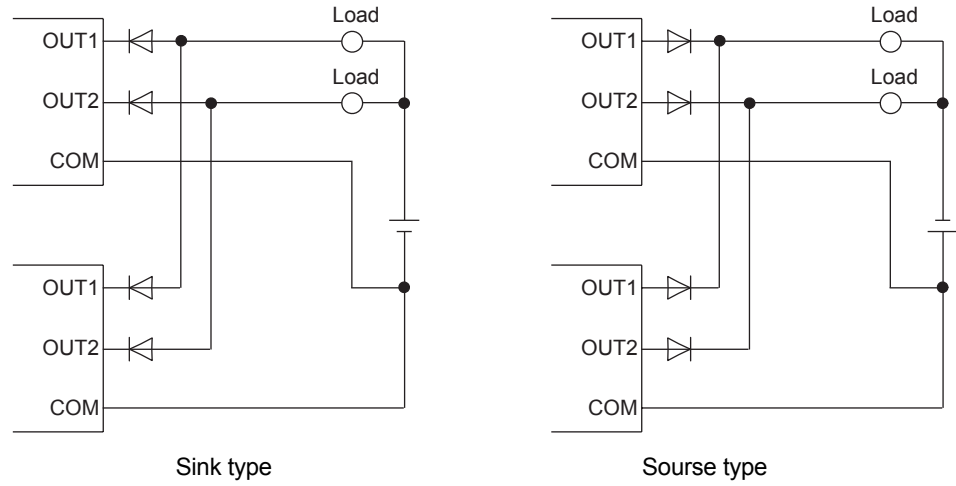
7.3.2 Output module

- (1) When using an output module to drive an inductive load, make sure that the relay inside the module is ON/OFF for 1 second or longer.
- (2) When the counter/time that uses DC-DC converter as load is applied to an output module, this causes the rush current to flow in a constant period while the device is ON or operating. If an average current is selected in this condition, the module may malfunction.
Therefore, when using above load, connect a resistor and an inductance to the load in series or select a module that includes large maximum load current, in order to reduce the influence of the rush current.



- (3) A fuse for output module is unexchangeable, which is designed to prevent the external wiring from burning out when the module output 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.

- (4) Connecting transistor output modules in parallel may cause output elements to fail. Set the diodes, as shown below, when connecting transistor output modules in parallel.



- (5) Caution points when using ST1Y2-TE8

Installing a fuse to each external terminal to prevent burn out of external devices and modules in the case of a load short is recommended.

A rated voltage 3A fast type fuse is recommended.

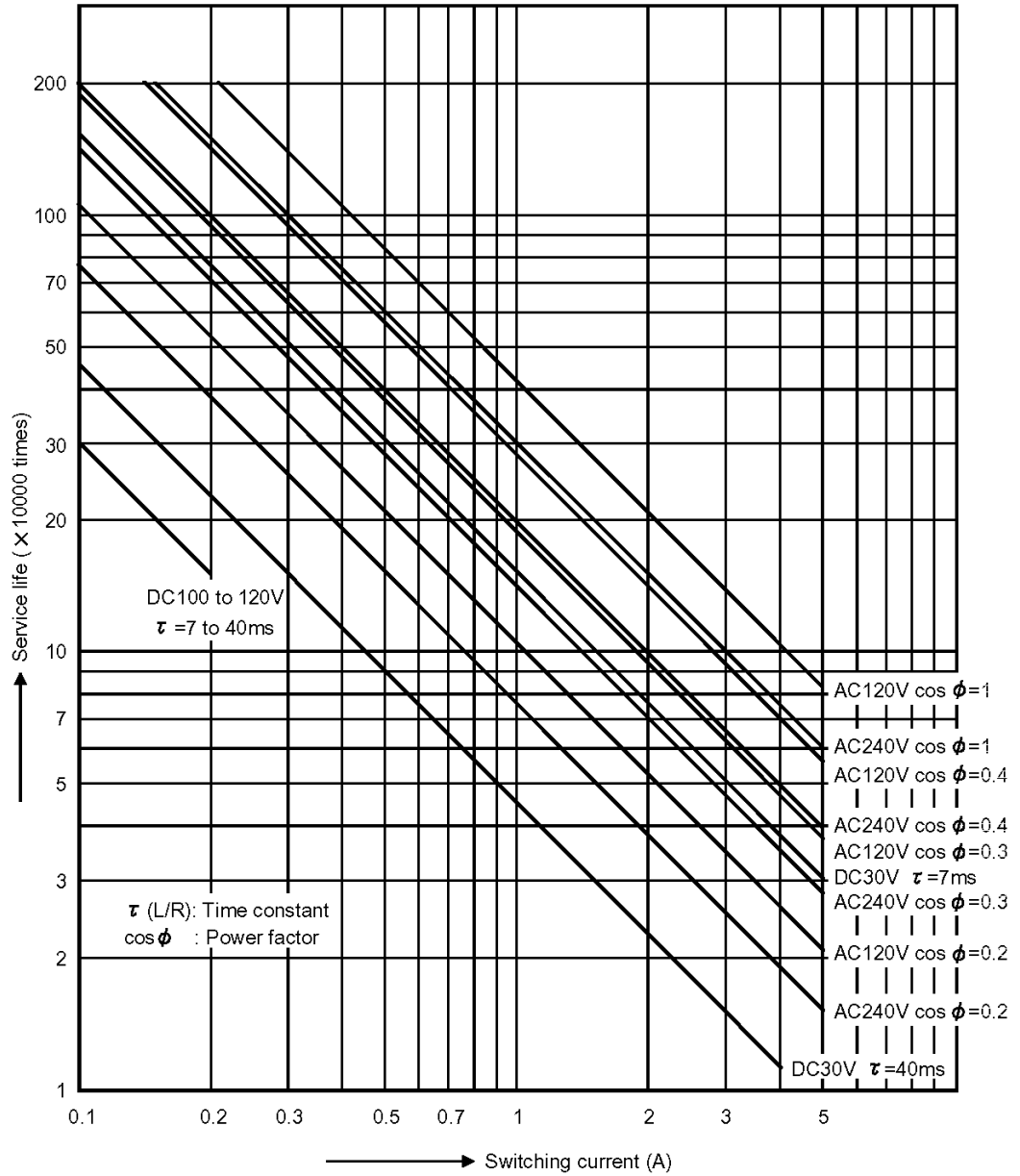
Fuses confirmed for operation by this company are listed below.

Fuse Model	216 3.15	312 003
Rated current	3.15A	3A
Manufacturer	Littelfuse, Inc	

(6) Precautions for the use of contact output module.

(a) Relay life of contact output module

Relevant module: ST1Y2-R2



POINT	
The relay life curve shows the value based on actual use, which is not guaranteed. Therefore, make sure to allow for a margin of error.	
The specifications of the relay life is as follows:	
Rated switching voltage, current load	100 thousand operations
200V AC 1.5A, 240V AC 1A (COS ϕ =0.7)	100 thousand operations
200V AC 1A, 240V AC 0.5A (COS ϕ =0.35)	100 thousand operations
24V DC 1A, 100V DC 0.1A (L/R=7ms)	100 thousand operations

(b) Measures against inrush current

Relay life significantly varies depending on its load type the characteristics of its inrush current.

Take following measures since the inrush current may cause contact welding.

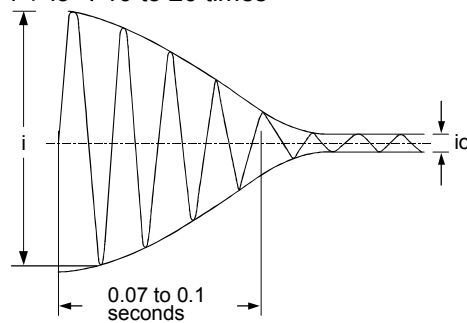
- In case of an increase in inrush current, select a load so that the inrush current will be within the rated current of the module.
- Connect the relay that can sustain inrush current outside the module.

1) Inductive load

Inrush current of inductive load may flow 20 times as large as the rated current depending on a load.

[Load of a solenoid]

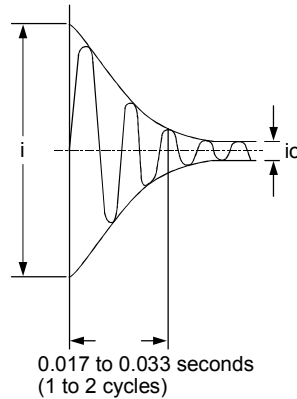
$$i \div i_o \doteq 10 \text{ to } 20 \text{ times}$$



i: Inrush current
io: Rated current

[Load of a magnetic contactor]

$$i \div i_o \doteq 3 \text{ to } 10 \text{ times}$$



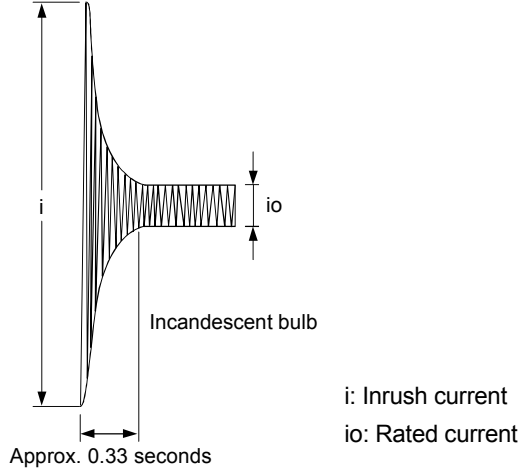
i: Inrush current
io: Rated current

2) Load of a lamp

Inrush current 10 times as large as the rated current may flow through the lamp circuit depending on a load.

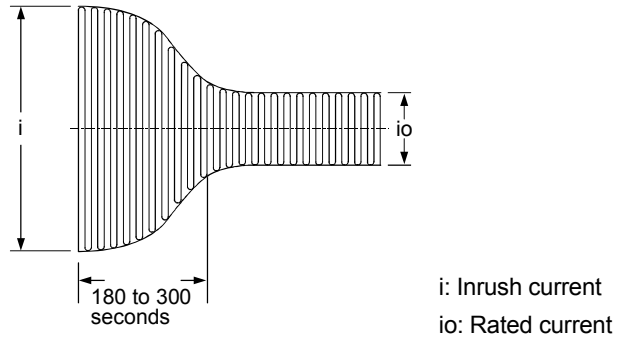
[Load of an incandescent bulb]

$i \div i_o \doteq 3 \text{ to } 10 \text{ times}$



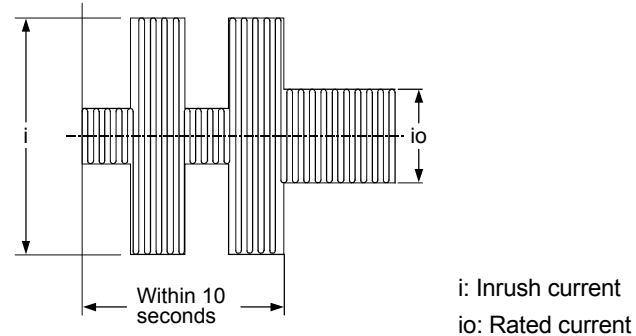
[Load of a mercury lamp]

$i \div i_o \doteq 3 \text{ times}$



[Load of a fluorescent]

$i \div i_o \doteq 5 \text{ to } 10 \text{ times}$



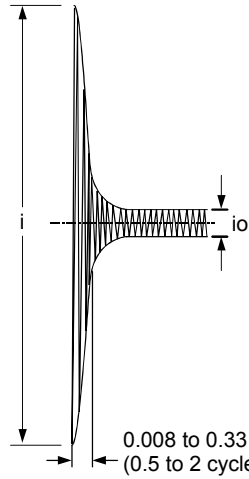
3) Capacitive load

When a load circuit includes such as a capacitor, inrush current 40 times as large as the rated current may flow through the load circuit depending on a load.

Also, pay attention to the wire capacity when the wiring is laid long.

[Capacitive load]

$i \div i_o \doteq 20 \text{ to } 40 \text{ times}$



i: Inrush current

i_o: Rated current

(c) Measures against back EMF

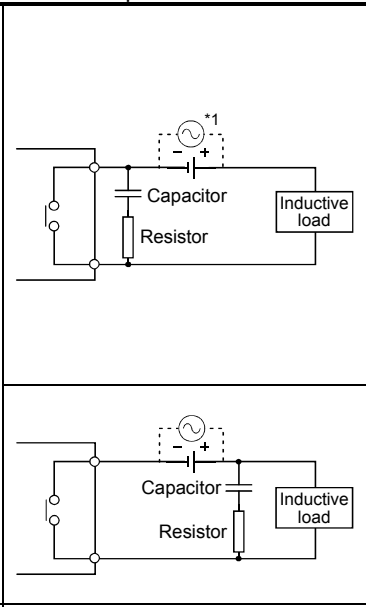
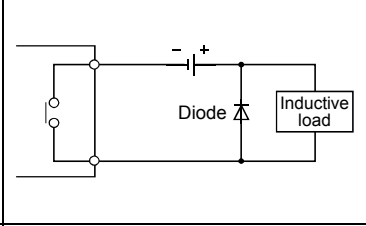
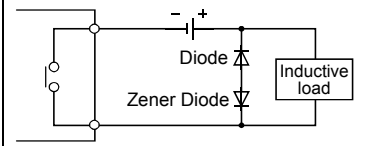
When inductive load such as a magnetic contactor and solenoid is shut off, high back EMF is generated between the contacts and arc discharge occurs.

Especially when the power factor is small, the life shortens due to arc discharge.

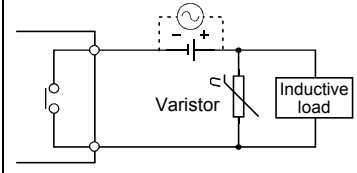
Therefore, take measures against arc discharge.

The following is four methods to protect a relay contact against back EMF.

- Capacitor + Resistor method (CR method)
- Diode method
- Diode + Zener diode method
- Varistor method

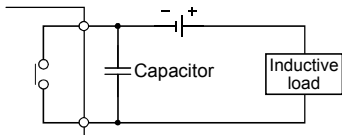
Circuit example	Method for selecting elements	Remarks
<p>Capacitor + Resistor method (CR method)</p> 	<p>Refer to the following for constants of the capacitor and resistor. Note that the following values may differ depending on a nature of the load and a variation of characteristics.</p> <ul style="list-style-type: none"> • Capacitor 0.5 to 1 (μF) against contact current of 1A • Resistor 0.5 to 1 (Ω) against contact voltage of 1V <p>Use a capacitor whose withstanding voltage is 200 to 300V. In AC circuit, use a capacitor having no polarity.</p>	<p>If a load is from a relay or solenoid, the recovery time delays. A capacitor suppresses electric discharge while a contact is off, and a resistor restricts a flow of current while a contact is on.</p> <p>*1: When using AC power, impedance of CR must be larger enough than that of the load. (prevention of a malfunction due to leak current from the CR)</p>
<p>Diode method</p> 	<p>Use a diode whose reverse breakdown voltage is 10 times as large as the circuit voltage or more and whose forward current is equal to or more than the load current.</p>	<p>The recovery time is later than the CR method.</p>
<p>Diode + Zener diode method</p> 	<p>Use zener voltage for the zener diode equal to or more than the power supply voltage.</p>	<p>The diode method is effective when the recovery time is too late.</p>

(To the next page)

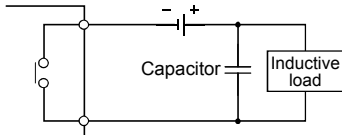
Circuit example	Method for selecting elements	Remarks
<p>Varistor method</p> 	<p>Select a cut voltage (V_c) for the varistor to meet the following condition. Multiply the value by root two for use of AC power.</p> $V_c > \text{Power supply voltage} \times 1.5 \text{ (V)}$ <p>Note that when selecting an element whose V_c is too high, its effect will weaken.</p>	<p>The recovery time delays slightly.</p>

POINT

(1) Avoid providing a protection circuit as shown below.



This circuit is greatly effective to an arc at shut-off. However, since an electric charge has been accumulated in a capacitor while a contact is off, short circuit current of the capacitor flows while the contact is on, which tends to result in contact welding.



This circuit is greatly effective to an arc at shut-off. However, since a charge current of the capacitor flows while the contact is on, which tends to result in contact welding.

(2) A protection circuit must be provided so that it may be close to a load or contact (module). If their distance is far, the protection circuit cannot show its effect. Provide the circuit so that their distance may be within 50cm (19.69 inch) (rough standard).

7.3.3 Module with protection function

(1) The following restrictions apply when the thermal protection is activated by the output module with protection functions.

The thermal protection indicates overload and overheat protection functions.

(a) ST1Y2-TPE3, ST1Y16-TPE3

Function	Description
Common (Overload and overheat protection functions)	<ul style="list-style-type: none">• If an overcurrent keeps flowing due to overload, heat is generated to activate the overheat protection function.• Each protection function is designed to protect the internal elements of the module, not the external equipment.
Overload protection function	<ul style="list-style-type: none">• The overload protection function is activated for each point in terms of 3A to 5A/point.• The overload protection function returns to normal operation when the load becomes a rated load
Overheat protection function	<ul style="list-style-type: none">• The overheat protection function is activated for each point.• The overheat protection function automatically returns to normal operation when heat reduces.

7.4 Part Names

This section explains the part names of the I/O modules.

<p>Front view</p> <p>Rear view</p> <p>1 slot width</p>		<p>Front view</p> <p>Rear view</p> <p>8 slot width</p>	
No.	Name	Application	
1)	RUN LED	Refer to Section 7.4 (1).	
2)	ERR. LED		
3)	I/O status LEDs (Example: 11 to 162)	Indicate whether the inputs/outputs are ON or OFF. The LED is lit when the corresponding input/output is ON, and is unlit when it is OFF.	
4)	Faceplate	<ul style="list-style-type: none"> The I/O module statuses in above 1) to 3) are indicated by the LEDs. The diagram of wiring to base module is printed on the surface. When checking the wiring diagram, remove the symbol label. The I/O module types are color-coded as indicated below. Input module: Light gray Transistor output module: Orange Contact output module: Brown 	
5)	Slice module fixing hooks (both ends)	Hooks provided to mount/remove the I/O module to/from the base module. Hold down the mounting/removing hooks at both ends and remove the module.	
6)	Coding element	Provided to prevent the I/O module from being improperly inserted into the base module. The I/O module can be inserted only when the coding element of the base module matches that of the I/O module. (Refer to Chapter 8 for details.)	

(1) Operating status LEDs

Input module

LED indication	LED status	Operating status
RUN	On	Normal
	Flickering (0.25s intervals)	Selected as the target of online module change
	Flickering (1s intervals)	Communication with the master station has stopped.*1 Parameter setting error *1 Other slice module fault Internal bus error has occurred
	Off	External power-off, internal bus error or hardware fault
ERR.	On	Hardware fault
	Off	Normal

*1: Refer to the head module manual for details.

Output module

LED indication	LED status	Operating status
RUN	On	Normal
	Flickering (0.25s intervals)	Selected as the target of online module change
	Flickering (1s intervals)	Communication with the master station has stopped.*1 Parameter setting error *1 Other slice module fault Internal bus error has occurred
	Off	External power-off, internal bus error or hardware fault
ERR.	On	Hardware fault (All modules) Fuse has blown. (ST1Y2-TE2, ST1Y16-TE2)
	Flickering (0.5s intervals)	Thermal protection and short circuit protection have occurred. (ST1Y2-TPE3, ST1Y16-TPE3)
	Off	Normal

*1: Refer to the head module manual for details.

8 ACCESSORIES

8.1 End Plate, End brackets

The end plate and end brackets are included with the head module prior to shipment. They are also available as options.

Refer to Section 10.2 for installation and removal.

Product name	Model	Purpose of use	Dimensions
End plate	ST1A-EPL	Installed to protect the terminals of the rightmost end module from exposure.	Refer to Appendix 1.
End brackets	ST1A-EPL	Installed on the left side of the head module and on the right side of the last end slice module (assembled in the end plate) to sandwich and fix the slice modules. This installation makes the base modules unmovable under vibration, etc.	Refer to Appendix 1.

8.2 Markers

Refer to Section 10.2 for installation and removal.

Product name	Model	Purpose of use	Description
Base module marker	ST1A-BMK-50	Used to assign an identification No. to a base module to manage the installation position of a slice module.	For No. 1 to 50
	ST1A-BMK-100		For No. 51 to 100
	ST1A-BMK-150		For No. 101 to 150
	ST1A-BMK-200		For No. 151 to 200
Wiring marker	ST1A-WMK-BL	Used to identify the connection position of a base module terminal block.	Terminal mark: Blue (-, 0V, N)
	ST1A-WMK-RD		Terminal mark: Red (24VDC, 5VDC)
	ST1A-WMK-GN		Terminal mark: Green (shield)
	ST1A-WMK-BK		Terminal mark: Black (signal line)
	ST1A-WMK-BR		Terminal mark: Brown (L1)
	ST1A-WMK-RD/BL		Terminal mark: Red/Blue (SYS, input)
	ST1A-WMK-GN/YL		Terminal mark: Green/Yellow (FG)
	ST1A-WMK-WH		Terminal mark: White

8.3 Coding Elements

The coding element is fitted to the slice module prior to shipment, and is also available as an option.

To ensure safety, make sure to install the coding element to the base module and slice module. Refer to Section 10.2 (5) for installation and removal.

Model	Description	Applicable slice module	Color	Shape	
				Base module side *1	Slice module side *1
ST1A-CKY-06	For power distribution module	ST1PSD	Red		
		ST1PDD			
ST1A-CKY-02	For input module	ST1X2-D□□	Light grey		
		ST1X4-D□□			
		ST1X16-D□□			
ST1A-CKY-08	For transistor output module	ST1Y2-T□□	Orange		
		ST1Y16-T□□			
ST1A-CKY-17	For contact output module	ST4Y2-R2	Brown		
ST1A-CKY-13	For analog-digital conversion module	ST1AD2-V	Green		
ST1A-CKY-14		ST1AD2-I			
ST1A-CKY-11	For digital-analog conversion module	ST1DA2-V (-F01)	Blue		
ST1A-CKY-12		ST1DA1-I (-F01)			
ST1A-CKY-16	For thermocouple input module	ST1TD2	Dusty grey		
ST1A-CKY-15	For platinum RTD input module	ST1RD2	Dusty gray		
ST1A-CKY-18	For SSI absolute encoder input module	ST1SS1	Dark green		

*1: Indicates the position of the coding element viewed from above.

: Male part (Projection) : Female part (Hole)

9 FUNCTIONS AVAILABLE BY USE OF SOFTWARE

9.1 For CC-Link

This chapter introduces the functions available by use of the GX Configurator-ST connected to a head module. This manual explains power distribution modules and I/O modules. For a head module and intelligent function modules, refer to the manuals of the corresponding modules.

9.1.1 Functions available by use of GX Configurator-ST

Function	Description	Operation method			Reference section
		1)	2)	3)	
Information monitoring	Various information on the head module and slice modules can be monitored.	○	×	×	*1
Status monitoring	The operating status of each slice module and error history of the head module can be monitored.	○	○	×	*2
I/O data monitoring function	Data of [Br] Bit input area, [Bw] Bit output area, [Wr] Word input area, and [Ww] Word output area can be monitored.	○	×	×	*1
Online module change	I/O modules and intelligent function modules can be replaced while the external power supply is on. However, a power distribution module cannot be replaced.	○	×	○	*2
Forced output test function	Slice module data in [Bw.n] Bit output area and [Ww.n] Word output area can be forcibly output.	○	×	×	*1
Input response time setting function	Setting of input response time (0.5ms/1.5ms) can be monitored.	○	×	×	This section (1)
Setting of output status (CLEAR/HOLD) at module error	Output module status (CLEAR/HOLD) setting can be monitored. CLEAR: Output is forcibly turned off when a module becomes faulty. HOLD: Output is held in the status as when a module becomes faulty.	○	×	×	This section (2)
Power supply capacity check function	Judges whether the 5VDC maximum rated output current of the power distribution module is sufficient for the total 5VDC internal current consumption of the slice modules.	○	×	×	*1

○: Applicable, ×: N/A

1) Operate with GXConfigurator-ST.

2) Execute a command from the master station to perform operation.

3) Use the button or switch of the head module to perform operation.

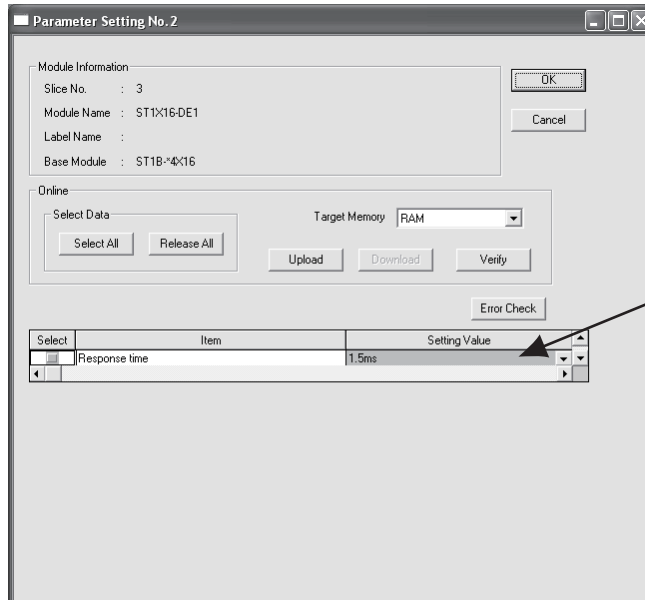
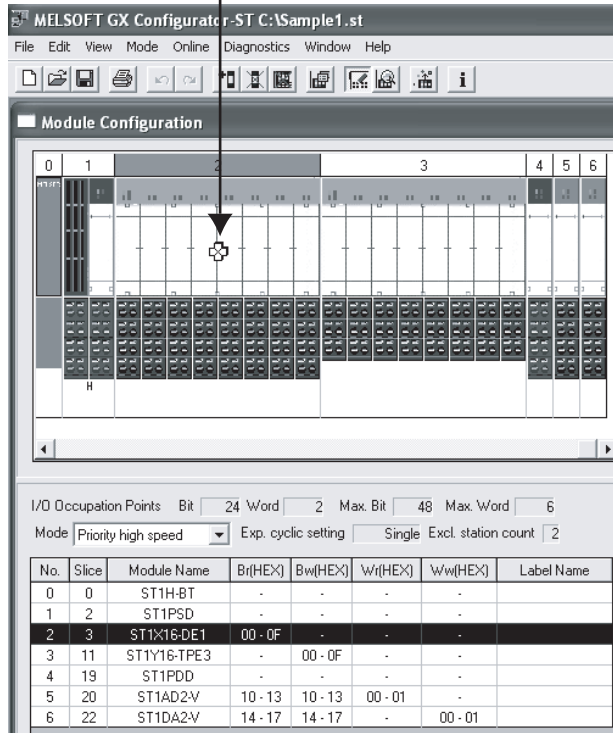
*1: For the operation of GX Configurator-ST, refer to the GX Configurator-ST Operating Manual.

*2: For details, refer to the MELSEC-ST CC-Link Head Module User's Manual.

(1) Input response time setting function

When the input module is selected, the set value is displayed in Setting Value.

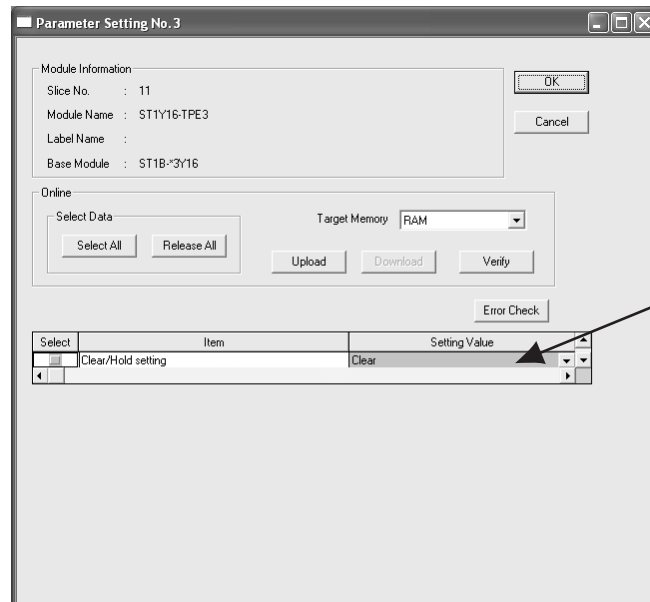
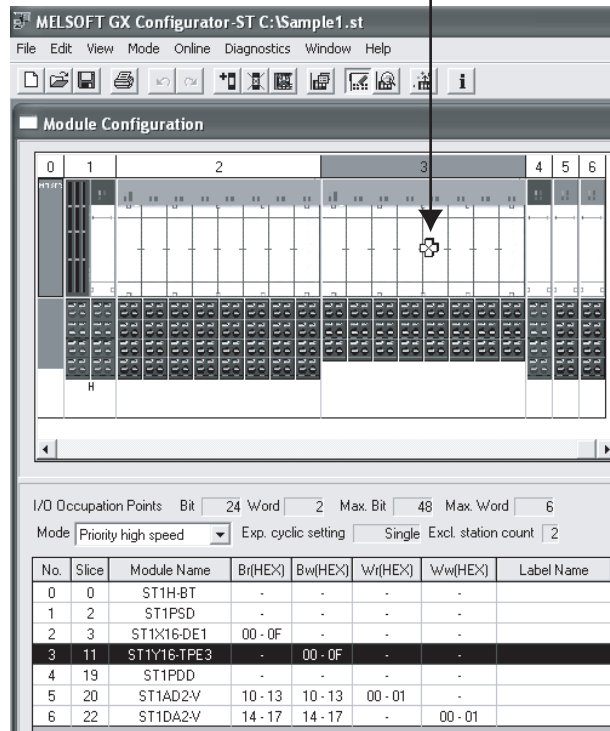
Select the input module.



Input response time

- (2) Setting of output status (CLEAR/HOLD) at module error
When the output module is selected, the setting is displayed in Setting Value.

Select the output module.



Output status at module error

9.2 For PROFIBUS-DP

This chapter introduces the functions available by use of the GX Configurator-ST connected to master station configuration software and a head module. This manual explains power distribution modules and I/O modules. For a head module and intelligent function modules, refer to the manuals of the corresponding modules.

9.2.1 Functions Available by Use of Configuration Software

Use GX Configurator-DP when the master station is the Mitsubishi PLC.

Function	Description	Reference section
Input response time setting function	Sets the response time of the input module as preset in the user parameter. 0.5ms or 1.5ms can be set in the user parameter. The default is 1.5ms.	Section 9.2.1 (1)
Setting of output status (CLEAR/HOLD) at module error	When a communication error or module error occurs, brings the output status of the output module into the status preset with the user parameter. The output status can be set to CLEAR or HOLD in the user parameter. The default is output status CLEAR. CLEAR: Output is forcibly turned off when a module becomes faulty. HOLD: Output is held in the status as when a module becomes faulty.	Section 9.2.1 (2)

(1) Input response time setting function

Set the input response time of the input module using the user parameter of the master station configuration software.

- Setting at the master station

Set the input response time using the user parameter of the slave parameters. The following is the setting item.

Response time
0.5ms
1.5ms (default)

(2) Setting of output status (CLEAR/HOLD) at module error

Set the output status (CLEAR/HOLD) of the output module using the user parameter of the master station configuration software.

- Setting at master station

Set the output status to CLEAR or HOLD using the user parameter of the slave parameters.

The following is the setting item.

Clear/hold setting
Clear (default)
Hold

9.2.2 Functions Available by Use of GX Configurator-ST

Function	Description	Operation method			Reference section
		1)	2)	3)	
Information monitor function	Monitors various information of the head module and slice modules.	○	×	×	*1
Status monitor function	Monitors the operating status of the slice modules and the error history, etc. of the head module.	○	○	×	*2
Online module change function	Replaces an I/O module or intelligent function module while external power supply is on. Note that the power distribution modules cannot be replaced.	○	×	○	*2
Forced output test function	Forcibly outputs the [Bw.n] Bit Output, [Ew.n] Error Clear and [Ww.n] Word Output of the head module and slice modules.	○	×	×	*1
Input response time setting monitoring function	Monitors the response time setting (0.5ms/1.5ms) of the input module.	○	×	×	This section (1)
Setting monitoring of output status (CLEAR/HOLD) at module error	Monitors the output status (CLEAR/HOLD) of the output module. CLEAR: Output is forcibly turned off when a module becomes faulty. HOLD: Output is held in the status as when a module becomes faulty.	○	×	×	This section (2)
Power supply capacity check function	Judges whether the 5VDC maximum rated output current of the power distribution module is sufficient for the total 5VDC internal current consumption of the slice modules.	○	×	×	*1

○: Applicable, ×: N/A

1) Operate with GXConfigurator-ST.

2) Execute a command from the master station to perform operation.

3) Use the button or switch of the head module to perform operation.

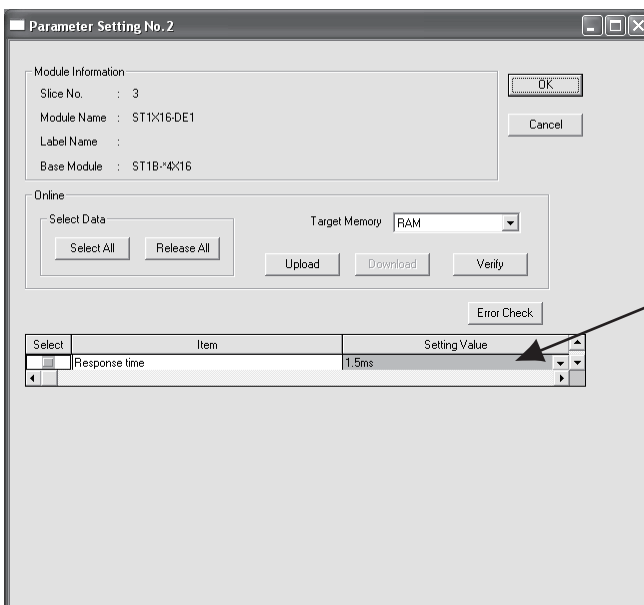
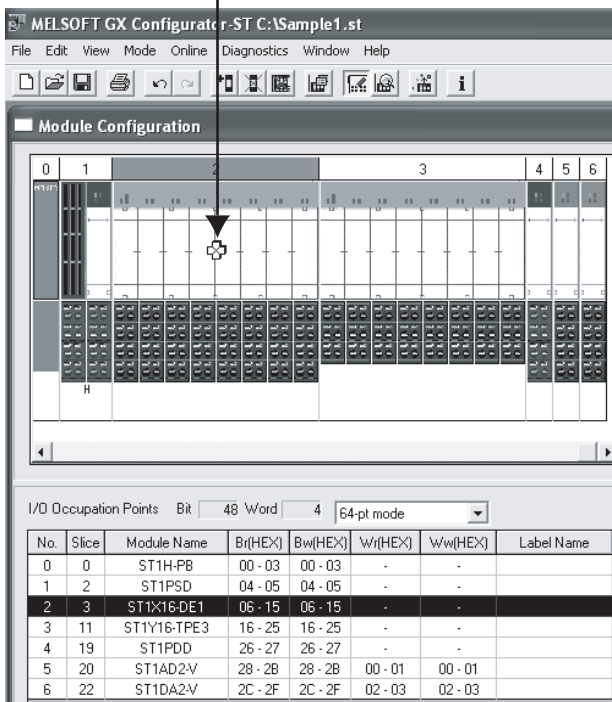
*1: For the operation of GX Configurator-ST, refer to the GX Configurator-ST Operating Manual.

*2: For details, refer to the MELSEC-ST PROFIBUS-DP Head Module User's Manual.

(1) Input response time setting function

When the input module is selected, the set value is displayed in Setting Value.

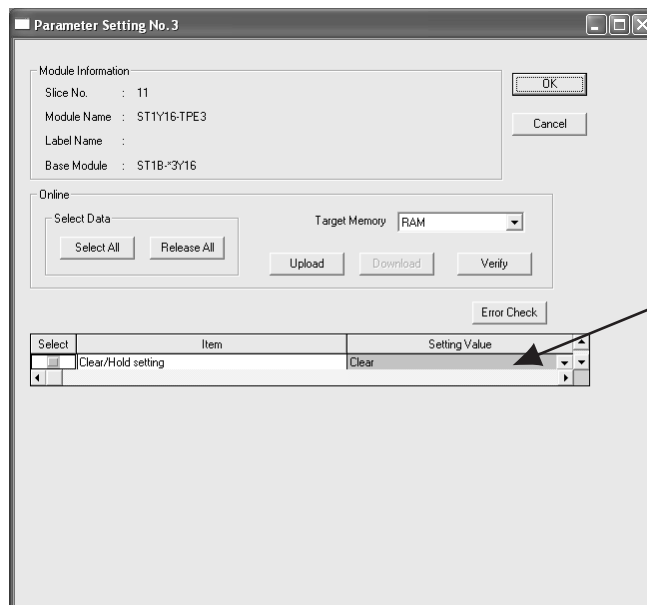
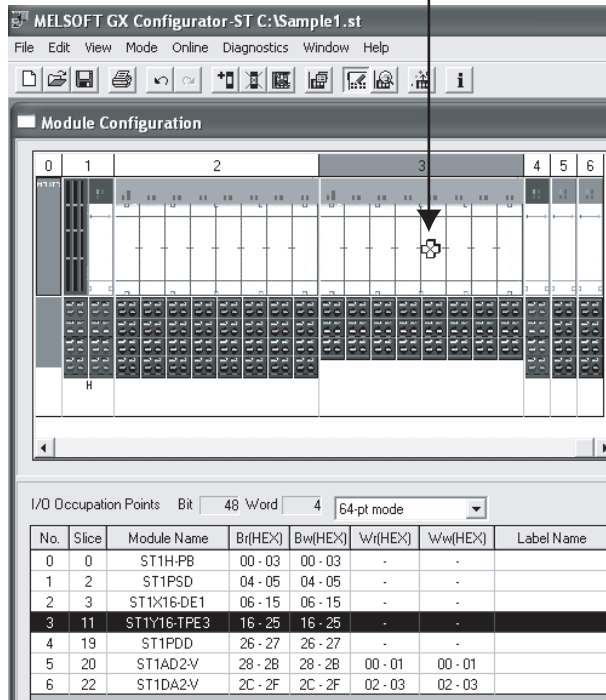
Select the input module.



Input response time

- (2) Setting of output status (CLEAR/HOLD) at module error
 When the output module is selected, the setting is displayed in Setting Value.

Select the output module.



Output status at module error

10 MOUNTING AND INSTALLATION

10.1 Handling Precautions

This section explains the precautions for handling the modules (head module, slice modules, base modules, etc.) of the MELSEC-ST system.

 **DANGER**

- Do not touch the terminals or connector while the power is on. This may cause electric shock or malfunction.

 **CAUTION**

- Make sure not to let foreign matters such as sawdust or wiring debris inside the module. This may cause fire, failure or malfunction.
- Do not disassemble or modify the module. This may cause failure, malfunction, injury or fire.
- Do not directly touch the module's conductive parts. This may cause malfunction or failure in the module.
- As the module case is made of resin, be careful not to drop it or expose it to strong impact. This may damage the module.
- Tighten the terminal screws within the specified torque. Loose tightening may cause fire or malfunction. Overtightening may damage the screws, resulting in short circuit or malfunction.
- When disposing of this product, treat it as industrial waste.
- Use the module in an environment specified in the general specifications of this manual. Failure to do so may cause electric shock, fire, malfunction, product deterioration or damage.
- Mount the module to a DIN rail securely. Failure to do so may cause a fall, short circuit or malfunction of the module.
- After mounting the head module and base module to the DIN rail, sandwich the head module and the rightmost base module using end brackets to securely fix them. Failure to do so may cause connection parts between modules may loosen due to vibration or other reason.
- Make sure to attach the rightmost part of the base module in order that terminals at the side of the base module will not be exposed. Failure to do so may cause electric shock, short circuit or malfunction.
- Make sure to shut off all phases of the external power supply for the whole system before mounting or removing the module. Failure to do so may cause the module fail or malfunction.

(1) Do not drop the module or give it a strong impact.

(2) Tighten the terminal block screws of the base module within the following ranges.

Screw location	Tightening torque range
Base module terminal block screw	0.27 to 0.80 N·m
End bracket screw	0.50 to 0.60 N·m

- (3) When mounting the base module to the DIN rail, hang the module's bottom groove on the DIN rail's bottom, and then push the module top against the DIN rail with your fingers until it clicks.
- (4) Note the following points when mounting the DIN rail.

(a) Applicable DIN rail

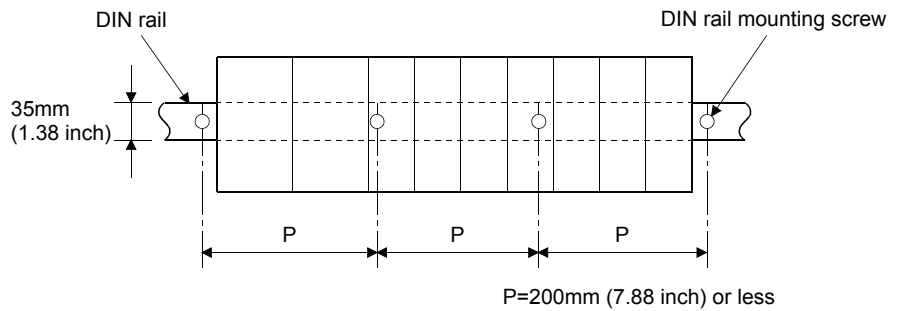
The function ground (FG) is connected between the slice modules by a conductive DIN rail.

Use a IEC-60715-compliant 35mm DIN rail, which is conductive (of which surface is not insulated).

Recommended: Weidmueller make DIN rail 35 × 7.5mm (steel type)

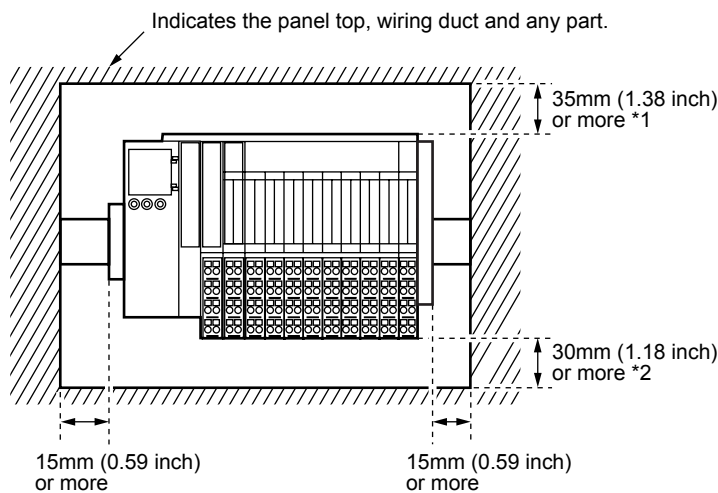
(b) DIN rail mounting screw intervals

When using a TH35-7.5Fe or TH35-7.5Al DIN rail, rail mounting screws should be tightened at a pitch of 200 mm (7.88 inch) or less in order to ensure that the rail has sufficient strength.



(5) Module mounting position

To ensure proper ventilation and easy replacement, ensure the following space above and under the module.

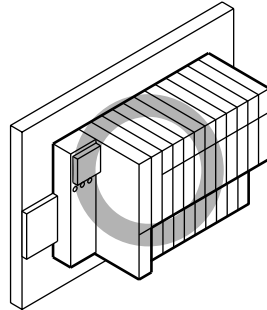


*1: This space should be ensured when the height of the wiring duct is 50mm or less.

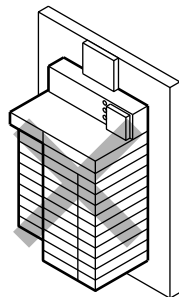
*2: 20mm (0.79 inch) or more when the ST1B-□ 6 □ □ is mounted.

(6) Module mounting orientation

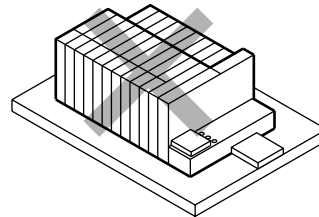
(a) Since the module generates heat, it should be mounted on a well ventilated location in the orientation shown below.



(b) Do not mount it in either of the orientations shown below.



Vertical



Horizontal

(7) Installation surface

Mount the DIN rail to which a base module is mounted onto a flat surface. If the mounting surface is not even, this may strain the printed circuit board and cause malfunctions.

(8) Mounting module in an area where the other devices are installed

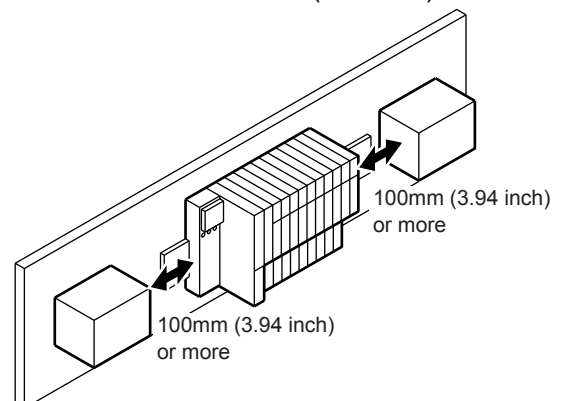
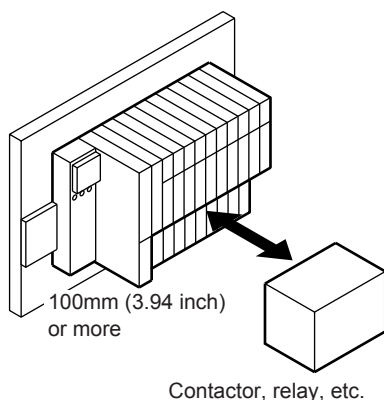
Avoid mounting base module in proximity to vibration sources such as large magnetic contractors and no-fuse circuit breakers; mount these on a separate panel or at a distance.

(9) Spaces from the other devices

In order to exchange parts easily/avoid the effects of radiated noise and heat, ensure the spaces indicated below between the MELSEC-ST system and devices that generate noise or heat (contactors and relays).

- Required space in front of MELSEC-ST system : 100 mm (3.94 inch) or more

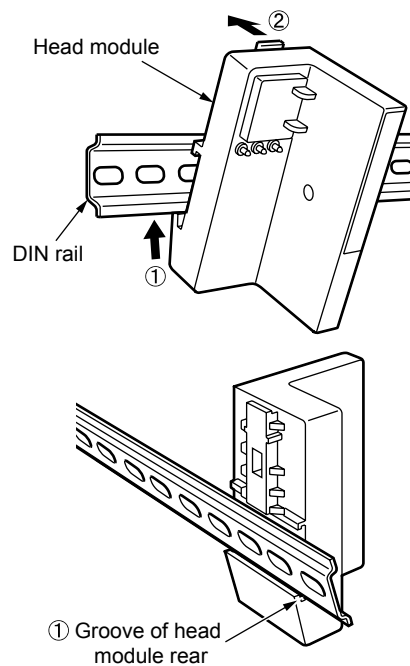
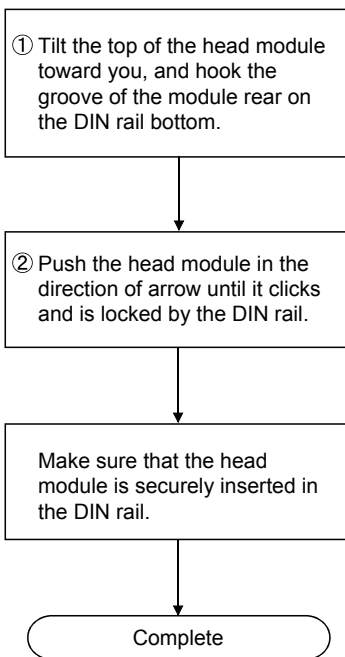
- Required space on the right and left of MELSEC-ST system : 100 mm (3.94 inch) or more



10.2 Mounting the Modules

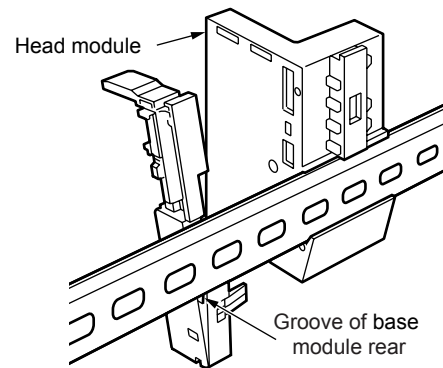
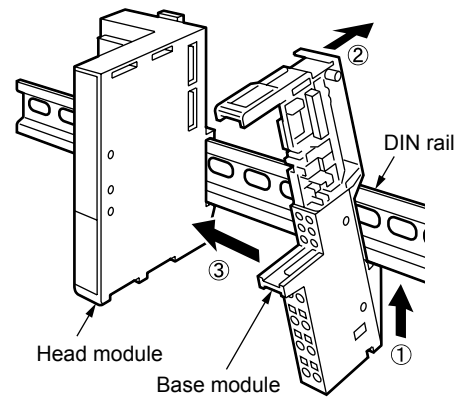
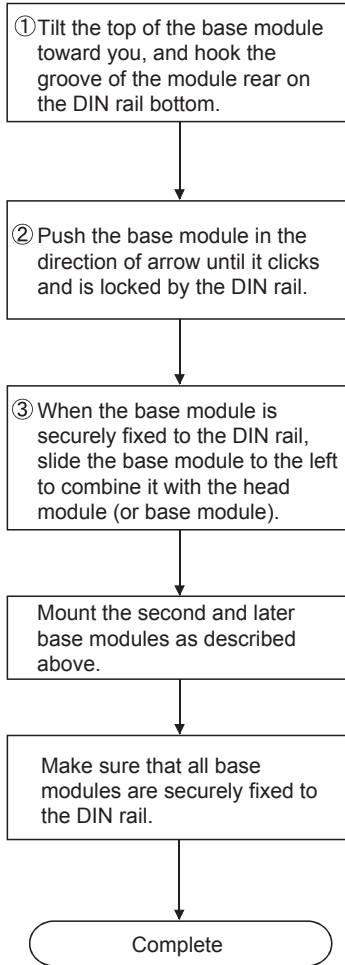
This section explains how to mount the head module, slice modules, end bracket, end plate, etc.

(1) Mounting the head module

**POINT**

After mounting all of base modules, attach the end bracket to the left of the head module. On the left side of the head module, leave a space for mounting the end bracket.

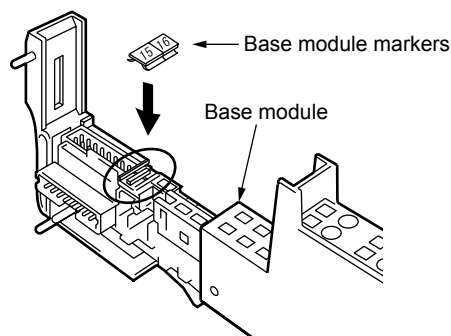
(2) Mounting the base modules



POINT
Securely combine the head module and base module or the base modules so that no gap exit between them.

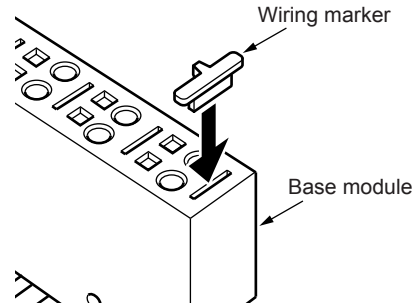
(3) Mounting the base module markers and wiring markers

- (a) Push the base module markers into the base module's bottom recess where the slice module will be fitted.



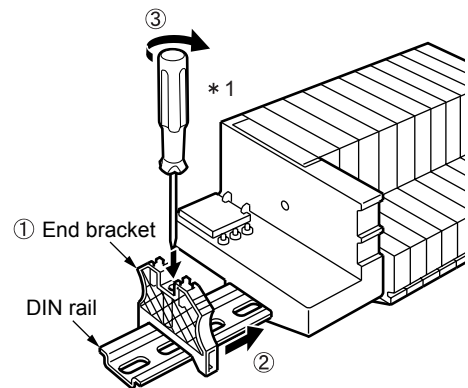
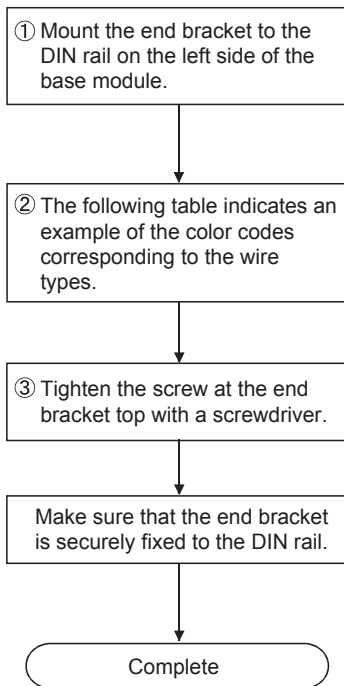
(b) According to the wiring of the slice module, push the wiring markers into the bottom recesses of the terminal block. The following table indicates an example of the color codes corresponding to the wire types.

Wiring marker color	Wire type
Black	Signal wire
Red	DC power supply (+24V; +5V)
Blue	-, 0V, N
Red-Blue	System power supply
Yellow-Green	FG
Green	Shield
Brown	L1 phase



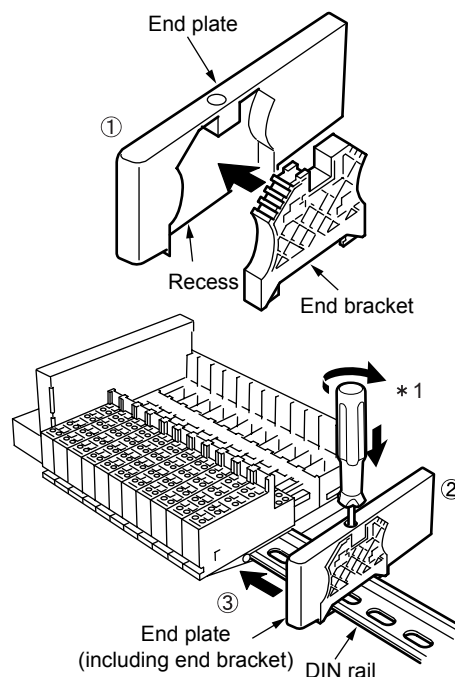
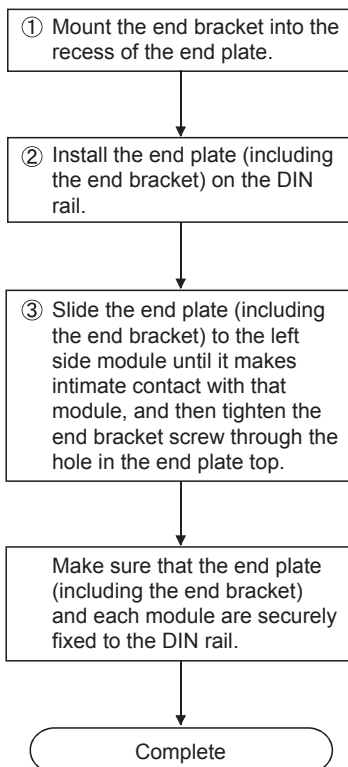
(4) Mounting the end bracket and end plate

(a) End bracket (left side)



* 1 : For mounting, removing and wiring, use the screwdriver recommended in Appendix 4 or equivalent.

(b) End plate (right side: including end bracket)

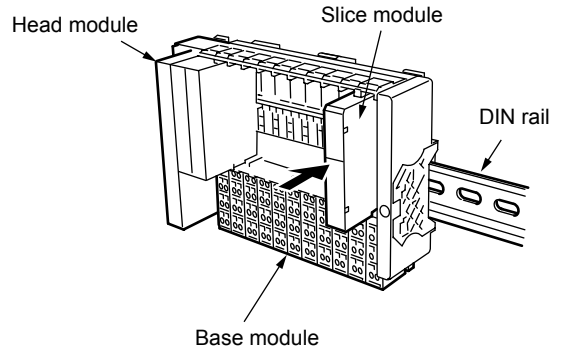
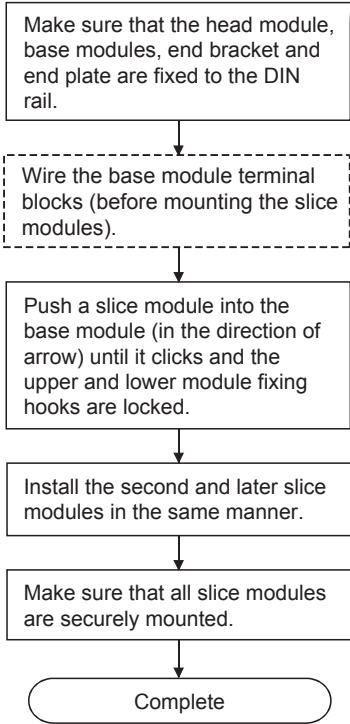


* 1 : For mounting, removing and wiring, use the screwdriver recommended in Appendix 4 or equivalent.

POINT

Mount the end plate (including the end bracket) to the DIN rail after loosening the end bracket screw.

(5) Mounting the slice modules



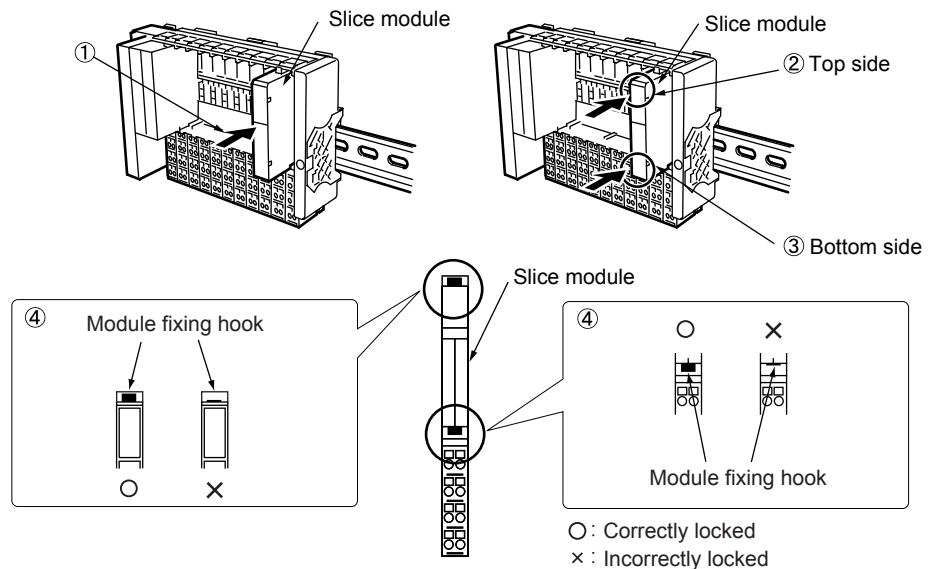
* 1 : Module fixing hooks are located on the top and bottom sides of a slice module.

POINT

Mount a 1-slot width or 2-slot width type slice module while paying full attention to the following points.

1-slot width type slice module is taken as an example in the figure below.

- (1) Push in the slice module in the direction of arrow ①, so that the module fixing hooks are securely locked.
- (2) After installation, push the top and bottom sides of the slice module as shown in figure ② and ③, in order to confirm that the hooks are correctly locked as shown in figure ④. Incorrect locking may cause the slice module to drop off or malfunction.



(a) Precautions for installing slice modules

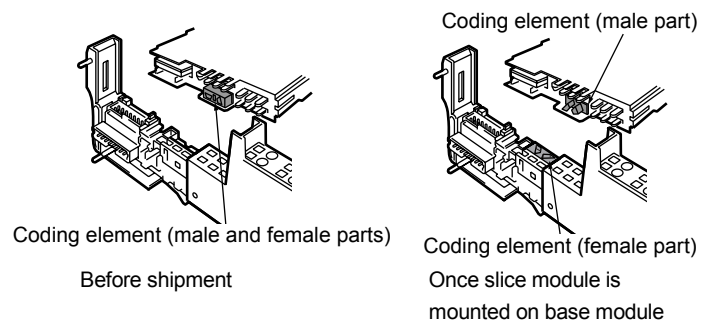
1) Wire the base module terminal blocks before installing the slice modules.

2) A coding element is mounted to the bottom of each slice module for preventing mis-insertion prior to shipment.

Once a slice module is mounted to a base module, the female part of the coding element is attached to the base module and the male part remains the slice module.

This determines the corresponding slice/head module for each head/slice module. Therefore, from the second insertion, the slice module cannot be mounted onto the base module other than the one that matches the element.

Make sure to confirm that the slice module matches the base module before mounting. When inserting a slice module to a base module first, there may be some resistance, as the female part of the coding element is attached to the base module. Make sure to insert the slice module into the base module until it stops.



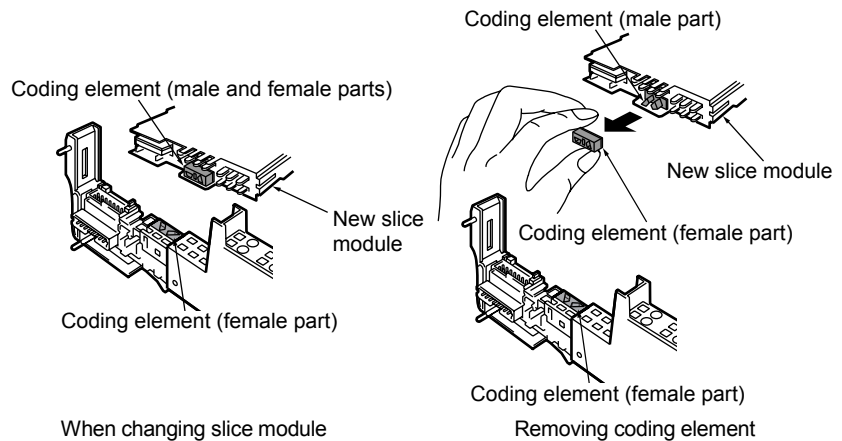
3) If the slice module cannot be mounted onto the base module, do not push it with force. The slice module may not match the base module. In this case, check the coding element hole, etc., whether they match or not.

4) Precautions for mounting slice module when changing module

- When changing slice module

As the base module is already fitted with the female part of the coding element, a new slice module (fitted with the male and female parts of the coding element) cannot be mounted.

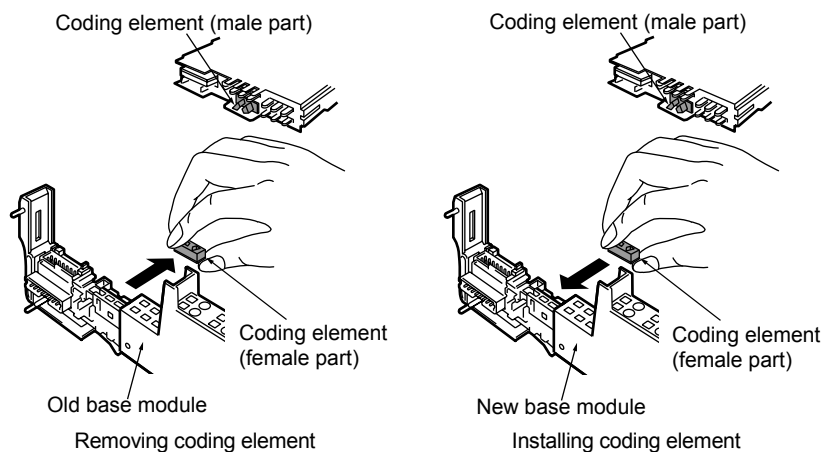
When changing the slice module, remove the female part of the coding element from the new slice module, and then mount it on the base module.



- When changing base module

As a new base module is not fitted with the female part of the coding element, remove and use the coding element from the old base module.

Mount the slice module after attaching the removed coding element to the new base module.



POINT

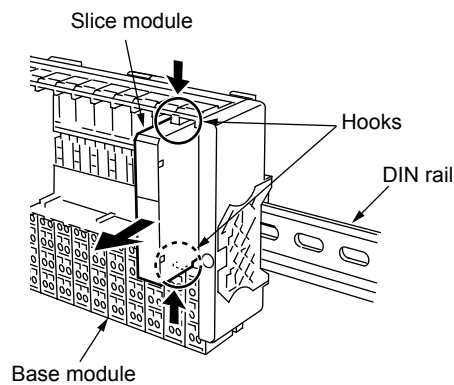
- (1) To ensure safety, be sure to attach the coding element to the base module and slice module.
- (2) During removal and installation, do not touch the connector of the slice module directly. To do so will cause the module to malfunction or fail.

10.3 Removing the Modules

This section explains how to remove the head module, slice modules, end bracket, end plate, etc.

(1) Removing the slice modules

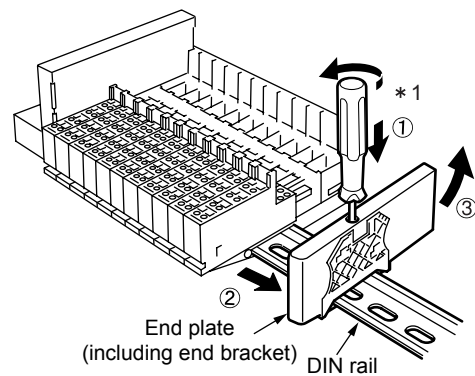
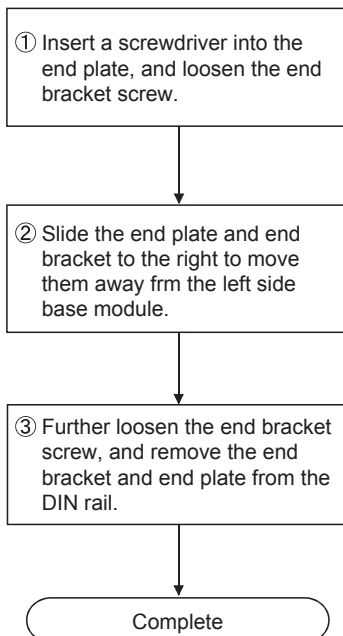
Push the hooks at both ends of the slice module with your fingers, and pull the slice module away from the base module in the direction of arrow. Dismount the second and later slice modules in the same manner.



POINT

Remove the wiring after removing the slice modules from the base modules.

(2) Removing the end bracket and end plate



* 1 : For mounting, removing and wiring, use the screwdriver recommended in Appendix 4 or equivalent.

(3) Removing the base modules

After powering off, disconnect all wiring of the base modules. The slice modules and end plate (including the end bracket) should have been removed in advance.

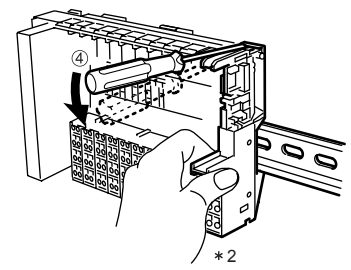
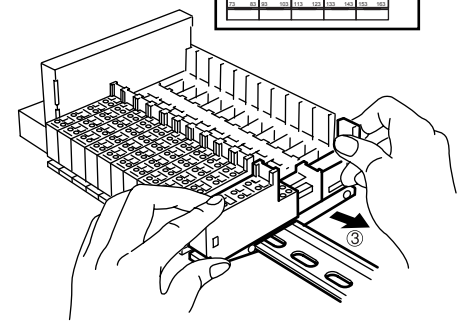
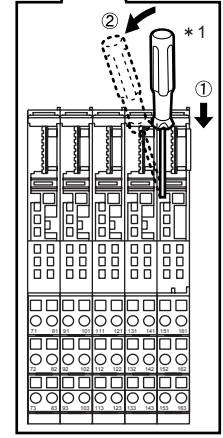
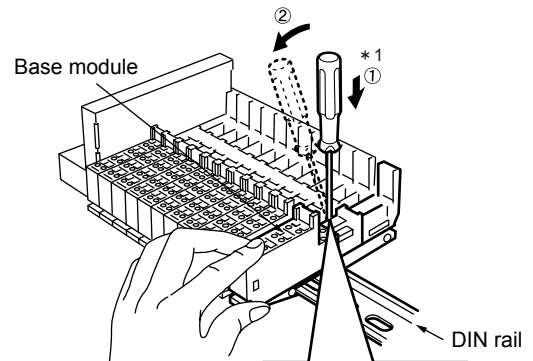
① Insert the screwdriver*1 into the rectangular hole of the base module indicated by the arrow.

② Using the inserted screwdriver as a reference point, pull the base module in the direction of arrow until the fixing hook at the base module top is released.

③ When the top of the base module is pulled away to some degree, remove the screwdriver, and pull the fixing hooks at the base module top and bottom with both hands. When the fixing hooks on both sides of the base module are completely released, slide the base module to the right to completely pull it away from the left side base module.

④ Insert the screwdriver into the groove at the base module top. Then, pull the screwdriver down to remove the base module from the DIN rail.

Complete



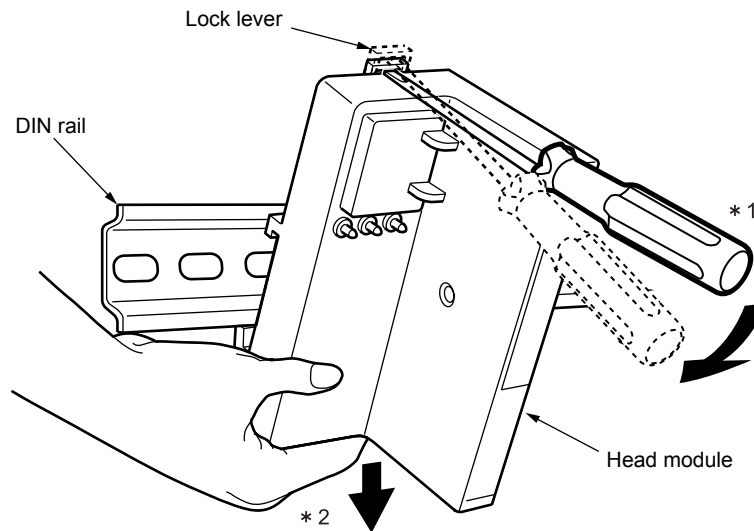
* 1 : For mounting, removing and wiring, use the screwdriver recommended in Appendix 4 or equivalent.

* 2 : Make sure to support the base module with your hand so as not to drop it.

POINT
Remove the base modules in order from the right.

(4) Removing the head module

First, disconnect all connections such as the cable from the head module. Then, hold the screwdriver on the lock lever at the head module top, and pull the screwdriver in the direction of arrow to remove the head module from the DIN rail.



- * 1 : For mounting, removing and wiring, use the screwdriver recommended in Appendix 4 or equivalent.
- * 2 : Make sure to support the base module so as not to drop it.

POINT

Remove all base modules from the DIN rail in advance.

10.4 Wiring

10.4.1 Wiring precautions

⚠ DANGER ● Completely shut off the external power supply for the whole system before installing or placing wiring. Failure to do so may result in electric shock or damage to the product.

⚠ CAUTION

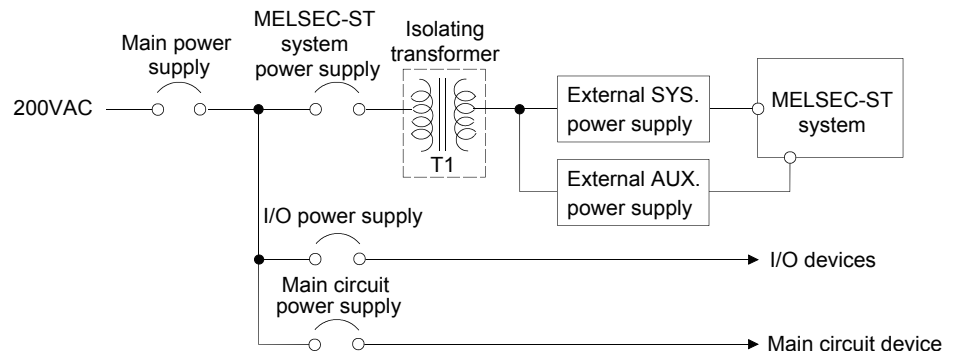
- Make sure to ground the FG and LG terminals to the protective ground conductor. Failure to do so may electric shock or malfunction.
- Confirm the rated voltage and terminal layout of the product and then install wiring to the base module correctly. Connecting to an external power supply other than the rated one or mis-wiring may cause fire or failure.
- Tighten the terminal screws within the specified torque range. Loose tightening may result in short circuit, fire or malfunction. Overtightening may cause damage to the screw and/or the module, resulting in a fall, short circuits or malfunctions.
- Make sure not to let foreign matter such as dust or wire chips get inside the module. Failure to do so may cause fire, failure or malfunction.

This section provides the precaution when wiring to power.

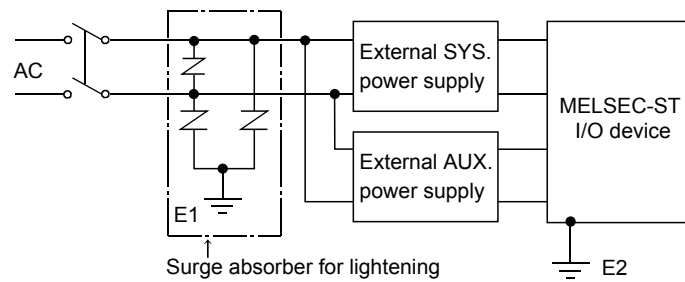
(1) Power supply wiring

(a) Separate the MELSEC-ST system's external power supply line from the lines for I/O devices and power devices as shown below.

When there is much noise, connect an isolating transformer.



- (b) The 24VDC wire should be twisted as dense as possible. Connect the modules with the shortest wire.
Also, to reduce the voltage drop to the minimum, use the thickest wires possible.
- (c) Do not install the 24VDC wire together with main circuit (high voltage, large current) and I/O signal lines or bring them close to each other. The space of at least 100 mm should be ensured.
- (d) As a countermeasure to power surge due to lightning, connect a surge absorber for lightning as shown below.

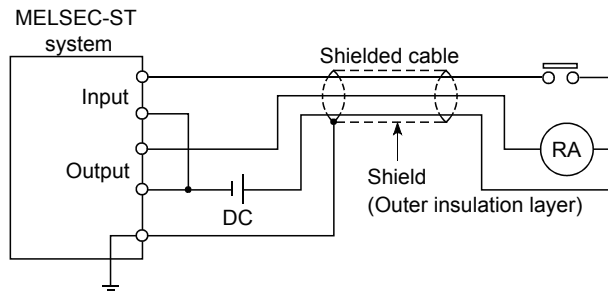


POINT

- | |
|---|
| <ul style="list-style-type: none"> (1) Separate the ground of the surge absorber for lightning (E1) from that of the MELSEC-ST system (E2). (2) Select a surge absorber for lightning of which power supply voltage will not exceed the maximum allowable circuit voltage even at the time of maximum power supply voltage elevation. |
|---|

(2) Wiring of I/O equipment

- (a) The wires used for connection to the terminal block should be of the applicable wire size indicated in Section 6.1.
- (b) Run the input and output lines away from each other.
- (c) When the wiring cannot be run away from the main circuit and power lines, use a batch-shielded cable and ground it on the MELSEC-ST. In some cases, ground it in the opposite side.



- (d) When running wires through pipes, ground the pipes securely.
- (e) Run the 24VDC input line away from the 100VAC and 200VAC lines.
- (f) Wiring of 200m(686.67 ft.) or longer will cause line capacity to lead to leakage current, resulting in failure. For details, refer to Section 12.3.3.

(3) Wiring of base module terminal blocks

(a) Wiring by spring clamp connection

1) Cable connection

Insert the exclusive tool into the tool hole until it stops. While the tool is inside the hole, insert the wire into the wire hole and remove the tool from the hole. After the wire has been clamped, gently pull the wire to confirm that it is secure.

2) Cable disconnection

Insert the exclusive tool into the tool hole that corresponds to the terminal to be removed until it stops, and then pull the wire.

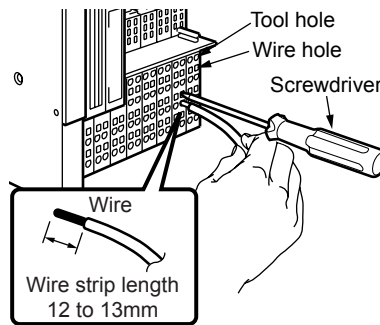
(b) Wiring by screw clamp connection

1) Cable connection

Insert the screwdriver into the tool hole, loosen the screw and insert the wire into the wire hole. Then, tighten the screw within the torque 0.27 to 0.80 N · m and pull the screwdriver. After the wire has been clamped, gently pull the wire to confirm that it is secure.

2) Cable disconnection

Insert the screwdriver into the tool hole that corresponds to the terminal to be removed, and loosen the screw. Then pull out the wire.



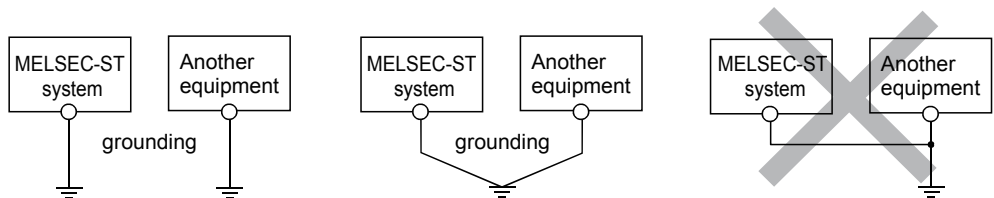
POINT
(1) If the wire strip length is too long, the conductive part may protrude over the terminal block front, which increases the risk of electric shock or short circuit between terminals. If the wire strip length is too short, this will result in the poor contact.
(2) Make sure to use the screwdriver recommended in Appendix 4 or the equivalent to connect/disconnect a cable. The bar type crimping terminals used for wiring should comply with DIN 46228-1.
(3) Start wiring (installation/removal) after removing the slice modules from the base modules.

(4) Grounding

Ground the cable according to the steps (a) to (c) shown below.

(a) The independent grounding is most recommended.

(b) When the independent grounding is not allowed, perform the common grounding as shown below (2).



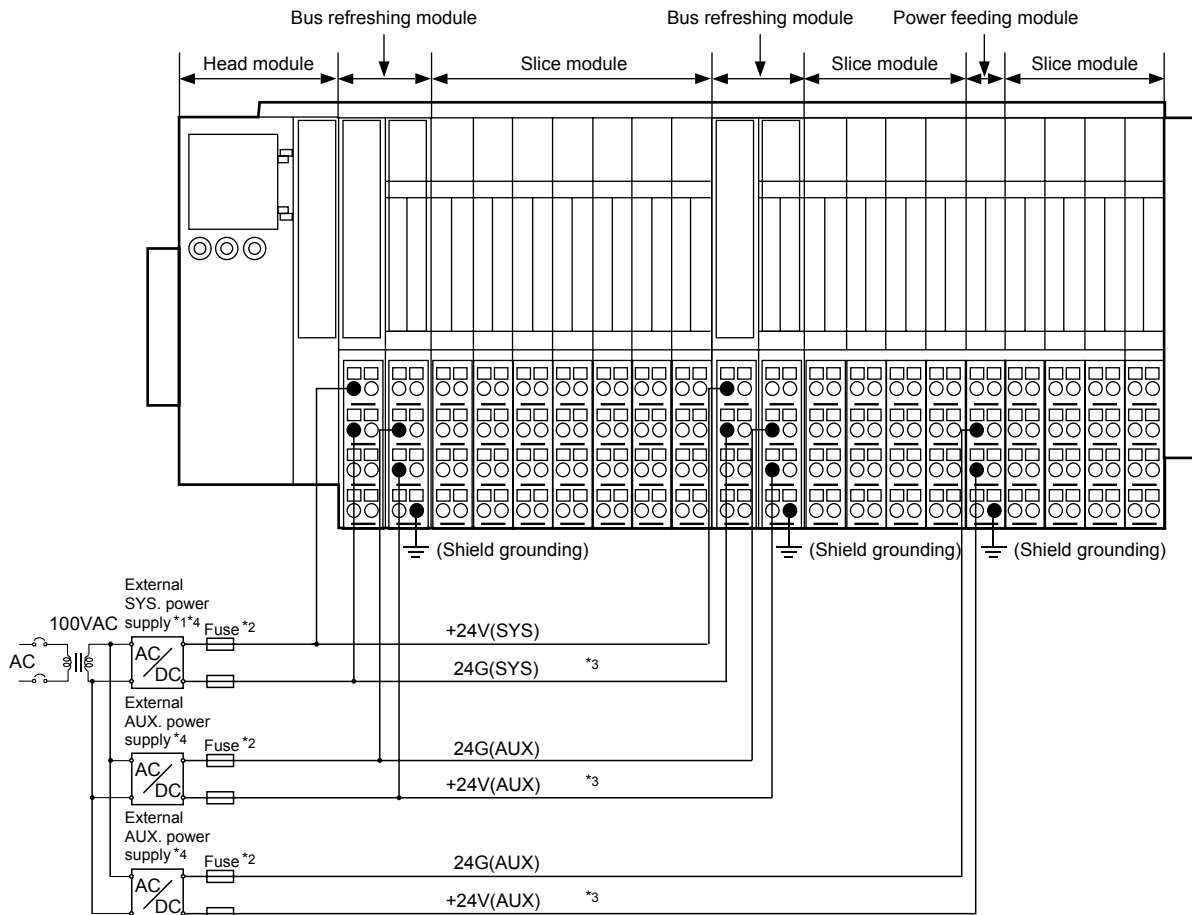
(1) Independent grounding.....Best (2) Common grounding.....Good (3) Joint grounding.....Not allowed

(c) For grounding, use the cable of 2 mm² or more.

Ground the cable closer to the MELSEC-ST system so that the grounding cable will be short as possible.

10.4.2 Wiring the power distribution modules

This section provides the example of connecting the power wires of the power distribution modules to the base modules.



- *1: When using multiple bus refreshing modules in the system, supply 24VDC external power from one external SYS. power supply to each bus refreshing module (SYS. input).
- *2: Provide safety circuits such as external fuses to prevent smoking or ignition that may occur if a load current higher than the rating or a long-duration overcurrent caused by a load short circuit, etc. flows in the power distribution module.
- *3: Use the thickest possible 24VDC power wires and be sure to twist them from the connected terminals.
- *4: Use different external power supplies for the external SYS. power supply and external AUX. power supplies.

POINT

When using more than one external power supply, firstly input external auxiliary power and then input system external power. If firstly system external power is input, a head module cannot recognize slice modules.

10.5 Calculating Heat Generation by unit

The ambient temperature inside the control panel storing the MELSEC-ST system must be suppressed to the MELSEC-ST system operating ambient temperature of 55°C.

When designing control panel to radiate heat, it is required to obtain the average power consumption (heating value) of the devices and instruments to be stored within the control panel.

This section explains how to obtain the average power consumption of the MELSEC-ST system. Based on the power consumption, calculate a rise in ambient temperature inside the control panel.

How to calculate average power consumption

The power consuming sections of the MELSEC-ST system are roughly classified into six blocks as shown below.

(1) Power consumption of bus refreshing module

The power conversion efficiency of the bus refreshing module is approx. 80 %, i.e., 20 % of the power is consumed by heating. As a result, 2/8 of the output power becomes the power consumption.

Therefore the calculation formula is as follows.

$$W_{pw} = \frac{2}{8} \times I_{5V} \times 5 \text{ (W)}$$

I_{5V} : 5VDC internal current consumption of each slice module

(2) Total power consumption of 5VDC circuit section for slice modules and head module

The power consumption of the 5VDC circuit section of slice modules (except the bus refreshing module) and head module is the total power consumption of these modules.

$$W_{5V} = I_{5V} \times 5 \text{ (W)}$$

(3) Total power consumption of 24VDC power supply section for output modules

(power consumption for simultaneous ON points)

The average power of the external AUX. power supply is the total power consumption of the output modules.

$$W_{24V} = I_{24V} \times 24 \text{ (W)}$$

I_{24V} : 24VDC

(4) Average power consumption due to voltage drop in the output section of the output module

(Power consumption for simultaneous ON points)

$$W_{OUT} = I_{OUT} \times V_{drop} \times \text{Number of outputs} \times \text{Simultaneous ON rate (W)}$$

I_{OUT} : Output current (Current in actual use) (A)

V_{drop} : Voltage drop in each output module (V)

(5) Average power consumption of the input section of the input module (Power consumption for simultaneous ON points)

$$W_{IN} = I_{IN} \times E \times \text{Number of input points} \times \text{Simultaneous ON rate (W)}$$

I_{IN} : Input current (A)

E : Input voltage (Voltage in actual use) (V)

(6) Power consumption of the power supply section of the intelligent function module

$$W_s = I_{s5V} \times 5 + I_{s24V} \times 24 \text{ (W)}$$

I_{s5V} : Current consumption of 5VDC circuit
 I_{s24V} : Current consumption of 24VDC circuit

The total of the power consumption values calculated for each block becomes the power consumption of the overall MELSEC-ST system.

$$W = W_{PW} + W_{5V} + W_{24V} + W_{OUT} + W_{IN} + W_s \text{ (W)}$$

Based on this overall power consumption (W), calculate the heating value and a rise in ambient temperature inside the board.
 The outline of the calculation formula for a rise in ambient temperature inside the control panel is shown below.

$$T = \frac{W}{UA} \text{ (}^\circ\text{C)}$$

- W : Power consumption of overall MELSEC-ST system (value obtained above)
- A : Surface area inside the control panel
- U : When the ambient temperature inside the control panel is uniformed by a fan 6
 When air inside the control panel is not circulated..... 4

POINT

When a rise in ambient temperature inside the control panel exceeds the specified limit, it is recommended to install a heat exchanger in the control panel to lower the ambient temperature inside the control panel.
 If a normal ventilating fan is used, dust will be sucked into the MELSEC-ST system together with the external air, this may affect the performance of the MELSEC-ST system.

(7) Example of calculating average power consumption

(a) System configuration example

ST1H-BT	ST1PSD	ST1X2-DE1	ST1Y2-TPE3	ST1PDD	ST1AD2-V
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(b) 5VDC internal current consumption of slice modules and head module

ST1H-BT	: 0.410 (A)
ST1X2-DE1	: 0.085 (A)
ST1Y2-TPE3	: 0.095 (A)
ST1PDD	: 0.060 (A)
ST1AD2-V	: 0.110 (A)

(c) Power consumption of power supply module

$$W_{PW} = 2/8 \times (0.410 + 0.085 + 0.095 + 0.060 + 0.110) \times 5 = 0.950 \text{ (W)}$$

(d) Total 5VDC internal current consumption of slice modules and head module

$$W_{5V} = (0.410 + 0.085 + 0.095 + 0.060 + 0.110) \times 5 = 3.80 \text{ (W)}$$

- (e) Total 24VDC average power consumption of the output module
 $W_{24V} = 0 \text{ (W)}$
- (f) Average power consumption due to voltage drop in the output section of the output module
 $W_{OUT} = 0 \text{ (W)}$
- (g) Average power consumption of the input section of the input module
 $W_{IN} = 0.004 \times 24 \times 2 \times 1 = 0.192 \text{ (W)}$
- (h) Power consumption of the intelligent function module
 $W_S = 0 \text{ (W)}$
- (i) Power consumption of overall system.
 $W = 0.95 + 3.8 + 0 + 0 + 0.192 + 0 = 4.942 \text{ (W)}$

11 EMC AND LOW VOLTAGE DIRECTIVE

In order to sell products in European countries, the manufacturers have been legally required to show that the products are compliant with the EMC Directive and the Low Voltage Directive, which are both European Directives, since 1996 and 1997, respectively.

The manufactures must declare that the corresponding products are compliant with the above European Directives and put the "CE mark" on them.

11.1 Requirements for Compliance with EMC Directive

The EMC Directive specifies that products on the market must "be constructed so that they do not cause excessive electromagnetic interference (emissions) and are not affected by electromagnetic interference (immunity)".

The target products are requested to meet these requirements. The sections 11.1.1 through 11.1.5 outline the precautions on compliance with the EMC Directive for the machinery that includes the MELSEC-ST series.

The description are based on the regulations, the relevant requirements and standards that Mitsubishi has satisfied, however, are not for assuring that the machinery is compliant with the above Directives, even if it is built according to the description.

Therefore, those who actually built the machinery should make a decision on how to comply with the EMC Directive and if the machinery is compliant with the standard or not.

11.1.1 EMC Directive standards

11

The EMC Directive standards are listed below.

Specification	Test item	Test details	Standard value
EN61131-2 : 2003	EN55011 Radiated emissions * ²	Radio emissions from the product are measured.	30 to 230 MHz QP: 40 dB μ V/m (10 m in measurement range) * ¹ 230 to 1000 MHz QP: 47 dB μ V/m (10 m in measurement range)
	EN55011 Conducted emission	Noise emissions from the product to the power line is measured.	150 to 500 kHz QP: 79 dB, Mean: 66 dB * ¹ 500 to 30 MHz QP: 73 dB, Mean: 60 dB
	EN61000-4-2 Electrostatic immunity * ²	Immunity test in which static electricity is applied to the equipment.	8 k V Aerial discharge 4 k V Contact discharge
	EN61000-4-3 Radiated electromagnetic field immunity * ²	Immunity test in which field is irradiated to the product.	1.4 to 2.0 GHz, 80 to 1000 MHz, 10 V/m, 80% AM modulation @ 1 kHz
	EN61000-4-4 Fast transient burst immunity * ^{2,3}	Immunity test in which burst noise is applied to the power and signal lines.	AC power line: Common mode \pm 2 kV I/O, analog, communication (shielded): Common mode \pm 1 kV
	EN61000-4-5 Surge immunity * ³	Immunity test in which a lightning surges are applied to power and signal lines.	AC power line: Common mode \pm 2 kV, differential mode \pm 1 kV I/O, analog, communication (shielded): Common mode \pm 1 kV
	EN61000-4-6 Conducted immunity * ³	Immunity test in which high-frequency noise is applied to power and signal lines.	0.15 to 80 MHz, 80% AM modulation @1 kHz, 3 Vrms

* 1: QP: Quasi-peak value, Mean : Average value

* 2: The MELSEC-ST series is an open type device (device incorporated in another device) and must be installed in a conductive control panel.

The corresponding test is performed while the MELSEC-ST series is installed inside a control panel.

* 3: Use an external power supply introduced in Section 11.1.4. Mount the external power supply and MELSEC-ST series modules to the same DIN rail.

Wiring connected between the following modules is treated as internal wiring and it is tested as an integrated system.

- Between external SYS. power supply and bus refreshing module (ST1PSD)
- Between external AUX. power supply and bus refreshing module (ST1PSD)
- Between external AUX. power supply and power feeding module (ST1PDD)

11.1.2 Instructions for installing into control panel

The MELSEC-ST series is open equipment and must be installed within a control panel for use. This ensures safety as well as effective shielding of the electromagnetic noise generated by the MELSEC-ST series.

(1) Control panel

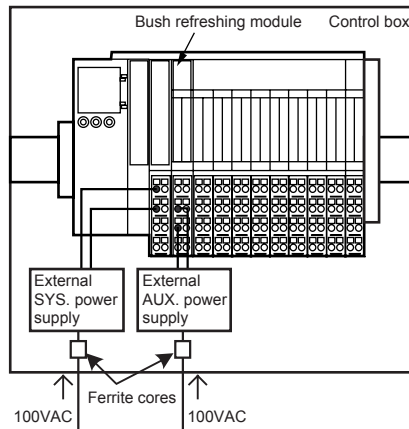
- (a) The control panel must be conductive.
- (b) When fixing a top or bottom plate of the control panel with bolts, do not coat the plate and bolt surfaces so that they will come into contact.
- (c) When using an inner plate to ensure electric conductivity with the control panel, do not coat the fixing bolt area of the inner plate and control panel to ensure conductivity in the largest area as possible.
- (d) Ground the control panel using a thick grounding cable in order to ensure low impedance under high frequency.
- (e) The diameter of cable holes in the control panel must be 10cm (3.94in.). In order to reduce the chance of radio waves leaking out, ensure that the space between the control panel and its door is small as possible. Attach some EMI gaskets to fill up the space and suppress the leakage of radio waves.
Our tests have been carried out on a panel having the damping characteristics of 37 dB max. and 30 dB mean (measured by 3 m method with 30 to 300 MHz).

(2) Connection of power and ground wires

Connect the ground and power supply wires for the MELSEC-ST series as described below.

- (a) The FG of power distribution module is grounded via the DIN rail.
Therefore, the grounding point to the control panel must be placed near the DIN rail. Make sure to use a long and thick ground wire (max. 30 cm) to ground the DIN rail. As the FG releases the noise generated inside the MELSEC-ST series onto the ground, select the ground wire that includes the lowest impedance as possible.
As the ground wire releases noise and wears large noise, install wiring so that the ground wire will be short as possible, in order to prevent it from functioning as an antenna.
- (b) The ground wire coming out from the grounding point must be twisted with the power wire. This releases more noise that flows from the power wire to the ground. When a noise filter is attached to the power wire, this may eliminate the necessity of twisting with the ground wire.
- (c) Use a DIN rail of which surface is conductive, i.e., not insulated.

- (d) Ferrite cores should be attached to all power wire at the wire hole of the control box.

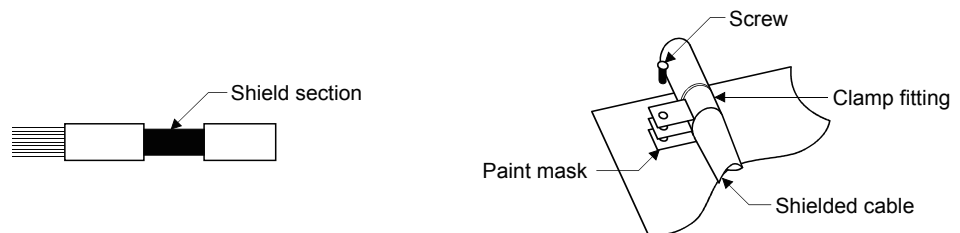


11.1.3 Cables

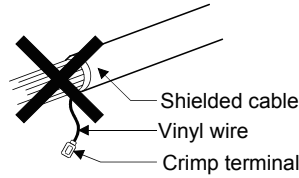
If cables are pulled out from the control panel, they will wear noise of high frequency and emit the noise outside the control panel by functioning as an antenna. The shielded cables should be used for the case that cables used for connecting to I/O modules or intelligent function modules will be pulled out from the control panel. The use of shielded cables increases noise immunity. The noise immunity of signal lines for MELSEC-ST series I/O modules and intelligent function modules is ensured under the conditions where shielded cables are used and the shield is grounded. If shielded cables are not used or the shield is not correctly grounded, the noise immunity will not meet the requirements specified by the standard.

(1) Grounding shield of shielded cable

- (a) Ground the shield of shielded cables as near as possible to the module, taking care so that the grounded cables will not be inducted electromagnetically by the ones not grounded yet.
- (b) Strip the outer insulation layer of the shielded cable to expose a part of braided shield as shown below. Then, ground the shielded section, i.e., exposed part of braided shield, in the largest area as possible to the control panel. A clamp fitting may be used as shown in the figure below. In this case, remove the coating from the inside of the control box, which will come in contact with the clamp fitting.



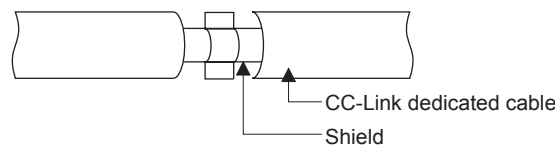
Note) The following method, i.e., soldering a vinyl wire for grounding is not recommended, as this will make the high frequency impedance higher and reduce the shielding effect.



(2) CC-Link dedicated cables

(a) When connecting with a master module or each of CC-link stations nearby, always ground the shields of the shielded cables within 30 cm (11.81 inch) from the module or the stations.

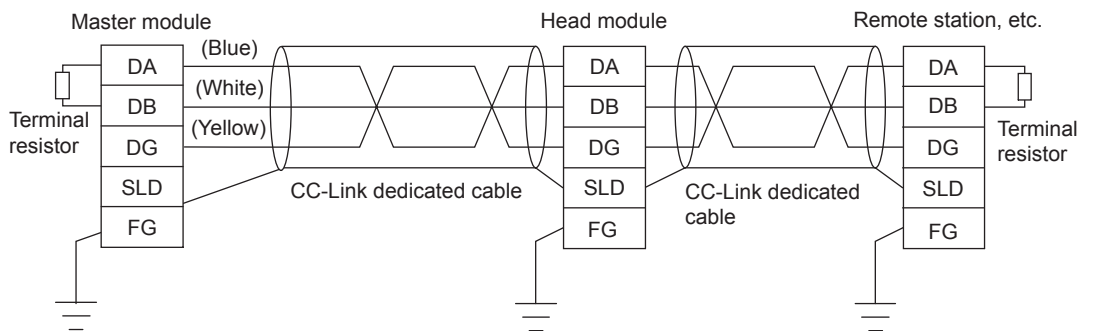
CC-Link dedicated cables are shielded cables. Strip the outer insulation layer of the shielded cable to expose a part of shield as shown below. Then, ground the shielded section, i.e., exposed part of shield, in the largest area as possible to the control panel.



(b) Always use specified CC-Link dedicated cables.

(c) The outline of connecting FG line in the control panel with a master module and each of CC-link stations is shown below.

[Simplified diagram]



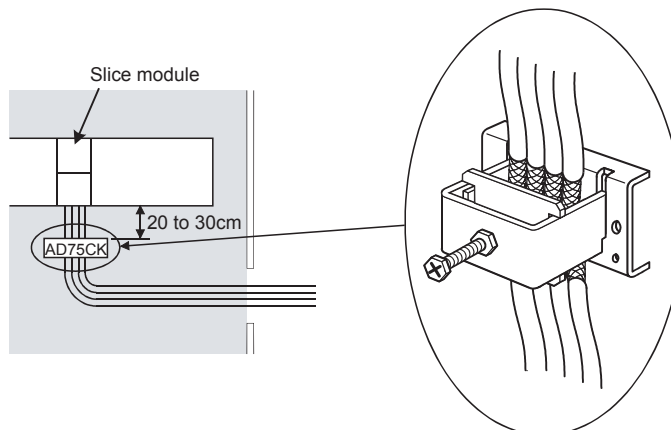
*1: FG of the head module is functionally grounded (FG1) through the DIN rail when the head module is mounted to the DIN rail.

(3) PROFIBUS cables

Use PROFIBUS cables with braided shield when using PROFIBUS-DP. For the shield's ground processing, refer to the description (1) above.

(4) I/O signal cables and other communication cables

For the I/O signal cables and other communication cables, always ground the shields of the shield cables as in (1) if they are pulled out of the control panel (Ground the shields 20 to 30cm away from the module.)



The AD75CK allows up to four cables to be grounded if the outside diameter of the shielded cable is about 7mm.

11.1.4 External power supply module

(1) External power supply module

Use a 24VDC inside-panel power supply that complies with CE. Be sure to ground the FG terminal.

Recommended models

Power supply model	DLP75-24-1	DLP100-24-1	DLP120-24-1	DLP180-24-1	DLP240-24-1
Manufacturer name	LAMBDA				
Rated input voltage	AC100 to 240V				
Rated output	Voltage	24VDC			
	Current	3.1A	4.1A	5.0A	7.5A

11.1.5 Others

(1) Ferrite core

A ferrite core is effective for reducing radiated noise in the band of 30 to 100MHz. It is not required to attach a ferrite core to a cable. However, this method is recommend when the shield cable pulled out from the control box cannot provide the shielding effect.

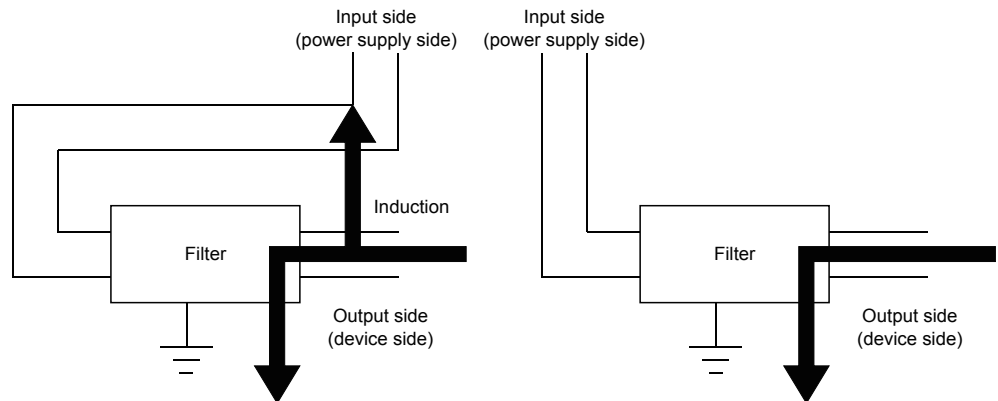
Make sure to attach a ferrite core to a cable inside the control panel at the position closes to the cable hole. If attached at an improper position, the ferrite core will not function effectively.

(2) Noise filter (power line filter)

A noise filter is effective for conducted noise. It is not required to attach a noise filter to the power line. However, this component is recommended as it can further suppress noise. (A noise filter is effective for reducing conducted noise in the band of 10MHz or less.)

The precautions required when attaching a noise filter are described below.

- (a) Do not install the input and output cables of the noise filter together to prevent the input noise inducing into the output cable.



1) Installing the input and output cables together will cause noise induction.

2) Separate the input from the output cable.

- (b) Connect the noise filter's ground terminal to the control panel with the shortest cable as possible (approx. 10cm (3.94 in.) or less).

Recommended models

Noise Filter Model Name	FN343-3/01	FN660-6/06	ZHC2203-11
Manufacturer	SCHAFFNER	SCHAFFNER	TDK
Rated current	3 A	6 A	3 A
Rated voltage	250 V		

11.2 Requirement for Compliance with the Low Voltage Directive

The Low Voltage Directive requires each device that operates with the power supply ranging from 50 to 1000VAC and 75 to 1500VDC to satisfy the safety requirements.

The sections 11.2.1 to 11.2.6, outline the precautions when installing and wiring the MELSEC-ST series in compliance with the Low Voltage Directive.

The description are based on the regulations, relevant requirements and standards that Mitsubishi has satisfied, however, are not for assuring that the machinery is compliant with the above Directives, even if it is built according to the description.

Therefore, the manufacturer who actually built the machinery should make a decision on how to comply with the Low Voltage Directive and if the machinery is compliant with the standard or not.

11.2.1 Standard applied for MELSEC-ST series

The standard applied for MELSEC-ST series is EN61010-1 safety of devices used in measurement rooms, control rooms, or laboratories.

The MELSEC-ST series modules which operate at the rated voltage of 50VAC/75VDC or above are also developed to comply with the above standard.

The modules which operate at the rated voltage of less than 50VAC/75VDC are out of the Low Voltage Directive application range.

11.2.2 MELSEC-ST series selection

(1) Power distribution module

As it has a rated voltage of 24VDC or less, the power distribution module is not the target of the Low Voltage Directive.

(2) I/O module

The I/O modules that have the rated I/O voltage of 100/200VAC include dangerous voltage inside. Therefore, the CE-marked models are reinforced-insulated between the internal primary and secondary sides.

The I/O modules of 24VDC or less rating are not the target of the Low Voltage Directive.

(3) Head module

As it uses only a 5VDC circuit internally, the head module is not the target of the Low Voltage Directive.

(4) Intelligent function module

As it has a rated voltage of 24VDC or less, the intelligent function modules are not the target of the Low Voltage Directive.

11.2.3 Power supply

The isolation specification of the power distribution module is designed assuming installation category II. Make sure to use the installation category II power supply to the MELSEC-ST series.

The installation category indicates the durability level against surge voltage generated by a thunderbolt. Category I has the lowest durability; category IV has the highest durability.

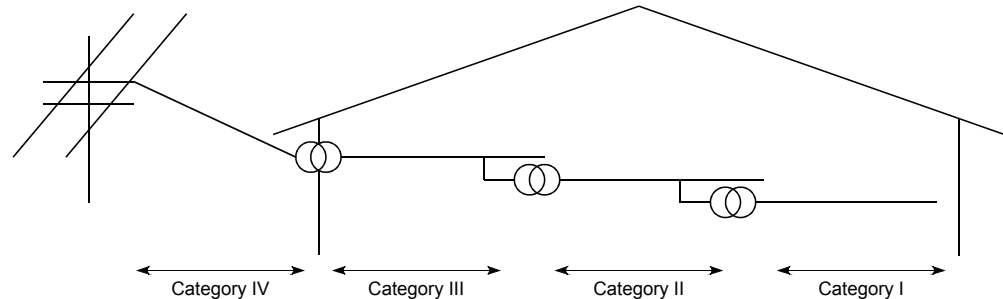


Figure 11.1: Installation Category

Category II indicates the power supply for which voltage is stepped down by using two or more isolation transformers from the public power distribution.

11.2.4 Control box

Because the MELSEC-ST series is an open device (a device designed to be stored within another module), make sure to use it after storing in the control box.

(1) Shock protection

In order to prevent those who are unfamiliar with power facility, e.g., an operator, from getting a shock, make sure to take the following measures on the control panel.

- (a) Install MELSEC-ST series within the locked control panel, and allow only those who are familiar with power facility to unlock the control panel.
- (b) Build the structure in order that the power supply will be shut off when the control panel is opened.

(2) Dustproof and waterproof features


The control box also has the dustproof and waterproof functions. Insufficient dustproof and waterproof features lower the dielectric withstand voltage, resulting in isolation destruction. The isolation in the MELSEC-ST series is designed to be resistant to the pollution level 2, so use in the environment equivalent to pollution level 2 or below.


- Pollution level 1 : An environment where the air is dry and conductive dust does not exist.
- Pollution level 2 : An environment where conductive dust does not usually exist, but temporary conductivity occurs due to the accumulated dust. Generally, this is the level for inside the control box equivalent to IP54 in a control room or on the floor of a typical factory.
- Pollution level 3 : An environment where conductive dust exists and conductivity may be generated due to the accumulated dust.
An environment for a typical factory floor.
- Pollution level 4 : Continuous conductivity may occur due to rain, snow, etc. An outdoor environment.

As shown above, the MELSEC-ST series can work under the pollution level 2 when installed in a control box equivalent to IP54.

11.2.5 Grounding

There are the following two different ground terminals.
Either of them must be grounded for use.

Protective grounding  : Maintains the safety of the MELSEC-ST series and improves the noise resistance.

Functional grounding  : Improves the noise resistance.

11.2.6 External wiring

(1) External power supply

For the MELSEC-ST series I/O modules and the intelligent function modules which require external supply power, use a model of which 24VDC circuit is reinforced-isolated from the hazardous voltage circuit.

(2) External devices

When a device with a hazardous voltage circuit is externally connected to the MELSEC-ST series, use a model of which circuit section of the interface to the MELSEC-ST series is reinforced-isolated from the hazardous voltage circuit.

(3) Reinforced isolation

Reinforced isolation refers to the isolation with the dielectric withstand voltage shown in Table 11.1.

Table 11.1 : Reinforced Isolation Withstand Voltage
(Installation Category II, source : IEC664)

Rated voltage of hazardous voltage area	Surge withstand voltage (1.2/50 μ s)
150VAC or below	2500 V
300VAC or below	4000 V

12 TROUBLESHOOTING

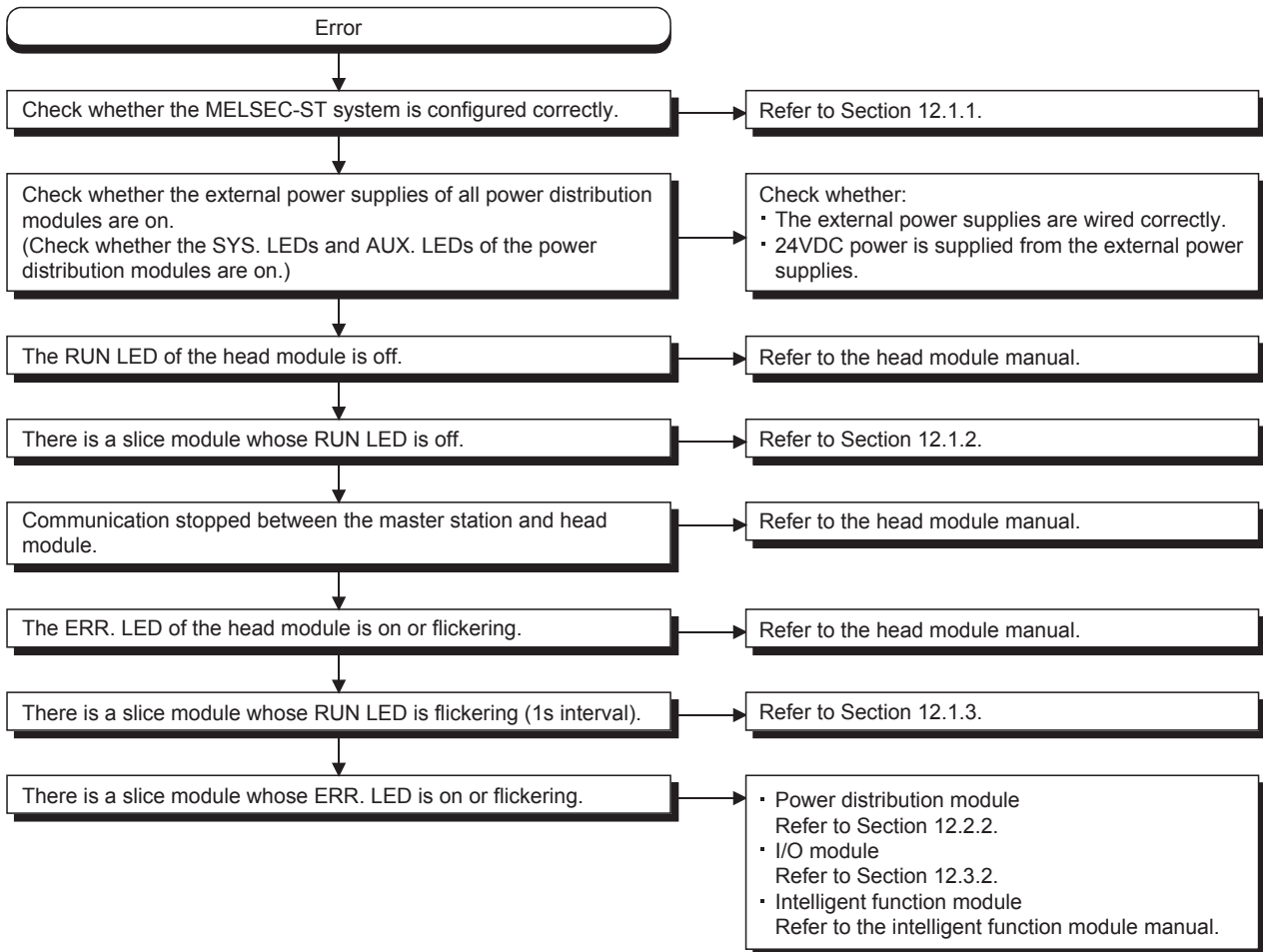
This chapter explains the troubleshooting of the MELSEC-ST system, I/O modules and power distribution modules.

Refer to the manuals of the corresponding modules for the troubleshooting of the head module and intelligent function modules.

12

12.1 MELSEC-ST System Troubleshooting

The troubleshooting of the whole MELSEC-ST system is shown below.



12.1.1 MELSEC-ST system checkup

Before starting slice module troubleshooting, check the description below.

- (1) Check that a proper number of slice modules are mounted.
 Check whether 63 or less slice modules are used with the head module.
 When intelligent function modules are mounted, check whether the number of the intelligent function modules is 26 or less.
 If the range is exceeded, the RUN LEDs of invalid slice modules are off.

- (2) Check that the total number of occupied I/O points is within the range of specifications.

Check whether the total number of occupied I/O points of the modules comprising the MELSEC-ST system is within the range shown below.

- CC-Link: 252 points*¹
- PROFIBUS-DP: 256 points

If the range is exceeded, the RUN LEDs of invalid slice modules are off.
 Refer to the head module manual for details.

*1: The available points will decrease by two points for each additional power distribution module.

- (3) Check that slice modules are mounted on base modules
 Before switching on the external power supplies of the MELSEC-ST system, check whether slice modules are mounted on all base modules.

- (4) Check the combination of slice modules and base modules.
 Check whether the slice modules are mounted on the applicable base modules.

Module type	Reference section
Power distribution module	Chapter 5
I/O module	Chapter 7
Intelligent function module	Refer to intelligent function module manual.

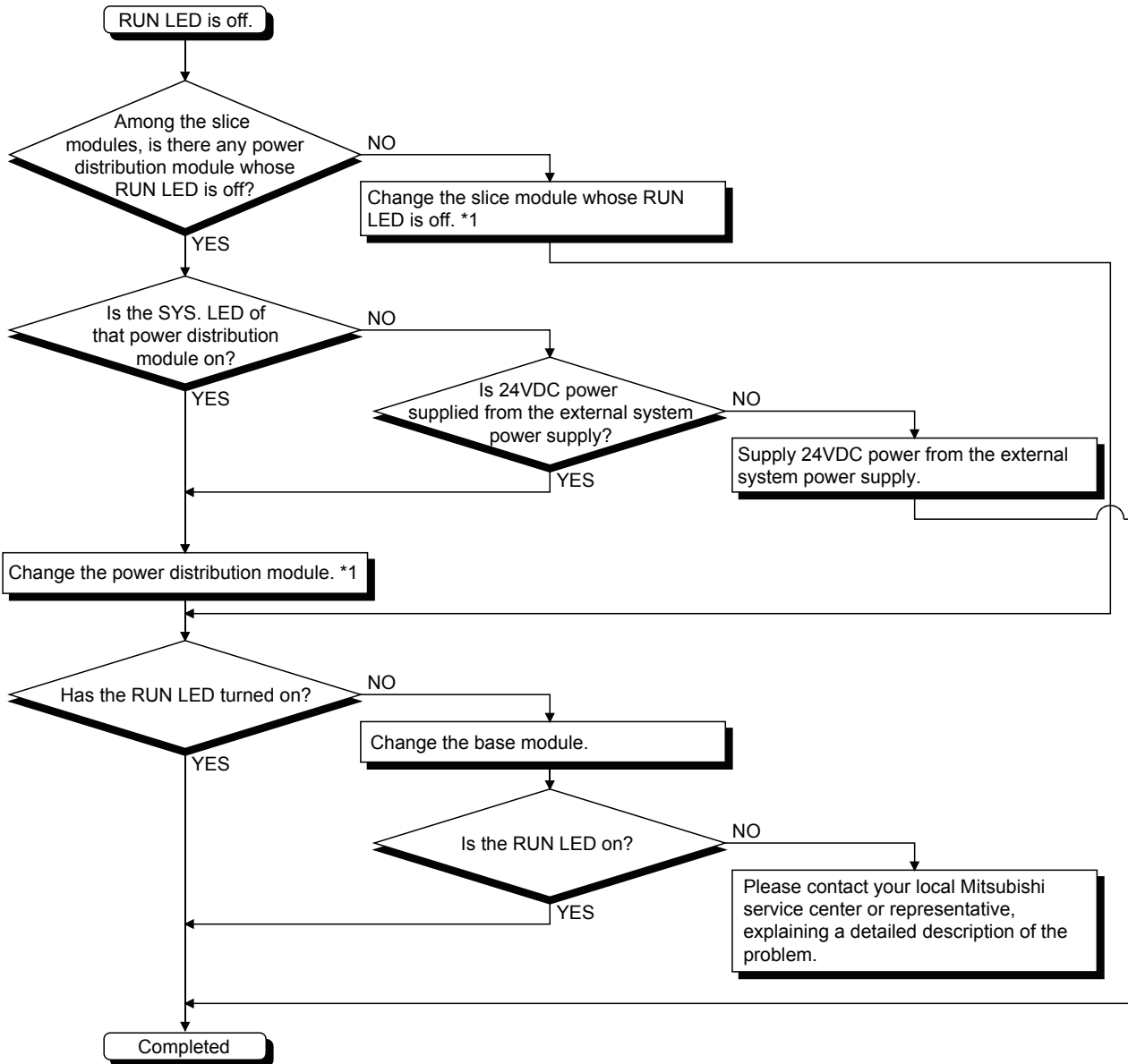
- (5) Check that the total slot width of slice modules is within 85cm.
 Check whether the total slot width of the slice modules (without the head module) comprising the MELSEC-ST system is within 85cm.
 Refer to Chapter 3 for details.

- (6) Check that the total 5VDC internal current consumption and total 24VDC current are within the capacity of the power distribution modules.
 Calculate the total 5VDC internal current consumption and total 24VDC current, and check whether they are within the capacity of the power distribution modules.
 Refer to Section 5.2.1 for the calculation of 5VDC internal current consumption and 24VDC current.

- (7) Check the error in the master station.
 When an error occurs in master station, check the error to fix.

12.1.2 When RUN LED of slice module is off

When the RUN LED of any slice module is off, troubleshoot according to the following flowchart.

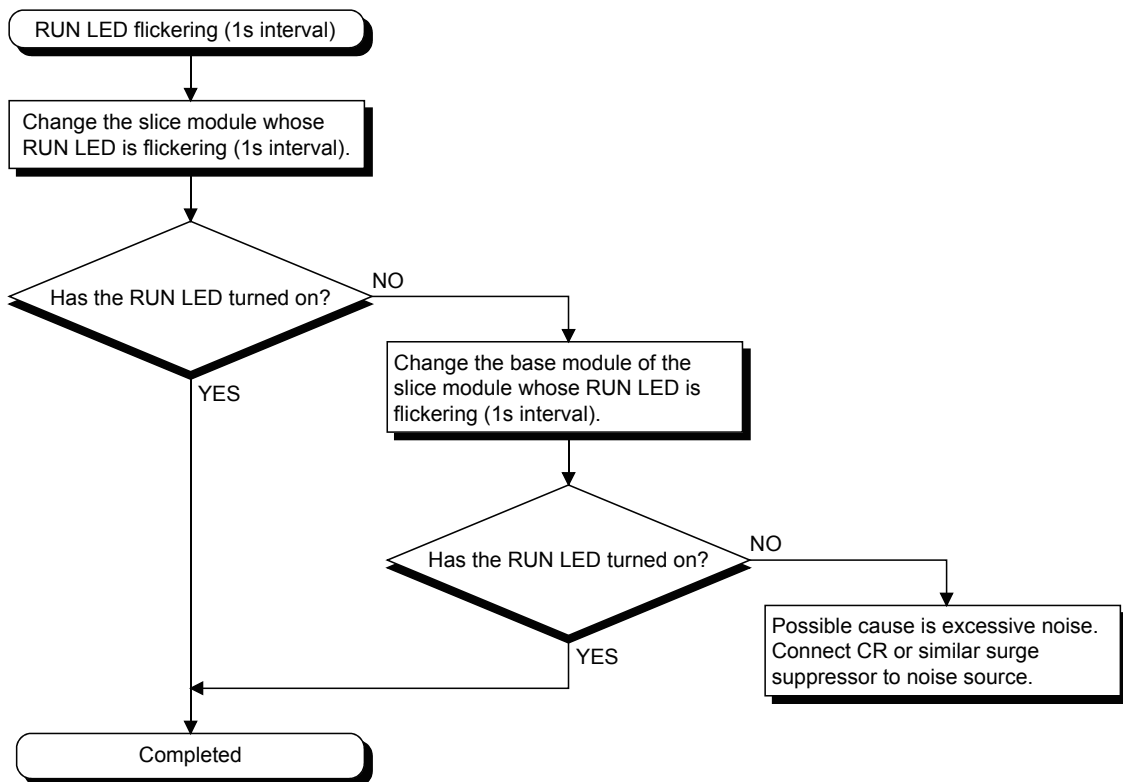
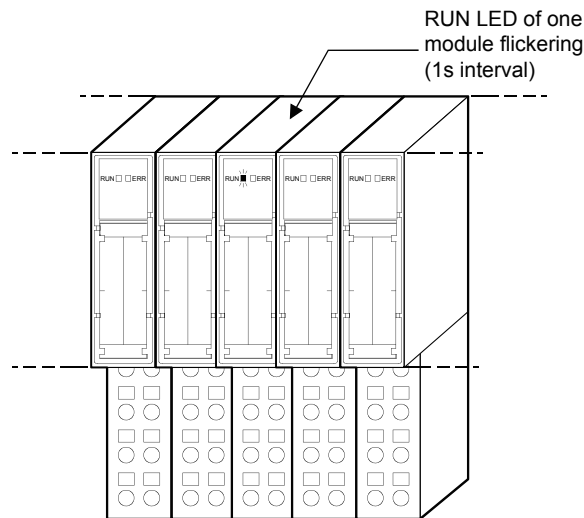


*1 When the RUN LEDs of multiple modules are off, replace them in order starting from the one on the left end.

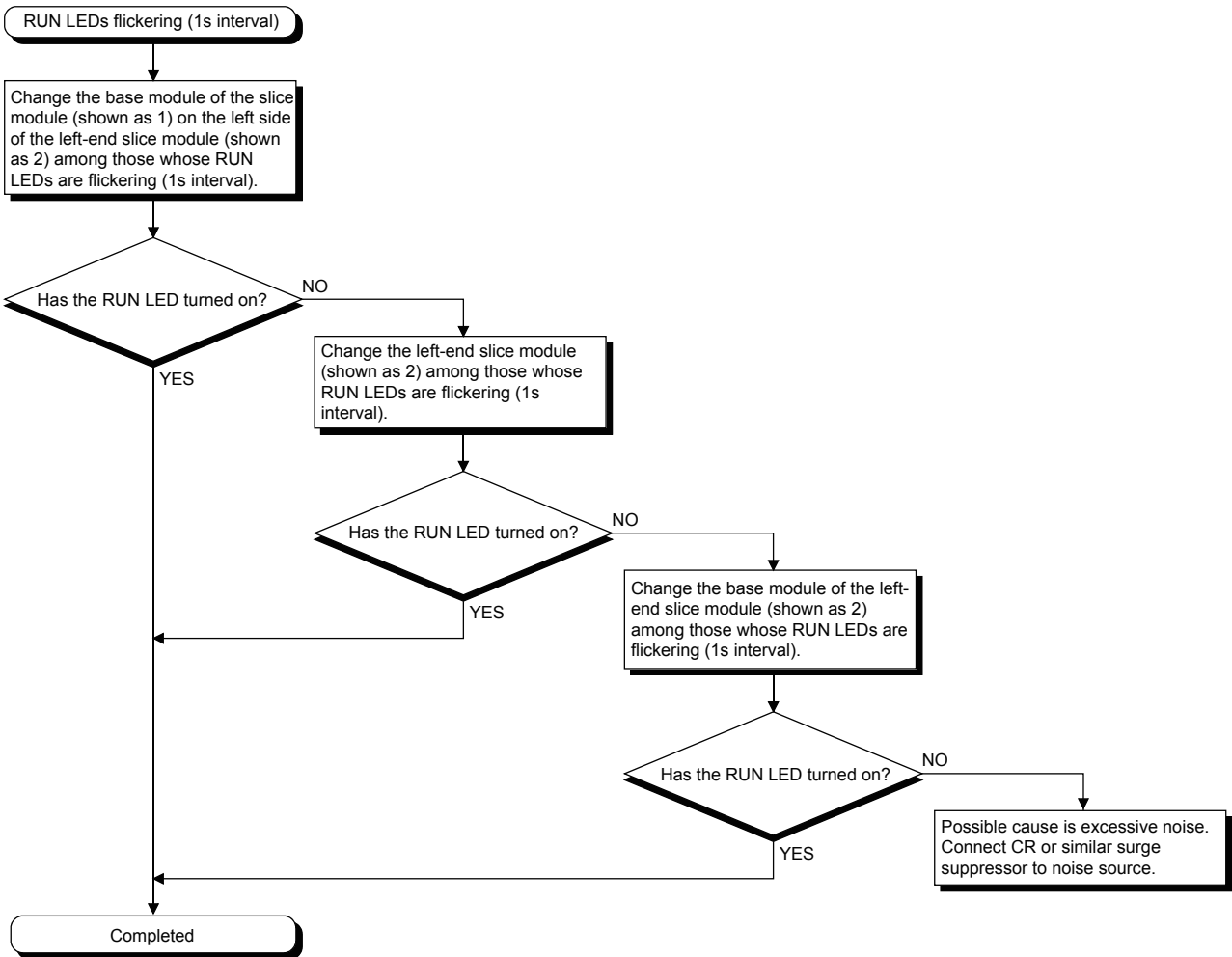
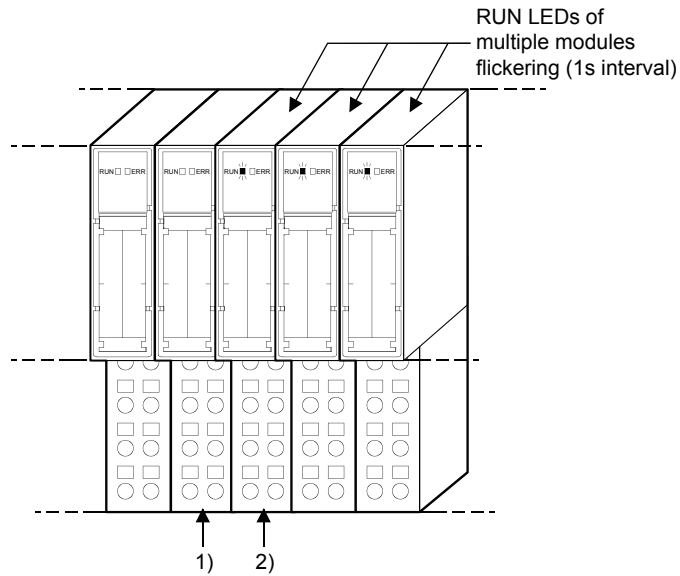
12.1.3 When RUN LED of slice module (excluding intelligent function module) is flickering (1s interval)

When the RUN LED of any slice module (excluding intelligent function module) is flickering (1s interval), troubleshoot according to the following flowchart.

(1) When RUN LED of one slice module (excluding intelligent function module) is flickering (1s interval)



(2) When RUN LEDs of multiple slice modules (excluding intelligent function module) are flickering (1s interval)



12.2 Power Distribution Module Troubleshooting

12.2.1 When RUN LED is flickering or off (Common to bus refreshing module and power feeding module)

(1) Flickering at 0.25s intervals

Check item	Corrective action
Check whether the power distribution module is selected as the target of online module change.	Select a slice module other than the power distribution module as the target of online module change. Refer to the head module manual for details.

POINT
 Only the I/O modules and intelligent function modules can be replaced online. The power distribution modules and base modules cannot be replaced online. Before changing the power distribution module or base module, make sure to shut off all phases of the external power supply for the whole system. Failure to do so may damage all products comprising the MELSEC-ST system.

(2) Flickering at 1s intervals

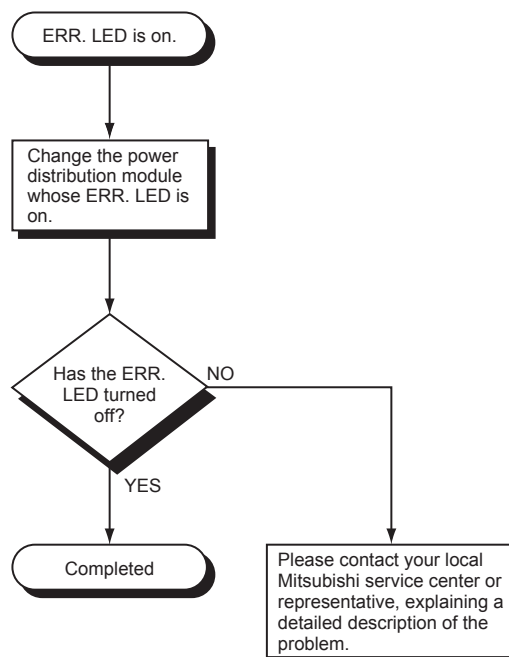
When the RUN LED of the power distribution module is flickering (1s interval), refer to Section 12.1.3 for details.

(3) Off

When the RUN LED of the power distribution module is off, refer to Section 12.1.2 for details.

12.2.2 When ERR. LED is on or flickering

(1) When ERR. LED is on



(2) When ERR. LED is flickering

When the ERR. LED of the power distribution module is flickering, check the following LEDs and take corrective action.

(a) When SYS. LED is off (only the bus refreshing module)

Check item	Corrective action
Is 24VDC of SYS. input supplied?	Check whether the input voltage to the bus refreshing module is within the rated range.

(b) When AUX. LED is off

Check item	Corrective action
Is 24VDC of AUX. input supplied?	Check whether the input voltage to the power distribution module is within the rated range.

12.3 I/O Module Troubleshooting

12.3.1 When RUN LED is flickering or off

(1) Flickering at 0.25s intervals

Check item	Corrective action
Check whether the I/O module is selected as the target of online module change.	Complete the online module change. Refer to the head module manual for details.

(2) Flickering at 1s intervals

When the RUN LED of the I/O module is flickering (1s interval), refer to Section 12.1.3 for details.

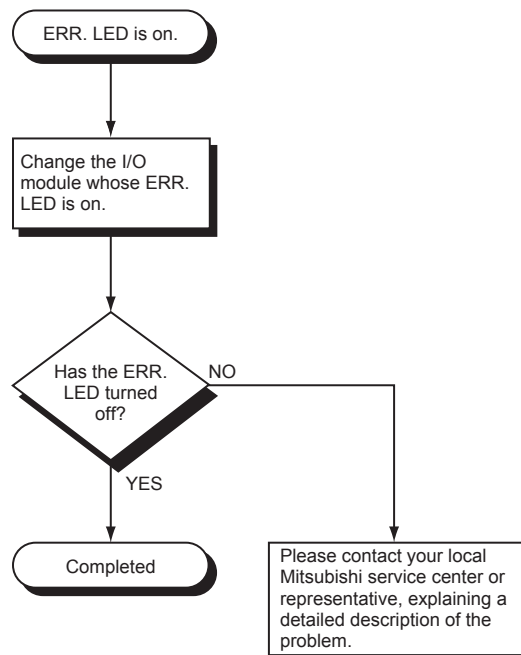
(3) Off

When the RUN LED of the I/O module is off, refer to Section 12.1.2 for details.

12.3.2 When ERR. LED is on or flickering

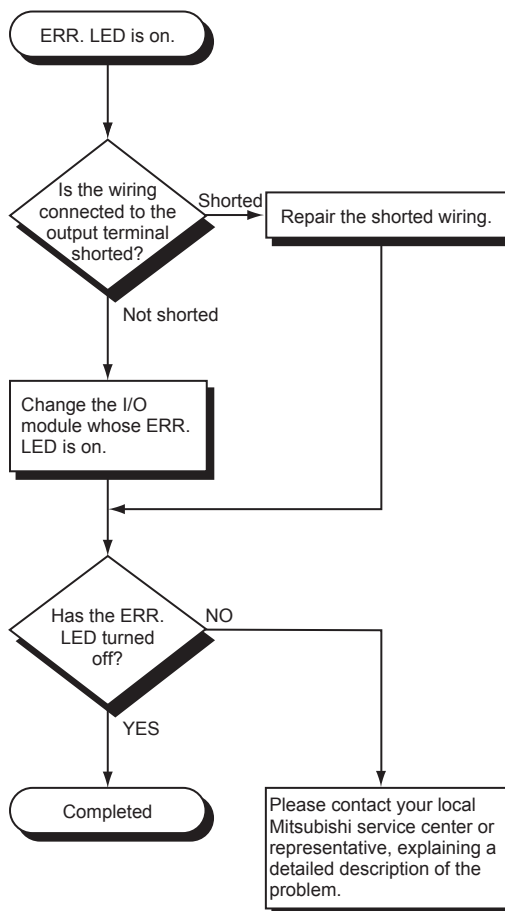
(1) I/O module (except the output module with protective function or fuse)

Target module: ST1X□-DE1, ST1Y2-R2



(2) Output module with fuse

Target module:ST1Y□-TE2



POINT

When the ERR. LED of the output module with fuse turned on, the fuse in the module is blown.

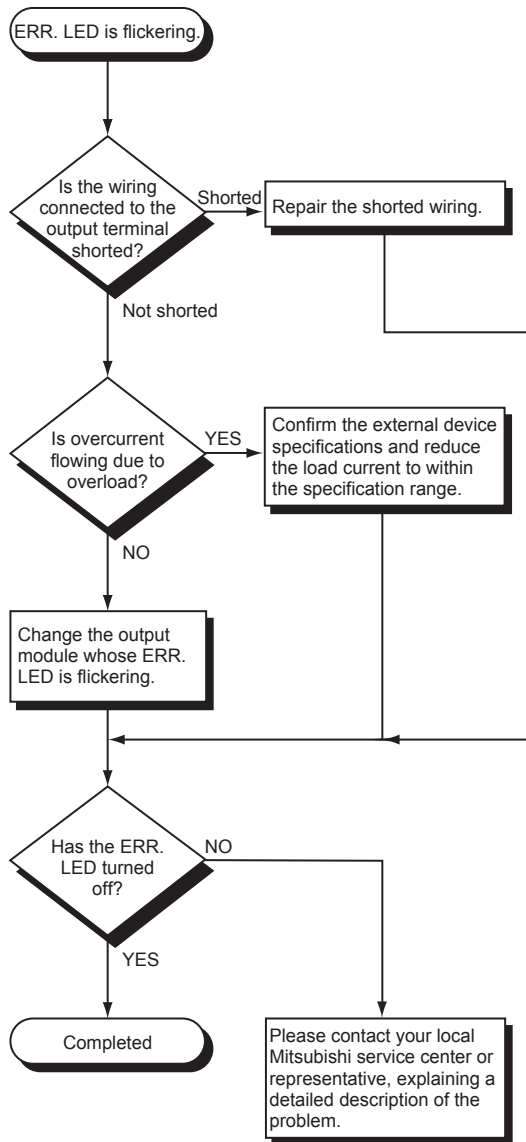
Change the output module with fuse.

Only the fuse inside the module cannot be changed.

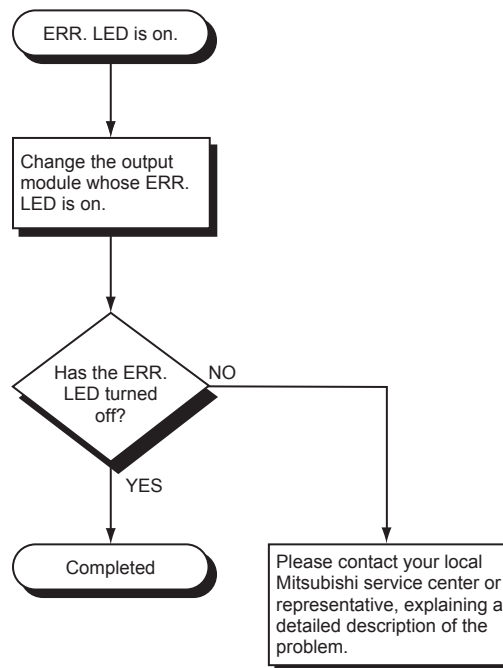
(3) Output module with protective function

Target module: ST1Y□-TPE3

(a) When ERR. LED is flickering



(b) When ERR. LED is on



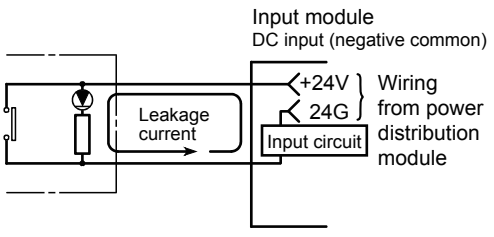
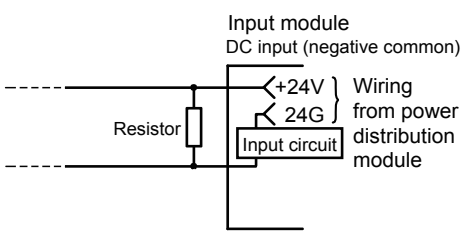
12.3.3 Troubleshooting examples

This section provides possible problems in the input circuit and output circuit and their corrective actions.

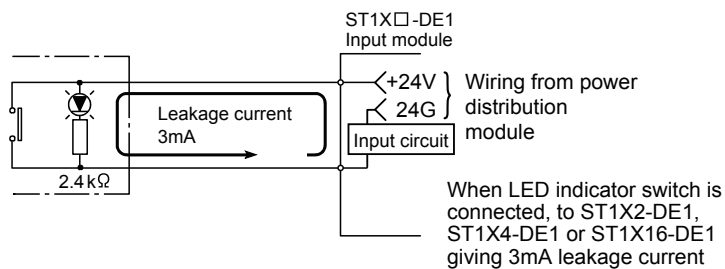
(1) Input circuit troubleshooting

The following explains possible problems in the input circuit and their corrective actions.

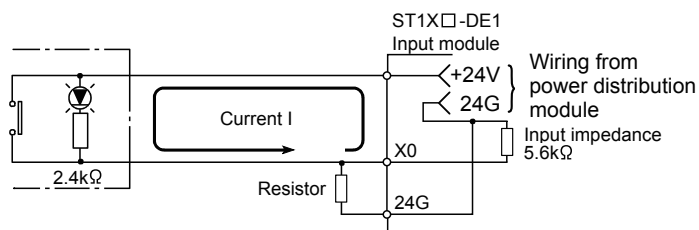
Input circuit troubleshooting

	Condition	Cause	Corrective action
Example 1	Input signal does not turn off.	Drive by LED indicator switch. 	Connect a proper resistor as shown below to make the voltage across input module terminal and common lower than the OFF voltage.  <p>*A calculation example for selecting the resistor to be connected is given in <Calculation for Example 1>.</p>
Example 2	Improper input due to noise	Noise is input depending on the response time setting.	Change the response time setting. Example: 0.5ms → 1.5ms (When excessive noise is periodic, shorter response time setting may have a greater effect.) If the above action does not have any effect, take the basic noise reduction measures to prevent noise entry, e.g. avoid installing power and I/O cables together, add surge absorbers to noise source such as relays and contactors used in the same power supply.

<Calculation for Example 1>



- The voltage V_{TB} across terminal and common is calculated as follows.
 $V_{TB} = 3[mA] \times 5.6[k\Omega] = 16.8[V]$ (Voltage drop across the LED is ignored.)
 As the OFF voltage 11[V] or less is not satisfied, the input signal does not turn off. Therefore, connect a resistor as shown below.



- Calculate the value of the resistor R as shown below.
To make the terminal-to-terminal voltage less than 11[V], the current I should be as indicated below.

$$(24 - 11[V])/2.4[k\Omega] = 5.42[mA]$$

Hence, select the resistor R that will give the current I higher than 5.42[mA].

- For the resistor R

$$11[V] / R > 5.42[mA] - \frac{11[V]}{5.6[k\Omega] \text{ (Input impedance)}}$$

$$11[V] / R > 5.42 - 1.96[mA]$$

$$11[V] / 3.46[mA] / R$$

$$3.18[k\Omega] / R$$

On the assumption that the resistor R of 2.7[kΩ] is connected, the power capacity W of the resistor is as follows when the switch turns on.

$$W = (\text{applied voltage})^2 / R$$

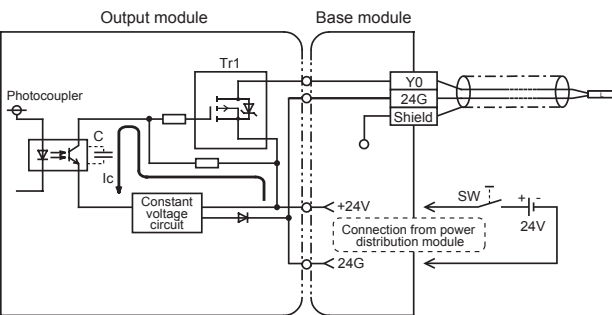
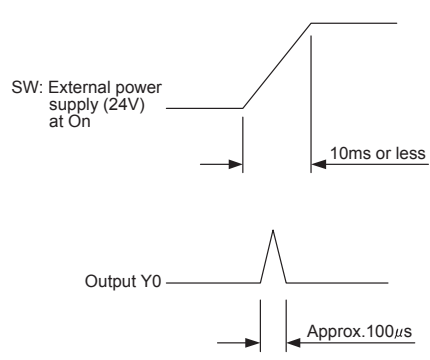
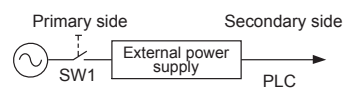
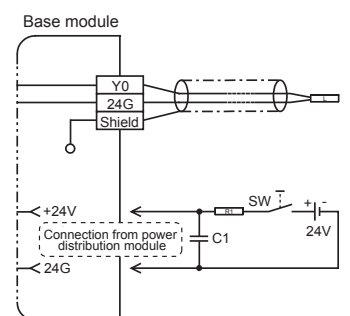
$$W = (28.8[V])^2 / 2.7[k\Omega] = 0.31[W]$$

- Since the power capacity of the resistor is determined to be 3 to 5 times larger than the actual power consumption, select a resistor of 1 to 1.8[W].
A resistor of 2.7[kΩ] and 1 to 1.8[W] should therefore be connected across the relevant terminal and COM.

(2) Output circuit troubleshooting

The following explains possible problems in the output circuit and their corrective actions.

Output circuit troubleshooting

	Condition	Cause	Corrective action
<p>Example 1</p> <p>When the external power supply turns on the load turns on for a moment</p>		<p>Erroneous output due to the stray capacitance (C) between collector and emitter of photocoupler.</p> <p>(There is no erroneous output at normal load. An erroneous output may occur at high sensitivity load (such as solid state relay).)</p>  <p>If the external power supply is turned on precipitously, I_c current flows due to the stray capacitance (C) between collector and emitter of photocoupler. When the current I_c flows, the potential difference is generated between the source and gate of transistor Tr1, which turns ON the output of Y0 for 100μs.</p> 	<p>When external power supply turns ON/OFF, check that the external power supply rising edge must be 10ms or more, and switch the SW1 to the primary side of external power supply.</p>  <p>When switching to the secondary side of the external power supply is required, the external power supply rising edge connected a condenser must be slow, and measured 10ms or more.</p>  <p>R1: Several tens of ohms</p> <p>Power capacity $\geq (\text{external power current}^{*1})^2 \times \text{resistance value} \times (3 \text{ to } 5)^{*2}$</p> <p>C1: Several hundreds of microfarads 50V</p> <p>*1 Refer to consumption current of the external power supply for modules used in this manual.</p> <p>*2 Select the power capacity of resistance to be 3 to 5 times larger than the actual power consumption.</p> <p>(Example) R1 = 40Ω, C1=300μF Use the below expression to calculated a time constant $C1 \times R1 = 300 \times 10^{-6} \times 40$ $= 12 \times 10^{-3}\text{s}$ $= 12\text{ms}$</p>

12.4 Error Code List

This section explains the error codes of the I/O modules and power distribution modules.

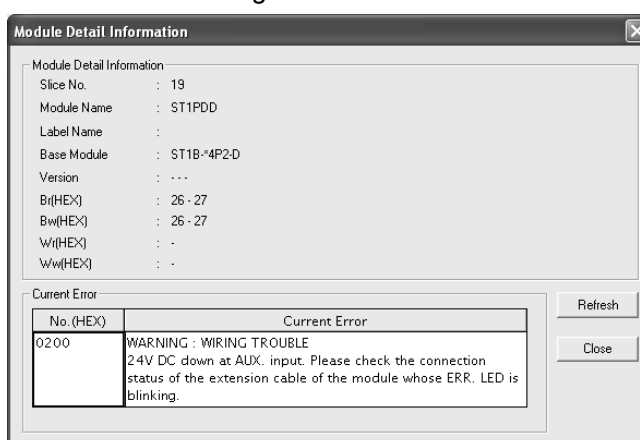
(1) How to confirm error codes

The error codes of the I/O modules and power distribution modules can be confirmed by the following method.

(a) Using GX Configurator-ST

Connect a personal computer to the head module and confirm the operating status and error code of any of the I/O modules and power distribution modules from GX Configurator-ST.

Refer to the GX Configurator-ST Manual for details.



(b) Using the programmable controller

Error code can be confirmed with commands.

Refer to the head module manual for details.

REMARK

The error definition of the I/O module or power distribution module using PROFIBUS-DP can also be confirmed using the input data ($\overline{\text{Er.n}}$ Error Information of the I/O module or power distribution module whose ERR. LED is on or flickering). For the power distribution module, the $\overline{\text{Br.n}}$ Bit Input can also be used to confirm the error definition.

Refer to Appendix 2 for details of the $\overline{\text{Er.n}}$ Error Information and $\overline{\text{Br.n}}$ Bit Input.

(2) Error code lists
(a) I/O module error codes

Error code (Hexadecimal)	Error level	Description	Corrective action	Target module
0001H	System error	Hardware fault	Please contact your local Mitsubishi service center or representative, explaining a detailed description of the problem.	All modules
0002H	Warning	Fuse blown	After checking the module, whose ERR. LED is on, for the following conditions, please contact your local Mitsubishi service center or representative, explaining a detailed description of the problem. • Load higher than the rated current • External wiring problem	ST1Y□-TE2
0100H	Warning	Protective function activated	Check the module, whose ERR. LED is flickering, for the following conditions. • Load higher than the rated current • External wiring problem	ST1Y□-TPE3

(b) Power distribution module error codes

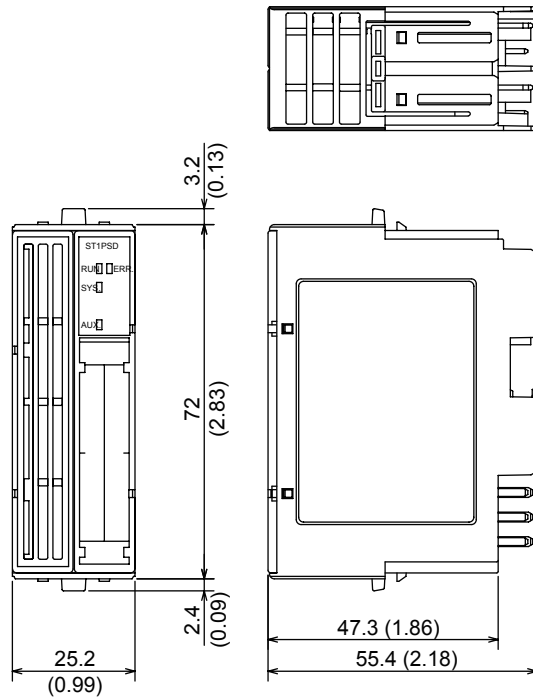
Error code (Hexadecimal)	Error level	Description	Corrective action	Target module
0001H	System error	Hardware fault	Please contact your local Mitsubishi service center or representative, explaining a detailed description of the problem.	All modules
0100H	Warning	SYS. input 24VDC voltage low	Check the module, whose ERR. LED is flickering, for the following conditions. • Load higher than the rated current • External wiring problem	ST1PSD
0200H	Warning	AUX. input 24VDC voltage low		All modules
0300H	Warning	24VDC input voltage low	The SYS. input 24VDC voltage is low and the AUX. input 24VDC voltage is low. Check the module, whose ERR. LED is flickering, for the following conditions. • Load higher than the rated current • External wiring problem	ST1PSD

APPENDICES

Appendix 1 Outer Dimension Drawings

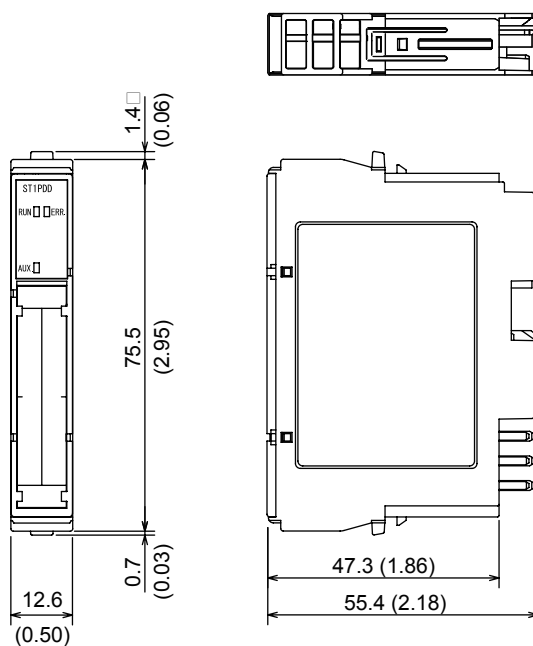
Appendix 1.1 Power distribution modules

(1) Bus refreshing module (ST1PSD)



Unit: mm (inch)

(2) Power feeding module (ST1PDD)

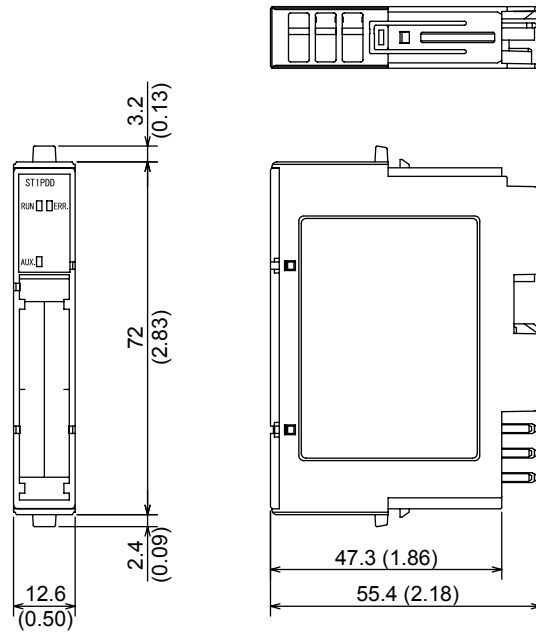


Unit: mm (inch)

App

REMARK

For Power feeding module (ST1PDD) of hardware version C or before, side face diagram of the module is as follows.

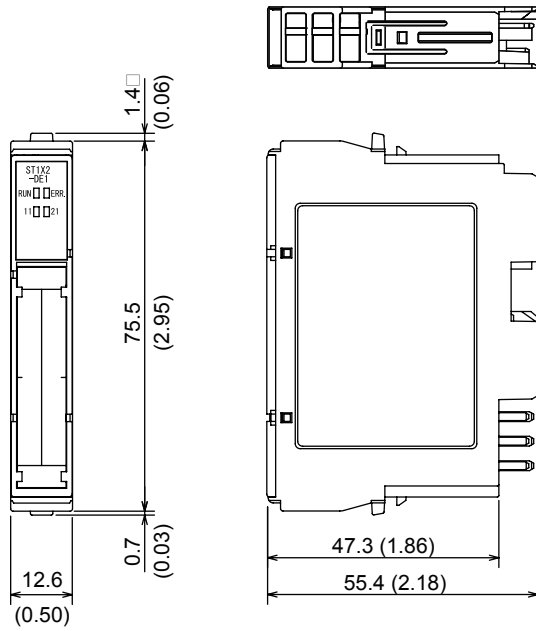


Unit: mm (inch)

App

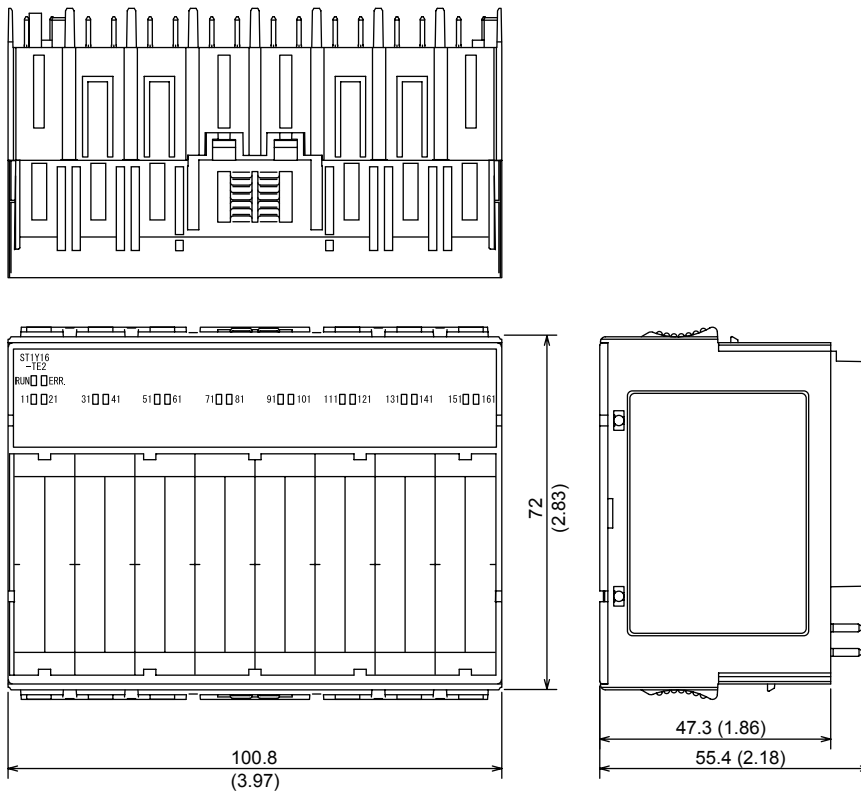
Appendix 1.2 I/O modules

- (1) ST1□2-DE1, ST1□4-DE1, ST1□2-TPE3, ST1□2-TE2, ST1Y2-R2, ST1Y2-TE8



Unit: mm (inch)

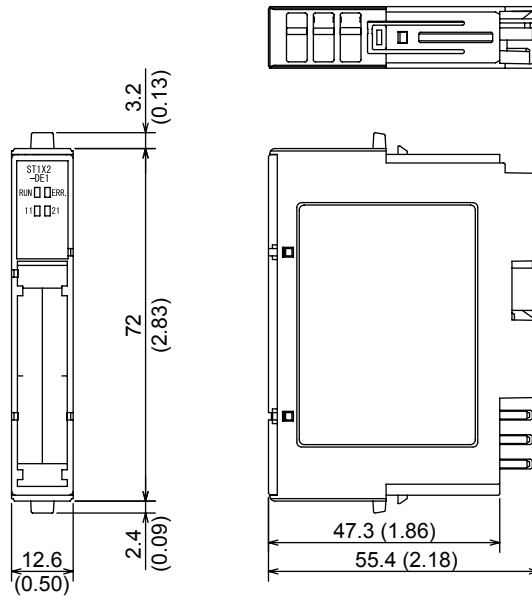
- (2) ST1□16-DE1, ST1□16-TE2, ST1□16-TPE3



Unit: mm (inch)

REMARK

For I/O module (ST1X2-DE1, ST1X4-DE1, ST1Y2-TE2, ST1Y2-TPE3, ST1Y2-R2) of hardware version B or before, side face diagram of the module is as follows.

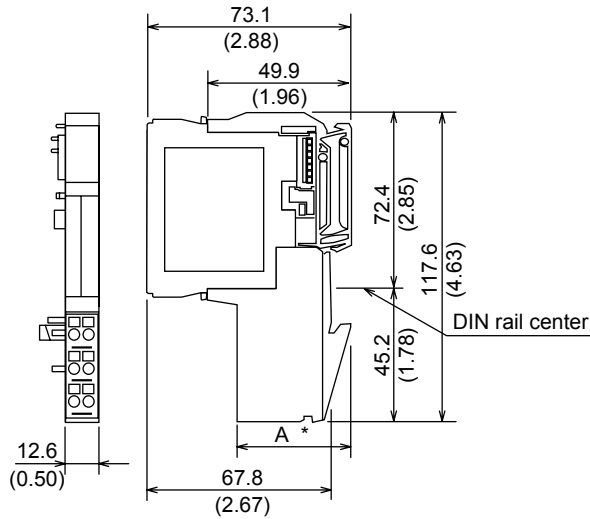


Unit: mm (inch)

Appendix 1.3 Base modules

The base modules shown below are mounted with slice modules.

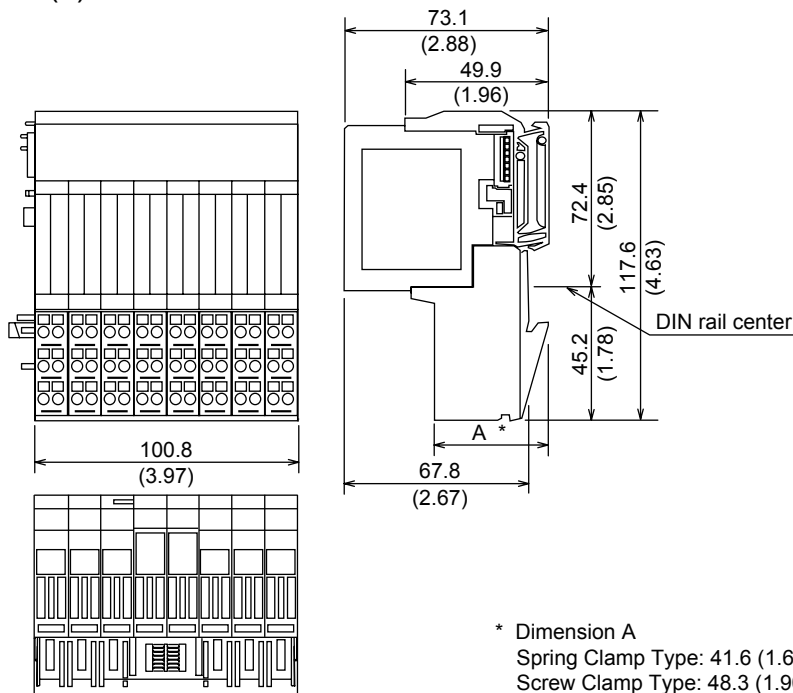
(1) ST1B-□3□2□



* Dimension A
 Spring Clamp Type: 41.6 (1.64)
 Screw Clamp Type: 48.3 (1.90)

Unit: mm (inch)

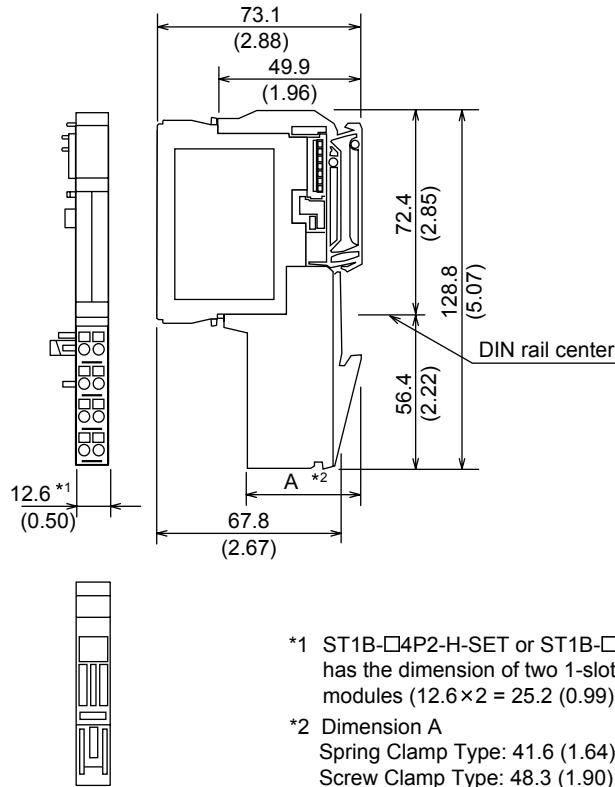
(2) ST1B-□3□16



* Dimension A
 Spring Clamp Type: 41.6 (1.64)
 Screw Clamp Type: 48.3 (1.90)

Unit: mm (inch)

(3) ST1B-□4□2□, ST1B-□4IR2, ST1B-□4□P□

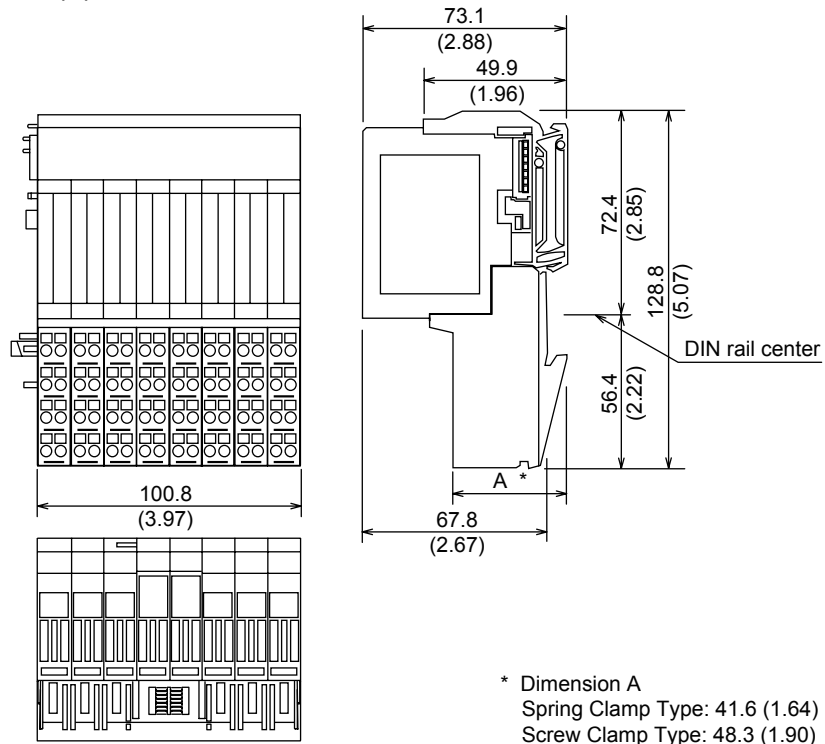


*1 ST1B-□4P2-H-SET or ST1B-□4P2-R-SET has the dimension of two 1-slot width base modules (12.6×2 = 25.2 (0.99)).

*2 Dimension A
Spring Clamp Type: 41.6 (1.64)
Screw Clamp Type: 48.3 (1.90)

Unit: mm (inch)

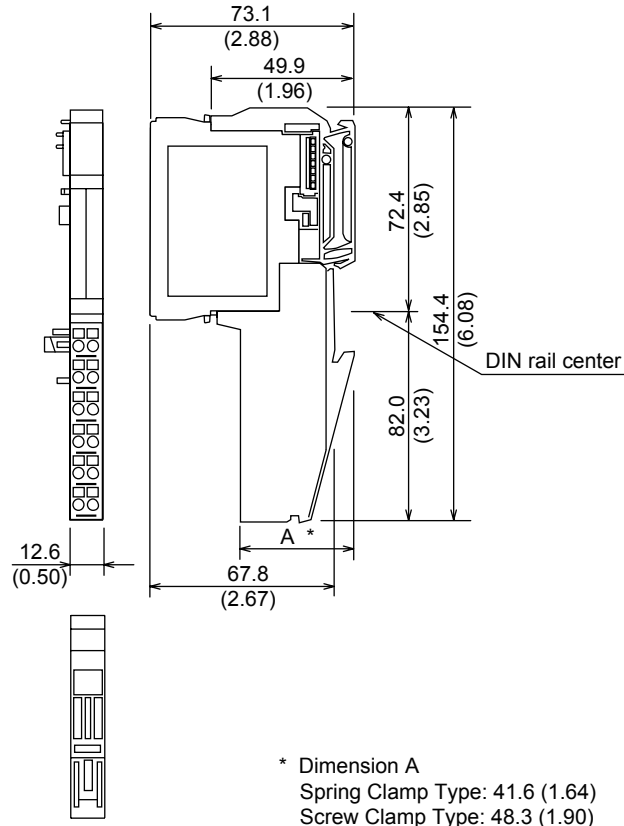
(4) ST1B-□4□16



* Dimension A
Spring Clamp Type: 41.6 (1.64)
Screw Clamp Type: 48.3 (1.90)

Unit: mm (inch)

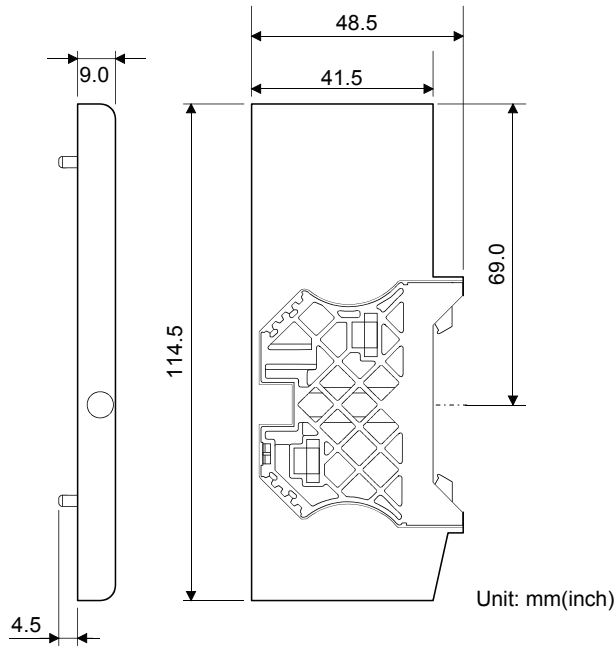
(5) ST1B-□6□4



Unit: mm (inch)

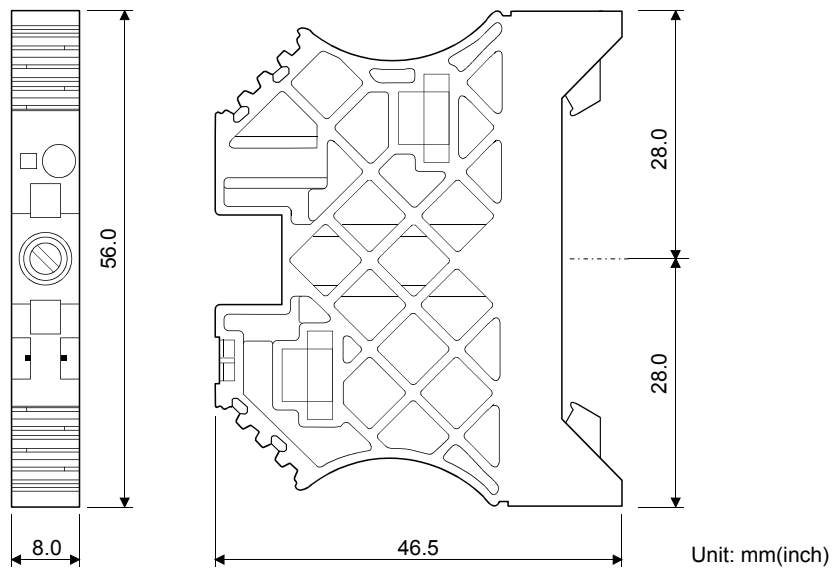
Appendix 1.4 Accessory

(1) End plate (ST1A-EPL) *1



* 1. In the above drawing, the end bracket is mounted on the end plate.

(2) End bracket (ST1A-EBR)



Appendix 2 CC-Link

Appendix 2.1 I/O data

Appendix 2.1.1 Power distribution modules

The power distribution module does not occupy the areas for data transfer to and from the head module.

Appendix 2.1.2 Input modules

The input module has the following areas for data transfer to and from the head module.

The structure of each area will be explained in this section.

Module	Number of occupied slices	Input Data		Output Data	
		Br	Wr	Bw	Ww
2-point input module ST1X2-□□□	1	2	0	0	0
4-point input module ST1X4-□□□	2	4	0	0	0
16-point input module ST1X16-□□□	8	16	0	0	0

(1) Input Data

(a) Br Bit Input Area

The Br Bit Input Area will be explained.

Target module	Bit Input	Item	Description
ST1X2-□□□	Br.n to Br.n+1	Input status	Stores the input information (ON/OFF) of the input module. 0: Input OFF 1: Input ON
ST1X4-□□□	Br.n to Br.n+3		
ST1X16-□□□	Br.n to Br.n+15		

(b) Wr Word Input Area

Word input area is not occupied.

(2) Output Data

(a) Bw Bit Output Area

Bit output area is not occupied.

(b) Ww Word Output Area

Word output area is not occupied.

Appendix 2.1.3 Output modules

The output module has the following areas for data transfer to and from the head module.

The structure of each area will be explained in this section.

Module	Number of occupied slices	Input Data		Output Data	
		Br	Wr	Bw	Ww
2-point output module ST1Y2-□□□□	1	0	0	2	0
16-point output module ST1Y16-□□□□	8	0	0	16	0

(1) Input Data

(a) Br Bit Input Area

Bit input area is not occupied.

(b) Wr Word Input Area

Word input area is not occupied.

(2) Output Data

(a) Bw Bit Output Area

Bit output area will be explained.

Target module	Bit Output	Item	Description
ST1X2-□□□□	Bw.n to Bw.n+1	Output status	Stores the output information (ON/OFF) of the output module. 0: Output OFF 1: Output ON
ST1X16-□□□□	Bw.n to Bw.n+15		

Appendix 2.2 I/O points sheet

Slice position No.	Start slice No. (Number of occupied slices)	Module name	Br.n	Bw.n	Wr.n	Ww.n	5VDC internal current consumption (Total value)	24VDC current (Total value)	Slot width (Total value)
0	0(2)	ST1H-BT	-	-	-	-	0.410A(0.410A)	0A(0A)	-
1	2(1)	ST1PSD	-	-	-	-	-	-	25.2mm(25.2mm)
2	()								
3	()								
4	()								
5	()								
6	()								
7	()								
8	()								
9	()								
10	()								
11	()								
12	()								
13	()								
14	()								
15	()								
16	()								
17	()								
18	()								
19	()								
20	()								
21	()								
22	()								
23	()								
24	()								
Total							-	-	-

Appendix 3 PROFIBUS-DP

Appendix 3.1 Input/Output Data

Appendix 3.1.1 Power distribution modules

The power distribution module has the following areas for data transfer to and from the head module.

The structure of each area will be explained in this section.

Module	Number of occupied slices	Input Data				Output Data		
		Br	Er	Mr	Wr	Bw	Ew	Ww
Power distribution modules ST1PSD, ST1PDD	1	2	2	1	0	(2)	2	0

The value within the parentheses is not used, but the number of assigned points is occupied.

Write 0 (fixed) when writing a value to the Output Data at the master station.

(1) Input Data

(a) Br Bit Input Area

The Br Bit Input Areas of the bus refreshing module and power feeding module will be explained.

1) Bus refreshing module

Bit Input		Item	Description
Br.n+1	Br.n		
1	1	SYS. input 24VDC voltage low AUX. input 24VDC voltage low	The 24VDC voltages input from the SYS. input and AUX. input to the power distribution module are low.
1	0	SYS. input 24VDC voltage low	The 24VDC voltage input from the SYS. input to the power distribution module is low.
0	1	AUX. input 24VDC voltage low	The 24VDC voltage input from the AUX. input to the power distribution module is low.
0	0	Normal	The 24VDC voltages input from the SYS. input and AUX. input to the power distribution module are within the rated range.

2) Power feeding module

Bit Input		Item	Description
Br.n+1	Br.n		
0	1	AUX. input 24VDC voltage low	The 24VDC voltage from the AUX. input to the power distribution module is low.
0	0	Normal	The 24VDC voltage from the AUX. input to the power distribution module is within the rated range.

(b) **Er** Error Information Area

The **Er** Error Information Areas of the bus refreshing module and power feeding module will be explained.

1) Bus refreshing module

Error Information		Item	Description
Er.n+1	Er.n		
0	1	External power supply 24VDC voltage low	(1) The 24VDC voltages input from the SYS. input and AUX. input to the power distribution module are low. (2) The 24VDC voltage input from the SYS. input to the power distribution module is low. (3) The 24VDC voltage input from the AUX. input to the power distribution module is low.
0	0	Normal	The 24VDC voltages input from the SYS. input and AUX. input to the power distribution module are within the rated range.

2) Power feeding module

Error Information		Item	Description
Er.n+1	Er.n		
0	1	AUX. input 24VDC voltage low	The 24VDC voltage input from the AUX. input to the power distribution module is low.
0	0	Normal	The 24VDC voltage input from the AUX. input to the power distribution is within the rated range.

(c) **Mr** Module Status Area

The Module Status Area will be explained.

Module Status		Item	Description
Mr.n			
0	Module Status	Hardware fault	
1		Normal	

(d) **Wr** Word Input Area

The Word Input Area is not occupied.

(2) Output Data

(a) **Bw** Bit Output Area

Two points of **Bw.n** and **Bw,n+1** are occupied.

Since it is not used by the power distribution module, write 0 (fixed) to this area.

(b) **Ew** Error Clear Area

The **Ew** Error Clear Area will be explained.

Error Clear	Item	Description
Ew.n+1 , Ew.n	Error Clear Request	(1) Turn Ew.n ON (1) when clearing error information. (2) After confirming that the error information has been cleared, turn OFF (0) the Ew.n Error Clear Request. When the module recovers from the error, the error information is automatically cleared. OFF (0) : Error clear not requested (default) ON (1) : Error clear requested Only Ew.n is used. Ew.n+1 is reserved for the system. (0 fixed)

(c) **Ww** Word Output Area

The Word Output Area is not occupied.

Appendix 3.1.2 Input modules

The input module has the following areas for data transfer to and from the head module.

The structure of each area will be explained.

Module	Number of occupied slices	Input Data				Output Data		
		Br	Er	Mr	Wr	Bw	Ew	Ww
2-point input module ST1X2-□□□	1	2	2	1	0	(2)	2	0
4-point input module ST1X4-□□□	2	4	4	2	0	(4)	4	0
16-point input module ST1X16-□□□	8	16	16	8	0	(16)	16	0

The value within the parentheses is not used, but the number of assigned points is occupied.

Write 0 (fixed) when writing a value to the Output Data at the master station.

(1) Input Data

(a) Br Bit Input Area

The Br Bit Input Area will be explained.

Target module	Bit Input	Item	Description
ST1X2-□□□	Br.n to Br.n+1	Input status	Stores the input information (ON/OFF) of the input module. 0: Input OFF 1: Input ON
ST1X4-□□□	Br.n to Br.n+3		
ST1X16-□□□	Br.n to Br.n+15		

(b) Er Error Information Area

The Er Error Information Area will be explained.

Target module	Error Information								Information	Description
	Er.n+15	Er.n+14	Er.n+13	Er.n+12	Er.n+11	Er.n+10	Er.n+9	Er.n+8		
ST1X2-□□□	-	-	-	-	-	-	-	-	Module error	Module error
	-	-	-	-	-	-	-	-		Hardware fault *1
ST1X4-□□□	-	-	-	-	-	-	-	-		Module error
	-	-	-	-	-	-	-	-		Hardware fault *1
ST1X16-□□□	0	0	0	1	0	0	0	1		Module error *2
	1	1	1	1	1	1	1	1		Hardware fault *1
Target module	Error Information								Information	Description
	Er.n+7	Er.n+6	Er.n+5	Er.n+4	Er.n+3	Er.n+2	Er.n+1	Er.n		
ST1X2-□□□	-	-	-	-	-	-	0	1	Module error	Module error
	-	-	-	-	-	-	1	1		Hardware fault *1
ST1X4-□□□	-	-	-	-	0	0	0	1		Module error
	-	-	-	-	1	1	1	1		Hardware fault *1
ST1X16-□□□	0	0	0	1	0	0	0	1		Module error *2
	1	1	1	1	1	1	1	1		Hardware fault *1

*1: A hardware fault occurs when the input module cannot be recognized by the head module.

*2: A module error is indicated when any of Er.n, Er.n+4, Er.n+8 and Er.n+12 turns ON (1).

(c) **Mr** Module Status Area

The **Mr** Module Status Area will be explained.

Target module	Module Status								Information	Description
	Mr.n+7	Mr.n+6	Mr.n+5	Mr.n+4	Mr.n+3	Mr.n+2	Mr.n+1	Mr.n		
ST1X2-□□□	-	-	-	-	-	-	-	0	Module Status	Hardware fault
□□□	-	-	-	-	-	-	-	1		Normal
ST1X4-□□□	-	-	-	-	-	-	0	0		Hardware fault
□□□	-	-	-	-	-	-	1	1		Normal
ST1X16-□□□	0	0	0	0	0	0	0	0		Hardware fault
□□□	1	1	1	1	1	1	1	1		Normal

(d) **Wr** Word Input Area

The Word Input Area is not occupied.

(2) Output Data

(a) **Bw** Bit Output Area

The area of assigned points (2/4/16 points) is occupied.

Since it is not used by the input module, write 0 (fixed) to this area.

(b) **Ew** Error Clear Area

The Error Clear Area will be explained.

Target module	Error Clear	Item	Description
ST1X2-□□□	Ew.n , Ew.n+1	Error Clear Request	(1) Turn Ew.n ON (1) when clearing error information. (2) After confirming that the error information has been cleared, turn OFF (0) the Ew.n Error Clear Request. When the module recovers from the error, the error information is automatically cleared. OFF (0) : Error clear not requested (default) ON (1) : Error clear requested Only Ew.n is used. Ew.n+1 to Ew.n+15 are reserved for the system. (0 fixed)
ST1X4-□□□	Ew.n to Ew.n+3		
ST1X16-□□□	Ew.n to Ew.n+15		

(c) **Ww** Word Output Area

The Word Output Area is not occupied.

Appendix 3.1.3 Output modules

The output module has the following areas for data transfer to and from the head module.

The structure of each area will be explained.

Module	Number of occupied slices	Input Data				Output Data		
		Br	Er	Mr	Wr	Bw	Ew	Ww
2-point output module ST1Y2-□□□□	1	(2)	2	1	0	2	2	0
16-point output module ST1Y16-□□□□	8	(16)	16	8	0	16	16	0

The value within the parentheses is not used, but the number of assigned points is occupied.

(1) Input Data

(a) Br Bit Input Area

The area of assigned points (2/16 points) is occupied.

Since it is not used by the output module, 0 (fixed) is stored into this area.

(b) Er Error Information Area

The Er Error Information Area will be explained.

Target module	Error Information								Information	Description
	Er.n+15	Er.n+14	Er.n+13	Er.n+12	Er.n+11	Er.n+10	Er.n+9	Er.n+8		
ST1Y2-□□□□	-	-	-	-	-	-	-	-	Module error	Module error
□□□□	-	-	-	-	-	-	-	-		Hardware fault *1
ST1Y16-□□□□	0	0	0	1	0	0	0	1	Module error	Module error *2
□□□□	1	1	1	1	1	1	1	1		Hardware fault *1

Target module	Error Information								Information	Description
	Er.n+7	Er.n+6	Er.n+5	Er.n+4	Er.n+3	Er.n+2	Er.n+1	Er.n		
ST1Y2-□□□□	-	-	-	-	-	-	0	1	Module error	Module error
□□□□	-	-	-	-	-	-	1	1		Hardware fault *1
ST1Y16-□□□□	0	0	0	1	0	0	0	1	Module error	Module error *2
□□□□	1	1	1	1	1	1	1	1		Hardware fault *1

*1: A hardware fault occurs when the output module cannot be recognized by the head module.

*2: A module error is indicated when any of Er.n, Er.n+4, Er.n+8 and Er.n+12 turns ON (1).

(c) Mr Module Status Area

The Mr Module Status Area will be explained.

Target module	Module Status								Information	Description
	Mr.n+7	Mr.n+6	Mr.n+5	Mr.n+4	Mr.n+3	Mr.n+2	Mr.n+1	Mr.n		
ST1Y2-□□□□	-	-	-	-	-	-	0	0	Module Status	Hardware fault
□□□□	-	-	-	-	-	-	1	1		Normal
ST1Y16-□□□□	0	0	0	0	0	0	0	0	Module Status	Hardware fault
□□□□	1	1	1	1	1	1	1	1		Normal

(d) Wr Word Input Area

The Word Input Area is not occupied.

(2) Output Data

(a) **Bw** Bit Output Area

The **Br** Bit Output Area will be explained.

Target module	Bit Output	Item	Description
ST1Y2-□□□□	Bw.n to Bw.n+1	Output status	Stores the output information (ON/OFF) to the output module. 0: Output OFF 1: Output ON
ST1Y16-□□□□	Bw.n to Bw.n+15		

(b) **Ew** Error Clear Area

The Error Clear Area will be explained.

Target module	Error Clear	Item	Description
ST1Y2-□□□□	Ew.n , Ew.n+1	Error Clear Request	(1) Turn Ew.n ON (1) when clearing error information. (2) After confirming that the error information has been cleared, turn OFF (0) the Ew.n Error Clear Request. When the module recovers from the error, the error information is automatically cleared. OFF (0) : Error clear not requested (default) ON (1) : Error clear requested Only Ew.n is used. Ew.n+1 to Ew.n+15 are reserved for the system. (0 fixed)
ST1Y16-□□□□	Ew.n to Ew.n+15		

(c) **Ww** Word Output Area

The Word Output Area is not occupied.

Appendix 3.2 Maximum input/output points setting sheet

Slice position No.	Module Name	Number of Occupied I/O Points	Start Slice No. (Number of occupied slices)	Wr.n	Ww.n	5VDC Internal Current Consumption (Total)	24VDC Current (Total)	Slot width (Total value)
0	ST1H-PB	4	0(2)	—	—	0.530A(0.530A)	0A(0A)	—
1	ST1PSD	2	2(1)	—	—	—	—	25.2mm(25.2mm)
2			()					
3			()					
4			()					
5			()					
6			()					
7			()					
8			()					
9			()					
10			()					
11			()					
12			()					
13			()					
14			()					
15			()					
16			()					
17			()					
18			()					
19			()					
20			()					
21			()					
22			()					
23			()					
24			()					
Total		*1	—	*2	*2	—	—	—

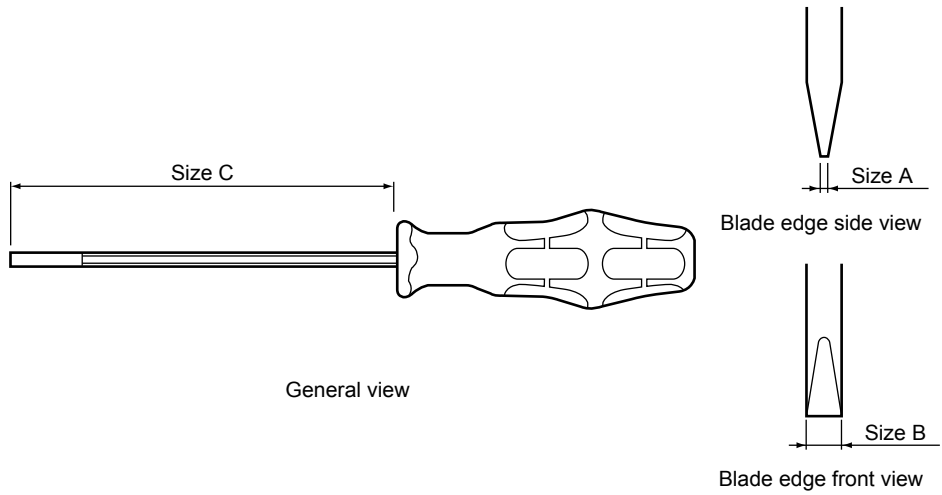
*1: Apply this value to [A] in the following table.
 *2: Apply the value, whichever is larger, to [D] in the following table.

[A] Sum total of occupied I/O points	[D] Maximum word input/output points						
	0 to 32 words				33 to 52 words		
	32-point mode	64-point mode	128-point mode	256-point mode	32-point mode	64-point mode	128-point mode
4 to 32 points							—
33 to 64 points	—	64-point mode	128-point mode	256-point mode	—	64-point mode	128-point mode
65 to 128 points	—		128-point mode	256-point mode	—		128-point mode
129 to 256 points	—			256-point mode	—		

Select the shaded setting when planning an expansion of the MELSEC-ST system for the future.

Appendix 4 Recommended Screwdriver

Product name	Product No.	Maker	Specifications	Size (mm)		
				A	B	C
SD	900833	Weidmueller	Flat-blade screwdriver without insulating cover (Blade edge compliant with DIN5264)	0.6	3.5	100



INDEX

- [B]
 Base module marker 8- 1
 Bit Input.....App- 9, App-12
 Bit Output.....App-18
 BrApp- 9, App-12
 BwApp-10, App-18
- [C]
 Coding Element..... 8- 2, 10- 9
- [D]
 DIN rail3-10, 10- 2
- [E]
 End brackets..... 8- 1
 End plate..... 8- 1
 ErApp-13, App-15, App-17
 Error clearApp-14, App-16, App-18
 Error InformationApp-13, App-15, App-17
 EwApp-14, App-16, App-18
 External power supply..... 3- 4, 11- 9
- [F]
 Forced output test function 9- 1, 9- 5
- [I]
 Information monitor function 9- 1, 9- 5
 Input DataApp- 9, App-12, App-15
 Input response time setting function..... 9- 4
 Input response time setting monitor function
 9- 1, 9- 5
- [M]
 Maximum number of connected modules ... 3- 10
 Module StatusApp-13, App-16, App-17
 MrApp-13, App-16, App-17
- [O]
 Online module change function 9- 1, 9- 5
 Operating status LEDs..... 5-12, 7-18
 Output DataApp-13, App-16, App-18
 Overload and overheat protection functions
 7-16
- [P]
 Performance specifications 5- 1,7- 1
 Power supply capacity check function .. 9- 1, 9- 5
 Precautions for online module change3-12
- [R]
 Relay life.....7-14
 Response time7-16
 Restrictions on base modules3-11
 Restrictions on power distribution
 modules.....3-10
 Restrictions on slot width3-12
- [S]
 Setting of output status9- 4
 Setting monitoring of output status..... 9- 1, 9- 5
 Status monitor function 9- 1, 9- 5
- [T]
 Thermal protection7-16
- [U]
 UL certification-relevant restrictions3-15
- [W]
 Wiring marker.....8- 1

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.

Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

- (1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
- (2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
 1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
 2. Failure caused by unapproved modifications, etc., to the product by the user.
 3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
 4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
 5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
 6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
 7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued.

Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

- (1) In using the Mitsubishi MELSEC programmable controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.
- (2) The Mitsubishi programmable controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or Public service purposes shall be excluded from the programmable controller applications.

In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable controller range of applications.

However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the users discretion.

MELSEC-ST System

User's Manual

MODEL	MELSEC-ST-SYS-U-E
MODEL CODE	13JR72
SH(NA)-080456ENG-H(0811)MEE	

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When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.

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