MELFA

Industrial robots

Installation description

RV-SD/RH-SDH
RV-SQ/RH-SQH

Art. No.: 231407
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Version A

Short operating instructions
Industrial robot RV-SD/RH-SDH, RV-SQ/RH-SQH
Article No.: 231407

Version			Changes / Additions / Corrections
A	11/2009	pdp – gb	—

About this manual

The texts, figures, diagrams and examples contained in this manual are exclusively intended to explain the installation, operation and control of the industrial robots described in this manual.

If questions arise concerning the installation and operation of the units described in this manual then please do not hesitate to contact your responsible sales office or sales partner (see cover page).
Current information as well as answers to frequently asked questions are located on the internet at: http://www.mitsubishi-automation.com.

MITSUBISHI ELECTRIC EUROPE B.V. reserves the right to make technical alterations to this manual at any time without notice.

Safety instructions

Target group

This manual is aimed solely at recognised, trained professional electricians acquainted with the safety standards valid within automation technology. Planning, installation, startup, maintenance and checking of the robot and its accessories may only be carried out by approved, trained professional electricians acquainted with the safety standards of automation technology. Any interference/ tampering with the hardware and software of our products not described in this manual may only be carried out by our expert personnel.

Use in accordance to the instructions

The industrial robot series SD and SQ are only intended to be used within the scope described in this manual. Make sure that all technical data contained in the manual is observed. The products have been developed, produced, tested and documented taking into consideration all relevant safety standards. In normal conditions, there are no dangers or hazards to property or persons when the handling instructions and safety instructions for planning, assembly and correct operation are observed. Unqualified tampering in the hardware or software or non-observance of the warning instructions contained in this manual or attached to the product may result in serious damage/injury to property and persons. Only those auxiliary units and expansion units recommended by MITSUBISHI ELECTRIC may be used together with the SD and SQ robot systems.

Any and all other use is determined as not in accordance to the instructions.

The industrial robots may only be switched on after all protective equipment has been installed and tested for correct function. This includes:

- the electrical connection and attachment of external EMERGENCY-STOP switches,
- the housing of the robot by separating protective equipment and
- the electrical connection and attachment of the door contact pushbutton.

A function test at a reduced speed of (T1) maximum 250mm/s can be carried out in "Manual" operating mode with the keyswitch in the "Manual" position. This test can be carried out with the protective housing opened (open door contact circuit).

DANGER:

To simplify the drawings, the robots are shown without separating protective equipment in the following description. Automatic mode is forbidden without separating protective equipment or suitable safety light barriers. Non-observance of this may result in serious injuries of the persons located within the working area of the robot.

Safety-relevant regulations

During planning, installation, startup, maintenance and testing/checking of the units, the safety and accident-prevention regulations valid for the case in question must be observed.

ATTENTION:

A safety manual is included with the robot. This manual deals with the safety aspects of installation/set up, startup and maintenance. You must always work through this manual thoroughly before installation/set up, startup or any other work with or on the robot. All specifications and details contained within it must be observed at all times without exception! If this manual is not included with the delivery then please immediately contact your Mitsubishi sales partner.

Furthermore, the following regulations must be observed (without claim to completeness):

- German VDE regulations
  - VDE 0100
    Regulations on the installation of high voltage systems with a rated voltage above 1000 V
  - VDE 0105
    Operation of high voltage systems
  - VDE 0113
    Electrical plants with electronic equipment
  - VDE 0160
    Fitting of high voltage systems and electrical equipment
  - VDE 0550/0551
    Regulations for transformers
  - VDE 0700
    Safety of electrical devices for domestic and similar uses
  - VDE 0860
    Safety regulations for mains-operated electronic devices and their accessories for domestic and similar uses
- Fire-protection regulations
- Accident-prevention regulations
  - VBG No. 4
    Electrical plants and equipment

Comments on the hazard instructions

There are instructions within this manual that are important for the correct and safe handling of the robot.

The individual instructions mean the following:

DANGER:

Means that there is a danger to life and health of the user, e.g. from electrical voltage, e.g. when the appropriate safety measures have not been taken.

ATTENTION:

Is a warning of possible damages to the robot, its periphery or other valuable property if the appropriate safety measures are not taken.

General hazard instructions and safety measures

The following hazard instructions should be understood as general regulations for handling the robot system. These instructions must always be observed in the planning, installation and operation of the robot system.

DANGER:

- ***The safety and accident-prevention regulations that apply to the specific use must be observed. Installation, wiring and opening of assemblies, components and devices/units must be carried out when the system is disconnected (dead).***
- ***Regularly check the live cable and lines to which the devices/units are connected for insulation faults or breaks. If you detect a fault in the wiring/cable then you must immediately switch off the devices and disconnect power from the cable and then replace the defective cable.***
- ***Before startup, check whether the permissible mains voltage range accords to the local mains voltage rating.***
- ***Take appropriate measures to restart any interrupted program after voltage failures and malfunctions. No hazardous/dangerous operating conditions must arise when doing this, even temporarily. If necessary, force an "EMERGENCY-STOP".***
- ***EMERGENCY-STOP equipment compliant to EN 60204/IEC 204 VDE 0113 must remain effective during all applications. Unlocking the EMERGENCY-STOP equipment must never result in uncontrolled movements of the robot arm.***

General safety instructions during handling

Detailed information on safety and protection is contained in the safety manual.

DANGER:

- ***Some of the robot arms are made of plastic. The robot arm does not take attachments of components or gross force effects in these parts. The covers are oil-resistant.***
- ***The robot axles are fitted with brakes. You should not apply any manual pressure to the robot joints to avoid damage to the gear reduction.***
- ***Even when the robot arm is within its normal working area, the wrist (articulated arm robot) or spindle (SCARA robot) may nevertheless collide. Pay special attention to this situation in jog mode.***
- ***The robot arm is comprised of precision parts that require suitable lubrication. During a cold start at low temperatures, a servo alarm may be triggered or positional accuracy may be lost. In such a situation, you should first operate the robot arm in standby.***
- ***The robot arm and the control unit require a class 3 grounding to permanently prevent risk of electrical shock and disturbances.***
- ***All details and specifications in the manuals are only valid if you carry out the maintenance work stipulated in the technical manual.***

DANGER:

- ***Before using the robot together with a linear unit or a lifting table, you must replace the lines with a highly-flexible alternative (trailing cable) to ensure that no cable break results in the standard connection cables.***
- ***If mounting an articulated robot on to the wall, then you must limit the range of movement of the J1 axle.***
- ***Make sure that the workpiece does not collide with any units in its immediate vicinity during robot movements because such collision may shift the position of the workpiece.***
- ***If the axles are moved with a very high level of accuracy then the position of the workpiece may be shifted. Make sure that there are no collisions between the workpiece or units in its immediate vicinity..***
- ***Do not fix any adhesive tape or labels to the robot arm or to the control unit. The adhesive tape may damage the coated surface. The IEC IP protection indicated by the appropriate symbol can then no longer be guaranteed.***
- ***If heavy loads are moved by the robot and the robot is moved at high speeds, the surface of the robot may become hot. Touching the robot arm in these circumstances will not result in burns but minor injuries may occur.***
- ***Do not switch off the power supply to stop the robot. If the voltage is regularly interrupted when the robot is moving a heavy load or is moving at high speeds then the reduction gearing may be damaged or the gear tolerance may be negatively affected (backlash).***
- ***If the J1, J2 and J3 axles collide with the mechanical end stops when an articulated robot is in automatic mode then the plastic buffers of the end stops must be replaced. Otherwise, the reduction gearing may be severely damaged on the next collision. Please contact your Mitsubishi partner to replace the buffers.***
- ***When the power supply is interrupted then the brakes grip the robot arm. If this happens, the robot arm may deviate from its predefined travel path. Depending on where automatic operation has been interrupted, this may result in difficulties with the mechanical end stops. Take suitable measures to ensure that any collision of the robot arm with the peripheral devices is prevented.***
- ***Do not carry out any surge voltage test. If any test is run accidentally then this may result in a malfunction. The surge voltage test is not covered by the warranty. If it is nevertheless run, then set the leakage current to 100 mA. If the leakage current has been set to just 10 mA, then a smaller measured value is displayed, owing to the leakage current of the installed AC filter.***
- ***If no cable is connected then always place the protection cap onto the SSCNET-III connection of SQ-Series devices. Otherwise, impurities may impair transmission behaviour and result in malfunction.***
- ***Do not remove the SSCNET-III cable from SQ-Series devices as long as the power supply of the CPU system or of the drive unit is still switched on.***
  Never look directly into the light emitted from the robot CPU or the SSCNET-III connections of the drive unit, or into the open end of the SSCNET-III cable. The light emitted from these complies with the IEC60825-1 standard of laser class 1 and may result in an irritation to the eyes if viewed directly.

Symbols used in the manual

The use of instructions

Instructions concerning important information is are marked separately and are displayed as follows:

NOTE | Text of instruction

Use of numbering in the figures

Numbering within the figures is displayed by white numbers within black circles and is explained in a table following it using the same number, e.g.:

❶ ❷ ❸ ❹

Use of handling instructions

Handling instructions are steps that must be carried out in their exact sequence during startup, operation, maintenance and similar operations.

They are numbered consecutively (black numbers in white circles)):

① Text

② Text

③ Text

Use of footnotes in tables

Instructions in tables are explained in footnotes underneath the tables (in superscript). There is a footnote character at the appropriate position in the table (in superscript).

If there are several footnotes for one table then these are numbered consecutively underneath the table (black numbers in white circles, in superscript):

① Text
② Text
③ Text

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1 Introduction

Mitsubishi Electric Corporation
2-7-3 Marunouchi, Chiyoda-ku, Tokyo, Japan
Mitsubishi Electric Europe B.V.
Gothaer Straße 8, 40880 Ratingen, Germany

This manual describes the unpacking, installation, connection and initial startup of the SD and SQ series robots.

This manual is a translation of the original German manual from MITSUBISHI ELECTRIC B.V.

The operating steps shown in this manual refer to the Teaching Box R32TB.

This manual applies to the following robots and control units:

Series	Model	Construction	Handling weight [kg]	Control unit
SD	RV-3SD/3SDJ	Vertical articulated arm	3	CR2D-711
	RV-6SD/6SDL		6	
	RV-12SD/12SDL		12	CR3D-701M (IP54)
	RH-6SDH	SCARA	6	CR2D-741
	RH-12SDH		12	
	RH-18SDH		18	CR2D-751
SQ	RV-3SQ/3SQJ	Vertical articulated arm	3	CR2Q-721
	RV-6SQ/6SQL		6	CR2Q-711
	RV-12SQ/12SQL		12	CR3Q-701
	RH-6SQH	SCARA	6	CR2Q-761
	RH-12SQH		12	CR2Q-741
	RH-18SQH		18	CR2Q-751

Tab. 1-1: *Overview of robot models and control units*

1.1 Name of model

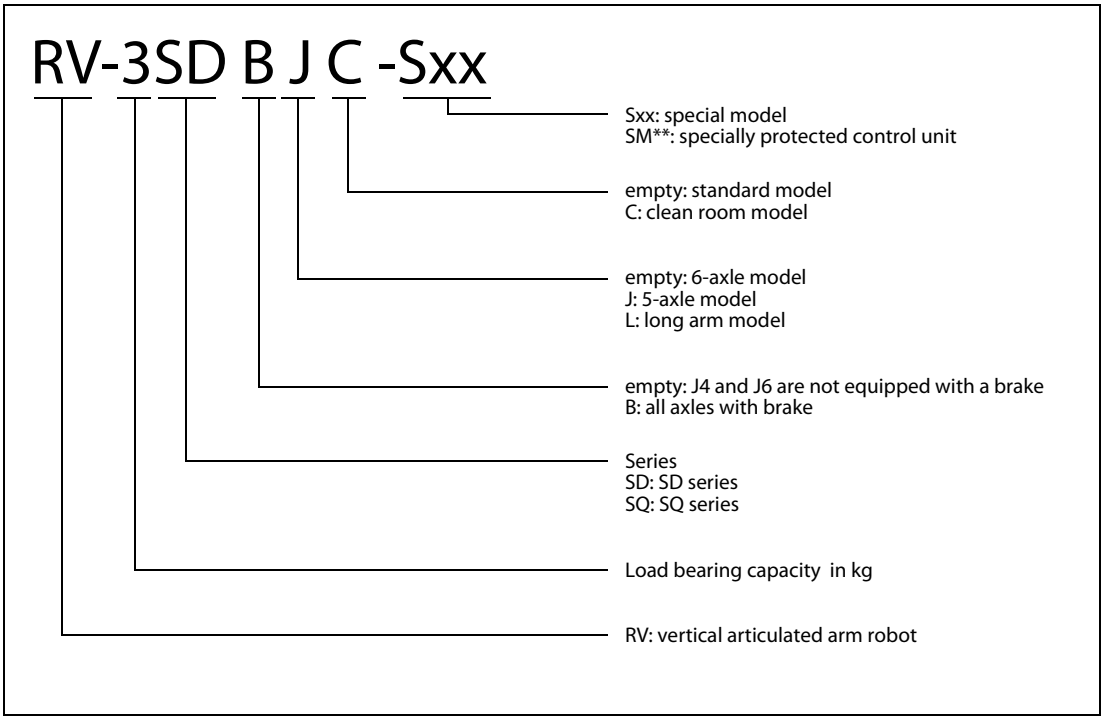


Fig. 2-1: *Model name of vertical articulated arm robot*

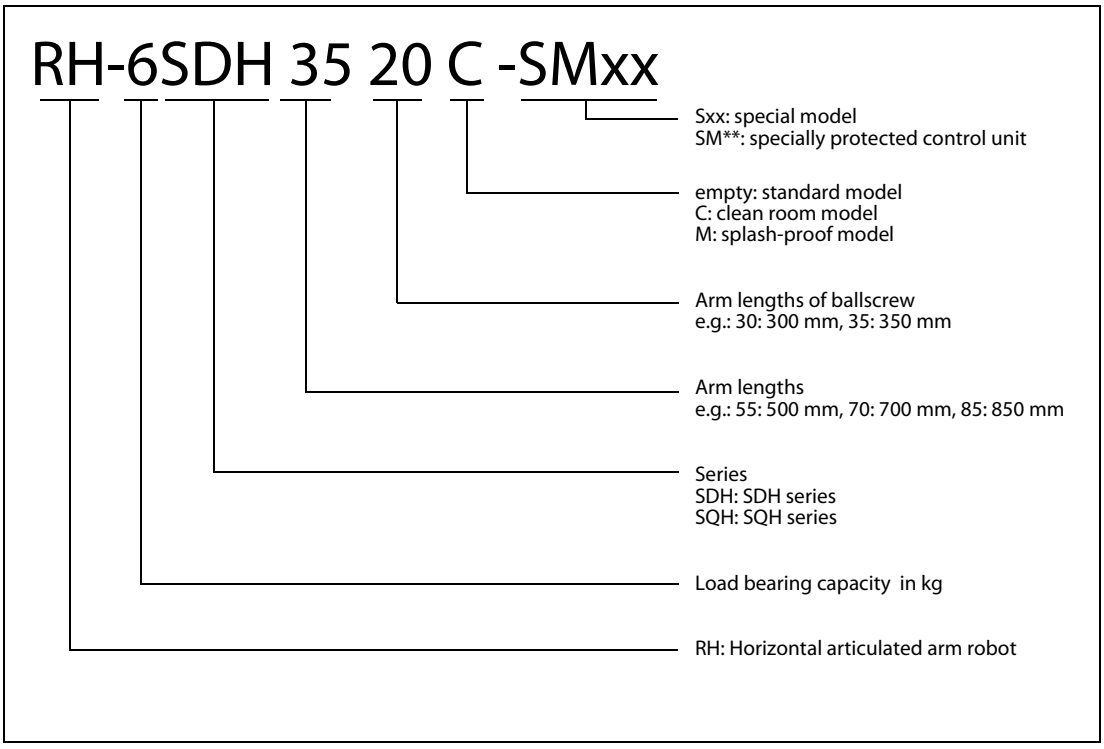


Fig. 2-2: *Name of model of the horizontal articulated arm robot (SCARA)*

1.2 Basic safety instructions

The MELFA robot has been constructed according to the state-of-the-art and has been configured for operational safety. Nonetheless, dangers/hazards may arise from the robot if is is not operated by trained personnel or at least by instructed personnel, or if it is used in an improper manner or not compliant to its intended use.

In particular, this means:

- **Danger to the life and limb of the user or of third-parties**
- **Impairments to the robot, other machines and other property of the user**

ATTENTION:

Every person authorised within the company of the operator to install, startup, operate, maintain and repair the robot must have read and understood the technical documentation for the robot and must pay special attention to the supplied SAFETY MANUAL.

ATTENTION:

Strictly observe the safety regulations. The following, additional instructions are provided within the scope of these introductory safety instructions:

The robot may only be operated by trained and authorised operating personnel.

Responsibilities for the various activities when operating the robot must be clearly defined and observed to ensure that there are no unclarities or unclear duties regarding the safety aspects

For all work relating to the installation, startup, equipping/fitting, operation, changes to operating conditions and modes of operation, maintenance, inspection and repairs, the switch-off procedures stipulated in the manual must be observed.

The position of the EMERGENCY-STOP pushbutton must be known and the EMERGENCY-STOP pushbutton must be accessible at all times.

No operating methods may be employed that impair the safety of the machine.

The operator must ensure that no unauthorized persons work at the robot (e.g. including enabling of equipment against unauthorized use).

The company used must ensure that the robot is always operated in perfect condition.

The company using the robot must provide special training to the appropriate operating personnel and obligate them to carry out all maintenance and inspection work only when the robot and all of its peripheral equipment is switched off.

DANGER:

The control unit must only (i.e. exclusively) be connected by a circuit breaker to the mains supply. There is a risk of electrical shock if this is not observed.

A detailed description of the mains connection is contained in section 4.2.

1.3 Environmental conditions for operation

Because the environmental conditions have a significant effect on the operational life of the equipment, you should not install the robot system in the following conditions:

- Power supply

  Do not use when

  – the power supply of CR2 devices is below 180 V AC or above 253 V AC, and the power supply of CR3 devices is below 360 V AC or above 480 V AC,

  – transient power failures last more than 20 ms,

  – the mains supply is unable to provide an output of at least 2.0 kVA (CR2) or 3.0 kVA (CR3).

- HF interference

  Do not use when

  – there are voltage peaks on the mains supply greater than 1000 V and longer than 1 µs,

  – there are large frequency inverters, transformers, magnetic switches or welding devices in the vicinity,

  – there are radios or televisions in the vicinity.

- Temperature/Humidity

  Do not use when

  – the ambient temperature is above 40 °C or below 0 °C,

  – the robot is subjected to direct sunlight,

  – the air humidity is below 45 % or above 85 %,

  – condensation can occur.

- Vibrations

  Do not use when

  – the robot is subjected to heavy vibrations or knocks,

  – the maximum load of the robot is above 34 m/s^2 during transport and above 5 m/s^2 in operation.

- Installation location

  Do not use when

  – subjected to strong electrical or magnetic fields,

  – the stand space is very uneven,

  – there is heavy contamination from dust and oil mist.

1.4 Performance Level (PL) compliant with EN ISO 13849-1

The robot systems listed in the following are compliant with

- Performance Level (PL): d
- Category: 3

2 System overview

All devices and system parts belonging to the industrial robots from the MELFA series SD and SQ and that are required for basic operation of the robot are described in this chapter. Options and spare parts are listed in the technical manual.

2.1 Scope of delivery

2.1.1 SD series

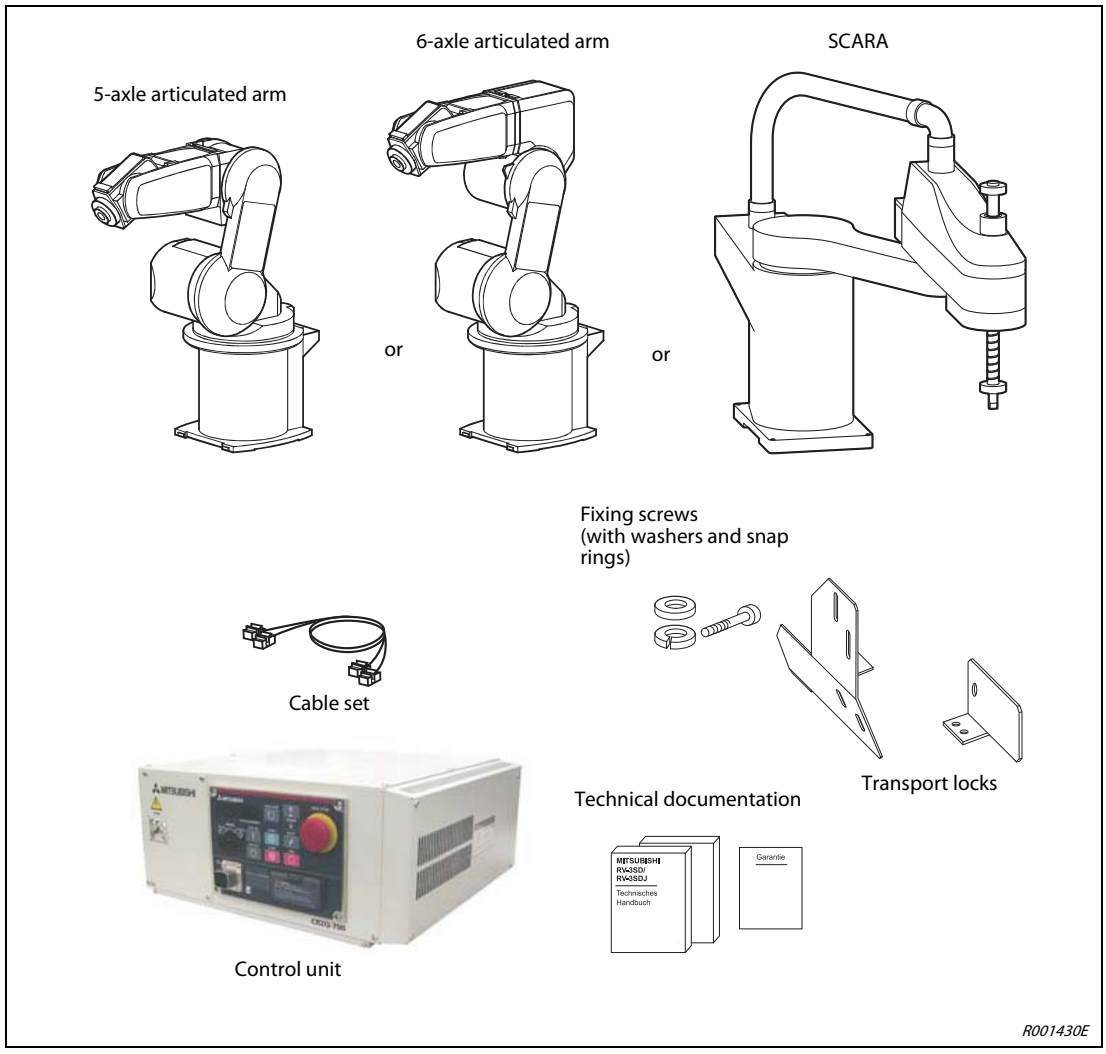


Fig. 2-1: *Scope of delivery of robot systems RV-SD and RH-SDH*

2.1.2 SQ series

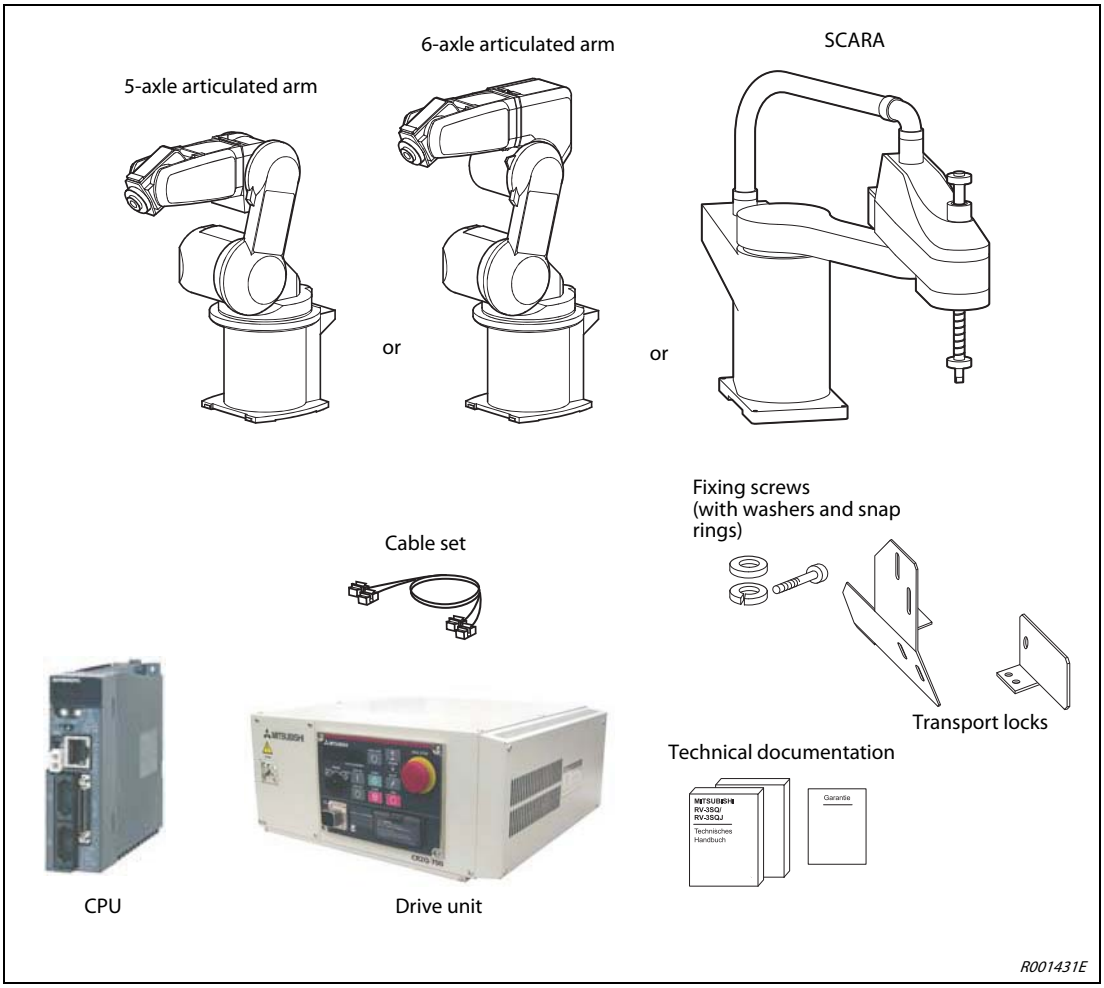


Fig. 2-2: *Scope of delivery of robot systems RV-SQ and RH-SQH*

2.2 System configuration

This section describes the components required for the basic configuration of a robot system.

2.2.1 SD series

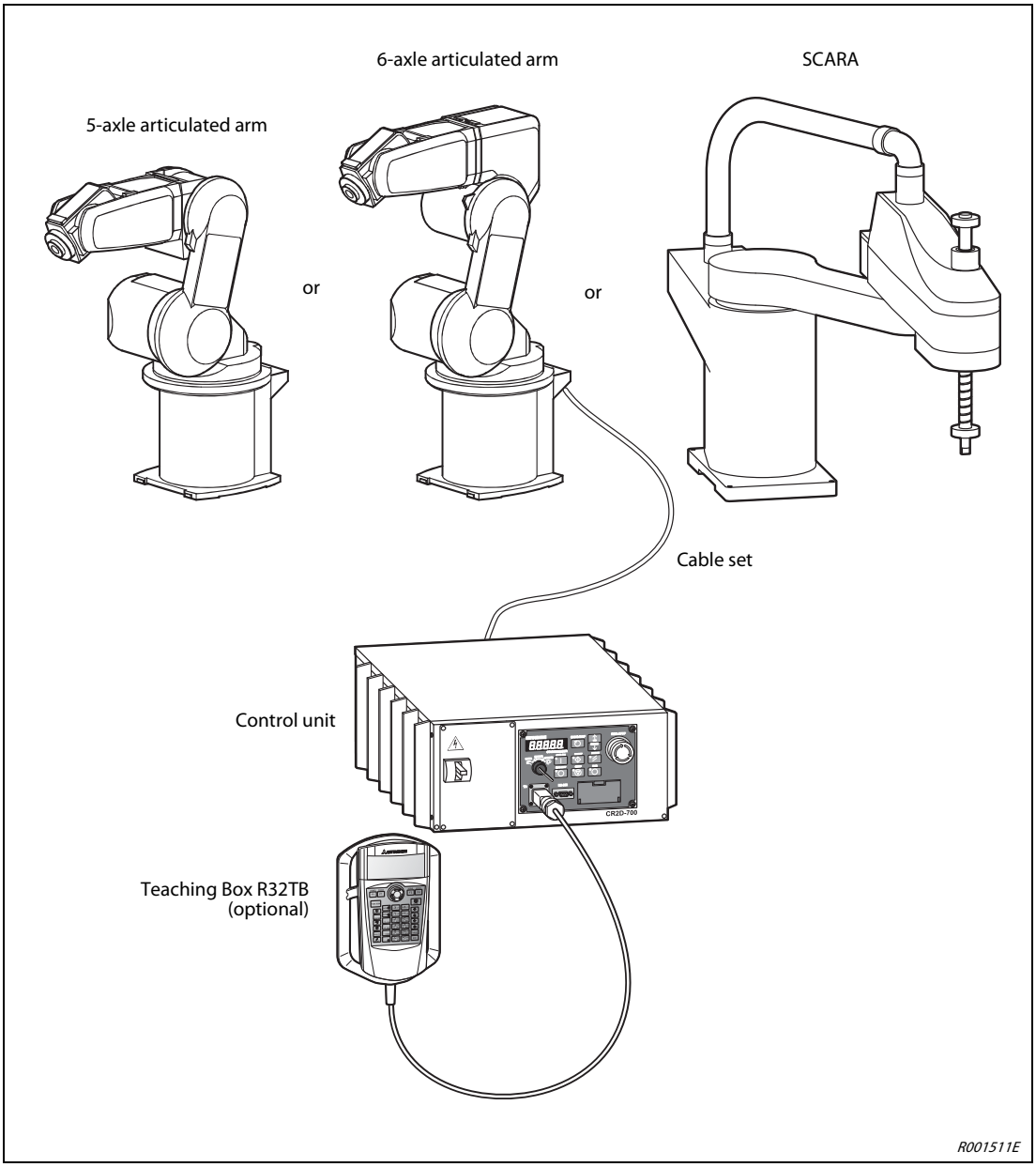


Fig. 2-3: *Configuration of an SD series robot system*

NOTE The Teaching Box is an optional extra. It is required for basic operation of the robot.

2.2.2 SQ series

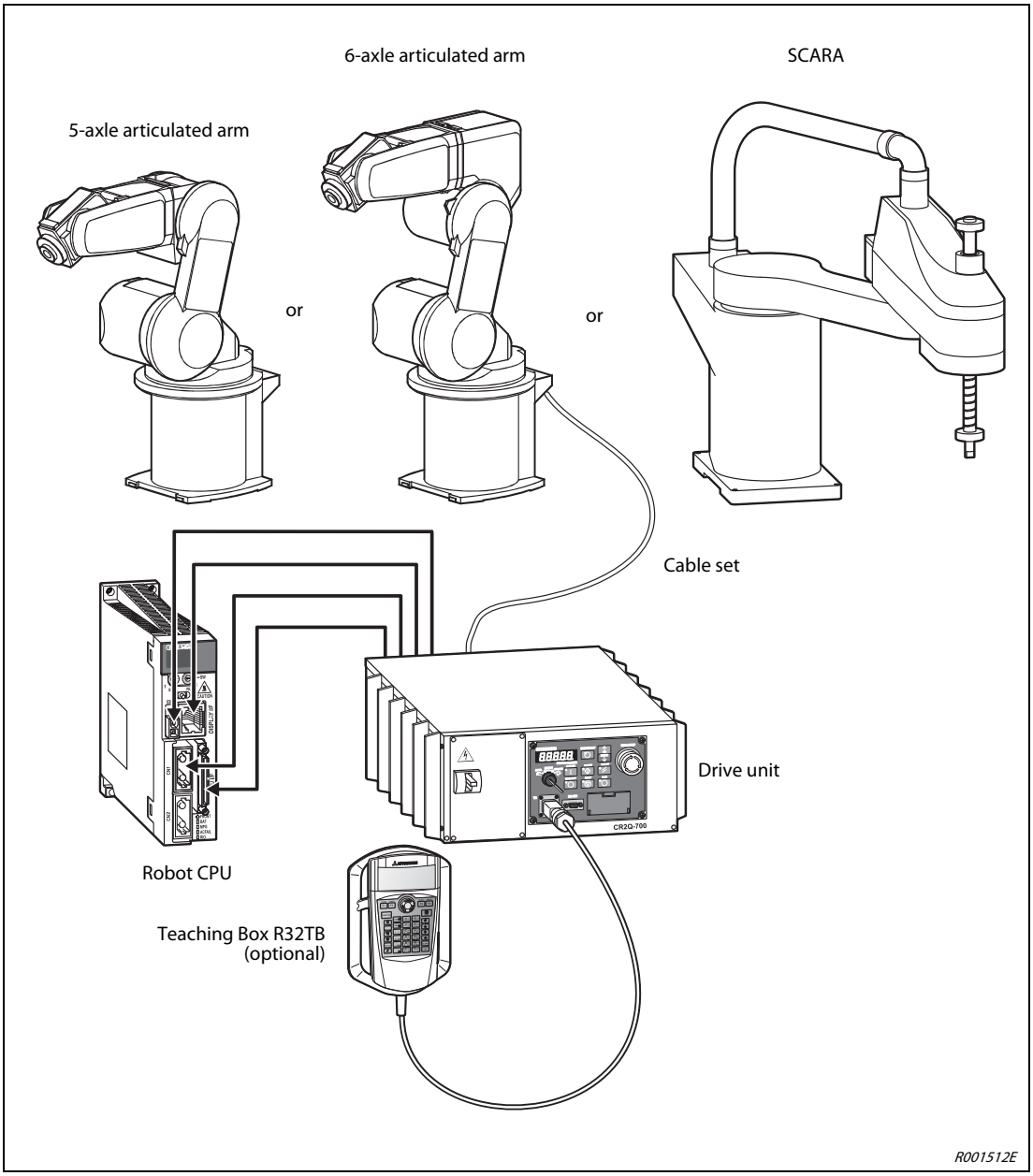


Fig. 2-4: *Configuration of an SQ series robot system*

NOTE The Teaching Box is an optional extra. It is required for basic operation of the robot.

2.2.3 Components of the robot arm

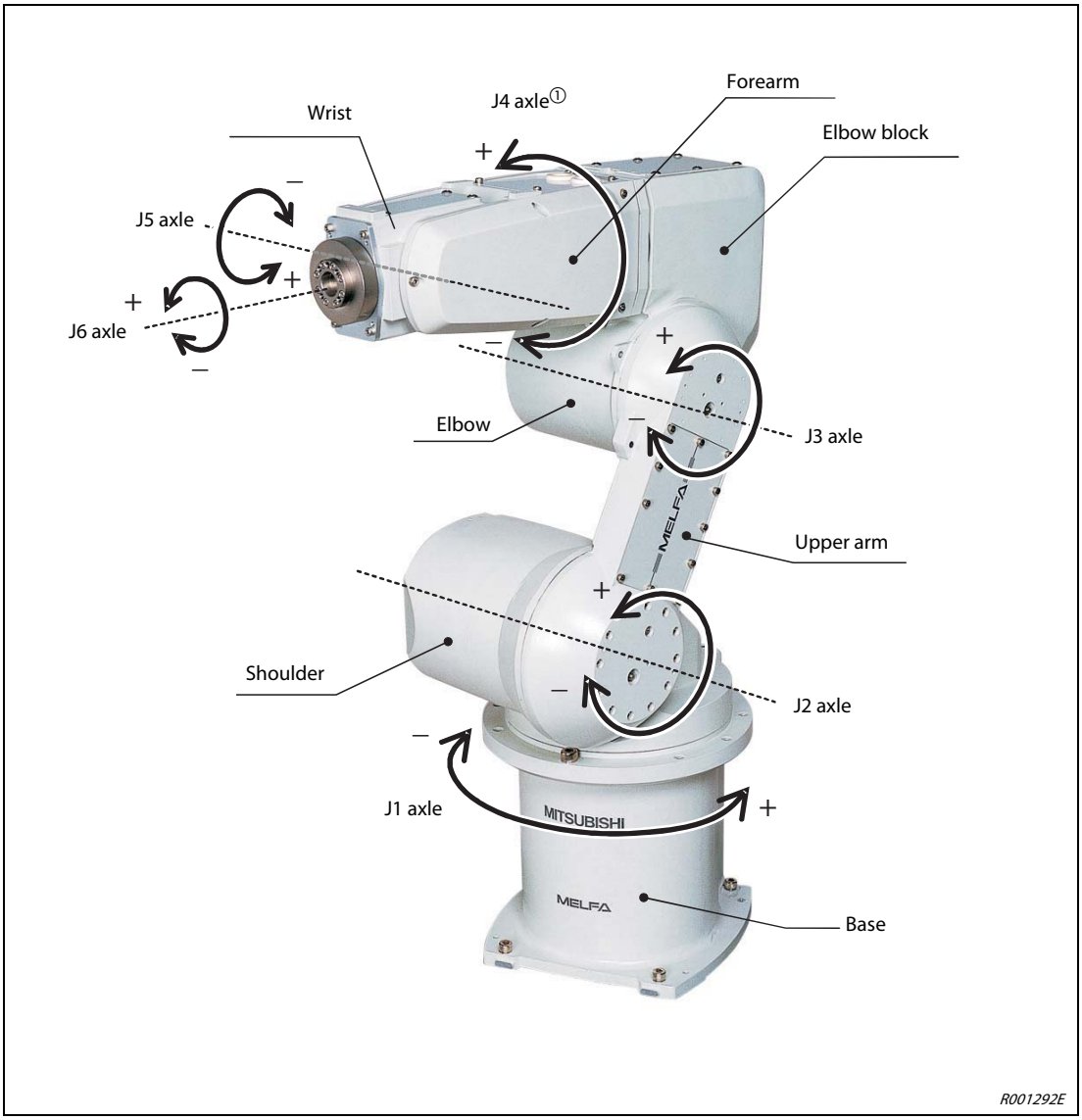


Fig. 2-5: *Components of the robot arm on the vertical articulated arm robot*

① The 5-axle robot does not have a J4 axle.

Name of axle	Meaning
J1 axle	Base axle
J2 axle	Shoulder axle
J3 axle	Elbow axle
J4 axle	Rotating forearm axle
J5 axle	Wrist tilting axle
J6 axle	Wrist rotating axle

Tab. 2-1: *Overview of axle names*

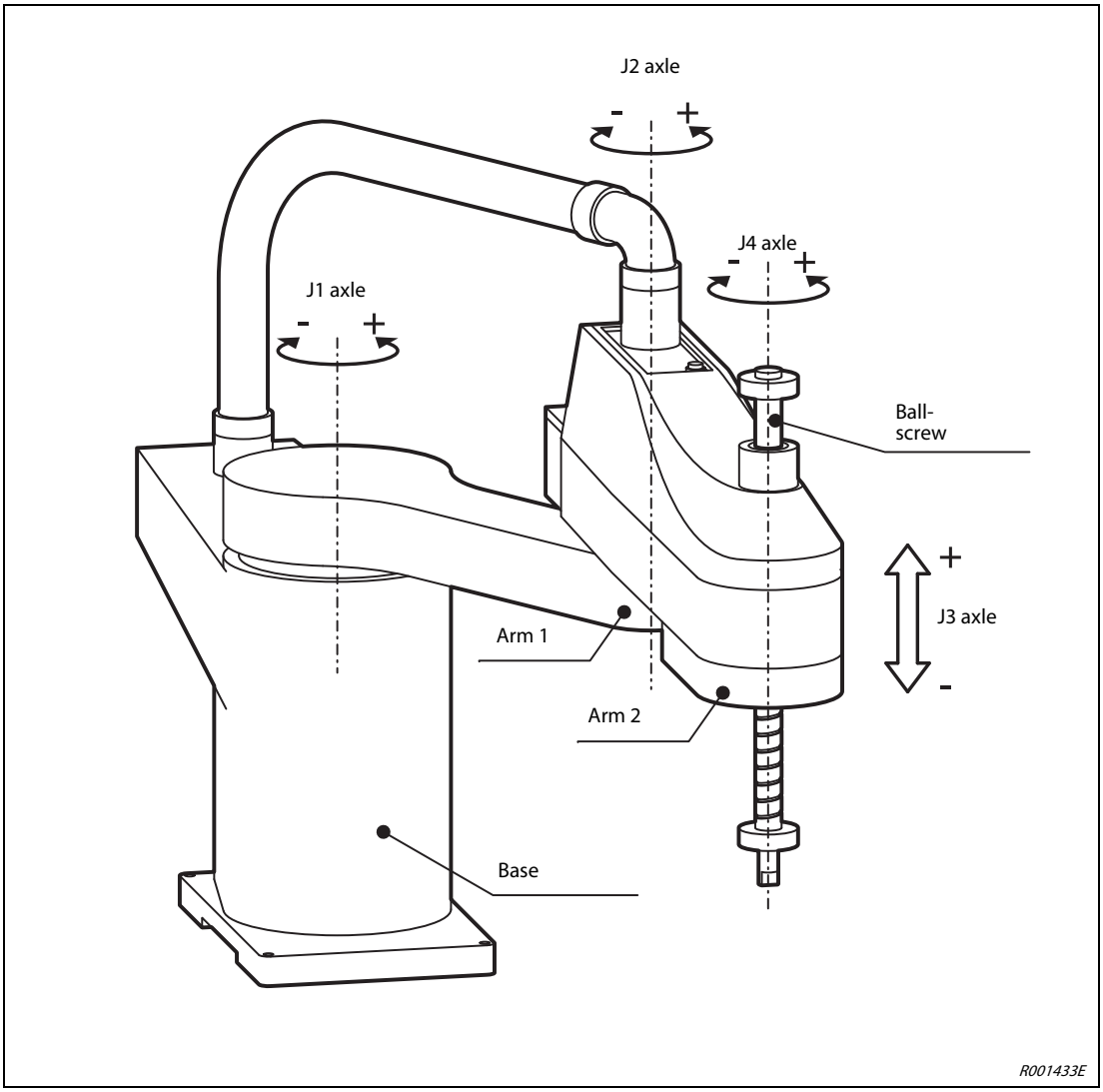


Fig. 2-6: *Components of the robot arm in the SCARA*

2.3 Control units

2.3.1 Control panel

The following figure shows the front view of the control panel of control units CR□D and CR□Q.

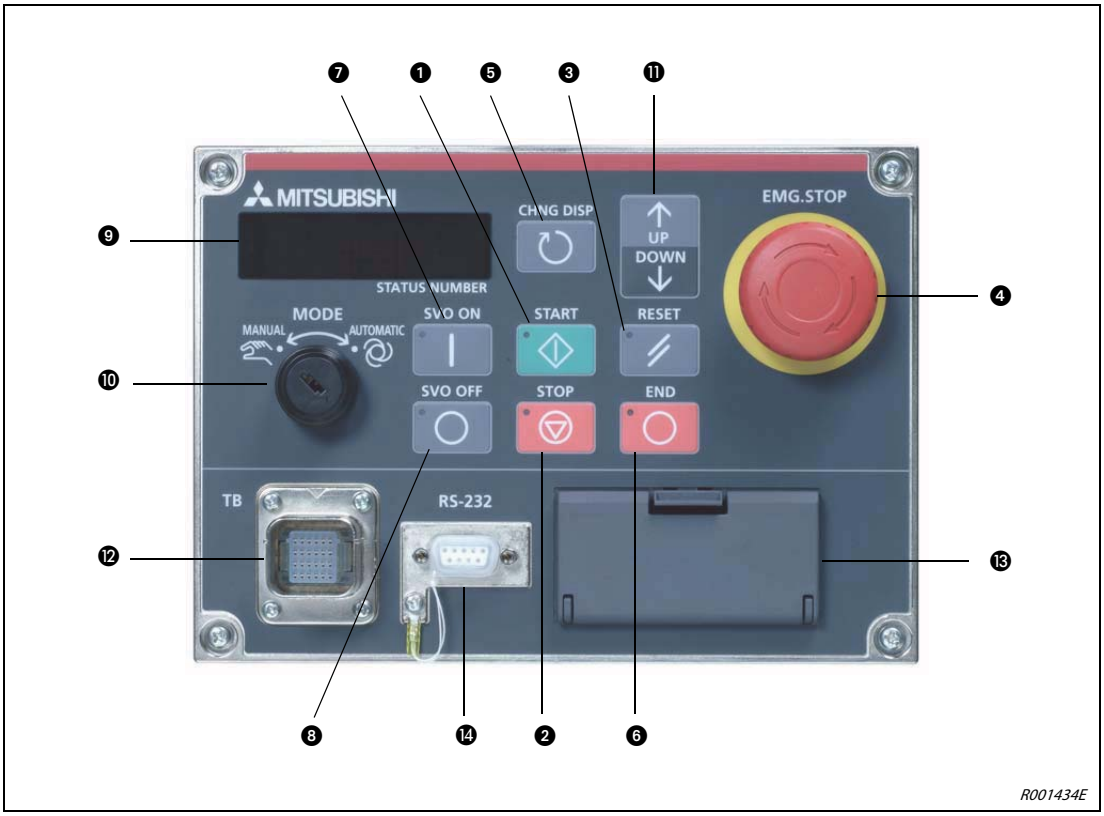


Fig. 2-7: *Front view of control panel*

No.	Name	Function
❶	[START] key	Start a program and operate the robot The program is processed continuously
❷	[STOP] key	Cancel the running program and stop the robot This function is the same as the function of the [STOP] key on the Teaching Box.
❸	[RESET] key	Acknowledges an error code Sets the hold state of the program and resets the program
❹	[EMG.STOP] pushbutton switch	The pushbutton switch is used for the EMERGENCY-STOP of the robot system. After pressing the pushbutton switch, the servo power supply is switched off immediately and the moving robot arm stops instantaneously. The pushbutton is unlocked by turning it to the right and then jumps back out.
❺	[CHNG DISP] key	Changes the display on the control unit in the following order: Program number → Line number → Override
❻	[END] key	Stops the running program after END instruction
❼	[SVO ON] key	Switches on the servo power supply
❽	[SVO OFF] key	Switches off the servo power supply
❾	[STATUS NUMBER] display	Displays alarm, program number and override value (%) etc.

Tab. 2-2: *Overview of control and signal elements (1)*

No.	Name		Function
⑩	[MODE] selector switch	AUTOMATIC	Operation can be carried out via the control unit or external devices. Operation via external signals or the Teaching Box is deactivated. The connection between the control unit and external devices must be enabled by the parameter for assigning operating rights. A detailed description of the operating rights is contained in the programming manual of the robot.
		MANUAL	If the Teaching Box is enabled then the robot can only be operated by the Teaching Box. Operation cannot be carried out using external signals or the control unit.
⑪	[UP/DOWN] key		Scrolls within the display
⑫	T/B connection		Port to connect the Teaching Box. Plug the protective cap onto the jack if the Teaching Box is not connected.
⑬	Port cover		USB port and battery
⑭	RS232 port (only CR□D)		The RS232 port is used to connect a personal computer.

Tab. 2-2: *Overview of control and signal elements (2)*

NOTE Keys ❶, ❷, ❸, ❻, ❼ and ❽ have integrated control displays.

2.3.2 CR2D components

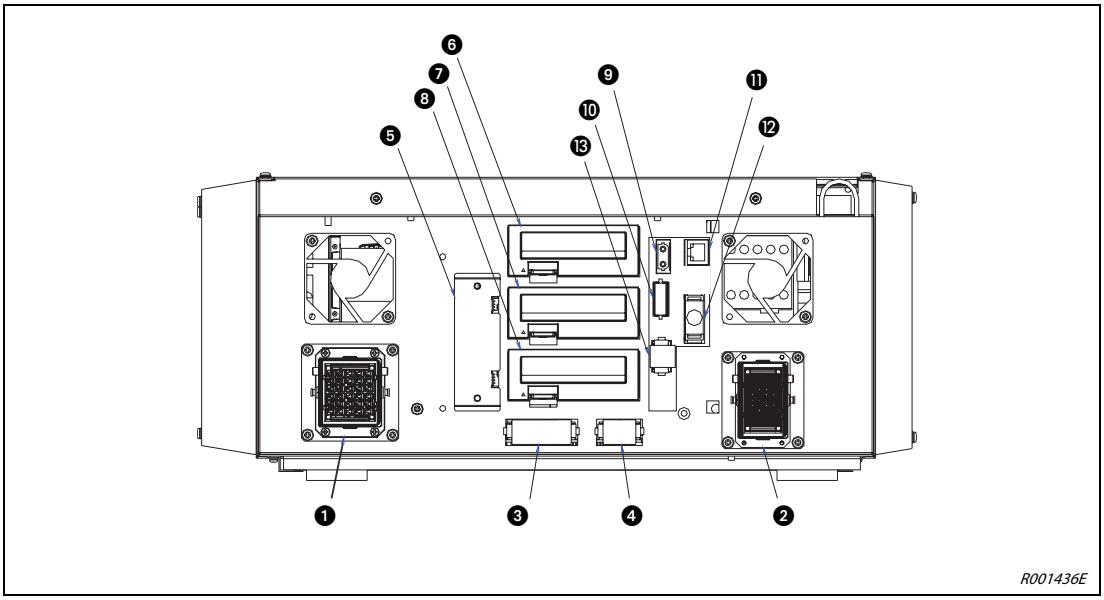


Fig. 2-8: *Rear of CR2D control unit*

No.	Name	Function
❶	Connection fro servo power supply cable (CN1)	For robot power supply
❷	Connection for signal cable (CN2)	For robot control cable
❸	Input for EMERGENCY-STOP pushbutton (EMGIN)	Connection for EMERGENCY-STOP pushbutton
❹	Output for EMERGENCY-STOP state (EMGOUT)	Output of current EMERGENCY-STOP state
❺	Slot for hand interface card (HND)	Slot for installing the interface card for the pneumatically operated gripper hand
❻	SLOT1	Slots for optional plug-in cards
❼	SLOT2	
❽	SLOT3	
❾	Connection for additional axle	Port for connecting an additional axle
❿	Connection of a parallel input/ output port (RIO)	Port to connect an additional parallel input/output port
⓫	Ethernet connection (LAN1)	Port to connect an ethernet cable For the CE-approved version, use the filter and ferrite core supplied with the equipment.
⓬	Port or conveyor belt tracking (CNENC)	Connection of encoder cable for conveyor belt tracking
⓭	Additional stop input (SKIP)	Additional robot stop

Tab. 2-3: *Components on the rear of the CR2D control unit*

2.3.3 CR3D components

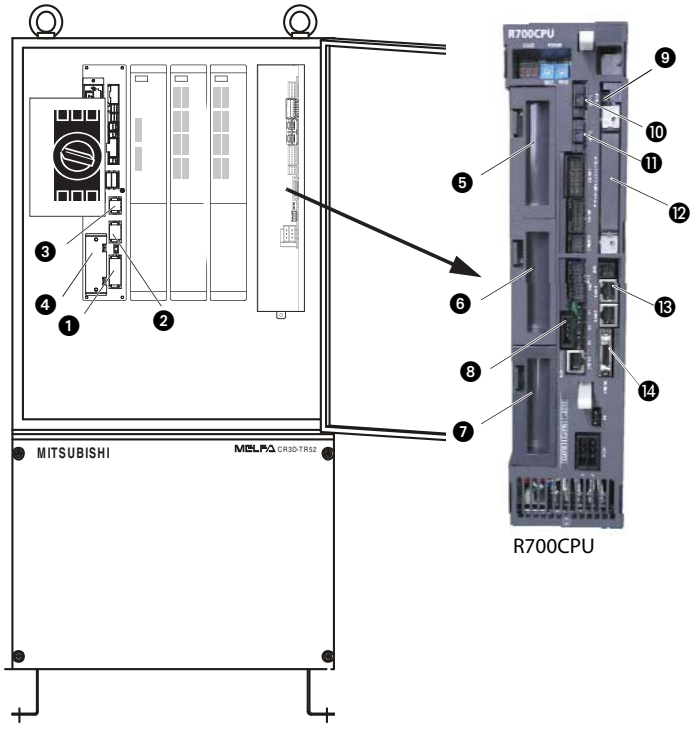


Fig. 2-9: *CR3D control unit*

No.	Name	Function
❶	Input for EMERGENCY-STOP pushbutton (EMGIN)	Connection for EMERGENCY-STOP pushbutton
❷	Output for EMERGENCY-STOP state (EMGOUT)	Output of current EMERGENCY-STOP state
❸	Special stop input (SKIP)	Immediate robot stop
❹	Slot for hand interface card (HND)	Slot for installing the interface card for the pneumatically operated gripper hand
❺	SLOT1	Slots for optional plug-in cards
❻	SLOT2	
❼	SLOT3	
❽	Connection of a parallel input/ output port (RIO)	Port to connect an additional parallel input/output port
❾	Battery connection (BAT)	Battery connection
❿	OPT1 connection	Reserved
⓫	Connection for additional axle (OPT2)	Port for connecting an additional axle
⓬	Memory cassette slot (MEMORY CASSETTE)	For installing an optional memory cassette
⓭	Ethernet connection (LAN1)	Port to connect an ethernet cable For the CE-approved version, use the filter and ferrite core supplied with the equipment.
⓮	Port or conveyor belt tracking (CNENC)	Connection of encoder cable for conveyor belt tracking

Tab. 2-4: *Components of the CR3D control unit*

2.3.4 CR2Q components

The CR2Q control unit is comprised of the robot CPU Q172DRCPU and the DU2 drive unit.

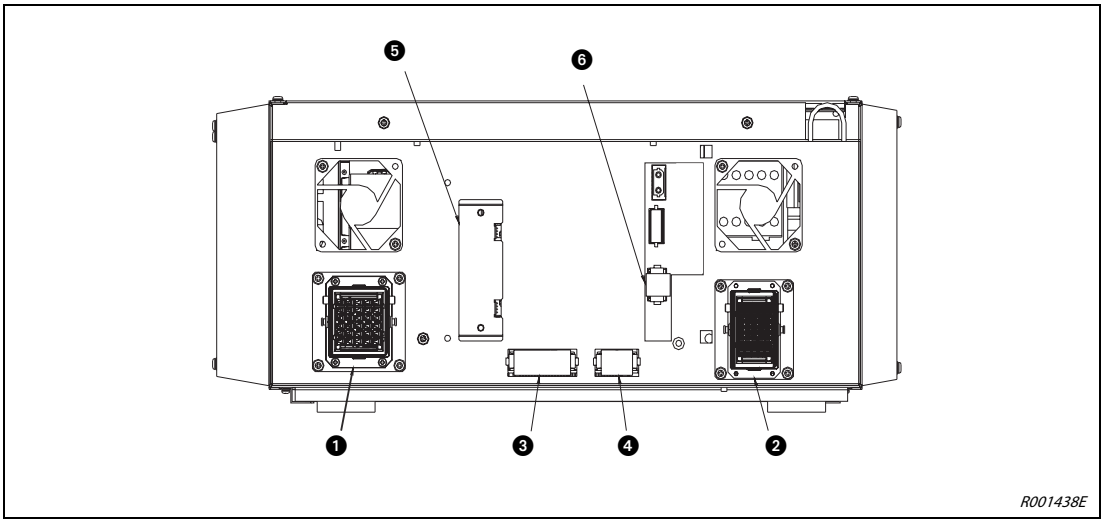


Fig. 2-10: *Rear of DU2-700 drive unit*

No.	Name	Function
❶	Connection fro servo power supply cable (CN1)	For robot power supply
❷	Connection for signal cable (CN2)	For robot control cable
❸	Input for EMERGENCY-STOP pushbutton (EMGIN)	Connection for EMERGENCY-STOP pushbutton
❹	Output for EMERGENCY-STOP state (EMGOUT)	Output of current EMERGENCY-STOP state
❺	Slot for hand interface card (HND)	Slot for installing the interface card for the pneumatically operated gripper hand
❻	Additional stop input (SKIP)	Additional robot stop

Tab. 2-5: *Components on the rear of the DU2 drive unit*

2.3.5 CR3Q components

The CR3Q control unit is comprised of the robot CPU Q172DRCPU and the DU3 drive unit.

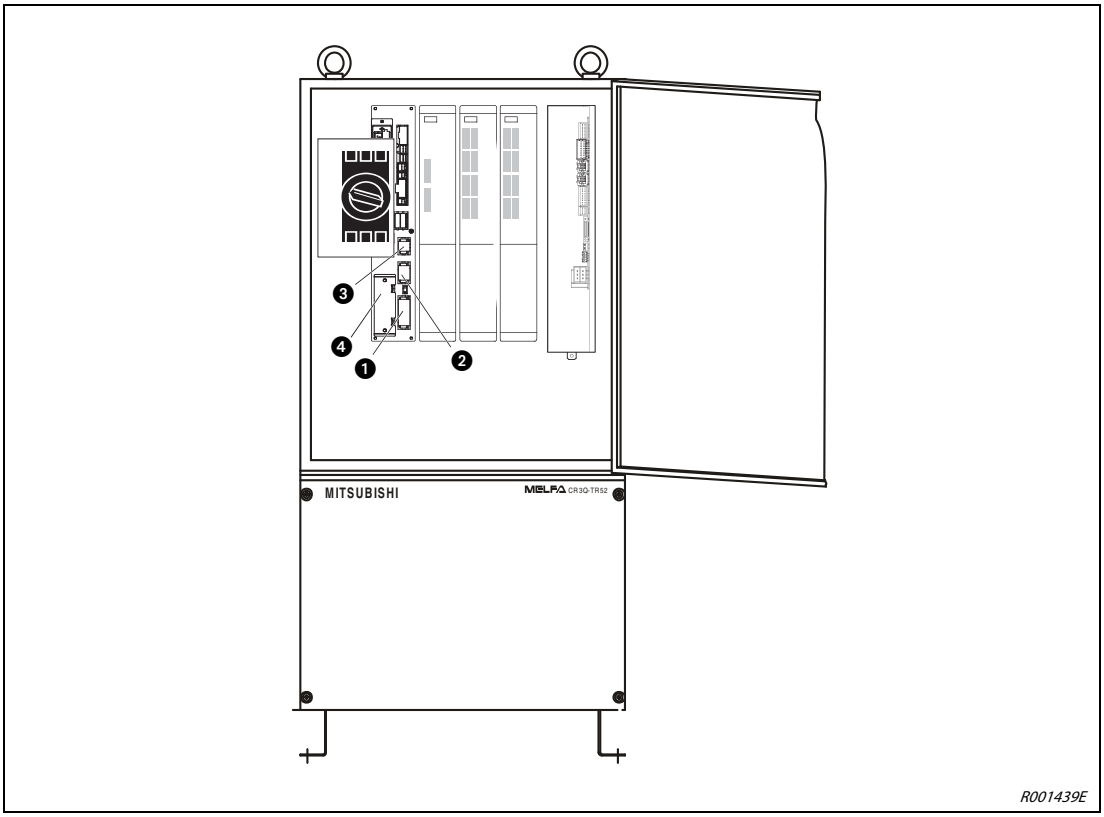


Fig. 2-11: *DU3 drive unit*

No.	Name	Function
❶	Input for EMERGENCY-STOP pushbutton (EMGIN)	Connection for EMERGENCY-STOP pushbutton
❷	Output for EMERGENCY-STOP state (EMGOUT)	Output of current EMERGENCY-STOP state
❸	Additional stop input (SKIP)	Additional robot stop
❹	Slot for hand interface card (HND)	Slot for installing the interface card for the pneumatically operated gripper hand

Tab. 2-6: *Components of the DU3 drive unit*

2.4 Robot CPU (SQ series only)

The control units of the SQ series have an external CPU, which can be added to an already existing SQ system.

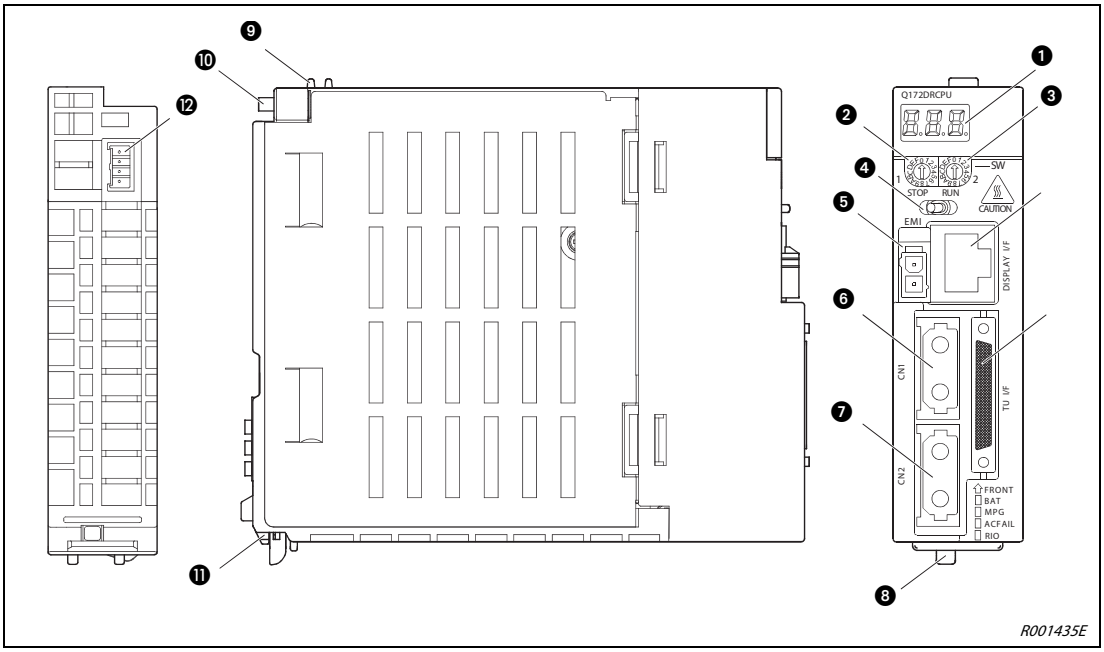


Fig. 2-12: *Robot CPU Q172DRCPU*

No.	Name	Function
❶	7-segment LED display	Status and alarm display
❷	Code switch SW1	Setting the operating mode Must be set to "0".
❸	Code switch SW2	
❹	[RUN/STOP] selector switch	Not used
❺	EMI ①	EMERGENCY-STOP input All servo motors can be stopped simultaneously via this input. EMI ON (stop): EMERGENCY-STOP enabled EMI OFF (connect 24 V DC): EMERGENCY-STOP disabled
❻	CN1 ②	Connection of control unit
❼	CN2 ②	Connection of an additional axle (up to 8 axles)
❽	Lock	The locking lever releases the plug when installed in the rack.
❾	Catch ③	Used to fix the CPU to the rack
❿	Fixing screw	Screw to fix the CPU to the rack (M3 x 13)
⓫	Catch	Used to fix the CPU to the rack
⓬	Battery connection ④	Connection for Q170DBATC battery unit
⓭	DISPLAY I/F	Connection for the Teaching Box (R56TB)
⓮	TU I/F	Connection for an RS422 connection to the control unit

Tab. 2-7: *Overview of robot CPU components*

① Always make sure to connect the EMI line, otherwise the EMERGENCY-OFF state is always enabled. The maximum permissible cable length is 30 m.

② Lay the cable in a cable channel or fix the cable near to the CPU to ensure a secure connection with plugs CN1 and CN2.

③ The catch is only used to simplify the installation process. Fix the CPU using the fixing screw on the rack.

④ Use an external battery as otherwise the program in the SRAM, the parameters, the home position data etc. will be lost.

2.5 Teaching Box.

2.5.1 R28TB

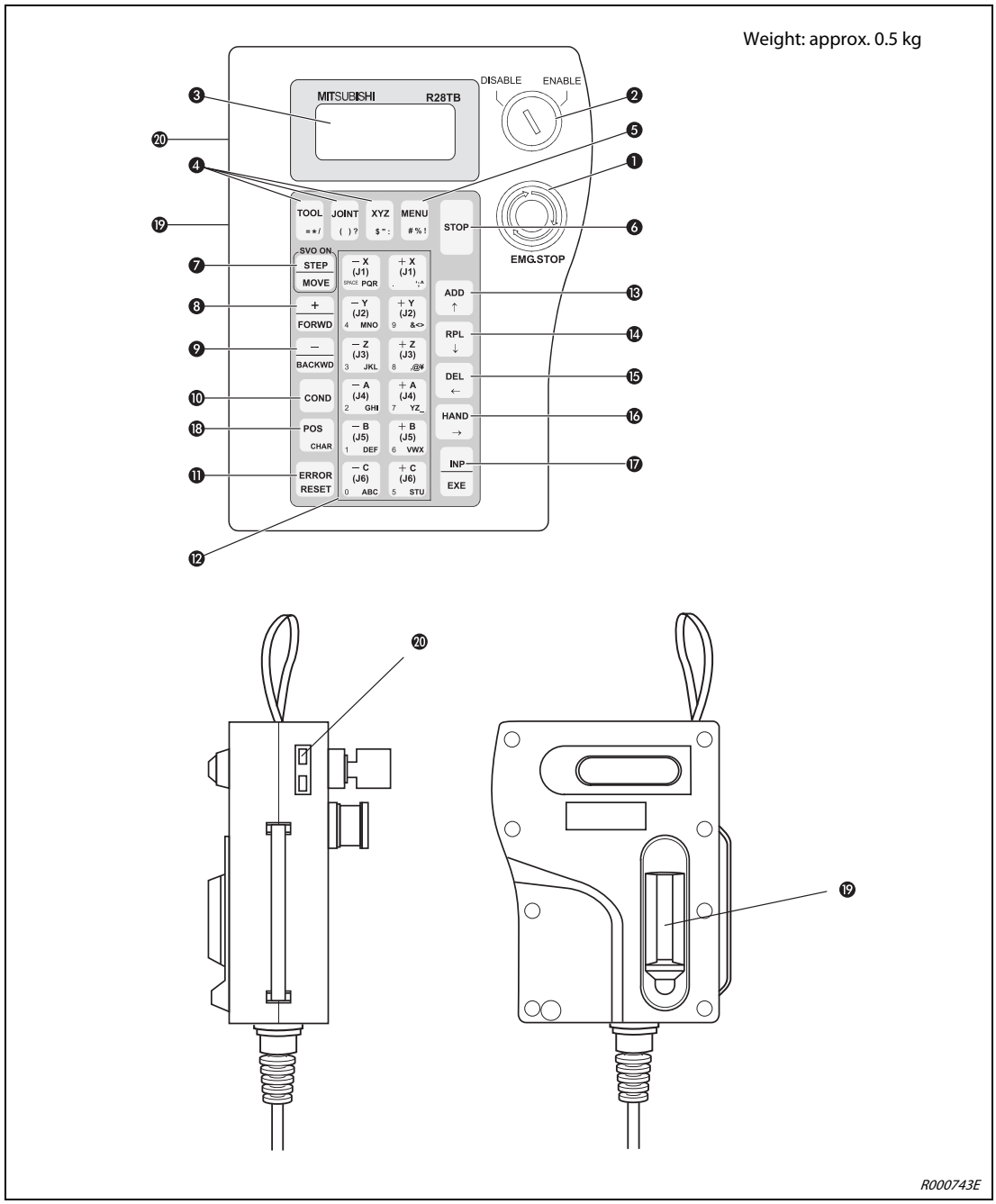


Fig. 2-13: *Views of Teaching Box R28TB*

No.	Name	Function
❶	[EMG.STOP] pushbutton switch	EMERGENCY-STOP pushbutton with locking function If you press the pushbutton then the robot arm stops instantaneously. The servo power supply is switched off The pushbutton switch is unlocked by turning it clockwise.
❷	[ENABLE/DISABLE] selector switch	Releases control over the Teaching Box Put switch into "ENABLE" position to control the robot arm via the Teaching Box. As long as the Teaching Box is enabled, the robot arm can neither be controlled from the control panel of the control unit nor externally.
❸	LCD display	The LCD display has 4 lines, each with 16 characters The state of the program or of the robot arm is displayed here
❹	[TOOL] key	Select the tool-jog mode
	[JOINT] key	Select the articulated joint-jog mode
	[XYZ] key	Select the XYZ-jog- or circular-jog mode
❺	[MENU] key	Returns to the main menu
❻	[STOP] key	Cancel the running program and stop the robot This function is the same as the function of the [STOP] key on the control panel of the control unit. This key function is always available, independent of the position of the [ENABLE/DISABLE] selector switch.
❼	[STEP/MOVE] key	Execute jog-mode together with jog keys ⓬ and the 3-step enable switch Instruction steps are executed together with the [INP/EXE] key. The servo power supply is switched off
❽	[+/FORWD] key	Forward steps are executed together with the [INP/EXE] key. The next program line in edit mode is displayed. Press the key together with the [STEP/MOVE] key to increase override.
❾	[–/BACKWD] key	Reverse steps are executed together with the [INP/EXE] key. The previous program line in edit mode is displayed. Press the key together with the [STEP/MOVE] key to decrease override.
❿	[COND] key	Edit the program
⓫	[ERROR RESET] key	Acknowledges an error code A program is reset when used together with the [INP/EXE] key.
⓬	12 keys for JOG mode: [–X/(J1)] ... [+C/(J6)]	Function key for jog mode All articulated joints can be moved individually in articulated joint-jog mode. The robot arm can be moved along any of the coordinate axes in XYZ jog mode. These keys are also used to enter the menu selection numbers or step numbers.
⓭	[ADD/] key	Enter positions or move cursor upwards
⓮	[RPL/↓] key	Change positions or move cursor downwards
⓯	[DEL/←] key	Delete positions or move cursor to the left
⓰	[HAND/→] key	Used together with keys [+C/(J6)] or [–C/(J6)] to move the first gripper hand Used together with keys [+B/(J5)] or [–B/(J5)] to move the second gripper hand Used together with keys [+A/(J4)] or [–A/(J4)] to move the third gripper hand Move the cursor to the right
⓱	[INP/EXE]	Enter data or move on a step
⓲	[POS/CHAR] key	Switches between numbers and letters, e.g. when editing position data
⓳	Three-step enable switch	The three-step enable switch must be actuated to switch on the servo drive when the Teaching Box is switched on.
⓴	Contrast adjustment	Brightness setting on the LCD display

Tab. 2-8: *Overview of Teaching Box R28TB controls*

2.5.2 R32TB

Fig. 2-14: *Views of Teaching Box R32TB*

No.	Name	Function
❶	[EMG.STOP] pushbutton switch	EMERGENCY-STOP pushbutton with locking function If you press the pushbutton then the robot arm stops instantaneously. The servo power supply is switched off The pushbutton switch is unlocked by turning it clockwise.
❷	[ENABLE/DISABLE] selector switch	Releases control over the Teaching Box Put switch into "ENABLE" position to control the robot arm via the Teaching Box. As long as the Teaching Box is enabled, the robot arm can neither be controlled from the control panel of the control unit nor externally.
❸	Enable switch	The three-step enable switch must be actuated to switch on the servo drive when the Teaching Box is switched on.
❹	LCD display	The status of the program or the robot arm is displayed on the LCD.
❺	Status display	The LED displays the status of the robot or the Teaching Box.
❻	[F1]-, [F2]-, [F3]-, [F4] key	Run the functions currently shown on the display
❼	[FUNCTION] key	Toggle the displayed functions
❽	[STOP] key	Cancel the running program and stop the robot This function is the same as the function of the [STOP] key on the control panel of the control unit. This key function is always available, independent of the position of the [ENABLE/DISABLE] selector switch.
❾	[OVRD]-, [OVRD ↓] key	Change the movement speed Press the [OVRD] key to increase the movement speed, and press the [OVRD ↓] key to decrease the speed.
❿	12 keys for JOG mode: [–X/(J1)] ... [+C/(J6)]	Function key for jog mode All articulated joints can be moved individually in articulated joint-jog mode. The robot arm can be moved along any of the coordinate axes in XYZ jog mode. These keys are also used to enter the menu selection numbers or step numbers.

Tab. 2-9: *Overview of Teaching Box R32TB (1) controls*

No.	Name	Function
⓫	[SERVO] key	Press the [SERVO] key with the ENABLE] key pressed halfway down to switch on the servo power supply.
⓬	[MONITOR] key	Switches to monitor mode and pops up the monitor menu
⓭	[JOG] key	Switches to jog mode and pops up the jog menu
⓮	[HAND] key	Switches to hand mode and pops up the hand menu
⓯	[CHARACTER] key	Calls up the Edit menu and switches between numbers and letters, e.g. when editing position data
⓰	[RESET] key	Acknowledges an error code A program is reset when used together with the [EXE] key.
⓱	[]-, [↓]-, [←]-, [→] key	Moves the cursor in the appropriate direction
⓲	[CLEAR] key	Deletes the character at the cursor position
⓳	[EXE] key	Enter data or move the robot in direct mode
⓴	Data key	Overwrites the character at the cursor position

Tab. 2-9: *Overview of Teaching Box R32TB (2) controls*

2.5.3 R46TB and R56TB

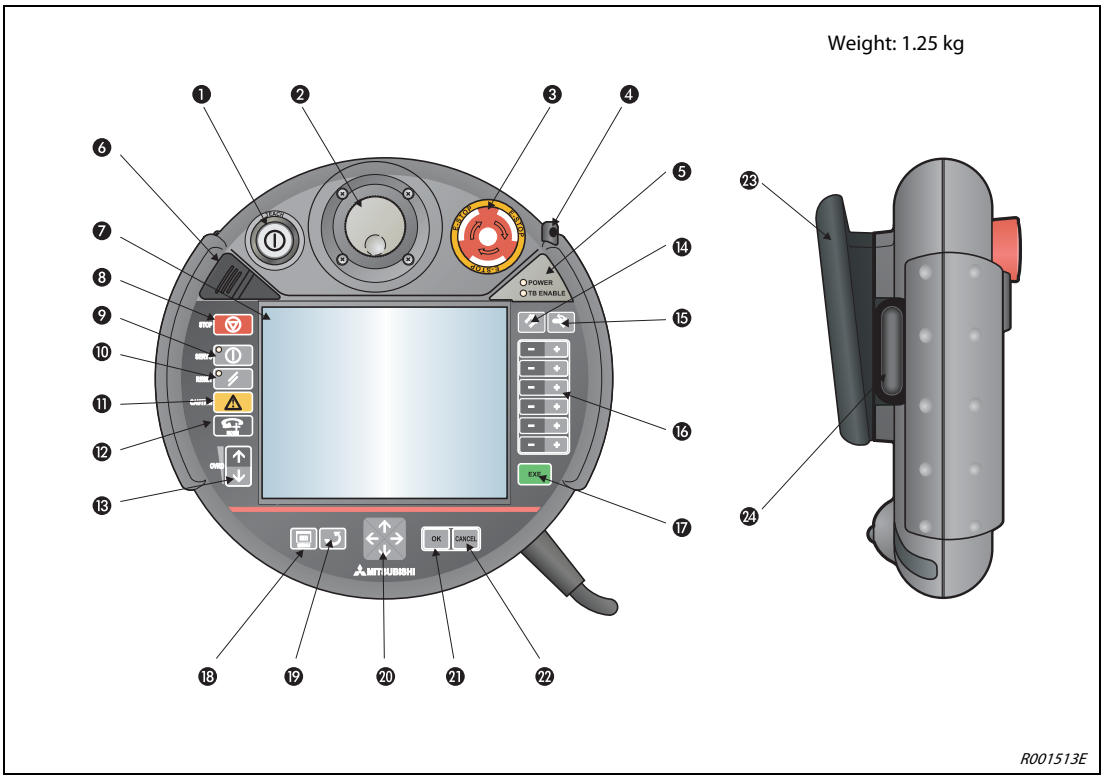


Fig. 2-15: *Views of Teaching Boxes R46TB and R56TB*

No.	Name	Function
❶	[TEACH] pushbutton switch	The operator device is switched on by this pushbutton switch. A white LED lights up when the TEACH pushbutton switch is locked on. Enable control via the operator device Press the pushbutton until it locks on ("ENABLE" position) to transfer control to the operator device. As long as the operator device is enabled, the control can neither be controlled from the control panel of the control unit nor externally. You can also toggle to enable operation even when the unit is locked, depending on the display and the override value. Once more press the pushbutton and the lock is disabled ("DISABLE" position); you can now save the current program and cancel editing with the operator device.
❷	Thumb and scroll wheel	Move within the screen menus of the operator device with the thumb and scroll wheel.
❸	[E-STOP] pushbutton	Pushbutton switch with locking function for EMERGENCY-STOP After pressing this, the robot is immediately stopped, irrespective of the respective operating condition. The pushbutton is once more unlocked by turning it to the right.
❹	Stylus (inserted into housing)	The touchscreen can be operated with this stylus. It is contained in a slot in the housing of the operator device and should be stored there after being used.
❺	POWER LED TB ENABLE LED	The POWER LED lights when the power supply is connected and switched on. The green TB ENABLE LED lights up when the touchscreen has been enables with the TEACH key ❶ .
❻	Protective cover with rear USB connection	For USB memory sticks
❼	Screen with touchscreen function	Touch-sensitive 6.5“ backlit TFT monitor with 640 × 480 pixel resolution; the touchscreen can be operated with your fingers or even better with the supplied stylus ❹ .
❽	[STOP] key	To instantaneously stop the robot. The servo is not switched off.

Tab. 2-10: *Overview of controls on Teaching Boxes R46TB and R56TB (1)*

No.	Name	Function
❾	[SERVO] key	The servos are started by simultaneously pressing the SERVO key and the enable switch. A green LED lights up when the servos are switched on.
❿	[RESET] key	If an error occurs, this is reset by pressing the RESET key.
⓫	[CAUTION] key	A limit switch can be ignored in JOG mode by pressing this key. Additionally, this key can also be used to trigger the brake.
⓬	[HOME] key	Is not used here.
⓭	[OVRD] key	Use arrow keys and ↓ to increase or lower the JOG speed and the speed in automatic mode.
⓮	[HAND] key	This key calls up the "HAND" screen menu.
⓯	[JOG] key	This key calls up the "JOG" screen menu.
⓰	[+/–] key	The movements of the entry fields accord to the options in the respective screen menu using these keys.
⓱	[EXE] key	Entries are executed by the robot using this key, e.g. when aligning the hand gripper.
⓲	[MENU] key	This key calls up the start menu
⓳	[RETURN] key	Jump back to the previous menu using this key.
⓴	[]-, [↓]-, [←]-, [→] key	Move the cursor through the screen menus and entry fields using these arrow keys.
㉑	[OK] key	Accept the settings in the current menu or entry field using this key.
㉒	[CANCEL] key	Reject the settings in the current menu or entry field using this key.
㉓	Multi-grip hand gripper	The multi-grip hand gripper provides for a sure and comfortable grip of the operator device and is suitable both for right- and left-handed operation.
㉔	Enable switch	The three-step enable switch ensures that the user is not exposed to any dangers during operation. All entries at the operation terminal are only accepted and executed when then enable switch is held in the middle position. You can feel a slight pressure point at the beginning After overcoming this pressure point, the pushbutton can easily be held in the enable position without having to use force. The third level ("step") of the enable switch, also referred to as the panic position, in turn guarantees that the enable function is always cancelled in case of an emergency.

Tab. 2-10: *Overview of controls on Teaching Boxes R46TB and R56TB (2)*

3 Installation

This chapter describes all preparations required for a successful use of the robot system, from unpacking right up to installation.

3.1 Unpacking the robot system

ATTENTION:

- ***Always unpack the robot only on a stable and even surface. If you do not hen the robot may fall and be damaged.***

3.1.1 Unpack the articulated arm robot

RV-3SD/SDJ, RV-6SD/6SDL, RV-3SQ/3SQJ and RV-6SQ/6SQL

The robot arm is packaged in a box. The following figure shows you step-by-step how to unpack the robot arm.

① Use a knife or similar object to open the packaging tape, as shown in ❶.

② Using both hands, remove the upper part of the packaging as shown in ❷ .

③ Remove the four screws with which the base is screwed onto the lower section.

④ Transport the robot arm to the place of installation, as described in Section 3.2.

NOTE Keep the packaging and transport locks for later transport.

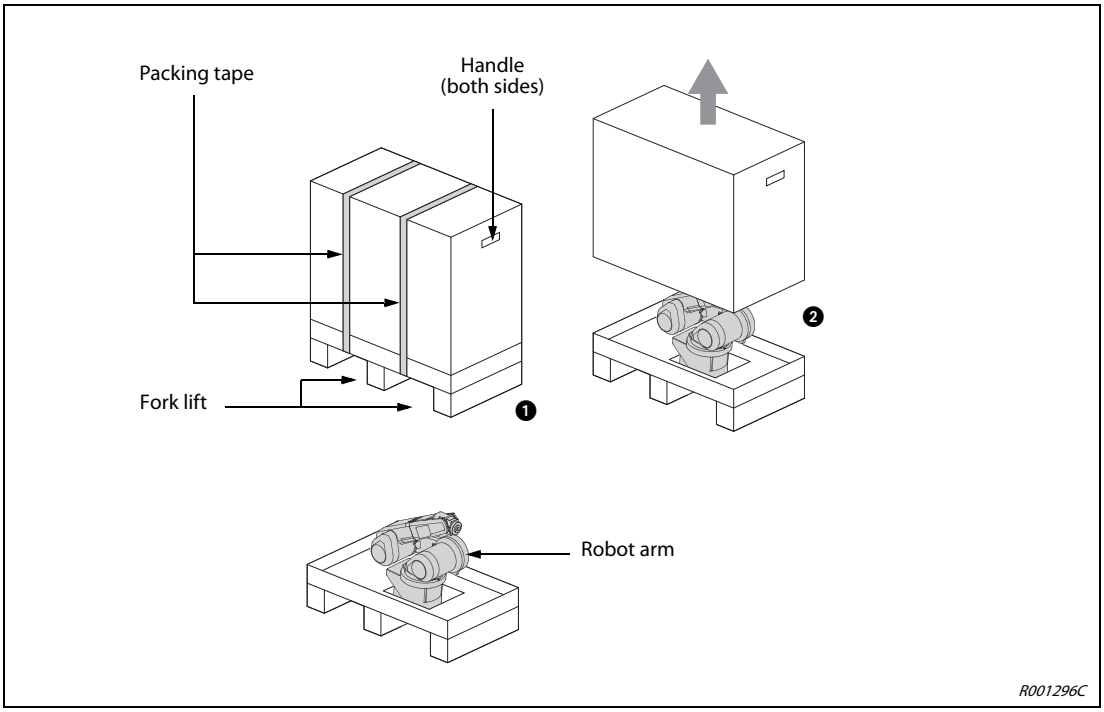


Fig. 3-1: *Unpack articulated arm robot RV-3SD/SDJ, RV-6SD/6SDL, RV-3SQ/3SQJ and RV-6SQ/6SQL*

RV-12SD/SDL and RV-12SQ/12SQL

The robot arm is packaged in a wooden frame. The following figure shows you step-by-step how to unpack the robot arm.

① Place the wooden frame on an even surface.

② To open, remove the nails from the wooden frame.

③ Remove the wooden frame and the packaging material.

④ Remove the four fixing screws with which the base is screwed onto the wooden frame.

⑤ Transport the robot arm to the place of installation, as described in Section 3.2.

NOTE Keep the packaging and transport locks for later transport.

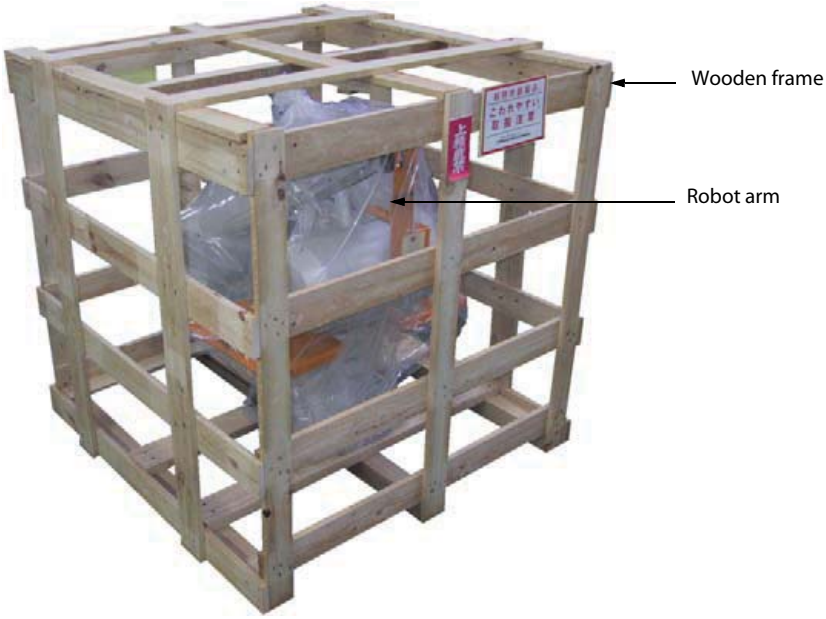


Fig. 3-2: *Unpack articulated arm robot RV-12SD/SDL and RV-12SQ/12SQL*

3.1.2 Unpack SCARA robot

The robot arm us fixed to a wooden frame and packaged in a box. The following figure shows you step-by-step how to unpack the robot arm.

① Place the box on an even surface.

② Use a knife or similar object to open the packaging tape, as shown in ❶.

③ Remove Part A of the packaging as shown in ❷.

④ Remove the four fixing screws with which the base is screwed onto the wooden frame (see ❸).

⑤ Transport the robot arm to the place of installation, as described in Section 3.2.

NOTE Keep the packaging and transport locks for later transport.

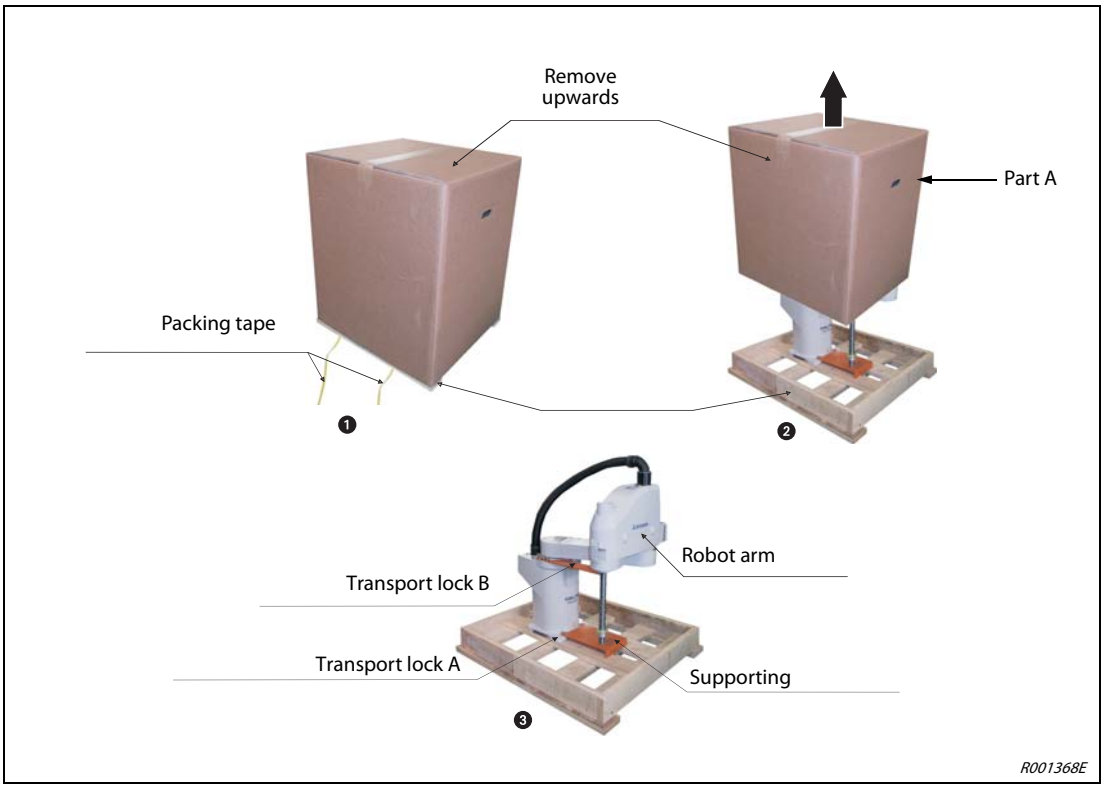


Fig. 3-3: *Unpack the SCARA robot*

3.2 Transport robot arm

3.2.1 RV-3SD/3SDJ and RV-3SQ/3SQJ

ATTENTION:

- ***Two persons are always required to transport the robot arm. The transport locks must not be removed before transport.***
- ***Always carry the robot arm at holding points ❶ and ❷. Never carry the robot arm at the covers because this may result in damages.***

NOTE

Keep the transport locks and their fixing screws in a safe place for any later transport.

① Two persons are always required for transport. When transporting, always carry the robot arm at points ❶ of the base and ❷ of the upper arm. Never carry the robot at the sides or at its covers because these may become loose and can destroy the robot arm.

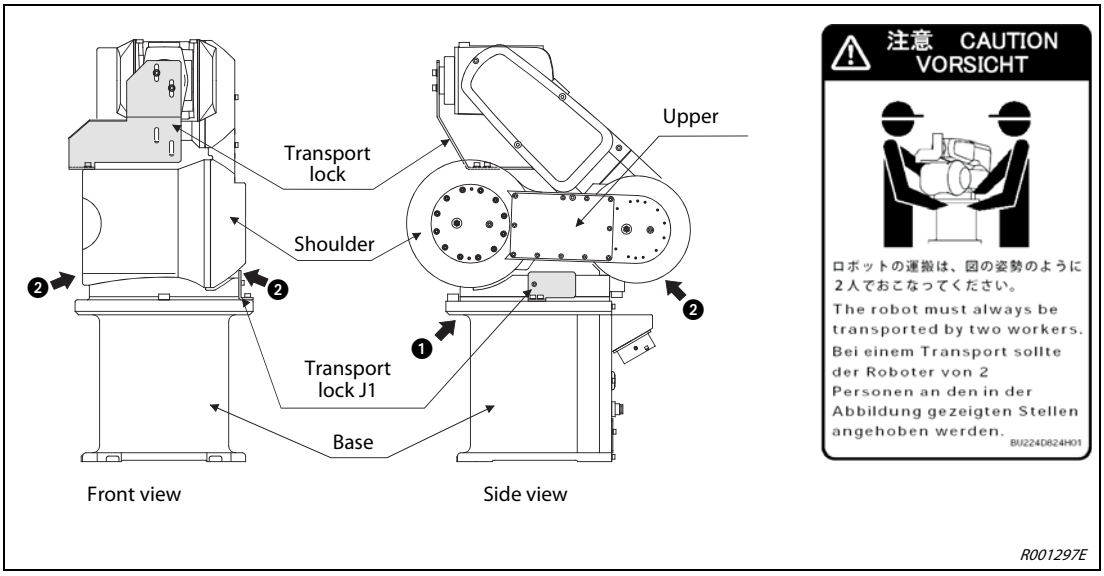


Fig. 3-4: *Transport 5-axle robot arm RV-3SDJ or RV-3SQJ*

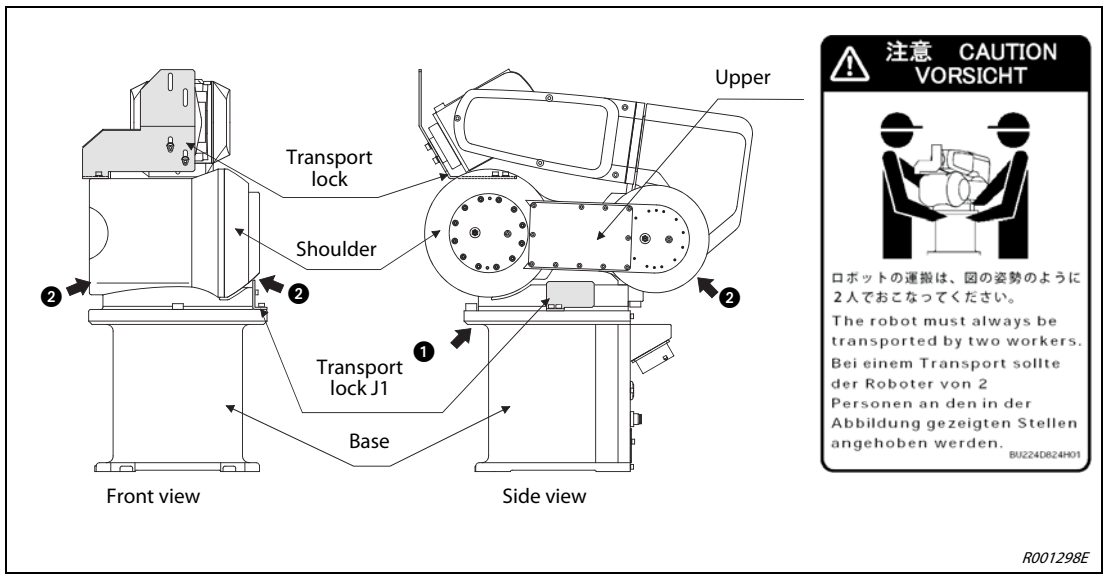


Fig. 3-5: *Transport 6-axle robot arm RV-3SD or RV-3SQ*

② Never carry the robot arm at its side or at the axles without holding points because this could result in damages.

③ Use a dolly if transporting longer distances. Only carry at the holding points for short periods of time.

④ Avoid knocks (impact loads) when transporting the robot arm.

ATTENTION:

Only remove the transport locks after installing the robot arm.

3.2.2 RV-6SD/6SDL, RV-6SQ/6SQL, RV-12SD/12SDL and RV-12SQ/12SQL

ATTENTION:

- ***Always use a crane to transport the robot arm. The transport lock must not be removed before transport.***
- ***The fixing screws of the transport lock and the transport bracket must be removed after transport.***

NOTE Keep the transport lock, the transport angle and their appropriate fixing screws in a safe place for any later transport.

ATTENTION:

To avoid faults, the wire rope of the crane must be attached as shown in Fig. 3-6.

① Fix the transport bracket in the shoulder area of the robot. Use the supplied Allen head screws for this. Use the two boreholes with the smallest distance to the front side of the robot arm for fixing.

NOTE The transport brackets are already mounted at the factory. Step ① is therefore redundant if the robot arm is being transported for the first time.

② Fix the crane hook onto the eyes of the transport bracket. You can now transport the robot.

③ Remove the attached transport angel after transport.

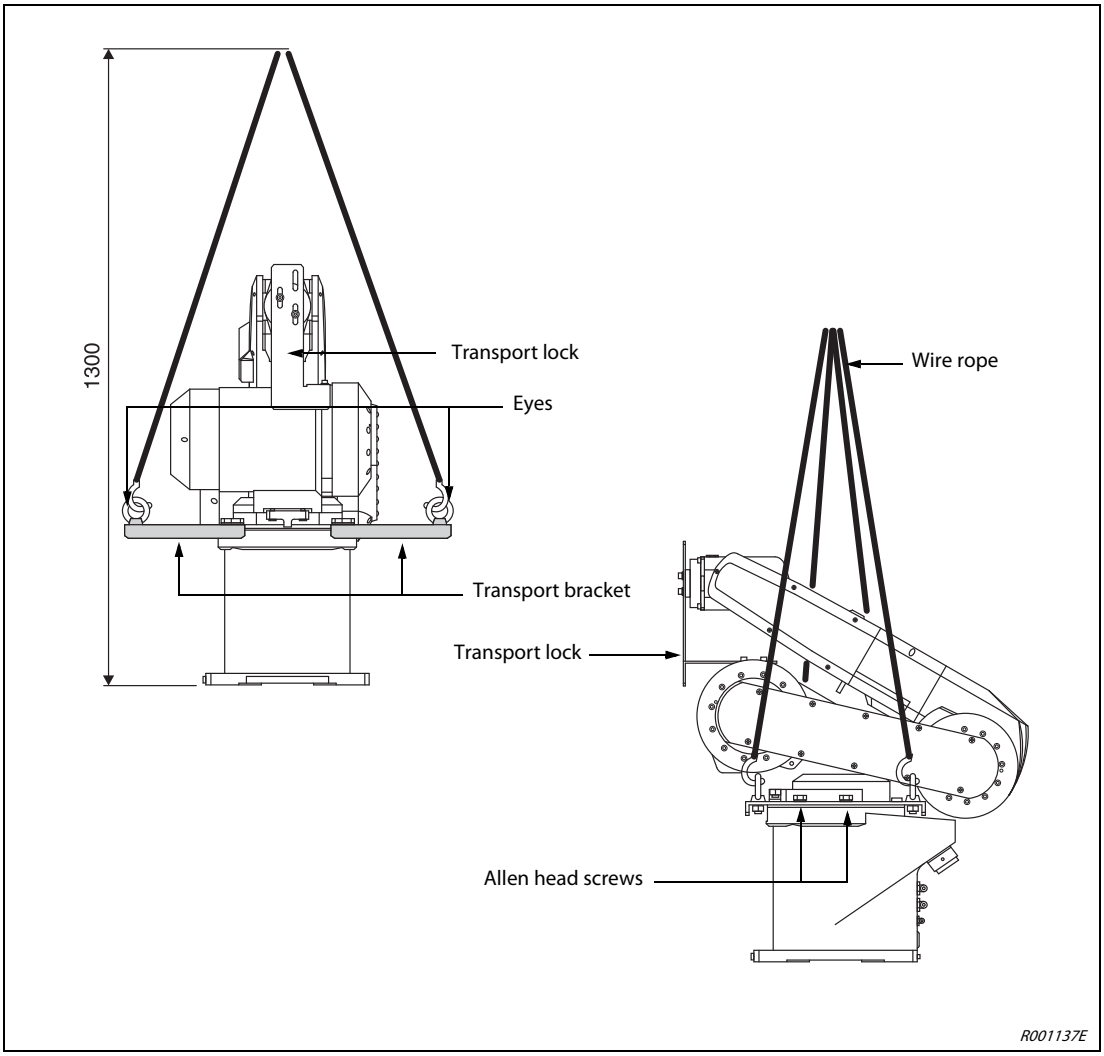


Fig. 3-6: *Fix the transport bracket*

3.2.3 RH-6SDH/6SQH

ATTENTION:

- ***The transport locks must not be removed before transport.***
- ***Two persons are always required to carry the robot arm.***
- ***Always carry the robot arm at holding points ❶ and ❷. Never carry the robot arm at the covers because this may result in damages.***

① Two persons are always required for transport. When doing so, always carry the robot arm at points ❶ in the base area and ❷ on arm 2, as well as at transport lock A (see Fig. 3-7). Never carry the robot at the sides or at its covers because these may become loose and can destroy the robot arm.

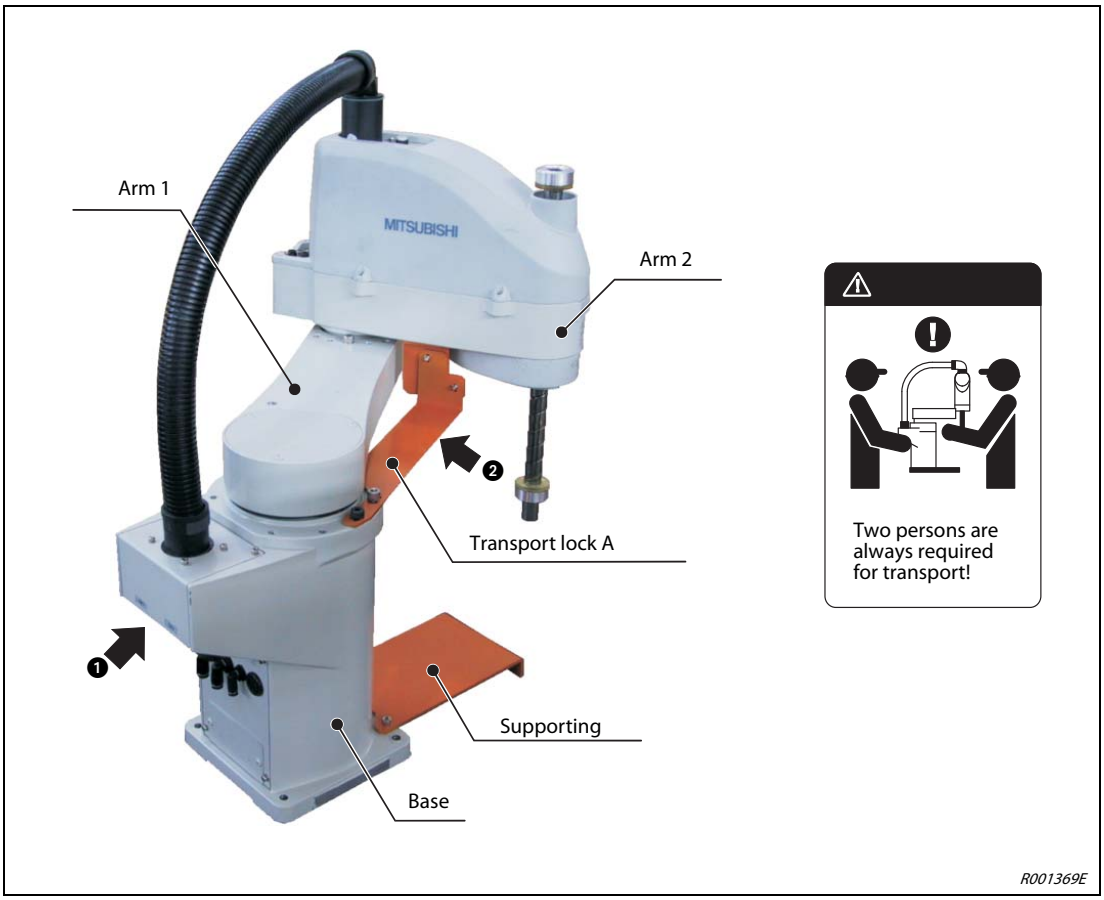


Fig. 3-7: *Holding points on robot arm*

② Never carry the robot at its side or at the axles without holding points because this could result in damages.

③ Use a dolly if transporting longer distances. Only carry at the holding points for short periods of time.

④ Do not strain any covers.

⑤ Avoid knocks (impact loads) when transporting the robot arm.

⑥ Only remove the transport locks after installing the robot arm.

3.2.4 RH-12SDH/18SDH and RH-12SQH/18SQH

ATTENTION:

- ***To avoid faults, the wire rope of the crane must be attached as shown in Fig. 3-8.***
- ***Always use four supporting ropes to transport the robot with a crane.***

NOTE

Keep the transport and support brackets as well as the transport locks and their fixing screws in a safe place for any later transport.

① Fix the crane hook onto the four eyes of the transport suspension. Make sure that the hooks are seated firmly in the eyes.

② You can now transport the robot. During transport, the wire ropes and the robot arm or the arm covers must not touch each other. Protect endangered areas using cloths or similar material.

③ Only release the wire rope after installing the robot and remove the attached transport locks, suspensions and brackets.

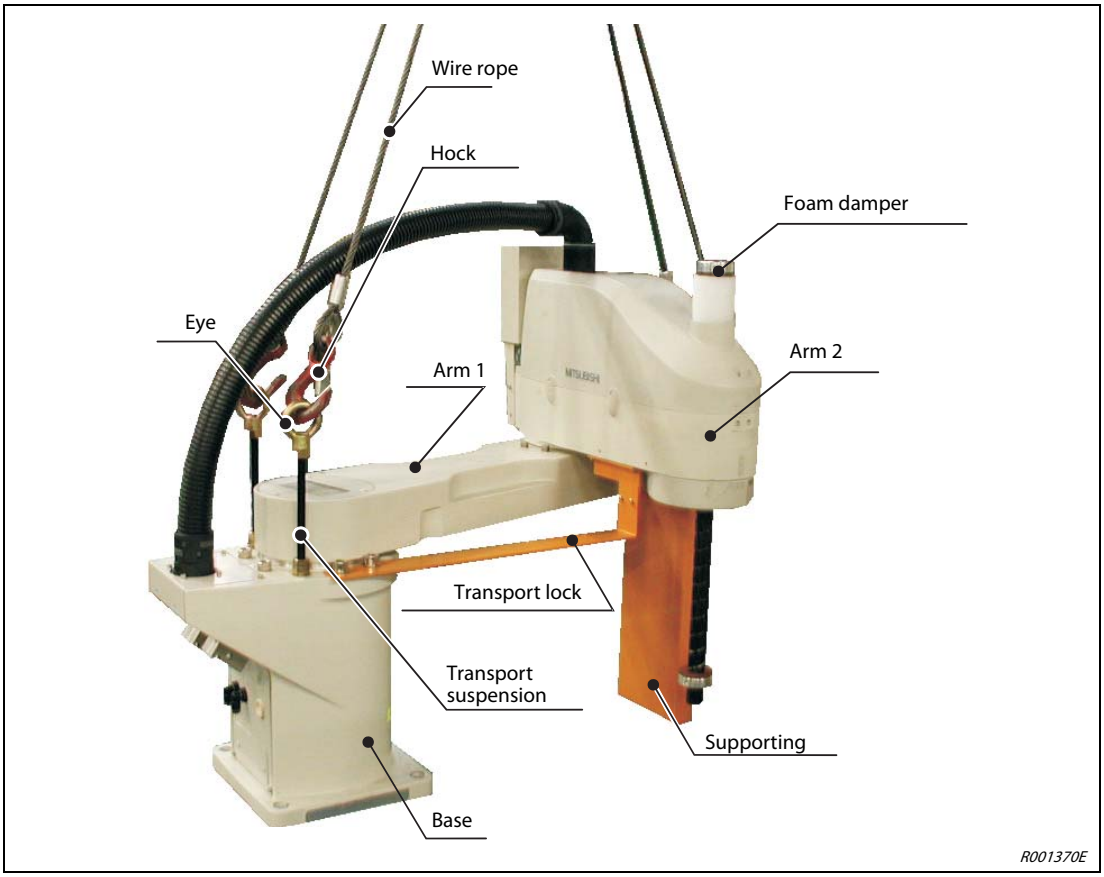


Fig. 3-8: *Fix the transport suspensions*

ATTENTION:

Also observe the above-mentioned steps when transporting the robot at a later time – e.g. when changing the installation location. If the robot is transported without the attached transport locks and supporting brackets, or if it is transported in operating position, then dangerous situations might arise due to a shifting of the centre of gravity during transport.

3.3 Set up the robot arm

3.3.1 Set up the articulated arm robot

The table below shows how to set up and fix the articulated arm robot.

① The base area of the robot arm has been leveled by machine.
If the bas area is too uneven then this may result in robot arm malfunctions.
Fix the robot arm above the assembly boreholes on the four outer edges of the base area using the supplies Allen head screws.

② Align the robot arm horizontally.

③ The average surface finish of the assembly surface should be Ra = 6.3 µm. If the surface is too rough then this may result in deviations in the position of the robot arm.

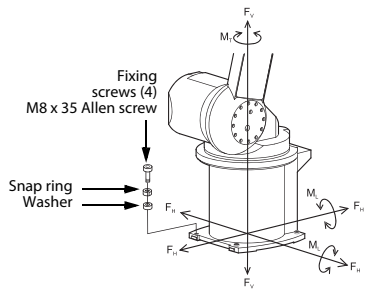
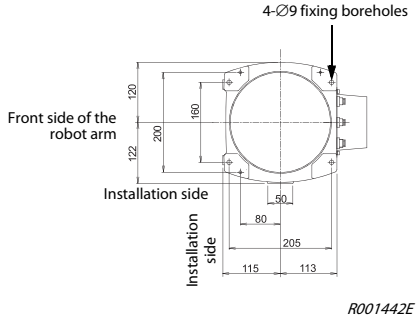
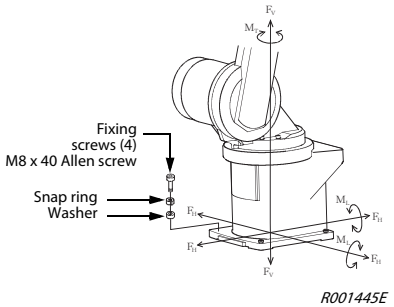
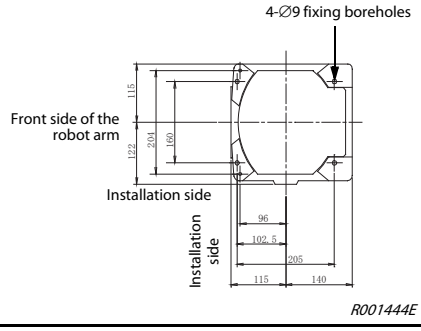
④ To avoid position deviations, the peripheral equipment that the robot accesses as well as the robot arm itself should be installed on a common assembly platform/area.

⑤ The base area must be designed so that no distortion can occur, even from the loads and vibrations emanating from the robot itself.

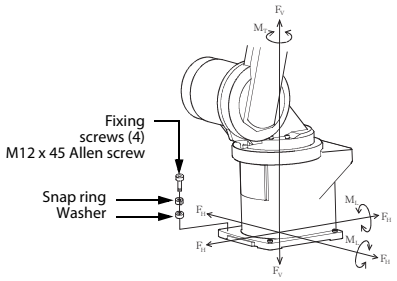
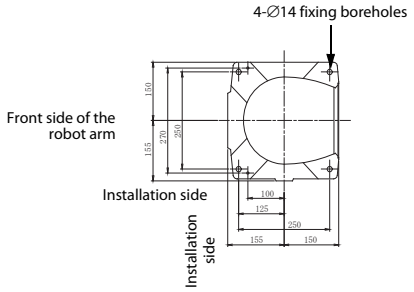
⑥ Only remove the transport locks after setting up the robot arm.

⑦ If the robot is mounted on the ceiling then the MEGDIR parameter must be changed. Additional information on this parameter is contained in the operation and programming instructions of the control units.

⑧ High loads and strains occur on the base area when operating the robot at high speeds. Make sure that the base area is suitable for the high forces and moments, as listed in Tab. 3-2.

Robot arm	Fixture	View from below
RV-3SD/3SDJ, RV-3SQ/3SQJ		
RV-6SD/6SDL, RV-6SQ/6SQL		

Tab. 3-1: *Set up the robot arm (1)*

Robot arm	Fixture	View from below
RV-12SD/12SDL, RV-12SQ/12SQL	 R001445E	 R001446E

Tab. 3-1: *Set up the robot arm (2)*

Load	RV-3SD/3SDJ, RV-3SQ/3SQJ	RV-6SD/6SDL, RV-6SQ/6SQL	RV-12SD/12SDL, RV-12SQ/12SQL
Moment of tilt M_L [Nm]	410	892	1530
Torsional moment M_T [Nm]	400	892	1530
Translational forces on horizontal plane F_H [N]	1000	800	1300
Translational forces on vertical plane F_V [N]	1200	1400	2300

Tab. 3-2: *Reaction forces on the base area of the robot*

ATTENTION:

When installing the robot, make sure that there is enough space remaining at the rear of the robot arm to connect the cable used and to replace the backup battery.

3.3.2 Set up the SCARA robot

The table below shows how to set up and fix the SCARA robot.

① The base area of the robot arm has been leveled by machine.
If the bas area is too uneven then this may result in robot arm malfunctions.
Fix the robot arm above the assembly boreholes on the four outer edges of the base area using the supplies Allen head screws.

② Align the robot arm horizontally.

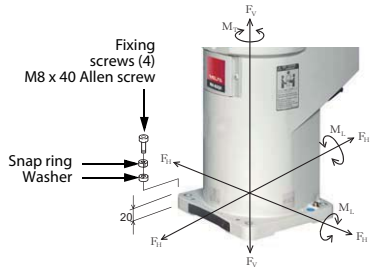
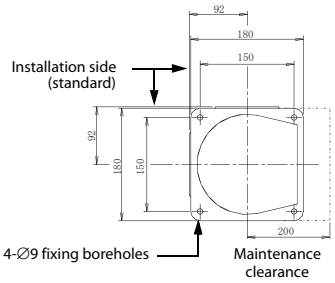
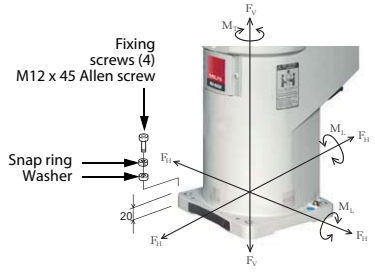
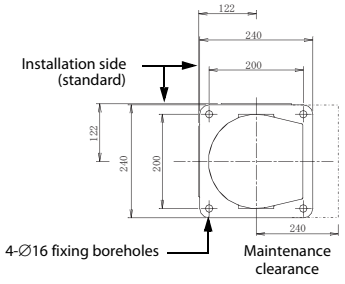
③ The average surface finish of the assembly surface should be Ra = 6.3 µm. If the surface is too rough then this may result in deviations in the position of the robot arm.

④ To avoid position deviations, the peripheral equipment that the robot accesses as well as the robot arm itself should be installed on a common assembly platform/area.

⑤ The base area must be designed so that no distortion can occur, even from the loads and vibrations emanating from the robot itself.

⑥ Only remove the transport locks, suspensions and supporting brackets after setting up the robot arm.

⑦ High loads and strains occur on the base area when operating the robot at high speeds. Make sure that the base area is suitable for the high forces and moments, as listed in Tab. 3-4.

Robot arm	Fixture	View from below
RH-6SDH, RH-6SQH		
RH-12SDH/18SDH, RH-12SQH/18SQH		

Tab. 3-3: *Set up the robot arm*

Load	RH-6SDH, RH-6SQH	RH-12SDH/18SDH, RH-12SQH/18SQH
Moment of tilt M_L [Nm]	380	1310
Torsional moment M_T [Nm]	410	1440
Translational forces on horizontal plane F_H [N]	920	1900
Translational forces on vertical plane F_V [N]	570	1280

Tab. 3-4: *Reaction forces on the base area of the robot*

ATTENTION:

When installing the robot, make sure that there is enough space remaining at the rear of the robot arm to connect the cable used and to replace the backup battery.

3.4 Handling the control unit

This section describes the handling and set up of the control unit.

3.4.1 Transport control unit CR2D and drive unit DU2

ATTENTION:

Two persons are always required to carry the control unit or the drive unit. To lift, take hold of the front side and the rear side. Never carry the control unit or the drive unit at their switches or plug connections.

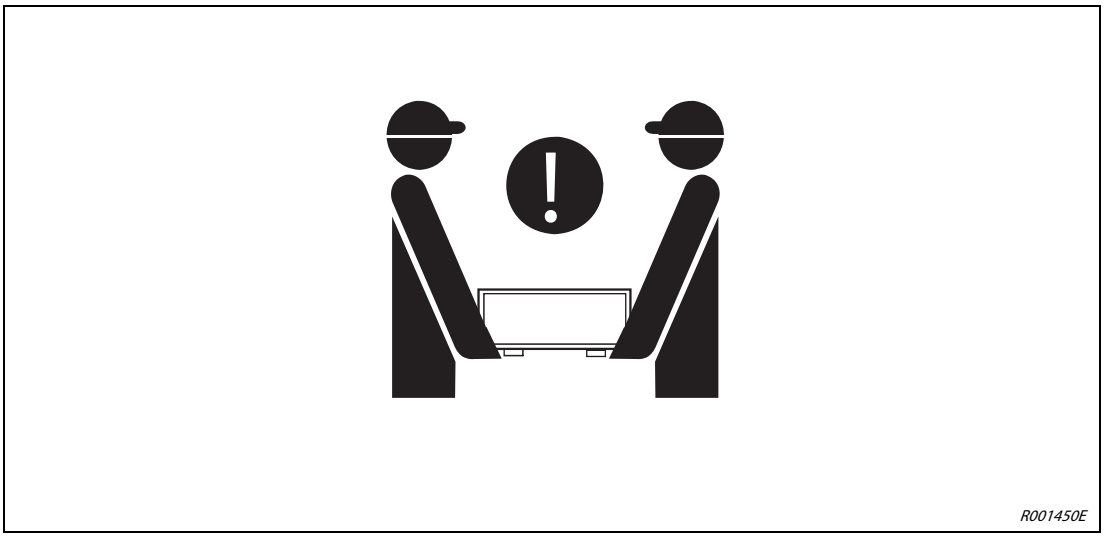


Fig. 3-9: *Transport control units CR2D and drive units DU2*

3.4.2 Transport control units CR3D and drive units DU3

ATTENTION:

Either use a dolly or a crane to transport the control unit or the drive unit. Two persons are always required to transport the control unit or the drive unit.

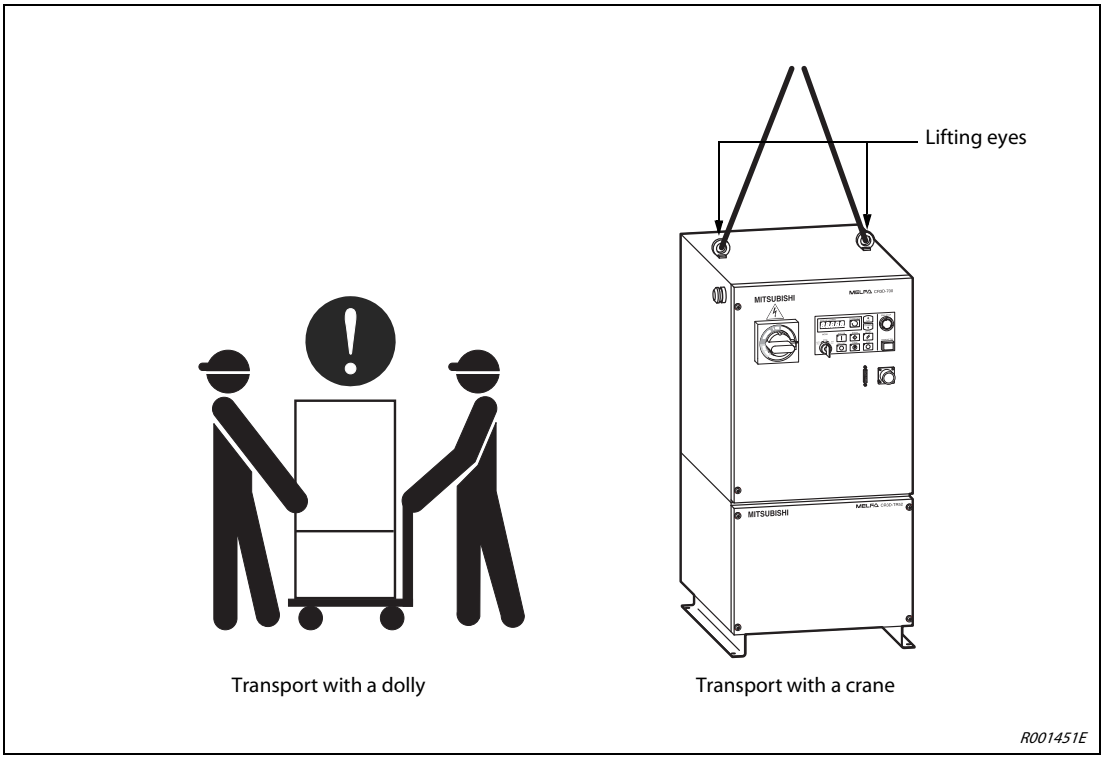


Fig. 3-10: *Transport control units CR3D and drive units DU3*

To transport using a crane, fix the hook of the crane into the eyes of the control unit or the drive unit. You can now transport the control unit or the drive unit.

3.4.3 Set up control unit CR2D and drive unit DU2

Set up of control unit CR2 and drive unit DU2 is shown in the following figure. Observe the following points:

- The control unit and the drive unit can be installed both horizontally and vertically. Only horizontal installation is described in this manual. You can obtain the required information for vertical installation of the control unit or the drive unit from you MITSUBISHI sales agent.
- Do not block the ventilation openings on the base of the control unit or the drive unit. Make sure that there is a clearance of at least 7 mm under the unit. To do this, place the unit on it plastic feet or use the spacers if you screw the unit into place
- Make sure that there is a lateral clearance of at least 145 mm and a clearance to the rear of at least 250 mm.
- Take measures to avoid excessive ambient temperatures (max. 40 °C) if the control unit or the drive unit is installed in a control cabinet.

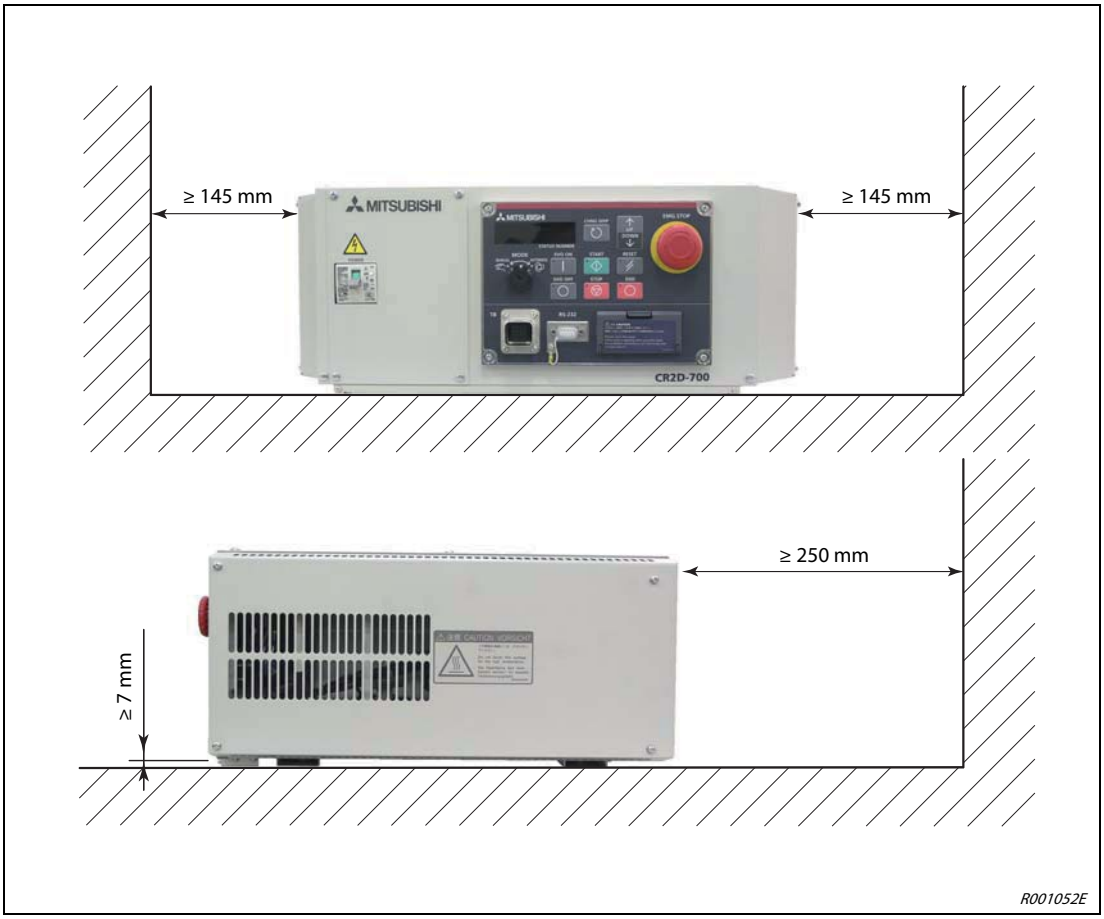


Fig. 3-11: *Set up control unit CR2 and drive unit DU2*

3.4.4 Set up control unit CR3D and drive unit DU3

Set up of control unit CR3D and drive unit DU3 is shown in the following figure. Please thereby observe the following points:

- Place the control unit or the drive unit on the foot rails.
- Do not block the ventilation openings on the rear and on the side walls of the control unit or drive unit.
- Make sure that there is a clearance of at least 200 mm on the left side, a clearance of at least 300 mm on the right side and a clearance of at least 500 mm on the front and rear side.
- If required, take measures to prevent excessive ambient temperatures (max. 40 °C).

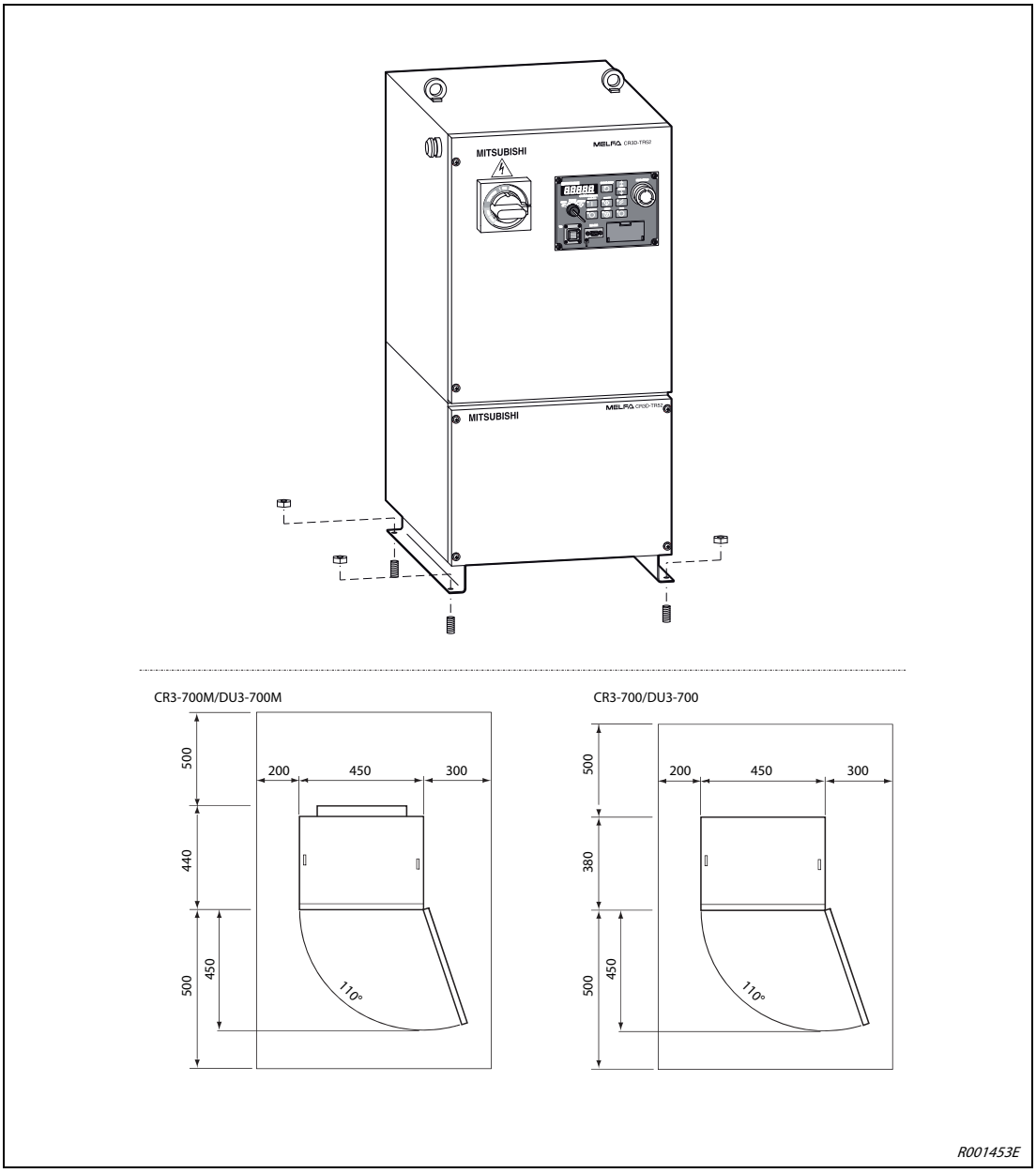


Fig. 3-12: *Set up control unit CR3D and drive unit DU3*

3.5 Installation of robot CPU Q172DRCPU

Notes on installation

- Always install the rack horizontally because only this ensures that there is enough ventilation.

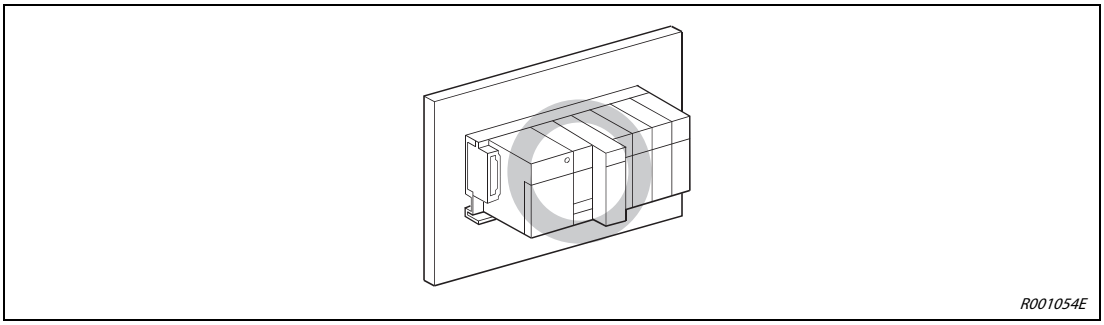


Fig. 3-13: *Correct assembly of the rack*

- The units must not be assembled lying flat or vertically, because this would prevent sufficient ventilation.

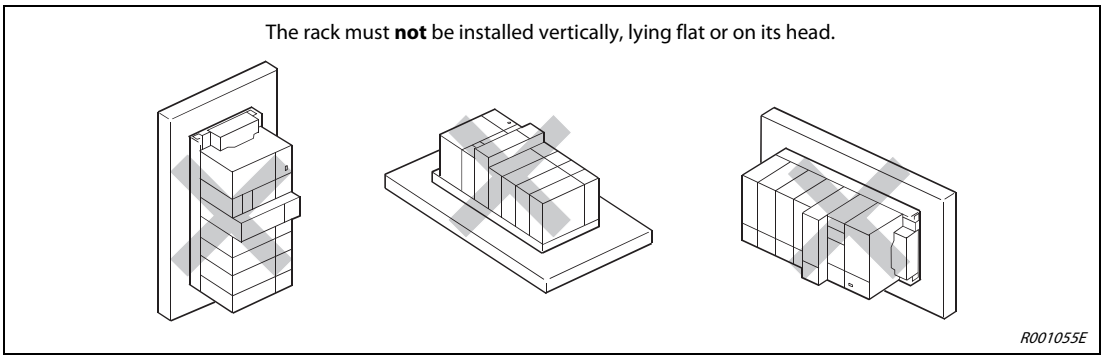


Fig. 3-14: *Incorrect assembly of the rack*

- The racks should be installed on an even surface to prevent deformation.
- The robot CPU must be installed far removed from electromagnetic switching devices which may cause vibrations and disturbances.
- If there is a device in the control cabinet that generates severe disturbances and heat, and this device is installed in front of the robot CPU, then a distance of at least 100 mm must be maintained between this device and the CPU. The device could be installed, e.g. on the inside of the control cabinet. If the robot CPU and such a device are assembled next to each other then they must have a minimum clearance of 50 mm.

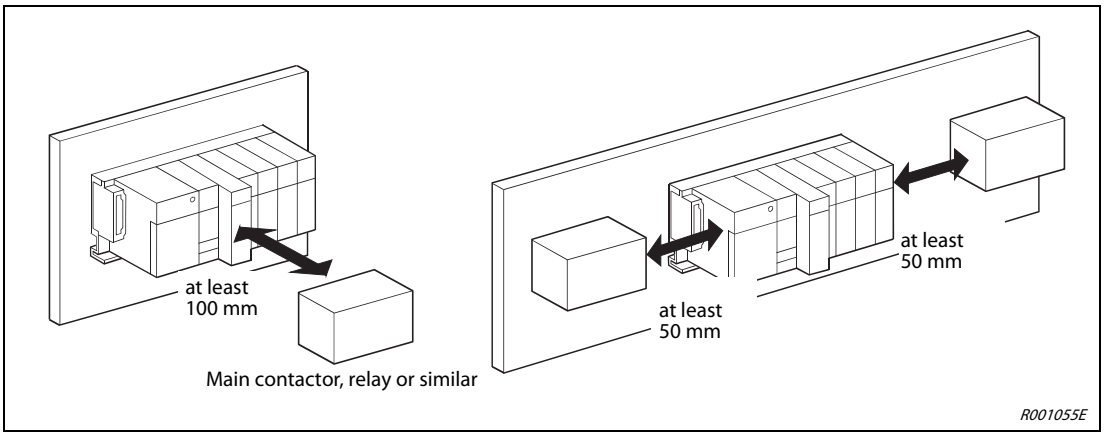


Fig. 3-15: *Arrangement of modules in the control cabinet*

3.5.1 Installation and removal of modules

This section shows you how to assemble modules onto the rack such as, e.g. power supply unit, a PLC or a robot CPU.

ATTENTION:

- ***The mains voltage must always be switched off before installing a module.***
- ***If the module is not placed correctly over the catch on the rack then the PINs on the module plug might become bent.***

Installation

- Switch off the mains voltage!
- Place the module with the lower catch into the guide on the rack.
- Then press the module onto the rack until it is lying fully onto the rack.
- Additionally secure the module with a screw (M3 x 12) if vibrations are to be expected. This screw is not supplied with the module. The robot CPU must always be secured with a fixing screw.

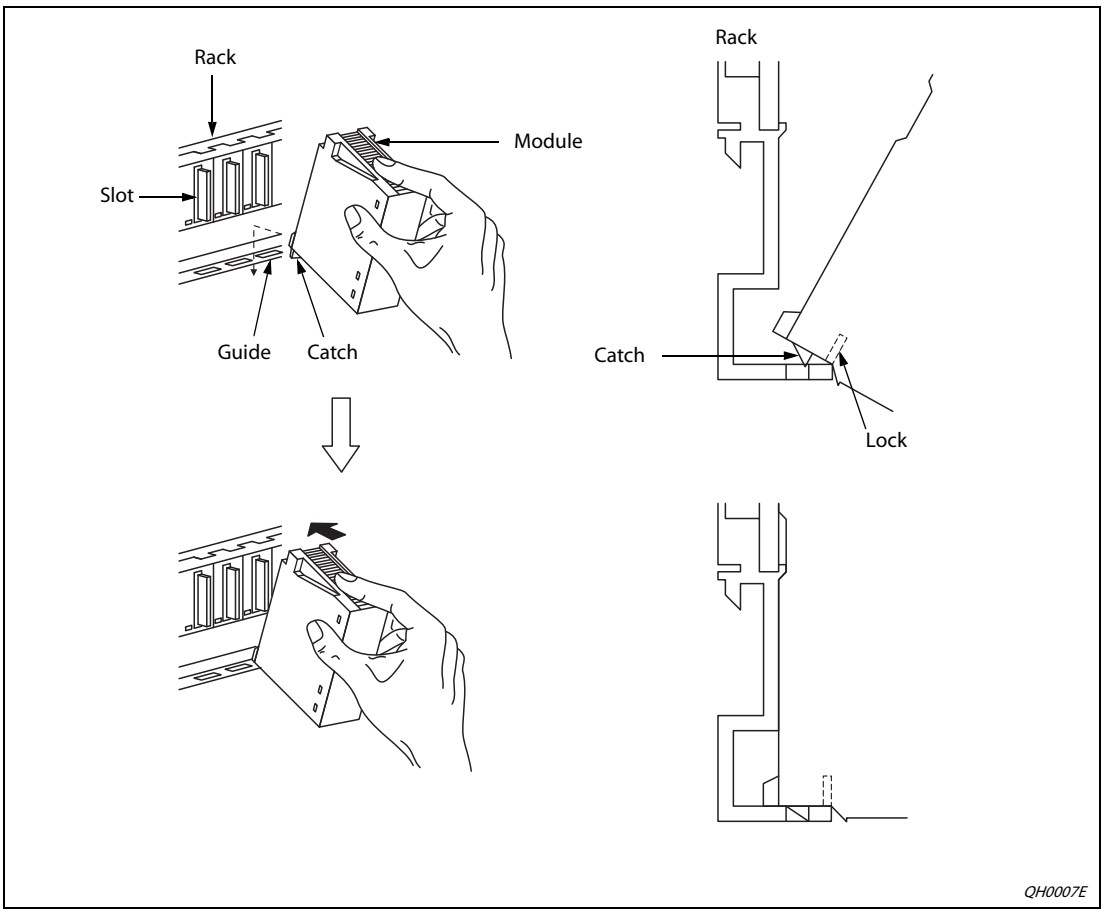
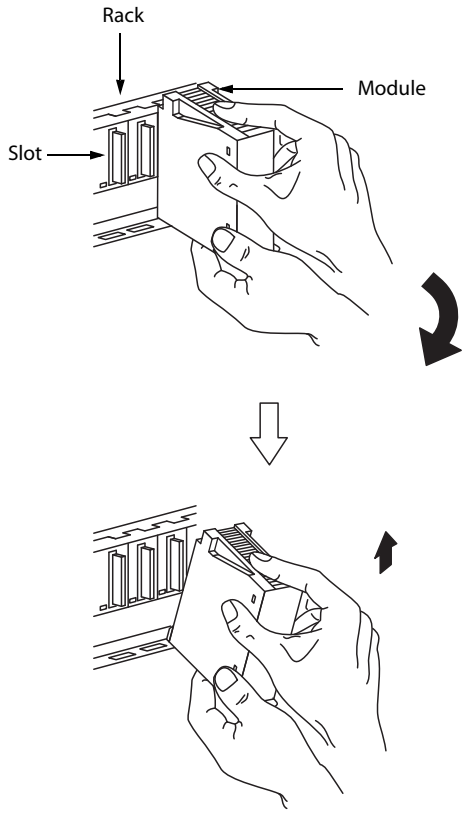


Fig. 3-16: *Installation of the module*

Removal

ATTENTION:

- ***The mains voltage must always be switched off before removing a module.***
- ***When removing a module, make sure that any fixing screw is release and that the catch on the module is not longer inserted into the guide. Otherwise, the mounting devices on the module may be damaged.***



To remove the module, hold it in both hands and press the upper catch downwards.

With the catch pressed, tilt the module downwards slightly. The lower catch acts as a pivot point.

Now lift the lower catch from the guide and remove the module.

QH0008E

Fig. 3-17: *Removal of the module*

ATTENTION:

- ***When removing the robot CPU, please note that the heat sink of the module may be very hot. There is a possible risk of burns.***

3.6 Grounding the robot system

General instructions on grounding the robot system

Three ways of grounding are shown in Fig. 3-18 .

- Separate grounding is the best solution.
  - The robot arm is grounded at an M4 threaded hole (see Fig. 3-19) on the base area.
  - The control unit is grounded together with the mains line (feed) connection.
    To ground the control unit, proceed as described in Section 4.2.
- If possible, the grounding of the robot arm must be separated from other units/devices.
- The minimum cross-section of the grounding cable must be 3.5 mm^2 .
- The grounding cable is not included in the scope of delivery of the robot system.
- The grounding cable should be kept as short as possible.

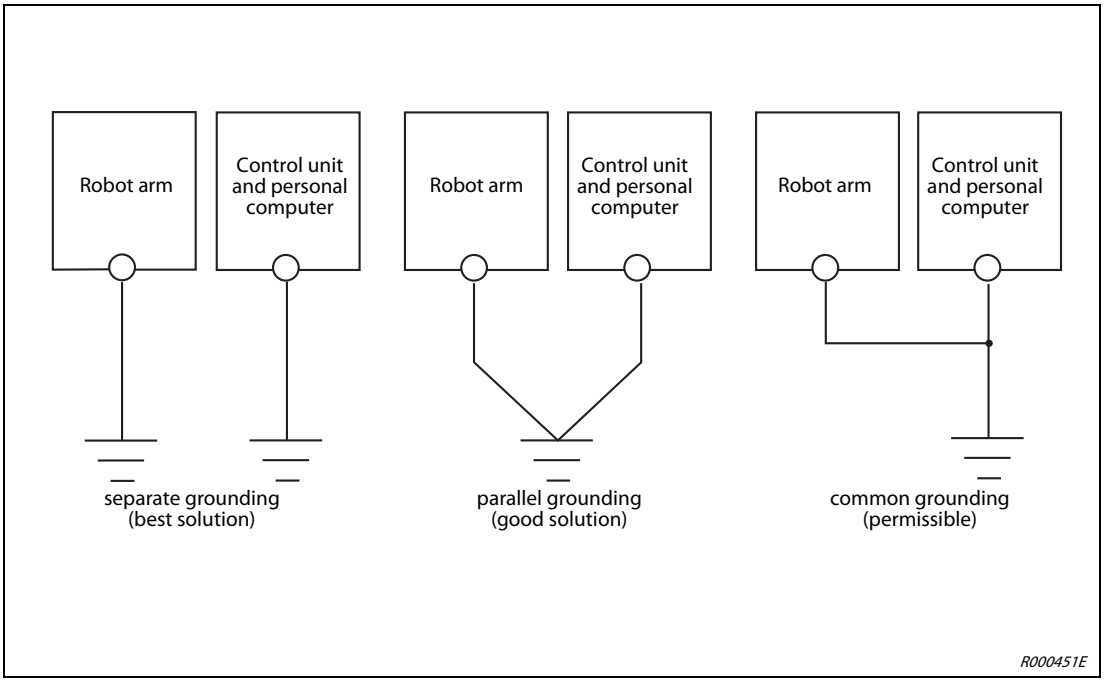


Fig. 3-18: *Grounding the robot system*

Grounding the robot arm

① Use a grounding cable with a minimum cross-section of 3.5 mm^2.

② Check the area around the grounding screw (A) for deposits and remove any using a file.

③ Fix the grounding cable with the grounding screw (M4 x 10) to the grounding connection of the robot arm (see here Fig. 3-19).

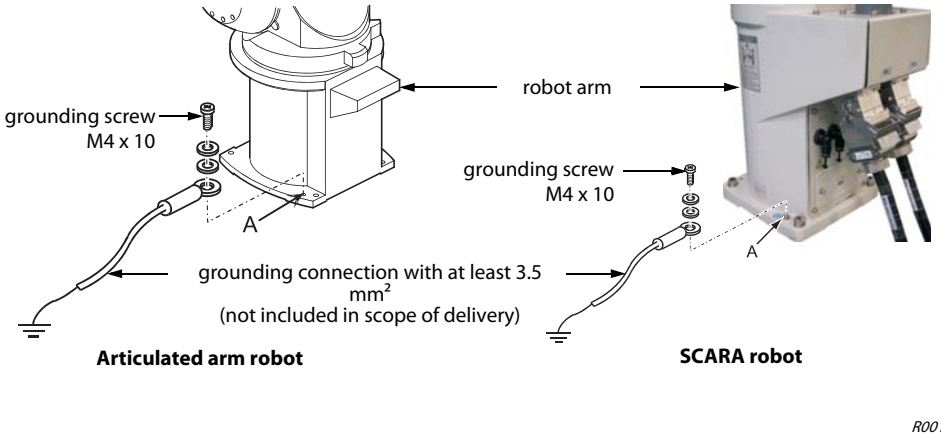


Fig. 3-19: *Grounding the robot arm*

4 Connection

This chapter explains how to connect the connection cable, the mains connection, the connection of the EMERGENCY-STOP switch and the connection of the Teaching Box.

4.1 Connection of the connection cable

4.1.1 Connect the robot arm to the control unit

The following figure shows the connection of the connection cable between the robot arm and the control unit.

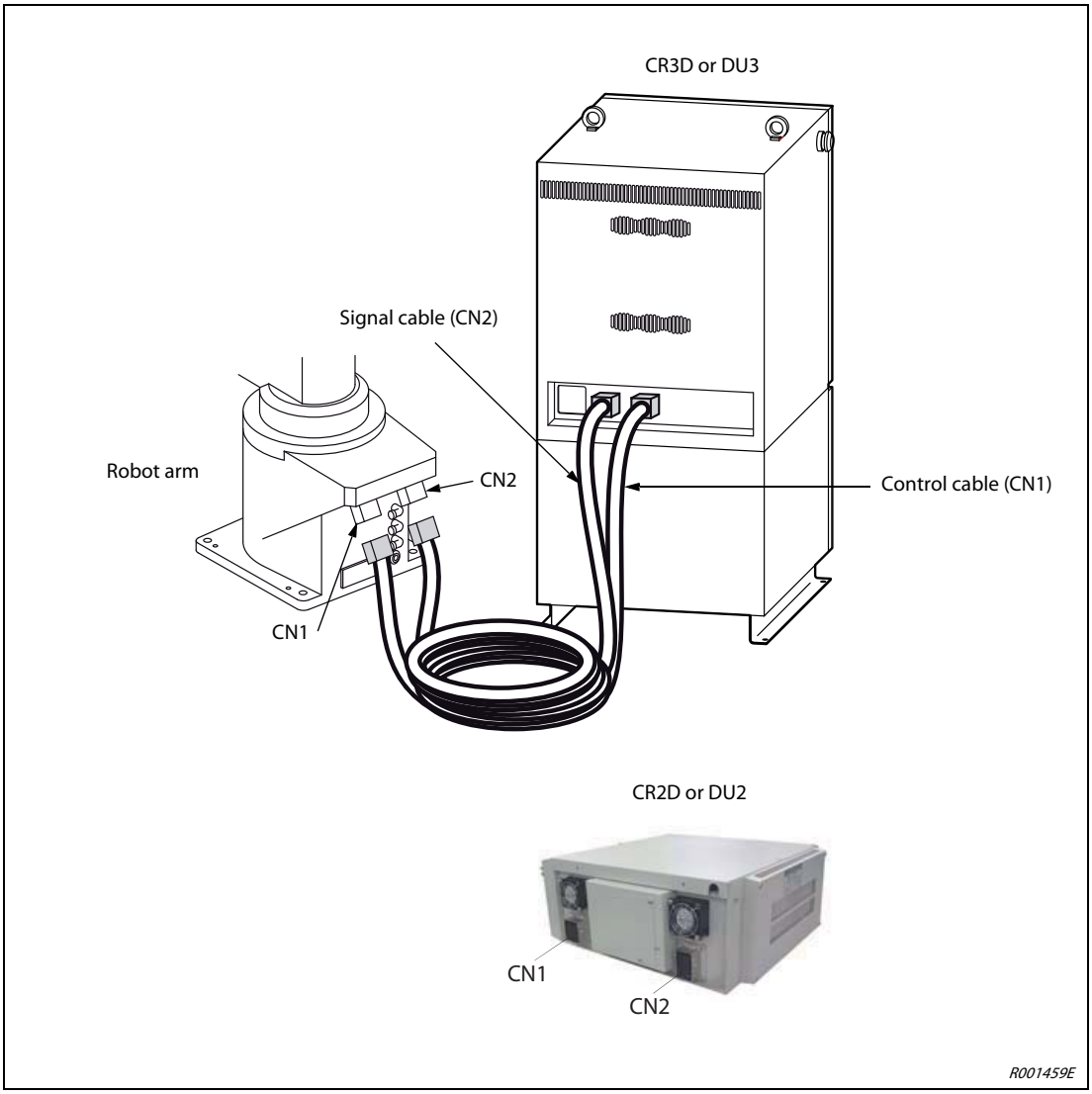


Fig. 4-1: *Connection of the connection cable*

① Make sure that the control unit or the drive unit is switched off. The [POWER] switch must be in the "OFF" position.

② Connect the power and control cable to the robot arm and the control unit or the drive unit. To do this, push the lock forwards and plug the plug into the jack. Avoid excessive pulling or bending of cable. This could damage the cable.

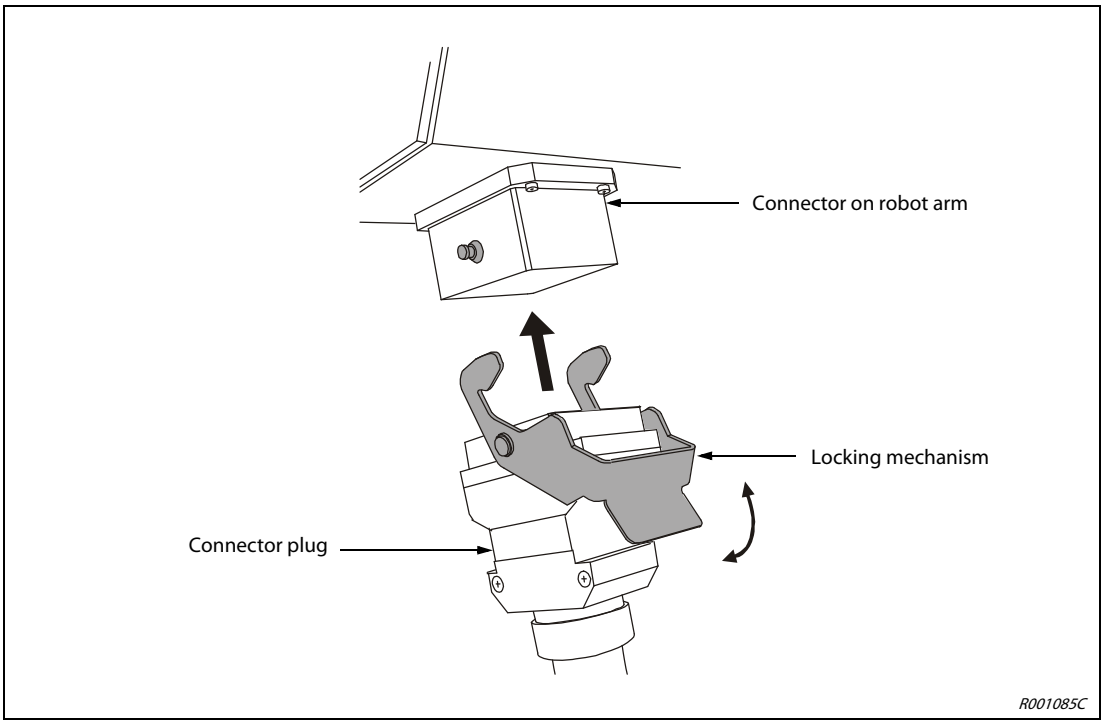


Fig. 4-2: *Detailed view of the locking mechanism*

③ Press the locking mechanism on the plug downwards. The plug can not be pulled out in this position. To release the connection, press the locking mechanism upwards. The plug can be removed in this position.

NOTE

The shape of the plugs is different for control cable and power cable. If connected incorrectly, the plug may be damaged.

ATTENTION:

The standard connection cable between the robot arm and the control unit or drive unit is only suitable for fixed laying. It must not be used within a dragchain.

4.1.2 Connection of robot CPU to the drive unit

Connection of robot CPU Q172DRCPU to drive unit DU2

ATTENTION:

- ***Always place the protective cap on the SSCNET-III connection when no cable is connected. Otherwise, soiling may lead to an impairment in the transmission and to malfunctions.***
- ***Do not remove the SSCNET-III cable as long as the power supply of the CPU system or the drive unit is switched on.***
  Never look directly into the light emitted from the robot CPU or the SSCNET-III connections of the drive unit, or into the open end of the SSCNET-III cable. The light emitted from these complies with the IEC60825-1 standard of laser class 1 and may result in an irritation to the eyes if viewed directly.

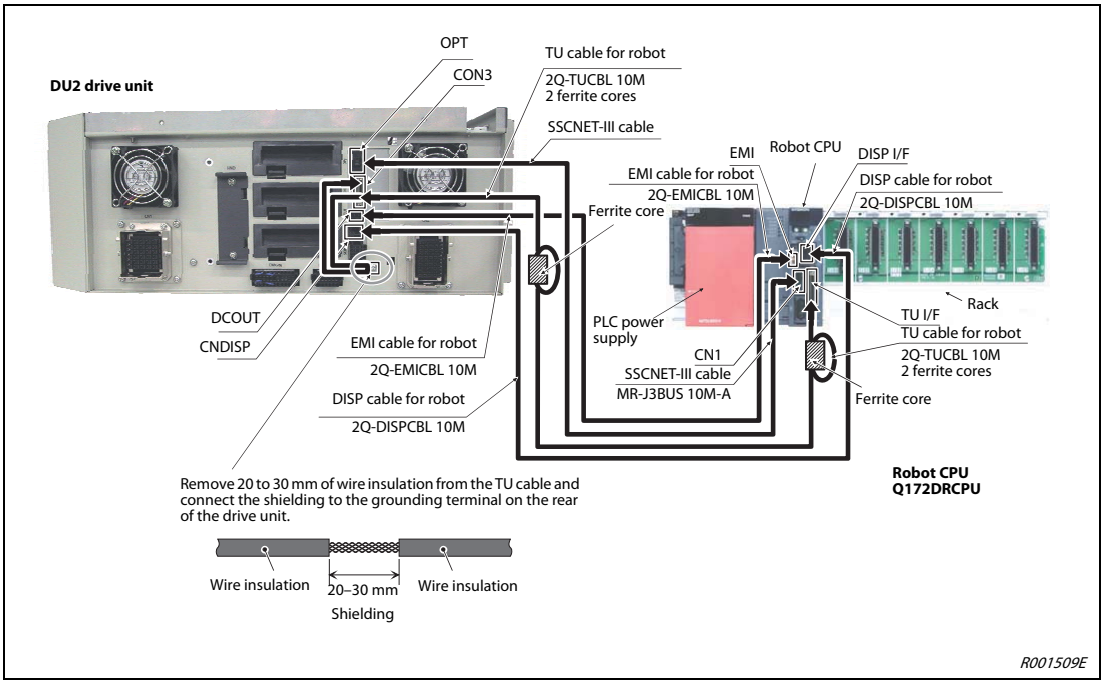


Fig. 4-3: *Connection of robot CPU to drive unit DU2*

NOTE

Connect the shielding of the TU cable to the grounding cable on the housing of the drive unit to prevent electromagnetic disturbances

Connection of robot CPU Q172DRCPU to drive unit DU3

ATTENTION:

- ***Always place the protective cap on the SSCNET-III connection when no cable is connected. Otherwise, soiling may lead to an impairment in the transmission and to malfunctions.***
- ***Do not remove the SSCNET-III cable as long as the power supply of the CPU system or the drive unit is switched on.***
  Never look directly into the light emitted from the robot CPU or the SSCNET-III connections of the drive unit, or into the open end of the SSCNET-III cable. The light emitted from these complies with the IEC60825-1 standard of laser class 1 and may result in an irritation to the eyes if viewed directly.

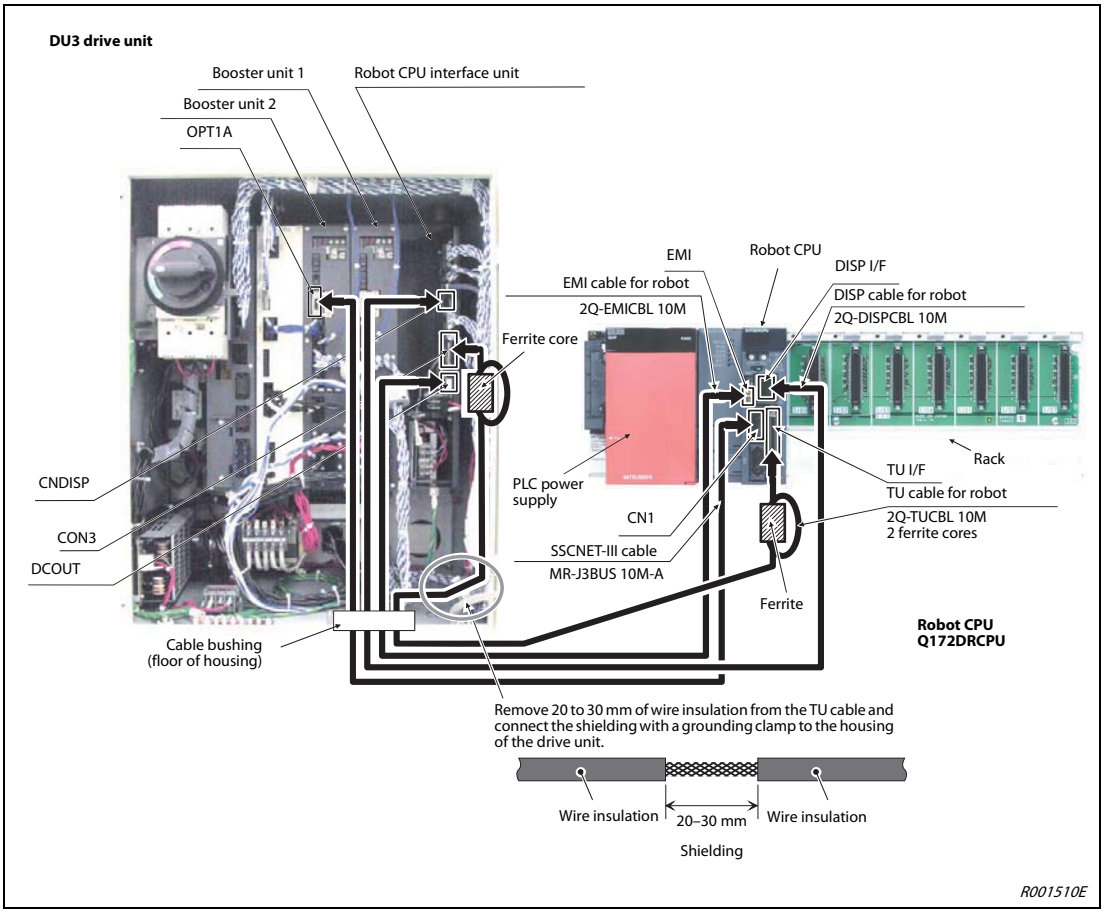


Fig. 4-4: *Connection of robot CPU to drive unit DU2*

NOTE

Connect the shielding of the TU cable with a grounding clamp to the to the housing of the drive unit to prevent electromagnetic disturbances. Connect the shielding on the side of the robot CPU with a grounding clamp to the ground potential.

4.2 Mains connection and grounding

Refer to Section 3.6on how to ground the robot arm.

ATTENTION:

Only carry out connection work at the control unit or the drive unit when the main switch for the power supply is switched off and protected against being switched back on.

4.2.1 Control unit CR2D and drive unit DU2

① Make sure that the mains voltage and the power switch of the control unit or the drive unit are switched off.

② Release the four screws ❶ on the cover ❷ and remove the cover. Release the four screws ❸ on the power switch cover ❸ and remove this cover.

③ Remove the terminal cover of the power switch ❺.

④ Prepare the mains line (feed) and the grounding cable. Use cable with a minimum cross-section of 2.5 mm^2.

⑤ Connect the mains line to the terminals of the power switch according to Fig. 4-5 . Connect the grounding cable with the grounding cable marked PE ❻ to the housing of the control unit.

⑥ Fix the terminal cover of the power switch back into place. You will hear a click when it locks in.

⑦ lay the mains line through the cable feed in the rear cover ❼.

⑧ Fix the cover and the power switch cover into place.

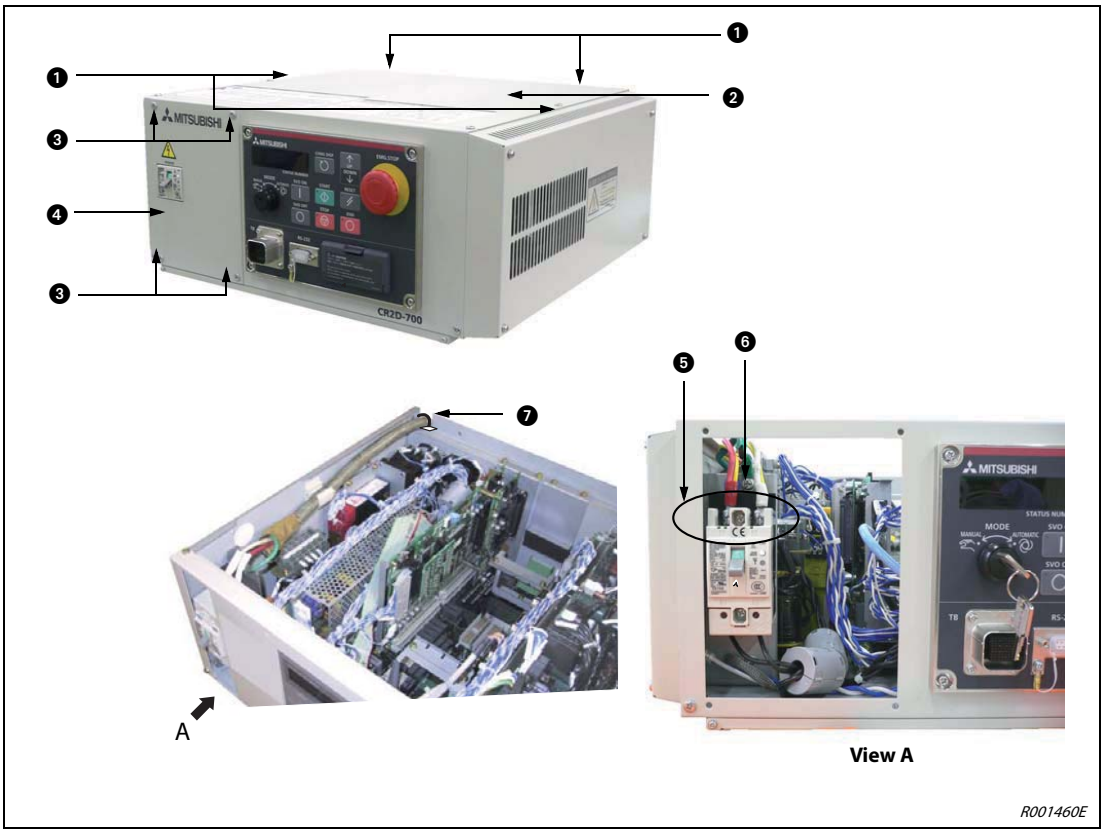


Fig. 4-5: *Connection of mains line and grounding on control unit CR2D and on drive unit DU2*

4.2.2 Control unit CR3D and drive unit DU3

① Make sure that the mains voltage and the power switch of the control unit or the drive unit are switched off.

② Release the two screws ❶ of the door ❷, rotate the [POWER] switch to the "OFF" position and open the door.

③ Remove the terminal cover ❸ of the power switch by pressing the lock upwards and then remove the cover.

④ Prepare the mains line (feed) and the grounding cable. Use cable with a minimum cross-section of 2.5 mm^2.

⑤ Release the cable connection on the side ❹ and lead the mains line and the grounding cable through the cable connection.

⑥ Connect the mains line to the terminals of the power switch according to Fig. 4-6 .

⑦ Connect the grounding cable with the ground connection ❺ (M5-screw) to the low-voltage board.

⑧ Fix the terminal cover ❸ of the power switch back into place. You will hear a click when it locks in.

⑨ Tighten the cable connection.

⑩ Close the door of the control unit ❷. You will hear a click when the door locks on. Fix the door with the screws ❶.

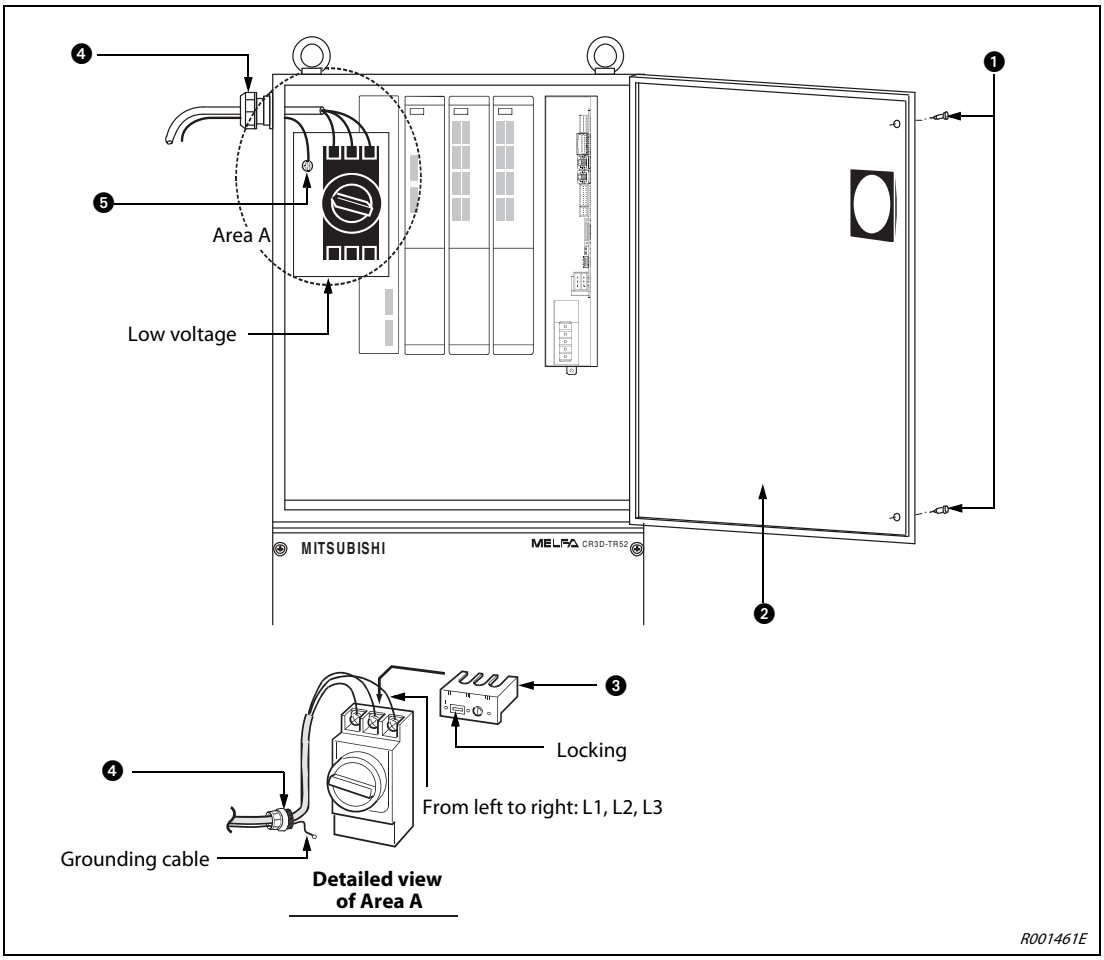


Fig. 4-6: *Connection of mains line and grounding on control unit CR3D and on drive unit DU3*

4.3 EMERGENCY-STOP connection

Connection for EMERGENCY-STOP pushbutton

- on control unit CR2D and on drive unit DU2 using the plug on the rear of the unit,
- on control unit CR3D and on drive unit DU3 using the plug on the safety module.

The EMERGENCY-STOP inputs are normally blank (see Fig. 4-8). The EMERGENCY-STOP pushbutton, the door closing contact and an activation (enabling) unit must be connected by the user.

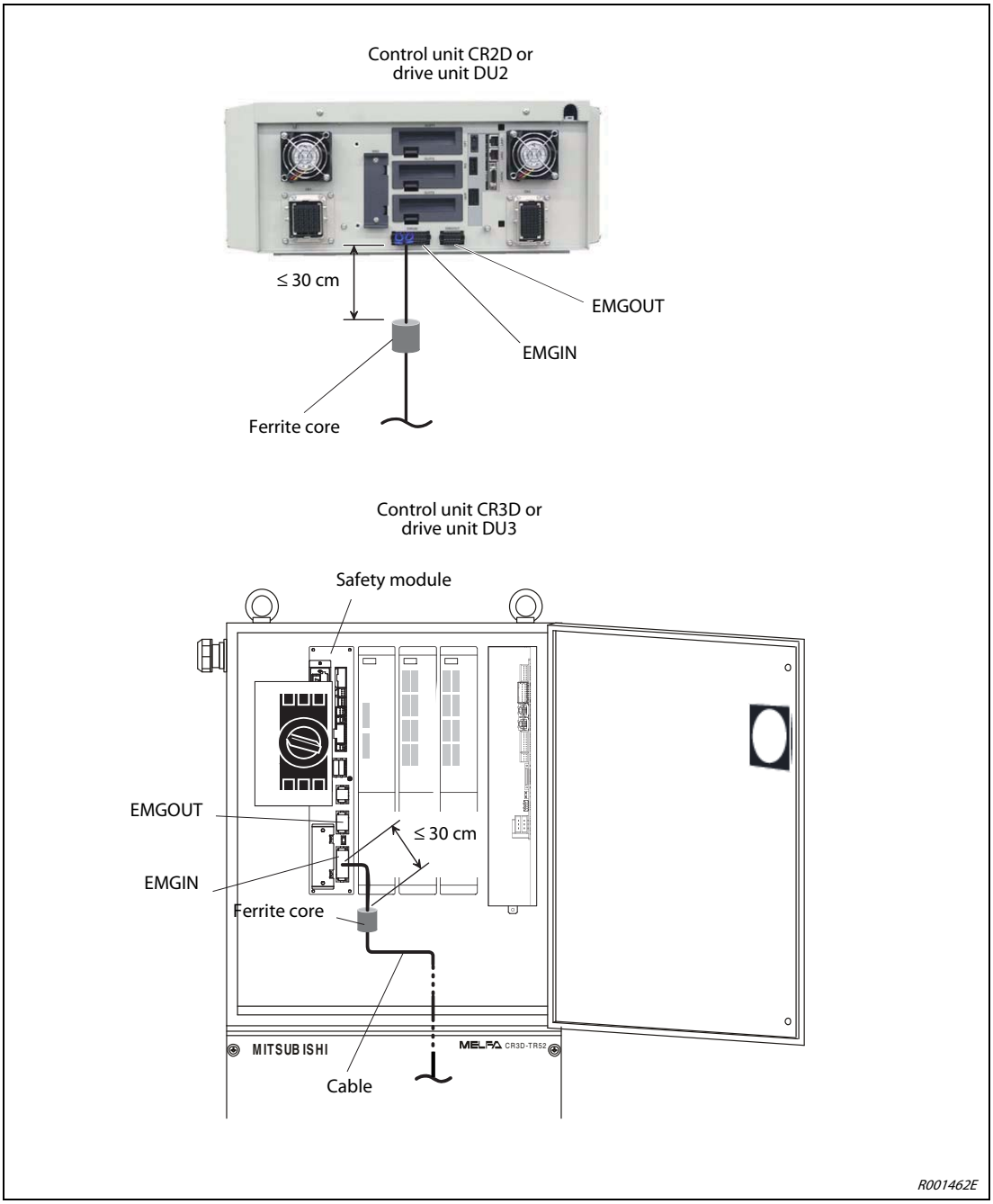


Fig. 4-7: *Connection for EMERGENCY-STOP circuit*

ATTENTION:

Do not carry out a surge voltage test.

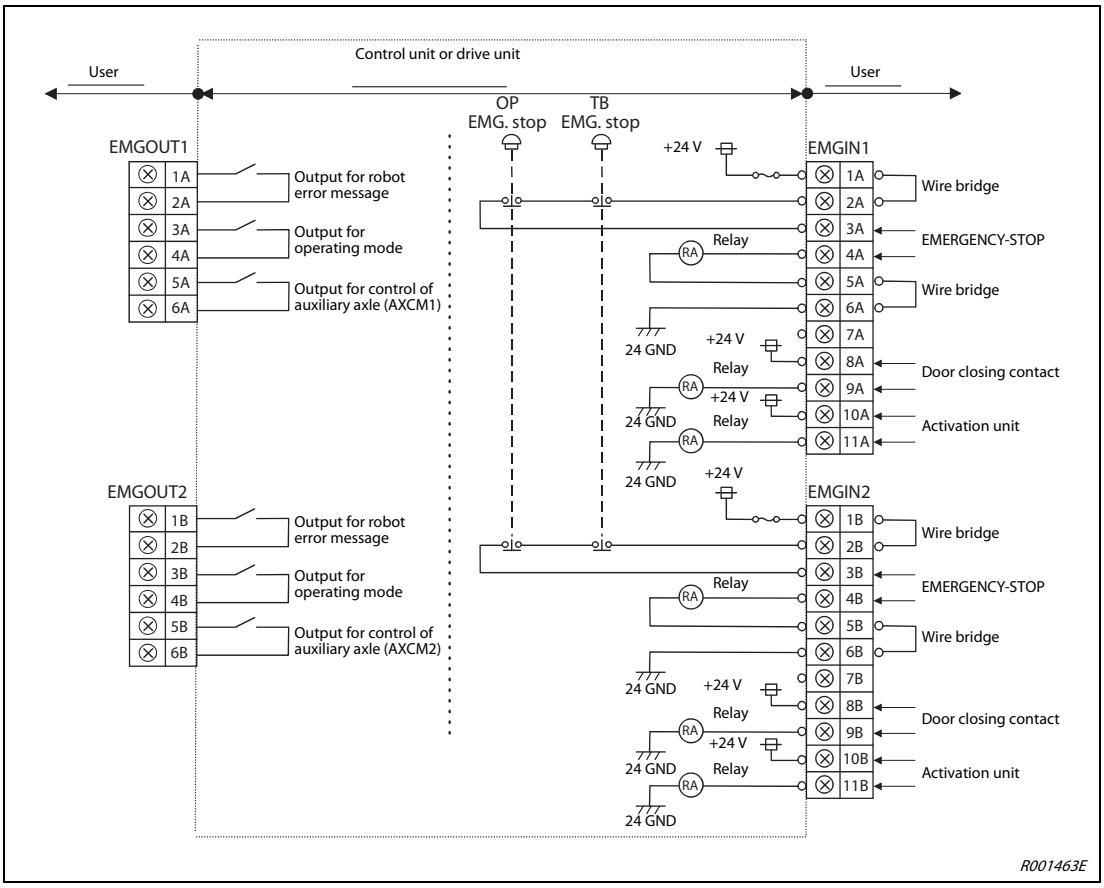


Fig. 4-8: *Internal wiring of EMERGENCY-STOP circuit*

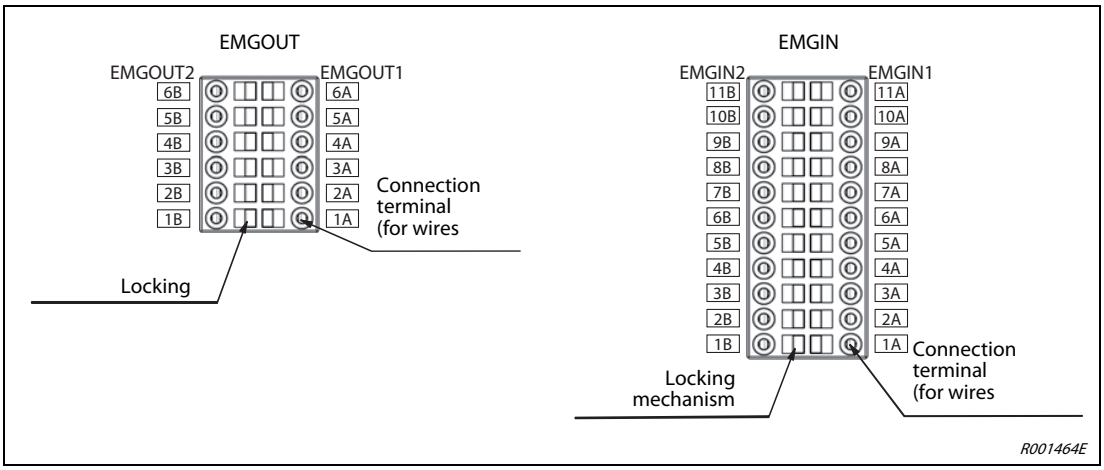


Fig. 4-9: *Terminal assignment for for EMERGENCY-STOP plug*

Connection to the terminals

① Remove approx. 7 mm of the line shielding Twist the end of the line in before the connection.

② Press down the retaining spring with a Philips screwdriver (cut: 1.4 mm to 2.4 mm).

③ Connect the EMERGENCY-STOP switch to terminals 3A-4A, 3B-4B,the door closing contact to terminals 8A-9A, 8B-9B and the activation unit to terminals 10A-11A, 10B-11B an.

④ Plug the twisted ends of the line into the connection terminal. Pull the screwdriver out of the locking mechanism.

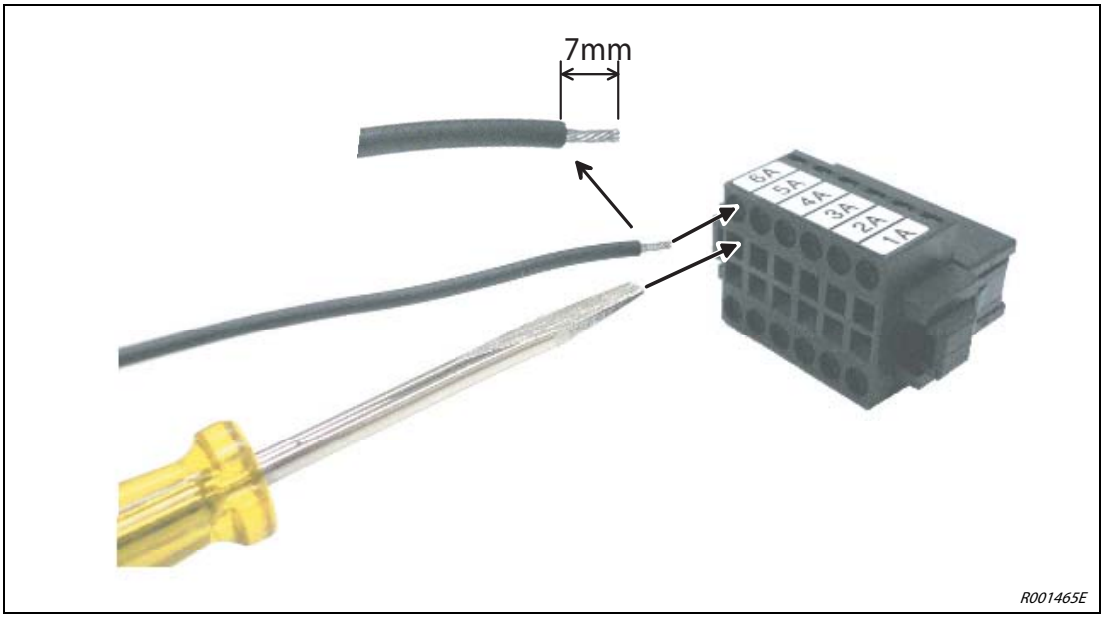


Fig. 4-10: *Connection to the terminals*

ATTENTION:

- ***Connect the EMERGENCY-STOP switch at an easily accessible location near the robot. If the robot behaves erratically then you must stop it immediately.***
- ***Twist the lines carefully when connecting to the EMGIN plug to prevent short-circuits with adjacent terminals. The end of the lines must never be tinned as they might otherwise come loose during operation.***

4.4 Safety circuits

Example 1

The following figure provides an example of the configuration of a safety circuit when using two control units, one external power supply, one door closing contact and one activation unit.

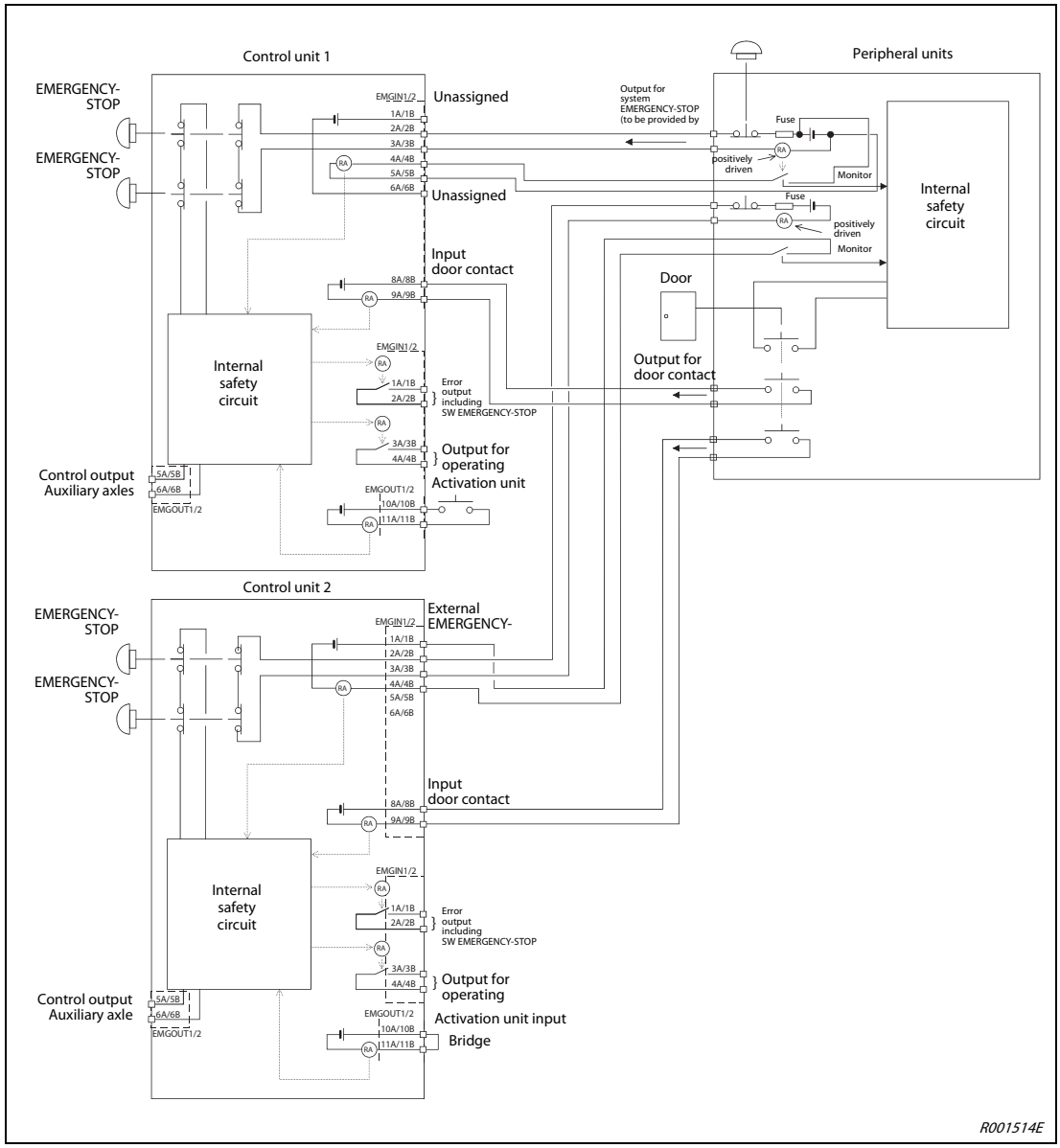


Fig. 4-11: *Configuration of a safety circuit (Example 1)*

NOTE

To facilitate clarity, some information has been omitted from the figure; the figure therefore deviates from the actual conditions of the product.

EMERGENCY-STOP input	I/O	connected
External EMERGENCY-STOP switch	E = I (input)	✔
Door contact	E = I (input)	✔
Activation unit input	E = I (input)	✔
Error output	A = O (output)	—
Auxiliary axle output	A = O (output)	—
Operating mode output	A = O (output)	—
External relay connection	—	✔

Tab. 4-1: *Inputs and outputs*

Example 2

The following figure presents an example of the configuration of a safety circuit using the output to output the operating mode.

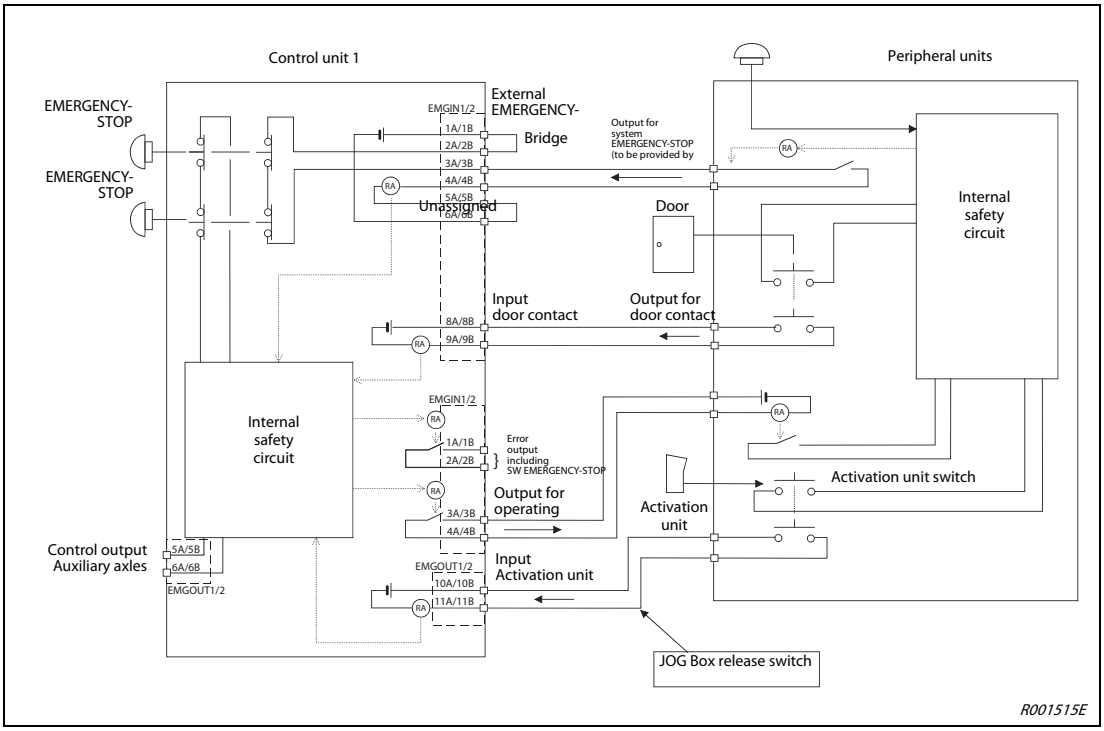


Fig. 4-12: *Configuration of a safety circuit (Example 2)*

NOTE

To facilitate clarity, some information has been omitted from the figure; the figure therefore deviates from the actual conditions of the product.

EMERGENCY-STOP input	I/O	connected
External EMERGENCY-STOP switch	E = I (input)	✔
Door contact	E = I (input)	✔
Activation unit input	E = I (input)	✔
Error output	A = O (output)	—
Auxiliary axle output	A = O (output)	—
Operating mode output	A = O (output)	✔
External relay connection	—	—

Tab. 4-2: *Inputs and outputs*

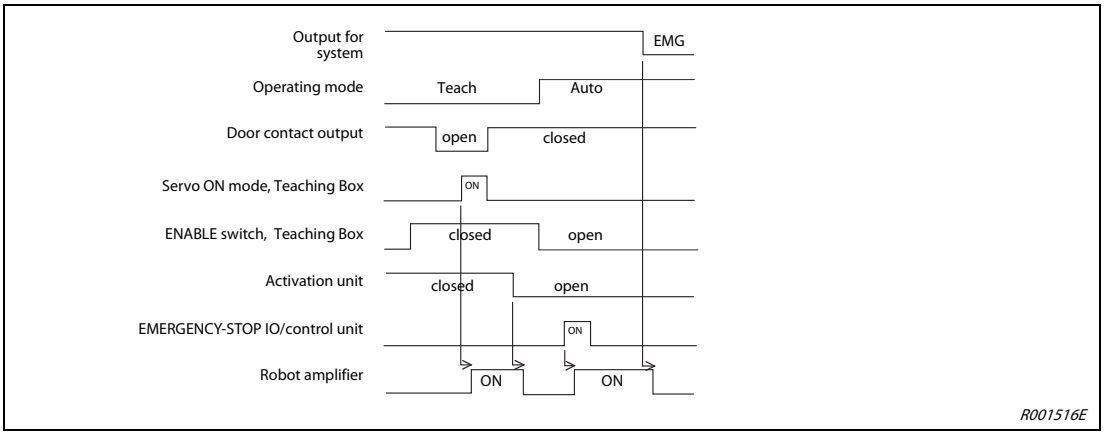


Fig. 4-13: *Signal flow plan*

4.5 Teaching Box connection

This section describes how to connect the Teaching Box with the supply voltage turned off. If the connection is established or terminated with the supply voltage turned on then an error message is issued.
Use the dummy plug if you want to operate the robot without connecting the Teaching Box.

ATTENTION:

Do not pull or bend the connection cable excessively! This could otherwise damage the cable.

Connection of the Teaching Box

① Switch off the control unit or the drive unit.

② Connect the Teaching Box cable to the Teaching-Box connection of the control unit or the drive unit. The lock must point upwards. You hear a click when the connection is correct.

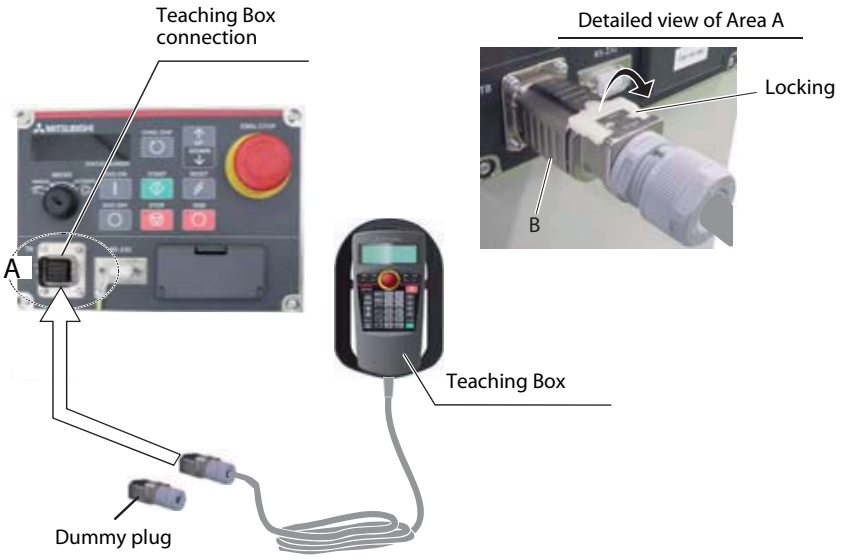


Fig. 4-14: *Teaching Box connection*

Release the connection between the control unit or drive unit and the Teaching Box

① Switch off the control unit or the drive unit.

② Lift the lock upwards on the Teaching Box plug connector. Take hold of the plug in Area B and pull it upwards and out.

③ Install the dummy plug if you want to operate the robot without connecting the Teaching Box.

5 Startup

5.1 Calibrate the robot system

5.1.1 Work flow

This section provides you step-by-step instructions on how to switch on the control voltage and the Teaching Box. It then describes how to adjust and save the home position.

ATTENTION:

To ensure perfect function of the robot the home position must first be set and must always be carried out after unpacking or reconfiguring (robot arm or control unit).

5.1.2 Prepare the system for maintenance mode

The preparations to be made for calling-up the maintenance menu are described in the following section.

Step 1: Switch on the supply voltage

DANGER:

Make sure that there is no-one within the movement area of the robot arm.

① Switch the [POWER] switch on the front side of the control unit to the "ON" position.

② The control LEDs on the control unit flash briefly. "o.100" appears on the STATUS NUMBER display.

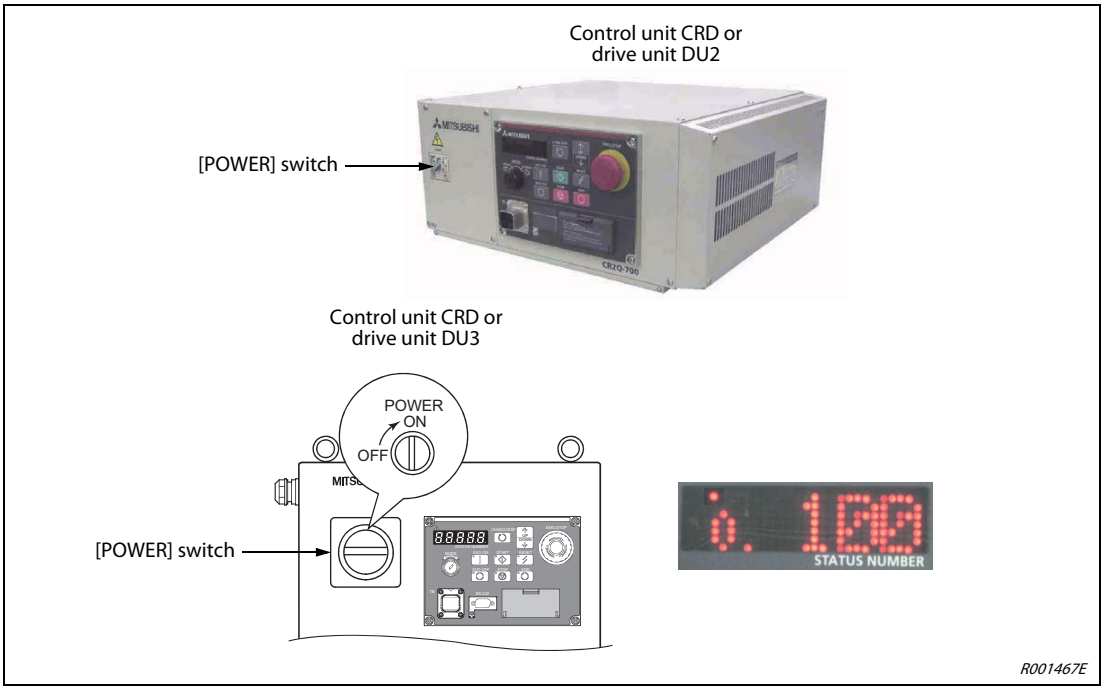


Fig. 5-1: *Switch on the power supply*

NOTE

Error message C0150 is issued the first time you switch on the control unit or the drive unit. In this case, enter the serial number of the robot arm in the RBSERIAL parameter. How to enter the serial number in the parameter is described in step 3.

Step 2: Switch on the Teaching Box

① Set the [MODE] switch of the control unit or the drive unit to "MANUAL".

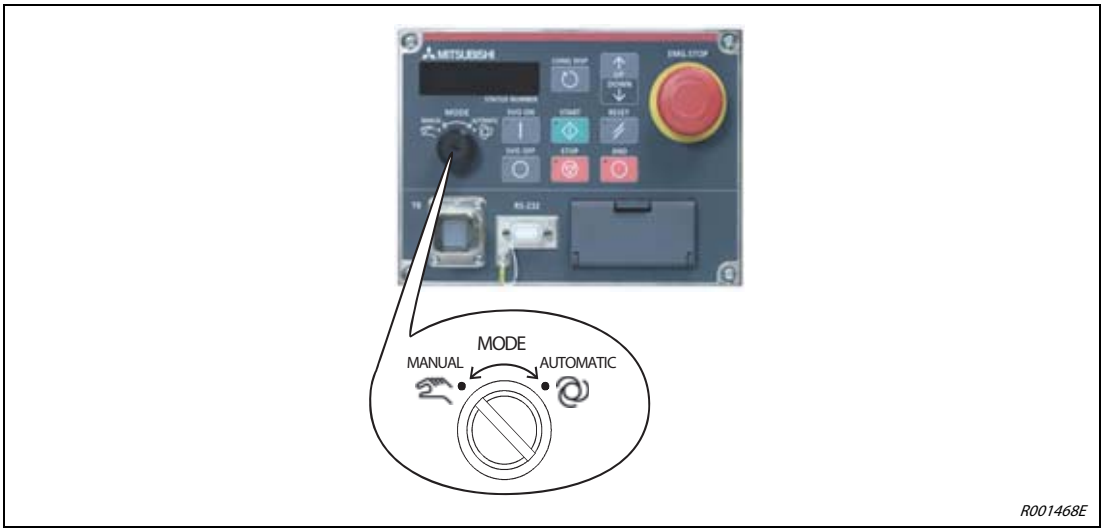


Fig. 5-2: *Set [MODE] switch to "MANUAL"*

② Set the [ENABLE/DISABLE] switch of the Teaching Box to "ENABLE".

③ The main menu appears on the display.

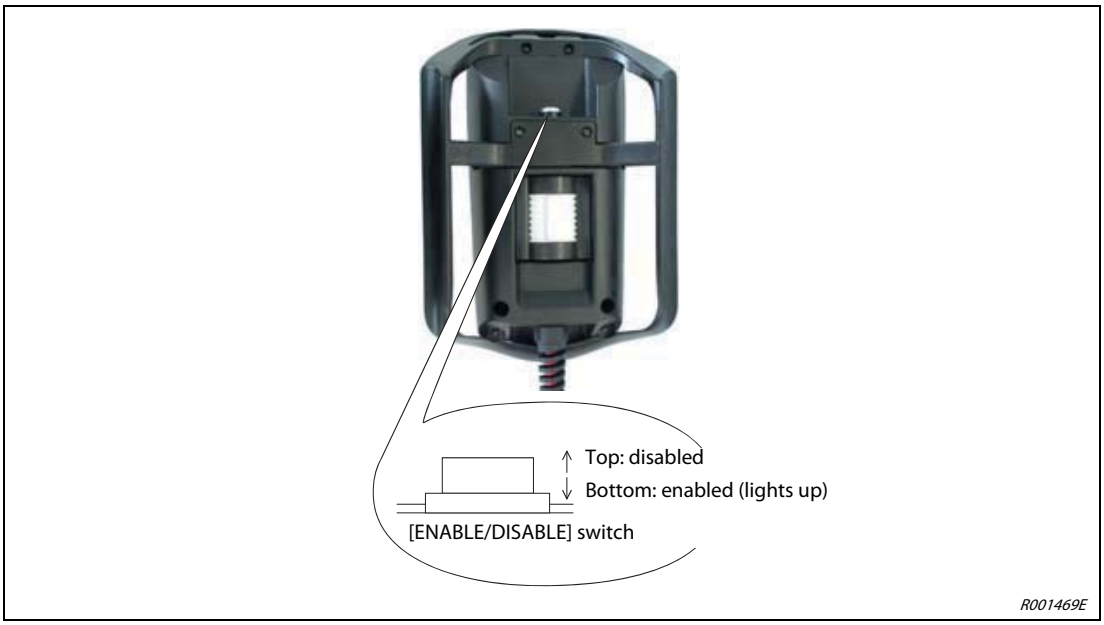


Fig. 5-3: *Switch on the Teaching Box*

ATTENTION:

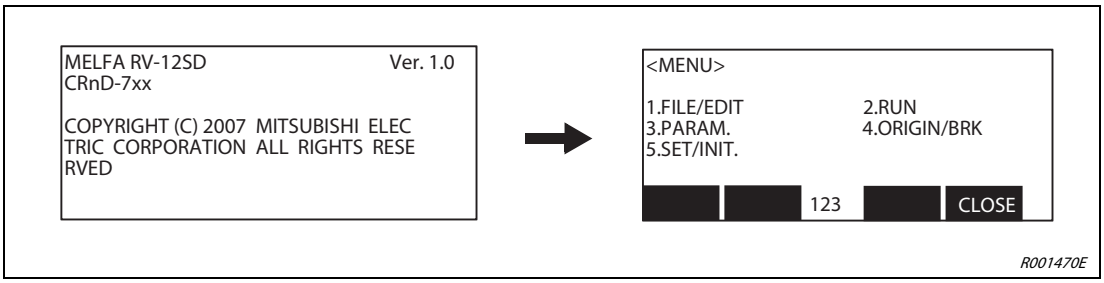
To gain sole control of the robot system, you must set the [ENABLE/DISABLE] switch of the Teaching Box to the "ENABLE" position. The control functions at the control unit are disabled in this state. For safety reasons, all EMERGENCY-STOP and STOP switches on the system are always active.

Step 3: Enter the serial number

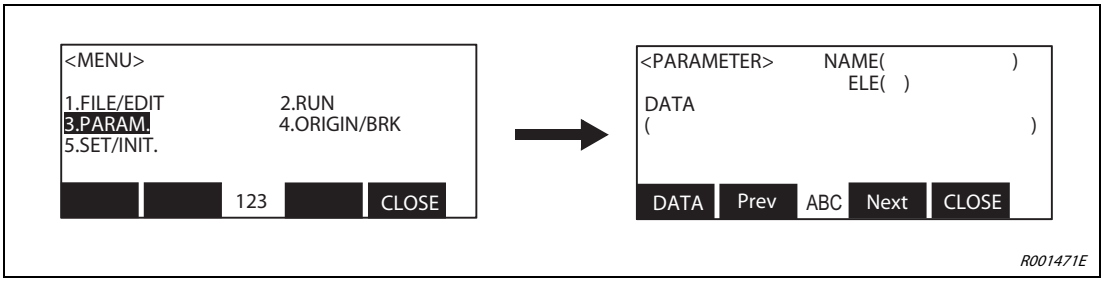
Error message C0150 is issued the first time you switch on the control unit or the drive unit. In this case, enter the serial number of the robot arm in the RBSERIAL parameter. The serial number is located on the type plate on the rear of the robot arm.

① Press the [RESET] key on the Teaching Box to reset the error.

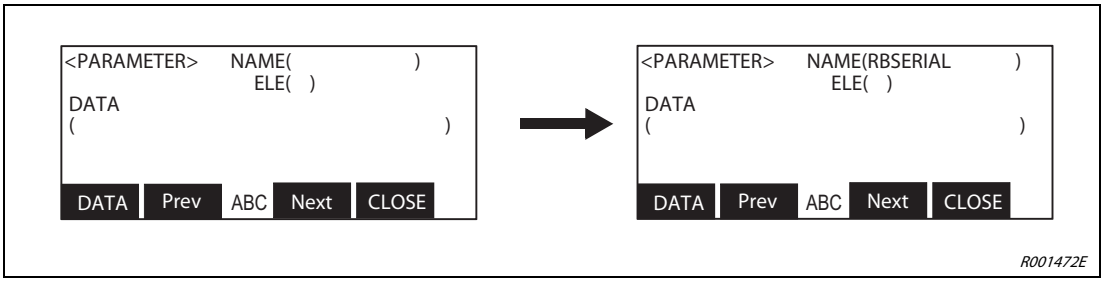
② Then press the [EXE] key. The main menu appears.



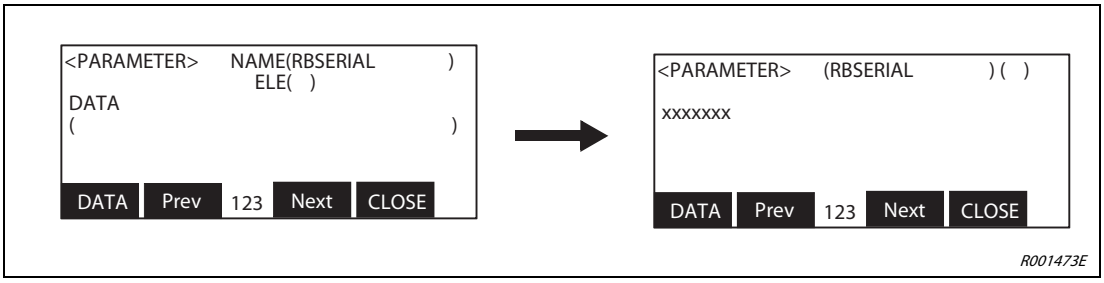
③ Press key [3] to call up the parameter menu.



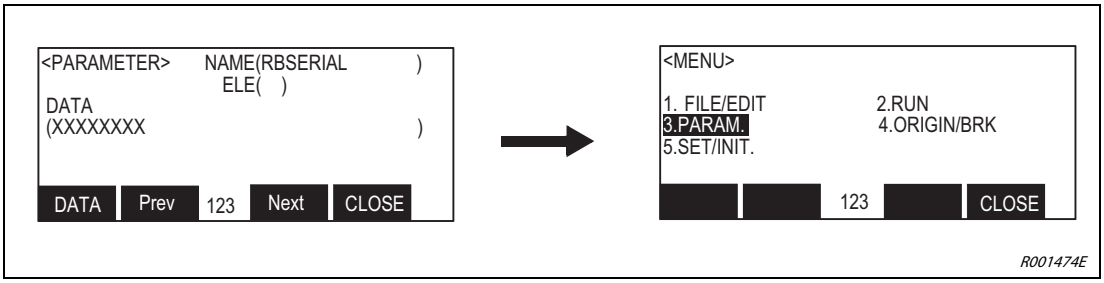
④ Enter "RBSERIAL" in the "NAME" box.



⑤ Press the key for "DATA" [F1] and enter the serial number of the robot arm. Press the [EXE] key to confirm the entry. A beep is issued and the value is stored.



⑥ Press the key for the "CLOSE" box [F1]. The main menu appears on the display.



5.1.3 Set the home position (zero point)

The home position is set after delivery of the robot by means of data entry. The data from the manufacturer for the stipulated home position is on the product insert in the robot arm box.
The data is also contained on a sticker on the robot:

- for RV-3SD/3SDJ and RV-3SQ/3SQJ on the inside of arm cover A
- for RV-6SD/6SDL, RV-6SQ/6SQL, RV-12SD/12SDL and RV-12SQ/12SQL on the inside of arm cover B
- for RH-6SDH/12SDH/18SDH and RH-6SQH/12SQH/18SQH on the inside of the J1 cover

A detailed description on how to remove a cover is contained in the technical manual of the respective robot.

ATTENTION:

The data used for the home setting of the zero point is in the "Default" column of the product insert. If the new setting of the home position of the robot arm has been carried out (e.g. when replacing a motor) using another method (e.g. a calibration device), then the last data to have been entered are valid.

● **Origin data history table Serial No. ES804008**

Date	Default	...	...	...
D	V!#S29			
J1	06DTYY			
J2	2?HL9X			
J3	1CP55V			
J4	T6!M$Y			
J5	Z2IJ%Z0			
J6	A12%Z0			
Method	E	E · N · SP	E · N · SP	E · N · SP

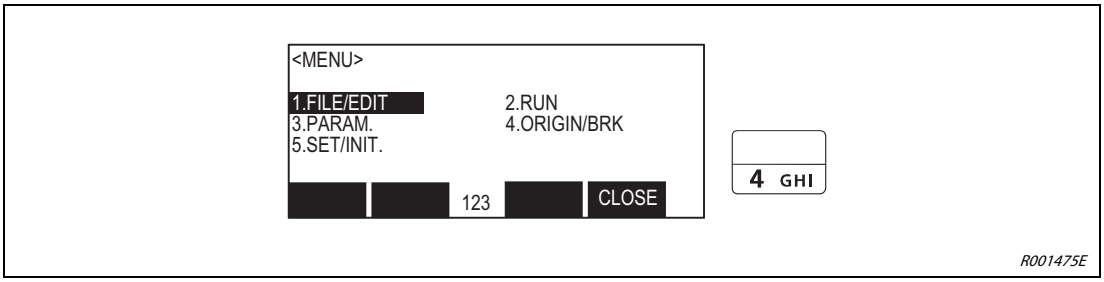
Adjustment method
E: with calibration device
N: no function
SP: no function

Fig. 5-4: *Product insert with the home position data (example data)*

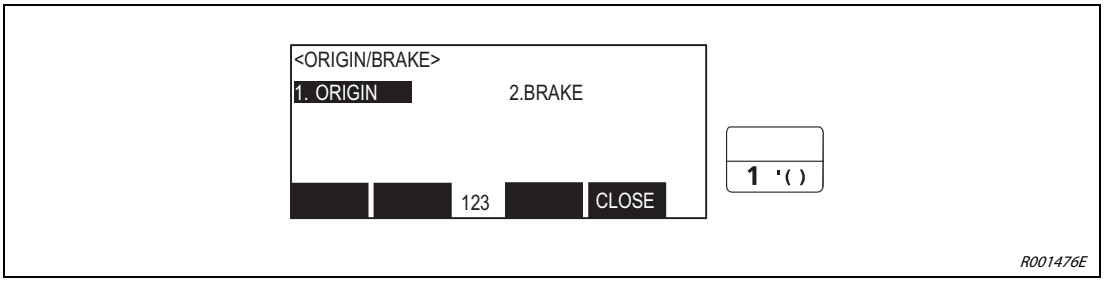
First make the settings as described in the instructions in section 5.1.2. Then select the "Setting by data entry" menu. To do so, proceed as follows:

Step 1: Select the setting (adjustment) method

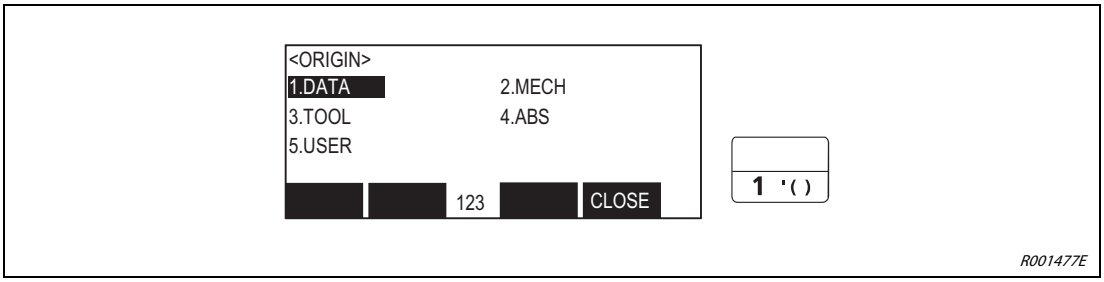
① Press key [4] to call up the "ORIGIN/BRK" menu.



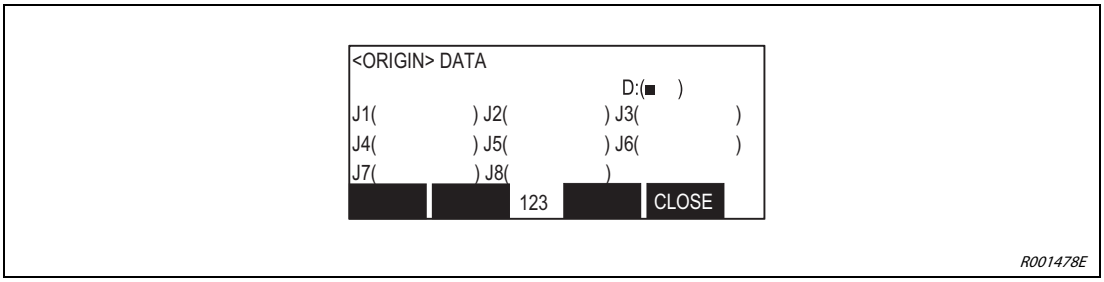
② Press key [1] to call up the "ORIGIN" menu.



③ Press key [1] to select the "DATA" method for the setting.



④ The home position setting menu is displayed.



Step 2: Enter the home position

The menu for entering the home position is displayed after the power supply to the servo drive is switched off. The entry fields shown correspond to the fields on the product insert.

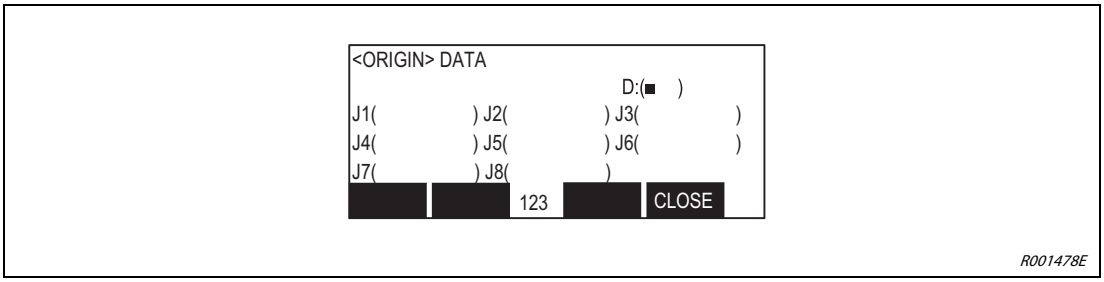


Fig. 5-5: *Menu for setting the home position*

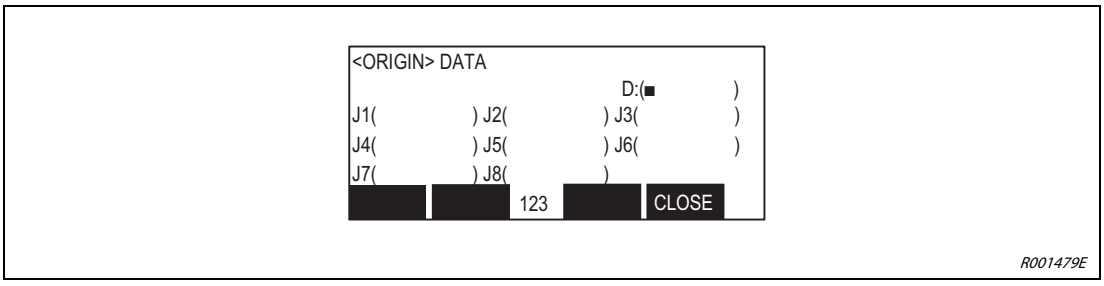
INSTRUCTIO

You can move the cursor on the display of the Teaching Box using keys [], [↓], [←] and [→]. Enter characters by pressing the [CHARACTER] key and the key for the character together. The next character is displayed by repeatedly pressing the character key. Numbers are entered at the numeric keypad. You can delete incorrect entries by pressing the [CLEAR] key.

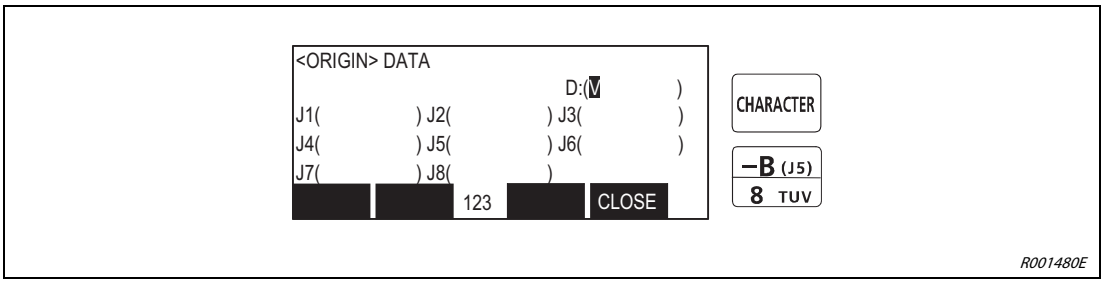
Alarm No. 1760 is displayed if incorrect home position data is entered. Press the [RESET] key and re-enter the home position data.

The following is an example of how to enter the home position data provided by the manufacturer.

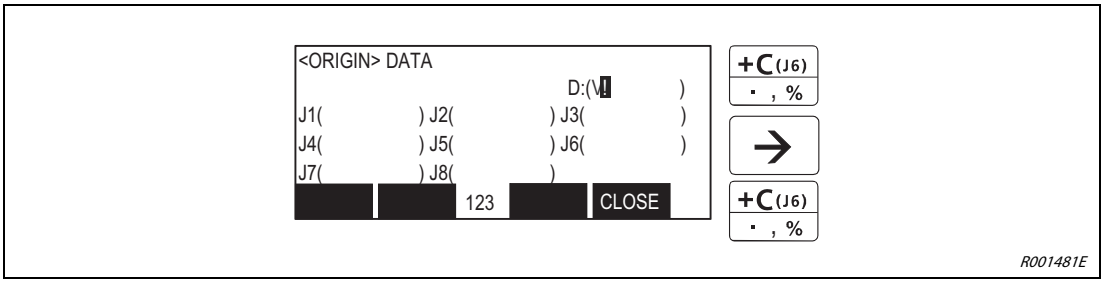
① Make sure that the cursor is in the "D" field.



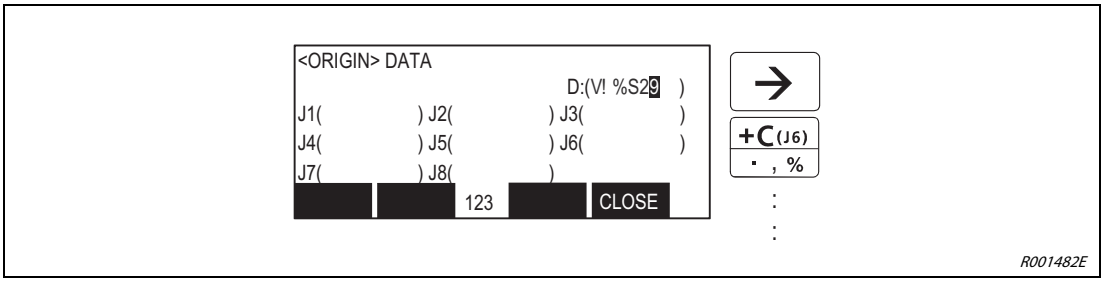
② The string "V!%S29" must be entered in the "D" field.
First enter "V". To do this, keep the [CHARACTER] key pressed and then press the [TUV] key 3 times.
A "V" appears



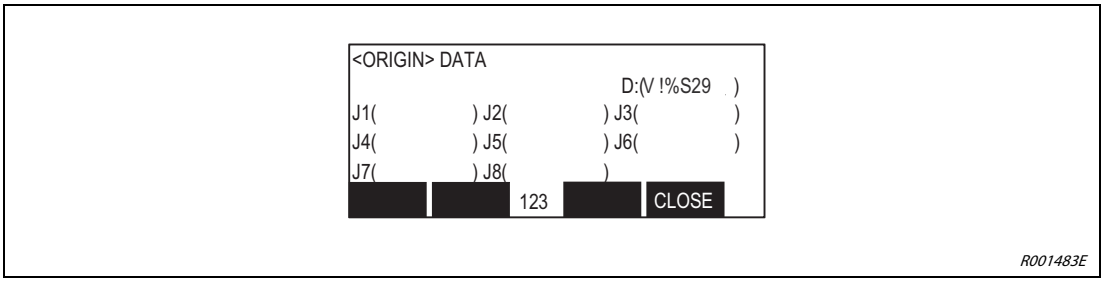
③ Enter "!". To do this, keep the [CHARACTER] key pressed and then press the [, %] key 5 times. A "!" appears



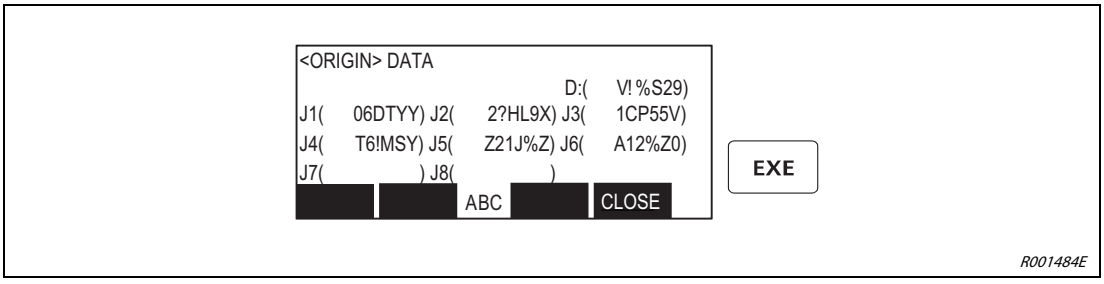
④ Enter the remaining characters in the same way. Press the [↓], key to move the cursor to the data.entry position for the J1 articulated joint.



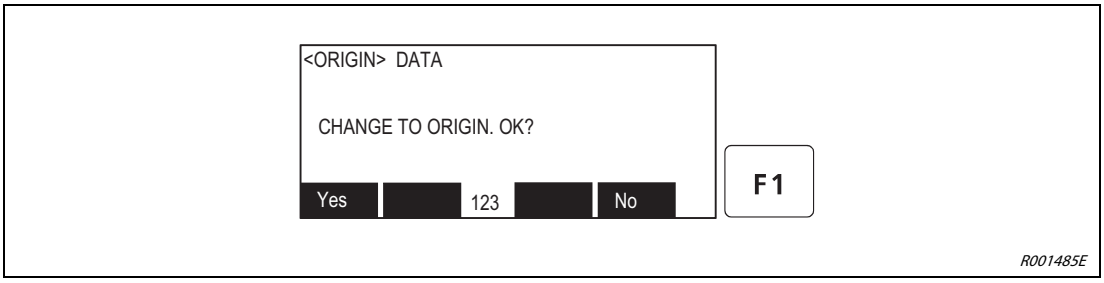
⑤ Data for the J1 to J2 articulated joints is entered in the same way as described above.



⑥ Press the [EXE] after entering all data. An acknowledgement screen pops up.



⑦ Press the [F1] key to complete the entry of the home position.



6 Operation of Teaching Box R32TB

This section describes the operation of the Teaching Box and the functions of the individual menus .

6.1 Menu tree

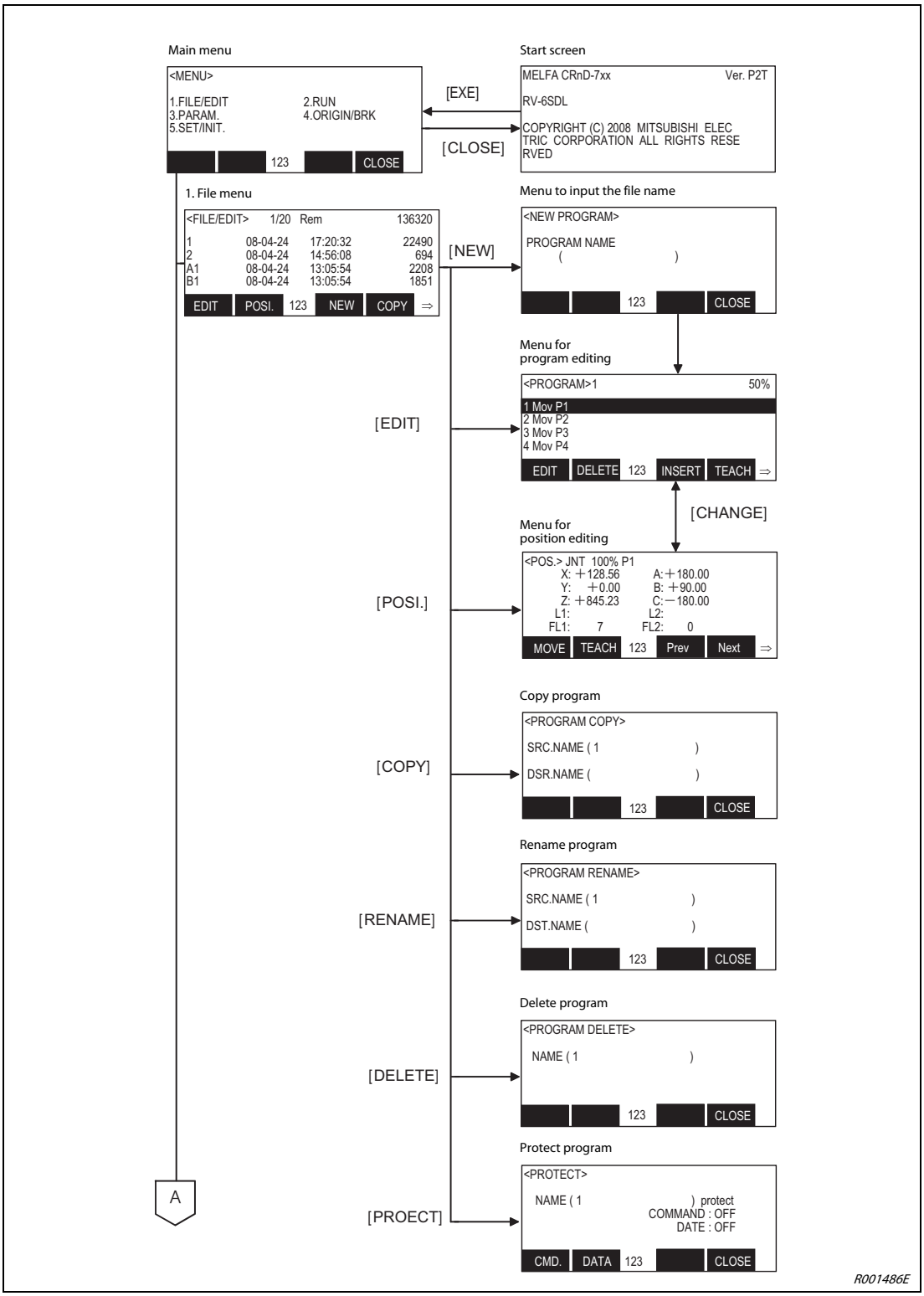


Abb. 6-1: *Menu tree (1)*

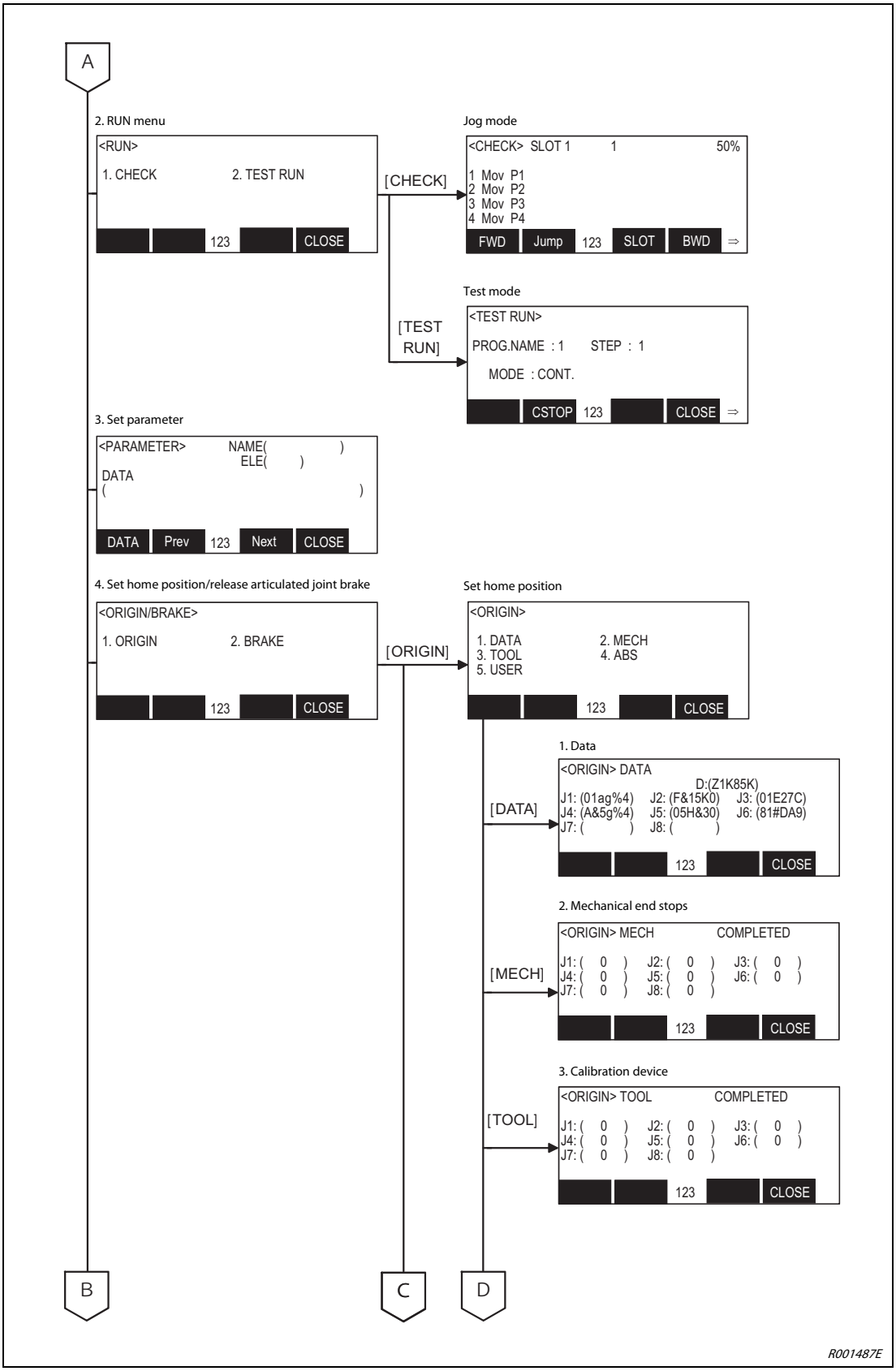


Fig. 6-1: *Menu tree (2)*

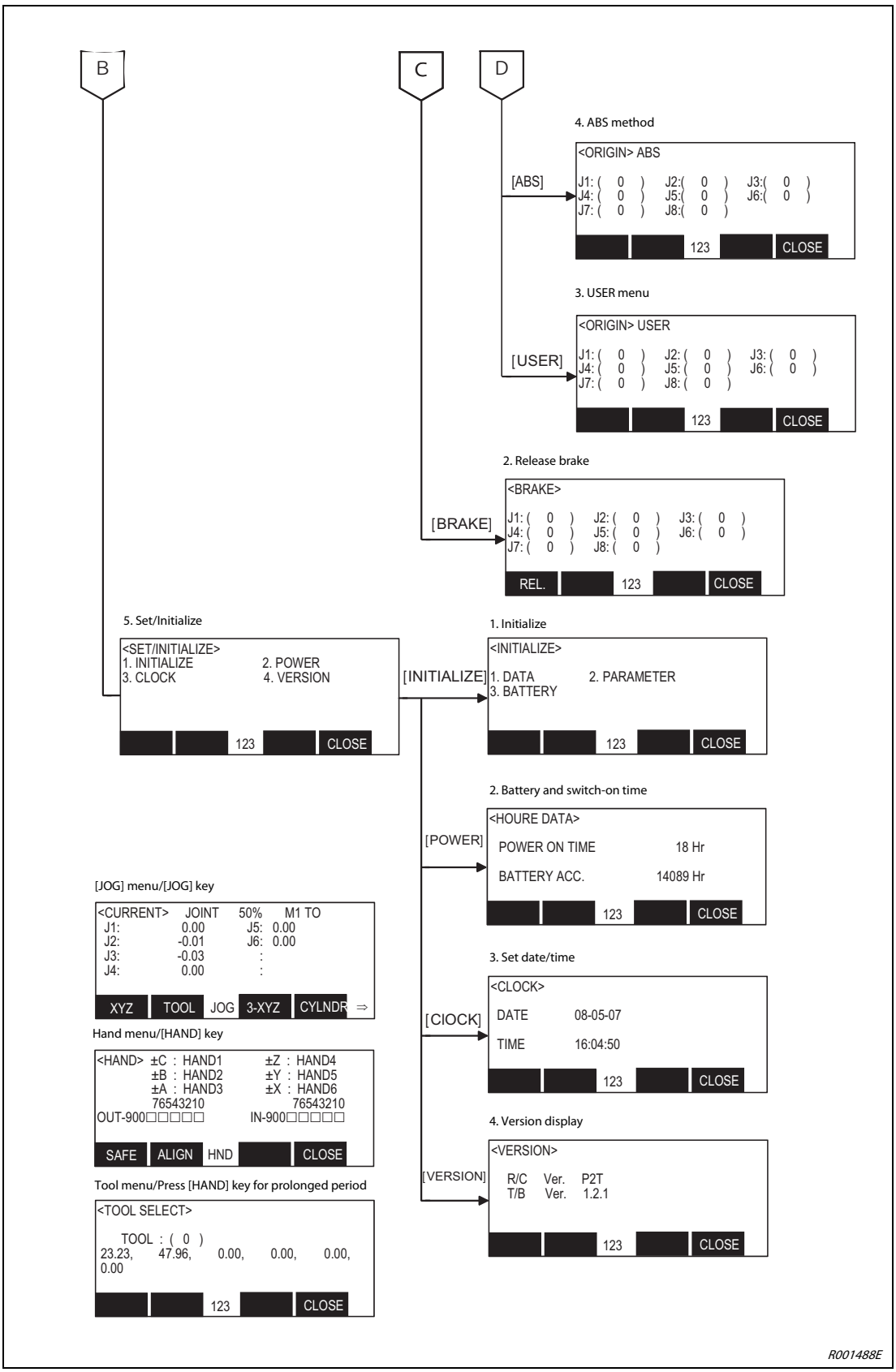


Fig. 6-1: *Menu tree (3)*

6.2 Enter a character

Every time you press the [CHARACTER] key, the write mode switches between entry of numbers and letters. The current mode is displayed at the bottom in the middle of the display

Enter numbers

Numbers are entered in number mode using the keys on which the appropriate number as well as the minus sign and the full stop are shown at the bottom left.

Example▽

"51" is entered as the program name.
To do this, press the [CHARACTER] key and keys [5] and [1].

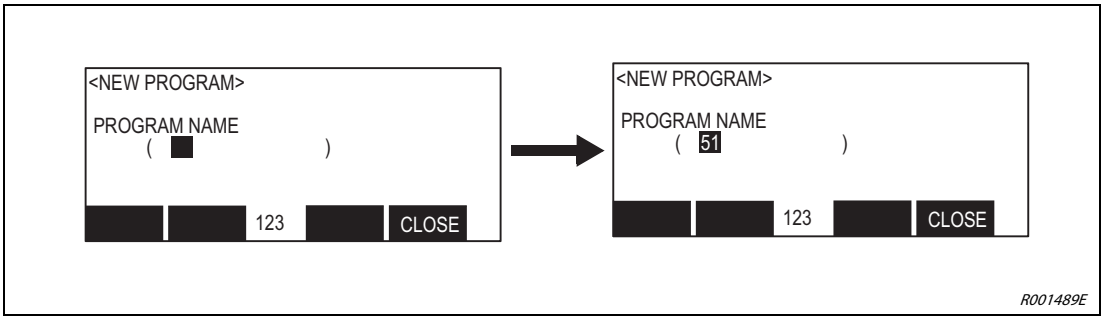


Abb. 6-2: *Enter numbers*

△

Enter letters

Letters are entered in letter mode using the keys on which the appropriate number indicated on the bottom right. Change the character by pressing the key repeatedly. For instance, pressing the [ABC] key repeatedly allows you to select from the following characters: "A" ... "B" ... "C" ... "a" ... "b" ... "c". When selecting letters assigned to the same key, you can move the cursor along a position by using the arrow key [→].

Example▽

How to enter letters "ABY".
Press the following keys: 1 x [ABC], [→], 2 x [ABC], 3 x [WXYZ].

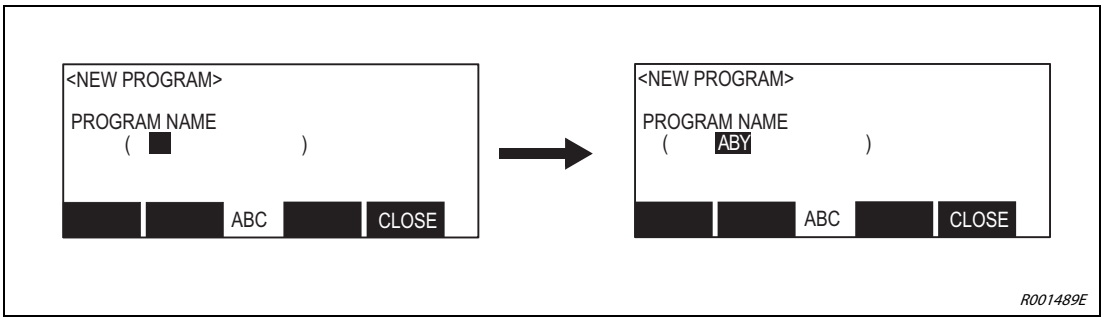


Abb. 6-3: *Enter letters*

△

The following characters are assigned to the keys:

- [' ( )] key: ' → (→) → " → ^ → : → ; → ¥ → ?
- [@ =] key: @ → = → + → − → ∗ → / → < → >
- [, %] key: , → % → # → $ → ! → & → _ → .

Clear a character

Clear an incorrectly entered character by placing the cursor on the character and pressing the [CLEAR] key.

Example ▽

Letter "B" of string "ABY" is to be changed to an "M", resulting in the new string "AMY".
Move the cursor with the [←] key to the "B" character and press the following keys: [CLEAR], 1 x [MNO], 3 x [WXYZ].

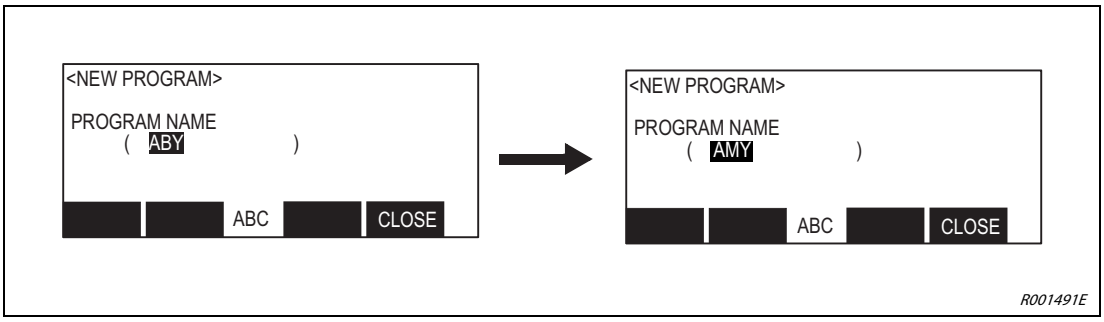


Abb. 6-4: *Clear a character*

△

NOTE Pressing the [CLEAR] key for a longer period clears all the characters in the brackets.

6.3 Select a menu item

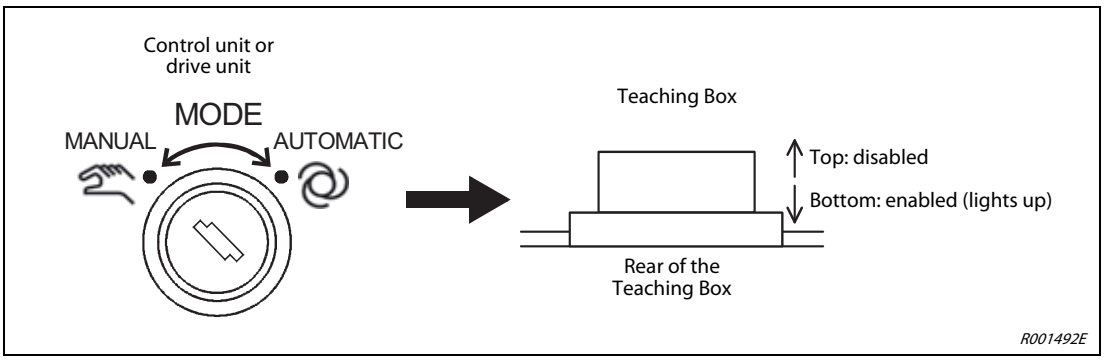
There are two ways to call up a menu:

- Select a menu by entering a number
- Select the menu with the cursor an press the [EXE] key

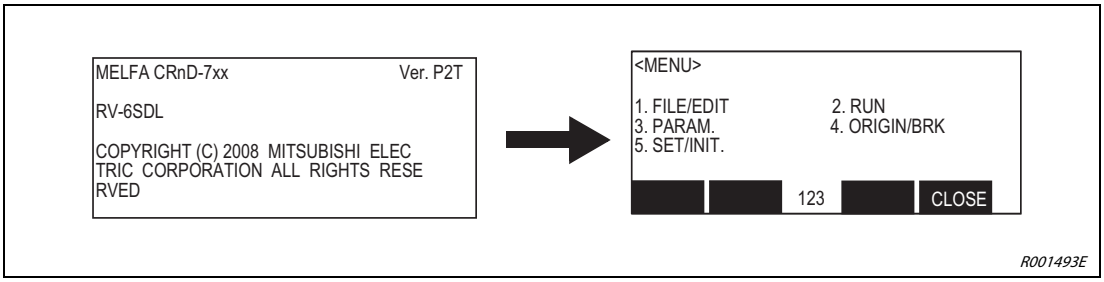
Running

Both possibilities are displayed in the following example by selecting menu item "1. FILE/EDIT" .

① Set the [MODE] switch of the control unit to "MANUAL". Activate the Teaching Box by setting the [ENABLE/DISABLE] switch of the Teaching Box to "ENABLE".

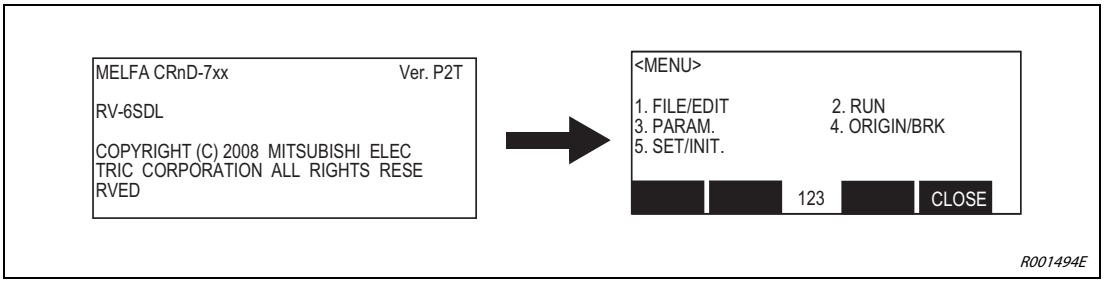


② The start screen appears after switching on. After the start screen appears, press [EXE] key to call up the main menu.



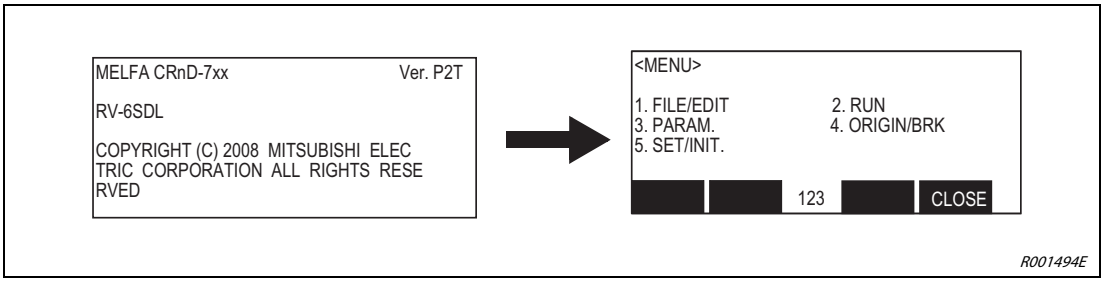
● Select a menu by entering a number

① Select the "FILE/EDIT" menu by entering "1". The "FILE/EDIT" menu is displayed.



● Select the menu with the cursor an press the [EXE] key

① With the arrow keys, move the cursor to the "FILE/EDIT" menu item and confirm with the [EXE] key. The "FILE/EDIT" menu is displayed.

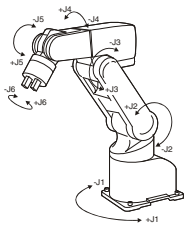
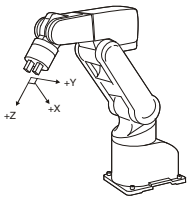
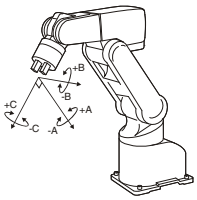
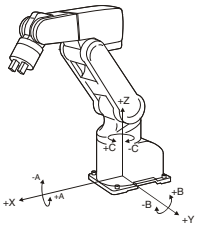


6.4 Move robot is JOG mode

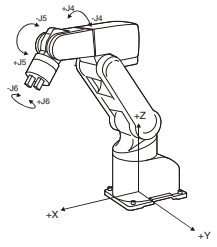
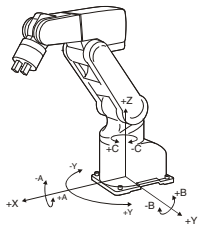
The robot can be moved in steps by the JOG mode. This section describes the JOG mode based on a 6-axle vertical articulated arm robot. Axle configuration depends on the robot type used A detailed description on the individual types of robot is contained in the technical manual of the respective robot

6.4.1 JOG modes

There are 5 JOG modes:

Operating mode	Mode	Description
Articulated joint JOG mode  R000862C	• Set the [MODE] switch of the Teaching Box to "ENABLE". • Keep the three-step switch in the middle position. • Then press the [SERVO] key. (The servo power supply is switched on). • Press [JOG]- and the [F1] key to switch to articulated joint JOG mode. • To move the articulated joints, press appropriate keys J1 to J6.	The axles of the robot can be moved individually in articulated joint JOG mode. This allows axles J1 and J6 and auxiliary axles J7 and J8 to be set independently. The number of axles depends on the type of robot. Auxiliary axles J7 and J8 are controlled by keys [J1] and [J2].
Tool JOG mode  R000863C  R000864C	Execute the three points listed above. • Press the function key to switch to the tool JOG mode. • To move the axles, press appropriate key X, Y, Z, A, B, C.	The position of the tipped tool can be moved along the axles in the tool coordinate system in tool JOG mode. The tipped tool is moved linearly. The position of the robot can be rotated by keys A, B and C around axles X, Y and Z of the tool coordinate system without changing the position of the tipped tool. The middle point of the tool must be set by parameter MEXTL. The tool coordinate system in which the position of the tipped tool is determined depends on the robot type. In case of vertical articulated arm robots, the direction from the gripper flange to the tipped tool is defined as +Z. In case of SCARA robots, the direction upwards from the assembly area is defined as +Z.
XYZ JOG mode  R000865C	Execute the three points listed above. • Press the function key to switch to the XYZ JOG mode.	The position of the tipped tool can be moved along the axles in the XYZ coordinate system in XYZ JOG mode. The position of the robot can be rotated by keys A, B and C around axles X, Y and Z of the XYZ coordinate system without changing the position of the tipped tool. The middle point of the tool must be set by parameter MEXTL.

Tab. 6-1: *JOG modes (1)*

Operating mode	Mode	Description
3-axle XYZ JOG mode  R000866C	Execute the three points listed above. ● Press the function key twice to switch to the 3-axle XYZ JOG mode.	The position of the tipped tool can be moved along the axles in the XYZ coordinate system in 3-axle XYZ JOG mode. In contrast to XYZ JOG mode, the position of the robot is changed as in articulated joint mode by rotating axles J4, J5 and J6. with a fixed position of the tipped too, the position is interpolated over axles X, Y, Z, J4, J5 and J6, i.e. the position is not constant. The middle point of the tool must be set by parameter MEXTL.
Circle JOG mode  R000867C	Execute the three points listed above. ● Press the function key three times to switch to the circle JOG mode.	The position of the tipped tool can be rotated in circles around the zero point in circle JOG mode. A change in the X-axle coordinate moves the tipped tool radially, starting from the middle point of the robot. A change in the Y-axle coordinate has the effect of the same movement as control of the J1 axle in articulated joint JOG mode. A change in the Z-axle coordinate has the effect of a manual movement in the Z direction as in XYZ JOG mode. If the coordinates of the A, B or C axle are changed then the hand gripper is rotated as in XYZ JOG mode The axles of robot type RH can be controlled.

Tab. 6-1: *JOG modes (2)*

NOTE

If the monitoring point of the hand in tool JOG mode, XYZ JOG mode or circle JOG mode approaches a single point then a warning sign appears on the Teaching Box and a warning signal is issued. The function can be deactivated by parameter MESNGLSW. A detailed description of the parameter and the function "Error message on reaching a singular point" is contained in the operating and programming instructions.

7 Troubleshooting and maintenance instructions

7.1 Faults in automatic mode

DANGER:

- ***Operation must be stopped immediately if you observe slight deviations when operating the robot or the auxiliary equipment. If immediate shutdown would result in concomitant dangers and hazards, then you must select a suitable time.***
- ***If the robot stops for no apparent reason when in automatic mode then the operator must never approach the robot. If the robot nevertheless needs to be accessed, then the EMERGENCY-STOP function must be previously triggered or the power supply must be switched off. Make sure than no new angers/hazards can arise from switching off the power supply.***
- ***If a program is restarted after a reset, you must make sure that from the very start of running this program no dangerous/hazardous states can aries from the auxiliary equipment (e.g. check of position on restart, necessity to initialise the auxiliary equipment, etc.)***
- ***If a program has been changed after a cancellation then it must be tested at least once before restarting of automatic mode is permitted.***

7.2 Troubleshooting

If a fault occurs, proceed as follows:

- Similar as during maintenance work, troubleshooting can be carried out from outside the protective enclosure or within the protective enclosure with the power supply switched off or from within the protective enclosure when automatic mode is deactivated.
  If troubleshooting has to be carried out from within the protective enclosure then set the [MODE] switch of the control unit to "MANUAL" and the [Enable/Disable] switch of the Teaching Box to "Enable".
- If a robot alarm occurs then first check the error code number or the error status. Take a note of this useful troubleshooting information and read the appropriate section in the operating and programming instructions.
- If the robot itself is affected and it is not possible for the user to remedy the cause of the error/ fault then you must immediately contact your MITSUBISHI sales agent.

7.3 Error diagnosis

When an error occurs, a 5-digit error code is shown on the display "STATUS.NUMBER" (e.g. C0010). The LED on the RESET pushbutton lights up.

A 4-digit error number appears on the display of the Teaching Box. The first character of the error number is not shown. For example the display shows "0010" for "C0010" and plain text.

A list of the messages that have previously occurred can be called up in the monitor menu of the "ERROR LOG" of the Teaching Box. The error must first be reset for this.

The error numbers, the errors causes and the countermeasures are listed in the operating and programming instructions. If an error can not be remedied by the countermeasures listed then please contact your sales partner.

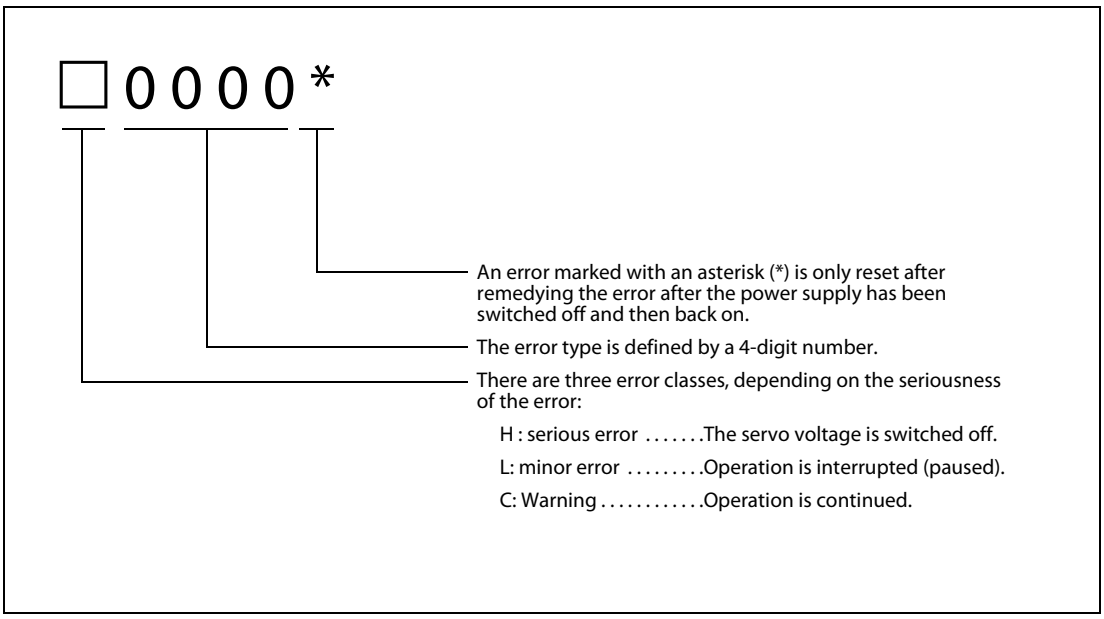


Fig. 7-1: *Design of an error message*

NOTE

The last position of the error number may be an axle number.
Example: Error number H0931 means overcurrent of axle 1 motor.

7.4 Replace the fuses

An error message is issued if a fuse on the interface card for the pneumatically operated gripper hand, or on the control board, is defective. The error message contains information on which fuse has to be replaced

7.4.1 Fuse and error messages

Error code	Description	Unit	Board/Module	Fuse
H0082	Fuse for pneumatic gripper hand defective	CR2D/DU2	RZ375	F1 (rated current: 1.6 A)
		CR3D/DU3		
H0083	Fuse of power supply or pneumatic gripper hand defective	CR2D/DU2	Module for installation of the optional units	F5 (rated current: 1.6 A)
		CR3D/DU3	R700SFT	F2 (rated current: 1.6 A)

Tab. 7-1: *Fuses*

7.4.2 Fuse for pneumatic gripper hand

If you see error message "H0082" replace fuse S1 (rated current: 1.6 A) on board RZ375 for the controller of the pneumatic gripper hand.

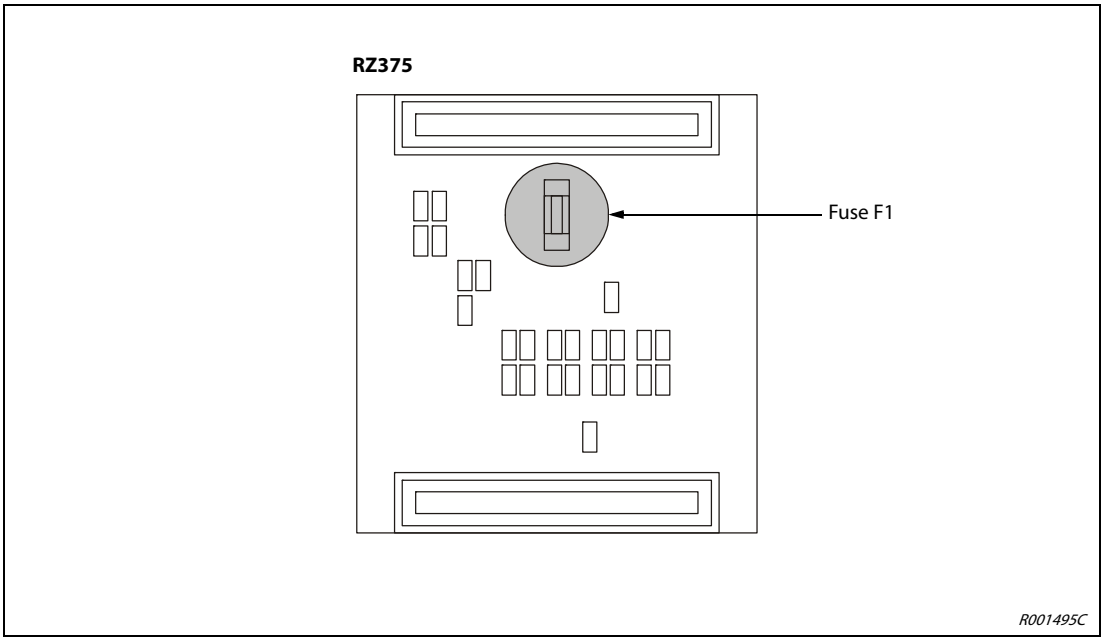


Fig. 7-2: *Fuse for pneumatic gripper hand*

7.4.3 Fuse of power supply of pneumatic gripper hand

Control unit CR2D / drive unit DU2

If you see error message "H0083" replace fuse S5 (rated current: 1.6 A) in the module for installation of the optional units.

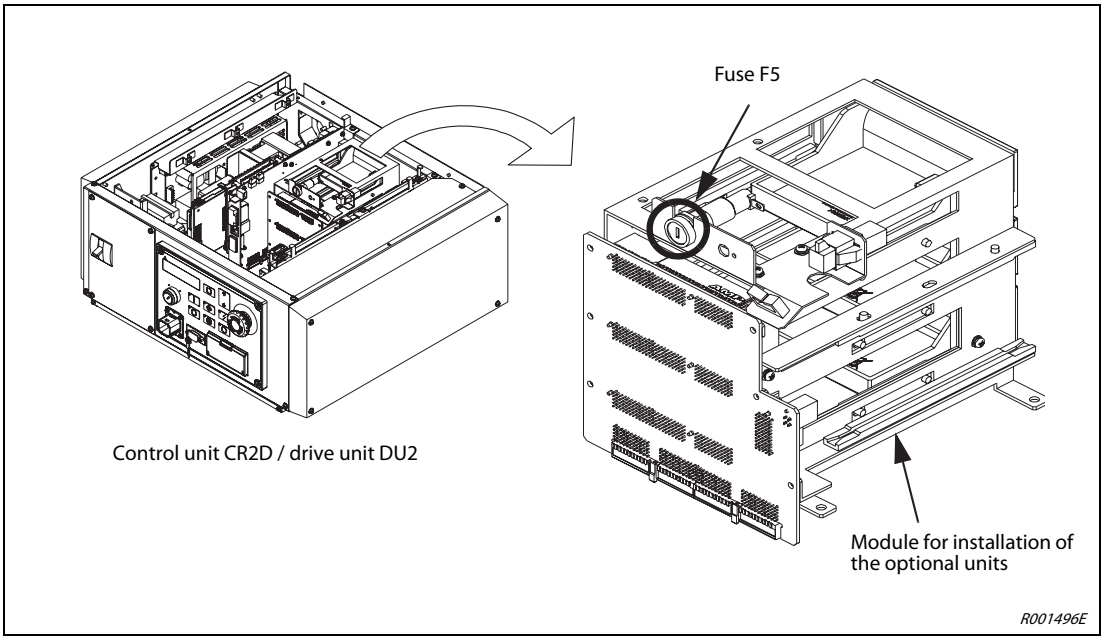


Fig. 7-3: *Fuse of power supply for pneumatic gripper hand (CR2D/DU2)*

Control unit CR3D / drive unit DU3

If you see error message "H0083" replace fuse S2 (rated current: 1.6 A) in unit R700SFT.

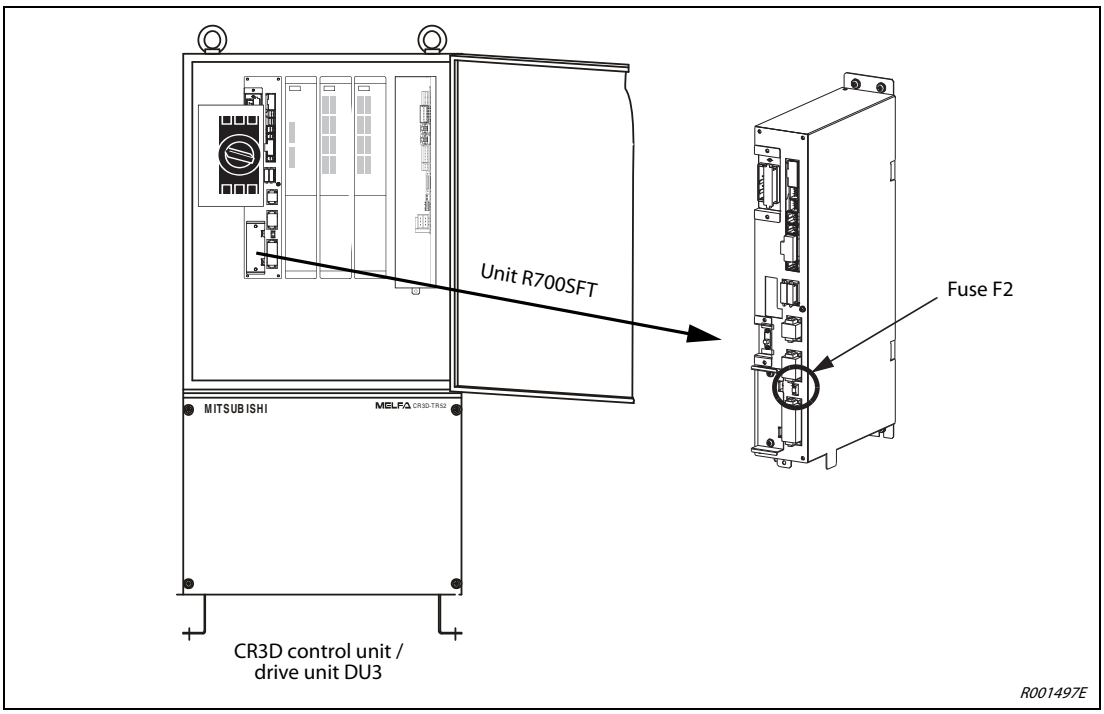


Fig. 7-4: *Fuse of power supply for pneumatic gripper hand (CR3D/DU3)*

7.5 Instructions on maintenance

ATTENTION:

All maintenance work on the robot must only be carried in full compliance to the following safety directives!

- Use the "Maintenance Forecast" function of the RT ToolBox2 robot programming software to determine the expected maintenance intervals.
- Maintenance work should be carried on outside of the protective area when possible.
- If the maintenance work has to be carried out from within the protective area then the power supply must be switched off at the main switch and must be protected by a padlock against being switched back on. However, switching off must never result in dangerous or hazardous states.
- You must make sure that the daily and periodic inspections are carried out compliant to the instructions in the technical manual. With regard to the robot system, the inspection and maintenance program of the manufacturer must be observed. If there is any special maintenance work that can not be easily carried out by the user then you must contact the service department of MITSUBISHI.
- When carrying out maintenance work at the controller unit, also check the function of the cooling fan, e.g. by making sure that there is an air current
- If the robot brakes are released then the robot arm (articulated arm robot) or the J3 axle (SCARA robot) must be supported manually to ensure that they do not fall uncontrolled into the end stop. You require the support of a second person for this.
- Small amounts of grease may exit from the robot arm. If this can result in soiling or environmental pollution then the robot should be checked regularly for loss of grease. If you determine that grease is exiting at the robot then wipe it off from the surface with a cleaning cloth to ensure that the floor and the vicinity around the robot are not soiled.
- To be able to easily carry out maintenance work, make sure there is sufficient space and lighting.
- The robot must not be retrofitted or changed using unauthorized parts. Only ever use original spare parts and accessories. Parts and accessories not approved by the manufacturer must never be used. Make sure that no safety functions can be modified.
- Before switching back on the power supply, make sure that no dangerous or hazardous conditions can be caused by this.
- After completion of maintenance work, all safety equipment that has been temporarily deactivated must be reactivated (e. g., door contact switch of the safety enclosure, etc).
- Do not check the insulation resistor during maintenance work.
- The batteries must not be shorted, charged, heated up, burnt or disassembled.

A Annex

A.1 Dimensions

A.1.1 Working areas of the robot

The following figure shows the range of motion of the 5-axle robot arms RV-3SDJB and RV-3SQJB.

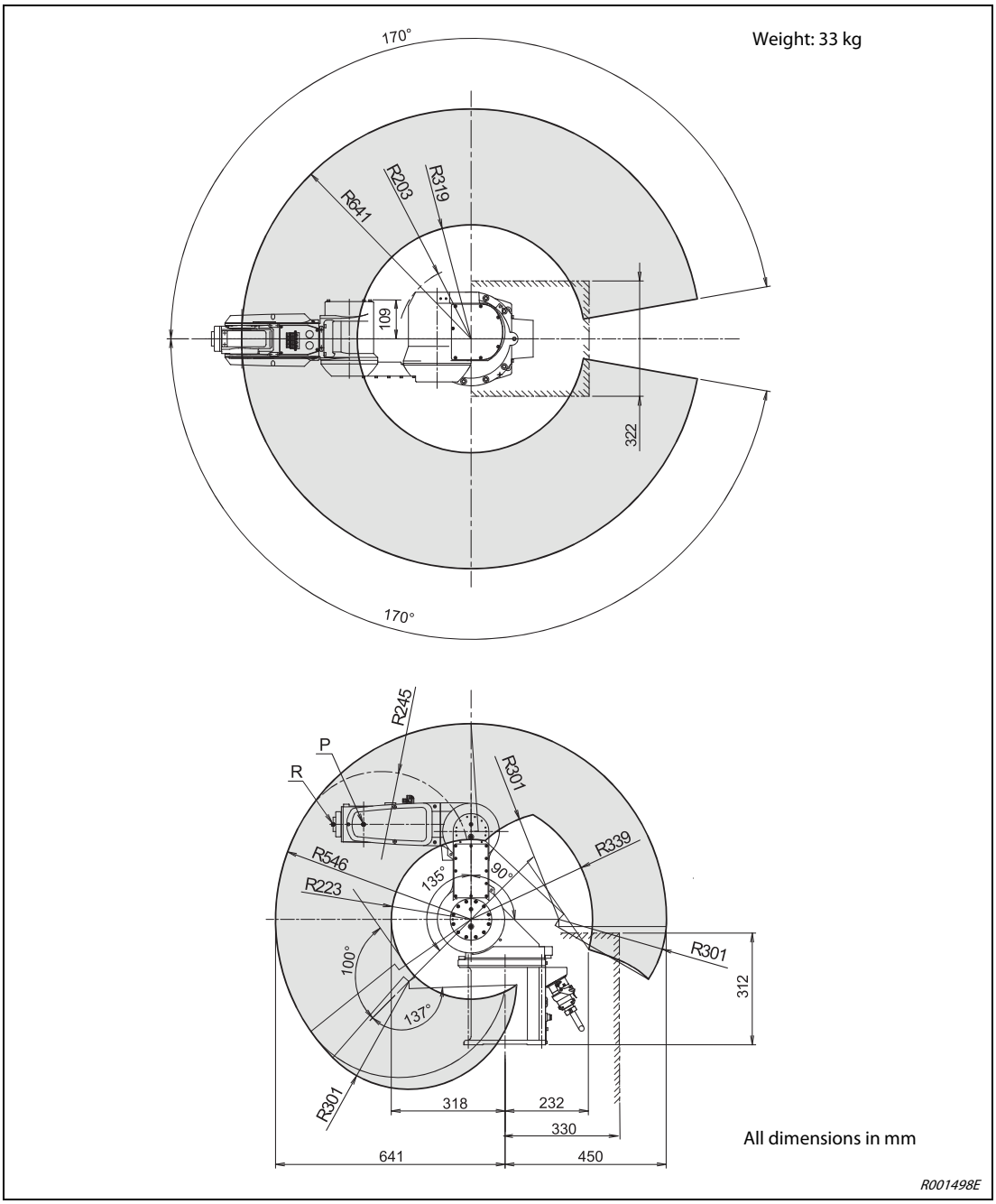


Fig. A-1: *Range of motion of robot arms RV-3SDJB and RV-3SQJB*

NOTE The working area stipulated refers to the P point of the robot arm without gripper hand.

The following figure shows the range of motion of the 6-axle robot arms RV-3SDB and RV-3SQB.

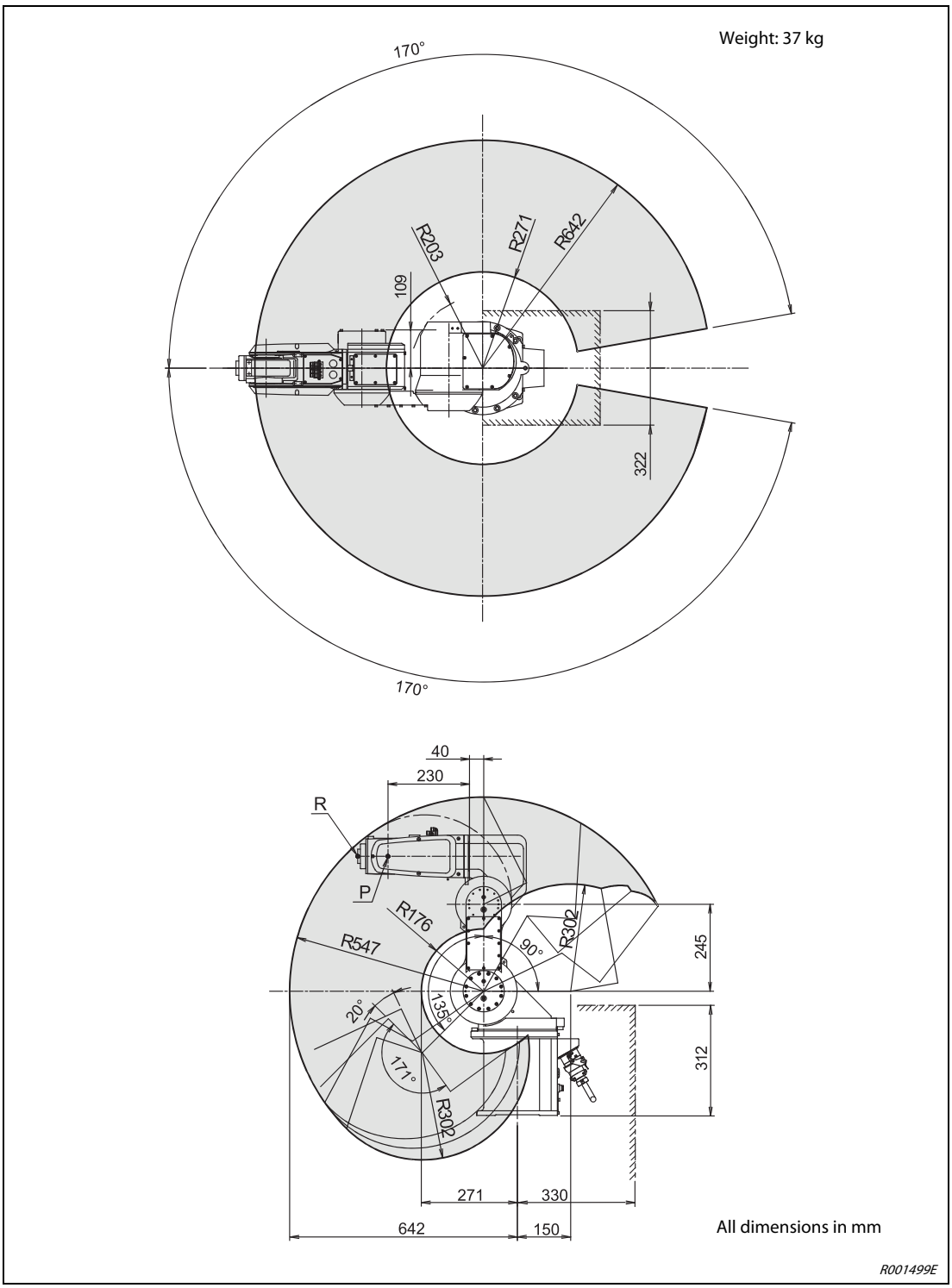


Fig. A-2: *Range of motion of robot arms RV-3SDB and RV-3SQB*

NOTE The working area stipulated refers to the P point of the robot arm without gripper hand.

The following figure shows the range of motion of robot arms RV-6SD and RV-6SQ.

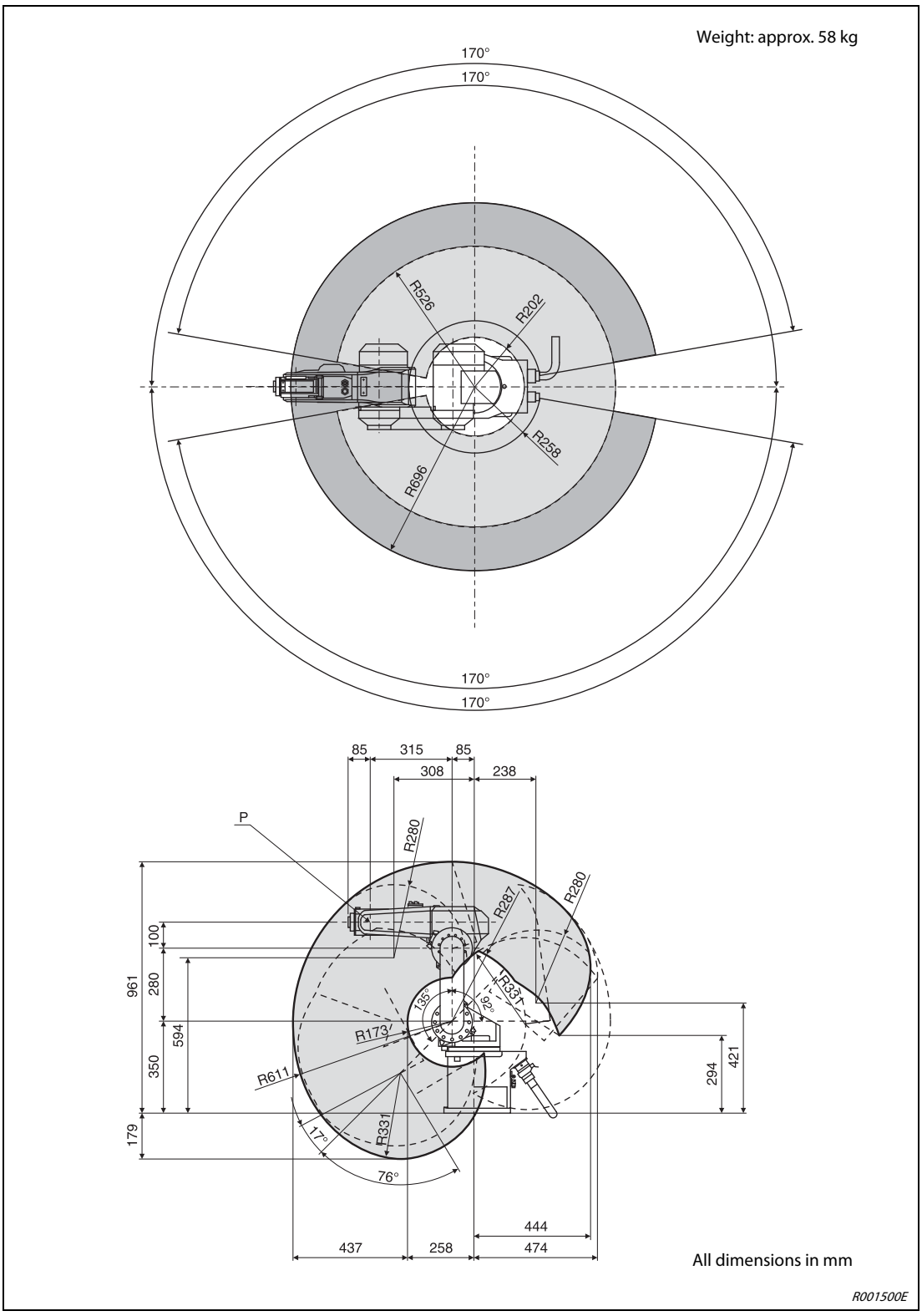


Fig. A-3: *Range of motion of robot arms RV-6SD and RV-6SQ*

NOTE The working area stipulated refers to the P point of the robot arm without gripper hand.

The following figure shows the range of motion of robot arms RV-6SDL and RV-6SQL.

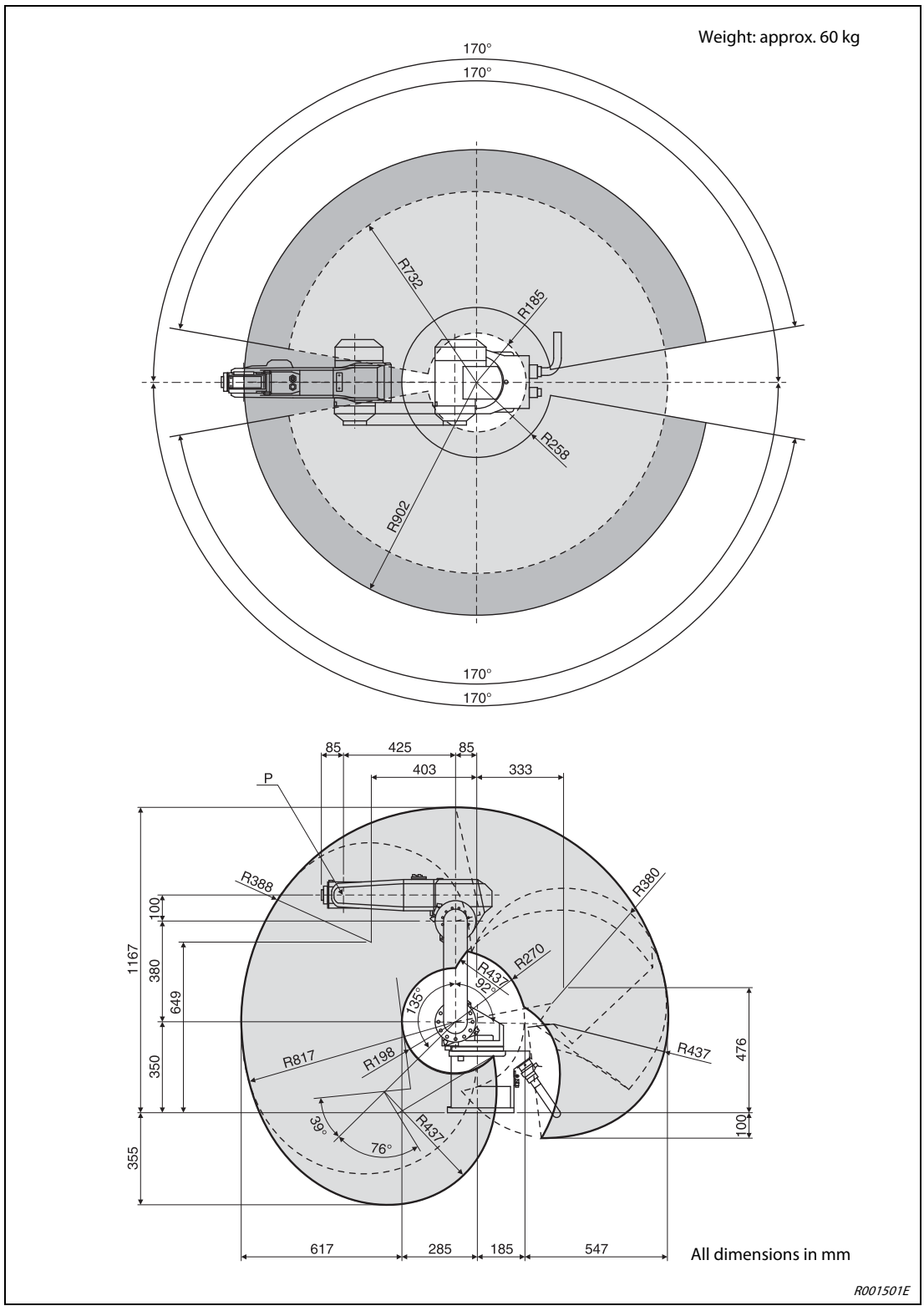


Fig. A-4: *Range of motion of robot arms RV-6SDL and RV-6SQL*

NOTE The working area stipulated refers to the P point of the robot arm without gripper hand.

The following figure shows the range of motion of robot arms RV-12SD and RV-12SQ.

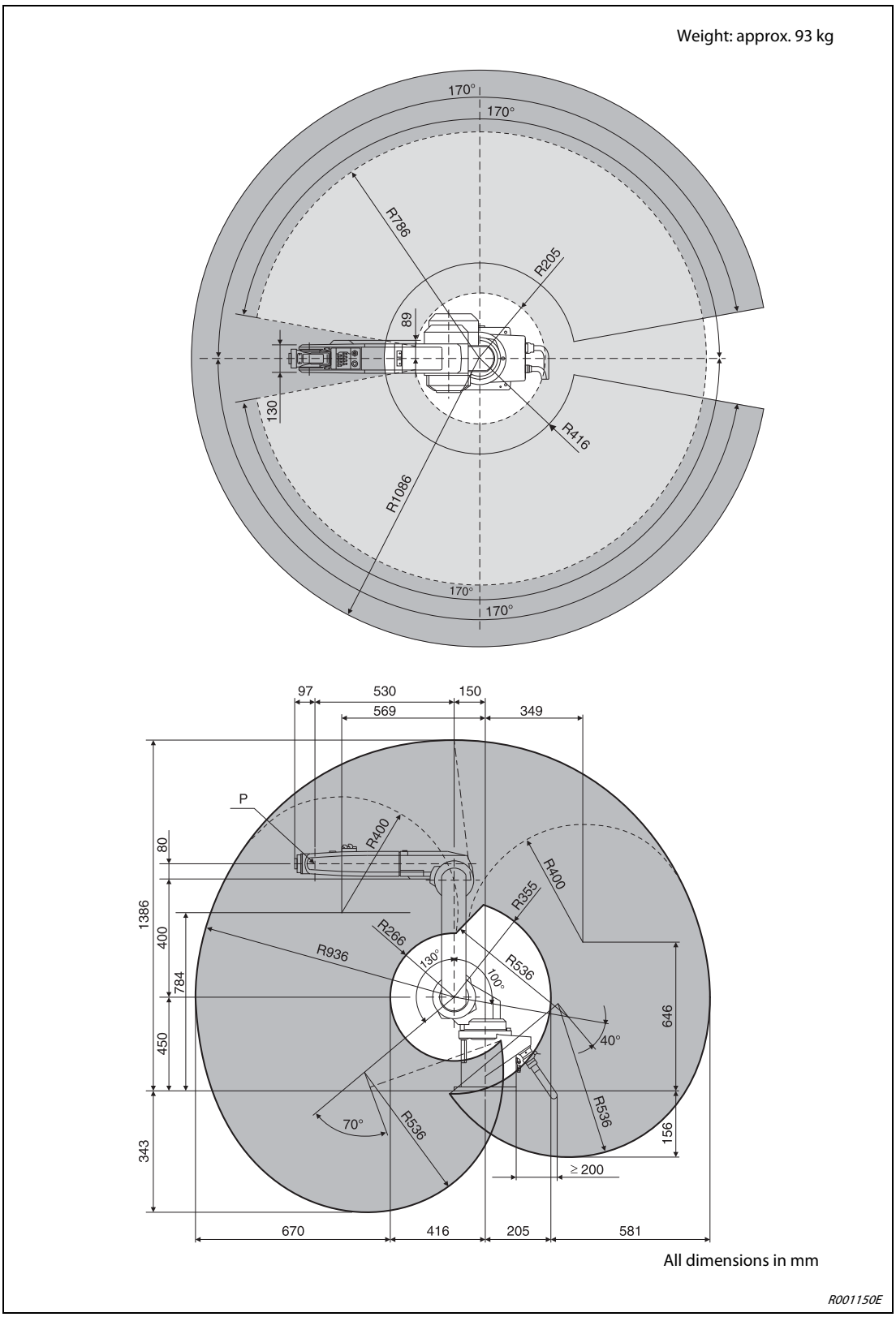


Fig. A-5: *Range of motion of robot arms RV-12SD and RV-12SQ*

NOTE The working area stipulated refers to the P point of the robot arm without gripper hand.

The following figure shows the range of motion of robot arms RV-12SDL and RV-12SQL.

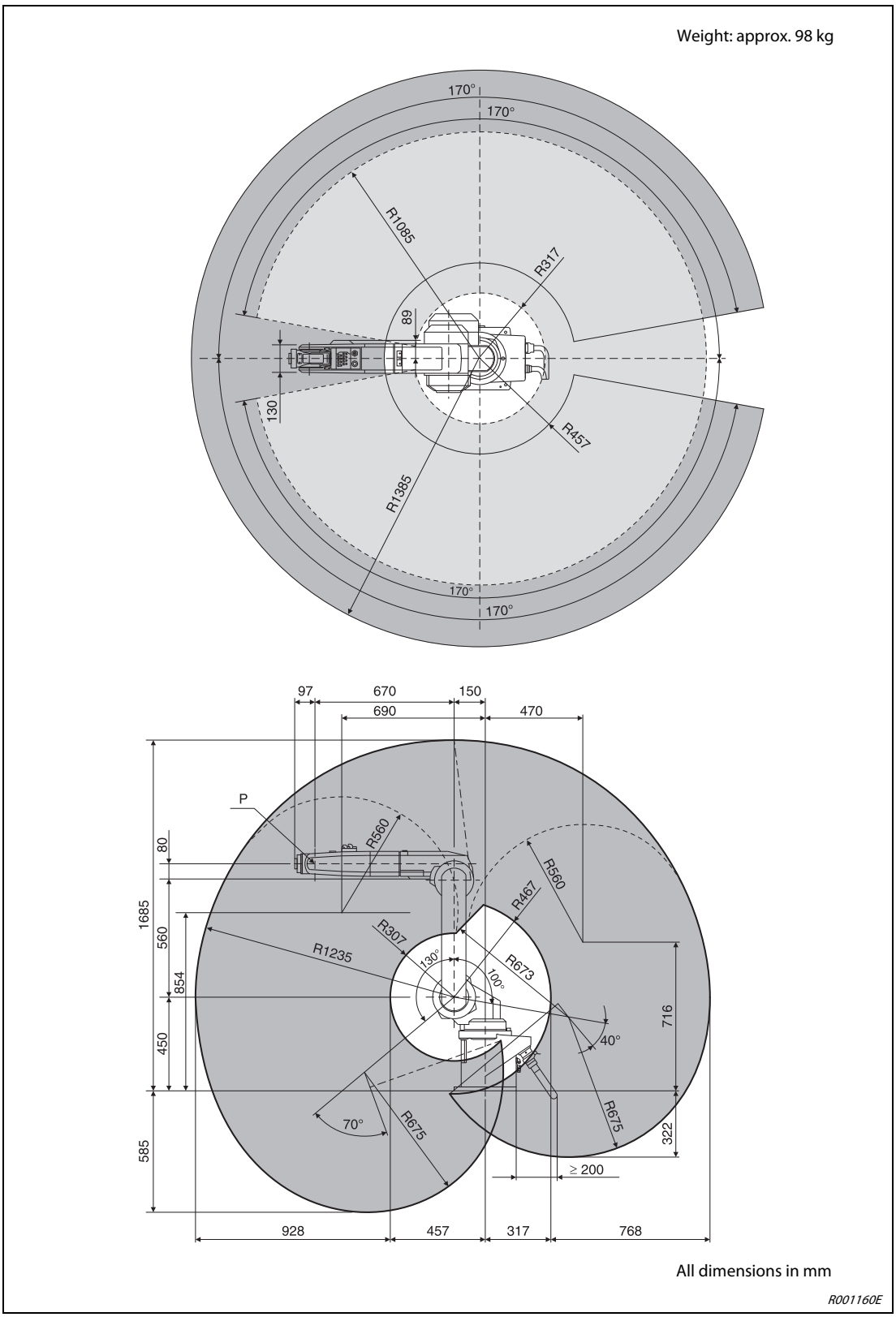


Fig. A-6: *Range of motion of robot arms RV-12SDL and RV-12SQL*

NOTE The working area stipulated refers to the P point of the robot arm without gripper hand.

The following figure shows the external dimensions and the range of motion of robot arms RH-6SDH3520 and RH-6SQH3520.

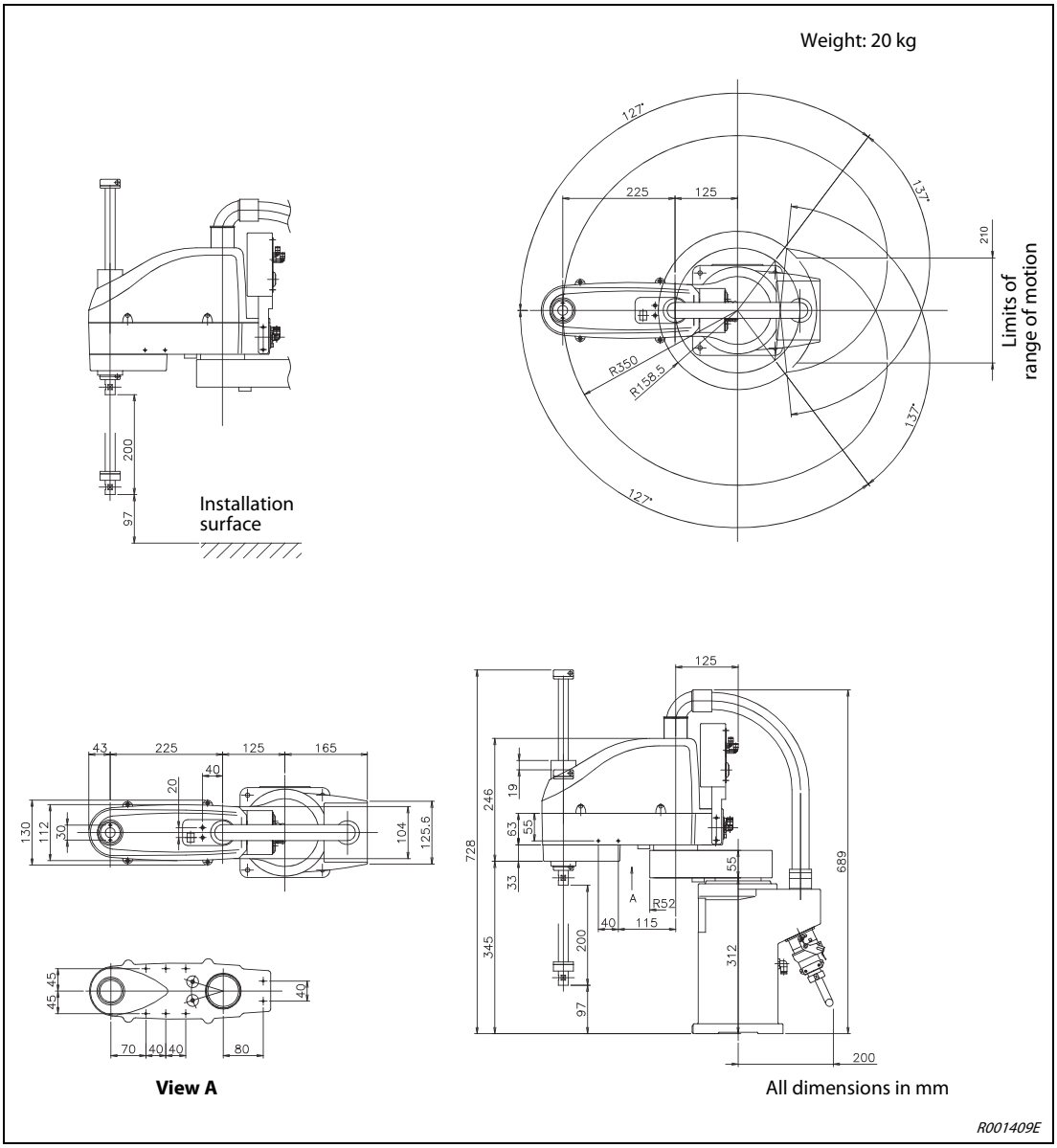


Fig. A-7: *External dimensions and range of motion of robot arms RH-6SDH3520 and RH-6SQH3520*

The following figure shows the external dimensions and the range of motion of robot arms RH-6SDH4520 and RH-6SQH4520.

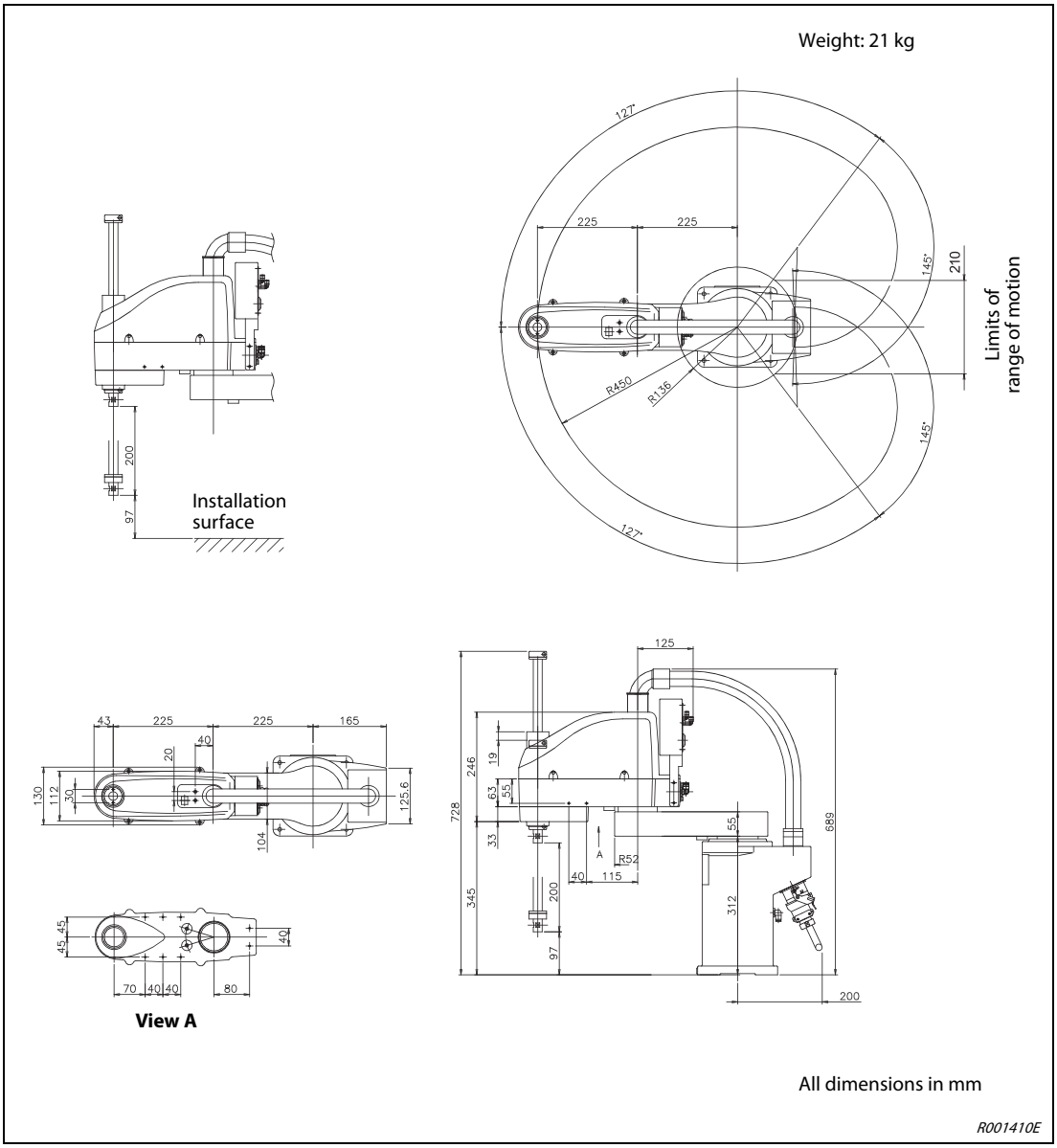


Fig. A-8: *External dimensions and range of motion of robot arms RH-6SDH4520 and RH-6SQH4520*

The following figure shows the external dimensions and the range of motion of robot arms RH-6SDH5520 and RH-6SQH5520.

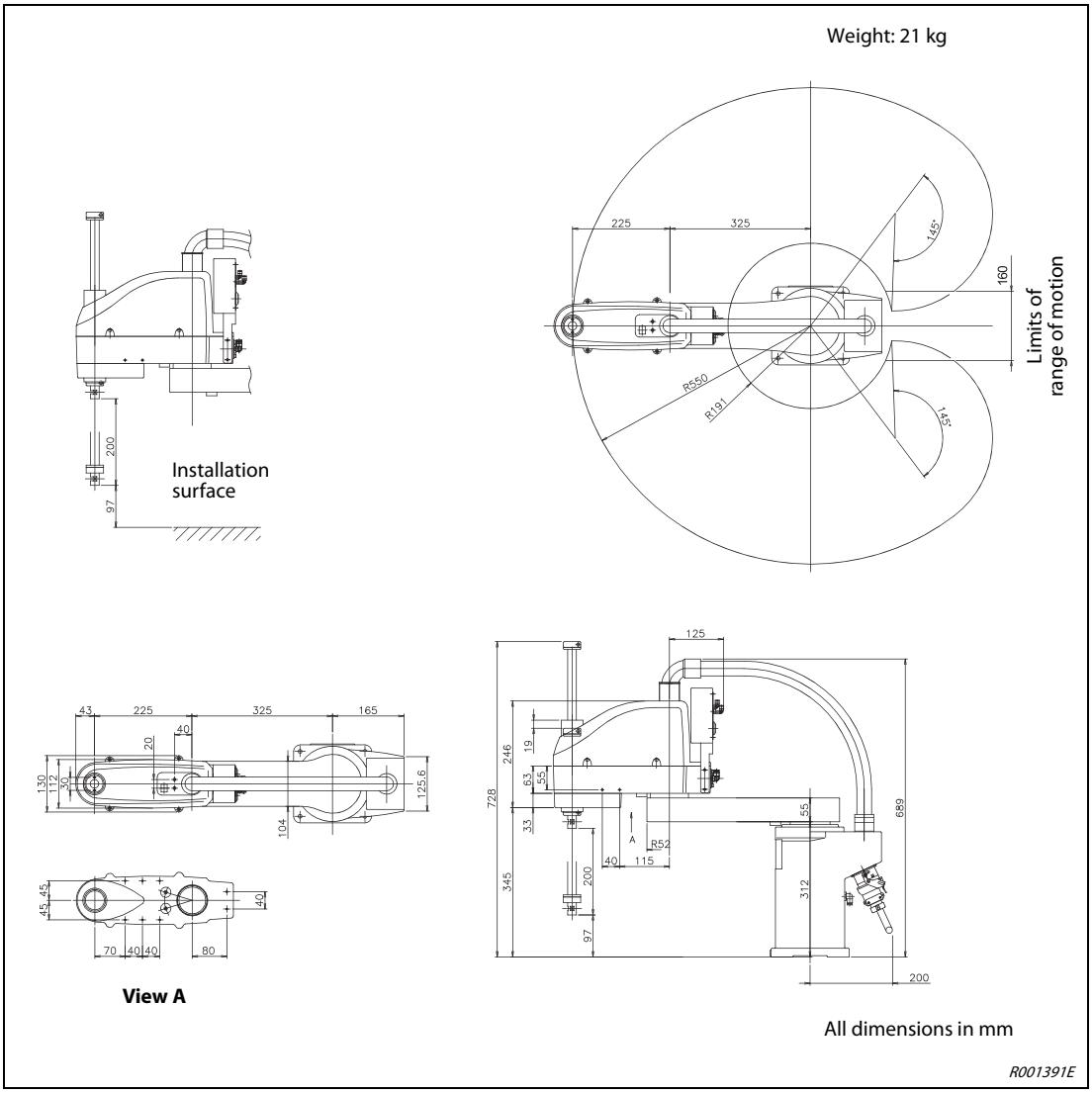


Fig. A-9: *External dimensions and range of motion of robot arms RH-6SDH5520 and RH-6SQH5520*

The following figure shows the external dimensions and the range of motion of robot arms RH-6SDH3517C and RH-6SQH3517C.

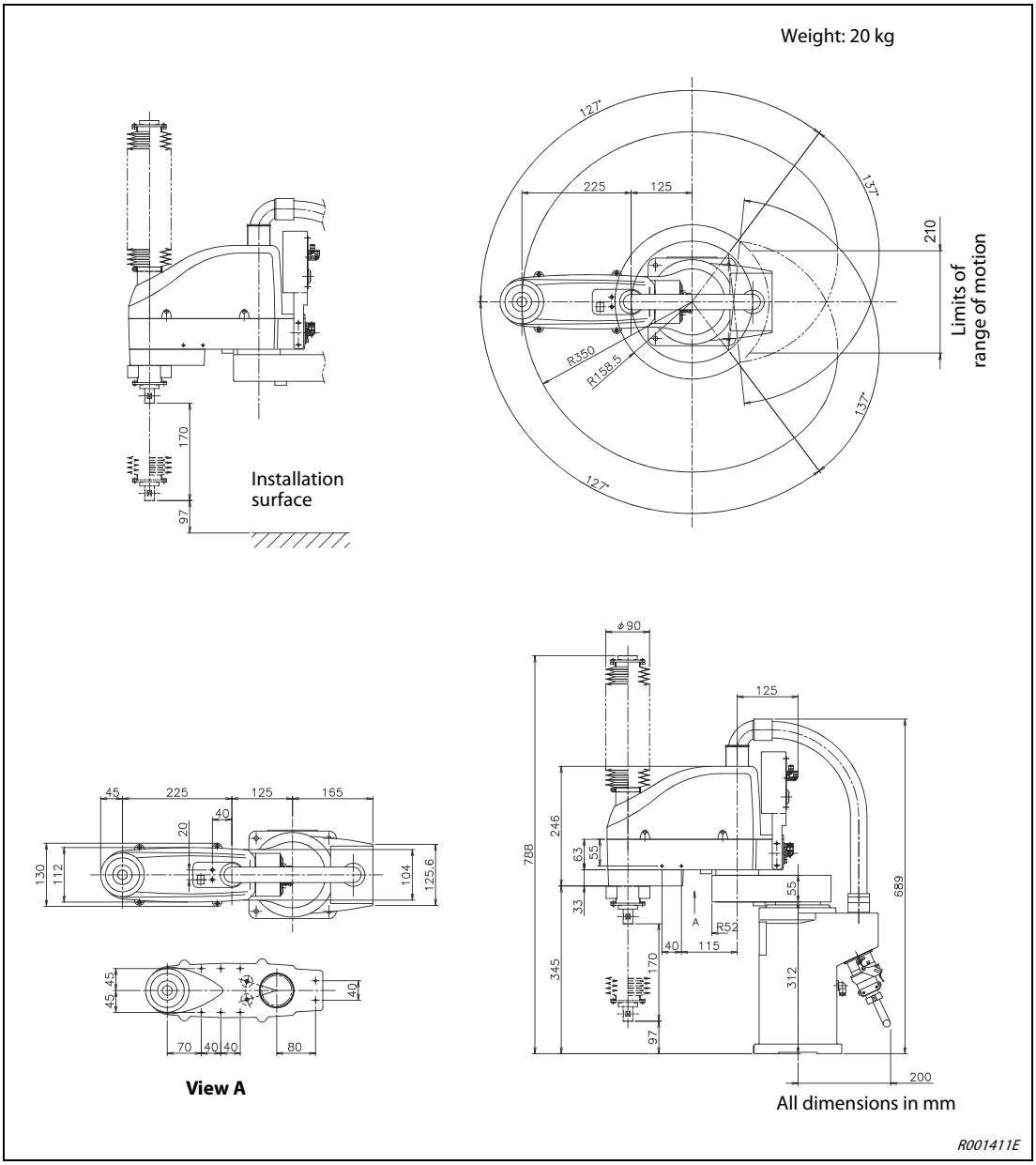


Fig. A-10: *External dimensions and range of motion of robot arms RH-6SDH3517C and RH-6SQH3517C*

The following figure shows the external dimensions and the range of motion of robot arms RH-6SDH4517C and RH-6SQH4517C.

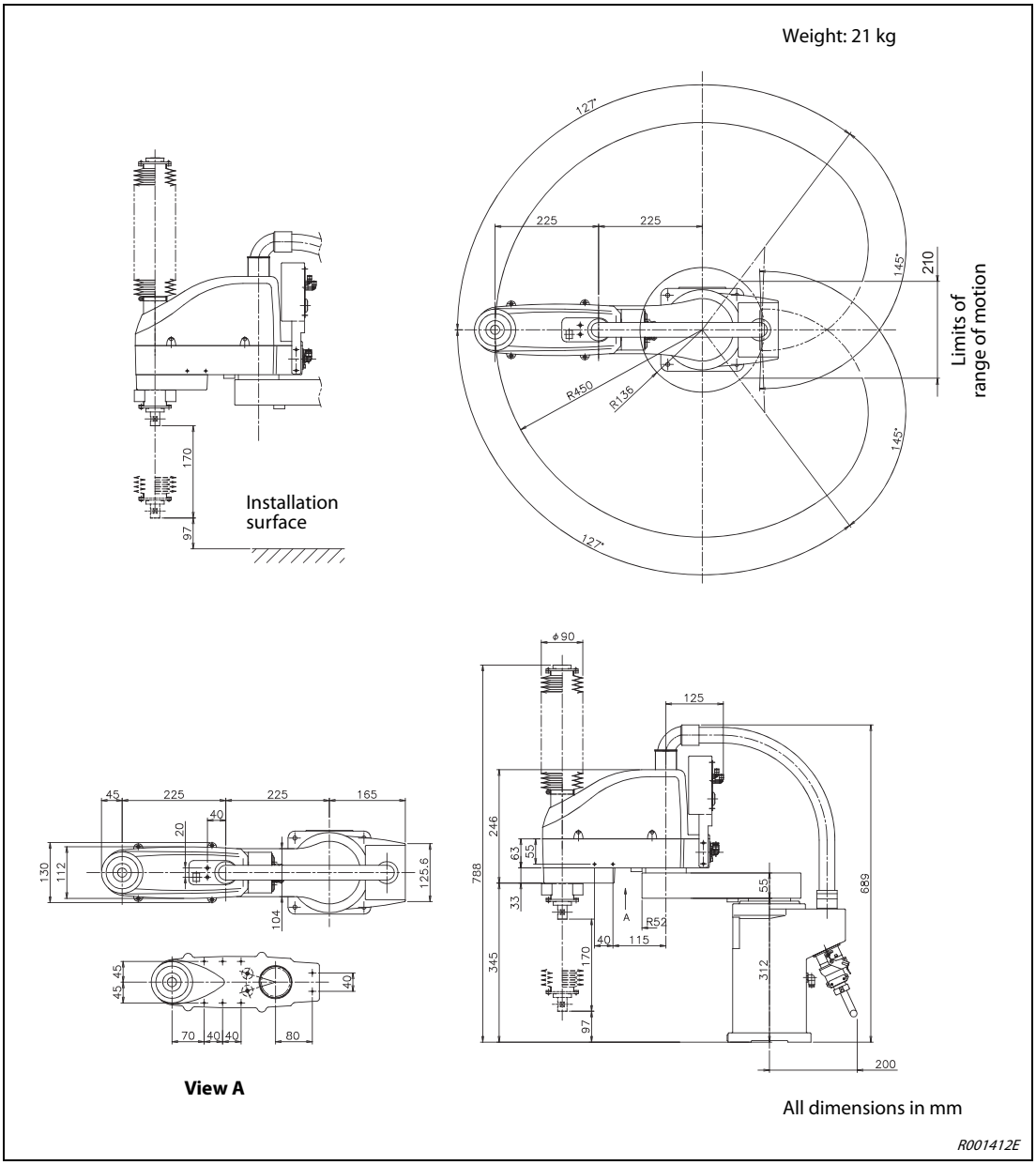


Fig. A-11: *External dimensions and range of motion of robot arms RH-6SDH4517C and RH-6SQH4517C*

The following figure shows the external dimensions and the range of motion of robot arms RH-6SDH5517C and RH-6SQH5517C.

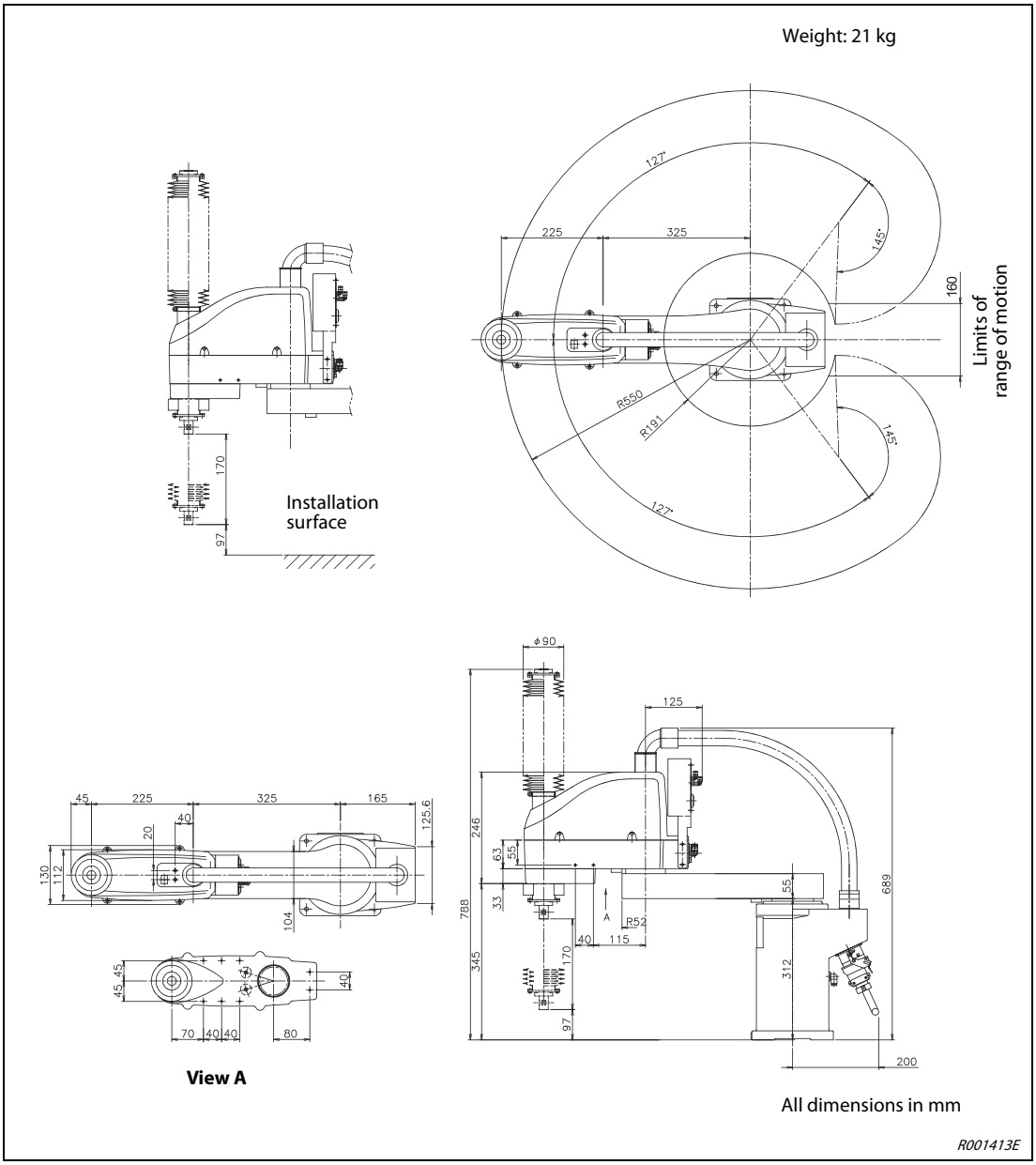


Fig. A-12: *External dimensions and range of motion of robot arms RH-6SDH5517C and RH-6SQH5517C*

The following figure shows the external dimensions and the range of motion of robot arms RH-6SDH3517M and RH-6SQH3517M.

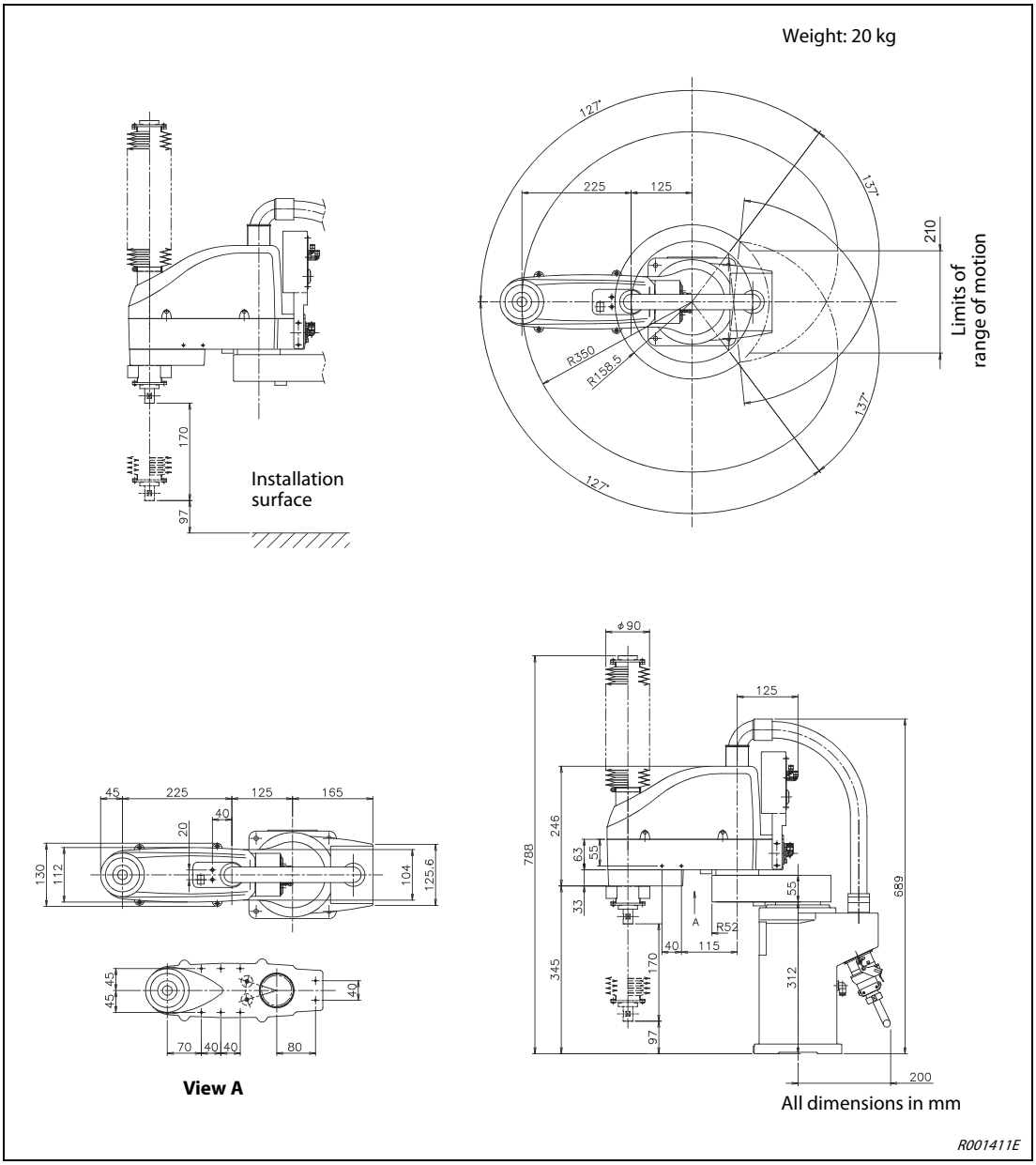


Fig. A-13: *External dimensions and range of motion of robot arms RH-6SDH3517M and RH-6SQH3517M*

The following figure shows the external dimensions and the range of motion of robot arms RH-6SDH4517M and RH-6SQH4517M.

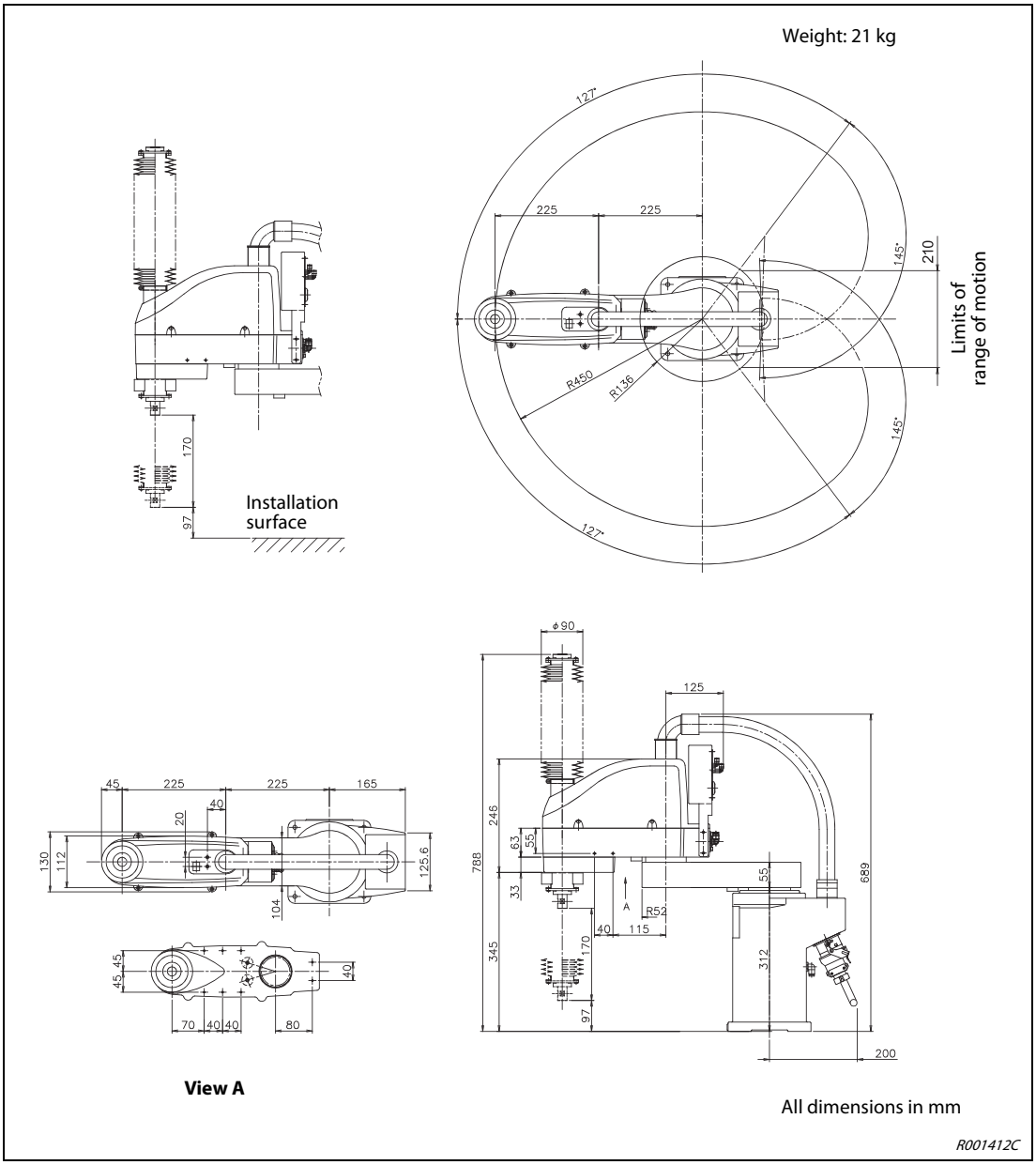


Fig. A-14: *External dimensions and range of motion of robot arms RH-6SDH4517M and RH-6SQH4517M*

The following figure shows the external dimensions and the range of motion of robot arms RH-6SDH5517M and RH-6SQH5517M.

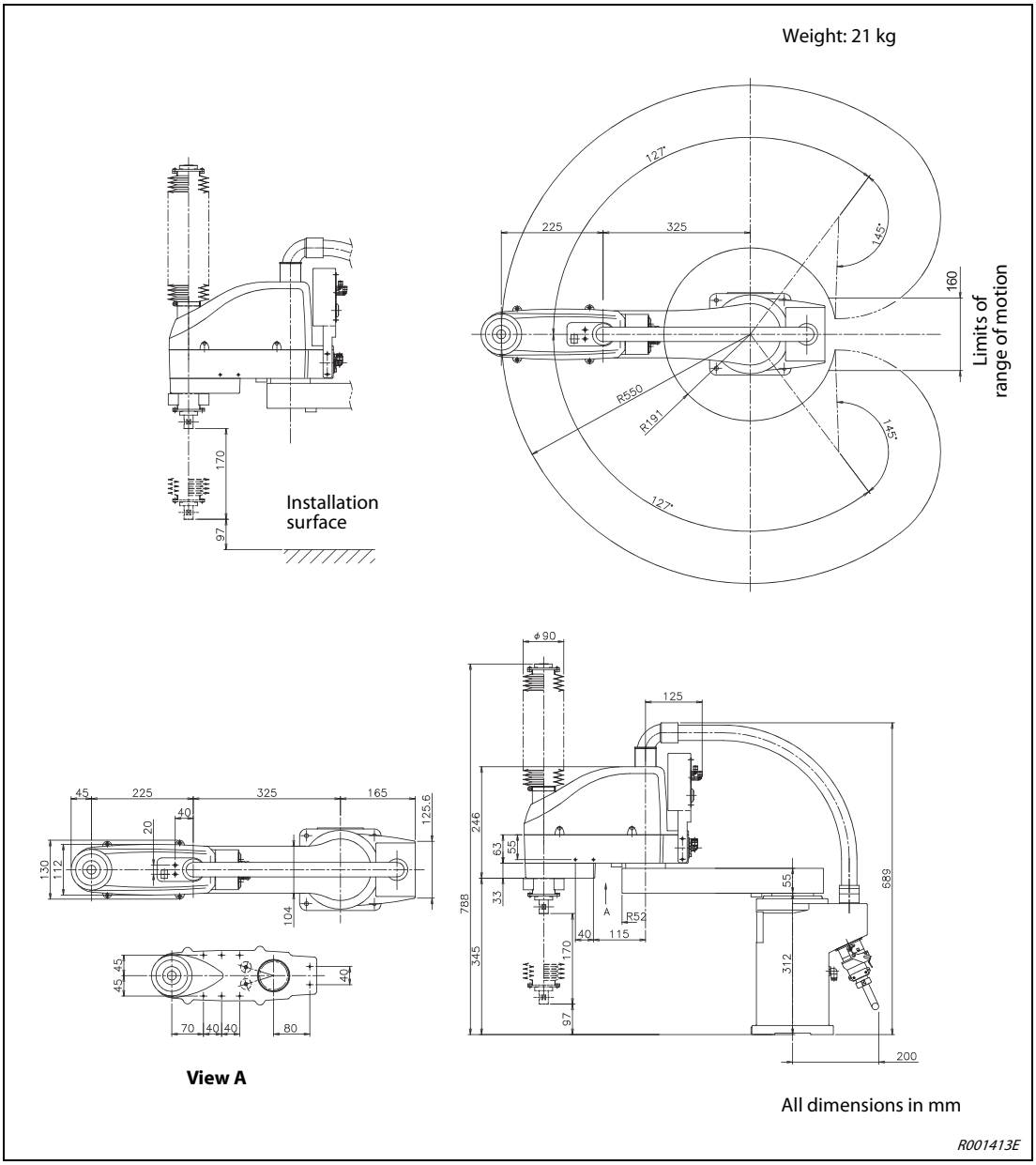


Fig. A-15: *External dimensions and range of motion of robot arms RH-6SDH5517M and RH-6SQH5517M*

The following figure shows the external dimensions and the range of motion of robot arms RH-12SDH5535 and RH-12SQH5535.

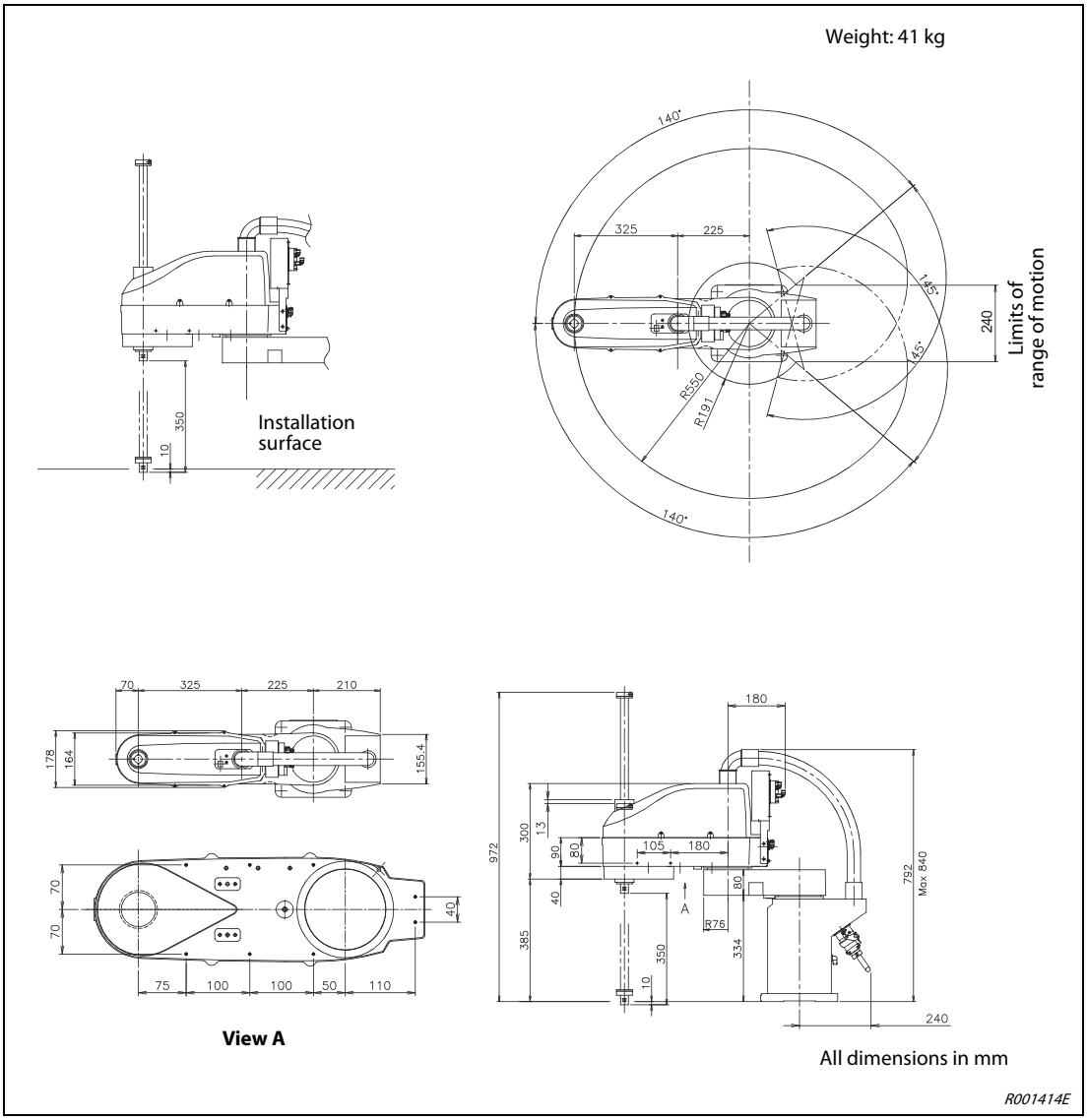


Fig. A-16: *External dimensions and range of motion of robot arms RH-12SDH5535 and RH-12SQH5535*

The following figure shows the external dimensions and the range of motion of robot arms RH-12SDH7035 and RH-12SQH7035.

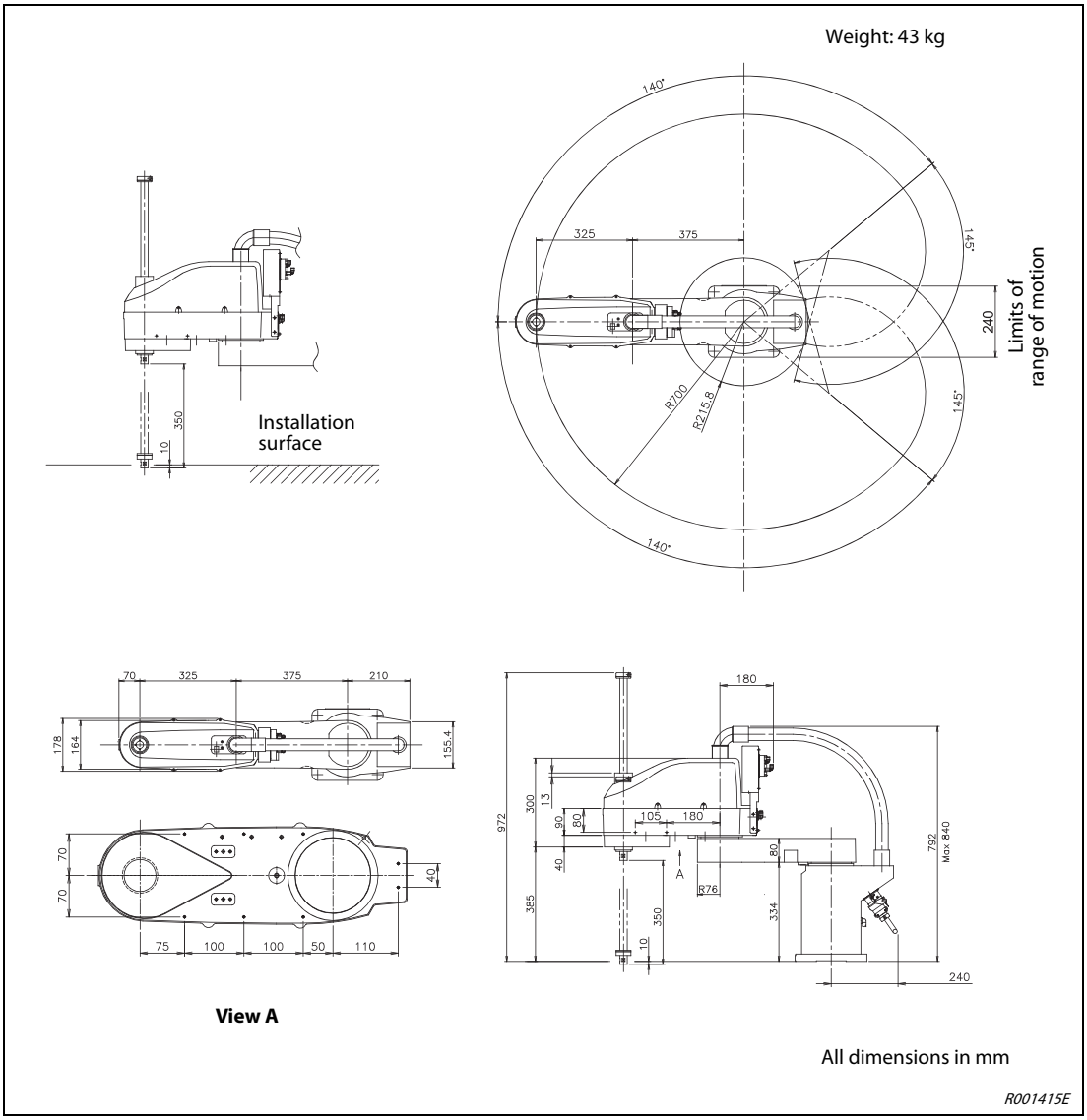


Fig. A-17: *External dimensions and range of motion of robot arms RH-12SDH7035 and RH-12SQH7035*

The following figure shows the external dimensions and the range of motion of robot arms RH-12SDH8535 and RH-12SQH8535.

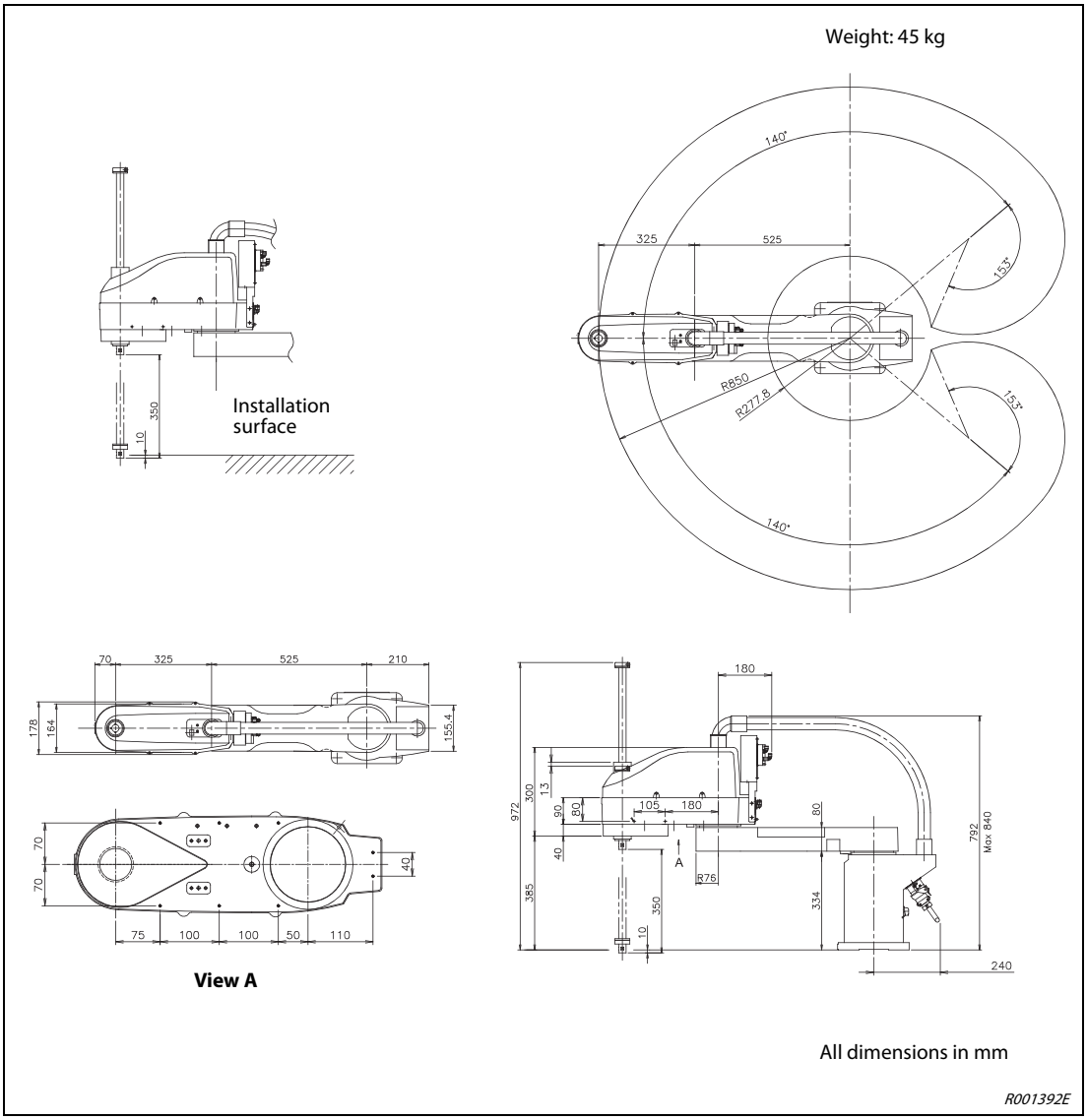


Fig. A-18: *External dimensions and range of motion of robot arms RH-12SDH8535 and RH-12SQH8535*

The following figure shows the external dimensions and the range of motion of robot arms RH-12SDH5530C and RH-12SQH5530C.

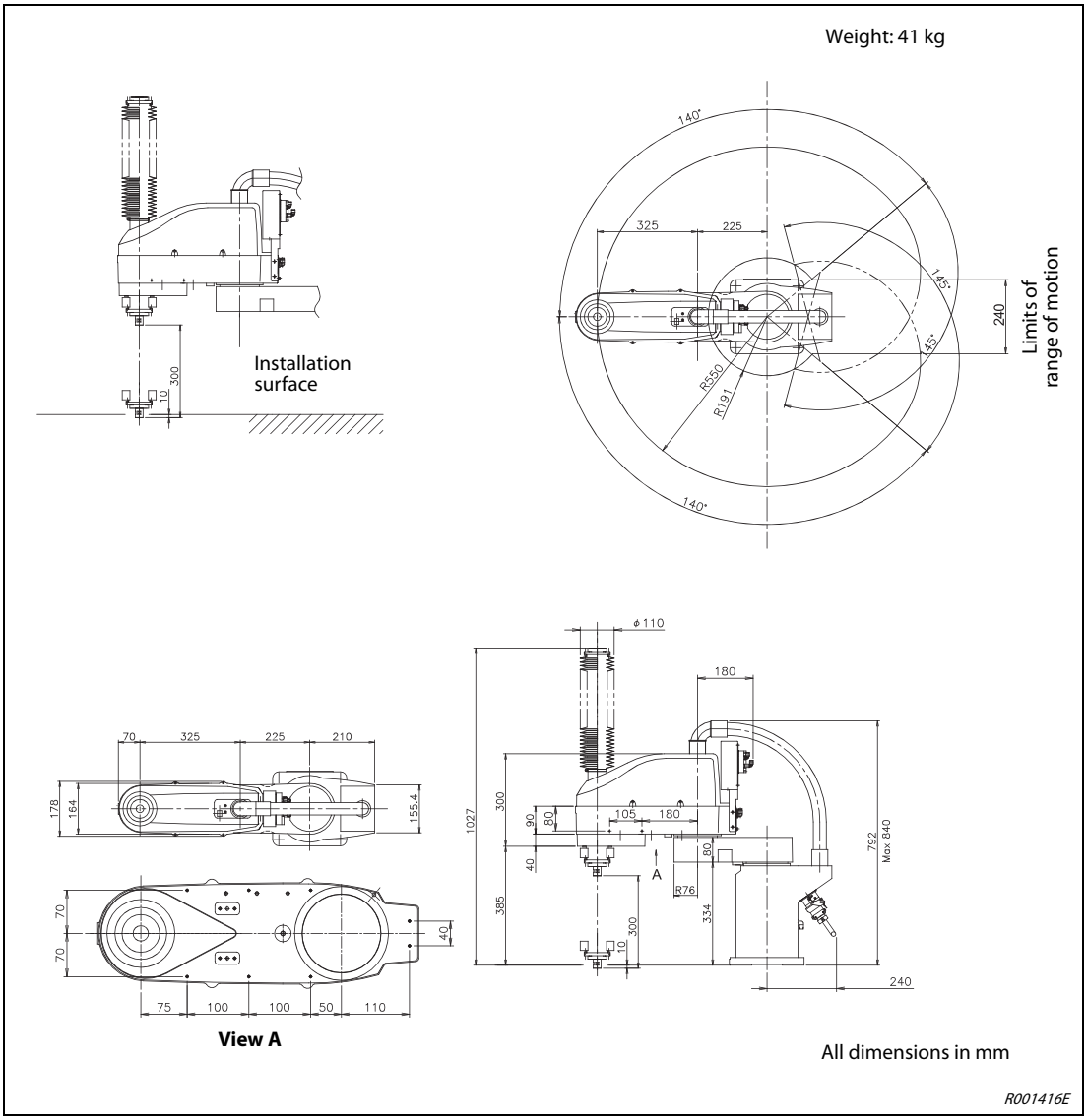


Fig. A-19: *External dimensions and range of motion of robot arms RH-12SDH5530C and RH-12SQH5530C*

The following figure shows the external dimensions and the range of motion of robot arms RH-12SDH7030C and RH-12SQH7030C.

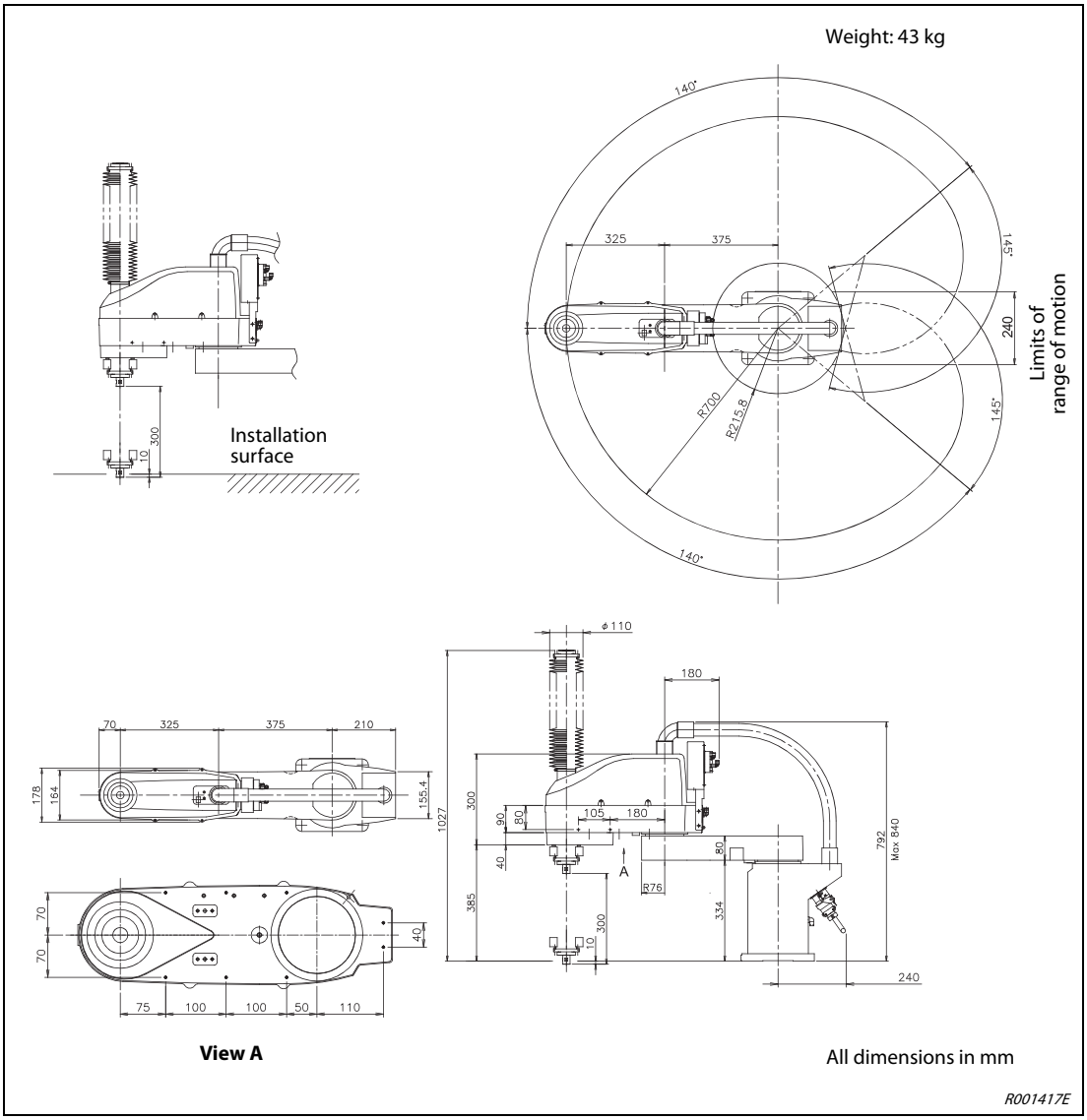


Fig. A-20: *External dimensions and range of motion of robot arms RH-12SDH7030C and RH-12SQH7030C*

The following figure shows the external dimensions and the range of motion of robot arms RH-12SDH8530C and RH-12SQH8530C.

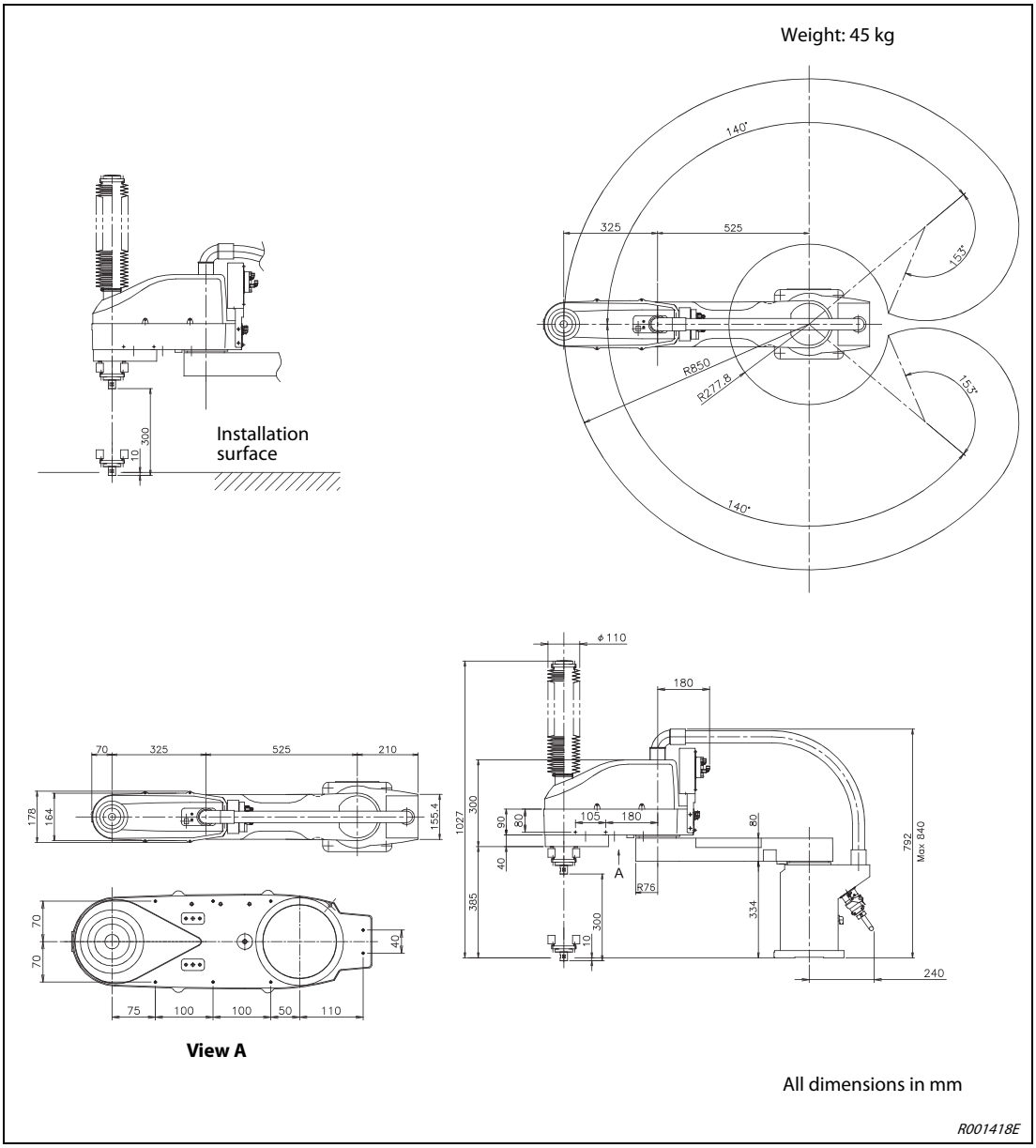


Fig. A-21: *External dimensions and range of motion of robot arms RH-12SDH8530C and RH-12SQH8530C*

The following figure shows the external dimensions and the range of motion of robot arms RH-12SDH5530M and RH-12SQH5530M.

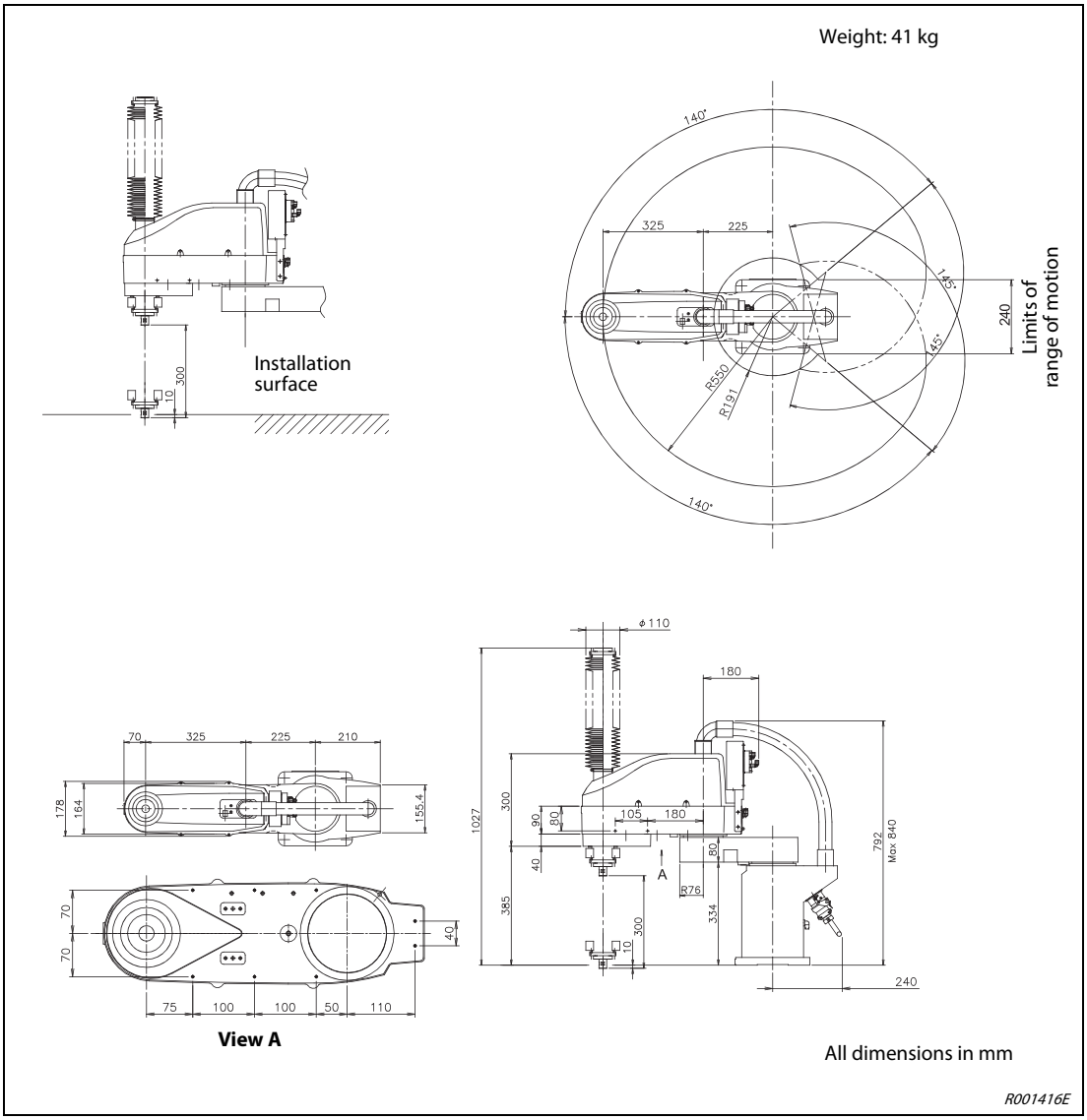


Fig. A-22: *External dimensions and range of motion of robot arms RH-12SDH5530M and RH-12SQH5530M*

The following figure shows the external dimensions and the range of motion of robot arms RH-12SDH7030M and RH-12SQH7030M.

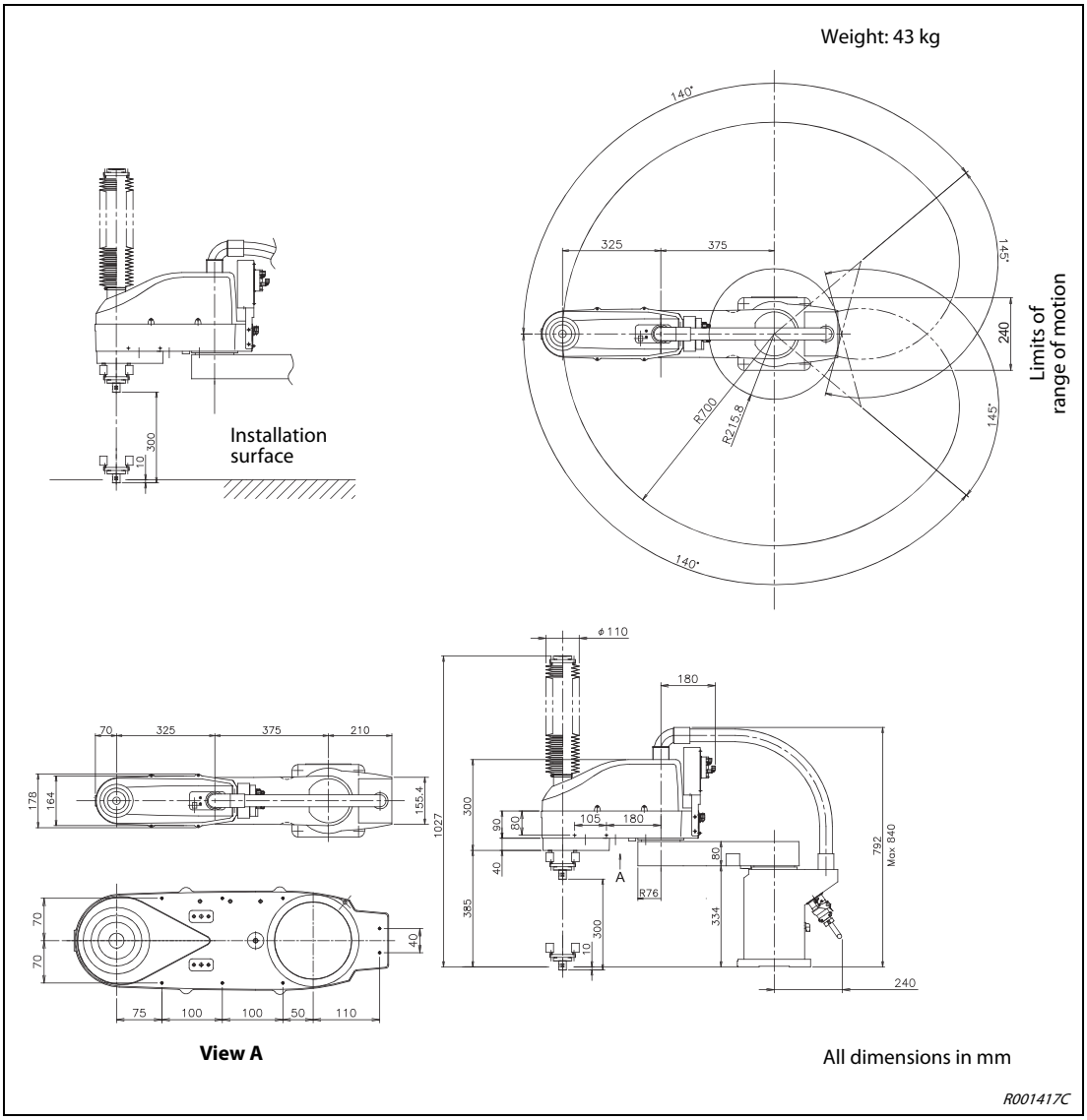


Fig. A-23: *External dimensions and range of motion of robot arms RH-12SDH7030M and RH-12SQH7030M*

The following figure shows the external dimensions and the range of motion of robot arms RH-12SDH8530M and RH-12SQH8530M.

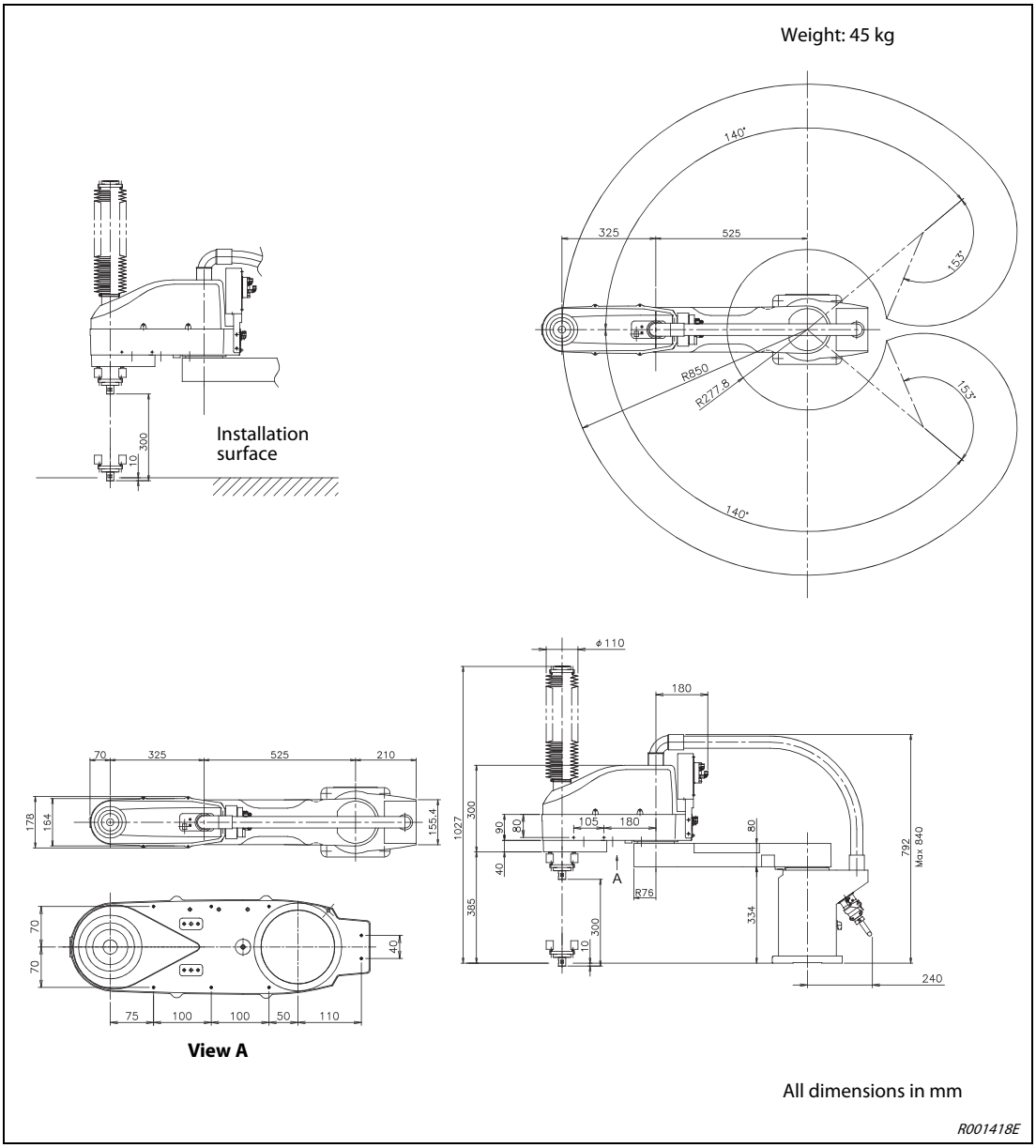


Fig. A-24: *External dimensions and range of motion of robot arms RH-12SDH8530M and RH-12SQH8530M*

The following figure shows the external dimensions and the range of motion of robot arms RH-18SDH8535 and RH-18SQH8535.

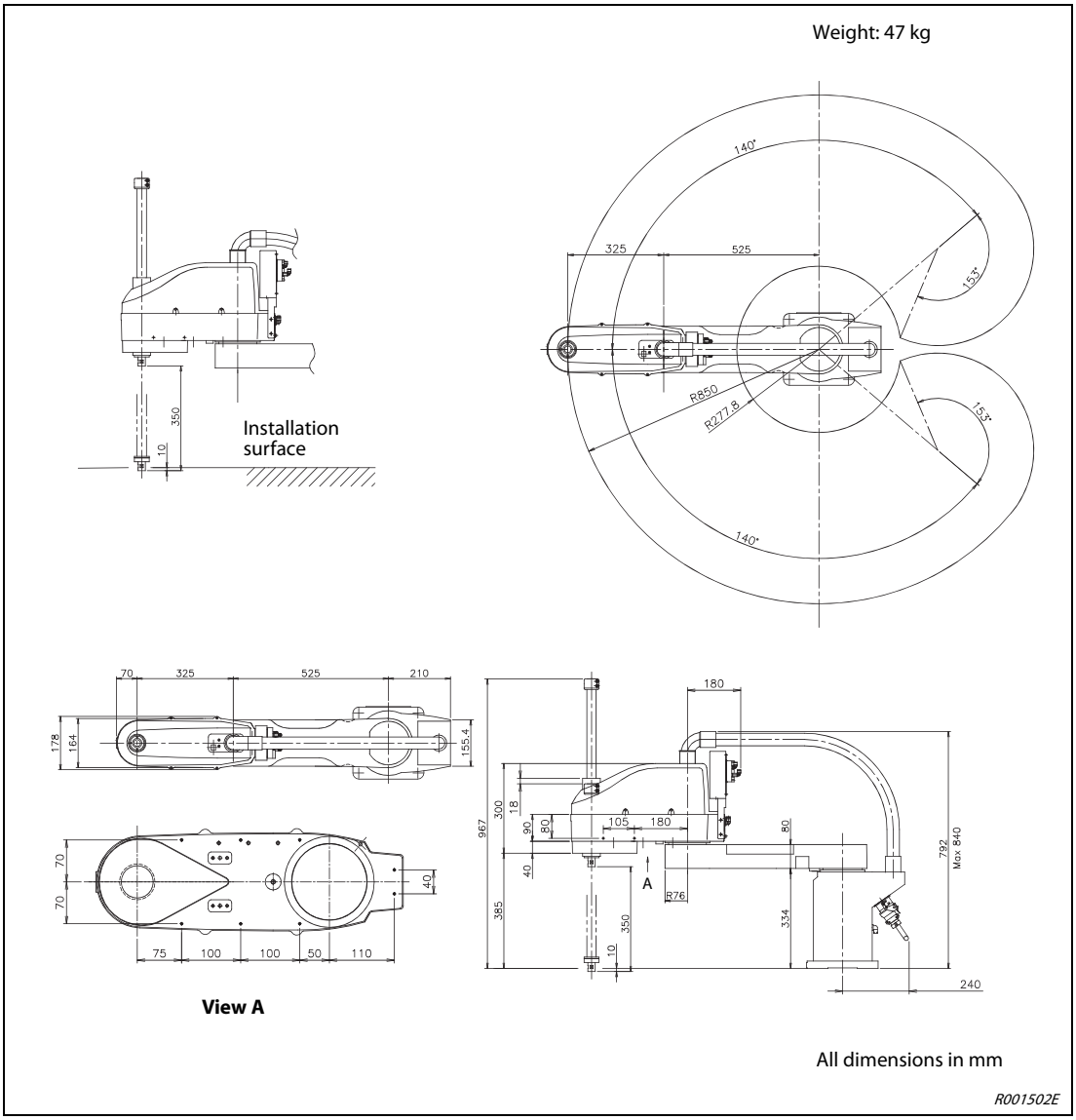


Fig. A-25: *External dimensions and range of motion of robot arms RH-18SDH8535 and RH-18SQH8535*

The following figure shows the external dimensions and the range of motion of robot arms RH-18SDH8530C and RH-18SQH8530C.

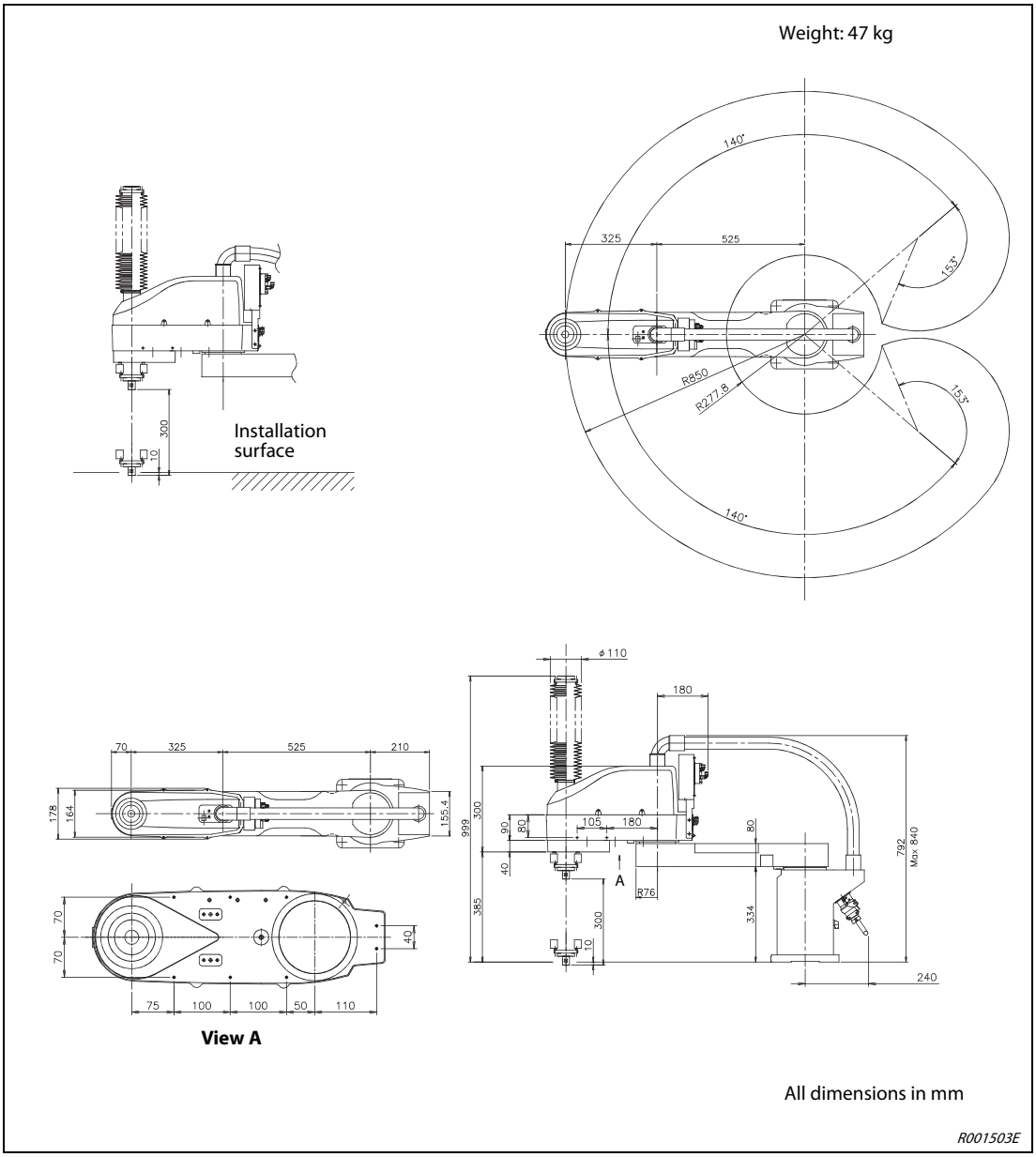


Fig. A-26: *External dimensions and range of motion of robot arms RH-18SDH8530C and RH-18SQH8530C*

The following figure shows the external dimensions and the range of motion of robot arms RH-18SDH8530M and RH-18SQH8530M.

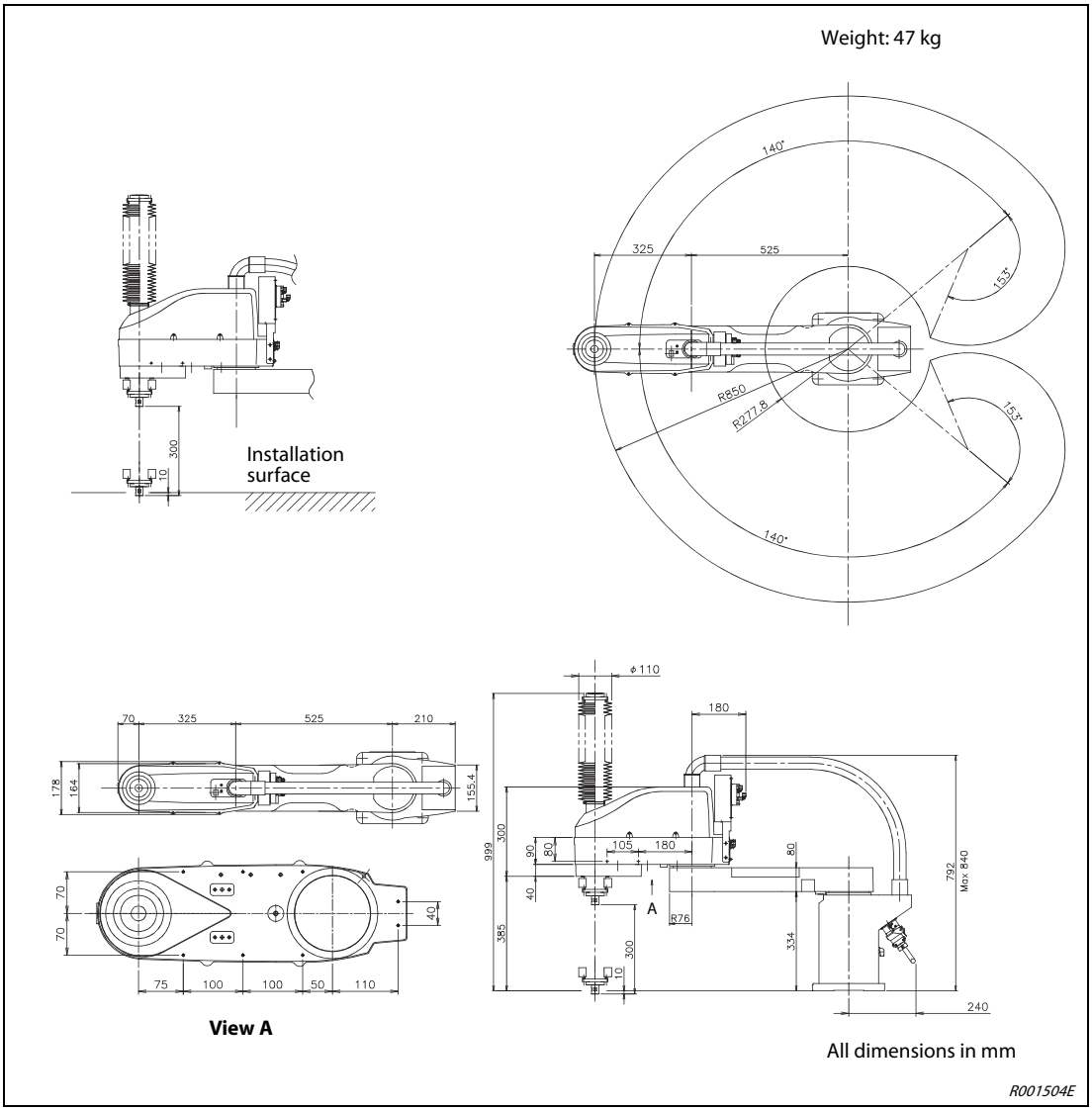


Fig. A-27: *External dimensions and range of motion of robot arms RH-18SDH8530M and RH-18SQH8530M*

A.1.2 Dimensions of the control units, the drive units and the CPU

Control unit CR2D and drive unit DU2

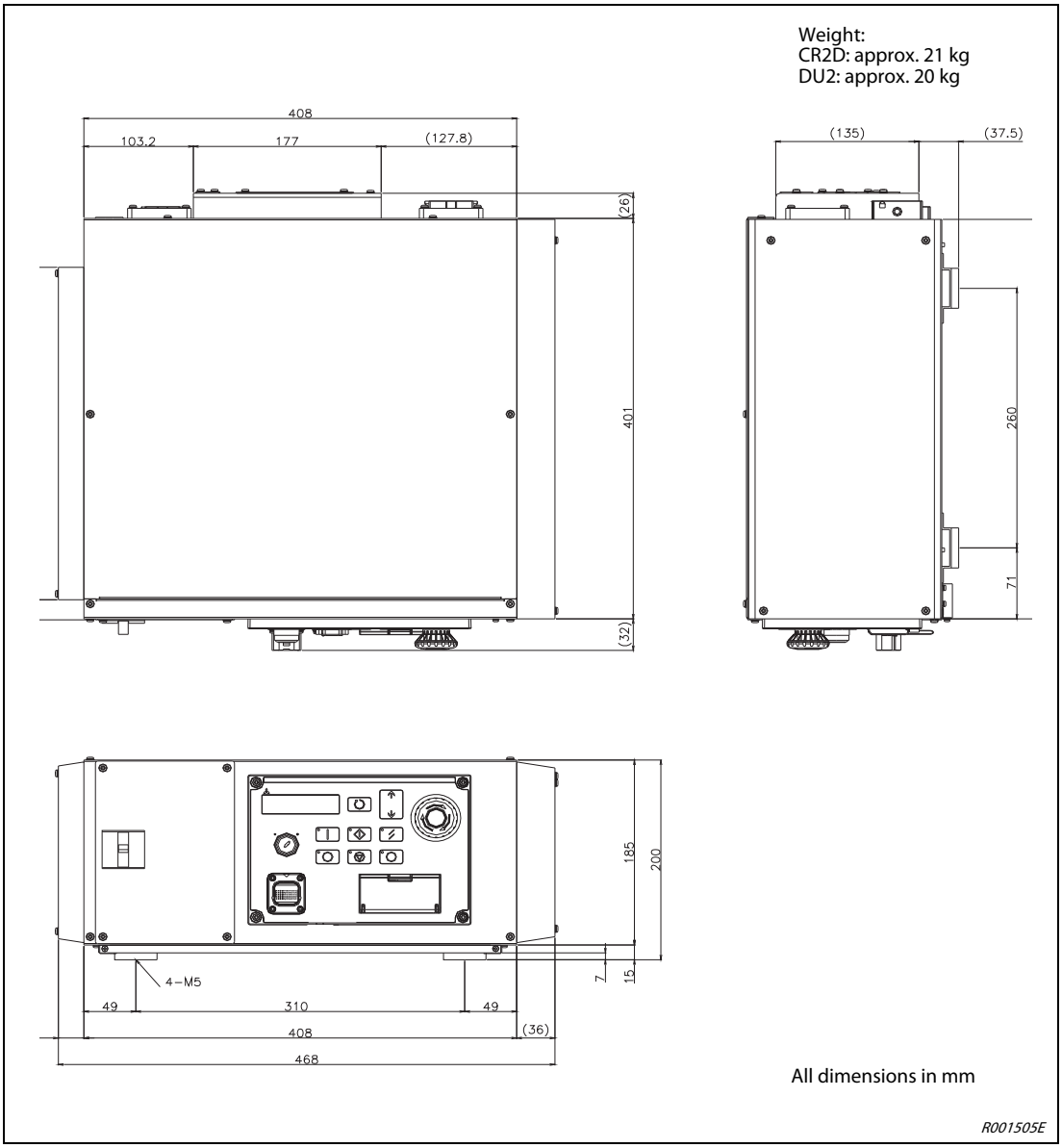


Fig. A-28: *Dimensions of control unit CR2 and drive unit DU2*

Control unit CR3D and drive unit DU3

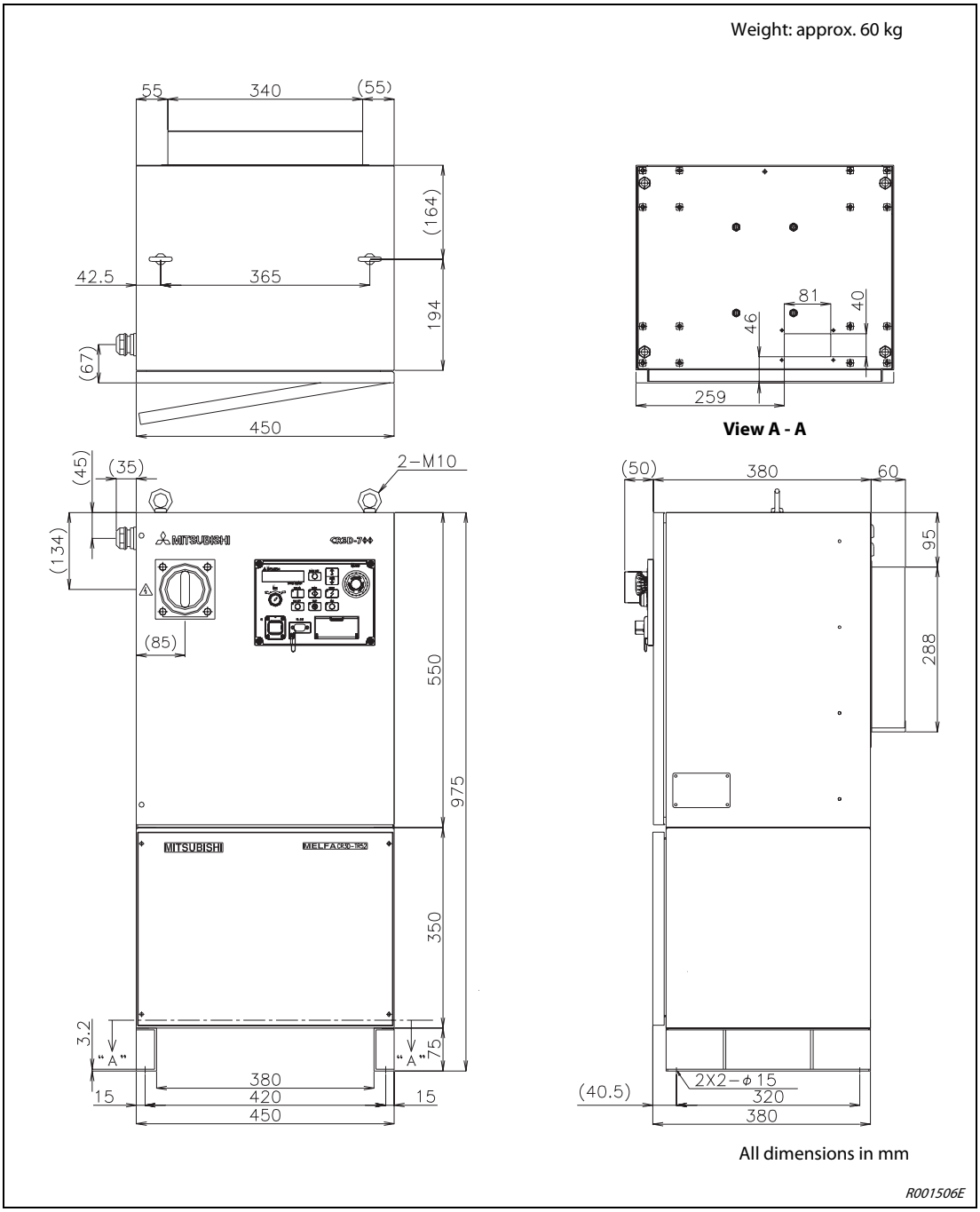


Fig. A-29: *Dimensions of control unit CR3D and drive unit DU3*

Robot CPU Q172DRCPU

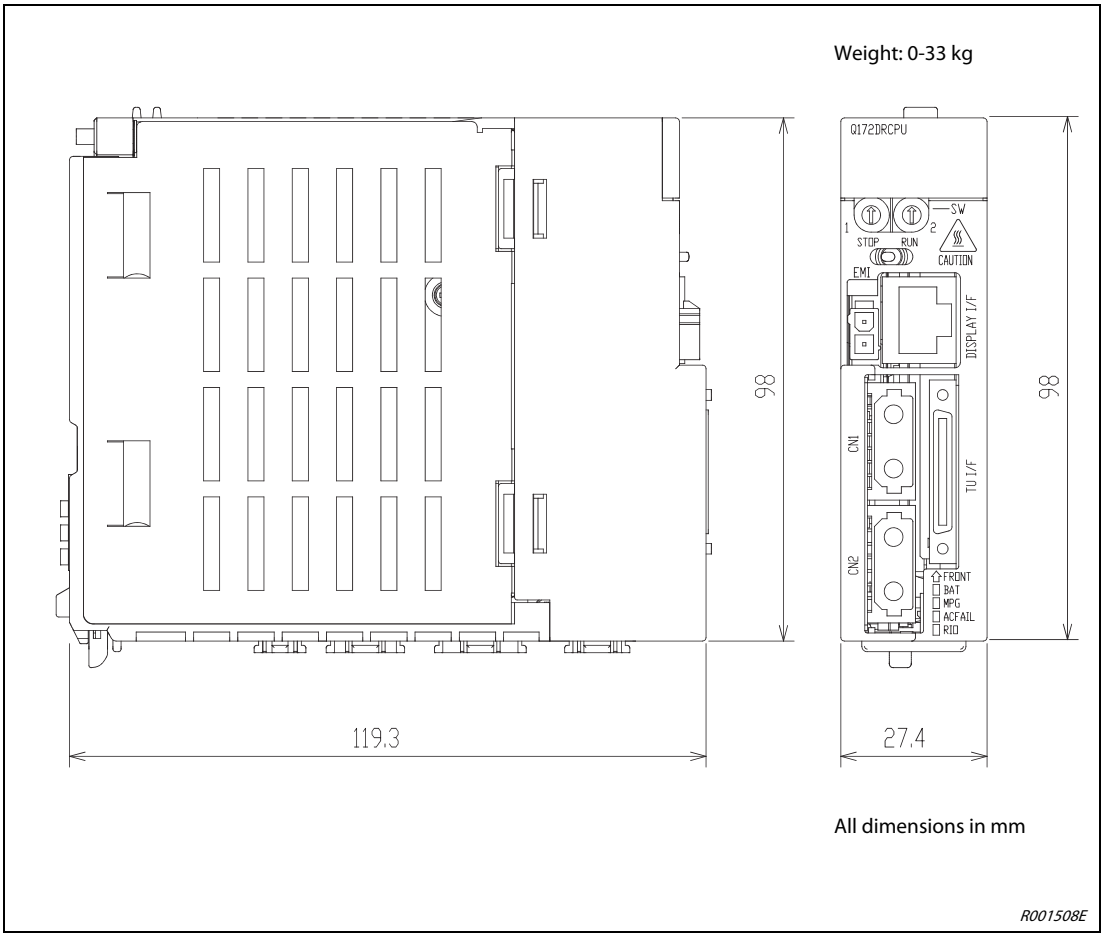


Fig. A-30: *Dimensions of robot CPU Q172DRCPU*

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Product Service

EC-Statement of Compliance

No. E6 09 04 25554 015

Holder of Certificate: **Mitsubishi Electric Corporation**
Tokyo BILD., 2-7-3 Marunouchi,
Chiyoda-ku
Tokyo
100-8310 JAPAN

Name of Object: **Industrial, Scientific and Medical equipment**
Industrial Robot

Model(s): **SD series**
(See Attachment for details)

Description of Object:

Rated Voltage:	230 VAC(1 phase)/ 230, 400 VAC(3 phases)
Rated Power:	1.7 kW (230 VAC)/ 3.4 kW (230, 400 VAC)
Protection Class:	I

Tested according to: EN 61000-6-4:2007; EN 61000-6-2:2005

This EC-Statement of Compliance is issued according to the Directive 2004/108/EC relating to electromagnetic compatibility. It confirms that the listed apparatus complies with such aspects of the essential requirements of the EMC directive as specified by the manufacturer or his authorized representative in the European Community and applies only to the sample and its technical documentation submitted to TÜV SÜD Product Service GmbH for testing and certification. See also notes overleaf.

Technical report no.: TYOEMC23189A

222149

Date, 2009-04-16

TÜV SÜD Product Service GmbH is Notified Body to the Directive 2004/108/EC of the European Parliament and of the council with the identification number 0123.

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstrasse 65 · 80339 München · Germany

Attachment
Statement No.

Product Service

E6 09 04 25554 015

Grouping Items 1:
AC 400V /230V 3 phase 3.4kW

RV-12SD(-S**), RV-12SDL(-S**),
RV-12SDC(-S**), RV-12SDLC(-S**),
RV-12SD-SUL**, RV-12SDL-SUL**,
RV-12SDC-SUL**, RV-12SDLC-SUL**,
RV-18SD(-S**), RV-18SDC(-S**),
RV-18SD-SUL**, RV-18SDC-SUL**,
RV-6SD-SM6**, RV-6SDL-SM6**,
RV-6SD-SULM6**, RV-6SDL-SULM6**,
RV-3SD-SM6**, RV-3SDB-SM6**,
RV-3SDB-SULM6**, RV-3SDJ-SM6**,
RV-3SDJB-SM6**, RV-3SDJB-SULM6**,
RH-6SDH4517M-SM6**, RH-6SDH3517M-SM6**,
RH-6SDH5517M-SM6**, RH-6SDH4517M-SULM6**,
RH-6SDH3517M-SULM6**, RH-6SDH5517M-SULM6**,
RH-12SDH7030M-SM6**, RH-12SDH5530M-SM6**,
RH-12SDH8530M-SM6**, RH-18SDH8530M-SM6**,
RH-12SDH7030M-SULM6**, RH-12SDH5530M-SULM6**,
RH-12SDH8530M-SULM6**, RH-18SDH8530M-SULM6**

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstrasse 65 · 80339 München · Germany

Attachment
Statement No.

Product Service

E6 09 04 25554 015

Grouping Items 2:
AC 230V 1 phase 1.7kW

RV-6SD(-S**), RV-6SDL(-S**),
RV-6SDC(-S**), RV-6SDLC(-S**),
RV-6SD-SUL**, RV-6SDL-SUL**,
RV-6SDC-SUL**, RV-6SDLC-SUL**,
RV-3SD-S3**, RV-3SDC-S3**,
RV-3SDB-S3**, RV-3SDBC-S3**,
RV-3SDB-SUL3**, RV-3SDBC-SUL3**,
RV-3SDJ-S3**, RV-3SDJC-S3**,
RV-3SDJB-S3**, RV-3SDJBC-S3**,
RV-3SDJB-SUL3**, RV-3SDJBC-SUL3**,
RH-6SDH4520-S3**, RH-6SDH3520-S3**,
RH-6SDH5520-S3**, RH-6SDH4517M-S3**,
RH-6SDH3517M-S3**, RH-6SDH5517M-S3**,
RH-6SDH4517C-S3**, RH-6SDH3517C-S3**,
RH-6SDH5517C-S3**, RH-6SDH4520-SUL3**,
RH-6SDH3520-SUL3**, RH-6SDH5520-SUL3**,
RH-6SDH4517M-SUL3**, RH-6SDH3517M-SUL3**,
RH-6SDH5517M-SUL3**, RH-6SDH4517C-SUL3**,
RH-6SDH3517C-SUL3**, RH-6SDH5517C-SUL3**,
RH-12SDH7035(-S**), RH-12SDH5535(-S**),
RH-12SDH8535(-S**), RH-18SDH8535(-S**),
RH-12SDH7030M(-S**), RH-12SDH5530M(-S**),
RH-12SDH8530M(-S**), RH-18SDH8530M(-S**),
RH-12SDH7030C(-S**), RH-12SDH5530C(-S**),
RH-12SDH8530C(-S**), RH-18SDH8530C(-S**),
RH-12SDH7035-SUL**, RH-12SDH5535-SUL**,
RH-12SDH8535-SUL**, RH-18SDH8535-SUL**,
RH-12SDH7030M-SUL**, RH-12SDH5530M-SUL**,
RH-12SDH8530M-SUL**, RH-18SDH8530M-SUL**,
RH-12SDH7030C-SUL**, RH-12SDH5530C-SUL**,
RH-12SDH8530C-SUL**, RH-18SDH8530C-SUL**

Attachment
Statement No.

Product Service

E6 09 04 25554 015

Nomenclature

Group A, B Model name description is shown as follows.

R V - x SD x - x
(1) (2) (3) (4) (5)

(1) V: Vertical Robot
(2) Maximum Payload specification:
6 : 6kg
12 : 12kg
18 : 18kg
(3) SD : SD series robot
(4) L : Arm extension model
C : Clean room model
LC : Clean room arm
extension model
(5) Dimension and Ambient specification:
[none] : driven by R/C
CR3D-7*1M (for RV-12SD)
CR2D-7*1 (for RV-6SD)
SM6xx: Oil mist model driven by R/C
CR3D-7*1M-SM6xx (only RV-6SD)
SULxx:UL specification/driven by R/C
CR3D-7*1M-SULxx (for RV-12SD)
CR2D-7*1-SULxx (for RV-6SD)
SULM6xx:UL specification/
Oil mist model driven by R/C
CR3D-7*1M-SULM6xx(only RV-6SD)

Group C Model name description is shown as follows.

RV-3 SD J B x - x
(1) (2) (3) (4) (5) (6) (7)

(1) V: Vertical Robot
(2) Rated Payload specification:
3 : 3kg
(3) SD : SD series robot
(4) J : 5 axes exist
[none] : 6 axes exist
(5) B : All axes are equipped with brake
[none] : Basic model
J4 axis and J6 axis are not equipped with brake.
(6) C : Clean room model
[none] : Basic model

Attachment

Statement No.

Product Service

E6 09 04 25554 015

(7) Special specification number
Pilot number and specification as follows
S3xx : driven by R/C CR2D-7*1-S3xx
SM6xx : R/C Oil mist model
driven by R/C CR3D-7*1M-SM6xx
SUL3xx : UL specification and R/C Oil mist model
driven by R/C CR2D-7*1-SUL3xx
SULM6xx: UL specification R/C Oil mist model
driven by R/C CR3D-7*1M-SULM6xx

Group D Model name description is shown as follows.
RH-x SDH xx xx x - xx
(1)(2) (3) (4) (5) (6) (7)
(1)H: Horizontal Robot
(2) Maximum Payload specification:
6 : 6kg
12 : 12kg
18 : 18kg
(3) SD : SD series robot
(4) Arm length(No1 and No2 arm) specification:
35 : 350 mm arm
45 : 450 mm arm
55 : 550 mm arm
70 : 700 mm arm
(5) Z axis working area specification:
17 : 170 mm arm
20 : 200 mm arm
30 : 300 mm arm
32 : 320 mm arm
(6) Dimension and Ambient specification:
M : Oil mist model
C : Clean room model
[none] : Basic model
(7) Optional specification:
S3xx : driven by R/C CR2D-7*1-S3xx
(only RH-6SDH)
SM6xx: Oil mist model driven by R/C
CR3D-7*1-SM6xx
SULxx: UL specification driven by R/C
CR3D-7*1M-SULxx
(only RH-12 / 18SDH)
SUL3xx: UL specification driven by R/C
CR2D-7*1-SUL3xx (only RH-6SDH)
SULM6xx:UL specification /
Oil mist model driven by R/C
CR3D-7*1M-SULM6xx
(only RV-12 / 18SDH)

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstrasse 65 · 80339 München · Germany

MITSUBISHI ELECTRIC
Changes for the Better

EC Declaration of Conformity

We, the undersigned,

Manufacturer	MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS
Address, City	1-14,Yada-minami 5-chome, Higashi-ku, Nagoya 461-8670
Country	Japan
Phone number	+81 52 712 2354
Fax number/e-mail	+81 52 722 0384
Authorized representative in Europe	MITSUBISHI Electric Europe B.V
Address, City	40880 Ratingen
Country	Germany

Certify and declare under our sole responsibility that the following apparatus:

Type Name	Industrial Robot
Manufacturer	MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS
Brand	MELFA
Model No.	SD series
Restrictive use	For industrial environment only

Conforms with the essential requirements of the **EMC Directive 2004/108/EC** and the **Machinery Directive 2006/42/EC**, based on the following specifications applied:

EU Harmonized Standards		Non-harmonized Standard
EMC(2004/108/EC)	EN61000-6-4:2007 EN61000-6-2:2005	CISPR 11:2003+A2:2006
Machinery(2006/42/EC)	Type A:Fundamental safety standards EN ISO12100-1:2003 EN ISO12100-2:2003 EN 1050:1997 Type B:Group safety standards B1:Safety aspects EN60204-1:2006, EN294:1992, EN349:1993 ISO13849-1:2006 Type C:Machine Safety standard ISO10218-1:2006	N/A

and therefore complies with the essential requirements and provisions of the EMC Directive and the Machinery Directive.

MITSUBISHI ELECTRIC
Changes for the Better

The Technical documentation is kept at the following address:

Company	MITSUBISHI Electric Europe B.V
Address, City	Gothaer St. 8 40880 Ratingen
Country	Germany
Phone number	+49 2102 486 0
Fax number	+49 2102 486 1120

Date	October 13, 2009
Name and position of person binding the manufacturer	Takaaki Nishimura Takaaki Nishimura Manager Robot Manufacturing Department MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS

■ Declaration Type of models

Table 1 : The list of RV-12SD series for grouping certification. ;A group

No.	Classification	Model name 12／18kg-Load	Robot Controller
1	Oil mist basic model	**RV-12SD(-S**)**	**CR3D-701M(-S**)**
2	Oil mist arm extension model	**RV-12SDL(-S**)**	
3	Oil mist ／heavy load model	**RV-18SD(-S**)**	
4	Clean room basic model (Class 10)	**RV-12SDC(-S**)**	**CR3D-701(-S**)**
5	Clean room arm extension model (Class 10)	**RV-12SDLC(-S**)**	
6	Clean room ／heavy load model (Class 10)	**RV-18SDC(-S**)**	
7	UL specification oil mist basic model including oil mist model robot controller	**RV-12SD-SUL****	**CR3D-701M-SUL****
8	UL specification oil mist arm extension model including oil mist model robot controller	**RV-12SDL-SUL****	
9	UL specification oil mist basic model including oil mist model robot controller	**RV-12SDC-SUL****	**CR3D-701-SUL****
10	UL specification oil mist arm extension model including oil mist model robot controller	**RV-12SDCL-SUL****	
11	UL specification clean room ／heavy load model	**RV-18SD-SUL****	**CR3D-701M-SUL****
12	UL specification clean room ／heavy load model	**RV-18SDC-SUL****	**CR3D-701-SUL****

Table 2 : The list of RV-6SD series for grouping certification. B group

No.	Classification	Model name 6kg-Load	Robot Controller
1	Oil mist basic model	**RV-6SD(-S**)**	**CR2D-711(-S**)**
2	Oil mist arm extension model	**RV-6SDL(-S**)**	
3	Clean room basic model (Class 10)	**RV-6SDC(-S**)**	
4	Clean room arm extension model (Class 10)	**RV-6SDLC(-S**)**	
5	Oil mist basic model including oil mist model robot controller	**RV-6SD-SM6****	**CR3D-711M(-S**)**
6	Oil mist arm extension model including oil mist model robot controller	**RV-6SDL-SM6****	
7	UL specification oil mist basic model	**RV-6SD-SUL****	**CR2D-711-SUL****
8	UL specification oil mist arm extension model	**RV-6SDL-SUL****	
9	UL specification clean room basic model (Class 10)	**RV-6SDC-SUL****	
10	UL specification clean room arm extension model (Class 10)	**RV-6SDLC-SUL****	
11	UL specification oil mist basic model including oil mist model robot controller	**RV-6SD-SULM6****	**CR3D-711M-SULM6****
12	UL specification oil mist arm extension model including oil mist model robot controller	**RV-6SDL-SULM6****	

Table 3 : The list of RV-3SD series robots for grouping certification; C group.

No.	Classification	Model name	Robot Controller
		6-axis	
1	Basic model (standard)	**RV-3SD-S3****	**CR2D-721-S3****
2	Clean room basic model (standard)	**RV-3SDC-S3****	
3	Basic model with brakes on all axis (standard)	**RV-3SDB-S3****	
4	Clean room basic model with brakes on all axis (standard)	**RV-3SDBC-S3****	
5	Oil mist basic model including robot controller *1	**RV-3SD-SM6****	**CR3D-721M-SM6****
6	Oil mist basic model with brakes on all axis including robot controller	**RV-3SDB-SM6****	
7	UL specification and basic model with brakes on all axis (standard)	**RV-3SDB-SUL3****	**CR2D-721-SUL3****
8	UL specification clean room basic model with brakes on all axis (standard)	**RV-3SDBC-SUL3****	
9	UL specification oil mist basic model with brakes on all axis including robot controller	**RV-3SDB-SULM6****	**CR3D-721M-SULM6****

Table 4 : The list of robots for grouping certification; C group -2.

No.	Classification	Model name	Robot Controller
		5-axis	
10	Basic model (standard)	**RV-3SDJ-S3****	**CR2D-731-S3****
11	Clean room basic model (standard)	**RV-3SDJC-S3****	
12	Basic model with brakes on all axis (standard)	**RV-3SDJB-S3****	
13	Clean room basic model with brakes on all axis (standard)	**RV-3SDJBC-S3****	
14	Oil mist basic model including robot controller *1	**RV-3SDJ-SM6****	**CR3D-731M-SM6****
15	Oil mist basic model with brakes on all axis including robot controller	**RV-3SDJB-SM6****	
16	UL specification basic model with brakes on all axis (standard)	**RV-3SDJB-SUL3****	**CR2D-731-SUL3****
17	UL specification clean room basic model with brakes on all axis (standard)	**RV-3SDJBC-SUL3****	
18	UL specification oil mist basic model with brakes on all axis including robot controller	**RV-3SDJB-SULM6****	**CR3D-731M-SULM6****

Table 5 : The list of RH-xSDH robots for grouping certification; D group.

No.	Classification	Model name 6kg-Load	Robot Controller
1	Basic model	**RH-6SDH4520-S3****	**CR2D-761 -S3****
2	Short arm model	**RH-6SDH3520-S3****	
3	Long arm model	**RH-6SDH5520-S3****	
4	Oil mist model	**RH-6SDH4517M-S3****	
5	Short arm／Oil mist model	**RH-6SDH3517M-S3****	
6	Long arm／Oil mist model	**RH-6SDH5517M-S3****	
7	Clean room model (Class 10)	**RH-6SDH4517C-S3****	
8	Short arm／Clean room model	**RH-6SDH3517C-S3****	
9	Long arm／Clean room model	**RH-6SDH5517C-S3****	
10	Oil mist model including R/C	**RH-6SDH4517M-SM6****	**CR3D-761M -SM6****
11	Short arm／Oil mist model including R/C	**RH-6SDH3517M-SM6****	
12	Long arm／Oil mist model including R/C	**RH-6SDH5517M-SM6****	
13	UL specification basic model	**RH-6SDH4520-SUL3****	**CR2D-761 -SUL3****
14	UL specification short arm model	**RH-6SDH3520-SUL3****	
15	UL specification long arm model	**RH-6SDH5520-SUL3****	
16	UL specification oil mist model	**RH-6SDH4517M-SUL3****	
17	UL specification short arm／Oil mist model	**RH-6SDH3517M-SUL3****	
18	UL specification long arm／Oil mist model	**RH-6SDH5517M-SUL3****	
19	UL specification clean room model (Class 10)	**RH-6SDH4517C-SUL3****	
20	UL specification short arm／Clean room model	**RH-6SDH3517C-SUL3****	
21	UL specification long arm／Clean room model	**RH-6SDH5517C-SUL3****	
22	UL specification oil mist model including R/C	**RH-6SDH4517M-SULM6****	**CR3D-761M -SULM6****
23	UL specification short arm／Oil mist model including R/C	**RH-6SDH3517M-SULM6****	
24	UL specification long arm／Oil mist model including R/C	**RH-6SDH5517M-SULM6****	

Table 6 : The list of RH-xSDH robots for grouping certification; D group -2.

No.	Classification	Model name 12／18kg-Load	Robot Controller
25	Basic model	**RH-12SDH7035(-S**)**	**CR2D-741(-S**)**
26	Short arm model	**RH-12SDH5535(-S**)**	
27	Long arm model	**RH-12SDH8535(-S**)**	
28	Long arm and heavy load model	**RH-18SDH8535(-S**)**	**CR2D-751(-S**)**
29	Oil mist model	**RH-12SDH7030M(-S**)**	**CR2D-741(-S**)**
30	Short arm／Oil mist model	**RH-12SDH5530M(-S**)**	
31	Long arm／Oil mist model	**RH-12SDH8530M(-S**)**	
32	Long arm and heavy load／Oil mist model	**RH-18SDH8530M(-S**)**	**CR2D-751(-S**)**
33	Clean room model (Class 10)	**RH-12SDH7030C(-S**)**	**CR2D-741(-S**)**
34	Short arm／Clean room model	**RH-12SDH5530C(-S**)**	
35	Long arm／Clean room model	**RH-12SDH8530C(-S**)**	
36	Long arm and heavy load／Clean room model (Class 10)	**RH-18SDH8530C(-S**)**	**CR2D-751(-S**)**
37	Oil mist model including R/C	**RH-12SDH7030M-SM6****	**CR3D-741M -SM6****
38	Short arm／Oil mist model including R/C	**RH-12SDH5530M-SM6****	
39	Long arm／Oil mist model including R/C	**RH-12SDH8530M-SM6****	
40	Long arm and heavy load／Oil mist model including R/C	**RH-18SDH8530M-SM6****	**CR3D-751M -SM6****
41	UL specification basic model	**RH-12SDH7035-SUL****	**CR2D-741-SUL****
42	UL specification short arm model	**RH-12SDH5535-SUL****	
43	UL specification long arm model	**RH-12SDH8535-SUL****	
44	UL specification long arm and heavy load model	**RH-18SDH8535-SUL****	**CR2D-751-SUL****
45	UL specification oil mist model	**RH-12SDH7030M-SUL****	**CR2D-741-SUL****
46	UL specification short arm／Oil mist model	**RH-12SDH5530M-SUL****	
47	UL specification long arm／Oil mist model	**RH-12SDH8530M-SUL****	
48	UL specification long arm and heavy load／Oil mist model	**RH-18SDH8530M-SUL****	**CR2D-751-SUL****
49	UL specification clean room model (Class 10)	**RH-12SDH7030C-SUL****	**CR2D-741-SUL****
50	UL specification short arm／Clean room model	**RH-12SDH5530C-SUL****	
51	UL specification long arm／Clean room model	**RH-12SDH8530C-SUL****	
52	UL specification long arm and heavy load／Clean room model (Class 10)	**RH-18SDH8530C-SUL****	**CR2D-751-SUL****
53	UL specification oil mist model including R/C	**RH-12SDH7030M -SULM6****	**CR3D-741M -SULM6****
54	UL specification short arm／Oil mist model including R/C	**RH-12SDH5530M -SULM6****	
55	UL specification long arm／Oil mist model including R/C	**RH-12SDH8530M -SULM6****	
56	UL specification long arm and heavy load／Oil mist model including R/C	**RH-18SDH8530M -SULM6****	**CR3D-751M -SULM6****

Revision history

Date	Specifications No.	Details of revisions	Rev.
September 22, 2008		First print	*
April 7, 2009	P1 P3 Table. 1	<Authorized representative in Europe> Change to "Mitsubishi Electric Europe B.V" <Machinery Directive> Added "EN954-1:1996" RV-18SD, RV-18SDC, RV-18SD-SUL, RV-18SDC-SUL added.	A
October 13, 2009	P1	Standards update(2006/42/EC)	B

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Product Service

EC-Statement of Compliance

No. E6 09 02 25554 014

Holder of Certificate: **Mitsubishi Electric Corporation**
Tokyo BILD., 2-7-3 Marunouchi,
Chiyoda-ku
Tokyo
100-8310 JAPAN

Name of Object: **Industrial, Scientific and Medical equipment**
Industrial Robot

Model(s): **SQ series**
(See Attachment for Nomenclature)

Description of Object:

Rated Voltage:	230 VAC (1 phase)/ 230 VAC, 400 VAC (3 phase)
Rated Power:	1.7 kW (230 VAC)/ 3.4 kW (230 VAC, 400 VAC)
Protection Class:	I

Tested according to: EN 61000-6-4:2007; EN 61000-6-2:2005

This EC-Statement of Compliance is issued according to the Directive 2004/108/EC relating to electromagnetic compatibility. It confirms that the listed apparatus complies with such aspects of the essential requirements of the EMC directive as specified by the manufacturer or his authorized representative in the European Community and applies only to the sample and its technical documentation submitted to TÜV SÜD Product Service GmbH for testing and certification. See also notes overleaf.

Technical report no.: TYOEMC23098A

Date, 2009-02-25

TÜV SÜD Product Service GmbH is Notified Body to the Directive 2004/108/EC of the European Parliament and of the council with the identification number 0123.

Attachment
Statement No.

Product Service

E6 09 02 25554 014

Grouping Items

1. AC 400V /230V 3 phase 3.4kW

RV-12SQ(-S**), RV-12SQL(-S**),
RV-12SQC(-S**), RV-12SQLC(-S**),
RV-12SQ-SUL**, RV-12SQL-SUL**,
RV-12SQC-SUL**, RV-12SQLC-SUL**,
RV-18SQ(-S**), RV-18SQC(-S**),
RV-18SQ-SUL**, RV-18SQC-SUL**,
RV-6SQ-SM6**, RV-6SQL-SM6**,
RV-6SQ-SULM6**, RV-6SQL-SULM6**,
RV-3SQ-SM6**, RV-3SQB-SM6**,
RV-3SQB-SULM6**, RV-3SQJ-SM6**,
RV-3SQJB-SM6**, RV-3SQJB-SULM6**,
RH-6SQH4517M-SM6**, RH-6SQH3517M-SM6**,
RH-6SQH5517M-SM6**, RH-6SQH4517M-SULM6**,
RH-6SQH3517M-SULM6**, RH-6SQH5517M-SULM6**,
RH-12SQH7030M-SM6**, RH-12SQH5530M-SM6**,
RH-12SQH8530M-SM6**, RH-18SQH8530M-SM6**,
RH-12SQH7030M-SULM6**, RH-12SQH5530M-SULM6**,
RH-12SQH8530M-SULM6**, RH-18SQH8530M-SULM6**

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2. AC 230V 1 phase 1.7kW

RV-6SQ(-S**), RV-6SQL(-S**),
RV-6SQC(-S**), RV-6SQLC(-S**),
RV-6SQ-SUL**, RV-6SQL-SUL**,
RV-6SQC-SUL**, RV-6SQLC-SUL**,
RV-3SQ-S3**, RV-3SQC-S3**,
RV-3SQB-S3**, RV-3SQBC-S3**,
RV-3SQB-SUL3**, RV-3SQBC-SUL3**,
RV-3SQJ-S3**, RV-3SQJC-S3**,
RV-3SQJB-S3**, RV-3SQJBC-S3**,
RV-3SQJB-SUL3**, RV-3SQJBC-SUL3**,
RH-6SQH4520-S3**, RH-6SQH3520-S3**,
RH-6SQH5520-S3**, RH-6SQH4517M-S3**,
RH-6SQH3517M-S3**, RH-6SQH5517M-S3**,
RH-6SQH4517C-S3**, RH-6SQH3517C-S3**,
RH-6SQH5517C-S3**, RH-6SQH4520-SUL3**,
RH-6SQH3520-SUL3**, RH-6SQH5520-SUL3**,
RH-6SQH4517M-SUL3**, RH-6SQH3517M-SUL3**,
RH-6SQH5517M-SUL3**, RH-6SQH4517C-SUL3**,
RH-6SQH3517C-SUL3**, RH-6SQH5517C-SUL3**,
RH-12SQH7035(-S**), RH-12SQH5535(-S**),
RH-12SQH8535(-S**), RH-18SQH8535(-S**),
RH-12SQH7030M(-S**), RH-12SQH5530M(-S**),
RH-12SQH8530M(-S**), RH-18SQH8530M(-S**),
RH-12SQH7030C(-S**), RH-12SQH5530C(-S**),
RH-12SQH8530C(-S**), RH-18SQH8530C(-S**),
RH-12SQH7035-SUL**, RH-12SQH5535-SUL**,
RH-12SQH8535-SUL**, RH-18SQH8535-SUL**,
RH-12SQH7030M-SUL**, RH-12SQH5530M-SUL**,
RH-12SQH8530M-SUL**, RH-18SQH8530M-SUL**,
RH-12SQH7030C-SUL**, RH-12SQH5530C-SUL**,
RH-12SQH8530C-SUL**, RH-18SQH8530C-SUL**

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Group A, B Model name description is shown as follows.

R V - x SQ x - x

(1) (2) (3) (4) (5)

(1) V: Vertical Robot

(2) Maximum Payload specification:

6 : 6kg

12 : 12kg

18 : 18kg

(3) **SQ** : **SQ** series robot

(4) **L** : Arm extension model

C : Clean room model

LC : Clean room arm

extension model

(5) Dimension and Ambient specification:

[none] : driven by R/C

CR3Q-7*1M (for RV-12SQ/18SQ)

CR2Q-7*1 (for RV-6SQ)

SM6xx: Oil mist model driven by R/C

CR3Q-7*1M-SM6xx (only RV-6SQ)

SULxx:UL specification/driven by R/C

CR3Q-7*1M-SULxx (for RV-12SQ/18SQ)

CR2Q-7*1-SULxx (for RV-6SQ)

SULM6xx:UL specification/

Oil mist model driven by R/C

CR3Q-7*1M-SULM6xx(only RV-6SQ)

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Group C Model name description is shown as follows.

RV-3 SQ J B x - x

(1) (2) (3) (4) (5) (6) (7)

(1) V: Vertical Robot

(2) Rated Payload specification:

3 : 3kg

(3) **SQ** : **SQ** series robot

(4) **J** : 5 axes exist

[none] : 6 axes exist

(5) **B** : All axes are equipped with brake

[none] : Basic model
J4 axis and J6 axis are not equipped with brake.

(6) **C** : Clean room model

[none] : Basic model

(7) Special specification number

Pilot number and specification as follows

S3xx : driven by R/C CR2Q-7*1-S3xx

SM6xx : R/C Oil mist model
driven by R/C CR3Q-7*1M-SM6xx

SUL3xx: UL specification and R/C Oil mist model
driven by R/C CR2Q-7*1-SUL3xx

SULM6xx: UL specification R/C Oil mist model
driven by R/C CR3Q-7*1M-SULM6xx

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Group D Model name description is shown as follows.

RH-x SQH xx xx x - xx

(1) (2) (3) (4) (5) (6) (7)

(1)H: Horizontal Robot
(2) Maximum Payload specification:
6 : 6kg
12 : 12kg
18 : 18kg
(3) **SQ** : **SQ** series robot
(4) Arm length(No1 and No2 arm) specification:
35 : 350 mm arm
45 : 450 mm arm
55 : 550 mm arm
70 : 700 mm arm
(5) Z axis working area specification:
17 : 170 mm arm
20 : 200 mm arm
30 : 300 mm arm
32 : 320 mm arm
(6) Dimension and Ambient specification:
M : Oil mist model
C : Clean room model
[none] : Basic model
(7) Optional specification:
S3xx : driven by R/C CR2Q-7*1-S3xx
(only RH-6SQH)
SM6xx: Oil mist model driven by R/C
CR3Q-7*1-SM6xx
SULxx: UL specification driven by R/C
CR3Q-7*1M-SULxx
(only RH-12 / 18SQH)
SUL3xx: UL specification driven by R/C
CR2Q-7*1-SUL3xx (only RH-6SQH)
SULM6xx:UL specification /
Oil mist model driven by R/C
CR3Q-7*1M-SULM6xx
(only RV-12 / 18SQH)

MITSUBISHI ELECTRIC
Changes for the Better

EC Declaration of Conformity

We, the undersigned,

Manufacturer	MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS
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Phone number	+81 52 712 2354
Fax number/e-mail	+81 52 722 0384
Authorized representative in Europe	MITSUBISHI Electric Europe B.V
Address, City	40880 Ratingen
Country	Germany

Certify and declare under our sole responsibility that the following apparatus:

Type Name	Industrial Robot
Manufacturer	MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS
Brand	MELFA
Model No.	SQ series
Restrictive use	For industrial environment only

Conforms with the essential requirements of the **EMC Directive 2004/108/EC** and the **Machinery Directive 2006/42/EC**, based on the following specifications applied:

EU Harmonized Standards		Non-harmonized Standard
EMC(2004/108/EC)	EN61000-6-4:2007 EN61000-6-2:2005	CISPR 11:2003+A2:2006
Machinery(2006/42/EC)	Type A:Fundamental safety standards EN ISO12100-1:2003 EN ISO12100-2:2003 EN 1050:1997 Type B:Group safety standards B1:Safety aspects EN60204-1:2006, EN294:1992, EN349:1993 ISO13849-1:2006 Type C:Machine Safety standard ISO10218-1:2006	N/A

and therefore complies with the essential requirements and provisions of the EMC Directive and the Machinery Directive.

The Technical documentation is kept at the following address:

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Phone number	+49 2102 486 0
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Date	October 13, 2009
Name and position of person binding the manufacturer	Takaaki Nishimura Manager Robot Manufacturing Department MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS

■ Declaration Type of models

Table 1 : The list of RV-12SQ series for grouping certification. ;A group

No.	Classification	Model name	Robot Controller
		12/18kg-Load	
1	Oil mist basic model	**RV-12SQ(-S**)**	**CR3Q-701M(-S**)**
2	Oil mist arm extension model	**RV-12SQL(-S**)**	
3	Clean room basic model (Class 10)	**RV-12SQC(-S**)**	**CR3Q-701(-S**)**
4	Clean room arm extension model (Class 10)	**RV-12SQLC(-S**)**	
5	UL specification oil mist basic model including oil mist model robot controller	**RV-12SQ-SUL****	**CR3Q-701M-SUL****
6	UL specification oil mist arm extension model including oil mist model robot controller	**RV-12SQL-SUL****	
7	UL specification clean room basic model (Class 10)	**RV-12SQC-SUL****	**CR3Q-701-SUL****
8	UL specification clean room arm extension model (Class 10)	**RV-12SQLC-SUL****	
9	Oil mist basic model	**RV-18SQ(-S**)**	**CR3Q-709M(-S**)**
10	Clean room basic model (Class 10)	**RV-18SQC(-S**)**	
11	UL specification oil mist basic model including oil mist model robot controller	**RV-18SQ-SUL****	**CR3Q-709-SUL****
12	UL specification clean room basic model (Class 10)	**RV-18SQC-SUL****	

Table 2 : The list of RV-6SQ series for grouping certification. B group

No.	Classification	Model name	Robot Controller
		6kg-Load	
1	Oil mist basic model	**RV-6SQ(-S**)**	**CR2Q-711(-S**)**
2	Oil mist arm extension model	**RV-6SQL(-S**)**	
3	Clean room basic model (Class 10)	**RV-6SQC(-S**)**	
4	Clean room arm extension model (Class 10)	**RV-6SQLC(-S**)**	
5	Oil mist basic model including oil mist model robot controller	**RV-6SQ-SM6****	**CR3Q-711M(-S**)**
6	Oil mist arm extension model including oil mist model robot controller	**RV-6SQL-SM6****	
7	UL specification oil mist basic model	**RV-6SQ-SUL****	**CR2Q-711-SUL****
8	UL specification oil mist arm extension model	**RV-6SQL-SUL****	
9	UL specification clean room basic model (Class 10)	**RV-6SQC-SUL****	
10	UL specification clean room arm extension model (Class 10)	**RV-6SQLC-SUL****	
11	UL specification oil mist basic model including oil mist model robot controller	**RV-6SQ-SULM6****	**CR3Q-711M-SULM6****
12	UL specification oil mist arm extension model including oil mist model robot controller	**RV-6SQL-SULM6****	

Table 3 : The list of robots for grouping certification; C group.

No.	Classification	Model name	Robot Controller
		6-axis	
1	Basic model (standard) *1	**RV-3SQ-S3****	**CR2Q-721-S3****
2	Clean room basic model (standard) *1	**RV-3SQC-S3****	
3	Basic model with brakes on all axis (standard)	**RV-3SQB-S3****	
4	Clean room basic model with brakes on all axis (standard)	**RV-3SQBC-S3****	
5	Oil mist basic model including robot controller *1	**RV-3SQ-SM6****	**CR3Q-721M-SM6****
6	Oil mist basic model with brakes on all axis including robot controller	**RV-3SQB-SM6****	
7	UL specification and basic model with brakes on all axis (standard)	**RV-3SQB-SUL3****	**CR2Q-721-SUL3****
8	UL specification clean room basic model with brakes on all axis (standard)	**RV-3SQBC-SUL3****	
9	UL specification oil mist basic model with brakes on all axis including robot controller	**RV-3SQB-SULM6****	**CR3Q-721M-SULM6****

Table 4 : The list of robots for grouping certification; C group -2.

No.	Classification	Model name	Robot Controller
		5-axis	
10	Basic model (standard) *1	**RV-3SQJ-S3****	**CR2Q-731-S3****
11	Clean room basic model (standard) *1	**RV-3SQJC-S3****	
12	Basic model with brakes on all axis (standard)	**RV-3SQJB-S3****	
13	Clean room basic model with brakes on all axis (standard)	**RV-3SQJBC-S3****	
14	Oil mist basic model including robot controller *1	**RV-3SQJ-SM6****	**CR3Q-731M-SM6****
15	Oil mist basic model with brakes on all axis including robot controller	**RV-3SQJB-SM6****	
16	UL specification basic model with brakes on all axis (standard)	**RV-3SQJB-SUL3****	**CR2Q-731-SUL3****
17	UL specification clean room basic model with brakes on all axis (standard)	**RV-3SQJBC-SUL3****	
18	UL specification oil mist basic model with brakes on all axis including robot controller	**RV-3SQJB-SULM6****	**CR3Q-731M-SULM6****

Table 5 : The list of robots for grouping certification; D group.

No.	Classification	Model name 6kg-Load	Robot Controller
1	Basic model	**RH-6SQH4520-S3****	**CR2Q-761 -S3****
2	Short arm model	**RH-6SQH3520-S3****	
3	Long arm model	**RH-6SQH5520-S3****	
4	Oil mist model	**RH-6SQH4517M-S3****	
5	Short arm／Oil mist model	**RH-6SQH3517M-S3****	
6	Long arm／Oil mist model	**RH-6SQH5517M-S3****	
7	Clean room model (Class 10)	**RH-6SQH4517C-S3****	
8	Short arm／Clean room model	**RH-6SQH3517C-S3****	
9	Long arm／Clean room model	**RH-6SQH5517C-S3****	
10	Oil mist model including R/C	**RH-6SQH4517M-SM6****	**CR3Q-761M -SM6****
11	Short arm／Oil mist model including R/C	**RH-6SQH3517M-SM6****	
12	Long arm／Oil mist model including R/C	**RH-6SQH5517M-SM6****	
13	UL specification basic model	**RH-6SQH4520-SUL3****	**CR2Q-761 -SUL3****
14	UL specification short arm model	**RH-6SQH3520-SUL3****	
15	UL specification long arm model	**RH-6SQH5520-SUL3****	
16	UL specification oil mist model	**RH-6SQH4517M-SUL3****	
17	UL specification short arm／Oil mist model	**RH-6SQH3517M-SUL3****	
18	UL specification long arm／Oil mist model	**RH-6SQH5517M-SUL3****	
19	UL specification clean room model (Class 10)	**RH-6SQH4517C-SUL3****	
20	UL specification short arm／Clean room model	**RH-6SQH3517C-SUL3****	
21	UL specification long arm／Clean room model	**RH-6SQH5517C-SUL3****	
22	UL specification oil mist model including R/C	**RH-6SQH4517M-SULM6****	**CR3Q-761M -SULM6****
23	UL specification short arm／Oil mist model including R/C	**RH-6SQH3517M-SULM6****	
24	UL specification long arm／Oil mist model including R/C	**RH-6SQH5517M-SULM6****	

Table 6 : The list of robots for grouping certification: D group -2.

No.	Classification	Model name 12／18kg-Load	Robot Controller
25	Basic model	**RH-12SQH7035(-S**)**	**CR2Q-741(-S**)**
26	Short arm model	**RH-12SQH5535(-S**)**	
27	Long arm model	**RH-12SQH8535(-S**)**	
28	Long arm and heavy load model	**RH-18SQH8535(-S**)**	**CR2Q-751(-S**)**
29	Oil mist model	**RH-12SQH7030M(-S**)**	**CR2Q-741(-S**)**
30	Short arm／Oil mist model	**RH-12SQH5530M(-S**)**	
31	Long arm／Oil mist model	**RH-12SQH8530M(-S**)**	
32	Long arm and heavy load／Oil mist model	**RH-18SQH8530M(-S**)**	**CR2Q-751(-S**)**
33	Clean room model (Class 10)	**RH-12SQH7030C(-S**)**	**CR2Q-741(-S**)**
34	Short arm／Clean room model	**RH-12SQH5530C(-S**)**	
35	Long arm／Clean room model	**RH-12SQH8530C(-S**)**	
36	Long arm and heavy load／Clean room model (Class 10)	**RH-18SQH8530C(-S**)**	**CR2Q-751(-S**)**
37	Oil mist model including R/C	**RH-12SQH7030M-SM6****	**CR3Q-741M -SM6****
38	Short arm／Oil mist model including R/C	**RH-12SQH5530M-SM6****	
39	Long arm／Oil mist model including R/C	**RH-12SQH8530M-SM6****	
40	Long arm and heavy load／Oil mist model including R/C	**RH-18SQH8530M-SM6****	**CR3Q-751M -SM6****
41	UL specification basic model	**RH-12SQH7035-SUL****	**CR2Q-741-SUL****
42	UL specification short arm model	**RH-12SQH5535-SUL****	
43	UL specification long arm model	**RH-12SQH8535-SUL****	
44	UL specification long arm and heavy load model	**RH-18SQH8535-SUL****	**CR2Q-751-SUL****
45	UL specification oil mist model	**RH-12SQH7030M-SUL****	**CR2Q-741-SUL****
46	UL specification short arm／Oil mist model	**RH-12SQH5530M-SUL****	
47	UL specification long arm／Oil mist model	**RH-12SQH8530M-SUL****	
48	UL specification long arm and heavy load／Oil mist model	**RH-18SQH8530M-SUL****	**CR2Q-751-SUL****
49	UL specification clean room model (Class 10)	**RH-12SQH7030C-SUL****	**CR2Q-741-SUL****
50	UL specification short arm／Clean room model	**RH-12SQH5530C-SUL****	
51	UL specification long arm／Clean room model	**RH-12SQH8530C-SUL****	
52	UL specification long arm and heavy load／Clean room model (Class 10)	**RH-18SQH8530C-SUL****	**CR2Q-751-SUL****
53	UL specification oil mist model including R/C	**RH-12SQH7030M -SULM6****	**CR3Q-741M -SULM6****
54	UL specification short arm／Oil mist model including R/C	**RH-12SQH5530M -SULM6****	
55	UL specification long arm／Oil mist model including R/C	**RH-12SQH8530M -SULM6****	
56	UL specification long arm and heavy load／Oil mist model including R/C	**RH-18SQH8530M -SULM6****	**CR3Q-751M -SULM6****

Revision history

Date	Specifications No.	Details of revisions	Rev.
July 1, 2009		First print	*
October 13, 2009	P1	Standards update(2006/42/EC)	A

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