Cat. No. I138E-EN-02

SCARA Robot
YRC Series

YRC SCARA Robot Controller

OPERATION MANUAL

OMRON

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Important information before reading this manual

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Safety Instructions

Contents

1. Safety Information

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

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

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

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

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

2. Signal words used in this manual

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

DANGER

THIS INDICATES AN IMMEDIATELY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

WARNING

THIS INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

CAUTION

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

NOTE

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

3. Warning labels

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

3.1 Warning labels

WARNING

IF WARNING LABELS ARE REMOVED OR DIFFICULT TO SEE, THEN THE NECESSARY PRECAUTIONS MAY NOT BE TAKEN, RESULTING IN AN ACIDENT.

- DO NOT REMOVE, ALTER OR STAIN THE WARNING LABELS ON THE ROBOT BODY.
- DO NOT ALLOW WARNING LABELS TO BE HIDDEN BY DEVICES INSTALLED ON THE ROBOT BY THE USER.
- PROVIDE PROPER LIGHTING SO THAT THE SYMBOLS AND INSTRUCTIONS ON THE WARNING LABELS CAN BE CLEARLY SEEN FROM OUTSIDE THE SAFETY ENCLOSURE.

3.1.1 Warning label messages on robot and controller

Word messages on the danger, warning and caution labels are concise and brief instructions. For more specific instructions, read and follow the "Instructions on this label" described on the right of each label shown below. See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

1. Warning label 1 (SCARA robots)

DANGER

SERIOUS INJURY MAY RESULT FROM CONTACT WITH A MOVING ROBOT.

- KEEP OUTSIDE OF THE ROBOT SAFETY ENCLOSURE DURING OPERATION.
- PRESS THE EMERGENCY STOP BUTTON BEFORE ENTERING THE SAFETY ENCLOSURE.

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

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

2. Warning label 2 (SCARA robots)

WARNING

MOVING PARTS CAN PINCH OR CRUSH HANDS.
KEEP HANDS AWAY FROM THE MOVABLE PARTS OF THE ROBOT.

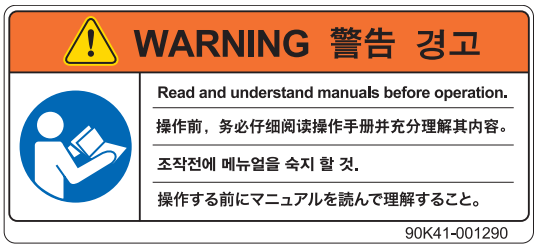
Instructions on this label
Use caution to prevent hands and fingers from being pinched or crushed by the movable parts of the robot when transporting or moving the robot or during teaching.

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

3. Warning label 3 (SCARA robots)

WARNING

IMPROPER INSTALLATION OR OPERATION MAY CAUSE SERIOUS INJURY.
BEFORE INSTALLING OR OPERATING THE ROBOT, READ THE MANUAL AND INSTRUCTIONS ON THE WARNING LABELS AND UNDERSTAND THE CONTENTS.



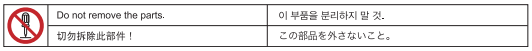
Instructions on this label
• Be sure to read the warning label and this manual carefully to make you completely understand the contents before attempting installation and operation of the robot. • Before starting the robot operation, even after you have read through this manual, read again the corresponding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

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

4. Warning label 4 (SCARA robots)

CAUTION

Do not remove the parts on which Warning label 4 is attached.
Doing so may damage the ball screw.

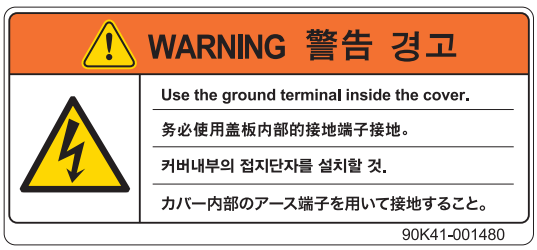


Instructions on this label
The Z-axis ball screw will be damaged if the upper end mechanical stopper on the Z-axis spline is removed or moved. Never attempt to remove or move it.

5. Warning label 5 (Controller)

WARNING

GROUND THE CONTROLLER TO PREVENT ELECTRICAL SHOCK.
GROUND TERMINAL IS LOCATED INSIDE THIS COVER.
READ THE MANUAL FOR DETAILS.



Instructions on this label
• High voltage section inside • To prevent electrical shock, always ground the robot using the ground terminal located inside the cover.

Potential hazard to human body	Electrical shock
To avoid hazard	Ground the controller.

6. "Read instruction manual" label (Controller)*

* This label is attached to the front panel.

CAUTION

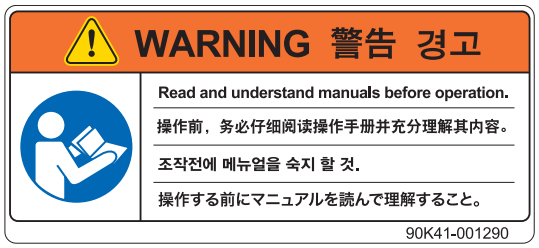
Refer to the manual.

	Instructions on this label
	This indicates important information that you must know and is described in the manual. Before using the controller, be sure to read the manual thoroughly. When adding external safety circuits or connecting a power supply to the controller, read the manual carefully and make checks before beginning the work. Connectors have an orientation. Insert each connector in the correct direction.

3.1.2 Supplied warning labels

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

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

		SCARA robots
Warning label 1		●*1 ○
Warning label 2		●*1
Warning label 3		●*1

*1: See "Part names" in each SCARA robot manual for label positions.

3.2 Warning symbols

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

1. Electrical shock hazard symbol

WARNING

TOUCHING THE TERMINAL BLOCK OR CONNECTOR MAY CAUSE ELECTRICAL SHOCK, SO USE CAUTION.

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

2. High temperature hazard symbol

WARNING

MOTORS, HEATSINKS, AND REGENERATIVE UNITS BECOME HOT, SO DO NOT TOUCH THEM.

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

3. Caution symbol

CAUTION

Always read the manual carefully before using the controller.

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

4. Major precautions for each stage of use

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

4.1 Precautions for using robots and controllers

General precautions for using robots and controllers are described below.

1. Applications where robots cannot be used

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

DANGER

OMRON ROBOT CONTROLLERS AND ROBOTS ARE DESIGNED AS GENERAL-PURPOSE INDUSTRIAL EQUIPMENT AND CANNOT BE USED FOR THE FOLLOWING APPLICATIONS.

- IN MEDICAL EQUIPMENT SYSTEMS WHICH ARE CRITICAL TO HUMAN LIFE
- IN SYSTEMS THAT SIGNIFICANTLY AFFECT SOCIETY AND THE GENERAL PUBLIC
- IN EQUIPMENT INTENDED TO CARRY OR TRANSPORT PEOPLE
- IN ENVIRONMENTS WHICH ARE SUBJECT TO VIBRATION SUCH AS ONBOARD SHIPS AND VEHICLES.

2. Qualification of operators/workers

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

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

WARNING

- THE ROBOT MUST BE OPERATED ONLY BY PERSONS WHO HAVE RECEIVED SAFETY AND OPERATION TRAINING. OPERATION BY AN UNTRAINED PERSON IS EXTREMELY HAZARDOUS.
- ADJUSTMENT AND MAINTENANCE BY REMOVING A COVER REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS, AND MAY ALSO INVOLVE HAZARDS IF ATTEMPTED BY AN UNSKILLED PERSON. THESE TASKS MUST BE PERFORMED ONLY BY PERSONS WHO HAVE ENOUGH ABILITY AND QUALIFICATIONS IN ACCORDANCE WITH LOCAL LAWS AND REGULATIONS. FOR DETAILED INFORMATION, PLEASE CONTACT YOUR DISTRIBUTOR WHERE YOU PURCHASED THE PRODUCT.

4.2 Design

4.2.1 Precautions for robots

1. Restricting the robot moving speed

WARNING

RESTRICTION ON THE ROBOT MOVING SPEED IS NOT A SAFETY-RELATED FUNCTION.
TO REDUCE THE RISK OF COLLISION BETWEEN THE ROBOT AND WORKERS, THE USER MUST TAKE THE NECESSARY PROTECTIVE MEASURES SUCH AS ENABLE DEVICES ACCORDING TO RISK ASSESSMENT BY THE USER.

2. Restricting the movement range

See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

WARNING

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

CAUTION

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

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

WARNING

- END EFFECTORS MUST BE DESIGNED AND MANUFACTURED SO THAT THEY CAUSE NO HAZARDS (SUCH AS A LOOSE WORKPIECE OR LOAD) EVEN IF POWER (ELECTRICITY, AIR PRESSURE, ETC.) IS SHUT OFF OR POWER FLUCTUATIONS OCCUR.
- IF THE OBJECT GRIPPED BY THE END EFFECTOR MIGHT POSSIBLY FLY OFF OR DROP, THEN PROVIDE APPROPRIATE SAFETY PROTECTION TAKING INTO ACCOUNT THE OBJECT SIZE, WEIGHT, TEMPERATURE, AND CHEMICAL PROPERTIES.

4. Provide adequate lighting

Provide enough lighting to ensure safety during work.

5. Install an operation status light

WARNING

INSTALL A SIGNAL LIGHT (SIGNAL TOWER) AT AN EASY-TO-SEE POSITION SO THAT THE OPERATOR WILL BE AWARE OF THE ROBOT STOP STATUS (TEMPORARILY STOPPED, EMERGENCY STOP, ERROR STOP, ETC.).

4.2.2 Precautions for robot controllers

1. Emergency stop input terminal

DANGER

EACH ROBOT CONTROLLER HAS AN EMERGENCY STOP INPUT TERMINAL TO TRIGGER EMERGENCY STOP. USING THIS TERMINAL, INSTALL A SAFETY CIRCUIT SO THAT THE SYSTEM INCLUDING THE ROBOT CONTROLLER WILL WORK SAFELY.

2. Maintain clearance

CAUTION

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

4.3 Moving and installation

4.3.1 Precautions for robots

■ Installation environment

1. Do not use in strong magnetic fields

WARNING
DO NOT USE THE ROBOT NEAR EQUIPMENT OR IN LOCATIONS THAT GENERATE STRONG MAGNETIC FIELDS. THE ROBOT MAY BREAK DOWN OR MALFUNCTION IF USED IN SUCH LOCATIONS.

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

WARNING
DO NOT USE THE ROBOT IN LOCATIONS SUBJECT TO ELECTROMAGNETIC INTERFERENCE, ELECTROSTATIC DISCHARGE OR RADIO FREQUENCY INTERFERENCE. THE ROBOT MAY MALFUNCTION IF USED IN SUCH LOCATIONS CREATING HAZARDOUS SITUATIONS.

3. Do not use in locations exposed to flammable gases

WARNING
- OMRON ROBOTS ARE NOT DESIGNED TO BE EXPLOSION-PROOF.
- DO NOT USE THE ROBOTS IN LOCATIONS EXPOSED TO EXPLOSIVE OR INFLAMMABLE GASES, DUST PARTICLES OR LIQUID. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH, OR LEAD TO FIRE.

■ Moving

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

WARNING
MOVING PARTS CAN PINCH OR CRUSH HANDS OR FINGERS.
KEEP HANDS AWAY FROM THE MOVABLE PARTS OF THE ROBOT.

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

2. Take safety measures when moving the robot

To ensure safety when moving a SCARA robot with an arm length of 500mm or more, use the eyebolts that come supplied with the robot.
Refer to the Robot Manual for details.

■ Installation

1. Protect electrical wiring and hydraulic/pneumatic hoses

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

■ Wiring

1. Protective measures against electrical shock

WARNING
ALWAYS GROUND THE ROBOT TO PREVENT ELECTRICAL SHOCK.

■ Adjustment

1. Adjustment that requires removing a cover

WARNING

ADJUSTMENT BY REMOVING A COVER REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS, AND MAY ALSO INVOLVE HAZARDS IF ATEMPTED BY AN UNSKILLED PERSON. THESE TASKS MUST BE PERFORMED ONLY BY PERSONS WHO HAVE ENOUGH ABILITY AND QUALIFICATIONS IN ACORDANCE WITH LOCAL LAWS AND REGULATIONS. FOR DETAILED INFORMATION, PLEASE CONTACT YOUR DISTRIBUTOR WHERE YOU PURCHASED THE PRODUCT.

4.3.2 Precautions for robot controllers

■ Installation environment

1. Installation environment

WARNING

OMRON ROBOTS ARE NOT DESIGNED TO BE EXPLOSION-PROOF. DO NOT USE THE ROBOTS AND CONTROLLERS IN LOCATIONS EXPOSED TO EXPLOSIVE OR INFLAMMABLE GASES, DUST PARTICLES OR LIQUID SUCH AS GASOLINE AND SOLVENTS. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH, AND LEAD TO FIRE.

WARNING

- USE THE ROBOT CONTROLLER IN LOCATIONS THAT SUPPORT THE ENVIRONMENTAL CONDITIONS SPECIFIED IN THIS MANUAL. OPERATION OUTSIDE THE SPECIFIED ENVIRONMENTAL RANGE MAY CAUSE ELECTRICAL SHOCK, FIRE, MALFUNCTION OR PRODUCT DAMAGE OR DETERIORATION.
- THE ROBOT CONTROLLER AND PROGRAMMING BOX MUST BE INSTALLED AT A LOCATION THAT IS OUTSIDE THE ROBOT SAFETY ENCLOSURE YET WHERE IT IS EASY TO OPERATE AND VIEW ROBOT MOVEMENT.
- INSTALL THE ROBOT CONTROLLER IN LOCATIONS WITH ENOUGH SPACE TO PERFORM WORK (TEACHING, INSPECTION, ETC.) SAFELY. LIMITED SPACE NOT ONLY MAKES IT DIFFICULT TO PERFORM WORK BUT CAN ALSO CAUSE INJURY.
- INSTALL THE ROBOT CONTROLLER IN A STABLE, LEVEL LOCATION AND SECURE IT FIRMLY. AVOID INSTALLING THE CONTROLLER UPSIDE DOWN OR IN A TILTED POSITION.
- PROVIDE SUFFICIENT CLEARANCE AROUND THE ROBOT CONTROLLER FOR GOOD VENTILATION. INSUFFICIENT CLEARANCE MAY CAUSE MALFUNCTION, BREAKDOWN OR FIRE.

■ Installation

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

1. Installation

WARNING

SECURELY TIGHTEN THE SCREWS FOR THE L-SHAPED BRACKETS USED TO INSTALL THE ROBOT CONTROLLER. IF NOT SECURELY TIGHTENED, THE SCREWS MAY COME LOOSE CAUSING THE CONTROLLER TO DROP.

2. Connections

WARNING

- ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE STARTING INSTALLATION OR WIRING WORK. FAILURE TO DO THIS MAY CAUSE ELECTRICAL SHOCK OR PRODUCT DAMAGE.
- NEVER DIRECTLY TOUCH CONDUCTIVE SECTIONS AND ELECTRONIC PARTS OTHER THAN THE CONNECTORS, ROTARY SWITCHES, AND DIP SWITCHES ON THE OUTSIDE PANEL OF THE ROBOT CONTROLLER. TOUCHING THEM MAY CAUSE ELECTRICAL SHOCK OR BREAKDOWN.
- SECURELY INSTALL EACH CABLE CONNECTOR INTO THE RECEPTACLES OR SOCKETS. POOR CONNECTIONS MAY CAUSE THE CONTROLLER OR ROBOT TO MALFUNCTION.

■ Wiring

1. Connection to robot controller

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

2. Wiring safety points

WARNING

ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE STARTING INSTALLATION OR WIRING WORK. FAILURE TO DO THIS MAY CAUSE ELECTRICAL SHOCK OR PRODUCT DAMAGE.

CAUTION

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

3. Wiring method

WARNING

SECURELY INSTALL THE CONNECTORS INTO THE ROBOT CONTROLLER AND, WHEN WIRING THE CONNECTORS, MAKE THE CRIMP, PRESS-CONTACT OR SOLDER CONNECTIONS CORRECTLY USING THE TOOL SPECIFIED BY THE CONNECTOR MANUFACTURER.

CAUTION

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

4. Precautions for cable routing and installation

CAUTION

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

5. Protective measures against electrical shock

WARNING

BE SURE TO GROUND THE CONTROLLER USING THE GROUND TERMINAL ON THE POWER TERMINAL BLOCK. POOR GROUNDING MAY CAUSE ELECTRICAL SHOCK.

4.4 Safety measures

4.4.1 Safety measures

1. Referring to warning labels and manual

WARNING

- BEFORE STARTING INSTALLATION OR OPERATION OF THE ROBOT, BE SURE TO READ THE WARNING LABELS AND THIS MANUAL, AND COMPLY WITH THE INSTRUCTIONS.
- NEVER ATTEMPT ANY REPAIR, PARTS REPLACEMENT AND MODIFICATION UNLESS DESCRIBED IN THIS MANUAL. THESE TASKS REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS AND MAY ALSO INVOLVE HAZARDS. PLEASE CONTACT YOUR DISTRIBUTOR FOR ADVICE.

NOTE

For details on warning labels, see "3. Warning labels" in "Safety instructions."

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

WARNING

DECIDE ON "WORK INSTRUCTIONS" IN CASES WHERE PERSONNEL MUST WORK WITHIN THE ROBOT SAFETY ENCLOSURE TO PERFORM STARTUP OR MAINTENANCE WORK. MAKE SURE THE WORKERS COMPLETELY UNDERSTAND THESE "WORK INSTRUCTIONS".

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

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

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

3. Take safety measures

DANGER

- NEVER ENTER THE ROBOT MOVEMENT RANGE WHILE THE ROBOT IS OPERATING OR THE MAIN POWER IS TURNED ON. FAILURE TO FOLLOW THIS WARNING MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH. INSTALL A SAFETY ENCLOSURE OR A GATE INTERLOCK WITH AN AREA SENSOR TO KEEP ALL PERSONS AWAY FROM THE ROBOT MOVEMENT RANGE.
- WHEN IT IS NECESSARY TO OPERATE THE ROBOT WHILE YOU ARE WITHIN THE ROBOT MOVEMENT RANGE SUCH AS FOR TEACHING OR MAINTENANCE/INSPECTION TASKS, ALWAYS CARRY THE PROGRAMMING BOX WITH YOU SO THAT YOU CAN IMMEDIATELY STOP THE ROBOT OPERATION IN CASE OF AN ABNORMAL OR HAZARDOUS CONDITION. INSTALL AN ENABLE DEVICE IN THE EXTERNAL SAFETY CIRCUIT AS NEEDED. ALSO SET THE ROBOT MOVING SPEED TO 3% OR LESS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH.

See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

WARNING

- DURING STARTUP OR MAINTENANCE TASKS, DISPLAY A SIGN "WORK IN PROGRESS" ON THE PROGRAMMING BOX AND OPERATION PANEL IN ORDER TO PREVENT ANYONE OTHER THAN THE PERSON FOR THAT TASK FROM MISTAKENLY OPERATING THE START OR SELECTOR SWITCH. IF NEEDED, TAKE OTHER MEASURES SUCH AS LOCKING THE COVER ON THE OPERATION PANEL.
- ALWAYS CONNECT THE ROBOT AND ROBOT CONTROLLER IN THE CORRECT COMBINATION. USING THEM IN AN INCORRECT COMBINATION MAY CAUSE FIRE OR BREAKDOWN.

4. Install system

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

WARNING

TO CHECK THE ROBOT CONTROLLER OPERATING STATUS, REFER TO THIS MANUAL AND TO RELATED MANUALS. DESIGN AND INSTALL THE SYSTEM INCLUDING THE ROBOT CONTROLLER SO THAT IT WILL ALWAYS WORK SAFELY.

5. Precautions for operation

WARNING

- DO NOT TOUCH ANY ELECTRICAL TERMINAL. DIRECTLY TOUCHING THESE TERMINALS MAY CAUSE ELECTRICAL SHOCK, EQUIPMENT DAMAGE, AND MALFUNCTION.
- DO NOT TOUCH OR OPERATE THE ROBOT CONTROLLER OR PROGRAMMING BOX WITH WET HANDS. TOUCHING OR OPERATING THEM WITH WET HANDS MAY RESULT IN ELECTRICAL SHOCK OR BREAKDOWN.

6. Do not disassemble and modify

WARNING

NEVER DISASSEMBLE AND MODIFY ANY PART IN THE ROBOT, CONTROLLER, AND PROGRAMMING BOX. DO NOT OPEN ANY COVER. DOING SO MAY CAUSE ELECTRICAL SHOCK, BREAKDOWN, MALFUNCTION, INJURY, OR FIRE.

4.4.2 Installing a safety enclosure

Be sure to install a safety enclosure to keep anyone from entering within the movement range of the robot. The safety enclosure will prevent the operator and other persons from coming in contact with moving parts of the robot and suffering injury.
See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

DANGER

SERIOUS INJURY MAY RESULT FROM CONTACT WITH A MOVING ROBOT.

- KEEP OUTSIDE OF THE ROBOT SAFETY ENCLOSURE DURING OPERATION.
- PRESS THE EMERGENCY STOP BUTTON BEFORE ENTERING THE SAFETY ENCLOSURE.

WARNING

- INSTALL AN INTERLOCK THAT TRIGGERS EMERGENCY STOP WHEN THE DOOR OR GATE OF THE SAFETY ENCLOSURE IS OPENED.
- THE SAFETY ENCLOSURE SHOULD BE DESIGNED SO THAT NO ONE CAN ENTER INSIDE EXCEPT FROM THE DOOR OR GATE EQUIPPED WITH AN INTERLOCK DEVICE.
- WARNING LABEL 1 (SEE "3. WARNING LABELS" IN "SAFETY INSTRUCTIONS") THAT COMES SUPPLIED WITH A ROBOT SHOULD BE AFFIXED TO AN EASY-TO-SEE LOCATION ON THE DOOR OR GATE OF THE SAFETY ENCLOSURE.

4.5 Operation

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

DANGER

CHECK THE FOLLOWING POINTS BEFORE STARTING ROBOT OPERATION.

- NO ONE IS WITHIN THE ROBOT SAFETY ENCLOSURE.
- THE PROGRAMMING UNIT IS IN THE SPECIFIED LOCATION.
- THE ROBOT AND PERIPHERAL EQUIPMENT ARE IN GOOD CONDITION.

4.5.1 Trial operation

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

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

Then rope off or chain off the movement range around the robot in place of the safety enclosure and observe the following points. See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

DANGER

PLACE A "ROBOT IS MOVING - KEEP AWAY!" SIGN TO KEEP THE OPERATOR OR OTHER PERSONNEL FROM ENTERING WITHIN THE MOVEMENT RANGE OF THE ROBOT.

WARNING

- USE STURDY, STABLE POSTS WHICH WILL NOT FALL OVER EASILY.
- THE ROPE OR CHAIN SHOULD BE EASILY VISIBLE TO EVERYONE AROUND THE ROBOT.

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

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

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

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

4. Working inside safety enclosures

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

DANGER

NEVER ENTER WITHIN THE MOVEMENT RANGE WHILE WITHIN THE SAFETY ENCLOSURE.

See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

WARNING

WHEN WORK IS REQUIRED WITHIN THE SAFETY ENCLOSURE, PLACE A SIGN "WORK IN PROGRESS" IN ORDER TO KEEP OTHER PERSONS FROM OPERATING THE CONTROLLER SWITCH OR OPERATION PANEL.

WARNING

WHEN WORK WITHIN THE SAFETY ENCLOSURE IS REQUIRED, ALWAYS TURN OFF THE CONTROLLER POWER EXCEPT FOR THE FOLLOWING CASES:

Exception

Work with power turned on, but robot in emergency stop

Origin position setting	**SCARA robots**	Follow the precautions and procedure described in "2. Adjusting the origin" in Chapter 3.
Standard coordinate setting	**SCARA robots**	Follow the precautions and procedure described in "4. Setting the standard coordinates" in Chapter 3.
Soft limit settings	**SCARA robots**	Follow the precautions and procedure described in "3. Setting the soft limits" in Chapter 3.

Work with power turned on

Teaching	**SCARA robots**	Refer to "5. Teaching within safety enclosure" described below.

5. Teaching within the safety enclosure

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

DANGER

NEVER ENTER WITHIN THE MOVEMENT RANGE WHILE WITHIN THE SAFETY ENCLOSURE.

See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

WARNING

- MAKE A VISUAL CHECK TO ENSURE THAT NO HAZARDS ARE PRESENT WITHIN THE SAFETY ENCLOSURE.
- CHECK THAT THE PROGRAMMING BOX OR HANDY TERMINAL OPERATES CORRECTLY.
- CHECK THAT NO FAILURES ARE FOUND IN THE ROBOT.
- CHECK THAT EMERGENCY STOP WORKS CORRECTLY.
- SELECT TEACHING MODE AND DISABLE AUTOMATIC OPERATION.

4.5.2 Automatic operation

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

1. Checkpoints before starting automatic operation

Check the following points before starting automatic operation

DANGER

- CHECK THAT NO ONE IS WITHIN THE SAFETY ENCLOSURE.
- CHECK THE SAFETY ENCLOSURE IS SECURELY INSTALLED WITH INTERLOCKS FUNCTIONAL.

WARNING

- CHECK THAT THE PROGRAMMING BOX / HANDY TERMINAL AND TOOLS ARE IN THEIR SPECIFIED LOCATIONS.
- CHECK THAT THE SIGNAL TOWER LAMPS OR OTHER ALARM DISPLAYS INSTALLED FOR THE SYSTEM ARE NOT LIT OR FLASHING, INDICATING NO ERROR IS OCCURRING ON THE ROBOT AND PERIPHERAL DEVICES.

2. During automatic operation and when errors occur

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

DANGER

NEVER ENTER THE SAFETY ENCLOSURE DURING AUTOMATIC OPERATION.

WARNING

IF AN ERROR OCCURS IN THE ROBOT OR PERIPHERAL EQUIPMENT, OBSERVE THE FOLLOWING PROCEDURE BEFORE ENTERING THE SAFETY ENCLOSURE.

1) PRESS THE EMERGENCY STOP BUTTON TO SET THE ROBOT TO EMERGENCY STOP.
2) PLACE A SIGN ON THE START SWITCH, INDICATING THAT THE ROBOT IS BEING INSPECTED IN ORDER TO KEEP OTHER PERSONS FROM RESTARTING THE ROBOT.

4.5.3 Precautions during operation

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

WARNING

- IF UNUSUAL ODORS, NOISE OR SMOKE OCCUR DURING OPERATION, IMMEDIATELY TURN OFF POWER TO PREVENT POSSIBLE ELECTRICAL SHOCK, FIRE OR BREAKDOWN. STOP USING THE ROBOT AND CONTACT YOUR DISTRIBUTOR.
- IF ANY OF THE FOLLOWING DAMAGE OR ABNORMAL CONDITIONS OCCURS THE ROBOT, THEN CONTINUING TO OPERATE THE ROBOT IS DANGEROUS. IMMEDIATELY STOP USING THE ROBOT AND CONTACT YOUR DISTRIBUTOR.

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

2. High temperature hazard

WARNING

- DO NOT TOUCH THE ROBOT CONTROLLER AND ROBOT DURING OPERATION. THE ROBOT CONTROLLER AND ROBOT BODY ARE VERY HOT DURING OPERATION, SO BURNS MAY OCCUR IF THESE SECTIONS ARE TOUCHED.
- THE MOTOR AND SPEED REDUCTION GEAR CASING ARE VERY HOT SHORTLY AFTER OPERATION, SO BURNS MAY OCCUR IF THESE ARE TOUCHED. BEFORE TOUCHING THOSE PARTS FOR INSPECTIONS OR SERVICING, TURN OFF THE CONTROLLER, WAIT FOR A WHILE AND CHECK THAT THEIR TEMPERATURE HAS COOLED.

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

WARNING

THE VERTICAL AXIS WILL SLIDE DOWNWARD WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION. TAKE ADEQUATE SAFETY MEASURES IN CONSIDERATION BY TAKING THE WEIGHT AND SHAPE INTO ACCOUNT.

- BEFORE RELEASING THE BRAKE AFTER PRESSING THE EMERGENCY STOP BUTTON, PLACE A SUPPORT UNDER THE VERTICAL AXIS SO THAT IT WILL NOT SLIDE DOWN.
- BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE VERTICAL AXIS AND THE INSTALLATION BASE WHEN PERFORMING TASKS (DIRECT TEACHING, ETC.) WITH THE BRAKE RELEASED.

4. Be careful of Z-axis movement when the controller is turned off or emergency stop is triggered (air-driven Z-axis)

WARNING

THE Z-AXIS STARTS MOVING UPWARD WHEN POWER TO THE CONTROLLER OR PLC IS TURNED OFF, THE PROGRAM IS RESET, EMERGENCY STOP IS TRIGGERED, OR AIR IS SUPPLIED TO THE SOLENOID VALVE FOR THE Z-AXIS AIR CYLINDER.

- DO NOT LET HANDS OR FINGERS GET CAUGHT AND SQUEEZED BY ROBOT PARTS MOVING ALONG THE Z-AXIS.
- KEEP THE USUAL ROBOT POSITION IN MIND SO AS TO PREVENT THE Z-AXIS FROM HANGING UP OR BINDING ON OBSTACLES DURING RAISING OF THE Z-AXIS EXCEPT IN CASE OF EMERGENCY STOP.

5. Take protective measures when the Z-axis interferes with peripheral equipment (air-driven Z-axis)

WARNING

WHEN THE Z-AXIS COMES TO A STOP DUE TO OBSTRUCTION FROM PERIPHERAL EQUIPMENT, THE Z-AXIS MAY MOVE SUDDENLY AFTER THE OBSTRUCTION IS REMOVED, CAUSING INJURY SUCH AS PINCHED OR CRUSHED HANDS.

- TURN OFF THE CONTROLLER AND REDUCE THE AIR PRESSURE BEFORE ATTEMPTING TO REMOVE THE OBSTRUCTION.
- BEFORE REDUCING THE AIR PRESSURE, PLACE A SUPPORT UNDER THE Z-AXIS BECAUSE THE Z-AXIS WILL DROP UNDER ITS OWN WEIGHT.

6. Be careful of Z-axis movement when air supply is stopped (air-driven Z-axis)

WARNING

THE Z-AXIS WILL SLIDE DOWNWARD WHEN THE AIR PRESSURE TO THE Z-AXIS AIR CYLINDER SOLENOID VALVE IS REDUCED, CREATING A HAZARDOUS SITUATION.
TURN OFF THE CONTROLLER AND PLACE A SUPPORT UNDER THE Z-AXIS BEFORE CUTTING OFF THE AIR SUPPLY.

7. Make correct parameter settings

CAUTION

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

8. If the X-axis, Y-axis or R-axis rotation angle is small

CAUTION

If the X-axis, Y-axis or R-axis rotation angle is set smaller than 5 degrees, then it will always move within the same position. This restricted position makes it difficult for an oil film to form on the joint support bearing, and so may possibly damage the bearing. In this type of operation, add a range of motion so that the joint moves through 90 degrees or more, about 5 times a day.

4.6 Inspection and maintenance

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

4.6.1 Before inspection and maintenance work

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

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

WARNING
NEVER ATTEMPT INSPECTION, MAINTENANCE, REPAIR, AND PART REPLACEMENT UNLESS DESCRIBED IN THIS MANUAL. THESE TASKS REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS AND MAY ALSO INVOLVE HAZARDS. PLEASE BE SURE TO CONTACT YOUR DISTRIBUTOR FOR ADVICE.

2. Precautions during repair and parts replacement

WARNING
WHEN IT IS NECESSARY TO REPAIR OR REPLACE PARTS OF THE ROBOT OR CONTROLLER, PLEASE BE SURE TO CONTACT YOUR DISTRIBUTOR AND FOLLOW THE INSTRUCTIONS THEY PROVIDE. INSPECTION AND MAINTENANCE OF THE ROBOT OR CONTROLLER BY AN UNSKILLED, UNTRAINED PERSON IS EXTREMELY HAZARDOUS.

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

WARNING
ADJUSTMENT AND MAINTENANCE BY REMOVING A COVER REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS, AND MAY ALSO INVOLVE HAZARDS IF ATTEMPTED BY AN UNSKILLED PERSON. FOR DETAILED INFORMATION, PLEASE CONTACT YOUR DISTRIBUTOR WHERE YOU PURCHASED THE PRODUCT.

3. Shut off all phases of power supply

WARNING
ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE CLEANING THE ROBOT AND CONTROLLER OR SECURELY TIGHTENING THE TERMINAL SCREWS ETC. FAILURE TO DO THIS MAY CAUSE ELECTRICAL SHOCK OR PRODUCT DAMAGE OR MALFUNCTION.

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

WARNING
- WHEN PERFORMING MAINTENANCE OR INSPECTION OF THE ROBOT CONTROLLER UNDER YOUR DISTRIBUTOR'S INSTRUCTIONS, WAIT AT LEAST 30 MINUTES FOR THE YRC SERIES AFTER TURNING THE POWER OFF. SOME COMPONENTS IN THE ROBOT CONTROLLER ARE VERY HOT OR STILL RETAIN A HIGH VOLTAGE SHORTLY AFTER OPERATION, SO BURNS OR ELECTRICAL SHOCK MAY OCCUR IF THOSE PARTS ARE TOUCHED.
- THE MOTOR AND SPEED REDUCTION GEAR CASING ARE VERY HOT SHORTLY AFTER OPERATION, SO BURNS MAY OCCUR IF THEY ARE TOUCHED. BEFORE TOUCHING THOSE PARTS FOR INSPECTIONS OR SERVICING, TURN OFF THE CONTROLLER, WAIT FOR A WHILE AND CHECK THAT THE TEMPERATURE HAS COOLED.

5. Precautions during inspection of controller

WARNING
- WHEN YOU NEED TO TOUCH THE TERMINALS OR CONNECTORS ON THE OUTSIDE OF THE CONTROLLER DURING INSPECTION, ALWAYS FIRST TURN OFF THE CONTROLLER POWER SWITCH AND ALSO THE POWER SOURCE IN ORDER TO PREVENT POSSIBLE ELECTRICAL SHOCK.
- DO NOT DISASSEMBLE THE CONTROLLER. NEVER TOUCH ANY INTERNAL PARTS OF THE CONTROLLER. DOING SO MAY CAUSE BREAKDOWN, MALFUNCTION, INJURY, OR FIRE.

4.6.2 Precautions during service work

1. Be careful when removing the Z-axis motor (SCARA robots)

WARNING

THE Z-AXIS WILL SLIDE DOWNWARD WHEN THE Z-AXIS MOTOR IS REMOVED, CAUSING A HAZARDOUS SITUATION.

- TURN OFF THE CONTROLLER AND PLACE A SUPPORT UNDER THE Z-AXIS BEFORE REMOVING THE Z-AXIS MOTOR.
- BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BY THE DRIVING UNIT OF THE Z-AXIS OR BETWEEN THE Z-AXIS DRIVE UNIT AND THE INSTALLATION BASE.

2. Do not remove the Z-axis upper limit mechanical stopper

CAUTION

Warning label 4 is attached to each SCARA robot. (For details on warning labels, see "3. Warning labels" in "Safety instructions.") Removing the upper limit mechanical stopper installed to the Z-axis spline or shifting its position will damage the Z-axis ball screw. Never attempt to remove it.

3. Use caution when handling a robot that contains powerful magnets

WARNING

POWERFUL MAGNETS ARE INSTALLED INSIDE THE ROBOT. DO NOT DISASSEMBLE THE ROBOT SINCE THIS MAY CAUSE INJURY. DEVICES THAT MAY MALFUNCTION DUE TO MAGNETIC FIELDS MUST BE KEPT AWAY FROM THIS ROBOT.

See "6. Cautions regarding strong magnetic fields" in "Safety instructions" for detailed information on strong magnetic fields.

4. Use the following caution items when disassembling or replacing the pneumatic equipment.

WARNING

AIR OR PARTS MAY FLY OUTWARD IF PNEUMATIC EQUIPMENT IS DISASSEMBLED OR PARTS REPLACED WHILE AIR IS STILL SUPPLIED.

- DO SERVICE WORK AFTER TURNING OFF THE CONTROLLER, REDUCING THE AIR PRESSURE, AND EXHAUSTING THE RESIDUAL AIR FROM THE PNEUMATIC EQUIPMENT.
- BEFORE REDUCING THE AIR PRESSURE, PLACE A SUPPORT STAND UNDER THE Z-AXIS SINCE IT WILL DROP UNDER ITS OWN WEIGHT.

5. Use caution to avoid contact with the controller cooling fan

WARNING

- TOUCHING THE ROTATING FAN MAY CAUSE INJURY.
- IF REMOVING THE FAN COVER, FIRST TURN OFF THE CONTROLLER AND MAKE SURE THE FAN HAS STOPPED.

6. Precautions for robot controllers

CAUTION

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

4.7 Disposal

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

1. Disposal of lithium batteries

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

2. Disposal of packing boxes and materials

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

3. Strong magnet

WARNING

STRONG MAGNETS ARE INSTALLED IN THE ROBOT. BE CAREFUL WHEN DISPOSING OF THE ROBOT.

See "6. Cautions regarding strong magnetic fields" in "Safety instructions" for detailed information on strong magnetic fields.

5. Emergency action when a person is caught by robot

If a person should get caught between the robot and a mechanical part such as the installation base, then release the axis.

■ Emergency action

Release the axis while referring to the following section in the manual for the robot controller.

Controller	Refer to:
YRC	Section 1, "Freeing a person caught by the robot" in Chapter 1

NOTE

Make a printout of the relevant page in the manual and post it a conspicuous location near the controller.

6. Cautions regarding strong magnetic fields

Some OMRON robots contain parts generating strong magnetic fields which may cause bodily injury, death, or device malfunction. Always comply with the following instructions.

- Persons wearing ID cards, purses, or wristwatches must keep away from the robot.
- Do not bring tools close to the magnet inside the robot.

7. Using the robot safely

7.1 Movement range

When a tool or workpiece is attached to the robot manipulator tip, the actual movement range enlarges from the movement range of the robot itself (Figure A) to include the areas taken up by movement of the tool and workpiece attached to the manipulator tip (Figure B).
The actual movement range expands even further if the tool or workpiece is offset from the manipulator tip.
The movement range here is defined as the range of robot motion including all areas through which the robot arms, the tool and workpiece attached to the manipulator tip, and the solenoid valves attached to the robot arms move.
To make the robot motion easier to understand, the figures below only show the movement ranges of the tool attachment section, tool, and workpiece.
Please note that during actual operation, the movement range includes all areas where the robot arms and any other parts move along with the robot.

Movement range

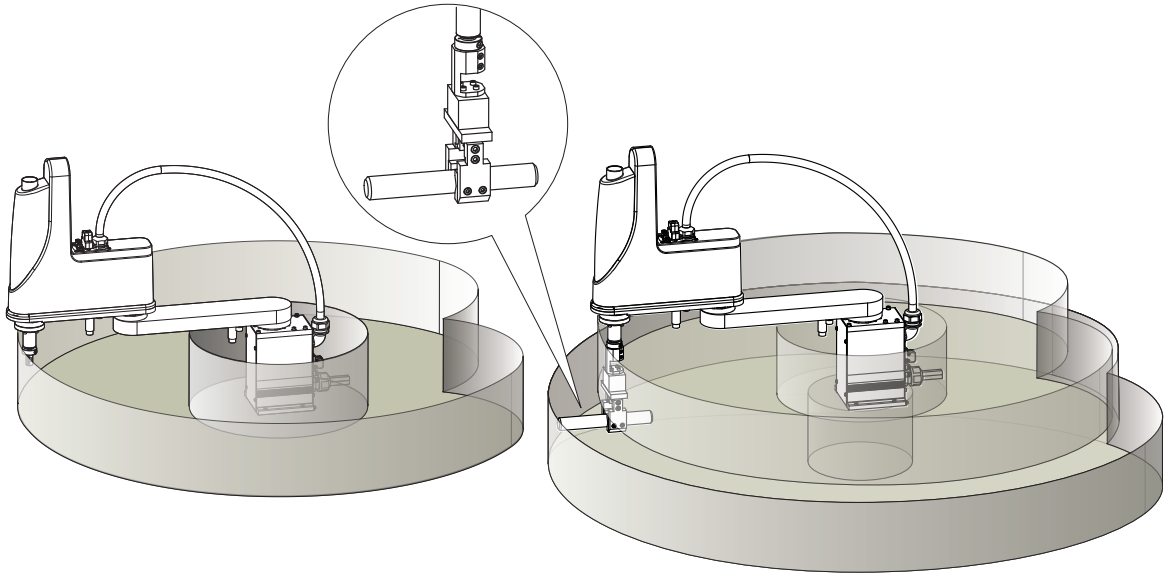


Figure A: Movement range of robot itself

Figure B: Movement range when tool and workpiece are attached to manipulator tip

CAUTION

To make the robot motion easier to understand, the above figures only show the movement ranges of the tool attachment section, tool, and workpiece. In actual operation, the movement range includes all areas where the robot arms and any other parts move along with the robot.

7.2 Robot protective functions

Protective functions for OMRON robots are described below.

1. Overload detection

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

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

2. Overheat detection

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

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

3. Soft limits

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

WARNING

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

4. Mechanical stoppers

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

SCARA robots	• The X and Y axes have mechanical stoppers that are installed at both ends of the maximum movement range. Some robot models have a standard feature that allows changing the mechanical stopper positions. On some other models, the mechanical stopper positions can also be changed by using option parts. • The Z-axis has a mechanical stopper at the upper end and lower end. The stopper positions can be changed by using option parts. • No mechanical stopper is provided on the R-axis.

WARNING

AXIS MOVEMENT DOES NOT STOP IMMEDIATELY AFTER THE SERVO IS TURNED OFF BY EMERGENCY STOP OR OTHER PROTECTIVE FUNCTIONS, SO USE CAUTION.

CAUTION

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

5. Z-axis (vertical axis) brake

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

WARNING

THE VERTICAL AXIS WILL SLIDE DOWNWARD WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION. TAKE ADEQUATE SAFETY MEASURES IN CONSIDERATION BY TAKING THE WEIGHT AND SHAPE INTO ACCOUNT.

- BEFORE RELEASING THE BRAKE AFTER PRESSING THE EMERGENCY STOP BUTTON, PLACE A SUPPORT UNDER THE VERTICAL AXIS SO THAT IT WILL NOT SLIDE DOWN.
- BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE VERTICAL AXIS AND THE INSTALLATION BASE WHEN PERFORMING TASKS (DIRECT TEACHING, ETC.) WITH THE BRAKE RELEASED.

7.3 Residual risk

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

7.4 Special training for industrial robot operation

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

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

Comparison of terms used in this manual with ISO

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

See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

Warranty

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

■ Warranty description

If a failure or breakdown occurs due to defects in materials or workmanship in the genuine parts constituting this OMRON robot and/or related product within the warranty period, then OMRON shall supply free of charge the necessary replacement/ repair parts.

■ Warranty period

The warranty period ends 24 months after the date of manufacturing as shown on the products.

■ Exceptions to the warranty

This warranty will not apply in the following cases:

1. Fatigue arising due to the passage of time, natural wear and tear occurring during operation (natural fading of painted or planted surfaces, deterioration of parts subject to wear, etc.)
2. Minor natural phenomena that do not affect the capabilities of the robot and/or related product (noise from computers, motors, etc.)
3. Programs, point data and other internal data were changed or created by the user.

Failures resulting from the following causes are not covered by warranty.

1. Damage due to earthquakes, storms, floods, thunderbolt, fire or any other natural or man-made disaster.
2. Troubles caused by procedures prohibited in this manual.
3. Modifications to the robot and/or related product not approved by OMRON or OMRON sales representative.
4. Use of any other than genuine parts and specified grease and lubricant.
5. Incorrect or inadequate maintenance and inspection.
6. Repairs by other than authorized dealers.

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NONINFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUERIMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE OR INAPPROPIATE MODIFICATION OR REPAIR.

Important information before reading this manual

Contents

Introduction

Our sincere thanks for your purchase of this OMRON robot controller.

Be sure to read this manual carefully as well as related manuals and comply with their instructions for using the OMRON robot controller safely and correctly.

About this manual

Warnings and cautions listed in this manual relate to OMRON robot controllers. To ensure safety of the user's final system that includes OMRON robots and controllers, please take appropriate safety measures as required by the user's individual system.

Industrial robots are highly programmable machines that provide a large degree of freedom in movement.
To use OMRON robots and controllers safely and correctly, be sure to comply with the safety instructions and precautions described in this manual.
Failure to take necessary safety measures or incorrect handling may result not only in trouble or damage to the robot and controller, but also in serious accidents involving injury or death to personnel (robot installer, operator, or service personnel). Observe the precautions given in each chapter.

To use OMRON robots and controllers safely and correctly, **first read "Safety Instructions" in this manual** and always comply with the safety rules and instructions.
Please note, however, this manual cannot cover all items regarding safety.
So it is extremely important that the operator or user have knowledge of safety and make correct decisions regarding safety.

Programming box display illustration shown in this manual

In this manual, the portion of the programming box display illustration shown by the ≈ mark is omitted.

Overview of the YRC series

The OMRON YRC series robot controllers were developed based on years of OMRON experience and proven achievements in robotics and electronics. These controllers are specifically designed to operate OMRON industrial robots efficiently and accurately.
Major features and functions are:

1. Multi-task function

Up to 8 tasks* can be run simultaneously in a specified priority. (Low priority tasks are halted while high priority tasks are run.) I/O parallel processing and interrupt processing are also available, so that operational efficiency of the total robot system including peripheral units is greatly improved.
(*: Refer to "Multi-tasking" in the programming manual for more details on tasks.)

2. Robot language

The YRC series controller comes with a BASIC-like high-level robot language that conforms to the industrial robot programming language SLIM*. This robot language allows easy programming even of complex movements such as multi-task operations and uses a compiling method* for rapid execution of programs.
(*: Standard Language for Industrial Manipulators)
(*: This compiling method checks the syntax in a robot language program, converts it into intermediate codes, and creates an execution file (object file) before actually performing the program.)

3. Movement command

Arch motion
Spatial movement during pick-and-place work can be freely set according to the work environment.
This is effective in reducing cycle time.

4. Maintenance

Software servo control provides unit standardization. This allows connection to most OMRON robot models and simplifies maintenance.

5. CE marking

The YRC series robot controller is designed to conform to machinery directives and EMC (Electromagnetic compatibility) directives as a OMRON robot series product. In this case, the robot controller is set to operate under SAFE mode.
For CE marking compliance, refer to the CE marking supplement manual.

This manual explains how to handle and operate the OMRON robot controllers correctly and effectively, as well as I/O interface connections.
Read this manual carefully before installing and using the robot controller.
Also refer to the separate programming manual and robot user's manual as needed.

Before using the robot controller (Be sure to read the following notes)

Please be sure to perform the following tasks before using the robot controller.
Failing to perform these tasks will require absolute reset for setting the origin position each time the power is turned on or may cause abnormal operation (vibration, noise).

[1]When connecting the power supply to the robot controller

Always make a secure connection to the ground terminal on the robot controller to ensure safety and prevent malfunctions due to noise.

TIP

Refer to the user's manual for detailed information.

[2]When connecting the battery cable to the robot controller

The absolute batteries shipped with the controller are unused, and the battery connectors are left disconnected to prevent discharge. After installing the controller, always connect the absolute batteries while referring to the user's manual before connecting the robot cables.
An error (relating to absolute settings) is always issued if the robot controller power is turned on without connecting the absolute batteries, so the origin position cannot be detected. This means the robot connected to this controller cannot be used with absolute specifications.

[3]When connecting robot cables to the robot controller

Be sure to keep robot cables separate from the robot controller power connection lines and other equipment power lines. Using in close contact with lines carrying power may cause malfunctions or abnormal operation.

TIP

Absolute reset is always required when the robot controller power is first turned on after connecting the robot cable to the robot controller. Perform absolute reset while referring to "10. Absolute reset" in Chapter 5. Absolute reset is also required after the robot cable was disconnected from the robot controller and then reconnected.

[4]Setting the maximum speed

When operating a ball screw driven robot, the ball screw's free length will increase as the movement stroke increases, and the resonant frequency will drop. This may cause the ball screw to resonate and vibrate severely depending on the motor rotation speed. (The speed at which resonance occurs is called the critical speed.)
To prevent this resonance, the maximum speed must be reduced depending on the robot model when the movement stroke increases. Refer to our robot catalog for the maximum speed settings.

CAUTION

Continuous operation while the ball screw is resonating may cause the ball screw to wear out prematurely.

[5]Duty

To lengthen the service life of robots, the robots must be operated within the allowable duty (50%).
The duty is calculated as follows:

$$\text{Duty (\%)} = \frac{\text{Operation time}}{\text{Operation time} + \text{Non-operation time}} \times 100$$

If the robot duty is too high, an error such as "overload" or "overheat" occurs. In this case, increase the stop time to reduce the duty.

Chapter 1 Using the robot safely

Contents

1. Freeing a person caught by the robot

If a person should get caught between the robot and mechanical part such as the installation base,or get captured by the robot, free the person by following the instructions below.

1. For axis not equipped with a brake

Put the robot into the emergency stop status to shut off the power to the robot. Then move the axis by pushing it with hands.

2. For axis equipped with a brake

The power to the robot can be shut off by putting the controller into the emergency stop status, but the axis cannot be moved due to the action of the brake.
Release the brake by following the procedure below, then move the axis by pushing it with hands.

WARNING

THE VERTICAL AXIS OF THE VERTICAL USE ROBOT WILL SLIDE DOWN WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION.

- PROP UP THE VERTICAL AXIS WITH A SUPPORT STAND BEFORE RELEASING THE BRAKE.
- BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE VERTICAL AXIS AND THE SUPPORT STAND WHEN RELEASING THE BRAKE.

1 ***Press*** UTILITY ***(*** LOWER + ESC ***).***

The display changes to the UTILITY mode screen and a confirmation message appears on the guideline. When the controller is not in the emergency stop status, this message will not appear. In this case, skip step 2 and go to step 3.

2 ***Press the*** F4 ***(Yes) key to cancel the internal emergency stop flag.***

At this point, it is not necessary to release the emergency stop button on the programming box and the external emergency stop.

3 ***Press*** F1 ***(MOTOR) in UTILITY mode.***

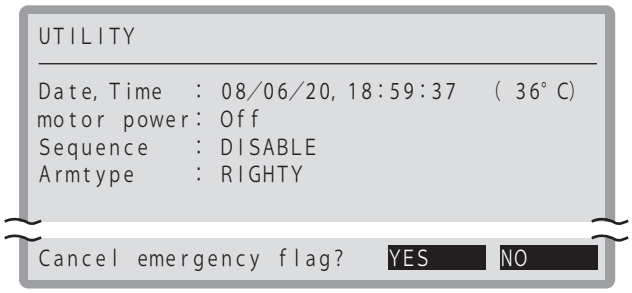
4 ***Use the cursor keys (▲/▼) to select the axis for the target brake.***

5 ***Press*** F8 ***(*** UPPER + F3 ***) (FREE) to release the brake.***

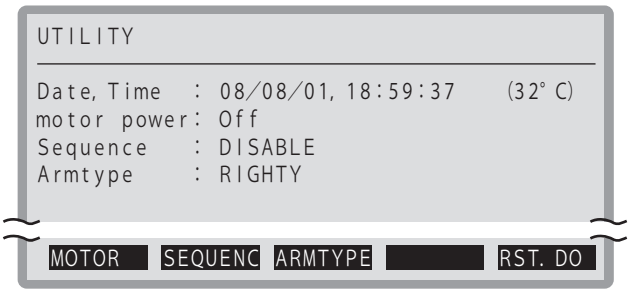
Make sure to prop up the vertical axis with a support stand before releasing the brake since the vertical axis will slide down when the brake is released.

To apply the brake again, press F2 (Brake) in the above screen.

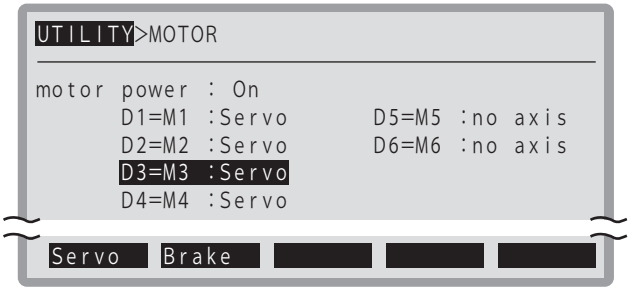
Step 1 Emergency stop screen



Step 3 Select "MOTOR"



Step 4 Selecting axis



2. Emergency stop

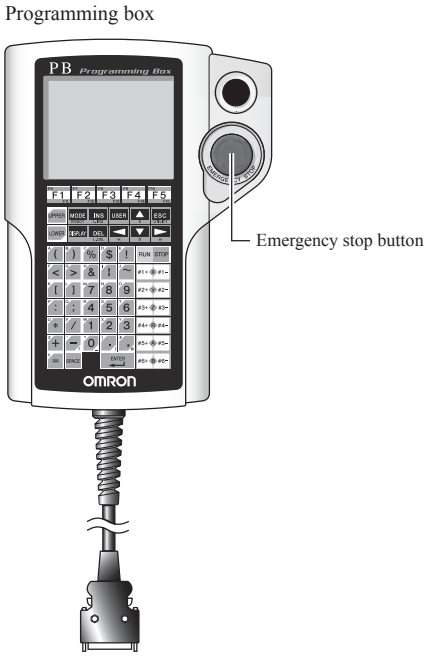
To stop the robot immediately in case of emergency during operation, press the emergency stop button on the programming box.
Pressing the emergency stop button cuts off power to the robot to stop operation.

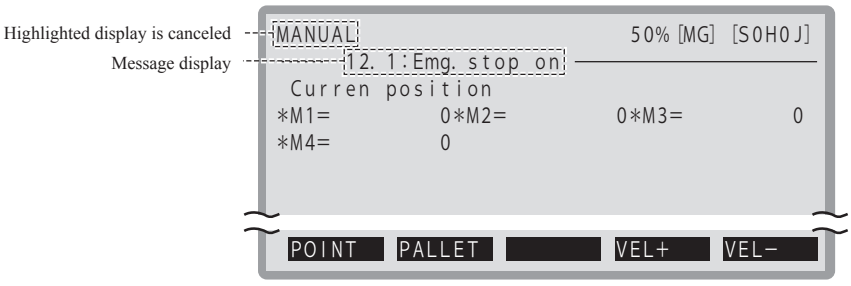
CAUTION

In addition to the emergency stop button on the programming box, the SAFETY connector has terminals for external dedicated input (emergency stop). For detailed information, refer to the user's manual.

A message appears on the programming box screen, indicating that the controller is in emergency stop. The highlighted display for the mode name on the upper left of the screen is cancelled during emergency stop.

Emergency stop





2.1 Emergency stop reset

To return to normal operation after emergency stop, emergency stop must be reset.

NOTE

- Emergency stop can also be triggered by an emergency stop input from the SAFETY I/O interface. To cancel this emergency stop, refer to the user's manual.
- Origin positions are retained even when emergency stop is triggered, so the robot can be restarted by canceling emergency stop without absolute reset or return-to-origin operation.

1 ***Cancel the emergency stop button on the programming box.***

Turning the emergency stop button clockwise releases the emergency stop and turns off the alarm output.

2 ***Cancel the emergency stop flag.***

Press UTILITY (LOWER + ESC). The screen then changes to UTILITY mode and a message appears asking whether to cancel the emergency stop flag. Press F4 (YES) to cancel it.

At this time, pressing ESC returns to the previous mode with the motor power still turned off. To turn on the motor power, continue the following operations.

3 ***Enter MOTOR mode.***

Press F1 (MOTOR) to enter UTILITY>MOTOR mode.

4 ***Turn on the motor power supply.***

Press F1 (On) to turn on the motor power supply.

The servomotor enters HOLD state and the mode name "UTILITY" on the system line (top line on the screen) is highlighted.

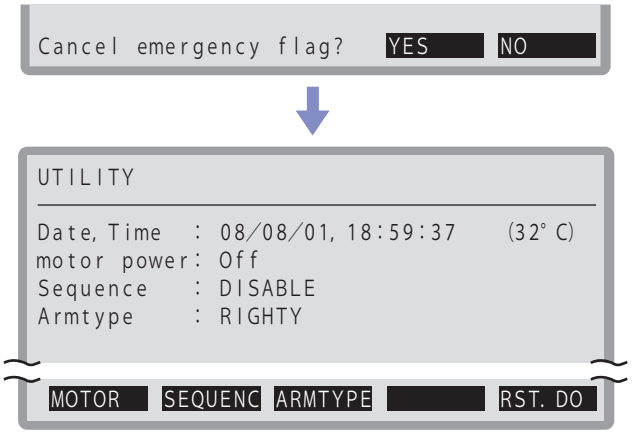
NOTE

If the motor power is turned off due to a serious error, the motor power will not turn on with UTILITY>MOTOR mode. In this case, the robot controller must be turned back on again.

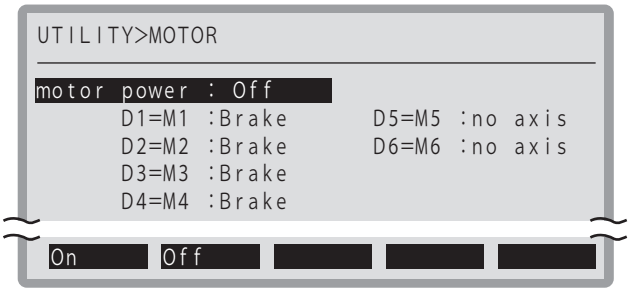
5 ***Exit MOTOR mode.***

Press ESC to return to the previous mode.

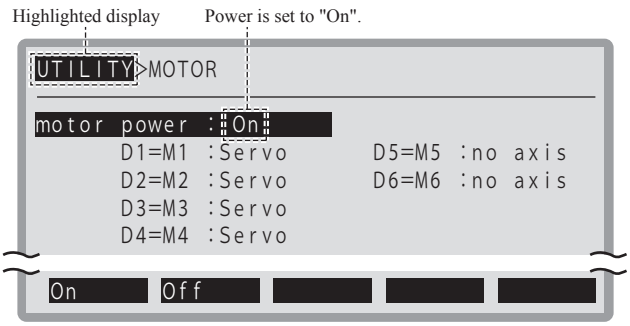
Step 2 **Emergency stop reset**



Step 3 **MOTOR mode**



Step 4 **Turn on the motor power supply**



2.2 Overload error reset

To return to normal operation after the “17.4: Overload” error state, reset the error after removing the cause of the overload error.

NOTE

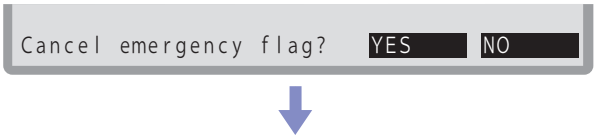
- If the overload error occurs, the robot enters the emergency stop state.
- Origin positions are retained even when emergency stop is triggered by the overload error, so the robot can be restarted by canceling emergency stop without absolute reset or return-to-origin operation.
- The overload reset function is valid in software version Ver. 1.65M or higher. If the overload error occurs in Ver. 1.64M or earlier, it is necessary to power off the controller, and then power it on again.

1 ***Cancel the emergency stop flag.***

Press UTILITY while holding down LOWER.

The screen then changes to UTILITY mode and a message appears asking whether to cancel the emergency stop flag. Press F4 (YES) to cancel it.

Step 1 **Emergency stop reset**



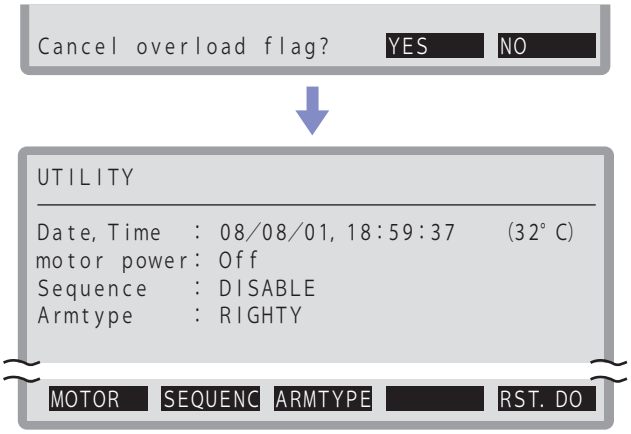
2 ***Cancel the overload error.***

After the emergency stop flag has been cancelled, the message appears asking whether to cancel the overload error. Press F4 (YES) to cancel it.

At this time, pressing ESC will return to the previous mode in the motor power off state. To turn on the motor power, turn it on from the MOTOR mode.

Additionally, when pressing F5 (NO), the overload error is not cancelled. If you attempt to turn on the motor power in the MOTOR mode without cancelling the overload error, the emergency flag turns on again. In this case, cancel the overload error again from Step 1.

Step 2 **Overload error reset**



3. Power-ON procedures

This section describes the procedures from turning on the controller power to performing return-to-origin of the robot.

CAUTION

To connect the programming box to the controller, always use the dedicated cable and connector that come supplied with the programming box. Do not modify the cable and do not connect a relay to the cable.

NOTE

- After turning off the robot controller, wait at least 5 seconds before turning the power back on again. If power is turned on again too quickly after the power was turned off, the controller might not start up correctly.
- Do not turn off the robot controller during program execution. If turned off, this causes errors in the internal system data and the program may not restart correctly when the power is again turned on. Always quit or stop the program before turning off the robot controller.
- When the "Servo on when power on" parameter is set to "INVALID", the controller always starts with the robot servo turned off when power is turned on, regardless of SAFE mode and serial I/O settings. For more details, refer to the user's manual.

1 ***Check the setup and connections.***
Make sure that the necessary setup and connections are correctly completed according to the instructions in the user's manual.

2 ***Activate emergency stop.***
Press the emergency stop button on the programming box to activate emergency stop.

3 ***Turn on the power.***
Supply the power to the AC IN terminal on the front panel of the robot controller.

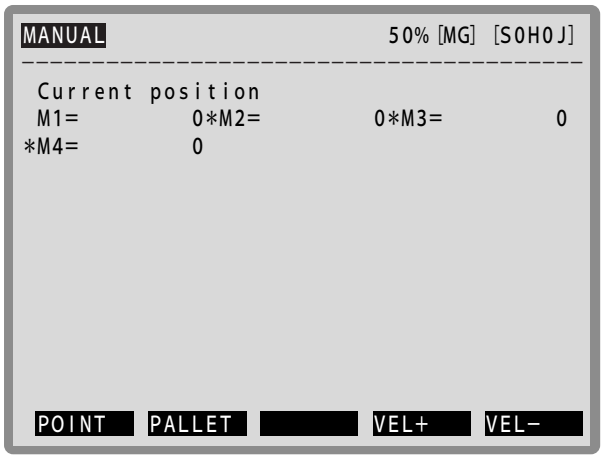
The "PWR" LED lights up and MANUAL mode screen appears. (After the "PWR" LED is lit, it will take a maximum of 3 seconds for the controller to operate normally.)

4 ***Cancel emergency stop.***
Turn the emergency stop button on the programming box clockwise to cancel emergency stop.

5 ***Turn on the servo.***
To turn on the servo, see Chapter 7, UTILITY mode.

6 ***Perform return-to-origin.***
For details on return-to-origin, see "9. Return-to-origin" and "10. Absolute reset" in Chapter 5.

Step 3 MANUAL mode screen



NOTE

- If an error message "Parameter destroyed" or "Memory destroyed" appears on the screen when the robot controller is turned on, be sure to initialize the parameters and memory in SYSTEM mode before performing absolute reset or return-to-origin.
  For more details, refer to the user's manual.
- If an error message "10.21 : Sys. backup battery low voltage" appears while the power supply is turned on, replace the lithium battery (typically 4 years service life) in the robot controller.

4. Usage environments

Operating temperature

Operating temperature	0°C to 40°C

The ambient temperature should be maintained within a range of 0 to 40°C during operation.
This is the range in which continuous operation of the robot controller is guaranteed according to the initial specifications. If the robot controller is installed in a narrow space, then heat generated from the controller itself and from peripheral equipment may drive the temperature above the allowable operating temperature range.
This may result in thermal runaway or malfunctions and may lower component performance along with shortening their useful service life. So be sure to install the controller in locations with a vent having a natural air flow. If this proves insufficient, provide forced air-cooling.

Storage temperature

Storage temperature	-10°C to 65°C

The controller should be stored in a location at an ambient temperature between -10 and 65°C when not being used.
If the robot controller is stored in a location at high temperatures for extended periods, deterioration of the electronic components may occur and the memory backup time may decrease.

Operating humidity

Operating humidity	35% to 85% RH (no condensation)

The ambient humidity of the robot controller should be 35% to 85% RH (no condensation) in order to guarantee continuous operation within the initial specifications. Installing the robot controller inside an air-conditioned or cooling unit is recommended when the ambient humidity is higher than 85% or when condensation occurs.

Storage humidity

Storage humidity	Below 95% RH (no condensation)

The controller should be stored in a location at an ambient humidity below 95% RH (no condensation) when not being used. If the robot controller is stored in a location at high humidity for an extended period of time, rust may form on the electronic components.

Vibration and shock

Do not apply strong shocks to the controller. Do not install the controller in locations subject to large vibrations or shocks. The controller may malfunction or break down if subjected to large vibrations or shocks.

Environments

The controller is not designed to meet explosion-proof, dust-proof, and drip-proof specifications, and so do not use it in the following locations. If used in these locations, component corrosion, improper installation, or fire may result.

1) Environments containing combustible gases or dust particles, or flammable liquids, etc.
2) Environments where conductive substances such as metal cutting chips are present.
3) Environments where water, cutting water, oils, dust, metal particles, or organic solvents are present.
4) Environments containing corrosive gases or substances such as acid or alkali.
5) Environments containing mist such as cutting fluids or grinding fluids.

If using the controller in locations where dust particles of gases may generate, it is recommended to install the controller in a box with a cooling unit.

Installation location

Always install the robot controller indoors, at a height of less than 1000 meters above sea level.
Install the controller in a control panel with a structure that does not allow water, oil, carbon or dust particles to penetrate it.
Do not install the controller in the following locations:

1) Near devices which may be a source of electrical noise, such as large inverters, highoutput high-frequency generators, large contactors, and welding machines.
2) Locations where electrostatic noise is generated.
3) Locations subject to radio frequency interference.
4) Locations where there is a possibility of exposure to radioactivity.
5) Locations where dangerous items such as ignitable, flammable or explosive materials are present.
6) Near combustible materials.
7) Environments exposed to direct sunlight.
8) Narrow space where tasks (teaching, inspections, etc.) cannot be performed safely.

Chapter 2 Overview

Contents

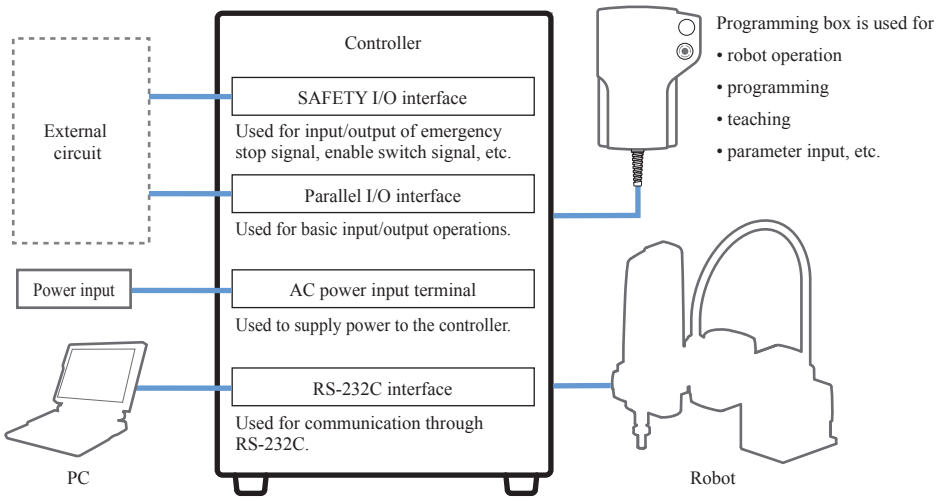
1. Operation overview

The controller configuration and main functions are shown below.
Set up the equipment as needed according to the operation to be performed.

NOTE

The external circuit connected to the robot controller should be prepared by the user.

Operation overview

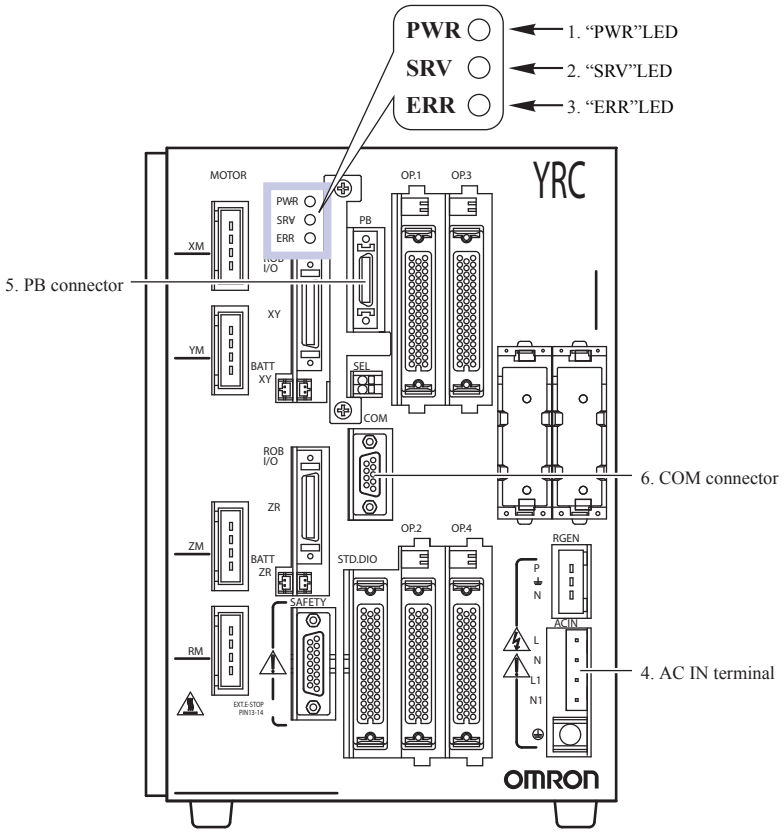


This manual mainly explains how to operate the programming box.
For other functions such as the SAFETY input/output interface, refer to the user's manual.

2. The YRC robot controller

The illustration below shows the controller's main display functions and connectors for connection to external devices.

Controller front panel



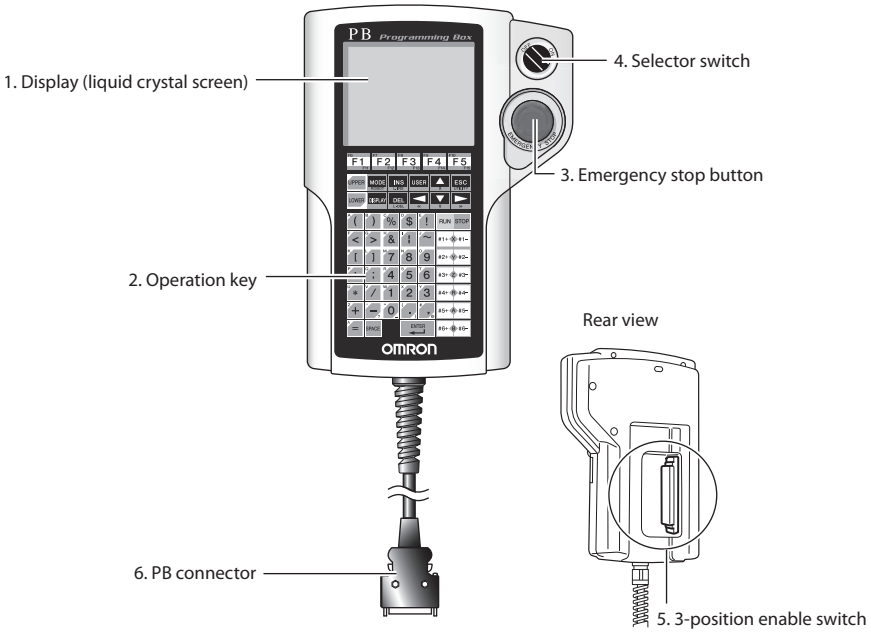
1. "PWR"LED : Lights up when the controller is turned on.
2. "SRV"LED : Lights up when the robot servo is on and turns off when the servo power is off.
3. "ERR"LED : Lights up when a serious error occurs.
4. AC IN terminal : Supplies power to the controller.
5. PB connector : Connects to the programming box.
6. COM connector : Connects to an external device via the RS-232C interface. (D-SUB 9P female connector)

3. Programming box

The programming box connects to the controller and is used to edit and execute robot programs.

3.1 Part names and functions

Programming box



1. Display (liquid crystal screen)

This is a liquid crystal display (LCD) with 40 characters × 15 lines, showing various types of information.

2. Operation keys

Use these keys to operate the robot or edit programs.
The operation keys are grouped into three main types: function keys, control keys and data keys.

3. Emergency stop button

Pressing this button during operation immediately stops robot operation. This is a normally closed, self-lock switch.

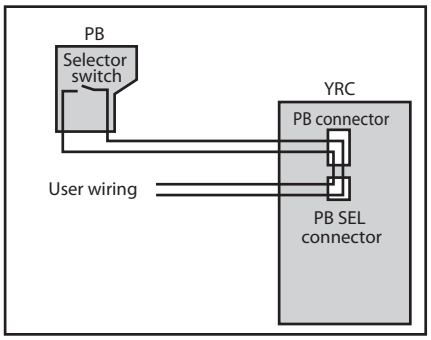
- PB emergency stop button

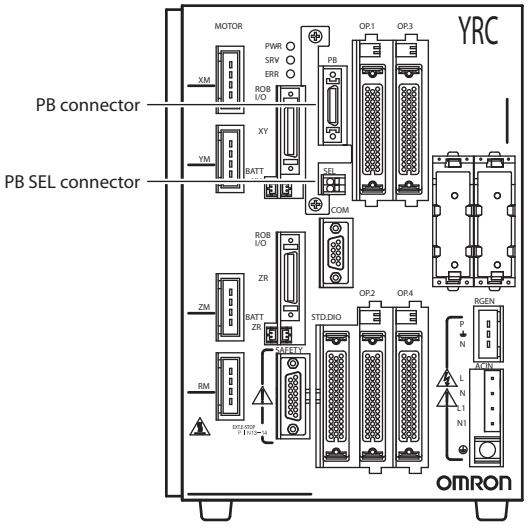
  Manufacturer : IDEC Corporation
  Type No. : XA 1E-BV302R

4. Selector switch

This is a contact switch connected to the PB SEL connector on the controller.
Connecting an external circuit to the PB SEL connector allows checking the selector switch status from the external device.

Selector switch





5. 3-position enable switch (PB only)

This switch is provided for safety. Pressing it to mid-position only allows robot operation.
To use this switch function, a safety circuit must be connected to the SAFETY connector.
For the connection to a safety circuit, refer to the user's manual.

Switch is released	: Emergency stop
Switch is pressed to mid position	: Operation possible
Switch is fully pressed	: Emergency stop

Manufacturer : IDEC Corporation
Type No. : HE2B-M200PB

6. PB connector

Use this connector to connect the programming box to the robot controller.

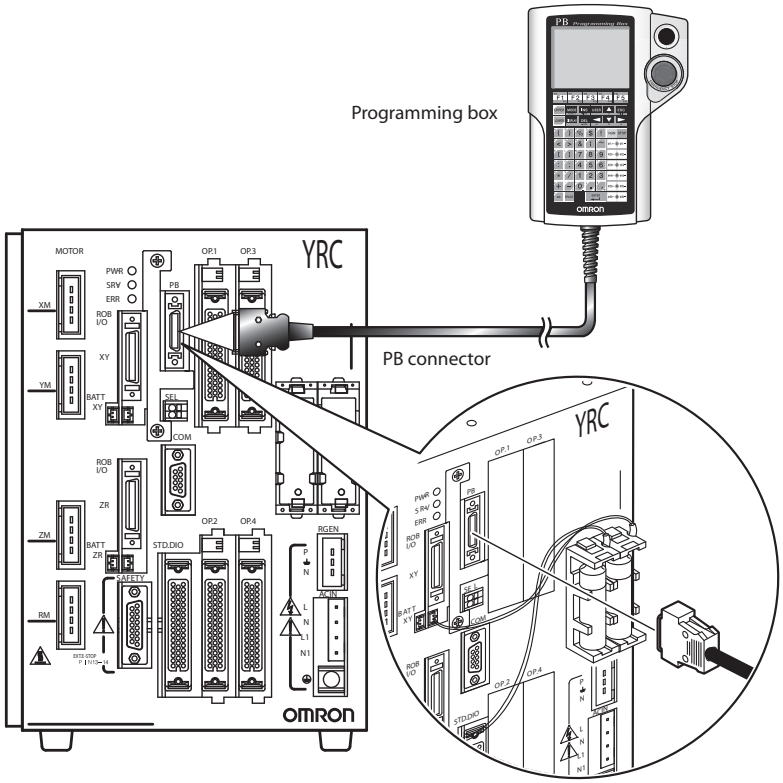
3.2 Connection to the robot controller

Connect the programming box to the PB connector on the front panel of the controller.
Make sure that the cable is securely connected since poor connections may cause malfunction or breakdown.

CAUTION

Emergency stop is triggered and the servo turns off when the programming box is connected to or disconnected from the controller while the controller power is on.

Connection to controller



3.3 Changing the programming box screen settings

When needed, the programming box screen contrast and key-press volume can be changed as described below.

1 *Display the programming box setting screen.*

Turn on the power while holding down DISPLAY on the programming box.
The programming box setting screen appears.

2 *Change the programming box settings.*

Use the following procedures to make changes.

- To adjust the screen contrast

Setting range: 0% (bright) to 100% (dark)

1.Press F1 (brightness + 5%) or F2 (brightness – 5%) to make adjustments.

2.Press ESC to end the setting.

The screen returns to the normal menu screen.

- To change the key-press volume

Setting range: 0% (off) to 100% (maximum)

1.Press F3 (volume + 5%) or F4 (volume – 5%) to make adjustments.

2.Press ESC to end the setting.

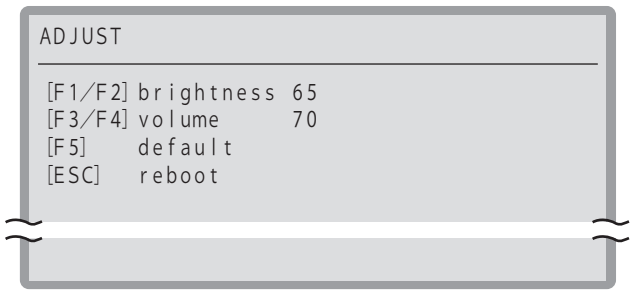
The screen returns to the normal menu screen.

- To initialize the settings

1.Press F5 (default).

The screen contrast and key-press volume return to the default settings.
(contract: 65%, key volume: 70%)

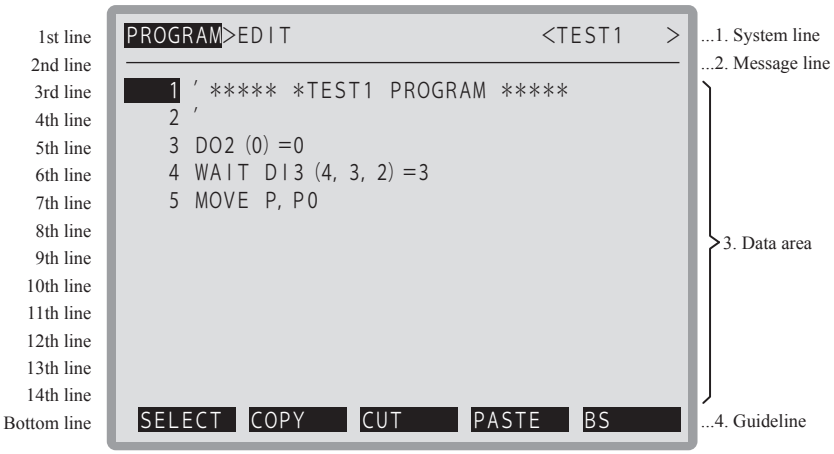
▶ **Step 1** **Programming box setting screen**



3.4 Programming box screen

The screen of the programming box is composed of 4 areas as shown below.

Programming box screen example



1. System line (1st line)

The current mode and its hierarchy are displayed on the 1st line at the top left of the screen. The above screen example shows that you are in the "EDIT" hierarchy in PROGRAM mode (or in PROGRAM>EDIT mode).
When the motor power is on, the mode name is highlighted.
If the motor power is turned off for example by pressing the emergency stop, the highlighted display for the mode name is cancelled.

2. Message line (2nd line)

An error message or the following status appears on the 2nd line.

Dashed line	Return-to-origin incomplete.
Solid line	Return-to-origin complete.
Double-solid line	Program is being executed.
"[XY]" mark in 3rd to 6th column (*1)	"[XY]" mark shows the X-arm rotation information and Y-arm rotation information at the current position (*2). The following describes the characters and the meanings of the data. + : Rotation information is "+1" - : Rotation information is "-1" Space : Rotation information is "0".
"@" mark in 2nd column	Online command is being executed through RS-232C interface. Changes to a dot "·" when the command ends.
"s" mark in 1st column	Sequence program is being executed.

(*1) The "[XY]" mark is valid in software version Ver. 1.66M or later.
Displays only when all the following conditions are satisfied:
1. The robot model is R6YXTW500.
2. A "return-to-origin complete" status is in effect.
3. The standard coordinates have been set.
4. Either the MANUAL mode (not including the "MANUAL > ABS Reset" mode) or the "AUTO > Point" mode has been selected.

(*2) For details, refer to "3. Displaying and editing point data".

3. Data area (3rd to 14th lines)

Various types of data and editing information are displayed on the 3rd to 14th lines. These lines scroll to the right and left to show up to 80 characters per line.

4. Guideline (bottom line)

The bottom line (15th line) mainly shows the contents assigned to the programming box function keys in highlighted display.

5. Pointer

The line number and item currently selected are highlighted by the pointer cursor.

Use the cursor (▲/▼) keys to move the pointer up and down.

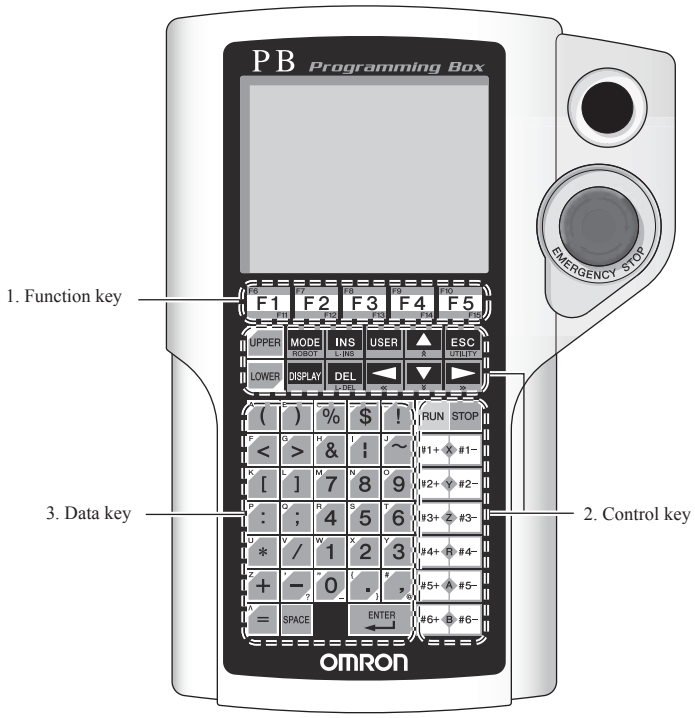
Use the cursor (◄/►) keys to move the pointer right and left.

4. Operation key

4.1 Operation key layout

The operation keys are covered with a plastic sheet to prevent dust. There are 3 types of keys: function keys, control keys, and data keys.

Operation key layout

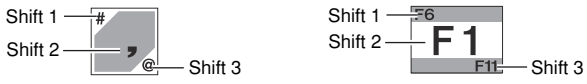


4.2 Basic key operation

Each operation key has 3 different functions as shown below.

Use UPPER or LOWER as needed.

Key configuration



■ Example of key input

Shift	Example of key input	Description	Input data
1	UPPER + # , @	Shift 1: Use a key while holding down UPPER.	"#"
2	# , @	Shift 2: Use a key without holding down UPPER and LOWER.	" , "
3	LOWER + # , @	Shift 3: Use a key while holding down LOWER.	"@"

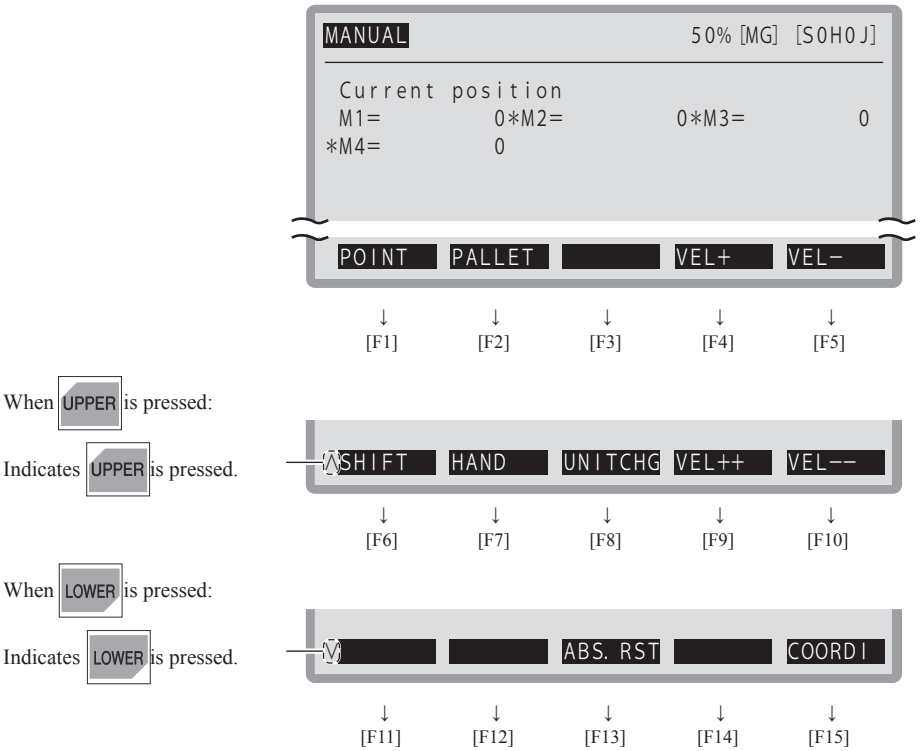
4.3 Function keys

To operate the programming box, select the menus by pressing the function keys.

If there are 6 or more submenus, press UPPER or LOWER shift key. The hidden menus are displayed as long as the shift key is pressed.

The relation of the function keys to their menus in MANUAL mode is shown below.

Function keys and menus



NOTE

From hereon, when F6 to F10 are mentioned, it means to press F6 F1 F11 to F10 F5 F15 while holding down UPPER on the side of the programming box.

Likewise, when F11 to F15 are mentioned, it means to press F6 F1 F11 to F10 F5 F15 while holding down LOWER on the side of the programming box.

4.4 Control keys

There are 6 kinds of control keys: (1) Mode selection keys, (2) Extended function keys, (3) Cursor keys, (4) Page keys, (5) Edit keys, (6) Jog keys.
The functions of each key are explained below.

1. Mode selection keys

MODE : Displays the mode menu (highest hierarchy).

DISPLAY : Selects the robot I/O monitor screen.

UTILITY : Selects UTILITY mode. (This key is shown as UTILITY from now on.)

2. Extended function keys

USER : Calls up the function key assigned by the user.

ROBOT : Switches robots. (This key is shown as ROBOT from now on.)

ESC : Returns to the previous screen (upper hierarchy).

3. Cursor keys

▲ : Moves the cursor up.

Moves the highlighted display up when the cursor is not displayed on the screen.

▼ : Moves the cursor down.

Moves the highlighted display down when the cursor is not displayed on the screen.

◄ : Moves the cursor to the left.

Data area display scrolls one character to the right when the cursor is at the left end of the screen or the cursor is not displayed on the screen.

► : Moves the cursor to the right.

Data area display scrolls one character to the left when the cursor is at the right end of the screen or the cursor is not displayed on the screen.

4. Page keys

» :... Data area display scrolls one screen up. (This key is shown as » from now on.)

» : Dat area display scrolls one screen down. (This key is shown as » from now on.)

« : Data area display scrolls one screen to the left. (This key is shown as « from now on.)

» : Data area display scrolls one screen to the right. (This key is shown as » from now on.)

5. Edit keys (These keys are enabled when the editing cursor is displayed.)

INS : Toggles between "Insert" and "Overwrite" modes.

The cursor " ■ " appears in "Overwrite" mode and "_" appears in "Insert" mode.

DEL : Deletes one character at the cursor position.

L.INS : Inserts one line at the cursor position. (This key is shown as L.INS from now on.)

L.DEL : Deletes one line at the cursor position. (This key is shown as L.DEL from now on.)

6. Jog keys

RUN : Starts automatic operation.

This key is valid only during AUTO mode or point trace.

STOP : Stops automatic operation.

After RUN has been pressed in AUTO mode, STOP is valid during program execution, direct command execution, point trace execution and return-to-origin operation.

#1+ X : Moves axis 1 in the + direction or the robot in the +X direction on the XY coordinates.

X #1- : Moves axis 1 in the – direction or the robot in the -X direction on the XY coordinates.

#2+ Y : Moves axis 2 in the + direction or the robot in the +Y direction on the XY coordinates.

Y #2- : Moves axis 2 in the - direction or the robot in the -Y direction on the XY coordinates.

#3+ Z : Moves axis 3 in the + direction.

Z #3- : Moves axis 3 in the - direction.

#4+ R : Moves axis 4 in the + direction.

R #4- : Moves axis 4 in the - direction.

#5+ A : Moves axis 5 in the + direction.

A #5- : Moves axis 5 in the - direction.

#6+ B : Moves axis 6 in the + direction.

B #6- : Moves axis 6 in the - direction.

NOTE

The #1+ X to B #6- keys are hereafter called the Jog keys. The Jog keys are enabled in MANUAL mode.

4.5 Data keys

The data keys are used for entering data, creating programs, and editing data.
There are 2 kinds of data keys.

1. Alphanumeric keys

0 to 9 : Enters numbers.

A to Z : Enters alphabetic characters.

2. Symbol keys

( ) % $!
< > & ¦ ~
[ ] : ; *
/ + − ^ = .
, @ SPACE

SPACE : Inserts spaces.

4.6 Other keys

1. Enter key

ENTER : When the cursor is displayed, pressing this key completes the data input on the cursor line.
Pressing this key executes a direct command when in AUTO>DIRECT mode.

2. Shift keys

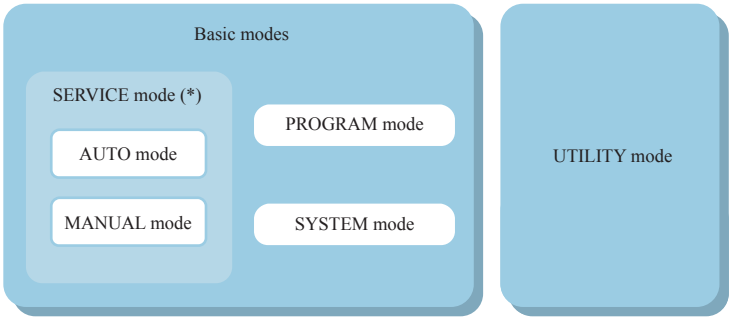
UPPER : Selects shift 1 for key operation.

LOWER : Selects shift 3 for key operation

5. Mode configuration

The robot operation mode consists of the following modes.

Mode configuration



* SERVICE mode can be used only when SAFE mode is enabled.

The controller operates in the following 6 modes:

1. AUTO mode
2. MANUAL mode
3. PROGRAM mode
4. SYSTEM mode
5. SERVICE mode (only when SAFE mode is enabled)
6. UTILITY mode

Among these modes, modes 1 to 4 (AUTO to SYSTEM modes) are called the basic modes.
The basic modes are grouped by function for the controller.
The controller is always in any of the basic modes or in UTILITTY mode.
SERVICE mode restricts some functions during operation in AUTO mode and MANUAL mode.

5.1 Basic modes

1. AUTO mode

This mode executes robot programs. Robot programs can be executed only in this mode.

2. MANUAL mode

Select this mode to move the robot manually or perform operation regarding point data. Return-to-origin and manual movement of the robot can be executed only in this mode.

NOTE

- Absolute reset and return-to-origin operation can be performed only in MANUAL mode.
- AUTO mode may be selected depending on the execution level when the robot controller is turned on.

3. PROGRAM mode

Select this mode to create and edit robot programs. Robot programs can be edited on the programming box screen.

4. SYSTEM mode

Select this mode to set parameters for the robot and axis.
For more details on SYSTEM mode, refer to the user's manual.

5. SERVICE mode

SERVICE mode can be used only when SAFE mode is enabled.
Use this mode to perform work using the programming box while within the safety enclosure of the robot system.
This mode includes AUTO and MANUAL modes in the basic operation mode, and can be selected by turning DI02 (SERVICE mode input) OFF. The following functions are selected in SERVICE mode.

1. Robot is controlled only by programming box operation.
2. Automatic operation is prohibited.
3. Robot moving speed is set to below 3% of the maximum speed.
4. Robot operation is allowed only when a operation key on the programming box is pressed.

WARNING

RESTRICTION ON THE ROBOT MOVING SPEED IS NOT A SAFETY-RELATED FUNCTION.
TO REDUCE THE RISK OF COLLISION BETWEEN THE ROBOT AND WORKERS, THE USER MUST TAKE THE NECESSARY PROTECTIVE MEASURES SUCH AS ENABLE DEVICES ACCORDING TO RISK ASSESSMENT BY THE USER.

CAUTION

To select or set the functions in SERVICE mode, refer to the user's manual.

5.2 Other modes

Other than the basic modes, UTILITY mode is also available.

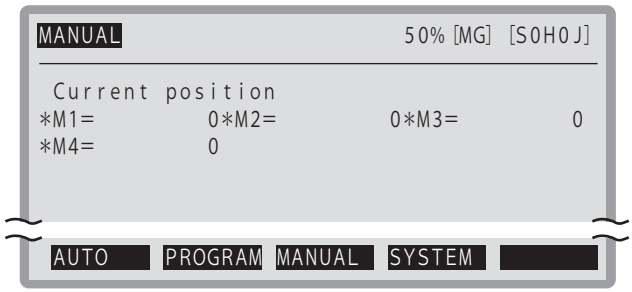
Use UTILITY mode to perform operations such as recovery from emergency stop and motor servo on/off switching.
Press UTILITY to select UTILITY mode.

5.3 Selecting mode hierarchy

Robot operation is mainly performed by selecting the desired mode from the hierarchy menu. (See the "Mode hierarchy diagram" described later.)
To select a menu, press the corresponding function key.

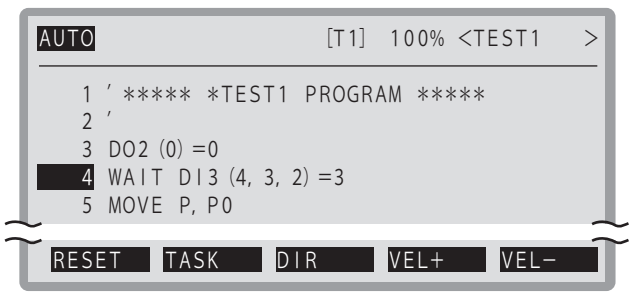
When the controller power is turned on, the programming box screen basically shows menus in MANUAL mode.
Pressing MODE displays the 4 basic modes on the guideline (bottom line) of the screen as shown below.
The selected basic mode is at the top of the hierarchy menu.

Mode menu



The display position for each mode name corresponds to each function key of F1 , F2 , F3 and F4 from the left.
For example, pressing F1 (AUTO) enters AUTO (automatic operation) mode.

AUTO mode menu



When AUTO mode is entered, the submenu for the AUTO mode operation appears on the guideline.

Pressing ESC returns to the previous mode hierarchy.

Pressing MODE returns to the top of the hierarchical menu and the basic mode menus are displayed on the guideline.

NOTE

- When the data is being edited such as in EDIT mode, MODE is inoperative. After pressing ESC to return the mode hierarchy, press MODE.
- From here in this user's manual the mode hierarchy status is stated in the order as shown below.

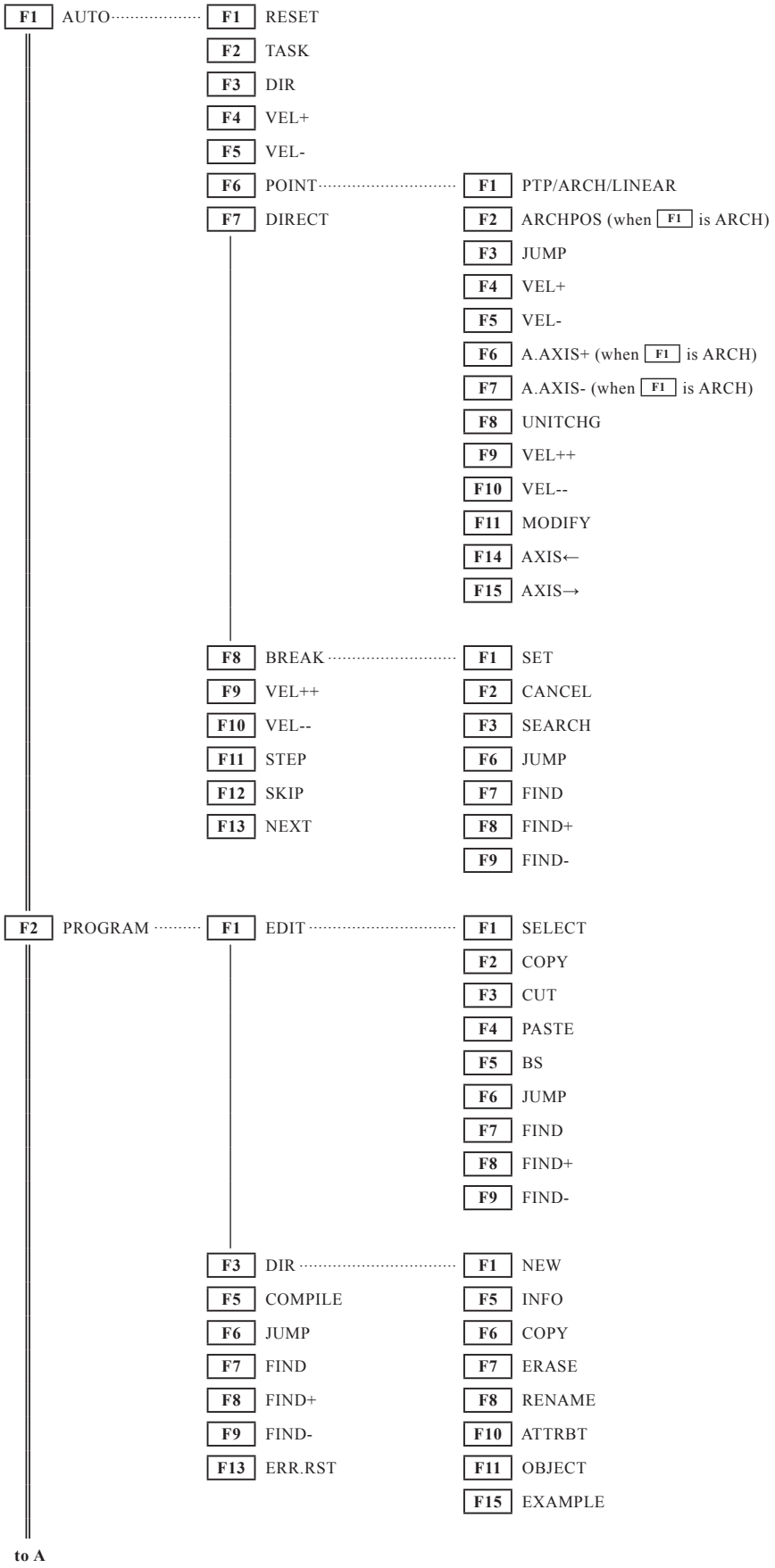
  First (highest) hierarchy>Second hierarchy>Third hierarchy>Fourth hierarchy

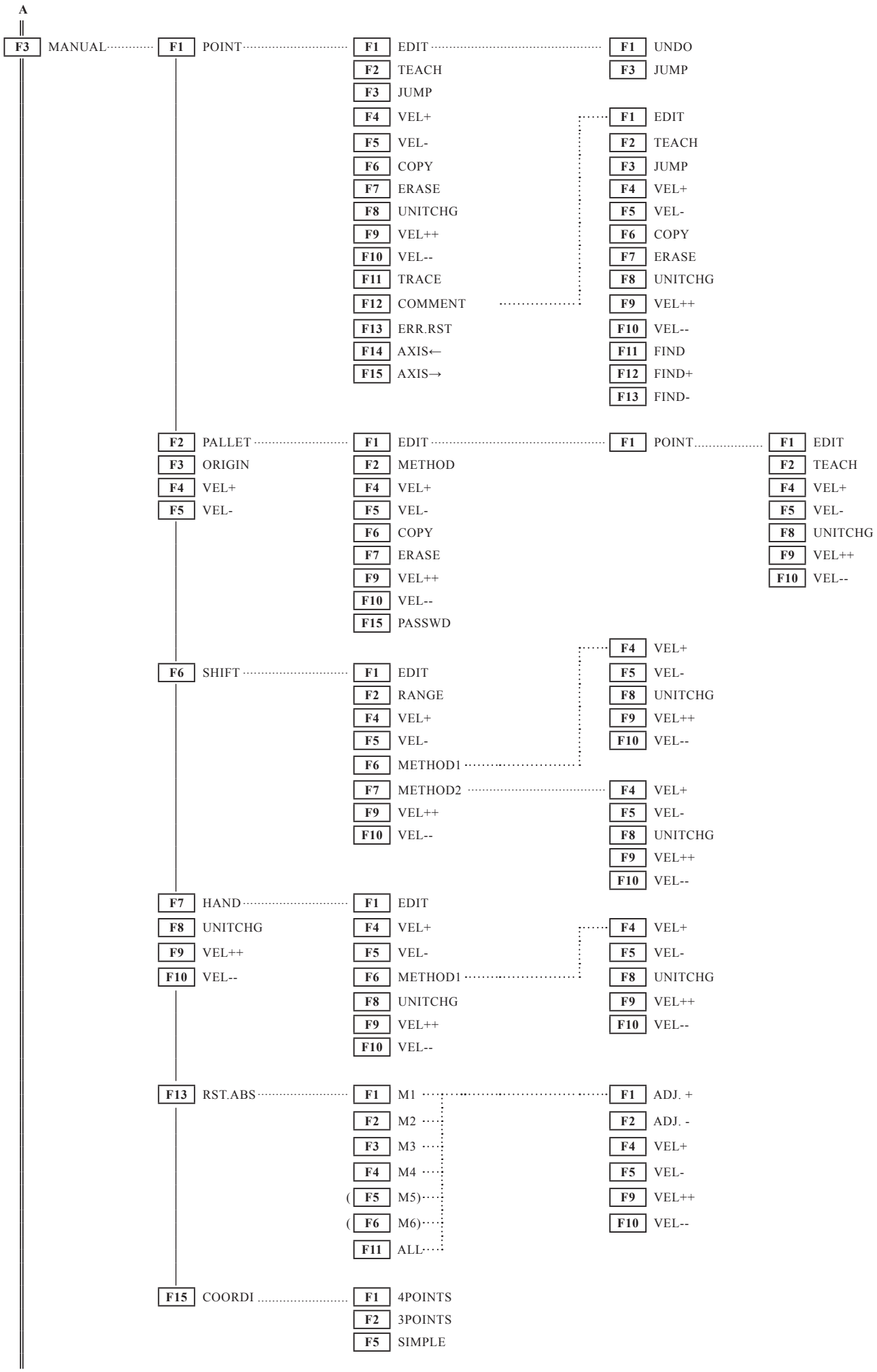
  Example: PROGRAM>DIR>ERASE

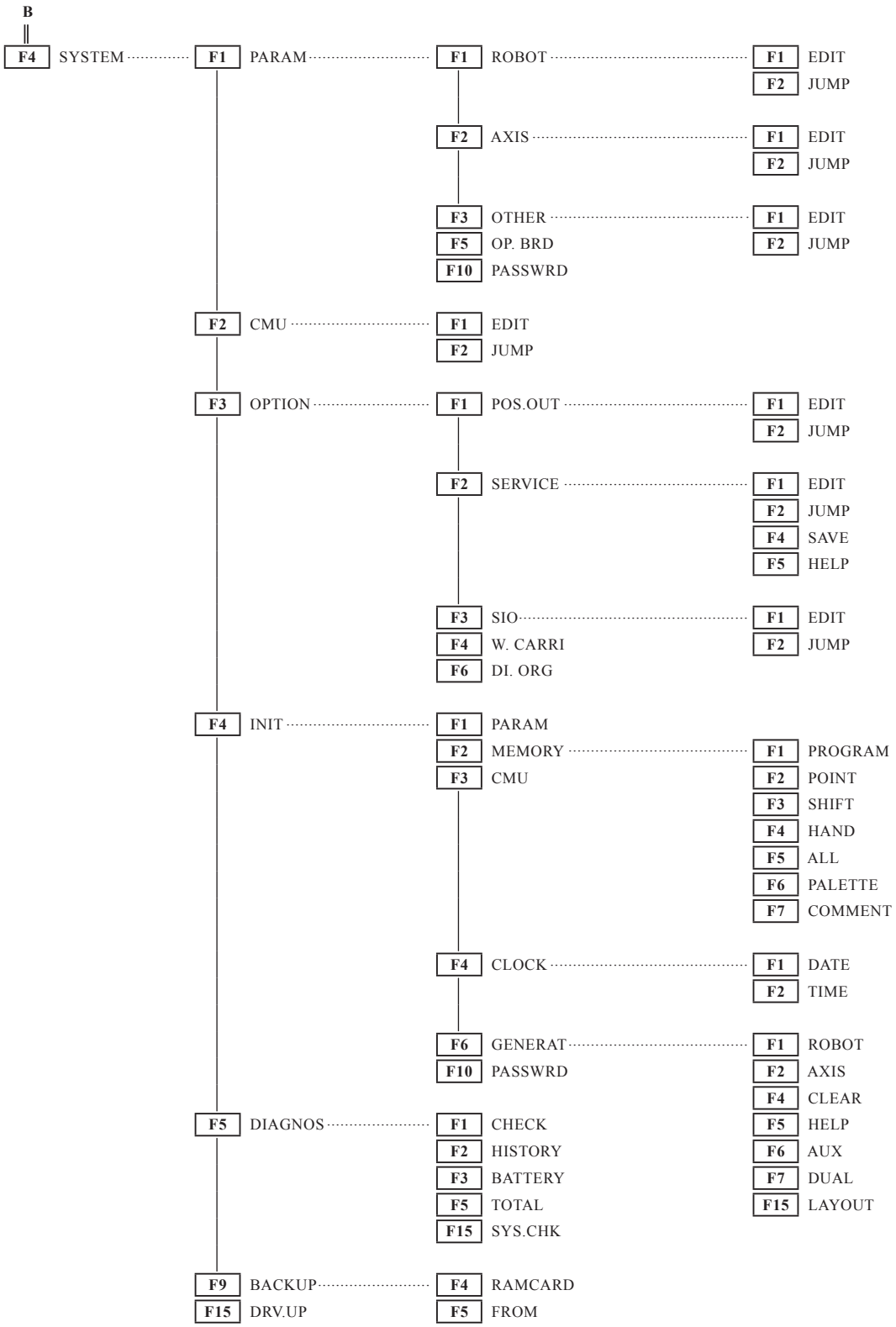
The above example shows that the current mode is entered by selecting F2 (PROGRAM) from the first hierarchy menu, F3 (DIR) from the second hierarchy menu, and F7 (ERASE) from the third hierarchy menu.

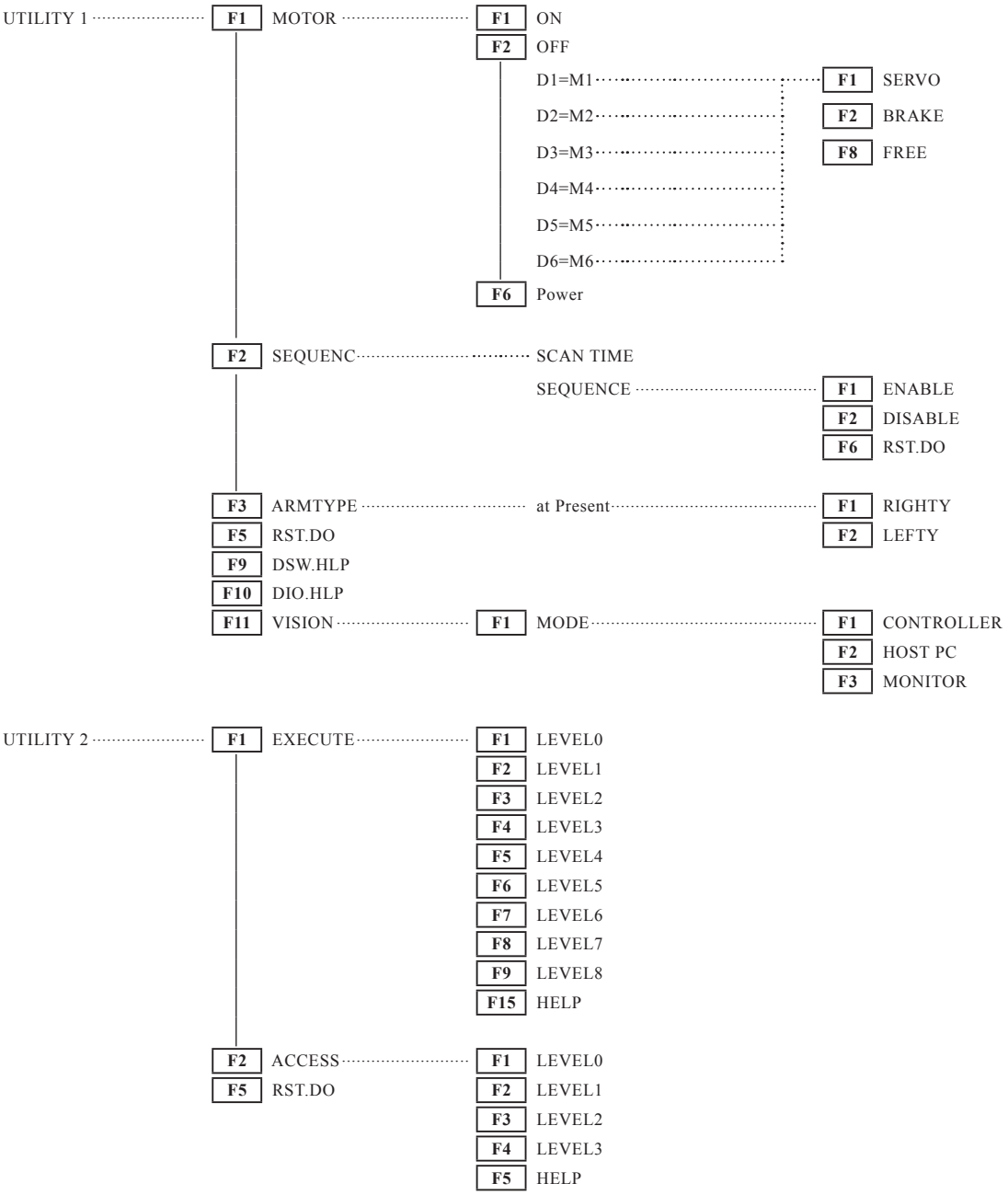
See the figure titled "Mode hierarchy diagram" on the next page for the entire mode hierarchy.

Mode hierarchy diagram




A
F3 MANUAL
F1 POINT
F1 EDIT
F1 UNDO
F3 JUMP
F2 TEACH
F3 JUMP
F4 VEL+
F1 EDIT
F5 VEL-
F2 TEACH
F6 COPY
F3 JUMP
F7 ERASE
F4 VEL+
F8 UNITCHG
F5 VEL-
F9 VEL++
F6 COPY
F10 VEL--
F7 ERASE
F11 TRACE
F8 UNITCHG
F12 COMMENT
F9 VEL++
F13 ERR.RST
F10 VEL--
F14 AXIS←
F11 FIND
F15 AXIS→
F12 FIND+
F13 FIND-
F2 PALLET
F1 EDIT
F1 POINT
F1 EDIT
F3 ORIGIN
F2 METHOD
F2 TEACH
F4 VEL+
F4 VEL+
F4 VEL+
F5 VEL-
F5 VEL-
F5 VEL-
F6 COPY
F8 UNITCHG
F7 ERASE
F9 VEL++
F9 VEL++
F10 VEL--
F10 VEL--
F15 PASSWD
F4 VEL+
F6 SHIFT
F1 EDIT
F5 VEL-
F2 RANGE
F8 UNITCHG
F4 VEL+
F9 VEL++
F5 VEL-
F10 VEL--
F6 METHOD1
F7 METHOD2
F4 VEL+
F9 VEL++
F5 VEL-
F10 VEL--
F8 UNITCHG
F9 VEL++
F10 VEL--
F7 HAND
F1 EDIT
F8 UNITCHG
F4 VEL+
F4 VEL+
F9 VEL++
F5 VEL-
F5 VEL-
F10 VEL--
F6 METHOD1
F8 UNITCHG
F8 UNITCHG
F9 VEL++
F9 VEL++
F10 VEL--
F10 VEL--
F13 RST.ABS
F1 M1
F1 ADJ. +
F2 M2
F2 ADJ. -
F3 M3
F4 VEL+
F4 M4
F5 VEL-
(F5 M5)
F9 VEL++
(F6 M6)
F10 VEL--
F11 ALL
F15 COORDI
F1 4POINTS
F2 3POINTS
F5 SIMPLE
to B


B
F4 SYSTEM
F1 PARAM
F1 ROBOT
F1 EDIT
F2 JUMP
F2 AXIS
F1 EDIT
F2 JUMP
F3 OTHER
F1 EDIT
F2 JUMP
F5 OP. BRD
F10 PASSWRD
F2 CMU
F1 EDIT
F2 JUMP
F3 OPTION
F1 POS.OUT
F1 EDIT
F2 JUMP
F2 SERVICE
F1 EDIT
F2 JUMP
F4 SAVE
F5 HELP
F3 SIO
F1 EDIT
F2 JUMP
F4 W. CARRI
F6 DI. ORG
F4 INIT
F1 PARAM
F2 MEMORY
F1 PROGRAM
F2 POINT
F3 SHIFT
F4 HAND
F5 ALL
F6 PALETTE
F7 COMMENT
F3 CMU
F4 CLOCK
F1 DATE
F2 TIME
F6 GENERAT
F1 ROBOT
F2 AXIS
F4 CLEAR
F10 PASSWRD
F5 DIAGNOS
F1 CHECK
F5 HELP
F2 HISTORY
F6 AUX
F3 BATTERY
F7 DUAL
F5 TOTAL
F15 LAYOUT
F15 SYS.CHK
F9 BACKUP
F4 RAMCARD
F15 DRV.UP
F5 FROM


UTILITY 1
F1 MOTOR
F1 ON
F2 OFF
D1=M1
D2=M2
D3=M3
D4=M4
D5=M5
D6=M6
F1 SERVO
F2 BRAKE
F8 FREE
F6 Power
F2 SEQUENC
SCAN TIME
SEQUENCE
F1 ENABLE
F2 DISABLE
F6 RST.DO
F3 ARMTYPE
at Present
F1 RIGHTY
F2 LEFTY
F5 RST.DO
F9 DSW.HLP
F10 DIO.HLP
F11 VISION
F1 MODE
F1 CONTROLLER
F2 HOST PC
F3 MONITOR
UTILITY 2
F1 EXECUTE
F1 LEVEL0
F2 LEVEL1
F3 LEVEL2
F4 LEVEL3
F5 LEVEL4
F6 LEVEL5
F7 LEVEL6
F8 LEVEL7
F9 LEVEL8
F15 HELP
F2 ACCESS
F1 LEVEL0
F2 LEVEL1
F3 LEVEL2
F4 LEVEL3
F5 HELP
F5 RST.DO

6. MONITOR mode

MONITOR mode displays the I/O status regardless of the currently selected hierarchy level. The display in MONITOR mode is overlapped onto the screen during normal operation at each hierarchy level. So the controller can still be operated even with the monitor screen displayed.

NOTE
I/O ports that do not actually exist as hardware are also displayed.

Pressing DISPLAY displays the input status in the data area (3rd to 7th lines) as shown below.

Input status display (1)

```
MANUAL>POINT                          50% [MG] [SOHOJ]
-----------------x----------y----------z----------r----------
DI monitor
 DI0 ()  =&B00000101    DI4 ()  =&B00000000
 DI1 ()  =&B00000010    DI5 ()  =&B00000000
 DI2 ()  =&B00000101    DI6 ()  =&B00000000
 DI3 ()  =&B00000101    DI7 ()  =&B00000000


         DISPLAY KEY -> NEXT PAGE

LOWER + DISPLAY KEY -> PREV PAGE


 EDIT    TEACH    JUMP    VEL+    VEL-
```

The display format is as follows:
<Port No.> = &B<bit 7><bit 6> to <bit 0>

Pressing DISPLAY again displays the input status in the data area (3rd to 7th lines) as shown below.

Input status display (2)

```
MANUAL>POINT                          50% [MG] [SOHOJ]
-----------------x----------y----------z----------r----------
DI monitor
 DI10 ( ) =&B00000101 DI14 ( ) =&B00000000
 DI11 ( ) =&B00000010 DI15 ( ) =&B00000000
 DI12 ( ) =&B00000000 DI16 ( ) =&B00000000
 DI13 ( ) =&B00000000 DI17 ( ) =&B00000000
≈                                                        ≈
 EDIT    TEACH    JUMP    VEL+    VEL-
```

Press DISPLAY again to display other monitor screens.

DI monitor → DO monitor → MO monitor → LO/TO monitor → SI monitor → SO monitor → SIW monitor → SOW monitor → Variable monitor → Task monitor → Current monitor → Normal screen display

Pressing LOWER + DISPLAY displays each monitor in the reverse sequence of the above.

NOTE

The screen display is updated at a constant time interval.

Pressing ESC exits MONITOR mode and returns to the normal display.

Monitor screen display examples

Example of bit information display

```
MANUAL>POINT                    50% [MG] [S0H0J]
──────────────x──────────y──────────z──────────r──
DI monitor
 DI0 () =&B00000101     DI4 () =&B00000000
 DI1 () =&B00000001     DI5 () =&B00000000
 DI2 () =&B00000000     DI6 () =&B00000000
 DI3 () =&B00000000     DI7 () =&B00000000

 EDIT   TEACH   JUMP   VEL+   VEL−
```

Display format:
<Port No.> = &B <7th bit> <6th bit> to <0th bit>

Example of word information display

```
MANUAL>POINT                    50% [MG] [S0H0J]
──────────────x──────────y──────────z──────────r──
SIW monitor
 SIW (0) =&H0000         SIW (4) =&H0000
 SIW (1) =&H0000         SIW (5) =&H0000
 SIW (2) =&H0000         SIW (6) =&H0000
 SIW (3) =&H0000         SIW (7) =&H0000

 EDIT   TEACH   JUMP   VEL+   VEL−
```

Display format:
<Register No.> = &H<hexadecimal>

Example of task information display

```
MANUAL>POINT                    50% [MG] [S0H0J]
──────────────x──────────y──────────z──────────r──
Task monitor:Line (Status), Pri
 T1 =     6 (RUN), 32  T5 =
 T2 =    10 (SUS), 32  T6 =
 T3 =                  T7 =
 T4 =                  T8 =    12 (RUN), 35

 EDIT   TEACH   JUMP   VEL+   VEL−
```

Display format:
<Task No.> = <Execution line> (<Execution state>), <Task priority>
<Execution state> : RUN (execute)/SUS (forced standby)/STP (stop)

Current command monitor display

```
MANUAL>POINT                    50% [MG] [S0H0J]
──────────────x──────────y──────────z──────────r──
Current monitor (100% = Max torque)
 D1 =           20   D5 =            0
 D2 =           −5   D6 =            0
 D3 =            3   D7 =            0
 D4 =            0   D8 =            0

 EDIT   TEACH   JUMP   VEL+   VEL−
```

Display format:
D<axis number> = <current command value>

Chapter 3 AUTO mode

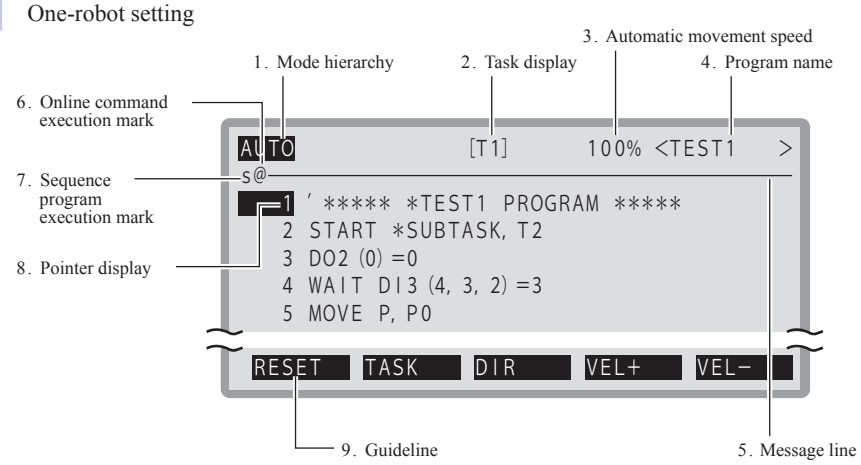
Contents

1. AUTO mode

AUTO mode executes robot language programs and related tasks.
When switched to AUTO mode, the initial screen appears as shown below.

AUTO mode

One-robot setting



1. Mode hierarchy

Shows the current mode hierarchy. When the highest mode is not highlighted, it means the motor power is off. When highlighted, it means the motor power is on.

2. Task display

Shows the task number for the program listing where the execution pointer is displayed.

3. Automatic movement speed

Robot movement speed is displayed during automatic operation.

4. Program name

Shows the program name currently selected.

5. Message line

If an error occurs, the error message appears here. A dashed line (----) means return-to-origin is incomplete. A solid line (————) means return-to-origin return is complete. A double-solid line (=====) means automatic operation is in progress.

6. Online command execution mark

When an online command is being executed, an "@" mark is displayed in the second column. This mark changes to a dot (.) when the online command ends.

7. Sequence program execution mark

When a sequence program is being executed, an "s" mark is displayed in the first column.

8. Pointer display

The program line number to be executed next is shown highlighted in the program listing.

9. Guideline

The contents assigned to function keys are shown highlighted.

Upon entering AUTO mode, the specified program is compiled and an object file is created to execute automatic operation.
However, when the same object file already exists, no compiling is executed. If an error is found in a command statement during compiling, the error message and the program listing after the command line where the error occurred are displayed.
If the compiling ends normally, the program listing is displayed from the top command line.

NOTE

Usually, return-to-origin must be completed before starting AUTO mode. If return-to-origin is not complete, the message "Origin incomplete" appears. In such a case, see "9. Return-to-origin" and "10. Absolute reset" in Chapter 5. However, the program can be executed depending on the command execution level even if return-to-origin has not been completed. For details, see "6. Execution level" in Chapter 7.

Valid keys and submenu descriptions in AUTO mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Scrolls the program listing one line up or down.
⏫ / ⏬		Scrolls the program listing one screen up or down.
F1	RESET	Resets the program.
F2	TASK	Changes the task to display the execution pointer and program listing.
F3	DIR	Displays a list of the registered program names. Use this key to change the execution program.
F4	VEL+	Increases automatic movement speed for the selected robot group in steps. (1→5→20→50→100%)
F5	VEL–	Decreases automatic movement speed for the selected robot group in steps. (100→50→20→5→1%)
F6	POINT	Displays the point trace screen.
F7	DIRECT	Executes a command statement written on one line.
F8	BREAK	Sets a break point.
F9	VEL++	Increases automatic movement speed for the selected robot group in 1% increments.
F10	VEL– –	Decreases automatic movement speed for the selected robot group in 1% decrements.
F11	STEP	Executes one line of the command statement.
F12	SKIP	Advances to the next line without executing the current command statement.
F13	NEXT	Executes one line of the command statement. (Subroutines are executed at a time.)
ROBOT		Switches the selected robot group.

2. Automatic operation

Program commands are executed continuously during automatic operation. Before starting automatic operation, make sure that return-to-origin, program debugging, I/O signal connections and point data teaching have already been completed. When the execution level is set to other than level 0, automatic operation is possible even if return-to-origin is incomplete.

NOTE

Regardless of the execution level, some commands such as the robot movement commands cannot be executed if return-to-origin is incomplete.
When the execution level 5, 6 or 8 is selected, the program will always be executed from the first line.

1 ***Enter AUTO mode.***

On the highest hierarchy screen, press F1 (AUTO) to enter AUTO mode.
The system line shows "AUTO".

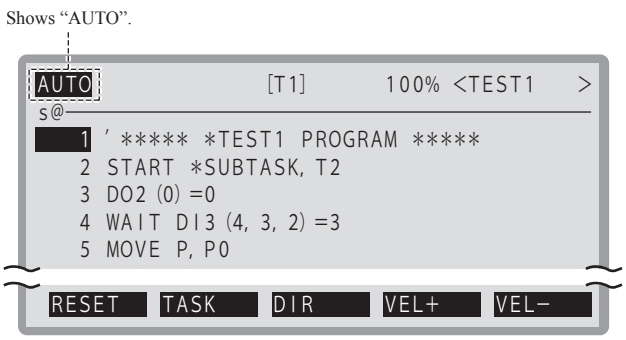
2 ***Execute the program.***

Pressing RUN executes command statements in order from the line number where the pointer is displayed.
The program listing disappears during automatic operation and the message "Running" appears on the message line (the second line).
The message line changes from a single solid line to a double-solid line during automatic operation.

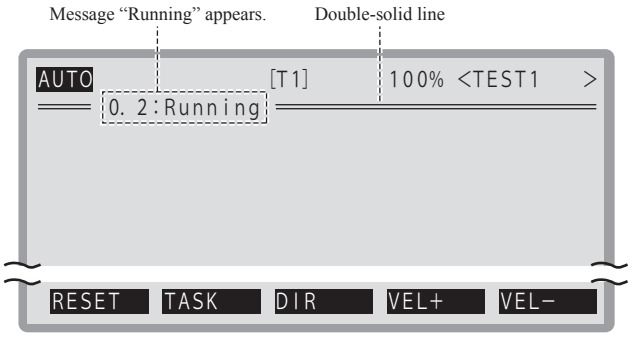
WARNING

- THE ROBOT MOVES WHEN AUTOMATIC OPERATION STARTS. THE ROBOT STARTS TO MOVE. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.
- WHEN CHANGING THE AUTOMATIC MOVEMENT SPEED DURING AUTOMATIC OPERATION, CHECK SAFETY FOR SURROUNDING AREAS.

Step 1 **AUTO mode**



Step 2 **Automatic operation in progress**



The following keys are enabled during automatic operation.

Valid keys	Menu	Function
F9		Increases automatic movement speed for the selected robot group in 5% increments.
F10		Decreases automatic movement speed for the selected robot group in 5% decrements.
ROBOT		Switches the selected robot group.

NOTE

If the automatic movement speed is changed while the robot is operating, the speed will be changed after operation.

3. Stopping the program

To temporarily stop the execution of a program, proceed as follows.

To temporarily stop the program during execution, press STOP.

To display the program listing, press ESC.

The pointer indicates the command line that is to be executed next in the program.

To resume the program execution, press RUN.

CAUTION

Do not turn off the robot controller during program execution.
If turned off, the internal system data may be corrupted and the program may not restart when the power is again turned on.
Always be sure to terminate or stop the program before turning the power off.

4. Resetting the program

To restart from the first line of a program that was temporarily stopped with STOP, the program must be reset.

NOTE

The output is also reset when the program is reset. However, the output will not be reset in the following cases:
1. "DO cond. on PGM reset / RESCDO" in Other parameters is set to "HOLD". (For details, refer to the user's manual.)
2. A sequence program is being executed without enabling the DO reset in the sequence execution flag setting.

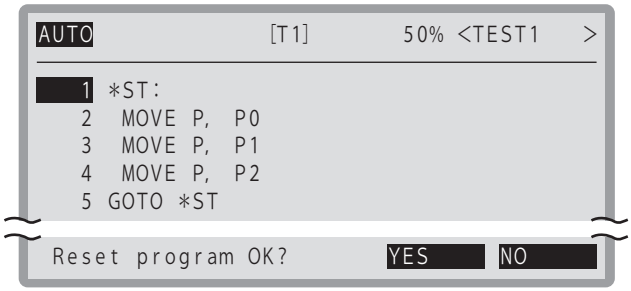
1. When the program "_SELECT" does not exist:

Press F1 (RESET) in AUTO mode.

A message "Reset program OK?" appears on the guideline. Press F4 (YES) to reset the program.

The program will be reset and list-displayed from the first line. (A pointer also appears on the first line number of the program.)

Program reset



2. When the program "_SELECT" exists:

1 ***Press F1 (RESET).***

When "_SELECT" exists in the programs, a confirmation message appears as shown on the right.

2 ***Select the program to reset.***

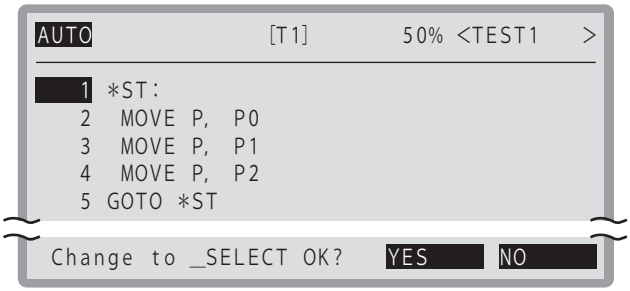
Press F4 (YES) to change the program to "_SELECT" and reset it.

To reset the currently selected program, press F5 (NO).

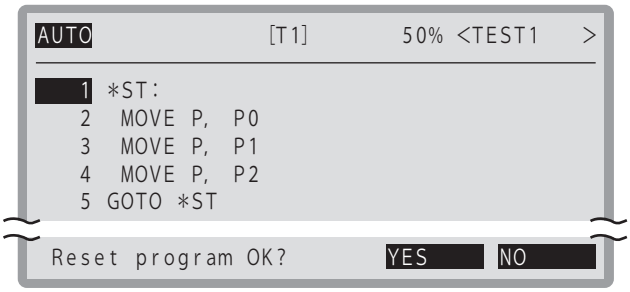
3 ***Reset the currently selected program.***

A confirmation message appears when F5 (NO) was pressed in step 2. Press F4 (YES) to reset the currently selected program, or press F5 (NO) to cancel resetting the program.

Step 1 **Program reset**



Step 3 **Check whether to reset program**



NOTE

The output is also reset when the program is reset. However, the output will not be reset in the following cases:

1. "DO cond. on PGM reset / RESCDO" in Other parameters is set to "HOLD". (For details, refer to the user's manual.)
2. A sequence program is being executed without enabling the DO reset in the sequence execution flag setting.

5. Switching task display

When a program is executing multiple tasks, the program listing for each task can be displayed.

NOTE
The program must be stopped to switch the task display.

1 ***Stop the program.***

Press STOP to stop the program execution.

2 ***Display the program listing.***

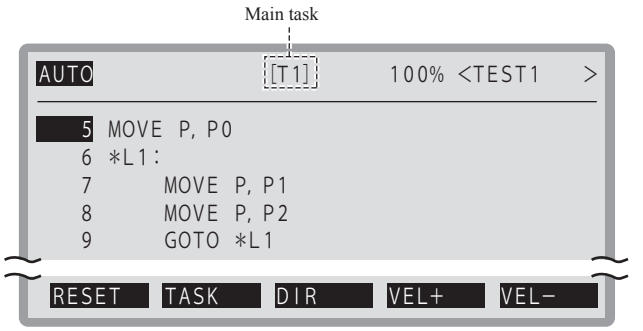
Press ESC to display the program listing.

The pointer indicates the command line that is to be executed next in the program.

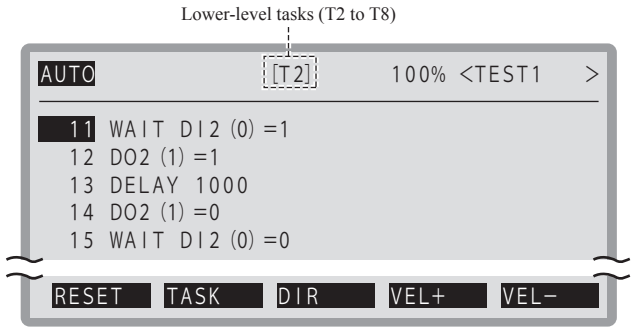
3 ***Switch the task.***

Press F2 (TASK) to select a lower-order task program. Each time F2 (TASK) is pressed, lower-order task programs (T2→T3→…T8) are displayed.
At this time, the pointer indicates the command line number that is to be executed next in each task.

Step 2 **Main task (T1) display**



Step 3 **Sub-task (T2 to T8) display**



6. Switching the program

If the program displayed on the screen is not the one you want to execute, it can be switched to the desired program.

NOTE
When a program is switched to another program, the output is also reset at the same time the program is reset. However, the output will not be reset in the following cases:
1. "DO cond. on PGM reset / RESCDO" in Other parameters is set to "HOLD". (For details, refer to the user's manual.)
2. A sequence program is being executed without enabling the DO reset in the sequence execution flag setting.

1 ***Display program information.***

Press F3 (DIR) to display program information.

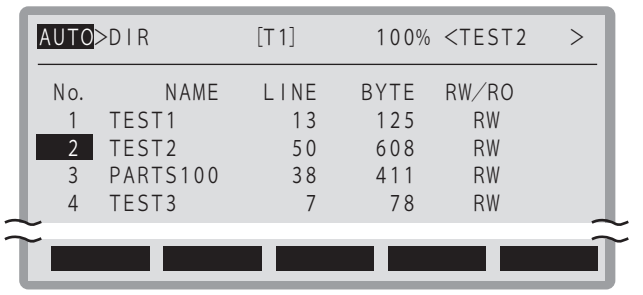
At this time, the pointer indicates the currently selected program number.

2 ***Select the desired program.***

Use the cursor (▲/▼) keys to select the program.

Then, pressing ESC automatically compiles the selected program and creates an object file.

Step 2 **Switching programs**



7. Changing the automatic movement speed

Automatic movement speed for the selected robot group can be set within the range of 1 to 100%.

- Press F4 (VEL+) or F5 (VEL-) in AUTO mode to change the speed in steps.

  Each time the F4 (VEL+) or F5 (VEL-) is pressed, the speed changes in steps of 1← →5←→20← →50← →100%.

  The robot moves at the maximum speed when set to 100%.

- Press F9 (VEL++) or F10 (VEL--) to change the speed gradually.

  Each time the F9 (VEL++) or F10 (VEL--) is pressed, the speed changes in units of 1%.

  Holding down the key changes the speed continuously.

NOTE

Automatic movement speeds once set here are stored in the internal memory and are retained even when the power is turned off.
If the speed is set with the program command statement (SPEED statement), the actual robot operating speed will be the product of that speed and the automatic movement speed.
For example, if the automatic movement speed is 80% and the speed specified by the SPEED statement is 50%, then the robot movement speed is set as follows.
Operating speed = 80% × 50% = 40%

8. Executing the point trace

Point data positions can be checked by actually moving the robot.
The robot can be moved in three motion modes: PTP motion, arch motion, and linear interpolation motion.

CAUTION

- Point trace cannot be performed unless return-to-origin is complete.

To display the point trace screen, press F6 (POINT) in AUTO mode.

Point data is displayed on the screen as shown below.

Point trace screen (with no auxiliary axis)

```
AUTO▷POINT   [RIGHTY]   50/100% [MG] [S0H0J]
          ──────x──────y──────z──────r──────
P3    = 150.50   64.53   21.78  -45.14
P4    =  96.65 -224.89   43.31   28.79
P5    = -63432   19735    6243   22642

COMNT:                          [LEFTY]
 [POS]       0       0       0       0
 PTP             JUMP    VEL+    VEL-
```

[R6YXTW500]

```
AUTO▷POINT   [RIGHTY]   50/100% [MG] [S0H0J]
── [+ ] ──────x──────y──────z──────r──────
P7    = 100.00  250.00   15.00   30.00
P8    = 220.00  150.00  115.00   90.00
P9    = 400.00  200.00   15.00  -30.00

COMNT:                          [LEFTY] [+ ]
 [POS] -100.00  400.00   50.15  111.23
 PTP             JUMP    VEL+    VEL-
```

* The "[RIGHTY]" message on the first line appears only when a SCARA robot is selected.
* The "[LEFTY]" message on the 13th line appears only when a SCARA robot is selected and a hand system flag is set for the point data.
* The [+] mark on the 13th line shows the X-arm rotation information and Y-arm rotation information (*1) of the currently selected point data.
  This mark appears only when the robot is R6YXTW500.
  On the screen shown above, the X-arm rotation information is “1” and the Y-arm rotation information is “0”.

(*1) The X-arm rotation information and Y-arm rotation information can be used in software version Ver. 1.66M or higher.

Valid keys and submenu descriptions in AUTO>POINT mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Switches the point number and scrolls the screen.
⏫ / ⏬		Switches to other screens.
F1	PTP/ARCH/ LINEAR	Switches the trace movement mode.
F2	A.POS	Specifies the arch position during ARCH motion mode.
F3	JUMP	Displays the specified point data.
F4	VEL+	Increases automatic movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL–	Decreases automatic movement speed for the selected robot group in steps. (100→50→20→5→1%)
F6	A.AXIS+	Moves the arch axis to the right during ARCH motion.
F7	A.AXIS–	Moves the arch axis to the left during ARCH motion.
F8	UNITCHG	Switches the units for indicating the current position to "mm/pulse".
F9	VEL++	Increases automatic movement speed for the selected robot group in 1% increments.
F10	VEL– –	Decreases automatic movement speed for the selected robot group in 1% decrements.
F11	MODIFY	Switches to the point data editing screen in MANUAL mode.
F14	AXIS←	Moves the cursor to the left to select another axis.
F15	AXIS→	Moves the cursor to the right to select another axis.
ROBOT		Switches the selected robot group.

1 F11 (MODIFY)

Pressing F11 (MODIFY) switches to the point data edit screen and allows you to correct the point data while checking the point trace position.

To return to the trace mode, press F11 (TRACE) again.

8.1 PTP motion mode

WARNING

THE ROBOT MOVES WHEN POINT TRACE STARTS. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

1. When no auxiliary axis is specified:

1 ***Select PTP motion.***

Press F1 (PTP) to select PTP motion.

2 ***Select the point number.***

Use the cursor (▲/▼) keys to select the point number you want to check.

NOTE

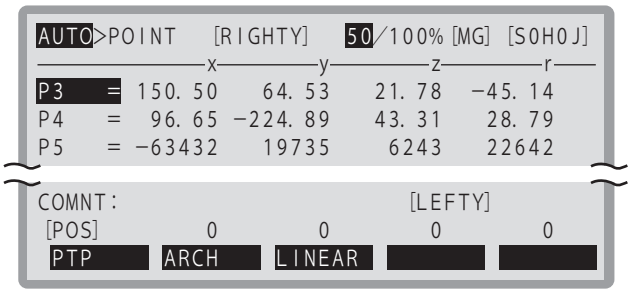
When a SCARA robot is used and a hand system flag is set for the point data, that hand system will have priority over the current arm type.

3 ***Execute point trace.***

Press RUN and the robot moves by PTP motion to the position of the selected point. The trace speed is 1/10th of the automatic movement speed.

To stop point trace, press STOP.

▶ **Step 1** **Select PTP motion**



2. When auxiliary axis is specified:

1 *Enter PTP mode.*

Press F1 (PTP).

The point values of the robot axes are highlighted.

2 *Select the point to be checked.*

Use the cursor (▲/▼) keys to select the point and press F14 (AXIS←)to select the main robot

NOTE

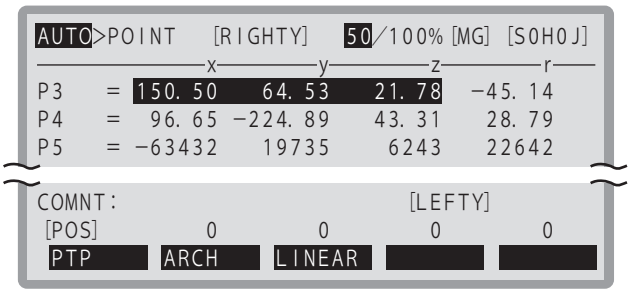
When a SCARA robot is used and a hand system flag is set for the point data, that hand system will have priority over the current arm type.

3 *Perform point trace.*

Press RUN to move the robot by PTP motion to the specified point position. The trace speed is 1/10th of the automatic movement speed.

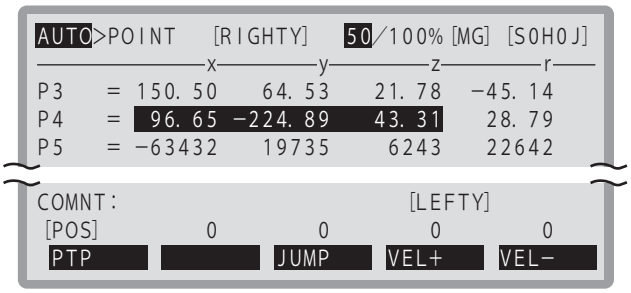
To stop point trace, press STOP.

Step 1 **Select PTP motion**

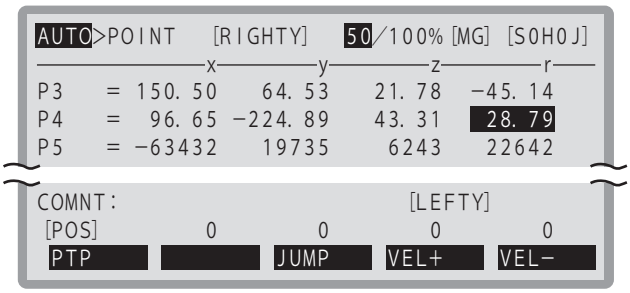


Step 2 **Select the point and axes to move in PTP mode**

To perform trace for the robot main axes:



To perform trace for the auxiliary axis:



WARNING

THE ROBOT MOVES WHEN POINT TRACE STARTS. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

1. When no auxiliary axis is specified:

1 ***Select ARCH motion.***

On the AUTO>POINT mode screen, press F2 (ARCH) to select ARCH motion.

2 ***Select the axis to move by arch motion.***

Press F6 (A.AXIS+) or F7 (A.AXIS-) to select the axis to move by arch motion.
The axis selected for arch motion is indicated on the message line as in "ARCH(z)".

3 ***Set the arch motion position.***

Press F2 (A.POS) and enter the arch motion position.

4 ***Select the point number to be checked.***

Use the cursor (▲/▼) keys to select the point number you want to check.

NOTE

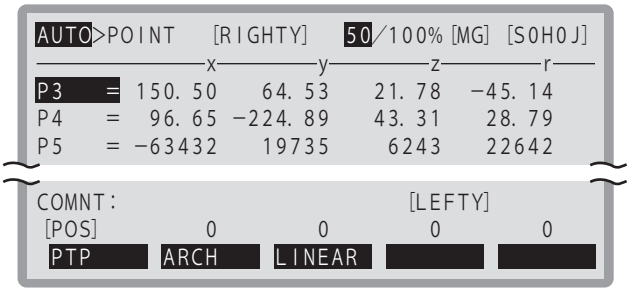
When a SCARA robot is used and a hand system flag is set for the point data, that hand system will have priority over the current arm type.

5 ***Perform point trace.***

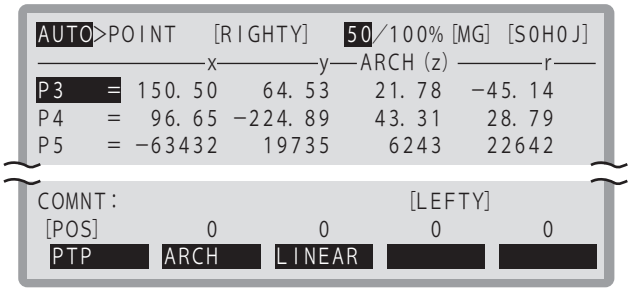
Press RUN to move the robot by arch motion to the specified point position. The trace speed is 1/10th of the automatic movement speed.

To stop point trace, press STOP.

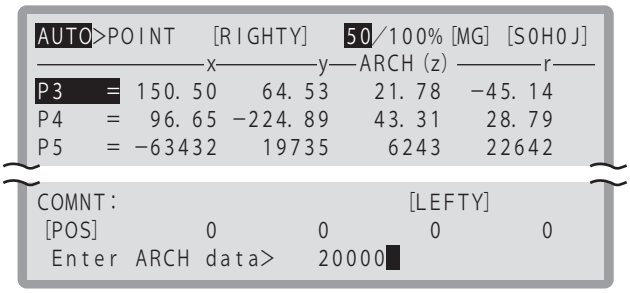
▶ **Step 1** **Select ARCH motion**



▶ **Step 2** **Select the axis to move by arch motion**



▶ **Step 3** **Set the arch motion position**



2. When auxiliary axis is specified:

1 *Select ARCH motion.*

On the AUTO>POINT mode screen, press F2 (ARCH) to select ARCH motion.
When performing point trace using an auxiliary axis, skip steps 2 and 3.

2 *Select the axis to move by arch motion.*

Press F6 (A.AXIS+) or F7 (A.AXIS-) to select the axis to move by arch motion.
The axis selected for arch motion is indicated on the message line as in "ARCH(z)".

3 *Set the arch motion position.*

Press F2 (A.POS) and enter the arch motion position.

4 *Select the point to be checked.*

Use the cursor (▲/▼) keys to select the point and press F14 (AXIS←)to select the main robot.

NOTE

When a SCARA robot is used and a hand system flag is set for the point data, that hand system will have priority over the current arm type.

5 *Perform point trace.*

Press RUN to move the robot by arch motion to the specified point position. he trace speed is 1/10th of the automatic movement
speed.
In the case of an auxiliary axis, it moves by PTP.
To stop point trace, press STOP.

Step 1 Select ARCH motion

```
AUTO>POINT   [RIGHTY]   50/100% [MG] [S0H0J]
          ----------x----------y----------z----------r----
P3    = 150. 50    64. 53    21. 78   -45. 14
P4    =  96. 65 -224. 89    43. 31    28. 79
P5    = -63432    19735     6243     22642

COMNT:                                [LEFTY]
 [POS]        0         0         0         0
 PTP      ARCH      LINEAR
```

Step 2 Select the axis to move by arch motion

```
AUTO>POINT   [RIGHTY]   50/100% [MG] [S0H0J]
          ----------x----------y--ARCH (z)----------r----
P3    = 150. 50    64. 53    21. 78   -45. 14
P4    =  96. 65 -224. 89    43. 31    28. 79
P5    = -63432    19735     6243     22642

COMNT:                                [LEFTY]
 [POS]        0         0         0         0
 ARCH     A. POS    JUMP      VEL+      VEL-
```

Step 3 Set the arch motion position

```
AUTO>POINT   [RIGHTY]   50/100% [MG] [S0H0J]
          ----------x----------y--ARCH (z)----------r----
P3    = 150. 50    64. 53    21. 78   -45. 14
P4    =  96. 65 -224. 89    43. 31    28. 79
P5    = -63432    19735     6243     22642

COMNT:                                [LEFTY]
 [POS]        0         0         0         0
 Enter ARCH data>    20000
```

8.3 Linear interpolation motion

WARNING

THE ROBOT MOVES WHEN POINT TRACE STARTS. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

1. When no auxiliary axis is specified:

1 ***Select linear interpolation motion.***

On the AUTO>POINT mode screen, press F3 (LINEAR) to select linear interpolation motion.

2 ***Select the point number.***

Use the cursor (▲/▼) keys to select the point number you want to check.

NOTE

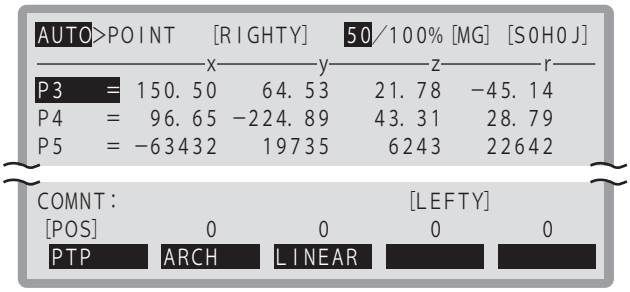
When a SCARA robot is used and a hand system flag is set for the point data, that hand system will have priority over the current arm type.

3 ***Perform point trace.***

Press RUN to move the robot by linear interpolation motion to the specified point position. The trace speed is 1/10th of the automatic movement speed.

To stop point trace, press STOP.

▶ **Step 1** **Select linear interpolation motion**



2. When auxiliary axis is specified:

1 *Select linear interpolation motion.*

On the AUTO>POINT mode screen, press F3 (LINEAR) to select linear interpolation motion.

2 *Select the point to be checked.*

Use the cursor (▲/▼) keys to select the point and press F14 (AXIS←)to select the main robot.

NOTE

When a SCARA robot is used and a hand system flag is set for the point data, that hand system will have priority over the current arm type.

3 *Perform point trace.*

Press RUN to move the robot by linear interpolation motion to the specified point position. The trace speed is 1/10th of the automatic movement speed. In the case of an auxiliary axis, it moves by PTP.

To stop point trace, press STOP.

Step 1 Select linear interpolation motion

```
AUTO>POINT   [RIGHTY]   50/100% [MG] [S0H0J]
              ──x──────y──────z──────r──
P3    = 150.50   64.53   21.78  -45.14
P4    =  96.65 -224.89   43.31   28.79
P5    = -63432   19735    6243   22642

COMNT:                          [LEFTY]
[POS]       0       0       0       0
 PTP     ARCH    LINEAR
```

Step 2 Select the axis to move by linear interpolation motion

To perform trace for the robot main axes:

```
AUTO>POINT   [RIGHTY]   50/100% [MG] [S0H0J]
              ──x──────y──────z──────r──
P3    = 150.50   64.53   21.78  -45.14
P4    =  96.65 -224.89   43.31   28.79
P5    = -63432   19735    6243   22642

COMNT:                          [LEFTY]
[POS]       0       0       0       0
 LINEAR          JUMP    VEL+    VEL-
```

To perform trace for the auxiliary axes:

```
AUTO>POINT   [RIGHTY]   50/100% [MG] [S0H0J]
              ──x──────y──────z──────r──
P3    = 150.50   64.53   21.78  -45.14
P4    =  96.65 -224.89   43.31   28.79
P5    = -63432   19735    6243   22642

COMNT:                          [LEFTY]
[POS]       0       0       0       0
 LINEAR          JUMP    VEL+    VEL-
```

9. Direct command execution

One line of the command statement can be executed just after you have entered it.

WARNING

THE ROBOT MAY START MOVING WHEN A COMMAND SUCH AS A MOVEMENT COMMEND IS EXECUTED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

1 ***Enter DIRECT mode.***

Press F7 (DIRECT) in AUTO mode.

The screen switches to AUTO>DIRECT mode and the prompt (>) appears on the bottom of the screen.

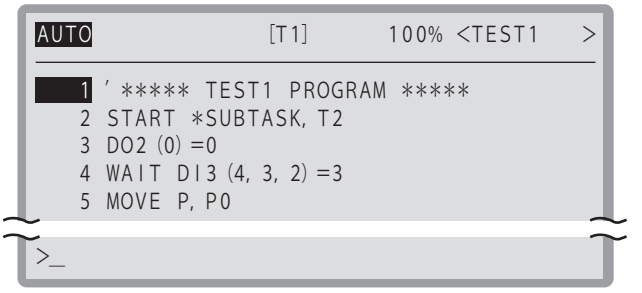
2 ***Enter a command.***

Enter a command statement.

3 ***Execute the command statement.***

Press ENTER to execute the command statement you have just entered.

Step 1 **Execute a direct command**



NOTE

Main command statements that can be executed in DIRECT mode are assignment statements, movement commands, SET statements, RESET statements, etc.

- Before executing a movement command, return-to-origin must have been completed.
- The STOPON option for movement commands cannot be used.
- A movement command ends after positioning on the axis is complete.

10. Breakpoint

An ongoing program can be stopped if a breakpoint is set in the program.
The program execution pauses on the line just prior to a breakpoint.
The program execution will restart from the breakpoint when RUN is pressed.

NOTE

- Up to 4 break points can be set in one program. These 4 break points cannot set in different programs. However, when used with a "COMMON" program, up to 4 breakpoints can be set including the main program. (For more information on the COMMON programs, refer to the programming manual.)
- If the program is edited or compiled, all breakpoints you have set are deleted.
- Break points are ignored during execution of STEP or NEXT. However, break points set in sub-routines are enabled when executing NEXT.

Valid keys and submenu descriptions in AUTO>BREAK mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the break point and scrolls the screen.
⇈ / ⇊		Switches the page display.
F1	SET	Sets the break point.
F2	CANCEL	Deletes the break point.
F3	SEARCH	Searches for the line set with the break point.
F6	JUMP	Shows the program listing from specified line.
F7	FIND	Specifies the character string to be found.
F8	FIND+	Finds the specified character string searching backwards from the cursor position.
F9	FIND–	Finds the specified character string searching forwards from the cursor position.

NOTE

The F6 to F9 keys have the same functions as edit operation in PROGRAM mode. For more details, see "3.10 Line jump" and "3.11 Searching a character string" in Chapter 4.

10.1 Setting breakpoints

To set breakpoints in a program, follow the steps below.

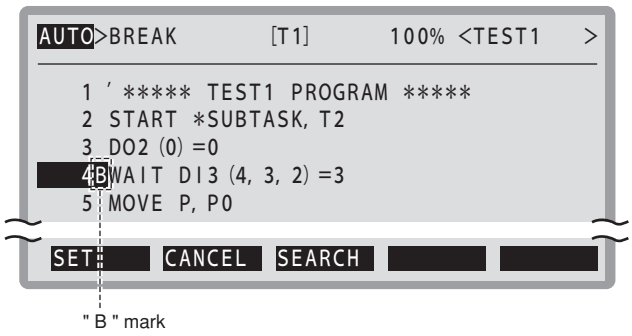
1 ***Select the line where you want to set a breakpoint.***

In AUTO mode, press F8 (BREAK) to enter AUTO>BREAK mode.
Then, use the cursor keys to select the line number where you want to set a breakpoint.

2 ***Set a breakpoint.***

Press F1 (SET) to set a breakpoint on the selected line. A breakpoint mark "B" appears to the left of the command statement.

▶ **Step 2** **Breakpoint setting**



10.2 Finding breakpoints

To find the line number where a breakpoint is set, press F3. The cursor jumps to the line number where a breakpoint is set.
If no breakpoint is set in the program, an error message "3.7 : Breakpoint doesn't exist" appears.

10.3 Canceling breakpoints

To cancel the breakpoints you have set, follow the steps below.

1 ***Select the breakpoint you want to cancel.***

Use the cursor (▲/▼) keys to select the line number where the breakpoint is set.

2 ***Cancel the breakpoint.***

Press F2 (CANCEL) to cancel the breakpoint.
The breakpoint mark "B" then disappears.

TIP

To find the line number on which another break point was set, press F3 (SEARCH).
This function makes it easier to find a breakpoint that you want to cancel.

11. Executing a step

WARNING

THE ROBOT MAY BEGIN TO MOVE WHEN STEP IS EXECUTED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

In AUTO mode, pressing F11 (STEP) executes the command statement of the line number indicated by the pointer and the pointer then moves to the next line.
Each time F11 (STEP) is pressed, the command statement of the line number indicated by the pointer is executed and the pointer then moves to the next line.
If the command statement is a sub-routine or sub-procedure, its top line is executed.

12. Skipping a step

In AUTO mode, pressing F12 (SKIP) skips to the next line without executing the command statement of the line number indicated by the pointer.
Each time F12 (SKIP) is pressed, the pointer moves to the next line without executing command statement of the line number the pointer is on.

13. Executing the next step

WARNING

THE ROBOT MAY BEGIN TO MOVE WHEN NEXT IS EXECUTED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

In AUTO mode, pressing F13 (NEXT) executes the command statement of the line number indicated by the pointer and the pointer then moves to the next line.
Each time F13 (NEXT) is pressed, the command statement of the line number indicated by the pointer is executed and the pointer then moves to the next line.
If the command statement is a sub-routine or sub-procedure, it is executed all at once.

NOTE

During STEP, SKIP and NEXT execution, the message "Running" is displayed on the screen.
After execution is complete, the pointer moves to the line number of the next command statement.

Chapter 4 PROGRAM mode

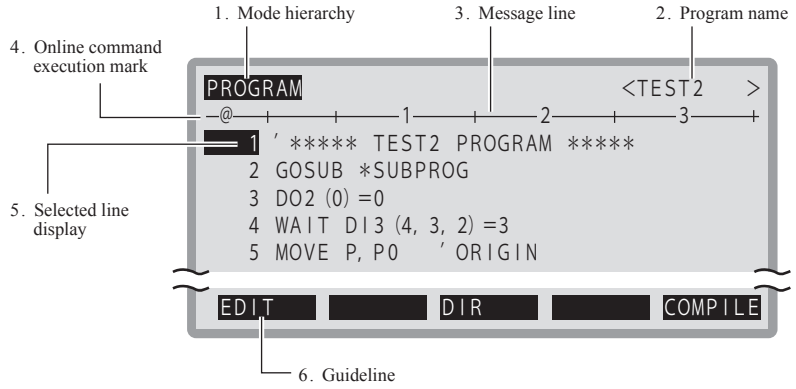
Contents

1. PROGRAM mode

Robot language programs can be edited, deleted and managed in PROGRAM mode.

The initial PROGRAM mode screen is shown below.
When PROGRAM mode is entered, the currently selected program appears on the screen.

PROGRAM mode



1. Mode hierarchy

Shows the current mode hierarchy. When the highest mode name is not highlighted, it means the servomotor power is off. When highlighted, it means the servomotor power is on.

2. Program name

Shows the program name currently selected.

3. Message line

This line shows the number of digits of the program. If an error occurs, the error message also appears here.

4. Online command execution mark

When an online command is being executed, an "@" mark is displayed in the second column. This mark changes to a dot "·" when the online command ends.

5. Selected line display

In the program listing, the line number to be edited is highlighted.

6. Guideline

The contents assigned to function keys are shown highlighted. A message on what to do next also appears here in some operation steps.

Valid keys and submenu descriptions in PROGRAM mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Selects a program, or scrolls up or down one line.
⇈ / ⇊		Scrolls up or down one screen.
F1	EDIT	Edits the program.
F3	DIR	Displays the program data.
F5	COMPILE	Compiles the program.
F6	JUMP	Displays the program listing from a specified line.
F7	FIND	Specifies the character string to be found.
F8	FIND+	Finds the specified character string searching backwards from the cursor position.
F9	FIND–	Finds the specified character string searching forwards from the cursor position.
F13	ERR.RST	Resets the checksum when a checksum error occurs in the selected program.

NOTE

Refer to the separate programming manual for details on the programming language.

2. Scrolling a program listing

• Pressing the cursor (▲/▼) keys scrolls up or down one line at a time in the program listing.

Pressing the cursor (◄/►) keys scrolls right or left through a program listing one character at a time.

Holding down the cursor key continuously scrolls through the screen.

• Pressing the page (≪, ≫, ⇊, ⇈) keys scrolls one page screen at a time.

3. Program editing

1 ***Enter PROGRAM>EDIT mode.***

In PROGRAM mode, press F1 (EDIT) to enter PROGRAM>EDIT mode.
A cursor appears on the top line of the program listing, indicating that the program can be edited.

2 ***Enter a program.***

Use the cursor keys to move the cursor to the position to be edited and enter a program command using the keys on the programming box.
A maximum of 75 characters can be entered on one line.
After entering one line of the program, press ENTER to determine that entry.
The cursor then moves to the top of the next line.

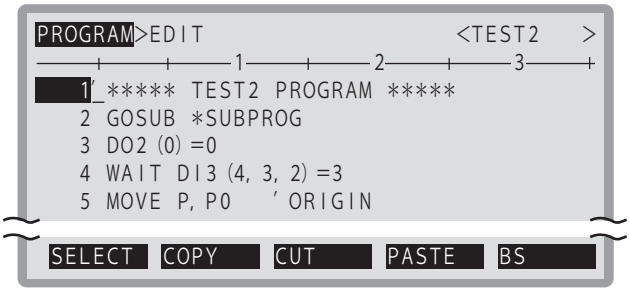
NOTE

The entry of the currently edited line is determined when any of ENTER, up/down cursor (▲/▼) keys, page up/down (⏫/⏬) keys, or ESC is pressed during program editing.
A maximum of 9999 lines can be written in one program as long as the program size is within about 98 Kbytes.

3 ***End the program editing.***

After entering the program, press ESC to complete the program editing.

▶ **Step 1** **Program editing**



Valid keys and submenu descriptions in PROGRAM>EDIT mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up or down, or scrolls up or down one line.
⇈ / ⇊		Scroll up or down one screen.
INS		Switches between the insert and overwrite cursors.
L-INS		Inserts one blank line.
DEL		Deletes one character the cursor is on.
L-DEL		Deletes one line.
USER		Displays the user function key.
ESC		Ends program editing.
ENTER		Finishes the program input for one line and moves the cursor to the beginning of the next line.
F1	SELECT	Selects the starting line for copy or cut.
F2	COPY	Copies the selected line and temporarily stores it in a buffer.
F3	CUT	Cuts the selected lines and temporarily stores it in a buffer.
F4	PASTE	Inserts the buffer data directly prior to the cursor line.
F5	BS	Deletes one character before the cursor.
F6	JUMP	Displays the program listing from the specified line.
F7	FIND	Specifies the character string to be found.
F8	FIND+	Finds the specified character string searching backwards from the cursor position.
F9	FIND–	Finds the specified character string searching forwards from the cursor position.

3.1 Cursor movement

• Pressing the cursor (▲/▼) keys in moves the cursor up or down one line at a time.

Pressing the cursor (◄/►) keys moves the cursor right or left one character at a time.

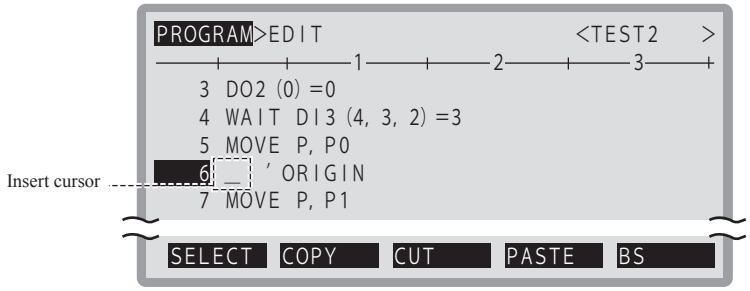
• Pressing the page (≪, ≫, ⇊, ⇈) keys moves the cursor one screen at a time.

3.2 Insert/overwrite cursor switching

Pressing INS alternately switches between the insert and overwrite cursors.

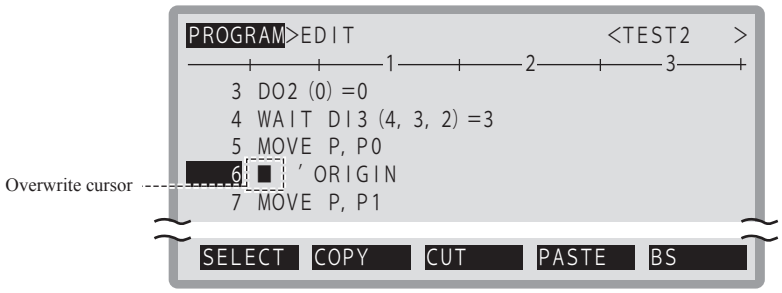
In insert mode, the cursor changes from a black square (n) to a thin line (_) and the input character is inserted just previous to the cursor position.

Insert cursor



In overwrite mode, the cursor changes from a thin line (_) to a black square (n) and the input character replaces the character at the cursor position.

Overwrite cursor



3.3 Inserting a line

A blank line can be inserted into a program.
Move the cursor to the position where you want to insert the line and press L-INS.
A blank line is inserted at the cursor position.

3.4 Deleting a character

Move the cursor to the character you want to delete and press DEL.
One character at the cursor position is deleted.

3.5 Deleting a line

Move the cursor to the line you want to delete and press L-DEL.
One line at the cursor position is deleted and the lines after the cursor position move upward.

3.6 User function key display

Character strings you repeatedly enter can be assigned to function keys.
When using this function, it is necessary to make a program named "FUNCTION" and then write command statements for registering functions.
User function keys can be registered up to 15 from F1 to F15.

NOTE
For information on how to register the function keys, refer to "4.9 Creating a sample program automatically" and "7. Registering user function keys" in this chapter.

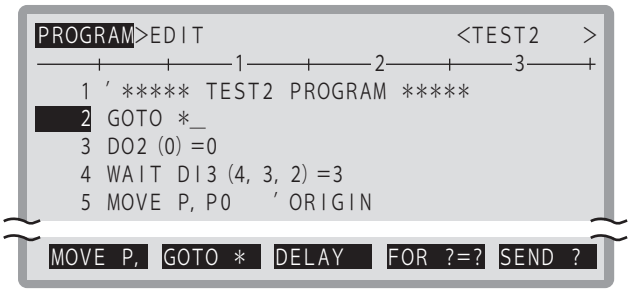
1 ***Display user function keys.***

Press USER.
The character strings are displayed on the guideline, which are preassigned to function keys F1 to F15. Each character string is displayed in up to 7 characters from the beginning.

2 ***Insert a character string.***

Press the function key that corresponds to the character string you want to enter.
For example, if you press F2 (GOTO), the character string "GOTO " is entered at the cursor position.

Step 2 **User function keys**



3.7 Quitting program editing

Press ESC to end program editing.

3.8 Copying or cutting lines

Specified lines can be copied or cut.

1 ***Move the cursor to the line you want copy or cut.***

Use the cursor (▲/▼) keys to move the cursor to the line you want to start a copy or cut.

2 ***Enable the line select mode.***

Press F1 (SELECT) to enable the line select mode.

3 ***Specify the range you want to copy or cut.***

Use the cursor (▼) keys to specify the range you want to copy or cut.

A " C " mark appears on each line which was specified.

Pressing ESC cancels the line selection.

NOTE

When selecting a line range, the maximum number of characters is 200. If the number of characters exceeds 200, the selected line range must be reduced. The number of characters on one line is the count from the top to the last characters (excluding blanks) plus 1.

4 ***Copy or cut the specified lines.***

Press F2 (COPY) or F3 (CUT) to copy the data on the selected lines into the buffer.

In the case of "cut", the selected lines are deleted after the data is copied into the buffer.

The " C " marks then disappear in either case.

5 ***Paste the lines.***

Press F4 (Paste) to paste the selected lines.

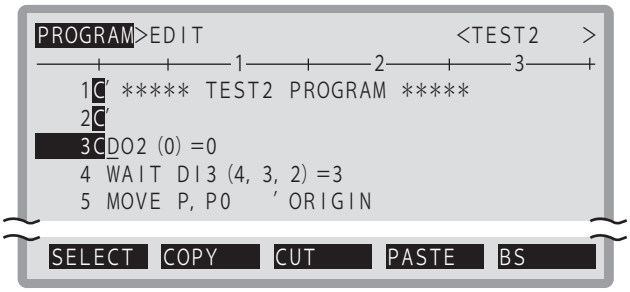
The data stored into the buffer is inserted just before the cursor line.

NOTE

The data stored in the buffer can be pasted repeatedly until you exit PROGRAM mode.

However, if another copy/cut operation is performed, then the data within the buffer is rewritten.

Step 3 Specifying the copy/cut lines



3.9 Backspace

Pressing F5 (BS) deletes one character before the cursor.

When the cursor is at the beginning of a line, it connects to the end of the previous line. However, any key operation is ignored if the number of characters on the connected line exceeds 75 characters.

3.10 Line jump

The currently selected program can be displayed from a specified line.

1 ***Enter the line jump mode.***

Press F6 (JUMP).

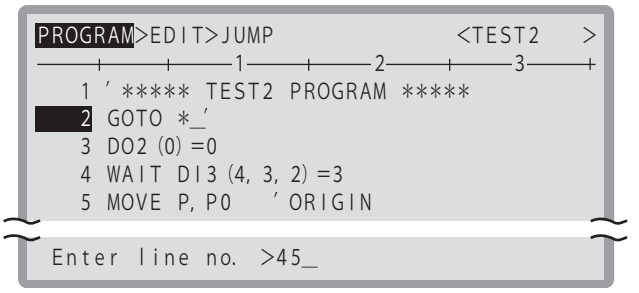
PROGRAM>EDIT>JUMP mode is entered, and the message "Enter line no. >" appears on the guideline.

2 ***Specify the line number.***

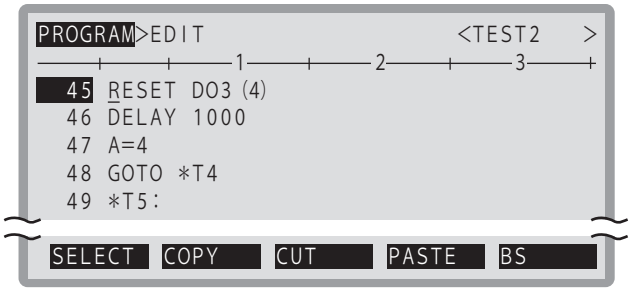
Enter the line number to jump to and press ENTER.

The program is then displayed from the specified line.

Step 1 **Line jump (enter line number)**



Step 2 **Line jump executed**



3.11 Searching a character string

1 ***Enter the find mode.***

Press F7 (FIND).

PROGRAM>EDIT>FIND mode is entered, and the message "Character string >" appears on the guideline.

2 ***Enter the character string you want to find.***

After entering the character string you want to find press ENTER.

A maximum of 20 characters can be used.

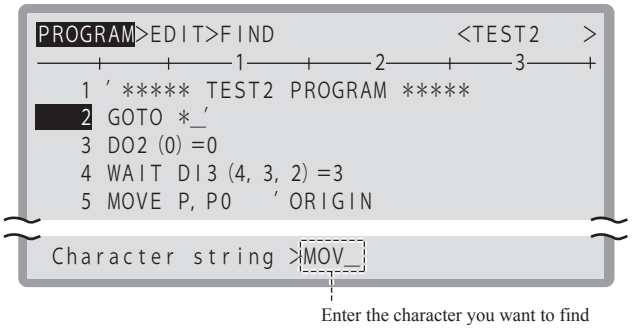
Search starts from the cursor position toward the end of the program and stops at the first matching character string.

To continuously search for another character string, press F8 (FIND+) or F9 (FIND-).

Pressing F8 (FIND+) restarts the search from the current cursor position towards the end of the program.

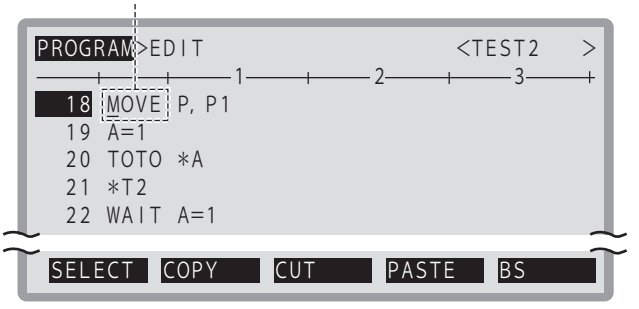
Pressing F9 (FIND-) restarts the search from the current cursor position towards the top of the program.

Step 2 **Character string search**



Enter the character you want to find

First matching character string



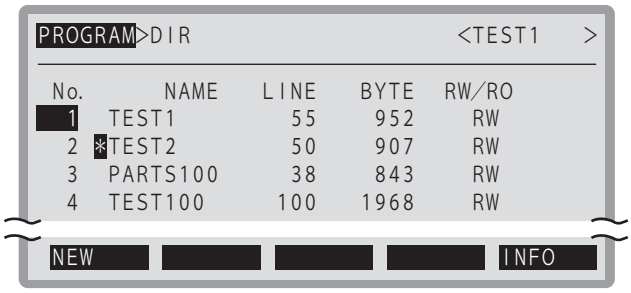
4. Directory

When F3 (DIR) is pressed in PROGRAM mode, information on each program appears as shown below.

NOTE

A maximum of 100 programs can be stored.

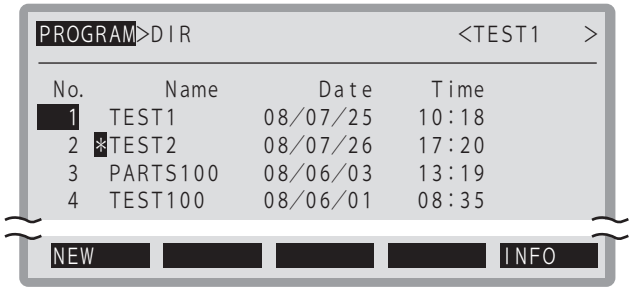
Program information



Pressing ► displays the "DATE" and "TIME" data. To return to the previous display, press ◄.

Program information

Date and time display



NOTE

The date and time are updated when the program is created or edited.

Contents of each item are shown below.

Item	Description
No.	Indicates the serial number of the program. The number of the program which is currently selected is highlighted (reversed background).
Name	Indicates the program name. The " " mark (reversed background) shows this program is compiled and the object program exists. The " s " mark (reverse background) shows an object exists in the sequence program.
Line	Shows the number of lines in the program.
Byte	Shows how many bytes of memory the program uses.
RW/RO	Indicates the program attribute. RW : Reading or writing enabled. RO : Reading only enabled; writing inhibited.
Date	Shows the date when the program was made or edited.
Time	Shows the time when the program was made or edited.

Valid keys and submenu descriptions in PROGRAM >DIR mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Selects the program, or scrolls the screen vertically.
◄ / ►		Switches between the program information display and the date/time display.
« / »		Scrolls up or down one screen.
F1	NEW	Registers a new program name.
F5	INFO	Shows the number of bytes used for the entire program.
F6	COPY	Copies the program.
F7	ERASE	Erases the program.
F8	RENAME	Renames the program.
F10	ATTRBT	Changes the program attribute.
F11	OBJECT	Shows the object program information.
F15	EXAMPLE	Automatically creates the program name "FUNCTION".

4.1 Cursor movement

To select a program, use the cursor (▲/▼) keys.

The pointer moves to the selected program number.
The program name is displayed at the right end on the system line (1st line).

4.2 Registering a new program name

To create a new program, first register the program name.

1 ***Enter a program name.***

Press F1 (NEW).

The message "Enter program name>" appears on the guideline. Enter the program name using 0 to 9, A to Z, and _.

Pressing ESC cancels the program name input.

NOTE

Program names can be up to 8 characters consisting of a combination of alphanumeric characters (0 to 9, A to Z) and underscores (_).

Do not use the following program names for normal programs because the controller recognizes them as special programs.

"FUNCTION"
"SEQUENCE"
"_SELECT"
"COMMON"

(For details on these programs, see "7. Registering user function keys" in this chapter or refer to the separate programming manual.)

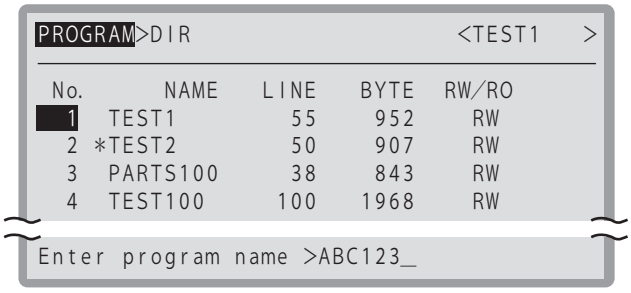
2 ***Register the program name.***

Press ENTER to register the program name.

Pressing ESC cancels the program name input.

If an error message "3.2 : Program already exists" appears, it means that a program with the same name that you have entered is already registered. Enter a different program name in this case.

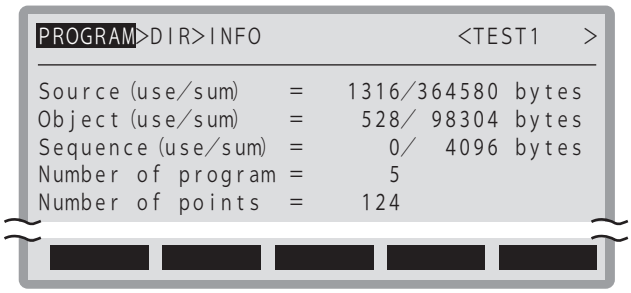
Step 1 **Register a new program name**



4.3 Directory information display

Pressing F5 (INFO) enters PROGRAM>DIR>INFO mode and displays the following directory information.

Directory information



Item	Description
Source (use/sum)	Displays a count of used bytes and bytes available for source program and point data.
Object (use/sum)	Displays a count of used bytes and bytes available for object program.
Sequence (use/sum)	Displays a count of used bytes and bytes available for sequence object program. (8 bytes are used for one circuit of sequence program.)
Number of program	Displays the number of programs.
Number of points	Displays the number of points that are registered. (28 bytes are used for one point.)

4.4 Copying a program

Programs in the directory can be copied under different program names.

1 ***Select the program you want to copy.***

Use the cursor (▲/▼) keys to select the program you want to copy.

2 ***Enter a new program name.***

Press F6 (COPY).

PROGRAM>DIR>COPY mode is entered and the message "Enter program name >" appears on guideline along with an edit cursor. Enter a new program name.

NOTE

Program names can be up to 8 characters and consist of a combination of alphanumeric characters (0 to 9, A to Z) and underscores (_).

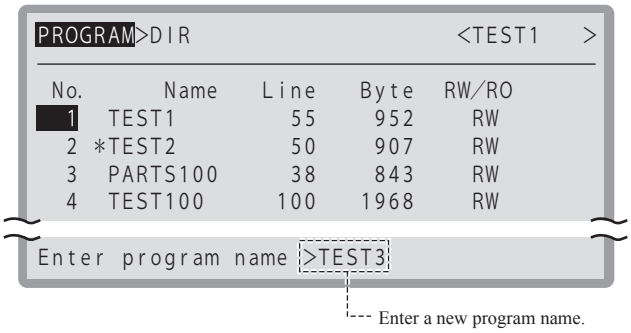
3 ***Copy the program.***

Press ENTER to copy the program.

Pressing ESC cancels the copy.

If an error message "3.2 : Program already exists" appears, it means that a program with the same name is already registered. Enter a different program name in this case.

▶ **Step 2** **Copying a program**



4.5 Erasing a program

Programs in the directory can be erased.

1 ***Select the program you want to erase.***

Use the cursor (▲/▼) keys to select the program you want to erase.

2 ***Erase the program.***

Press F7 (ERASE).

PROGRAM>DIR>ERASE mode is entered and the message "Erase program OK?" appears on the guideline.

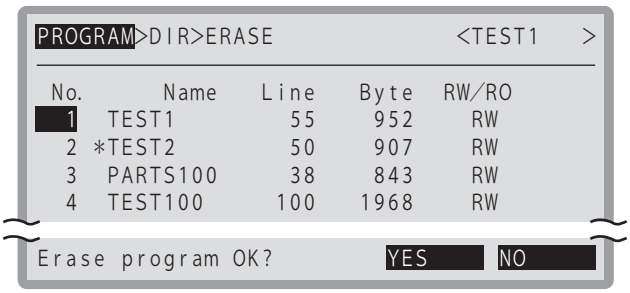
Press F4 (YES) to erase the selected program.

Pressing F5 (NO) cancels the erasing.

NOTE

- Programs with an "RO (read only)" attribute cannot be erased. When these programs must be erased, change the attribute.
- To change the program attribute, see "4.7 Changing the program attribute" in this chapter.

▶ **Step 2** **Erasing a program**



4.6 Renaming a program

The names of programs in the directory can be changed.

1 ***Select the program you want to rename.***

Use the cursor (▲ / ▼) keys to select the program you want to rename.

2 ***Enter a new program name.***

Press F8 (RENAME).

PROGRAM>DIR>RENAME mode is entered and the message "Enter program name >" appears on the guideline along with the original program name. Enter a new program name.

NOTE

Program names can be up to 8 characters and consist of a combination of alphanumeric characters (0 to 9, A to Z) and underscores (_).

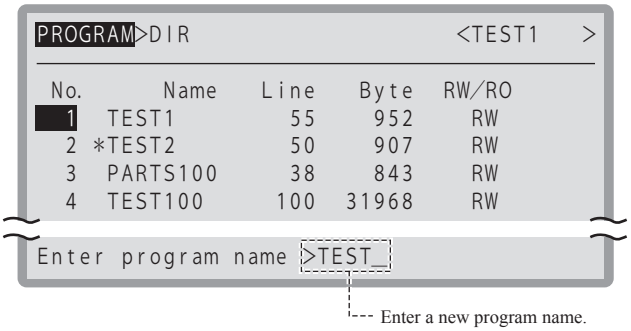
3 ***Rename the program.***

Press ENTER to rename the program.

Pressing ESC cancels the renaming.

If an error message "3.2 : Program already exists" appears, it means that a program with the same name is already registered. Enter a different program name in this case.

Step 2 Renaming a program



4.7 Changing the program attribute

Editing and erasing the programs can be prohibited by specifying the program attribute in PROGRAM>DIR mode.

There are the following two program attributes.

1. **RW (read or write)**

   Program contents can be edited and erased.
   This is automatically specified as a default when a program name is registered.

2. **RO (read only)**

   Program contents cannot be edited or erased.
   To change the attribute of a program, follow the steps below.

1 ***Select the program whose attribute you want to change.***

Use the cursor (▲ / ▼) keys to select the program whose attribute you want to change.

2 ***Change the program attribute.***

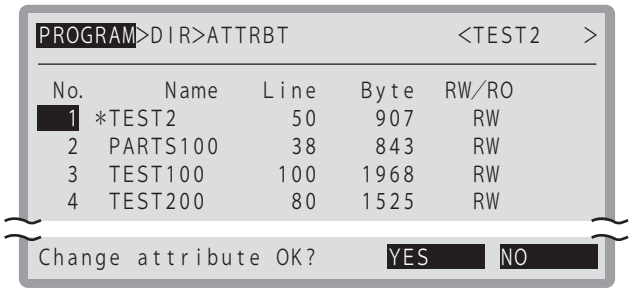
Press F10 (ATTRBT).

PROGRAM>DIR>ATTRBT mode is entered and a confirmation message appears on the guideline.

Press F4 (YES) to change the attribute.

Pressing F5 (NO) cancels this operation.

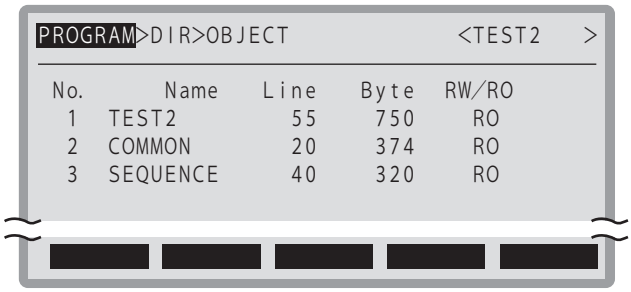
▶ **Step 2** **Changing a program attribute**



4.8 Displaying object program information

Pressing F11 (OBJECT) enters PROGRAM>DIR>OBJECT mode and displays object information as shown below.

Object program information



4.9 Creating a sample program automatically

This section explains the procedure of automatically creating a sample program for defining user function keys which can be used in MANUAL and PROGRAM modes.

NOTE

Use caution when creating a sample program automatically, since previously defi ned user function data will be rewritten.

1 ***Enter PROGRAM>DIR>EXAMPLE mode.***

Press F15 (EXAMPLE).

PROGRAM>DIR>EXAMPLE mode is entered and a confirmation message appears on the guideline.

2 ***Create a sample program.***

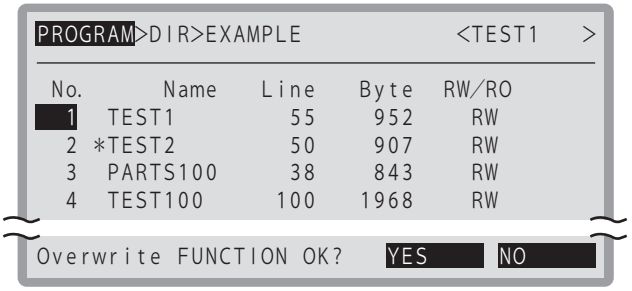
Press F4 (YES) to create a sample program.

Pressing F5 (NO) cancels creating a sample program.

3 ***Customize the program contents.***

Customize the contents of the created program as needed.

Step 1 **Check whether to create a sample program**



NOTE

See "3.6 User function key display" for details on user function keys. See"7. Registering user function keys" when registering user function keys.

[Sample program listing]

```
*** <FUNCTION> SAMPLE PROGRAM ****
'*You can change any statements              *
'*as you like.                                *
'*<FUNCTION> will help you in                 *
'*MANUAL and PROGRAM mode.                    *
'*********************************************
*M_F1:'DO(20)ALTERNATE
     DO(20)=~DO(20)
*M_F2:'DO(21)ALTERNATE
     DO(21)=~DO(21)
*M_F3:'DO(22)ALTERNATE
     DO(22)=~DO(22)
*M_F4:'DO(23)ALTERNATE
     DO(23)=~DO(23)
*M_F5:'DO(24)ALTERNATE
     DO(24)=~DO(24)
*M_F6:'DO(25)MOMENTARY
     DO(25)=1
     DO(25)=0
*M_F7:'DO(26)MOMENTARY
     DO(26)=1
     DO(26)=0
*M_F8:'DO(27)MOMENTARY
     DO(27)=1
     DO(27)=0
*M_F9:'DO2()ON
     DO2()=255
*M_F10:'DO2()OFF
     DO2()=0
*M_F11:'OPEN
     DO3(0)=&B1
*M_F12:'CLOSE
     DO3(0)=O
*M_F13:'AND
     DO3(1)=1 & DO3(0)
*M_F14:'DI4->DO4
     DO4()=DI4()
*M_F15:'DO5INC
     DO5()=DO5()+1
'*********************
*P_F1:'MOVE P,P
*P_F2:'MOVE L,P
*P_F3:'GOTO *
*P_F4:'DELAY
*P_F5:'WAIT
*P_F6:'GOSUB *
*P_F7:'RETURN
*P_F8:'PRINT
*P_F9:'SPEED
*P_F10:'HALT
*P_F11:'IF     THEN
*P_F12:'ELSE
*P_F13:'ENDIF
*P_F14:'FOR    =    TO
*P_F15:'NEXT
```

5. Compiling

To compile the program and create an executable object program, follow the procedure below.
The object program allows you to check input errors or bugs after program editing.

1 ***Select the program you want to compile.***

In PROGRAM>DIR mode, use the cursor (▲ / ▼) keys to select the program.

2 ***Compile the program.***

Press ESC to return to PROGRAM mode and then press F5 (COMPILE).

PROGRAM>COMPILE mode is entered and a confirmation message appears on the guideline.

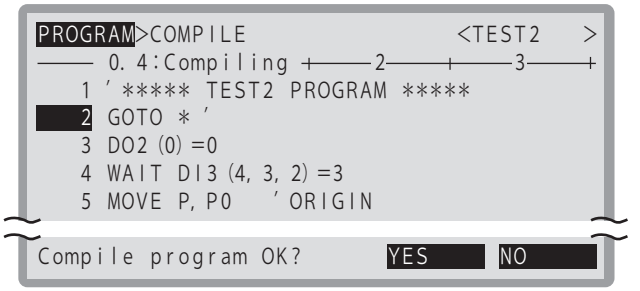
Press F4 (YES) to compile the program.

Pressing F5 (NO) cancels the compiling.

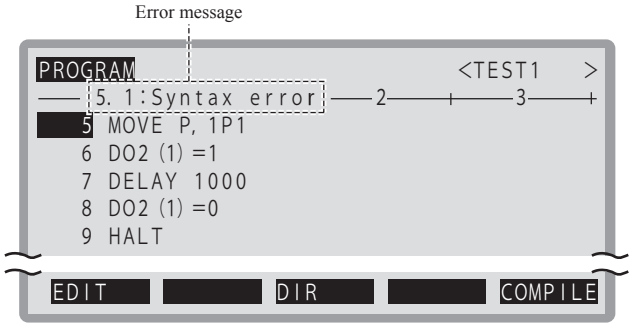
3 ***Check the compiled results.***

If an error is found in the command statements, the program listing for that line appears along with an error message, and the compiling stops. When the compiling ends normally, an object program has been created. The object program that was last compiled is deleted.

▶ **Step 2** **Compiling**



▶ **Step 3** **Compile error**



NOTE

Even if the specified program is yet not compiled, it is compiled automatically when you move to AUTO mode.

6. Line jump and character string search

The F6 (JUMP), F7 (FIND), F8 (FIND+) and F9 (FIND-) can be used in the same way as in PROGRAM>EDIT mode.
(For details, see "3.10 Line jump" and "3.11 Searching a character string" in this chapter.)

7. Registering user function keys

To register the user function keys which are used in PROGRAM and MANUAL modes, make a program named "FUNCTION" and enter the command statements for registering the user function keys.

NOTE

The controller recognizes a program named "FUNCTION" as a special program for registering the user function keys. Therefore, do not use this name for normal programs.

1 ***Enter PROGRAM>DIR mode.***

In PROGRAM mode, press F3 (DIR) to enter PROGRAM>DIR mode.

2 ***Enter the program name.***

Press F1 (NEW).

The message "Enter program name >" then appears on the guideline. Enter "FUNCTION" following this message on the guideline.

3 ***Register the program.***

Press ENTER to register the program name "FUNCTION".

Then press ESC to return to PROGRAM mode.

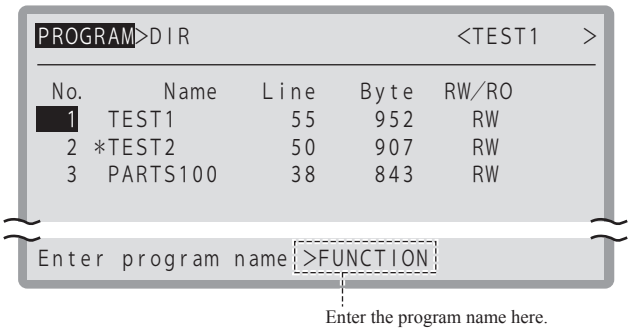
The program name "FUNCTION" is displayed on the system line.

4 ***Enter a command statement for registering function keys.***

Press F1 (EDIT) to enter PROGRAM>EDIT mode and the cursor appears on the first line.
The command statement format differs between the PROGRAM mode and MANUAL mode. Refer to the examples below.
Enter a command statement by referring to the "command statement format" examples shown below.

Then press ESC to complete the command input.

Step 2 **Enter the program name**



■ Command statement formats

1. When registering function keys for editing in PROGRAM mode

```
*P_F<n>:'<character string>
```

<n>.....Function key number to be registered (n=1 to15)

<character string>.....Character string to be assigned to the function key (displayed on the screen).

Example) *P_F2:'MOVE, P.... Character string "MOVE, P" is assigned to F2.

*P_F8:'DELAY Character string "DELAY" is assigned to F8.

2. When registering function keys for I/O commands in MANUAL mode

```
*M_F<n>:'<character string>
<I/O statement 1>
<I/O statement 2>
```

<n>.....Function key number to be registered (n=1 to 15)

<character string>.....Character string to be assigned to the function key (displayed on the screen).

<I/O statement 1>.....Command statement to be executed when the key is pressed.

<I/O statement 2>.....Command statement to be executed when the key is released.

NOTE

<I/O statement 2> may be omitted. If omitted the <I/O statement 1>will be executed when the key is pressed, but nothing will be executed when released.

Example) *M_F2:'MOMENT ..... Character string "MOMENT" is assigned to F2.

DO (20) =1..... DO (20) is turned ON when F2 is pressed.

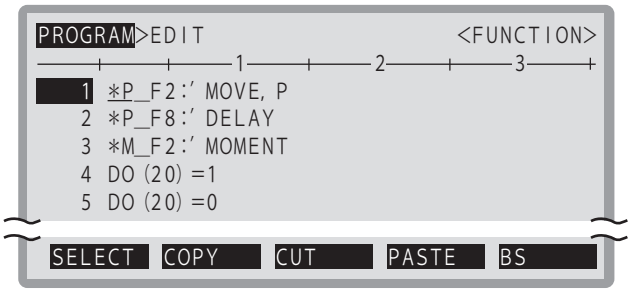
DO (20) =0..... DO (20) is turned OFF when F2 is released.

*M_F14:'ALTER..... Character string "ALTER" is displayed on F14.

DO (20) =~DO (20).... DO (20) is highlighted when F14 is pressed.

In the above example, "MOMENT" a "momentary" type function, and "ALTER" defines an "alternate" type function. A character string of up to 65 characters can be entered. However, up to 7 characters following the colon (:) are displayed on the function key menu.

Registering user functions



NOTE

- In one "FUNCTION" program, functions for program edit and I/O functions in MANUAL mode can be used together and defined.
- Besides the above method, user functions can also be defined by the next method.
  1) "FUNCTION" can be made automatically according to the user function-defined sample program registered in the unit. See "4.9 Creating a sample program automatically" for more details.
  2) In the PROGRAM>EDIT mode, rewrite the contents of the "FUNCTION" program to create desired user functions.
- When assignment was made to a function key that has already been assigned, the new assignment will be valid.

8. Resetting an error

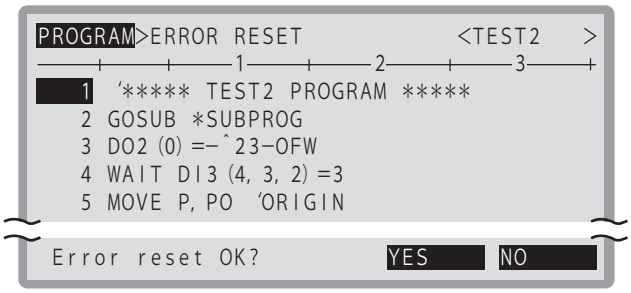
If an error "9.1 : Program destroyed" occurs in the selected program, reset the error. The program can be edited after resetting the error.

CAUTION

If a checksum error occurs, the program may have a problem. The following operation resets an error but does not restore the program dataprogram, so check and correct the program in PROGRAM>EDIT mode.

In PROGRAM mode, press F13 (ERR. RST), and a confirmation message appears on the guideline. Press F4 (YES) to reset the error.
The program can be edited after resetting the error.
Pressing F5 (NO) cancels the error reset.

Check whether to reset error



NOTE

This reset function does not work if an error "9.3 : Memory destroyed" occurs. In this case, initialize the memory.

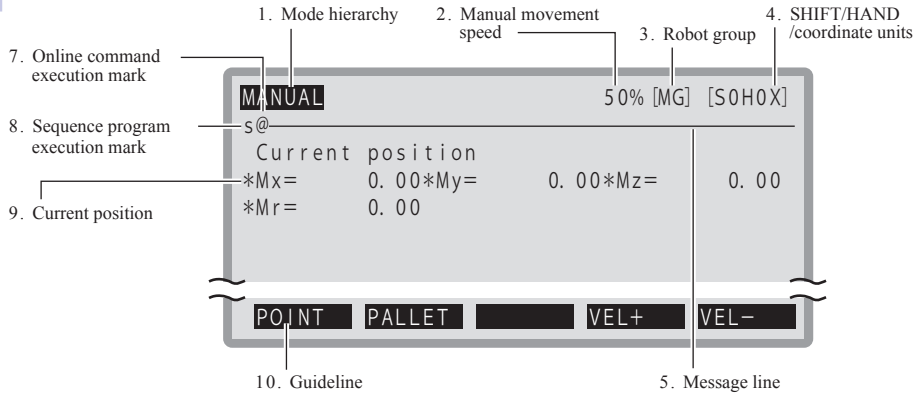
Chapter 5 MANUAL mode

Contents

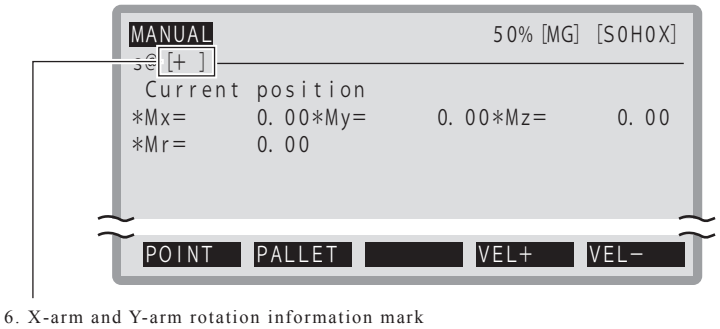
1. MANUAL mode

Point data and shift data coordinates can be defined and edited in MANUAL mode.
The initial MANUAL mode screen is shown below.

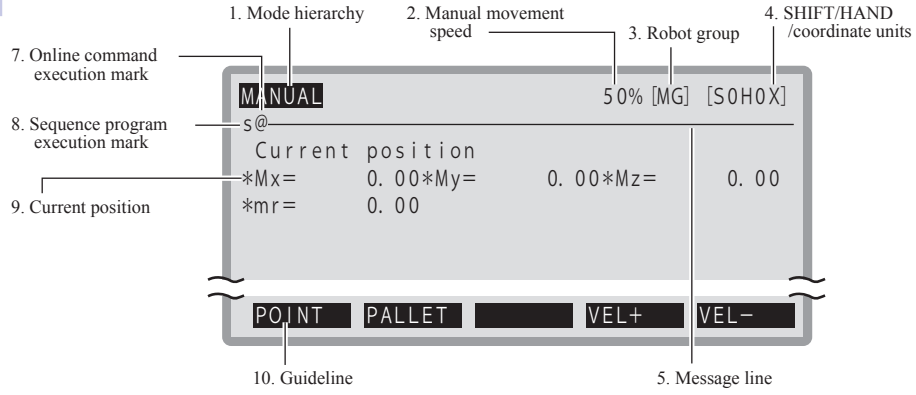
MANUAL mode (One-robot setting)



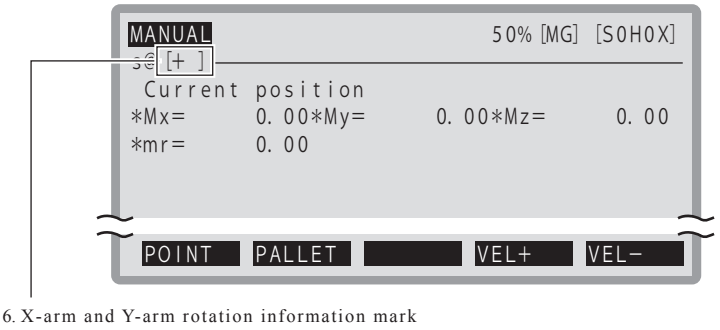
[R6YXTW500]



MANUAL mode (with auxiliary axis)



[R6YXTW500]



1. Mode hierarchy

Shows the current mode hierarchy. When the highest mode is not highlighted it means the servomotor power is off. When highlighted it means the servomotor power is on.

2. Manual movement speed

Shows the robot movement speed selected for manual operation.

3. Robot group

This shows the robot group currently selected for manual movement.
When one robot is specified, the "[MG]" (main group) appears.

4. SHIFT/HAND/coordinate units

Shows the shift coordinate number, hand definition number and coordinate units.

5. Message line

If an error occurs, the error message appears here. A dashed line means return-to-origin is incomplete. A solid line means return-to-origin return is complete.

6. X-arm and Y-arm rotation information mark (*1)

"[XY]" mark appears in the 3rd to 6th column.
The 4th column shows the X-arm rotation information while the 5th column shows the Y-arm rotation information.
The following describes the characters and the meaning of the data.

+ : Rotation information is “+1”.
- : Rotation information is “-1”.
Space : Rotation information is “0”.

(*1) The X-arm and Y-arm rotation information mark is valid in software version Ver. 1.66M or later.
This display occurs only on the R6YXTW500 model robot where a "return-to-origin complete" status is in effect and the standard coordinates have been specified.
For details, refer to " 3. Displaying and editing point data".

7. Online command execution mark

When an online command is being executed, a "@" mark is displayed in the second column. This mark changes to a dot " . " when the online command ends.

8. Sequence program execution mark

When a sequence program is being executed, an "s" letter is displayed in the first column.

9. Current position

This shows the current position of the robot. When an "M" or "S" letter is followed by a number, it indicates the position in "pulse" units (integer display). When an "x" to "a" letter follows, it indicates "mm" units (decimal point display). When an asterisk (*) appears at the left of the "M" and "S" letters, it indicates the origin sensor for the corresponding axis is on. An asterisk (*) is always displayed when no origin sensor is used.
An "M" letter means the main robot axis, and an "S" letter means the sub robot axis. When auxiliary axes are specified, the lower-case letters "m" and "s" appear instead of upper-case letters "M" and "S".

10. Guideline

The contents assigned to function keys are shown highlighted. A message on what to do next also appears here in some operation steps.

Valid keys and submenu descriptions in MANUAL mode are shown below.

Valid keys	Menu	Function
#1+ X to B #6−		Moves the robot manually.
F1	POINT	Switches to the point data screen.
F2	PALLET	Switches to the pallet data screen.
F3	ORIGIN	Performs return-to-origin.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F6	SHIFT	Switches to the shift data screen.
F7	HAND	Switches to the hand data screen.
F8	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.
F13	RST.ABS	Resets the absolute position sensor.
F15	COORDI	Sets the standard coordinates.
ROBOT		Switches the robot group.

2. Manual movement

In MANUAL mode, you can manually move the robot with the Jog keys as explained below.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

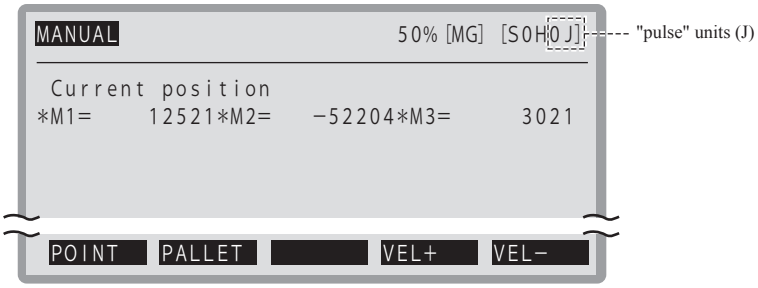
- For details on the soft limits, refer to the user's manual.
- When the current position is displayed in "pulse" units, the robot can be moved manually along the axes whose servos are on, even if the servos of the other axes are off.
- When the current position is displayed in "mm" units, the robot can be moved manually only when the servos of all axes are on.
- The maximum jog movement time for one movement command is 300 seconds. So if the movement time exceeds 300 seconds at the specified speed, the robot movement will stop in 300 seconds. To move the robot further, use jog movement once again.

2.1 Manual movement when return-to-origin has been completed

- **When the current position is displayed in "pulse" units:**

  A letter "J" is displayed on the upper right of the programming box screen.

Display shown in "pulse" units (J)



Each time a Jog key is pressed, the robot moves a specified distance (inching distance) along the corresponding axis. When the Jog key is held down, the robot keeps moving towards the soft limit of the axis. The robot stops when the Jog key is released or the soft limit is reached.
The movement distance (inching distance) is equal to the manual movement speed setting value.

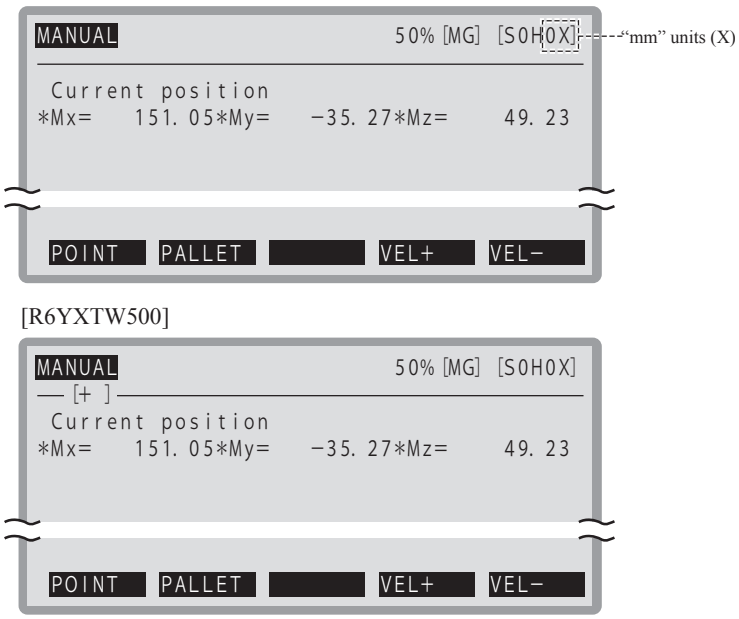
Example): When manual movement speed is 20%:
Inching distance in "pulse" units = 20 pulses

If robot movement beyond the +/- soft limits is attempted with the Jog keys, the error message "2.1: Over soft limit" appears and the robot does not move.

- **When the current position is displayed in "mm" units:**

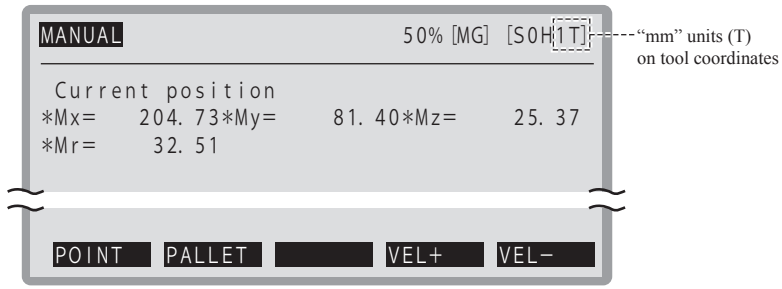
  A letter "X" is displayed on the upper right of the programming screen. If tool coordinates are selected, a letter "T" is displayed.

Example shown in “mm” units (X)

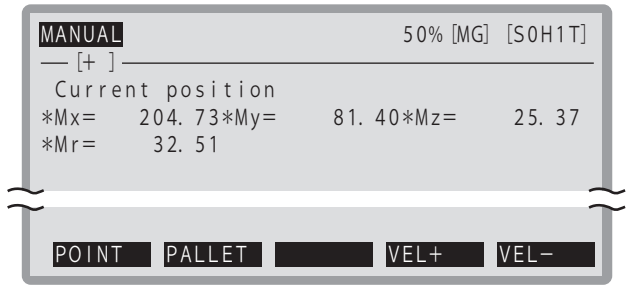


[R6YXTW500]

Example shown in “mm” units (Tool coordinate mode: T)



[R6YXTW500]



1) When "X" is displayed (When tool coordinates are not selected)
   When a Jog key is pressed, the robot arm tip moves in the corresponding direction on the Cartesian coordinates. If auxiliary axis setting is made, then the robot moves only along the corresponding axis.

2) When "T" is displayed (When tool coordinates are selected)
   Tool coordinates can be used only when hand data for the R-axis of a SCARA robot is selected (hand definition is made).

   Pressing the #1+ X or X #1− key moves the hand forwards or backwards.

   Pressing the #2+ Y or Y #2− key moves the hand to the left or right.

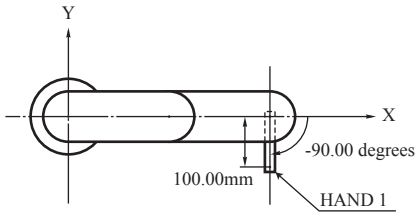
   Pressing the #4+ R or R #4− key rotates the end of the hand around its center.

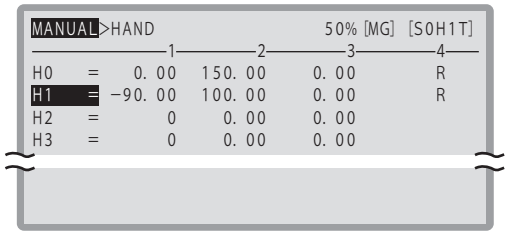
   When the other Jog keys are pressed, the robot moves the same way as when tool coordinates are not displayed.

When the following hand definition is made, the robot moves with Jog keys as illustrated below.

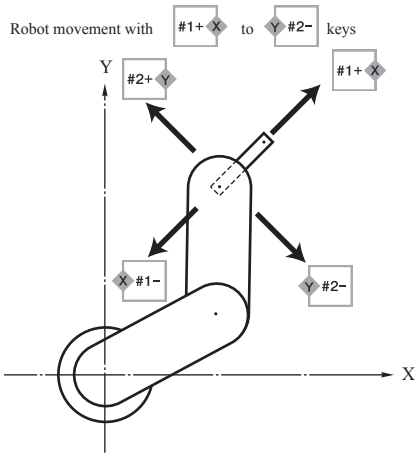
Robot movement in "Tool coordinate" mode (example)

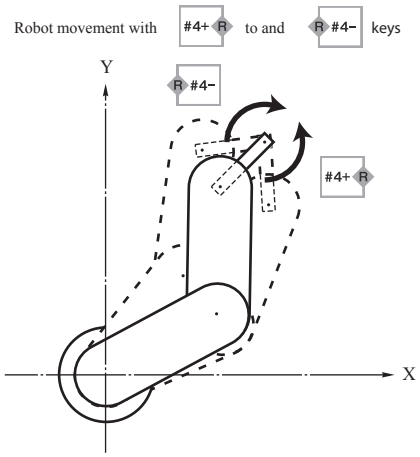
Hand definition





Movement with Jog keys





Each time a Jog key is pressed, the robot moves a specified distance (inching movement). When the Jog key is held down, the robot keeps moving. The robot stops when the Jog key is released or either of the soft limit or shift coordinate range is reached. The robot stops when the Jog key is released or the soft limit is reached.

The movement distance (inching distance) is equal to the manual movement speed setting (%) multiplied by 0.01mm or 0.01 deg.

Example): When manual movement speed is 20%:
Inching distance in "mm" units = 0.20mm

If robot movement beyond the +/- soft limits is attempted with the Jog keys, the error message "2.1: Over soft limit" appears and the robot does not move. If robot movement beyond the shift coordinate range is attempted, the error message "2.11: Exceeded shift coord. range" appears and the robot does not move.

If the current position is outside the soft limits, the error message "2.1: Over soft limit" also appears and the robot does not move.

2.2 When return-to-origin is not complete

CAUTION

When return-to-origin is incomplete, the robot does not stop even if soft limits are exceeded.

When the current position is displayed in "pulse" units:

Robot movement with the Jog keys is possible the same as when return-to-origin is complete. However, the message "0.1: Origin incomplete" appears when a Jog key is pressed.

When the current position is displayed in "mm" units:

When return-to-origin becomes incomplete, the current position display automatically switches to "pulse" units and the error message "0.1: Origin incomplete" appears.
The current position cannot be displayed in "mm" units unless return-to-origin is complete.

NOTE

If return-to-origin is incomplete, the current position always appears as "pulse" units when the controller is turned on.

3. Displaying and editing point data

When in MANUAL mode, pressing F1 (POINT) displays the data screen.

One point is made up of data from 6 axes (x, y, z, r, a, b). The hand system flag, X-arm rotation information, and Y-arm rotation information can be set as extension settings for the point data set with the Cartesian coordinates ("mm" units). (*1) The hand system flag is valid only in the SCARA robot. Additionally, the X-arm rotation information and Y-arm rotation information are invalid in a robot other than R6YXTW500.

Since the operating area range of both the X-arm and Y-ram is extended to 360 or more degrees, from -225 to +225 degrees in R6YXTW500, the X-arm rotation information and Y-arm rotation information are added next to the hand system flag of the point data (“mm” units).

Point data format (Controller version Ver. 1.65M or earlier)

X-coordinate	Y-coordinate	Z-coordinate	R-coordinate	A-coordinate	B-coordinate	Hand system
fxxxxxx	fyyyyyy	fzzzzzz	frrrrrr	faaaaaa	fbbbbbb	t

Point data format (Controller version Ver. 1.66M or higher)
· Robot other than R6YXTW500

X-coordinate	Y-coordinate	Z-coordinate	R-coordinate	A-coordinate	B-coordinate	Hand system
fxxxxxx	fyyyyyy	fzzzzzz	frrrrrr	faaaaaa	fbbbbbb	t

· R6YXTW500

X-coordinate	Y-coordinate	Z-coordinate	R-coordinate	A-coordinate	B-coordinate	Hand system	X-arm rotation information	Y-arm rotation information
fxxxxxx	fyyyyyy	fzzzzzz	frrrrrr	faaaaaa	fbbbbbb	t	xr	yr

f.....Coordinate sign: +/-/Space
xxxxxx/../bbbbbb .....A number of up to 8 digits. When the number includes a dot, the coordinates (“mm” units) are used.
t.....Hand system flag for extended settings of SCARA robot
0 : Non-setting (The hand system conforms to the arm type setting in the UTILITY mode.)
1 : Right-handed system
2 : Left-handed system
xr.....X-arm rotation information for extended settings
0 : The range of the angle data x (*2) after converted from “mm” to “pulse” is -180.00 degrees < x <= 180.00 degrees.
1 : The range of the angle data x (*2) after converted from “mm” to “pulse” is 180.00 degrees < x <= 540.00 degrees.
-1 : The range of the angle data x (*2) after converted from “mm” to “pulse” is -540.00 degrees < x <= -180.00 degrees.
yr.....Y-arm rotation information for extended settings
0 : The range of the angle data y (*2) after converted from “mm” to “pulse” is -180.00 degrees < y <= 180.00 degrees.
1 : The range of the angle data y (*2) after converted from “mm” to “pulse” is 180.00 degrees < y <= 540.00 degrees.
-1 : The range of the angle data y (*2) after converted from “mm” to “pulse” is -540.00 degrees < y <= -180.00 degrees.

· The hand system flag is valid only when the SCARA robot is used and the coordinates (“mm” units) are specified.
· If a number other than “1” or “2”, or no number is specified for the hand system flag, the hand system flag is not set (0).
· The X-arm rotation information and Y-arm rotation information are valid only when the SCARA robot "R6YXTW500" is used and the coordinates (“mm” units) are specified.
· If a number other than “0”, “1”, or “-1”, or no number is specified for the X-arm rotation information and Y-arm rotation information, these settings become “0”.

(*1) The X-arm rotation information and Y-arm rotation information can be used in software version Ver. 1.66M or later.
(*2) This data is that the pulse data after converted into the joint coordinates is converted to the angle from the mechanical origin of each arm.

Point numbers can be specified in the range of 0 to 9999.

The axis data for 10 points is displayed on the screen along with a point comment on the selected point number. To see the other data, scroll the screen with the cursor keys or page keys.

Scrolls up or down one line at a time.

Scrolls right or left one character at a time.

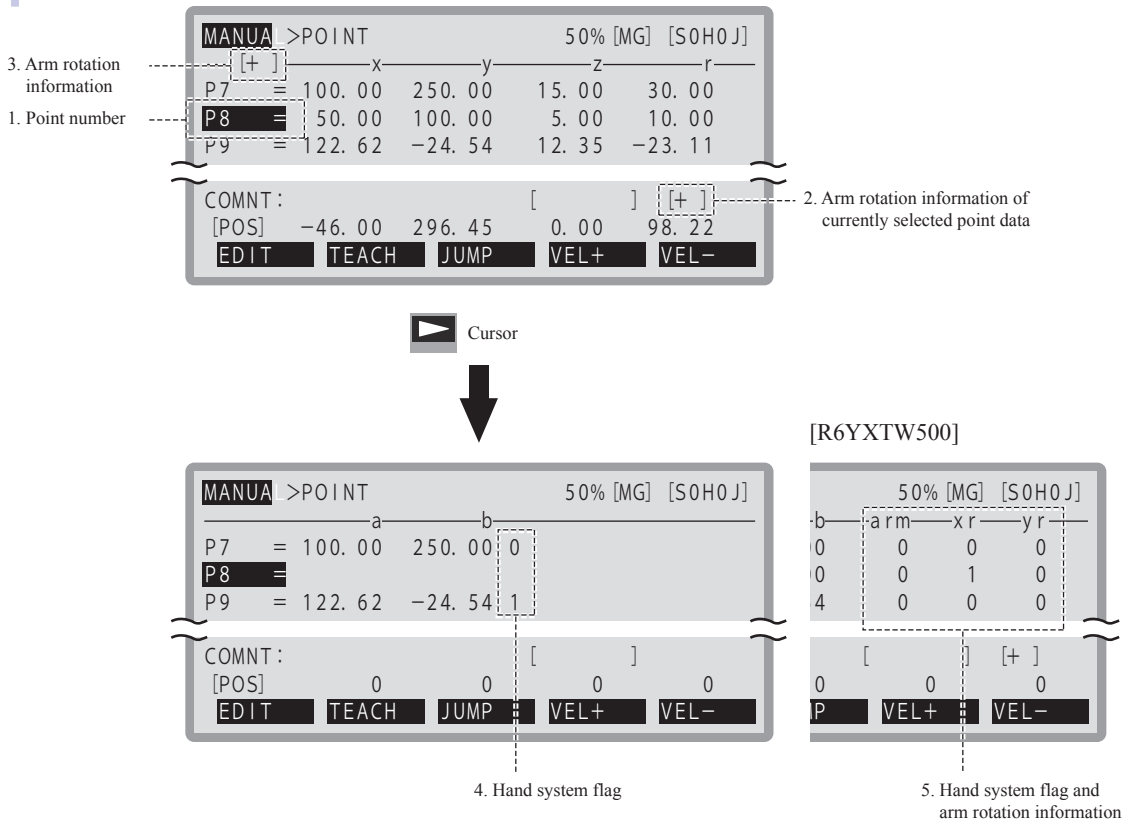
Scrolls up or down ten lines at a time.

Scrolls right or left one page at a time.

CAUTION

Repetitive positioning accuracy in the robot specifications does not apply to the stop position of a different hand system if it is used to move to a point data on the Cartesian coordinates (millimeter units).

Point data screen



1. Pont number

The number for editing the point is highlighted.

2. Arm rotation information of currently selected point data

The X-arm rotation information and Y-arm rotation information of the currently selected point data are shown.
The arm rotation information is displayed only when the robot is R6YXTW500.
The following shows the meanings of the data.

+ : Rotation information is “+1”.
- : Rotation information is “-1”.
Space : Rotation information is “0”.

Example : When “[+]” is displayed, the X-arm rotation information is “+1” and the Y-arm rotation information is “0”.

3. Arm rotation information

The X-arm rotation information and Y-arm rotation information of the current position are displayed.
This arm rotation information is displayed only when the robot is R6YXTW500.
The meanings of the data are the same as those described in 2.
This display occurs only when a "return-to-origin complete" status is in effect and the standard coordinates have been specified.

4. Hand system flag

The hand system is displayed in the 7th column when the SCARA robot is used and the point data is set with the Cartesian coordinates ("mm" units).

5. Hand system flag and arm rotation information

When the robot is R6YXTW500 and the point data is set with the Cartesian coordinates ("mm" units), the X-arm rotation information and Y-arm rotation information are shown next to the hand system display.

Valid keys and submenu descriptions on the point data screen are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the point data and scrolls the screen.
⇈ / ⇊		Scrolls up or down one screen.
F1	EDIT	Enters point data with keys.
F2	TEACH	Enters point data by teaching.
F3	JUMP	Displays point data of the specified number.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F6	COPY	Copies point data.
F7	ERASE	Deletes point data.
F8	UNITCHG	Changes the current position display units to "mm" or "pulses".
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.
F11	TRACE	Moves the axis to the specified point position.
F12	COMMENT	Switches to the point comment screen.
F13	ERR.RST	Allows editing even if the point data is destroyed.
F14	AXIS←	Moves the cursor to the left to select another axis. (Enabled only when auxiliary axis is added.)
F15	AXIS→	Moves the cursor to the right to select another axis. (Enabled only when auxiliary axis is added.)
ROBOT		Switches the robot group.

3.1 Point data input and editing

1 ***Select the point to enter or edit.***

Use the cursor (▲ / ▼) keys to select the point to enter or edit.

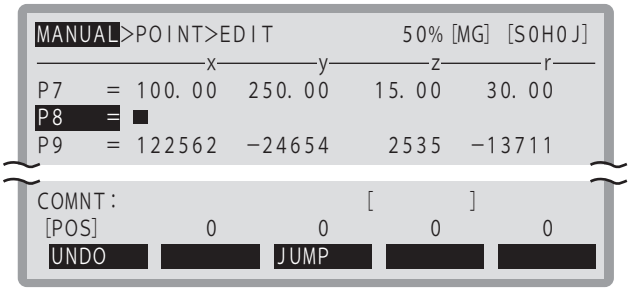
2 ***Open the point edit screen.***

Press F1 (EDIT), and an edit cursor appears at the left end of the selected point line.

3 ***Enter point data.***

Use 0 to 9, +, −, ., and SPACE to enter point data.
Enter a space to separate between the data for x, y, z, r, a, and b. The data input formats are as follows.

▶ **Step 2** **Editing point data**



• To enter the data in joint coordinates ("pulse" units)

Enter an integer of up to 8 digits. : ±######
When the number of display digits is set to 8 in SYSTEM>PARAM mode, data is displayed in 8 digits as in ± ########.

Enter all point data for the X-axis to b-axis. If omitted, "0" will be automatically entered for that axis.
The error message "Digit number error" appears when the data format is wrong.
Enter it in the correct format.

• To enter the data in Cartesian coordinates ("mm" units)

Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point.
: ±###.##,±####.#,±#####.
When the number of display digits is set to 8 in SYSTEM>PARAM mode, data is displayed in 8 digits as in ± #####.##, ± ######.#, and ± ########.

• To set a hand system flag for the extended setting

Set 1 or 2 at the end of the b data. If a value other than 1 or 2 is set, or if no value is designated, then 0 will be set to indicate that no hand system flag was set.
1: Indicates that point has been set with RIGHTY (right-handed system).
2: Indicates that point has been set with LEFTY (left-handed system).

When the robot is R6YXTW500, set the X-arm rotation information and Y-arm rotation information next to the hand system flag. (*1)
The set values are as follows.

0: The range of the angle data x (*2) after converted from “mm” to “pulse” is -180.00 degrees < x <= 180.00 degrees.
1: The range of the angle data x (*2) after converted from “mm” to “pulse” is 180.00 degrees < x <= 540.00 degrees.
-1: The range of the angle data x (*2) after converted from “mm” to “pulse” is -540.00 degrees < x <= -180.00 degrees.

(*1) The X-arm rotation information and Y-arm rotation information can be used in software version Ver. 1.66M or later.
This data is invalid in a robot other than R6YXTW500.
(*2) This data is that the pulse data after converted into the joint coordinates is converted to the angle from the mechanical origin of each arm.

4 ***Finish the point data input.***

Press ENTER, cursor up/down (▲/▼) keys or page up/down (⇈, ⇊) keys to finish the point data input.

Press ESC if you want to cancel the point data input.

Valid keys and submenu descriptions in MANUAL>POINT>EDIT mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor and scrolls the screen.
⇈ / ⇊		Scrolls up and down one screen.
INS		Switches between the key input cursors. (insert ↔ overwrite)
DEL		Deletes one character on the cursor position.
F1	UNDO	Restores the point data being edited.
F3	JUMP	Displays the data of the specified point number.

■ Restoring point data

During point data editing, pressing F1 (UNDO) reverses the last data input and restores the preceding data. This function is enabled only on lines that are not yet complete.

3.2 Point data input by teaching

The current position of the robot can be obtained as point data by teaching.

WARNING

THE ROBOT MOVES DURING TEACHING. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

CAUTION

"[MG]" indicates the main robot group is selected.

NOTE

- Point data teaching cannot be performed when return-to-origin is incomplete. Perform point teaching after performing absolute reset or return-to-origin.
- When teaching the point data (“mm” units), “0” (non-setting) is set for the hand system flag of the point data.
  When the robot is R6YXTW500, relevant arm rotation information in response to the joint coordinates (“pulse” units data) of the teaching point is set for the X-arm rotation information and Y-arm rotation information. (*1)
  When a robot other than R6YXTW500 is used, “0” is set for the X-arm rotation information and Y-arm rotation information.
  (*1) The X-arm rotation information and Y-arm rotation information can be used in software version Ver. 1.66M or later.

1. When no auxiliary axis is used:

1 ***Select the point.***

Use the cursor (▲ / ▼) keys to select the point number you want to input.

2 ***Move the robot axis.***

Use the Jog keys to move the robot axis. As the axis move, the current position display on the 12th line on the screen changes.

3 ***Perform teaching.***

When the axis reaches the target point, press F2 (TEACH).
Teaching is performed so that the current robot position data is allotted to the currently selected point number.
After teaching, the pointer cursor moves down to the next line. The format for point data input by teaching is the same as that used to display the current position.

CAUTION

The robot will not move to the same position if moving with a hand system different from that used for teaching.
When changing the hand system that was used for registering the point data, re-teach the position using the hand system that you have changed to.

When point data is already allotted to the currently selected point number, a confirmation message appears on the guideline when F2 (TEACH) is pressed.

Press F4 (YES) to perform teaching, and the data of the specified point number is rewritten.

Pressing F5 (NO) cancels the teaching.

▶ **Step 1** **Select the point**

```
MANUAL>POINT                    50% [MG] [S0H0X]
              x         y         z         r
P7    = 100.00   250.00    15.00    30.00
P8    =
P9    = 122.62   -24.54    12.35   -23.11

COMNT:                          [        ]
 [POS]    10.00   100.00     5.00    10.00
 EDIT     TEACH    JUMP     VEL+     VEL-
```

▶ **Step 3** **Check whether to rewrite the point data**

```
MANUAL>POINT>TEACH              50% [MG] [S0H0X]
              x         y         z         r
P7    = 100.00   250.00    15.00    30.00
P8    =  50.00   100.00     5.00    10.00
P9    = 122.62   -24.54    12.35   -23.11

COMNT:                          [        ]
 [POS]    50.00   100.00     5.00    10.00
 Overwrite point OK?          YES       NO
```

2. When an auxiliary axis is used:

1 *Select the point.*

Use the cursor (▲/▼) keys to select the point number you want to input.

2 *Select the axis to perform teaching.*

Use the cursor (▲/▼) keys, F14 (AXIS←) or F15 (AXIS→) to select the axis to perform teaching.

Select the point number at the left end when teaching on all axes. When teaching on the standard axes, select their point data values. When teaching on the auxiliary axis, select its point data value. Note that an undefined point cannot be specified except for point numbers.

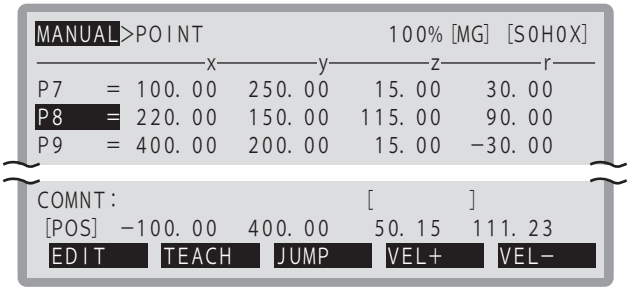
3 *Move the axis to perform teaching.*

Use the jog keys to move the axis to perform teaching.

As the axis moves, the current position data on the 12th line on the screen changes.

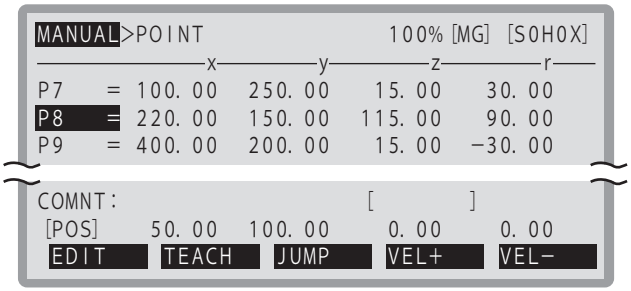
▶ Step 1 Select the point

When an auxiliary axis is used:

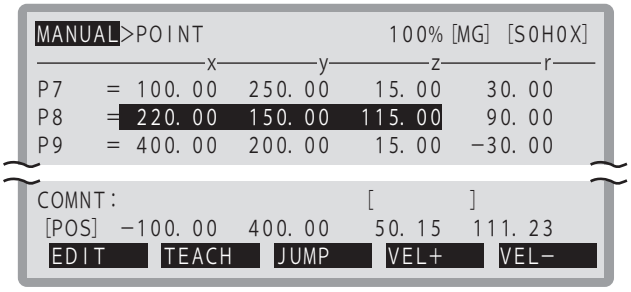


▶ Step 2 Point data teaching

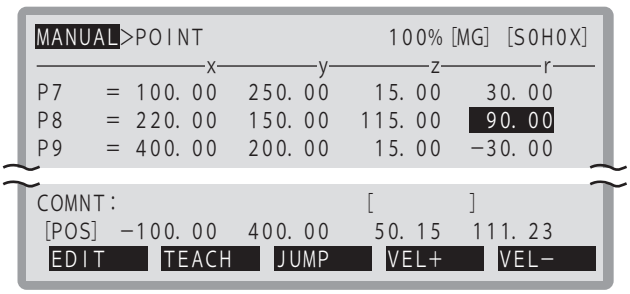
When teaching on all axes



When teaching on standard axes



When teaching on auxiliary axis



4 ***Perform teaching.***

When the axis reaches the target point, press F2 (TEACH).

Teaching is performed so that the current robot position data is allotted to the currently selected point. After teaching, the pointer cursor moves down to the next line. The format for point data input by teaching is the same as that used to display the current position. However, when teaching is performed on different axes, they must use the same coordinates as the teach points. Therefore, if the point data is in "mm" units, then the current position must also be in "mm" units.

When point data is already allotted to the currently selected point, a confirmation message "Overwrite point OK?" appears on the guideline.

Press F4 (YES) to perform teaching.

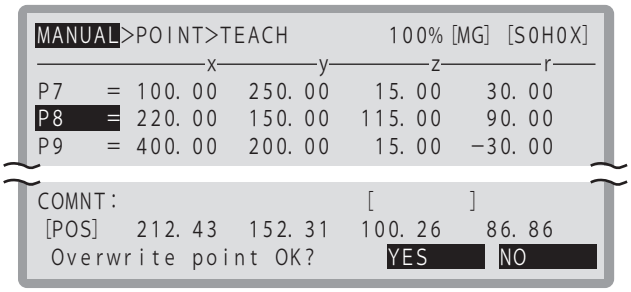
Pressing F5 (NO) cancels the teaching.

CAUTION

The robot will not move to the same position if moving with a hand system different from that used for teaching.
When changing the hand system that was used for registering the point data, re-teach the position using the hand system that you have changed to.

Step 4 Teach the point data

When point data exists:



3.3 Point data input by direct teaching

Point data can also be obtained by direct teaching (moving the robot by hand to the target point while the robot servo is off).

WARNING

BEFORE STARTING DIRECT TEACHING, PRESS THE EMERGENCY STOP BUTTON ON THE PROGRAMMING BOX SO THAT THE SERVO WILL NOT TURN ON BY EXTERNAL OPERATION.

1 ***Activate emergency stop.***

Press the emergency stop button on the programming box.

2 ***Perform point teaching.***

For point data teaching methods, see "3.2 Point data input by teaching" in this chapter. In this procedure, move the robot by hand since the Jog keys cannot be used.

NOTE

When the robot servo is off, automatic and manual operation cannot be performed. To turn on the servo, use the programming box or dedicated input.
See "1. UTILITY mode" in Chapter 7, or refer to the user's manual.

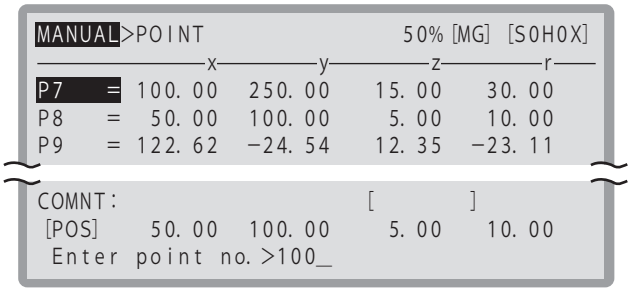
3.4 Point jump display

Point data can be displayed from the point number you specify.

Press F3 (JUMP), and the message "Enter point no.>" appears on the guideline. Enter the point number to jump to, and press ENTER.

Point data is then displayed from the point number you specified.

Point number input



NOTE

Valid point numbers are from 0 to 9999.

3.5 Copying point data

Point data can be copied under another point number.

NOTE

If a hand system flag is set in the point data, the hand system flag will also be copied.
When the robot is R6YXTW500, the X-arm rotation information and Y-arm rotation information (*1) are also copied.
(*1) The X-arm rotation information and Y-arm rotation information can be used in software version Ver. 1.66M or higher.

1 ***Open the copy screen.***

Press F6 (COPY) to open the copy screen that shows the message "Copy (####-####,####) >" on the guideline.

2 ***Enter the point number range you want to copy.***

Use 0 to 9, −, and , to enter the point number range for the copy source and the point number for the copy destination in the following format.

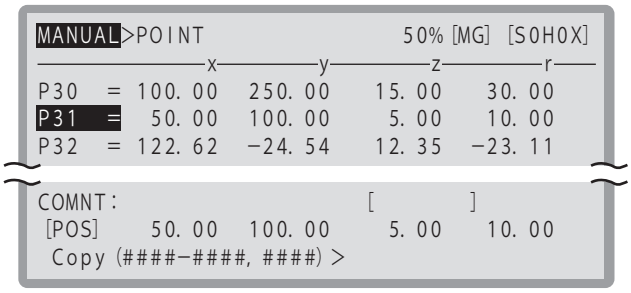
"(copy start number) – (copy end number), (copy destination start number)"

For example, to copy the data between P30 and P34 onto the lines after P50, enter "30 - 34, 50".

NOTE

Valid point numbers are from 0 to 9999.

Step 1 **Open the copy screen**

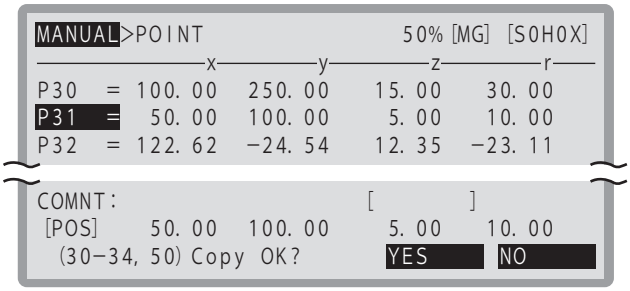


3 ***Copy the point data.***

Press ENTER and a confirmation message appears on the guideline, then press F4 (YES) to make a copy. The point data in the selected range is copied onto the data lines starting from the specified copy destination number.

Pressing F5 (NO) cancels the copy.

▶ **Step 3** **Confirm copy**

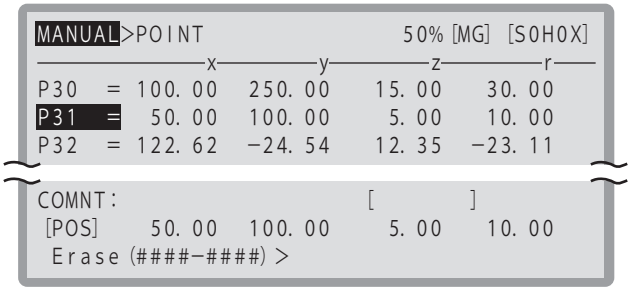


3.6 Erasing point data

1 ***Open the erase screen.***

Press F7 (ERASE) to open the erase screen that shows the message "Erase (####-####) >" on the guideline.

▶ **Step 1** **Erasing point data**



2 ***Enter the point number range you want to delete.***

Use 0 to 9, and − to enter the point number range to delete in the following format.
"(erase start number) - (erase end number)"

For example, to erase the data between P30 and P34, enter "30 - 34".

NOTE

Valid point numbers are from 0 to 9999.

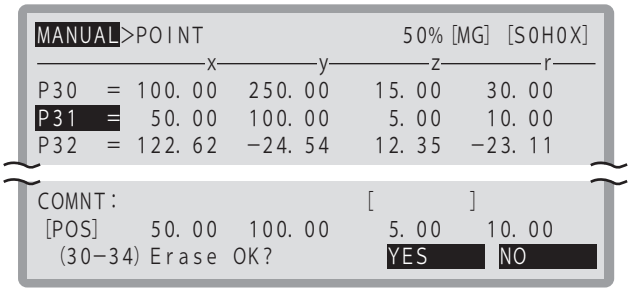
3 ***Delete the point data.***

Press ENTER and a confirmation message appears on the guideline, then press F4 (YES).

The point data in the selected range is deleted.

Pressing F5 (NO) cancels the deletion.

▶ **Step 3** **Confirm deletion**



3.7 Point data trace

Positions of point data you have entered can be checked by actually moving the robot.

To execute point trace, enter AUTO>POINT mode by pressing F11 (TRACE) in MANUAL>POINT mode. Then use the point trace function to execute point trace.

See "8. Point trace function" in Chapter 3 for details.

WARNING

THE ROBOT STARTS TO MOVE WHEN POINT TRACE IS EXECUTED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

- In AUTO>POINT mode, pressing F11 (MODIFY) returns to MANUAL>POINT mode that was active before trace.
- When AUTO>POINT mode was entered from MANUAL>POINT mode, pressing ESC also returns to MANUAL>POINT mode.

3.8 Point comment input and editing

A comment can be entered for each point.

Press F12 (COMMENT) to open the point comment screen.

NOTE

- Point comments can be entered for point numbers having no data.
- A point comment can be up to 15 characters.

Valid keys and submenu descriptions on the point comment screen are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies point data or scrolls the screen vertically.
⏫ / ⏬		Scrolls up or down one screen.
F1	EDIT	Edits point comments.
F2	TEACH	Enters point data by teaching.
F3	JUMP	Displays the point data of the specified number.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F6	COPY	Copies point comments.
F7	ERASE	Deletes point comments.
F8	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL–	Decreases manual movement speed for the selected robot group in 1% decrements.
F11	FIND	Enters the character string to be found.
F12	FIND+	Starts searching for a comment containing the specified character string towards the end of the program.
F13	FIND–	Starts searching for a comment containing the specified character string towards the top of the program.
ROBOT		Switches the robot group.

3.8.1 Entering or editing point comments

Point comments can be entered and edited as needed.

NOTE

For point comments, it is advisable to enter a character string that is easy to understand. A point comment can be up to 15 characters.
For point data teaching methods, see "3.2 Point data input by teaching" in this chapter.

1 ***Select the point number.***

Use the cursor (▲/▼) keys to select the point number to enter or edit the comment.

2 ***Enter a point comment.***

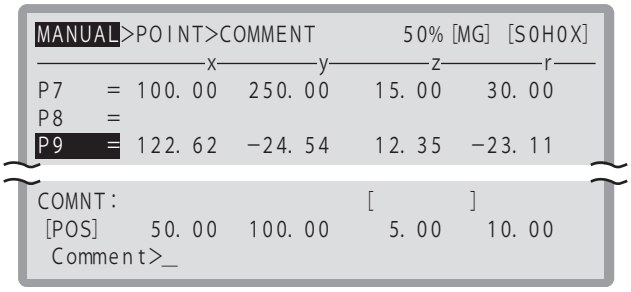
Press F1 (EDIT), and the message "Comment >_" appears on the guideline. Enter a comment with the data keys.
Up to 15 characters can be entered as a comment.

3 ***Store the comment.***

Press ENTER to store the point comment you have entered.

Pressing ESC cancels the comment input.

▶ **Step 2** **Enter a point comment**



3.8.2 Jump to a point comment

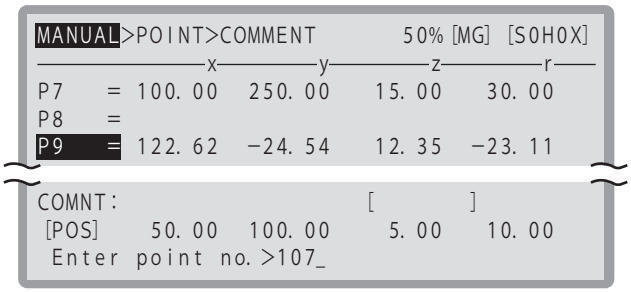
Press F3 (JUMP), and the message "Enter point no. >" appears on the guideline. Enter the point number to jump to, and press ENTER.

NOTE

Valid point numbers are from 0 to 9999.

A jump is made to the specified point and its comment is then displayed.

Entering the point number



3.8.3 Copying a point comment

Point comments can be copied to other point numbers.

1 ***Open the comment copy screen.***

Press F6 (COPY) to open the comment copy screen that shows the message "Copy (####-####,####) >" on the guideline.

2 ***Enter the point number range you want to copy.***

Use 0 to 9, −, and , to enter the point number range for the copy source and the point number for the copy destination in the following format.

"(copy start number) – (copy end number), (copy destination start number)"

For example, to copy the point comments between P7 and P16 onto the lines after P107, enter "7 - 16, 107".

NOTE

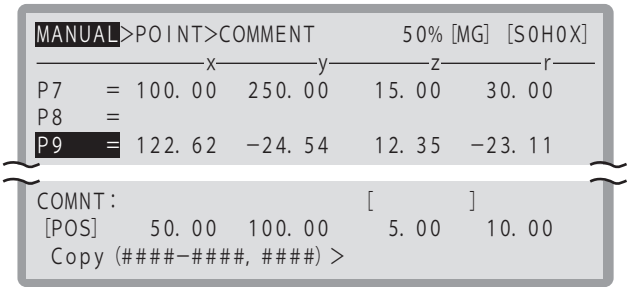
Valid point numbers are from 0 to 9999.

3 ***Copy the point comments.***

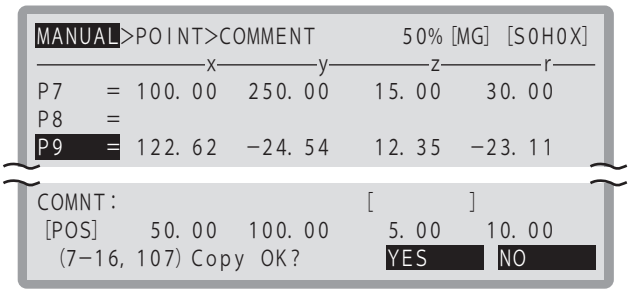
Press ENTER and a confirmation message appears on the guideline, then press F4 (YES) to make a copy. The point comments in the selected range are copied onto the data lines starting from the specified copy destination number.

Pressing F5 (NO) cancels the copy.

Step 1 **Copying a point comment**



Step 3 **Confirm copy**



3.8.4 Deleting point comments

Points comments already entered can be deleted.

1 ***Open the comment erase screen.***

Press F7 (ERASE) to open the comment erase screen that shows the message "Erase (####-####) >" on the guideline.

2 ***Enter the point number range you want to delete.***

Use 0 to 9, and − to enter the point number range to delete in the following format.

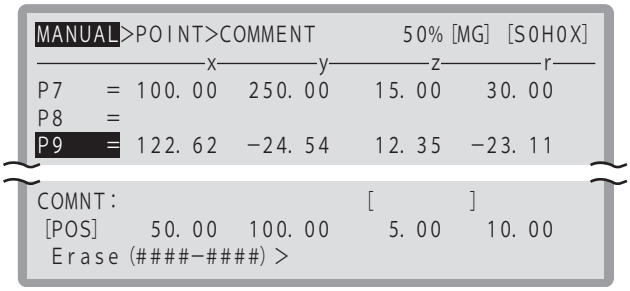
"(erase start number) - (erase end number)"

For example, to erase the point comments between P7 and P16, enter "7 - 16".

NOTE

Valid point numbers are from 0 to 9999.

Step 1 **Deleting a point comment**

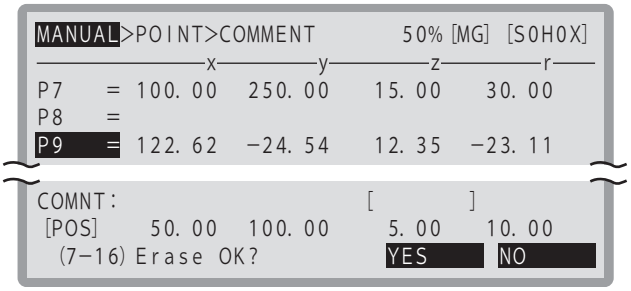


3 ***Delete the point comments.***

Press ENTER and a confirmation message appears on the guideline, then press F4 (YES). The point comments in the selected range are deleted.

Pressing F5 (NO) cancels the deletion.

▶ **Step 3** **Confirm deletion**



3.8.5 Point comment search

Points comments already entered can be located.

1 ***Open the comment search screen.***

Press F11 (FIND) and the message "Character string >" appears on the guideline.

2 ***Enter the point comment you want to find.***

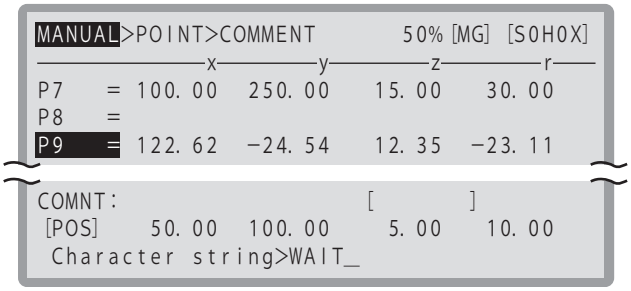
Use the data keys to enter the point comment you want to find.

Up to 15 characters can be entered.

NOTE

A point comment can be up to 15 characters.

▶ **Step 2** **Enter the point comment to find**



3 ***Find the character string.***

Press ENTER.

A search starts from the cursor position toward the end of the program and stops at the first comment that contains the matching character string.

To continuously search for another comment, press F12 (FIND+) or F13 (FIND-).

Pressing the F12 (FIND+) restarts the search from the current cursor position toward the end of the program and stops at the first comment that contains the matching character string.

Pressing the F13 (FIND-) restarts the search from the current cursor position toward the top of the program and stops at the first comment that contains the matching character string.

3.9 Point data error reset

If an error "9.2:Point data destroyed" occurs in point data, reset the error as described below.

CAUTION

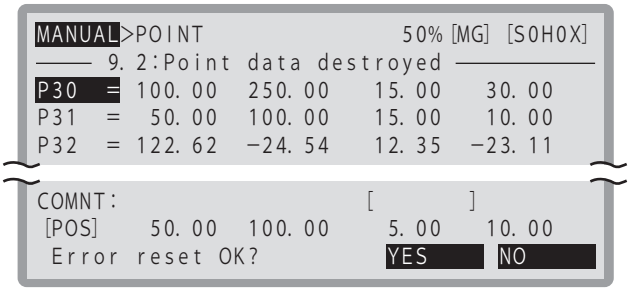
If an error occurs in point data, the point data may have a problem. The following operation resets the error, but does not restore the point data. Always check and correct the point data after resetting the error.

In MANUAL>POINT mode, press F13 (ERR. RST) and a confirmation message appears on the guideline.

Press F4 (YES) to reset the error. The point can be edited after the error is reset.

Pressing F5 (NO) cancels the error reset.

Error reset confirmation



NOTE

This reset function does not work if an error "9.3:Memory destroyed" occurs. In this case, initialize the memory.

4. Displaying, editing and setting pallet definitions

In MANUAL mode, press F12 (PALLET) to open the pallet data screen.

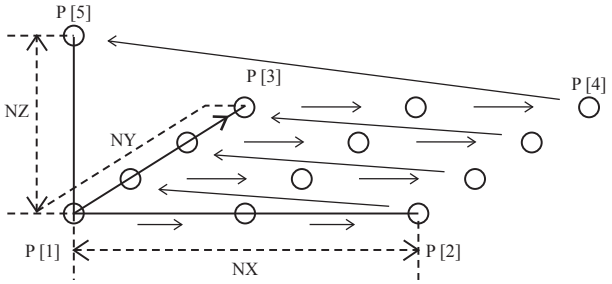
This screen allows you to display, edit and set pallet definitions. However, the standard coordinates must be set when a SCARA robot is used. See "11. Setting the standard coordinates" in this chapter for details.

A total of 20 pallets (definition numbers 0 to 19) can be defined to assign point data areas (P3901 to P4000) to each pallet. Five points are used for each pallet. The maximum number of points that can be defined in one pallet is 32767 (=NX*NY*NZ).

NOTE

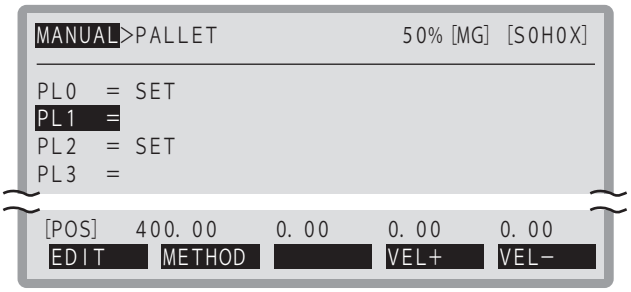
- A total of 20 pallets can be defined.
- The maximum number of points that can be defined as the positions on one pallet is 32767.
- Data in the point data area is used for pallet definition.

Pallet definition



Pallet number	Point number used	Pallet number	Point number used
PL0	P3996 to P4000	PL10	P3946 to P3950
PL1	P3991 to P3995	PL11	P3941 to P3945
PL2	P3986 to P3990	PL12	P3936 to P3940
PL3	P3981 to P3985	PL13	P3931 to P3935
PL4	P3976 to P3980	PL14	P3926 to P3930
PL5	P3971 to P3975	PL15	P3921 to P3925
PL6	P3966 to P3970	PL16	P3916 to P3920
PL7	P3961 to P3965	PL17	P3911 to P3915
PL8	P3956 to P3960	PL18	P3906 to P3910
PL9	P3951 to P3955	PL19	P3901 to P3905

Pallet definition screen



Pallet definition numbers marked "SET" mean that their data have already been defined.

Valid keys and submenu descriptions in MANUAL>PALLET mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the pallet definition number.
⏫ / ⏬		Scrolls up or down one screen.
F1	EDIT	Edits pallet definitions.
F2	METHOD	Sets the pallet definition point by teaching.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F6	COPY	Copies pallet definitions.
F7	ERASE	Deletes pallet definitions.
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.
F15	PASSWD	Does not function.
ROBOT		Switches the robot group.

1 ***Select the pallet you want to edit its definition.***

Use the cursor (▲ / ▼) keys to select the pallet number and press F1 (EDIT) to enter MANUAL>PALLET>EDIT mode.

2 ***Enter the pallet definition.***

Use the cursor (▲ / ▼) keys to move the cursor to the data (NX, NY, NZ) you want to edit, and enter the desired values with 0 to 9. Then press ENTER to determine the values you have entered.

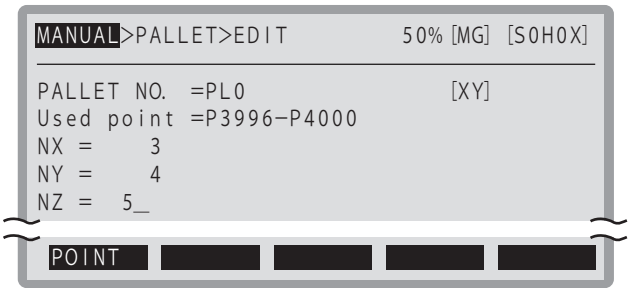
NOTE

The value of each input value must satisfy the conditions: NX*NY*NZ ≤ 32767.

Repeat step 2 to enter the values in NX, NY and NZ.

Press ESC to return to MANUAL>PALLET mode.

Step 2 Edit the pallet definition



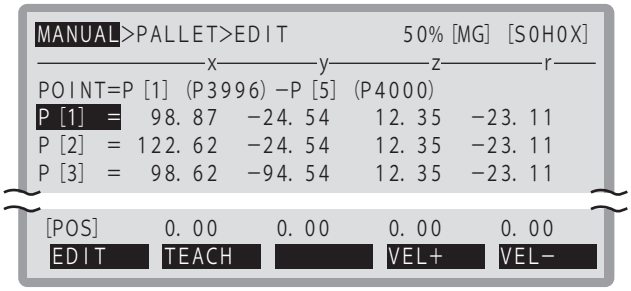
Valid keys and submenu descriptions in MANUAL>PALLET>EDIT mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Move cursors.
F1	POINT	Set point data in the pallet definitions.

4.2 Point setting in pallet definition

In MANUAL>PALLET>EDIT mode for setting points, a screen like that shown below appears.

Point editing in pallet definition



The first line shows the point numbers and point data in the pallet definition.

NOTE

- There are 5 point data in pallet definition.
- The order of the points in pallet definition has a meaning. See "4. Displaying, editing and setting pallet definitions" in this chapter.

Valid keys and submenu descriptions in this mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the point data or scrolls the screen.
F1	EDIT	Edits the point in pallet definition.
F2	TEACH	Sets the point in pallet definition by teaching.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.
ROBOT		Switches the robot group.

4.2.1 Editing the point in pallet definition

NOTE

- Each pallet is generated (outlined) with 5 points, so always specify these 5 points for pallet definition.
- Point data in the pallet definition must be entered in "mm" units.
- The points in pallet definition have the specific order. See "4. Displaying, editing and setting pallet definitions" in this chapter.

1 ***Open the pallet point edit screen.***

Press F1 (EDIT) to open the pallet point edit screen.

2 ***Enter the point data.***

Use the cursor (►/◄/▲/▼) keys to move the cursor to the position you want to edit, and enter the point data with 0, to 9, +, −, . and SPACE.

3 ***Set the point data.***

Press ENTER or the cursor up/down (▲/▼) keys to determine the point data input.

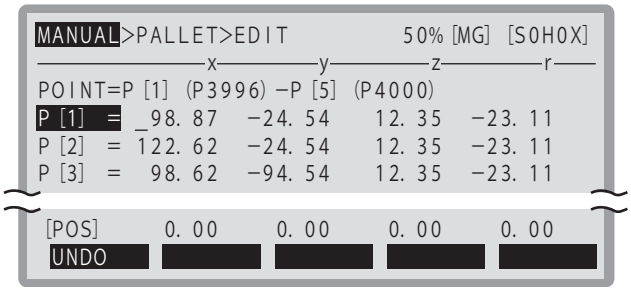
Pressing ESC cancels the input.

4 ***Enter other points.***

To continue editing, repeat steps 2 to 3.

After entering all point data, press ESC to return to MANUAL>PALLET mode.

▶ **Step 1** **Open the pallet point edit screen**



Valid keys and submenu descriptions in this mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor.
F1	UNDO	Reverses the last action and restores the preceding data.

4.2.2 Setting the point in pallet definition by teaching

For point data teaching methods, see "3.2 Point data input by teaching" in this chapter.

4.3 Pallet definition by teaching

NOTE

Pallets cannot be defined by teaching if return-to-origin is incomplete. Perform teaching after performing absolute reset or return-to-origin.

1 ***Open the pallet definition screen.***

Use the cursor (▲ / ▼) keys to select the pallet number and press F2 (METHOD) to enter MANUAL>PALLET>METHOD mode.

2 ***Select the pallet to define.***

Select "2-D" (plane) or "3-D" (solid).

3 ***Teach point P[1].***

Move the robot work point to P[1] used in pallet definition and press ENTER to perform teaching.

WARNING

TO AVOID HAZARDOUS SITUATIONS DO NOT ENTER THE ROBOT MOVEMENT RANGE WHEN MANIPULATING THE ROBOT.

NOTE

- Each pallet is generated (outlined) with 5 points for pallet definition.
- Point data in the pallet definition must be entered in "mm" units.
- The points in pallet definition have the specific order. See "4. Displaying, editing and setting pallet definitions" in this chapter.

4 ***Teach other points.***

Perform teaching at P[2], P[3], P[4] and P[5] (only when "3-D" is selected) as in step 3).

5 ***Enter the number of points between points.***

Enter the number of points NX between P[1] and P[2] on the pallet with a positive integer.
Enter the number of points NY and NZ (only when "3-D" is selected) in the same way.

When a confirmation message appears, press F4 (YES) to set the definition you have entered.

Pressing F5 (NO) cancels the definition.

Step 1 **Open the pallet definition screen**

```
MANUAL>PALLET>METHOD          50% [MG] [S0H0X]

PALLET NO.  =PL0                        [XY]
Select dimension of this pallet

 2-D    3-D
```

Step 3 **Teach point P[1]**

```
MANUAL>PALLET>METHOD          50% [MG] [S0H0X]

PALLET NO.  =PL0                        [XY]
Move arm  to P[1]  and press ENTER key

[POS]    0.00    0.00    0.00    0.00
                         VEL+    VEL-
```

Step 5 **Enter the number of points**

```
MANUAL>PALLET>METHOD          50% [MG] [S0H0X]

PALLET NO.  =PL0                        [XY]
Enter number of points (NX)  on P[1]-P[2]

[POS]     0.00     0.00     0.00     0.00
[1-1000]  ENTER >_
```

Step 5 **Set the pallet definition**

```
MANUAL>PALLET>METHOD          50% [MG] [S0H0X]

PALLET NO.  =PL0                        [XY]
Used point =P3996-P4000
NX =     5
NY =     9
NZ =     3

Set OK?                        YES     NO
```

NOTE

- Each pallet is generated with 5 points for pallet definition.
- The points in pallet definition have the specific order. See "4. Displaying, editing and setting pallet definitions" in this chapter.

Valid keys and submenu descriptions in MANUAL>PALLET>METHOD mode are shown below.

Valid keys	Menu	Function
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.

4.4 Copying a pallet definition

Pallet definitions can be copied to other pallets.

1 ***Select the pallet number.***

Use the cursor (▲/▼) keys to select the pallet number.

2 ***Enter the pallet number where you want to copy the currently selected pallet definition.***

Press F6 (COPY) and the message "Copy (PL NO.) >" appears on the guideline, then enter the copy destination pallet number.

NOTE

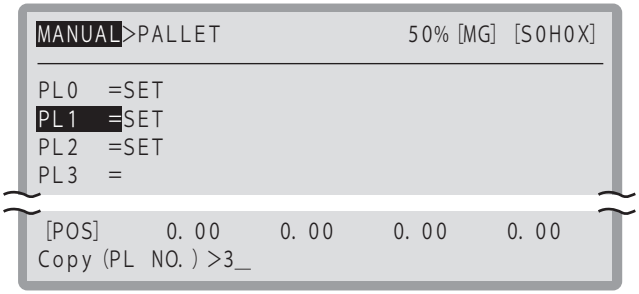
- Enter the pallet number from 0 to 19.
- Pallet definition cannot be copied if the currently selected pallet is undefined.

3 ***Copy the pallet definition.***

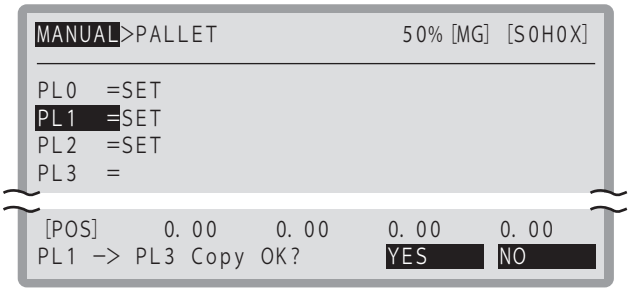
Press ENTER and a confirmation message appears on the guideline, then press F4 (YES) to make a copy.

Pressing F5 (NO) cancels the copy.

▶ **Step 2** **Enter the copy destination pallet number**



▶ **Step 3** **Confirm copy**



4.5 Deleting a pallet definition

NOTE

Pallet definition cannot be deleted if the currently selected pallet is undefined.

1 ***Select the pallet number to delete the pallet definition.***

Use the cursor (▲/▼) keys to select the pallet number.

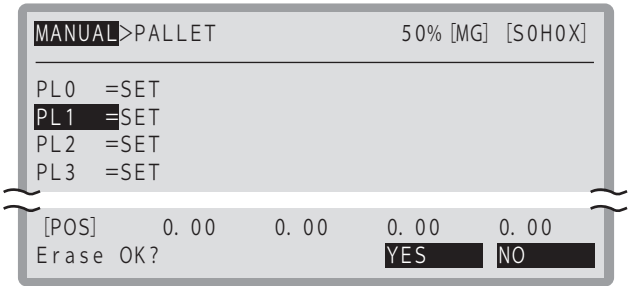
2 ***Delete the pallet definition.***

Press F7 (ERASE) and a confirmation message appears asking whether to delete the currently selected pallet definition.

Press F4 (YES) to delete the pallet definition.

Pressing F5 (NO) cancels the deletion.

▶ **Step 2** **Confirm deletion of pallet definition**



5. Changing the manual movement speed

Manual movement speed of the selected robot group can be set anywhere within the range from 1 to 100%.
Movement speed in MANUAL mode differs from the AUTO mode movement speed. 1/5th of the maximum speed in AUTO mode is equal to the maximum movement speed in MANUAL mode.

- Press F4 (VEL+) or F5 (VEL-) to change the manual movement speed in steps.
  Each time this key is pressed, the speed changes in steps of 1 ← → 5 ← → 20 ← → 50 ← → 100%.
- Press F9 (VEL++) or F10 (VEL--) to change the manual movement speed gradually.
  Each time this key is pressed, the speed changes in units of 1%.
  Holding down the key changes the speed continuously.

6. Displaying, editing and setting shift coordinates

In MANUAL mode, press F6 (SHIFT) to enter MANUAL>SHIFT mode.

This mode allows you to display, edit and set shift coordinates. However, the standard coordinates must be set when a SCARA robot is used. Refer to "11. Setting the standard coordinates" in this chapter for details.

The robot work position specified by point data on the Cartesian coordinates ("mm" units) can be shifted by setting shift coordinates. The movement range can also be restricted in each direction.

Up to 10 shift coordinates (shift coordinate numbers 0 to 9) can be set to shift the standard coordinates in the X, Y, Z and R (XY plane rotation) directions. The robot movement range can also be set to shift coordinates.

NOTE

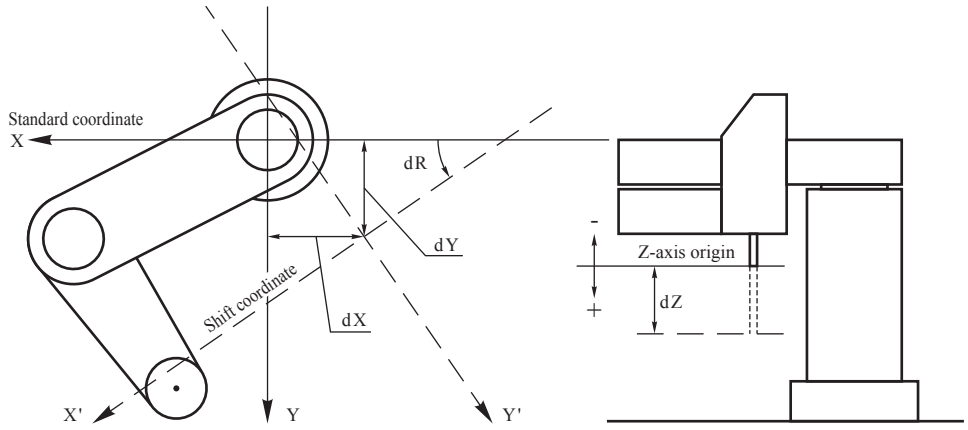
- A maximum of 10 shift coordinates can be set per robot.

Shift coordinate data format

Sn=	±###.##	±###.##	±###.##	±###.##
	dX (mm)	dY (mm)	dZ (mm)	dR (degrees)
	(n=0 to 9)			

When the shift amount is dX=0.00, dY=0.00, dZ=0.00, dR=0.00, the shift coordinates equal the standard coordinates.

Standard coordinates and shift coordinates

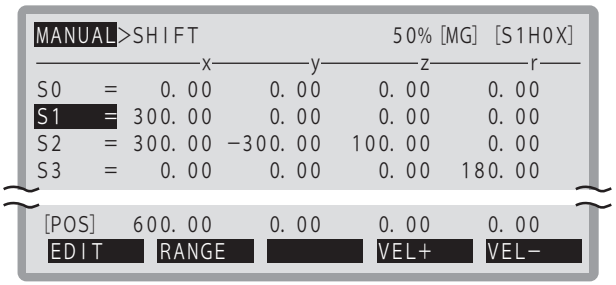


When MANUAL>SHIFT mode is entered, a screen like that shown below appears.

The currently selected shift coordinate number is highlighted.

Shift coordinate screen

One-robot setting



Valid keys and submenu descriptions in MANUAL>SHIFT mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the shift coordinate number.
⏫ / ⏬		Scrolls up or down the screen.
F1	EDIT	Edits the shift coordinates.
F2	RANGE	Sets the shift coordinates range.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F6	METHOD1	Makes setting 1 for shift coordinates.
F7	METHOD2	Makes setting 2 for shift coordinates.
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.
ROBOT		Switches the robot group.

1 ***Select the shift coordinate number.***

Use the cursor (▲/▼) keys to select the shift coordinate and press F1 (EDIT) to enter MANUAL>SHIFT>EDIT mode.

2 ***Enter the shift coordinate data.***

Use the cursor (◄/►) keys to move the cursor to the position you want to edit, and enter the shift coordinate data with 0, to 9, +, −, ., and SPACE.

Enter a space to separate between the data for x, y, z, and r. The data input formats are as follows.
Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point. :± ###.##, ±####.#, ±#####.

NOTE

Enter all shift data for x, y, z and r. If omitted, "0" will be automatically entered for that axis. Shift data should be entered in Cartesian coordinates (millimeter units)

3 ***Determine the data input.***

Press ENTER, cursor up/down (▲/▼) keys or page up/down (⇈/⇊) keys to determine the data input.

Pressing ESC cancels the data input.

4 ***Return to MANUAL>SHIFT mode.***

Press ESC to return to MANUAL>SHIFT mode.

NOTE

The data of the shift coordinate number that was highlighted prior to returning to MANUAL>SHIFT mode is used as the shift coordinates for the currently selected robot group.

▶ **Step 1** **Select the shift coordinate number**

Valid keys and submenu descriptions in MANUAL>SHIFT>EDIT mode are shown below.

Valid keys	Menu	Function
F1	UNDO	Reverses the last data input and restores the preceding data.

■ Restoring shift coordinates

During shift coordinate data editing, pressing F1 (UNDO) reverses the last data input and restores the preceding data.
This function is enabled only on lines that are not yet complete.

6.2 Editing the shift coordinate range

The robot movement range in each shift coordinated can be restricted to by setting the shift coordinate range. Moreover, setting the soft limit parameters allows you to specify the robot movement range more precisely.

Shift coordinate range data format

- Plus side

  SPn= ±###.## ±###.## ±###.## ±###.##
  dPX (mm) dPY (mm) dPZ (mm) dPR (degrees)
  (n=0 to 9)

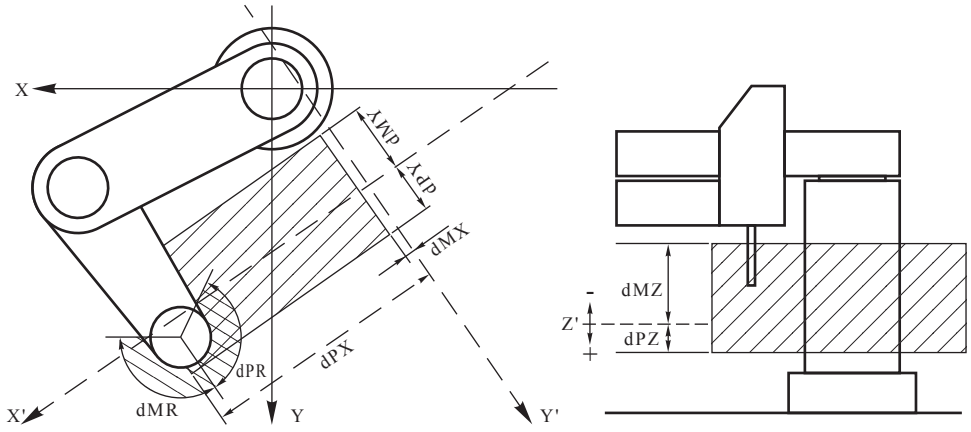
- Minus side

  SMn= ±###.## ±###.## ±###.## ±###.##
  dMX (mm) dMY (mm) dMZ (mm) dMR (degrees)
  (n=0 to 9)

NOTE

- "n" is a shift coordinate number.
  Example)
  SP1… Plus side work area of shift coordinate S1
  SM2…Minus side work area of shift coordinate S2
- When the plus and minus sides on an axis (x, y, z, r) are both at 0.00, the work area on that axis is not be restricted.

Shift coordinate range



To edit a shift coordinate range, use the procedure below.

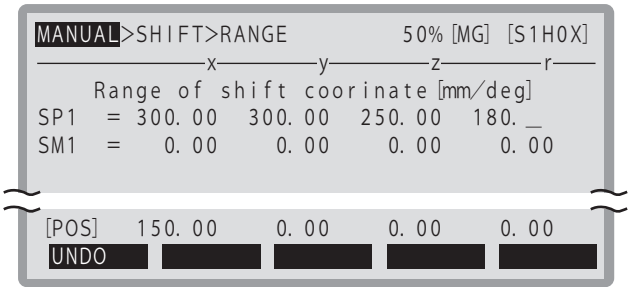
1 ***Select the shift coordinate number.***

In MANUAL>SHIFT mode, select the shift coordinate number with the cursor (▲/▼) keys.

2 ***Enter the shift coordinate range.***

Press F2 (RANGE) to enter MANUAL>SHIFT>RANGE mode.
A cursor for editing the shift coordinate range appears.
Use the cursor (◄/►) keys to move the cursor to the position you want to edit, and enter the shift coordinate data with 0 to 9, +, −, . and SPACE.
Enter a space to separate between the data for x, y, z, and r. The data input formats are as follows.
Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point. :
±###.##, ±####.#, ±#####.
Enter the minus shift coordinate range in the same way.

▶ **Step 2** **Edit the shift coordinate range**



NOTE

Enter all shift data for x, y, z and r. If omitted, "0" will be automatically entered for that axis. Shift data should be entered in Cartesian coordinates (millimeter units)

3 ***Finish the point data input.***

Press ENTER , cursor up/down (▲ / ▼) keys or page up/down (⏫ , ⏬) keys to finish the point data input.

Pressing ESC cancels the data input.

4 ***Returns the shift coordinate screen.***

Press ESC to return to MANUAL>SHIFT mode.

NOTE

The data of the shift coordinate number that was highlighted prior to returning to MANUAL>SHIFT mode is used as the shift coordinates for the currently selected robot group.

Valid keys and submenu descriptions for editing shift coordinates range are shown below.

Valid keys	Menu	Function
F1	UNDO	Reverses the last data input and restores the preceding data.

■ Restoring a shift coordinate range

During shift coordinate data editing, pressing F1 (UNDO) reverses the last data input and restores the preceding data.

This function is enabled only on lines that are not yet complete.

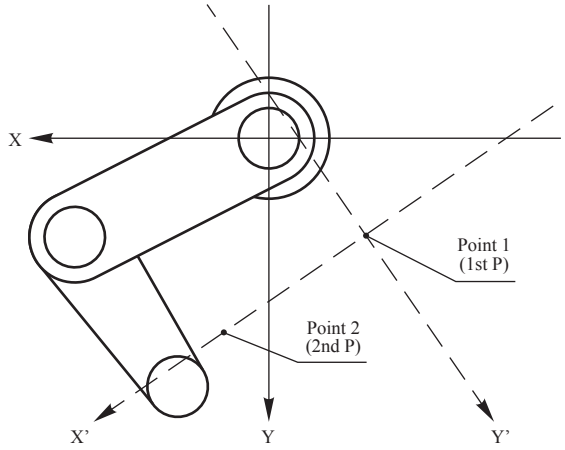
6.3 Shift coordinate setting method 1

This method sets the shift coordinate data by performing teaching at 2 points and then entering the plus/minus direction of those 2 points.
The first teach point 1 (1st P) becomes the shift coordinate origin. The Z-axis value of the taught point 1 is the Z-axis value of the shift coordinate.

WARNING

THE ROBOT STARTS TO MOVE WHEN TEACHING IS PERFORMED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Shift coordinate setting method 1



CAUTION

"[MG]" indicates the main robot group is selected.

1 ***Select the shift coordinate number.***

Use the cursor (▲/▼) keys to select the shift coordinate number.

2 ***Open the shift coordinate setting screen 1.***

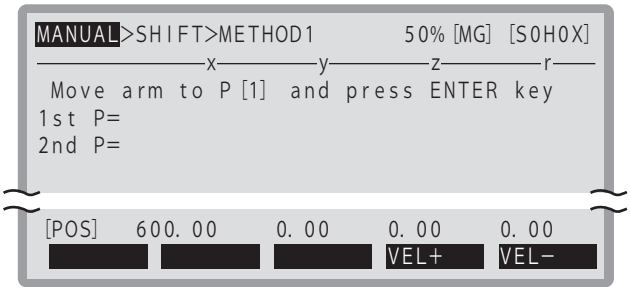
Press F6 (METHOD 1) to enter MANUAL>SHIFT>METHOD 1 mode.

3 ***Set the teach point 1.***

Use the Jog (manual) keys to move the robot arm tip to point 1, and press ENTER.

The current position is then obtained as "1st P".
This value becomes the shift coordinate origin.
Position the robot arm tip accurately.

▶ **Step 2** Open the shift coordinate setting screen 1 (METHOD 1)



NOTE

Perform teaching carefully to obtain accurate points. Precise shift coordinates cannot be set if the point is inaccurate.

4 ***Set the teach point 2.***

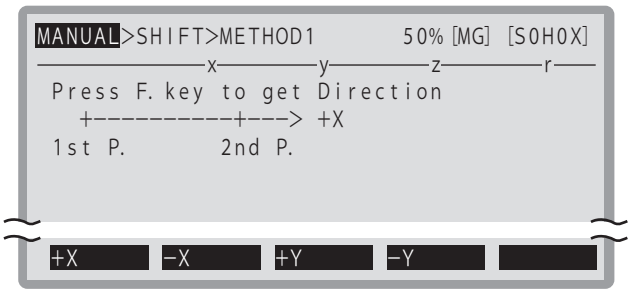
Set the teach point 2 in the same way as for point 1.

5 ***Select the coordinate direction of point 1 towards point 2.***

Press F1 (+X), F2 (-X), F3 (+Y), or F4 (-Y) to select the direction.

The shift coordinate data (dX, dY, dZ, dR) are automatically calculated and stored. The screen then returns to MANUAL>SHIFT mode.

▶ **Step 5** **Set the coordinate direction**



NOTE

The Z-direction shift value is automatically defined based on the Z-axis coordinate value of point 1. The Z-axis coordinate value of point 2 is not therefore reflected in the shift coordinate data.

Valid keys and submenu descriptions in MANUAL>SHIFT>METHOD1 mode are shown below.

Valid keys	Menu	Function
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.

6.4 Shift coordinate setting method 2

This method sets the shift coordinate data by performing teaching at 2 points and then entering the coordinate values of those 2 points.
The Z-axis value of the taught point 1 becomes the Z-axis value of the shift coordinate.

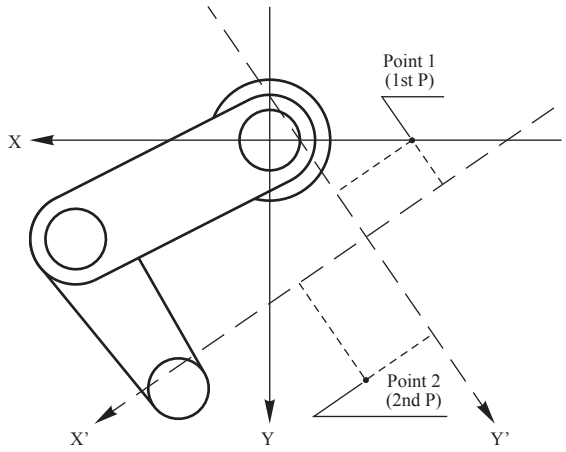
WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

CAUTION

If the input point coordinates for the teach points are inaccurate, incorrect calculation results will be stored. Enter the point coordinate values accurately.

Shift coordinate setting method 2



CAUTION

"[MG]" indicates the main robot group is selected.

1 ***Select the shift coordinate number.***

Use the cursor (▲ / ▼) keys to select the shift coordinate number.

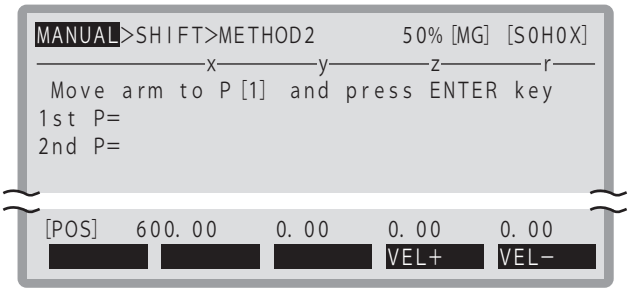
2 ***Open the shift coordinate setting screen 2.***

Press F7 (METHOD 2) to enter MANUAL>SHIFT>METHOD 2 mode.

3 ***Move the robot arm tip to the teach point 1.***

Use the Jog keys to move the robot arm tip to the teach point 1.

▶ **Step 2** Open the shift coordinate setting screen 2 (METHOD 2)



NOTE

Perform teaching carefully to obtain accurate points. Position the robot arm tip accurately. Precise shift coordinates cannot be set if the teach point is inaccurate.

4 ***Enter the value of point 1.***

Press ENTER and an edit cursor appears at the head of the "1st P= " line. Use 0 to 9, +, −, . and SPACE to enter the point data (x, y, z), and press ENTER.

NOTE

Enter all point data (x, y, z) (x, y). If omitted, "0" will be automatically entered for that axis.

5 ***Set the teach point 2.***

Set the teach point 2 in the same way as for point 1.

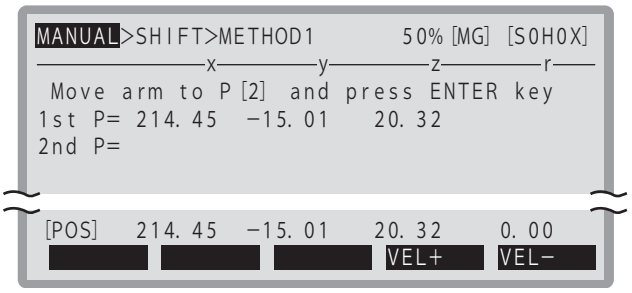
NOTE

The Z-direction shift value is automatically defined based on the Z-axis coordinate value of point 1. The Z-axis coordinate value of point 2 is not therefore reflected in the shift coordinate data.

6 ***Store the shift coordinates.***

When point 2 has been entered, the shift coordinates (dX, dY, dZ and dR) are automatically calculated and stored.
When completed, the screen returns to MANUAL>SHIFT mode.

Step 4 **Teach the shift coordinates**



Valid keys and submenu descriptions in MANUAL>SHIFT>METHOD2 mode are shown below.

Valid keys	Menu	Function
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.

7. Displaying, editing and setting hand definitions

Pressing F7 (HAND) enters MANUAL>HAND mode. This mode allows you to display, edit and set hand definitions.
However, the standard coordinates must be set when a SCARA robot is used. See "11. Setting the standard coordinates" for details.
Hand definitions cannot be used with MULTI type robots.

NOTE

The main robot uses H0 - H3 for hand data.

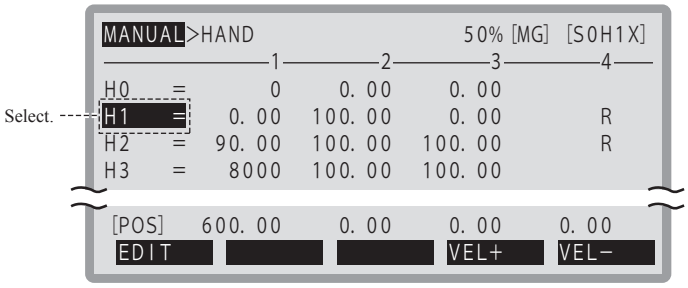
The tip position of the tool attached to the second arm (Y-axis) or the R-axis can be specified as the robot coordinate position by hand definition.
There are 4 hand definitions depending on the combination of the robot type and tool attachment position.
Using hand definitions allows moving the tips of different tools to positions on the same Cartesian coordinates.

When MANUAL>HAND mode is entered, a screen like that shown below appears.

The currently selected hand definition number is highlighted.

Hand definition screen

One-robot setting



Data format for hand definition

Hn= ±aaaaaa ±bbbbbb ±cccccc [R]
(main robot :n=0 to 3)

1st parameter : ±aaaaaa
Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point, or an integer of up to 7 digits (depending on the robot type setting and hand definition type).

2nd to 3rd parameters : ±bbbbbb, ±cccccc
Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point.

4th parameter : R
Enter one character (Determined by hand definition type.).

* When all values for a hand definition are "0", this means the hand definition is not set.

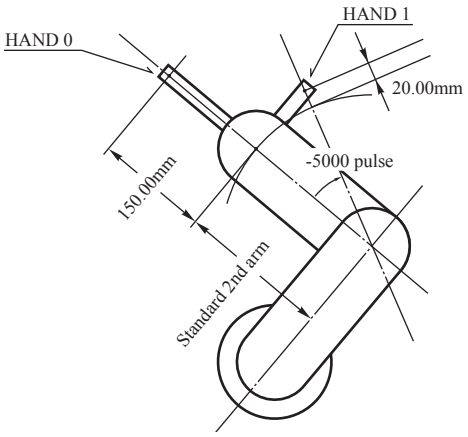
The parameter setting and movement of each robot type are shown below.

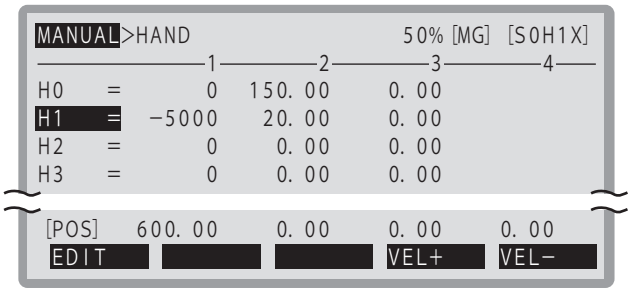
1. SCARA robots

1. Hand attached to 2nd arm
   a. Robot movement
      - Imaginary 2nd arm of hand "n" moves to a specified point as if it were the actual 2nd arm.
      - Imaginary 2nd arm of hand "n" determines whether the robot is in a right-handed system or left-handed system.

   b. Parameter descriptions
      Setting units for each parameter are shown in parentheses.
      <1st parameter>: Specify with an integer, the difference between the number of offset pulses of the standard 2nd arm and the number of offset pulses of the imaginary 2nd arm of hand "n". If counterclockwise, enter a "+" value. (unit: pulses)
      <2nd parameter>: Specify with a real number, the difference between the imaginary 2nd arm length of hand "n" and the standard 2nd arm length. (unit: mm)
      <3rd parameter>: Specify the Z-axis offset amount of hand "n" with a real number. (unit: mm)
      <4th parameter>: No setting for "R".

Hands attached to 2nd arm

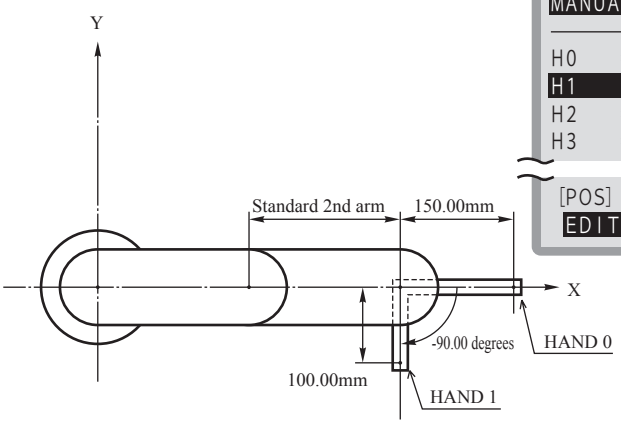


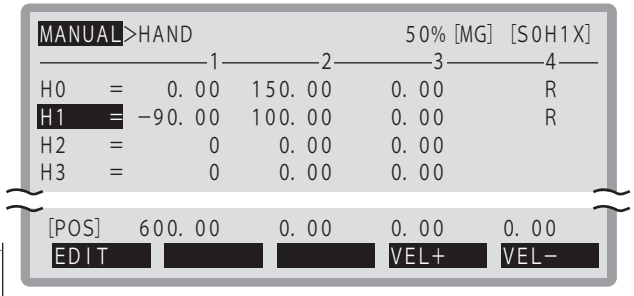


2. Hand attached to R-axis
   a. Robot movement
      The tip of hand "n" moves to a specified point. The direction of hand "n" changes according to the R coordinate of the point.
      Even if hand "n" is between obstacles, it can move while avoiding the obstacles. Hand "n" moves in parallel to or perpendicular to its direction.

   b. Parameter descriptions
      <1st parameter>: When the current R-axis position is 0.00, specify with a real number the angle between the +X direction of Cartesian coordinates and hand "n".
      If counterclockwise, enter a "+" value. (unit: degrees)
      <2nd parameter>: Specify the length of hand "n" with a positive real number. (unit: mm)
      <3rd parameter>: Specify the Z-axis offset amount of hand "n" with a real number. (unit: mm)
      <4th parameter>: Specify "R".

Hands attached to R-axis





7.1 Editing hand definitions

1 ***Open the hand definition edit screen.***

Press F1 (EDIT).

2 ***Select the hand definition you want to edit.***

Use the cursor (▲/▼) keys to select the hand definition.
An edit cursor appears at the left end of the selected hand definition line.

3 ***Enter the hand data.***

Use the cursor (◄/►) keys to move the cursor to the position you want to edit, and enter the hand data with 0 to 9, +, −, ., R, SPACE and ENTER.

4 ***Determine the data input.***

Press ENTER or the cursor up/down (▲/▼) keys to determine the data input.

Press ESC if you want to cancel the settings.

To continue editing other hand definitions, repeat steps 2 to 4.

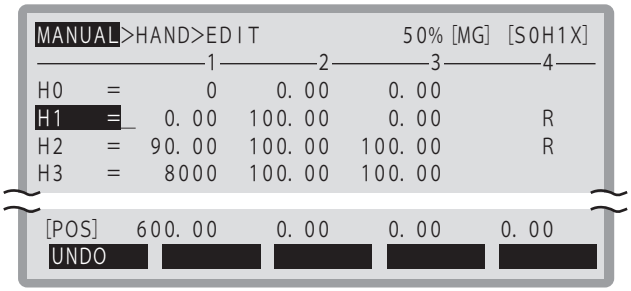
5 ***Return to MANUAL>HAND mode.***

Press ESC to return to MANUAL>HAND mode.

NOTE

The hand data number that was highlighted prior to returning to MANUAL>HAND mode is used as the current hand definition.

▶ **Step 2** **Select the hand definition to edit**



Valid keys and submenu descriptions in MANUAL>HAND>EDIT mode are shown below.

Valid keys	Menu	Function
F1	UNDO	Reverses the last action and restores the preceding data.

■ Restoring hand definitions

During hand definition editing, pressing F1 (UNDO) cancels the data you have entered and restores the preceding data.
This function is enabled only on lines that are not yet complete.

7.2 Hand definition setting for a hand attached to the 2nd arm

Set hand definitions by teaching as described below.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

CAUTION

"[MG]" indicates the main robot group.

NOTE

- SCARA robots use mutually different methods for making settings.
  Set hand definition data by teaching the same point to the tool tip in both right-hand system and left-hand system.
  To perform teaching at point 1, always move in the right-hand system.
  To perform teaching at point 2, always move in the left-handed system.

1 ***Select the hand definition number.***

Use the cursor (▲ / ▼) keys to select the hand definition number and press F6 (METHOD 1).
MANUAL>HAND>METHOD 1 mode is entered.

2 ***Teach the robot working point at point 1.***

Use the Jog keys to move the robot axis to point 1.
After positioning the robot, press ENTER to determine the point.

NOTE

Position the robot carefully to obtain the accurate point. If the positioning point is not accurate, the hand definition will be inaccurate.

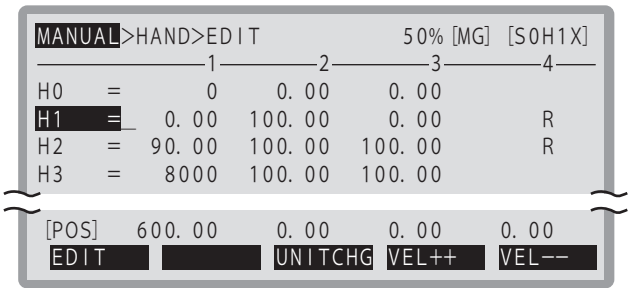
3 ***Teach the robot working point at point 2.***

Use the Jog keys to move the robot axis to point 2.
After positioning the robot, press ENTER to determine the point.
The hand definition setting ends and the screen returns to MANUAL>HAND mode.

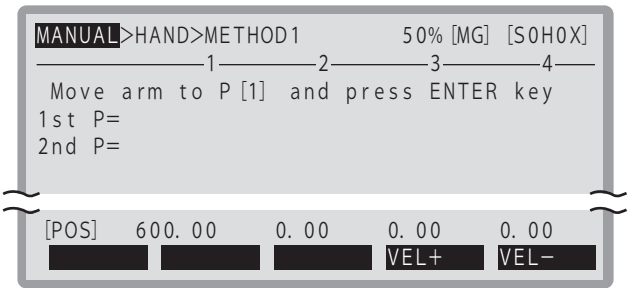
NOTE

- When point 1 is obtained, the Z direction shift value is automatically determined.
- If the ESC was pressed during hand definition or hand definition was not calculated, the input data returns to the preceding value.
- If teach points are not accurately determined, the hand definition will be inaccurate, so always determine these points correctly.

▶ **Step 1** **Select the hand definition number**



▶ **Step 2** **Teach at point 1**



Valid keys and submenu descriptions in MANUAL>HAND>METHOD1 mode are shown below.

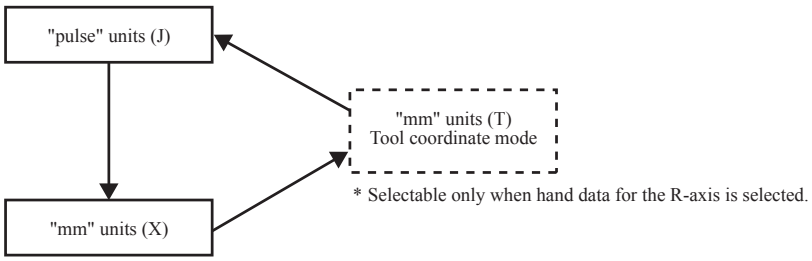
Valid keys	Menu	Function
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.

8. Changing the display units

The units used to indicate the current position on the programming box screen can be switched to either "pulses" and "mm". If hand data for the R-axis is selected (hand definition is made), then the tool coordinates can also be selected.

- In MANUAL mode, pressing F8 (UNITCHG) switches the units used to indicate the current position.
- Each time the key is pressed, the display units are switched.
  On the upper right of the programming box screen, either of "J" or "X" or "T" is displayed according to the selected units. However, "T" (tool coordinates) can be selected only when hand data for the R-axis is selected (hand definition is made).

Switching the display units



* Selectable only when hand data for the R-axis is selected.

- "mm" units (Cartesian coordinates)
  Displays the current position with a number consisting of an integer and a decimal fraction.
- "pulse" units (joint coordinates)
  Displays the current position with an integer.

Robot manual movement with Jog keys differs depending on the currently selected display units. For more details, see "2. Manual movement" in this chapter.

9. Return-to-origin

After the power to the controller is turned on, return-to-origin must be performed before starting robot operation.
When return-to-origin is performed, each axis of the robot moves to its mechanical origin position and the position data in the controller is reset.
Return-to-origin must be performed on incremental type axes. On semi-absolute type axes, an absolute search (also called absolute reset) is performed by return-to-origin operation.

The following parameters relate to return-to-origin operation. For more details on each parameter, refer to the user's manual.

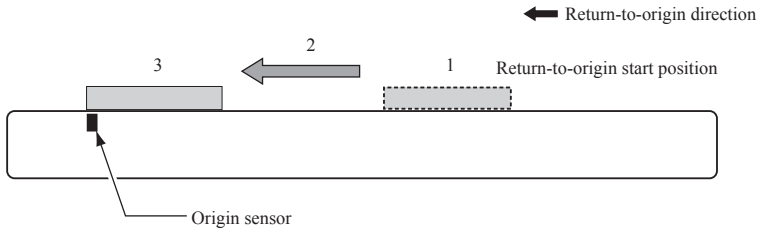
Category	Parameter name	Description
Robot parameter	Origin sequence	Sets the order in which to perform return-to-origin or absolute search on each axis.
Axis parameter	Origin speed	Sets the speed at which to perform return-to-origin or absolute search.
	Origin shift	Sets the offset of origin position data.
	Origin method	Sets the method for performing return-to-origin or absolute search.
	Origin direction	Sets the direction for performing return-to-origin or absolute search.

9.1 Return-to-origin operation

Return-to-origin methods include the sensor method and stroke end detection method.
Each return-to-origin method is described below.
See "9.3 Return-to-origin procedure" for instructions on how to perform return-to-origin.

1. Return-to-origin operation using the sensor method

Return-to-origin operation using the sensor method



1. Before performing return-to-origin, check that all axes are in positions that allow return-to-origin.

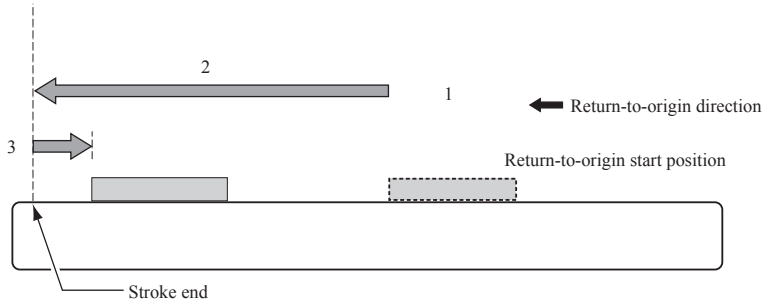
Return-to-origin direction	Position allowing return-to-origin
Minus (-) direction	Plus (+) side from origin sensor position
Plus (+) direction	Minus (-) side from origin sensor position

2. When a return-to-origin operation is started, each axis of the robot moves in the return-to-origin direction.
   However, if the origin sensor was on when return-to-origin was started, then the robot first moves in a direction opposite the return-to-origin direction. Then, when the origin sensor turns off, the robot stops and restarts return-to-origin from that position.
3. After the origin sensor turns on, the robot stops and the origin position is then found. At this point, the current position of each axis is set as an origin shift parameter value.

NOTE
In the sensor method, if return-to-origin is started with the origin sensor turned on and continues without the origin sensor being turned off, then an error "17.21:D?,Bad origin sensor" will occur.

2. Return-to-origin operation using the stroke end detection method

Return-to-origin operation using the stroke end detection method



1. In the stroke end detection method, return-to-origin can start from any position.
2. Upon starting return-to-origin, the robot starts moving in the return-to-origin direction.
3. When the robot axis strikes and detects the stroke end, it moves back slightly and stops, and the origin position is then determined. At this point, the current position of the axis is set as an origin shift parameter value.

CAUTION

During stroke end detection, if the robot arm movement is obstructed or a load is applied to the robot arm during return-to-origin, the stroke end might not be detected accurately so return-to-origin ends at an incorrect position. If return-to-origin is interrupted while the robot axis is still contacting the stroke end, then an error "17.4:D?, Overload" may occur.

9.2 Return-to-origin procedure

The robot must be at servo-on to perform return-to-origin operation.

WARNING

THE ROBOT STARTS MOVING AS SOON AS RETURN-TO-ORIGIN IS PERFORMED. TO AVOID HAZARDOUS SITUATIONS, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

CAUTION

Before performing return-to-origin, check that incremental type axes are in positions that allow return-to-origin operation.
Emergency stop might be triggered if return-to-origin or absolute search is simultaneously performed on three or more axes whose return-to-origin method is the stroke end detection method. In this case, change the setting so that stroke end return-to-origin or absolute search is simultaneously performed on two axes or is performed separately on each axis.

1 ***Perform return-to-origin.***

Press F3 (ORIGIN).

A confirmation message appears on the guideline.

Press F4 (YES) to perform return-to-origin.

Press F5 (NO) to cancel return-to-origin.

To stop the return-to-origin operation, press the STOP.

In this case, the message "0.14: Stop executed" appears on the message line.

2 ***Check the machine reference.***

After return-to-origin (absolute search on semi-absolute type axes) is complete, the machine reference on each axis is displayed. Check that the machine reference is within the allowable range.

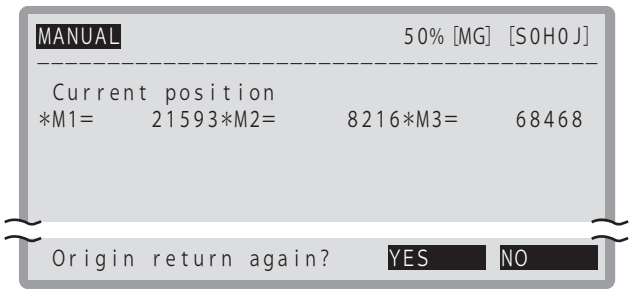
NOTE

- See "9.1 Return-to-origin operation" for details on return-to-origin operation, and see "9.2 Semi-absolute" for details on absolute search operation.
- The machine reference is expressed as a percentage of the number of position detection pulses showing the difference between the origin sensor signal and position detector reference signal (encoder zero signal, etc.). This is also called the "grid position" or "grid pulse".

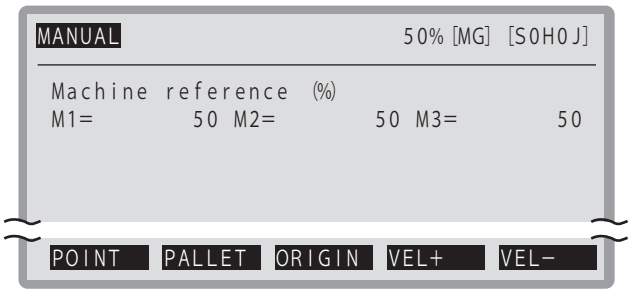
3 ***Check the message line display.***

When return-to-origin on all axes is complete, the dashed line (- - - -) on the message line changes to a solid line (——) indicating that return-to-origin is now complete. Then, pressing an axis movement key displays the current position on each axis.
When origin incomplete status cannot be cancelled, this means that absolute type axes exist and absolute reset has not yet been completed on those axes. Perform absolute reset on those axes.

Step 1 **Check and perform return-to-origin**



Step 2 **Check the machine reference**



NOTE

Once return-to-origin is completed, it is not necessary to re-perform return-to-origin even after using emergency stop. However, return-to-origin must be re-performed after the controller power is turned off or the system parameter settings are changed.

10. Absolute reset

Absolute reset is an operation to find the origin position, when the position detector in the motor cannot identify the origin position (called "origin incomplete" from now on).
Movement commands in robot language cannot be executed if the origin is incomplete. Always perform absolute reset if the origin is incomplete.

CAUTION

Emergency stop might be triggered if return-to-origin is simultaneously performed on three or more axes whose return-to-origin method is the stroke end detection method. In this case, change the setting so that stroke end return-to-origin is simultaneously performed on two axes or is performed separately on each axis.

NOTE

- Basically, use the programming box to perform absolute reset.
- Absolute reset can also be performed by dedicated input. In this case, however, absolute reset axes are limited to those using the stroke end (torque detection) or sensor method for return-to-origin. The dedicated input absolute reset will not work on axes that use the mark method for return-to-origin.

"Origin incomplete" occurs in the following cases.

a. An absolute-related error occurred on the axis.
   17.73:D?.Resolver wire breakage
   17.91:D?.Cannot perform ABS.reset
   etc.
b. Absolute battery wire breakage or voltage drop was detected by the controller.
c. Cable connecting to the robot unit from the robot Controller was disconnected.
   (This is the status when shipped from the factory.)
d. Robot generation was changed.
e. Parameters were initialized.
f. Axis-related parameters such as "Origin shift", "Origin detection method" and "Origin return direction" and "Axis polarity" were changed.
   (This occurs when some parameters were changed.)
g. Motor was replaced.
h. All data files (data file with extension "ALL") or parameter files (data files with extension "PRM") were written into the robot controller.

"Origin incomplete" occurs if any of the following errors occur. These errors occur when the power to the controller is turned on.

17.81:D?.ABS.battery wire breakage
17.83:D?.Backup position data error 1
17.85:D?.Backup position data error 2
17.92:D?.Resolver disconnected during power off
17.93:D?.Position backup counter overflow
etc.

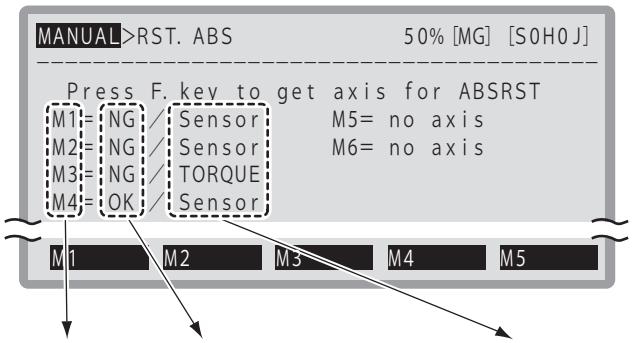
10.1 Checking absolute reset

To check the absolute reset status of each axis on the controller, press F13 (RST.ABS) in MANUAL mode. The MANUAL>RST.ABS mode screen appears as shown below. Check the absolute reset status of each axis.

1. When all axes are absolute type axes:

Checking absolute reset status

When all axes are absolute type axes



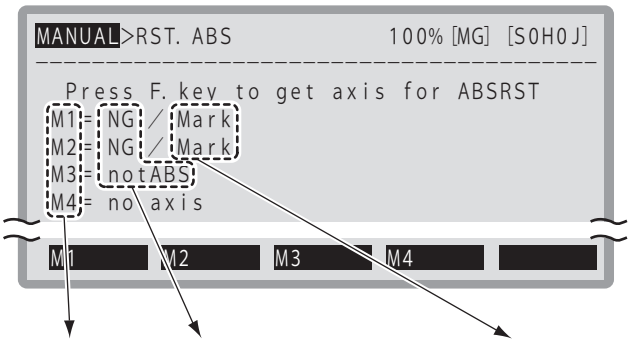
Axis	Absolute reset status	"Origin method" of Axis Parameter
Axis 1	Origin incomplete	Sensor method
Axis 2	Origin incomplete	Sensor method
Axis 3	Origin incomplete	Stroke end method
Axis 4	Return-to-origin complete	Sensor method
No axis		

The above programming box screen shows the return-to-origin is incomplete on axis 1, axis 2 and axis 3 but complete on axis 4. The robot controller is in "origin incomplete" status, since not all axes performed return-to-origin.

2. When both absolute and incremental type axes exist:

Checking absolute reset status

When both absolute and incremental type axes exist



Axis	Absolute reset status	"Origin method" of Axis Parameter
Axis 1	Origin incomplete	Mark method
Axis 2	Origin incomplete	Mark method
Axis 3	Incremental type axis	
Axis 4	No axis	

The above programming box screen shows the return-to-origin is incomplete on axis 1 and axis 2, and axis 3 is an incremental type axis which requires a return-to-origin operation to be performed. (See "9. Return-to-origin" in this chapter.) When return-to-origin has been performed on all axes including the incremental axis, the return-to-origin is complete.

Valid keys	Menu *1	Function
F1	M1	Performs absolute reset on axis 1.
F2	M2	Performs absolute reset on axis 2.
F3	M3	Performs absolute reset on axis 3.
F4	M4	Performs absolute reset on axis 4.
F11	ALL	Performs absolute reset on all axes.

*1 The menu for valid keys may vary if sub robot or auxiliary axis setting is made. For example, the menu "S?" is displayed if sub robot setting is made, and the menu "m?" is displayed if auxiliary axis setting is made.

10.2 Absolute reset on each axis

This section explains how to perform absolute reset of each axis using the robot controller.
The absolute reset operation differs depending on the return-to-origin method (mark method or stroke end / sensor method) of each axis.

NOTE

When the mark method is used as the origin detection method, absolute reset is impossible unless the machine reference is between 44 to 56%.

10.2.1 When the mark method is used for return-to-origin

Return-to-origin is not performed on a mark method axis. So use the movement keys while in servo-on or use direct movement while in servo-off to move to a position where absolute reset can be performed.

WARNING

THE ROBOT STARTS TO MOVE WHEN A MOVEMENT KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Valid keys	Menu	Function
F1	ADJ+	Moves the selected axis in the plus direction to the first position where absolute reset is possible.
F2	ADJ−	Moves the selected axis in the minus direction to the first position where absolute reset is possible.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.

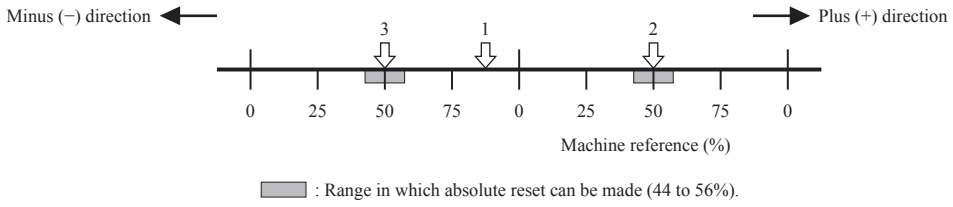
Key operations to move to a position where absolute reset is possible

For instance, when the current axis position is 1 (machine reference: 82%):

Press F1 (ADJ. +), and the axis moves to 2 and the machine reference will change to around 50%. (Absolute reset is now possible.)

Press F2 (ADJ. −), and the axis moves to 3 and the machine reference will change to around 50%. (Absolute reset is now possible.)

Key operations to move to a position where absolute reset is possible



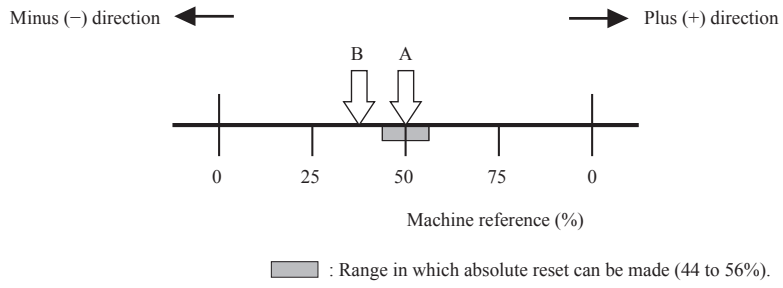
■ Absolute reset position and "0" pulse position

When absolute reset is performed at position A, position B (machine reference 38%) is reset as the "0" pulse position. This means that the robot will move to the "0" pulse position after performing absolute reset with the servo turned on.

WARNING

THE ROBOT STARTS TO MOVE SLIGHTLY WHEN ABSOLUTE RESET IS PERFORMED WHILE THE SERVO IS ON. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Absolute reset position and "0" pulse position



1 ***Select the axis to perform absolute reset.***

Press a key from F1 (M1) to F4 (M4) to select the axis to perform absolute reset.
The selected axis becomes highlighted and ready for absolute reset.

2 ***Move the robot axis to a position where absolute reset can be performed.***

■ In servo-on

Use the Jog keys or F1 (ADJ.+) and F2 (ADJ.−) to move the selected axis to a position where absolute reset is possible. Set so that the machine reference is within a range of 44 to 56%.

WARNING

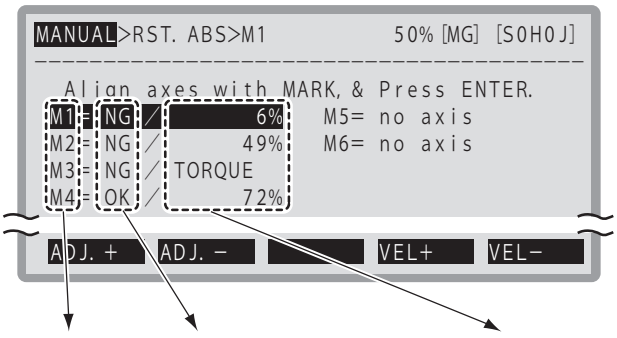
THE ROBOT STARTS TO MOVE WHEN A JOG KEY OR MOVEMENT KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

An error message "17.91:D?.Cannot perform ABS. reset" appears if the machine reference is not within a range of 44 to 56%. The absolute reset operation then ends as an error. If the robot controller is in origin incomplete due to some kind of problem perform absolute reset on the axis which was unable to return to origin. After absolute reset, always check if the axis can move to the same position as before origin incomplete.

Step 1 **Absolute reset of each axis**

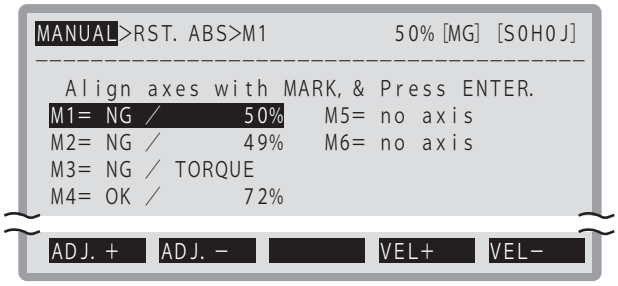
Mark method



Axis	Absolute reset status	Machine reference (%)
Axis 1	Origin incomplete	6
Axis 2	Origin incomplete	49
Axis 3	Origin incomplete	(Torque detection)
Axis 4	Return-to-origin complete	72
Axis 5	No axis	
Axis 6	No axis	

Step 2 **Absolute reset of each axis**

Mark method



■ When in servo-off

Press the emergency stop button on the programming box to activate emergency stop. Move the axis by hand to a position where absolute reset can be performed. At this point, make sure the machine reference is within a range of 44 to 56%.

WARNING

BEFORE MOVING THE AXIS, ALWAYS PRESS THE EMERGENCY STOP BUTTON SO THAT THE SERVO CANNOT BE TURNED ON FROM AN EXTERNAL UNIT.

3 *Perform absolute reset.*

WARNING

THE ROBOT STARTS TO MOVE SLIGHTLY WHEN ABSOLUTE RESET IS PERFORMED WHILE THE SERVO IS ON. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

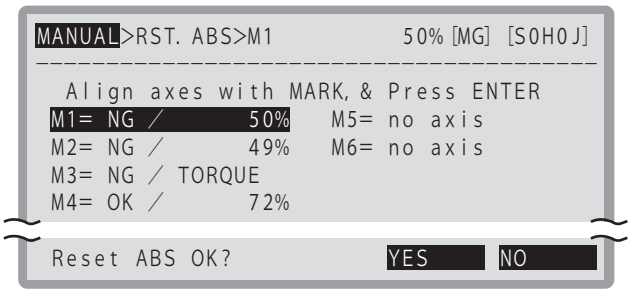
Press ENTER and a confirmation message appears on the guideline, then press F4 (YES) to perform absolute reset on the selected axis.
Pressing F5 (NO) cancels the absolute reset.

If the servo is on when performing absolute reset, the axis will move to the "0" pulse position after absolute reset.

4 *Check the message line.*

When all axes have returned to their origins, the dashed line (- - - -) on the message line changes to a solid line (——), and return-to-origin is now complete. Next, press an axis movement key and the programming box screen will display the current position of each axis.
When origin incomplete status cannot be canceled, this means an axis has still not returned to origin. So repeat the absolute reset operation.

▶ **Step 3** **Check and perform absolute reset**



10.2.2 When the stroke end or sensor method is used for return-to-origin

To perform return-to-origin on an axis that uses the stroke end (torque detection) or sensor method for return-to-origin.

WARNING

THE ROBOT STARTS TO MOVE WHEN ABSOLUTE RESET IS PERFORMED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

When the axis parameter "Origin method" is "TORQUE" (stroke end detection):
The axis moves toward the stroke end in the specified return-to-origin direction. When the stroke end is detected, the axis moves back in the opposite direction and stops at a position where absolute reset can be performed. The absolute reset is then performed.
When the axis parameter "Origin method" is "SENSOR":
The axis moves in the specified return-to-origin direction. When sensor input is detected, the axis moves at a low speed in the same direction and stops at a position where absolute reset can be performed. The absolute reset is then performed.

1 ***Select the axis to perform absolute reset.***

Press a key from F1 (M1) to F4 (M4) to select the axis to perform absolute reset.
A confirmation message appears on the guideline.

2 ***Perform absolute reset.***

Press F4 (YES) to perform absolute reset on the selected axis.
Pressing F5 (NO) cancels the absolute reset.

To stop the absolute reset, press STOP. In this case, the message "Origin incomplete" appears on the message line.

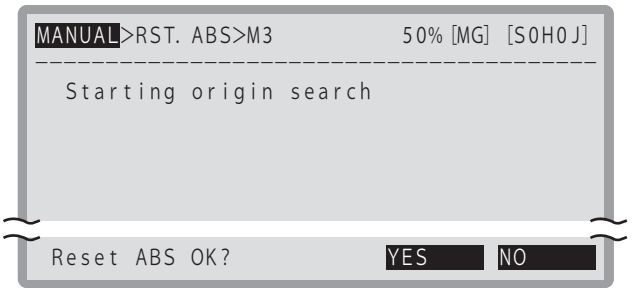
3 ***Check the machine reference.***

After return-to-origin is complete, the machine reference on the selected axis is displayed. Check that the machine reference is within the allowable range.

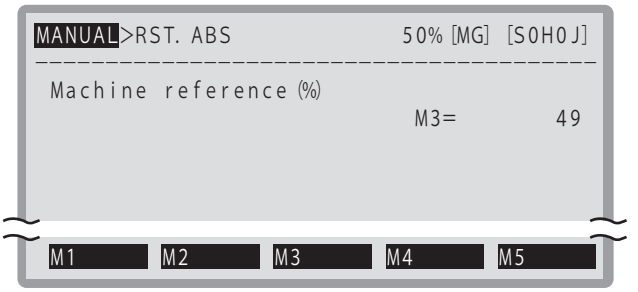
4 ***Check the message line display.***

When all axes have returned to origin, the dashed line (- - - -) on the message line changes to a solid line (———), and return-to-origin is now complete. Then, press an axis movement key and the programming box screen displays the current position of each axis.
When origin incomplete status cannot be cancelled, this means that incremental type axes exist, but return-to-origin has not yet been completed on those axes. Perform return-to-origin on those axes.

Step 2 **Check and perform absolute reset**



Step 3 **Check the machine reference**



10.3 Absolute reset on all axes

This section explains how to perform absolute reset on all axes of the robot controller. The sequence for performing absolute reset of the axes is given below.

1. First, perform absolute reset on all axes that use the mark method.
2. Next, perform absolute reset according to the return-to-origin sequence on axes using the stroke end and sensor methods.

Valid keys	Menu	Function
▲ / ▼		Specifies the axis definition number.
F1	ADJ.+	Moves the selected axis in the plus direction to the first position where absolute reset is possible.
F2	ADJ.−	Moves the selected axis in the minus direction to the first position where absolute reset is possible.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL−	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F9	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	VEL−−	Decreases manual movement speed for the selected robot group in 1% decrements.

■ Key operations to move to a position where absolute reset is possible

WARNING

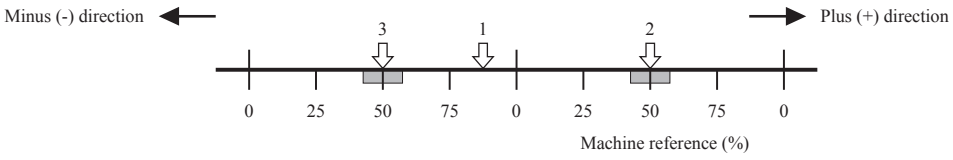
THE ROBOT STARTS TO MOVE WHEN KEY OPERATION AND ABSOLUTE RESET ARE PERFORMED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

For instance, when the current axis position is 1 (machine reference: 82%):

Press F1 (ADJ.+) to move to position 2 and the machine reference will change to around 50%. (Absolute reset is now possible.)

Press F2 (ADJ.-) to move to position 3 and the machine reference will change to around 50%. (Absolute reset is now possible.)

Key operations to move to a position where absolute reset is possible

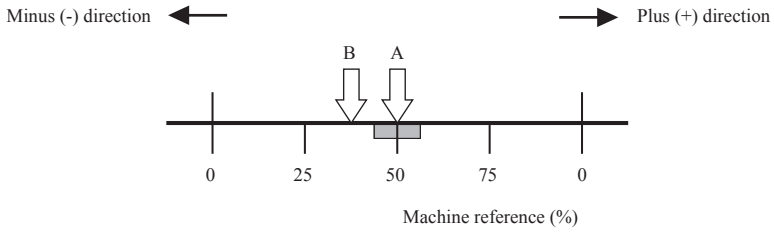


: Range in which absolute reset can be made (44 to 56%).

■ Absolute reset position and "0" pulse position

When absolute reset is performed at position A, the position B (machine reference 38%) is reset as the "0" pulse position.If the servo is on when performing absolute reset, the axis will move to the "0" pulse position after absolute reset.

Absolute reset position and "0" pulse position



: Range in which absolute reset can be made (44 to 56%).

1 ***Select all axes to perform absolute reset.***

Press F11 (ALL).

All axes are selected for absolute reset and the mark method axes are highlighted.

2 ***Move all mark-method axes to positions where absolute reset can be performed.***

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY OR MOVEMENT KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Use Jog keys or F1 (ADJ.+) and F2 (ADJ.-) to move the selected axis to a position for performing absolute reset. Set at this time so that the machine reference is between 44 to 56%.

Use the cursor (▲/▼) keys to select each axis.

NOTE

When the mark method is used as the origin detection method, absolute reset is impossible unless the machine reference is between 44 to 56%.

3 ***Perform absolute reset on all mark-method axes.***

Press ENTER and a confirmation message appears on the guideline.

Press F4 (YES) to perform absolute reset on all mark-method axes.

Pressing F5 (NO) cancels the absolute reset.

If the servo is on when performing absolute reset, the axes will move to the "0" pulse position after absolute reset.

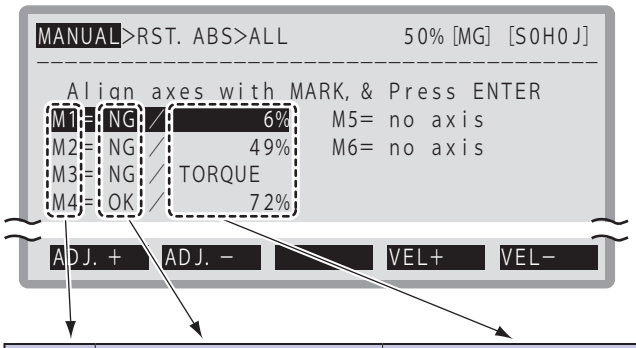
WARNING

THE ROBOT STARTS TO MOVE WHEN ABSOLUTE RESET IS PERFORMED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

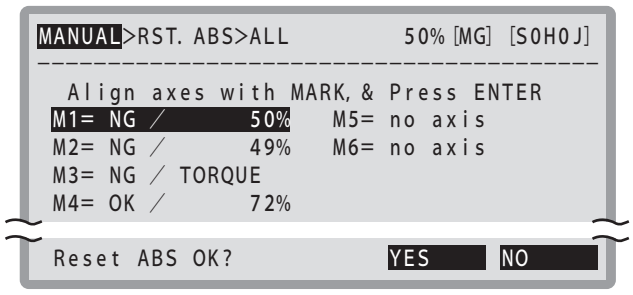
An error message, "17.91:D?.Cannot perform ABS.reset" appears if the machine reference is not within a range of 44 to 56%. Absolute reset operation then terminates as an error. If the robot controller is in origin incomplete due to some kind of problems, perform absolute reset on the axis which was unable to return to origin. After absolute reset, always check if the axis can move to the same position as before origin incomplete.

Step 1 **Absolute reset of all axes**



Axis	Absolute reset status	Machine reference (%)
Axis 1	Origin incomplete	6
Axis 2	Origin incomplete	49
Axis 3	Origin incomplete	(Torque detection)
Axis 4	Return-to-origin complete	72
Axis 5	No axis	
Axis 6	No axis	

Step 3 **Perform absolute reset on all axes**



4 ***Perform absolute reset on stroke end method and sensor method axes.***

After absolute reset on all mark-method axes is finished correctly, a confirmation message appears on the guideline if a stroke end method or sensor method axis exists.

Press F4 (YES) to perform absolute reset on the stroke end method and sensor method axes.

Pressing F5 (NO) cancels the absolute reset.

To stop the absolute reset before it is complete, press STOP. In this case, the message "Origin incomplete" appears on the message line.

5 ***Check the machine reference.***

After return-to-origin is complete, the machine reference for axes using the stroke end or sensor method is displayed. Check that the machine reference is within the allowable range.

CAUTION

If the robot controller is in origin incomplete due to some kind of problems, perform absolute reset on the axis which was unable to return to origin. After absolute reset, always check if the axis can move to the same position as before origin incomplete.

6 ***Check the message line display.***

When absolute reset on all axes is finished correctly, the dashed line (- - - -) on the message line to a solid line (——), indicating that return-to-origin is now complete.

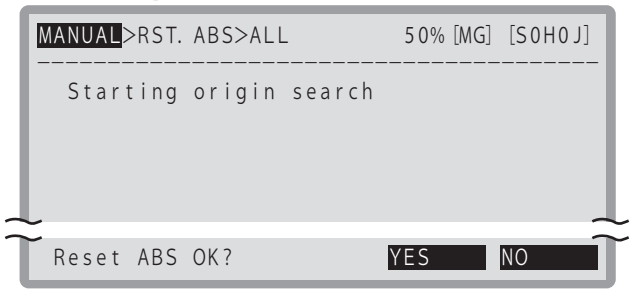
Next press an axis movement key and the programming box screen will display the current position of each axis.

CAUTION

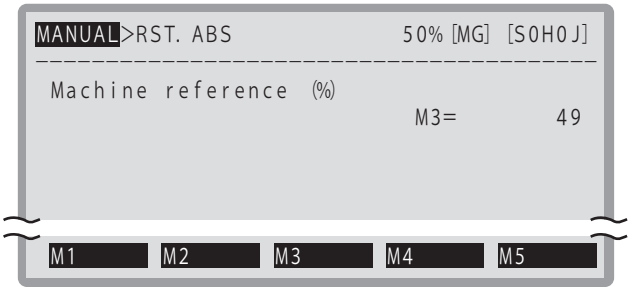
If absolute reset is not finished correctly, check the return-to-origin status on each axis. Then try absolute reset on all axes once again or try absolute reset on each individual axis until the "Return-to-origin complete" status is obtained.

Step 4 **Perform absolute reset on all axes**

Check whether to perform reset



Step 5 **Check the machine reference (stroke end method and sensor method axes)**



11. Setting the standard coordinates

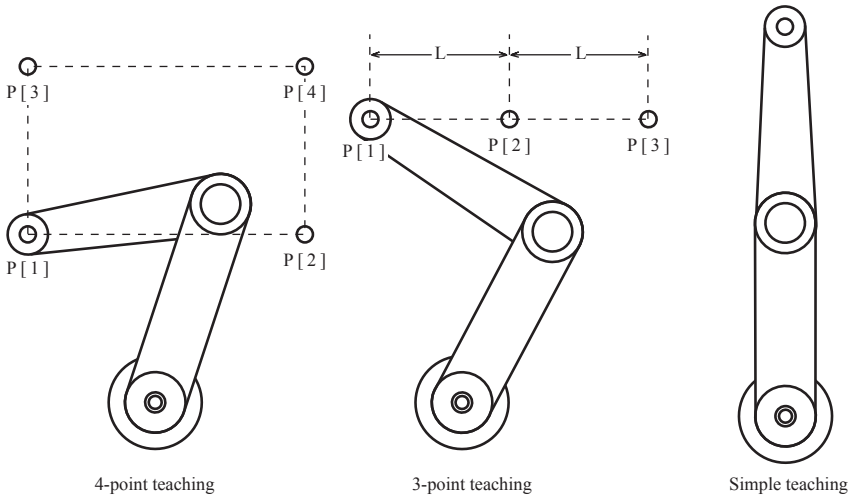
The standard coordinates for SCARA robots are treated as Cartesian coordinates using the X-arm rotating center as the coordinate origin.
The following operations and functions are enabled on SCARA robots by setting the standard coordinates.

- Moving the robot arm tip in the direction of the Cartesian coordinates.
- Using pallet definition, SHIFT coordinates, and HAND definition.
- Using commands requiring coordinate conversion, such as linear/circular interpolation and pallet movement commands.

There are the following 3 methods for setting the standard coordinates.

- 4-point teaching
  This method sets the standard coordinates by using 4 points that form a rectangle. The first point is specified as the teaching origin and the positions of the other 3 points are entered relative to the first point.
- 3-point teaching
  This method sets the standard coordinates by using 3 points (equally spaced) on a straight line. The direction and length from the first point to the last point must be entered.
- Simple teaching
  This method sets the standard coordinates by moving the X and Y arms of a SCARA robot so as to set them in a straight line and then entering the length of the X and Y arms.

Setting the standard coordinates



4-point teaching　3-point teaching　Simple teaching

The following parameters are automatically set when the standard coordinates are entered.

CAUTION

When setting the standard coordinates, note the following points.

- Always perform teaching with the same hand system carefully and accurately.
- Set the teach points as near as possible to the center of actual work area and also separate them from each other as much as possible.
- The plane formed by the robot X and Y axis movement must be parallel to the actual working plane.
- Perform point teaching at the rotation center of the R-axis.
- The standard coordinate setting accuracy greatly affects the Cartesian coordinate precision.

1) "Arm length [mm]"

M1= ###.## X-axis arm length (distance from the X-axis rotation center to the Y-axis rotation center)

M2= ###.## Y-axis arm length (distance from the Y-axis rotation center to the R-axis rotation center)

2) "Offset pulse"

M1= ###### X-axis offset pulse (angle formed by the X-arm when the X-axis motor is at the "0" pulse position and the X-axis on the standard coordinates)

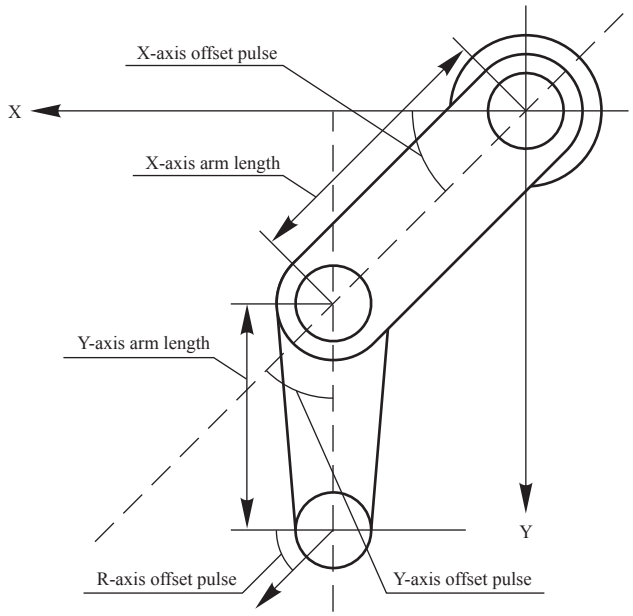
M2= ###### Y-axis offset pulse (angle formed by the X-arm and Y-arm when the Y-axis motor is at "0" pulse position)

M4= ###### R-axis offset pulse (angle formed by the R-axis direction when the R-axis motor is at the "0" pulse position and the X-axis on the standard coordinates)

NOTE

- Standard coordinate settings are made prior to shipment.
- The number of offset pulses equals the number of pulses used by the X, Y and R axes when they moved towards the X-axis on the standard coordinates.

Setting the standard coordinates

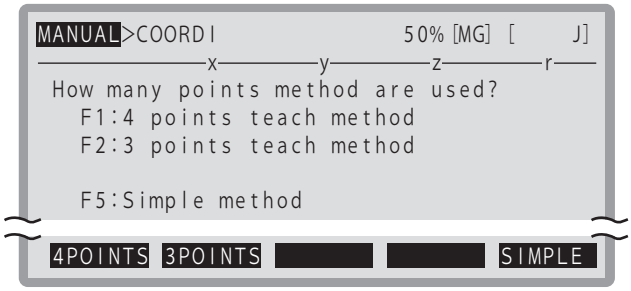


Press F15 (COORDI) in MANUAL mode.

The standard coordinates can be set on this screen.

Setting the standard coordinates

Selecting the setting method



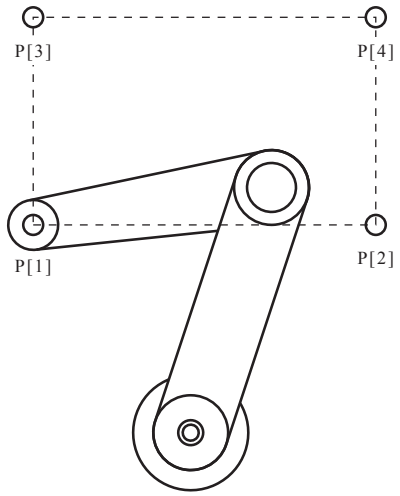
Valid keys and submenu descriptions in MANUAL>COORDI mode are as shown below.

Valid keys	Menu	Function
F1	4POINTS	Sets standard coordinates by 4-point teaching.
F2	3POINTS	Sets standard coordinates by 3-point teaching.
F5	SIMPLE	Sets standard coordinates by simple teaching.

NOTE

- Separate the points from each other as much as possible.
- If the length of one side is inadequate, setting might be impossible due to an error.

Setting the standard coordinates by 4-point teaching



4-point teaching

Precondition: Relative coordinate values made for P[2], P[3] and P[4] must be accurate when P[1] is set as the origin.

1 ***Select the 4-point teaching to set the standard coordinates.***

Press F1 (4POINTS).

2 ***Determine point P[1].***

Use the Jog keys to move the robot arm tip to point P[1] and press ENTER to determine the position.

NOTE

Perform teaching carefully to obtain accurate points. Precise standard coordinates cannot be set if a point is inaccurate.

3 ***Determine point P[2].***

Use the same procedure as in step 2.

4 ***Enter the coordinates of point P[2].***

Enter the XY coordinates of point P[2] in millimeters, relative to P[1] set as the origin.

▶ **Step 1** **Setting the standard coordinates by 4-point teaching**

```
MANUAL>COORDI>4POINTS      50% [MG] [    J]
              x         y         z         r
Move arm to P[1] and press ENTER key
P[2] =
P[3] =
P[4] =

[POS]      0         0         0         0
                                 VEL+      VEL-
```

▶ **Step 4** **Enter the coordinates of point P[2]**

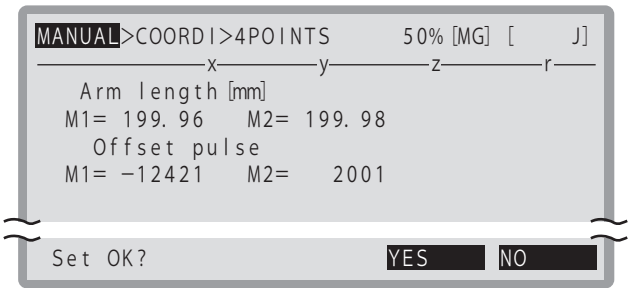
```
MANUAL>COORDI>4POINTS      50% [MG] [    J]
              x         y         z         r
Move arm to P[2] and press ENTER key
P[2] = 100.00     0.00_
P[3] =
P[4] =

[POS]      0         0         0         0
                                 VEL+      VEL-
```

5 ***Determine points P[3] and P[4].***
Use the same procedure as in steps 3 and 4.

6 ***Set the standard coordinates.***
A message for checking the arm length and offset pulse value appears on the guideline. Press F4 (YES) to save and end the setting.
Pressing F5 (NO) ends the setting without saving it.
If the calculation failed, an error message appears.

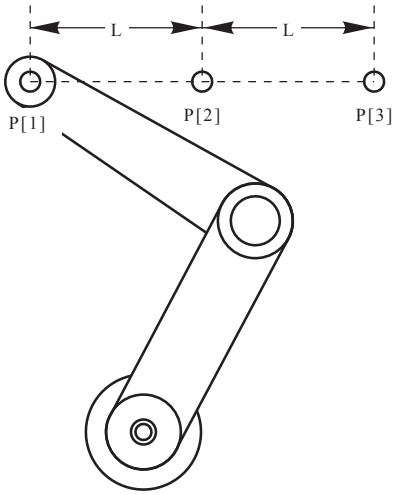
Step 6 **Check and set the standard coordinates**



11.2 Setting the standard coordinate by 3-point teaching

NOTE
Separate the teach points from each other as much as possible.

Setting the standard coordinate by 3-point teaching

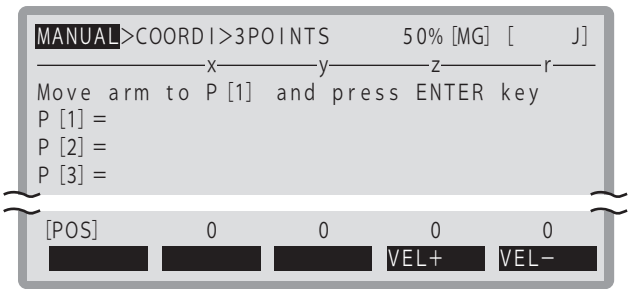


Precondition: All 3 points P[1], P[2] and P[3] must be on a straight line, with P[2] set at the midpoint between P[1] and P[3].

1 ***Select the 3-point teaching to set the standard coordinates.***
Press F2 (3POINTS).

2 ***Determine point P[1].***
Use the Jog keys to move the robot arm tip to point P[1] and press ENTER to determine the position.

Step 1 **Set standard coordinates by 3-point teaching**



NOTE

Perform teaching carefully to obtain accurate points. Precise standard coordinates cannot be set if a point is inaccurate.

3 ***Determine points P[2] and P[3].***

Use the same procedure as in step 2.

4 ***Determine the direction from P[1] to P[3].***

Use F1 (+X) to F4 (-Y) to determine the direction from P[1] to P[3].

5 ***Enter the length between P[1] and P[3].***

Use 0 to 9 and . to enter the length between P[1] and P[3], and press ENTER.

The upper limit of the length is 1000.

6 ***Set the standard coordinates.***

A message for checking the arm length and offset pulse value appears on the guideline.

Press F4 (YES) to save and end the setting.

Pressing F5 (NO) ends the setting without saving it.

If the calculation failed, an error message appears.

Step 2 **Set standard coordinates by 3-point teaching**

```
MANUAL>COORDI>3POINTS      50% [MG] [    J]
──────────x─────────y─────────z─────────r──
Move arm to P[2] and press ENTER key
P[1] = -43202   47158
P[2] =
P[3] =

[POS]   -43202   47158       0       0
                            VEL+    VEL-
```

Step 4 **Set the direction from P[1] to P[3]**

```
MANUAL>COORDI>3POINTS      50% [MG] [    J]
──────────────────────────────────────────
Select 1st P. to 3nd P. get Direction
   +-----------+--->
  P[1]         P[3]

[POS]    -9654   48567       0       0
 +X      -X      +Y      -Y
```

Step 5 **Set standard coordinates by 3-point teaching**

```
MANUAL>COORDI>3POINTS      50% [MG] [    J]
──────────────────────────────────────────
Select 1st P. to 3nd P. get Direction
   +-----------+--->
  P[1]         P[3]
Enter the length of P[1]-P[3]  [mm]

[1-1000] Enter >_
```

Step 6 **Check and set the standard coordinates**

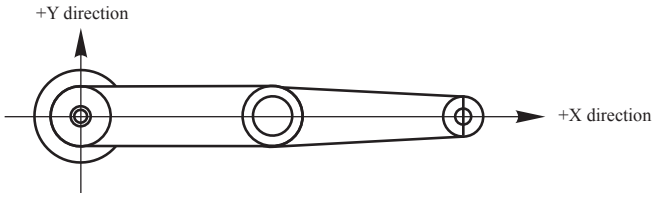
```
MANUAL>COORDI>3POINTS      50% [MG] [    J]
──────────────────────────────────────────
  Arm length [mm]
M1= 199.96  M2= 199.98
  Offset pulse
M1= -12421  M2=   2001

Set OK?                    YES     NO
```

NOTE

Position the XY arms and R-axis so that their rotation centers are aligned in a straight line as much as possible.

Setting the standard coordinates by simple teaching



1 ***Select the simple teaching to set the standard coordinates.***

Press F5 (SIMPLE).

2 ***Align and XY arms in a straight line.***

Use the Jog keys or your hands (if the servo is off) to move the X and Y arms so that they are aligned in a straight line, then press ENTER.

At this point, the +X direction is set as shown above.

3 ***Enter the arm length.***

Enter the X arm length and press ENTER. Then enter the Y arm length and press ENTER.

4 ***Set the standard coordinates.***

A message for checking the arm length and offset pulse value appears on the guideline.

Press F4 (YES) to save and end the setting.

Pressing F5 (NO) ends the setting without saving it.

Step 1 Select the simple teaching mode to set the standard coordinates

```
MANUAL>COORDI>SIMPLE          50% [MG] [     J]
──────────────x──────y──────z──────r──
Please Move X & Y arms straight
before press Enter key.
       X Arm  Y Arm
     0=======0======[  -> +X

[POS]    24349   -1029       0       0
                            VEL+    VEL-
```

Step 3 Enter the XY arm length

```
MANUAL>COORDI>SIMPLE          50% [MG] [     J]
──────────────x──────y──────z──────r──
Enter the length of X Arm [mm]

[1-1000] Enter > 225.00_
```

```
MANUAL>COORDI>SIMPLE          50% [MG] [     J]
──────────────x──────y──────z──────r──
Enter the length of Y Arm [mm]

[1-1000] Enter > 175.00_
```

Step 4 Set the standard coordinates by simple teaching

```
MANUAL>COORDI>SIMPLE          50% [MG] [     J]
──────────────x──────y──────z──────r──
    Arm length [mm]
   M1=   225.00 M2=   175.00
    Offset pulse
   M1=    24349 M2=    -1029

Set OK?                       YES     NO
```

12. Executing the user function keys

User function keys allow you to perform various tasks easily when needed. For example, assigning operation of an air-driven unit connected to an output port to a function key will prove useful when performing point teaching in MANUAL mode.

NOTE

- When using the user function keys, it is necessary to make a program named "FUNCTION" and then write command statements for storing functions.
- To register the function keys, see "4.9 Creating a sample program automatically" and "7. Registering user function keys" in Chapter 4.

The user function keys registered by the program "FUNCTION" are divided into two groups.
Group 1: *M_F1 to *M_F15
Group 2: *M_F16 to *M_F30

When USER is pressed, the character strings assigned to the user function keys of group 1 appear on the guideline. In this state, pressing USER again displays the character strings assigned to the user functions keys of group 2.

TIP

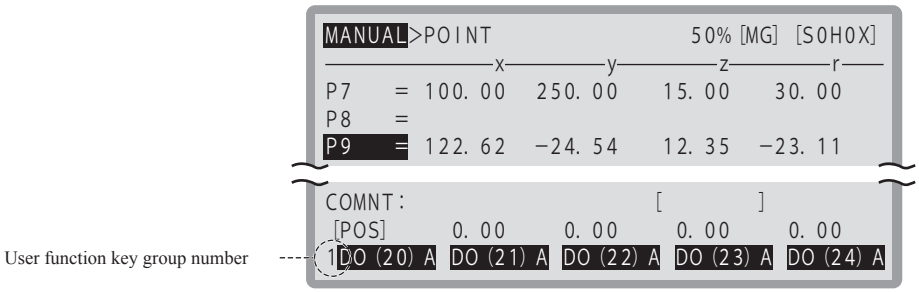
Pressing USER once more returns to the screen that displays the character strings assigned to normal function keys.
Each character string is displayed in up to 7 characters from the beginning.

Pressing a function key executes the command that is registered for that key.

WARNING

- THE ROBOT STARTS TO MOVE WHEN SOME COMMANDS ARE EXECUTED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.
- ROBOT MOVEMENT SPEED CONFORMS TO THE SETTING IN AUTO MODE RATHER THAN THE MANUAL MODE SPEED.

Executing the user function keys



13. Initializing the flash ROM

The data stored in the controller's internal flash ROM can be initialized as needed.

NOTE

If the data in the internal memory is destroyed for any reason, it can be restored by loading the backup data from the internal flash ROM. We recommend backing up the data in the internal flash ROM before starting the robot system.
For instructions on how to save the data in the internal flash ROM and how to restore it, refer to the user's manual.

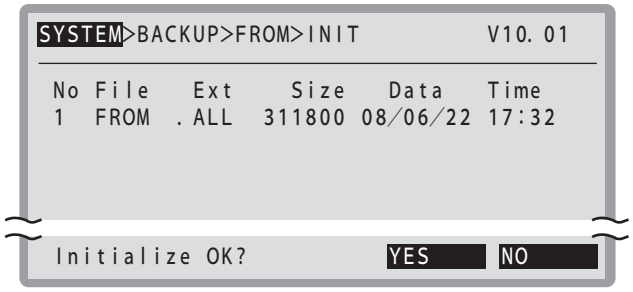
In SYSTEM>BACKUP>FROM mode, press F4 (INIT).

A confirmation message appears on the guideline, and press F4 (YES) to initialize the flash ROM.

The message "0.5: Accessing" appears during initialization.

Press F5 (NO) to cancel the procedure.

Check and initialize the flash ROM



CAUTION

- If data is already written in, the data must be saved after the initialization process.
- Data saved in the internal flash ROM cannot be restored if any hardware trouble occurs. Always save the data onto an external PC storage device.
- If an abnormal process occurs, for example, the power is cut off during data initialization, the data cannot be guaranteed.

Chapter 6 SERVICE mode

Contents

1. SERVICE mode

The SERVICE mode function is intended to prohibit running commands from any operation device other than the programming box when, for example, operating the robot system from within the safety enclosure.
The SERVICE mode function is enabled only in SAFE mode. This function is selected by setting DI02 (SERVICE mode input) to OFF.

CAUTION

- The SERVICE mode default setting only allows operating the robot system from the programming box and so prohibits operation by application software (SCARA Studio/Windows, etc.) that executes online commands via a communication port or by PLC using dedicated input signals. However, the user can change the SERVICE mode setting to operate the robot system from online commands and dedicated inputs.

* To set or select the SERVICE mode function, refer to the user's manual.

1.1 Operation device

If robot operation from a device other than the programming box is permitted, the operator using the programming box near the robot may be exposed to hazardous situations including:

- **if the robot starts moving due to a start signal of dedicated input without the programming box operator being aware of it.**
- **if the robot starts moving due to an online command from an external unit without the programming box operator being aware of it.**

To prevent these types of accidents, the SERVICE mode default setting allows operating the robot only from the programming box and prohibits operation from all other control devices.

1.2 Prohibition of AUTO mode operation

If a robot program is run in AUTO mode while someone is working within the safety enclosure of the robot system, the robot may move contrary to the will of the worker.
So the SERVICE mode setting basically disables operation in AUTO mode.

1.3 Hold-to-Run function

The Hold-to-Run function permits robot movement as long as the programming box key is kept pressed.
Hazardous situations may occur for an operator who trips or falls while operating the programming box within the safety enclosure of the robot system.
To ensure safety in such cases, the Hold-to-Run function is enabled by default in SERVICE mode so that the robot only moves as long as the operator keeps pressing the programming box key.

1.4 Limits on robot moving speed

Robot operation from within the safety enclosure of the robot system is mainly for teaching and maintenance for the robot. Therefore, robot moving speed in SERVICE mode is limited to 3% of the maximum speed so that the robot will move at a speed no faster than 250mm/sec.
Note that, on some SCARA robot models, the manipulator tip might move faster than 250mm/sec in MANUAL mode when the robot X and Y arms are moved simultaneously.
This speed limiting function is a general function and is not a safety-related function defined by ISO13849-1. In other words, this function does not meet the PL (performance level) indicating the safety-related performance level.
To lower the risk of collision between the robot and workers, the user must install necessary protective measures such as enable switches based on the user's risk assessment.
If the robot moving speed must be set higher than 3% of the maximum speed to check the robot operation within the safety enclosure, then the user can cancel the speed limiting function only in cases where judged not hazardous.

WARNING

RESTRICTION ON THE ROBOT MOVING SPEED IS NOT A SAFETY-RELATED FUNCTION.
TO REDUCE THE RISK OF COLLISION BETWEEN THE ROBOT AND WORKERS, THE USER MUST TAKE THE NECESSARY PROTECTIVE MEASURES SUCH AS ENABLE DEVICES ACCORDING TO RISK ASSESSMENT BY THE USER.

Chapter 7 UTILITY mode

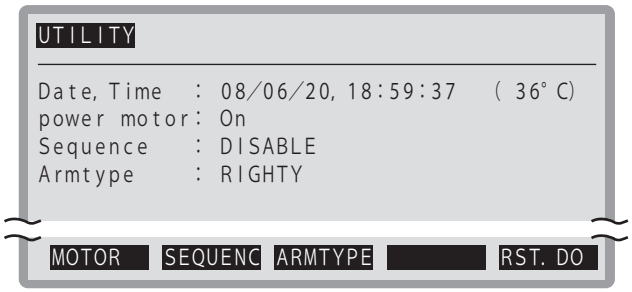
Contents

1. UTILITY mode

The UTILITY mode can be entered from any other mode except edit mode regardless of the mode level.
Pressing UTILITY enters UTILITY mode and the following screen is displayed.

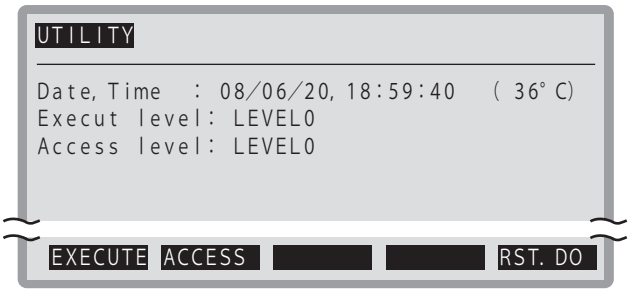
NOTE
The current internal controller temperature is displayed to the right of the date and time display.

UTILITY mode (1)



Pressing UTILITY again displays the following screen.

UTILITY mode (2)



Pressing ESC returns to the mode level that was displayed before switched to UTILITY mode.

Valid keys and submenu descriptions in UTILITY mode are shown below.

Valid keys	Menu	Function
F1	MOTOR	Turns the motor power and servo on and off.
F2	SEQUENC	Prohibits or permits executing the sequence program.
F3	ARMTYPE	Sets the hand system during robot operation.
F5	RST.DO	Clears the output port.

Valid keys	Menu	Function
F1	EXECUTE	Sets the execution level.
F2	ACCESS	Sets the access level.
F5	RST.DO	Clears the output port.

2. Canceling emergency stop; Motor power and servo on/off

2.1. Canceling the emergency stop flag

1 ***Enter UTILITY mode.***

Press UTILITY.

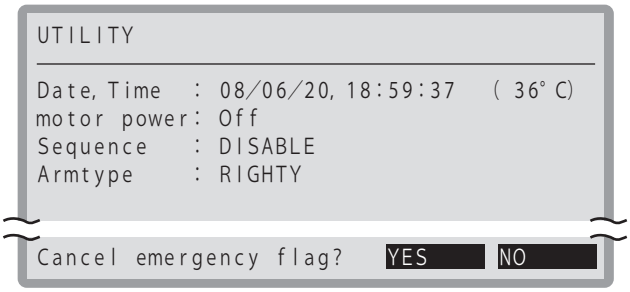
The UTILITY mode screen opens and a confirmation message appears on the guideline.

2 ***Cancel the internal emergency stop flag.***

Press F4 (YES) to cancel the internal emergency stop flag.
If not canceling the internal emergency stop flag, press F5 (NO).

When the internal emergency stop flag is canceled, the alarm caused by emergency stop is reset.

▶ **Step 1** **Check whether to cancel emergency stop**



2.2 Motor power and servo on/off

This is usually used with the motor power turned on.
This operation is performed after emergency stop has been cancelled or when turning the servo on/ off temporarily in order to perform direct teaching.

WARNING

- THE BRAKE FOR THE BRAKE-EQUIPPED AXIS CAN BE RELEASED BY PRESSING THE F8 (FREE) KEY. HOWEVER, RELEASING THE BRAKE OF THE VERTICAL AXIS OF THE VERTICAL USE ROBOT WILL CAUSE THE AXIS TO SLIDE DOWN, CAUSING A HAZARDOUS SITUATION.
- AFTER PRESSING THE EMERGENCY STOP BUTTON, PROP UP THE VERTICAL AXIS WITH A SUPPORT STAND BEFORE RELEASING THE BRAKE.
- BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE VERTICAL AXIS AND INSTALLATION BASE WHEN RELEASING THE BRAKE TO PERFORM DIRECT TEACH.

Follow these steps to turn the motor power and servo on or off.

1 ***Enter UTILITY>MOTOR mode.***

In UTILITY mode, press F1 (MOTOR).

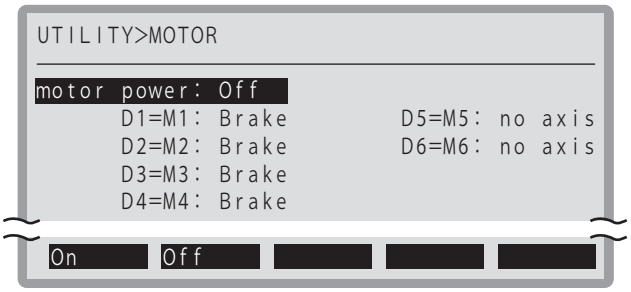
2 ***Turn the motor power and servo on or off.***

Press F1 (On) to turn on the servo.

Press F2 (Off) to turn off the servo.

Press F6 (Power) to turn on the motor power supply only.

Step 2 **Servo on/off**



The servo status can be set for each axis.

1 ***Enter UTILITY>MOTOR mode.***

In UTILITY mode, press F1 (MOTOR).

2 ***Turn the motor power on.***

Press F6 (Power) to turn on the motor power supply.

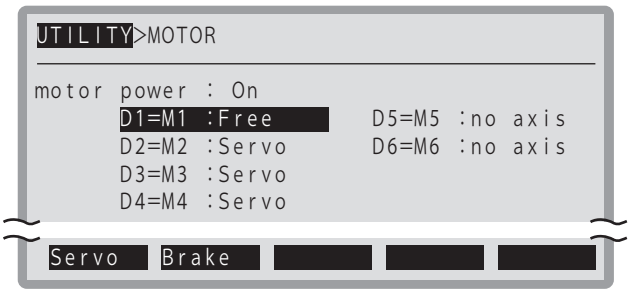
3 ***Select the axis.***

Use the cursor (▲/▼) keys to select the axis.

4 ***Set the servo status.***

Press F1 (Servo), F2 (Brake) or F8 (Free) to set the servo status.

Step 3 **Select the axis to set the servo status**



3. Enabling/disabling the sequence execution flag

To enable or disable execution of sequence programs, follow the procedure below.

NOTE

Sequence programs can be executed when all of the following conditions are met.

1. An object program is created for sequence execution.
2. Sequence program execution is enabled.
3. DI10 (Sequence control) contact point is closed.
4. Operation is in AUTO mode or MANUAL mode.

1 ***Enter UTILITY>SEQUENC mode.***

In UTILITY mode, press F2 (SEQUENCE).

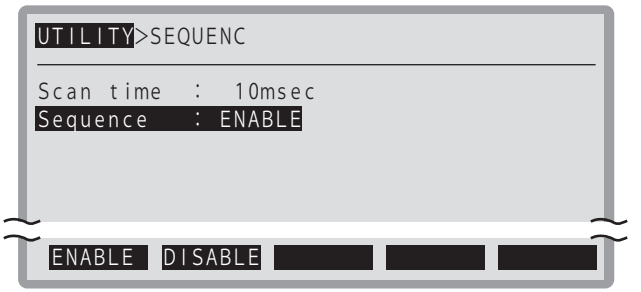
2 ***Set the sequence execution flag.***

To enable execution of sequence programs, press F1 (ENABLE).

To disable execution of sequence programs, press F2 (DISABLE).

To enable DO reset during sequence program execution, press F6 (RST.DO).

Step 2 **Enabling/disabling the sequence program**



4. Arm type

To set the hand type on SCARA robots that move using Cartesian coordinate data, follow the procedure below. The right-handed system is selected when the parameters are initialized.

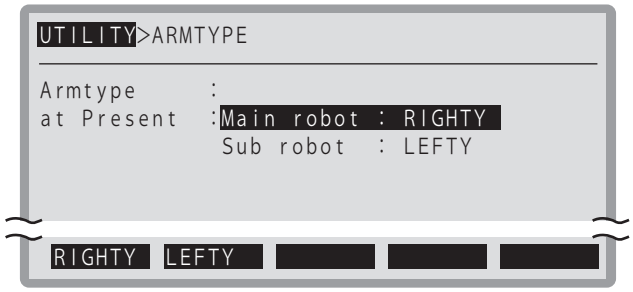
1 ***Enter UTILITY>ARMTYPE mode.***

In UTILITY mode, press F3 (ARMTYPE).

2 ***Select the hand system.***

Use the cursor (▲/▼) keys to select the robot and press F1 (RIGHTY) or F2 (LEFTY) to select the hand system.

Step 1 **Enter UTILITY>ARMTYPE mode**



5. Resetting the output ports

This resets the general-purpose output ports DO2() to DO27()/MO2() to MO27()/LO0()/TO0()/SO2() to SO27()/SOW(2) to SOW(15).

Press F5 (RST.DO) in UTILITY mode, and a confirmation message appears on the guideline.

To reset the general-purpose outputs, press F4 (YES).

To cancel the reset, press F5 (NO).

6. Execution level

Program execution levels can be set as shown in the table below. Program execution is set "enabled" even when return-to-origin is incomplete. However, the following commands cannot be used unless return-to-origin is complete.

Movement commands : MOVE, MOVE2, MOVEI, MOVEI2, DRIVE, DRIVE2, DRIVEI, DRIVEI2, PMOVE, PMOVE2, PATH START

Position acquisition command : WHERE, WHERE2, WHRXY, WHRXY2

NOTE

Execution level is automatically set to "LEVEL 0" in the following cases.

1. When parameter data was damaged.
2. When system generation data was damaged.

Level	Description				
	Program execution at origin incomplete	When power is turned on		Program reset at program start	Return-to-origin signal in AUTO mode
		Mode	Program reset		
LEVEL0	Disabled	MANUAL mode	NO	NO	Invalid
LEVEL1	Enabled	MANUAL mode	NO	NO	Invalid
LEVEL2	Enabled	MANUAL mode	YES	NO	Invalid
LEVEL3	Enabled	AUTO mode	NO	NO	Invalid
LEVEL4	Enabled	AUTO mode	YES	NO	Invalid
LEVEL5	Enabled	MANUAL mode	YES	YES	Invalid
LEVEL6	Enabled	AUTO mode	YES	YES	Invalid
LEVEL7	Enabled	AUTO mode	NO	NO	Valid *
LEVEL8	Enabled	AUTO mode	YES	YES	Valid *

* When the DI17 (Absolute reset/Return-to-origin) is valid in AUTO mode, turns on during processing DO13 (Robot program-in-progress).

6.1 Changing the execution level

To change the execution level, follow these steps.

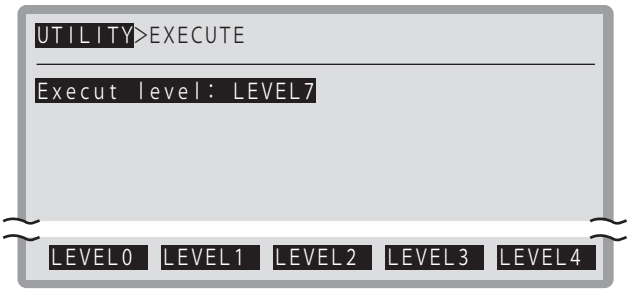
1 ***Enter UTILITY>EXECUTE mode.***

Press UTILITY twice to enter UTILITY>EXECUTE mode and press F1 (EXECUTE).

2 ***Set the execution level.***

Press a key from F1 (LEVEL0) to F9 (LEVEL8) to set the execution level.

Step 1 **Changing the execution level**



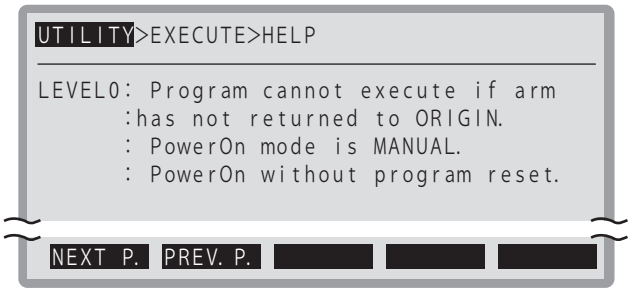
6.2 Displaying the help message

To display the help message for execution levels, press F15 (HELP) in UTILITY>EXECUTE mode.

Press F1 (NEXT P.) or cursor (▼) key to refer to the next page or press F2 (PREV. P.) or cursor (▲) key to refer to the previous page.

Press ESC to exit the help screen.

Displaying the help message



7. Access level (operation level)

Changing a program or point data incorrectly may cause the robot and/or controller to break down or malfunction. To prevent such problems, the controller can be set to operating levels that permit or prohibit changing programs and point data.
The operation level can be set to any of the following levels.

Level	Description
LEVEL0	All operations are allowed.
LEVEL1	All data changes are prohibited. (Program changes, teaching, data deletion, data initializing, etc are prohibited.)
LEVEL2	In addition to level 1, mode selection is restricted to MANUAL and AUTO modes.
LEVEL3	In addition to level 2, mode speed changes and display of program list in AUTO mode are prohibited.

NOTE

Access level is automatically set to "LEVEL 0" in the following cases.

1. When "ALL" was executed during memory initialization setting (Refer to the user's manual.)
2. When the memory was destroyed (when "9.3: Memory destroyed" message was displayed)
3. When a program was destroyed (when "9.1: Program destroyed" message was displayed)
4. When point data was destroyed (when "9.2: Point data destroyed" message was displayed)
5. When shift data was destroyed (when "9.6: Shift data destroyed" message was displayed)
6. When hand data was destroyed (when "9.7: Hand data destroyed" message was displayed)
7. When a parameter was destroyed (when "9.4: Parameter destroyed" message was displayed)
8. When generation data was destroyed (when "9.33: Sys. generation destroyed" message was displayed)

7.1 Changing the access level

To change the access level, follow the procedure below.

NOTE

The correct password must be entered to change the access level. However, the online command (@ACCESS) via RS-232C does not need the password.

1 ***Enter "UTILITY>ACCESS" level.***

In UTILITY mode, press F2 (ACCESS).

A message "Enter password" appears on the guideline.

2 ***Enter the password.***

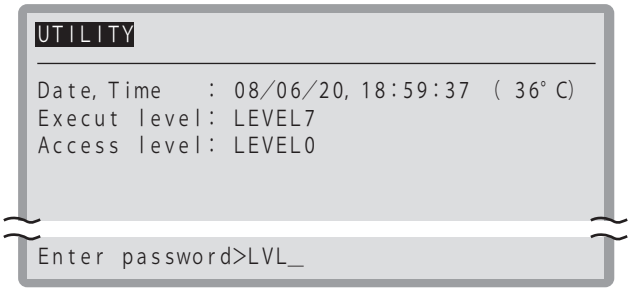
Enter "LVL" as the password and press ENTER.

If the correct password was entered, the following screen appears.

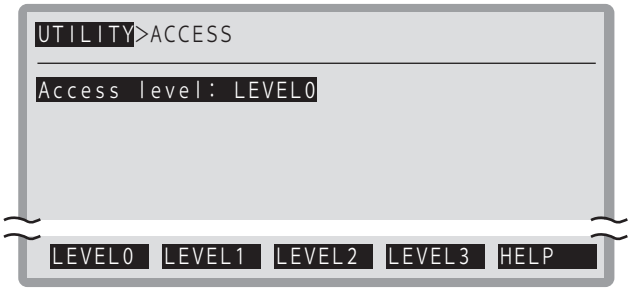
3 ***Set the access level.***

Press a key from F1 (LEVEL 0) to F4 (LEVEL 3) to set the access level.

▶ **Step 1** **Enter the password**



▶ **Step 2** **Set the access level**



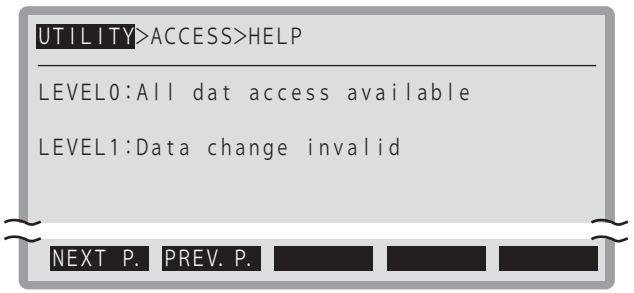
7.2 Displaying the help message

To display the help message for access levels, press F5 (HELP) in UTILITY>ACCESS mode.

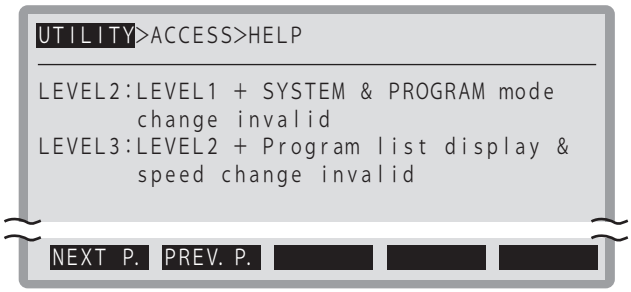
Press F1 (NEXT P.) or cursor (▼) key to refer to the next page or press F2 (PREV. P.) or cursor (▲) key to refer to the previous page.

Press ESC to exit the help screen.

Access level help screen (first page)



Access level help screen (second page)



Troubleshooting

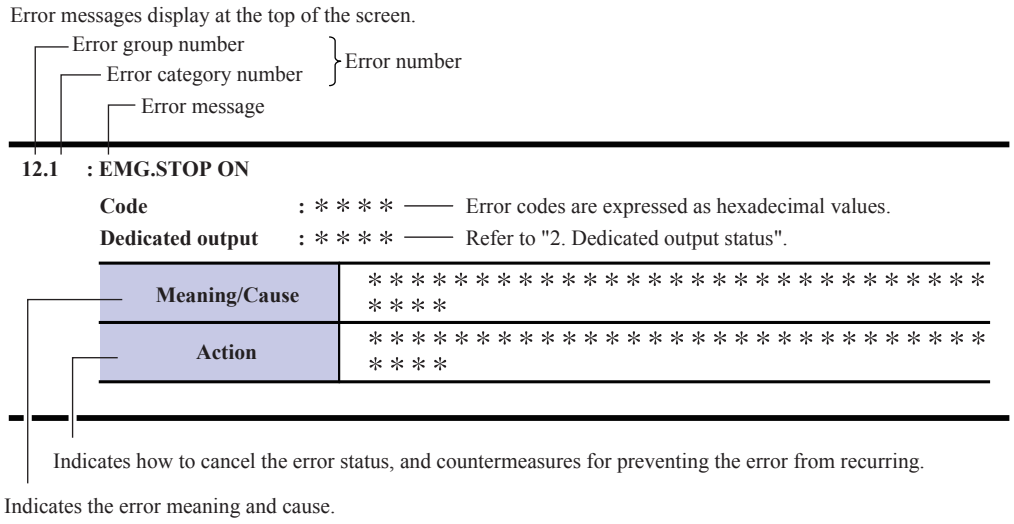
Contents

1. Error messages

1.1 Robot controller error messages

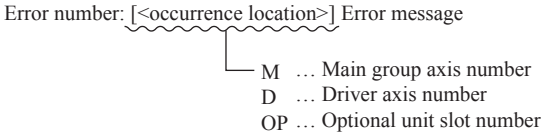
When an error occurs, an error message appears on the message line of the programming box.
The error messages and their explanations are given below.

[Error message display format]



NOTE
Please contact your distributor if the recommended countermeasures fail to resolve an error.

* In some cases information about the error occurrence location (axis, optional unit, etc.) is inserted at the beginning of the error message.



For example, the "2.1: M1, Over soft limit" error message indicates that a "soft limit over" error occurred at the 1st axis of a main group robot. In the same manner, the "17.4:D2, Over load" error message indicates that an "overload" error occurred at the 2nd axis of the driver unit.
Although the axis No. is normally 1-to-1 as viewed from both the robot and the driver, there are cases, like in a dual drive axis system, where the axis configuration may appear as the 1st axis when viewed from the robot, but the 2nd axis when viewed from the driver.

1. Error group number

Error messages are classified by content into groups [0] to [22]. Contents of each error group are shown below.

Group No.	Contents
[0]	Warnings and messages
[1]	Warnings (error history entry)
[2]	Robot operating area errors
[3]	Program file operating errors
[4]	Data entry and edit errors
[5]	Robot language syntax (compiling) errors
[6]	Robot language execution errors
[7]	(Not used)
[8]	(Not used)
[9]	Memory errors
[10]	System setting or hardware errors
[11]	(Not used)
[12]	I/O and option board errors
[13]	Programming box errors
[14]	RS-232C communication errors
[15]	Memory card errors
[16]	(Not used)
[17]	Motor control errors
[18]	(Not used)
[19]	YC-Link related error
[20]	iVY system errors
[21]	Major software errors
[22]	Major hardware errors
[26]	"Alarm message" occurred in electric gripper main body (serious error)
[27]	"Error message" occurred in electric gripper main body

NOTE

Messages for group No. 0 are not stored in the error history.

2. Dedicated output status

Dedicated output status items described below in *1 to *3 show the following contents.

***1... CPU stop**

- Turn the power ON again to reset.

DO01a (CPU OK) =OFF
DO02a (SERVO ON) =OFF
DO03a (ALARM) =ON

***2 ... Driver stop**

- Turn the power ON again to reset.

DO01a (CPU OK) =ON
DO02a (SERVO ON) =OFF
DO03a (ALARM) =ON

***3 ... Servo stop**

- Turn the power ON again in UTILITY mode to reset.

DO01a (CPU OK) =ON
DO02a (SERVO ON) =OFF
DO03a (ALARM) =ON

3. [26] Alarm messages occurred in electric gripper main body

If an alarm message described in error group number 26 (Alarm message occurred in electric gripper main body) appears, the electric gripper enters the status shown below.

- Origin incomplete
- Servo-off

To recover from the alarm status, follow the steps below.

1. Remove the cause of the alarm.
2. Reset the emergency stop flag.
3. Turn on the servo of all axes.
4. Perform the return-to-origin of the electric gripper, in which the alarm occurred.

[0] Warnings and messages

0.0 : Undefined error

Code : &H0000

Meaning/Cause	Undefined system error.
Action	Contact your distributor with details of the problem.

0.1 : Origin incomplete

*** If the cause of the origin incomplete error can be pinpointed, an error code will be attached in parentheses at the end.**

Code : &H0001

Meaning/Cause	a. One of the following operations was performed while return-to-origin was incomplete. • Execution of program or command was attempted. • Point teaching was attempted. • Movement on Cartesian coordinates was attempted. Absolute reset for absolute type axis has not been performed, or return-to-origin for increment type axis has not been performed. b. Absolute battery was removed from controller or robot position data becomes undefined due to battery voltage drop. c. ROB I/O cable was removed or disconnected. d. Absolute reset was interrupted. e. System generation was changed or parameters initialized. Or parameters for specifying the origin position such as for the return-to-origin direction or axis polarity were changed. (Equivalent to writing ALL or PRM file on controller.)
Action	Perform absolute reset or return-to-origin so that "origin complete" status is set.

0.2 : Running

Code : &H0002

Meaning/Cause	Program or command is running.
Action	—

0.3 : Program terminated by "HALT"

Code : &H0003

Meaning/Cause	Program execution was terminated by a HALT command.
Action	—

0.4 : Compiling

Code : &H0004

Meaning/Cause	Robot language compiling (making an object program) is in progress.
Action	—

0.5 : Busy

Code : &H0005

Meaning/Cause	Data is being saved on a memory card or internal ROM.
Action	—

0.6 : Program suspended by "HOLD"

Code : &H0006

Meaning/Cause	Program execution was interrupted by a HOLD command.
Action	Press the RUN key to cancel hold condition and start running the program from the next command.

0.7 : Turn on power again

Code : &H0007

Meaning/Cause	a. System generation was performed due to a robot change, etc. b. Parameter was changed by data transfer. c. System generation data was destroyed. d. Error occurred when servo was turned ON.
Action	Turn the controller on again.

0.8 : Try again

Code : &H0008

Meaning/Cause	Operation failed.
Action	Try again.

0.9 : Arrived at breakpoint

Code : &H0009

Meaning/Cause	Break point was reached during program execution.
Action	—

0.10 : INC.motor disconnected

Code : &H000A

Meaning/Cause	Return-to-origin command was attempted on an absolute axis or an axis that does not exist.
Action	1. Specify the correct axis. 2. Check the system generation data.

0.11 : ABS.motor disconnected

Code : &H000B

Meaning/Cause	Absolute reset was attempted on an incremental type axis or semi-absolute type axis, or an axis that does not exist.
Action	1. Specify the correct axis. 2. Check the system generation data.

0.14 : Stop excuted

Code : &H000E

Meaning/Cause	An external stop command was input during execution of a direct command, so operation was interrupted.
Action	—

0.15 : Can't execute while servo on

Code : &H000F

Meaning/Cause	Writing in "ALL" or "PRM" files was attempted during servo ON. "ALL" or "PRM" files cannot be written in servo ON.
Action	Turn off the servo before writing files.

0.16 : Changed SERVICE mode input

Code : &H0010

Meaning/Cause	Writing in "ALL" or "PRM" files was attempted during servo ON. "ALL" or "PRM" files cannot be written in servo ON.
Action	Turn off the servo before writing files.

0.17 : Can't edit while STD.DIO DC24V on

Code : &H0011

Meaning/Cause	Setting to disable the 24VDC monitoring function of STD.DIO was attempted even though 24VDC was being supplied at STD.DIO connector. (Monitor function cannot be disabled while 24VDC is being supplied to STD. DIO.)
Action	To disable the monitor function, change the parameter after first stopping the 24VDC supply.

0.18 : Gripper not included in Origin

Code : &H0012

Meaning/Cause	A gripper axis other than the command target axis was specified for the gripper axis when the other parameter, "Include Gripper in Origin", was set at "NO" and any of the following commands was executed. (1) "ORIGIN" command (2) "@ORGRTN" command (3) "@ORGRTN2" command
Action	1. Set "Include Gripper in Origin" to "YES". 2. For "@ORGRTN" and "@ORGRTN2" commands, execute an axis other than the gripper axis individually.

[1] Warnings (error history entry)

1.31 : CPU Reset start

Code : &H011F

Meaning/Cause	Power was turned on and CPU operation commenced.
Action	—

1.32 : CPU Normal start

Code : &H0120

Meaning/Cause	Start-up checks and initialization ended and controller operation started.
Action	—

1.33 : ABS.Backup start

Code : &H0121

Meaning/Cause	Power was cut off so backup of robot position data commenced.
Action	—

1.34 : ABS.Backup fin

Code : &H0122

Meaning/Cause	Finished making backup of robot position data during power cutoff.
Action	—

[2] Robot operating area errors

2.1 : Over soft limit

Code : &H0201

Meaning/Cause	Soft limit value preset in the parameter for operation position was exceeded.
Action	1. Change the operating position to within the soft limits. 2. Change the soft limit value.

2.2 : Std. coord. doesn't exist

Code : &H0202

Meaning/Cause	Setting of standard coordinates is incomplete.
Action	1. Set the standard coordinates. 2. Set the parameter arm length and offset pulse.

2.3 : Coordinate cal. failed

Code : &H0203

Meaning/Cause	a. Preset calculation for setting standard coordinates is not functioning. b. Operating position exceeded the operating area range.
Action	1. Set the standard coordinates correctly. 2. Change operating position to within operating area.

2.5 : Shift cal. failed

Code : &H0205

Meaning/Cause	Calculating for setting shift coordinates failed.
Action	Set shift coordinates correctly.

2.6 : Hand cal. failed

Code : &H0206

Meaning/Cause	Calculation for setting hand definition failed.
Action	Set hand definition correctly.

2.7 : Illegal Pallet parameter

Code : &H0207

Meaning/Cause	Calculation for setting pallet definition failed.
Action	Set pallet definition correctly.

2.8 : Movable range cal. failed

Code : &H0208

Meaning/Cause	a. Calculation of movement path failed. b. Current position is not within movement range.
Action	1. Change to a correct movement point. 2. Change current position to within movement range.

2.9 : Overlap soft limit

Code : &H0209

Meaning/Cause	The sum of the absolute values for the X-axis (or Y-axis) minus soft limit and the X-axis (or Y-axis) plus soft limit is making the arm move 1 rotation or more.
Action	1. Set the soft limit values correctly. 2. Set the soft limit values so that the movement range of the arm is less than 1 rotation.

2.10 : Exceeded movable range

Code : &H020A

Meaning/Cause	Area is outside the movable range of movement path.
Action	1. Set movement points correctly. 2. Specify movement path to be within the movable range.

2.11 : ? exceeded shift coord. range

Code : &H020B

Meaning/Cause	Shift coordinate range ? value was exceeded.
Action	1. Change the operating position of ? value to within the shift coordinates range. 2. Change shift coordinates range ? value.

2.17 : Arch condition bad

Code : &H0211

Meaning/Cause	Arch motion cannot be performed on the X and Y axes if the arch position is specified in "mm" units. Arch motion cannot be performed on the X and Y axes if the target position is specified in "mm" units.
Action	Change to correct arch motion command.

2.18 : RIGHTY now selected

Code : &H0212

Meaning/Cause	The arm will now use the right-handed system for starting Cartesian movement.
Action	—

2.19 : LEFTY now selected

Code : &H0213

Meaning/Cause	The arm will now use the left-handed system for starting Cartesian movement.
Action	—

2.20 : Illegal hand type

Code : &H0214

Meaning/Cause	An R-axis hand definition was attempted on a robot not having an R-axis.
Action	1. Change to Y-axis hand definition. 2. Do not use a hand definition.

2.22 : Arm length is 0

Code : &H0216

Meaning/Cause	When arm length setting is 0, movement on Cartesian coordinates was attempted.
Action	1. Set standard coordinates. 2. Set the arm length parameter.

2.23 : Cannot move(RIGHTY to LEFTY)

Code : &H0217

Meaning/Cause	Interpolation movement shifting from the right-handed system to the left-handed system was executed.
Action	Check the current hand system and point data hand system flag.

2.24 : Cannot move(LEFTY to RIGHTY)

Code : &H0218

Meaning/Cause	Interpolation movement shifting from the left-handed system to the right-handed system was executed.
Action	Check the current hand system and point data hand system flag.

2.25 : Cannot use TOOL coord.

Code : &H0219

Meaning/Cause	Failed to select tool coordinates could because no hand data has been entered.
Action	Set the hand data.

CAUTION

An R-axis unit must be installed. Set the hand data while a hand or gripper is attached to the tip of the R-axis.

2.26 : Collision in W.carrier

Code : &H021A

Meaning/Cause	Failed to move the double-carrier axis, because one carrier will interfere with the other carrier.
Action	If this error occurred during MANUAL mode: 1. Move the other carrier to a position where the two carriers will not interfere with each other and then move the robot manually. If this error occurred during AUTO mode: 1. Change the target position of one carrier so it will not interfere with the other carrier. 2. Move the other carrier to a position where it will not interfere with the first carrier's target position, and then move that first carrier. 3. Set the double-carrier parameter control mode to "Off" or "On". When set to "Off", this error does not occur, but the anti-collision function for double-carriers will not work so the carriers might collide with each other. When set to "On", one carrier starts moving after waiting until the other carrier moves to a position where no interference occurs.

2.27 : W.carrier deadlock

Code : &H021B

Meaning/Cause	Failed to move the double carrier axis and a deadlock occurred, because the target positions of both carriers will interfere with each other.
Action	Check the robot program.

2.29 : Cannot move without the limit

Code : &H021D

Meaning/Cause	1. The DRIVE statement used a "movement direction option" for an axis where the "limitless motion" parameter is set to INVALID. 2. DRIVE statement movement was attempted with a "limitless motion" VALID setting for the SCARA robot's X or Y axis. 3. DRIVE statement movement was attempted with a "limitless motion" VALID setting for a non-rotary type axis. 4. The attempted simultaneous movement of multiple axes by a MOVE or MOVEI statement, etc., included an axis with a "limitless motion" VALID setting. 5. A Point Trace was executed with a "limitless motion" VALID setting specified at one of the robot axes.
Action	1. Use the DRIVE statement to perform movement without the "movement direction option". Or, set the "limitless motion" parameter to VALID. 2. Set the "limitless motion" parameter to INVALID. 3. Set the "limitless motion" parameter to INVALID. 4. Set the "limitless motion" parameter to INVALID. Or, specify an "additional axis" setting in the system generation data for the axis where "limitless motion" is desired.*1 5. Set the "limitless motion" parameter to INVALID. Or, specify an "additional axis" setting in the system generation data for the axis where "limitless motion" is desired.*1

*1 An "additional axis" is excluded from the axes which are moved by a MOVE statement, etc. An "additional axis" can be moved by using the DRIVE statement.

[3] Program file operating errors

3.1 : Too mamy programs

Code : &H0301

Meaning/Cause	Making of a new program was attempted after number of programs exceeded 100.
Action	Make a new program after deleting an unnecessary program. (Make a backup if necessary.)

3.2 : Program already exists

Code : &H0302

Meaning/Cause	An attempt to make/copy/transmit (by using SEND command) a new program with a name already registered was attempted.
Action	Making a new program/copy/transmission (by using SEND command) using a new (unregistered) program name.

3.3 : Program doesn't exist

Code : &H0303

Meaning/Cause	A registered program of the specified name does not exist.
Action	Correctly enter a registered program name.

3.4 : Writing prohibited

Code : &H0304

Meaning/Cause	The specified program is write protected.
Action	Use a program that is not write protected.

3.5 : File type error

Code : &H0305

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of the problem.

3.6 : Too many breakpoints

Code : &H0306

Meaning/Cause	Setting of break point exceeding 4 points was attempted.
Action	After deleting unnecessary break points, set the new break point. (Up to 4 break points can be set in one program.)

3.7 : Breakpoint doesn't exist

Code : &H0307

Meaning/Cause	Break point was not found during search.
Action	Set a break point if needed.

3.9 : Cannot find strings

Code : &H0309

Meaning/Cause	Could not find specified character string during search.
Action	If needed change the character string and try searching again.

3.10 : Object program doesn't exist

Code : &H030A

Meaning/Cause	The object program name is not registered.
Action	Make an object program.

3.11 : Cannot use function

Code : &H030B

Meaning/Cause	Unable to execute or unneeded hierarchy was selected.
Action	—

3.12 : Cannot overwrite

Code : &H030C

Meaning/Cause	In AUTO mode or PROGRAM mode, overwrite of a program being selected cannot be made by communication with a program of the same name.
Action	1. Change the mode. 2. Change the program name.

3.13 : Changing data prohibited

Code : &H030D

Meaning/Cause	Data cannot be changed because access level is not at 0.
Action	Set the access level to 0.

3.14 : Cannot use mode

Code : &H030E

Meaning/Cause	Specified mode cannot be changed because access level is set to level 2 or level 3.
Action	Change the access level to 0 or 1.

3.15 : Illegal password

Code : &H030F

Meaning/Cause	There is a mistake in the password entry.
Action	Enter the correct password.

3.16 : Cannot reset ABS

Code : &H0310

Meaning/Cause	Failed to perform absolute reset or return-to-origin correctly.
Action	1. Perform absolute reset or return-to-origin again. 2. Replace the robot cable. 3. Replace the controller.

3.17 : Cannot erase current program

Code : &H0311

Meaning/Cause	Currently selected program cannot be deleted.
Action	1. Cancel deletion of program. 2. Change the specified program.

3.18 : Duplicated Breakpoint

Code : &H0312

Meaning/Cause	Setting of breakpoint was attempted on line already set with breakpoints.
Action	To set the breakpoint, specify a line where breakpoints have not yet been set.

[4] Data entry and edit errors

4.1 : Point number error

Code : &H0401

Meaning/Cause	A point number was entered exceeding P9999.
Action	Input a correct point number.

4.2 : Input format error

Code : &H0402

Meaning/Cause	Wrong format was used to enter the data.
Action	Use the correct data format.

4.3 : Undefined pallet

Code : &H0403

Meaning/Cause	Specified pallet is undefined.
Action	1. Change the specified pallet. 2. Define the pallet.

4.4 : Undefined robot number

Code : &H0404

Meaning/Cause	Specified robot number does not exist.
Action	Enter a correct robot number.

4.5 : Undefined axis number

Code : &H0405

Meaning/Cause	Specified axis number does not exist.
Action	Enter a correct axis number.

4.6 : Invalid input number

Code : &H0406

Meaning/Cause	Invalid data was entered. a. Invalid data was entered in the area check output port number. b. Same port number was set for "G1 status output (DO & SO)" and "G2 status output (DO & SO)" of electrical gripper.
Action	1. Enter a port number that can be used. 2. Enter different port numbers.

4.7 : Invalid input axis

Code : &H0407

Meaning/Cause	An axis specified as "no axis" was selected for one axis of double carrier.
Action	Select an axis that is not specified as "no axis".

[5] Robot language syntax (compiling) errors

5.1 : Syntax error

Code : &H0501

Meaning/Cause	Syntax error found in program.
Action	Change to the correct syntax.

5.2 : Data error

Code : &H0502

Meaning/Cause	Data entered in wrong format.
Action	Input the data in the correct format.

5.3 : Number error

Code : &H0503

Meaning/Cause	a. Mistake in the number entry. b. Expression value is wrong.
Action	1. Change to the correct number. 2. Change to the correct value.

5.4 : Bit number error

Code : &H0504

Meaning/Cause	Specified bit number is not within 0 to 7.
Action	Change to the correct bit number.

5.5 : Port number error

Code : &H0505

Meaning/Cause	a. Port number specified for DO, DI, MO, SI, SO ports is outside the range 0 to 7, 10 to 17, or 20 to 27. b. Specified port number for LO, TO is not 0. c. An output to port 0 or port 1 was set for ports DO, MO, SO.
Action	1. Change to the correct port number. 2. Change output for ports DO, MO, SO to a port other than port 0 or port 1.

5.6 : Digit number error

Code : &H0506

Meaning/Cause	a. Binary number has exceeded 8 digits (places). b. Octal number has exceeded 6 digits (places). c. Decimal number has exceeded the specified range. d. Hexadecimal number has exceeded 8 digits (places). e. Cartesian coordinate point data has more than 3 decimal places.
Action	1. Change to the correct number of digits (places). 2. Specify the Cartesian coordinate point data of up to 2 decimal places.

5.7 : Illegal axis name

Code : &H0507

Meaning/Cause	Robot axis name is wrong.
Action	Change to the correct axis name.

5.8 : Illegal order

Code : &H0508

Meaning/Cause	Wrong bit specified for input/output port.
Action	Change to ascending order starting from right.

5.10 : Too many characters

Code : &H050A

Meaning/Cause	a. Character string was defined in excess of 75 characters. b. Addition to the character string total exceeds 75 characters.
Action	1. Change to character string count of 75 characters or less. 2. Change additions to character string to a total of 75 characters or less.

5.12 : Stack overflow

Code : &H050C

Meaning/Cause	a. Parenthesis was used 6 times or continuously in an expression. b. Overflow in stack area for compiling/execution.
Action	1. Reduce parentheses in the expression to 5 times or less. 2. Reduce program size. 3. Reduce nesting of GOSUB statement, CALL statement and FOR to NEXT statement. 4. Reduce argument of CALL statement. (especially character variables)

5.13 : Illegal variable

Code : &H050D

Meaning/Cause	A variable other than a global variable was used in SEND/@READ/@WRITE commands.
Action	Change to a global variable.

5.14 : Type mismatch

Code : &H050E

Meaning/Cause	a. Expression does not match on both sides. b. Prohibited type constant/variable/expression was used.
Action	1. Change so that both sides of expression match. 2. Use a correct type of constant/variable/expression.

5.15 : FOR variable error

Code : &H050F

Meaning/Cause	Variable names for NEXT statement and corresponding FOR statement do not match.
Action	Change so that FOR statement variable names match with NEXT statement variable names.

5.16 : WEND without WHILE

Code : &H0510

Meaning/Cause	There is no WHILE statement corresponding to the WEND statement.
Action	1. Delete the WEND statement. 2. Add a WHILE statement corresponding to the WEND statement.

5.17 : WHILE without WEND

Code : &H0511

Meaning/Cause	There is no WEND statement corresponding to WHILE statement.
Action	1. Delete the WHILE statement. 2. Add a WEND statement corresponding to the WHILE statement.

5.18 : NEXT without FOR

Code : &H0512

Meaning/Cause	a. There is no FOR statement corresponding to NEXT statement. b. NEXT command was executed without executing FOR command.
Action	1. Delete the NEXT statement. 2. Add a FOR statement corresponding to the NEXT statement. 3. Confirm execution of FOR command.

5.19 : FOR without NEXT

Code : &H0513

Meaning/Cause	There is no NEXT statement corresponding to FOR statement.
Action	1. Delete the FOR statement. 2. Add a NEXT statement corresponding to the FOR statement.

5.20 : ENDIF without IF

Code : &H0514

Meaning/Cause	There is no IF statement corresponding to ENDIF statement.
Action	1. Delete the ENDIF statement. 2. Add an IF statement corresponding to the ENDIF statement.

5.21 : ELSE without IF

Code : &H0515

Meaning/Cause	There is no IF statement corresponding to ELSE statement.
Action	1. Delete the ELSE statement. 2. Add an IF statement corresponding to the ELSE statement.

5.22 : IF without ENDIF

Code : &H0516

Meaning/Cause	There is no ENDIF statement corresponding to IF statement.
Action	1. Delete the IF statement. 2. Add an ENDIF statement corresponding to the IF statement.

5.23 : ELSE without ENDIF

Code : &H0517

Meaning/Cause	There is no ENDIF statement corresponding to ELSE statement.
Action	1. Delete the ELSE statement. 2. Add an ENDIF statement corresponding to the ELSE statement.

5.24 : END SUB without SUB

Code : &H0518

Meaning/Cause	a. There is no SUB statement corresponding to END SUB statement. b. END SUB command was executed without SUB command.
Action	1. Delete the END SUB statement. 2. Add a SUB statement corresponding to the END SUB statement. 3. Confirm execution of SUB command.

5.25 : SUB without END SUB

Code : &H0519

Meaning/Cause	There is no END SUB statement corresponding to SUB statement.
Action	1. Delete the SUB statement. 2. Add an END SUB statement corresponding to the SUB statement.

5.26 : Duplicated variable

Code : &H051A

Meaning/Cause	Two or more array variables were defined for the same name.
Action	Delete a definition statement for the array variables with the same name.

5.27 : Duplicated identifier

Code : &H051B

Meaning/Cause	Two or more identifiers were defined for the same name.
Action	Define another identifier.

5.28 : Duplicated label

Code : &H051C

Meaning/Cause	Two or more of the same labels were defined.
Action	Define another label.

5.29 : Undefined array

Code : &H051D

Meaning/Cause	Assignment/reference was made for undefined array.
Action	Define the undefined array.

5.30 : Undefined identifier

Code : &H051E

Meaning/Cause	An undefined identifier was used.
Action	Define an identifier for undefined identifier.

5.31 : Undefined label

Code : &H051F

Meaning/Cause	Reference made to undefined label.
Action	Set definition for undefined label.

5.32 : Undefined user function

Code : &H0520

Meaning/Cause	Undefined function was called.
Action	Set definition for undefined function.

5.34 : Too many dimensions

Code : &H0522

Meaning/Cause	An array exceeding 3 dimensions was defined.
Action	Change array to within 3 dimensions.

5.35 : Dimension mismatch

Code : &H0523

Meaning/Cause	The number of array dimensions does not match that defined by the DIM statement.
Action	1. Make the number of array dimensions match that defined by the DIM statement. 2. Make the number of array dimensions match the DIM statement.

5.36 : Argument mismatch

Code : &H0524

Meaning/Cause	The number of SUB statement arguments does not correspond to the CALL statement.
Action	Make the number of SUB statements correspond to the CALL statement.

5.37 : Specification mismatch

Code : &H0525

Meaning/Cause	Cannot execute command under present robot specifications.
Action	Change command for execution.

5.38 : Illegal option

Code : &H0526

Meaning/Cause	Error is present in command option.
Action	Define another identifier.

5.39 : Illegal identifier

Code : &H0527

Meaning/Cause	Reserved word was used as an identifier.
Action	Change to an identifier not used as a reserved word. Refer to the programming manual.

5.40 : Illegal command in procedure

Code : &H0528

Meaning/Cause	Cannot execute command within procedure (from SUB to END SUB statements).
Action	Delete command that cannot be executed within procedure.

5.41 : Illegal command outside proce.

Code : &H0529

Meaning/Cause	Command cannot be executed outside of procedure (between SUB to END SUB statements).
Action	Delete command that cannot be executed outside of procedure.

5.42 : Illegal command inside IF

Code : &H052A

Meaning/Cause	Cannot execute command between IF to ENDIF statements. (Command can be executed for one IF statement line.)
Action	Delete command that cannot be executed between IF to ENDIF statements.

5.43 : Illegal direct

Code : &H052B

Meaning/Cause	Independent execution of command is impossible.
Action	1. Change execution according to program. 2. Change it to a command that can be executed independently.

5.44 : Cannot use external label

Code : &H052C

Meaning/Cause	Command cannot use an external label.
Action	1. Change to an internal label. 2. Change execution command.

5.45 : Illegal program name

Code : &H052D

Meaning/Cause	a. When transmitting a program file by SEND command, the NAME statement was not defined on beginning line of the program data. b. Characters other than alphanumeric and underscore (_) were used in the program name. c. Program name has exceeded 8 characters.
Action	1. Define NAME statement on beginning line of program data. 2. Use only alphanumeric and underscore (_) characters in the program name. 3. Use 8 characters or less in the program name.

5.46 : Too many identifiers

Code : &H052E

Meaning/Cause	Number of identifiers exceeded 500.
Action	Ensure the number of identifiers is within 500 items.

5.47 : CASE without SELECT

Code : &H052F

Meaning/Cause	There is no SELECT statement corresponding to CASE statement.
Action	1. Delete the CASE statement. 2. Add a SELECT statement corresponding to the CASE statement.

5.48 : END SELECT without SELECT

Code : &H0530

Meaning/Cause	There is no SELECT statement corresponding to END SELECT statement.
Action	1. Delete the END SELECT statement. 2. Add a SELECT statement corresponding to the END SELECT statement.

5.49 : SELECT without END SELECT

Code : &H0531

Meaning/Cause	There is no END SELECT statement corresponding to SELECT statement.
Action	1. Delete the SELECT statement. 2. Add an END SELECT statement corresponding to the SELECT statement.

5.50 : CASE without END SELECT

Code : &H0532

Meaning/Cause	There is no END SELECT statement corresponding to CASE statement.
Action	1. Delete the CASE statement. 2. Add an END SELECT statement corresponding to the CASE statement.

5.51 : Illegal command line

Code : &H0533

Meaning/Cause	Cannot execute command statement between SELECT and CASE statements.
Action	Delete the command statement between SELECT and CASE statements.

5.52 : Command doesn't exist

Code : &H0534

Meaning/Cause	Line does not have a command statement.
Action	1. Add a command statement. 2. Delete the line that does not have a command statement.

5.53 : Compile failure

Code : &H0535

Meaning/Cause	Error occurred in software.
Action	Contact your distributor with details of the problem.

5.54 : ELSEIF without IF

Code : &H0536

Meaning/Cause	There is no IF statement corresponding to ELSEIF statement.
Action	1. Delete the ELSEIF statement. 2. Add an IF statement corresponding to the ELSEIF statement.

5.55 : ELSEIF without ENDIF

Code : &H0537

Meaning/Cause	There is no ENDIF statement corresponding to ELSEIF statement.
Action	1. Delete the ELSEIF statement. 2. Add an ENDIF statement corresponding to the ELSEIF statement.

[6] Robot language execution errors

6.1 : Illegal command

Code : &H0601

Meaning/Cause	Execution of a non-supported or non-executable command was attempted.
Action	Change to a command that can be executed.

6.2 : Illegal function call

Code : &H0602

Meaning/Cause	The expression "ON <expression> GOTO"/"ON <expression> GOSUB" command was a negative value.
Action	Change <expression> to a positive value.

6.3 : Division by 0

Code : &H0603

Meaning/Cause	A command to divide by 0 (÷ 0) was attempted.
Action	Change from the divide by 0 command.

6.4 : Point doesn't exist

Code : &H0604

Meaning/Cause	Assignment/movement/reference to an undefined point was attempted.
Action	Define the point.

6.5 : Coordinate type error

Code : &H0605

Meaning/Cause	a. Arithmetic operations of joint coordinate point data and Cartesian coordinate point data were attempted. b. Joint coordinate system and Cartesian coordinate system were mixed together within the MOVE C, command point data. c. Point data in PMOVE command was not specified in Cartesian coordinates.
Action	1. Change to same coordinate system. 2. Change to Cartesian coordinate system.

6.6 : Subscript out of range

Code : &H0606

Meaning/Cause	A subscript of an array variable has exceeded the range defined in DIM statement.
Action	Change the subscript of array variable to within the defined range.

6.7 : RETURN without GOSUB

Code : &H0607

Meaning/Cause	RETURN command was executed without executing the GOSUB command.
Action	Confirm execution of GOSUB command.

6.8 : END SUB without CALL

Code : &H0608

Meaning/Cause	END SUB command was executed without executing CALL command.
Action	Confirm execution of SUB command.

6.9 : EXIT SUB without CALL

Code : &H0609

Meaning/Cause	EXIT SUB command was executed without executing CALL command.
Action	Confirm execution of SUB command.

6.10 : SUSPEND without START

Code : &H060A

Meaning/Cause	SUSPEND command was executed for a task not executed by START command.
Action	Confirm execution of START command.

6.11 : CUT without START

Code : &H060B

Meaning/Cause	CUT command was executed for a task not executed by START command.
Action	Confirm execution of START command.

6.12 : RESTART without START

Code : &H060C

Meaning/Cause	RESTART command was executed for a task not executed by START command.
Action	Confirm execution of START command.

6.13 : RESTART without SUSPEND

Code : &H060D

Meaning/Cause	RESTART command was executed for a task not executed by SUSPEND command.
Action	Confirm execution of SUSPEND command.

6.14 : Task number error

Code : &H060E

Meaning/Cause	a. Task number is outside the range 2 to 8. b. START, CUT, SUSPEND or RESTART command was executed for task 1 (main task). c. START, CUT, SUSPEND or RESTART command was executed for its own task.
Action	1. Change to a correct task number. 2. Delete task command for task 1. 3. Delete command for its own task.

6.15 : Task running

Code : &H060F

Meaning/Cause	START command was executed for a task currently in operation.
Action	Delete START command.

6.16 : Task suspending

Code : &H0610

Meaning/Cause	START or SUSPEND command was executed for a task in pause (suspend) condition.
Action	Delete START or SUSPEND command.

6.17 : Illegal command in error routine

Code : &H0611

Meaning/Cause	Command which could not be executed was attempted within an error processing routine.
Action	Delete the command which could not be executed.

6.18 : EXIT FOR without FOR

Code : &H0612

Meaning/Cause	EXIT FOR command was executed without executing FOR command.
Action	Confirm execution of FOR command.

6.19 : SUB without CALL

Code : &H0613

Meaning/Cause	SUB command was executed without executing CALL command.
Action	Confirm execution of CALL command.

6.20 : Not execute CALL

Code : &H0614

Meaning/Cause	CALL command was not executed.
Action	Confirm execution of CALL command.

6.21 : Same point exists

Code : &H0615

Meaning/Cause	a. Same points exist for 1 of 3 points of an MOVE C command. b. Same points are consecutively on the path of PATH motion.
Action	1. Change the MOVE C command to 3 different points. 2. Make changes so that the same points are not consecutively on the path of PATH motion.

6.22 : 3 points on line

Code : &H0616

Meaning/Cause	3 points of an MOVE C command were placed on a straight line.
Action	Change the 3 different points of the MOVE C command so they are not on the same straight line.

6.23 : Circular arc radius too small

Code : &H0617

Meaning/Cause	MOVE C command radius is less than 1mm.
Action	Change MOVE C command to 1mm or more for circular arc radius.

6.24 : Circular arc radius too large

Code : &H0618

Meaning/Cause	MOVE C command radius exceeded 5000mm (5 meters).
Action	Change MOVE C command to within 5000mm (5 meters) for circular arc radius.

6.25 : Too low speed

Code : &H0619

Meaning/Cause	Specified speed was too low so movement time exceeded 300 seconds. Maximum movement time is 300 seconds.
Action	Increase the specified speed.

6.26 : No sufficient memory for OUT

Code : &H061A

Meaning/Cause	Failed to run an OUT command due to insufficient memory caused by multiple OUT commands that were run in succession.
Action	Check the number of OUT commands. The maximum number of OUT commands that can be run in parallel is 16.

6.27 : PATH without SET

Code : &H061B

Meaning/Cause	Any of PATH L, PATH C and PATH END was executed without executing PATH SET.
Action	First execute PATH SET when setting a path.

6.28 : PATH without END

Code : &H061C

Meaning/Cause	PATH START was executed without executing PATH END.
Action	Execute PATH END to end the path setting and then execute PATH START.

6.29 : No PATH data

Code : &H061D

Meaning/Cause	No path is set for PATH motion.
Action	Set a path with PATH L and PATH C. The previously set path will be lost in the following cases: • When PATH SET is executed. • When program is changed. • When program is reset. • When controller power is turned off.

6.30 : Too many PATH data

Code : &H061E

Meaning/Cause	The number of PATH motion paths has exceeded 300.
Action	Reduce the number of PATH motion paths to 300 or less in total of straight lines and circular arcs.

6.31 : Not PATH start position

Code : &H061F

Meaning/Cause	Robot's current position is not the start position of PATH motion.
Action	Move the robot to the start position specified with PATH SET and then execute PATH START.

6.32 : PATH execute error

Code : &H0620

Meaning/Cause	Cannot execute PATH motion. a. Acceleration zone distance is too short. b. Speed is too high in the position where the direction changes.
Action	1. Reduce the speed setting. 2. Lengthen the straight line or circular arc distance containing acceleration/deceleration. 3. Make setting so that the direction at the connection point of straight lines does not change greatly.

6.33 : ABS of MARK incomplete

Code : &H0621

Meaning/Cause	Absolute reset was attempted with an ABSRST statement or dedicated input while absolute reset on an axis whose return-to-origin method is set to "Mark" is incomplete.
Action	First perform absolute reset on the axes whose return-to-origin method is set to "Mark".

6.34 : MARK method is not allowed

Code : &H0622

Meaning/Cause	Return-to-origin was attempted with an ORIGIN statement or dedicated input while the return-to-origin method for an incremental type axis or semi-absolute type axis is set to "Mark".
Action	Return-to-origin on the incremental type axis or semi-absolute type axis cannot be performed by the mark method. Change the return-to-origin method.

6.35 : Expression value error

Code : &H0623

Meaning/Cause	The expression value is other than -1 and 0 even though conditional expression is a numeric expression.
Action	1. Set the expression value correctly. 2. Change the "TRUE condition" parameter setting.

[9] Memory errors

9.1 : Program destroyed

Code : &H0901

Meaning/Cause	a. Part or all of the program data has been destroyed. b. This error message is sometimes issued due to a major error or the power being turned off during rewrite of program data.
Action	1. Delete that program during selection. 2. Initialize the program data.

9.2 : Point data destroyed

Code : &H0902

Meaning/Cause	a. Part or all of the point data has been destroyed. b. This error message is sometimes issued due to a major error or the power being turned off during rewrite of point data.
Action	Initialize the point data.

9.3 : Memory destroyed

Code : &H0903

Meaning/Cause	Error or malfunction occurred in the memory.
Action	Initialize memory.

9.4 : Parameter destroyed

Code : &H0904

Meaning/Cause	Part or all of the parameter data has been destroyed.
Action	Initialize the parameter data.

9.5 : Illegal object code

Code : &H0905

Meaning/Cause	An object program has been destroyed.
Action	Compile and make an object program.

9.6 : Shift data destroyed

Code : &H0906

Meaning/Cause	Part or all of the shift data has been destroyed.
Action	Initialize the shift data.

9.7 : Hand data destroyed

Code : &H0907

Meaning/Cause	Part or all of the hand data has been destroyed.
Action	Initialize the hand data.

9.8 : POS.OUT data destroyed

Code : &H0908

Meaning/Cause	Part or all of the POS.OUT data was destroyed.
Action	Initialize the POS.OUT data.

9.9 : Pallet data destroyed

Code : &H0909

Meaning/Cause	Part or all of the pallet definition data was destroyed.
Action	Initialize the pallet definition data.

9.31 : Memory full

Code : &H091F

Meaning/Cause	No available space in the program/point data area.
Action	Delete unnecessary programs/points.

9.32 : Object memory full

Code : &H0920

Meaning/Cause	Object program size exceeded the upper limit.
Action	Compress the source program size, so that the object program size is smaller.

9.33 : Sys. generation destroyed

Code : &H0921

Meaning/Cause	Part or all of the system generation data has been destroyed.
Action	Remake the system generation data correctly.

9.34 : Sys. generation mismatch

Code : &H0922

Meaning/Cause	Mistake made in specifying the robot type/axis number of system generation data.
Action	Redo the system generation correctly.

9.35 : Program too big

Code : &H0923

Meaning/Cause	Source program size exceeded the permissible size.
Action	Compress the source program size.

9.36 : Task data destroyed

Code : &H0924

Meaning/Cause	Part or all of the data used in a task has been destroyed.
Action	Reset the program.

9.37 : Object program destroyed

Code : &H0925

Meaning/Cause	Part or all of an object program has been destroyed.
Action	Make the object program again.

9.38 : Sequence object memory full

Code : &H0926

Meaning/Cause	Sequence object program exceeded its memory capacity.
Action	Compress the source size of sequence program, so that the object program size is reduced.

9.39 : Sequence object destroyed

Code : &H0927

Meaning/Cause	Part or all of the sequence object program has been destroyed.
Action	Make the sequence object program again.

9.40 : Cannot found sequence object

Code : &H0928

Meaning/Cause	No sequence object program.
Action	Make the sequence object program.

9.41 : Local variable memory full

Code : &H0929

Meaning/Cause	Number of local variables defined within subroutine has exceeded upper limit.
Action	1. Reduce number of local variables defined in the subroutine. 2. Use the global variable.

9.50 : Indiv. origin data destroyed

Code : &H0932

Meaning/Cause	Part or all of the definition data of the individual axis origin return function by DI/SI has been destroyed. The individual axis origin return definition data by DI/SI is initialized.
Action	—

9.51 : Gripper origin data destroyed

Code : &H0933

Meaning/Cause	Part or all of the data saved after completion of the return-to-origin of the electric gripper was destroyed.
Action	Perform the return-to-origin of the electric gripper.

[10] System setting or hardware errors

10.1 : Robot disconnected

Code : &H0A01

Meaning/Cause	Axis control was attempted with "no axis" specified for all axes of system generation.
Action	Re-perform the system generation.

10.3 : D.unit disconnected

Code : &H0A03

Meaning/Cause	Manual movement was attempted on the axis that is not specified.
Action	Do not perform any axis-related operation.

10.6 : DRIVER.unit version mismatch

Code : &H0A06

Meaning/Cause	Driver unit version does not match the CPU unit.
Action	Make sure the CPU unit and driver unit versions match each other.

10.7 : CPU.unit version mismatch

Code : &H0A07

Meaning/Cause	CPU unit version does not match the CPU.
Action	Make sure the CPU unit and driver unit versions match each other.

10.8 : Cannot set auxiliary axis

Code : &H0A08

Meaning/Cause	Setting of axis that cannot be set as an auxiliary axis was attempted. The following axes cannot be set as an auxiliary axis. • SCARA type robot axes
Action	1. Do not set an auxiliary axis. 2. Change the axis setting.

10.9 : Cannot set no axis

Code : &H0A09

Meaning/Cause	A no-axis setting was attempted on an axis which cannot accept it.
Action	1. Do not make a no-axis setting. 2. Change the axis setting.

10.10 : Cannot change axis

Code : &H0A0A

Meaning/Cause	Changing of an axis whose setting cannot be changed was attempted. The following axes cannot be changed. • X and Y axes on SCARA type robots
Action	1. Do not change that axis. 2. Change a different axis.

10.13 : Cannot set Dualdrive

Code : &H0A0D

Meaning/Cause	A dual drive setting was attempted on an axis that cannot be set to dual drive.
Action	1. Do not set to dual drive. 2. Change the axis setting.

10.14 : Undefined parameter found

Code : &H0A0E

Meaning/Cause	a. Undefined, wrong parameter data was written because controller data from different controller version was used b. Parameter name is wrong.
Action	1. Write the correct parameter data. 2. Enter the parameter name correctly. 3. Set the "Skip undefined parameters" parameter to "VALID".

10.15 : Cannot set YC-Link

Code : &H0A0F

Meaning/Cause	An attempt was made to set a YC-Link for an axis that is set to dual drive.
Action	1. Do not set the YC-Link. 2. Change the axis setting.

10.17 : Cannot set Gripper

Code : &H0A11

Meaning/Cause	a. It was attempted to set the gripper for the YC-Link set axis. b. It was attempted to set the gripper for the dual drive set axis. c. It was attempted to set the gripper for an axis number exceeding the number of boards installed.
Action	1. Do not set the gripper for such axis. 2. Change the setting axis.

10.18 : Cannot change auxiliary axis

Code : &H0A12

Meaning/Cause	It was attempted to reset the auxiliary axis setting of the gripper set axis.
Action	Do not reset the auxiliary axis setting.

10.19 : CPU soft version mismatch

Code : &H0A13

Meaning/Cause	Combination of CPU board and software is wrong.
Action	Install the software that supports the CPU board.

10.21 : Sys. backup battery low voltage

Code : &H0A15

Dedicated output : DO03a (Alarm) and the port set by the "Battery alarm output port (DO & SO)" parameter turn on.

Meaning/Cause	a. System backup battery voltage is low. b. System backup battery is disconnected from CPU board.
Action	1. Replace system backup battery. 2. Connect system backup battery securely to CPU board.

10.22 : STD.DIO DC24V power low

Code : &H0A16

Meaning/Cause	a. 24VDC not supplied to STD.DIO connector. b. Drop in 24VDC being supplied for STD.DIO. c. STD.DIO connector is not connected.
Action	1. Supply 24VDC to STD.DIO connector. 2. Check if line to STD.DIO connector is shorted, broken or miswired. 3. Check if load connected to STD.DIO is beyond capacity of 24VDC supply. 4. If STD.DIO is not used, make the "Watch on STD.DIO 24V DC" parameter invalid in SYSTEM>PARAM>OTHER mode.

10.26 : Gripper software version mismatch

Code : &H0A1A

Meaning/Cause	Software for gripper option board is incorrect.
Action	Use the same software version for the two CPUs on the gripper option board.

[12] I/O and option board errors

12.1 : Emg.stop on

Code : &H0C01

Dedicated output : *3

Meaning/Cause	a. Programming box emergency stop button was pressed. b. Emergency stop terminals on SAFETY connector are open (emergency stop status). c. Programming box or terminator are not connected to PB connector. d. SAFETY connector is not connected.
Action	1. Release the programming box emergency stop button. 2. Close the emergency stop terminals on SAFETY connector. 3. Connect programming box or terminator to PB connector. 4. Attach the SAFETY connector.

12.2 : Interlock on

Code : &H0C02

Meaning/Cause	a. Program was executed or moving of axis attempted while interlock signal was still input. b. Interlock signal turned ON during execution of program or axis movement. c. 24VDC not supplied to STD.DIO connector. d. STD.DIO connector is not connected.
Action	1. Cancel the interlock signal, and execute program or move axis. 2. Supply 24VDC to STD.DIO connector. 3. Connect the STD.DIO connector. 4. Disable the "Watch on STD.DIO 24VDC" parameter when not using STD.DIO.

12.3 : Arm locked

Code : &H0C03

Meaning/Cause	Movement of an arm was attempted while the arm lock variable LO was ON.
Action	Clear the arm lock variable LO.

12.11 : CC-Link communication error

Code : &H0C0B

Meaning/Cause	a. Error in cable for CC-Link system. b. Wrong communication setting for CC-Link system. c. Master station sequencer power is turned off, has stopped operating or is damaged. d. Breakdown in CC-Link compatible unit.
Action	1. Check for a break, misconnection or wiring error in CC-Link cable, and check the specifications (cable length, etc.). 2. Check the station No. and communication baud rate settings. 3. Check if the master station sequencer is operating correctly. 4. Replace the corresponding CC-Link compatible unit.

12.12 : CC-Link overtime error

Code : &H0C0C

Meaning/Cause	1. Error in CC-Link system communications due to noise pickup, etc. 2. Master station sequencer (PLC) power is turned off or has stopped operating.
Action	1. Implement countermeasures to protect the CC-Link system cable and controller from noise. 2. Check if the master station sequencer (PLC) is operating correctly.

12.16 : DeviceNet link error

Code : &H0C10

Meaning/Cause	a. Error in cable for DeviceNet system. b. The DeviceNet system's MacID or communication speed setting is incorrect. c. No power supplied for communication. d. The master PLC's power is turned off, has stopped operating, is not operating correctly or is damaged. e. Breakdown in DeviceNet compatible unit.
Action	1. Check for a break, misconnection or wiring error in DeviceNet cable, and check the specifications (cable length, etc.). 2. Check the MacID and communication speed settings. 3. Check whether the communication power is supplied. 4. Check whether the master PLC is operating correctly. 5. Replace the DeviceNet compatible unit.

12.17 : DeviceNet hardware error

Code : &H0C11

Meaning/Cause	Breakdown in DeviceNet compatible unit.
Action	Replace the DeviceNet compatible unit.

12.18 : Incorrect DeviceNet setting

Code : &H0C12

Meaning/Cause	The MacID or communication speed setting is incorrect.
Action	Check the MacID and communication speed settings.

12.19 : DeviceNet link error(Explicit)

Code : &H0C13

Meaning/Cause	The DeviceNet board was reset by an Explicit message request (Reset request to Identity Obj) from the client (master PLC).
Action	

12.21 : PROFIBUS link error

Code : &H0C15

Meaning/Cause	a. Error in cable for PROFIBUS system. b. The PROFIBUS system's station address setting is incorrect. c. The master station PLC power is turned off, or the PLC has stopped operating or is not operating correctly, or is broken. d. Breakdown in PROFIBUS compatible unit.
Action	1. Check for a break, misconnection or wiring error in PROFIBUS cable, and check the specifications (cable length, etc.). 2. Check the station address settings. 3. Check whether the master station PLC is operating correctly. 4. Check the hardware configuration settings. 5. Replace the PROFIBUS compatible unit.

12.22 : PROFIBUS hardware error

Code : &H0C16

Meaning/Cause	Breakdown in PROFIBUS compatible unit.
Action	Replace the PROFIBUS compatible unit.

12.31 : DI DC24V disconnected

Code : &H0C1F

Meaning/Cause	a. 24VDC not being supplied to DI section of OPT.DIO unit. b. Drop in 24VDC supply voltage to DI section of OPT.DIO unit. c. OPT.DIO connector is not connected.
Action	1. Supply 24VDC to DI section of OPT.DIO. 2. Check for short, breakage or wiring error in OPT.DIO connector. 3. Check if a sufficient 24VDC is supplied to DI section of OPT.DIO unit.

12.32 : DO1 DC24V disconnected

Code : &H0C20

Meaning/Cause	a. 24VDC not being supplied to DO1 section of OPT.DIO unit. b. Drop in 24VDC supply voltage to DO1 section of OPT.DIO unit. c. OPT.DIO connector is not connected.
Action	1. Supply 24VDC to DO1section of OPT.DIO unit. 2. Check for short, breakage or wiring error in OPT.DIO connector. 3. Check if load connected to DO1 section of OPT.DIO unit is too large for the 24VDC supply to handle.

12.33 : DO2 DC24V disconnected

Code : &H0C21

Meaning/Cause	a. 24VDC not being supplied to DO2 section of OPT.DIO unit. b. Drop in 24VDC supply voltage to DO2 section of OPT.DIO unit. c. OPT.DIO connector is not connected.
Action	1. Supply 24VDC to DO2 section of OPT.DIO unit. 2. Check for short, breakage or wiring error in OPT.DIO connector. 3. Check if load connected to DO2 section of OPT.DIO unit is too large for the 24VDC supply to handle.

12.34 : POS.OUT Point not exist

Code : &H0C22

Meaning/Cause	Comparison point data does not exist.
Action	Set comparison point data correctly.

12.35 : POS.OUT Point unit error

Code : &H0C23

Meaning/Cause	Comparison points 1 and 2 do not use the same unit system.
Action	Change them to the same unit system.

12.41 : EtherNet link error

Code : &H0C29

Meaning/Cause	TELENET is disconnected. a. The cable is broken or disconnected. b. Communicating with a client was off for more than the time specified by the "7. timeout [min]" parameter for EtherNet. c. Logout was attempted while the 11. logout" parameter for EtherNet is set to "STOP". d. No response for a keep-alive packet from the client.
Action	1. Connect the cable or connector securely. 2. Communicate with a client at least once within the time specified by the "7. timeout [min]" parameter, or set the parameter to "0" to disable the timeout function. 3. Set the "11. logout" parameter to "CONT." to avoid errors during logout. 4. Check whether the client is responding to the keep-alive packet, or set the "12. keep-alive [sec]" parameter to "0" to stop the keep-alive packet from being sent out.

12.42 : EtherNet hardware error

Code : &H0C2A

Meaning/Cause	Breakdown in EtherNet compatible unit.
Action	Replace the EtherNet compatible unit.

12.51 : EtherNet/IP link error

Code : &H0C33

Meaning/Cause	An error occurred at the EtherNet/IP option board.
Action	Contact your distributor with details of the problem.

12.70 : Incorrect option setting

Code : &H0C46

Meaning/Cause	a. Error in DIP switch setting on option unit. b. Mismatched option units have been installed. c. Cannot identify the installed option unit.
Action	1. Check the DIP switch settings on the option unit. 2. Install the correct unit. 3. Replace the option unit. 4. Replace the controller.

12.75 : Illegal remote command

Code : &H0C4B

Meaning/Cause	The remote command or command data is incorrect.
Action	Check the remote command or command data.

12.80 : Incorrect Indiv. Origin setting

Code : &H0C50

Meaning/Cause	a. 2 or more axes were specified for the "Axes selection port (DI & SI)" parameter. b. No axis was specified for the "Axes selection port (DI & SI)" parameter. c. Axis which is not present was specified for the "Axes selection port (DI & SI)" parameter.
Action	1. Specify only 1 axis. 2. Specify an appropriate axis. 3. Specify an axis which is present.

12.85 : Bad Gripper status setting

Code : &H0C55

Meaning/Cause	The same port number was set for the other parameters "G1 status output (DO & SO)" and "G2 status output (DO & SO)".
Action	Set different port numbers for the other parameters "G1 status output (DO & SO)" and "G2 status output (DO & SO)".

[13] Programming box errors

13.1 : PB communication error

Code : &H0D01

Meaning/Cause	Error occurred in communication with programming box.
Action	1. Install the programming box correctly. 2. Replace the programming box. 3. Replace the controller.

13.2 : PB parity error

Code : &H0D02

Meaning/Cause	Abnormal data was entered in communication with programming box.
Action	1. Install the programming box correctly. 2. Install the programming box in a good operating environment. (Do not install near sources of noise.)

13.11 : PB version mismatch

Code : &H0D0B

Meaning/Cause	Programming box version does not match the controller, and connection refused.
Action	Use an programming box version that matches the controller.

13.12 : PB system error

Code : &H0D0C

Meaning/Cause	Error occurred in communication with programming box.
Action	1. Replace the programming box. 2. Replace the controller.

[14] RS-232C communication errors

14.1 : Communication error

Code : &H0E01

Meaning/Cause	a. During external communication via the RS-232C, an error occurred. b. An overrun error or framing error occurred via the RS-232C. c. Power supply for external device turned on or off after connecting communication cable with the external device.
Action	1. Change to a correct system environment for RS-232C. (Do not install near sources of noise.) 2. Replace the communications cable. 3. Check the communication parameter settings.

14.2 : Parity error

Code : &H0E02

Meaning/Cause	During external communication via the RS-232C, an error occurred.
Action	Check the communication parameter settings.

14.11 : Receive buffer overflow

Code : &H0E0B

Meaning/Cause	Communication receive buffer exceeded permissible capacity.
Action	1. Delay the communication parameter speed (baud rate). 2. Change communication parameter so that flow control is enabled.

14.12 : CMU is not ready

Code : &H0E0C

Meaning/Cause	Could not sent data from controller because receive prohibit status of other party continued for more than 10 seconds.
Action	1. Replace the communications cable. 2. Check that flow control is normal in software processing for other party.

14.20 : Too many Command characters

Code : &H0E14

Meaning/Cause	a. Online command character string in 1 line exceeded 80 letters. b. Command statement created with a remote command exceeded 80 letters.
Action	1. Limit number of characters in 1 line for an online command to 80 letters or less. 2. Check the command data of the remote command.

14.21 : No return code(C/R)

Code : &H0E15

Meaning/Cause	a. Character string in 1 line exceeded 75 letters. b. C/R code (0Dh) was not added at end of line.
Action	1. Limit number of characters in 1 line to 75 letters. 2. Add a C/R code at the end of a single line.

14.22 : No start code(@)

Code : &H0E16

Meaning/Cause	Starting code "@" was not added at beginning of single line in an online command.
Action	Add starting code "@" at the beginning of online command.

14.23 : Illegal command,Operating

Code : &H0E17

Meaning/Cause	During data editing, an online command was executed.
Action	After completing data edit, execute an online command.

14.24 : Illegal command,Running

Code : &H0E18

Meaning/Cause	During program run, a non-executable online command was attempted.
Action	After stopping the program, execute the online system command which could not previously be executed.

14.25 : Illegal command in this mode

Code : &H0E19

Meaning/Cause	Cannot execute the specified online command in the current mode.
Action	1. Stop the online command. 2. Change the mode.

14.26 : Illegal command,SERVICE mode

Code : &H0E1A

Meaning/Cause	Unable to execute since operation is in SERVICE mode.
Action	1. Cancel SERVICE mode. 2. Change the exclusive control setting so it can be used in SERVICE mode.

14.31 : Illegal port type

Code : &H0E1F

Meaning/Cause	Communication port not specified.
Action	Contact your distributor with details on this problem.

[15] Memory card errors

15.1 : Invalid file attribute

Code : &H0F01

Meaning/Cause	a. Directory was accessed. b. Read/write protected file was accessed.
Action	1. Change to a file which can be accessed. 2. Change to a file allowing read/write.

15.2 : Read only file

Code : &H0F02

Meaning/Cause	Writing was attempted on a write protected file.
Action	1. Change to another file. 2. Change to a file not write protected.

15.3 : Same file name already exists

Code : &H0F03

Meaning/Cause	File name change was attempted but the same file name already exists.
Action	Change it to an unused file name.

15.4 : File doesn't exist

Code : &H0F04

Meaning/Cause	Loading of file was attempted but file name does not exist.
Action	Change to a file name that currently exists.

15.11 : Directory full

Code : &H0F0B

Meaning/Cause	The file storage capacity was exceeded.
Action	1. Use a new memory card. 2. Change the directory to save. 3. Delete unnecessary files.

15.12 : Disk full

Code : &H0F0C

Meaning/Cause	Write failed. No space is available on memory card. (File contents cannot be guaranteed.)
Action	1. Use a new memory card. 2. Delete unnecessary files.

15.13 : Unformatted media

Code : &H0F0D

Meaning/Cause	a. Memory card was not formatted. b. Wrong memory card format.
Action	1. Format correctly. 2. Replace memory card backup battery.

15.14 : Media protected

Code : &H0F0E

Meaning/Cause	Cannot write. Memory card has been set to write protect.
Action	1. Change to allow writing. 2. Use another memory card.

15.15 : Media type mismatch

Code : &H0F0F

Meaning/Cause	Memory card is unusable.
Action	Replace the memory card.

15.16 : Media data destroyed

Code : &H0F10

Meaning/Cause	All or part of data stored on memory card is damaged.
Action	1. Format the memory card. 2. Overwrite the damaged portion with new data. 3. Replace the memory card backup battery. 4. Replace the memory card.

15.21 : Cannot find media

Code : &H0F15

Meaning/Cause	Memory card not inserted correctly in slot.
Action	Insert the memory card correctly unit.

15.23 : Aborted

Code : &H0F17

Meaning/Cause	STOP key was pressed during reading/writing from or into memory card, and the operation halted.
Action	—

15.24 : Media hardware error

Code : &H0F18

Meaning/Cause	a. Memory card is defective b. Error occurred in controller.
Action	1. Replace the memory card. 2. Replace the controller.

15.27 : Data read error

Code : &H0F1B

Meaning/Cause	Failed to load file.
Action	1. Try to reload the file. 2. Replace the memory card. 3. Replace the controller.

15.28 : Data write error

Code : &H0F1C

Meaning/Cause	Failed to write file.
Action	1. Try rewriting the file. 2. Replace the memory card. 3. Replace the controller.

15.29 : Timeout error

Code : &H0F1D

Meaning/Cause	Failed to load/write file.
Action	1. Try to reload/rewrite the file. 2. Replace the memory card. 3. Replace the controller.

[17] Motor control errors

17.1 : System error (DRIVER)

Code : &H1101

Dedicated output : *2

Meaning/Cause	Error occurred in software for driver unit.
Action	Contact your distributor with details of the problem.

17.2 : Watchdog error (DRIVER)

Code : &H1102

Dedicated output : *2

Meaning/Cause	a. Malfunction occurred in driver unit due to external noise. b. Controller is defective.
Action	1. Turn the power on again. 2. Replace the controller.

17.3 : Over current

Code : &H1103

Dedicated output : *2

Meaning/Cause	a. Short in motor cable. b. Malfunction occurred in motor.
Action	1. Replace the motor cable. 2. Replace the motor.

17.4 : Over load

Code : &H1104
Dedicated output : *2

Meaning/Cause	a. Robot drive section mechanically locked. b. Motor current exceeded its rated value due to a motor overload. c. Motor acceleration is excessive. d. System generation setting is wrong. e. Motor cable wiring is broken or wiring is incorrect. f. Electromagnetic brake for holding vertical axis is defective. g. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis. h. SAFETY connector is not used correctly.
Action	1. Perform robot service and maintenance. 2. Decrease load on motor. 3. Lower the motor acceleration. 4. Redo the system generation. 5. Wire the motor cable correctly. 6. Replace the motor cable. 7. Replace the magnetic brake for holding the vertical axis. 8. Replace the ROB I/O cable. 9. Do not use 24VDC from SAFETY connector as power source for external loads.

17.5 : Over heat

Code : &H1105
Dedicated output : *2

Meaning/Cause	Temperature in power module of driver unit exceeded 80°C.
Action	1. Improve the equipment environment. 2. Check that cooling fan is working correctly. 3. Lower the robot duty cycle and decrease the amount of heat generated. 4. Replace the controller.

17.6 : P.E.counter overflow

Code : &H1106
Dedicated output : *2

Meaning/Cause	a. Robot drive section mechanically locked. b. Motor acceleration is excessive. c. System generation setting is wrong. d. Motor cable wiring is broken or wiring is incorrect. e. Electromagnetic brake for holding vertical axis is defective. f. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis. g. SAFETY connector is not used correctly.
Action	1. Perform robot service and maintenance. 2. Lower the motor acceleration. 3. Redo the system generation. 4. Wire the motor cable correctly. 5. Replace the motor cable. 6. Replace the magnetic brake for holding the vertical axis. 7. Replace the ROB I/O cable. 8. Do not use 24VDC from SAFETY connector as power source for driving external loads.

17.9 : Command error

Code : &H1109
Dedicated output : *2

Meaning/Cause	Driver cannot identify commands from CPU.
Action	Check the versions of the CPU unit and driver unit.

17.10 : Feedback error 1

Code : &H110A

Dedicated output : *2

Meaning/Cause	Wiring of motor cable or ROB I/O cable is incorrect.
Action	1. Rewire the motor cable or ROB I/O cable correctly. 2. Replace the motor cable or ROB I/O cable.

17.11 : Feedback error 2

Code : &H110B

Dedicated output : *2

Meaning/Cause	Motor cable is broken.
Action	Replace the motor cable or encoder cable.

17.16 : Over velocity 1

Code : &H1110

Dedicated output : *2

Meaning/Cause	Axis movement speed exceeded the limit during linear interpolation, circular interpolation or manual orthogonal movement.
Action	1. Reduce the acceleration. 2. Reduce the speed.

17.17 : Mode error

Code : &H1111

Dedicated output : *2

Meaning/Cause	Driver unit is in abnormal control mode status.
Action	Contact your distributor with details on the problem.

17.18 : DPRAM data error

Code : &H1112

Dedicated output : *2

Meaning/Cause	2 tries at loading the dual port RAM failed.
Action	Contact your distributor with details on the problem.

17.19 : Coord. value error

Code : &H1113

Dedicated output : *2

Meaning/Cause	Error occurred during linear interpolation, circular interpolation or manual orthogonal movement.
Action	Contact your distributor with details on the problem.

17.20 : Motor type error

Code : &H1114

Meaning/Cause	A motor type unidentifiable by drive unit was selected.
Action	1. Redo the system generation. 2. Replace the controller.

17.21 : Bad origin sensor

Code : &H1115

Meaning/Cause	a. Origin sensor is defective. b. Origin sensor wiring is broken.
Action	1. Replace the origin sensor. 2. Replace the ROB I/O cable.

17.22 : Bad PZ

Code : &H1116

Meaning/Cause	a. Motor is defective. b. Resolver signal wire is broken.
Action	1. Replace the motor. 2. Replace the ROB I/O cable.

17.28 : Dual P.E.counter overflow

Code : &H111C

Meaning/Cause	On a dual-axis drive, the position differential between the main axis and sub axis is too large. a. Friction in the robot drive section is too large. b. Motor brake wiring is broken.
Action	1. Check the drive sections for assembled condition and lubrication to ensure smooth movement. 2. Check that the motor brake works properly.

17.30 : Bad position

Code : &H111E

Dedicated output : *2

Meaning/Cause	Cannot perform positioning.
Action	1. Turn the power off and then on again. 2. Replace the controller.

17.31 : Servo off

Code : &H111F

Meaning/Cause	Movement command was attempted in servo-off state.
Action	Change status to servo-on.

17.33 : Busy now

Code : &H1121

Dedicated output : *2

Meaning/Cause	a. Servo OFF command was attempted while the driver was stopped. b. Return-to-origin command was attempted before manual movement was complete.
Action	1. Turn off the power to the controller and then turn it back on. 2. Wait until the command has finished.

17.34 : Servo on failed

Code : &H1122

Meaning/Cause	a. Servo ON was attempted for each axis while motor power was off. b. Servo ON processing failed because the drive unit had been stopped.
Action	1. First turn on the motor power if servo ON for each axis was attempted. 2. Turn the power off and then on again.

17.35 : Axis weight over

Code : &H1123

Meaning/Cause	The weight (sum of work weight + axis weight) on a particular robot axis exceeded the maximum payload of that axis.
Action	1. Redo the system generation. 2. Select the axis weight parameter to a correct value.

17.39 : Servo off failed

Code : &H1127

Dedicated output : *2

Meaning/Cause	Servo OFF processing failed because the drive unit had been stopped.
Action	Turn the power off and then on again.

17.40 : Torque mode now

Code : &H1128

Meaning/Cause	Manual movement attempted while in torque mode.
Action	Cancel the torque mode.

17.42 : Cannot reset position

Code : &H112A

Meaning/Cause	a. The ABSINIT statement was executed at a position where a "current position reset" is not possible. b. The ABSINIT2 statement was executed at a position where a "current position reset" is not possible.
Action	1. Execute the ABSINIT statement after moving to a position where a "current position reset" is possible. 2. Execute the ABSINIT2 statement after moving to a position where a "current position reset" is possible.

17.73 : Resolver wire breakage

Code : &H1149

Meaning/Cause	a. Resolver signal wire is broken. b. Motor malfunction occurred. c. Controller malfunction occurred.
Action	1. Replace the ROB I/O cable. 2. Replace the motor. 3. Replace the controller.

17.78 : Power module error

Code : &H114E

Meaning/Cause	a. Power module overheated. b. Power module/motor drew excessive current.
Action	Lighten the load on the robot.

17.81 : ABS.battery wire breakage

Code : &H1151

Meaning/Cause	a. Absolute battery cable is broken. b. Absolute battery cable is not connected. c. Drop in absolute battery voltage.
Action	1. Replace the absolute battery. 2. Connect the absolute battery. 3. Enable the "Incremental mode control" parameter for use in incremental mode.

17.82 : CS read error

Code : &H1152

Meaning/Cause	a. Readout check of resolver electrical angle information failed twice. b. Over-acceleration occurs due to collision, etc.
Action	1. Perform absolute reset or return-to-origin operation. 2. Replace the motor. 3. Replace the controller. 4. Change the operation pattern to avoid over-acceleration.

17.83 : Backup position data error 1

Code : &H1153

Meaning/Cause	Backup position information did not match the resolver angle information when robot position information was recalculated at controller startup.
Action	Perform absolute reset.

17.84 : Over velocity 2

Code : &H1154

Meaning/Cause	Movement speed is too high during power-off of the controller.
Action	Perform absolute reset.

17.85 : Backup position data error 2

Code : &H1155

Meaning/Cause	Failed to read out the robot position data during start-up of the controller.
Action	Perform absolute reset.

17.90 : DRIVE2 module type error

Code : &H115A

Meaning/Cause	Motor specifications do not match current sensor specifications.
Action	1. Replace the controller. 2. Redo the system generation.

17.91 : Cannot perform ABS.reset

Code : &H115B

Meaning/Cause	Absolute reset was attempted at a position where absolute reset cannot be performed.
Action	Move the axis to a position (machine reference from 44 to 56%) where absolute reset can be performed, and then try again.

17.92 : Resolver disconnected during power off

Code : &H115C

Meaning/Cause	a. Resolver signal line was disconnected or broken while power to the controller was cut off. (Same as when ROB I/O connector is removed.) b. The controller was restarted, after resolver signal line was disconnected while the power was on. (Same as when ROB I/O connector is removed.) (Even after turning off the power, the controller still knows that resolver signal line was disconnected while the power was on. This is displayed as an error when the controller is restarted.)
Action	Perform absolute reset.

17.93 : Position backup counter overflow

Code : &H115D

Meaning/Cause	Position information lost when motor speed (rotation) exceeded 4096 when controller power was cut off.
Action	1. Do not rotate motor more than necessary when the controller power is being cut off. 2. Perform absolute reset.

17.94 : ABS.battery low voltage

Code : &H115E

Dedicated output : When the absolute battery voltage becomes low, DO03a (Alarm) and the port set by the "Battery alarm output port (DO & SO)" parameter turn on.

Meaning/Cause	Battery for retaining absolute data is low or not installed.
Action	1. Replace battery. 2. Install battery.

17.99 : Pole Search Error

Code : &H1163

Meaning/Cause	Failed to detect the motor magnetic pole when the servo was turned on. a. Servo wire is broken or misconnected. b. Position sensor cable is miswired. c. Axis parameter setting related to motor control is wrong.
Action	1. Correct the motor wiring. 2. Check the position sensor cable wiring. 3. Correct the parameter setting.

17.111:Controller fan failed

Code : &H116F

Meaning/Cause	Power is not supplied to controller cooling fan. a. Open-circuit fault in controller cooling fan cable. b. Short-circuit of ROB I/O cable. c. Controller is at fault. Abnormal condition occurred in controller cooling fan. d. Controller cooling fan is at fault. e. Controller is at fault.
Action	1. Replace the controller cooling fan cable. 2. Replace the ROB I/O cable. 3. Replace the controller. 4. Replace the controller cooling fan. 5. Replace the controller.

[19] YC-Link related error

19.1 : OVER LOAD

Code : &H1301

Meaning/Cause	a. Motor current higher than rated current has flown due to excessive load on motor. b. Motor drive parts were mechanically locked. c. Electromagnetic brake failure or wire breakage. d. Robot number setting is incorrect.
Action	1. Reduce the load on the motor. Set the payload and acceleration to their optimal values. Lower the operation duty on the robot. 2. Check the conditions of the movable parts. Perform maintenance on the robot. 3. Replace the electromagnetic brake. 4. Set the correct robot number and initialize the parameters.

19.2 : OVER CURRENT

Code : &H1302

Meaning/Cause	a. Short-circuit, earth fault or wire breakage occurred in motor cable. b. Motor failure. c. Controller board is defective. d. Robot number setting is incorrect.
Action	1. Replace the motor cable. 2. Replace the motor. 3. Replace the controller. 4. Set the correct robot number and initialize the parameters.

19.3 : OVER HEAT

Code : &H1303

Meaning/Cause	a. Ambient temperature around the controller is above 40°C. b. Excessive load on motor. c. Cooling fan stopped working. d. Thermal sensor failed.
Action	1. Correct the ambient conditions so that temperature is below 40°C. 2. Lower the load on the motor. 3. Replace the controller.

19.4 : POWER DOWN

Code : &H1304

Meaning/Cause	a. AC power line voltage is less than 80V. b. Momentary power outage occurred.
Action	1. Use the correct AC line voltage. 2. Reset the alarm to resume operation.

19.5 : BATT.LOW-VOLTAGE

Code : &H1305

Meaning/Cause	a. Battery connection is incorrect. b. Battery voltage is lower than specified.
Action	1. Connect the battery correctly. 2. Replace the battery.

19.6 : 24V POWER OFF

Code : &H1306

Meaning/Cause	Internal 24V circuit failure. Controller board failed.
Action	Replace the controller.

19.7 : P.E. COUNTER OVER

Code : &H1307

Meaning/Cause	Deviation counter error.
Action	—

19.11 : SYSTEM FAULT

Code : &H130B

Meaning/Cause	a. Driver was not recognized correctly at power-on. b. External noise has disrupted software program. c. RS-232C receiving buffer has overflown.
Action	1. Replace the controller. 2. Check the environment for noise. 3. Select the XON/XOFF control with the host device.

19.12 : BAD ORG-SENSOR

Code : &H130C

Meaning/Cause	a. Origin sensor connection is incorrect. b. Origin sensor wire broke or sensor became defective. c. Origin sensor dog (target) is not properly adjusted.
Action	1. Connect the origin sensor correctly. 2. Replace the origin sensor. 3. Adjust the origin sensor dog correctly.

19.13 : BAD PZ

Code : &H130D

Meaning/Cause	a. Position detector failure. b. Phase Z detection error.
Action	1. Replace the motor or robot. 2. Connect the ROB I/O cable correctly. 3. Replace the ROB I/O cable.

19.14 : FEEDBACK ERROR 1

Code : &H130E

Meaning/Cause	a. Controller position detection circuit failed. b. Position detector (motor) failed.
Action	1. Replace the controller. 2. Replace the motor.

19.15 : FEEDBACK ERROR 2

Code : &H130F

Meaning/Cause	a. ROB I/O cable connection is incorrect. b. ROB I/O cable is broken.
Action	1. Connect the ROB I/O cable correctly. 2. Replace the ROB I/O cable.

19.16 : ABNORMAL VOLTAGE

Code : &H1310

Meaning/Cause	a. AC power line voltage is too high. b. Regenerative unit (RG1) connection is incorrect. c. Temperature of regenerative absorption resistance is too high (above 120°C). d. RGEN cable failed. e. Regenerative unit failed. f. Power supply voltage setting (200V/100V) is incorrect.
Action	1. Use the correct AC line voltage. 2. Connect the regenerative unit correctly. 3. Reduce the ambient temperature. Use the correct AC line voltage. Lower the operation duty on the robot. 4. Replace the RGEN cable. 5. Replace the regenerative unit. 6. Check the wiring on the input voltage select terminals.

19.17 : SYSTEM FAULT 2

Code : &H1311

Meaning/Cause	Controller board failed.
Action	Replace the controller.

19.18 : FEEDBACK ERROR 3

Code : &H1312

Meaning/Cause	Motor drive parts are mechanically locked.
Action	Check the conditions of the movable parts. Perform maintenance on the robot. Correctly adjust the Mechanical locking detect level (PRM142).

19.19 : SYSTEM FAULT 3

Code : &H1313

Meaning/Cause	a. External noise has disrupted software program. b. CPU failure or malfunction.
Action	1. Check the environment for noise. 2. Replace the controller.

19.21 : BAD NETWORK

Code : &H1315

Meaning/Cause	a. Poor connection of communication cable. b. Open-circuit fault of communication cable.
Action	1. Connect the communication cable securely. 2. Replace the communication cable.

19.23 : ABS.BAT.L-VOLTAGE

Code : &H1317

Meaning/Cause	Absolute battery voltage is less than 3.1V.
Action	Replace the absolute battery.

19.24 : ABS.DATA ERROR

Code : &H1318

Meaning/Cause	Absolute search for "semi-absolute" ended abnormally.
Action	1. Register the correct stroke length (PRM102). 2. Initialize the parameters.

19.26 : FEEDBACK ERROR 4

Code : &H131A

Meaning/Cause	a. Motor cable connection is incorrect. b. Motor cable broke or failed. c. Motor failed. d. Controller board failed.
Action	1. Connect the motor cable correctly. 2. Replace the motor cable. 3. Replace the motor. 4. Replace the controller.

19.27 : POLE SEARCH ERROR

Code : &H131B

Meaning/Cause	a. Motor cable connection is incorrect. b. Motor cable broke or failed. c. ROB I/O cable connection is incorrect. d. ROB I/O cable broke. e. Motor failed. f. Controller board failed. g. Robot number setting is incorrect.
Action	1. Connect the motor cable correctly. 2. Replace the motor cable. 3. Connect the ROB I/O cable correctly. 4. Replace the ROB I/O cable. 5. Replace the motor. 6. Replace the controller. 7. Set the correct robot number and initialize the parameters.

19.28 : COORD.VAL. ERROR

Code : &H131C

Meaning/Cause	a. Poor connection of communication cable. b. Open-circuit fault of communication cable. c. Data destruction due to external noise.
Action	1. Connect the communication cable securely. 2. Replace the communication cable. 3. Check the ambient conditions.

19.29 : NET DATA ERROR

Code : &H131D

Meaning/Cause	Data destruction due to external noise.
Action	Check the ambient conditions.

19.32 : 12V POWER OFF

Code : &H1320

Meaning/Cause	Internal 12V circuit failure. Controller board failed.
Action	Replace the controller.

19.33 : MAIN POWER OFF

Code : &H1321

Meaning/Cause	a. AC power line voltage is less than 100V (when 200V is selected). b. AC power line voltage is less than 40V (when 100V is selected). c. Power supply voltage setting (200V/100V) is incorrect. d. Controller failed.
Action	1. Use the correct AC line voltage. 2. Use the correct AC line voltage. 3. Check the wiring on the input voltage select terminals. 4. Replace the controller.

19.34 : LOW VOLTAGE

Code : &H1322

Meaning/Cause	a. AC line voltage is low. b. Power supply voltage setting (200V/100V) is incorrect.
Action	1. Use the correct AC line voltage. 2. Check the wiring on the input voltage select terminals.

19.35 : DRIVER DISCONNECT

Code : &H1323

Meaning/Cause	Driver board connection failure
Action	Replace the controller.

19.40 : ABS.OS ERROR

Code : &H1328

Meaning/Cause	—
Action	—

19.41 : ABS.RO ERROR

Code : &H1329

Meaning/Cause	ROB I/O cable broke during power-off.
Action	—

19.42 : ABS.RE ERROR

Code : &H132A

Meaning/Cause	ROB I/O cable broke during power-on.
Action	—

19.43 : ABS.OF ERROR

Code : &H132B

Meaning/Cause	—
Action	—

19.44 : ABS.ME ERROR

Code : &H132C

Meaning/Cause	—
Action	—

19.45 : ABS.BAT ERROR

Code : &H132D

Meaning/Cause	Absolute battery voltage is less than 2.5V.
Action	Replace the absolute battery.

[20] iVY system errors

20.0 : Vision not installed

Code : &H1400

Meaning/Cause	No robot vision function settings.
Action	Check to see if the iVY board is properly connected.

20.1 : Vision init. error

Code : &H1401

Meaning/Cause	Error occurred during iVY board initial processing.
Action	Contact your distributor with details of the problem.

20.2 : Vision control mode error

Code : &H1402

Meaning/Cause	Vision system robot language commands and parameter changes, etc., are not possible in the "Host PC" vision control mode.
Action	Switch to the "Controller" vision control mode.

20.3 : Vision camera disconnected

Code : &H1403

Meaning/Cause	Camera recognition problem.
Action	1. Check the camera cable connection. 2. Check the camera channel. 3. Check for severed/disconnected camera cable. 4. Check power supply wiring for the iVY board.

20.4 : Vision undefined error

Code : &H1404

Meaning/Cause	"Undefined" error occurred at iVY board.
Action	Contact your distributor with details of the problem.

20.5 : Vision not ready

Code : &H1405

Meaning/Cause	iVY board startup is in progress.
Action	Do not attempt operation until the iVY board's board status LED (green) changes from a "blinking" to "constant on" (not blinking) condition.

20.7 : Vision hardware error

Code : &H1407

Meaning/Cause	Hardware error occurred at the iVY board.
Action	Contact your distributor with details of the problem.

20.8 : Vision calibration error

Code : &H1408

Meaning/Cause	Error occurred during camera calibration.
Action	1. Check to see if fiducial marks have been registered. 2. Check to see if fiducial marks are being recognized properly. 3. Check the calibration settings.

20.9 : Vision calibration in prog.

Code : &H1409

Meaning/Cause	Switching to the "Host PC" vision control mode is not possible during camera calibration.
Action	Switch the mode after camera calibration is completed.

20.10 : Vision calibration not set

Code : &H140A

Meaning/Cause	Incorrect calibration number specified.
Action	1. Change the specified calibration number. 2. Perform a camera calibration setting operation.

20.11 : Vision calib. data type error

Code : &H140B

Meaning/Cause	Mismatch between calibration data and the robot configuration.
Action	1. Check the specified calibration number. 2. Specify the calibration setting operation again.

20.12 : Vision calib. data destroyed

Code : &H140C

Meaning/Cause	Calibration data error occurred.
Action	Contact your distributor with details of the problem.

20.13 : Vision no pattern data

Code : &H140D

Meaning/Cause	No model has been registered for the specified model number.
Action	1. Change the specified model number. 2. Register the model.

20.14 : Vision trigger timeout

Code : &H140E

Meaning/Cause	Trigger timeout occurred.
Action	1. Check the "Trigger timeout (9. Trigger timeout [sec]) setting in iVY board's parameter data. 2. Check the camera trigger input cable wiring and connection. 3. Check for severed/disconnected camera trigger input cable.

20.15 : Vision Disk full

Code : &H140F

Meaning/Cause	iVY board's disk is full.
Action	Read out image data and erase unnecessary data from the iVY board.

20.16 : Vision parameter error

Code : &H1410

Meaning/Cause	Incorrect parameter value specified.
Action	Change the specified parameter value.

20.17 : Vision search timeout

Code : &H1411

Meaning/Cause	Search ended due to timeout.
Action	Change the timeout setting for the specified model.

20.50 : V_Plus not installed

Code : &H1432

Meaning/Cause	No settings are made for the lighting control function and/or conveyor tracking function.
Action	Check whether the lighting control board and tracking board are correctly connected.

20.51 : V_Plus Watchdog error

Code : &H1433

Meaning/Cause	Lighting control board or tracking board operation is abnormal. Bits which should be reversed periodically are not being reversed due to a stopped clock or CPLD freeze, etc.
Action	Perform a restart power. If the restart fails to restore a normal condition, check the board connection condition and the board recognition at the programming box.

20.52 : V_Plus counter wire breakage

Code : &H1434

Meaning/Cause	Disconnected encoder input cable detected.
Action	Set unused encoder input channels to "INVALID". Verify that the cable connector is not disconnected or severed. Check to see if the encoder is operating normally.

20.53 : V_Plus Tracking error

Code : &H1435

Meaning/Cause	Tracking was attempted during tracking.
Action	Review the robot program and change it so that the CTMOVE statement will not be executed during tracking.

20.54 : V_Plus Not Tracking error

Code : &H1436

Meaning/Cause	A command that should be executed during tracking was executed while tracking is not in progress.
Action	Review the robot program and change it so that the command will be executed during tracking.

20.55 : V_Plus not have Z Axis error

Code : &H1437

Meaning/Cause	The CTDRIVE statement was executed for the robot with no Z-axis.
Action	Change the main robot setting to a robot with the third axis.

20.56 : V_Plus parameter error

Code : &H1438

Meaning/Cause	The lighting control board parameter and/or tracking board parameter are incorrect.
Action	Initialize the parameters and set them correctly.

20.57 : V_Plus calibration not set

Code : &H1439

Meaning/Cause	Conveyor calibration data is not set.
Action	Set the conveyor calibration data and re-execute calibration.

20.58 : V_Plus out of Tracking work area

Code : &H143A

Meaning/Cause	Tracking was attempted after the first point data in the position monitoring array has passed the work area.
Action	Use the CRMVQUE command to delete the data that indicates the first point data in the position monitoring array has passed the work area, and then review the robot program and change it so that the CTMOVE statement will be executed.

20.59 : V_Plus Tracking queue empty

Code : &H143B

Meaning/Cause	Tracking was attempted while no data is registered in the position monitoring array.
Action	Use the CADDQUE command to add data to the position monitoring array, and then review the robot program and change it so that the CTMOVE statement will be executed.

[21] Major software errors

21.1 : System error (JOG)

Code : &H1501

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.2 : System error (srvmod)

Code : &H1502

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.3 : System error (TaskID)

Code : &H1503

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.4 : System error (drcom)

Code : &H1504

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.5 : System error (drmod)

Code : &H1505

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.6 : System error (Gen.Data)

Code : &H1506

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.10 : Watchdog error (CPU)

Code : &H150A

Dedicated output : *1

Meaning/Cause	a. CPU malfunctioned due to external noise. b. Controller is defective.
Action	1. Turn the power off and then on again. 2. Replace the controller.

21.11 : System error (EmgHalt)

Code : &H150B

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.12 : System error (RTOS)

Code : &H150C

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.13 : System error (CRFPOS)

Code : &H150D

Meaning/Cause	Current position of driver does not match the instructed position.
Action	1. Replace the driver. 2. Replace the controller.

21.14 : DPRAM error (PTP data)

Code : &H150E

Meaning/Cause	Failed to write PTP command data into driver.
Action	1. Replace the driver. 2. Replace the controller.

21.15 : System error (Gripper)

Code : &H150F

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.16 : System error (EherNet/IP)

Code : &1510

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.41 : System error (EXCEPTION)

Code : &H1529

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

[22] Major hardware errors

22.1 : AC power low

Code : &H1601

Dedicated output : *1

Meaning/Cause	a. AC supply voltage of control power supply dropped below 85% of rated voltage. b. Power source has insufficient capacity.
Action	1. Check the AC supply voltage. 2. Check if supply voltage drops during robot operation. 3. Lower the robot duty cycle.

CAUTION

This error always occurs when the power is cut off.

22.3 : DC24V power low

Code : &H1603

Dedicated output : *1

Meaning/Cause	a. 24VDC power supply malfunctioned and the voltage dropped. b. Electromagnetic brake for vertical axis is defective. c. Wiring for electromagnetic brake of vertical axis is shorted. d. Short in 24VDC for safety connector.
Action	1. Replace the controller. 2. Replace the vertical axis electromagnetic brake. 3. Replace the ROB I/O cable. 4. Check the SAFETY connector wiring.

22.9 : Abnormal over voltage

Code : &H1609

Meaning/Cause	a. Output voltage for motor power supply exceeded 420 volts. b. Regenerative unit not connected to controller. c. Regenerative unit safety device triggered due to temperature rise (120°C or more) in regeneration damping resistor. d. Cable connecting regenerative unit and controller is defective. e. Regenerative unit is defective. f. Safety connector is used incorrectly.
Action	1. Check the power supply voltage. 2. Connect the regenerative unit. 3. Lower the robot operating duty. 4. Replace the RGEN cable. 5. Replace the regenerative unit. 6. Do not supply 24VDC to SAFETY connector from external source.

22.10 : Abnormal drop in voltage

Code : &H160A

Meaning/Cause	a. Output voltage for motor power supply dropped below 140V. b. Power supply has insufficient capacity. c. Vertical axis electromagnetic brake is defective. d. SAFETY connector is used incorrectly.
Action	1. Check the power supply voltage. 2. Check if supply voltage drops during robot operation. 3. Lower the robot duty cycle. 4. Replace the vertical axis electromagnetic brake. 5. Do not supply 24VDC to SAFETY connector from external source. 6. Do not use 24VDC from SAFETY connector as power source for driving external loads.

22.12 : Abnormal temperature

Code : &H160C

Dedicated output : *1

Meaning/Cause	Controller internal temperature rose to 60°C or more.
Action	1. Improve the operating environment. 2. Check if the cooling fan is operating correctly. 3. Replace the controller.

22.13 : Bus interface overtime

Code : &H160D

Dedicated output : *1

Meaning/Cause	Could not acquire access rights to dual port RAM.
Action	Replace the controller.

22.14 : Abnormal DRIVER unit error

Code : &H160E

Dedicated output : *1

Meaning/Cause	Error occurred in hardware.
Action	Contact your distributor with details of the problem.

22.20 : DRIVER unit disconnected

Code : &H1614

Dedicated output : *1

Meaning/Cause	a. CPU unit could not recognize driver unit. b. Dual port RAM is defective.
Action	Replace the controller.

22.30 : DRIVER unit abnormality

Code : &H161E

Dedicated output : *1 or *2

Meaning/Cause	a. Wrong DIP switch setting on drive unit. b. Drive unit not operating correctly. c. Dual port RAM is defective.
Action	Replace the controller.

22.40 : PCMCIA interface overtime

Code : &H1628

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for PCMCIA interface.
Action	1. Replace the PCMCIA interface driver. 2. Replace the controller.

22.41 : OPT.1 interface overtime

Code : &H1629

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with option board connected to option slot 1.
Action	1. Replace the option board connected to option slot 1. 2. Replace the controller.

22.42 : OPT.2 interface overtime

Code : &H162A

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with option board connected to option slot 2.
Action	1. Replace the option board connected to option slot 2. 2. Replace the controller.

22.43 : OPT.3 interface overtime

Code : &H162B

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with option board connected to option slot 3.
Action	1. Replace the option board connected to option slot 3. 2. Replace the controller.

22.44 : OPT.4 interface overtime

Code : &H162C

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with option board connected to option slot 4.
Action	1. Replace the option board connected to option slot 4. 2. Replace the controller.

22.45 : DRIVER interface overtime

Code : &H162D

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with driver.
Action	1. Replace the driver. 2. Replace the controller.

22.50 : YC-Link disconnect

Code : &H1632

Meaning/Cause	The secondary station connection test failed at primary station startup. a. The secondary station power is OFF. b. The YC-link communication cable and terminal resistor are disconnected. c. The secondary station's "station No." setting is incorrect.
Action	1. Configure so that the secondary station power switches ON before or simultaneously with the primary station power ON. 2. Verify that the YC-link cable and the terminal resistor are connected. 3. Check the station No. settings.

22.51 : YC-Link error

Code : &H1633

Meaning/Cause	The secondary station failed to start properly. a. Secondary station communication failure.
Action	Verify that the YC-link cable and the terminal resistor are connected.

22.52 : YC-Link type error

Code : &H1634

Meaning/Cause	Mismatch between the secondary station specifications and the setting. a. The secondary station controller or the current sensor specification has been changed (controller was replaced).
Action	1. Check the connected controller and the current sensor specification. 2. Verify that the station No. setting is correct. 3. Perform a system generation.

22.53 : YC-Link robot-type error

Code : &H1635

Meaning/Cause	Mismatch between the secondary station robot No. and the setting. a. The secondary station controller setting was changed, or the controller was replaced.
Action	1. Verify that the correct controller is connected. 2. Verify that the station No. setting is correct. 3. Perform a system generation.

22.54 : YC-Link parameter error

Code : &H1636

Meaning/Cause	Mismatch between the secondary station parameter and the setting. a. The secondary station parameter setting was changed, or the controller was replaced.
Action	1. Verify that the correct controller is connected. 2. Verify that the station No. setting is correct. 3. Perform a system generation.

22.55 : YC-Link network error

Code : &H1637

Meaning/Cause	The secondary station failed to reply. a. The communication cable is disconnected. b. The communication is malfunctioning due to noise. c. A serious failure has occurred at the secondary station controller.
Action	1. Verify that the communication cable is connected. 2. Implement noise countermeasures. 3. Check the secondary station controller's condition.

22.56 : YC-Link Emg. stop on

Code : &H1638

Meaning/Cause	The secondary station is in emergency stop.
Action	Release the secondary station emergency stop.

22.70 : Gripper disconnect

Code : &H1646

Meaning/Cause	It was attempted to execute a gripper dedicated robot language command even though the gripper option was not set.
Action	Set the gripper option.

22.71 : Gripper timeout error

Code : &H1647

Meaning/Cause	Execution of the command sent to the gripper control board ended due to timeout.
Action	Contact your distributor with details of this problem.

22.72 : Gripper cannot get error

Code : &H1648

Meaning/Cause	It was failed to obtain the error that occurred in the gripper main body.
Action	Contact your distributor with details of this problem.

22.73 : Gripper not initialized

Code : &H1649

Meaning/Cause	The gripper initial setting was not complete.
Action	Execute the initial setting of the gripper axis using the generation.

22.74 : Gripper DC24V power low

Code : &H164A

Meaning/Cause	The 24VDC power voltage of the gripper dropped.
Action	Check the 24VDC power voltage.

[26] Alarm messages occurred in electric gripper main body (Fatal error)

26.1 : Gripper Over load

Code : &H1A01

Meaning/Cause	The motor overload occurred. a. The motor was faulty. b. The parameter was faulty. c. The capacity of the power line was insufficient. d. The friction of the machine main body was large.
Action	1. If a symptom, such as excessively heavy motion is found when the motor is moved manually, replace the motor. 2. Initialize the parameters. 3. Check the power capacity. If the power capacity is insufficient, adjust the power voltage to its correct range. 4. Check the movable part of the mechanical part for heavy motion. If the motion is excessively heavy, make the readjustment.

26.2 : Gripper Over current

Code : &H1A02

Meaning/Cause	The motor overcurrent occurred. a. The motor cable was short-circuited. b. The gripper control board was faulty. c. The parameter was faulty.
Action	1. Inspect the electric continuity of the motor cable. If any fault is found, replace the motor. 2. Replace the gripper control board. 3. Initialize the parameters.

26.3 : Gripper Machine reference over

Code : &H1A03

Meaning/Cause	The encoder Z-phase position deviated from the initial value stored in the controller. a. The gripper main body was replaced. b. The finger with the setting on the origin close side was replaced. c. The CPU board in the YRC controller was replaced. d. The CPU software version for the YRC controller was changed. e. Struck an obstacle while returning to the origin point. f. The encoder Z-phase had faulty wiring or malfunctioned. g. The gripper drive section or transmission section malfunctioned.
Action	1. Perform the return-to-origin again. 2. Remove the obstacle and perform the return-to-origin again. 3. Replace the gripper main body.

26.4 : Gripper Power supply voltage low

Code : &H1A04

Meaning/Cause	The DC power voltage dropped to 80% or less of the rated value.
Action	Check the power capacity. If the power capacity is insufficient, adjust the power voltage to its correct range.

26.6 : Gripper P.E. Counter over

Code : &H1A06

Meaning/Cause	a. Mechanical lock occurred in the gripper drive part. b. The motor cable had faulty wiring or incorrect wiring. c. The parameter was faulty.
Action	1. Check the gripper drive part for mechanical lock. 2. Check the motor and encoder cable connections. 3. Initialize the parameters.

26.7 : Gripper Internal fault

Code : &H1A07

Meaning/Cause	Error occurred inside the gripper control board.
Action	Contact your distributor with details of this problem.

26.8 : Gripper 24V Power off

Code : &H1A08

Meaning/Cause	a. 24VDC power cable was not connected. b. 24VDC power was not supplied. c. 24VDC power cable had faulty wiring.
Action	1. Check the 24VDC power cable connection. 2. Check the 24VDC power. 3. Check the 24VDC power cable.

26.9 : Gripper System fault 1

Code : &H1A09

Meaning/Cause	The software entered the runaway status due to external noise.
Action	Contact your distributor with details of this problem.

26.10 : Gripper Feedback error 1

Code : &H1A0A

Meaning/Cause	a. The finger overrun the software limit due to external force. b. The encoder counting was incorrect due to external noise.
Action	1. Turn on the power to check that no external force is applied. After that, perform the return-to-origin. 2. Contact your distributor with details of this problem.

26.11 : Gripper Feedback error 2

Code : &H1A0B

Meaning/Cause	a. The encoder cable has faulty wiring. b. The guide block was locked.
Action	1. Check the encoder cable connections. 2. Unlock the guide block.

26.12 : Gripper Abnormal voltage

Code : &H1A0C

Meaning/Cause	a. The power voltage increased by regeneration. b. The 24VDC power voltage was incorrect.
Action	1. Decrease the duty of the mechanism part. 2. Check the capacity of the 24VDC power supply. If the capacity is insufficient, adjust the power voltage to its correct range.

26.13 : Gripper System fault 2

Code : &H1A0D

Meaning/Cause	The software entered the runaway status due to external noise.
Action	Contact your distributor with details of this problem.

26.14 : Gripper Feedback error 3

Code : &H1A0E

Meaning/Cause	The motor cable had faulty wiring or incorrect wiring.
Action	Check the motor cable connections.

[27] Error messages occurred in electric gripper main body

27.32 : Gripper Soft limit over

Code : &H1B20

Meaning/Cause	The operation position exceeded the software limit set by the parameter.
Action	1. Change the operation position to put it within a software limit area. 2. Change the software limit value. 3. Change the limit width.

27.35 : Gripper Origin incomplete

Code : &H1B23

Meaning/Cause	The return-to-origin was not performed.
Action	Perform the return-to-origin to put the gripper in the return-to-origin completion status.

27.36 : Gripper Servo off

Code : &H1B24

Meaning/Cause	A movement command was executed in the servo OFF status.
Action	Turn on the servo.

27.37 : Gripper Interlock

Code : &H1B25

Meaning/Cause	It was attempted to execute a program or move an axis in the interlock status.
Action	Reset the interlock and execute the program or move the axis.

27.50 : Gripper Data error

Code : &H1B32

Meaning/Cause	The option data, such as movement command to be sent to the gripper control board exceeded the input range.
Action	Restart the system generation.

27.51 : Gripper type error

Code : &H1B33

Meaning/Cause	It was attempted to initialize with an unspecified actuator type.
Action	Enter a correct value for the gripper axis number.

27.52 : Gripper Internal failure

Code : &H1B34

Meaning/Cause	a. The 24VDC power was not turned on. b. An error occurred in the gripper control board.
Action	1. Check the 24VDC power. 2. Contact your distributor with details of this problem.

1.2 Programming box error messages

When a hardware error or a software error occurs in the programming box, the following messages are highlighted (shown with reversed background) on the guideline of the lowest line of the screen.

PB TRAP !!

Contents : Undefined operation code was executed.
Cause : A hardware error occurred.
Action : Replace the programming box.

PB Receive Error!! (Data Register Full)

Contents : Data receive register is full.
Cause : A hardware error occurred.
Action : Replace the programming box.

PB Receive Error!! (Over Run Error)

Contents : An overrun occurred while receiving data.
Cause : a. Malfunction occurred due to noise.
b. The cable is broken or disconnected.
c. The connector is not making contact.
Action : 1. Separate equipment away from noise source.
2. Replace the PB cable.
3. Replace the programming box.

PB Receive Error!! (Parity Error)

Contents : Parity error occurred during communication.
Cause : a. Malfunction occurred due to noise.
b. The cable is broken or disconnected.
c. The connector is not making contact.
Action : 1. Separate equipment away from noise source.
2. Replace the PB cable.

PB Receive Error!! (Framing Error)

Contents : Framing error occurred during communication.
Cause : Malfunction occurred due to noise.
Action : Separate equipment away from noise source.

PB Receive Error!! (Buffer Overflow)

Contents : Remaining area in receive buffer fell below 1% during communications.
Cause : a. Large amount of data was sent from the controller.
b. Communication control error.
Action : 1. Replace the programming box.
2. Replace the controller.

PB Transmit Error!! (Time Out Error)

Contents : Transmitting to controller is impossible.
Cause : a. The cable is broken or disconnected.
b. No response from controller due to problem in CPU unit.
Action : 1. Replace PB cable.
2. Replace the programming box.
3. Replace the controller.

PB Device Not Ready!! (Time Out Error)

Contents : Cannot control the controller.
Cause : a. The cable is broken or disconnected.
b. Handshake with controller is defective due to problem with controller.
Action : 1. Replace PB cable.
2. Replace the programming box.
3. Replace the controller.

PB RS-422 Error!! (RTS/CTS LINE Error)

Contents : Cannot control the controller.
Cause : a. The cable is broken or disconnected.
b. Controller operation is abnormal.
c. The connector is not making contact.
Action : 1. Replace the PB cable.
2. Replace the controller.

PB RS-422 Error!! (DATA LINE Error)

Contents : Data communication with controllers is defective.
Cause : a. The cable is broken or disconnected.
b. The connector is not making contact.
Action : 1. Replace the PB cable.
2. Replace the controller.

PB Memory Error!! (DATA Write Error)

Contents : Internal memory is defective.
Cause : Internal memory circuit is defective.
Action : Replace the programming box.

PB Receive Error!! (Buffer Overflow)

Contents : Remaining capacity of data receive data buffer fell below 1 percent.
Cause : a. Massive amount of data was sent from controller.
b. Communication control error.
Action : 1. Replace the programming box.
2. Replace the controller.

2. Troubleshooting

2.1 When trouble occurs

Please contact your distributor with details of the problem that occurs. Report the following items in as much detail as possible.

Item	Description
What happened	• Controller model name and serial No. example:YRC + regenerative unit • Robot model name + serial No. example:R6YXGL250 • Controller version No. example:V10.01 R1001
When	• Date of purchase example:June 2008 • How long used example: Since delivery, about 1 year
Under what conditions	• Usage conditions example: when power is turned on when creating program during manual movement when robot is moved to particular location during program operation.
Current status is	• Status on programming box screen example: Nothing is displayed on screen Error message appears on screen • Robot servo status example: Servo won't turn on Abnormal sound when robot is moved Sets to origin incomplete. • Programming box operating status example: Keys won't function Response after pressing key is slow Only the emergency stop button functions etc.
How often it happens	• How often above problem occurs example: Always occurs when power is turned on. Occurs at particular line during program operation. Only occurs once, then does not occur again.

NOTE

When the programming box is connected, the error message appearing on the screen is a valuable source of information for troubleshooting.

2.2 Acquiring error information

Error history (log) information is stored inside the robot controller. The following 2 methods are available for checking this information.

2.2.1 Acquiring information from the programming box

1 ***Enter DIAGNOS mode.***

Press the F5 (DIAGNOS) key in SYSTEM mode.

2 ***Check the error status or error history.***

Pressing F1 (CHECK) shows the controller error status.

A maximum of 12 errors are displayed.

Pressing F2 (HISTORY) shows a list of errors.

A maximum of 500 error histories can be checked.

2.2.2 Acquiring information from the RS-232C

1 ***Connect the controller to the PC.***

Use an RS-232C cable to connect the controller to the PC and set the communication conditions.

2 ***Check the error log.***

Send a command "@READ LOG" from the PC to receive the internal error history in the controller.
A maximum of 500 error histories can be checked.

2.3 Troubleshooting checkpoints

1. Installation and power supply

	Symptom	Possible cause	Check items	Corrective action
1	Controller won't turn on even with power supplied.	• Power not supplied. • Problem in controller internal power.	• Check power input terminal connection (L/N/L1/N1). • Check power input terminal voltage (L/N/L1/N1). • Check if "PWR" LED on front panel is lit.	• Connect power input terminal correctly. • Supply rated power supply voltage. • Replace the controller.
2	Controller turns on but no programming box display.	• Programming box not connected. • Wrong programming box connection. • Programming box malfunctioning. • Problem in controller internal power supply.	• Check PB connector. • Check how PB connector is inserted. • Replace programming box and check operation.	• Plug in PB connector correctly. • Replace the programming box. • Replace the controller.
3	Controller turns on but "ERR" LED on front panel lights up.	• Now in emergency stop.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check the DI00 (Emergency stop input) status on the programming box display screen.	• Release programming box emergency stop button. • Insert PB connector. • Connect the emergency stop terminal of SAFETY connector.
		• Error of error group No. 17 occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information.	• Check the axis from the error information. • Check the cause from the error information. • Eliminate the cause of the error.
		• Error of error group No. 21, 22 occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information.	• Check the cause from the error information. • Eliminate the cause of the error.

2. Robot operation

	Symptom	Possible cause	Check items	Corrective action
1	Controller turns on but can't execute program and manual movement.	• Interlock signal.	• Check standard I/O interface connector (for interlock signal) and check if 24VDC is supplied. • Check the DI11 (Interlock) status on the programming box display screen.	• Connect the standard I/O interface connector for interlock signal. • Connect the 24VDC power supply. • Disable interlock signal with the parameter.
		• Robot is in emergency stop.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check the DI00 (Emergency stop input) status on the programming box display screen.	• Release programming box emergency stop button. • Plug in PB connector. • Connect emergency stop terminal of SAFETY connector.
		• Error occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check if "ERR" LED on front panel is lit.	• Check the cause from the error information. • Eliminate the cause of the error.
2	Abnormal sound or vibration.	• Wrong robot or axis type setting.	• Connect programming box and check robot settings in SYSTEM mode. • Check if robot and controller are compatible.	• Change to correct robot or axis type setting. • Make sure robot and controller are compatible.
		• Tip weight/ acceleration settings are incorrect.	• Check tip weight parameter setting in SYSTEM mode. • Check "Accel. Coefficient" parameter setting in SYSTEM mode. • Check AXWGHT/ACCEL commands in program language.	• Set a correct tip weight parameter. • Set a correct "Accel. Coefficient" parameter. • Make a correct setting in the program language.
		• Mechanical problem occurred.	• Check for resonance in robot frame. • Check for loose screws on robot cover. • Check for warping or damage on guides or ball screws.	• Reinforce the robot frame. • Tighten the robot cover screws. • Remove foreign matter if found. • Replace if warped or damaged guides or ball screws are found.
		• Controller is defective.	• Replace with another controller and check operation.	• If operation is normal use the substitute controller.
3	Position deviation occurred.*	• Position sensor device is defective. • Cable is defective.	• Move axis in emergency stop and check the pulse count.	• Replace motor if count is incorrect. • Replace cable if found to be defective.
		• Position detection error due to noise.	• Check grounding of robot and controller. • Check robot periphery for noise. • Check for noise sources around ROB I/O cable.	• Ground the robot and controller. • Isolate from noise sources around robot. • Isolate from noise sources around ROB I/O cable.
		• Mechanical error occurred.	• Check the belt tension • Check for warping or damage on guides or ball screws.	• Adjust to correct tension if necessary. • Remove foreign matter if found. • Replace guides or ball screws if warping or damage is found.
		• Controller is defective.	• Replace with another controller and check operation.	• If operation is normal use the substitute controller.

* There are 2 main types of position deviation.
1. Electrical position deviation
2. Mechanical position deviation
In case 1, if position deviation occurs, you can perform absolute reset and return to original position. In case 2, you cannot return to original position.

3. I/O operation

	Symptom	Possible cause	Check items	Corrective action
1	Won't operate even when dedicated input signal is supplied.	• No 24VDC supply.	• Check that 24VDC is supplied from standard I/O interface connector. • Check DI04 on programming box screen.	• Supply 24VDC.
		• Problem in signal connection.	• Check wiring on standard I/O interface connector.	• Make the correct wiring on standard I/O interface connector.
		• Error has occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check if "ERR" LED is lit on front of controller.	• Check the cause from the error information. • Eliminate the cause of the error.
2	No output of dedicated output signal.	• No 24VDC supply.	• Check that 24VDC is supplied from standard I/O interface connector. • Check DI04 on programming box screen.	• Supply 24VDC.
		• Problem in signal connection.	• Check wiring on standard I/O interface connector.	• Make the correct wiring on standard I/O interface connector.
		• Error has occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check if "ERR" LED is lit on front of controller.	• Check the cause from the error information. • Eliminate the cause of the error.
3	No output of general-purpose I/O signal.	• No 24VDC supply.	• Check that 24VDC is supplied from standard. I/O interface connector. • Check DI04 on programming box screen. • Check that 24VDC is supplied for option I/O interface.	• Supply 24VDC.
		• Problem in signal connection.	• Check wiring on standard I/O interface connector. • Check wiring on option I/O interface connector.	• Make the correct wiring on standard I/O interface connector. • Make the correct wiring on option I/O interface connector.
		• Error in option I/O interface setting.	• Check the option I/O interface setting on the DIP switch.	• Make the correct option I/O interface setting.
		• Error has occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check if "ERR" LED is lit on front of controller.	• Check the cause from the error information. • Eliminate the cause of the error.

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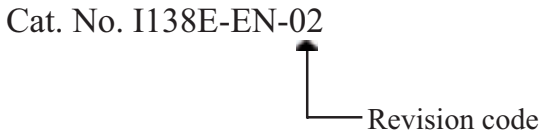
Revision history

A manual revision code appears as a suffix to the catalog number on the front cover manual.



The following table outlines the changes made to the manual during each revision.

Revision code	Date	Description
01	January 2013	Original production
02	January 2014	Parameters related to R6YXTW500 model were added, troubleshooting items were added, system error section was updated and text errors were corrected

OMRON

Authorized Distributor:

Cat. No. I138E-EN-02

Note: Specifications subject to change without notice.

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