

MELFA

Industrial robots

Installation description

RV-1A/2AJ

RP-1AH/3AH/5AH

Installation instructions
RV-1A/2AJ and RP-1AH/3AH/5AH Industrial robots

Version	Revisions / Additions / Corrections
A 03/2010 akI	—

About this manual

The texts, figures, diagrams and examples in this manual are solely intended as a guide to installation, operation and use of the industrial robots described in it.

If you have questions regarding the installation and operation of the devices 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 available on the internet at: <http://www.mitsubishi-automation.de>.

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

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Safety instructions

Target group

This manual is solely intended for recognised, trained electricians acquainted with the safety standards of automation technology. Planning, installation, startup, maintenance and testing of the robots and their accessories may only be carried out by recognised, trained electricians who are acquainted with the safety standard of automation technology. Any manipulation of our hardware and software products not explicitly described in this manual may only be carried out by our expert personnel.

Use in accordance to the instructions

The RV-2AJ/1A and RP-1AH/3AH/5AH industrial series of robots are solely intended for the usage described in this manual. Observe all relevant basic data listed in this manual. The products have been developed, manufactured, checked and documented compliant to the safety standards. If the handling instructions and safety instructions are observed during planning, assembly/installation and correct operation then there are normally no hazards to persons or property arising from the equipment. Unqualified manipulation/tampering of the hardware and software, or non-observance of the warning instruction contained in this manual or attached to the product may result in serious injuries to persons and/or damage to property. Only those additional devices and expansions recommended by MITSUBISHI ELECTRIC may be used together with the RV-2AJ/1A and RP-1AH/3AH/5AH robot systems.

Any additional use is deemed as improper and not in accordance to the instructions.

The industrial robots may only be switched on after all safety measures have been attached and the functional test has been carried out. In detail, this includes:

- the connection and attachment of external EMERGENCY-STOP switches,
- casing the robot within separating protective equipment (isolation) and
- attachment and connection of the door-contact switch.

A function test at a reduced speed (T1) of maximum 250 mm/s can be carried out in "TEACH" mode with the keyswitch set to "TEACH". This mode is possible when the protective casing is open (open door contact switch).



DANGER:

To simplify the descriptions, the robots are displayed without isolating protective equipment in the following. Automatic operation is not permitted without isolating protective equipment or suitable safety light curtains. Non-observance of this may result in serious injuries to persons within the working area of the robot.

Safety-relevant regulations

During planning, installation, startup, maintenance and checking of the devices, the valid safety and accident-prevention regulations specific to the case in hand must be observed.



CAUTION:

A safety manual is included in the delivery of the robot. This manual deals with all safety-relevant details for installation/setup, startup and maintenance. This manual must be worked through (i.e. fully read, understood and implemented) before installation/setup, startup or any other work with or at the robot. All specifications and instructions contained therein must be observed (mandatory)!

If this manual is not included with the delivery then please immediately contact your Mitsubishi sales partner.

The following regulations must also be observed (listed without a claim to completeness):

- Regulations of the VDE (German Electrical Engineering Association)
 - VDE 0100
Regulations for installation of electrical power installations with a rated voltage up to 1000 V
 - VDE 0105
Operation of electrical power installations
 - VDE 0113
Electrical plants with electronic resources
 - VDE 0160
Equipping of electrical power installations and electrical resources
 - VDE 0550/0551
Regulations for transformers
 - VDE 0700
Safety of electrical devices for use in the home and similar purposes
 - VDE 0860
Safety regulations for mains-operated electronic devices and their accessories for use in the home and similar purposes
- Fire-prevention regulations
- Accident-prevention regulations
 - VBG No. 4
Electrical plants and resources

Explanation of the hazard warnings

There are warnings contained in this manual that are important for the safe handling of the robots.
The individual warnings mean the following:



DANGER:

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



CAUTION:

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

General hazard warnings and safety measures

The following hazard warnings should be understood as general regulations and guidelines for handling the robot system. You must always observe these warnings during the planning, installation and operation of the robot system.



DANGER:

- *The safety and accident-prevention regulations applicable in the specific case must be observed. Installation, wiring and opening of components, modules and devices must be carried out when the system is dead (no live voltage).*
- *Regularly check the hot cable and lines connected to the devices for isolation faults or breaks. If a defect is detected in the wiring then the devices and the wiring must be immediately disconnected from the mains the the defective cable must be replaced.*
- *Before startup, check whether the permissible mains voltage range agrees to that of the local mains voltage.*
- *Take the appropriate measures to correctly restart an interrupted program after voltage drops and failures. No dangerous operating states must occur during this time, even for short periods. If necessary, force an "EMERGENCY-STOP".*
- *EMERGENCY-STOP equipment compliant to EN 60204/IEC 204 VDE 0113 must remain effective at all times in all applications. Unlocking the EMERGENCY-STOP equipment must not result in any uncontrolled movements of the robot arm.*

General safety instructions for handling

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



DANGER:

- *Some of the covers on the robot arm are made of plastic. The robot arm can not bear the load of components on those parts, or of any severe forces. The covers are oil-resistant.*
- *The robot axes are fitted with brakes. You should not apply any manual force to the robot joints to avoid damage to the reduction gear.*
- *Even when the robot arm is within its normal operating range, collisions may occur in articulated arm robots between the wrist joint and the robot body Pay special attention to this situation when in jog mode.*
- *The robot arm is made or precision components that require sufficient lubrication. During a cold-start, or at low temperatures, a servo alarm may be issued or positional accuracy may be lost. In such a situation you should initially operate the robot arm in idling mode.*
- *The robot arm and the control unit require Class 3 earthing to permanently prevent the risk of electrical shock and the occurrence of interference.*
- *All details and specifications in the manuals are only valid if you periodically carry out all maintenance work listed 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 make (trailing cable) to ensure that no wire break occurs in the standard connection lines.*
- *If you mount an articulated arm robot on the wall then you must limit the range of movement of the J1 axis.*
- *Make sure that when the robot moves, there is no collision of the workpiece with units in its immediate vicinity, because this would then shift the position of the workpiece.*
- *If the axes are moved at very high speeds then the position of the workpiece can shift. Make sure that there are no collisions of the workpiece or units in the vicinity.*
- *Do not fix any adhesive strip or labels onto the robot arm and on the control unit. The glue used could damage the coated surface. The protection indicated by the IEC IP symbols can then no longer be guaranteed.*
- *If the J1, J2 and J3 axes of an articulated arm robot collide with the mechanical end stops in automatic mode then the plastic buffer of the end stops must be replaced. Otherwise, the reduction gear may be significantly damaged on the next collision. Contact your Mitsubishi partner for the replacement.*

Symbols used within the manual

Use of references

References to important information are marked separately and are displayed as follows:

NOTE

| Explanatory text

Use of numeration in the figures

Numeration in the figures is displayed by white numbers contained within black circles, and is explained in a subsequent table using the same number, e.g.:

① ② ③ ④

Use of handling instructions

Handling instructions are steps taken during startup, operation, maintenance, etc. that must be carried out in the exact order given.

They are listed consecutively (black numbers in white circle):

① Text

② Text

③ Text

Use of footnotes in tables

References in tables are explained in footnotes beneath the table (superscript). There is a footnote (superscript) at the appropriate location in the table.

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

① Text

② Text

③ Text

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1 Introduction

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All rights reserved • We accept no liability for the correctness of the information that describes the product features, or for the technical data in this manual.

This manual describes how to unpack, setup, connect and startup the robots from the RV-2AJ/1A and RP-1AH/3AH/5AH series.

This is an original manual from MITSUBISHI ELECTRIC B.V.

The operating steps described in this manual refer to the R28TB Teaching Box.

The manual is valid for the following robots and control units:

Series	Model	Construction	Handling weight [kg]	Control unit
A	RV-2AJ	Vertical articulated arm	2	CR1
	RV-1A		1,5	
	RP-1AH	SCARA	1	
	RP-3AH		3	
	RP-5AH		5	

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

1.1 Name of model

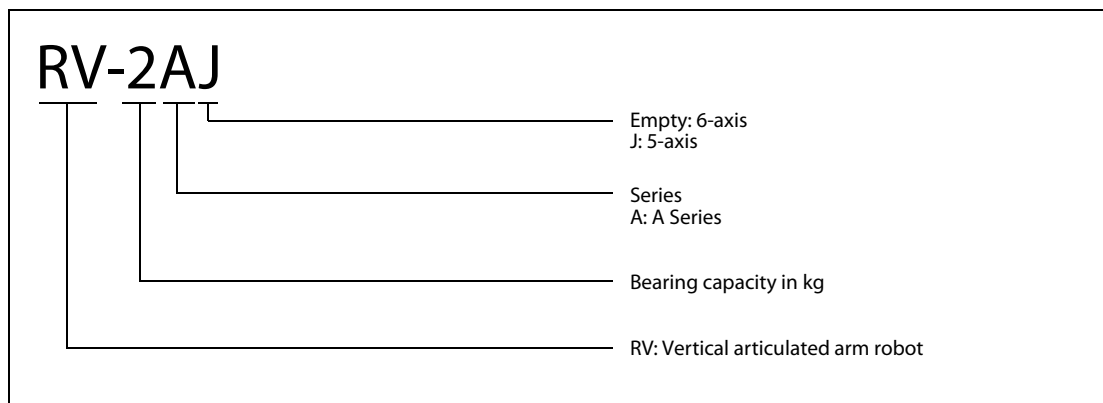


Fig. 2-1: Name of model of the vertical articulated arm

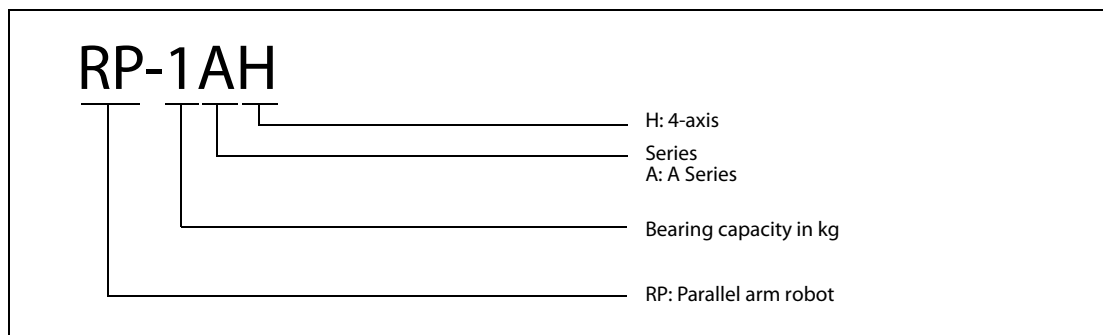


Fig. 2-2: Name of model of parallel arm robot (SCARA)

1.2 Basic safety instructions

The MELFA robot has been constructed according to the state-of-the-art and and configured for operational safety. Nevertheless, hazards may arise from the robot if it is not operated by trained persons, or at the least by persons who have been instructed in its use, or if the robot is used improperly or not for its intended purpose.

In particular, this means:

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



CAUTION:

Each and every person assigned within the company of the user with the setup, startup, operation, maintenance and repair of the robot must, in addition to having read and understood the technical documentation pertaining to the robot, have also read and understood the supplied

SAFETY-RELATED MANUAL.



CAUTION:

Pay strict attention to observance of all safety regulations. The following additional instructions are provided within the framework of these introductory safety instructions:

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

The responsibilities for the various activities pertaining to operation of the robot must be clearly determined and observed to ensure that no undefined competencies can arise regarding the safety of the machine.

The switch-off procedures listed in the operating instructions must be observed during all work relating to setup, startup, fitting/equipping, operation, changes/revisions of the conditions of use and mode of operation, maintenance, inspection and repairs.

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

All modes of operation that impair the safety of the machine are forbidden.

The operator must ensure that no persons work at/on the robot who are not authorised to do so (e.g. also by actuating equipment installed to prevent unauthorized usage).

The company using the robot must ensure that it is only ever operated when in perfect working condition.

The plant/company running the robot must provide special training to the operating personnel and must oblige them to carry out all maintenance and inspection work with the robot shut down and peripheral units switched off.



DANGER:

The control unit may only be connected to the mains power by a power switch. There is danger of an electrical shock if this requirement 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 units, you should not setup the robot system under the following conditions:

- Power supply

Do not use when:

- there are voltage fluctuations greater than +10 % or –10 %,
- there are transient voltage failures for longer than 20 ms,
- the mains supply is not able to deliver a minimum power of 0.7 kVA.

- HF interference

Do not use when:

- there are voltage peaks greater than 1000 V and longer than 1 μ s on the mains supply,
- there are large frequency converters, transformers, magnetic switches or welding equipment in the vicinity,
- there are televisions or radios 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 humidity is below 45 % or above 85 %,
- condensation can form.

- Vibrations

Do not use when:

- the robot is subjected to heavy vibrations or knocks,
- the maximum load of the robot during transport is more than 34 m/s² and more than 5 m/s² in operation.

- Installation location

Do not use when:

- there are effects from severe electrical or magnetic fields,
- the surface is very uneven,
- there is heavy contamination from dust or oil mist.

1.4 Performance Level (PL) according to EN ISO 13849-1

The robot systems listed in the following are compliant to

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

2 System overview

This chapter describes all devices and system parts from the MELFA Series A industrial robots required for basic operation. Options and spare parts are listed in the technical manual.

2.1 Scope of delivery

2.1.1 RV-2AJ and RV-1A Series

RV-2AJ is the 5-axis robot and RV-1A is the 6-axis robot.

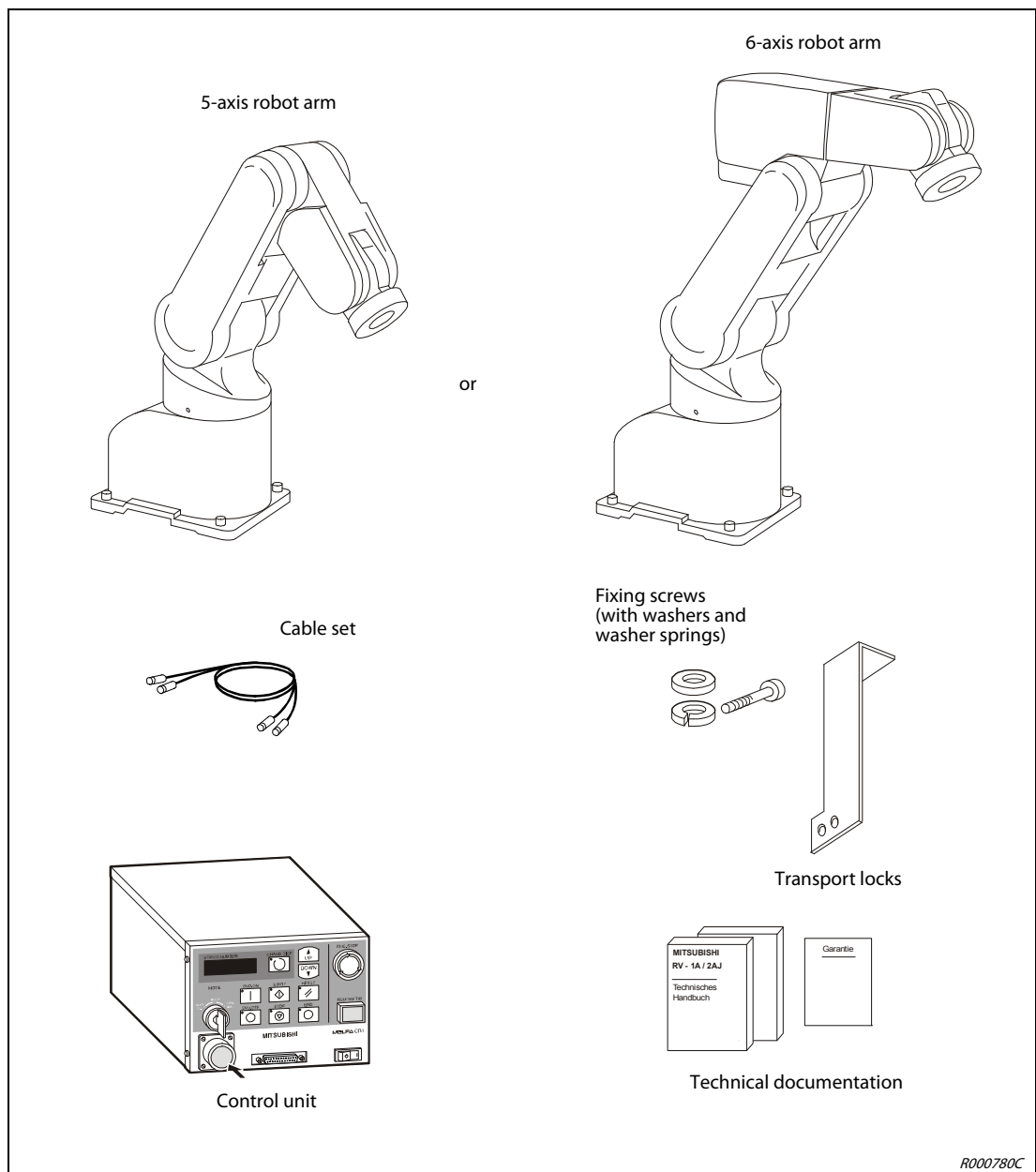


Fig. 2-1: Scope of delivery of the RV-2AJ and RV-1A robot systems

2.1.2 RP-1AH/3AH/5AH Series

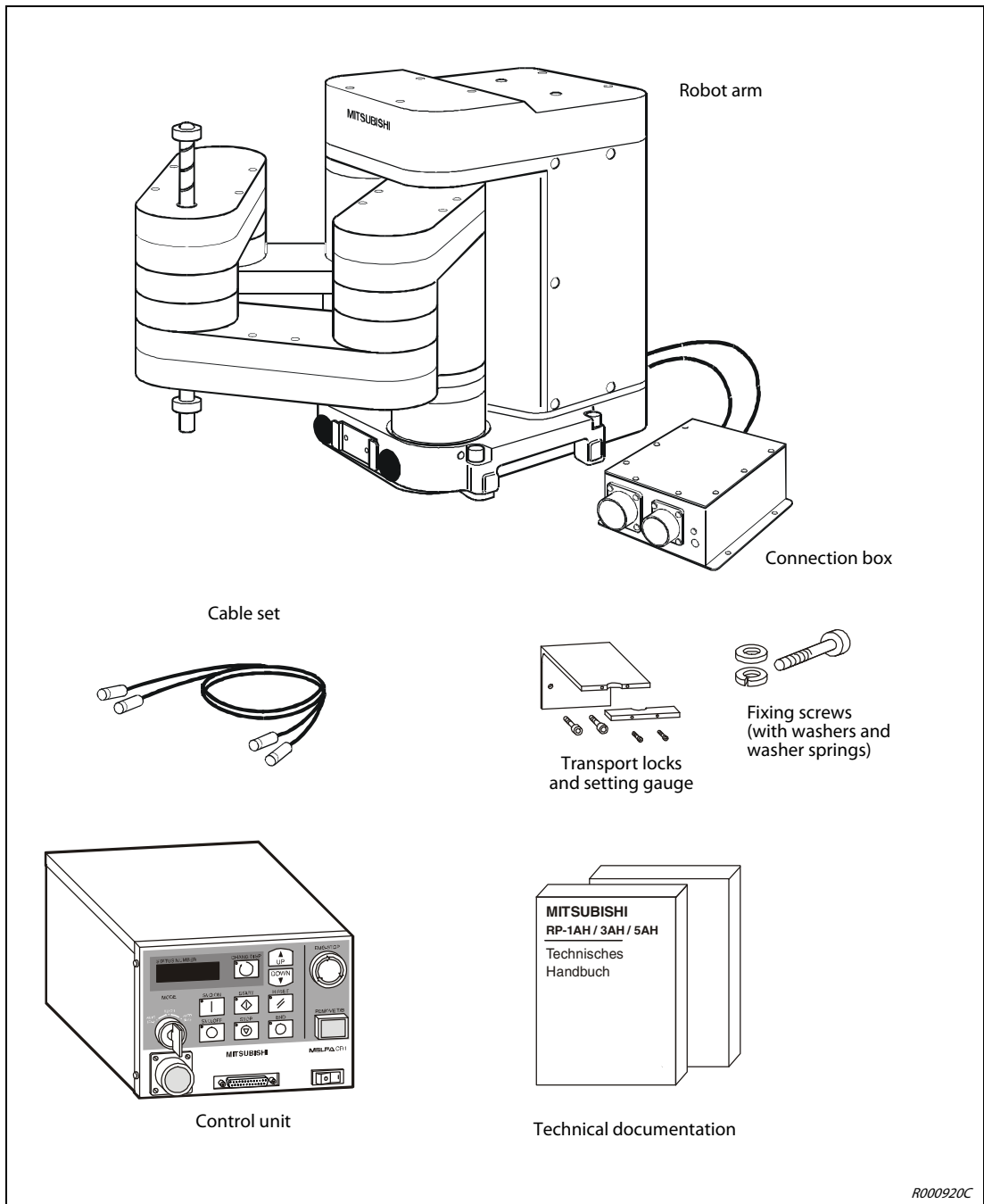


Fig. 2-2: Scope of delivery of the RP-1AH/3AH/5AH robot system

2.2 System configuration

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

2.2.1 RV-2AJ and RV-1A Series

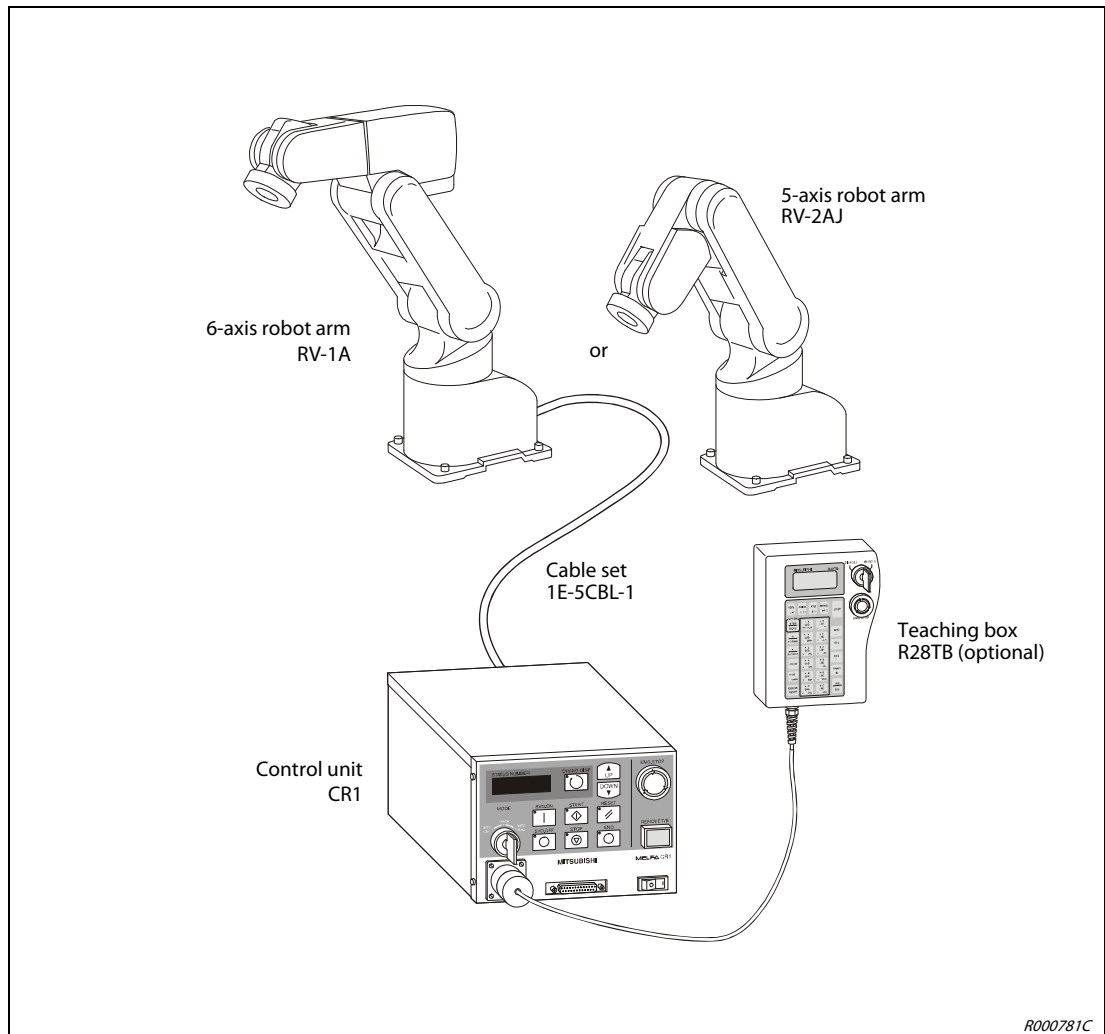


Fig. 2-3: Configuration of the RV-2AJ and RV-1A robot systems

NOTE

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

2.2.2 RP-1AH/3AH/5AH Series

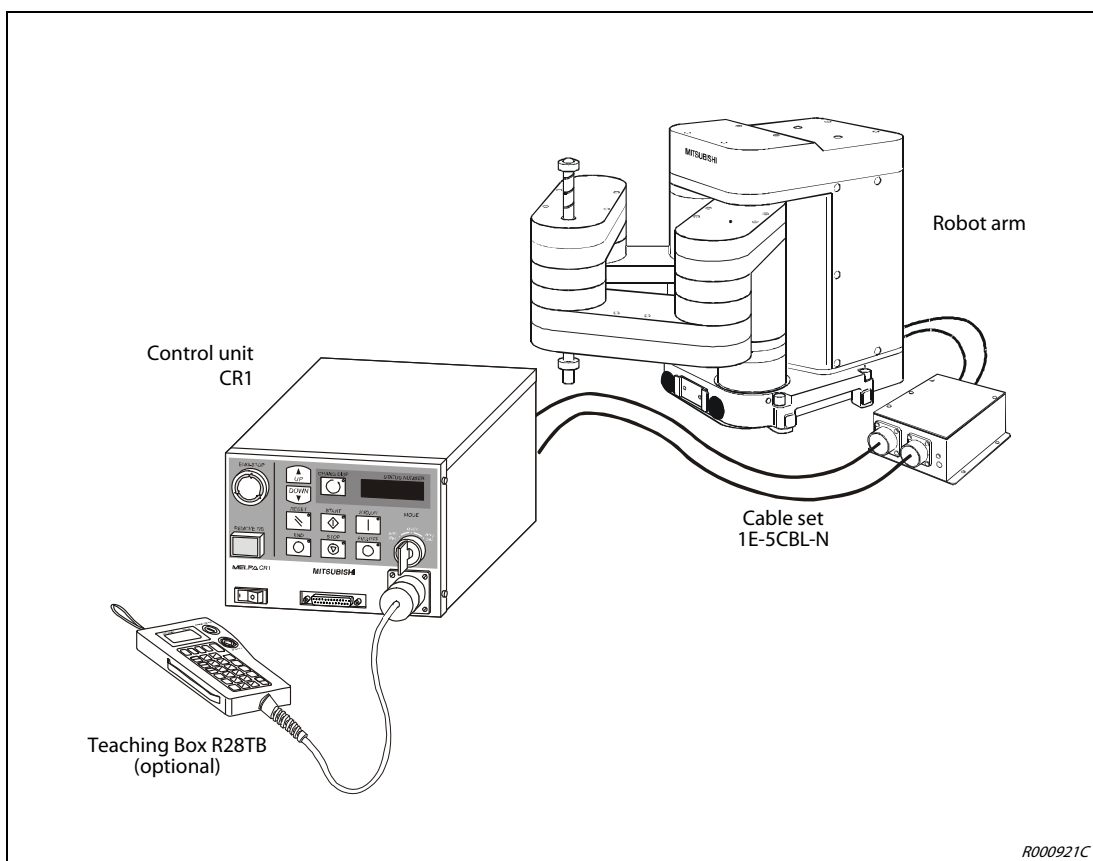


Fig. 2-4: Configuration of the RP-1AH/3AH/5AH robot system

NOTE

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

2.2.3 Components of the robot arm

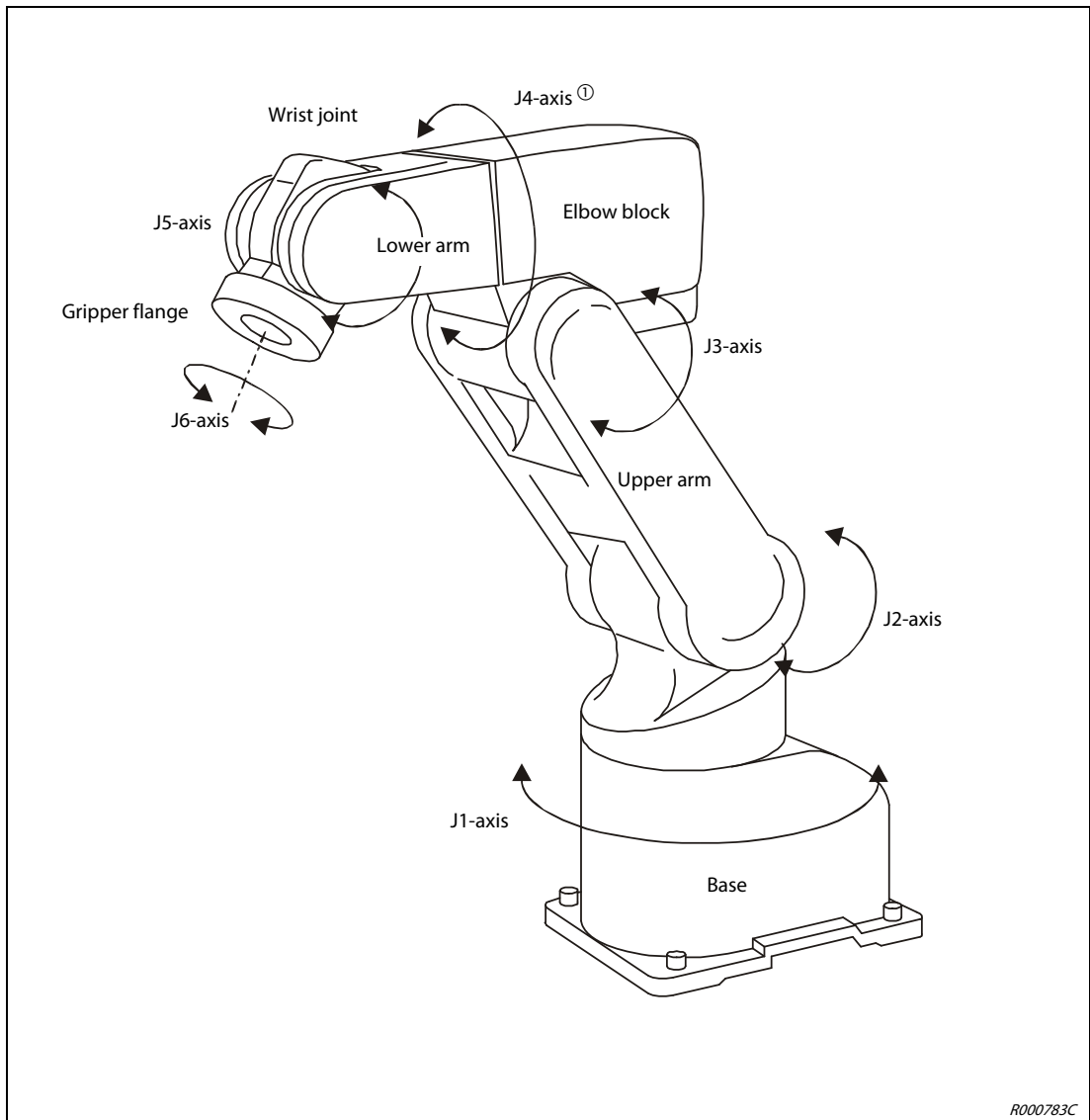


Fig. 2-5: Components of the robot arm on the vertical articulated arm robot

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

Axis name	Meaning
J1-axis	Base axis
J2-axis	Shoulder axis
J3-axis	Elbow axis
J4-axis	Lower arm rotational axis
J5-axis	Wrist tilting axis
J6-axis	Wrist rotational axis

Tab. 2-1: Overview of axis names

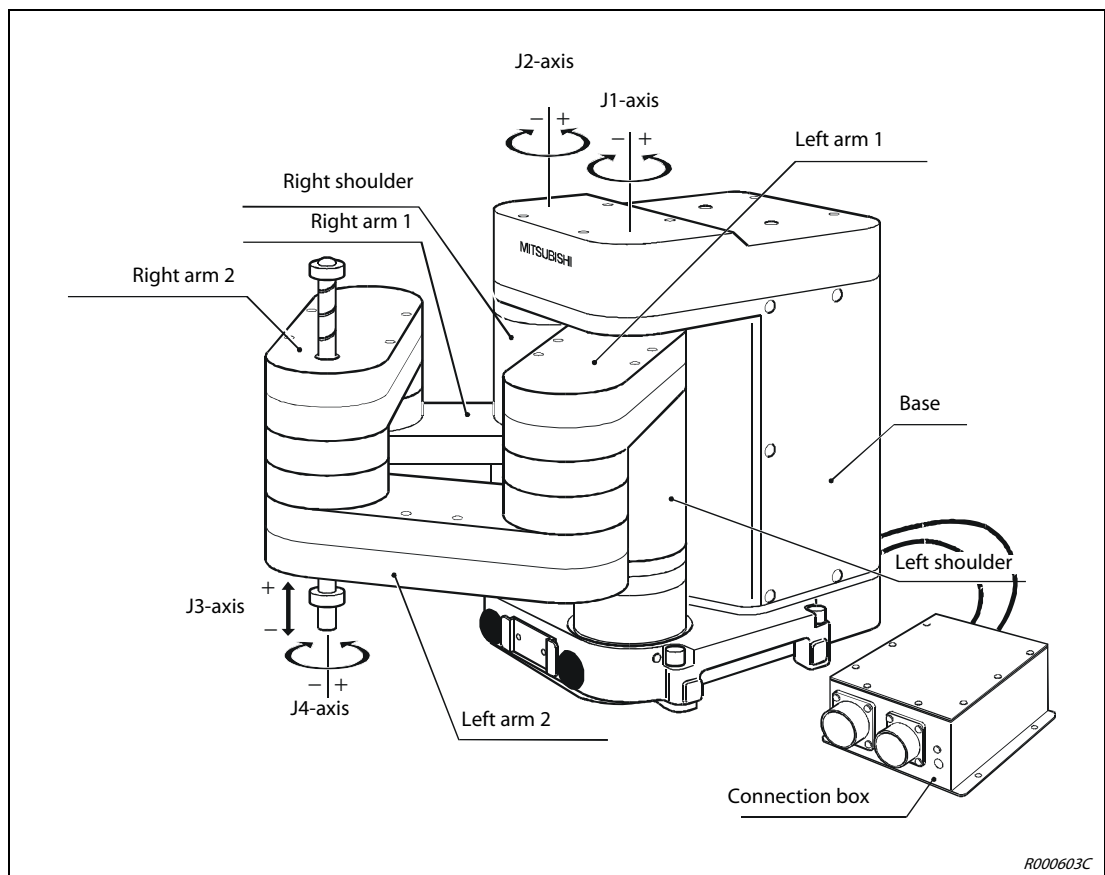


Fig. 2-6: Components of the robot arm on the SCARA

2.3 Control unit

2.3.1 Control panel

The following figure shows the front view of the control panel of the CR1 control unit.

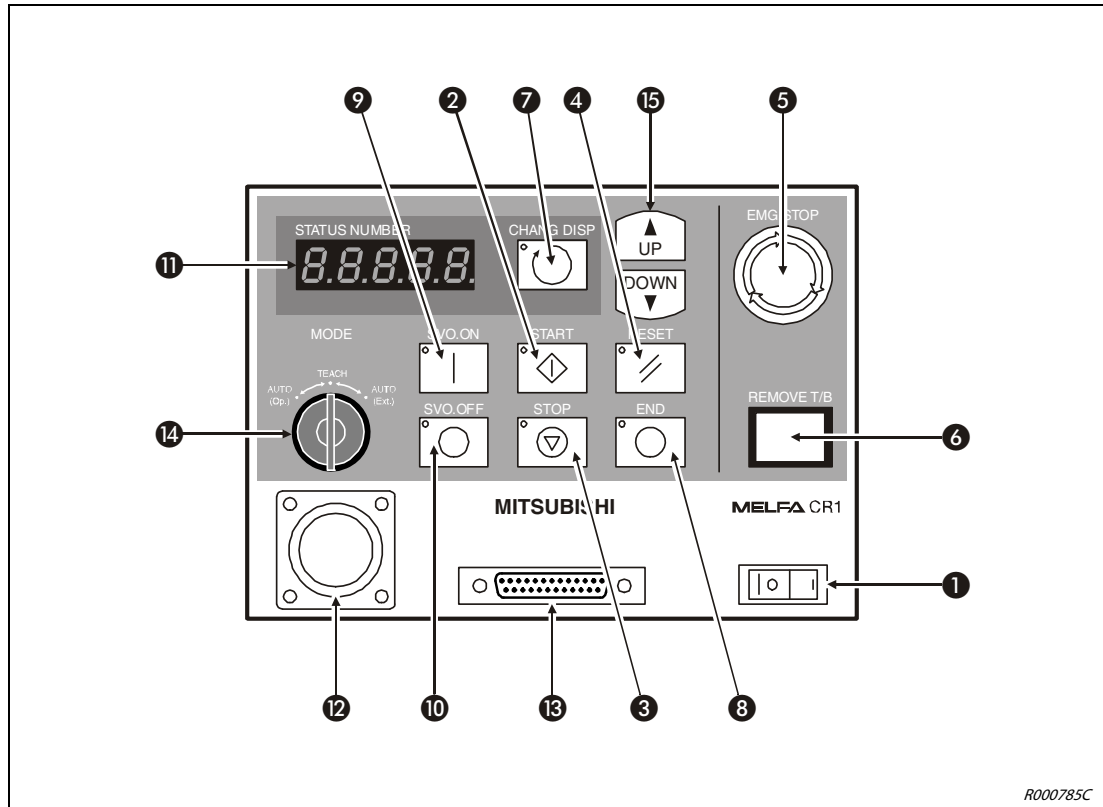


Fig. 2-7: Front view of the control panel

No.	Name	Function
①	[POWER] switch	On/off switch of supply voltage (earth connection switch)
②	[START] key	Start a program and operate the robot arm The program is processed in continuous cycles.
③	[STOP] key	Interruption of running program and stop (brake) of robot This function corresponds to the function of the [STOP] key on the teaching box.
④	[RESET] key	Acknowledges an error code Resets the program as well as the stop condition of the program
⑤	[EMG.STOP] switch	This pushbutton switch is used for EMERGENCY-STOP of the robot system. After actuating the switch, the servo power supply is immediately switched off and the robot arm that is moving stops immediately. The switch is unlocked by rotating it to the right; it then jumps back out.
⑥	[REMOVE T/B] switch	Actuate this switch if you connect the teaching box when the control unit power supply is switched on or if you want to release the connection.
⑦	[CHNG DISP] key	Change of indicator on the display of the control unit in this order: Program number → Line number → Oversteer
⑧	[END] key	Stop the running program with the END instruction
⑨	[SVO ON] key	Switch on the servo power supply

Tab. 2-2: Overview of the operating/signal elements of the control unit (1)

No.	Name	Function	
⑩	[SVO OFF] key	Switch off the servo power supply	
⑪	[STATUS NUMBER] display	Display of alarm, program number, oversteer value (%) etc.	
⑫	T/B connection	Interface for teaching box connection	
⑬	RS232 interface	The RS232 interface (port) is used to connect a PC.	
⑭	[MODE] changeover switch	AUTO (Op.)	Operation is only possible using the control unit. Operation using external signals or the teaching box is deactivated.
		TEACH	Operation is only possible using the teaching box when the teaching box is activated. Operation using external signals or the control unit is deactivated. Remove the key from the [MODE] changeover switch, thereby activating the teaching box.
		AUTO (Ext.)	Operation is only possible using external signals. Operation using the teaching box or the control unit is deactivated.
⑮	[UP/DOWN] key	Scroll within the display	

Tab. 2-2: Overview of the operating/signal elements of the control unit (2)

NOTE

Keys ②, ③, ④, ⑧, ⑨ and ⑩ have integrated control displays/indicators.

2.3.2 CR1 components

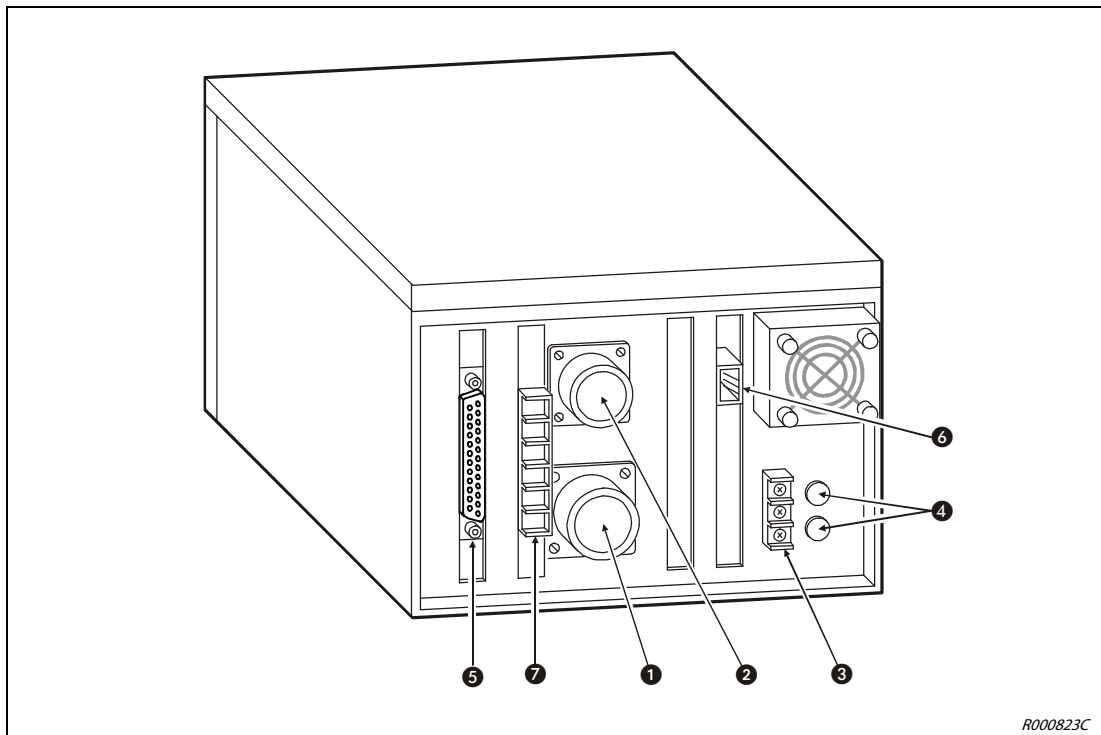


Fig. 2-8: Rear of CR1 control unit

No.	Name	Function
①	Connection for servo supply voltage cable	For robot supply voltage
②	Connection for signal cable	For robot control cable
③	Connection for power cable and earth	
④	Fuses	
⑤	Connection for external input/output modules	For RV-E-E/A (I/O) type connection cable
⑥	Network connection of parallel input/output module	For network cable (NETCable-1)
⑦	Terminal block of external EMERGENCY-STOP switch	For external EMERGENCY-STOP switch, door locking contact or signal lamp

Tab. 2-3: Components on the rear of the CR1 control unit

2.4 Teaching box

2.4.1 R28TB

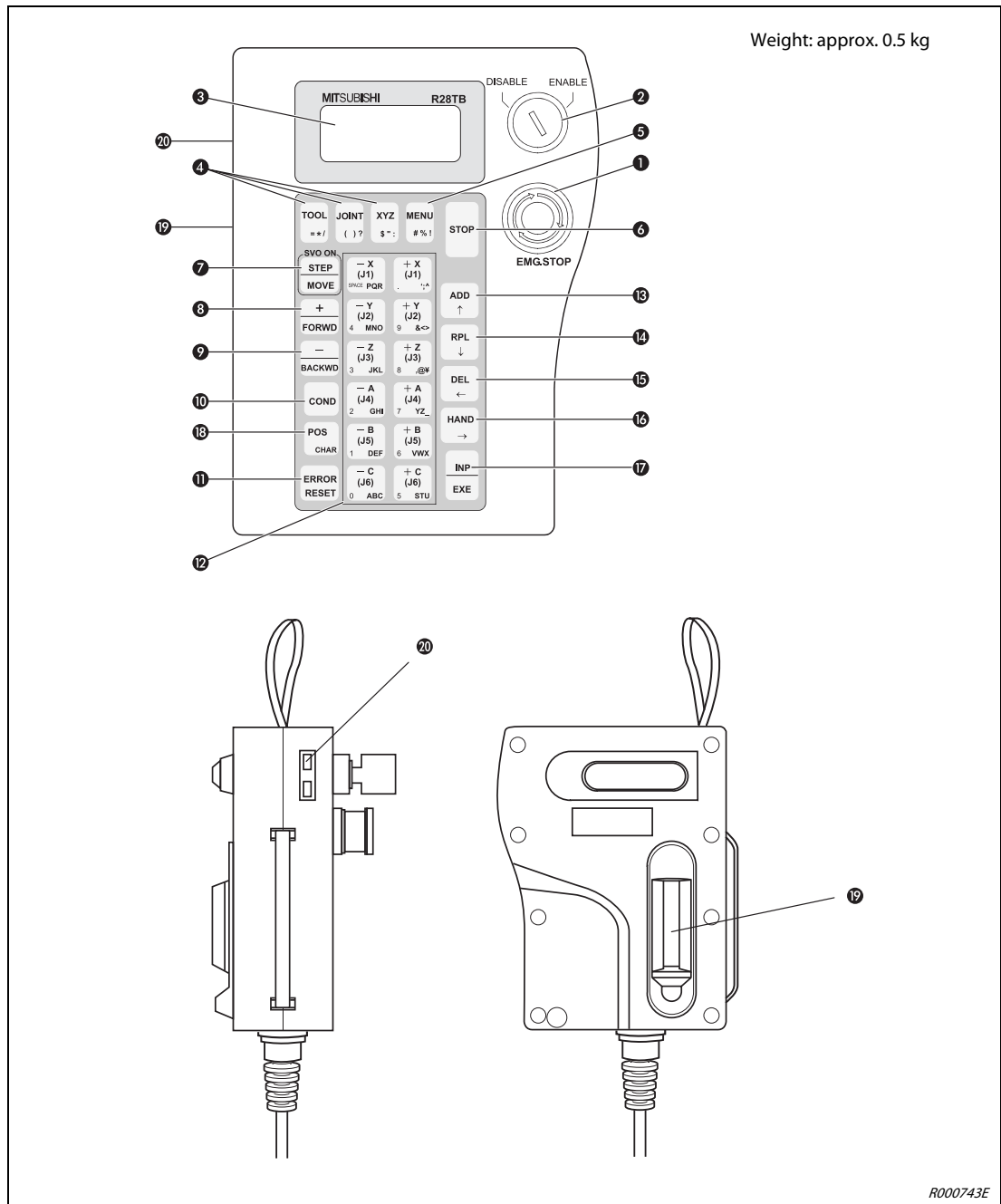


Fig. 2-9: Views of R28TB teaching box

No.	Name	Function
①	[EMG.STOP] pushbutton switch	EMERGENCY-STOP switch with locking function The robot arm stops immediately when you press the pushbutton switch. The servo supply voltage is switched off. The switch is unlocked by rotating it clockwise.
②	[ENABLE/DISABLE] switch	Enables the controller via the teaching box Set the switch to the "ENABLE" position to control the robot arm via the teaching box. If the teaching box is active (enabled) then you can neither gain control of the robot arm via the control panel of the control unit, nor externally.
③	LCD display	The LCD display has 4 lines, each with 16 characters. The condition of the program or of the robot arm is displayed here.
④	[TOOL] key	Selection of tool-jog mode
	[JOINT] key	Selection of joint-jog mode
	[XYZ] key	Selection of XYZ-jog or circle-jog mode
⑤	[MENU] key	Return to main menu
⑥	[STOP] key	Interruption of running program and stop (brake) of robot This function corresponds to the function of the [STOP] key on the control panel of the control unit. The key function is always available, irrespective of the position of the [ENABLE/DISABLE] switch
⑦	[STEP/MOVE] key	Run jog-mode together with jog key ⑫ and the three-step acknowledgement pushbutton Instruction steps are run together with the [INP/EXE] key. The servo supply voltage is switched off.
⑧	[+/FORWD] key	Forward steps are run together with the [INP/EXE] key. The next program line is displayed in edit mode If you press the key together with the [STEP/MOVE] key then oversteering increases.
⑨	[-/BACKWD] key	Backward steps are run together with the [INP/EXE] key. The previous program line is displayed in edit mode If you press the key together with the [STEP/MOVE] key then oversteering decreases.
⑩	[COND] key	Edit the program
⑪	[ERROR RESET] key	Acknowledge an error code A program is reset together with the [INP/EXE] key.
⑫	12 keys for JOG mode: [-X/(J1)] ... [+C/(J6)]	Function key for jog mode All joints can be modes individually in joint-jog mode. The robot arm can be moved along any of the coordinate axes in XYZ-jog mode. The keys are also used to enter menu selection numbers and step numbers.
⑬	[ADD/↑] key	Enter positions or move the cursor upwards
⑭	[RPL/↓] key	Change positions or move the cursor downwards
⑮	[DEL/←] key	Delete positions or move the cursor to the left
⑯	[HAND/→] key	Together with keys [+C/(J6)] or [-C/(J6)], movement of first gripper hand Together with keys [+B/(J5)] or [-B/(J5)], movement of second gripper hand Together with keys [+A/(J4)] or [-A/(J4)], movement of third gripper hand Movement of cursor to the right
⑰	[INP/EXE]	Data entry or move onto next step
⑱	[POS/CHAR] key	Changes between numbers and letters, e.g. when editing position data
⑲	Three-step acknowledgement key	The three-step acknowledgement key must be actuated to switch on the servo drive when then teaching box is switched on.
⑳	Contrast adjustment	Brightness adjustment of LCD display

Tab. 2-4: Overview of operating elements of R28TB teaching box

2.4.2 R46TB and R56TB

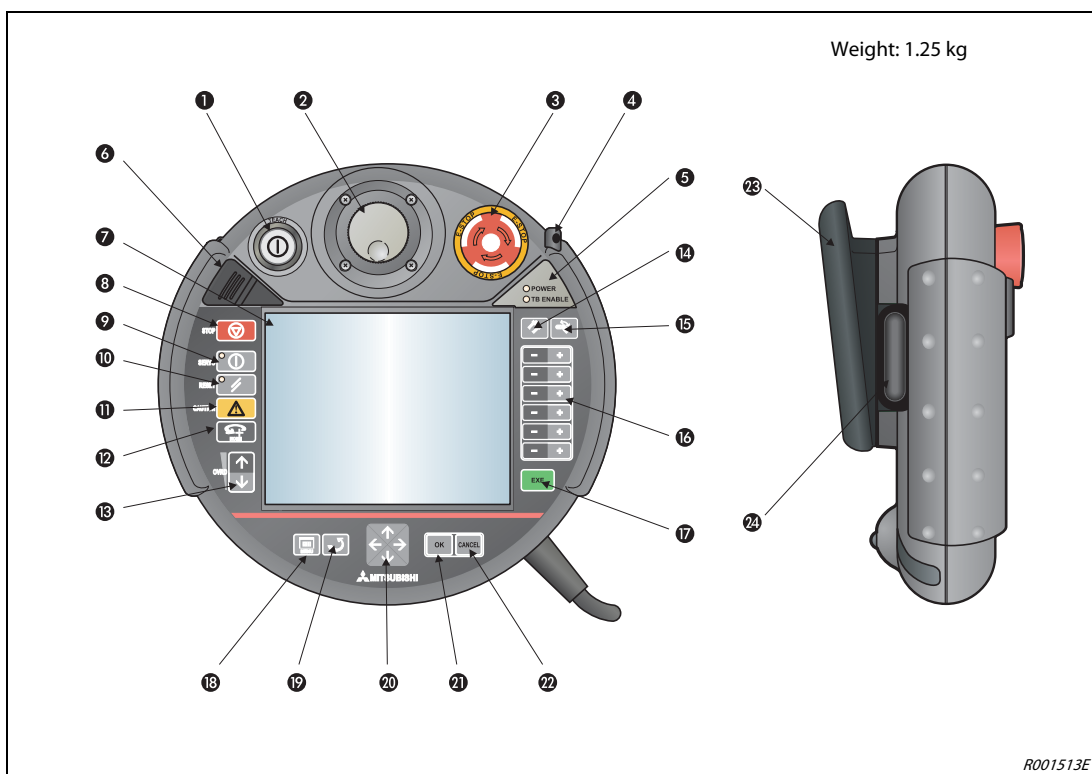


Fig. 2-10: Views of R46TB and R56TB teaching boxes

No.	Name	Function
1	[TEACH] pushbutton	The control unit is switched on with the pushbutton switch If the TEACH pushbutton is engaged then a white LED lights up. Enable the controller via the control unit Press the pushbutton until it engages ("ENABLE" position) to accept control from the control unit. If the control unit is active (enabled) then you can neither gain control of the controller via the control panel of the control unit, nor externally. Operation can also be switched-over to enabled in locked condition, depending on the display or the oversteering value. Press the pushbutton again and the lock is disengaged ("DISABLE" position) to store the current program and to end editing with the control unit.
2	Mode and scroll wheel	Move between the screen menus of the control unit using the mode and scroll wheel.
3	[E-STOP] pushbutton	Pushbutton with lock function for EMERGENCY-STOP After pressing this, the robot is stopped immediately irrespective of the current operating condition. The pushbutton is unlocked by rotating its surface to the right.
4	Stylus (slotted into the housing)	The touchscreen can be operated by this stylus. It is located inside a slide-in casing in the housing of the control unit and should be stored there after being used.
5	POWER LED TB ENABLE LED	The POWER LED lights when the supply voltage is connected. The green TB ENABLE LED lights when the touchscreen has been enabled with the TEACH pushbutton 1.
6	Protective cover with USB connection at rear	For a USB memory stick
7	Screen with touchscreen function	Touch-sensitive 6.5" backlit TFT monitor and 640 × 480 pixel resolution. The touchscreen can be operated by your fingers, or preferably with the supplied stylus 4.
8	[STOP] key	To immediately stop the robot. The servo is not switched off.

Tab. 2-5: Overview of operating elements of R46TB and R56TB (1) teaching boxes

No.	Name	Function
9	[SERVO] key	The servos are started by pressing the SERVO key and the acknowledgement pushbutton simultaneously. A green LED lights up when the servos are switched on.
10	[RESET] key	After a fault has occurred, the fault is reset by pressing the RESET key.
11	[CAUTION] key	When in JOG mode, a limit switch can be ignored by pressing this key. The brakes can also be released with this key.
12	[HOME] key	Not used here.
13	[OVRD] key	The JOG speed and the speed in automatic mode are increased or decreased here using the ↑ and ↓ arrow keys.
14	[HAND] key	The "HAND" screen menu is called up with this key.
15	[JOG] key	The "JOG" screen menu is called up with this key.
16	[+/-] key	The entry field command movements are carried out according to the options in the respective screen menu using these keys.
17	[EXE] key	Entries (commands) are run by the robot using this key, e.g. when aligning the hand gripper.
18	[MENU] key	The start menu is called up with this key.
19	[RETURN] key	Pressing this key returns you to the previous menu.
20	[↑, [↓], [←], [→] key	Use these arrow keys to move the cursor through the screen menus and entry fields.
21	[OK] key	Use this key to accept the settings in the current menu or entry field.
22	[CANCEL] key	Use this key to discard the settings in the current menu or entry field.
23	Multi-Grip hand grip	The Multi-Grip hand grip allows you to hold the control unit safely and comfortably and is suitable both for right-handed as well as left-handed use.
24	Acknowledgement pushbutton	The three-step acknowledgement pushbutton ensures that the user is not exposed to any danger during operation. All entries at the console (operating terminal) are only accepted and run when the acknowledgement pushbutton is held in its middle position. There is only a pressure point at the beginning. After this, the key can be easily held in its acknowledgement position without any additional force. The third-level of the acknowledgement pushbutton, also referred to as the panic position, guarantees that the acknowledgement is always lifted (cancelled) in case of an emergency.

Tab. 2-5: Overview of operating elements of R46TB and R56TB (2) teaching boxes

3 Installation

All preparations required for successful operation of the robot system are described in this chapter, from unpacking right up to installation.

3.1 Unpack the robot system



CAUTION:

Always unpack the robot only on a stable and even surface. If this condition is not observed then the robot may fall down and be damaged.

3.1.1 Unpack articulated arm robot

The robot arm is packaged in a box. The following figure provides a step-by-step guide of how to unpack the robot arm

- ① Place the robot arm box on its side on the floor, as shown in ①.
- ② Open the packaging tape with a knife or similar object.
- ③ Pull the inside packaging horizontally out of the box.
- ④ Remove the upper section ② of the inside packaging.
- ⑤ Straighten up the robot arm together with the lower section ③ of the inside packaging.
- ⑥ Remove the lower section of the inside packaging.
- ⑦ Transport the robot arm to its place of installation as described in Section 3.2.

NOTE

Keep the packaging and transport locks for later transport.

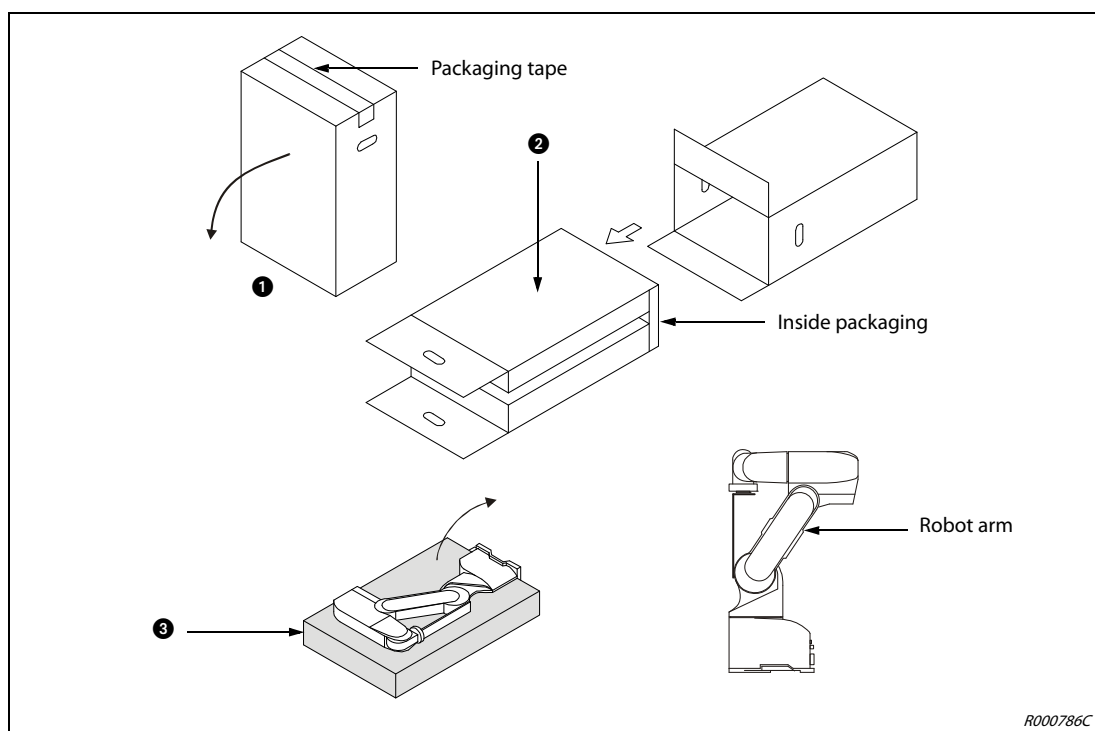


Fig. 3-1: Unpack the RV-2AJ ad RV-1A articulated arm robots

3.1.2 Unpack SCARA robots

The robot arm is packaged in a box. The following figure provides a step-by-step guide of how to unpack the robot arm

- ① Open the box and remove the upper cover.
- ② Transport the robot arm to its place of installation as described in Section 3.2.

NOTE

Keep the packaging and transport locks for later transport.

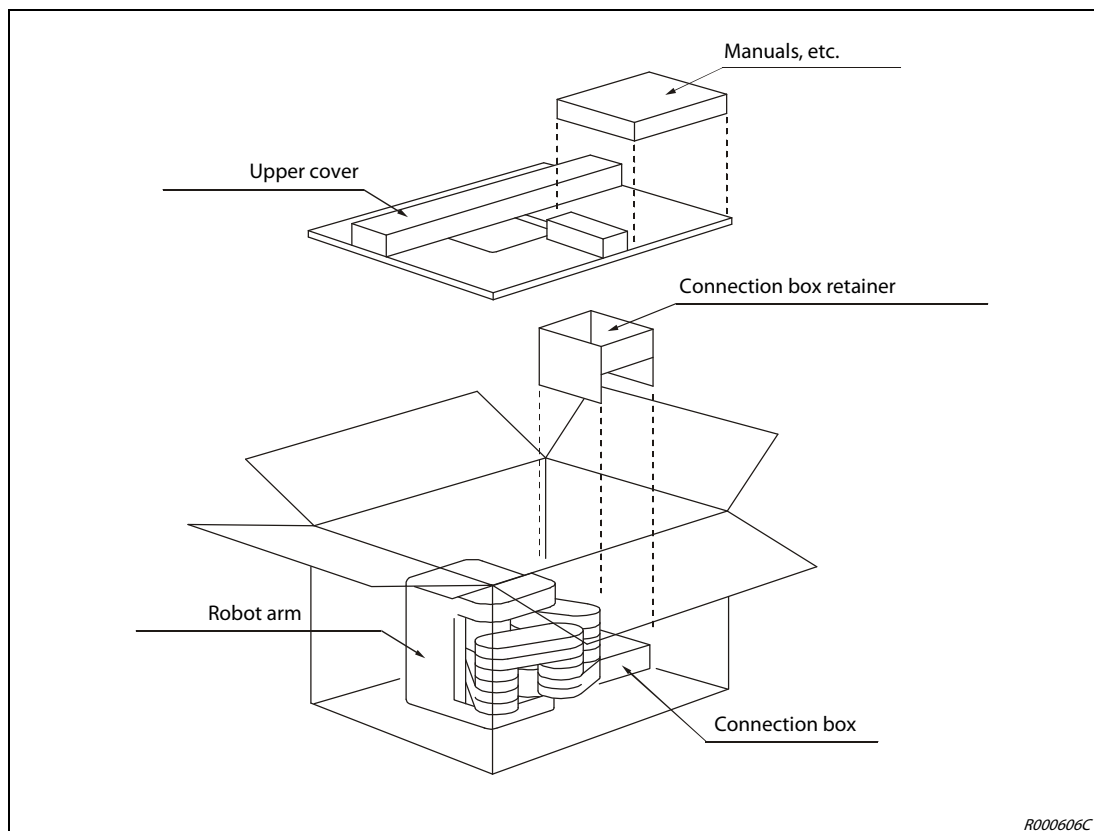


Fig. 3-2: Unpack the SCARA robot

3.2 Transport robot arm

3.2.1 RV-2AJ and RV-1A



CAUTION:

- *Two persons should always transport the robot arm. The transport lock must not be removed before transport.*
- *Always carry the robot arm at holding points ① and ②. Never carry the robot arm by its covers; this may result in damages.*

NOTE

Carefully store and keep the transport lock and the appropriate fixing screws for any later transport that might be required

- ① Two persons must always transport the robot arm. When doing so, always carry the robot arm at point ① in the area of the upper arm and ② of the base of the unit. Never carry the robot at its sides or covers as these might become loose and the robot arm will then be destroyed.

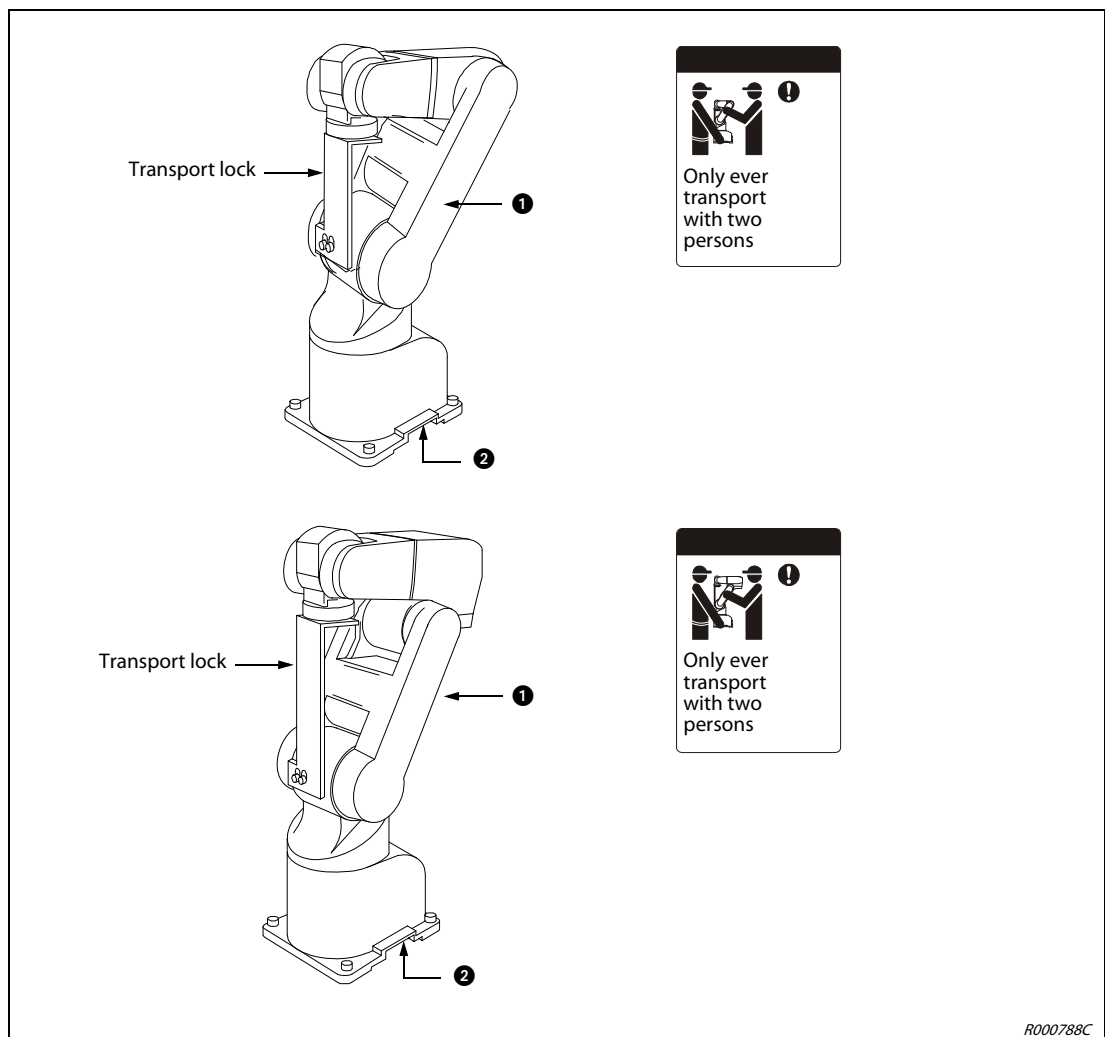


Fig. 3-3: Transport robot arms RV-2AJ and RV1A

- ② Never carry the robot arm on its side or at its axes without holding points; this could result in damages.
- ③ Use a dolly if transporting over longer distances. The equipment should only be carried by the holding points for shorter distances and times.
- ④ Do not strain any of the covers.
- ⑤ Avoid knocks and bumps when transporting the robot arm.

**CAUTION:**

Only remove the transport locks after the robot arm has been installed.

3.2.2 RP-1AH/3AH/5AH



CAUTION:

- **Two persons should always transport the robot. Transport locks A or D and B must not be removed before transport.**
- **Always carry the robot arm at holding points ①, ② and ③. Never carry the robot at its front end in the area of the axis and avoid unnecessary loads to the cable; this could result in damages.**

NOTE

Carefully store and keep the transport locks and the appropriate fixing screws for any later transport that might be required

- ① Three persons must always transport the robot. When doing so, carry the robot at point ① of the arm, ② of the base area and ③ of the connection box. The robot must thereby be in its packaging position. Never carry the robot at its front end in the area of the axis or by the cable; this could result in damages.
- ② Transport locks A or D and B must be attached during transport to protect the robot from the effects of external forces.
- ③ Avoid knocks and bumps when carrying the robot.
- ④ Observe the above mentioned points every time you transport the robot (e.g. when switching the installation location). If the robot is not lifted in its packaging position, or lifted without transport locks engaged then dangerous situations may arise during transport, e.g. due to a shift in the centre of gravity, etc.

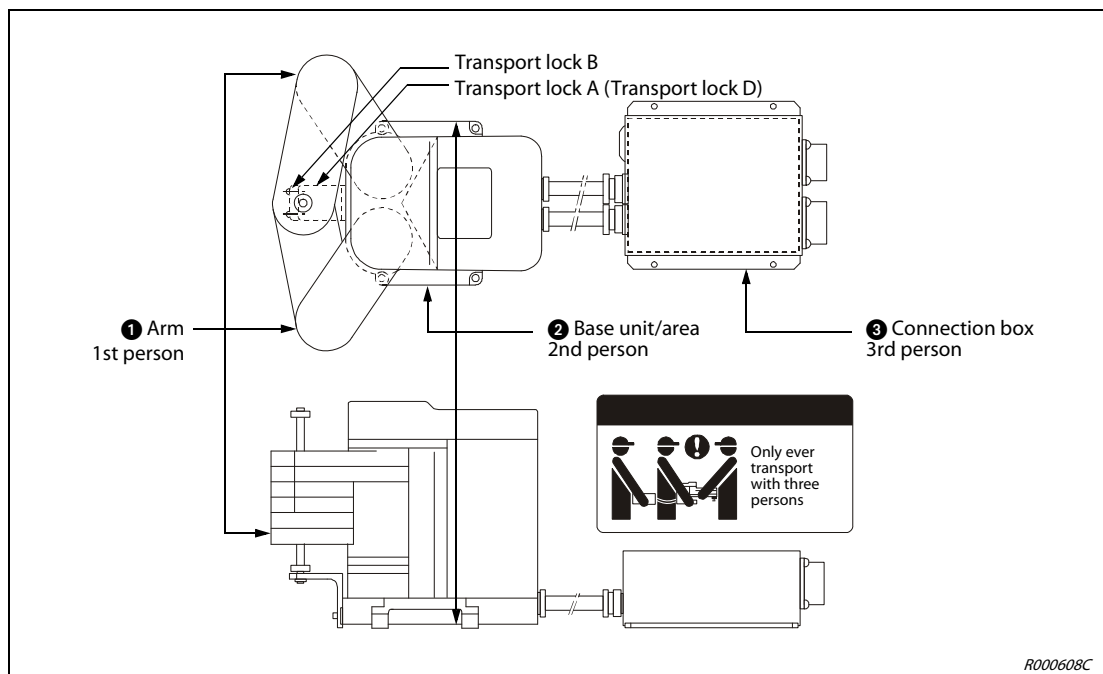


Fig. 3-4: Transport robot arm RP-1AH/3AH/5AH

3.3 Setup the robot arm

3.3.1 Setup the articulated arm robot

The following figure shows how to erect and fix the robot arm. This is identical for 5-axis and 6-axis robot arms.

- ① The surface of the robot arm is machine-planned.
Functional faults may occur in the robot arm if it is installed too unevenly.
Fix the robot arm at the assembly holes ($\varnothing 9$ mm) to the four outer corners of the surface using the supplied Allen screws (M8 x 30).
- ② Align the robot arm horizontally.
- ③ The average surface finish of the assembly surface should be $R_a = 6.3 \mu\text{m}$. If the surface is too rough then this might result in position deviations of the robot arm.
- ④ To avoid position deviations, the peripheral equipment accessed by the robot should be installed on the same mounting surface as the robot arm itself.
- ⑤ The base area must be designed so that no deformations can arise there due to the loads and vibrations from the robot.
- ⑥ Only remove the transport lock in the hand area after installing the robot arm.



CAUTION:

The transport lock fixing screws must be removed after transport. Keep the fixing screws for later transport of the robot arm.

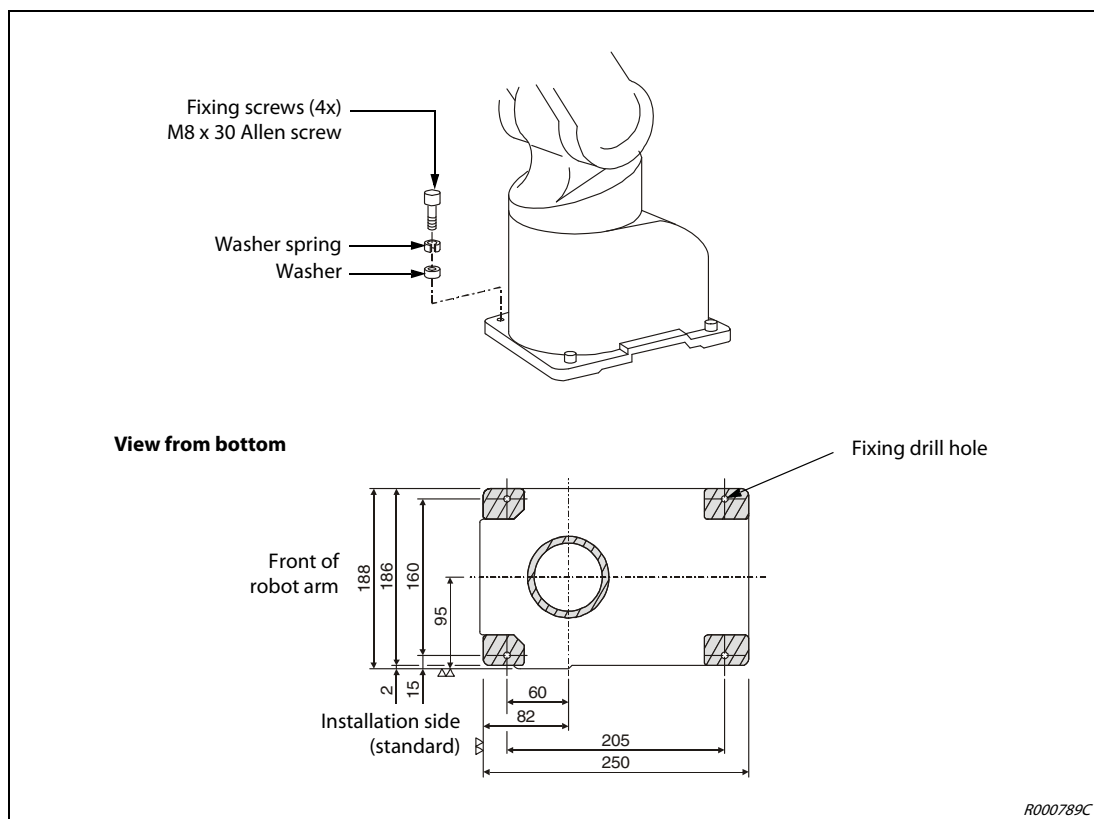


Fig. 3-5: Setup the robot arm

3.3.2 Setup the SCARA robot

The following figure shows how to erect and fix the robot arm. Correct installation of the robot arm is an important precondition for perfect operation.

- ① The surface of the robot arm is machine-planed.
Functional faults may occur in the robot if it is installed too unevenly. Fix the robot at the assembly drill holes (RP-1AH: $\varnothing 7$ mm, RP-3AH/5AH: $\varnothing 9$ mm) to the four outer corners of the surface using the supplied Allen screws (RP-1AH: M6 x 35, RP-3AH/5AH: M8 x 45).
- ② Align the robot horizontally.
- ③ The average surface finish of the assembly surface should be $\nabla\nabla$. If the surface is too rough then this might result in position deviations of the robot.
- ④ To avoid position deviations, the peripheral equipment accessed by the robot should be installed on the same mounting surface as the robot arm itself.
- ⑤ The base area must be designed so that no deformations can arise there due to the loads and vibrations from the robot.
- ⑥ Fix the connection box with 4 Allen screws (M4 x 10). (the screws are not supplied.)
- ⑦ Only remove transport lock A or D after installing the robot arm.



CAUTION:

The transport lock fixing screws must be removed after transport. Keep the fixing screws for later transport of the robot arm.

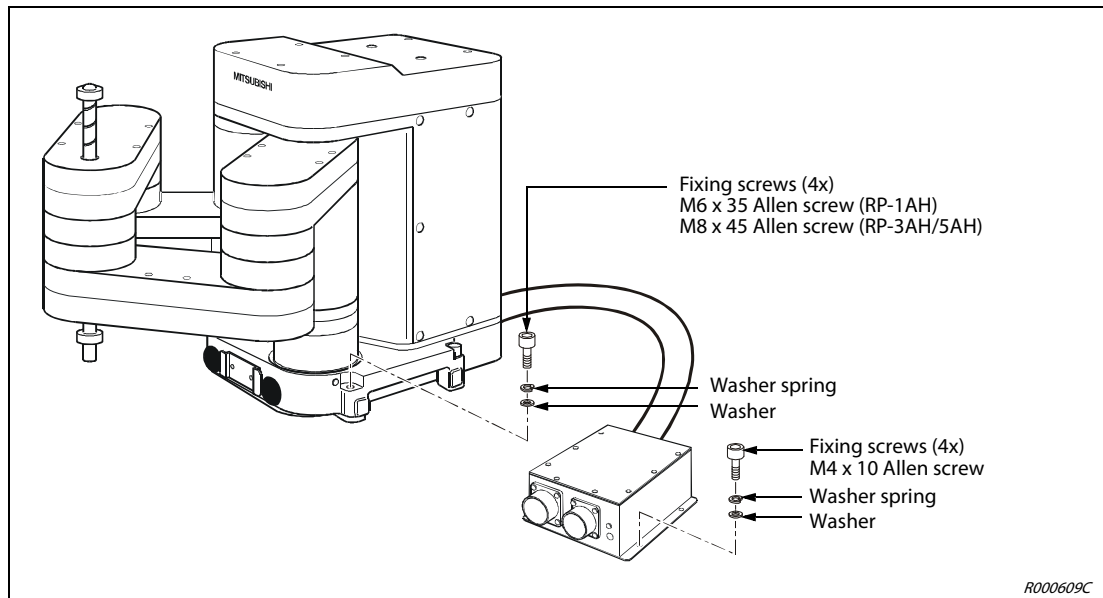


Fig. 3-6: Setup the robot arm

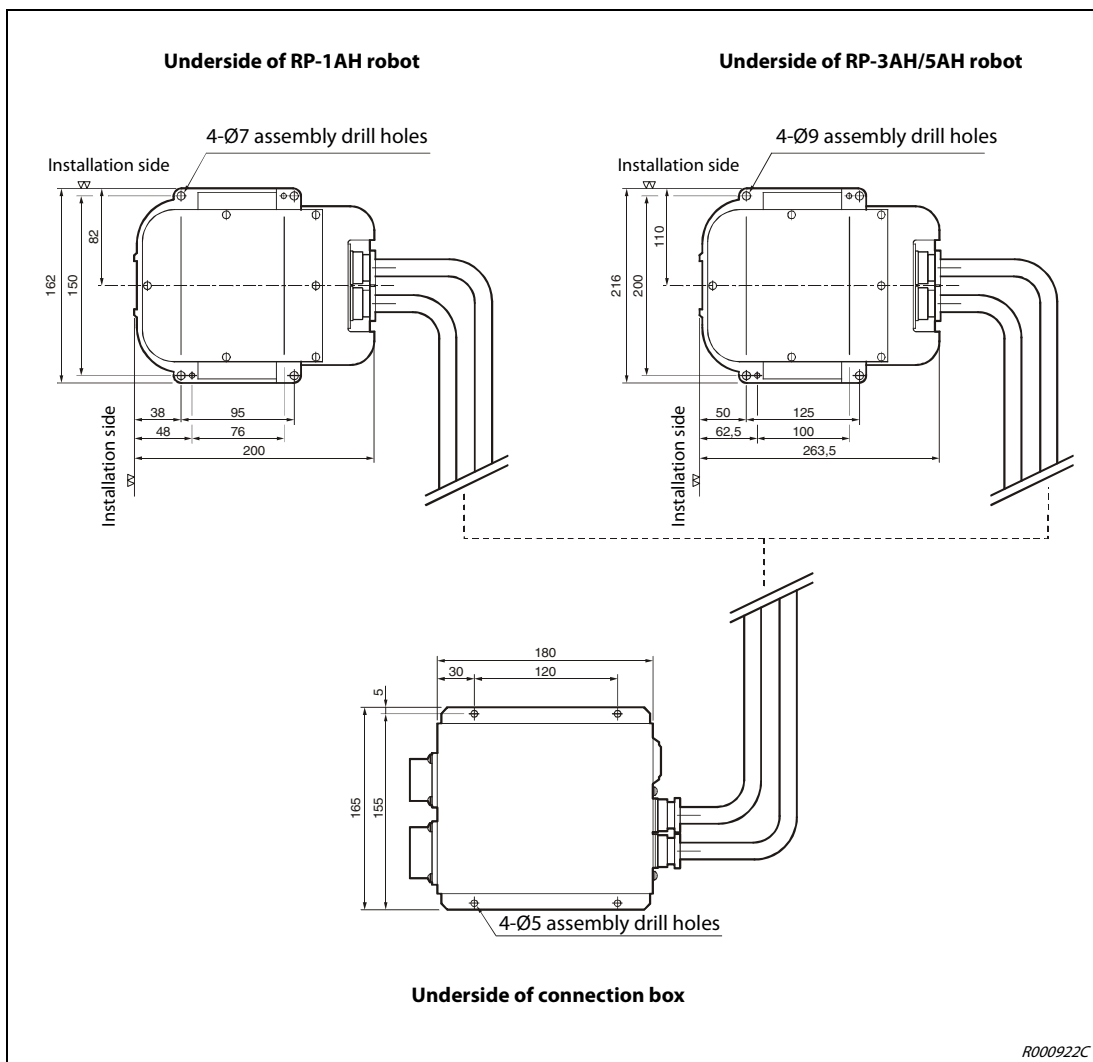


Fig. 3-7: Installation dimensions of the robot arm

3.4 Handling the control unit

This section describes the correct handling and installation of the control unit.

3.4.1 Transport control unit



CAUTION:

To lift the unit, hold it by its front and rear ends. Do not carry the control unit at its shoulders or plug connections.

3.4.2 Install control unit

The following figure shows how to install the control unit. Observe the following points:

- There is a ventilator on the base of the control unit. Make sure that the feet of the control unit are installed.
- Make sure that there is a lateral clearance of at least 50 mm and a clearance at the rear of at least 170 mm.

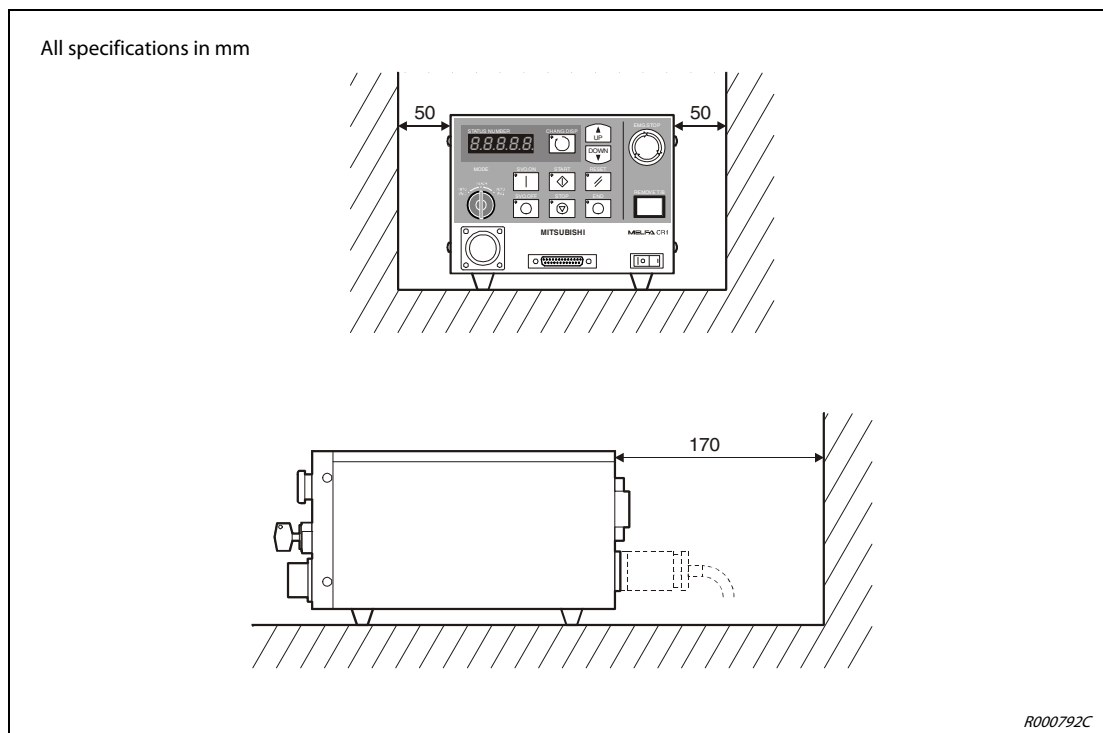


Fig. 3-8: Install the control unit



CAUTION:

To prevent overheating of the control unit, the feet must be mounted as distance pieces on the base of the control unit.

3.5 Earthing the robot system

General instructions on earthing the robot system

The three possibilities for earthing are shown in Fig. 3-9.

- Separate earthing is the best solution.
 - An articulated arm robot is earthed by an M4 threaded hole (see Fig. 3-10) on its surface and a SCARA robot is earthed by an M3 threaded hole on its base (see Fig. 3-11).
 - The connection box on a SCARA robot is earthed by an M4 thread (see Fig. 3-11) on the housing.
 - The control unit is jointly earthed together with the mains line connection. To earth the control unit, proceed as described in Section 4.2.
- If possible, the earthing of the robot arm must be separated from other devices.
- The minimum cross-section of the earthing cable must be 3.5 mm^2 .
- The earthing cable is not included in the delivery of the robot system.
- The earthing cable should be as short as possible.

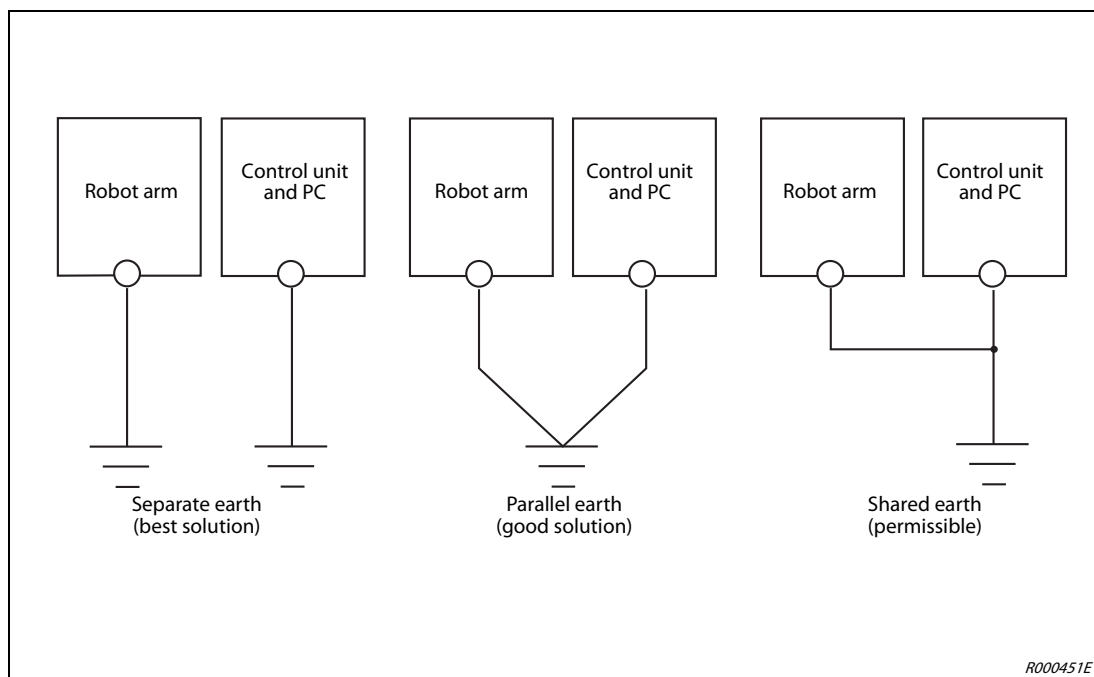


Fig. 3-9: Earthing the robot system

3.5.1 Earthing the robot arm

Earthing an articulated arm robot

- ① Use an earthing cable with a cross-section of at least 3.5 mm².
- ② Check the area around the earthing screw for deposits and remove these with a file if necessary.
- ③ Fix the earthing cable with the earthing screw (M4 x 10) to the earth-connection of the robot arm (for this, see Fig. 3-10).

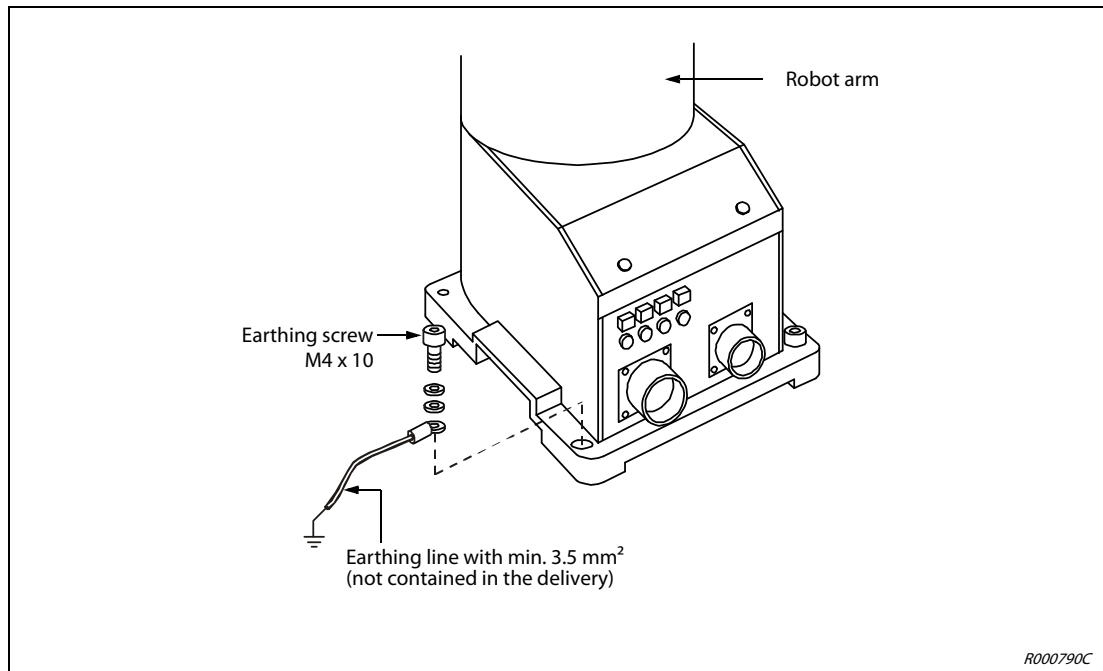


Fig. 3-10: Earthing the articulated arm robot

Earth SCARA robot and connection box

- ① Use an earthing cable with a cross-section of at least 3.5 mm².
- ② Check the area around the earthing screw for deposits and remove these with a file if necessary.
- ③ Connect the earthing cable to the earth connection.

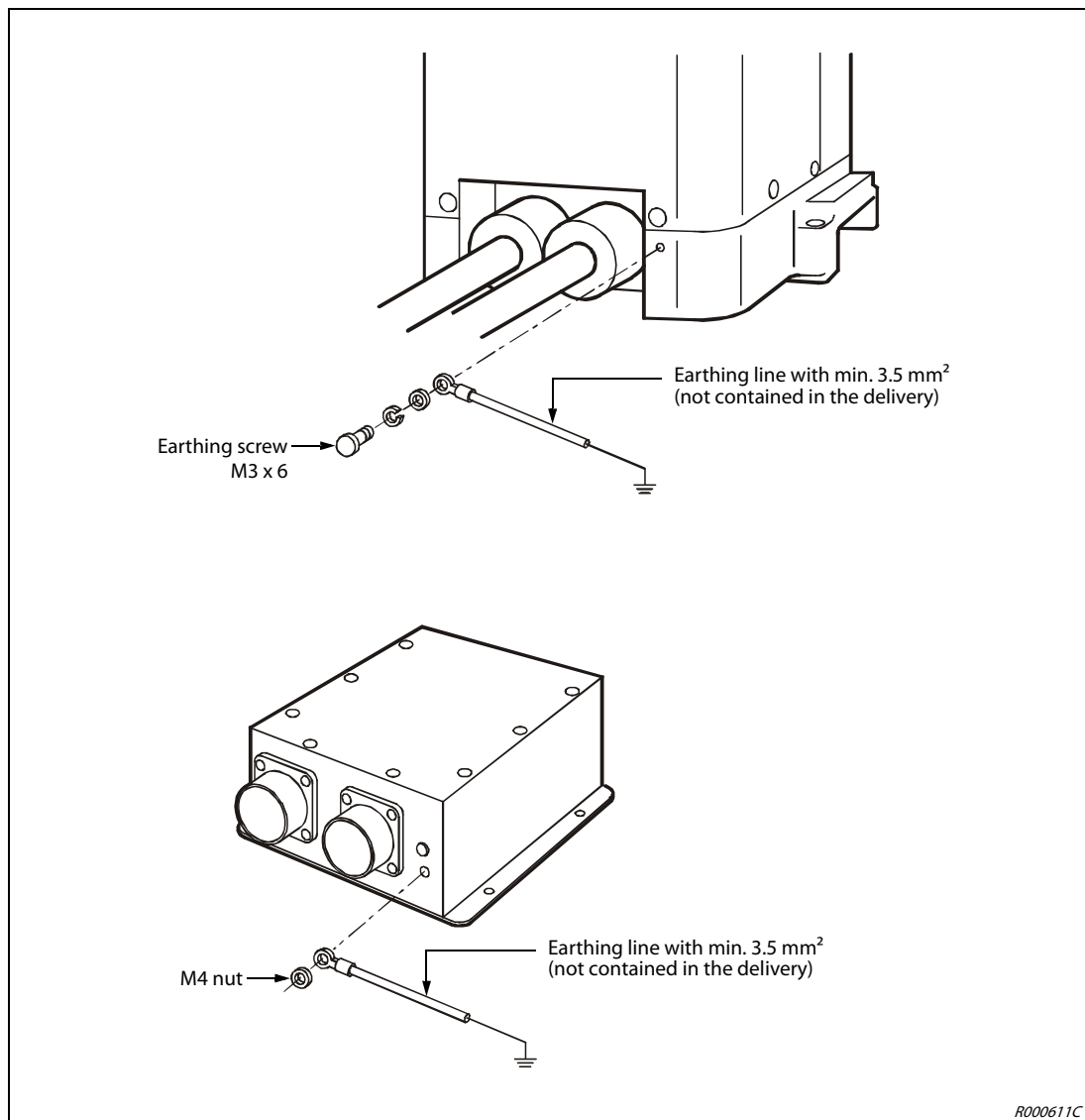


Fig. 3-11: Earth the SCARA robot and the connection box

R000611C

4 Connection

This chapter describes the connection of the connection cable, the mains connection, the connection of the EMERGENCY-STOP switch and the connection of the teaching box.

4.1 Connect the connection cable

4.1.1 Connect the articulated arm robot to the control unit

The following figure shows how to connect the connection cable between the robot arm and the control unit.

- ① Make sure that the control unit is switched off. The [POWER] switch must be set to the "OFF" position.
- ② Connect the power and control cable to the robot arm and the control unit. Avoid heavy pulling or bending of the cable. This could damage the cable.
- ③ Screw on the plug with the threaded ring. A click indicates that the connection is correct.

NOTE

There are noses on the plugs. The plug therefore only fits in one direction into the connection socket. The plug can be damaged if connected incorrectly.

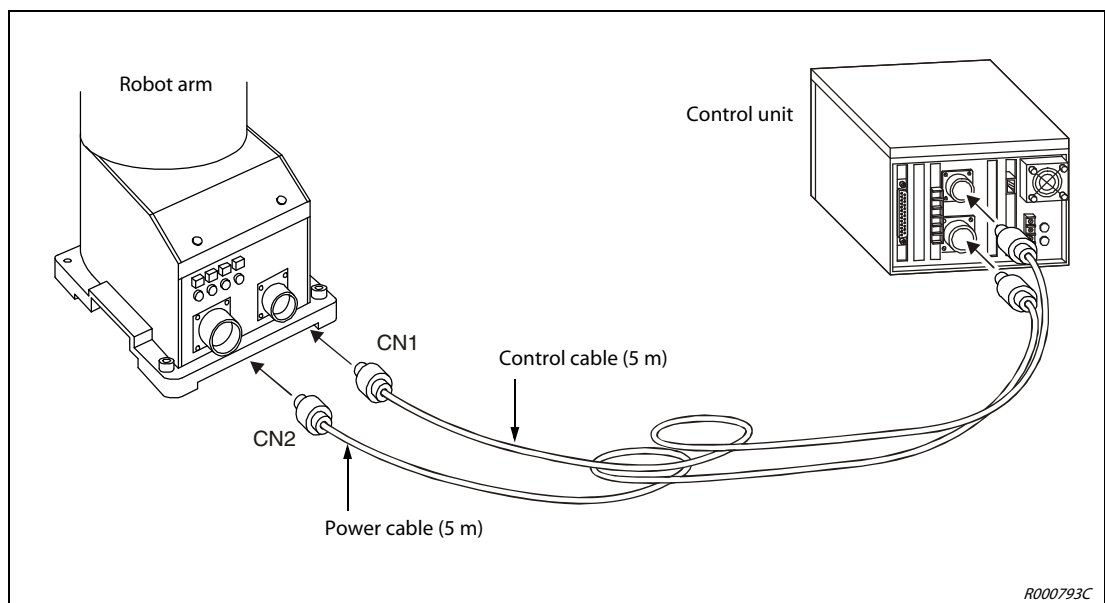


Fig. 4-1: Connect the connection cable

**CAUTION:**

The standard connection cable between the robot arm and the control unit is only suitable for fixed laying. It is forbidden to use it within a dragline.

4.1.2 Connecting the SCARA robot to the control unit

The following figure shows how to connect the connection cable between the robot arm and the control unit.

- ① Make sure that the control unit is switched off. The [POWER] switch must be set to the "OFF" position.
- ② Connect the power and control cable to the connection box and the control unit. Avoid heavy pulling or bending of the cable. This could damage the cable.
- ③ Screw on the plug with the threaded ring. A click indicates that the connection is correct.

NOTE

There are noses on the plugs. The plug therefore only fits in one direction into the connection socket. The plug can be damaged if connected incorrectly.

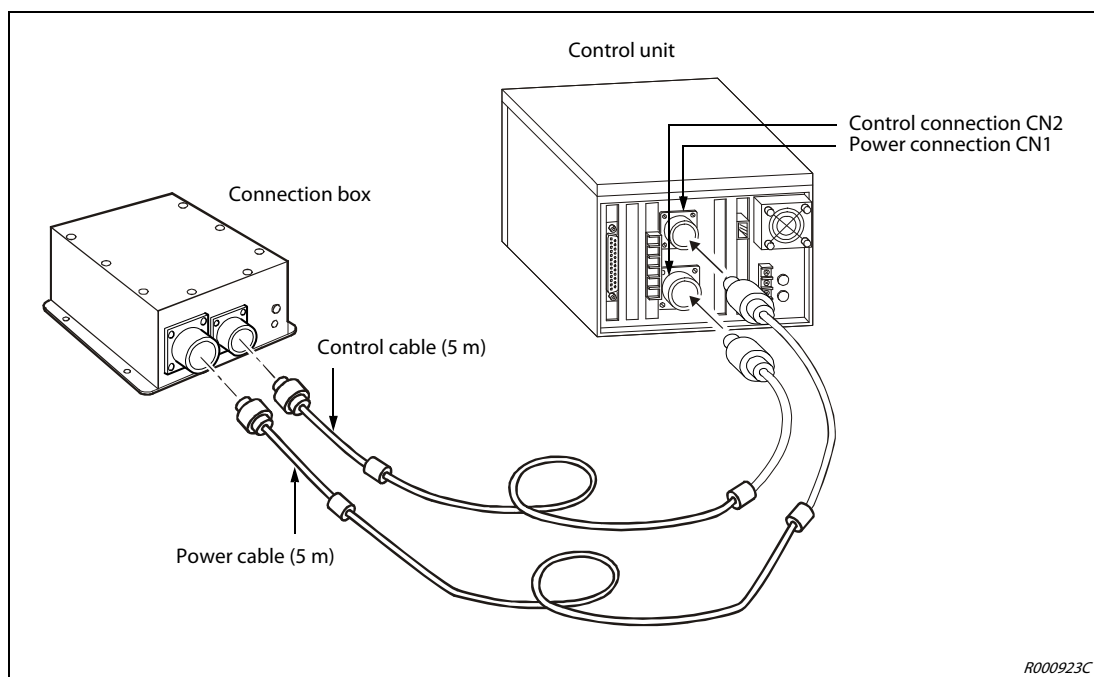


Fig. 4-2: Connect the connection cable

NOTE

The maximum cable length between the robot arm and the control unit is 15 m. Appropriate cable lengths of 10 m and 15 m are available on request.



CAUTION:

The standard connection cable between the robot arm and the control unit is only suitable for fixed laying. It is forbidden to use it within a dragline.

4.2 Mains connection and earthing

To find out how to earth the robot arm, refer to Section 3.5.



CAUTION:

Only carry out connection work at the control unit when the equipment is switched off and when the main switch is secured against being switched back on.

NOTE

| The control unit can only be switched on with 1-phase.

- ① Make sure that the mains voltage and the power switch of the control unit are switched off.
- ② Make ready the mains line and the earthing cable. Use a cable with a minimum cross-section of 2 mm².
- ③ Release the two cover screws of the terminal block and remove the cover.
- ④ Connect the power supply cable according to the Fig. 4-3 on the terminals of the terminal block.

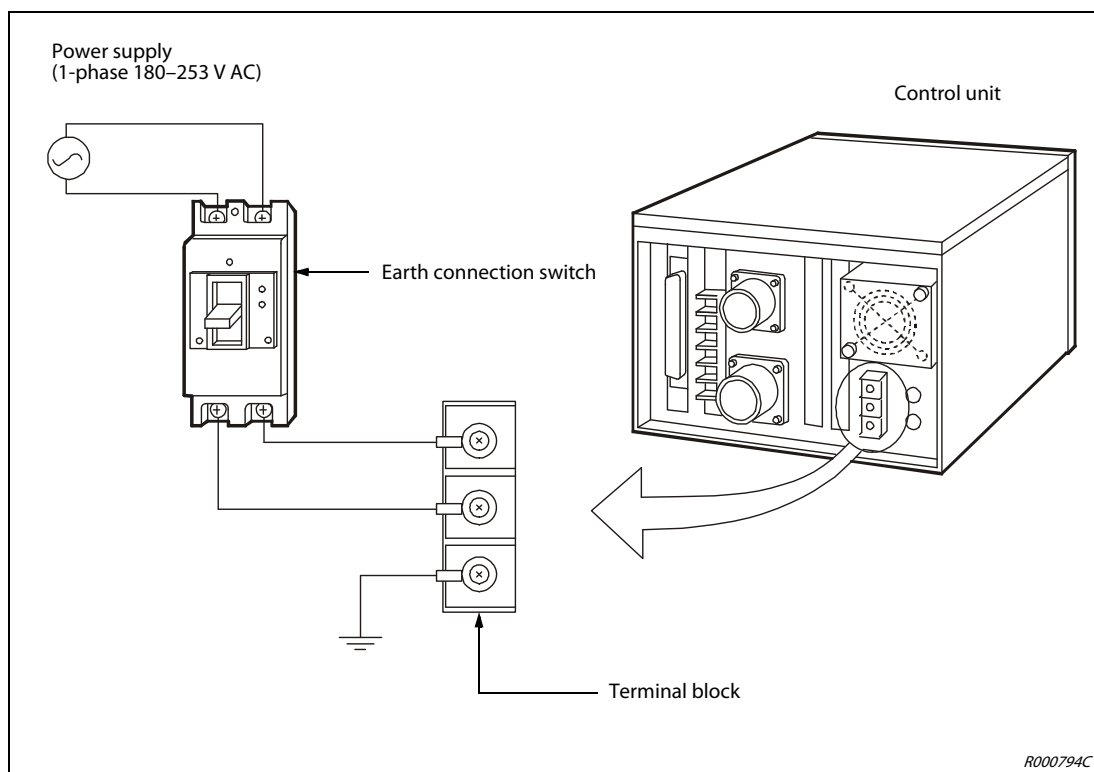


Fig. 4-3: Connect the mains line and earth to the control unit



CAUTION:

The control unit can be operated with 1-phase within a voltage range of 180-253 V AC or 90-132 V AC. The control unit has been prepared for a voltage range of 180-253 V AC at the factory. If you want to operate it within a voltage range of 90-132 V AC then please contact your Mitsubishi partner.

- ⑤ Connect the other end of the power supply cable to the earth connection switch.
- ⑥ Connect the mains line to the upper terminals of the earth connection switch.
- ⑦ Connect the earthing cable to the earthing connection marked PE on the terminal block.
- ⑧ Fix the terminal cover with the two screws.

4.3 EMERGENCY-STOP connection

The EMERGENCY-STOP plug is located on the rear of the control unit. There are 6 connection terminals on this plug to integrate the following into the circuit of the robot: two each for an EMERGENCY-STOP switch, one door locking contact and one signal lamp. The connection terminals for the EMERGENCY-STOP switch and the door locking contact are each short-circuited by a wire bridge (standard). The robot can be stopped at the front side of the control unit by the EMERGENCY-STOP switch.

Proceed as follows to integrate an external EMERGENCY-STOP switch or door locking contact into the robot circuit:

- ① Release the screws of the corresponding connection terminals and remove the wire-bridge.
- ② Take the connection line of the external switch, e.g. EMERGENCY-STOP switch, and remove 5 to 7 mm of the line insulation.
- ③ Place the bare end of the line underneath the screw terminal.
- ④ Tighten the screws.

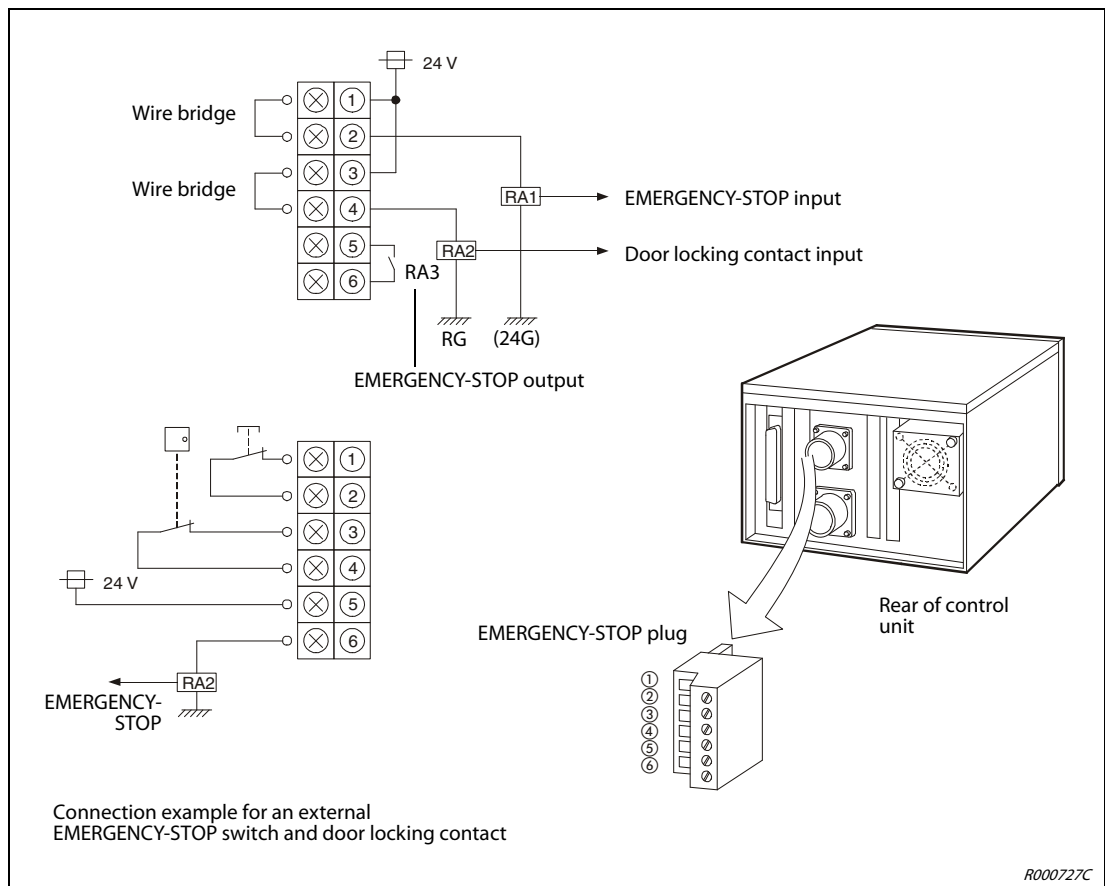


Fig. 4-4: Connect the EMERGENCY-STOP switch and the door locking contact

4.4 Safety circuits

Example

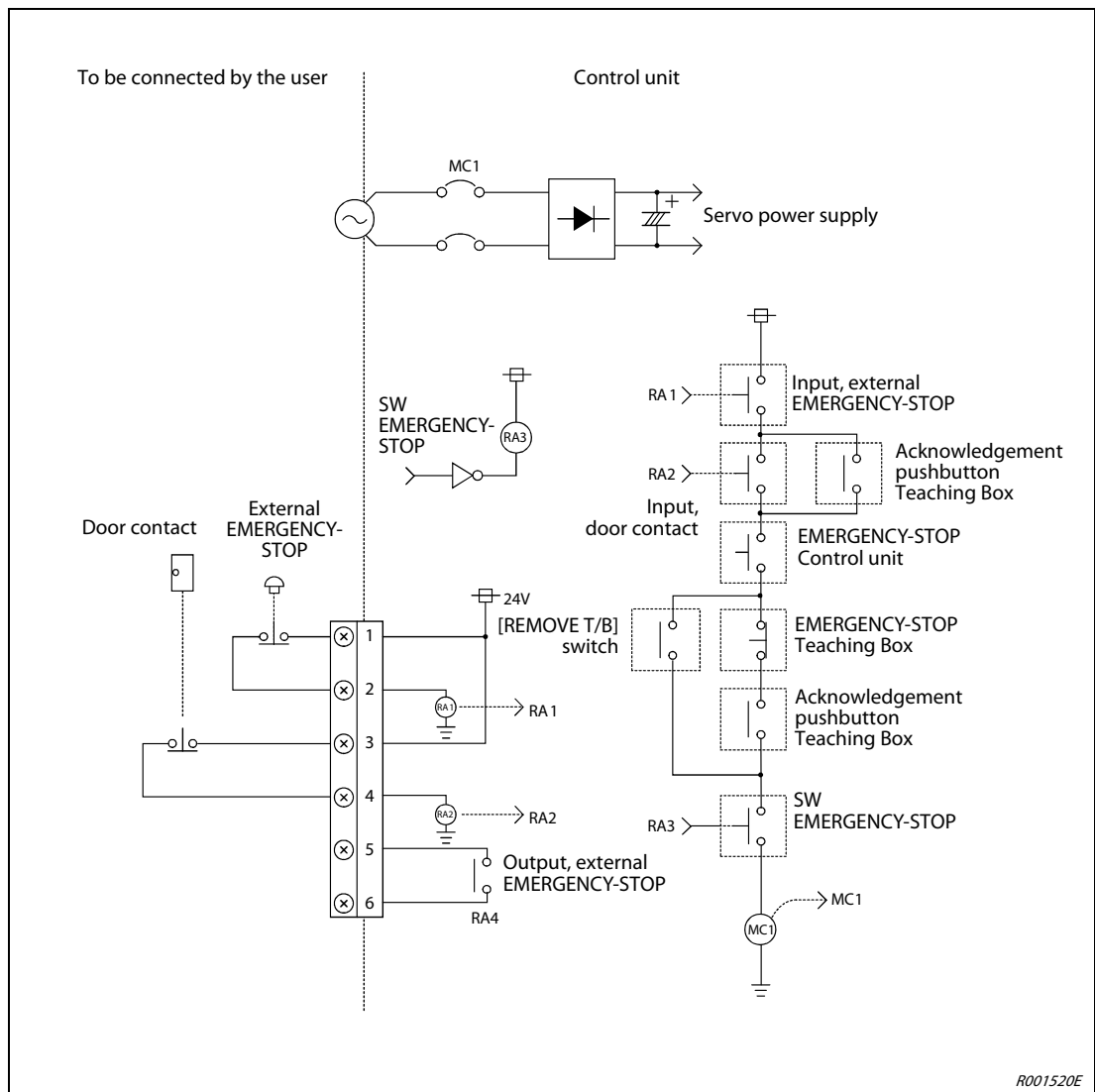


Fig. 4-5: Design of a safety circuit

NOTE

For reasons of clarity, some information has not been presented in full in the figure; the figure is therefore different than the actual conditions of the product.

4.5 Connect teaching box

This section describes the teaching box connection when the power supply is switched on and off. The connection of the teaching box is described in Fig. 4-6.

**CAUTION:**

Do not excessively pull or bend the connection cable! Otherwise, the cable could be damaged.

Connect the teaching box with power supply switched off

- ① Switch off the control unit.
- ② Connect the cable from the teaching box to the teaching box connection of the control unit.
- ③ Fix the plug by turning the threaded ring to the right. A click indicates that the connection is correct.
- ④ Make sure that the [REMOVE T/B] pushbutton switch is not pressed. The [REMOVE T/B] pushbutton switch must not be pressed when connecting the teaching box. The control unit emits an acoustic signal when the [REMOVE T/B] pushbutton switch is actuated. In this case, press the pushbutton switch once.
- ⑤ Set the [ENABLE/DISABLE] switch on the teaching box to the "DISABLE" position.
- ⑥ Make sure that there is nobody within the movement radius of the robot arm. Switch the power supply back on.

**CAUTION:**

Press the [REMOVE T/B] pushbutton switch before removing the cable from the teaching box! If the pushbutton switch is not pressed then an EMERGENCY-STOP is triggered for the robot arm! If the power supply of the control unit is switched on when the [ENABLE/ DISABLE] switch of the teaching box is in the "ENABLE" position and the enabling switch is not pressed then the servo power supply does not switch on. Set the teaching box to "DISABLE" and switch on the power supply of the control unit. You can also set the servo drive to "ON" via the switched-on teaching box, thereby switching on the servo power supply, while simultaneously pressing the enabling switch.

Connect the teaching box with power supply switched on

The [REMOVE T/B] pushbutton switch allows the teaching box to be connected when the power supply of the control unit is switched on. Proceed as described in the following. If any other method is used then an EMERGENCY-STOP is triggered.



CAUTION:

The EMERGENCY-STOP switch of the teaching box is ineffective when the [REMOVE T/B] pushbutton switch is pressed! The robot can be started by a signal or another source.

Disconnect the connection between the control unit and the teaching box

- ① Set the [ENABLE/DISABLE] switch on the teaching box to the "DISABLE" position.
- ② Press the [REMOVE T/B] pushbutton switch of the control unit (pressed in condition). The pushbutton switch LED starts to flash.
- ③ Release the teaching box plug by turning the threaded ring to the left.
- ④ Pull out the plug of the teaching box from the control unit within the next 5 seconds. The LED goes off.

Connect teaching box

- ① Set the [ENABLE/DISABLE] switch on the teaching box to the "DISABLE" position.
- ② Connect the teaching box to the control unit. The pushbutton switch LED starts to flash.
- ③ Press the [REMOVE T/B] pushbutton switch of the control unit within the next 5 seconds (the switch protrudes) after having connected the teaching box. The LED now lights permanently.
- ④ Fix the teaching box plug by turning the threaded ring to the right. A click indicates that the connection is correct.

NOTE

If an EMERGENCY-STOP is triggered during the above-mentioned steps then proceed as follows: Press the [REMOVE T/B] pushbutton switch of the control unit (the switch protrudes). The LED lights permanently. Set the [ENABLE/DISABLE] switch on the teaching box to the "ENABLE" position. Press the [ERROR RESET] key on the teaching box.

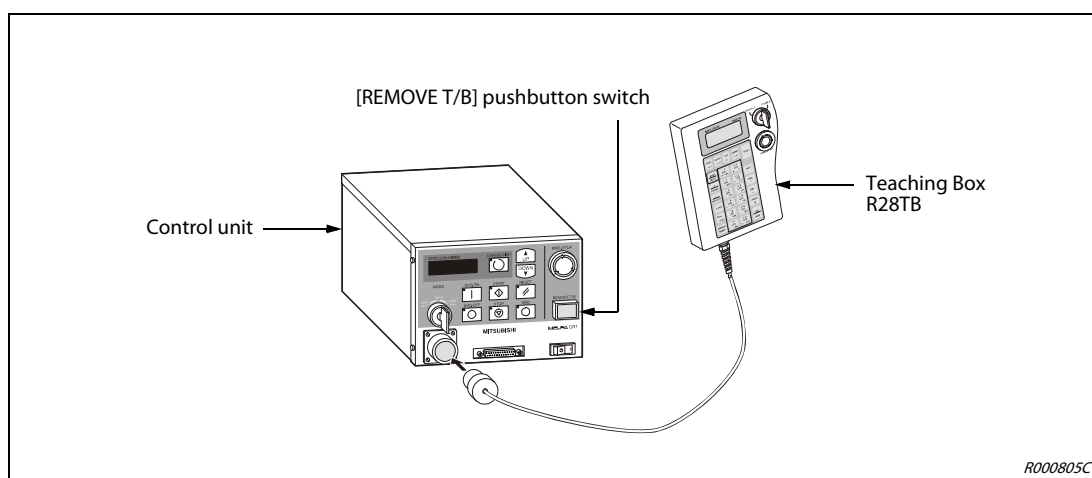


Fig. 4-6: Connect teaching box

5 Startup

5.1 Calibrate the robot system

5.1.1 Workflow

This section contains step-by-step instructions on how to switch on the power supply and the teaching box. A description is then provided on how to adjust and store the home position (referred to in the menus as the "ORIGIN" position).

**CAUTION:**

The home position must be adjusted to ensure perfect function of the robot and must be carried out after unpacking and every time the equipment is reconfigured (robot arm or control unit).

5.1.2 Prepare the system for maintenance mode

The following section describes the preparations to be made to call-up the maintenance menu.

Step 1: Switch on the power supply**DANGER:**

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

- ① Set the [POWER] switch on the front side of the control unit to the "ON" position.
- ② The control LEDs on the control unit flash on and off briefly. "o.100" is now indicated on the STATUS NUMBER display.

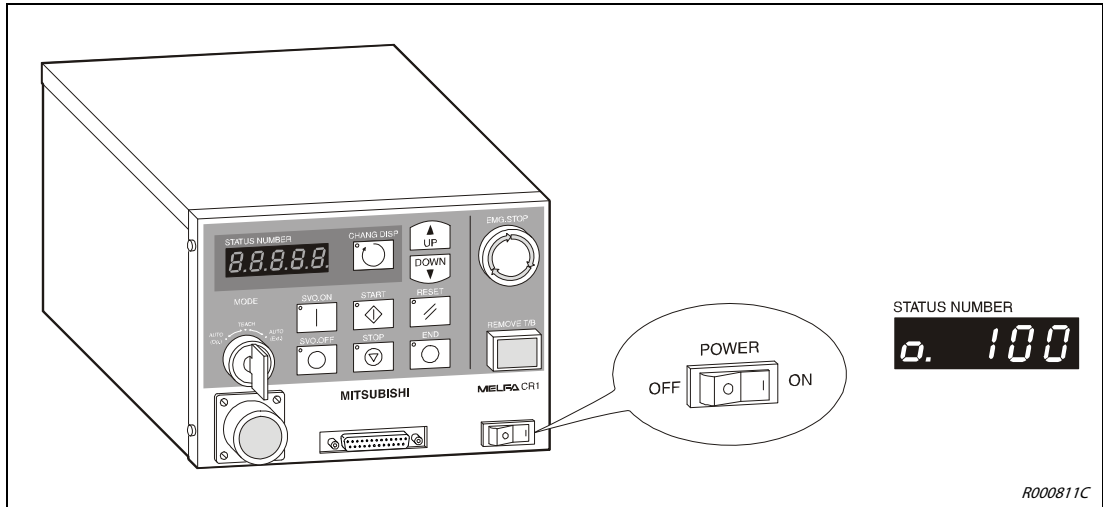


Fig. 5-1: Switch on the power supply

Step 2: Switch on the teaching box

- ① Set the [MODE] switch of the control unit to the "TEACH" position.

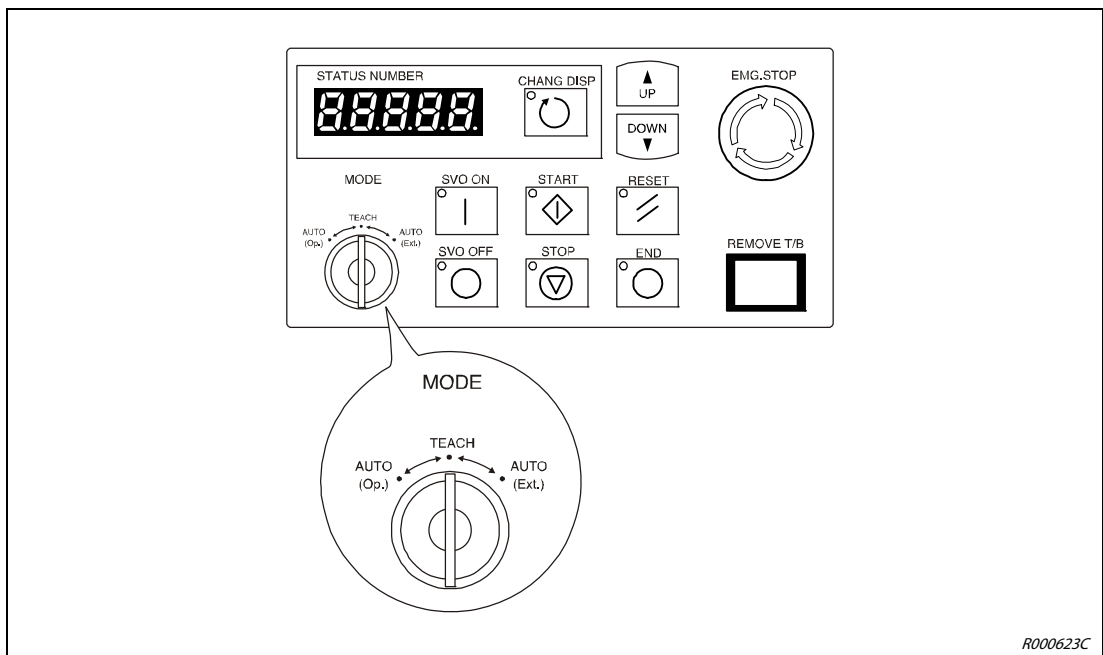


Fig. 5-2: Set [MODE] switch on control unit to "TEACH"

- ② Set the [ENABLE/DISABLE] switch on the teaching box to the "ENABLE" position.
- ③ The main menu appears on the display.

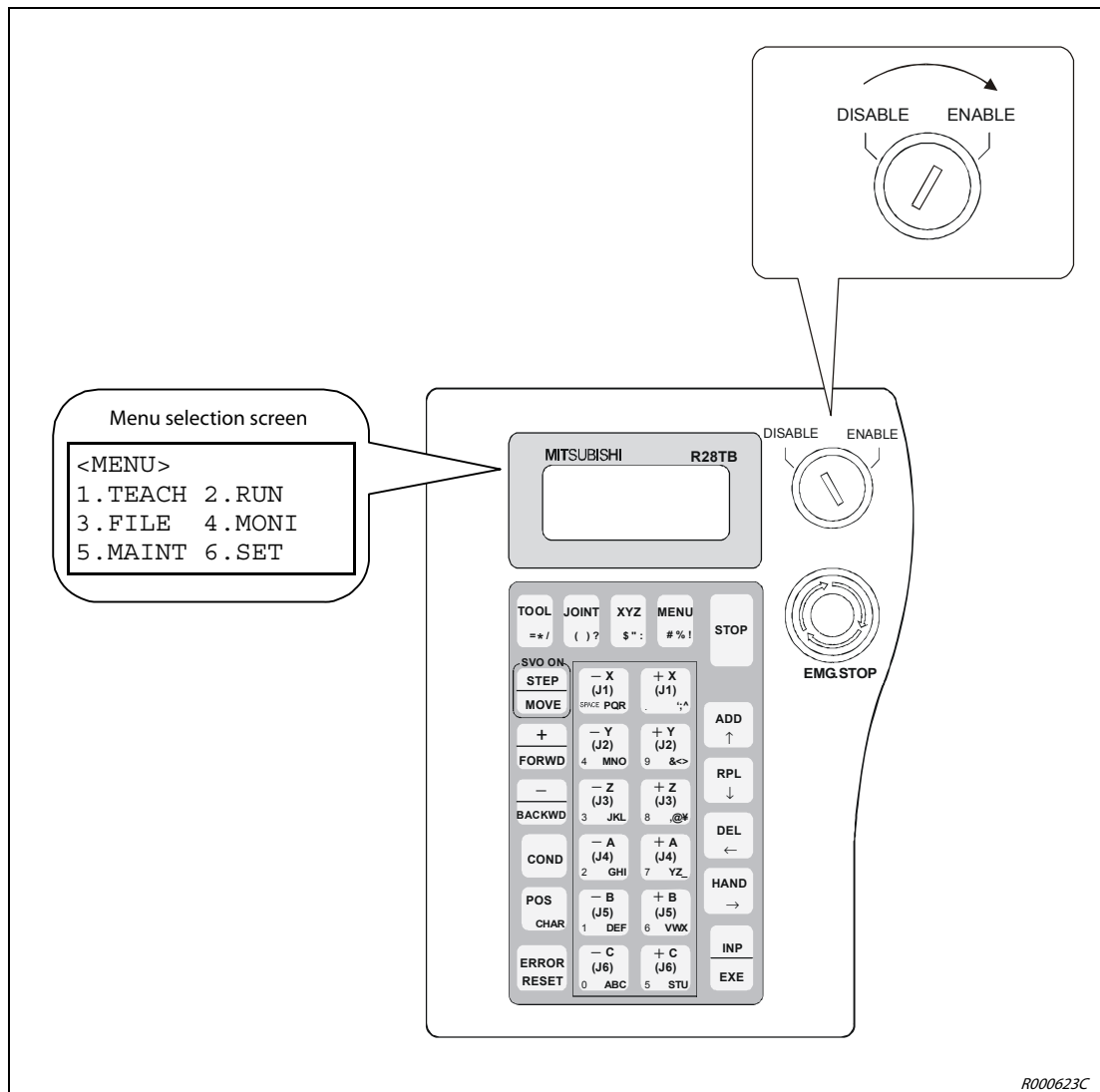


Fig. 5-3: Switch on the teaching box



CAUTION:

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 on the control unit are deactivated in this state. However, all EMERGENCY-STOP and STOP switches always remain active on the system for safety reasons.

NOTE

To move back from a submenu item to the main menu, you must press the [MENU] key or set the [ENABLE/DISABLE] switch to "DISABLE" and then back to "ENABLE".


5.1.3 Adjust the home position (zero point)

The home position is set by inputting data after the robot has been delivered. The home position data of the manufacturer is located on the instruction leaflet in the robot arm box.


This data is also additionally located on a sticker on the robot:

- for RV-2AJ and RV-1A, on the inside of the battery compartment cover
- for RP-1AH/3AH/5AH, on the inside of the connection box cover

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



CAUTION:
Switch off the power supply of the control unit before removing the batter compartment cover (RV-2AJ and RV-1A) or connection box cover (RP-1AH/3AH/5AH)!



CAUTION:
The home position data of the zero point is contained in the "Default" column of the instruction leaflet. If another method has been used to re-adjust the home position of the robot arm (e.g. when replacing a motor) then the last-entered data is 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




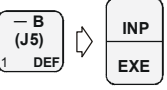
Fig. 5-4: Instruction leaflet with the home position data (example data)

NOTES

The J4-axis is not installed on the 5-axis articulated arm robot. Axes J5 and J6 are not installed on the SCARA robot. They are not listed on the sticker.

At the start, carry out the steps according to the instructions in Section 5.1.2. Then select the "Adjust using data input" menu Proceed as follows:

Step 1: Select the adjustment method

No.	Displayed	Keystrokes	Description
①	<pre><MENU> 1 . TEACH 2 . RUN 3 . FILE 4 . MONI 5 . MAINT 6 . SET</pre>		The "MAINTENANCE" menu is selected.
②	<pre><MAINT> 1 . PARAM 2 . INIT 3 . BRAKE 4 . ORIGIN 5 . POWER</pre>		The "ORIGIN" menu is selected.
③	<pre><ORIGIN> 1 . DATA 2 . MECH 3 . TOOL 4 . ABS 5 . USER</pre>		Adjustment method "1.DATA" is selected.
④	<pre><ORIGIN> SERVO OFF OK? (1) 1 : EXECUTE</pre>		The servo drive power supply is switched off.

Tab. 5-1: Select the "Adjust using data input" method

Step 2: Enter the home position

After the servo drive power supply is switched off, the menu for entering the home position data is displayed.

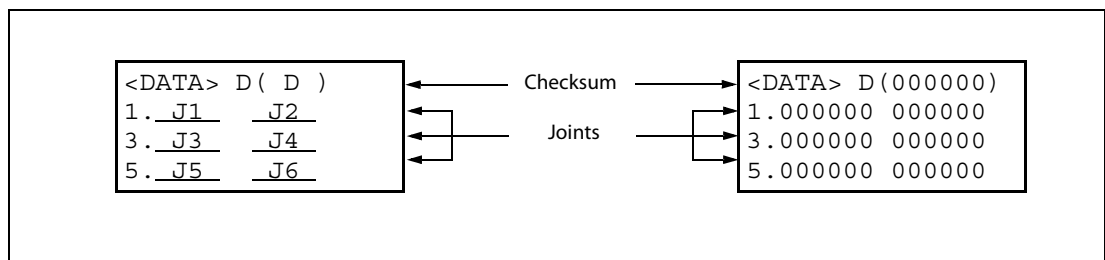


Fig. 5-5: Arrangement of data on the display

Section Tab. 5-2 contains an example of how to enter the data stipulated by the manufacturer (see also Fig. 5-5).

NOTES

You can move the cursor on the display of the teaching box using keys [ADD], [RPL ↓], [DEL ←] and [HAND →]. Characters are entered by simultaneously pressing the [POS/CHAR] key and the key for the character required. The next character is called-up by repeatedly pressing the data key. Numbers are entered using the numeric keys. You can delete incorrect entries by pressing the [DEL ←] + [POS/CHAR] key.

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

No.	Displayed	Keystrokes	Description
①	<pre><DATA> D (V00000) 1.000000 000000 3.000000 000000 5.000000 000000</pre>		The character "V" is entered.
②	<pre><DATA> D (V!00000) 1.000000 000000 3.000000 000000 5.000000 000000</pre>		The character "!" is entered.
③	<pre><DATA> D (V!#0000) 1.000000 000000 3.000000 000000 5.000000 000000</pre>		The character "#" is entered.
④	<pre><DATA> D (V!#S00) 1.000000 000000 3.000000 000000 5.000000 000000</pre>		The character "S" is entered.
⑤	<pre><DATA> D (V!#S20) 1.000000 000000 3.000000 000000 5.000000 000000</pre>		The number "2" is entered.
⑥	<pre><DATA> D (V!#S29) 1.000000 000000 3.000000 000000 5.000000 000000</pre>		The number "9" is entered.
⑦	<pre><DATA> D (V!#S29) 1.000000 000000 3.000000 000000 5.000000 000000</pre>		The cursor is moved to enter data for the J1 joint.
⑧	Data is entered for axes J1 to J6 (articulated arm robot) or J1 to J4 (SCARA robot) using the method described above.		
⑨	<pre><DATA> D (V!#S29) 1:06DTYY 2?HL9X 3:1CP55V T6!M\$Y 5:000000 000000</pre>		The confirmation screen is called-up after entering all data.
⑩	<pre><ORIGIN> CHANGES TO ORIGIN OK? (1) 1: EXECUTE</pre>		The home position adjustment is run.

Tab. 5-2: Adjust the home position by entering data

6 Operate the teaching box (R28TB)

This section describes how to operate the teaching box, as well as providing a description of the single menus.

6.1 Menu tree

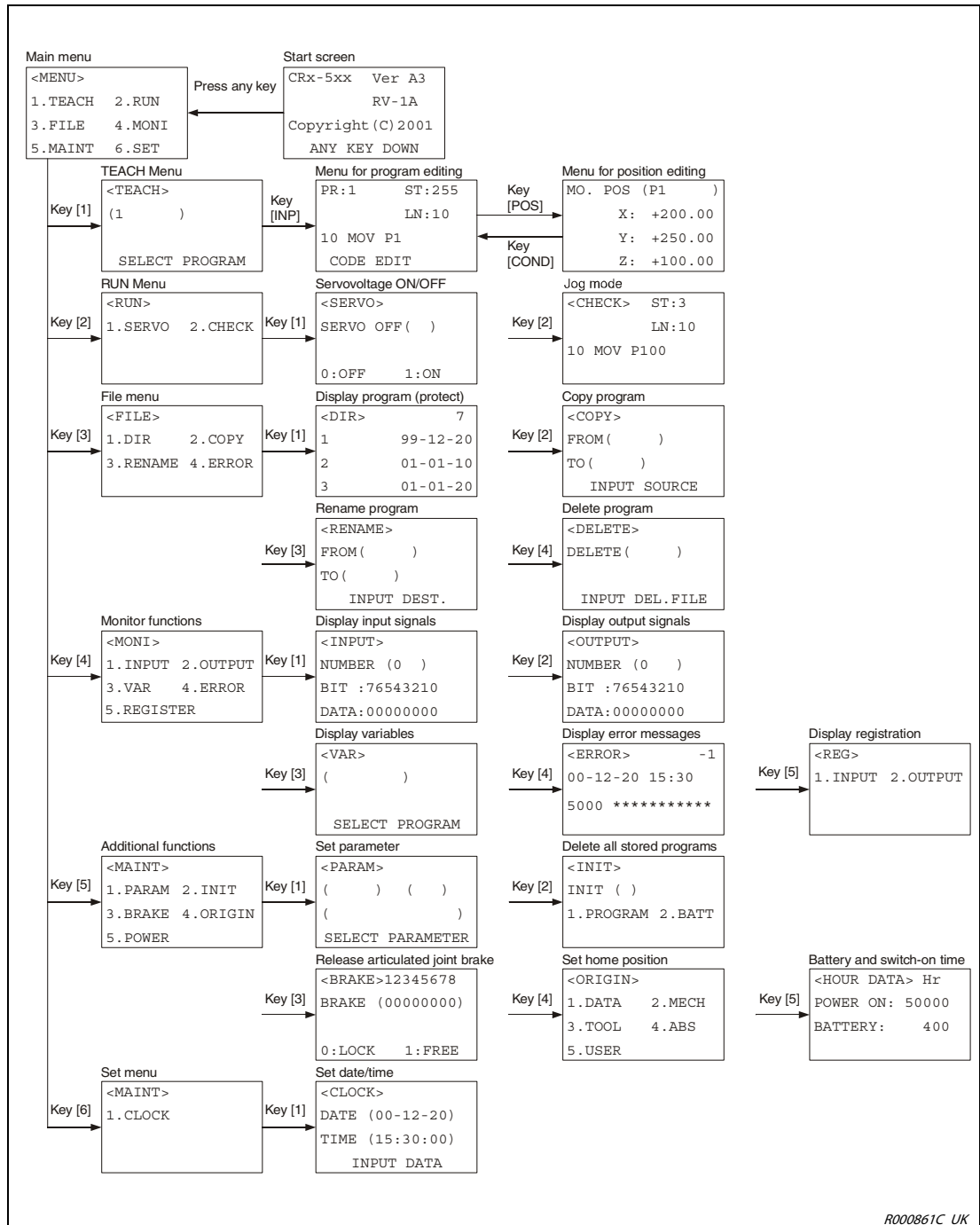


Fig. 6-1: Menu tree

6.2 Select a menu item

There are two ways of calling up a menu:

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

Execute (run)

An example of these two possibilities is shown in Tab. 6-2 and Tab. 6-3 for the selection of menu item "1. TEACH".

Set the [MODE] switch of the control unit to the "TEACH" position. Activate the teaching box by setting the [ENABLE/DISABLE] switch on the teaching box to "ENABLE".

The start screen appears after switching on.

No.	Displayed	Keystrokes	Description
①	<pre>CRn-5xx Ver.A3 RP-1AH COPYRIGHT (C) 2001 ANY KEY DOWN</pre>		After the start menu appears, press the [MENU] key to call up the main menu.
②	<pre><MENU> 1. TEACH 2. RUN 3. FILE 4. MONI 5. MAINT 6. SET</pre>		The main menu is displayed.



Tab. 6-1: Call up the main menu

- Select the menu by entering a number

No.	Displayed	Keystrokes	Description
①	<pre><MENU> 1. TEACH 2. RUN 3. FILE 4. MONI 5. MAINT 6. SET</pre>		The "TEACH" menu is selected by entering the number "1".
②	<pre><TEACH> () SELECT PROGRAM</pre>		The "TEACH" menu is displayed.

Tab. 6-2: Example of menu selection by entering a number

- Select the menu with the cursor and press the [EXE] key

No.	Displayed	Keystrokes	Description
①	<pre><MENU> 1 . TEACH 2 . RUN 3 . FILE 4 . MONI 5 . MAINT 6 . SET</pre>		The cursor is moved the required menu item by keys [ADD], [RPL ↓], [DEL ←] or [HAND →].
②	<pre><MENU> 1 . TEACH 2 . RUN 3 . FILE 4 . MONI 5 . MAINT 6 . SET</pre>		The selection is confirmed.
③	<pre><TEACH> () SELECT PROGRAM</pre>		The "TEACH" menu is displayed.

Tab. 6-3: Example of menu selection using the cursor

NOTES

As long as the [MODE] switch of the control unit is not set to the "TEACH" position, only some functions can be run when the teaching box is switched off (e.g. display the current position in JOG mode, change the speed oversteer, display the signal conditions of the input and output, error lists, etc.).

Numbers are entered using the keys, with a number in the lower corner to the left. A space is entered using the [SPACE] key.

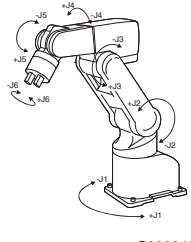
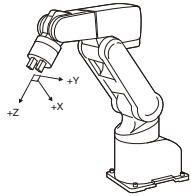
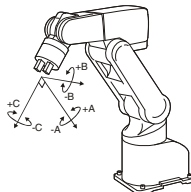
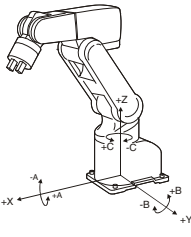
A character is deleted by pressing the [CHAR] and [DEL ←] keys simultaneously. When deleting an entry, the cursor must be placed to the right next to the character to be deleted. To insert a character, move the cursor with the [DEL ←] key or the [HAND →] key to the position where the character is to be inserted. You can then enter the required character.

6.3 Move robot in JOG mode

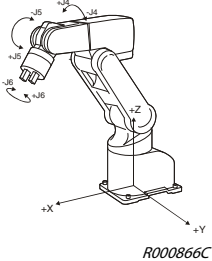
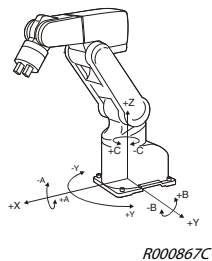
The robot can be manually positioned in steps in the JOG mode. This section explains the JOG mode based on a 6-axis vertical articulated arm robot. The axes are configured depending on the model of robot used. A detailed description of the single robot models is contained in the technical manual of the robot.

6.3.1 JOG modes

There are 5 different JOG modes:

Mode	Operation	Describe
<p>Joint JOG mode</p>  <p>R000862C</p>	<ul style="list-style-type: none"> Set the [MODE] switch of the teaching box to the "ENABLE" position. Hold the acknowledgement pushbutton in the middle position. Press the [STEP/MOVE] key. /The servo supply voltage is switched on). Press the [JOINT] key to switch to joint JOG mode. Press the appropriate key from J1 to J6 to move the joint Press the [JOINT] key twice to call-up the menu for setting the additional axes. 	<p>The robot axes can be moved individually in joint JOG mode. This thereby allows axes J1 to J6 and additional axes J7 and J8 to be set independently. The number of axes installed depends on the robot model. Additional axes J7 and J8 are controlled by keys [J1] and [J2].</p>
<p>Tool JOG mode</p>  <p>R000863C</p>  <p>R000861C</p>	<p>Run the first three points listed above.</p> <ul style="list-style-type: none"> Press the [TOOL] key to switch to tool JOG mode. To move the axes, press the appropriate key X, Y, Z, A, B, C. 	<p>In tool JOG mode, the position of the tip of the gripper can be moved along the axes within the tool coordinate system.</p> <p>The tip of the gripper is moved in a line. The position of the robot can be rotated around axes X, Y and Z of the tool coordinate system using keys A, B and C, without changing the position of the tip of the gripper. The centre point of the tool must be set using the MEXTL parameter.</p> <p>The tool coordinate system in which the position of the tip of the gripper is set depends on the robot model. In case of the vertical articulated arm robot, the direction from the gripper flange to the tip of the hand is defined as +Z.</p> <p>In case of SCARA robots, the direction from the area of assembly upwards is defined as +Z.</p>
<p>XYZ-JOG mode</p>  <p>R000865C</p>	<p>Run the first three points listed above.</p> <ul style="list-style-type: none"> Press the [XYZ] key to switch to XYZ-JOG mode. 	<p>In XYZ-JOG mode, the position of the tip of the gripper can be moved along the axes within the XYZ coordinate system.</p> <p>The position of the robot can be rotated around axes X, Y, and Z of the XYZ coordinate system using keys A, B and C, without changing the position of the tip of the gripper. The centre point of the tool must be set using the MEXTL parameter.</p>

Tab. 6-4: JOG modes (1)

Mode	Operation	Describe
<p>3-axis XYZ-JOG mode</p> 	<p>Run the first three points listed above.</p> <ul style="list-style-type: none"> Press the [XYZ] key to switch to 3-axis XYZ-JOG mode. 	<p>In 3-axis XYZ-JOG mode, the position of the tip of the gripper can be moved along the axes within the XYZ coordinate system. In contrast to XYZ-JOG mode, the position of the robot is changed as in joint JOG mode by rotating axes J4, J5 and J6. If the position of the tip of the gripper is fixed, the position is interpolated over axes X, Y, Z, J4, J5 and J6, i.e. the position is not constant. The centre point of the tool must be set using the MEXTL parameter.</p>
<p>Circle-JOG mode</p> 	<p>Run the first three points listed above.</p> <ul style="list-style-type: none"> Press the [XYZ] key three times to switch to circle-JOG mode. 	<p>In circle-JOG mode, the position of the tip of the gripper can be moved in circles around the zero point. A change in the X-axis coordinate results in a radial movement of the tip of the gripper from the centre point of the robot. A change in the Y-axis coordinate results in the same movement as run when controlling the J1 axis in joint JOG mode. A change in the Z-axis coordinate results in a movement of the gripper in the Z-direction as run when in XYZ-JOG mode. If the coordinates of the A, B or C axis are changed, then the gripper is rotated as in XYZ-JOG mode.</p>

Tab. 6-5: JOG modes (2)

NOTE

If the monitoring point of the gripper approaches a singular point when in tool-JOG, XYZ-JOG or circle-JOG mode, then a caution signal appears on the teaching box and an alarm is sounded. This function can be deactivated by parameter MESNGLSW. A detailed description of the parameter and the "Error message on reaching the singular point" function is contained in the operating and programming instructions.

7 Fault remedy and maintenance instructions

7.1 Faults in automatic mode

**DANGER:**

- ***Operation must be stopped immediately if you observe slight deviations during operation of the robot or the auxiliary equipment. If other hazards are caused by immediate cancellation then you must select a suitable time to stop operation.***
- ***If the robot stops in automatic mode for no apparent reason then the operator must on no account approach the robot. If access to the robot is nevertheless necessary then the EMERGENCY-STOP function must first be enabled or the power supply must be switched off. Make sure that no new hazardous situations can arise by switching off the power supply.***
- ***If a program is re-started after a reset then you must ensure that from the start of running this program onwards no hazardous situations can be caused or arise at the auxiliary equipment (e.g. check the position during a re-start, necessity of initialisation of auxiliary equipment, etc.).***
- ***If the program has been changed after a cancellation/interruption then it must be tested at least once before you are permitted to re-enter automatic mode***

7.2 Troubleshooting

If there is a fault then proceed as follows:

- Just as during maintenance work, troubleshooting can be carried out outside or inside of the safety fence with the power supply switched off, or within the safety fence when automatic mode is deactivated.
If troubleshooting has to be carried out inside the safety fence, set the [MODE] switch of the control unit to the "TEACH" position and the [Enable/Disable] switch of the teaching box to "Enable".
- If a robot alarm occurs then you should first check the error code number or the error state. 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 the user is not able to remedy the fault himself then you must immediately contact your MITSUBISHI sales partner.

7.3 Error diagnosis

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

If a key is pressed on the teaching box (e.g. MENU key) then a 4-digit error number appears on the teaching box display. The first character of the error number is not displayed. The display shows, e.g. "0010" for "C0010" and a plain text.

A list of errors that have already occurred can be called up in the "Display error messages" menu of the teaching box. The error must first be reset to do this.

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

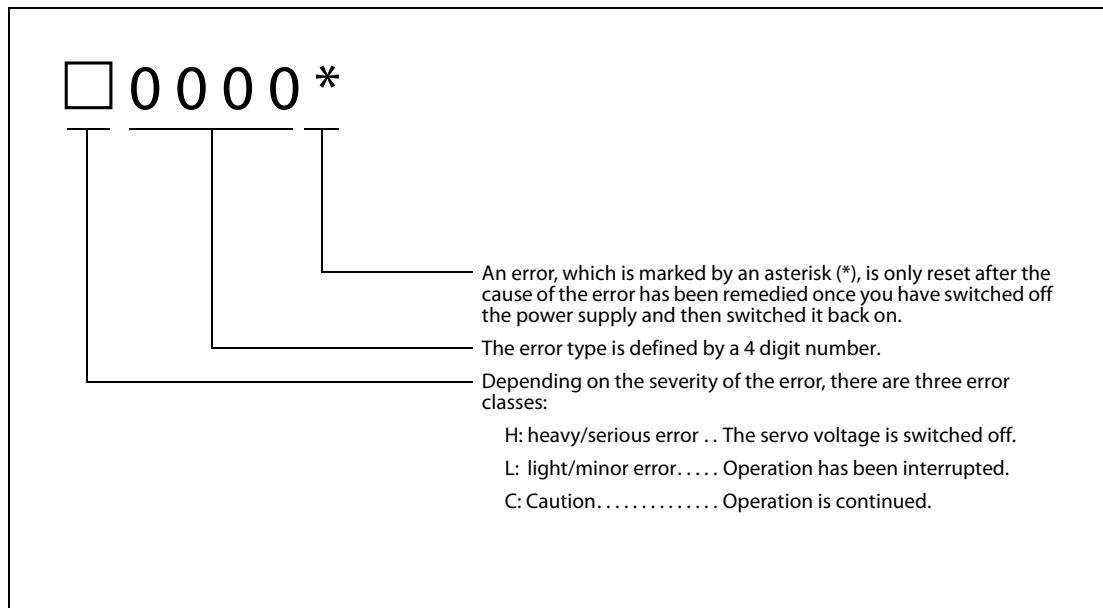


Fig. 7-1: Design of an error message

NOTE

The last digit of the error number can display an axis number.
Example: Error number H0931 means overcurrent in axis No. 1 motor

7.4 Replace the fuses

If a fuse is defective on the interface board for the pneumatically-operated gripper or on the control board, then an error message is issued. You can recognize from the error message which fuse has to be replaced.

7.4.1 Fuses and error messages

Error code	Description	Board/module	Fuse
H0082	Fuse for pneumatic gripper defective	RZ375	F1 (rated current: 1.6 A)
H0083	Fuse of pneumatic gripper power supply defective	RZ387	F1 (rated current: 1.6 A)

Tab. 7-1: Fuses

7.4.2 Fuse for pneumatic gripper

If error message "H0082" is displayed then replace fuse F1 (rated current: 1.6 A) on board RZ375 for the control of the pneumatic gripper.

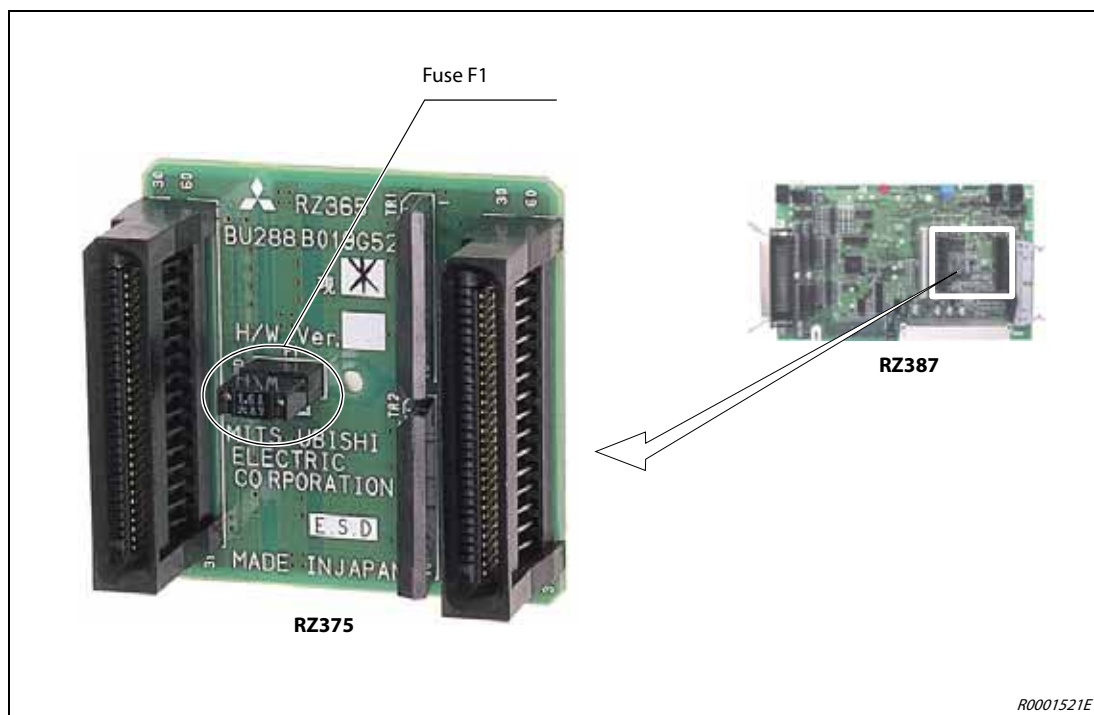


Fig. 7-2: Fuse for pneumatic gripper

7.4.3 Fuse of pneumatic gripper power supply

Control unit CR2D/drive unit DU2

If error message "H0083" is displayed then replace fuse F1 (rated current: 1.6 A) on control board RZ387.

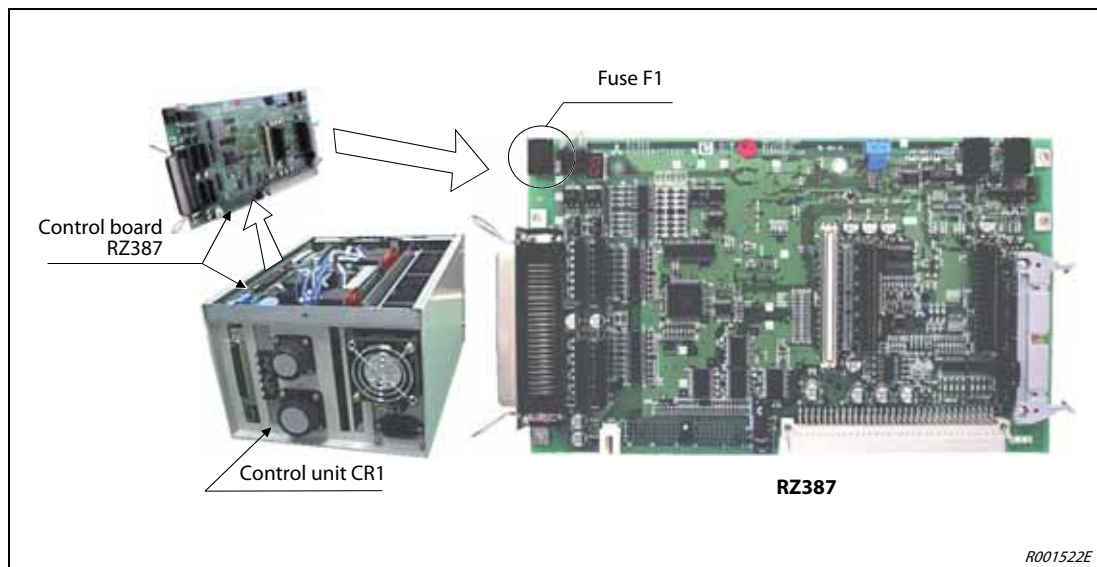


Fig. 7-3: Fuse of pneumatic gripper power supply

7.5 Notes on maintenance

**CAUTION:**

All maintenance work on the robot may only be carried out in full compliance to the following safety guidelines!

- To determine the expected maintenance intervals, use the "Maintenance Forecast" function of the RT ToolBox2 robot programming software.
- When possible, maintenance work should be carried out outside of the protective area.
- If maintenance work has to be carried out 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 not result in any hazardous conditions.
- You must make sure that daily and periodic inspections are carried out compliant to the instructions in the technical manual. You must observe the inspection and maintenance program of the manufacturer for the robot system. In case of special maintenance work that can not be easily carried out by the user, you should contact your MITSUBISHI service partner.
- During maintenance of the controller unit, also check the function of the cooling fan, e.g. by making sure that there is a flow of air from it.
- If the brakes on the robot are released, the robot arm (articulated arm robot) or the J3-axis (SCARA robot) must be supported manually to ensure that they do not drop to the end stop in an uncontrolled manner. You require the assistance of a second person for this.
- Small amounts of lubricant may exit from the robot arm. If this might result in soiling or damage to the environment then the robot should be regularly checked for loss of lubricant. If you detect the loss of grease at the robot then wipe the grease off from the surface with a cleaning cloth to ensure that the ground and the environment around the robot is not soiled.
- To facilitate ease of maintenance, make sure that there is enough space and sufficient lighting.
- The robot must not be retrofitted or changed by installing non-authorized parts. Only ever use original spare parts and accessories. parts and accessories not authorized by the manufacturer must never be used. Make sure that no safety functions can be modified or manipulated.
- Before switching back on the power supply, make sure that no dangerous conditions can arise from this.
- After completion of maintenance work, all safety equipment that has been temporarily deactivated must be re-activated (e. g. door contact switch of the safety casing, etc.).
- Do not check the insulation resistor when carrying out maintenance work.
- The batteries must not be shorted, charged, heated up, burned or disassembled.

A Annex

A.1 Dimensions

A.1.1 Working ranges of the robots

The following figure shows the range of movement of the 5-axis RV-2AJ robot arm.

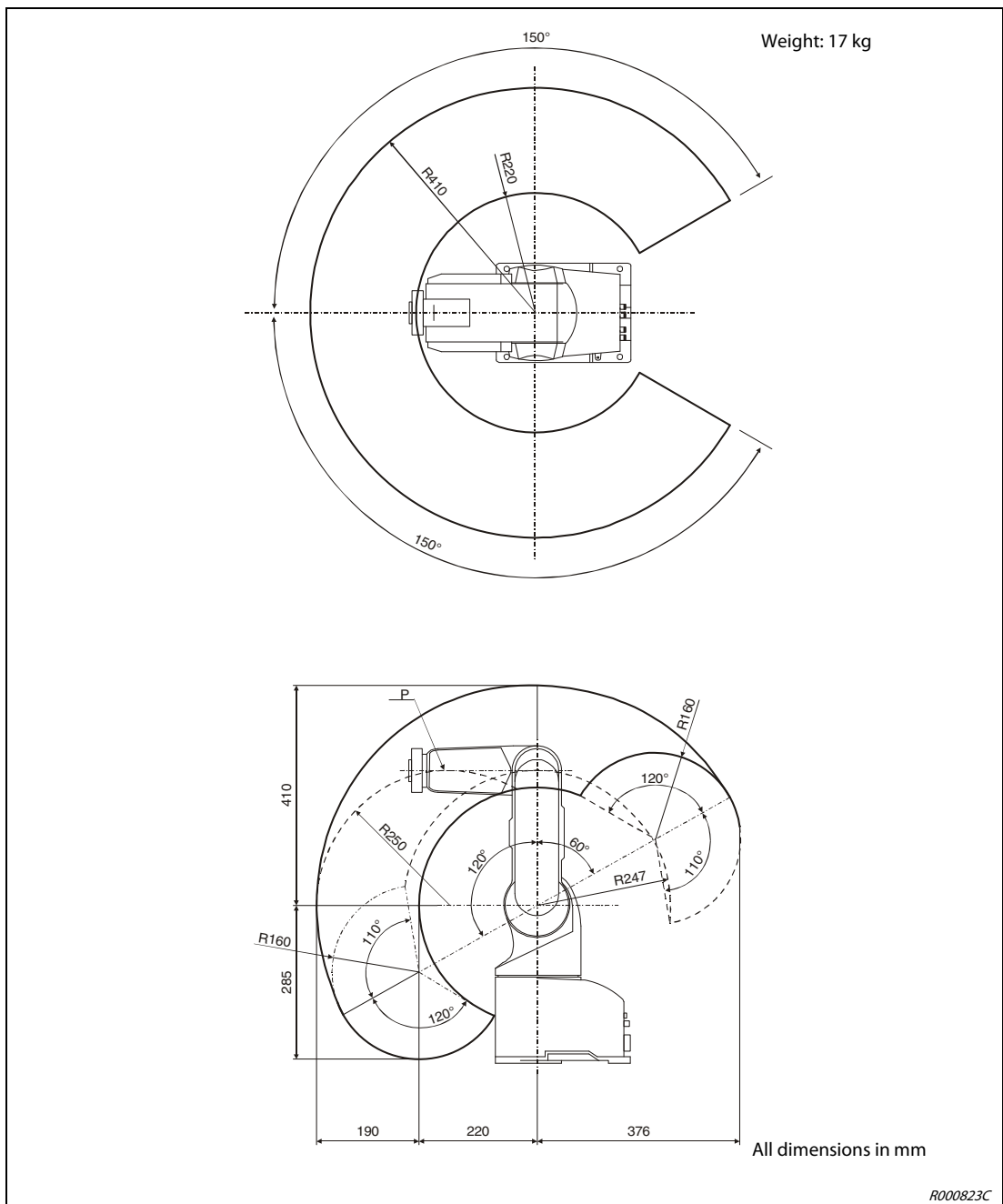


Fig. A-1: Range of movement of the RV-2AJ robot arm

NOTE

The working range indicated refers to Point P of the robot arm without the gripper hand.

The following figure shows the range of movement of the 6-axis RV-1A robot arm.

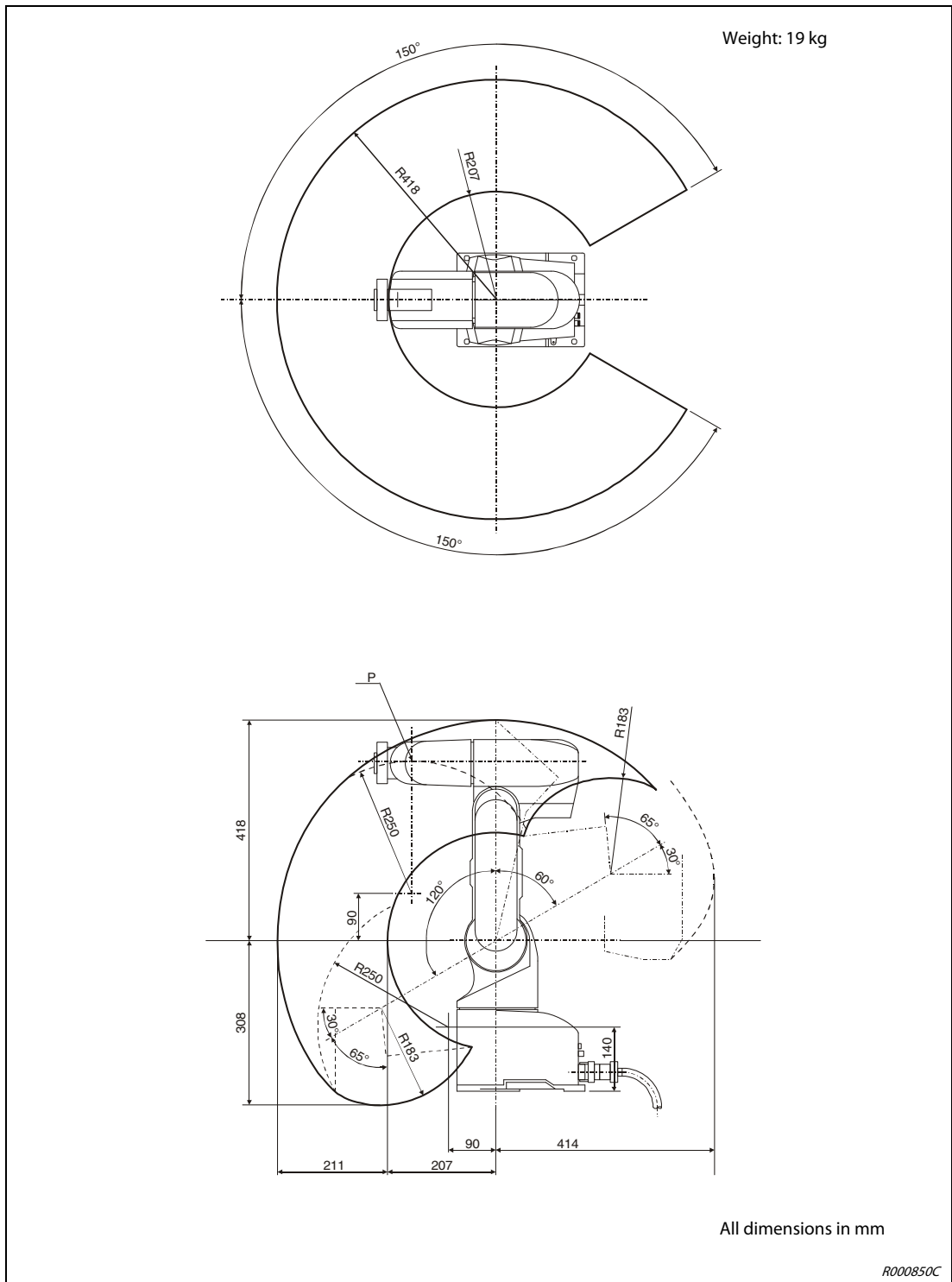


Fig. A-2: Range of movement of the RV-1A robot arm

NOTE

The working range indicated refers to Point P of the robot arm without the gripper hand.

The following figure shows the outer dimensions and the range of movement of the RP-1AH robot arm.

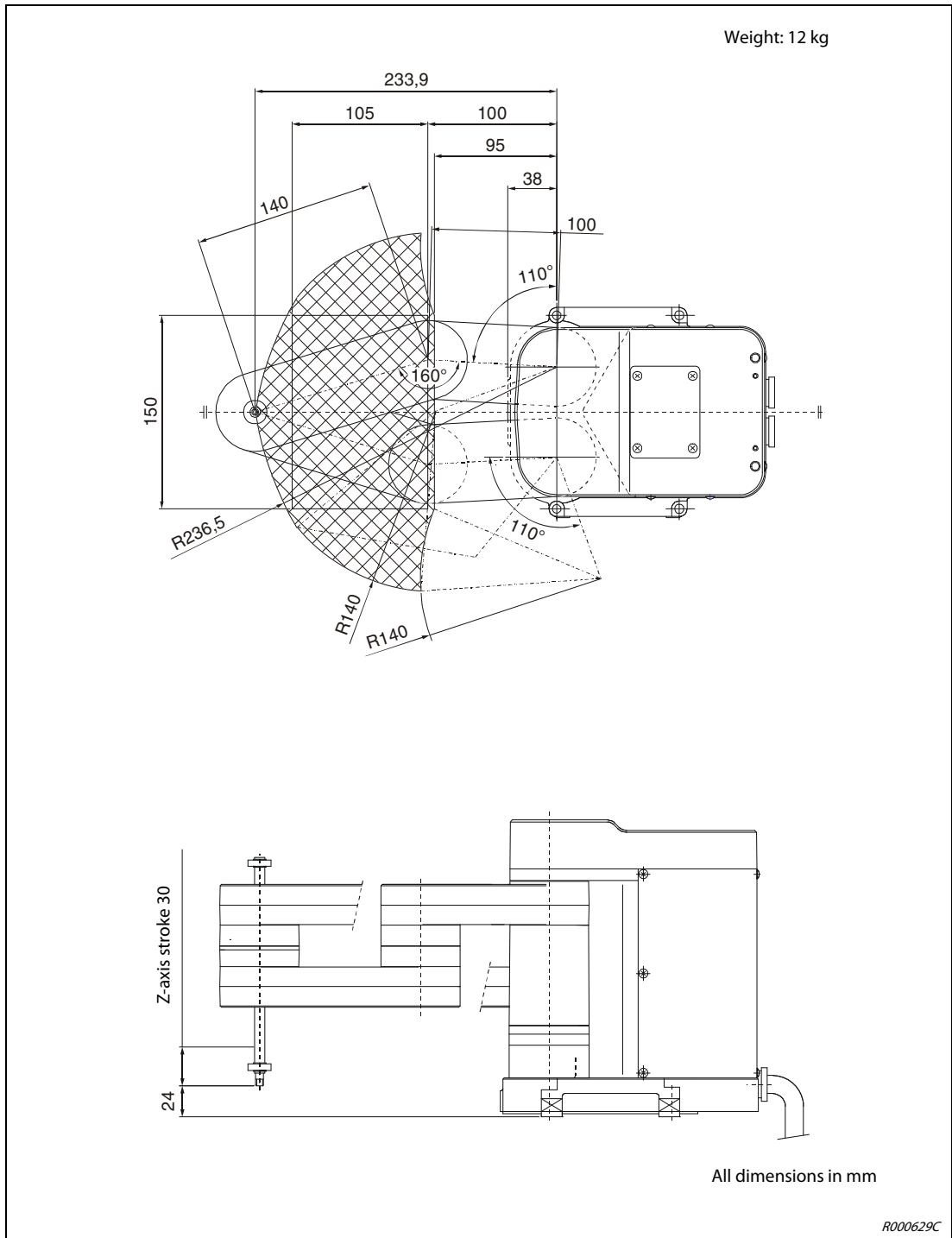


Fig. A-3: Outer dimensions and range of movement of the RP-1AH robot arm

The following figure shows the outer dimensions and the range of movement of the RP-3AH robot arm.

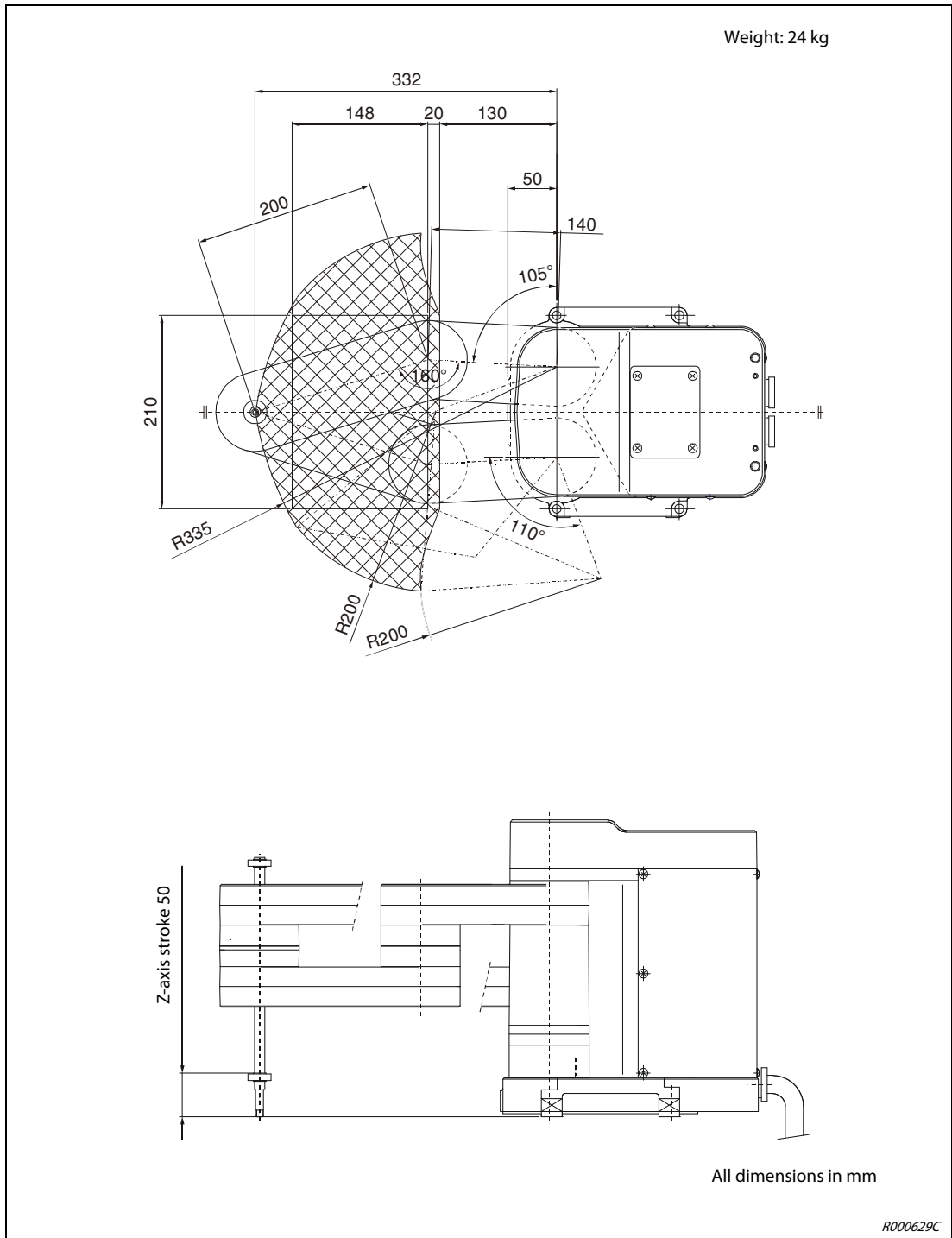


Fig. A-4: Outer dimensions and range of movement of the RP-3AH robot arm

The following figure shows the outer dimensions and the range of movement of the RP-5AH robot arm.

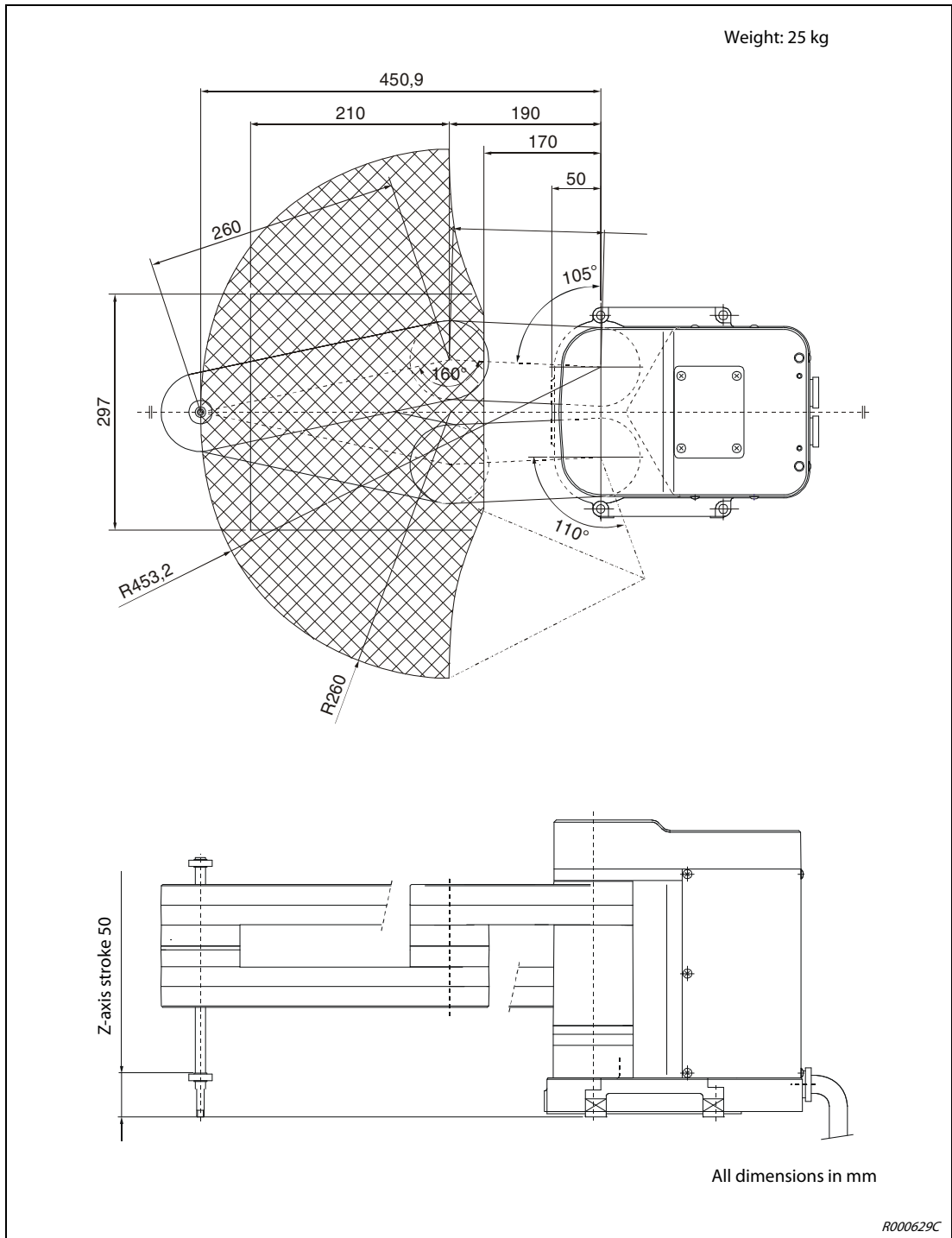


Fig. A-5: Outer dimensions and range of movement of the RP-5AH robot arm

A.1.2 Dimensions of the control unit

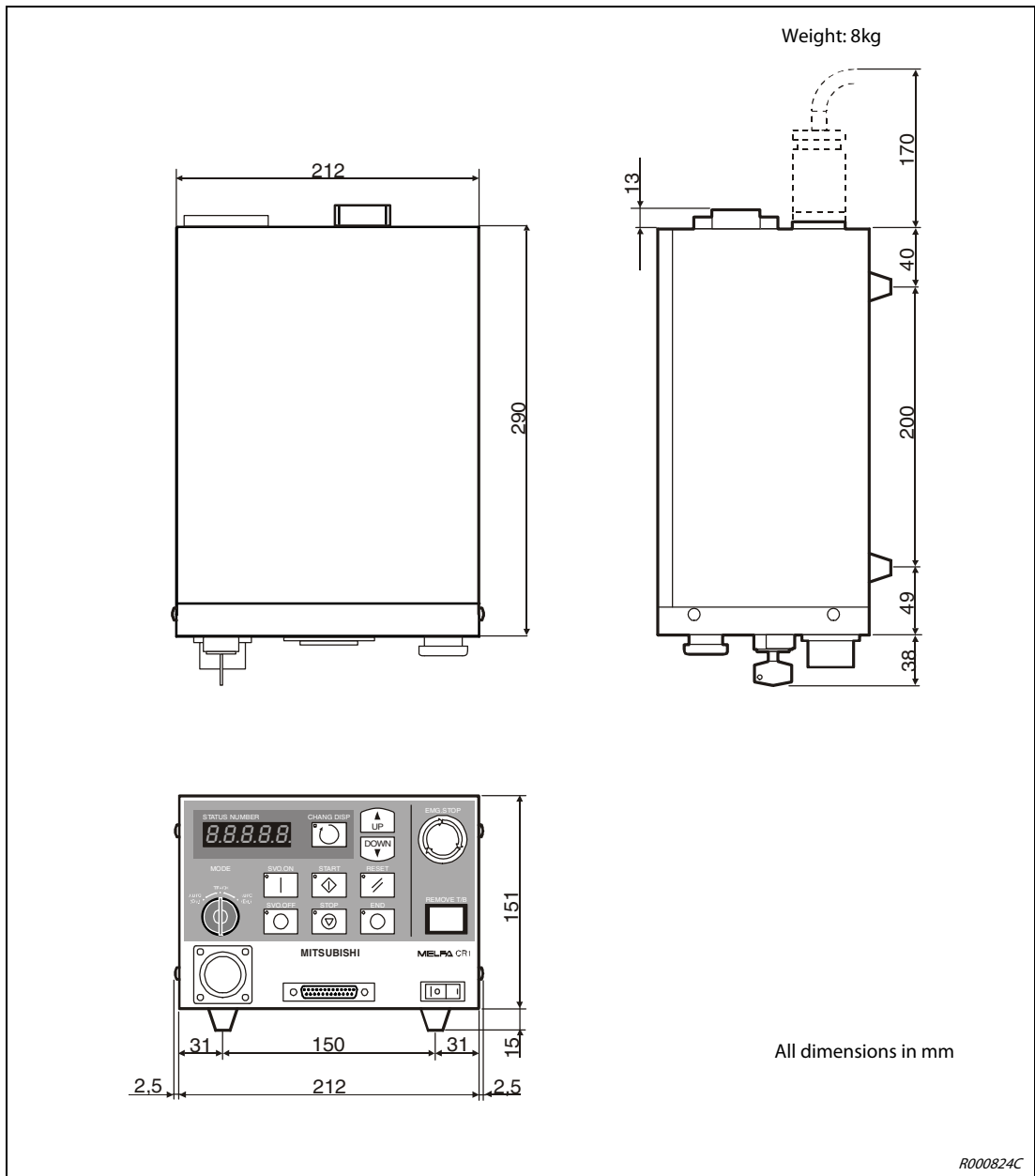


Fig. A-6: Dimensions of the CR1 control unit

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Product Service

EC-Statement of Compliance

No. E6 09 07 25554 016

Holder of Certificate: Mitsubishi Electric CorporationTokyo BILD., 2-7-3 Marunouchi,
Chiyoda-ku
Tokyo
100-8310 JAPAN**Name of Object:** Industrial Robot**Model(s):** RV-1A seriesRV-1A,
RV-1AC-SB,
RV-1AM,
RV-2AJ,
RV-2AJC-SB,
RV-2AJM

(See Attachment for Nomenclature)

Description of Object:Rated Voltage: 230 VAC, 1 Phase
Rated Power: 0.6 kW
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.: TYOEMC23262A**Date,** 2009-07-14

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.

Page 1 of 2

Attachment
Statement No.



Product Service

E6 09 07 25554 016

Model name description is shown as follows.

RV-x A J x - x
(1) (2)(3)(4) (5) (6)

- (1) V: Vertical Robot
(2) Rated Payload specification:
1 : 1kg
2 : 2kg
(3) A : A series robot
(4) J : 5 axes exist
[none] : 6 axes exist
(5) C : Clean room model
M : Oil mist model
[none] : Basic model
(6) Special specification number
Pilot number and specification as follows
SB : Clean class 100
[none] : Basic model

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.	RV-1A 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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Date	September 4, 2009
Name and position of person binding the manufacturer	 <hr/> <p>Takaaki Nishimura Manager Robot Manufacturing Department MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS</p>

■ Declaration Type of models (March,2002 -)

A.6-axis Robot Arm (RV-1A)

Model Name	Language	Robot Arm	Controller	Software Version
RV-1A	Japanese /English/German	BU220C865G56	TU117C101G01	H3 or Later
		BU220C865G57	TU117C102G01	
		BU220C865G57	TU117C103G01	
RV-1AC-SB	Japanese /English/German	BU160C638G56	TU117C101G01	H3 or Later
		BU160C638G57	TU117C102G01	
		BU160C638G57	TU117C103G01	
RV-1AM	Japanese /English/German	BU160C640G56	TU117C101G01	H3 or Later
		BU160C640G57	TU117C102G01	
		BU160C640G57	TU117C103G01	

B.5-axis Robot Arm (RV-2AJ)

Model Name	Language	Robot Arm	Controller	Software Version
RV-2AJ	Japanese /English/German	BU220C866G56	TU117C101G01	H3 or Later
		BU220C866G57	TU117C102G01	
		BU220C866G57	TU117C103G01	
RV-2AJC-SB	Japanese /English/German	BU160C639G56	TU117C101G01	H3 or Later
		BU160C639G57	TU117C102G01	
		BU160C639G57	TU117C103G01	
RV-2AJM	Japanese /English/German	BU160C641G56	TU117C101G01	H3 or Later
		BU160C641G57	TU117C102G01	
		BU160C641G57	TU117C103G01	

Revision history

Date	Specifications No.	Details of revisions	Rev.
June 14, 2000		First print	*
March 20, 2002	P1	A1 : "prEN50082-2/Aug.1996" was updated by "EN61000-6-2/1999". A2: "Declaration Type of models" was updated.	A
April 6, 2006	P1	Standards update	B
June 25 , 2009	P1	Standards update(2004/108/EC)	C
September 4, 2009	P1	Standards update(2006/42/EC)	D



Product Service

EC-Statement of Compliance

No. E6 09 07 25554 017

Holder of Certificate: Mitsubishi Electric CorporationTokyo BILD., 2-7-3 Marunouchi,
Chiyoda-ku
Tokyo
100-8310 JAPAN**Name of Object:** Industrial Robot**Model(s):** RP-1AH series
RP-1AH, RP-1AHC-SB,
RP-1AHW, RP-1AHC-SA,
RP-1AH-Sxx, RP-1AHC-SBxx,
RP-1AHW-Sxx, RP-1AHC-SAxx,
RP-3AH, RP-3AHC-SB,
RP-3AHW, RP-3AHC-SA,
RP-3AH-Sxx, RP-3AHC-SBxx,
RP-3AHW-Sxx, RP-3AHC-SAxx,
RP-5AH, RP-5AHC-SB,
RP-5AHW, RP-5AHC-SA,
RP-5AH-Sxx, RP-5AHC-SBxx,
RP-5AHW-Sxx, RP-5AHC-SAxx
(See Attachment for Nomenclature)**Description of Object:**Rated Voltage: 230 VAC, 1 Phase
Rated Power: 0.6 kW
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.: TYOEMC23259A**Date,** 2009-07-14

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.



Page 1 of 2

Attachment
Statement No.



Product Service

E6 09 07 25554 017

Model name description is shown as follows.

R P - x A H x - x

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

(1) P: Parallel Link Robot

(2) Maximum Payload specification:

1 : 1kg

3 : 3kg

5 : 5kg

(3) A : A series robot

(4) C : Clean room model

W : Water Proof model

(5) Dimension and Ambient specification:

[none]: basic model

SA: clean class 10

SB: clean class 100

Sxx: basic model ,and special specification

SAXx: clean class 10, and special specification

SBxx: clean class 100, and special specification

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.	RP-1AH 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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Country	Germany
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Fax number	+49 2102 486 1120

Date	September 4, 2009
Name and position of person binding the manufacturer	 <hr/> <p>Takaaki Nishimura Manager Robot Manufacturing Department MITSUBISHI ELECTRIC CORPORATION NAGOYA WORKS</p>

■ Declaration type of models (March,2002-)

A. RP-1AH Series

Model Name	Language	Robot Arm	Controller	Software Version
RP-1AH	Japanese/	BU220C930G55	TU117C111G01	H3 or Later
	English/German	BU220C930G56	TU117C112G01	
		BU220C930G56	TU117C113G01	
RP-1AHC-SB	Japanese/	BU220C930G65	TU117C111G01	H3 or Later
	English/German	BU220C930G66	TU117C112G01	
		BU220C930G66	TU117C113G01	
RP-1AHW	Japanese/	BU220C930G75	TU117C111G01	H3 or Later
	English/German	BU220C930G76	TU117C112G01	
		BU220C930G76	TU117C113G01	
RP-1AHC-SA	Japanese	BU220C930G85	TU117C111G01	H3 or Later
	English/German	BU220C930G86	TU117C112G01	
		BU220C930G86	TU117C113G01	
RP-1AH-S00	Japanese	BU220C734G51	TU117C201G01	C1 or Later
	English(CE)	BU220C734G52	TU117C203G01	
	German(CE)	BU220C734G53	TU117C204G01	
	English(Not CE)	BU220C734G54	TU117C202G01	
RP-1AHC-SB00	Japanese	BU220C734G61	TU117C201G01	C1 or Later
	English(CE)	BU220C734G62	TU117C203G01	
	German(CE)	BU220C734G63	TU117C204G01	
	English(Not CE)	BU220C734G64	TU117C202G01	
RP-1AHW-S00	Japanese	BU220C734G71	TU117C201G01	C1 or Later
	English(CE)	BU220C734G72	TU117C203G01	
	German(CE)	BU220C734G73	TU117C204G01	
	English(Not CE)	BU220C734G74	TU117C202G01	
RP-1AHC-SA00	Japanese	BU220C734G81	TU117C201G01	C1 or Later
	English(CE)	BU220C734G82	TU117C203G01	
	German(CE)	BU220C734G83	TU117C204G01	
	English(Not CE)	BU220C734G84	TU117C202G01	

B. RP-3AH Series

Model Name	Language	Robot Arm	Controller	Software Version
RP-3AH	Japanese/	BU220C932G11	TU117C111G01	H3 or Later
	English/German	BU220C932G13	TU117C112G01	
		BU220C932G13	TU117C113G01	
RP-3AHC-SB	Japanese/	BU220C932G21	TU117C111G01	H3 or Later
	English/German	BU220C932G23	TU117C112G01	
		BU220C932G23	TU117C113G01	
RP-3AHW	Japanese/	BU220C932G31	TU117C111G01	H3 or Later
	English/German	BU220C932G33	TU117C112G01	
		BU220C932G33	TU117C113G01	
RP-3AHC-SA	Japanese	BU220C932G41	TU117C111G01	H3 or Later
	English/German	BU220C932G43	TU117C112G01	
		BU220C932G43	TU117C113G01	
RP-3AH-S00	Japanese	BU220C813G51	TU117C201G01	C1 or Later
	English(CE)	BU220C813G53	TU117C203G01	
	German(CE)	BU220C813G55	TU117C204G01	
	English(Not CE)	BU220C813G57	TU117C202G01	
RP-3AHC-SB00	Japanese	BU220C813G61	TU117C201G01	C1 or Later
	English(CE)	BU220C813G63	TU117C203G01	
	German(CE)	BU220C813G65	TU117C204G01	
	English(Not CE)	BU220C813G67	TU117C202G01	
RP-3AHW-S00	Japanese	BU220C813G71	TU117C201G01	C1 or Later
	English(CE)	BU220C813G73	TU117C203G01	
	German(CE)	BU220C813G75	TU117C204G01	
	English(Not CE)	BU220C813G77	TU117C202G01	
RP-3AHC-SA00	Japanese	BU220C813G81	TU117C201G01	C1 or Later
	English(CE)	BU220C813G83	TU117C203G01	
	German(CE)	BU220C813G85	TU117C204G01	
	English(Not CE)	BU220C813G87	TU117C202G01	

C. RP-5AH Series

Model Name	Language	Robot Arm	Controller	Software Version
RP-5AH	Japanese/ English/German	BU220C932G12	TU117C111G01	H3 or Later
		BU220C932G14	TU117C112G01	
		BU220C932G14	TU117C113G01	
RP-5AHC-SB	Japanese/ English/German	BU220C932G22	TU117C111G01	H3 or Later
		BU220C932G24	TU117C112G01	
		BU220C932G24	TU117C113G01	
RP-5AHW	Japanese/ English/German	BU220C932G32	TU117C111G01	H3 or Later
		BU220C932G34	TU117C112G01	
		BU220C932G34	TU117C113G01	
RP-5AHC-SA	Japanese English/German	BU220C932G42	TU117C111G01	H3 or Later
		BU220C932G44	TU117C112G01	
		BU220C932G44	TU117C113G01	
RP-5AH-S00	Japanese	BU220C813G52	TU117C201G01	C1 or Later
	English(CE)	BU220C813G54	TU117C203G01	
	German(CE)	BU220C813G56	TU117C204G01	
	English(Not CE)	BU220C813G58	TU117C202G01	
RP-5AHC-SB00	Japanese	BU220C813G62	TU117C201G01	C1 or Later
	English(CE)	BU220C813G64	TU117C203G01	
	German(CE)	BU220C813G66	TU117C204G01	
	English(Not CE)	BU220C813G68	TU117C202G01	
RP-5AHW-S00	Japanese	BU220C813G72	TU117C201G01	C1 or Later
	English(CE)	BU220C813G74	TU117C203G01	
	German(CE)	BU220C813G76	TU117C204G01	
	English(Not CE)	BU220C813G78	TU117C202G01	
RP-5AHC-SA00	Japanese	BU220C813G82	TU117C201G01	C1 or Later
	English(CE)	BU220C813G84	TU117C203G01	
	German(CE)	BU220C813G86	TU117C204G01	
	English(Not CE)	BU220C813G88	TU117C202G01	

■ Revision history

Date	Specifications No.	Details of revisions	Rev.
November 19, 1999		First print	*
June 14, 2000	P1	A1 : "Declaration Type of models" was updated.	A
March 20, 2002	P1	B1 : "prEN50082-2/Aug.1996" was updated by "EN61000-6-2/1999". B2: "Declaration Type of models" was updated.	B
April 6, 2006	P1	Standards Update	C
June 25 , 2009	P1	Standards update(2004/108/EC)	D
September 4, 2009	P1	Standards update(2006/42/EC)	

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