MITSUBISHI ELECTRIC
FACTORY AUTOMATION

MELFA

Industrial Robots

Consistent Quality –
Precise Control

Articulated-arm robots /// **SCARA robots** /// High-performance Controllers /// **Programming software** /// Simulation ///

MELFA Industrial Robots

Robots from € 1.65/hr

Calculated on the basis of their average service life, around 6–7 years in typical applications, Mitsubishi robots have a surprisingly low total cost of ownership at around € 1.65/h per hour for both purchasing and operation.

More than 30,000 applications

Modern automation technology from Mitsubishi Electric is helping to power technological progress and business success all over the world. Since 1978, Mitsubishi's small industrial robots have been installed in over 30,000 applications in a huge diversity of fields.

Intelligent design

The high performance of Mitsubishi's robots is the result of market-leading technology combined with intelligent, carefully-planned design. For example, locating pneumatic and wiring extensions directly in the robot body reduces wiring complexity and costs.

The robots have hollow shaft motors and transmissions for maximum rigidity.

The high-precision Harmonic Drive transmission helps to provide exceptional repeatability performance.

Suitable for high-precision component placement with repeatability performance of ±0.005 mm and a cycle period of just 0.28 s.

The World's first twin-arm SCARA robot with parallel structure for maximum precision.

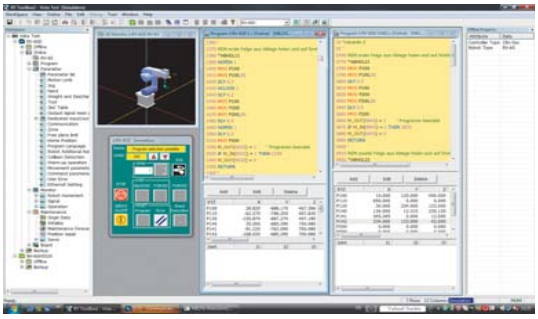
All the gripper hands of the articulated-arm robots conform to the ISO 9409-1 standard.

Internally-routed cables and hoses prevent snagging on peripheral equipment.

The sensorless crash detection feature reliably detects and prevents unexpected collisions.

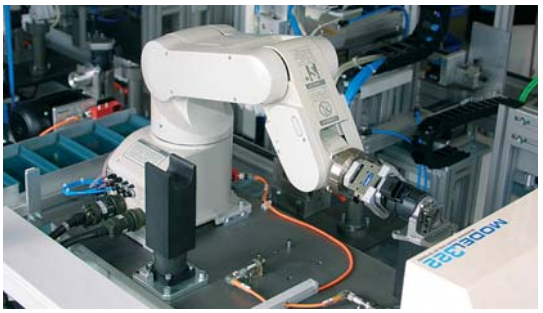
Soft compliance control mode improves the quality of assembly and joining processes.

A very compact design takes up minimum space for applications in cramped quarters.



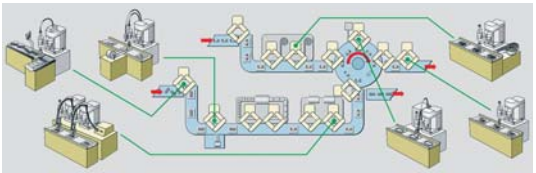
Simple programming

A powerful range of robots needs an equally powerful and user-friendly programming interface. Mitsubishi's RT ToolBox2 and MELFA WORKS packages are powerful programming and simulation software tools tailored precisely for the needs of your robots.



Compact and economical

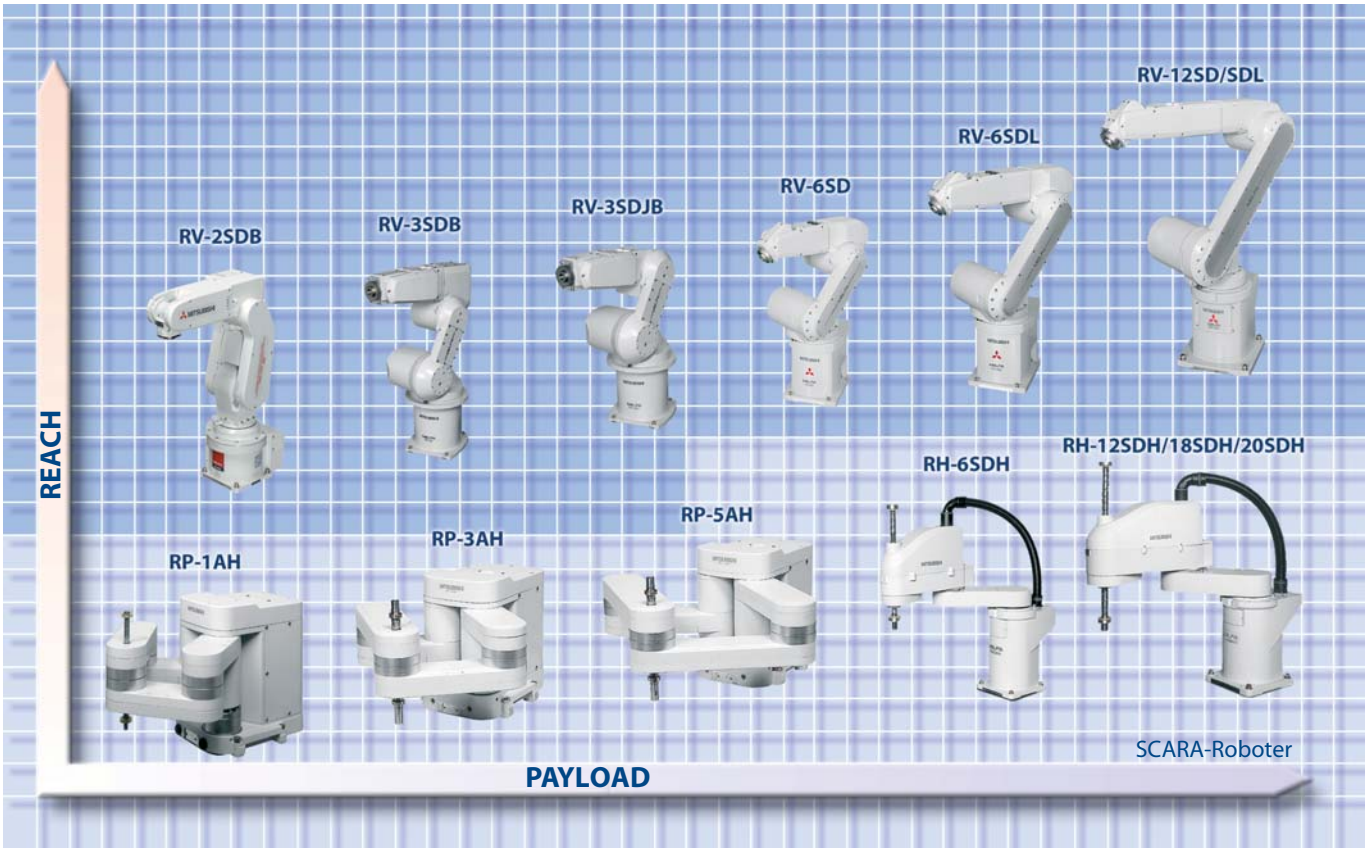
A small installation footprint and outstanding reliability are all key factors for many applications.



Network capabilities

Network connections like Ethernet and CC-Link make it easy to integrate Mitsubishi robot controllers in to larger systems, providing users with access to every step of the process.

A Complete Range



The MELFA range includes a robot for every application, with a wide selection of versions and power ratings.

Powerful robots for different applications.

Comprehensive range

The MELFA range of robots includes a great diversity of types, models and versions. The articulated-arm RV-A and RV-SD lines include everything from high-performance compact models with 1kg payloads to powerful models that can handle up to 12 kg.

For high-precision positioning tasks Mitsubishi offers the RP-AH and RH-SDH ranges of SCARA robots with cycle periods of less than 1s and positioning accuracy as precise as 5 µm.

The right solution for every application

The MELFA robots are designed from the ground up to cater to the needs of virtually all industrial applications, providing the flexibility you need to reconfigure your production facilities fast.

MELFA robots have models which have capabilities such as:

- SCARA or articulated-arm construction
- 4 to 6 degrees of freedom (axes)
- Handling payloads from 1 kg to 12 kg
- Working reaches from 150 mm to 1,385 mm

The Powerful Compact Class

Handling critical liquids in a laboratory application

Trouble-free handling

Up to two pneumatic grippers can be installed for handling workpieces. Pneumatic hoses are pre-installed in the robot arm to facilitate connection of the grippers.

If you need to enlarge the robot workspace, whilst maintaining compact dimensions, you can also install these robots on a linear axis, just like many of the other models. Controller support for the grippers or up to a total of 8 axes is included in the standard configuration.

RV-2SDB Facts and Figures

Degrees of freedom (axes):
6
Max. payload (nom.):
3 kg
Gripper flange reach:
574 mm
Repeatability:
±0.02 mm
Max. speed:
4,400 mm/s
Controller:
CR1D

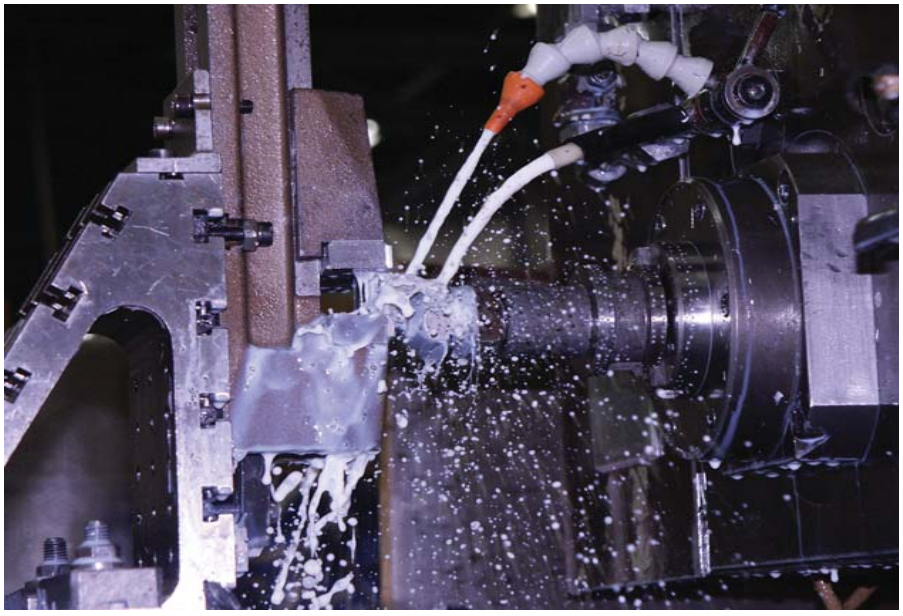
The movement axes of the RV-2SDB robot

Small, compact and powerful

The compact dimensions and corresponding reach of around 500 mm make this 6-DOF robot the ideal choice for a multitude of applications where only a really small, compact unit can be installed directly on or even in the system it is servicing. The RV-2SDB robots are particularly good at handling, placing and removing small parts. Other applications include quality control and handling samples in medical and other laboratories.

The RV-2SDB at work in typically cramped quarters

Fast and Economical



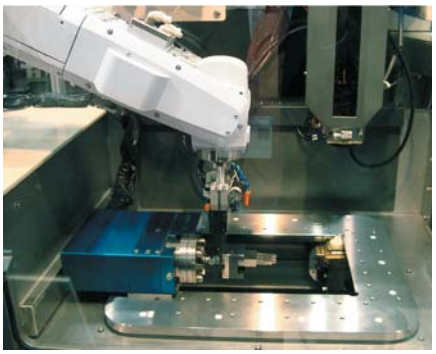
Ideal for operation in tough environments like metal-cutting tools

The movement axes of the RV-3SDB

Easy integration

The RV-3SD series robots are designed for easy integration in existing work cells. For example, 32 integrated inputs and outputs permit direct interaction with sensors and actuators, reducing cycle periods and making system configuration simpler and easier.

Good communication with other automation components is naturally essential for full work cell integration. The RV-3SD series supports connection via the three main industry standard networks: Ethernet, Profibus/DP and CC-Link.



The RV-3SDB at work in an EDM machine

The RV-3SD can also control up to 8 additional axes for easy integration in to work cells where movement is restricted or where the processing points are far apart. Additionally two of these axes can be interpolated, providing greater flexibility to program the robots movement to avoid obstacles. The other six axes can be used for other purposes – for example to install the robot on a linear axis so that it can traverse between two processing points.

High protection rating

The RV-3SD gives users more flexibility for planning their automation solutions. For example, the high IP65 ingress protection rating makes it possible to install the robot not just next to the machine or workstation but actually within the machine itself. This is particularly useful in metal-cutting applications where the robot may be exposed to fluids and cutting oils.

RV-3SDB/-3SDJB Facts and Figures

Degrees of freedom (axes):

RV-3SDB	6
RV-3SDJB	5

Max. payload:

RV-3SDB	3.5 (3) kg
RV-3SDJB	3.5 (3) kg

Gripper flange reach:

RV-3SDB	727 mm
RV-3SDJB	726 mm

Repeatability:

RV-3SDB	±0.02 mm
RV-3SDBJ	±0.02 mm

Max. speed:

RV-3SDB	5,500 mm/s
RV-3SDJB	5,300 mm/s

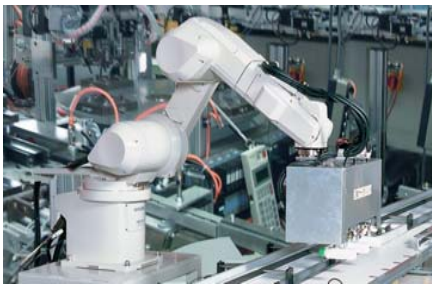
Controller:

RV-3SDB	CR1D
RV-3SDJB	CR1D

More Power and Reach

Heavy payloads of up to 12 kg can be handled with ease

The movement axes of the RV-12SDL



An RV-SD robot in action

Engineered for performance

The payload handling capacity of up to 12kg, maximum working radius of 1,385mm and high precision (repeatability ±0.05mm) of the RV-SD series make these robots ideal for handling workpieces in industrial manufacturing and for daisy-chaining production installations. Equipped with the latest technology that drastically reduces cycle periods: These new robots can complete the "12 inch test" in less than a second!

Multi-functional controllers

The RV-SD robots are controlled by the CR2D controller with multitasking support. The ability to connect to any image processing system, options for controlling up to 8 additional axes and high-speed Ethernet connections are just a few of the impressive highlights of these powerful robot controllers. Other features include conveyor belt tracking, sensorless crash detection and many other functions for optimising cycle times.

RV-6SD/-6SDL/ -12SD/-12SDL Facts and Figures

Degrees of freedom (axes):

6

Max. payload (nom.):

RV-6SD/-6SDL	6 (5) kg
RV-12SD/12SDL	12 (10) kg

Gripper flange reach:

RV-6SD	781 mm
RV-6SDL	987 mm
RV-12SD	1,183 mm
RV-12SDL	1,482 mm

Repeatability:

RV-6SD/-6SDL	±0.02 mm
RV-12SD/12SDL	±0.05 mm

Max. speed:

RV-6SD	9,300 mm/s
RV-6SDL	8,500 mm/s
RV-12SD	9,600 mm/s
RV-12SDL	9,500 mm/s

Controller:

RV-6SD/-6SDL	CR2D
RV-12SD/-12SDL	CR2D

Intelligent Design

Mass production of similar products like CD-ROMs on a production line

Intelligent self-monitoring

The sensorless crash detection system helps to preventing accidental damage, for example caused by contact between the vertical ball screw axis and peripherals during teaching operations. When the function is activated any contact immediately stops the robot motion automatically.

Optimised design

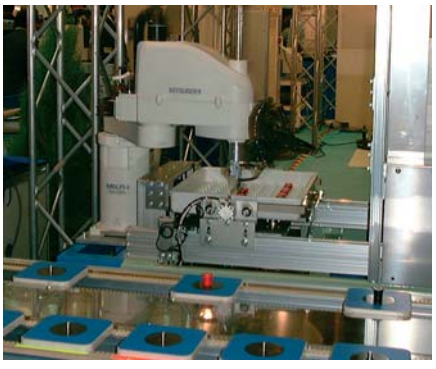
The solenoid valves for controlling the gripper hands are installed on the back of arm 2. This optimised design minimises tangling and catching of the gripper supply lines and the surrounding components.

In addition, pneumatic hoses and sensor cables are routed inside the robot arm for easier connection of grippers and sensors.

The movement axes of an RH-SDH robot

The powerful SCARA robots of the RH-SDH series are a great choice for palletising and assembly tasks.

The robots are fitted with newly-developed servo motors and step-down transmissions that enable operation at high speeds with optimum acceleration and braking performance. For example, the RH-12SDH achieves speeds that are 18 % faster than comparable robots, giving users an easy, flexible, high speed solution.



An RH-6SDH in a palletising application

RH-6SDH/-12SDH/ -20SDH Facts and Figures

Degrees of freedom (axes):

4

Max. payload (nom.):

RH-6SDH	6 (2) kg
RH-12SDH	12 (4) kg
RH-20SDH	20 (5) kg

Gripper flange reach:

RH-6SDH	550 mm
RH-20SDH	850/1000 mm

Repeatability:

RH-6SDH	±0.02 mm
RH-12SDH/-20SDH	±0.025 mm

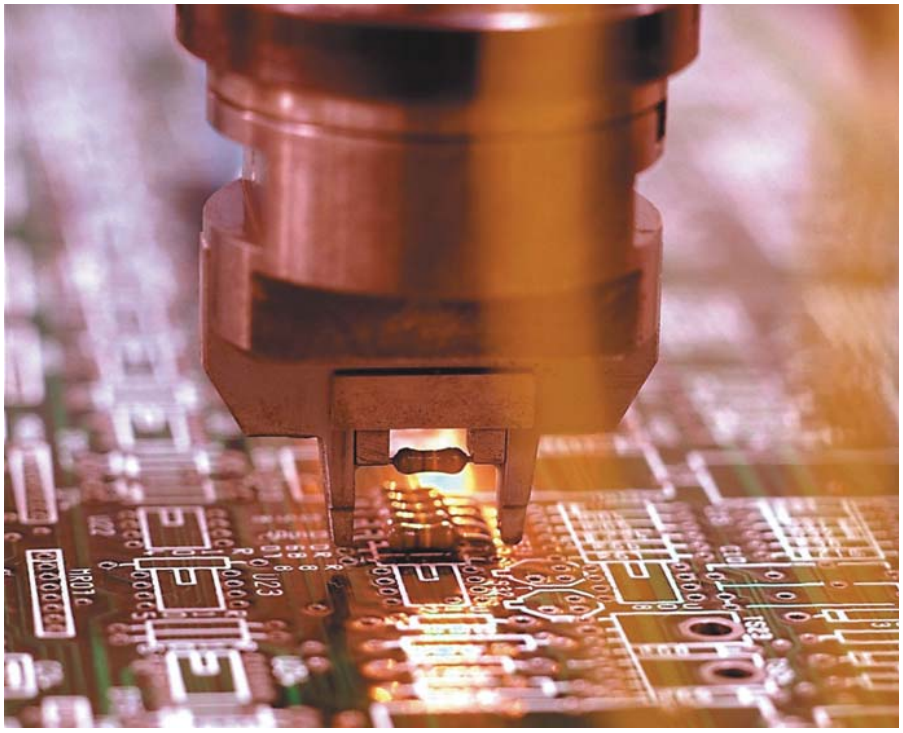
Max. speed:

RH-6SDH	7,782 mm/s
RH-12SDH/-20SDH	11,221 mm/s

Controller:

CR2D

Superfast, Superprecise



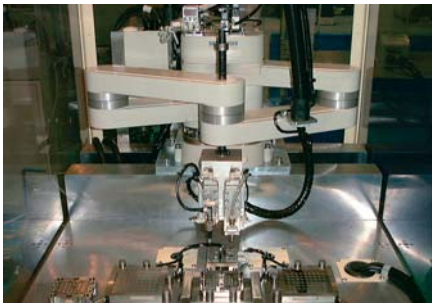
Fast "pick & place" applications – are a major application area for Mitsubishi robots

For applications requiring larger payloads or reaches users can select the RP-3AH and RP-5AH models, which can handle up to 3 kg and 5 kg and have reaches of 335 and 453 mm, respectively.

Boosting efficiency in production

The RP robots' small size and high precision make them perfect for micro-handling applications – for example micro-assembly, placement and soldering of SMD components on to circuit boards for many of today's electronic consumer good, such as mobile phones. These robots are much more versatile than traditional inflexible automated assembly machines, providing a significant boost to production efficiency.

The movement axes of the RP-AH series



Precise operation in restricted space

Precision in cramped quarters

The RP-1AH is in its element in all applications where components need to be handled quickly and with precision. With an installation footprint of just 200 x 160 mm it has a reach of 236 mm and can place parts, at speed, with a precision of ±0.005 mm.

This makes it one of the ultimate "pick & place" solutions available.

RP-1AH/-3AH/-5AH Facts and Figures

Degrees of freedom (axes):

4

Max. payload:

RP-1AH	1 kg
RP-3AH	3 kg
RP-5AH	5 kg

Repeatability:

RP-1AH	±0.005 mm
RP-3AH	±0.008 mm
RP-5AH	±0.01 mm

Max. speed:

RP-1AH	800 mm/s
RP-3AH	960 mm/s
RP-5AH	960 mm/s

Controller:

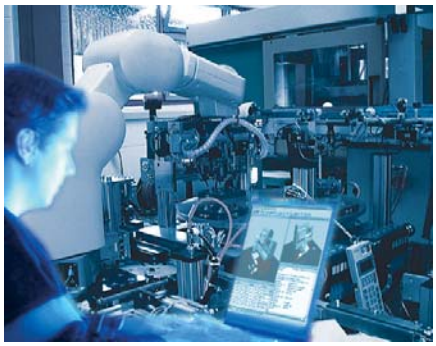
CR1

Programming made Easy

Using Mitsubishi robots is easy

Programming a Mitsubishi robot arm is a lot easier than most people imagine. The programming language of the teach pendent is a simple sentence like structure with commands such a MOV being used to program the robot to move.

In addition to this the advanced RT ToolBox2 und MELFA WORKS software packages provide enhanced programming and simulation capabilities, making it possible to design and simulate your robot applications before you actually purchase the hardware.

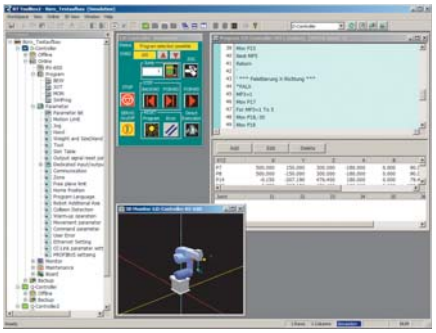


Easy programming on the spot

RT ToolBox2 – from professionals for experts

A powerful robot programming language needs an equally powerful programming environment.

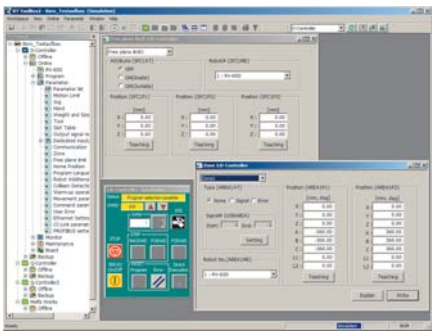
RT ToolBox2 is the programming environment for all Mitsubishi Electric robots. It enables you to create programs in minutes using the MELFA BASIC V or MELFA BASIC IV robot languages. After testing and optimisation it then just takes a couple of mouse clicks to transfer them to the actual robots, using an efficient direct link between the PC and the robot via a network, USB or a serial connection.



Parameter lists

Monitoring and visualisation

While the programs are being executed you can monitor and visualise the robots movement with the help of RT ToolBox2 comprehensive control and diagnostics functions. The real-time axis speeds and motor currents are clearly displayed, together with the statuses of all the inputs and outputs of the robot. Live monitoring fully supports all the programs executed by the controller enabling you to track down program errors quickly and reliably.



Groups of windows for parameter entry

RT ToolBox2 also provides tools for program archiving and for backing up the robot's parameters and settings.

Many functions – for your benefit

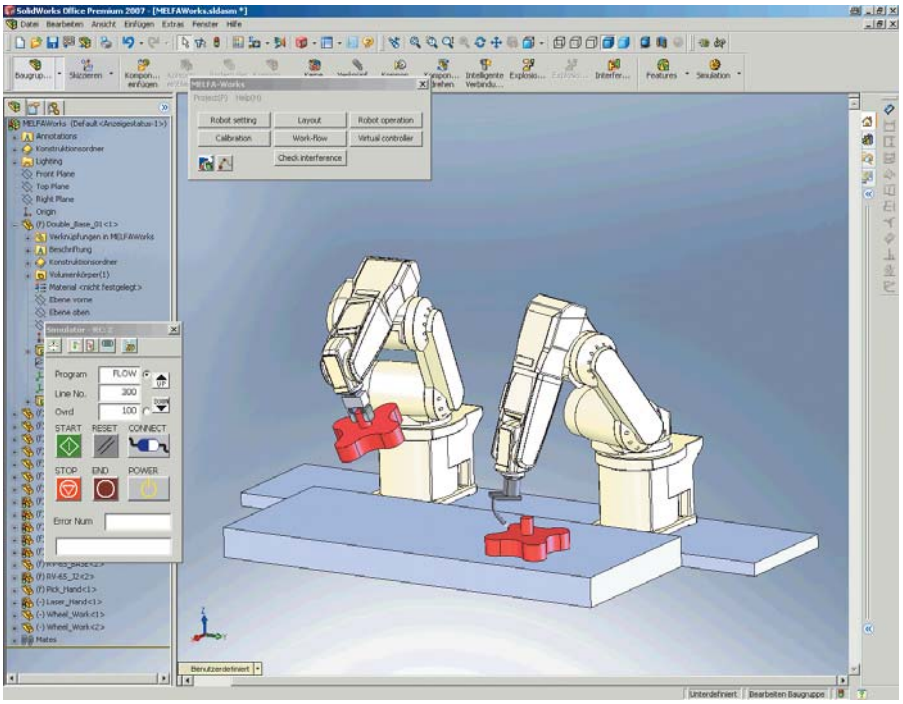
- Online "teach-in" function for robot positions
- Position display on a 3-D representation of the robot
- Syntax checking
- I/O monitor
- Variable monitor
- Online command execution
- Error diagnostics
- Position editor
- Project management

Fast and Easy Simulation

MELFA WORKS is a 3D robot simulation software package. It can simulate entire work cells, i.e. both the robot itself and its interaction with its environment.
MELFA WORKS is an add-on for SolidWorks and is able to use all the advanced functions of this modern 3D CAD package. You can select grippers, sensors and other components from a large range of libraries and integrate them directly in MELFA WORKS.

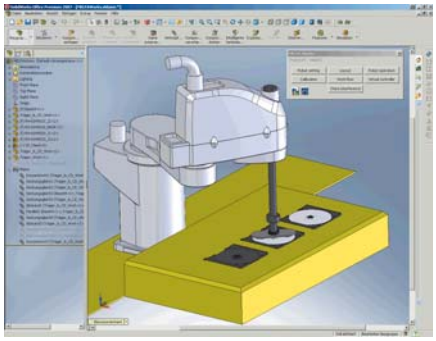
Powerful tools

This set of powerful software tools helps you throughout the planning, programming and test phases of your project. "Reachability" checks in the early planning stages help you to select the most suitable robot systems for the task. You can move the robots and other work cell components around in the simulation at will, making it easy to optimise the layout of your system.



MELFA WORKS industrial simulation software

Authentic simulation environment

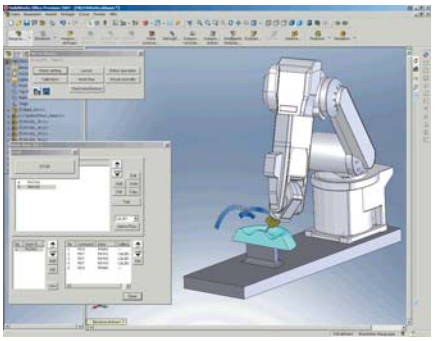


The Model Explorer simplifies object management

RT ToolBox2 uses the native robot languages (MELFA BASIC V or MELFA BASIC IV) to program the robots within the simulation environment. This means that no additional conversion or processing steps are required when you transfer the resulting programs to real robots. In addition, this enables you to use familiar robot programming languages and all your existing know-how and skills when you are working with the simulation. The comprehensive online help system is always available when you need support, for example, with the formulation of the necessary programming syntax. After creating your robot programs you can test them directly in the simulation environment, eliminating the need to remove the actual work cell from the production process for testing.

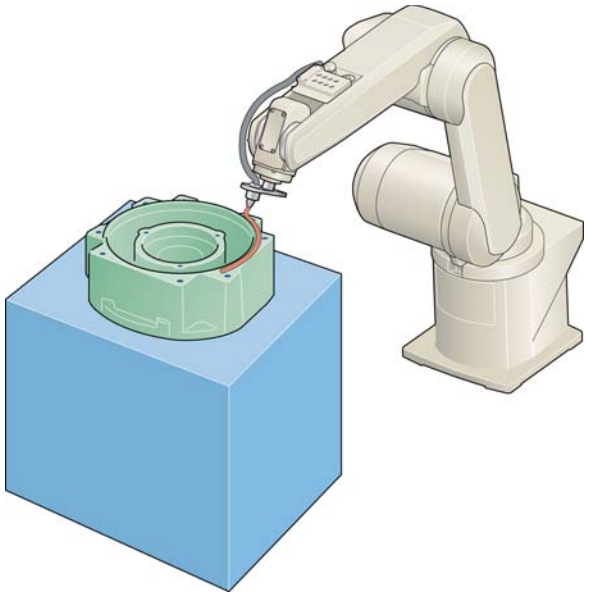
Saving costs

The RT ToolBox2 and MELFA WORKS packages are powerful tools for achieving maximum efficiency and cost-effectiveness in the configuration and operation of robot-supported automation solutions. They allow you to plan and operate your systems with a very high degree of confidence, even before any hardware is purchased.



Program execution monitoring in the simulation

Innovation in Movement



Sealing a workpiece

For years, Mitsubishi robots have been demonstrating the power and productivity of their innovative technology in thousands of demanding applications.

These robots are now in service in virtually all branches of the motor industry and its suppliers, and also in medical, education and training applications. With their powerful controllers they provide cost-effective, reliable and easily-installable solutions for everything from simple tool and component handling tasks to complex applications in which the entire system is controlled by the robot.

Precise operation in restricted space

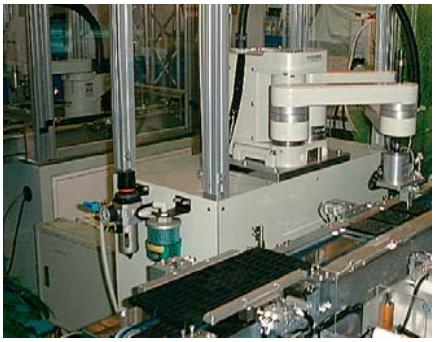
Mitsubishi's compact, 5-Joint closed link robot is the only one of its kind in the world. It has an installation footprint no larger than an A5 sheet of paper and repeatability of ±0.005 mm. This accuracy, combined with a cycle period of just 0.28 s, makes it suitable for use in precise component placement applications.

Small and compact

MELFA robot controllers are equally small and compact. With dimensions close to those of a standard PC they can be installed in the most cramped environments without taking up valuable production space. Their multitasking operating system and the powerful MELFA BASIC programming language make it easy to use them to control other system components. For example, the language instruction set also includes simple commands for the integration of cameras for object identification.

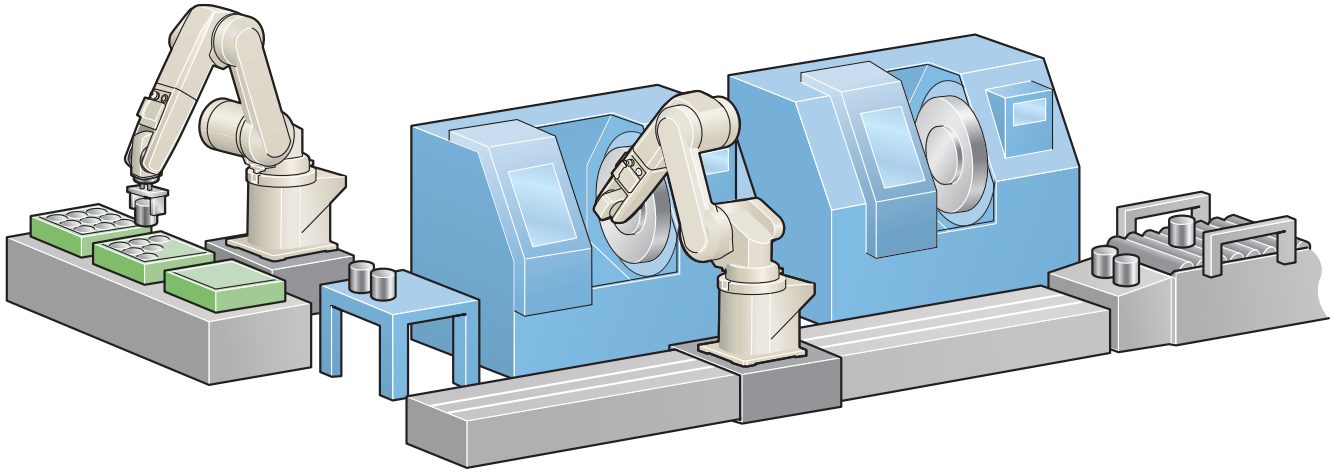
Strength and accuracy

The individual joints and axes of the robots are powered by high-precision AC servo motors coupled with play-free Harmonic Drive gears. Absolute position encoders are fitted to every motor, saving time by enabling the robot to start work as soon as it is powered up.



Applications in limited space

Precision and Flexibility



Machining/providing

Versatility

Mitsubishi robots are fitted with a standard robot gripper flange so you can attach any ISO 9404-1 compatible grippers. Cables and hoses are routed internally where they cannot snag on peripherals. The sensorless collision detection system enables the robot to respond to unforeseen collisions. The robots also feature Compliance Control for gentle and responsive handling to improve performance in assembly processes.

■ Fast Configuration

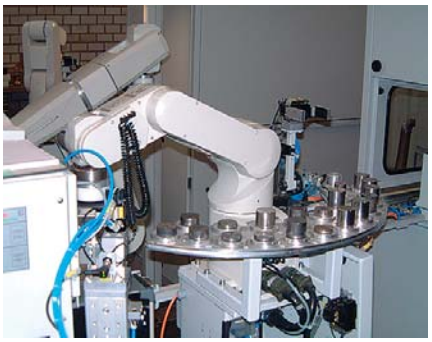
The initial setup of a new Mitsubishi robot system only takes around 5 minutes. The easy-to-understand programming language and powerful, user-friendly software tools make programming and operation child's play.

■ Universal Expansion Options

A comprehensive range of options and expansion cards can be added to adapt your robot to the precise requirements of your environment and application. These include robot grippers, interface cards for connection to a wide range of networks, I/O expansion modules and much more besides.

The ideal trainer

Festo Didactic, one of the world's leading suppliers of training applications, has already been using Mitsubishi robots in its training systems for years. Thousands of students and trainees have already learned to appreciate the capabilities of Mitsubishi robots on these systems.



Mitsubishi Robots in Quality Control

Small robots. Big solutions.

Modern automation technology from Mitsubishi Electric is one of the driving forces behind technical progress and commercial success all over the world. Although MELFA robots can be used in individual machines and "island solutions" they really develop their full versatility as components in integrated systems.

Maximum reliability is always the top priority for our robots, no matter whether they are used in simple handling operations or the highly-complex applications of car manufacturers and their high-tech suppliers. Whatever the job, you can always depend on the reliability of Mitsubishi robots.

Other typical applications for these robots include manipulation of components and tools, quality control, placement and installation of small and miniature parts and handling tasks in medical and laboratory environments.

Compact and High Functional

The compact, modular robot controller is an integral part of the robot system. It contains the CPU and the power electronics for powering and controlling the robot.

Small and compact

At Mitsubishi Electric "switchgear cabinets" are relics of the past – everything is now packed into a single compact controller. Depending on the robot model either the CR1 controller with a footprint no larger than an A4 sheet of paper or the CR2D/CR3D controller is used. The powerful control performance is the same in both the smaller and larger versions; the only difference between the two is in the power output stages. No matter which controller you use you always work with the same programming language – MELFA BASIC IV/V – and have the same options at your disposal.

This transparent compatibility pays off when you need to use different robot types or models when the needs of your application change.

■ Numbercrunching power

A 64-bit RISC processor with DSP provides ample power for 3-D circular and linear interpolation, and for multi-tasking with up to 32 programs running in parallel.

■ Gentle joining

The standard "compliance control" function guarantees gentle positioning. This function can be activated and deactivated as required, making it possible to optimise demanding joining and assembly processes, saving wear and tear on both components and robots.

■ Sensorless collision monitoring

Potential collision situations are identified reliably without an additional sensor, preventing damage to both workpieces and peripherals.

■ Digital inputs and outputs

System connectability is excellent: A full 16 digital inputs and 16 digital outputs are included as standard equipment with the CR1 controller and 32 inputs and 32 outputs are available as an option with the CR2D/CR3D controllers. Optional remote I/O boxes make it possible to increase this to up to 256 inputs and 256 outputs for complex applications.

■ Large program memory

The controller can store up to 88 independent programs, all of which can call each other, for example when different program sequences are needed for different products.

CR1, CR1D, CR2D and CR3D Facts and Figures

Control mode:

PTP and CP

Processor:

64 Bit RISC + DSP

Control functions:

Axial, linear and 3-D circular interpolation; palletising functions, interrupt control and multitasking

Max. number of programs:

256 for CR1D/CR2D/CR3D
88 for CR1

Max. number of program steps:

26,000 for CR1D/CR2D/CR3D
5,000 for CR1

Max. number of teaching points:

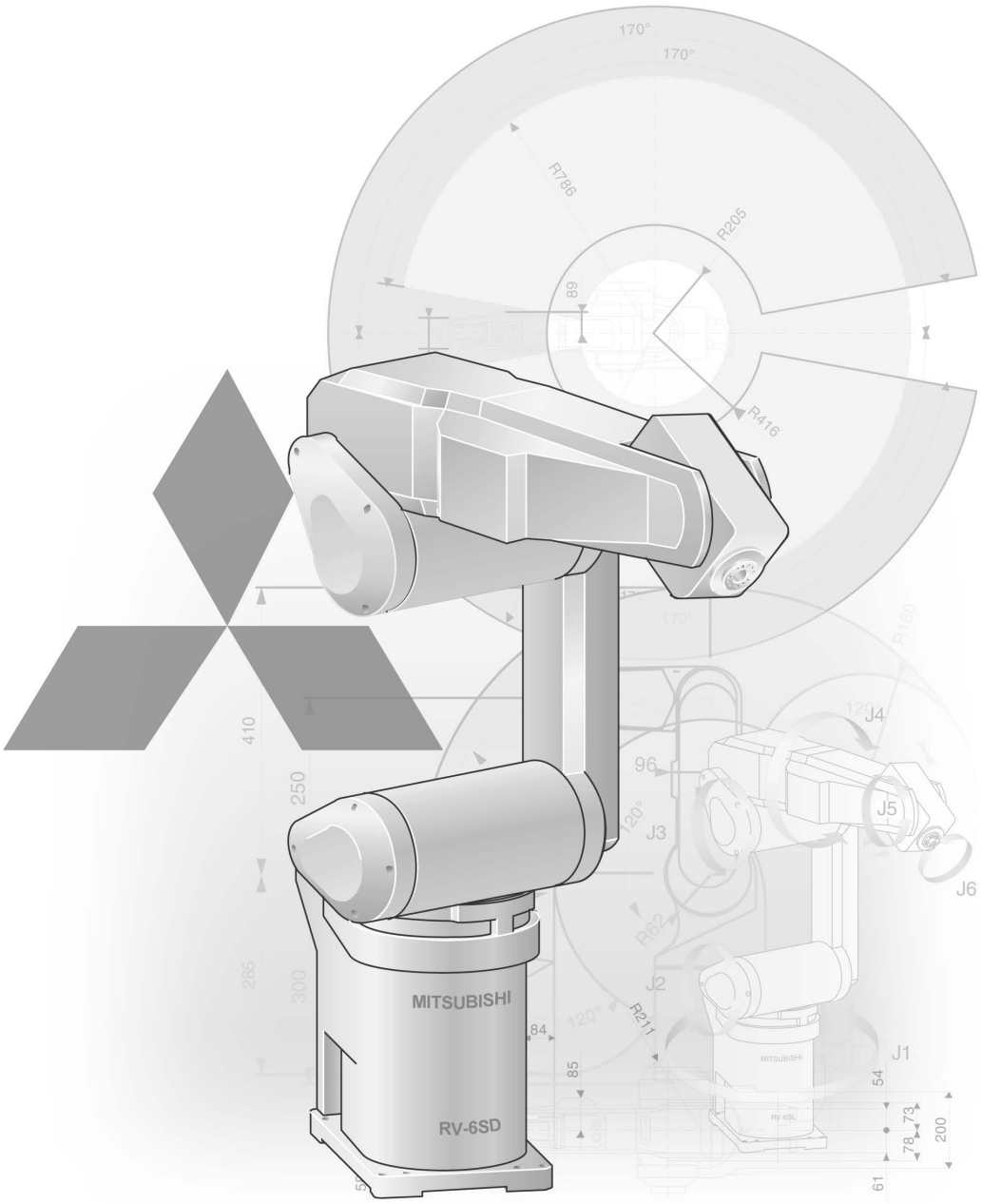
13,000 for CR1D/CR2D/CR3D
2,500 for CR1

Internal I/Os:

CR1	16 E/16 A, max. 240 E/240 A
CR1D, CR2D, CR3D	32 E/32 A optional, max. 256 E/256 A

Safety functions:

EMERGENCY OFF and door contact switch (CR1D, CR2D, CR3D)



Technical Information Section

Further Publications within the Industrial Automation Range

Brochures

System Q Family and FX Family

Product catalogues for programmable logic controllers, operator terminals and accessories for the MELSEC PLC series

HMI Family

Product catalogue for operator terminals, supervision software and accessories

Inverter Family

Product catalogue for frequency inverters and accessories

MR Family

Product catalogue for servo amplifiers and servo motors as well as motion controller and accessories

Networks

Product catalogue for Master and Slave modules as well as accessories for the use of programmable logic controllers in open and MELSEC networks

Low Voltage Switchgears

Product catalogue for low voltage switchgears, magnetic contactors and circuit breakers

Automation Book

Overview on all Mitsubishi automation products, like frequency inverters, servo/motion, robots etc.

Further service supplies

This product catalogue is designed to give an overview of the extensive range of Mitsubisi MELFA RV-SD, RH-SDH and RP-AH robots series. If you cannot find the information you require in this catalogue, there are a number of ways you can get further details on configuration and technical issues, pricing and availability.

For technical issues visit the www.mitsubishi-automation.com website.

Our website provides a simple and fast way of accessing further technical data and up to the minute details on our products and services. Manuals and catalogues are available in several different languages and can be downloaded for free.

For technical, configuration, pricing and availability issues contact our distributors and partners.

Mitsubishi partners and distributors are only too happy to help answer your technical questions or help with configuration building. For a list of Mitsubishi partners please see the back of this catalogue or alternatively take a look at the "contact us" section of our website.

About this product catalogue

This catalogue is a guide to the range of products available. For detailed configuration rules, system building, installation and configuration the associated product manuals must be read. You must satisfy yourself that any system you design with the products in this catalogue is fit for purpose, meets your requires and conforms to the product configuration rules as defined in the product manuals.

Specifications are subject to change without notice. All trademarks acknowledged.

MELFA Industrial Robot Systems

1 Robots

2 Controller

3 Accessories

4 Programming Language

5 Software

MELFA - Industrial Robot Systems

For many years Mitsubishi Electric's innovative and powerful robots have been delivering reliable performance in thousands of applications. These robots are now used throughout the motor industry by both car manufacturers and their suppliers, and in a wide variety of medical, training and many other different applications.

Broad Range of Products

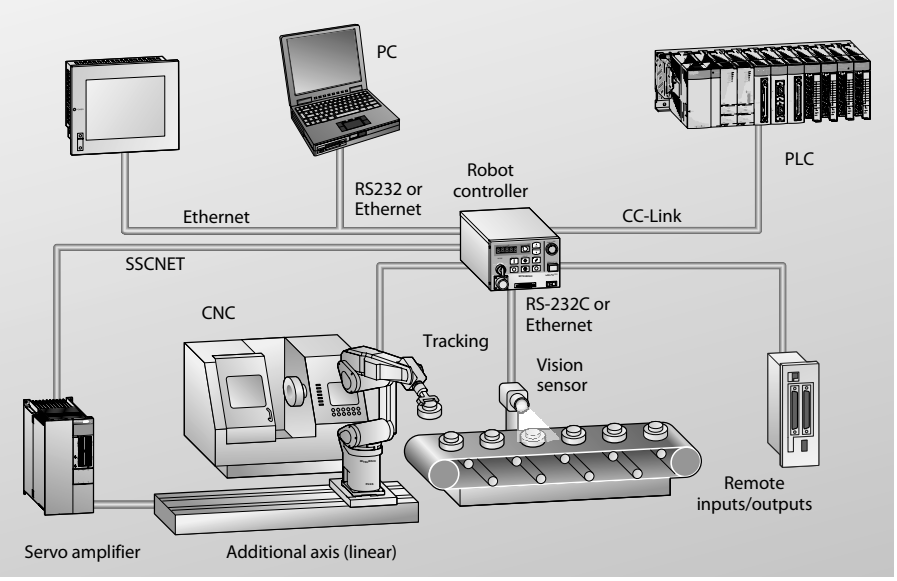
The MELFA family includes a wide selection of models in many different versions. The articulated-arm robots of the RV-SD serie range from the high-performance compact class with a 2 kg payload capacity to powerful models that can handle up to 12 kg. Mitsubishi's line of SCARA robots in the RP-AH and RH-SDH series are designed for high-precision positioning tasks and feature cycle periods of less than 1 s with positioning accuracy up to 5 µm.

Small and Compact

Mitsubishi's robot controllers are small and compact. With a footprint no larger than a PC they can be installed even in the most cramped quarters without taking up valuable production space. Their multitasking operating system and powerful MELFA BASIC programming language make it easy to develop programs to control your production systems. For example, MELFA BASIC includes instructions that make it easy to integrate a camera in the system for object identification.

Power and Precision

The robots are fitted with modern hollow shaft motors and transmissions designed for maximum drive train rigidity.
High-precision AC servo motors and play-free harmonic drive transmissions ensure outstanding precision.



Example of a robot system configuration

Versatility for Countless Applications

The robots are fitted with a standard robot gripper flange so you can attach any ISO 9404-1 compatible grippers. Cables and hoses are routed internally where they cannot snag on peripherals. The sensorless collision detection system enables the robot to respond to unforeseen collisions. The robots also feature Compliance Control for gentle and responsive handling to improve performance in assembly processes.

Fast Configuration

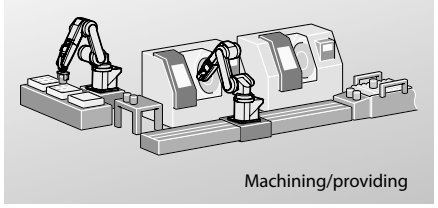
The initial setup of a new Mitsubishi robot system only takes around 5 minutes.
The easy-to-understand programming language and powerful, user-friendly software tools make programming and operation child's play.

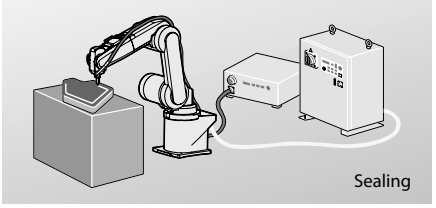
Universal Expansion Options

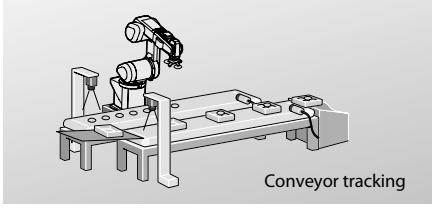
A comprehensive range of options and expansion cards can be added to adapt your robot to the precise requirements of your environment and application. These include robot grippers, interface cards for connection to a wide range of networks, I/O expansion modules and much more besides.

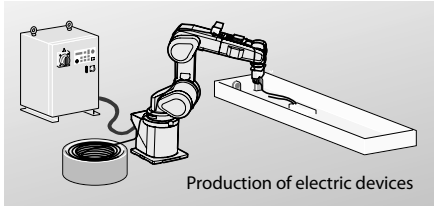
New Robot Controller

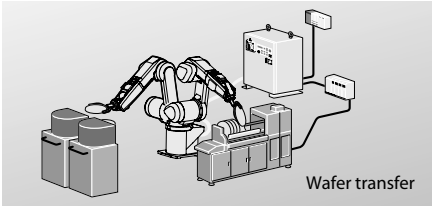
With the D-Controller several connectors and features are implemented as a standard. Besides the Ethernet- and R232-Connection for connecting other communicating devices a USB-Port for programming is a standard feature. Up to 8 additional Axes can be directly connected to the D-Controller

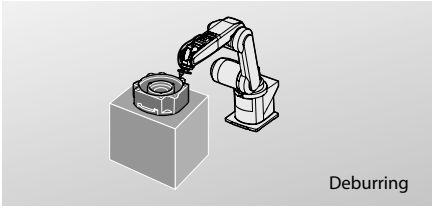

Machining/providing


Sealing


Conveyor tracking


Production of electric devices


Wafer transfer


Deburring

Optional Network Capabilities

Ethernet

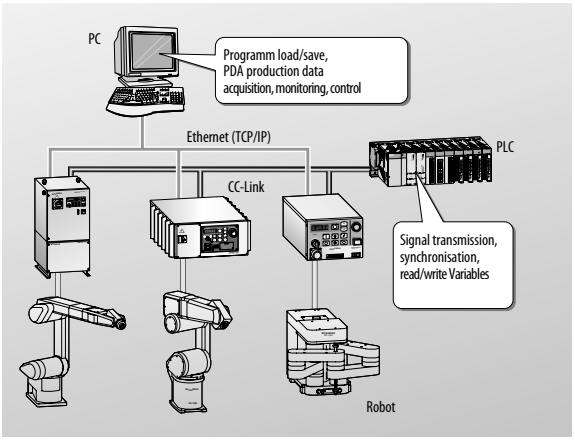
The Ethernet expansion card uses the standard TCP/IP protocol for high-speed communications between the robot controller and PCs or sensors. You can configure the card in master or slave mode as required by your application. One of the most attractive features of this communications option is the ability to control the robot in real time, so that the robot's movements can respond instantaneously to sensor data.

CC-Link

This option provides a large number of virtual I/Os, for example for communication between several robots or connection of a PLC via a simple twisted-pair line.

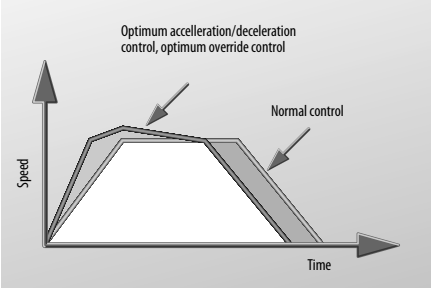
Profibus/DP

The Profibus/DP network is particularly well suited for time-critical applications. A wealth of distributed I/O solutions are also available for this network.

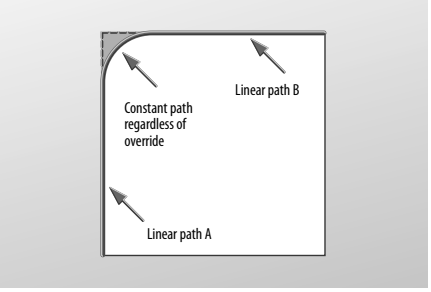


Possible network connection configuration

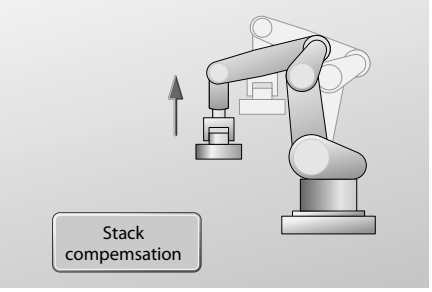
Practical Functions for all Applications



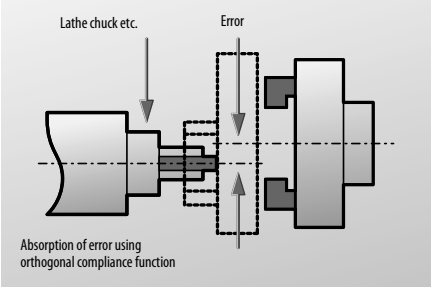
Automatic acceleration and braking ramp optimisation for faster cycle times



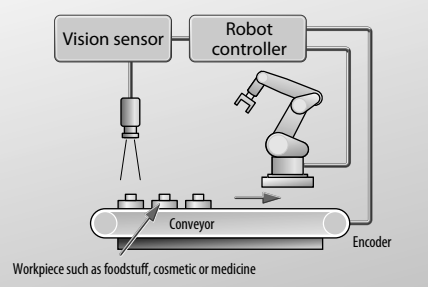
Continous path function for faster cycle times



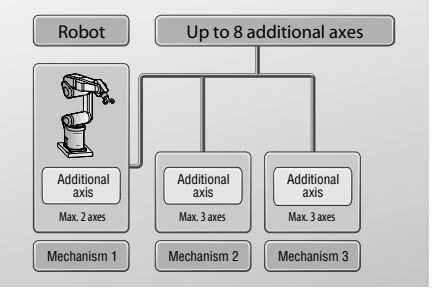
Gravity compensation for greater positioning and palletising precision



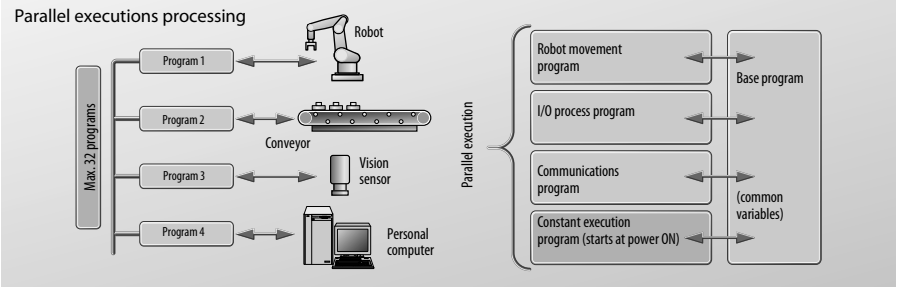
Orthogonal compliance control function for interactive response to opposing forces



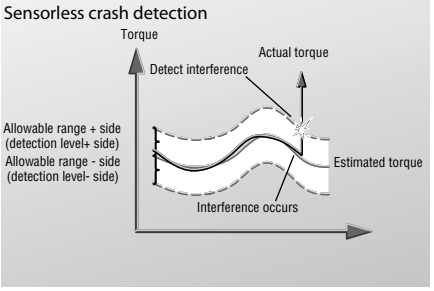
Object tracking function for faster cycle times



Control functions for up to 8 additional axes



Multitasking function for parallel execution of multiple tasks



■ Overview Articulated Arm Robots

Large Range of Robot Models Makes Selection Easy

Mitsubishi produces a comprehensive range of robot models to cater to the full spectrum of modern needs. All Mitsubishi robots are powerful, fast and compact – that goes almost without saying.

The product range includes the almost universal articulated-arm robots with 5 or 6 degrees of freedom and SCARA robots for assembly and palletising tasks.

There is also a line of special high-precision robots for very fast and exact handling tasks.

RV-2SDB

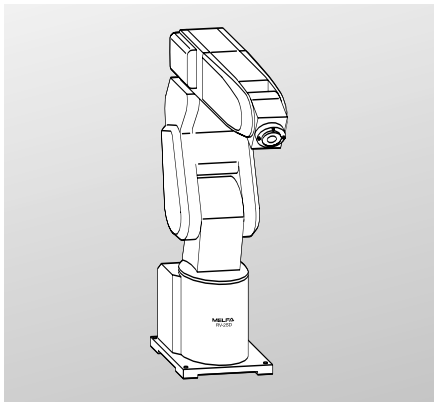
The powerful robots of the compact class are ideal for handling and component placement applications in cramped quarters. These robots are also well suited for handling tasks at machines, for example automated laboratory equipment etc.

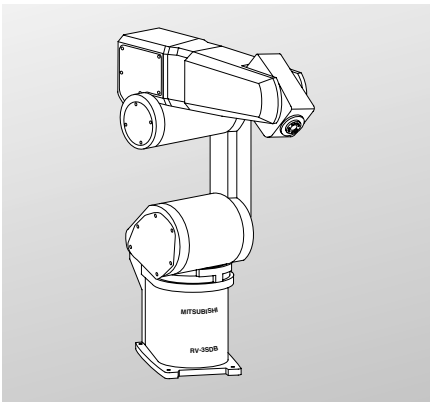
RV-3SDJB, RV-3SDB

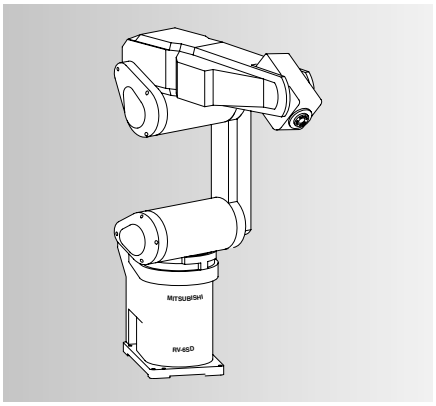
The RV-3SD deliver robots outstanding performance at or even in machines. The entire robot has an IP65 protection rating for reliable operation even under the most extreme conditions.

RV-6SD, RV-6SDL, RV-12SD, RV-12SDL

The RV-6SD and RV-12SD are the high-performance robots in Mitsubishi's SD series. Available in both 6 kg and 12 kg payload versions and with standard or long-reach arms, the robots of this series are ideal for handling workpieces in industrial manufacturing processes and for daisy-chaining production stations.







Model		RV-2SDB	RV-3SDJB	RV-3SDB	RV-6SD	RV-6SDL	RV-12SD	RV-12SDL
Degrees of freedom		6	5	6	6	6	6	6
Type		Standard						
Installation posture		Installation on floor or ceiling possible	Installation on floor, wall or ceiling possible		Installation on floor, wall or ceiling possible		Installation on floor, wall or ceiling possible	
Max. composite speed [mm/s]		4400	5300	5500	9300	8500	9600	9500
Payload [kg]	maximum	3	3.5	3.5	6	6	12	12
	nominal	2	3	3	5	5	10	10
Position repeatability [mm]		±0.02	±0.02	±0.02	±0.02	±0.02	±0.05	±0.05
Weight [kg]		19	33	37	58	60	93	98
Reach without hand [mm]		504	641	642	696	902	1086	1385
Catalogue reference page		8	10	10	12	12	12	12

■ Overview SCARA Robots

The robots described in this section are SCARA robots, which have 4 degrees of freedom. Whilst the RH-SDH series has the typical SCARA design, the closed-loop arm of the RP-AH series puts it in a special class of its own.

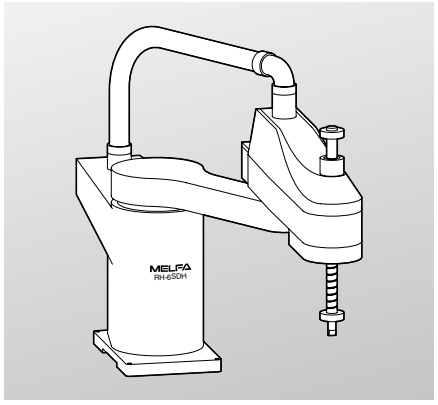
The kinematic advantages of this design enable the robot to perform positioning tasks with precision of up to 5 µm.

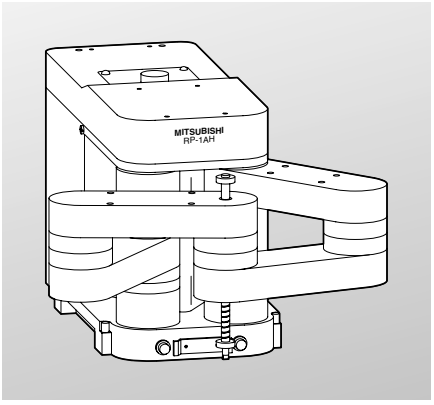
RH-6SDH, RH-12SDH, RH-20SDH

SCARA robots are designed for tasks like sorting, palletising and workpiece placement. Depending on the application they can achieve cycle times of less than 1 second.

RP-1AH, RP-3AH, RP-5AH

Their compact dimensions and high precision predestine the RP robots for micro-handling applications like micro-assembly, component placement and soldering SMD circuit boards.

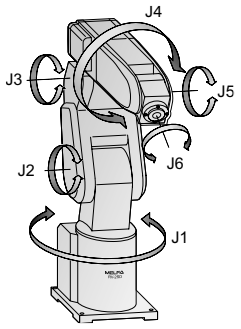




Model		RH-6SDH	RH-12SDH	RH-20SDH
Degrees of freedom		4		
Installation posture		Floor mounting		
Payload [kg]	maximum	6	12	20
	nominal	2	2	5
Max. reach (arm 1 + 2) [mm]		550	850	850
Max. composite speed [mm/s]		7782 (J1, J2, J4) 6003 (J1, J2)	11221 (J1, J2, J4) 6612 (J1, J2)	11221
Repeatability	X, Y direction [mm]	±0.02	±0.025	±0.025
	J3 (Z) direction [mm]	±0.01	±0.01	±0.01
	J4 direction (θ axis) [degree]	±0.02	±0.03	±0.03
Weight [kg]		21	45	47
Reference page		15		

Model		RP-1AH	RP-3AH	RP-5AH
Degrees of freedom		4		
Installation posture		Floor mounting		
Payload [kg]	maximum	1.0	3.0	5.0
	nominal	0.5	1.0	2.0
Rectangular operating range (width x depth) [mm]		150x105 (DIN A6)	210x148 (DIN A5)	207x210 (DIN A4)
Repeatability	X, Y direction [mm]	±0.005	±0.008	±0.01
	Z direction [mm]	±0.01	±0.01	±0.01
	wrist roll direction [degree]	±0.02	±0.02	±0.02
Weight [kg]		12	24	25
Reference page		18		

■ Industrial Robots RV-2SDB



RV-2SDB

The Articulated Arm Robots RV-2SDB

High-tech arms and robot controllers are among the outstanding features of the RV-2SDB, who has 6 degrees of freedom, respectively. The compact controller is easy to install, even in systems where space is at a premium.

Highlights:

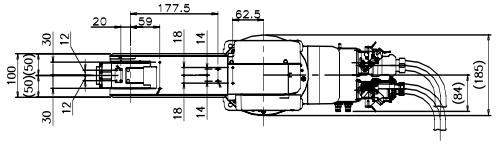
- Slim design allows operation in cramped quarters
- Additional axes can be added
- Multitasking operating system

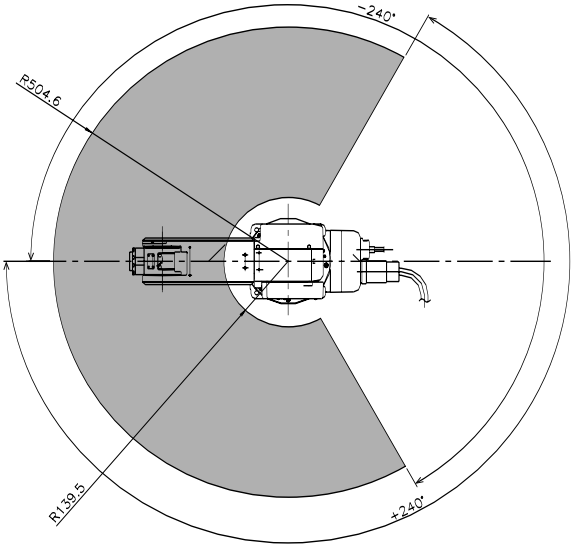
Characteristics/Functions			Specification
			RV-2SDB
Degrees of freedom (no. of axes)			6
Installation posture			Floor or ceiling mounting possible
Structure			Vertical multiple-joint type
Drive system			AC servo (Brakes on all axes)
Position detection method			Absolute encoder
Operating range	waist (J1)	degree	480 (-240 to +240)
	shoulder (J2)		240 (-120 to +120)
	elbow (J3)		160 (0 to +160)
	wrist twist (J4)		400 (-200 to +200)
	wrist pitch (J5)		240 (-120 to +120)
	wrist roll (J6)		720 (-360 to +360)
Maximum speed	waist (J1)	degree/s	225
	shoulder (J2)		150
	elbow (J3)		275
	wrist twist (J4)		412
	wrist pitch (J5)		450
	wrist roll (J6)		720
Maximum composite speed		mm/s	4,400
Payload capacity	rated	kg	3
	maximum		2
Position repeatability		mm	± 0.02
Ambient temperature		°C	0 to 40
Weight		kg	19
Tolerable moment	wrist twist (J4)	Nm	4.17
	wrist pitch (J5)		4.17
	wrist roll (J6)		2.45
Tolerable inertia	wrist twist (J4)	kgm^2	0.18 (0,27)
	wrist pitch (J5)		0.18 (0,27)
	wrist roll (J6)		0.04 (0,1)
Arm reachable radius (to the center point of the J5 axis)		mm	504
Tool wiring			4 input signal lines (connections in robot gripper area), 4 output signal lines (connections in base area)
Tool pneumatic pipes			Ø4x4 (from the base level to the gripper hand area)
Supply pneumatic pressure		MPa (bar)	0.5 ± 10 % (5 ± 10 %)
Gripper flange			ISO 9409-1-31.5
Protection rating			IP30
Robot controller			CR1D

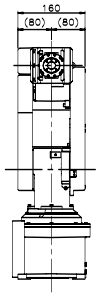
Order information	Art. no.	231174

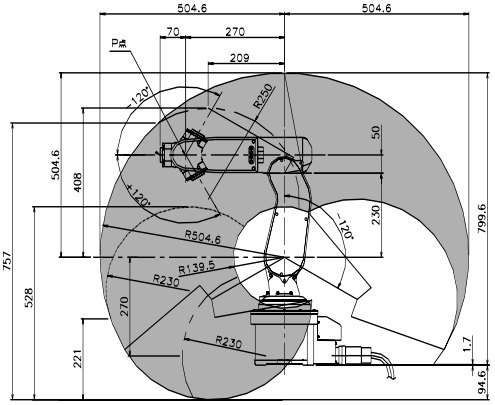
■ Robot Arms RV-2SDB

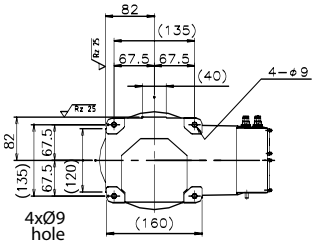
RV-2S DB

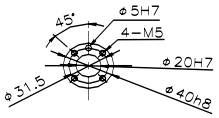








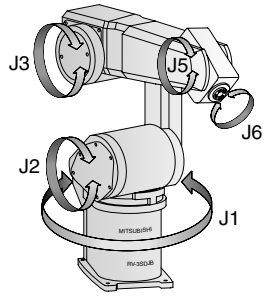




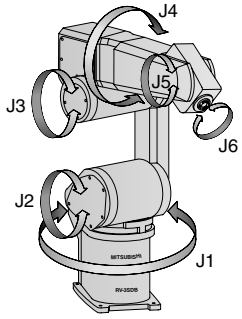
Gripper flange
ISO 9409-1-31,5

Dimensions: mm

■ Industrial Robots RV-3SDJB and RV-3SDB



RV-3SDJB



RV-3SDB

The Articulated Arm Robots RV-3SDJB, RV-3SDB

The RV-3SD robots are specially designed for handling tasks with payloads of up to 3.5 kg. They are encapsulated with an IP65 ingress protection rating for operation in extreme environments.

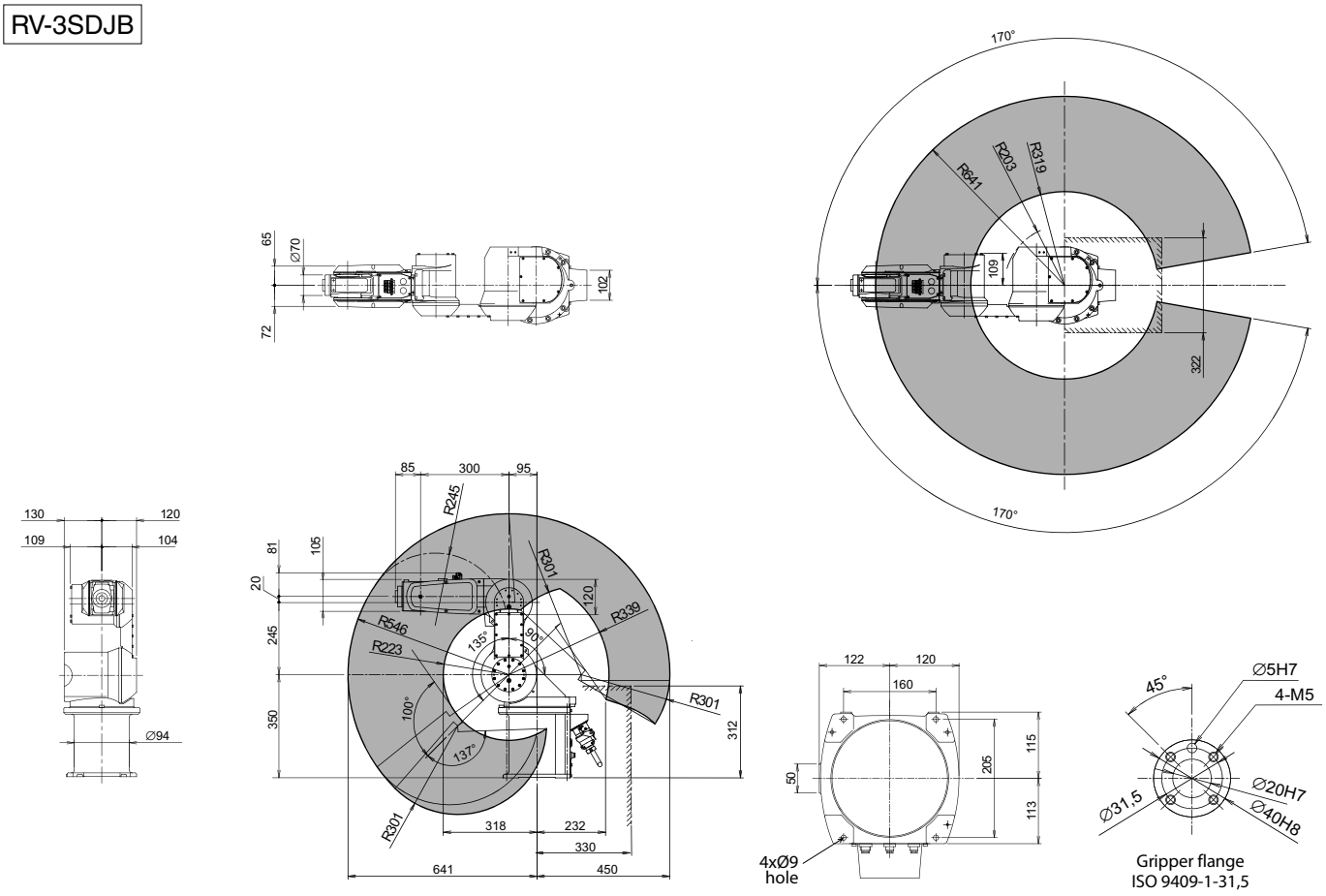
Highlights:

- Compliance Control function to compensate for workpiece tolerances
- Conveyor belt tracking
- Sensorless collision detection
- Encapsulated design with IP65 rating
- Adaptive speed optimisation

Characteristics/Functions			Specifiactions	
			RV-3SDJB	RV-3SDB
Degrees of freedom (no. of axes)			5	6
Machine class			Standard	
Installation posture			Floor, wall or ceiling mounting possible (wall mounting with limitations in the J1 axis)	
Structure			Vertical multiple-joint type	
Drive system			AC servo (all axes with brakes)	
Position detection method			Absolute encoder	
Operating range	waist (J1)	degree	340 (-170 to +170)	
	shoulder (J2)		225 (-90 to +135)	
	elbow (J3)		237 (-100 to +137)	191 (-20 to +171)
	wrist twist (J4)		—	320 (-160 to +160)
	wrist pitch (J5)		240 (-120 to +120)	
	wrist roll (J6)		720 (-360 to +360)	
Maximum speed	waist (J1)	degree/s	250	
	shoulder (J2)		187	
	elbow (J3)		250	
	wrist twist (J4)		—	412
	wrist pitch (J5)		412	
	wrist roll (J6)		660	
Maximum composite speed		mm/s	5300	5500
Payload capacity	rated	kg	3	
	maximum		3.5	
Position repeatability		mm	± 0.02	
Ambient temperature		℃	0 to 40	
Weight		kg	33	37
Tolerable moment	wrist twist (J4)	Nm	—	5.83
	wrist pitch (J5)		5.83	
	wrist roll (J6)		3.9	
Tolerable inertia	wrist twist (J4)	kgm^2	—	0.137
	wrist pitch (J5)		0.137	
	wrist roll (J6)		0.047	
Arm reachable radius (to the center point of the J5 axis)		mm	641	642
Tool wiring			8 inputs/8 outputs 8 spare wires 0.2 mm^2 (shielded)	
Tool pneumatic pipes			Primary: Ø6x2 (base to forearm section) Secondary: Ø4x8 (optional)	
Supply pneumatic pressure		MPa (bar)	0.5 ± 10 % (5 ± 10 %)	
Gripper flange			ISO 9409-1-31,5	
Protection rating			IP65	
Robot controller			CR1D	
Order information		Art. no.	218850	218849

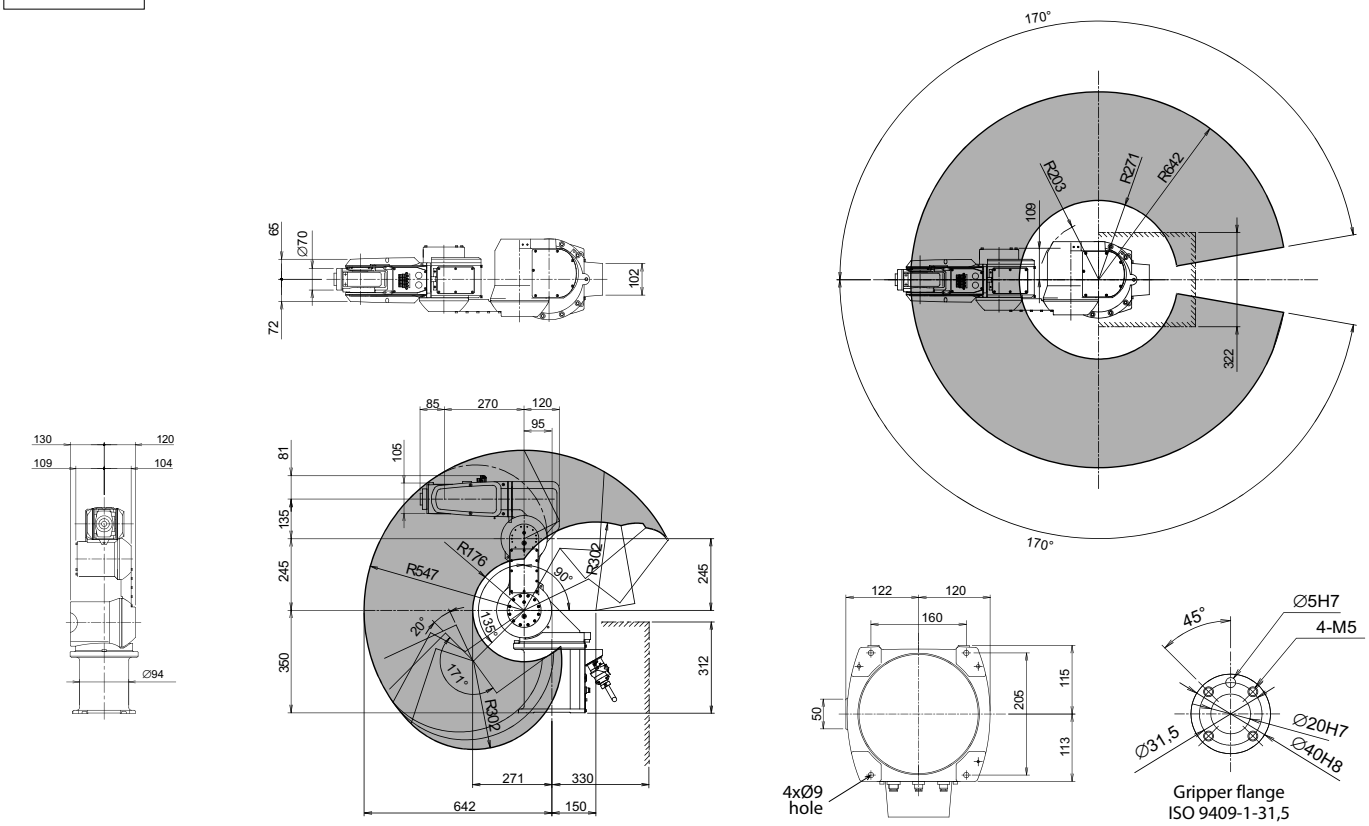
■ Robot Arms RV-3SDJB and RV-3SDB

RV-3SDJB

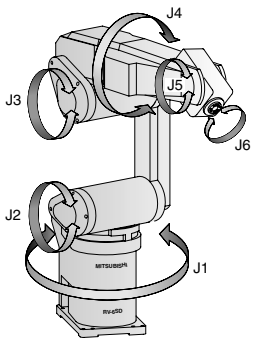


RV-3SDB

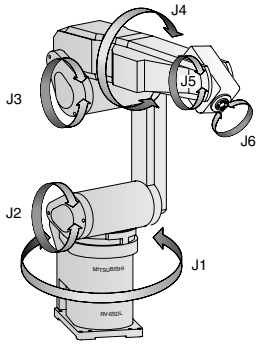
Dimensions: mm



■ Industrial Robots RV-6SD, RV-6SDL, RV-12SD and RV-12SDL



RV-6SD



RV-6SDL

The Articulated Arm Robots RV-6SD(L) and RV- 12SD(L)

Combining high speeds with maximum handling payloads of 6 kg and 12 kg, these robots are an ideal choice for virtually any application.

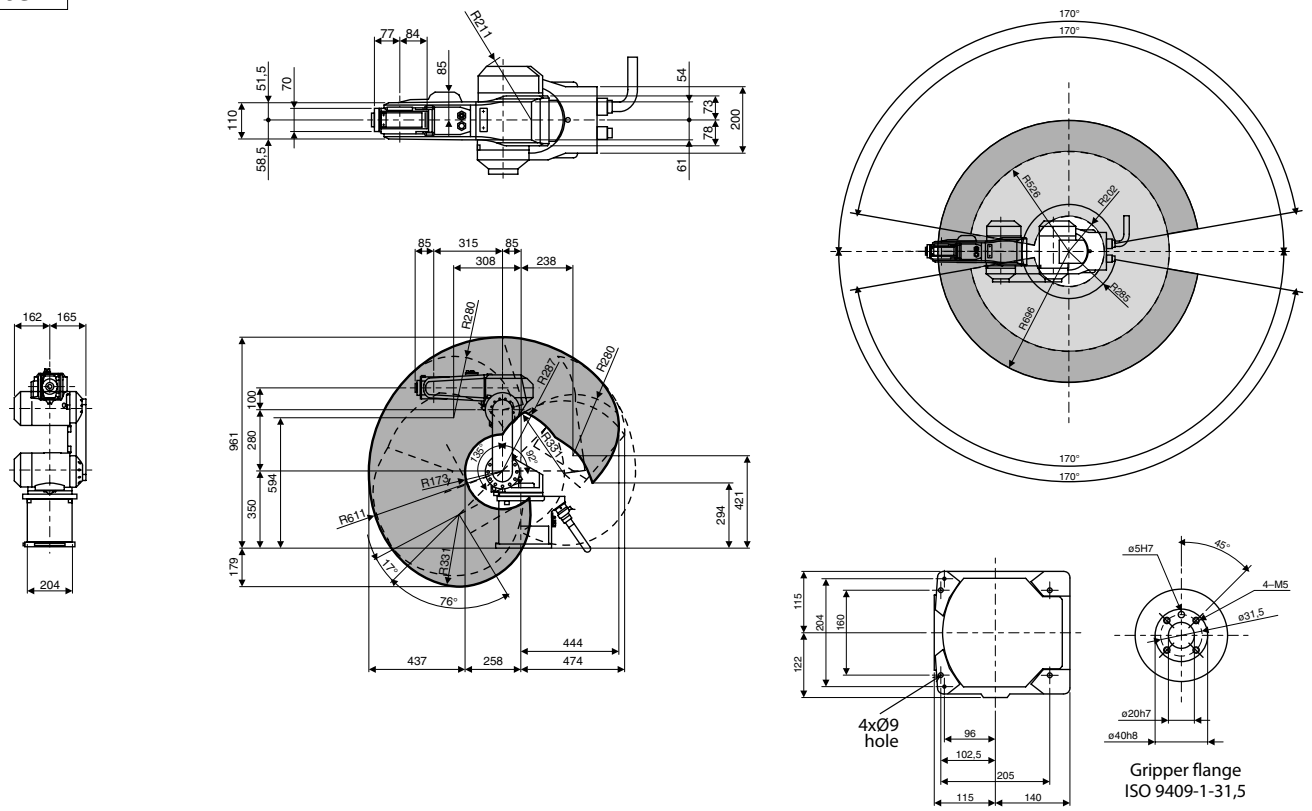
Highlights:

- Sensorless collision detection
- Conveyor belt tracking
- Compliance Control function to compensate for workpiece tolerances

Characteristics/Functions			Specifiactions			
			RV-6SD	RV-6SDL	RV-12SD	RV-12SDL
Degrees of freedom (no. of axes)			6	6 (long arm)	6	6 (long arm)
Machine class			Standard			
Installation posture			Floor, wall or ceiling mounting possible (wall mounting with limitations in the J1 axis)			
Structure			Vertical multiple-joint type			
Drive system			AC servo (all axes with brakes)			
Position detection method			Absolute encoder			
Operating range	waist (J1)	degree	340 (-170 to +170)			
	shoulder (J2)		227 (-92 to +135)		230 (-100 to +130)	
	elbow (J3)		273 (-107 to +166)	295 (-129 to +166)	290 (-130 to +160)	
	wrist twist (J4)		320 (-160 to +160)			
	wrist pitch (J5)		240 (-120 to +120)			
	wrist roll (J6)		720 (-360 to +360) (expandable)			
Maximum speed	waist (J1)	degree/s	401	250	276	230
	shoulder (J2)		321	267	230	172
	elbow (J3)		401	267	267	200
	wrist twist (J4)		352			
	wrist pitch (J5)		450		375	
	wrist roll (J6)		660			
Maximum composite speed		mm/s	9300	8500	9600	9500
Payload capacity	rated	kg	5		10	
	maximum		6		12	
Position repeatability		mm	±0.02		±0.05	
Ambient temperature		℃	0 to 40			
Weight		kg	58	60	93	98
Tolerable moment	wrist twist (J4)	Nm	12		19.3	
	wrist pitch (J5)		12		19.3	
	wrist roll (J6)		4,5		11	
Tolerable inertia	wrist twist (J4)	kgm^2	0.29		0.4	
	wrist pitch (J5)		0.29		0.4	
	wrist roll (J6)		0.46		0.14	
Arm reachable radius (to the center point of the J5 axis)		mm	696	902	1086	1385
Tool wiring			8 inputs/8 outputs, 6 spare wires 0.1 mm^2 (shielded)			
Tool pneumatic pipes			Primary: Ø 6x2 (base to fore arm section) secondary: Ø 4x8		Primary: Ø 6x2 (base to fore arm section) secondary: Ø 4x8	
Supply pneumatic pressure		MPa (bar)	0.49 ± 10 % (4.9 ± 10 %)			
Gripper flange			ISO 9409-1-31,5		ISO 9409-1-40	
Protection rating			IP54 (J1 to J3), IP65 (J4 to J6)			
Robot controller			CR2D		CR2D	
Order information		Art. no.	214965	218866	218852	218853

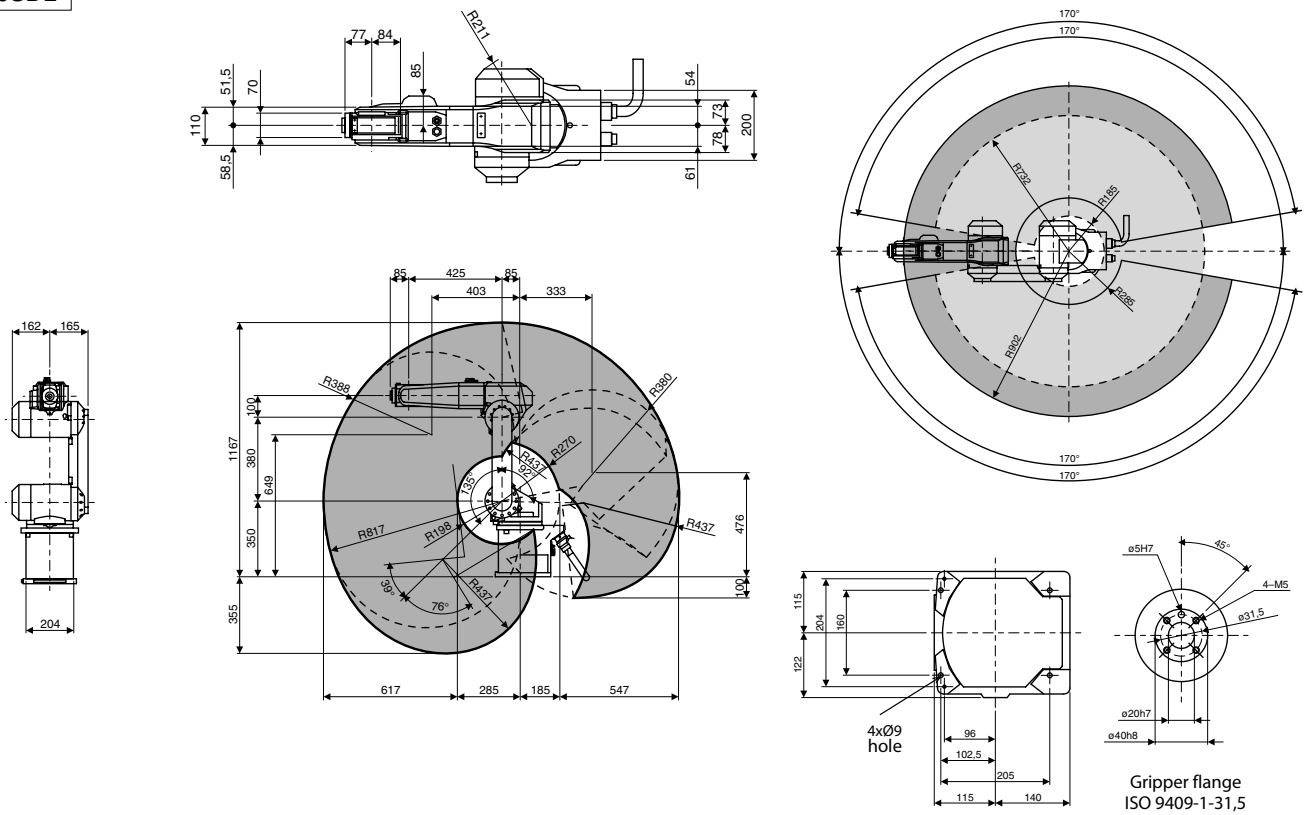
■ Robot Arms RV-6SD and RV-6SDL

RV-6SD



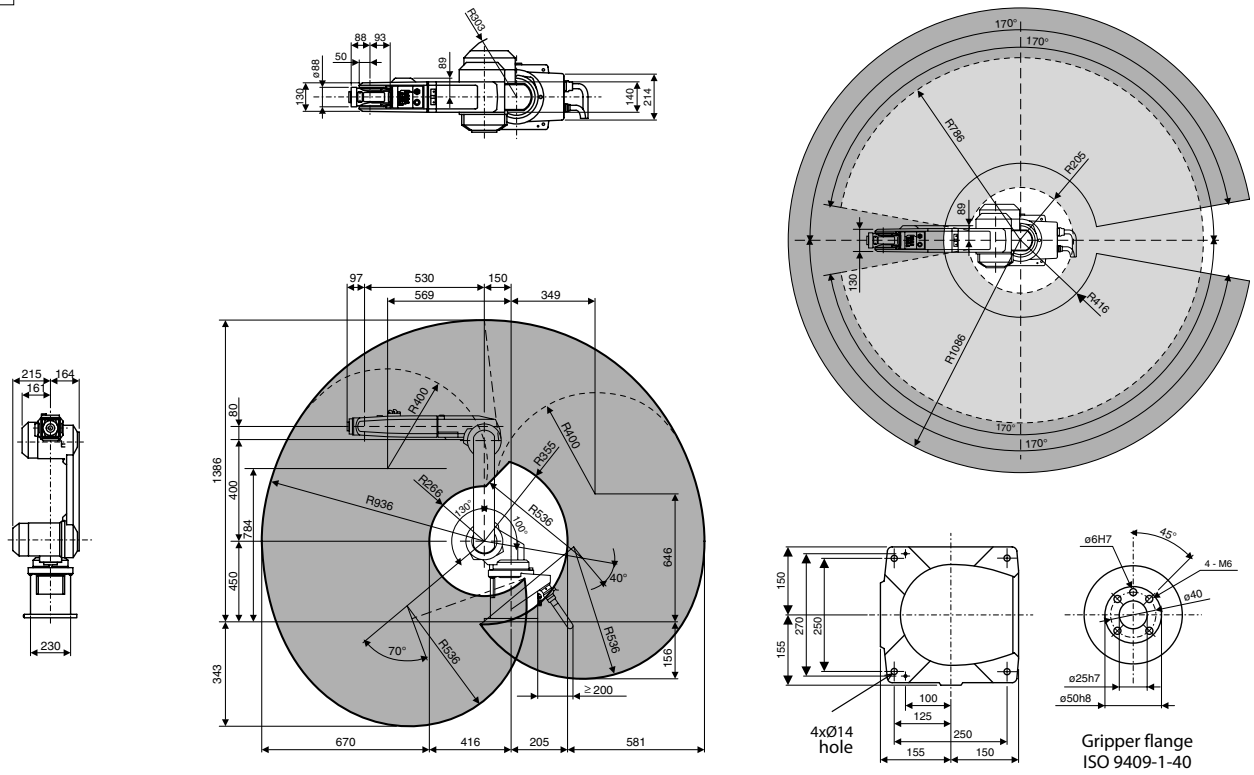
Dimensions: mm

RV-6SDL



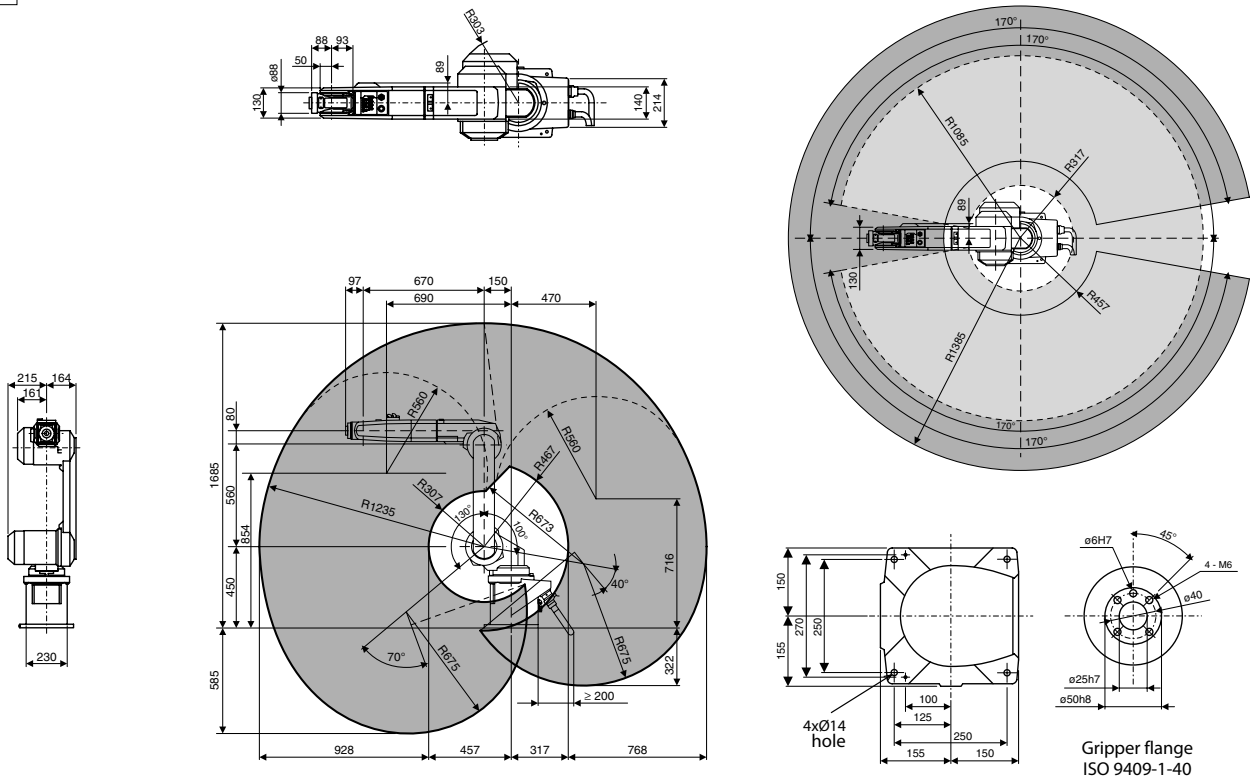
■ Robot Arms RV-12SD and RV-12SDL

RV-12SD

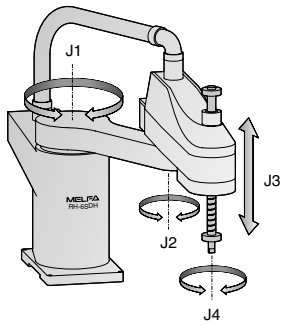


Dimensions: mm

RV-12SDL



■ Industrial Robots RH-6SDH, RH-12SDH and RH-20SDH



The SCARA Robots RH-6SDH, RH-12SDH and RH-20SDH

Assembly, handling and palletising are the strengths of these 6 kg and 12 kg SCARA robots. A version with an 20 kg payload capacity is available for handling particulary heavy loads and for special applications Cleanroom- and Moisture Models are also available for every payload.

Highlights:

- Slim design
- 6/12/20 kg payload capacity
- Speeds up to 11200 mm/s with axis interpolation
- High Repeatability from 0.02–0.025 mm (x/y)
- Palletizing Function

Characteristics/Functions			Specifications		
			RH-6SDH5520	RH-12SDH8535	RH-20SDH8535
Degrees of freedom (no. of axes)			4		
Machine class			Standard		
Structure			SCARA		
Installation posture			Floor mounting		
Drive system			AC servo		
Position detection method			Absolute encoder		
Brake attachment			J1, J2, J4 axes: without brake, J3 axis: with brake		J1, J2 axes: without brake, J3, J4 axes: without brake
Payload capacity (hand gripper included)	rated	kg	2	2	5
	maximum		6	12	18
Maximum reach	arm 1 + arm 2	mm	550 (350/450) ①	850 (550/700) ①	850 (1000) ①
Leadscrew travel		mm	200 ③	350 ②	350 ②
Operating range	J1	degree	254 (±127)	280 (±140)	280 (±140)
	J2	degree	290 (±145)	306 (±153)	306 (±153)
	J3 (Z)	mm	200 (97–297)	350 (-10–340)	350 (-10–340)
	J4 (θ axis)	degree	720 (±360)		720 (±360)
Maximum speed	J1	degree/s	375	288	288
	J2	degree/s	612	412.5	412.5
	J3 (Z)	mm/s	1177	1300	1200
	J4 (θ axis)	degree/s	2411	1500	1500
Maximum composite speed		mm/s	7782 (J1, J2 and J4) 6003 (J1 and J2)	11221 (J1, J2 and J4) 6612 (J1 and J2)	11221
Allowable wrist moment of inertia	rated	kgm	0.01	0.02	0.02
	maximum		0.04	0.1	0.1
Position repeatability	X, Y direction	mm	±0.02	±0.025	±0.025
	J3 (Z direction)	mm	±0.01	±0.01	±0.01
	J4 (θ axis)	degree	±0.02	±0.03	±0.03
Ambient temperature		℃	0 to 40		
Weight		kg	21	45	47
Tool wiring			8 inputs/8 outputs/8 spare wires		
Tool pneumatic pipes			Ø 6x2		
Supply pneumatic pressure		MPa (bar)	0.5 ± 10 % (5 ± 10 %)		
Protection rating			IP20		
Robot controller			CR1D	CR2D	CR2D
Order information		Art. no.	219008	219009	219010

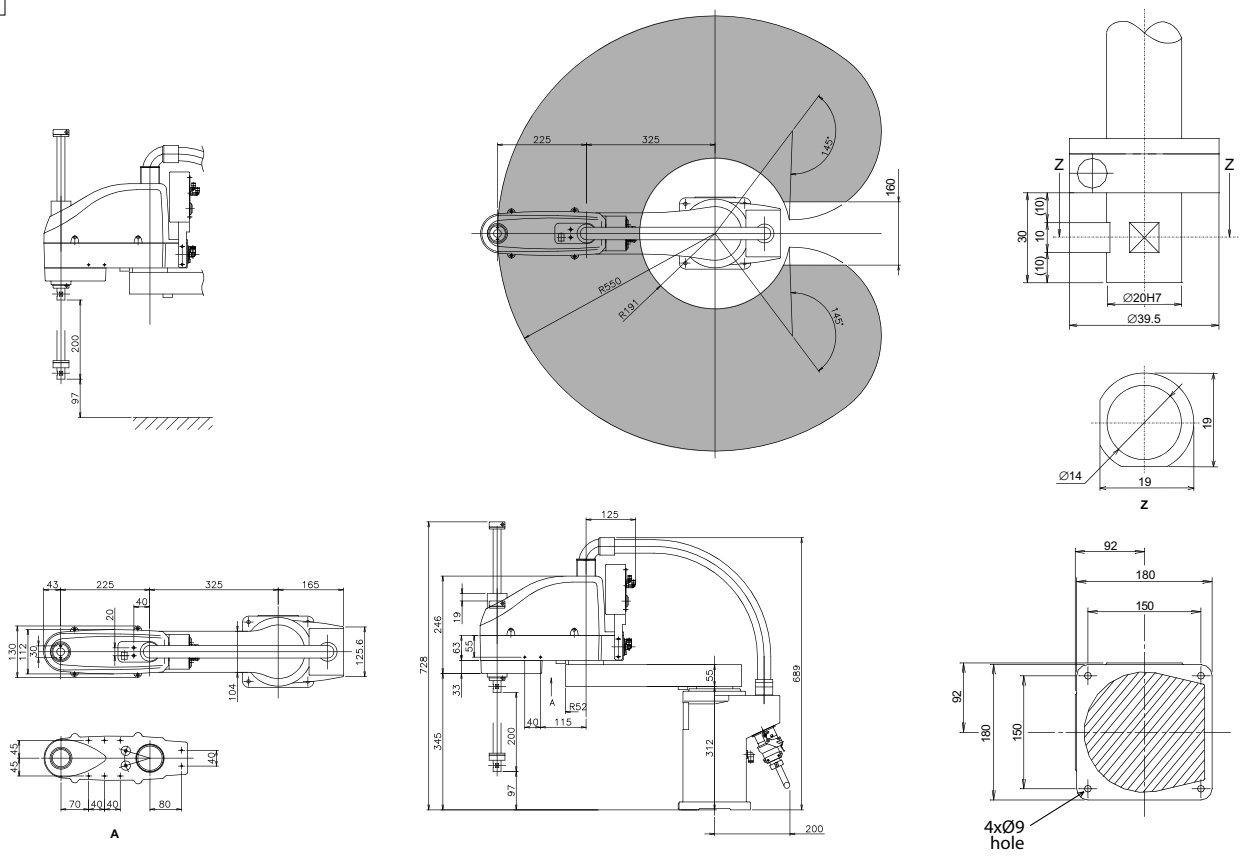
① Other available units

② Available with 350 or 450 mm leadscrew travel

③ Available with 200 or 320 mm leadscrew travel

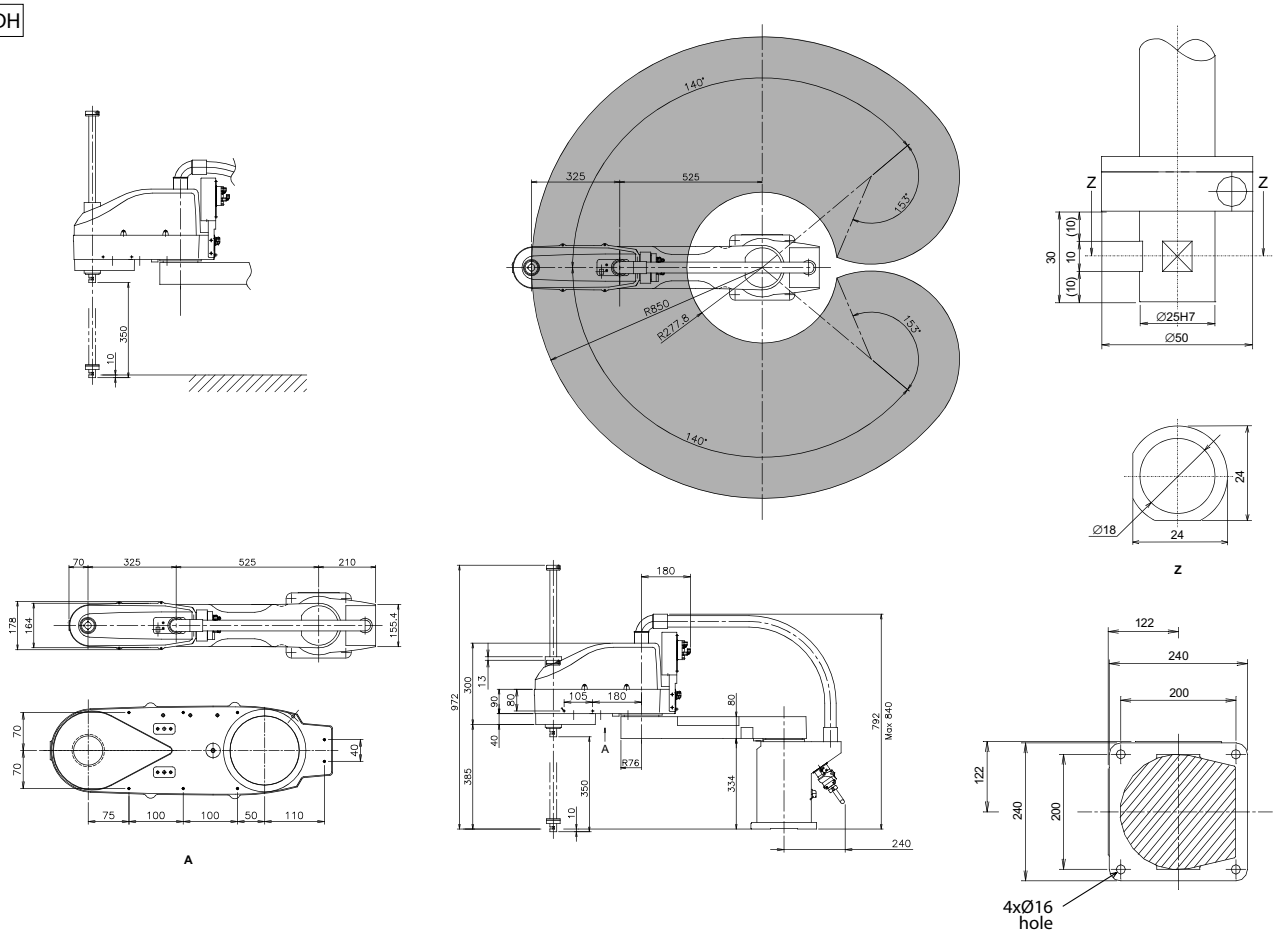
■ Robot Arms RH-6SDH, RH-12SDH

RH-6SDH



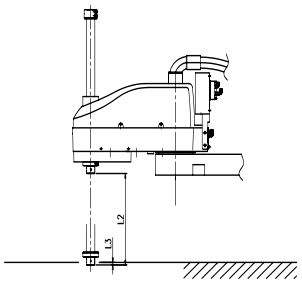
Dimensions: mm

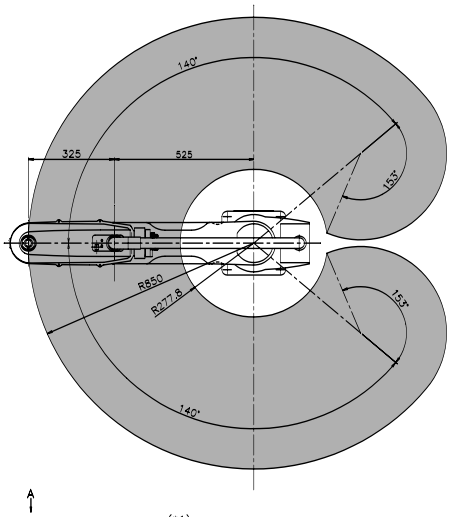
RH-12SDH

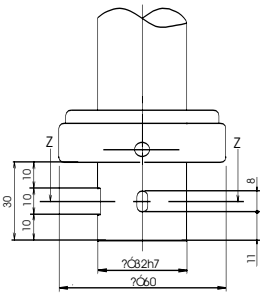


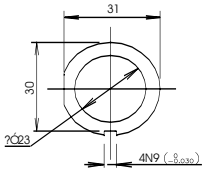
■ Robot Arms RH-20SDH

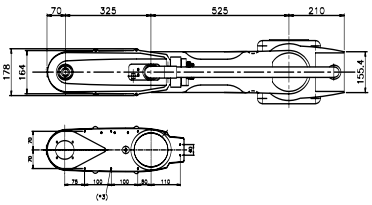
RH-20SDH85xxM

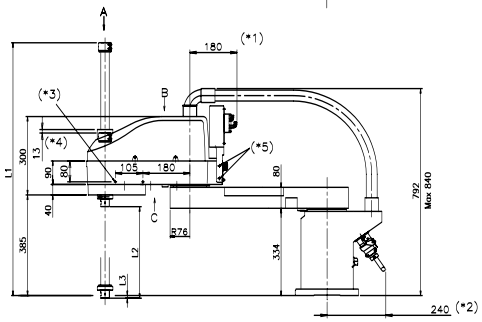


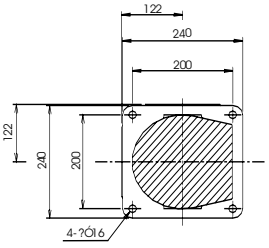




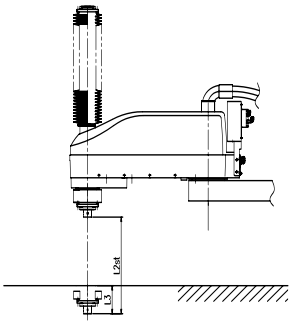


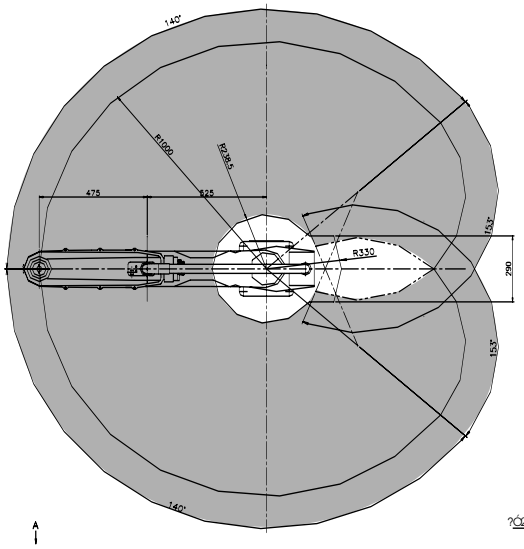


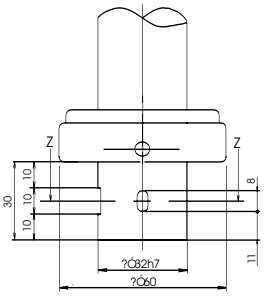


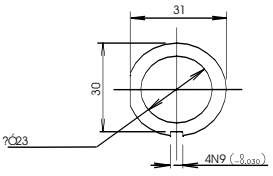


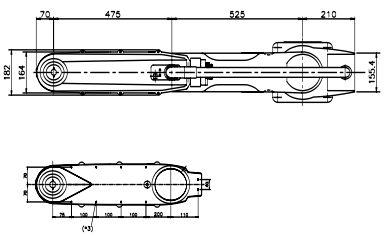
RH-20SDH100xxM

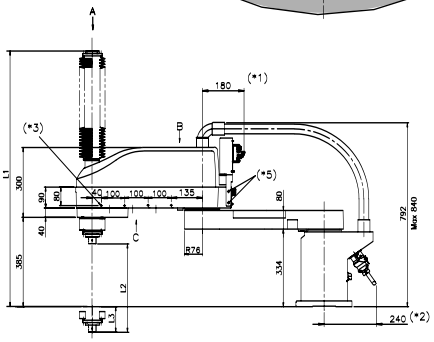


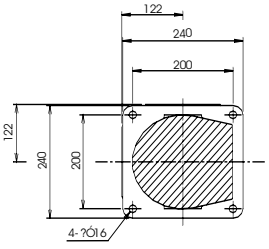




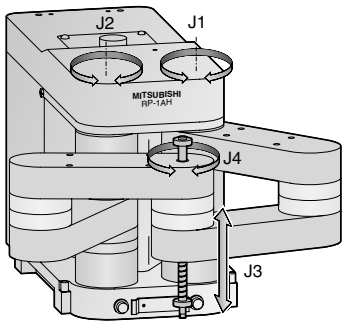








■ Industrial Robots RP-1AH, RP-3AH and RP-5AH



The SCARA Robots RP-1AH, RP-3AH and RP-5AH

The RP-1AH, RP-3AH and RP-5AH SCARA robots are in their element in all applications calling for fast and precise placement of components in limited space. The unique mechanical design of these robots gives them a significant edge for improved productivity and micro-handling quality.

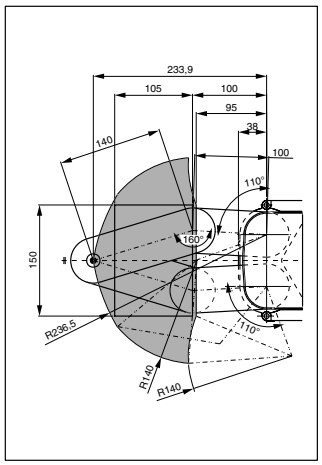
Highlights:

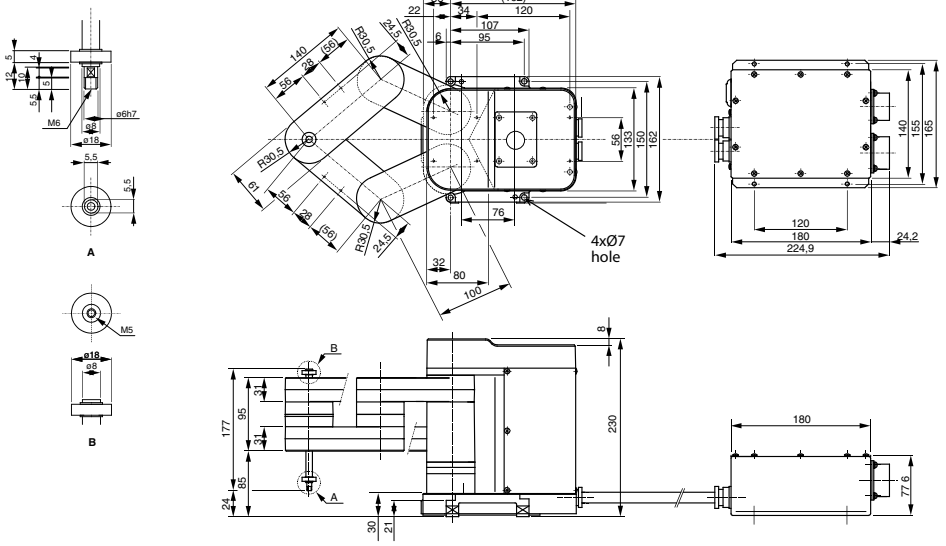
- Repeatability ±0.005 mm (RP-1AH)
- Footprint just 200 x 160 mm (RP-1AH)
- Pick & Place cycle time < 0.5 s

Characteristics/Function			Specifications		
			RP-1AH	RP-3AH	RP-5AH
Degrees of freedom (no. of axes)			4		
Installation posture			Floor mounting		
Drive system			AC servo		
Position detection method			Absolute encoder		
Brake attachment			All axes		
Max. load capacity	rated	kg	0.5	1.0	2.0
	maximum		1.0	3.0	5.0
Operating range	width × depth	mm	150x105 (DIN-A6)	210x148 (DIN-A5)	297x210 (DIN-A4)
	vertical	mm	30	50	
	twist	degree	±200		
Maximum speed	J1/J2	degree/s	480	432	
	J3	mm/s	800	960	
	J4	degree/s	3000	1330	
Inertial moment	wrist	kgm^2	$3.10x10^{-4}$	$1.60x10^{-3}$	$3.20x10^{-3}$
Position repeatability	X, Y direction	mm	±0.005	±0.008	±0.01
	Z direction	mm	±0.01		
	direction of the wrist twist	degree	±0.02	±0.03	
Ambient temperature		℃	0 to 40		
Weight		kg	12	24	25
Tool wiring			8 inputs/8 outputs		
Supply pneumatic pressure		MPa (bar)	0.5 ± 10 % (5 ± 10 %)		
Tool pneumatic pipes			—		
Robot controller			CR1		
Order information		Art. no.	134183	131626	131628

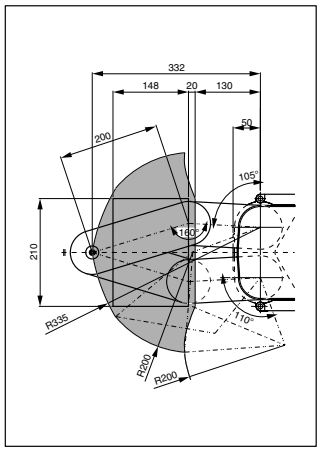
■ Robot Arms RP-1AH, RP-3AH and RP-5AH

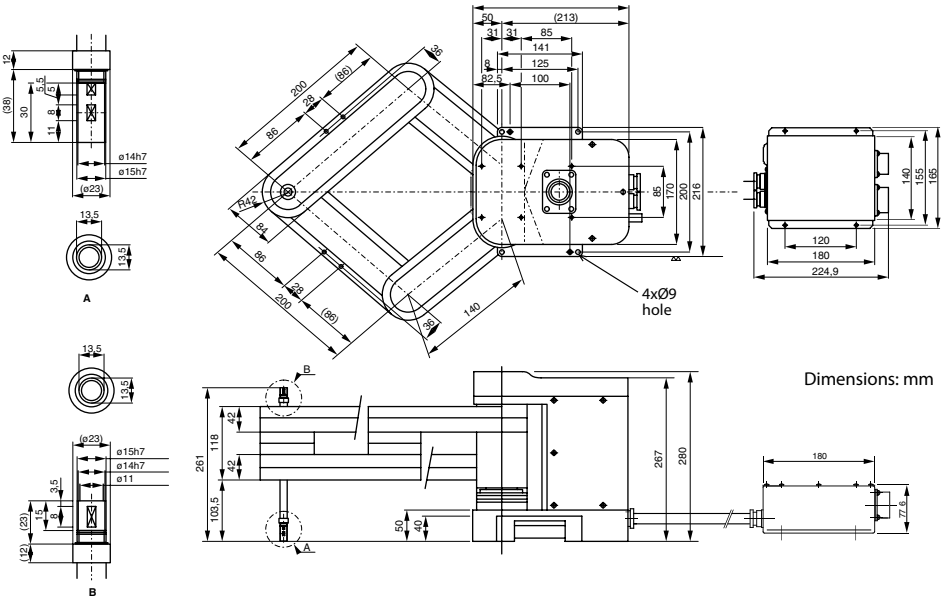
RP-1AH





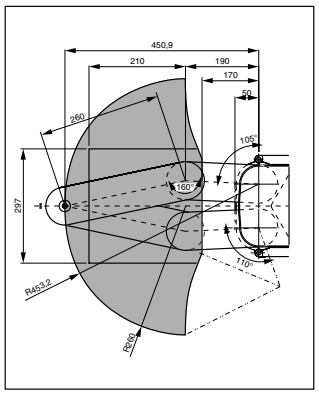
RP-3AH

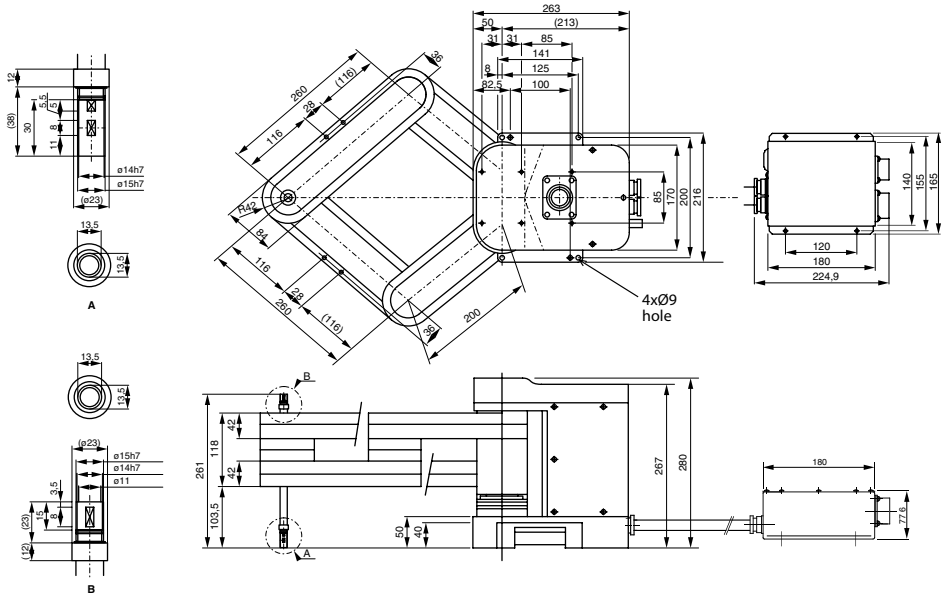




Dimensions: mm

RP-5AH





■ Controller Overview

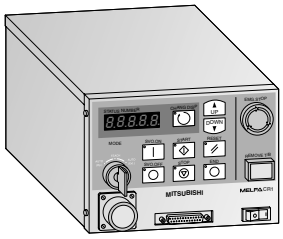
Powerful Controllers CR1, CR1D, CR2D and CR3D

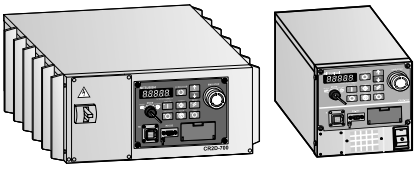
Which controller is used depends on the specific robot model. But the CR1, CR1D, CR2D and CR3D are all programmed with exactly the same language, no matter which robot is connected to them. You can add special application functions by inserting expansion option cards in the slots in the controllers. For example, there are option cards for connecting the controllers to different networks and for controlling additional robot axes.

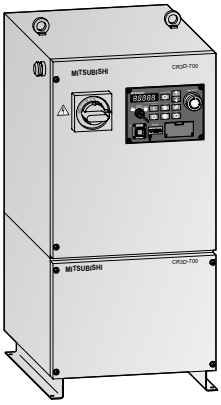
The D-Controller has already implemented some functions like Ethernet- and USB-Connection, Additional Axes Control over SSCNET III and Tracking Encoder interface as a standard.

A teaching box for defining the robots' working positions can be connected to the controller's RS-422 port. The teaching box can also be used for testing the entire program sequence.

There is also an RS-232C port beside the USB- and Ethernet-Port in the D-Controller for connecting a personal computer. This makes it possible to develop programs with a powerful PC software package with a user-friendly interface, and to perform 3D simulations of complete work cells.







CR1-571

With a footprint not larger than a DIN A4 sheet of paper the CR1-571 can be used to control the following robots:

- RV-1A
- RV-2AJ
- RP-1AH/3AH/5AH

The controller comes with 16 general inputs and outputs that can be expanded up to a maximum of 240. It uses a single-phase, 180–253 V AC power supply.

CR1D-700/CR2D-700

The controller units control the robots movements:

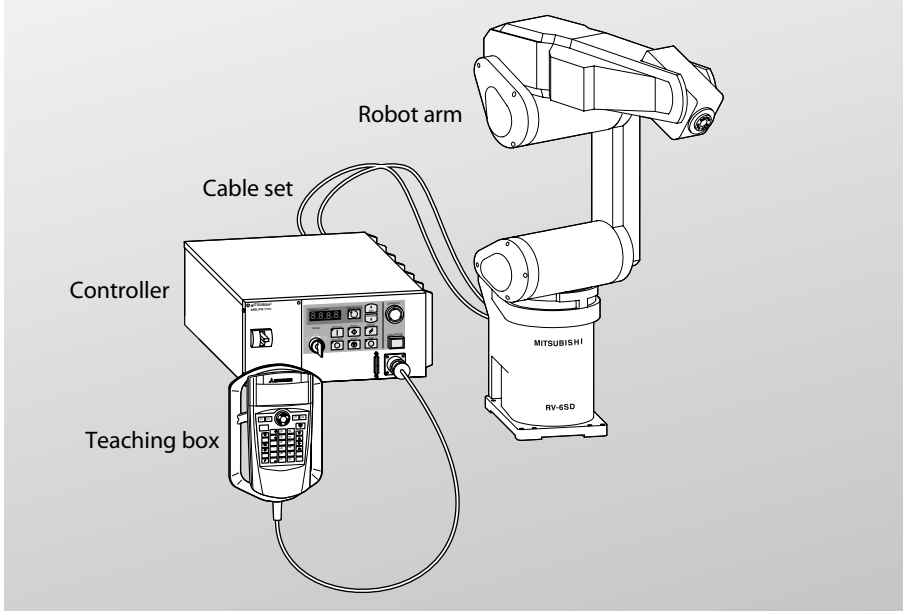
CR1D	CR2D
● RV-2SDB	RV-6SD/6SDL
● RV-3SDB/3SDJB	RV-12SD/12SDL
● RH-6SDH	RH-20SDH

The controllers have slots for system expansion options. It uses a single-phase, 180–253 V AC power supply.

CR3D-700M

The IP54 controller is for the RV-12SD/12SDL robots and like them it is designed for use in heavy-duty conditions.
The programming language and options are the same for the CR2D controller.
It uses a three-phase, 400 V AC power supply.

■ System Configuration



The illustration on the left shows the basic configuration of a robot system with the following components:

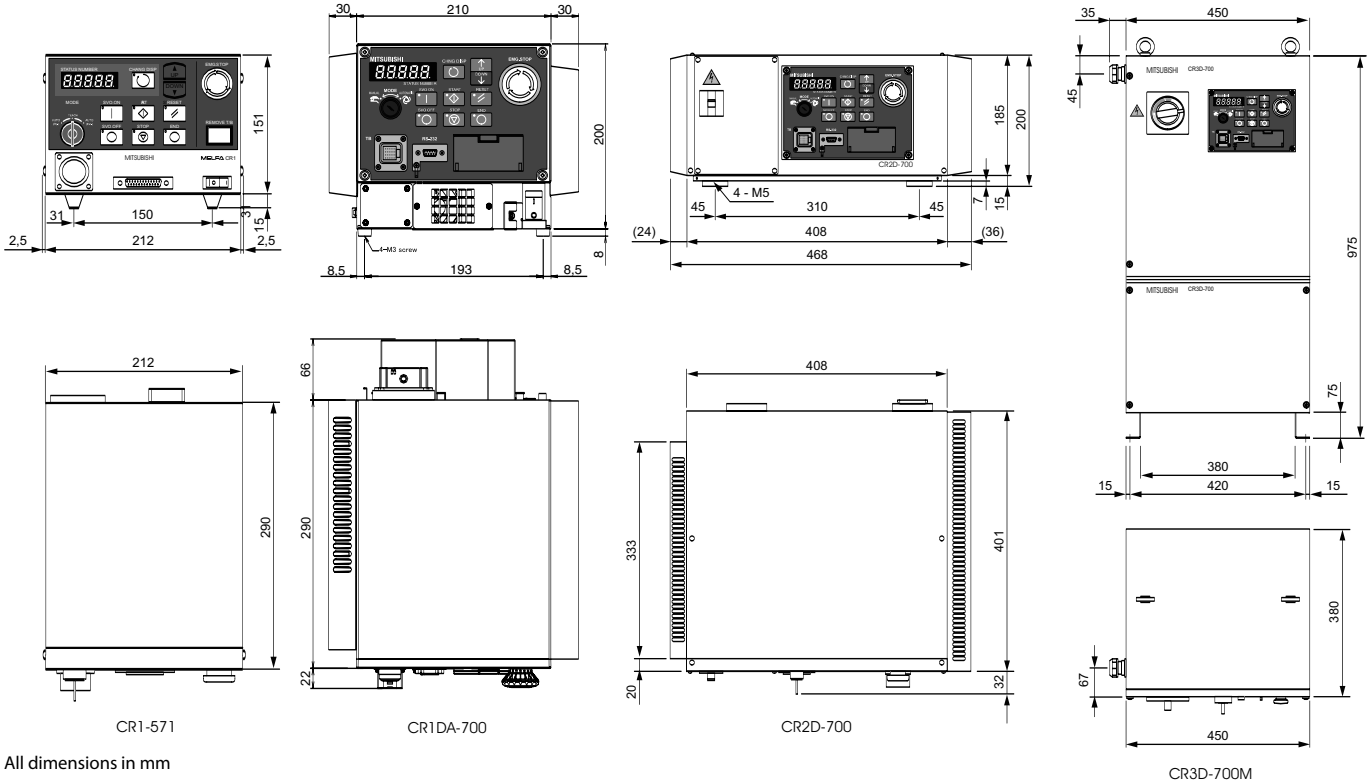
- RV-6SD robot arm
- CR2D controller
- 5 m controller connection cable set
- R32TB teaching box

Mitsubishi Electric offers a wide range of optional accessories with which you can configure your robot system for the individual requirements of your application. An overview of the available options can be found on page 21 and there is a detailed list on page 32.

■ Controller Specifications

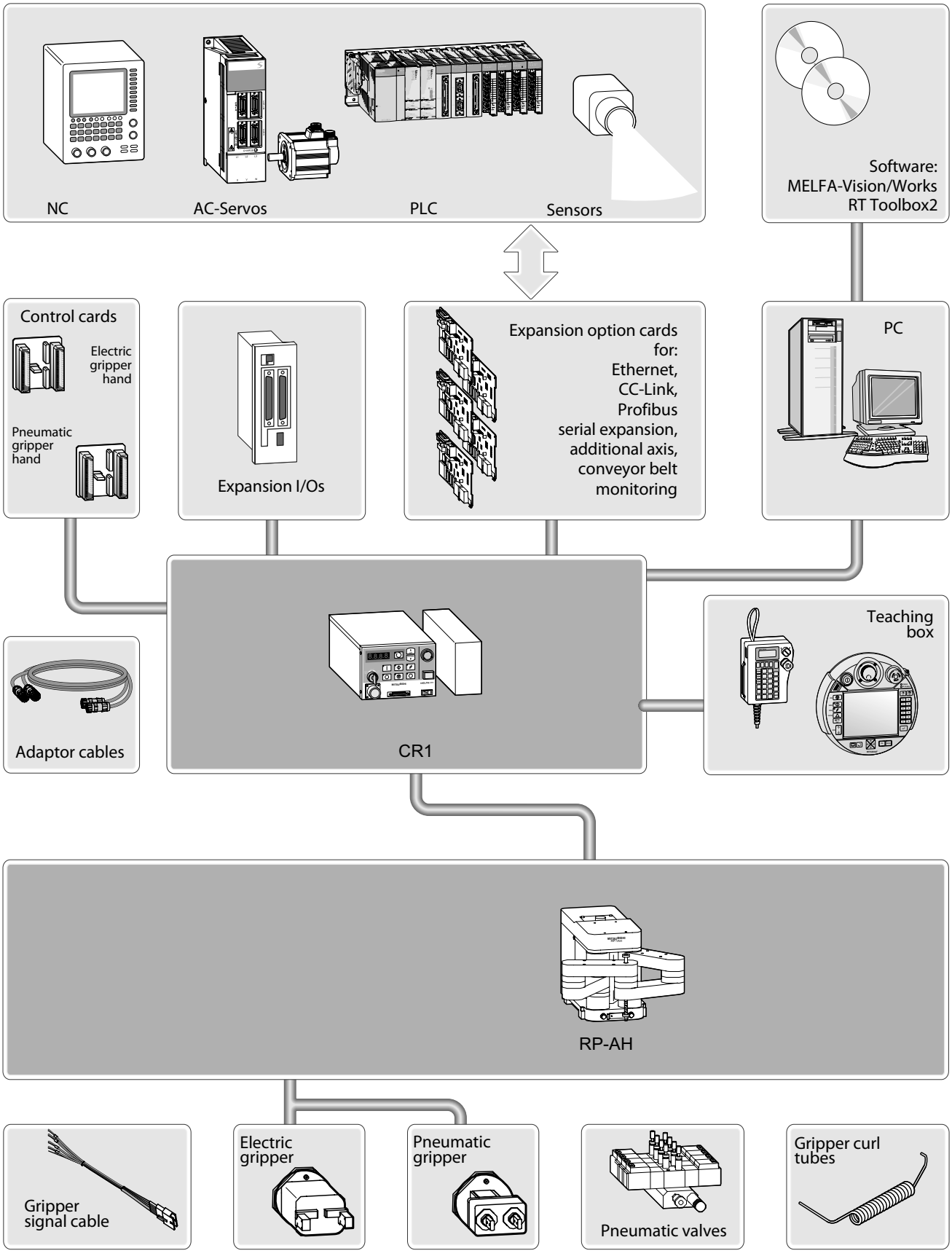
Characteristics/Functions		CR1-571	CR1D, CR2D	CR3D-700M
Number of controllable axes		6 robot axes + 2 interpolation axes + 6 independent axes		
Processor type (CPU)		Main CPU: 64 Bit RISC; servo CPU: DSP		
Memory capacity	number of teaching points and program steps	Max. 2500 position teaching points, max. 5000 steps		
	number of programs	88		
Programming languag		MELFA-BASIC IV or MOVEMASTER COMMAND	MELFA-BASIC IV or MELFA BASIC V	MELFA-BASIC IV or MELFA BASIC V
External inputs/outputs	general purpose I/Os	16 inputs and 16 outputs	32 inputs and 32 outputs	32 inputs and 32 outputs
	dedicated I/Os	User assigned from general purpose I/O	User assigned from general purpose I/O	User assigned from general purpose I/O
	hand open/close	8 inputs and 0 outputs (up to 4 output points can be added as an option)	8 inputs und 0 outputs (up to 8 output points can be added as an option)	8 inputs und 0 outputs (up to 8 output points can be added as an option)
	emergency stop I/Os	1	Terminal block with screw terminals for the connection of a redundant EMERGENCY STOP switch compliance DIN ISO 10218 (2066)	Terminal block with screw terminals for the connection of a redundant EMERGENCY STOP switch compliance DIN ISO 10218 (2066)
	door switch input	1	1	1
Interface	RS232C/USB	1 interface for PC	1 interface for PC/USB	1 interface for PC/USB
	RS422 + Ethernet	1 interface for teaching box	1 interface for Teaching Box	1 interface for Teaching Box
	slot dedicated for hand	1 interface card for pneumatic hand	1 interface card for pneumatic hand	1 interface card for pneumatic hand
	extension slot	For 3 expansion options (optional)	CR1D: 1, CR2D: 3	For 2 expansion options
	memory expansion slot	—	1 memory option	1 memory option
	Ethernet	—	1 for communication device (PC, Camera)	1 for communication device (PC, Camera)
	Additional Axes	—	1 for optical SSCNET 3	1 for optical SSCNET 3
	Tracking Encoder	—	2 for encoder input	2 for encoder input
	robot I/O link	1 channel (expansion to up to 240 inputs and 240 outputs possible)	1 channel (expansion to up to 256 inputs and 256 outputs possible)	1 channel (expansion to up to 256 inputs and 256 outputs possible)
Power supply		1-phase 90–132 V AC; 50/60 Hz; 0.7 kVA 1-phase 180–253 V AC; 50/60 Hz; 0.7 kVA	1-phase 90–132 V AC; 50/60 Hz; 0.5 kVA CR1D; 2.0 kVA CR2D	3-phase 400 V AC; 50/60 Hz; 3.0 kVA;
Ambient temperature		0 to 40 °C		
Ambient humidity		45 to 85 % without condensation		
Grounding		Via seperate terminal; earth resistance ≤ 100 Ω		
Mounting		Self-contained floor type/closed structure	Self-contained floor type/closed structure, vertical	Self-contained floor type/closed structure
Dimensions (W x H x D)	mm	212 x 166 x 290	CR2D: 468x200x408; CR1D: 270x290x200	450x975x380
Weight	kg	8	CR2D: 20; CR1D: 9	60

■ Controller Dimensions

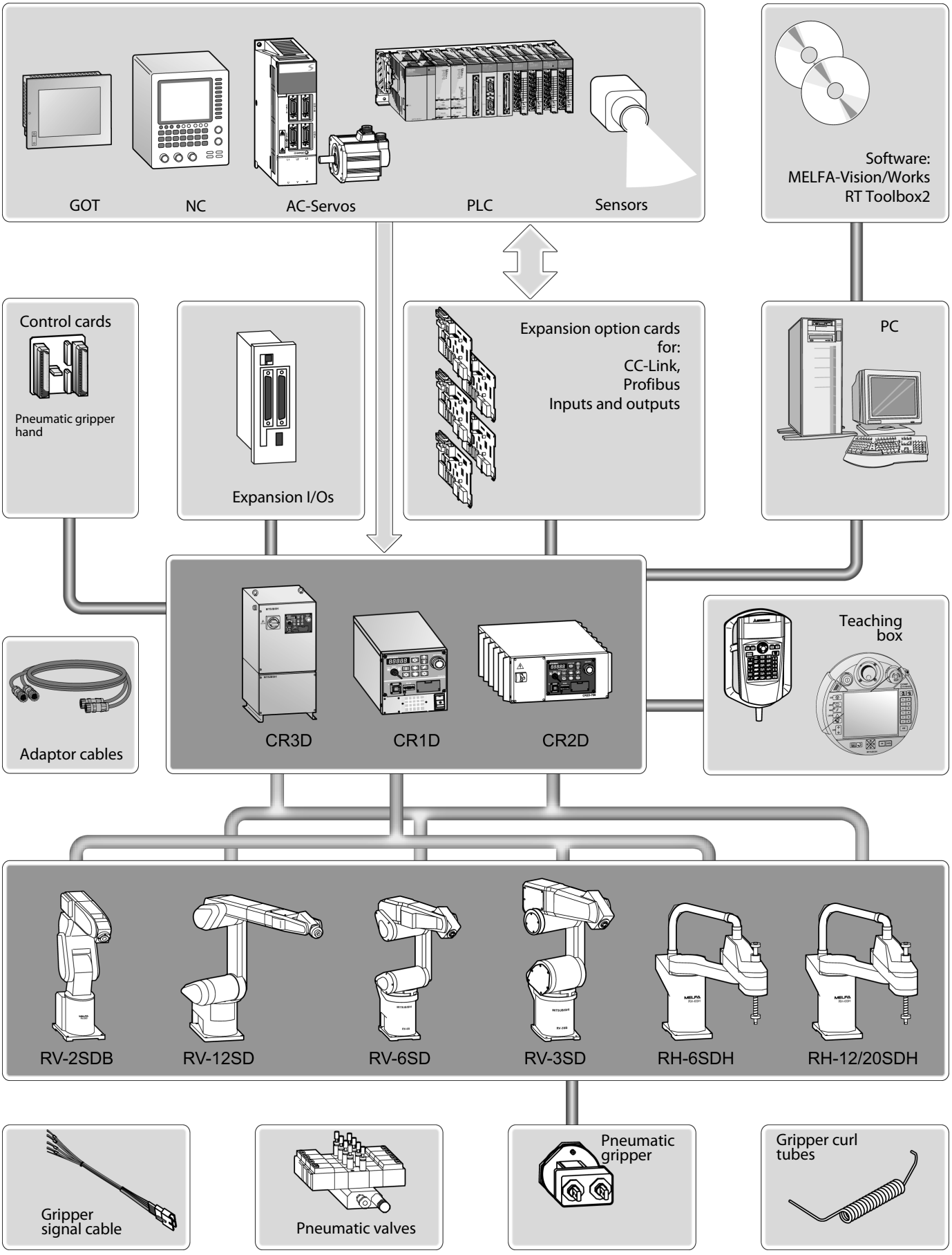


All dimensions in mm

■ System Components and Options for RP-Series



■ System Components and Options for RV-6SD/6SDL/12SD/12SDL and RH-12SDH/6SDH/18SDH



■ Teaching Box for RP Series

R28TB

R46TB

Operation and Programming

The R46TB teach panel is a multifunctional control and programming terminal for all Mitsubishi A and S series robots. Its intuitive user interface makes it easy to control robot movements and perform extensive diagnostics and monitoring functions for users of all levels. All safety-critical functions such as robot movements are assigned to keys. Programming and monitoring functions are accessed and adjusted quickly and easily via the bright 6.5" touchscreen display.

In addition to controlling robot movements the terminal has many other functions: For example, writing programs with a virtual on-screen keyboard and monitoring all system status parameters, inputs and outputs, including those accessed via the network.

The R46TB's flexible monitoring function enables the display of all important system parameters. Access to production data like the number of work cycles, the average cycle time and many other parameters make it easy to get a quick overview of the production situation.

Extensive analysis functions for checking robot workload also make it easy to optimise your robot applications and minimise cycle times.

Screen input templates make it easy to enter the parameters for grippers and workpieces for quick system optimisation. Entering the reference points data when you install the system just takes a few minutes, then the robot is ready for programming.

Specifications		R46TB	R28TB
Compatibility		All Mitsubishi A and S series robots	
Functions		Operation, programming and monitoring of all robot functions	Position teaching, JOG feed, program control and editing
Programming and monitoring		Read out information, also during operation; program editing with virtual keyboard; display up to 14 lines of program code; I/O monitoring for up to 256 inputs and 256 outputs; service display with information on maintenance intervals; error display with details of the last 128 alarms	Program and parameter editing. Maintenance functions and monitoring.
Software		Integrated operating system software with menu-based user interface	Integrated system OS
Menu navigation (language)		German, English, French, Italian	Japanese, English
Display	type/dimensions	6.5" TFT display (640 x 480 pixels)	LCD with 4 lines x 16 characters (with backlight illumination)
	technology	Touchscreen with backlight	
Interfaces		USB, RS-422 for connection to the robot controller	RS422
Connection		Direct connection to the robot controller, cable length 7m	7 m
Protection rating		IP54	IP65
Weight [kg]		1.25	Approx. 0.5 kg (without cable)
Order information	Art. no.	193409	124656

■ Teaching Box for RV-SD and RH-SDH Series

R56TB

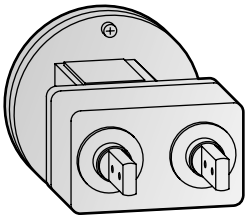
R32TB

Operation and Programming

The R56TB teach panel is a multifunctional control and programming terminal for all Mitsubishi SD serie robots. Its intuitive user interface makes it easy to control robot movements and perform extensive diagnostics and monitoring functions for users of all levels. All safety-critical functions such as robot movements are assigned to keys. Programming and monitoring functions are accessed and adjusted quickly and easily via the bright 6.5" touchscreen display.In addition to controlling robot movements the terminal has many other functions: For example, writing programs with a virtual on-screen keyboard and monitoring all system status parameters, inputs and outputs, including those accessed via the network.

Specifications		R56TB	R32TB
Compatibility		All Mitsubishi SD serie robots	
Functions		Operation, programming and monitoring of all robot functions	Operating, programming and monitoring of robot functions
Programming and monitoring		Read out information, also during operation; program editing with virtual keyboard; display up to 14 lines of program code; I/O monitoring for up to 256 inputs and 256 outputs; service display with information on maintenance intervals; error display with details of the last 128 alarms	Read out information, also during operation, program editing with T9-Key standard, supervising of I/Os, display of error alarms, Right-/Left-Hand usage, 36 keys for operation selection
Software		Integrated operating system software with menu-based user interface	
Menu navigation (language)		German, English, French, Italian	English, Japanese
Display	type/dimensions	6.5" TFT display (640 x 480 pixels)	Monochrome LCD graphic display (24 characters x 8 lines
	technology	Touchscreen with backlight	LCD with backlight
Interfaces		USB, RS-422 for connection to the robot controller	RS-422 for connection to the robot controller
Connection		Direct connection to the robot controller, cable length 7m	Direct connection to the robot controller, cable length 7 m
Protection rating		IP54	IP65
Weight [kg]		1.25	0.9
Order information	Art. no.	218854	214968

■ Hand Sets

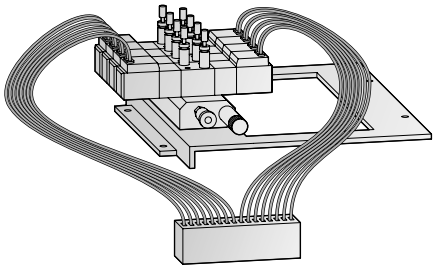


Tools

The pneumatic gripper is available in a set consisting of the gripper, spiral pneumatic hose, interface, one-way valve and adapter. It has a service life of 10 million gripping cycles. The gripper is fitted with sensors that provide feedback information on the current gripper position.

Specifications		4A-HM01	4A-HP01E
Drive		DC servo motor	Oil-free compressed air
Grip force		4.9–68.6 N	—
Operating preassure range		—	0.4–7.0 bar
Operating temperatur range		0–40 °C	0–40 °C
Ambient humidity		45–85 %	—
Life		1 mio. gripper cycles (at 100 % load) 10 mio. gripper cycles (at 50 % load)	10 mio. gripper cycles
Operation confirmation sensors		None	Open edge and close edge
Weight [kg]		0.59 (includes the adapter)	0.45 (includes the adapter)
Order information	Art. no.	129874	129873

■ Solenoid Valve Sets



Solenoid Gripper Control Valve Sets

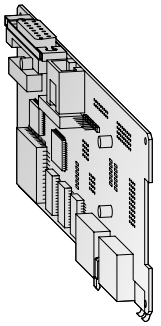
This option is used to control the gripper tool installed on the robot arm. The valve set comes with all the components required for installation, including the branch manifold, couplings and dampers. The valves are fitted with plug-in control cables for quick and easy wiring.

The solenoid valve sets are for use with oil-free compressed air.

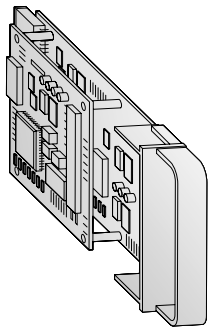
Specifications	1A-VD0□E-RP				RV-E-1E-VD0□E	
	1	2	3	4	1	2
No. of valves	1	2	3	4	1	2
Range of use (robot type)	AH				A	
Valve function	Double solenoid				Double solenoid	
Operating method	Internal pilot method				Internal pilot method	
Effective sectional area (CV value)	1.5 mm				1.5 mm	
Operating preassure range	2–7 bar				2–7 bar	
Maximum preassure	10 bar				10 bar	
Response time	< 12 ms at 24 V DC				< 12 ms at 24 V DC	
Max. operating frequency	5 Hz				5 Hz	
Ambient temperature	-5 to +50 °C				-5 to +50 °C	
Coil rated voltage	24 V DC ± 10 %				24 V DC ± 10 %	
Order information Art. no.	129780	129781	129792	129793	47397	47398

Specifications	1S-VD0□E-01				1S-VD0□E-02				1S-VD0□ME-03				1S-VD0□ME-04			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
No. of valves	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Range of use (see page 38)	12SD/12SDL				3SD/6SD				12SDH				6SDH			
Valve function	Double solenoid				Double solenoid				Double solenoid				Double solenoid			
Operating method	Internal pilot method				Internal pilot method				Internal pilot method				Internal pilot method			
Effective sectional area (CV value)	0.64 mm				0.64 mm				0.64 mm				0.64 mm			
Operating preassure range	1–7 bar				1–7 bar				1–7 bar				1–7 bar			
Maximum preassure	10 bar				10 bar				10 bar				10 bar			
Response time	< 22 ms at 5 bar				< 22 ms at 5 bar				< 22 ms at 5 bar				< 22 ms at 5 bar			
Max. operating frequency	5 Hz				5 Hz				5 Hz				5 Hz			
Ambient temperature	-5 to +50 °C				-5 to +50 °C				-5 to +50 °C				-5 to +50 °C			
Coil rated voltage	24 V DC ± 10 %				24 V DC ± 10 %				24 V DC ± 10 %				24 V DC ± 10 %			
Order information Art. no.	153057	153058	153059	153062	153074	153075	153076	153077	166278	166279	166280	166281	166274	166275	166276	166277

■ Interface Boards for Robot Controllers



2A-HR575E



2D-TZ576

Ethernet Interface

The Ethernet interface is used for high-speed network communications with other controllers and TCP/IP-enabled peripherals. It can also be used for programming the robot controller and for external, real-time control of the robot itself.

Specifications		2A-HR533E
Application		Ethernet interface; TCP/IP
Type		Built-in board
Range of use		RP-Series
LAN interface		10BASE-5, 10BASE-T (selectable)
Connector		RJ-45
Transmission speed		10 Mbps
Order information	Art. no.	129809

CC-Link Interface

The 2A-HR575E interface makes it possible to integrate the CR□-R robot controller in a CC-Link network.

The 2D-TZ576 interface makes it possible to integrate the CR□-D robot controller in a CC-Link network.

Specifications		2A-HR575E	2D-TZ576
Application		CC-Link interface	
Type		Built-in board	
Range of use		RP-Series	RV-SD and RH-SDH
Communications cable		Shielded 3-core twisted cable	
Max. number of I/O points and data registers		126 I/Os/16 data register	
Refresh rate		7.2 ms	
Max. transmission length		100 m at 10 Mbps, 150 m at 5 Mbps, 250 m at 2.5 Mbps, 600 m at 0.62 Mbps, 1500 m at 0.15 Mbps	
Order information	Art. no.	129808	219063

PROFIBUS Interface

These interface cards make it possible to integrate the robot controller in a PROFIBUS network.

Specifications		2A-RZ577A)	2D-TZ577
Application		PROFIBUS/DP interface	
Type		Built-in board	
Range of use		RP-Series	RV-SD and RH-SDH
Communications cable		Twisted pair cable	
Communications distances		1200 m at 9.6/19.2/93.75 Kbps, 1000 m at 187.5 Kbps, 400 m at 500 Kbps, 200 m at 1500 Kbps	
Max. no. of communications words		122	
No. of mountable interface cards		1	
Order information	Art. no.	155317	218861

Serial Expansion Interface

The 2A-RZ581E interface card adds additional serial inputs to the controller. In addition to this the card also provides two encoder signal inputs for registering the speed of conveyor belts for the tracking function.

Specifications		2A-RZ581E
Application		Serial extension
Type		Built-in board
Range of use		RP-Series
Connections		1 x RS232, 1 x RS422, 2 encoder inputs
No. of mountable interface cards		2
Order information	Art. no.	129807

■ Interface Boards for Robot Controllers

I/O Interface

All the robot controllers have an I/O interface with at least 16 inputs and outputs as standard equipment. You can increase the number of I/Os to a maximum of 256 (depends on controller model) by adding 2A-RZ371 interface modules.

The D-Controller has 32 inputs and outputs as standard equipment. You can increase the number of I/Os internally to 96 by adding 2D-TZ378 slot-in cards.

Specifications		2A-RZ371	2D-TZ378
Application		Interface for additional inputs/outputs	
Type		Decentralized I/O box with 32 inputs and 32 outputs	Slot-In Card with 32 Inputs and 32 Outputs
Range of use		RP-Series	RV-SD and RH-SDH
Rated load voltage		Inputs: 12 V/24 V; outputs: 12 V/24 V, max. 0.1 A/per output	
Max. no. of usable I/O boxes		7	2
Order information	Art. no.	124658	218862

Additional Axis Interface

The 2A-RZ541E interface card enables the controller to control additional axes. It can then control up to two additional axes, interpolating them with the robot's own axes. The additional axes can be connected to configure two 3-axis systems.

Specifications		2A-RZ541E
Application		Controller board for additional axes
Type		Built-in board
Range of use		RP-Series
Connections		SSCNET x 1 channel
Max. no. of control axes		8
No. of mountable interface cards		1
Encoder type		Absolute
Order information	Art. no.	129801

Pneumatic Hand Interface

The 2A-RZ375 interface card is used to operate the robot's pneumatic gripper. It controls the solenoid valve set (see page 30).

Specifications		2A-RZ375
Application		Interface for pneumatic hand (pneumatic valves)
Type		Built-in board
Range of use		All MELFA robots
Connections		Up to 4 pneumatic valves
Order information	Art. no.	124657

■ Gripper Signal Cables

Connection Cables

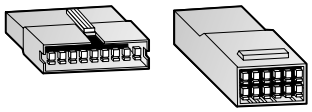
A variety of different cables are available for connecting the control and status monitoring signals of the gripper tools.

When the pneumatic gripper is used you need to monitor the position of the gripper. You should thus always connect a gripper signal input cable when you use the pneumatic gripper.

One end of the cable set is fitted with a plug for the gripper's sensor signals. The other end is without connectors and can be wired as required for your system.

Specifications	1A-GR200-RP	1A-HC200-RP	1S-GR35S-01	1S-GR35S-02	1S-HC35C-02	1S-HC25C-01
Type	Hand signal output cable	Hand signal input cable	Hand signal output cable	Hand signal output cable	Hand signal input cable	Hand signal input cable
Range of use (robot type)	AH	AH	SD	SDH	SD/SDH	SD/SDH
Design	Custom-made	Custom-made	Single sided with connector	Single sided with connector	Single sided with connector	Single sided with connector
Application	Custom-made magnetic valve set	Monitoring of the gripper condition	Pneumatic gripper	Pneumatic gripper	Monitoring of the gripper condition	Monitoring of the gripper condition
No. of cores	9	10	12	12	12	12
Length	2000 mm	2000 mm	400 mm	350 mm	1200 mm	800 mm
Order information Art. no.	129778	129779	153078	166272	166273	153079

■ Connectors and Valve Signal Cables



The Connection to Your System

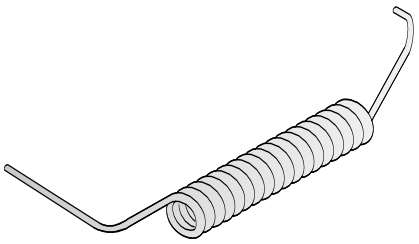
Choose additional components to configure the optimal interface between the robot system and your application.

The wide range of options makes it possible to configure the robot precisely for the individual requirements of your application.

The connectors listed in the following table can be used for making your own cables for the gripper input and output signals (see also the table above).

Specifications	R-SMR-09V-B	R-SMR-10V-N	R-SMR-02V-B	SD series Hand OUTPUT	SD series Hand INPUT
Type	Gripper output connector	Gripper output connector	Valve connector	Hand signal output connector	Hand signal input connector
Range of use (robot type)	A/AH	AH	2SD	SD/SDH	SD/SDH
Design	Black, 9 pins	White, 10 pins	2 pins	8 pins	6 pins
Shipping contents	Plug and contacts	Plug and contacts	Plug and contacts	Plug and contacts	Plug and contacts
Order information Art. no.	132112	132113	143798	164814	164815

■ Hand Curl Tube

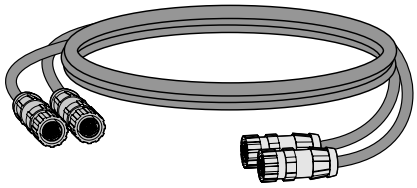


Replacement Gripper Hoses

These spiral hoses are for use with the pneumatic gripper. They are also suitable for use with clean room robots.

Specifications		RV-E-1E-ST0402C	RV-E-1E-ST0404C
Type		Spiral hose	Spiral hose
Range of use (robot type)		All	All
Application		For single pneumatic gripper	For double pneumatic gripper
Dimensions		2xØ 4 mm	4xØ 4 mm
Order information	Art. no.	47390	47389

■ Drag Chain Cable

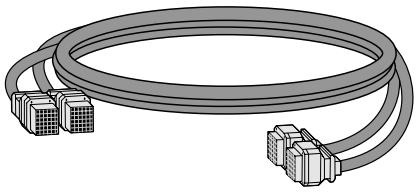


Cables for Flexible Robot Deployment

The standard cable for connecting the robot arm to the controller is 5m long and can only be used for fixed installation. You must use the special cable sets listed in the table below if you need flexible power and signal cables for installation in a drag chain installation.
You can also replace the standard connection cables with longer ones if necessary.

Specifications		Cable Flex 5 m	Cable Flex 15 m
Type		Flexible drag chain cable	
Range of use (robot type)		AH	
Minimum bending radius		More than 100 mm	
Cable bear isovolumetric ration		≤ 50 %	
Max. movement speed		2000 mm/s	
Protection rating		Oil-proof specification sheath	
No. of cores power cable		10	
No. of cores signal cable		6/1 (7 total)	
Length	m	5	15
Order information	Art. no.	149006	149010

■ Extension Cables for Robots and Controllers



Extension Cables for Power and Signal Connections

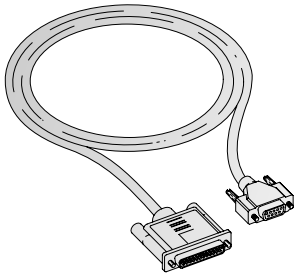
These power and signal extension cables make it possible to increase the distance between the controller and the robot arm. Versions are available for either flexible and fixed routing of the cables between the controller and the robot arm.

Use the flexible versions for installation of the cables in drag chains and similar configurations. You can also use these cables to extend the length of the standard cables supplied with the robot.

Specifications		1S-05CBL-01	1S-10CBL-01	1S-15CBL-01	1S-05CBL-03	1S-10CBL-03	1S-15CBL-03
Type		Extension cable for a fixed installation in a drag chain					
Range of use (robot type)		6SD/6SDL/12SD/12SDL/12SDH/18SDH			2SD/3SD/6SDH		
Minimum bending radius		More than 100 mm					
Max. movement speed		2000 mm/s					
Guidance of life count		—					
Protection rating		Oil-proof specification sheath					
No. of cores power cable		1			1		
No. of cores signal cable		1			1		
Length	m	5	10	15	5	10	15
Order information	Art. no.	155827	155830	155665	165967	165968	165969

Specifications		1S-05LCBL-01	1S-10LCBL-01	1S-15LCBL-01	1S-05LCBL-03	1S-10LCBL-03	1S-15LCBL-03
Type		Extension cable for a flexible installation in a drag chain					
Range of use (robot type)		6SD/6SDL/12SD/12SDL/12SDH/18SDH			2SD/3SD/6SDH		
Minimum bending radius		More than 100 mm					
Cable bear isovolumetric ration		≤ 50 %					
Max. movement speed		2000 mm/s					
Guidance of life count		$7.5x10^6$					
Protection rating		Oil-proof specification sheath					
No. of cores power cable		3/6 (9 total)			10		
No. of cores signal cable		6/1 (7 total)			5/1/1 (7 total)		
Length	m	5	10	15	5	10	15
Order information	Art. no.	157582	157583	157594	165970	165971	165972

■ Connection Cables for PCs and Inputs/Outputs



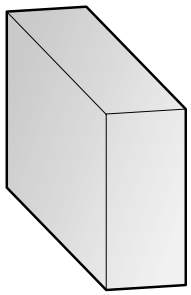
Connection Cables, Connectors

The RV-CAB□ cable is for establishing an RS-232C serial connection between the robot controller and a personal computer.

The RV-E I/O connection cable is for connecting peripherals to the parallel I/O interface. One end of the cable is fitted with a connector for the controller's parallel I/O port. The other end is supplied without a connector so that you can connect the appropriate connectors for your equipment.

Specifications		RV-CAB4	2A-CBL05	2A-CBL15	2D-CBL05	2D-CBL15
Type		Connection cable				
Application		Serial (RS232C) connection PC–Controller	I/O port			
Range of use		RP-Series			SD/SDH	
Design		9/25-pin plug	Plug on one side			
Length	m	3	5	15	5	15
Order information	Art. no.	55653	47387	59947	218857	218858

■ Expansion Option Box

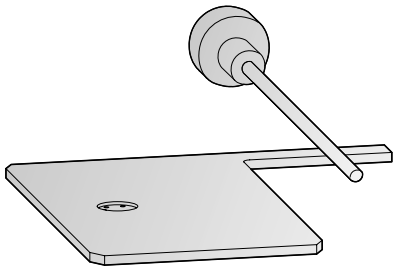


Expansion for Additional Interface Cards

This expansion box is required for the installation of additional interface cards in the CR1 controller (CC-Link, Ethernet, Profibus and serial interface cards and interface cards for additional robot axes). You can install up to 3 additional interface cards in the box.

Specifications		CR1-EB3
Type		Expansion box for interface cards
Application		Controller CR1
Range of use (robot type)		AH
Power supply		From the controller by the RT bus coupling
Ambient temperature		0–40 °C
Ambient humidity		45–85 %
Grounding		Class 3 grounding earth (via external terminal; earth resistance ≤ 100 Ω)
Structure		Floor mounting
Dimensions (W x H x D)		87.5 mm x 166 mm x 290 mm
Weight		Approx. 3 kg
Order information	Art. no.	129878

■ Calibration Device

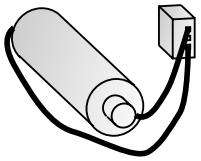


Zero Point Calibration Jig

This calibration jig is used for setting the robot arm's zero point. Zero point calibration is used to maximise the robot's positioning accuracy.

Specifications		RV-E-1E-INST	RH-CAL
Type		Calibration device	Calibration pin
Application		Zero point setting with high accuracy	
Range of use (robot type)		A	SD/SDH
Order information	Art. no.	47388	145715

■ Buffer batteries



Batteries

The backup batteries are used to maintain the encoder and memory power supply. One battery supplies the control unit and up to five batteries are installed in the robot arm.

Specifications		RV-2SD	RV-3S...	RV-6../12..	RH-6../12..	RP-1/3/5AH	Art. no.
A6BAT	Number	—	4	5	4	3	4077
ER6BAT	Number	4	1	1	1	1	131168
Q6BAT	Number	1	—	—	—	—	130376

■ Options Assignment

Option	Marking	RV-2SD	RV-3SDJB/3SDB	RV-6SD/6SDL	RV-12SD/12SDL	RH-6SDH	RH-12SDH/18SDH	RP-1/3/5AH	Art. no.	See page
Robot model name in catalogue	—	SD	SD	SD	SD	SDH	SDH	AH	—	—
Teaching Box	R28TB							●	124656	25
Teaching Box	R46TB							●	193409	25
Teaching Box	R32TB	●	●	●	●	●	●		214968	25
Teaching Box	R56TB	●	●	●	●	●	●		218854	25
Electrical hand set	4A-HM01								129874	25
Pneumatic hand set	4A-HP01E								129873	25
Single valve set	1A-VD01E-RP							●	129780	26
Double valve set	1A-VD02E-RP							●	129781	26
Triple valve set	1A-VD03E-RP							●	129792	26
Quadruple valve set	1A-VD04E-RP							●	129793	26
Single valve set	RV-E-1E-VD01E	●							47397	26
Double valve set	RV-E-1E-VD02E	●							47398	26
Single valve set	1S-VD01E-01				●				153057	26
Double valve set	1S-VD02E-01				●				153058	26
Triple valve set	1S-VD03E-01				●				153059	26
Quadruple valve set	1S-VD04E-01				●				153062	26
Single valve set	1S-VD01E-02		●	●					153074	26
Double valve set	1S-VD02E-02		●	●					153075	26
Triple valve set	1S-VD03E-02		●	●					153076	26
Quadruple valve set	1S-VD04E-02		●	●					153077	26
Single valve set	1S-VD01ME-03						●		166278	26
Double valve set	1S-VD02ME-03						●		166279	26
Triple valve set	1S-VD03ME-03						●		166280	26
Quadruple valve set	1S-VD04ME-03						●		166281	26
Single valve set	1S-VD01ME-04					●			166274	26
Double valve set	1S-VD02ME-04					●			166275	26
Triple valve set	1S-VD03ME-04					●			166276	26
Quadruple valve set	1S-VD04ME-04					●			166277	26
Ethernet interface	2A-HR533E							●	129809	27
CC-Link interface	2A-HR575E							●	129808	27
CC-Link interface	2D-TZ576	●	●	●	●	●	●		219063	27
PROFIBUS interface	2A-RZ577A							●	155317	27
PROFIBUS interface	2D-TZ577	●	●	●	●	●	●		218861	27
Serial expansion	2A-RZ581E							●	129807	27
I/O interface	2A-RZ371							●	124658	27
I/O interface	2D-TZ378	●	●	●	●	●	●		218862	27
Additional axis interface	2A-RZ541E							●	129801	27
Pneumatic hand interface	2A-RZ375	●	●	●	●	●	●	●	124657	27
Electric hand interface	2A-RZ364								129875	29
Curled connection cable	1A-GHCD								132101	29
Hand signal output cable	1A-GR200-RP							●	129778	29
	1S-GR35S-01		●	●	●				153078	29
	1S-GR35S-02					●	●		166272	29
Hand signal input cable	1A-HC20								129877	29
	1A-HC200-RP							●	129779	29
	1S-HC35C-02		●	●	●	●	●		166273	29
	1S-HC25C-01		●	●	●	●	●		153079	29
Gripper output connector	R-SMR-09V-B							●	132112	29
Gripper input connector	R-SMR-10V-N							●	132113	29

Option	Marking	RV-2SD	RV-3SDJB/3SDB	RV-6SD/6SDL	RV-12SD/12SDL	RH-6SDH	RH-12SDH/18SDH	RP-1/3/5AH	Art. no.	See page
Robot model name in catalogue	—	SD	SD	SD	SD	SDH	SDH	AH	—	—
Valve input connect	R-SMR-02V-B	●							143798	29
Hand signal output connector	S-series Hand OUTPUT		●	●	●	●	●		164814	29
Hand signal input connector	S-series Hand INPUT		●	●	●	●	●		164815	29
Valve connection cable	RV-E-1E-GR35S	●							47391	29
Hand curl tube	RV-E-1E-ST0402C	●	●	●				●	47390	30
	RV-E-1E-ST0404C	●	●	●				●	47389	30
Flexible drag chain cable	Cable Flex 5 m							●	149006	30
	Cable Flex 15 m							●	149010	30
Extension cable for fixed installation in a drag chain	1S-05CBL-01			●	●		●		155827	31
	1S-10CBL-01			●	●		●		155830	31
	1S-15CBL-01			●	●		●		155665	31
	1S-05CBL-03	●	●			●			165967	31
	1S-10CBL-03	●	●			●			165968	31
	1S-15CBL-03	●	●			●			165969	31
Extension cable for flexible installation in a drag chain	1S-05LCBL-01			●	●		●		157582	31
	1S-10LCBL-01			●	●		●		157583	31
	1S-15LCBL-01			●	●		●		157594	31
	1S-05LCBL-03	●	●			●			165970	31
	1S-10LCBL-03	●	●			●			165971	31
	1S-15LCBL-03	●	●			●			165972	31
PC connection cable	RV-CAB4							●	55653	32
Connection cable for I/O interface	2A-CBL05							●	47387	32
	2A-CBL15							●	59947	32
	2D-CBL05	●	●	●	●	●	●		218857	32
	2D-CBL15	●	●	●	●	●	●		218858	32
Extension box	CR1-EB3							●	129878	32
Calibration device	RV-E-1E-INST								47388	32
Adapter cable	TB-2D-28CON05M	●	●	●	●	●	●		218863	32
Calibration pin	6 mm Tool		●	●	●	●	●		155831	32
Calibration pin	8 mm Tool		●	●	●				155832	32
Batteries	A6BAT	●	●	●	●	●	●	●	4077	33
	ER6BAT	●	●	●	●	●	●	●	131168	33
	Q6BAT	●							130376	33

■ MELFA-BASIC IV/V Programming

Easy-to-Learn MELFA-BASIC IV/V Programming Language

Mitsubishi robots are controlled with programs written in the powerful MELFA BASIC IV/V programming language. This language is based on standard BASIC, which makes it very easy to learn. In addition to the familiar standard BASIC instructions and constructs like FOR … NEXT and GOTO, MELFA BASIC IV/V also has some extensions required for robots, including additional data types, instructions for movement and gripper control and I/O instructions. The familiarity of standard BASIC makes it easy for beginners to get started with robot programming.

Despite its simplicity and short learning curve, MELFA BASIC IV/V is a powerful language that can be used to create very complex robot programs.

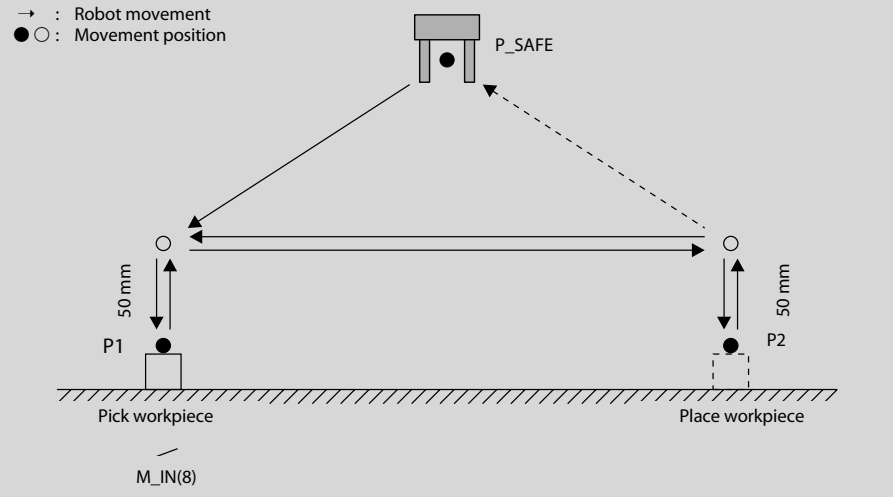
In addition to controlling simple movement sequences this high-level language can also perform complex calculations without having to access a connected PC. This is made possible by a comprehensive library of integrated functions, including trigonometry functions.

You can store up to 88 programs in the controller, in the D-Controller even 256, and manage up to 256 inputs and outputs. Another powerful feature is 3D circular interpolation, which makes it possible to program highly-complex processing sequences in 3D space.

Programming

Robot programs are written with the MELFA BASIC IV/V instructions with the help of a PC and the teaching box. The positions are defined with the teaching box and the actual program is written on the PC.

Programs are written using the RT Toolbox2 programming and project managing software or the CIROS programming software for industrial robots. You can find more information about the programming software on page 36 and 37.



Sample Program

The sample program below is for a pick-and-place operation. The input signal M_IN(8) tells the program that there is a workpiece in position P1. When a workpiece is present the input signal is set to 1 and the pick-and-place operation is performed. The workpiece is picked up from position P1 and deposited in position P2. If no workpiece is present the robot remains in the retracted position P_SAFE.

Pick-and-Place Program

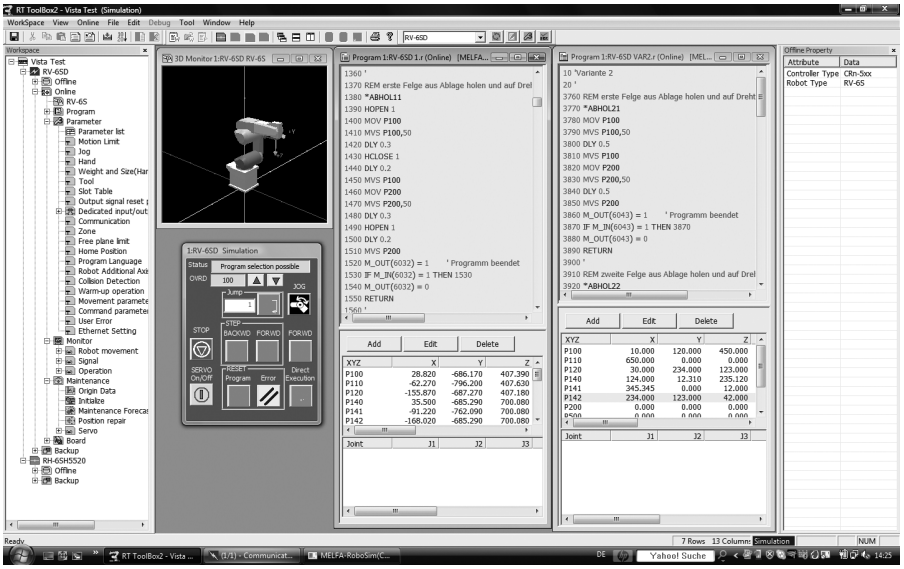
10	MVS P_SAFE	Move to safe position
20	IF M_IN(8) = 0 THEN 20 ELSE 30	Wait until input bit 8 is set
30	HOPEN 1	Open gripper 1
40	MVS P1, –50	Move longitudinally to a position 50 mm from P1 relative to the tool
50	MVS P1	Move to position P1
60	HCLOSE 1	Close gripper 1
70	DLY 0.2	Wait for 0.2 s to ensure proper closing of gripper
80	MVS P1, –50	Move longitudinally to a position 50 mm from P1 relative to the tool
90	MVS P2, –50	Move longitudinally to a position 50 mm from P2 relative to the tool
100	MVS P2	Move to position P2
110	HOPEN 1	Open gripper 1 and deposit workpiece
120	DLY 0.2	Wait for 0.2 s to ensure proper opening of gripper
130	MVS P2, –50	Move longitudinally to a position 50 mm from P2 relative to the tool
140	IF M_IN(8) = 1 THEN 40 ELSE 150	If another workpiece is present repeat the pick-and-place operation
150	MVS P_SAFE	If no workpiece is present return to safe position and end program
160	END	Program end

■ RT Toolbox2

RT Toolbox2:

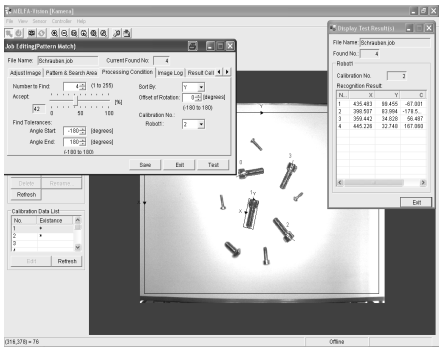
The RT Toolbox2 is the standard programming tool for every MELFA Robot. Besides Syntax Highlighting, 3-D Robot View and a Program Manager the software offers structured Parameter settings, Monitor and Backup functions and a Position repair function. This helps to recalculate the positions after displacing the robot or changing the gripper.
The Workspace structure allows connecting up to 12 robots simultaneously via Ethernet-Network and displaying them in real time on just one PC.

Among the standard softwareversion 3D-12C-WINE there is also the software 3D-11C-WINE availible. This software has the additional ability to simulate the movement of the robot in a 3-dimensional graphical display. Furthermore a special feature of this software is, to display the cycle time of the movement at the end of the simulation. So you can already optimize the program at your PC instead of optimizing at the real equipment.



Software		3D-12C-WINE	3A-11C-WINE
Supported robot models		All	
Language		English, German, Italian, French	
Functions for robot models	program editing	All	
	monitor function	All	
	parameter setting	All	
	program backup	All	
	program conversion	From M/E/EN to NARC and Post NARC	
	remote maintenance (via modem)	All	
	position repair	SD/SDH	
	maintenance forecast	SD/SDH	
Robot movement simulation		No	Yes
Calculation of the cycle time		No	Yes
Operating system		Microsoft Windows 98/XP/2000/Vista	
Order information	Art. no.	218856	218855

■ Network Vision Support Software



MELFA-Vision

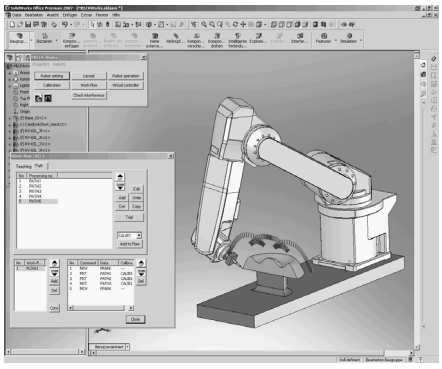
MELFA-Vision is an easy to use application to set up Cognex-Vision sensors and MELFA robot controllers. It supports you with a user friendly menu to set up the parameters on the Vision sensor and the Robot controller within just a few mouse clicks. The easy calibration function that supports various camera installation positions, calibrates the Vision system with the robot by only four positions. The Network vision job library helps the user to set up a vision program that can detect moving and rotated parts with pattern matching also at high speeds.

Through its Ethernet® connection interface it is possible to control one vision sensor by up to three robot controllers. Special Network Vision commands reduces the efforts of robot programming to a minimum by using just 3 commands to connect the vision sensor, trigger the camera and to read out the detected positions.

Melfa Vision supports the Cognex In-Sight 5000-Series and the new Cognex In-Sight Micro with the PatMax function.

Software	MELFA-Vision V1.1.1.0
Supported robot models	A/SD series
Language	English
Description	Network vision support software
Operating system	Microsoft Windows XP/2000
Order information Art. no.	206077

■ 3D Simulation and Programming Tool



MELFA-Works

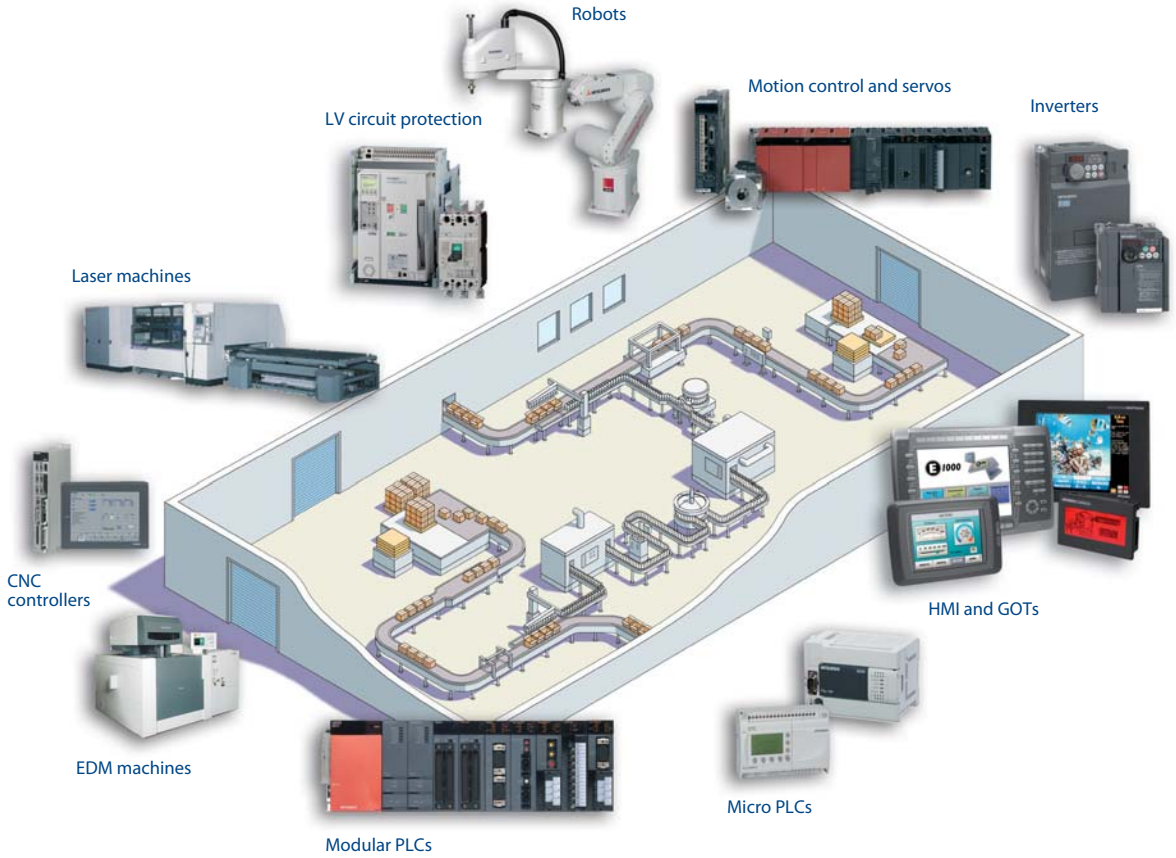
The 3D-CAD system SolidWorks® offers a wide range of construction tools. With the add-on tool MELFA-Works it is possible to implement full functional CAD models of the robots into your application and to simulate them.

The installation of designed hands or ATCs (Auto Tool Changers) and the use of external in- and outputs offers the possibility to simulate applications close to reality. With the implemented virtual controller and the use of robot parameters the calculation of tact times reaches an unrivalled accuracy.

By using the workflow tool, a path can be calculated by only selecting the edge and the corresponding surface and a complete movement program can be automatically generated. For transforming the virtual created path and positions into reality MELFA-Works supports with an intelligent calibration tool by using only three positions. This offers also an implemented interference check as well as a video function that saves moving applications into a video file.

Software	MELFA-Works V2.2
Supported robot models	SD series, RP series
Language	English
Description	3D simulation and programming software
Operating system	Microsoft Windows XP/2000, SolidWorks® 2004
Order information Art. no.	206076

A world of automation solutions



Mitsubishi offer a wide range of automation equipment from PLCs and HMIs to CNC and EDM machines

A name to trust

Since its beginnings in 1870, some 45 companies use the Mitsubishi name, covering a spectrum of finance, commerce and industry.

The Mitsubishi brand name is recognized around the world as a symbol of premium quality.

Mitsubishi Electric Corporation is active in space development, transportation, semiconductors, energy systems, communications and information processing, audio visual equipment, home electronics, building and energy management and automation systems, and has 237 factories and laboratories worldwide in over 121 countries.

This is why you can rely on a Mitsubishi automation solution – because we know first hand about the need for reliable, efficient, easy-to-use automation and control in our own factories.

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