ADVANCED THREAD TIGHTENING ROBOT **NITOMAN** RC5500TS TEACHING PENDANT

OPERATION MANUAL Ver1.05



NITTO SEIKO CO.,LTD.

[Notes]

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Safety precautions

Before using this machine, fully read the safety precautions shown below for correct use.

- ◆ To secure safety of the robot, refer to JIS B 8433 (Manipulating Industrial Robots—Safety).
- ◆ This machine is designed and manufactured for the purpose of use for general industrial machinery.
- ◆ Installation of the robot and setup of the system must be carried out by technicians only.
- ♦ When moving or selling this machine, have the owner to be fully read this manual for correct use.

To prevent hazards to operators or other persons and damages to properties, be sure to observe the instructions in this operation manual shown below.

Marks indicating possible hazards and damages

\triangle	WARNING	Noncompliance with the instructions adjacent to this mark may lead to a loss of life or serious injury.
\triangle	CAUTION	Noncompliance with the instructions adjacent to this mark may lead to injury or physical damages.

Marks showing points to be observed

0	This mark is accompanied with acts to be prohibited.
0	This mark is accompanied with acts to be performed.

∕ ! WARNING

[Installation]

Be sure to provide grounding cables.



Otherwise, you may suffer electric shocks.

DO NOT use this machine near combustibles, inflammables, and explosive substances, or in the corrosive or flammable atmosphere.



Otherwise, combustion, inflammation, or explosion may occur.

DO NOT use this machine where the robot and the controller may be splashed with water or oil.



Otherwise, malfunctions, fires, or electric shocks may occur.

DO NOT modify the robot and the controller. NEVER connect the controller to the robot other than of the specified type.



Otherwise, the controller may be damaged, or the robot may be malfunctioned, causing fires or serious accidents.

DO NOT install the robot and the controller to the locations where are unstable or subjected to vibrations.



Otherwise, the robot may be moved or tipped, leading to accidents or breakage.

∕! WARNING

[Installation]

Install the safety guard to the outside of motion areas.



Otherwise, you may suffer serious injury.

For safety, be sure to provide the interlock switch for the door of the safety guard. Secure working space to carry out works related to teaching, maintenance, and check safely.

Correctly carry out wiring, referring to "Operation Manual".



Be sure to connect cables and connectors securely to prevent any looseness or disconnection. Otherwise, malfunctions or fires may occur.

DO NOT damage cables.



NEVER damage, forcibly bend or pull, wind, pinch them, nor put heavy objects on them. Otherwise, fires, electric shocks, or malfunctions due to earth leakage or disconnection may be caused.

Always provide the emergency stop switch for a location convenient for operation.



Otherwise, you cannot deal with unexpected troubles quickly, causing serious injury.

⚠ WARNING

[Operation]

When you find any heating, fume, or odor, immediately turn off the power switch, and disconnect the power plug.



Otherwise, the machine may be damaged, or fires may occur.

Make sure that the machine is in the "SERVO OFF" mode (operated by the teaching pendant) before operating the moving parts of the robot by the direct teaching.



Otherwise, you may suffer injury.

NEVER use the robot or the controller if they have been dropped or immersed in water.



Otherwise, malfunctions or electric shocks due to faults or damages may occur.

[Maintenance and check]

Turn off the power switch, disconnect the power plug to shut off the power completely, and wait for ten minutes or longer before moving, wiring, or checks. Wiring must be provided by electrical technicians only.



Provision of these measures helps prevention of electric shocks.

Be sure to read operation manual before maintenance and check.



Otherwise, accidents may occur in case of misoperation.

⚠ CAUTION

[Installation]

Completely provide electric shielding measures before using this machine in the locations shown below. Otherwise, malfunctions may occur.



- 1. Where there are high tension current or great magnetic field
- 2. Where welding is being performed and arc discharge may occur
- 3. Where noises due to static electricity are generated
- 4. Where exposure to radio activity may occur

DO NOT hold moving parts or cables when installing the machine.



Otherwise, you may suffer injuries.

NEVER block the vent of the controller.



Otherwise, heat is trapped in the machine, leading to fires or malfunctions.

DO NOT use this machine outdoors exposed to direct sunlight.



Otherwise, malfunctions or faults may occur.

! CAUTION

[Operation]

Be sure to use this machine in locations where ambient temperature is within the range between 0° C and 40° C; humidity is within the range between 30% and 80%, free from dew condensation.



Otherwise, malfunctions, fires, or electric shocks may occur.

DO NOT use this machine with the power supply and under the voltage other than specified.



Otherwise, malfunctions, fires, or electric shocks may occur.

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1. Preface

This chapter describes the structure of the teaching pendant (RC5500TS).

1.1 Outline

Teaching pendant features the Handy Indicator and the thread tightening robot control screen software allowing both functions of the control panel and the teaching pendant for easier control of thread tightening robot. Since the basic performance and operations are quite the same as those for our conventional model RC5000TS, you can use this model without confusion.

This machine should be connected to the controller for thread tightening robot (RC5500-S) only. Machine controller is used for this robot controller as the main control unit, and the thread tightening robot controlling software enables various controlling functions required for thread tightening.

[For details of the robot controller (RC5500-S, Nitto Seiko), Handy Indicator (GT1455HS, Mitsubishi Electric Corp.), and machine controller (MP2310, Yaskawa Electric Corp.), refer to the operation manuals for them.]

1.2 Product structure

Model of our teaching pendant should be indicated as shown below.

Model RC5500TS Ver *.**

Accessories

Handy Indicator (GT1455HS-QTBDE, Mitsubishi Electric Corp.) · · · · · 1 unit Handy Indicator connector cable, 3 m (GT11H-C30-37P, Mitsubishi Electric Corp.) · · · · · 1 pce. Operation Manual for Handy Indicator hardware · · · · · · 1 copy

One complete set of the items shown above are provided for our standard type machine.

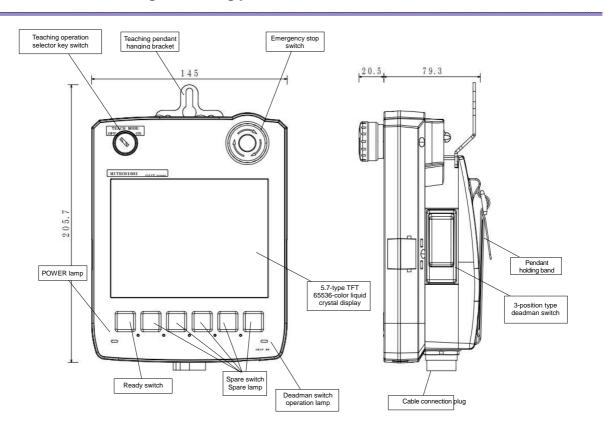
Optional items

Handy Indicator connector cable, 6 m (GT11H-C60-37P, Mitsubishi Electric Corp.) (For the special type, either of the Handy Indicator connector cables shown above can be chosen.)

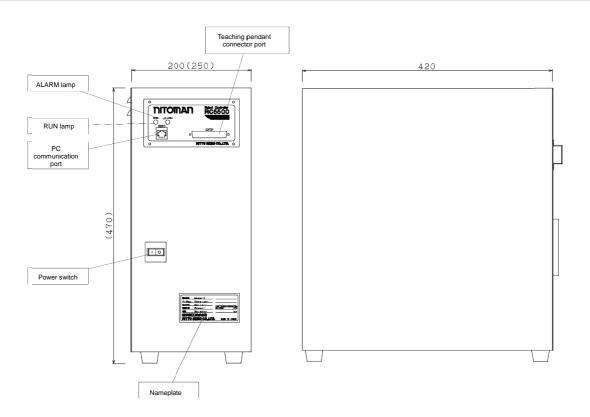
Protective sheet (GT14H-50PSC, Mitsubishi Electric Corp.) · · · · · 5 sheets per set

• Specify the models of optional items when purchasing them.

1.3 Schematic drawing of teaching pendant



1.4 Schematic drawing of robot controller



* The controller width varies depending on the servo amplifier capacity (W). When an amplifier with 400 W or larger capacity is used, the controller width is 250 mm.

Specifications of teaching pendant 1.5

[Specifications of RC5500TS]

Name	Teaching pendant RC5500TS (with software for thread tightening robot screen installed)					
Madal	GT1455HS- QTBDE (Mitsubishi Electric Corp.) standard controller connector cable,					
Model	GT11H-C30-37P (3 m) (Mitsubishi Electric Corp.), optionally applicable to 6 m types, weight: 0.79 kg					
Power supply voltage 24 V DC +10% -15% (supplied by RC5500-S controller)						
Current consumption	350 mA/24 V DC (290 mA/24 V DC when backlight is lit up)					
	Operation switch	6 pcs. (6 contacts/common)	a contact: 10 mA/24 V DC, service life: a million times			
	Deadman switch	1 pce. (IDEC Corp., HE3B-M2PB) 3-positions (OFF-ON-OFF) (single wiring)	2a contact 1A/24 V DC (resistance load), service life: a hundred thousand times			
Switches	Emergency stop switch	1 pce. (OMRON, A165E-S-02) (single wiring)	3b contact 1A/24 V DC (resistance load), service life: a hundred thousand times			
	Selector key switch	1 pce. (with two keys) (IDEC Corp., AS6Q-2KT1PB) (single wiring)	1c contact 1A/24 V DC (resistance load), service life: a hundred thousand times			
Display element	TFT-type 65536-color					
Display size	5.7 inch, 320 × 240 dots, 115 × 86 mm					
Number of characters 16-dot font: 20 characters × 15 lines (Full-size character)						
to be displayed	to be displayed 12-dot font: 26 characters × 20 lines (Full-size character)					
Service life of displayer	Approximately 50,00	0 hours				
Backlight (service life)						
Touch-switch	Analog screen,					
External interface	For controller	Conforming to standards of serial RS-232C (Round, 32-pin) Conforming to USB standard (Mini-B)				
Battery (Service life)	GT11-50BAT lithium battery (Replacement interval: approx. 5 years)					

Specifications of robot controller 1.6

Controller model	RC5500-S			
Power supply voltage	Single phase, from 200 VAC to 230 VAC, 50/60 Hz			
Number of axes to be controlled	Maximally six			
Desitioning system	PTP, linear, and circular interpolation			
Positioning system	(interpolation is inapplicable to Yθ-type robots)			
Position detecting system	Absolute value encoder system			
Position detecting system	(battery backup: approximately 5 years)			
Serial port	RS232C: Used for the teaching pendant.			
Serial port	Ethernet (100Base-TX): For PC connection			
Memory	SRAM (battery backup: approximately 5 years)			
External input	Standard user port, 16-pos.			
External input	[External 64 ports can be added]			
External output	Standard user port, 16-pos.			
External output	[External 64 ports can be added]			
Field network	[CC-Link slave interface]			
Teaching system	MDI, remote teaching, direct teaching			
	Work area: 40 (50 *1) points x 100 models			
Point control	Fixed area: 40 points (50 *1)			
	Palletize area: 200 points \times 3 patterns (inapplicable to Y θ -robots)			
Point work information	2-sets per point (4-sets *1)			
T OILL WORK IIIIOITHAUOH	(Operation pattern/torque)			
Sequence program Ladder diagram (40K step or equivalence)				
Robot program	Special motion language			
Outside dimensions (W×H×D)	200 (250 *1) × 450 × 420			
Odiside differisions (WXI IXD)	(Excluding rubber feet)			
Weight	Approximately 20 kg			
Toaching pondant	Handy type touch panel (with key switch and deadman switch)			
Teaching pendant	Teaching pendant can be used as control panel			
PC software [Provided]				

^{*1:} Depending on specifications
[] is optionally available.

For improvement in performance, specifications may be modified without notice.

2. Functions of control panel

This chapter describes the general functions of the control panel.

In the teaching pendant, function of the control panel, separated from the conventional type machine, is added to the teaching pendant function, allowing emergency stop, ready, automatic running, and manual running (optional, including manual running of peripheral equipment).

Descriptions shown below are applicable, provided that the teaching pendant is securely connected to the robot controller, power is supplied to the robot controller, and the system is correctly running (in the status that teaching or the setup of parameters has been finished completely).

When either of conditions shown below is satisfied, the system is faulty.

- Teaching pendant or control screen software is faulty.
- Control unit in the robot controller is not in the RUN status, or it is faulty.

2.1 Outline of functions

This system has been developed for the purpose of easier position control and operation of the thread tightening robot by adoption of the robot controller (RC5500-S) as the main control unit, and using the Handy Indicator connected as the teaching pendant (hereafter called "TP").

It enables the control of peripheral equipment (including jigs), as well as the same of two units of the thread tightening robot (number of axes to be controlled: 6 axes, max.). Detailed characteristics are shown below.

- The three-position type deadman switch (safety switch used for the JOG or POINT MOVE operation during teaching of the robot) function, necessary for the use for the teaching pendant of the robot, is available from the side of the pendant (grip section), as well as the control panel function, such as ready and emergency stop.
- 2) Control panel functions required for the automatic and manual running are available.
- 3) Setup of thread tightening parameters, check of equipment cycle time, and specific functions of the I/O monitor and the tightening fault monitor are also available.
- 4) Teaching pendant functions, such as editing of position data (teaching), JOG operation, and the servo system fault monitor are available.

Development of the special software enables the functions shown above by operations easier than in the conventional type machine.

2.2 Functions and features of control panel

This chapter describes the functions and features of the control panel.

2.1.1 Ready for operation

This function, provided for startup before production, is available for the thread tightening robot series only.

Features

 Activation or deactivation of the machine by hard switches to be ready for operation is displayed on the TP screen.

To startup the machine, ready for operation at first. While the message "READY OFF" is displayed on the TP screen, press the "Ready switch" on the lower left side of the TP. Then, the machine is ready for operation, and the Operation preparation tab is lit in green, the tab display will disappear after 2 seconds. As soon as the machine is ready for operation, the "MAN RUN" screen appears on the TP screen. (In standard type)

Note ···· When the ready switch is faulty or the robot controller controlling system is not operated correctly (in STOP status), the machine cannot be ready for operation.





2.2.2 Emergency stop

This function allows cancellation of ready and emergency stop.

Features

 Cancellation of ready or emergency stop by hard switches and emergency stop status are displayed on the TP screen.

When the emergency stop switch (red) on the upper right side of the TP is pressed in while the machine is ready for operation, the machine enters the emergency stop status. Whenever any hazard occurs while the ready status is cancelled or the machine is being operated, carry out this step.

Terminal for installing the "External emergency stop" switch, having the equivalent function to this switch, is located at the back of the robot controller. Emergency stop from the devices other than the teaching pendant is available by connecting this terminal to the emergency stop switch.

Note ···· Be sure to ground this terminal when the "External emergency stop" switch is not used.



2.2.3 Canceling emergency stop

This function allows cancellation of emergency stop.

Features

• Emergency stop canceling procedures and emergency stop cancel status are displayed on the TP screen.

When the emergency stop switch on the upper right side of the TP is pressed in, the screen shown below on the left side appears to indicate the machine is in the "EMERGENCY STOP ON" status. When the "external emergency stop" switch is actuated, the same screen appears.

Switch allowing the "push-lock and turn-reset" function is adopted for the emergency stop switch on the TP. To cancel emergency stop, turn the switch clockwise.

Note ···· If "EMERGENCY STOP ON" is displayed on the screen even after the emergency stop switch on the TP is released, check the "external emergency stop switch".

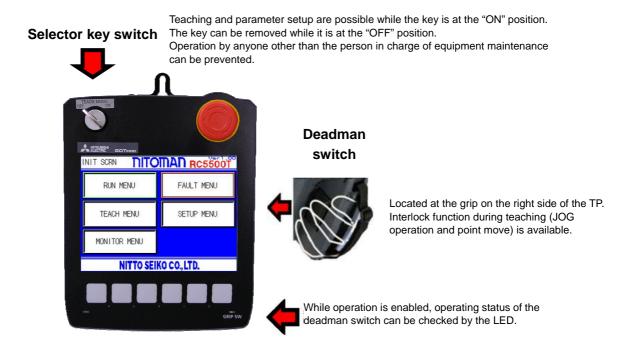


2.2.4 Three-position type deadman switch and selection of teaching mode

The interlock function allows prohibition of "teaching" and "parameter setup" done by personnel other than the person in charge of equipment maintenance to secure safety during the JOG operation or POINT MOVE operation in teaching of the robot.

Features

- In order to improve safety during the JOG operation or POINT MOVE operation in teaching of the robot, this interlock function is available by operating the three-position type deadman switch (hard switch) located at the TP grip. While this switch is not pressed in, this function is not activated (OFF). When it is pressed once, the function is activated (ON), and is deactivated (OFF) when it is pressed again.
- Robot teaching mode can be selected with the selector key switch (hard switch) located on the upper left side of the TP. The key can be removed while it is at the "OFF" position. The person in charge of equipment maintenance is required to keep this key to enable the interlock function for important operations such as "teaching" and "parameter setup".



2.3 Automatic running

This function, provided for the thread tightening robot series only, allows the automatic running of the machine.

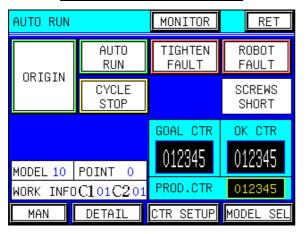
Features

- Start and stop of automatic running
- · Selection of model
- Counter setup display
- Check of detailed information on the machine (model, work position, work information, screws shortage, faulty thread tightening, robot fault, etc.)

Functions required for the automatic running shown above are provided.

This section describes the details of operating procedures and functions available by the switches on the "AUTO RUN" screen.

AUTO RUN screen (in normal status)



AUTO RUN screen (when detailed information is displayed)

AUTO RUN	MONITOR		RET		
ORIGIN	AUTO RUN	TIGHTEN FAULT		ROBOT FAULT	
UKIGIN	CYCLE STOP			SCREWS SHORT	
ROBOT(1)	ROBOT(1) SPEED 100% Y1-1234.56 mm				
RUN TABLE	MODEL 10 A1-1234.56deg				
FIXED	POINT O Z1-1234.56 mn			234.56 mm	
WORK INFO C1 0 1 C2 0 1 -1234.56 mm					
MAN DETAIL CTR SETUP MODEL SEL					

• [ORIGIN]

Whether the machine is at the origin or not is indicated.

While the machine is at the origin · · · · · Highlighted in green

While the machine is not at the origin Highlighted in white

• [AUTO RUN]

Automatic running of this machine can be started with this switch. When the "external start switch" is pressed during the automatic running, the machine starts thread tightening according to the information (work position and work information) recorded for the selected "model number".

Terminal for installing the "external start switch" is located on the back of the robot controller. Connect the start switch to the terminal before using it.

While automatic running is carried out ······ Highlighted in green

While automatic running is stopped ······ Highlighted in white

[CYCLE STOP]

Automatic running of the machine can be stopped with this switch. It is highlighted in yellow while the cycle is stopped. When this operation is carried out during thread tightening, the automatic running is stopped when a cycle is completed.

While the cycle is stopped ······ Highlighted in yellow While the cycle is not stopped ···· Highlighted in white

[TIGHTEN FAULT]

When this switch is touched, the "TIGHTEN FAULT" screen appears. When faulty tightening occurs, it is highlighted in red to warn of the fault.

When faulty tightening occurs ······ Highlighted in red

While faulty tightening does not occur to the machine Highlighted in white

[ROBOT FAULT]

When this switch is touched, the "ROBOT FAULT" screen appears. When the robot is faulty, it is highlighted in red to warn of the fault.

When the robot is faulty Highlighted in red While the robot is not faulty Highlighted in white

[SCREWS SHORT]

When screws in the screw feeder are insufficient, this item is highlighted in yellow to warn of shortage. In such a case, supply screws to the screw feeder.

While screws are insufficient ······ Highlighted in yellow While screws are sufficient ····· Highlighted in white

• [MAN]

When this switch is touched, the "MAN RUN" screen appears. Select this switch when you want to start the manual running. When this switch is touched in the automatic running cycle, operation is interrupted after the robot completes moving.

• [DETAIL]

The "AUTO RUN" screen (in normal status) can be switched to the "AUTO RUN" (with the detailed information displayed) with this switch. Select it when you want to display the detailed information of the robot.

[CTR SETUP]

When this switch is touched, the "COUNTER SETUP/CLEAR" screen appears. Select it when you want to carry out "setup of products quantity to be produced" or "goal/reject/good/total counter clear". Operation of this switch is invalid during the automatic running.

[MODEL SEL]

When this switch is touched, the "MODEL SELECT" screen appears. Select it when you want to change the model. Operation of this switch is invalid during the automatic running.

2. Function of control panel

• [MONITOR]

When this switch is touched, the "MONITOR MENU" screen appears. From the "MENU" screen, you can access to the "CYCLE TIME MONITOR" or "I/O MONITOR" or "Z_axis SCREW HEIGHT MONITOR" screen.

• [RET]

When this switch is touched, the "INIT" screen appears. From the "INIT" screen, you can access to the "MAN RUN", "FAULT MENU", "TEACH MENU", "SETUP MENU", or "MONITOR MENU" screen.

When this switch is touched in the automatic running cycle, operation is interrupted after the robot completes moving.

Details to be displayed in the center of the "AUTO RUN" screen (in normal status) differ from those when detailed information is displayed.

• Items to be displayed on "AUTO RUN" screen in normal status only

• [MODEL]

Currently specified model number is indicated. Up to a hundred types of models, from 0 to 99, can be recorded. Work positions up to 40 points can be recorded for the selected model.

• [POINT]

Point number of the running table (area) on which the robot is working can be indicated.

While the fixed table (area) is running

While the work table (area) is running

From 0 to 39

While the palletize table (area) is running

From 0 to 199

• [WORK INFO, C1, C2]

While the robot is running the work table (area), information on the work recorded to the point can be indicated, and the values fluctuate as shown below.

C1 From 00 to 99

C2 From 00 to 99

• [Counter]

"PRODUCED COUNTER "counter and "GOOD COUNTER" are displayed in the example. This function allows display of the counter selected from the "COUNTER SELECT" screen accessible by the parameter setup function (advanced mode setup).

Counters

- Produced counter ······· It indicates the total quantity of manufactured products. Sum of the number indicated in the reject counter and that in the good counter is the total quantity.
- Reject counter ······ It indicates the quantity of products rejected among manufactured products.
- Good counter ······ It indicates the quantity of products accepted among manufactured products.
- Total counter · · · · · · It indicates the total quantity of products manufactured. Use this counter when estimating the service life of tools including the thread tightening bit.

Intended two types of counters among four shown above can be selected.

Since the functions of the counter not to be displayed are always valid, quantity of products can be checked from the "GOAL/REJECT/GOOD COUNTER CLEAR" or the "TOTAL COUNTER CLEAR" screen of the TP.

2. Function of control panel

• [PROD. CTR]

Currently set quantity of products to be produced can be displayed.

Produced counter setup

- Produced counter setup valid ······· When quantity of products to be produced is set from 0 to 999998 pcs., the setup is valid. After products of the preset quantity have been completed, the cycle is stopped.
- Produced counter setup invalid ······ When quantity of products to be produced is set to 999999 pcs.,
 the setup is invalid. Even after products of the preset quantity
 have been completed, the cycle will not be stopped.

• Items to be displayed on "AUTO RUN" screen (when detailed information is displayed) only

• [SPEED]

Sped ratio currently set for the robot can be displayed.

Example 1

When set to 100% ····· The robot is operated at the maximum speed during the automatic or manual running.

Example 2

When set to 20% ····· The robot is operated at 20% of the maximum speed during the automatic or manual running.

Note) Speed ratio during the JOG operation is not influenced by this setup. Speed during the JOG operation can be selected or altered from the "JOG" screen.

[MODEL]

Currently specified model number is indicated. Up to a hundred types of models, from 0 to 99, can be recorded. Work positions up to forty points can be recorded for the selected model.

[RUN TABLE]

Table that was run while the machine was operated or immediately after the machine was stopped (teaching point table to which position information used for moving) can be indicated.

FixWhile operating in the fixed area or when operation is completed immediately after the machine was stopped, "FIX" is displayed.

Thread tighten ······ While operating in the work area or when operation is completed immediately after the machine was stopped, "THREAD TIGHTEN" is displayed.

Palletize While operating in the palletize area or when operation is completed immediately after the machine was stopped, "PALLETIZE" is displayed.

• [POINT]

Point number of the running table (area) on which the robot is currently working can be indicated.

While the fixed table (area) is running

While the work table (area) is running

From 0 to 39

While the palletize table (area) is running

From 0 to 199

• [WORK INFO, C1, C2]

While the robot is running the work table (area), work information recorded to the point can be indicated.

C1 From 00 to 99

C2 From 00 to 99

• [Current coordinates and control increments of axes (arms)]

In the example, arms are called Y1, A1, and Z1. Designations of the arms differ depending on the types of the robots. For details, refer to "4.1 Robot axes configuration".

Current coordinates and control increments of axes (arms) of the robot are displayed.

2.4 Manual running

This function, provided for the thread tightening robot series only, allows the manual running of the machine.

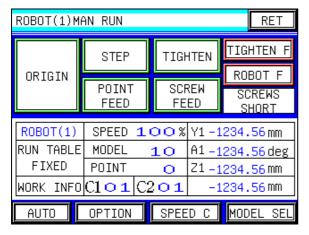
Features

- Return of the machine to origin
- · Selection of model
- Switching robot running speed
- STEP operation
- Point feeding (moving to work position)
- · Thread tightening
- · Screws feeding
- Check of detailed information on the machine (model, work position, work information, screws shortage, faulty thread tightening, robot fault, etc.)
- · Optional functions

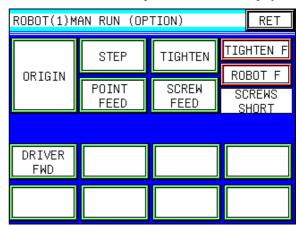
Functions required for operations during the manual running shown above are provided.

This section describes the details of operating procedures and functions available by the switches on the "MAN RUN" screen.

MAN RUN screen (in normal status)



MAN RUN screen (when optional switches are displayed)



• [ORIGIN]

The machine can be returned to the origin with this switch. It is moved to the standby position specified by the teaching operation.

While the machine is at the origin Highlighted in green While the machine is not at the origin Highlighted in white During return to origin Blinks in green

[STEP]

STEP operation (inching) can be performed with this switch. The same action as that during the automatic running is carried out for each input by the switch according to the information (work position, work information) recorded for the "model number" currently selected.

During STEP operation Highlighted in green While STEP operation is stopped Highlighted in white

[POINT FEED]

Point of the machine can be moved with this switch. Only the motion to the work positions can be executed for each switch input according to the information (work position, work information) recorded for the "model number" currently selected.

Lifting and lowering of the Z-axis capable type cannot be performed. (Only moving to the area above the work position is available.)

During point feeding Highlighted in green While point feeding is stopped Highlighted in white

[TIGHTEN]

Thread tightening can be started with this switch. Use this switch when you want to forward or reverse the screw tightening driver, or start thread tightening.

During thread tightening ······ Highlighted in green While thread tightening is stopped ···· Highlighted in white

• [SCREW FEED]

Screws can be fed with this switch. Use this switch when checking the screws feeding status.

During screw feeding Highlighted in green While screw feeding is stopped Highlighted in white

• [TIGHTEN F]

When this switch is touched, the "TIGHTEN FAULT" screen appears. When faulty tightening occurs, it is highlighted in red to warn of the fault.

When faulty tightening occurs ······ Highlighted in red While faulty tightening does not occur ····· Highlighted in white

[ROBOT F]

When this switch is touched, the "ROBOT FAULT" screen appears. When the robot is faulty, it is highlighted in red to warn of the fault.

When the robot is faulty······ Highlighted in red While the robot is not faulty····· Highlighted in white

2. Function of control panel

• [SCREWS SHORT]

When screws in the screw feeder are insufficient, this item is highlighted in yellow to warn of shortage. In such a case, supply screws to the screw feeder.

When screws are insufficient · · · · · · Highlighted in yellow

While screws are sufficient · · · · · · Highlighted in white

• [RET]

When this switch is touched, the "INIT" screen appears. From the "INIT" screen, you can access to the "AUTO RUN", "FAULT MENU", "TEACH MENU", "SETUP MENU", or "MONITOR MENU" screen.

Details to be displayed in the center of the "MAN RUN" screen (in normal status) differ from those when detailed information is displayed.

• Items to be displayed on "MAN RUN" screen in normal status only

• [AUTO]

When this switch is touched, the "AUTO RUN" screen appears. Select it when you want to start the automatic running. Operation of this switch is invalid while teaching is valid.

• [OPTION]

When this switch is touched, the "MAN RUN" screen with the optional switches appears. Select it when you want to operate the optional peripheral equipment manually.

• [SPEED C]

When this switch is touched, the "SPEED CHANGE" screen appears. Select it when you want to change the robot moving speed.

• [MODEL SEL]

When this switch is touched, the "MODEL SELECT" screen appears. Select it when you want to change the model of manufacturing machine.

Operation of this switch is invalid during the STEP operation or point feeding.

[SPEED]

Currently set speed ratio of the robot can be indicated.

Example 1

When set to 100% ····· The robot is operated at the maximum speed during the automatic or manual running.

Example 2

When set to 20% ····· The robot is operated at 20% of the maximum speed during the automatic or manual running.

Note) Speed ratio during the JOG operation is not influenced by this setup. Speed during the JOG operation can be selected or altered from the JOG screen.

• [MODEL]

Currently specified model number is indicated. Up to a hundred types of models, from 0 to 99, can be recorded. Work positions up to forty points can be recorded for the selected model.

• [RUN TABLE]

Table that was run while the machine was operated or immediately after the machine was stopped (teaching point table to which position information used during moving) can be indicated.

Fix While operating in the fixed area or when running is completed immediately after the machine was stopped, "FIX" is displayed.

Thread tighten ······ While operating in the thread tightening area or when running is completed immediately after the machine was stopped, "THREAD TIGHTEN" is

displayed.

Palletize While operating in the palletize area or when running is completed immediately after the machine was stopped, "PALLETIZE" is displayed.

[POINT]

Point number of the running table (area) on which the robot is currently working can be indicated.

While the fixed table (area) is running

While the work table (area) is running

From 0 to 39

While the palletize table (area) is running

From 0 to 199

• [WOR INFO, C1, C2]

While the robot is running the work table (area), work information recorded to the point can be indicated.

C1 From 00 to 99

C2 From 00 to 99

• [Current coordinates and control increments of axes (arms)]

In the example, arms are called Y1, A1, and Z1. Designations of the arms differ depending on the types of the robots. For details, refer to "4.1 Robot axes configuration".

Current coordinates and control increments of axes (arms) of the robot are displayed.

• Items to be displayed in "MAN RUN" screen (when optional switches are displayed) only

• [DRIVER FWD]

In this example, only the "DRIVER FWD" is displayed.

This switch allows the manual running of optional peripheral equipment by assigning the designation of the equipment to this switch. While the equipment is being operated, the switches are highlighted in green to indicate running of equipment.

Note) Prior to use of this optional function, discussion in advance and decision of specifications are required.

2.5 Model selection

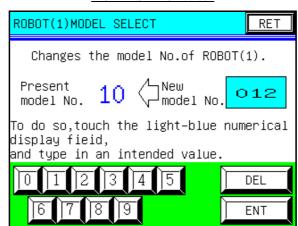
This function, provided for the thread tightening robot series only, allows the selection of the model number during the manual or automatic running.

Number of models and points to be set

• Work positions up to forty points for up to a hundred types of models, from 0 to 99, can be recorded. Thus, four thousand points in total can be recorded.

Work information, (C1, C2), and any code between 0 and 99 can be recorded for each point.

This section describes the details of operating procedures and functions available by the switches on the "MODEL SELECT" screen.



MODEL SELECT screen

[Model selection]

Touch the light-blue numerical display field (area indicating "012" on the screen above) with your finger according to the instruction displayed on the screen. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

When the intended model is confirmed, the new model number entered as the "Present model No." is indicated. Deletion of the model number of which input has not been completed yet is possible with the "DEL" key.

• [RET]

2.6 Move speed change

This function, provided for the thread tightening robot series only, allows the setup of the robot moving speed during the manual or automatic running and the setup of the robot retracting speed during the manual running.

Adjustable speed range

• Speed can be set by ratio (%). The robot moves at the speed ratio set against the maximum speed preset by the motion program (robot program).

Example 1

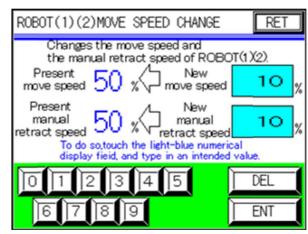
When set to 100% ······ The robot is operated at the maximum speed during the automatic or manual running.

Example 2

When set to 20% ····· The robot is operated at 20% of the maximum speed during the automatic or manual running.

Note) Speed ratio during the JOG operation is not influenced by this setup. Speed during the JOG operation can be selected or altered from the JOG screen.

This section describes the details of operating procedures and functions available by the switches on the "MOVE SPEED CHANGE" screen.



MOVE SPEED CHANGE screen

[Move speed change]

Touch the light-blue numerical display field (area indicating "10" on the screen above) with your finger according to the instruction displayed on the screen. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

When the intended moving speed ratio is confirmed, the new move speed ratio entered as the "New move speed" is indicated. Deletion of the moving speed ratio of which input has not been completed yet is possible with the "DEL" key.

[RET]

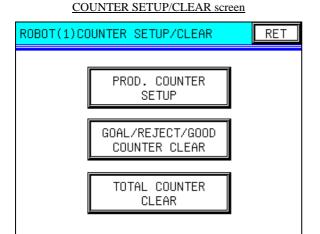
2.7 Counter setup (Setup of products quantity to be produced)

This function, provided for the thread tightening robot series only, allows the setup of quantity of products to be produced during the automatic running. After this setup is carried out, automatic running is stopped after products of preset quantity are manufactured. (Cycle stop)

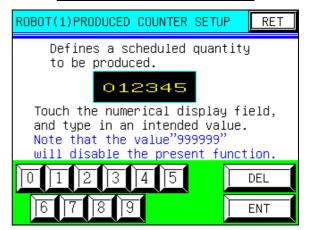
Produced counter setup

- Produced counter setup valid · · · · · · When quantity of products to be produced is set from 0 to 999998 pcs., the setup is valid. After products of the preset quantity have been completed, the cycle is stopped.
- Produced counter setup invalid..... When quantity of products to be produced is set to 999999 pcs., the setup is invalid. Even after products of the preset quantity have been completed, the cycle will not be stopped.

This section describes the details of operating procedures and functions available by the switches on the "PRODUCED COUNTER SETUP" screen.



PRODUCED COUNTER SETUP screen



- [Produced counter setup]
 - Select "PROD. COUNTER SETUP" on the "COUNTER SETUP/CLEAR" screen to switch to the "PRODUCED COUNTER SETUP" screen.
 - Touch the numerical display filed (area indicating "012345" on the screen above) with your finger according to the instruction displayed on the screen. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

Deletion of the quantity to be produced of which input has not been completed yet is possible with the "DEL" key.

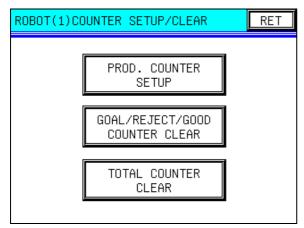
• [RET]

2.8 Counter setup (goal/reject/good counter clear)

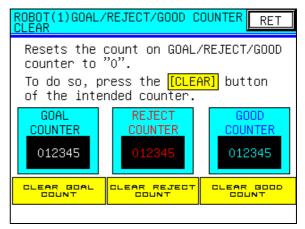
This function, provided for the thread tightening robot series only, allows reset of "goal/reject/good counter". Each counter can be reset individually.

This section describes the details of operating procedures and functions available by the switches on the "GOAL/REJECT/GOOD COUNTER" screen.

COUNTER SETUP/CLEAR screen



GOAL/REJECT/GOOD COUNTER CLEAR screen



• [CONTER CLEAR]

Select the "GOAL/REJECT/GOOD COUNTER CLEAR" on the "COUNTER SETUP/CLEAR" screen to switch to the "GOAL/REJECT/GOOD COUNTER" screen.

Touch any yellow counter clear switch with your finger according to the instruction displayed on the screen.

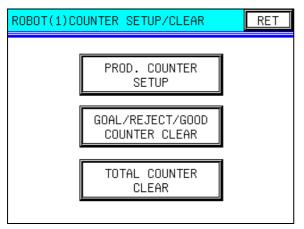
• [RET]

2.9 Counter setup (total counter clear)

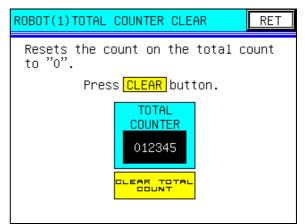
This function, provided for the thread tightening robot series only, allows reset of the total counter.

This section describes the details of operating procedures and functions available by the switches on the "TOTAL COUNTER CLEAR" screen.

COUNTER SETUP/CLEAR screen



TOTAL COUNTER CLEAR screen



• [Counter clear]

Select the "TOTAL COUNTER CLEAR" on the "COUNTE SETUP/CLEAR" screen to switch to the "TOTAL COUNTER CLEAR" screen.

Touch the yellow counter clear switch with your finger according to the instruction displayed on the screen.

• [RET]

2.10 Selecting of action after tightening failure occurs during automatic running

This function, provided for the thread tightening robot series only, allows the selection of action taken after tightening failure occurs during the automatic running. It is valid only when the "CHOICE MODE" is selected on the "ACTION TAKEN AFTER TIGHTEN FAILURE" screen accessible by the thread tightening robot parameters setup function (advanced mode setup).

When thread tightening is faulty during the automatic running, thread tightening by the robot is interrupted, and the robot is moved to the standby position. At the same time, the "TIGHTEN FAULT IN AUTO RUN" screen is displayed, and the machine waits for actions taken by the operator.

This section describes the details of operating procedures and functions available by the switches on the "TIGHTEN FAULT IN AUTO RUN" screen.

ROBOT(1)TIGHTEN FAULT IN AUTO RUN

MODEL 10 POINT 5

TIGHTEN TOR FAULT

SCREW HEIGHT FAULT

CONTINUE REJECT RETRY BREAK

TIGHTEN FAULT IN AUTO RUN screen

• [Action taken after tightening failure occurs]

When tightening failure occurs, immediately stop the machine. Then, access to the "ACTION TAKEN AFTER TIGHTENING FAILURE OCCURS" screen of the TP, and select any intended action among the four choices shown below.

"GOOD CONTINUE"	Select this item if you accept the thread tightening done at the work
	position judged to be rejected and want to proceed to the next
	operation. (The machine does not store data of rejection.)
"REJECT CONTINUE" ·······	Select this item if you do not accept the thread tightening done at the
	work position judged to be rejected and want to proceed to the next
	operation. (The machine stores data of work point where the fault
	occurred.)
"RETRY"	Select this item if you want to repeat thread tightening at the work
	position judged to be rejected. (In case of faulty screw feeding or
	when rework after correction by operator is possible.)
"BREAK"	Select this item if you want to interrupt thread tightening and finish
	the cycle.
	(The machine stores data of work point where the fault occurred.)

The machine continues or stops working according to the selection. As soon as the action is selected, this screen is switched to the "AUTO RUN" screen.

2.11 Notifying tightening fault

This function, provided for the thread tightening robot series only, allows the notification of thread tightening fault.

When the "CONTINUE mode" or "BREAK mode" is selected by the function described in "2.2.3 Selection of action taken after tightening failure occurs during automatic running", this screen appears after a cycle is completed or it is interrupted to inform tightening failure.

Details of tightening failure

- TIGHTEN TOR FAULT ······ When thread tightening is not completed with appropriate tightening torque during thread tightening, this item is highlighted in red to warn of the fault.
- TIGHTEN HGT FAULT When the tighten screw height is inappropriate during thread tightening, this item is highlighted in red to warn of the fault.

This section describes the details of operating procedures and functions available by the switches on the "TIGHTEN FAULT" screen.

TIGHTEN FAULT screen

• [Tightening fault indication]

Type of a fault occurred to a work during operation is indicated by red indicator.

• [FAULT DETAIL]

When this switch is touched, the "TIGHTEN FAULT-DETAIL" screen appears. Select it when you want to check what kind of tightening fault occurred and which point is faulty.

• [FAULT LOG]

When this switch is touched, the "FAULT LOG" screen appears. Select it when you want to check the fault log.

• [RESET]

This switch allows reset of tightening fault. When any fault occurs, this switch is highlighted in red.

• [RET]

2.12 Recording points tightening fault occurred during automatic running

This function, provided for the thread tightening robot series only, allows the record of points where tightening faults occurred during the automatic running, related to the point number.

Faults and number of points to be recorded

- Tighten torque fault · · · · · Thread tightening is not completed with appropriate tightening torque.
- Tighten screw height fault Thread tightening is not completed with appropriate screw height.

Faults at up to forty points, from 0 to 39, can be recorded for each model.

This section describes the details of operating procedures and functions available by the switches on the "TIGHTEN FAULT-DETAIL" screen.

ROBOT(1)TIGHTEN FAULT RESET RET DETAIL

POINT NO.
O 1 2 3 4 5 6 7 8 9 1011121314
TORQUE
SUREH
HEIGHT SO3132334336373839
TIGHTEN SO313233343336373839
TIGHTEN SO31323334336373839

TIGHTEN FAULT-DETAIL screen

- [Tightening fault indication]
 - Type of fault occurred at each point is indicated by red indicators.
- [RESET]

This switch allows resetting the "TIGHTEN FAULT-DETAIL" screen. When any fault occurs, this switch is highlighted in red.

• [RET]

Notifying fault occurrence 2.13

This function, provided for the thread tightening robot series only, allows the notification of fault occurrence.

Details and types of faults

•	Tighten cycle time fault	· Tightening cannot be completed within the preset period	od.
	righten eyere time raurt	rightening cannot be completed within the preset perio	,

Return cycle time fault ····· Return cycle cannot be completed within the preset period.

Screw parameter number setup fault When the Z- axis is provided for the machine (Example:

 $SR565Y\theta-Z)$

Wrong screw parameter number is set to the work information (first digit of C2) recorded to the point in the work area to be recorded for each model (product).

When operation at the point is performed during the automatic running, this fault is notified.

Screw parameter value fault When the Z- axis is provided for the machine (Example:

 $SR565Y\theta-Z)$

Screw length parameter of the screw parameter number is set to 0 for work information (first digit of C2) recorded to the point in the work area to be recorded for each model (product). When operation at the point is performed during the

automatic running, it is notified.

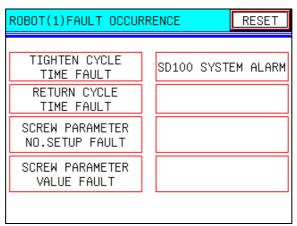
When our KX/NX driver (screw tightening driver) is provided • SD500 system alarm ······

for the machine

When system alarm of the SD*** (T) driver controller is issued, it is notified. Type of the fault is displayed on the front face of the driver controller by any alarm code. For details, refer to the operation manual of the driver controller.

This section describes the details of operating procedures and functions available by the switches on the "FAULT OCCURRENCE" screen.

FAULT OCCURRENCE screen



• [FAULT OCCURRENCE]

When any fault occurs to the machine, this screen appears, and details of the fault are indicated by the red indicators.

• [RESET]

This switch allows reset of faults occurred to the machine. It is highlighted in red when any fault occurs. After it is reset, the previously displayed screen reappears.

2.14 Fault log

This function, provided for the thread tightening robot series only, allows the log and notification of faults occurred to the machine.

Details of fault log

- Log of up to ten faults, such as tightening faults and faults in devices or robot can be displayed on the TP screen.
- In the log, dates, times, and messages of fault occurrence are indicated. If the number of logged faults exceeds ten, the oldest log is deleted, and the latest log is added.

This section describes the details of operating procedures and functions available by the switches on the "FAULT LOG" screen.



FAULT LOG screen

- [Fault log display]
 - This function allows check of the fault log in the past.
- [CLEAR LOG]

The entire fault log can be cleared with this switch.

[RET]

2.15 Cycle time monitor

This function, provided for the thread tightening robot series only, allows measurement of moving time of the thread tightening robot and thread tightening time, as well as the time required for completion of a cycle (cycle time).

Times to be measured and number of points to be recorded

- Robot moving time····· Time required for moving from a work point to another is measured.
- Tightening time · · · · · · Time required for tightening at a work point (including the time required for lifting and lowering of the screw tightening driver) is measured.
- Origin return time ······ Time required for moving from the final work point to the standby point is measured.
- Cycle time · · · · · Time required for completion of a cycle after the machine starts running is measured.
- Data clear All the measurement data can be cleared.

Data of time measured at forty points from 0 to 39 for each model can be recorded.

This section describes the details of operating procedures and functions available by the switches on the "CYCLE TIME MONITOR" screen.

CYCLE TIME MONITOR screen (1)

ROBOT(1)CYCLE TIME MONITOR					EXT	RET
		MOVE	TIGHTEN		MOVE	TIGHTEN
1 CYCLE	0	0.55	2.00	10	0.00	0.00
6.00	1	0.35	2.50	11	0.00	0.00
	2	0.00	0.00	12	0.00	0.00
	3	0.00	0.00	13	0.00	0.00
RETURN	4	0.00	0.00	14	0.00	0.00
ORIGIN	5	0.00	0.00	15	0.00	0.00
0.60	6	0.00	0.00	16	0.00	0.00
	7	0.00	0.00	17	0.00	0.00
DATA	8	0.00	0.00	18	0.00	0.00
CLEAR	9	0.00	0.00	19	0.00	0.00

CYCLE TIME MONITOR screen (2)

ROBOT(:	REV	RET				
		MOVE	TIGHTEN		MOVE	TIGHTEN
1 CYCLE	20	0.00	0.00	30	0.00	0.00
6.00	21	0.00	0.00	31	0.00	0.00
	22	0.00	0.00	32	0.00	0.00
	23	0.00	0.00	33	0.00	0.00
RETURN	24	0.00	0.00	34	0.00	0.00
DRIGIN	25	0.00	0.00	35	0.00	0.00
0.60	26	0.00	0.00	36	0.00	0.00
	27	0.00	0.00	37	0.00	0.00
DATA	28	0.00	0.00	38	0.00	0.00
CLEAR	29	0.00	0.00	39	0.00	0.00

• [CYCLE TIME MONITOR]

From this screen, "Time required for moving to respective points", "Tightening time", "Time required for returning from final work point to origin", and "Cycle time" can be checked.

• [DATA CLEAR]

All the stored cycle time data can be cleared with this switch.

• [NEXT][PREV]

The "CYCLE TIME MONITOR" (1) and (2) screens can be switched with these switches.

• [RET]

2.16 I/O monitor

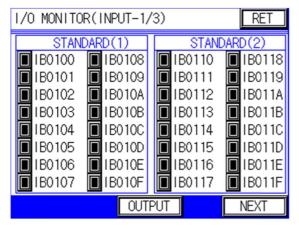
This function allows monitor of the system I/O and the controlling peripheral I/O.

I/O monitor functions

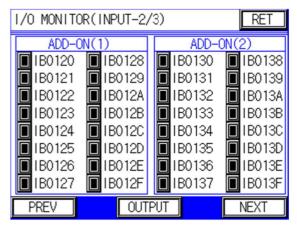
- Standard input monitor It monitors input signal (32-points) provided for the standard type.
- Add-on input monitor · · · · · It monitors input signal (64-points) provided optionally.
- Standard output monitor It monitors output signal (32-points) provided for the standard type.
- Add-on output monitor ····· It monitors output signal (64-points) provided optionally.

This section describes the details of operating procedures and functions available by the switches on the "I/O MONITOR" screens.

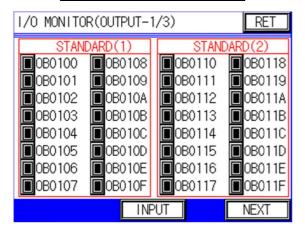
I/O MONITOR screen (INPUT-1/3)



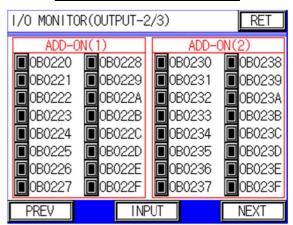
I/O MONITOR screen (INPUT-2/3)



I/O MONITOR screen (OUTPUT-1/3)



I/O MONITOR screen (OUTPUT-2/3)



2. Function of control panel

• [I/O MONITOR]

From these screens, monitor of the I/O is possible.

• [OUTPUT MONITOR][INPUT MONITOR]

The "INPUT MONITOR" and "OUTPUT MONITOR" screens can be switched with these switches.

[NEXT][PREV]

This switch is used to change over the monitor screens (1/3 to 3/3).

• [RET]

When this switch is touched, the previously displayed screen reappears.

2.17 Z_axis Screw height monitor

If your robot is the robot using Z_axis, you can use this function. This function can monitor the screw height that calculated by CPU.

Z_axis SCREW HEIGHT MONITOR screen

ROB	OT(1) Z M	-AX ONT	(IS SCRE TOR	EW H	HETGHT		RET
SCF	REW HEI	GHT	[mm]		D/	ATA.	CLEAR
0	5.00	10	0.00	20	0.00	30	0.00
1	0.20	11	0.00	21	0.00	31	0.00
2	0.20	12	0.00	22	0.00	32	0.00
3	0.10	13	0.00	23	0.00	33	0.00
4	0.00	14	0.00	24	0.00	34	0.00
5	0.00	15	0.00	25	0.00	35	0.00
6	0.00	16	0.00	26	0.00	36	0.00
7	0.00	17	0.00	27	0.00	37	0.00
8	0.00	18	0.00	28	0.00	38	0.00
9	0.00	19	0.00	29	0.00	39	0.00

• [DATA CLEAR]

All the screw height data can be cleared with this switch.

• [RET]

3. Setup of thread tightening robot parameters (Normal mode setup)

This chapter describes the setup of the thread tightening robot parameters (normal mode setup).

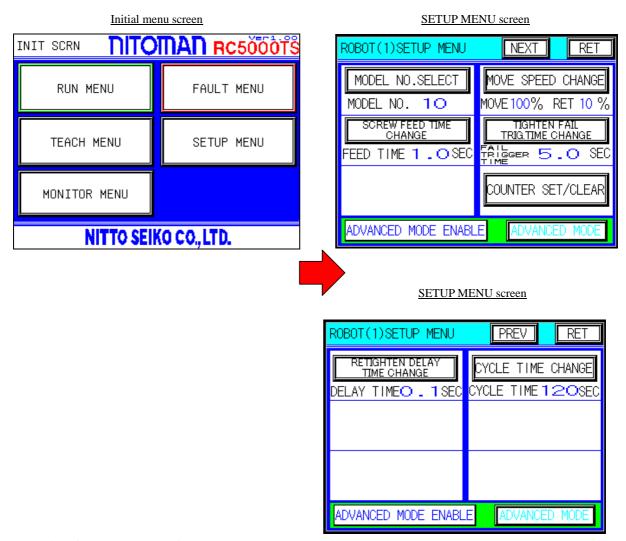
Normal mode setup is the setup of basic conditions required for thread tightening. Setup is valid only when teaching is possible (when the teaching selector key switch is at the "ON" position).

While the setup is valid, characters of "TEACH MENU" and "SETUP MENU" switches on the initial menu screen are indicated in black.

While the setup is invalid, characters of "TEACH MENU" and "SETUP MENU" switches on the initial menu screen are indicated in green.

Switching to "SETUP" screen

- Select the "SETUP MENU" switch on the initial menu screen of the TP. Then, the "SETUP MENU" screen appears, and the selector switches to access to the respective setup screens are displayed.
- Select any intended item switch. Then, the intended screen appears.
- If you push the "NEXT" switch or "PREV" switch of the upper "SETUP MENU" screen, the "SETUP MENU" screen changes.



Details of parameter setup from the setup screens are shown on the next and later pages.

3.1 Selecting model number

This function, provided for the thread tightening robot series only, allows selection of the model number appropriate for works on which thread tightening is performed.

Features

Selection of model number is available from the "MODEL SELECT" screen of the TP. Setup of up to a
hundred types of models, from 0 to 99, is possible. Data of work points up to forty and work
information can be recorded for the selected model.

For details, refer to section 2.5.

3.2 Move speed change

This function, provided for the thread tightening robot series only, allows measurement of moving time of the thread tightening robot and thread tightening time, as well as the time required for completion of a cycle (cycle time).

Features

• Selection of move speed change is available from the "MOVE SPEED CHANGE" screen of the TP. The moving speed can be set within the range between 1% and 100%.

Example 1

Example 2

When set to 20% ····· The robot is operated at 20% of the maximum speed during the automatic or manual running.

Note) Speed ratio during the JOG operation is not changed by this setup. Speed during the JOG operation can be selected or altered from the "JOG" screen.

For details, refer to section 2.6.

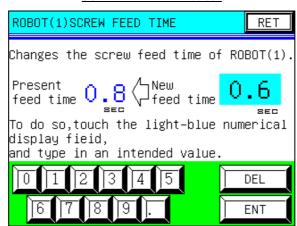
3.3 Screw feed time screen

This function, provided for the thread tightening robot series only, allows change in the screw feeding time (pneumatic type screw feeder) at the screw feeding and tightening point of the thread tightening robot.

Features

• Change in the screw feeding time is available from the "SCREW FEED TIME" screen of the TP. The screw feeding time can be set within the range between 0.1 sec. and 0.9 sec.

This section describes the details of operating procedures and functions available by the switches on the "SCREW FEED TIME" screen.



SCREW FEED TIME screen

• [Changing screw feed time]

Touch the light-blue numerical display field (area indicating "0.6 SEC" on the screen above) with your finger according to the instruction displayed on the screen. Then, a cursor appears on the screen. In this status, type in an the intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

When the intended screw feed time is confirmed, the new value entered as the "Present feed time" is indicated. Deletion of the screw feed time that input has not been completed yet is possible with the "DEL" key.

• [RET]

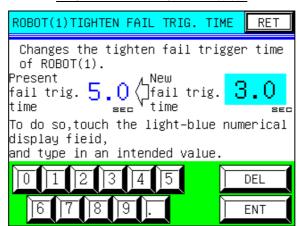
3.4 Changing tightening fail trigger time

This function, provided for the thread tightening robot series only, allows change in the waiting time required for judgment of tightening fail by the tightening robot.

Features

• Change in the waiting time required for judgment of tightening fail by the tightening robot is available from the "TIGHTEN FAIL TRIG. TIME" screen of the TP. The tightening fail trigger time can be set within the range between 0.1 sec. and 9.9 sec.

This section describes the details of operating procedures and functions available by the switches on the "TIGHTEN FAIL TRIG. TIME" screen.



"TIGHTEN FAIL TRIG. TIME" screen

• [Changing tightening fail trigger time]

Touch the light-blue numerical display field (area indicating "3.0 SEC" on the screen above) with your finger according to the instruction displayed on the screen. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

When the intended value is confirmed, the newly typed in value is indicated as the "Present fail trig. time". Deletion of the value that input has not been completed yet is possible with the "DEL" key.

• [RET]

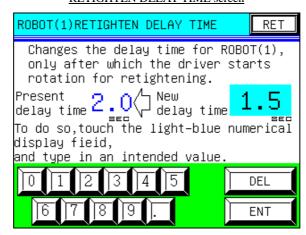
3.5 Changing retightening delay time

This function, provided for the thread tightening robot series only, allows setup of the waiting time from the time the thread tightening tool is forwarded at the retightening point to the time the screw tightening driver starts rotation.

Features

- Change in the retightening delay time is available from the "RETIGHTEN DELAY TIME" screen of the TP. The retightening delay time can be set within the range between 0.1 sec. and 9.9 sec.
- Note) If the lifting speed of the screw tightening driver is changed in this setup, tightening conditions are changed drastically whether the lifting/lowering shaft is the servo motor type or the pneumatic cylinder type. Before changing the speed of the screw tightening driver, be sure to recheck the setup.

This section describes the details of operating procedures and functions available by the switches on the "RETIGHTEN DELAY TIME" screen.



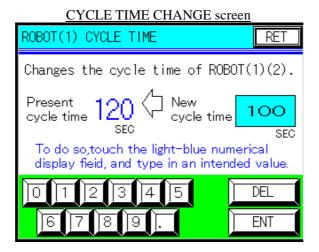
RETIGHTEN DELAY TIME screen

- [Changing retightening delay time]
 - Touch the light-blue numerical display field (area indicating "1.5 SEC" on the screen above) with your finger according to the instruction displayed on the screen. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.
 - When the intended value is confirmed, the newly typed in value is indicated as the "Present delay time". Deletion of the value that input has not been completed yet is possible with the "DEL" key.
- [RET]
 When this switch is touched, the previously displayed screen reappears.

3.6 Cycle time change

This function allows the setup of cycle time up during automatic running.

Note) if you set cycle time at short time, "CYCLE TIME FAULT" may be output before the robot complete fastening of all points.



• [Cycle time change]

Touch the light-blue numerical display field with your finger according to the instruction displayed on the screen. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

When the intended moving speed ratio is confirmed, the new move speed ratio entered as the "New move speed" is indicated. Deletion of the moving speed ratio of which input has not been completed yet is possible with the "DEL" key.

• [RET]

4. Setup of thread tightening robot parameters (Advanced mode setup)

This chapter describes the setup of the thread tightening robot parameters (advanced mode setup).

Advanced mode setup is the setup of system required for the initial startup of the thread tightening robot (basically, this setup does not need to be modified by users). Setup is enabled only when teaching is possible (when the teaching selector key switch is at the "ON" position).

While the setup is valid, characters of "TEACH MENU" and "SETUP MENU" switches on the initial menu screen are indicated in black.

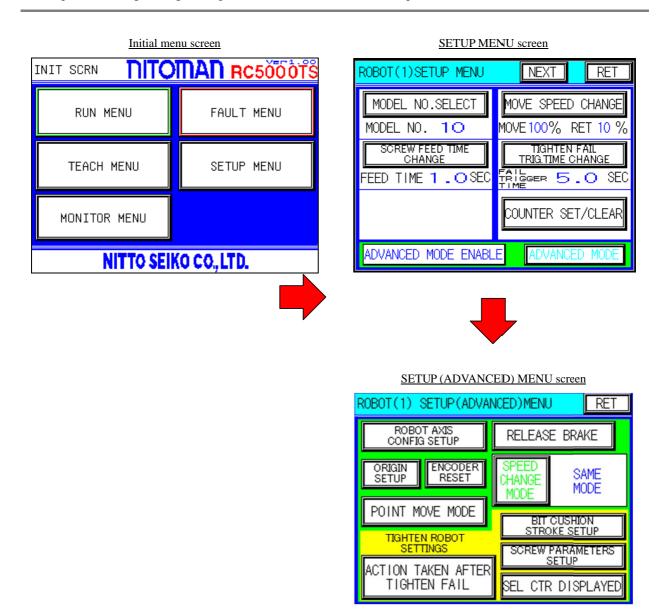
While the setup is invalid, characters of "TEACH MENU" and "SETUP MENU" switches on the initial menu screen are indicated in green.

Note) Modification to this setup shall not be carried out by persons other than our service personnel or the person in charge of equipment maintenance.

Inappropriate modification may lead to breakage of equipment due to unexpected motion of the robot, loss of life caused hazard motion, and faults in production line, causing serious accidents and faults.

Switching to setup screen

- Select "SETUP MENU" switch on the initial menu screen of the TP. Then, the "SETUP MENU" screen appears, and setup menu selector switches are displayed.
- Touch the "ADVANCED MODE DISABLED" field in the lower part of the screen with your finger
 three times. Then, message "ADVANCED MODE ENABLED" is displayed, and the "ADVANCED
 MODE" screen selector switch on the right side of the screen is highlighted in light blue. Then,
 switching to the "SETUP (ADVANCED) MENU" screen is enabled.
- When the "ADVANCED MODE" screen selector switch is touched in this status, the "SETUP (ADVANCED) MENU" screen appears, and the setup screen selector switches are displayed.
- Select any intended selector switch. Then, your intended setup screen appears.



Details of parameter setup from the setup screens are shown on the next and later pages.

4.1 Robot axes configuration

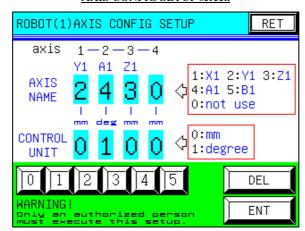
This function allows setup of name and control unit of the axes (arms) provided for the robot.

Features

• Change in the setup of axes configuration is available from the "AXIS CONFIG SETUP" screen of the TP. Setup of name and control unit of the axes (arms) provided for the robot is available from this screen.

Note) This setup must be carried out by the manufacturer only at the initial startup of the machine. DO NOT change it by yourselves.

This section describes the details of operating procedures and functions available by the switches on the "AXIS CONFIG SETUP" screen.



AXIS CONFIG SETUP screen

• [Axis configuration setup]

Touch the light-blue numerical display field in the screen with your finger. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

Deletion of the value that input has not been completed yet is possible with the "DEL" key.

• [axis]

Axis numbers (arm numbers) are indicated here.

• [AXIS NAME]

Axis names (arm names) are indicated here.

Basically, setup of "X1", "Y1", and "Z1" is required for names of axes working with three-dimensional coordinate system (X, Y, and Z-coordinate system).

Basically, setup of "A1" and "B1" is required for name of axis in other than three-dimensional coordinate system (attachment axis in rotary motion or pitch change at the tip of Z-axis).

• [CONTROL UNIT]

Axis control units (arm control units) are indicated here.

When you want to set a control unit to "mm", type in "0". Type in "1" when you want to set it to "degree".

• [Example of axis name parameter setup]

Setup of axis name parameter

When the axis 1 = X1, axis 2 = Y1, and axis 3 = Z1, available input range is as shown below.

Type in any intended value for respective axes from 0 to 5 with numerical keys, referring to the red field on the right side of arrows on the screen.

- 1) Touch the input field of name parameter for the axis 1 with your finger.
- 2) Type in "1".
- 3) Touch the "ENT" key for conformation.
- 4) Touch the input filed of name parameter for the axis 2 with your finger.
- 5) Type in "2".
- 6) Touch the "ENT" key for conformation.
- 7) Touch the input field of name parameter for the axis 3 with your finger.
- 8) Type in "3".
- 9) Touch the "ENT" key for conformation.
- 10) Touch the input field of name parameter for the axis 4 with your finger.
- 11) Type in "0".
- 12) Touch the "ENT" key for conformation.
 - Note 1) Parameters cannot be updated without touching the "ENT" key.
 - Note 2) Be sure to type "0" into the axis name parameter of the arm unused. In this example, "0" must be typed in, since axes 4 and 5 are not used.

• [Example of axis name parameter setup]

Setup of control unit parameter

When only the axes 1 and 2 are used, control unit of the axis 1 is mm, and that of the axis 2 is deg., available input range is as shown below.

Type in any intended value for respective axes with numerical keys, 0 and 1, referring to the blue field on the right side of arrows on the screen.

- 1) Touch the input field of control unit parameter for the axis 1 with your finger.
- 2) Type in "0".
- 3) Touch the "ENT" key for conformation.
- 4) Touch the input field of control unit parameter for the axis 2 with your finger.
- 5) Type in "1".
- 6) Touch the "MDI ENT" key for conformation.
 - Note 1) Parameters cannot be updated without touching the "ENT" key.
 - Note 2) Setup of the control unit parameter of the unused arm is unnecessary.

 In this example, setup of the control unit parameters of the axes 3 and 4 is unnecessary.

• [RET]

When this switch is touched, the "SETUP (ADVANCED) MENU" screen reappears.

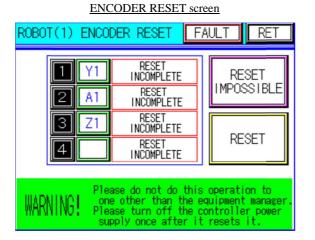
4.2 Encoder reset (initialization) procedure

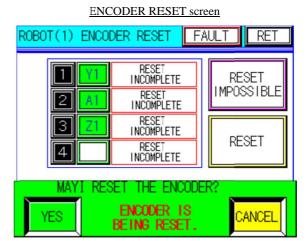
This function is used to reset (initialize) the servo motor encoder incorporated in the robot.

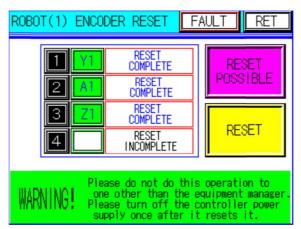
Major function:

- This function resets (initializes) the encoder on the ENCODER RESET screen of the TP. On this screen, you can reset each axis of the servo motor encoder incorporated in the robot.
- Note) The setting of this function is assumed to be conducted by the manufacturer at the time of initial startup of the robot. Do not allow any person other than a system administrator to change the default setting.

This section describes the details of operating procedures and functions available by the switches on the "ENCODER RESET" screen.







- [Encoder reset (initialization) procedure]
 - 1) Select an axis subject to encoder reset processing with the encoder reset axis selection switch on the screen. The selected switch lights up in green. (In this example, "Y1", "A1" and "Z1" are selected.)
 - 2) Touch the [RESET IMPOSSIBLE] display field with a finger three times, to change the indication to [RESET POSSIBLE]. When the system becomes ready for origin setup, the indicator lights up in purple. This operation is interlock for protection against encoder reset operation.
 - 3) In this status, press the [RESET] switch on the screen.

- 4) The confirmation window opens at the bottom of the screen, asking if you intend to reset the encoder.
- 5) If you intend to reset the encoder, press [YES]. The "ENCODER IS BEING RESET" message appears at the center of the confirmation window, and then the window automatically closes. At this time, the "ENCODER IS BEING RESET" message appears at the center of the confirmation window. Then, the character indicated on the right of the axis selection field changes to [RESET COMPLETE], and you can confirm that the encoder reset processing is completed. If you do not intend to reset the encoder, press [CANCEL].
- 6) After completion of the encoder reset processing, turn OFF the controller power supply once. This completes the encoder reset procedure.

• [RET]

When this switch is touched, the "SETUP (ADVANCED) MENU" screen reappears.

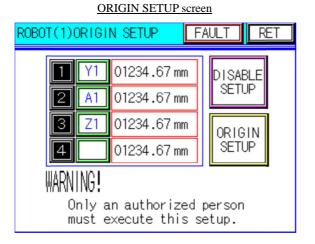
4.3 Origin setup

This function allows setup of the origins of axes (arms) provided for the robot.

Features

- Origins of axes (arms) of the robot can be set from the "ORIGIN SETUP" screen of the TP for each axis.
- Note) The setting of this function is assumed to be conducted by the manufacturer at the time of initial startup of the robot. Do not allow any person other than a system administrator to change the default setting.

This section describes the details of operating procedures and functions available by the switches on the "ORIGIN SETUP" screen.



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ORIGIN SETUP screen (confirmation)

• [Origin setup]

- Select any intended axis with the origin setup axis selector switches. The selected switch is highlighted in green.
 - (In this example, "Y1", "A1", and "Z1" are displayed.)
- 2) Touch the "DISABLE SETUP" field with your finger <u>three times</u> to enable the setup of origins. Then, the "DISABLE SETUP" field is changed to the "ENABLE SETUP" field, and is highlighted in purple. This interlock function is provided to prevent mis-operation in origin setup.
- 3) In this status, select the "ORIGIN SETUP" switch.
- 4) Window with confirmation message "SETS UP THE ORIGIN. ARE YOU SURE?" opens in the lower part of the screen again.
- 5) To confirm the setup, select the "YES" switch. When the setup is completed, message "ORIGIN SETUP COMPLETED!" appears in the center of the window, and the window closes automatically. To cancel the setup, select the "CANCEL" switch.
- [RET]
 When this switch is touched, the "SETUP (ADVANCED) MENU" screen reappears.

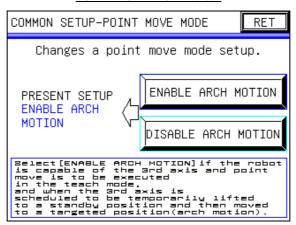
4.4 Point move mode

This function allows the setup of moving order of the third axis equipped with the robot during teaching (point move operation).

Features

- Setup of the point move mode is available from the "POINT MOVE MODE" screen. If the robot is equipped with the third axis (such as models SR560Yθ-Z and XYZ), setup of the arm moving order during the point move operation is possible.
- Selecting "ENABLE ARCH MOTION"
 If the third axis is equipped with the lifting/lowering shaft, select the "ENABLE ARCH MOTION".
 After the lifting/lowering shaft is raised to the standby point during the point move operation, it is moved to the area above the target point, and lowered.
- Selecting "DISABLE ARCH MOTION"
 If the third axis is not equipped with the lifting/lowering shaft, select the "DISABLE ARCH MOTION".
 The lifting/lowering shaft is directly moved to the target point during the point move operation.
- Note) This setup must be carried out by the manufacturer only at the initial startup of the machine. DO NOT change it by yourselves.

This section describes the details of operating procedures and functions available by the switches on the "POINT MOVE MODE" screen.



POINT MOVE MODE screen

• [Setup in point move mode]

The mode can be switched by choosing either of the "ENABLE ARCH MOTION" or "DISABLE ARCH MOTION" switch on the screen. When the "ENABLE ARCH MOTION" switch is chosen, message notifying the execution of the arch motion is displayed on the left side of the arrow on the screen. When the "DISABLE ARCH MOTION" switch is chosen, message notifying the non-execution of the arch motion is displayed on the same field on the screen.

• [RET]

When this switch is touched, the "SETUP (ADVANCED) MENU" screen reappears.

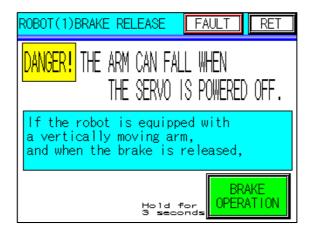
4.5 Brake release operation

This function allows release of the brake of the servo motor provided for the axis (arm) of the robot.

Features

- Release of the brake is available from the "BRAKE RELEASE" screen of the TP. All the brakes of the servo motors provided for the axes (arms) of the robot can be released.
- Note) If the robot is equipped with the lifting/lowering axis (arm), release of the brake may lead to drop of the arm at a high speed. Before releasing the brake, move the arm to safe location by the JOG operation. This operation shall be carried out by our service personnel or the person in charge of equipment maintenance only.

This section describes the details of operating procedures and functions available by the switches on the "BRAKE RELEASE" screen.



BRAKE RELEASE screen

• [Brake release operation]

The brake operates every time the switch on the lower right of the screen is pushed. If you hold down the switch for more than 3 seconds in that state, the brake will be released.

If the brake is being applied, message "BRAKE OPERATION" indicated on the switch is highlighted in green in the lower right part of the screen. If the brake is released, message "BRAKE RELEASED" indicated on the switch is highlighted in yellow on the same field.

• [FAULT]

When this switch is touched, the "ROBOT FAULT" screen appears.

• [RET]

4.6 Speed change mode (function to be used in the future)

This function is provided for use in the future, and is not used at present.

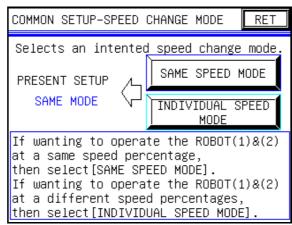
If the function enabling the control of two robots will be provided in the future, they may be used in a unit or separately.

When change in the speed of the both robots is required because you want to use them in a unit or for other reasons, select the "SAME SPEED MODE".

Features

- Setup of the speed change mode is possible from the "SPEED CHANGE MODE" screen of the TP.
- Selecting "SAME SPEED MODE"
 When change in the speeds of the two robots used in a unit may cause interference, or change in the speeds of the both robots is required for other reasons, select the "SAME SPEED MODE".
- Selecting "INDIVIDUAL SPEED MODE"
 When two robots are used in separate units or independent change in the speeds of the two robots is required for other reasons, select the "INDIVIDUAL SPEED MODE".
- Note) This setup must be carried out by the manufacturer only at the initial startup of the machine. DO NOT change it by yourselves.

This section describes the details of operating procedures and functions available by the switches on the "SPEED CHANGE MODE" screen.



SPEED CHANGE MODE screen

• [Change of speed mode]

The speed mode can be switched by choosing the "SAME SPEED MODE" switch or "INDIVIDUAL SPEED MODE" switch on the screen. When the "SAME SPEED MODE" switch is chosen, message "PRESENT SETUP SAME MODE" is displayed on the left side of the arrow on the screen. When the "INDIVIDUAL SPEED MODE" switch is chosen, message "PRESENT SETUP INDIVIDUAL MODE" is displayed on the same field on the screen.

• [RET]

When this switch is touched, the "SETUP (ADVANCED) MENU" screen appears.

4.7 Selecting action taken after tightening failure occurred

This function, provided for the thread tightening robot series only, allows selection of the action to be taken after tightening failure occurred during the automatic running. Selection of troubleshooting mode is possible from the "ACTION TAKEN AFTER TIGHTEN FAILURE" screen of the TP.

Selecting action to be taken

•	CONTINUE mode ······ If this mode is selected, operation will not be interrupted even when
	tightening failure occurs, and a cycle will be completed.

- BREAK mode ······ If this mode is selected, operation will be interrupted when tightening failure occurs, and a cycle will be stopped.
- CHOICE mode ······ If this mode is selected, operation will be stopped when tightening failure occurs, screen to select actions appears, and the operator can select any action among the four choices shown below.

"GOOD CONTINUE"	Select this item if you accept the thread
	tightening done at the work position judged to
	be rejected and want to proceed the next
	operation. (The machine does not store
	rejection data.)

"REJECT CONTINUE"..... Select this item if you do not accept the thread tightening done at the work position judged to be rejected and want to proceed the next operation. (The machine stores data of work point where the fault occurred.)

"RETRY" Select this item if you want to repeat thread tightening at the work position judged to be rejected. (In case of faulty screw feeding or when rework after correction by operator is

possible.)

"BREAK" Select this item if you want to interrupt thread

tightening and stop the cycle.

(The machine stores data of work point where

the fault occurred.)

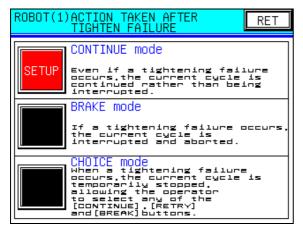
Only one action can be selected among the three actions above.

Note) This operation shall not be carried out by persons other than our service personnel or the person in charge of equipment maintenance.

This section describes the details of operating procedures and functions available by the switches on the "ACTION TAKEN AFTER TIGHTEN FAILURE" screen.

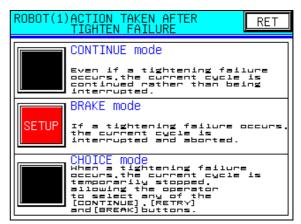
ACTION TAKEN AFTER TIGHTEN FAILURE

(CONTINUE mode selected) screen



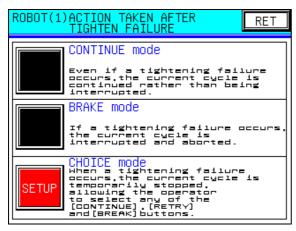
ACTION TAKEN AFTER TIGHTEN FAILURE

(BREAK mode selected) screen



ACTION TAKEN AFTER TIGHTEN FAILURE

(CHOICE mode selected) screen



- [Selection of action taken after tightening failure occurred]

 Any intended action to be taken after tightening failure occurred can be selected by selecting any

 "SETUP" switch on the left side of the descriptions of action modes on the screens shown above. The
 selected switch is highlighted in red with "SETUP" displayed to indicate the selected mode.
- [RET]
 When this switch is touched, the "SETUP (ADVANCED) MENU" screen reappears.

4.8 Screw parameters setup

Setup of the screw parameters, provided for the thread tightening robot series only, must be carried out if the robot is equipped with the axis-Z (for example, $SR565Y\theta$ -Z). This function allows setup of screw length used for tightening and tightening conditions.

This function can be set on the "SCREW PARAMETER SIMPLE SETUP (1) to (5)" screen and the "SCREW PARAMETER DETAIL SETUP (1) to (5)" screens of the teaching pendant.

Normally, the simple setup mode should be used.

To execute more close control, use the detail setup mode. This mode enables more detailed settings of the robot operations.

Setup of the screw parameters up to five types is available.

Simple setup function

Si	mple setup function	
•	Distance setup (mm)	
	Screw length ·····	Length of screw used can be set within the range between 0.1 mm and 999.9 mm.
	Approach offset on work ······	Offset distance to change the tightening torque (for initial tightening) of the lifting/lowering shaft (tightening driver) and the speed (from initial tightening to final tightening) before the bottom of the screw comes in contact with a workpiece can be set within the range between 0.1 mm and 999.9 mm.
	Workpiece thickness ·····	Set a thickness of a target workpiece. The setting range is 0.1 to 999.9 mm.
	Final torque change point ······	Offset distance from the teaching point to change the tightening torque of the tightening driver (for final tightening) can be set within the range between 0.1 mm and 999.9 mm.
	Target offset·····	Offset distance from the teaching point to offset a step to be set against a workpiece can be set within the range between 0.1 mm and 999.9 mm.
	Height detect range ·····	Range of screw height detection to be set against a workpiece can be set in \pm value within the range between 0.1 mm and 99.9 mm.
	Vacuum OFF ·····	Set a vacuum OFF position relative to a teaching position. The setting range is 0.1 to 99.9 mm. When the driver reaches an overhead position at a distance of a "vacuum OFF" value from the teaching position, the vacuum (vacuum
		chuck of a screw) is turned OFF.

• Tightening force limit (%)

Fast forward······ Tightening force at the time that the lifting/lowering shaft

(tightening driver) is lowered from the standup point to the "screw length + approach offset on work" point can be set within the range between 0% and 300%.

Initial torque ····· Tightening force at the time that the lifting/lowering shaft (tightening driver) is lowered from the "screw length + approach offset on work" point to the "final torque change" point can be set within the range between 0% and 300%.

Final torque ····· Tightening force at the time that the lifting/lowering shaft (tightening driver) is lowered from the "final torque change" point to the "target offset" point can be set within the range between 0% and 300%.

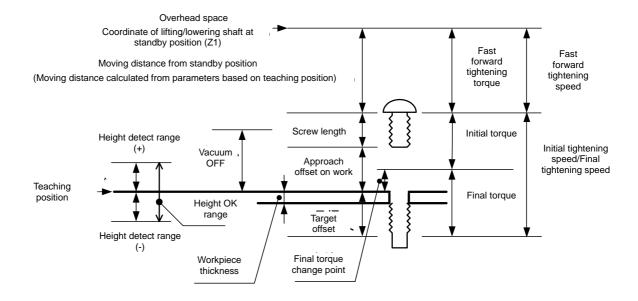
• <u>Tightening speed setup (mm/sec.)</u>

Fast forward Tightening speed at the time that the lifting/lowering shaft

(tightening driver) is lowered from the standup point to the "screw length + approach offset on work" point can be set within the range between 0 mm/sec. and 720 mm/sec.

From initial torque to final torque ··· Tightening speed at the time that the lifting/lowering shaft (tightening driver) is lowered from the "screw length + approach offset on work" point to the "target offset" point can be set within the range between 0 mm/sec. and 720 mm/sec.

Illustration of screw parameter simple setup

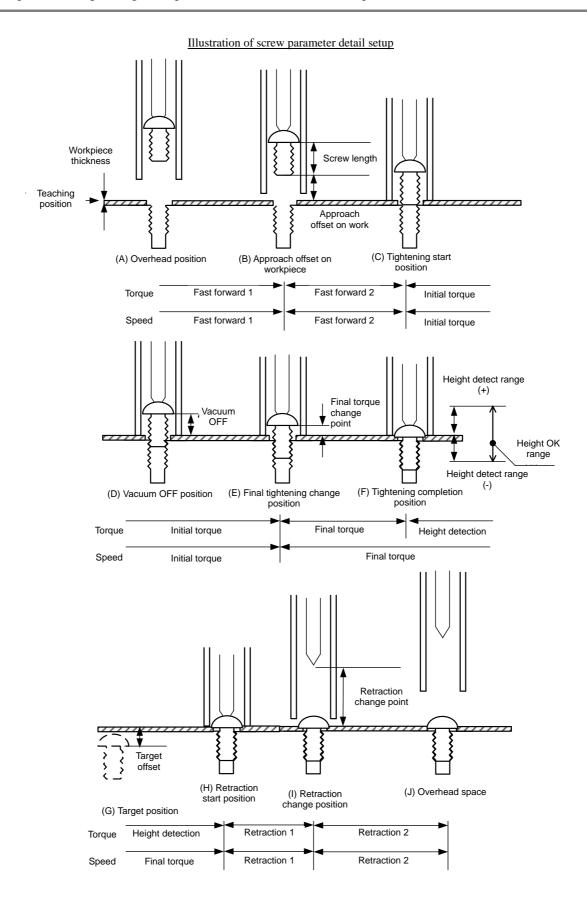


De	etail setup function	
•	Distance setup (mm)	
	Screw length · · · · · · · · · · · · · · · · · · ·	· Length of screw used can be set within the range between 0.1 mm and 999.9 mm.
	Approach offset on work······	• Set an offset value to change torque and speed of the lifting/lowering shaft (tightening driver) to "fast forward 2" torque and "fast forward 2" speed immediately before the driver reaches a tightening surface. The setting range is 0.1 to 999.9 mm.
	Workpiece thickness ·····	• Set a thickness of a target workpiece. The setting range is 0.1 to 999.9 mm.
	Final torque change point ······	• Set an offset value relative to a teaching position to change torque and speed of the tightening driver to "final tightening" torque and "final tightening" speed. The setting range is 0.1 to 999.9 mm.
	Target offset·····	Offset distance from the teaching point to offset a step to be set against a workpiece can be set within the range between 0.1 mm and 999.9 mm.
	Height detect range + · · · · · · · · · · · · · · · · · ·	Range of screw height detection to be set against a workpiece can be set in + value within the range between 0.1 mm and 99.9 mm.
	Height detect range – · · · · · · · · · · · · · · · · · ·	Range of screw height detection to be set against a workpiece can be set in – value within the range between 0.1 mm and 99.9 mm.
	Vacuum OFF ·····	· Set a vacuum OFF position relative to a teaching position. The setting range is 0.1 to 99.9 mm. When the driver reaches an overhead position at a distance of a "vacuum OFF" value from the teaching position, the vacuum (vacuum chuck of a screw) is turned OFF.

Retraction change point ······ Set an offset value relative to a teaching position to change the driver's torque and speed to "retraction 2" speed and "retraction 2" torque. The setting range is 0.1 to 999.9 mm.

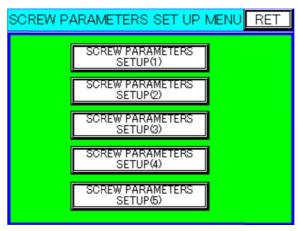
Fast forward 1 ······	· Tightening force at the time that the lifting/lowering shaft (tightening driver) is lowered from the standby point to the "screw length + approach offset on work" point can be set within the range between 0% and 300%.
Fast forward 2 ······	· Set a torque to lower the lifting/lowering shaft (tightening driver) from a position of "screw length + approach offset on workpiece" to a position of "screw length – workpiece thickness". The setting range is 0% to 300%.
Initial torque ·····	· Tightening force at the time that the lifting/lowering shaft (tightening driver) is lowered from the "screw length + approach offset on work" point to the "final torque change" point can be set within the range between 0% and 300%.
Final torque ······	· Tightening force at the time that the lifting/lowering shaft (tightening driver) is lowered from the "final torque change" point to the "target offset" point can be set within the range between 0% and 300%.
Height detection ·····	· Set a torque during height detection when the lifting/lowering shaft (tightening driver) starts retraction after completion of tightening. The setting range is 0% to 300%.
Retraction 1 ·····	· Set a torque to raise the lifting/lowering shaft (tightening driver) from a tightening completion position to a "retraction change point". The setting range is 0% to 300%.
Retraction 2 ·····	· Set a torque to raise the lifting/lowering shaft (tightening driver) from a "retraction change point" to the standby point. The setting range is 0% to 300%.

Tightening speed setup (mm/sec.)	
Fast forward 1 ······	··· Tightening speed at the time that the lifting/lowering shaft (tightening driver) is lowered from the standup point to the "screw length + approach offset on work" point can be set within the range between 0 mm/sec. and 720 mm/sec.
Fast forward 2 ·····	··· Set a speed to lower the lifting/lowering shaft (tightening driver) from a position of "screw length + approach offset on workpiece" to a position of "screw length – workpiece thickness". The setting range is 0 to 720 mm/sec.
Initial torque ······	··· Set a speed to lower the lifting/lowering shaft (tightening driver) from a position of "screw length – workpiece thickness" to a "final tightening change position". The setting range is 0 to 720 mm/sec.
Final torque ·····	··· Set a speed to lower the lifting/lowering shaft (tightening driver) from a "final tightening change position" to a "target offset position". The setting range is 0 to 720 mm/sec.
Retraction 1 ······	··· Set a torque to raise the lifting/lowering shaft (tightening driver) from a tightening completion position to a "retraction change point". The setting range is 0 to 720 mm/sec.
Retraction 2 ·····	··· Set a torque to raise the lifting/lowering shaft (tightening driver) from a "retraction change point" to the standby position. The setting range is 0 to 720 mm/sec.



This section describes the details of operating procedures and functions available by the switches on the "SCREW PARAMETER SELECTION MENU" screen.

SCREW PARAMETER SELECTION MENU screen



• SCREW PARAMETER SELECTION MENU screen [RET]

When this switch is touched, the "SETUP (ADVANCED) MENU" screen reappears.

[SCREW PARAMETER (*) SETUP]

These switches are used to show the SCREW PARAMETER (*) SETUP screen.

In the case of simple setup, or when no parameter has been set, you will go to the simple setup screen.

In the case of detail setup, you will go to the detail setup screen.

*: Number of 1 to 5.

SCREW PARAMETER SIMPLE SETUP (1) screen

SCREW PAR. SIMPLICITY(AMETEI 1)	RS 🕝		RET
MODE CHANGE			WORK WIDTH	012.4
DISTANCE	SCREW LENGTH	APPROACH OFFSET	FINAL TRO CHANGE	TARGET OFFSET
SETUP(mm)	012.4	012.4	012.4	012.4
TIGHTEN FORCE	FAST FORWARI	INITIAL D TORQUE	FINAL TORQUE	HEIGHT DETECT
LIMIT (%)	012	012	012	01.3
TIGHTEN	FAST INITIAL → FINAL FORWARD TORQUE		CUT	
SPEED(mm/s)	012	01	2	01.3
0 1 2 6 7	DEL ENT			

• SCREW PARAMETER SIMPLE SETUP screen

[Setup of screw parameters]

Touch the light-blue numerical display field in the screen with your finger. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

Deletion of value that input has not been completed yet is possible with the "DEL" key.

[MODE SELECTION]

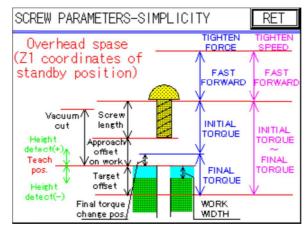
This switch is used to change the screw parameter setup mode from simple setup to detail setup, to show the SCREW PARAMETER (*) DETAIL SETUP screen.

[RET]

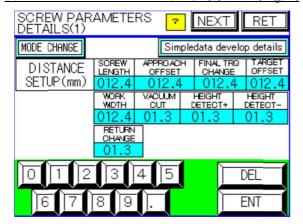
This switch is used to return to the SCREW PARAMETER SELECTION (ADVANCED) MENU screen.

• [?] When this switch is touched, the "SCREW PARAMETERS-DETAIL" screen (help function) appears.

Screw parameter simple setup explanation screen



SCREW PARAMETER DETAIL SETUP (1) screen (Page 1)



SCREW PARAMETER DETAIL SETUP (1) screen (Page 2)

SCREW PARAMETERS PREV RET DETAILS(1)						
TIGHTEN FORCE LIMIT(%)	FORWARDI 012	FORWARD2 012	TORQUE 012	TORQUE 012		
	HEIGHT DETECT	RETURN1 012	RETURN2 012			
TIGHTEN SPEED (mm/s)	FORWARDI 012	FORWARDS 012	NITIAL SPD 012	FINAL 012		
	RETURN1 012	RETURN2 012				
0 1 2 3 4 5			DEL			
6 7 8 9				ENT		

• SCREW PARAMETER DETAIL SETUP screen

[Setup of screw parameters]

Touch the light-blue numerical display field in the screen with your finger. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

Deletion of value that input has not been completed yet is possible with the "DEL" key.

[MODE SELECTION]

This switch is used to change the screw parameter setup mode from detail setup to simple setup, to show the SCREW PARAMETER (*) SIMPLE SETUP screen.

[CHANGE FROM SIMPLE SETUP TO DETAIL]

This switch is used to reflect the data specified on the simple setup screen into the detail setup screen. A parameter that has not been specified on the simple setup screen will be set at a default value for simple setup.

[NEXT PAGE] [PREVIOUS PAGE]

These switches are used to change over the distance setup screen and the torque/speed setup screen.

[RET]

This switch is used to return to the SCREW PARAMETER SELECTION (ADVANCED) MENU screen.

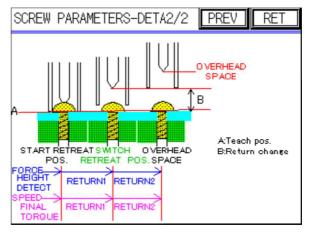
• [?]

When this switch is touched, the "SCREW PARAMETERS-DETAIL" screen (help function) appears.

Screw parameter detail setup explanation screen (1)

SCREW PARAMETERS-DETA1/2 NEXT RET A:Teach pos. B:Screwleng O:Work width D:Approach offset on work WORK OFFSET TIGHTEN FIGHNALTRQ TARGET POS. START POS. POS. POS. POS. E:Vacuum cut FORCE FAST FAST FORWARD2 INITIAL TORQUE F:FinalTRQ change TORQUE G:Height detect+ H:Height detectl:Target offset

Screw parameter detail setup explanation screen (2)



4.9 Counter selection

This function, provided for the thread tightening robot series only, allows selection of counters to be displayed on the "AUTO RUN" screen of the TP.

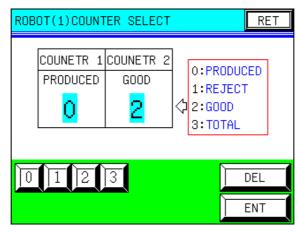
Counters

- Produced counter It indicates the total quantity of manufactured products. Sum of the number indicated in the reject counter and that in the good counter is the total quantity.
 Reject counter It indicates the quantity of products rejected among manufactured products.
- Good counter ····· It indicates the quantity of products accepted among manufactured products.
- Total counter ····· It indicates the total quantity of products manufactured. Use it when measuring the service life of tools including the thread tightening bit.

Two types of counters among four shown above can be selected.

Since the functions of the counter not to be displayed are always valid, quantity of products can be checked from the "GOAL/REJECT/GOOD COUNTER CLEAR" screen or the "TOTAL COUNTER CLEAR" screen of the TP.

This section describes the details of operating procedures and functions available by the switches on the "COUNTER SELECT" screen.



COUNTER SELECT screen

- [Selecting counters to be displayed]
 - Touch the light-blue numerical display field (area indicating "0" or "2" on the screen above) with your finger. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.
 - Deletion of value that input has not been completed yet is possible with the "DEL" key.
- [RET]

When this switch is touched, the "SETUP (ADVANCED) MENU" screen reappears.

4.10 Bit cushion setup function

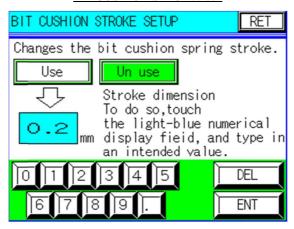
This function is incorporated in the Thread Tightening Robot series.

To use the robot of the Z-axis control type (e.g. $SR565Y\theta$ -Z), be sure to set up this function.

This function can be set up on the "BIT CUSHION SETUP" screen of the TP.

* For a robot other than the Z-axis control type (e.g. $SR565Y\theta$), this function needs not to be set up.

BIT CUSHION SETUP screen



Setup function

• Bit cushion spring installation setting

Installed Select this item when the bit cushion mechanism (bit cushion spring) is installed.

Numerical input field

(within the light blue frame) Enter a free length of the bit cushion spring. The setting range is 0.1 to 9.9 mm.

Not installed Select this item when the bit cushion mechanism (bit cushion spring) is not installed.

5. Teaching pendant function

This chapter describes the teaching pendant function.

5.1 Outline of function

This system provides the teaching pendant function allowing teaching of the robot, as well as "control panel function" and "parameters setup" described in previous chapters.

The teaching pendant is equipped with the software intended for teaching only, enabling the interface type teaching system to be understood easily and the control of faults in the robot.

Features are shown below.

1) The teaching system allows "Manual data input (MDI) teaching", "Remote teaching", and "Direct teaching".

It also enables "JOG operation" and "Point move" as auxiliary operations.

- In the "Manual data input (MDI) teaching", teaching can be performed by entering intended values with the numerical keys.
- In the "Remote teaching", teaching can be performed by moving the robot by the JOG operation.
- In the "Direct teaching", teaching can be performed by setting the robot to the "Servo OFF" status, and manually moving it to the target point.
- In the "JOG operation", auxiliary operation during teaching, the robot is moved for each axis (arm).
- In the "Point move", auxiliary operation during teaching, the robot is moved to the point that teaching has already been performed. This function enables the selection and moving of the intended axis (arm).
- 2) The robot fault control function allows the control of "System error (fault and alarm)", "Motion program alarm", "Motion parameter alarm", and "Servo pack alarm".
 - The "System error (fault and alarm)" means robot controller fault and alarm.
 - The "Motion program alarm" means robot program fault.
 - The "Motion parameter alarm" means robot parameter fault.
 - The "Servo pack alarm" means servo motor driver fault.

- 3) Data of up to forty thread tighten points for a hundred models can be stored.
 - Two teaching systems, "STEP teaching" and "Tabular teaching", as well as "COPY function" (teaching data of the model on which teaching has already been performed can be duplicated to another) are available.
 - Thread tightening point can be stored into the "Work area".
 - In the "STEP teaching", teaching is performed on each thread tightening point.
 - In the "Tabular teaching", teaching is performed with thread tightening points indicated in a table.
- 4) Fixed point data (data of points for which operation is fixed, such as the standby point) of up to forty points can be stored.
 - "Tabular teaching" is available.
 - Fixed points can be stored into the "Fixed area".
 - In the "Tabular teaching", teaching is performed with fixed work points indicated in a table.
- 5) Palletize point data (data of point that parts are taken out from the parts tray) of up to two hundred points for three groups can be stored.
 - "Tabular teaching" and "Three-point teaching" are available.
 - Palletize points can be stored into the "Palletize area".
 - In the "Tabular teaching", teaching is carried out with palletize points indicated in a table.
 - In the "Three-point teaching", reference points (three points) on the tray on which palletizing is to be performed and number of parts on the tray are set, and teaching of the points that parts are taken out from the tray is automatically carried out.
 - Palletize points are available only when the axes (1) and (2) form the rectangular coordinate system.

5.2 Position information control

This system allows storage of robot position information into the group of information, "Table (area)". This table comprises three areas, work area, fixed area, and palletize area.

5.2.1 Work area

Work area is the area to store different work positions depending on model numbers, such as thread tightening points and pass points (position information and work information) in a thread tightening machine. Up to a hundred work areas (models), from 0 to 99, and maximally forty work points for each area, four thousand work points in total, can be stored.

Work information, (C1, C2), and any code between 0 and 99 can be recorded for each point.

5.2.2 Fixed area

Fixed area comprises the single table which can store up to forty points as a complete set. Use it for storage of the points at which work to be done is fixed without record of work information (fixed position), such as stand-by points of the robot and points that parts are taken out from the parts feeder.

Work information cannot be stored into this table.

This table features the record of position information, which does not require work information, since work to be done at the position is fixed in advance, unlike the work area, which can record data of positions, changed depending on the types of workpieces.

5.2.3 Palletize area

Palletize area comprises three types of tables (from 1 to 3) which can store data of up to two hundred points as a complete set.

Points on the parts tray for taking parts out (position information) can be recorded into the palletize area. This table cannot store work information, like the fixed area. However, whether each point should be used or not can be decided individually.

This table features the "Three-point teaching", automatic teaching of parts-taking points on the parts tray by setting the reference points (at three positions) and number of parts on the tray for palletizing (taking parts from the parts tray).

5.3 Teaching

This function allows teaching of the robot. Detailed procedures are as shown below.

The teaching is valid only when the teaching selector key switch is set to the "ON" position.

While the teaching is valid, characters of the "TEACH MENU" and "SETUP MENU" switches on the initial menu screen are indicated in black.

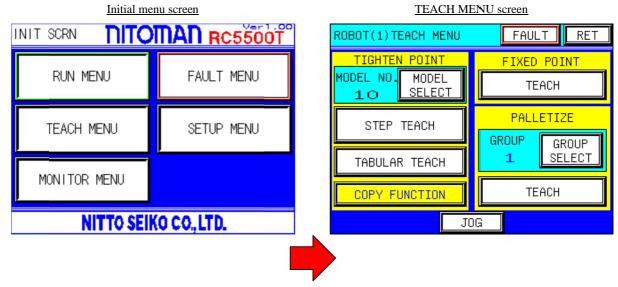
While the setup is invalid, characters of the "TEACH MENU" and "SETUP MENU" switches on the initial menu screen are indicated in green.

Note) This operation shall not be carried out by persons other than our service personnel or the person in charge of equipment maintenance.

Wrong operation may lead to breakage of equipment due to unexpected motion of the robot, loss of life caused hazard motion, and faults in production line, causing serious accidents and faults.

Switching to "TEACH MENU" screen

- Select the "TEACH MENU" switch on the initial menu screen of the TP. Then, the "TEACH MENU" screen appears, and teaching menu selector switches are displayed.
- Select any intended teaching switch at the point (area) you want to carry out the teaching. Then, your intended teaching screen appears.



Details of teaching from the teaching menu screens are shown on the next and later pages.

5.4 Thread tightening point teaching

This function allows the teaching at "Thread tightening points". Detailed procedures are shown below.

5.4.1 Selecting model number

Before teaching at "Thread tightening points", setup of "Model No." on which the teaching to be performed is required.

Select the "MODEL SELECT" switch in the upper part of the yellow "TIGHTEN POINT" field. Then, the "MODEL SELECT" screen appears.

Currently selected "Model No." is indicated on the left side of the "MODEL SELECT" switch.

For details, refer to section 2.5.

5.4.2 STEP teaching

This function allows teaching for each thread tightening point in order of tightening.

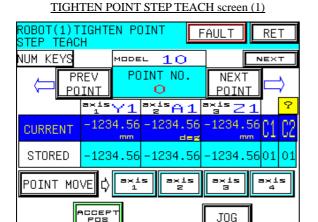
Select the "STEP TEACH" switch in the center of the yellow "TIGHTEN POINT" field on the "TEACH MENU" screen to access to the "STEP TEACH" screen.

Number of models and points to be set

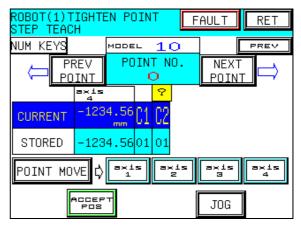
Up to a hundred types of models, from 0 to 99, and work positions up to forty points, from 0 to 39, can be recorded for the selected model. Thus, records of four thousand points in total can be stored.

Work information, (C1, C2), and any code between 0 and 99 can be recorded for each point.

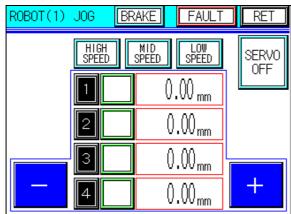
This section describes the details of operating procedures and functions available by the switches on the "TIGHTEN POINT STEP TEACH" screens.



TIGHTEN POINT STEP TEACH screen (2)

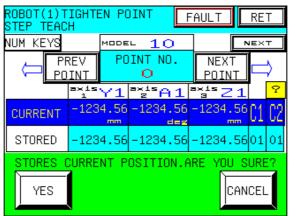






• [STEP teaching (Remote teaching)]

- 1) Ensure that the selected model number indicated as the "MODEL" in the upper part of the "TIGHTEN POINT STEP TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "PREV POINT" and the "NEXT POINT" switches in the upper part of the "TIGHTEN POINT STEP TEACH" screen.
- 3) Access to the "JOG" screen with the "JOG" switch in the lower right part of the "TIGHTEN POINT STEP TEACH" screen.
- 4) Make sure that the servo motor is activated by checking the "SERVO ON" in the upper right part of the "JOG" screen.
- 5) Select any intended robot moving speed with the "HIGH SPEED", "MID SPEED", and "LOW SPEED" selector switches in the center of the upper part of the "JOG" screen. The selected speed selector switch is highlighted in light blue.
- 6) Select any intended axis (arm) on which the JOG operation should be performed with the moving axis selector switches in the center of the "JOG" screen ("Y1", "A1", and "Z1" in the example). The selected axis selector switch is highlighted in green.
- 7) While holding the deadman switch on the teaching pendant grip, choose the "+" or "-" switch on the right and left sides of the "JOG" screen to move the robot to the target point. When the "+" or "-" switch is released or the deadman switch is released, the robot is stopped at the current point. When the "+" or "-" key is touched once while the "LOW SPEED" switch is selected, the robot moves by "0.02". While the key is being touched and held, it moves at a low speed.
- 8) Repeat the steps 5), 6) and 7) above, and move the robot to the target point.
- 9) When the "RET" switch in the upper right part of the "JOG" screen is touched, the "TIGHTEN POINT STEP TEACH" screen reappears.
- 10) Coordinates of the point moved by the JOG operation are indicated as the "CURRENT" in the center of the "TIGHTEN POINT STEP TEACH" screen. In this status, select "ACCEPT POS" switch in the lower part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 11) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.

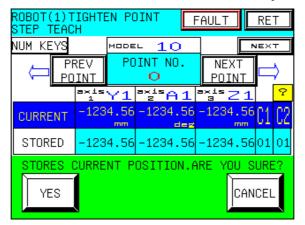


TIGHTEN POINT STEP TEACH screen to store current position

- 12) After the step 11) above is completed, the previously displayed "TIGHTEN POINT STEP TEACH" screen reappears.
- 13) Return to the step 2), and repeat the steps above until the teaching is completed against all the thread tightening points.

• [STEP teaching (Direct teaching)]

- 1) Ensure that the selected model number indicated as the "MODEL" on the "TIGHTEN POINT STEP TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "PREV POINT" and the "NEXT POINT" switches in the upper part of the "TIGHTEN POINT STEP TEACH" screen.
- 3) Access to the "JOG" screen with the "JOG" switch in the lower right part of the "TIGHTEN POINT STEP TEACH" screen.
- 4) Check the "SERVO ON" in the upper right part of the "JOG" screen. If the servo motor is activated, touch the "SERVO ON" switch while touching the "deadman" switch to enter the "SERVO OFF" status.
- 5) When this step is completed, the robot arm is released. However, the lifting/lowering "Z1" axis cannot be released and the brake is applied, since it incorporates the servo motor with brake. To release the brake of the "Z1" axis, select the "BRAKE" switch in the center of upper part of the "JOG" screen to switch to the "BRAKE RELEASE" screen. For details of the brake release operation, refer to section 4.4.
- 6) After finishing the step 5) above, manually move the robot to the target point.
- 7) When the "RET" switch in the upper right part of the "JOG" screen is touched, the screen is returned to the "TIGHTEN POINT STEP TEACH" screen.
- 8) Coordinates of the point moved by manual operation are indicated as the "CURRENT" in the center of the "TIGHTEN POINT TEACH" screen. In this status, select the "ACCEPT POS" switch in the lower part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 9) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.



TIGHTEN POINT STEP TEACH screen to store current position

- 10) After the step 9) above is completed, the previously displayed "TIGHTEN POINT STEP TEACH" screen reappears.
- 11) Return to the step 2), and repeat the steps above until the teaching is completed against all the thread tightening points.
- 12) After teaching is finished, switch to the "JOG" screen again, and carry out the "SERVO ON" operation. The procedures are common to those of the "SERVO OFF" operation.

• [STEP teaching (MDI teaching)]

This function allows the storage of teaching data by entering values for each point with the numerical keys.

- 1) Ensure that the selected model number indicated as the "MODEL" in the upper part of the "TIGHTEN POINT STEP TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "PREV POINT" and the "NEXT POINT" switches in the upper part of the "TIGHTEN POINT STEP TEACH" screen.
- 3) Select the "NUM KEYS" switch in the upper left part of the "TIGHTEN POINT STEP TEACH" screen. Then, the screen shown below appears, and entry with the numerical keys is enabled.

:OBOT(1)TIGHTEN POINT FAULT RET TEP TEACH NUM KEYS POINT NO. NEXT PREV O ^{exis}A1 -1234.56CURRENT STORED -1234.56 -1234.56 -1234.56|01 DEL **ENT**

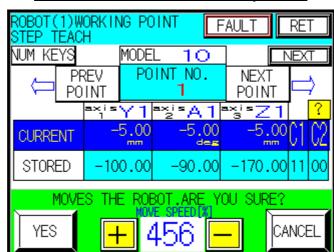
TIGHTEN POINT STEP TEACH screen for MDI teaching

- 4) In this status, touch the stored coordinates or work information in the light-blue numerical display field in the center of the screen with your finger. Then, a cursor appears on the screen. Type in intended coordinates or work information (C1, C2) with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.
 - Deletion of the value that input has not been completed yet is possible with the "DEL" key.
- 5) After entering all the coordinates or work information, select the "NUM KEYS" switch in the upper left part of the screen again. Then, the previously "TIGHTEN POINT STEP TEACH" screen reappears.
- 6) Return to the step 2), and repeat the steps above until the MDI teaching is completed against all the thread tightening points.

• [STEP teaching (point move)]

This function allows you to check whether teaching on the point is appropriate by moving the robot to the point that teaching has already been completed.

- Ensure that the selected model number indicated as the "MODEL" on the "TIGHTEN POINT STEP TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "PREV POINT" and the "NEXT POINT" switches in the upper part of the "TIGHTEN POINT STEP TEACH" screen.
- 3) Select any intended axis (arm) to be moved with axis selector switches from "axis 1 to 4" in the lower part of the "TIGHTEN POINT STEP TEACH" screen. The selected axis selector switch is highlighted in light blue. To move all the axes, select intended switches for all the axes. To move each axis individually, select the intended axis only.
- 4) In this status, select the "POINT MOVE" switch in the lower left part of the "TIGHTEN POINT STEP TEACH" screen. Then, the screen shown below appears. Decide whether the robot should be moved or not.



TIGHTEN POINT STEP TEACH screen for point move

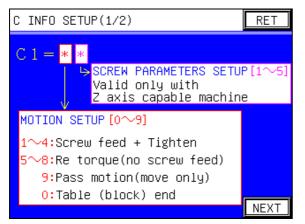
- 5) If you want to execute the point move, choose the "YES" switch. Choose the "CANCEL" switch if you do not want. To stop the robot, touch the "CANCEL" switch or release the deadman switch. Then, the robot is stopped immediately. To stop the robot for emergency, press the "EMERGENCY STOP" switch of the teaching pendant.
 - You can set the robot moving speed from 1 [mm/sec] to 20[mm/sec]. If you push the "+" switch, the robot moving speed is increased. If you push the "-" switch, the robot moving speed is decreased. Before the robot move, you should set the robot moving speed. Please be careful about you push the wrong switch that the "YES" switch and the "+" switch.
- 6) After the step 5) above is completed, the previously displayed "TIGHTEN POINT STEP TEACH" screen reappears.
- 7) Return to the step 2), and repeat the steps above until the moving to the points is completed.

• [Setup of work information]

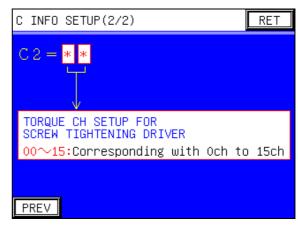
• [?]

Located in the yellow field above the "C2" in the center of the screen. When this switch is touched, the "C INFO SETUP" screen (for help) appears. Descriptions on the values of work information (C1, C2) shown on this screen are as shown below.

C INFO SETUP (1/2) screen

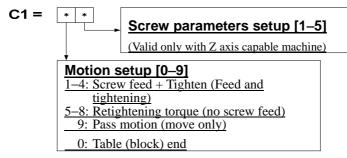


C INFO SETUP (2/2) screen

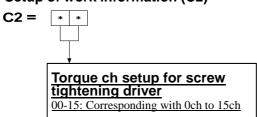


WORK INFO (C1, C2) SETUP

Setup of work information (C1)



Setup of work information (C2)



5. Teaching pendant function

• [NEXT][PREV] ······Located in the upper right part of the screen

The "STEP TEACH" screen for the first to third axes and the "STEP TEACH" screen for the fourth axis can be switched with these switches.

• [FAULT]

When this switch is touched, the "ROBOT FAULT" screen appears. If the robot is faulty, it is highlighted in red to warn of faults in the robot.

• [RET]

When this switch is touched, the previously displayed screen reappears.

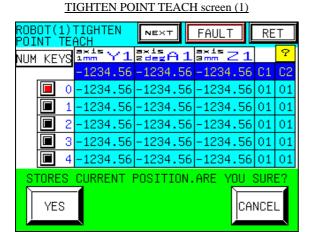
5.4.3 Tabular teaching

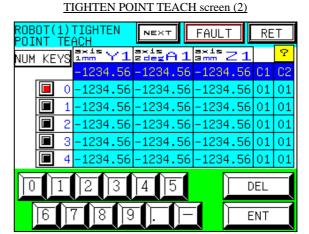
This function allows teaching with "Thread tightening points" displayed in tables. Select the "TABULAR TEACH" switch in the center of the yellow "TIGHTEN POINT" field on the "TEACH MENU" screen to access to the "TIGHTEN POINT TEACH" screen.

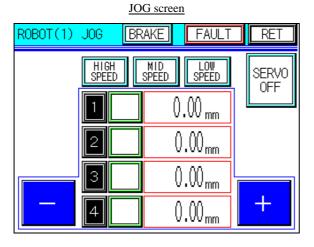
Number of models and points to be set

Up to a hundred types of models, from 0 to 99, and work positions up to forty, from 0 point to 39 point, can be recorded for the selected model. Thus, data of four thousand points in total can be stored. Work information, (C1, C2), and any code between 0 and 99 can be recorded for each point.

This section describes the details of operating procedures and functions available by the switches on the "TIGHTEN POINT TEACH" screen.

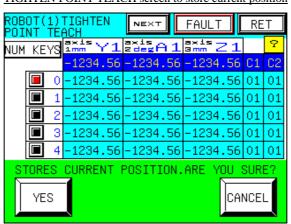






• [Tabular teaching (Remote teaching)]

- Ensure that the selected model number indicated as the "MODEL NO." in the lower part of the "TIGHTEN POINT TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "▲", "▼", "★", and "ᢏ" point scroll switches in the lower left part of the "TIGHTEN POINT TEACH" screen.
- 3) Access to the "JOG" screen with the "JOG" switch in the right lower part of the "TIGHTEN POINT TEACH" screen.
- 4) Make sure that the servo motor is activated by checking the "SERVO ON" in the upper right part of the "JOG" screen.
- 5) Select any intended robot moving speed with the "HIGH SPEED", "MID SPEED", and "LOW SPEED" selector switches in the center of upper part of the "JOG" screen. The selected speed selector switch is highlighted in light blue.
- 6) Select any intended axis (arm) on which the JOG operation should be performed with the moving axis selector switches in the center of the "JOG" screen ("Y1", "A1", and "Z1" in the example). The selected axis selector switch is highlighted in green.
- 7) While holding the deadman switch on the teaching pendant grip, choose the "+" or "-" switch on the right and left sides of the "JOG" screen to move the robot to the target point. When the "+" or "-" switch is released or the deadman switch is released, the robot is stopped at the current point. When the "+" or "-" key is touched once while the "LOW SPEED" switch is selected, the robot moves by "0.02". While the key is being touched and held, it moves at a low speed.
- 8) Repeat the steps 5), 6) and 7) above, and move the robot to the target point.
- 9) When the "RET" switch in the upper right part of the "JOG" screen, the previously displayed "TIGHTEN POINT TEACH" screen reappears.
- 10) Coordinates of the point moved during the JOG operation is indicated in the blue "CURRENT" field in the center of the "TIGHTEN POINT TEACH" screen. In this status, select "ACCEPT POS" switch in the lower right part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 11) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.



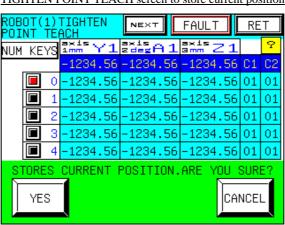
TIGHTEN POINT TEACH screen to store current position

- 12) After the step 11) above is completed, the previously displayed "TIGHTEN POINT TEACH" screen reappears.
- 13) Return to the step 2), and repeat the steps above until the teaching is completed against all the thread tightening points.

• [Tabular teaching (Direct teaching)]

- 1) Ensure that the selected model number indicated as the "MODEL NO." in the lower part of the "TIGHTEN POINT TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "▲", "▼", "★", and "ᢏ" point scroll switches in the lower left part of the "TIGHTEN POINT TEACH" screen.
- 3) Access to the "JOG" screen with the "JOG" switch in the lower right part of the "TIGHTEN POINT TEACH" screen.
- 4) Check the "SERVO ON" in the upper right part of the "JOG" screen. If the servo motor is activated, touch the "SERVO ON" switch while touching the "deadman" switch to enter the "SERVO OFF" status.
- 5) When this step is completed, the robot arm is released. However, the lifting/lowering axis "Z1" cannot be released and the brake is applied, since it incorporates the servo motor with brake. To release the brake of the axis "Z1", select the "BRAKE" switch in the center of the upper part of the "JOG" screen to switch to the "BRAKE RELEASE" screen.

 For details of the brake release operation, refer to section 4.4.
- 6) After finishing the step 5) above, manually move the robot to the target point.
- 7) When the "RET" switch in the upper right part of the "JOG" screen is touched, the "TIGHTEN POINT TEACH" screen reappears.
- 8) Coordinates of the point moved by manual operation is indicated in the blue "CURRENT" field in the center of the "TIGHTEN POINT TEACH" screen. In this status, select the "ACCEPT POS" switch in the lower right part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 9) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.



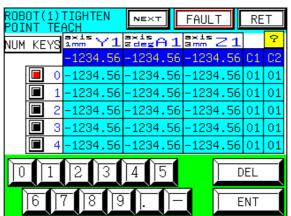
TIGHTEN POINT TEACH screen to store current position

- 10) After the step 9) above is completed, the previously displayed "TIGHTEN POINT TEACH" screen reappears.
- 11) Return to the step 2), and repeat the steps above until the teaching is completed against all the thread tightening points.
- 12) After teaching is finished, switch to the "JOG" screen again, and carry out the "SERVO ON" operation. The procedures are common to those of the "SERVO OFF" operation.

• [Tabular teaching (MDI teaching)]

This function allows the storage of teaching data by entering values for each point with the numerical keys.

- 1) Ensure that the selected model number indicated as the "MODEL NO." in the lower part of the "TIGHTEN POINT TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "▲", "▼", "★", and "ᢏ" point scroll switches in the lower left part of the "TIGHTEN POINT TEACH" screen.
- 3) Select the "NUM KEYS" switch in the upper left part of the "TIGHTEN POINT TEACH" screen. Then, the screen shown below appears, and entry with the numerical keys is enabled.



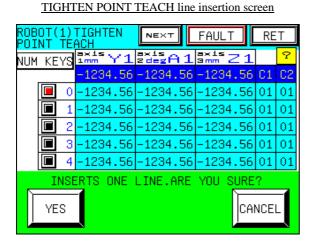
TIGHTEN POINT TEACH screen for MDI teaching

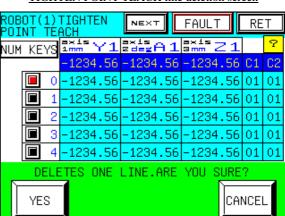
- 4) In this status, touch the stored coordinates or work information in the light-blue numerical display field in the center of the screen with your finger. Then, a cursor appears on the screen. Type in intended coordinates or work information (C1, C2) with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.
 - Deletion of the value that input has not been completed yet is possible with the "DEL" key.
- 5) After entering all the coordinates or work information, select the "NUM KEYS" switch in the upper left part of the screen again. Then, the "TIGHTEN POINT TEACH" screen reappears.
- 6) Return to the step 2), and repeat the steps above until the MDI teaching is completed against all the thread tightening points.

• [Tabular teaching (deleting or inserting line)]

This function assists editing of point data. A line of point data can be deleted or inserted with the "INSERT LINE" or "DEL LINE" switch.

- 1) Ensure that the selected model number indicated as the "MODEL NO." in the lower part of the "TIGHTEN POINT TEACH" screen is correct.
- 2) Select any intended point number to be deleted or to which new point should be inserted with the "▲", "▼", "▲", and "▼" point scroll switches in the lower left part of the "TIGHTEN POINT TEACH" screen. When a new line is to be inserted, a new point is inserted between the selected point and the previous point. When any line is to be deleted, data of the selected point is deleted.
- 3) Choose either of the "INSERT LINE" or "DEL LINE" switch in the lower part of the "TIGHTEN POINT TEACH" screen. Then, either of the screens shown below appears. Decide whether a line should be inserted or not, or it should be deleted or not.
- 4) If you want to insert or delete it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.





TIGHTEN POINT TEACH line deletion screen

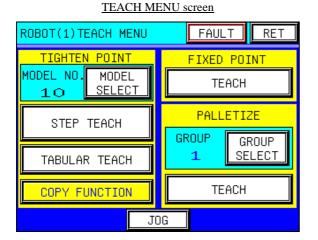
- 5) After the step 4) above is completed, the previously displayed "TIGHTEN POINT TEACH" screen reappears.
- 6) Return to the step 2), and repeat the steps above until editing is completed against all the thread tightening points.
- Note) When insertion of a line is executed, data of the last point No. 39 before a line is inserted is

When deletion of a line is executed, data of the last point No. 39 is set to "0".

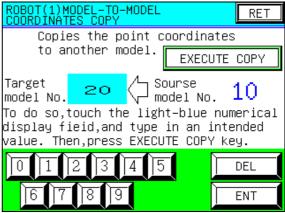
• [Point copy]

This function allows copy of the point coordinates of model that teaching has already been completed to another model.

- 1) Enter the model number of which point coordinates to be copied as the "MODEL NO." on the "TEACH MENU" screen.
- 2) Select the "COPY FUNCTION" switch in the yellow "TIGHTEN POINT" field on the "TEACH MENU" screen. Then, the "MODEL-TO-MODEL COORDINATES COPY" screen appears.

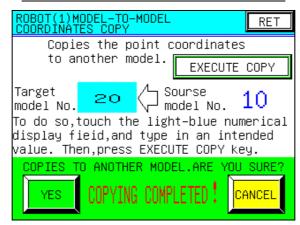


MODEL-TO-MODEL COORDINATES COPY screen



- 3) Touch the light-blue numerical display field (area indicating "20" on the screen above) with your finger. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key. Deletion that input has not been completed yet is possible with the "DEL" key.
- 4) Select the "EXECUTE COPY" switch on the upper part of the "MODEL-TO-MODEL COORDINATES COPY" screen. Then, the screen shown below appears. Decide whether copy should be executed or not.
- 5) If you want to copy, choose the "YES" switch. Choose the "CANCEL" switch if you do not want. As soon as copy is completed, message "COPYING COMPLETED!" appears in the center of the lower part of the screen.

MODEL-TO-MODEL COORDINATES COPY screen

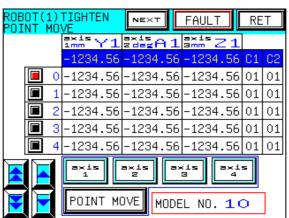


- 7) After the step 6) is complete, the "MODEL-TO-MODEL COORDINATES COPY" screen reappears.
- 8) When the "RET" switch on the upper right part of the screen is touched, the "TEACH MENU" screen reappears.

• [Tabular teaching (Point Move)]

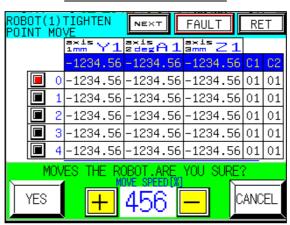
This function allows you to check whether teaching on the point is appropriate by moving the robot to the point that teaching has already been completed.

- Ensure that the selected model number indicated as the "MODEL NO." in the lower part of the "TIGHTEN POINT TEACH" screen is correct.
- 2) Select the "POINT MOVE" switch in the lower right part of the "TIGHTEN POINT TEACH" screen. Then, the screen shown below appears, and selection of point and axis to be moved is enabled.



TIGHTEN POINT MOVE screen

- 3) Select any intended point with the "▲", "▼", "★", and "▼" point scroll switches in the lower left part of the "TIGHTEN POINT MOVE" screen.
- 4) Select any intended axis (arm) to be moved with the axis selector switches from "axis 1 to 4" in the lower part of the "TIGHTEN POINT MOVE" screen. The selected axis selector switch is highlighted in light blue. To move all the axes, select intended switches for all the axes. To move each axis individually, select the intended axis only.
- 5) In this status, select the "POINT MOVE" switch in the lower part of the "TIGHTEN POINT MOVE" screen. Then, the screen shown below appears. Decide whether the point move should be executed or not.



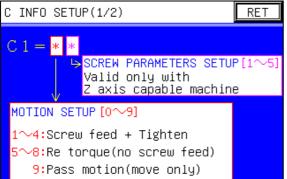
TIGHTEN POINT MOVE screen

- 6) If you want to execute the point move, choose the "YES" switch. Choose the "CANCEL" switch if you do not want. To stop the robot, touch the "CANCEL" switch or release the deadman switch. Then, the robot is stopped immediately. To stop the robot for emergency, press the "EMERGENCY STOP" switch of the teaching pendant.

 You can set the robot moving speed from 1 [mm/sec] to 20[mm/sec]. If you push the "+" switch, the robot moving speed is increased. If you push the "—" switch, the robot moving speed is decreased. Before the robot move, you should set the robot moving speed. Please be careful about you push the wrong switch that the "YES" switch and the "+" switch.
- 7) After the step 6) above is completed, the previously displayed "TIGHTEN POINT MOVE" screen reappears.
- 8) Return to the step 3), and repeat the steps above until the point move is completed.

• [Setup of work information]

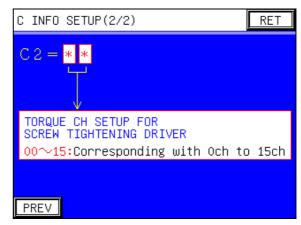
• [?]..... Located in the yellow field above the "C2" in the center of the screen. When this switch is touched, the "C INFO SETUP" screen (for help) appears. Descriptions on the values of work information (C1, C2) shown on this screen are as shown below.



O:Table (block) end

C INFO SETUP (1/2) screen

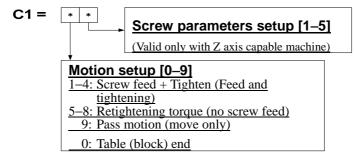
C INFO SETUP (2/2) screen



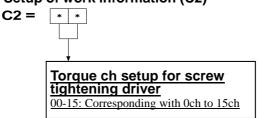
WORK INFO (C1, C2) SETUP

Setup of work information (C1)

NEXT



Setup of work information (C2)



• [NEXT][PREV] ······Located in the upper right part of the screen
The "TIGHTEN POINT TABULAR TEACH, POINT MOVE" screen for the first to third axes and the
"TIGHTEN POINT TABULAR TEACH, POINT MOVE" screen for the fourth axis can be switched with these switches.

• [FAULT]

When this switch touched, the "ROBOT FAULT" screen appears. If the robot is faulty, it is highlighted in red to warn of faults in the robot.

• [RET]

When this switch is touched, the previously displayed screen reappears.

5.5 Fixed point teaching

This function allows the teaching of "Fixed points". Operating procedures are shown below.

5.5.1 Tabular teaching

This function allows teaching with "Fixed points" displayed in tables.

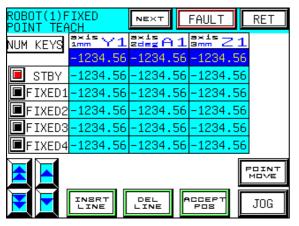
Select the "TEACH" switch in the yellow "FIXED POINT" field on the "TEACH MENU" screen to access to the "FIXED POINT TEACH" screen.

Number of models and points to be set

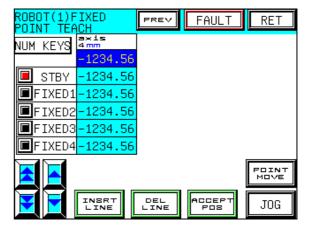
• Fixed work points up to forty, from 0 to 39, can be recorded.

This section describes the details of operating procedures and functions available by the switches on the "FIXED POINT TEACH" screen.

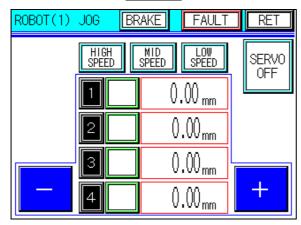
FIXED POINT TEACH screen (1)



FIXED POINT TEACH screen (2)



JOG screen



• [Tabular teaching (Remote teaching)]

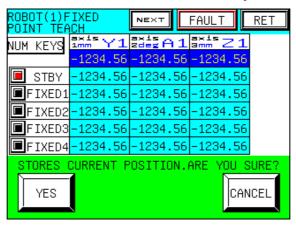
- 1) Select any intended point to be recorded with the "▲", "▼", "★", and "▼" point scroll switches in the lower left part of the "FIXED POINT TEACH" screen.
- 2) Access to the "JOG" screen by touching the "JOG" switch in the lower right part of the "FIXED POINT TEACH" screen.
- 3) Make sure that the servo motor is activated by checking the "SERVO ON" in the upper right side of the "JOG" screen.
- 4) Select any intended robot moving speed with the "HIGH SPEED", "MID SPEED", and "LOW SPEED" selector switches in the center of the upper part of the "JOG" screen. The selected speed selector switch is highlighted in light blue.
- 5) Select any intended axis (arm) on which the JOG operation should be performed with the moving axis selector switches in the center of the "JOG" screen ("Y1", "A1", and "Z1" in the example). The selected axis selector switch is highlighted in green.
- 6) While holding the deadman switch on the teaching pendant grip, choose the "+" or "-" switch on the right and left sides of the "JOG" screen to move the robot to the target point. When the "+" or "-" switch is released or the deadman switch is released, the robot is stopped at the current point. When the "+" or "-" key is touched once while the "LOW SPEED" switch is selected, the robot moves by "0.02". While the key is being touched and held, it moves at a low speed.
- 7) Repeat the steps 4), 5) and 6) above, and move the robot to the target point.
- 8) When the "RET" switch in the upper right part of the "JOG" screen is touched, the "FIXED POINT TEACH" screen reappears.
- Occordinates of the point moved during the JOG operation is indicated in the blue "CURRENT" field in the center of the "FIXED POINT TEACH" screen. In this status, select "ACCEPT POS" switch in the lower right part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 10) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.

FIXED POINT TEACH screen to store current position

- 11) After the step 10) above is completed, the previously displayed "FIXED POINT TEACH" screen reappears.
- 12) Return to the step 2), and repeat the steps above until the teaching is completed against all the fixed points.

• [Tabular teaching (Direct teaching)]

- Select any intended point to be recorded with the "▲", "▼", "▲", and "ᢏ" point scroll switches in the lower left part of the "FIXED POINT TEACH" screen.
- 2) Access to the "JOG" screen by touching the "JOG" switch in the lower right part of the "FIXED POINT TEACH" screen.
- 3) Check the "SERVO ON" in the upper right part of the "JOG" screen, and if the servo motor is activated, touch the "SERVO ON" switch while touching the "deadman" switch to enter the "SERVO OFF" status.
- 4) When this step is completed, the robot arm is released. However, the lifting/lowering axis "Z1" cannot be released and the brake is applied, since it incorporates the servo motor with brake. To release the brake of the axis "Z1", select the "BRAKE" switch in the center of the upper part of the "JOG" screen to switch to the "BRAKE RELEASE" screen.
 - For details of the brake release operation, refer to section 4.4.
- 5) After finishing the step 4) above, manually move the robot to the target point.
- 6) When the "RET" switch in the upper right part of the "JOG" screen is touched, the "FIXED POINT TEACH" screen reappears.
- 7) Coordinates of the point moved by manual operation is indicated in the blue "CURRENT" field in the center of the "FIXED POINT TEACH" screen. In this status, select "ACCEPT POS" switch in the lower right part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 8) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.



FIXED POINT TEACH screen to store current position

- 9) After the step 8) above is completed, the previously displayed "FIXED POINT TEACH" screen reappears.
- 10) Return to the step 2), and repeat the steps above until the teaching is completed against all the fixed points.
- 11) After teaching is finished, access to the "JOG" screen again, and carry out the "SERVO ON" operation. The procedures are common to those of the "SERVO OFF" operation.

• [Tabular teaching (MDI teaching)]

This function allows the storage of teaching data by typing values into each point with the numerical keys.

- 1) Select any intended point to be recorded with the "▲", "▼", "▲", and "▼" point scroll switches in the lower left part of the "FIXED POINT TEACH" screen.
- 2) Select the "NUM KEYS" switch in the upper left part of the "FIXED POINT TEACH" screen. Then, the screen shown below appears, and entry with the numerical keys is enabled.



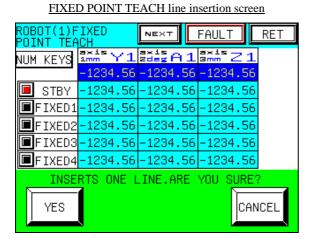
FIXED POINT TEACH screen for MDI teaching

- 3) In this status, touch the stored coordinates in the light-blue numerical display field in the center of the screen with your finger. Then, a cursor appears on the screen. Type in intended coordinates with numerical keys in the lower part of the screen, and confirm with using the "ENT" key. Deletion of the value of which input has not been completed yet is possible with the "DEL" key.
- 4) After entering all the coordinates, select the "NUM KEYS" switch in the lower left part of the screen again. Then, the "FIXED POINT TEACH" screen reappears.
- 5) Return to the step 1), and repeat the steps above until the MDI teaching is completed against all the fixed points.

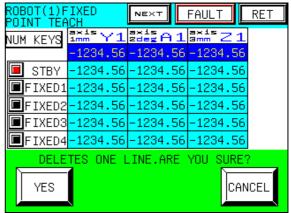
• [Tabular teaching (deleting or inserting line)]

This function assists editing of point data. A line of point data can be deleted or inserted with the "INSRT LINE" or "DEL LINE" switch.

- 1) Select any intended point number to be deleted or to which new line should be inserted with the "▲", "▼", "▲", and "▼" point scroll switches in the lower left part of the "FIXED POINT TEACH" screen. When a new line is to be inserted, a new point is inserted between the selected point and the previous point. When any line is to be deleted, data of the selected point is deleted.
- 2) Choose either of the "INSERT LINE" or "DEL LINE" switch in the lower part of the "FIXED POINT TEACH" screen. Then, either of the screens shown below appears. Decide whether a line should be inserted or not, or it should be deleted or not.
- 3) If you want to insert or delete it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.







- 4) After the step 3) above is completed, the "FIXED POINT TEACH" screen reappears.
- 5) Return to the step 1), and repeat the steps above until the teaching is completed against all the fixed points.
- Note) When insertion of a line is executed, data of the last point No. 39 before a line is inserted is deleted.

When deletion of a line is executed, data of the last point No. 39 is set to "0".

• [Tabular teaching (Point Move)]

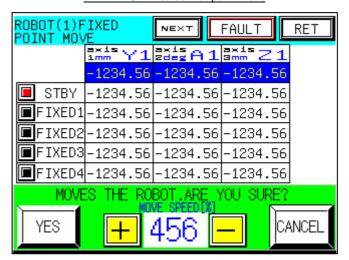
This function allows you to check whether teaching of the point is appropriate by moving the robot to the point that teaching has already been completed.

1) Select the "POINT MOVE" switch in the lower right part of the "FIXED POINT TEACH" screen. Then, the screen shown below appears, and selection of point and axis to be moved is enabled.

NEXT FAULT RET -1234.56 -1234.56 -1234.56 STBY FIXED1 -1234.56 -1234.56 -1234.56 ■FIXED2 -1234.56 -1234.56 **■**FIXED3 -1234.56 -1234.56 -1234.56 FIXED4 -1234.56|-1234.56| -1234.56 axis 2 POINT MOVE

FIXED POINT screen for point move

- 2) Select any intended point with the "▲", "▼", "★", and "ᢏ" point scroll switches in the lower left part of the "FIXED POINT MOVE" screen.
- 3) Select any intended axis (arm) to be moved with the axis selector switches from "axis 1 to 4" in the lower part of the "FIXED POINT MOVE" screen. The selected axis selector switch is highlighted in light blue. To move all the axes, select intended switches for all the axes. To move each axis individually, select the intended axis only.
- 4) In this status, select the "POINT MOVE" switch in the lower part of the "FIXED POINT MOVE" screen. Then, the screen shown below appears. Decide whether the point move should be executed or not.



FIXED POINT screen for point move

- 5) If you want to execute the point move, choose the "YES" switch. Choose the "CANCEL" switch if you do not want. To stop the robot, touch the "CANCEL" switch or release the deadman switch. Then, the robot is stopped immediately. To stop the robot for emergency, press the "EMERGENCY STOP" switch of the teaching pendant.

 You can set the robot moving speed from 1 [mm/sec] to 20[mm/sec]. If you push the "+" switch, the robot moving speed is increased. If you push the "-" switch, the robot moving speed is decreased. Before the robot move, you should set the robot moving speed. Please be careful about you push the wrong switch that the "YES" switch and the "+" switch.
- 6) After the step 5) above is completed, the previously displayed "FIXED POINT MOVE" screen reappears.
- 7) Return to the step 2), and repeat the steps above until the point move is completed.
- [NEXT][PREV] ······located in the upper right part of the screen
 The "FIXED POINT TEACH, POINT MOVE" screen for the first to third axes and the "FIXED POINT TEACH, POINT MOVE" screen for the fourth axis can be switched with these switches.
- [FAULT]

When this switch is touched, the "ROBOT FAULT" screen appears. If the robot is faulty, it is highlighted in red to warn of faults in the robot.

• [RET]

When this switch is touched, the previously displayed screen reappears.

5.6 Palletize point teaching

This function allows the teaching of "Palletize points". Details are shown below. The XYZ rectangular coordinate system robot is given as an example here.

Note) Palletize points can be used only when the axes (1) and (2) form the rectangular coordinate system.

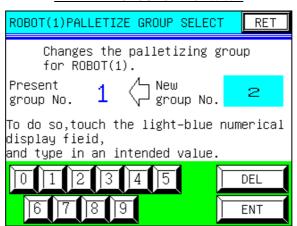
5.6.1 Selecting group number

Before executing the teaching of "Palletize points", selection of "Group" for which teaching should be executed is required.

Select the "GROUP SELECT" switch in the upper part of the yellow "PALLETIZE" field on the "TEACH MENU" screen to access to the "GROUP SELECT" screen.

Currently selected "Group No." is displayed on the left side of the "PALLETIZE GROUP SELECT" screen.

This section describes the details of operating procedures and functions available by the switches on the "PALLETIZE GROUP SELECT" screen.



PALLETIZE GROUP SELECT screen.

• [Selecting group number]

Touch the light-blue numerical display field (area indicating "2" on the screen above) with your finger. Then, a cursor appears on the screen. In this status, type in an intended value with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.

When the intended group number is confirmed, the new value entered as the "Present group No." is indicated. Deletion of the value of which input has not been completed yet is possible with the "DEL" key.

• [RET]

When this switch is touched, the "TEACH MENU" screen reappears.

5.6.2 Tabular teaching (Palletize point)

This function allows teaching with "Palletize points" displayed in tables.

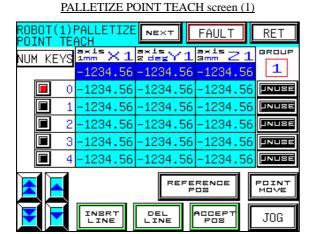
Select the "TEACH" switch in the yellow "PALLETIZE" field on the "TEACH MENU" screen to access to the "PALLETIZE POINT TEACH" screen.

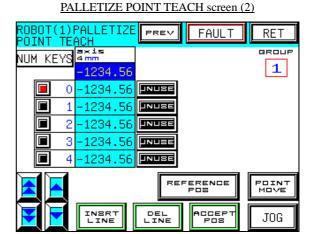
Number of models and points to be set

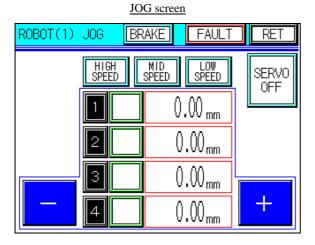
• Up to two hundred palletize points, from 0 to 199, can be recorded to the three groups, from 1 to 3. Thus, six hundred points in total can be recorded.

Whether individual point should be used or not can be chosen.

This section describes the details of operating procedures and functions available by the switches on the "PALLETIZE POINT TEACH" screen.

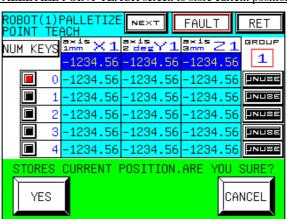






• [Tabular teaching, palletize points (Remote teaching)]

- 1) Ensure that the selected model number indicated as the "GROUP" in the upper right part of the "PALLETIZE POINT TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "▲", "▼", "▲", and "▼" point scroll switches in the lower left part of the "PALLETIZE POINT TEACH" screen.
- 3) Access to the "JOG" screen with the "JOG" switch in the lower right part of the "PALLETIZE POINT TEACH" screen.
- 4) Make sure that the servo motor is activated by checking the "SERVO ON" in the upper right part of the "JOG" screen.
- 5) Select any intended robot moving speed with the "HIGH SPEED", "MID SPEED", and "LOW SPEED" selector switches in the center of the upper part of the "JOG" screen. The selected speed selector switch is highlighted in light blue.
- 6) Select any intended axis (arm) on which the JOG operation should be performed with the moving axis selector switches in the center of the "JOG" screen ("X1", "Y1", and "Z1" in the example). The selected axis selector switch is highlighted in green.
- 7) While holding the deadman switch on the teaching pendant grip, choose the "+" or "-" switch on the right and left sides of the "JOG" screen to move the robot to the target point. When the "+" or "-" switch is released or the deadman switch is released, the robot is stopped at the current point. When the "+" or "-" key is touched once while the "LOW SPEED" switch is selected, the robot moves by "0.02". While the key is being touched and held, it moves at a low speed.
- 8) Repeat the steps 5), 6), and 7) above, and move the robot to the target point.
- 9) When the "RET" switch in the upper right part of the "JOG" screen is touched, the "PALLETIZE POINT TEACH" screen reappears.
- 10) Coordinates of the point moved during the JOG operation are indicated in the blue "CURRENT" field in the center of the "PALLETIZE POINT TEACH" screen. In this status, select "ACCEPT POS" switch in the lower right part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 11) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.



PALLETIZE POINT TEACH screen to store current position

- 12) After the step 11) above is completed, the previously displayed "PALLETIZE POINT TEACH" screen reappears.
- 13) Return to the step 2), and repeat the steps above until the teaching is completed against all the palletize points.

• [Tabular teaching (Direct teaching)]

- 1) Ensure that the selected model number indicated as the "GROUP" in the upper right part of the "PALLETIZE POINT TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "▲", "▼", "▲", and "▼" point scroll switches in the lower left part of the "PALLETIZE POINT TEACH" screen.
- 3) Access to the "JOG" screen with the "JOG" switch in the right lower part of the "PALLETIZE POINT TEACH" screen.
- 4) Check the "SERVO ON" in the upper right part of the "JOG" screen, and if the servo motor is activated, touch the "SERVO ON" switch while touching the "deadman" switch to enter the "SERVO OFF" status.
- 5) When this step is completed, the robot arm is released. However, the lifting axis "Z1" cannot be released and the brake is applied, since it incorporates the servo motor with brake. To release the brake of the axis "Z1", select the "BRAKE" switch in upper the center of the upper part of the "JOG" screen to access to the "PALLETIZE POINT TEACH" screen. For details of the robot release operation, refer to section 4.4.
- 6) After finishing the step 5) above, manually move the robot to the target point.
- 7) When the "RET" switch in the upper right part of the "JOG" screen is touched, the "PALLETIZE POINT TEACH" screen reappears.
- 8) Coordinates of the point moved by manual operation are indicated in the blue "CURRENT" in the center of the "PALLETIZE POINT TEACH" screen. In this status, select "ACCEPT POS" switch in the lower right part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 9) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.

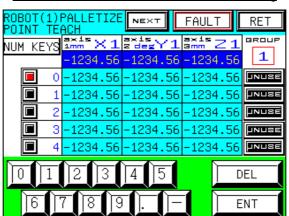
PALLETIZE POINT TEACH screen to store current position

- 10) After the step 9) above is completed, the previously displayed "PALLETIZE POINT TEACH" screen appears.
- 11) Return to the step 2), and repeat the steps above until the teaching is completed against all the palletize points.
- 12) After teaching is finished, access to the "JOG" screen again, and carry out the "SERVO ON" operation. The procedures are common to those of the "SERVO OFF" operation.

• [Tabular teaching, palletize point (MDI teaching)]

This function allows the storage of teaching data by entering values for each palletize point with the numerical keys.

- 1) Ensure that the selected model number indicated as the "GROUP" in the upper right part of the "PALLETIZE POINT TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "▲", "▼", "★", and "ᢏ" point scroll switches in the lower left part of the "PALLETIZE POINT TEACH" screen.
- 3) Select the "NUM KEYS" switch in the upper left part of the "PALLETIZE POINT TEACH" screen. Then, the screen shown below appears, and entry with the numerical keys is enabled.



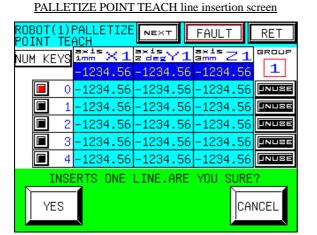
PALLETIZE POINT TEACH screen for MDI teaching

- 4) In this status, touch the stored coordinates in the light-blue numerical display field in the center of the screen with your finger. Then, a cursor appears on the screen. Type in intended coordinates with numerical keys in the lower part of the screen, and confirm with using the "ENT" key. Deletion of the value of which input has not been completed yet is possible with the "DEL" key. Whether the points should be used or not can be decided for each point with the "UNUSE" switches in the center of the right side of the screen. These switches are highlighted in red and the words "UNUSE" are changed to "USE" for points used. For unused points, they are highlighted in black with the words "UNUSE" indicated.
- 5) After entering all the coordinates, select the "NUM KEYS" switch in the lower left part of the screen again. Then, the "PALLETIZE POINT TEACH" screen reappears.
- 6) Return to the step 2), and repeat the steps above until the MDI teaching is completed against all the palletize points.

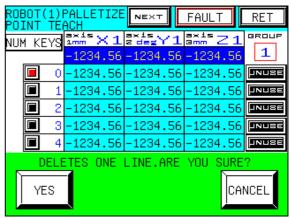
• [TABULAR teaching, palletize point (deleting or inserting line)]

This function assists editing of point data. A line of point data can be deleted or inserted with the "INSERT LINE" or "DEL LINE" switch.

- 1) Ensure that the selected model number indicated as the "GROUP" in the upper right part of the "PALLETIZE POINT TEACH" screen is correct.
- 2) Select any intended point number to be deleted or to which new line should be inserted with the "▲", "▼", "★", and "▼" point scroll switches in the lower left part of the "PALLETIZE POINT TEACH" screen. When a new line is to be inserted, a new point is inserted between the selected point and the previous point. When any line is to be deleted, data of the selected point is deleted.
- 3) Choose either of the "INSERT LINE" or "DEL LINE" switch on the lower part of the "PALLETIZE POINT TEACH" screen. Then, either of the screens shown below appears. Decide whether a line should be inserted or not, or it should be deleted or not.
- 4) If you want to insert or delete it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.







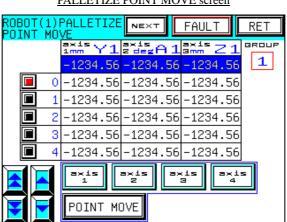
- 5) After the step 4) above is completed, the previously displayed "PALLETIZE POINT TEACH" screen reappears.
- 6) Return to the step 2), and repeat the steps above until the teaching is completed against all the palletize points.
- Note) When insertion of a line is executed, data of the last point No. 199 before a line is inserted is

When deletion of a line is executed, data of the last point No. 199 is set to "0".

• [TABULAR teaching, palletize point (Point Move)]

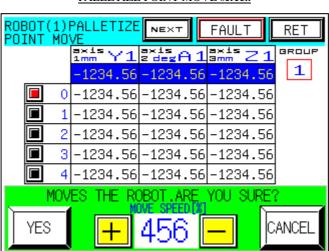
This function allows you to check whether teaching of the point is appropriate by moving the robot to the palletize point that teaching has already been completed.

- 1) Ensure that the selected model number indicated as the "GROUP" in the upper right side of the "PALLETIZE POINT TEACH" screen is correct.
- Select the "POINT MOVE" switch in the lower right part of the "PALLETIZE POINT TEACH" screen. Then, the screen shown below appears, and selection of point and axis to be moved is enabled.



PALLETIZE POINT MOVE screen

- 3) Select any intended point with the "▲", "▼", "★", and "▼" point scroll switches in the lower left part of the "PALLETIZE POINT MOVE" screen.
- 4) Select any intended axis (arm) to be moved with the axis selector switches from "axis 1 to 4" in the lower part of the "PALLETIZE POINT MOVE" screen. The selected axis selector switch is highlighted in light blue. To move all the axes, select intended switches for all the axes. To move each axis individually, select the intended axis only.
- 5) In this status, select the "POINT MOVE" switch in the lower left part of the "PALLETIZE POINT MOVE" screen. Then, the screen shown below appears. Decide whether the point move should be executed or not.



PALLETIZE POINT MOVE screen

- 6) If you want to execute the point move, choose the "YES" switch. Choose the "CANCEL" switch if you do not want. To stop the robot, touch the "CANCEL" switch or release the deadman switch. Then, the robot is stopped immediately. To stop the robot for emergency, press the "EMERGENCY STOP" switch of the teaching pendant.

 You can set the robot moving speed from 1 [mm/sec] to 20[mm/sec]. If you push the "+" switch, the robot moving speed is increased. If you push the "—" switch, the robot moving speed is decreased. Before the robot move, you should set the robot moving speed. Please be careful about you push the wrong switch that the "YES" switch and the "+" switch.
- After the step 6) above is completed, the previously displayed "PALLETIZE POINT MOVE" screen reappears.
- 8) Return to the step 3), and repeat the steps above until the point move for the intended point is completed.
- [NEXT][PREV] ······Located in the upper right part of the screen
 The "PALLETIZE POINT TEACH, POINT MOVE" screen for the first to third axes and the
 "PALLETIZE POINT TEACH, POINT MOVE" screen for the fourth axis can be switched with these
 switches.

• [FAULT]

When this switch is touched, the "ROBOT FAULT" screen appears. If the robot is faulty, it is highlighted in red to warn of faults in the robot.

• [RET]

When this switch is touched, the previously displayed screen reappears.

5.7 Palletize reference point teaching (three-point teaching)

This function allows the setup of reference points (three points) on the tray and number of parts placed on the tray for palletizing (taking out parts from the parts tray) and teaching of the points at which parts are taken out from the tray is automatically carried out. Details are shown below. The XYZ rectangular coordinate system robot is given as an example here.

5.7.1 Selecting group number

Before executing teaching of "Palletize points", selection of "Group" teaching should be executed is required.

Select the "GROUP SELECT" switch in the upper part of the yellow "PALLETIZE" field on the "TEACH MENU" screen to access to the "PALLETIZE GROUP SELECT" screen.

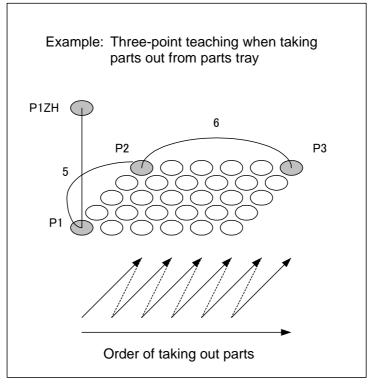
Currently selected "Group No." is displayed on the left side of the "PALLETIZE GROUP SELECT" screen.

For details, refer to section 5.6.1.

5.7.2 Tabular teaching (Palletize reference point)

This function allows teaching of reference points with "Palletize reference points" displayed in tables. Select the "REFERENCE POS" switch in the lower part of the "PALLETIZE POINT TEACH" screen to access to the "PALLETIZE REFERENCE POINT TEACH" screen.

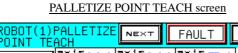
Note) Data entry is possible when both the number of parts at P1-P2 and P2-3 are 1 or more. When storing data, product of the both numbers must be 200 or less.



Note) Operating procedures differ depending on the sequence software and motion program produced for each equipment. Be sure to refer to the reference of teaching attached to each equipment before teaching.

3

This section describes the details of operating procedures and functions available by the switches on the "PALLETIZE REFERENCE TEACH" screen.





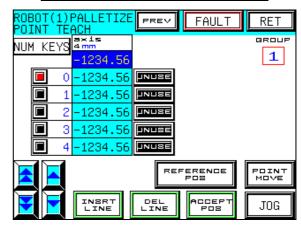
-1234.56

INUSE

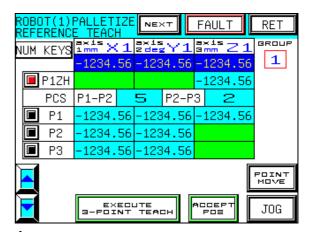


-1234.56 -1234.56

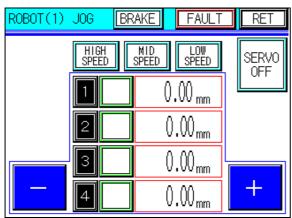
PALLETIZE REFERENCE TEACH screen (1)



PALLETIZE REFERENCE TEACH screen (2)

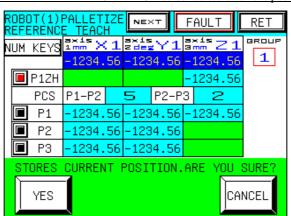


JOG screen



• [Tabular teaching, palletize reference points (Remote teaching)]

- 1) Ensure that the selected group number indicated as the "GROUP" in the upper right part of the "PALLETIZE REFERENCE TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "▲", and "▼" point scroll switches in the lower left part of the "PALLETIZE REFERENCE TEACH" screen.
- 3) Access to the "JOG" screen with the "JOG" switch in the lower right part of the "PALLETIZE REFERENCE TEACH" screen.
- 4) Make sure that the servo motor is activated by checking the "SERVO ON" in the upper right part of the "JOG" screen.
- 5) Select any intended robot moving speed with the "HIGH SPEED", "MID SPEED", and "LOW SPEED" selector switches in the center of the upper part of the "JOG" screen. The selected speed selector switch is highlighted in light blue.
- 6) Select any intended axis (arm) on which the JOG operation should be performed with the moving axis selector switches in the center of the "JOG" screen ("X1", "Y1", and "Z1" in the example). The selected axis selector switch is highlighted in green.
- 7) While holding the deadman switch on the teaching pendant grip, choose the "+" or "-" switch on the right and left sides of the "JOG" screen to move the robot to the target point. When the "+" or "-" switch is released or the deadman switch is released, the robot is stopped at the current point. When the "+" or "-" key is touched once while the "LOW SPEED" switch is selected, the robot moves by "0.02". While the key is being touched and held, it moves at a low speed.
- 8) Repeat the steps 5), 6), and 7) above, and move the robot to the target point.
- 9) When the "RET" switch in the upper right part of the "JOG" screen, the "PALLETIZE POINT TEACH" screen reappears.
- 10) Coordinates of the point moved during the JOG operation is indicated in the blue "CURRENT" in the center of the "PALLETIZE REFERENCE TEACH" screen. In this status, select the "ACCEPT POS" switch in the lower right part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 11) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.



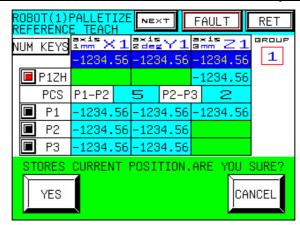
PALLETIZE REFERENCE TEACH screen to store current position

- 12) After the step 11) above is completed, the previously displayed "PALLETIZE REFERENCE TEACH" screen reappears.
- 13) Return to the step 2), and repeat the steps above until the teaching is completed against all the palletize points.

• [Tabular teaching, palletize reference point (Direct teaching)]

- 1) Ensure that the selected group number indicated as the "GROUP" in the upper right part of the "PALLETIZE REFERENCE TEACH" screen is correct.
- 2) Select any intended point to be recorded with the "▲", and "▼" point scroll switches in the lower left part of the "PALLETIZE REFERENCE POINT TEACH" screen.
- 3) Access to the "JOG" screen with the "JOG" switch in the lower right part of the "PALLETIZE REFERENCE TEACH" screen.
- 4) Check the "SERVO ON" in the upper right part of the "JOG" screen. If the servo motor is activated, touch the "SERVO ON" switch while touching the "deadman" switch to enter the "SERVO OFF" status.
- 5) When this step is completed, the robot arm is released. However, the lifting/lowering axis "Z1" cannot be released and the brake is applied, since it incorporates the servo motor with brake. To release the brake of the axis "Z1", select the "BRAKE" switch in the center of the upper part of the "JOG" screen to switch to the "BRAKE RELEASE" screen.

 For details of the brake release operation, refer to section 4.4.
- 6) After finishing the step 5) above, manually move the robot to the target point.
- 7) When the "RET" switch in the upper right side of the "JOG" screen is touched, the "PALLETIZE REFERENCE TEACH" screen reappears.
- 8) Coordinates of the point moved by manual operation is indicated in the blue "CURRENT" in the center of the "PALLETIZE REFERENCE TEACH" screen. In this status, select "ACCEPT POS" switch in the lower right part of the screen. Then, the screen shown below appears. Decide whether the current position should be stored or not.
- 9) If you want to store it, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.



PALLETIZE REFERENCE TEACH screen to store current position

- 10) After the step 9) above is completed, the previously displayed "PALLETIZE REFERENCE TEACH" screen reappears.
- 11) Return to the step 2), and repeat the steps above until the teaching is completed against all the palletize reference points.
- 12) After teaching is finished, switch to the "JOG" screen again, and carry out the "SERVO ON" operation. The procedures are common to those of the "SERVO OFF" operation.

• [Tabular teaching, palletize reference point (MDI teaching)]

This function allows the storage of teaching data by entering values for each palletize point with the numerical keys.

- 1) Ensure that the selected group number indicated as the "GROUP" in the upper right part of the "PALLETIZE REFERENCE TEACH" screen is correct.
- 2) Select the "NUM KEYS" switch in the upper left part of the "PALLETIZE REFERENCE TEACH" screen. Then, the screen shown below appears, and entry with the numerical keys is enabled.

ROBOT(1) PALLETIZE NEXT FAULT RET
REFERENCE TEACH
NUM KEYS TEACH
-1234.56 -1234.56 -1234.56

P1 -1234.56 -1234.56 -1234.56

P2 -1234.56 -1234.56

P2 -1234.56 -1234.56

P3 -1234.56 -1234.56

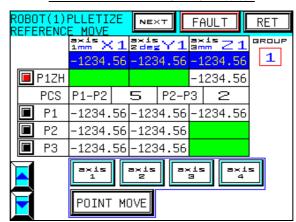
PALLETIZE REFERENCE TEACH screen for MDI teaching

- In this status, touch the stored coordinates in the light-blue numerical display field in the center of the screen with your finger. Then, a cursor appears on the screen. Type in intended coordinates or number of parts with numerical keys in the lower part of the screen, and confirm with using the "ENT" key.
 - Deletion of the value of which input has not been completed yet is possible with the "DEL" key.
- 4) After entering all the coordinates or numbers of parts, select the "NUM KEYS" switch in the lower left part of the screen. Then, the "PALLETIZE REFERENCE TEACH" screen reappears.
- 5) Return to the step 3), and repeat the steps above until the MDI teaching is completed against all the palletize reference points.

• [Tabular teaching, palletize reference point (Point Move)]

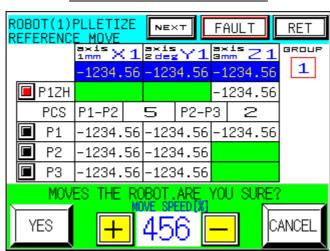
This function allows you to check whether teaching of the point is appropriate by moving the robot to the palletize reference point that teaching has already been completed.

- 1) Ensure that the selected group number indicated as the "GROUP" in the upper right part of the "PALLETIZE REFERENCE TEACH" screen is correct.
- Select the "POINT MOVE" switch in the lower right part of the "PALLETIZE REFERENCE TEACH" screen. Then, the screen shown below appears, and selection of point and axis to be moved is enabled.



PALLETIZE REFERENCE MOVE screen

- 3) Select any intended point to be moved with the "▲", and "▼" point scroll switches in the upper left part of the "PALLETIZE REFERENCE MOVE" screen.
- 4) Select any intended axis (arm) to be moved with axis selector switches from "axis 1 to 4" in the lower part of the "PLLETIZE REFERENCE MOVE" screen. The selected axis selector switch is highlighted in light blue. To move all the axes, select intended switches for all the axes. To move each axis individually, select the intended axis only.
- 5) In this status, select the "POINT MOVE" switch in the lower part of the "PLLETIZE REFERENCE MOVE" screen. Then, the screen shown below appears. Decide whether the point move should be executed or not.



PLLETIZE REFERENCE MOVE screen

- If you want to execute the point move, choose the "YES" switch. Choose the "CANCEL" switch if you do not want. To stop the robot, touch the "CANCEL" switch or release the deadman switch. Then, the robot is stopped immediately. To stop the robot for emergency, press the "EMERGENCY STOP" switch of the teaching pendant.

 You can set the robot moving speed from 1 [mm/sec] to 20[mm/sec]. If you push the "+" switch, the robot moving speed is increased. If you push the "—" switch, the robot moving speed is decreased. Before the robot move, you should set the robot moving speed. Please be careful about you push the wrong switch that the "YES" switch and the "+" switch.
- 7) After the step 6) above is completed, the previously displayed "PLLETIZE REFERENCE MOVE" screen reappears.
- 8) Return to the step 3), and repeat the steps above until the point move for the intended point is completed.
- [NEXT][PREV] ······Located in the upper right part of the screen
 The "PALLETIZE REFERENCE POINT TABULAR TEACH, POINT MOVE" screen for the first to
 third axes and the "PALLETIZE REFERENCE POINT TEACH, POINT MOVE" screen for the fourth
 axis can be switched with these switches.

• [FAULT]

When this switch touched, the "ROBOT FAULT" screen appears. If the robot is faulty, it is highlighted in red to warn of faults in the robot.

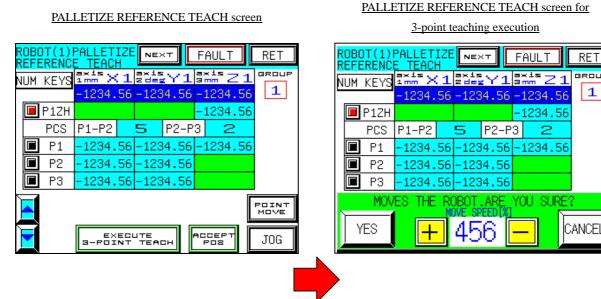
[RET]

When this switch is touched, the previously displayed screen reappears.

• [Tabular teaching, palletize reference point (Three-point teaching)]

This function allows automatic teaching of the points parts are taken out from the parts tray with using the reference points (four points, P1ZH, P1, P2, and P3) on which teaching has been performed and the numbers of parts on the parts tray (P1-P2 and P2-P3).

- 1) Ensure that the selected group number indicated as the "GROUP NO." in the upper right part of the "PALLETIZE REFERENCE TEACH" screen is correct.
- 2) Select the "EXECUTE 3-POINT TEACH" switch in the lower part of the "PALLETIZE REFERENCE TEACH" screen. Then, the screen shown below on the right side appears. Decide whether the three-point teaching should be carried out or not.



3) If you want to execute the three-point teaching, choose the "YES" switch. Choose the "CANCEL" switch if you do not want.

When the "YES" switch is chosen, the three-point teaching is executed while the robot is being moved between the points. At first, it moves in order between the points above the three reference points (P1, P2, and P3) on which teaching is executed.

(In the robot with the Z-axis, Z-axis coordinates stored at the P1ZH are used for motion as the Z-axis element.)

Then, the three-point teaching is executed after the robot moves in order between the points above the palletize points.

(In the robot with the Z-axis, Z-axis coordinates stored at the P1ZH are used for motion as the Z-axis element.)

To stop the robot, touch the "CANCEL" switch or release the deadman switch. Then, the robot is stopped immediately. To stop the robot for emergency, press the "EMERGENCY STOP" switch on the teaching pendant.

- Note) The deadman switch is invalid during the three-point teaching. When carrying out the three-point teaching, pay extreme care for safety.
- 4) After the three-point teaching in the 3) above is completed, the previously displayed "PLLETIZE REFERENCE TEACH" screen reappears.

5) Select the "RET" switch in the upper right part of the screen to access to the "PALLETIZE POINT TEACH" screen. Then, use the teaching point move function to check the points on which automatic teaching has been carried out by the three-point teaching.

For details of operation, refer to section 5.6.2 "TABULAR teaching, palletize point (Point Move)".

6. Robot fault indication

This chapter describes the robot fault indicating functions.

6.1 Outline

This system features the "Robot fault indicating function" to indicate faults in the robot as well as "Teaching pendant functions" described in the previous chapter.

The robot fault indicating function allows the indication of:

- "System error (fault and alarm)"
- "Motion program alarm"
- "Motion parameter alarm"
- and "Servo pack alarm".

These functions enable notification of details of faults by alarm indicators and alarm codes. The help screen allows you to check details of alarm codes to improve troubleshooting in case of faults.

To access to the "Robot fault" screen, carry out any of the steps show below.

- Step 1) Select "FAULT MENU" switch on the initial menu screen to access to the "FAULT MENU" screen, and select the "ROBOT (*) ROBOT FAULT" switch.
- Step 2) Select the "ROBOT FAULT" switch on the "AUTO RUN" or "MAN RUN" screen.
- Step 3) Select the "FAULT" switch on the "TEACH MENU", "TEACH", or "JOG" screen.
- Step 4) Select the "FAULT" switch on the "ENCODER RESET", "ORIGIN SETUP" and "BRAKE RELEASE" screen.

6.1.1 System error (Fault and alarm)

This function allows notifying faults and alarms of the machine controller MP2310 (hereafter called "MC unit"), provided in the RC5500 controller, by indicator lamps and alarm codes. The help screen enables checking details of major failure alarm codes.

For details of system errors, refer to "User's Manual for Machine Controller MP2310".

6.1.2 Motion program alarm

Errors due to motion function of the MC unit are classified into alarms detected by the motion program (motion program alarm) and axis alarms detected by the servo packs (motion parameter alarms).

This system allows notifying details of the task (T1, T2) with motion program alarm issued and alarms by alarm codes. The help screen enables checking details of the alarm codes.

For details of motion program alarms, refer to "User's Manual for Machine Controller MP2310, Motion Program Alarm".

6.1.3 Motion parameter alarm

Errors due to motion function of the MC unit are classified into alarms detected by the motion program (motion program alarm) and axis alarms detected by the servo packs (motion parameter alarms).

This system allows notifying the axis number (arm number) with motion parameter alarm issued. The help screen enables checking details of alarms for each axis number.

For details of motion parameter alarms, refer to "User's Manual for Machine Controller MP2310, Motion Parameter Alarm".

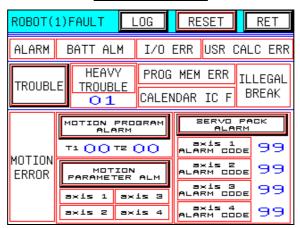
6.1.4 Servo pack alarm

This function allows notifying the axis number (arm number) with alarm detected by the servo pack provided in the RC5500 controller and alarm codes. Details of alarms can be checked from the help screen. For details of servo pack alarms, refer to "User's Manual for Σ -V Series SGDV, Design and Maintenance".

6.2 Robot Fault screen

This section describes the details of operating procedures and functions available by the switches on the "ROBOT FAULT" screen.

ROBOT FAULT screen



• [ALARM]

When any system error (alarm) occurs, this item is highlighted in red.

• [BATT ALM]

When "Battery alarm" classified into system error (alarm) occurs, this item is highlighted in red.

• [I/O ERR]

When "I/O error" classified into system error (alarm) occurs, this item is highlighted in red.

• [USR CALC ERR]

When "User calculation error" classified into system error (alarm) occurs, this item is highlighted in red.

• [TROUBLE]

When any system error (trouble) occurs, this item is highlighted in red. You can access to the "HEAVY TROUBLE ALARM CODE-DETAIL (Help)" screen by selecting this switch.

• [HEAVY TROUBLE]

When "Heavy trouble" classified into system error (trouble) occurs, this item is highlighted in red. Corresponding alarm code will be displayed under it. (Code (01) will be displayed on the screen above).

• [PROG MEM ERR]

When "Program memory error" classified into system error (trouble) occurs, this item is highlighted in red.

• [CALENDAR IC F]

When "Calendar IC fault" classified into system error (trouble) occurs, this item is highlighted in red.

• [ILLEGAL BREAK (Hardware trouble)]

When "Illegal break (hardware trouble)" classified into system error (trouble) occurs, this item is highlighted in red.

For details of system errors, refer to "User's Manual for Machine Controller MP2310, Design and Maintenance".

• [MOTION ERROR]

When any motion error occurs, this item is highlighted in red.

• [MOTION PROGRAM ALARM]

When "Motion program alarm" classified into motion error occurs, this item is highlighted in red. Corresponding alarm code will be displayed under it. Codes (T1, 00) (T2, 00) will be displayed on the screen on the previous page.

For details of motion program alarms, refer to "User's Manual for Machine Controller MP2310, Design and Maintenance, Motion Program Alarm Code List".

• [MOTION PARAMETER ALM]

When "Motion parameter alarm" classified into motion error occurs, this item is highlighted in red. You can access to the "MOTION PARAMETER ALARM CODE-DETAIL (Help)" screen by selecting this switch.

As soon as this alarm occurs, any of "axis 1" to "axis 4" shown on the screen on the previous page is highlighted in red to inform faulty axis number.

For details of motion parameter alarms, refer to "User's Manual for Machine Controller MP2310, Design and Maintenance, Axis Alarm Flag List".

[SERVO PACK ALARM]

When "Servo pack alarm" classified into motion error occurs, this item is highlighted in red. You can access to the "SERVO PACK ALARM CODE-DETAIL (Help)" screen by selecting this switch. As soon as this alarm occurs, any of "axis 1" to "axis 4" shown on the screen on the previous page is highlighted in red to inform faulty axis number, and code (99) will be displayed on the right side.

For details of servo pack alarm, refer to "User's Manual for Σ-V Series SGDV Design and Maintenance".

• [LOG]

When this switch is touched, the "FAULT LOG" screen appears. Select it to check fault logs.

• [RESET]

Faults occurred to the robot can be reset with this switch. When any fault occurs, this switch is highlighted in red.

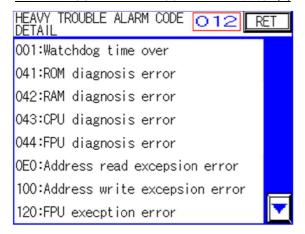
• [RET]

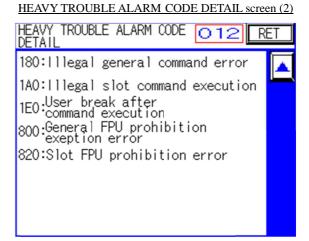
When this switch is touched, previously displayed screen reappears.

6.3 Details of "HEAVY TROUBLE ALARM CODE DETAIL" screen

This section describes the details of operating procedures and functions available by the switches on the "HEAVY TROUBLE ALARM CODE DETAIL" screen.

HEAVY TROUBLE ALARM CODE DETAIL screen (1)





[ALARM CODE]

Heavy trouble alarm code corresponding to the heavy trouble occurred to the machine is displayed in the red field in the center of the upper part of the screen. Code (01) is displayed on the screen shown above.

• [▲][▼]

Switching of displayed screen is possible with using the " \blacktriangle ", and " \blacktriangledown " scroll switches in the right part of the screen.

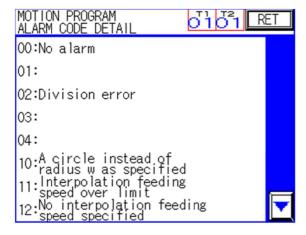
• [RET]

When this switch is touched, the "ROBOT FAULT" screen appears.

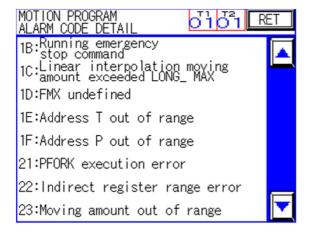
6.4 Details of "MOTION PROGRAM ALARM CODE DETAIL" screen

This section describes the details of operating procedures and functions available by the switches on the "MOTION PROGRAM ALARM CODE DETAIL" screens.

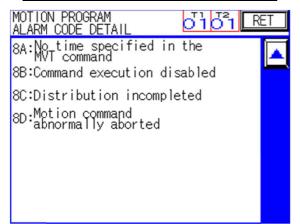
MOTION PROGRAM ALARM CODE DETAIL (1)



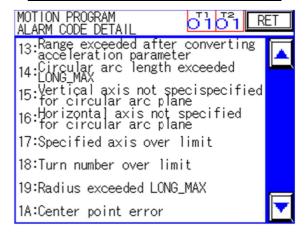
MOTION PROGRAM ALARM CODE DETAIL (3)



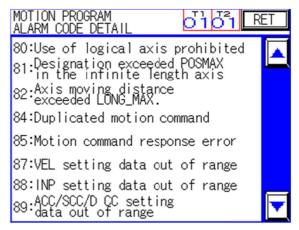
MOTION PROGRAM ALARM CODE DETAIL (5)



MOTION PROGRAM ALARM CODE DETAIL (2)



MOTION PROGRAM ALARM CODE DETAIL (4)



• [Alarm code (T1) (T2)]

Motion program alarm codes corresponding to the alarms occurred to the machine are displayed in the red field on the upper right part of the screen. Codes (T1, 01) and (T2, 01) are displayed on the screen shown on the previous page.

• [▲][▼]

Switching of displayed screen is possible with using the " \blacktriangle ", and " \blacktriangledown " scroll switches in the right part of the screen.

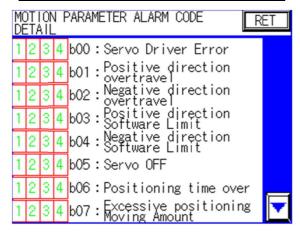
• [RET]

When this switch is touched, the "ROBOT FAULT" screen appears.

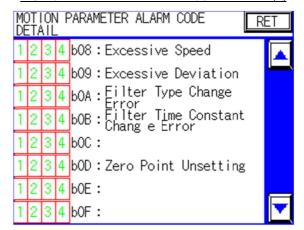
6.5 Details of "MOTION PARAMETER ALARM CODE DETAIL" screen

This section describes the details of operating procedures and functions available by the switches on the "MOTION PARAMETER ALARM CODE DETAIL" screens.

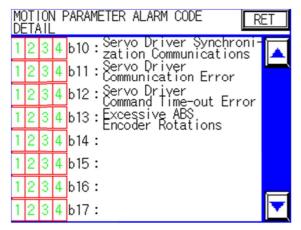
MOTION PARAMETER ALARM CODE DETAIL (1)



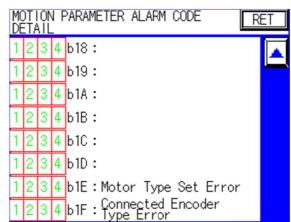
MOTION PARAMETER ALARM CODE DETAIL (2)



MOTION PARAMETER ALARM CODE DETAIL (3)



MOTION PARAMETER ALARM CODE DETAIL (4)



• [Axis No. (Arm No.)]

Number of the axis (arm) to which motion parameter alarm occurs is indicated by highlighted numerical field (on the screens shown above, (1), (2), (3), or (4)) in red.

[▲][▼]

Switching of displayed screen is possible with using the " \blacktriangle ", and " \blacktriangledown " scroll switches in the right part of the screen.

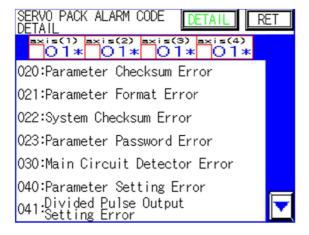
• [RET]

When this switch is touched, the "ROBOT FAULT" screen appears.

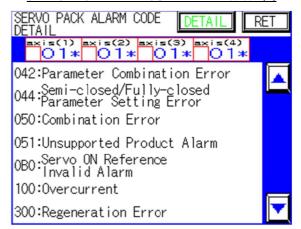
6.6 Details of "SERVO PACK ALARM CODE DETAIL" screen

This section describes the details of operating procedures and functions available by the switches on the "SERVO PACK ALARM CODE DETAIL" screens.

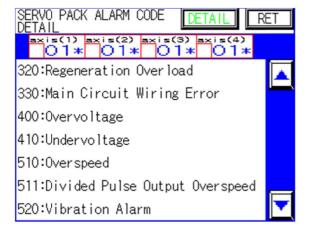
SERVO PACK ALARM CODE DETAIL screen (1)



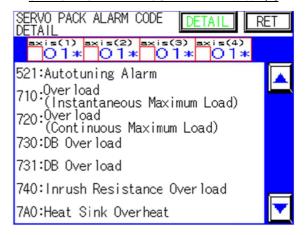
SERVO PACK ALARM CODE DETAIL screen (2)



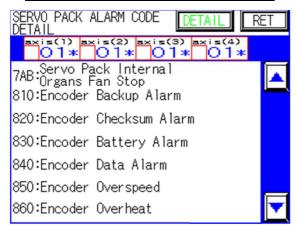
SERVO PACK ALARM CODE DETAIL screen (3)



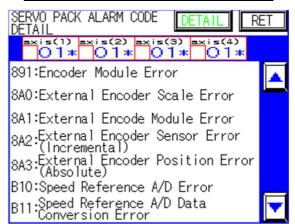
SERVO PACK ALARM CODE DETAIL screen (4)



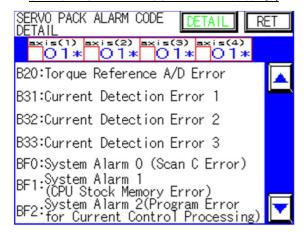
SERVO PACK ALARM CODE DETAIL screen (5)



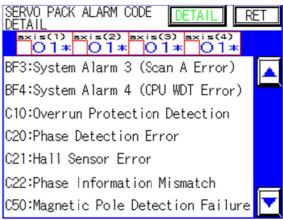
SERVO PACK ALARM CODE DETAIL screen (6)



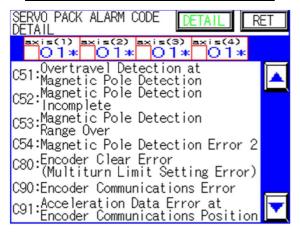
SERVO PACK ALARM CODE DETAIL screen (7)



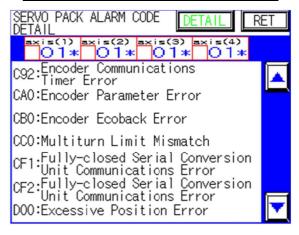
SERVO PACK ALARM CODE DETAIL screen (8)



SERVO PACK ALARM CODE DETAIL screen (9)



SERVO PACK ALARM CODE DETAIL screen (10)



SERVO PACK ALARM CODE DETAIL screen (11)



SERVO PACK ALARM CODE DETAIL screen (12)



6. Robot fault indication

• [Faulty axis No. (arm No.) lamp and alarm code] Number of the axis (arm) to which servo pack alarm occurs is indicated by indicator highlighted in red in the center of the screen. Alarm codes are displayed on the right side of the indicators. On the screens shown above, any of alarm indicators for axis (1) to (4) in the red field is highlighted in the lower left part, and alarm codes are displayed in the lower right part.

• [▲][▼]

Switching of displayed screen is possible with using the " \blacktriangle ", and " \blacktriangledown " scroll switches in the right side of the screen.

• [RET]

When this switch is touched, the "ROBOT FAULT" screen appears.

7. Appendix

This chapter describes functions that need supplementary explanation.

7.1 Screw tightening procedure for a robot of Z-axis control type

Regarding the $SR565Y\theta$ -Z screw tightening procedure that has been described in "4-8 Screw parameter setup", this section provides supplementary descriptions on teaching, tightening operation and screw parameters.

Introduction

With $SR565Y\theta$ -Z, the Z-axis stroke is not synchronized with rotation of the screw tightening driver. For Z-axis lowering operation, the driver's speed and torque will be changed over when the Z-axis reaches a position specified in the screw parameter. For rotation of the screw tightening driver (tightening bit), initial tightening torque and final tightening torque are changed over when a current value specified in the driver controller (KX driver, as the standard) is reached. Thus, the stroke control and torque control are independent from each other.

Teaching of screw tightening position

For a cross recessed socket head screw, set up a workpiece with a screw as shown on the right figure, wherein a position at which the cross bit of the thread tightening robot is fit in the cross recess on the screw head is defined as a teaching position.

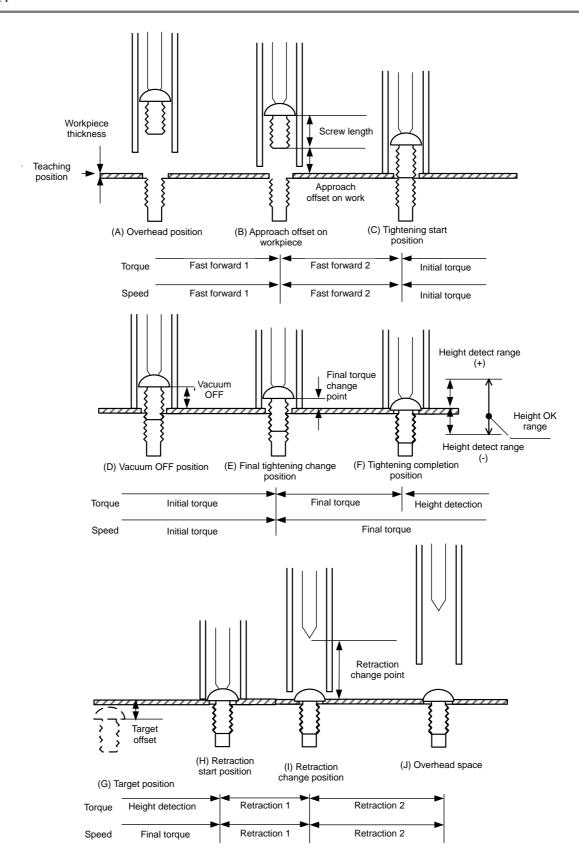
* To ensure accurate detection of a screw height, it is recommended that the screw should be actually tightened through manual operation after teaching, and the Z-axis coordinate value at completion of tightening should be entered as the teaching position.

Description on screw tightening operation using Z-axis control (torque change control)

Refer to "Screw parameter explanation diagram" on the next page.

- 1. The thread tightening robot moves to the position (A) above a tightening position.
- 2. With a screw being held with the vacuum chuck, the screw tightening driver (KX driver, as the standard) starts rotation, and the Z-axis starts lowering at a "fast forward 1 speed" and "fast forward 1 torque".
- 3. When the Z-axis reaches an offset position before the workpiece (B) ("screw length" + "approach offset on workpiece"), the speed and torque are changed to "fast forward 2 speed" and "fast forward 2 torque" respectively, and the Z-axis continues down stroke.
- 4. When the Z-axis reaches the tightening start position (C) ("screw length" "workpiece thickness"), the speed and torque are changed to "initial tightening speed" and "initial tightening torque" respectively, and the Z-axis continues down stroke.
- 5. When the Z-axis reaches the vacuum OFF position (D), the vacuum chuck is turned OFF.
- 6. When the Z-axis reaches the final tightening change position (E), the speed and torque are changed to "final tightening speed" and "final tightening torque" respectively, and the Z-axis continues down stroke.
- 7. With the torque UP signal input from the screw tightening driver, the Z-axis torque is changed to a height detection torque at which the workpiece is not forcedly pressed, and the robot checks for loose fitting of the screw (*1).
- 8. The speed and torque are increased to "retraction 1 speed" and "retraction 1 torque" respectively, until the Z-axis reaches the retraction change position (I).
- 9. When Z-axis reaches the retraction change position (I), the speed and torque are changed to "retraction 2 speed" and "retraction 2 torque" respectively, and the Z-axis is raised to the overhead position (J).

^{*1:} If the height of the Z-axis (tightening bit) comes into the range between "height detection width (+)" and "height detection width (-)" within 0.3 second from the torque UP signal input, the screw height is judged OK.



Screw parameter explanation diagram

Description on screw parameters

Screw parameters can be set on the "SCREW PARAMETER (1) to (5)" screens of the teaching pendant. Simple setup mode and detail setup mode are available.

Normally, the simple setup mode should be used. In the simple setup mode, you can set minimum required parameters for tightening work.

The detail setup mode should be used to execute more close control. This mode enables more detailed settings of the robot operation than the simple setup mode.

Setup items

For each parameter, the following 1) to 3) are described.

- 1) Description on the parameter
- 2) Function
- 3) Precaution for setup

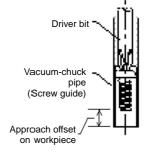
Distance setup (mm)

"Screw length"

- 1) Length of screw used can be set within the range between 0.1 mm and 999.9 mm.
- 2) This parameter determines a position (B) to change the driver's speed/torque to "fast forward 2 speed/torque" and a position (C) to change the driver's speed/torque to "initial tightening speed/torque" in the screw parameter explanation diagram. This parameter must be set without fail.

"Approach offset on work"

- Set an offset value to change torque and speed of the lifting/lowering shaft (tightening driver) to "fast forward 2" torque and "fast forward 2" speed immediately before the driver reaches a tightening surface.
 - The setting range is 0.1 to 999.9 mm.
- 2) This parameter determines a position (B) to change the driver's speed/torque to "fast forward 2 speed/torque" in the screw parameter explanation diagram.



- The value of "approach offset on workpiece" should be determined with the figure on the right, which shows relationship of the driver bit, screw guide and screw positions.
- This parameter should be set so that the driver's speed and trust will be changed to "fast forward 2 speed/torque" at a position where the screw guide almost reaches the workpiece.
- 3) If you set a value smaller than the actual distance, the screw guide will hit against the workpiece at the fast forward 1 speed/torque (high speed and high torque), which may result in damage to the workpiece and the internal thread. If you set a value larger than the actual distance, the driver's speed will be changed to an initial speed at a higher position, which may result in a longer tightening time, and cause a tightening failure. This parameter must be set without fail.

"Workpiece thickness"

- 1) Set a workpiece thickness.
 - The setting range is 0.1 to 999.9 mm.
- 2) Set a tightening start position and a position (C) to change the driver's speed/torque to "initial tightening speed/torque" in the screw parameter explanation diagram.

3) If you set a value different from the actual workpiece thickness, the internal and external threads are hit against each other, which may result in a longer tightening time, and cause a tightening failure such as oblique tightening. This parameter must be set without fail.

"Final torque change point"

- 1) Set a distance from a teaching position, to change the tightening driver's torque to "final tightening torque".
 - The setting range is 0.1 to 999.9 mm.
- 2) This parameter determines a position (E) to change the driver's speed/torque to "final tightening speed/torque" in the screw parameter explanation diagram.
 For final tightening torque, refer to the description on "final tightening" torque limit setup below.
- 3) If this parameter is set too large, the torque will be changed to the final tightening torque at a higher position. This causes the tightening driver to be overloaded during rotation, which may result in a longer tightening time, and cause a tightening failure.

 On the other hand, if this parameter is set too small for a workpiece with an irregular height, the Z-axis cannot reach the final tightening position, causing a tightening failure. Normally, the setting for a machine screw should be 1.0 to 2.0 mm. This parameter must be set without fail.

"Target offset"

- Set an offset distance relative to a teaching position, to cancel variations in target workpieces.
 The setting range is 0.1 to 999.9 mm.
- 2) This parameter determines a tightening target position (G) in the screw parameter explanation diagram.
 - If a workpiece whose height is smaller than the teaching value is applied because of variations in workpiece height, the Z-axis (tightening bit) may not reach the teaching position if the Z-axis down stroke is aimed at the teaching position. To prevent this, set a "target offset" so that the Z-axis down stroke is aimed at a target position (D) that is lower than the teaching position by the offset value.
- 3) On the other hand, if this parameter is set too small for a workpiece with an irregular height, the Z-axis cannot reach the final tightening position, causing a tightening failure. Normally, the setting for a machine screw should be 2.0 to 5.0 mm. This parameter must be set without fail.

"Height detect range +"

- 1) Set a screw height (loose tightening) detection width (positive (+) value). The setting range is 0.1 to 99.9 mm.
- 2) If the Z-axis screw tightening driver torque up position is within a range between "height detection width (+)" and "height detection width (–)" relative to a teaching position (F) in the screw parameter explanation diagram, the tightening height is judged OK.
- 3) Because of variations in bit, screw and workpiece dimensions, an extremely small setting of this parameter causes "screw height error" to frequently occur. Normally, the setting for a machine screw should be 2.0 mm or more. This parameter must be set without fail.

"Height detect range -"

- 1) Set a screw height (loose tightening) detection width (positive (–) value). The setting range is 0.1 to 99.9 mm.
- 2) If the Z-axis screw tightening driver torque up position is within a range between "height detection width (+)" and "height detection width (-)" relative to a teaching position (F) in the screw parameter explanation diagram, the tightening height is judged OK.
- 3) Because of variations in bit, screw and workpiece dimensions, an extremely small setting of this parameter causes "screw height error" to frequently occur. Normally, the setting for a machine screw should be 2.0 mm or more. In the case of simple setup, this parameter is set at the same value as "height detection width (+)".

"Vacuum OFF"

- Set a vacuum OFF position (position to turn OFF the vacuum-chuck) relative to the teaching position.
 - The setting range is 0.1 to 99.9 mm.
- 2) When the tightening driver reaches an overhead position (D) at a specified height of "vacuum OFF" value from the teaching position, the vacuum (vacuum chuck of a screw) is turned OFF.
- 3) If you set a value larger (higher) than the actual vacuum OFF position, the vacuum chuck will turn OFF before a screw reaches the workpiece, which may cause a screw fall, oblique tightening, come-out, etc.

"Retraction change point"

- Set a retraction change position relative to a teaching position.
 The setting range is 0.1 to 99.9 mm.
- 2) The driver is raised from the teaching position at "retraction 1 speed/torque", and when it reaches "retraction change position" (G), the speed/torque will be changed to "retraction 2 speed/torque".
- 3) If a large (high) value is set for the retraction change point, the up stroke time becomes long, resulting in a prolonged cycle time. In the case of simple setup, this parameter is set at "0".

<u>Tightening force limit (%)</u>

"Fast forward 1"

- 1) Set a torque for Z-axis fast forward operation. The setting range is 0 to 300%.
- 2) Set a torque to lower the Z-axis from an "overhead position" (A) to "approach offset on workpiece" (B) in the screw parameter explanation diagram.
- 3) Normally, this parameter should be set at 300%. This parameter must be set without fail.

"Fast forward 2"

- 1) Set a torque for Z-axis fast forward operation. The setting range is 0 to 300%.
- 2) Set a torque to lower the Z-axis from "approach offset on workpiece" (B) to "tightening start position" (C) in the screw parameter explanation diagram.
- 3) Normally, this parameter should be set at the same value as "initial tightening torque". In the case of simple setup, this parameter is set at the same value as "initial tightening torque".

"Initial torque"

- 1) Set a torque for Z-axis initial tightening operation. The setting range is 0 to 300%.
- 2) Set a torque to lower the Z-axis from a "tightening start position" (C) to "final tightening change position" (E) in the screw parameter explanation diagram.
 If the workpiece has internal threads, the screw will be spontaneously lowered with rotation of the tightening driver during initial tightening operation. If a large torque is applied in this step, load of the tightening driver during rotation becomes larger than required, disabling ideal tightening operation. Therefore, "initial tightening torque" should be set at a small value.
- 3) If this parameter is set too large, load of the tightening driver during rotation becomes larger than required. This may result in a longer tightening time, and cause a tightening failure, unless a large value is set for the initial tightening torque of the tightening driver. Normally, the setting for a machine screw should be 20 to 40%.
 - This parameter must be set without fail.

"Final torque"

- 1) Set a torque for Z-axis final tightening operation. The setting range is 0 to 300%.
- Set a torque to lower the Z-axis from "final tightening change position" (E) in the screw parameter explanation diagram.
 Normally, when the tightening driver's tightening torque is changed to the final tightening
 - torque for final tightening of a cross recessed socket head screw, the bit will come over the cross recess on the screw head (come-out) unless the bit torque is increased, disabling tightening operation. Therefore, the "final tightening torque" setting should be a value that does not allow the bit to come over the cross recess on the screw head.
- 3) If this parameter is set too small, the bit will come over the cross recess on the screw head in final tightening operation, which may cause a tightening failure. Normally, the setting for a machine screw should be 50 to 60%. This parameter must be set without fail.

"Height detection"

- 1) Set a torque for Z-axis height detection after completion of tightening. The setting range is 0 to 300%.
- 2) Set a torque for the section from "tightening completed position" (F) to "retraction start position" (H) in the screw parameter explanation diagram.
- 3) If this parameter is set too large, the workpiece is forcedly pressed, disabling accurate height detection. Normally, this parameter should be set at 30%. In the case of simple setup, this parameter is set at 30%.

"Retraction 1"

- 1) Set a torque to retract the Z-axis at a low speed after completion of tightening. The setting range is 0 to 300%.
- 2) Set a torque to raise the Z-axis from "retraction start position" (H) to "retraction speed change position" (I) in the screw parameter explanation diagram.
- 3) If this parameter is set too small, the screw tightening tool cannot be raised, disabling raising operation. Normally, this parameter should be set at 300%. In the case of simple setup, this parameter is set at 300%.

"Retraction 2"

- 1) Set a torque for Z-axis fast retraction. The setting range is 0 to 300%.
- 2) Set a torque to raise the Z-axis from "retraction speed change position" (I) to "overhead position" (J) in the screw parameter explanation diagram.
- 3) If this parameter is set too small, the screw tightening tool cannot be raised, disabling raising operation. Normally, this parameter should be set at 300%. In the case of simple setup, this parameter is set at 300%.

<u>Tightening speed setup (mm/sec.)</u>

"Fast forward 1"

- 1) Set a speed for Z-axis fast forward 1 operation. The setting range is 0 to 720 mm/sec.
- 2) Set a speed to lower the Z-axis from an "overhead position" (A) to "approach offset on workpiece" (B) in the screw parameter explanation diagram.
- 3) Normally, for SR565Yθ-Z, this parameter should be set at 720 mm/sec. This parameter must be set without fail.

"Fast forward 2"

- 1) Set a speed for Z-axis fast forward 2 operation. The setting range is 0 to 720 mm/sec.
- 2) Set a speed to lower the Z-axis from "approach offset on workpiece" (B) to "tightening start position" (C) in the screw parameter explanation diagram.
- 3) Normally, for $SR565Y\theta$ -Z, this parameter should be the same value as "initial tightening speed". In the case of simple setup, this parameter is set at the same value as "initial tightening speed".

"Initial torque"

- 1) Set a speed for Z-axis initial tightening operation. The setting range is 0 to 720 mm/sec.
- 2) Set a position to lower the Z-axis from "tightening start position" (C) to "final tightening change position" (E) in the screw parameter explanation diagram.
 During initial tightening operation, the screw will be spontaneously lowered with rotation of the tightening driver. The initial tightening speed should be a little higher than the screw lowering speed according to rotation of the tightening driver, so that the tightening bit will not come out of the recess on the screw head.
- 3) If you set an extremely low speed, the tightening bit will come out of the recess on the screw head, causing a tightening failure. Normally, the setting for a machine screw should be 50 to 100 mm/sec. This parameter must be set without fail.

"Final torque"

- 1) Set a speed for Z-axis final tightening operation. The setting range is 0 to 720 mm/sec.
- 2) Set a speed to lower the Z-axis from "final tightening change position" (E) in the screw parameter explanation diagram.
 - During final tightening operation, the screw will be spontaneously lowered with rotation of the tightening driver. The final tightening speed should be a little higher than the screw lowering speed according to rotation of the tightening driver, so that the tightening bit will not come out of the recess on the screw head.
- 3) If you set an extremely low speed, the tightening bit will come out of the recess on the screw head, causing a tightening failure. Normally, the setting for a machine screw should be 50 to 100 mm/sec. In the case of simple setup, this parameter is set at the same value as "initial tightening speed".

"Retraction 1"

- 1) Set a speed for Z-axis slow retraction. The setting range is 0 to 720 mm/sec.
- 2) Set a speed to raise the Z-axis from "retraction start position" (H) to "retraction speed change position" (I) in the screw parameter explanation diagram.
- 3) If you set an extremely low speed, the cycle time becomes longer. Normally, set this parameter at 10 to 50 mm/sec. In the case of simple setup, this parameter is set at 720 mm/sec.

"Retraction 2"

- 1) Set a speed for Z-axis fast retraction. The setting range is 0 to 720 mm/sec.
- 2) Set a speed to raise the Z-axis from "retraction speed change position" (I) to "overhead position" (J) in the screw parameter explanation diagram.
- 3) If you set an extremely low speed, the cycle time becomes longer. Normally, set this parameter at 720 mm/sec. In the case of simple setup, this parameter is set at 720 mm/sec.
- Reference [Torque limit value setting table: Ball thread torque (N) calculation]
 The thread tightening robot uses a Z-axis lifting/lowering ball thread with 12 (mm) lead. Set a torque limit value by referring to the table below.
 - Note) The tool unit's own weight (screw tightening driver, etc.) is added to the actual torque (in the case of downward screw-tightening operation).

Ball thread torque (N) calculation

Ball thread torque	Rated motor torque (N·m) × Motor torque output ratio (%) × 2π	T
F(N) =	Lead of ball thread (mm) / 1000	× Transmission efficiency

Lead (mm)	10	12	16	20	25
Transmission efficiency	0.9	0.9	0.9	0.9	0.9
Motor type	SGMAV-01A				
Rated torque (N·m)	0.318				
10%	17.982	14.985	11.239	8.991	7.193
20%	35.965	29.971	22.478	17.982	14.386
30%	53.947	44.956	33.717	26.974	21.579
40%	71.930	59.942	44.956	35.965	28.772
50%	89.912	74.927	56.195	44.956	35.965
70%	125.877	104.898	78.673	62.939	50.351
80%	143.860	119.883	89.912	71.930	57.544
100%	179.825	149.854	112.390	89.912	71.930
200%	359.650	299.708	224.781	179.825	143.860
300%	539.474	449.562	337.171	269.737	215.790

7.2 Teaching pendant function (For screw removal)

[Setup of work information]

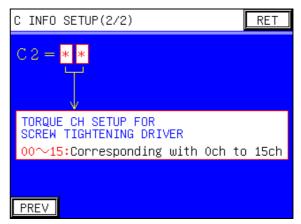
• [?]...... Located in the yellow field above the "C2" in the center of the screen.

When this switch is touched, the "C INFO SETUP" screen (for help) appears. Descriptions on the values of work information (C1, C2) shown on this screen are as shown below.

C INFO SETUP(1/2) RET C INFO SETUP(1/2) RET C 1 = * * SCREW PARAMETERS SETUP[1~5] Valid only with 2 axis capable machine MOTION SETUP[0~9] 1~4:Screw feed + Tighten 5~8:Re torque(no screw feed) 9:Pass motion(move only)

O:Table (block) end

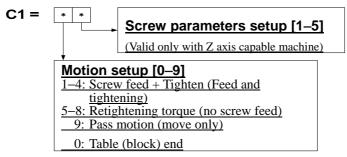
C INFO SETUP (2/2) screen



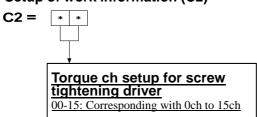
WORK INFO (C1, C2) SETUP

Setup of work information (C1)

NEXT



Setup of work information (C2)



[Revision record]

May 2010, first edition, RC5500TS Ver1.00 RC5500T0001
Feb 2013, Revision edition, RC5500TS Ver1.02 RC5500T0003
Dec 2016, Revision edition, RC5500TS Ver1.03 RC5500T0004
Apr 2017, Revision edition, RC5500TS Ver1.04 RC5500T0005
Feb 2018, Revision edition, RC5500TS Ver1.05 RC5500T0006

ADVANCED THREAD TIGHTENING ROBOT **NITOMAN RC5500TS**

TEACHING PENDANT

OPERATION MANUAL Ver1.05

NITTO SEIKO CO., LTD.

http://www.nittoseiko.co.jp/

• For improvement in performance, specifications may be modified without notice.