MISUMI SINGLE-AXIS ROBOT CONTROLLER

C1/C21/C22

User's Manual

Ver. 2.01

EUMM20C201
KE3

CONTENTS

Safety Instructions

1. Safety Information **S-1**

2. Signal words used in this manual **S-2**

3. Warning labels **S-3**

3.1 Warning labels S-3
3.1.1 Warning label messages on robot and controller S-3
3.1.2 Supplied warning labels S-5
3.2 Warning symbols S-6

4. Important precautions for each stage of the robot life cycle **S-7**

4.1 Precautions for using robots and controllers S-7
4.2 Design S-8
4.2.1 Precautions for robots S-8
4.2.2 Precautions for robot controllers S-8
4.3 Moving and installation S-9
4.3.1 Precautions for robots S-9
4.3.2 Precautions for robot controllers S-10
4.4 Safety measures S-12
4.4.1 Safety measures S-12
4.4.2 Installing a safety enclosure S-13
4.5 Operation S-14
4.5.1 Trial operation S-14
4.5.2 Automatic operation S-16
4.5.3 Precautions during operation S-16
4.6 Inspection and maintenance S-18
4.6.1 Before inspection and maintenance work S-18
4.6.2 Precautions during service work S-19
4.7 Disposal S-19

5. Using the robot safely **S-20**

5.1 Movement range S-20
5.2 Robot protective functions S-20
5.3 Residual risk S-21
5.4 Special training for industrial robot operation S-21

Warranty

Important information before reading this manual

Introduction **i**

CONTENTS

Main functions ii

About this manual iii

CE marking iv

1. Safety standard iv
2. Safety measures iv
3. Robot safety measures v
4. EMC countermeasure example v

Chapter 1 Overview

1. Unpacking check 1-1

2. Part names and functions 1-2

3. System configuration 1-4

4. Installation and operation sequence 1-5

Chapter 2 Installation and wiring

1. Installation method 2-1

1.1 Controller main body 2-1
1.2 Regenerative unit (RGT) C21 C22 2-2

2. Installation conditions 2-3

3. Wiring 2-5

3.1 Power supply connection C1 2-5
3.2 Power supply connection C21 C22 2-7
3.3 Malfunction prevention measures C21 C22 2-10

4. Connecting the robot 2-11

5. Connecting the communication unit 2-13

6. Connecting the regenerative unit C21 C22 2-15

6.1 Connecting the RGT C21 C22 2-15

7. Absolute battery C21 C22 2-16

7.1 Connecting the absolute battery 2-16
7.2 Replacing the absolute battery 2-16

8. Connecting the I/O signals 2-17

CONTENTS

9. Configuring an emergency stop circuit 2-18

10. Configuring an emergency stop circuit C21 C22 2-19
10.1 EXT connector signal names and functions 2-19
10.2 Wiring and connecting the EXT connector 2-21
10.3 Circuit details 2-22

11. Connecting the I/O unit 2-23

12. Safety circuit construction example 2-26
12.1 Performance level 2-26
12.2 Circuit configuration examples C1 2-27
12.2.1 Category 3 2-27
12.2.2 Overview of circuit operation 2-28
12.3 Circuit configuration examples C21 C22 2-29
12.3.1 Category 3 2-29
12.3.2 Overview of circuit operation 2-30

Chapter 3 Data setting

1. Data overview 3-1
1.1 Overview 3-1

2. Point data 3-2
2.1 "Standard setting" type 3-3
2.2 "Custom setting" type 3-4

3. Point data details 3-5

4. Parameter data 3-9
4.1 Parameter list 3-9
4.1.1 RUN parameters 3-9
4.1.2 I/O parameters 3-10
4.1.3 Option parameters 3-10
4.1.4 Servo parameters 3-11
4.2 Parameter details 3-11
4.2.1 RUN parameters 3-11
4.2.2 I/O parameters 3-14
4.2.3 Servo parameters 3-16
4.2.4 Option parameters 3-17
4.2.5 CC-Link 3-17
4.2.6 DeviceNet 3-18

Chapter 4 I/O signal functions

1. I/O specifications 4-1
1.1 NPN and PNP type 4-1
1.2 CC-Link type 4-2
1.3 DeviceNet type 4-4

2. I/O signal list 4-5

3. I/O signal details 4-6
3.1 Input signal details 4-6
3.2 Output signal details 4-8

Chapter 5 Operation

1. Operation procedure 5-1
1.1 Overall operation timing chart 5-1
1.1.1 C1 5-1
1.1.2 C21 C22 5-2
1.1.3 Communication check (field network) 5-3
1.2 Alarm occurrence and clearing 5-4

2. Origin search (return-to-origin) 5-5
2.1 Origin point detection method 5-5
2.2 Origin point and coordinates relationship 5-6
2.3 Return-to-origin timing chart 5-7

3. Positioning operation 5-8
3.1 Basic operation 5-8
3.2 Positioning timing chart 5-11
3.3 Positioning merge operation 5-13
3.4 Push operation 5-15
3.5 Deceleration push operation 5-17
3.6 Continuous operation 5-18
3.7 Output function 5-19
3.8 Speed switch function 5-20
3.9 Operation examples 5-21

4. MANUAL mode 5-24
4.1 MANUAL mode timing chart 5-24
4.2 JOG movement 5-25
4.3 TEACH (Teaching) 5-26

5. Remote commands 5-27
5.1 Overview 5-27
5.2 Remote command list 5-27
5.3 Timing chart 5-31
5.4 Query 5-32
5.5 Point data writing 5-33
5.6 Point data reading 5-34
5.7 Parameter data writing 5-35
5.8 Parameter data reading 5-36
5.9 Continuous query 5-37
5.10 Positioning operation 5-38
5.11 Special operations 5-40
5.12 Special codes 5-40

6. Operation modes 5-41

7. Other functions 5-42
7.1 Soft limit function 5-42
7.2 Zone output function 5-42
7.3 Alarm No. output function 5-43
7.4 Changing the payload 5-43
7.5 Stop mode C1 5-44

8. LED status indicators 5-44

Chapter 6 Troubleshooting

1. Alarm groups 6-1

2. Alarm recording function 6-2

3. Alarm list 6-3

4. Alarms: Possible causes and actions 6-4

Chapter 7 Specifications

1. Controller basic specifications 7-1
1.1 Basic specifications 7-1
1.2 Dimensional outlines 7-2

2. I/O interface specifications 7-3
2.1 NPN 7-3
2.2 PNP 7-3

2.3 CC-Link 7-3
2.4 DeviceNet 7-4

3. Regenerative unit specifications 7-5
3.1 Dimensional outlines (RGT) 7-5

H1 Operation Guide

Introduction A-1

1. What the H1 does A-2
1.1 H1 panel layout A-3
1.2 Connecting to the external safety circuit (HD1) A-5

2. Connecting or disconnecting the H1 A-6
2.1 Connecting to the controller A-6
2.2 Disconnecting from the controller A-7

3. Basic operations A-8
3.1 Operation key layout and functions A-8
3.2 Screen configuration A-9
3.3 Starting to use the keys A-11
3.4 How to enter numbers A-14
3.5 Menu structure A-15

4. Editing the point data A-16
4.1 Point teaching A-16
4.1.1 Teaching playback A-16
4.1.2 Direct teaching A-18
4.2 Copying point data A-19
4.3 Deleting point data A-20
4.4 Displaying a list of point data A-21

5. Parameter setting A-22
5.1 Setting Run parameters A-22
5.2 Setting I/O parameters A-23
5.3 Setting Option parameters A-24
5.4 Setting Servo parameters A-25

6. Operating the robot A-26
6.1 Turning the servo on or off A-26
6.2 Origin search (return-to-origin) A-27
6.3 Operating the robot A-28

6.4 Resetting an alarm A-30

7. Monitor functions A-31

7.1 I/O monitor A-31
7.2 Status monitor A-32
7.3 Run monitor A-33
7.4 Alarm display A-34
7.5 Warning display A-34
7.6 Message display A-35
7.7 Alarm record display A-36
7.8 Information display A-37

8. Other functions A-38

8.1 Operation mode A-38
8.2 Setting mode A-39
8.2.1 Changing the display language A-39

9. Specifications A-40

9.1 Basic specifications A-40
9.2 Dimensional outlines A-40
9.2.1 H1 A-40
9.2.2 HD1 A-41

Communication Command Guide

Introduction B-1

1. Communication specifications B-2

1.1 Communication parameter specifications B-2
1.2 Communication command specifications B-2

2. Communication command lists B-3

3. Communication command description B-5

3.1 Robot operation commands B-5
Positioning operation (START) B-5
Operation stop (STOP) B-5
Return-to-origin (ORG) B-6
JOG movement (JOG+, JOG-) B-6
Inching movement (INCH+, INCH-) B-7
3.2 Status change commands B-8
Servo status change (SRVO) B-8
Brake status change (BRK) B-8

Reset (RESET) B-8
3.3 Edit commands B-9
Point data writing 1 (M, P, S, AC, DC, Q, ZL, ZH, N, J, F, T) B-9
Point data writing 2 (P_, S_, AC_, DC_, Q_) B-10
Current position teaching (TEACH) B-11
Point data copying (COPY) B-11
Point data deleting (DEL) B-12
Parameter data writing (K) B-12
Automatic node number setting (SETID) B-13
3.4 Query commands B-14
Point data reading (?M, ?P, ?S, ?AC, ?DC, ?Q, ?ZL, ?ZH, ?N, ?J, ?F, ?T) B-14
Parameter data reading (?K) B-15
Status data reading (?D) B-16
Input/output information reading (?IN, ?INB, ?OUT, ?OUTB) B-17
Word input/output information reading (?WIN, ?WOUT) B-18
Option information reading (?OPT, ?OPTB) B-19
Alarm/warning information reading (?ALM, ?WARN) B-20

Daisy Chain Guide

Introduction C-1

1. Installation and wiring C-2
1.1 Installation C-2
1.2 Wiring C-3

2. Node number setting C-5
2.1 Automatic node number assignment function C-5
2.1.1 When using the RS-Manager C-5
2.1.2 When using the H1 C-7
2.2 When controllers with same node number exist on network C-8
2.2.1 When using the RS-Manager C-8
2.2.2 When using the H1 C-9
2.3 Switching the controllers C-10
2.3.1 When using the RS-Manager C-10
2.3.2 Switching the controllers using the H1 C-12

3. Writing and transferring saved and newly made data C-13
3.1 Writing data to controller C-13
3.2 Transferring data to controller C-16

Safety Instructions

Contents

1. Safety Information S-1

2. Signal words used in this manual S-2

3. Warning labels S-3

3.1 Warning labels S-3
3.1.1 Warning label messages on robot and controller S-3
3.1.2 Supplied warning labels S-5
3.2 Warning symbols S-6

4. Important precautions for each stage of the robot life cycle S-7

4.1 Precautions for using robots and controllers S-7
4.2 Design S-8
4.2.1 Precautions for robots S-8
4.2.2 Precautions for robot controllers S-8
4.3 Moving and installation S-9
4.3.1 Precautions for robots S-9
4.3.2 Precautions for robot controllers S-10
4.4 Safety measures S-12
4.4.1 Safety measures S-12
4.4.2 Installing a safety enclosure S-13
4.5 Operation S-14
4.5.1 Trial operation S-14
4.5.2 Automatic operation S-16
4.5.3 Precautions during operation S-16
4.6 Inspection and maintenance S-18
4.6.1 Before inspection and maintenance work S-18
4.6.2 Precautions during service work S-19
4.7 Disposal S-19

5. Using the robot safely S-20

5.1 Movement range S-20
5.2 Robot protective functions S-20
5.3 Residual risk S-21
5.4 Special training for industrial robot operation S-21

1. Safety Information

Industrial robots are highly programmable, mechanical devices that provide a large degree of freedom when performing various manipulative tasks. To ensure safe and correct use of robots and controllers*, carefully read and comply with the safety instructions and precautions in this "Safety Instructions" guide. Failure to take necessary safety measures or incorrect handling may result in trouble or damage to the robot and controller, and also may cause personal injury (to installation personnel, robot operator or service personnel) including fatal accidents.
* The descriptions about the controller stated in this manual also include the contents of the robot driver.

Before using this product, read this manual and related manuals and take safety precautions to ensure correct handling.
The precautions listed in this manual relate to this product. To ensure safety of the user's final system that includes robots, please take appropriate safety measures as required by the user's individual system.

To use robots and controllers safely and correctly, always comply with the safety rules and instructions.

- For specific safety information and standards, refer to the applicable local regulations and comply with the instructions.
- Warning labels attached to the robots are written in English, Japanese, Chinese and Korean. This manual is available in English or Japanese (or some parts in Chinese). Unless the robot operators or service personnel understand these languages, do not permit them to handle the robot.
- Cautions regarding the official language of EU countries
  For equipment that will be installed in EU countries, the language used for the manuals, warning labels, operation screen characters, and CE declarations is English only.
  Warning labels only have pictograms or else include warning messages in English. In the latter case, messages in Japanese or other languages might be added.

It is not possible to list all safety items in detail within the limited space of this manual. So please note that it is essential that the user have a full knowledge of safety and also make correct judgments on safety procedures.

Refer to the manual by any of the following methods when installing, operating or adjusting the robot and controller.

1. Install, operate or adjust the robot and controller while referring to the printed version of the manual (available for an additional fee).
2. Install, operate or adjust the robot and controller while viewing the disc version of the manual on your computer screen.
3. Install, operate or adjust the robot and controller while referring to a printout of the necessary pages from the disc version of the manual.

2. Signal words used in this manual

This manual uses the following safety alert symbols and signal words to provide safety instructions that must be observed and to describe handling precautions, prohibited actions, and compulsory actions. Make sure you understand the meaning of each symbol and signal word and then read this manual.

DANGER

This indicates an immediately hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

This indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

This indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or damage to the equipment.

NOTE

Explains the key point in the operation in a simple and clear manner.

3. Warning labels

Warning labels shown below are attached to the robot body and controller to alert the operator to potential hazards. To ensure correct use, read the warning labels and comply with the instructions.

3.1 Warning labels

WARNING

If warning labels are removed or difficult to see, then the necessary precautions may not be taken, resulting in an accident.

- **Do not remove, alter or stain the warning labels on the robot body.**
- **Do not allow warning labels to be hidden by devices installed on the robot by the user.**
- **Provide proper lighting so that the symbols and instructions on the warning labels can be clearly seen from outside the safety enclosure.**

3.1.1 Warning label messages on robot and controller

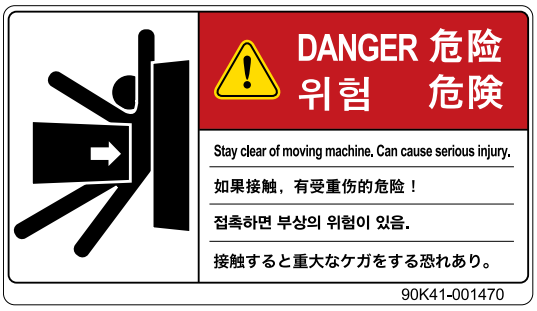
Word messages on the danger, warning and caution labels are concise and brief instructions. For more specific instructions, read and follow the "Instructions on this label" described on the right of each label shown below. See “5.1 Movement range” for details on the robot’s movement range.

■ Warning label 1

DANGER

Serious injury may result from contact with a moving robot.

- **Keep outside of the robot safety enclosure during operation.**
- **Press the emergency stop button before entering the safety enclosure.**



Instructions on this label
• Always install a safety enclosure to keep all persons away from the robot movement range and prevent injury from contacting the moving part of the robot. • Install an interlock that triggers emergency stop when the door or gate of the safety enclosure is opened. • The safety enclosure should be designed so that no one can enter inside except from the door or gate equipped with an interlock device. • Warning label 1 that comes supplied with a robot should be affixed to an easy-to-see location on the door or gate of the safety enclosure.

Potential hazard to human body	Serious injury may result from contact with a moving robot.
To avoid hazard	• Keep outside of the robot safety enclosure during operation. • Press the emergency stop button before entering the safety enclosure.

90K41-001470

■ Warning label 2

WARNING

Moving parts can pinch or crush hands.
Keep hands away from the movable parts of the robot.

Instructions on this label
Use caution to prevent hands and fingers from being pinched or crushed by the movable parts of the robot when transporting or moving the robot or during teaching.

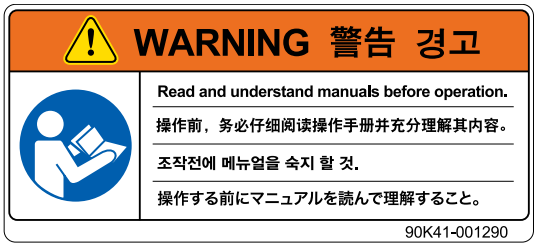
Potential hazard to human body	Moving parts can pinch or crush hands.
To avoid hazard	Keep hands away from the movable parts of the robot.

90K41-001460

■ Warning label 3

WARNING

Improper installation or operation may cause serious injury.
Before installing or operating the robot, read the manual and instructions on the warning labels and understand the contents.



Instructions on this label
• Be sure to read the warning label and this manual carefully to make you completely understand the contents before attempting installation and operation of the robot. • Before starting the robot operation, even after you have read through this manual, read again the corresponding procedures and "Safety Instructions". • Never install, adjust, inspect or service the robot in any manner that does not comply with the instructions in this manual.

Potential hazard to human body	Improper installation or operation may cause serious injury.
To avoid hazard	Before installing or operating the robot, read the manual and instructions on the warning labels and understand the contents.

90K41-001290

■ Warming label 4 (controllers C21/C22)

WARNING

- **Before touching the terminals or connectors on the outside of the controller, turn off the power and wait at least 10 minutes to avoid burns or electrical shock.**
- **Motors and heatsinks become hot during and shortly after operation, so do not touch them.**

CAUTION

- **Before using the controller, be sure to read the manual thoroughly.**
- **Be sure to ground the ground terminal.**

Instructions on this label
• This indicates a high voltage is present. Touching the terminal block or connector may cause electrical shock. • This indicates the area around this symbol may become very hot. Motors and heatsinks become hot during and shortly after operation. Do not touch them to avoid burns. • This indicates important information that you must know is described in the manual. Before using the controller, be sure to read the manual thoroughly. When adding external safety circuits or connecting a power supply to the controller, read the manual carefully and make checks before beginning the work. • Be sure to ground the ground terminal to avoid electrical shock.

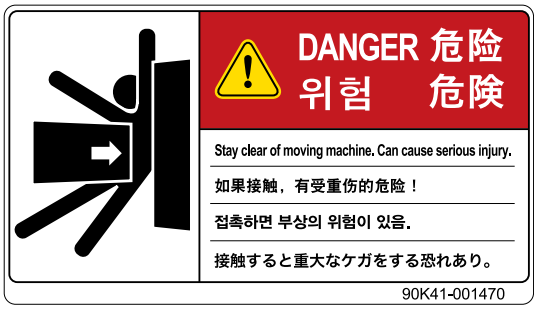
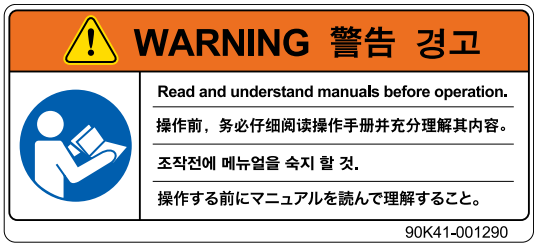
Potential hazard to human body	To avoid hazard
Electrical shock	Do not touch the terminal section for 10 minutes after power-off.
Do not touch them to avoid burns.	Do not touch the motors and heatsinks during power-on.
Improper installation or operation may cause serious injury.	Before installing or operating the robot, read the manual and instructions on the warning labels and understand the contents.
Electrical shock	Be sure to ground the ground terminal.

90K41-000950

3.1.2 Supplied warning labels

Some warning labels are not affixed to robots but included in the packing box. **These warning labels should be affixed to an easy-to-see location.**

● Warning label is attached to the robot body.
○ Warning label comes supplied with the robot and should be affixed to an easy-to-see location on the door or gate of the safety enclosure.
◎ Warning label comes supplied with the robot and should be affixed to an easy-to-see location.

		RS1/RS2/RS3/RSD1/ RSD2/RSD3/RSDG1/ RSDG2/RSDG3	RSH1/RSH2/RSH3/ RSH4/RSH5/RSF4/ RSB1/RSB2
Warning label 1		○	○
Warning label 2		○	●
Warning label 3		○	◎

3.2 Warning symbols

Warning symbols shown below are indicated on the robots and controllers to alert the operator to potential hazards. To use the robot safely and correctly always follow the instructions and cautions indicated by the symbols.

1. Electrical shock hazard symbol

WARNING

Touching the terminal block or connector may cause electrical shock, so use caution.

	Instructions by this symbol
	This indicates a high voltage is present. Touching the terminal block or connector may cause electrical shock.

93006-X0-00

2. High temperature hazard symbol

WARNING

Motors, heatsinks, and regenerative units become hot, so do not touch them.

	Instructions by this symbol
	This indicates the area around this symbol may become very hot. Motors, heatsinks, and regenerative units become hot during and shortly after operation. To avoid burns be careful not to touch those sections.

93008-X0-00

3. Caution symbol

CAUTION

Always read the manual carefully before using the controller.

	Instructions by this symbol
	This indicates important information that you must know and is described in the manual. Before using the controller, be sure to read the manual thoroughly. When adding external safety circuits or connecting a power supply to the controller, read the manual carefully and make checks before beginning the work. Connectors must be attached while facing a certain direction, so insert each connector in the correct direction.

93007-X0-00

4. Important precautions for each stage of the robot life cycle

This section describes major precautions that must be observed when using robots and controllers. Be sure to carefully read and comply with all of these precautions even if there is no alert symbol shown.

4.1 Precautions for using robots and controllers

General precautions for using robots and controllers are described below.

1. Applications where robots cannot be used

Robots and robot controllers are designed as general-purpose industrial equipment and cannot be used for the following applications.

DANGER

Robot controllers and robots are designed as general-purpose industrial equipment and cannot be used for the following applications.

- **In medical equipment systems which are critical to human life**
- **In systems that significantly affect society and the general public**
- **In equipment intended to carry or transport people**
- **In environments which are subject to vibration such as onboard ships and vehicles.**

2. Qualification of operators/workers

Operators or persons who perform tasks for industrial robots (such as teaching, programming, movement check, inspection, adjustment, and repair) must receive appropriate training and also have the skills needed to perform the tasks correctly and safely.
Those tasks must be performed by qualified persons who meet requirements established by local regulations and standards for industrial robots. They must also read the manual carefully and understand its contents before attempting the robot operation or maintenance.

WARNING

- **It is extremely hazardous for persons who do not have the above qualifications to perform tasks for industrial robots.**
- **Adjustment and maintenance that require removing a cover must be performed by persons who have the above qualifications. Any attempt to perform such tasks by an unqualified person may cause an accident resulting in serious injury or death.**

4.2 Design

4.2.1 Precautions for robots

1. Restricting the robot moving speed

WARNING

Restriction on the robot moving speed is not a safety-related function.
To reduce the risk of collision between the robot and workers, the user must take the necessary protective measures such as enable devices according to risk assessment by the user.

2. Restricting the movement range

See "5.1 Movement range" for details on the robot's movement range.

WARNING

Soft limit function is not a safety-related function intended to protect the human body.
To restrict the robot movement range to protect the human body, use the mechanical stoppers installed in the robot (or available as options).

CAUTION

If the robot moving at high speed collides with a mechanical stopper installed in the robot (or available as option), the robot may be damaged.

3. Provide safety measures for end effector (gripper, etc.)

WARNING

- End effectors must be designed and manufactured so that they cause no hazards (such as a loose workpiece or load) even if power (electricity, air pressure, etc.) is shut off or power fluctuations occur.
- If the object gripped by the end effector might possibly fly off or drop, then provide appropriate safety protection taking into account the object size, weight, temperature, and chemical properties.

4. Provide adequate lighting

Provide enough lighting to ensure safety during work.

5. Install an operation status light

WARNING

Install a signal light (signal tower) at an easy-to-see position so that the operator will be aware of the robot stop status (temporarily stopped, emergency stop, error stop, etc.).

4.2.2 Precautions for robot controllers

1. Emergency stop input terminal

DANGER

Each robot controller has an emergency stop input terminal to trigger emergency stop. Using this terminal, install a safety circuit so that the system including the robot controller will work safely.
For the robot driver without emergency stop input terminal, construct a safety circuit including the emergency stop function using an external circuit.

2. Maintain clearance

CAUTION

Do not bundle control lines or communication cables together or in close to the main power supply or power lines. Usually separate these by at least 100mm. Failure to follow this instruction may cause malfunction due to noise.

4.3 Moving and installation

4.3.1 Precautions for robots

■ Installation environment

1. Do not use in strong magnetic fields

WARNING
Do not use the robot near equipment or in locations that generate strong magnetic fields. The robot may BREAK DOWN or malfunction if used in such locations.

2. Do not use in locations subject to possible electromagnetic interference, etc.

WARNING
Do not use the robot in locations subject to electromagnetic interference, electrostatic discharge or radio frequency interference. The robot may malfunction if used in such locations creating hazardous situations.

3. Do not use in locations exposed to flammable gases

WARNING
- Robots are not designed to be explosion-proof.
- Do not use the robots in locations exposed to explosive or inflammable gases, dust particles or liquid. Failure to follow this instruction may cause serious accidents involving injury or death, or lead to fire.

■ Moving

1. Use caution to prevent pinching or crushing of hands or fingers

WARNING
Moving parts can pinch or crush hands or fingers.
Keep hands away from the movable parts of the robot.

As instructed in Warning label 2, use caution to prevent hands or fingers from being pinched or crushed by movable parts when transporting or moving the robot. For details on warning labels, see "3. Warning labels".

2. Take measures to prevent the robot from falling

When moving the robot by lifting it with equipment such as a hoist or crane, wear personal protective gear and be careful not to move the robot at higher than the required height.
Make sure that there are no persons on paths used for moving the robot.

WARNING
A robot falling from a high place and striking a worker may cause death or serious injury. When moving the robot, wear personal protective gear such as helmets and make sure that no one is within the surrounding area.

■ Installation

1. Protect electrical wiring and hydraulic/pneumatic hoses

Install a cover or similar item to protect the electrical wiring and hydraulic/pneumatic hoses from possible damage.

■ Wiring

1. Protective measures against electrical shock

WARNING
Always ground the robot to prevent electrical shock.

■ Adjustment

1. Adjustment that requires removing a cover

WARNING

Adjustment by removing a cover require specialized technical knowledge and skills, and may also involve hazards if attempted by an unskilled person. This adjustment must be performed only by persons who have the required qualifications described in “2. Qualification of operators/workers” in section 4.1 of this “Safety Instructions”.

4.3.2 Precautions for robot controllers

■ Installation environment

1. Installation environment

WARNING

Robots are not designed to be explosion-proof. Do not use the robots and controllers in locations exposed to explosive or inflammable gases, dust particles or liquid such as gasoline and solvents. Failure to follow this instruction may cause serious accidents involving injury or death, and lead to fire.

WARNING

- Use the robot controller in locations that support the environmental conditions specified in this manual. Operation outside the specified environmental range may cause electrical shock, fire, malfunction or product damage or deterioration.
- The robot controller and programming box must be installed at a location that is outside the robot safety enclosure yet where it is easy to operate and view robot movement.
- Install the robot controller in locations with enough space to perform work (teaching, inspection, etc.) safely. Limited space not only makes it difficult to perform work but can also cause injury.
- Install the robot controller in a stable, level location and secure it firmly. Avoid installing the controller upside down or in a tilted position.
- Provide sufficient clearance around the robot controller for good ventilation. Insufficient clearance may cause malfunction, breakdown or fire.

■ Installation

To install the robot controller, observe the installation conditions and method described in the manual.

1. Installation

WARNING

Securely tighten the screws to install the robot controller. If not securely tightened, the screws may come loose causing the controller to drop.

2. Connections

WARNING

- Always shut off all phases of the power supply externally before starting installation or wiring work. Failure to do this may cause electrical shock or product damage.
- Never directly touch conductive sections and electronic parts other than the connectors, rotary switches, and DIP switches on the outside panel of the robot controller. Touching them may cause electrical shock or breakdown.
- Securely install each cable connector into the receptacles or sockets. Poor connections may cause the controller or robot to malfunction.

■ Wiring

1. Connection to robot controller

The controller parameters are preset at the factory before shipping to match the robot model. Check the specified robot and controller combination, and connect them in the correct combination.
Since the software detects abnormal operation such as motor overloads, the controller parameters must be set correctly to match the motor type used in the robot connected to the controller.

2. Wiring safety points

WARNING

Always shut off all phases of the power supply externally before starting installation or wiring work. Failure to do this may cause electrical shock or product damage.

CAUTION

- **Make sure that no foreign matter such as cutting chips or wire scraps get into the robot controller. Malfunction, breakdown or fire may result if these penetrate inside.**
- **Do not apply excessive impacts or loads to the connectors when making cable connections. This might bend the connector pins or damage the internal PC board.**
- **When using ferrite cores for noise elimination, be sure to fit them onto the power cable as close to the robot controller and/or the robot as possible, to prevent malfunction caused by noise.**

3. Wiring method

WARNING

Securely install the connectors into the robot controller and, when wiring the connectors, make the crimp, press-contact or solder connections correctly using the tool specified by the connector manufacturer.

CAUTION

When disconnecting the cable from the robot controller, detach by gripping the connector itself and not by tugging on the cable. Loosen the screws on the connector (if fastened with the screws), and then disconnect the cable. Trying to detach by pulling on the cable itself may damage the connector or cables, and poor cable contact will cause the controller or robot to malfunction.

4. Precautions for cable routing and installation

CAUTION

- **Always store the cables connected to the robot controller in a conduit or clamp them securely in place. If the cables are not stored in a conduit or properly clamped, excessive play or movement or mistakenly pulling on the cable may damage the connector or cables, and poor cable contact will cause the controller or robot to malfunction.**
- **Do not modify the cables and do not place any heavy objects on them. Handle them carefully to avoid damage. Damaged cables may cause malfunction or electrical shock.**
- **If the cables connected to the robot controller may possibly become damaged, then protect them with a cover, etc.**
- **Check that the control lines and communication cables are routed at a gap sufficiently away from main power supply circuits and power lines, etc. Bundling them together with power lines or close to power lines may cause faulty operation due to noise.**

5. Protective measures against electrical shock

WARNING

Be sure to ground the ground terminals of the robot and controller. Poor grounding may cause electrical shock.

4.4 Safety measures

4.4.1 Safety measures

1. Referring to warning labels and manual

WARNING

- **Before starting installation or operation of the robot, be sure to read the warning labels and this manual, and comply with the instructions.**
- **Never attempt any repair, parts replacement and modification unless described in this manual. These tasks require specialized technical knowledge and skills and may also involve hazards. Please contact your distributor for advice.**

NOTE

For details on warning labels, see "3. Warning labels".

2. Draw up "work instructions" and make the operators/workers understand them

WARNING

Decide on "work instructions" in cases where personnel must work within the robot safety enclosure to perform startup or maintenance work. Make sure the workers completely understand these "work instructions".

Decide on "work instructions" for the following items in cases where personnel must work within the robot safety enclosure to perform teaching, maintenance or inspection tasks. Make sure the workers completely understand these "work instructions".

1. Robot operating procedures needed for tasks such as startup procedures and handling switches
2. Robot speeds used during tasks such as teaching
3. Methods for workers to signal each other when two or more workers perform tasks
4. Steps that the worker should take when a problem or emergency occurs
5. Steps to take after the robot has come to a stop when the emergency stop device was triggered, including checks for cancelling the problem or error state and safety checks in order to restart the robot.
6. In cases other than above, the following actions should be taken as needed to prevent hazardous situations due to sudden or unexpected robot operation or faulty robot operation as listed below.
   - Place a display sign on the operator panel
   - Ensure the safety of workers performing tasks within the robot safety enclosure
   - Clearly specify position and posture during work
     Specify a position and posture where worker can constantly check robot movements and immediately move to avoid trouble if an error/problem occurs
   - Take noise prevention measures
   - Use methods for signaling operators of related equipment
   - Use methods to decide that an error has occurred and identify the type of error

Implement the "work instructions" according to the type of robot, installation location, and type of work task.
When drawing up the "work instructions", make an effort to include opinions from the workers involved, equipment manufacturer technicians, and workplace safety consultants, etc.

3. Take safety measures

DANGER

- **Never enter the robot movement range while the robot is operating or the main power is turned on. Failure to follow this warning may cause serious accidents involving injury or death. Install a safety enclosure or a gate interlock with an area sensor to keep all persons away from the robot movement range.**
- **When it is necessary to operate the robot while you are within the robot movement range such as for teaching or maintenance/inspection tasks, always carry the programming box with you so that you can immediately stop the robot operation in case of an abnormal or hazardous condition. Install an enable device in the external safety circuit as needed. Also set the robot moving speed to 3% or less. Failure to follow these instructions may cause serious accidents involving injury or death.**

See “5.1 Movement range” for details on the robot’s movement range.

WARNING

- During startup or maintenance tasks, display a sign "WORK IN PROGRESS" on the programming box and operation panel in order to prevent anyone other than the person for that task from mistakenly operating the start or selector switch. If needed, take other measures such as locking the cover on the operation panel.
- Always connect the robot and robot controller in the correct combination. Using them in an incorrect combination may cause fire or breakdown.

4. Install system

When configuring an automated system using a robot, hazardous situations are more likely to occur from the automated system than the robot itself. So the system manufacturer should install the necessary safety measures required for the individual system. The system manufacturer should provide a proper manual for safe, correct operation and servicing of the system.

WARNING

To check the robot controller operating status, refer to this manual and to related manuals. Design and install the system including the robot controller so that it will always work safely.

5. Precautions for operation

WARNING

- Do not touch any electrical terminal. Directly touching these terminals may cause electrical shock, equipment damage, and malfunction.
- Do not touch or operate the robot controller or programming box with wet hands. Touching or operating them with wet hands may result in electrical shock or breakdown.

6. Do not disassemble and modify

WARNING

Never disassemble and modify any part in the robot, controller, and programming box. Do not open any cover. Doing so may cause electrical shock, breakdown, malfunction, injury, or fire.

4.4.2 Installing a safety enclosure

Be sure to install a safety enclosure to keep anyone from entering within the movement range of the robot. The safety enclosure will prevent the operator and other persons from coming in contact with moving parts of the robot and suffering injury.
See “5.1 Movement range” for details on the robot’s movement range.

DANGER

Serious injury may result from contact with a moving robot.

- Keep outside of the robot safety enclosure during operation.
- Press the emergency stop button before entering the safety enclosure.

WARNING

- Install an interlock that triggers emergency stop when the door or gate of the safety enclosure is opened.
- The safety enclosure should be designed so that no one can enter inside except from the door or gate equipped with an interlock device.
- Warning label 1 (See "3. Warning labels") that comes supplied with a robot should be affixed to an easy-to-see location on the door or gate of the safety enclosure.

4.5 Operation

When operating a robot, ignoring safety measures and checks may lead to serious accidents. Always take the following safety measures and checks to ensure safe operation.

DANGER

Check the following points before starting robot operation.

- **No one is within the robot safety enclosure.**
- **The programming unit is in the specified location.**
- **The robot and peripheral equipment are in good condition.**

4.5.1 Trial operation

After installing, adjusting, inspecting, maintaining or repairing the robot, perform trial operation using the following procedures.

1. If a safety enclosure has not yet been provided right after installing the robot:

Then rope off or chain off the movement range around the robot in place of the safety enclosure and observe the following points.
See “5.1 Movement range” for details on the robot’s movement range.

DANGER

Place a "Robot is moving - KEEP AWAY!" sign to keep the operator or other personnel from entering within the movement range of the robot.

WARNING

- **Use sturdy, stable posts which will not fall over easily.**
- **The rope or chain should be easily visible to everyone around the robot.**

2. Check the following points before turning on the controller.

- Is the robot securely and correctly installed?
- Are the electrical connections to the robot wired correctly?
- Are items such as air pressure correctly supplied?
- Is the robot correctly connected to peripheral equipment?
- Have safety measures (safety enclosure, etc.) been taken?
- Does the installation environment meet the specified standards?

3. After the controller is turned on, check the following points from outside the safety enclosure.

- Does the robot start, stop and enter the selected operation mode as intended?
- Does each axis move as intended within the soft limits?
- Does the end effector move as intended?
- Are the correct signals being sent to the end effector and peripheral equipment?
- Does emergency stop function?
- Are teaching and playback functions normal?
- Are the safety enclosure and interlocks functioning as intended?

4. Working inside safety enclosures

Before starting work within the safety enclosure, **always confirm from outside the enclosure that each protective function is operating correctly (see the previous section 2.3).**

DANGER

Never enter within the movement range while within the safety enclosure.

See "5.1 Movement range" for details on the robot's movement range.

WARNING

When work is required within the safety enclosure, place a sign "Work in progress" in order to keep other persons from operating the controller switch or operation panel.

WARNING

When work within the safety enclosure is required, always turn off the controller power except for the following cases:

Exception

Work with power turned on, but robot in emergency stop

Soft limit settings	Follow the precautions and procedure described in "Setting the soft limits".

Work with power turned on

Teaching	Refer to "5. Teaching within safety enclosure" described below.

5. Teaching within the safety enclosure

When performing teaching within the safety enclosure, check or perform the following points **from outside the safety enclosure**.

DANGER

Never enter within the movement range while within the safety enclosure.

See "5.1 Movement range" for details on the robot's movement range.

WARNING

- **Make a visual check to ensure that no hazards are present within the safety enclosure.**
- **Check that the programming box or handy terminal operates correctly.**
- **Check that no failures are found in the robot.**
- **Check that emergency stop works correctly.**
- **Select teaching mode and disable automatic operation.**

4.5.2 Automatic operation

Check the following points when operating the robot in AUTO mode. Observe the instructions below in cases where an error occurs during automatic operation. Automatic operation described here includes all operations in AUTO mode.

1. Checkpoints before starting automatic operation

Check the following points before starting automatic operation.

DANGER

- Check that no one is within the safety enclosure.
- Check the safety enclosure is securely installed with interlocks functional.

WARNING

- Check that the programming box / handy terminal and tools are in their specified locations.
- Check that the signal tower lamps or other alarm displays installed for the system are not lit or flashing, indicating no error is occurring on the robot and peripheral devices.

2. During automatic operation and when errors occur

After automatic operation starts, check the operation status and the signal tower to ensure that the robot is in automatic operation.

DANGER

Never enter the safety enclosure during automatic operation.

WARNING

If an error occurs in the robot or peripheral equipment, observe the following procedure before entering the safety enclosure.

1) Press the emergency stop button to set the robot to emergency stop.
2) Place a sign on the start switch, indicating that the robot is being inspected in order to keep other persons from restarting the robot.

4.5.3 Precautions during operation

1. When the robot is damaged or an abnormal condition occurs

WARNING

- If unusual odors, noise or smoke occur during operation, immediately turn off power to prevent possible electrical shock, fire or breakdown. Stop using the robot and contact your distributor.
- If any of the following damage or abnormal conditions occurs the robot, then continuing to operate the robot is dangerous. Immediately stop using the robot and contact your distributor.

Damage or abnormal condition	Type of danger
Damage to machine harness or robot cable	Electrical shock, robot malfunction
Damage to robot exterior	Damaged parts fly off during robot operation
Abnormal robot operation (position deviation, vibration, etc.)	Robot malfunction
Z-axis (vertical axis) or brake malfunction	Z-axis unit falls off

2. High temperature hazard

WARNING

- Do not touch the robot controller and robot during operation. The robot controller and robot body are very hot during operation, so burns may occur if these sections are touched.
- The motor and speed reduction gear casing are very hot shortly after operation, so burns may occur if these are touched. Before touching those parts for inspections or servicing, turn off the controller, wait for a while and check that their temperature has cooled.

3. Use caution when releasing the Z-axis (vertical axis) brake

WARNING

The vertical axis will slide downward when the brake is released, causing a hazardous situation. Take adequate safety measures in consideration by taking the weight and shape into account.

- Before releasing the brake after pressing the emergency stop button, place a support under the vertical axis so that it will not slide down.
- Be careful not to let your body get caught between the vertical axis and the installation base when performing tasks (direct teaching, etc.) with the brake released.

4. Make correct parameter settings

CAUTION

The robot must be operated with the correct tolerable moment of inertia and acceleration coefficients that match the manipulator tip mass and moment of inertia. Failure to follow this instruction will lead to a premature end to the drive unit service life, damage to robot parts, or cause residual vibration during positioning.

4.6 Inspection and maintenance

Always perform daily and periodic inspections and make a pre-operation check to ensure there are no problems with the robot and related equipment. If a problem or abnormality is found, then promptly repair it or take other measures as necessary.
Keep a record of periodic inspections or repairs and store this record for at least 3 years.

4.6.1 Before inspection and maintenance work

1. Do not attempt any work or operation unless described in this manual.

Never attempt any work or operation unless described in this manual.
If an abnormal condition occurs, please be sure to contact your distributor. Our service personnel will take appropriate action.

WARNING

Never attempt inspection, maintenance, repair, and part replacement unless described in this manual. These tasks require specialized technical knowledge and skills and may also involve hazards. Please be sure to contact your distributor for advice.

2. Precautions during repair and parts replacement

WARNING

When it is necessary to repair or replace parts of the robot or controller, please be sure to contact your distributor and follow the instructions they provide. Inspection and maintenance of the robot or controller by an unskilled, untrained person is extremely hazardous.

Adjustment, maintenance and parts replacement require specialized technical knowledge and skills, and also may involve hazards. These tasks must be performed only by persons who have enough ability and qualifications required by local laws and regulations.

WARNING

Adjustment and maintenance by removing a cover require specialized technical knowledge and skills, and may also involve hazards if attempted by an unskilled person. This adjustment must be performed only by persons who have the required qualifications described in "2. Qualification of operators/workers" in section 4.1 of this "Safety Instructions".

3. Shut off all phases of power supply

WARNING

Always shut off all phases of the power supply externally before cleaning the robot and controller or securely tightening the terminal screws etc. Failure to do this may cause electrical shock or product damage or malfunction.

4. Allow a waiting time after power is shut off (Allow time for temperature and voltage to drop)

WARNING

- **When performing maintenance or inspection of the robot controller under your distributor's instructions, wait at the 10 minutes or more after turning the power off. Some components in the robot controller are very hot or still retain a high voltage shortly after operation, so burns or electrical shock may occur if those parts are touched.**
- **The motor and speed reduction gear casing are very hot shortly after operation, so burns may occur if they are touched. Before touching those parts for inspections or servicing, turn off the controller, wait for a while and check that the temperature has cooled.**

5. Precautions during inspection of controller

WARNING

- **When you need to touch the terminals or connectors on the outside of the controller during inspection, always first turn off the controller power switch and also the power source in order to prevent possible electrical shock.**
- **Do not disassemble the controller. Never touch any internal parts of the controller. Doing so may cause breakdown, malfunction, injury, or fire.**

4.6.2 Precautions during service work

1. Precautions when removing a motor (Vertical mount single-axis robots)

WARNING

The vertical axis will slide down when the motor is removed, causing a hazardous situation.

- **Turn off the controller and place a support under the vertical axis before removing the motor.**
- **Be careful not to let your body get caught by the driving unit of the vertical axis or between the vertical axis and the installation base.**

2. Precautions for robot controllers

CAUTION

- **Back up the robot controller internal data on an external storage device. The robot controller internal data (programs, point data, etc.) may be lost or deleted for unexpected reasons. Always make a backup of this data.**
- **Do not use thinner, benzene, or alcohol to wipe off the surface of the programming box. The surface sheet may be damaged or printed letters or marks erased. Use a soft, dry cloth and gently wipe the surface.**
- **Do not use a hard or pointed object to press the keys on the programming box. Malfunction or breakdown may result if the keys are damaged. Use your fingers to operate the keys.**

4.7 Disposal

When disposing of robots and related items, handle them carefully as industrial wastes. Use the correct disposal method in compliance with your local regulations, or entrust disposal to a licensed industrial waste disposal company.

1. Disposal of lithium batteries

When disposing of lithium batteries, use the correct disposal method in compliance with your local regulations, or entrust disposal to a licensed industrial waste disposal company. We do not collect and dispose of the used batteries.

2. Disposal of packing boxes and materials

When disposing of packing boxes and materials, use the correct disposal method in compliance with your local regulations. We do not collect and dispose of the used packing boxes and materials.

5. Using the robot safely

5.1 Movement range

When a tool or workpiece is attached to the robot manipulator tip, the actual movement range enlarges from the movement range of the robot itself to include the areas taken up by movement of the tool and workpiece attached to the manipulator tip.
The actual movement range expands even further if the tool or workpiece is offset from the manipulator tip.
The movement range here is defined as the range of robot motion including all areas through which the tool and workpiece attached to the manipulator tip.

5.2 Robot protective functions

Protective functions for robots are described below.

1. Overload detection

This function detects an overload applied to the motor and turns off the servo.
If an overload error occurs, take the following measures to avoid such errors:

1. Insert a timer in the program.
2. Reduce the acceleration.

2. Overheat detection

This function detects an abnormal temperature rise in the driver inside the controller and turns off the servo.
If an overheat error occurs, take the following measures to avoid the error:

1. Insert a timer in the program.
2. Reduce the acceleration.

3. Soft limits

Soft limits can be set on each axis to limit the working envelope in manual (jog) operation and automatic operation after return-to-origin. The working envelope is the area limited by soft limits.

WARNING

Soft limit function is not a safety-related function intended to protect the human body.
To restrict the robot movement range to protect the human body, use the mechanical stoppers installed in the robot (or available as options).

4. Mechanical stoppers

If the servo is turned off by emergency stop operation or protective function while the robot is moving, then these mechanical stoppers prevent the axis from exceeding the movement range. The movement range is the area limited by the mechanical stoppers.

CAUTION

If the robot moving at high speed collides with a mechanical stopper installed in the robot (or available as option), the robot may be damaged.

5. Z-axis (vertical axis) brake

An electromagnetic brake is installed on the Z-axis to prevent the Z-axis from sliding downward when the servo is OFF. This brake is working when the controller is OFF or the Z-axis servo power is OFF even when the controller is ON. The Z-axis brake can be released by the programming unit / handy terminal or by a command in the program when the controller is ON.

WARNING

The vertical axis will slide downward when the brake is released, causing a hazardous situation. Take adequate safety measures in consideration by taking the weight and shape into account.

- **Before releasing the brake after pressing the emergency stop button, place a support under the vertical axis so that it will not slide down.**
- **Be careful not to let your body get caught between the vertical axis and the installation base when performing tasks (direct teaching, etc.) with the brake released.**

5.3 Residual risk

To ensure safe and correct use of robots and controllers, System integrators and/or end users implement machinery safety design that conforms to ISO12100.
Residual risks for robots and controllers are described in the DANGER or WARNING instructions provided in each chapter and section. Read them carefully.

5.4 Special training for industrial robot operation

Operators or persons who handle the robot for tasks such as for teaching, programming, movement checks, inspections, adjustments, and repairs must receive appropriate training and also have the skills needed to perform the job correctly and safely. They must also read the manual carefully to understand its contents before attempting the robot operation or maintenance.

Tasks related to industrial robots (teaching, programming, movement check, inspection, adjustment, repair, etc.) must be performed by qualified persons who meet requirements established by local regulations and safety standards for industrial robots.

Comparison of terms used in this manual with ISO

This manual	ISO 10218-1	Note
Maximum movement range	maximum space	Area limited by mechanical stoppers.
Movement range	restricted space	Area limited by movable mechanical stoppers.
Working envelope	operational space	Area limited by software limits.
Within safety enclosure	safeguarded space	

See “5.1 Movement range” in for details on the robot’s movement range.

Warranty

The MISUMI robot and/or related product you have purchased are warranted against defects or malfunctions as described below.

Warranty description:

This warranty conforms to the "warranty description" listed at the end of the MISUMI "FA Mechanical Standard Components" catalog.

The following cases are not covered under the warranty:

(1) Products whose serial number or production date (month & year) cannot be verified.

(2) Changes in software or internal data such as programs or points that were created or changed by the customer.

(3) Products whose trouble cannot be reproduced or identified by MISUMI.

(4) Products utilized, for example, in radiological equipment, biological test equipment applications or for other purposes whose warranty repairs are judged as hazardous by MISUMI.

Warranty Period:

The warranty period ends when any of the following applies:

(1) After one year has elapsed from the date of installation

(2) After 2,400 hours of operation

Important information before reading this manual

Contents

Introduction i

Main functions ii

About this manual iii

CE marking iv

1. Safety standard iv
2. Safety measures iv
3. Robot safety measures v
4. EMC countermeasure example v

Introduction

Thank you for purchasing the C1/C21/C22 controller (hereafter referred to simply as "Controller"). Please read this manual carefully to ensure correct and safe use of this controller.

This manual explains three controller models, C1, C21, and C22 .
So, some functions or numeric values may vary depending on the controller model you are using. In this manual, the models, C1, C21, and C22, are expressed by C1 , C21 , and C22 , respectively.
Be sure to check the items corresponding to the controller model you are using.

Main functions

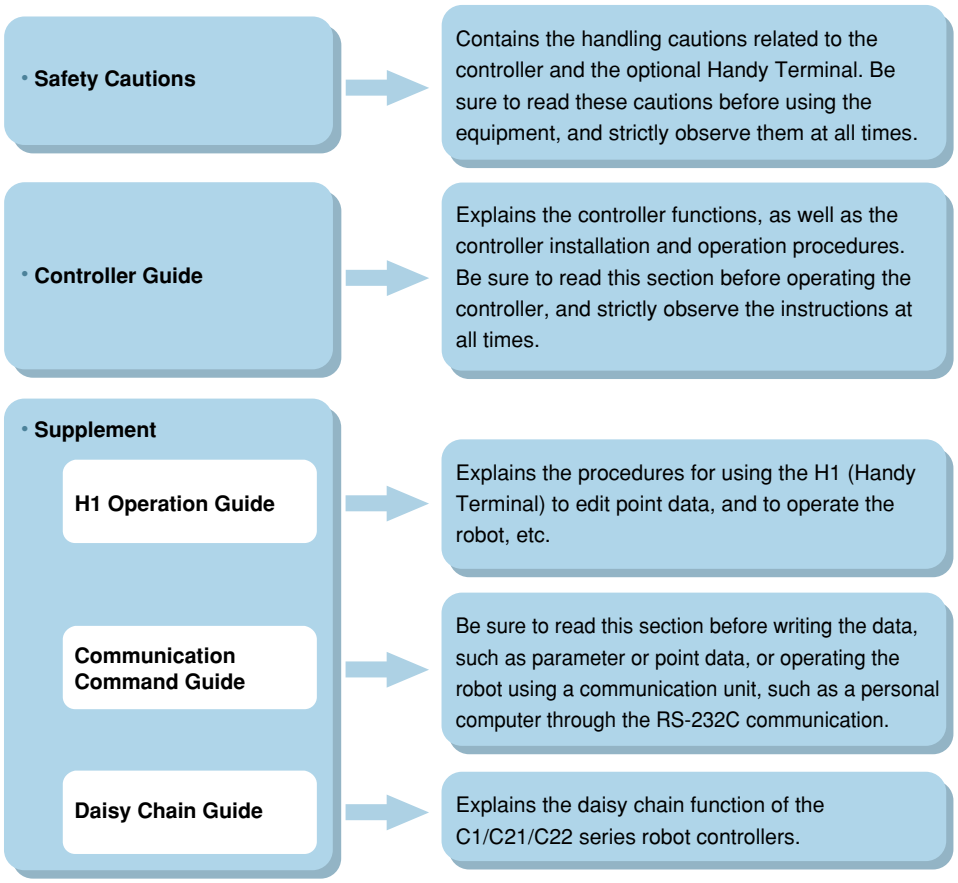
The following table shows the main functions of the controller.

Function	Explanation	Reference Section
Positioning operation	Moves the robot slider to the specified position. There are 4 types of position operation: 1. Positioning operation 2. Positioning merge operation 3. Push operation 4. Decel. Push *Positioning can be specified in an "absolute position" or "relative position" format.	→ Chapter 5 section 3, "Positioning operation". → Chapter 5 section 3.3, "Positioning merge operation". → Chapter 5 section 3.4, "Push operation". → Chapter 5 section 3.5, "Deceleration push operation".
Point data	Specifies the slider position (point). Up to 255 points of point data can be handled. Each point includes the following elements: RUN Type, Position, Speed, Accel., Decel., Push Force, Zone (-), Zone (+), Near Width (In-Position Zone), Jump, Flag, Timer.	Chapter 3 section 2, "Point data".
Point table type setting	The "point data type" setting can be selected as "Standard setting" or "Custom setting". This is possible only from the support software.	Chapter 3 section 2, "Point data".
Origin search	Performs an origin search (return-to-origin) simply by entering a return-to-origin command.	Chapter 5 section 1, "Operation procedure". Chapter 5 section 2, "Origin search".
Absolute function C21 C22	Once the absolute battery has been connected and a single origin return has been executed, further origin returns are not required at subsequent power ONs.	Chapter 5 section 2.1, "Origin point detection method".
JOG operation and current position teaching	Robot JOG operation and current position teaching can be performed from the host controller.	Chapter 5 section 3, "Positioning operation".
Soft limit function	Sets the robot's movement range. This function is used to avoid collisions, etc., when obstacles are present.	Chapter 5 section 7.1, "Soft limit function"
Output function	The following statuses can be selected and output to the host controller. Point No. output, alarm No. output, zone output, personal zone output, near output (in-position zone output), push status, origin return completion status, warning output, movement-in-progress output, manual mode status.	Chapter 4 section 3, "I/O signal details".
Alarm history	Saves up to 50 of the most recent alarms. The following elements are saved: Cause, start time, position, speed, operation status, operation point, elec. current, voltage, input, output.	Chapter 6 "2. Alarm recording function".
Operation modes	Exclusive I/O and communication control is possible.	Chapter 5 section 6, "Operation modes".
Support tools	■ H1 (Handy Terminal) Offers point and parameter data editing/monitoring functions. ■ RS-Manager (PC software for Windows) Support software for data designing, debugging, maintenance, and management.	H1 Operation Guide

About this manual

This manual is divided into 3 main parts: Safety Cautions, Controller Guide, and a Supplement (H1 Operation Guide, Communication Command Guide, Daisy Chain Guide). In order to use the controller and optional devices in an efficient manner, users should read the parts which are pertinent to the objective in question. Moreover, after reading this manual, keep it on hand for easy referencing as needed, and always make it available to the end user.

Configuration of this manual



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Use any of the following methods for referencing this manual content during controller installation, operation, and adjustment procedures.

- **Keep this manual close at hand for referencing when performing installation, operation, and adjustments.**
- **Display the CD-ROM version of this manual onscreen for referencing when performing installation, operation, and adjustments.**
- **Print out the required pages of this manual from the CD-ROM in advance, and use them for reference when performing installation, operation, and adjustments.**

Although every effort was made to ensure that this manual content is accurate and complete, please contact MISUMI if errors, misprints, or omissions are found.
For information related to the robot unit, support software, and other optional devices, please refer to the operation manuals for those items.

CE marking

1. Safety standard

Cautions regarding compliance with EC Directives

The MISUMI robot (robot and controller) is not, in itself, a robot system. The MISUMI robot is just one component that is incorporated into the customer's system (built-in equipment), and MISUMI robots are in compliance with the EC Directives as they apply to built-in equipment. Therefore, this does not guarantee EC Directive compliance in cases where the robot is used independently. Customers who incorporate a MISUMI robot into a system which will be shipped to, or used in, the EU, should therefore verify that the overall system is compliant with EC Directives.

● Differences between MISUMI single-axis robot (robot and controller) and industrial robot

MISUMI single-axis robot (robot and controller) is not the industrial robot that is defined in European standard EN ISO10218-1. Article 3.10 of this standard defines "industrial robot" as "multipurpose manipulator programmable in three or more axes" and MISUMI single-axis robot does not apply to this definition.

CE marking

MISUMI robots are components that are incorporated into the customer's system (built-in equipment). We therefore declare regarding EC Directives that MISUMI robots are "Partly completed machinery" and so we do not affix a CE mark to the robots.

Applicable EC Directives and their related standards

The following table lists the Directives (and related standards) which apply to the robot's CE Marking compliance.

EC Directive	Related Standards
Machinery Directive 2006/42/EC	EN ISO12100 : Safety of machinery – General principles for design – Risk assessment and risk reduction EN 60204-1 : Safety of machinery – Electrical equipment of machines – Part1: General requirements
EMC Directive 2014/30/EU	EN 55011 : Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement EN 61000-6-2 : Electromagnetic compatibility (EMC) – Part6-2: Generic standards – Immunity for industrial environments

Cautions regarding the official language of EU countries

For equipment that will be installed in EU countries, the language used for the manuals, warning labels, operation screen characters, and CE declarations is English only.
Warning labels only have pictograms or else include warning messages in English. In the latter case, messages in Japanese or other languages might be added.

2. Safety measures

Usage Conditions

The usage conditions which apply to the MISUMI robot series are described below.

- EMC (Electromagnetic Compatibility)

  MISUMI robots are designed for industrial environments. (Applicable standard relating to the EMC Directive: Refer to the EN61000-6-2 Standard, Item 1 "Scope".)
  EMC Directive compliance requires that the customer have the final product (over equipment system) evaluated, with any necessary measures being implemented.

- Installation conditions C21 C22

  · MISUMI robots are classified as "built-in equipment", and feature a "Class I" protective structure with regard to electrical shocks. Be sure to ground the robot and robot controller in order to ensure electrical shock protection.

  · The robot controller case is not designed to meet the "enclosure" requirement specified by the EN60204-1 Standard. Suitable protection should therefore be provided to prevent contact electrical shock hazards, and to protect the controller from dust and water, etc., in the ambient environment.

  · Regarding insulation coordination, MISUMI robots are designed for the following conditions (refer to the IEC60664-1 Standard):

  Over-voltage category II
  Pollution degree 2

  Suitable measures should be taken if the robot is to be used in environments more severe than those shown above.

- Explosion-proof

  The robot and controller do not have explosion-proof specifications, and the robot should therefore not be used in environments exposed to flammable gases which could explode or ignite, or to gasoline and solvents, etc.

3. Robot safety measures

■ Electrical Shock Prevention Measures

Use the protective ground terminal in order to ensure safety with regard to electrical shocks. For details, refer to the robot's operation manual.

4. EMC countermeasure example

Regarding EMC directives, the customer's final product (entire system) including the MISUMI robot must provide the necessary countermeasures. We at MISUMI determine a model for single units of MISUMI robots (controller, robot, and peripheral device) and verify that it complies with the relevant standards of EMC directives.
In order to ensure the customer's final product (entire system) complies with EMC directives, the customer should take appropriate EMC countermeasures. Typical EMC countermeasures for a single unit of MISUMI robot are shown for your reference.

CAUTION

The examples shown here are the countermeasures tested under our installation conditions. When our product is installed in the customer's system, the test results may differ due to the difference in the installation conditions.

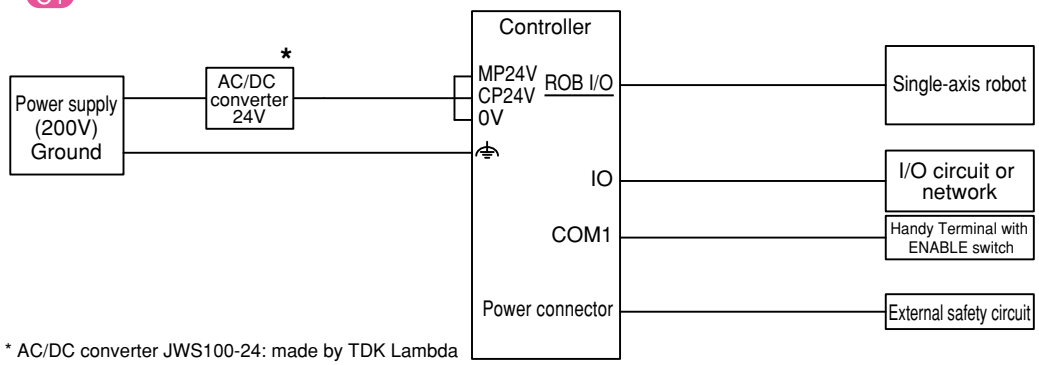
• Configuration

CAUTION

As shown in the drawing below, install the ferrite cores and noise filter as close to the controller as possible. Also install another ferrite core as close to the robot as possible.

EMC countermeasure example

C1

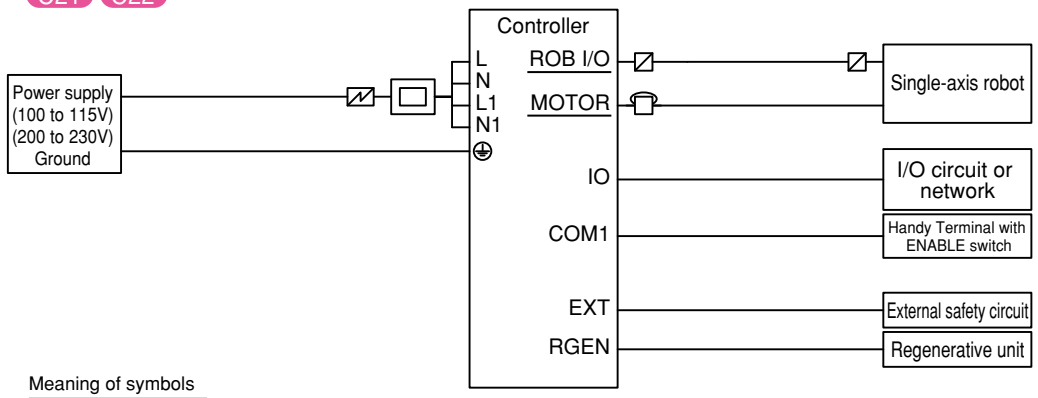


* AC/DC converter JWS100-24: made by TDK Lambda

23001-M3-00

EMC countermeasure example

C21 C22



Meaning of symbols

	Surge absorber	LT-C12G801WS	: SOSHIN ELECTRIC CO., LTD.
	Noise filter	NAP-10-472	: COSEL CO., LTD.
	Ferrite core	ZCAT3035-1330	: TDK
	Ferrite core	ZCAT2132-1130	: TDK
	Ferrite core	2 turns	

23001-M1-00

• **Countermeasure components**

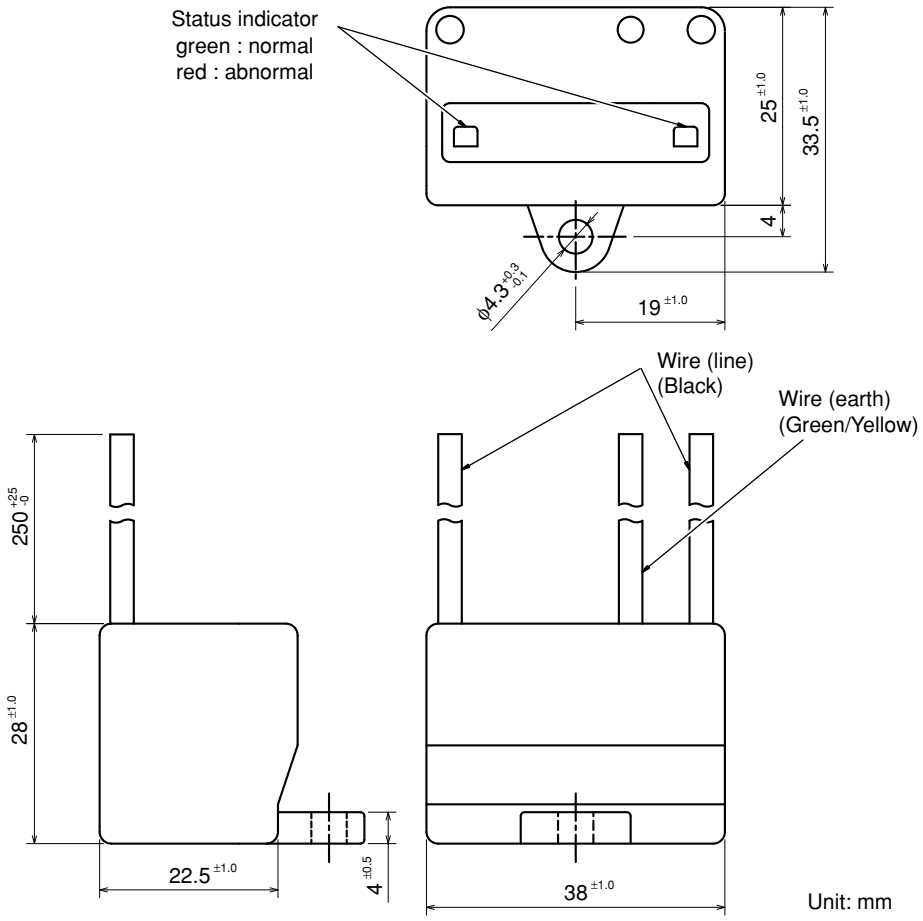
(1) Surge absorber

Always install an external surge absorber to protect the controller from surge noise that may be generated by lightning. A recommended surge absorber is shown below.

• **Recommended surge absorber**

Manufacturer : SOSHIN ELECTRIC CO., LTD.
Type No. : LT-C12G801WS

Dimensional outline



23002-M1-00

(2) Noise filter

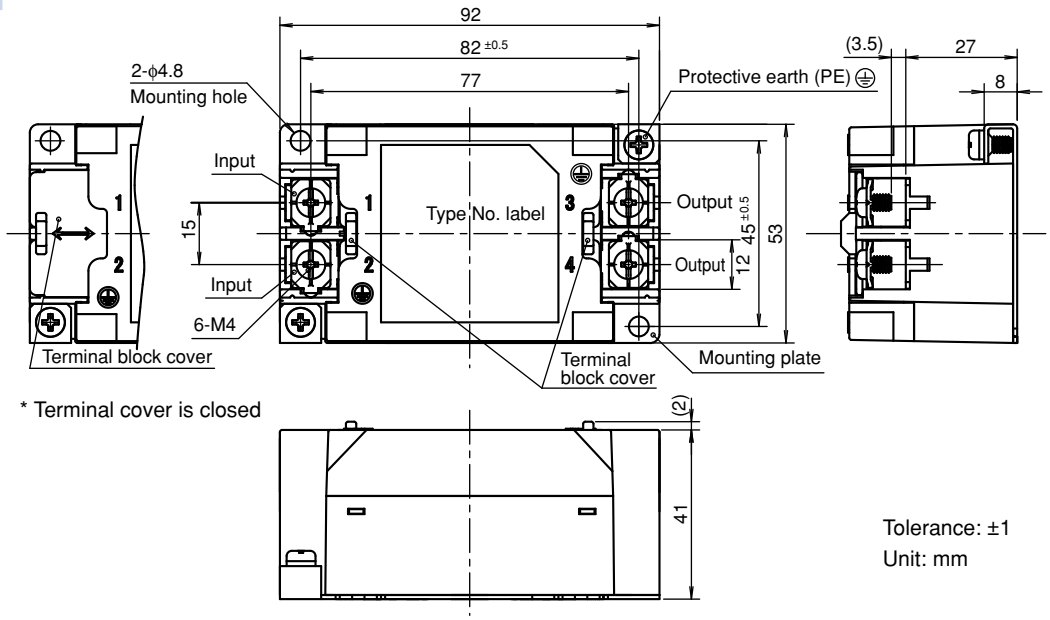
Always install an external noise filter to reduce conduction noise to the power supply line.
A recommended noise filter is shown below.

- **Recommended noise filter**

Type No.: EXRS-NF1*

* This product is made by COSEL CO., LTD (type No.: NAP-10-472).

Dimensional outline



Tolerance: ±1
Unit: mm

23003-M1-00

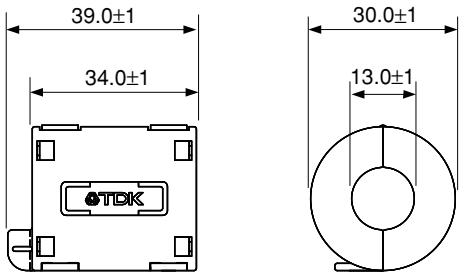
(3) Ferrite core

Install ferrite cores according to the customer's final product (entire system).
Recommended ferrite cores are shown below.

- **Recommended ferrite core 1**

Manufacturer : TDK
Type No. : ZCAT3035-1330

Dimensional outline



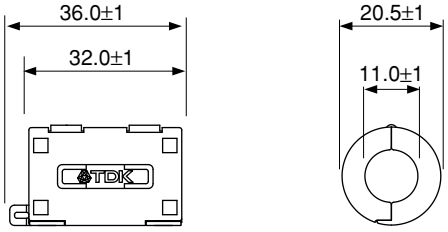
Unit: mm

23004-M1-00

- **Recommended ferrite core 2**

Manufacturer : TDK
Type No. : ZCAT2132-1130

Dimensional outline



Unit: mm

23005-M1-00

Chapter 1 Overview

Contents

1. Unpacking check 1-1
2. Part names and functions 1-2
3. System configuration 1-4
4. Installation and operation sequence 1-5

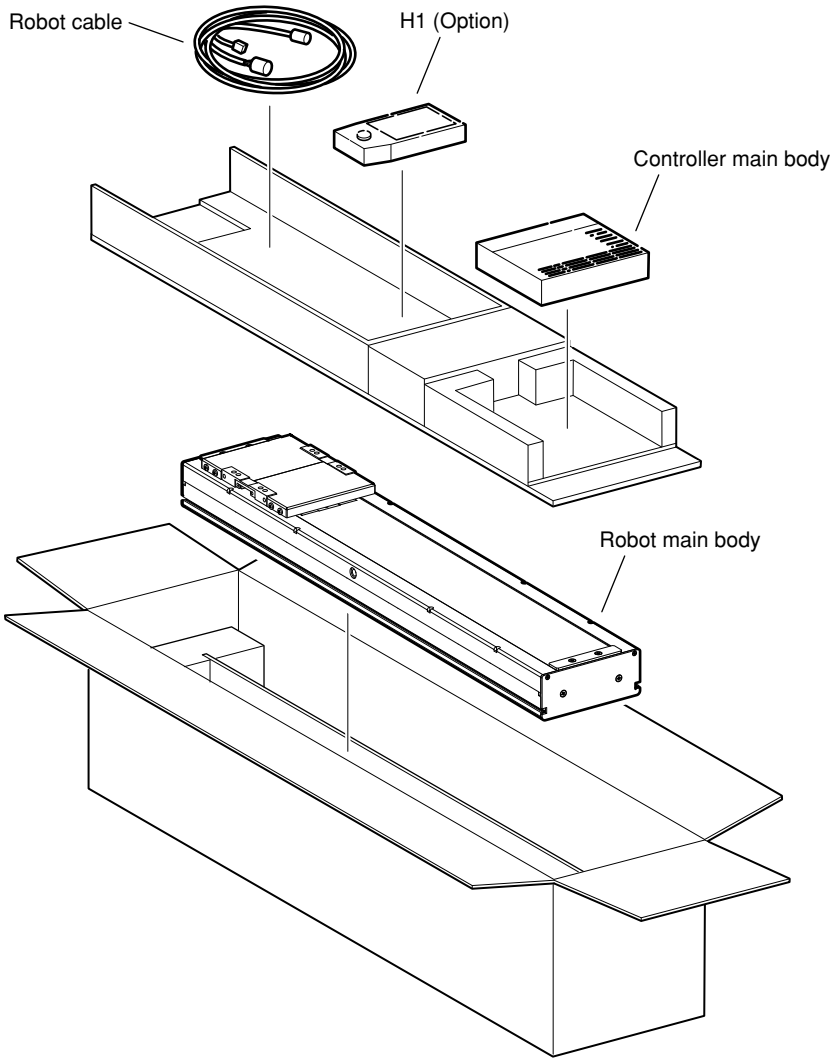
1. Unpacking check

The following accessories are shipped together with this product.

Accessories	Qty	Remarks
Controller	1 unit	
Power connector	1 piece	With wire-release lever C21 C22
EXT connector C21 C22	1 piece	With wire-release lever
Dummy connector	1 piece	For COM1 connector
Absolute battery C21 C22	1 piece	
CC-Link connector	2 piece	For CC-Link
CC-Link jump socket	1 piece	For CC-Link
DeviceNet connector	1 piece	For DeviceNet

The accessories vary according to the shipment configuration. For details, contact MISUMI Corporation.

Example of package contents



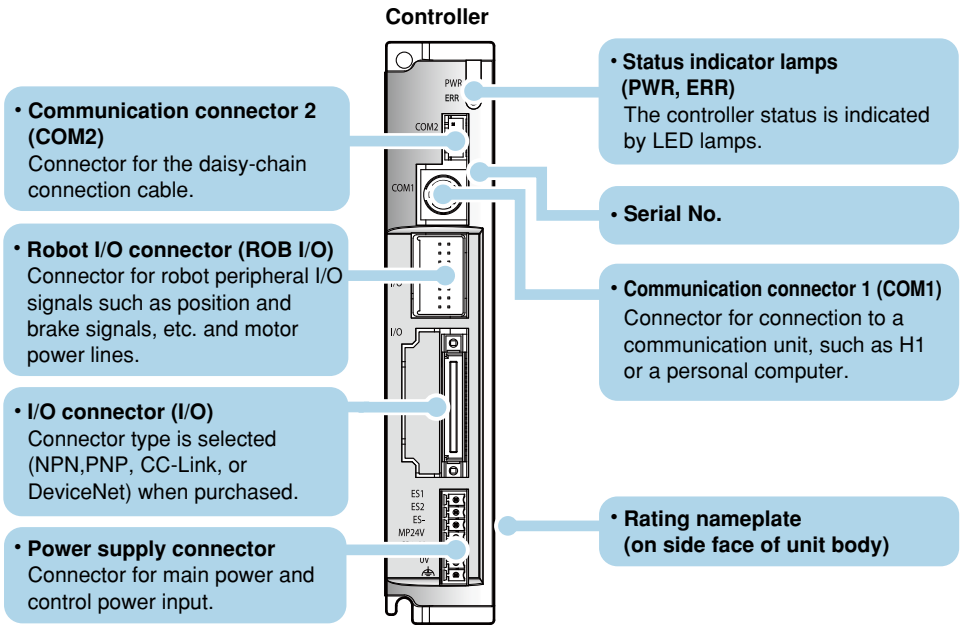
23101-M0-00

2. Part names and functions

This section explains the part names and functions of the controller.

Part names and functions

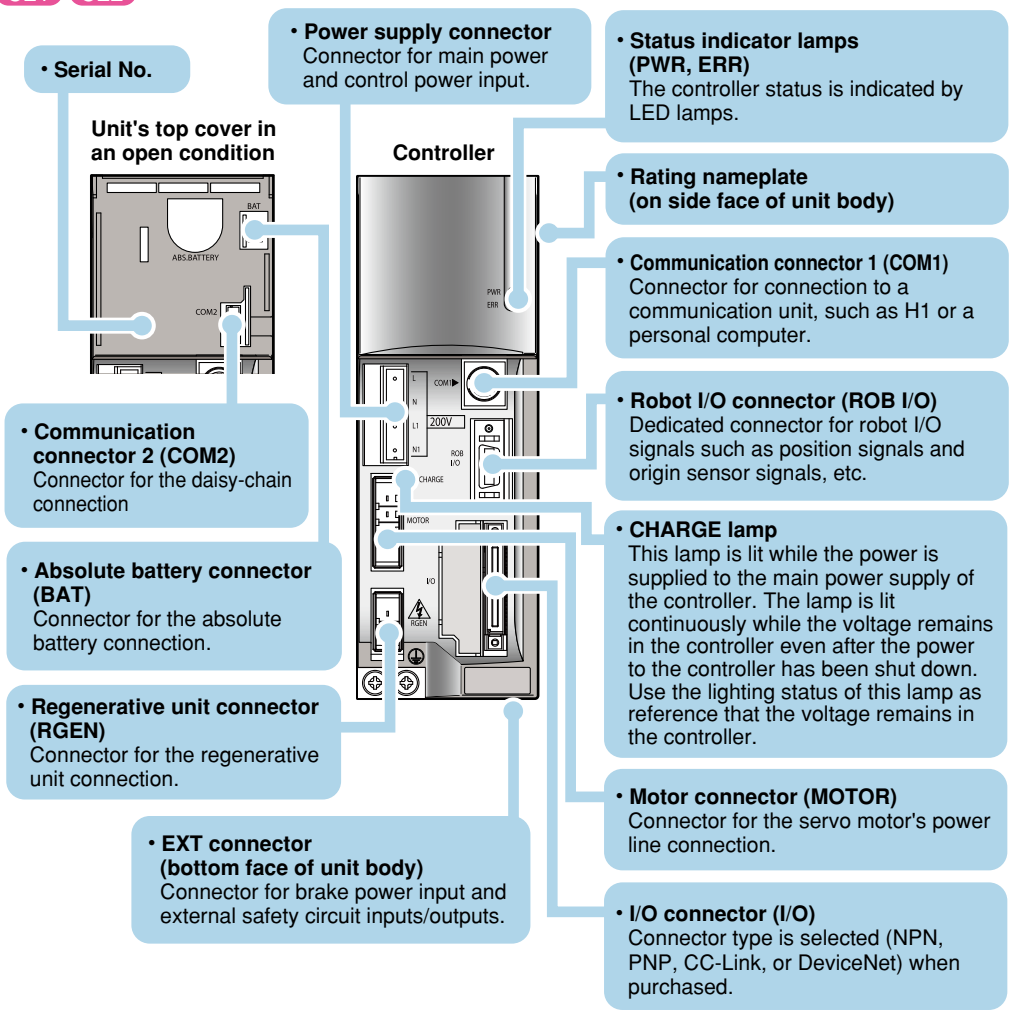
C1



23101-M3-00

Part names and functions

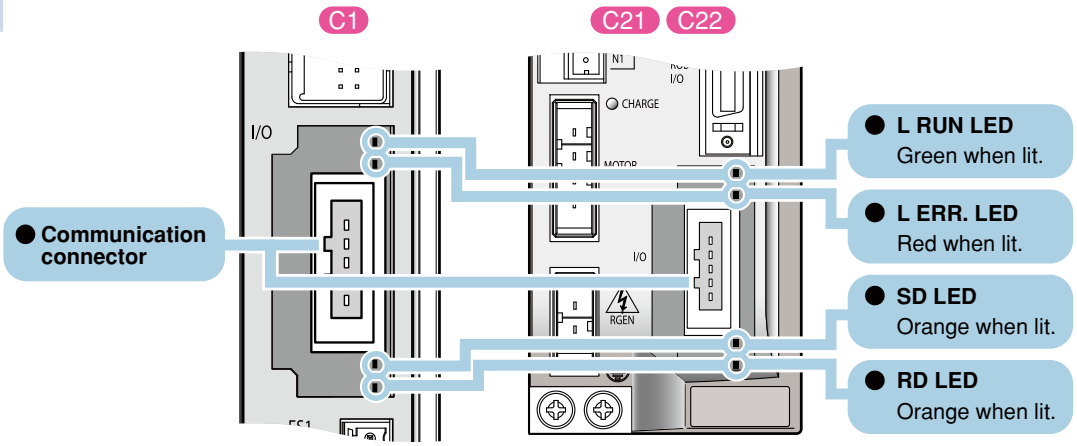
C21 C22



23101-M1-00

When CC-Link or DeviceNet is connected to the I/O connector, LEDs are arranged. The interface or communication state can be checked through the LED lighting pattern.

CC-Link

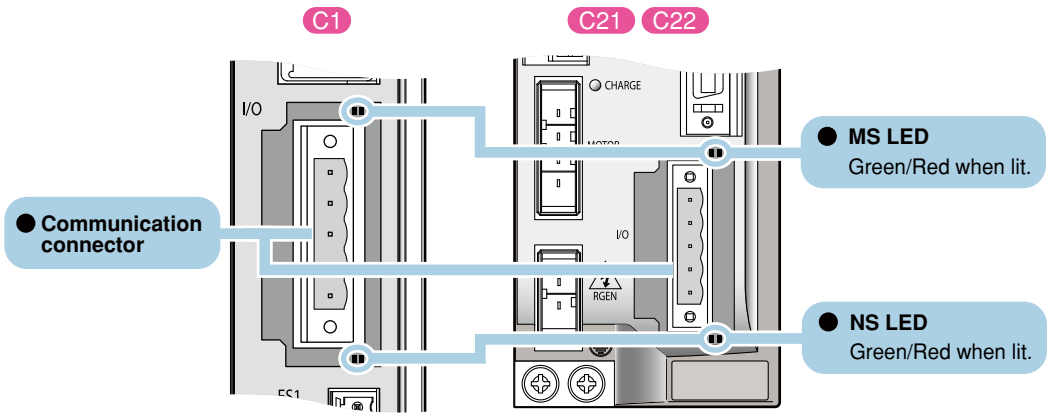


23102-M0-00

TIP

See Chapter 7 section 2.3, "CC-Link" for details of LED indicator lamp meanings.

DeviceNet



23103-M0-00

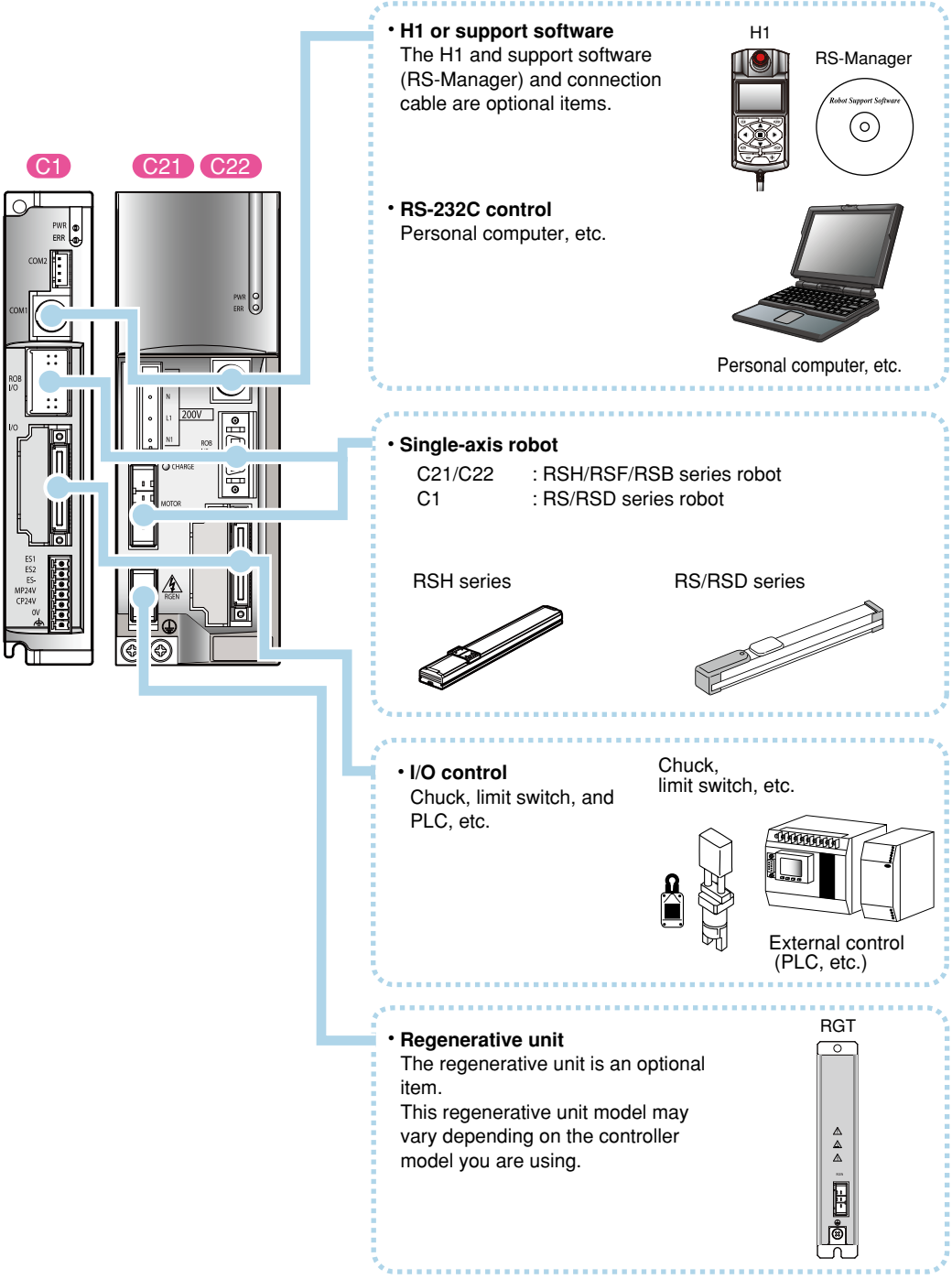
TIP

See Chapter 7 section 2.4, "DeviceNet" for details of LED indicator lamp meanings.

3. System configuration

Connect a robot and PLC to the controller to configure a desired system.
The following shows connection examples.

System configuration diagram

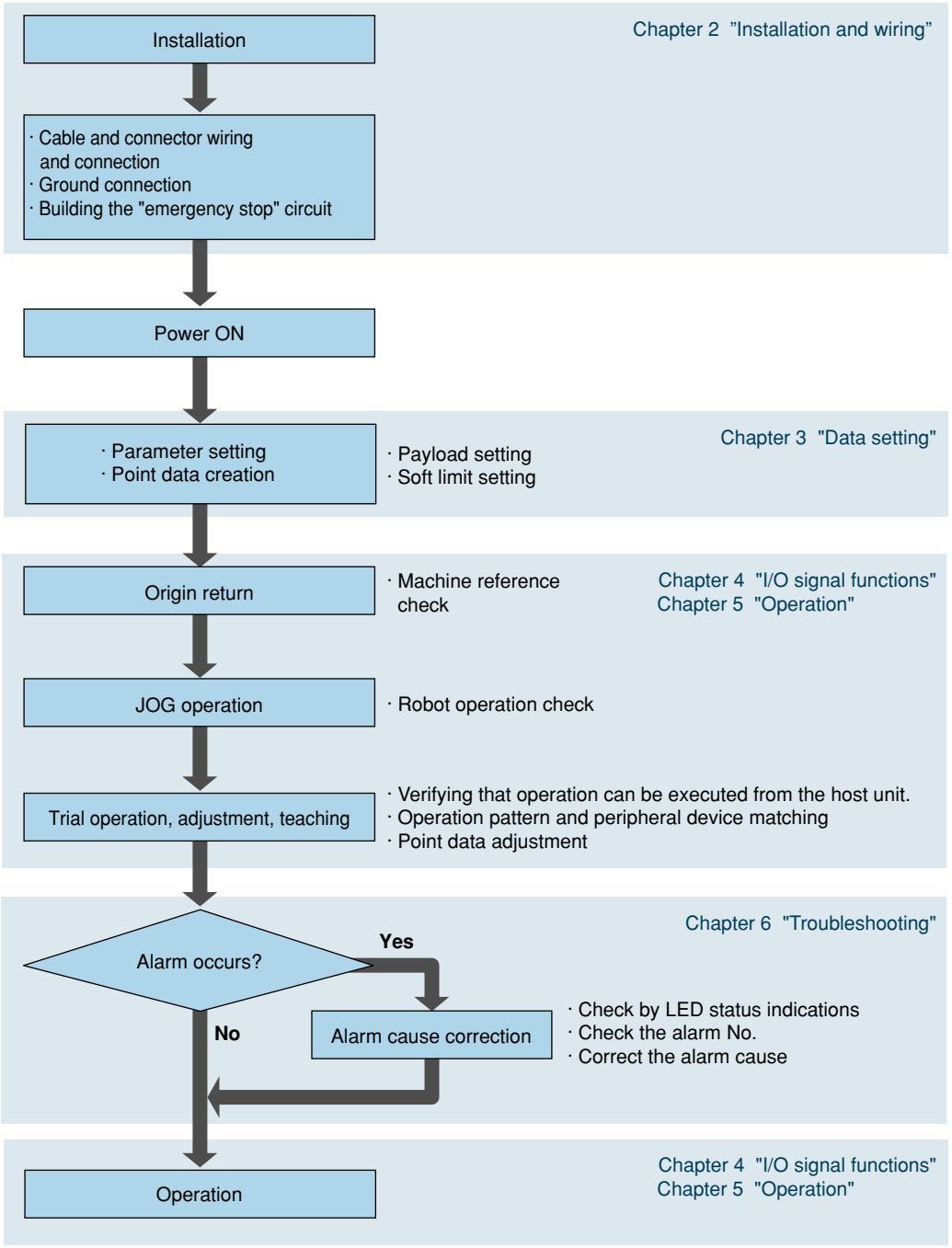


23104-M0-00

4. Installation and operation sequence

The basic sequence from controller installation to actual operation is shown below.

Installation and operation sequence



23105-M0-00

Chapter 2 Installation and wiring

Contents

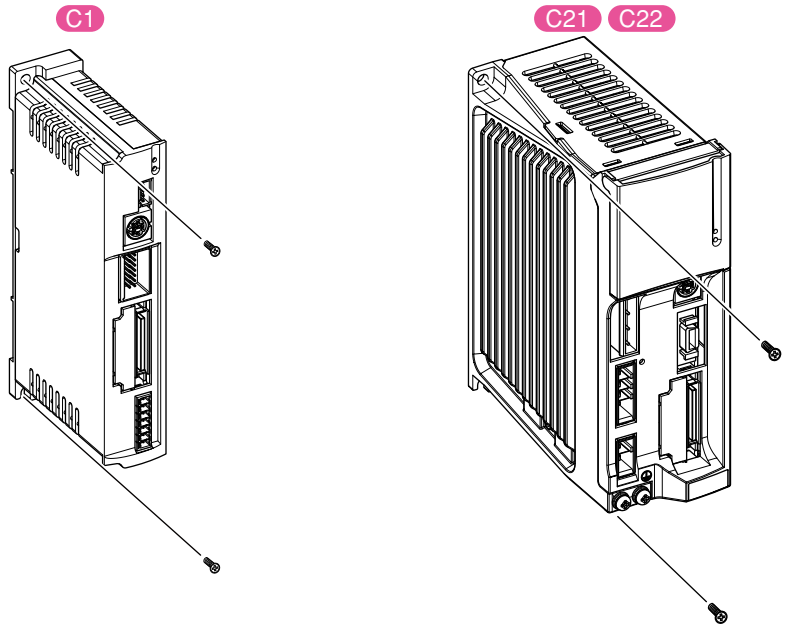
1. Installation method 2-1
1.1 Controller main body 2-1
1.2 Regenerative unit (RGT) C21 C22 2-2
2. Installation conditions 2-3
3. Wiring 2-5
3.1 Power supply connection C1 2-5
3.2 Power supply connection C21 C22 2-7
3.3 Malfunction prevention measures C21 C22 2-10
4. Connecting the robot 2-11
5. Connecting the communication unit 2-13
6. Connecting the regenerative unit C21 C22 2-15
6.1 Connecting the RGT C21 C22 2-15
7. Absolute battery C21 C22 2-16
7.1 Connecting the absolute battery 2-16
7.2 Replacing the absolute battery 2-16
8. Connecting the I/O signals 2-17
9. Configuring an emergency stop circuit C1 2-18
10. Configuring an emergency stop circuit C21 C22 2-19
10.1 EXT connector signal names and functions 2-19
10.2 Wiring and connecting the EXT connector 2-21
10.3 Circuit details 2-22
11. Connecting the I/O unit 2-23
12. Safety circuit construction example 2-26
12.1 Performance level 2-26
12.2 Circuit configuration examples C1 2-27
12.2.1 Category 3 2-27
12.2.2 Overview of circuit operation 2-28
12.3 Circuit configuration examples C21 C22 2-29
12.3.1 Category 3 2-29
12.3.2 Overview of circuit operation 2-30

1. Installation method

1.1 Controller main body

Use the mounting screw holes to install the controller on a vertical wall in the manner shown below.

Installation of controller main body



23201-M0-00

■ Installation screws

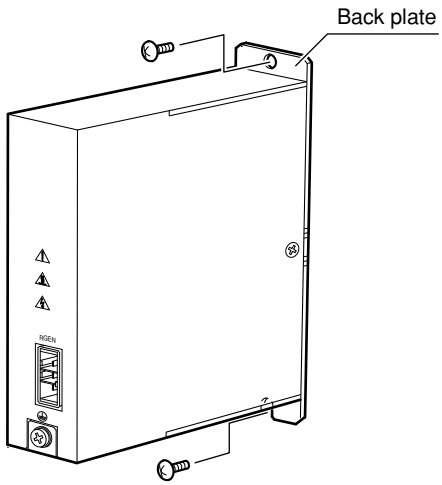
Use the following screw type for installation.

Controller Model	Mounting Area Thickness	Hole Dia.	Recommended Screw	Recommended Tightening Torque
C21/C22	4mm	ϕ 5.4	M5	1.5 N·m
C1	5mm	ϕ 4.5	M4	0.5 N·m

1.2 Regenerative unit (RGT) C21 C22

Use the back plate of the RGT to install it on a vertical wall in the manner shown below.

Installation of RGT



23201-M1-00

Installation screws

Use the following screw type for installation.

Mounting Area Thickness	Hole Dia.	Recommended Screw	Recommended Tightening Torque
2mm	ϕ 5.5	M5	1.5 N·m

2. Installation conditions

This section explains the installation conditions necessary to operate the controller in safe and correct manner.

Installation location

- Install the controller inside the control panel.
- The controller and the regenerative unit become hot during operation, and must be secured to a metal wall in order to prevent the risk of fires.

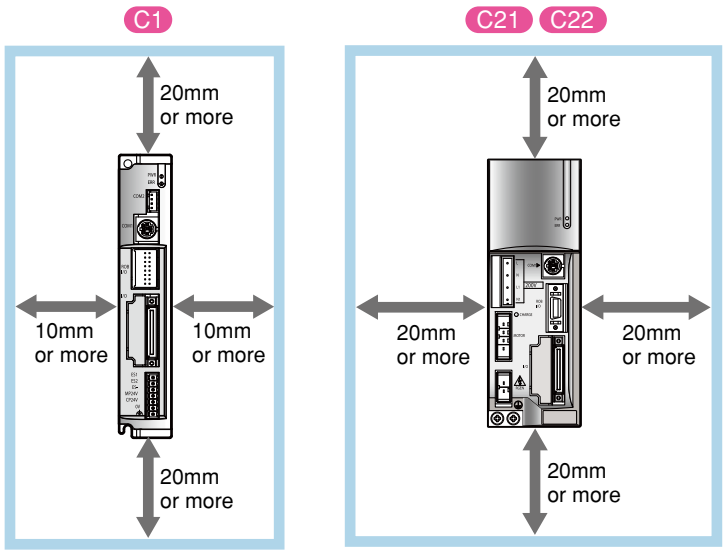
Installation direction

Install the controller on a vertical wall.

Surrounding space

Install the controller in a well ventilated location, with space on all sides of the controller (See the figure below.).

Surrounding space



23202-M0-00

Ambient operating temperature and humidity

The controller's ambient operating temperature and humidity must be maintained within the following ranges.

- Ambient temperature : 0 to 40˚C
- Ambient humidity : 35 to 85% RH
  (no condensation)

Environments to be avoided

To ensure safe and correct controller operation, avoid using the controller in the following environments.

- Environments which contain corrosive gases such as sulfuric acid or hydrochloric acid, or where flammable gases and liquids are present in the atmosphere.
- Environments with excessive dust.
- Environments which contain metal cutting chips, oil, and water, etc., from other machinery.
- Environments subject to excessive vibration.
- Environments where electromagnetic noise or electrostatic noise is generated.
- Environments exposed to direct sunlight.

Prevention of abnormal sound caused by the electromagnetic noise

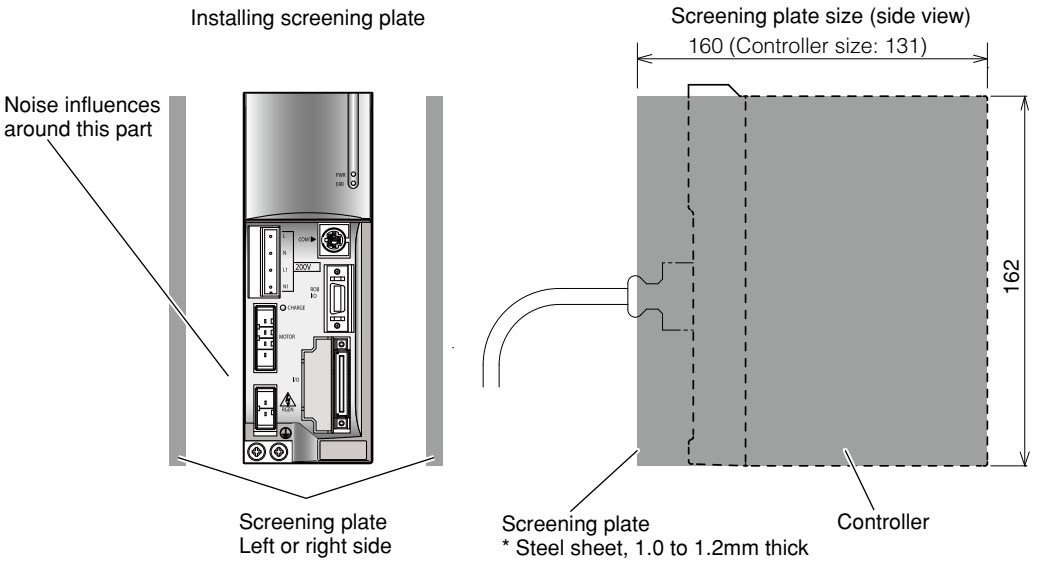
Electromagnetic noise generated from devices such as an electromagnetic contractor may cause abnormal sounds.

Take either of noise preventive measures described below:

- Install the device away from the electromagnetic noise source.
- Install steel screening plates beside the controller (right or left side depending on the noise direction).

Example of noise abnormal sound caused by the electromagnetic noise prevention

Screening plate



23223-M0-00

CAUTION

- **Do not install the controller upside down or at an angle. Doing so could reduce the cooling capacity and cause performance deterioration or malfunctions.**
- **Provide the prescribed spacing between the controller and the inner face of the control panel, and between the controller and other devices.**
- **Avoid using the controller in environments other than those specified. Usage in inappropriate environments could cause product deterioration and malfunctions.**

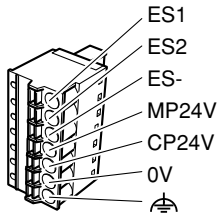
3. Wiring

3.1 Power supply connection C1

Use the power connector supplied with the controller to connect the power supply.

■ Power supply connector terminal names and functions

Power supply connector



Signal name	Description
ES1	Emergency stop contact 1
ES2	Emergency stop contact 2
ES-	Emergency stop ready signal (open: emergency stop)
MP24V	Main power supply 24V
CP24V	Control power supply 24V
0V	Power supply 0V
⏚	Ground terminal

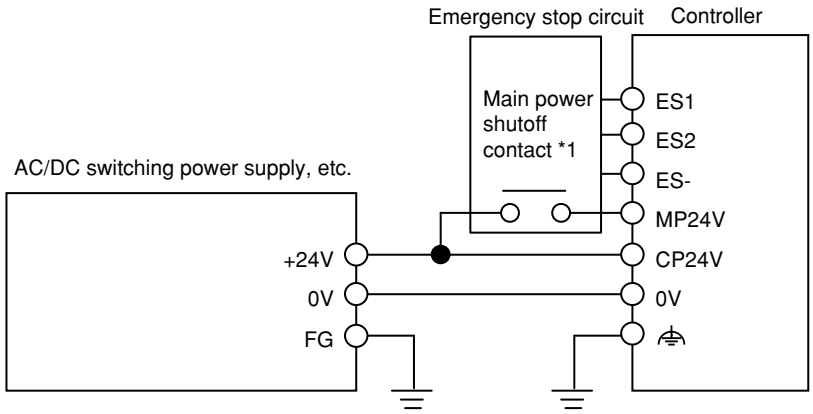
23201-M3-00

CAUTION

Always ground the ground terminal to prevent equipment malfunctions which may be caused by noise.

■ Power supply connection examples

Power supply connection examples



*1 : The main power supply constructs a shutoff circuit in conjunction with the emergency stop contact to form an emergency stop circuit.
For details, refer to section 9, "Configuring an emergency stop circuit", in this Chapter.

23202-M3-00

CAUTION

Be sure that the power supply voltage and the terminal connections are correct. Incorrect voltage and connections could cause an equipment failure.

■ Power requirements

Voltage	24VDC ± 10%
Current	Control power supply 0.5A per unit Main power supply 2A to 4A per unit
Recommended wire size	0.5 to 0.75 sq (AWG 20 to 18)

CAUTION

- **If the current supplied to the controller is too low, alarm stop or abnormal operation may occur. Carefully select a 24V power supply that provides an adequate current capacity.**
- **Since the controller uses a capacitor input type power supply circuit, a large inrush current flows when the power is turned on. Do not use fast-blow circuit breakers and fuses. For the same reason, avoid turning the power off and on again repeatedly in intervals of less than 10 seconds. This could harm the main circuit elements in the controller.**

Considering generated heat amount

Use the following tables as a guide to determine the control panel size, controller installation method, and cooling means.

Generated heat amount (W)	18

Signal Details

• Emergency stop READY signal (ES-)

This signal is used by the external safety circuit (e.g., safety enclosure, manual switch, etc.) in order to perform robot emergency stops.

Signal Name	Description	Type
ES-	Emergency stop input (emergency stop READY signal)	Input

Explanation

An emergency stop status is established when this signal input is switched OFF, and a "servo OFF" status also occurs at that time.

DANGER

DIRECTLY CONNECTING A POWER SUPPLY (+24V) TO ES- WILL DISABLE EXTERNAL EMERGENCY STOPS (INCLUDING THE HANDY TERMINAL'S EMERGENCY STOP BUTTON), THEREBY CREATING AN EXTREMELY HAZARDOUS CONDITION. BE SURE TO USE A COMBINATION OF ES-, ES1, AND ES2 TERMINALS IN ORDER TO CONFIGURE AN EMERGENCY STOP CIRCUIT. (REFER TO SECTION 9, "CONFIGURING AN EMERGENCY STOP CIRCUIT ".)

• Emergency stop contacts 1, 2 (ES1, ES2)

Signal Name	Description	
	When using Handy Terminal without an ENABLE switch	When using Handy Terminal with an ENABLE switch
ES1	Handy Terminal's emergency stop contact output 1	Connected to Handy Terminal's safety connector Pin No.14
ES2	Handy Terminal's emergency stop contact output 2	Connected to Handy Terminal's safety connector Pin No.15

Explanation

When using a Handy Terminal which has no ENABLE switch, ES1 and ES2 serve as the Handy Terminal emergency stop button's contact outputs.
When using a Handy Terminal which has an ENABLE switch, ES1 is connected to Handy Terminal's safety connector Pin No.14, and ES2 is connected to Pin No.15.
ES1 and ES2 should be used when building an external safety circuit.
Load: 24VDC 300mA Max.

NOTE

ES1 and ES2 will be short-circuited if the accessory dummy connector is connected to COM1.

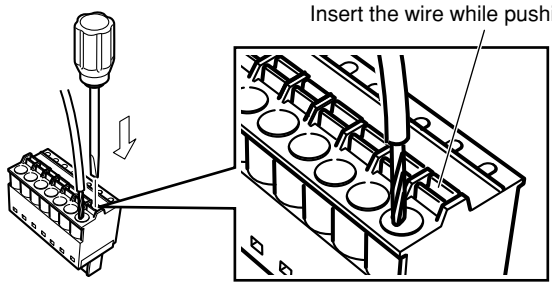
Power supply connector wiring procedure

CAUTION

- **Disconnect the power connector from the controller before wiring.**
- **Only one wire can be inserted into one wire hole of the power connector.**
- **When inserting the wire into the terminal, use care to prevent the core wire from making contact with other conductive parts.**
- **If the inserted portion of the wire is frayed, etc., cut off that portion and restrip the wire, then connect the wire securely.**

The usable wire size is 0.5 to 0.75sq (AWG20 to 18). Strip the sheath from the wire and insert it as shown below.
Insert the core wire into the power supply connector's hole as shown below, then verify that the wire is locked (cannot be pulled out).

Wiring method



23203-M3-00

3.2 Power supply connection C21 C22

Use the power connector supplied with the controller to connect the power supply.

Power supply connector terminal names and functions

Power supply connector (C22 200VAC specs.)

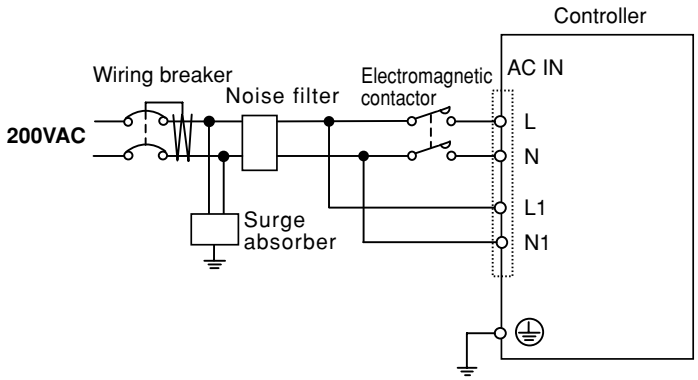
Signal Name	Description
L	Main power input 200 to 230VAC ±10%, 50/60Hz
N	
L1	Control power input 200 to 230VAC ±10%, 50/60Hz Consumption current 150mA MAX
N1	

Power supply connector (C21 100VAC specs.)

Signal Name	Description
L	Main power input 100 to 115VAC ±10%, 50/60Hz
N	
NC	No connection
L1	Control power input 100 to 115VAC ±10%, 50/60Hz Consumption current 300mA MAX
N1	

Power supply connection examples

For 200VAC power supply:



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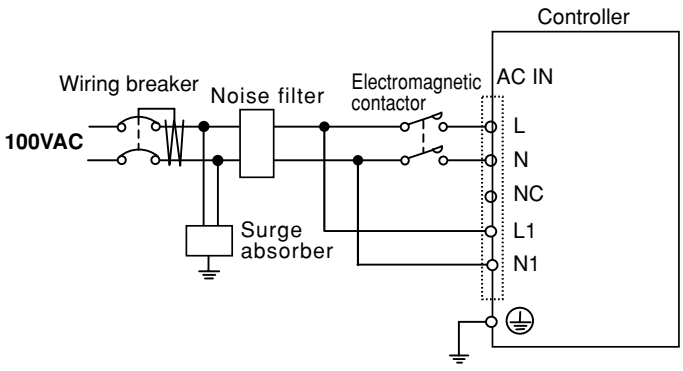
For 100VAC power supply:



23203-M1-00

CAUTION

- **Be sure that the power supply voltage and the terminal connections are correct. Incorrect voltage and connections could cause an equipment failure.**
- **Shut the control power off while in a "servo off" condition.**

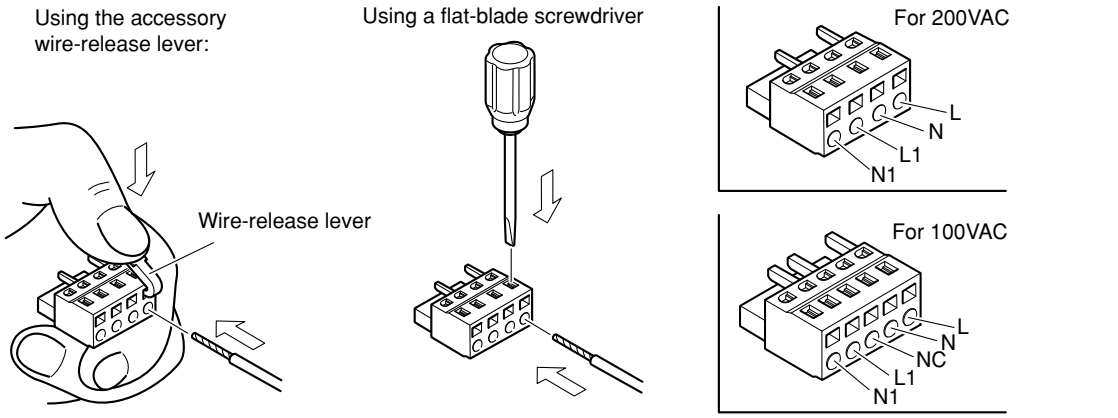
Power supply connector wiring procedure

CAUTION

- **Disconnect the power connector from the controller before wiring.**
- **Only one wire can be inserted into one wire hole of the power connector.**
- **When inserting the wire into the terminal, use care to prevent the core wire from making contact with other conductive parts.**
- **If the inserted portion of the wire is frayed, etc., cut off that portion and restrip the wire, then connect the wire securely.**

The usable wire size is 1.25 to 2.5 sq (AWG16 to 12) or more. Strip the sheath from the wire and insert it as shown below. (Please note that when wire of AWG 12 is used, it may not be connected depending on the sheath outer diameter. Use either of the following methods to insert the core wire into the power supply connector's hole, then verify that the wire is locked (cannot be pulled out).

Wiring method



23204-M1-00

Ground terminal

The controller must be grounded to prevent electrical shocks in case of electrical leakage, and to prevent equipment malfunctions due to electrical noise.
A Class D or higher grounding (grounding resistance of 100Ω or less) is required.

WARNING

BE SURE THAT GROUND IS SECURELY CONNECTED.

Tighten the ground terminal screw to the torque shown below.

Recommended Tightening Torque	0.75N·m

Considering power capacity and generated heat amount

The required power capacity and generated heat amount depend on the robot model.
Use the following tables as a guide to prepare a power supply and to determine the control panel size, controller installation method, and cooling means.

Axis current sensor value	Power capacity (VA)	Generated heat amount (W)
5	400	20

Installing wiring breakers

Leakage breaker

The controller drives the motors by PWM control, thereby creating a high-frequency leakage current flow which could cause external leakage breaker malfunctions. Therefore, when installing an external leakage current breaker, be sure to select the optimum sensitivity current rating (IΔn). (Refer to the leakage breaker manufacturer's data sheets to select the optimum product compatible with inverters.)

Power Supply Type	Leakage Current
Main power supply (L,N)	Total 1mA
Control power supply (L1, N1)	

CAUTION

1. **Leakage current is measured by a leak tester (Hioki Electric 3283), with the low-pass filter (100Hz) turned on.**
2. **When using multiple controllers, use the sum of the leakage currents from each controller.**
3. **Be sure that the controller is securely grounded.**
4. **Stray capacitance between the cable and the FG may vary depending on the cable installation condition, causing the leakage current to fluctuate.**

Circuit protector

An inrush current (several times to 10 times the rated current) occurs at the instant the controller is turned on, or at the instant robot motors begin to run. When installing an external circuit protector, select a circuit protector that provides optimum operating characteristics. (Refer to the circuit protector manufacturer's data sheets when making the selection.)

Input Power Voltage	Driver	Rated Current (Arms)	Recommended Characteristics
200VAC	205	2	Medium to slow response type with inertial delay
100VAC	105	4	

Installing a surge absorber

Be sure to install an external surge absorber to protect the equipment from surge noise caused by lightning strikes.

Recommended Surge Absorber Model	Manufacturer
LT-C12G801WS	SOSHIN Electric Co., Ltd.

Installing an electromagnetic contactor

In order to flexibly accommodate the various safety categories required by customers, this controller is not equipped with an internal main power shutoff circuit.
Please select the products that meet the required safety category, and always install an electromagnetic contactor on the main power supply side to configure an main power shutoff circuit.

TIP

Use the EXT connector to configure the emergency stop circuit. (Refer to section 10 "Configuring an emergency stop circuit" and section 12 "Safety circuit construction example" in this chapter.

DANGER

BE SURE TO INSTALL AN EXTERNAL MAIN POWER SHUTOFF CIRCUIT AND AN "EMERGENCY STOP" CIRCUIT.

Installing a noise filter

Install an external noise filter to suppress noise conductance to the power line.

Recommended Noise Filter Model	Manufacturer
EXRS-NF1	This noise filter is made by Cosel Co., Ltd. (Model: NAP-10-472)
NF2010A-UP	SOSHIN Electric Co., Ltd.

3.3 Malfunction prevention measures C21 C22

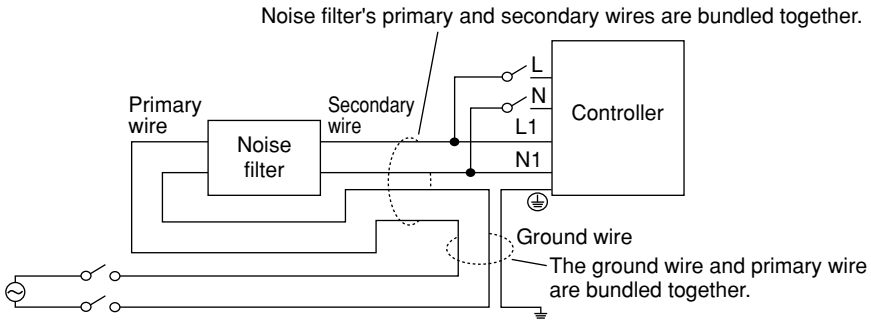
The following precautions must be taken to prevent noise related malfunctions.

Installation of noise filter and ferrite core

Install a noise filter and ferrite core near the controller.
Do not bundle the noise filter's primary and secondary wires together.

Installation of noise filter

Bad example



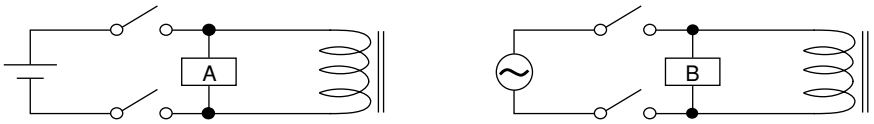
23205-M1-00

Installation of surge absorbing circuit

A surge absorbing circuit must be installed at induction load (induction motor, solenoid valve, brake solenoid, relay, etc.) coils which are located near the controller.

Surge absorbing circuit installation examples

(For solenoid valve and solenoid)



DC type
A: Diode, varistor, CR element

AC type
B: Varistor, CR element

23206-M1-00

4. Connecting the robot

Connect the robot cables to the robot I/O connector on the controller's front face, and to the motor connector.

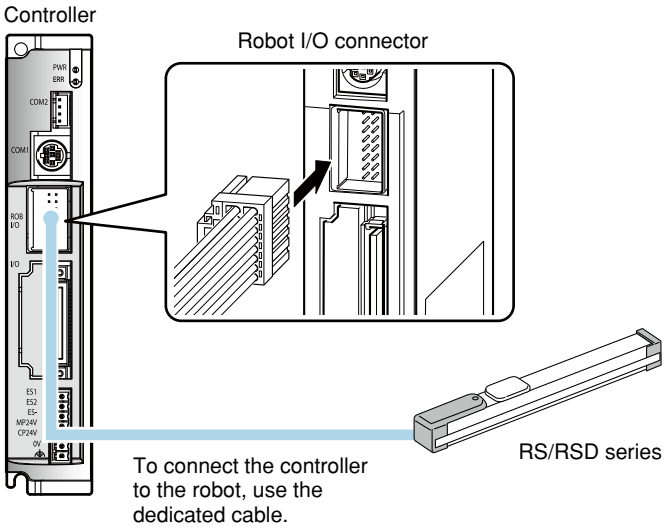
CAUTION

- **Be sure to use the cable dedicated to the RS controller when connecting the robot.**
- **Shut the power off before connecting the cables.**
- **Insert the cable plug into the connector until a clicking sound is heard (fully inserted).**
- **Connect only the robot which is to be used.**
- **Always grasp the connector body when plugging in and unplugging the cables.**

Connection method

Connecting the robot

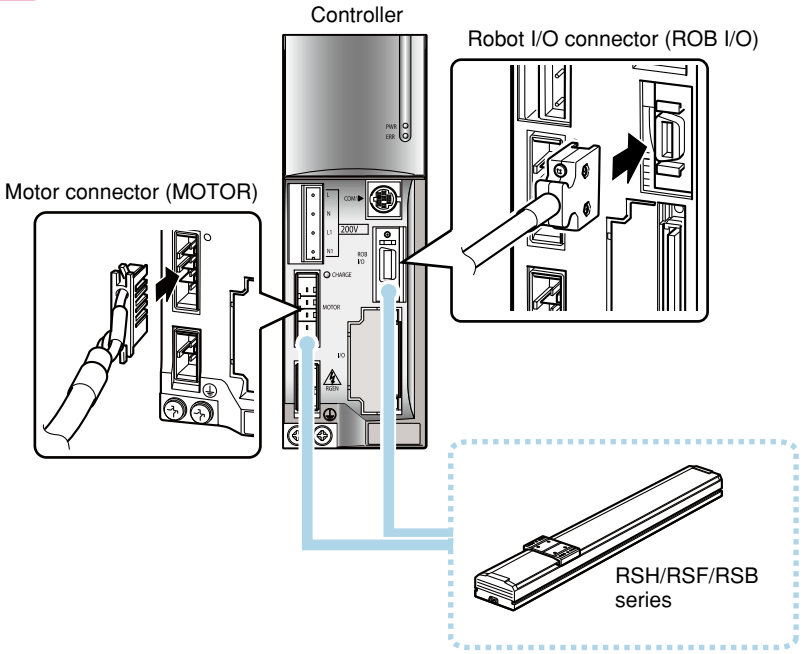
C1



23204-M3-00

Connecting the robot

C21 C22



23207-M1-00

■ Robot I/O connector signal table

C1

Pin No.	Signal Name	Description
1A	PS+	Resolver SIN input (+)
1B	PS-	Resolver SIN input (-)
2A	PC+	Resolver COS input (+)
2B	PC-	Resolver COS input (-)
3A	R+	Resolver excitation output (+)
3B	R-	Resolver excitation output (-)
4A	FG	Frame ground
4B	FG	
5A	BK+	Brake signal (+)
5B	BK-	Brake signal (-)
6A	A+	Motor "phase A" output (+)
6B	A-	Motor "phase A" output (-)
7A	ACOM	Motor "phase A" common
7B	BCOM	Motor "phase B" common
8A	B+	Motor "phase B" output (+)
8B	B-	Motor "phase B" output (+)

C21 C22

Pin No.	Signal Name	Description
1	PS+	Resolver SIN input (+)
2	PS-	Resolver SIN input (-)
3	PC+	Resolver COS input (+)
4	PC-	Resolver COS input (-)
5	R+	Resolver excitation output (+)
6	R-	Resolver excitation output (-)
7	FG	Frame ground
8	NC	No connection
9	NC	
10	PG	Origin sensor power 0V
11	+24V	Origin sensor power 24V
12	ORG	Origin sensor signal input
13	BK+	Brake signal (+)
14	BK-	Brake signal (-)

5. Connecting the communication unit

The controller can be operated from the H1 (Handy Terminal) or a communication device with the RS-232C interface, such as a personal computer.

- The H1 is an optional item.
- Connection with a communication device, such as a personal computer requires a separate communication connection cable.

CAUTION

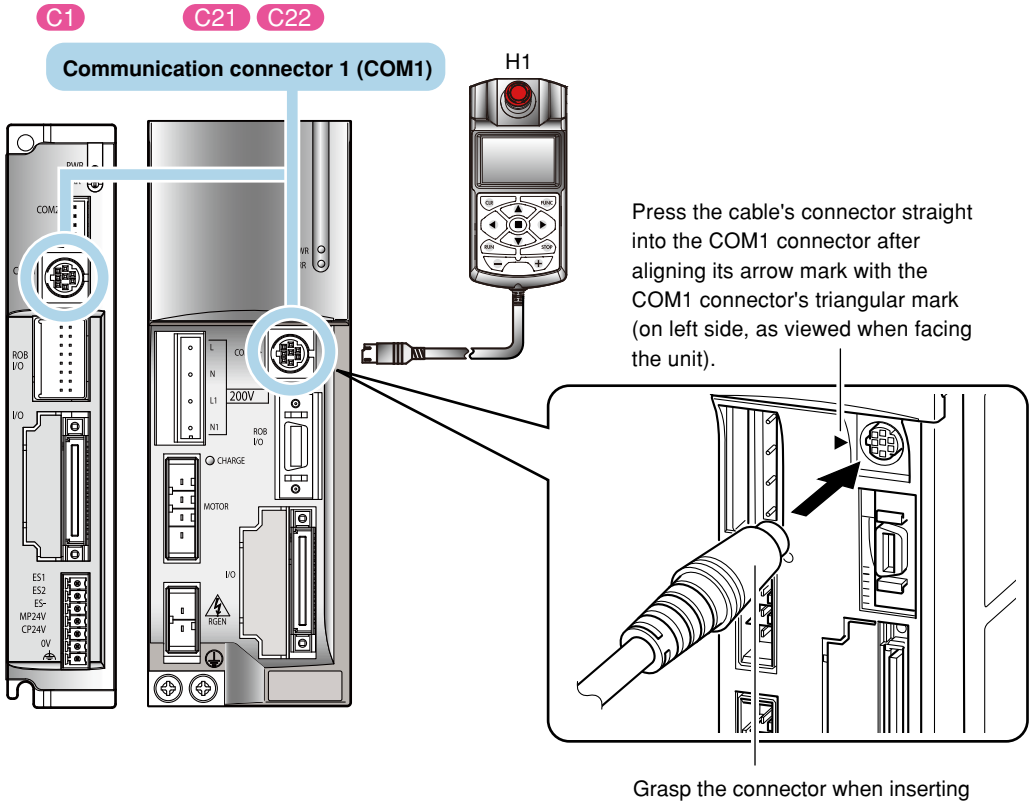
- **Be sure to turn off the controller power when connecting or disconnecting the communication connector (COM1). When connecting or disconnecting the communication connector (COM1) with the power turned on, this may cause the internal circuit to break.**
- **The USB connector of the communication cable (personal computer side) is hot plugging. Therefore, connect the communication cable first on the controller side and then on the personal computer side.**

■ Connecting the controller to the H1

CAUTION

- **Do not modify the connection cable. This can cause communication errors and equipment failure.**
- **Always grasp the connector body when connecting/disconnecting the connection cable at the controller. Pulling on the cable can cause an equipment failure.**
- **An incorrectly inserted connector or poor contact condition can cause malfunctions or equipment failure. Be sure that the connector is correctly and securely connected.**
- **When disconnecting the connector from the controller, pull the connector straight out to avoid bending the connector pins.**

Connecting to the H1



23203-M0-00

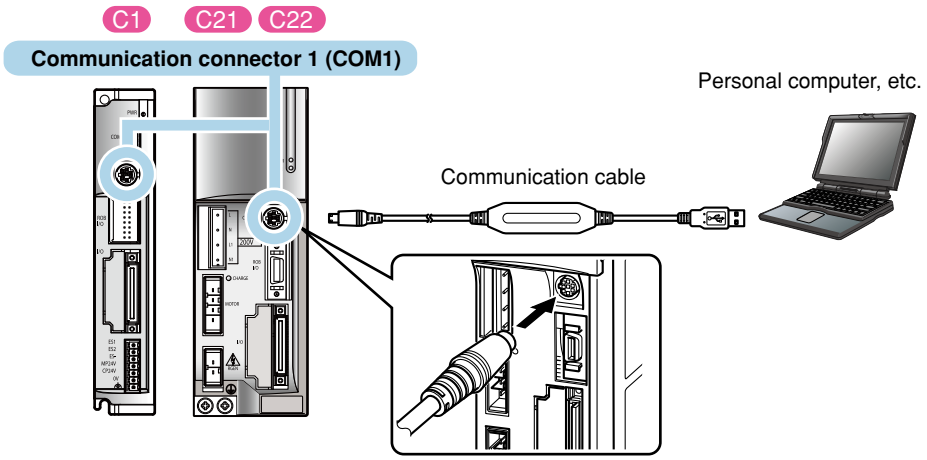
Connecting the controller to a communication device

Make this connection by using the optional communication cable (dedicated cable) for connection to a communication device, such as a personal computer.

CAUTION

- **Select either the USB or D-Sub connection cable for the communication cable. To perform the communication through the USB port of a communication device, such as a personal computer, use the USB communication cable. If the D-Sub communication cable is connected to the USB port through a commercially available USB conversion cable, the operation cannot be guaranteed.**
- **Do not modify the communication cable. This can cause communication errors and equipment failure.**
- **Always grasp the connector body when connecting/disconnecting the communication cable at the controller. Pulling on the cable can cause equipment failure or breaking of wire.**
- **An incorrectly inserted connector or poor contact condition can cause malfunctions or equipment failure. Be sure that the connector is correctly and securely connected.**
- **When disconnecting the connector from the controller, pull the connector straight out to avoid bending the connector pins.**
- **An emergency stop occurs if the communication cable (or Handy Terminal cable) is unplugged while the controller power is on, and a "servo off" status is established at the robot.**

Communication device connection



23204-M0-00

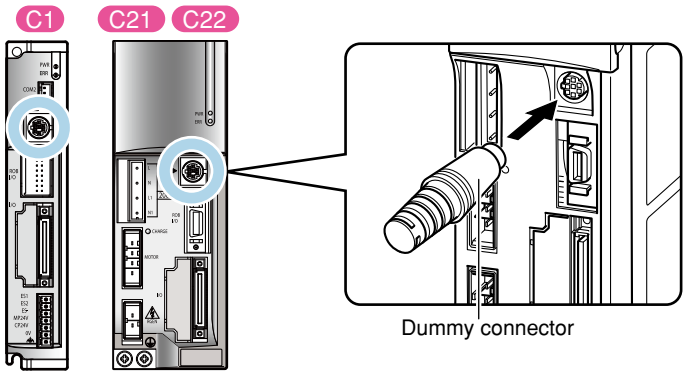
Connecting a dummy connector

The provided dummy connector must be plugged into the COM1 connector when operating the controller without connecting it to a communication unit.

CAUTION

- **An incorrectly inserted connector or poor contact condition can cause malfunctions or equipment failure. Be sure that the connector is correctly and securely connected.**
- **When disconnecting the connector from the controller, pull the connector straight out to avoid bending the connector pins.**
- **If the dummy connector is disconnected with the power to the controller turned on, an emergency stop occurs and the robot enters the servo off status.**

Dummy connector connection



23205-M0-00

6. Connecting the regenerative unit C21 C22

The regenerative unit absorbs regenerative current produced during motor speed reduction and radiates it as heat. A regenerative unit is required when operating certain robot models specified by MISUMI or when handling large-inertia loads. Use the MISUMI-specified dedicated cable to connect a regenerative unit to the controller.

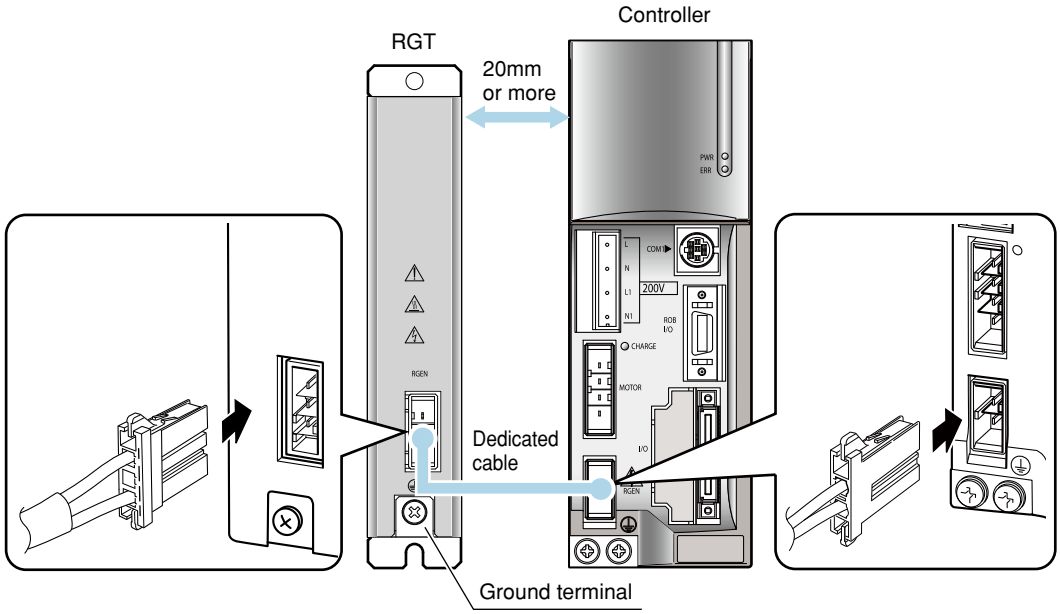
6.1 Connecting the RGT C21 C22

The following explains how to connect the RGT.

CAUTION

- **The power must be off when connecting the regenerative unit.**
- **Insert the cable plug into the connector until a clicking sound is heard (fully inserted).**
- **Install the regenerative unit in a well ventilated location with ample peripheral space (20mm or more).**

Connecting the RGT



23208-M1-00

Ground terminal

The controller must be grounded to prevent electrical shocks in case of electrical leakage, and to prevent equipment malfunctions due to electrical noise.
A Class D or higher grounding (grounding resistance of 100Ω or less) is required.

WARNING

BE SURE THAT GROUND IS SECURELY CONNECTED.

Tighten the ground terminal screw to the torque shown below.

Recommended Tightening Torque	0.75N·m

7. Absolute battery C21 C22

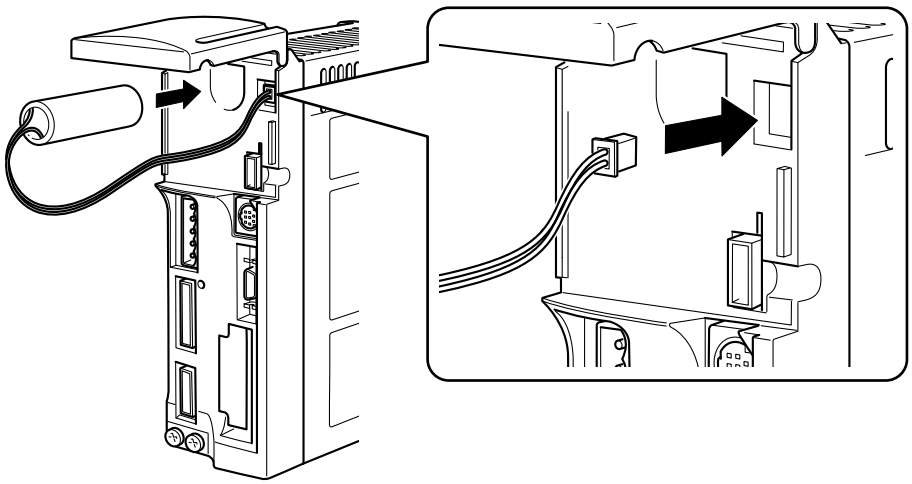
The absolute battery is used to retain robot position data.

7.1 Connecting the absolute battery

To install the battery, first connect its cable to the BAT connector inside the panel, then install the battery.

CAUTION
- **Plug in and unplug the battery cable while grasping the connector body.**
- **When closing the cover, be careful so that the absolute battery cable is not pinched by the cover.**

Connecting the absolute battery



23209-M1-00

7.2 Replacing the absolute battery

The absolute battery is a consumable item, and should be replaced when data backup problems occur (battery life expired).
Although the battery life varies depending on the operating conditions, a general guideline is 8,000 hours (about one (1) year) (when left with the power turned off after connected to the controller).

Battery specification	3.6V 1650mAh
Battery model (for ordering)	EXRS-BA2

■ Replacing the absolute battery with the power to the controller turned on

CAUTION
- **Before replacing the absolute battery, be sure to put the robot in the safe state (emergency stop state).**
- **Since the power to the controller is turned on (electrically live state), replace the absolute battery with great care.**
- **If the absolute battery is replaced with the robot cable disconnected when replacing the battery with the power to the controller turned on, the robot enters the return-to-origin incomplete state.**

■ Replacing the absolute battery with the power to the controller turned off

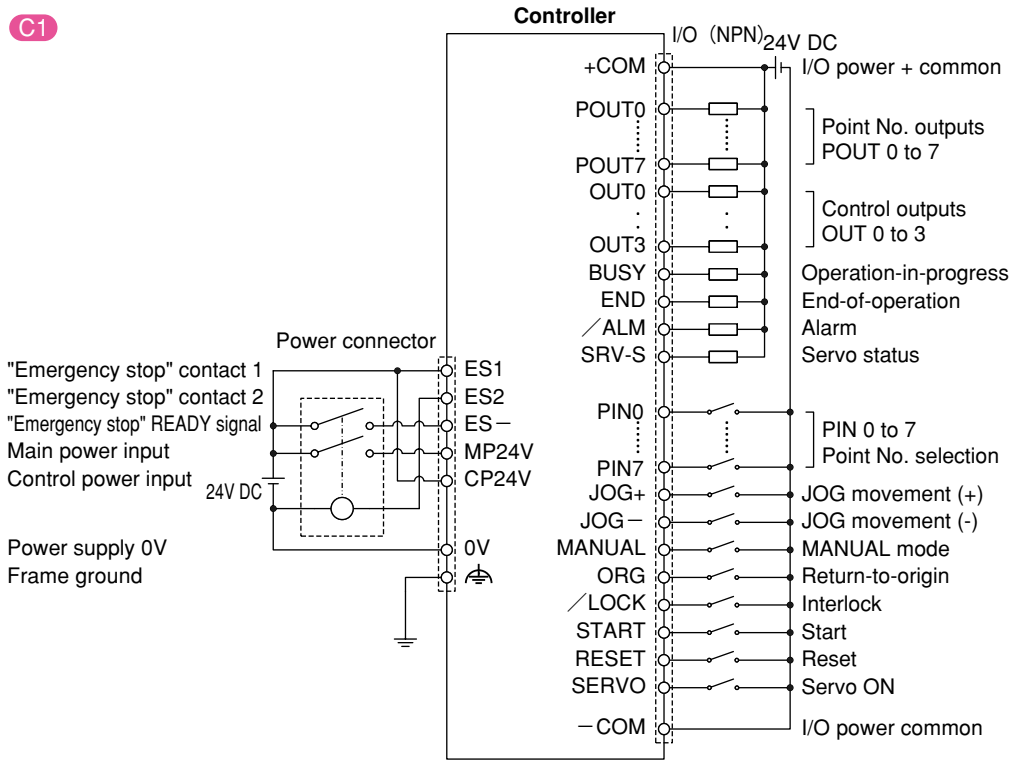
CAUTION
If the absolute battery is replaced with the power to the controller turned off, "8A ABS. BATTERY ERR." occurs and the robot enters the return-to-origin incomplete state.

8. Connecting the I/O signals

Two types of I/O signal connections (I/O and EXT I/O C21 C22) are provided for connection to external device such as a PLC.

I/O wiring diagram

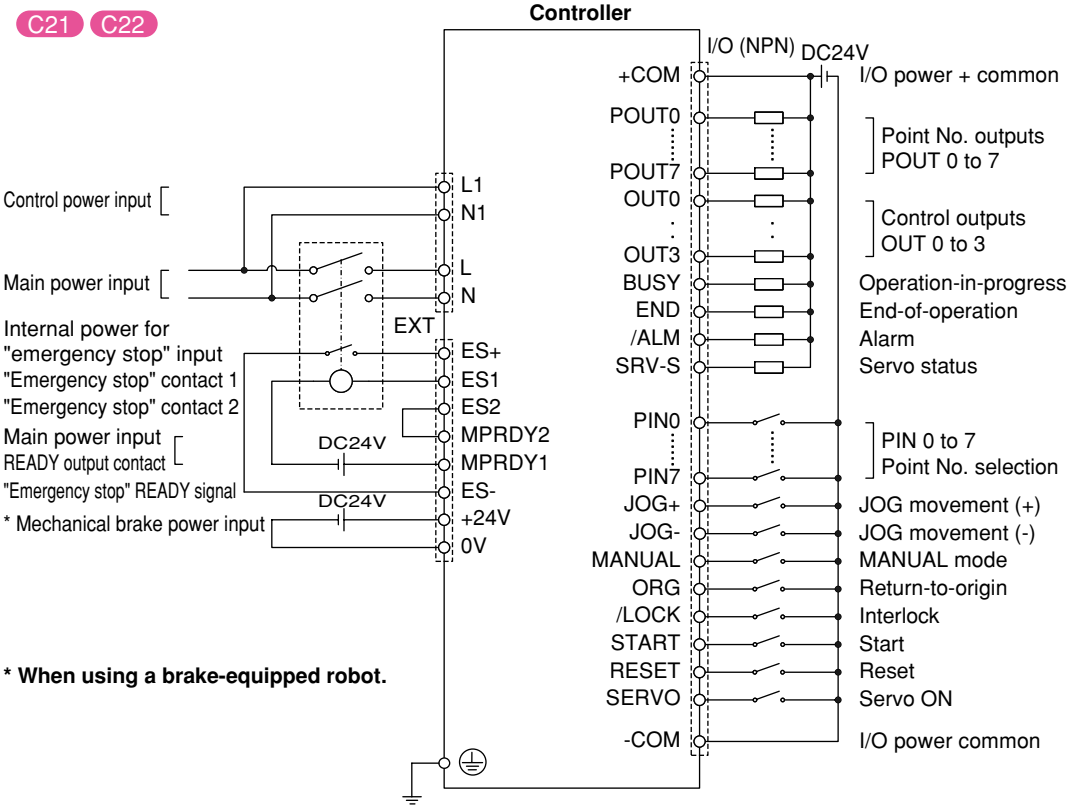
C1



23205-M3-00

I/O wiring diagram

C21 C22



*** When using a brake-equipped robot.**

23210-M1-00

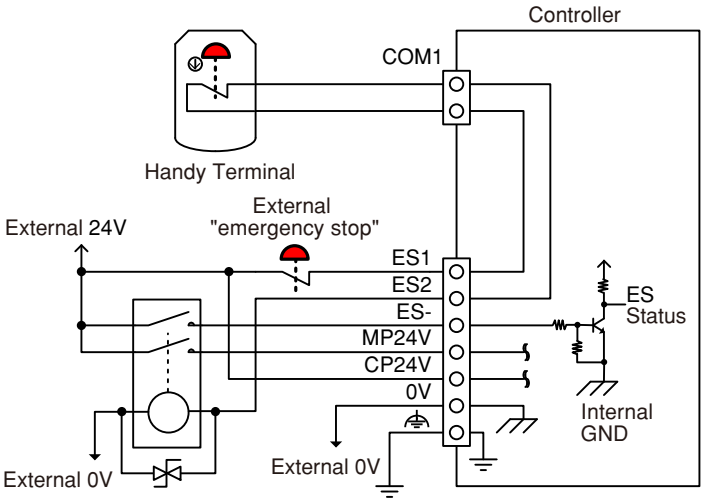
CAUTION

The above wiring diagram applies to an NPN type I/O unit. The wiring for PNP and serial I/O differs from the above diagram.

9. Configuring an emergency stop circuit C1

The power supply connector provides functions for configuring safety circuits, including the robot. The following shows a power connector and host unit connection example.

Emergency stop circuit



23206-M3-00

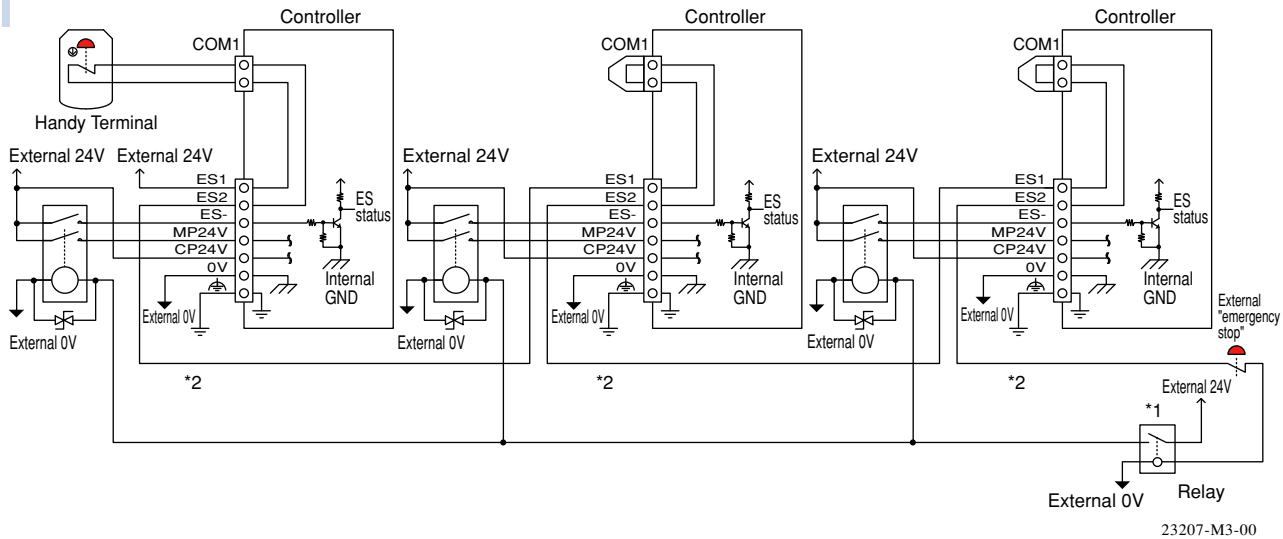
DANGER

IN ORDER TO FLEXIBLY ACCOMMODATE THE VARIOUS SAFETY CATEGORIES REQUIRED BY CUSTOMERS, THIS CONTROLLER IS NOT EQUIPPED WITH AN INTERNAL MAIN POWER SHUTOFF CIRCUIT.
THEREFORE, BE SURE TO INSTALL AN EXTERNAL MAIN POWER SHUTOFF CIRCUIT AND AN "EMERGENCY STOP" CIRCUIT.

DANGER

DIRECTLY CONNECTING A POWER SUPPLY (+24V) TO ES- WILL DISABLE EXTERNAL EMERGENCY STOPS (INCLUDING THE HANDY TERMINAL'S EMERGENCY STOP BUTTON), THEREBY CREATING AN EXTREMELY HAZARDOUS CONDITION. BE SURE TO USE A COMBINATION OF ES-, ES1, AND ES2 TERMINALS IN ORDER TO CONFIGURE AN EMERGENCY STOP CIRCUIT.

Emergency stop circuit connected in daisy chain



23207-M3-00

DANGER

IN ORDER TO FLEXIBLY ACCOMMODATE THE VARIOUS SAFETY CATEGORIES REQUIRED BY CUSTOMERS, THIS CONTROLLER IS NOT EQUIPPED WITH AN INTERNAL MAIN POWER SHUTOFF CIRCUIT.
BE SURE TO CONFIGURE AN EXTERNAL MAIN POWER SHUTOFF CIRCUIT TO FORM AN EMERGENCY STOP CIRCUIT.

CAUTION

- Be sure to check the contact capacity of the relay contact. If the capacity is insufficient, use multiple contacts as needed. (*1 in the diagram)
- Connect a load with a current of 300 mA or less to the emergency stop wiring using ES1 and ES2. If a load with a current of more than 300 mA is connected or if a current of more than 300 mA flows without connecting any load, the controller may malfunction. (*2 in the diagram.)

10. Configuring an emergency stop circuit C21 C22

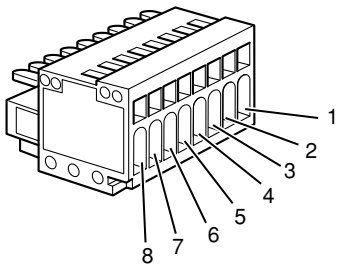
The EXT connector provides functions for configuring safety circuits, including the robot.
The following shows the EXT connector wiring and an example of connection with the host controller.

10.1 EXT connector signal names and functions

The following explains the EXT connector signal names and functions.
The EXT connector contains the robot's external safety circuit signals used for safe stops, and for the brake power supply terminal on robots equipped with brakes.

■ Signal List

EXT connector



Pin No.	Signal Name	Description
1	+24V	Power input for mechanical brake
2	0V	
3	ES+	Internal power for emergency stop input
4	ES1	Emergency stop contact 1
5	ES2	Emergency stop contact 2
6	ES-	Emergency stop READY signal
7	MPRDY1	"Main power input READY" output contact
8	MPRDY2	

23211-M1-00

■ Signal Details

- **Power input for mechanical brake (+24V, 0V)**

This input supplies power for the mechanical brake.

Signal Name	Description	Type
+24V 0V	Power input for mechanical brake	Input

Explanation

When using a brake-equipped robot, this terminal serves as the 24VDC input to power the brake. If the robot has no brake, this terminal connection is not required.
Brake power supply: 24VDC ± 10% 300mA

- **Internal power for emergency stop input (ES+), and emergency stop READY signal (ES-)**

These signals are used by the external safety circuit (e.g., safety enclosure, manual switch, etc.) in order to perform robot emergency stops.

Signal Name	Description	Type
ES+	Internal power for emergency stop input	Output
ES-	Emergency stop input (emergency stop READY signal)	Input

Explanation

An emergency stop status is established when the relay contact between ES+ and ES- is open (OFF), and a "servo OFF" status also occurs at that time.

DANGER

DIRECTLY SHORT-CIRCUITING THE EXT CONNECTORS ES+ AND ES- SIGNALS WILL DISABLE EXTERNAL EMERGENCY STOPS (INCLUDING THE HANDY TERMINAL'S EMERGENCY STOP BUTTON), THEREBY CREATING AN EXTREMELY HAZARDOUS CONDITION. BE SURE TO USE ES+ AND ES- SO THAT THE EXTERNAL SAFETY CIRCUIT FUNCTIONS PROPERLY.

- **Emergency stop contacts 1, 2 (ES1, ES2)**

Signal Name	Description	
	When using Handy Terminal without an ENABLE switch	When using Handy Terminal with an ENABLE switch
ES1	Handy Terminal's emergency stop contact output 1	Connected to Handy Terminal's safety connector Pin No.14
ES2	Handy Terminal's emergency stop contact output 2	Connected to Handy Terminal's safety connector Pin No.15

Explanation

When using a Handy Terminal which has no ENABLE switch, ES1 and ES2 serve as the Handy Terminal emergency stop button's contact outputs.
When using a Handy Terminal which has an ENABLE switch, ES1 is connected to Handy Terminal's safety connector Pin No.14, and ES2 is connected to Pin No.15.
ES1 and ES2 should be used when building an external safety circuit.
Load: 24VDC 300mA Max.

NOTE

ES1 and ES2 will be short-circuited if the accessory dummy connector is connected to COM1.

- **"Main power input READY" output contacts (MPRDY1, MPRDY2)**

These signals are ON when a main power input is enabled.

Signal Name	Description		Type
MPRDY1	"Main power input READY" output	Transistor input	Input
MPRDY2		Transistor output	Output

Explanation

These signals switch OFF when an error alarm (internal cause) occurs. Use these signals for the external safety circuit's main power ON/OFF condition judgments, etc.
Load: 24VDC 300mA Max.

10.2 Wiring and connecting the EXT connector

This section explains the EXT connector wiring and connecting methods.

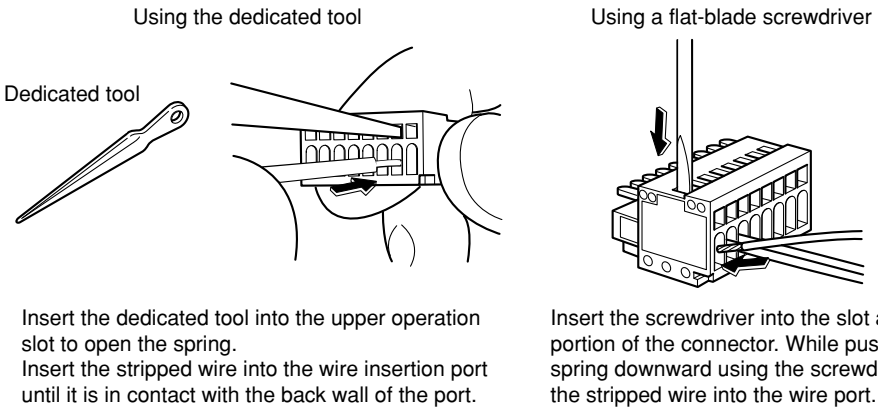
EXT connector wiring method

CAUTION

- **Disconnect the EXT connector from the controller before wiring.**
- **Only one wire can be inserted into one wire port of the EXT connector.**
- **When inserting the wire into the terminal, use care to prevent the core wire from making contact with other conductive parts.**
- **If the inserted portion of the wire is frayed, etc., cut off that portion and restrip the wire, then connect the wire securely.**

The usable wire size is AWG28 to 20 and its maximum outside diameter of the sheath is F2.2 mm. Strip the wire sheath 5 to 6 mm and use it as it is.
Use either of the methods as shown in the figure below to insert the core wire into the opening in EXT connector and perform the wiring.
After the wiring has been completed, pull the wire lightly to verify that the wire is locked. (At this time, do not pull the wire strongly.)

Wiring method



Insert the dedicated tool into the upper operation slot to open the spring.
Insert the stripped wire into the wire insertion port until it is in contact with the back wall of the port.

Insert the screwdriver into the slot at the upper portion of the connector. While pushing the spring downward using the screwdriver, insert the stripped wire into the wire port.

23212-M1-00

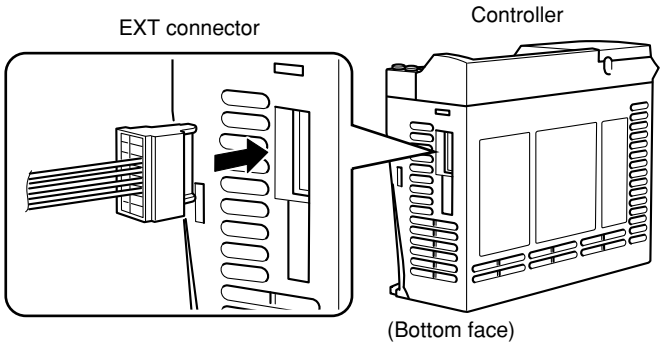
Connecting the EXT connector

Connect the wired connector to the controller.

CAUTION

Always grasp the connector body when plugging in and unplugging the cable.

Connecting to the EXT connector



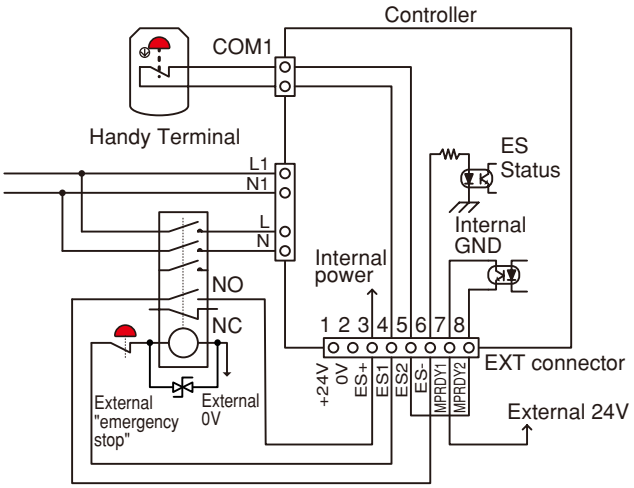
23213-M1-00

10.3 Circuit details

The following shows an EXT connector and host unit connection example.

Safety circuit

C21 C22



23214-M1-00

DANGER

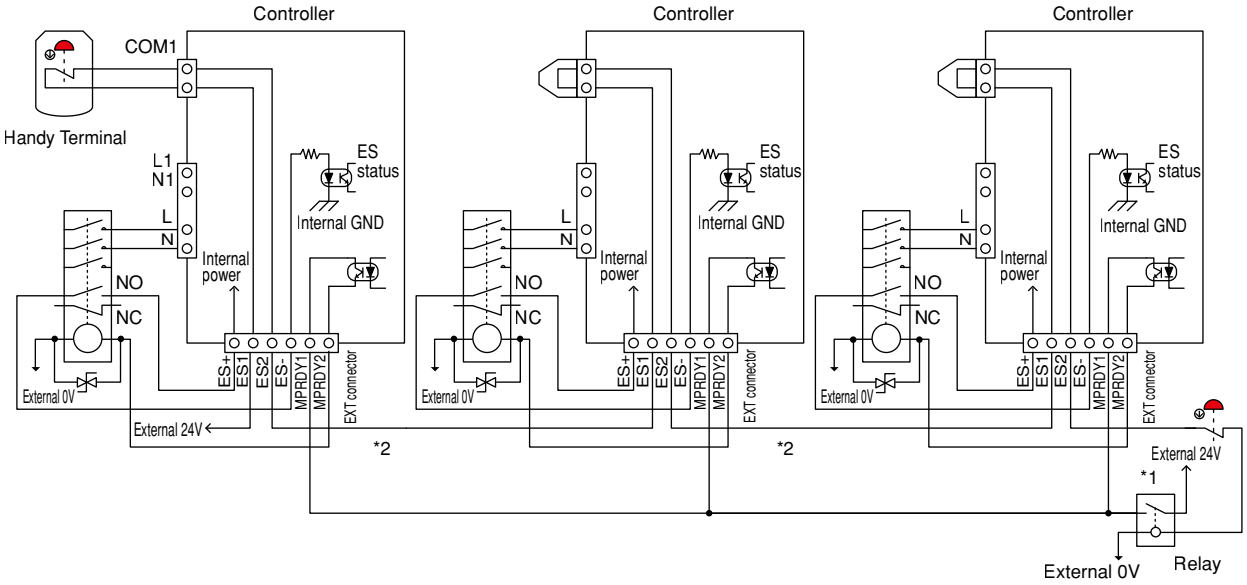
IN ORDER TO FLEXIBLY ACCOMMODATE THE VARIOUS SAFETY CATEGORIES REQUIRED BY CUSTOMERS, THIS CONTROLLER IS NOT EQUIPPED WITH AN INTERNAL MAIN POWER SHUTOFF CIRCUIT.
THEREFORE, BE SURE TO INSTALL AN EXTERNAL MAIN POWER SHUTOFF CIRCUIT AND AN "EMERGENCY STOP" CIRCUIT.

CAUTION

Be sure to install a surge absorber unit at the electromagnetic contactor's coil.

Safety circuits connected in daisy chain

C21 C22



23215-M1-00

DANGER

IN ORDER TO FLEXIBLY ACCOMMODATE THE VARIOUS SAFETY CATEGORIES REQUIRED BY CUSTOMERS, THIS CONTROLLER IS NOT EQUIPPED WITH AN INTERNAL MAIN POWER SHUTOFF CIRCUIT.
BE SURE TO CONFIGURE AN EXTERNAL MAIN POWER SHUTOFF CIRCUIT TO FORM AN EMERGENCY STOP CIRCUIT.

CAUTION

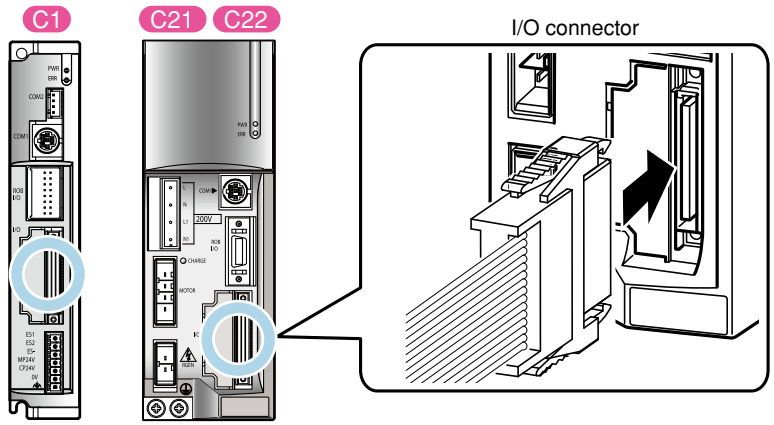
- **Be sure to check the contact capacity of the relay contact. If the capacity is insufficient, use multiple contacts as needed. (*1 in the diagram)**
- **Connect a load with a current of 300 mA or less to the emergency stop wiring using ES1 and ES2. If a load with a current of more than 300 mA is connected or if a current of more than 300 mA flows without connecting any load, the controller may malfunction. (*2 in the diagram.)**

11. Connecting the I/O unit

When purchasing the controller, a desired I/O unit can be selected from the NPN, PNP, CC-Link, and DeviceNet.
The positioning or push operation can be controlled from the host unit, such as PLC through the I/O unit.

■ Parallel I/O (NPN type and PNP type)

Connecting a parallel I/O

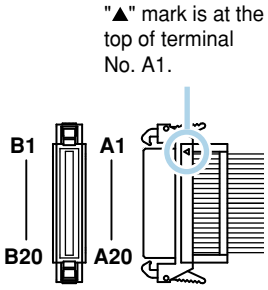


23206-M0-00

CAUTION

- **Use care to avoid incorrect terminal connections and short-circuits between terminals when performing the wiring work. Incorrect wiring could damage the controller. Carefully verify the terminal arrangement, using care to avoid short-circuits between terminals.**
- **The color of the cables for I/O power input (+COM) and point number outputs 0 and 1 (POUT0 and POUT1) is identical. Make the wiring, being careful not to confuse their connections. Wrong wiring may damage the controller.**

	Item	Color	Signal Name	Terminal No.
Outputs	Point No. outputs 0 to 7	Brown	POUT0	B1
		Red	POUT1	B2
		Orange	POUT2	B3
		Yellow	POUT3	B4
		Green	POUT4	B5
		Blue	POUT5	B6
		Purple	POUT6	B7
		Gray	POUT7	B8
	Control output 0	White	OUT0	B9
	Control output 1	Black	OUT1	B10
	Control output 2	Brown	OUT2	B11
	Control output 3	Red	OUT3	B12
	Operation in progress	Orange	BUSY	B13
	End of operation	Yellow	END	B14
	Alarm	Green	/ALM	B15
	Servo status	Blue	SRV-S	B16
No connection		Purple	NC	B17
		Gray		B18
I/O power input, negative common (0V)		White	-COM	B19
		Black		B20

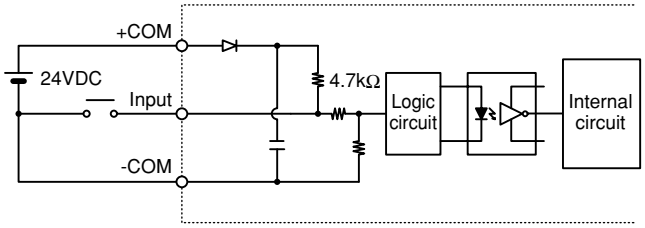


Terminal No.	Signal Name	Color	Content	
A1	+COM	Brown	I/O power input, positive common (24VDC ±10%)	
A2		Red		
A3	NC	Orange	No connection	
A4		Yellow		
A5	PIN0	Green	Inputs	Point No. selections 0 to 7
A6	PIN1	Blue		
A7	PIN2	Purple		
A8	PIN3	Gray		
A9	PIN4	White		
A10	PIN5	Black		
A11	PIN6	Brown		
A12	PIN7	Red		
A13	JOG+	Orange		JOG movement (+)
A14	JOG-	Yellow		JOG movement (-)
A15	MANUAL	Green		MANUAL mode
A16	ORG	Blue		Return-to-origin
A17	/LOCK	Purple		Interlock
A18	START	Gray		Start
A19	RESET	White		Reset
A20	SERVO	Black		Servo ON

23207-M0-00

■ NPN type I/O circuit details

Input circuit

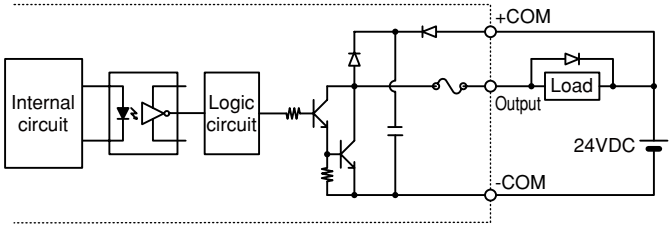


23208-M0-00

Type : DC input (plus common type)
Photo-coupler isolation format

Load : 24VDC ± 10%, 5.1mA
OFF voltage :19.6Vmin (1.0mA)
ON voltage :4.9Vmax (4.0mA)

Output circuit



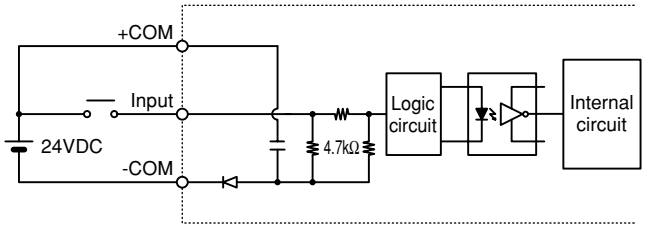
23209-M0-00

Type : NPN open collector output
(Minus common type)
Photo-coupler isolation format

Load : 24VDC, 50mA per point

■ PNP type I/O circuit details

Input circuit

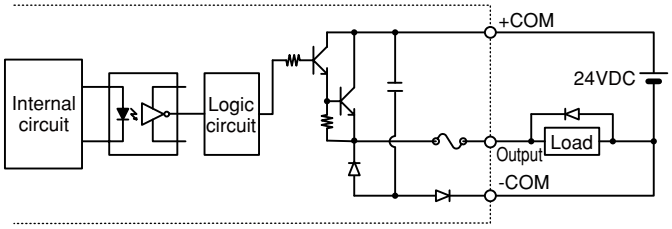


23210-M0-00

Type : DC input (minus common type)
Photo-coupler isolation format

Load : 24VDC ± 10%, 5.5mA
ON voltage :19.6Vmin (4.5mA)
OFF voltage :4.9Vmax (1.1mA)

Output circuit



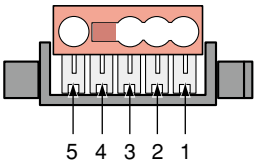
23211-M0-00

Type : PNP open collector output
(Plus common type)
Photo-coupler isolation format

Load : 24VDC, 50mA per point

■ CC-Link

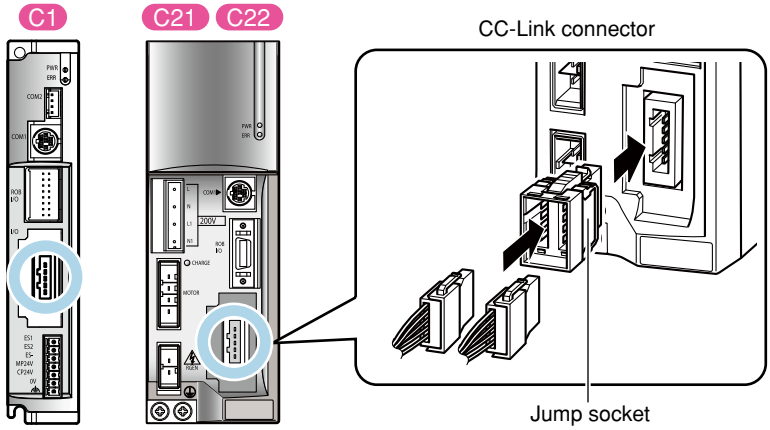
Terminal arrangement and connector specifications



No.	Name
1	DA
2	DB
3	DG
4	NC
5	SLD

23212-M0-00

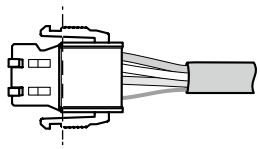
Connection method



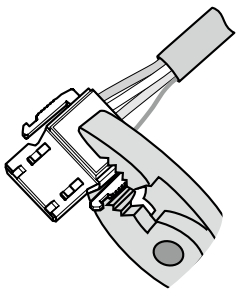
23213-M0-00

	Manufacturer part name	Manufacturer name
CC-LINK connector	35505-6000-B0M GF	3M Japan Corporation
Jump socket	35715-L010-B00 AK	3M Japan Corporation

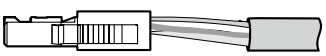
Wiring method



Insert the cable all the way into the connector, and view from the top cover to verify that the wires are fully inserted (to the position of the dotted line).



Position the pliers from the side of the connector, and press the cover onto the body to clamp the connector onto the cable.



Verify that the cover is level with the body, and that there is no gap between the body and the cover.

* We recommend that you use heat-shrink tubing to protect the drain wire and the other wires.

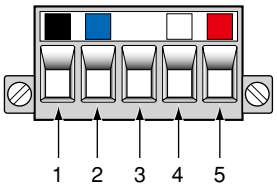
23220-M0-00

NOTE

The CC-Link unit supports CC-Link Ver.1.10. The use of Ver.1.10 compatible CC-Link cable eliminates some restrictions which apply to items such as the cable length between nodes, etc. For details, refer to the instruction manual for the Ver.1.10 compatible master station PLC.

DeviceNet

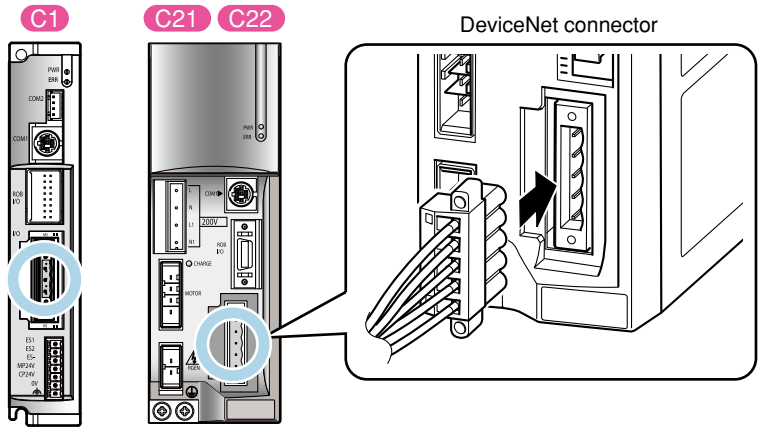
Terminal array and connector specifications



No.	Name
1	V- (Black)
2	CAN_L (Blue)
3	Shield
4	CAN_H (White)
5	V+ (Red)

23214-M0-00

Connection method



23215-M0-00

12. Safety circuit construction example

This section describes category-specific safety circuit configuration examples using a Handy Terminal which has an ENABLE switch.
Customers should install the appropriate safety measures for their system by referring to the safety circuits shown in circuit configuration examples, in order to use single-axis robots more safely.

12.1 Performance level

To comply with the machinery directives, the "performance level (PL)" required of the safety circuit must be evaluated.
Performance levels (PL) are determined by the following parameters:

Major factors that determine performance levels

1. Category
2. MTTFd (Mean Time To Dangerous Failure)
3. DCavg (Average Diagnostic Coverage)
4. CCF (Common Cause Failure) : Checklist score > 65 ?
(Please obtain the data on each component from the component manufacturer.)

The performance level (PL) of a safety circuit is determined by the following flow.

Flow for determining performance levels

1. Determine the "performance level (PLr) required of the safety circuit" by means of risk assessment.
2. Configure the safety circuit that satisfies the requirements of the category that meets PLr.
3. Calculate the safety circuit's "performance level (PL)" from the MTTFd, DCavg, and CCF of the devices used for the safety circuit, and then make sure that the calculated PL is equal to or higher than the "performance level (PLr) required of the safety circuit" (PLr ≤ PL).

In the customer's final system, the performance level (PLr) required of the safety circuit should be determined by means of risk assessment, and then the safety circuit with the corresponding performance level (PL) should be configured.

Safety parts subject to performance level calculation

The table below shows the safety parts and B10d reference values.

CAUTION

Please obtain the latest information from the parts manufacturers.

	Parts Name	Model Name	Manufacturer	B10d
H1	Emergency stop button	HA1E-V2S2R-TK2354	IDEC	1×10^5
HD1	Emergency stop button	HA1E-V2S2R-TK2354	IDEC	1×10^5
	Enable switch	A4E-B200HS	OMRON	1×10^5

12.2 Circuit configuration examples C1

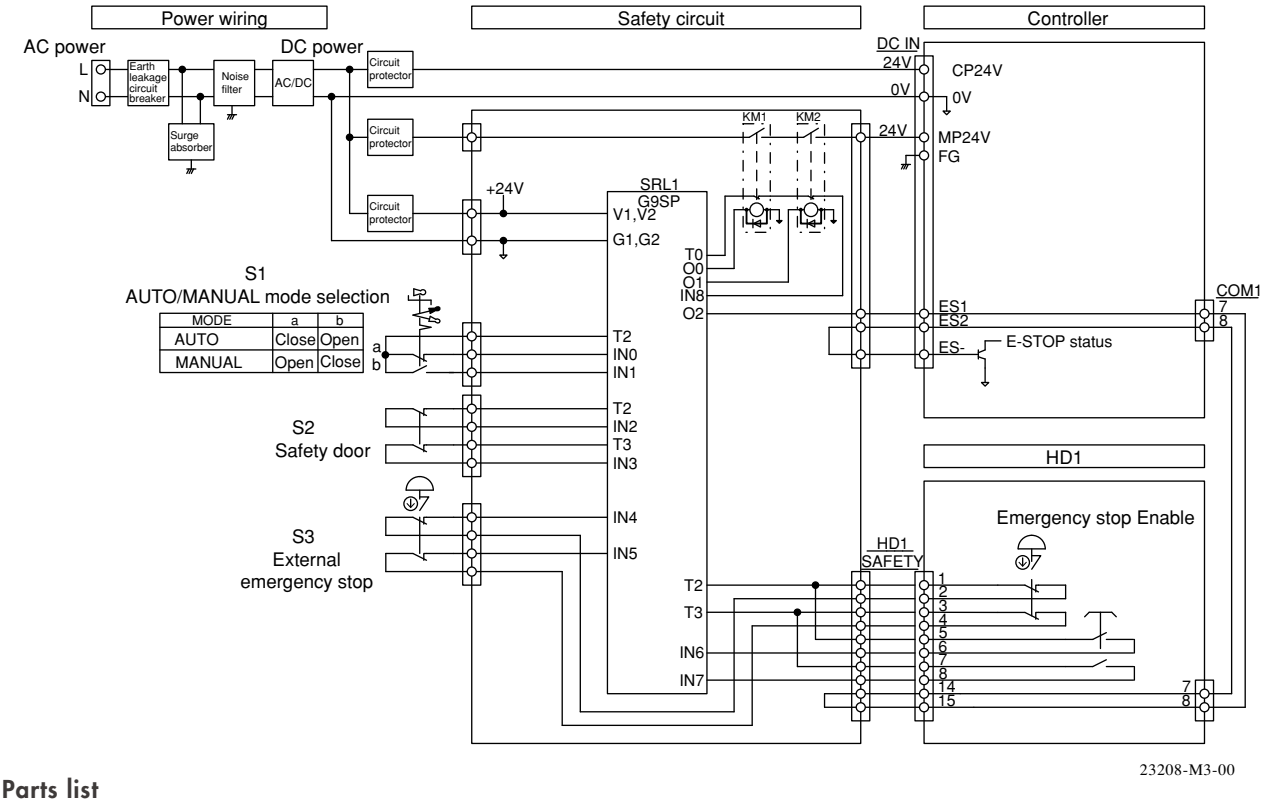
Safety circuit configuration examples are shown below.
Customers should install the appropriate safety measures for their system by referring to these safety circuit configuration examples in order to use the robots more safely.

12.2.1 Category 3

A safety circuit configuration example of category 3 is shown below.

Category 3 safety circuit example

C1



23208-M3-00

Parts list

Circuit No.	Part name	Type No.	Manufacturer
S1	Key selector switch	A22TK series	OMRON
S2	Safety door switch	D4 series	OMRON
S3	Emergency stop button	A22E series	OMRON
KM1,2	Safety relay (linked contact)	G7SA-3A1B	OMRON
	Socket for safety relay	P7SA-10F-ND	OMRON
SRL1	Safety controller	G9SP series	OMRON

12.2.2 Overview of circuit operation

This section describes an overview of the circuit operation for each safety circuit configuration example shown in the previous sections.
The safety controller is programmed so that the operation is performed in the table below.
Additionally, the safety controller is programmed so that it complies with the required standards other than the operations.

Operation mode	Input				Output	
	Mode select switch	Emergency stop button	Safety door	Enable switch	ES-	Relay
AUTO mode outside safety enclosure	Input a: Close Input b: Open	Open	–	–	OFF	OFF
		Close	Open	–	OFF	OFF
			Close	–	ON	ON
				–		
				–		
MANUAL mode inside safety enclosure	Input a: Open Input b: Close	Open	–	–	OFF	OFF
		Close	Close	–	OFF	OFF
			Open	Open	OFF	OFF
				Close	ON	ON

1. Emergency stop operation

When the emergency stop button is pressed, the controller main power (motor drive power) is shut down.
When the emergency stop button is pressed, the category 0 emergency stop is activated regardless of other switch settings.

2. Each mode operation by mode select switch setting

2.1 AUTO mode (Mode select switch setting, input a: Close, input b: Open)

The enable switch of the pendant is disabled, and only if the following conditions are all met the relay turns ON and main power (motor operating power) is supplied to the controller.

Conditions

- The emergency stop switch is closed.
- The safety door is closed.

CAUTION

Connect a dummy connector or HD1 to COM1 on the controller front panel. If the COM1 connector on the controller front panel is open, an emergency stop occurs.

2.2 MANUAL mode (Mode select switch setting, input a: Open, input b: Close)

The enable switch of the pendant is enabled, and only if the following conditions are all met the relay turns ON and main power (motor operating power) is supplied to the controller.

Conditions

- The emergency stop switch is closed.
- The safety door is opened.
- The enable switch of the pendant is closed (center position)

CAUTION

You must disconnect the dummy connector from the COM1 connector on the controller front panel, and connect HD1.

12.3 Circuit configuration examples C21 C22

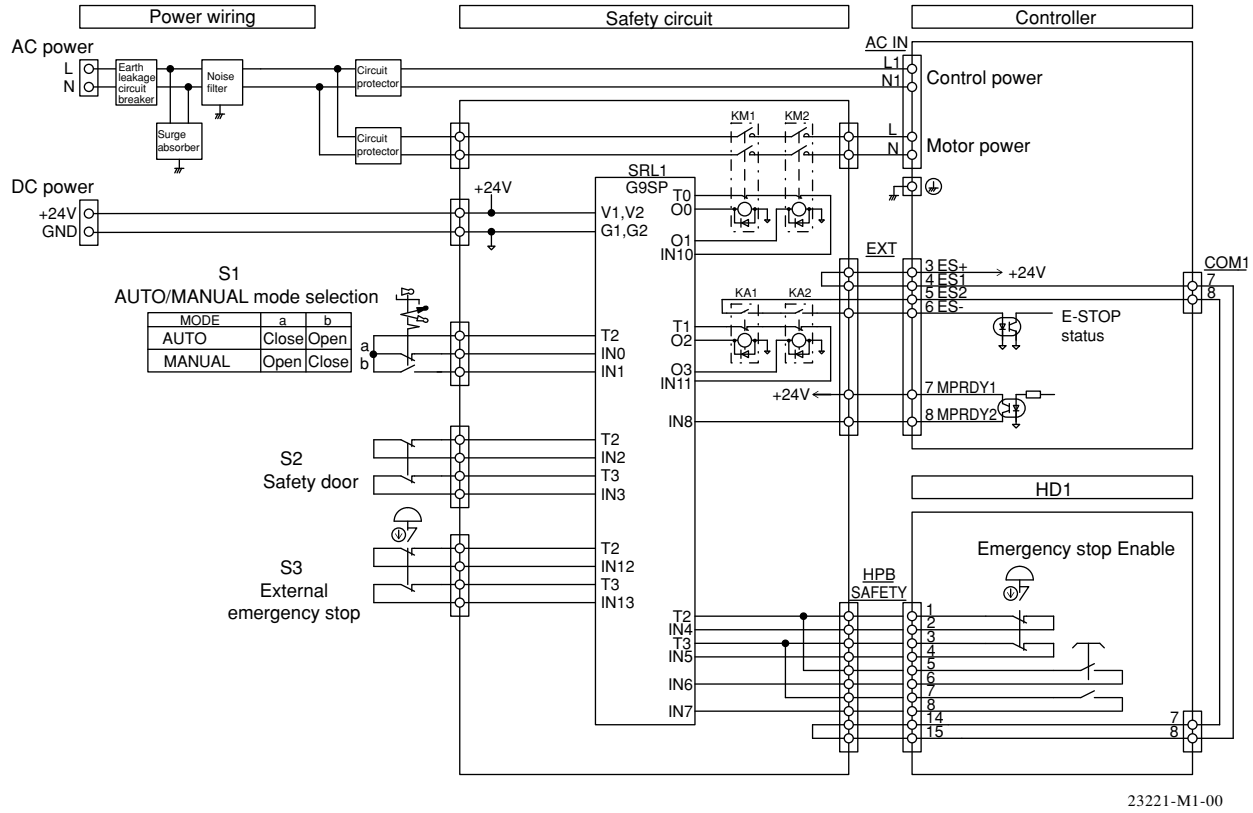
Safety circuit configuration examples are shown below.
Customers should install the appropriate safety measures for their system by referring to these safety circuit configuration examples in order to use the robots more safely.

12.3.1 Category 3

A safety circuit configuration example of category 3 is shown below.

Category 3 safety circuit example

C21 C22



23221-M1-00

Parts list

Circuit No.	Part name	Type No.	Manufacturer
S1	Key selector switch	A22TK series	OMRON
S2	Safety door switch	D4 series	OMRON
S3	Emergency stop switch	A22E series	OMRON
KM1,2	Contactor (mirror contact)	3RT20**-1FB42	SIEMENS
KA1,2	Safety relay	G7SA-3A1B	OMRON
	Socket for safety relay	P7SA-10F-ND	OMRON
SRL1	Safety controller	G9SP series	OMRON

12.3.2 Overview of circuit operation

This section describes an overview of the circuit operation for each safety circuit configuration example shown in the previous sections.
The safety controller is programmed so that the operation is performed in the table below.
Additionally, the safety controller is programmed so that it complies with the required standards other than the operations.

Operation mode	Input					Output	
	Mode select switch	Emergency stop switch	Safety door	Enable switch	MPRDY	ES-	Contactor
AUTO mode outside safety enclosure	Input a: Close Input b: Open	Open	–	–	–	OFF	OFF
		Close	Open	–	–	OFF	OFF
			Close	–	–	ON	OFF
				–	OFF		OFF
				–	ON		ON
MANUAL mode inside safety enclosure	Input a: Open Input b: Close	Open	–	–	–	OFF	OFF
		Close	Close	–	–	OFF	OFF
			Open	Open	–	OFF	OFF
				Close	OFF	ON	OFF
					ON		ON

1. Emergency stop operation

When the emergency stop switch is pressed, the controller main power (motor drive power) is shut down.
When the emergency stop switch is pressed, the category 0 emergency stop is activated regardless of other switch settings.

2. AUTO mode (Mode select switch setting, input a: Close, input b: Open)

2.1 AUTO mode (Mode select switch setting, input a: Close, input b: Open)

The enable switch of the pendant is disabled, and only if the following conditions are all met the contactor turns ON and main power (motor operating power) is supplied to the controller.

Conditions

- The emergency stop switch is closed.
- The safety door is closed.
- The MP RDY signal is on. (Output from the controller when the controller main power is ready to turn on.)

CAUTION
Connect a dummy connector or HD1 to COM1 on the controller front panel. If the COM1 connector on the controller front panel is open, an emergency stop occurs.

2.2 MANUAL mode (Mode select switch setting, input a: Open, input b: Close)

The enable switch of the pendant is enabled, and only if the following conditions are all met the contactor turns ON and main power (motor operating power) is supplied to the controller.

Conditions

- The emergency stop switch is closed.
- The safety door is opened.
- The enable switch of the pendant is closed (intermediate position).
- The MP RDY signal is on. (Output from the controller when the controller main power is ready to turn on.)

CAUTION
You must disconnect the dummy connector from the COM1 connector on the controller front panel, and connect HD1.

Chapter 3 Data setting

Contents

1. Data overview 3-1
1.1 Overview 3-1
2. Point data 3-2
2.1 "Standard setting" type 3-3
2.2 "Custom setting" type 3-4
3. Point data details 3-5
4. Parameter data 3-9
4.1 Parameter list 3-9
4.1.1 RUN parameters 3-9
4.1.2 I/O parameters 3-10
4.1.3 Option parameters 3-10
4.1.4 Servo parameters 3-11
4.2 Parameter details 3-11
4.2.1 RUN parameters 3-11
4.2.2 I/O parameters 3-14
4.2.3 Servo parameters 3-16
4.2.4 Option parameters 3-17
4.2.5 CC-Link 3-17
4.2.6 DeviceNet 3-18

1. Data overview

1.1 Overview

Point data and parameter data settings must be specified in order to operate a robot from a C1/C21/C22 controller.

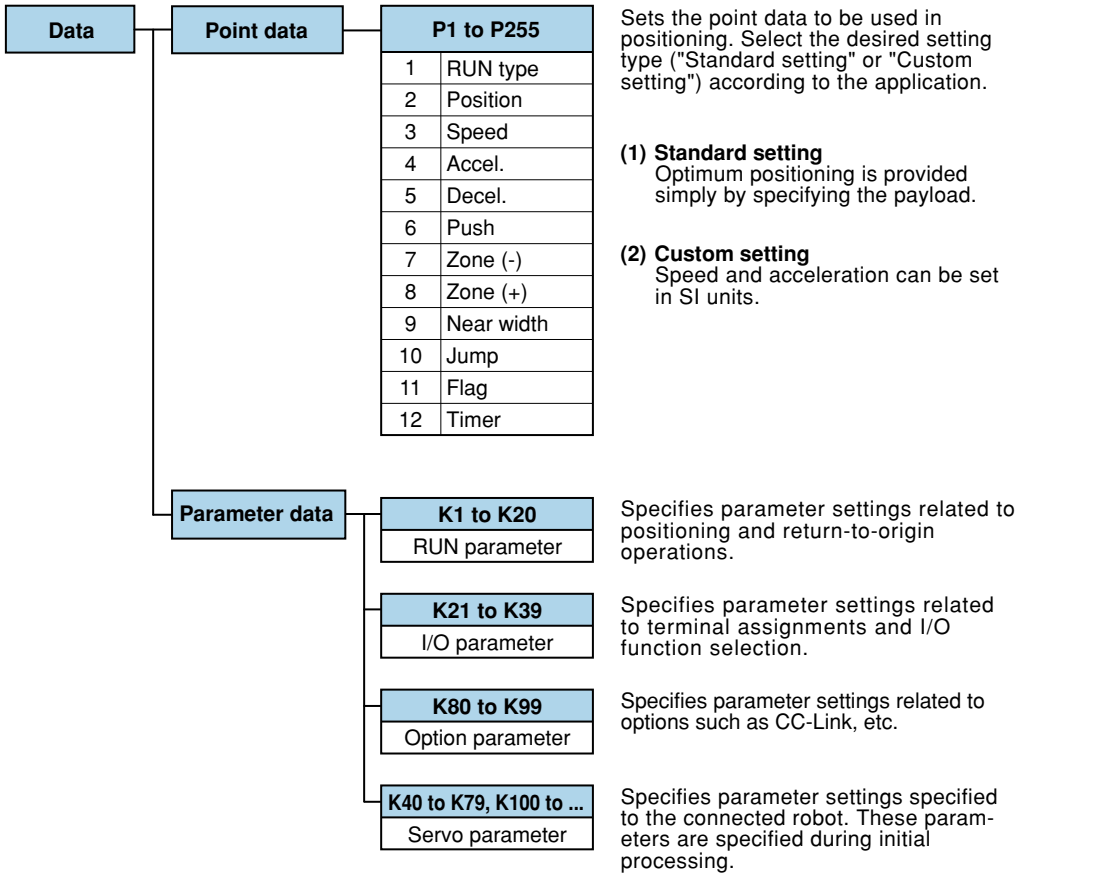
Point data

The point data used in positioning operations includes items such as the "RUN type", "Position", and "Speed", etc.
Up to 255 points (P1 to P255) can be registered.
There are two point data setting types: "Standard setting" type that automatically defines optimal positioning simply by specifying the payload and "Custom setting" type that allows setting the speed (mm/s) and acceleration (m/s^2) in SI units.
Select the desired setting type according to the application.

Parameter data

Parameter data is divided into the following categories: "RUN parameters", "I/O parameters", "Option parameters", and "Servo parameters".

Data configuration



23301-M0-00

2. Point data

The point data includes items such as the "RUN type", "Position", and "Speed", etc.

■ Point data item list

P1 to P255		
Item		Description
1	RUN type	Specifies the positioning operation pattern.
2	Position	Specifies the positioning target position or movement amount.
3	Speed	Specifies the positioning speed.
4	Accel.	Specifies the positioning acceleration.
5	Decel.	Specifies the positioning deceleration (as a percentage of the acceleration).
6	Push	Specifies the electrical current limit value for "Push" operations.
7	Zone (-)	Specifies the "personal zone" output range.
8	Zone (+)	
9	Near width	Specifies the "near width" zone (distance tolerance relative to target position).
10	Jump	Specifies the next movement destination, or the next merge operation merge destination point No. following positioning completion.
11	Flag	Specifies other information related to the positioning operation.
12	Timer	Specifies the waiting time (delay) after positioning completion.

■ "Standard setting" and "Custom setting"

There are 2 setting types for point data ("Standard setting" or "Custom setting"). Select the desired setting type according to the application.
The maximum number of setting points for both setting types is 255 points (P1 to P255).

Setting Type	Description
Standard setting	Optimum positioning is provided simply by specifying the payload. This setting type is well-suited to assembly and transport applications.
Custom setting	Allows changing the speed and acceleration in SI units so the desired positioning operation can be set. This setting type is suited for machining and inspection systems.

■ "Standard setting" and "Custom setting" selection

Specify the "Point Type" setting as "Standard setting" or "Custom setting" when creating new data with the support software (RS-Manager).

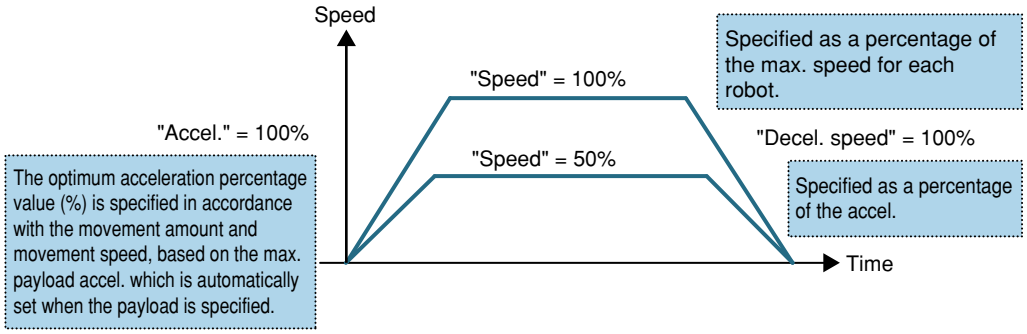
CAUTION

- **The "Point Type" ("Standard setting" or "Custom setting") can be selected only when creating new robot data with the support software (RS-Manager).**
- **Changing the "Point Type" setting clears all point data which has been in use. Be sure to specify the "Point Type" setting before editing the point data.**

2.1 "Standard setting" type

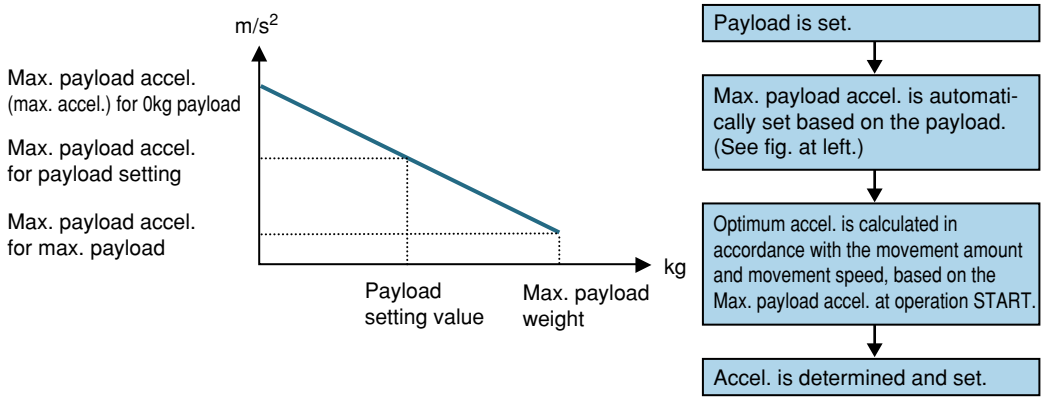
The optimum acceleration is automatically set simply by specifying the desired payload.

Speed and acceleration concept



23302-M0-00

Acceleration calculating algorithm



23303-M0-00

TIP

Payload settings are specified at the K76 (Payload 1) and K78 (Payload 2) servo parameters. (See section 4.2, "Parameter details" of this manual for details.)
If 2 payloads have been set, either setting can be selected for each point data. (See the "Flag" item in section 3, "Point data details" of this manual for details.)

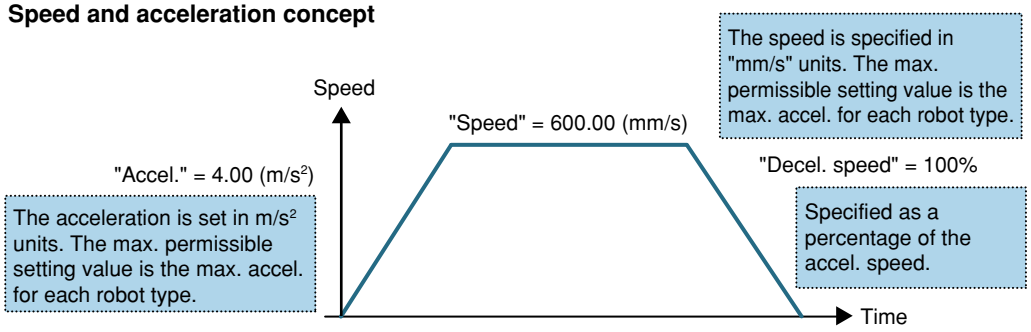
■ Point data setting range and default settings

Data Item		Setting Range	Units	Default
1	RUN type	1 to 8 (8 types)	-	1
2	Position	-9999.99 to 9999.99	mm	0.00
3	Speed	1 to 100	%	100
4	Accel.	1 to 100	%	100
5	Decel.	1 to 100	%	100
6	Push	C1 : 1 to upper limit (depends on robot type) C21/C22 : 1 to 100	%	C1 : Depends on robot type C21/C22 : 100
7	Zone (-)	-9999.99 to 9999.99	mm	0.00
8	Zone (+)			
9	Near width	0.00 to 9999.99	mm	1.00
10	Jump	0 to 255	-	0
11	Flag	C1 : 0 to 3 C21/C22 : 0 to 1	-	0
12	Timer	0 to 30000	ms	0.00

2.2 "Custom setting" type

This setting type allows a more detailed positioning operation.

Speed and acceleration concept



23304-M0-00

TIP

The payload setting is specified by servo parameter K76 (Payload 1). (See section 4.2, "Parameter details" of this manual for details.)

Point data setting range and default settings

	Data Item	Setting Range	Units	Default
1	RUN type	1 to 8 (8 types)	-	1
2	Position	-9999.99 to 9999.99	mm	0.00
3	Speed	0.01 to upper limit (depends on robot type) Depends on robot type	mm/s	Depends on robot type
4	Accel.	0.01 to upper limit (depends on robot type) Depends on robot type	m/s²	Depends on robot type
5	Decel.	1 to 100	%	100
6	Push	C1 : 1 to upper limit (depends on robot type) C1/C22 : 1 to 100	%	C1 : Depends on robot type C21/C22 : 100
7	Zone (-)	-9999.99 to 9999.99	mm	0.00
8	Zone (+)			
9	Near width	0.00 to 9999.99	mm	1.00
10	Jump	0 to 255	-	0
11	Flag	C1 : 0 to 3 C21/C22 : 0 to 1	-	0
12	Timer	0 to 30000	ms	0.00

TIP

"Depends on robot type" indicates that the default setting varies according to the robot type being used.

CAUTION

When the "Custom setting" type is selected, the max. permissible accel. setting value is the max. accel. for each robot type. However, if a payload is registered, operation will not occur at an acceleration which exceeds the max. accel. (max. payload accel.) which has been determined based on the payload.

3. Point data details

This section explains the details of each point data item.

1. RUN type

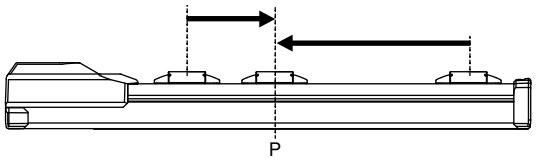
Specifies the positioning operation pattern.

TIP

For details on positioning operation, ABS (absolute position movement), and INC (relative position movement), see section 3, "Positioning operation", in Chapter 5.

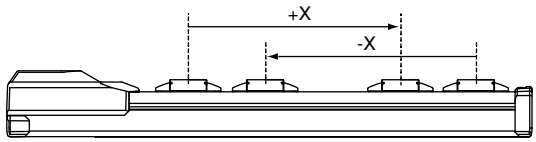
1. ABS

Moves to absolute coordinate P relative to the origin point and completes positioning.



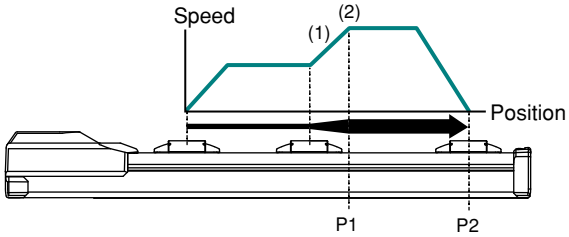
2. INC

Moves a specified distance X from the current position and completes positioning.



3. ABS Merge

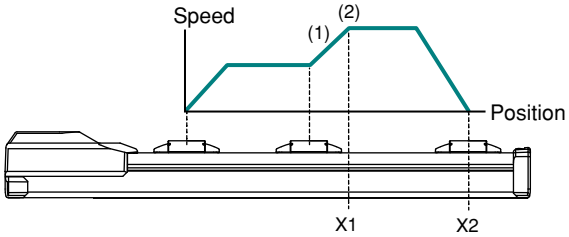
Moves to multiple points in succession while changing the speed but not decelerating and stopping.



P1 and P2 are absolute coordinates relative to the origin point.
(1) Accelerates to the speed specified by point 2.
(2) After reaching P1, moves to P2 without decelerating to stop.

4. INC Merge

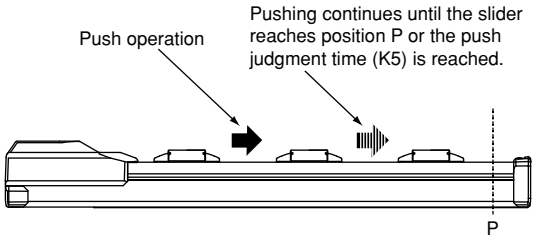
Moves to multiple points in succession while changing the speed but not decelerating and stopping.



Moves a specified distance from the current position of the slider.
(1) Accelerates to the speed specified by point 2.
(2) After reaching X1, moves to X2 without decelerating to stop.

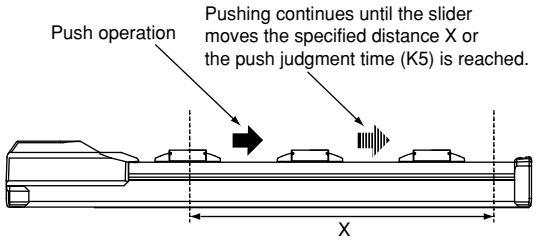
5. ABS Push

Moves while pushing at a preset push force.
Position P is an absolute coordinate relative to the origin point.



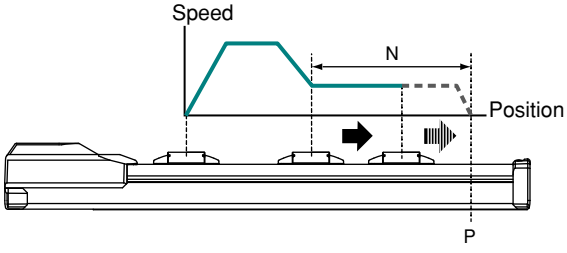
6. INC Push

Moves while pushing at a preset push force.
X is the specified distance from the current position.



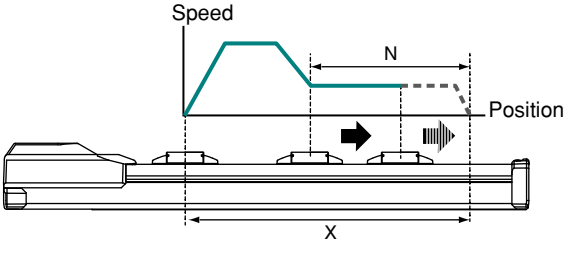
7. ABS → Push

Starts push operation at the speed specified by the push speed (K6) parameter after completing deceleration at a distance equal to "Near width (N)" from position P.
Pushing continues until the slider reaches position P or the push judgment time (K5) is reached.
Position P is an absolute coordinated relative to the origin point.



8. INC → Push

Starts push operation at the speed specified by the push speed (K6) parameter after completing deceleration at a distance equal to "Near width" from the target position.
Pushing continues until the slider moves the specified distance X or the push judgment time (K5) is reached.



23305-M0-00

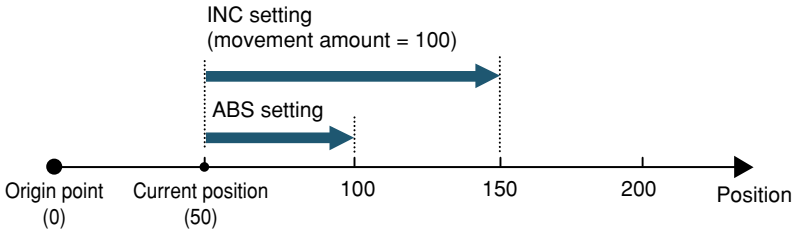
2. Position

Specifies the positioning target position or movement amount.

- When the "RUN type" is specified as "ABS (absolute position) ..... Target position.
- When the "RUN type" is specified as "INC (relative position)..... Movement amount from current position.

The illustration below shows a positioning example when a "Position = 100 (mm)" point data setting has been specified.

ABS and INC settings



23306-M0-00

3. Speed

Specifies the positioning speed.

- Standard setting..... The speed is specified as a percentage (%) of each robot's max. speed.
- Custom setting ..... The speed is specified in mm/s units.

CAUTION

In the case of push operation, make this setting so that the movement speed does not exceed 20.00 (mm/s).

4. Accel.

Specifies the positioning acceleration.

- Standard setting..... The acceleration is specified as a percentage (%) of each operation's optimum acceleration.
- Custom setting ..... The acceleration is specified in m/s^2 units.

WARNING

PAYLOAD, ACCELERATION, AND DECELERATION SETTINGS WHICH DIFFER GREATLY FROM THE ACTUAL VALUES WILL RESULT IN OPERATION TIME LOSS, SHORTEN THE ROBOT LIFE, AND CAUSE VIBRATION. BE SURE TO SET THEM TO APPROPRIATE VALUES.

5. Decel.

Specifies the positioning deceleration setting as a percentage (%) of the accel. setting value.

<Setting examples>

- For "Standard setting" with an "Accel." setting of 80% and a "Decel." setting of 70%:
  80%×70% = 56% (56% of the optimum accel.).
- For "Custom setting" with an "Accel." setting of 4.00 (m/s^2) and a "Decel." setting of 70%:
  4.00 (m/s^2)×70% = 2.80 (m/s^2).

6. Push

Specifies the electrical current limit value during a push operation. The push force is specified as a percentage (%) of each robot's rated current.

CAUTION

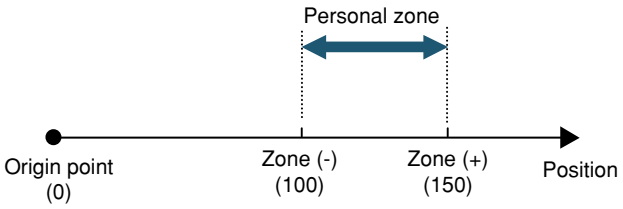
A 100% "push force" is equal to the rated current, and the thrust generated by the rated current is called the "rated thrust". The rated thrust indicated by each robot's specifications is the theoretical (guideline) thrust when the motor is running at its rated current. The actual thrust varies according to friction conditions, etc..

7. Zone (-)
8. Zone (+)

"Zone (-)" specifies the personal zone output (PZONE) range's lower limit (minus-direction limit).
"Zone (+)" specifies the personal zone output (PZONE) range's upper limit (plus-direction limit).
The personal zone output can be specified for each point data, and it switches ON when the robot's current position enters the personal zone.

The following example shows a personal zone set as the absolute position range of 100 to 150mm, as measured from the origin point.

Personal zone setting example (absolute position)

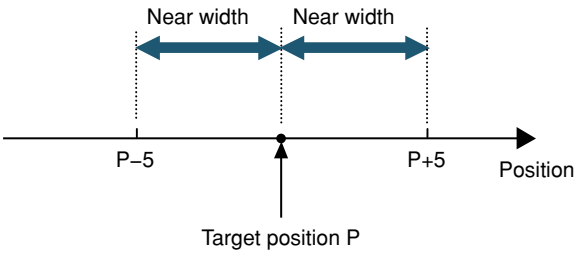


23307-M0-00

9. Near width

Specifies the near width zone (distance tolerance relative to target position) for the "near width output". The "near width output" switches ON while the robot is passing through the near width zone.
When the RUN type is "Decel → Push", this range represents the position (distance from target position) where deceleration ends and the push status begins.

Example for a setting of "Near width = 5mm"

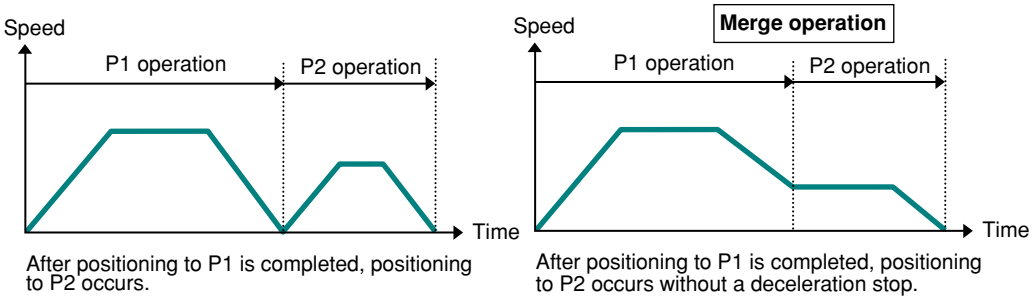


23308-M0-00

10. Jump

Specifies the next point No. when movement to a next operation is to occur after a positioning completion. If this setting is specified as "0", there is no movement to a next point (operation ends).
In merge operations, this setting specifies the merge destination point No.

Setting example of "Jump = 2"



23309-M0-00

11. Flag

Specifies the following setting items with regard to the positioning operation.

Bit Setting	Setting Item	Setting Value / Setting Range
bit0	Payload select	Standard setting: Selects the payload setting for positioning operations. Custom setting: Limits the max. payload accel. which is determined according to the payload. 0: Payload 1 (K76) 1: Payload 2 (K78)
bit1 C1	Stop mode select	Selects the control method during stop state after positioning operations. 0: Closed mode 1: Open mode

* This function is available from Ver. 1.10.121 onwards.

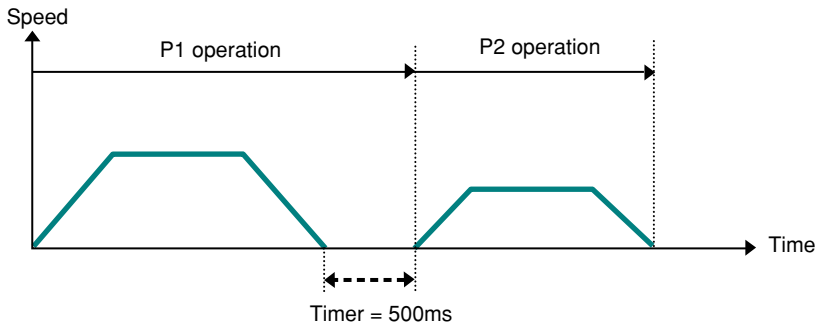
TIP

For details about how to select the payload, see section 7.4, "Changing the payload", in Chapter 5. For details about stop mode C1, see section 7.5, "Stop mode" in Chapter 5.

12. Timer

Specifies the waiting time (delay) before proceeding to the next specified (by Jump setting) operation following the completion of a positioning operation. This setting is disabled in merge operations.

Setting example of "Timer = 500ms"



After completion of the P1 operation, there is a 500ms delay (wait) before the P2 operation begins.

23310-M0-00

4. Parameter data

The 4 types of parameter data are shown below.

Type	Description
RUN parameter	These parameters are required for robot operation, and they include "soft limit" and "zone" settings.
I/O parameter	These parameters are for terminal assignment and I/O functions.
Option parameter	These parameters are for optional settings (CC-Link and DeviceNet, etc.), and include the "node No." and "baud rate" settings.
Servo parameter	These parameters are robot-specific parameters, and they include "encoder pulse count", "gain", "rating", and "max. current" settings.

4.1 Parameter list

At the initializing routine, all parameters are set to their default values in accordance with the specifications of the selected robot and the payload. The following list shows the parameter setting ranges and default settings.

NOTE

For details regarding parameters see section 4.2, "Parameter details".

4.1.1 RUN parameters

- **Positioning**

No.	Name	Setting / Setting Range	Units*	Default	Restart
1	(-) soft limit	-9999.99 to 9999.99	mm	0.00	-
2	(+) soft limit	-9999.99 to 9999.99	mm	Depends on robot type	-
3	In-position	0.01 to 1.00	mm	0.01	-
4	Push mode	0: Continue push after judgment, no push failure judgment 1: Positioning after judgment, no push failure judgment 2: Continue push after judgment, with push failure judgment 3: Positioning after judgment, with push failure judgment	-	0	-
5	Push judge time	1 to 60000	ms	10	-
6	Push speed	0.01 to 20.00	mm/s	Depends on robot type	-
7	Zone (-)	-9999.99 to 9999.99	mm	0.00	-
8	Zone (+)	-9999.99 to 9999.99	mm	0.00	-
9	Speed override	1 to 100	%	100	-
10	JOG speed	1 to 100	%	100	-
11	Inching width	0.01 to 1.00	mm	1.00	-
12	MOVE output level	0.01 to 100.00	mm/s	0.01	-

- **Return-to-origin**

No.	Name	Setting / Setting Range	Units*	Default	Restart
13	Origin speed	0.01 to 100.00	mm/s	Depends on robot type	-
14	Origin dir.	0: CCW direction; 1: CW direction	-	Depends on robot type	-
15	Origin coordi.	0: Standard; 1: Reversed	-	0	-
16	Origin shift	-9999.99 to 9999.99	mm	0.00	-

• Speed switch

No.	Name	Setting / Setting Range	Units	Default	Restart
17	Speed switch function	0: Disable 1: Enable	-	0	-
18	Switched speed	1 to 100	%	10	-

4.1.2 I/O parameters

• Terminal assignment

No.	Name	Setting / Setting Range	Units	Default	Restart
21	OUT0 select	0: No output 1: PZONE 2: NEAR 3: TLM-S 4: ORG-S 5: ZONE 6. MOVE 7: /WARN 8: MANU-S 9: /ES-S 10: RCOM-A	-	1	Required
22	OUT1 select		-	2	Required
23	OUT2 select		-	3	Required
24	OUT3 select		-	4	Required
25	POUT select	0: None 1: At positioning completion (AFTER) 2: At positioning start (WITH)	-	1	Required

• Function selection

No.	Name	Setting / Setting Range	Units	Default	Restart
30	Alarm No. output function	0: Disable 1: Enable	-	0	-
31	SERVO sequence	0: Edge 1: Level	-	0	-
32	JOG response time	0: JOG movement only 1 to 1000: Inching at leading edge, with JOG movement after specified time elapses.	ms	0	-
33	Input filter	1 to 10	ms	2	-

• Communication

No.	Name	Setting / Setting Range	Units	Default	Restart
38	Node (controller)	1 to 16	-	1	-

4.1.3 Option parameters

• I/O function

No.	Name	Setting / Setting Range	Units	Default	Restart
80	Option enable	0: Disable 1: Enable	-	1	-

• CC-Link

No.	Name	Setting / Setting Range	Units	Default	Restart
81	Node	1 to 64	-	1	Required
82	Transmission rate	0: 156Kbps 1: 625Kbps 2: 2.5Mbps 3: 5Mbps 4: 10Mbps	-	4	Required

• DeviceNet

No.	Name	Setting / Setting Range	Units	Default	Restart
81	Node	0 to 63	-	0	Required
82	Transmission rate	0: 125Kbps 1: 250Kbps 2: 500Kbps	-	2	Required

4.1.4 Servo parameters

• **Controller setting** C21 C22

No.	Name	Setting / Setting Range	Units	Default	Restart
74	Absolute setting	0: Disable 1: Enable	-	1	Required

• **Adjustment**

No.	Name	Setting / Setting Range	Units	Default	Restart
76	Payload 1	0 to max. payload (K47)	kg	Depends on robot type	-
77	Max. payload accel.1 *1	-	m/s^2	Depends on robot type	-
78	Payload 2	0 to max. payload (K47)	kg	Depends on robot type	-
79	Max. payload accel.2 *2	-	m/s^2	Depends on robot type	-

*1. When "payload 1" (K76) is registered, this setting is converted to a value calculated by the prescribed formula.
*2. When "payload 2" (K78) is registered, this setting is converted to a value calculated by the prescribed formula.

• **Stop mode** C1

No.	Name	Setting / Setting Range	Units	Default	Restart
123	Stop mode setting	0 to 1	-	0	-
124	Stop mode switching time	0 to 5000	ms	200	-
125	Holding current during stop	0 to 100	%	Depends on robot type	-

4.2 Parameter details

The parameters described below can be adjusted to conform to the actual application and usage conditions.

4.2.1 RUN parameters

• **Positioning related parameters**

		Setting Range	Default	Units	Restar
K1 K2	Soft limit (-) Soft limit (+)	-9999.99 to 9999.99	Depends on robot type	mm	-

Function

Specifies the robot movement range. K1 specifies the minus-side limit, and K2 specifies the plus-side limit. Although the robot's effective stroke is factory-set as the soft limit when shipped, it should be changed if necessary to avoid collisions with obstacles, etc.

WARNING

SOFT LIMIT FUNCTION IS NOT A SAFETY-RELATED FUNCTION INTENDED TO PROTECT THE HUMAN BODY.
TO RESTRICT THE ROBOT MOVEMENT RANGE TO PROTECT THE HUMAN BODY, USE THE MECHANICAL STOPPERS INSTALLED IN THE ROBOT (OR AVAILABLE AS OPTIONS).

TIP

The plus and minus directions differ according to the "origin coordi." (K15) setting. For soft limit details, see section 7.1, "Soft limit function", in Chapter 5.

		Setting Range	Default	Units	Restart
K3	In-position	0.01 to 1.00	0.01	mm	-

Function

Specifies the range in which end-of-positioning is recognized.

		Setting Range	Default	Units	Restart
K4	Push mode	0 to 3	0	-	-

Function

Specifies the push operation following a push judgment, and specifies the push failure judgment ("nothing was pushed" judgment).

Settings

Setting Value	Description
0	Push continuation after completion, with no failure judgment.
1	Positioning after completion, with no failure judgment.
2	Push continuation after completion, with failure judgment.
3	Positioning after completion, with failure judgment.

		Setting Range	Default	Units	Restart
K5	Push judgment time	1 to 60000	10	ms	-

Function
Specifies the time from "push start" to "push end" at push operations.

		Setting Range	Default	Units	Restart
K6	Push speed	0.01 to 20.00	Depends on robot type	mm/s	-

Function
Specifies the push speed after deceleration at "Decel. push" operations.

		Setting Range	Default	Units	Restart
K7 K8	Zone (-) Zone (+)	-9999.99 to 9999.99	0.00	mm	-

Function
Specifies the zone output (ZONE) range's upper and lower limits.

TIP

For zone output details, see section 7.2, "Zone output function", in Chapter 5.

		Setting Range	Default	Units	Restart
K9	Speed override	1 to 100	100	%	-

Function
Performs an override (uniform adjustment) of the speed specified for the positioning operation.

		Setting Range	Default	Units	Restart
K10	JOG speed	1 to 100	100	%	-

Function
Specifies the JOG movement speed. A setting of 100% is 100mm/s.

		Setting Range	Default	Units	Restart
K11	Inching width	0.01 to 1.00	1.00	mm	-

Function
Specifies the inching width (amount) for JOG movement.

		Setting Range	Default	Units	Restart
K12	MOVE output level	0.01 to100.00	0.01	mm/s	-

Function
Specifies the minimum movement speed which is output by the MOVE (movement-in-progress) output.

• Return-to-origin related parameters

K13	Return-to-origin speed	Setting Range	Default	Units	Restart
		0.01 to 100.00	Depends on robot type	mm/s	-

Function

Specifies the return-to-origin movement speed.

CAUTION

An alarm may occur during return-to-origin operation if the return-to-origin speed is set too high. Always set it to an appropriate value.

K14	Return-to-origin direction	Setting Range	Default	Units	Restart
		0 to 1	Depends on robot type	-	-

Function

Specifies the return-to-origin direction.

Settings

Setting Value	Description
0	CCW
1	CW

K15	Origin Coordi.	Setting Range	Default	Units	Restart
		0 to 1	0	-	-

Function

Specifies the coordinate system polarity.

Settings

Setting Value	Description
0	Standard (Plus-polarity is opposite direction from return-to-origin direction.)
1	Reverse (Plus-polarity is same direction as return-to-origin direction)

K16	Origin shift	Setting Range	Default	Units	Restart
		-9999.99 to 9999.99	0.00	mm	-

Function

Specifies the coordinates of the return-to-origin end position.

• Speed switch

K17	Speed switch function	Setting Range	Default	Units	Restart
		0 to 1	0	-	-

Function

Enables/disables the speed switch function.

Settings

Settings	Description
0	Disable
1	Enable

CAUTION

This function is available from controller's software version 1.06.111 onwards. This parameter can be changed from the H1 with software version 1.09 onwards and the RS-Manager with software version 1.2.1 onwards.

NOTE

Refer to section 3.8, "Speed switch function", in Chapter 5 for more details.

K18	Switched speed	Setting Range	Default	Units	Restart
		1 to 100	10	%	-

Function

Specifies the speed to be used after "Speed switch" has been performed. The maximum speed to be used by the speed switch function will be calculated by multiplying the current maximum speed by the value set in this parameter.

CAUTION

This function is available from controller's software version 1.06.111 onwards. The parameter can be changed by the H1 with the software version 1.09 onwards and by the RS-Manager with the software version 1.2.1 onwards.

NOTE

Refer to section 3.8, "Speed switch function", in Chapter 5 for more details.

4.2.2 I/O parameters

• Terminal assignment related parameters

No.	Name	Setting / Setting Range	Default	Units	Restart
K21	OUT0 select	0 to 10	1	-	Required
K22	OUT1 select	0 to 10	2	-	Required
K23	OUT2 select	0 to 10	3	-	Required
K24	OUT3 select	0 to 10	4	-	Required

Function

Specifies the functional signals (shown below) for the control outputs (OUT0 to OUT3).

Settings

Setting Value	Signal Type	Description	Setting Value	Signal Type	Description
0	–	No output	6	MOVE	Movement-in-progress
1	PZONE	Personal zone output	7	/WARN	Warning output
2	NEAR	NEAR output	8	MANU-S	MANUAL mode status
3	TLM-S	Push status	9	/ES-S	Emergency stop status
4	ORG-S	Return-to-origin end status	10	RCOM-A	Remote command response output
5	ZONE	Zone output			

CAUTION

The setting values 9 and 10 are available from controller's software version 1.14.138 onwards. Editing / referring to them is enabled by H1 (from version 1.17 onwards) / RS-Manager (from version 1.4.5 onwards).

K25	POUT select	Setting Range	Default	Units	Restart
		0 to 2	1	-	Required

Function

Specifies the output timing for the POUT0 to POUT7 point No. outputs.

Settings

Setting Value	Description
0	No output
1	Output at positioning end (AFTER)
2	Output at movement start (WITH)

• **Function selection related parameters**

K30	Alarm No. output function	Setting Range	Default	Units	Restart
		0 to 1	0	-	-

Function

Enables/disables the alarm No. output function.

Settings

Setting Value	Description
0	Disable
1	Enable

TIP

For details regarding alarm No. outputs, see section 7.3, "Alarm No. output function", in Chapter 5.

K31	SERVO sequence	Setting Range	Default	Units	Restart
		0 to 1	0	-	-

Function

Specifies the SERVO input's servo ON/OFF conditions.

Settings

Setting Value	Description
0	Edge (servo ON at leading edge, servo OFF at trailing edge)
1	Level (ON: servo on; OFF: servo off)

K32	JOG response time	Setting Range	Default	Units	Restart
		0 to 1000	0	ms	-

Function

Specifies the JOG movement sequence at JOG+/JOG- inputs.

Settings

Setting Value	Description
0	JOG operation only
1 to 1000	Inching operation + JOG operation after specified time elapses

K33	Input filter	Setting Range	Default	Units	Restart
		1 to 10	2	ms	-

Function

Specifies the filter processing time for inputs from the host unit. The larger the setting value, the longer the filtering time, and the slower the response to the input.

K38	Node (controller)	Setting Range	Default	Units	Restart
		1 to 16	1	-	-

Function

Specifies the node number for a daisy-chained controller.

4.2.3 Servo parameters

• **Controller setting** C21 C22

K74	Absolute setting	Setting Range	Default	Units	Restart
		0 to 1	1	-	Required

Function

This function can be set from RS-Manager Ver.1.4.6 and later.

Settings

Setting value	Description
0	Disable
1	Enable

• **Adjustment**

K76	Payload 1	Setting Range	Default	Units	Restart
		0 to ... (depends on robot type)	Depends on robot type	kg	-

Function

Specifies the maximum weight of objects (tools, workpieces, etc.) which can be mounted on the robot. Based on this setting, the maximum acceleration (max. payload accel. 1 (K77)) for each robot type is automatically calculated and set.

WARNING

PAYLOAD, ACCELERATION, AND DECELERATION SETTINGS WHICH DIFFER GREATLY FROM THE ACTUAL VALUES WILL RESULT IN OPERATION TIME LOSS, SHORTEN THE ROBOT LIFE, AND CAUSE VIBRATION. BE SURE TO SET THEM TO APPROPRIATE VALUES.

TIP

For payload details, see section 7.4, "Changing the payload", in Chapter 5.

K77	Max. payload accel. 1	Setting Range	Default	Units	Restart
		-	Depends on robot type	m/s^2	-

Function

Specifies the maximum payload acceleration defined by the "Payload 1" (K76) parameter. This is a "read only" parameter.

K78	Payload 2	Setting Range	Default	Units	Restart
		0 to ... (depends on robot type)	Depends on robot type	kg	-

Function

Specifies the maximum weight of objects (tools, workpieces, etc.) which can be mounted on the robot. The maximum acceleration (max. payload accel. 2 (K79)) for each robot type is automatically calculated and set based on this setting.

WARNING

PAYLOAD, ACCELERATION, AND DECELERATION SETTINGS WHICH DIFFER GREATLY FROM THE ACTUAL VALUES WILL RESULT IN OPERATION TIME LOSS, SHORTEN THE ROBOT LIFE, AND CAUSE VIBRATION. BE SURE TO SET THEM TO APPROPRIATE VALUES.

TIP

For payload details, see section 7.4, "Changing the payload", in Chapter 5.

K79	Max. payload accel. 2	Setting Range	Default	Units	Restart
		-	Depends on robot type	m/s^2	-

Function

Specifies the maximum payload acceleration defined by the "Payload 2" (K78) parameter. This is a "read only" parameter.

• **Stop mode** C1

K123	Stop mode setting	Setting Range	Default	Units	Restart
		0 to 1	0	-	-

Function

Specifies the stop mode.

Settings

Setting value	Description
0	Closed mode
1	Open mode

TIP

For details regarding the stop mode, see section 7.5, "Stop mode", in Chapter 5.

K124	Stop mode switching time	Setting Range	Default	Units	Restart
		0 to 5000	200	ms	-

Function

Specifies the time to wait before shifting to the stop mode after positioning is completed.

K125	Holding current during stop	Setting Range	Default	Units	Restart
		0 to 100	Depends on robot type	%	-

Function

Specifies the holding current when the stop mode is in open mode. A setting of 100% is the rated current for each robot type.

4.2.4 Option parameters

K80	Option enable	Setting Range	Default	Units	Restart
		0 to 1	1	-	-

Function

Specifies the I/O enable/disable setting.

Settings

Setting Value	Description
0	Disable
1	Enable

4.2.5 CC-Link

K81	CC-Link node	Setting Range	Default	Units	Restart
		1 to 64	1	-	Required

Function

Specifies the CC-Link communication node.

K82	CC-Link speed	Setting Range	Default	Units	Restart
		0 to 4	4	-	Required

Function

Specifies the CC-Link baud rate.

Settings

Setting Value	Description
0	156Kbps
1	625Kbps
2	2.5Mbps
3	5Mbps
4	10Mbps

CAUTION

The baud rate setting specified here must be the same as the baud rate specified at the master station. A normal data link cannot be established if the settings are not the same.

4.2.6 DeviceNet

		Setting Range	Default	Units	Restart
K81	DeviceNet node	0 to 63	0	-	Required

Function

Specifies the DeviceNet communication node.

		Setting Range	Default	Units	Restart
K82	DeviceNet speed	0 to 2	2	-	Required

Function

Specifies the DeviceNet baud rate.

Settings

Setting Value	Description
0	125Kbps
1	250Kbps
2	500Kbps

CAUTION

The baud rate setting specified here must be the same as the baud rate specified at the master station. A normal data link cannot be established if the settings are not the same.

Chapter 4 I/O signal functions

Contents

1. I/O specifications 4-1
1.1 NPN and PNP type 4-1
1.2 CC-Link type 4-2
1.3 DeviceNet type 4-4
2. I/O signal list 4-5
3. I/O signal details 4-6
3.1 Input signal details 4-6
3.2 Output signal details 4-8

1. I/O specifications

The C1/C21/C22 controller allows positioning and push operations to be controlled from a host unit such as a PLC, etc., by way of an I/O interface. The I/O specifications for the I/O interface are shown below. (Selected at the time of purchase.)

I/O Specification		Explanation
Parallel I/O	NPN	16 input points, 24VDC ± 10%, 5.1mA/point, plus common 16 output points, 24VDC ± 10%, 50mA/point, sync type
	PNP	16 input points, 24VDC ± 10%, 5.5mA/point, minus common 16 output points, 24VDC ± 10%, 50mA/point, source type
Serial I/O	CC-Link	CC-Link Ver.1.10 compatible, remote device station (1 station)
	DeviceNet	Number of channels occupied by DeviceNet slaves: Inputs: 6CH; Outputs: 6CH.

1.1 NPN and PNP type

Both the NPN and PNP types have 16 input points and 16 output points.

■ I/O signal table

No.	Signal Name	Description		No.	Signal Name	Description	
A1	+COM	I/O power input, positive common (24VDC ±10%)		B1	POUT0	Outputs	Point No. outputs
A2				B2	POUT1		
A3	NC	No connection		B3	POUT2		
A4	NC			B4	POUT3		
A5	PIN0	Inputs	Point No. select	B5	POUT4		
A6	PIN1			B6	POUT5		
A7	PIN2			B7	POUT6		
A8	PIN3			B8	POUT7		
A9	PIN4			B9	OUT0		Control outputs
A10	PIN5			B10	OUT1		
A11	PIN6			B11	OUT2		
A12	PIN7			B12	OUT3		
A13	JOG+		JOG movement (+ direction)	B13	BUSY		Operation-in-progress
A14	JOG-		JOG movement (- direction)	B14	END		Operation-end
A15	MANUAL		MANUAL mode	B15	/ALM		Alarm
A16	ORG		Return-to-origin	B16	SRV-S		Servo status
A17	/LOCK		Interlock	B17	NC	No connection	
A18	START		Start	B18	NC		
A19	RESET		Reset	B19	-COM	I/O power input, negative common (0V)	
A20	SERVO		Servo ON	B20			

1.2 CC-Link type

Operation occurs as a CC-Link remote device station, on a one-unit to one-station basis.

NOTE

"Station No." and "baud rate" settings must be specified in order for the C1/C21/C22 controller to be recognized as remote station in the CC-Link system. These settings can be specified in the support software (RS-Manager), or from the H1. (For the setting procedure, see section 5.3 "Setting Option parameters".)

■ Remote I/O (bit I/O)

Input (Master → Remote)			Output (Remote → Master)		
No.	Signal Name	Description	No.	Signal Name	Description
RYn0	PIN0	Point No. select	RXn0	POUT0	Point No. output
RYn1	PIN1		RXn1	POUT1	
RYn2	PIN2		RXn2	POUT2	
RYn3	PIN3		RXn3	POUT3	
RYn4	PIN4		RXn4	POUT4	
RYn5	PIN5		RXn5	POUT5	
RYn6	PIN6		RXn6	POUT6	
RYn7	PIN7		RXn7	POUT7	
RYn8	JOG+	JOG movement (+ direction)	RXn8	OUT0	Control output
RYn9	JOG-	JOG movement (- direction)	RXn9	OUT1	
RYnA	MANUAL	MANUAL mode	RXnA	OUT2	
RYnB	ORG	Return-to-origin	RXnB	OUT3	
RYnC	/LOCK	Interlock	RXnC	BUSY	Operation-in-progress
RYnD	START	Start	RXnD	END	Operation-end
RYnE	RESET	Reset	RXnE	/ALM	Alarm
RYnF	SERVO	Servo ON	RXnF	SRV-S	Servo status
RY(n+1)0	-	-	RX(n+1)0	-	-
RY(n+1)1	-	-	RX(n+1)1	-	-
RY(n+1)2	-	-	RX(n+1)2	-	-
RY(n+1)3	-	-	RX(n+1)3	-	-
RY(n+1)4	-	-	RX(n+1)4	-	-
RY(n+1)5	-	-	RX(n+1)5	-	-
RY(n+1)6	-	-	RX(n+1)6	-	-
RY(n+1)7	-	-	RX(n+1)7	-	-
RY(n+1)8	-	-	RX(n+1)8	-	-
RY(n+1)9	-	-	RX(n+1)9	-	-
RY(n+1)A	-	-	RX(n+1)A	-	-
RY(n+1)B	-	-	RX(n+1)B	R-RDY	Remote READY
RY(n+1)C	-	-	RX(n+1)C	-	-
RY(n+1)D	-	-	RX(n+1)D	-	-
RY(n+1)E	-	-	RX(n+1)E	-	-
RY(n+1)F	-	-	RX(n+1)F	-	-

n: Value determined by CC-Link station No. setting.

Remote registers (word I/O)

Remote commands can be executed by using the 4-word input and 4-word output remote registers.

Inputs (Master → Remote)			Output (Remote → Master)		
Address	**Signal Name**	**Description**	**Address**	**Signal Name**	**Description**
RWwn	WIN0	Execution command	RWrn	WOUT0	Status
RWwn+1	WIN1	Command option	RWrn+1	WOUT1	Command response
RWwn+2	WIN2		RWrn+2	WOUT2	
RWwn+3	WIN3		RWrn+3	WOUT3	

n: Value determined by CC-Link station No. setting.

1.3 DeviceNet type

Operate as slave stations, with each unit occupying 6 input and 6 output channels.

NOTE

MAC ID and baud rate settings are required in order for C1/C21/C22 controller to be properly recognized as a slave station in the DeviceNet system. These settings can be specified from the support software (RS-Manager), or from the H1. (For the setting procedure, see section 5.3 "Setting Option parameters".)

■ Remote I/O (bit I/O)

Inputs (Master → Remote)				Output (Remote → Master)			
Channel No.		Signal Name	Description	Channel No.		Signal Name	Description
m	bit0	PIN0	Point No. selection	n	bit0	POUT0	Point No. output
	bit1	PIN1			bit1	POUT1	
	bit2	PIN2			bit2	POUT2	
	bit3	PIN3			bit3	POUT3	
	bit4	PIN4			bit4	POUT4	
	bit5	PIN5			bit5	POUT5	
	bit6	PIN6			bit6	POUT6	
	bit7	PIN7			bit7	POUT7	
	bit8	JOG+	Jog movement (+direction)		bit8	OUT0	Control output
	bit9	JOG-	Jog movement (-direction)		bit9	OUT1	
	bit10	MANUAL	Manual mode		bit10	OUT2	
	bit11	ORG	Return-to-origin		bit11	OUT3	
	bit12	/LOCK	Interlock		bit12	BUSY	Operation-in-progress
	bit13	START	Start		bit13	END	Operation-end
	bit14	RESET	Reset		bit14	/ALM	Alarm
	bit15	SERVO	Servo ON		bit15	SRV-S	Servo status
m+1	bit0	-	-	n+1	bit0	-	-
	bit1	-	-		bit1	-	-
	bit2	-	-		bit2	-	-
	bit3	-	-		bit3	-	-
	bit4	-	-		bit4	-	-
	bit5	-	-		bit5	-	-
	bit6	-	-		bit6	-	-
	bit7	-	-		bit7	-	-
	bit8	-	-		bit8	-	-
	bit9	-	-		bit9	-	-
	bit10	-	-		bit10	-	-
	bit11	-	-		bit11	-	-
	bit12	-	-		bit12	-	-
	bit13	-	-		bit13	-	-
	bit14	-	-		bit14	-	-
	bit15	-	-		bit15	-	-

"m", "n": These values are determined in accordance with the channel setting.

■ Remote registers (word I/O)

Remote commands can be executed by using the 4-word input and 4-word output areas.

Inputs (Master → Remote)			Output (Remote → Master)		
Channel No.	Signal Name	Description	Channel No.	Signal Name	Description
m+2	WIN0	Execution command	n+2	WOUT0	Status
m+3	WIN1	Command option	n+3	WOUT1	Command response
m+4	WIN2		n+4	WOUT2	
m+5	WIN3		n+5	WOUT3	

"m", "n": These values are determined in accordance with the channel setting.

2. I/O signal list

A list of the I/O signals is given below. For details regarding each signal, refer to section 3 "I/O signal details".

Type	Signal Name	Meaning	Description
Inputs	PIN0 to PIN7	Point No. select 0 to 7	• Specifies the point No. for the positioning operation. • Specifies the point No. for current position teaching (MANUAL mode).
	JOG+	JOG movement (+ direction)	Plus-direction movement occurs while ON (MANUAL mode)
	JOG-	JOG movement (- direction)	Minus-direction movement occurs while ON (MANUAL mode)
	SPD	Speed switch	Enabled when assigned to the JOG+ signal, with Speed switch function set to "Enable" and MANUAL set to "OFF". Performs the positioning operation at the speed set in "Switched speed".
	MANUAL	MANUAL mode	ON: MANUAL mode
	ORG	Return-to-origin	Begins a return-to-origin.
	/LOCK	Interlock	ON: movement enabled; OFF: movement disabled; If switched OFF during movement, a deceleration stop occurs.
	START	Start	Begins positioning to the specified point.
	TEACH	Current position teach	Enabled when assigned to the START signal, with /LOCK set to OFF in the MANUAL mode. Sets (teaches) the current position at the specified point No.
	RESET	Reset	• Alarm reset • Point No. output reset • Relative positioning "remaining movement amount" clear
	SERVO	Servo ON	ON: servo on; OFF: servo off.
Outputs	POUT0 to POUT7	Point No. output 0 to 7	• Outputs the point No. of the positioning operation. • Outputs the alarm No. of the alarm which occurred.
	OUT0	Control output 0	Assigns the following outputs by I/O parameter setting: • Zone output • Personal zone output • MANUAL mode status • Return-to-origin end status • Push status • Warning output • NEAR output • Movement-in-progress output • Emergency stop status • Remote command response output
	OUT1	Control output 1	
	OUT2	Control output 2	
	OUT3	Control output 3	
	ZONE *1	Zone output	ON when robot enters the parameter-specified zone.
	PZONE *1	Personal zone output	ON when specified zone for each point is entered.
	MANU-S *1	MANUAL mode status	ON when in the MANUAL mode.
	ORG-S *1	Return-to-origin end status	ON at return-to-origin end.
	TLM-S *1	Push status	ON during push operation.
	/WARN *1	Warning output	OFF when a warning alarm occurs.
	NEAR *1	NEAR output	ON near the end of positioning.
	MOVE *1	Movement-in-progress	ON while movement is in progress.
	/ES-S *1	Emergency stop status	ON at emergency stop.
	RCOM-A *1	Remote command response output	ON at remote command responding.
	BUSY	Operation-in-progress	ON while operation is in progress.
	END	Operation end	Operation result output; ON at normal end.
	/ALM	Alarm	ON when normal. OFF when alarm occurs.
	SRV-S	Servo status	ON when servo is on.

*1. Used for OUT0 to OUT3 signal assignment by parameter selection. The factory settings when shipped are as follows: OUT0 = PZONE, OUT1 = NEAR, OUT2 = TLM-S, OUT3 = ORG-S.

3. I/O signal details

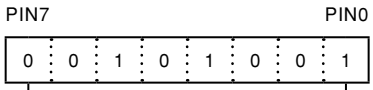
This section explains the I/O signals in detail.

3.1 Input signal details

■ PIN0 to PIN7 (Point No. Select)

These inputs are read as 8-bit binary code Point Nos. when the START and TEACH commands are executed.

• **Input example**



Sum at ON		Example
2^0	1	Total = 41 (Point No.41)
2^1	0	
2^2	0	
2^3	8	
2^4	0	
2^5	32	
2^6	0	
2^7	0	

■ JOG+ / JOG-

While this input is ON in the MANUAL mode, JOG movement to the specified direction's (+/-) soft limit occurs. When this input switches OFF, a deceleration stop occurs. (See section 4.2, "JOG movement", in Chapter 5.)

■ SPD

Switches the overall positioning operation speed between two levels.
* Assigned to JOG+ terminal when "Speed switch function" (K17) is set to "Enable".
* This cannot be assigned when in MANUAL mode (MANUAL=ON).

CAUTION

This function is available from controller's software version 1.06.111 onwards.

NOTE

Refer to section 3.8, "Speed switch function", in Chapter 5 for more details.

■ MANUAL

The MANUAL mode is established when this input switches ON. The MANUAL mode status is output to MANU-S.

■ ORG

This input executes a return-to-origin operation, thereby setting the robot's coordinates and enabling positioning operations. The return-to-origin method varies according to the robot type and configuration. (See section 2, "Origin search (return-to-origin)", in Chapter 5.)

■ /LOCK (interlock)

A deceleration stop occurs if this input switches OFF during operation. This input must be ON in order to operate the robot.

WARNING

INTERLOCKS ARE NOT SAFETY INPUTS, AND SHOULD NOT BE USED FOR SAFETY PURPOSES.
SERVOS DO NOT SWITCH OFF EVEN IF AN INTERLOCK IS APPLIED.

START

This input begins positioning to the point data specified by the PIN0 to PIN7 point No. select input.

NOTE

This input is enabled only when the MANUAL mode is OFF.

TEACH

This input sets (teaches) the current position at the point data position specified by PIN0 to PIN7 (point No. select).

NOTE

The TEACH input is only enabled when in the MANUAL mode (MANUAL = ON), with the /LOCK (interlock) input OFF.

RESET

The following operations occur at the leading edge of the RESET signal ON.

(1) Alarm reset

After an alarm has occurred and its cause has been eliminated, the alarm status is cleared when this signal is switched ON. After the alarm status clears, the /ALM signal switches ON.
Some alarm statuses cannot be cleared by the RESET signal. (See Chapter 6 "Troubleshooting".)

(2) Point No. output clear

The POUT0 to POUT7 outputs are reset (all points OFF).

(3) Relative positioning's "remaining movement amount" clear

When restarted after a relative positioning stop, the "remaining movement amount" for the previous relative positioning operation is cleared.

SERVO

A servo ON status is established while this signal is ON. The servo ON status is output to SRV-S.
A servo ON is not possible while an alarm is active.

CAUTION

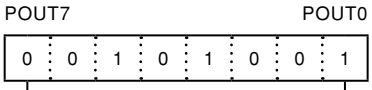
A "servo OFF" should be performed only when operation is stopped. Do not use "servo OFF" to perform emergency stops.

3.2 Output signal details

■ POUT0 to POUT7 (point No. output)

Outputs the current positioning operation's point No. as a binary output. When an alarm occurs, these signals output the alarm No. as a binary output.

• **Output example**



Sum at ON	Example	
2^0	1	Total = 41 (Point No.41)
2^1	0	
2^2	0	
2^3	8	
2^4	0	
2^5	32	
2^6	0	
2^7	0	

■ OUT0 to OUT3 (control outputs)

Performs the following outputs which have been assigned by the OUT0 Select (K21) to OUT3 Select (K24) I/O parameters.

No.	Signal Type	Description	Default
0	-	No output	-
1	PZONE	Personal zone output	OUT0
2	NEAR	NEAR output	OUT1
3	TLM-S	Push status	OUT2
4	ORG-S	Return-to-origin end status	OUT3
5	ZONE	Zone output	-
6	MOVE	Movement-in-progress	-
7	/WARN	Warning output	-
8	MANU-S	MANUAL mode status	-
9	/ES-S	Emergency stop status	-
10	RCOM-A	Remote command response output	-

■ BUSY

This signal is ON while operation is in progress.

TIP

• The "BUSY" ON conditions are "operation in progress" OR "RUN command input in progress".

■ END

Outputs the operation's execution result. This signal switches OFF during operation, and switches ON if operation ends normally. If the operation ends in error, this signal remains OFF.

TIP

The END signal will not switch ON after a normal operation stop if the RUN command input is ON. The END signal switches ON only after the RUN command input switches OFF.

■ /ALM

This signal is ON during a normal status, and switches OFF when an alarm occurs.

■ SRV-S

This signal is ON while a "servo ON" status exists, and switches OFF when a "servo OFF" status occurs.

PZONE

This signal switches ON during a positioning operation when the current position enters the point data's "Zone+" and "Zone-". After positioning ends, this signal remains enabled until the next positioning operation is executed.
This signal is enabled only when assigned to one of the OUT0 to OUT3 control outputs.

NEAR

This signal switches ON during a positioning operation when the current position enters tolerance distance range versus the target position (the tolerance distance is specified by the point data's "Near Width" setting). After positioning ends, this signal remains enabled until the next positioning operation is executed.
This signal is enabled only when assigned to one of the OUT0 to OUT3 control outputs.

TLM-S

This signal output is ON during a push operation.
This signal is enabled only when assigned to one of the OUT0 to OUT3 control outputs.

ORG-S

This signal output is ON when return-to-origin is complete, and is OFF when incomplete.
This signal is enabled only when assigned to one of the OUT0 to OUT3 control outputs.

ZONE

This signal switches ON only while the current position is within the zone specified by the "Zone (-)" and "Zone (+)" parameters, and it can be used to verify the robot position at the host unit, or to identify zones where movement is permitted or prohibited, etc.
This signal is enabled only when assigned to one of the OUT0 to OUT3 control outputs. It is disabled until a return-to-origin is completed.

MOVE

This signal switches ON while movement is in progress (while the actual speed exceeds the "movement-in-progress" output level (K12)). This signal is enabled only when assigned to one of the OUT0 to OUT3 control outputs.

/WARN

This signal remains OFF while a warning alarm is active, and is enabled only when assigned to one of the OUT0 to OUT3 control outputs.

MANU-S

This signal switches ON when the MANUAL mode input switches ON, and switches OFF when the MANUAL mode inputs switches OFF.
This signal is enabled only when assigned to one of the OUT0 to OUT3 control outputs.

Emergency stop status (/ES-S)

ON output at emergency stop.
Effective only when it is assigned to one of control output. (OUT0 to OUT3)

Remote command response output (RCOM-A)

ON output at remote command responding.
Effective only when it is assigned to one of control output. (OUT0 to OUT3)

READY (R-RDY)

This signal outputs the CC-Link communication status. This signal is ON when the communication status is normal. (This signal is enabled only when using the CC-Link option.)

Chapter 5 Operation

Contents

1. Operation procedure 5-1

1.1 Overall operation timing chart 5-1
1.1.1 C1 5-1
1.1.2 C21 C22 5-2
1.1.3 Communication check (field network) 5-3
1.2 Alarm occurrence and clearing 5-4

2. Origin search (return-to-origin) 5-5

2.1 Origin point detection method 5-5
2.2 Origin point and coordinates relationship 5-6
2.3 Return-to-origin timing chart 5-7

3. Positioning operation 5-8

3.1 Basic operation 5-8
3.2 Positioning timing chart 5-11
3.3 Positioning merge operation 5-13
3.4 Push operation 5-15
3.5 Deceleration push operation 5-17
3.6 Continuous operation 5-18
3.7 Output function 5-19
3.8 Speed switch function 5-20
3.9 Operation examples 5-21

4. MANUAL mode 5-24

4.1 MANUAL mode timing chart 5-24
4.2 JOG movement 5-25
4.3 TEACH (Teaching) 5-26

5. Remote commands 5-27

5.1 Overview 5-27
5.2 Remote command list 5-27
5.3 Timing chart 5-31
5.4 Query 5-32
5.5 Point data writing 5-33
5.6 Point data reading 5-34
5.7 Parameter data writing 5-35

5.8 Parameter data reading 5-36
5.9 Continuous query 5-37
5.10 Positioning operation 5-38
5.11 Special operations 5-40
5.12 Special codes 5-40

6. Operation modes 5-41

7. Other functions 5-42

7.1 Soft limit function 5-42
7.2 Zone output function 5-42
7.3 Alarm No. output function 5-43
7.4 Changing the payload 5-43
7.5 Stop mode C1 5-44

8. LED status indicators 5-44

1. Operation procedure

1.1 Overall operation timing chart

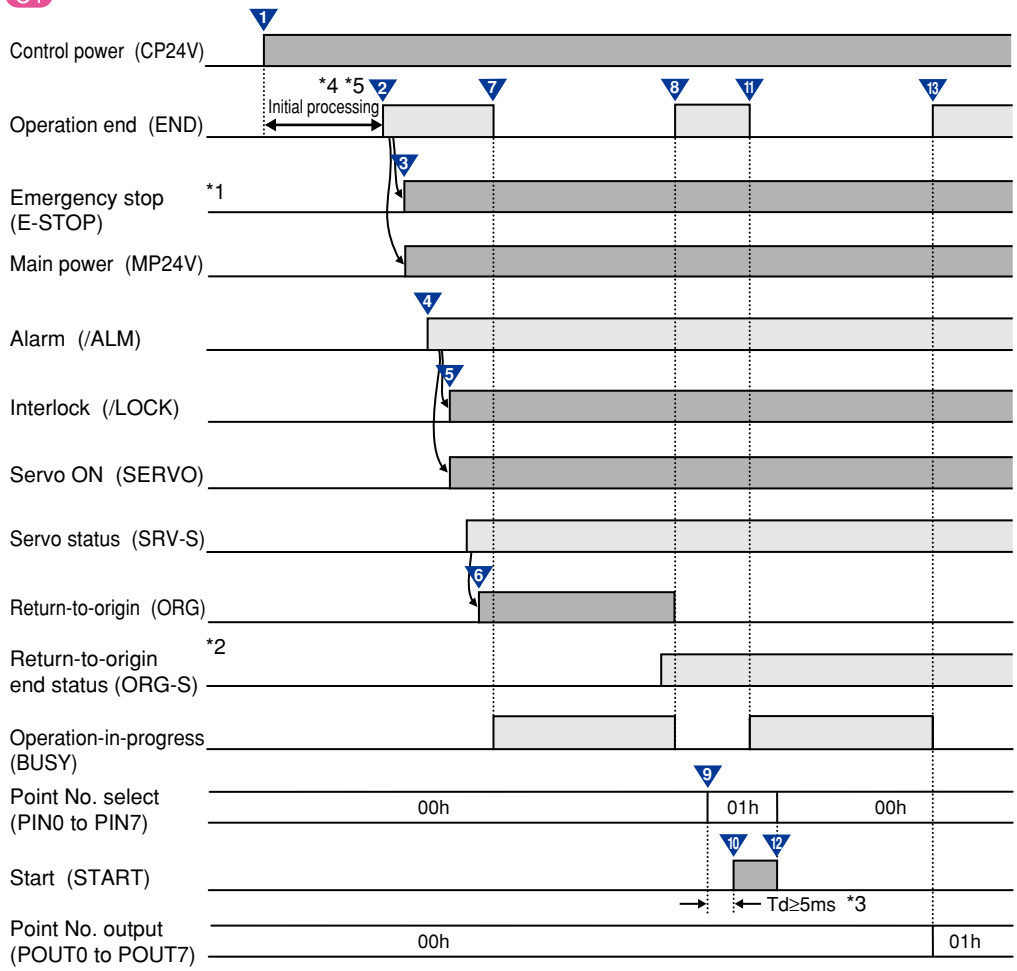
The operation timing chart from "power ON" to the "positioning operation" is shown below.

1.1.1 C1

The following shows the timing chart of the C1 controller.

From power ON to positioning operation

C1



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1: Turn the control power ON.
2: After initial processing is completed the END signals switch ON.
3: The safety circuit and main circuit switch ON.
4: The /ALM signal switches ON.
5: The /LOCK and SERVO inputs switch ON.
6: After the SRV-S signal switches ON, the ORG input switches ON.
7: The END signal switches OFF when the return-to-origin begins, and BUSY switches on.
8: The ORG input switches OFF when the ORG-S signal switches ON. At this time, END switches ON, and BUSY switches OFF.
9: The PIN0 to PIN7 inputs occur.
10: The START input switches ON after the Td delay period elapses.
11: The END signal switches OFF when positioning begins, and BUSY switches ON.
12: The START input switches OFF.
13: The END signal switches ON when positioning ends, and BUSY switches OFF. The specified positioning point No. is output (this output is also possible when the robot starts moving.).

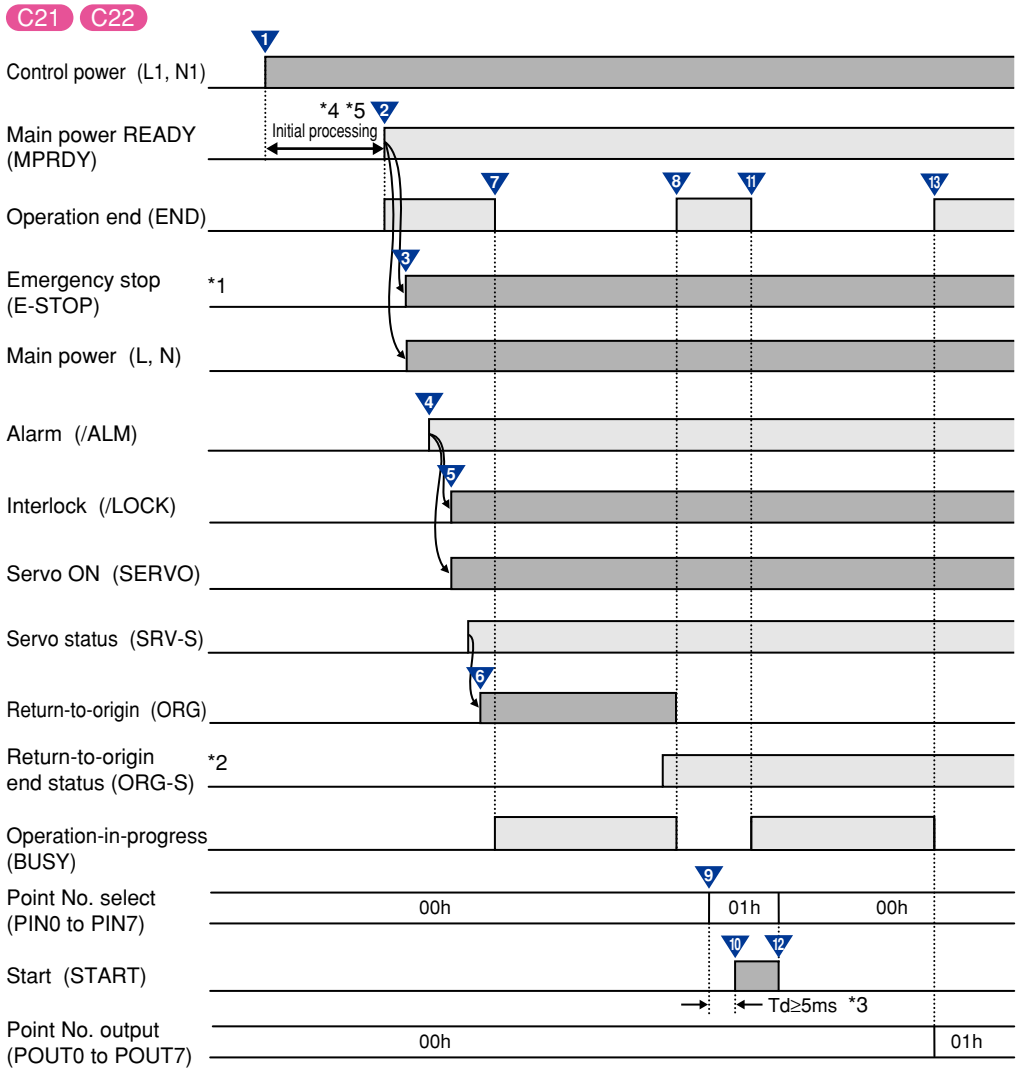
*1 : For details regarding how to configure "emergency stop" and "main power" related safety circuits (external main power breaker circuit), see section 9, "Configuring an emergency stop circuit", in Chapter 2.
*2 : The ORG-S signal is assigned to one of the OUT0 to OUT3 control outputs. It is factory-assigned to OUT3 prior to shipment.
*3 : A delay of 5ms or longer is required between the point No. input and the START command input in order to ensure that the point No. is specified.
*4 : It takes approx. 1 sec. When the initial processing is completed, the END output switches ON. However, when a field network option, such as CC-Link is installed, this period of time until the END is output may differ. (For details, see section 1.1.3, "Communication check (field network)", in Chapter 5.)
*5 : Data may be output from the COM port on the controller during initial processing. Discard all of those data.

1.1.2 C21 C22

The following shows the timing chart of the C21/C22 controller.

From power ON to positioning operation

C21 C22



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1: Turn the control power ON.
2: After initial processing is completed the MPRDY and END signals switch ON.
3: The safety circuit and main circuit switch ON.
4: The /ALM signal switches ON.
5: The /LOCK and SERVO inputs switch ON.
6: After the SRV-S signal switches ON, the ORG input switches ON.
7: The END signal switches OFF when the return-to-origin begins, and BUSY switches on.
8: The ORG input switches OFF when the ORG-S signal switches ON. At this time, END switches ON, and BUSY switches OFF.
9: The PIN0 to PIN7 inputs occur.
10: The START input switches ON after the Td delay period elapses.
11: The END signal switches OFF when positioning begins, and BUSY switches ON.
12: The START input switches OFF.
13: The END signal switches ON when positioning ends, and BUSY switches OFF. The specified positioning point No. is output (this output is also possible when the robot starts moving.).

*1 : For details regarding how to configure "emergency stop" and "main power" related safety circuits (external main power breaker circuit), see section 10.2, "Wiring and connecting the EXT connector", in Chapter 2.

*2 : The ORG-S signal is assigned to one of the OUT0 to OUT3 control outputs. It is factory-assigned to OUT3 prior to shipment.

*3 : A delay of 5ms or longer is required between the point No. input and the START command input in order to ensure that the point No. is specified.

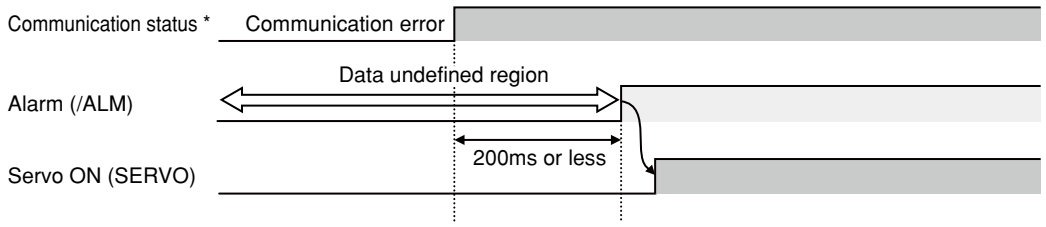
*4 : It takes approx. 1 sec. When the initial processing is completed, the END output switches ON. However, when a field network option, such as CC-Link is installed, this period of time until the END is output may differ. (For details, see section 1.1.3, "Communication check (field network)", in Chapter 5.)

*5 : Data may be output from the COM port on the controller during initial processing. Discard all of those data.

1.1.3 Communication check (field network)

In a field network, always check that the communication state is normal before starting operation. When using the host unit's communication status flag to monitor the communication state, allow a time delay of about 200ms after recognizing a normal state, and then start operation. If the time delay is short, the controller output information may not be read correctly, so the operation cannot start normally.

Field network



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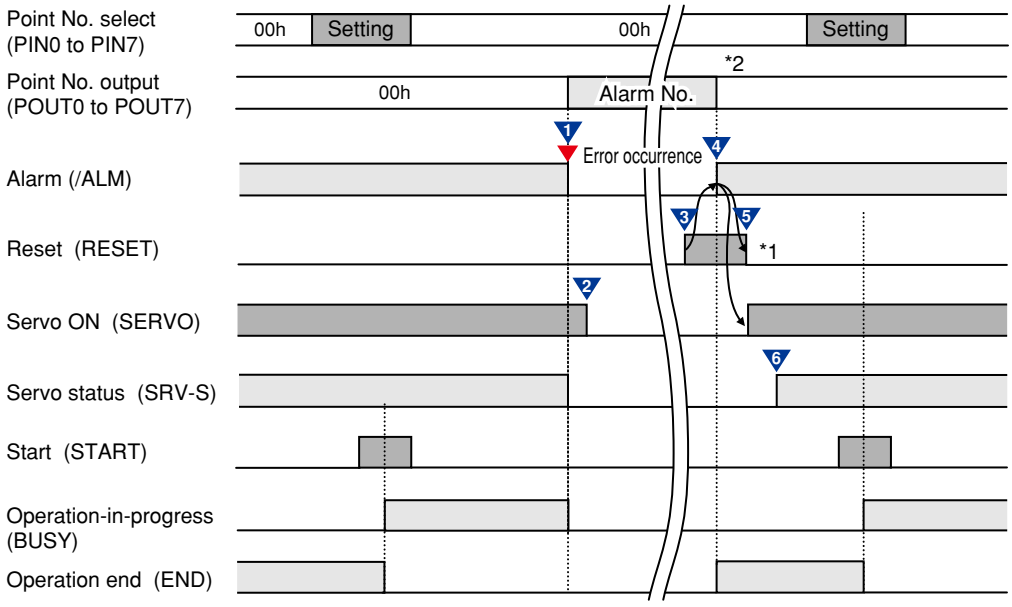
* In the case of CC-Link, the time delay is not required if remote READY (R-RDY) is used to check whether the link state is normal.

1.2 Alarm occurrence and clearing

The operation timing chart from "alarm occurrence" to "alarm clear" is shown below.

"alarm occurrence" to "alarm clear"



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1: /ALM switches OFF if an error occurs during operation. BUSY and SRV-S also switch OFF at this time, and the alarm No. is output. END remains OFF.

2: The SERVO input switches OFF.

3: The RESET input switches ON after the alarm cause has been eliminated.

4: /ALM and END switch ON.

5: The RESET input switches OFF, and the SERVO input switches ON.

6: SRV-S switches ON and the START input is enabled.

*1 : RESET is enabled after the alarm cause has been eliminated. Although some alarms can be cleared simply by eliminating the cause and executing a RESET, others require a restart. For alarm details, see Chapter 6 "Troubleshooting".

*2 : The No. output at alarm occurrences can be enabled/disabled by the K30 (Alarm No. output function) I/O parameter setting. For details, see section 4.2.2, "I/O Parameters", in Chapter 3.

2. Origin search (return-to-origin)

This controller needs to determine the origin point in order to operate the robot in the single axis coordinate system. This operation is called "origin search" (or "return-to-origin").
Performing the return-to-origin will set the coordinates of the robot and enable the positioning operation.

NOTE

For the robot with the incremental specifications, the return-to-origin of the robot is needed each time the control power is started.

2.1 Origin point detection method

The following methods are available to detect the origin point. Each detection method is set as follows:

Origin Detection Method	C1	C21/C22
Stroke-end method	◎	◎
Sensor method	×	×
Mark method	×	×

◎: Factory setting; ○: Supported; ×: Not supported

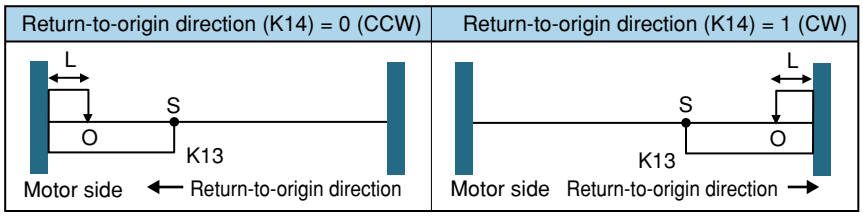
● Absolute function C21 C22

The absolute function is enabled by connecting the absolute battery (optional). Once the absolute battery has been connected and a single return-to-origin has been executed, further return-to-origins are not required at subsequent power ONs because the origin position information is saved.

■ Stroke-end (torque detection) method

Movement in the return-to-origin direction occurs when a return-to-origin begins, and continues until the mechanical end is struck. The movement direction is reversed at that time by motor torque detection, and returns by an amount which is unique to each robot. Movement then stops, and a return-to-origin end status is established.

Stroke-end (torque detection) method



S: Return-to-origin start position; 0: Origin point; L: Reversed (return) movement amount; K13: Return-to-origin speed

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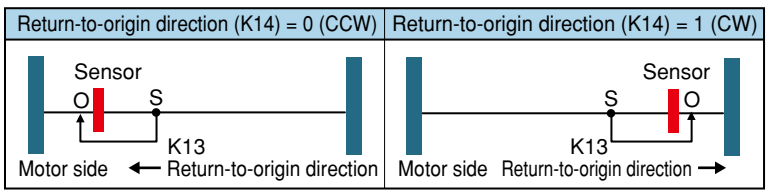
■ Sensor method

Movement in the return-to-origin direction occurs when a return-to-origin begins, and movement stops when the sensor detects the origin point dog. A return-to-origin end status is then established.

Sensor method



S: Return-to-origin start position; 0: Origin point; K13: Return-to-origin speed

23503-M1-00

Mark method

When the mark method is specified (K66 (return-to-origin method): "Mark") as origin point detection method, movement in the return-to-origin direction occurs when a return-to-origin begins, and movement stops at the nearest motor reference position. A return-to-origin end status is then established.

CAUTION

The appropriate return-to-origin method is factory-set for each robot according to its type. If you want to change the return-to-origin method, contact MISUMI.
An alarm may occur during return-to-origin operation if the return-to-origin speed is set too high. Always set it to an appropriate value.

23502-M2-00

2.2 Origin point and coordinates relationship

Coordinates are determined in accordance with the return-to-origin direction. The opposite direction from the return-to-origin direction is the "plus" direction. This direction (coordinate) setting can be reversed by changing the K15 ("Origin Coordi.") parameter setting.

Return-to-origin direction

Return-to-origin direction (K14)	Origin coordinates (K15)	
	Standard Direction	Reverse Direction
CCW	← Return-to-origin direction O (Origin point) Coordinate "plus" direction →	← Return-to-origin direction O (Origin point) ← Coordinate "plus" direction
CW	Return-to-origin direction → O (Origin point) ← Coordinate "plus" direction	Return-to-origin direction → O (Origin point) Coordinate "plus" direction →

23503-M0-00

"Origin shift amount" setting

The origin point coordinates can be changed by changing the K16 (Origin Shift Amount) parameter setting.
The origin point coordinates are therefore this parameter's setting value.

Machine reference

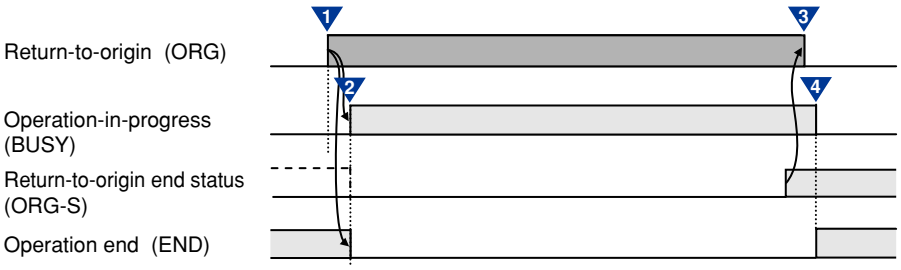
The machine reference is a numeric value that expresses the difference between the position where the signal that becomes the origin reference for the return-to-origin is generated and the reference position of the motor position sensor. This value was adjusted in a range of 25 to 75% at shipment. (The adjustment range may vary depending on the robot type. For details, refer to the user's manual for the robot being used.) The machine reference can be checked by executing the return-to-origin from the optional Handy Terminal (H1) or the support software (RS-Manager).

NOTE

The machine reference must be readjusted if it is not within the 25 to 75% range (or if it is outside the allowable range of the robot being used). For details on the adjustment procedure, please contact us.

2.3 Return-to-origin timing chart

Return-to-origin timing chart



23504-M0-00

1: The ORG input switches ON.

2: When the return-to-origin begins, the END signal switches OFF, and BUSY switches ON.

3: When ORG-S switches ON, the ORG input switches OFF.

4: BUSY switches OFF, and END switches ON.

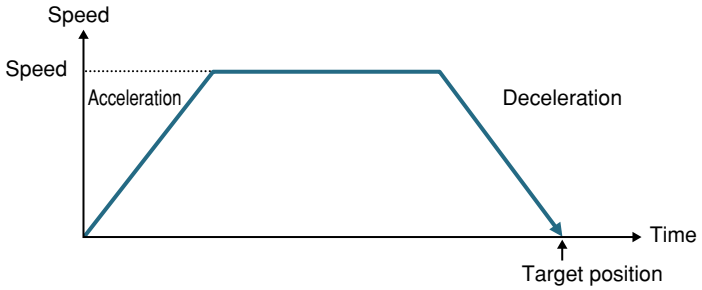
3. Positioning operation

A positioning operation can be performed by creating the required point data ("RUN type", "Position", "Speed", "Accel.", data, etc.), specifying the desired Point Nos. at PIN0 to PIN7 (point No. select), and then executing the START command input. Positioning can be executed as absolute position movement (ABS), as relative position movement (INC), or by a "push" or "merge" operation, etc.

3.1 Basic operation

The positioning operation (absolute and relative position movement) and its relationship to the point data is explained here.

Positioning operation



23505-M0-00

■ Setting the "Position" data

1.When the RUN type is "ABS"

Positioning occurs to the target position defined by the "position" data.
[Example]:
If positioning to the 300mm position is specified when the current stop position is 50mm:

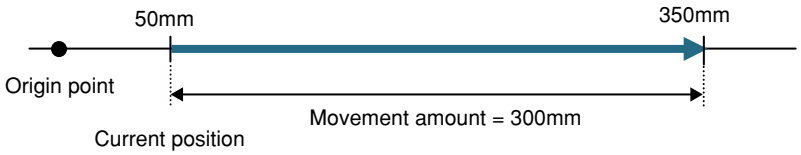
RUN type: ABS

23506-M0-00

2.When the RUN type is "INC"

Positioning occurs with the value defined by the "position" data representing the amount of movement from the current stop position.
[Example]:
If positioning to the 300mm position is specified when the current stop position is 50mm:

RUN type: INC



23507-M0-00

TIP

If relative positioning (INC) is stopped while in progress and then restarted, movement occurs for only the remaining movement amount. To perform new relative positioning from the stopped position, the RESET command must first be executed to clear the remaining movement amount.

CAUTION

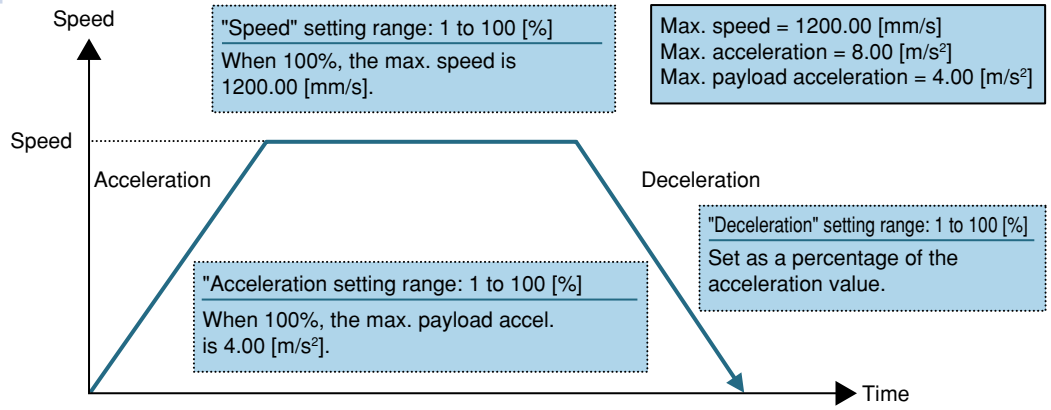
"Remaining movement amount" movement occurs only at interlock stops. When a servo OFF occurs due to an alarm or by an "emergency stop", etc., the relative positioning's remaining movement amount clears, and the next relative positioning operation begins from the original start position.

■ Setting the "Speed", "Accel.", and "Decel." data

1.When using the "Standard setting" point type

The "Speed" and "Accel." settings are specified as a percentage of the optimal positioning speed and acceleration values for each robot type, based on that robot's maximum speed and maximum payload acceleration values. The "Decel." is specified as a percentage of the "Accel." setting.

Point type: Standard setting

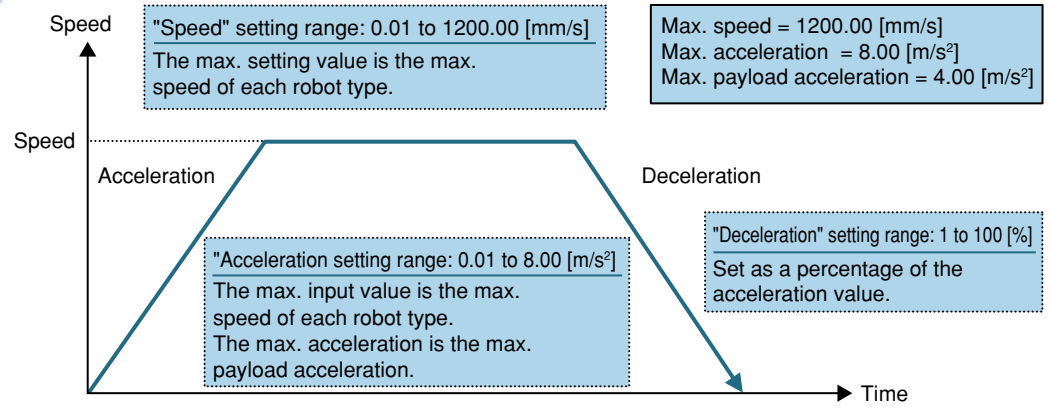


23508-M0-00

2.When using the "Custom setting" point type

The "Speed" and "Accel." settings are specified by adopting the maximum speed and acceleration (max. payload acceleration with 0kg payload) values for each robot type as the maximum setting values. If the specified acceleration value exceeds the max. payload acceleration defined by the payload setting, the max. payload acceleration value is used as the setting value.

Point type: Custom setting



23509-M0-00

CAUTION

Select "Standard setting" or "Custom setting" in the initial processing performed by the RS-Manager support software (optional).

■ Speed command error during custom setting

The setting speed error can be calculated according to the relationship between the resolution and lead length per motor rotation.

Example: When the resolution is 16384 (pulses/rotation) and the lead length (movement amount per rotation) is 20.00 mm, the number of pulses per 1 mm is 819.2 (16384÷20).
When the speed is set to 0.01 mm/s, 8.192 (819.2 x 0.01) is obtained. The fractional portion (0.192 pps) of this number is truncated (8.192 ⇒ 8 pps).
So, an error of 2.4% (8.192 - 8.000)/8.000) may occur.

CAUTION

This calculated error value is a logical value (reference). Actually, this value may vary depending on the conditions, such as friction.

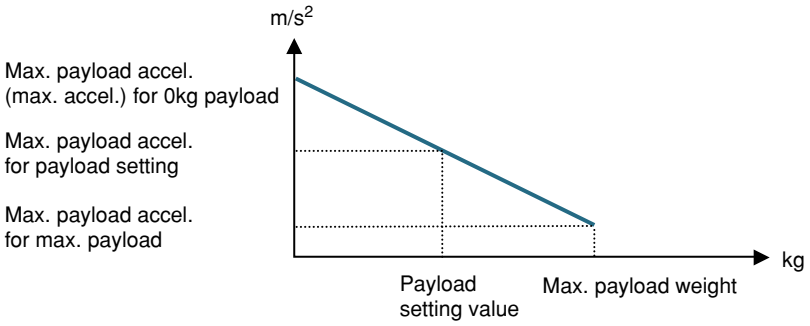
TIP

The C1 resolution is 20480 (pulses/rotation). The C21 and C22 resolution is 16384 (pulses/rotation).

Maximum payload acceleration and the payload

The maximum payload acceleration varies according to the payload setting. The optimum "maximum payload acceleration" is determined based on the robot's registered payload weight. Two "maximum payload acceleration" settings can be selected by "flag" acceleration selection.

Maximum payload acceleration and the payload

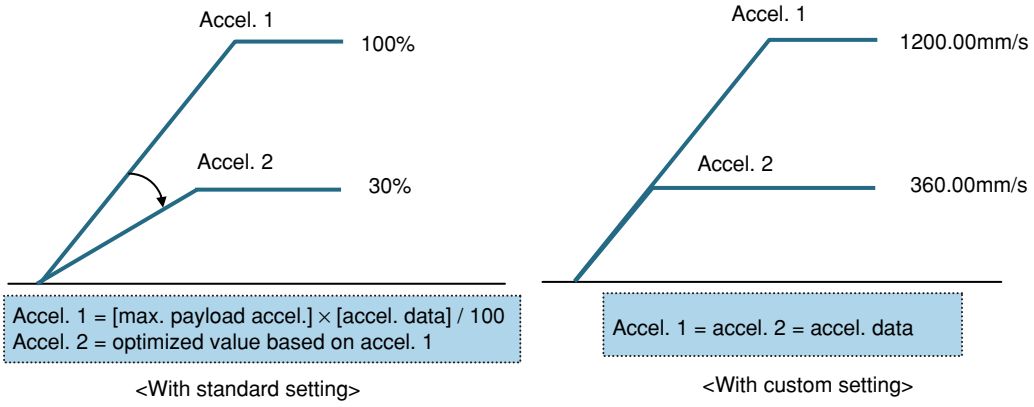


23510-M0-00

Relationship between "maximum payload acceleration" and "acceleration"

In the "Standard setting" point type, the acceleration is optimized within the maximum payload acceleration, based on the positioning speed and movement distance. The "acceleration" and "maximum payload acceleration" are the same in cases where the actual operation speed reaches the robot's maximum speed, but in all other cases, the optimum acceleration is calculated for the positioning operation.
In the "Custom setting" point type, the specified acceleration setting becomes the actual operation acceleration unless it exceeds the maximum payload acceleration. In that case, it is limited by the maximum payload acceleration (the operation acceleration cannot exceed the maximum payload acceleration).

Maximum payload acceleration and acceleration



23511-M0-00

Setting the speed override

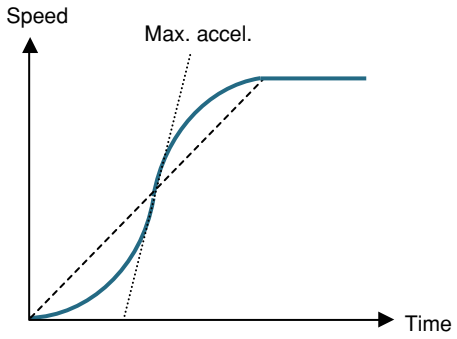
The overall positioning operation speed can be adjusted by the K9 (Speed Override) parameter setting. The actual operation speed will be as shown below. The actual operation speed will be as shown below.

Speed = speed data specified at each point data×speed override (K9) / 100

■ Acceleration S-curve

The C1/C21/C22 controller an S-curve function (standard item) to ensure smooth acceleration/deceleration. This results in a maximum acceleration which is 1.4 times that of a trapezoidal acceleration/deceleration format.

Acceleration S-curve



23512-M0-00

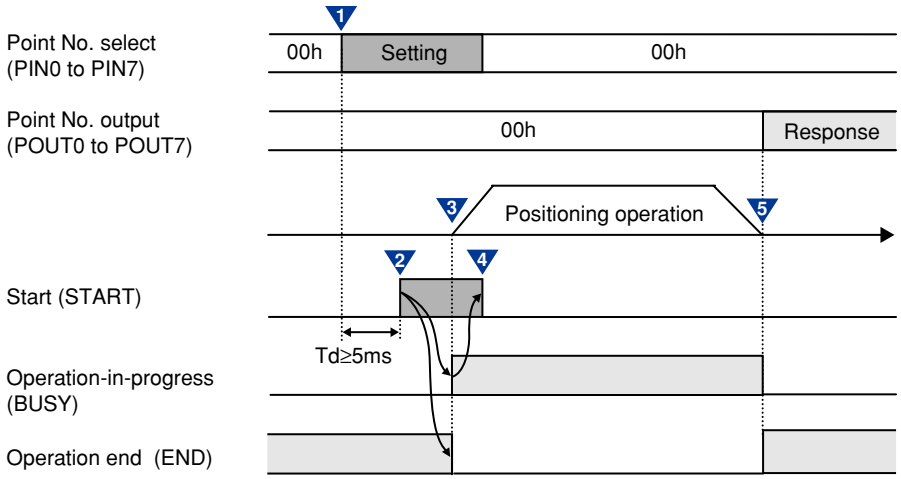
3.2 Positioning timing chart

The timing chart for positioning operations is shown below.

■ For "normal end"

Positioning timing chart

For "normal end"



23513-M0-00

1: The PIN0 to PIN7 point number settings are specified.

2: The START input switches ON after the Td delay period elapses.

3: When positioning begins, the END signal switches OFF, and the BUSY signal switches ON.

4: The START input switches OFF.

5: When positioning ends, the BUSY signal switches OFF, and the END signal switches ON.

TIP

The "BUSY" ON conditions are "operation in progress" OR "RUN command input in progress".

■ Point No. setting conditions

A delay time (Td) is provided between the point No. setting input and the START command input, and these signals are input securely until the BUSY signal turns ON. If the point No. is not specified properly due to an insufficient delay time, a malfunction may occur.
Normally, a delay of 5 ms or longer (reference value) is required.

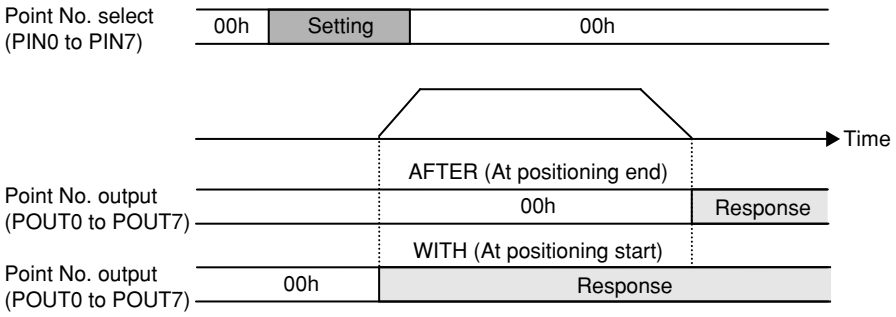
CAUTION

When the timer function of the host unit is used to specify the delay time, the design is made so that the actual delay time is longer than the reference value shown above by carefully checking the timer response accuracy.

■ Point No. outputs

An answer-back for the point Nos. used in the positioning operation occurs at the POUT0 to POUT7 point No. outputs. This output can be set to occur "WITH" (at movement start), or "AFTER" (at positioning end) by the K25 (POUT select) I/O parameter. (This parameter is factory-set as "AFTER".)

Point No. outputs



23514-M0-00

NOTE

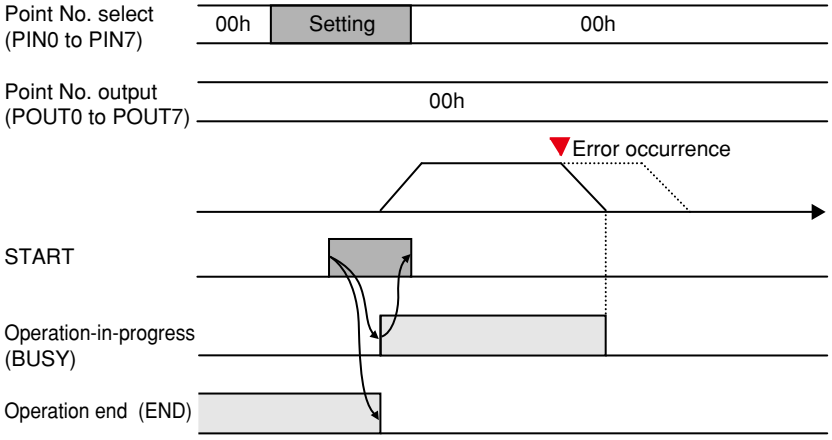
In merge operations, the operation's merge timing is adopted as the point No. output timing.

■ For "error end"

If an error occurs before positioning ends, operation stops and the BUSY signal switches OFF. The END signal remains OFF.

Point No. outputs

For "error end"



23515-M0-00

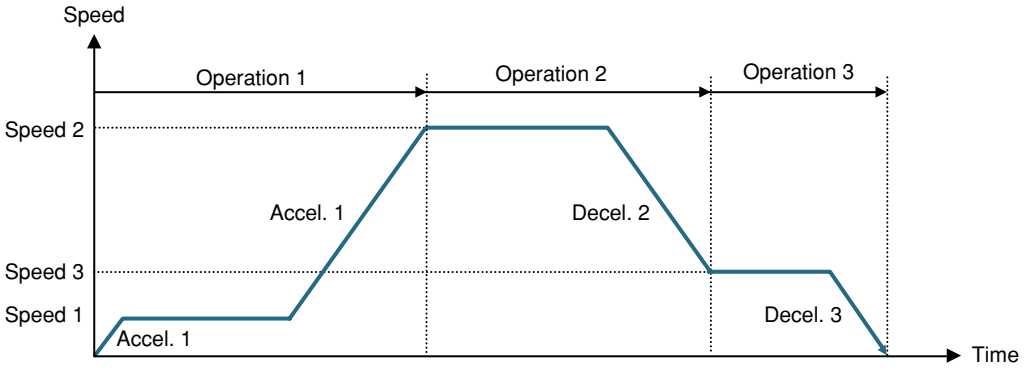
An "error end" condition can be caused by the following conditions.

Type	Cause
Error detected prior to operation	• START input occurred during an operation fault status (alarm, servo OFF, interlock, return-to-origin not completed). • START input occurred with data either not set, or with point data set for a position which exceeds the soft limit.
Error detected during operation	• Alarm occurred during operation. • Interlock stop processing occurred during operation. • A push failure occurred during a push operation.

3.3 Positioning merge operation

The positioning movement speed can be changed while in progress by performing positioning in the merge operation mode.
The figure below shows an example of the following merge operation: "operation 1 (P1 positioning) → operation 2 (P2 positioning) → operation 3 (P3 positioning).

Merge operation example



23516-M0-00

Point data settings

No.	RUN type	Position [mm]	Speed[%]	Accel. [%]	Decel. [%]	Jump
P1	ABS merge	200	10	100	100	2
P2	ABS merge	400	100	100	100	3
P3	ABS	500	30	100	100	0

NOTE

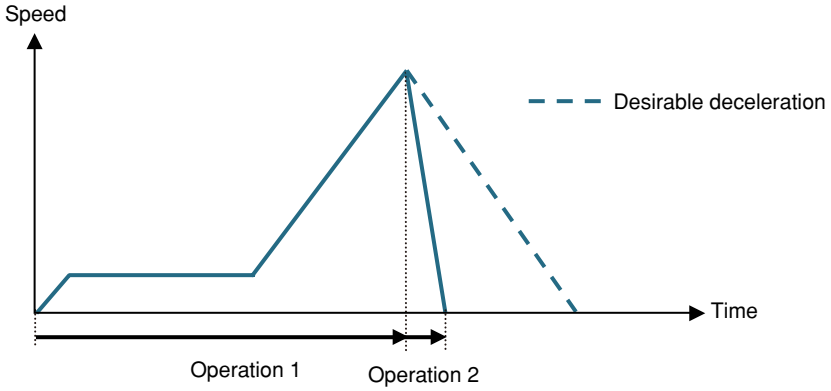
- Select "ABS merge" or "INC merge" as the RUN type, then set the next point to be merged at the "Jump" item.
- Even if a "merge" RUN type is selected, merging will not occur if the "Jump" setting is "0". In this case, standard positioning occurs.
- If the merge destination target positions are in both the forward and reverse directions, a deceleration stop occurs, followed by positioning in the opposite direction.

Cautions on creation of operation pattern

The deceleration time after the merge is insufficient.

Positioning merge operation

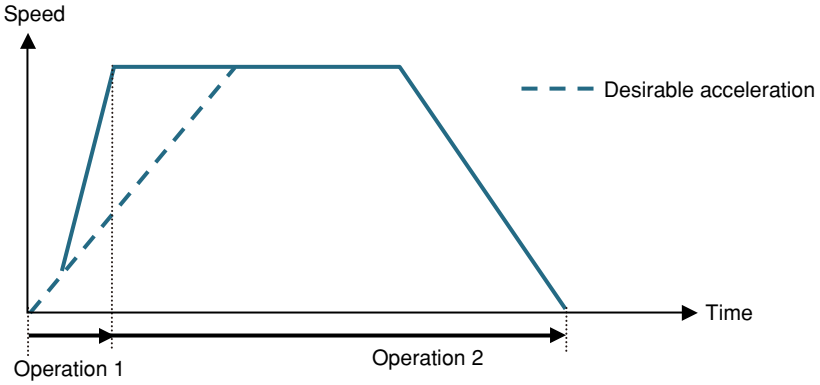
The deceleration time after the merge is insufficient.



23517-M0-00

Positioning merge operation

A period of time required to reach the merge destination speed is insufficient.



23518-M0-00

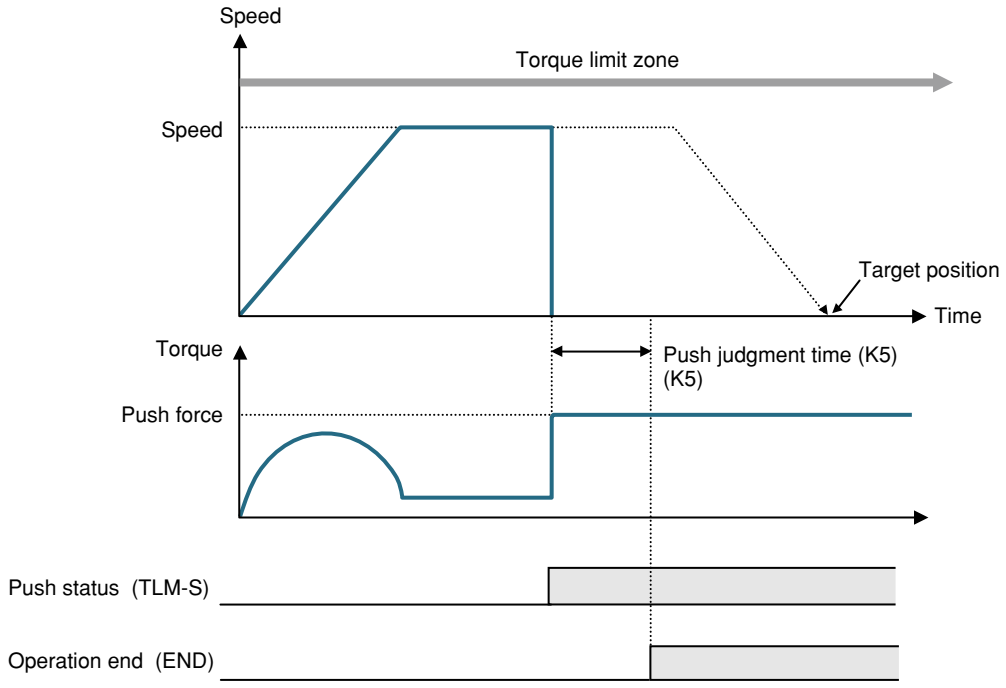
CAUTION

In the example shown above, a sufficient period of time required for the acceleration or deceleration during operation cannot be taken, causing the robot operation to malfunction.
Additionally, when the movement direction of the merge destination is reversed, the sufficient acceleration (deceleration) distance cannot be kept.
To reverse the movement direction, finish the positioning operation once, and then start the movement in the reverse direction again.

3.4 Push operation

A push operation is performed at the positioning operation. During the push operation, the torque is limited in accordance with the push force being used, allowing workpieces to be grasped and press-fit.

Push operation example



23519-M0-00

● Movement speed during push operation

A push operation is performed by suppressing the torque that is generated by limiting the current. Since this operation also suppresses the current needed to move the robot, a problem may occur if the movement speed is high.
Set the push speed to meet the following conditions:

Speed during push operation ≤ 20.00 [mm/s]

NOTE

At Ver.1.02.102 and later controllers, the maximum push operation speed is limited according to the push speed.

■ Push force

The push force is specified as a percentage of the rated current for each robot type.

● About maximum push force

A thrust generated at the push upper limit is called "maximum push force". The maximum push force indicated in each robot's specifications is the theoretical value (guideline). So, the accrual thrust may vary depending on working conditions, such as friction and others.

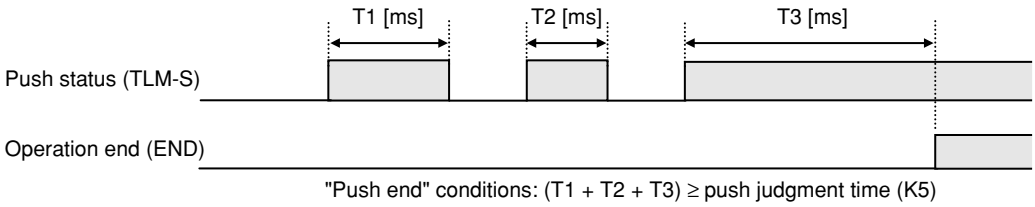
● About push upper limit

This push upper limit shows the maximum setting value which can be set by the push force. This value is unique to each robot.

Push judgment time

This setting is used as the reference for "operation end" judgments at push operations. The "operation end judgment" is made when the time during which the torque level is at the push force reaches the K5 (push judgment time) RUN parameter setting. If a push operation was stopped and then resumed, the judgment time count is the total time during which the torque was at the push force level.

Judgment example when push continued



23520-M0-00

Selecting the operation which follows the push judgment

The operation which occurs after the push operation ends (after push judgment) can be selected as another push operation (push continue) or as a positioning operation. This selection is made at the K4 (push mode) RUN parameter. (Default setting: "Push continue")

Push failure judgment

If positioning to the target position is completed before the push judgment has ended, this is processed as a "push failure". This "push failure" function can be enabled/disabled by the K4 (push mode) RUN parameter setting.
If failed to push, a "PUSH MISTAKE" alarm (operation alarm No. 47) occurs.

CAUTION

If the intended push operation cannot be performed, possible causes are:

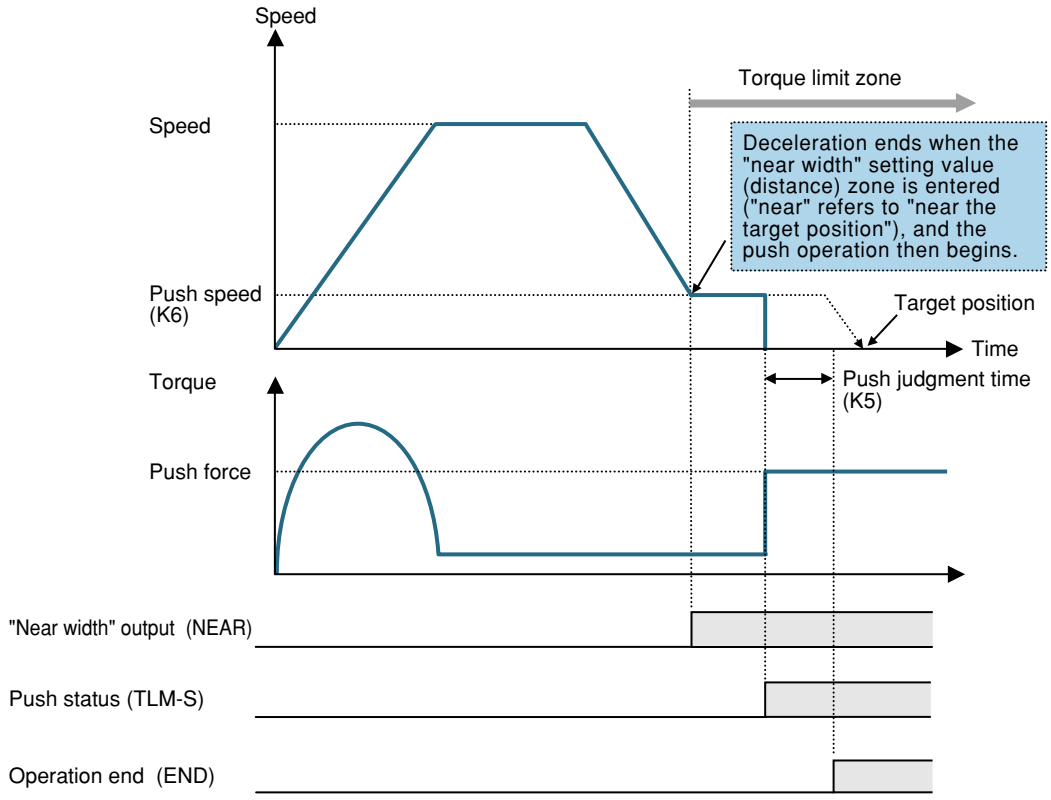
- **Push judgment time is too short.**
- **Acceleration during push operation is too large.**
- **Push operation was started too soon after an operation other than push was performed.**

In these cases, taking account of the effects on the object to be pushed, make adjustments such as to extend the push judgment time, reduce the acceleration, and set a timer before starting push operation.

3.5 Deceleration push operation

Deceleration ends at the position set as the "Near width" value (distance) short of the target position, and the push operation then begins in accordance with the K6 (push speed) RUN parameter setting.

Deceleration push operation



23521-M0-00

NOTE

- The "push force", "push judgment time", "operation after the push judgment", and "push failure judgment", etc., settings are specified in the same manner as for a standard push operation.
- The torque limit remains in effect until the next operation begins.

CAUTION

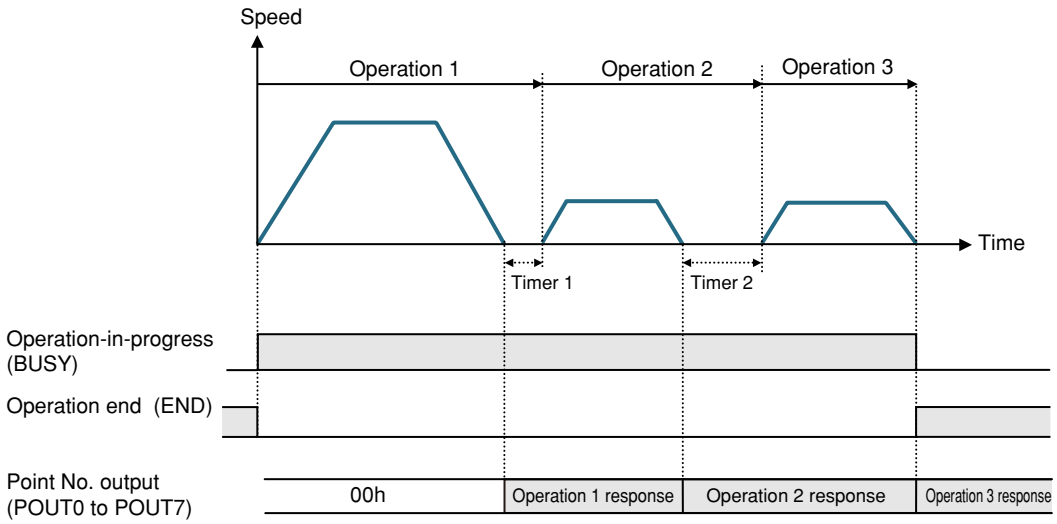
A "near width" distance should be specified which allows an adequate distance for the deceleration speed to be reached. A fast push speed and very small "near width" distance, for example, could hinder operation.

3.6 Continuous operation

"Continuous operation" refers to consecutive positioning operations which occur in response to an initial START command input. When one positioning operation ends, and the "Timer" specified delay (wait) time elapses, the next positioning operation begins for the "Jump" specified point No. Operation ends when there are no more "Jump" settings.

The figure below shows the following continuous operation example: Operation 1 (P1 positioning) → Operation 2 (P2 positioning) → Operation 3 (P3 positioning).

Continuous operation example



23522-M0-00

Point data settings

No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Jump	Timer [sec]
P1	ABS	200	100	100	100	2	500
P2	ABS	400	30	100	100	3	1000
P3	ABS	500	30	100	100	0	0

NOTE

- The next positioning point No. for continuous operation is specified by the "Jump" setting.
- If a delay (wait) time is desired before proceeding to the next positioning operation, it can be specified at the "Timer" setting.
- When "Jump" is not specified (set to 0), the operation ends when that positioning is completed.

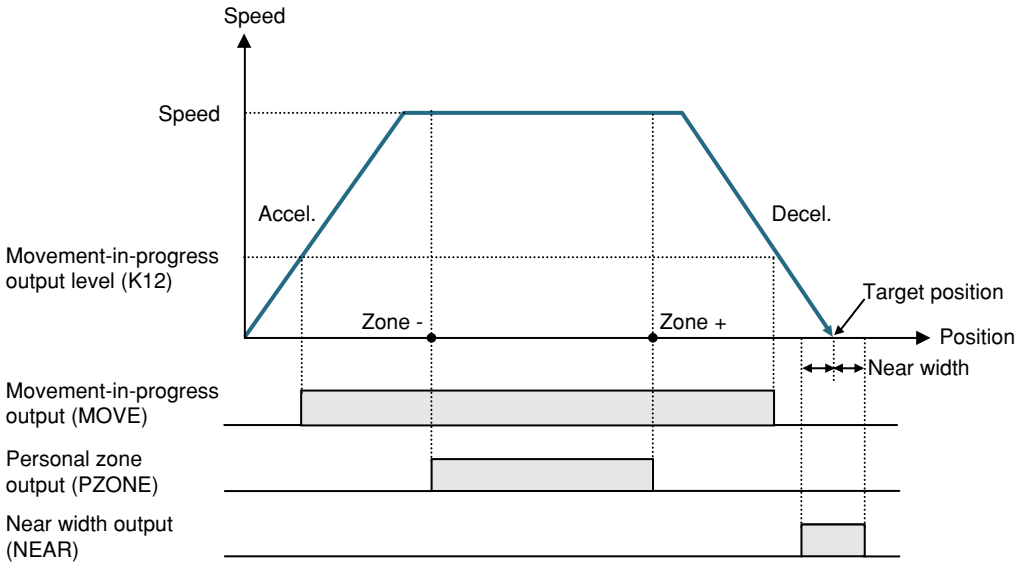
TIP

When the "POUT select" I/O parameter is set to "AFTER", the point No. output occurs after each positioning operation, regardless of the timer setting.

3.7 Output function

During positioning operations, individual operation speeds and position information are transmitted to the host unit by the outputs shown below.

Output function



23523-M0-00

Personal zone output (PZONE)

This output switches ON when the current position enters the zone of each point.

Near width (NEAR)

This output switches ON when the current position enters the near width zone (near-target-position zone).

Movement-in-progress output (MOVE)

This output is ON while robot movement is in progress. The minimum speed for recognizing a movement-in-progress condition can be specified at the K12 (movement-in-progress output level) RUN parameter.

3.8 Speed switch function

The overall positioning operation speed can be switched between two levels from the host equipment by using the speed switch input (SPD).

■ Assigning method

When you set the "Speed switch function" (K17) to "Enable", the speed switch (SPD) will be assigned to JOG+ input. SPD will be ON at the same time as the selection of point number, and the positioning operation will be performed at the speed calculated by multiplying the current speed by the value specified at "Switched speed" (K18).

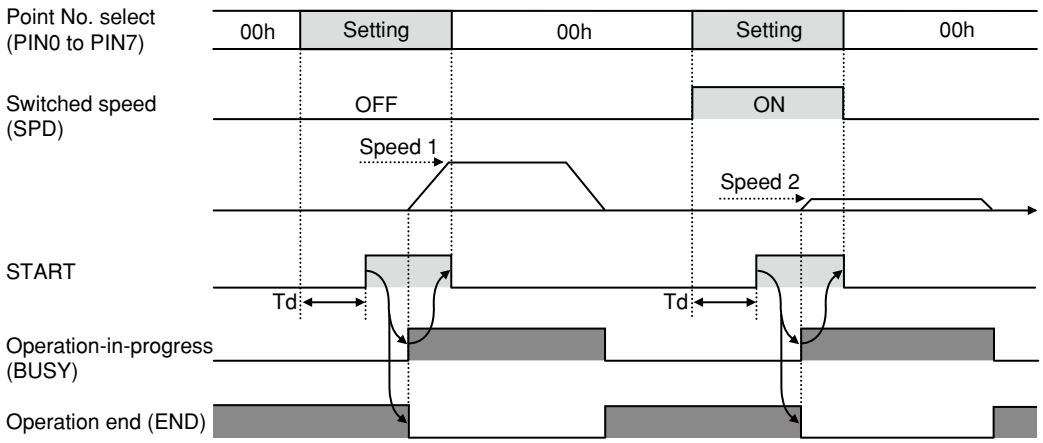
SPD	Speed
OFF	Speed 1 = Specified speed
ON	Speed 2 = Specified speed×Switched speed (K18) / 100

NOTE

- Cannot be assigned in the manual mode (MANUAL=ON).
- Specified speed means "speed data specified at each point data×speed override (K9) / 100".

■ Timing chart

Speed switch function



23524-M0-00

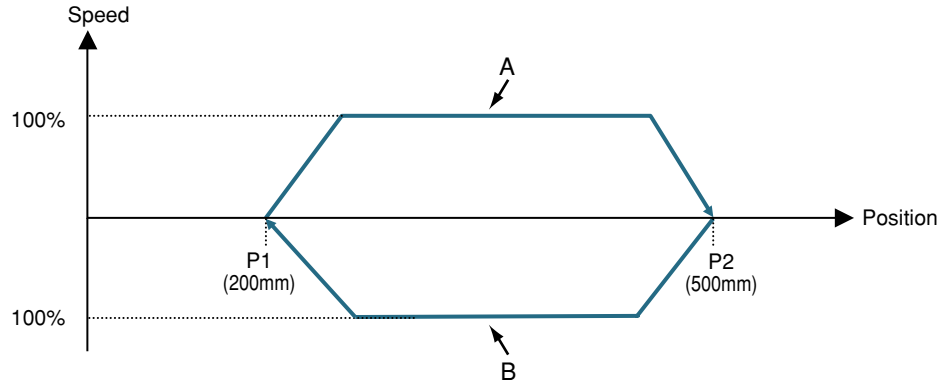
CAUTION

This function is available from controller's software version 1.06.111 onwards.

3.9 Operation examples

Setting example 1

Movement between 2 points, standard setting



23525-M0-00

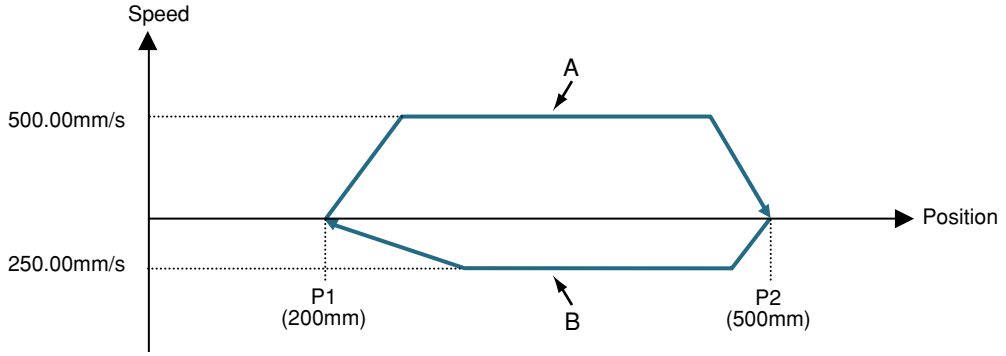
No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Flag
P1	ABS	200	100	100	100	1
P2	ABS	500	100	100	100	0

A:P1 → P2 positioning occurs.

B:Return to P1.

Setting example 2

Movement between 2 points, custom setting



23526-M0-00

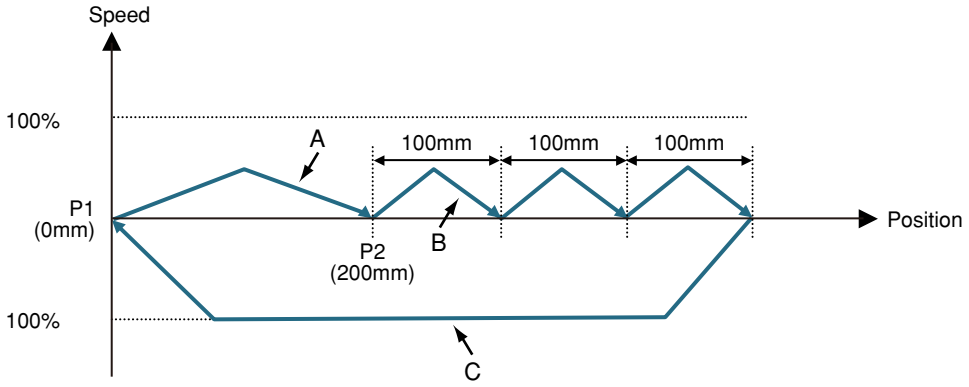
No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]
P1	ABS	200	250.00	4.00	100
P2	ABS	500	500.00	4.00	50

A:P1 → P2 positioning occurs.

B:Return to P1.

Setting example 3

Positioning + pitch feed



23527-M0-00

No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]
P1	ABS	0	100	100	100
P2	ABS	200	100	75	100
P3	INC	100	100	100	100

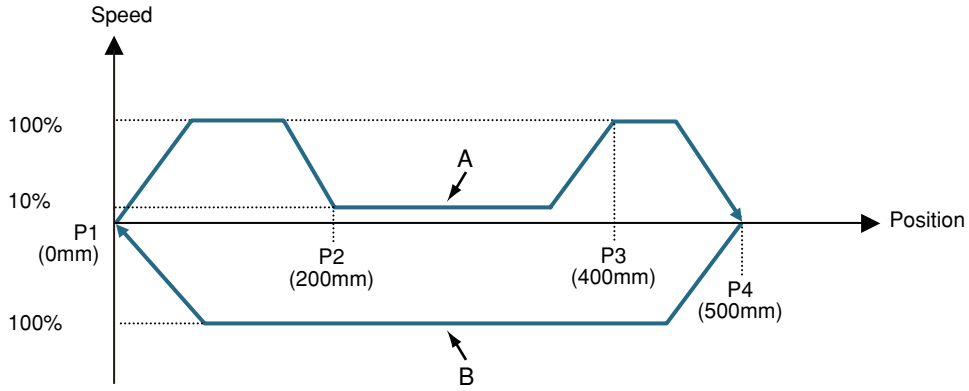
A:P1 → P2 positioning occurs.

B:Pitch feed corresponding to the P3 movement amount occurs.

C:Return to P1.

Setting example 4

Merge operation



23528-M0-00

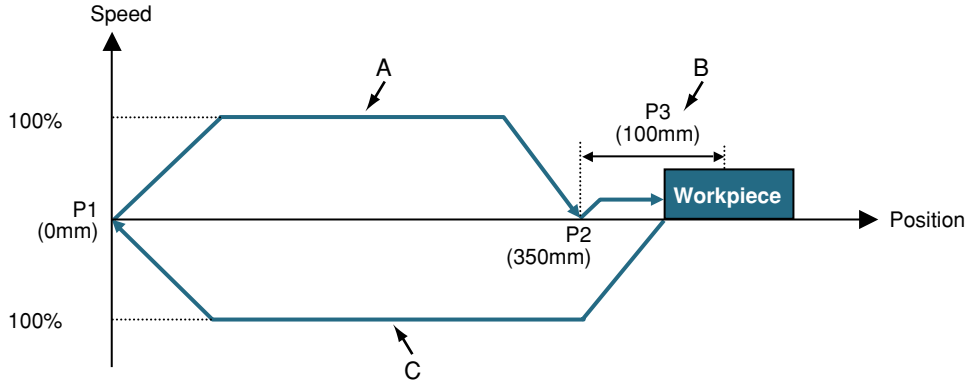
No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Jump
P1	ABS	0	100	100	100	0
P2	ABS Merge	200	100	100	100	3
P3	ABS Merge	400	10	100	100	4
P4	ABS	500	100	100	100	0

A:Merge operation from P1 → P2 → P3 → P4.

B:Return to P1.

Setting example 5

Workpiece push



23529-M0-00

No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Push Force [%]
P1	ABS	0	100	100	100	100
P2	ABS	350	100	100	100	100
P3	INC Push	100	10	100	100	70

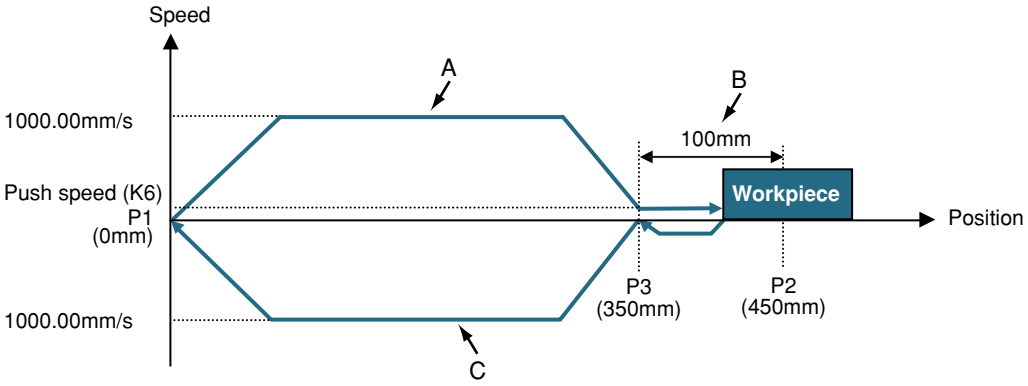
A:P1 → P2 positioning occurs.

B:Push operation corresponding to the P3 movement amount occurs.

C:Return to P1.

Setting example 6

Workpiece push



23530-M0-00

No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Push Force [%]	Near Width [mm]
P1	ABS	0	1000.00	4.00	100	100	1.00
P2	ABS → Push	450	1000.00	4.00	100	70	100.00
P3	ABS	350	100.00	1.00	100	100	1.00

A:P1 → P2 push operation occurs (deceleration occurs 100.00mm before P2).

B:After push operation ends, positioning to P3 occurs.

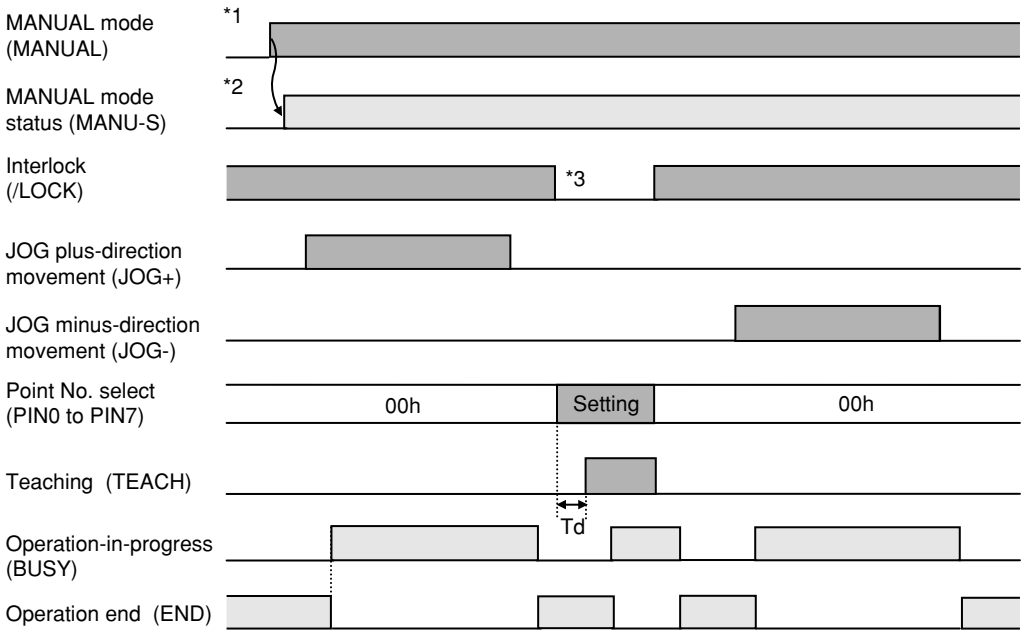
C:Return to P1.

4. MANUAL mode

In the MANUAL mode, JOG movement and position teaching, etc., can be performed from a host unit by using the optional Handy Terminal (H1) or the RS-Manager support software. This section explains the MANUAL mode functions.

4.1 MANUAL mode timing chart

MANUAL mode



23531-M0-00

*1 :The MANUAL mode is established while the MANUAL input is ON.

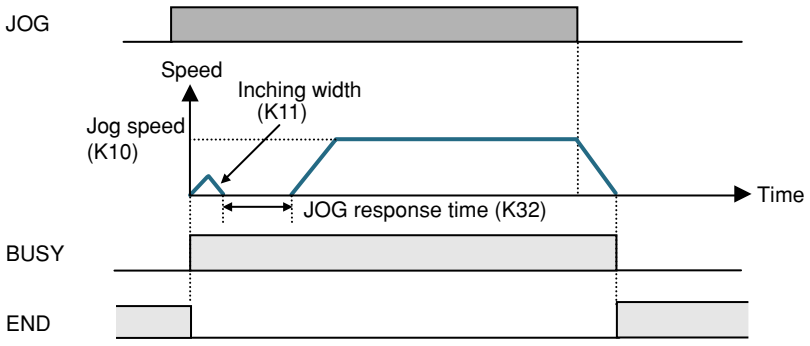
*2 :The MANU-S output can be assigned to the OUT0 to OUT3 control outputs. This requires the assignments to be specified by I/O parameter setting.

*3 :The interlock function must be OFF in order to execute the TEACH command.

4.2 JOG movement

When in the MANUAL mode ("MANUAL" ON), robot JOG movement in the specified direction is possible while the JOG+ / JOG- input is ON. When this input switches OFF, a deceleration stop occurs. JOG movement can be performed even if a return-to-origin has not been completed.

JOG movement



23532-M0-00

- **When the K32 (JOG response time) I/O parameter is set as "0":**

  Movement continues at the JOG speed (K10) until the JOG input switches OFF.

- **When the K32 (JOG response time) I/O parameter is set as other than "0":**

  Movement corresponding to the inching amount (K11) occurs at the leading edge of the JOG movement input ON, and, after the JOG response time elapses, movement continues at the JOG speed (K10) until the JOG movement input switches OFF.

CAUTION

The soft limit is disabled if a return-to-origin has not been completed. Use care when performing operations at this time.

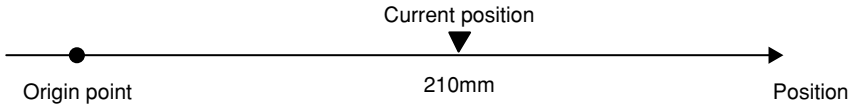
4.3 TEACH (Teaching)

When in the MANUAL mode ("MANUAL" ON) with "/LOCK" switched OFF, the current position can be written to the specified point No. at the leading edge of the TEACH input ON.

NOTE

The TEACH function is disabled if a return-to-origin has not yet been completed.

Current position is written to the specified point No.



23533-M0-00

● **Writing the current position to a point for which data exists**

No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Flag
P3	ABS	500	50	100	100	0

▼ TEACH

No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Flag
P3	ABS	210	50	100	100	0

The current position is written to the position data.

● **Writing the current position to a point for which data does not exist**

No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Flag
P3	-	-	-	-	-	-

▼ TEACH

No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Flag
P3	ABS	210	100	100	100	0

The current position is written to the position data, and default values are adopted for the other data.

■ **Point No. setting conditions**

An appropriate period of delay time must be provided between the point No. input and the current position TEACH command so that this TEACH command is kept ON securely until the BUSY signal switches ON. If the point No. is not set properly due to an insufficient delay time, this may cause a malfunction.
This delay time is set to 5 ms or longer.

CAUTION

When the timer function of the host unit is used to specify the delay time, the design is made so that the actual delay time is longer than the reference value shown above by carefully checking the timer response accuracy.

5. Remote commands

5.1 Overview

Remote commands use the field network's remote registers to read and write various types of information.

■ CC-Link

Inputs (Master → Remote)			Output (Remote → Master)		
Address	Signal Name	Description	Address	Signal Name	Description
RWwn	WIN0	Execution command	RWrn	WOUT0	Status
RWwn+1	WIN1	Command option	RWrn+1	WOUT1	Command response
RWwn+2	WIN2		RWrn+2	WOUT2	
RWwn+3	WIN3		RWrn+3	WOUT3	

n: Value determined by CC-Link station No. setting.

■ DeviceNet

Inputs (Master → Remote)			Output (Remote → Master)		
Channel No.	Signal Name	Description	Channel No.	Signal Name	Description
m+2	WIN0	Execution command	n+2	WOUT0	Status
m+3	WIN1	Command option	n+3	WOUT1	Command response
m+4	WIN2		n+4	WOUT2	
m+5	WIN3		n+5	WOUT3	

"m", "n": These values are determined in accordance with the channel setting.

5.2 Remote command list

■ Query

Name	Command	Command Option		Command Response	
	WIN0	WIN1	WIN2, WIN3	WOUT1	WOUT2, WOUT3
Current position read	0100h	0000h	-	-	Current position
Current speed read	0100h	0001h	-	-	Operation speed
Electrical current read	0100h	0002h	-	-	Electrical current
Voltage read	0100h	0009h	-	-	Voltage
Temperature read	0100h	000Ah	-	-	Temperature
Current point No. read	0100h	000Dh	-	-	Operation-in-progress point No.
Load rate read	0100h	000Eh	-	-	Load rate

NOTE

- 2-word data is registered as the command response (Little Endian).
- When "8100h" is set for the command (WIN0), the query becomes the continuous query.

■ Point data writing

Name	Command	Command Option		Command Response	
	WIN0	WIN1	WIN2, WIN3	WOUT1	WOUT2, WOUT3
Operation type write	0200h	Point No.	Operation type	Point No.	-
Position write	0201h	Point No.	Position data	Point No.	-
Speed write	0202h	Point No.	Speed data	Point No.	-
Acceleration write	0203h	Point No.	Acceleration data	Point No.	-
Deceleration write	0204h	Point No.	Deceleration data	Point No.	-
Push force write	0205h	Point No.	Push force data	Point No.	-
Zone (-) write	0206h	Point No.	Zone (-) data	Point No.	-
Zone (+) write	0207h	Point No.	Zone (+) data	Point No.	-
"Near width" write	0208h	Point No.	"Near width" data	Point No.	-
Jump write	0209h	Point No.	Jump data	Point No.	-
Flag write	020Ah	Point No.	Flag data	Point No.	-
Timer write	020Ch	Point No.	Timer data	Point No.	-

NOTE

- "Position", "speed", "acceleration", "deceleration", and "push force" writing occurs in the RAM. To save the data to memory, the "operation type" must be written after writing each of these data items.
- The permissible point No. setting range at the command option is "1 (0001h) to 255 (00FFh)". When a command is executed, a point No. answerback is returned to the command response (WOUT1).

■ Point data reading

Name	Command	Command Option		Command Response	
	WIN0	WIN1	WIN2, WIN3	WOUT1	WOUT2, WOUT3
Operation type read	0300h	Point No.	-	Point No.	Operation type
Position read	0301h	Point No.	-	Point No.	Position data
Speed read	0302h	Point No.	-	Point No.	Speed data
Acceleration read	0303h	Point No.	-	Point No.	Acceleration data
Deceleration read	0304h	Point No.	-	Point No.	Deceleration data
Push force read	0305h	Point No.	-	Point No.	Push force data
Zone (-) read	0306h	Point No.	-	Point No.	Zone (-) data
Zone (+) read	0307h	Point No.	-	Point No.	Zone (+) data
"Near width" read	0308h	Point No.	-	Point No.	"Near width" data
Jump read	0309h	Point No.	-	Point No.	Jump data
Flag read	030Ah	Point No.	-	Point No.	Flag data
Timer read	030Ch	Point No.	-	Point No.	Timer data

NOTE

- The permissible point No. setting range at the command option is "1 (0001h) to 255 (00FFh)".
- 2-word data is registered (Little Endian) at the command response (WOUT2, WOUT3).

Parameter writing

Name	Command	Command Option		Command Response	
	WIN0	WIN1	WIN2, WIN3	WOUT1	WOUT2, WOUT3
In-position (K3) write	0400h	0003h	In-position data	-	-
Push mode (K4) write	0400h	0004h	Push mode	-	-
Push judge time (K5) write	0400h	0005h	Push judge time data	-	-
Push speed (K6) write	0400h	0006h	Push speed data	-	-
Zone (-) (K7) write	0400h	0007h	Zone (-) data	-	-
Zone (+) (K8) write	0400h	0008h	Zone (+) data	-	-
Speed override (K9) write	0400h	0009h	Speed override	-	-
JOG speed (K10) write	0400h	000Ah	JOG speed	-	-
Inching width (K11) write	0400h	000Bh	Inching width	-	-
MOVE output level (K12) write	0400h	000Ch	MOVE output level data	-	-

Parameter reading

Name	Command	Command Option		Command Response	
	WIN0	WIN1	WIN2, WIN3	WOUT1	WOUT2, WOUT3
In-position (K3) read	0500h	0003h	-	-	In-position data
Push mode (K4) read	0500h	0004h	-	-	Push mode
Push judge time (K5) read	0500h	0005h	-	-	Push judge time data
Push speed (K6) read	0500h	0006h	-	-	Push speed data
Zone (-) (K7) read	0500h	0007h	-	-	Zone (-) data
Zone (+) (K8) read	0500h	0008h	-	-	Zone (+) data
Speed override (K9) read	0500h	0009h	-	-	Speed override
JOG speed (K10) read	0500h	000Ah	-	-	JOG speed
Inching width (K11) read	0500h	000Bh	-	-	Inching width
MOVE output level (K12) read	0500h	000Ch	-	-	MOVE output level data

NOTE

2-word data is registered as the command response (WOUT2, WOUT3) (Little Endian).

Positioning operation

Name	Command	Command Option		Command Response	
	WIN0	WIN1	WIN2, WIN3	WOUT1	WOUT2, WOUT3
Positioning operation (data designation 1)	08xxh	-	Position data	-	-
Positioning operation (data designation 2)	18xxh	Speed	Position data	-	-

Special operations

Name	Command	Command Option		Command Response	
	WIN0	WIN1	WIN2, WIN3	WOUT1	WOUT2, WOUT3
Brake release	0E00h	-	-	-	-
Brake ON	0E01h	-	-	-	-

Special codes

Name	Command	Command Option		Command Response	
	WIN0	WIN1	WIN2, WIN3	WOUT1	WOUT2, WOUT3
Status clear (no execution)	0000h	-	-	-	-
Status clear (continuous query continuation)	8000h	-	-	-	-
Command response clear	0F00h	-	-	0000h	00000000h

Status

Name	Status	Description
	WOUT0	
Command ready	0000h	Command execution is enabled.
Command-in-progress	0100h	Command has been received and is being executed.
Command-end	0200h	Command ended normally.
Command error end	40xxh	Command ended in error alarm. The error alarm No. is output as the "xx" value.

NOTE

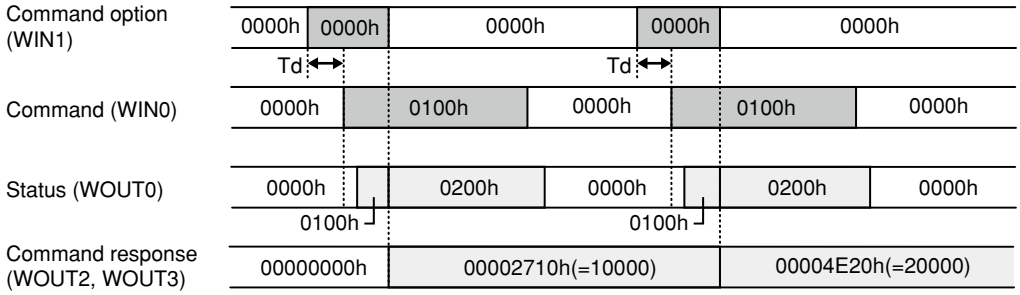
- When a "command error end" (40xxh) condition occurs, the alarm No. is output as the "xx" value. For details regarding alarm numbers and alarm meanings, see section 4, "Alarms: Possible causes and actions ", in Chapter 6.
- Error alarm denotes "Error alarm (internal causes)" and "Error alarm (external causes)".
- For details regarding error alarms, see section 1, "Alarm groups", in Chapter 6.

5.3 Timing chart

This section explains the remote command input/output timing charts using remote command execution flowcharts and examples.

■ When executing a query

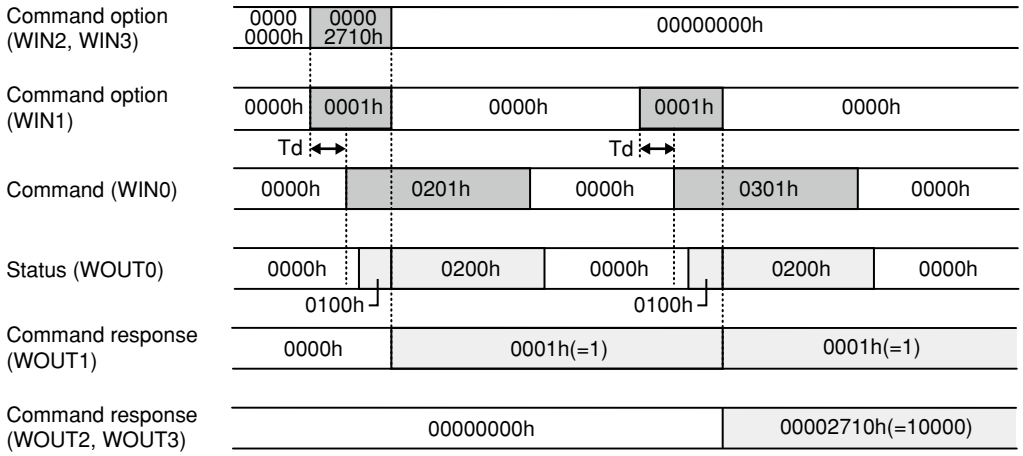
[Example] Executing "current position" reading



23534-M0-00

■ When executing point data writing/reading

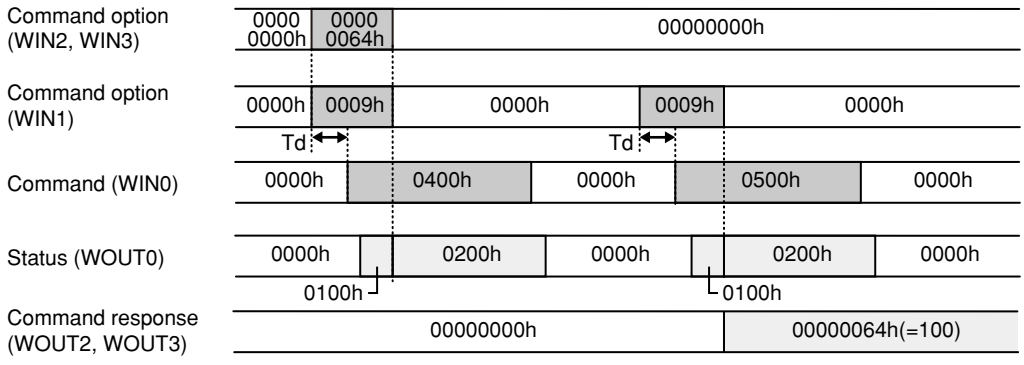
[Example] Executing position writing/reading



23535-M0-00

■ When executing parameter data writing/reading

[Example] Executing speed override (K9) writing/reading



23536-M0-00

■ Delay time (Td) setting

Because remote commands are processed across multiple channel (word) information, a prescribed time period is required for each area's information to be refreshed. Therefore, after each command option setting, a delay time (Td) is required before the command is set. For "Td" details, refer to the operation manuals for the network and host types being used.

5.4 Query

Reads information (current position and speed, etc.) related to the operation.

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	-	-	Type	0100h

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	Data		-	0200h

NOTE

The "Data" is output as 2-word, Little Endian data.

■ Command type and response data

Command (WIN0)	Command Option	Command Response	Units
	Type (WIN1)	Data (WOUT2, WOUT3)	
0100h	0000h	Current position	0.01mm
	0001h	Current speed	0.01mm/s
	0002h	Electrical current	%
	0009h	Voltage	0.1V
	000Ah	Temperature	˚C
	000Dh	Current point No.	-
	000Eh	Load rate	%
	0100h	Bit status	-

5.5 Point data writing

Point data is written.

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	Data		Point No.	02xxh

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	-		Point No. (response)	0200h

■ Commands and data

Command (WIN0)	Command Option		Units		Data Write Destination
	Point No. (WIN1)	Data (WIN2, WIN3)	Standard Setting	Custom Setting	
0200h	1(0001h) to 255(00FFh)	Operation type	-		ROM
0201h		Position	0.01mm		RAM
0202h		Speed	%	0.01mm/s	RAM
0203h		Acceleration	%	0.01m/s^2	RAM
0204h		Deceleration	%		RAM
0205h		Push force	%		RAM
0206h		Zone (-)	0.01mm		ROM
0207h		Zone (+)	0.01mm		ROM
0208h		Near width	0.01mm		ROM
0209h		Jump	-		ROM
020Ah		Flag	-		ROM
020Ch		Timer	ms		ROM

CAUTION

Because an EEPROM is used as the ROM, the number of writing operations is limited. Users should therefore refrain from writing unnecessary data to the ROM.

NOTE

Data which has been written to the RAM is not saved to memory, and the original data is restored when a restart occurs. To save the RAM data to memory, the "operation type" must be written after writing each data item.

TIP

For point data details, see section 2, "Point data", in Chapter 3.

5.6 Point data reading

Point data is read.

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	-		Point No.	03xxh

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	Data		Point No. (response)	0200h

NOTE

The "Data" is output as 2-word, Little Endian data.

■ Commands and data

Command (WIN0)	Command Option	Command Response	Unit	
	Point No. (WIN1)	Data (WOUT2, WOUT3)	Standard Setting	Custom Setting
0300h	1(0001h) to 255(00FFh)	Operation type	-	
0301h		Position	0.01mm	
0302h		Speed	%	0.01mm/s
0303h		Acceleration	%	0.01m/s^2
0304h		Deceleration	%	
0305h		Push force	%	
0306h		Zone (-)	0.01mm	
0307h		Zone (+)	0.01mm	
0308h		Near width	0.01mm	
0309h		Jump	-	
030Ah		Flag	-	
030Ch		Timer	ms	

TIP

For point data details, see section 2, "Point data", in Chapter 3.

5.7 Parameter data writing

Parameter data is written.

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	Data		Parameter No.	0400h

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	-		-	0200h

■ Command type and data

Command (WIN0)	Command Option		Unit
	Parameter No. (WIN1)	Data (WIN2, WIN3)	
0400h	0003h	In-position (K3)	0.01mm
	0004h	Push mode (K4)	-
	0005h	Push judge time (K5)	ms
	0006h	Push speed (K6)	0.01mm/s
	0007h	ZONE (-) (K7)	0.01mm
	0008h	ZONE (+) (K8)	0.01mm
	0009h	Speed override (K9)	%
	000Ah	JOG speed (K10)	%
	000Bh	Inching width (K11)	0.01mm
	000Ch	MOVE output level (K12)	0.01mm/s

CAUTION

The number of write processes is limited since the parameter dada is written into the EEPROM. So, avoid writing parameter data unnecessarily. Additionally, the write target is a part of operation parameters related to the positioning operation.

TIP

For parameter data details, see section 4, "Parameter data", in Chapter 3.

NOTE

0003h to 0008h, and 000Ch of the writable parameters are available from controller's software version Ver.1.11.125.

5.8 Parameter data reading

Parameter data is read.

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	-		Parameter No.	0500h

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	Data		-	0200h

■ Command type and response data

Command (WIN0)	Command Option	Command Response	Unit
	Parameter No. (WIN1)	Data (WOUT2, WOUT3)	
0500h	0003h	In-position (K3)	0.01mm
	0004h	Push mode (K4)	-
	0005h	Push judge time (K5)	ms
	0006h	Push speed (K6)	0.01mm/s
	0007h	ZONE (-) (K7)	0.01mm
	0008h	ZONE (+) (K8)	0.01mm
	0009h	Speed override (K9)	%
	000Ah	JOG speed (K10)	%
	000Bh	Inching width (K11)	0.01mm
	000Ch	MOVE output level (K12)	0.01mm/s

TIP

For parameter data details, see section 4, "Parameter data", in Chapter 3.

NOTE

0003h to 0008h, and 000Ch of the readable parameters are available from controller's software version Ver.1.11.125.

5.9 Continuous query

This function outputs operation information such as the current position and speed, etc., in a continuous manner.

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	–	–	Type	8100h

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	Data		–	0200h

CAUTION

Output occurs as 2-word, Little Endian data.

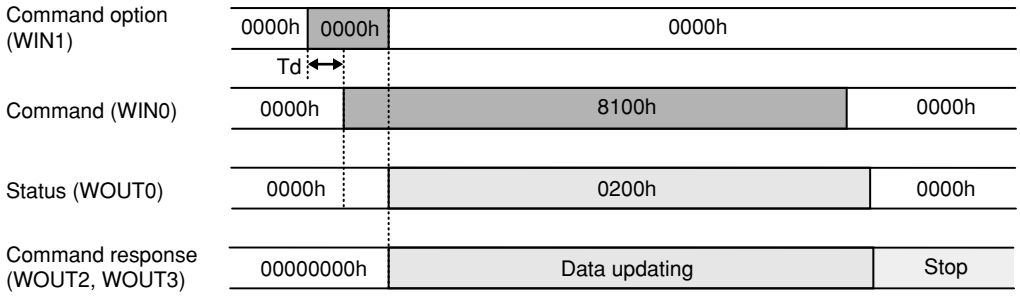
■ Command type and response data

Command (WIN0)	Type (WIN1)	Data (WOUT2, WOUT3)	Units
8100h	0000h	Current position	0.01mm
	0001h	Current speed	0.01mm/s
	0002h	Electrical current	%
	0009h	Voltage	0.1V
	000Ah	Temperature	˚C
	000Dh	Current point No.	-
	000Eh	Load rate	%
	0100h	Bit status	-

■ Timing chart

Timing chart

For a current position continuous query



23540-M0-00

* Data updates occur every 5ms.
* Data updates continue until a 0x0000 (status clear) command is specified.
* Data updates output continuously until the status becomes the command ready status by executing the status clear (no execution) (WIN0=0000h).
  To put in the command ready status without stopping the data update, execute the status clear (continuous query continuation) (WIN0=8000h).

NOTE

This function is effective from CC-Link: Controller's software version Ver.1.08.118, DeviceNet: Controller's software version Ver.1.10.121 and later.

5.10 Positioning operation

There are two kinds of positioning operations available, "data designation type 1" that performs the operation by specifying the position data and "data designation type 2" that performs the operation by specifying the position and speed data.
So, it is necessary to register the point data to the designation points beforehand.

NOTE
This function is available from controller's software version Ver.1.11.125.

1. Data destination type 1

	Command Option			Command
Input	WIN3	WIN2	WIN1	WIN0
	Position data		-	(0800 + n) h

	Command Response			Status
Output	WOUT3	WOUT2	WOUT1	WOUT0
	-		-	(0200 + n) h

n: Point number

In the data designation type 1, the position data to be specified is newly registered using WIN2, 3 based on the information registered at the designation point number "n" to perform the positioning operation.

2. Data destination type 2

	Command Option			Command
Input	WIN3	WIN2	WIN1	WIN0
	Position data		Speed data	(1800 + n) h

	Command Response			Status
Output	WOUT3	WOUT2	WOUT1	WOUT0
	-		-	(0200 + n) h

n: Point number

In the data designation type 2, the speed data to be specified and the position data to be specified are registered using WIN1 and WIN2, 3, respectively based on the information registered at the designation point number "n" to perform the positioning operation.

CAUTION
The data designation types 1 and 2 write the point data in the RAM area. Therefore, as the power is turned on again, the position of the point data and the speed data value return to the values registered in the EEPROM.

■ Data setting

The following shows the range of the data that can be input and the unit of the set value.

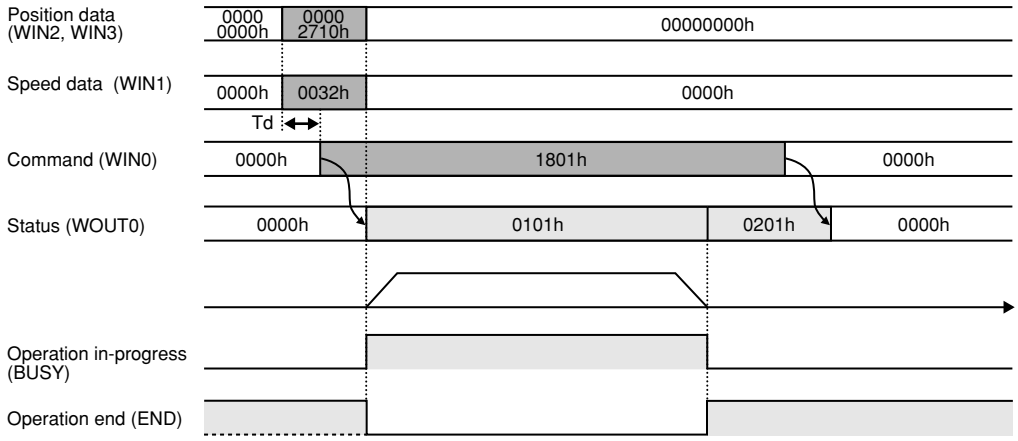
Name	Input range	Unit
Point number	1 to 255	-
Position data	-999999 to 999999	0.01mm
Speed data	Standard setting : 1 to 100	%
	Custom setting : 1 to 65535	mm/s

Status

Name	Status	Description
	WOUT0	
Command ready	0000h	Shows the command executable status.
Positioning operation in-progress	(0100 + n) h	Receives the command to show that the positioning operation is in progress. The point number that is registered when entering the data is output to "n".
Positioning operation normal end	(0200 + n) h	Shows that the operation ends normally. Outputs the point number registered when entering the data to "n".
Positioning operation abnormal end	40xxh	Shows that the operation ends abnormally. Outputs the error code to "xx".

Timing chart (Normal end)

Use the data designation type 2 to specify "P1", "10000 (100.00mm)", and "50" are for the point number, position, and speed, respectively.



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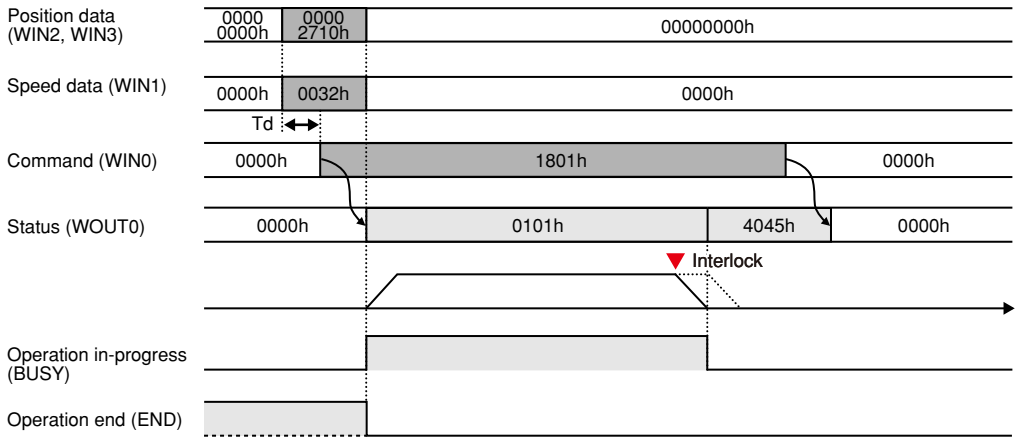
Timing chart (Abnormal end)

Use the data designation type 2 to specify "P1", "10000 (100.00mm)", and "50" are for the point number, position, and speed, respectively.



23543-M0-00

An "error end" condition can be caused by the following conditions.

Type	Cause
Error detected prior to operation	• START input occurred during an operation fault status (alarm, servo OFF, interlock, return-to-origin incomplete, manual mode). • START input occurred with data either not set, or with point data set for a position which exceeds the soft limit.
Error detected during operation	• Alarm occurred during operation. • Interlock stop processing occurred during operation. • A push failure occurred during a push operation.

5.11 Special operations

Special operations are explained below.

1. Brake release

Releases the brake.

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	-		-	0E00h

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	-		-	0200h

2. Brake ON

Turns the brake on.

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	-		-	0E01h

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	-		-	0200h

NOTE

These functions were added starting with controller version V1.13.131.

5.12 Special codes

This section explains the special codes.

1. Status clear (no execution)

The status is changed to the command ready (command executable status).

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	-		-	0000h

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	-		-	0000h

2. Status clear (continuous query continuation)

The status is changed to the command ready while continuing the data output to WOUT2, 3 by executing the continuous query.

Input	Command Option			Command
	WIN3	WIN2	WIN1	WIN0
	-		-	8000h

Output	Command Response			Status
	WOUT3	WOUT2	WOUT1	WOUT0
	Data (continuous query response)		-	0000h

NOTE

This function is available from controller's software version Ver.1.11.125.

3. Command response clear

The command response is cleared to zero.

	Command Option			Command
Input	WIN3	WIN2	WIN1	WIN0
	-		-	0F00h

	Command Response			Status
Output	WOUT3	WOUT2	WOUT1	WOUT0
	0000 0000h		0000h	0200h

6. Operation modes

In addition to I/O control from a host unit (PLC, etc.), the C1/C21/C22 controller also offers communication control from a personal computer (running the RS-Manager support software) and from Handy Terminal (H1). In order to use these tools in a safe manner, the desired operation mode can be selected to enable exclusive operation.
To select the operation mode, use the RS-Manager or H1.

- Normal mode (NRM)
  This mode permits both I/O control and communication control from the PC or H1.
- Monitor mode (MON)
  This mode permits full I/O control, but communication control from the PC or H1 is limited to "monitoring" only, and data editing is not possible. Data can be transmitted from the controller to the PC in this mode.
- Debug mode (DBG)
  Communication control from the PC or H1 is possible in this mode, but I/O control inputs are prohibited.

■ Operation mode functions

Each mode and its available functions are shown below.

Type	I/O Control		Communication Control				
	Input	Output	Data Change PC, H1	Data Transmission PC → Controller	Data Transmission Controller → PC	Monitor PC, H1	Operation PC, H1
NRM mode NRM mode (safety)	○	○	○	○	○	○	○
MON mode MON mode (safety)	○	○	×	×	○	○	×
DBG mode DBG mode (safety)	×	○	○	○	○	○	○

○: Permitted ×: Prohibited

In the "safety" status of each mode, the robot operation is limited to the safety speed.

CAUTION

- **Normal mode allows operation by I/O control and communication control. However, if an operation is attempted by one control method while operated by the other method, unexpected operation may occur or communication may fail. Use only one of these control methods in Normal mode.**
- **In Monitor mode, the (STOP) button on the PC software and the STOP key on the H1 are disabled. To stop the robot during operation by a method other than I/O control, press the emergency stop button.**
- **In Debug mode, I/O control input is disabled, so the robot does not stop by interlock input. To stop the robot during operation, use the (STOP) button on the PC software or the STOP key on the H1, or press the emergency stop button.**

WARNING

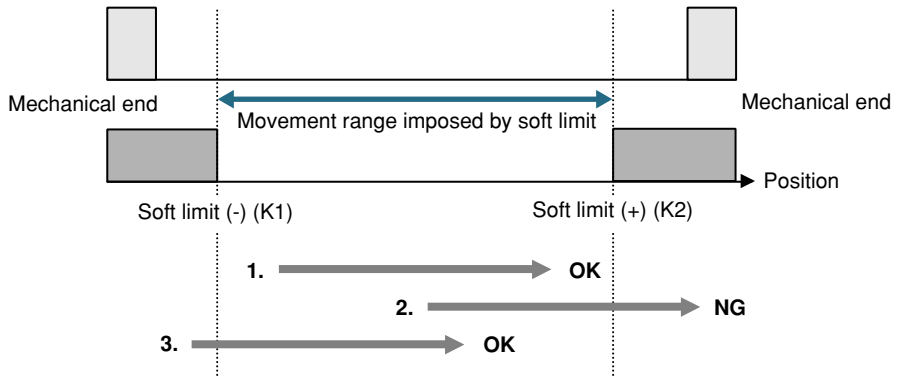
THE ROBOT NORMALLY MOVES AT A HIGH SPEED. WHEN PERFORMING TASKS WITHIN THE ROBOT MOVEMENT RANGE OR WHEN PERFORMING TRIAL OPERATIONS, ETC., IT IS RECOMMENDED TO OPERATE THE ROBOT AT A LOW SPEED. THIS LOW SPEED IS FACTORY-SET TO 250MM/S PRIOR TO SHIPMENT.
HOWEVER, NOTE THAT THIS FUNCTION IS NOT A SAFETY RELATED FUNCTION DEFINED IN ISO13849-1.

7. Other functions

7.1 Soft limit function

Software imposed limits can be applied to the robot's range of motion in order to prevent interference with peripheral equipment. Robot movement is then restricted to target positions which are within the range specified by the soft limit function. The soft limit range can be set at the K1 (soft limit (-)) and K2 (soft limit (+)) RUN parameters.

Soft limit function



23537-M0-00

1: Movement from a stop position within the soft limit to a target position within the soft limit → OK (permitted).
2: Movement from a stop position within the soft limit to a target position outside the soft limit → NG (prohibited).
3: Movement from a stop position outside the soft limit to a target position within the soft limit → OK (permitted).

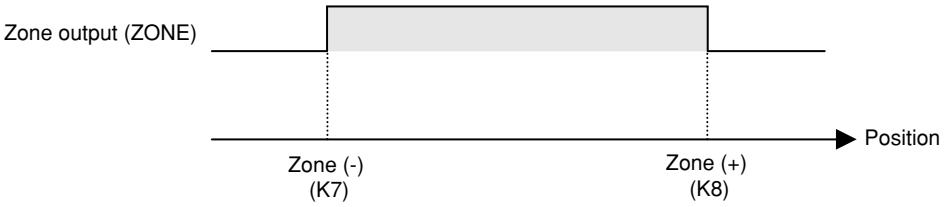
WARNING

SOFT LIMIT FUNCTION IS NOT A SAFETY-RELATED FUNCTION INTENDED TO PROTECT THE HUMAN BODY.
TO RESTRICT THE ROBOT MOVEMENT RANGE TO PROTECT THE HUMAN BODY, USE THE MECHANICAL STOPPERS INSTALLED IN THE ROBOT (OR AVAILABLE AS OPTIONS).

7.2 Zone output function

This function outputs information which indicates whether or not the robot's current position is within a specified zone, and it can be used to check the robot's position from a host unit, or to recognize zones where movement is permitted or prohibited, etc. The zone boundaries can be set by the K7 (Zone -) and K8 (Zone +) RUN parameters.

Zone output function



23538-M0-00

NOTE

The zone output function is disabled if a return-to-origin has not yet been completed.

7.3 Alarm No. output function

When an error alarm occurs, the alarm No. is output to the POUT0 to POUT7 point No. outputs. If multiple alarms have occurred, the highest priority alarm No. is output. The alarm No. output function can be enabled/disabled by the K30 (Alarm No. output function) I/O parameter setting.

NOTE

- Error alarm denotes "Error alarm (internal causes)" and "Error alarm (external causes)".
- For details regarding error alarms, see section 1, "Alarm groups", in Chapter 6.

Output examples

Alarm Type	No.	Point No. Output							
		POUT7	POUT6	POUT5	POUT4	POUT3	POUT2	POUT1	POUT0
Position detection error	82	1	0	0	0	0	0	1	0
Overload error	86	1	0	0	0	0	1	1	0
Main power outage	C2	1	1	0	0	0	0	1	0

1 : ON 0 : OFF

7.4 Changing the payload

The C1/C21/C22 controller. automatically sets the acceleration and optimizes positioning operations based on the payload which has been defined. However, in conveyance systems, the payload can vary greatly depending on whether or not the conveyance objects are loaded or not. In such cases, selection is possible from 2 payload types for each operation. The payload selection is made at each point data's "Flag" setting.

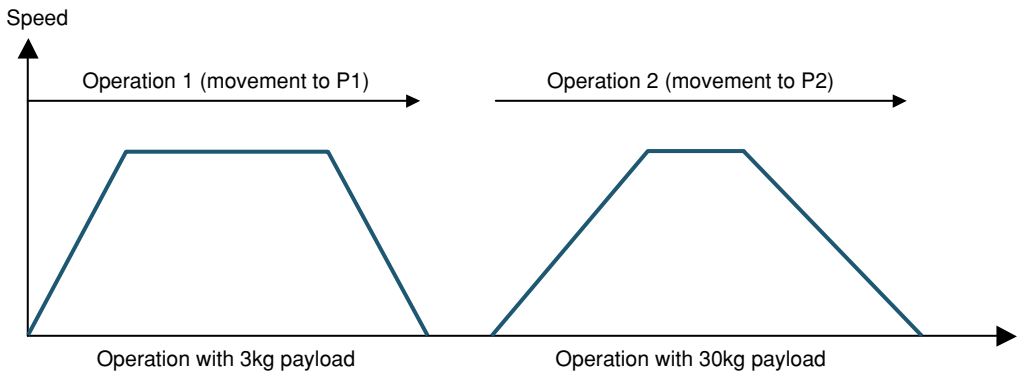
Item	Setting	Description
Payload select	Flag bit0 = 0	Payload 1 (K76) applies
	Flag bit0 = 1	Payload 2 (K78) applies

Setting examples

No.	RUN type	Position [mm]	Speed [%]	Accel. [%]	Decel. [%]	Flag
P1	ABS	200.00	100	100	100	1
P2	ABS	500.00	100	100	100	0

Payload 1: 30kg
(Max. payload accel. 1: 1.60m/s^2)
Payload 2: 3kg
(Max. payload accel. 2: 4.00m/s^2)

Setting examples



23539-M0-00

TIP

In the "Custom setting" mode, if the acceleration of point data exceeds the acceleration upper limit determined by the payload, then the actual acceleration is restricted to the acceleration upper limit.

7.5 Stop mode C1

This switches the control during stop state after positioning operations. Use "Flag" for each point to switch the stop mode.

Item	Setting value	Description
Stop mode select	Flag bit1=0	Closed mode
	Flag bit1=1	Open mode

■ Closed mode

This controller delivers high stop performance equivalent to servomotors by the vector control. This ensures "no step-out" and reduces the holding torque required during stop.

■ Open mode

This mode enables the holding torque during stop. In closed mode, the motor operates like a servo motor and tends to cause a hunting to occur during stop. In open mode, a hunting caused by external disturbing effects can be avoided since the holding torque is enabled. The holding torque amount and the time to enable the holding torque can be set by the parameters.

NOTE

The stop mode after the "Point trace" operations will be determined by the "Flag" setting for each point data. The stop mode after the operations such as "Jog" and "Return-to-origin" operations (other than "Point trace" operations) will be determined by the parameter "Stop mode" (K123).

CAUTION

- **In the open mode, correction of the stop position will not be made if the position has been shifted by an external force, etc. because the feedback control is not done in this mode.**
- **When the stop mode is switched from closed to open mode, the stop position may change to a certain degree due to the effect of the step angle.**

8. LED status indicators

Operation statuses are indicated by 2 types of LEDs located on the front face of the controller.
The following table shows the LED statuses and their meanings.

LED Name	Color	Status	Meaning
PWR	Blue	OFF	Control power shutoff
		Blinking (at 0.5sec intervals)	Servo OFF
		ON (constant ON)	Servo ON
ERR	Red	OFF	Control power shutoff or no active error alarms (normal)
		Blinking (at 0.5sec intervals)	Error alarm active (external cause)
		ON (constant ON)	Error alarm active (internal cause)

Chapter 6 Troubleshooting

Contents

1. Alarm groups 6-1
2. Alarm recording function 6-2
3. Alarm list 6-3
4. Alarms: Possible causes and actions 6-4

1. Alarm groups

Alarms on this controller are one of the following 5 groups.

Group	Description
Message alarm	Error messages involving data editing or operation commands sent as data.
Operation alarm	Alarm that appears when operation ends due to an error.
Error alarm (internal cause)	Alarm that occurs due to internal causes. To resume operation after eliminating the cause of the problem, you must reset the alarm or turn the power off and back on again. An alarm description is stored in the alarm history.
Error alarm (external cause)	Alarm that occurs due to external causes. Alarm occurs when safety circuit is triggered. Operation can resume after eliminating the cause.
Warning alarm	Alarm that is displayed as a warning. (This does not directly affect operation.)

2. Alarm recording function

This function records and stores the error alarms (internal cause) as they occur, along with their alarm number and alarm conditions at that time. Up to 50 alarms can be stored.

* This function does not store the "81: AC POWER DOWN" error alarm.

■ Alarm description

Item	Description	Units
Cause	If 2 or more error alarms occur, the cause of the alarm with the smaller alarm No. is stored.	-
Time	Total time counted while control power was on.	Day : hour : minute
Position	Current position information when an alarm occurred	mm
Speed	Speed at which robot was moving when alarm occurred.	mm/s
Run status	"Run type" that was selected when alarm occurred.	-
Run point	Point number that was selected for operation when alarm occurred. When not in operation a 0 (zero) is entered.	-
Current	Command current when alarm occurred	%
Voltage	Motor power voltage when alarm occurred	V
Input	Input information when alarm occurred	-
Output	Output information when alarm occurred	-

3. Alarm list

The following table shows alarm numbers, messages, and reset methods.

Alarm No.	Alarm Message	Reset *1	Origin Position *2
02	DATA ERROR	-	-
03	DATA RANGE OVER	-	-
04	MONITOR MODE	-	-
05	RUNNING	-	-
06	MANUAL MODE	-	-
41	SERVO OFF	-	-
42	ORIGIN INCOMPLETE	-	-
43	NO POINT DATA	-	-
44	SOFTLIMIT OVER	-	-
45	INTERLOCK	-	-
46	STOP KEY	-	-
47	PUSH MISTAKE	-	-
48	ORG. MISTAKE	-	-
49	SERIAL COMM. ERR.	-	-
81	AC POWER DOWN	Restart	C1 : × C21/C22 : -
82	ENCODER ERROR	Restart	×
83	ABS. ENCODER ERR. C21 C22	Reset	×
84	IPM ERROR C21 C22	Reset	-
85	OVERHEAT	Reset	-
86	OVERLOAD	Reset	-
87	OVERVOLTAGE	Reset	-
88	LOW VOLTAGE	Reset	-
89	POSITION ERROR	Reset	
8A	ABS. BATTERY ERR. C21 C22	Reset	×
8B	ABS. COUNT ERROR C21 C22	Reset	×
8C	ABS. ME. ERROR C21 C22	Reset	×
8D	ABS.OVERFLOW ERR. C21 C22	Reset	×
8E	OVERCURRENT	Reset	-
8F	MOTOR CURRENT ERR.	Reset	-
91	INT. COMM. ERROR	Reset	-
92	CPU ERROR	Reset	-
93	I/O FAULT	Reset *3	-
C1	EMERGENCY STOP	Eliminate cause	-
C2	MOTOR POWER DOWN	Eliminate cause	-
F1	ABS. BATT. LOW WARNIN C21 C22	-	-
F2	PUSH WARNING	-	-
F4	I/O ERROR	-	-

*1. Indicates the alarm reset method.
*2. Indicates whether or not origin position is retained when alarm occurred. (× : Not retained)
*3. Power must be turned off and then back on when using CC-Link or DeviceNet.

4. Alarms: Possible causes and actions

Message alarms

No.	Message	Meaning	Possible Cause	Action
02	DATA ERROR	Data setting error	Attempt was made to enter data that exceeded the specified range.	Enter data within the specified range.
03	DATA RANGE OVER	Data setting range exceeded.	Written data exceeded the specified range.	Write data within the specified range.
04	MONITOR MODE	Operation or edit command was executed in Monitor mode.	Operation or data edit was executed while "Run" mode was in Monitor mode.	Change the "Run" mode to Normal mode or Debug mode.
05	RUNNING	Operation command was executed during operation.	Another operation was attempted during operation.	Stop the operation and then re-execute the command.
06	MANUAL MODE	Operation command was executed during Manual mode.	Positioning was attempted during Manual mode.	Exit the Manual mode and re-execute the command.

Operation alarms

No.	Message	Meaning	Possible Cause	Action
41	SERVO OFF	Servo is off.	Operation was attempted while the servo was off. Servo turned off during operation.	Turn the servo on.
42	ORIGIN INCOMPLETE	Origin search (return-to-origin) is incomplete.	Positioning operation was attempted while origin search was incomplete	Perform an origin search.
			Origin search direction (K14) or Axis polarity (K15) was changed.	
			Parameter was transferred from PC.	
43	NO POINT DATA	Point data is not registered.	Positioning operation was attempted by specifying unregistered point data.	Register the point data. Positioning operation must be performed using registered point data.
44	SOFTLIMIT OVER	Software limit was exceeded.	Positioning operation attempted to move to a point exceeding the soft limits.	Adjust the target position so that it is within the soft limits.
45	INTERLOCK	Interlock was activated.	Operation was attempted while / LOCK was off.	Release the interlock and then start operation.
			/LOCK was turned off during operation.	
46	STOP KEY	Operation stop was input.	Stop command was input during operation using PC or H1.	Resume operation.
47	PUSH MISTAKE	Failed to push	Push operation was judged a "failed to push" error.	Correct the problem to cancel the "failed to push" error.
48	ORG. MISTAKE	Failed to detect origin at return-to-origin	5 minutes or more elapsed after return-to-origin occurred.	Correct the environment related to the return-to-origin operation.
			Origin sensor avoidance width (250mm) was exceeded with the origin sensor remaining ON (when using sensor format).	
49	SERIAL COMM. ERR.	Serial communication error occurred between controller and communication device.	Communication cable is defective.	Replace the communication cable.
			Communication device failed.	Replace the communication device.

Error alarms (internal causes)

No.	Message	Meaning	Possible Cause	Action
81	AC POWER DOWN	Drop in control power supply voltage.	Power supply voltage too low.	Check the power supply.
			Momentary power outage (below 50% of specified input voltage) occurred for more than 40ms. C21 C22	
			Power supply does not have sufficient capacity.	
82	ENCODER ERROR	Error occurred during data exchange with position detector.	Robot I/O cable is not securely connected.	Connect the robot I/O cable correctly.
			Robot I/O cable broke or failed.	Replace the robot I/O cable.
			Wrong combination of controller and robot.	Connect the correct controller to a matching robot.
			Position detector failed.	Replace the motor.
			Position detection circuit failed.	Replace the controller.
83	ABS. ENCODER ERR. C21 C22	Robot I/O cable is disconnected or broke (when control power supply is off).	Robot I/O cable is not securely connected (when control power supply is off).	Connect the robot I/O cable correctly.
			Robot I/O cable broke or failed (when control power supply is off).	Replace the robot I/O cable.
			Absolute battery is disconnected.	Connect the absolute battery correctly.
			Absolute battery has worn out or failed.	Replace the absolute battery.
84	IPM ERROR C21 C22	Excessive current flow was detected.	Phases U, V and W in the motor cable are shorted.	Replace the motor cable.
			Motor failed.	Replace the motor.
			Motor drive circuit failed.	Replace the controller.
85	OVERHEAT	Temperature protection level (90˚C) was exceeded.	Ambient temperature is above 40˚C.	Check the ambient condition.
			Thermal sensor failed.	Replace the controller.
86	OVERLOAD	Overload detection level was exceeded.	Rated current was exceeded.	Reduce the load. Set the payload correctly. Lower the duty cycle.
			Robot drive system collided with some objects.	Check the operation pattern.
			Electromagnetic brake is not working.	Supply the brake power correctly. C21 C22 Replace the brake.
			Wrong robot setting	Make correct robot setting.
87	OVERVOLTAGE	Overload detection level (45V for C1 or 420V for C21 C22) was exceeded.	Main power supply voltage exceeded the specified range.	Check the power supply.
			Regenerative unit is not securely connected. C21 C22	Connect the regenerative unit correctly. C21 C22
			Regenerative unit connection cable broke or failed. C21 C22	Replace the connection cable. C21 C22
88	LOW VOLTAGE	Power supply voltage dropped below the low voltage detection level (15V for C1 or 180V for C21 C22).	Main power supply voltage does not reach the specified value.	Check the power supply.
			Controller failed.	Replace the controller.
89	POSITION ERROR	Position deviation overflow level was exceeded.	Robot drive unit collided with some objects.	Check the operation pattern.
			Motor cable is not securely connected.	Connect the motor cable correctly.
			Motor cable broke or failed.	Replace the motor cable.
			Wrong robot setting	Make correct robot setting.
			Return-to-origin speed (K13) setting is too high.	Reduce the setting.

No.	Message	Meaning	Possible Cause	Action
8A	ABS. BATTERY ERR. C21 C22	Absolute battery voltage dropped below the low error detection level (2.5V).	Absolute battery is disconnected.	Connect the absolute battery correctly.
			Absolute battery has worn out or failed.	Replace the absolute battery.
8B	ABS. COUNT ERROR C21 C22	Robot moved at acceleration higher than the specified value during absolute battery operation.	Large external force was applied to the robot drive unit while the control power supply was shut off.	Recheck the surrounding environment where the robot is used.
			Position detection circuit failed.	Replace the controller.
8C	ABS. ME. ERROR C21 C22	Mismatch of absolute multi-turn data and position data	Position detection circuit failed.	Replace the controller.
8D	ABS.OVERFLOW ERR. C21 C22	Absolute multi-turn data exceeded the specified value.	Robot moved to a position outside of specified value.	Check the operating conditions and environment.
			Position detection circuit failed.	Replace the controller.
8E	OVERCURRENT	Current higher than the allowable current flow was detected.	Robot drive unit collided with some objects.	Check the operation pattern.
			Motor cable is shorted.	Replace the motor cable.
			Motor failed.	Replace the motor.
8F	MOTOR CURRENT ERR.	Motor current does not follow up on command.	Motor cable is disconnected.	Connect the motor cable correctly.
			Motor cable broke or failed.	Replace the motor cable.
			Motor failed.	Replace the motor.
			Wrong robot setting	Make correct robot setting.
91	INT. COMM. ERROR	Communication error occurred between CPU and I/O module.	CPU peripheral circuits failed.	Cancel the alarm. If the alarm occurs again, replace the controller.
92	CPU ERROR	CPU stopped due to error.	CPU failed.	Cancel the alarm. If the alarm occurs again, replace the controller.
93	I/O FAULT	I/O module stopped due to error.	I/O power supply is not input or exceeds a range of DC24V ± 10%.	Input a voltage of DC24V ± 10% to the I/O power supply.
			I/O power supply is turned off by the NPN/PNP.	Turn the I/O power supply back on.
			I/O module failed.	Cancel the alarm (For the NPN/PNP, turn off the I/O power supply, and then turn it on again before cancelling the alarm.). If the alarm occurs again, replace the controller.

■ Error alarms (external causes)

No.	Message	Meaning	Possible Cause	Action
C1	EMERGENCY STOP	Emergency stop was activated.	External safety circuit functioned and emergency stop was activated.	Ensure safety and then cancel the safety circuit.
			Emergency stop wiring is incomplete. Wiring is wrong.	Configure the safety circuit correctly.
C2	MOTOR POWER DOWN	Drop in main power supply voltage.	External safety circuit functioned and main power supply turned off.	Ensure safety and then cancel the safety circuit.
			Main power was not supplied.	Supply the main power correctly.

Warning alarms

No.	Message	Meaning	Possible Cause	Action
F1	ABS. BATTERY LOW C21 C22	Absolute battery voltage dropped below the warning level (3.1V).	Absolute battery has worn out or failed.	Replace the absolute battery.
F2	PUSH WARNING	Failed to push a workpiece.	Push operation was judged as a "failed to push" error.	Correct the problem to cancel the "failed to push" error.
F4	I/O ERROR	I/O module is not operating correctly.	24V was not correctly supplied to NPN or PNP circuits.	Supply 24 V power correctly.
			I/O module was not operating correctly.	Replace the controller.

Chapter 7 Specifications

Contents

1. Controller basic specifications 7-1
1.1 Basic specifications 7-1
1.2 Dimensional outlines 7-2
2. I/O interface specifications 7-3
2.1 NPN 7-3
2.2 PNP 7-3
2.3 CC-Link 7-3
2.4 DeviceNet 7-4
3. Regenerative unit specifications 7-5
3.1 Dimensional outlines (RGT) 7-5

1. Controller basic specifications

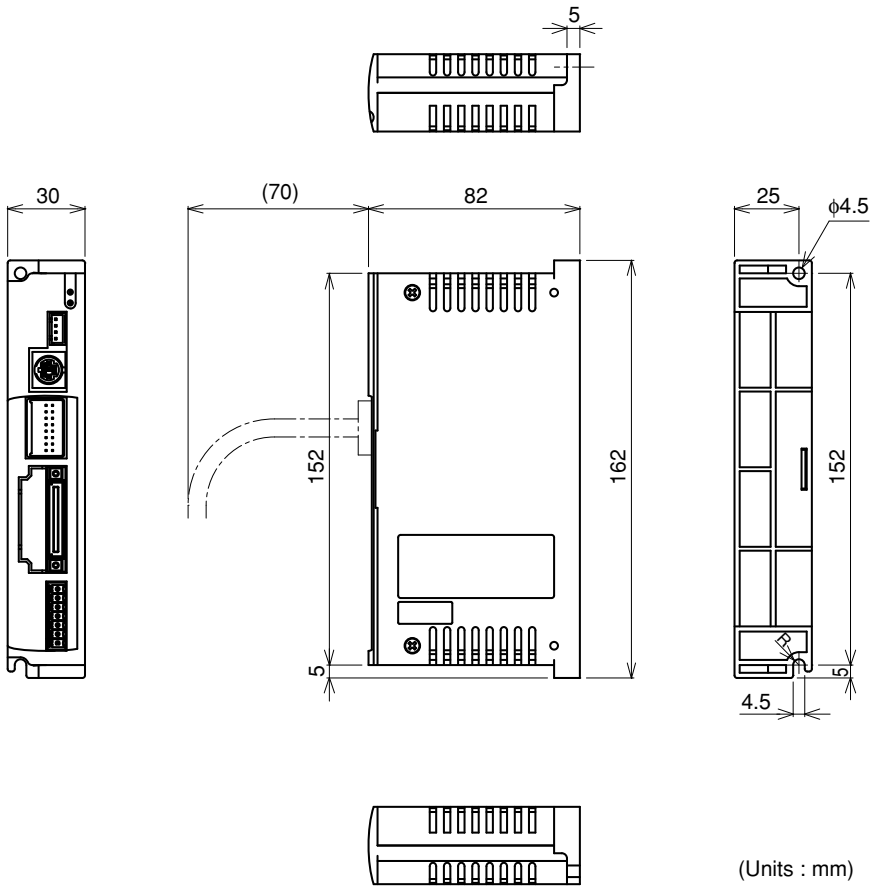
1.1 Basic specifications

Item	C1	C21	C22
Controllable robot	RS1 / RS2 / RS3 RS1C / RS2C / RS3C RSD1 / RSD2 / RSD3 RSDG1 / RSDG2 / RSDG3	RSF4 RSH1 / RSH2 / RSH3 / RSH4 / RSH5 RSH1C / RSH2C / RSH3C RSB1 / RSB2	
Current consumption	2.5A (Max. 4.5A)	-	
Power capacity	-	400VA	
Dimensions	W30×H162×D82mm	W58×H162×D131mm	
Weight	Approx. 0.2kg	Approx. 0.9kg	
Control power supply	24V DC ±10%	Single-phase 100 to 115V AC ±10%, 50/60Hz	Single-phase 200 to 230V AC ±10%, 50/60Hz
Main power supply	24V DC ±10%	Single-phase 100 to 115V AC ±10%, 50/60Hz	Single-phase 200 to 230V AC ±10%, 50/60Hz
Control method	Closed loop vector control method		
Position detection method	Resolver (resolution: 20480 P/r)	Multi-turn resolver with absolute position function (resolution: 16384 P/r)	
Operation mode	Positioning operation by specifying point number		
Types of operation	Positioning, merge-positioning, push, and jog operations		
Number of points	255		
Point type setting	1) Standard setting: Set speed and acceleration in percent of the respective maximum settings. 2) Custom setting : Set speed and acceleration in SI units.		
Point teaching	Manual data input (coordinate input), teaching, direct teaching		
I/O interface	Selectable from the following: NPN, PNP, CC-Link, DeviceNet.		
Input	Servo ON (SERVO), reset (RESET), start (START), interlock (/LOCK), origin search (ORG), manual mode (MANUAL), jog motion - (JOG-), jog motion +(JOG+), point number selection (PIN0 to PIN7)		
Output	Servo status (SRV-S), alarm (/ALM), operation end (END), operation in progress (BUSY), control output (OUT0 - OUT3), point number output 0 to 7 (POUT0 - POUT7)		
Communication	RS-232C, 1 channel		
Power for brake	-	24V DC ±10%, 300mA (prepared by user)	
Emergency stop circuit	Emergency stop input, emergency stop contact output (1 system: When the H1 is used.)	Emergency stop input, main power input ready output, emergency stop contact output (1 system: When the H1 is used.)	
Protection function	Position detection error, overheat, overload, overvoltage, low voltage, position deviation, over current, motor current error		
Ambient operating temperature and humidity	0 to 40˚C, 35 to 85% RH (no condensation)		
Storage ambient temperature and humidity	-10 to 65˚C, 10 to 85% RH (no condensation)		
Atmosphere	Indoor, not exposed to direct sunlight. No corrosive gas, inflammable gas, oil mist, and dust particles should be present.		
Vibration resistance	10 to 57Hz in each of XYZ directions, single amplitude 0.075mm, 57 to 150Hz, 9.8m/s^2		
Protective structure	-	IP20	

1.2 Dimensional outlines

Dimensional outlines

C1

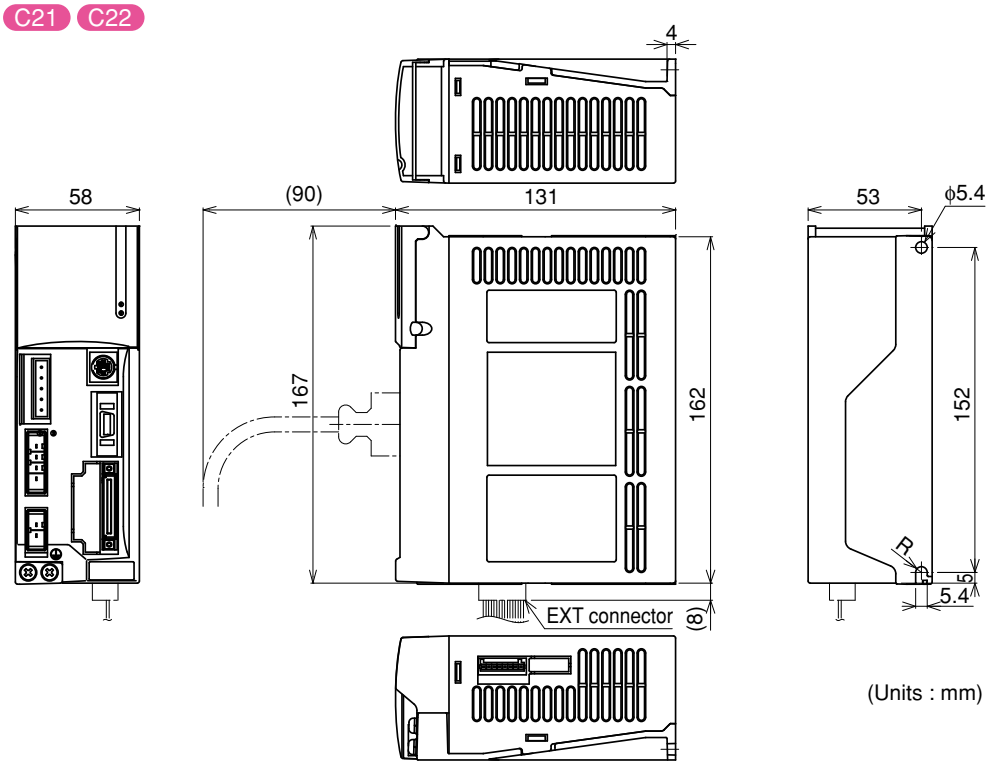


(Units : mm)

23701-M3-00

Dimensional outlines

C21 C22



(Units : mm)

23701-M1-00

2. I/O interface specifications

2.1 NPN

Input	16 points, 24V DC ±10%, 5.1mA per point, positive common
Output	16 points, 24V DC ±10%, 50mA per point, total 0.4A or less per 8 points, sink type

2.2 PNP

Input	16 points, 24V DC ±10%, 5.5mA per point, negative common
Output	16 points, 24V DC ±10%, 50mA per point, total 0.4A or less per 8 points, source type

2.3 CC-Link

■ CC-Link specifications

Item	Description
CC-Link support version	Ver. 1.10
Remote station type	Remote station device
Station used	1
Station No. setting	1 to 64
Communication speed setting	10M / 5M / 2.5M / 625K / 156Kbps
Minimum length between station	0.2m or more
Overall distance	100m (10Mbps) / 160m (5Mbps) / 400m (2.5Mbps) / 900m (625Kbps) / 1200m (156Kbps)
Monitor LED	L RUN, L ERR., SD, RD

■ LED indicators

L RUN	L ERR.	SD	RD	Operation
○	◎	◎	○	Communication is normal, but CRC errors occasionally occur due to noise.
○	◎ 0.4s	◎	○	Either the "baud rate" or "node No." setting was changed from that which existed when the status was cleared by a reset.
○	◎	◎	●	- (Implausible operation status)
○	◎	●	○	CRC error in reception data, and response is not possible.
○	◎	●	●	- (Implausible operation status)
○	●	◎	○	Normal communication
○	●	◎	●	- (Implausible operation status)
○	●	●	○	Data destined for local station did not arrive.
○	●	●	●	- (Implausible operation status)
●	◎	◎	○	Polling response is occurring, but CRC error occurred at the refresh reception.
●	◎	◎	●	- (Implausible operation status)
●	◎	●	○	CRC error in data destined for local station.
●	◎	●	●	- (Implausible operation status)
●	●	◎	○	- (Implausible operation status)
●	●	◎	●	- (Implausible operation status)
●	●	●	○	There is no data destined for the local station, but local station reception is disabled due to noise.
●	●	●	●	Data reception is disabled due to severed/disconnected line. Power is off or hardware is being installed.
●	○	●	○, ●	Incorrect "baud rate" or "node No." setting.

○: ON ●: OFF ◎: Blinking

2.4 DeviceNet

DeviceNet specifications

Item	Description
Compatible DeviceNet Specs.	Volume1 Release2.0 Volume2 Release2.0
Vendor name	MISUMI Corporation (ID=927)
Device type	Generic Device (Device No.0)
Product code	101
Product revision	1.1
Max. network current consumption	40mA
Physical layer insulation present/absent	Present
Support LED	MS, NS
MAC ID setting	0 to 63
Baud rate setting	500K / 250K / 125Kbps
Communication data	Predefined Master/Slave Connection Set : Group 2 Only server Dynamic connection support (UCMM) : No Explicit message divided transmission support : Yes
Network length	Total extension length / Branch line length / Total branch line length 500Kbps 100m 6m or less / 39m or less 250Kbps 250m 6m or less / 78m or less 125Kbps 500m 6m or less / 156m or less
Number of input/output points	Inputs: 6CH; Outputs: 6CH

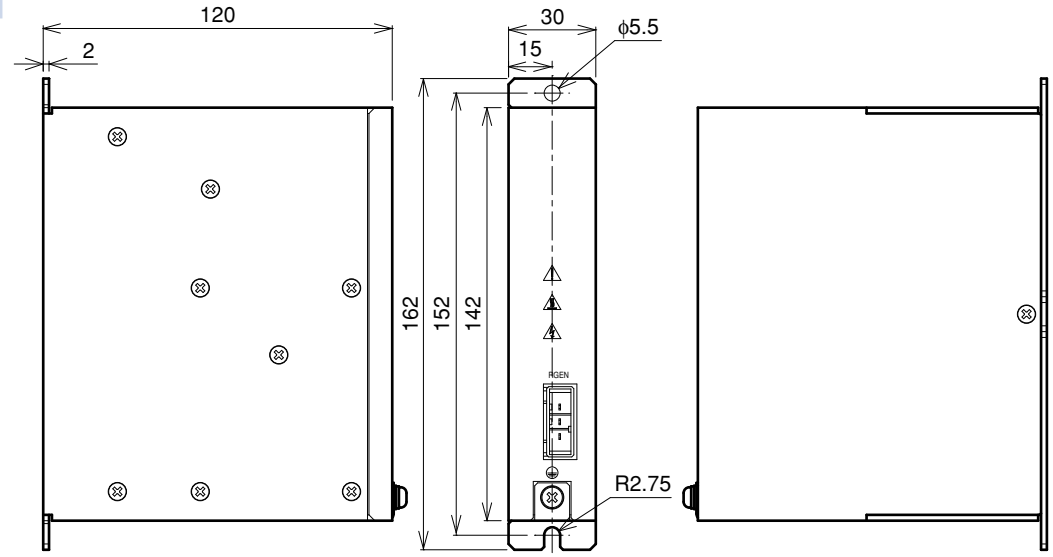
LED indicators

Type	Indication Status	Description
MS (module status)	OFF	Power OFF status
	Green ON	Normal initializing completed
	Red blinking	Incorrect communication setting
	Red ON	Hardware error
NS (network status)	OFF	Power OFF status. Communication error check in progress
	Green ON	Normal communication
	Green blinking	Establishing communication status
	Red blinking	Connection time-out in progress
	Red ON	MAC ID type. Busoff error

3. Regenerative unit specifications

3.1 Dimensional outlines (RGT)

RGT



(Units : mm)

23705-M1-00

H1 Operation Guide

Contents

Introduction A-1

1. What the H1 does A-2

1.1 H1 panel layout A-3

1.2 Connecting to the external safety circuit (HD1) A-5

2. Connecting or disconnecting the H1 A-6

2.1 Connecting to the controller A-6

2.2 Disconnecting from the controller A-7

3. Basic operations A-8

3.1 Operation key layout and functions A-8

3.2 Screen configuration A-9

3.3 Starting to use the keys A-11

3.4 How to enter numbers A-14

3.5 Menu structure A-15

4. Editing the point data A-16

4.1 Point teaching A-16

4.1.1 Teaching playback A-16

4.1.2 Direct teaching A-18

4.2 Copying point data A-19

4.3 Deleting point data A-20

4.4 Displaying a list of point data A-21

5. Parameter setting A-22

5.1 Setting Run parameters A-22

5.2 Setting I/O parameters A-23

5.3 Setting Option parameters A-24

5.4 Setting Servo parameters A-25

6. Operating the robot A-26

6.1 Turning the servo on or off A-26

6.2 Origin search (return-to-origin) A-27

6.3 Operating the robot A-28

6.4 Resetting an alarm A-30

7. Monitor functions A-31

7.1 I/O monitor A-31
7.2 Status monitor A-32
7.3 Run monitor A-33
7.4 Alarm display A-34
7.5 Warning display A-34
7.6 Message display A-35
7.7 Alarm record display A-36
7.8 Information display A-37

8. Other functions A-38

8.1 Operation mode A-38
8.2 Setting mode A-39
8.2.1 Changing the display language A-39

9. Specifications A-40

9.1 Basic specifications A-40
9.2 Dimensional outlines A-40
9.2.1 H1 A-40
9.2.2 HD1 A-41

Introduction

This "H1 Operation Guide" explains how to use the H1 and HD1 (with ENABLE switch) Handy Terminals that come with the C1/C21/C22 controller as an option.
Before reading this section, read the precautions and descriptions stated in the "Controller Guide" (main part of this manual) to understand the point data and parameter data, as well as controller functions and usage.

1. What the H1 does

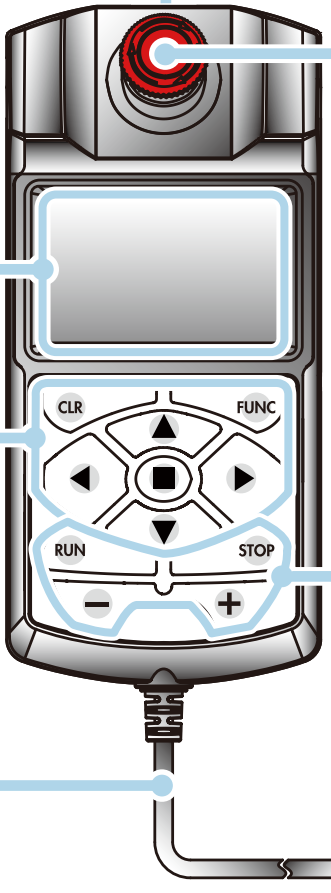
The H1 Handy Terminal is provided as an option for the C1/C21/C22 controller. When connected to the controller, the H1 allows you to perform the following operations and checks.

H1 tasks		With the H1 you can:	Refer to:
Point data editing	Data editing	Set point data including "Run type", Position", "Speed", "Push" and other information.	3.3
	Teaching	Move the robot to a position and teach that position to store it in point data.	4.1
	Copy and deletion	Copy or delete point data you created.	4.2 to 4.3
	List display	Display a list of point data in the point data number sequence.	4.4
Parameter setting	Run parameters	Set parameters needed for robot operation such as positioning and origin search.	5.1
	I/O parameters	Set parameters for terminal pin assignments and I/O functions.	5.2
	Option parameters	Set parameters for options such as CC-Link.	5.3
	Servo parameters	Set parameters such as payload, etc.	5.4
Robot operation	Servo status	Turn the servo on or off.	6.1
	Origin search	Return the robot to its origin position.	6.2
	Positioning	Move the robot to position it at a specified point.	6.3
	Jog	Move the robot in jog mode or inching mode with the Jog keys.	4.1
Display function	I/O monitor	Display I/O signal status to or from host device.	7.1
	Status monitor	Display internal status such as servo, brake and emergency stop status.	7.2
	Run monitor	Display information such as current position and speed during operation.	7.3
	Alarm and warning	Display recent alarms and warnings that have occurred. A past alarm history can also be displayed.	7.4 to 7.7
	Other information	Display the model numbers and specs of the controller and robot being used.	7.8
Others	Emergency stop	Immediately stop the robot movement if needed in case of emergency.	1.2
	Operation mode setup	Set the operation mode.	8.1
	Setting mode	Select the LCD display language (English/Japanese).	8.2

1.1 H1 panel layout

The H1 consists of a LCD screen, data edit keys, run/stop keys, and emergency stop button as shown below.

H1 panel layout



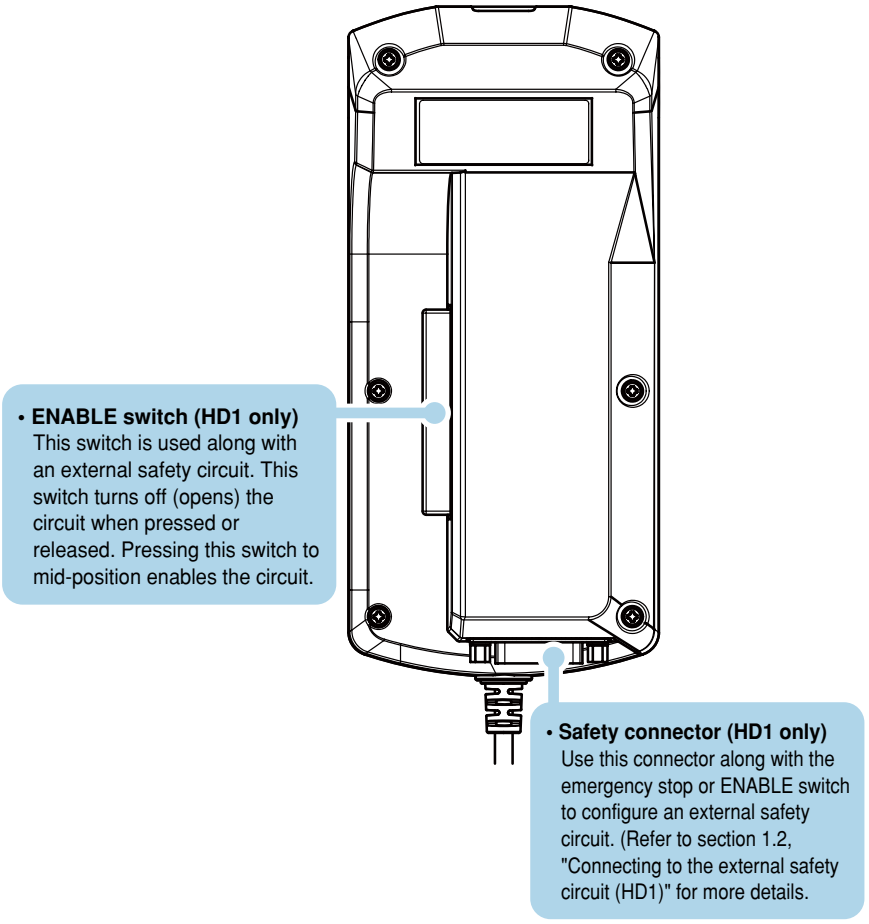
- **Strap holder**
  Attaching a short strap or necklace strap here prevents dropping the H1 while operating it or installing it onto equipment.
- **LCD screen**
  This is a liquid crystal display (LCD) screen with 32 characters × 10 lines (pixel display), showing the operation menus and various types of information.
- **Data edit keys**
  Use these keys to select menus and edit various data. (Refer to section 3, "Basic operations" for more details.)
- **Connection cable**
  This cable connects to the controller. One end of this cable is terminated with an 8-pin MD connector (male). Plug this cable into the COM1 connector on the controller front panel.
- **Emergency stop button**
  Pressing this button during operation immediately stops robot movement. To release this button, turn it clockwise. Releasing this button also cancels emergency stop.
- **Run/stop keys**
  Use these keys to operate the robot for teaching or positioning, or to stop operation. The − and + keys are also provided to move the robot in jog mode. (Refer to section 3, "Basic operations" for more details.)

23A01-M0-00

WARNING

- DO NOT PUSH OR STRIKE THE LCD SCREEN SURFACE WITH A POINTED TOOL OR HARD OBJECT. THIS MIGHT SCRATCH OR DAMAGE THE LCD SCREEN.
- THE FLUID (LIQUID CRYSTAL) IN THE LCD DISPLAY IS A HAZARDOUS SUBSTANCE. IF THIS FLUID LEAKS FROM THE DISPLAY DUE TO DAMAGE AND ADHERES TO SKIN OR CLOTHES, WASH IT OFF IMMEDIATELY WITH SOAP AND WATER. THEN CONSULT A PHYSICIAN.
- DO NOT WIND THE CONNECTION CABLE AROUND THE H1 BODY WHEN STORING, AND DO NOT BEND IT SHARPLY. DOING SO MIGHT BREAK THE WIRES IN THE CONNECTION CABLE.
- DO NOT USE AN EXTENSION CORD WITH THE CONNECTION CABLE.
- NEVER DISASSEMBLE OR MODIFY ANY PART OF THE H1. DOING SO WILL CAUSE FAILURES OR MALFUNCTIONS.

Rear view (HD1)



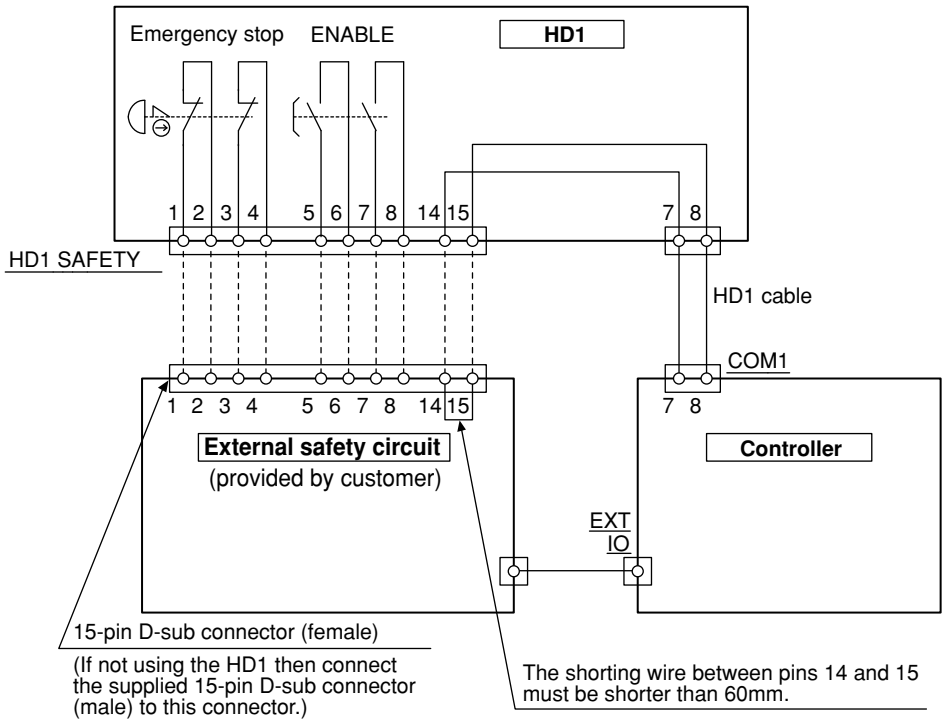
23A02-M0-00

1.2 Connecting to the external safety circuit (HD1)

Using the safety connector on the HD1 allows configuring an external safety circuit with the HD1 emergency stop button or ENABLE switch.

■ HD1 wiring diagram

HD1 wiring diagram

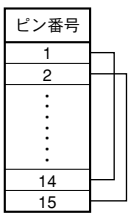


23A03-M0-00

- **15-pin D-sub connectors (supplied only with HD1)**

  Use these connectors with the emergency stop or ENABLE switch to configure an external safety circuit.

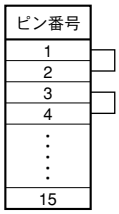
15-pin D-sub connector (female: KS9-M532A-000)



Attaching this connector directly to the safety connector on the HD1 enables the emergency stop button only.

23A04-M0-00

15-pin D-sub connector (male: KS9-M532E-001)



If not using the HD1 then attach this connector directly to the 15-pin D-sub connector on the external safety circuit so that the emergency stop circuit is shorted.

23A05-M0-00

CAUTION

Set so the voltage and current ratings on the circuit connected to pins 1 to 8 on the supplied 15-pin D-sub connector are no higher than 30V DC and 1A.
Pins 1 and 14, and pins 2 and 15 on the supplied 15-pin D-sub connector are shorted prior to shipment. When connecting the HD1 contacts to the external emergency stop circuit, change the wiring as shown in the above diagram to short pins 14 and 15 together.
Never attempt to extend the shorting wire between pins 14 and 15. Doing so might cause noise in the wiring that interferes with HD1 or controller operation and causes faulty operation. This wiring should be kept short.

2. Connecting or disconnecting the H1

The H1 can be connected or disconnected from the controller as needed regardless of whether controller power is on or off.

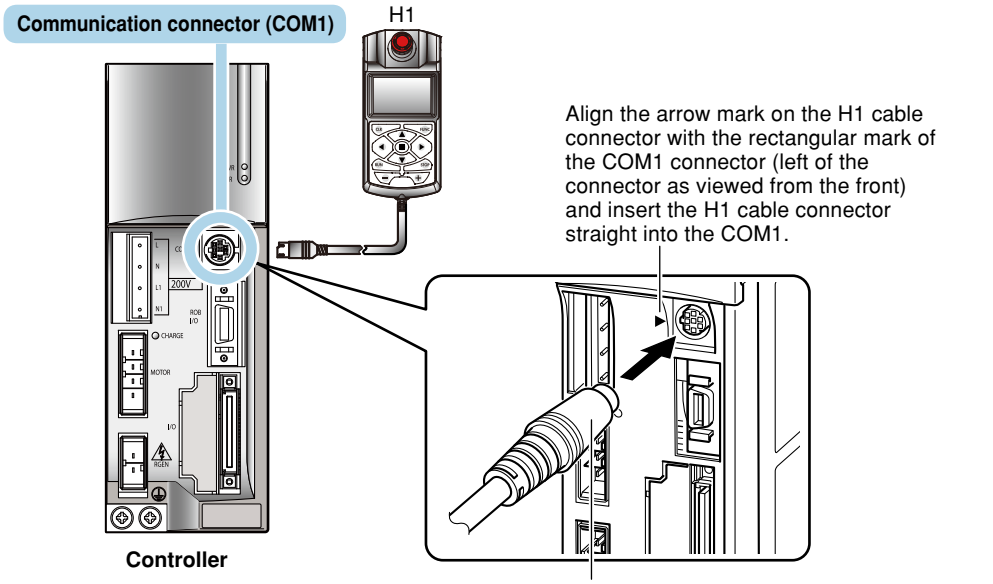
CAUTION

- **Do not modify the H1 cable. Modified cables might cause communication errors or malfunctions.**
- **When connecting the H1 to the controller or disconnecting it from the controller, always grip it by the connector body itself.**
- **A poor connection or inserting the connector the wrong way can result in failure or malfunctions. Be sure that the cable is securely connected.**
- **When unplugging the connector from the controller, pull it straight out so as not to bend the connector pins.**

2.1 Connecting to the controller

Step 1 Connect the H1 cable to the COM1 connector on the controller front panel.

Connection



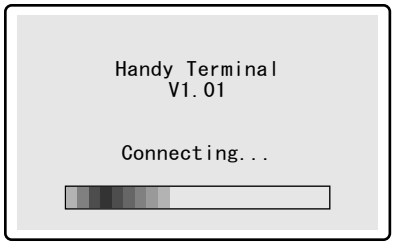
23A06-M0-00

Step 2 Turn on the power to the controller.

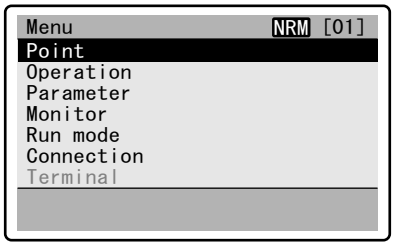
The initial screen (version display) appears for about 2 seconds and then the MENU (main menu) screen appears.
(The same as when the H1 is connected to the controller with the power turned on.)

24A01-M0-00

Step 2 Initial screen and main menu screen



Initial screen

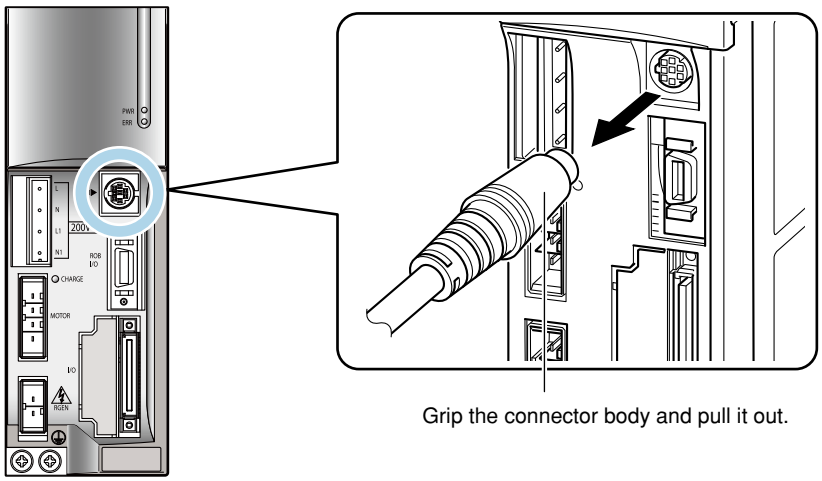


Main menu screen

2.2 Disconnecting from the controller

The H1 can be disconnected from the controller, regardless of whether the controller power is on or off. Pull the H1 cable connector straight outwards from the COM1 connector on the controller.

Disconnection



23A07-M0-00

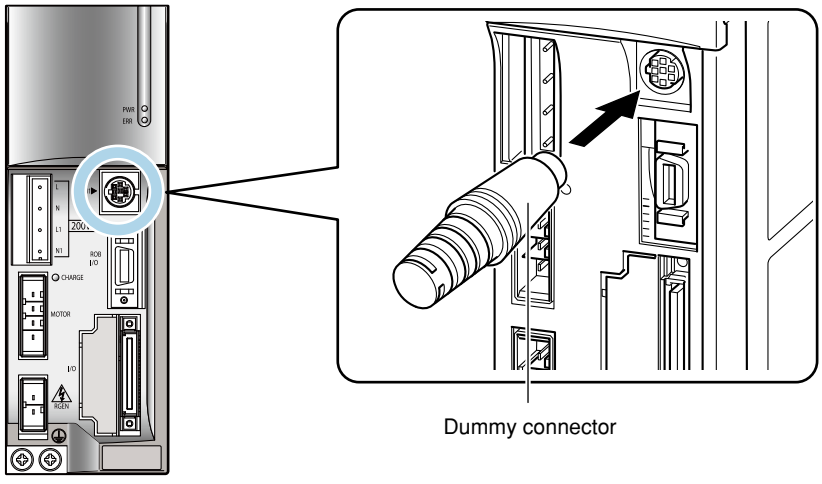
CAUTION

Disconnecting the H1 while the controller power is on, will trigger emergency stop and the robot servo will turn off.

When not using the H1

When not using the H1, plug the dummy connector (supplied with the controller) into the COM1 connector.

Dummy connector for COM1



23A08-M0-00

CAUTION

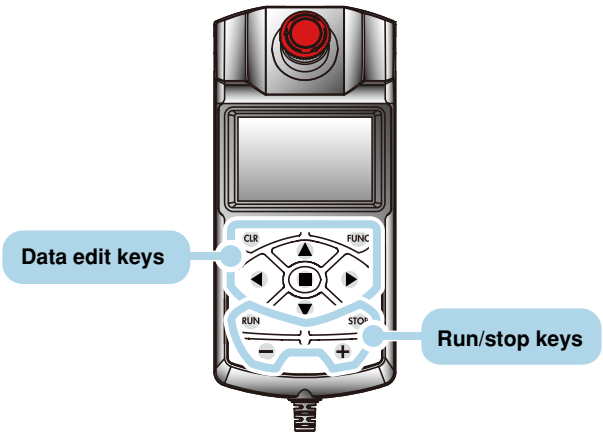
When not using the H1, always attach the dummy connector to the COM1. Operating without the dummy connector attached will trigger emergency stop and operation cannot be performed.

3. Basic operations

The H1 operation keys are only a minimum number of necessary keys, so H1 operating procedures can easily be mastered even by first-time users.
The H1 operation keys are divided into two groups: data edit keys and run/stop keys.

3.1 Operation key layout and functions

Operation key layout



23A09-M0-00

Data edit keys

Keys	Use the key to:
CLR	Return to the preceding menu or screen.
FUNC	Display the "Function" menu window for the item being selected.
▲ ▼	Scroll up or down the screen or increment/decrement numbers.
◀ ▶	Move the cursor to a desired digit to enter a numerical value or switch the page in the menu area.
■	Enable the entry you selected or changes you made.

NOTE

The H1 has no number keys. Use ▲ ▼ and ◀ ▶ to enter (increment or decrement) numbers. (Refer to section 3.4, "How to enter numbers".)

Run/stop keys

Keys	Use the key to:
RUN	Start moving the robot to perform origin search (return-to-origin) or positioning. Obtain the current position and store it in specified point data. (teaching) Turn the servo on or off.
STOP	Stop moving the robot during operation such as origin search or positioning. Press RUN to resume operation.
−	Move the robot in the - (minus) direction during teaching. The robot moves as long as this key is pressed. Pressing this key once moves the robot in inching mode (initial setting: 1mm).
+	Move the robot in the + (plus) direction during teaching. The robot moves as long as this key is pressed. Pressing this key once moves the robot in inching mode (initial setting: 1mm).

3.2 Screen configuration

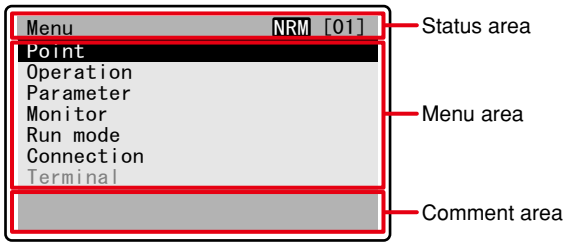
TIP

For position and zone parameters, a two decimal place number can be displayed and input.

Main menu screen

On the main menu screen, the title "MENU" is displayed in the status area at the top of the screen.
Selectable menus are displayed in the menu area. Nothing is displayed in the comment area at the bottom of the screen.
To select a menu, use ▲ or ▼ to move the cursor to it, and press ■ .
Operations can be selected and settings can be made while selecting the menus displayed on the screen. (Refer to section 3.5, "Menu structure".)

Main menu screen



24A02-M0-00

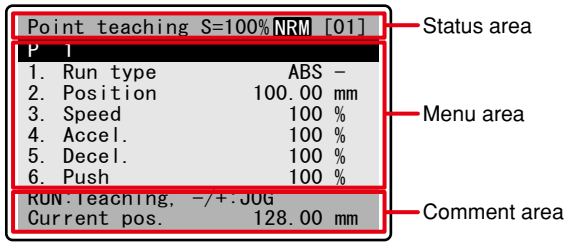
Menu	Select the menu to:
Point	Perform point teaching or edit point data.
Operation	Turn the servo on or off, or return the robot to its origin, or perform operation.
Parameter	Edit parameters relating to operation and I/O settings.
Monitor	Display I/O status, operation status, alarm history, etc.
Run mode	Switch between Normal mode, Monitor mode, and Debug mode.
Connection	This is not currently used.
Terminal	Make adjustments (factory adjustments). This menu is usually grayed out and not available to users.

Screen display example

Each screen consists of a status area, menu area, and comment area.
The display contents differ depending on the selected menu.

In the screen display shown below, a point number and point data are displayed in the menu area.
In this example, the comment area shows the operation keys that can be used and the current robot position.

Screen display example ("Point teaching" screen)

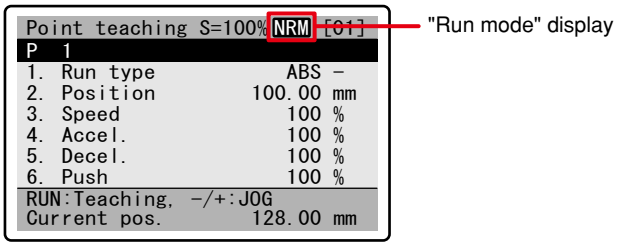


24A03-M0-00

"Run mode" display

The currently selected "Run mode" is displayed as an abbreviation on the right of the status area. The meaning of each abbreviation is described below.

"Run mode" display



24A04-M0-00

Abbreviation	Run mode
NRM	Normal mode
MON	Monitor mode
DBG	Debug mode
NRM S	Normal mode (safety)
MON S	Monitor mode (safety)
DBG S	Debug mode (safety)

TIP

"Run mode" can be changed from the H1. Refer to section 8.1, "Operation mode" for more details.

3.3 Starting to use the keys

You can operate the H1 while selecting the displayed menus (Refer to section 3.5, "Menu structure"). The following steps explain a basic H1 key operation, showing the procedure for setting point data.

CAUTION

Before editing data, always make sure that the robot is stopped. Editing data while the robot is moving may cause problems with the operation.

■ Editing point data

Step 1 ***On the main menu screen, move the cursor to "Point" and press ■ .***

The "Point" menu screen appears as shown below. (To return to the main menu screen, press CLR .)

24A05-M0-00

Step 2 ***Move the cursor to "Point edit" and press ■ .***

The "Point edit" screen opens showing a point number and point data.
The cursor is placed in the point number row where "P1" is selected when this screen first opens.
In this state, pressing ▼ displays the second page of point data in the menu area.
Pressing ▲ returns to the previous page.

24A06-M0-00

Step 3 ***Select the point number you want to edit.***

There are 2 methods for selecting a point number.

1) Increment or decrement the point number

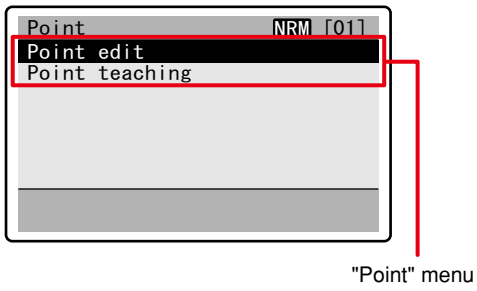
   Pressing ◀ or ▶ will increment or decrement the point number. When "P1" is displayed, pressing ◀ changes it to "P255". When "P255" is displayed, pressing ▶ changes it to "P1".

2) Press FUNC to open the "Function" menu and select the point number.

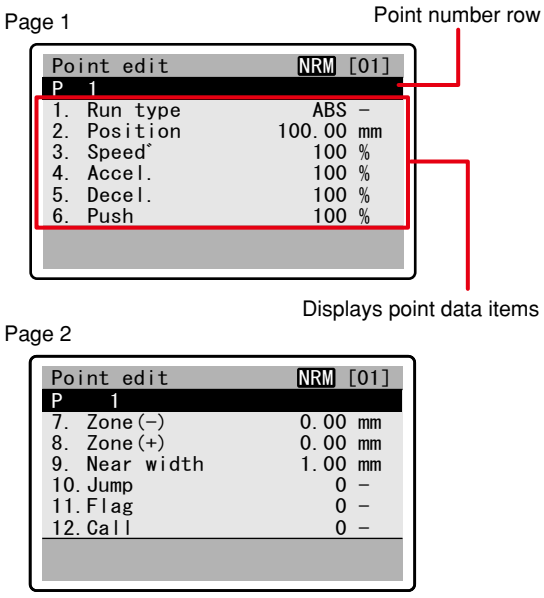
   1. On the "Function" menu, select "Select number".
      The "Function" menu changes to the screen for selecting a point number. The point number that first appears is the number that was selected when the "Function" menu was opened.
   2. Press ◀ or ▶ to move the edit cursor to the point number digit you want to enter, and increment or decrement the number using ▲ or ▼.
   3. After entering the number, press ■. The cursor moves to "Yes".
   4. Press ■ to enable the setting. The number you entered is then displayed in the point number row.

24A07-M0-00

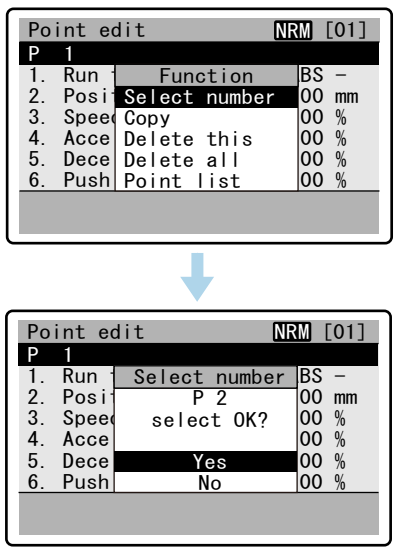
Step 1 "Point" menu screen



Step 2 "Point edit" screen



Step 3 "Function" menu window



TIP

- The point number can also be selected from the point number list that appears when you select "Point list" from the "Function" menu. (Refer to section 4.4, "Displaying a list of point data".)
- For instructions on how to enter numbers such as point numbers, refer to section 3.4, "How to enter numbers".

Step 4 ***After selecting the point number, press ■.***

The cursor moves to the data item area, allowing you to select a data item for the selected point number.

24A08-M0-00

TIP

When the "Point type" parameter was set to "Standard setting" by initial processing using the support software "RS-Manager", then "Speed" and "Accel." are displayed in percent (%).
When the "Point type" parameter was set to "Custom setting", then "Speed" and "Accel." are displayed in SI unit systems (mm/s and m/s^2).

Step 5 ***Use ▲ ▼ to move the cursor up or down to highlight the data item you want to edit.***

When the cursor is on the bottom row of the screen, pressing ▼ scrolls to the next page.

Step 6 ***After selecting the data item, press ■.***

This allows you to edit the selected data item. Data you can edit now appears left-aligned as shown below.

24A09-M0-00

TIP

- If "Run type" is not selected, then other data items are grayed out and cannot be edited. When "Run type" is set for point data whose data is not defined, then the initial values will be defined.
- For detailed information on each point data item, refer to the "Controller Guide", Chapter 3, section 2, "Point data".

24A09-M0-00

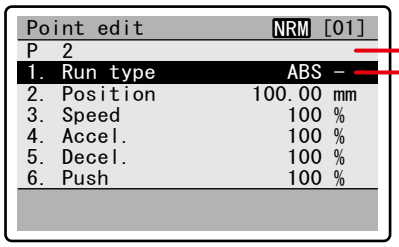
Step 7 ***Set the selected data item.***

There are 2 setting methods depending on the selected item: selective method and direct entry method.

- In the selective method like "Run type", the selectable options are displayed in the comment area. Use ▲ or ▼ to select the desired option and press ■ .
- In the direct entry method for data items like "Position", the edit cursor appears at the rightmost digit of the numerical value. Set the numerical value by incrementing or decrementing it with ▲ or ▼. To enter another digit, use ◀ or ▶ to move the cursor to that digit and press ▲ or ▼ to set the numerical value. After entering each digit, press ■ to enable the setting. (Refer to section 3.4, "How to enter numbers".

Step 4 **Data edit screen**

Point number row

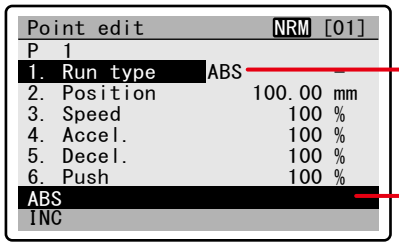


Cursor moves to the data item area ("1. Run type").

Step 6 **Editable screen**

When "Run type" is selected

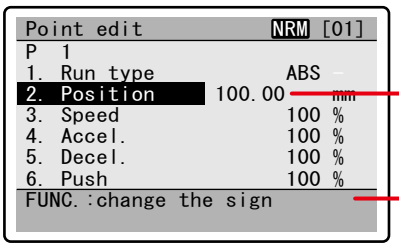
Data for the selected item is left-aligned, showing it can be edited.



Selectable options for "Run type" are displayed here. If there are 3 or more options, press ▲ or ▼ to view them.

When "Position" is selected

Data for the selected item is left-aligned, showing it can be edited.



Pressing FUNC toggles the plus and minus signs for the numerical value.

Step 8 ***Set the other point data items.***

Follow steps 5 to 7 to set the necessary data items.

NOTE

Repeat steps 3 to 7 when setting data items for other point numbers.

Step 9 ***After editing the data, press*** CLR .

The cursor returns to the point number row. Pressing CLR *returns to the "Point" menu screen in step 1.*

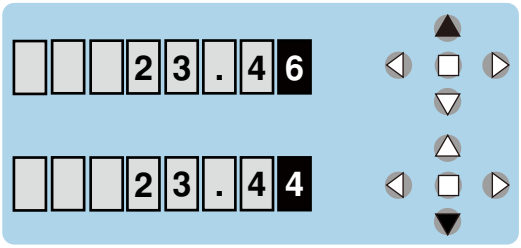
3.4 How to enter numbers

The H1 has no number keys. Use ▲ ▼ and ◀ ▶ to enter numbers.

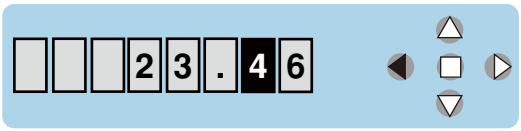
How to enter numbers

1. When in number edit mode, the edit cursor appears at the rightmost digit of the number.

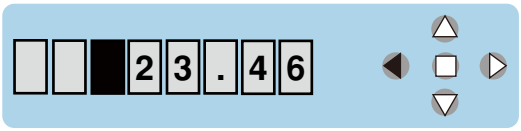
2. To change the number at the specified digit (cursor position), press ▲ or ▼ . Pressing ▲ increments the number, and pressing ▼ decrements the number.



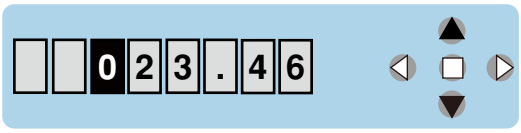
3. To move the edit cursor to other digits, press ◀ or ▶ . (If the number contains a decimal point, skip it.)



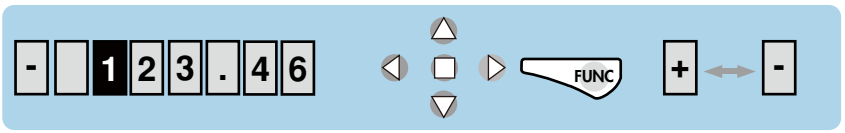
4. To enter a number at a digit where no number is entered, first move the edit cursor to that digit.



5. Pressing ▲ or ▼ causes "0" to appear. Then press ▲ or ▼ to set the number.



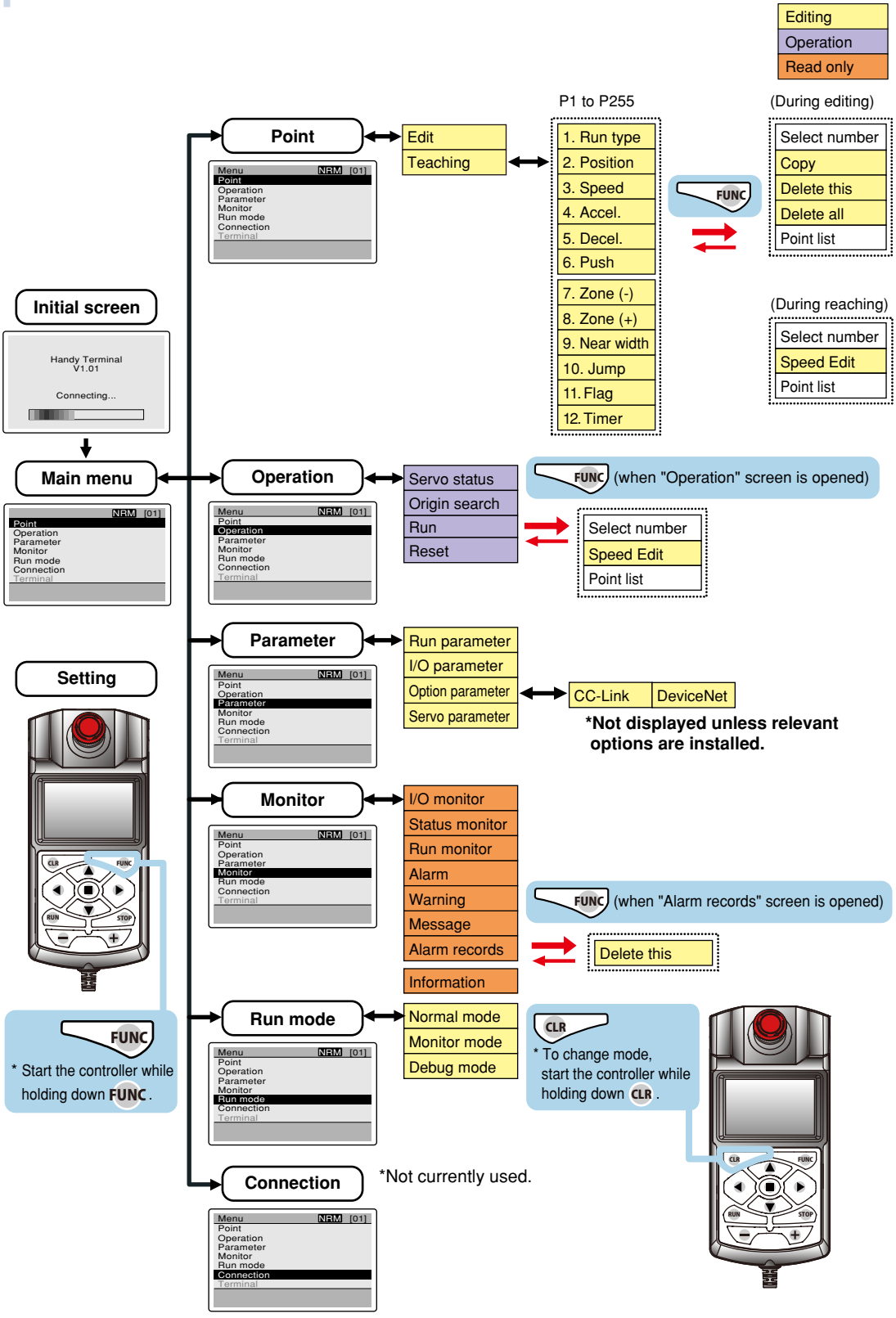
6. To change the plus/minus signs, press FUNC. Pressing FUNC toggles the plus (+) and minus (-) signs.



7. After entering the number, press ■ to enable the setting.

23A10-M0-00

Menu structure



23A11-M0-00

4. Editing the point data

The procedure for editing point data is described in the previous section 3.3, "Starting to use the keys", so please read it again. This section describes how to set the position for point data using point teaching, as well as how to copy or delete the point data you created.

CAUTION

Before editing data, always make sure that the robot is stopped. Editing data while the robot is moving might cause problems with operation.

4.1 Point teaching

There are two methods for point teaching: teaching playback and direct teaching.

NOTE

In either point teaching method, origin search (return-to-origin) must first be completed. (For instructions on how to perform an origin search using the H1, refer to section 6.2, "Origin search (return-to-origin".)

Point teaching	Description
Teaching playback	This method moves the robot in manual operation to a desired position and obtains that position as point data.
Direct teaching	This is basically the same as teaching playback, except that you move the robot by hand in an emergency stop state.

4.1.1 Teaching playback

In teaching playback, you move the robot in manual operation to a desired position and obtain that position as a "Position" for point data. Follow these steps to perform teaching playback.

WARNING

THE ROBOT WILL NOW MOVE, SO USE CAUTION.

Step 1 ***On the main menu screen, select "Point".***

The "Point" menu screen appears.

Step 2 ***Move the cursor to "Point teaching" and press ■.***

The "Point teaching screen appears.
The status area shows the speed (like "S=100%") at which the robot will move during teaching.
The menu area shows point data items.
The comment area shows the valid key functions and the current robot position.

24A10-M0-00

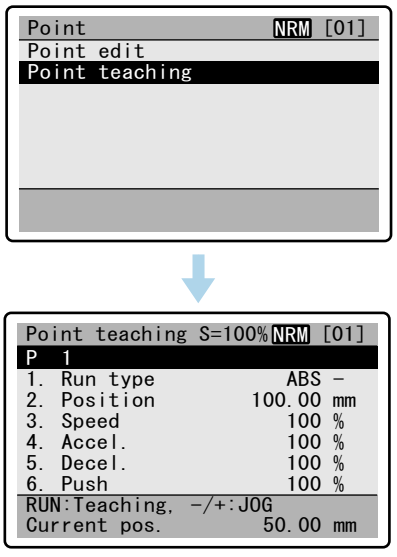
TIP

The displayed data items are the same as those shown on the "Point edit" screen, but cannot be changed here.

Step 3 ***Select the point number to perform teaching.***

To select the point number, use the same procedure as for point data editing. (Press ◀ or ▶ to select the point number, or press FUNC to select it from the "Function" menu.)

▶ **Step 2** "Point teaching" screen



Step 4 *Specify the speed to move the robot.*

Specify the speed as described below, on the "Function" menu that appears when you press FUNC .

1. Select "Change speed" and press ■ . The edit cursor then appears on the speed value.
2. Set the speed and press ■ . To set the speed, use the same procedure as for setting a point number. The cursor then moves to "Yes" under the "Change OK?" message.
3. Press ■ to enable the setting. The speed you set is then displayed as "S=** %" in the status area.

24A11-M0-00

Step 5 *Press the jog keys to move the robot to the teaching position.*

Pressing the + or − key moves the robot in the direction of the sign. The robot keeps moving as long as the jog key is pressed and the message "Running..." will appear during movement.

24A12-M0-00

TIP

Pressing the jog key once moves the robot in inching mode. (Initial setting is 1.00mm, which can be changed as needed by using the "Inching width" (K11) parameter.

Step 6 *When the robot reaches the teaching position, release the jog key to stop the robot.*

The message "Running..." no longer appears when the robot is stopped.

Step 7 *Press* RUN *to teach the position.*

A confirmation message then appears asking whether to teach the current position. Press ▲ or ▼ to select "Yes" or "No", and then press ■ .
Selecting "Yes" sets the current robot position in "Position" for point data. Selecting "No" cancels the current position setting and returns to the previous screen.

24A13-M0-00

Step 8 *Perform teaching for other point data.*

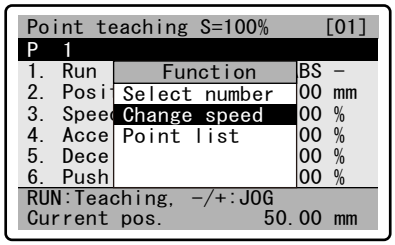
Specify the desired point number and repeat the above procedure.

Step 9 *After teaching the positions, press* CLR .

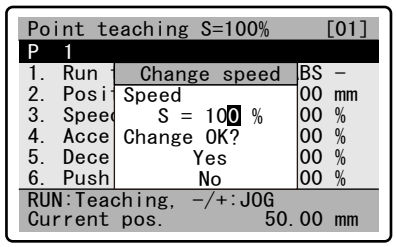
This returns to the "Point" menu screen.

Step 4 Specifying movement speed

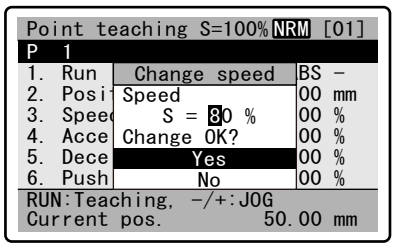
1.



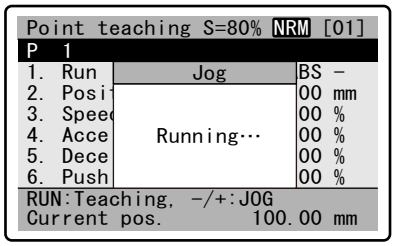
2.



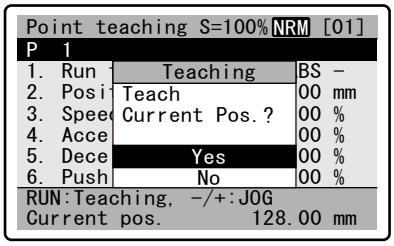
3.



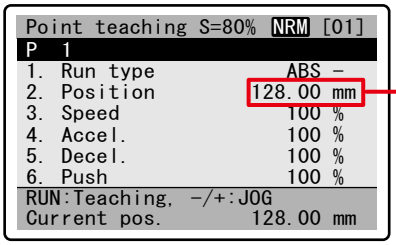
Step 5 Running screen



Step 7 Teaching current position



Current robot position is entered here.



4.1.2 Direct teaching

Direct teaching is basically the same as teaching playback, except that you move the robot by hand to a desired position in emergency stop.

Step 1 ***Open the "Point teaching" screen and select the point number.***

Follow the instructions described in steps 1 to 3 in section 4.1.1, "Teaching playback".

Step 2 ***Press the emergency stop button.***

Step 3 ***Move the robot by hand to the target position.***

WARNING

DO NOT TURN ON THE SERVO DURING DIRECT TEACHING.

Step 4 ***Press RUN to teach the position.***

A confirmation message then appears asking whether to teach the current position. Press ▲ or ▼ to select "Yes" or "No", and then press ■ .

Selecting "Yes" sets the current robot position in "Position" for point data. Selecting "No" cancels the current position setting and returns to the previous screen.

24A14-M0-00

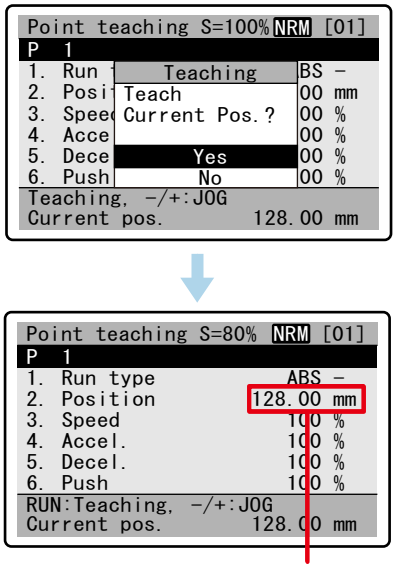
Step 5 ***Perform teaching for other point data.***

Specify the desired point number and repeat the above procedure.

Step 6 ***After teaching the positions, press CLR .***

This returns to the "Point" menu screen.

▶ Step 4 Teaching current position



Current robot position is entered here.

4.2 Copying point data

This section describes how to copy created point data to another point data number.

Step 1 ***On the main menu screen, select "Point".***

The "Point" menu screen appears.

Step 2 ***Move the cursor to "Point teaching" and press ■ .***

The "Point teaching" screen appears, showing the point data items in the menu area.

24A15-M0-00

Step 3 ***Press FUNC to open the "Function" menu and select "Copy".***

The "Function" menu changes to the window for specifying the copy source and destination. The point number that is first displayed as the copy source is the point number that was selected when the "Function" menu was opened.

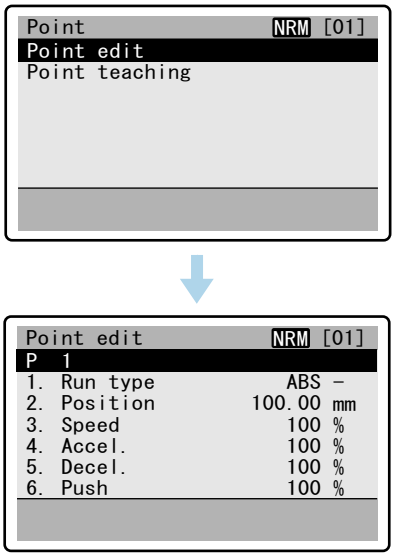
24A16-M0-00

Step 4 ***Specify the copy source and destination point numbers.***

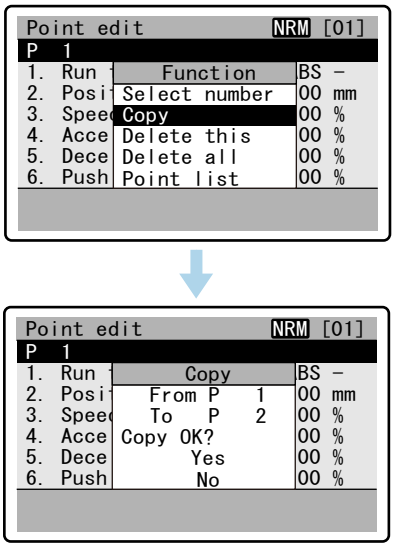
1. Use ▲ ▼ and ◀ ▶ to specify the copy source point number, and press ■ . The cursor then moves to the copy destination item.
2. Use ▲ ▼ and ◀ ▶ to specify the copy destination point number, and press ■ . The cursor then moves to "Yes" under the confirmation message.
3. Press ■ to copy the data. The display then returns to the screen that was displayed before the "Function" menu was opened. (The copy source point number is displayed.)

24A17-M0-00

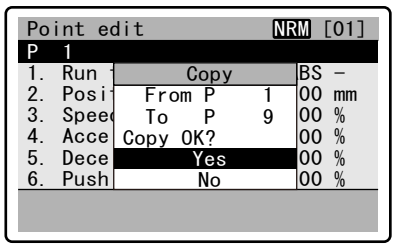
Step 2 "Point edit" screen



Step 3 "Copy" screen



Step 4 Specifying point number



4.3 Deleting point data

This section describes how to delete created point data.

CAUTION
Deleted data cannot be restored, so be careful.

Step 1 ***On the main menu screen, select "Point".***
The "Point" menu screen appears.

Step 2 ***Move the cursor to "Point teaching" and press ■.***
The "Point teaching" screen appears, showing the point data items in the menu area.

24A18-M0-00

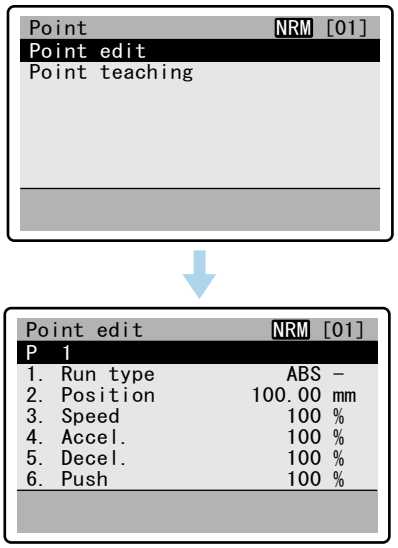
Step 3 ***Select the point number you want to delete.***
To select the point number, use the same procedure as for point data editing. (Press ◀ or ▶ to select the point number, or press FUNC to select it from the "Function" menu.)

24A19-M0-00

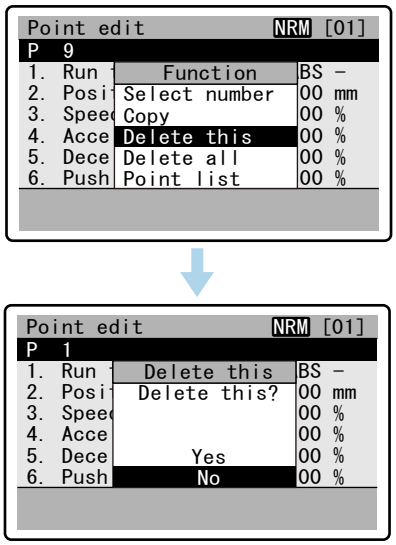
Step 4 ***Press FUNC to open the "Function" menu and select "Delete".***
A confirmation message appears asking whether to delete data of the selected point number.
If you select "Delete all", another confirmation message will appear asking whether to delete all point data.

Step 5 ***If it is okay to delete the data, move the cursor to "Yes" and press ■.***
The data of the selected point number is then deleted.
If you selected "Delete all", all point data will be deleted.
The display then returns to the screen that was displayed before the "Function" menu opened.

▶ **Step 2** "Point edit" screen



▶ **Step 3** Point number select screen



4.4 Displaying a list of point data

You can display a list of point data. You can also make entries on the data edit screen by selecting a point number from the displayed list.

Step 1 ***On the main menu screen, select "Point".***

The "Point" menu screen appears.

Step 2 ***Move the cursor to "Point edit" and press ■.***

The "Point edit" screen opens showing the point data items in the menu area.

24A20-M0-00

Step 3 ***Press FUNC to display the "Function" menu and select "Point list".***

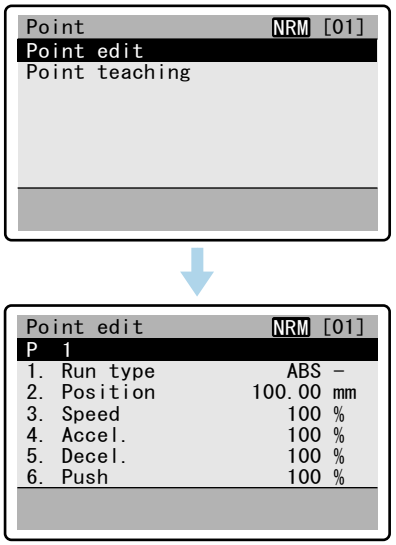
Point data appears in the order of point number, showing "Run type" and "Position" data.

In this list, pressing ▲ or ▼ moves the cursor up or down, and pressing ◀ or ▶ switches the page.

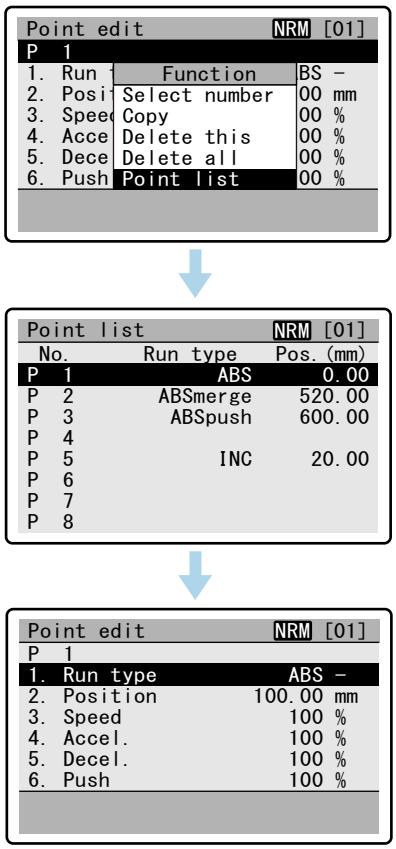
While a point number is selected, pressing ■ enters the data edit screen for the selected point number.

24A21-M0-00

▶ **Step 2** "Point edit" screen



▶ **Step 3** "Function" menu



5. Parameter setting

The H1 allows you to set parameters needed for robot operation.
For detailed information and the setting range of each parameter, refer to the "Controller Guide", Chapter 3, section 4, "Parameter data".

CAUTION

Before editing data, always make sure that the robot is stopped. Editing data while the robot is moving might cause problems with operation.

5.1 Setting Run parameters

This section describes how to set a Run parameter using "Soft limit (+)" as an example. Basically, other RUN parameters can also be set in the same manner.

NOTE

Power must be turned off and then back on to enable changes made to Run parameters.

Step 1 ***On the main menu screen, select "Parameter".***

The "Parameter" menu screen opens showing selectable parameter groups.

Step 2 ***Move the cursor to "Run parameter" and press ■.***

The currently set Run parameters are displayed.

Pressing ◀ or ▶ switches the parameter display page. When the cursor is on the bottom row of the screen, pressing ▼ scrolls to the next page.

24A22-M0-00

Step 3 ***Move the cursor to the parameter you want to change and press ■.***

The value of the selected parameter can now be changed.

24A23-M0-00

Step 4 ***Change the parameter value.***

For instructions on how to change numerical values, refer to section 3.4, "How to enter numbers".

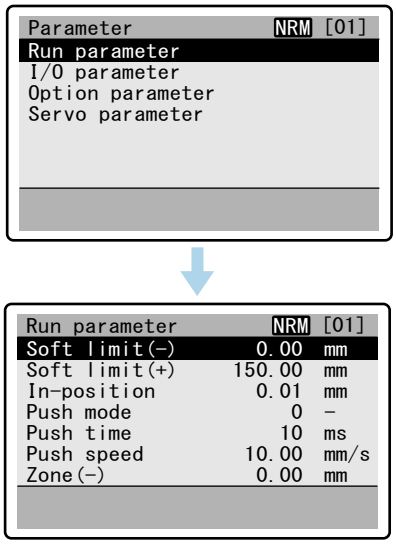
Step 5 ***Press ■ to enable the change.***

The cursor returns to the previous state. If you want to set another Run parameter, repeat steps 3 to 5.

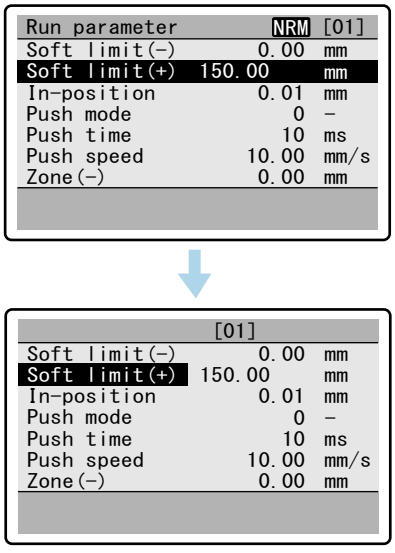
Step 6 ***Press CLR .***

This returns to the "Parameter" menu screen.

▶ **Step 2** "Run parameter"



▶ **Step 3** Changing parameter value



5.2 Setting I/O parameters

This section describes how to set an I/O parameter using "OUT0 select" (terminal assignment) as an example. Basically, other I/O parameters can also be set in the same manner.

NOTE
Power must be turned off and then back on to enable changes made to I/O parameters.

Step 1 ***On the main menu screen, select "Parameter".***
The "Parameter" menu screen opens showing selectable parameter groups.

Step 2 ***Move the cursor to "I/O parameter" and press ■.***
The currently set I/O parameters are displayed.
Pressing ◀ or ▶ switches the parameter display page. When the cursor is on the bottom row of the screen, pressing ▼ scrolls to the next page.

24A24-M0-00

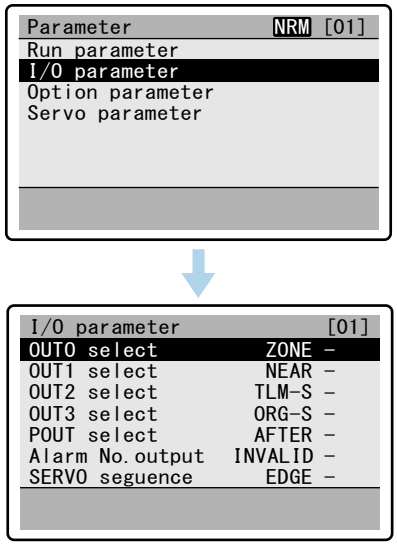
Step 3 ***Move the cursor to the parameter you want to change and press ■.***
The selected parameter can now be changed.

24A25-M0-00

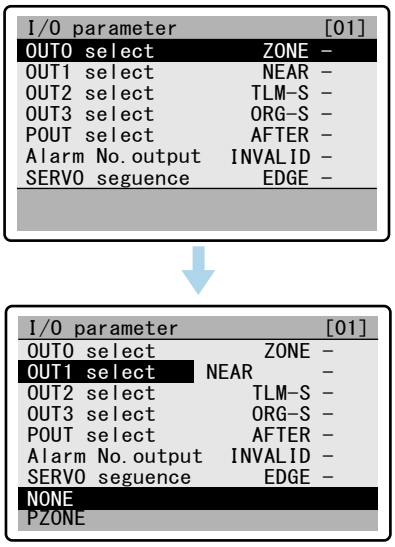
Step 4 ***Change the parameter.***
Selectable options are displayed in the comment area. Use ▲ or ▼ to select the desired option and press ■.
To change another I/O parameter, repeat steps 3 to 4.

Step 5 ***Press CLR.***
This returns to the "Parameter" menu screen.

▶ **Step 2** "I/O parameter"



▶ **Step 3** Parameter change screen



5.3 Setting Option parameters

The following example shows the option parameters setting method when using CC-Link. The same setting method is used for DeviceNet.

NOTE
Power must be turned off and then back on to enable changes made to Option parameters.

Step 1 ***On the main menu screen, select "Parameter".***
The "Parameter" menu screen opens showing selectable parameter groups.

Step 2 ***Move the cursor to "Option parameter" and press ■.***
The currently set Option parameters are displayed.
(The display contents differ depending on the installed option.)

24A26-M0-00

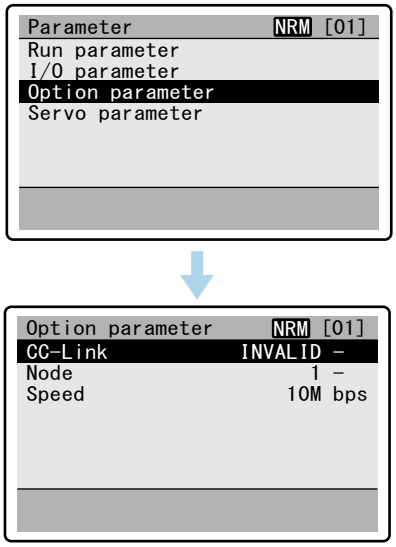
Step 3 ***Move the cursor to "CC-Link" and press ■.***
The CC-Link settings can now be changed.

24A27-M0-00

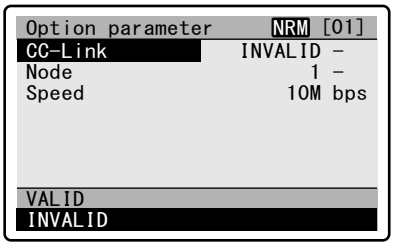
Step 4 ***Change the parameter.***
Selectable options are displayed in the comment area. Use ▲ or ▼ to select "Valid" and press ■.
Change the node number and speed as needed.

Step 5 ***Press CLR.***
This returns to the "Parameter" menu screen.

Step 2 "Option parameter"



Step 3 "CC-Link"screen



5.4 Setting Servo parameters

This section describes how to set a Servo parameter using "Payload" as an example.

Step 1 ***On the main menu screen, select "Parameter".***
The "Parameter" menu screen opens showing selectable parameter groups.

Step 2 ***Move the cursor to "Servo parameter" and press ■.***
The currently set Servo parameters are displayed.

24A28-M0-00

NOTE
The "Max. accel." parameter is enabled only when the H1 was started while holding down CLR .

Step 3 ***Move the cursor to "Payload 1" and press ■.***
The selected parameter can now be changed.

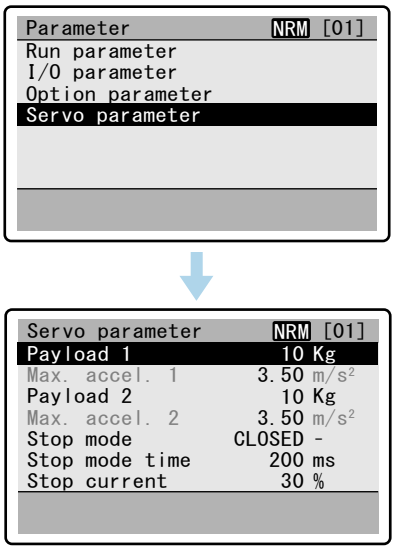
24A29-M0-00

Step 4 ***Change the parameter value.***
For instructions on how to change numerical values, refer to section 3.4, "How to enter numbers".

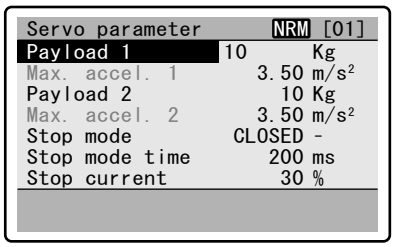
Step 5 ***Press ■ to enable the change.***
Use the same procedure to change "Payload 2" if needed.

Step 6 ***Press CLR .***
This returns to the "Parameter" menu screen.

▶ **Step 2** "Servo parameter"screen



▶ **Step 3** Payload change screen



6. Operating the robot

6.1 Turning the servo on or off

This section describes how to check the servo status or how to turn the servo on or off. If the robot has a brake, the brake can also be engaged or released.

Step 1 ***On the main menu screen, select "Operation"***

The "Operation" menu screen appears showing selectable menu items.

Step 2 ***Move the cursor to "Servo status" and press ■.***

The servo on/off status is displayed. The brake status is also displayed if the robot has a brake.

24A30-M0-00

Step 3 ***Press RUN to turn the servo on or off.***

The servo turns on and off each time you press RUN .

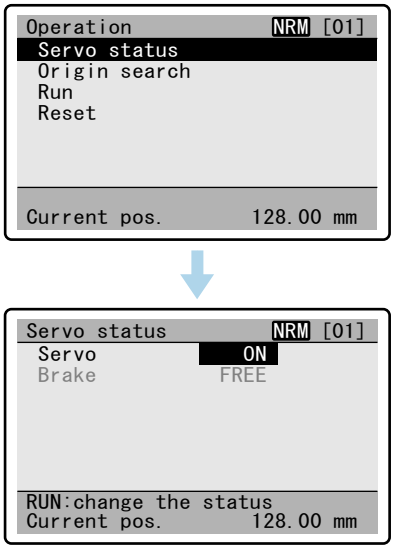
NOTE

The brake can be operated only when the servo is off.

Step 4 ***Press CLR .***

This returns to the "Operation" screen.

▶ **Step 2** "Servo status"screen



6.2 Origin search (return-to-origin)

To find the robot origin position, use the following procedure after making sure that the servo is on.

NOTE

Origin search cannot be performed unless the servo is on.

WARNING

THE ROBOT WILL NOW MOVE, SO USE CAUTION.

Step 1 ***On the main menu screen, select "Operation".***

The "Operation" menu screen appears showing selectable menu items.

Step 2 ***Move the cursor to "Origin Search" and press ■.***

The "Origin Search" screen appears showing the origin search method and direction.

24A31-M0-00

Step 3 ***Ensure safety and press RUN to start an origin search.***

The message "Running..." appears during origin search.

If you want to stop the origin search, press STOP .

24A32-M0-00

Step 4 ***When origin search is complete, check the message.***

*The message "OK" and machine reference (Ref. = ** %) appear when the origin search has ended successfully.*

24A33-M0-00

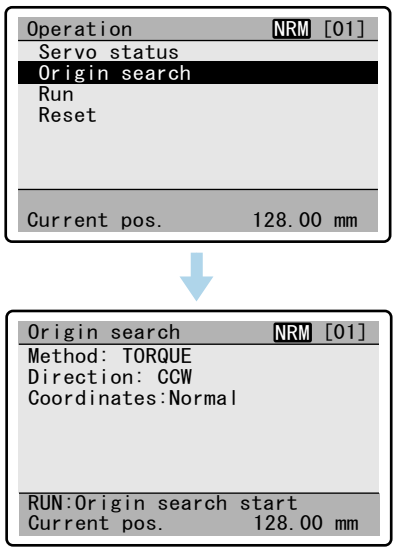
NOTE

The machine reference must be adjusted if it is outside an allowable range of 25% to 75% (allowable range may differ depending on the robot type, so refer to the robot user's manual). For information on how to adjust the machine reference, contact our sales office or representative.

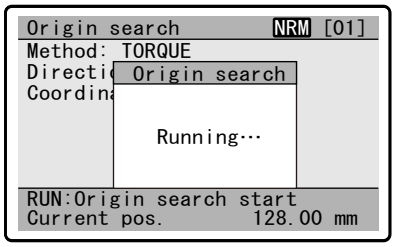
Step 5 ***Press CLR .***

This returns to the "Origin Search" screen. Pressing CLR once more returns to the "Operation" menu screen.

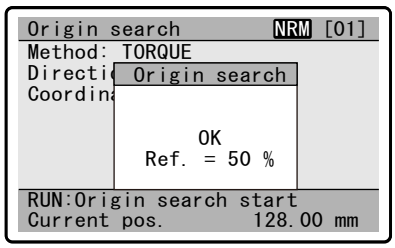
Step 2 "Origin Search" screen



Step 3 Origin search (return-to-origin) running screen



Step 4 Origin search (return-to-origin) completion screen



6.3 Operating the robot

This section describes how to position the robot using the H1.

WARNING

THE ROBOT WILL NOW MOVE, SO USE CAUTION.

Step 1 *On the main menu screen, select "Operation".*

The "Operation" menu screen appears showing selectable menu items.

Step 2 *Move the cursor to "Run" and press ■.*

The "Run" screen opens showing a point number and point data items.
*"S=**%" in the status area indicates a speed override for positioning operation. (Refer to the "Controller Guide", Chapter 3, section 4, "Parameter data".)*

24A34-M0-00

TIP

The displayed data items are the same as those shown on the "Point edit" screen, but cannot be edited here.

Step 3 *Specify the point number.*

To specify the point number, use the same procedure as for point data editing.
(Press ◀ or ▶ to specify the point number, or press FUNC to select it from the "Function" menu.)

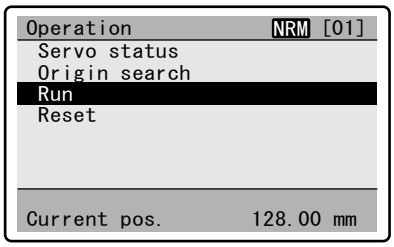
Step 4 *Specify the speed.*

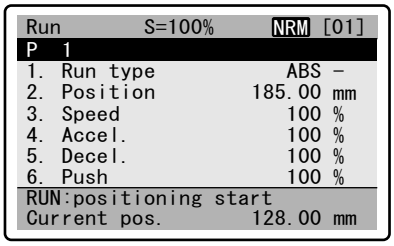
If you want to change the speed, press FUNC to open the "Function" menu and specify the speed as follows:

1. Select "Change speed" and press ■.
   The edit cursor then appears at the speed value.
2. Specify the speed and press ■.
   To specify the speed, use the same procedure as for setting a point number.
   The cursor then moves to "Yes" under the "Change OK?" message.
3. Press ■ to enable the setting.
   The speed you specified is then displayed as "S=** %" in the status area.

24A35-M0-00

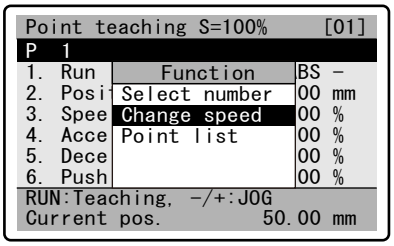
Step 2 "Run" screen



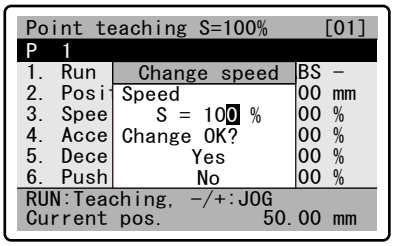


Step 4 Specifying operation speed

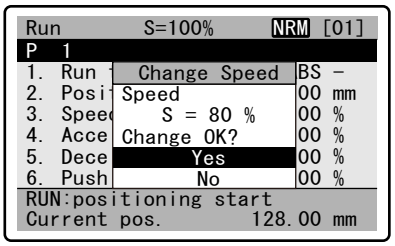
1.



2.



3.



Step5 ***Press RUN to start operation.***

The robot starts moving to the position specified by the point data. The message "Running..." appears during operation.

If you want to stop the operation, press STOP .

24A36-M0-00

NOTE

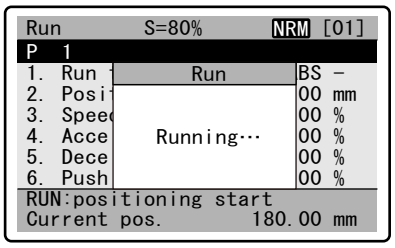
The robot slows down and stops after pressing STOP .

Step6 ***To operate the robot using another point data, repeat steps 3 to 5.***

Step7 ***When operation is complete, press CLR .***

This returns to the "Operation" menu screen.

Step 5 Running screen



6.4 Resetting an alarm

If an alarm occurs during operation, the robot will immediately stop. After removing the cause of the alarm, the operation can be resumed by reset.

Step1 ***On the "Operation" menu screen, move the cursor to "Reset" and press ■.***
The "Reset" screen opens showing a description of that alarm.

24A37-M0-00

Step2 ***Remove the cause of the alarm.***

Step3 ***Press RUN to perform a reset.***
The message "OK" appears when reset is complete.

24A38-M0-00

Step4 ***Press CLR .***
This returns to the "Operation" menu screen.

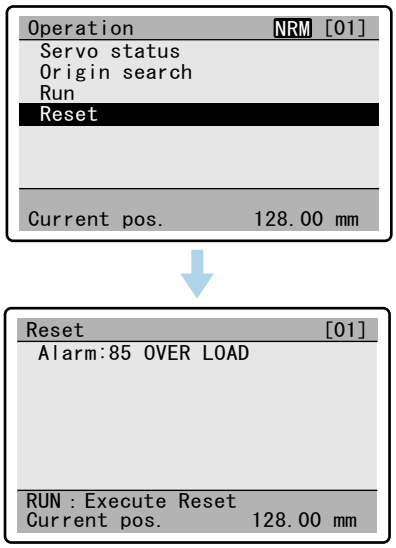
CAUTION

Some alarms cannot be reset here. (Refer to the "Controller Guide", Chapter 6, section 4, "Alarms: Possible causes and actions".) In such cases, shut down the control power supply and then restart the controller.

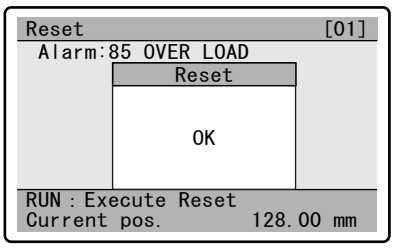
WARNING

THE ROBOT STOPS IF AN OVERLOAD OCCURS. IF THIS HAPPENS, AVOID RESTARTING THE ROBOT OPERATION SHORTLY AFTER THE OVERLOAD. DOING SO MIGHT CAUSE THE MOTOR MALFUNCTIONS. THE SYSTEM SHOULD BE DESIGNED SO THAT ROBOT OPERATION RESUMES AT LEAST 5 MINUTES AFTER AN OVERLOAD ALARM OCCURS.

Step 1 Alarm contents screen



Step 3 "Reset" screen



7. Monitor functions

The H1 has the following monitor functions that display various types of information for checking operation and status.

Monitor Function	Description
I/O monitor	Displays the status of I/O signals exchanged with the host device.
Status monitor	Displays the status of servo, brake, emergency stop, etc.
Run monitor	Displays the current position, speed, run type, etc. during operation.
Alarm	Displays up to 8 alarms that occurred most recently.
Warning	Displays up to 8 warnings that occurred most recently.
Message *	Displays 1 cause (alarm) of the operation stop that occurred most recently.
Alarm records	Displays past alarms and their descriptions.
Information	Displays the model name and specs of the controller and robot being used.

* This function was added from Ver. 1.06.

7.1 I/O monitor

Step 1 ***On the main menu screen, select "Monitor".***

The "Monitor" menu screen opens showing selectable menu items.

Step 2 ***Move the cursor to "I/O monitor" and press ■.***

The "I/O monitor" screen opens showing the current I/O status.

Pressing ▼ displays the second page.
Pressing ▲ returns to the first page.

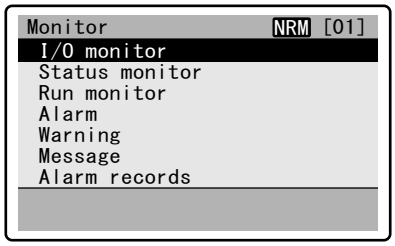
- The first page shows the ON/OFF status of each I/O signal.
  □ = OFF, ■ = ON
- On the second page, IN and OUT show bit addresses (byte units), and WIN and WOUT show hexadecimal addresses (word units).

24A39-M0-00

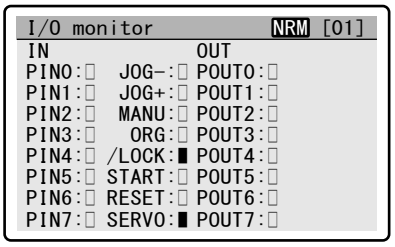
Step 3 ***Press CLR .***

This returns to the "Monitor" menu screen.

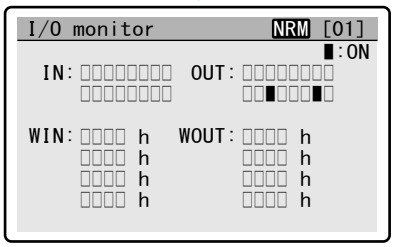
▶ **Step 2** "I/O monitor" screen



Page 1



Page 2



7.2 Status monitor

Step 1 ***On the main menu screen, select "Monitor".***

The "Monitor" menu screen opens showing selectable menu items.

Step 2 ***Move the cursor to "Status monitor" and press ■.***

The "Status monitor" screen opens. The meaning of each item is as follows:

□ = OFF, ■ = ON

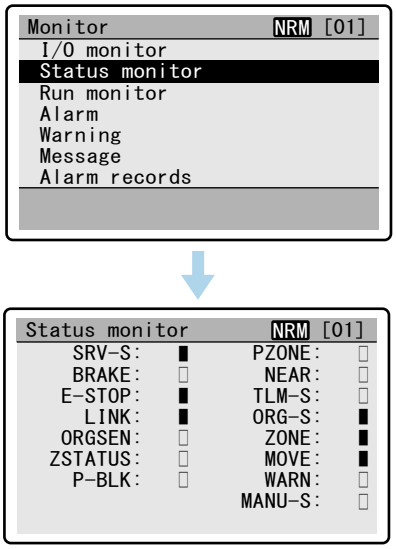
SRV-S : Servo status
BRAKE : Brake
E-STOP : Emergency stop
LINK : Network link
ORGSEN : Origin sensor
ZSTATUS : Linear Z phase
P-BLK : Main power outage
PZONE : Personal zone
NEAR : Near width output
TLM-S : Pushing status
ORG-S : Origin search status
ZONE : Zone output
MOVE : Moving
WARN : Warning output
MANU-S : Manual mode status

24A40-M0-00

Step 3 ***Press CLR .***

This returns to the "Monitor" menu screen.

▶ **Step 2** "Status monitor" screen



7.3 Run monitor

Step 1 ***On the main menu screen, select "Monitor".***

The "Monitor" menu screen opens showing selectable menu items.

Step 2 ***Move the cursor to "Run monitor" and press ■.***

The "Run monitor" screen opens. Pressing ▼ displays the second page. Pressing ▲ returns to the first page. The meaning of each item is as follows:

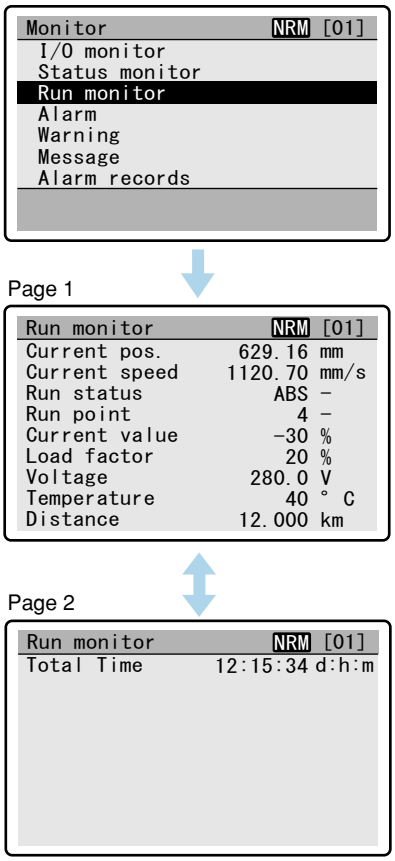
Current pos.	: Current robot position (mm)
Current speed	: Robot operation speed (mm/s)
Run status	: Operation status
Run point	: Operation point
Current value	: Electrical current (%)
Load factor	: Load factor (%)
Voltage	: Voltage (V)
Temperature	: Temperature in controller (˚C)
Distance	: Total distance robot has moved (km)
Total time	: Total time robot has run (d:h:m)

24A41-M0-00

Step 3 ***Press CLR .***

This returns to the "Monitor" menu screen.

▶ **Step 2** "Run monitor" screen



7.4 Alarm display

Step 1 ***On the main menu screen, select "Monitor".***

The "Monitor" menu screen opens showing selectable menu items.

Step 2 ***Move the cursor to "Alarm" and press ■ .***

The "Alarm" screen opens showing up to 8 alarms that have occurred most recently. If 9 or more alarms have occurred, they will be automatically deleted starting from the oldest alarm.

24A42-M0-00

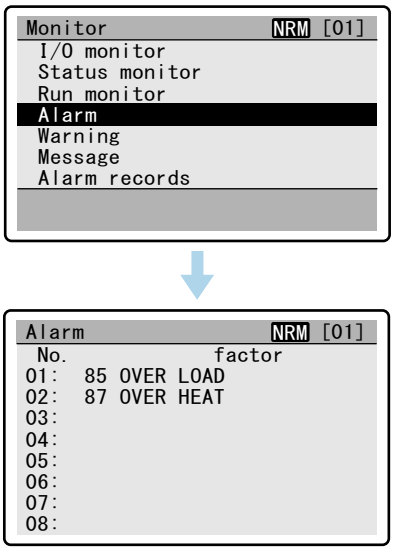
TIP

For details on alarms and corrective actions, refer to the "Controller Guide", Chapter 6, section 4, "Alarms: Possible causes and actions".)

Step 3 ***Press CLR .***

This returns to the "Monitor" menu screen.

▶ **Step 2** "Alarm" screen



7.5 Warning display

Step 1 ***On the main menu screen, select "Monitor".***

The "Monitor" menu screen opens showing selectable menu items.

Step 2 ***Move the cursor to "Warning" and press ■ .***

The "Warning" screen opens showing up to 8 warnings that have occurred most recently. If 9 or more warnings have occurred, they will be automatically deleted starting from the oldest warning.

24A43-M0-00

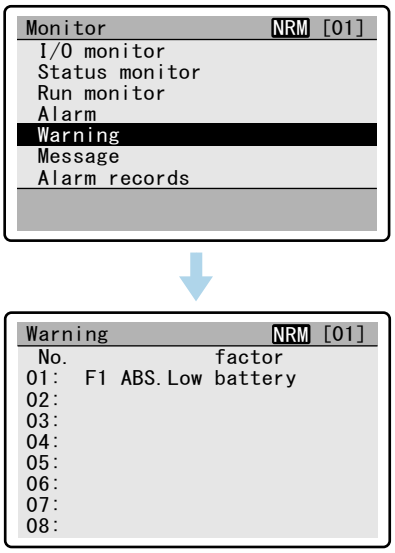
TIP

For details on warnings and corrective actions, refer to the "Controller Guide", Chapter 6, section 4, "Alarms: Possible causes and actions".)

Step 3 ***Press CLR .***

This returns to the "Monitor" menu screen.

▶ **Step 2** "Warning" screen



7.6 Message display

Step 1 ***On the main menu screen, select "Monitor".***

The "Monitor" menu screen opens showing selectable menu items.

Step 2 ***Move the cursor to "Message" and press ■ .***

The "Message" screen opens showing 1 cause (alarm) of the operation stop that occurred most recently.

24A44-M0-00

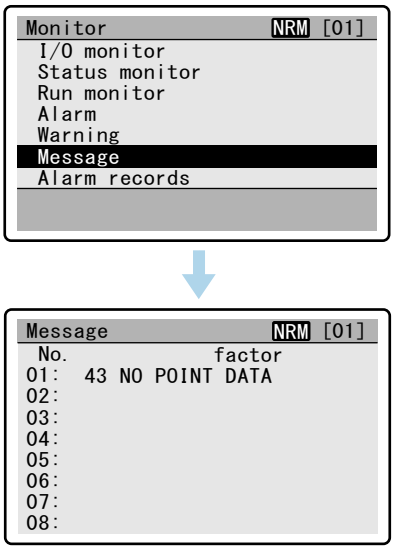
TIP

For details on messages and corrective actions, refer to the "Controller Guide", Chapter 6, section 4, "Alarms: Possible causes and actions".)

Step 3 ***Press CLR .***

This returns to the "Monitor" menu screen.

▶ **Step 2** "Message" screen



7.7 Alarm record display

Step 1 ***On the main menu screen, select "Monitor".***

The "Monitor" menu screen opens showing selectable menu items.

Step 2 ***Move the cursor to "Alarm records" and press ■.***

The "Alarm records" screen opens showing up to 50 past alarms that occurred. Pressing ▲ or ▼ moves the cursor up or down. Pressing ◀ or ▶ switches the page.

24A45-M0-00

Step 3 ***To view the details of an alarm, move the cursor to it and press ■.***

The screen shows the date when the alarm occurred, as well as operating conditions. On this screen, pressing ▼ displays the second page. Pressing ▲ returns to the first page.

24A46-M0-00

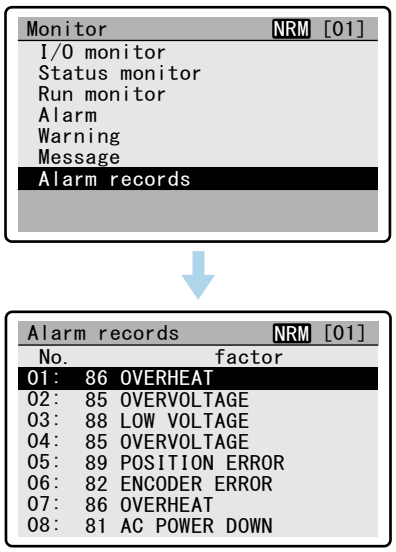
Step 4 ***Press CLR to return to the "Alarm records" screen.***

Pressing CLR once more returns to the "Monitor" menu screen.

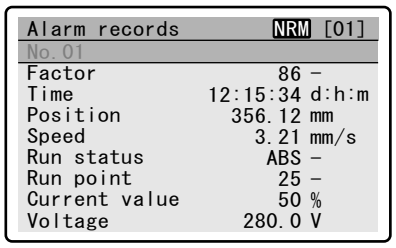
CAUTION

The alarm records are important data used to analyze problems that occurred in this product, so do NOT delete them. Leaving the alarm records undeleted will cause no problems. However, if you want to delete them, use the procedure below.

Step 2 "Alarm records" screen



Step 3 Alarm record details screen



■ To delete the alarm records:

1. On the "Alarm records" screen, press FUNC.
2. When the "Function" menu appears showing "Delete all", press ■.
3. When a confirmation message appears, select "Yes" and press ■.

7.8 Information display

The model names and specifications of the controller and robot being used can be displayed.

Step 1 ***On the main menu screen, select "Monitor".***

The "Monitor" menu screen opens showing selectable menu items.

Pressing ▼ displays the second page.

(Pressing ▲ returns to the first page.)

Press ▼ to display the "Information" on the second page.

Step 2 ***Move the cursor to "Information" and press ■.***

The "Information" screen opens showing the model names and specifications of the controller and robot being used.

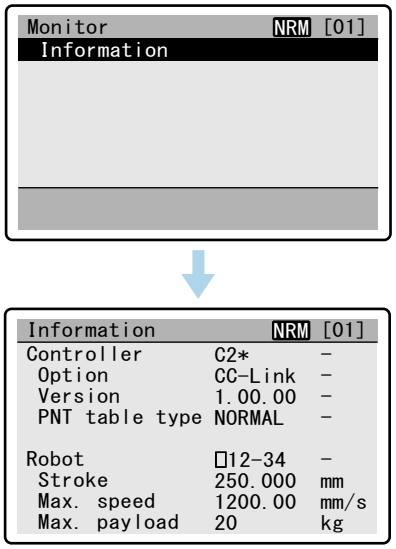
24A47-M0-00

Step 3 ***Press CLR .***

This returns to the "Monitor" menu screen.

▶ **Step 2** "Information" screen

Page 2



8. Other functions

8.1 Operation mode

When using the H1, the operation mode can be set to any of the followings modes. The default setting is "Normal mode".

Run mode	H1 operation	I/O control from host device	Description
Normal mode	Permitted	Permitted	All H1 operations and host device I/O controls can be performed.
Normal mode (safety)			
Monitor mode	Only monitor mode permitted	Permitted	H1 can be used only in Monitor mode, so editing data or operating the robot is impossible. Robot can be operated only from host device by I/O control.
Monitor mode (safety)			
Debug mode	Permitted	Prohibited	All H1 operations can be performed, but host device I/O controls are prohibited. Use this mode when point-teaching or making adjustments using the H1 within a safety enclosure.
Debug mode (safety)			

*Robot operation is limited to low speed in the "safety" modes listed above.

CAUTION

To change the operation mode, turn on the power to the controller while holding down the CLR on the H1, or reinsert the H1 cable connector into the COM1 connector on the controller front panel. For details on each operation mode, refer to section 6, "Operation modes", in Chapter 5 of the Controller Guide.

Step 1 ***On the main menu screen, select "Run mode".***

The "Run mode" menu screen appears. An asterisk (*) is displayed to the left of the currently selected mode.

24A48-M0-00

NOTE

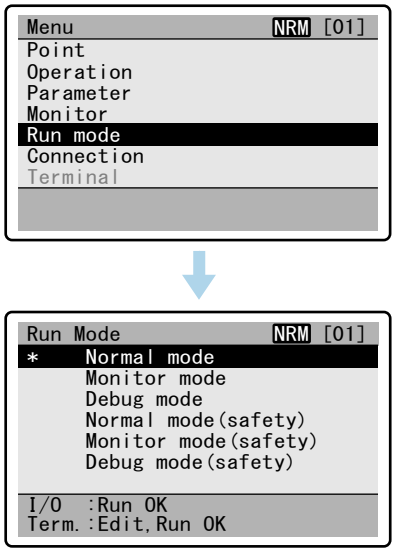
On the H1 screen, the menu item to select the operation mode is named "Run mode". The "Run mode" is selectable only when the H1 was started while holding down CLR . Otherwise, all modes other than the currently selected mode are grayed out and cannot be selected.

Step 2 ***Move the cursor to the mode you want to set, and press ■.***

Step 3 ***Press CLR .***

This returns to the main menu screen.

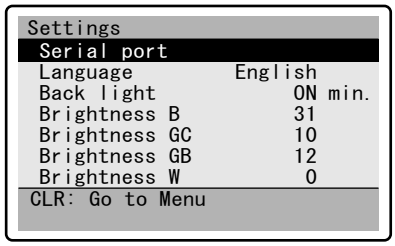
Step 1 "Run mode"screen



8.2 Setting mode

When you start the H1 while holding down FUNC, the "Settings" screen appears as shown below. From this screen, you can change the LCD display language (Japanese/English) if needed.

"Settings" screen



23A12-M0-00

CAUTION

In Setting mode, do not change any settings other than the LCD display language (Japanese/English).

NOTE

After changing the setting, press CLR to enter the main menu screen and enable the change.

8.2.1 Changing the display language

Step 1 ***Move the cursor to "Language" and press ■.***

The language can now be changed. Selectable options are shown in the comment area.

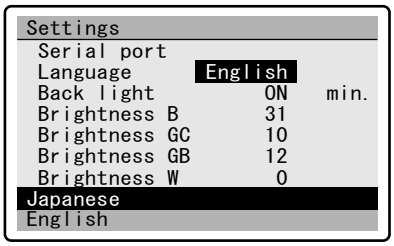
24A49-M0-00

Step 2 ***Use ▲ or ▼ to select the desired language (Japanese/English) and press ■.***

Step 3 ***Press CLR.***

This returns to the "Settings" screen.

▶ **Step 1** "Language"screen



9. Specifications

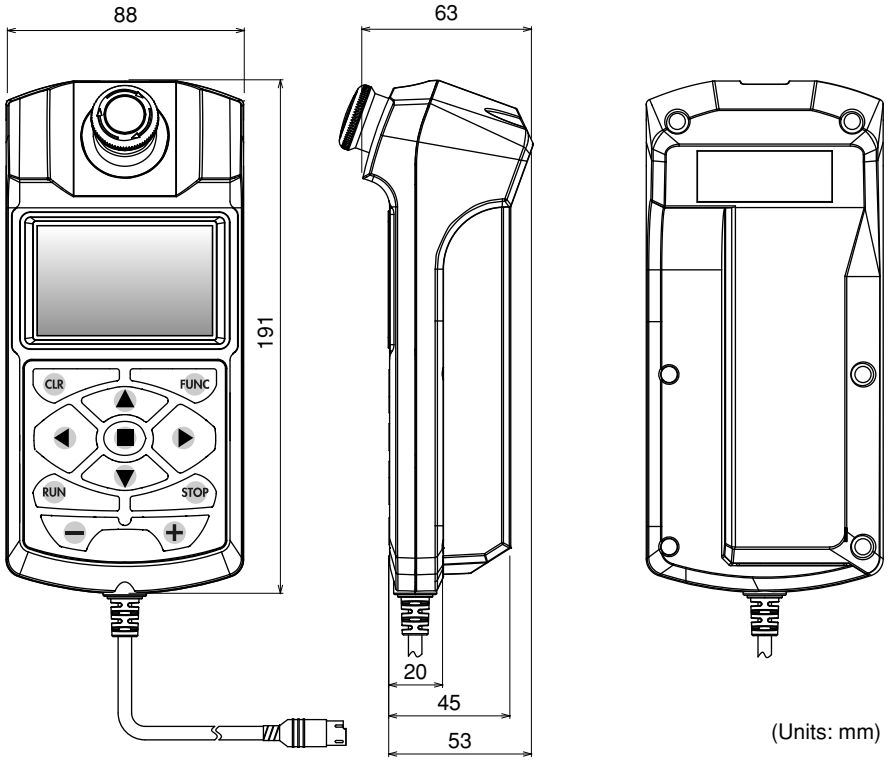
9.1 Basic specifications

Item		Specifications
Basic specifications	Outer dimensions	W88 × H191 × D45 mm (not including emergency stop button)
	Weight	H1 : 260kg (without cable), 400g (including cable) HD1 : 300kg (without cable), 440g (including cable)
	Power	12V DC, 0.25A or less (supplied from controller)
	Cable length	3.5m
External inputs/outputs	Interface	RS-232C
	Display	Dot matrix monochrome LCD (with backlight), 32 characters × 10 lines
	Operation keys	Mechanical switch
	Emergency stop button	Normally-closed (with lock mechanism)
	ENABLE switch (HD1 only)	3-position switch
	Safety connector (HD1 only)	15-pin D-sub connector (male)
Ambient conditions	Ambient operating Temperature/humidity	0 to +40˚C / 35 to 85% RH (no condensation)
	Ambient storage Temperature/humidity	-10 to +65˚C / 10 to 85% RH (no condensation)
Others	Compatible controllers	C1 and C21/C22 controllers

9.2 Dimensional outlines

9.2.1 H1

H1

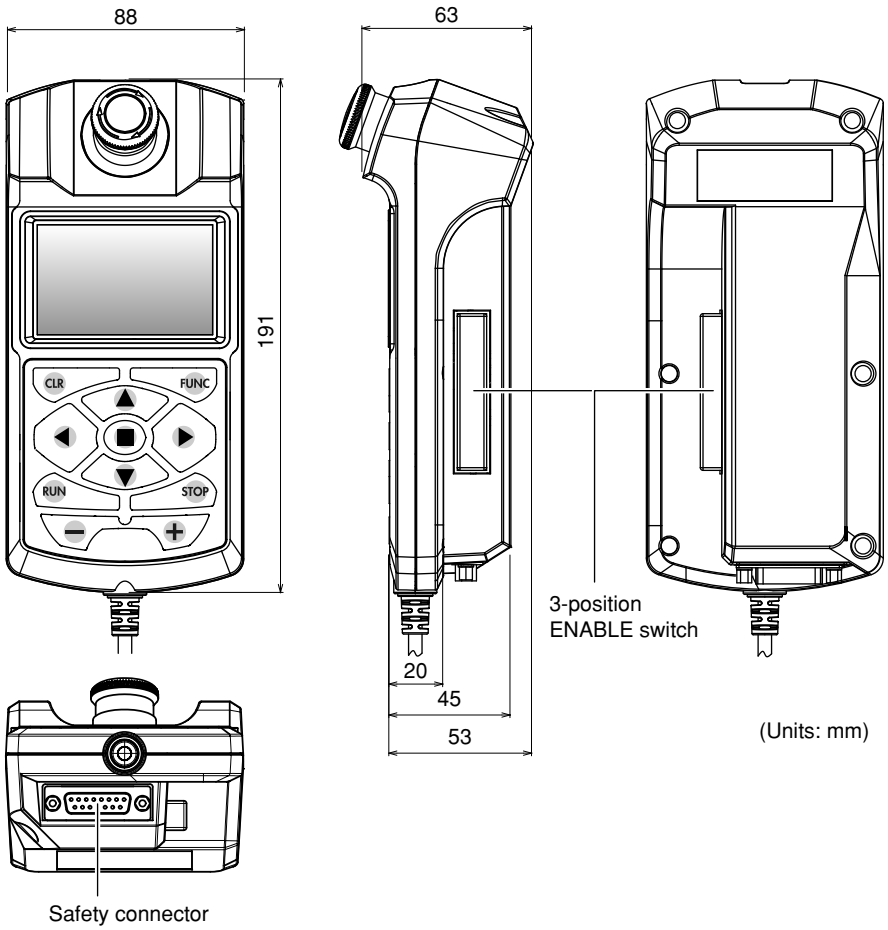


(Units: mm)

23A13-M0-00

9.2.2 HD1

HD1



23A14-M0-00

Communication Command Guide

Contents

Introduction B-1

1. Communication specifications B-2

1.1 Communication parameter specifications B-2

1.2 Communication command specifications B-2

2. Communication command lists B-3

3. Communication command description B-5

3.1 Robot operation commands B-5

Positioning operation (START) B-5
Operation stop (STOP) B-5
Return-to-origin (ORG) B-6
JOG movement (JOG+, JOG-) B-6
Inching movement (INCH+, INCH-) B-7

3.2 Status change commands B-8

Servo status change (SRVO) B-8
Brake status change (BRK) B-8
Reset (RESET) B-8

3.3 Edit commands B-9

Point data writing 1 (M, P, S, AC, DC, Q, ZL, ZH, N, J, F, T) B-9
Point data writing 2 (P_, S_, AC_, DC_, Q_) B-10
Current position teaching (TEACH) B-11
Point data copying (COPY) B-11
Point data deleting (DEL) B-12
Parameter data writing (K) B-12
Automatic node number setting (SETID) B-13

3.4 Query commands B-14

Point data reading (?M, ?P, ?S, ?AC, ?DC, ?Q, ?ZL, ?ZH, ?N, ?J, ?F, ?T) B-14
Parameter data reading (?K) B-15
Status data reading (?D) B-16
Input/output information reading (?IN, ?INB, ?OUT, ?OUTB) B-17
Word input/output information reading (?WIN, ?WOUT) B-18
Option information reading (?OPT, ?OPTB) B-19
Alarm/warning information reading (?ALM, ?WARN) B-20

Introduction

The C1/C21/C22 controller allows you to write the point data or operate the robot using a communication device, such as a personal computer through the RS-232C communication.
This "Communication Command Guide" explains how to set the communication parameters necessary to perform the communication between the communication device and the C1/C21/C22 controller, and also explains the communication command specifications.

Before reading this section, read the precautions and descriptions stated in the "Controller Guide" (main part of this manual) to understand the point data and parameter data, as well as controller functions and usage.

1. Communication specifications

1.1 Communication parameter specifications

The communication parameters on the mating unit, such as personal computer must be set as follows. Refer to the relevant unit's operation manual for the setting procedure.

Communication parameter specifications

Parameter	Setting
Baudrate	38,400bps
Data bit	8 bits
Parity	Odd
Stop bit	1 bit
Flow control	None

NOTE

Data that does not conform to the controller specifications may be received due to a variety of factors during RS-232C communication.

1.2 Communication command specifications

The C1/C21/C22 controller provides ASCII character string communication commands to communicate with an external communication device.
The communication commands are classified into four categories as follows.

Type	Contents
Robot operation command	Operates or stops the robot.
Status change command	Changes the servo or brake status.
Edit command	Writes the parameter or point data.
Query command	Reads the data or robot status.

NOTE

The communication commands are applicable to the controller software version Ver.1.04.106 or higher.

The basic format of the communication command is as follows.

Data transmission format

```
@<command>[<data number/status>][.n] c/r l/f
@<command>[<data number>][.n]=<setting value> c/r l/f
```

n: Node number

Data response format

```
OK.n c/r l/f
NG.n=<alarm number>c/r l/f
RUN.n c/r l/f
END.n c/r l/f
```

n: Node number

- All communication commands consist of an ASCII character string that begins with a start code '@'(=40h) and ends with c/r(=0Dh)l/f(=0Ah).
- 'n' (node number) is used for the daisy chain connection. One host communication device communicates with one robot controller, or with all the daisy-chained controllers (up to 16 controllers).

NOTE

When 'n' (node number) is omitted, commands are sent to all the daisy-chained controllers.

CAUTION

Make sure to perform automatic node number setting when you first use the daisy-chained controller or when you have replaced the controllers.
To perform the node number setting, execute "Automatic node number assignment" in the support software RS-Manager or send the "Automatic node number setting (SETID)" command (communication command).

- The number of bytes, which can be output by one command response, is 255.
- " , " (comma) means the same as c/r l/f during data transmission.

2. Communication command lists

■ Robot operation commands

Command	Format	Command Description
START	@START<point number>[.<n>]	Positioning operation
STOP	@STOP[.<n>]	Operation stop
ORG	@ORG[.<n>]	Return-to-origin
JOG+	@JOG+[.<n>]	JOG movement (+ direction)
JOG-	@JOG-[.<n>]	JOG movement (- direction)
INCH+	@INCH+[.<n>]	Inching movement (+ direction)
INCH-	@INCH-[.<n>]	Inching movement (- direction)

n: Node number

■ Status change commands

Command	Format	Command Description
SRVO	@SRVO<1 or 0>[.<n>]	Servo status change
BRK	@BRK<1 or 0>[.<n>]	Brake status change
RESET	@RESET[.<n>]	Reset

n: Node number

■ Edit commands

Command	Format	Command Description		
M	@M<point number>[.<n>]=<setting value>	Point data writing	Operation type	
P	@P<point number>[.<n>]=<setting value>		Position	
P_	@P_<point number>[.<n>]=<setting value>			(Data is not saved into the memory.)
S	@S<point number>[.<n>]=<setting value>		Speed	
S_	@S_<point number>[.<n>]=<setting value>			(Data is not saved into the memory.)
AC	@AC<point number>[.<n>]=<setting value>		Acceleration	
AC_	@AC_<point number>[.<n>]=<setting value>			(Data is not saved into the memory.)
DC	@DC<point number>[.<n>]=<setting value>		Deceleration	
DC_	@DC_<point number>[.<n>]=<setting value>			(Data is not saved into the memory.)
Q	@Q<point number>[.<n>]=<setting value>		Push	
Q_	@Q_<point number>[.<n>]=<setting value>			(Data is not saved into the memory.)
ZL	@ZL<point number>[.<n>]=<setting value>		Zone (-)	
ZH	@ZH<point number>[.<n>]=<setting value>		Zone (+)	
N	@N<point number>[.<n>]=<setting value>		Near width	
J	@J<point number>[.<n>]=<setting value>		Jump	
F	@F<point number>[.<n>]=<setting value>		Flag	
T	@T<point number>[.<n>]=<setting value>		Timer	
TEACH	@TEACH<point number>[.<n>]	Current position teaching		
COPY	@COPY<point number 1>-<point number 2>[.<n>]	Point data copying		
DEL	@DEL<point number 1>[-<point number 2>][.<n>]	Point data deleting		
K	@K<parameter number>[.<n>]=<setting value>	Parameter data writing		
SETID	@SETID	Automatic node number setting (when daisy chain function is used)		

n: Node number

Query commands

Command	Format	Command Description	
?M	@?M<point number>[.<n>]	Point data reading	Operation type
?P	@?P<point number>[.<n>]		Position
?S	@?S<point number>[.<n>]		Speed
?AC	@?AC<point number>[.<n>]		Acceleration
?DC	@?DC<point number>[.<n>]		Deceleration
?Q	@?Q<point number>[.<n>]		Push
?ZL	@?ZL<point number>[.<n>]		Zone (-)
?ZH	@?ZH<point number>[.<n>]		Zone (+)
?N	@?N<point number>[.<n>]		Near width
?J	@?J<point number>[.<n>]		Jump
?F	@?F<point number>[.<n>]		Flag
?T	@?T<point number>[.<n>]		Timer
?K	@?K<parameter number>[.<n>]	Parameter data reading	
?D	@?D<status number>[.<n>]	Status information reading	
?IN	@?IN<input number>[.<n>]	Input information reading	
?INB	@?INB<input bit number>[.<n>]	Input information (bit) reading	
?OUT	@?OUT<output number>[.<n>]	Output information reading	
?OUTB	@?OUTB<output bit number>[.<n>]	Output information (bit) reading	
?WIN	@?WIN<word input number>[.<n>]	Input word information reading	
?WOUT	@?WOUT<word output number>[.<n>]	Output word information reading	
?OPT	@?OPT<option number>[.<n>]	Option information reading	
?OPTB	@?OPTB<option bit number>[.<n>]	Option information (bit) reading	
?ALM	@?ALM<alarm occurrence number>[.<n>]	Alarm information reading	
?WARN	@?WARN<warning occurrence number>[.<n>]	Warning information reading	

n: Node number

3. Communication command description

3.1 Robot operation commands

The robot operation commands are intended to operate or stop the robot.

Positioning operation (START)

Format	@START<point number>[.<node number>] c/r l/f @START<point number>[#P<position data>][.<node number>] c/r l/f
Meaning	Starts the positioning operation of specified point data.

Function

This command has the same function as the start (START) input.
When #P<position data> is added to a portion immediately after the position number, the operation can be performed by registering the position data into the point data again.
This is called direct position designation positioning operation.
The unit of the position data is the same as that used for the point data writing. For details, refer to section 3.3 "Edit commands" in this Communication Command Guide.

NOTE
The direct position designation positioning operation is available from controller's software version Ver.1.11.125.

Setting

<Point number> : 1 to 255
<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@START1.1 c/r l/f		Positioning operation of point data 1
	RUN.1 c/r l/f	Starts the positioning operation.
	END.1 c/r l/f	Normal end
@START2.1 c/r l/f		Positioning operation of point data 2
	RUN.1 c/r l/f	Accepts the positioning operation and starts it.
	NG.1=44 c/r l/f	Abnormal end (Operation is stopped by alarm "44: SOFTLIMIT OVER".)
@START1#P10000.1 c/r		Operates by registering "position = 100.00mm" into the point data 1.
	RUN.1 c/r l/f	Starts the positioning operation.
	END.1 c/r l/f	Normal end

Operation stop (STOP)

Format	@STOP[.<node number>] c/r l/f
Meaning	Stops the operation.

Function

Stops the operation/movement of the robot.
When the operation/movement is stopped by this command, the robot decelerates, and then stops.

Setting

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@START1.1 c/r l/f		Positioning operation of point data 1
	RUN.1 c/r l/f	Starts the positioning operation.
@STOP.1 c/r l/f		Stop
	NG.1=46 c/r l/f	Abnormal end (Operation is stopped by alarm "46: STOP KEY".)

Return-to-origin (ORG)

Format	@ORG[.<node number>] c/r l/f
Meaning	Performs the return-to-origin.

Function

This command has the same function as the return-to-origin (ORG) input.

Setting

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@ORG.1 c/r l/f		Return-to-origin operation
	RUN.1 c/r l/f	Starts the return-to-origin.
	END.1 c/r l/f	Normal end

JOG movement (JOG+, JOG-)

Format	@JOG+[.<node number>] c/r l/f @JOG-[.<node number>] c/r l/f
Meaning	Performs the JOG movement in the + or - direction.

Function

Performs the JOG movement of the robot in a specified direction (+/-).

NOTE

- The JOG movement speed is set using "JOG speed (K10)" of the RUN parameter. (See also Chapter 3, section 4.2 "Parameter details" of the Controller Guide.)
- The JOG movement using the communication command does not relate to the manual mode status.

Setting

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@JOG+.1 c/r l/f		JOG movement in the + direction.
	RUN.1 c/r l/f	Starts the JOG movement.
@STOP.1 c/r l/f		Transmits the operation stop.
	OK.1 c/r l/f	JOG movement normal stop

Inching movement (INCH+, INCH-)

Format	@INCH+[.<node number>] c/r l/f @INCH-[.<node number>] c/r l/f
Meaning	Performs the inching movement in the + or - direction.

Function

Performs the inching movement of the robot in a specified direction (+/-).

NOTE

- The inching width (amount) is set using "Inching width (K11)" of the RUN parameter. (See also Chapter 3, section 4.2 "Parameter details" of the Controller Guide.)
- The inching movement using the communication command does not relate to the manual mode status.

Setting

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@INCH-.1 c/r l/f		Inching movement in the - direction.
	RUN.1 c/r l/f	Starts the inching movement.
	END.1 c/r l/f	Normal end

3.2 Status change commands

The status change commands are intended to change the servo or brake status.

Servo status change (SRVO)

Format	@SRVO<1 or 0>[.<node number>] c/r l/f
Meaning	Changes the servo status.

Function

This command has the same function as the servo ON (SERVO) input.

Setting

<1 or 0> : 1 Servo ON, 0 Servo OFF

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@SRVO1.1 c/r l/f		Servo ON
	OK.1 c/r l/f	Normal end

Brake status change (BRK)

Format	@BRK<1 or 0>[.<node number>] c/r l/f
Meaning	Changes the brake status.

Function

Changes the brake status. Note that the brake status cannot be changed while the servo is ON.

Setting

<1 or 0> : 1 Brake ON, 0 Brake release

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@BRK0.1 c/r l/f		Brake release
	OK.1 c/r l/f	Normal end

Reset (RESET)

Format	@RESET[.<node number>] c/r l/f
Meaning	Performs the reset.

Function

This command has the same function as the reset (RESET) input.
When executing this command, the following operations are performed.

(1) Resets the alarm.

(2) Clears the point number output.

(3) Clears the remaining movement amount of the relative positioning operation.

Setting

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@RESET.1 c/r l/f		Reset
	OK.1 c/r l/f	Normal end

3.3 Edit commands

The edit commands are intended to write data, such as parameter or point.

Point data writing 1 (M, P, S, AC, DC, Q, ZL, ZH, N, J, F, T)

Format	@M<point number>[.<node number>]=<setting value> c/r l/f @P<point number>[.<node number>]=<setting value> c/r l/f @S<point number>[.<node number>]=<setting value> c/r l/f @AC<point number>[.<node number>]=<setting value> c/r l/f @DC<point number>[.<node number>]=<setting value> c/r l/f @Q<point number>[.<node number>]=<setting value> c/r l/f @ZL<point number>[.<node number>]=<setting value> c/r l/f @ZH<point number>[.<node number>]=<setting value> c/r l/f @N<point number>[.<node number>]=<setting value> c/r l/f @J<point number>[.<node number>]=<setting value> c/r l/f @F<point number>[.<node number>]=<setting value> c/r l/f @T<point number>[.<node number>]=<setting value> c/r l/f
Meaning	Writes the setting value to the individual data of a specified point, and saves it into the memory.

Function

Writes the setting value to the individual data of a specified point. The written data is saved into the memory (EEPROM). The command may vary depending on the type of individual data. For details, see the table below.

■ Command and data type

Command	Type	Unit	
		Standard Setting	Custom Setting
M	Operation type	-	
P	Position	0.01mm	
S	Speed	%	0.01mm/s
AC	Acceleration	%	0.01m/s^2
DC	Deceleration	%	
Q	Push	%	
ZL	Zone (-)	0.01mm	
ZH	Zone (+)	0.01mm	
N	Near width	0.01mm	
J	Jump	-	
F	Flag	-	
T	Timer	ms	

CAUTION

There is a limit to the number of data writing cycles for the memory (EEPROM). So, when it is required to frequently write the data to the memory, use commands described in "point data writing 2".

NOTE

The individual data of the point data related to the position or speed may include the decimal point due to the specifications. However, when handling such data using the communication command, all of data are handled as integer values. For example, when the position data is 20(mm), the communication command handles this value as "2000(10^{-2}mm)" not including the decimal point.

TIP

For point data details, see Chapter 3, section 2, "Point data" of the Controller Guide.

Setting

<Point number> : 1 to 255

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@P1.1=30000 c/r l/f		Writes "30000" to "Position" of point data 1.
	OK.1 c/r l/f	Normal end
@S1.1=50 c/r l/f		Writes "50" to "Speed" of point data 1.
	OK.1 c/r l/f	Normal end
@AC1.1=100 c/r l/f		Writes "100" to "Acceleration" of point data 1.
	OK.1 c/r l/f	Normal end
@DC1.1=50 c/r l/f		Writes "50" to "Deceleration" of point data 1.
	OK.1 c/r l/f	Normal end
@M1.1=1 c/r l/f		Writes "1" (ABS) to "Operation type" of point data 1.
	OK.1 c/r l/f	Normal end

Point data writing 2 (P_, S_, AC_, DC_, Q_)

Format	@P_<point number>[.<node number>]=<setting value> c/r l/f @S_<point number>[.<node number>]=<setting value> c/r l/f @AC_<point number>[.<node number>]=<setting value> c/r l/f @DC_<point number>[.<node number>]=<setting value> c/r l/f @Q_<point number>[.<node number>]=<setting value> c/r l/f
Meaning	Writes the setting value to the individual data of a specified point.

Function

Writes the setting value to the individual data of a specified point. The written data is not saved into the memory. The command may vary depending on the type of individual data. For details, see the table below.

■ Command and data type

Command	Type	Unit	
		Standard Setting	Custom Setting
P_	Position	0.01mm	
S_	Speed	%	0.01mm/s
AC_	Acceleration	%	0.01m/s^2
DC_	Deceleration	%	
Q_	Push	%	

NOTE

- Even when the setting value is written using this command, the value is not saved into the memory. So, the value is returned to its previous value after the power has been turned off, and then turned on again. When the setting value needs to be saved into the memory, it is necessary to write the operation type (M) after the setting value has been written.
- The individual data of the point data related to the position or speed may include the decimal point due to the specifications. However, when handling such data using the communication command, all of data are handled as integer values. For example, when the position data is 20(mm), the communication command handles this value as "2000(10^{-2}mm)" not including the decimal point.
- This command is valid from version 1.04.xxx or higher.

TIP

For point data details, see Chapter 3, section 2, "Point data" of the Controller Guide.

Setting

<Point number> : 1 to 255

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@P_1.1=30000 c/r l/f		Writes "30000" to "Position" of point data 1.
	OK.1 c/r l/f	Normal end
@S_1.1=50 c/r l/f		Writes "50" to "Speed" of point data 1.
	OK.1 c/r l/f	Normal end
@AC_1.1=100 c/r l/f		Writes "100" to "Acceleration" of point data 1.
	OK.1 c/r l/f	Normal end
@DC_1.1=50 c/r l/f		Writes "50" to "Deceleration" of point data 1.
	OK.1 c/r l/f	Normal end

Current position teaching (TEACH)

Format	@TEACH<point number>[.<node number>] c/r l/f
Meaning	Teaches the current position to the position data of specified point data.

Function

This command has the same function as the current position teaching (TEACH) input.

NOTE

- The current position teaching using the communication command does not relate to the manual mode and interlock statuses.
- If the return-to-origin is not completed, the abnormal end is returned.

Setting

<Point number> : 1 to 255

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@TEACH2.1 c/r l/f		Teaches the current position to point data 2.
	OK.1 c/r l/f	Normal end

Point data copying (COPY)

Format	@COPY<point number 1>-<point number 2>[.<node number>] c/r l/f
Meaning	Copies the data of the point number 1 to the data of the point number 2.

Function

Copies the data of point number 1 to point number 2.

Setting

<Point number> : 1 to 255

< Point number 1> Copy source number

< Point number 2> Copy destination number

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@COPY2-3.1 c/r l/f		Copies point data 2 to point data 3.
	OK.1 c/r l/f	Normal end

Point data deleting (DEL)

Format	@DEL<point number 1>[-<point number 2>][.<n>] c/r l/f
Meaning	Deletes specified point data.

Function

Deletes the point data between Point No.1 and Point No.2.

NOTE

If the number specified for Point No.1 is larger than that of Point No.2, the point data between Point No.2 and Point No.1 is deleted.

Setting

<Point number> : 1 to 255

< Point number 1> Delete start number

< Point number 2> Delete end number

When the number of point data you want to delete is "1", < point number 2> can be omitted.

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@DEL1.1 c/r l/f		Deletes point data 1.
	OK.1 c/r l/f	Normal end
@DEL1-3.1 c/r l/f		Deletes point data 1 to 3.
	OK.1 c/r l/f	Normal end

Parameter data writing (K)

Format	@K<parameter number>[.<node number>]=<setting value> c/r l/f
Meaning	Writes the setting value to a specified parameter.

Function

Writes the setting value to a specified parameter.

CAUTION

When parameters need to be edited, do not edit parameters not described in this guide. Doing so may cause a communication failure or malfunction.

NOTE

- Some parameter data may include the decimal point due to the specifications. However, when handling such data using the communication command, all of data are handled as integer values.For example, when K1 ((-) software limit) is 20(mm), the communication command handles this value as "2000(10^{-2}mm)" not including the decimal point.
- The operation parameter, I/O parameter, and option parameter you have changed become valid after the power has been turned off, and then turned on again.

Setting

<Parameter number> :1 to 138

<Node number> :1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

TIP

For parameter number details, see Chapter 3, section 4, "Parameter data" of the Controller Guide.

Communication example

Transmission	Response	
@K10.1=50 c/r l/f		Writes "50" to parameter data K10 (JOG speed).
	OK.1 c/r l/f	Normal end

Automatic node number setting (SETID)

Format	@SETID
Meaning	Sets node numbers for daisy-chained controllers.

Function

Sets the node numbers to the daisy-chained controllers from "1" in order of distance starting from the controller nearest to the host communication device.

WARNING

- THE MAXIMUM NUMBER OF CONTROLLERS THAT CAN BE DAISY-CHAINED IS 16. IF 17 OR MORE CONTROLLERS ARE CONNECTED, THEY MAY NOT OPERATE PROPERLY.
- MAKE SURE THAT THERE ARE NO DAISY-CHAINED CONTROLLERS HAVING THE SAME NODE NUMBER BEFORE SENDING OTHER COMMAND.
  IF THERE ARE CONTROLLERS WITH THE SAME NODE NUMBER, PERFORM AUTOMATIC NODE NUMBER SETTING AGAIN. IF YOU DO NOT DO THIS, THE SYSTEM MAY NOT OPERATE PROPERLY.

Communication example (16 daisy-chained controllers)

Transmission	Response	
@SETID c/r l/f		Performs automatic node number setting
	OK.1 c/r l/f	Node number 1 setting end
	OK.2 c/r l/f	Node number 2 setting end
	:	
	OK.16 c/r l/f	Node number 16 setting end

CAUTION

If you receive several identical responses, there is a duplication of node number.
(Example) When reading the node number (K38) from all the nodes by query command

Transmission	Response	
@?K38 c/r l/f	K38.1=1 c/r l/f	
	OK.1 c/r l/f	
	K38.2=2 c/r l/f	Duplication
	OK.2 c/r l/f	
	K38.2=2 c/r l/f	
	OK.2 c/r l/f	

In this case, be sure to perform automatic node number setting.

3.4 Query commands

The query commands are intended to read the data or robot status.

Point data reading (?M, ?P, ?S, ?AC, ?DC, ?Q, ?ZL, ?ZH, ?N, ?J, ?F, ?T)

Format	@?M<point number>[.<node number>] c/r l/f @?P<point number>[.<node number>] c/r l/f @?S<point number>[.<node number>] c/r l/f @?AC<point number>[.<node number>] c/r l/f @?DC<point number>[.<node number>] c/r l/f @?Q<point number>[.<node number>] c/r l/f @?ZL<point number>[.<node number>] c/r l/f @?ZH<point number>[.<node number>] c/r l/f @?N<point number>[.<node number>] c/r l/f @?J<point number>[.<node number>] c/r l/f @?F<point number>[.<node number>] c/r l/f @?T<point number>[.<node number>] c/r l/f
Meaning	Reads the individual data of a specified point.

Function

Reads the individual data of a specified point.
The command may vary depending on the type of individual data. For details, see the table below.

■ Command and data type

Command	Type	Unit	
		Standard Setting	Custom Setting
?M	Operation type	-	
?P	Position	0.01mm	
?S	Speed	%	0.01mm/s
?AC	Acceleration	%	0.01m/s^2
?DC	Deceleration	%	
?Q	Push	%	
?ZL	Zone (-)	0.01mm	
?ZH	Zone (+)	0.01mm	
?N	Near width	0.01mm	
?J	Jump	-	
?F	Flag	-	
?T	Timer	ms	

NOTE

The individual data of the point data related to the position or speed may include the decimal point due to the specifications. However, when handling such data using the communication command, all of data are handled as integer values. For example, when the position data is 20(mm), the communication command handles this value as" 2000(10^{-2}mm)" not including the decimal point.

Setting

<Point number> : 1 to 255

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Communication example

Transmission	Response	
@?P1.1 c/r l/f		Reads "Position" of point data 1.
	P1.1=30000 c/r l/f	Receives the data.
	OK.1 c/r l/f	Normal end
@?S2.1 c/r l/f		Reads "Speed" of point data 2.
	S2.1=100 c/r l/f	Receives the data.
	OK.1	Normal end

Parameter data reading (?K)

Format	@?K<parameter number>[.<node number>] c/r l/f
Meaning	Reads a specified parameter.

Function

Reads the setting value of a specified parameter.

NOTE

Some parameter data may include the decimal point due to the specifications. However, when handling such data using the communication command, all of data are handled as integer values. For example, when K1 ((-) software limit) is 20(mm), the communication command handles this value as" 2000(10^{-2}mm)" not including the decimal point.

Setting

<Parameter number> :1 to 138

<Node number> :1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

TIP

For parameter number details, see Chapter 3, section 4, "Parameter data" of the Controller Guide.

Communication example

Transmission	Response	
@?K10.1 c/r l/f		Reads parameter data K10 (JOG speed).
	K10.1=50 c/r l/f	Receives the data.
	OK.1 c/r l/f	Normal end

Status data reading (?D)

Format	@?D<status number>[.<node number>] c/r l/f
Meaning	Reads specified status information.

Function

Reads the status information, such as current position or speed.

Setting

<Status number> : 0 to 20 (See the table below.)

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

■ Data number and type of status information

Number	Name	Unit	Contents
0	Current position	0.01mm	Current position information
1	Current speed	0.01mm/s	Actual speed information
2	Electrical current	%	Percentage of electrical current to rated current
6	Position command	0.01mm	Position command information currently running
7	Speed command	0.01mm/s	Speed command information currently running
9	Voltage value	0.1V	Motor drive voltage
10	Temperature	°C	Temperature of motor drive module
13	Current point number	-	Point number of positioning operation currently running
14	Load rate	%	Overload error occurs if the load rate reaches 100%.
17	Machine reference	%	Machine reference (See the explanation on Machine reference stated in Chapter 5, section 2.3, "Origin point and coordinates relationship" of the Controller Guide.)
18	Operation status	-	See the table below.

Value	Meaning	
-1	Return-to-origin is being executed.	
0	Stopping	
1	Operation type	ABS
2		INC
3		ABS merge
4		INC merge
5		ABS push
6		INC push
7		ABS deceleration push
8		INC deceleration push

Communication example

Transmission	Response	
@?D0.1 c/r l/f		Reads the information on status number 0 (current position).
	D0.1=32000 c/r l/f	Receives the data.
	OK.1 c/r l/f	Normal end

Input/output information reading (?IN, ?INB, ?OUT, ?OUTB)

Format	Input information @?IN<input number>[.<node number>] c/r l/f @?INB<input bit number>[.<node number>] c/r l/f Output information @?OUT<output number>[.<node number>] c/r l/f @?OUTB<output bit number>[.<node number>] c/r l/f
Meaning	Reads specified input/output information.

Function

Reads the information on specified input/output signal.
The read-out results of the input/output information in decimal notation are returned.

Setting

<Input/output number> :1 (See the table below.)

<Input/output bit number> :0 to 15 (See the table below.)

<Node number> :1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Input/output information type

Input/output Number	Input/output Bit Number	Input		Output	
		Symbol	Meaning	Symbol	Meaning
1	0	PIN0	Point number selection	POUT0	Point number output
	1	PIN1		POUT1	
	2	PIN2		POUT2	
	3	PIN3		POUT3	
	4	PIN4		POUT4	
	5	PIN5		POUT5	
	6	PIN6		POUT6	
	7	PIN7		POUT7	
	8	JOG+	JOG movement (+ direction)	OUT0	Control output
	9	JOG-	JOG movement (- direction)	OUT1	
	10	MANUAL	Manual mode	OUT2	
	11	ORG	Return-to-origin	OUT3	
	12	/LOCK	Interlock	BUSY	Operation is being executed.
	13	START	Start	END	Operation completion
	14	RESET	Reset	/ALM	Alarm
	15	SERVO	Servo ON	SRV-S	Servo status

Communication example

Transmission	Response	
@?IN1.1 c/r l/f		Reads the information on input 1 (bit 15 to 0).
	IN1.1=36864 c/r l/f	Receives the data. 36864 = 9000h
	OK.1 c/r l/f	Normal end
@?OUTB0.1 c/r l/f		Reads the information on output bit 0.
	OUTB0.1=1 c/r l/f	Receives the data.
	OK.1 c/r l/f	Normal end

Word input/output information reading (?WIN, ?WOUT)

Format	Input information @?WIN<word input number>[.<node number>]c/r l/f Output information @?WOUT<word output number>[.<node number>]c/r l/f
Meaning	Reads specified word input/output information.

Function

Reads the word input/output information.
The read-out results of the word input/output information in decimal notation are returned.

NOTE
The word input/output is a data area to be used by the remote command.

Setting

<Word input/output number> : 0 to 3 (See the table below.)
<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

■ Input/output information type

Input/output Number	Input		Output	
	Symbol	Meaning	Symbol	Meaning
0	WIN0	Execution command	WOUT0	Status
1	WIN1	Command option	WOUT1	Command response
2	WIN2		WOUT2	
3	WIN3		WOUT3	

Communication example

Transmission	Response	
@?WIN1.1 c/r l/f		Reads the information on word input 1 (WIN1).
	WIN1.1=4096 c/r l/f	Receives the data. 4069 = 1000h
	OK.1 c/r l/f	Normal end

Option information reading (?OPT, ?OPTB)

Format	@?OPT<option number>[.<node number>] c/r l/f @?OPTB<option bit number>[.<node number>] c/r l/f
Meaning	Reads specified option information.

Function

Reads the option information, such as zone output or emergency stop status.
The read-out results of the option information in decimal notation are returned.

Setting

<Option number> : 0 to 2 (See the table below.)

<Option bit number> : 0 to 31 (See the table below.)

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

Option information type

	Option Number		Option Bit Number	Symbol	Meaning
Option Information 1	0	1	0	PZONE	Individual zone output
			1	NEAR	Near width output
			2	TLM-S	Push status
			3	ORG-S	Return-to-origin completion status
			4	ZONE	Zone output
			5	MOVE	Moving
			6	WARN	Warning output (1: Warning occurs.)
			7	MANU-S	Manual mode status
			8	BUSY	Operation is being executed.
			9	END	Operation completion
			10	ALM	Alarm (1: Alarm status)
			11	SRV-S	Servo status
			12	LOCK	Interlock (1: Interlock status)
			13	BRAKE	Brake status
			14	E-STOP	Emergency stop status (1: Emergency stop)
			15	-	(Reserved.)
Option Information 2		2	16	-	(Reserved.)
			17	-	(Reserved.)
			18	-	(Reserved.)
			19	LINK	Network link status
			20	ORGSEN	Origin sensor signal input
			21 to 31	-	(Reserved.)

NOTE

When option number 0 is specified, all of the 32-bit information are output at once in binary notation.

Communication example

Transmission	Response	
@?OPT1.1 c/r l/f		Reads option information 1 (bit 15 to 0).
	OPT1.1=35336 c/r l/f	Receives the data. 35336 = 8A08h
	OK.1 c/r l/f	Normal end
@?OPTB11.1 c/r l/f		Reads option information bit 11.
	OPTB11.1=1 c/r l/f	SRV-S = 1 (Servo ON status)
	OK.1 c/r l/f	Normal end

Alarm/warning information reading (?ALM, ?WARN)

Format	@?ALM<alarm occurrence number>[.<node number>] c/r l/f @?WARN<warning occurrence number>[.<node number>] c/r l/f
Meaning	Reads the alarm/warning information currently occurring.

Function

Reads the alarm/warning information currently occurring.

TIP

For details regarding the alarm and warning numbers and their contents, see Chapter 6 "Troubleshooting" of the Controller Guide.

Setting

<Alarm/warning occurrence number> : 1 to 32

<Node number> : 1 to 16 (This setting can be omitted when the same command is sent to all the controllers connected with the host device, as by daisy chain connection.)

NOTE

If multiple alarms and warnings occur, the alarm/warning occurrence numbers are sequentially assigned to 1, 2, and so on from a smaller alarm number.

Example) If overload (86) and emergency stop (C1) occur, the alarm occurrence numbers are assigned as follows.
Alarm occurrence number 1 = 86 (overload)
Alarm occurrence number 2 = C1 (emergency stop)

Communication example

Transmission	Response	
@?ALM1.1 c/r l/f		Reads the alarm information.
	ALM1.1=86 c/r l/f	Receives the data. Alarm number 86: Overload error is occurring.
	OK.1 c/r l/f	Normal end
@?WARN1.1 c/r l/f		Reads the warning information.
	OK.1 c/r l/f	Normal end (No warning occurs.)

Daisy Chain Guide

Contents

Introduction C-1

1. Installation and wiring C-2

1.1 Installation C-2

1.2 Wiring C-3

2. Node number setting C-5

2.1 Automatic node number assignment function C-5

2.1.1 When using the RS-Manager C-5

2.1.2 When using the H1 C-7

2.2 When controllers with same node number exist on network C-8

2.2.1 When using the RS-Manager C-8

2.2.2 When using the H1 C-9

2.3 Switching the controllers C-10

2.3.1 When using the RS-Manager C-10

2.3.2 Switching the controllers using the H1 C-12

3. Writing and transferring saved and newly made data C-13

3.1 Writing data to controller C-13

3.2 Transferring data to controller C-16

Introduction

The daisy chain function of the C1/C21/C22 controller allows connection of up to 16 controllers in a daisy chain. Data settings such as point data and parameter data for any desired controller in the daisy chain can be set and the controller status monitored with a single computer or Handy Terminal.
This section explains the daisy chain function when used with the support software RS-Manager or H1.

For details on the basic operations of the support software RS-Manager, refer to the RS-Manager manual and its online help.

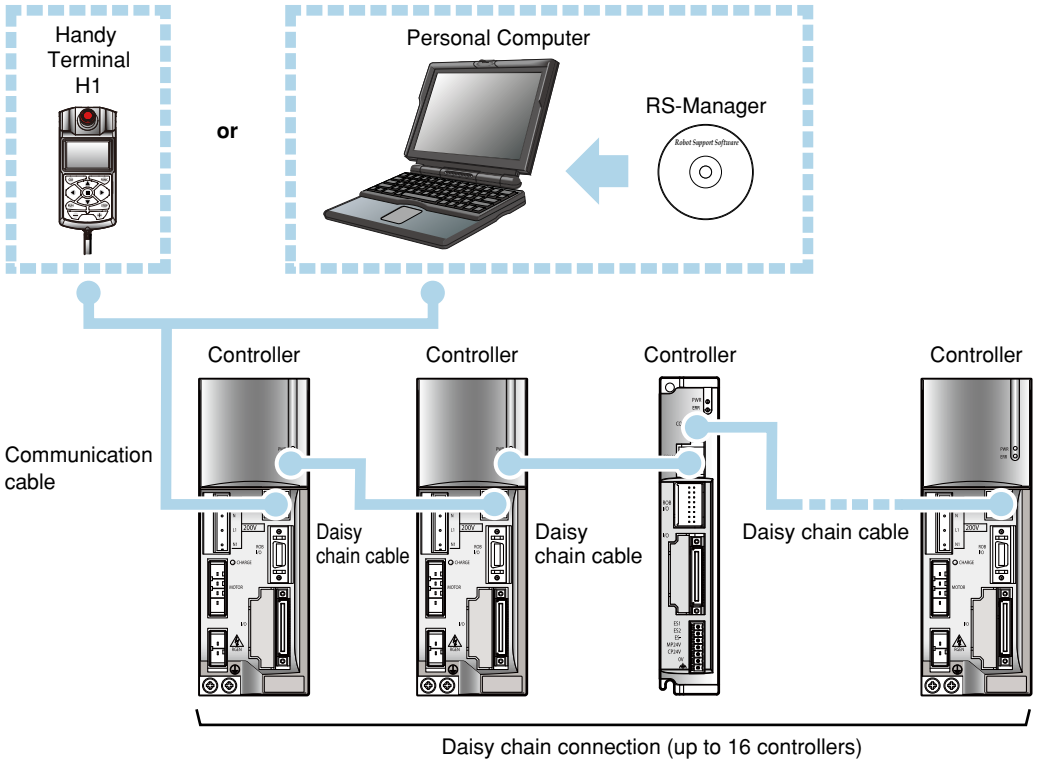
1. Installation and wiring

1.1 Installation

WARNING

- TO USE THE DAISY CHAIN CONNECTION, BE SURE TO INSTALL AN EXTERNAL EMERGENCY STOP CIRCUIT.
- BE SURE TO BE READY TO PERFORM EXTERNAL EMERGENCY STOP BEFORE YOU OPERATE A DAISY-CHAINED CONTROLLER FROM THE HANDY TERMINAL OR A COMPUTER.
- ONLY THE CONTROLLER DIRECTLY CONNECTED WITH THE HANDY TERMINAL CAN BE EMERGENCY-STOPPED WITH THE EMERGENCY STOP BUTTON ON THE HANDY TERMINAL. MAKE SURE TO INSTALL EXTERNAL EMERGENCY STOP CIRCUITS BECAUSE OTHER CONTROLLERS CANNOT BE STOPPED WITH THE EMERGENCY STOP BUTTON ON THE HANDY TERMINAL. (REFER TO SECTIONS 9, "CONFIGURING AN EMERGENCY STOP CIRCUIT C1 " AND 10, "CONFIGURING AN EMERGENCY STOP C21 C22" IN CHAPTER 2 OF THE "CONTROLLER GUIDE".)
- DO NOT CONNECT MORE THAN 16 CONTROLLERS IN A DAISY CHAIN.
  THIS MAY CAUSE UNPREDICTABLE OPERATION AND INCORRECT COMMUNICATION.

System configuration diagram



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CAUTION

- **The applicable controller software version for the daisy chain function is Ver.1.05.110 or later. The controllers with the earlier version software cannot utilize this function. Make sure to check the software version.**
- **The daisy chain function can be used with the H1 with the software version 1.09 onwards.**

NOTE

For details about the installation of the controller, refer to the "Controller Guide", Chapter 2 "Installation and wiring".

1.2 Wiring

To connect controllers in a daisy chain, the MISUMI-specified daisy chain connection cables must be used. The number of connection cables required is the number of controllers to be connected minus one.
Also a computer with the RS-Manager software installed and one communication cable for connecting the computer with the controller are required.
The following describes how to connect with your personal computer and how to make daisy chain connections.

WARNING

- BE SURE TO SHUT OFF THE CONTROL POWER TO THE CONTROLLER BEFORE CONNECTING THE CONTROLLERS IN A DAISY CHAIN. FAILURE TO DO SO MAY CAUSE THE ROBOT TO START RUNNING, RESULTING IN A SERIOUS ACCIDENT OR EVEN DEATH.
- THE DAISY CHAIN CABLE IS A DEDICATED CABLE FOR CONNECTING CONTROLLERS IN A DAISY CHAIN. SO, DO NOT USE THE DAISY CHAIN CABLE FOR OTHER EQUIPMENT. THIS MAY CAUSE EQUIPMENT FAILURE.
- MAKE SURE EACH CONNECTOR IS FACING CORRECTLY AND INSERT IT STRAIGHT INWARDS.
- TAKE APPROPRIATE MEASURES SO THAT THE METALLIC PART OF THE CONNECTOR IS NOT IN CONTACT WITH THE EXTERNAL POWER TERMINAL. FAILURE TO DO SO MAY CAUSE HEATING, FIRE, OR EXPLOSION.
- MAKE SURE THERE ARE NO METALLIC OBJECTS SUCH AS PINS OR NEEDLES MAKING CONNECT BETWEEN THE CONNECTOR PINS. THESE MIGHT CAUSE HEAT, FIRE, OR DAMAGE.
- DO NOT DISASSEMBLE, MODIFY OR MAKE A DIRECT SOLDER CONNECTION SINCE THIS MIGHT CAUSE HEAT, FIRE, OR DAMAGE.
- DO NOT LET WATER OR MOISTURE GET ON THE UNIT. DO NOT TOUCH THE CONNECTOR WITH MOIST HANDS SINCE THIS MIGHT CAUSE ELECTRICAL SHOCKS.
- DO NOT APPLY STRONG IMPACTS TO THE UNIT SINCE THIS MIGHT CAUSE BREAKDOWNS.
- WHEN INSERTING OR REMOVING THE CONNECTOR GRIP IT BY THE CONNECTOR BODY. DO NOT PULL ON THE CABLE SINCE THIS MIGHT CAUSE WIRE BREAKAGE OR CONNECTION DEFECTS.
- IF THE CABLE BECOMES WORN OR DAMAGED THEN PROMPTLY STOP USING IT AND ASK FOR REPAIR AT THE DEALER WHERE YOU PURCHASED OR CONTACT OUR SALES OFFICE.
- DO NOT PLACE HEAVY ITEMS ON THE CABLE OR FORCEFULLY BEND OR PULL ON THE CABLE SINCE THIS MIGHT CAUSE FIRES OR BREAKDOWNS.
- NEVER CONNECT TO ANY EQUIPMENT OTHER THAN THE SPECIFIED MODEL SINCE THIS MIGHT DAMAGE THE INTERNAL IC.
- IF YOU NOTICE SMOKE OR A STRANGE ODOR THEN REMOVE THE CABLE, STOP USING THE EQUIPMENT, AND ASK FOR REPAIR AT THE DEALER WHERE YOU PURCHASED OR CONTACT OUR SALES OFFICE.

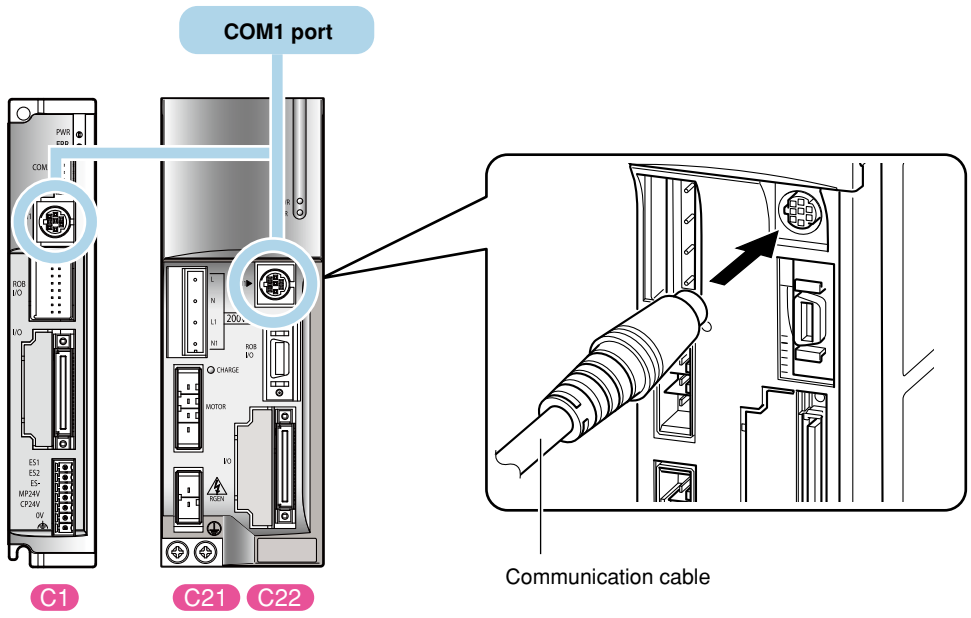
NOTE

For details regarding the connection of personal computer and Handy Terminal, refer to section 5, "Connecting the communication unit" in Chapter 2.

Step 1 *Connect the communication cable.*

Connect the communication cable to the COM1 port on the controller that will be connected with the computer.

Communication cable connection



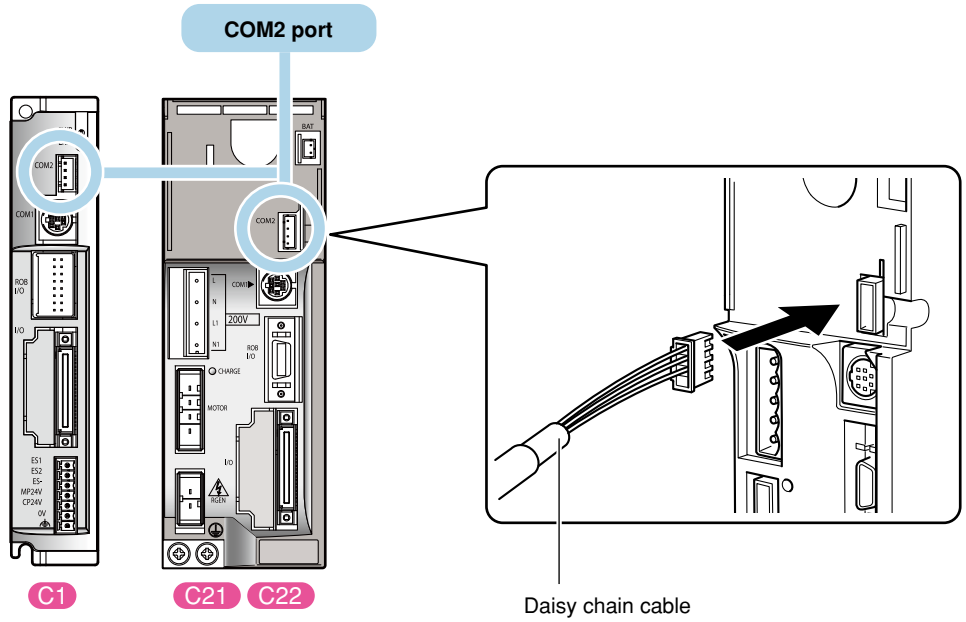
CAUTION

- **Select either the USB or D-Sub connection cable for the communication cable. To perform the communication through the USB port of a communication device, such as a personal computer, use the USB communication cable. If the D-Sub communication cable is connected to the USB port through a commercially available USB conversion cable, the operation cannot be guaranteed.**
- **Do not modify the communication cable. This can cause communication errors and equipment failure.**
- **Always grasp the connector body when connecting/disconnecting the communication cable at the controller. Pulling on the cable can cause equipment failure or breaking of wire.**
- **An incorrectly inserted connector or poor contact condition can cause malfunctions or equipment failure. Be sure that the connector is correctly and securely connected.**
- **When disconnecting the connector from the controller, pull the connector straight out to avoid bending the connector pins.**

Step2 *Connect the daisy chain cable to the controller.*

Insert the white connector of the daisy chain cable into the COM2 port on the controller to which you connected the communication cable.

Connecting a daisy chain cable



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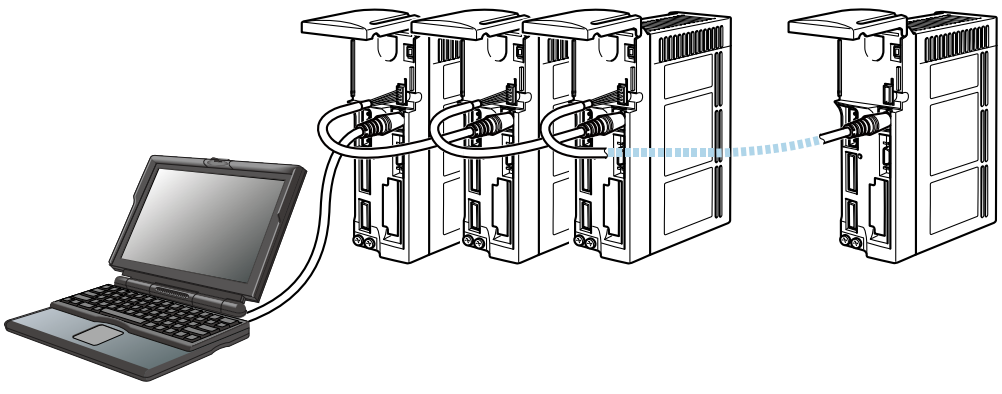
Step3 *Connect the controllers to each other in a daisy chain.*

Insert the other end (black connector) of the daisy chain cable into the COM1 port on another controller.
Two controllers are now daisy-chained. Up to 16 controllers can be daisy-chained in the same way.

Connecting controllers



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2. Node number setting

2.1 Automatic node number assignment function

Daisy-chained controllers can be distinguished from each other by being assigned a different "node number". Node numbers can be set with the "Automatic node number assignment function" of the support software RS-Manager or with the H1. They can also be set using the "Automatic node number setting (SETID)" communication command.
The following sections describe how to perform automatic node number assignment using the RS-Manager or H1.

WARNING

AFTER YOU CONNECT CONTROLLERS IN A DAISY CHAIN, BE SURE TO PERFORM AUTOMATIC NODE NUMBER ASSIGNMENT. ALSO BE SURE TO DO IT WHEN ANOTHER CONTROLLER IS ADDED AFTER AUTOMATIC NODE NUMBER ASSIGNMENT HAS BEEN PERFORMED.
IF MULTIPLE CONTROLLERS WITH THE SAME NODE NUMBER EXIST ON A NETWORK, DATA MAY NOT BE EXCHANGED CORRECTLY. (REFER TO SECTION 2.2, "WHEN CONTROLLERS WITH SAME NODE NUMBER EXIST ON NETWORK", IN THIS DAISY CHAIN GUIDE.)

CAUTION

- **To use the RS-Manager, the RS-Manager software must be installed on your computer.**
- **The daisy chain function is not supported by the RS-Manager software with a version prior to 1.2.0. Always use the software with version 1.2.0 or later. If the RS-Manager with an earlier version is already installed on your computer, first uninstall it and then install new one.**

NOTE

For details on the basic operations of the RS-Manager, refer to the RS-Manager manual and its online help.

2.1.1 When using the RS-Manager

To perform automatic node number assignment using the RS-Manager, follow the steps below.

Step 1 ***Start the RS-Manager.***
From the Windows (Start) button, select "Programs" – "RS-Manager" – "RS-Manager".

TIP

You can also double-click the "RS-Manager" icon on the desktop to start the RS-Manger.

RS-Manager icon

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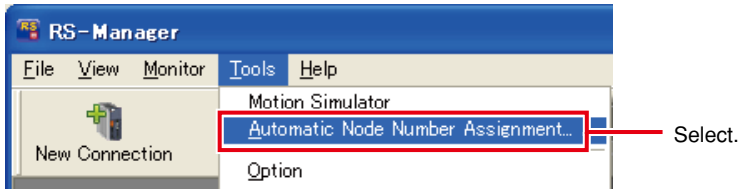
Step 2 ***Select "Automatic Node Number Assignment".***
From the "Tool" menu in the main window, select "Automatic Node Number Assignment".

Selecting "Automatic Node Number Assignment"



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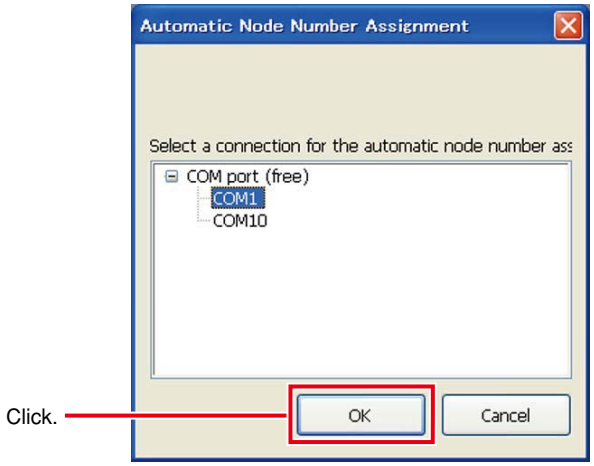
Step3 *Select the COM port.*

Select the COM port to which the communication cable is connected, and click the (OK) button.
A confirmation message appears asking whether to start automatic node number assignment.

"Automatic Node Number Assignment" screen



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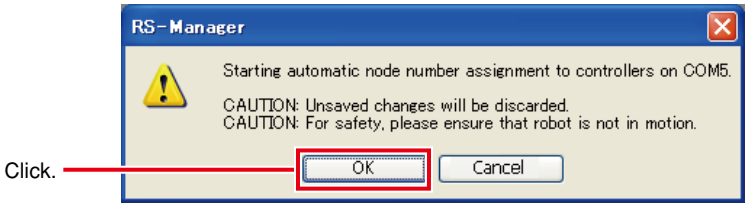
Step4 *Start automatic node number assignment.*

Check the confirmation message and click the (OK) button to start automatic node number assignment.

Confirmation message for starting automatic node number assignment



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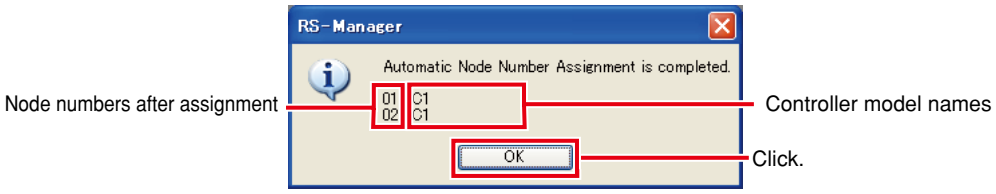
Step5 *Check the assigned node numbers.*

When the message appears stating that the automatic node number assignment is completed, check the assigned node numbers.
The figures on the left side show the node numbers and the letters on the right mean the controller model names set for each node number.
Click the (OK) button after checking the message.

"Automatic node number assignment completed" message



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NOTE

The node numbers will be assigned to the controllers from "1" in order starting from the controller nearest the computer.

2.1.2 When using the H1

To perform automatic node number assignment using the H1, follow the steps below.

Step 1 ***Select "Connection".***

On the H1 menu screen, select "Connection".
The Connection screen appears.

24C29-M0-00

Step 2 ***Select "Auto Node Set".***

On the Connection screen, press FUNC to display the Function menu, check that the cursor is on "Auto Node Set, and press ■ .

24C30-M0-00

Step 3 ***Perform automatic node number assignment.***

When the message "Set OK?" appears, move the cursor to "Yes" and press ■ .

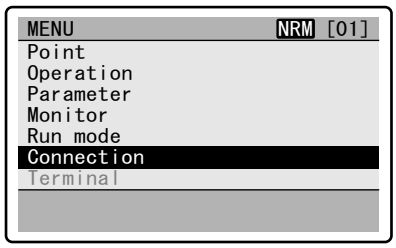
24C32-M0-00

Step 4 ***Check the assigned node numbers.***

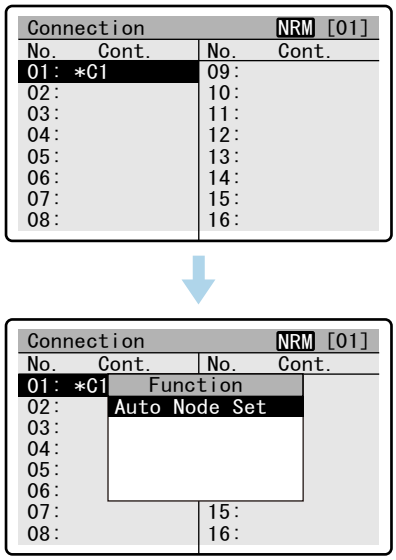
The message "OK" appears when automatic node number assignment is finished normally. Check the assigned node numbers.

24C33-M0-00

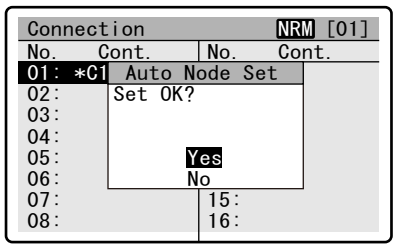
Step 1 Main menu screen



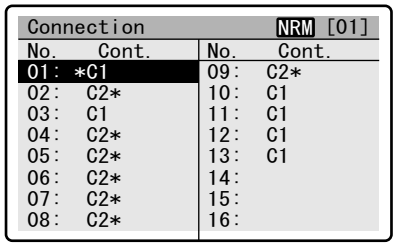
Step 2 Connection screen and Function menu



Step 3 Node number setting



Step 4 Assigned node numbers

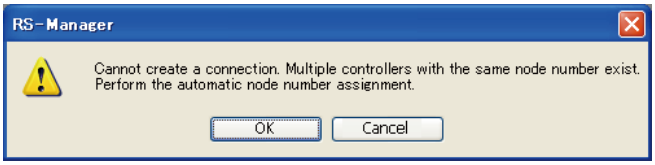


2.2 When controllers with same node number exist on network

2.2.1 When using the RS-Manager

If controllers having the same node number are connected in a daisy chain, a warning message appears when you try to connect a computer with the controllers. (See below.)
In this case, perform automatic node number assignment by following the message.

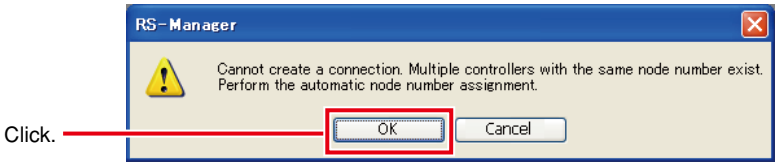
Node number overlap warning message



24C07-M0-00

Step 1 ***Perform automatic node number assignment.***
Click the (OK) button in to perform automatic node number assignment.

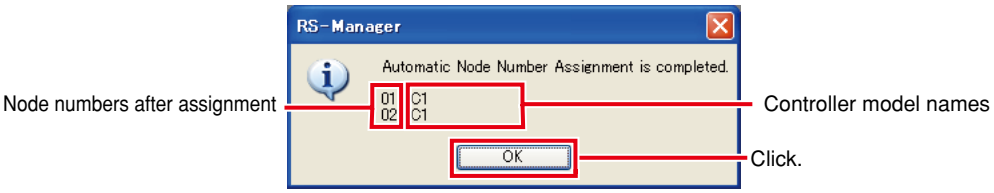
Confirmation message for starting automatic node number assignment



24C34-M0-00

Step 2 ***Check the assigned node numbers.***
When the message appears stating that the automatic node number assignment is completed, check the assigned node numbers.
The figures on the left side show the node numbers and the letters on the right mean the controllers' model names set for each node number.
Click the (OK) button after checking the message.

"Automatic node number assignment completed" message

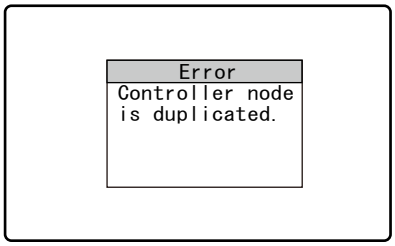


24C08-M0-00

2.2.2 When using the H1

If controllers having the same node number are connected in a daisy chain, an error message appears on the H1 screen stating that there exist controllers with the same node number. In this case, perform automatic node number assignment as described below.

Error message stating controllers with the same node number exist



24C35-M0-00

TIP

Node number overlap is checked when the H1 is connected to a controller, the controller power is turned on, or the displayed page on the H1 is switched. An error massage appears if an overlap is detected.

Step 1 *Check the error message.*

Check the error message and press ■ .

24C36-M0-00

Step 2 *Perform automatic node number assignment.*

When the message "Set OK?" appears, place the cursor on "Yes" and press ■ .

24C37-M0-00

Step 3 *Select the controller.*

When automatic node assignment is finished, the "Connection" screen appears. Move the cursor to the controller you want to connect and press ■ .

24C38-M0-00

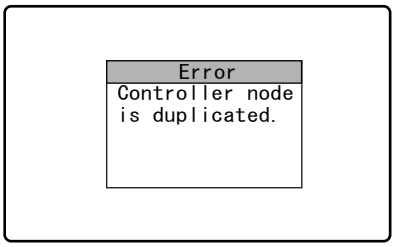
Step 4 *Check that the selected controller is connected.*

When the selected controller is connected, an asterisk (*) appears to the left of the controller name and the node number for the controller is displayed in brackets ( ) on the upper right.

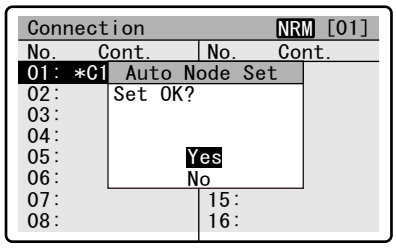
Press CLR *to return to the menu screen.*

24C39-M0-00

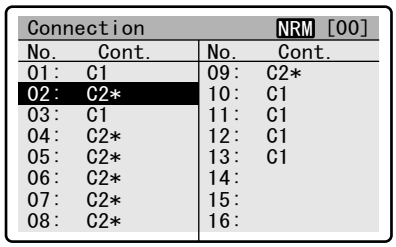
Step 1 Check error message



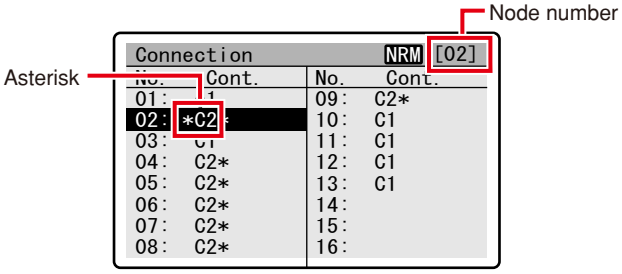
Step 2 Node number setting



Step 3 Assigned node numbers



Step 4 Selected controller and node number



2.3 Switching the controllers

You can check and edit the information of the daisy-chained controllers from the RS-Manager or from the H1.

2.3.1 When using the RS-Manager

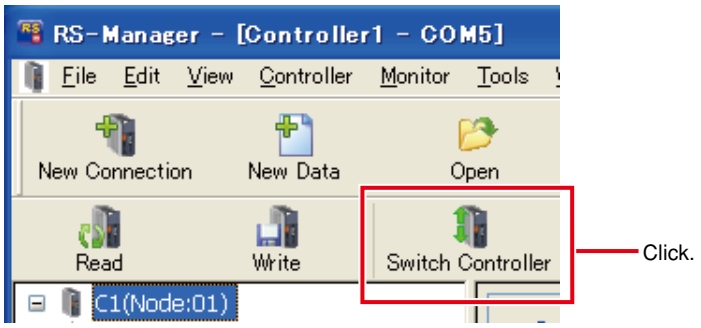
Step 1 ***From the "File" menu, select "New" – "Connection...".***
The "New Connection" dialog box then appears.

TIP
You can also click the (New Connection) button on the toolbar.

Step 2 ***Select the COM port.***
Select the COM port to which the controllers are connected and click the (OK) button.

Step 3 ***Click the "Switch Controller" button on the toolbar.***
The "Switch Controller" window appears.

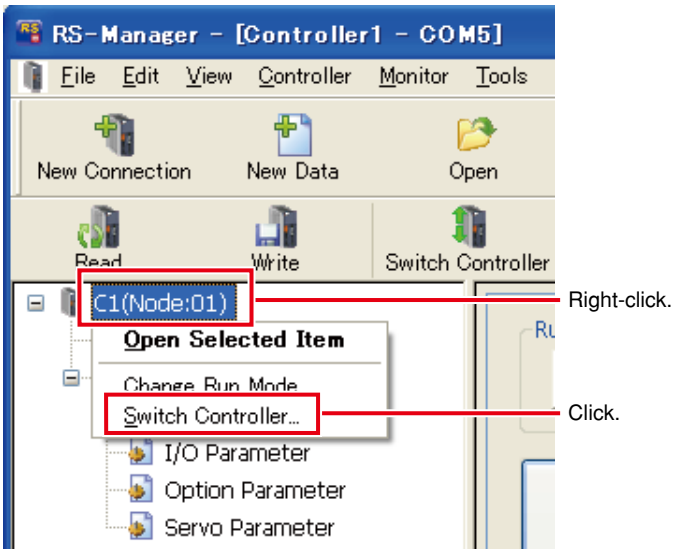
"Switch Controller" button on toolbar



24C10-M0-00

TIP
You can use the right-click menu to display the "Switch Controller" window.
1. Right-click the controller name on the controller tree.
2. Click "Switch Controller" on the displayed menu.
(See below.)

"Switch Controller" menu



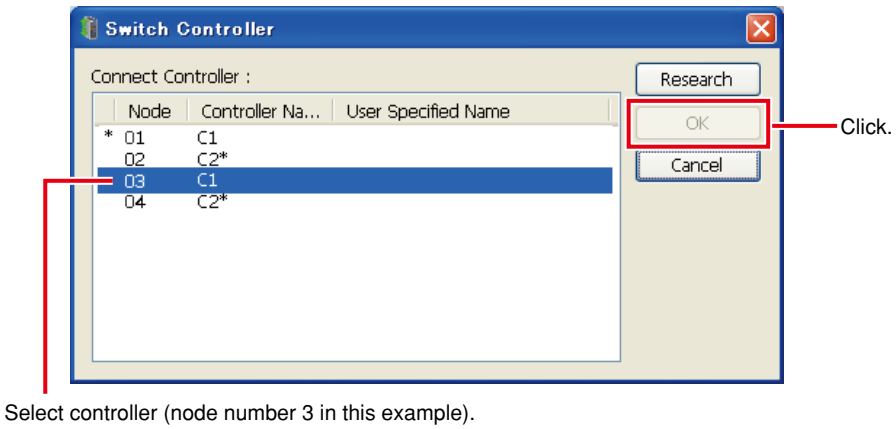
24C43-M0-00

Step 4 ***Select the controller.***
Select the controller you want to connect and then click the (OK) button.
If not all controllers are displayed, click the (Research) button.

NOTE

If controllers having the same node number are found when "Research" is performed, a message screen appears asking whether to execute automatic node number assignment. Clicking the (OK) button on that screen will start automatic node number assignment. If you do not require automatic node number assignment, click the (Cancel) button.

"Switch Controller" window



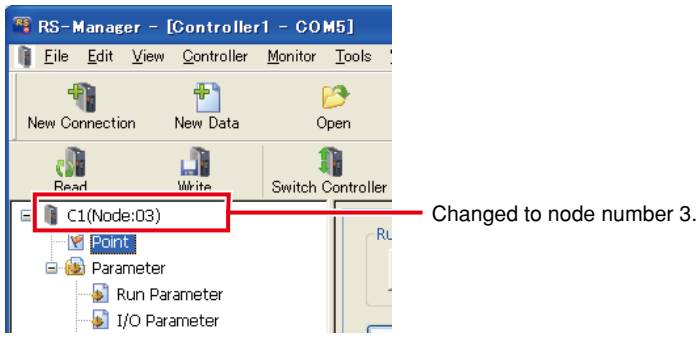
24C11-M0-00

Step 5 ***Check the node number.***

The node number of the selected controller appears next to the controller model name on the controller tree.

Controller tree showing selected controller

Check node number



24C12-M0-00

2.3.2 Switching the controllers using the H1

To switch the controllers using the H1, follow the steps below.

Step 1 ***Select "Connection".***

On the H1 menu screen, select "Connection". A list of daisy-chained controllers is then displayed.

24C40-M0-00

Step 2 ***Select the controller you want to connect.***

Move the cursor to the controller you want to connect and press ■ .

24C41-M0-00

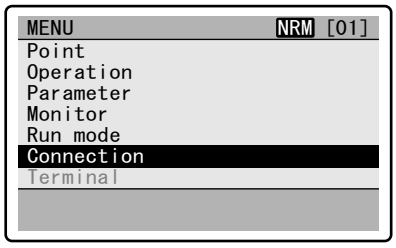
Step 3 ***Check that the selected controller is connected.***

When the selected controller is connected, an asterisk (*) appears to the left of the controller name and the node number for the controller is displayed in brackets ( ) on the upper right.

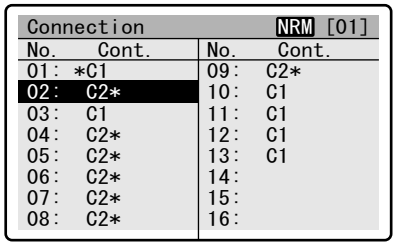
Press CLR *to return to the menu screen.*

24C42-M0-00

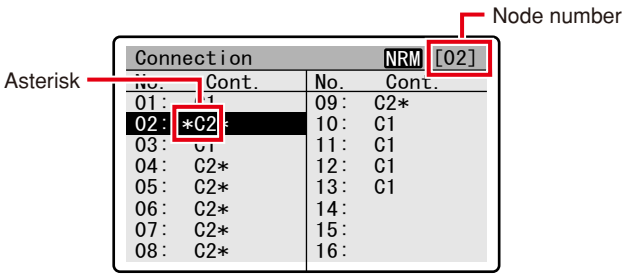
▶ **Step 1** Main menu screen



▶ **Step 2** Controller list



▶ **Step 3** Selected controller and node number



3. Writing and transferring saved and newly made data

This section describes how to write or transfer data from the computer to a daisy-chained controller.

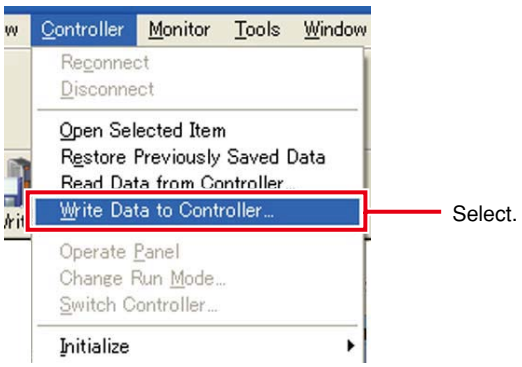
NOTE
- If a computer and a controller have already been connected, transfer and writing of data will be made to the currently connected controller.
- For details on how to write and transfer data to the controller, refer to the support software RS-Manager manual.

3.1 Writing data to controller

Step 1 ***Select "Write Data to Controller...".***
The "Write Data to Controller" dialog box appears.

TIP
You can also click the (Write) button on the toolbar.

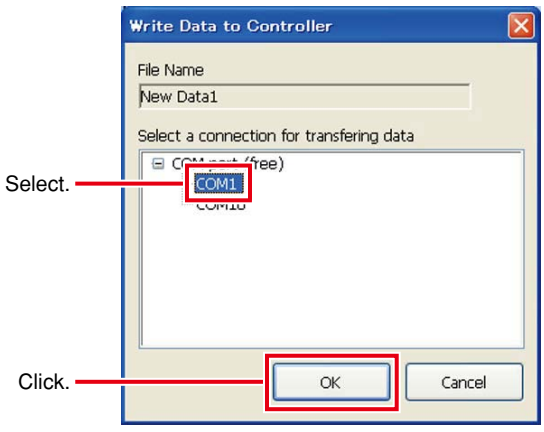
Writing data to controller



24C13-M0-00

Step 2 ***Select the COM port.***
Select the COM port to connect to the controller and click the (OK) button.

"Write Data to Controller" window

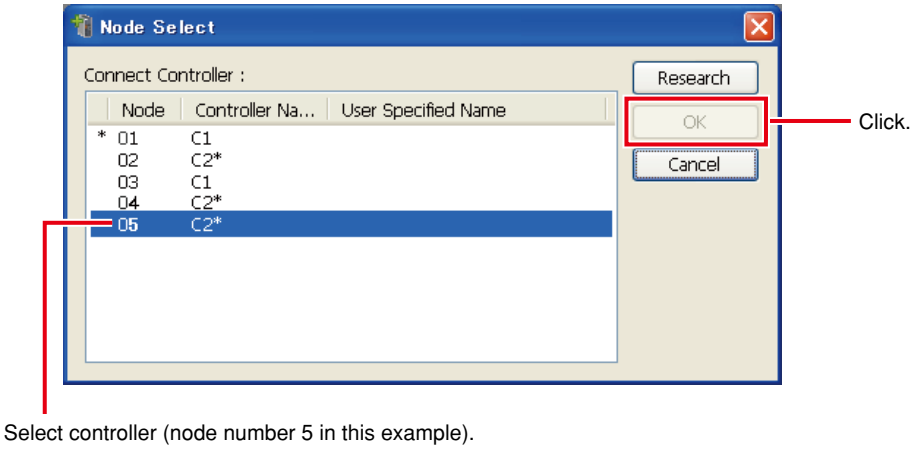


24C14-M0-00

Step3 *Select the controller where you want to transfer data.*

In the "Node Select" window, select the controller where you want to transfer data and click the (OK) button.
If not all controllers are displayed, click the (Research) button.

"Node Select" window



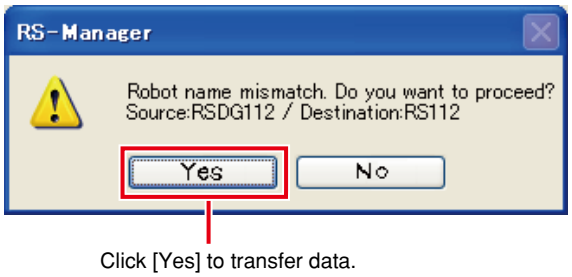
24C15-M0-00

NOTE

If controllers having the same node number are found when "Research" is performed, a message screen appears asking whether to execute automatic node number assignment. Clicking the (OK) button on that screen will start automatic node number assignment. If you do not require automatic node number assignment, click the (Cancel) button.

If the robot name set in the data to be transferred to the controller does not match the robot name currently set in the controller, a confirmation message appears asking whether to continue data transfer. If you want to continue data transfer, click the (Yes) button.

Transfer confirmation message due to robot name mismatch



24C16-M0-00

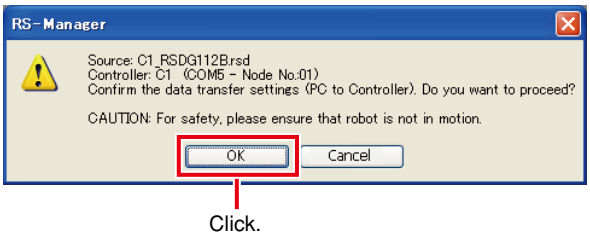
CAUTION

If the above confirmation message appears, check whether the robot name currently used is the same as that to be displayed as the transfer destination. Please note that if they don't have the same name, clicking the (Yes) button may affect the operation.

Step 4 *Write the data.*

When a confirmation message appears asking whether to write the data to the selected controller, check the data name and the target controller, and click the (OK) button to start writing the data. If you want to cancel writing the data, click the (Cancel) button.

Confirmation message

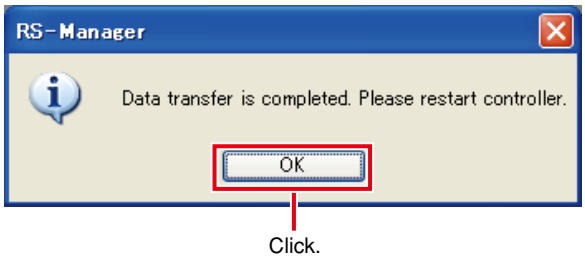


24C17-M0-00

Step 5 *Check that the data has been written.*

When the message appears stating the data writing has been completed, click the (OK) button. The data will be usable after turning the control power off and then back it on again. (Restarting the control power may not be necessary depending on the parameters to be written.)

"Writing completed" message

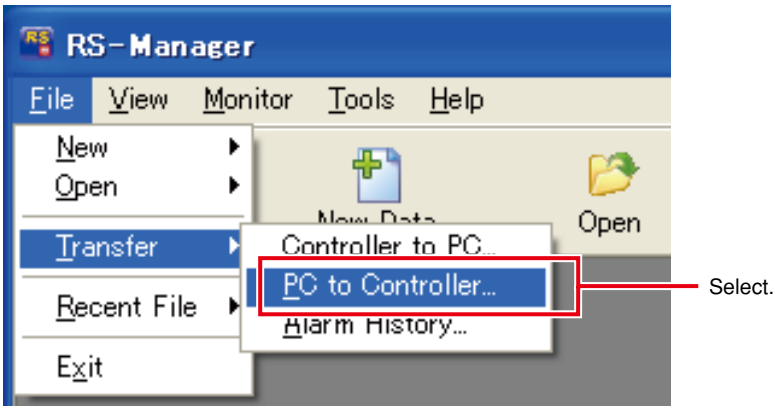


24C18-M0-00

3.2 Transferring data to controller

Step 1 *Select the "PC to Controller..." command.*

Transferring data to controller

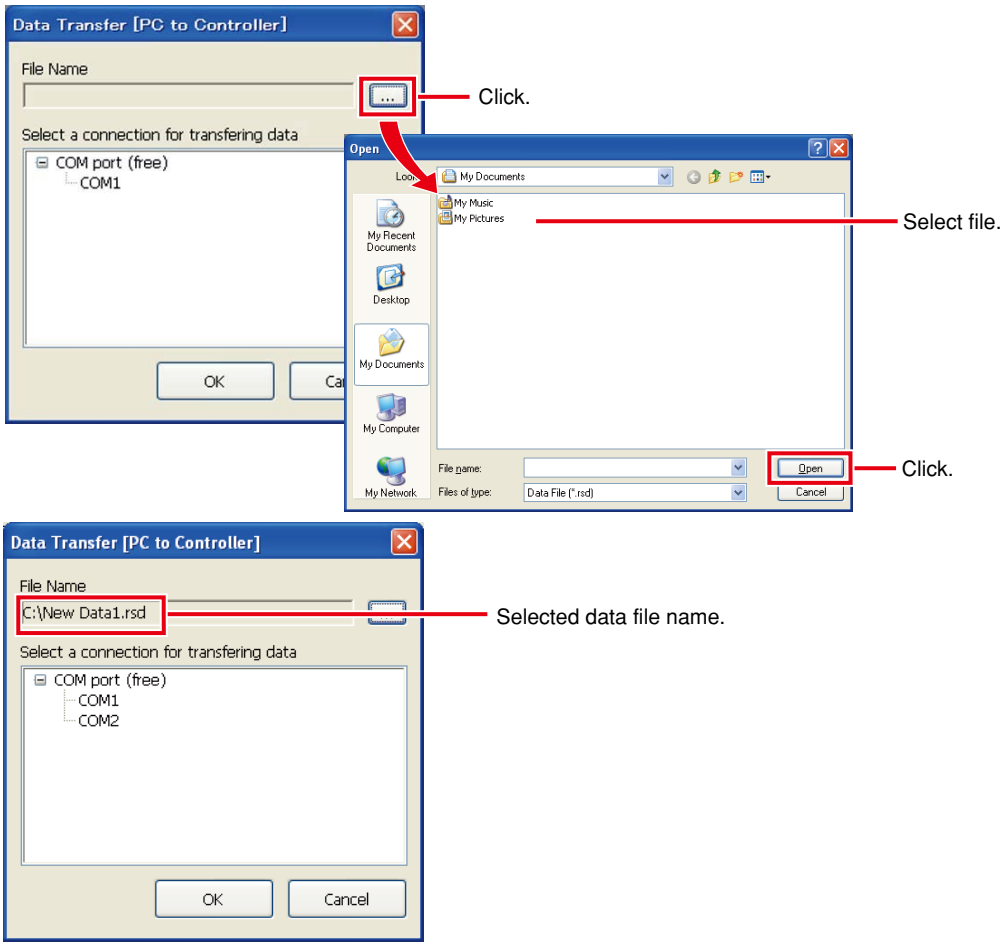


24C19-M0-00

Step 2 *Select the file you want to transfer.*

When the "Data Transfer (PC to Controller)" window appears, click the (...) button next to the "File Name" box.
The "Open" dialog box then appears. Select the file to transfer and click the (Open) button. The selected data file name is then displayed in the "File Name" box.

"Data Transfer [PC to Controller]" window

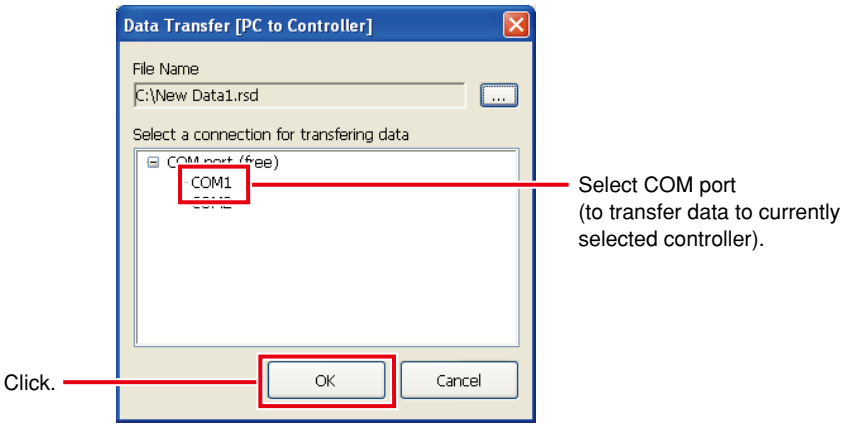


24C20-M0-00

Step3 *Select the COM port to connect to the controller.*

To transfer data to a currently connected controller, select the "COM port (in use)" (See below.).
When you want to transfer data to a controller other than the currently connected one, either disconnect the connection or change the node number by performing "Switch Controller" first, and then execute data transfer again.
Select the "COM port (in use)", and click the (OK) button.

"Data Transfer [PC to Controller]" window

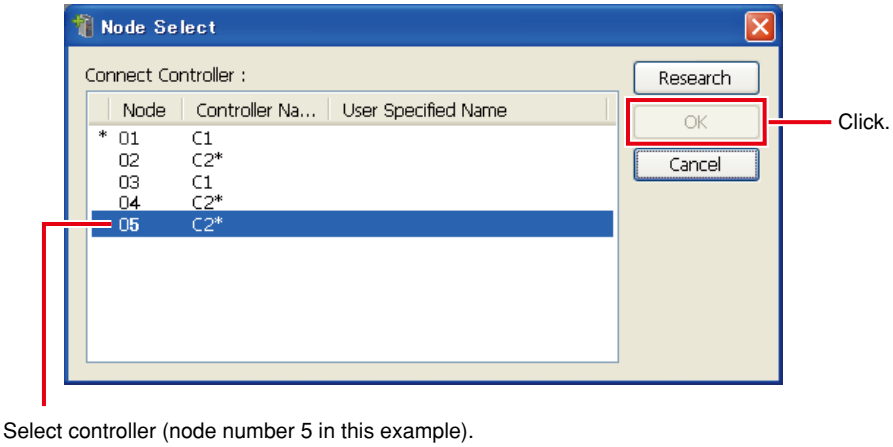


24C22-M0-00

Step4 *Select the node number.*

If the "Node Select" window appears, select the controller where you want to transfer the data and click the (OK) button.
If not all controllers are displayed, click the (Research) button.

"Node Select" window



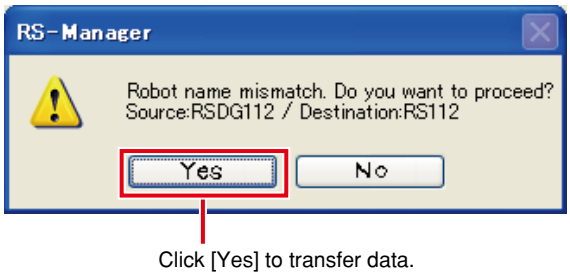
24C23-M0-00

NOTE

If controllers having the same node number are found when "Research" is performed, a message screen appears asking whether to execute automatic node number assignment. Clicking the (OK) button on that screen will start automatic node number assignment. If you do not require automatic node number assignment, click the (Cancel) button.

If the robot name set in the data to be transferred to the controller does not match the robot name currently set in the controller, a confirmation message appears asking whether to continue data transfer. If you want to continue data transfer, click the (Yes) button.

Transfer confirmation message due to robot name mismatch



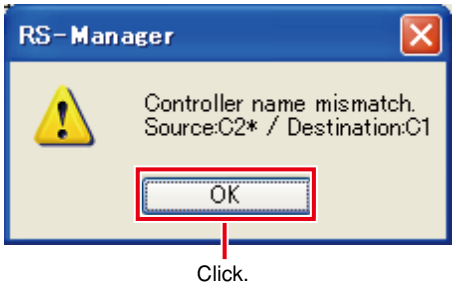
24C24-M0-00

CAUTION

Please note that clicking the (Yes) button in the transfer confirmation message may affect the operation.

If the controller information in the data to be transferred does not match the controller name currently at the transfer destination, an error message appears and the data transfer will be canceled. Check the setting and then transfer the data again.

"Data transfer cancelled" message due to controller name mismatch

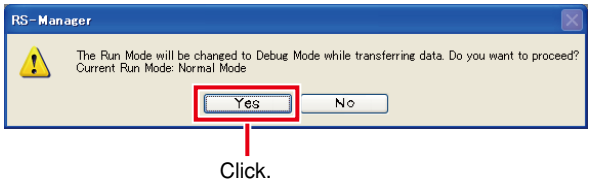


24C25-M0-00

Step 5 *Perform data transfer.*

When a confirmation message appears asking whether to change the Run Mode to the Debug Mode. Click the (Yes) button to perform data transfer.

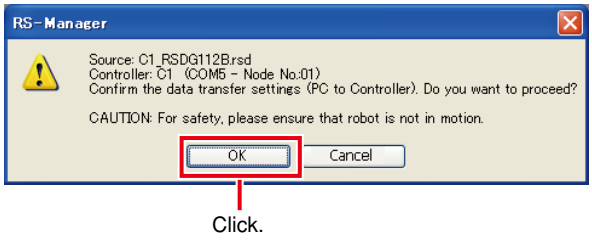
Mode change (Normal Mode to Debug Mode) confirmation dialog box



24C26-M0-00

Another message appears asking whether to start data transfer. Check the data name and target controller, and click the (OK) button to start data transfer.
To cancel data transfer, click the (Cancel) button.

"Data transfer confirmation" message

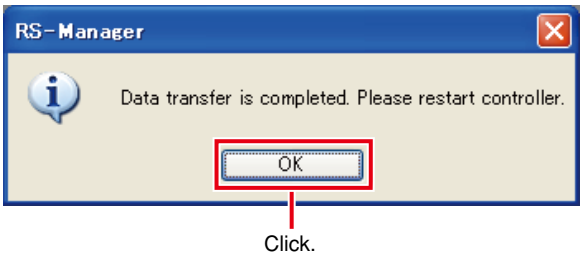


24C27-M0-00

Step 6 *Check that the data has been transferred.*

When the message appears stating the data transfer has been completed, click the (OK) button.
The data will be usable after turning the control power off and back it on again. (Restarting the control power may not be necessary depending on the parameters to be written.)

"Data transfer completed" message



24C28-M0-00

Revision record

Manual version	Issue date	Description
Ver. 1.00	Mar. 2014	First edition
Ver. 2.00	Jan. 2018	Added "Safety Instructions" section, Added "Warranty" contents, Deleted I/O cable in "Unpacking check", Added and corrected the contents of "Chapter 2 Installation and Wiring", Added and corrected the contents of "Chapter 3 Data setting", Added and corrected the contents of "Chapter 5 Operation", Corrected the contents of "Controller Basic Specifications", Corrected the contents of "What the H1 does", etc.
Ver. 2.01	Dec. 2020	Corrected the contents of "Safety Standards" to EMC Directive 2014/30/EU

User's Manual

Single-axis Robot Controller

C1/C21/C22

Dec. 2020
Ver. 2.01
This manual is based on Ver. 2.01 of Japanese manual.

MISUMI Corporation

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