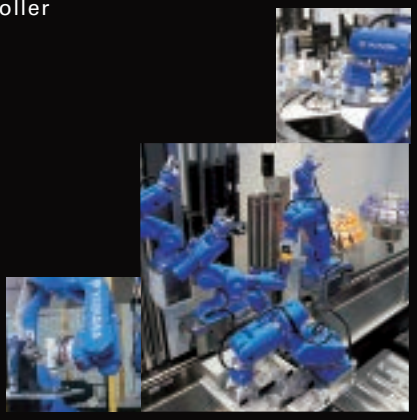
YASKAWA

Robot System Solutions

Multi-Purpose Application

MOTOMAN-GP Series

Compatible with YRC1000 Robot Controller



Solution
MOTOMAN-GP Series

Certified for
ISO9001 and
ISO14001

JAB
QMS Accreditation
R009

JQA-0813

JQA-EM0202

Robot System Solutions

MOTOMAN-GP Series

Find smart solutions for your production site with YASKAWA's cutting-edge robot systems.


Precision fitting


Picking, aligning


Transfer between/ within equipment


Polishing

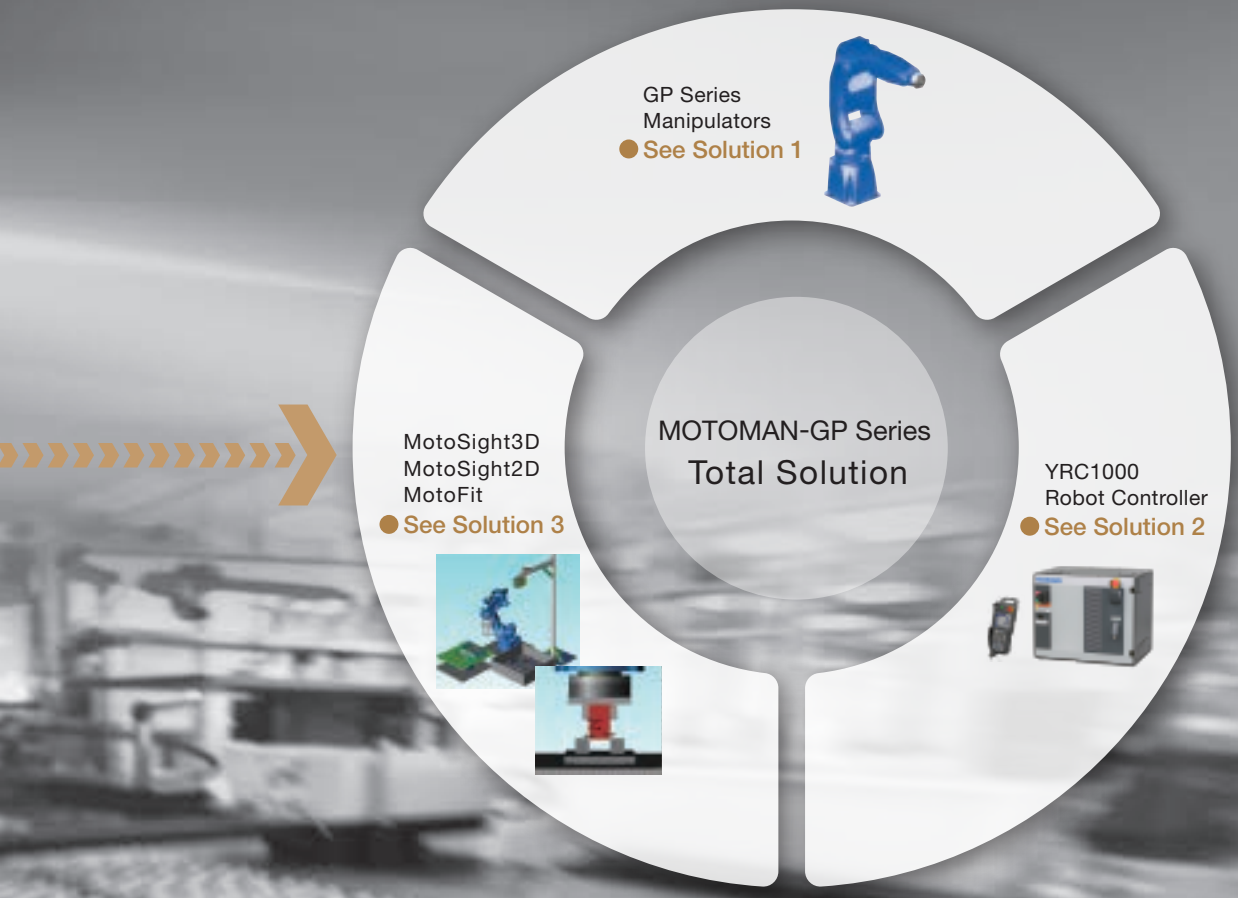

Assembly

YASKAWA has the answer

We can meet our customers' diverse needs with a wide range of functions and components.

Application examples

Bin picking of parts, fitting, assembly, polishing, and machine work.
See application examples on page 4 and 5.



GP7 GP8 GP12 YRC1000

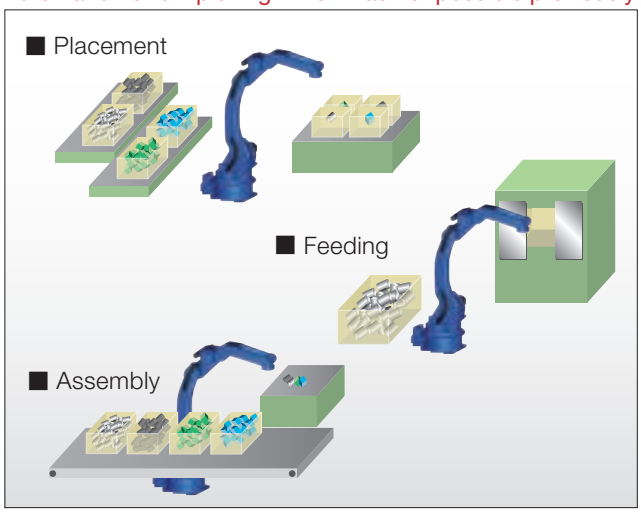
YASKAWA can meet the requirements of a wide range of applications with its cutting-edge robot systems.

Bin picking of parts

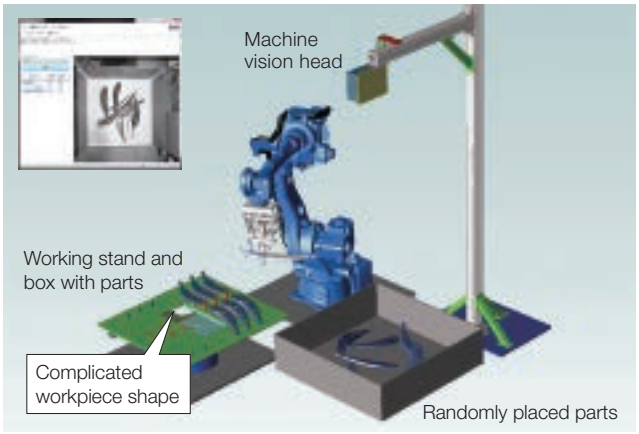
Full automation with 3D vision package "MotoSight3D"

Bin picking of parts can be automated as:
· Parts with complicated forms and greasy metal parts can be recognized and handled by MOTOMAN robots using MotoSight3D, YASKAWA's 3D vision package.
· Work required to register the different parts, which used to take days, can now be executed in approximately 4 hours.

Automation of bin picking which was not possible previously



Workpieces can easily be registered without programming. → Bin picking can now be completely automated.



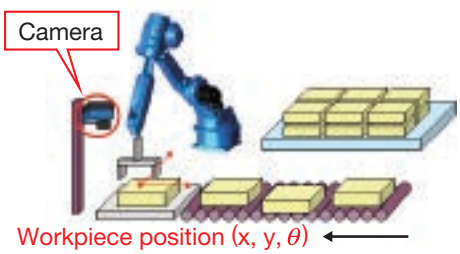
Picking from pallet, conveyor

Correction of workpiece position

The 2D vision package "MotoSight2D" eliminates the need for positioning mechanism

■ Picking from conveyor

· Die-cast aluminum product, cardboard cases, etc.

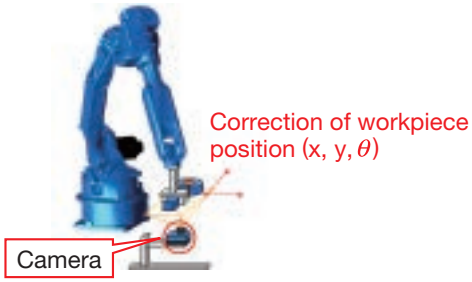


Removes necessity of complex positioning mechanism

System that operates correction by vision after conveyor stops without using conveyor synchronization.

■ Correction of workpiece position after picking

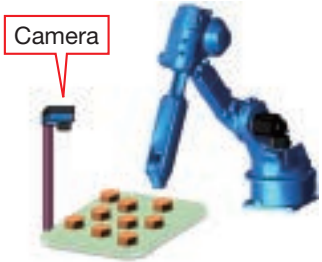
· Panel shape workpieces, connecting rods, etc.



■ Picking from pallet (multiple workpiece recognition)

· Applications requiring high-speed processing.

Detecting multiple workpieces with just one time imaging



Mirror-like polishing

Achieve polishing quality of skilled craftsmen without having to teach the manipulator

The YRC1000 robot controller is equipped (as a standard) with an application program for polishing workpieces. Moreover, the new controller has improved motion path accuracy, enabling smooth and high-quality polishing, which is comparable to the technique of a highly skilled craftsman.

Polishing product
(mirror-like polishing)

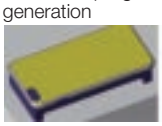
"Integration of robot technology with application technologies"

- **Higher speed** → Reduces time required for polishing.
- **Increased payloads** → Increases product value.
- **More working space** → Secures enough space for optimal robot postures.
- **Environmental consideration** → Provides countermeasures for dust and oil mists.

Integration

- **No teaching required** → Can be used by anyone.
- **Variety of polishing patterns** → Craftsmanship is included as a standard specification.

Automatic program generation



Different polishing patterns

Precision fitting (control by force tracking)

High-speed automation of precision fitting (which was difficult manually) with six-axis force sensor package "MotoFit"

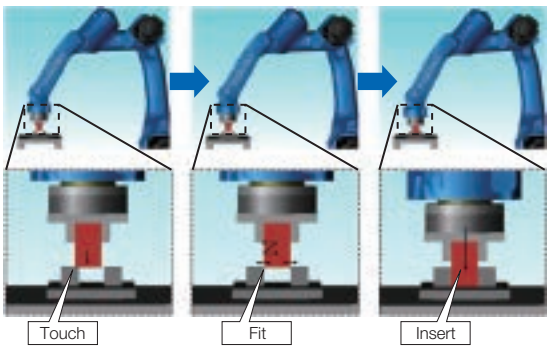
MotoFit, YASKAWA's six-axis force sensor, can be attached to the wrist section of the MOTOMAN robot. MotoFit detects changes in force that the robot arm is subjected to and feeds back the information to robot motions. This allows the robot to perform precision fitting, which involves sophisticated human hand movement, to smoothly search for the right position and angle at high speed.

Precision fitting function (search and insertion)

- ◎ Fitting time of 10 μm clearance gap and 20 mm depth is within 5 seconds (fastest in the industry).
- ◎ Parameter automatic tuning and monitoring functions reduced teaching time.
- ◎ Hole position search and biting prevention function improve reliability.

Three operation patterns have achieved high-speed fitting.

■ Touch ■ Search ■ Insertion



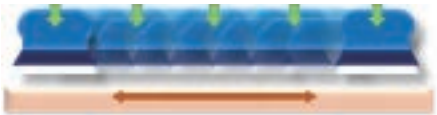
Force tracking and force change detection

- ◎ Detects beads (convex) and applies force only to beads to grind them down.

■ Polishing work (Removing beads)

- ◎ Enables the repetition of surface tracing motion with the application of pressure at a force that is specified by teaching.

■ Polishing work (pressing a workpiece against a grinder)
Can press at constant force even if grinder wears off.



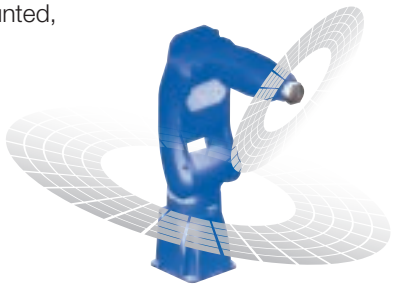
MOTOMAN-GP Series Robot : GP7 and GP8, Compact and High Speed

Customer needs

Increase productivity

Achieve high transfer capabilities with number 1 payloads, speeds, and wrist allowable moments in their classes

- A wide range of workpieces can be transferred and different grippers can be mounted, with 7 kg/8 kg payloads (class number 1) and 38% greater allowable moment.
- Speeds of all axes have been increased by 39% (max.).
- Acceleration/deceleration control has been improved to achieve maximum reduction of acceleration/deceleration times for all robot postures.



Customer needs

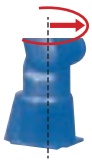
Make equipment compact

Slim and easy to use body and arm structure enabling efficient installation space

- Slim manipulator body requires minimum installation space (minimizes L and U axis offset).
- Power cable can be connected at the bottom section, which reduces interference with walls when compared with cable connections on the side of the manipulator.
- Increased maximum reach and horizontal reach enables manipulator to operate in wider work areas.
- Slim, straight, and symmetrical arm design minimize interference with peripheral devices, even in small spaces.
- Three-way solenoid valve can be installed inside the arm (optional), which provides a V-shape space and reduces motion limitations.

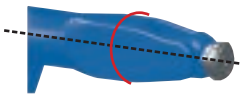
■ Reduced interference radius when S-axis is turning

Former model: MH5(L)SII
Interference radius 182 mm



New model: GP7 and GP8
Interference radius 140 mm

■ Reduced interference radius when the wrist is turning



Former model: MH5(L)SII Interference radius 73 mm
New model: GP7 and GP8 Interference radius 67 mm

Built-in three-way solenoid valve (optional)

Power cable connection on the side and bottom (optional) of the manipulator

Customer needs

Improve equipment installation, operation, and maintenance

High environmental performance

- The IP67-rated body and wrist are standard on the GP7 and GP8 models, providing strong protection against dust and coolant.

Easy-to-clean design

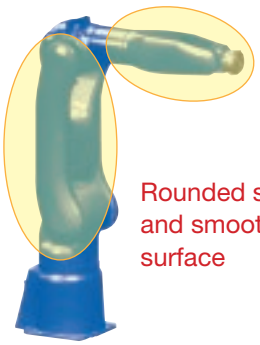
- Manipulator surface is designed to prevent adherence of dust.

Easy maintenance

- Zero position data can be saved without the need to connect to a battery when replacing wire harness.
- Number of cables and connectors have been reduced for better work efficiency.

Reduced wiring time

- Power cable is reduced to one cable, which reduces wiring time.



MOTOMAN-GP Series Robot: GP12, World's Highest Speed in its Class

Customer needs

Increase productivity

Achieve high transfer capability with number 1 payload, speed, and wrist allowable moment in its class

· Productivity of customers' equipment can be improved significantly with the robot's high speed (highest speed in 12 kg payload class).
· Acceleration/deceleration control has been improved to achieve maximum reduction of acceleration/deceleration times for all robot postures.
· Robot with a 12 kg payload can carry heavy objects and a double gripper can be attached to the arm.

Maximum speed has been increased by 15% (max.), compared with former model.

Customer needs

Make equipment compact

Slim hollow arm design reduces interference

· Hollow arm structure to store cables reduces operation restriction due to cable interference, simplifies teaching, and eliminates cable disconnection caused by interference.
· Slim wrist and curvy arm design minimizes interference with surrounding equipment.

Minimized interference radius of the wrist

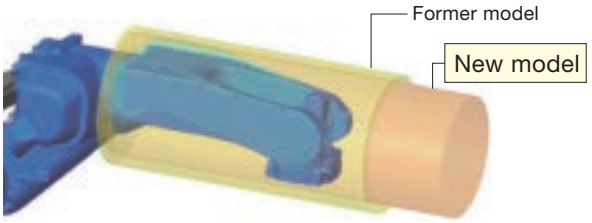
Former model: MH12
Interference radius 138 mm
New model: GP12
Interference radius 120 mm

■ Hollow arm

R-axis hollow arm: 50 mm dia.

T-axis hollow arm: 50 mm dia.

■ Reduced interference area



Customer needs

Improve equipment installation, operation, and maintenance

Easy set-up

· Only one cable is required, which reduces setup time.

Wrist structure with high environmental resistance

· The IP67-rated wrist is standard on the GP12 model.

Easy maintenance

· Zero position data can be saved without the need to connect to a battery when replacing wire harness.
· Number of cables and connectors have been reduced for better work efficiency.

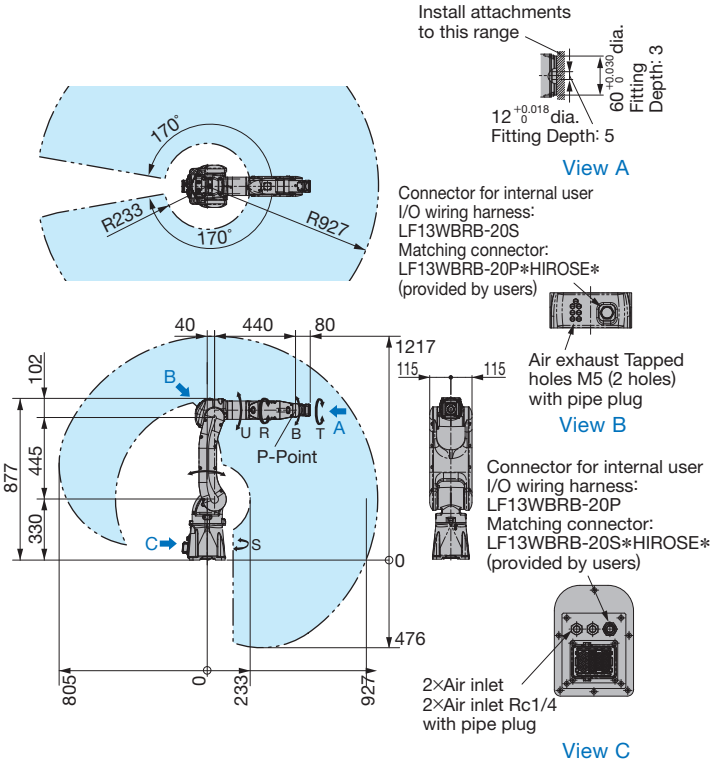
Reduced wiring time

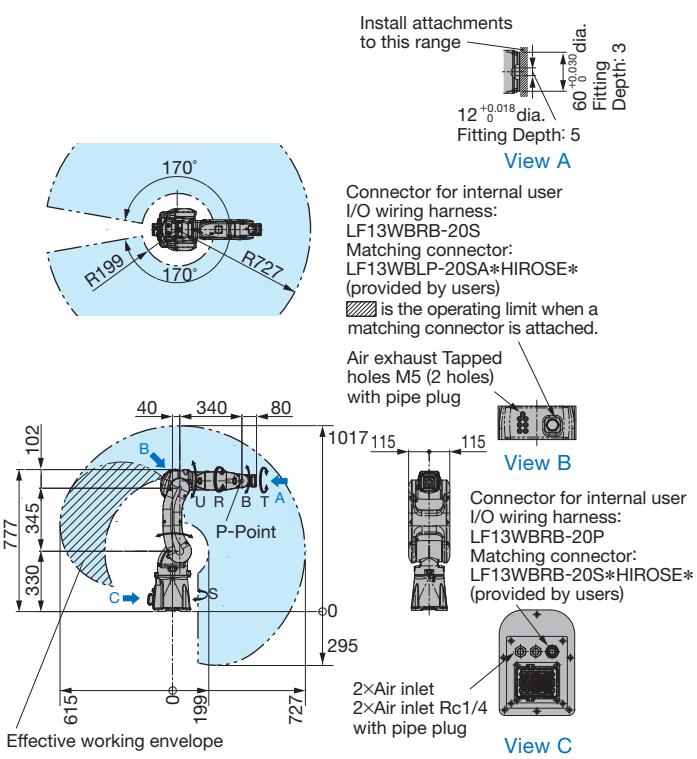
· Power cable is reduced to one cable, which reduces wiring time.

GP7

GP8

■Dimensions Units: mm : P-point Maximum Envelope

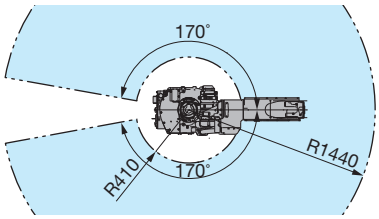


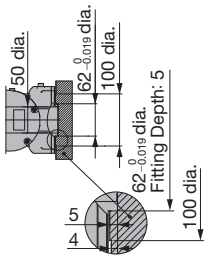


Specifications		GP7	GP8
Type		YR-1-06VX7-A00	YR-1-06VX8-A00
Controlled Axis		6 (vertically articulated)	6 (vertically articulated)
Payload*1		7 kg	8 kg
Repeatability*2		±0.03 mm	±0.02 mm
Range of Motion	S -axis (turning)	−170°−+170°	−170°−+170°
	L -axis (lower arm)	− 65°−+145°	− 65°−+145°
	U -axis (upper arm)	−116°−+255°	−113°−+255°
	R -axis (wrist roll)	−190°−+190°	−190°−+190°
	B -axis (wrist pitch/yaw)	−135°−+135°	−135°−+135°
	T -axis (wrist twist)	−360°−+360°	−360°−+360°
Maximum Speed	S -axis (turning)	6.54 rad/s, 375°/s	7.94 rad/s, 455°/s
	L -axis (lower arm)	5.50 rad/s, 315°/s	6.72 rad/s, 385°/s
	U -axis (upper arm)	7.15 rad/s, 410°/s	9.07 rad/s, 520°/s
	R -axis (wrist roll)	9.59 rad/s, 550°/s	9.59 rad/s, 550°/s
	B -axis (wrist pitch/yaw)	9.59 rad/s, 550°/s	9.59 rad/s, 550°/s
	T -axis (wrist twist)	17.45 rad/s, 1000°/s	17.45 rad/s, 1000°/s
Allowable Moment	R -axis (wrist roll)	17 N·m	17 N·m
	B -axis (wrist pitch/yaw)	17 N·m	17 N·m
	T -axis (wrist twist)	10 N·m	10 N·m
Allowable Inertia (GD²/4)	R -axis (wrist roll)	0.5 kg·m²	0.5 kg·m²
	B -axis (wrist pitch/yaw)	0.5 kg·m²	0.5 kg·m²
	T -axis (wrist twist)	0.2 kg·m²	0.2 kg·m²
Approx. Mass		34 kg	32 kg
IEC Protection Class		Body: IP67, Wrist: IP67	
Ambient Conditions	Temperature	0°C to +45°C	
	Humidity	20% to 80%RH (non-condensing)	
	Vibration	4.9 m/s² or less	
	Others	Free from corrosive gasses or liquids, or explosive gasses Free from excessive electrical noise (plasma)	
Power Requirements*3		1 kVA	
Mounting*4		Floor, wall, ceiling, tilt	

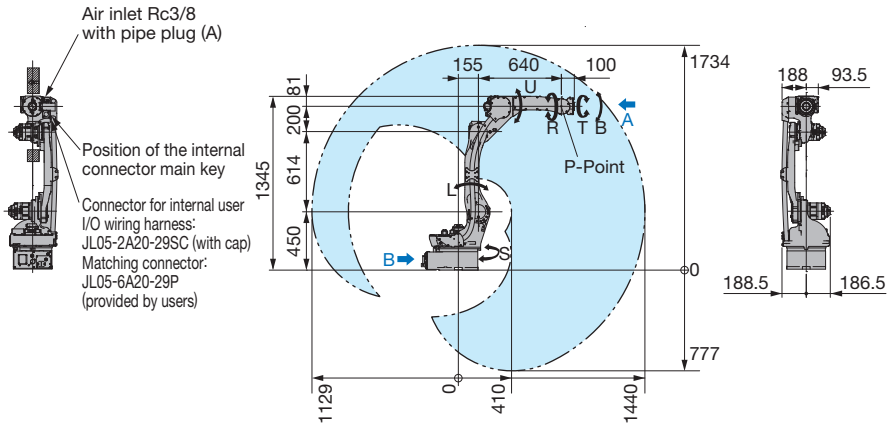
∗1: U arm payload capacity will vary according to payload carried by wrist.
∗2: Conforms to ISO 9283.
∗3: Varies in accordance with applications and motion patterns.
∗4: There are motion limitations on S-axis for wall, tilt mounting type.
Note: SI units are used for the specifications.

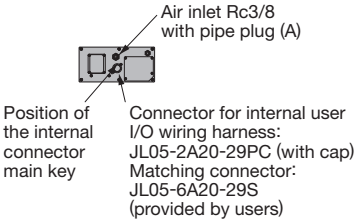
GP12





View A





View B

Specifications		GP12
Type		YR-1-06VXH12-A00
Controlled Axis		6 (vertically articulated)
Payload*1		12 kg
Repeatability*2		±0.08 mm
Range of Motion	S -axis (turning)	−170°−+170°
	L -axis (lower arm)	− 90°−+155°
	U -axis (upper arm)	−175°−+240°
	R -axis (wrist roll)	−200°−+200°
	B -axis (wrist pitch/yaw)	−150°−+150°
	T -axis (wrist twist)	−455°−+455°
Maximum Speed	S -axis (turning)	4.53 rad/s, 260°/s
	L -axis (lower arm)	4.01 rad/s, 230°/s
	U -axis (upper arm)	4.53 rad/s, 260°/s
	R -axis (wrist roll)	8.20 rad/s, 470°/s
	B -axis (wrist pitch/yaw)	8.20 rad/s, 470°/s
	T -axis (wrist twist)	12.2 rad/s, 700°/s
Allowable Moment	R -axis (wrist roll)	22 N·m
	B -axis (wrist pitch/yaw)	22 N·m
	T -axis (wrist twist)	9.8 N·m
Allowable Inertia (GD²/4)	R -axis (wrist roll)	0.65 kg·m²
	B -axis (wrist pitch/yaw)	0.65 kg·m²
	T -axis (wrist twist)	0.17 kg·m²
Approx. Mass		130 kg
IEC Protection Class		Body: IP54, Wrist: IP67
Ambient Conditions	Temperature	0°C to +45°C
	Humidity	20% to 80%RH (non-condensing)
	Vibration	4.9 m/s² or less
	Others	Free from corrosive gasses or liquids, or explosive gasses Free from exposure to water, oil, or dust Free from excessive electrical noise (plasma)
Power Requirements*3		1.5 kVA
Mounting*4		Floor, wall, ceiling, tilt

*1: U arm payload capacity will vary according to payload carried by wrist.
*2: Conforms to ISO 9283.
*3: Varies in accordance with applications and motion patterns.
*4: There are motion limitations on S-axis for wall, tilt mounting type.
Note: SI units are used for the specifications.

YRC1000 Robot Controller

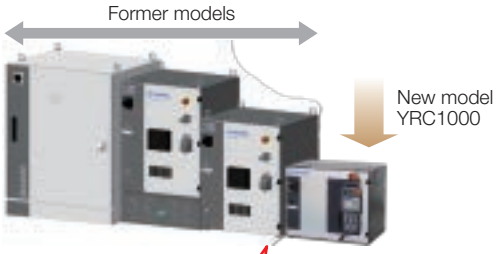
Four Features

Customer needs

Make equipment compact

Smallest size in the world reduces installation space

This 125 L compact size controller does not require a transformer and has built-in external axis amplifiers for three axes.



Realized this size by internalizing three external axes, and removing need for transformer (transformer-less).

Customer needs

Standardization of equipment

Global standardization (Controller for use worldwide)

- Common size for use in Japan, Asia, Europe, and the U.S.
- Available with specifications for Europe (CE certified) and North America (UL certified).
- Transformer for power supply voltage (380 VAC to 480 VAC) is not required for use in Asia, Europe, and the U.S.

Customer needs

Improve work efficiency

New motion control (high precision and high speed)

- Reduce time required for confirmation process with minimized track changes caused by differences in motion speeds.
- Reduce time for teaching since it is now possible to specify the distance where the corner operation should start.
- Successfully carry out corner operation under suppressed speed changes with simple settings.

Red: playback track
Green: speed override track (50%)
Blue: test operation track

Customer needs

Improve work efficiency

Lighter programming pendant with better operability

- Weighs only 730 g, the lightest programming pendant in its class, with improved cable installation.
- Can confirm robot positions and postures on the 3D robot model display (optional).
- Touch screen allows intuitive operation to easily move the cursor and scroll.

Superlative Performance and Design

YRC1000

Programming Pendant

YRC1000 Robot Controller

■ YRC1000 Robot Controller Specifications

Items	Specifications
Configuration	Dust proof IP54 (area of backside duct fan: IP2X)
Dimensions	598 (W)×427 (D)×490 (H) mm, 125 L
Approx. Mass	65 kg max. (External axis amplifiers for up to three axes can be built in.)
Cooling System	Indirect cooling
Ambient Temperature	During operation: 0°C to +45°C, During storage: −10°C to +60°C
Relative Humidity	90% max. (non-condensing)
Altitude	2000 m (with temperature derating) Derating condition of over 1000 m: max. ambient temperature decreases 1% per 100 m.
Power Supply	Japan: three-phase 200 VAC to 240 VAC (+10% to −15%), 50/60 Hz (±2%) Overseas: three-phase 380 VAC to 480 VAC (+10% to −15%), 50/60 Hz (±2%) (neutral grounding)
Grounding	Grounding resistance: 100 Ω or less for 200-V class, 10 Ω or less for 400-V class
Digital I/Os	Specialized signals: 19 inputs and 6 outputs General signals: 40 inputs and 40 outputs (32 transistor outputs, 8 relay outputs)
Positioning System	Serial communications (absolute encoder)
Programming Capacity	JOB: 200,000 steps, 10,000 instructions CIO ladder: 20,000 steps max.
Expansion Slots	PCI express: 2 slots
LAN (Connection to Host)	2 (10BASE-T/100BASE-TX)
Interface	RS-232C: 1ch
Control Method	Software servo control
Drive Units	SERVOPACK for AC servomotors
Painting Color	Front panel: light gray (Munsell notation N7.7 or equivalent) Body except front panel: dark gray (Munsell notation N3 or equivalent)

■ Programming Pendant Specifications

Items	Specifications
Dimensions	152 (W) × 53 (D) × 299 (H) mm
Approx. Mass	0.730 kg
Material	Reinforced plastics
Operation Device	Select keys, axis keys, numerical/application keys, mode selector switch with keys (mode: teach, play, and remote), emergency stop button, enable switch, compact flash card interface device (compact flash is optional.), USB port (USB2.0, 1 port)
Display	5.7-inch TFT color LCD, touch panel VGA 640×480 pixels (alphanumeric characters, Chinese characters, Japanese letters, and others)
IEC Protection Class	IP54
Cable Length	Standard: 8 m, max.: 36 m (with optional extension cable)

Extensive Optional Software Lineup

3D Vision Package

MotoSight3D

Bin picking, which used to be impossible with robots, can be automated with the high-performance 3D vision package.

Range of detectable workpieces have increased

Works exceptionally well with metal workpieces

- ◎ Greasy parts with high reflection of light can be handled.
- ◎ Workpiece with curved surface or with complicated structure can be handled. Note: Optimal for pressed parts for automobile.

Highly accurate detection capability

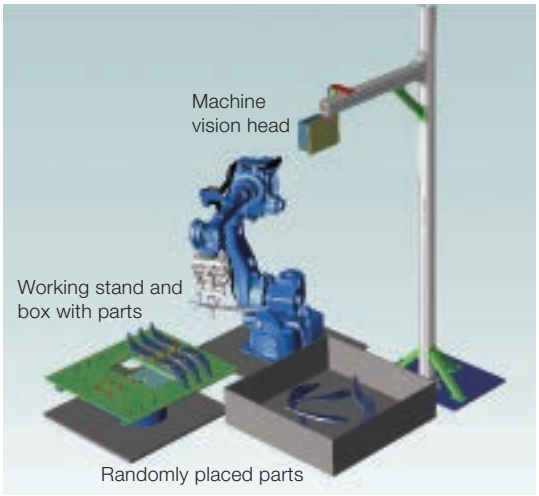
Reduces the number of processes

- ◎ 3D position posture (6 degree-of-freedom) can be detected for one measurement.
- ◎ Temporary placing table or the other positioning sensor is not needed.

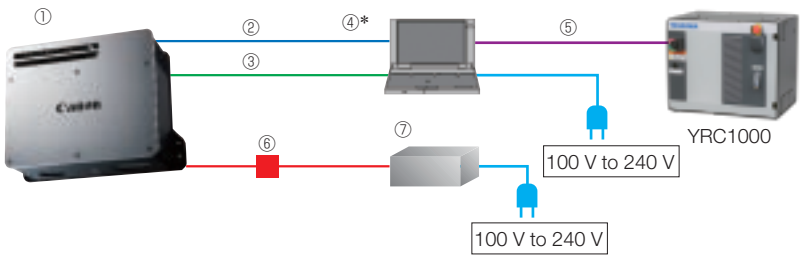
Very simple setting operation

Reduces setup time

- ◎ Workpiece can be registered by inputting the CAD data and imaging the piled parts.



■ System Configuration



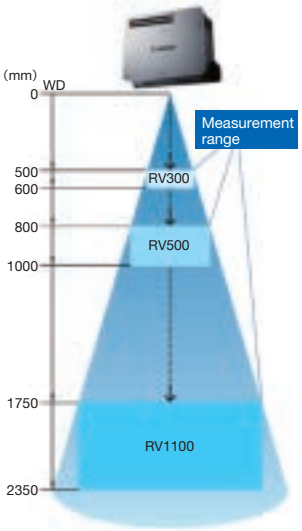
*: Please contact us if you are planning to use other PCs (general PCs, etc.). We will provide information on how to select PCs.

■ Device composition table

NO.	Name	Specification
①	Machine vision head	RV1100/RV500/ RV300
②	Communications cable (PC - sensor)	Cable length: 16 m (option: 36 m)
③	Vision cable (PC - sensor)	Cable length: 16 m (option: 36 m)
④*	PC (option)	Industrial computer
⑤	Communications cable (PC - YRC1000)	Cable length: 10 m
⑥	Power cable (thin)	Cable length: 5 m
	Power cable (thick)	Cable length: 10 m
⑦	Power source box and cable	—

■ Machine Vision Head Specifications

Items		RV1100	RV500	RV300
Measurement	Measurement distance	1750 mm to 2350 mm	800 mm to 1000 mm	500 mm to 600 mm
	Measurement range	1160 mm × 1160 mm × 600 mm (H)	540 mm × 540 mm × 200 mm (H)	340 mm × 340 mm × 100 mm (H)
	Target minimum parts size Note: Necessary projection area	45 mm × 45 mm	20 mm × 20 mm	10 mm × 10 mm
Time	Measurement + recognition time	2.5 s	1.8 s	1.8 s
	Measurement cycle	5.0 s	3.0 s	3.0 s
Main unit	External dimensions Note: exclude protrusions.	252 (W) × 206 (D) × 124 (H) mm		
	Weight	6.4 kg		
Recognition	Recognition method	3D CAD matching		
	Repeatability	±0.5 mm	±0.15 mm	±0.1 mm
	Number of types to be registered	200 types		
Function (standard)	Empty palette judgment function	Function to judge whether the palette is empty or not		
	Palette measurement function	Function to measure the position of thrown-in palette		
	Interference check function	Function to detect the interferences between the hand and the workpiece or between the hand and the palette		
	Calibration function	Function to perform the calibration of the robot and the machine vision head		
	Exposure time automatic adjustment function	Function that eliminates gloss of industry components/parts, and halation due to oil adhesion		

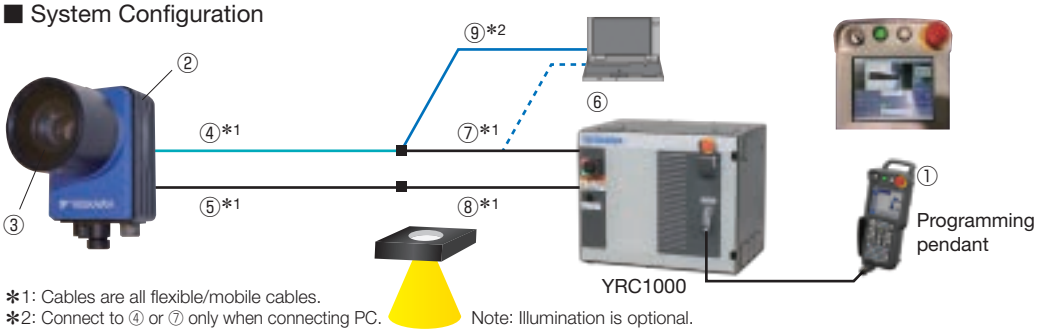


2D Vision Package

MotoSight2D

MotoSight2D is a package enabling to operate vision by PP with YASKAWA's own software.

■ System Configuration



*1: Cables are all flexible/mobile cables.
*2: Connect to ④ or ⑦ only when connecting PC.
Note: Illumination is optional.

■ Device composition table

NO.	Name	Specification
①	MotoSight2D (PP application + MotoPlus + macro job)	Set up before shipping
②	Camera (built-in image processing device, with IP67 resin lens cover)	Select Entry/Standard/High specification
③	Lens	Focal length: 9 mm/12.5 mm/16 mm/25 mm/50 mm
④	Camera communications cable	Cable length: 5 m
⑤	Camera power cable	Cable length: 5 m
⑥	Customization of YRC1000 controller for MotoSight2D functions	Attaching connector panel, wiring (Ethernet) of power/communications cables
⑦	Camera communications extension cable	Cable length: 5 m (standard)/15 m/30 m (option) (total cable length up to 35 m)
⑧	Camera power extension cable	Cable length: 5 m (standard)/15 m/30 m (option) (total cable length up to 35 m)
⑨	Cable for PC connection	Cable length: 0.5 m (connect to camera communications cable)

Three camera models Select model depending on use.

Models		Applications	Resolution	CPU Speed ratio	Image processing functions
Entry model MS100	Corresponds to In-Sight 7050-01	· Workpiece not needing high precision Ex: automobile parts, etc	800 × 600 pixel	× 1.0	COGNEX Limited tool set
Standard model MS200	Corresponds to In-Sight 7200-11	· High-speed processing · General 2D vision Ex: highly precise positioning, articles of food, automobile parts which were polished, etc	800 × 600 pixel	× 3.0	COGNEX Full tool set
High-spec model MS300	Corresponds to In-Sight 7402-11	· Wide field, highly precise Ex: correction of large workpieces	1280 × 1024 pixel	× 6.0	COGNEX Full tool set

Six-axis Force Sensor Package

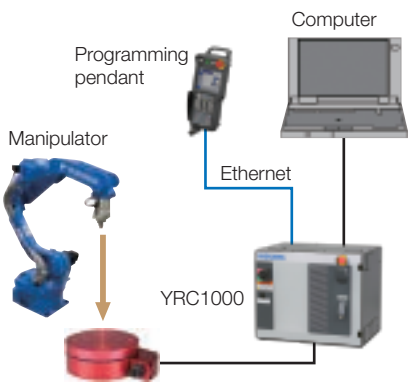
MotoFit

Changes in force that robot is subjected to are detected by six-axis force sensor and fed back to robot movements.

■ Force Sensor Specifications

Items		Rating 200N-IP compatible product	Rating 1000N-IP compatible product
Model		WEF-6A200-4-RC24-YB3	WEF-6A1000-30-RC24-YB3
Rated mass	Fx, Fy, Fz	200 N	1000 N
	Mx, My, Mz	4.0 N·m	30 N·m
Power supply voltage		24 VDC	
Sampling frequency		2 kHz	
IEC Protection Class		IP65	
EMC directive compliance		EN61000-6-4, EN61000-6-2	
Shock resistance		50 G (number of times: 3, status: no-load)	
Vibration resistance		5 G (10 kHz to 2 kHz, X/Y/Z: 25 hours each, status: no-load)	
Dimension		80 dia. mm × 32.5 mm (H)	90 dia. mm × 40 mm (H)
Mass		360 g	580 g

■ System Configuration



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LITERATURE NO. CHEP C941111 00A <0>-0

Published in Japan August 2016
16-8-43