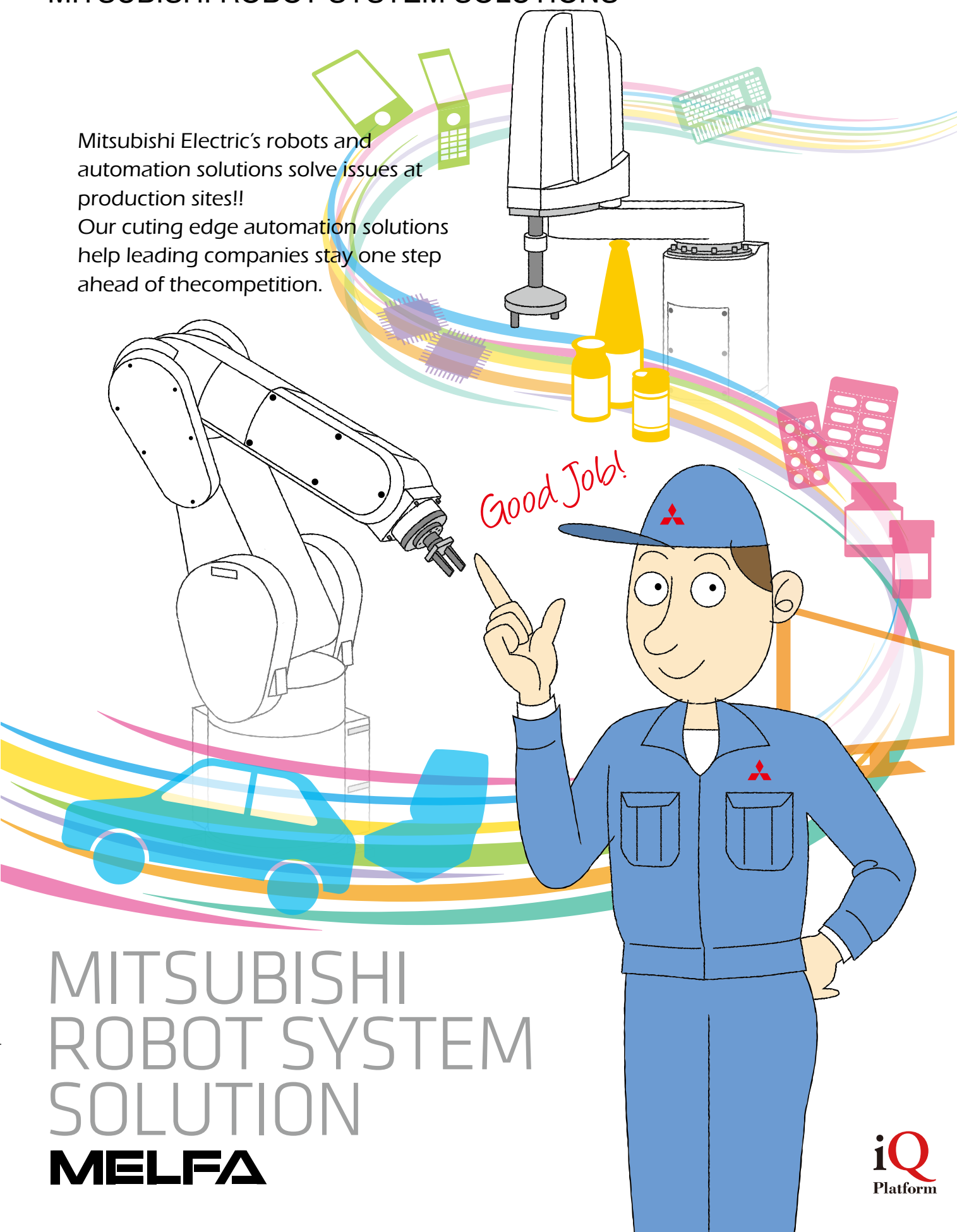
MITSUBISHI ELECTRIC

Changes for the Better

for a greener tomorrow eco Changes

MITSUBISHI ROBOT SYSTEM SOLUTIONS

Mitsubishi Electric's robots and automation solutions solve issues at production sites!!
Our cuting edge automation solutions help leading companies stay one step ahead of thecompetition.



MITSUBISHI ROBOT SYSTEM SOLUTION

MELFA

iQ Platform

Concept

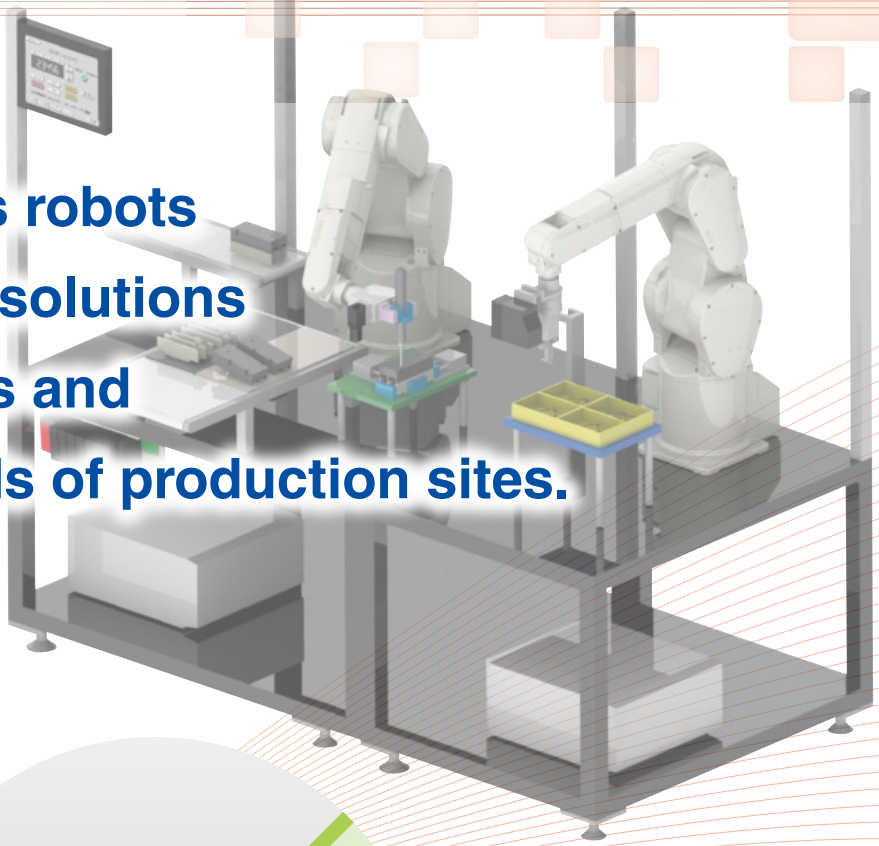
Our robotic solutions allow companies productivity and reducing costs.

MITSUBISHI ROBOT SYSTEM SOLUTION

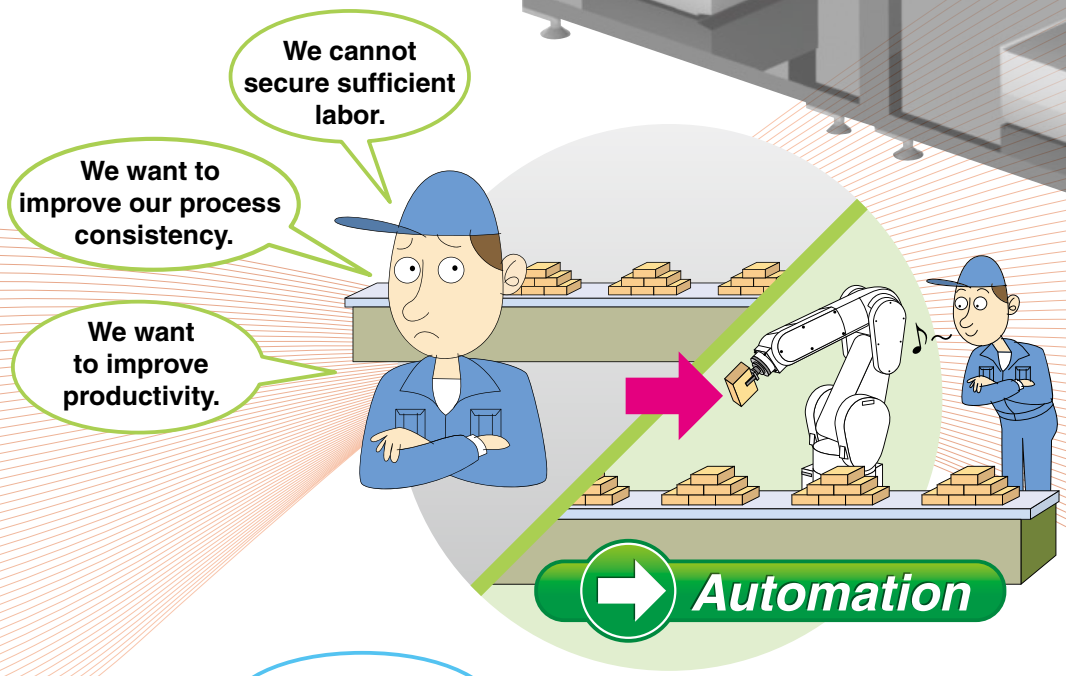
Mitsubishi Electric Corporation is a leading maker of factory automation systems, and has abundant experience in various areas including automobile parts, electronic and electric components, liquid crystal displays, semiconductors, food products, medicines, cosmetic products, potteries, education and research.

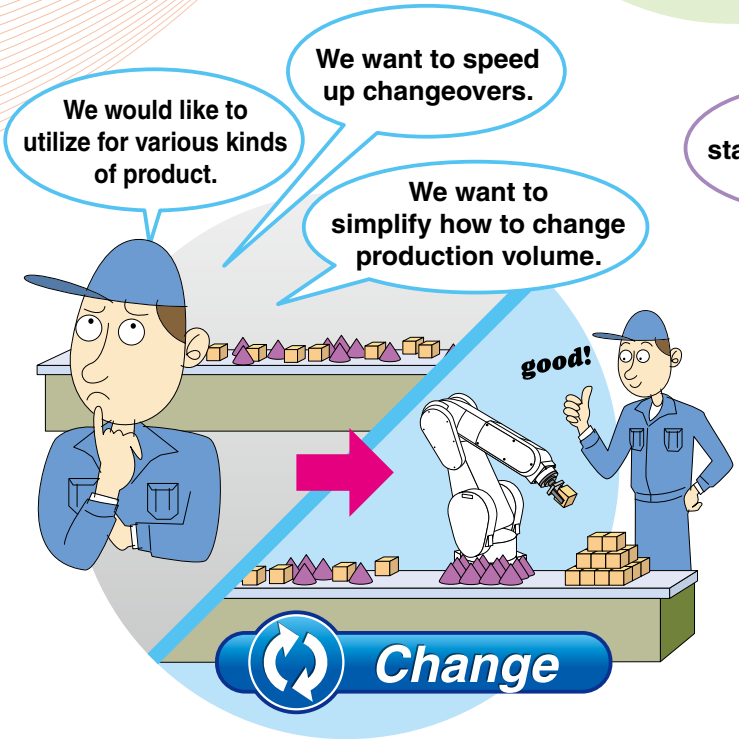
The company proudly offers the best of its kind intelligent solution with highly rigid arms which enable high-speed and high-precision operations, to support factories, to arrange optimization and to be one step ahead of other manufactures.

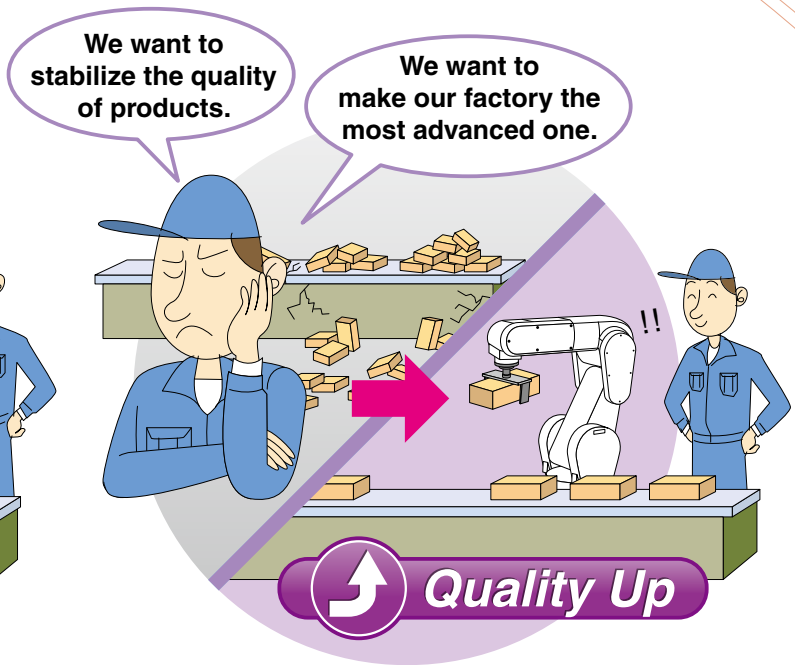
to upgrade their production lines thereby improving



Mitsubishi Electric's robots and robotic system solutions solve various issues and satisfy diverse needs of production sites.



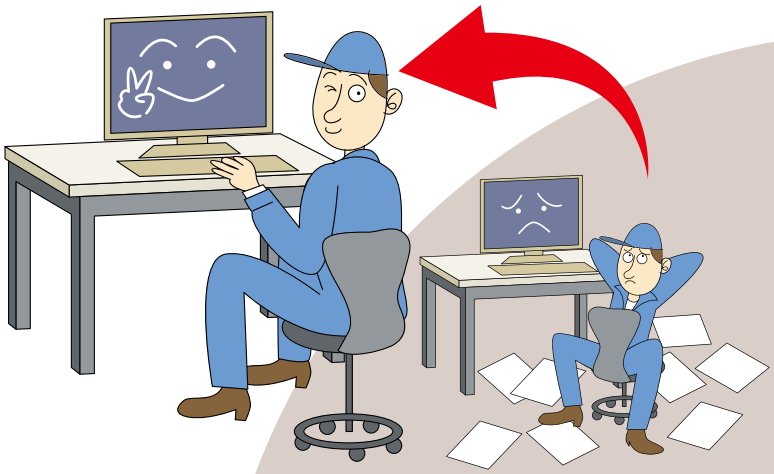




We will immediately answer to your

Smooth system configuration!!

- We propose the most appropriate automation system out of our ample FA products.
- There are various ways to learn how to operate a robot in advance, such as e-learning and Robot School. Note 1)
- Call center is available for consultation for operating method and programming, including sudden needs such as a startup at a production site.
- In partnership with experienced system integrators (SI), we will provide proposals which satisfy your requests.



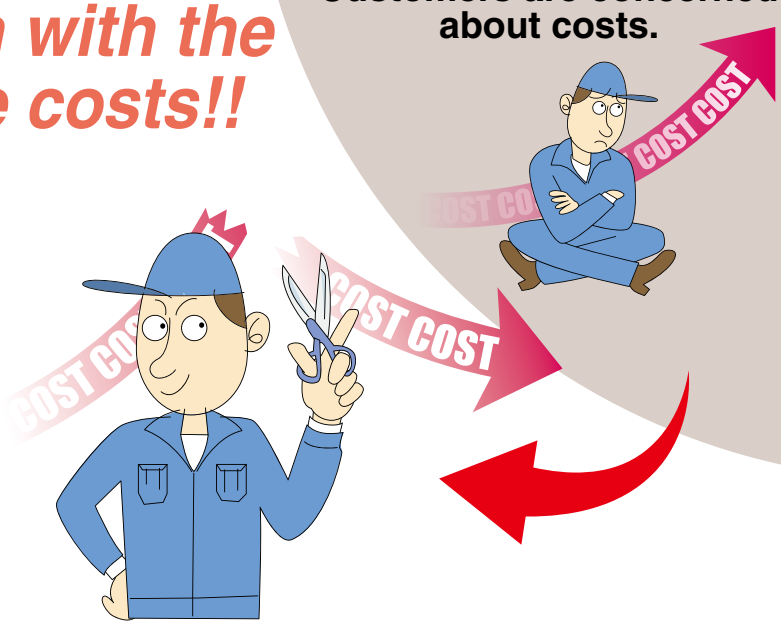
One of customers' concern is how to build a system.

To automate a plant, you will face various issues Mitsubishi Electric will provide customers with reliable

Plant automation with the most appropriate costs!!

- By utilizing a wide range of functions, interface and components of robots, we will realize automation with the minimum peripherals.
- Customers can select the best robots for their layouts from an abundant lineup of robots.
- We will support our customers to implement the most appropriate system introduction in partnership with experienced system integrator partners.

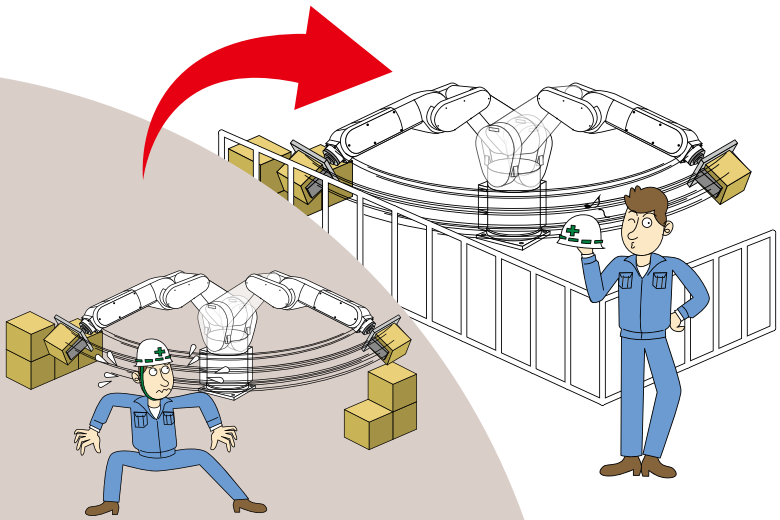
Customers are concerned about costs.



Note 1) Online information service, "Mitsubishi Electric FA Global Website" http://www.mitsubishielectric.com/fa/
Mitsubishi Electric FA Global Website provides technical information such as product information and case studies as well as the notice on training schools and contacts. Once you register as a member, you will be ale to download manuals and CAD date etc. and take advantage of various services including e-learning.

questions regarding the introduction of robots.

The best safety measures!!

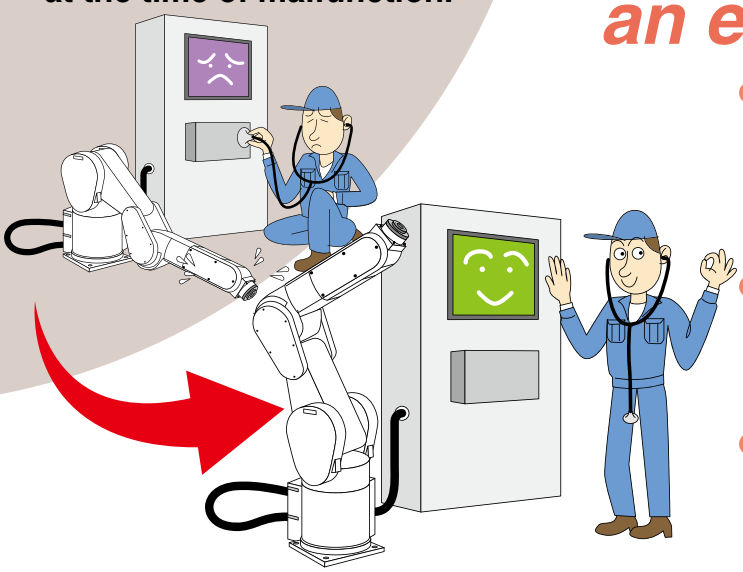


Customers are worried about safety measures.

- At Robot School, customers can learn about matters to be observed regarding the usage of robots such as the installation of a safety fence and a door switch. Note 2)
- Robots are equipped with various safety functions to ensure the safety of operators.
  (They are in compliance with ISO-10218, Safety Requirements for Industrial Robots.)
- We will propose our customers safe and comprehensive solution with our wide range of safety product lineup.

and concern.
support for the introduction of robots in their plants.

Customers want to know if they will be well looked after at the time of malfunction.



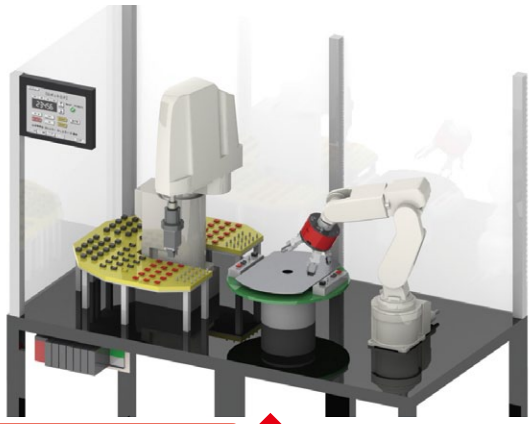
Shorter downtime at an emergency case!!

- We globally deploy our after-sales service offices for factory automation equipment and robot which are the key parts of automation systems to establish a reliable support system.
- Utilizing our expertise in factory automation equipment, we will support customers to be equipped with necessary maintenance functions.
- We will provide our support to customers for the design, delivery and maintenance of a robot system through the strong alliance with our partners.

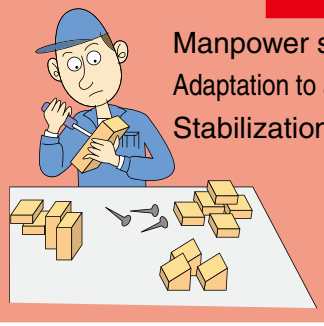
Note 2: With regards to the safety related to robots, it is mandatory to abide by Industrial Safety and Health Law and Ordinance on Industrial Safety and Health in Japan.

Delivering the best automation solut

Assembly of electric equipment

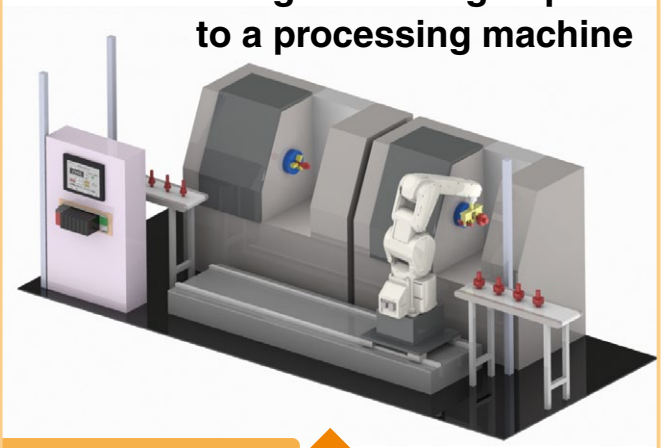


Case study: Page 7 and 8



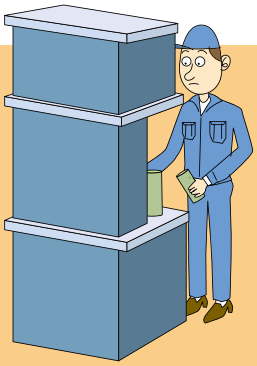
Manpower saving
Adaptation to a wide variety of products
Stabilization of quality

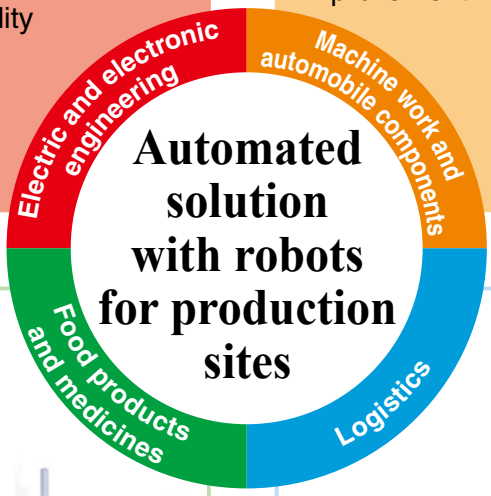
Loading/Unloading of pars to a processing machine



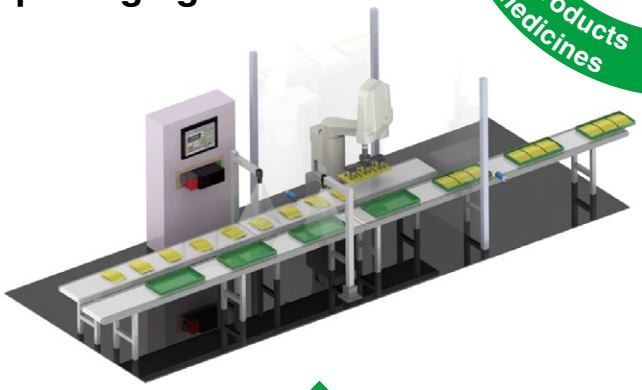
Case study: Page 9 and 10

Manpower saving
Higher operating ratio
Improvement in cycle time

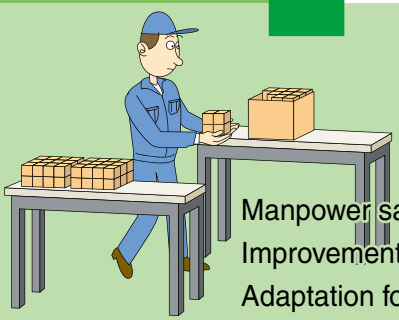




Alignment and packaging

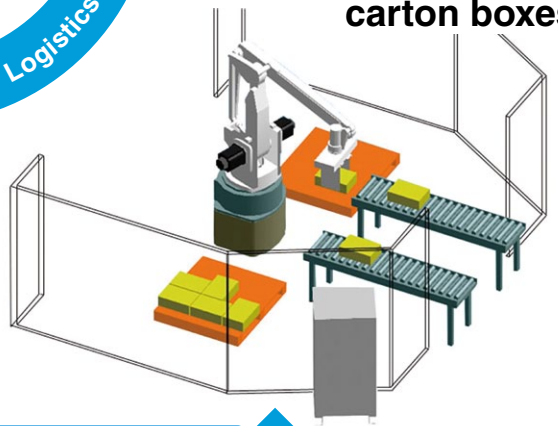


Case study: Page 11,12



Manpower saving
Improvement of traceability
Adaptation for load changes

Handling of packed carton boxes



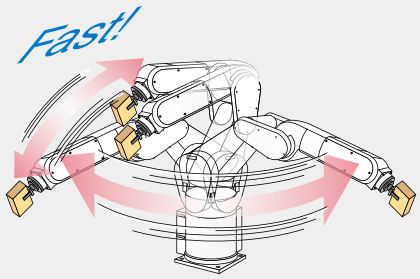
Case study: Page 13

Manpower saving
Improvement in cycle time
Reduction of heavy labor

Merits of robot introduction

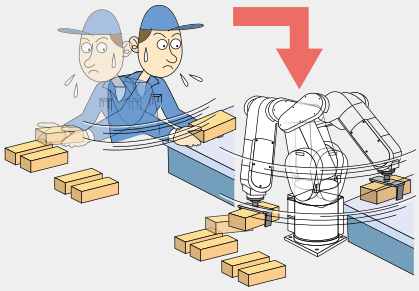
Productivity improvement

Productivity will be improved.



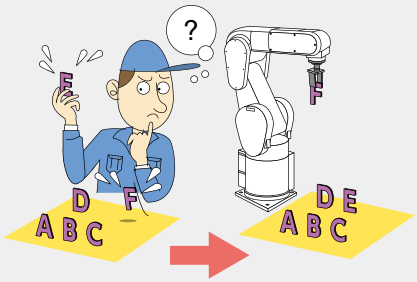
It enables high-speed operation. Continuous operation is possible even at workers' recess time and midnight.

Manpower will be saved.



Robots work taking over the hands and arms of operators. (Robots are able to duplicate complicated movement.)

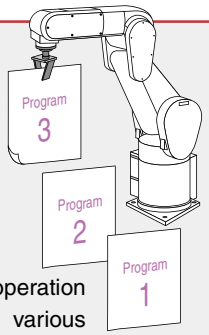
Product quality will be improved.



Since the movement of robots is consistent, there is no mistake such as skipping attachment of a component.

Reduction of total costs

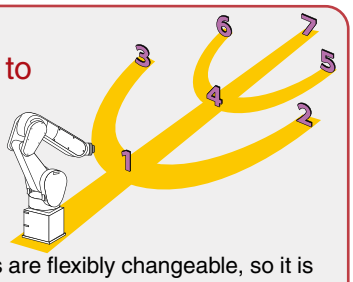
Versatile system can be created. (Adaptation to a wide variety of products.)



Robot — Robots enable a quick operation mode change by saving various complicated moves and allowing program and automatic hand change.

Dedicated machine — Device tends to have complicated structure which requires changeovers of various parts.

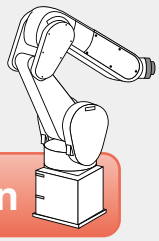
It is easy to change to a new model and to switch to another operation.



Robot — Moves of robots are flexibly changeable, so it is easy to add a product type and a process in the future. When a line is stopped, a robot can be easily utilized with another production facility.

Dedicated machine — It is necessary to newly design and manufacture a machine for the change and it requires costs.

The start-up time of system will be shortened. There will be fewer troubles at a start-up and adjustment time will become shorter.



Teaching → **Programming** → **Automatic operation**

Robot — Since the system is flexible, it is easy to design coordinating with other peripherals. In addition, at the installation, there is no need to adjust a position against those of peripherals, which reduce a start-up time.

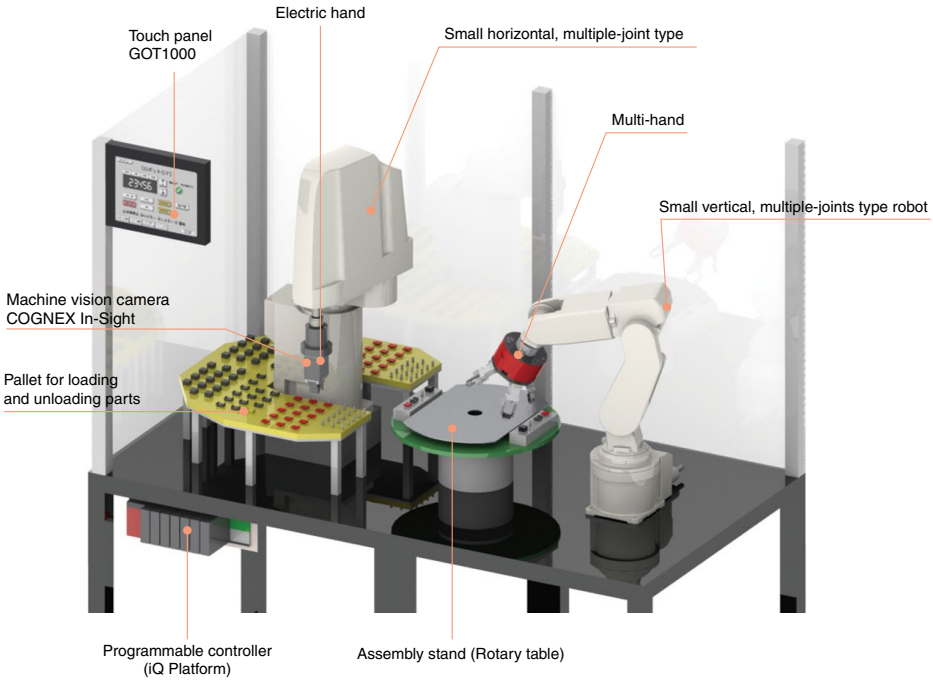
Dedicated machine — Since it requires dedicated work, it requires a long time to design and manufacture a machine. In addition, it is not flexible, so it takes a very long time to adjust a position at the installation.

Mitsubishi Electric, one of the leading with the most appropriate systems

Electric and Electronic Engineering

Assembly of electric components (switch)

System configuration diagram



Points for the employment of robots

High-speed parts kitting with a horizontal, multiple-joint type robot, fine assembly with a vertical, multiple-joint type robot, and the ability to handle a variety of workpieces with a high-functioning hand (a multi-hand and an electric hand)

High-speed kitting
It enables high-speed picking from multiple pallets.

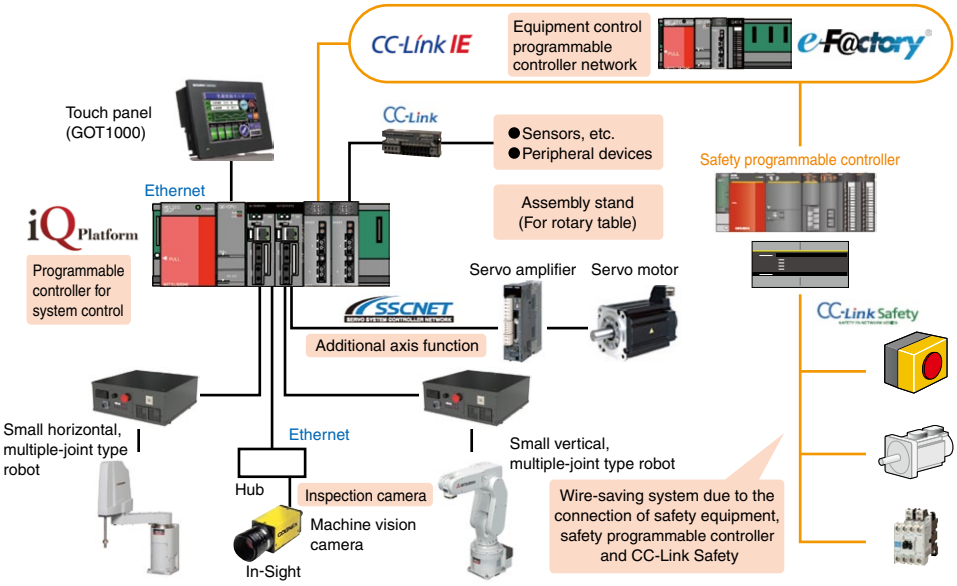
Capable of handling a wide variety of workpieces using only a small space
Utilizing a small horizontal, multiple-joint type robot which has a wide motion range requiring a small installation space, a plant can keep a various kinds of parts as a stock using a smaller space.

No need to change hands to switch a kind of work
Easily attachable electric hand can flexibly handle parts with different sizes and configurations.

Complicated assembly process
A small vertical, multiple-joint type robot, which is versatile and has a wide motion range, processes a complicated assembly process at a low cost.

Reduction of cycle time
Easily attachable four-head multiple hands can process continuous mounting of parts.

Control device configuration diagram



iQ Platform strengthens the link between programmable controller, GOT and a robot. It enables the best system operation and visualization. In addition, it realizes effective production control utilizing various networks and MES interface.

Reduction of cycle time with iQ Platform, which arranges high-speed communication between a robot and a programmable controller.

Unit-saving with the robot's Additional axis function

Easy connectivity with COGNEX machine vision camera

Visualization of data by linking factory automation equipment and wire-saving of various networks

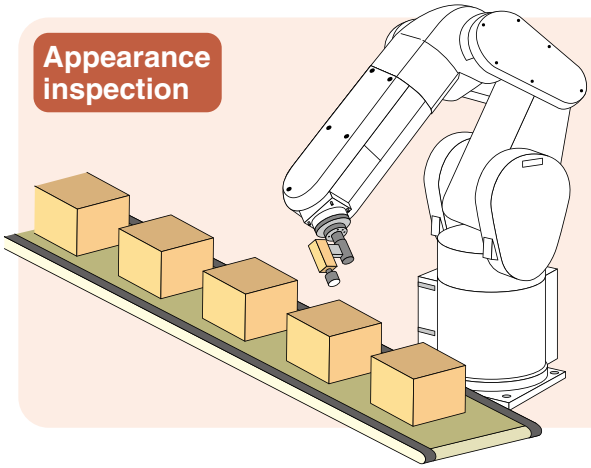
Benefits of introducing

- Manpower-saving with the introduction of facility: It is possible to depreciate the investment cost in about 2 years. (Note: The calculation is based on the conditions that Mitsubishi Electric uses.)
- Introduction merit due to increased production capacity: Production will increase about 2.5 times due to the shorter cycle time and longer operating hours. (Note: The calculation is based on the conditions that Mitsubishi Electric uses.)

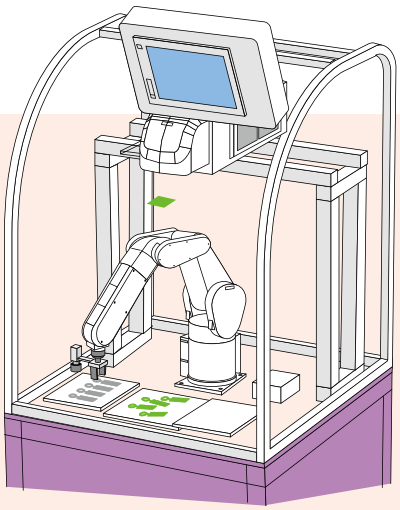
Other merits: Adaptation to the production of a wide variety of products, the simplification of production adjustment, and the stabilization of quality

factory automation system makers, will provide customers through the strong alliance with partners.

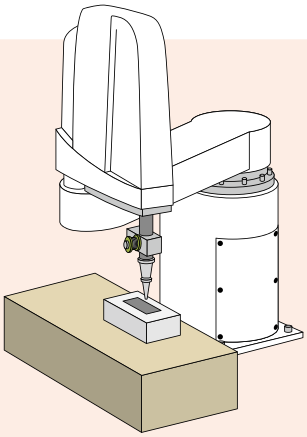
Appearance inspection



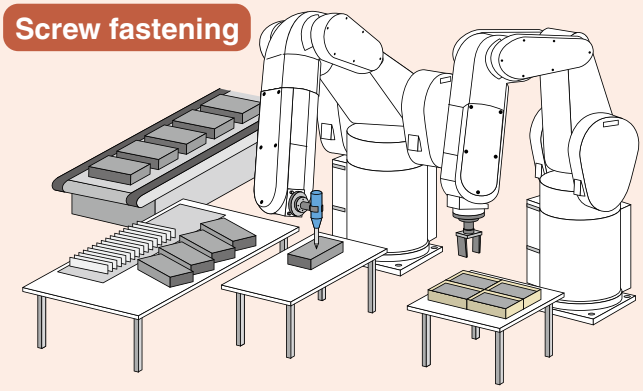
Laser marking



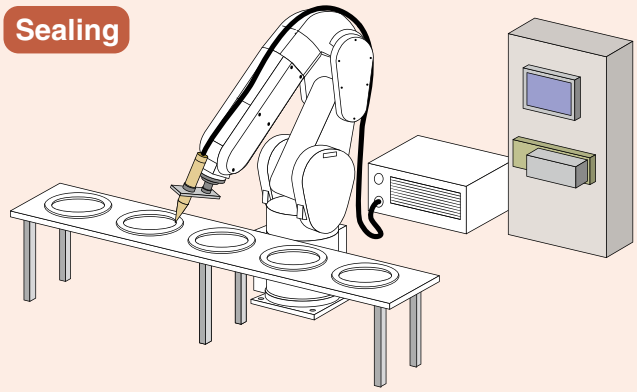
Soldering



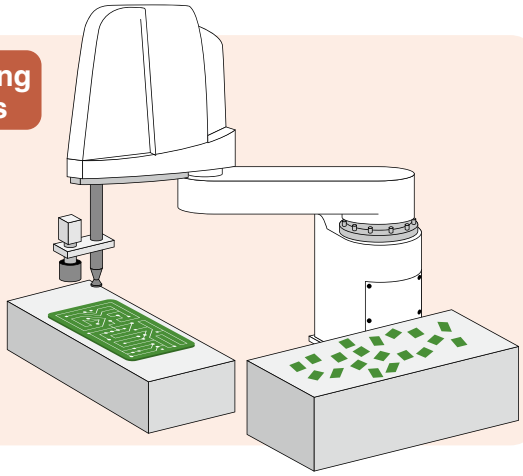
Screw fastening



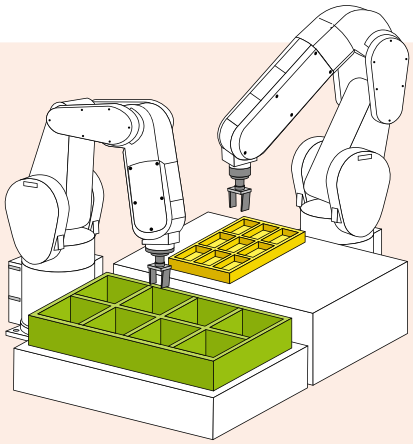
Sealing



Mounting of parts



Kitting

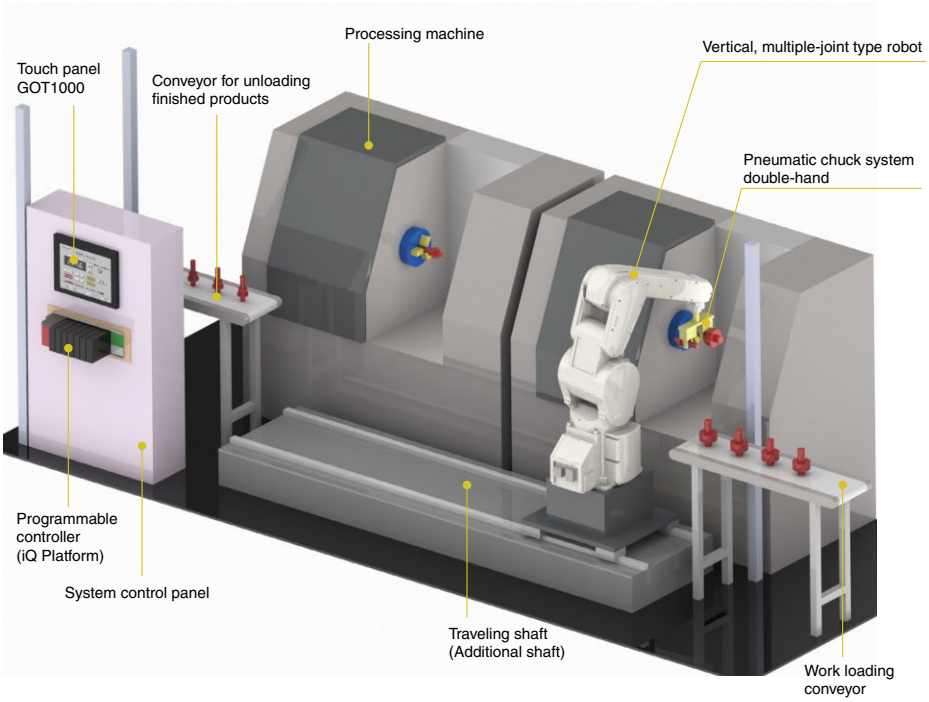


Robot System Case Study

Machine work and automobile components

Loading/Unloading of parts to a processing machine (A lathe, a machining center, a press machine, and a make-up machine, etc.)

System configuration diagram



Points for the employment of robots

A vertical, multiple-joint type robot realizes high-speed loading and unloading of parts to a processing machine. (Oil mist proof) Additional traveling shaft improves the operating rate of a robot and efficiently utilizes the facility.

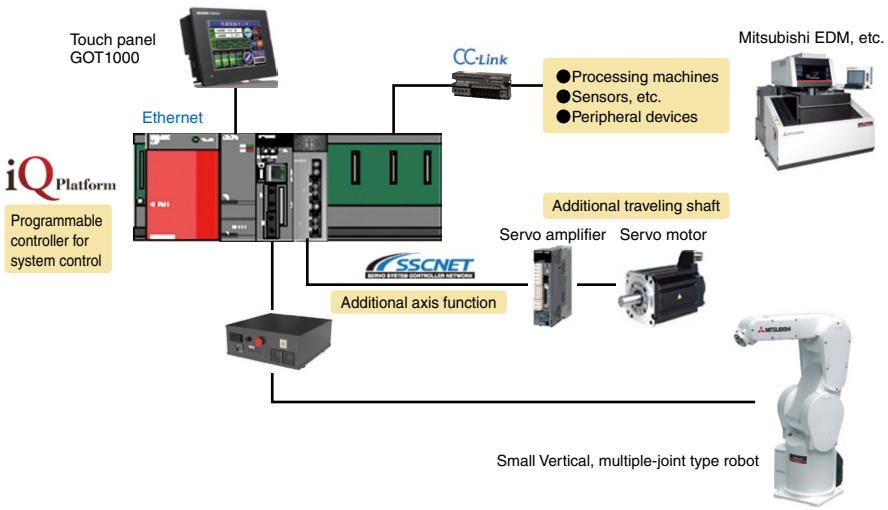
Improvement of environmental resistance
Oil mist proof assures a safe access to a processing machine.

Smooth hand-over of products with various processing machines
It is possible to place a robot in many styles changing the height and the positions of arms, enabling smooth hand-over of products with processing machines.

Higher operating rate of robot
One robot can be slided to access multiple number of processing machines during its operation.

Shorter cycle time
Double-hand operation minimizes the time to replace a workpiece in a processing machine.

Control device configuration diagram



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In addition, it realizes effective production control utilizing various networks and MES interface.

Reduction of cycle time with iQ Platform, which arranges high-speed communication between a robot and a programmable controller.

Unit-saving with robot's Additional axis function

Visualization of data by linking factory automation equipment and wire-saving of various networks

Benefits of introducing

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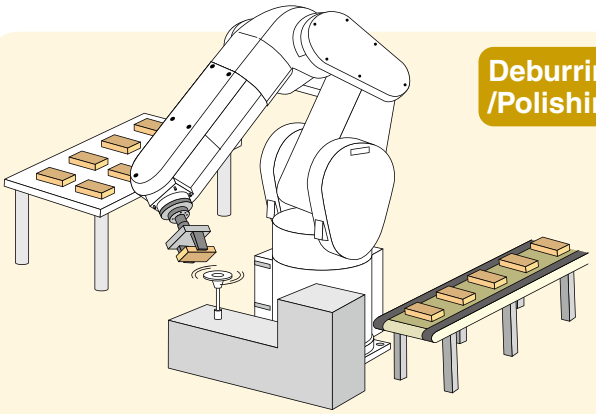
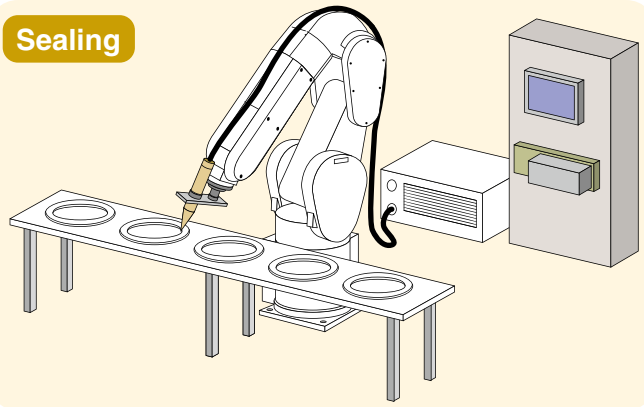
- Introduction merit due to increased production capacity: Production will increase about 1.5 times due to the longer operating hours. (Note: The calculation is based on the conditions that Mitsubishi Electric uses.)

Other merits: Adaptation to the production of a wide variety of products, the simplification of production adjustment, and the reduction of dangerous work

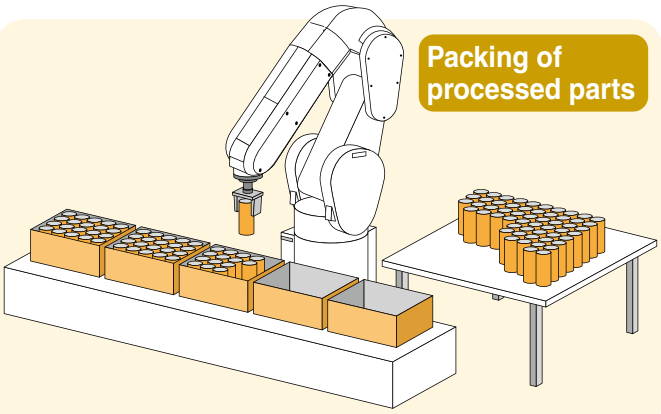
Deburring /Polishing



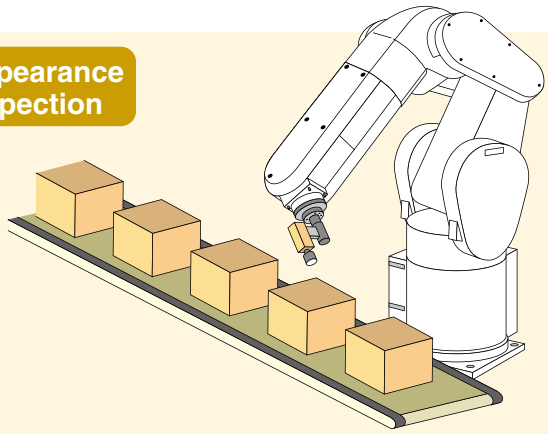
Sealing



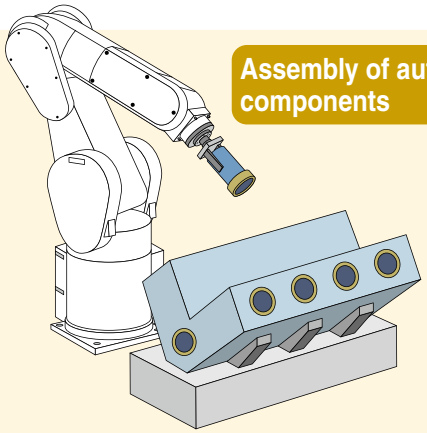
Packing of processed parts



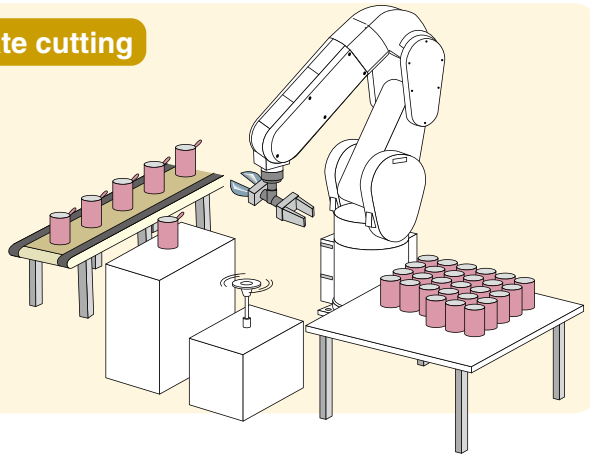
Appearance inspection



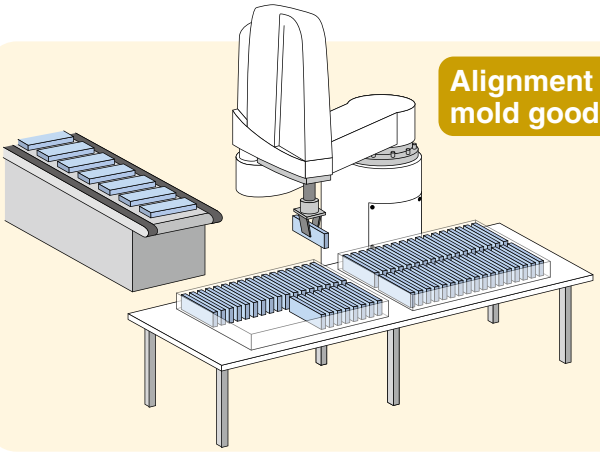
Assembly of automobile components



Gate cutting



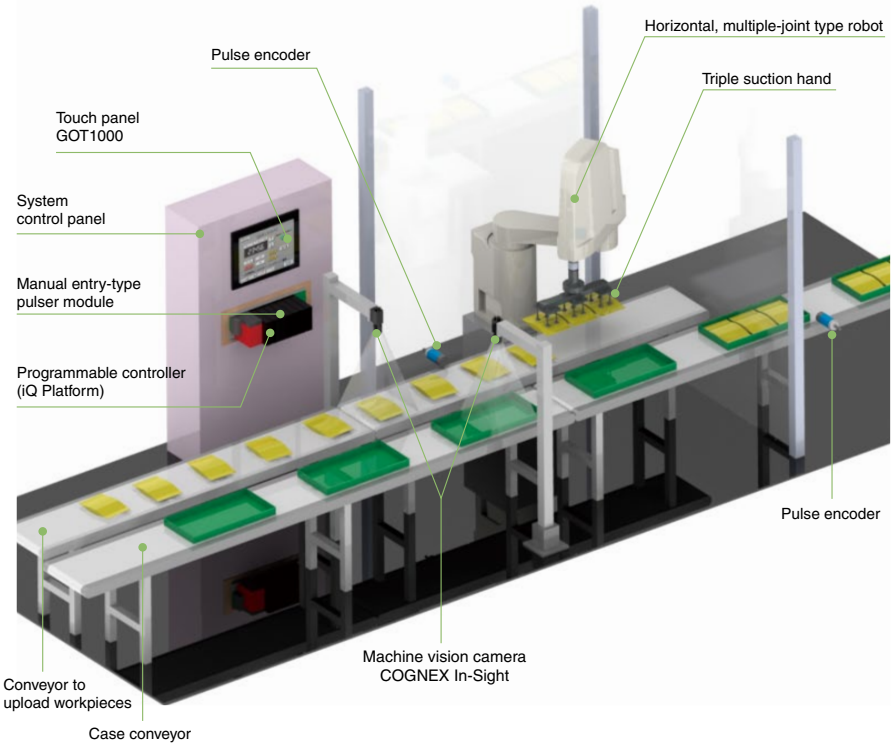
Alignment of mold goods



Food Products and Medicines

Conveyor alignment for packed food products

System configuration diagram



Points for the employment of robots

High-speed vision-tracking of horizontal, multiple-joint type robot realizes non-stopping alignment process. It also processes simultaneous tracking for multiple conveyors.

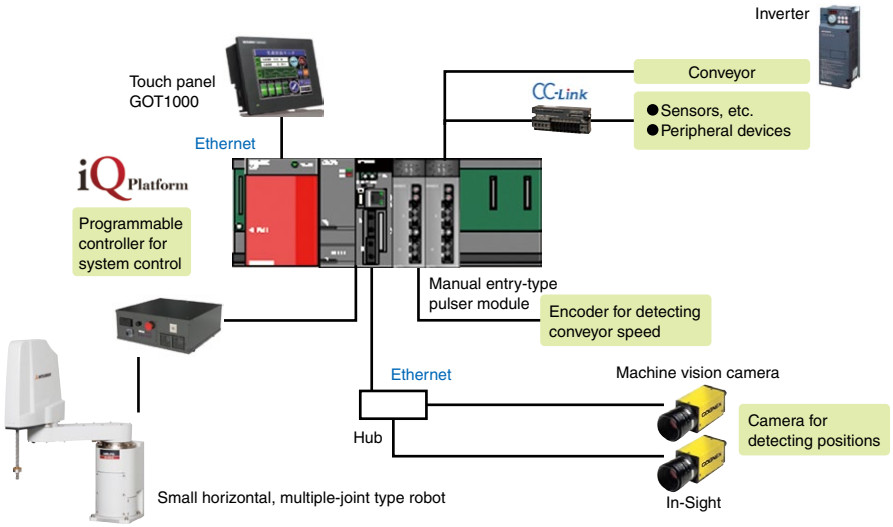
High-speed tracking
Tracking function of robot allows the line to arrange transfer and alignment processes while easily following the moves of workpieces on a conveyor.

No need of alignment device
No dedicated alignment device is required due to the utilization of machine vision camera, which contributes to the setup of versatile system at a low cost.

Reduction of cycle time
Synthesis rate of joint of horizontal, multiple-joint type robot realizes the highest speed and highly accurate operation of its kind.

Stable quality due to automated process
Highly accurate repeating movement of robot eliminates the variation in quality due to the quality and operating speed of each operator.

Control device configuration diagram



iQ Platform strengthens the link between GOT and a robot. It enables the best system operation and visualization. In addition, it realizes effective production control utilizing various networks and MES interface.

Reduction of cycle time with iQ Platform, which arranges high-speed communication between a robot and a programmable controller

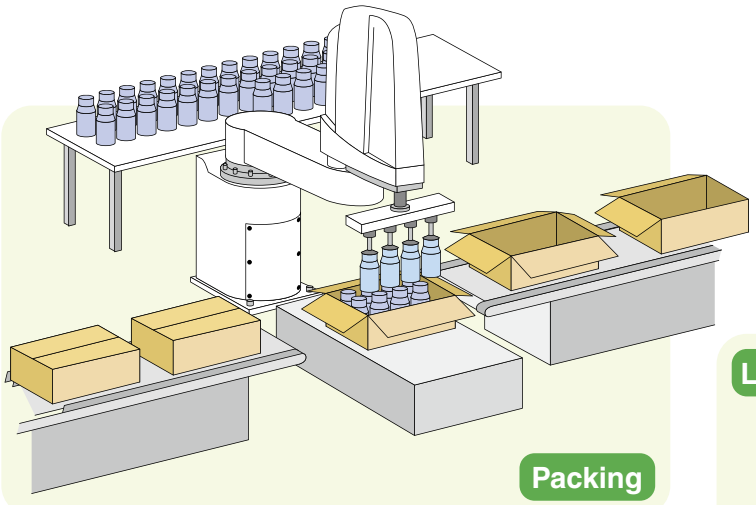
Easy connectivity with COGNEX machine vision camera

Visualization of data by linking factory automation equipment and wire-saving of various networks

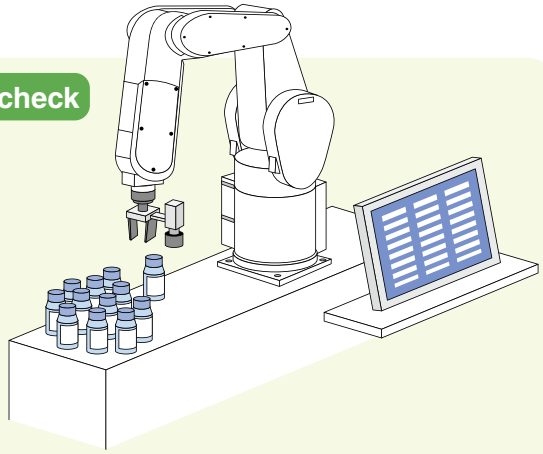
Benefits of introducing

- Manpower-saving from the introduction of facilities: It is possible to depreciate the investment cost in about 1.5 years. (Note: The calculation is based on the conditions that Mitsubishi Electric uses.)
- Introduction merit due to increased production capacity: Production will increase about 1.5 times due to the longer operating hours. (Note: The calculation is based on the conditions that Mitsubishi Electric uses.)

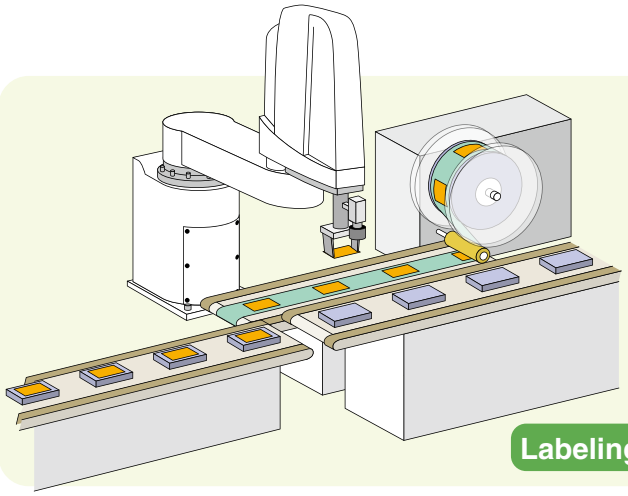
Other merits: Adaptation to the production of a wide variety of products, the simplification of production adjustment, and the stabilization of quality



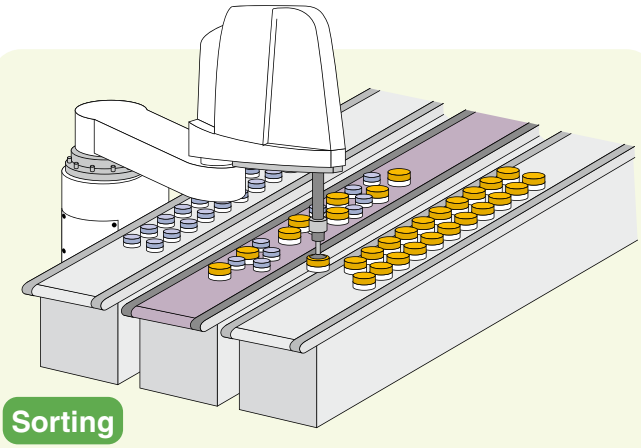
Packing



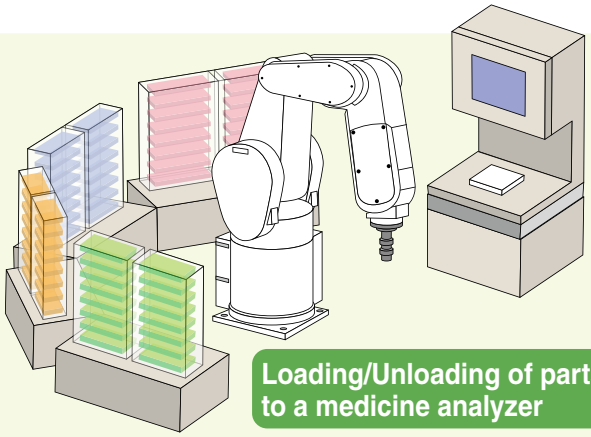
Label check



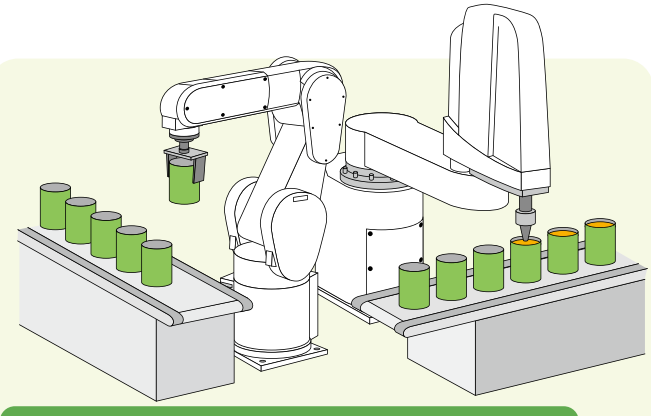
Labeling



Sorting



Loading/Unloading of parts to a medicine analyzer

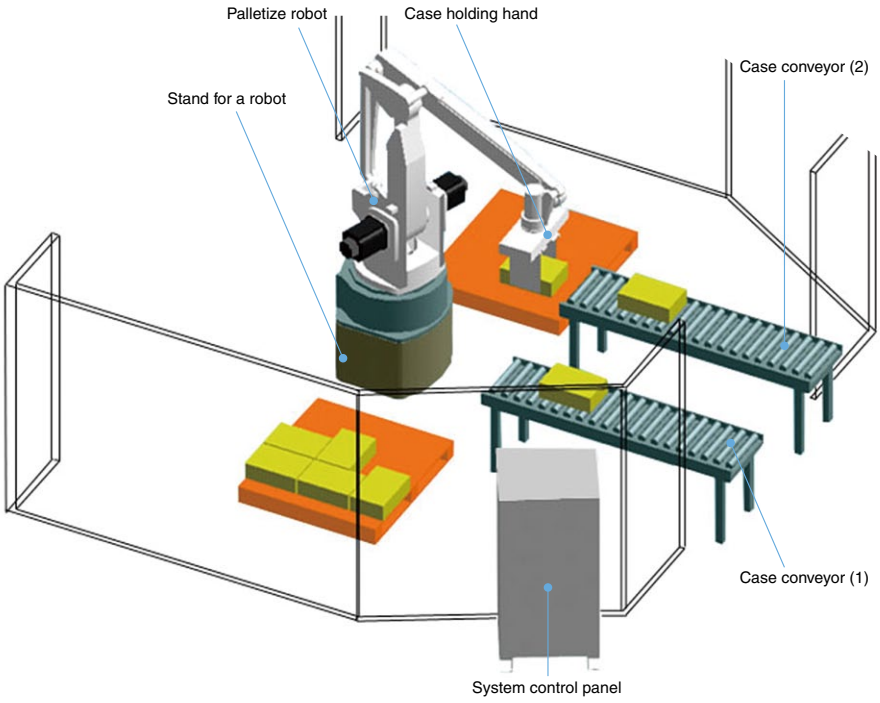


Loading/Unloading processes for a filler

Palletize

Palletize of carton boxes

System configuration diagram



Points for the employment of robots

A palletizing-dedicated robot enables high speed palletizing operation. The length and structure of arms, which have been optimized for palletizing process, improves the flexibility of layout.

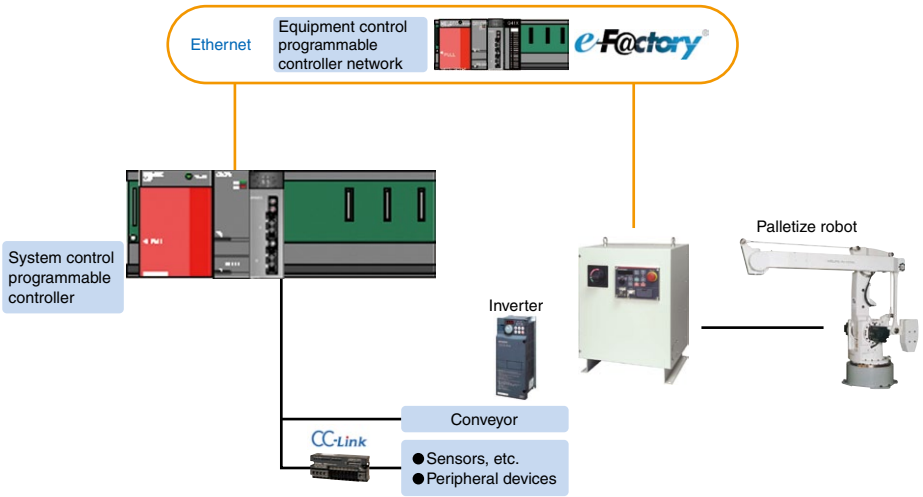
High-speed operation
The use of palletizing-dedicated robot assures the highest speed palletizing of its kind.

Reduction of cycle time
To make the most use of the ability of robot, the most appropriate speed control is adopted depending on the load and the condition of posture of the robot.

Flexible layout
The optimized arm length and structure minimizes an idle space around a robot for the operation using standard pallet sizes.

Stable quality due to automated processes
Highly accurate repeating movement of robot eliminates the variation in quality due to the quality and operating speed of each operator.

Control device configuration diagram



Substantial network function including CC-Link and Ethernet assures the connectivity with upper programmable controllers and computers.

Visualization of data by linking factory automation equipment and wire-saving of various networks

Benefits of introducing

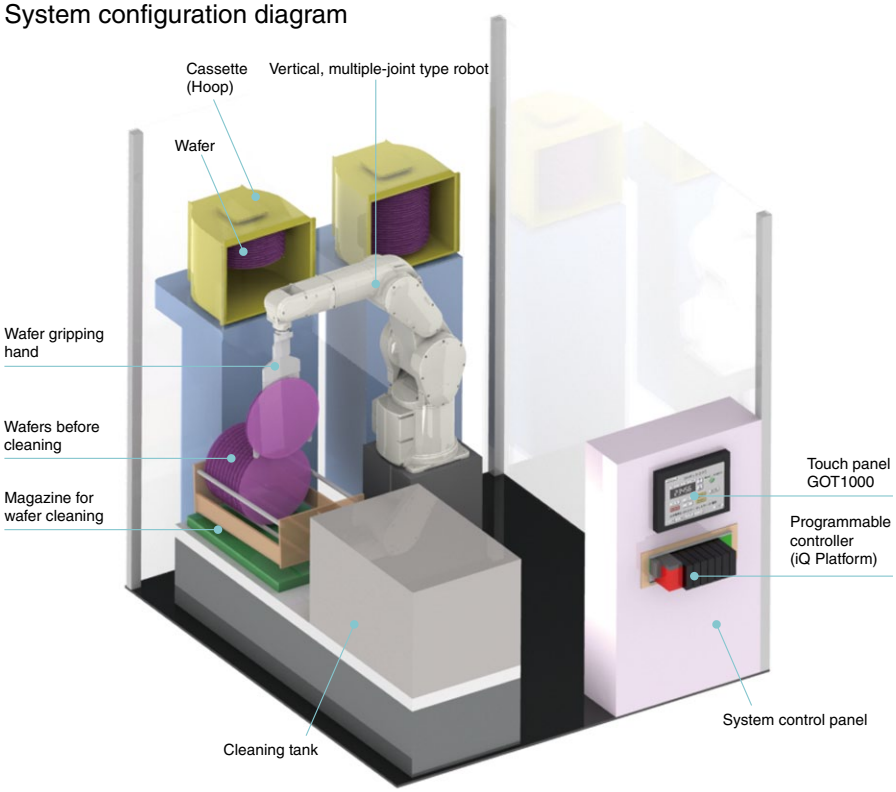
- Manpower-saving from the introduction of facilities: It is possible to depreciate the investment cost in about 1.5 years. (Note: The calculation is based on the conditions that Mitsubishi Electric uses.)
- Introduction merit due to increased production capacity: Production will increase about 4 times due to the shorter cycle time. (Note: The calculation is based on the conditions that Mitsubishi Electric uses.)

Other merits: The simplification of production adjustment, the stabilization of quality, and the reduction of heavy labor

Clean room

Loading and unloading from cassettes

System configuration diagram



Points for the employment of robots

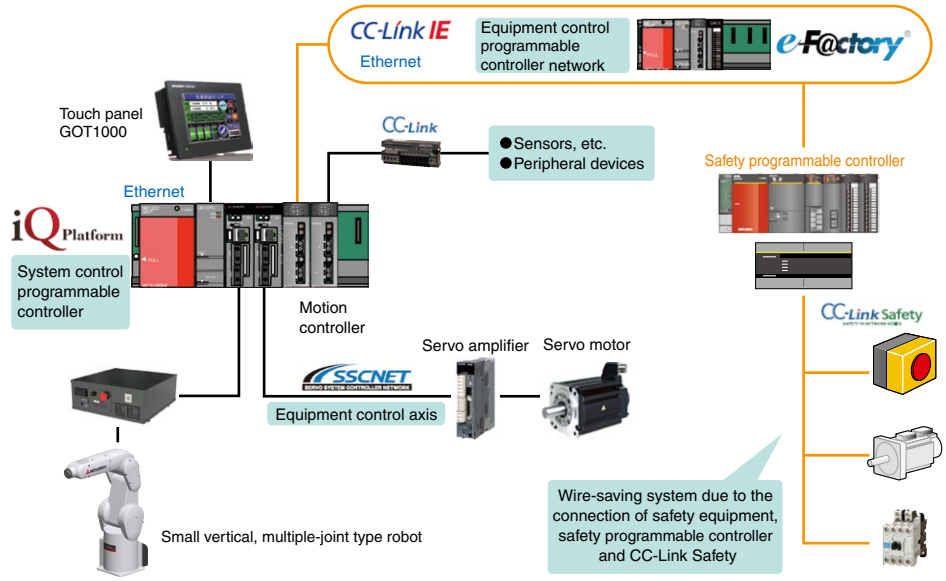
It is possible to perform high-speed loading and unloading of wafer cassettes (hoops) by a vertical, multiple-joint type robot (Long arm and clean room compatible).

Clean room compatible
Clean-type robot is used to satisfy ISO Class 3 clean room.

Space-saving
Layout is space-saving type which utilizes a wide motion range of robot.

Supporting various cassette types
It is possible to hand over wafers to cassette in various styles and requires no dedicated machine such as an inverting machine.

Control device configuration diagram



iQ Platform strengthens the link between programmable controller, GOT and a robot. It enables the best system operation and visualization. In addition, it realizes effective production control utilizing various networks and MES interface.

Reduction of cycle time with iQ Platform, which arranges high-speed communication between a robot and a programmable controller.

Visualization of data by linking factory automation equipment and wire-saving of various networks

Benefits of introducing

The improvement of cleanness, manpower saving, higher productivity, and the simplification of production adjustment

Mitsubishi Electric's industrial robots of production sites in a fast, skillful

Vertical, multiple-joints robot

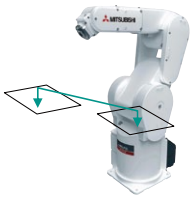
RV-F SERIES

- A compact 6-axis jointed robot with an optimal arm length and wider range of movement suited for complex assembly and processing tasks.
- Compact body and slim arm design, allowing operating area to be expanded and load capacity increased.
  Layout accommodates a wide range of applications from transport of mechanical parts to assembly of electrical parts.
- Environmental resistance specifications enable application to a wide range of uses without needing to consider the installation environment.

■ Features

Contribute to higher productivity with highly frequeut movements

The employment of an in-house developed motor and the enhanced overload detection method improved has the continuous operating performance. User can comfortably use the robot for highly frequent movements.

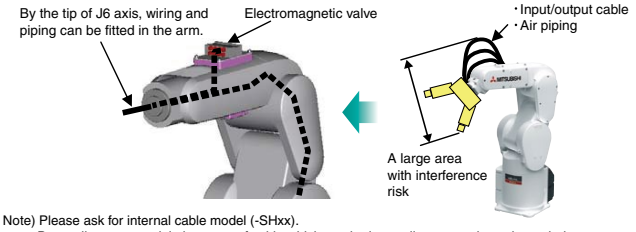


Changes in operating posture can be made even more quickly!!

Changes in operating posture, which occur frequently during assembly, can be completed at rapid speed, increasing the speed of the axis close at hand as well as that of the base axis. Enables changes to be made to the operating posture at high speed.

Cable interference proof

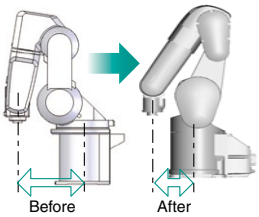
The tip of axis has a route for cables to be placed in a hand.
It allows wiring and piping to the root of the hand.
Since cables can be internally stored, it minimizes the interference of cable against peripheral devices. This eliminates the issue of entanglement of wires and pipes.



Note) Please ask for internal cable model (-SHxx).
Depending on a model, the types of cable which can be internally arranged may be varied.

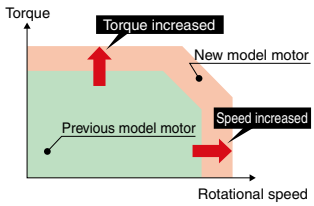
Compact installation with operation performed near the robot base

Use of a flap-style arm contributes to a slimming of customer equipment, enabling operations to be completed in even closer proximity to the robot.



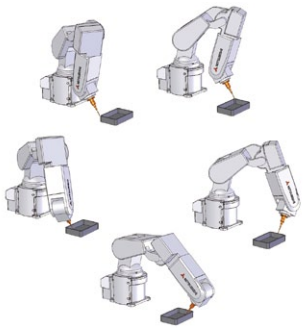
Highest-speed operation of its kind

A in-house developed motor, highly rigid arm and proprietary drive control technology enable high torque output with high revolution and the best performance of its kind.
Continuous operating performance, which has been also improved, contributes to higher productivity by shortening cycle time.



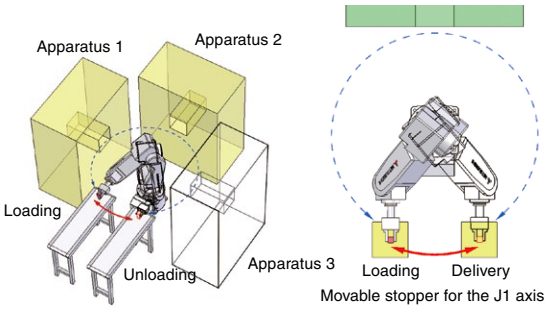
Enlargement of J4 axis motion range

Enlarged J4 axis motion range makes continuous posture changes possible for assembly and transfer. Inverting motion is no longer needed in the middle of the change.



Full use of installation space

It adds more flexibility to the consideration of the installation of robot. The robot has 360° access including back side, which allows the space to be fully utilized. The shorter travel distance will shorten a cycle time.



contribute to the advancement and simple way.

Horizontal, multiple-joints robot

RH-F SERIES

- Matches perfectly to a variety of applications with a wide range of operating areas and variations.
- High speed and high accuracy achieved with the highly rigid arm and latest servo control technology.
  Suitable for a wide range of fields from mass production of food and pharmaceutical products requiring high-speed operation to assembly operations requiring high precision.

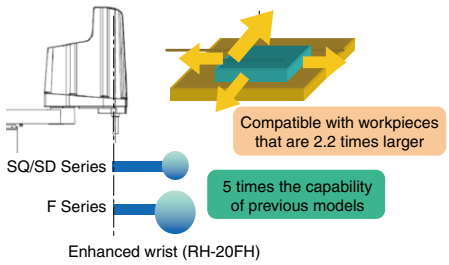
■ Features

Faster vertical motion

The speed of vertical motion, which is inevitable for horizontal, multiple-joint type robots, has been improved.
2400mm/s **[RH-6FH: Double speed compared to the conventional model]**

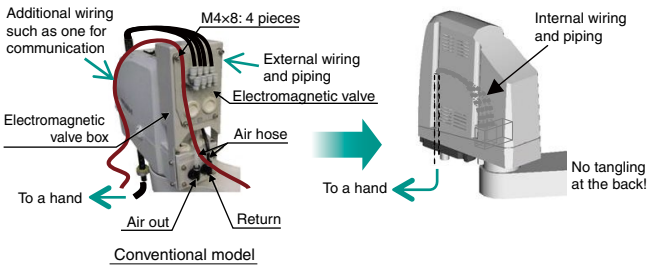
Strengthened axis wrist

Tolerable J4 axis inertia dramatically increased. Applies easily to multiple hands, offset hands, etc. **[5 times that of previous models (RH-20FH)]**



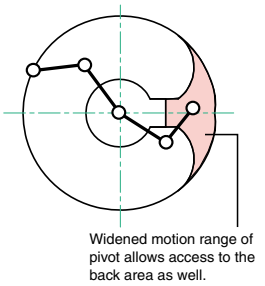
Cable interference proof

The tip of axis has a route for cables to be placed in a hand. It allows wiring and piping to the root of the hand. Since cables can be internally stored, it minimizes the interference of cable against peripheral devices. This eliminates the issue of entanglement of wires and pipes.



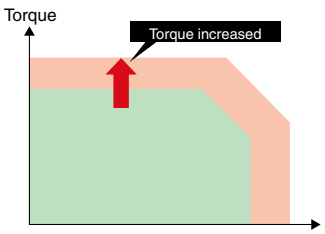
Full utilization of installation space

The motion range of pivot was significantly widened.
It enables 360° access, which adds more flexibility to consideration of the installation of robot.
In addition, a widened motion range removed the necessity for the troublesome hand changes. This eliminates unproductive operation and shortens cycle time.



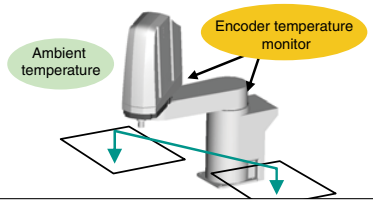
Highest-speed operation of its kind

An in-house developed motor, highly rigid arm and proprietary drive control technology enable high torque output with high speed rotation and the best performance of its kind. Continuous operating performance, which has been also improved, contributes to higher productivity by shortening cycle time.



Improvement of continuous operating performance

The employment of a motor developed in-house and the enhanced overload detection method has improved the continuous operation capability.
It enables 1.7 times higher transfer capability compared to conventional model (RH-6FH).
It is ideal for highly frequent operations.



The overload level of robot is optimized by calculating the load level based on actual environment of each axis of robot.

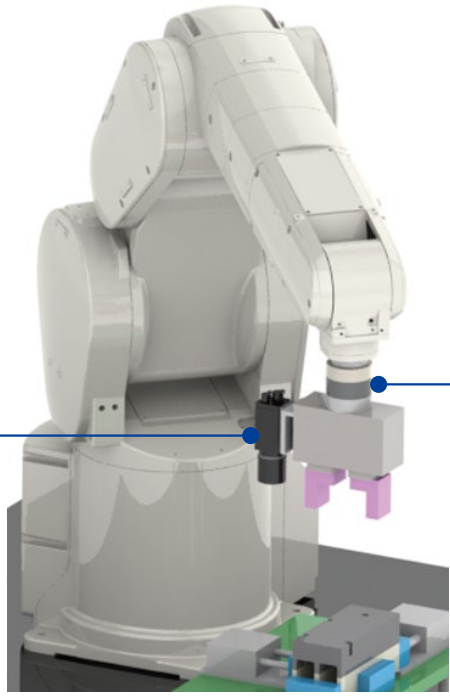
System configuration is strongly sup for MELFA robots focusing on their

2D Vision System (Manufactured by COGNEX)

Simple connection and easy setup

Simple connection via Ethernet.
Setup tool allows easy calibration.

1) Mitsubishi Electric's space-saving systems realize adaptation to the production of a wide variety of products, high accuracy and high-speed positioning at a low cost. Jig and device for positioning are no longer needed.
2) Measurements are possible without stopping workpieces on conveyors, and this helps to reduce cycle time.



2D Vision System (Manufactured by COGNEX)

In-Sight Vision system

(Manufactured by COGNEX: For Mitsubishi Electric FA devices)

The In-Sight EZ software developed exclusively for use with Mitsubishi Electric FA devices with enhanced linking to In-Sight, the vision system produced by COGNEX Corporation, offers better compatibility with FA devices, allowing it to be utilized more easily as a more user-friendly vision system.

Simplified settings using Easy Builder

Easy Builder allows connection to vision systems, setting of job (vision programs) settings, and calibration between the robot and vision system to be completed easily and quickly.

Simplified connection using Ethernet

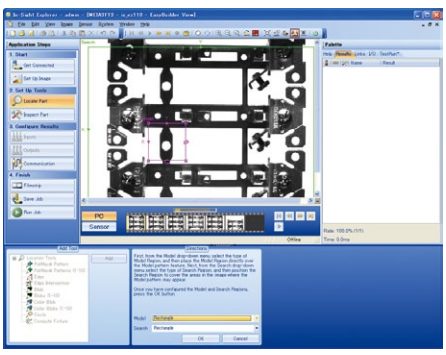
Up to three robots and seven vision systems can be connected together to the same system by Ethernet connection. Vision system information can be shared between multiple robots.

Simplified control using robot language

The included dedicated vision system commands enable vision system startup, job selection, and control of data receiving and other operations to be completed quickly and easily using a single command without any need for protocols.

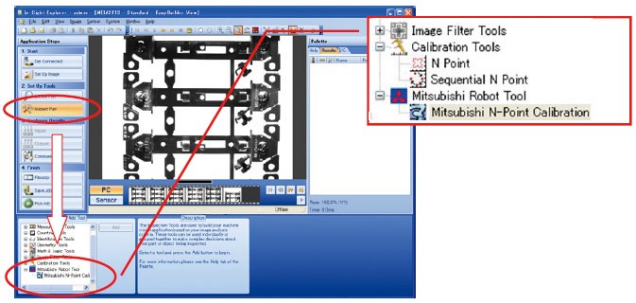
Simplified job editing

Jobs (Vision recognition programs) are created from the job editing screen. Jobs can be edited using condition settings and other data, eliminating the need for specialized knowledge of vision control commands and other programming instructions.



Simplified calibration

The calibration wizard allows settings used in converting workpiece positions recognized by the vision system into robot coordinate system coordinates easily and quickly.



ported by components developed only refined usability.

Force sensor

Realization of the processes which had been regarded as impossible before

It realizes processes such as highly accurate fitting process, mounting of uneven parts and inspection by force condition.

1) It enables pushing with a stable force, handling of uneven parts, assembling processes which had been hard to execute due to OK/NG evaluation based on force data.
2) Teaching process time can be shortened by easily evaluating contact condition which is invisible using real-time force data.

Force sensor set

Allows copy and fitting work to be completed in the same way a person would while the force applied to the hand is monitored.
Enables necessary work such as fine force adjustments and force detection to be completed.

Improved production stability

Enables parts to be inserted or attached without being damaged while absorbing shifts in position due to part variations and emulating the slight amounts of external force applied. Improved operating stability gained through position latches and retry processes when work operations fail. Log data can be used to manage quality control and analyze causes of work errors and other issues.

Simple control

Simple programs can be created using specialized robot language.

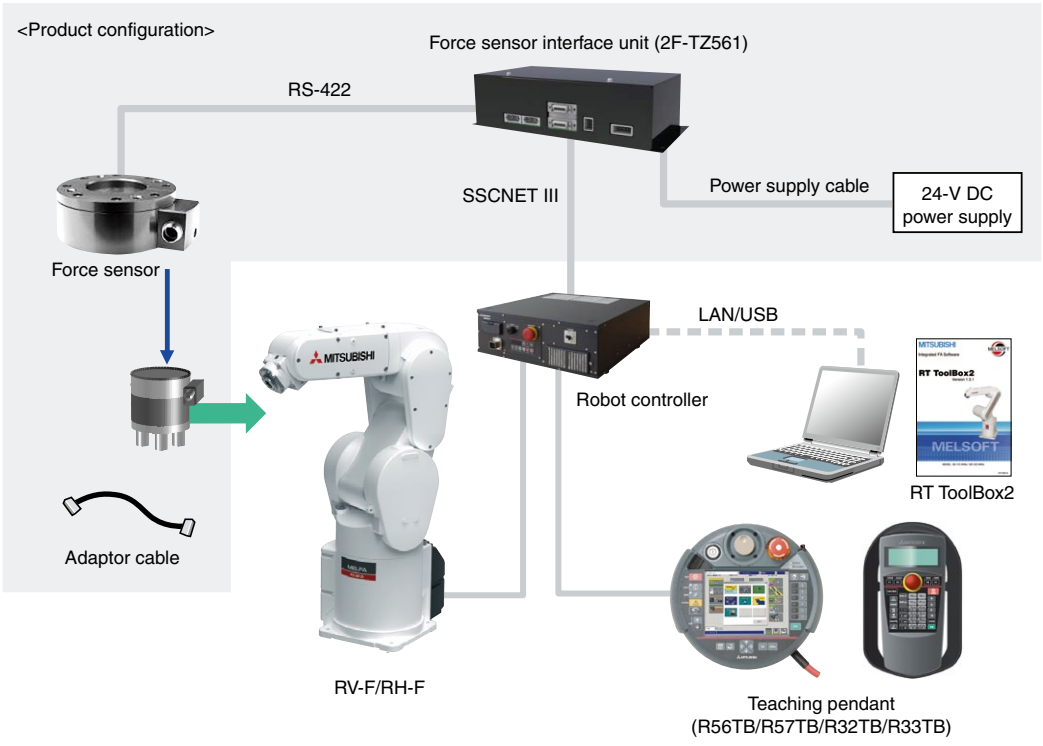
Allows assembly of more complicated configurations

Force detection during contact allows operating directions and applied force to be changed and interrupts to be executed under trigger conditions combining position and force information.

Simple operation

Work conditions can be checked and adjusted by viewing position and force data from the teaching box and graphs on RT ToolBox2.

System configuration



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eco Changes

for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.

MITSUBISHI ELECTRIC CORPORATION

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http://Global.MitsubishiElectric.com/

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