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SM-396072-A

CKD

INSTRUCTION MANUAL

ELECTRIC SLIDER

KBB Series

CONTROLLER

KCA-20-M10/M40

KCA-20-S10/S40

Operating Manual

(Basic Section)

SLIDER

INSTRUCTION MANUAL

- Read this manual carefully and thoroughly before using this product.
- Pay extra attention to the instructions concerning safety.
- After reading this manual, keep it in a safe and convenient place.

CKD Corporation

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Introduction

Thank you for selecting the Electric Slider KBB series.
To ensure correct usage, read this instruction manual before starting use of the Electric Slider KBB series.

For information on the actuators in Electric Slider KBB series, refer to the Actuator Operating Manual supplied with the actuator.

PRECAUTION

1. The contents of this manual are subject to change without prior notice.
2. An effort has been made to ensure the contents of this manual. If you have any questions, or find any mistakes, please contact CKD.
3. Regardless of item 2 above, CKD will not be held responsible for any effect caused by using this Electric Slider KBB.

Discontinue

Contents

Chapter 1 General Safety Instruction

1.1 Important messages **1-1**

1.2 Safe Operation **1-5**
1.2.1 Auxiliary safety precautions before Electric Actuator installation 1-5
1.2.2 Precautions for installing the Electric Actuator 1-6
1.2.3 Precautions for operation of the Electric Actuator 1-6

1.3 Warranty **1-8**
1.3.1 Warranty period 1-8
1.3.2 Warranty details 1-8
1.3.3 Exemption of liability 1-8
1.3.4 Notes 1-8

Chapter 2 Devices

2.1 Features **2-1**

2.2 System components and specifications **2-3**
2.2.1 System components 2-3
2.2.2 Controller specifications 2-4
(1) Master unit specifications 2-5
(2) Slave unit specifications 2-6
(3) Various units and options 2-7

2.3 Explanation of each part **2-8**
2.3.1 External dimensions and explanation of each part 2-8
2.3.2 Function of each part 2-9
2.3.3 Explanation of expansion input/output unit 2-11
2.3.4 Explanation of Teach Pendant 2-12

2.4 Procedures from installation to operation **2-15**
2.4.1 Installing the controller 2-16
2.4.2 Supply power and grounding 2-17
2.4.3 Improvement of noise resistance 2-19
2.4.4 Connecting the axis and controller 2-20
2.4.5 Connecting the emergency stop circuit 2-23
2.4.6 Effect of leakage current 2-24
2.4.7 Setting the Robot Type 2-25
2.4.8 Setting the software limit and Return to Origin 2-27
2.4.9 Servo gain adjustment 2-29
2.4.10 Absolute encoder backup 2-30

2.5 Moving the Electric Actuator **2-33**

Discontinue

Chapter 3 General Programming

3.1 Explanation of operation modes **3-1**
3.1.1 Explanation of RUN mode 3-3
3.1.2 Explanation of PRGM mode 3-4
3.1.3 Return to Origin 3-5

3.2 General programming **3-6**
3.2.1 Basic programming 3-10
3.2.2 Position data input 3-12
(1) Remote teaching 3-13
(2) Direct teaching 3-15
(3) MDI (Manual Data Input) 3-17
3.2.3 Memory Clear (Initialization) 3-19
3.2.4 MOV system command words and parameters 3-22

Chapter 4 Sequential Mode

4.1 Sequential PRGM mode **4-1**
4.1.1 How to enter and leave PRGM (program) mode 4-1
4.1.2 Editing of steps in sequential program 4-2
4.1.3 Copy editing of sequential programs 4-4
4.1.4 Clearing of sequential programs 4-5
4.1.5 HELP function in entering a command 4-7
4.1.6 Method to restart operation of sequential mode after turning power OFF 4-8
4.1.7 Palletizing work with MVM commands 4-10

4.2 Sequential RUN mode **4-16**
4.2.1 AUTO mode of sequential mode 4-16
(1) Continuous operation 4-16
(2) Single operation 4-17
4.2.2 STEP mode of sequential mode 4-18
4.2.3 Changing of speed during operation (override) 4-19

Chapter 5 Multi-task

5.1 Multitasking **5-1**

5.2 Merits of multitasking **5-1**

5.3 Multitasking usage methods **5-2**
5.3.1 Multitasking specifications 5-2
5.3.2 Multitasking functions and settings 5-2
5.3.3 Starting and stopping tasks 5-3
5.3.4 Multitasking operation 5-4
5.3.5 Applying timing between tasks 5-5

5.4 Details on multitasking **5-6**

Discontinue

5.4.1 Task status 5-6
5.4.2 Transition of states 5-6
5.4.3 Transfer of data between tasks 5-7
5.4.4 Task priority 5-7

Chapter 6 Easy Mode

6.1 PRGM mode of easy mode 6-2
6.1.1 How to enter and leave the easy mode 6-2
6.1.2 Editing easy mode program 6-3
6.1.3 Copy editing of easy mode 6-15
6.1.4 Clearing of easy mode programs 6-16

6.2 RUN mode of easy mode 6-17
6.2.1 AUTO mode of easy mode 6-17
(1) Continuous operation 6-17
(2) Single operation 6-18
6.2.2 STEP mode of easy mode 6-19
6.2.3 Changing of speed during operation (override) 6-20

Chapter 7 Palletizing mode

7.1 Basic flow chart of palletizing mode 7-3

7.2 PRGM mode in palletizing mode 7-4
7.2.1 How to enter and leave the PRGM mode 7-7
7.2.2 Editing palletizing mode program 7-8
7.2.3 Copy editing of palletizing mode 7-11
7.2.4 Clearing of palletizing mode programs 7-12
7.2.5 How to restart operation after turning power OFF in palletizing mode 7-13

7.3 RUN mode of palletizing mode 7-14
7.3.1 AUTO mode of palletizing mode 7-14
(1) Continuous operation 7-14
(2) Single operation 7-17
7.3.2 STEP mode of palletizing mode 7-17
7.3.3 Changing of speed during operation (override) 7-19

Chapter 8 External Point Designation Mode

8.1 Explanation of external point designation mode 8-1

8.2 Operation method of external point designation mode 8-5
8.2.1 Execution with input/output 8-5
8.2.2 Operation with Teach Pendant 8-6

8.3 Changing of speed during operation (Override) 8-6

Chapter 9 Pulse train input mode

Discontinue

9.1 System **9-1**
9.1.1 System configuration method 9-1
9.1.2 Specifications of pulse train input mode 9-2

9.2 Input/output signals **9-3**
9.2.1 Input/output connector signal names and pin numbers 9-3
9.2.2 Functions of each input/output signal 9-4
9.2.3 Example of input/output signal connection 9-8

9.3 Operation methods **9-10**
9.3.1 Designation of pulse train input mode 9-10
9.3.2 Matters to be set for pulse train input mode 9-10
9.3.3 Protective functions 9-11

9.4 Precautions for operation **9-12**

9.5 Operation procedures **9-12**

Chapter 10 Connection with External Devices

10.1 Input/output signal **10-1**
10.1.1 Master unit input/output connector signal names and pin numbers 10-1
10.1.2 Slave unit input/output connector signal names and pin numbers 10-2
10.1.3 Expansion input/output signal names and pin Nos. 10-8
10.1.4 Names of general-purpose input/output ports and Teach Pendant displays 10-9
10.1.5 Example of input/output signal connection 10-10

10.2 Details of system input/output function **10-13**
10.2.1 Return to origin input 10-13
10.2.2 Start input 10-13
10.2.3 Stop input 10-14
10.2.4 Reset input 10-14
10.2.5 Robot single operation input 10-14
10.2.6 Continuous start input 10-15
10.2.7 Escape input 10-15
10.2.8 Pause (temporary stop) input 10-15
10.2.9 Program No. selection input 10-16
10.2.10 Palletizing input 10-17
10.2.11 Running output 10-17
10.2.12 Error output 10-17
10.2.13 Positioning complete output 10-17

10.2.14 Return to origin complete output 10-17
10.2.15 Input wait output 10-18
10.2.16 Pausing (temporarily stopped) output 10-18
10.2.17 READY output 10-18

Discontinue

10.2.18 Individual task positioning complete output 10-18
10.2.19 Individual task return to origin complete output 10-18
10.2.20 Battery alarm output 10-18

10.3 RS-232C communication specifications 10-18

Chapter 11 CC-Link

11.1 CC-Link Function 11-1
11.1.1 Overview 11-1
11.1.2 CC-Link specifications 11-2
11.1.3 How to attach the CC-Link module 11-2
11.1.4 Explanation of CC-Link component and external dimensions 11-3
11.1.5 Connection of exclusive CC-Link cable 11-4
11.1.6 CC-Link settings 11-4

11.2 Connection with External Devices 11-5
11.2.1 List of master unit I/O signals 11-5
11.2.2 System I/O 11-6
11.2.3 Name of general-purpose I/O port and teach pendant display 11-7
11.2.4 Jog input/output 11-8

11.3 Data Communication 11-10
11.3.1 Overview of data communication 11-10
11.3.2 Command mode 11-11
11.3.2.1 Transmitting and receiving data 11-11
11.3.2.2 Command table 11-13
11.3.2.3 Descriptions on each command 11-14
11.3.3 Monitor mode 11-21
11.3.3.1 Data receiving method 11-21
11.3.3.2 List of monitor types 11-22
11.3.3.3 Explanation of monitors 11-22

11.4 Speed control mode through CC-Link 11-27
11.4.1 Overview 11-27
11.4.2 Speed control specifications 11-27
11.4.3 Items prohibited 11-27
11.4.4 Settings of speed control mode 11-28
11.4.5 List of I/O signals 11-28
11.4.6 List of I/O data 11-29
11.4.7 Details of I/O signals 11-30

11.5 Selection table extension in external point designation mode 11-34
11.5.1 Overview 11-34

11.5.2 How to set selection table extension 11-34
11.5.3 Assignment of input signals and tables 11-35

11.6 Maximum torque limit function 11-38
11.6.1 Overview 11-38

Discontinue

11.6.2 Specifications for the maximum torque limit function 11-38
11.6.3 Setting of the maximum torque limit function 11-38
11.6.4 Setting of a maximum torque limit value 11-39
11.6.5 Special I/O signals 11-39

11.7 CC-Link status 10-41

Chapter 12 DeviceNet

12.1 DeviceNet Function 12-1
12.1.1 Overview 12-1
12.1.2 DeviceNet specifications 12-1
12.1.3 How to attach the DeviceNet module 12-2
12.1.4 Explanation of DeviceNet component and external dimensions 12-2
12.1.5 Connection of exclusive DeviceNet cable 12-4
12.1.6 DeviceNet settings 12-4

12.2 Connection with External Devices 12-5
12.2.1 List of master unit I/O signals 12-5
12.2.2 System I/O 12-6
12.2.3 Name of general-purpose I/O port and teach pendant display 12-7
12.2.4 Jog input/output 12-8

Chapter 13 Parameter Setting

13.1 How to enter and leave the PARA mode 13-1

13.2 Method of mode setting 13-2
13.2.1 Designation of single operation mode input bit 13-3
13.2.2 Designation of continuous start input bit 13-3
13.2.3 Designation of escape input bit 13-3
13.2.4 Designation of pause input bit 13-4
13.2.5 Designation of program selection input bit 13-4
13.2.6 Designation of return to origin input bit 13-5
13.2.7 Designation of pausing output bit 13-5
13.2.8 Designation of input wait output bit 13-5
13.2.9 Setting of Teach Pendant display (Japanese/English) mode 13-5
13.2.10 OFF (Invalid), easy, point, pulse 1, pulse 2 13-6
13.2.11 Setting of general-purpose output clear mode during emergency stop and reset 13-6
13.2.12 Setting of state when continuous start is valid (Input ON) 13-7
13.2.13 Setting of state when continuous start is valid (Input OFF) 13-7
13.2.14 Setting of direct output bit 13-7

13.2.15 Designation of READY output bit 13-8
13.2.16 Designation of palletizing input bit 13-8
13.2.17 Expansion input/output during external point designation mode Valid/Invalid 13-8
13.2.18 Setting of task positioning output 13-8
13.2.19 Setting of task return to origin output 13-9

Discontinue

13.2.20 Setting of CC-Link 13-9
13.2.21 Setting of DeviceNet 13-10
13.2.22 Designation of battery alarm output bit 13-10
13.2.23 Moving coordinate table number output in external point designation mode 13-10

13.3 Parameter 1 setting 13-11
13.3.1 Setting of software limit value (upper limit) 13-12
13.3.2 Setting of software limit value (lower limit) 13-12
13.3.3 Setting of servo gain (position/speed) 13-12
13.3.4 Setting of pass area 13-13
13.3.5 Setting of origin offset value 13-13
13.3.6 Setting of sequence of return to origin 13-14
13.3.7 Setting of JOG speed 13-15
13.3.8 Setting of JOG inching movement 13-15

13.4 Parameter 2 setting 13-16
13.4.1 Setting of axis display 13-18
13.4.2 Setting of in-position data value 13-18
13.4.3 Setting of overflow data value 13-18
13.4.4 Setting of feed forward data value 13-19
13.4.5 Setting of direction of motor revolution 13-19
13.4.6 Setting of maximum speed 13-19
13.4.7 Setting of return to origin speed 13-20
13.4.8 Setting of return to origin method 13-22
13.4.9 Setting of origin sensor logic 13-23
13.4.10 Setting of high speed return to origin position 13-23
13.4.11 Setting of lead 13-23
13.4.12 Setting of encoder No. of divisions 13-24
13.4.13 Setting of encoder pulse multiplier 13-24
13.4.14 Setting of encoder type 13-24
13.4.15 Setting of task and axis combination 13-25
13.4.16 Setting of task order of priority 13-25
13.4.17 Setting of task point table 13-26
13.4.18 Setting of No. of task steps 13-26
13.4.19 KBA I/O compatibility mode 13-26

13.5 How to set the tables 13-27
13.5.1 Setting of coordinate (point) table 13-28
13.5.2 Setting of speed table 13-28
13.5.3 Setting of acceleration/deceleration table 13-29
13.5.4 Setting of MVM table 13-30

Chapter 14 Monitoring

14.1 Program step No. monitoring 14-2

14.2 Input/output monitoring 14-3

Discontinue

14.3 Counter and timer monitoring 14-5

14.4 Coordinate monitoring 14-6

14.5 Origin sensor/encoder Z-phase pulse monitoring 14-8

Chapter 15 Search Function

15.1 Search of sequential step No. 15-1

15.2 Search of tag No. 15-1

15.3 Search of easy step No. 15-2

15.4 Search of easy program No. 15-2

15.5 Search of palletizing program No. 15-3

15.6 Search of palletizing program screen No. 15-3

Chapter 16 Manual Operation of General-purpose Outputs

16.1 Manual output using function keys 16-1

16.2 Manual output of random bit designation from PRGM mode 16-2

Chapter 17 Other Handy Operations

17.1 Teach Pendant ON/OFF 17-1

17.2 Reset operation 17-2

17.3 Counter direct set 17-3

17.4 Version display 17-4

17.5 JOG operation (Manual operation of axis) 17-5

17.6 Clearing (initializing) coordinate table 17-7

Discontinue

17.7 KBA I/O Compatibility Mode **17-8**
17.7.1 Selection method of KBA I/O compatibility mode 17-8
17.7.2 Operation specifications for return to origin complete output and positioning complete output 17-9

Chapter 18 Commands

ACC (Setting acceleration/deceleration) 18-4
BRAC (Counter jump) 18-5
CAL (Unconditional call) 18-6
CALC (Counter conditional call) 18-7
CALI (Input conditional call) 18-8
CALT (Timer conditional call) 18-10
CNT (Preset counter value) 18-11
CNT+ (Count up) 18-12
CNT– (Count down) 18-13
CNTC (Clear all counters) 18-14
END (End) 18-15
HOME (Return to origin) 18-16
IN (Waiting for input) 18-17
INPC (Setting general-purpose port input to counter) 18-18
JMP (Unconditional jump) 18-19
JMPC (Counter conditional jump) 18-20
JMPI (Input conditional jump) 18-21
JMPT (Timer conditional jump) 18-23
LOOP (Loop for MVM) 18-24
MINI (Initial counter value for MVM) 18-25
MOVP (Axis Movement to the Indirectly Designated Point by Coordinate Table) 18-26
MVB (Move (return) to point immediately before the current position) 18-28
MVE (Escape move) 18-29
MVM (Palletizing movement) 18-31
NOP (No function) 18-33
OFS (Offset) 18-34
OUT (General-purpose port output) 18-35
OUTC (General-purpose port output of counter value) 18-37
OUTP (General-purpose port pulse output) 18-38
PSEL (Program selection) 18-39
RET (Return) 18-40
SPD (Setting speed) 18-41
STOP (Stop) 18-42
SVOF (Servo-off) 18-43
SVON (Servo-on) 18-44
TAG (Tag) 18-45
TCAN (Task forced end) 18-46
TIM (Waiting) 18-47
TIMP (Timer preset) 18-48
TRSA (Task restart) 18-49
TSTO (Task temporary stop) 18-50
TSTR (Task start) 18-51

Discontinue

Chapter 19 Error messages

19.1 Error Display **19-1**

19.2 Error Table **19-2**

19.3 Flashing of status display LED **19-8**

Chapter 20 KBZ series

20.1 Specification **20-1**

20.2 Explanation of each part **20-2**

20.3 Connections **20-6**

20.4 Selecting the power supply **20-7**

20.5 Installing **20-8**

20.6 Supply power and grounding **20-9**

20.7 Improvement of noise resistance **20-10**

20.8 Connecting controllers **20-10**

20.9 Resolver ABS backup **20-11**

20.10 Regenerative Resistors **20-14**
20.10.1 Specifications 20-14
20.10.2 External dimensions 20-16
20.10.3 Installation 20-16
20.10.4 Connection example 20-17

Chapter 21 Maintenance and Inspection

21.1 Procedures before and after inspection and maintenance **21-1**

21.2 Inspection before operation **21-2**

21.3 Periodic inspection **21-2**
21.3.1 Inspection of timing belt 21-3

21.4 Lubrication **21-4**

21.5 Cleaning **21-5**

Discontinue

21.6 Spare parts **21-5**
21.6.1 Controller spare parts 21-5
21.6.2 Axis spare parts 21-5

Discontinue

Chapter 1 General Safety Instruction

■ 1.1 Important messages

- READ THIS MANUAL carefully for important information about safety, handling, installation, operation, maintenance, and parts replacements.

- This manual and all accompanying drawings should be considered a permanent part of the equipment.
  They should be readily available for review and reference at all times.

IMPORTANT MESSAGES

Read this manual and follow its instructions. Signal words such as DANGER, WARNING and CAUTION will be followed by important safety information that must be carefully reviewed.

DANGER : Indicates a situation which will result in death, serious injury, or severe property damage if you do not follow instructions.

CAUTION : Means that you might be injured if you do not follow instructions. Equipment damage might also occur.

NOTE : Gives you helpful information.

? : Means that the description of glossaries is written and the corresponding page is indicated.

Discontinue

QUALIFIED PERSONS ONLY

Only qualified persons are to install, operate or service this equipment according to all applicable codes and established safety practices.

A qualified person must:

1) Carefully read the entire instruction manual.
2) Be skilled in the installation, construction or operation of the equipment and aware of the hazards involved.
3) Be trained and authorized to safely energize, de-energize, clear, ground, lockout and tag circuits in accordance with established safety practice.
4) Be trained and authorized to perform the service, maintenance or repair of this equipment.
5) Be trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses, face shield, flash clothing, etc. in accordance with established practices.
6) Be trained in rendering first aid.

Discontinue

DANGER HAZARDOUS VOLTAGE will cause severe injury, death, fire, explosion and property damage.

- Disconnect and lock out primary and control circuit power before servicing.
- This equipment contains capacitors which stay charged after power has been shut off. Wait for a minimum of 3 minutes before servicing.

DANGER MOVING PARTS will cause severe injury, death or property damage.

- An effective safety barrier with appropriate interlocks and emergency stop provisions must be placed around the robot to protect all personnel from the intended and unintended movement of the robot and the potential of throwing of work pieces and materials by the robot. No personnel should be allowed within this area during operation of the robot.
- Never defeat, modify or bypass any of the safety interlocks.
- Never modify the robot arm or controller without written permission of the manufactures.
- Only properly trained and qualified persons are to install, program, operate or service this equipment according to all applicable codes and established safety practices.

DANGER

- Do not get water on the inside or outside or the robot and do not wipe it off with water. Doing so could lead to electric shocks or faults. (If the robot is dirty, wipe it off with a strongly wrung out cloth.) (Do not use organic solvents such as paint thinner or benzene.)
- Do not insert or drop in foreign matter such as metals into the robot from the ventilation holes. Doing so could lead to fires or electric shocks.

Discontinue

⚠CAUTION AMBIENT POTENTIAL OR EQUIPMENT DAMAGE

- Do not install in area where the ambient temperature exceeds 40°C or where equipment is subjected to extreme temperature changes that could condensation or where the equipment is subjected to direct sunlight.
  Keep the ambient temperature of controller at 0 to 40°C.
- Do not use in the place exposed heavy shock and vibrations.
- Do not install in environments where conductive dust, corrosive gases, or oil mist are present. Equipment damage will occur.
- Install in a place where are the air convection or provide cooling device.
- High temperature may cause failure or deterioration.
- An ambient temperature increase when it is installed a narrow space since controller itself generates a heat or receive from other devices.

⚠CAUTION HEAVY

- Attempting to manually lift the robot can cause serious injury or equipment damage.
  Always use suitable lifting equipment.

⚠CAUTION DISPOSAL

- Contact your state environmental agency for details on disposal of electrical components and packaging in your particular area.

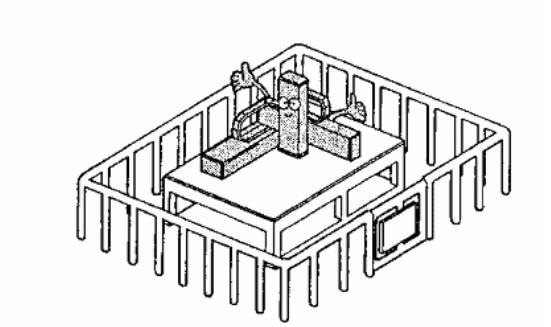
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■ 1.2 Safe Operation

Take measures to satisfy the following items when using the Electric Actuator KBB series.

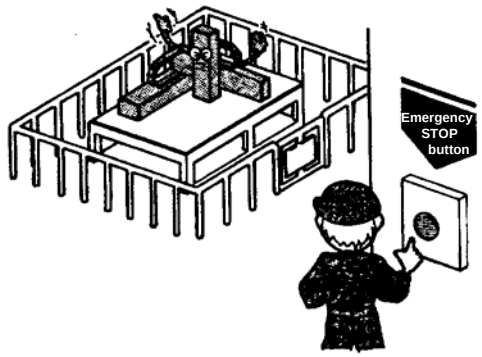
■ 1.2.1 Auxiliary safety precautions before Electric Actuator installation

(1) Install a safety fence to prevent people from entering the area of Electric Actuator operation.



1. The fence should be strong enough to withstand any force it might be expected to encounter during normal Electric Actuator or other operations. It should not be easy to breach, climb over or move.
2. It should be constructed of safe material with no sharp edges.
3. The foundation should be rigid and immobile.
4. Any door on the fence must be interlocked with the Electric Actuator so that Electric Actuator operations stop automatically when the door is opened.

(2) Install an emergency stop device in an easily accessible place to enable an operator to quickly stop the Electric Actuator in case of an emergency.



1. When an emergency stop switch is operated the braking device must stop the Electric Actuator quickly without fail.
2. The emergency stop button or other activating device should be red.
3. The activating device must be readily accessible so the operator can easily trigger it by, for example, pressing, pulling, or touching a switch or by blocking a light beam.
4. Once triggered, the emergency stop device must be restorable only through deliberate action of an operator. It must not allow operations to be resumed automatically or through inattention on the part of an operator.

(3) No alteration or modification of the products is allowed.

Discontinue

■ 1.2.2 Precautions for installing the Electric Actuator

(1) Allow ample clearance for teaching the Electric Actuator, maintenance operations and inspection.

(2) The Electric Actuator controller, other control devices must be installed outside the Electric Actuator s zone of operation, but within easy access of the operator.

(3) The pressure gauge, oil pressure gauge and other indicators must be located so the operator can monitor them easily.

(4) Cover electric cables, oil hydraulic lines and pneumatic pipe lines when necessary to protect them from damage.

(5) Install an emergency stop switch at appropriate locations other than the operator's station.

■ 1.2.3 Precautions for operation of the Electric Actuator

[Operation inside the actuator operating area]

(1) Safety regulations for personnel working in the actuator's operating area

Safety regulations for personnel working in the actuator's operating area should include, but not be limited to, the following:

1) Basic operations such as starting, stopping and switch handling.
2) Electric Actuator speed during teaching procedures.
3) Communications, including signals, among operators when the Electric Actuator is operated by more than one person.
4) Emergency procedures to be taken for malfunctions or abnormal operations of the Electric Actuator.
5) Procedures to be taken for verifying recovery from abnormal conditions and confirming safety conditions before restarting the Electric Actuator after it is stopped by an emergency stop device.
6) Procedures to be taken to prevent accidents caused by inattentive operation or mishandling of the Electric Actuator.
   - Precautions including notices on all operation switches.
   - Precautions as needed to assure the safety of personnel in the Electric Actuator’s area of operation.
   - The exact location of personnel during work. (This should be determined before work begins.)
   - Procedures to be taken to prevent malfunctions arising from electrical noise.
   - Communications, including signals, between personnel in the actuator operation area and operators of Electric Actuator and other devices.
   - Procedures to determine the cause of a malfunction.
7) The safety regulations must be appropriate for the robot type, installation place and work details, etc.
8) When creating the safety regulations, an effort should be made to obtain the opinions of the related personnel, manufacturer's engineers and labor safety consultants, etc.

(2) Install notices on Electric Actuator switches to alert personnel that work is underway in the Electric Actuator operation area and lock the cover to the operator's station.

Discontinue

(3) To secure the zone of Electric Actuator operation, take measures such as but not limited to the following.

1) Assign a guard to watch the Electric Actuator operating area to prevent unauthorized persons from entering the operating zone. The guard should be trained to activate emergency stop devices.
2) Personnel working inside the operating zone should carry emergency stop switches.
3) The operator should use a portable operator's station that can be used to turn ON or OFF power to the Electric Actuator, oil pressure devices, and pneumatic devices.

(4) Make the following inspections before teaching or other operations:

1) Turn the power switch OFF, and check the power cable for damage.
2) Test the actuator to make sure it moves properly.
3) Inspect the control devices and emergency stop devices.
4) Check for leakage in pneumatic pressure lines and hydraulic oil lines.

(5) Procedures for cleaning Electric Actuator hand tools, such as paint spray nozzles, should be automated so operators do not have to enter the actuator's operating area.

(6) Release residual pressure before disassembling or changing parts in a pneumatic system.

(7) Do not enter the actuator's operating area zone to confirm proper operation.

(8) Maintain proper lighting at the work site.

[Automatic operation]

(1) Notice at the start

Before beginning operation, confirm the following items and confirm communication procedures including hand signals among operators.

1) Make sure no one is inside the actuator operating area.
2) Portable operator stations, tools and devices are located at their assigned sites.
3) Indicators on the Electric Actuator and auxiliary devices are normal.

(2) Procedures for automatic operation and malfunctions

1) After start, confirm that the indicator shows automatic operation is underway.
2) Before personnel enter the Electric Actuator's zone of operation to recover the Electric Actuator or related devices from a malfunction, the operator must activate the emergency stop device and attach an "under repair" message to operation switches and take other measures to prevent others from starting the Electric Actuator.

Discontinue

■ 1.3 Warranty

■ 1.3.1 Warranty period

The warranty period for this product is any of the following periods, whichever expires first:

1) 24 months after the shipment from our plant
2) 18 months after the installation at your site
3) 4000 hours of operation

■ 1.3.2 Warranty details

1) This product is to be warranted. Our warranty covers the specifications and functions that are defined in the specifications, catalog, and instruction manual of the product. We assume no liability for any secondary or incidental damage due to a failure of the product in any circumstances.
2) This product is to be repaired free of charge only if it fails under normal handling and use as defined in the instruction manual attached to the product within the warranty period. The product is to be returned to the plant where it is repaired. If our service engineer(s) is sent to your site at your request, expenses such as transportation and hotel expenses, which are not directly related to the product repair, may be charged separately.

■ 1.3.3 Exemption of liability

The product is not covered by warranty in the following cases:

1) Failure or damage caused by operation which does not conform to the instruction manual or caused by operators' carelessness
2) Trouble caused by deterioration due to aging or wear due to use (e.g., discoloration of painted surfaces or deterioration of consumables*1)
3) Trouble due to sensory sensitivity (e.g., sound emitted in a condition where no adverse effect is exerted on the product functions)
4) Modifying or disassembling the product without our prior approval
5) Failure or damage caused by improper maintenance/inspection or inadequate repair
6) Failure or damage caused by natural disaster, fire, or other external factors
7) Internal data such as programs and points that have been created or changed by the client
8) Taking the product out of Japan that was purchased in Japan

*1: Consumables refer to service/maintenance parts (spare parts) shown in the instruction manual of the product, and parts (e.g., backup batteries) which need periodic replacement.

■ 1.3.4 Notes

1) We cannot guarantee the fundamental performance of this product if it is used beyond the specifications.
2) We assume no liability for any injury accident, damage accident, or failure caused by not observing "WARNING" or "CAUTION" in the instruction manual.
3) Only the warnings, cautions and other safety descriptions we could assume are shown under the "WARNING" and "CAUTION" notices in the instruction manual, which please note.
4) The numeric values shown as technical information are calculated values which indicate approximate durability, and they are not guaranteed. Caution should be taken that the values vary depending on the operating conditions.

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Discontinue

Chapter 2 Devices

■ 2.1 Features

This Electric Slider is a new concept arm robot controller for which the Built Block System (KBB) idea has been incorporated to the popular "Electric Slider KBB Series".

[Features of axis unit]

- Combinations with KBB method
  A built block method (building block method) combination is possible by selecting unit parts such as the axis unit, angle bracket and cable. A system upgrade is possible by further adding optional parts.

- Importance on basic functions
  Importance has been laid on achievements and reliability for the main components that configure the robot axis such as the compact AC servo, highly rigid linear guide and grinding ball screw, etc. Downsizing has been pursued amid accurate movement.

- Cable connection
  Inter-axis cables are necessary but often become obstacles.
  With the CN box and special shape flexible tube, the wiring and piping can be stored and vertical or horizontal layout is possible.

- Corresponding to the needs of the time - Q. C. D.
  High quality, short delivery and low cost is realized by the units standardized with the KBB method.

- Absolute encoder compatible
  KBB Series mounts the motor with absolute encoder as a standard. The absolute encoder will constantly monitor the motor operation through battery backup even when the power is shut off, so return to origin does not need to be repeated when the system is started.

[Features of controller]

- Compact appearance
  The controller at 55W × 160H × 134D is as small as the compact AC servo driver that fits neatly into a panel.

- Simple program
  The "Easy Mode" for which basic pick & place operation patterns are created as modes is mounted as a standard.

- Mounting of pulse train input port
  The axis can be operated directly with an external controller or programmable controller with pulse generator function, etc. This is used when real-time operations are required.

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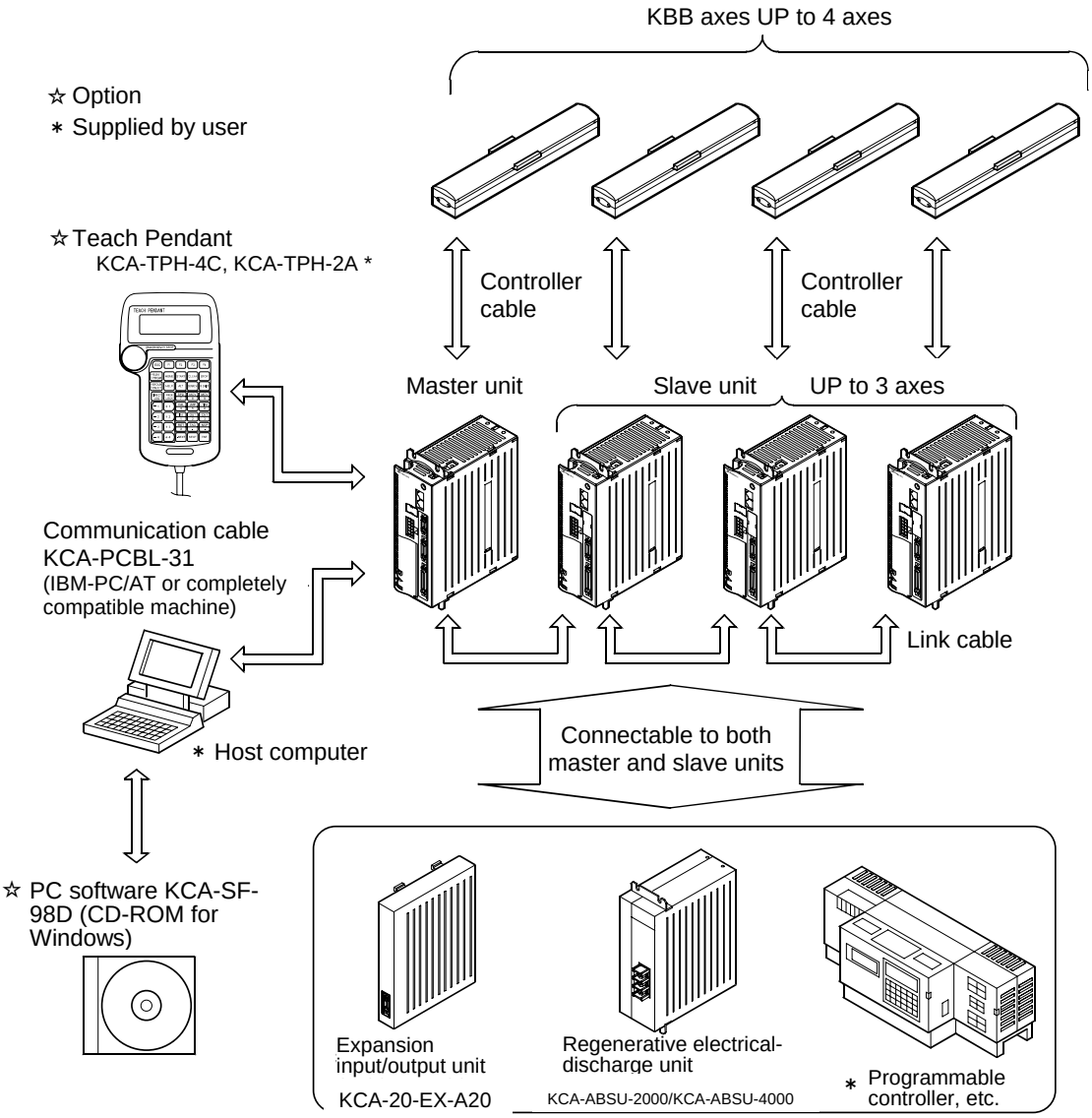
- Corresponding to globalized production bases
  Input voltages from 100 to 120VAC or 200 to 240VAC can be handled.
  * KCA-20-M40 and S40 can handle 200 to 230 VAC.

  Incorporation of Electric Slider language popular for its simple teaching method
  Besides teaching with a personal computer, the Electric Slider KBB Series Teach Pendant (KCA-TPH-4C, KCA-TPH-2A) can be used to overcome the Electric Slider language and correspond to multitasking.

Discontinue

■ 2.2 System components and specifications

■ 2.2.1 System components

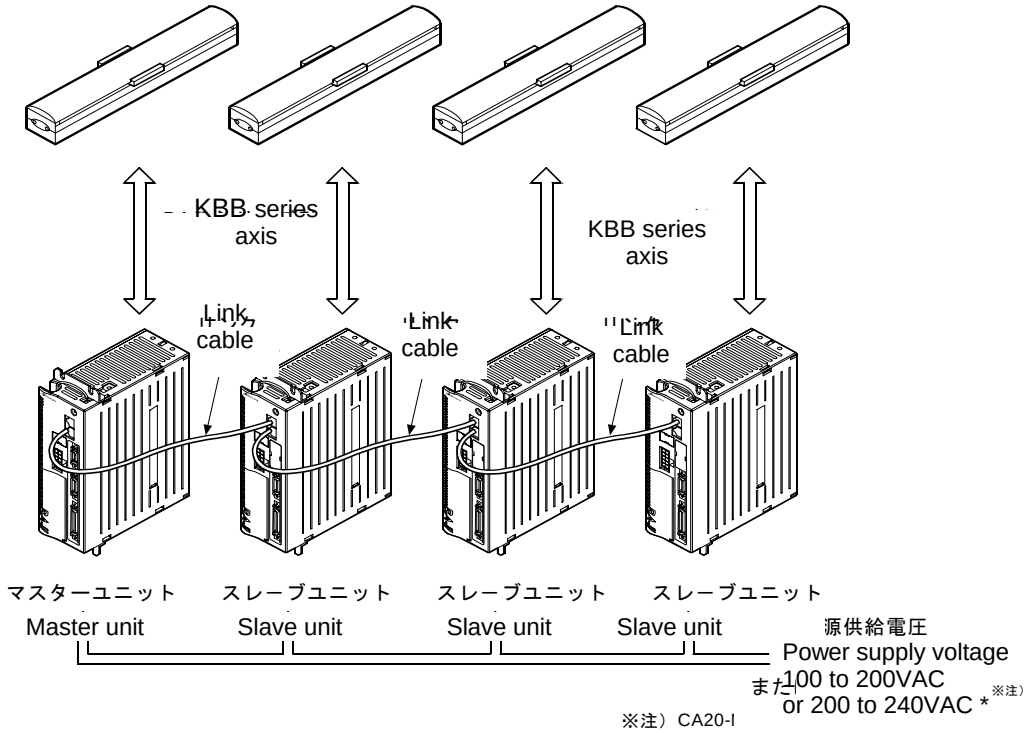


*Note: There is not a part of functions in KCA-TPH-2A.

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■ 2.2.2 Controller specifications

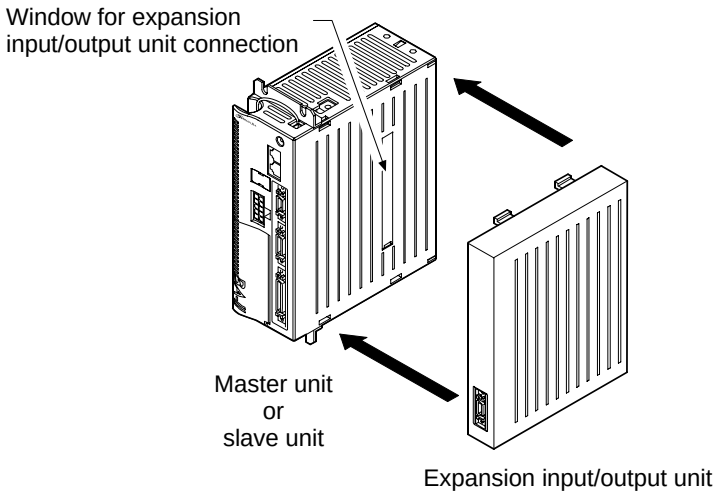
The Electric Slider series KBB controller can control one axis with the master unit, but when a slave unit is connected with a link cable, up to four axes can be controlled. Refer to section 2.2.2. (2) for the slave unit specifications.



概念図 *Note: KCA 20-M40/S40 handles 200 to 230 VAC.

Outline drawing

By directly coupling the expansion input/output unit to the master unit and slave unit, the general-purpose input/output can be increased.



Discontinue

(1) Master unit specifications

Applicable robot	KBB series			
Controller type	KCA-20-M10			KCA-20-M40 **(Note 1)**
Number of controllable axes	One axis, or two to four axis control with slave unit connection			
Motor capacity **(Note 2)**	50W	100W	200W	400W
Drive method	AC servomotor			
Control method	PTP, Semi-closed loop control			
Teaching method	Remote teaching, Direct teaching or MDI			
Speed setting	10 steps (variable)			
Acceleration setting	20 steps (variable)			
Operation mode	Sequential, Palletizing, External point designation, Easy, Pulse train input			
Operation method	Step, Continuous, Single robot movement			
CPU type	32-bit RISC·SH7145			
Self-diagnostic function	CPU error by WDT, Memory error, Driver error, Power voltage error, Program error, etc.			
Number of programs	Sequential 8, Palletizing 8			
Number of program steps	Max. 2000 steps (total of all tasks) + 999 × 4 tasks per coordinate table (When slave is connected)			
Memory method	FRAM			
Number of counters	99			
Number of timers	9			
Error signal	Error display lamp lights (front panel), Teach Pendant			
External input	System input	24V 10mA 4 points		
	General purpose input	24V 10mA 4 points **(Note 3)**		
External output	System output	24V max. 20mA 4 points		
	General purpose output	24V max. 300mA 4 points **(Note 3)**		
Communication function	1 channel for Teach Pendant (RS-232C)			
Power supply	100VAC to 120VAC, 200VAC to 240VAC ±10% 50–60HZ Change between the 100V system and 200V system using the short bar on the front terminal board			200VAC to 230VAC ±10% 50–60HZ
Power capacity (per axis)	100VA	160VA	450VA	700VA
Operation conditions	Installation place	Indoors		
	Working ambient temperature	0 to 40°C		
	Working ambient humidity	30% to 90%RH With no dew condensation		
	Working ambient atmosphere	With no corrosive gases		
	Storage ambient temperature	–20 to 70°C		
	Storage ambient humidity	With no dew condensation		
	Storage ambient atmosphere	30% to 90%RH With no corrosive gases		
	Vibration	9.8m/s^2 or less		
Dimensions	55 (W) × 160 (H) × 134 (D) Excluding installation fittings			85 (W) × 160 (H) × 134 (D) Excluding installation fittings
Mass	0.93kg			1.36kg

Discontinue

NOTE

(Note 1) To use KCA-20-M40, be sure to use regenerative electrical-discharge unit KCA-ABSU-4000.

(Note 2) The applicable motor capacity is displayed on the controller front panel. Connection with the motor with different capacity causes the motor to burn out. Do not connect the motor with different capacity.

(Note 3) The number of general-purpose input/output points will be reduced when the signals using the general-purpose input/output terminals are assigned.

(2) Slave unit specifications

Applicable robot	KBB series			
Controller type	KCA-20-S10			KCA-20-S40 **(Note 1)**
Number of controllable axes	One axis (with connection to master unit)			
Motor capacity **(Note 2)**	50W	100W	200W	400W
Drive method	AC servomotor			
Error signal	Error display lamp lights (front panel), Teach Pendant (Connect to master unit)			
External input/output	General purpose input	24V max. 10mA 8 points		
	General purpose output	24V max. 300mA 8 points		
Power supply	100VAC to 120VAC, 200VAC to 240VAC ±10% 50–60Hz Change between the 100V system and 200V system using the short bar on the front terminal board			200VAC to 230VAC ±10% 50–60Hz
Power capacity (per axis)	100VA	160VA	450VA	700VA
Operation conditions	Installation place	Indoors		
	Working ambient temperature	0 to 40°C		
	Working ambient humidity	30% to 90%RH With no dew condensation		
	Working ambient atmosphere	With no corrosive gases		
	Storage ambient temperature	–20 to 70°C		
	Storage ambient humidity	30% to 90%RH With no dew condensation		
	Storage ambient atmosphere	With no corrosive gases		
	Vibration	9.8m/s^2 or less		
Dimensions	55 (W) × 160 (H) × 134 (D) Excluding installation fittings			85 (W) × 160 (H) × 134 (D)
Mass	0.91kg			1.34kg

NOTE

(Note 1) To use KCA-20-M40, be sure to use regenerative electrical-discharge unit KCA-ABSU-4000.

(Note 2) The applicable motor capacity is displayed on the controller front panel. Connection with the motor with different capacity causes the motor to burn out. Do not connect the motor with different capacity.

Discontinue

(3) Various units and options

The following units and options are available for the ROIbot. (Option)

Part name	Type	Application
Teach Pendant	KCA-TPH-4C, KCA-TPH-2A *	For programming
Expansion input/output unit	KCA-20-EX-A20	Expanded input: 12 points, output: 8 points
Input/output cable	KCA-10-IC-A 0A	For master unit and slave unit
Input/output cable (for expansion input/output)	KCA-10-IC-B□0A	For expansion input/output unit
Link cable	KCA-10-LC-A A	Between master unit and each slave
Personal computer software	KCA-SF-98D (CD-ROM)	Program creation and data maintenance (for Windows)
Communication cable	KCA-PCBL-31	Connection cable between personal computer and controller
Regenerative electrical-discharge unit	KCA-ABSU-2000	Electrical-discharge unit for regenerative voltage suppression (for 50–200W)
	KCA-ABSU-4000	Electrical-discharge unit for regenerative voltage suppression (for 400W)

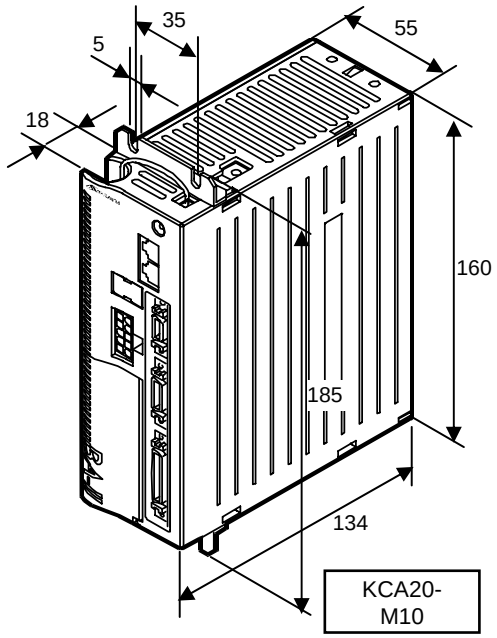
*Note: There is not a part of functions in KCA-TPH-2A.

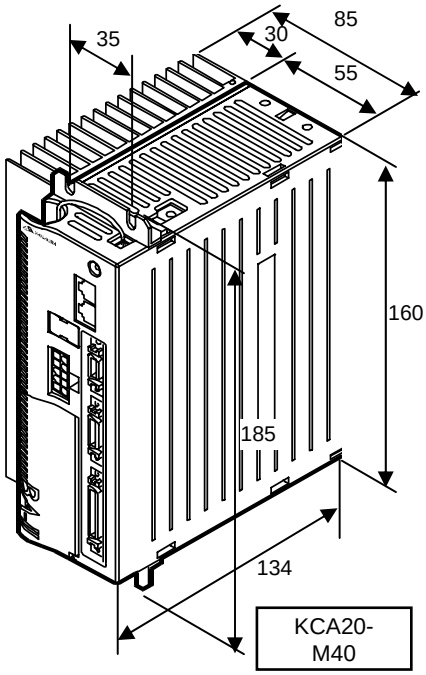
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■ 2.3 Explanation of each part

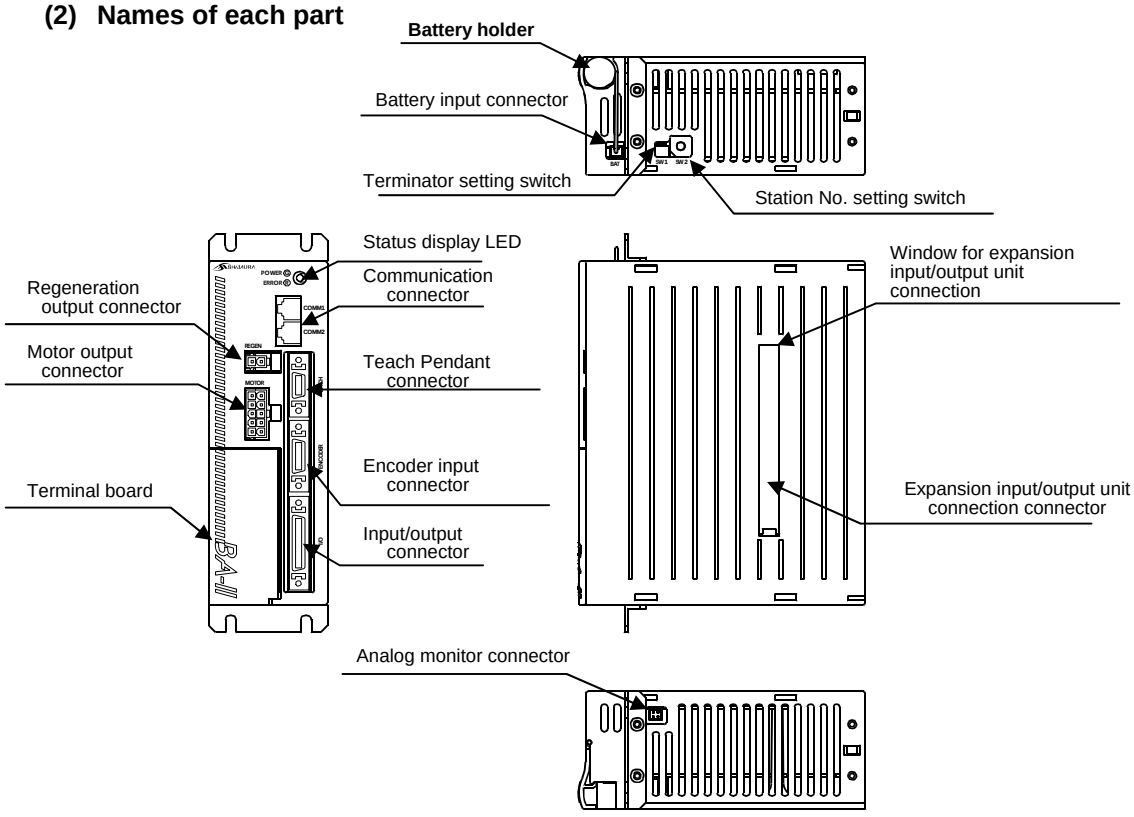
■ 2.3.1 External dimensions and explanation of each part

(1) External dimensions





(2) Names of each part



Discontinue

■ 2.3.2 Function of each part

Status display LED
This LED displays the status of the controller. The green LED lights when the power is ON, and the red LED lights when an error has occurred.

Teach Pendant connector
This connector is used to connect a Teach Pendant or a communication cable (option) for connecting a personal computer.

Motor output connector and encoder input connector
A controller cable is connected to this connector.

Input/output connector
An external control unit (sequencer (programmable controller), etc.) is connected to this connector.

⚠CAUTION Turn the controller power OFF before connecting or disconnecting the motor output, encoder input or input/output connectors.
If a connection is made while the power is ON, the controller could malfunction.

Terminal board
The power input terminal, power voltage changeover terminal, FG (Frame Ground) and LG (Line Ground) terminals are provided on this board.

⚠CAUTION Incorrect wiring of the power supply, incorrect connections (mismatch of supplied power voltage and power voltage and power voltage changeover terminal, disconnection of LG and FG, and other disconnections), and incorrect connections of input/output connectors could cause controller faults, malfunctioning, or malfunctioning of the entire system.

Communication connector
The slave unit (option) link cable is connected to this connector.

Regeneration output connector
The regenerative electrical-discharge unit (option) is connected to this connector.

Terminator setting switch
This switch is used to connect a terminator for communication when a slave unit is connected.

Station No. setting switch
This switch is used to set the station No. of each slave unit when a slave unit is connected and multiple axes are controlled. The master unit is set to 0.

Expansion input/output connection connector
The expansion input/output unit (option) is connected to this connector.
Battery input connector
This connector is used to connect the battery harness (option). This is used when using the absolute encoder.

Analog monitor connector: Note: This connector is used for adjustment by manufacturer.

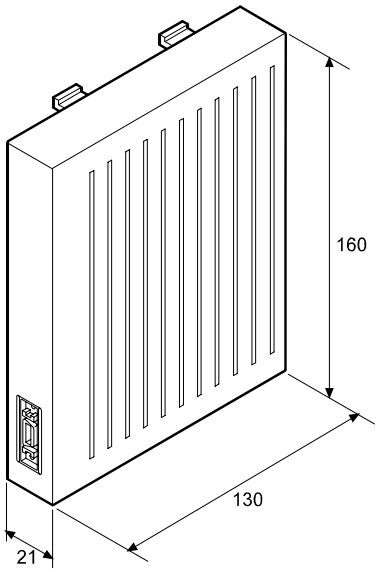
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Do not connect the equipment to this connector.

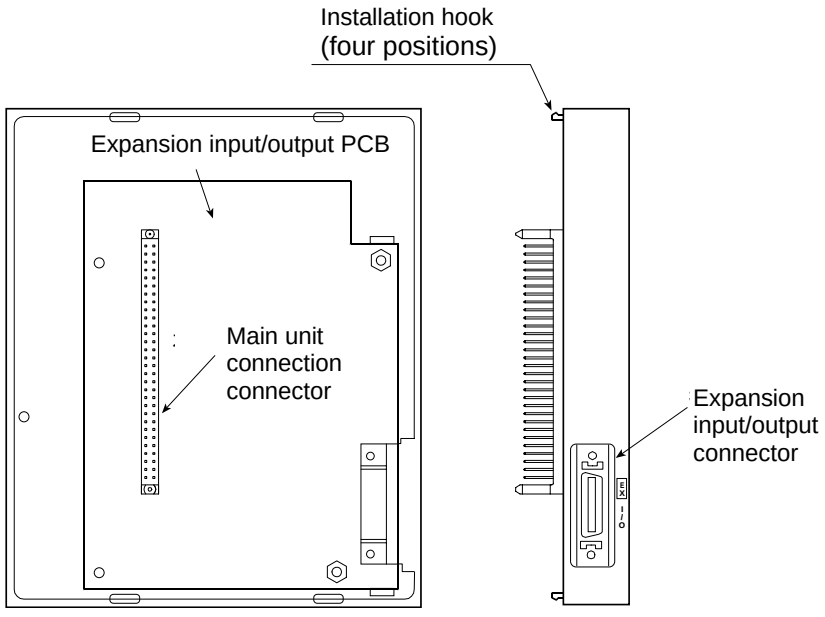
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■ 2.3.3 Explanation of expansion input/output unit

(1) External dimensions



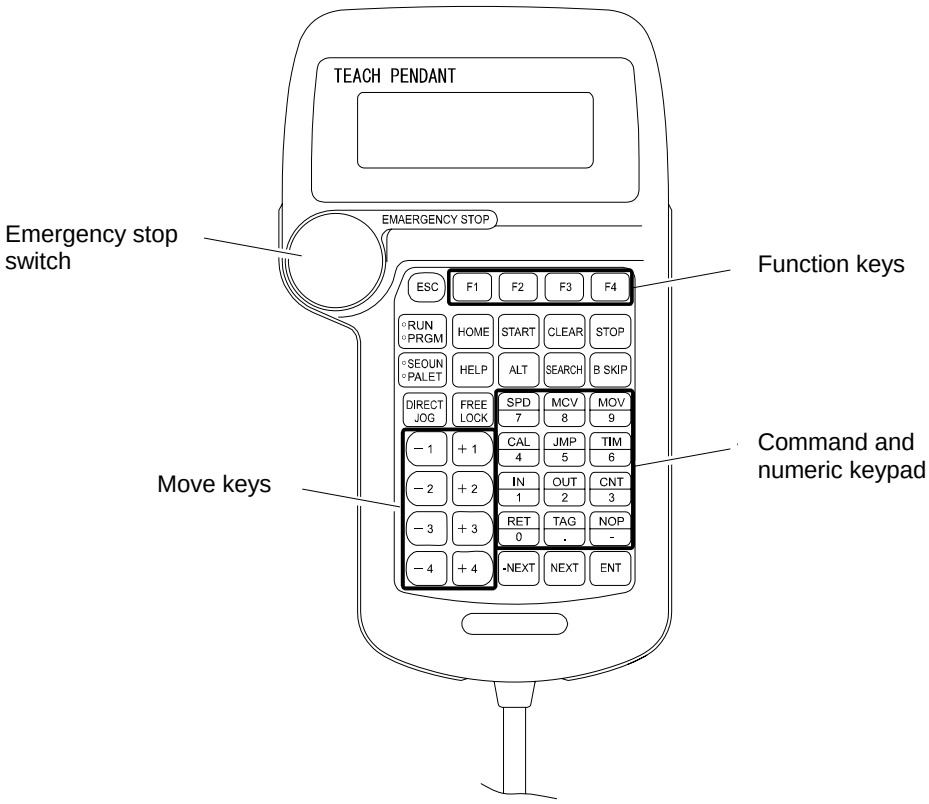
(2) Names of each part



The expansion input/output can be connected to the master unit or slave unit.

Discontinue

■ 2.3.4 Explanation of Teach Pendant



Model: KCA-TPH-4C

- ESC key
  The operator can use this key to exit the function key mode.

- F1 to F4 key
  These keys perform various functions.

- RUN/PRGM key
  This key is used to toggle between run and program modes.

- HOME key
  This key executes Return to Origin.

- START key
  The key executes the program.
  The program will be executed from the step currently stopped at.
  When using a multitasking, the program will be executed from the multitasking step currently stopped at.

- CLEAR key
  The key clears the input item, and release alarms.

Discontinue

- STOP key
  Program execution is terminated after the current step is completed.

- SEQUN/PALET key
  This key is used to toggle between the sequential mode and palletizing mode. When the key is pressed, the mode will alternate.

- HELP key
  An explanation of the current function is displayed.
  When this key is pressed once, the initial screen is displayed. When it is pressed again, the next screen is displayed.

- ALT key
  This key is used to change and select input data other than values in program or parameter mode.
  This key is also used to change the display task in the RUN mode or program mode.

- SEARCH key
  This key is used to search for step No., tag No., parameter No. and table No.

- B SKIP key
  This key is used to reversely shift the cursor.

- DIRECT/JOG key
  When this key is pressed in servo-lock condition, JOG mode (manual operation mode) is enabled, and JOG operation of the axis can be executed by using Move keys. When this key is pressed in servo-free condition, Direct Teaching is enabled.

- FREE/LOCK key
  This key is used to set the ROIbot in servo-lock condition or release it. When the ROIbot is in free-lock condition, the FREE signal lamp on the Teach Pendant lights.

- MOVE keys
  These keys are used to execute JOG operations for each ROIbot axis. An axis moves while its corresponding key is pressed. Each key corresponds to the first axis or second axis. The plus and minus on the keys indicate the direction of movement.

- Commands and ten keys
  These keys are used for programming. Main commands and numbers are indicated on the keys. When a key is pressed the command or number is entered at the position of the cursor.

- -NEXT key
  This key is used to display the step and the parameter preceding the one currently on display.

- NEXT key
  Displays the step and the parameter ahead of the one currently on display.

Discontinue

- ENT key
  Writes commands and other data into a step in the program.

- Emergency stop switch
  Push-lock and turn-reset switch. Pressing this switch causes the robot to enter the emergency stop state. To clear emergency stop, turn the switch clockwise to unlock the switch, and then press the CLEAR key.



In servo-free condition, the ROIbot is separated electrically from the control system, and the axis arm can be moved freely by hand.
In the servo-lock condition, the ROIbot axis is connected electrically to the controller, which controls the ROIbot's position. It cannot be easily moved by hand.

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■ 2.4 Procedures from installation to operation

The procedures for installing the ROIbot to operating the ROIbot are as follow.

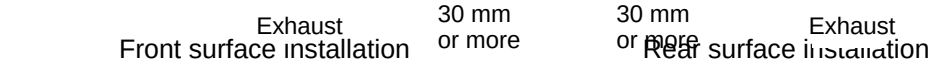
1)	Installing the axis	Axis Installation Secti
2)	Installing the controller	Section 2.4.1
3)	Connecting the emergency stop circuit	Section 2.4.5
4)	Connecting the axis and controller	Section 2.4.4
5)	Connecting with the external control unit (programmable controller, etc.)	Section 10.1.5
6)	Checking supply power and grounding wires	Section 2.4.2
7)	Checking each wiring (Make sure that none of the polarities are mistaken.)	
8)	Connecting the Teach Pendant to controller	Section 2.4.4
9)	Supplying the designated power supply. (POWER ON)	Section 2.4.2
10)	Setting the robot type	Section 2.4.7
11)	Setting the task and axis combination	Section 13.4.15
12)	Setting the soft limit	Section 2.4.8
13)	Home return	Section 2.4.8
14)	Adjusting the servo gain	Section 2.4.9
15)	Entering program mode and starting program write	Section 3.2
16)	Completing the program (Check that there are no mistakes.)	
17)	Confirming program with step operation (STEP mode)	
18)	Trial operation	
19)	Adjustment	
20)	Operation	
21)	Operate ROIbot with the above steps while referring to the reference page.	

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■ 2.4.1 Installing the controller

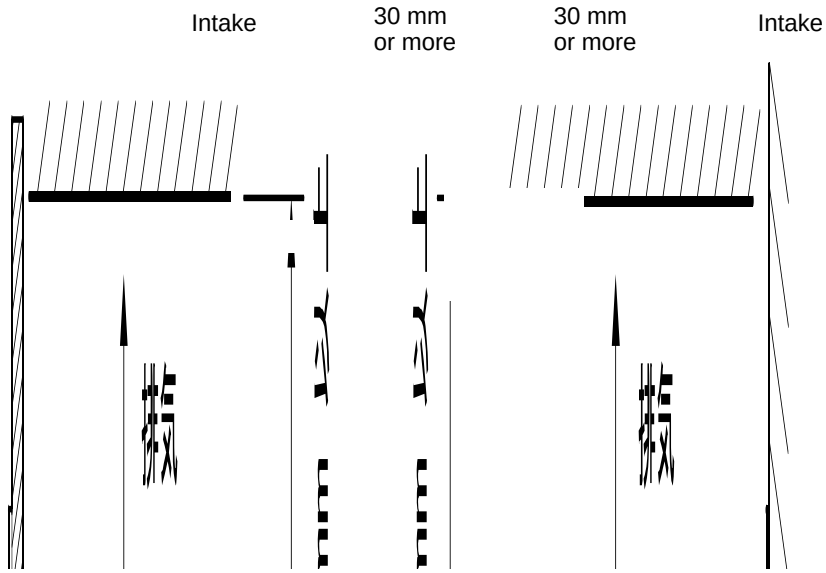
The controller uses a natural cooling method through convection. When installing the controller, place it vertically as shown below, and leave a space of 30mm* or more around it so that the ventilation holes on the top and bottom are not blocked.
If the ventilation is insufficient, the sufficient performance will not be achieved, and faults could occur.

* If the controller is installed in parallel with regenerative electrical-discharge unit ABSU-4000, the space depends on the installation dimensions of ABSU-4000.



Front surface installation　　Rear surface installation

Make sure that foreign matter such as fluids or dust does not enter the controller from the ventilation holes.
This unit does not have a dust proof structure. Avoid use in dusty places.



Front surface installation　　Rear surface installation

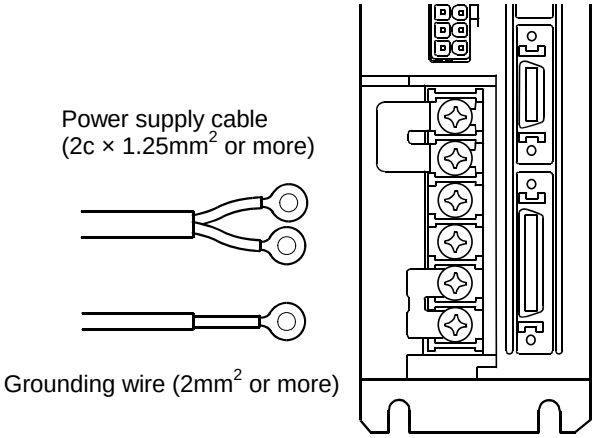
Make sure that foreign matter such as fluids or dust does not enter the controller from the ventilation holes.
This unit does not have a dust proof structure. Avoid use in dusty places.

Discontinue

■ 2.4.2 Supply power and grounding

The power voltage supplied to the KCA-20-M10/S10 can be either 100VAC system or 200VAC system by changing the VOLTAGE SELECT terminal's short bar on the terminal board. The power voltage supplied to the KCA-20-M40/S10 can only be 200 VAC system.

KCA-20-M10/S10	100VAC system: Single-phase 100VAC to 120VAC ±10% 50/60Hz 200VAC system: Single-phase 200VAC to 240VAC ±10% 50/60Hz
KCA-20-M40/S40	200VAC system: Single-phase 200VAC to 230VAC ±10% 50/60Hz



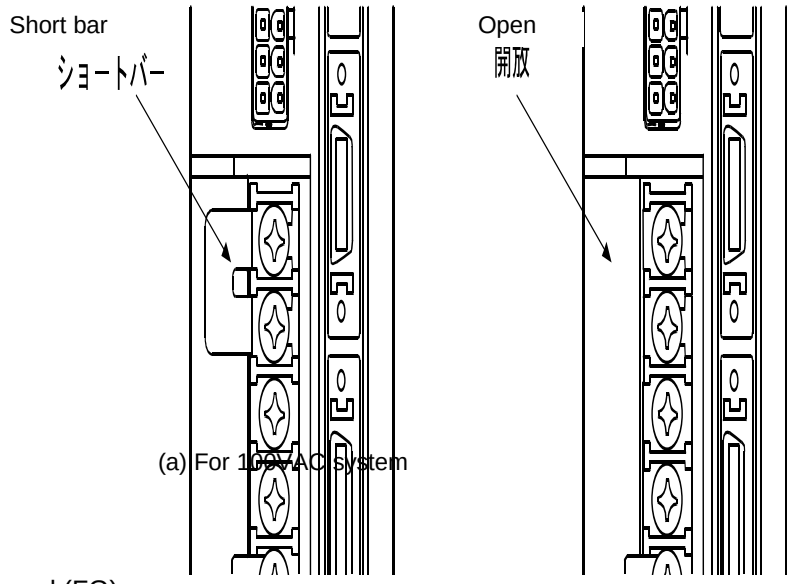
● Power input terminal (AC IN)

When used in Japan, the supply voltage is normally ±10% in respect to the nominal voltage. However, if the voltage fluctuation is particularly large, connect a constant voltage device externally.

To change between the 100VAC system and 200VAC system, short circuit the VOLTAGE SELECT terminal with the enclosed short bar to select 100VAC, and leave the terminal opened to select the 200VAC system.

Use the KCA-20-M40/S40 with the 200 VAC system left open.

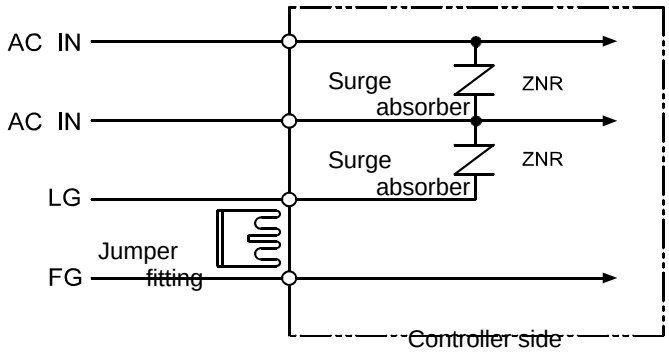
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● Frame ground (FG)
This terminal is connected to the cabinet. To prevent electric shocks, carry out Class 3 grounding by connecting the dedicated wire.

⚠CAUTION A surge absorbing element is provided between the controller's power line and cabinet. Confirm that the supply power is 290V or less between the power line and grounding, and then connect. If the power between the power line and grounding is 290V or more, the absorbing element could be damaged and the controller could be damaged.

● Surge absorber dedicated terminal (LG)
This terminal is provided in addition to the FG terminal to protect the circuit from external lightening surges or noise, etc.



When installing the controller, short circuit the LG and FG terminals with the enclosed jumper fitting so as to protect the circuit from external lightening surges and noise, etc.

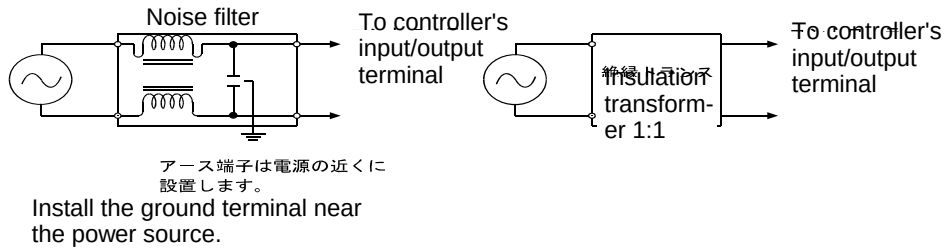
⚠CAUTION Normally (when shipped from the factory) LG and FG are short circuited with a jumper fitting. When carrying out an insulation resistance test (500V megger test) or withstand voltage test (1000VAC), the results may appear faulty due to the current leaked by the surge absorber. In this case, remove the jumper fitting between LG and FG before carrying out the tests.

Discontinue

■ 2.4.3 Improvement of noise resistance

A line filter is built into the controller, but using the following measures to further improve the noise resistance is recommended.

- Insert a power line insulation transformer (1:1) or noise filter.



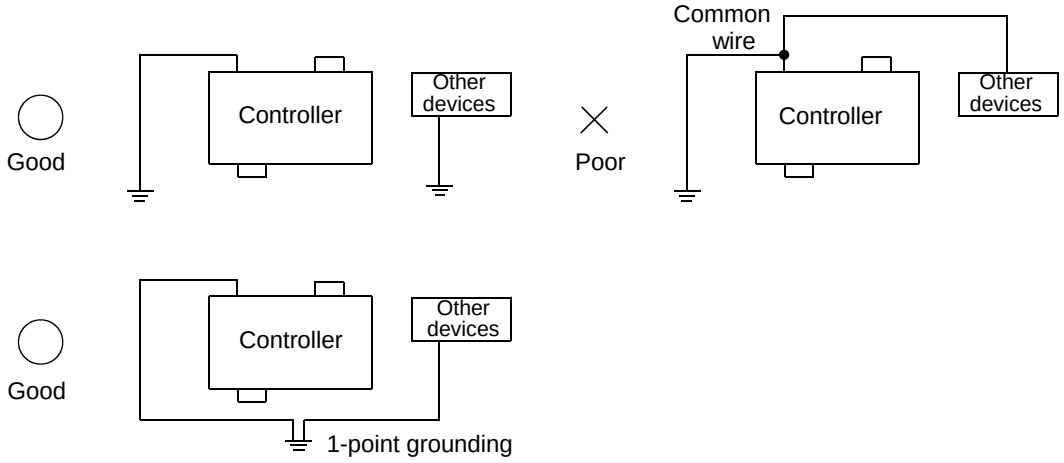
- Avoid installing the controller near high-voltage devices (induction hardening machines, electric welding machines, etc.).

- Install the controller at a position 200mm or more away from the power wire.

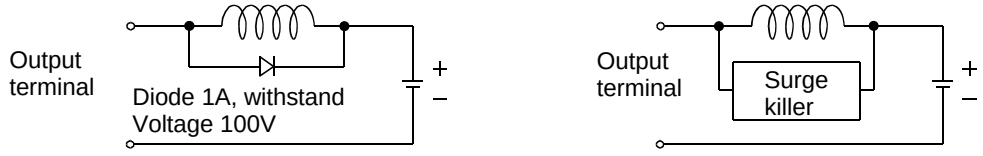
- When treating the input/output signal and controller cables, if the high voltage wires and power wires are bundled together, malfunctioning could occur due to induction. Thus, separately wire these wires.

- Use Class 3 or higher grounding (grounding resistance 100Ω or less) for the controller grounding.

- If the grounding wire is used also for other devices, an adverse effect could occur.



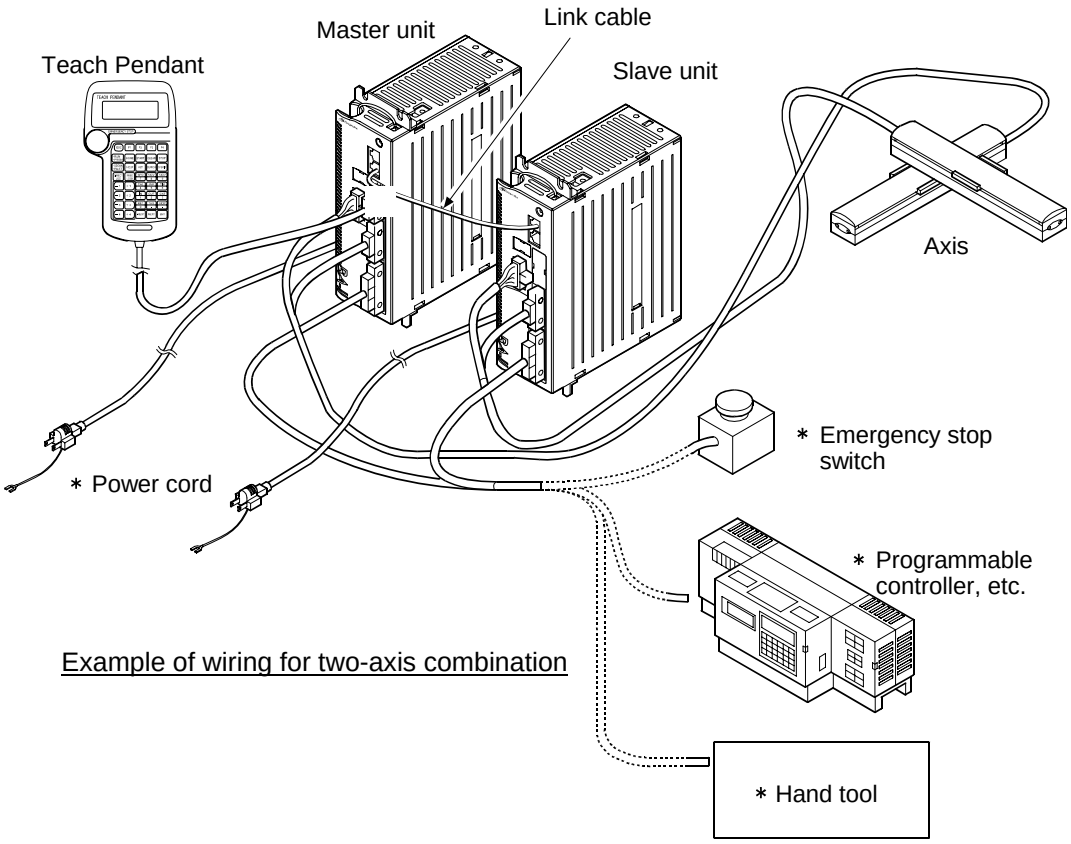
- When connecting induction load to the output, connect a diode or surge killer in parallel.



Discontinue

■ 2.4.4 Connecting the axis and controller

Connect the axis and Teach Pendant to the controller as shown below.



Example of wiring for two-axis combination

Items marked with a * are to be prepared by the user.

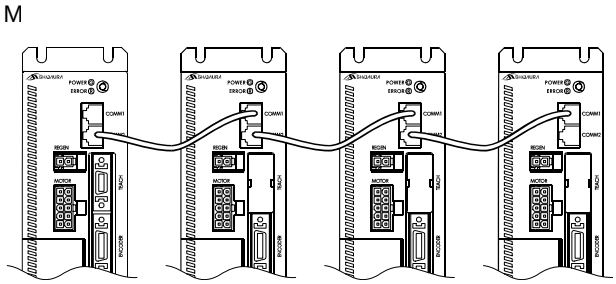
Discontinue

● Control of multiple axis

The master unit can control one axis by itself, but by connecting a slave unit for one to three axes with link cables, up to four axes can be controlled.

(1) Connecting the controller

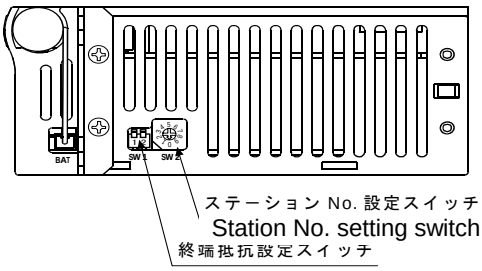
To connect the master unit and slave unit, use the communication connectors (COMM1, COMM2) on the front side, and connect a link cable between COMM2 on the master unit to COMM1 on slave unit 1, and between COMM2 on salve unit 1 to COMM1 on slave unit 2.

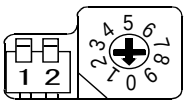


(2) Setting station No.

When controlling two or more axes, the station No. must be set with the station No. setting switch on the top of the unit so that the hardware of each unit can recognize the station No. Set the master unit's station No. to "0", and the slave unit station No. to "1" to "3". If other settings are made, or if the same No. if set for the slave units, a communication error will occur.

	Master unit	Slave unit
Setting of station No.	Set to "0"	Set to "1" to "3"





スイッチ部拡大

Enlarged view of switch

コントローラ上面図

Top view of controller

(3) Setting of task and axis combination

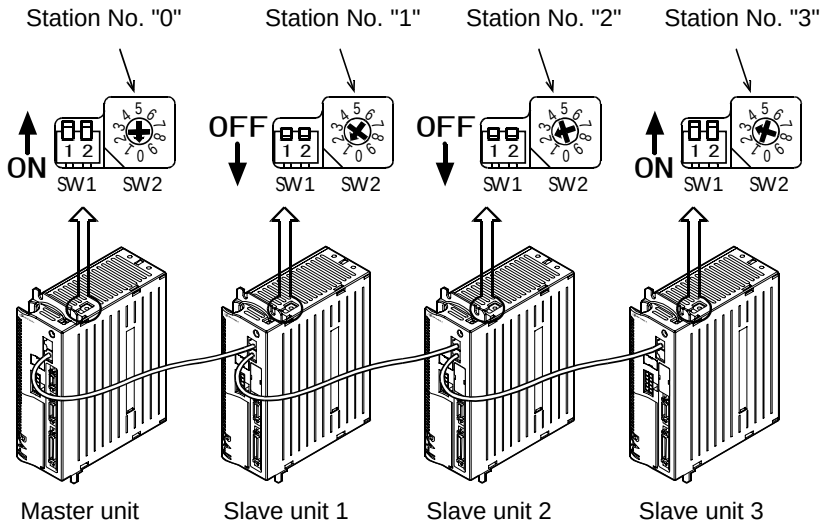
This setting is made with parameter 2. Refer to the task and axis combination settings given in section 13.4.15.

Discontinue

(4) Setting terminator

When multiple units are connected, the end of the communication line must be treated so that the communication will be accurate. This end treatment is possible by setting a terminator and setting the terminator setting switch on the unit to ON. When using three or four axes, turn ON bit 1 and bit 2 of the terminator setting switch on the unit (master unit and slave unit with open COMM2) at the end of the communication line. Leave the switches set to OFF for all other units. When using two axes, turn ON bit 1 and bit 2 of the terminator setting switch on the master unit and slave unit. When using one axis, leave these bits set to OFF.

[For four-axis combination]



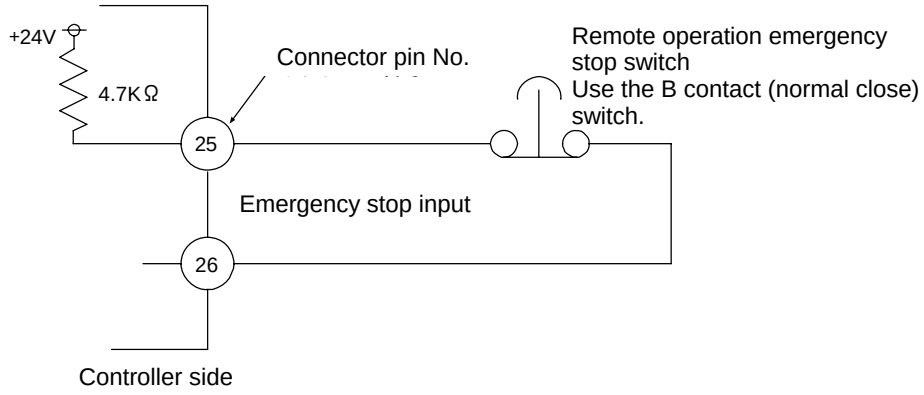
Discontinue

■ 2.4.5 Connecting the emergency stop circuit

Before using the ROIbot, always connect the emergency stop circuit to the enclosed input/output connector. If this circuit is not connected, the controller will enter the emergency stop state.

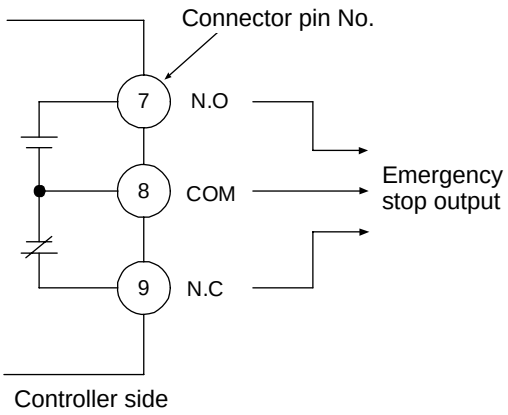
● Emergency stop input

⚠CAUTION If this signal is input (the circuit is shut off), the general-purpose output state during emergency stop will differ according to the mode setting, but with the default setting, the general-purpose output will be maintained. The robot will enter the emergency stop state, but the stopping distance will differ according to the load size, speed and inertia, etc.



● Emergency stop output

An output terminal is provided to notify the external source that the controller has entered the emergency stop state when the ROIbot enters the emergency stop state. This is used to make a display to an external source or to activate an interlock with other devices, etc.



Output type: Relay contact output
(OMRON G6E-134P or equivalent)

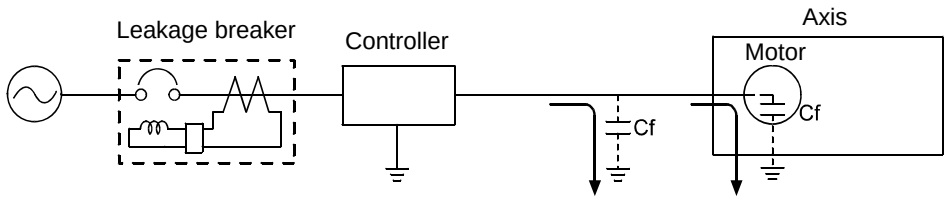
	N.O	N.C
During emergency stop	Closed	Opened
Normal state	Opened	Closed

NOTE Use the emergency stop output within a voltage range of 5 to 30V and current range of 10mA to 300mA.

Discontinue

■ 2.4.6 Effect of leakage current

This controller (master unit, slave unit) controls the motor assembled into the axis with PWM (Pulse Width Modulation). Thus, a high frequency leakage current (Cf·dV/dt) that do not affect the human body will flow through the cable from the controller to motor and the motor's floating capacity (Cf). General leakage breakers, excluding those for high frequencies, normally detect the leakage current at the same level between the low frequency and high frequency regardless of the frequency zone. Thus, the leakage breaker will function when the leakage current in the high frequency zone exceeds the operating frequency of the leakage breaker.



Measures when leakage breaker functions needlessly by high frequency leakage current

(1) Use a high frequency and surge corresponding leakage breaker.
Use a leakage breaker that is sensitive to the high frequency element leakage breaker contained in the controller's leakage current to prevent needless functioning.

(2) Decrease the floating capacity between the controller and ground.
Select as short a controller cable as possible to be used between the controller and axis.

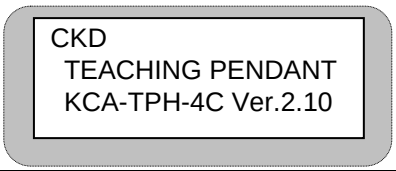
⚠CAUTION Always ground the controller with Class 3 or higher grounding (grounding resistance 100Ω or less) to prevent electric shock accidents.

⚠CAUTION Needless functioning of the leakage breaker could occur in a separate system that is not directly related to the circuit connected to the controller because of leading in of the leakage current.

Discontinue

■ 2.4.7 Setting the Robot Type

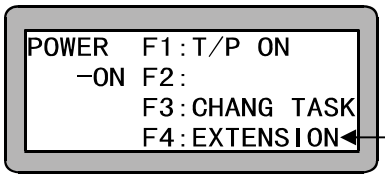
Inputting the Robot Type enables you to automatically set various parameter values according to the axis to be used.



STEP 1

When the power is turned ON, the first display is shown for two seconds.

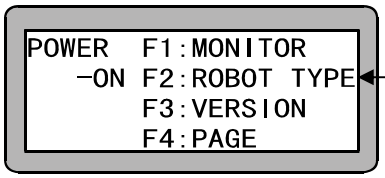
*The display format and version may vary depending on the teach pendant to be used.



STEP 2

After the first screen, the display at left is shown.

Press F4 .

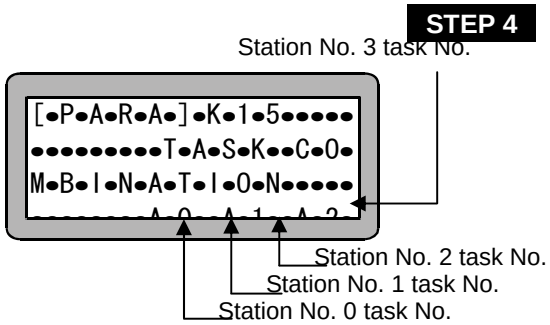


STEP 3

Press F2 to select the Robot type.

Press ESC to return to STEP 2.

STEP 4



Enter the task combination before entering the robot type of each axis.

Use the numeric keypad to enter the task No. of each station and press ENT . (A setting other than 0 to 4 will be invalid.)

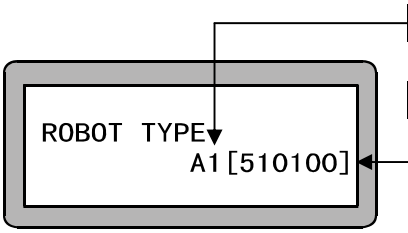
Press ALT to display the next screen.

Press ESC to return to STEP 3.

- Refer to section 13.4.15 for details.
- Set the task No. as shown below.

	Task 1	Task 2	Task 3	Task 4
[1] [0] [0] [0]	1-axis specifications	No axis	No axis	No axis
[1] [2] [0] [0]	1-axis specifications	1-axis specifications	No axis	No axis
[1] [2] [2] [0]	1-axis specifications	2-axis specifications	No axis	No axis
[1] [2] [3] [0]	1-axis specifications	1-axis specifications	1-axis specifications	No axis
[1] [2] [3] [3]	1-axis specifications	1-axis specifications	2-axis specifications	No axis
[1] [2] [3] [4]	1-axis specifications	1-axis specifications	1-axis specifications	1-axis specifications
[1] [2] [2] [3]	1-axis specifications	2-axis specifications	1-axis specifications	No axis
[1] [1] [0] [0]	2-axis specifications	No axis	No axis	No axis
[1] [1] [2] [0]	2-axis specifications	1-axis specifications	No axis	No axis
[1] [1] [2] [2]	2-axis specifications	2-axis specifications	No axis	No axis
[1] [1] [2] [3]	2-axis specifications	1-axis specifications	1-axis specifications	No axis

Discontinue



STEP 5

Use the ALT key to select the station No. (0 to 3). Press ALT to return to STEP 4.

STEP 6

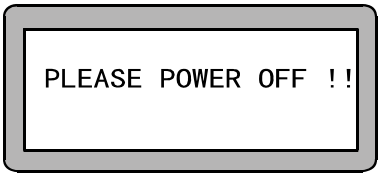
Use the numeric keypad to enter the Robot type and press ENT . The robot type will be set.

Press ALT to repetitiously display STEP 4 and STEP 5, and press ESC to return to STEP 3.

- The station No. is a number assigned to each unit. (Refer to section 2.4.5) (Setting range: 0 to 3)
- Refer to the Instruction Manual (Axis Installation Section) for details on the robot type (six-digit figure).

NOTE

- To confirm the robot type, do not press ENT at STEP 5 and instead press ESC to return to STEP 3.



STEP 7

This screen will appear when ENT and ESC are pressed after changing the robot type in STEP 6.

Follow the instructions on the display and turn OFF the controller power.

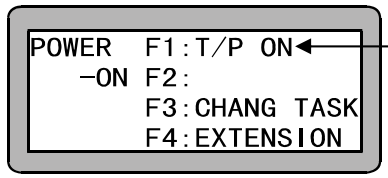
NOTE

- After the Robot type has been entered, turn OFF the controller switch to write the data into the controller.
- If a nonexistent Robot type is entered, a buzzer sounds and the error message "ROBOT NO. ERROR" is displayed.

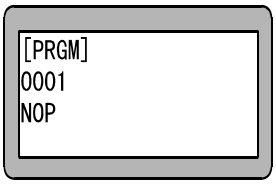
Discontinue

■ 2.4.8 Setting the software limit and Return to Origin

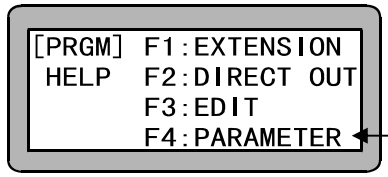
Software limits can be defined to prevent the ROIbot from overrunning its maximum safe operating limits within the range of the ROIbot axes.
The software limit is set to the positive and negative range of movement of a motor drive shaft. The limits on the movement range can be changed easily by software, but it is not easy to do so using hardware.
To set the software limits, use the Teach Pendant and follow the directions below.



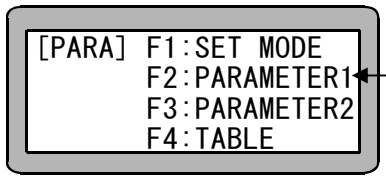
STEP 1 Turn ON the power. After the first display at left is shown, press the F1 key.
Then, press the RUN PRGM key to set the program mode.



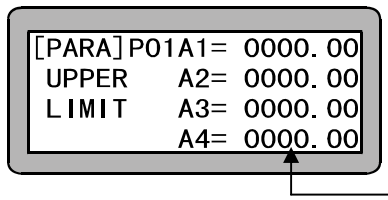
STEP 2 Press HELP .



STEP 3 Press F4 to set the parameter mode.

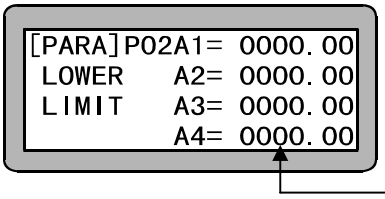


STEP 4 Press F2 to set parameter 1.



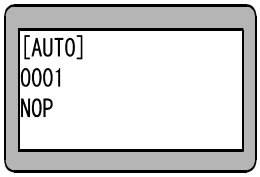
STEP 5 Use the numeric keypad to enter the plus soft limit coordinates and press ENT . Next, press NEXT .

Discontinue



STEP 6 Use the numeric keypad to enter the minus soft limit coordinates and press (ENT) .
(Normally 0 is input for the minus soft limit.)
Next, press (ESC) twice, enter the program mode, press (RUN PRGM) and enter the RUN mode.

The station No. is a number assigned to each unit and the soft limit is a value set for each unit. (Refer to section 2.4.4.)



STEP 7 Press (HOME) to execute Return to Origin.

NOTE
- The software limits must be within the maximum stroke of the actuator(s) installed. After completion of the setting, the stroke range of the slider (hereafter called the work area) is from the software upper limit to the software lower limit.
- The software upper limit is the maximum and the software lower limit is the minimum moving distance of the axis.

Discontinue

■ 2.4.9 Servo gain adjustment

There are two kinds of gain in the servo mechanism of this ROIbot: position gain and speed gain. They are set through parameter 1. Generally, a larger servo gain enables higher speed response in the servo mechanism and a smaller servo gain enables smooth movement of the ROIbot. An inappropriate gain setting can cause overshoot or undershoot. It can also result in vibration and noise. Normally, the appropriate servo gain is set automatically when the Robot Type (six-digit figure) is entered. However, when you have to adjust the gain according to actual load conditions of the ROIbot, adjust it following the instruction below.

NOTE There are 100 gain settings, 0 to 99. Change the gain setting little by little according to the Robot Type's preset value while checking the ROIbot movement.

- Servo gain (position)
  When high speed response is desired, set the value of the servo gain for positioning to a larger value. Note that if it is set too large, hunting (oscillation) can occur. If this happens, adjust it to a smaller setting. A smaller value will enable smoother movement of the ROIbot, but the positioning time increases with smaller values.

- Servo gain (speed)
  Set the servo gain for speed at a value one lower than the level at which the motor begins to generate small vibration in servolock condition (the motor is stopped with the power ON.)
  When the value is set too large, beat noise will be caused by small vibration of the motor. In this case, set it to a smaller value.
  When the servo gain for speed is too low, low frequency hunting (oscillation) occurs in the motor. In this case, set the gain to a larger value. When the value is set too small, an overflow error can be generated because of the delayed response to a command of the motor.

Discontinue

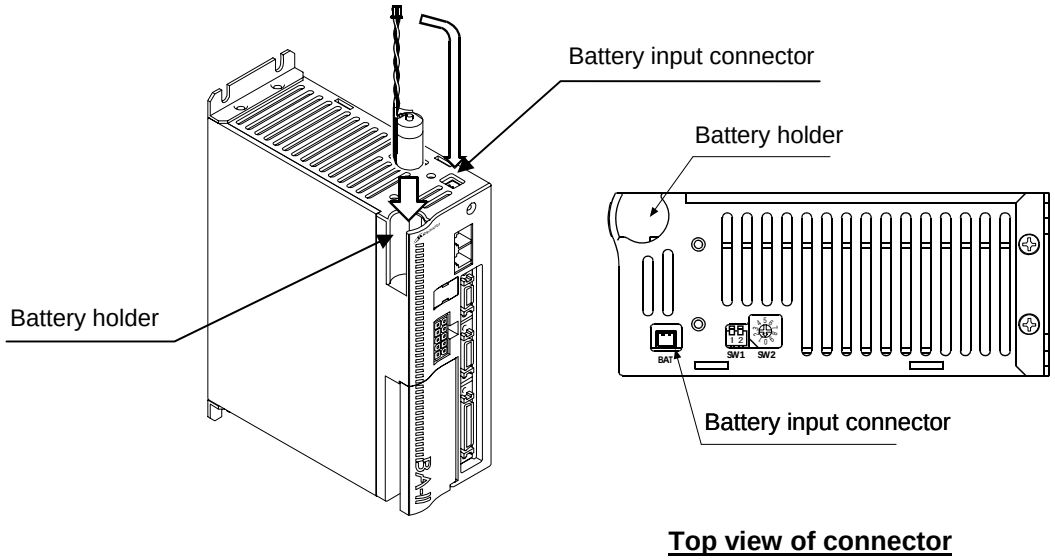
■ 2.4.10 Absolute encoder backup

All AC servomotors with KBB axis mount the absolute encoder. The encoder is backed up with a battery, etc. to constantly monitor the motor operation even when the power to the controller is shut off. This enables smooth starting without the need for return to origin when starting the system or recovering from emergency stop.

NOTE When the encoder type in the parameter (refer to section 13.4.14) is set to the incremental encoder, the absolute function does not operate even if the backup power is connected.

● Installing the lithium battery

One lithium battery for encoder backup comes with each unit of this ROIbot. Put the lithium battery in the battery holder on the top of the controller and connect it to the battery input connector as shown below.

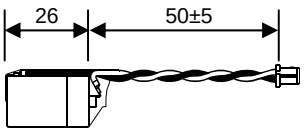


Top view of connector

Install the lithium battery on all controllers.

Discontinue

● Lithium battery specification

Item			Description	Remarks
Part name			Lithium battery	Thionyl chloride lithium battery
Type No.			KCA-20-EB-05	Main unit of battery: ER3V (Toshiba Battery)
Specification	Nominal voltage and capacity		3.6V 1000mAh	
	Outside	Main unit of battery	ϕ14.5 × 26mm (Excluding protrusion)	
		Harness length	50 ±5mm (Excluding connector)	
	Mass		About 10 kg	
Backup duration time **(Note 1)**			About 50,000 hours **(Note 2)**	25°C, backup current 20 μA

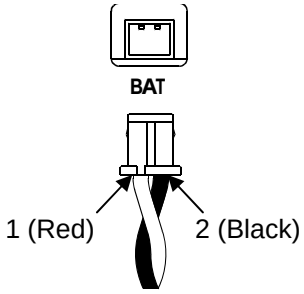
NOTE **(Note 1)** The backup duration time is the cumulative time when the power to the control is off.

(Note 2) The duration time of the battery depends on the temperature, etc. Set the numeric value as a measure of the duration time.

● **Battery input connector signal names and pin Nos**

No.	Signal name	Meaning
1	EBAT	Backup power +
2	EBA0	Backup power –

NOTE If the polarity is mistaken, the backup will not be possible and faults could occur.



● Controller side connector type No.
L header DF3-2P-2DS(01) (Hirose Electric Co., Ltd.)

● Harness side connector type No.
Crimp socket DF3-2S-2C (Hirose Electric Co., Ltd.)
Socket crimp terminal DF3-2428SCFC
(Hirose Electric Co., Ltd.)
[Applicable wire size: AWG22 to 28 (0.33 to 0.1mm^2)]

Discontinue

● **Backup specification**

Item		Specification	Remarks
Backup voltage		3.6VDC (Standard) 6.5VDC (Maximum) 2.5VDC (Minimum)	The controller surface LED flickers at 2.7 VDC or less (voltage drop alarm).
Current consumption	When the controller is not energized	20μA (Standard) 30μA (Maximum)	25°C Up to 2 mA instantaneously
	When the controller is energized	3μA (Standard)	
Maximum response rotation speed during backup		5000min^{-1}	

● **Encoder-related errors**

(1) Battery voltage drop alarm
When the backup power becomes 2.7 V or less, the state LED on the controller surface flickers in green as an alarm. If multiple axes are used, only the LED on the controller with the relevant axis flickers in green. Error output will not turn ON.

(2) Encoder backup error
An encoder backup error occurs in the following cases. Reset input or pressing the [CLEAR] key on the Teach Pendant can clear this error.

- If the power is turned on for the first time after the main unit of axis (motor) is connected to the controller
- If the encoder cable connector is temporarily removed during backup
- If the backup power becomes 2.5 V or less and normal backup cannot be done when the power is not supplied to the controller

(3) Encoder error
An encoder error occurs in the following cases. Turn on the power again. Reset input and pressing the [CLEAR] key on the Teach Pendant cannot clear this error.

- If normal backup cannot be done because the motor rotation speed exceeds 5000 min-I
- If the motor rotation speed exceeds 200 min-I during power on
- If the encoder cable connector is removed or the encoder cable is disconnected while the controller is energized

If an encoder error and encoder backup error occur, the absolute counter value will be unreliable. Thus, the axis movement will be inhibited unless return to origin is carried out. When these errors occur, axis movement will be inhibited unless return to origin is carried out for all axes besides the axis for which the error occurs.

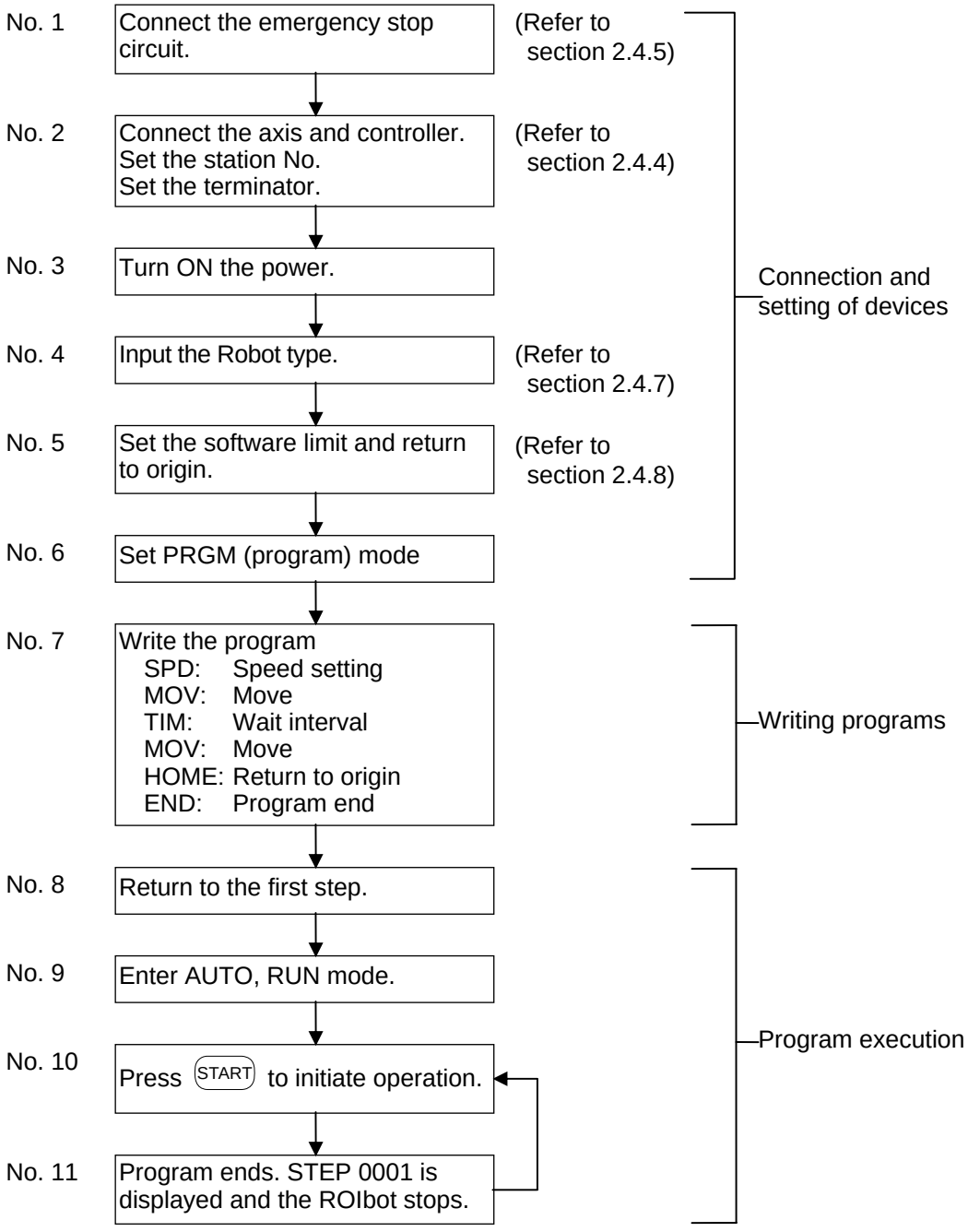


If an encoder error or encoder backup error and other error (emergency stop, etc.) occur concurrently, the error other than the encoder-related errors may be displayed, depending on the order of occurrence. Thus, it may not be apparent that an encoder-related error has occurred. If the error message "RETURN TO HOME NOT COMPLETED!" appears during axis movement after the error is cleared, an encoder error or encoder backup error may have occurred concurrently.

Discontinue

■ 2.5 Moving the ROIbot

Now, let's try moving the ROIbot with a simple program following the flow chart below.



Discontinue

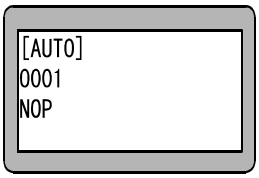
When the software limit is set and Return to Origin movement is completed following the key operation procedures explained in section 2.4.8, the display below is shown. The display indicates that the controller is now in sequential AUTO mode corresponding to the No. 5 stage of the flow chart.
Let's try moving the ROIbot with a simple program.

When writing a program press ENT to move the cursor forward.

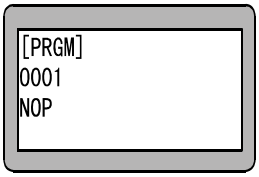
Press the NEXT key to move to the step ahead of the one currently displayed. Press the -NEXT key to move to the step just before the one currently displayed.

NOTE You can enter the data displayed on the screen into the controller by pressing the NEXT or -NEXT key when the display is changed.
Note that the ENT key does not enter data into the controller.

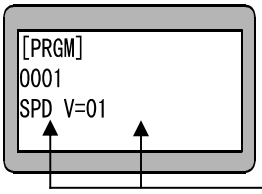
Writing programs



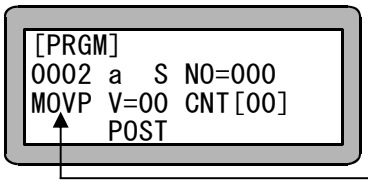
STEP 1 Press the RUN PRGM key to set the program mode.



STEP 2 The screen shows an initial display of PRGM mode.
This is stage No. 6 of the flow chart.

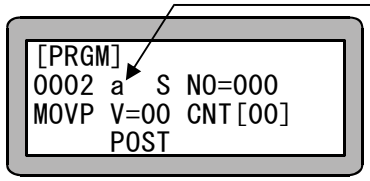


STEP 3 Press the SPD 7 key to select the speed command, then press the ENT key. Input the speed No. 1 with the numeric keypad and press ENT . The speed is now defined.
Press the NEXT key to go to the next step.

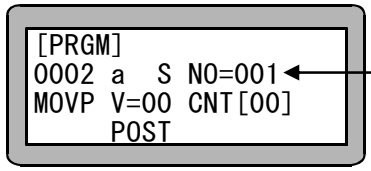


STEP 3A Press the MOV 9 key to select the MOVP command and then press ENT .

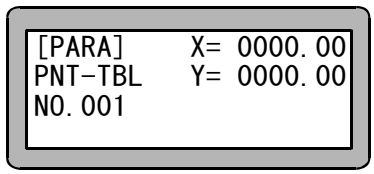
Discontinue



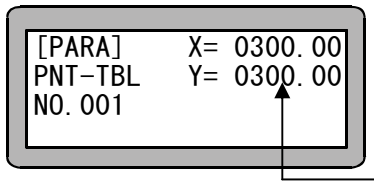
STEP 3B The cursor moves to point a (absolute coordinate), so just press ENT .



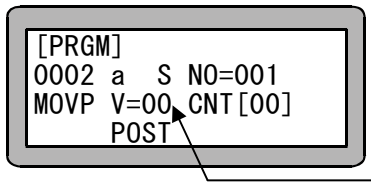
STEP 3C The cursor moves to point table No. position, so use the numeric keypad to enter No. =1 and press ENT .



STEP 3D Next, press F1

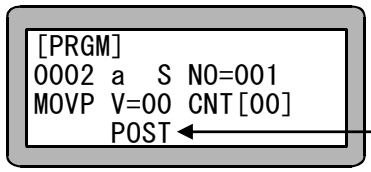


STEP 3E Use the numeric keypad to enter coordinate X=300 and press ENT . Then enter coordinate Y=300 and press ENT .



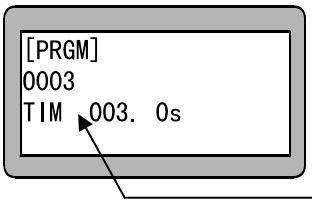
STEP 3F After pressing ESC , press ENT .

The cursor moves to speed No. (V=00). Confirm V=00 and press ENT .



STEP 3G When the cursor moves to POST, press ENT . Programming STEP 3A to STEP 3G sets the MOVP command.

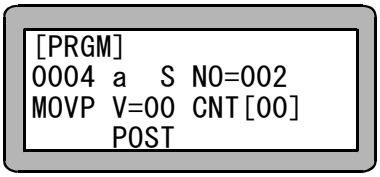
Now, press NEXT to display the next step.

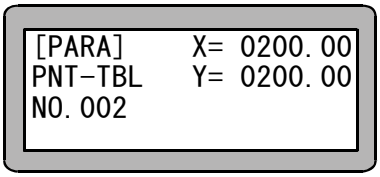


STEP 4 Press TIM 6 to select the TIM command and press ENT . Enter 3 with the numeric keypad and press ENT . This command will make the ROIbot wait for three seconds.

Press NEXT to display the next step.

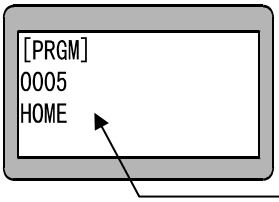
Discontinue





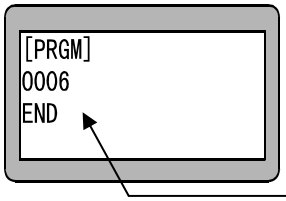
STEP 5

As in STEP 3A to STEP 3H, enter MOVP as shown at left. Here, 2 is input as the point table No., and the coordinate X=200 and Y=200 data is input.
With this command, movement to X=200, Y=200 is set.
Press (NEXT) to display the next step.



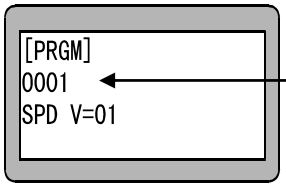
STEP 6

Press (F 1) , (IN 1) and (MOV 9) , select the HOME command, and press (ENT) . The ROIbot will execute Return to Origin.
Press (NEXT) to display the next step.



STEP 7

Press (END 8) .
The command defines the program end.



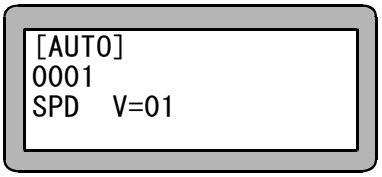
STEP 8

Press (-NEXT) five times and program STEP 0001 will be displayed. This is stage No. 8 in the flow chart.

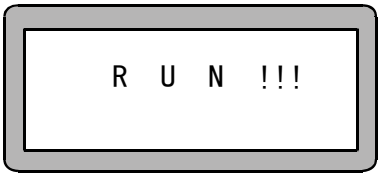
● You have now completed the program.

Discontinue

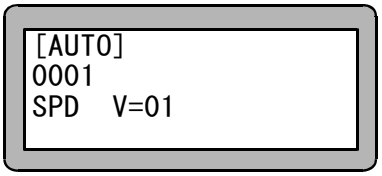
● Program execution



STEP 9 Press (RUN PRGM) to enter the sequential AUTO mode. Now, press (START) .



STEP 10 The program will be executed as it is displayed on the screen.



STEP 11 When program execution ends, program STEP 0001 will be displayed and the ROIbot will stop.

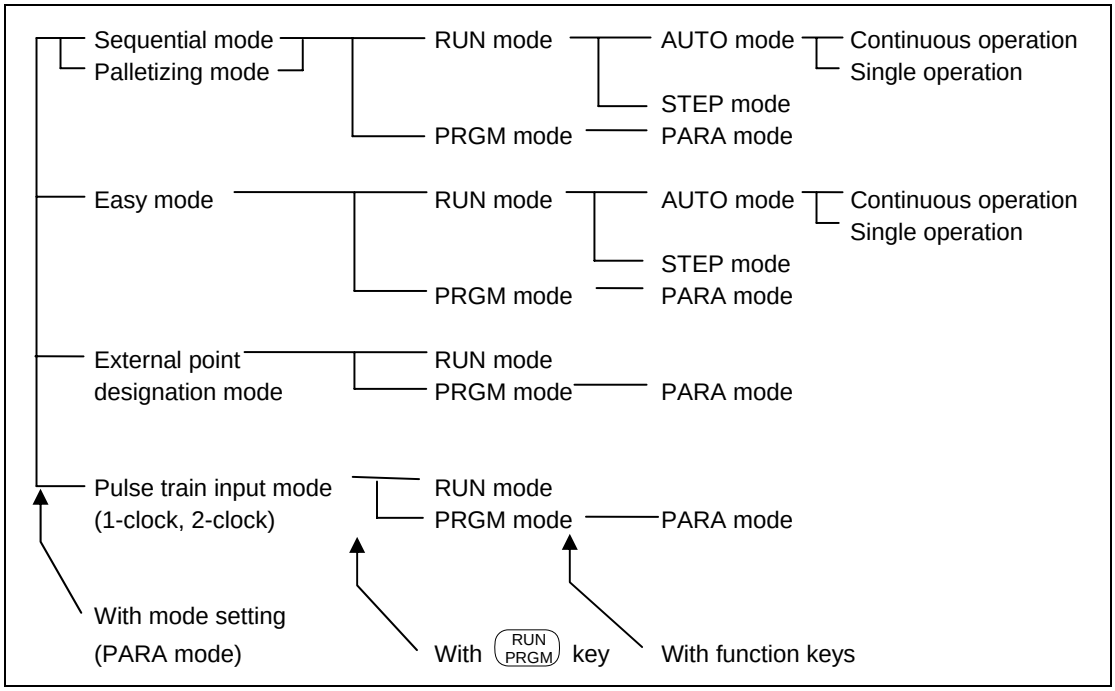
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Chapter 3 General Programming

■ 3.1 Explanation of operation modes

The Electric Actuator is provided with the following types of operation modes.



(1) Sequential mode

The sequential mode is a mode used to execute or program in order of steps. With the sequential mode, the operation program is structured from the beginning, so operations more complex than the easy mode or palletizing mode are possible.
By using multitasking, up to four sequential programs can be executed simultaneously.
Refer to Chapter 4 for details on the sequential mode, and Chapter 5 for details on multitasking.

(2) Easy mode

In the easy mode, after moving with a movement command, the hand operation subroutine is called and the next step to be executed is designated. With pairs of steps, programming and execution can be carried out easily without creating a complex structure.

(3) Palletizing mode

The palletizing is a mode exclusive for moving and loading. In this mode, operation is carried out using a mode program and by inputting matrix information that indicates the movement point and loading state, etc.
The following types of modes are prepared in the palletizing mode.

- 1 to M mode
  Movement from set position (source side: S) to matrix-type point configured with X and Y axes (destination side: D)

Discontinue

M to 1 mode
Movement from matrix-type point configured with X and Y axes (source side: S) to set position (destination side: D)

- M to M mode
  Movement from matrix-type point configured with X and Y axes (source side: S) to matrix-type point configured with X and Y axes (destination side: D)

Refer to Chapter 7 for details on the palletizing mode.

(4) External point designation mode

The external point designation mode does not use the controller's command language. The point table, speed table and acceleration/deceleration table are input beforehand with the Teach Pendant, and by directly designating these tables from an external source with general-purpose inputs, movement takes place.
Refer to Chapter 8 for details on the external point designation mode.

(5) Pulse train input mode

The pulse train input mode is a mode that moves and controls the axis by inputting the pulse that corresponds to the movement amount from an external source. The master unit functions as a pulse train input type servo driver. The movement amount and speed are decided by the No. of pulses and frequency of the pulse generator, by that increasing the real-time feel. However, protective functions for home return operations and soft limit, etc., must all be provided from the external controller.
Refer to Chapter 9 for details on the pulse train input mode.

Discontinue

■ 3.1.1 Explanation of RUN mode

The RUN mode is a mode that operates the robot. The mode can be divided into the AUTO mode and STEP mode. Both the AUTO and STEP modes can be operated in the sequential, easy and palletizing modes.

(1) AUTO mode

By pressing the start key, the program displayed on the Teach Pendant will be executed in order of the step numbers.
Normally continuous operation takes place, but if the single mode setting is validated, when the system input is started or when the Teach Pendant start key is pressed, the I/O input single signal state (ON: single operation, OFF: continuous operation) will be determined. Operation stops and the single operation can be started, after a specific command (axis movement related or output related command) is executed in the sequential mode; directly after movement in the easy mode; and after movement to the S (source side), D (destination side) is completed in the palletizing mode.

(2) STEP mode

When the start key is pressed, one step of the program displayed on the Teach Pendant will be executed, and the operation will stop. To execute the following program, press the start key again.
When multiple tasks are operated using the multitasking function, one step of the task displayed on the Teach Pendant will be executed and then will stop. The other tasks will stop when the step being executed is stopped at the time the displayed tasks have stopped.

Discontinue

■ 3.1.2 Explanation of PRGM mode

The PRGM mode is used to program the various operations for sequential, easy and palletizing modes with the Teach Pendant or to set the point tables for the external point designation mode. The program screen differs for each mode, so follow the cursor that appears on the Teach Pendant and input the data.
Functions handy during programming such as copy, delete and search are provided. Refer to each chapter for details on the operation methods.

● PARA mode

The various parameters related to operation of the robot are set in this mode. These parameter can also be set from the PRGM mode.
There are some parameters that will not be validated until the power is turned OFF and ON after making a setting, and some that will be validated when the PARA mode is quit. Follow the screen displayed on the Teach Pendant and input the data.

Discontinue

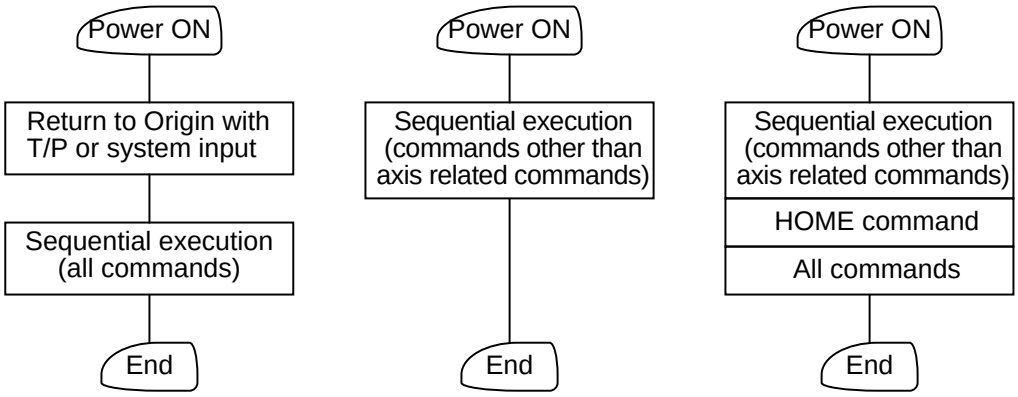
■ 3.1.3 Return to Origin

In the sequential RUN mode, if the absolute encoder is being used, the program can be executed without Return to Origin unless recovering from an encoder related error (NOTE).
When using the incremental encoder, the commands other than the axis related commands (MOVP, MVB, MVE, MVM,) will execute the program even without the Return to Origin, so if the program is programmed to execute a HOME command before the axis related command is executed, Return to Origin will not be required by pressing the HOME key or inputting Return to Origin before the program is executed.

(Note) Errors requiring Return to Origin even when absolute encoder is used.
- DRIVER ENCODER ERROR
- ENCODER BACKUP ERROR
- ENCODER CHANGEOVER ERROR
  (Refer to Chapter 19 Error Messages for details.)

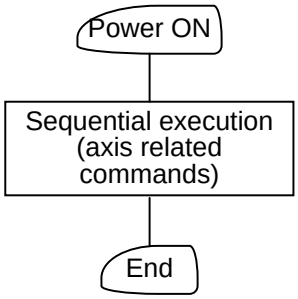
● Operation possible

(using an incremental encoder)



● Operation not possible

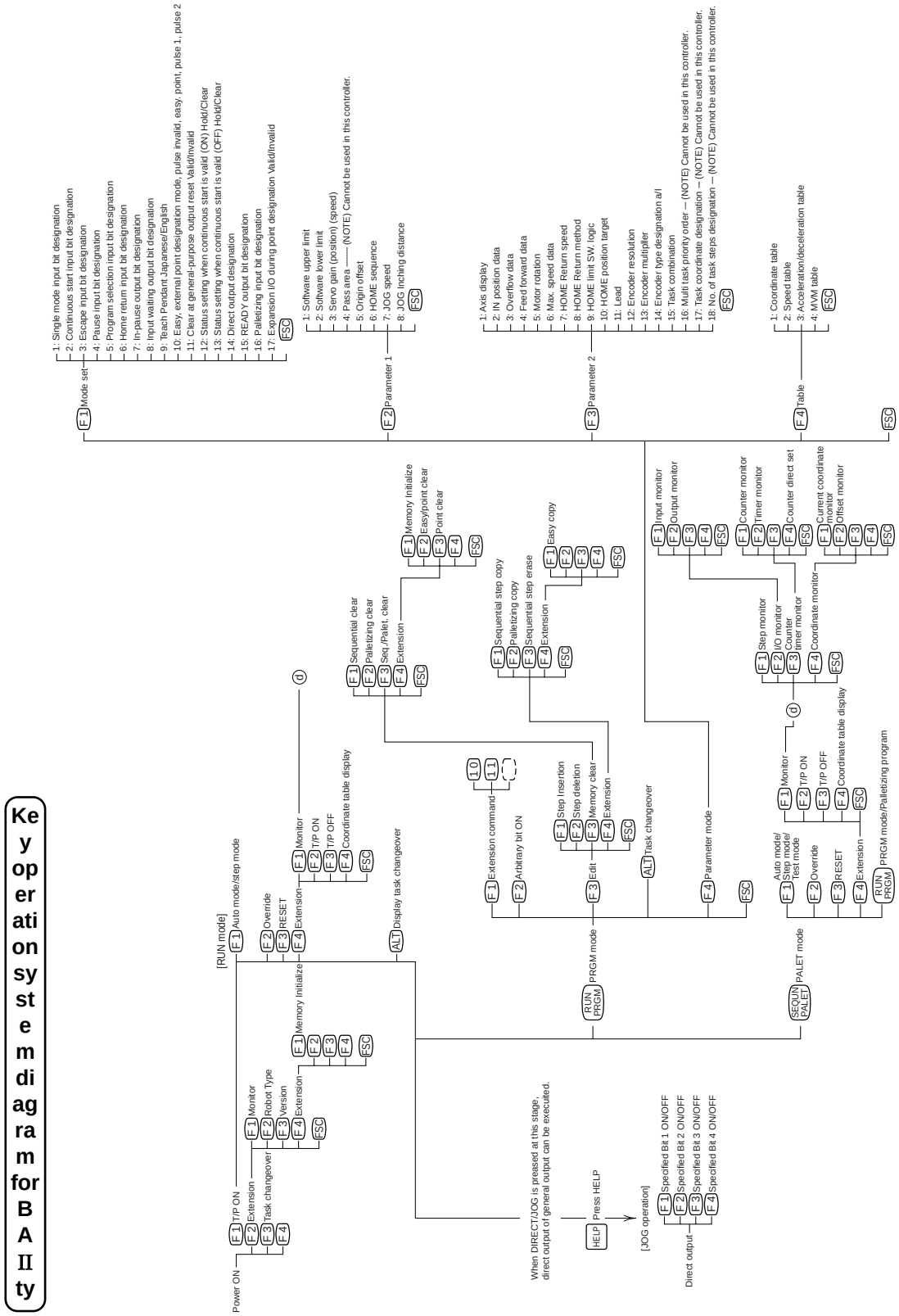
(using an incremental encoder)



Discontinue

■ 3.2 General programming

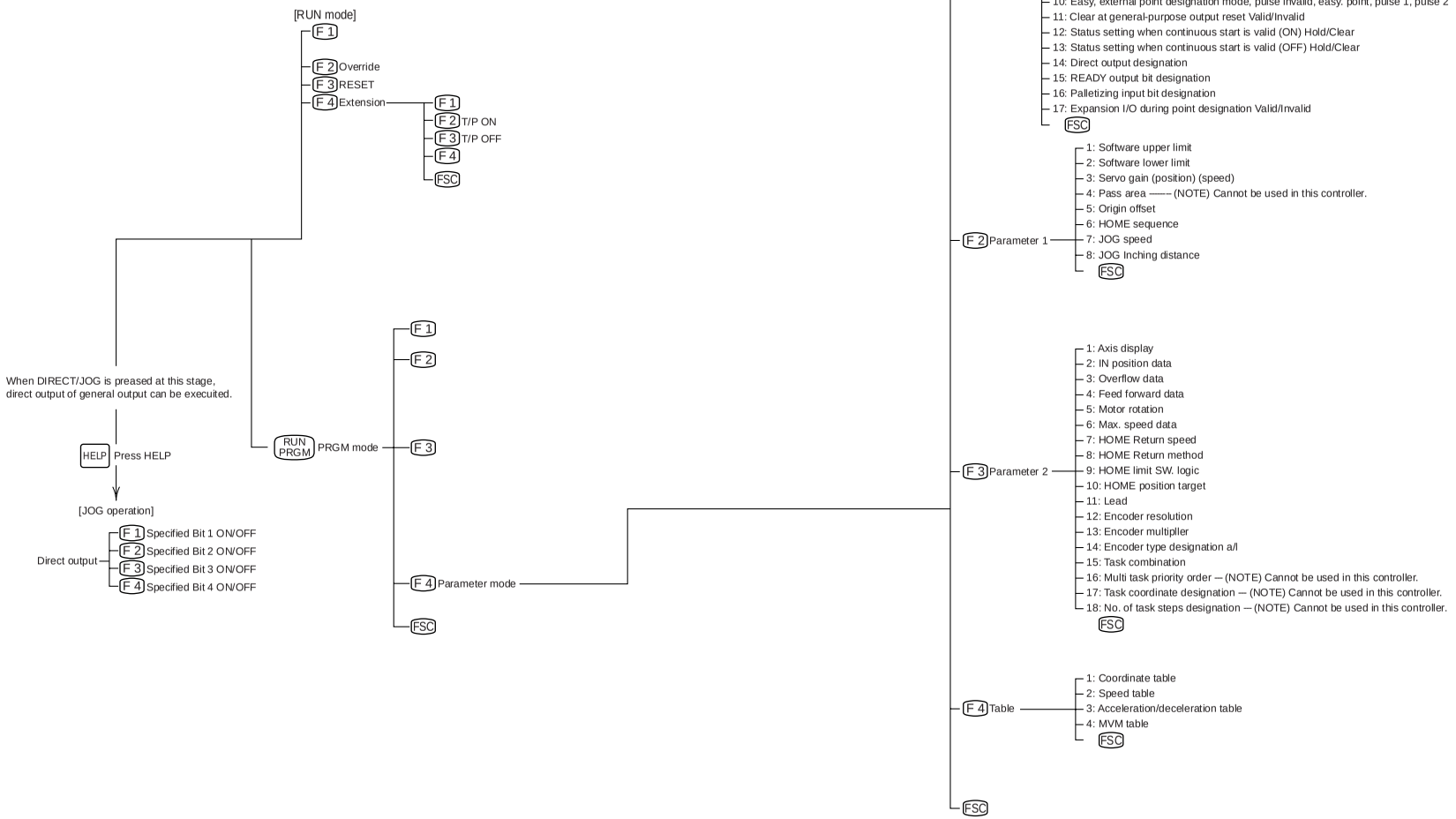
The operation system diagrams of the Teach Pendant in each mode are shown in this section.



Discontinue

Key operation system diagram for easy mod

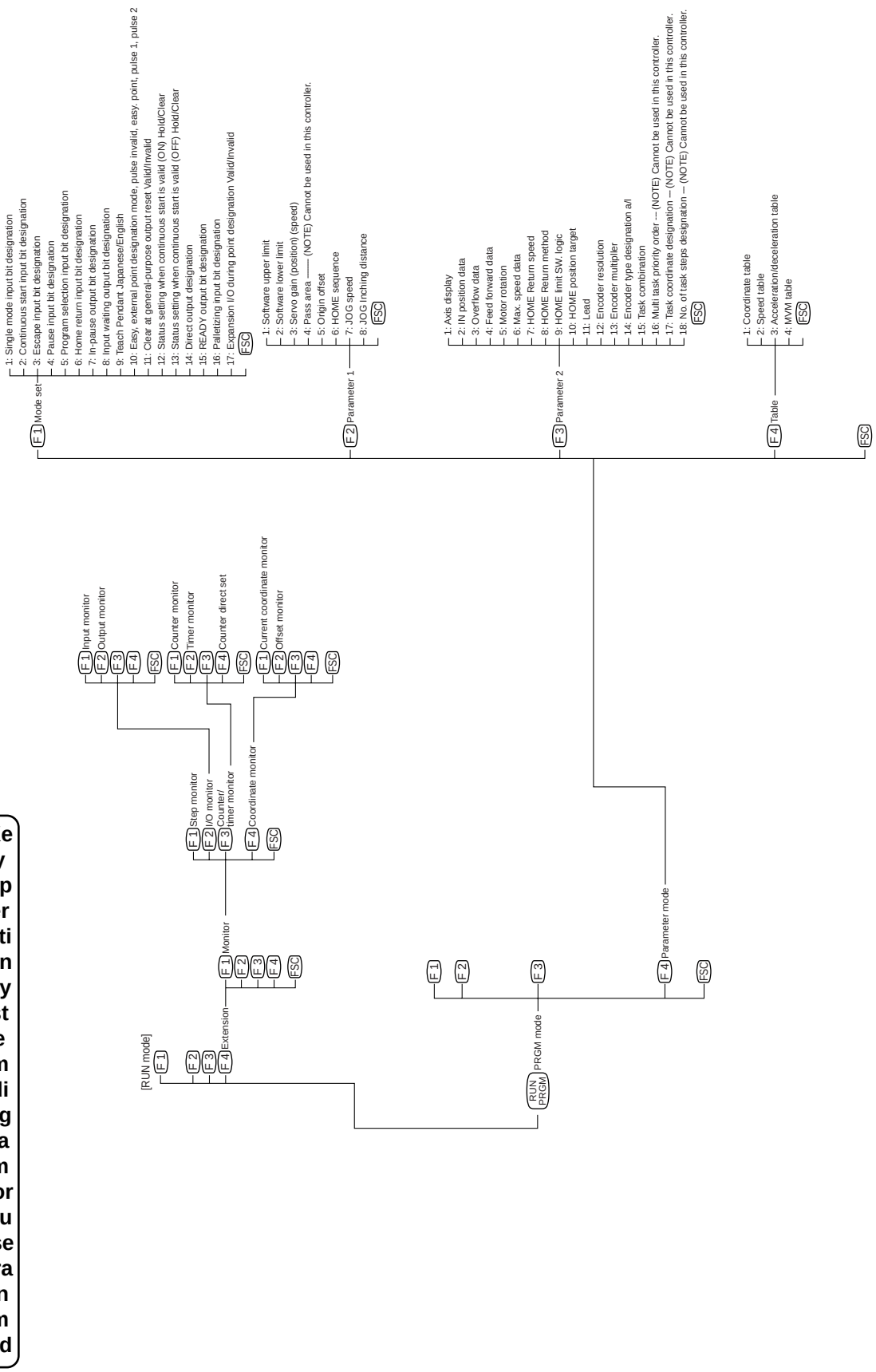




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Discontinue

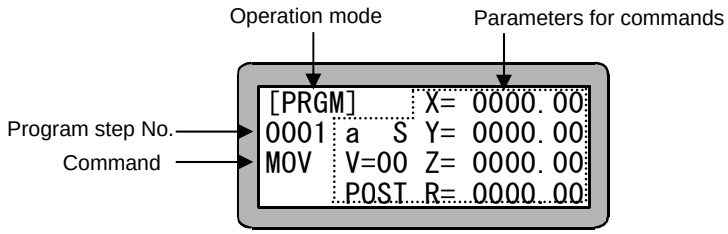
Key operation system diagram for pulse train mod



Discontinue

■ 3.2.1 Basic programming

This section explains basic Electric Actuator programming, using examples of a Teach Pendant display. The following illustration shows a display of sequential mode in PRGM (program) mode.



NOTE In programming single-axis Electric Actuator operation, enter only the X axis (1st axis) coordinate. If you enter the Y axis coordinate, it is ineffective.

● Operation mode

The mode selected by the Teach Pendant is displayed. [PRGM] is displayed for PRGM mode, and [RUN] is displayed for RUN mode.
In case of KCA-TPH-2A, when PRGM mode is selected, a green indicator lights, when AUTO mode is selected, a red indicator lights and when STEP mode is selected, a red indicator blinks.

● Program step No.

A maximum of 2,000 steps can be written in the sequential mode. The next step of the currently displayed step can be shown by pressing the NEXT or -NEXT key. In case of KCA-TPH-2A, note that one command may be displayed in two successive screens. When two successive screens are used for the display of a step, an open parenthesis "(" appears on the front screen and a close parenthesis ")" appears on the second screen. Thus, the first and second screens for the command display can be identified.

● Commands

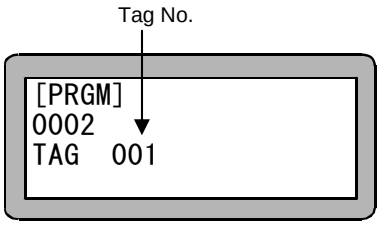
Various commands are selected by pressing the command key, function key or numeric keypad. The command is then written by pressing ENT .

● Parameters for commands

When a command is being written, the cursor automatically moves to a field where a parameter should be entered. Write the parameter and press ENT .

Discontinue

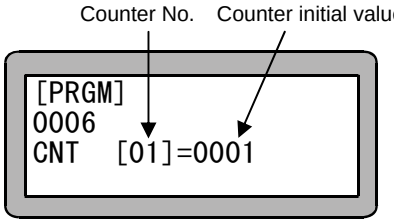
● **Tag No.**



In sequential mode, the tag No. (1 to 999) can be written in steps from No. 0001 to No. 2000. Tag Nos. have the following uses:

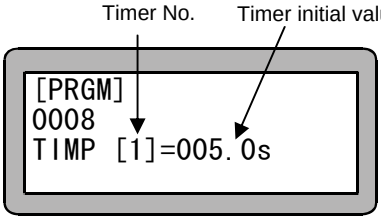
(1) Designating the step to jump to in a JMP command.
(2) Fetching a subroutine. Enter a tag No. at the beginning of a subroutine, then you can fetch it by using a subroutine call command. To end a called subroutine, enter RET.
(3) Selecting a program No. A tag No. (1 to 8) can be selected by PSEL (program selection) command as a program No.

● **Counter**



A counter (01 to 99) is a type of variable. Counter contents can be added or subtracted in a rate of 0 to 9999. In the above example, counter No. 01 is defined at step 0006, and the counter initial value is set to 1.

● **Timer**



Four timers can be used to count time. The maximum value is 999.9 seconds. In the above example, timer No. 1 is used at program step No. 0008, and a 5-second wait is set.

Discontinue

■ 3.2.2 Position data input

The following three methods can be used to input the position data for the coordinate table (used in the sequential mode, external point designation mode), easy mode and palletizing mode.

(1) Remote teaching

When you are programming while the Electric Actuator is in servo-lock, use this method to move the Electric Actuator to the desired location.

(2) Direct teaching

With this method, the servo lock is released during programming, and the position is directly taught by the operator directly moving the robot arm to the required position.
If the axis is provided with brakes, the brakes will be applied during the servo-free state, so direct teaching is not possible.

(3) MDI (Manual Data Input)

Use the Teach Pendant keys to enter the coordinates of the desired location.

The teaching methods will be described below using the Teach Pendant displays.

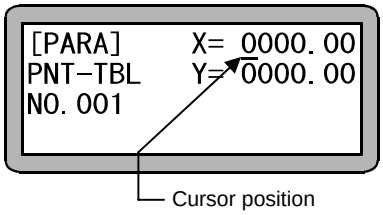
(In the coordinate tables, easy mode and palletizing mode, the screens for entering the position data will differ. The screens in each mode will be used for explanations, but the operation methods are the same. For the palletizing mode, the M to M screen is used as an example.)

Discontinue

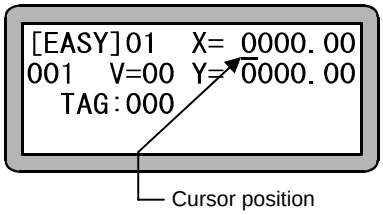
(1) Remote teaching procedures

Remote teaching procedures of the position data are given below. These procedures can be executed during programming in PRGM mode.

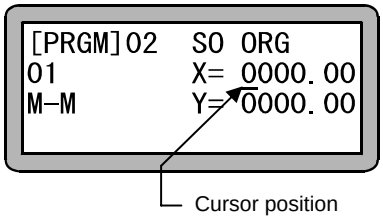
[Coordinate table input screen]



[Easy mode coordinate input screen]



[Palletizing mode coordinate input screen]



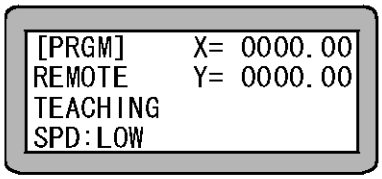
STEP 1 Move the cursor to the position shown at left, and press DIRECT JOG .

NOTE

- When the cursor is not located at the position shown in the above display, remote teaching cannot be executed.
  When DIRECT JOG is pressed when the cursor is not located at the position shown in the above display, jog operation to only move the axis will take place. (Refer to section 17.5.)
- If Return to Origin has not been executed before DIRECT JOG is pressed, an error alarm sounds and remote teaching mode cannot be entered.

Discontinue

[Common screen]



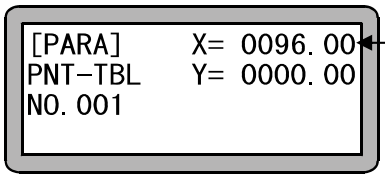
STEP 2

Remote teaching screen is displayed and JOG operation can be executed in remove teaching mode.
Toggling of speed operation can be executed by pressing ALT .
LOW (low speed) and HIGH (high speed)

NOTE

- Movement of the axes in JOG operation is done by pressing the +1 and -1 keys for the first axis and the +2 and -2 keys for the second axis. If the key is a plus key, the axis will move in the direction opposite the origin while the key is held down, and if it is a minus key will move in the direction of the origin.
- The JOG operation speed can be set with the JOG speed in parameter 1. (Refer to section 13.3.7.)
- Inching movement in JOG operation can be performed by pressing and quickly releasing the MOVE keys (+1 -1 +2 -2). The distance of an inching movement can be set by JOG increment of parameter 1. (Refer to section 13.3.8.)

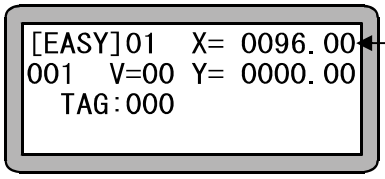
[Coordinate table input screen]



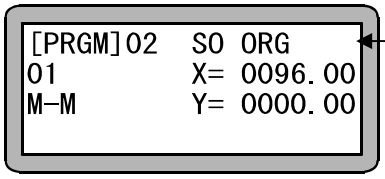
STEP 3

For example, hold down +1 until the controller moves to an appropriate point. Then, release the key to stop the axis and press ENT . The current coordinates will be entered.

[Easy mode coordinate input screen]



[Palletizing mode coordinate input screen]

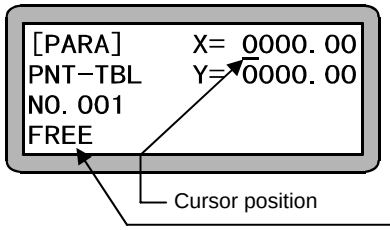


Discontinue

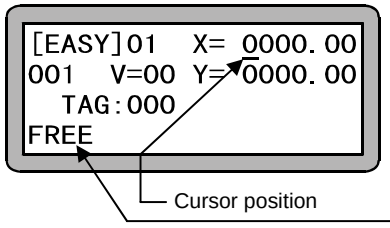
(2) Direct Teaching Procedures

The method to carry out direct teaching of the position data in the PRGM mode is described below.

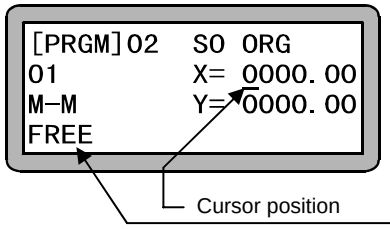
[Coordinate table input screen]



[Easy mode coordinate input screen]



[Palletizing mode coordinate input screen]



STEP 1

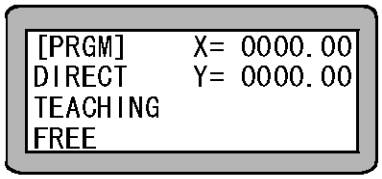
Press (FREE LOCK) and the "FREE" will be displayed. The axis will be in servo-free condition. Move the cursor to the point shown at left and press (DIRECT JOG) .

NOTE

- When the cursor is positioned at a point other than the one shown in the display above, Direct Teaching cannot be executed.
- The axis provided with brakes will be stopped when the (FREE LOCK) key is pressed.
- If Return to Origin has not been executed before the (DIRECT JOG) key is pressed, an error alarm sounds and Direct Teaching mode cannot be entered.

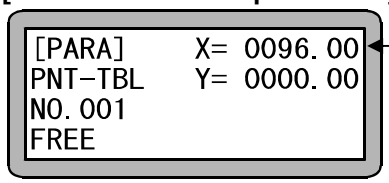
Discontinue

[Common screen]

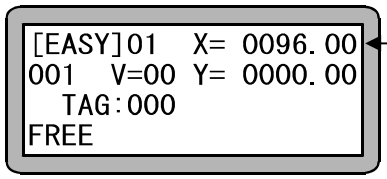


STEP 2 Direct Teaching screen is displayed and Direct Teaching can be executed.

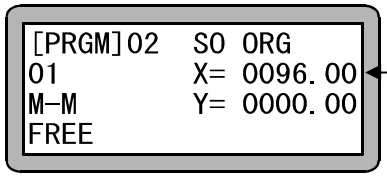
[Coordinate table input screen]



[Easy mode coordinate input screen]

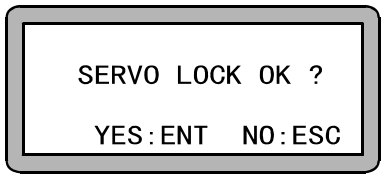


[Palletizing mode coordinate input screen]



STEP 3 Move the axis manually to a desired position and press (ENT) . The current coordinates will be entered.

[Common screen]



STEP 4 Press (FREE LOCK) to release the servo-free condition, and the display at left will appear. Then, press (ENT) and the axis will be servo-locked. When (ESC) is pressed, the display returns to STEP 3.

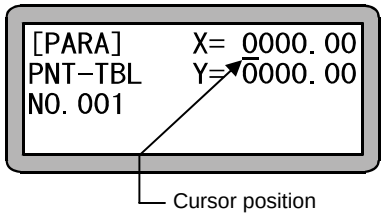
NOTE Direct teaching cannot be used with an axis equipped with a brake, because the brake will be activated in servo-free condition. Use Remote Teaching for an axis equipped with brakes.

Discontinue

(3) MDI (Manual Data Input) method

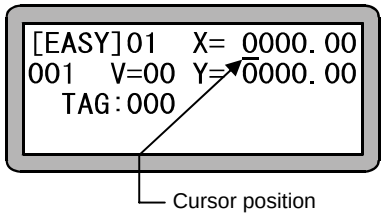
The method to teach the position data in the PRGM mode with MDI is described below.

[Coordinate table input screen]

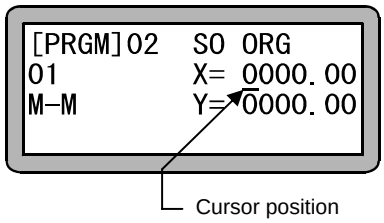


STEP 1 Move the cursor to the point shown at the left, enter the set coordinates with the numeric keypad, and press ENT .

[Easy mode coordinate input screen]

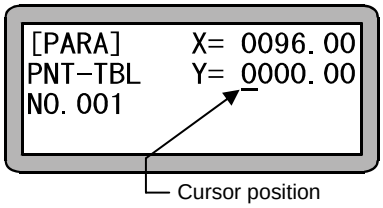


[Palletizing mode coordinate input screen]



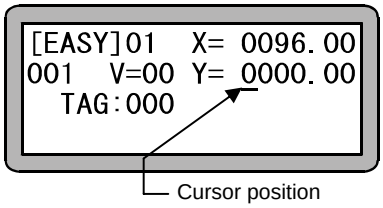
Discontinue

[Coordinate table input screen]

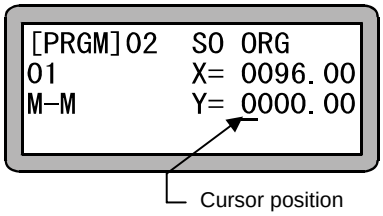


STEP 2 Move the cursor to the point shown at the left, enter the set coordinates with the numeric keypad, and press ENT .

[Easy mode coordinate input screen]



[Palletizing mode coordinate input screen]



NOTE Surely set the coordinate value within the stroke of the axis being used.

Discontinue

■ 3.2.3 Memory Clear (Initialization)

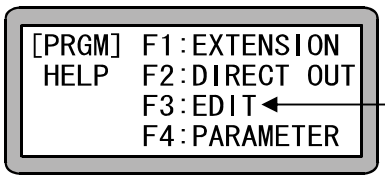
- The memory in the controller that stores the programs and parameters can be initialized (cleared).

NOTE When the memory is initialized, the various parameters in the memory will be initialized, and the sequential, palletizing and easy mode programs will all be cleared.

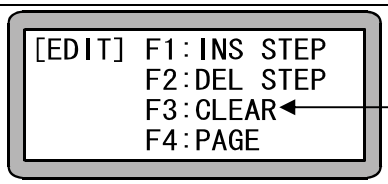
- The memory can be initialized by operations from the PRGM (program) mode or by not turning ON the Teach Pendant (T/P).

(1) Method to initialize the memory from the PRGM (program) mode

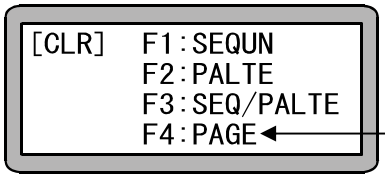
Enter the PRGM (program) mode and press HELP . The following will display. (Refer to section 4.1.1.)



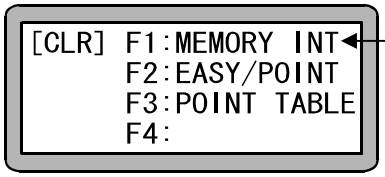
STEP 1 Press F3 in this state.



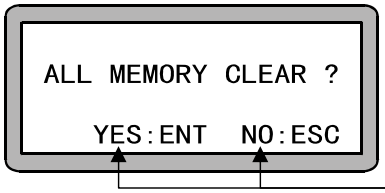
STEP 2 When F3 is pressed, the clear mode will be entered. Press ESC to return to the initial screen of the program mode.



STEP 3 To initialize the entire memory press F4 . Press ESC to return to the previous screen.

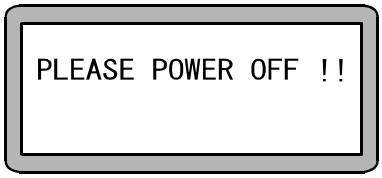


STEP 4 Press F1 in this state.



STEP 5 To clear the memory, press ENT , and to not clear the memory press ESC .

Discontinue



STEP 6 Follow the instructions on the screen, and turn the controller power OFF.

NOTE

- After the memory is initialized, the robot type "510100" (single axis specifications) parameter will be set. When using a type other than "510100", set the robot type again. Moreover, the task combination is initialized as follows.

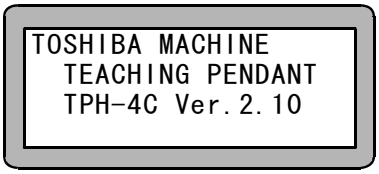
A0	A1	A2	A3
[1]	[0]	[0]	[0]

- Refer to the Instruction Manual (Axis Installation Section) for how to set the robot type.

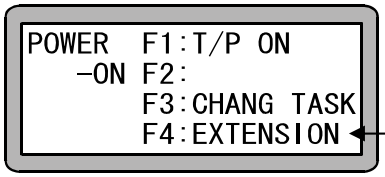
Discontinue

(2) Method to initialize the memory without turning the Teach Pendant ON (T/P ON) after turning the power ON

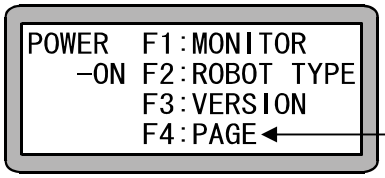
The memory of the Electric Actuator can be initialized without turning the T/P ON (validating the Teach Pendant) after the main power is turned ON. Use this method when an error occurs and the memory cannot be initialized from the PRGM (program) mode.



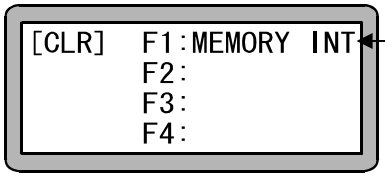
STEP 1 Turn the power switch ON.
The initial screen will display for two seconds.



STEP 2 After the initial screen ends, the following screen will display.
Press F4 .



STEP 3 Press F4 .
Press ESC to return to the display of STEP 2.



STEP 4 Press F1 in this state.

The following steps are the same as STEPS 6 and 7 on the previous page.

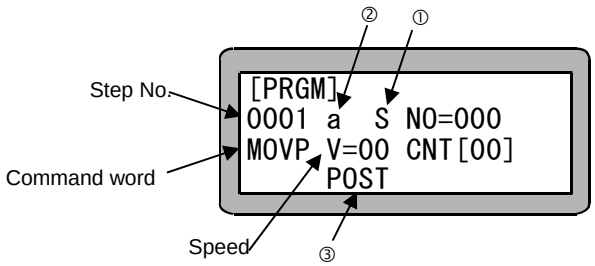
Discontinue

■ 3.2.4 MOV system command words and parameters

The MOV system commands and their parameters which can be used on the machine are herein described.
If any of the MOV system commands is commanded, the relevant axis will be moved as commanded, and there are 5 kinds of the commands as follows.

MOVP	Linear interpolated movement (coordinate table assignment)
MVB	Last position movement (return to the last position)
MVE	Escape movement
MVM	Palletizing movement
HOME	Return to origin

For the using method of the command words, refer to "Chapter 18 Commands".
To input MOV system command (excluding HOME), input Parameters as shown below.



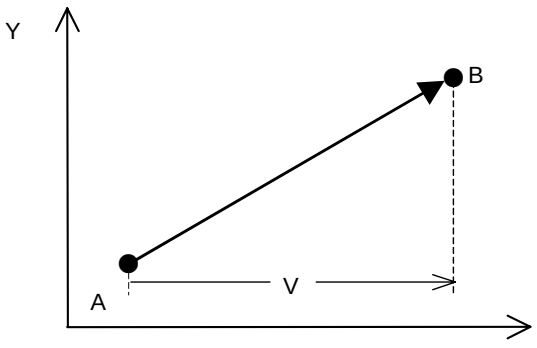
①: Axial speed (S) and linear speed (T)
②: Absolute coordinate position (a) and relative coordinate position (i)
③: Position (POST) and pass point (PASS)

The method to use ① through ③ is hereafter described.

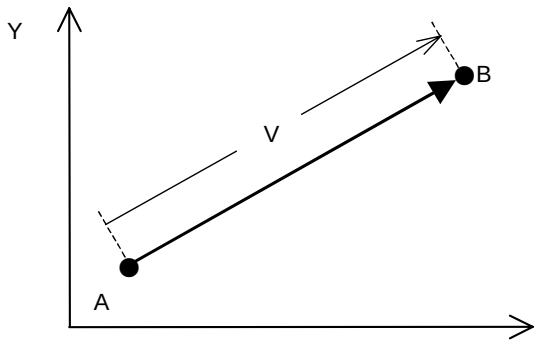
①Axial speed (S) and linear speed (T)

For the movement from Point A to Point B as shown below, the X-axis speed of the longest movement stroke is instructed as the speed V when the axial speed (S) is selected, and the axis composed speed is instructed as the speed V when the linear speed (T) is selected.

However, if any axis exceeds the maximum speed set by the parameter, the movement speed of the axis will be at the maximum speed, and the other axes will move at such speeds as all axes simultaneously arrive at the target position.



Axial speed (S)

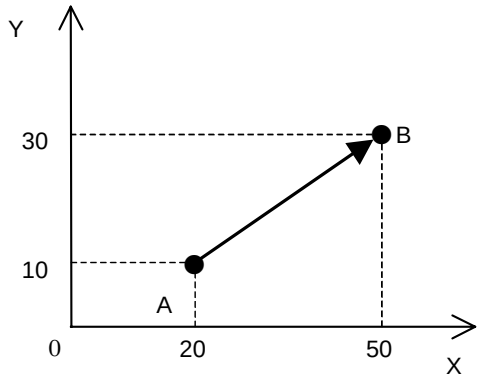


Linear speed (T)

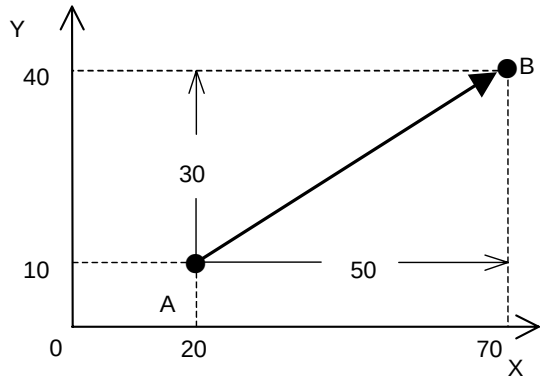
Discontinue

②Absolute coordinate position (a) and relative coordinate position (i)

When the absolute coordinate position (a) is selected, the target position becomes the coordinate position according to the origin point (coordinate X=0, Y=0). When the relative coordinate position (i) is selected, the target position becomes the relative movement amount from the axis position at the time of the command execution start. For example, when the current position is Point A (coordinate X=20, Y=10) and the movement amount is X=50, Y=30, the target position of Point B becomes as shown below.



Absolute coordinate position (a)



Relative coordinate position (i)

NOTE

- When OFS command is used, the absolute coordinate position is gained by adding the amount which is set with OFS command.
- The relevant coordinate position movement during the MOVP or MVE commands will be the relative movement from the axis position when the execution of that command starts.
- When the first axis movement after the axis stops due to an error during the axis movement command is designated as a relative coordinate position, the movement will be relative from that coordinate position and will not be the commanded start position before the error occurred.
- In the same manner, if an absolute encoder axis is connected, and the first axis movement after the axis stops due to the power being turned OFF and ON during execution of an axis movement command is designated as a relative position, the movement will be relative from that coordinate position and will not be the commanded start position before the power was turned OFF.

Discontinue

③Position (POST) and course (COSE)

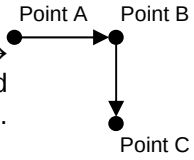
If a position (POST) is selected for movement to a target position on the way when consecutive MOV system commands are executed, control waits at the target position until robot positioning is completed, and moves to the next point when the positioning is completed.

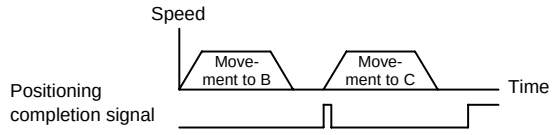
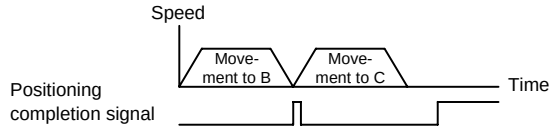
If a course (COSE) is selected, control moves to the next point without waiting for the completion of robot positioning.

Robot tact time can be reduced by using a course (COSE) in operation which does not need to wait for an exact position.

Examples of operation

If the robot moves as shown in the figure on the right, point A → point B → point C, the operation differs between when a position (POST) is selected for the point B and when a course (COSE) is selected for the point B. The operations are as shown below.



Move command to the point B	Operation
Position (POST)	
Course (COSE)	

Discontinue

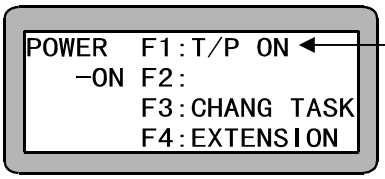
Chapter 4 Sequential Mode

■ 4.1 Sequential PRGM mode

Sequential programs are structured of a command words written in as series of steps.

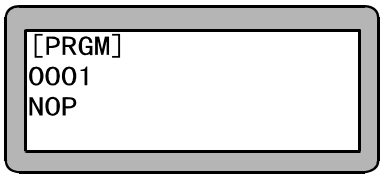
■ 4.1.1 How to enter and leave PRGM (program) mode

The PRGM mode is used for programming, setting parameters, and for controlling direct output. The method for entering and leaving the PRGM mode (sequential mode) will be described in this section.



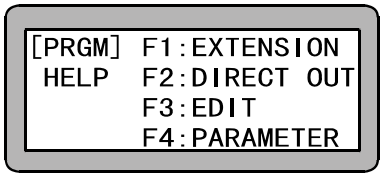
STEP 1

Turn the power ON. When the display shown at left appears after the initial screen, press F1. Then press RUN PRGM to enter PRGM mode.
Refer to section 5.3.2 (1) when the task must be changed with multitasking.



STEP 2

A program can now be written. Press NEXT or -NEXT until the desired step is displayed. To set parameters and edit the program, press HELP to display the screen in STEP 3.
When RUN PRGM is pressed, the program editing will end, and the AUTO mode will be entered.



STEP 3

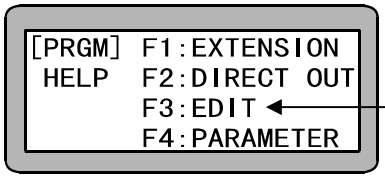
From this step, it is possible to input the extension command, control the direct output, edit the program and set various parameters.
Press ENT to display the next screen.
Press ESC to return to STEP 2.

Discontinue

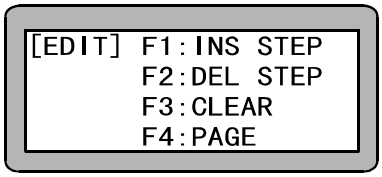
■ 4.1.2 Editing of steps in sequential program

● In sequential programming, steps can be inserted or deleted either individually or as a block.

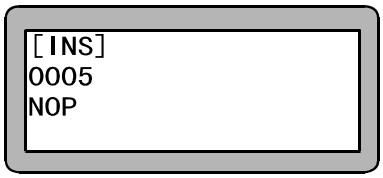
Individual step deletion/insertion
First, define the program step No. to be inserted or deleted, and display it on the screen. Refer to section 15.1 for details on searching for the step No. Insert the new step before the displayed step and move down the remaining program steps in the controller's memory. For a deletion, erase the target step and move up all successive steps in memory. Press HELP in program mode to show the following display. (Refer to section 4.1.1.)



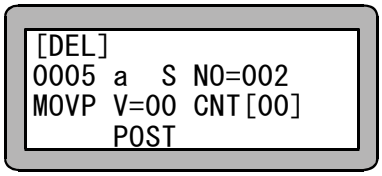
STEP 1 Press F3 .



STEP 2 To insert a step, press F1 .
Press F2 to delete a step.
To return to the initial screen in the PRGM mode, press ESC .



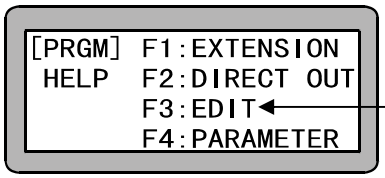
STEP 3A In inserting a new step, the instruction field will indicate a NOP instruction. When successive insertion is necessary, press F1 again.
Press ESC to return to PRGM mode after the insertion.



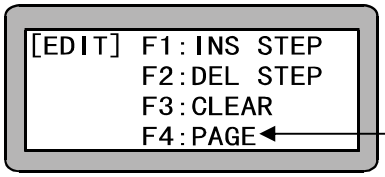
STEP 3B When a step is deleted in delete mode, all successive steps are moved up. When successive deletions are necessary, press F2 again.
Press ESC to return to PRGM mode after the deletion.

Discontinue

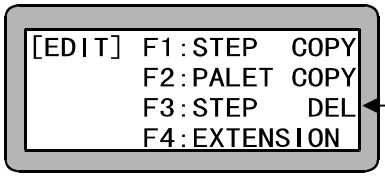
● In sequential programming, a series of steps can be deleted in a block.
To delete a block, set the program mode and press HELP . The following display will appear. (Refer to section 4.1.1.)



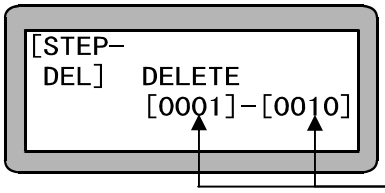
STEP 1 When this instruction appears, press F 3 .



STEP 2 Press F 4 .
To return to the initial screen in the PRGM mode, press ESC .



STEP 3 Press F 3 .
To return to STEP 2, press ESC .

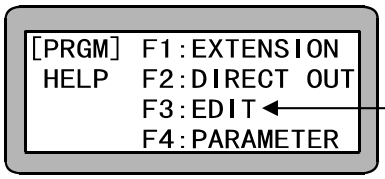


STEP 4 Use the numeric keypad to enter the Nos. of the first and last steps to be deleted.
Press ENT . NOP instructions are indicated for all steps deleted, and the program returns to STEP 3. Pressing ESC returns the display to STEP 3.

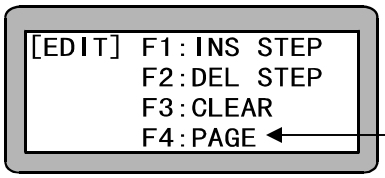
Discontinue

■ 4.1.3 Copy editing of sequential programs

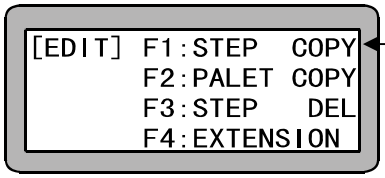
A series of steps can be copied in a block from one program and entered into another.
Set the program mode and press (HELP) . The following display will appear. (Refer to section 4.1.1.)



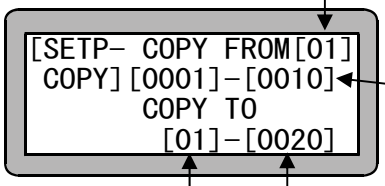
STEP 1 When this instruction appears, press (F 3) .



STEP 2 Press (F 4) . Press (ESC) to return to the initial screen of the program mode.



STEP 3 Press (F 1) . Press (ESC) to return the display to STEP 2.



STEP 4 Use the numeric keypad to enter the task No. of the copy origin program. (Input range: 01 to 04)

STEP 5 Use the numeric keypad to enter the first and last steps of the copy origin.

STEP 6 Use the numeric keypad to enter the task No. of the copy designation program. (Input range: 01 to 04)

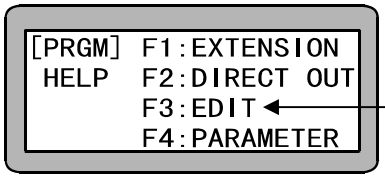
STEP 7 Next use the numeric keypad to enter the copy destination step and then press (ENT) .
Copy will be executed, and the program will return to STEP 3.
Press (ESC) to return the display to STEP 3.

NOTE
- When program steps in which tag Nos. are written are copied, the tag No. in the smaller step No. or the smaller tag No. will be effective after copying.
- To prevent a double tag error, change the tag Nos. after copying.

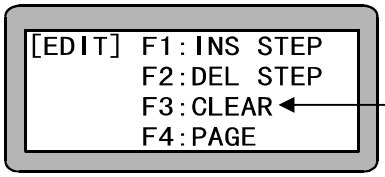
Discontinue

■ 4.1.4 Clearing of sequential programs

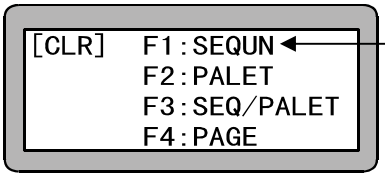
All of the sequential programs in the controller memory can be cleared (all steps can be returned to NOP).
For multitasking, the program of the currently displayed task will be cleared. Change the task before carrying out the following steps. (Refer to section 5.3.2 (1).)
Enter the PRGM mode and press HELP . The following screen will display (Refer to section 4.1.1.)



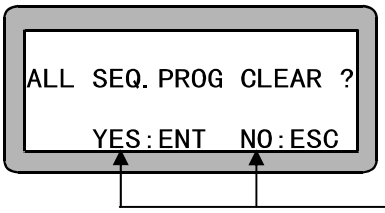
STEP 1 Press F3 in this state .



STEP 2 When F3 is pressed, the clear mode will be entered. Press ESC to return to the initial screen of the program mode.



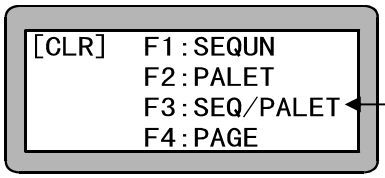
STEP 3A To clear the sequential program alone, Press F1 .
Press ESC to return to STEP 2.



STEP 4A To clear the program, press ENT . To not clear the program, press ESC .

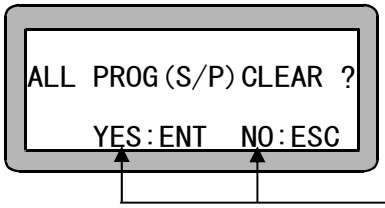
Discontinue

The sequential program and palletizing programs can be cleared in a batch. The sequential program that can be used from the palletizing program is the main task (task No.1), so the programs of tasks other than the main task will not be cleared with this operation.
In this case, press F 3 at STEP 2, and display the following screen.



STEP 3B

Press F 3 . Press ESC to return to the previous screen.



STEP 4B

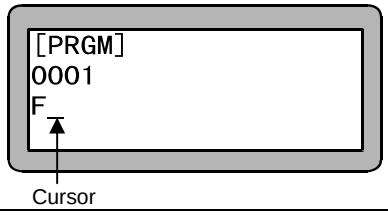
To clear the program, press ENT . To not clear the program, press ESC .

Discontinue

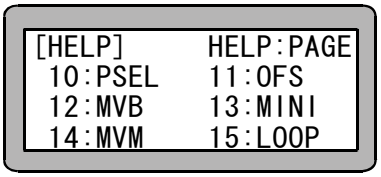
■ 4.1.5 HELP function in entering a command

When function keys are used to enter a command in PRGM mode, pressing HELP displays the input number of each command.

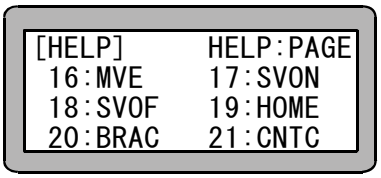
Press F 1 . The following display appears:



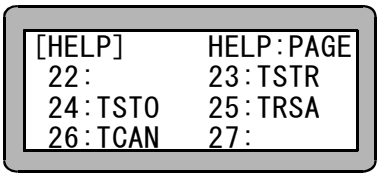
STEP 1 Press HELP when this display is shown.



STEP 2 Press HELP again, when the command to be entered is not shown.



STEP 3 Press HELP again when the command to be entered is not shown.



STEP 4 See the input number of the command to be entered. Pressing HELP returns to STEP 2. Press ESC to return to STEP 1 and use numeric keypad to input the input number.

Discontinue

■ 4.1.6 Method to restart operation of sequential mode after turning power OFF

With this Electirc Actuator, even if the power is turned OFF, the program can be restarted from the step where the program was stopped when the power was turned OFF. However, this is only limited to when the program was stopped with the Teach Pendant or by inputting stop with the system before the power was turned OFF.
Refer to section 10.2.6 for details on the data, etc., that is held until the program is restarted.
This function can also be used to restart operation that has been stopped with emergency stop input.

Use the following procedure to restart the operation.

(1) Designate the restart input bit in the mode setting with the Teach Pendant.

(2) When the power is turned OFF and then ON again in the state with restart ON, the operation can be restarted after return to origin is completed.

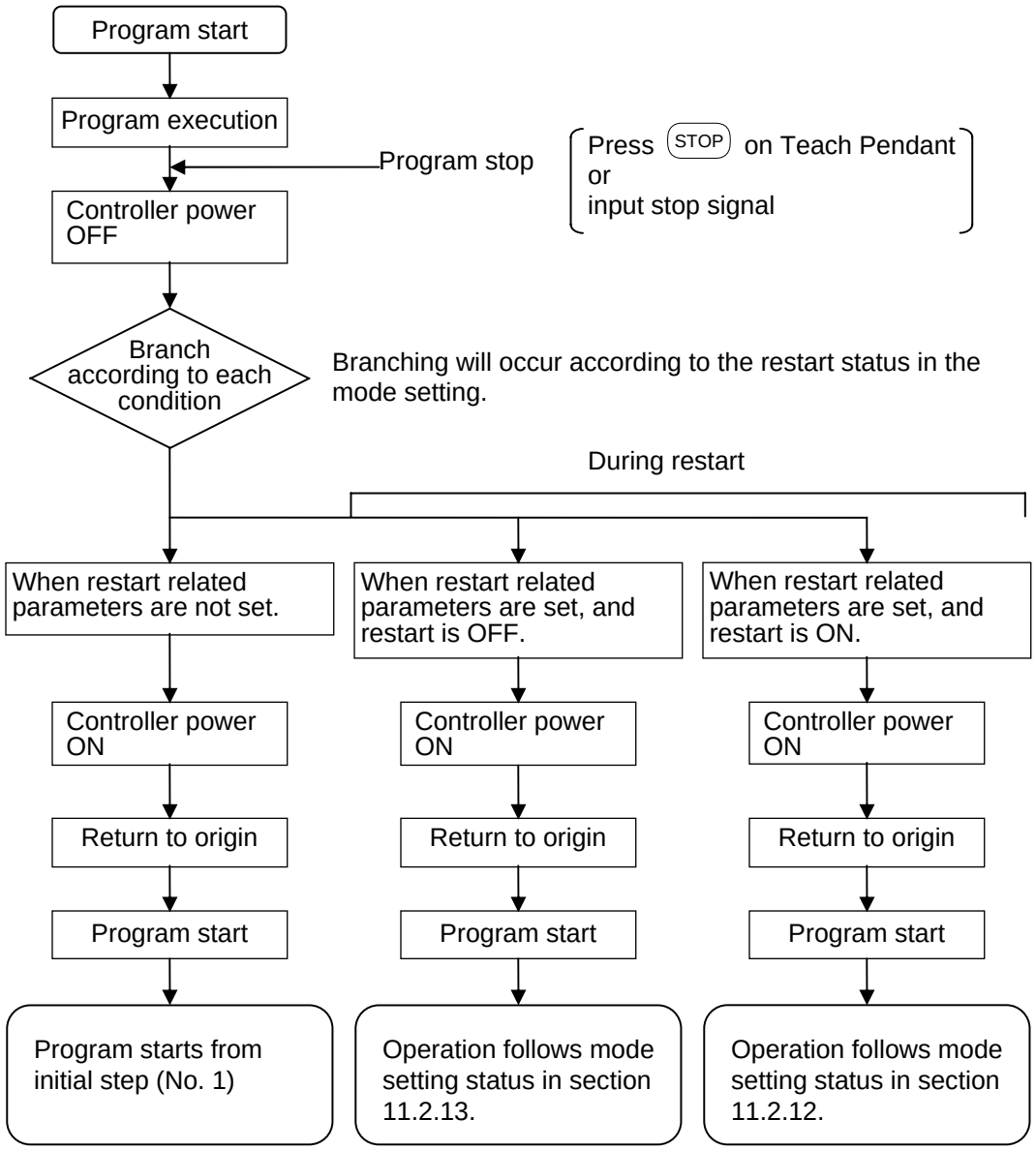
NOTE

- The mode settings given in sections 11.2.2, 11.2.12 and 11.2.13 must be made to use the restart function. Use the initial values for the status setting when restart is valid.
- Restart is not possible if the power is turned OFF while a program is being executed. An error will occur.
- During normal operation, the restart input functions as a general-purpose input.

Discontinue

<Example>

[Starting of sequential program]



Counter is initialized. (0)

The general-purpose output state is OFF.

NOTE There are cases where Return to Origin does not need to be carried out. Refer to section 3.1.3 Return to Origin.

Discontinue

■ 4.1.7 Palletizing work with MVM commands

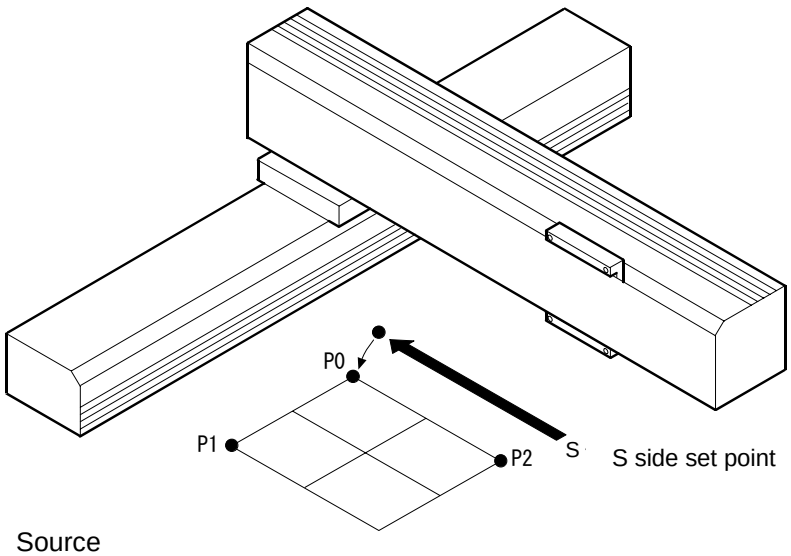
In the palletizing mode described in Chapter 7, palletizing operation can be carried out by just setting various data and not using commands.
However, if a mode is used for the palletizing operation, there will be some restrictions to the degree of operation freedom. To cover for these demerits, the degree of operation freedom and complex palletizing operations can be used by creating a program using MVM commands. (Sequential movement operation such as 1 to M, M to 1, M to M and on matrix.)

[Example]

- Correspondence of pallet on which work are arranged in a zigzag pattern.
- Transferring of works on pallet according to passing and failing state, etc.

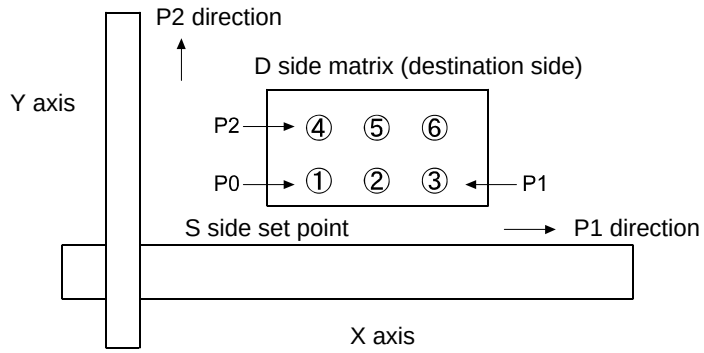
■ Procedure for carrying out palletizing work with MVM commands

1. Setting of MVM table details — Set the data such as the matrix (pallet, etc.) shape. (Refer to section 13.5.4 MVM table setting.)
2. Setting of coordinate table details — Set the data of the coordinate table used with the MVM table. (Refer to section 13.5.1 Setting of coordinate tables.)
3. Creation of program in sequential mode — (Refer to section 4.1 Sequential PRGM mode.)
4. Execution of program — (Refer to section 4.2 Sequential RUN mode.)



S side: Source
D side: Destination

Discontinue



(1) Explanation of MVM table

The MVM table is used to set the matrix (pallet, etc.) shape, etc.
For the matrix shape as shown above, the parameters are set in the MVM table as shown below.

Point	Coordinate table No.
P0	① Point coordinate table No.(*1)
P1	③ Point coordinate table No.(*1)
P2	④ Point coordinate table No.(*1)

Direction	No. of matrixes	Applicable counter No.
P1	3 (*2)	1 (*3)
P2	2 (*2)	2 (*3)

One group (GRP)

The set of table data as shown above is called one group (GRP).
A total of 32 tables (GRP = No. 1 to 32) can be set.

*1: Explanation of coordinate table No.

- The P0, P1 and P2 coordinates set the points of each matrix end.
- The coordinates are set indirectly using the coordinate table No. so the actual coordinate data must be set in the coordinate table.
- "0 to 999" can be set for the coordinate table No.
- If the matrix only has one row, set P0 and P1 to the normal values, and set P2 to "0".
- P0 does not always have to be set to the point closest to the origin. The operation order can be changed by changing the P0. P1 and P2 coordinate settings.

*2: Explanation of No. of matrixes

- Set the No. of matrixes in the P1 direction and in the P2 direction.
- "0 to 9999" can be set for the No. of matrixes.
- If the matrix only has one row, set P1 to the normal value, and set P2 to "0".

*3: Explanation of applicable counter

- The applicable counter is used to control the matrix movement (MVM command).
- "0 to 99" can be set for the applicable counter.

Discontinue

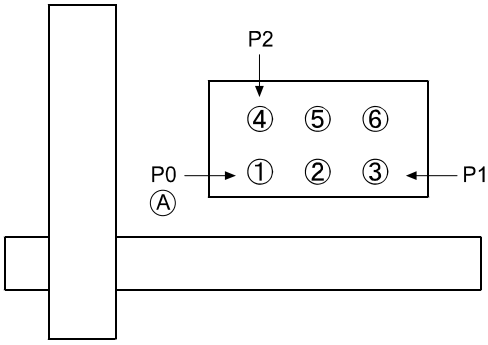
- If the matrix only has one row, set P1 to the normal value, and set P2 to "0".

Discontinue

(2) Relation of P0, P1, P2 coordinate setting and operation pattern

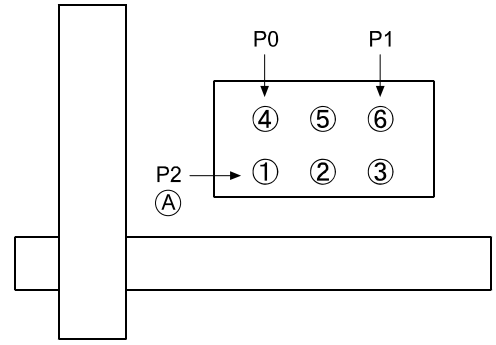
Even if the same program is executed, the operation pattern can be changed by changing the coordinate settings of P0, P1 and P2 set in the MVM table.
The following is an operation example of when the 1 to M program given on the next page is executed.

[Operation example]



Set the ① coordinates in P0.
Set the ③ coordinates in P1.
Set the ④ coordinates in P2.

[Operation pattern]
To execute the 1 to M program.
Ⓐ → ① → Ⓐ → ② → Ⓐ → ③
→ Ⓐ → ④ → Ⓐ → ⑤ → Ⓐ → ⑥

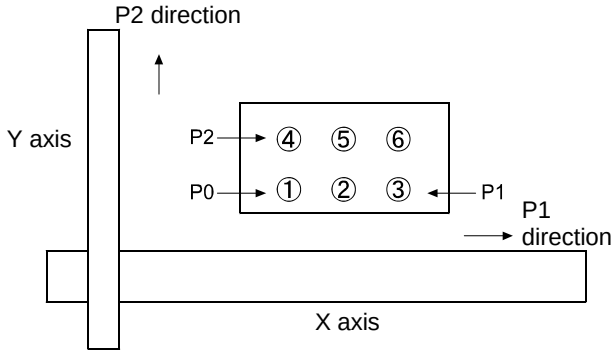


Set the ④ coordinates in P0.
Set the ⑥ coordinates in P1.
Set the ① coordinates in P2.

[Operation pattern]
To execute the 1 to M program.
Ⓐ → ④ → Ⓐ → ⑤ → Ⓐ → ⑥
→ Ⓐ → ① → Ⓐ → ② → Ⓐ → ③

(3) Relation of counter details and movement position

The MVM command is a command that looks at only the P1 and P2 direction counter details and moves the unit.
The relation of the counter details and movement point is shown below.

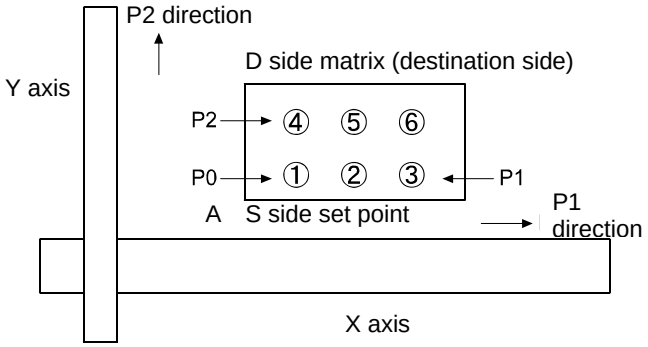


Details of MVM table
P0: ① point coordinates
P1: ③ point coordinates
P2: ④ point coordinates
No. in P1 direction: 3
No. in P2 direction: 2
P1 direction counter: No. 1
P2 direction counter: No. 2

Discontinue

MVM table setting counter		Movement destination point when MVM command is executed with the counter details given on the left.
Details of counter No. 1	Details of counter No. 2	
1	1	①
2	1	②
3	1	③
1	2	④
2	2	⑤
3	2	⑥

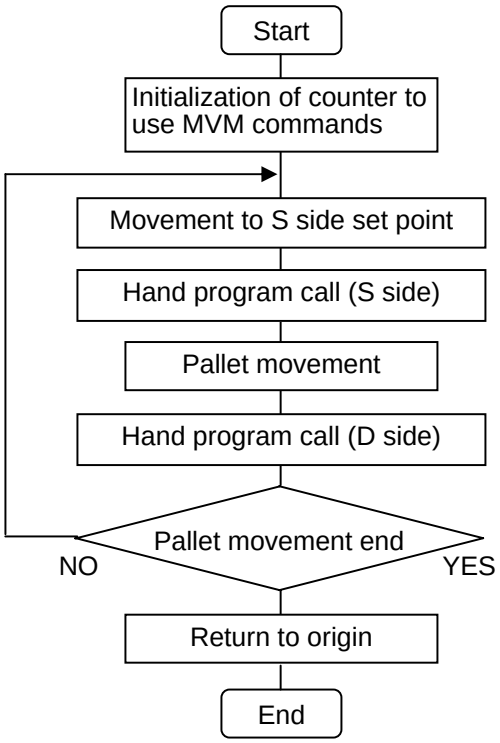
(4) Example of palletizing work program using MVM commands



Details of MVM table
P0: ┌ point coordinates
P1: ┌ point coordinates
P2: ┌ point coordinates
No. in P1 direction: 3
No. in P2 direction: 2
P1 direction counter: No. 1
P2 direction counter: No. 2

[Operation pattern 1 to M]
Ⓐ → ① → Ⓐ → ② → Ⓐ → ③ → Ⓐ → ④ → Ⓐ → ⑤ → Ⓐ → ⑥ → Origin

The flow of the 1 to M program example as shown above is given below.



[Usage commands] --- Refer to Chapter 18.

MINI command

TAG command
MVP command

CAL command

MVM command

CAL command

LOOP command
TAG command

HOME command

END command

Discontinue

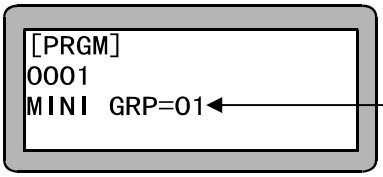
[Explanation of changing counter details]

The counter details when the MINI command is executed are initialized to "1". When the MVM command is executed, point ① will be moved to.
The LOOP command will increment the counter No. 1 details by one during the movement from point ① to ③.
When moving from ③ to ④ the counter No. 1 details are initialized to "1", and the details of counter No. 2 are incremented by "1".
(Counter No. 2 details: 1 to 2.)
When moving from ④ to ⑥ the counter No. 1 details are incremented by "1".
When the pallet movement is completed, the program will jump to the tag No. set with the LOOP command.

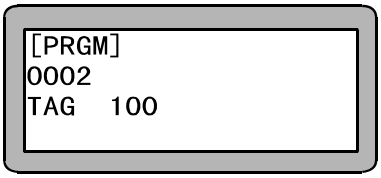
The program example given on the previous page will be explained with the Teach Pendant screens.

● **Writing of program**

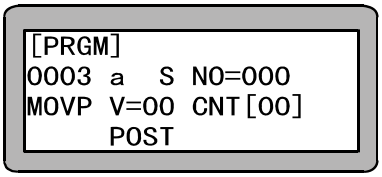
Enter the sequential PRGM mode. Write the following command in step 0001.
(For this example, the program will be written from step 0001.)
The following screen will display. (Refer to section 4.1.1.)
Refer to "Chapter 18 Commands" on how to input the commands.



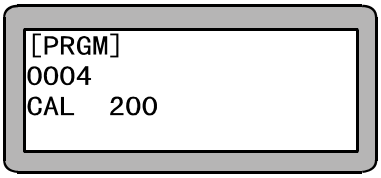
STEP 1 Set the details (value) of the counter to be used for the preset MVM table (group No. 1) to "1".



STEP 2 Assign a tag No.

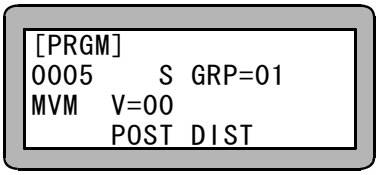


STEP 3 Move to the S side set point with the MOVP command.

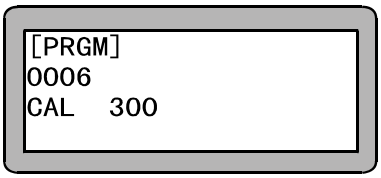


STEP 4 Call the tag No. of the hand program on the S side set point side. The hand program is a subroutine program that carries out handling work.

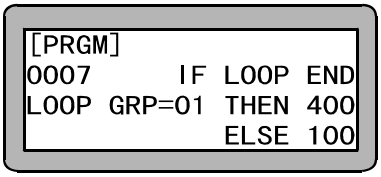
Discontinue



STEP 5 Write the MVM command. With this command, the point on the D side (destination) will be moved to.

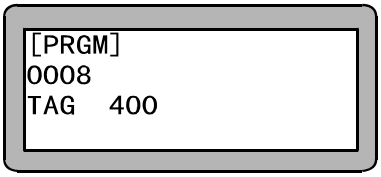


STEP 6 Call the tag No. of the D side hand program, and carry out the handling work.

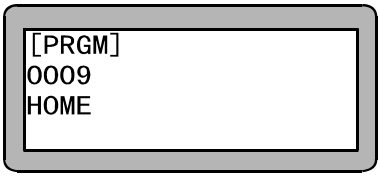


STEP 7 The MVM table (GRP No. 01) counter will be incremented by 1. When the counter used for each axis reaches the No. of the MVM tables, tag No. 400 will be jumped to.
If the number is not reached, the program will jump to tag No. 100, and will realize the loading by carrying out STEP 2 to 6 following the counted counter.

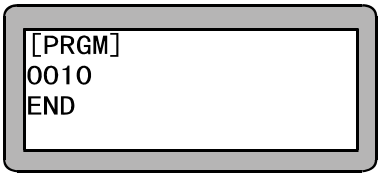
If the details of the designated counter reaches the set No. and the MVM loop is ended (LOOP END), the program will jump to the THEN tag. If not ended (ELSE) , the program will jump to the ELSE tag.
It is configured of the jump commands with IF~THEN ••• ELSE conditions attached.



STEP 8 Assign a tag No.



STEP 9 Carry out return to origin.



STEP 10 End the program.

Discontinue

■ 4.2 Sequential RUN mode

This Electric Actuator can be operated with the following methods.

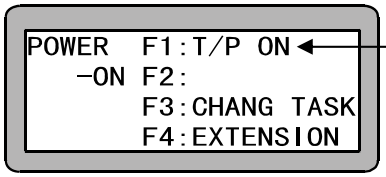
- Continuous operation, signal operation of the AUTO mode
- STEP mode

■ 4.2.1 AUTO mode of sequential mode

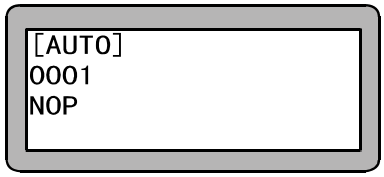
(1) Continuous operation

Carry out operation in the STEP mode and confirm the operation before starting operation in the AUTO mode.

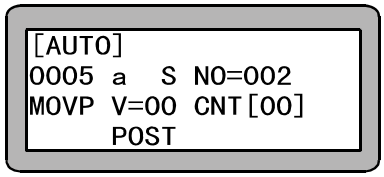
Operation using Teach Pendant



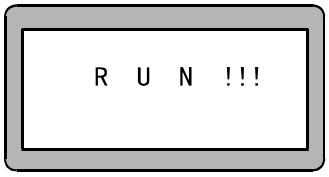
STEP 1 Turn ON the power switch. After the initial screen displays, the following screen will display, so press F1 and HOME to carry out return to origin. (There are cases where Return to Origin does not need to be carried out. Refer to section 3.1.3 Return to Origin.)



STEP 2 In this state, the sequential mode's RUN mode will be entered. Press NEXT or -NEXT to display the first step of the program to be executed.



STEP 3 After displaying the step to be executed, press START .

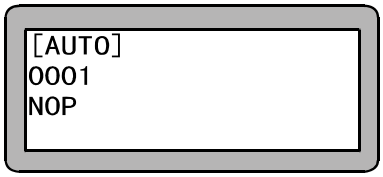


STEP 4 When the program is being executed, RUN!!! will display.

If STOP is pressed, the program will stop after completing the step currently being executed. To restart the program, press START again.

WARNING If the EMERGENCY STOP button is pressed, the robot will coast to a stop. The stopping distance will differ according to the load size, speed and inertia.

Discontinue



STEP 5 When the program END command is completed, the program will return to step No. 0001, program step 1 will display, and the operation will stop.

Operation with external signals

Use the following procedure to carry out operation with the external signals. Refer to section 17.1 on how to disconnect the Teach Pendant.

[Operation procedures]

1. Carry out return to origin with the system input return to origin. (There are cases where Return to Origin does not need to be carried out. Refer to section 3.1.3 Return to Origin.)
2. Input the start signal to execute the program from step 0001. If there are multiple tasks in the multitasking, the execution will start with step 0001 of the main task.
3. If the stop signal is input during operation, the program will stop after ending the program step currently being executed.
4. To restart from the step where the program was stopped, input the start signal.
5. To start from step 1, input the reset signal and then input the start signal. If the restart function is valid, the reset input will be ignored. Refer to section 10.2.6 for details.

(2) Single operation

During single operation, the program will stop once after the axis movement or output related operation is executed. To start or restart the program, input the start signal or press START . Normally this is used to verify a program.

An example of single operation is given below.

1. Turn the single operation input signal ON.
2. The following operations are basically the same as continuous operation. (Refer to section 4.2.1 (1) Continuous operation.)
3. When the program has stopped operation, press START or input the start signal to sequentially start the program.

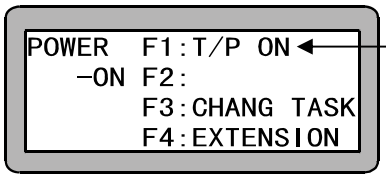
- The single operation mode input bit setting in the mode setting must be set. (Refer to section 13.2.1.)
- Operation with either the Teach Pendant or external signal is possible.
- The single operation input signal must retain the ON state during single operation. If the single operation input signal is turned OFF during single operation, the remaining program will be continuously operated.
- Even if the single operation input signal is input during continuous operation, it will be ignored, and continuous operation will continue.
- The following commands can be used for stopping after execution.

  MOVP, MVB, MVE, HOME, MVM
  OUT, OUTP, OUTC

Discontinue

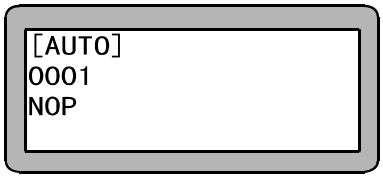
■ 4.2.2 STEP mode of sequential mode

The STEP mode is used to execute the program in the controller one step at a time.
When multiple tasks are operated using the multitasking function, one step of the task displayed on the Teach Pendant will be executed and then will stop. The other tasks will stop when the step being executed is stopped at the time the displayed tasks have stopped.
Use this mode to confirm the program operation, etc., before executing the program in the AUTO mode.



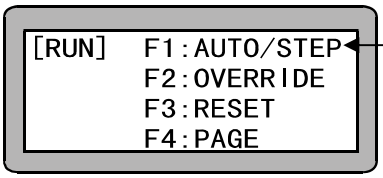
STEP 1

Turn ON the power switch. After the initial screen displays, the following screen will display, so press F1 and HOME to carry out return to origin. (There are cases where Return to Origin does not need to be carried out. Refer to section 3.1.3 Return to Origin.)



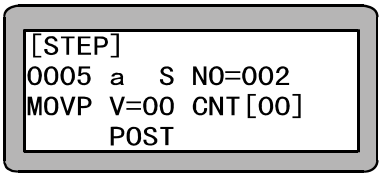
STEP 2

In this state, the sequential mode's RUN mode will be entered. Press HELP .



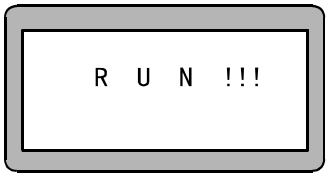
STEP 3

When this screen displays, press F1 . The STEP mode will be entered.



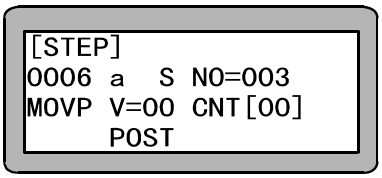
STEP 4

Press NEXT or -NEXT to display the first step of the program to be executed. After displaying the step to be executed, press START .



STEP 5

When the program is being executed, RUN!!! will display.



STEP 6

The next step will display and the robot will stop. When next step will be executed when the START key is pressed. After this, the program will be executed in the step order, and will stop after each executed.

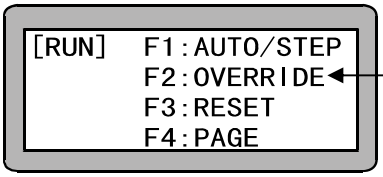
Discontinue

The search function can be used in this mode. This is handy for confirming the jump conditions, etc., in the program by using the tag No. search. Refer to Chapter 15 for details on the search function.

NOTE The timing of the input signal and output signal during operation with the STEP mode will be differ compared to operation during the AUTO mode.

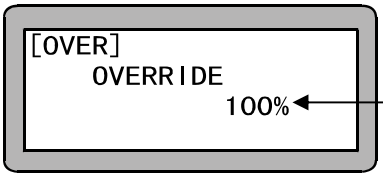
■ 4.2.3 Changing of speed during operation (override)

The entire program execution speed can be delayed by using the override function. This allows the program to be confirmed at a low speed.



STEP 1

Enter the RUN mode and press HELP . This screen will display, so press F2 and enter the override mode.



STEP 2

Use the numeric keypad to enter the override value. When ENT is pressed, the speed will change to the set speed. Press ESC to return to the RUN mode. (Initial value: 100)
(Override value: 1 to 100)

NOTE The override setting is valid only while the program is stopped.

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Discontinue

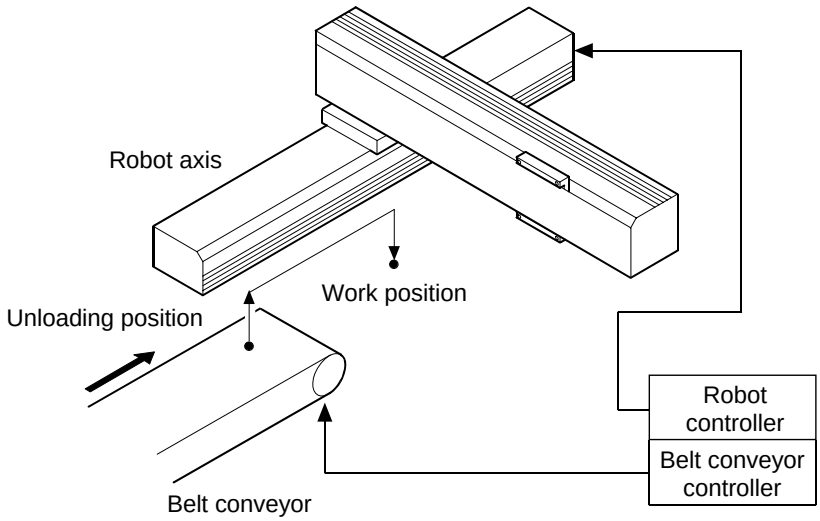
Chapter 5 Multi-task

■ 5.1 Multitasking

Multitasking refers to executing multiple tasks simultaneously. The multitasking referred to with this controller refers to executing multiple programs simultaneously. This multiple execution of programs is asynchronous operation in which the programs do not interfere with each other.
However, the start of the command execution can be synchronized using commands dedicated for multitasking, and using counters and timers I/O common between the tasks.

■ 5.2 Merits of multitasking

The explanation will follow the case of creating a system that unloads the part from the conveyor and places it on the work table.
When the axis is moving to move the part to the work table, the conveyor must be operated to supply the next part to the unloading position.



- When multitasking is not used
  In addition to the robot, a programmable logic controller (PLC) for controlling the conveyor will be required.
  Due to this, the system will become complicated as wiring for interlocks, etc., will be required. This will in turn lead to a larger and more expensive system.
  If the conveyor is controlled with the robot I/O instead of using a PLC, the conveyor cannot be used while the axis is moving, and thus the tact time will increase.

- When multitasking is used
  The I/O such as the conveyor control and the axis movement can be controlled simultaneously, so a system can be structured without using a PLC, etc. Thus, the wiring is simplified and the system is less expensive. Control can be carried out just with the controller program, so the system development and maintenance are simplified.

Discontinue

■ 5.3 Multitasking usage methods

Each task program is the same as the conventional sequential program. The multitasking settings and the programming methods will be described below.

■ 5.3.1 Multitasking specifications

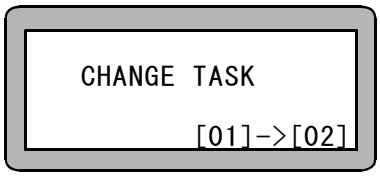
Mode	Only sequential mode
Max. No. of tasks	4
Max. No. of axes	4 Note that only two axes can be used per task
No. of program steps	2,000 (total of all tasks) Note that the easy program area is used for step 1001 and following.
Max. No. of coordinate tables	999 × 4 (total of all tasks) Note that when only the master unit is used, 999 tables can be set per task.

■ 5.3.2 Multitasking functions and settings

(1) Changing the task to be displayed and edited

Only one task can be displayed on the Teach Pendant's sequential program display.

To change the task targeted for display or editing, carry out the following operation while the RUN mode or PRGM mode sequential program step is displayed.



First press (ALT) .
Using the numeric keypad enter the task No. (01 to 04) in this state.
The displayed task will change when (ENT) is pressed.

NOTE It is impossible to change to a task in which the step number is 0 (the error tone PPPP is generated if changed).

(2) Setting the task and axis combination

The CA-10 controller can use up to four tasks, and up to two axes can be set per task.

To use up to four tasks, (for example, to use only one axis), assign the axis to task No. 1, and set the No. 2 to 4 tasks as tasks with no axis designation. Then, execute a command other than the axis related command (movement command, etc.).

Refer to section 13.4.15 Setting of task and axis combination for the setting methods.

(3) Setting the No. of task steps

As the total for the four tasks, up to 2,000 steps can be set for the program.

If the No. of steps is set to 1,001 or more, the easy program area will be cleared in use. Thus, the easy program cannot be used.

Refer to section 13.4.18 Setting the No. of task steps for the setting methods.

Discontinue

(4) Setting the positioning output

The system output positioning completed output (pin No. 13) will turn ON when the positioning of all axes is completed.

The output that turns ON when a specific axis completes positioning can be designated with a port and bit described in section 11.2.18 Setting of positioning complete output.

(5) Setting the Return to Origin complete output

The system output Return to Origin completed output (pin No. 14) will turn ON when all axes have returned to the origin.

The output that turns ON when a specific axis completes the return to origin can be designated with the port and bit described in section 11.2.19 Setting of Return to Origin complete output.

■ 5.3.3 Starting and stopping tasks

One of the four tasks is the main task.

(1) Starting the tasks

If start is applied by the Teach Pendant or system input, task 1 (main task) will start.

The other tasks will start with the TSRT command.

(2) Stopping the task

If stop is applied by the Teach Pendant or system input, all task will stop when the command being executed at that point is completed. The step No. will remain that at the stopped time, and will be used for executed when start is applied again.

The other task can be stopped with the TSTO command. To stop the task itself, use the STOP command.

(3) Restarting the task

The task will start from the step where the main task was stopped.

(4) Ending a task

If stop is applied by the system output, all task will stop when the command being executed at that point is completed. The step No. will remain that at the stopped time, but if reset is applied from the system No., step No. will change to 1 and be the same as the end state.

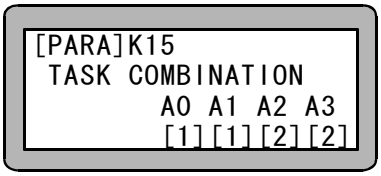
The task will end (enter the stop state, and step No. will return to 1) when the END command is executed. However, if the main task executes the END command, all task will end when the command being executed at that time. Thus, all tasks will be canceled. To avoid this, use a counter to apply a timing between the tasks (refer to section 5.3.5), and create a program so that the main task does not execute the END command until the other tasks end.

The tasks other than the main task can be ended with the TCAN command.

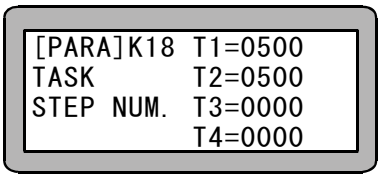
Discontinue

■ 5.3.4 Multitasking operation

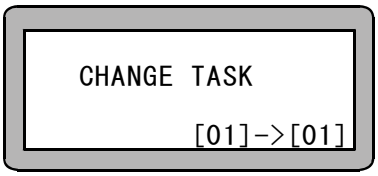
The method for creating and running a multitasking program will be explained in this section. The case for controlling two steps of 2-axis combinations such as X-Y and four controllers will be described.



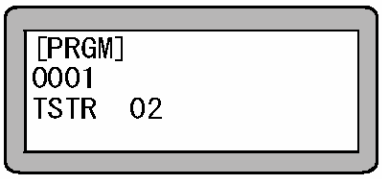
STEP 1 Set the task and axis combination with the task axis setting in the PARA mode. (Refer to section 13.4.15)
In the example on the left, the station No. 0 and No. 1 axes are controlled by task No. 1, and the station No. 2 and No. 3 axes are controlled by task No. 2.



STEP 2 Set the No. of steps in each task with the No. of task step setting in the PARA mode. (Refer to section 13.4.18)
In the example on the left, 500 steps are assigned to each task No. 1 and No. 2. Changing to a task with zero steps is not allowed.

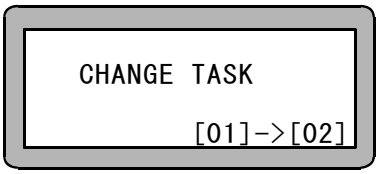


STEP 3 Next, enter the program in task No. 1. Enter the sequential PRGM mode, and press ALT . The display shown on the left will appear.
Use the numeric keypad to enter the task No. 01, and then press ENT . The display task will change.

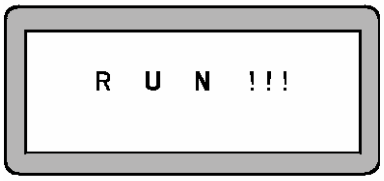


STEP 4 Enter the TSTR command for starting task No. 2.
When start is input from the Teach Pendant or system input, the main task (task No. 1) will start.
Task No. 2 will start with the TSTR command at the beginning of task No. 1.
Enter the task No. 1 program in sequential order for the steps that follow.

Discontinue



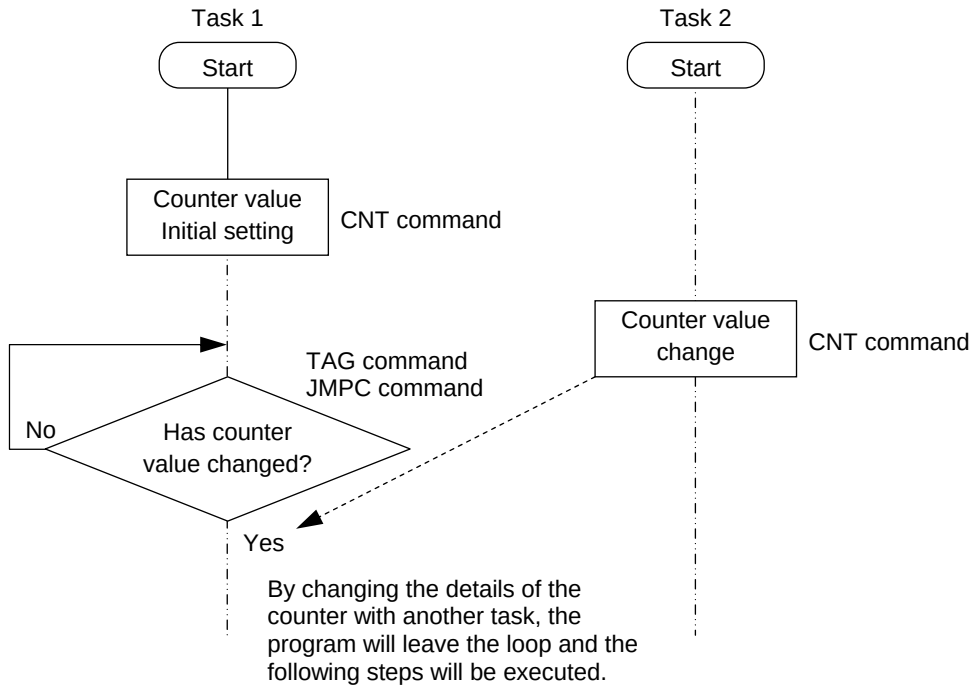
STEP 5 Next, enter the program in task No. 2.
Enter the sequential PRGM mode, and press (ALT) . The display shown on the left will appear.
Use the numeric keypad to enter the task No. 2, and then press (ENT) . The display task will change.
Sequentially enter the task No. 2 program in the following steps.



STEP 6 When completed entering the program, enter the RUN mode and press (START) . The program will start from the head of task No. 1.
Use the operation described in STEP 3 to change the task display.

■ 5.3.5 Applying timing between tasks

A timing is applied to multiple tasks that run in association by using a counter as shown below.



Discontinue

■ 5.4 Details on multitasking

Information important for efficiently using the multitask function is described below.

■ 5.4.1 Task status

With the multitasking, multiple task can be executed simultaneously by executing other task during the task's open time.
The following four task states exist.

(1) Stopped state

State in which nothing is occurring. (No tasks have been started.)

(2) Execution state

State in which task is being executed.

(3) Ready state

State waiting for task processing priority.

(4) Wait state

Status in which task is waiting.

Waiting refers to positioning complete waiting, input waiting, timer waiting.

Commands with wait states ··· MOVP, MVB, MVE, IN, TIM, MVM, HOME

■ 5.4.2 Transition of states

(1) Starting the task

The main task (task 1) will start when start is input from the system, or when started with the Teach Pendant.

The task stopped from the execution state will enter the ready state with the task start command (TSTR).

(2) Ending the task

When the task being executed executes the END command, that task will end. The step No., for the ended task will change to 1, and the task will stop. If the END command is executed with the main task, all tasks will end when the commands for all tasks are completed.

If the task being executed executes the TCAN command, the task will end when the task command designated with that command is completed. The main task cannot be ended with the TCAN command.

(3) Restarting the task

The main task will enter the execution state from the stopped step, and the other task will enter the ready state.

Discontinue

(4) Execution state and ready state

The task with the highest task processing priority of the task in the ready state will enter the execution state in the following cases.

- When the execution state task enters the wait state.
  The task that is waiting will enter the ready state when a waiting occurs.

- When the execution state task executes a branch command.
  The task that executes the branch command will enter the ready state at the branch designation step.

- When the execution state of a task continues for one second or more.
  When one second or more has passed, the step being executed will end, and the ready state will be entered.

■ 5.4.3 Transfer of data between tasks

The same counters and timers are used for all tasks, so a value can be set with one task and referred to by another task, or the data or status can be transferred by using condition judgment commands such as JMPC or CALC.

■ 5.4.4 Task priority

If there are multiple tasks in the ready state and the execution state task enters the wait state or a branch command is executed, the priority to move the ready state task to the execution state is set.

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Chapter 6 Easy Mode

Easy mode is a mode in which movement to each point, and simple sequential operation such as operation of the hand after completing movement can be done without creating a program. In other words, the movement commands, calling of the hand operation subroutine, and designation of the step to be executed next are configured as a pair of steps per program, allowing programming and execution to be carried out without a complicated configuration.

The easy mode program can have a maximum of 100 steps per program, and eight programs can be created.

No. of programs: Eight programs
No. of steps: 100 steps/program

The following subroutine programs used in the easy mode are created in the sequential program.

- Hand subroutine: Sequential program executed a point after to moving to it such as when operating the hand, etc.
- Start subroutine: Sequential program executed before moving to the point.
- End subroutine: Sequential program executed after the easy mode operation ends.

This controller can execute multiple sequential programs with multitasking, but the only sequential program that can be executed from the easy mode is task No. 1.

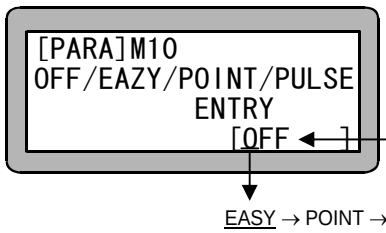
Discontinue

■ 6.1 PRGM mode of easy mode

Before using the easy mode, validate the easy mode in the mode setting.
Refer to section 6.1.1 for the setting method.

■ 6.1.1 How to enter and leave the easy mode

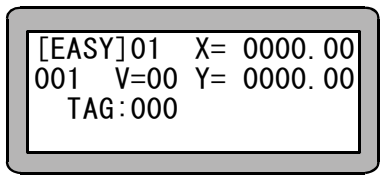
Display the easy mode setting screen in the PARA mode. (Refer to section 13.2.10.)



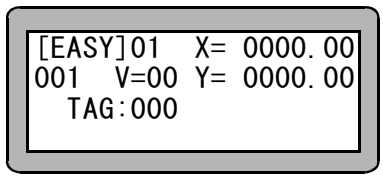
STEP 1A **[How to enter the easy mode]**

Press (ALT) to display EASY and then press (ESC) twice.

The display will change when (ALT) is pressed.

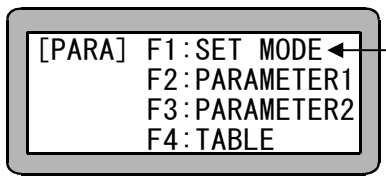


STEP 2A The easy mode will be validated and the initial screen of the PRGM mode (easy) will display.

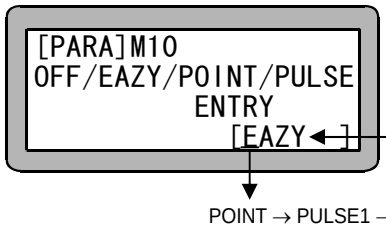


STEP 1B **[How to leave the easy mode]**

Press (F 4) .



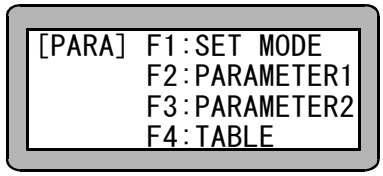
STEP 2B Press (F 1) and display the mode setting screen.



STEP 3B Press (NEXT) nine times to display the STEP1A screen.

Press (ALT) , display another mode, and then press (ESC) .

Press (ESC) to set the mode.



STEP 4B Leave the easy mode and display the screen shown on the left. Press (ESC) and the PRGM mode screen for the selected mode will display.

Discontinue

■ 6.1.2 Editing easy mode program

The items input for the easy mode are as follow.

(1) Program No. 1 to No. 8 setting

Program No. 1 ------- Program step 001 to 100
Program No. 2 ------- Program step 101 to 200
Program No. 3 ------- Program step 201 to 300
Program No. 4 ------- Program step 301 to 400
Program No. 5 ------- Program step 401 to 500
Program No. 6 ------- Program step 501 to 600
Program No. 7 ------- Program step 601 to 700
Program No. 8 ------- Program step 701 to 800

(2) Setting of start tag No.

Set the tag No. of the start subroutine program to be executed before moving to the point. No program will be designated if the tag No. is set to 000.

(3) Setting of point coordinates

Input the coordinate values in the point table No.
MDI, remote teaching or direct teaching can be used to input the coordinate values. (Refer to section 3.2.2.)

NOTE The coordinate data will be written into the coordinate table of the point table No. that is the same as the step No.

(4) Setting of speed

Set the speed to move to the point at.

(5) Setting of hand subroutine tag No.

Set the tag No. of the sequential program to be executed after moving to the point.

(6) Setting of number of repetitions

Set the number of times to execute the series of operations. (0 to 9999 times)
If 0 is designated, the operations will be repeated infinitely.

(7) Setting of end tag No.

Set the tag No. of the sequential program to be executed after the easy operation ends.

(8) Setting of branch conditions

Set the branch designation and branch conditions.
Input condition, counter condition, timer condition or unconditional branching is possible.

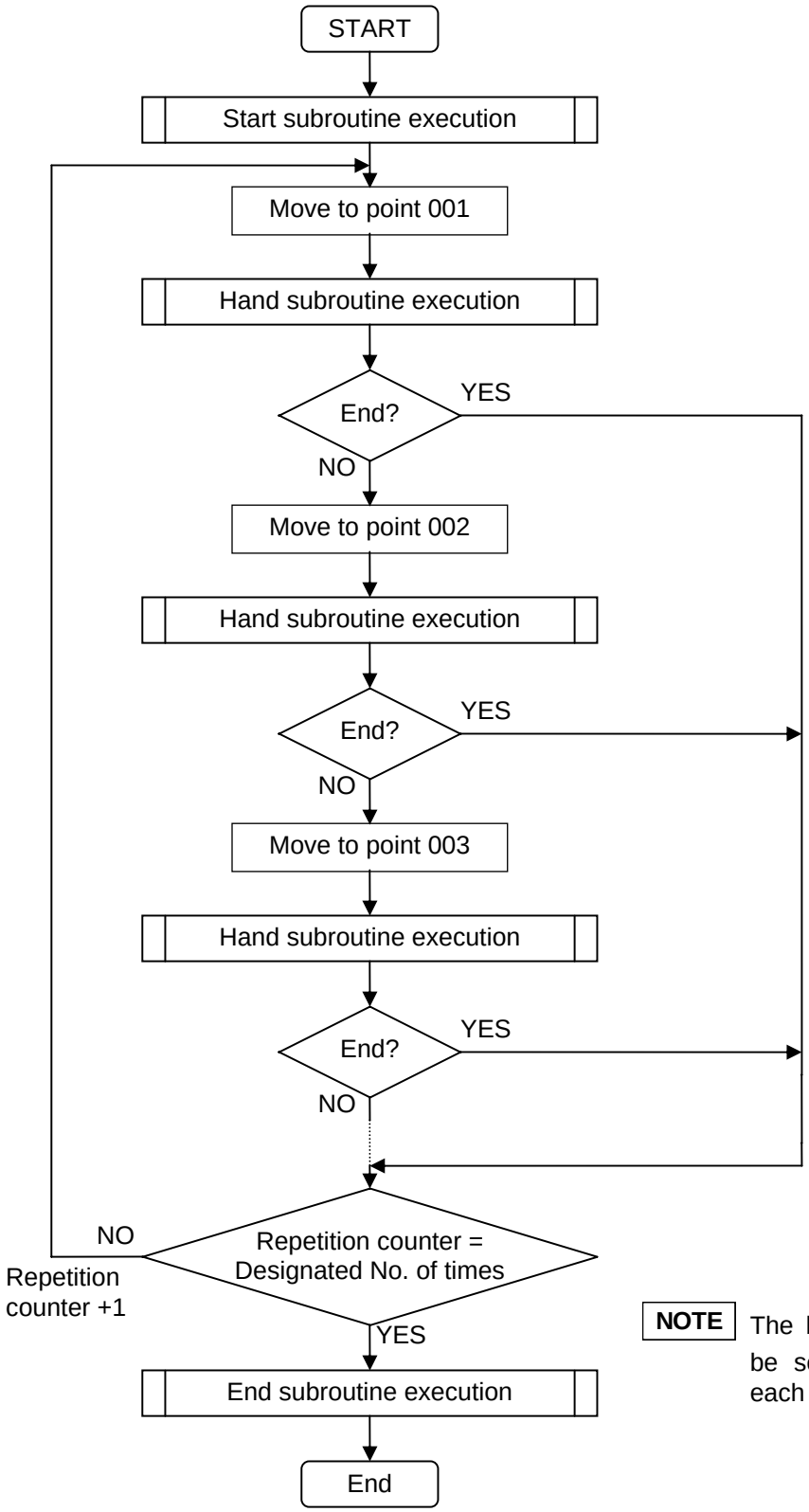
(9) Setting of end

Designate the end step of the easy operation. (Input and display "∗".)

NOTE Always set the end. If an end is not set, a step No. error will occur during execution.

Discontinue

A flow chart of the easy mode operation is shown below.



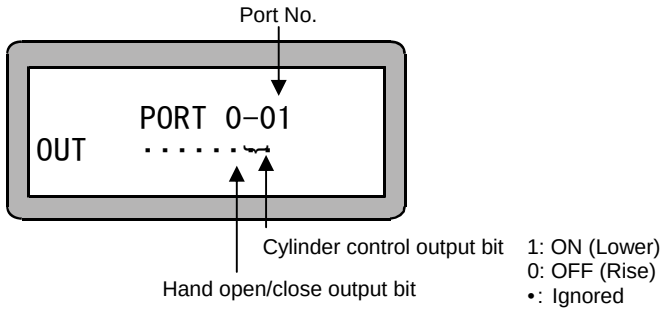
NOTE The branching conditions can be set by pressing F1 at each step.

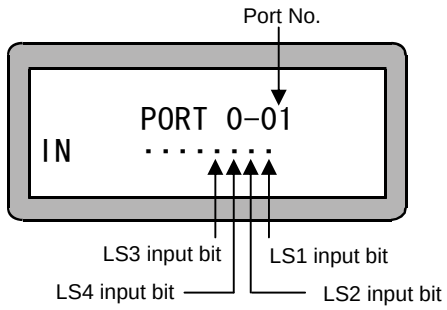
Discontinue

(10) Setting of reservation tag No.

The hand subroutine creates a random program in the sequential program, but when carrying out predetermined operation such as pick & place of the work (operation to move the air cylinder vertically, pick up the work by opening/closing the chuck, and placing the work), a subroutine program with fixed details can be used.
The reservation tag No. refers to the tag No. of this fixed subroutine program. By designating the reservation tag No., a sequential program does not need to be created, and the required operations can be carried out.
When using the reservation tag No., external devices such as a solenoid and limit switch must be connected beforehand to the assigned general-purpose input/output ports.
The general-purpose input/output ports for the external devices (air cylinder, hand, limit switch) used when using a reservation tag No. are shown.

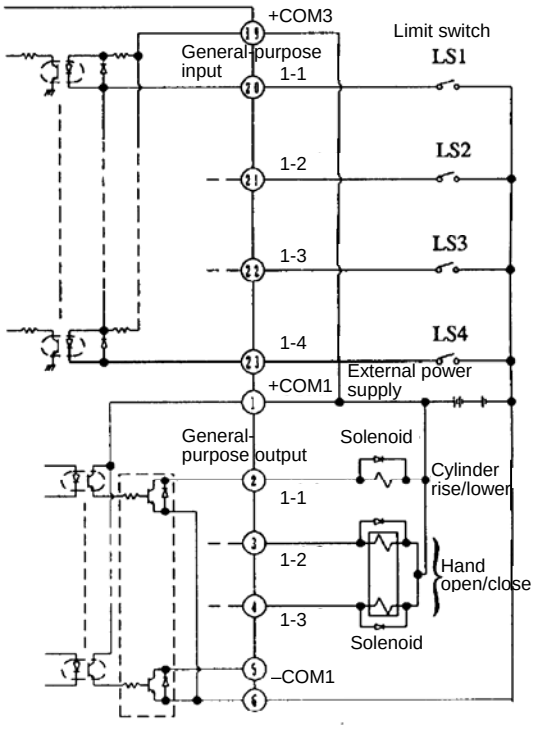
Assignment of general-purpose input/output ports when using reservation tag No.





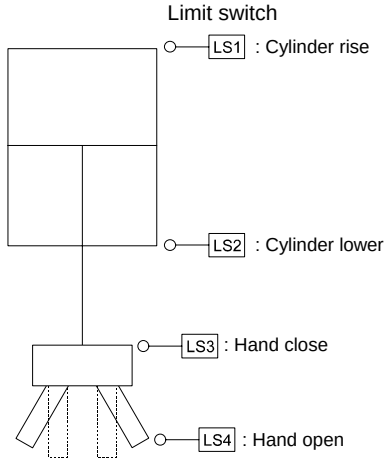
Discontinue

Connection of external devices when using reservation tag No.



Discontinue

Layout of limit switches in reservation tag No.



LS1: Cylinder rise detection
LS2: Cylinder lower detection
LS2: Hand close detection
LS4: Hand open detection

NOTE Use normal open switches for the limit switches LS1 to LS4.

Reservation tag No. 900 ------Subroutine program that goes to pick up work
Reservation tag No. 901 ------Subroutine program that goes to place work

The details of the reservation tag No. hand subroutine are shown below.

Tag No. 900: Operation to go to pick work

Step No. display	Operation details	Details
*001	OUT 0-01 • • • • • • • 1	Cylinder lower instruction
*002	IN 0-01 • • • • • • 10	Wait for cylinder lower completion
*003	TIM 0.1	Timer wait
*004	OUT 0-01 • • • • • 01•	Chuck close instruction
*005	IN 0-01 • • • • 10• •	Wait for chuck close completion
*006	TIM 0.1	Timer wait
*007	OUT 0-01 • • • • • • • 0	Cylinder rise instruction
*008	IN 0-01 • • • • • • 01	Wait for cylinder rise completion
*009	TIM 0.1	Timer wait
*010	RET	

Tag No. 901: Operation to go to place work

Step No. display	Operation details	Details
*001	OUT 0-01 • • • • • • • 1	Cylinder lower instruction
*002	IN 0-01 • • • • • • 10	Wait for cylinder lower completion
*003	TIM 0.1	Timer wait
*004	OUT 0-01 • • • • • 10•	Chuck open instruction
*005	IN 0-01 • • • • 01• •	Wait for chuck open completion
*006	TIM 0.1	Timer wait
*007	OUT 0-01 • • • • • • • 0	Cylinder rise instruction
*008	IN 0-01 • • • • • • 01	Wait for cylinder rise completion
*009	TIM 0.1	Timer wait
*010	RET	

NOTE The details of the reservation tag No. cannot be confirmed on the Teach Pendant.

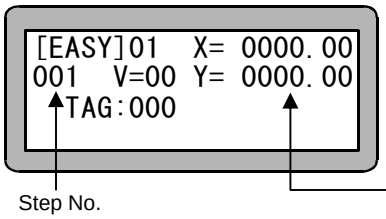
Discontinue

Programming in easy mode

The method for programming the easy mode is given below.

● **Input of point coordinates, speed and hand subroutine tag No.**

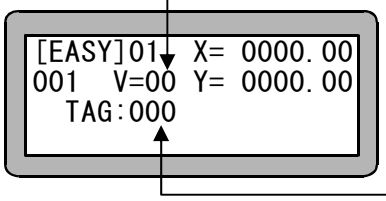
Select the easy mode with the mode setting, and display the initial screen of the PRGM mode (easy). (Refer to section 6.1.1)



STEP 1

Use the numeric keypad to enter the X, Y coordinates, and then press (ENT) . (–8000 to 8000 can be input.)
The coordinate data is input in the coordinate table having the same point table No. as the step No.

NOTE Remote teaching and direct teaching is also possible by pressing (DIRECT JOG) . (Refer to section 3.2.2)



STEP 2

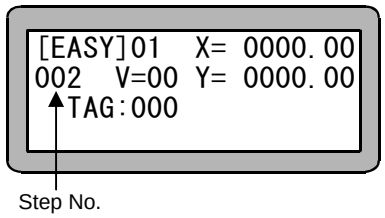
Use the numeric keypad to enter the speed No., and then press (ENT) . (0 to 10)
When V = 0 is entered, the speed is set to the designated speed preset by SPD command.

STEP 3

Use the numeric keypad to enter the tag No. (hand subroutine), and then press (ENT) .
(0 to 999)
If a determined operation is to be carried out by using the reservation tag No., use the reservation tag No. 900 and 901.
(Refer to section 6.1.2 (10).)
Press (NEXT) and move to the next step.

NOTE The hand subroutine program is written into the sequential program.
When entering the program, if (SEQUN PALET) is pressed, the sequential PRGM mode can be changed to. The easy mode PRGM mode will be returned to when (SEQUN PALET) is pressed again.

Discontinue



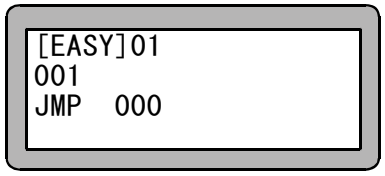
STEP 4 Use the numeric keypad and enter the point coordinates, speed No. and tag No. (hand subroutine) in the same manner as STEP 1, STEP 2 and STEP 3.
Press (NEXT) to move to the next step, and (-NEXT) to return to the previous step.

NOTE The easy mode coordinates are written into the coordinate table having the same point table No. as the step No.

● **Setting of branching conditions**

Display the step for which a branch condition is to be set on the easy mode screen and press (F1) . The branch condition setting screen will display.

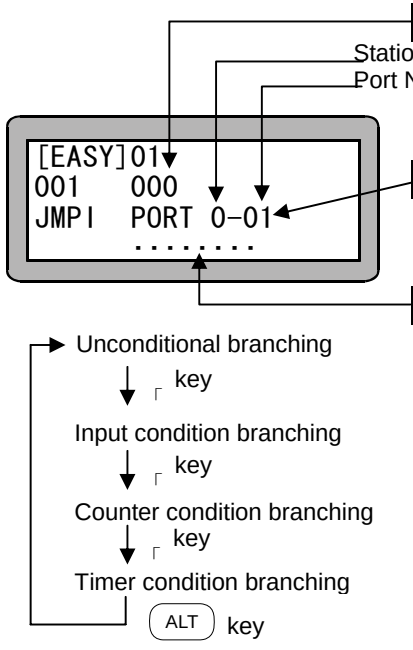
[Unconditional branch conditions]



STEP 1 Use the numeric keypad to enter the step No. to be branched, and then press (ENT) . When (ALT) is pressed, STEP 2 will be moved to. When (ESC) is pressed, the easy mode initial screen will display

---

[Input condition branching]



STEP 2 Use the numeric keypad to enter the step No. to be branched with the input conditions, and then press (ENT) . (0 to 999)
Branching will not take place if 000 is set.

STEP 3 Use the numeric keypad to enter the station No. (0 to 3) and port No. (1 to 3) to be used with the input conditions, and then press (ENT) .

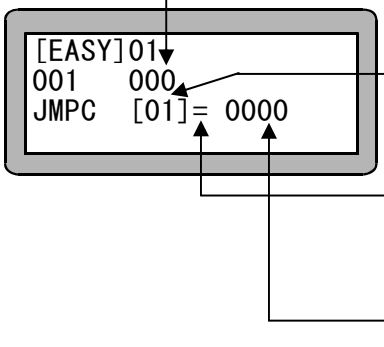
STEP 4 Enter the input conditions with (RET 0) , (IN 1) and (TAG •) , and then press (ENT) . The procedure for entering the input conditions is as follows.

(RET 0) Input OFF
(IN 1) Input ON
(TAG •) No reference (ignore)

When (ALT) is pressed, step 5 will be moved to. When (ESC) is pressed, the easy mode initial screen will display.

Discontinue

[Counter condition branching]



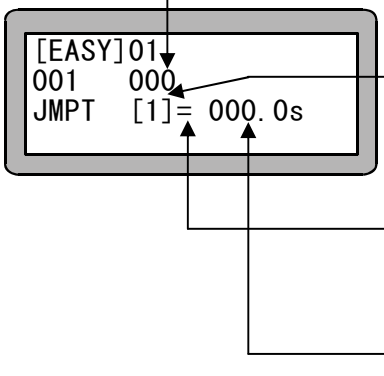
STEP 5 Use the numeric keypad to enter the step No. to be branched with the counter conditions, and then press NEXT . (0 to 999)
Branching will not take place if 000 is set.

STEP 6 Use the numeric keypad to enter the No. of the counter to be used, and then press ENT .
(1 to 99)

STEP 7 When ALT is pressed, the operators (=, <, >, <=, >=) will display. Select an operator, and then press ENT .

STEP 8 Use the numeric keypad to enter the counter value to be compared, and then press ENT . (0 to 9999)
When ALT is pressed, step 9 will be moved to. When ESC is pressed, the easy mode initial screen will display.

[Timer branching conditions]



STEP 9 Use the numeric keypad to enter the step No. to be branched with the timer conditions, and then press ENT . (0 to 999)
Branching will not take place if 000 is set.

STEP 10 Use the numeric keypad to enter the No. of the timer to be used, and then press ENT .

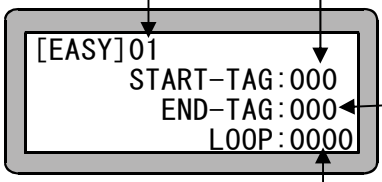
STEP 11 When ALT is pressed, the operators (=, <, >, <=, >=) will display. Select an operator, and then press ENT .

STEP 12 Use the numeric keypad to enter the timer value to be compared, and then press ALT . (0 to 999.9)
When ALT is pressed, step 1 of the unconditional branching screen will be moved to. When ESC is pressed, the easy mode initial screen will display.

Discontinue

Setting of start subroutine, end subroutine and repetition conditions

When F 2 is pressed on the easy mode screen, the following setting and display screen will display.



STEP 1

Use the numeric keypad to enter the start tag No., and then press ENT . (0 to 999)
If there is no designation, a start subroutine will not be executed. The reservation tag Nos. 900 and 901 can also be input.

STEP 2

Use the numeric keypad to enter the end tag No., and then press ENT . (0 to 999)
If there is no designation, an end subroutine will not be executed. The reservation tag Nos. 900 and 901 can also be input.

STEP 3

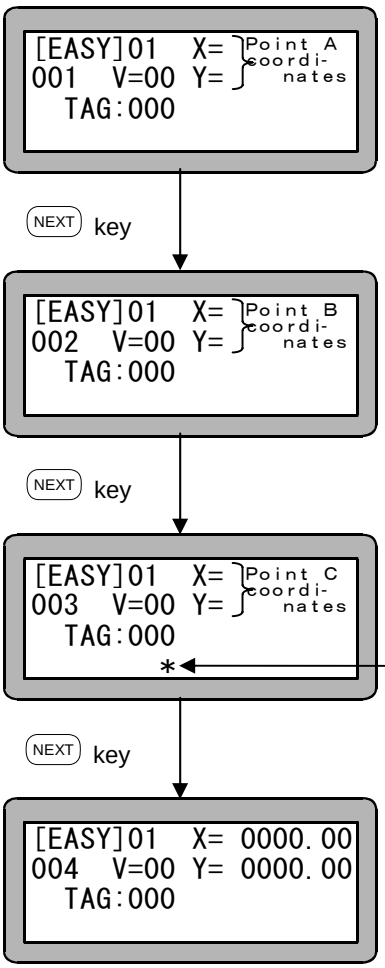
Use the numeric keypad to enter the designated number of repetition conditions, and then press ENT . (0 to 9999)
If 0 is designated, infinite repetition will occur.
Press ESC to end the settings and return to the initial screen of the easy mode.

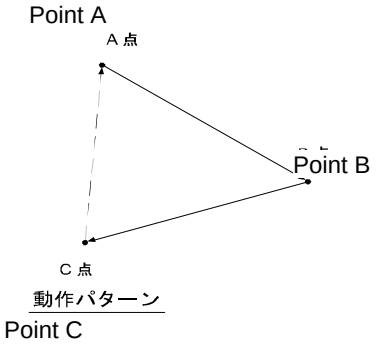
Discontinue

● **End setting**

In the easy mode, a setting to indicate the end of the operation at the final step of the series of operations (including cycle operation) must be set regardless of the operation pattern.

For example, with an operation pattern of point A to point B to point C is carried out as shown below, the step point C at the end of the cycle will be the end step.





Operation pattern

STEP 1

Display the end step screen and press F 3 . A "∗" to indicate the end will display, and the end setting will be completed.

To delete the end setting "∗", press F 3 again.

NOTE Always set the end when using the easy mode. If the end is not set, a step No. error will occur when the program is executed.

Discontinue

● **No. of programs and No. of steps**

The No. of programs and No. of steps used in the easy program are shown below.

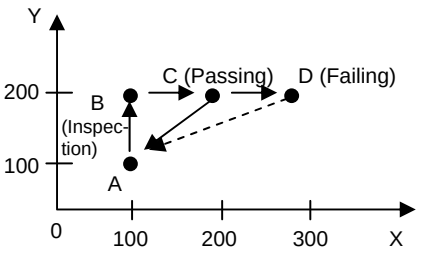
Program No.	Step No.
1	001 to 100
2	101 to 200
3	201 to 300
4	301 to 400
5	401 to 500
6	501 to 600
7	601 to 700
8	701 to 800

No. of programs.: 8 (No. 1 to No. 8)
No. of steps: 100 steps/program

NOTE Do not branch (jump) between program Nos. in the easy mode.

Discontinue

An example of a program in the easy mode is shown below.
[Example]
Pick up the workpiece at point A, check for passing or failing at point B. If general-purpose input port 01-1 turns "ON" at point B, place work at point D (failing part), and if "OFF", place work at point C (passing part). After replacing work at point B and C, return to point A and pick up work. The speed is 10, and the No. of repetitions is infinite.



Setting of program at point A

Input items

```
[EASY]01   X= 0100.00
001   V=10 Y= 0100.00
  TAG:900
```

- Coordinates---------- Point A coordinates (X=100, Y=100)
- Speed
- Hand tag No. ---------- Input reservation tag No. 900.

Program setting at point B

Input items

```
[EASY]01   X= 0100.00
002   V=10 Y= 0200.00
  TAG:000
```

- Coordinates---------- Point B coordinates (X=100, Y=200)
- Speed

```
[EASY]01
002    004
JMPI   PORT 0-01
       .......1
```

Press (F1) at step 002, and press (ALT) to select the input conditions branching.

- Input conditions branching setting
  ---------- If general-purpose input port 01-1 is "ON" (failing), jump to 004.

Program setting at point C

Input items

```
[EASY]01   X= 0200.00
003   V=10 Y= 0200.00
  TAG:901
         *
```

- Coordinates---------- Point C coordinates (X=200, Y=200)
- Speed
- Hand tag No. ---------- Input reservation tag No. 901.
- End setting "*"

Program setting at point D

Input items

```
[EASY]01   X= 0300.00
004   V=10 Y= 0200.00
  TAG:901
```

- Coordinates---------- Point D coordinates (X=300, Y=200)
- Speed
- Hand tag No. ---------- Input reservation tag No. 901.

```
[EASY]01
004
JMP   001
```

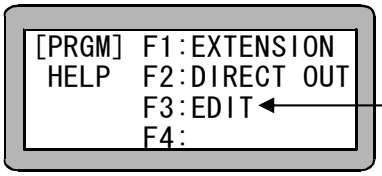
Press (F1) at step 004, and select unconditional branching conditions.

- Unconditional branching condition setting
  ---------- Jump to step 001.

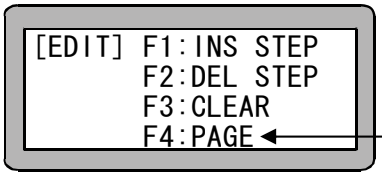
Discontinue

■ 6.1.3 Copy editing of easy mode

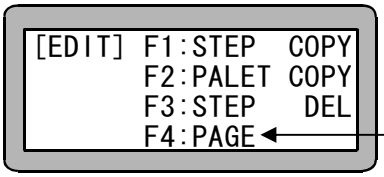
A random program in the easy mode can be copied to another easy program.
Enter the PRGM mode (sequential) and press HELP . (Refer to section 6.1.1.)
The following screen will display.



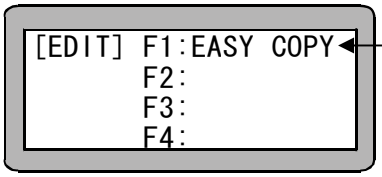
STEP 1 From this state, press F3 .



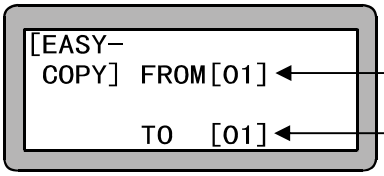
STEP 2 In this state, press F4 .



STEP 3 Press F4 .
Press ESC to return to STEP 2.



STEP 4 Press F1 .
Press ESC to return to STEP 3.



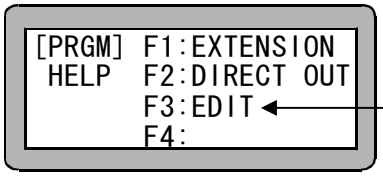
STEP 5 Use the numeric keypad to enter the copy origin easy program No. and the copy destination easy program No.
Press ENT . The program will be copied, and STEP 4 will be returned to.
Press ESC to return to STEP 4.

Discontinue

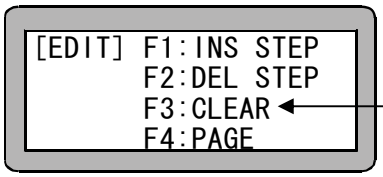
■ 6.1.4 Clearing of easy mode programs

All of the easy programs in the controller can be cleared.

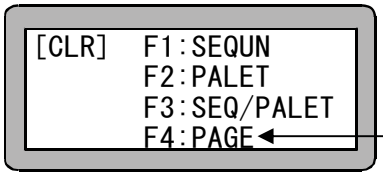
Enter the PRGM mode (sequential) and press HELP . (Refer to section 6.1.1.) The following screen will display.



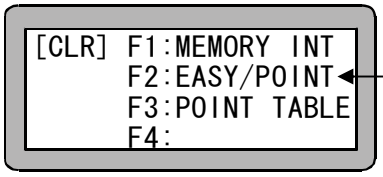
STEP 1 From this state, press F 3 .



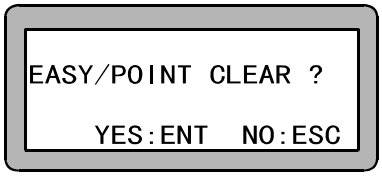
STEP 2 In this state, press F 3 .
Press ESC to return to the initial screen of the PRGM mode.



STEP 3 Press F 4 .
Press ESC to return to STEP 2.



STEP 4 Press F 2 .
Press ESC to return to STEP 3.



STEP 5 To clear the program, press ENT . To not clear the program, press ESC .

NOTE The coordinate table Nos. 1 to 800 will be cleared.

Discontinue

■ 6.2 RUN mode of easy mode

This Electric Actuator can be operated with the following methods.

- Continuous operation, single operation of the AUTO mode
- STEP mode

NOTE Operation cannot be restarted after the power is turned OFF in the easy mode.

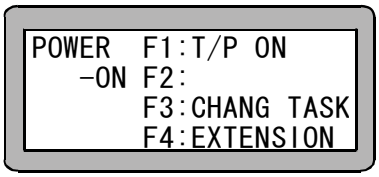
■ 6.2.1 AUTO mode of easy mode

Before using the easy mode, the easy mode must be validated with the mode setting. Refer to section 6.1.1 on how to make the setting.

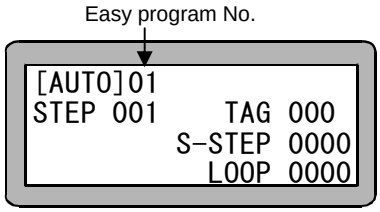
(1) Continuous operation

Carry out operation in the STEP mode to verify the program operation before starting operation in the AUTO mode.

- Operation using Teach Pendant

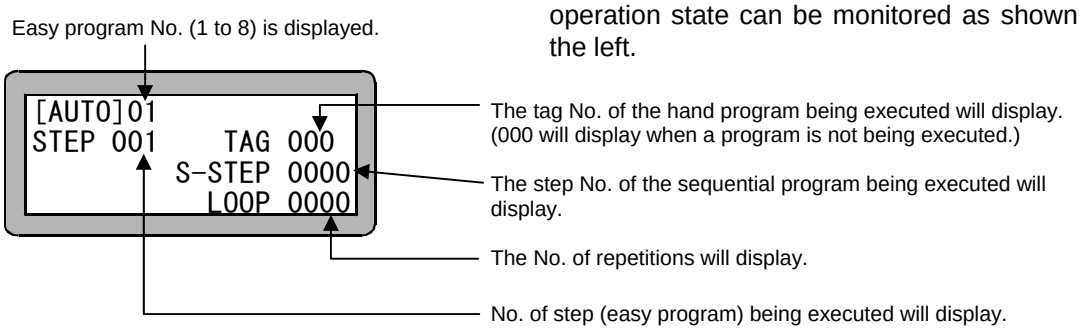


STEP 1 Turn ON the power switch. After the initial screen displays, the following screen will display, so press F1 and HOME to carry out return to origin.



STEP 2 This state is the easy mode RUN mode. Press SEARCH and then use the numeric keypad to enter the easy program No. to be executed. Then press ENT to display the corresponding program.

STEP 3 The program execution will start when START is pressed. During execution, the easy mode operation state can be monitored as shown on the left.



Discontinue

If STOP is pressed, the program will stop after completing the step currently being executed. To restart the program, press START .

NOTE If the EMERGENCY STOP button is pressed, the robot will coast to a stop. The stopping distance will differ according to the load size, speed and inertia.

● **Operation with external signals**

Use the following procedure to carry out operation with the external signals. Refer to section 17.1 on how to disconnect the Teach Pendant.
The following settings must be made before carrying out operation.
Set the controller mode setting to the easy mode. (Refer to section 13.2.10.)
Set the program selection input bit designation to the general-purpose input. (Refer to section 13.2.5.)

[Operation procedures]

1. Carry out return to origin with the system input return to origin.
2. Designate the easy program No. to be executed with the system input program No. selection.
3. Input the start signal to execute the program.
4. If the stop signal is input during operation, the program will stop after ending the step currently being executed.
5. To restart from the step where the program was stopped, input the start signal.
6. To start from step 001, input the reset signal and then input the start signal. If the restart function is valid, the reset input will be ignored. Refer to section 10.2.6 for details.

(2) Single operation

During single operation, the program will stop once after the axis movement or output related operation is executed. To start or restart the program, input the start signal or press START . Normally this is used to verify a program.

An example of single operation is given below.

1. Turn the single operation input signal ON.
2. The following operations are basically the same as continuous operation. (Refer to section 6.2.1 (1) Continuous operation.)
3. When the program has stopped operation, press START or input the start signal to sequentially start the program.

- The single operation mode input setting in the mode setting must be set. (Refer to section 13.2.1.)
- Operation with either the Teach Pendant or external signal is possible.
- The single operation input signal must retain the ON state during single operation. If the single operation input signal is turned OFF during single operation, the remaining program will be continuously operated.
- Even if the single operation input signal is input during continuous operation, it will be ignored, and continuous operation will continue.
- The following commands can be used for stopping after execution.

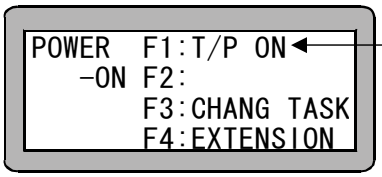
  MOVP, MVB, MVE, HOME,
  OUT, OUP, OUTC

Discontinue

■ 6.2.2 STEP mode of easy mode

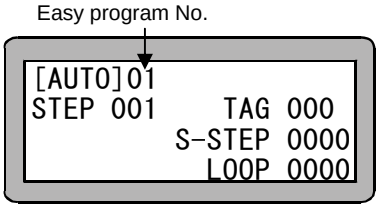
STEP mode is used to execute the program in the controller one step at a time.
Use this mode to confirm the easy program operation, etc., before executing the program in the AUTO mode.

Before using the STEP mode, the easy mode must be validated with the mode setting on the easy mode setting screen. (Refer to section 6.1.1.)



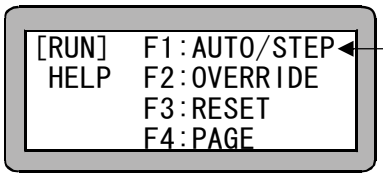
STEP 1

Turn ON the power switch. After the initial screen displays, the following screen will display, so press F 1 and HOME to carry out return to origin.



STEP 2

This is the easy mode's RUN mode. Press SEARCH and then use the numeric keypad to enter the No. of the easy program to be executed. Then, press ENT to display the corresponding program. Then, press HELP .

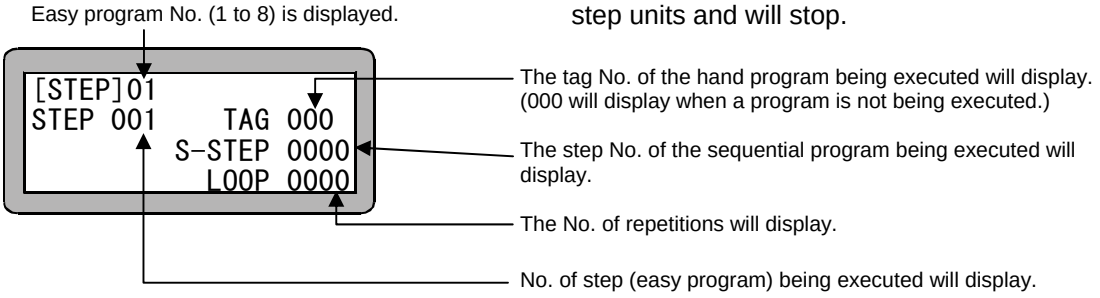


STEP 3

When this screen displays, press F 1 . The STEP mode will be entered. The mode signal lamp will flicker in red during the STEP mode.

STEP 4

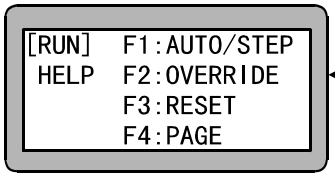
Each time START is pressed, one step of the program will be executed.
The program will be executed sequentially in step units and will stop.



Discontinue

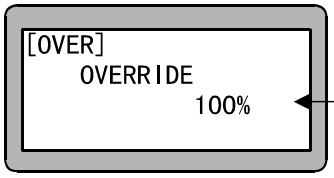
■ 6.2.3 Changing of speed during operation (override)

The entire program execution speed can be delayed by using the override function. This allows the program to be confirmed at a low speed.



STEP 1

Enter the RUN mode and press HELP . This screen will display, so press F 2 and enter the override mode.



STEP 2

Use the numeric keypad to enter the override value. When ENT is pressed, the speed will change to the set speed. Press ESC to return to the RUN mode.
(Initial value: 100)
(Override value: 1 to 100)

NOTE The override setting is valid only while the program is stopped.

Discontinue

Chapter 7 Palletizing mode

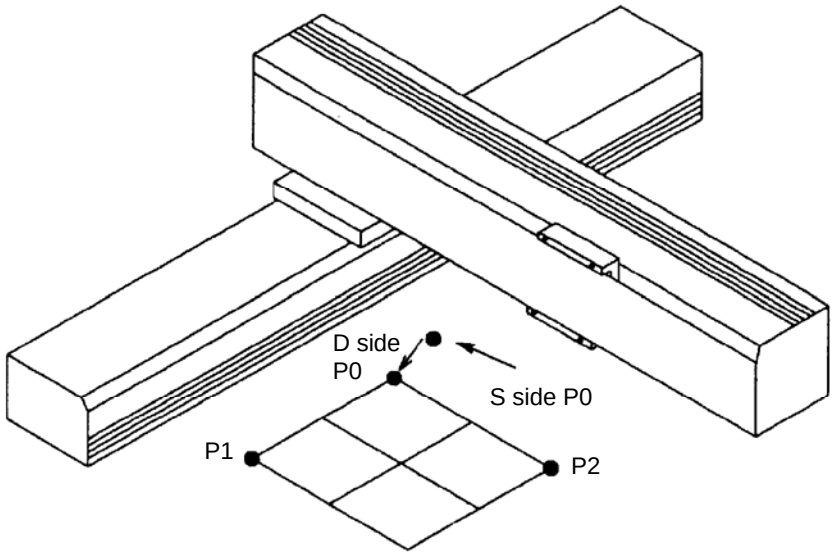
The palletizing is a mode exclusive for moving and loading. This program can be executed just by setting the parameters.
The following types of modes are prepared in the palletizing mode.

- Movement from set position to matrix-type point on X and Y axes direction (1 to M mode)
- Movement from matrix-type point in X and Y axes direction to set position (M to 1 mode)
- Movement from matrix-type point in X and Y axes direction to matrix-type point in X and Y axes direction (M to M mode)

Palletizing operation is carried out in the P1 direction and P2 direction order.

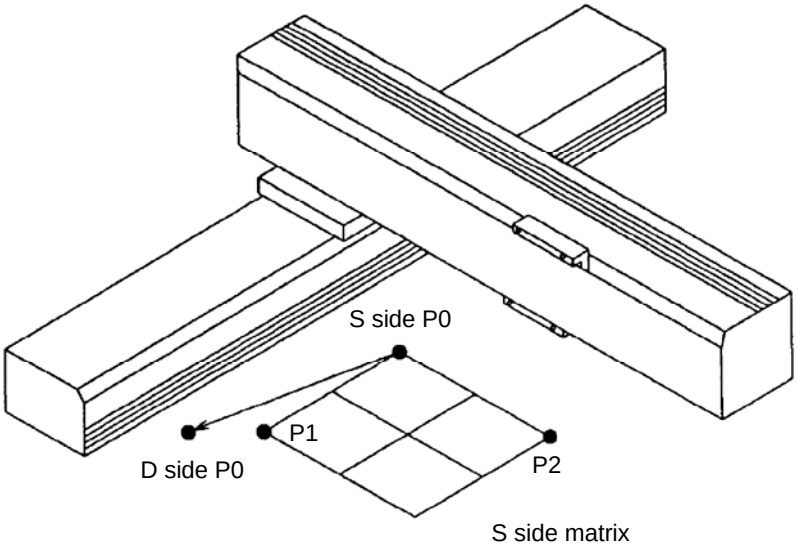
The matrix work origin P0 does not always need to be near the origin. The matrix-shape P0 to P2 can be set at a random position, by that allowing the palletizing operation order to be changed. This Electric Actuator's palletizing mode has the following procedures.

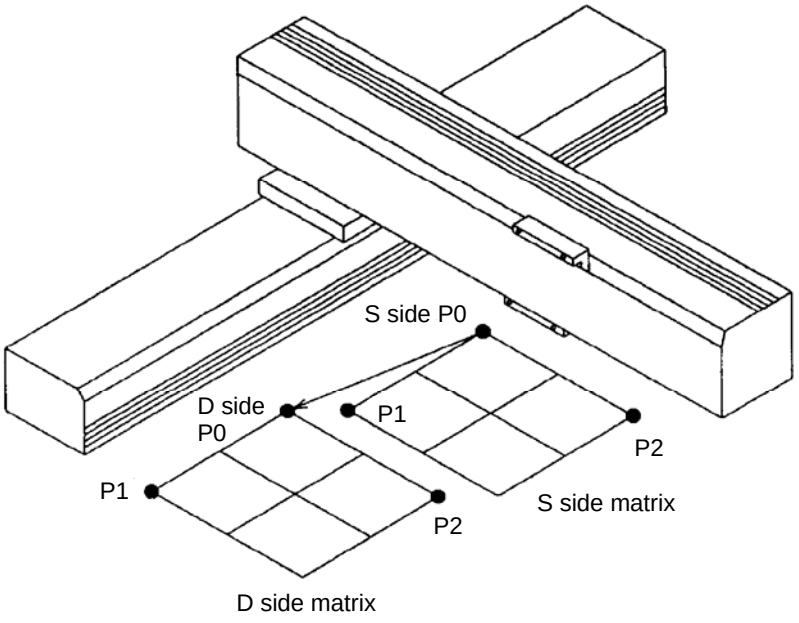
- The program position data can be input with remote teaching or direct teaching.
- By writing in the tag No. of the start program and end program, a sequential program can be executed before and after the palletizing operation.



● 1 to M mode

Discontinue

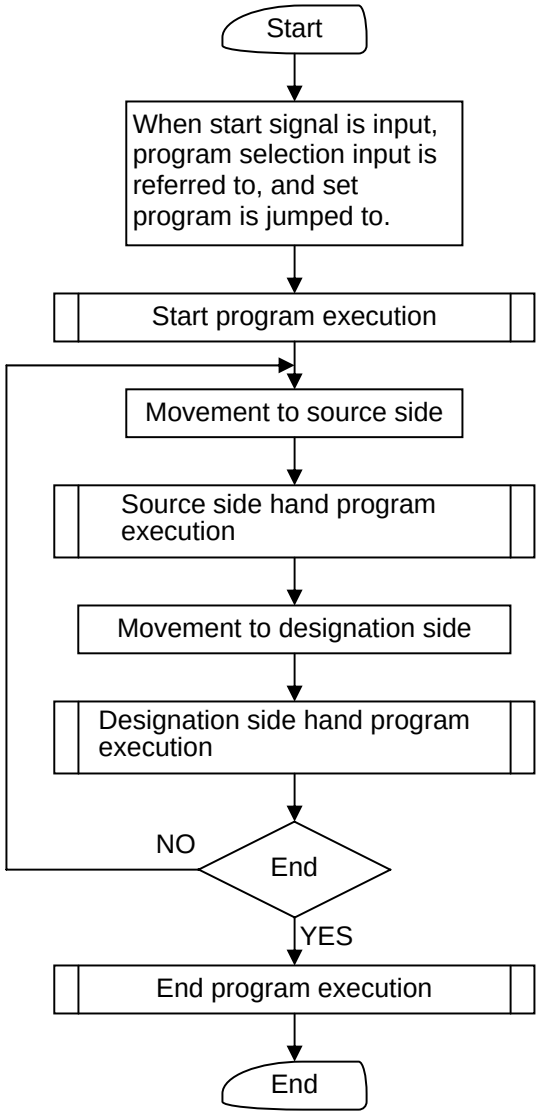




Discontinue

■ 7.1 Basic flow chart of palletizing mode

● The execution order of this palletizing mode is as follows. After the start signal is input, the start program tag No. is referred to. If the tag No. is "000", the start program is passed, and if it is other than "000", the program jumps to the step of the tag No. written in the sequential program. Then that subroutine is executed.
After ending the palletizing operation, the end program tag No. is referred to, and the subroutine is executed and stopping in the same manner as the start program.



[Start program]

The tag No. of the sequential program to be executed before palletizing operation is indicated.

Tag No. 000	Program is passed.
Tag No. other than "0"	The designated tag No. program is executed.

[Hand program]

● The hand program operates the chuck, etc., that is installed.

● Programs are made for both the source side (S side) and destination side (D side).

Tag No. 000	Program is passed.
Tag No. other than "0"	The designated tag No. program is executed.

[End program]

The tag No. of the sequential program to be executed after palletizing operation is indicated.

Tag No. 000	Program is passed.
Tag No. other than "0"	The designated tag No. program is executed.

NOTE

● The above three types of programs are written as subroutines in the appropriate steps of the sequential program.
● The tag No. must always be set at the first step of this subroutine, and "RET" written at the end.
● This subroutine tag No. is written in the palletizing program.

Discontinue

■ 7.2 PRGM mode in palletizing mode

The PRGM (program) screen in the palletizing mode is configured of 14 screens. The screens are common in all modes, but the screens that do not need to be set for the 1 to M mode or M to 1 mode will not display. The positions indicated with an X in the following table are not displayed.

Screen No.	Details	M to M	1 to M	M to 1
01	Start tag No.	○	○	○
02	S side matrix P0 coordinates	○	○	○
03	S side matrix P1 coordinates	○	×	○
04	S side matrix P2 coordinates	○	×	○
05	No. of S side matrixes	○	×	○
06	Movement speed toward S side	○	○	○
07	S side hand program tag No.	○	○	○
08	D side matrix P0 coordinates	○	○	○
09	D side matrix P1 coordinates	○	○	×
10	D side matrix P2 coordinates	○	○	×
11	No. of D side matrixes	○	○	×
12	Movement speed toward D side	○	○	○
13	S side hand program tag No.	○	○	○
14	End tag No.	○	○	○

NOTE

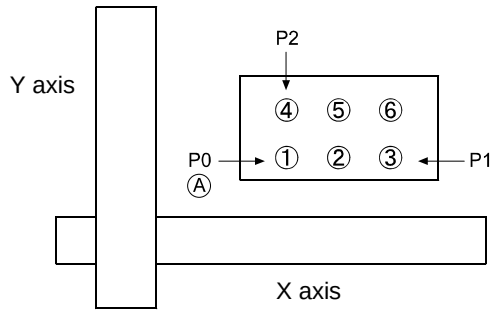
- Inclined compensation is possible by setting each coordinate data P0 to P2. The matrix (pallet, etc.) does not need to be parallel to each axis, but each point coordinate of the matrix must not exceed the soft limit value.
- The operation pattern can be changed on the same matrix by changing the coordinate data P0, P1 and P2 settings.

Discontinue

Operation example: 1 to M

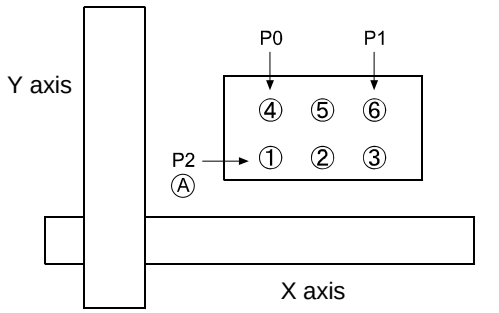
The place of 2-axis combination is shown below for example.

Set the coordinates ① in the D side P0 coordinates
Set the coordinates ③ in the D side P1 coordinates
Set the coordinates ④ in the D side P2 coordinates



[Operation pattern]
To execute the 1 to M program.
Ⓐ → ① → Ⓐ → ② → Ⓐ → ③ → Ⓐ → ④ → Ⓐ → ⑤ → Ⓐ → ⑥

Set the coordinates ④ in the D side P0 coordinates
Set the coordinates ⑥ in the D side P1 coordinates
Set the coordinates ① in the D side P2 coordinates



[Operation pattern]
To execute the 1 to M program.
Ⓐ → ④ → Ⓐ → ⑤ → Ⓐ → ⑥ → Ⓐ → ① → Ⓐ → ② → Ⓐ → ③

- In the palletizing program, counter Nos. 91 to 94 are used as the palletizing counter.

		Applicable counter
S side	Count in P0 to P1 direction	No. 91
	Count in P0 to P2 direction	No. 92
D side	Count in P0 to P1 direction	No. 93
	Count in P0 to P2 direction	No. 94

NOTE Counter Nos. 91 to 94 are counters exclusive for palletizing. Do not use these in programs other than the palletizing program.

- Refer to the relation of the counter details and movement position given in Section 4.1.7 (3) for details on the counter and movement position.

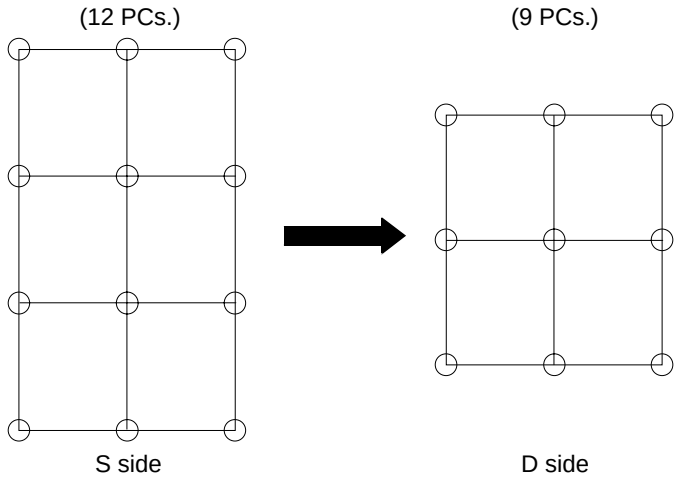
- The counter details are automatically processed (counted up, initialized) after the destination side hand program is executed.

- The S side and D side coordinate data P0 to P2 can be remotely taught or directly taught. However, direct teaching cannot be used for axes provided with brakes. (Refer to section 3.2.2.)

Discontinue

- If the No. of S sides and D sides differs in the M to M mode, the palletizing operation will be continuously repeated. (If the D side pallet is full, the first point of the D side pallet will be returned to.)
  This operation will be repeated until the work at the final point of the S side reaches the final point on the D side.

[Example]

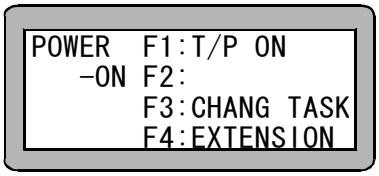


In the above example, after 36 works (min. nominal multiple of 12 and 9) are palletized, the program will end.
(The palletizing operation is repeated three times on the S side pallet and four times on the D side pallet.)

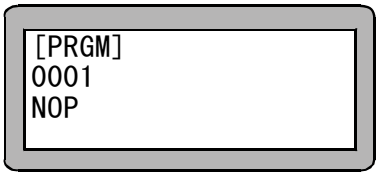
Discontinue

■ 7.2.1 How to enter and leave the PRGM mode

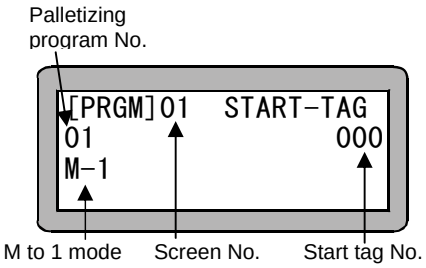
The PRGM mode is used for programming. The method for entering and leaving the PRGM mode in the palletizing mode will be described in this section.



STEP 1 Turn the power ON. When the display shown at the left appears after the initial screen press [F1] . Then press [RUN PRGM] to enter the PRGM mode.



STEP 2 Press [SEQUN PALET] and enter the palletizing mode.



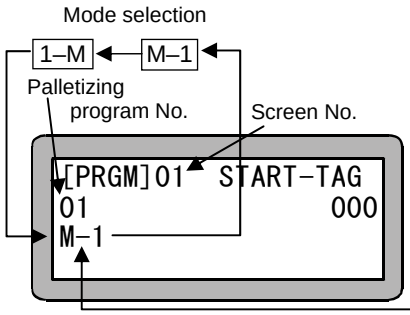
STEP 3 The initial screen of the palletizing mode will display.
Press [NEXT] to display the next screen.
Press [SEQUN PALET] to leave the palletizing mode and return to the sequential mode.

Discontinue

■ 7.2.2 Editing palletizing mode program

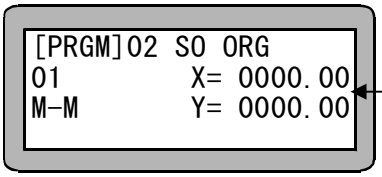
The programming screen using the M to M mode is shown below.

Enter the PRGM (program) mode and press SEQUN PALET . (Refer to section 7.2.1.)



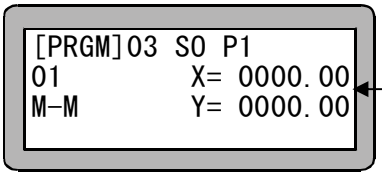
STEP 1

When ALT is pressed, the mode will alternate, so select the required mode and press ENT . Next, use the numeric keypad to enter the tag No. and press ENT . Press NEXT to display the next screen.



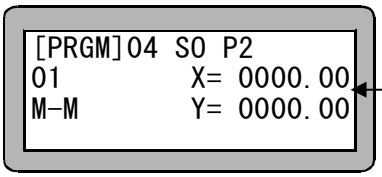
STEP 2

Use the numeric keypad to enter the S side P0 coordinates (absolute coordinates) and press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.



STEP 3

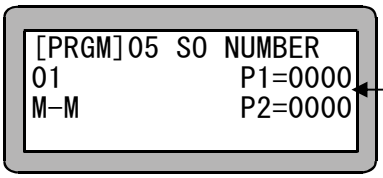
Use the numeric keypad to enter the S side P1 coordinates (absolute coordinates) and press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.



STEP 4

Use the numeric keypad to enter the S side P2 coordinates (absolute coordinates) and press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.

If the S side matrix is one row, set "0" for the X, Y coordinates.

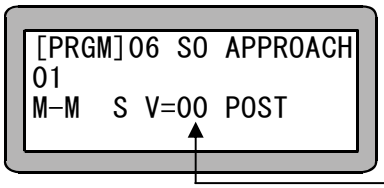


STEP 5

Use the numeric keypad to enter the No. of pieces on the S side and then press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.

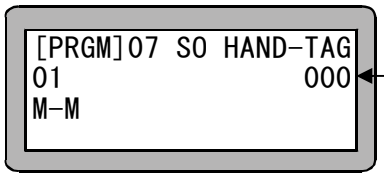
If the S side matrix is one row, set "0" for P2.

Discontinue



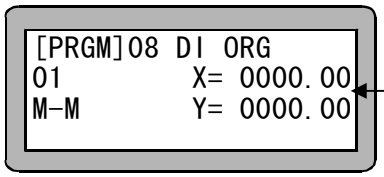
STEP 6

Use the numeric keypad to enter the No. of the speed to be applied when moving toward the S side and then press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.



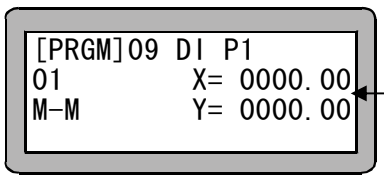
STEP 7

Use the numeric keypad to enter the tag No. of the hand program on the S side and then press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.



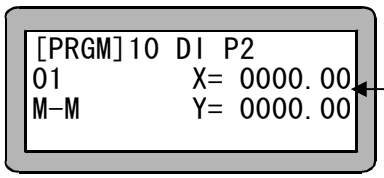
STEP 8

Use the numeric keypad to enter the D side P0 coordinates (absolute coordinates) and press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.



STEP 9

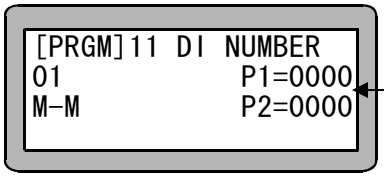
Use the numeric keypad to enter the D side P1 coordinates (absolute coordinates) and press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.



STEP 10

Use the numeric keypad to enter the D side P2 coordinates (absolute coordinates) and press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.

If the D side matrix is one row, set "0" for the X, Y coordinates.

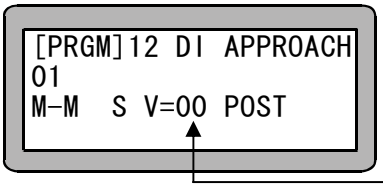


STEP 11

Use the numeric keypad to enter the No. of pieces on the D side and press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.

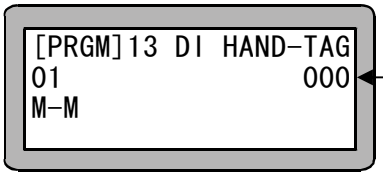
If the D side matrix is one row, set "0" for P2.

Discontinue



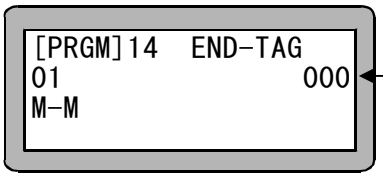
STEP 12

Use the numeric keypad to enter the No. of the speed to be applied when moving toward the D side and then press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.



STEP 13

Use the numeric keypad to enter the tag No. of the hand program on the D side and then press ENT . Press NEXT to display the next screen and -NEXT to display the previous screen.



STEP 14

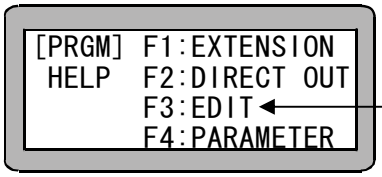
Use the numeric keypad to enter the tag No. and then press ENT .
Press -NEXT to display the previous screen.

NOTE If SEARCH is pressed during STEP 1 to 14, the program No. can be searched (1 to 8), and when pressed twice the screen No. can be searched (1 to 14). (Refer to sections 15.5 and 15.6.)
If ESC is pressed after searching, the original screen will display.

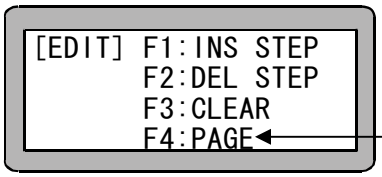
Discontinue

■ 7.2.3 Copy editing of palletizing mode

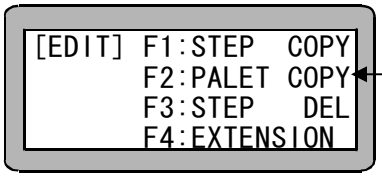
A random program in the palletizing mode can be copied to another palletizing program.
Enter the PRGM mode (sequential mode) and press HELP .
The following screen will display. (Refer to section 4.1.1.)



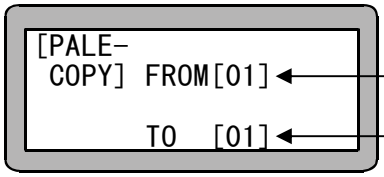
STEP 1 From this state, press F 3 .



STEP 2 In this state, press F 4 .
Press ESC to return to the initial screen of the PRGM mode.



STEP 3 Press F 2 .
Press ESC to return to STEP 2.

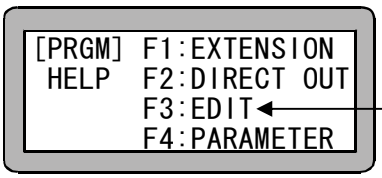


STEP 4 Use the numeric keypad to enter the copy origin palletizing program No. and the copy destination palletizing program No.
Press ENT . The program will be copied, and STEP 3 will be returned to.
Press ESC to return to step 3.

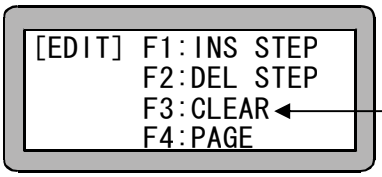
Discontinue

■ 7.2.4 Clearing of palletizing mode programs

Enter the PRGM mode (sequential) and press HELP . (Refer to section 4.1.1.) The following screen will display.

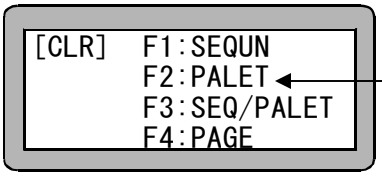


STEP 1 From this state, press F 3 .

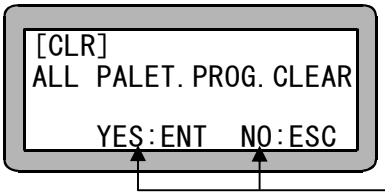


STEP 2 In this state, press F 3 to enter the clear mode.
Press ESC to return to the initial screen of the PRGM mode.

[To clear only palletizing program]

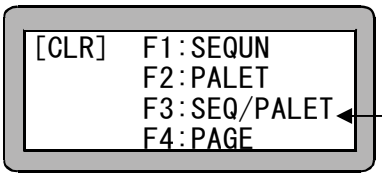


STEP 3A Press F 2 , and all palletizing programs will be initialized.
Press ESC to go to STEP 2.

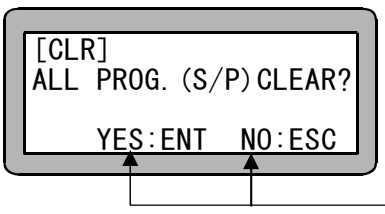


STEP 4A To clear the program, press ENT . To not clear the program, press ESC .

[To clear palletizing and sequential programs]



STEP 3B Press F 3 is pressed, both the sequential and palletizing programs will be initialized.
Press ESC to return to the previous screen.



STEP 4B To clear the program, press ENT . To not clear the program, press ESC .

Discontinue

■ 7.2.5 How to restart operation after turning power OFF in palletizing mode

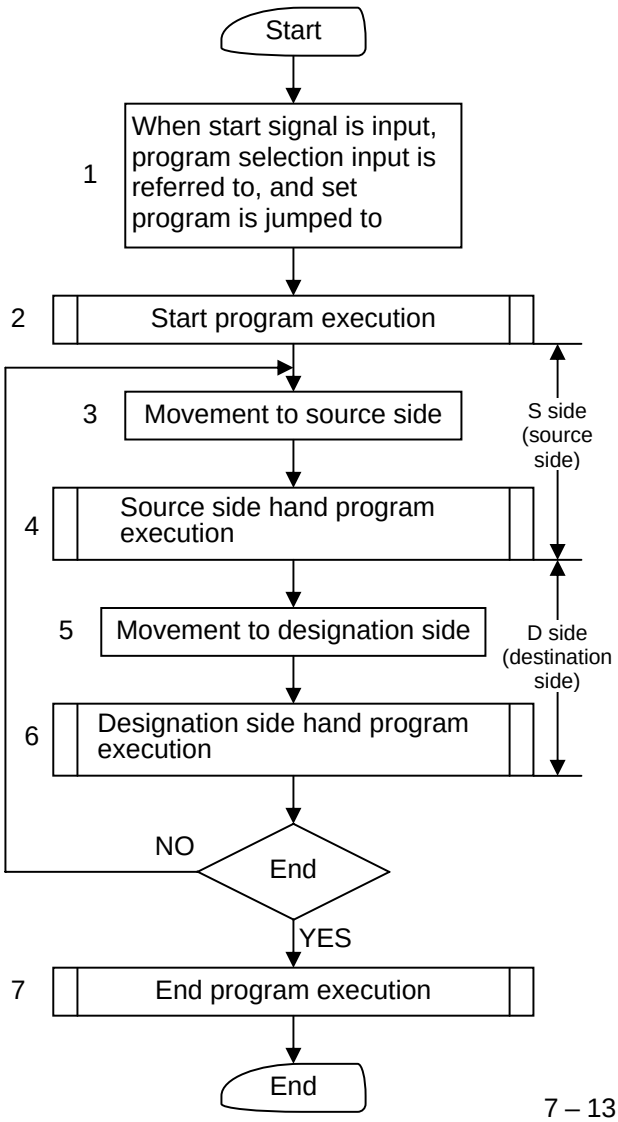
During palletizing with this Electric Actuator, work can be restarted with the following conditions even if the power is turned OFF while the program execution is stopped.

Set the restart input bit in the mode setting. (Refer to section 13.2.2.)

Using the status setting (input ON) step No. and counter items when the mode setting restart is validated at the initial settings.
(Refer to section 13.2.12.)

After turning the power OFF, turn the restart input ON, and turn the power ON. After returning to the origin, the program will be restarted with the following conditions.
Note that the status setting (input ON) step No. and counter items when the mode setting restart is validated must be used at the initial settings.

Palletizing flow chart



Position where power is turned OFF	Restart method
At processes 1 to 2	Starts from process 1 (from beginning)
At processes 3 to 6	Starts from process 3 (continuing of operation)
At process 7	Starts from process 1 (It is interpreted that the process has been completed, so operation will start from process 1.)

NOTE

- If the operation is stopped between processes 3 and 6, the axis will stop at the S side or D side. However, if it is stopped at the D side (process 5 or 6), start again after returning one work to the S side pallet.
  When stopped at the S side (process 3 or 4), confirm that the work is at the S side pallet, and then start.
- Resuming of operation is possible only when the power is turned OFF while the program execution is stopped (stopped in normal state). If the power is turned OFF during execution of a program (during operation), restarting will not be possible. A restarting not possible error will occur.

Discontinue

■ 7.3 RUN mode of palletizing mode

This Electric Actuator can be operated with the following methods.

- AUTO mode
  - Continuous operation
  - Single operation
- STEP mode

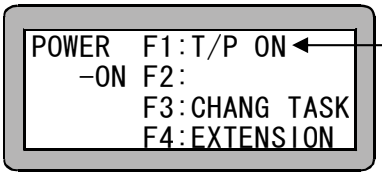
■ 7.3.1 AUTO mode of palletizing mode

(1) Continuous operation

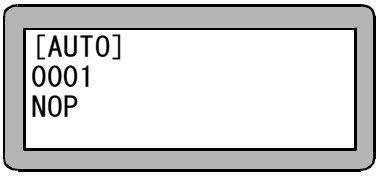
Continuous operation will automatically execute the program in sequence. When running the program for the first time after creating it, verify the operation of the program using the STEP mode before starting continuous operation. (Refer to section 7.3.2.)

Operation using Teach Pendant

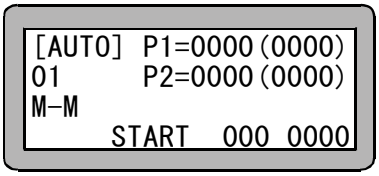
The operation procedures using the Teach Pendant are shown below.



STEP 1 Turn ON the power switch. After the initial screen displays, the following screen will display, so press F1 and HOME to carry out return to origin.



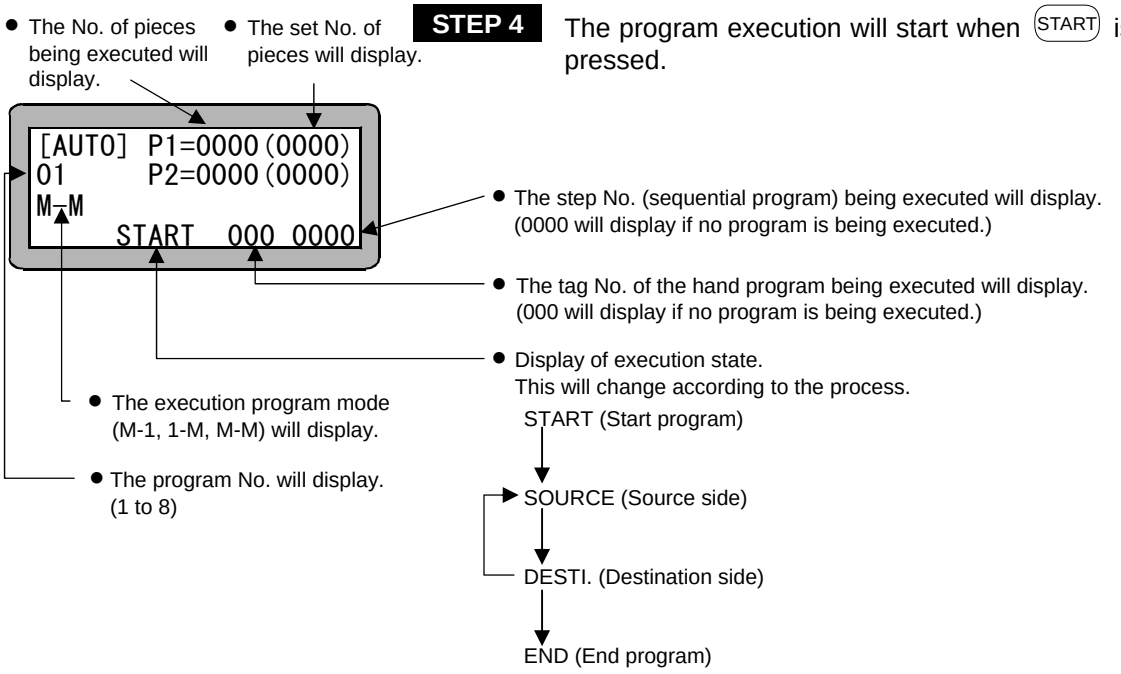
STEP 2 Press SEQUN PALET in this state.
The palletizing mode will be entered.

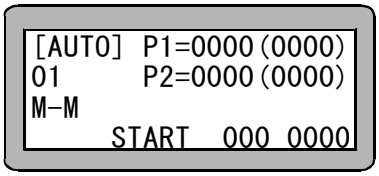


STEP 3 Press SEARCH and then use the numeric keypad to enter the program No. to be executed. Then press ENT to display the corresponding program.

Discontinue

STEP 4 The program execution will start when (START) is pressed.





STEP 5 When the end program execution has completed, the display will change from END to START, and the initial state will be returned to.

Discontinue

Operation with external signals

Use the following procedure to carry out operation with the external signals.
The Teach Pendant must be disconnected from the controller or turned OFF to carry out operation with external signals. (Refer to section 17.1.)

1. Turn the palletizing input signal ON.
   The palletizing input signal must be set with the mode setting. (Refer to section 13.2.16.)

2. Turn the controller power ON.

3. If READY output is set with the mode setting, check the ON state and then input the input signal. (Refer to section 13.2.15.)
   If the READY signal is not set with the mode setting, the next input signal will be input approximately two seconds after the power is turned ON.

4. Turn the return to origin signal ON and return to the home.
   The return to home input signal must be set with the mode setting. (Refer to section 13.2.6.)

5. Confirm that the return to origin signal is ON and then input the next signal.

6. Turn the start signal ON and start the program.
   The palletizing input signal state will be checked when the start signal is input. If the signal is ON, the palletizing mode program will be started.

NOTE The palletizing mode can be entered only from the sequential mode. Thus, the mode setting must be set to "Invalid" as shown in section 11.2.10. If a state other than "Invalid" is selected, the palletizing input signal will be ignored.



- If a stop signal is input during operation, the program will stop after ending the operation currently being executed.
- To restart the program after stopping with a stop signal or STOP command, input the start signal again. To start the program from the start again, input the reset signal and then input the start signal.
  Note that the restart mode setting and restart signal input state are related. (Refer to sections 13.2.2, 13.2.12 and 13.2.13.)
- Refer to section 7.2.5 for how to restart operation after turning the power OFF.

Discontinue

(2) Single operation

During single operation, the program will stop once after the axis movement or output related operation is executed. To start or restart the program, input the start signal or press START .
Normally this is used to verify a program.

An example of single operation is given below.

1. Turn the single operation input signal ON.
2. The following operations are basically the same as continuous operation. (Refer to section 7.3.1 (1) Continuous operation.)
3. When the program has stopped operation, press START or input the start signal to sequentially start the program.

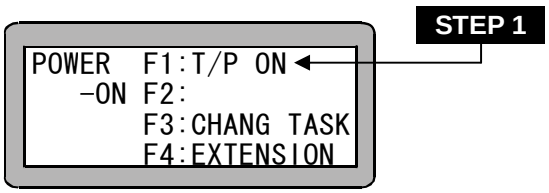
- The single operation mode input bit setting in the mode setting must be set. (Refer to section 13.2.1.)
- Operation with either the Teach Pendant or external signal is possible.
- The single operation input signal must retain the ON state during single operation.
  If the single operation input signal is turned OFF during single operation, the remaining program will be continuously operated.
- Even if the single operation input signal is input during continuous operation, it will be ignored, and continuous operation will continue.
- The palletizing input signal must be ON when the start signal is input.
- The following commands can be used for stopping after execution.

  MOVP, MVB, MVE, HOME,
  OUT, OUTP, OUTC

■ 7.3.2 STEP mode of palletizing mode

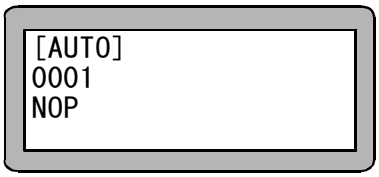
The STEP mode is used to execute the program in the controller one step at a time using the teach pendant.
After creating a program, use this mode to verify the program, etc., before executing the program in the AUTO mode.

The operation procedures of the step mode are given below.

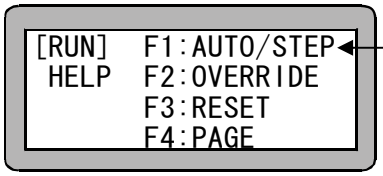


Turn ON the power switch. After the initial screen displays, the following screen will display, so press F1 and HOME to carry out return to origin.

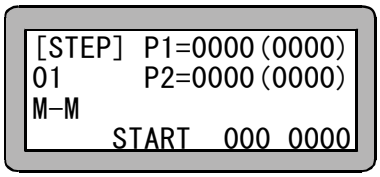
Discontinue



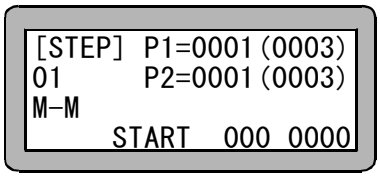
STEP 2 This is the sequential mode's RUN mode.
Press HELP .



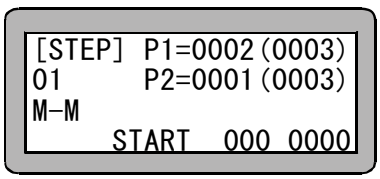
STEP 3 When this screen displays, press F1 . The STEP mode will be entered.
Press the SEQUN PALET .



STEP 4 Press SEARCH and then use the numeric keypad to enter the program No. to be executed. Then press ENT to display the corresponding program.



STEP 5 Press START to start the program.



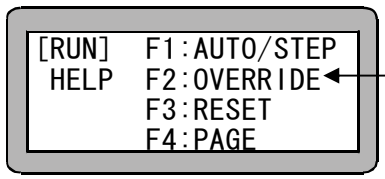
STEP 6 The next step will display, and the robot will stop.
Press START to execute the next step. The program will be executed sequentially in step units and will stop.

NOTE During the operation with the STEP mode, the input signal and output signal timings will differ compared to operation in the AUTO mode.

Discontinue

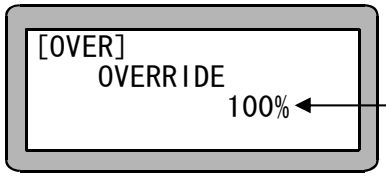
■ 7.3.3 Changing of speed during operation (override)

The entire program execution speed can be delayed by using the override function. This allows the program to be confirmed at a low speed.



STEP 1

Enter the RUN mode and press (HELP) . This screen will display, so press (F 2) and enter the override mode.



STEP 2

Use the numeric keypad to enter the override value. When (ENT) is pressed the speed will change to the set speed.
Press (ESC) to return to the RUN mode.
(Initial value: 100)
(Override value: 1 to 100)

NOTE The override setting is valid only while the program is stopped.
This page is blank.

Discontinue

Chapter 8 External Point Designation Mode

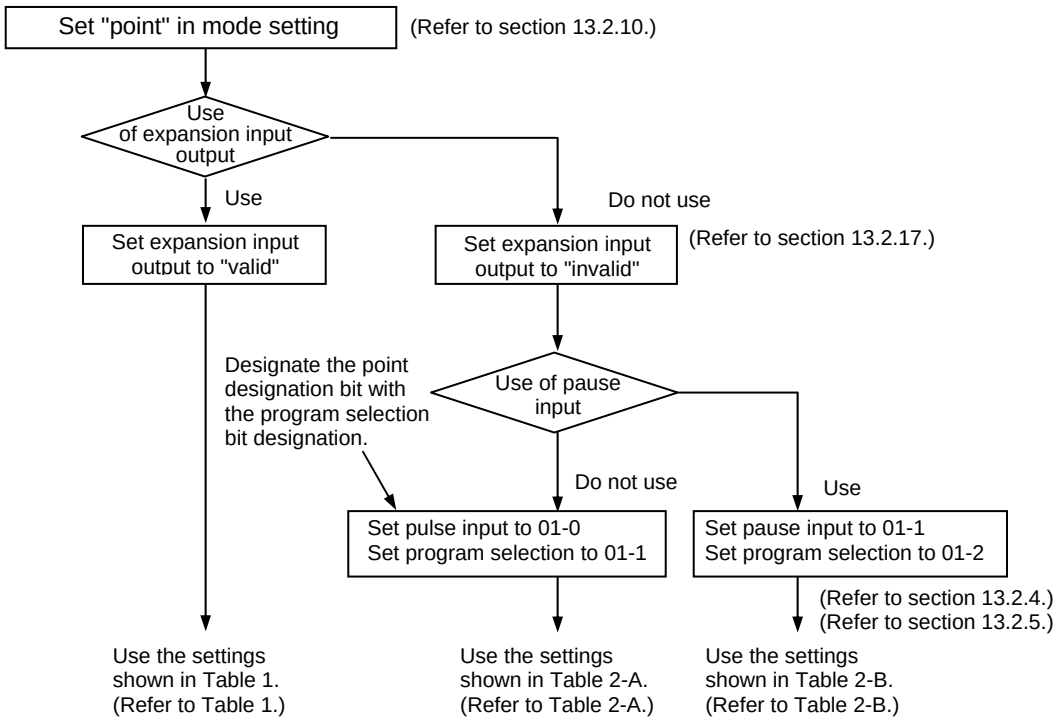
■ 8.1 Explanation of external point designation mode

The external point designation mode does not use the controller's command language and instead, the positioning movement takes place according to the signals input from the input/output connector. The signals input from the input/output connector are as follow.

	When expansion input/output is not used	When expansion input/output is used *2
Point table	Max. 4 bits 16 points *1	10 bits 999 poinpts
Speed table	1 table (Fixed to table No. 1)	2 bits 3 tables (Table Nos. 1 to 3)
Acceleration/deceleration table	1 table (Fixed to table No. 5)	1 bits 2 tables (Table Nos. 1, 2)
Coordinate system	Fixed absolute coordinates	1 bit Absolute coordinates/ relative coordinates

*1 When the pause input is used, this will be 8 points (3 bits).
*2 Connect the option expansion input/output and validate the expansion input/output in the mode setting. (Refer to section 13.2.17.)

● Setting of external point designation mode
The procedure for making settings to operate with this mode, and the relation of the input ports is shown below.



Discontinue

Table 1. Input ports when using expansion input/output

	Function
Port 01-1	Speed table designation 2^0 input
Port 01-2	Speed table designation 2^1 input
Port 01-3	Acceleration/deceleration table designation input
Port 01-4	Coordinate system designation input
Port 02-1	Point table designation 2^0 input
Port 02-2	Point table designation 2^1 input
· · ·	· · ·
Port 02-8	Point table designation 2^7 input
Port 03-1	Point table designation 2^8 input
Port 03-2	Point table designation 2^9 input

Table 2. Input ports when using expansion input/output

	A When not using pause input (No. of point tables: 16)	B When using pause input (No. of point tables: 8)
Port 01-1	Point table designation 2^0 input	Pause input
Port 01-2	Point table designation 2^1 input	Point table designation 2^0 input
Port 01-3	Point table designation 2^2 input	Point table designation 2^1 input
Port 01-4	Point table designation 2^3 input	Point table designation 2^2 input

NOTE An extension input/output unit should be connected to the master unit in the case of using this input/output unit.
If connecting to the salve unit, this input/output unit does not operate.

Discontinue

(1) Point (coordinate) table designation method

- When not using the expansion input/output, a maximum of 4 bits (16 points) can be designated.
- When using the expansion input/output, 10 bits (999 points) can be designated.

When not using expansion input/output
(When not using pause input)

When not using expansion input/output
(When using pause input)

		Point table designation4									
		2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Designated table No.	1	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	1
	:	:	:	:	:	:	:	:	:	:	:
	8	0	0	0	0	0	0	0	1	1	1
	:	:	:	:	:	:	:	:	:	:	:
	16	0	0	0	0	0	0	1	1	1	1
		:	:	:	:	:	:	:	:	:	:
	256	0	0	1	1	1	1	1	1	1	1
	:	:	:	:	:	:	:	:	:	:	:
	999	1	1	1	1	1	0	0	1	1	0
Error	1000 or more	1	1	1	1	1	1	1	1	1	1

1: ON 0: OFF

Refer to section 13.5.1 for details on how to set the point (coordinate) table.

- If 1000 or more point tables are designated, an error will occur.
- The relation of the point table No. and input port is as follows.
  When the input port values are arranged in the order of 2^9, 2^8, ... 2^1, 2^0 and interpreted as binaries, the number achieved by adding 1 to that value is the table No.

  <Example> For table No. 16

  $16 = (2^9 \times 0 + 2^8 \times 0 + 2^7 \times 0 + 2^6 \times 0 + 2^5 \times 0 + 2^4 \times 0 + 2^3 \times 1 + 2^2 \times 1 + 2^1 \times 1 + 2^0 \times 1) + 1$

  $= (8 + 4 + 2 + 1) + 1$

Discontinue

(2) Speed table designation method

- When not using the expansion input/output, the speed table is fixed to No. 1.
- When using the expansion input/output, 12 bits (3 steps) can be designated.

		Speed table designation input	
		2^1	2^0
Designated speed table No.	1	0	0
	1	0	1
	2	1	0
	3	1	1

1: ON 0: OFF

Refer to section 13.5.2 for the method of setting the speed table.

- The relation of the speed table No. and input port is the same as for the point table designation.

(3) Acceleration/deceleration table designation method

- When not using the expansion input/output, the acceleration/deceleration table is fixed to No. 5.
- When using the expansion input/output, 1 bit (2 steps) can be designated.

		Acceleration/ deceleration table designation input
Designated acceleration/deceleration table No.	1	0
	2	1

1: ON 0: OFF

Refer to section 13.5.3 for the method of setting the acceleration/deceleration table.

(4) Coordinate system designation

- When not using the expansion input/output, the system is fixed to the absolute coordinates.
- When using the expansion input/output, 1 bit (relative coordinates/absolute coordinates) can be designated.

		Coordinate system designation input
Designated coordinate system	Absolute coordinates	0
	Relative coordinates	1

1: ON 0: OFF

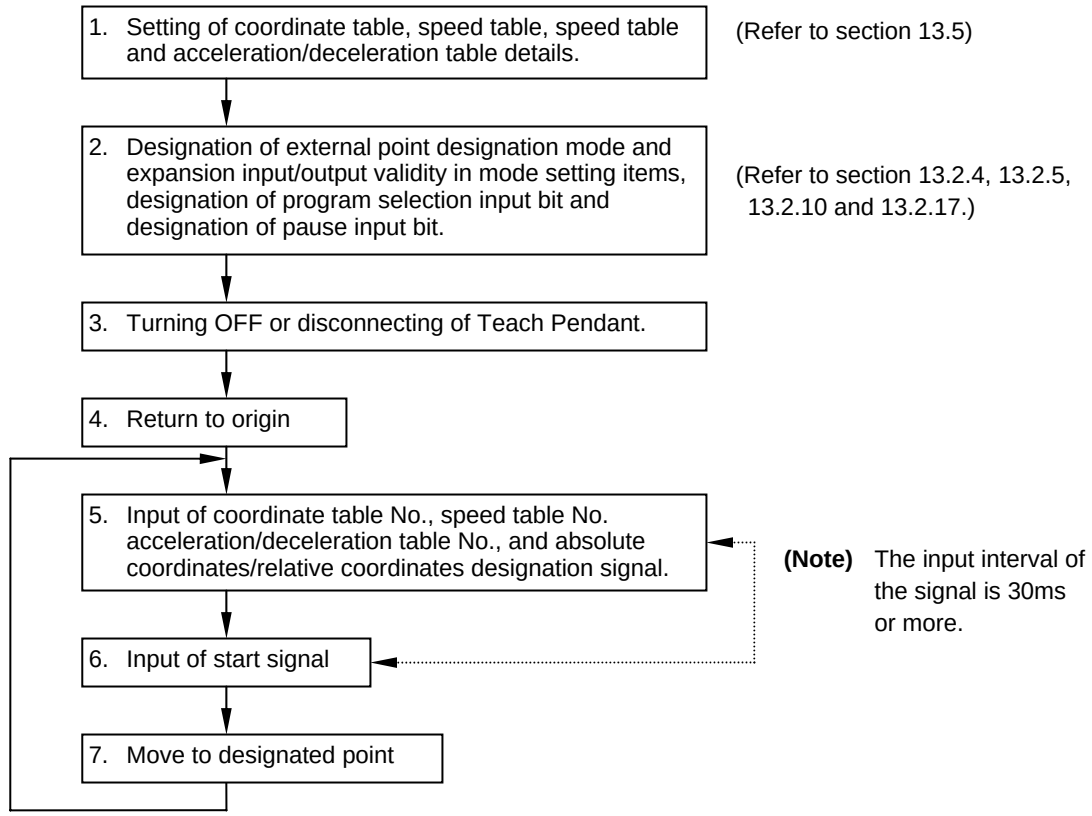
Discontinue

■ 8.2 Operation method of external point designation mode

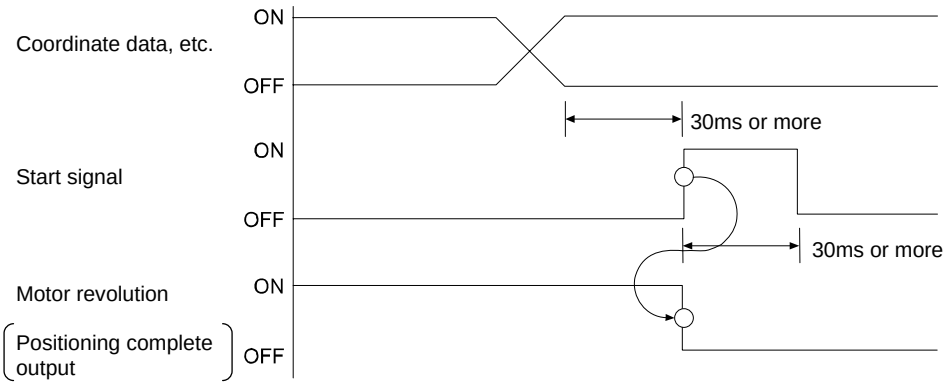
In the external point designation mode, operation can be carried out with system inputs and general-purpose inputs or with the Teach Pendant.

■ 8.2.1 Execution with input/output

An example of the settings and operation procedures in the external point designation mode is shown below.



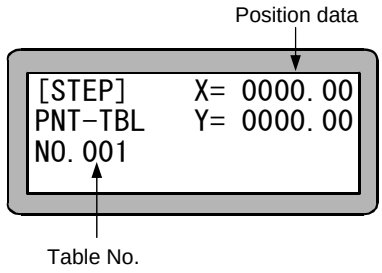
NOTE The start input must be turned ON 30ms or longer after the input signal is designated.



Discontinue

■ 8.2.2 Operation with Teach Pendant

In this mode, each point can be moved to using the Teach Pendant.
When the Teach Pendant is turned ON in the external point designation mode, the following screen will display.



Display the coordinate table to be moved using (NEXT) , (-NEXT) ,or (SEARCH) .
Press (START) .

NOTE The following restrictions will apply when executing operation with the Teach Pendant.

Speed designation: Fixed to table No. 1
Acceleration/deceleration designation: Fixed to table No. 5
Coordinate system designation: Fixed to absolute coordinates

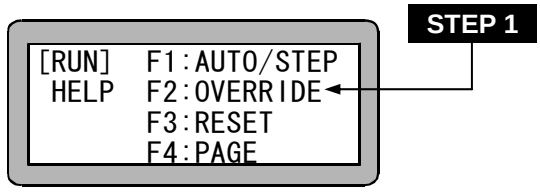
Other operations

The following operations can be done in the external point designation mode.

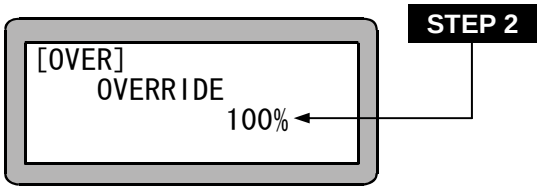
- Parameter setting
- Override setting
- RESET operations

■ 8.3 Changing of speed during operation (Override)

The entire execution speed can be delayed by using the override function. This allows the robot operation to be confirmed at a low speed.



STEP 1 Enter the RUN mode and press (HELP) . This screen will display, so press (F2) and enter the override mode.



STEP 2 Use the numeric keypad to enter the override value. When (ENT) is pressed, the speed will change to the set speed.
Press (ESC) to return to the RUN mode.
(Initial value: 100)
(Override value: 1 to 100)

NOTE The override setting is valid only while the program is stopped.

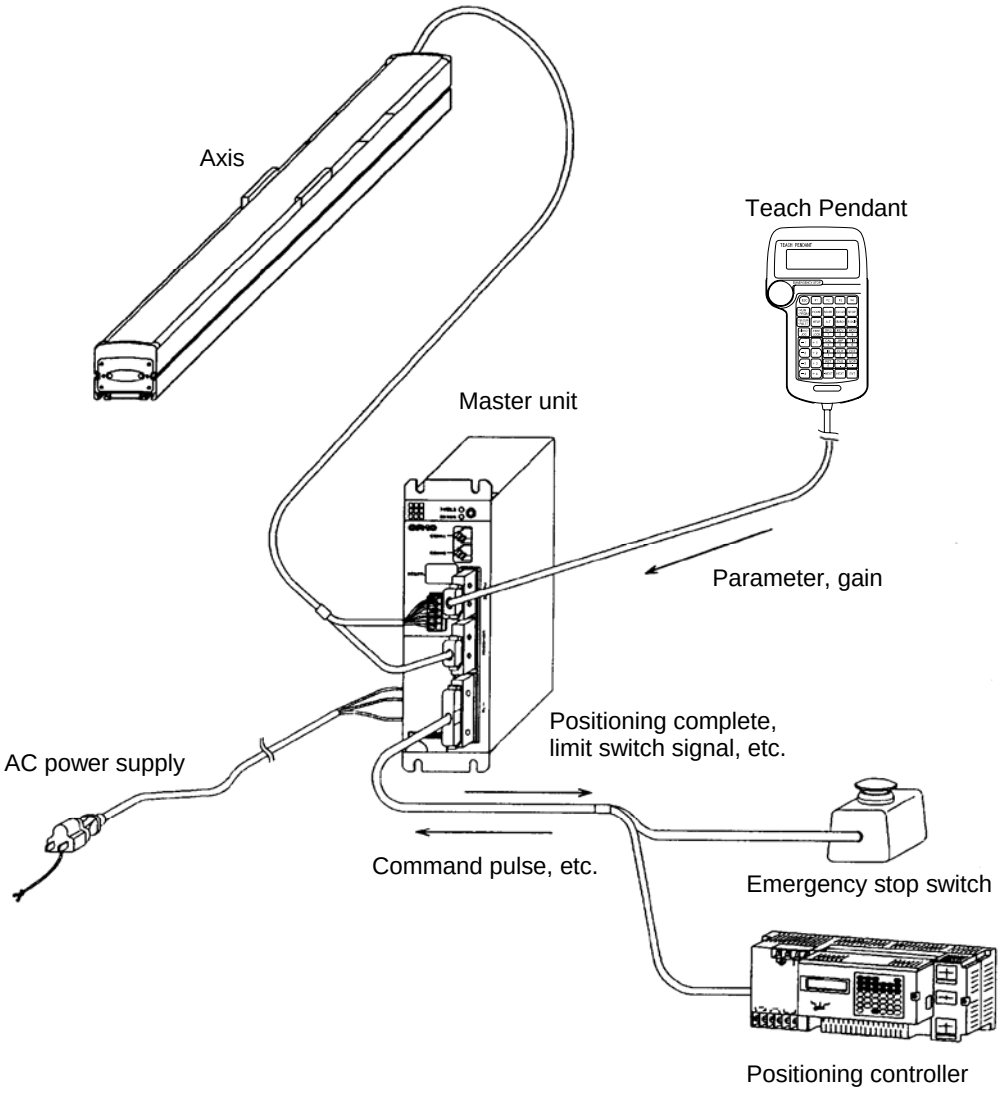
Discontinue

Chapter 9 Pulse train input mode

■ 9.1 System

■ 9.1.1 System configuration method

When operating with the pulse train input mode, the master unit controls the movement amount and speed according to the pulse train input supplied from an external source. Thus, operations such as return to origin, acceleration/deceleration control and protection with soft limit are carried out by the externally provided controller.



Discontinue

■ 9.1.2 Specifications of pulse train input mode

Applicable robot		Electric Slider KBB series
Parameter memory		FRAM (Various parameters required for operation are saved)
Command input method		2-clock method, 1-clock method
Command pulse frequency		Max. 500kHz (NOTE1)
Input	Signal	Servo ON, Reset, Counter clear
	Specifications	24VDC 10mA
Output	Signal	Positioning complete, Error, Origin limit, Motor index signal
	Specifications	24VDC 20mA (Max.)
Applicable encoder		Line driver output (Low-wiring type)
Display		Error display lamp lighting (Front panel)
Error display		Error display lamp lighting, Teach Pendant
Protective functions		Encoder error, Overload, Overvoltage, etc.

NOTE The command pulse frequency 500kHz is the value for the line driver interface. When an open collector interface is used, the pulse wave form may flatten due to the effect of the floating capacity in the wiring. Thus, when using at 200kHz or higher, use of a line driver interface is recommended.

Discontinue

■ 9.2 Input/output signals

■ 9.2.1 Input/output connector signal names and pin numbers

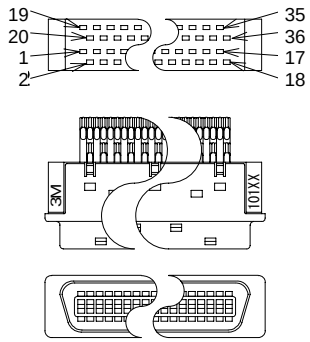
When the pulse train input mode is designated in the mode selection, the input/output connector will be changed to the following functions.

No.	Signal name	No.	Signal name
1	+COM1	19	COM3 *
2	General-purpose output port 1-1*	20	General-purpose input port 1-1 *
3	General-purpose output port 1-2*	21	General-purpose input port 1-2 *
4	General-purpose output port 1-3*	22	General-purpose input port 1-3 *
5	General-purpose output port 1-4*	23	General-purpose input port 1-4 *
6	–COM1 *	24	N.C
7	Emergency stop output (NO)	25	Emergency stop input
8	Emergency stop output (COM)	26	Emergency stop input
9	Emergency stop output (NC)	27	COM4
10	N.C	28	System input *
11	System output *	29	Servo ON input
12	Error output	30	Counter clear input
13	Positioning complete output	31	Reset input
14	System output *	32	N.C
15	Origin LS output	33	+CLK/±CLK (P)
16	ø Z	34	↑ (N)
17	–COM2	35	-CLK/SIGN (P)
18	N.C	36	↑ (N)

N.C: No Connection

NOTE The pins marked with a * will not function. Do not connect the external circuit.

Use the enclosed connector.



- Cable side connector type
  Plug 10136-3000VE (Sumitomo 3M)
  Shell kit 10336-52F0-008 (Sumitomo 3M)

- Panel side connector type
  Receptacle 10236-52A2JL (Sumitomo 3M)

Applicable wire size: AWG24 (0.22 mm^2)

Discontinue

■ 9.2.2 Functions of each input/output signal

(1) Error output

This turns ON when an error occurs in the controller.
Refer to Chapter 19 for the error types and process methods.

(2) Positioning complete output

This turns ON when the deflection of the cumulative value of the command pulse (pulses from external controller) and cumulative value of the feed-back pulses (pulses of motor encoder in axis) is smaller than the in-position value set with the parameters.
Note that this will turn OFF regardless of the cumulative value deflection during the servo free state.

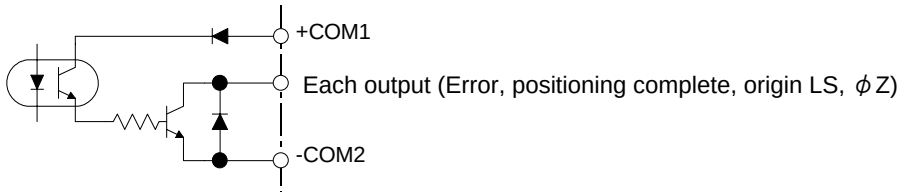
(3) Origin LS output

This outputs the information on the origin limit switch in the axis.

(4) φZ (Encoder Z-phase pulse)

This outputs one signal per motor rotation output from the motor encoder in the axis.

Output signal circuit



(5) Counter clear input

This clears the software counter in the controller accumulating the command pulses and the deflection counter that shows the difference of the command pulses and feedback pulses.

ON: Clear
OFF: Normal

(6) Servo ON input

This controls the exciting and non-exciting state of the servomotor in the axis.

Servo ON: Servo locked state.
Servo OFF: Servo free state.

NOTE

- Turn the power ON when the servo ON signal is in the OFF state. When recovering from an error or emergency stop state, turn the servo ON signal OFF once.
  If the power is turned ON while the servo ON signal is ON, or when recovering from an error or emergency stop state, the servo will not lock.
- The servo free state caused by the servo ON input differs from the servo free state caused by a hardware state such as emergency stop. This is the servo free state caused by the software.

Discontinue

(7) Reset input

This resets an error that has occurred in the controller.

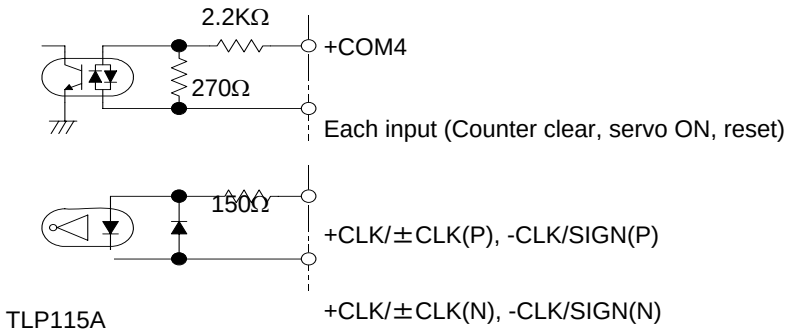
ON: Error reset
OFF: Normal

(8) +CLK/±CLK(P) (N), -CLK/SIGN(P) (N)

The 2-clock method or 1-clock method can be selected for the command pulse input method using the Teach Pendant.

	2-clock method	1-clock method
+CLK/±CLK	+ clock input	Clock input
-CLK/SIGN	- clock input	Sign input

Input signal circuit



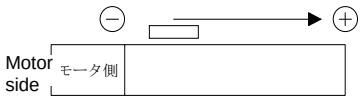
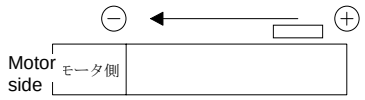
(P) and (N) each indicate the positive logic or negative logigic input.

NOTE Do not turn the servo ON signal OFF to ON when the CLK signal is input.

Discontinue

2-clock method

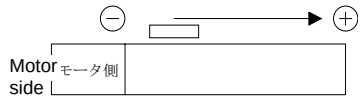
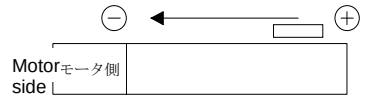
With this method, the movement direction and movement amount are designated with the + clock and – clock, and operation is carried out.

Pin No.	Signal name	Signal waveform	Movement direction
33, 34	+CLK	ON / OFF	
35, 36	-CLK	ON / OFF	
33, 34	+CLK	ON / OFF	
35, 36	-CLK	ON / OFF	

1-clock method

With this method, operation takes place with the clock (±CLK) that designates the movement amount (does not include the movement direction element) and the SIGN signal that indicates the movement direction.

NOTE Provide a time interval of 1μs or more from when the SIGN input is designated to when ±CLK is input.

Pin No.	Signal name	Signal waveform	Movement direction
33, 34	±CLK	ON / OFF	
35, 36	SIGN	ON / OFF	
33, 34	±CLK	ON / OFF	
35, 36	SIGN	ON / OFF	

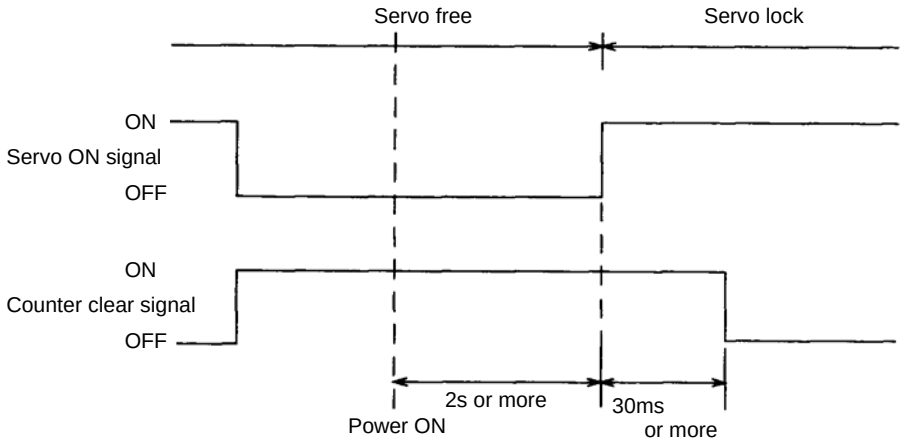
NOTE

- The wave form in the above diagram is the wave form shown with ★ in the line driver interface and open collector interface diagrams in section 9.2.3.
- The movement direction indicates the direction when the direction of motor revolution is set as described in the BA Instruction Manual (Axis Installation Section).

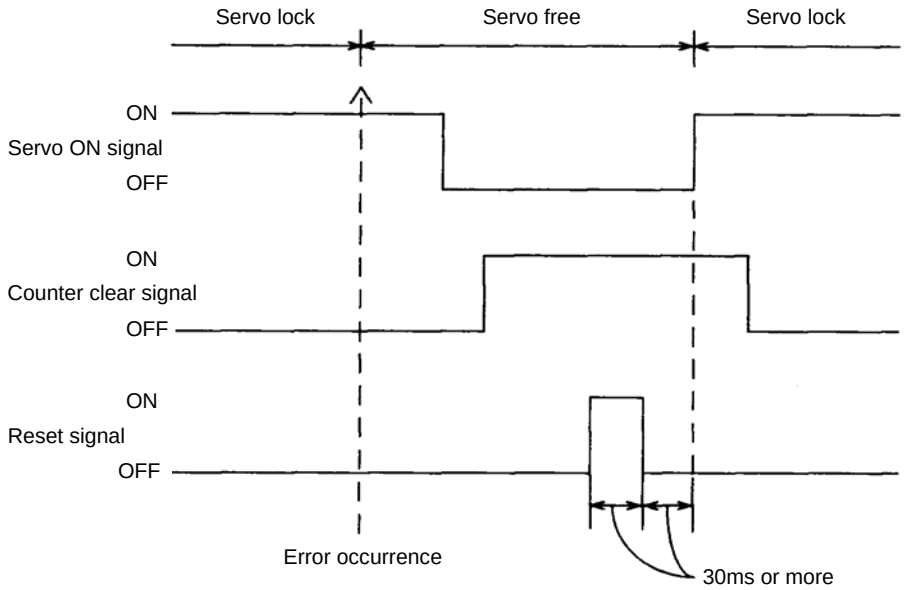
Discontinue

Timing of each signal

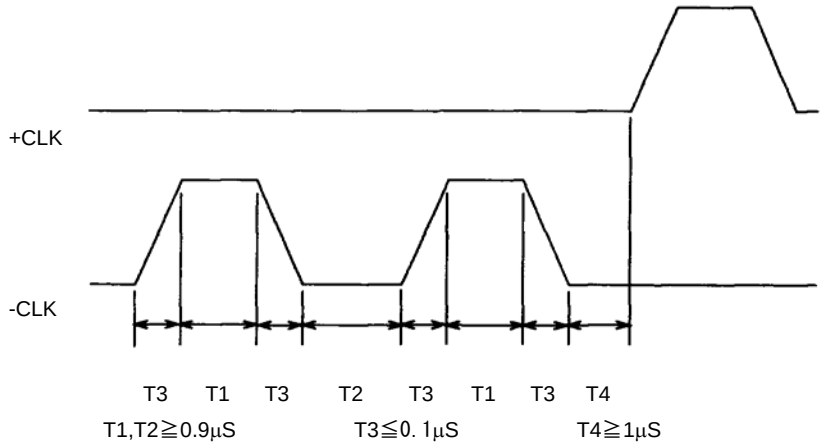
● Power ON sequence



● Recovery sequence from error or emergency stop

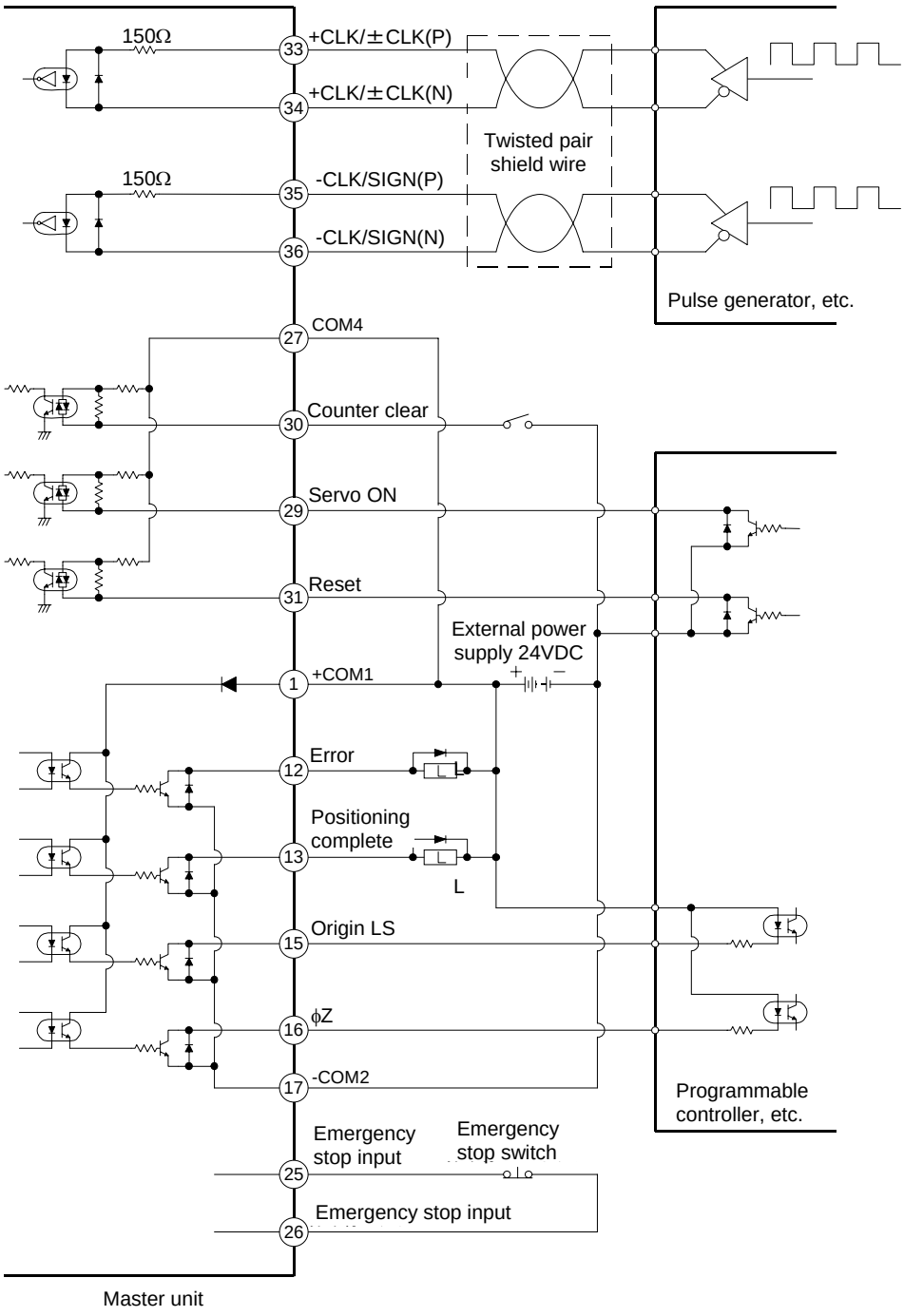


● Command clock wave form



Discontinue

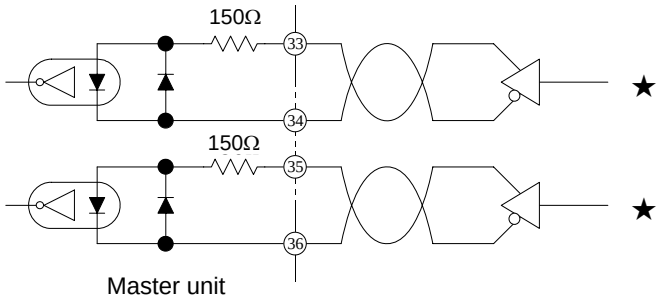
■ 9.2.3 Example of input/output signal connection



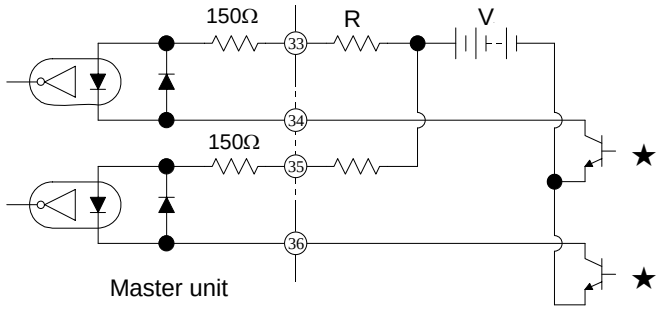
Discontinue

NOTE Both line driver interface and open collector interface can be handled with the pulse train input. However, use with the line driver interface is recommended to improve the reliability against noise, etc.

● **Line driver interface**



● **Open collector interface**



$\frac{V-2.0}{R+150} \fallingdotseq 10mA$

V=12 to 24V

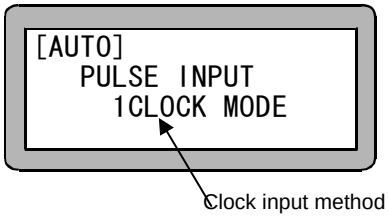
NOTE When the external power voltage is 24VDC, the external resistance R will be approx. 2kΩ.

Discontinue

■ 9.3 Operation methods

■ 9.3.1 Designation of pulse train input mode

To run the master unit with this mode, the pulse train input mode must be set in the PARA mode settings using the Teach Pendant. Refer to section 13.2.10 for details on the settings.
There is a 1-clock method and 2-clock method for the pulse train input operation, and the current pulse input method can be confirmed with the following screen displayed when the Teach Pendant is turned ON.



This screen displays only when the pulse train input mode is designated.

■ 9.3.2 Matters to be set for pulse train input mode

The parameters that can be set when using the pulse train input mode for operation are shown below. When operating as a robot, the optimum values are set by the robot type designation. However, these can be changed individually.

In-position data value [mm]
Overflow data value [pulse]
Direction of revolution
Encoder division value: 2000 [pulse] (Cannot be changed)
Encoder multiplier value: 1, 2, 4 multiplication
Lead: 5, 10, 20 [mm]

Conversion of mm unit and No. of pulses

No. of pulses required for 1 [mm] movement =

$$\frac{\frac{1\ [mm]}{Lead\ [mm]}}{\text{No. of encoder divisions} \times \text{encoder multiplier value}}$$

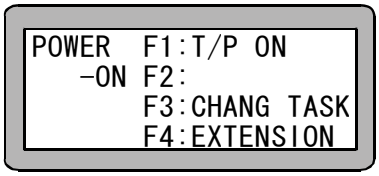
$$\frac{\text{No. of encoder divisions} \times \text{encoder multiplier value}}{Lead\ [mm]}\ [pulse]$$

Frequency for 1 [mm/s] movement command =

$$\frac{\text{No. of encoder divisions} \times \text{encoder multiplier value}}{Lead\ [mm]}\ [Hz]$$

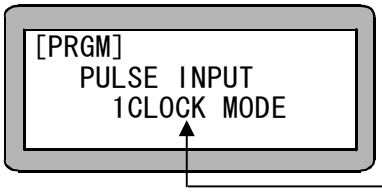
Discontinue

● Method of setting various parameters
The basic Teach Pendant operation method does not change from sequential operation, but the normally displayed screen will be exclusive for pulse inputs.



STEP 1

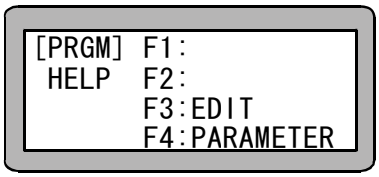
When the power of the controller set with the pulse train input mode is turned ON, the following screen will display after the initial screen. Press F1 and RUN PRGM to enter the program mode. The robot type will be set when F2 is pressed.



STEP 2

Press HELP to display the STEP3 screen. If RUN PRGM is pressed, the program mode will be quit, and the AUTO mode for carrying output operation will be entered.

The display will be 2CLOCK during the 2-clock mode.



STEP 3

Press F4 to enter the parameter mode.
Press ESC to return to STEP 2.

Refer to Chapter 13 for details on how to edit the parameters.
Refer to section 2.4.7 for details on entering the robot type.

■ 9.3.3 Protective functions

The following protective functions are available in the pulse train input mode. Refer to Chapter 19 for the displays on the Teach Pendant, causes and measures.

- Overvoltage error
- Emergency stop
- Overload error
- Overspeed error
- Other driver errors
- Parameter memory error
- WDT error
- Overcurrent error
- Overflow
- Encoder error
- ID error

Discontinue

■ 9.4 Precautions for operation

This Electric Actuator does not have a limit switch for preventing overrun. Collision to the end block by overrunning could damage the axis. Do not collide into the end block.

Operate the unit so that the motor's frame temperature (ambient temperature [°C] + external cover temperature rise value [K]) is 100°C or less. The insulation class of the motor being used is Class F (JISD4004).

Operate the unit so that the encoder's outer cover temperature (ambient temperature [°C] + external cover temperature rise value [K]) is 80°C or less.

Refer to section 2.4.1 for details on installing the controller.
The maximum input frequency of the command pulses must be 3000min^{-1} with the motor output shaft conversion. An overspeed error will occur when the controller is the motor speed 5000min^{-1} or more.

■ 9.5 Operation procedures

(1) Initial settings

Confirm that the emergency stop circuit, controller cable, power cable, signal cable and Teach Pendant are securely connected and then turn the power ON.

NOTE When the controller is delivered, the pulse train input mode is set to "OFF" (Invalid), so the servo lock state will be entered as a normal robot.

1. Confirm that the status display LED on the front of the controller is lit up in green.

2. Turn the Teach Pendant ON, and designate the axis robot type and pulse train input mode. (Refer to sections 2.4.7 and 9.3.1.)

(2) Turn the servo ON signal OFF, turn the counter clear signal ON, and turn the power ON again.

1. Confirm that the status display LED on the front of the controller is lit up in green.

2. Turn the servo ON signal ON. The servo lock state will be entered.

(3) Input the command pulse with the input method set in the pulse train input mode.

1. Adjust the gain if necessary.

   Refer to section 2.4.9 on how to adjust the gain.

NOTE The data set in (1)-2 and (3)-1 is self-held. It does not need to be input again when the power is turned ON the next time.

Discontinue

Chapter 10 Connection with External Devices

■ 10.1 Input/output signal

The input/output connector is configured of the system input/output and general-purpose input/output. The system input/output is basically connected to the programmable controller, etc., and is used to control the robot from an external source. The general-purpose input/output is connected to the hand sensor or proximity sensor, etc., and is mainly used to control the external peripheral devices.

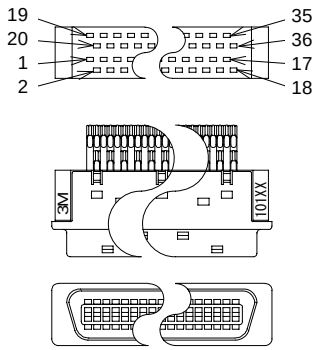
■ 10.1.1 Master unit input/output connector signal names and pin numbers

No.	Signal name		No.	Signal name	
1	+COM1 **(Note 2)**		19	COM3 **(Note 2)**	
2	General-purpose output port 1-1		20	General-purpose input port 1-1	
3	General-purpose output port 1-2		21	General-purpose input port 1-2	
4	General-purpose output port 1-3		22	General-purpose input port 1-3	
5	General-purpose output port 1-4		23	General-purpose input port 1-4	
6	–COM1 **(Note 2)**		24	N.C	
7	Emergency stop output (NO)		25	Emergency stop input	
8	Emergency stop output (COM)		26	Emergency stop input	
9	Emergency stop output (NC)		27	COM4 **(Note 2)**	
10	N.C		28	Return to origin	
11	Running	**(Note 1)**	29	Start	Servo ON **(Note 1)**
12	Error	Error **(Note 1)**	30	Stop	Counter clear **(Note 1)**
13	Positioning complete	Positioning complete **(Note 1)**	31	Reset	Reset **(Note 1)**
14	Return to origin complete		32	N.C	
15	Origin LS output		33	+CLK/±CLK (P)	**(Note 1)**
16	ϕZ		34	↑ (N)	**(Note 1)**
17	–COM2		35	-CLK/±SIGN (P)	**(Note 1)**
18	N.C		36	↑ (N)	**(Note 1)**

NOTE

(Note 1) These are the signal names for the pulse train mode, and will not function in other modes.
To prevent malfunctioning, do not connect pin Nos. 33 to 36 when not using them in the pulse train input mode.

(Note 2) +COM1, COM3 and COM4, and –COM1 and –COM2 are not connected internally.



Use the enclosed connector.

- Cable side connector type
  Plug 10136-3000VE (Sumitomo 3M)
  Shell kit 10336-52F0-008 (Sumitomo 3M)

- Panel side connector type
  Receptacle 10236-52A2JL (Sumitomo 3M)

Applicable wire size: AWG24 (0.22 mm^2)

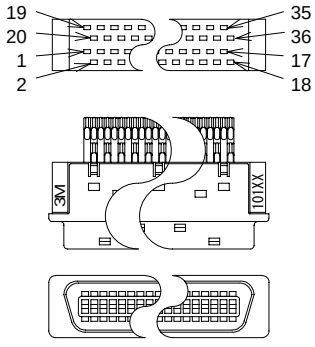
Discontinue

■ 10.1.2 Slave unit input/output connector signal names and pin numbers

No.	Signal name	No.	Signal name
1	+COM1 **(Note 1)**	19	COM3 **(Note 1)**
2	General-purpose output port 1-1 **(Note 3)**	20	General-purpose input port 1-1
3	General-purpose output port 1-2 **(Note 3)**	21	General-purpose input port 1-2
4	General-purpose output port 1-3 **(Note 3)**	22	General-purpose input port 1-3
5	General-purpose output port 1-4 **(Note 3)**	23	General-purpose input port 1-4
6	–COM1 **(Note 2)**	24	N.C
7	Emergency stop output (NO)	25	N.C
8	Emergency stop output (COM)	26	N.C
9	Emergency stop output (NC)	27	COM4 **(Note 1)**
10	N.C	28	General-purpose input port 1-5
11	General-purpose output port 1-5 **(Note 3)**	29	General-purpose input port 1-6
12	General-purpose output port 1-6 **(Note 3)**	30	General-purpose input port 1-7
13	General-purpose output port 1-7 **(Note 3)**	31	General-purpose input port 1-8
14	General-purpose output port 1-8 **(Note 3)**	32	N.C
15	N.C	33	N.C
16	N.C	34	N.C
17	–COM2 **(Note 2)**	35	N.C
18	N.C	36	N.C

NOTE

(Note 1) +COM1, COM3 and COM4 are not connected internally.
(Note 2) –COM1 and –COM2 are not connected internally.
(Note 3) The rated current of general-purpose outputs 1-1 to 1-8 is 300mA or less/point (open collector output)



Use the enclosed connector.

- Cable side connector type
  Plug 10136-3000VE (Sumitomo 3M)
  Shell kit 10336-52F0-008 (Sumitomo 3M)

- Panel side connector type
  Receptacle 10236-52A2JL (Sumitomo 3M)

Applicable wire size: AWG24 (0.22 mm^2)

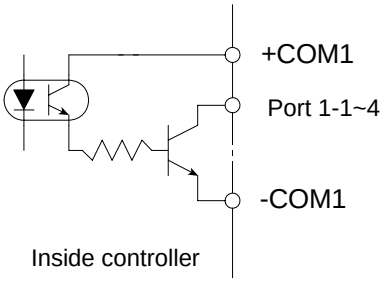
Discontinue

(1) General-purpose input/output

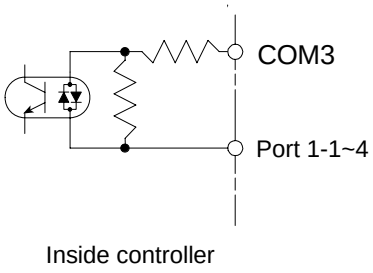
master unit

No.	Signal name	No.	Signal name
1	+COM1 (common for output signal)	19	COM3 (common for input signal)
2	General-purpose output port 1-1	20	General-purpose input port 1-1
3	General-purpose output port 1-2	21	General-purpose input port 1-2
4	General-purpose output port 1-3	22	General-purpose input port 1-3
5	General-purpose output port 1-4	23	General-purpose input port 1-4
6	-COM1		

General-purpose output circuit



General-purpose input circuit



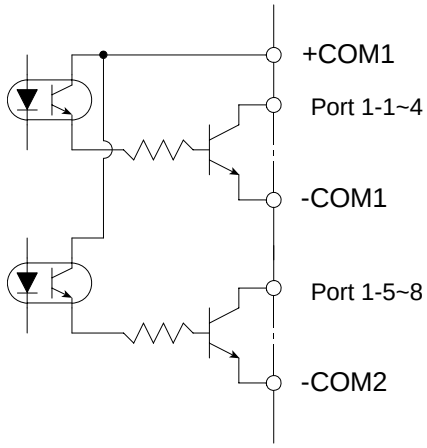
1) Input signal: 10 mA
2) Output signal: The Rated current is 300mA or less/point (open collector output)
3) This Electric Actuator does not have an input/output power output (24VDC). Supply it from an external source.
4) The general-purpose input/output can be used for various system input/output signals by setting the mode. (Refer to section 13.2)

Discontinue

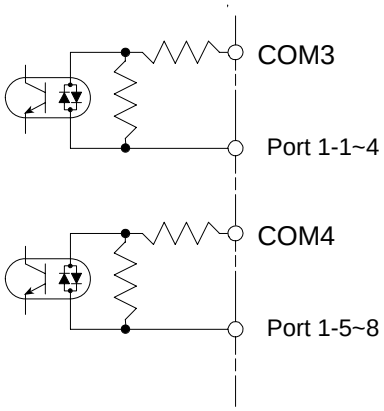
Slave unit

No.	Signal name	No.	Signal name
1	+COM1 (common for output signal)	19	COM3 (common for input signal)
2	General-purpose output port 1-1	20	General-purpose input port 1-1
3	General-purpose output port 1-2	21	General-purpose input port 1-2
4	General-purpose output port 1-3	22	General-purpose input port 1-3
5	General-purpose output port 1-4	23	General-purpose input port 1-4
6	–COM1	27	COM4 (common for input signal)
11	General-purpose output port 1-5	28	General-purpose input port 1-5
12	General-purpose output port 1-6	29	General-purpose input port 1-6
13	General-purpose output port 1-7	30	General-purpose input port 1-7
14	General-purpose output port 1-8	31	General-purpose input port 1-8
17	–COM2		

General-purpose output circuit in controller



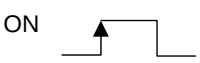
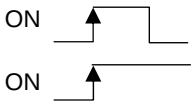
General-purpose input circuit in collector



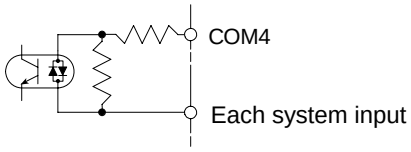
1) Input signal: 10mA
2) Output signal: The rated current is 300mA or less/point (open collector output).
3) This Electric Actuator does not have an input/output power output (24VDC). Supply it from an external source.
4) The general-purpose input/output can be used for various system input/output signals by setting the mode. (Refer to section 13.2)

Discontinue

(2) System input

Pin No.	Signal name	Normal mode	External point designation mode	Remarks
27	COM4	Common for system input		
28	Return to origin	ON: Start return to origin	Return to origin	Rising edge detection 
29	Start	ON: Restart from currently stopped step or temporarily stopped state	ON: Start movement according to information in currently designated table	Rising edge detection 
30	Stop	ON: Complete execution of current step and then stop	Invalid	When this input is ON, return to origin and start input are invalid
31	Reset	ON: Reset error state (Valid when program execution is stopped.)	ON: Reset error state	Rising edge detection 

System input circuit



Inside controller

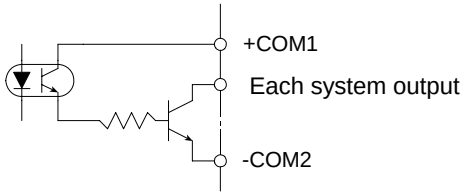
- The function for the return to origin input can be moved to the general-purpose input by setting the mode. (Refer to section 13.2.6.)

Discontinue

(3) System output

Pin No.	Signal name	Normal mode	External point designation mode	Reference page
1	+COM1	Common for output signal		
11	Running	ON during controller execution/during return to origin	ON during robot operation	Section 10.2.11
12	Error	ON during error occurrence	Same as left	Section 10.2.12
13	Positioning complete	ON when robot positioning is completed OFF when robot is moving (Stays OFF when stopped with pause)	Same as left	Section 10.2.13
14	Return to origin complete	ON while return-to-origin operation is not required for movement system command execution. OFF when return-to-origin operation is required.	Same as left.	Section 10.2.14
17	–COM2	Common for system output		

System output circuit



NOTE To use system output, supply external power to +COM1 (because the photocoupler output for old CA20-M10/M40 is changed to transistor output).

Discontinue

(4) Inputs and outputs that can be set for general-purpose input/output

Signal name	Input/ output	Details	Reference page
Robot single operation	Input	The single operation mode is entered when start is input or the start key is ON, and this input is ON. The commands that stop execution in this mode are the axis movement related and output related commands.	Section 10.2.5
Continuous start	Input	The data in the counter, etc., is held or cleared when the power is turned ON or when reset is input according to the status of this input.	Section 10.2.6
Escape	Input	If this input turns ON during execution of the MVE command, the movement will decelerate and stop, and the step will be completed.	Section 10.2.7
Pause (temporary stop)	Input	ON: Temporary stop (The axis will decelerate and stop) Restart: Input start Cancel: Input reset	Section 10.2.8
Program selection 2^0 Program selection 2^1 Program selection 2^2 (Program selection 2^3)	Input	Input program No. designation signal No.1 to No.8 using a binary number in sequential mode PSEL instruction, palletizing mode, and easy mode. Input point table No. designation signal No.1 to No.16 using a binary number in external point designation mode.	Section 10.2.9
Operation mode selection	Input	ON: Palletizing mode OFF: Sequential mode	Section 10.2.10
Input wait output	Output	This turns ON when the program is waiting for an input.	Section 10.2.15
Pausing	Output	This turns ON when the pause input is recognized and the axis decelerates and stops. This will turn OFF when pause is canceled.	Section 10.2.16
READY	Output	The operation status of the controller, including the master unit and slave unit is indicated. Preparing for operation: OFF Operation preparation complete: ON	Section 10.2.17
Positioning per task complete	Output	ON when positioning per task is completed.	Section 10.2.18
Return to origin per task complete	Output	ON when return to origin per task is complete and axis is at origin position.	Section 10.2.19

- Refer to section 13.2 for details on setting this function.
- The pause input, pausing output and READY output can also be used in the external point designation mode.

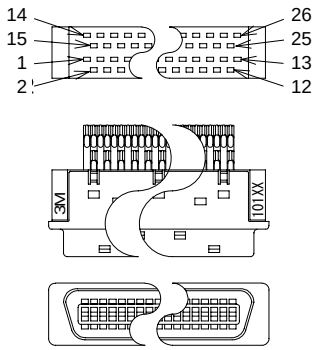
Discontinue

■ 10.1.3 Expansion input/output signal names and pin Nos.

PIN No.	Signal name	PIN No.	Signal name
1	+COM5 **(Note 1)**	14	COM6 **(Note 1)**
2	General-purpose output port 2-1	15	General-purpose input port 2-1
3	General-purpose output port 2-2	16	General-purpose input port 2-2
4	General-purpose output port 2-3	17	General-purpose input port 2-3
5	General-purpose output port 2-4	18	General-purpose input port 2-4
6	General-purpose output port 2-5	19	General-purpose input port 2-5
7	General-purpose output port 2-6	20	General-purpose input port 2-6
8	General-purpose output port 2-7	21	General-purpose input port 2-7
9	General-purpose output port 2-8	22	General-purpose input port 2-8
10	N.C	23	General-purpose input port 3-1
11	N.C	24	General-purpose input port 3-2
12	N.C	25	General-purpose input port 3-3
13	–COM5	26	General-purpose input port 3-4

NOTE

(Note 1) +COM5 and COM6 are not connected internally.



Use the enclosed connector.

- Cable side connector type
  Plug 10126-3000VE (Sumitomo 3M)
  Shell kit 10326-52F0-008 (Sumitomo 3M)

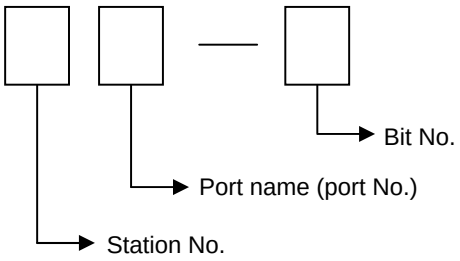
- Panel side connector type
  Receptacle 10226-52A2JL (Sumitomo 3M)

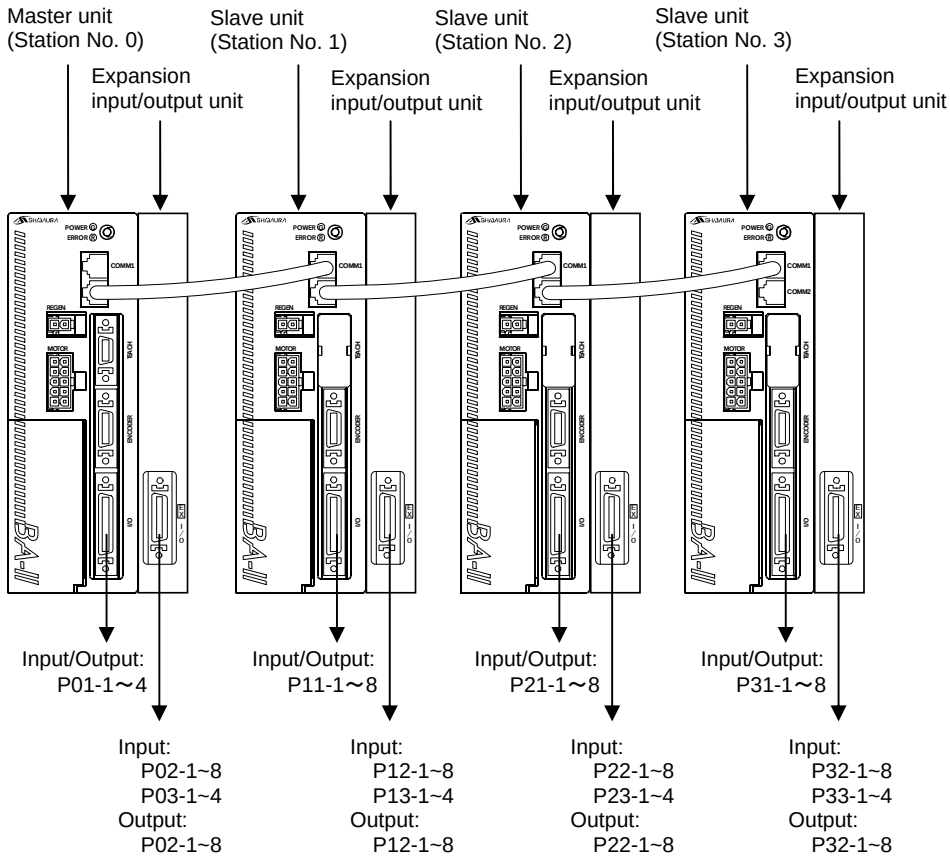
Applicable wire size: AWG24 (0.22 mm^2)

Discontinue

■ 10.1.4 Names of general-purpose input/output ports and Teach Pendant displays

In the controller's system configuration, there are master unit, slave unit and expansion input/output unit input/output ports. The No. of points will change according to the use of options. These input/output ports are displayed on the Teach Pendant as shown below.

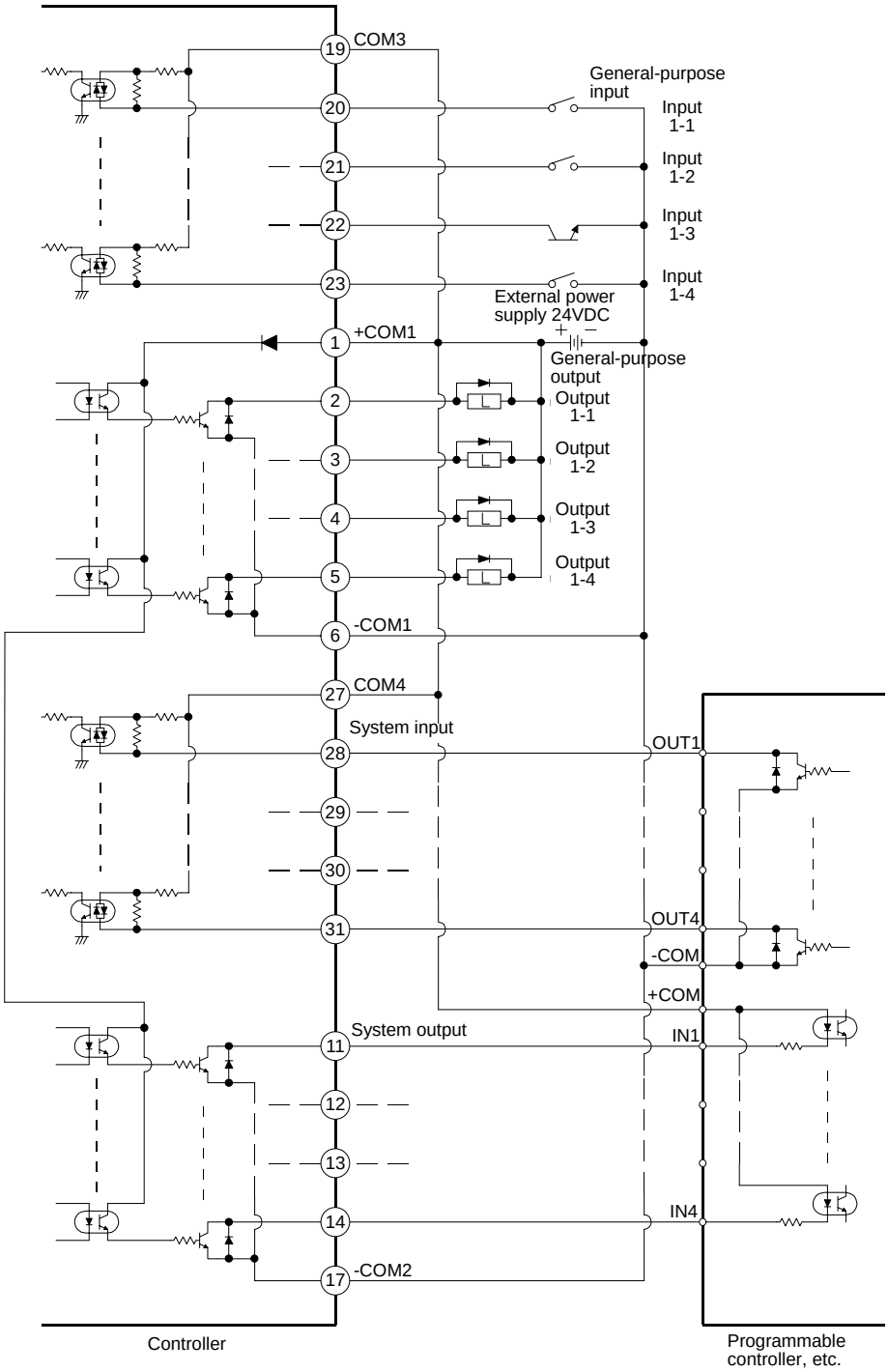




Discontinue

■ 10.1.5 Example of input/output signal connection

● Example of master unit connection

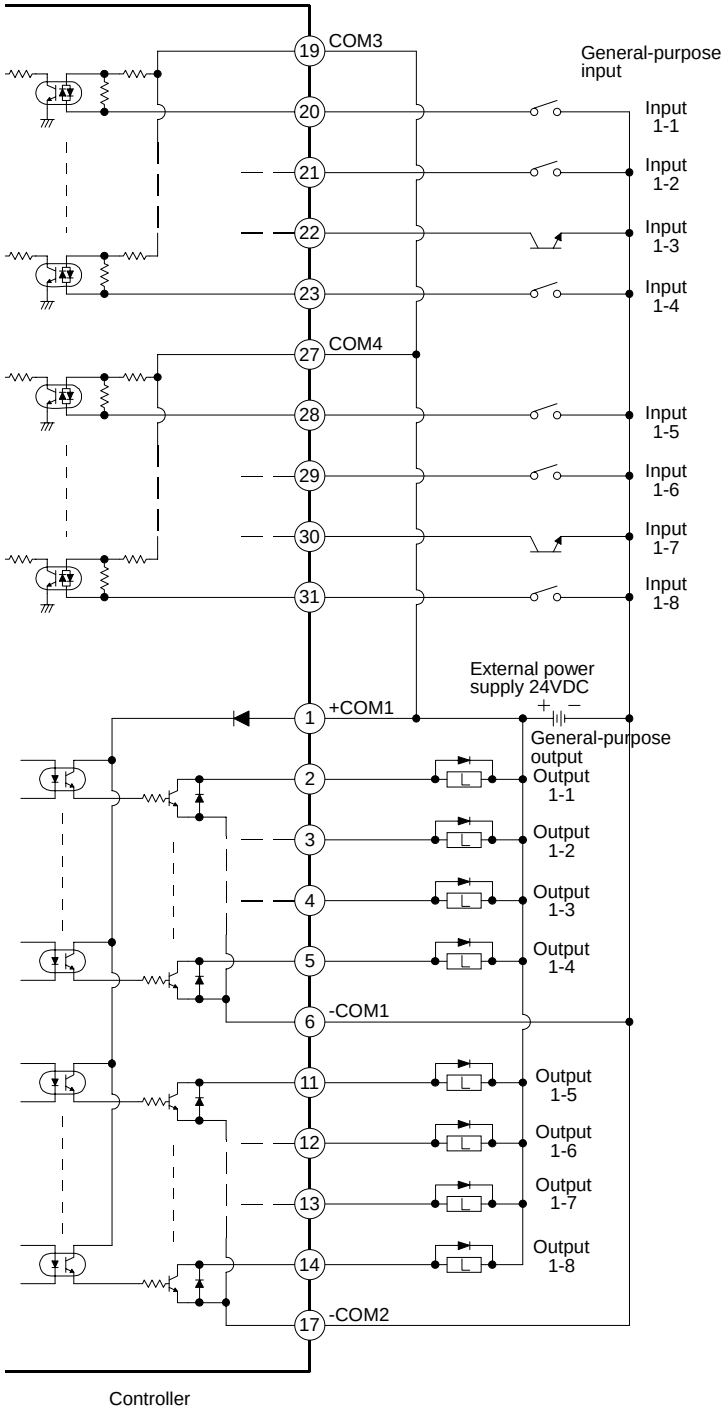


NOTE

- COM3 and COM4, and −COM1 and −COM2 are not connected internally.
- To use system output, supply external power to +COM1 (because the photocoupler output for old CA20-M10/M40 is changed to transistor output).

Discontinue

● **Example of slave unit connection**

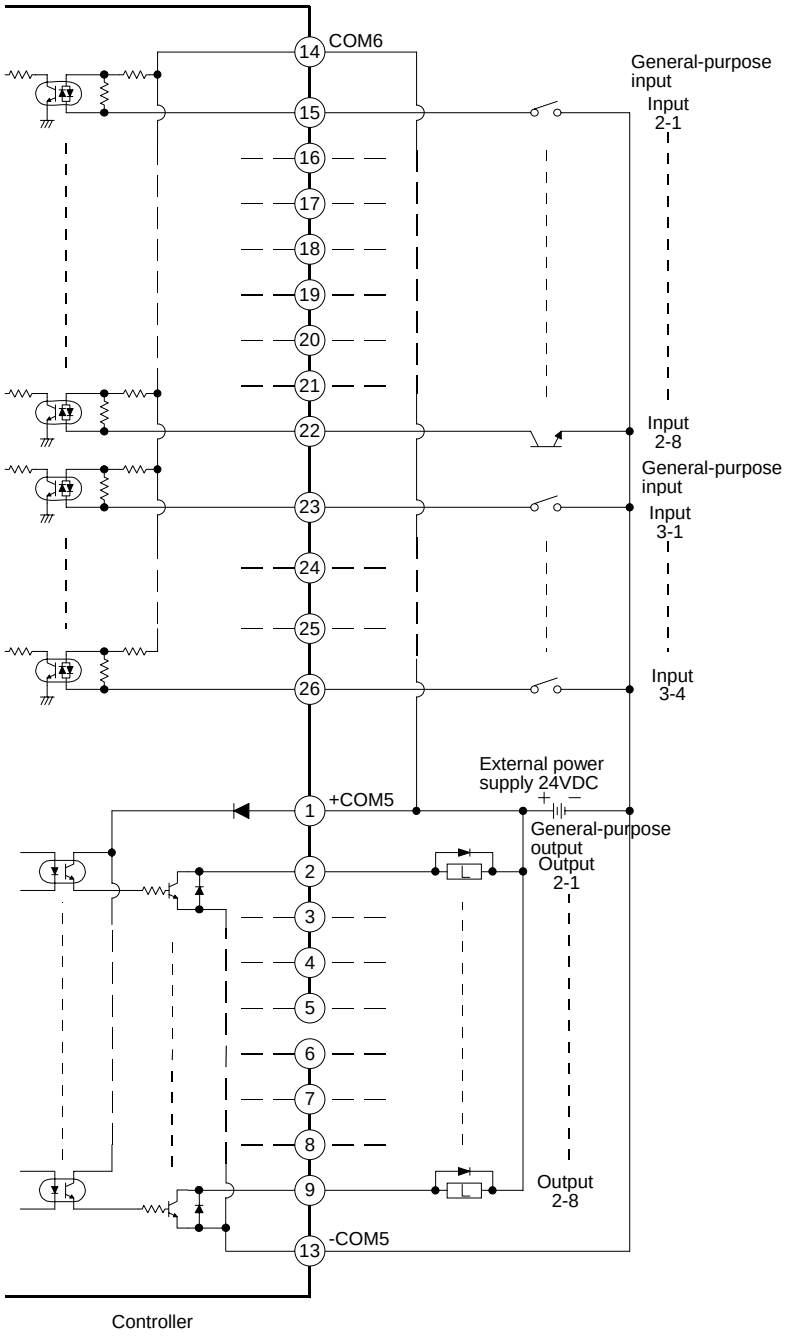


NOTE

- COM3 and COM4 or –COM1 and –COM2 are not connected internally.
- To use system output, supply external power to +COM1 (because the photocoupler output for old CA20-S10/S40 is changed to transistor output).

Discontinue

● **Example of expansion input/output unit connection**



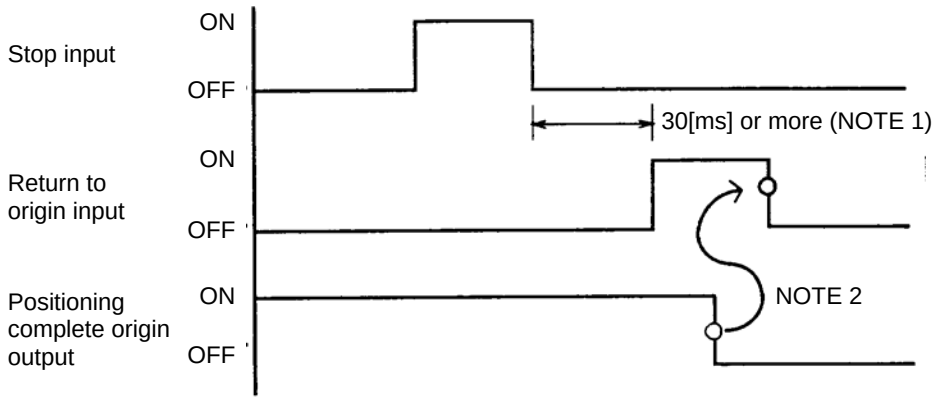
NOTE +COM5 and COM6 are not connected internally.

Discontinue

■ 10.2 Details of system input/output function

■ 10.2.1 Return to origin input

- This input starts the return to origin.
- This input can be accepted only when the Teach Pendant is not connected or is turned OFF.
- This input will be invalid for approx. two seconds after the controller power is turned ON. Thus, turn it ON after two seconds or more have passed.
- Carry out the operation as shown below when executing return to origin after inputting the stop signal.



(Note 1) Turn the return to origin input ON after 30ms or more has passed after the stop input has turned OFF.

(Note 2) Return the return to origin input to OFF after the positioning complete output has turned OFF.

■ 10.2.2 Start input

- This input restarts the operation from the currently stopped step or the temporarily stopped step.
- If operation is restarted with this input after inputting reset, in the sequential mode the program will start from step 0001. In the palletizing mode, the program No. selection input will be judged and then the program will start from the beginning. (Other than when holding of the step is designated with continuous start.)
- This input is valid only when the Teach Pendant is not connected or is turned OFF.
- When there are multiple tasks with the multitasking function, the program will start from the main task step that is currently stopped.

Discontinue

■ 10.2.3 Stop input

- This input is used to stop the axis after the step currently being executed is ended. (During execution of the IN or TIM commands, after that step is completed.)
- After this input turns ON, return to origin and start input will be invalid.

■ 10.2.4 Reset input

- This input resets the error state when an error has occurred.
- This input can be accepted only when execution of the program in the controller has been stopped. (When the program is not running.)
- When reset is input, the program will return to step 0001 in the sequential mode. In the palletizing mode, the step will be returned to the initial state. Furthermore, if the mode setting is the initial value, the general-purpose output will be held, and all of the counter details will be cleared to zero.
  However, if continuous start input is designated, whether to hold or clear the values of each data can be designated. (Refer to section 10.2.6.)

■ 10.2.5 Robot single operation input

- The general-purpose input port designated for robot single operation input with the mode setting can be used for the robot single operation input. (Refer to section 13.2.1.)
- This input is used to verify the program. If this signal is ON when start is input or the start key is pressed, the single operation mode will be entered.
  The commands used to execute/stop in this mode are the axis movement related and output related commands.
- The robot single operation input is also led in as the general-purpose input data.

Discontinue

■ 10.2.6 Continuous start input

- The general-purpose input port designated for robot continuous start input with the mode setting can be used for the robot continuous start input. (Refer to section 13.2.2.)
- Depending on the status (ON, OFF) of the continuous start input when the power is turned ON or reset is input, the values for the step No., counter and general-purpose output will be held or cleared. Whether to hold or clear each data according to the status of the continuous start input depends on the "status setting for when continuous start is valid" in the mode setting. (Refer to sections 13.2.12 and 13.2.13.)
- The continuous start input is also led in as the general-purpose input data.
- Continuous operation can be resumed only when the power is turned OFF while the program execution is stopped (stopped in normal state). If the power is turned OFF during execution of a program (when running output is ON) to stop the operation, continuous operation cannot be resumed. A continuous operation unavailable error will occur. (The operation can be continued when the emergency stop is applied.)
- In the easy mode, continuous start cannot be used after the power is turned OFF.

<table>
<tr><th colspan="2" rowspan="2">Mode setting</th><th colspan="2">Valid
(When bit is designated)</th><th>Invalid
(When bit is not designated)</th></tr>
<tr><th>Continuous start input</th><th>When ON</th><th>When OFF</th><th>—</th></tr>
<tr><td rowspan="3">Reset input</td><td>Step No.</td><td rowspan="5">Refer to section 13.2.12</td><td rowspan="5">Refer to section 13.2.13</td><td>Initialize</td></tr>
<tr><td>Counter</td><td>Clear</td></tr>
<tr><td>General-purpose output</td><td>According to mode setting (initial value : Hold)</td></tr>
<tr><td rowspan="3">Power OFF→ON</td><td>Step No.</td><td>Initialize</td></tr>
<tr><td>Counter</td><td>Clear</td></tr>
<tr><td>General-purpose output</td><td>Clear</td><td>Clear</td><td>Clear</td></tr>
</table>

■ 10.2.7 Escape input

- The general-purpose input port designated as the escape input with the mode setting can be used as the escape input. (Refer to section 13.2.3.)
- If the designated input port turns ON during execution of the MVE command, the robot will decelerate to a stop, and at the same time it will be interpreted that step has been completed. The next step will be executed. After the robot decelerates to a stop, the positioning complete output turns ON.
- The escape input is valid only for the MVE command.

■ 10.2.8 Pause (temporary stop) input

- The general-purpose input port designated as the pause input with the mode setting can be used as the pause input. (Refer to section 13.2.4.)
- If this input turns ON during execution of the MOV system command, the axis will decelerate and stop. After the axis decelerates and stops, the positioning complete output also remains OFF.
  The pause input is invalid in respect to commands other than the MOV system command.
- Pause input is invalid during return to origin with the return to origin input or during execution of the HOME command.
- To restart (start midway) after stopping temporarily, input start.
  Note that the start input is invalid when the Teach Pendant is ON. In this case, use the start key on the Teach Pendant. Cancellation is also possible using reset.

Discontinue

■ 10.2.9 Program No. selection input

The general-purpose input port designated as the program selection input with the mode setting can be used as the program selection 2^0 to 2^2 input. (Refer to section 13.2.5.)
In the external point designation mode (when the expansion input-output unit is not mounted), the general-purpose input port can be used as point table designation selection 2^0 to 2^3. (Refer to the explanation of External point designation mode in section 8.)

(1) For sequential mode

- This input allows the program to be jumped to the required tag No. step by a 3-bit input signal from the external controller (programmable controller, digital switch, etc.). (Tag. No. 1 to 8)
- This input is valid only during execution of the PSEL command.

1 ... ON 0 ... OFF

Tag No.	1	2	3	4	5	6	7	8
Program selection 2^0	0	1	0	1	0	1	0	1
Program selection 2^1	0	0	1	1	0	0	1	1
Program selection 2^2	0	0	0	0	1	1	1	1

[Example] If input pin 2^0 is ON, 2^1 is ON and 2^2 is OFF during PSEL execution.
The step for which tag No. "004" is input will be jumped to.

(2) For palletizing mode

- This input is the palletizing program No. selection input.
- This input is valid only when the start signal is input.
- The input signal and selection program No. are as follow.

1 ... ON 0 ... OFF

Program No.	1	2	3	4	5	6	7	8
Program selection 2^0	0	1	0	1	0	1	0	1
Program selection 2^1	0	0	1	1	0	0	1	1
Program selection 2^2	0	0	0	0	1	1	1	1

(3) For external point designation mode

- This input is the point table designation input (when the expansion input/output unit is not mounted).
  The value obtained by subtracting 1 from the designed point table No. is converted to a binary number, and 1 is set as ON and 0 is set as OFF to this input port.
  [Example] For point table No.006:
  6 - 1 = 5 (decimal) = 0101 (binary)
  Set OFF input 2^3, ON input 2^2, OFF input 2^1, and ON input 2^0.

Discontinue

■ 10.2.10 Palletizing input

- The general-purpose input port designated as the palletizing input with the mode setting can be used as the palletizing input. (Refer to section 13.2.16.)
- This is the sequential and palletizing mode changeover input. After resetting or execution of the END command, when the start input is turned ON, the controller will judge this signal and change the mode.

  OFF : Sequential mode
  ON : Palletizing mode

- This input can be accepted only when the Teach Pendant is not connected or when the Teach Pendant and RS-232C are invalid.

■ 10.2.11 Running output

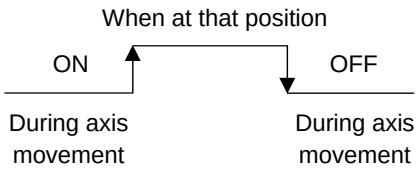
- This signal turns ON when the controller is executing a program or during return to origin. In the external point designation mode, this signal will turn ON during robot operation.
- This signal remains ON even when the operation is stopped with the pause (temporary stop) input.
- This signal will turn OFF when the program is stopped with the END command or stop input.

■ 10.2.12 Error output

- This signal turns ON when an error has occurred in the controller.
- Refer to Chapter 19 for details on the error types and processes.

■ 10.2.13 Positioning complete output

- This is the positioning complete signal used in the movement system commands.
- This signal turns ON when at the position (in-position).
- This signal will also turn ON when the origin is reached during return to origin.
- When using two to four axes, this signal will turn ON when all axes have completed positioning.



■ 10.2.14 Return to origin complete output

- This is the origin return and HOME command execution completion signal.
- This signal will turn ON when the robot can identify the current position and return to origin is not required for execution of move instructions.
- This signal will turn OFF when return to origin is required for execution of move instructions due to an encoder-related error, etc.

Discontinue

■ 10.2.15 Input wait output

- The general-purpose output port designated as input wait output with the mode setting can be used as the input wait output. (Refer to section 13.2.8.)
- This output turns ON during IN command execution (general-purpose wait state).

■ 10.2.16 Pausing (temporarily stopped) output

- The general-purpose output port designated as pause output with the mode setting can be used as the pause output. (Refer to section 13.2.7.)
- The pause input is recognized and the robot is decelerated and stopped. This output will turn OFF when the pause is canceled.

■ 10.2.17 READY output

- The general-purpose output port designated as READY output with the mode setting can be used as the READY output. (Refer to section 13.2.15.)
- This output turns ON when the power has been turned ON and the controller configured with the master unit and slave unit is ready for operation.
- This output is valid when the Teach Pendant is not connected or is turned OFF.

■ 10.2.18 Individual task positioning complete output

- After a general-purpose output port is designated for the individual task positioning complete output by the mode setting, the port can be used for individual task positioning complete output. (Refer to section 13.2.18.)
- This setting can set the positioning complete output separately for each task.

■ 10.2.19 Individual task return to origin complete output

- After a general-purpose output port is designated for the individual task return to origin complete output by the mode setting, the port can be used for individual task return to origin complete output. (Refer to section 13.2.19.)
- This setting can set the return to origin complete output separately for each task.

■ 10.2.20 Battery alarm output

- After a general-purpose output port is designated for the battery alarm output by the mode setting, the port can be used for battery alarm output. (Refer to section 13.2.22.)
- This signal is turned ON when a voltage drop occurs in the encoder backup power supply.

■ 10.3 RS-232C communication specifications

This Electric Actuator can communicate data with the host computer (personal computer, etc.) by using the optional communication cable (Type: PCBL-31). Refer to the KCA-RS-232C communication specifications for details.
Ask you nearest branch or dealer for the KCA-RS-232C communication specifications.

Discontinue

Chapter 11 CC-Link

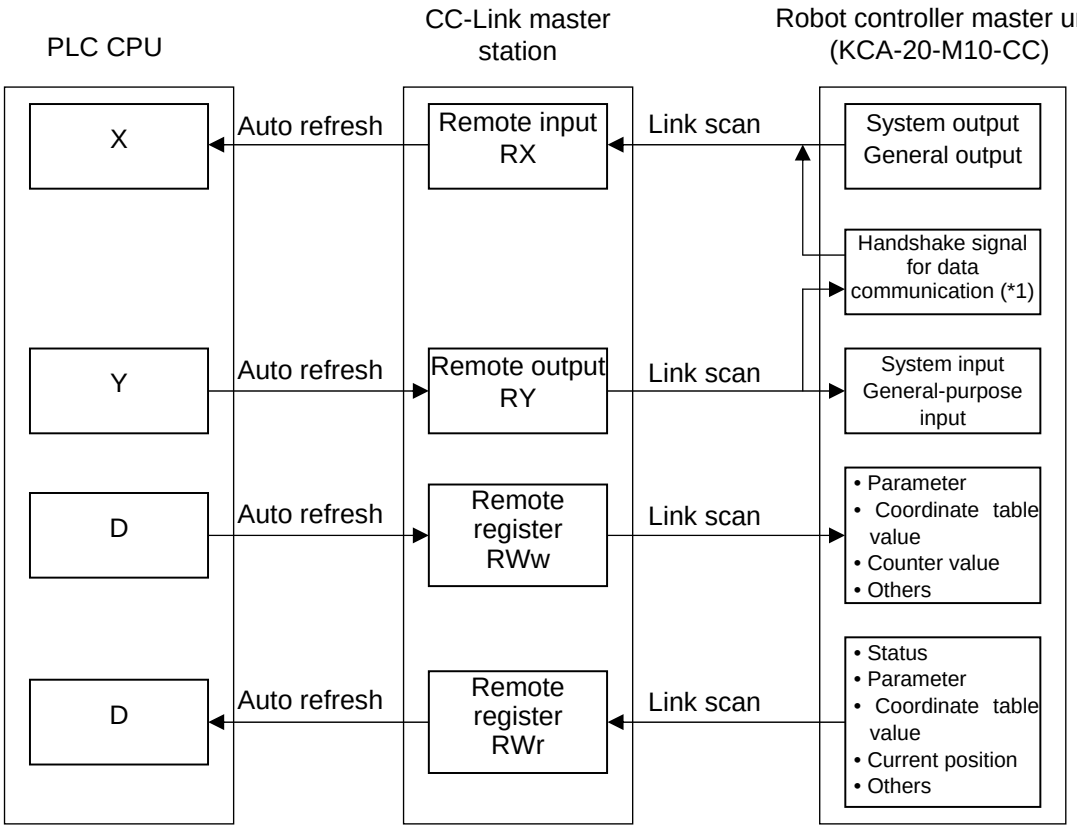
■ 11.1 CC-Link Function

This controller enables adding of a CC-Link function by a CC-Link module. This chapter describes the CC-Link interface.

CC-Link is a field network interface that features a minimized wiring design in a low-cost structure and high-speed data communication. The CC-Link interface allows data communication for various input/output and jog operation.

■ 11.1.1 Overview

This controller serves as the remote device station (Fixed at four (4) stations) and allows communication of I/O data and other data.
Data communication is performed through remote registers RWw and RWr, and some of remote inputs RX and remote outputs RY are used.



*1 The data communication handshake signal on the robot controller side is created by the robot controller automatically.

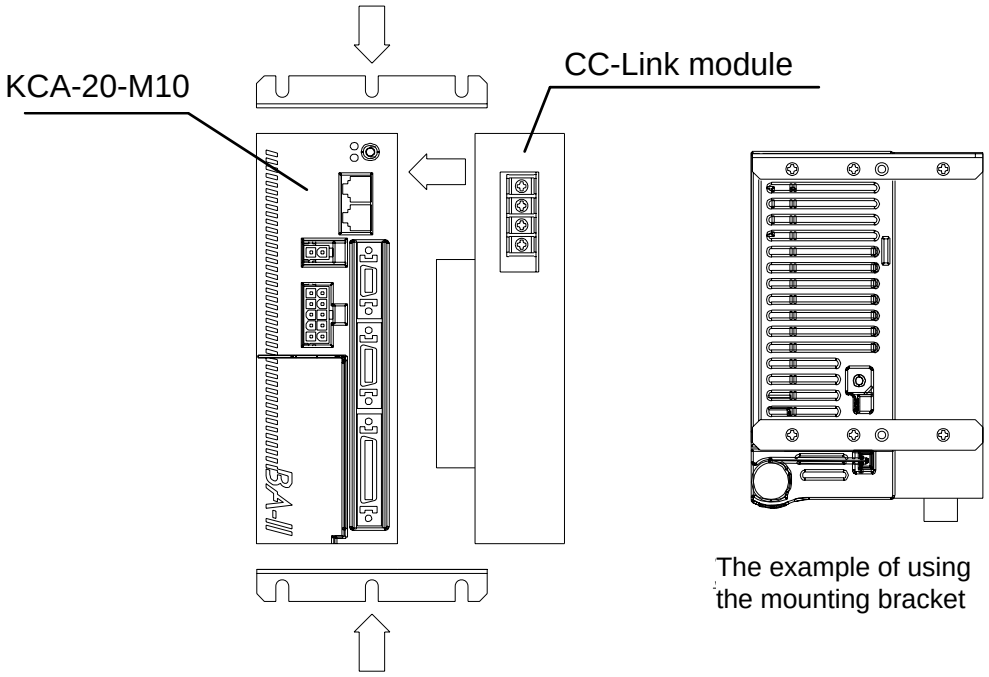
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■ 11.1.2 CC-Link specifications

Item	Specification
Transmission specifications	CC-Link Ver 1.10
Communication speed	10M/5M/2.5M/625k/156kbps (Set by parameter)
Station type	Remote device station
Number of occupied stations	Fixed at 4 stations (RX/RY: 128 points each, RWw/RWr: 16 points each)
Station number setting	1 – 64 (Set by parameter)
Number of input/output points	System input: 4 points, System output: 4 points
	General-purpose input: 64 points, General-purpose output: 64 points
	Jog input: 8 points, Jog output: 8 points
	Handshake input: 1 point, Handshake output: 2 points
	Data selection input: 4 points, Data selection check output: 4 points
Data communication functions	Coordinate table sending and receiving, current position monitor, error code request, status request, etc.

*1: The input and output are based on the direction viewed from the robot controller.

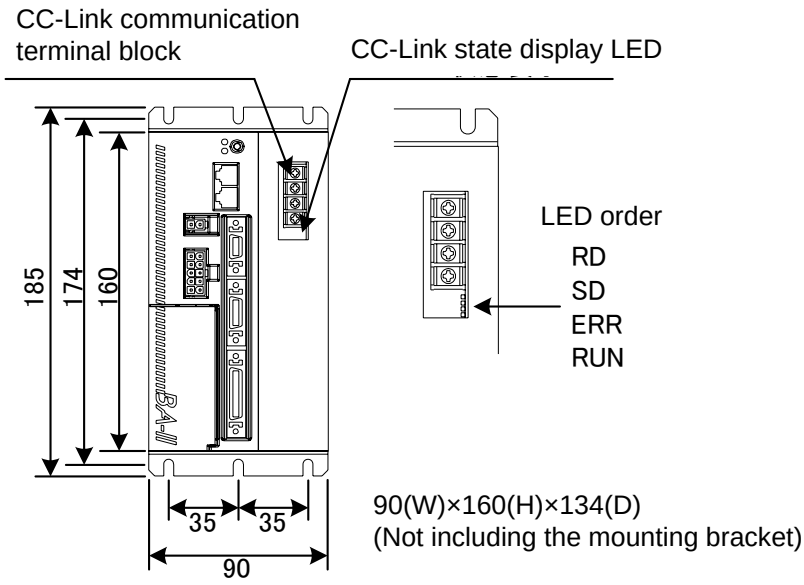
■ 11.1.3 How to attach the CC-Link module



The example of using the mounting bracket

Discontinue

■ 11.1.4 Explanation of CC-Link component and external dimensions



① CC-Link status display LED

Name	Color	On/Off	Description
RD	Green	On	When receiving data
		Off	When not receiving data
SD	Green	On	When sending data
		Off	When not sending data
ERR	Red	On	CRC error, error speed, error station number setting
		Off	During normal operation
RUN	Green	On	During normal operation
		Off	During timeout or network stoppage

② CC-Link connection terminal block

The exclusive CC-Link cable for data linkage is connected to this terminal block.

Pin No.	Signal name	Wire color
1	Communication line (DA)	Blue
2	Communication line (DB)	White
3	Digital ground (DG)	Yellow
4	Shield (SLD)	Shield

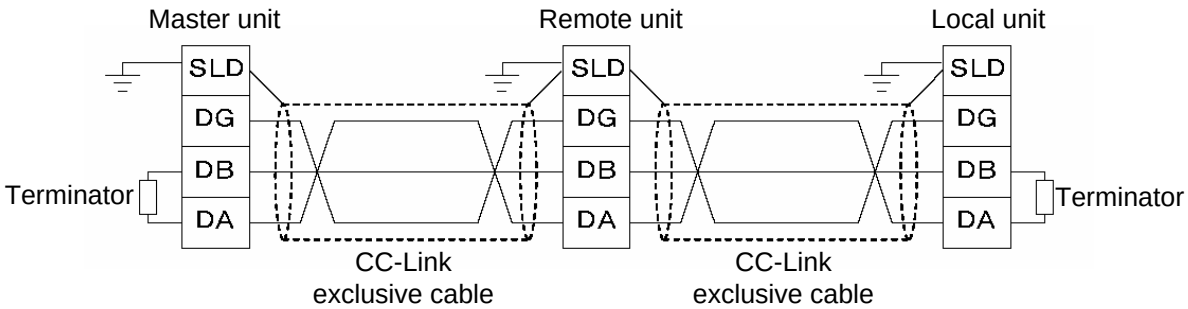
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■ 11.1.5 Connection of exclusive CC-Link cable

The order of cable connection is unrelated to the station number.
Be sure to connect the terminators for the units located at both ends of the CC-Link system. Connect each terminator between DA and DB.
In the CC-Link system, the terminator to be connected differs with the cable to be used.

Type of cable	Terminator
CC-Link exclusive cable	110 Ω, 1/2 W (Brown, brown, brown)
CC-Link exclusive cable designed for Ver 1.10	
CC-Link exclusive high-performance cable	130 Ω, 1/2 W (Brown, orange, brown)

No terminator is attached to this controller.
The master unit can be located at other than the both ends.
Star-connection is not possible.
The connecting method is shown below.



For details on the cable connection, see the master station instruction manual and CC-Link cable wiring manual (published by the CC-Link Partner Association).

■ 11.1.6 CC-Link settings

(1) KCA-20-M10-CC settings
The station number (MAC ID) and baud rate are specified by [PARA] M20 in the mode setting. To enable a modified value, turn the power off and then on again. (Refer to section 13.2.20.)

(2) CC-Link master station settings
Make the CC-Link master station settings by following the master station operating manual.
The type of KCA-20–M10–CC is the remote device station, and the number of exclusive stations is four (4).

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■ 11.2 Connection with External Devices

■ 11.2.1 List of master unit I/O signals

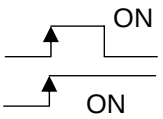
Signal direction: CC-Link master station ← KCA−20−M10-CC		Signal direction: CC-Link master station → KCA−20–M10-CC	
Device No. (Input)	Signal name	Device No. (Output)	Signal name
RXn0	"Running" output	RYn0	Return to origin input
RXn1	Error output	RYn1	Start input
RXn2	Positioning finish output	RYn2	Stop input
RXn3	Return to origin finish output	RYn3	Reset input
RXn4~RXn7	Use prohibited	RYn4~RYn7	Use prohibited
RXn8~RXnF	General output port 1–1 ~ 8	RYn8~RYnF	General input port 1–1 ~ 8
RX(n+1)0~RX(n+1)7	General output port 2–1 ~ 8	RY(n+1)0~RY(n+1)7	General input port 2–1 ~ 8
RX(n+1)8~RX(n+1)F	General output port 3–1 ~ 8	RY(n+1)8~RY(n+1)F	General input port 3–1 ~ 8
RX(n+2)0~RX(n+2)7	General output port 4–1 ~ 8	RY(n+2)0~RY(n+2)7	General input port 4–1 ~ 8
RX(n+2)8~RX(n+2)F	General output port 5–1 ~ 8	RY(n+2)8~RY(n+2)F	General input port 5–1 ~ 8
RX(n+3)0~RX(n+3)7	General output port 6–1 ~ 8	RY(n+3)0~RY(n+3)7	General input port 6–1 ~ 8
RX(n+3)8~RX(n+3)F	General output port 7–1 ~ 8	RY(n+3)8~RY(n+3)F	General input port 7–1 ~ 8
RX(n+4)0~RX(n+4)7	General output port 8–1 ~ 8	RY(n+4)0~RY(n+4)7	General input port 8–1 ~ 8
RX(n+4)8~RX(n+4)F	Jog output (*3)	RY(n+4)8~RY(n+4)F	Jog input (*3)
RX(n+5)0~RX(n+5)7	Reserved (*1)	RY(n+5)0~RY(n+5)7	Reserved (*1)
RX(n+5)8~RX(n+5)F		RY(n+5)8~RY(n+5)F	
RX(n+6)0~RX(n+6)7		RY(n+6)0~RY(n+6)7	
RX(n+6)8	Command processing finish (*2)	RY(n+6)8	Request for command processing (*2)
RX(n+6)9	Command error (*2)	RY(n+6)9	Use prohibited
RX(n+6)A~RX(n+6)B	Use prohibited	RY(n+6)A~RY(n+6)B	Use prohibited
RX(n+6)C~RX(n+6)F	Data selection check output	RY(n+6)C~RY(n+6)F	Data selection input
RX(n+7)0~RX(n+7)7	Use prohibited	RY(n+7)0~RY(n+7)7	Use prohibited
RX(n+7)8~RX(n+7)F	Use prohibited	RY(n+7)8~RY(n+7)F	Use prohibited

n: Address assigned to the master unit by station number setting.
*1 Area reserved for future extension of function.
*2 Handshake signal for data transmission.
*3 Refer to sections 11.2.2 and 11.2.4.

Discontinue

■ 11.2.2 System I/O

(1) System input (CC-Link master station → KCA−20−M10−CC)

Signal name	Remote output (*1)	Normal mode	External point designation mode	Remarks
Return to origin	RYn0	ON: Start of return to origin operation.	Return to origin	Detection of leading edge 
Start	RYn1	ON: Restart from currently stopped step or from feed hold state.	ON: Starts moving based on currently specified table information.	
Stop	RYn2	ON: Stops after current step has been executed.	Invalid	When this input is ON, return to origin and start input are invalid.
Reset	RYn3	ON: Cancels an error status. (Valid while program execution is stopped.)	ON: Cancels an error status.	
Jog input	RY(n+4)8 ~ RY(n+4)F	A selected axis is moved by jogging after the motion mode (jog, low-speed or high-speed) and travel direction are specified.		Section 11.2.4

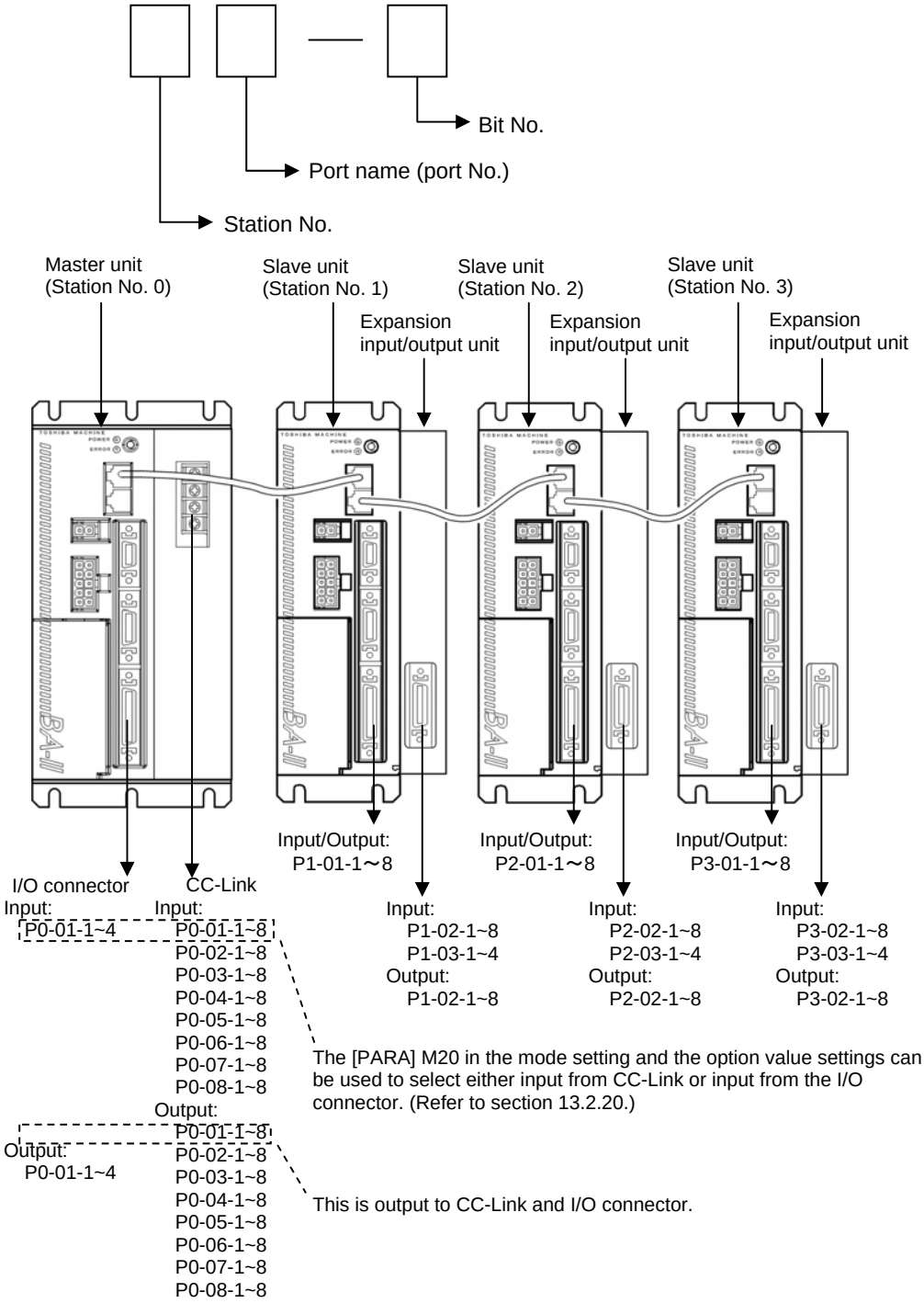
(2) System output (KCA–20–M10-CC → CC-Link master station)

Signal name	Remote input (*1)	Normal mode	External point designation mode	Ref.
Running	RXn0	ON during controller operation and during return to origin.	ON during robot operation.	Section 10.2.11
Error	RXn1	ON at error generation.	Same as left	Section 10.2.12
Positioning finish	RXn2	ON when the robot has been located at a predetermined position. OFF while the robot is moving. (Remains OFF when it is paused.)	Same as left	Section 10.2.13
Return to origin finish	RXn3	ON when return to origin is completed.	Same as left	Section 10.2.14
Jog output	RX(n+4)8 ~ RX(n+4)F	Acceptance or rejection of jog, active status, etc. are displayed.		Section 11.2.4

Discontinue

■ 11.2.3 Name of general-purpose I/O port and teach pendant display

In the controller's system configuration, there are master unit, slave unit and expansion input/output unit input/output ports. The No. of points will change according to the use of options. These input/output ports are displayed on the Teach Pendant as shown below.



- For details on the port numbers and support for input devices and output devices, refer to section 12.2.1.

Discontinue

■ 11.2.4 Jog input/output

(1) List of jog input/output signals

Signal direction: CC-Link master station ← KCA−20–M10–CC		Signal direction: CC-Link master station →▪KCA−20–M10–CC	
Input Device No.	Signal name	Output Device No.	Signal name
RX(n+4)8	Axis 1 "jogging" output	RY(n+4)8	Axis 1 "request jog" input
RX(n+4)9	Axis 2 "jogging" output	RY(n+4)9	Axis 2 "request jog" input
RX(n+4)A	Axis 3 "jogging" output	RY(n+4)A	Axis 3 "request jog" input
RX(n+4)B	Axis 4 "jogging" output	RY(n+4)B	Axis 4 "request jog" input
RX(n+4)C	Jog-ready output	RY(n+4)C	"Request inching" input
RX(n+4)D	Unused	RY(n+4)D	"Request low-speed jog" input
RX(n+4)E	Unused	RY(n+4)E	"Request high-speed jog" input
RX(n+4)F	Unused	RY(n+4)F	"Designate jog direction" input OFF: + direction ON: – direction

- When the jog conditions (inching request, low-speed jog request, high-speed jog request) and jog direction are specified, and the jog request is ON, the corresponding axis performs the jog operation. (Refer to Fig. 11.2.4-1.)
- Jogging by I/O signal is not accepted as long as the jog ready output signal is OFF. The jog ready output signal is OFF under the following conditions.
  - While the robot is controlled through the teach pendant (T/P).
    → While the T/P is connected and turned on.
  - While the robot is controlled by the personal computer software.
    → While the execution screen of the personal computer software is opened.
  - While the "running" output is ON.
  - While the error output is ON.
- When the multiple bits for the "request inching" input, "request low-speed jog" input and "request high-speed jog" input are ON, the motions are executed according to the following order.
  Inching > Low-speed jog > High-speed jog
- It is not possible to simultaneously move two (2) or more axes at jogging. Move each axis separately.
- The axis stops if the communication through the CC-Link has been severed during jogging.

Discontinue

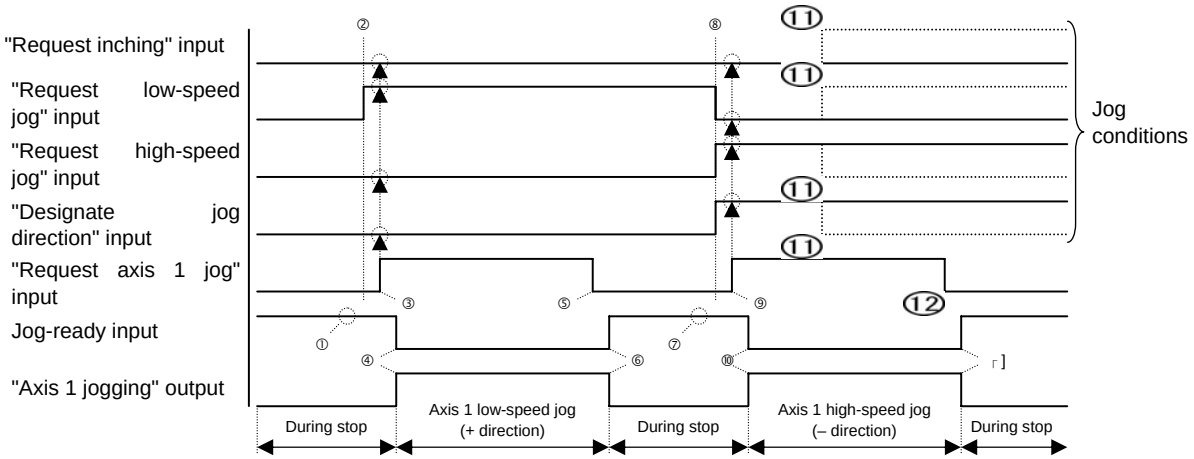


Fig. 11.2.4–1 Example of First axis moving

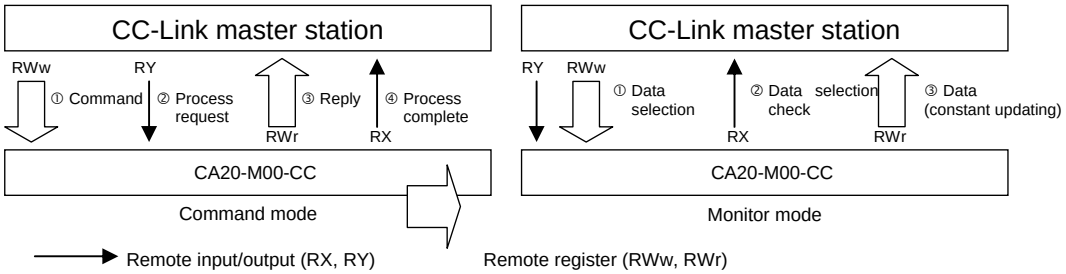
① Make sure that the jog-ready signal is ON.
② Set the jog conditions. (In the above figure, low-speed jog and plus "+" direction are specified.)
③ Turn on the "request axis 1 jog" input. (With this timing, the jog conditions are input.)
④ The jog-ready output turns off and the "axis 1 jogging" output turns on. Then the axis 1 starts jogging at low speed in the plus "+" direction.
⑤ To stop the axis, turn off the "request axis 1 jog" input signal.
⑥ The jog-ready output turns on and the "axis 1 jogging" output turns off. Then the axis 1 jogging at low speed in the plus "+" direction stops.
⑦ Make sure that the jog-ready signal is ON.
⑧ Set the jog conditions. (In the above figure, high-speed jog and "–" direction are specified.)
⑨ Turn on the "request axis 1 jog" input. (With this timing, the jog conditions are input.)
⑩ The jog-ready output turns off and the "axis 1 jogging" output turns on. Then the axis 1 starts jogging at high speed in the minus "–" direction.
⑪ Even if the jog conditions have been changed during travel, they are neglected.
⑫ To stop the axis, turn off the "request axis 1 jog" input signal.
⑬ The jog-ready output turns on and the "axis 1 jogging" output turns off. Then the axis 1 jogging at high speed in the minus "–" direction stops.

Discontinue

■ 11.3 Data Communication

■ 11.3.1 Overview of data communication

Two types of data communication are available: Command mode and Monitor mode.
In Command mode, the KCA-20-M10-CC returns reply to commands from the CC-Link master station. Although this enables complex data communication, its characteristic of returning replies to commands requires a certain amount of time for the data updating cycle.
In Monitor mode, the data selected by data selection input [RY(n+6)C to RY(n+6)F] and RWw(n) is constantly updated. This eliminates the need for complex handshake signals for realizing high-speed updating cycles.

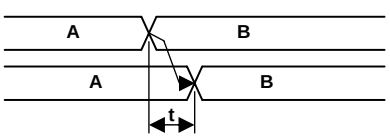


In Command mode, set all the data selection input [RY(n+6)C to RY(n+6)F] to 0. In Monitor mode, set from 0001 to 1111 based on the monitoring content.

No	RY(n+6)F	RY(n+6)E	RY(n+6)D	RY(n+6)C	Mode	Description
1	0	0	0	0	Command mode (section 11.3.2)	Status request Writing of coordinate table Reading of coordinate table Current position request (monitor) Current offset value request (monitor) Counter value request (monitor) Counter set
2	0	0	0	1	Monitor mode (section 11.3.3)	Status monitor
3	0	0	1	0		Current position monitor
4	0	0	0	0		Counter monitor (Note 1) ① Arbitrary selection mode (RWw(n) = 0000h) ② Designated sequence number mode (RWw(n) = 0001h)
5	0	0	0	0		Torque monitor (Note 2)
	···	···	···	···		Reserved
16	1	1	1	1		Reserved

Note 1: The counter monitor is controlled by a controller in version 2.88n or later.
Note 2: The torque monitor is controlled by a controller in version 2.88w or later.

The value of the data selection input [RY(n+6)C to RY(n+6)F] is output unchanged to the data selection check output [RX(n+6)C to RX(n+6)F]. During this output, a time difference (t = several 10 mSEC) occurs, and so pay attention to the timing when changing.

Signal name	Device	Timing
Data selection input signal	RY(n+6)C～RY(n+6)F	
Data selection check output signal	RX(n+6)C～RX(n+6)F	

*: The input and output are based on the direction viewed from the robot controller.

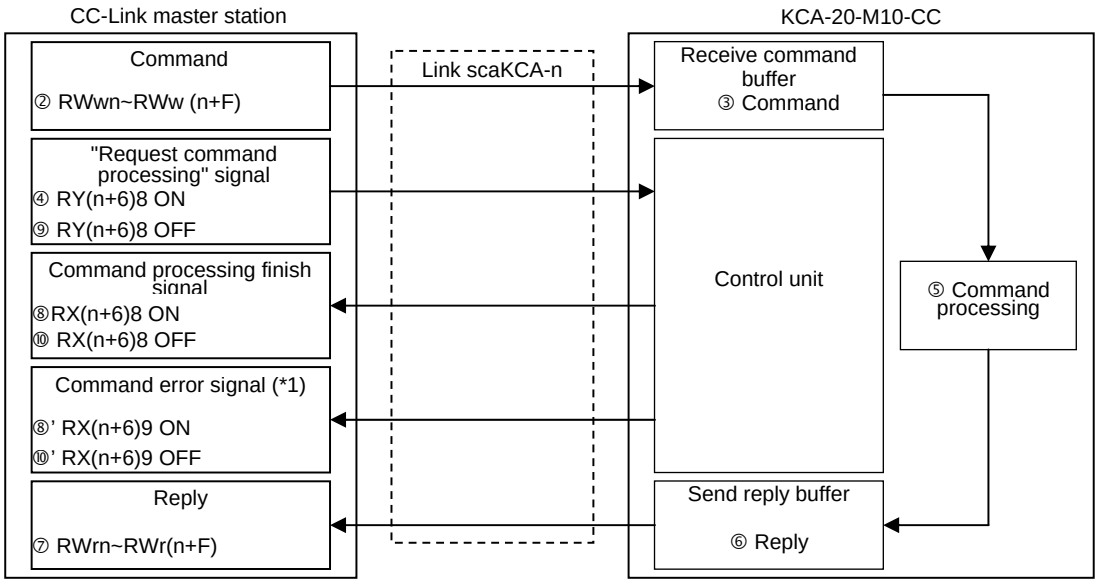
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■ 11.3.2 Command mode

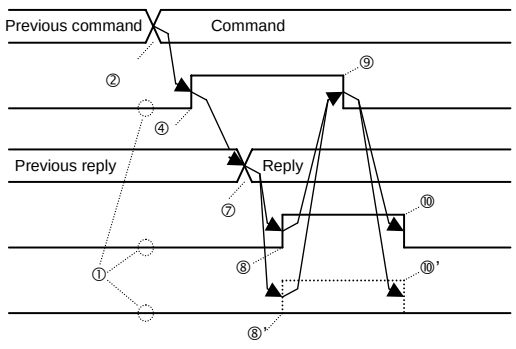
In the relationship between the KCA-20-M10-CC and CC-Link master station, the CC-Link master station is always the main station, and the KCA-20-M10-CC is the secondary station. Communication uses a half-duplex system where the CC-Link master station issues commands and the KCA-20-M10-CC sends back a reply.
When the KCA-20-M10-CC receives a command that can be processed, an affirmative response or the necessary data is returned. If the process is not possible because the KCA-20-M10-CC is busy or other reasons, an error reply is returned.

■ 11.3.2.1 Transmitting and receiving data

(1) Data flow and timing



(*1) Only when an error has occurred.

Signal name	Device	Timing
Command	RWwn ~ RWw(n+F)	
"Request command processing" signal	RY(n+6)8	
Reply	RWrn ~ RWr(n+F)	
Command processing finish signal	RX(n+6)8	
Command error signal	RX(n+6)9	
Data selection input signal	RY(n+6)C～RY(n+6)F	
Data selection check output signal	RX(n+6)C～RX(n+6)F	

Set the data selection input RY(n+6)C to RY(n+6)F to 0000.

Discontinue

① Before sending a command, make sure that all handshake signals ("request command processing" signal, command processing finish signal and command error signal) are set OFF.
② Set the command in the remote register.
③ The command set in the remote register is transferred to the KCA-20–M10–CC "receive command" buffer via the link scan of the CC-Link.
④ The "request command processing" signal is turned on.
⑤ The command is processed based on the data in the "receive command" buffer in Step ③ above.
⑥ The results are set in the "send reply" buffer.
⑦ The response set in the "send reply" buffer is transferred to the remote register of the CC-Link master station via the link scan of the CC-Link.
⑧ The command processing finish signal turns on.
⑧' If an error has occurred, the command error signal turns on at the same time.
⑨ The "request command processing" signal turns off.
⑩ The command processing finish signal turns off.
⑩' If the command error signal is ON, it turns off at the same time.

Discontinue

■ 11.3.2.2 Command table

No.	Description	Mode	Command/ reply	Remote register (Command = RWwn, Reply = RWrn)					
				+0	+1	+2	+3	+4 ~ +B	+C ~ +F
1	Request status	%	Command	B900H	Status No.				Reserved (0 fixed)
			Reply			Status value	Error code		Reserved (0 fixed)
2	Write coordinate table	%	Command	C2C1H	Table No.	0 (fixed)	0 (fixed)	Axis 1 ~ Axis 2 coordinates	Reserved (0 fixed)
			Reply		0 (fixed)	0 (fixed)	Error code		Reserved (0 fixed)
3	Read coordinate table	%	Command	C3C1H	Table No.				Reserved (0 fixed)
			Reply			0 (fixed)	Error code	Axis 1 ~ Axis 2 coordinates	Reserved (0 fixed)
4	Request current position (monitor)	%	Command	E300H					Reserved (0 fixed)
			Reply		0 (fixed)	0 (fixed)	Error code	Axis 1 ~ Axis 2 coordinates	Reserved (0 fixed)
5	Request current offset value (monitor)	%	Command	E400H					Reserved (0 fixed)
			Reply		0 (fixed)	0 (fixed)	Error code	Axis 1 ~ Axis 2 coordinates	Reserved (0 fixed)
6	Request counter value (monitor)	%	Command	E500H	Counter No.				Reserved (0 fixed)
			Reply			Counter value	Error code		Reserved (0 fixed)
7	Set counter	%	Send	E700H	Counter No.	Counter value			Reserved (0 fixed)
			Reply		0 (fixed)	0 (fixed)	Error code		Reserved (0 fixed)
8	Write speed table	%	Send	C2C2H	Table No.	0 (fixed)	0 (fixed)	Speed	Reserved (0 fixed)
			Reply		0 (fixed)	0 (fixed)	Error code		Reserved (0 fixed)
9	Read speed table	%	Send	C3C2H	Table No.				Reserved (0 fixed)
			Reply			0 (fixed)	Error code	Speed	Reserved (0 fixed)
10	Write acceleration/ deceleration table	%	Send	C2C3H	Table No.	0 (fixed)	0 (fixed)	Time to set speed	Reserved (0 fixed)
			Reply		0 (fixed)	0 (fixed)	Error code		Reserved (0 fixed)
11	Read acceleration/ deceleration table	%	Send	C3C3H	Table No.				Reserved (0 fixed)
			Reply			0 (fixed)	Error code	Time to set speed	Reserved (0 fixed)
12	Write override	%	Send	D900H	Override				Reserved (0 fixed)
			Reply		0 (fixed)	0 (fixed)	Error code		Reserved (0 fixed)
13	Read override	%	Send	DA00H					Reserved (0 fixed)
			Reply		Override	0(fixed)	Error code		Reserved (0 fixed)
14	Torque monitor	%	Send	EE08H					Reserved (0 fixed)
			Reply		0(fixed)	0(fixed)	Error code	Axis 1 torque	Reserved (0 fixed)

Note : No.8 to No.14 is used by a controller in version 2.88w or later.

Discontinue

% Can be accepted at all times.
@ Can be accepted only when the program is stopped. (If data is transmitted during program execution, an error occurs.)
Error code
0000H Normal
1000H Command analysis error (An error is found in the command.)
20**H Command cannot be executed. (See the explanation of each command.)

■ 11.3.2.3 Descriptions on each command

(1) "Request Status" Command (B900H)

Command (CC-Link master station → KCA-20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWwn	B9H	00H	Command
RWw(n+1)	K0-K2		Status number
RWw(n+2) ~ RWw(n+F)	Fixed at "K0"		Use prohibited

Response (CC-Link master station ← KCA-20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWrn	B9H	00H	Same value as command
RWr(n+1)	K0-K2		Status number
RWr(n+2)	00	**H	Status value (*1)
RWr(n+3)	Error code		
RWr(n+4) ~ RWr(n+F)	Fixed at “K0”		Unused

*1 The status value is saved in the lower byte.
The upper byte is always fixed at "00".
Error code
0000H Normal
1000H Command analysis error (An error is found in the command.)

Details of each status

Status 0	
BIT	Description
0	1: Error is found.
1	1: During execution
2	1: During pause
3	1: During return to origin
4	1: Return to origin finish
5	1: Positioning finish
6	
7	1: Change in Parameter 2.

Status 1	
BIT	Description
0	Error code (See section 19.2.)
1	
2	
3	
4	
5	
6	
7	

Status 2	
BIT	Description
0	00: Sequential mode 01: Palletizing mode 10: External point designation mode 11: Easy mode
1	
2	00: Auto mode 01: Step mode 10: Program mode
3	
4	1: Single operation mode
5	1: Pulse frequency input mode
6	1: Teach pendant ON
7	1: Host computer ON

Discontinue

(2) "Write coordinate table" command (C2C1H)

Command (CC-Link master station → KCA-20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWwn	C2H	C1H	Command
RWw(n+1)	K1-K999		Table number
RWw(n+2)	K1-K4		Task number
RWw(n+3)	Fixed at "K0"		Use prohibited
RWw(n+4)	K-800000～K+800000		Axis 1 coordinate
RWw(n+5)			
RWw(n+6)	K-800000～K+800000		Axis 2 coordinate
RWw(n+7)			
RWw(n+8) ～ RWw(n+F)	Fixed at “K0”		Use prohibited

Response (CC-Link Master station ← KCA-20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWrn	C2H	C1H	Same value as command
RWr(n+1)	Fixed at "K0"		Unused
RWr(n+2)	Fixed at "K0"		Unused
RWr(n+3)	Error code		
RWr(n+4) ～ RWr(n+F)	Fixed at “K0”		Unused

- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → K+10000)
- When writing "********", specify H7FFFFFFF.
- When 0 is specified in task number, the controller controls for an active task.

Error code

0000H Normal

1000H Command analysis error (An error is found in the command.)

(3) "Read coordinate table" command (C3C1H)

Command (CC-Link master station → KCA-20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWwn	C3H	C1H	Command
RWw(n+1)	K1-K999		Table number
RWw(n+2)	K1-K4		Task number
RWw(n+3) ～ RWw(n+F)	Fixed at “K0”		Use prohibited

Response (CC-Link master station ← KCA-20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWrn	C3H	C1H	Same value as command
RWr(n+1)	K1-K999		Table number
RWr(n+2)	Fixed at “K0”		Unused
RWr(n+3)	Error code		
RWr(n+4)	K-800000～K+800000		Axis 1 coordinate
RWr(n+5)			
RWr(n+6)	K-800000～K+800000		Axis 2 coordinate
RWr(n+7)			
RWr(n+8) ～ RWr(n+F)	Fixed at “K0”		Unused

- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → K+10000)
- When writing "********", reply H7FFFFFFF.
- When 0 is specified in task number, the controller controls for an active task.

Error code

0000H Normal

1000H Command analysis error (An error is found in the command.)

2003H Access to coordinate table is not possible. (During writing of EEPROM)

Discontinue

(4) "Request current position" (monitor) command (E300H)

Command (CC-Link master station → KCA−20−M10-CC)				Response (CC-Link master station ← KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	E3H	00	Command	RWrn	E3H	00H	Same value as command
RWw(n+1)	K1-K4		Task number	RWr(n+1)	Fixed at "K0"		Unused
RWw(n+2) ～ RWw(n+F)	Fixed at "K0"		Use prohibited	RWr(n+2)	Fixed at "K0"		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K-800000～K+800000		Axis 1 coordinate
				RWr(n+5)			
				RWr(n+6)	K-800000～K+800000		Axis 2 coordinate
				RWr(n+7)			
				RWr(n+8) ～ RWr(n+F)	Fixed at "K0"		Unused

- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → K+10000)
- When 0 is specified in task number, the controller controls for an active task.

Error code

0000H Normal

1000H Command analysis error (An error is found in the command.)

(5) "Request current offset value" (monitor) command (E400H)

Command (CC-Link master station → KCA−20-M10-CC)				Response (CC-Link master station ← KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	E4H	00	Command	RWrn	E4H	00H	Same value as command
RWw(n+1)	K1-K4		Task number	RWr(n+1)	Fixed at "K0"		Unused
RWw(n+2) ～ RWw(n+F)	Fixed at "K0"		Use prohibited	RWr(n+2)	Fixed at "K0"		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K-800000～K+800000		Axis 1 coordinate
				RWr(n+5)			
				RWr(n+6)	K-800000～K+800000		Axis 2 coordinate
				RWr(n+7)			
				RWr(n+8) ～ RWr(n+F)	Fixed at "K0"		Unused

- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → K+10000)
- When 0 is specified in task number, the controller controls for an active task.

Error code

0000H Normal

1000H Command analysis error (An error is found in the command.)

Discontinue

(6) "Request counter value" (monitor) command (E500H)

Command (CC-Link master station → KCA−20-M10-CC)				Response (CC-Link master station ← KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	E5H	00H	Command	RWrn	E5H	00H	Same value as command
RWw(n+1)	K1-K99		Counter number	RWr(n+1)	K1-K99		Counter number
RWw(n+2) ～ RWw(n+F)	Fixed at “K0”		Use prohibited	RWr(n+2)	K0-K9999		Counter value
				RWr(n+3)	Error code		
				RWr(n+4) ～ RWr(n+F)	Fixed at “K0”		Unused

Error code
0000H Normal
1000H Command analysis error (An error is found in the command.)

(7) "Set counter" command (E700H)

Command (CC-Link master station →KCA−20-M10-CC)				Response (CC-Link master station ←KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	E7H	00H	Command	RWrn	E7H	00H	Same value as command
RWw(n+1)	K1-K99		Counter number	RWr(n+1)	Fixed at “K0”		Unused
RWw(n+2)	K0-K9999		Counter value	RWr(n+2)	Fixed at “K0”		Unused
RWw(n+3) ～ RWw(n+F)	Fixed at “K0”		Use prohibited	RWr(n+3)	Error code		
				RWr(n+4) ～ RWr(n+F)	Fixed at “K0”		Unused

Error code
0000H Normal
1000H Command analysis error (An error is found in the command.)

(8) " Write speed table " command (C2C2H)

Command (CC-Link master station →KCA−20-M10-CC)				Response (CC-Link master station ←KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	C2H	C2H	Command	RWrn	C2H	C2H	Same value as command
RWw(n+1)	K1-K10		table number	RWr(n+1)	Fixed at “K0”		Unused
RWw(n+2)	Fixed at “K0”		Use prohibited	RWr(n+2)	Fixed at “K0”		Unused
RWw(n+3)	Fixed at “K0”		Use prohibited	RWr(n+3)	Error code		
RWw(n+4)	K10-K9999		Speed	RWr(n+4) ～ RWr(n+F)	Fixed at “K0”		Unused
RWw(n+5)							
RWw(n+3) ～ RWw(n+F)	Fixed at “K0”		Use prohibited				

- Data length of speed value: 32 bits
- Unit of speed value: 0.1 [mm/SEC] (Ex.: +100.00[mm/SEC] → K+1000)

Error code
0000H Normal
1000H Command analysis error (An error is found in the command.)

Discontinue

(9) " Read speed table " command (C3C2H)

Command (CC-Link master station →KCA−20-M10-CC)				Response (CC-Link master station ←KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	C3H	C2H	Command	RWrn	C3H	C2H	Same value as command
RWw(n+1)	K1-K10		Table number	RWr(n+1)	K1-K10		Table number
RWw(n+2) ～ RWw(n+F)	Fixed at “K0”		Use prohibited	RWr(n+2)	Fixed at “K0”		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K10-K9999		Speed
				RWr(n+5)			
				RWr(n+6) ～ RWr(n+F)	Fixed at “K0”		Unused

- Data length of speed value: 32 bits
- Unit of speed value: 0.1 [mm/SEC] (Ex.: +100.00[mm/SEC] → K+1000)

Error code

0000H Normal

1000H Command analysis error (An error is found in the command.)

(10) " Write acceleration/deceleration table " command (C2C3H)

Command (CC-Link master station →KCA−20-M10-CC)				Response (CC-Link master station ←KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	C2H	C3H	Command	RWrn	C2H	C3H	Same value as command
RWw(n+1)	K1-K20		table number	RWr(n+1)	Fixed at “K0”		Unused
RWw(n+2)	Fixed at “K0”		Use prohibited	RWr(n+2)	Fixed at “K0”		Unused
RWw(n+3)	Fixed at “K0”		Use prohibited	RWr(n+3)	Error code		
RWw(n+4)	K1-K999		Time to set speed	RWr(n+4) ～ RWr(n+F)	Fixed at “K0”		Unused
RWw(n+5)							
RWw(n+6) ～ RWw(n+F)	Fixed at “K0”		Use prohibited				

- Data length of “time to set speed” value: 32 bits
- Unit of “time to set speed” value: 0.01 [SEC] (Ex.: +0.30[SEC] → K+30)

Error code

0000H Normal

1000H Command analysis error (An error is found in the command.)

Discontinue

(11) " Read acceleration/deceleration table " command (C3C3H)

Command (CC-Link master station →KCA−20-M10-CC)				Response (CC-Link master station ←KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	C3H	C3H	Command	RWrn	C3H	C3H	Same value as command
RWw(n+1)	K1-K20		Table number	RWr(n+1)	K1-K20		Table number
RWw(n+2) ～ RWw(n+F)	Fixed at “K0”		Use prohibited	RWr(n+2)	Fixed at “K0”		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K1-K999		Time to set speed
				RWr(n+5)			
				RWr(n+6) ～ RWr(n+F)	Fixed at “K0”		Unused

- Data length of “time to set speed” value: 32 bits
- Unit of “time to set speed” value: 0.01 [SEC] (Ex.: +0.30[SEC] → K+30)

Error code

0000H	Normal
1000H	Command analysis error (An error is found in the command.)

(12) " Write override " command (D900H)

Command (CC-Link master station →KCA−20-M10-CC)				Response (CC-Link master station ←KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	D9H	00H	Command	RWrn	D9H	00H	Same value as command
RWw(n+1)	K1-K100		Override	RWr(n+1)	Fixed at “K0”		Unused
RWw(n+2) ～ RWw(n+F)	Fixed at “K0”		Use prohibited	RWr(n+2)	Fixed at “K0”		Unused
				RWr(n+3)	Error code		
				RWr(n+4) ～ RWr(n+F)	Fixed at “K0”		Unused

- Unit of override value: [%]

Error code

0000H	Normal
1000H	Command analysis error (An error is found in the command.)
2000H	Controller error state

Discontinue

(13) " Read override " command (DA00H)

Command (CC-Link master station →KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWwn	DAH	00H	Command
RWw(n+1) ～ RWw(n+F)	Fixed at “K0”		Use prohibited

Response (CC-Link master station ←KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWrn	DAH	00H	Same value as command
RWr(n+1)	K1-K100		Override
RWr(n+2)	Fixed at “K0”		Unused
RWr(n+3)	Error code		
RWr(n+4) ～ RWr(n+F)	Fixed at “K0”		Unused

- Unit of override value: [%]

Error code

0000H	Normal
1000H	Command analysis error (An error is found in the command.)
2000H	Controller error state

(14) " Read override " command (DA00H)

Command (CC-Link master station →KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWwn	EEH	08H	Command
RWw(n+1) ～ RWw(n+F)	Fixed at “K0”		Use prohibited

Response (CC-Link master station ←KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWrn	EEH	08H	Same value as command
RWr(n+1)	Fixed at “K0”		Unused
RWr(n+2)	Fixed at “K0”		Unused
RWr(n+3)	Error code		
RWr(n+4)	K-999-K999		Axis 1 torque
RWr(n+5)			
RWr(n+6) ～ RWr(n+F)	Fixed at “K0”		Unused

- Data length of torque value: 32 bits
- Unit of torque value: 0.01 [T] (Ex.: +2.00[T] → K+200)
- T: Rating torque
- It is impossible to monitor axis 2 to axis 4.

Error code

0000H	Normal
1000H	Command analysis error (An error is found in the command.)

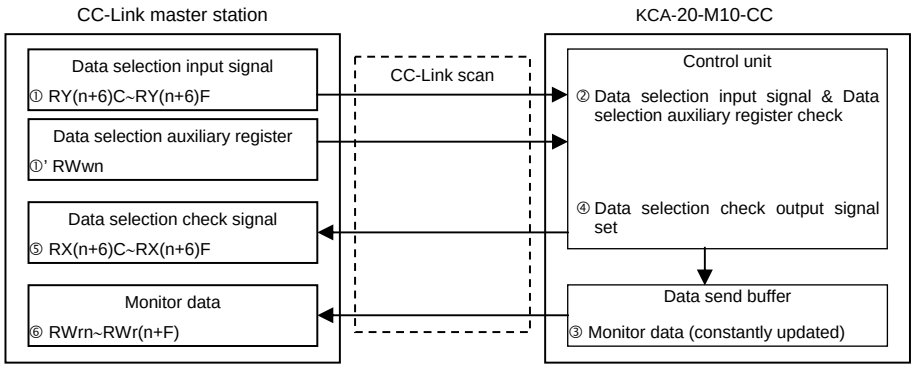
Discontinue

■ 11.3.3 Monitor mode

In Monitor mode, the data selected by data selection input [RY(n+6)C to RY(n+6)F] is constantly updated for realizing high-speed updating cycles.

■ 11.3.3.1 Data receiving method

(1) Data flow and timing



Signal name	Device	Timing
Data selection input signal	RY(n+6)C~RY(n+6)F	A → B (①)
Data selection auxiliary register	RWwn	A' → B' (①')
Monitor data	RWrn~RWr(n+F)	Previous data → Monitor data (constantly updated) (③)
Data selection check output signal	RX(n+6)C~RX(n+6)F	A → B (④)

- For the values of the data selection signal and data selection check signal, refer to section 12.3.3.2.
- The data selection auxiliary register may not be used depending on a selected monitor.

① Set the data selection signal and data selection auxiliary register.

② The data selection signal is transferred to KCA-20-M00/M01 by the CC-Link scan.

③ The data selected by the data selection signal and data selection auxiliary register is set to the data send buffer. The data send buffer is updated at 1-ms cycles.

④ Set the data selection check signal. Set the value of the data selection check signal to the same value as the data selection signal.

⑤ The data selection check signal that was set in step ④ is transferred to the remote input (RX) of the CC-Link master station by the CC-Link scan.

⑥ The data that was set in step ③ is transferred to the remote register (RWr) of the CC-Link master station by the CC-Link scan.

Discontinue

■ 11.3.3.2 List of monitor types

No.	Description	Data selection input signal				Auxiliary register	Remarks
		RY(n+6)F	RY(n+6)E	RY(n+6)D	RY(n+6)C	RWwn	
1	Status monitor	0	0	0	1	Unused	
2	Current position monitor	0	0	1	0	Unused	
3	Counter monitor *1	0	0	1	1	0000h	Arbitrary selection mode
						0001h	Designated sequence number mode
4	Torque monitor *2	0	1	0	0	Unused	
5	Reserved	0	1	0	1	-	
···	Reserved	···	···	···	···	-	
15	Reserved	1	1	1	1	-	

Note 1: The counter monitor is controlled by a controller in version 2.88n or later.

Note 2: The torque monitor is controlled by a controller in version 2.88w or later.

■ 11.3.3.3 Explanation of monitors

(1) Status monitor

Remote register	b15------b8	b7------b0	Remarks
RWrn	00H	01H	Data selection check (*1)
RWr(n+1)	Fixed at K0		Use prohibited
RWr(n+2)	Fixed at K0		Use prohibited
RWr(n+3)	Fixed at K0		Use prohibited
RWr(n+4)	00H	**H	Status 0 (*2)
RWr(n+5)	00H	**H	Status 1 (*2)
RWr(n+6)	00H	**H	Status 2 (*2)
RWr(n+7)	00H	**H	Status 3 (*2)
RWw(n+8) ～ RWr(n+F)	Fixed at K0		Use prohibited



*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored.

*2: The status value is stored to the lower byte.
The upper byte is constantly fixed at 00.

Discontinue

Status descriptions

Status 0	
BIT	Description
0	1: Error occurred
1	1: Execution in progress
2	1: Pause in progress
3	1: Return to origin in progress
4	1: Return to origin complete
5	1: Positioning complete
6	
7	1: Parameter 2 modified

Status 1	
BIT	Description
0	Error code (Refer to section 19.2.)
1	
2	
3	
4	
5	
6	
7	

Status 2	
BIT	Description
0	00: Sequential mode 01: Palletizing mode 10: Point mode 11: Easy mode
1	
2	00: Auto mode 01: Step mode 10: Program mode
3	
4	1: Single operation mode
5	1: Pulse train input mode
6	1: Teach pendant ON
7	1: Host computer ON

Status 3	
BIT	Description
0	1: Servo ON
1	
2	
3	
4	
5	
6	
7	

(2) Current position monitor

Remote register	b15------b8	b7------b0	Remarks
RWrn	00H	02H	Data selection check (*1)
RWr(n+1)	Fixed at K0		Use prohibited
RWr(n+2)	Fixed at K0		Use prohibited
RWr(n+3)	Fixed at K0		Use prohibited
RWr(n+4)	K-800000～K+800000		Axis 1 coordinate
RWr(n+5)			
RWr(n+6)	K-800000～K+800000		Axis 2 coordinate
RWr(n+7)			
RWr(n+8)	K-800000～K+800000		Axis 3 coordinate
RWr(n+9)			
RWr(n+A)	K-800000～K+800000		Axis 4 coordinate
RWr(n+B)			
RWr(n+C)	00_H	$**_H$	Status 0 (*2)
RWr(n+D)	00_H	$**_H$	Status 1 (*2)
RWr(n+E)	00_H	$**_H$	Status 2 (*2)
RWr(n+F)	00_H	$**_H$	Status 3 (*2)

- Coordinate data length: 32 bits
- Coordinate units: 0.01 mm (Example: +100.00 mm → K +10000)
- The current coordinates for four axes are stored regardless of task combination [K15].

*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored.

*2: The status values are stored at low byte.
High bytes are always fixed at 00.
Refer to section 11.3.3.3(1) for the status description.

Discontinue

(3) Counter monitor

The counter monitor can be operated in two modes: arbitrary selection mode for monitoring arbitrary seven counters; and designated subsequent number mode for monitoring 14 coupled counters. Either of two modes can be selected using the data selection auxiliary register RWwn.

① Arbitrary selection mode (RWwn = 0000H)

Monitoring up to seven arbitrary counters set to RWw(n+2, 4, 6, 8, A, C, E)

Monitor (CC-Link master station → KCA−20-M10-CC)				Response (CC-Link master station ← KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	00_H	00_H	Mode selection	RWrn	00_H	03_H	Arbitrary selection mode *1
RWw(n+1)	Fixed at K0		Use prohibited	RWr(n+1)	Fixed at K0		Use prohibited
RWw(n+2)	K1-K99*2		Counter number 1	RWr(n+2)	K1-K99		Counter number 1
RWw(n+3)	Fixed at K0		Use prohibited	RWr(n+3)	K0-K9999		Value of counter number 1
RWw(n+4)	K1-K99*2		Counter number 2	RWr(n+4)	K1-K99		Counter number 2
RWw(n+5)	Fixed at K0		Use prohibited	RWr(n+5)	K0-K9999		Value of counter number 2
RWw(n+6)	K1-K99*2		Counter number 3	RWr(n+6)	K1-K99		Counter number 3
RWw(n+7)	Fixed at K0		Use prohibited	RWr(n+7)	K0-K9999		Value of counter number 3
RWw(n+8)	K1-K99*2		Counter number 4	RWr(n+8)	K1-K99		Counter number 4
RWw(n+9)	Fixed at K0		Use prohibited	RWr(n+9)	K0-K9999		Value of counter number 4
RWw(n+A)	K1-K99*2		Counter number 5	RWr(n+A)	K1-K99		Counter number 5
RWw(n+B)	Fixed at K0		Use prohibited	RWr(n+B)	K0-K9999		Value of counter number 5
RWw(n+C)	K1-K99*2		Counter number 6	RWr(n+C)	K1-K99		Counter number 6
RWw(n+D)	Fixed at K0		Use prohibited	RWr(n+D)	K0-K9999		Value of counter number 6
RWw(n+E)	K1-K99*2		Counter number 7	RWr(n+E)	K1-K99		Counter number 7
RWw(n+F)	Fixed at K0		Use prohibited	RWr(n+F)	K0-K9999		Value of counter number 7

*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored. "00H" is stored at high byte.

*2:In the case where a number other than "K1 to K99" is designated for counter number, 0 will be returned to that counter number.

Discontinue

② Designated subsequent mode (RWwn =0001H)
Monitoring subsequent counters (up to 14) starting with the counter number set to RWw(n+1).

Monitor (CC-Link master station →KCA−20-M10-CC)				Response (CC-Link master station ←KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	00_H	01_H	Mode selection	RWrn	01_H	03_H	Arbitrary selection mode *1
RWw(n+1)	K1-K99 2		First counter number	RWr(n+1)	K1-K99		First counter number
RWw(n+2)	Fixed at 0		Use porhibited	RWr(n+2)	K0-K9999		Value of first counter
RWw(n+3)				RWr(n+3)	K0-K9999		Value of first counter +1
RWw(n+4)				RWr(n+4)	K0-K9999		Value of first counter +2
RWw(n+5)				RWr(n+5)	K0-K9999		Value of first counter +3
RWw(n+6)				RWr(n+6)	K0-K9999		Value of first counter +4
RWw(n+7)				RWr(n+7)	K0-K9999		Value of first counter +5
RWw(n+8)				RWr(n+8)	K0-K9999		Value of first counter +6
RWw(n+9)				RWr(n+9)	K0-K9999		Value of first counter +7
RWw(n+A)				RWr(n+A)	K0-K9999		Value of first counter +8
RWw(n+B)				RWr(n+B)	K0-K9999		Value of first counter +9
RWw(n+C)				RWr(n+C)	K0-K9999		Value of first counter +10
RWw(n+D)				RWr(n+D)	K0-K9999		Value of first counter +11
RWw(n+E)				RWr(n+E)	K0-K9999		Value of first counter +12
RWw(n+F)				RWr(n+F)	K0-K9999		Value of first counter +13



*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored at low byte of RWwn. "01H" is stored at high byte.

*2:In the case where a number other than "K1 to K99" is designated for counter number, 0 will be returned to that counter number. In the case where a number above K87 is designated for the first counter number, 0 will be returned to the values after counter number 99.

Discontinue

(4) Torque monitor

The counter monitor can be operated in two modes: arbitrary selection mode for monitoring arbitrary seven counters; and designated subsequent number mode for monitoring 14 coupled counters. Either of two modes can be selected using the data selection auxiliary register RWwn.

① Arbitrary selection mode (RWwn = 0000H)

Monitoring up to seven arbitrary counters set to RWw(n+2, 4, 6, 8, A, C, E)

Monitor (CC-Link master station → KCA−20-M10-CC)				Response (CC-Link master station ← KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks	Remote register	b15------b8	b7------b0	Remarks
RWwn	00_H	00_H	Mode selection	RWrn	00_H	03_H	Arbitrary selection mode *1
RWw(n+1)	Fixed at K0		Use prohibited	RWr(n+1)	Fixed at K0		Use prohibited
RWw(n+2)	K1-K99*2		Counter number 1	RWr(n+2)	K1-K99		Counter number 1
RWw(n+3)	Fixed at K0		Use prohibited	RWr(n+3)	K0-K9999		Value of counter number 1
RWw(n+4)	K1-K99*2		Counter number 2	RWr(n+4)	K1-K99		Counter number 2
RWw(n+5)	Fixed at K0		Use prohibited	RWr(n+5)	K0-K9999		Value of counter number 2
RWw(n+6)	K1-K99*2		Counter number 3	RWr(n+6)	K1-K99		Counter number 3
RWw(n+7)	Fixed at K0		Use prohibited	RWr(n+7)	K0-K9999		Value of counter number 3
RWw(n+8)	K1-K99*2		Counter number 4	RWr(n+8)	K1-K99		Counter number 4
RWw(n+9)	Fixed at K0		Use prohibited	RWr(n+9)	K0-K9999		Value of counter number 4
RWw(n+A)	K1-K99*2		Counter number 5	RWr(n+A)	K1-K99		Counter number 5
RWw(n+B)	Fixed at K0		Use prohibited	RWr(n+B)	K0-K9999		Value of counter number 5
RWw(n+C)	K1-K99*2		Counter number 6	RWr(n+C)	K1-K99		Counter number 6
RWw(n+D)	Fixed at K0		Use prohibited	RWr(n+D)	K0-K9999		Value of counter number 6
RWw(n+E)	K1-K99*2		Counter number 7	RWr(n+E)	K1-K99		Counter number 7
RWw(n+F)	Fixed at K0		Use prohibited	RWr(n+F)	K0-K9999		Value of counter number 7



- Data length of torque value: 32 bits
- Unit of torque value: 0.01 [T] (Ex.: +2.00[T] → K+200)
- T: Rating torque
- It is impossible to monitor axis 2 to axis 4.

*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored.

*2: The status values are stored at low byte.
High bytes are always fixed at 00.
Refer to section 11.3.3.3(1) for the status description.

Discontinue

■ 11.4 Speed control mode through CC-Link

■ 11.4.1 Overview

This controller is operable in the speed control mode when instructed via the CC-Link. This mode can be used for applications that features continued unidirectional rotation, such as the drive source of a belt-driven device.

⚠CAUTION The speed control mode is not subject to the software limit. Therefore, do not set the speed control mode for mechanisms whose operating range is limited. Doing so can cause damage to the machines and workpieces or personal injury.

■ 11.4.2 Speed control specifications

Speed control specifications

Controller type	KCA-20-M10 / M40
Software version	2.88h or higher
Number of control axes	1 (*1)
Speed specification range	-3000 to +3000 [rpm] (Specified with RWwn)
Acceleration/deceleration time	20 steps (variable)

*1: Speed control cannot be performed through slave units. To use the speed control mode with multiple motors, control all the motors through the master unit.

■ 11.4.3 Items prohibited

Do not perform any of the following operations/settings when the speed control mode is active:

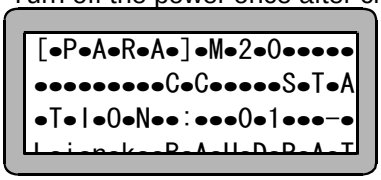
- Operations performed by the teach pendant
  - Return to origin
  - Start operation
  - Jog operation
  - Servo locking
- Change to any of the following modes
  - Point mode
  - Easy mode
  - Pulse train mode
  - Palletizing mode

Discontinue

■ 11.4.4 Settings of speed control mode

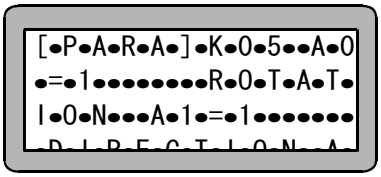
(1) CC-Link setting

To activate the speed control mode, set "9" as the ones digit of the option value.
Turn off the power once after changing the value.



(2) Setting of motor rotation direction

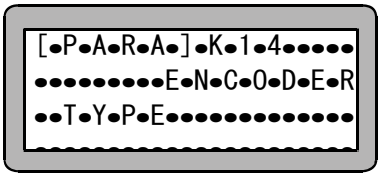
When a positive target speed is given, specify the rotation direction with the motor output shaft viewed from the load side. Turn off the power once after changing the value.



Setting value	Rotation direction
0	Counterclockwise (CCW)
1	Clockwise (CW)

(3) Encoder type setting

Set the incremental encoder type "i". If the absolute encoder type "a" is left unchanged, an encoder backup error occurs each time the power is turned on. Turn off the power once after changing the value.



■ 11.4.5 List of I/O signals

If the speed control mode is set, the I/O signals are changed as shown in the following table:

Signal direction: CC-Link master station ← KCA-20-M10-CC		Signal direction: CC-Link master station → KCA-20-M10-CC	
Device No. (Input)	Signal name	Device No. (Output)	Signal name
RXn0	Running output	RYn0	Rotation command input
RXn1	Error output	RYn1	Servo-on input
RXn2	Target speed achievement output	RYn2	Use prohibited
RXn3	Use prohibited	RYn3	Reset input
RXn4～RXn7	Target speed validation output	RYn4～RYn7	Target speed validation input
RXn8～RXnF	Acceleration/deceleration table number selection output	RYn8～RYnF	Acceleration/deceleration table number selection input
RX(n+1)0～RX(n+7)F	Use prohibited	RY(n+1)0～RY(n+7)F	Use prohibited

- n: Address assigned to the master unit by setting the station number
  Inputs and outputs in the signal names: Directions when viewed from the KCA-20-M10-CC
- "Use prohibited" bits: Always set these bits to 0.

Discontinue

■ 11.4.6 List of I/O data

If the speed control mode is set, the I/O data is changed as shown in the following table:

Output (CC-Link master station → KCA−20-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWwn	K-3000 to K+3000		Target speed
RWw(n+1)	K0 fixed		Use prohibited
RWw(n+2)			
RWw(n+3)			
RWw(n+4)			
RWw(n+5)			
RWw(n+6)			
RWw(n+7)			
RWw(n+8) ～ RWw(n+F)			

Input (CC-Link master station ← KCA−0-M10-CC)			
Remote register	b15------b8	b7------b0	Remarks
RWrn	Current speed		Unit: [rpm]
RWr(n+1)	K0 fixed		Unused
RWr(n+2)			
RWr(n+3)			
RWr(n+4)	00_H	$**_H$	Status 0 (*1)
RWr(n+5)	00_H	$**_H$	Status 1 (*1)
RWr(n+6)	00_H	$**_H$	Status 2 (*1)
RWr(n+7)	00_H	$**_H$	Status 3 (*1)
RWr(n+8) ～ RWr(n+F)	K0 fixed		Unused

- Target speed unit: 1 [rpm] (Example: +1000 [rpm] → K+1000)
- Current speed: Speed at which the motor is running. The units of current speed and target speed are the same.

*1: The status value is stored in the low-order byte. The high-order byte is always set to 00.
For the details of each status, refer to (1) of section 11.3.3.3.

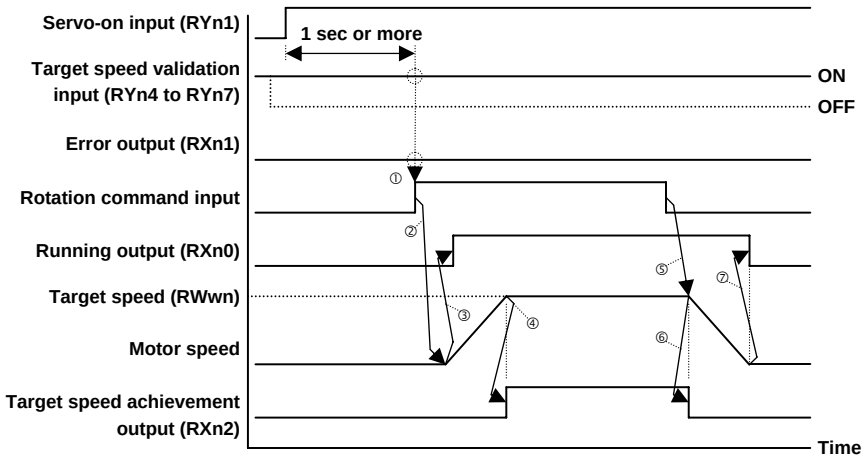
- The target speed (RWwn) value can be changed while the motor is running. For example, when the target speed (RWwn) is changed from K+1,500 to K+3,000, the motor speed changes from 1,500 [rpm] to 3,000 [rpm].
- To change the sign of the target speed (RWwn) value (i.e., to reverse the rotation direction of the motor), set the target speed (RWwn) to K+0, and change the sign of the value after the motor has stopped (with running output (RXn0) OFF). The motor is stopped if the sign of the target speed value is changed without this procedure being performed. To recover the motor, turn OFF the rotation command input (RYn0), and then turn it ON.

Discontinue

■ 11.4.7 Details of I/O signals

(1) Rotation command input (RYn0), running output (RXn0), and target speed achievement output (RXn2)

- When the rotation command input (RYn0) is turned ON, the motor starts running; when it is turned OFF, the motor stops.
- The rotation command input (RYn0) is not accepted in the following cases:
  - Servo-on input (RYn1) is OFF.
  - Error output (RXn1) is ON.
  - Not all the target speed validation inputs (RYn4 to RYn7) are set to 1's.
  - The robot is being operated with the teach pendant (T/P).
    → T/P is ON with the teach pendant connected.
  - The robot is being operated with the personal computer software.
    → The execution screen of the personal computer software is open.
- Turn ON the rotation command input (RYn0) one second or more after the servo-on input (RYn1) is turned ON.
  If the time interval is too short, the motor will not start running. If the motor does not start, turn OFF the rotation command input (RYn0), and turn it ON one second or more after the servo-on input is turned ON.
- If the error output (RXn1) is turned ON, turn OFF both the rotation command input (RYn0) and the servo-on input (RYn1).
- The running output (RXn0) is ON during motor rotation.
- The target speed achievement output (RXn2) is ON while the motor speed is maintained at the target speed (RWwn).
  This output is based on the speed command value in the controller, and the actual motor speed is not reflected in the output. Thus, use the output as a rough standard. If the information of actual motor speed is necessary, refer to the current speed (RWrn).



① Before turning ON the rotation command input (RYn0), confirm that:
- one second or more has passed after turning ON the servo-on input (RYn1),
- the four bits of target speed validation inputs (RYn4 to RYn7) are all ON, and
- the error output (RXn1) is OFF.

② When the rotation command input (RYn0) is turned ON, the motor starts running.

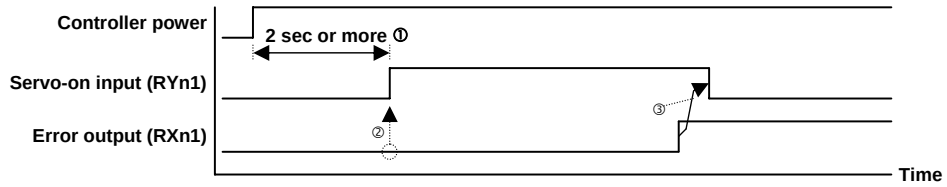
③ When the motor starts running, the running output (RXn0) is turned ON.

Discontinue

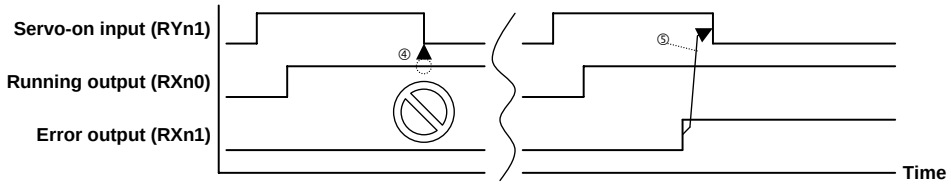
④ When the target speed (RWwn) is achieved, the target speed achievement output (RXn2) is turned ON.
⑤ When the rotation command input (RYn0) is turned OFF, the motor starts deceleration.
⑥ When the motor starts deceleration, the target speed achievement output (RXn2) is turned OFF.
⑦ When the motor has stopped, the running output (RXn0) is turned OFF.

(2) Servo-on input (RYn1)

- This signal gets the motor to enter the servo-on state. When the signal is turned ON, the servo is turned on; when it is turned OFF, the servo is turned off.
  The signal is valid when the error output (RXn1) is OFF.
- The servo-on input (RYn1) is not accepted in any of the following cases:
  - Error output (RXn1) is ON.
  - The robot is being operated with the teach pendant (T/P).
    → T/P is ON with the teach pendant connected.
  - The robot is being operated with the personal computer software.
    → The execution screen of the personal computer software is open.
- If the error output (RXn1) is turned ON, turn OFF the servo-on input (RYn1).
- Do not turn OFF the servo-on input (RYn1) when the running output (RXn0) is ON. (Except when the error output (RXn1) is turned ON)
  If the servo-on input (RYn1) is turned OFF during motor rotation, the motor enters the servo-off state, and runs through inertia until it stops.



① Turn ON the servo-on input at least two seconds after turning ON the power.
② Before turning ON the servo-on input (RYn1), confirm that the error output (RXn1) is OFF.
If the error output (RXn1) is ON, eliminate the cause of the error, and then reset the error state.
③ When the error output (RXn1) is turned ON, turn OFF the servo-on input (RYn1).

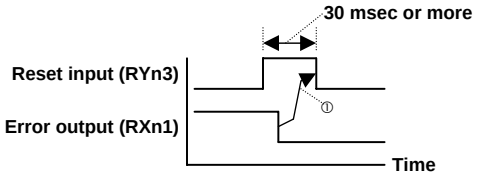


④ Do not turn OFF the servo-on input (RYn1) when the running output (RXn0) is ON. (The motor enters the servo-off state, and runs through inertia until it stops.)
⑤ Even when the running output (RXn0) is ON, turn OFF the servo-on input (RYn1) if the error output (RXn1) is turned ON.

Discontinue

(3) Reset input (RYn3)

- This signal resets the error state.



① After the error output (RXn1) is turned OFF, change the reset input (RYn3) back to OFF.
Alternatively, turn it OFF 30 msec or more after the reset input (RYn3) is turned ON.
Note that if the cause of the error is not eliminated, the error output (RXn1) is not turned OFF.

(4) Target speed validation inputs (RYn4-RYn7), and target speed validation outputs (RXn4-RXn7)

- Target speed validation inputs (RYn4-RYn7) are interlock signals to prevent the motor from accidentally running.
- When all the target speed validation inputs (RYn4-RYn7) are set to 1's, the target speed (RWwn) value becomes valid. If any of the bits is not set to 1, the target speed (RWwn) value becomes invalid and the motor does not run.
- For target speed validation outputs (RXn4-RXn7), the values of target speed validation inputs (RYn4-RYn7) are output without being changed.

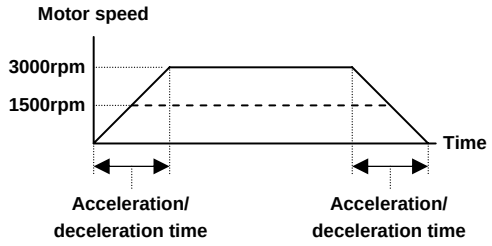
(5) Acceleration/deceleration table number selection inputs (RYn8-RYnF), and acceleration/deceleration table number selection outputs (RXn8-RXnF)

- Specify an acceleration/deceleration table number (1-20) with acceleration/deceleration table number selection input (RYn8-RYnF).
- The acceleration/deceleration table value turns out to be motor acceleration/deceleration time (unit: seconds). This value can be changed with the acceleration/deceleration table in the parameter.
- Acceleration/deceleration time is a period of time until the motor speed reaches 0-3000 rpm.
- If the target speed (RWwn) is lower than 3000 rpm, time for reaching the target speed (RWwn) is shorter than the acceleration/deceleration time.
- For acceleration/deceleration table number selection outputs (RXn8-RXnF), the values of acceleration/deceleration table number selection inputs (RYn8-RYnF) are output without being changed.

Discontinue

		Bit Patterns							
		RYnF	RYnE	RYnD	RYnC	RYnB	RYnA	RYn9	RYn8
Acceleration/deceleration table numbers to be specified	1	0	0	0	0	0	0	0	1
	2	0	0	0	0	0	0	1	0
	.								
	10	0	0	0	0	1	0	1	0
	.								
	19	0	0	0	1	0	0	1	1
	20	0	0	0	1	0	1	0	0

- The table number 20 is selected when the bit pattern is not any of those in the above table.



(6) Error output (RXn1)

- This signal is turned ON if a controller error occurs.
- When the error output (RXn1) is turned ON, turn OFF both the rotation command input (RYn0) and the servo-on input (RYn1).

Discontinue

■ 11.5 Selection table extension in external point designation mode

■ 11.5.1 Overview

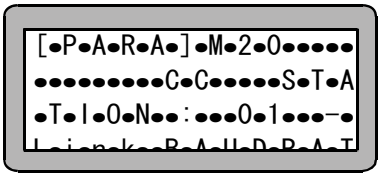
Use of the CC-Link enables the selection of all speed tables and acceleration/deceleration tables.
If this function is used, set selection table extension in [PARA]M20 of mode settings (refer to section 13.2.20). When the setting is made, the assignment of input signals is equivalent to that of our highly functional master unit.
This section explains parameter setting methods and input-signal assignment. For operation methods, refer to chapter 8.
This function is available with controllers of the software version 2.88k or higher.

	Extension input/ output not used	Extension input/ output used	Selection table extension mode	
			Number of tables	Input ports
Point table	Up to 4 bits (Up to 16 tables)	10 bits (999 tables)	10 bits (999 tables)	Station No. 0 General input ports 01-1 to 02-2
Speed table	1 table	2 bits (3 tables)	Up to 4 bits (Up to 10 tables)	Specification permitted *1
Acceleration/ deceleration table	1 table	1 bit (2 tables)	5 bits (20 tables)	Station No. 0 General input ports 02-3 to 02-7
Coordinate system	Absolute coordinates fixed	1 bit Absolute/relative coordinates	1 bit Absolute/relative coordinates	Specification permitted *2

*1: Specify the value in the "program selection input bit specification" ([PARA]M05) of mode settings. (Refer to section 13.2.5.)
*2: Specify the value in the "palletizing input bit specification" ([PARA]M16) of mode settings. (Refer to section 13.2.16.)

■ 11.5.2 How to set selection table extension

To activate the selection table extension mode, set "8" as the ones digit of the option value of [PARA]M20.
Turn off the power once after changing the value.



- The above setting supersedes the setting of "extension input/output in external point specification mode: valid/invalid" ([PARA]M17).

Discontinue

■ 11.5.3 Assignment of input signals and tables

(1) How to specify coordinate (point) tables

Specify point tables with ten bits of the general input ports 01-1 to 01-8, 02-1, and 02-2 of the station No. 0 (master unit). (999 points)

Table to be specified	General input port numbers of the station No. 0									
	02-2	02-1	01-8	01-7	01-6	01-5	01-4	01-3	01-2	01-1
	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
001	0	0	0	0	0	0	0	0	0	0
002	0	0	0	0	0	0	0	0	0	1
003	0	0	0	0	0	0	0	0	1	0
:	:	:	:	:	:	:	:	:	:	:
008	0	0	0	0	0	0	0	1	1	1
:	:	:	:	:	:	:	:	:	:	:
016	0	0	0	0	0	0	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:
256	0	0	1	1	1	1	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:
999	1	1	1	1	1	0	0	1	1	0

1: ON 0: OFF

- An error occurs if 1000 or more point tables are specified.
- Relationship between point table numbers and input ports: The input port values are assumed as binary numbers while arranged in order of 2^9, 2^8 ··· 2^1, 2^0, and the result of adding 1 to the value becomes the table number.

<Example> With the table number 16:

$16 = (2^9\times0+2^8\times0+2^7\times0+2^6\times0+2^5\times0+2^4\times0+2^3\times1+2^2\times1+2^1\times1+2^0\times1)+1$

$= (8+4+2+1)+1$

Discontinue

(2) How to specify speed tables

Specify general input ports in M05 "program selection input bit specification" of mode settings.

Ten tables can be selected with up to four bits, but the number of selection bits varies depending on the assigned bit position. (Consecutive bits in specified ports become valid.)

<Example> If the leading bit is specified for the port 02-7 of the extension I/O unit of slave units, the specification results in the two bits of 02-7 and 02-8.

If the leading bit is specified for the port 03-1 of the station No. 0 (master unit), the specification results are as shown in the following table:

Table to be specified	General input port numbers			
	03-4	03-3	03-2	03-1
	2^3	2^2	2^1	2^0
01	0	0	0	1
02	0	0	1	0
03	0	0	1	1
04	0	1	0	0
05	0	1	0	1
06	0	1	1	0
07	0	1	1	1
08	1	0	0	0
09	1	0	0	1
10	1	0	1	0

1: ON 0: OFF

NOTE The default speed table (01) is specified in the following cases:

① General input ports cannot be assigned in M05 "program selection input bit specification" of mode settings, or the specified bits are all 0's (OFF) even when ports are assigned.

② Eleven or more tables are specified.

Discontinue

(3) How to specify acceleration/deceleration tables

Specify acceleration/deceleration tables with the five bits of the general input ports 02-3 to 02-7 of the station No. 0 (master unit). (20 tables)

Table to be specified	General input port numbers of the station No. 0				
	02-7	02-6	02-5	02-4	02-3
	2^4	2^3	2^2	2^1	2^0
01	0	0	0	0	1
02	0	0	0	1	0
03	0	0	0	1	1
04	0	0	1	0	0
05	0	0	1	0	1
06	0	0	1	1	0
07	0	0	1	1	1
08	0	1	0	0	0
09	0	1	0	0	1
10	0	1	0	1	0

Table to be specified	General input port numbers of the station No. 0				
	02-7	02-6	02-5	02-4	02-3
	2^4	2^3	2^2	2^1	2^0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0

1: ON 0: OFF

NOTE The default acceleration/deceleration table (05) is specified in the following cases:

① The five bits are all 0's (OFF).

② Twenty-one or more tables are specified.

(4) How to specify coordinate systems

Specify the general input port in M16 "palletizing input bit specification" of mode settings.

Specified bit ON: Relative coordinate system

OFF: Absolute coordinate system

An absolute coordinate system is selected if no general input port is assigned in M16 "palletizing input bit specification" of mode settings.

Discontinue

■ 11.6 Maximum torque limit function

■ 11.6.1 Overview

This controller enables the limitation of the maximum torque when indicated via the CC-Link. This function can be used for clamping or inserting workpieces.

⚠CAUTION If the maximum torque limit is too low when used with a vertical axis, the current position cannot be retained, and a sudden drop can cause damage to the workpiece or the hand, or cause your hand to be caught in.

■ 11.6.2 Specifications for the maximum torque limit function

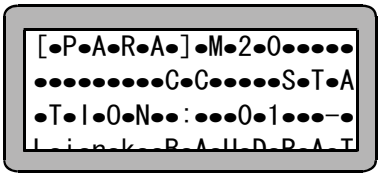
Specifications for the maximum torque limit function

Controller type	KCA−20-M10 / M40
Software version	2.88w or higher
Number of control axes	1 (*1)
Available torque levels	4
Torque setting range	0.01 to 2.00 T (*2)
Operation with the maximum torque limit function excluded	Return to origin (*3)

*1 The maximum torque limit function cannot be used through slave units. To perform the maximum torque limit function with multiple axes, control all the axes through the master unit.
*2 T: Rated torque
*3 If a maximum torque limit is applied, return to origin might not be performed normally. Thus, the maximum torque limit function is disabled during return to origin.

■ 11.6.3 Setting of the maximum torque limit function

To enable the maximum torque limit function, set "7" as the ones digit of the option value of [PARA]M20. Turn off the power once after changing the value.



Discontinue

■ 11.6.4 Setting of a maximum torque limit value

Use the setting value of an acceleration/deceleration table Nos. 17 to 20.

- For how to set an acceleration/deceleration table, refer to section 13.5.3. For setting via the CC-Link, refer to (10) of section 11.3.2.3.
- Assuming the rated torque to be 1.00, set n-fold torque to be the maximum torque.
- A torque value can be entered in a range of 0.01 to 9.99 T, but a value higher than 2.00 T is not output.
- Select a table number through table selection input. (Refer to (1) of section 11.6.5.)
- An acceleration/deceleration table value can be changed at arbitrary timing. The new value is reflected to the maximum torque of the motor immediately after the change. (For the change method, refer to (10) of section 11.3.2.3.)
- The initial values are as follows:

ACC table number	17	18	19	20
Maximum torque limit value [T]	0.90	0.95	1.00	1.05

NOTE Set 2.00 for acceleration/deceleration tables which are not used.
The accuracy is not guaranteed, so use it as a rough standard.
As the maximum torque limit value is smaller, error increases due to an influence from the sliding resistance.

■ 11.6.5 Special I/O signals

If the maximum torque limit function is set, the following I/O signals are assigned as special I/O signals.

Signal direction: CC-Link master station ← KCA−20-M10-CC		Signal direction: CC-Link master station → KCA−20-M10-CC	
Device No. (Input)	Signal name	Device No. (Output)	Signal name
RX(n+4)0〜RX(n+4)1	Table confirmation output	RY(n+4)0〜RY(n+4)1	Table selection input



- n: Address assigned to the master unit by setting the station number
- Inputs and outputs in the signal names: Directions when viewed from the KCA-20-M10-CC
- No change to the I/O signals other than the above (Refer to section 11.2.1.)

Discontinue

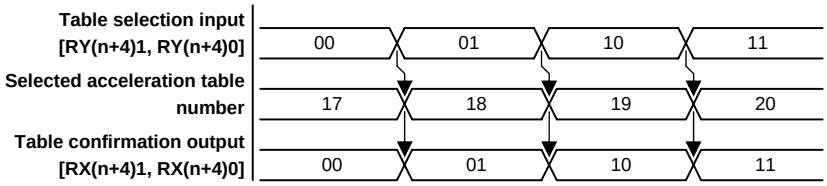
(1) Table selection inputs [RY(n+4)0 to RY(n+4)1]

- Select one of the acceleration/deceleration tables Nos. 17 to 20.
- Another table can be selected during movement.
- Table selection inputs are assigned to general input ports, so the status can be viewed through the sequential program.
  - RY(n+4)0: General input port 8-1
  - RY(n+4)1: General input port 8-2

Acceleration/deceleration table to be selected	Table selection input	
	[RY(n+4)1]	[RY(n+4)0]
17	0	0
18	0	1
19	1	0
20	1	1

(2) Table confirmation outputs [RX(n+4)0 to RX(n+4)1]

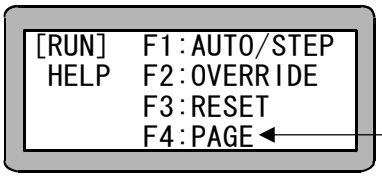
- Use the signals to confirm the acceleration/deceleration table number selected.
- For the table confirmation outputs, the values of table selection inputs [RY(n+4)0 to RY(n+4)1] are output without being changed.



- Table confirmation outputs [RX(n+4)0 to RX(n+4)1] are assigned to general output ports, so the values can be changed through the sequential program. However, note that they are overwritten with the values of table selection inputs [RY(n+4)0 to RY(n+4)1] in a cyclic manner.
  - RX(n+4)0: General input port 8-1
  - RX(n+4)1: General input port 8-2

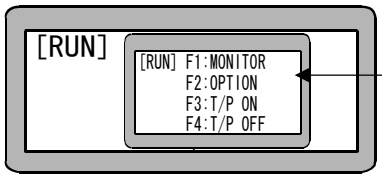
Discontinue

■ 11.7 CC-Link status



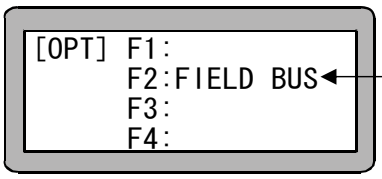
STEP 1

Activate the RUN mode, and press the HELP key.
The screen on the left will appear.
Press the F4 key.



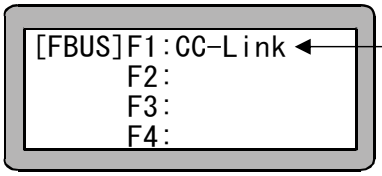
STEP 2

Press the F2 key.



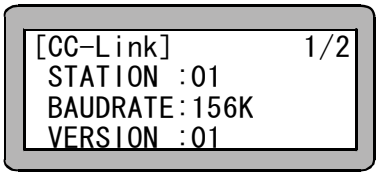
STEP 3

Press the F2 key.
To return to STEP2, press the ESC key.



STEP 4

Press the F1 key.
To return to STEP3, press the ESC key.

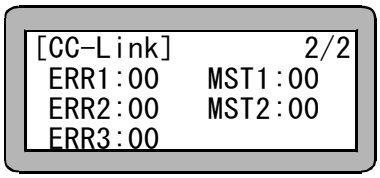


STEP 5

To display the STEP6 screen, press the NEXT key.
To return to STEP4, press the ESC key.

- If the CC-Link module is not connected, a hyphen (-) is displayed instead of the setting value.
- "STATION" indicates the currently set CC-Link station number.
- "BAUDRATE" indicates the currently set communication speed.
- "VERSION" indicates the version number of the LSI mounted on the CC-Link board.

Discontinue



STEP 6

To display the STEP5 screen, press the NEXT key.

To return to STEP4, press the ESC key.

- If the CC-Link module is not connected, a hyphen (-) is displayed instead of the numeric value.

- ERR1: Error information 1

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
0	0	0	0	0	0	0	STERR

STERR: Station number setting error 0: Normal 1: Error
(Zero, 62, or a greater value is set as a station number.)

- ERR2: Error information 2 (transmission status)

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
0	0	0	0	0	ERR22	ERR21	ERR20

ERR20: CRC error 0: Normal 1: Error
ERR21: Time-out error 0: Normal 1: Error
ERR22: Channel-0 carrier detection status 0: Normal 1: CRC Error

- ERR3: Error information 3 (number of received-data items)

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
0	0	0	0	0	ERR32	ERR31	ERR30

ERR30: RY or RWw data count error
0: Normal
1: Less than the local station data count

ERR31: RY data count error
0: Normal
1: Less than the local station data count

ERR32: RWw data count error
0: Normal
1: Less than the local station data count

- MST1: Status information 1

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
MST17	MST16	MST15	MST14	MST13	MST12	MST11	MST10

MST10: Sequencer CPU 0: STOP 1: RUN
MST11: Sequencer CPU 0: Normal 1: Abnormal
MST12: Refresh 0: Stop 1: Start
MST13: Transient 0: No 1: Yes
MST14: Transient receiving 0: Permitted 1: Not permitted
MST15: Transfer 0: Permitted 1: Not permitted
MST16: Transfer to the master station 0: No 1: Yes
MST17: Master station 0: Current master station
1: Standby master station

Discontinue

● MST2: Status information 2

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
MST27	MST26	MST25	MST24	MST23	MST22	MST21	MST20

MST23	MST22	MST21	MST20	RY data transmission points
0	0	0	0	0 points
0	0	0	1	256 points (32 bytes)
0	0	1	0	512 points (64 bytes)
0	0	1	1	768 points (96 bytes)
0	1	0	0	1024 points (128 bytes)
0	1	0	1	1280 points (160 bytes)
0	1	1	0	1536 points (192 bytes)
0	1	1	1	1792 points (224 bytes)
1	0	0	0	2048 points (256 bytes)

MST27	MST26	MST25	MST24	RWw data transmission points
0	0	0	0	0 points
0	0	0	1	32 points (64 bytes)
0	0	1	0	64 points (128 bytes)
0	0	1	1	96 points (192 bytes)
0	1	0	0	128 points (256 bytes)
0	1	0	1	160 points (320 bytes)
0	1	1	0	192 points (384 bytes)
0	1	1	1	224 points (448 bytes)
1	0	0	0	256 points (512 bytes)

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Discontinue

Chapter 12 DeviceNet

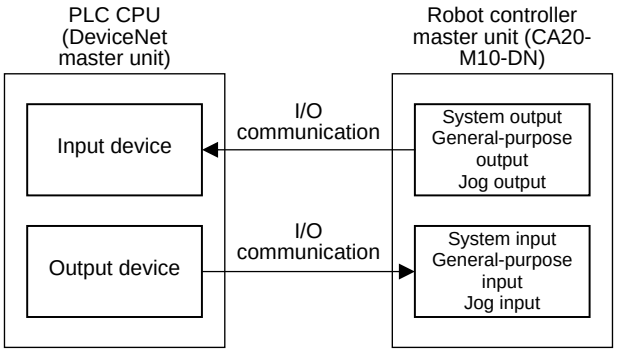
■ 12.1 DeviceNet Function

This controller enables adding of a DeviceNet function by a DeviceNet module. This chapter describes the DeviceNet interface.

DeviceNet is a field network interface that features a minimized wiring design in a low-cost structure and high-speed data communication. The DeviceNet interface allows data communication for various input/output and jog operation.

■ 12.1.1 Overview

This controller can be handled as a DeviceNet slave station for enabling I/O data communication. For details of the DeviceNet system specifications and various limitations, refer to the document published by ODVA (Open DeviceNet Vendor Association, Inc.) or the document supplied with the master station unit of the DeviceNet system.



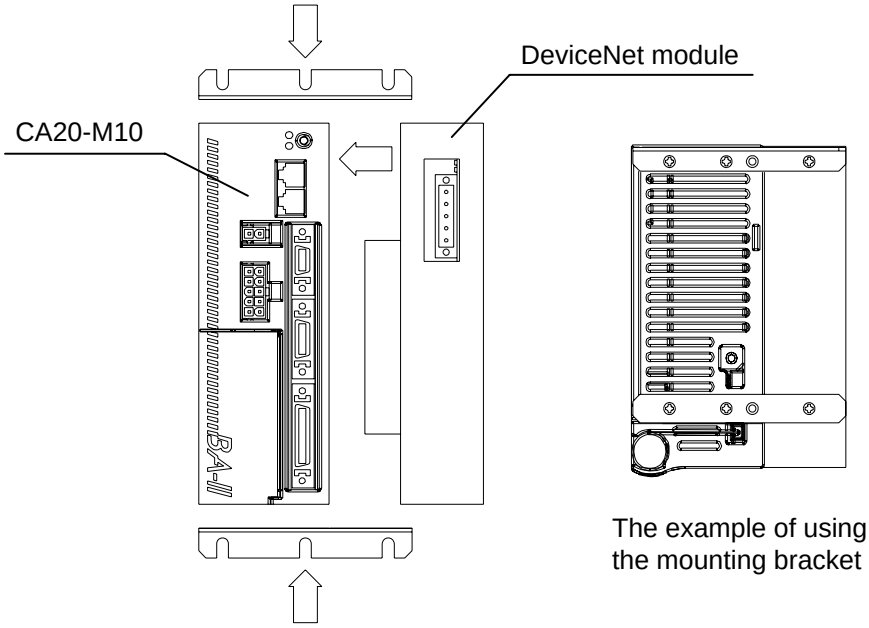
■ 12.1.2 DeviceNet specifications

Item	Specification		
Communication protocol	Compliant with DeviceNet		
Support connection	I/O connection (polling)		
Communication speed	125k / 250k / 500kbps (Set by parameter)		
Station number setting	0 – 63 (Set by parameter)		
Cable lengths	Baud rate	Thick cable	Thin cable
	125k	500m	100m
	250k	250m	
	500k	100m	
Number of occupied points	Send: 128 points	Receive: 128 points	
Number of input/output points	System input: 4 points, System output: 4 points		
	General-purpose input: 64 points, General-purpose output: 64 points		
	Jog input: 8 points, Jog output: 8 points		
Device type	0 (Generic Device)		
Product code	4 (KCA-20-M10-DN)		

*1: The input and output are based on the direction viewed from the robot controller.

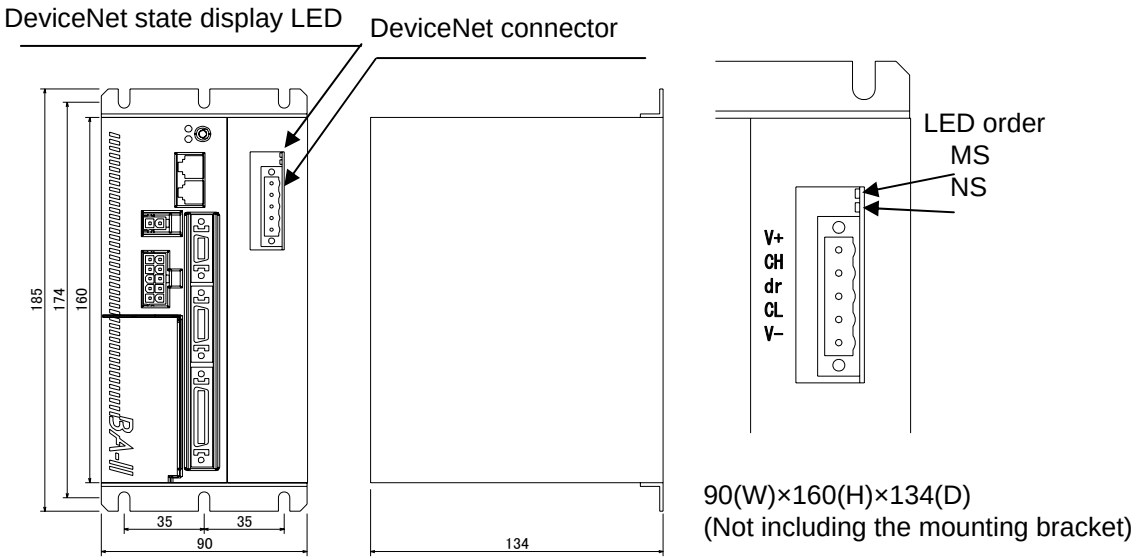
Discontinue

■ 12.1.3 How to attach the DeviceNet module



The example of using
the mounting bracket

■ 12.1.4 Explanation of DeviceNet component and external dimensions



90(W)×160(H)×134(D)
(Not including the mounting bracket)

Discontinue

① DeviceNet status display LED

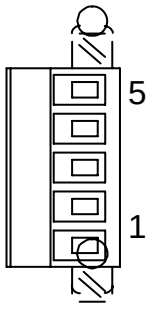
Name	Color	On/Off		Cause/Remedy
MS	Green	● On	Normal	Normal status
		★ Flashing	Unset status	An error has occurred in the setting value in the KCA-20-M10. Check the settings and restart. This can also indicate standby status. Check if the master unit has started normally.
	Red	● On	Critical fault	A hardware error has occurred (such as DPRAM, internal ROM, internal RAM, EEPROM, CAN error, or WDT error). Restart. If the error occurs again, replace the unit.
		★ Flashing	Minor fault	An error has occurred in the user settings, and a user-side interrupt timeout has occurred. Re-check the settings, and restart.
	Green/ Red	○ Off	No power supply	The power is not supplied, or initialization is in progress. Check the power supply.
NS	Green	● On	Normal	One or more connections are established (running) in online status.
		★ Flashing	Connection wait	The master unit is not starting normally. (A configuration area has occurred in the master unit I/O area.) Check if the master unit has started normally.
	Red	● On	Critical communication error	A communication error has occurred (such as a duplicate node address, busoff detection, mismatched baud rate, etc.) Check the connection, noise, node address settings, baud rate settings, and other parameters, and then restart.
		★ Flashing	Minor communication error	Communication with the master unit has timed out. Check the master unit status, connection, noise, node address settings, baud rate settings, and other parameters, and then restart.
	Green/ Red	○ Off	No power supply	Either there is no power supply, or there is a WDT error, baud rate check in progress, or duplicate node address check in progress. Check the power supply.

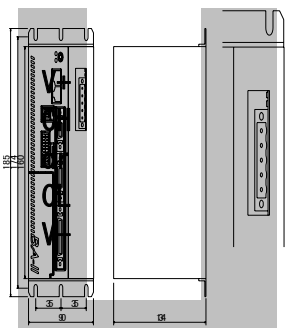
The LED turns on for 0.5 second and turns off for 0.5 second.

② DeviceNet connector

The exclusive DeviceNet cable for data linkage is connected to this connector.

Pin no.	Signal name	Symbol	Wire color
5	V+	V+	Red
4	CANH	CH	White
3	Shield	dr	Shield
2	CANL	CL	Blue
1	V-	V-	Black

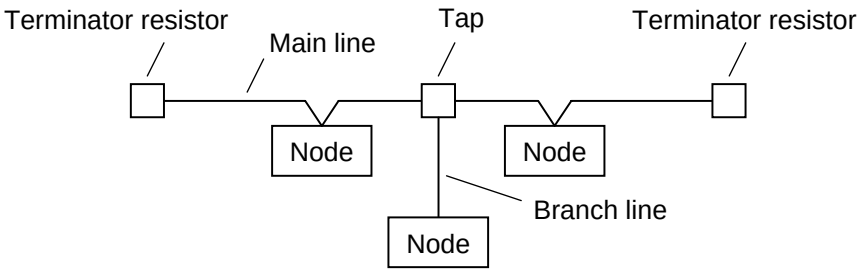




Discontinue

■ 12.1.5 Connection of exclusive DeviceNet cable

The cable connection order is not related to the station number setting (MAC ID).
Be sure to always connect a terminator resistor (121 Ω, 1% metal coating, 1/4 W) at both ends of the main line. Connect the terminator resistor between CANH and CANL.
A terminator resistor is not supplied with this controller.



For details on the cable connections, refer to the master station operating manual or document published by the ODVA.

■ 12.1.6 DeviceNet settings

(1) KCA-20-M10-DN settings
The station number (MAC ID) and baud rate are specified by [PARA] M21 in the mode setting. To enable a modified value, turn the power off and then on again. (Refer to section 13.2.21.)

(2) DeviceNet master station settings
Make the DeviceNet master station settings by following the master station operating manual.

Discontinue

■ 12.2 Connection with External Devices

■ 12.2.1 List of master unit I/O signals

Signal direction: DeviceNet master station ← KCA−20–M10-DN		Signal direction: DeviceNet master station → KCA−20–M10-DN (*1)	
Input Device No. (Offset*2)	Signal name	Output Device No. (Offset*2)	Signal name
+0	Running" output	+0	Return to origin input
+1	Error output	+1	Start input
+2	Positioning finish output	+2	Stop input
+3	Return to origin finish output	+3	Reset input
+4～+7	Use prohibited	+4～+7	Use prohibited
+8～+15	General output port 1–1 ~ 8	+8～+15	General input port 1–1 ~ 8
+16～+23	General output port 2–1 ~ 8	+16～+23	General input port 2–1 ~ 8
+24～+31	General output port 3–1 ~ 8	+24～+31	General input port 3–1 ~ 8
+32～+39	General output port 4–1 ~ 8	+32～+39	General input port 4–1 ~ 8
+40～+47	General output port 5–1 ~ 8	+40～+47	General input port 5–1 ~ 8
+48～+55	General output port 6–1 ~ 8	+48～+55	General input port 6–1 ~ 8
+56～+63	General output port 7–1 ~ 8	+56～+63	General input port 7–1 ~ 8
+64～+71	General output port 8–1 ~ 8	+64～+71	General input port 8–1 ~ 8
+72～+79	Jog output (*3)	+72～+79	Jog input (*3)
+80～+127	Reserved (*4)	+80～+127	Reserved (*4)

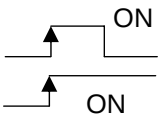


- *1: If DeviceNet communication is cut off, the stop input is set to 1, and all others are cleared to 0. However, during T/P operation, the stop input is also cleared to 0.
- *2: Offset amount from the start device (unit: bits)
- *3: Refer to section 12.2.2 and 12.2.4.
- *4: Area reserved for future function expansion (Fix at 0.)

Discontinue

■ 12.2.2 System I/O

(1) System input (DeviceNet master station → KCA−20–M10-DN)

Signal name	Remote device (*1)	Normal mode	External point designation mode	Remarks
Return to origin	+0	ON: Start of return to origin operation.	Return to origin	Detection of leading edge 
Start	+1	ON: Restart from currently stopped step or from feed hold state.	ON: Starts moving based on currently specified table information.	
Stop	+2	ON: Stops after current step has been executed.	Invalid	When this input is ON, return to origin and start input are invalid.
Reset	+3	ON: Cancels an error status. (Valid while program execution is stopped.)	ON: Cancels an error status.	
Jog input	+72 ~ +79	A selected axis is moved by jogging after the motion mode (jog, low-speed or high-speed) and travel direction are specified.		Section 12.2.4

*1) Offset amount from the start device (unit: bits)

(2) System output (KCA−20–M10-DN → DeviceNet master station)

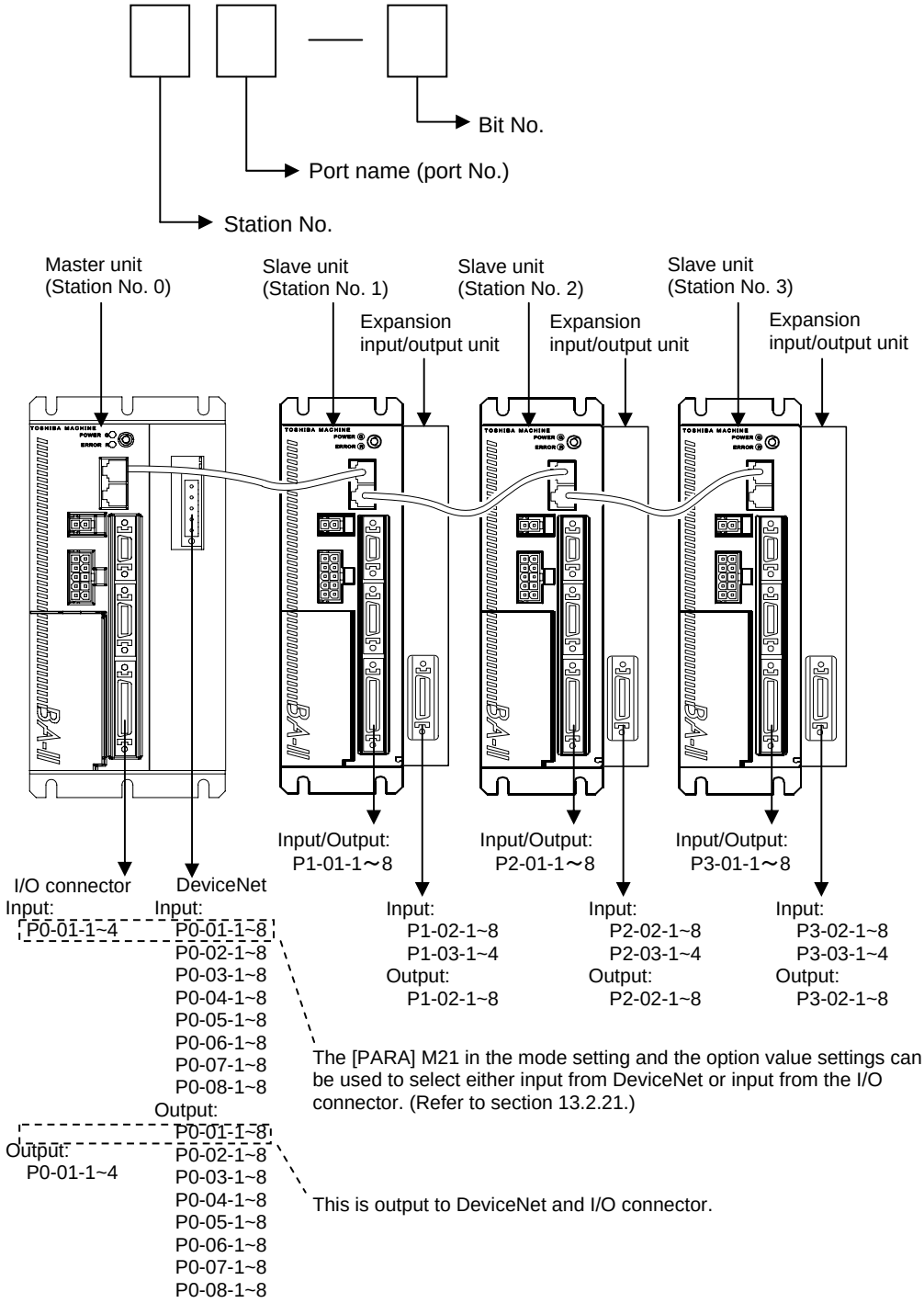
Signal name	Remote device (*1)	Normal mode	External point designation mode	Ref.
Running	+0	ON during controller operation and during return to origin.	ON during robot operation.	Section 10.2.11
Error	+1	ON at error generation.	Same as left	Section 10.2.12
Positioning finish	+2	ON when the robot has been located at a predetermined position. OFF while the robot is moving. (Remains OFF when it is paused.)	Same as left	Section 10.2.13
Return to origin finish	+3	ON when return to origin is completed.	Same as left	Section 10.2.14
Jog output	+72 ~ +79	Acceptance or rejection of jog, active status, etc. are displayed.		Section 12.2.4

*1) Offset amount from the start device (unit: bits)

Discontinue

■ 12.2.3 Name of general-purpose I/O port and teach pendant display

In the controller's system configuration, there are master unit, slave unit and expansion input/output unit input/output ports. The No. of points will change according to the use of options. These input/output ports are displayed on the Teach Pendant as shown below.



- For details on the port numbers and support for input devices and output devices, refer to section 12.2.1.

Discontinue

■ 12.2.4 Jog input/output

(1) List of jog input/output signals

Signal direction: DeviceNet master station ← KCA−20–M10–DN		Signal direction: DeviceNet master station → KCA−20–M10–DN	
Input Device No. (Offset *1)	Signal name	Output Device No. (Offset *1)	Signal name
+72	Axis 1 "jogging" output	+72	Axis 1 "request jog" input
+73	Axis 2 "jogging" output	+73	Axis 2 "request jog" input
+74	Axis 3 "jogging" output	+74	Axis 3 "request jog" input
+75	Axis 4 "jogging" output	+75	Axis 4 "request jog" input
+76	Jog-ready output	+76	"Request inching" input
+77	Unused	+77	"Request low-speed jog" input
+78	Unused	+78	"Request high-speed jog" input
+79	Unused	+79	"Designate jog direction" input OFF: + direction ON: – direction

*1: Offset amount from the start device (unit: bits)

- When the jog conditions (inching request, low-speed jog request, high-speed jog request) and jog direction are specified, and the jog request is ON, the corresponding axis performs the jog operation. (Refer to Fig. 12.2.4-1.)
- Jogging by I/O signal is not accepted as long as the jog ready output signal is OFF. The jog ready output signal is OFF under the following conditions.
  - While the robot is controlled through the teach pendant (T/P).
    → While the T/P is connected and turned on.
  - While the robot is controlled by the personal computer software.
    → While the execution screen of the personal computer software is opened.
  - While the "running" output is ON.
  - While the error output is ON.
- When the multiple bits for the "request inching" input, "request low-speed jog" input and "request high-speed jog" input are ON, the motions are executed according to the following order.
  Inching > Low-speed jog > High-speed jog
- It is not possible to simultaneously move two (2) or more axes at jogging. Move each axis separately.
- The axis stops if the communication through the DeviceNet has been severed during jogging.

Discontinue

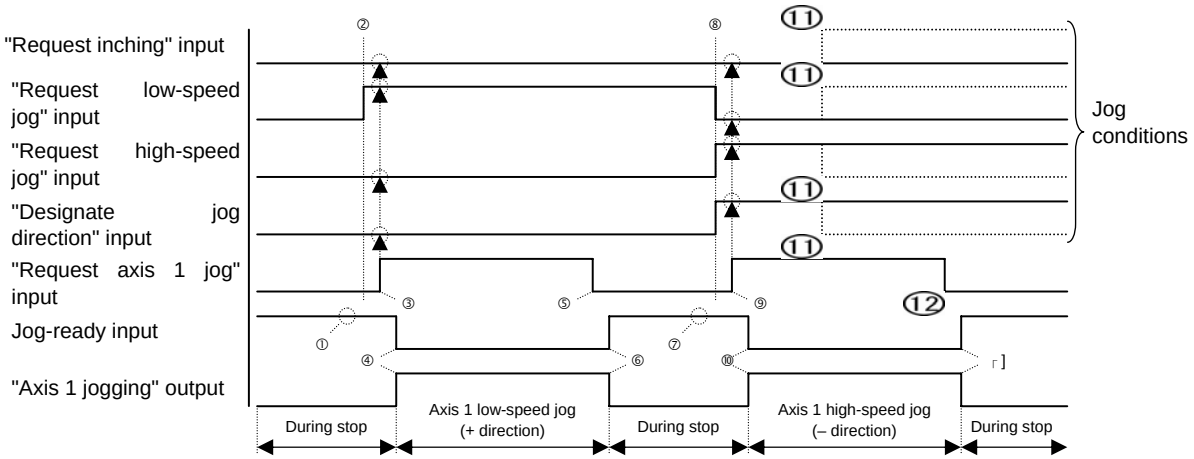


Fig. 12.2.4–1 Example of First axis moving

① Make sure that the jog-ready signal is ON.
② Set the jog conditions. (In the above figure, low-speed jog and plus "+" direction are specified.)
③ Turn on the "request axis 1 jog" input. (With this timing, the jog conditions are input.)
④ The jog-ready output turns off and the "axis 1 jogging" output turns on. Then the axis 1 starts jogging at low speed in the plus "+" direction.
⑤ To stop the axis, turn off the "request axis 1 jog" input signal.
⑥ The jog-ready output turns on and the "axis 1 jogging" output turns off. Then the axis 1 jogging at low speed in the plus "+" direction stops.
⑦ Make sure that the jog-ready signal is ON.
⑧ Set the jog conditions. (In the above figure, high-speed jog and "–" direction are specified.)
⑨ Turn on the "request axis 1 jog" input. (With this timing, the jog conditions are input.)
⑩ The jog-ready output turns off and the "axis 1 jogging" output turns on. Then the axis 1 starts jogging at high speed in the minus "–" direction.
⑪ Even if the jog conditions have been changed during travel, they are neglected.
⑫ To stop the axis, turn off the "request axis 1 jog" input signal.
⑬ The jog-ready output turns on and the "axis 1 jogging" output turns off. Then the axis 1 jogging at high speed in the minus "–" direction stops.

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Discontinue

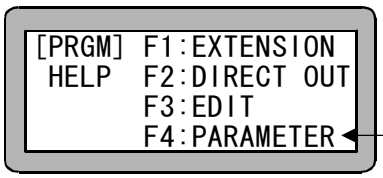
Chapter 13 Parameter Setting

Various parameters can be set in the PRGM modes other than the palletizing mode. The parameters can be divided into the following four kinds.

- ---------- Mode setting Designation of the bits for system input, and setting of the easy mode, external point designation mode and pulse train input mode, etc., can be carried out.
- ---------- Parameter 1 Parameters whose settings will be changed frequently
- ---------- Parameter 2 Parameters whose settings will be changed frequently
- ---------- Table Tables of various points, speed and acceleration

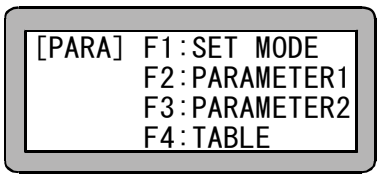
■ 13.1 How to enter and leave the PARA mode

Press HELP in program mode. The following display appears. (Refer to section 4.1.1.)



STEP 1

When this display appears, press F4 to go to PARA mode instruction.
Press ESC to return to the program mode screen.



STEP 2

Press F1 to enable mode setting.
Press F2 to set parameter 1.
Press F3 to parameter 2.
Press F4 to enable table setting mode.
Press ESC to return to the program mode screen.

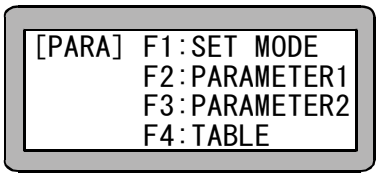
Discontinue

■ 13.2 Method of mode setting

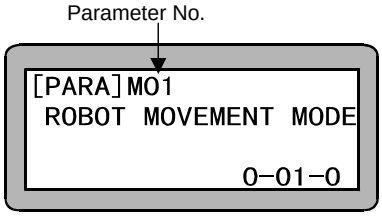
The mode should be set for the following items.
The power must be turned off and then on again after changing the value of 21. Setting of DeviceNet. The power does not have to be turned off for other items.

1. Single operation mode input bit designation
2. Continuous start input bit designation
3. Escape input bit designation
4. Pause input bit designation
5. Program selection input bit designation
6. Return to origin input bit designation
7. Pausing output bit designation
8. Input wait output bit designation
9. Teach Pendant display language Japanese/English
10. OFF (Invalid), easy, point, pulse 1, pulse 2
11. Clear at general-purpose output reset Valid/Invalid
12. Status setting when continuous start is ON Hold/Clear
13. Status setting when continuous start is OFF Hold/Clear
14. Direct output designation
15. READY output bit designation
16. Palletizing input bit designation
17. Expansion I/O during point designation Valid/Invalid
18. Task positioning output designation
19. Task return to origin output designation
20. Setting of CC-Link
21. Setting of DeviceNet ---------- The power must be turned off and then on again
22. Designation of battery alarm output bit
23. Moving coordinate table number output in external point designation mode

Enter the PARA mode to set the mode. (Refer to section 13.1.)



STEP 1 When this display appears, press F1 .



STEP 2 Press NEXT or -NEXT to move to the M01 to M23 mode setting screens.

● Search function

When SEARCH is pressed and the parameter No. 1 to 23 is input, the mode setting screen can be searched.

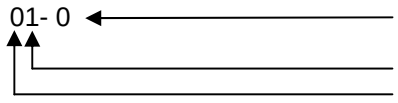
Discontinue

● Jump function

When [F1] is pressed in M01 to M09, M10 appears, when [F1] is pressed in M10 to M19, M20 appears and when [F1] is pressed in M20 to M23, M01 appears.

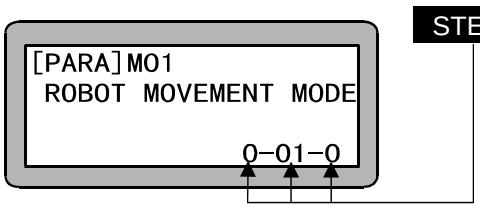
● Bit designation screen

When designating a bit, 01-0 will display on the lower right of the screen. The meanings of the numbers are as follow.



Refer to section 10.1.4 for the names of the ports.

■ 13.2.1 Designation of single operation mode input bit

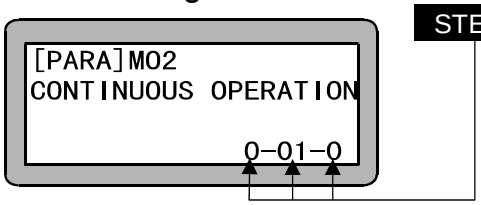


STEP 1

Use the numeric keypad to designate the input bit and press [ENT] . When [NEXT] is pressed, the next screen will display. Press [ESC] to return to the PARA mode screen.

When the single operation mode input bit is designated and operation is started with the designated bit turned ON, the robot single operation mode will be entered. (Refer to section 10.2.5.)

■ 13.2.2 Designation of continuous start input bit

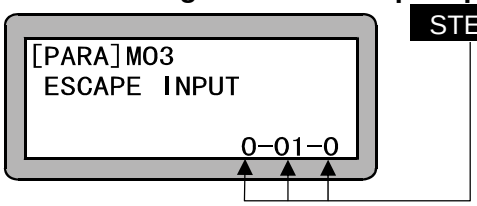


STEP 1

Use the numeric keypad to designate the input bit and press [ENT] . When [NEXT] is pressed, the next screen will display, and when [-NEXT] is pressed, the previous screen will display. Press [ESC] to return to the PARA mode screen.

When the continuous start input bit is designated and reset is input or the power is turned ON, the values (step No., counter value, etc.) in the controller's memory will be held according to the mode settings M12 and M13. (Refer to sections 10.2.6, 13.2.12 and 13.2.13.)

■ 13.2.3 Designation of escape input bit



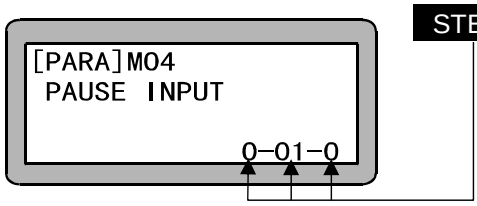
STEP 1

Use the numeric keypad to designate the input bit and press [ENT] . When [NEXT] is pressed, the next screen will display, and when [-NEXT] is pressed, the previous screen will display. Press [ESC] to return to the PARA mode screen.

If the escape input bit is designated and the MVE command is executed, the axis will decelerate and stop when the designated bit turns ON. It will be interpreted that the step has ended, and the next step will be executed. (Refer to section 10.2.7.)

Discontinue

■ 13.2.4 Designation of pause input bit

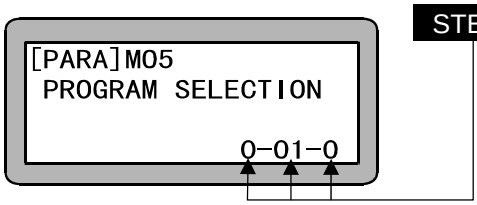


STEP 1

Use the numeric keypad to designate the input bit and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

If pause input bit is designated, the axis will decelerate and stop when the designated bit turns ON.

■ 13.2.5 Designation of program selection input bit



STEP 1

Use the numeric keypad to designate the input bit and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

- When the program selection input bit is designated and the PSEL command is executed, the program will be executed from the tag No. designated with the designated bit (continuous 3 bits). (Refer to section 10.2.9.)
  In the easy or palletizing mode, the program No. designated with the designated bit will be executed.
- Continuous 3 bits
  The bit designated with this mode setting is a 2^0 bit. The 3 bits following the designated bit will be the program selection input.

<Example> When 01-1 is set
When 01-1 is designated, the setting will be as follows.
Port 01-1 → Program selection input 2^0
Port 01-2 → Program selection input 2^1
Port 01-3 → Program selection input 2^2
} The program selection number will be 8.

NOTE

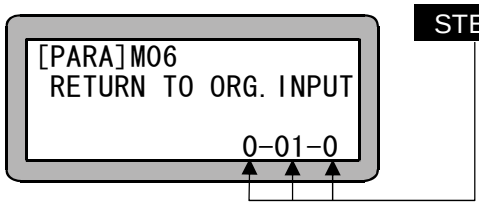
- The continuous 3 bits cannot be set to bridge over ports.

<Example> When 01-3 is set.
When port 01-3 is set, since port 01 is bit 1 to 4, the setting will be as follows.
Port 01-3 → Program selection input 2^0
Port 01-4 → Program selection input 2^1
} The program selection number will be 4.

- This setting is also used as the point table designation input 2^0 to 2^2 or 2^3 during the external point designation mode. (Refer to section 8.1.)
- If the pause input is not being used during the external point designation mode, set 01-1, and when using the pause input, set 01-2.

Discontinue

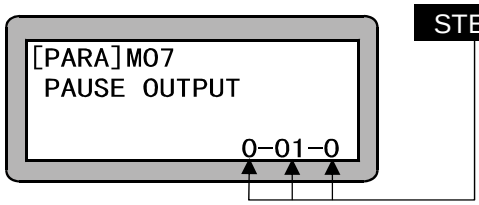
■ 13.2.6 Designation of return to origin input bit



Use the numeric keypad to designate the input bit and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

- The initial value (port 01-5) of the return to origin input is decided, but it can be changed with this bit designation.
- When CC-link is used, this parameter is not available.

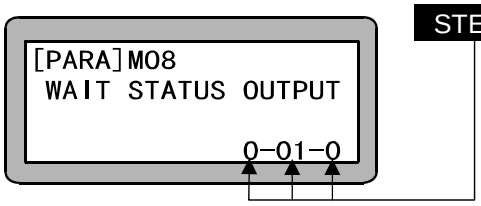
■ 13.2.7 Designation of pausing output bit



Use the numeric keypad to designate the output bit and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

When the pausing output bit is designated, the designated bit will turn ON while operation is paused (temporarily stopped). (Refer to section 10.2.16.)

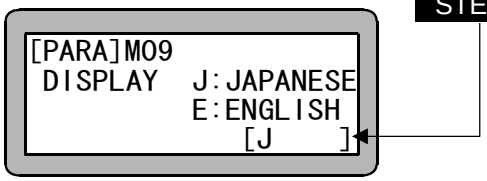
■ 13.2.8 Designation of input wait output bit



Use the numeric keypad to designate the output bit and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

When the input wait output bit is designated, the designated bit will remain ON while the program is waiting for the input of the IN command. (Refer to section 10.2.15.)

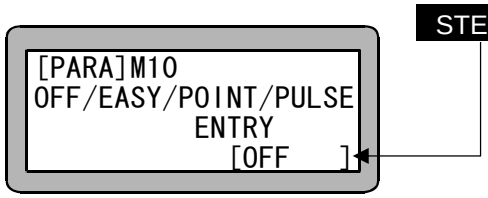
■ 13.2.9 Setting of Teach Pendant display (Japanese/English) mode



Switch between Japanese/English by pressing ALT and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.
J: Japanese E: English

The display here refers to the display of the Teach Pendant screens.

■ 13.2.10 OFF (Invalid), easy, point, pulse 1, pulse 2



STEP 1

Select the operation mode with the ALT . When the required mode is displayed, press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

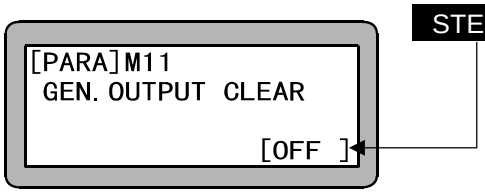
- When ALT is pressed, the mode will display in order as shown below.



- The relation of the display and mode is as follows.

OFF (Invalid)	Sequential mode or palletizing mode	Refer to Chapters 4 and 7
EASY	Easy mode	Refer to Chapter 6
POINT	External point designation mode	Refer to Chapter 8
PULSE1	Pulse train input mode (1-clock operation)	Refer to Chapter 9
PULSE2	Pulse train input mode (2-clock operation)	Refer to Chapter 9

■ 13.2.11 Setting of general-purpose output clear mode during emergency stop and reset



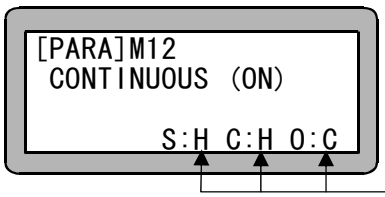
STEP 1

Switch between Invalid/Valid with ALT and then press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

- When this mode setting is validated, all general-purpose outputs will be turned OFF during emergency stop or reset.
- When continuous start input is set, the continuous start setting will have a priority.

Discontinue

■ 13.2.12 Setting of state when continuous start is valid (Input ON)

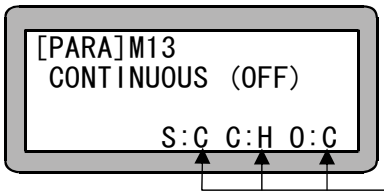


STEP 1

Switch between Hold (H) and Clear (C) with ALT and then press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

- The continuous start input bit is designated, and whether to hold or clear the step No., counter and general-purpose outputs when reset is input while the designated bit is ON is designated. (Refer to section 10.2.6.)
- The meanings of the characters on the screen are as follows.
  Item S: Step No. C: Counter O: General-purpose output
- The above screen is the initial setting screen. Use this for the initial settings.

■ 13.2.13 Setting of state when continuous start is valid (Input OFF)

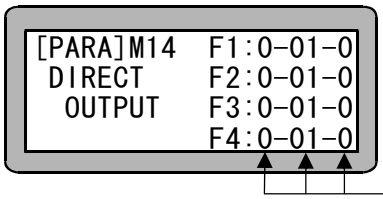


STEP 1

Switch between Hold (H) and Clear (C) with ALT and then press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

- The continuous start input bit is designated, and whether to hold or clear the step No., counter and general-purpose outputs when reset is input while the designated bit is OFF is designated. (Refer to section 10.2.6.)
- The meanings of the characters on the screen are as follows.
  Item S: Step No. C: Counter O: General-purpose output
- The above screen is the initial setting screen. Use this for the initial settings.

■ 13.2.14 Setting of direct output bit



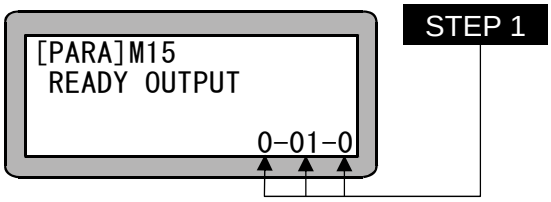
STEP 1

Use the numeric keypad to designate the output bit and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

Direct output means to turn the general-purpose output ON or OFF directly by pressing the function keys (F1 to F4) on the Teach Pendant. (Refer to section 16.1.) The general-purpose output bit assigned to each function key is set here.

Discontinue

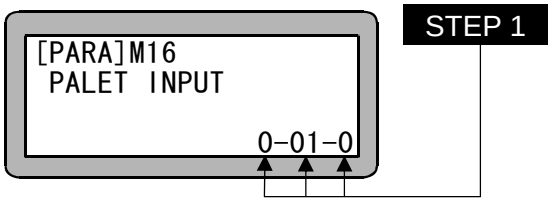
■ 13.2.15 Designation of READY output bit



Use the numeric keypad to designate the output bit and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

When the READY output bit is designated, the designated output bit will turn OFF until the controller is ready for operation after the power is turned ON. The bit will turn ON when the controller is ready for operation. (Refer to section 10.2.17.)

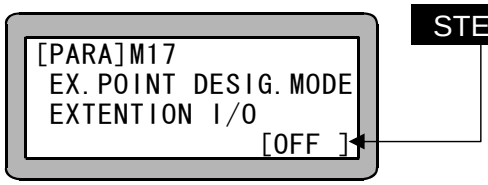
■ 13.2.16 Designation of palletizing input bit



Use the numeric keypad to designate the output bit and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

When the palletizing input bit is designated, the controller will enter the palletizing mode if start is input while the designated bit is ON. If start is input while the bit is OFF, the controller will enter the sequential mode. (Refer to section 10.2.10.)

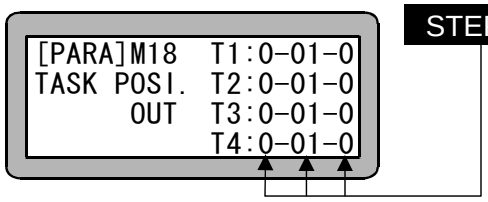
■ 13.2.17 Expansion input/output during external point designation mode Valid/Invalid



Switch between Invalid/Valid with ALT and press ENT . When -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

When using the controller to which the expansion input/output unit (option) is connected with the external point designation mode, if this bit is validated, the expansion input/output input bits will be used as the point table designation bits. (Refer to Chapter 8)
If this bit is validated, the designation of point table input bit (section 13.2.5) becomes invalid. The designation of each data bit is fixed. (Refer to section 8.1)

■ 13.2.18 Setting of task positioning output

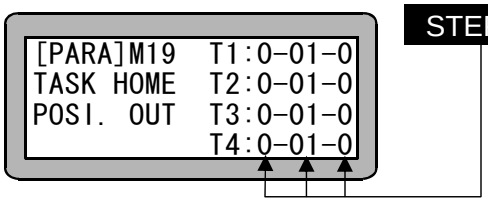


Use the numeric keypad to designate the output bit and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

The positioning completion output explained in section 10.2.13 will turn ON when positioning of all axes is completed. The positioning completed output can be set for each task with this setting.

Discontinue

■ 13.2.19 Setting of task return to origin output

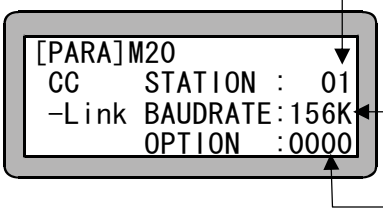


STEP 1

Use the numeric keypad to designate the output bit and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

The return to origin completion output explained in section 10.2.14 will turn ON when all axes have return to the origin. The return to origin completed output can be set for each task with this setting.

■ 13.2.20 Setting of CC-Link



STEP 1

Use the numeric keypad to enter the station number, and press ENT .

STEP 2

Use ALT to select BAUD RATE, and press ENT .

STEP 3

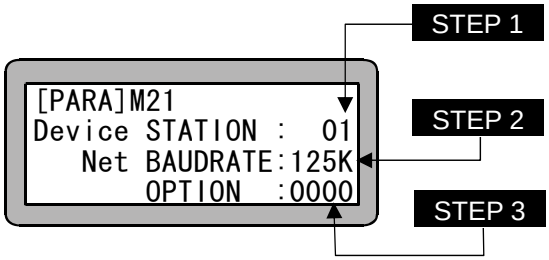
Use the numeric keypad to enter the option flag value, and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

- The STATION option sets the CC-Link unit station number. This controller occupies the four consecutive stations from the station number that was set. Therefore, the valid range of setting values is 1 to 61. The setting is invalid if the 0 station or 62 station or higher is set.
  (Initial value: 0, Setting range: 0 to 99)
- The BAUD RATE option sets the CC-Link transmission speed. The settable transmission speed varies depending on the total cable length, CC-Link version, and cable types.
  (Initial value: 156K, Selection range: 156K, 625K, 2.5M, 5M, 10M)
- When the thousands place of the option value is set to "0", all system input and general-purpose input from CC-Link is enabled.
  When "1" is set, system input and general-purpose input (ports 1 to 3) of the master unit is enabled from the input/output connectors.
  (Initial value: 0000, Setting range: 0000 to 9999) (Refer to section 11.2.3.)
- The functions below are assigned to the ones place of the option value.
  0: Normal
  7: Maximum torque limit function (Refer to section 11.6)
  8: Selection table extension in external point designation mode (Refer to section 11.5)
  9: Speed control mode (Refer to section 11.4)

⚠CAUTION The other functions are assigned to the ones, tens and thousands place of the option value. Change a value after understanding the contents of the applicable function well. When a value is changed carelessly, the robot may move unexpectedly and a machine or a workpiece may be damaged or someone may be injured.

Discontinue

■ 13.2.21 Setting of DeviceNet



STEP 1 Use the numeric keypad to enter the station number, and press ENT .

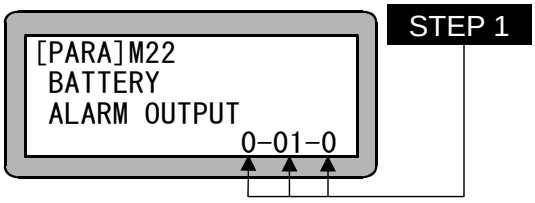
STEP 2 Use ALT to select BAUD RATE, and press ENT .

STEP 3 Use the numeric keypad to enter the option flag value, and press ENT .

When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

- ●The power must be turned off and then on again after changing the value of this parameter.
- ●The STATION option sets the DeviceNet unit station number.
  (Initial value: 0, Setting range: 0 to 99)
- ●The BAUD RATE option sets the DeviceNet transmission speed. The settable transmission speed varies depending on the total cable length and cable types.
  (Initial value: 125K, Selection range: 125K, 250K, 500K)
- ●When the thousands place of the option value is set to "0", all system input and general-purpose input from DeviceNet is enabled.
  When "1" is set, system input and general-purpose input (ports 1 to 3) of the master unit is enabled from the input/output connectors.
  (Initial value: 0000, Setting range: 0000 to 9999)

■ 13.2.22 Designation of battery alarm output bit

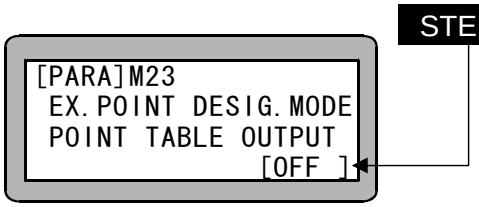


STEP 1 Use the numeric keypad to designate the output bit and press ENT .

When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode screen.

When the battery voltage drops, the bit designated for battery alarm output is set to ON. (Refer to section 10.2.20.)

■ 13.2.23 Moving coordinate table number output in external point designation mode



STEP 1 This parameter is not available.

Press -NEXT to display the previous screen.

Press ESC to return to the PARA mode screen.

Discontinue

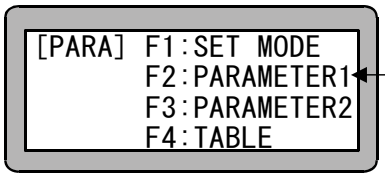
■ 13.3 Parameter 1 setting

Parameters must be set for the following items. For items marked with ◆, the most appropriate parameters are set automatically when the robot type is selected.
Refer to section 2.4.8 for details on selecting the robot type.
During the pulse train input mode, the items marked with ▲ will be effective.

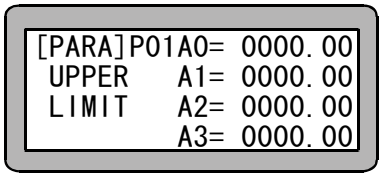
1. Software limit value (upper limit)
2. Software limit value (lower limit)
3. Servo gain (position/speed) ◆ ▲
4. Pass area data value ---------- (Disabled)
5. Origin offset value ◆
6. Sequence of Return to Origin
7. JOG speed
8. JOG inching movement

NOTE Note that the parameter "4. Pass area data value" above cannot be used. Even if it is set, the parameter is ineffective.

Set PARA mode for setting parameter 1. (Refer to 13.1.)



STEP 1 When this display appears, press F 2 .



STEP 2 Use NEXT and -NEXT to move to the P01 to P08 parameter 1 setting screen.

- Search function

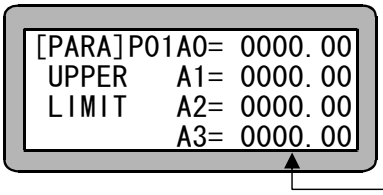
  When SEARCH is pressed and the parameter No. 1 to 8 is input, the parameter 1 setting screen can be searched.

- Jump function

  When F 1 is pressed in P01 to P08, M01 appears.

Discontinue

■ 13.3.1 Setting of software limit value (upper limit)

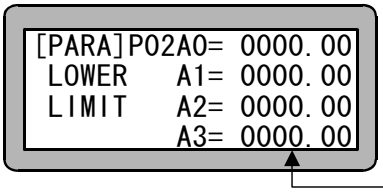


STEP 1

Use the numeric keypad to enter the coordinates and press ENT . When NEXT is pressed, the next screen will display. Press ESC to return to the PARA mode.

The software limit upper value indicates the maximum value [mm] of the robot's movement range.
(Initial value: 0, setting range: -8000 to 8000)

■ 13.3.2 Setting of software limit value (lower limit)

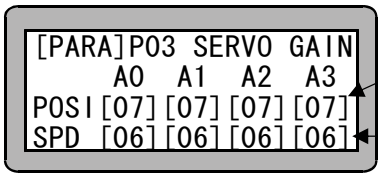


STEP 1

Use the numeric keypad to enter the coordinates and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to return to the PARA mode.

The software limit lower value indicates the minimum value [mm] of the robot's movement range.
(Initial value: 0, setting range: -8000 to 8000)

■ 13.3.3 Setting of servo gain (position/speed)



STEP 1

Use the numeric keypad to enter the servo gain (position) and press ENT .

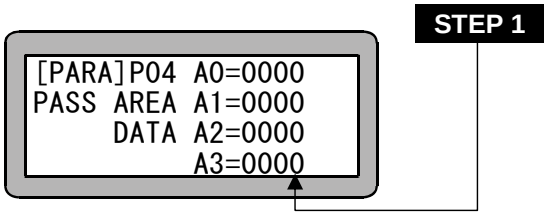
STEP 2

Use the numeric keypad to enter the servo gain (speed) and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display.
Press ESC to return to the PARA mode.

- If the servo system position gain setting value is too small, the positioning time will increase, and if too large, hunting (vibration) will occur. (Setting range: 0 to 98)
- If the servo system speed gain setting value is too small, hunting (vibration) will increase, and if too large, a groaning sound will be heard. (Setting range: 0 to 98)
- 99 is for adjustment by the maker. Do not set the value.
- When the robot type is input, the optimum values for the servo gain (position, speed) are automatically set. However, these should be changed as required. Refer to the BA Instruction Manual (Axis Installation Section) for the setting values.

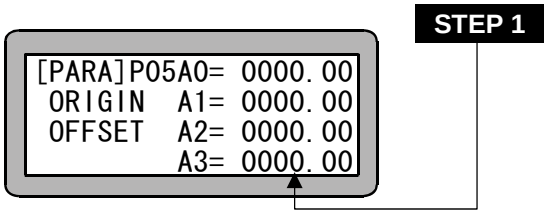
Discontinue

■ 13.3.4 Setting of pass area



This parameter cannot be used, so press NEXT and move to the next screen.
When -NEXT is pressed, the previous screen will display.
Press ESC to return to the PARA mode screen.

■ 13.3.5 Setting of origin offset value

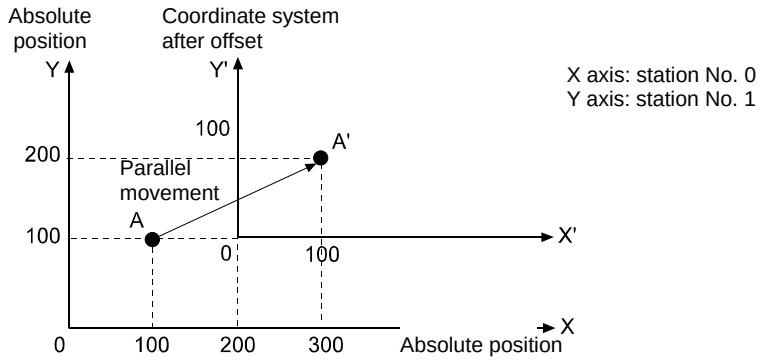


Use the numeric keypad to enter coordinates of the origin offset value and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display.
Press ESC to return to the PARA mode.

- The offset value is the distance [mm] to offset the origin when required. This is used to move all points in the program parallel in respect to the coordinate axis. After changing the origin offset, all points in the program will be moved in parallel by the offset value. The movement coordinates will also be offset when using the sequential, easy, palletizing or external point designation mode.
  (Initial value: 0, setting range: -8000 to 8000)
- If the OFS command is used in the sequential mode, this offset value will be added.

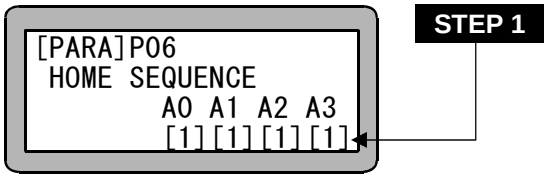
  [General offset value] = [Offset value set in parameter 1] + [Offset value set with OFS command]
- Always return to the origin after changing the origin offset. If the origin is not returned to, the origin offset will not be set.

[Example] When using a two-axis combination and the origin offset values X axis = 200 and Y axis = 100 are validated, the point A (X = 100, Y = 100) in the program will be moved in parallel 200 in the X axis direction and 100 in the Y axis direction. This will change the point A' position to X = 300, Y = 200.



Discontinue

■ 13.3.6 Setting of sequence of return to origin

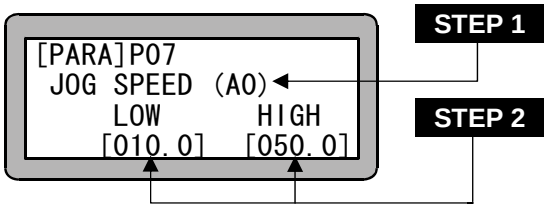


Use the numeric keypad to enter the sequence of return to origin (1 to 4) and press ENT . When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display.
Press ESC to return to the PARA mode.

- The sequence of return to origin is the order that each axis of the robot returns to the origin. For example, if the sequence of return to origin for station No. 0 is set to "1" and the sequence of return to origin for station No. 1 is set to "2", the axis controlled by the station No. 0 unit will return to the origin, and then the axis controlled by the station No. 1 unit will return to the origin. If both are set to "1", both axes will simultaneously return to the origin. (Initial value: 1, setting range: 1 to 4)
- During multitasking, the return to origin order will be effective for each task. For example, if the task and axis combination (refer to section 13.4.15) is [1][1][2][3] and set as A0=1, A1=2, A2=1, A3=1, the A0, A2 and A3 axes will start return to origin simultaneously. The A1 axis will start return to origin after the A0 axis completes return to origin.

Discontinue

■ 13.3.7 Setting of JOG speed

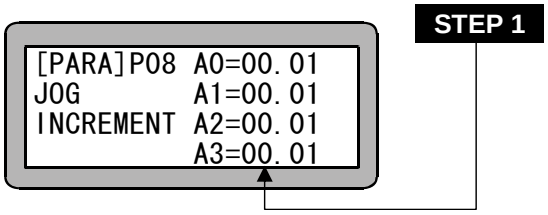


Use the numeric keypad to enter the station No. (0 to 3) and press ENT.

Use the numeric key pad to enter the JOG speed (low speed) and press ENT .
Use the numeric key pad to enter the JOG speed (high speed) and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display.
Press ESC to return to the PARA mode.

- JOG speed refers to the speed [mm/s] for manual operation (JOG operation) using the movement keys (-1 , +1 , -2 , +2). (Refer to section 17.5.)
  (Initial value: L = 10, H = 50, setting range: 0.1 to 999.9)
- When 0.1 to 0.9 is set, JOG speed become to be 1 mm/s.

■ 13.3.8 Setting of JOG inching movement



Use the numeric key pad to enter the JOG inching movement rate and press ENT .
When -NEXT is pressed, the previous screen will display. Press ESC to return to the initial screen.

- The JOG inching movement rate is the movement amount [mm] when the movement keys (-1 , +1 , -2 , +2) are pressed during JOG operation. (Initial value: 0.01, setting range: 0 to 65)
- When a small value is set for the axis whose the sixth column of robot type is 7, it may not move according to the setting value. For example, when 0.01 [mm] is set for JOG inching movement, sensor number of divisions is 2048 [pulse/rev] and 6 [mm] is set for lead, 3.41[pulse] is needed for moving 0.01 [mm] but it moves by 3[pulse] (0.0088[mm]) cutting off decimal point.

Discontinue

■ 13.4 Parameter 2 setting

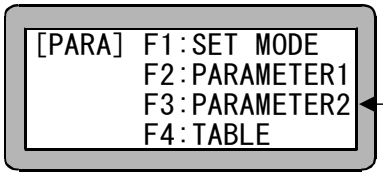
Parameter 2 contains the following items. For the items marked with a ◆, the optimum values are automatically entered when the robot type is entered. Refer to section 2.4.7 on how to enter the robot type.
After setting parameter 2, turn the controller power OFF and ON. As opposed to parameter 1, parameter 2 will not be validated unless the controller power is turned OFF.
During the pulse train input mode, the items marked with ▲ will be effective.

1.	Axis display		
2.	In position data value		▲
3.	Overflow data value	◆	▲
4.	Feed forward data value	◆	▲
5.	Direction of motor revolution	◆	▲
6.	Maximum speed	◆	
7.	Return to origin speed	◆	
8.	Return to origin method	◆	
9.	Origin sensor logic	◆	
10.	High speed return to origin position		
11.	Lead	◆▲	
12.	Encoder No. of divisions	◆	▲
13.	Encoder pulse multiplier	◆	▲
14.	Encoder type	▲	
15.	Task and axis combination		
16.	Task order of priority		
17.	Task point table (Cannot be used with this Electric Actuator. Will be invalid when set.)		
18.	No. of task steps		
19.	BA I/O compatibility mode		

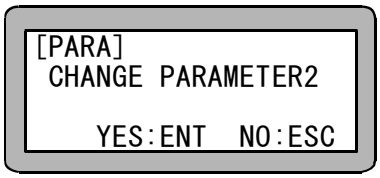
NOTE Some settings in parameter 2 have been created for future axis developments. Be careful not to use inappropriate settings.
Also do not change initial values set when the robot type is entered. If these initial value are changed, malfunctions may occur.

Discontinue

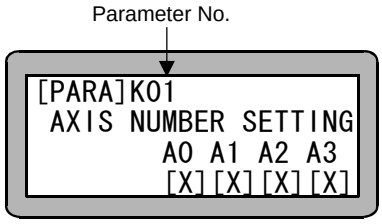
Set PARA mode to input parameter 2. (Refer to section 13.1.)



STEP 1 When this display is shown, press F3 .



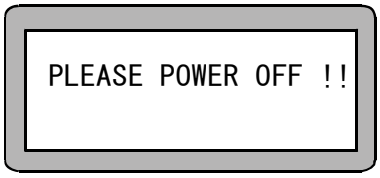
STEP 2 Press ENT to change parameter 2 and go to STEP 3.
Press ESC to ignore changes and return to the previous screen.



STEP 3 Use NEXT and -NEXT to move to the K01 to K19 parameter setting screens from this state. To end the parameter setting, press ESC . Press ESC to move to step 4.

- Search function
  When SEARCH is pressed and the parameter No. 1 to 19 is input, the parameter 2 setting screen can be searched.

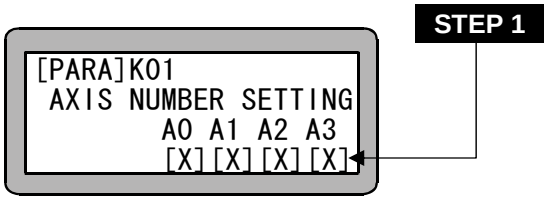
- Jump function
  When F1 is pressed in K01 to K09, K10 appears, when F1 is pressed in K10 to K19, K01 appears.



STEP 4 This is the parameter 2 end screen.
Follow the instructions on the screen, and turn the power OFF. The parameter 2 setting will be validated when the power is turned ON again.

Discontinue

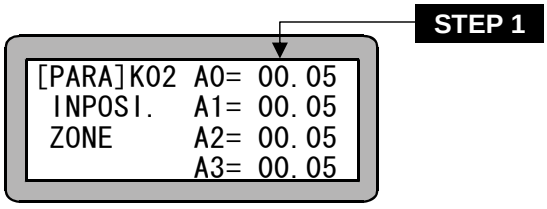
■ 13.4.1 Setting of axis display



Select the axis display (X, Y, Z, R, ?) with ALT and press ENT .
When NEXT is pressed, the next screen will display. Press ESC to display the parameter 2 end screen.

- The axis display refers to the name of the axis connected to each unit when displayed on the Teach Pendant. (Selective display: X, Y, Z, R and ?)
- Even when this item is set, if the task and axis combination (refer to section 13.4.15) is set, the X will be set for the 1st axis and Y will be set for the 2nd axis for each task.

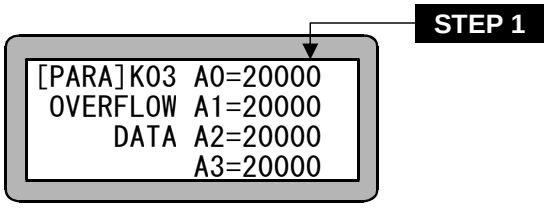
■ 13.4.2 Setting of in-position data value



Use the numeric keypad to enter the in-position data and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- The in-position data is an item used as a judgment standard of the completion of positioning.
  When the logic coordinates reach the target coordinates and the deflection counter (difference of target position and current position) becomes less than this value, it will be judged that positioning has been completed, and the program will move to the next operation (step).
  Even if this value is increased, the positioning will not be completed until the two conditions are established.
  (Initial value: 0.05, setting range: 0.01 to 65.00, unit: mm)

■ 13.4.3 Setting of overflow data value

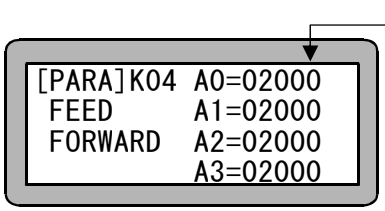


Use the numeric keypad to enter the overflow data and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- When the value of the deflection counter (difference of target position and current position) increases above this value, an overflow error will occur.
  (Initial value: 20000, setting range: 1 to 65535, unit: pulse)
- This value is set automatically when the robot type is entered. Refer to section 2.4.7.

Discontinue

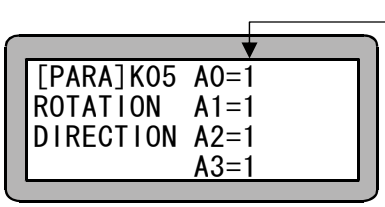
■ 13.4.4 Setting of feed forward data value



Use the numeric keypad to enter the feed forward data and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- This is the feed forward control constant.
  (Initial value: 2000, setting range: 0 to 65535, unit: pulse)
- This value is set automatically when the robot type is entered. Refer to section 2.4.7.

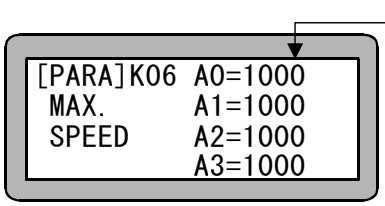
■ 13.4.5 Setting of direction of motor revolution



Use the numeric keypad to enter the direction of motor revolution (0: forward, 1: reverse) and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- Forward (0): Motor rotates in clockwise direction in respect to the positive movement command when the motor output shaft is looked from the load side.
  Reverse (1): Motor rotates in counterclockwise direction in respect to the positive movement command when the motor output shaft is looked from the load side.
- This value is set automatically when the robot type is entered. Refer to section 2.4.7.

■ 13.4.6 Setting of maximum speed

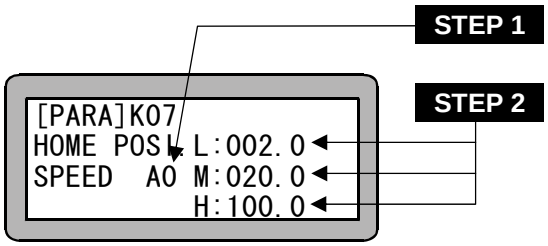


Use the numeric keypad to enter the maximum speed and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- This is the movement speed limit value. This setting will have a priority over all other settings. (setting range: 1.0 to 9999.9, unit: mm/s)
- This value is set automatically when the robot type is entered. Refer to section 2.4.7.

Discontinue

■ 13.4.7 Setting of return to origin speed



Use the numeric keypad to enter the station No. (0 to 3) and press ENT .

Use the numeric keypad to enter the origin speed and press ENT .

When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- Set movement speed L (low speed), M (medium speed) and H (high speed) for returning to the origin.
  (Setting range: L, M = 1 to 250, H = 1 to 999, unit: mm/s)
- This value is set automatically when the robot type is entered. Refer to section 2.4.7.

NOTE

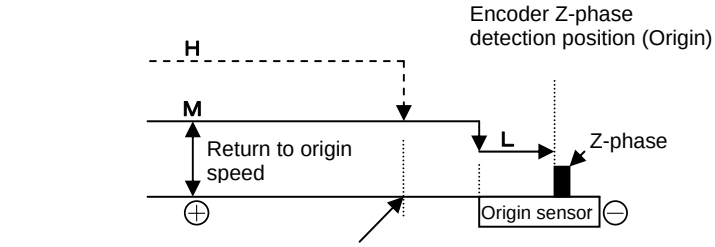
- If movement speed L (low speed) and M (medium speed) are set to more than the initial value, normal return to the origin may not be possible.
- Even if a value after the decimal point is entered, it is assumed to be a numeric value rounded down for operation.

[Explanation of return to origin speed L, M and H]

This Electric Actuator has two methods of returning to the origin. (Refer to section 13.4.8.) Furthermore, there is the initial return to origin after the power is turned ON and the second and following return to origin.

(1) When parameter 2 return to origin method is set to "0" (Refer to section 13.4.8)

●When carrying out initial return to origin



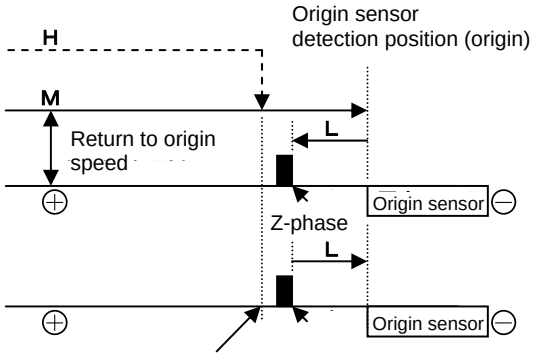
High speed return to origin position set with parameter 2
(Refer to section 13.4.10)

NOTE If the robot is at the origin, it moves outside the origin sensor once and then carries out return to the origin again.

Discontinue

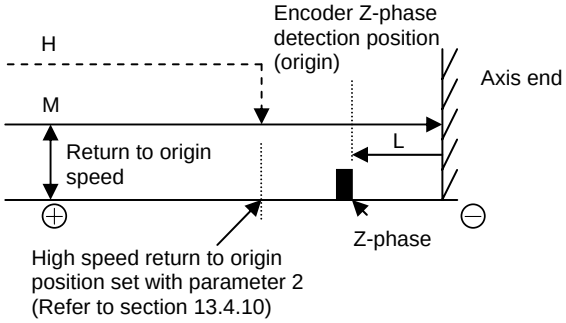
(2) When parameter 2 return to origin method is set to "1" (Refer to section 13.4.8)

● **When carrying out initial return to origin**

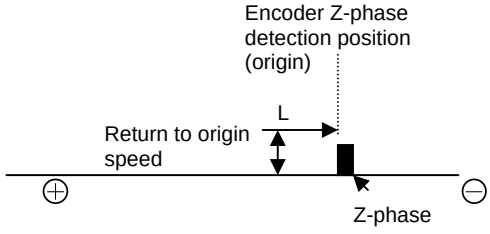


High speed return to origin position set with parameter 2
(Refer to section 13.4.10)

(3) When parameter 2 return to origin method is set to "2" (Refer to section 13.4.8)



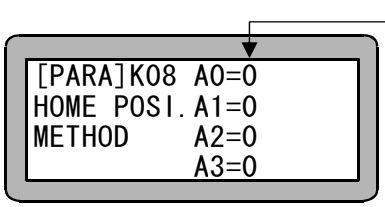
(4) When parameter 2 return to origin method is set to "3" (Refer to section 13.4.8)



NOTE The operation is the same for both initial return to origin after the power is turned ON and the second and following return to origin.

Discontinue

■ 13.4.8 Setting of return to origin method



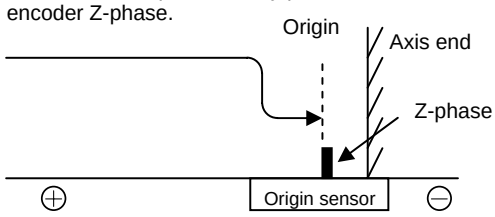
STEP 1

Use the numeric keypad to enter the return to origin method (0 or 1) and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

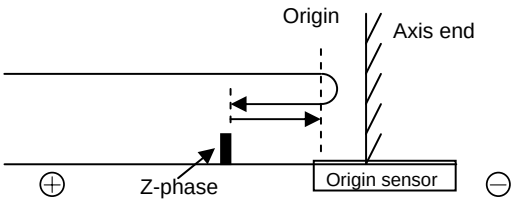
This value is set automatically when the robot type is entered. Refer to section 2.4.7.

NOTE ●When a return to origin method has been set under a condition where an axis type is wrong, this makes this equipment it impossible to return to the origin, or causes a difference in return position, so that the values set when the robot type is entered must not be changed.

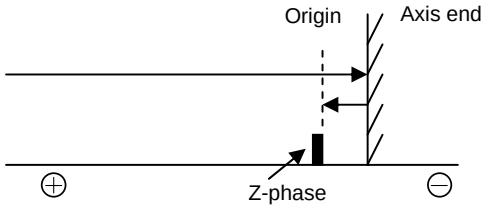
0 ….. After the origin sensor turns ON, the encoder Z-phase is detected at a low speed, and the origin is set.
If the value of the return to origin speed M (medium speed) (refer to section 10.4.7) is increased, the operation may pass over the encoder Z-phase.



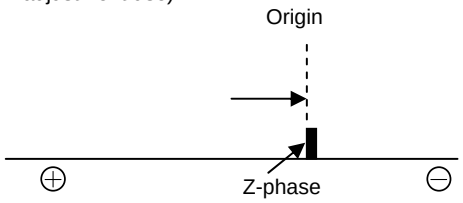
1 ….. After the origin sensor turns ON, the axis moves forward (+ direction) once and stops at the encoder Z-phase, and then searches for the origin sensor again at a low speed. When the origin sensor turns ON, the origin is set.



2 ….. After moving to the axis end, the axis moves forward (+ direction) at a low speed and the encoder Z-phase is detected, then the origin is set.

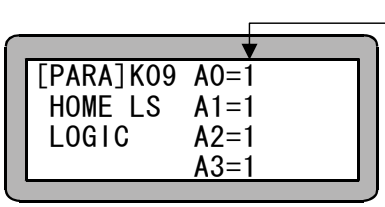


3 ….. The axis moves backward (- direction) at a low speed from the current position and the first encoder Z-phase is detected, then the origin is set. This mode should not be used (for manufacturer adjustment use).



Discontinue

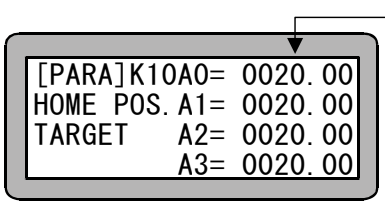
■ 13.4.9 Setting of origin sensor logic



Use the numeric keypad to enter the origin sensor logic (0 or 1) and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- Setting of the origin sensor logic means to select whether the output signal of the sensor assembled in the axis turns OFF or ON when detected.
  (Initial value: 1, selective value: 0 or 1)
  1: OFF when detected 0: ON when detected
- This value is set automatically when the robot type is entered. Refer to section 2.4.7.

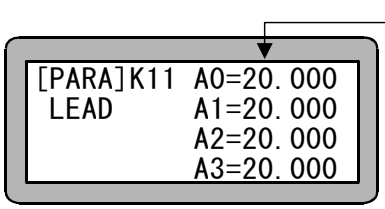
■ 13.4.10 Setting of high speed return to origin position



Use the numeric keypad to enter the high speed return to origin position data and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- The high speed return to origin position refers to the target position when moving at a high speed (return to origin speed H) while executing high speed return to origin. The initial value is 20, and a value less than this must not be set.
  (Initial value: 20.00, setting range: –8000.00 to 8000.00, unit: mm)

■ 13.4.11 Setting of lead

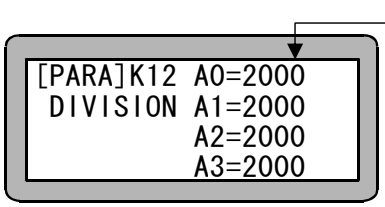


Use the numeric keypad to enter the axis lead and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- The lead is the advance direction per motor revolution.
  (Initial value: 20.00, setting range: 1.000 to 99.999, unit: mm)
- This value is set automatically when the robot type is entered. Refer to section 2.4.7.

Discontinue

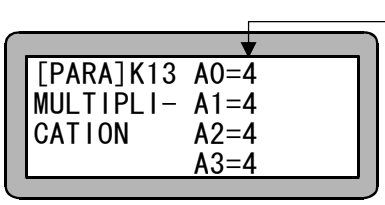
■ 13.4.12 Setting of encoder No. of divisions



Use the numeric keypad to enter the encoder No. of divisions and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- The encoder No. of divisions refers to the No. of pulses per revolution of the encoder installed on the motor.
  (Initial value: 2000, setting range; 1 to 9999, unit: pulse/rev)
- This value is set automatically when the robot type is entered. Refer to section 2.4.7.

■ 13.4.13 Setting of encoder pulse multiplier



Use the numeric keypad to enter the encoder pulse multiplier and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

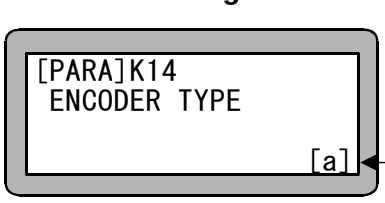
- The multiplier determines at what fold to generate the pulses of the encoder installed on the motor.
  (If a multiplier of 3 is set, the operation will be 2-fold.)
  (Initial value: 4, setting range: 1 to 4)
- This value is set automatically when the robot type is entered. Refer to section 2.4.7.

The lead, No. of divisions and multiplier are parameters used to calculate the pulse rate (distance advanced per pulse). The calculation equation is as shown below.

$$\text{Pulse rate} = \frac{\text{Lead (= slider movement amount per motor revolution)}}{\text{Encoder No. of divisions} \times \text{multiplier}} \text{ (mm/pulse)}$$

Even if the pulse rate value is 0.01 or less, the minimum unit that can be input with the Teach Pendant is 0.01.

■ 13.4.14 Setting of encoder type

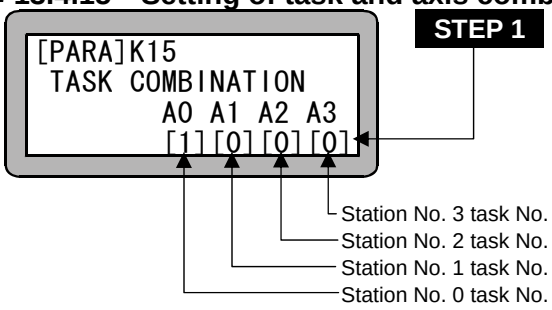


Select the encoder type with ALT and press ENT .
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- The encoder type is the type of encoder installed on the motor. The following types are available.
  a : Absolute encoder
  i : Incremental encoder
  (Initial value: a, selective types: a, i)
- If “i” is set, an absolute encoder is used as an incremental encoder.

Discontinue

■ 13.4.15 Setting of task and axis combination



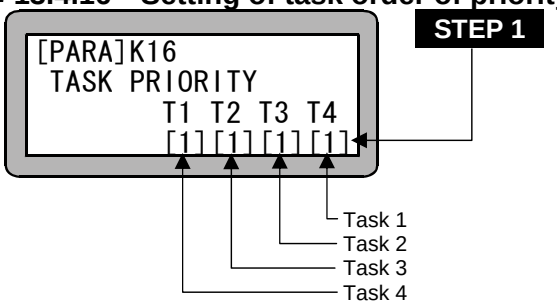
Use the numeric keypad to enter the each station No. task No. and press ENT .
(Setting range: 0 to 4)
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

● Set the task No. as shown below.

	Task 1	Task 2	Task 3	Task 4
[1] [0] [0] [0]	1-axis specifications	No axis	No axis	No axis
[1] [2] [0] [0]	1-axis specifications	1-axis specifications	No axis	No axis
[1] [2] [2] [0]	1-axis specifications	2-axis specifications	No axis	No axis
[1] [2] [3] [0]	1-axis specifications	1-axis specifications	1-axis specifications	No axis
[1] [2] [3] [3]	1-axis specifications	1-axis specifications	2-axis specifications	No axis
[1] [2] [3] [4]	1-axis specifications	1-axis specifications	1-axis specifications	1-axis specifications
[1] [2] [2] [3]	1-axis specifications	2-axis specifications	1-axis specifications	No axis
[1] [1] [0] [0]	2-axis specifications	No axis	No axis	No axis
[1] [1] [2] [0]	2-axis specifications	1-axis specifications	No axis	No axis
[1] [1] [2] [2]	2-axis specifications	2-axis specifications	No axis	No axis
[1] [1] [2] [3]	2-axis specifications	1-axis specifications	1-axis specifications	No axis

NOTE The task Nos. 1 to 4 can be used, but the task (No. 0) not designated for a unit will be handled as the "Task with no axis". Only commands excluding the axis related commands (movement commands, etc). will be executable.

■ 13.4.16 Setting of task order of priority



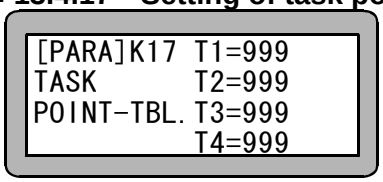
Use the numeric keypad to enter each task priority (1 to 4) and press ENT .
1 has the highest priority and 4 has the lowest priority.
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display.
Press ESC to display the parameter 2 end screen.

- With multitasking, the open time of each task is used to execute the other tasks, so it appears that each task is carried out simultaneously.
  The priority to execute which task is set to determine which task to execute when an opening is generated in the task.
- If the priority is low, the execution of that task will be delayed, so set a higher priority for tasks that have time limits. If the same priority is set for multiple tasks, the task with the smaller task No. will have the higher priority.
- If three or more tasks are to be used, the tasks set to low priority may not be executed at all. In that case, set all tasks to the same priority.

NOTE If the priority is set to 0, that task will not be executed.
The task (main task) can be set only 1.

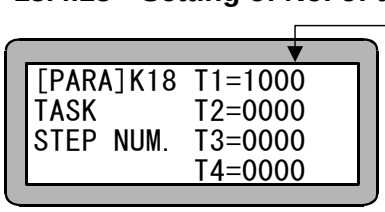
Discontinue

■ 13.4.17 Setting of task point table



This value is set to 999 for each task with this Electric Actuator.
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display.
Press ESC to display the parameter 2 end screen.

■ 13.4.18 Setting of No. of task steps

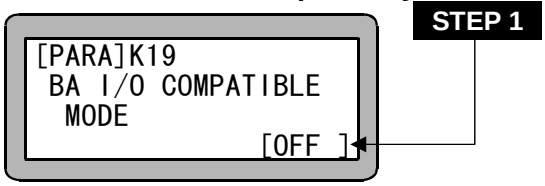


Use the numeric keypad to enter the max. No. of steps in each task and press ENT .
A total of 2,000 steps can be set.
When NEXT is pressed, the next screen will display, and when -NEXT is pressed, the previous screen will display.
When this setting is changed, the program will be cleared, so a confirmation message will display.
Press ESC to display the parameter 2 end screen.

NOTE

- If the max. No. of steps is set to lower than the current value, the program of that step will be cleared.
- When 1,001 or more steps are set, the easy mode program area will be cleared and used as the sequential program area.
- A total of 1,001 or more steps cannot be set from the easy mode with this setting.
- A total of 1,001 or more steps is set with this setting, and the easy mode cannot be entered. (Refer to section 13.2.10)

■ 13.4.19 BA I/O compatibility mode



Press ALT to switch between Valid and Invalid.
When -NEXT is pressed, the previous screen will display. Press ESC to display the parameter 2 end screen.

- When this mode is set to Valid the positioning complete signal and return to origin complete signal are based on the BA series controller specifications. (Refer to section 17.7.)

Discontinue

■ 13.5 How to set the tables

The tables are groups of data for which addresses are assigned to each data item.
To use the table, designate the data indirectly using the address (table No.) in the program.
As an example, the concept of the coordinate table as shown in a table below.

Coordinate table No. (address)	Coordinate data [mm]
001	X = 100, Y = 150
002	X = 700, Y = 500
:	:
999	X = 600, Y = 300

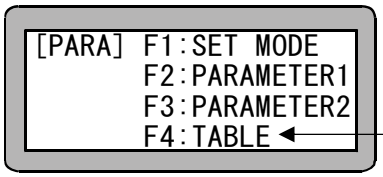
The following types of tables are available.

- ---------- Coordinate (point) table table Nos. 1 to 999 (Set for each task when using multitasking)
- ---------- Speed table table Nos. 1 to 10
- ---------- Acceleration (ACC) table table Nos. 1 to 20
- ---------- MVM table table Nos. 1 to 32

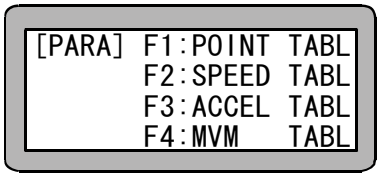
Refer to section 4.1.7 for details on the MVM command.

NOTE When using multitasking, the coordinate tables are provided for each task, so change the task first. (Refer to section 5.3.2 (1).)

Enter the PARA mode. (Refer to section 13.1.)



STEP 1 When the display at left is shown, press F4 .

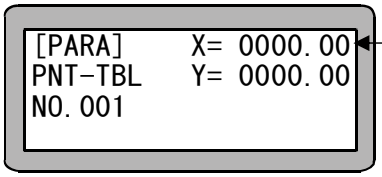


STEP 2 Press F1 to F4 to select the table to be set.

Discontinue

■ 13.5.1 Setting of coordinate (point) table

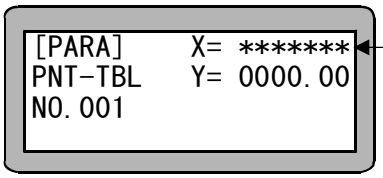
Press F1 in the table selection screen shown in section 13.5, and select the coordinate (point) table.



STEP 1

Use the numeric keypad to enter the coordinates (–8000 to 8000) and press ENT .
Press NEXT or -NEXT to scroll the table.
If SEARCH is pressed and the table No. is input, the display will jump to that table.
Press ESC to return to the table selection screen.

- Unit: mm
- The tables that can be set are Nos. 1 to 999.
- Remote teaching and direct teaching can be used. (Refer to section 3.2.2.)

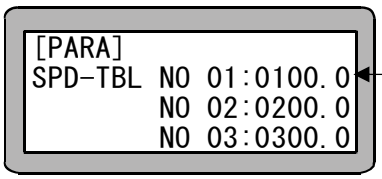


STEP 2

If ALT is pressed instead of a value, the display will change to *******, and that coordinate will be handled in the same manner as the current coordinate value.

■ 13.5.2 Setting of speed table

Press F2 in the table selection screen shown in section 13.5, and select the speed table.

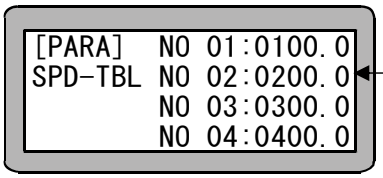


STEP 1

Input is possible for the speed table at the second line from the top.
Use the numeric keypad to enter the speed and press ENT .
Press NEXT to scroll the screen.

- The input range is 1.0 to 9999.9 [mm/s].
- Even if the speed is specified with this parameter, the speed is limited by the value set in "setting of maximum speed data" in parameter 2.
- The initial values are as shown below.

SPD table No.	1	2	3	4	5	6	7	8	9	10
Initial value [mm/s]	100	200	300	400	500	600	700	800	900	1000



STEP 2

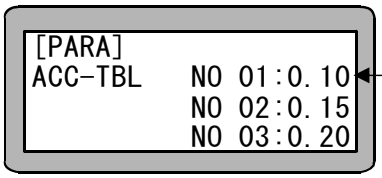
Press NEXT or -NEXT to scroll the screen.
If SEARCH is pressed and the table No. is input, the display will jump to that table.
Press ESC to return to the table selection screen.

The tables that can be set are Nos. 1 to 10.

Discontinue

■ 13.5.3 Setting of acceleration/deceleration table

Press F3 in the table selection screen shown in section 13.5, and select the acceleration table.



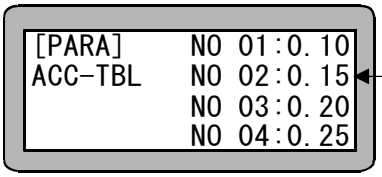
STEP 1

Input is possible for the acceleration table at the second line from the top.
Use the numeric keypad and enter the acceleration speed (time to reach set speed) and press ENT .
Press -NEXT to scroll to the next screen.

- The input range is 0.01 to 9.99 [s].
- The initial values are as shown below.

ACC table No.	1	2	3	4	5	6	7	8	9	10
Time [s]	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55

ACC table No.	11	12	13	14	15	16	17	18	19	20
Time [s]	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05



STEP 2

Press -NEXT or NEXT to scroll the screen.
Press ESC to return to the table selection screen.

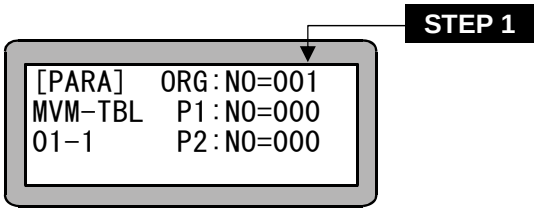
The tables that can be set are Nos. 1 to 20.

NOTE The maximum portable weight will differ according to the acceleration speed.

Discontinue

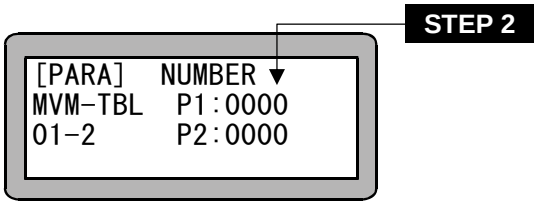
■ 13.5.4 Setting of MVM table

Press F4 in the table selection screen shown in section 13.5, and select the MVM table.

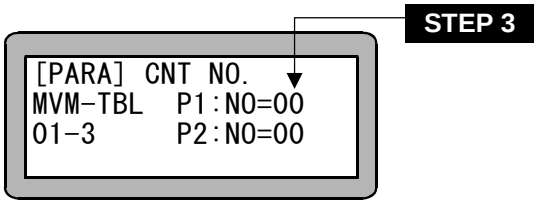


Use the numeric keypad to enter the P0, P1 and P2 coordinate table Nos. (1 to 999) and press ENT .
When NEXT is pressed, the next screen will display.
Press ESC to return to the table selection screen.

- If a specific MVM table is to be displayed or revised while inputting the MVM table (STEP 1 to 3), press SEARCH and then enter the table No. with the numeric keypad (1 to 32).
- Refer to section 4.1.7 for program examples using the MVM table.



Use the numeric keypad to enter the No. of pieces to be moved and loaded and then press ENT .
When -NEXT is pressed, the previous screen will display. Press ESC to return to the table selection screen.



Use the numeric keypad to enter the No. of the counter to be used and press ENT . When -NEXT is pressed, the previous screen will display. Press ESC to return to the table selection screen.

Discontinue

Chapter 14 Monitoring

This Electric Actuator has a function to monitor the various parameters on a screen during operation. The parameters that can be monitored are as shown below.

1. Program step No. monitor ------ Active step No. of the sequential program

2. Input/output monitor ---------- Input status of system and general purpose port
   Output status of system and general purpose port

3. Counter and timer monitor ------ Status of counter
   Status of timer

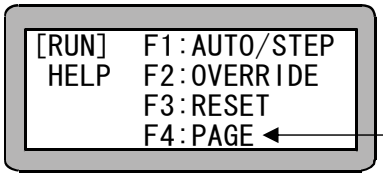
4. Coordinate monitor ---------- Current position coordinate
   Offset coordinate

5. Origin sensor/encoder
   Z-phase pulse monitor ---------- Status of origin sensor ON/OFF
   Status of encoder Z-phase pulse (ϕZ) output

NOTE
- Stop input is not effective during monitoring.
- The encoder Z-phase pulse (ϕZ) monitor is valid only for a master unit.
- When using multitasking, the status of the task displayed on the Teach Pendant will be monitored.

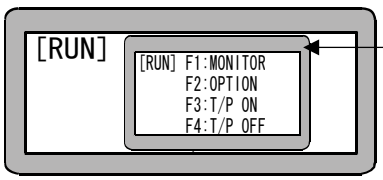
Method of monitoring

Programming for monitoring.



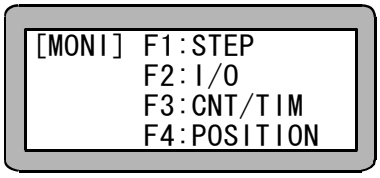
STEP 1

The prompt is displayed when HELP is pressed in run mode. When it appears, press F4.
When using multitasking, change to the task to be monitored before starting this operation. (Refer to section 5.3.2 (1).)



STEP 2

When the display at left appears, press F1 to enter the monitor mode.



STEP 3

This is the initial display for monitoring.
Press ENT to display the next screen. Select a key from F1 to F4 and press it for necessary monitoring. When ESC is pressed, the display returns to STEP 2.

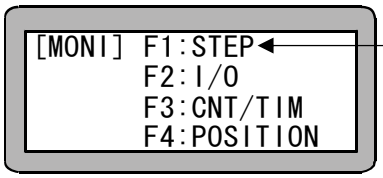
Discontinue

Discontinue

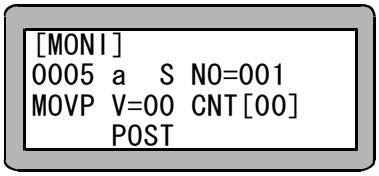
■ 14.1 Program step No. monitoring

The content and process of the currently executed program step of sequential program is displayed.

● Display the initial instruction.



STEP 1 When this display is shown, press F1 .



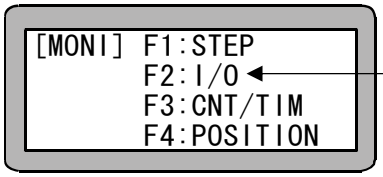
STEP 2 The currently active program step is displayed. The display varies according to the progress of the program.
Press ESC to return to STEP 1.

Discontinue

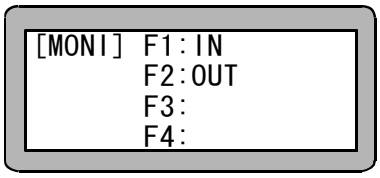
■ 14.2 Input/output monitoring

Status of input/output port in program execution is monitored according to the progress of the program.

● Display the initial instruction.

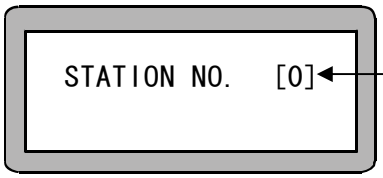


STEP 1 When this display is shown, press F 2 .

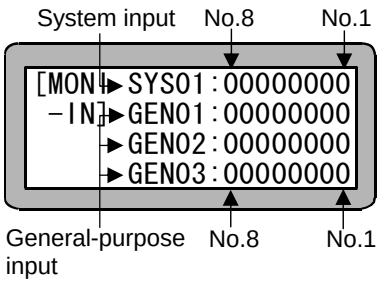


STEP 2 Press F 1 to monitor the input port and F 2 to monitor the output. Press ESC to return to STEP 1.

● When F1 is pressed (Input monitor)



STEP 3A Enter the station No. of the controller to be monitored and press ENT .



Display "0": OFF
Display "1": ON

STEP 4A The status of the current system input port and general-purpose input port will be displayed in bit units.
Press NEXT to display the next screen.
Press ESC to return to STEP 2.

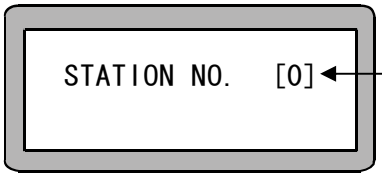
System input	Signal name	
	When normal	During pulse train input mode
Bit No. 5	Return to origin (monitor)	
Bit No. 6	Start	Servo ON
Bit No. 7	Stop	Counter clear
Bit No. 8	Reset	Reset

Discontinue

NOTE

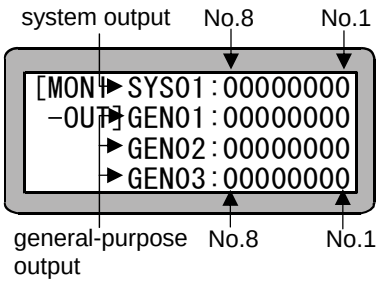
- For the station No. 0 (master unit) only bit Nos. 6 to 8 are valid for the system input S01 and bit Nos. 1 to 5 for the general-purpose input G01. No. 5 of S01 can be used only as the input monitor of return to origin.
- The return to home input (initial value) is set to No. 5 of G01, but the function can be moved to a random general-purpose input by designating the bit. (Refer to section 13.2.6.)
  Even if the input is changed with bit designation, the return to home input status can be monitored with bit No. 5 of S01.
- The display for the invalid bits is 0.

- When F2 is pressed (output monitor)



STEP 3B

Enter the station No. of the controller to be monitored and press ENT .



Display “0”: OFF
Display “1”: ON

STEP 4B

The status of the current system output port and general-purpose output port will be displayed with a bit units.
When NEXT is pressed, the next screen will display. Press ESC to return to STEP 2.

System output	Signal name
Bit No. 5	Running
Bit No. 6	Error
Bit No. 7	Positioning complete
Bit No. 8	Return to origin complete

NOTE

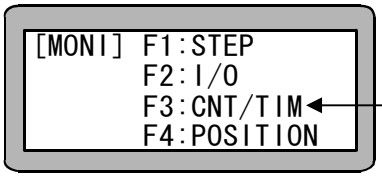
- For the station No. 0 (master unit) only bit Nos. 5 to 8 are valid for S01. Only bits Nos. 1 to 4 are valid for G01.
- The display for the invalid bits is 0.

Discontinue

■ 14.3 Counter and timer monitoring

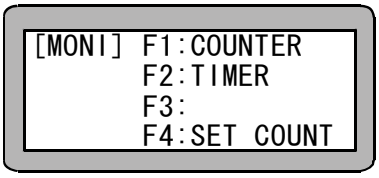
Current counter and timer condition are monitored according to the proceedings of program execution.

● Display the initial instruction for monitoring.



STEP 1

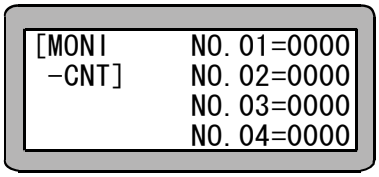
When the display at left is shown, press F3 .



STEP 2

To monitor the counter, press F1 . Press F2 to monitor the timer. Press ESC to return to STEP 1.

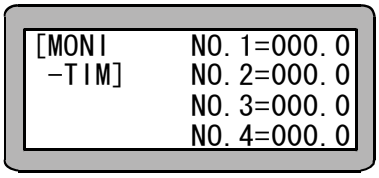
● When F1 is pressed: Counter monitoring



STEP 3A

The current conditions of the counter are monitored.
Press NEXT or -NEXT to scroll the display.
Press SEARCH and enter the counter number to perform a search in the counter monitor screen.
Press ESC to return to STEP 2.

● When F2 is pressed: Timer monitoring



STEP 3B

The current conditions of the timer are monitored.
Press NEXT or -NEXT to scroll the display.
Press ESC to return to STEP 2.

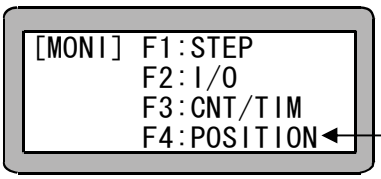
NOTE
- Counter No. 1 to No. 99 can be monitored.
- Timer No. 1 to No. 9 can be monitored.

Discontinue

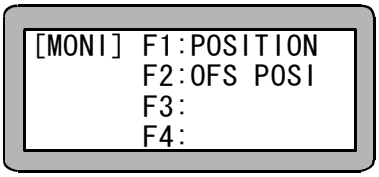
■ 14.4 Coordinate monitoring

Current coordinates are monitored according to the progress of the program.

● Display the initial screen for monitoring.

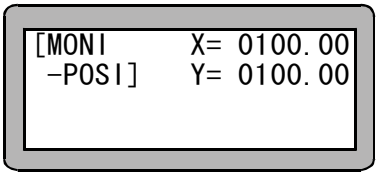


STEP 1 When the display at left appears, press F4 .



STEP 2 Press F1 to monitor the current position coordinate (absolute coordinate). Press F2 to monitor the offset coordinates.
Press ESC to return to STEP 1.

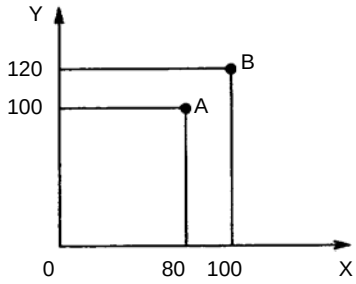
● When F1 is pressed (Coordinate monitoring)



STEP 3 Current position coordinate is displayed. Press ESC to return to STEP 2.

NOTE

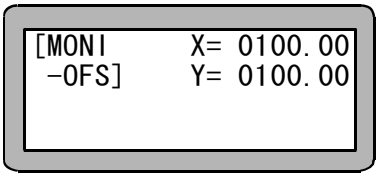
- The value displayed for the current position is the absolute value minus the offset value.
- When the controller does not execute the OFS command, the display shows OFS = 0 in the current position monitor.



[Example] When the point A (X = 80, Y = 100) movement command is executed in the program, if the offset command (OFS X = 20, Y = 20) is executed before the movement, the robot will move to point B. If this point B is monitored as the current position, (X = 80, Y = 100) will display.

Discontinue

● When F 2 is pressed: Offset coordinate monitoring



STEP 4 Current offset coordinate is displayed.
Press ESC to return to STEP 2.

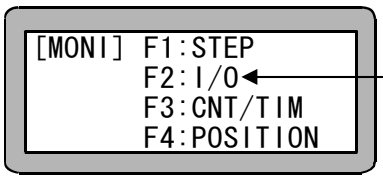
The offset coordinates refer to the coordinate system using the origin that has been offset (moved in parallel) with the command. This is not displayed for the origin offset.

Discontinue

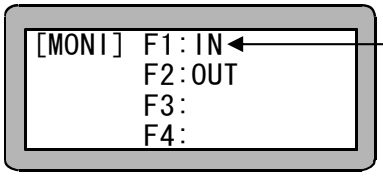
■ 14.5 Origin sensor/encoder Z-phase pulse monitoring

The ON or OFF status of the origin sensor and the output status of the encoder Z-phase pulse (ϕZ) is displayed on the system input monitor screen.

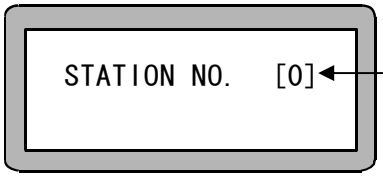
● Display the initial screen for monitoring.



STEP 1 When the display at left appears, press F2 .

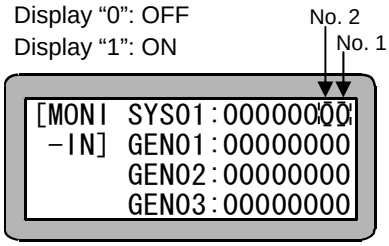


STEP 2 Press F1 .



STEP 3 Enter the station No. (0 to 3) of the controller to which the axis to be monitored is connected and press ENT .

Display "0": OFF
Display "1": ON



STEP 4 The current origin sensor and encoder Z-phase status will be displayed as bits at the system input No. 1 and No. 2.

System input	Signal name
Bit No. 1	Origin sensor
Bit No. 2	Encoder Z-phase

NOTE
- The encoder Z-phase monitor is valid only for a master unit.
- The JOG key is invalid while monitoring the origin sensor or encoder Z-phase pulse.

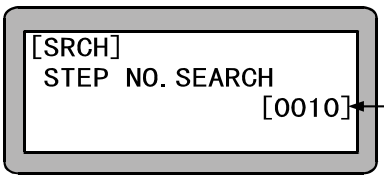
Discontinue

Chapter 15 Search Function

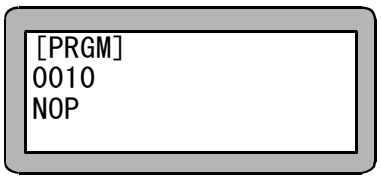
When SEARCH is pressed in any mode, the following search operation can be carried out.

■ 15.1 Search of sequential step No.

When SEARCH is pressed in the sequential PRGM mode, AUTO mode or STEP mode, the following screen will display.



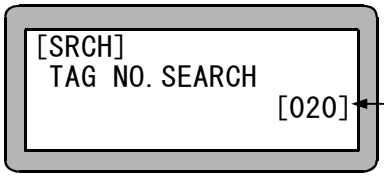
STEP 1 Use the numeric keypad to enter the step No. and press ENT .(1 to 2000)
Press ESC to return to the original screen.



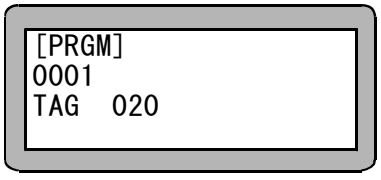
STEP 2 The designated step will display.

■ 15.2 Search of tag No.

If SEARCH is pressed twice in the sequential PRGM mode, AUTO mode or STEP mode, the following screen will display.



STEP 1 Use the numeric keypad to enter the tag No. and press ENT . (1 to 999) Press ESC to return to the original screen.

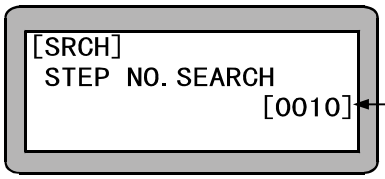


STEP 2 The designated tag No. step will display.

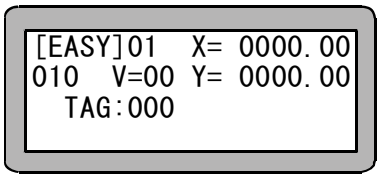
Discontinue

■ 15.3 Search of eazy step No.

When (SEARCH) is pressed in the PRGM mode of easy mode, the following screen will display.



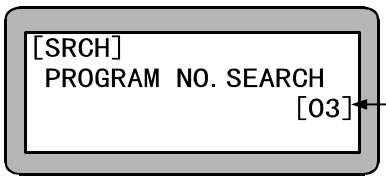
STEP 1 Use the numeric keypad to enter the step No. and press (ENT) .(1 to 800)
Press (ESC) to return to the original screen.



STEP 2 The designated step will display.

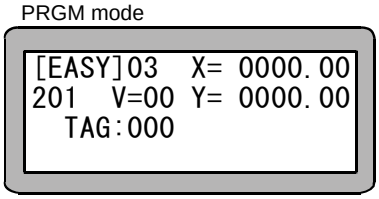
■ 15.4 Search of easy program No.

If (SEARCH) is pressed in the easy mode, the easy program screen can be searched.
If (SEARCH) is pressed twice in the PRGM mode, or once in the AUTO mode or STEP mode, the following screen will display.



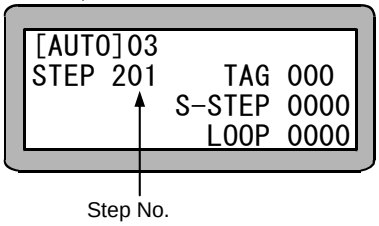
STEP 1 Use the numeric keypad to enter the easy program No. and press (ENT) .(1 to 8)
Press (ESC) to return to the original screen.

PRGM mode



STEP 2 The designated easy program will display.

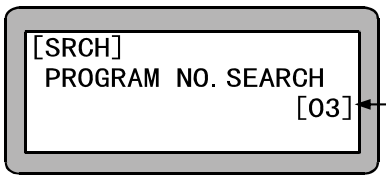
AUTO, STEP mode



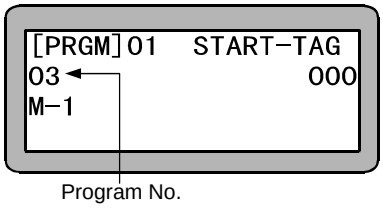
Discontinue

■ 15.5 Search of palletizing program No.

If SEARCH is pressed in the palletizing mode's PRGM mode, AUTO mode or STEP mode, the following screen will display.



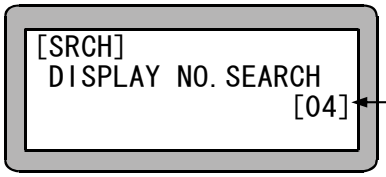
STEP 1 Use the numeric keypad to enter the palletizing program No. and press ENT .(1 to 8)
Press ESC to return to the original screen.



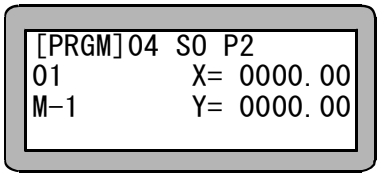
STEP 2 The designated palletizing program will display.

■ 15.6 Search of palletizing program screen No.

If SEARCH is pressed twice in the palletizing mode's PRGM mode, the following screen will display.



STEP 1 Use the numeric keypad to enter the screen No. and press ENT . (1 to 14)
Press ESC to return to the original screen.



STEP 2 The designated screen will display.

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Discontinue

Chapter 16 Manual Operation of General-purpose Outputs

The general-purpose output from the Teach Pendant can be directly turned ON and OFF. There are two methods for this outputting method.

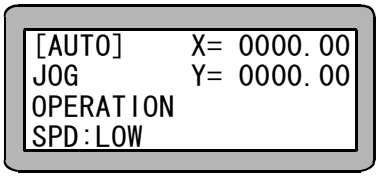
1. Manual output using function keys
2. Manual output of random bit from PRGM (program) mode

■ 16.1 Manual output using function keys

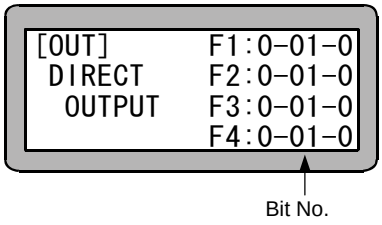
The random output port and random output bits set in the mode setting can be manually output using the function keys. This method is valid only during the JOG mode or remote teaching mode.

NOTE Set the output bit to be directly output with the mode setting before starting this operation. (Refer to section 13.2.14.)

Press DIRECT JOG in the AUTO mode or PRGM mode.



STEP 1 The JOG screen display will appear, and JOG operation will be possible.
Press F4 to proceed to STEP 2.



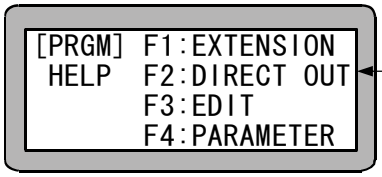
STEP 2 The bit No. set in F1 to F4 will display.
When F1 to F4 is pressed, the designated port is ON, when pressed again, it is OFF.
Press ESC to return to STEP 1.

Discontinue

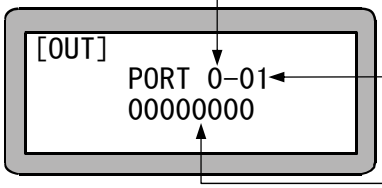
■ 16.2 Manual output of random bit designation from PRGM mode

A random bit can be manually output in the PRGM mode.

Enter the program mode and press (HELP) . The following screen will display. (Refer to section 4.1.1.)



STEP 1 Press (F 2) and enter the direct output mode.

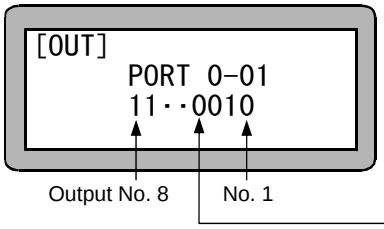


STEP 2 Use the numeric keypad to enter the station No. and press (ENT) .

STEP 3 Use the numeric keypad to enter the port No. and press (ENT) .

STEP 4 The status of the output port designated in STEPS 2 and 3 is displayed.

? The station No. is a number assigned to each unit. (Refer to section 2.4.4.)



STEP 4 Press (IN / 1) (ON), (RET / 0) (OFF) or (TAG / ·) (no change) to designate the bit. Confirm the data and press (ENT) . The set general-purpose output bit will turn ON.
Press (ESC) to return to the initial screen of the PRGM mode.

NOTE ● For the station No., port No. and bit No. which can be used, refer to "Names of general-purpose output ports and Teach Pendant displays" (section 10.1.4).

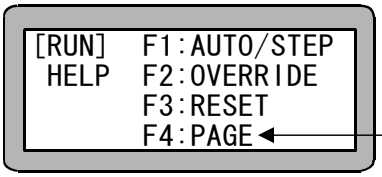
Discontinue

Chapter 17 Other Handy Operations

■ 17.1 Teach Pendant ON/OFF

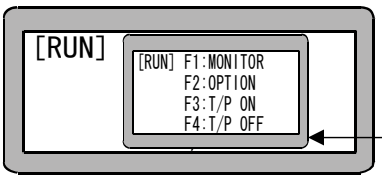
When the Teach Pendant is physically connected to the controller, it can be logically disconnected by the following key operation and make system input signals effective.

●Teach pendant OFF operation



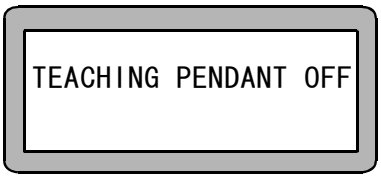
STEP 1

After exiting the initial screen, start RUN mode, and press HELP to display the screen on the left.
Press F4 to proceed to STEP 2.
Press ESC to return to RUN mode.



STEP 2

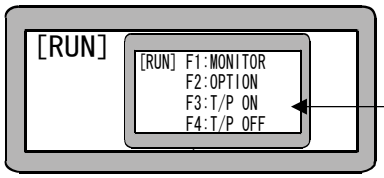
The screen on the left is displayed.
Press F4 to proceed to STEP 3.
Press ESC to return to RUN mode.



STEP 3

The Teach Pendant OFF screen is displayed. This enables simulation with the teach pendant disconnected.

●Teach pendant OFF operation



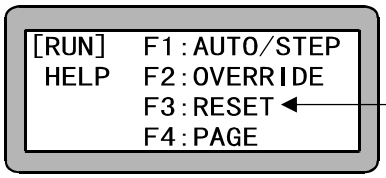
STEP 4

When the teach pendant is OFF, press HELP to display the screen on the left.
Press F3 to establish the connection and return to RUN mode.
Press ESC to return to STEP 3.

Discontinue

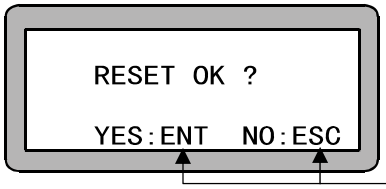
■ 17.2 Reset operation

The Teach Pendant can perform the same function as the reset signal (Pin No. 31) of the system input.



STEP 1

In RUN mode, press (HELP) to display the screen on the left.
Press (F 3) to proceed to STEP 2.
Press (ESC) to return to RUN mode.



STEP 2

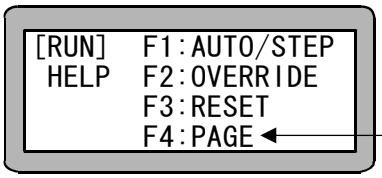
To reset, press (ENT) . To not reset, press (ESC) .
After pressing the key, operation returns to RUN mode.

- For operation after reset input, refer to section 10.2.4 "Reset input".

Discontinue

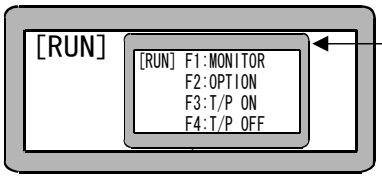
■ 17.3 Counter direct set

Teach Pendant can be used to set the counter value directly.



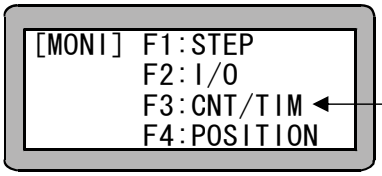
STEP 1

In RUN mode, press (HELP) to display the screen on the left.
Press (F 4) to proceed to STEP 2.
Press (ESC) to return to RUN mode.



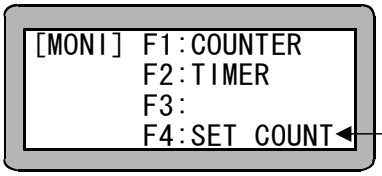
STEP 2

The screen on the left is displayed.
Press (F 1) to set to Monitor mode.
Press (ESC) to return to RUN mode.



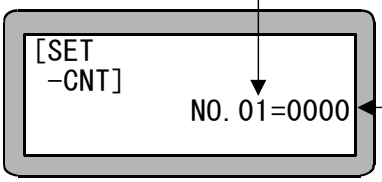
STEP 3

The screen on the left is displayed.
Press (F 3) to proceed to STEP 4.
Press (ESC) to return to STEP 2.



STEP 4

The screen on the left is displayed.
Press (F 4) to proceed to STEP 5.
Press (ESC) to return to STEP 3.



STEP 5

Enter the specified counter No. with the numeric keypad, and press (ENT) .
(Counter No. ranges from 1 to 99)

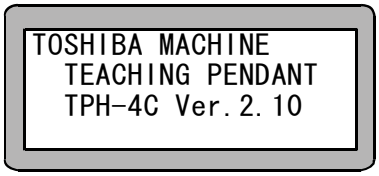
STEP 6

Enter the counter value with the numeric keypad, and press (ENT) . (Counter values range from 0 to 9999)
Press (ESC) to return to STEP 4.

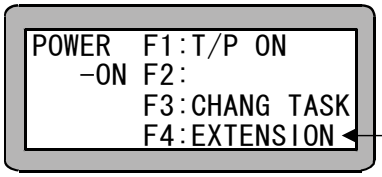
Discontinue

■ 17.4 Version display

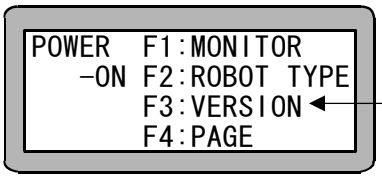
The ROM version of the controller and Teach pendant can be displayed.



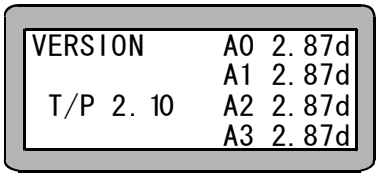
STEP 1 When you turn on the power, the initial screen is displayed for two seconds.



STEP 2 When this display appears after the initial screen, press F 4 .



STEP 3 Press F 3 to continue to step 4.
Press ESC to return to step 2.



STEP 4 The version will display on the screen.
Press ESC to return to STEP 3.

The displayed indicators on the screen have the meanings below.
A0: Master unit (station No. 0)
A1: Slave unit (station No. 1)
A2: Slave unit (station No. 2)
A3: Slave unit (station No. 3)
T/P: Teach pendant

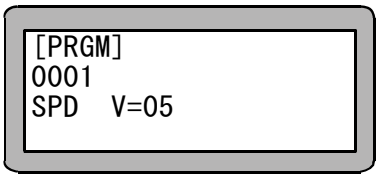
Discontinue

■ 17.5 JOG operation (Manual operation of axis)

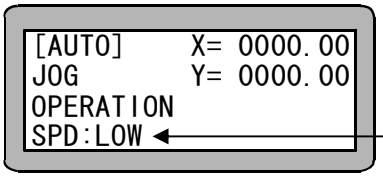
JOG operation is the operation in which the axis is moved with remote operations using the Teach Pendant.
This is used to stop the program and move the axis during operations, or to move the axis during a program editing.
If the axis is provided with brakes, the brakes will be applied and the axis will not move in the servo free state. Thus, the JOG operation is used to move the axis.

Refer to section 3.2.2 on how to input the position data using JOG operation while creating the program.

JOG operation can be used in the PRGM mode or RUN mode when the Teach Pendant is connected and turned ON.
This cannot be used when the pulse train input mode is set.
During the sequential mode, JOG is carried out for each task. If task 1 is assigned for the 1st axis and task 2 is assigned for the 2nd axis, the 2nd axis will not operate even if the +2 and -2 keys on the Teach Pendant are pressed. In this case, change to task 2 to jog the 2nd axis.
An example of operation in the sequential mode is given below.



STEP 1 Press DIRECT JOG in the state shown on the left.
When using multitasking in the sequential mode, the task in which the axis to be jogged is assigned must be changed to. (Refer to section 5.3.2 (1).)



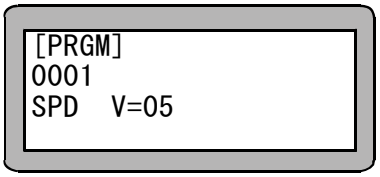
STEP 2 The JOG screen is displayed, and jog operation is enabled.

STEP 3 The jog speed is switched between HIGH and LOW by pressing ALT .
As an example, the first axis will move when +1 is pressed.

Discontinue

NOTE

- For the axis movement during JOG operation, [+1] and [-1] are used for the first axis and [+2] and [-2] are used for the second axis. If a plus key is held down, the axis will move in the direction opposite the origin, and if a minus key is held down, the axis will move in the direction of the origin.
- Jog operation can be executed even when the controller has lost track of the current axis position (when return to origin is required). In this case, the soft limit is not applied.
- The JOG operation speed can be set with parameter 1 JOG speed. (Refer to section 13.3.7.)
- Inching during JOG operation is possible by pressing the movement keys ([+1] , [-1] , [+2] , [-2]) and release the key immediately.
  The movement amount per inching movement can be set with parameter 1 inching movement amount. (Refer to section 13.3.8.)



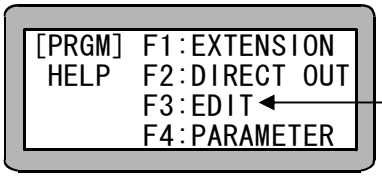
STEP 4 After moving the axis to the designated position, press [DIRECT JOG] .
The JOG operation will be canceled, and the display will return to the first screen.

Discontinue

■ 17.6 Clearing (initializing) coordinate table

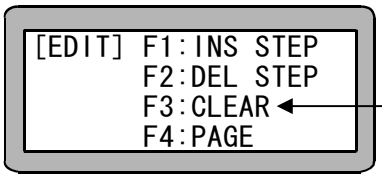
All coordinate tables in the controller memory can be cleared.
When using multitasking, only the coordinate table of the displayed task will be cleared. Thus, change to the task containing the table to be cleared before carrying out the following operation. (Refer to section 5.3.2 (1).)

Enter the PRGM mode (sequential) and press HELP . (Refer to section 4.1.1.)
The following screen will display.



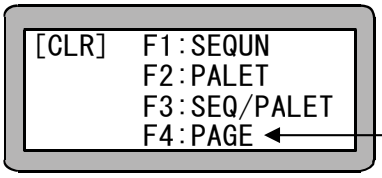
STEP 1

Press F 3 in this state to proceed to STEP 2.
Press ESC to return to PRGM mode.



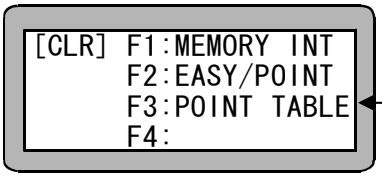
STEP 2

The screen on the left is displayed.
Press F 3 to proceed to STEP 3.
Press ESC to return to the PRGM mode screen.



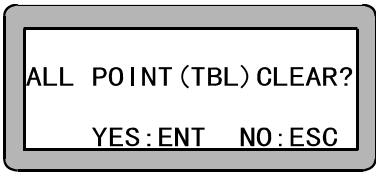
STEP 3

The screen on the left is displayed.
Press F 4 to proceed to STEP 4.
Press ESC to return to STEP 2.



STEP 4

The screen on the left is displayed.
Press F 3 to proceed to STEP 5.
Press ESC to return to STEP 3.



STEP 5

To clear the coordinate table, press ENT .
To not clear the table, press ESC .
After pressing the key, operation returns to STEP 4.

NOTE All of the easy program coordinate data will also be cleared (initialized) with this operation.

Discontinue

■ 17.7 KBA I/O Compatibility Mode

The KBA I/O compatibility mode is a function that sets the operation specifications for return to origin complete output and positioning complete output to match the BA series.

■ 17.7.1 Selection method of KBA I/O compatibility mode

KBA I/O compatibility mode can be selected by the Disable/Enable setting in KBA I/O Compatibility Mode of Parameter 2. (Refer to section 13.4.19.)

Setting	Mode	Output signal specifications (*1)	Remarks
Disable	Standard mode	KBB series controller specifications	Default
Enable	KBA I/O compatibility mode	KBA series controller specifications	

*1: Positioning complete signal/Return to origin complete signal

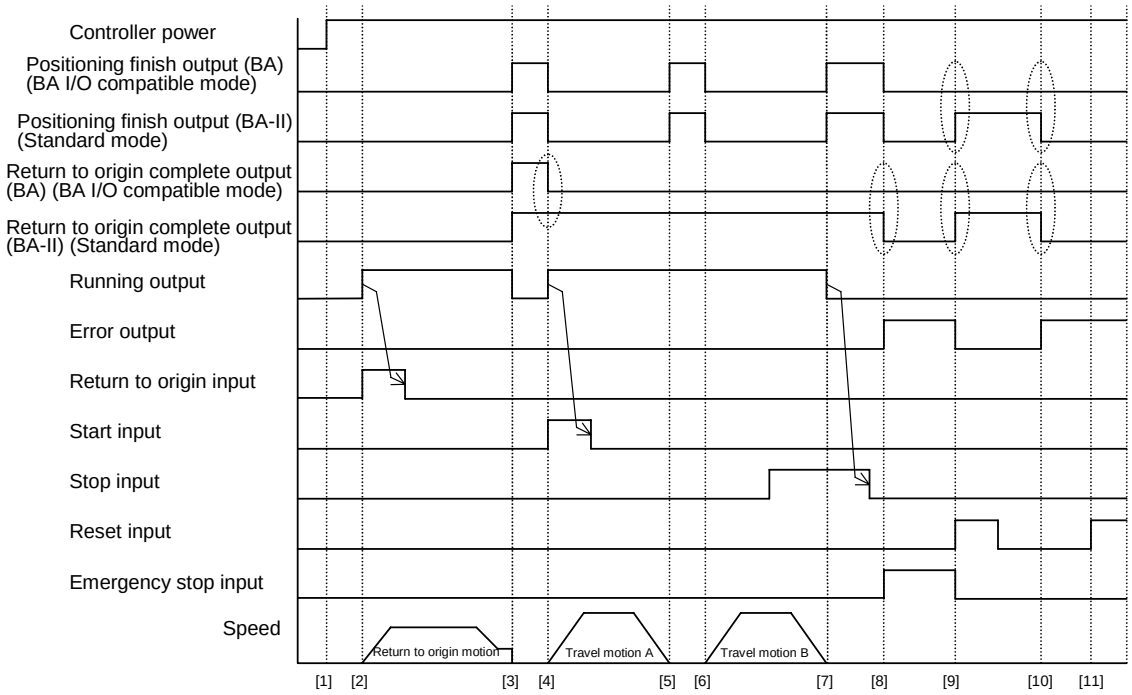


- The default setting (at factory shipping and after memory initialization) is Disable.
- The KBA series controller specifications are referred to as " KBA I/O compatibility mode".
- The KBB series controller specifications are referred to as "Standard mode".

Discontinue

■ 17.7.2 Operation specifications for return to origin complete output and positioning complete output

(1) When incremental encoder type is specified



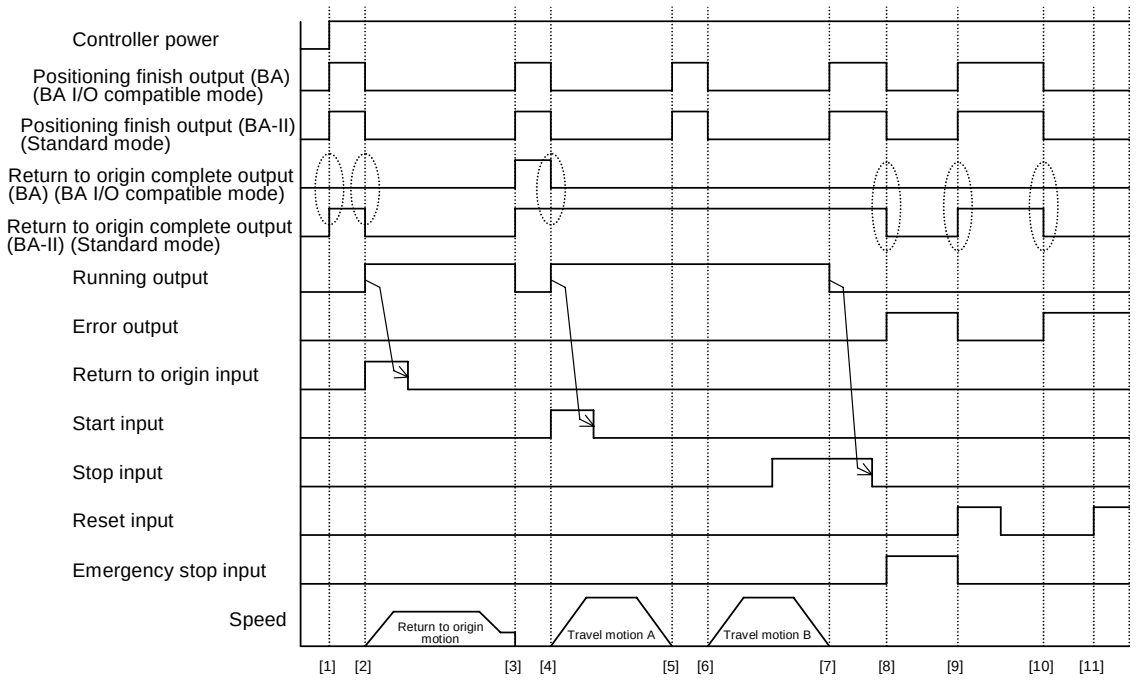
Motion program
MOV A
TIM ***
MOV B

Difference

① Power ON
② Return to origin start
③ Return to origin complete
④ Travel motion A start
⑤ Travel motion A finish
⑥ Travel motion B start
⑦ Travel motion B finish
⑧ Emergency stop input ON
⑨ Reset input (Emergency stop cancel)
⑩ Encoder error generation
⑪ Reset input → Error clear is not possible.

Discontinue

(2) When absolute encoder type is specified



① Power ON
② Return to origin start
③ Return to origin complete
④ Travel motion A start
⑤ Travel motion A finish
⑥ Travel motion B start
⑦ Travel motion B finish
⑧ Emergency stop input ON
⑨ Reset input (Emergency stop cancel)
⑩ Encoder error generation
⑪ Reset input → Error clear is not possible.

NOTE Use the personal computer software (SF-98D) whose version is 2.1.0 or later.

Discontinue

Chapter 18 Commands

Program commands and the key operation for this Electric Actuator are listed below.

● **Move**

Command	Reading	Function	Key operation	Refer to
MOVP	Move P	Axis movement to a point indirectly specified by coordinate table	Press MOV 9 .	18-26
MVB	Move B	Move (return) to point immediately before the current position	Press F 1 , IN 1 and OUT 2 .	18-28
MVE	Move E	Escape move	Press F 1 , IN 1 and TIM 6 .	18-29
HOME	Home	Return to origin	Press F 1 , IN 1 and MOV 9 .	18-16

● **Setting parameters**

Command	Reading	Function	Key operation	Refer to
SPD	Speed	Setting speed	Press SPD 7 .	18-41
ACC	Accel	Setting acceleration/ deceleration	Press SPD 7 twice.	18-4
OFS	Offset	Offset	Press F 1 , IN 1 and IN 1 .	18-34

● **Input/output port control**

Command	Reading	Function	Key operation	Refer to
OUT	Out	General-purpose port output	Press OUT 2 .	18-35
OUTP	Out P	General-purpose port pulse output	Press OUT 2 twice.	18-38
OUTC	Out C	General-purpose port output of counter value	Press OUT 2 three times.	18-37
IN	In	Waiting for input	Press IN 1 .	18-17
INPC	In PC	Setting general-purpose port input to counter	Press IN 1 twice.	18-18

Discontinue

● **Timer and counter control**

Command	Reading	Function	Key operation	Refer to
TIM	Time	Waiting	Press TIM 6 .	18-47
TIMP	Time P	Timer preset	Press TIM 6 twice.	18-48
CNT	Counter	Preset counter value	Press CNT 3 .	18-11
CNT+	Counter Plus	Count up	Press CNT 3 twice.	18-12
CNT–	Counter Minus	Count down	Press CNT 3 three times.	18-13
CNTC	Counter Clear	Clear all counters	Press F 1 , OUT 2 and IN 1 .	18-14

● **Jump**

Command	Reading	Function	Key operation	Refer to
JMP	Jump	Unconditional jump	Press JMP 5 .	18-19
JMPI	Jump I	Input conditional jump	Press JMP 5 twice.	18-21
JMPC	Jump C	Counter conditional jump	Press JMP 5 three times.	18-20
JMPT	Jump T	Timer conditional jump	Press JMP 5 four times.	18-23
BRAC	Branch	Counter jump	Press F 1 , OUT 2 and RET 0 .	18-5

● **Subroutine call**

Command	Reading	Function	Key operation	Refer to
CAL	Call	Unconditional call	Press CAL 4 .	18-6
CALI	Call I	Input conditional call	Press CAL 4 twice.	18-8
CALC	Call C	Counter conditional call	Press CAL 4 three times.	18-7
CALT	Call T	Timer conditional call	Press CAL 4 four times.	18-10

Discontinue

● **Program control**

Command	Reading	Function	Key operation	Refer to
NOP	NOP	No function	Press NOP - .	18-33
RET	Return	Return	Press RET 0 .	18-40
STOP	Stop	Stop	Press RET 0 twice.	18-42
END	End	Program end	Press END 8 .	18-15
TAG	Tag	Tag	Press TAG • .	18-45
PSEL	Sel	Program selection	Press F1 , IN 1 and RET 0 .	18-39

● **Servo control**

Command	Reading	Function	Key operation	Refer to
SVON	Servo-ON	Servo-on	Press F1 , IN 1 and SPD 7 .	18-44
SVOF	Servo-OFF	Servo-off	Press F1 , IN 1 and END 8 .	18-43

● **MVM commands**

Command	Reading	Function	Key operation	Refer to
MVM	Move M	Palletizing movement	Press F1 , IN 1 and CAL 4 .	18-31
LOOP	Loop	Loop for MVM	Press F1 , IN 1 and JMP 5 .	18-24
MINI	Matrix Initial	Initial counter value for MVM	Press F1 , IN 1 and CNT 3 .	18-25

● **Task control**

Command	Reading	Function	Key operation	Refer to
TSTR	Task Start	Task start	Press F1 , OUT 2 and OUT 2 .	18-51
TSTO	Task Stop	Task temporary stop	Press F1 , OUT 2 and CNT 3 .	18-50
TRSA	Task Restart	Task restart	Press F1 , OUT 2 and CAL 4 .	18-49
TCAN	Task Cancel	Task forced end	Press F1 , OUT 2 and JMP 5 .	18-46

Discontinue

ACC Acceleration/deceleration command

[Function] This command is used to set the acceleration/deceleration time required for the Electric Actuator to reach a specified speed.

[Explanation]
- Twenty acceleration/deceleration levels can be set from ACC1 to ACC20. ACC command must be set before a Move command (MOVP, MVB, MVE, MVM, HOME).
- When using multitasking, a setting must be made for each task.
- The value at each level sets the time required for the Electric Actuator to reach a specified speed. Times for acceleration and deceleration are equal for each setting. The settings can be changed according to the acceleration/ deceleration table. (Refer to section 13.5.3.)

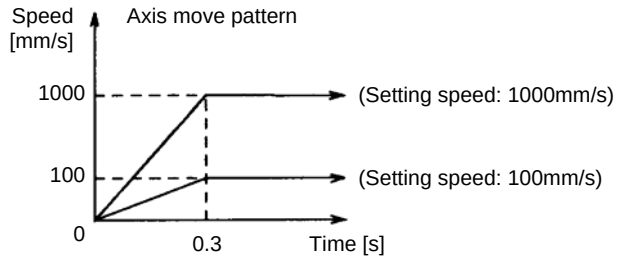
The initial values are shown in the table below.

ACC level	1	2	3	4	5	6	7	8	9	10
Time [s]	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55

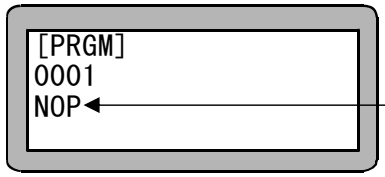
ACC level	11	12	13	14	15	16	17	18	19	20
Time [s]	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05

- Once set, the acceleration rate remains unchanged until it is reset. If you do not set it the default of ACC5 is used.
- Trapezoidal speed control (a constant level of acceleration control) is used.

(Example) Axis move pattern at ACC5

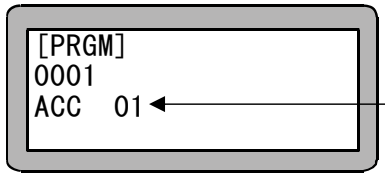


[Key operation]



STEP 1

Press SPD 7 twice.
NOP changes to ACC.
Press ENT .



STEP 2

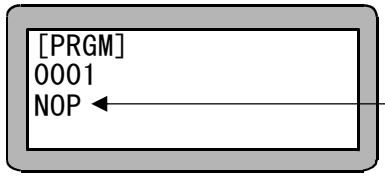
Input an acceleration/deceleration No. with the numeric keypad and press ENT .
(Input range: 1 to 20)

Discontinue

BRAC Counter jump

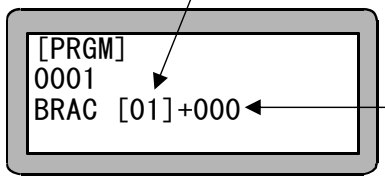
[Function] The command BRAC is used to jump to a program to the tag No. which is the resultant value of a counter No. plus the set counter value.

[Key operation]



STEP 1

Press F 1 followed by OUT 2 and RET 0 . NOP changes to BRAC.
Press ENT .



STEP 2

Enter the counter No. with the numeric keypad. Press ENT . (Input range: 1 to 99)

STEP 3

Enter the counter setting value with the numeric key-pad. Press ENT . (Input range: 0 to 999)

NOTE

- The control jumps to the tag No. which is the resultant value of the counter value + counter Nos. The counter content will remain unchanged after the execution of this command.
- When the counter value details are "0" and the number to be added is "0", if the command is executed, the "TAG NOT FOUND" error will occur.
- If any total of (counter value) + (setting value) exceeds "999", "TAG NO. error" will occur.

Discontinue

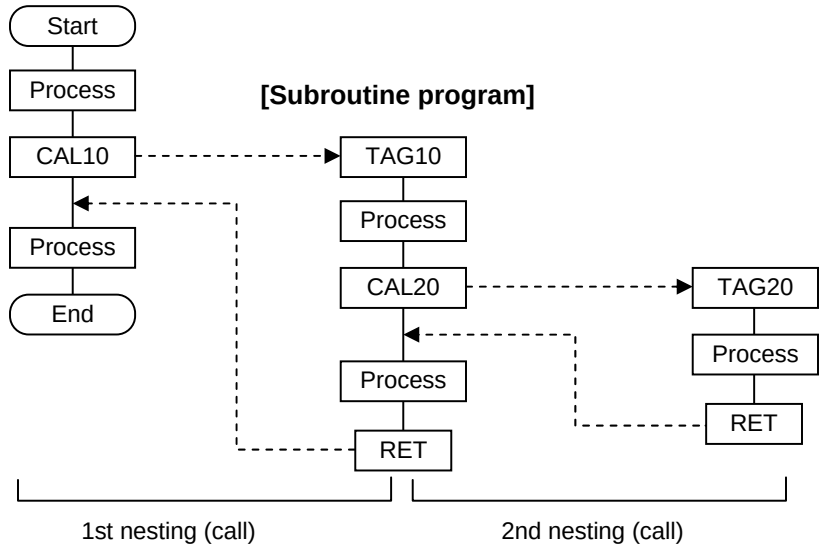
CAL Unconditional Call

[Function] This command is used to call a subroutine program of a designated step identified by tag No.

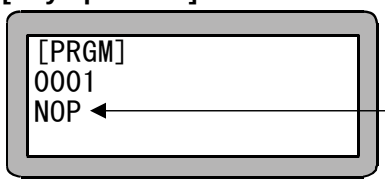
[Explanation]

- This command is used to call a subroutine program of a designated program step identified by tag No.
- This instruction requires a RET (return) command after the last step jumped to. Each subroutine must end with a RET command.
  When the return instruction is executed, the program returns to the step immediately following the CAL (call) step.
- Subroutines can be nested up to 10 levels. Nesting is the system in which another subroutine is called in a subroutine program.
- A diagram of the main routine and subroutine relation is shown below.

[Main routine program]

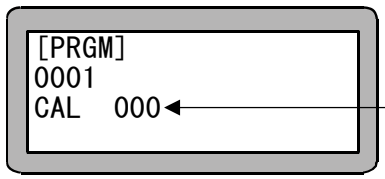


[Key operation]



STEP 1

Press CAL 4 .
NOP changes to CAL.
Press ENT .



STEP 2

Use the numeric keypad to enter the tag No. to be called. Press ENT .
(Input range: 0 to 999.)

NOTE

- The tag No. for STEP 2 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be called.

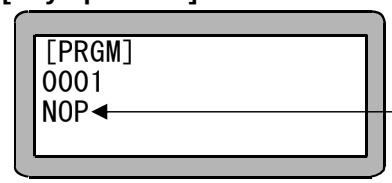
Discontinue

CALC Counter Conditional Call

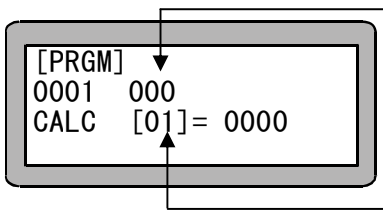
[Function] This command is used to call a subroutine of a specified tag No. when the specified counter contents agree with the setting condition.

[Explanation]
- The program proceeds to the next step when the contents of the specified counter do not meet the setting conditions.
- This command is used in the program with the command used to set the counter value (CNT) and the command to increment (CNT+) or decrement (CNT–) the counter value.
- Five comparisons are available: (=), (<), (>), (≤), (≥).
- Refer to the CAL command for the relation of the main routine and subroutine.

[Key operation]



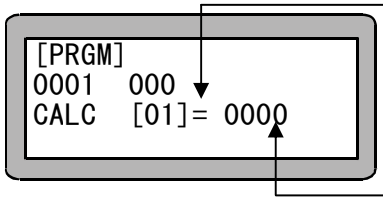
STEP 1 Press CAL 4 three times.
NOP changes to CALC.
press ENT .



STEP 2 Use the numeric keypad to enter the tag No. to be called. Press ENT .
(Input range: 1 to 999.)

STEP 3 Use the numeric keypad to enter the counter No. and press ENT .
(Input range: 1 to 99.)

NOTE
- The tag No. for STEP 2 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be called.



STEP 4 Press ALT to display operators (=, <, >, < =, >=). Select one and press ENT .

STEP 5 Use the numeric keypad to enter the counter value to be compared and press ENT .
(Input range: 0 to 9999.)

Discontinue

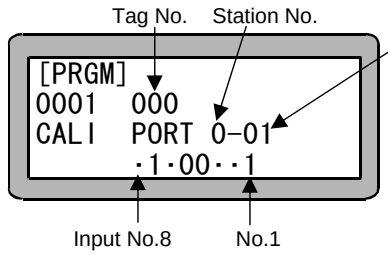
CALI Input Conditional Call

[Function] The subroutine program with the specified tag No. is called when the input state of the specified general-purpose input (general-purpose input port) corresponds to the setting conditions.

[Explanation]

- If all of the details of the designated general-purpose port do not match the set conditions, the subroutine of the designated tag No. will not be called, and the program will move to the next step.
- If the CALI command is set as shown below, when the general-purpose input port 1 No. 1 (general-purpose input port 1-1) and No. 7 (general-purpose input port 1-7) are ON and the general-purpose input port 1 No. 4 (general-purpose input port 1-4) and No. 5 (general-purpose input port 1-5) are OFF for the unit of which the station No. is set to "0", the designated subroutine will be called. The subroutine will not be called unless all of the ON and OFF conditions match. The general-purpose input signal at the "•" display section will not judge the conditions.

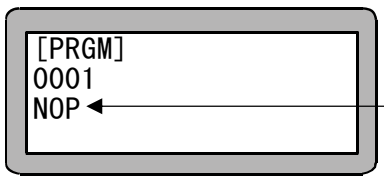
(Example)



"1" ---------- Input ON
"0" ---------- Input OFF
"•" ---------- Ignore
The input signal is judged with an AND condition.

- Refer to the CAL command for the relation of the main routine and subroutine.

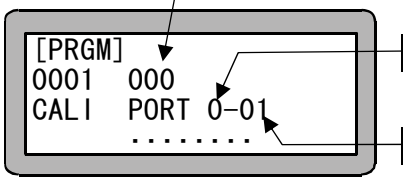
[Key operation]



STEP 1

Press CAL 4 twice.
NOP changes to CALI.
Press ENT .

Discontinue

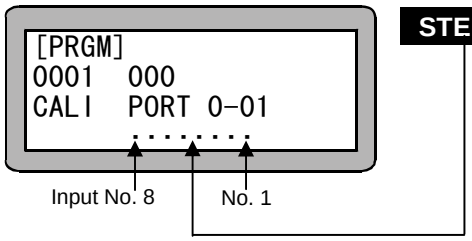


STEP 2 Use the numeric keypad to enter the tag No. to be called, and Press ENT .
(Input range: 0 to 999.)

STEP 3 Use the numeric keypad to enter a station No., and press ENT .

STEP 4 Use the numeric keypad to enter a port No., and press ENT .

NOTE
- The tag No. for STEP 2 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be called.



STEP 5 Enter the input conditions with RET 0 , IN 1 and TAG • , and press ENT .
The key functions.

RET 0 Input OFF

IN 1 Input ON

TAG • Ignored

NOTE
- The station No. is a number assigned to each unit. (Refer to section 2.4.4.)
- For the station No., port No. and bit No. which can be used, refer to section 10.1.4 "Names of general-purpose input/output ports and Teach Pendant displays".
- Don't use any port which is not present.

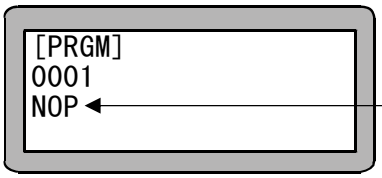
Discontinue

CALT Timer Conditional Call

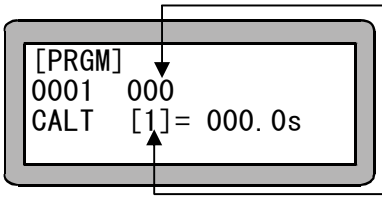
[Function] This subroutine program with specified tag No. is called when the content of the specified timer meets the setting condition.

[Explanation]
- When the content of the specified timer does not meet the setting condition, the program proceeds to the next step.
- When CALT is used in a program, another command TIMP is necessary in the program to set the timer.
- Nine timers are available: 1 to 9.
- Five comparisons are available: (=), (<), (>), (≤), (≥).
- Refer to the CAL command for the relation of the main routine and subroutine.

[Key operation]



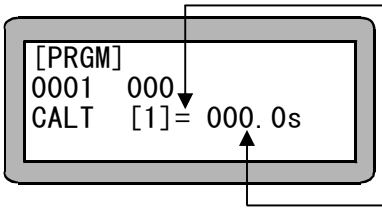
STEP 1 Press CAL 4 four times.
NOP changes to CALT.
Press ENT .



STEP 2 Use the numeric keypad to enter the tag No. to be called. Press ENT .
(Input range: 0 to 999.)

STEP 3 Use the numeric keypad to enter the timer No. and press ENT . (Input range: 1 to 9.)

NOTE
- The tag No. for STEP 2 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be called.



STEP 4 Press ALT to display operators (=, <, >, <=, >=). Select one and press ENT .

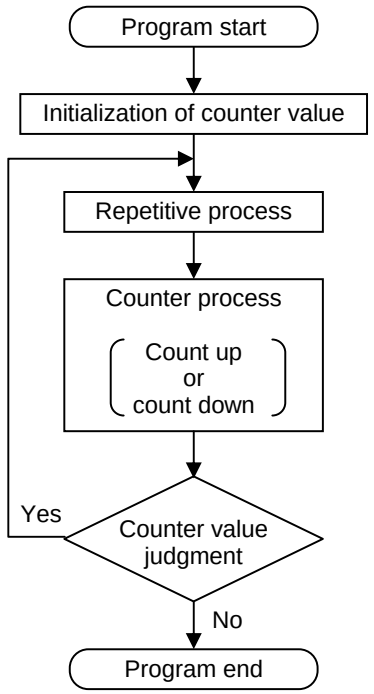
STEP 5 Use the numeric keypad to enter the timer value to be compared, then press ENT .
(Input range: 0 to 999.9)

Discontinue

CNT Preset Counter Value

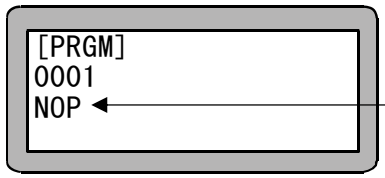
[Function] This command is used to set the value for a specified counter.

[Explanation]
- Ninety-nine counters from No. 1 through No. 99 can be used.
- Any value from 0 through 9999 can be set for each counter.
- A usage example is shown below.
  The counter is used when repetitive movement is to be carried out for a designated number of times, etc.



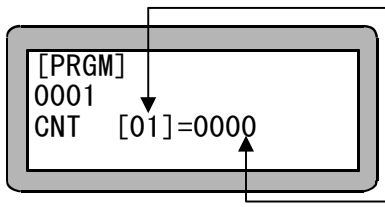
[Commands used]
CNT command
TAG command
CNT+ command
CNT- command
JMPC command
END command

[Key operation]



STEP 1

Press CNT 3 .
NOP changes to CNT.
Press ENT .



STEP 2

After entering the counter No. with the numeric keypad, press ENT .
(Input range: 1 to 99.)

STEP 3

Enter preset values (initial values) with the numeric keypad, Press ENT .
(Input range: 0 to 9999.)

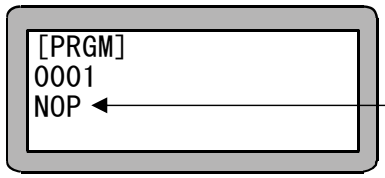
Whether to clear the counter details (set the counter details to "0") or to hold (not change the counter details) when the controller power is turned ON or reset is executed can be selected. (Refer to section 10.2.6.)

Discontinue

CNT+ Counts up

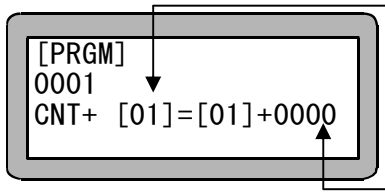
[Function] This command is used to increment the counter value for a specified counter.

[Key operation]



STEP 1

Press CNT/3 twice ENT .
NOP changes to CNT+
Press ENT .



STEP 2

After entering the counter No. with the numeric keypad and press ENT .
(Input range: 1 to 99.)

STEP 3

Enter the increment value with the numeric keypad and press ENT .
(Input range: 0 to 9999.)

NOTE ●If any value gained with addition becomes more than "9999", the counter value will stay at "9999".

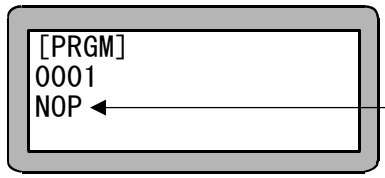
Refer to the CNT command for the usage method.

Discontinue

CNT– Counts down

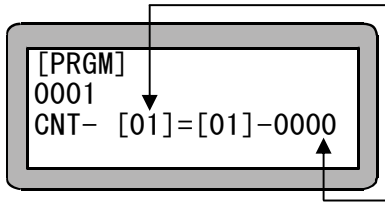
[Function] This command is used to decrement the specified counter value for the specified counter.

[Key operation]



STEP 1

Press CNT/3 three times.
NOP changes to CNT-.
Press ENT .



STEP 2

Enter the counter No. with the numeric keypad and press ENT .
(Input range: 1 to 99.)

STEP 3

Enter the decrement value with the numeric keypad and press ENT .
(Input range: 0 to 9999.)

NOTE

- If any value gained with subtraction becomes less than "0", the counter value will stay at "0".

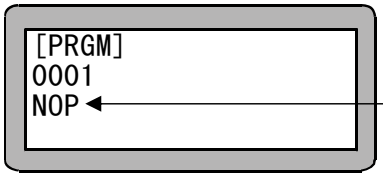
Refer to the CNT command for the usage method.

Discontinue

CNTC Counter All Clear

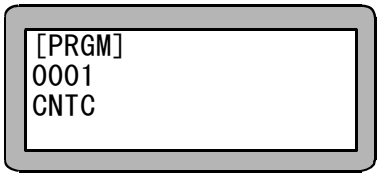
[Function] This command is used to clear all counters, that is to set all counter values to zero.

[Key operation]



STEP 1

Press F 1 , OUT 2 and IN 1 in order.
NOP changes to CNTC.
Press ENT .



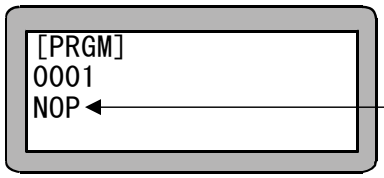
Discontinue

END Program End

[Function] The program end defined with this command

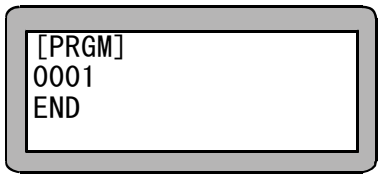
[Explanation] When executed, the END instruction will return the program step counter to step 0001 and the Electric Actuator will wait for another START input.
If the END command is executed in task 2 to 4 of multitasking, that task will return to step 0001 and stop. Then, it will wait for starting with TSTR.

[Key operation]



STEP 1

Press END/8 .
NOP changes to END.
Press ENT .



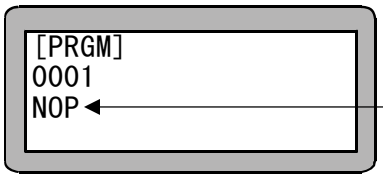
Discontinue

HOME Return to Origin

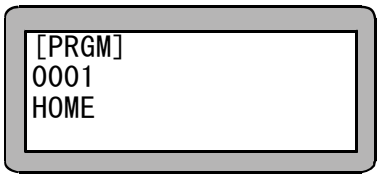
[Function] An Axis returns to origin at high Home positioning speed set with parameters. When using multitasking, only the task that executes this command will return to the origin.

[Explanation] The axes are moved in an order preset with the parameters. (Refer to section 13.3.6.)

[Key operation]



STEP 1 Press F 1 , IN 1 and MOV 9 in order. NOP changes to HOME.
Press ENT .



Refer to sections 13.4.7 Setting of return to origin speed.

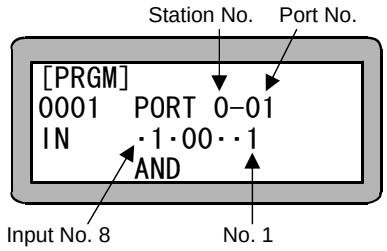
Discontinue

IN Waiting for General Purpose Port Input

[Function] This command is used to stop a program from proceeding to the next step until conditions set by general purpose input ports are satisfied.

[Explanation] If the IN command is set as shown below, when the general-purpose input port 1 No. 1 (general-purpose input port 1-1) and No. 7 (general-purpose input port 1-7) are ON and the general-purpose input port 1 No. 4 (general-purpose input port 1-4) and No. 5 (general-purpose input port 1-5) are OFF for the unit of which the station No. is set to "0", the program will move to the next step. The general-purpose input signal at the "." display section will not judge the conditions.

(Example)

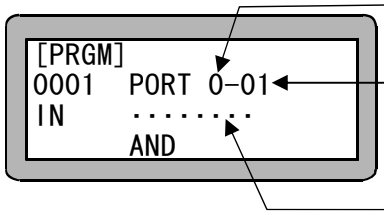


"1" ---------- Input ON
"0" ---------- Input OFF
"•" ---------- Ignore
The input signal is judged with an AND condition.

[Key operation]



STEP 1 Press IN/1 .
NOP changes to IN.
Press ENT .



STEP 2 Use the numeric keypad to enter a station No., and press ENT .

STEP 3 Use the numeric keypad to enter a port No., and press ENT .

STEP 4 Enter the input conditions with RET/0 , IN/1 - and TAG/• , and press ENT .
The key functions
RET/0 Input OFF
IN/1 Input ON
TAG/• Ignored

NOTE
- The station No. is a number assigned to each unit. (Refer to section 2.4.4.)
- For the station No., port No. and bit No. which can be used, refer to section 10.1.4 "Names of general-purpose input/output ports and Teach Pendant displays".
- Don't use any port which is not present.

Discontinue

INPC Setting General Purpose Port Input to Counter

[Function] This command is used to set general purpose input as the content of a specified counter.

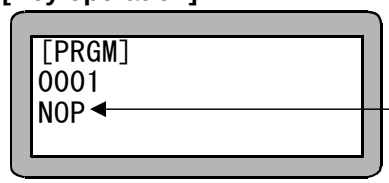
[Explanation]
- In the unit with the designated station No., the designated general-purpose input port signal is interpreted as a binary value, is converted into a decimal value and is set in the designated counter.
- The counter values that can be led in are "0 to 15" for the master unit and "0 to 255" for the slave unit. For the expansion input/output unit, the values are "0 to 255" when using the general-purpose input port 2 and "0 to 15" when using the general-purpose input port 3.

General-purpose input bit pattern (Binary)	Counter value (Decimal)
0000 0000	0
0000 0001	1
0000 0010	2
0000 0011	3
... ...	...
0000 1111	15
... ...	...
1111 1111	255

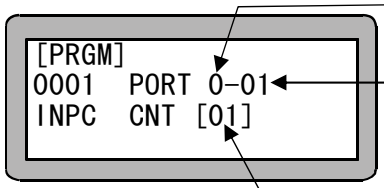
Input No. 8 No. 1

0 ... Input OFF
1 ... Input ON

[Key operation]



STEP 1 Press IN 1 twice.
NOP changes to INPC.
Press ENT .



STEP 2 Use the numeric keypad to enter a station No., and press ENT .

STEP 3 Use the numeric keypad to enter a port No., and press ENT .

STEP 4 Enter a counter No. with the numeric keypad and press ENT .
(Input range: 1 to 99.)

NOTE
- The station No. is a number assigned to each unit. (Refer to section 2.4.4.)
- For the station No., port No. and bit No. which can be used, refer to section 10.1.4 "Names of general-purpose input/output ports and Teach Pendant displays".
- Don't use any port which is not present.

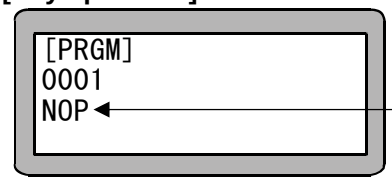
Discontinue

JMP Unconditional Jump

[Function] The control jumps to a specified tag No.

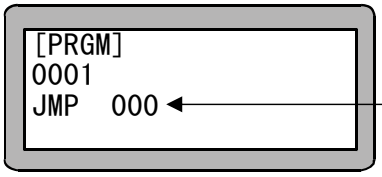
[Explanation]
- This command is used to instruct a program to jump unconditionally to a step specified by a tag No.
- Refer to the TAG command for usage examples.

[Key operation]



STEP 1

Press JMP/5 .
NOP changes to JMP.
Press ENT .



STEP 2

After entering a tag No. with the numeric keypad, press ENT .
(Input range: 1 to 999.)

NOTE
- The tag No. for STEP 2 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be jumped to.

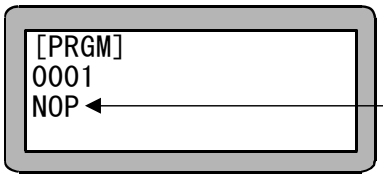
Discontinue

JMPC Counter Conditional Jump

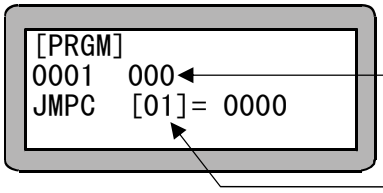
[Function] This command is used to instruct a program to jump to a step with a specified tag No. only when the set counter value meets specified conditions in the program.

[Explanation]
- When the set counter value does not meet the specified conditions, the program proceeds to the next step.
- Programs for which this command is used need another program to execute setting of the counter value, CNT and to increment and decrement the counter value, CNT+, CNT−.
- Five comparisons are available: (=), (<), (>), (≤), (≥).
- Refer to the CNT command for the usage methods.

[Key operation]



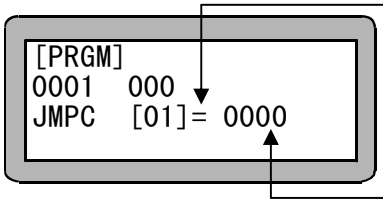
STEP 1 Press JMP/5 three times. NOP changes to JMPC. Press ENT .



STEP 2 Use the numeric keypad to enter the tag No. which the program jumps to, then press ENT . (Input range: 1 to 999.)

STEP 3 Enter a counter No. with the numeric keypad and press ENT . (Input range: 1 to 99.)

NOTE
- The tag No. for STEP 2 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be jumped to.



STEP 4 Press ALT to display operators (=, <, >, <=, >=). Select one and press ENT .

STEP 5 Use the numeric keypad to enter a counter value to be compared and press ENT . (Input range: 0 to 9999.)

Discontinue

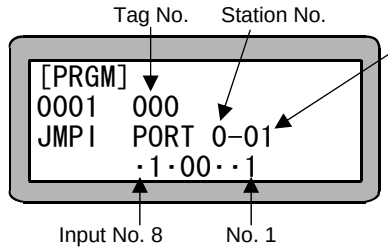
JMPI Input Conditional Jump

[Function] This command is used to instruct a program to jump to a step with a specified tag number when the input conditions of a general purpose input signal meet the set conditions in the program.

[Explanation]

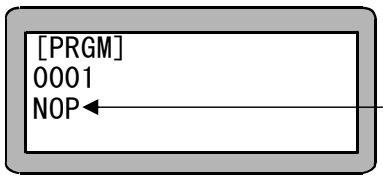
- The jump is executed only when the input of ports set by this command satisfy the ON/OFF conditions of general input port; if they do not, the program proceeds to the next step.
- If the JMPI command is set as shown below, when the general-purpose input port 1 No. 1 (general-purpose input port 1-1) and No. 7 (general-purpose input port 1-7) are ON and the general-purpose input port 1 No. 4 (general-purpose input port 1-4) and No. 5 (general-purpose input port 1-5) are OFF for the unit of which the station No. is set to "0", the program will jump to the designated step. The general-purpose input signal at the "•" display section will not judge the conditions.

(Example)

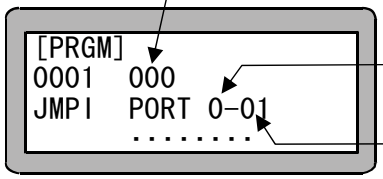


"1" ---------- Input ON
"0" ---------- Input OFF
"•" ---------- Ignore
The input signal is judged with an AND condition.

[Key operation]



STEP 1 Press JMP/5 twice.
NOP changes to JMPI.
Press ENT .



STEP 2 Use the numeric keypad to enter the tag No. the program jumps to, then press NEXT .
(Input range: 1 to 999.)

STEP 3 Use the numeric keypad to enter a station No., and press ENT .

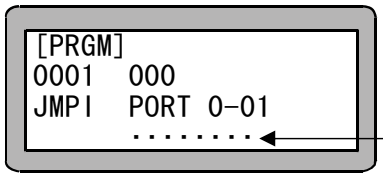
STEP 4 Use the numeric keypad to enter a port No., and press ENT .

NOTE

- The tag No. for STEP 2 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be jumped to.

Discontinue

[Key operation]



STEP 5

Enter the input conditions with RET 0 , IN 1 - and TAG • , and press ENT .
The key functions.

RET 0 Input OFF

IN 1 Input ON

TAG • Ignored

NOTE

- The station No. is a number assigned to each unit. (Refer to section 2.4.4.)
- For the station No., port No. and bit No. which can be used, refer to section 10.1.4 "Names of general-purpose input/output ports and Teach Pendant displays".
- Don't use any port which is not present.

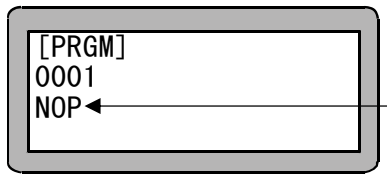
Discontinue

JMPT Timer Conditional Jump

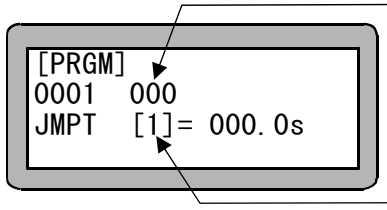
[Function] This command is used to instruct a program to jump to a step with a specified tag No. only when the specified timer value meets the set conditions in the program.

[Explanation]
- When the specified timer value does not meet the set conditions, the program proceeds to the next step.
- Programs for which this command is used need another program to command the timer setting (TIMP).
- Nine timers from No. 1 to No. 9 are used.
- Five comparisons are available: (=), (<), (>), (≤), (≥).
- Refer to the TIMP command for usage examples.

[Key operation]



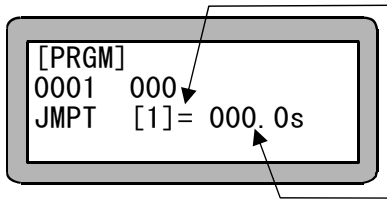
STEP 1 Press JMP/5 four times. NOP changes to JMPT. Press ENT .



STEP 2 Use the numeric keypad to enter the tag No. which the program jumps to, then press ENT . (Input range: 1 to 999.)

STEP 3 Use the numeric keypad to enter the timer No. and press ENT . (Input range: 1 to 9).

NOTE
- The tag No. for STEP 2 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be jumped to.



STEP 4 Press ALT to display operators (=, <, >, <=, >=). Select one and press ENT .

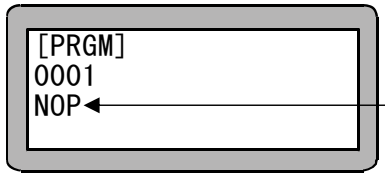
STEP 5 Use the numeric keypad to enter a timer value to be compared and press ENT . (Input range: 0 to 999.9.)

LOOP MVM Loop

[Function] This command is used to control loop operation in the specified MVM table.

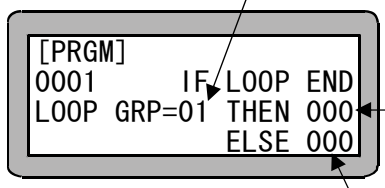
[Explanation] When this command is executed, the counter specified in the MVM table of the specified group is controlled. the program jumps to the step with the tag No. specified by the content and conditions of the counter.

[Key operation]



STEP 1

Press F 1 followed by IN 1 and JMP 5 .
NOP changes to LOOP.
Press ENT .



STEP 2

Use the numeric keypad to enter the group No. (MVM table No.), then press ENT .
(Input range: 1 to 32.)

STEP 3

Enter a tag No. for THEN with the numeric keypad and press ENT .
(Input range: 1 to 999.)

STEP 4

Enter a tag No. for ELSE with the numeric keypad and press ENT .
(Input range: 1 to 999.)

Tag for THEN: A program jumps to the THEN tag when an MVM program has completed.
Tag for ELSE: A program jumps to the ELSE tag when an MVM program has not completed.

NOTE

- The tag No. for STEP 3 and STEP 4 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be designated.
- For an application example of the command, refer to "Palletizing work with MVM commands" (section 4.1.7).

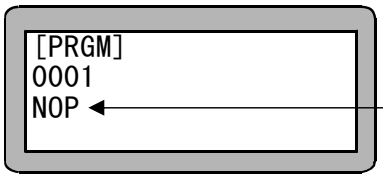
Discontinue

MINI MVM Counter Initial

[Function] This command is used to set "1" to the counter in a specified group used for matrix movement.

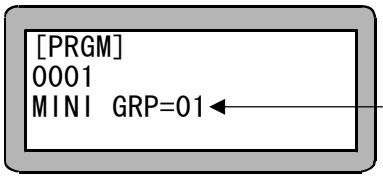
[Explanation]
- This command MINI is a command related to matrix movement and used together with MVM and LOOP.
- When MINI is executed, the values of all counters in the MVM table of the specified group No. are set to "1."

[Key operation]



STEP 1

Press F 1 followed by IN 1 and CNT 3 .
NOP changes to MINI.
Press ENT .



STEP 2

Enter a group No. (MVM group No.) with the numeric keypad and press ENT .
(Input range: 1 to 32.)

? When this command is used, the values of all counters in a specified MVM table are set to "1."

NOTE ●For an application example of the command, refer to "Palletizing work with MVM commands" (section 4.1.7).

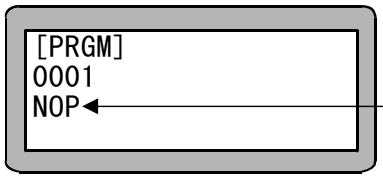
Discontinue

MOVP Axis Movement to the Indirectly Designated Point by Coordinate Table

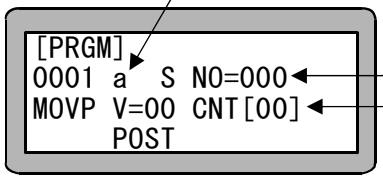
[Function] The Electric Actuator moves a point set indirectly by coordinate table No.

[Explanation]
- This command is used to execute Electric Actuator movement to a point set by the coordinate table in parameter mode.
- There are two ways to designate the coordinate table No. : directly and indirectly by counter.
- When using multitasking, a separate coordinate table is used for each task.

[Key operation]



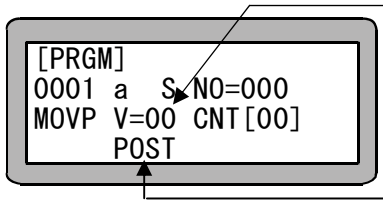
STEP 1 Press MOV 9 .
NOP changes to MOVP.
Press ENT .



STEP 2 Press ALT and select either "a" (absolute coordinate) or i (relative coordinate) and press ENT .

STEP 3 In case of designating the coordinate table No. directly, enter the coordinate table No. with the numeric keypad and press ENT .
(Input range: 0 to 999. 0 means "No designation.")

STEP 4 In case of designating the coordinate table No. indirectly by counter, enter the counter No. with the numeric keypad, then press ENT .
(Input range: 0 to 99. 0 means "No appointment.")



STEP 5 Enter the speed table No. with the numeric keypad and press ENT .
(Input range: 0 to 10.) When V = 0 is entered, the speed is set to the designated speed preset by SPD command.

STEP 6 Press ALT and select either POST (position) or COSE (course) and press ENT .

Discontinue

NOTE

- If neither STEP 3 nor STEP 4 or if both are designated, a "PARAMETER ERROR" will occur when the command is executed. If the counter No. is designated in STEP 3 and the counter details are "0", a "TABLE No. ERROR" will occur when the command is executed.
- For details of a (absolute coordinate position), i (relative coordinate position), POST and COSE, refer to "MOV System Command Words and Parameters" (section 3.2.4).



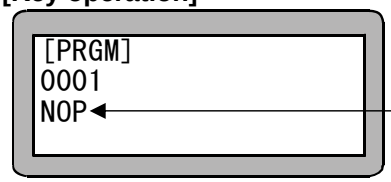
If the cursor is at STEP 2 to 6, press F 1 to change to the coordinate table display and set the coordinates. (Refer to section 13.5.1 on how to set the coordinate table.)
Press ESC to return to the original display.

Discontinue

MVB Return to Previous Point

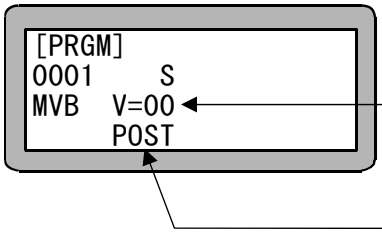
[Function] This command is used to return the Electric Actuator to the point prior to the current position, form which the previous move command was is used.

[Key operation]



STEP 1

Press F 1 , IN 1 and OUT 2 .
NOP changes to MVB.
Press ENT .



STEP 2

Enter the speed No. with the numeric keypad and press ENT . (Input range: 0 to 10.) When V = 0 is entered, the speed is set to the designated speed preset by SPD command.

STEP 3

Press ALT and select either POST (position) or COSE (course) and press ENT .

NOTE ●For details of POST and COSE, refer to "MOV System Command Words and Parameters" (section 3.2.4).

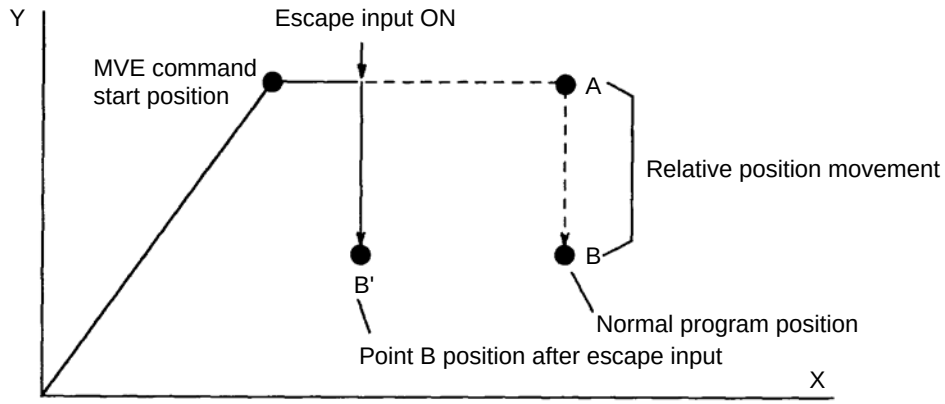
Discontinue

MVE Escape Move

[Function] When escape input signal set in the mode setting is ON while an MVE command is executed, the current program step will be recognized completed and the program will proceed to the next step.

[Explanation]

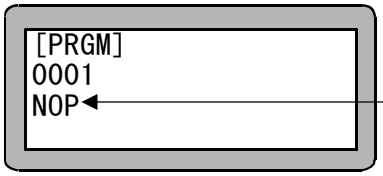
- If escape input is set in the mode setting, the set general-purpose input signal will function as the escape input during execution of the MVE command. When this input turns ON, the axis will decelerate to a stop, and then the next step will be executed. (Refer to section 13.2.3.)
- The deceleration time will be the time set with the ACC command. If ACC is not set, the speed in ACC5 will be used.
- If the MVE command is executed while the escape input is ON, the MVE command will not be executed, and the next step will be executed.
- The set general-purpose input signal will be the escape input only when the MVE command is executed. It will function as the general-purpose input port during commands other than the MVE command.
- If the axis has been decelerated and stopped with the escape input and the next command is a move command to a relative position, the relative movement will take place using this stop position as a reference. (B → B' in Fig. shown below.)



- The MVE command includes a method to directly designate the coordinate table No. and a method to designate the coordinate table No. indirectly using a counter.

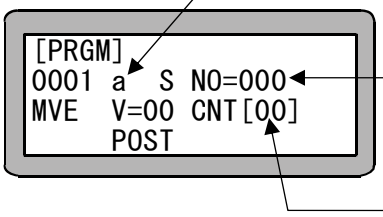
Discontinue

[Key operation]



STEP 1

Press F 1 , IN 1 and TIM 6 .
NOP changes to MVE.
Press ENT .



STEP 2

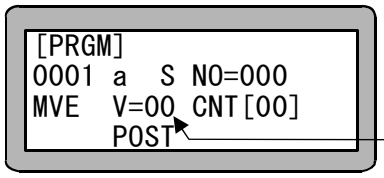
Press ALT to select "a" (absolute coordinate) or "i" (relative coordinate) and press ENT .

STEP 3

Enter the coordinate table No. with the numeric keypad and press ENT .
(Input range: 0 to 999. 0: No designation.)

STEP 4

Use the numeric keypad to enter the counter No., which designates the coordinate table No. of the destination. Press ENT .
(Input range: 0 to 99. 0: No designation.)



STEP 5

Enter the speed table No. with the numeric keypad and press ENT .
(Input range: 0 to 10.) When V = 0 is entered, the speed is set to the designated speed preset by SPD command.

NOTE

- If neither STEP 3 nor STEP 4 or if both are designated, a "PARAMETER ERROR" will occur when the command is executed. If the counter No. is designated in STEP 3 and the counter details are "0", a "TABLE No. ERROR" will occur when the command is executed.
- For details of a (absolute coordinate position), i (relative coordinate position), refer to "MOV System Command Words and Parameters" (section 3.2.4).

If the cursor is at STEP 2 to 5, press F 1 to change to the coordinate table display and set the coordinates. (Refer to section 13.5.1 on how to set the coordinate table.)
Press ESC to return to the original display.

Discontinue

MVM Palletizing Move

[Function] This command is used to execute palletizing movement according to the MVM table of a specified group.

[Explanation]

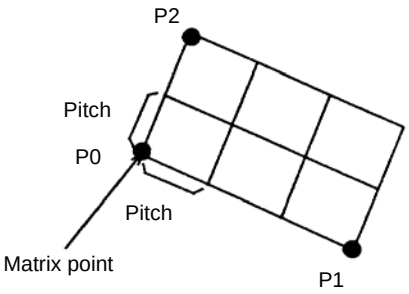
- Before using the MVM command, you set the parameters listed below relating to the MVM operation in parameter mode.
  - Coordinate table No. of operation origin points P0, P1 and P2.
  - Numbers of objects to be picked up and carried
  - Counter No. used for the palletizing operation

Refer to section 13.5.4 MVM Table Setting for the parameter setting.

- When MVM command is executed, the Electric Actuator moves to the coordinate calculated by the following equations:

Coordinates of each matrix point
P0: (X_0, Y_0)
P1: (X_1, Y_1)
P2: (X_2, Y_2)

$P_0 \rightarrow P_1$ pieces: n_1
$P_0 \rightarrow P_2$ pieces: n_2



Value of counter used in $P_0 \rightarrow P_1$ direction: C_1
Value of counter used in $P_0 \rightarrow P_2$ direction: C_2

C_1 and C_2 are incremented by one with the LOOP command. These are variables that are the details (value) of the counter.

MVM calculation expression

$X \text{ coordinate value} = X_0 + x_1 (C_1 - 1) + x_2 (C_2 - 1)$
$Y \text{ coordinate value} = Y_0 + y_1 (C_1 - 1) + y_2 (C_2 - 1)$
Where, x_1 and y_1 are the X and Y elements of the pitch in the $P_0 \rightarrow P_1$ direction

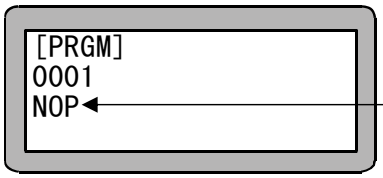
$$x_1 = \frac{X_1 - X_0}{n_1 - 1}, \quad y_1 = \frac{Y_1 - Y_0}{n_1 - 1}$$

x_2 and y_2 are the X and Y elements of the pitch in the $P_0 \rightarrow P_2$ direction

$$x_2 = \frac{X_2 - X_0}{n_2 - 1}, \quad y_2 = \frac{Y_2 - Y_0}{n_2 - 1}$$

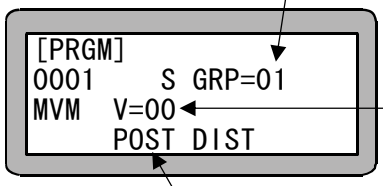
Discontinue

[Key operation]



STEP 1

Press F 1 , IN 1 and CAL 4 .
NOP changes to MVM.
Press ENT .



STEP 2

Enter the group No. with the numeric keypad and press ENT .
(Input range: 1 to 32.)

STEP 3

Enter the speed No. with the numeric keypad and press ENT .
(Input range: 0 to 10.)
When V = 0 is entered, the speed becomes the value preset by the SPD command.

STEP 4

Press ALT and select either POST (position) or COSE (course) and press ENT .

NOTE

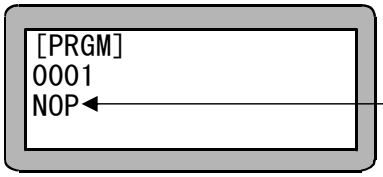
- For an application example of the command, refer to "Palletizing work with MVM commands" (section 4.1.7).
- For details of POST and COSE, refer to "MOV System Command Words and Parameters" (section 3.2.4).

Discontinue

NOP No Operation

[Function] There is no execution at this step, and the program proceeds to the next step.

[Key operation]



STEP 1 Press NOP - , and press ENT .

NOTE NOP is entered in any program step in which no instruction is written.

Discontinue

OFS Offset

[Function] This command is used to shift the absolute position for an axis by the amount of the specified offset value.

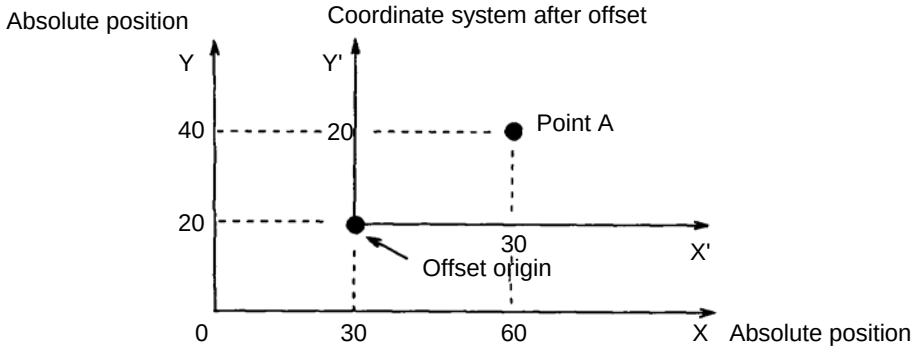
[Explanation]
- It can be used for move commands (MOVP, MVB, MVE, and MVM).
- The OFS command, once executed, remains effective until the next OFS command is executed.
- Enter "OFS X = 0, Y = 0" into the program and execute it to release the offset.
- Note that the current position after the execution of the offset command is displayed as follows.

[Current position monitor display] = [absolute position] − [executed offset value]

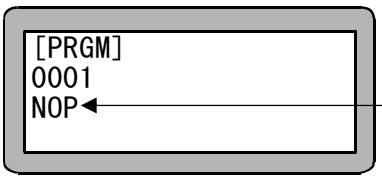
(Example)

When offset value is X = 30, Y = 20

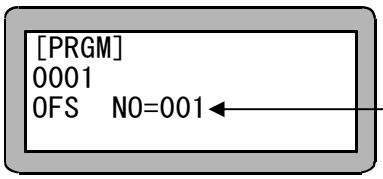
Point A absolute coordinates:	X = 60, Y = 40
−) Executed offset value:	X = 30, Y = 20
Current position monitor display:	X = 30, Y = 20



[Key operation]



STEP 1 Press F1 followed by IN 1 , IN 1 (press twice).
NOP changes to OFS.
Press ENT .



STEP 2 Enter the coordinate table No. with the numeric keypad and press ENT .
(Input range: 1 to 999)

Discontinue

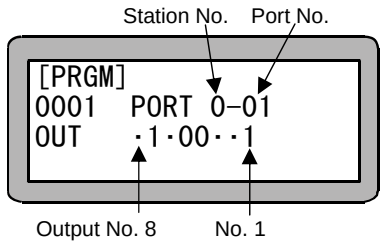
OUT General-purpose Port Output

[Function] The general-purpose output of the unit with the designated station No. is turned ON or OFF.

[Explanation]

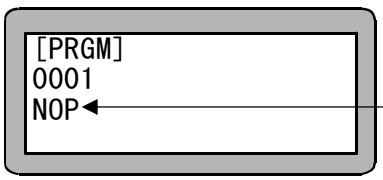
- After execution, the output state is held until the next OUT command is issued. Even if the END command is executed and the program ended, the output signal will be held.
- To turn OFF the output signal, set "0" at the output bit desired to be turned OFF with OUT command, or turn OFF the power supply of the controller.
- Whether to hold or clear (turn OFF) the general-purpose output signal in the mode setting and continuous start signal state when the reset signal is input can be selected. (Refer to sections 10.2.6 and 15.2.11.)
- If the OUT command is set as shown below, the general-purpose output port 1 No. 1 (general-purpose output port 1-1) and No. 7 (general-purpose output port 1-7) will turn ON and the general-purpose output port 1 No. 4 (general-purpose output port 1-4) and No. 5 (general-purpose output port 1-5) will turn OFF for the unit of which the station No. is set to "0". The general-purpose output signal at the "•" display section will hold the current signal state.

(Example)



"1" ---------- Output ON
"0" ---------- Output OFF
"•" ---------- Hold current output state

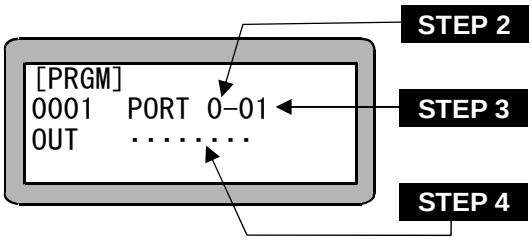
[Key operation]



STEP 1

Press OUT 2 .
NOP changes to OUT.
Press ENT .

Discontinue



Use the numeric keypad to enter a station No., and press ENT .

Use the numeric keypad to enter a port No., and press ENT .

Enter the output conditions with RET 0 , IN 1 , TAG • . Then press ENT .

Key functions for output conditions:

RET 0	Output OFF
IN 1	Output ON
TAG •	Hold current output state

NOTE

- The station No. is a number assigned to each unit. (Refer to section 2.4.4.)
- For the station No., port No. and bit No. which can be used, refer to section 10.1.4 "Names of general-purpose input/output ports and Teach Pendant displays".
- Don't use any port which is not present.

Discontinue

OUTC Counter Value General-purpose Port Output

[Function] The counter details are output to the general-purpose port of the designated station No.

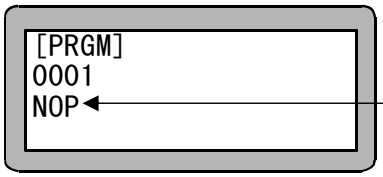
[Explanation]
- The designated counter details are interpreted as a binary value, and are output to the designated general-purpose output port.
- The counter values that can be output are "0 to 15" for the master and slave unit, and "0 to 255" for the expansion input/output unit. (A parameter error will occur if the counter value exceeds this range.)

Counter value (Decimal)	General-purpose output bit pattern (Binary)
0	0000 0000
1	0000 0001
2	0000 0010
3	0000 0011
•	• •
•	• •
•	• •
15	0000 1111
•	• •
•	• •
•	• •
255	1111 1111

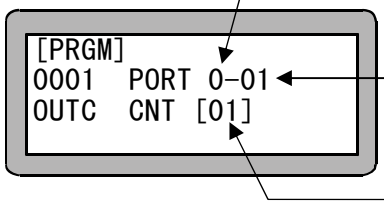
Output No. 8 No. 1

0 ... Output OFF
1 ... Output ON

[Key operation]



STEP 1 Press OUT 2 three times.
NOP changes to OUTC.
Press ENT .



STEP 2 Use the numeric keypad to enter a station No., and press ENT .

STEP 3 Use the numeric keypad to enter a port No., and press ENT .

STEP 4 Enter the counter No. with the numeric keypad and press ENT .
(Input range: 1 to 99)

NOTE
- The station No. is a number assigned to each unit. (Refer to section 2.4.4.)
- For the station No., port No. and bit No. which can be used, refer to section 10.1.4 "Names of general-purpose input/output ports and Teach Pendant displays".
- Don't use any port which is not present.

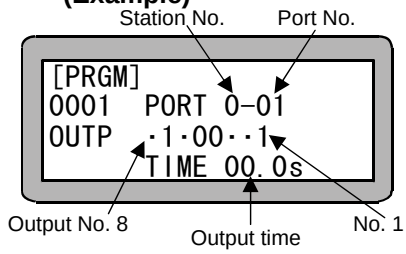
Discontinue

OUTP General-purpose Port Pulse Output

[Function] The output of the designated general-purpose output port of the designated station No. unit is turned ON or OFF for a designated time.

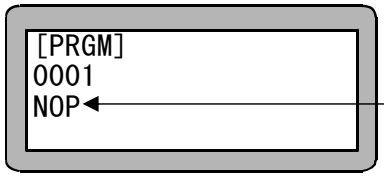
[Explanation]
- The next step will not be moved to unless the set time has passed.
- The time can be set between 0 and 99.9 sec. in one second increments.
- If the OUTP command is set as shown below, the general-purpose output port 1 No. 1 (general-purpose output port 1-1) and No. 7 (general-purpose output port 1-7) will turn ON and the general-purpose output port 1 No. 4 (general-purpose output port 1-4) and No. 5 (general-purpose output port 1-5) will turn OFF for the unit of which the station No. is set to "0". The general-purpose output signal at the "•" display section will hold the current signal state.

(Example)

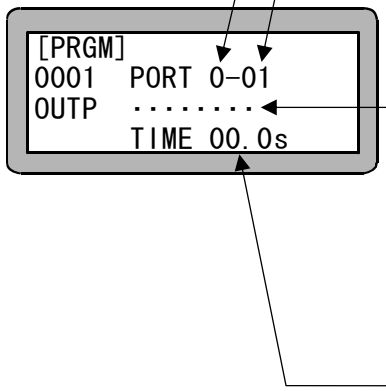


"1" .....Output ON
"0" .....Output OFF
"•" .....Hold current output state

[Key operation]



STEP 1 Press OUT 2 twice.
NOP changes to OUTP.
Press ENT .



STEP 2 Use the numeric keypad to enter a station No., and press ENT .

STEP 3 Use the numeric keypad to enter a port No., and press ENT .

STEP 4 Enter output conditions with RET 0 , IN 1 , TAG • . Then press ENT .
Key functions for output conditions:

RET 0 Output OFF
IN 1 Output ON
TAG • Hold current output state.

STEP 5 Enter the output time with the numeric key pad and press ENT . (Input range:0 to 99.9 sec.)

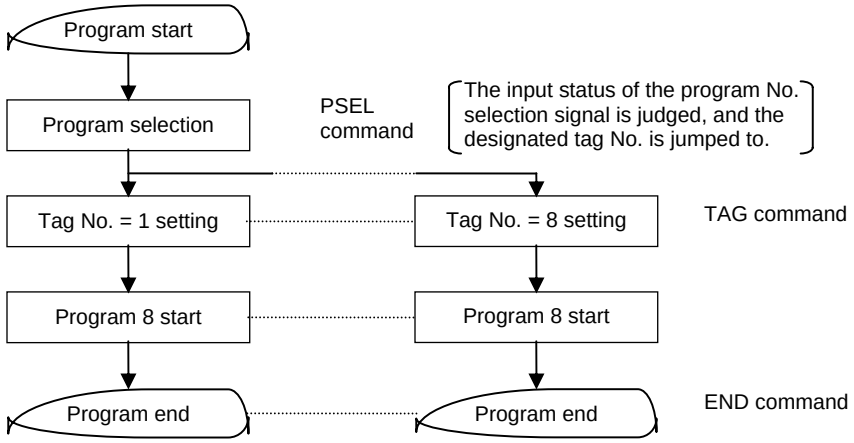
NOTE
- The station No. is a number assigned to each unit. (Refer to section 2.4.4.)
- For the station No., port No. and bit No. which can be used, refer to section 10.1.4 "Names of general-purpose input/output ports and Teach Pendant displays".
- Don't use any port which is not present.

Discontinue

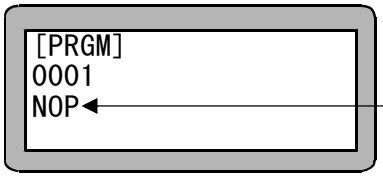
PSEL Program Selection

[Function] The status of the program No. selection input signal set with the mode setting is judged, and the tag No. is jumped to according to the input state. (Refer to section 10.2.9.)

[Explanation] ● The program No. input signal is judged at the point the PSEL command is executed.

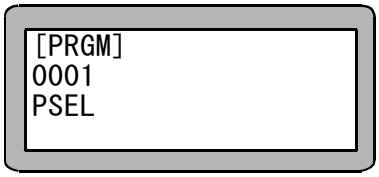


[Key operation]



STEP 1

Press F 1 , and then press IN 1 and RET 0 . NOP changes to PSEL.
Press ENT .



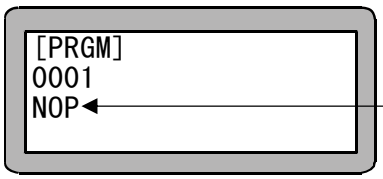
Refer to section 13.2.5 for details on the bit No. selection input bit designation.
During multitasking, if the PSEL command is input for multiple tasks and is executed, the "NO TAG FOUND" error will occur. Jumping to a tag No. in another task is also not possible.

Discontinue

RET Return Command

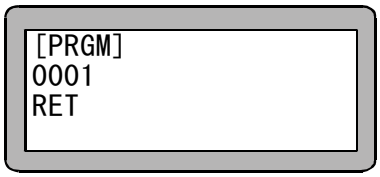
[Function] This command is used with a Call command (CAL, CALI, CALC and CALT) in pairs to return the program to the next step following the step called by it. The subroutine program ends when this command is executed.

[Key operation]



STEP 1

Press RET/0 .
NOP changes to RET.
Press ENT .



Refer to the CAL command for the ideology on the main routine and subroutine.

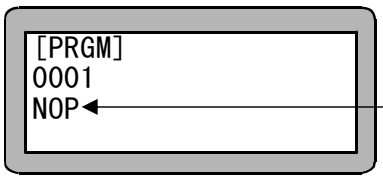
Discontinue

SPD Speed Command

[Function] This command is used to set the speed for the actuator movement.

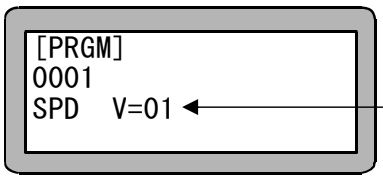
[Explanation]
- Ten levels of speed from SPD1 to SPD10 can be set.
- This command must be set before a Move command (MOVP, MVB, MVE and MVM.)
- When using multitasking, a setting must be made for each task.
- The speed at each level can be changed with the speed table. (Refer to section 13.5.2.)
- Once the speed is set, this value remains unchanged until the next setting. If no speed value is set, the speed defaults to the SPD1.
- Do not set the speed higher than the maximum allowed. If the speed value exceeds the maximum, the speed defaults to the speed set in parameter 2. (Refer to section 13.4.6.)
- The allowable maximum speed depends on the length of the axis stroke and ball screw lead. (Refer to the Electric Actuator instruction manual for details.)

[Key operation]



STEP 1

Press SPD/7 followed by ENT .
NOP changes to SPD.
Press ENT .



STEP 2

Enter speed No. with the numeric keypad and press ENT .
(Input range: 1 to 10.)

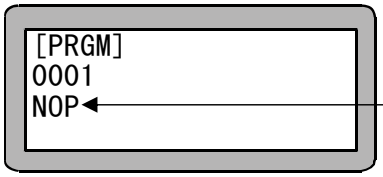
Discontinue

STOP Stop Command

[Function] This command is used to stop the program and display the next program step.
When using multitasking, the task that executed this command will stop.

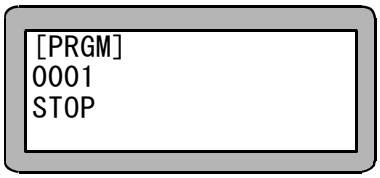
[Explanation] If the program is to be continued after stopping it with a command, input the start signal. If the program is to be returned to step No. 1 and then executed, input the reset signal, and then input the start signal. Note that the setting of the continuous start mode and the status of the continuous start input signal are related. (Refer to section 10.2.6.)

[Key operation]



STEP 1

Press RET/0 twice followed by ENT .
NOP changes to STOP.
Press ENT .



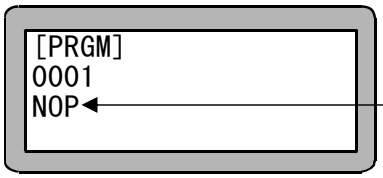
Discontinue

SVOF Servo-off Command

[Function] The axis is set in servo-free condition.
When using multitasking, the axis of the task that executed this command will enter the servo-free condition.

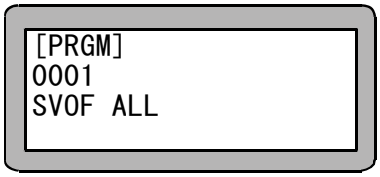
[Explanation] When the SVOF command is executed, any axis equipped with a brake is broke.

[Key operation]



STEP 1

Press F 1 , IN 1 and MVC 8 .
NOP changes to SVOF.
Press ENT .



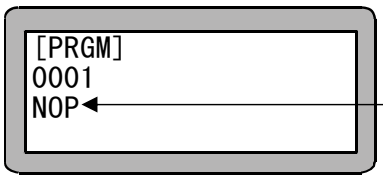
Discontinue

SVON Servo-on Command

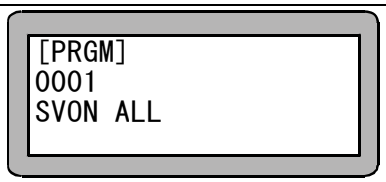
[Function] The axis is set in servo-lock condition.
When using multitasking, the axis of the task that executed this command will enter the servo-lock condition.

[Explanation] When SVON command is executed, any axis brake is released.

[Key operation]



STEP 1 Press F 1 , IN 1 and SPD 7 .
NOP changes to SVON.
Press ENT .

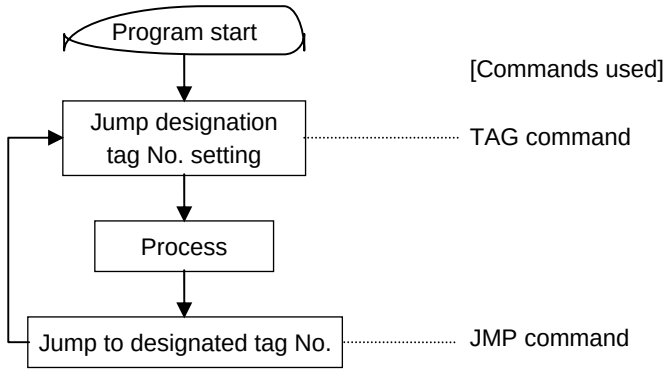


Discontinue

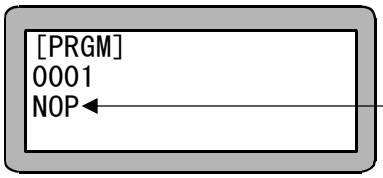
TAG Tag Command

[Function] This command is used to enter the tag No. in the program.

[Explanation]
- The tag No. is an address that designates the jump designation.
- The tag No. can be entered from No. 1 to 999.
- When this command is executed, the program proceeds to the next step with no program execution similarly to NOP command.
- A usage example is shown below.
  This is a program that repeats a certain process.

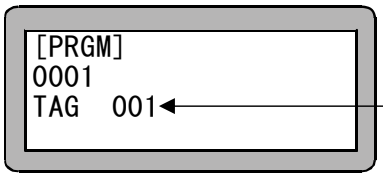


[Key operation]



STEP 1

Press TAG/• .
NOP changes to TAG.
Press ENT .



STEP 2

Enter the tag No. with the numeric keypad and press ENT .
(Input range: 1 to 999.)

NOTE If the same tag No. is input, the "DOUBLE TAG ERR." will occur.
When using multitasking, if the same tag No. is input even in another task, the "DOUBLE TAG ERR." will occur.

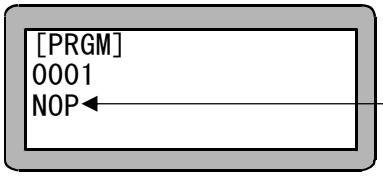
Discontinue

TCAN Task Forced End

[Function] The designated task is ended.

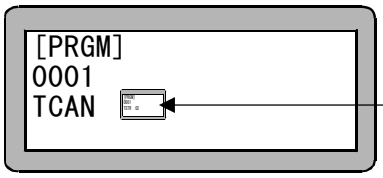
[Explanation] The designated task will be set in the same state as when that task executes the END command.

[Key operation]



STEP 1

Press F 1 and then OUT 2 and TIM 6 .
NOP changes to TCAN.
Press ENT .



STEP 2

Enter the task No. with the numeric keypad and press ENT . (Input range: 2 to 4)

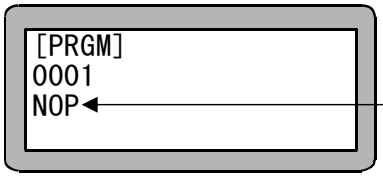
Discontinue

TIM Wait Command

[Function] This command is used to stop the program execution for a specified period of time.

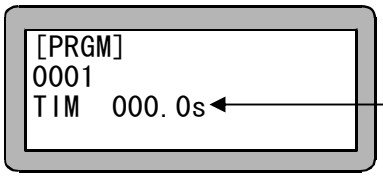
[Explanation] The amount of time to wait can be set from 0.0 to 999.9 seconds in increments of 0.1 seconds.

[Key operation]



STEP 1

Press TIM/6.
NOP changes to TIM.
Press ENT .



STEP 2

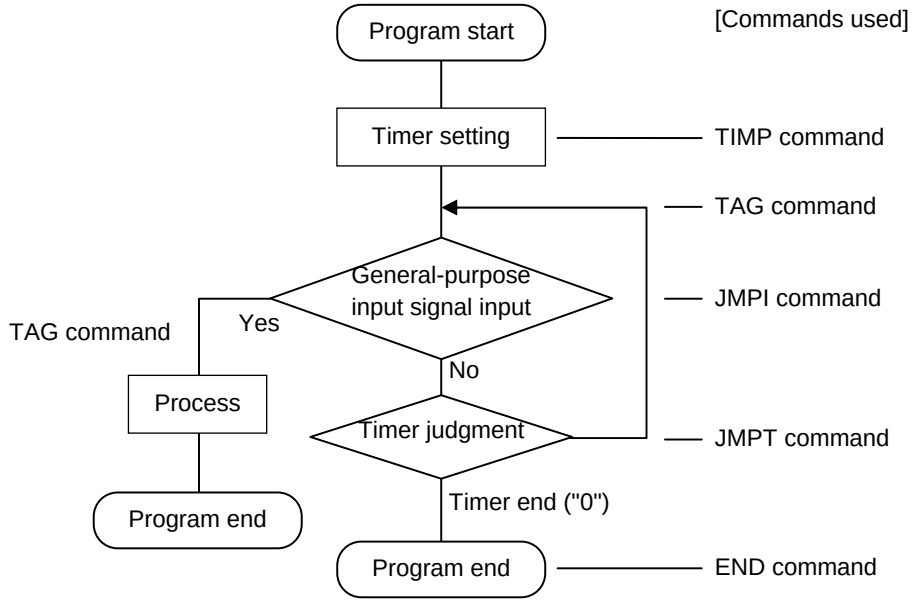
Enter the wait period (in seconds) with the numeric keypad and press ENT .
(Input range: 0.0 to 999.9)

Discontinue

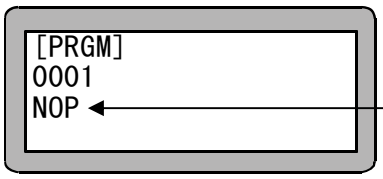
TIMP Timer Preset Command

[Function] This command is used to set the initial time value to a specified timer.

[Explanation]
- There are nine timers from No. 1 to No. 9 Initial time value can be set in each timer from 0.0 to 999.9 seconds in increments of 0.1 second.
- After the time is set, the timer begins counting to 0. Program execution, however, proceeds to the following steps independently of the count down.
- This command is used together with JMPT and CALT.
- A usage example is shown below.
  The program waits the specified time for the general-purpose input signal input from an external source. If there is an input signal, it is processed. If there is no signal input within the designated time, the program is ended.

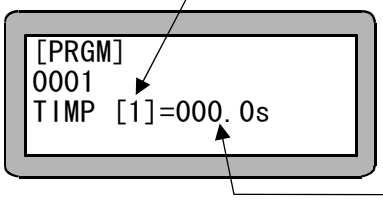


[Key operation]



STEP 1

Press TIM 6 twice.
NOP changes to TIMP.
Press ENT .



STEP 2

Enter the timer No. with the numeric keypad and press ENT .
(Input range: 1 to 9.)

STEP 3

Enter the preset value (initial value) with the numeric keypad and press ENT .
(Input range: 0.0 to 999.9.)

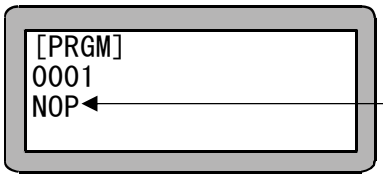
Discontinue

TRSA Task Restart

[Function] The designated task is restarted.

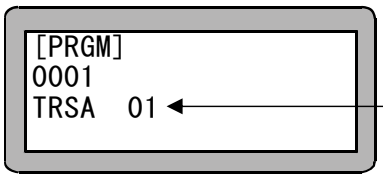
[Explanation]
- The task that was started and then stopped with the STOP command or TSTO command will enter the ready state again.
- If this command is executed to a task that has not been started once, an error will occur.

[Key operation]



STEP 1

Press F 1 and then OUT 2 and JMP 5.
NOP changes to TRSA.
Press ENT .



STEP 2

Enter the task No. with the numeric keypad and press ENT . (Input range: 1 to 4)

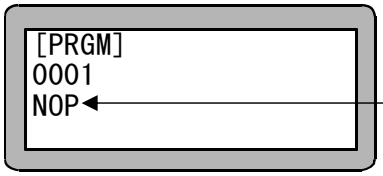
Discontinue

TSTO Task Temporary Stop

[Function] The designated task is stopped temporarily.

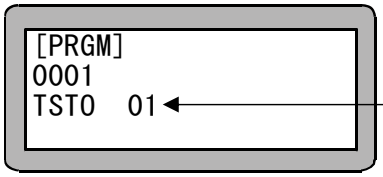
[Explanation] The designated task will be set in the same state as when that task executes the STOP command.

[Key operation]



STEP 1

Press F 1 and then OUT 2 and CAL 4 .
NOP changes to TSTO.
Press ENT .



STEP 2

Enter the task No. with the numeric keypad and press ENT . (Input range: 1 to 4)

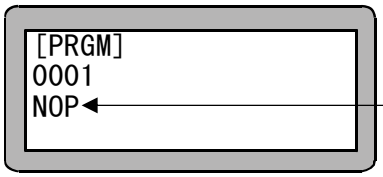
Discontinue

TSTR Task Start

[Function] The designated task is started.

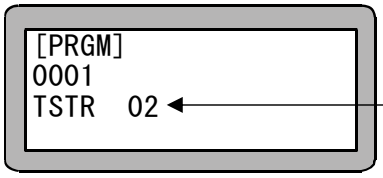
[Explanation] When this command is executed, the designated task will enter the ready state. Task 1 will start from the Teach Pendant or system input start, so it will not start with this command.

[Key operation]



STEP 1

Press F 1 and then OUT 2 and CNT 3 .
NOP changes to TSTR.
Press ENT .



STEP 2

Enter the task No. with the numeric keypad and press ENT . (Input range: 2 to 4)

This page is blank.

Discontinue

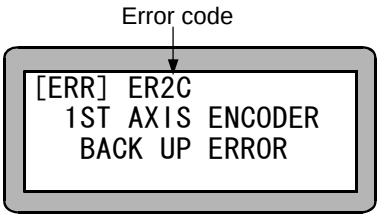
Chapter 19 Error messages

- When an error is generated, the ERROR LED (red) on the front panel of the controller will light and the Teach Pendant will display error messages.
- If an error occurs during multitasking, the Teach Pendant display will automatically change to the task in which an error occurred, and an error message will display.
- There are four ways to clear an error.
  When an error cannot be cleared, the power must be turned off and then on again.

1. Teach Pendant clear	Press CLEAR on the Teach Pendant.
2. System input clear	Input a RESET signal to the system by setting pin No.31 ON. Reset will be executed. (Refer to section 10.2.4.)
3. CC-Link clear	Perform a reset input. (Set RYn3 to ON.)(*1)
4. DeviceNet clear	Perform a reset input. (Set the start device+3 to ON.)(*2)

*1: n: Address assigned to the master unit by the station number setting
*2: +3: Offset amount from the start device (unit: bits)

■ 19.1 Error Display



When an error occurs, the error code and error message are displayed on the teach pendant. Check the meaning and cause of the error from the error list, and perform the remedy.

When multiple errors occur, the error that was detected first is displayed.
Although all errors are cleared by the error clear procedure, if these errors include an error that cannot be cleared, that error will be displayed, and the power must be turned off and then on again.

Discontinue

■ 19.2 Error Table

No.	Error name	Meaning/Cause	Remedy	State
ER02	Incompatible controller	An incompatible type of T/P was connected to the controller.	Check the T/P and controller model, and use the correct type.	L-*G-N
ER12	Watchdog timer error	The CPU is being overloaded.	Turn the power off and then on again. The CPU may be overloaded due to noise. Refer to section 2.4.3 for measures for reducing and preventing noise. *The error cannot be cleared by CLEAR or a reset. The power must be turned off and on again.	F-R-1
ER13	Emergency stop	The emergency stop switch or emergency stop input was activated.	Clear the emergency stop switch or emergency stop input.	F-R-1
ER20	Axis 1 communication error	An error occurred in communication with the slave unit.	Check if the link cable is disconnected, has a bad contact, or a broken wire. Also, check that the power supply is operating normally. *The error cannot be cleared by CLEAR or a reset. The power must be turned off and on again.	F-R-1
ER30	Axis 2 communication error			
ER40	Axis 3 communication error			
ER50	Axis 4 communication error			
ER21	Axis 1 overspeed error	The motor speed is abnormally high	Check if the maximum speed setting is within the specification range.	F-R-1
ER31	Axis 2 overspeed error			
ER41	Axis 3 overspeed error			
ER51	Axis 4 overspeed error			
ER22	Axis 1 overcurrent error	A driver error occurred due to a low voltage, excessive current, or driver overheating.	Check if the input current has fallen below -10% of the voltage setting, the transportable weight has been exceeded, the robot has contacted the mechanical stopper, the robot has contacted a foreign object, or the controller cable has a short-circuit or ground fault.	F-R-1
ER32	Axis 2 overcurrent error			
ER42	Axis 3 overcurrent error			
ER52	Axis 4 overcurrent error			
ER23	Axis 1 overload error	The motor load is large, or a current exceeding the rated current has flowed continuously.	Check if the transportable weight has been exceeded, the robot has contacted the mechanical stopper, the robot has contacted a foreign object, or the cable has a broken wire.	F-R-1
ER33	Axis 2 overload error			
ER43	Axis 3 overload error			
ER53	Axis 4 overload error			
ER24	Axis 1 overflow	The motor could not perform tracking for the command.	Check if the overflow data value is set correctly, the acceleration/deceleration time is normal, the transportable weight has been exceeded, the robot has contacted the mechanical stopper, the robot has contacted a foreign object, or the cable has a broken wire.	F-R-1
ER34	Axis 2 overflow			
ER44	Axis 3 overflow			
ER54	Axis 4 overflow			

Discontinue

No.	Error name	Meaning/Cause	Remedy	State
ER26	Axis 1 encoder error	The encoder signal line has a disconnected connector, broken wire, bad contact, or faulty encoder.	Check if the encoder signal line connector is connected securely and if there is a bad contact or broken wire in the cable. *The error cannot be cleared by CLEAR or a reset. The power must be turned off and on again.	F-R-1
ER36	Axis 2 encoder error			
ER46	Axis 3 encoder error			
ER56	Axis 4 encoder error			
ER27	Axis 1 home positioning error	When the robot carrying out home positioning, even if it moves 20mm in the state the origin sensor is ON, the state do not change.	Check if the origin sensor connector is connected securely and if there is a bad contact or broken wire in the cable. Check if the origin sensor connector breaks down. (Check if the origin sensor is normally ON/OFF by bringing close or keeping away the slider to the origin manually.)	F-R-1
ER37	Axis 2 home positioning error			
ER47	Axis 3 home positioning error			
ER57	Axis 4 home positioning error			
ER28	Axis 1 + soft limit exceeded (during execution)	The designated coordinate value has exceeded the soft limit positive value. This was detected during program execution.	Check the soft limit positive value and the program.	F-R-1
ER38	Axis 2 + soft limit exceeded (during execution)			
ER48	Axis 3 + soft limit exceeded (during execution)			
ER58	Axis 4 + soft limit exceeded (during execution)			
ER29	Axis 1 - soft limit exceeded (during execution)	The designated coordinate value has exceeded the soft limit negative value. This was detected during program execution.	Check the soft limit negative value and the program.	F-R-1
ER39	Axis 2 - soft limit exceeded (during execution)			
ER49	Axis 3 - soft limit exceeded (during execution)			
ER59	Axis 4 - soft limit exceeded (during execution)			
ER2A	Axis 1 overvoltage error	The main power has risen to an abnormally high level (rise in power supply voltage or regenerative voltage).	Check if the input voltage is within +10% of the voltage setting, or the transportable weight has been exceeded.	F-R-1
ER3A	Axis 2 overvoltage error			
ER4A	Axis 3 overvoltage error			
ER5A	Axis 4 overvoltage error			
ER2B	Axis 1 motor overheat error	The temperature in the encoder exceeds 90°C	Check if the acceleration/deceleration time is normal, the transportable weight has been exceeded, the robot has contacted the mechanical stopper, or the robot has contacted a foreign object.	F-R-1
ER3B	Axis 2 motor overheat error			
ER4B	Axis 3 motor overheat error			
ER5B	Axis 4 motor overheat error			

Discontinue

No.	Error name	Meaning/Cause	Remedy	State
ER2C	Axis 1 encoder backup error	The absolute counter value of the encoder could not be backed up normally. This error also occurs if the encoder connector is temporarily disconnected during backup.	Check if the voltage of the backup power supply (such as the battery) is less than 3.6 V. After this error occurs, the return to origin operation must be performed before executing any axis operations.	F-R-1
ER3C	Axis 2 encoder backup error			
ER4C	Axis 3 encoder backup error			
ER5C	Axis 4 encoder backup error			
ER2D	Axis 1 encoder switching error	During backup, the robot was subjected to a sudden acceleration, and the encoder motion could not be tracked.	Check if the axis unit was stopped during high-speed movement, collided with the axis end or other component, and has rebounded. Also, check if the axis unit has been subjected to a sudden acceleration by an external force when the power was turned off. If an error has occurred because of rebound acceleration due to a collision, cushioning materials can be installed at the collision location to reduce the rebound acceleration. *The error cannot be cleared by CLEAR or a reset. The power must be turned off and on again.	F-R-1
ER3D	Axis 2 encoder switching error			
ER4D	Axis 3 encoder switching error			
ER5D	Axis 4 encoder switching error			
ER60	Continuous execution failure	This equipment is in a state where continuous execution cannot be performed. (The power was during off during program execution (during operation).)	Set the continuous start input to OFF, and then turn the power off and then on again. After the power is turned off, continuous restart is enabled only when program execution is stopped or the power was turned off. *The error cannot be cleared by CLEAR or a reset. The power must be turned off and on again.	F-R-1
ER61	Return to origin incomplete	An axis-related command was executed (sequential) or started while return to origin operation had not been performed after an encoder-related error occurred or after a synchronized axes search.	Perform return to origin operation.	F-R-1
ER62	Unexecutable	•The stop input is ON, or a start or return to origin was performed in a servo free state.	•After clearing the error, check that the stop input of system input is not set to ON. Also, if the servo is turned off, turn on the servo.	F-R-1

Discontinue

No.	Error name	Meaning/Cause	Remedy	State
EP80	TP communication error	Communication cannot be established using the teach pendant or RS-232C cable.	Check if the connector is connected securely, there is a bad contact, or the cable has a broken wire. *The error cannot be cleared by CLEAR or a reset. The power must be turned off and on again.	F-R-1
ER90	ID error	The contents of the backup memory were corrupted by noise, fluctuations in the supply voltage, or other cause.	Clear the error. All the programs and parameters are initialized, and so re-enter the programs and parameters.	F-R-1
ER91	Sequential program memory error	The contents of the sequential program were corrupted by noise, fluctuations in the supply voltage, or other cause.	The error step number is displayed on the screen, and so check the program. If errors occurred in multiple locations, another error step number is displayed when an error is cleared.	F-R-1
ER92	Palletizing program memory error	The contents of the palletizing program were corrupted by noise, fluctuations in the supply voltage, or other cause.	The program number and screen number where the error occurred are displayed on the screen. (Program number – Screen number) If errors occurred in multiple locations, the program number and screen number for another error are displayed when an error is cleared.	F-R-1
ER93	Parameter memory error	The contents of the parameters were corrupted by noise, fluctuations in the supply voltage, or other cause.	Check the parameters.	F-R-1
ER94	Coordinate table memory error	The contents of the coordinate table were corrupted by noise, fluctuations in the supply voltage, or other cause.	The error table number is displayed on the screen, and so check the coordinate table. If errors occurred in multiple locations, another error table number is displayed when an error is cleared.	F-R-1
ER95	Speed table memory error	The contents of the speed table were corrupted by noise, fluctuations in the supply voltage, or other cause.	The error table number is displayed on the screen, and so check the speed table. If errors occurred in multiple locations, another error table number is displayed when an error is cleared.	F-R-1

Discontinue

No.	Error name	Meaning/Cause	Remedy	State
ER96	Acceleration/deceleration table memory error	The contents of the acceleration/deceleration table were corrupted by noise, fluctuations in the supply voltage, or other cause.	The error table number is displayed on the screen, and so check the acceleration/deceleration table. If errors occurred in multiple locations, another error table number is displayed when an error is cleared.	F-R-1
ER97	MVM table memory error	The contents of the MVM table were corrupted by noise, fluctuations in the supply voltage, or other cause.	The error table number is displayed on the screen, and so check the MVM table. If errors occurred in multiple locations, another error table number is displayed when an error is cleared.	F-R-1
ER98	Easy program memory error	The contents of the easy program were corrupted by noise, fluctuations in the supply voltage, or other cause.	The error step number is displayed on the screen, and so check the program. If errors occurred in multiple locations, another error step number is displayed when an error is cleared.	F-R-1
ERA0	Command error (impossible command)	The program tried to execute an impossible command.	Check the program.	F-R-1
ERA1	Tag undefined	An undefined tag number was found in a jump, call, BRAC, PSEL, or tag number search.	Check the program.	F-R-1
ERA2	Tag duplicate definition	A tag number was double-defined.	Correct the tag number.	F-R-1
ERA3	Stack overflow	Nesting was performed more than 10 times in the CAL system command.	Check the program.	F-R-1
ERA4	Stack underflow	An extra RET command was executed in the relationship between the CAL system commands and RET commands.	Check the program.	F-R-1
ERA8	Parameter error	Command and other parameters are invalid. The OUTS command is set to 65 or higher.	Check the program.	F-R-1

Discontinue

No.	Error name	Meaning/Cause	Remedy	State
ERB0	Step number error	A program was executed that exceeded the number of task steps (refer to section 13.4.18) setting. In easy mode, a program was executed that went past the final step. In external point designation mode, the program selection input bit was not designated for the mode designation.	Check the program. In external point designation mode, designate the program selection input bit.	F-R-1
ERB1	Tag number error	The tag number is outside the range.	Check the program.	F-R-1
ERB8	Robot number error	The robot type is outside the range.	Set the correct robot type.	L-G-0
ERC0	Axis 1 + soft limit exceeded	The designated coordinate value has exceeded the soft limit positive value.	Check the axis 1 soft limit positive value and the program.	F-R-1
ERC1	Axis 1 - soft limit exceeded	The designated coordinate value has exceeded the soft limit negative value.	Check the axis 1 soft limit negative value and the program.	F-R-1
ERC2	Axis 2 + soft limit exceeded	The designated coordinate value has exceeded the soft limit positive value.	Check the axis 2 soft limit positive value and the program.	F-R-1
ERC3	Axis 2 + soft limit exceeded	The designated coordinate value has exceeded the soft limit negative value.	Check the axis 2 soft limit negative value and the program.	F-R-1
ERC4	Axis 3 + soft limit exceeded	The designated coordinate value has exceeded the soft limit positive value.	Check the axis 3 soft limit positive value and the program.	F-R-1
ERC5	Axis 3 - soft limit exceeded	The designated coordinate value has exceeded the soft limit negative value.	Check the axis 3 soft limit negative value and the program.	F-R-1
ERC6	Axis 4 + soft limit exceeded	The designated coordinate value has exceeded the soft limit positive value.	Check the axis 4 soft limit positive value and the program.	F-R-1
ERC7	Axis 4 - soft limit exceeded	The designated coordinate value has exceeded the soft limit negative value.	Check the axis 1 soft limit negative value and the program.	F-R-1
ERE0	Other errors	This indicates other errors		F-R-1



The state column refers to the state of the controller when an error occurs (servo LED error output).

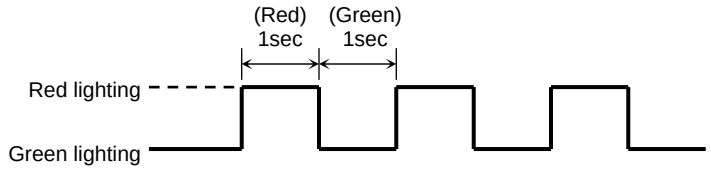
- Servo state L: Lock, F: Free
- LED state R: Lit red, *R: Flashing red, G: Lit green, * G: Flashing green
- Error output 0: OFF, 1: ON

Discontinue

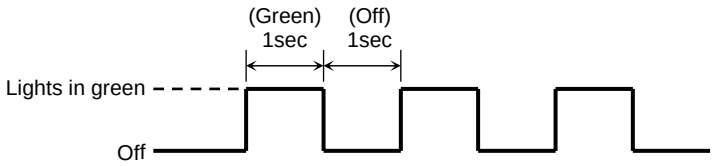
■ 19.3 Flashing of status display LED

There are 3 following patterns in flashing of status display LED. The status of controller is
judged by the color and the time of flashing.

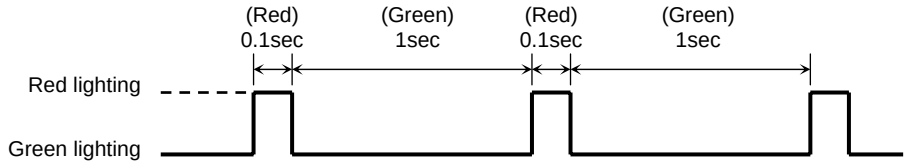
(1) Request for power OFF



(2) Backup voltage drop alarm



(3) Waiting for communication with Slaves



Discontinue

Chapter 20 KBZ series

This master unit can be connected to KCA-01-S05 (slave unit of KBZ series). KCA-01-S05 will be explained in this chapter. Refer to the Axis Instruction Manual for details on the robot type (six-digit figure)

■ 20.1 Specification

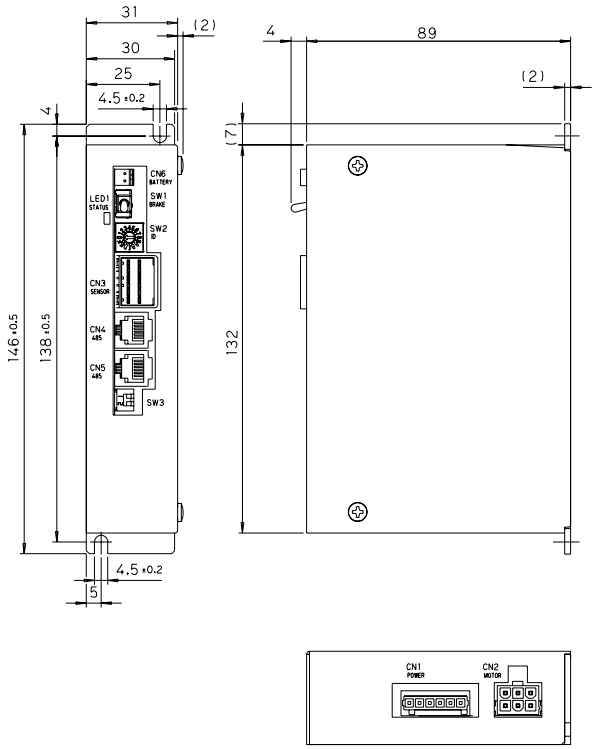
Item		Description	
Compatible robot		Electric Slider KBZ series	
Controller model		KCA-01-S05	
Number of controllable axes		1 axis(by connecting to master unit)	
Motor capacity		50 W	
Error signal		Error display lamp lights (front panel), Teach Pendant (Connect to master unit)	
Origin sensor input		Included	
Regenerative function		Included (with external regenerative resistor mounted)	
Dynamic brake function		None	
Mechanical brake drive output		24 V DC -0.4 A or less (for non-excitation operation holding brake) Manual reset is possible by Brake Reset Switch (SW1)	
Protective functions	Hardware errors	Sensor error, Drive power supply error, EEPROM error, and more	
	Software errors	Overspeed, Overload, Positional deviation exceeded and more	
	Warnings	Low battery voltage	
Status indicators		The green LED lights when the power is ON, and the red LED lights when an error has occurred.	
Control power supply voltage (Note 1)		24 V DC ±10%	
Drive power supply voltage (Note 1)		24 V DC ±10%	
Control power supply capacity		0.25 A	
Drive power supply capacity		Based on axis model. Rating 3 A (Max. 9 A)	
Environmental conditions		Operating temperature range	0 to 40°C
		Operating humidity range	90% max. (no condensation)
		Storage temperature range	-10 to 85°C
		Storage humidity range	90% max. (no condensation)
		Environment	Indoor (not exposed to direct sunlight), maximum altitude of 1000 m, location not exposed to dust, dirt, corrosive gases, or flammable gases
		Vibrations/Impact	4.9 m/s^2 max. / 19.6 m/s^2 max.
Dimensions		31(W) × 146(H) × 89(D) (not including screw protrusions)	
Weight		Approx. 0.25 kg	

Note 1: Do not use the same power supply for the control power supply and drive power supply. This could result in a breakdown.

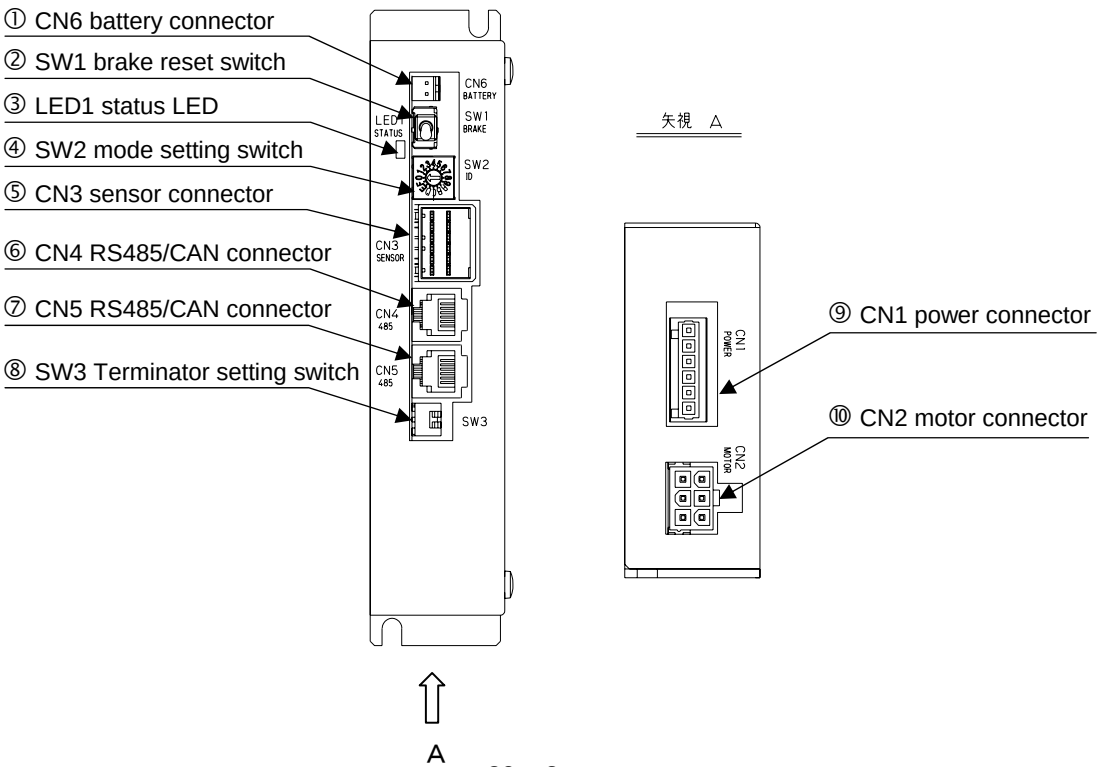
Discontinue

■ 20.2 Explanation of each part

(1) External dimensions



(2) Names of each part



Discontinue

① CN6 battery connector

This is a connector for the resolver ABS backup battery.
For details on the battery connector, refer to section 2.7.8.

② SW1 brake reset switch

This is a momentary switch for manually resetting the brake.
The brake is manually reset while the lever is raised to the up position, and the brake returns to normal brake control when it is released.

⚠CAUTION Use caution when manually releasing the brake. It could drop suddenly, resulting in damage to the workpiece or robot hand or entanglement of the operator's hand.

③ LED1 status LED

This LED displays the status of the controller. The green LED lights when the power is ON, and the red LED lights when an error has occurred.

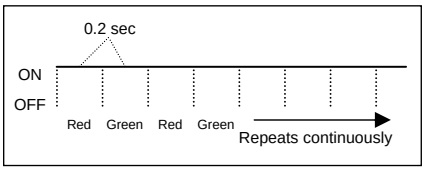
I. Normal mode (SW2 is set to 1 to 3)

Refer to "① Status display LED" in section 2.3.2.

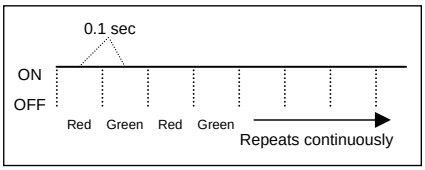
II. Boot mode (SW2 is set to F)

Color	Status	Flashing pattern
Flashing red + green	Boot standby	①
	Boot in progress	②
Solid green	Normal end	–
Solid red	Abnormal end	–

● Flashing pattern ①



● Flashing pattern ②



④ SW2 mode setting switch

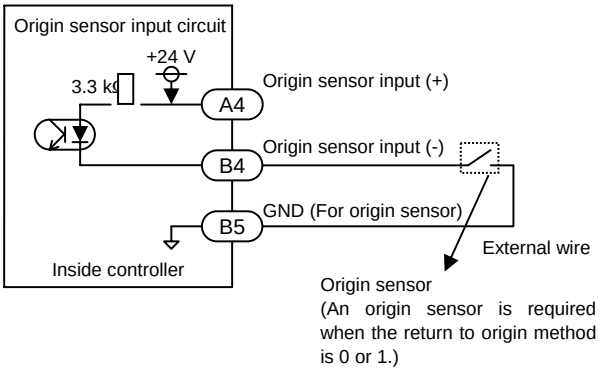
This switch is used to set the station No. of each slave unit when a slave unit is connected and multiple axes are controlled.
Set to "F" when the firmware is updated.

Discontinue

⑤ CN3 sensor

This is a connector for connecting the motor sensor cable.

Pin No.	Signal name
A1	S2 (Resolver output)
B1	S4 (Resolver output)
A2	S1 (Resolver output)
B2	S3 (Resolver output)
A3	R1 (Resolver excitation)
B3	R2 (Resolver excitation)
A4	Origin sensor input (+)
B4	Origin sensor input (-)
A5	N.C.
B5	GND (For origin sensor)
A6	N.C.
B6	GND (Shield)



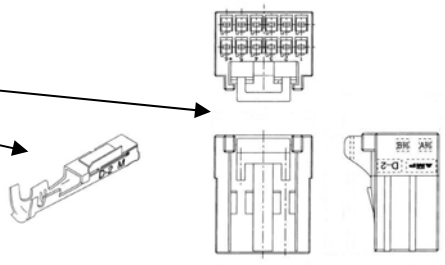
N.C.: No Connection

● Cable-side connector model

Receptacle housing 1-1318118-6

Terminal 1318108-1

Manufacturer Tyco Electronics AMP



● Controller-side connector model

Tab header 1376020-1

Manufacturer Tyco Electronics AMP

⑥ CN4 RS485/CAN connector

Link cable is connected to this connector. Refer to section 20.8.

⑦ CN5 RS485/CAN connector

Link cable is connected to this connector. Refer to section 20.8.

⑧ SW3 Terminator setting switch

This switch is used to connect a terminator for communication. Refer to section 20.8.

Pin No.	Signal name	Notes
1	Terminator setting	Terminator is connected when this switch is on
2	N.C.	

Discontinue

⑨ CN1 power connector

This connector inputs the control power supply and drive power supply.

Pin No.	Signal name	Notes	Refer to section
1	GND (Drive power supply)	Connected with pin No. 3 inside the controller	20.6
2	24 V DC (Drive power supply)		
3	GND (Control power supply)	Connected with pin No. 1 inside the controller	
4	24 V DC (Control power supply)		
5	PA	Connected to external regenerative resistor	20.10
6	JP1	Connected to external regenerative resistor	

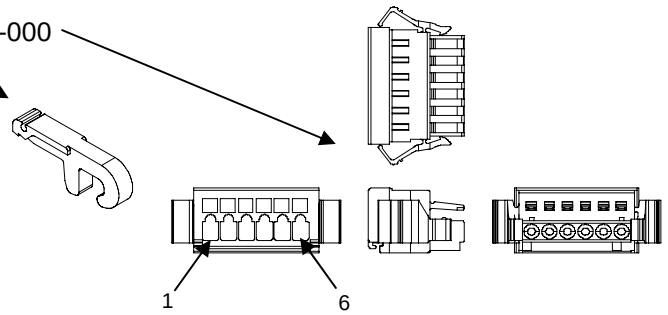
NOTE Do not use the same power supply for the control power supply and drive power supply. This could result in a breakdown.
For details on selecting the power supply, refer to section 20.4.

● Cable-side connector model

Plug 734-106/037-000
Pushbutton 734-230
Manufacturer WAGO

● Controller-side connector model

Header 734-166
Manufacturer WAGO



⑩ CN2 motor connector

This is a connector for connecting the motor cable.

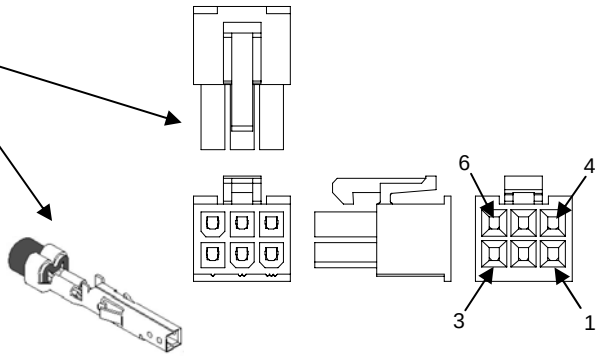
Pin No.	Signal name	Notes
1	U	
2	V	
3	W	
4	F.G	
5	BK+	Brake
6	BK-	Brake

● Cable-side connector mode

Receptacle housing 5557-06R
Terminal 5556TL
Manufacturer MOLEX

● Controller-side connector model

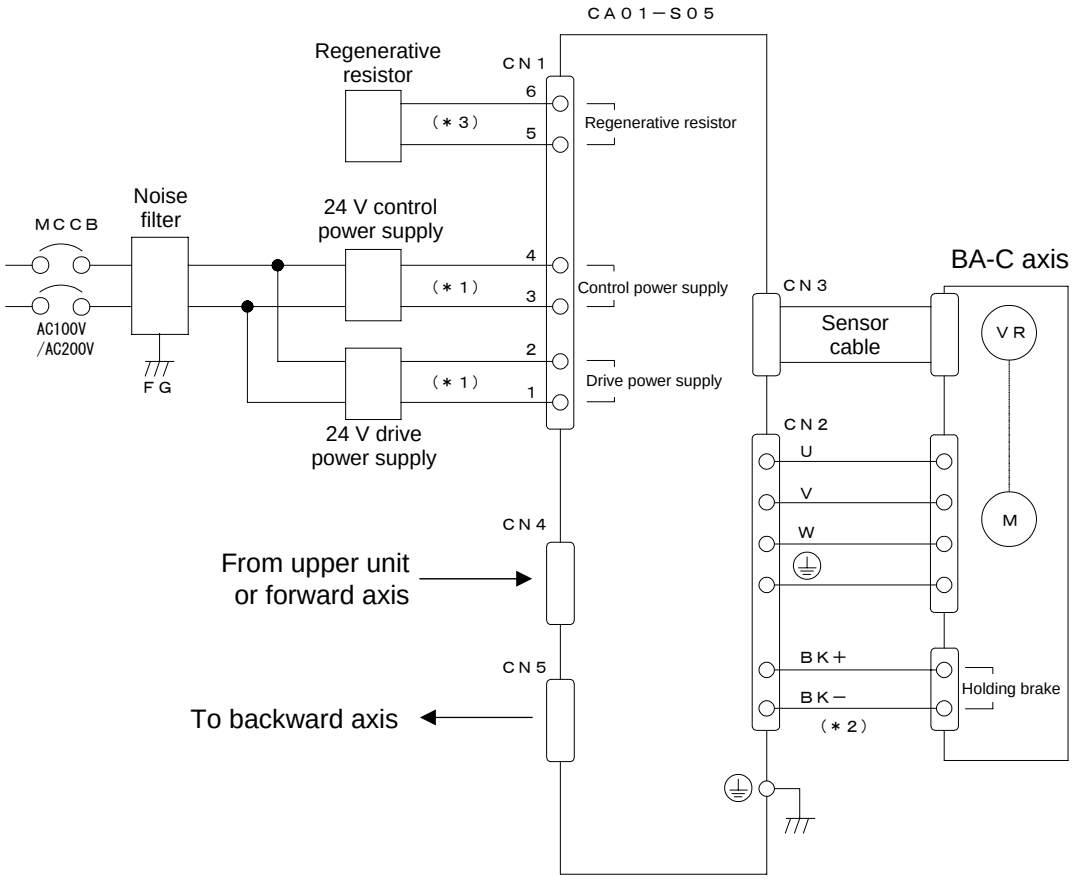
Header 5569-06A1
Manufacturer MOLEX



Discontinue

■ 20.3 Connections

KCA-01-S05 is connected like the chart below.



(*1) Do not use the same power supply for the control power and control power. This could result in a breakdown.

(*2) This connection is not needed if using a motor without a holding brake.

(*3) This connection is required when the regenerative energy is large. Refer to section 2.10.

Discontinue

■ 20.4 Selecting the power supply

The power supply of KCA-01-S05 is the list shown below. Use a two-line system for the control power supply and drive power supply, even if they have the same voltage.
If capacity of the drive power supply is insufficient, low power output, low torque, and other problems can occur that prevent full performance during operation.

NOTE The control power supply and drive power supply share the same ground. Use power supplies with the same ground level so that no difference in electrical potential occurs in the ground.

Power supply capacity

Power supply	Voltage	Capacity	Notes
Control power supply (Note 1)	24 V DC±10%	0.25 A	
Drive power supply	24 V DC±10%	3 A	Rating 3 A (Max. 9 A)

Note 1: Use a separate power supply from the drive power supply.

- When connecting multiple controllers

  If multiple controllers are connected to a single power supply, a power capacity equivalent to the sum of the power capacities of the power supplies of each controller is required.
  However, in cases where axes do not operate simultaneously, the power capacity can be reduced for the drive power supply based on the operation pattern.
  For example)
  Control power supply : 0.25A x 2 = more than 0.50A
  Drive power supply :
  9A x 2 = more than 18A (In case two axes accelerate or decelerate at same time)

- Regenerative operation

  If the motor decelerates suddenly or rotary torque is applied externally, the regenerative operation can generate a back electromotive force, which can cause an increase in drive voltage.

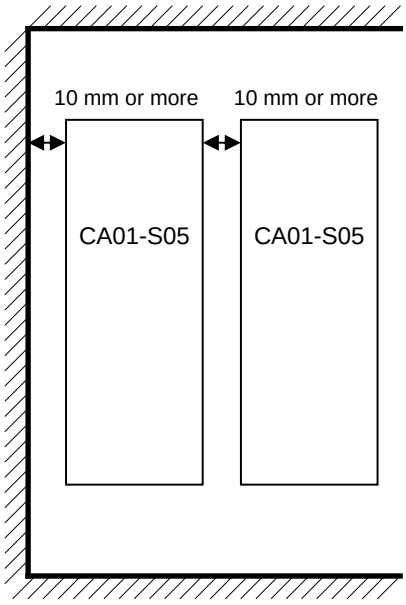
Discontinue

■ 20.5 Installing

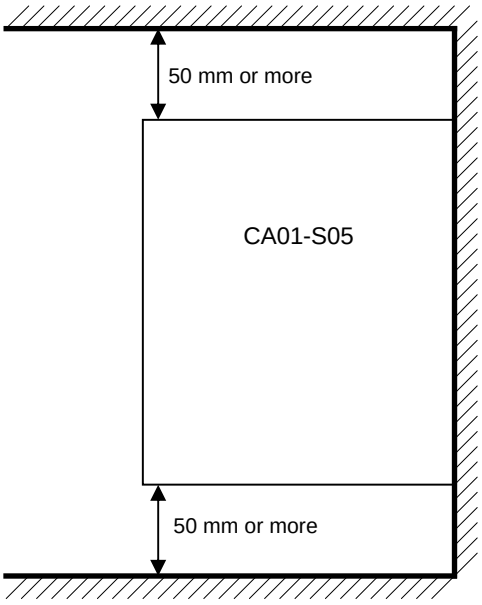
The controller uses a natural cooling method through convection. When installing the controller, place it in the vertical orientation as shown in the figure below, and leave a space of at least 10 mm right and left, 50 mm above and below it.
If the ventilation is insufficient, the sufficient performance will not be achieved, and faults could occur.

Make sure that foreign matter such as fluids or dust does not enter the controller from the ventilation holes.
This unit does not have a dust proof structure. Avoid use in dusty places.

If the ambient temperature exceeds +40°C, install cooling fans or implement other cooling measures.



Front side



Side surface

Discontinue

■ 20.6 Supply power and grounding

The power supply cable of the controller is connected as shown below.

Power supply connector wiring procedure

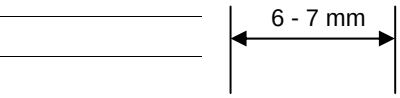
① Peel off the covering of the wires.
Uncovered wire length: 6 to 7 mm

② Open the wire terminal pockets of the power supply connector. Fit on the connection lever supplied with the controller, and press it in the direction of the arrow in the figure below to open.

③ Insert the uncovered wire section into the opening. After inserting, release the pressure of the connection lever.

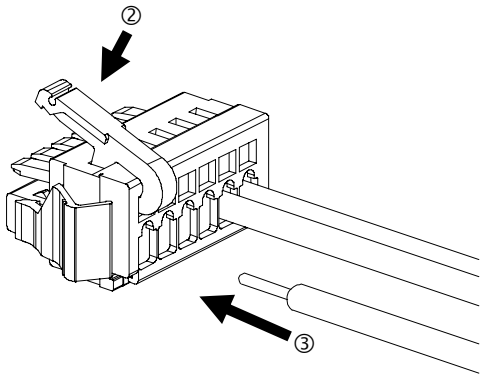
* Insert the wire firmly all the way inside.

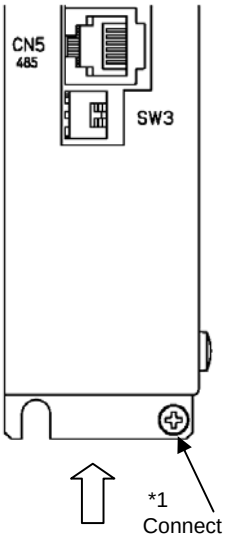
* Be careful that you do not form a short-circuit with an adjacent wire.

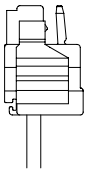


①

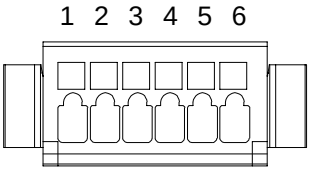
Peel off 6 to 7 mm of the wire covering.







Connect to the power supply connector at the bottom of the controller.



The pin number indicators are not shown on the wire connectors. As shown in the figure, they are numbered 1, 2, … 6 from the left.

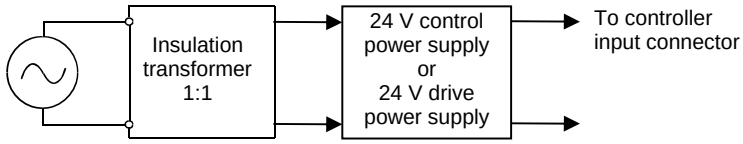
Pin No.	Signal name	Notes
1	GND (Drive power supply)	Connected with pin No. 3 inside the controller
2	24 V DC (Drive power supply)	
3	GND (Control power supply)	Connected with pin No. 1 inside the controller
4	24 V DC (Control power supply)	
5	PA	Connected to external regenerative resistor
6	JP1	Connected to external regenerative resistor

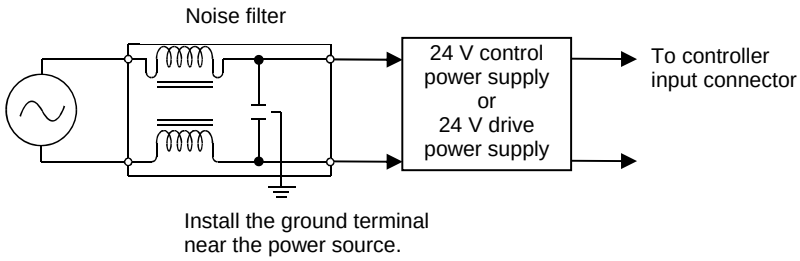
*1 Two plain washers are inserted to prevent dropping during transportation. Adjust based on your usage conditions.

Discontinue

■ 20.7 Improvement of noise resistance

For details on Improvement of noise resistance, refer to section 2.4.3. But be like the chart below in case of inserting a power line insulation transformer (1:1) or noise filter.

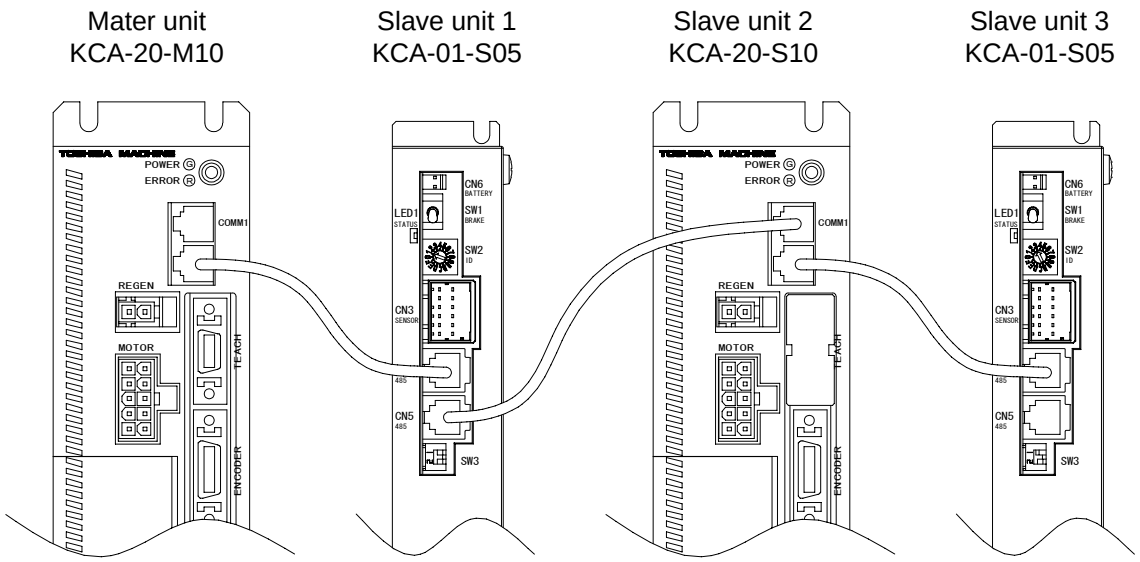




■ 20.8 Connecting controllers

The master unit can control up to four axes by connecting more than one KCA-01-S05 with link cables. Also it is possible to control axes, putting together KCA-20-S10 or KCA-20-S40. For details on how to connect, refer to section 2.4.4. But regard COMM1 as CN4 and COMM2 as CN5 about communication connectors. Also Set station No. of KCA-01-S05 with SW2 and terminator of KCA-01-S05 with 1 pin of SW3.

Show the connection example below when second and fourth axis are KCA-01-S05 and third axis is KCA-20-S10.



Discontinue

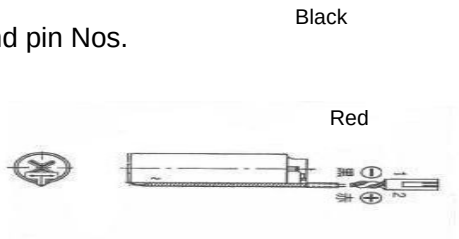
■ 20.9 Resolver ABS backup

All models of the KBB-C axis AC servomotor include a resolver ABS. The power is driven by a battery to enable constant monitoring of motor operation even when the power supply to the controller is cut off and to allow smooth startup without returning to the origin when starting the system and recovering from an emergency stop.

NOTE If the setting of “Setting of encoder type” (refer to section 13.4.14) is “Incremental encoder”, the absolute function does not operate even if the battery is connected.

● CN6 battery connector signal names and pin Nos.

Pin No.	Signal name
1	GND(-)
2	VB(+)



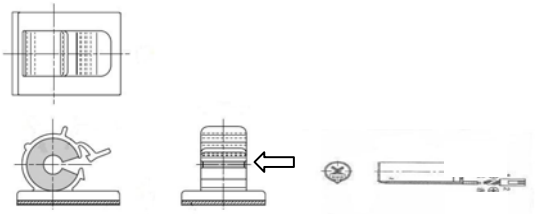
NOTE If the polarity is mistaken, the backup will not be possible and faults could occur.

● Controller-side connector model

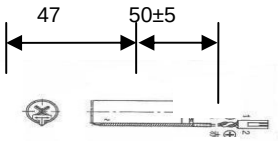
Header IL-2P-S3FP2-1
Manufacturer JAE

● Battery holder

Wire clamp SSP-518
Manufacturer Shinagawa Shoko
*As shown in the figure at right, insert and secure the battery in the battery holder, and use by affixing to the controller top surface or other location.



● Lithium battery specifications

Item			Description	Remarks
Part name			Lithium battery	Thionyl chloride lithium battery
Model			ER17500V C	Manufactured by Toshiba Battery
Specification	Nominal voltage/capacity		3.6 V 2700 mAh	
	Dimensions	Battery body	ϕ17 × 47 mm (excluding protrusions)	
		Harness length	50±5 mm (excluding connectors)	
	Weight		Approx. 20 g	

Discontinue

Backup connection time (Note 1)	Approx. 1 year (Note 2)	25°C, backup current 260 μA

(Note 1) This is the cumulative time that the controller unit power remains in the OFF state.
(Note 2) The retention time of the battery varies depending on the temperature and other factors. Use these figures as a general guide only.

Discontinue

- Backup specification

Item		Specification	Remarks
Backup voltage		3.6 V DC (Standard)	Controller front LED flashes in orange when at 3.1 V DC or less (low voltage warning) Battery error occurs at 2.5 V DC or less (Note 1)
Consumption current	When controller is in non conducting state	260 μA (Maximum)	25°C Maximum instantaneous current: 2 mA
	When controller is in conducting state	1 μA (Standard)	

Note 1: The LED indicator does not change even if the backup voltage is recovered while the power is on. The power is turned on again.

- Encoder-related errors

  For details on Encoder-related errors, refer to section 2.4.10.

Discontinue

■ 20.10 Regenerative Resistors

Regenerative resistors are devices that absorb the energy generated when the axis unit motor is decelerated. These are used when the load inertia exceeds the allowable value or when a large load descends down a long stroke (generating a large amount of power) along the Z-axis. (The regenerative resistor prevents an overvoltage from occurring in the controller.)

* A resistor type (KCA-CAR-0500) and a unit type (KCA-CAR-UN50) are available.
* All discharged energy is converted to heat.
* When the resistor generates an abnormal amount of heat, a contact output (N.C.) occurs.
* This unit is for one axis.

■ 20.10.1 Specifications

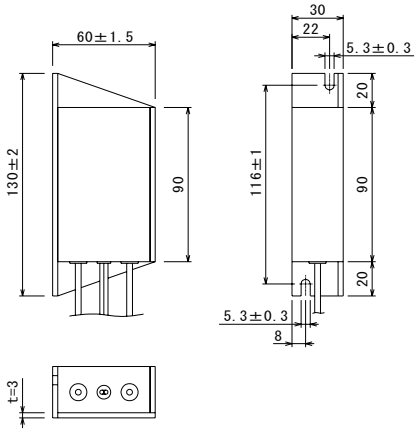
Item		Description	
Model		KCA-CAR-0500	KCA-CAR-UN50
Regenerative operation voltage		48 V DC (controller by controller)	
Cooling system		Natural air cooling	
Protective functions		Temperature relay is activated at a resistor internal temperature of 135°C Output contact: 1b Maximum switching voltage: 250 V AC/42 V DC Maximum switching current: 0.2 A AC/DC (Minimum switching current: 1 mA AC/DC)	Temperature relay is activated at a unit surface temperature of 120°C Output contact: 1b Maximum switching voltage: 110 V AC/DC Maximum switching current: 0.3 A AC/DC Maximum switching power: 6 W AC/DC (Minimum switching current: 0.1 mA/1 V DC)
Environmental condition	Installation environment	Indoor (not exposed to direct sunlight), maximum altitude of 1000 m location not exposed to dust, dirt, corrosive gases, or flammable gases	
	Operating temperature	0 to 40°C	
	Operating humidity	90% max. No condensation	
	Operating atmosphere	No corrosive gases	
	Storage temperature	-10 to 85°C	
	Storage humidity	90% max. No condensation	
	Storage atmosphere	No corrosive gases	
	Vibrations	4.9 m/s^2 max.	

Discontinue

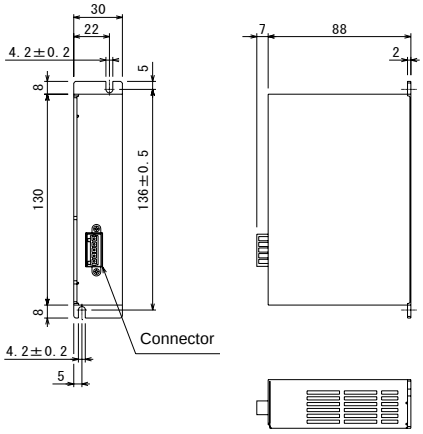
S			
Dimensions		30(W) × 130(H) × 60(D)	30(W) × 146(H) × 88(D)
Weight		Approx. 0.39 kg	Approx. 0.22 kg

■ 20.10.2 External dimensions

CAR-0500



CAR-UN50

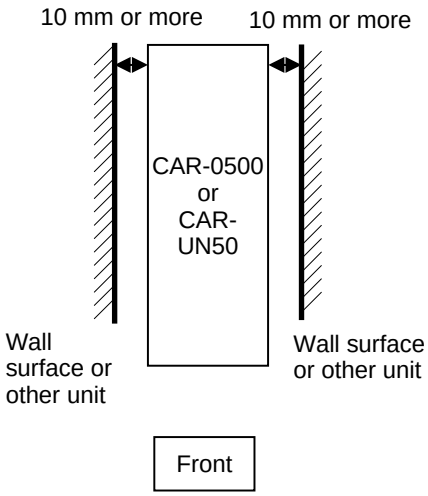


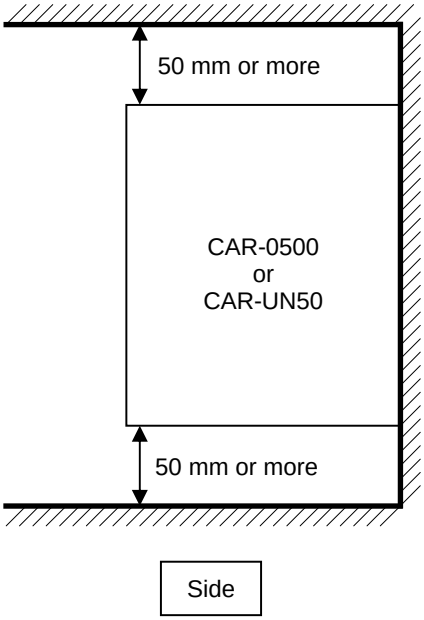
■ 20.10.3 Installation

The regenerative resistors uses a natural cooling system based on convection currents. When installing the regenerative resistors, install it standing vertically as shown in the figure, and provide at least 10 mm of space on the right and left sides and at least 50 mm of space at the top and bottom.
If proper ventilation is not provided, the controller will not only fail to provide full performance, but a breakdown could also occur.

Be careful that liquids, dust, and other foreign objects do not get inside the regenerative resistors.
The controller does not have a dust-proof structure. Therefore, avoid using it in locations with large amounts of dust or dirt.

If the ambient temperature exceeds +40°C, install cooling fans or implement other cooling measures.

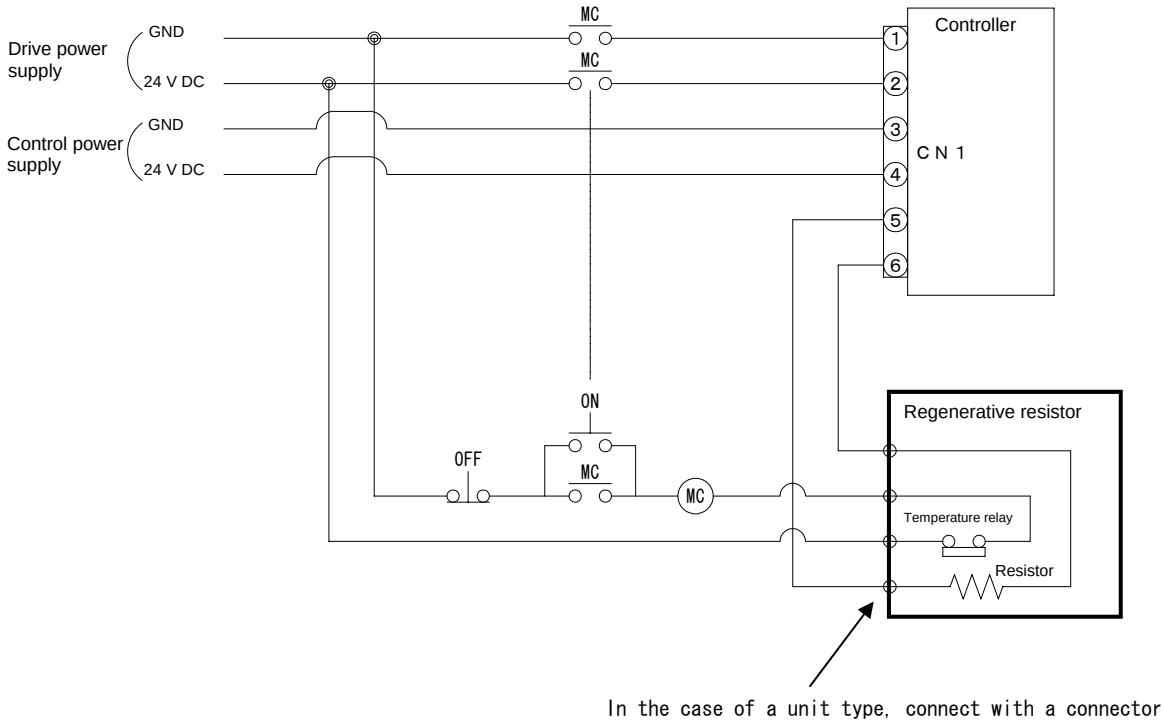




Discontinue

■ 20.10.4 Connection example

Connect the controller and the power supply to the regenerative resistors like the chart below.



- Usage Notes
  - · An internal temperature relay is activated when the KCA-CAR-0500 reaches 135°C and when the KCA-CAR-UN50 reaches 120°C.
  - · When this relay is activated, the outputs of the temperature relay are opened.
  - · Organize the sequence so that the drive power supply of the controller always turns off when the temperature relay is activated.
  - · If the temperature relay is activated momentarily, about three minutes are required until it is reset (restored to normal status).

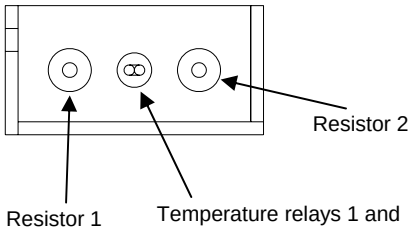
⚠CAUTION The regenerative resistors are very hot while operating. Allow sufficient time for cooling before servicing.

Discontinue

● Connection terminal

KCA-CAR-0500

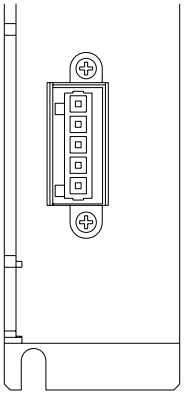
Bottom View



* If the length of the output lines of the temperature relay is not enough, use by connecting the supplied relay connector.
* The wires should be provided by the customer.

KCA-R-UN50

Front View



Pin No.● Name● ● 1● Resistor
1● ● 2● Resistor
2● ● 3● Temperature relay
1● ● 4● Temperature relay
2● ● 5● FG● ●

* The wires should be provided by the customer.

● Using the accessories

KCA-CAR-0500

Accessory: Relay connector × 2

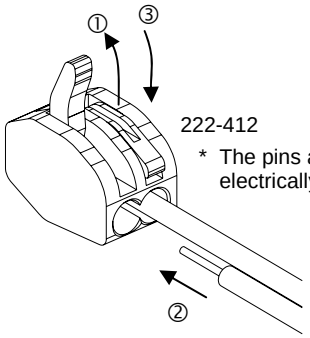
● Connector model

Plug	222-412
Manufacturer	WAGO

● Wiring procedure

① Raise the top lever by about 90°.
② Insert the wire all the way inside.
③ Return the top lever to its original position.
④ Gently pull on the wire to check that it is connected correctly.

* Peel off about 9 mm of the wire covering.



222-412

* The pins are connected electrically inside the connector.

KCA-CAR-UN50

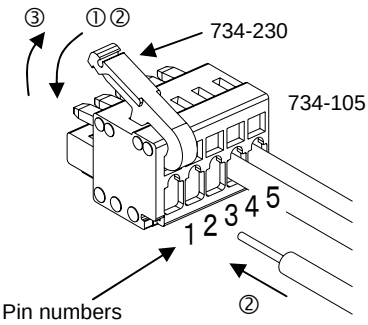
Accessory: Connector, wire connection lever

● Connector model

Plug	734-105
Wire connection lever	734-230
Manufacturer	WAGO

● Wiring procedure

① Hook the supplied wire connection lever as shown in the figure below.
② Insert the wire all the way inside while pressing the wire connection lever. Downward as shown in the figure below.
③ Return the wire connection lever to its original position.
④ Gently pull on the wire to check that it is connected correctly.



* These are not displayed on the connector body.

Discontinue

Chapter 21 Maintenance and Inspection

■ 21.1 Procedures before and after inspection and maintenance

(1) Before inspection and maintenance

1) Be sure maintenance and inspection personnel are adequately trained. If none of your personnel has adequate training, ask your manufacturer's representative to carry out inspection and maintenance or to train your personnel.

2) Make sure the Electric Actuator operating area is adequately illuminated.

3) Put a nice on the start switch and other devices at the operator's stationary panel informing that inspection or maintenance is underway.
Before personnel enter the operating area of the Electric Actuator, the Electric Actuator's power switch must be locked open to prevent power being supplied to the Electric Actuator. Also, if the entrance to the fence around the operating area is equipped with a safety plug, personnel should carry it when entering the fenced area.

4) Before personnel enter fenced areas of cabinets for inspection or maintenance of control circuits, cut off power to all drive units.

5) If inspection or maintenance must be done within the operating area while the Electric Actuator is moving, take the following precautions:

Do not enter the area alone. Work in pairs. One person might act as a watchman while the other performs the inspection.

Operate the Electric Actuator at the slowest speed practical to accomplish its job to give personnel time to avoid being struck by any unexpected movement by the Electric Actuator.

Have an operator closely monitor the Electric Actuator, so he can immediately activate emergency stop if the Electric Actuator makes any unexpected movement or if inspection personnel appear endangered.

6) Discharge residual pneumatic pressure in the cylinder before disassembling or changing parts in the pneumatic gauge.

7) When disassembling or changing parts in hydraulic and pneumatic lines, be very careful to prevent dust or other foreign matter from contaminating them.

(2) Procedures after inspection or maintenance

1) Return tools and instruments to their designated place.

2) Always perform a test run. Make sure all personnel are out of the operating area before starting the test.

3) Report completion of inspection and maintenance work and the test run to the appropriate person in charge.

Discontinue

■ 21.2 Inspection before operation

(1) Check the following before operation:

1) Braking device performance
2) Emergency stop device performance
3) Interlock device between bumpers and the Electric Actuator
4) Interlock devices between the Electric Actuator and auxiliary devices
5) External cables and piping for damage
6) Power source voltage, hydraulic oil pressure and pneumatic pressure
7) Electric Actuator movement
8) Presence of abnormal sound or vibration
9) Bumpers

(2) Determine the positions from which personnel will perform the inspection or maintenance.

They should remain as far out of the Electric Actuator operating area as possible.

■ 21.3 Periodic inspection

Make an inspection standard including inspection items, method, criteria and timing considering the installation location, operating frequency, parts durability and other conditions and factors of the Electric Actuator, and conduct periodic inspections.
Check the following during inspection work:

1) Loose parts on the main components
2) Lubrication and other conditions of moving parts
3) Power transmission components
4) Hydraulic and pneumatic systems
5) Electric systems
6) Fault detection systems
7) Encoder section
8) Servo system

[Controller inspection places]

9) Check that the voltage supplied to the controller is in the usage range (±10% of rated voltage).
10) Inspect the ventilation holes to the controller, and remove any dirt or dust, etc., that is adhered.
11) Inspect the controller cable (controller to axis), and confirm that none of the screws, etc., are loose.
12) Confirm that the controller installation screws, etc., are not loose.
13) Inspect each connector (motor output connector, encoder input connector, Teach Pendant connector), and confirm that there is no looseness or play, etc.

Discontinue

■ 21.3.1 Inspection of timing belt

The timing belt should be inspected approximately every 500 hours.

- Check the belt for deterioration, fatigue and scratches, etc., and replace it immediately if any abnormality is found. Refer to the Axis Instruction Manual for the replacement procedures.
- When using the motor folding axis with brakes for vertical use (as the Z axis) observe the following items.

  1) The belt must be replaced periodically within 3,000 hours of operation.

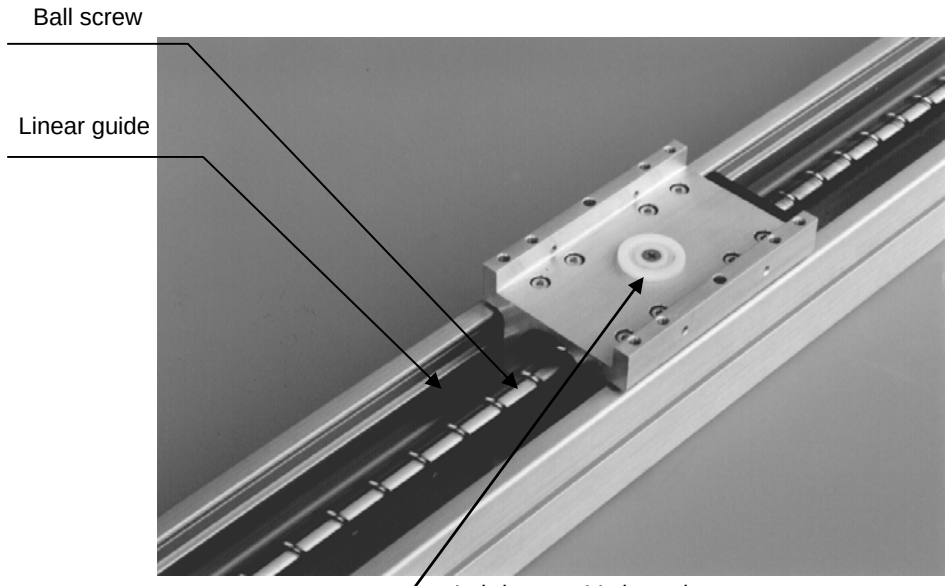
  2) The belt's life will be greatly affected by the working environment and conditions. If any abnormality is found during inspection, replace the belt immediately.

⚠CAUTION Snapping of the belt used for vertical use will be extremely dangerous. Make sure to replace the belt at an early stage.

Discontinue

■ 21.4 Lubrication

(1) Parts to be lubricated



Parts to be lubricated	Lubricant (Maker)	Interval	Quantity of lubricant
Ball screw	Alvania No. 2 (Showa Shell)	Every three months	Apply light coat on ball screw shaft
Linear guide			Supply approx. 1 cc of grease to each part with a grease nipple.

(The first lubrication must be performed on the 30th day after the starting operation.)

(2) Lubrication procedure

1) Turn OFF the power switch and unplug the power cable to disconnect the Electric Actuator from the power source.
2) Remove the axis frame cover.
3) Lubricate the parts listed in the table above.
4) Wipe off excess lubricant.
5) Reassemble the frame cover.

Discontinue

■ 21.5 Cleaning

Clean the robot body.

Cleaning procedure

(1) Turn OFF the power switch and disconnect the Electric Actuator from the power source.

(2) Use a rag to wipe dust and foreign matter off the frame and covers.

(3) Remove the frame cover and wipe away dust and foreign matter from the inside.
Lubricate according to the lubrication procedure given in section 21-4.

(4) Resecure the frame cover.

■ 21.6 Spare parts

■ 21.6.1 Controller spare parts

Although a fault or error may be found at an early stage, repairs cannot be made without the required parts. It is recommended that spare parts for consumable components be kept on hand.

Part name	Qty. per unit	Part and type	Maker	Specifications	Size
Fuse	2	Cylindrical glass tube fuse. 232008MA250	Littelfuse, Inc.	250V-8A Electricity Control Law Class B specified. Rush-resistant type	ø5.2 × 20mm

■ 21.6.2 Axis spare parts

Refer to the Axis Instruction Manual for the axis spare parts.

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