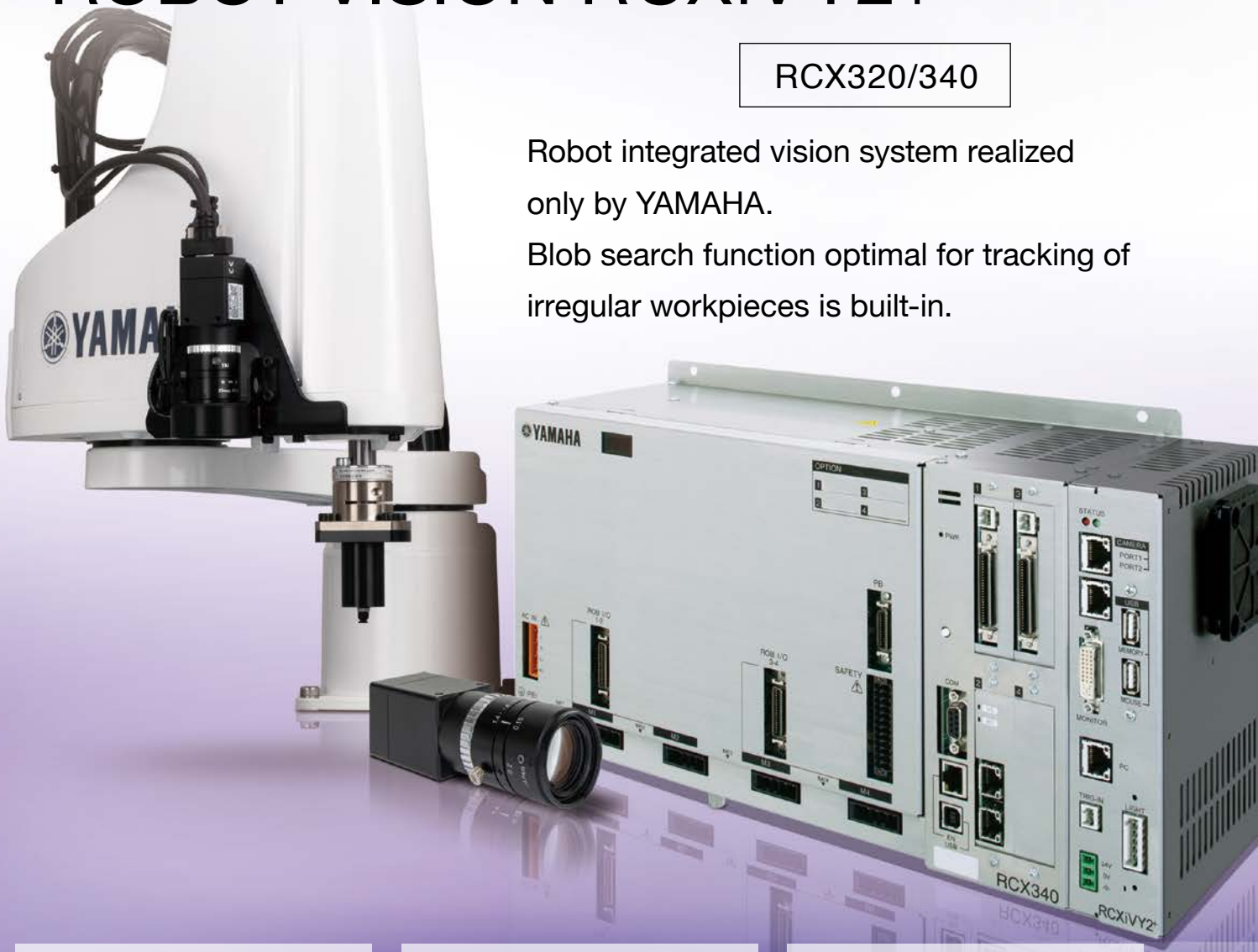
ROBOT VISION RCXiVY2+

RCX320/340

Robot integrated vision system realized only by YAMAHA.
Blob search function optimal for tracking of irregular workpieces is built-in.



Simplicity

Setup is completed as little as eight minutes after power-on.
Auto-calibration makes setup easy.

Sophistication

With up to five million pixels, a variety of workpieces can be supported.
Improve throughput to 100 CPM with conveyor tracking.

Assurance

Comprehensive support covers everything from camera image acquisition to the operation of the gripper and robot.
With support that only the robot manufacturer can provide, you can relax.

For customers who consider to replace "iVY2" with "RCXiVY2+"

Workpieces that have been able to be recognized by the iVY2 system can also be detected by the RCXiVY2+ system under the same conditions without changing the installation position.
Therefore, it is not necessary to evaluate the workpieces again.
However, the exposure time and aperture may need to be adjusted.
In addition, since the installation hole positions of the camera are changed, the plate of the installation section needs to be changed.

Camera	Parts registration	Search time reduced by	Maximum cable length	Monitoring
400,000 to 5 million pixels	254 types	Approximately 50 % less	15 m	Monitor output is provided

* Time depends on the workpiece.

Solutions RCXiVY2+ can provide:

Reducing teaching process time

Robot teaching work requires a lot of labor and time. The RCX-iVY2+ system acts as “robot eye”. The final fine positioning can be automated and greatly reduce the teaching time that was required for the conventional models.

Simplified positioning process

Reducing positioning process time in frequent lot change in small lot production.
Cost in preparation, control, and switching positioning jigs can be reduced.

Conveyor tracking

With a feedback from encoder of a conveyor RCXiVY2+ can do pick & place following conveyor move.

Yamaha’s comprehensive support of Robot and Vision

Yamaha’s integrated robot vision system. It means Yamaha supports both robot and vision system seamlessly.
If you have any questions and don’t know if it is robot or vision related? Simply contact a Yamaha representative. We have answers.

Random workpieces need to be handled.

With position detection function of RCXiVY2+, pick & place operation of random shaped parts from parts feeder or pallet can be simplified.

RCXiVY2+ features:

- **Adjusting parts orientation on the fly**
- **Conveyor follower**
- **Searching randomly placed parts**
- **Top/bottom judgement**
- **OK/NG judgement**

POINT 1

High speed positioning of irregular shaped parts (foods or clothes)

Blob search function

Suitable for pick & place or detection of parts with wide tolerance in shape and size, or high speed counting.
Detection speed is 2 to 10 times faster that edge detection.


POINT 2

Suitable for parts detection and high volume parts count

Application examples

- Detection of electronics components on PC board
- Detection of accessories in package
- Counting of the number of bottles in pallet
- Detection of food labels
- Detection of screws and washers that secure parts
- Checking drilled holes
- Counting of electronics components

*Subject to application and conditions.

POINT 3

Overlap can be eliminated.

Overlapped workpieces are recognized and they can be excluded from the search target.

POINT 4

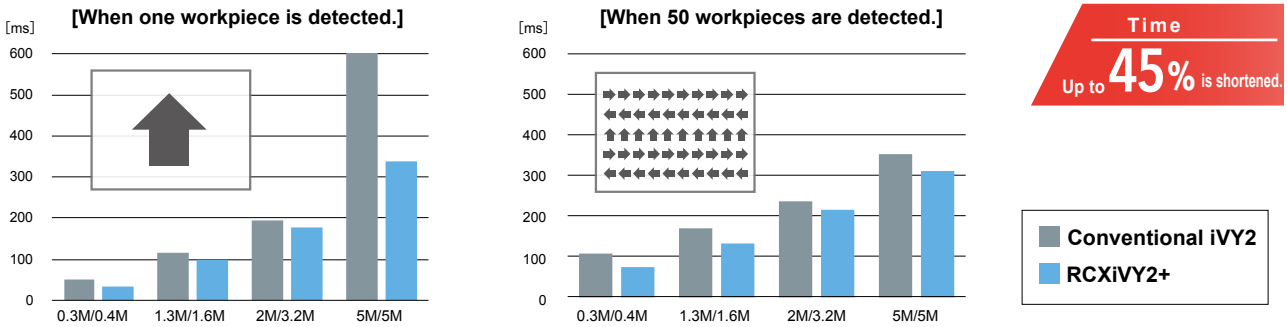
Detection time is shortened up to 45%.

By adopting a high-performance camera and improving the camera frame rate and CPU capability, detection time is reduced 8 to 45% while the resolution is improved.

CMOS camera

- Improved camera pixels
- Improved camera frame rate
- Improved CPU

Comparison of search time



POINT 5

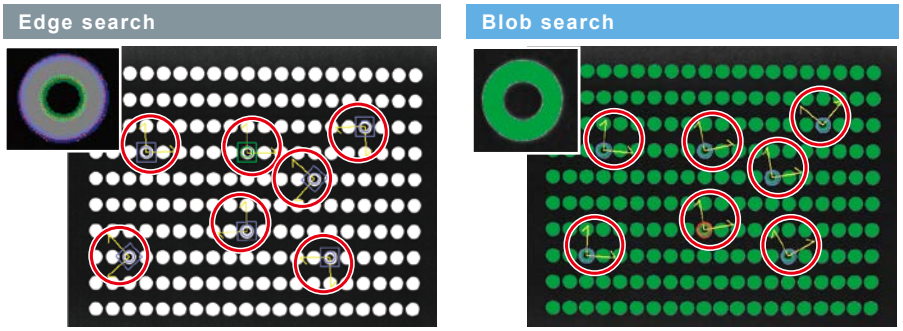
Detection with Speed

Comparing with edge search, blob search speed is 2 to 10 times faster.

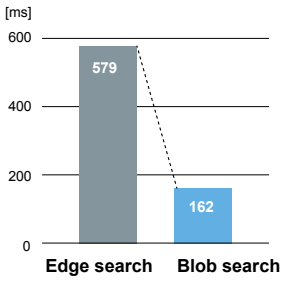
Search speed
Up to 10 times faster

Comparison of edge search and blob search

*** Only doughnut shape workpieces are detected.**



[Comparison of search speed]



POINT 6

Code recognition function

Codes such as QR codes, data matrix codes, and barcodes can be recognized.
This code recognition function is optimal for applications that change the operation corresponding to the code contents such as traceability management, workpiece sorting, and tracking change of sealing. It is not necessary to separately purchase a handy terminal or code reader. Troublesome communication control is also not needed.

[Supported codes]
- QR code
- Data matrix code
- Barcode (JAN/EAN-13 JAN/EAN-8 ITF NW7 CODE39 CODE128)

* Up to 255 characters can be read. Only alphanumeric characters and symbols are supported. (2-byte characters such as HIRAGANA and KANJI characters cannot be read.)

POINT 7

Automatic image save function/History image function

Automatic image save function

Images are automatically saved to a USB memory when search is executed.
This function is very useful when you want to go back in time to check captured images during operation or debugging or when you want to save images for traceability purposes.
A USB connectable SSD or HDD can also be used.

[Parameter]

Image save mode	All images / NG images / Disabled
Image size	Full size / Reduced size (320 x 240 pix.)
Overwrite save	Disabled / Enabled (The images are deleted from the oldest image when enabled.)

[Number of images that can be saved]

Number of images that can be saved when the memory size is 128 GB.

Number of camera pixels	Image size	Number of images that can be saved
0.4 million pixels	0.4MB	327,680
1.6 million pixels	1.6MB	81,920
3.2 million pixels	3.2MB	40,960
5 million pixels	5.0MB	26,214
Reduced size	0.08MB	1,638,400

Number of images that can be saved = Memory size / Image size
81920 images can be saved by 1.6 million pixels camera when 128 GB memory is used.
When the cycle time is 3 seconds, images for 68 hours can be saved.

Connector for USB memory

A connector that connects a USB memory to save images.
This connector is used for the automatic image save function.

USB connector for mouse

A USB connector that connects a mouse to operate an external monitor.
This connector is used for the history image function.

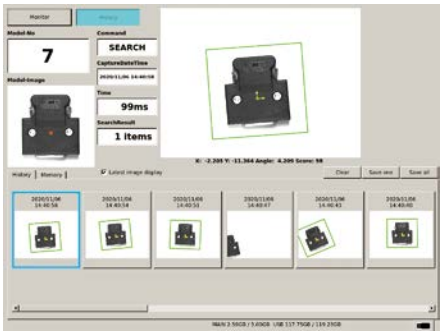
Monitor output connector

A connector that outputs images captured by the camera to a monitor.

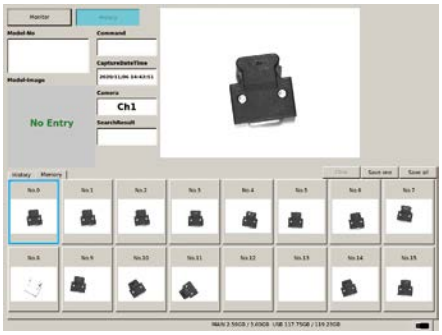
History image function

Images can be displayed on an external monitor during searching. The images and search results can be checked retrospectively with a USB mouse connected.

Past search images and results are checked.



Images in the memories (No. 0 to 15) are checked.



[Number of images that can be saved]

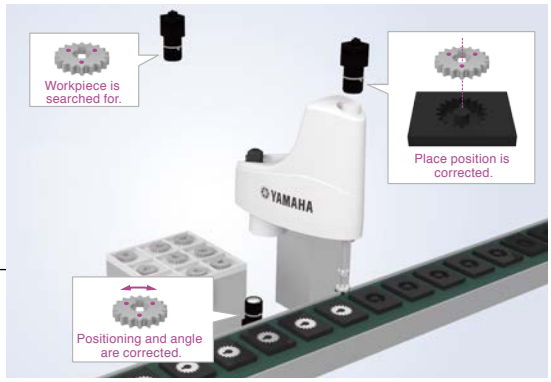
Number of camera pixels	Image size	Number of images that can be saved
0.4 million pixels	0.4MB	1250
1.6 million pixels	1.6MB	312
3.2 million pixels	3.2MB	156
5 million pixels	5.0MB	100

Area for history images 500 MB
Number of images that can be recorded to the history = 500 MB / Image size

POINT 8

Connection of multiple cameras

By controlling multiple cameras with one controller, multiple processes such as component supply, position correction, and mounting can be performed by one robot and controller.
This makes it possible to dramatically improve the setup man-hours prepared for each component type and contributes to improvement of production efficiency.

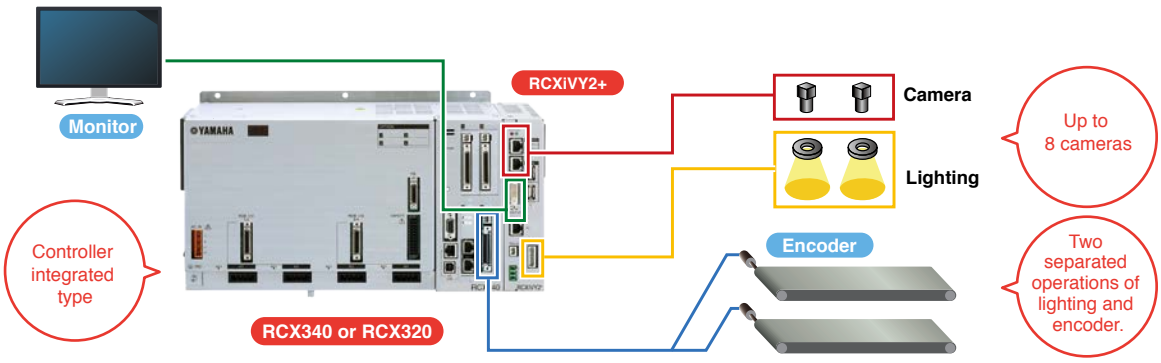


[Application using three cameras]

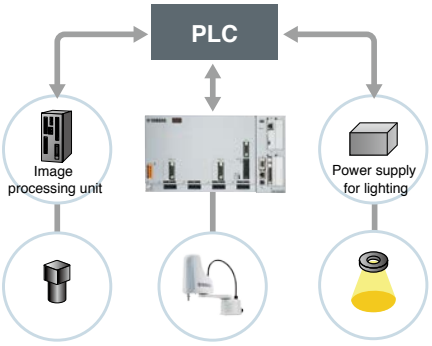
① Workpiece supply position is corrected using the downward camera.
② Workpiece positioning or angle is corrected using the upward camera.
③ Place position is corrected using the downward camera.

POINT 9

Robot controller integrated type



Typical Robot Vision setup



1 Time consuming robot coordinates alignment.
2 Need to calculate compensation for moving camera setup.
3 Operation deviation between the camera and robot due to communication time.
4 Adjustment of communication format is needed.

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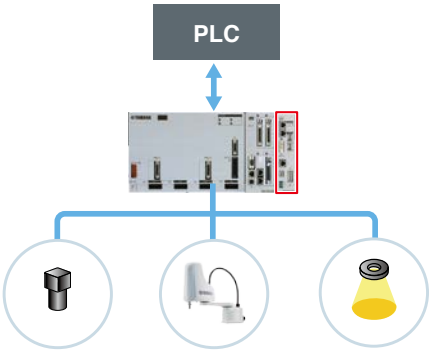
- Handling not easy
- Installation and setup costs are high.
- Robot issue or vision issue? Who to call?

RCXiVY2+ system



1 Simple calibration function is incorporated.
2 Coordinates are corrected automatically even when the camera moves.
3 High-speed connections through dedicated bus line.
4 Controller is incorporated to provide the central operation.
5 Applicable to all models of YAMAHA robot lineup.

○

- Easy to use
- Various applications are supported using easy operation.
- Cost reduction by reducing work steps.
- Robot and vision supported by Yamaha

Typical Robot Vision setup

```
MOVE P, P9
OFF LINE
SEND (* *) TO CMU
SEND CMU TO P10
ON LINE
MOVE P, P10
```

Communication with image processing unit

RS-232C

Program of image processing unit ⟷ Program of host PLC

Camera and robot have separate programs

RCXiVY2+ system

```
MOVE P, P9
VSEARCH 1,2,0      ——— Searches for workpiece.
P10=VGETPOS(0)     ——— Reads the point.
MOVE P, P10        ——— Moves to this point.
```

POINT
- No communication time lag
- Needs only few command lines.
- Simple and easy to understand

Centralized control using only the robot program

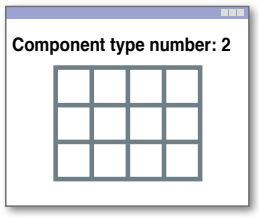
Examples of program commands

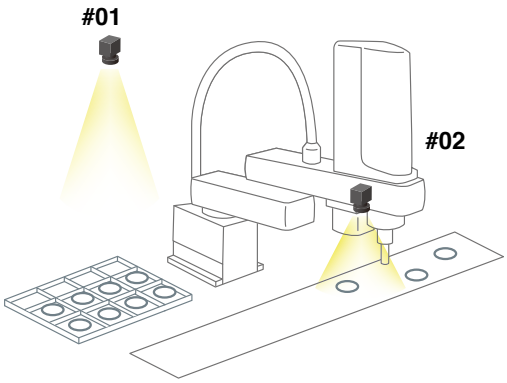
VSEARCH ・・・ Detect parts with designated camera

Camera and component type to be used for detection and the calibration data to be used can be switched with one command.

VSEARCH 1, 2, 1

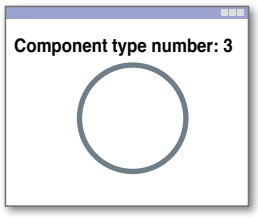
- Camera: 1
- Component type number: 2
- Calibration data: 1





VSEARCH 2, 3, 2

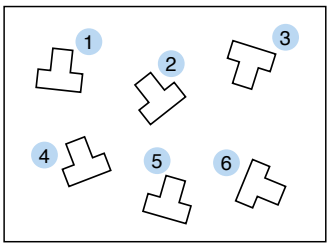
- Camera: 2
- Component type number: 3
- Calibration data: 2



VGETPOS ・・・ Acquires the coordinates of the detected workpieces.

The search results can be substituted into the point coordinates directly.

VSEARCH 1, 2, 1 ・・・ Detects the workpieces.
N = VGETCNT ・・・ Substitutes the number of detected workpieces.
FOR J = 0 TO N-1
P[J] = VGETPOS (J) ・・・ Acquires the workpiece coordinates.
NEXT J



VGETPOS (0) → Coordinates of 1
VGETPOS (1) → Coordinates of 2
VGETPOS (2) → Coordinates of 3
VGETPOS (3) → Coordinates of 4
VGETPOS (4) → Coordinates of 5
VGETPOS (5) → Coordinates of 6

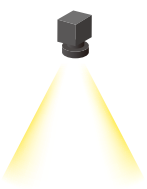
* The order to substitute into VGETPOS can be selected from the following.
1) Score order, 2) X coordinate, and 3) Y coordinate

LVOLUME ・・・ Intensity of light is adjustable from 0 to 100% range

In detection mode intensity of light can be adjusted with one command. Detection can be repeated with adjusted intensity.

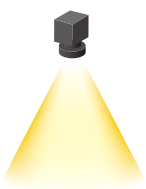
With a robot program of RCXiVY2+, retry detection with adjusted light intensity can be easily performed

・Light 1 is set to 10%.

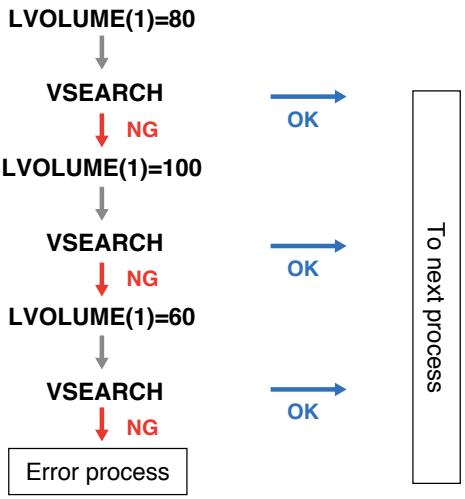


LVOLUME(1)=10

・Light 1 is set to 100%.



LVOLUME(1)=100



POINT 10

3 easy steps for parts registration

From image acquisition, registration takes just three steps.

Requires as little as 3 minutes

STEP. 1

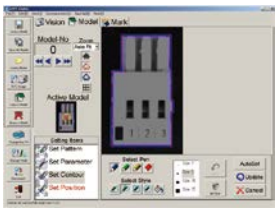
Capture images.

Put the workpiece within the camera field-of-view and specify an image capturing range.

STEP. 2

Set the contour.

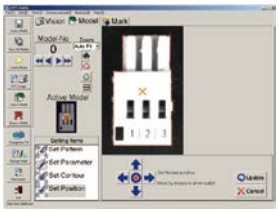
Contour is automatically extracted. Paint the necessary contour with a pen tool.



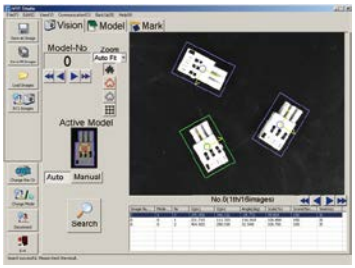
STEP. 3

Register the detection position.

Specify the detection position with the mouse. Desired positions can be set.

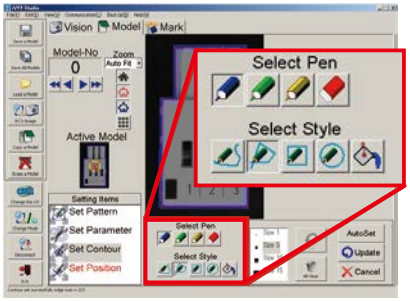


Search results



POINT 11

Simple parts judgement process

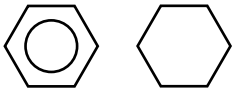


Contour setting pen
Paints the areas to be used from among the automatically detected edges.

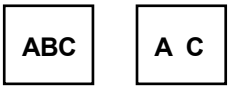
Priority area pen
Paints the areas to be used as priority areas during search from among the edges.

Reduction area pen
Paints the areas where there should not be an edge during search.

[Usage example]



· Workpiece top or bottom judgement

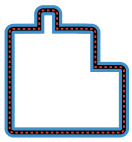


· Simple OK or NG judgement

• Usage example of contour setting pen

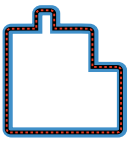
When a workpiece with a partially different shape needs to be distinguished and recognized or when the top or bottom needs to be judged, the detection can be performed by painting the contours in different colors by combining the contour setting pen with the priority area pen and reduction area pen.

Detection results

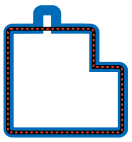


Blue : Normal contour setting

All contours are handled equivalently.

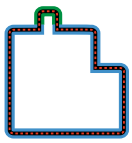


OK



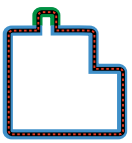
OK

The score may slightly vary depending on the presence status of the protrusion. However, both are detected.

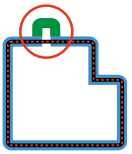


Green : Priority area setting

In addition to the blue area search, areas painted in green are used as priority areas to perform the judgement.

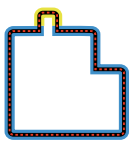


OK



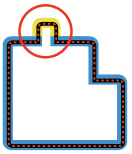
NG

When no edge is detected in the area set as priority area, this is judged as NG and the workpiece is not detected.

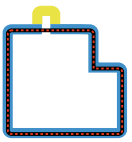


Yellow : Reduction area settin

When there is an edge in the unnecessary area painted in yellow, the score is reduced.



NG



OK

When an edge is detected in the area set as unnecessary area, the score is reduced and the workpiece is not detected.

POINT 12

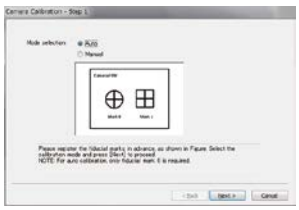
Simple calibration

Conventional equipment combining "image processing unit + robot" requires many steps in "calibration" that aligns the camera coordinates with the robot coordinates. With the RCXiVY2+ system, following the wizard to perform the operation will complete the calibration easily within a short time. In addition, even when the setting position deviates, the calibration is executed and restored immediately.

Requires as little as 5 minutes

STEP. 1

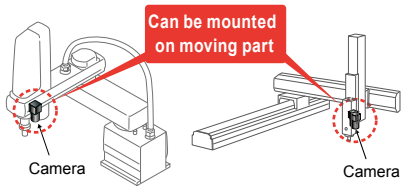
Register the desired fiducial mark



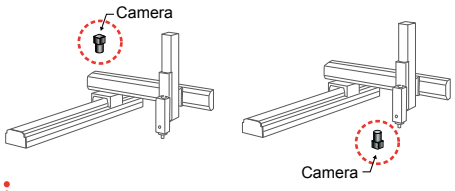
STEP. 2

Select the camera mounting method

Mounted on robot



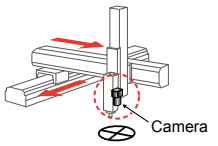
Fixed upward



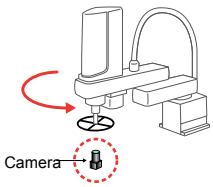
STEP. 3

Align fiducial mark position

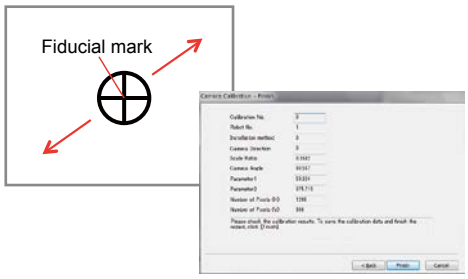
If camera is movable, move the robot



If camera is fixed, attach fiducial mark to robot, and move it



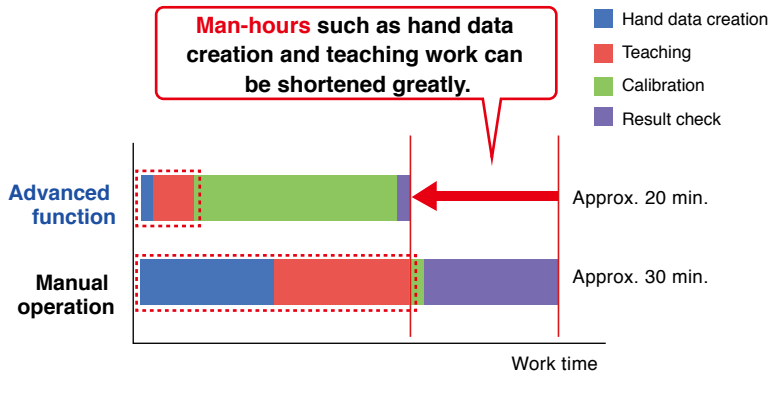
Execute auto-calibration



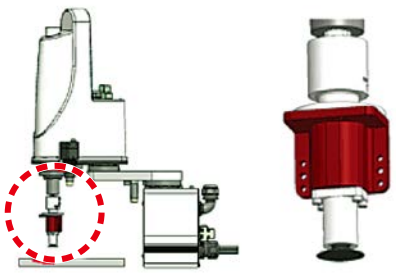
POINT 13

Calibration is automated with the dedicated jig.

By automating the calibration using the advanced calibration function, highly accurate calibration can be achieved easily without depending on the operator's skill.
The hand data can also be created automatically and the time necessary for the calibration is reduced greatly.
Since the dedicated jig is the standard part (option part), the jig does not need to be designed and manufactured and can be used immediately.



Calibration jig



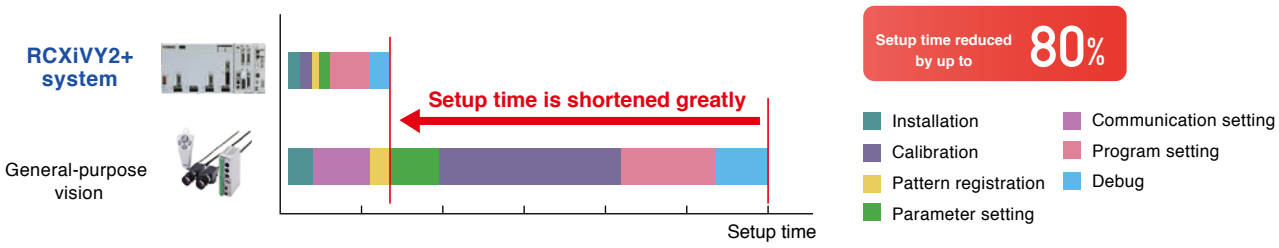
* This jig can be used only with the downward camera.

POINT 14

Setup time reduced greatly

When using third-party vision, a coordinate conversion program needs to be created in the robot controller since the robot coordinate data differs from the vision format.
In RCXiVY2+, vision system is incorporated in robot controller the robot coordinate data can be stored into the robot point data using single process. This ensures very simple operation. Additionally, the unified control of the camera control and light control can be performed using the robot program. Start-up process will be greatly simplified.

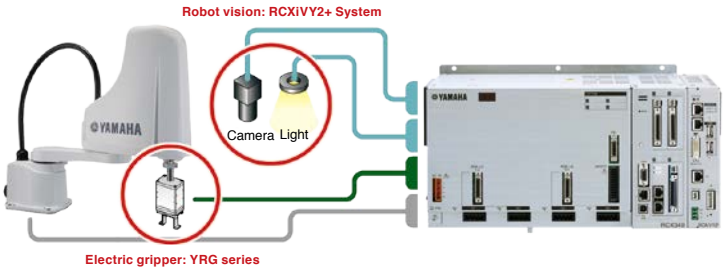
Comparison of setup time



POINT 15

Easy link with peripheral equipment

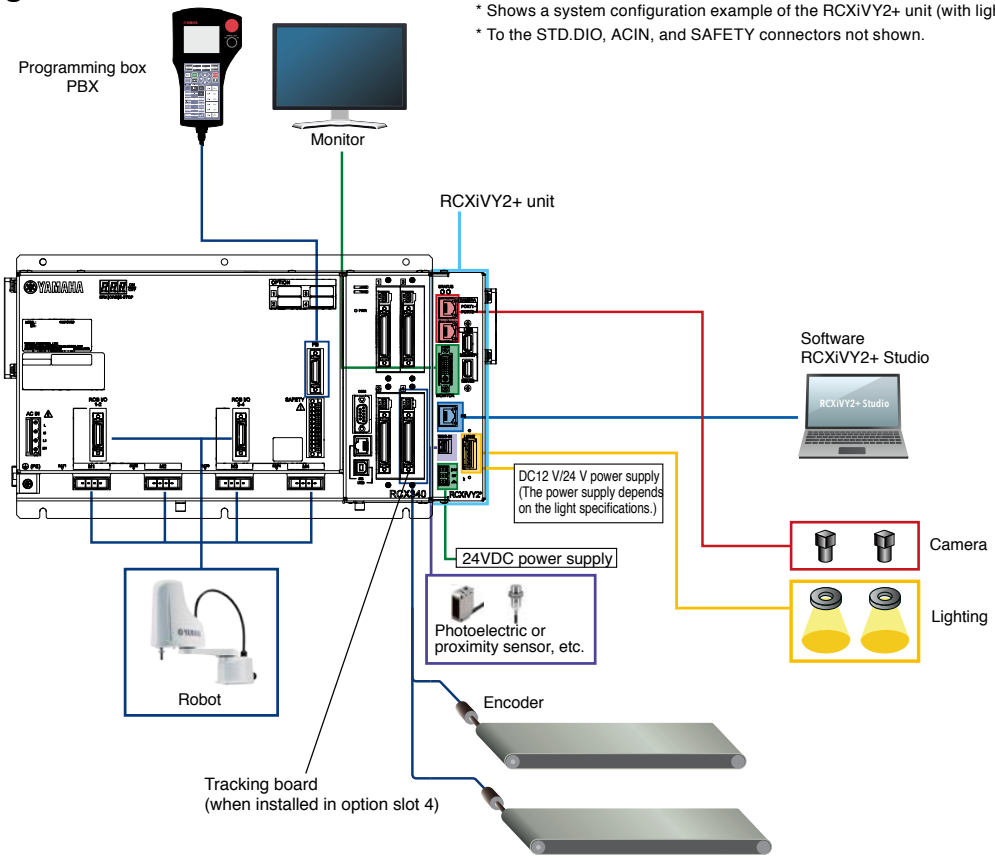
One controller provides unified control of robot, gripper, and lighting.



POINT 16

System configuration illustration

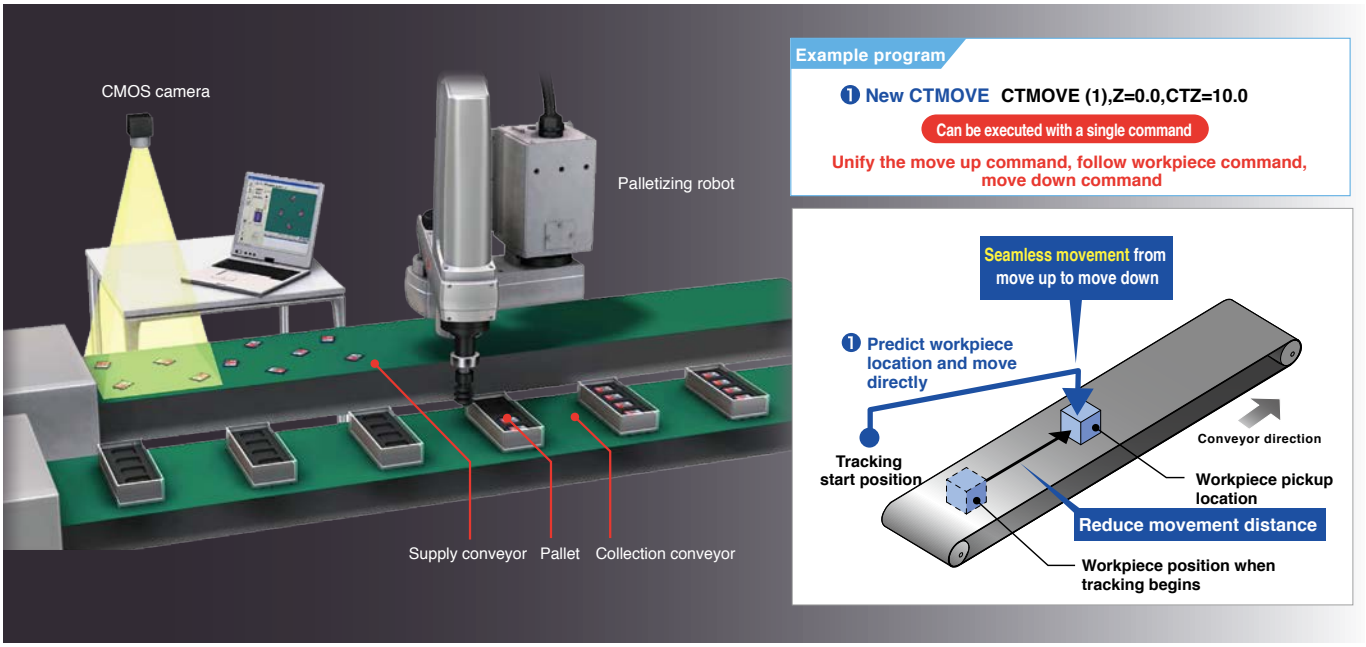
* Shows a system configuration example of the RCXiVY2+ unit (with light control board option).
* To the STD.DIO, ACIN, and SAFETY connectors not shown.



POINT 17

Conveyor tracking

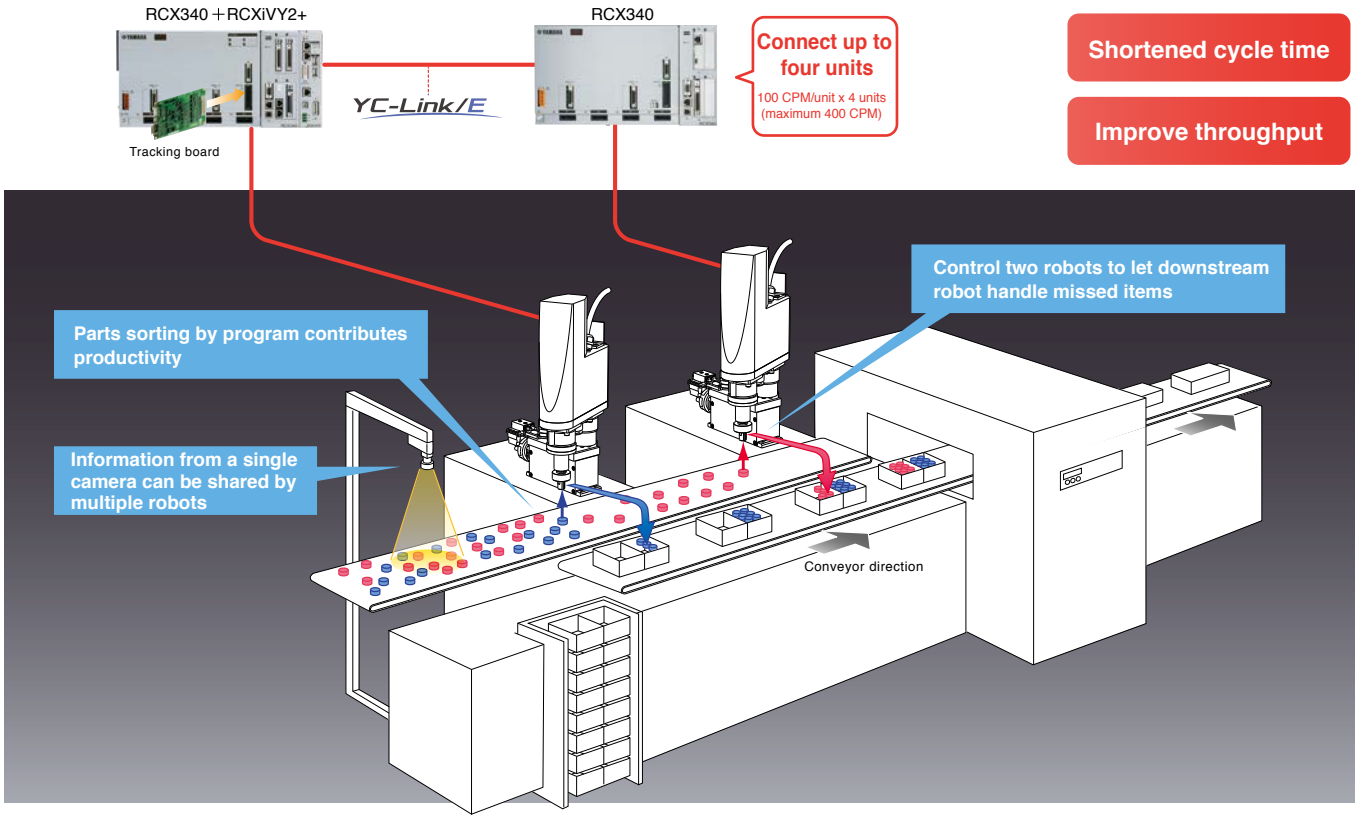
Ideal for high-speed packaging arrangement high-speed transport of multiple types of items such as pharmaceuticals, cosmetics, and food products.
The vision camera detects the position and orientation of parts moving on the conveyor, and the robot picks them up.



Operating conditions: YK500XG / payload 1 kg (total of workpiece and tool) / horizontal movement 250 mm / vertical movement 1 mm / conveyor speed 100 mm/sec

POINT 18

Improving productivity by controlling multiple robot systems



POINT 19

Up to 254 types of parts registration

Setup changes require only that part numbers be changed.
Setup changes are easy.

POINT 20

Monitor output

Monitor the operating status

Monitor the search status while making calibration settings or during automatic operation.

Contents of output
- Selected type / Captured image
- Search result (position, score, scale)
- Executed command
- Time required by command

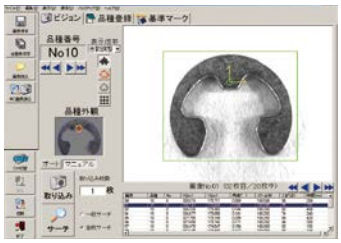
Output method
- DVI-I (supports digital monitor or analog monitor)

POINT 21

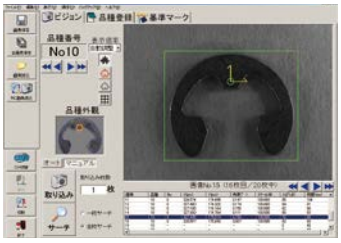
High-precision search even under low light

Edge search engine is built-in

Supports a variety of applications while being minimally affected by the external environment.



When lighting is sufficient



Accurate search even if lighting is insufficient

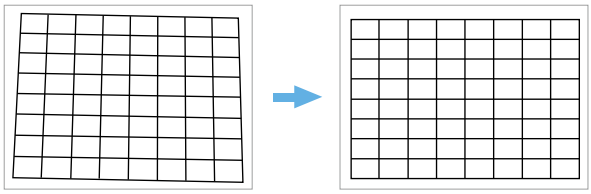
POINT 22

Lens distortion and camera inclination correction function

Mounting accuracy is improved Camera is installed in the inclined status*

The lens distortion and camera inclination when the angle of visibility is wide or when the camera is installed in the inclined status can be corrected.
When the distortion and inclination correction function is enabled during calibration, the calibration data for the distortion and inclination correction is created. When images are captured using this calibration data, captured images are corrected and output.

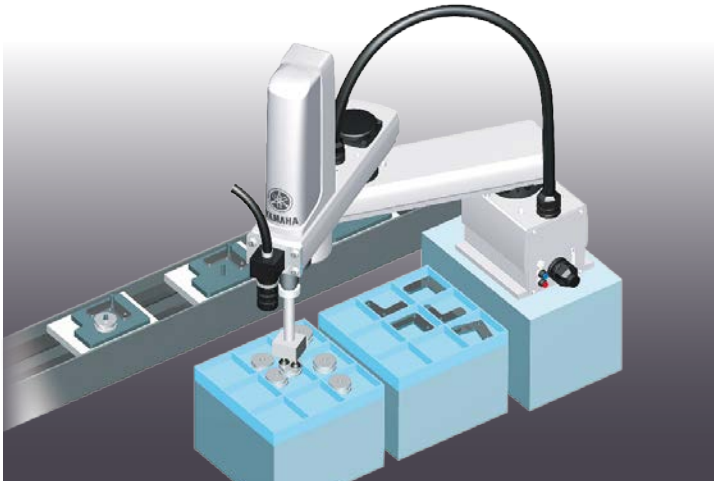
* Up to approx. 15 degrees


(Before correction) (After correction)

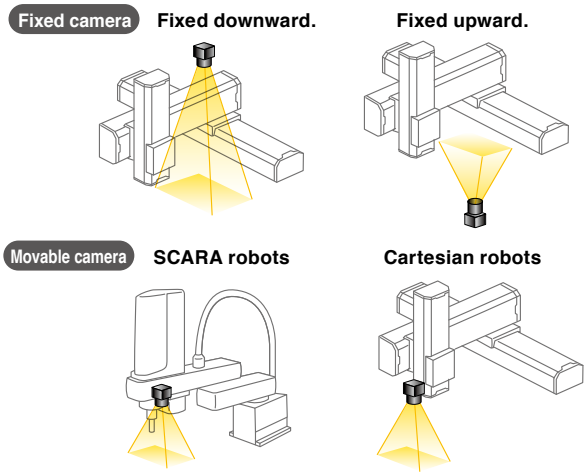
POINT 23

Also supports moving camera

Even if the camera is mounted on the robot, coordinates are automatically converted according to the robot's movement.



Camera position can be selected in accordance with the application.



Even when the camera is moved, the coordinates are corrected automatically.

POINT 24

Easy-to-use programming software RCXiVY2+ Studio

With programming software “RCXiVY2+ Studio”, all vision related operations such as registration of fiducial marks and workpieces used for calibration (contour settings, various parameter settings, and read range settings), backup, restore operation, and operation monitor can be performed.

- **Search trial-run, part type registration**
- **Reference mark registration (for calibration)**
- **Up to 254 workpiece types can be registered.**
- **Workpiece can also be added easily.**
- **Up to 100 workpieces can be detected at once.**
- **Data backup**
- **This software functions as a monitor during program operation.**

Download from website (member site)

POINT 25

Easy programming

Constructing the most suitable robot vision system for an application.

RCX-Studio 2020 program template function

◆ Program is created automatically simply following step-by-step operating process

RCX3 series programming software RCX-Studio 2020 also has following five templates for vision system:

- **Pallet picking using the vision**
- **Dispensing work using the vision**
- **Gripping deviation correction using the vision**
- **Gripping deviation and mounting position correction using the vision**
- **Gripping deviation and mounting position correction using the vision (without using any master)**

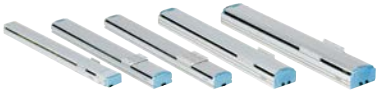
POINT 26

A wide variety of robot systems to choose from the most suitable and economical solution for the robot vision system

XY-X Cartesian robots

YK-XG/XE SCARA robots

YK-TW orbit type robots



FLIP-X single-axis robots

POINT 27

Verifying application prior to purchase

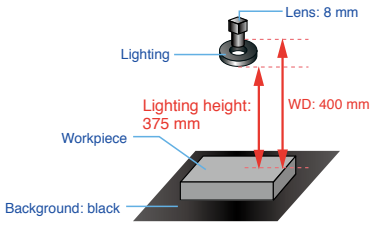
User's application is verified using actual sample parts before making a purchase decision.
Based on the evaluation result, recommendation will be made for most suitable and economical solution.

- Application review
- Sample parts review
- Actual Simulation
- Actual machine test
- Recommendation with evaluation report
- Robot training
- Follow-up after delivery

Preliminary evaluation

Starting evaluation with actual sample piece

■ Evaluation conditions (example)



Actual machine test

Evaluation of application with robot and vision setup

Recommendation

Based on the results of preliminary evaluation necessary recommendation is made
Recommendation on vision system setup

Advice regarding camera, lens, and lighting settings

Robot training

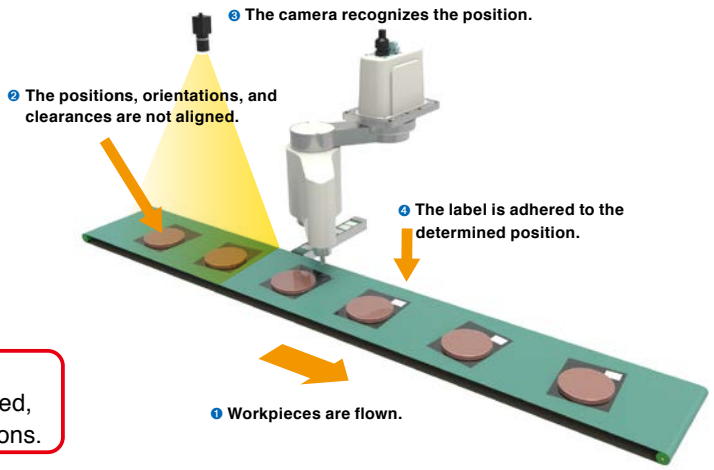
Training is available upon request

POINT 28

Lot application examples

Random flow of parts on conveyor

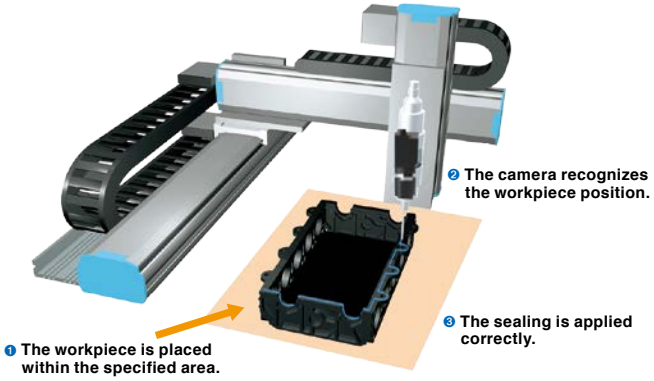
The workpiece positions are recognized by the camera and the labels are adhered to the determined positions on workpieces. The adhesion position can also be specified for each part type.



POINT Even when the positions or orientations of workpieces that are flown are not aligned, the labels are adhered to the same positions.

Automatically adjusting sealing points

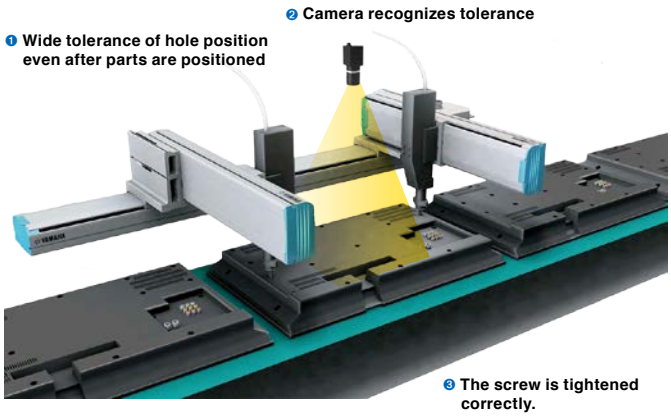
Position of workpiece is correctly recognized by its shape.
Changing setup or jig between production lot can be eliminated.



POINT The workpiece shape is recognized by the camera and the sealing is applied to the correct position.

Adjusting screw fastening position

Vision camera recognizes actual hole position with wide tolerance and adjust fastening position.



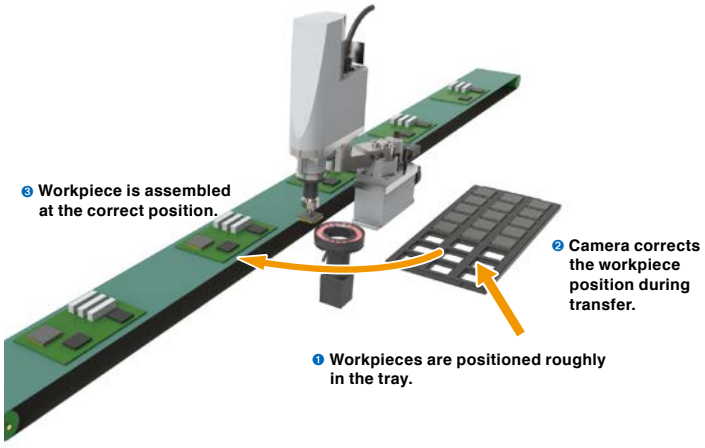
POINT Even when there are variations in product accuracy such as resin mold product, the products can be assembled correctly.

Continues on next page »

» Application examples continued.

“Pick-and-Assemble” in one motion

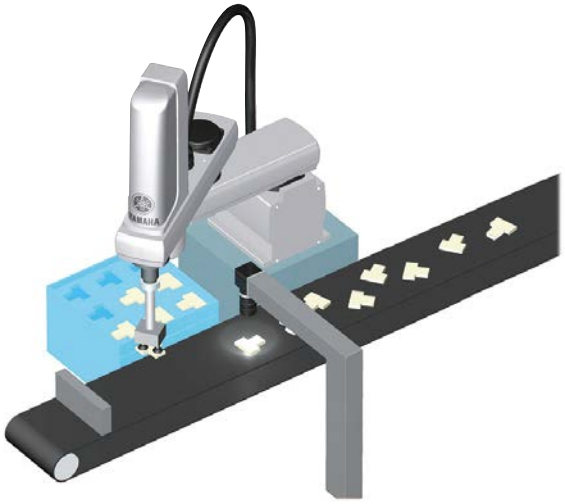
Pick up parts from a tray, adjust position on the fly and install directly.



POINT Use of the upward camera makes it possible to correct the position during transfer.

Conveyor tracking

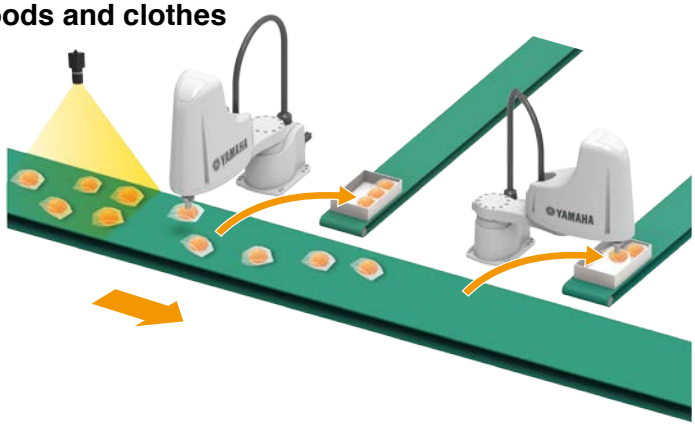
Pick-and-pace operation of randomly positioned parts on the conveyor by a SCARA robot. Position and orientation of parts are recognized by a vision camera.



POINT Handling process is reduced without teaching

Irregular shape workpieces such as foods and clothes

Pick-and-place with conveyor tracking for parts with wide tolerance like foods and clothes.



POINT Increasing productivity with two robots

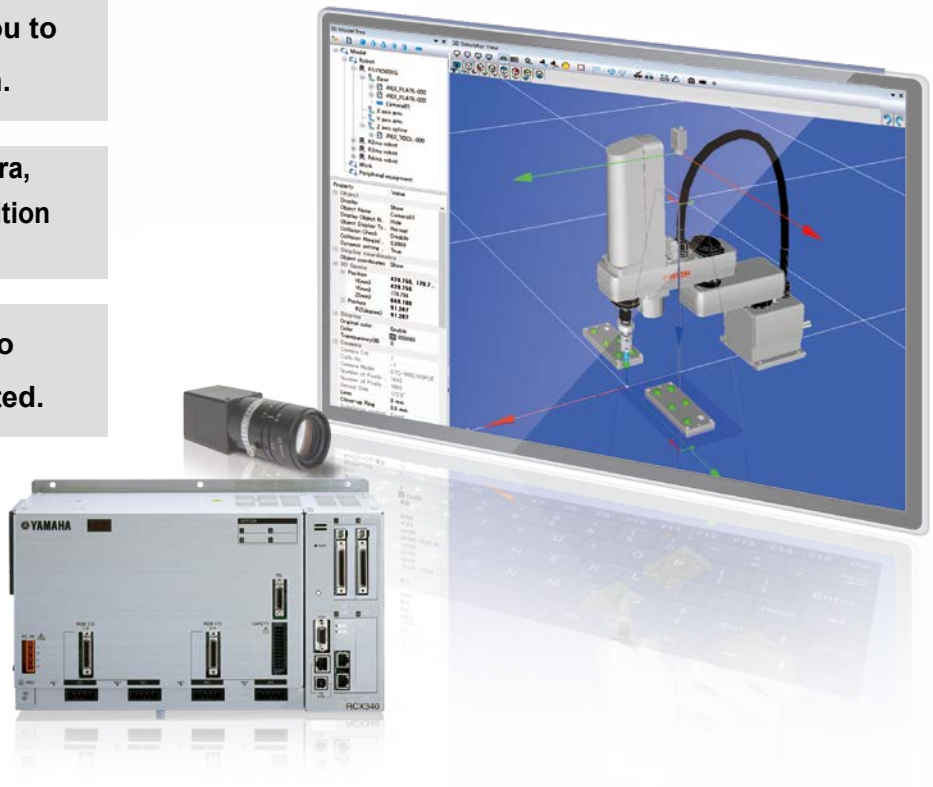
PC-based Machine Vision
RCXiVY2+ PCVision

PCVision provides the same ease of use use and affinity with robots as the RCXiVY2+ system.

"Robot+ vision" allows you to perform the simulation.

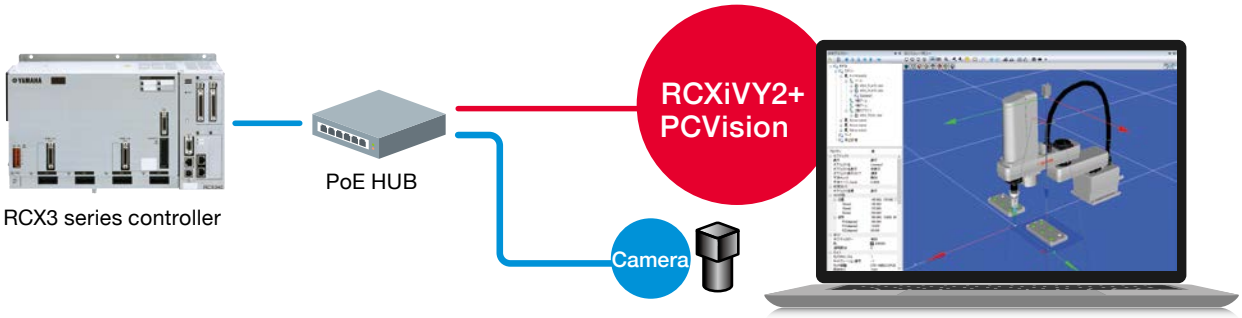
If you have a PC and camera, you can perform the recognition test of workpieces.

High-pixel camera up to 25 megapixels is supported.



What is "RCXiVY2+ PCVision"?

Apps working as RCXiVY2+ on Windows.
By connecting the PC into which this software has been installed to the RCX controller, a PC vision system that is equivalent to the "RCXiVY2+ System" can be constructed.



Free DL **RCXiVY2+ PCVision**
Download from the web site (member site).

RCXIVY2+ PCVision

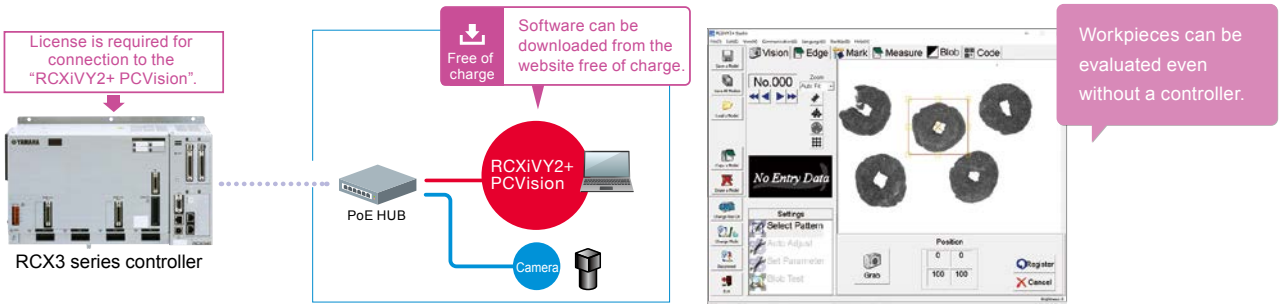
To connect the RCX3 series controller to RCXiVY2+ PCVision and use it as a robot vision system, a license for RCXiVY2+ PCVision needs to be purchased.

When using the “RCXiVY2+ PCVision” without building it into the equipment

POINT 1

The system can be used for pre-evaluation.

Simply install the “RCXiVY2+ PCVision” software and connect the camera to check the vision system even without an RCX controller. It is possible to register the component type of the target workpiece, check the detection status, and adjust parameters from the camera connected to the PC or the images stored in the PC.



POINT 2

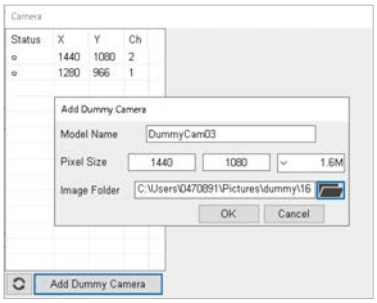
Dummy camera can be set.

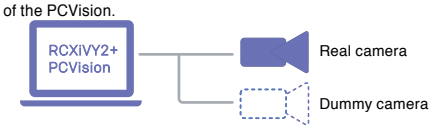
By setting a dummy camera, images can be loaded from the specified folder at the time of the image capture command.

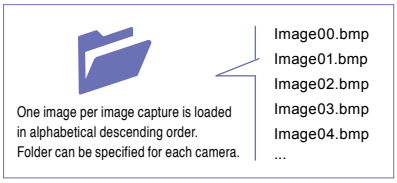
- **Workpiece can be evaluated with images in the PC.**
- **Images of different sizes are automatically corrected to the image size of the dummy camera.**
- **Color images are also automatically corrected to monochrome images.**

Images from a digital camera or smartphone are also acceptable.

Dummy camera can be added from the Camera window of the PCVision.







POINT 3

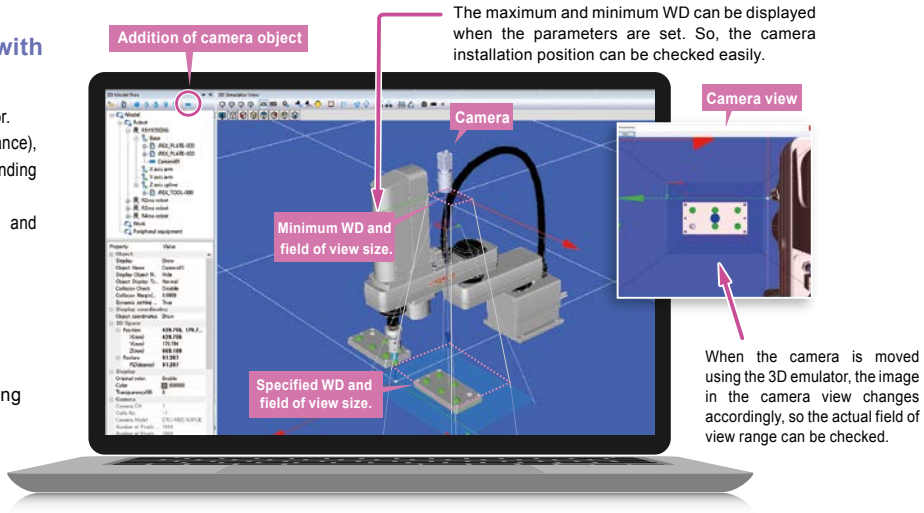
From camera layout examination to operation verification can be performed on the 3D emulator.

- **Simple equipment layout with RCX-Studio 2020**

  Camera can be installed in the 3D simulator. Maximum and minimum WD (work distance), and field of view range are displayed depending on the camera and lens combinations. Pre-verification of optimal combination and installation position can be performed.

- **Program simulation with RCX-Studio 2020**

  Test execution of programs containing vision commands can be performed. Program debugging and cycle time measurement can be performed without an actual machine.

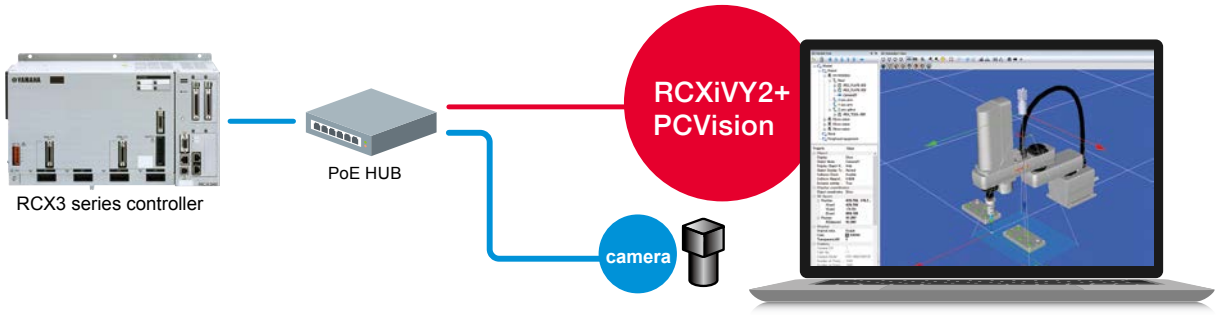


When using the “RCXiVY2+ PCVision” with building it into the equipment

POINT 1

Machine Vision on the PC of your production machinery.

In the conventional “RCXiVY2+ System”, the dedicated vision unit needs to be built into the robot controller.
In the “RCXiVY2+ PCVision”, your PC can be utilized for the equipment instead of the dedicated vision unit.
The equipment can be designed at lower cost, and the degree of freedom in designing equipment and systems that utilize PCs is expanded.



POINT 2

Various cameras are supported.

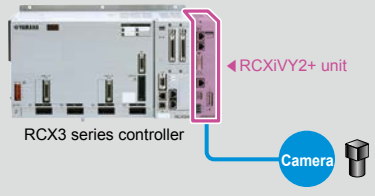
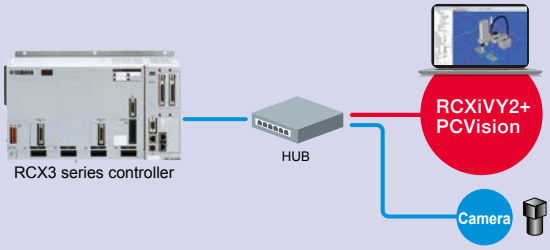
GigE and USB cameras compatible with the GenICam standards can be used. In addition, a camera with 5 megapixels or more can also supported.
Use of a high-resolution camera makes it possible to perform more accurate detection and expand the field of view.

	RCXiVY2+ unit	RCXiVY2+PCVision
Usable camera	OMRON SENTECH	OMRON SENTECH HIKROBOT BASLER Other camera manufacturers (* Camera needs to be compliant with the GeniCam standards.)
Number of camera pixels	5 megapixels or less	25 megapixels or less

Compatibility with the “RCXiVY2+ system”.

There is a compatibility with the conventional built-in type “RCXiVY2+ system”.
Robot commands, component type data, and calibration are common to the “RCXiVY2+ system”.
The “RCXiVY2+ PCVision” can be controlled by conventional robot commands.

[Comparison of “RCXiVY2+ PCVision” and “RCXiVY2+ unit”]

RCXiVY2+ unit	RCXiVY2+PCVision
	

RCXiVY2+ System

Applicable controllers
RCX3 series

Robot with image processing functions

Integrated Robot Vision System with "plug-and-play" simplicity.
New functions have been added to the conventional iVY2 to make the vision system even easier to use.

Ordering method

RCX340 – [Controller] – [No. of controllable axes] – [Safety standards] – [Controller option A to D (OP.A to D)] – [Controller option E (OP.E)] – [Absolute battery]

- Controller option A to D (OP.A to D): TR: Tracking Note1
- Controller option E (OP.E): No entry: without RCXiVY2+ / WY: with RCXiVY2+, without lighting / WL: with RCXiVY2+, with lighting

RCX320 – [Controller] – [No. of controllable axes] – [Safety standards] – [Regenerative unit] – [Controller option A / B (OP.A / OP.B)] – [Vision System] – [Absolute battery]

- Controller option A / B (OP.A / OP.B): TR: Tracking Note1
- Vision System: No entry: Non-selection / WY: with RCXiVY2+, without lighting / WL: with RCXiVY2+, with lighting

For details on the various selection items
RCX320 ▶ P.626
RCX340 ▶ P.637

Note1. Only one tracking board can be selected.

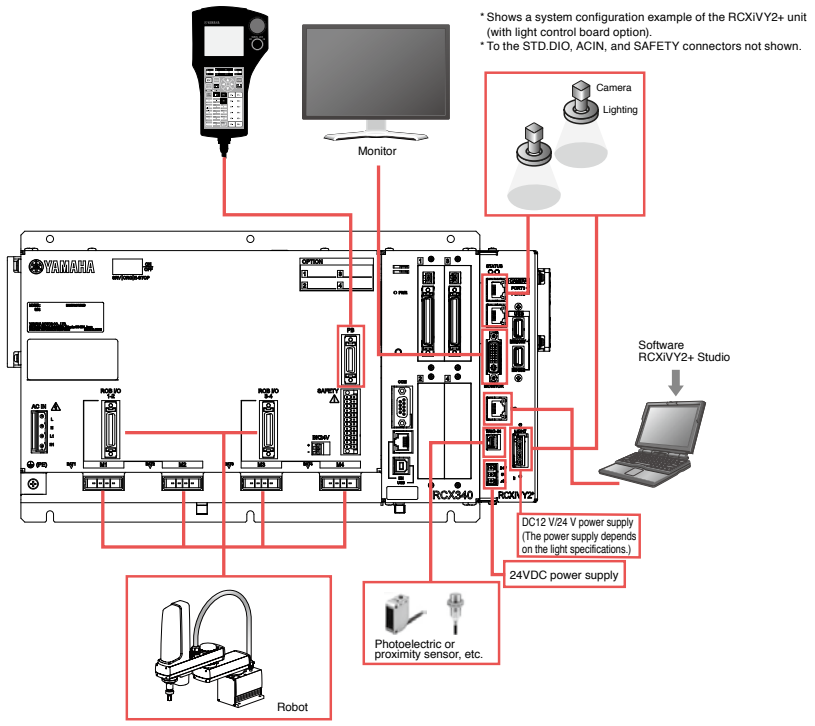
Basic specifications

Robot vision basic specifications

Item		RCXiVY2+ unit
Basic specifications	Applicable controllers	RCX340 / RCX320
	Number of screen pixels	720(H) × 540(V) (400,000 pixels) 1440(H) × 1080(V) (1,600,000 pixels) 2048(H) × 1536(V) (3,200,000 pixels) 2592(H) × 1944(V) (5,000,000 pixels) Note1
	Model setting capacity	254 models
	Number of connectable cameras	2 cameras (8 units when the HUB is used.)
	Connectable camera	GigE camera PoE: IEEE802.3af 1 ch up to 7W
	External interface	Ethernet (1000BASE-T) Note2 USB 2.0 2Ch (Up to 5V 2.5W / ch)
	External monitor output	DVI-I Note3 Monitor resolution: 1024 × 768 Vertical periodic frequency: 60 Hz Horizontal periodic frequency: 48.4 kHz
	Power supply	24 VDC +/- 10%, Maximum 1.5 A
	Dimensions	W45 × H195 × D130 (RCXiVY2+ unit only)
	Weight	0.8kg (RCXiVY2+ unit only, when the lighting control board option is selected)
	Operating environment	Compliant with the RCX340/RCX320 controller.
	Storage environment	Compliant with the RCX340/RCX320 controller.
Search method		Edge search, Measuring search, Blob search, Code search
Image capturing	Trigger mode	S/W trigger, H/W trigger
	External trigger input	2 points
Function		Position detection, coordinate conversion, automatic point data generation, distortion and inclination correction
Camera installation position		Fixed to the fixed camera (up, down) or robot (Y-axis, Z-axis). Vertical direction to the image capturing target workpiece is recommended.
Setting support function		Calibration, image save function, model registration Note4, fiducial mark registration Note4, measuring registration Note4, blob registration Note4, code registration Note4, monitor function Note4
Lighting control options	Number of connectable lighting units	Maximum 2
	Modulated light format	PWM modulated light control (0 to 100%), PWM frequency switchable 62.5 kHz/ 125 kHz Continuous light, strobe light (follows camera exposure)
	Lighting power input	12V DC or 24V DC (external supply shared by both channels)
	Lighting output	For 12V DC supply: Total of less than 40W for both channels. For 24V DC supply: Total of less than 80W for both channels.

Note1. Since the rolling shutter is used, the tracking is not supported.
Note2. For setting and monitor operations
Note3. Also usable with an analog monitor by using a conversion adaptor.
Note4. RCXiVY2+ Studio function (requires a Windows PC)

System configuration illustration

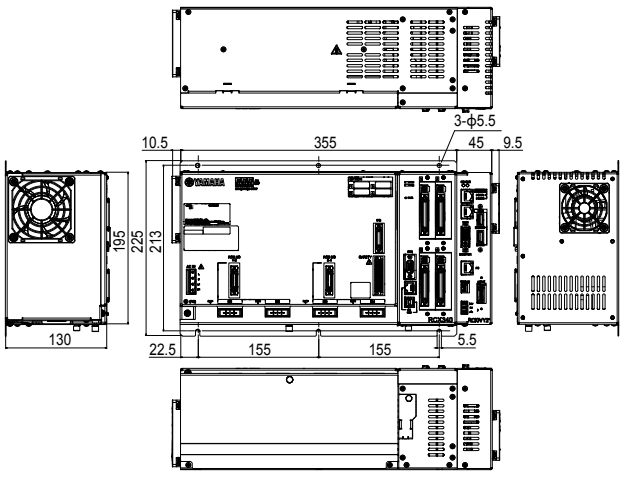


Tracking board basic Specifications

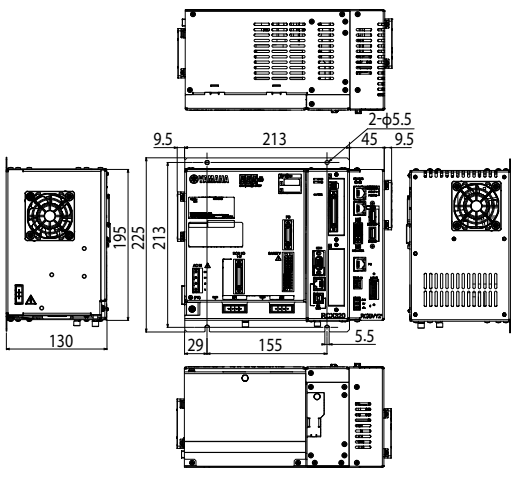
Item		Tracking board
Basic specifications	Applicable controllers	RCX340 / RCX320
	Number of connected encoders	Up to 2 units.
	Encoder power supply	5VDC (2 counters total 500 mA or less) (Supplied from controller)
	Applicable encoder	26LS31/26C31 or equivalent line driver (RS-422 compliance).
	Input phase	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$
	Max. response frequency	2MHz or less
	Counter	0 to 65535
	Multiplier	4x
	Other	With disconnection detection function

Dimensional outlines

RCX340+RCXiVY2+



RCX320+RCXiVY2+

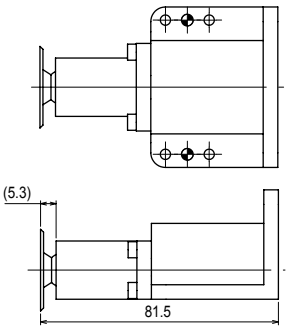


Dimensional outlines

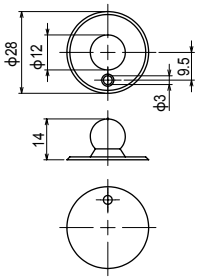
Calibration jig

Calibration jig
(Model: KCX-M7200-00)

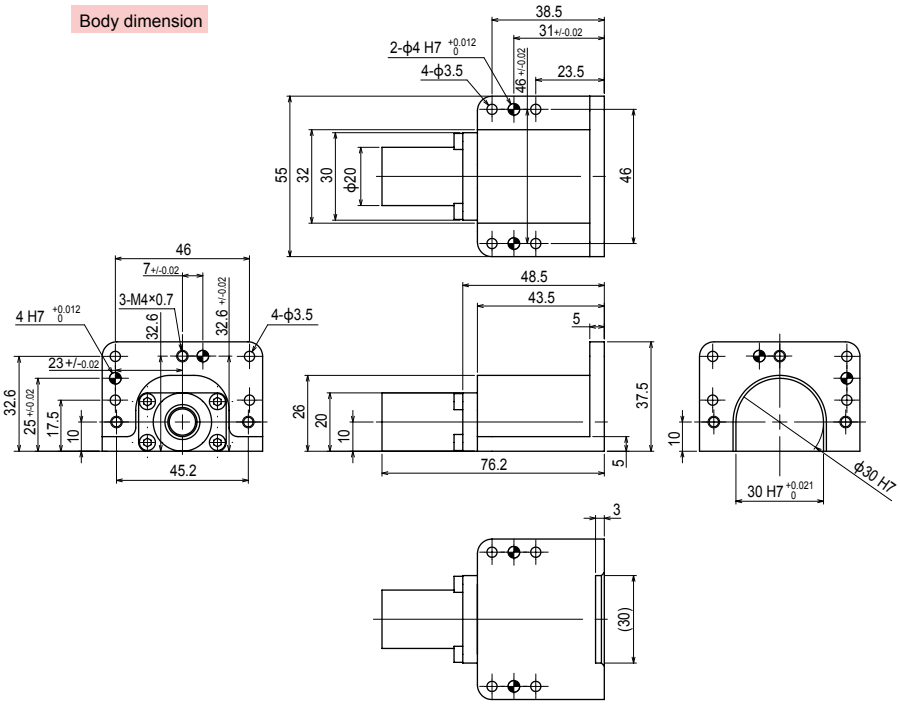
Mark gripper dimension



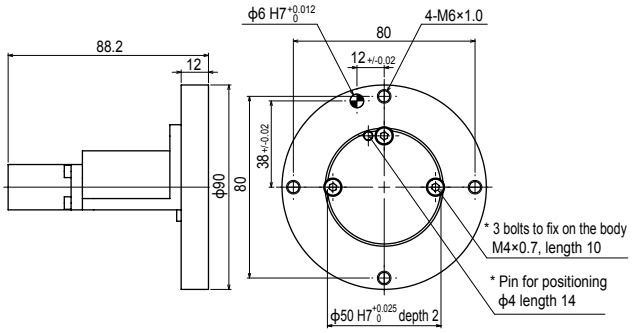
Mark dimension



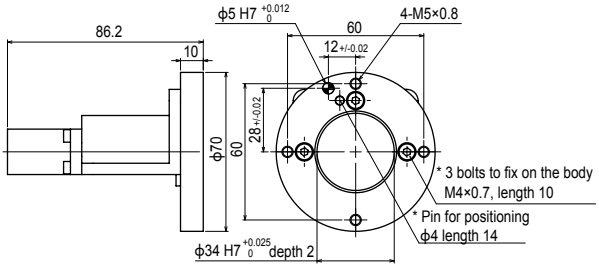
Body dimension



When using attachment (large)



When using attachment (small)

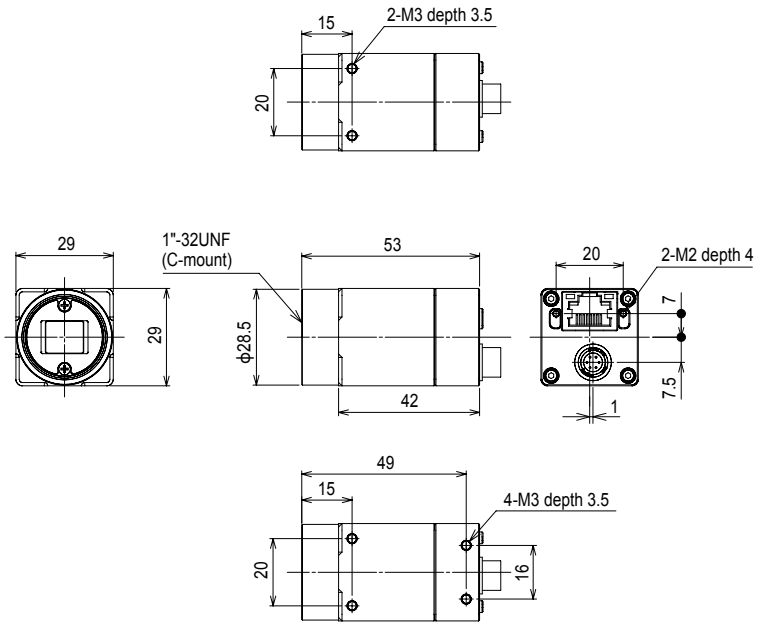


Dimensional outlines

Camera

CMOS camera

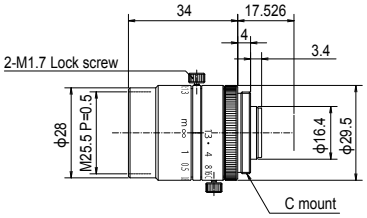
(400,000 pixel • 1,600,000 pixel • 3,200,000 pixel)



Lenses

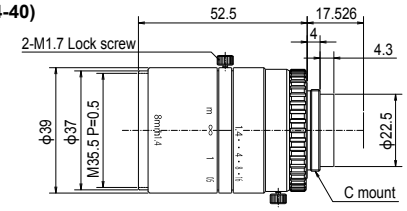
8mm lens

(Model: KCX-M7214-00)



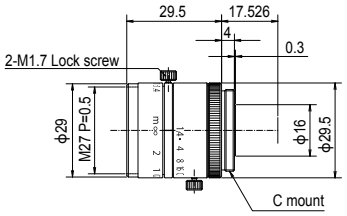
8mm lens (megapixel support)

(Model: KCX-M7214-40)



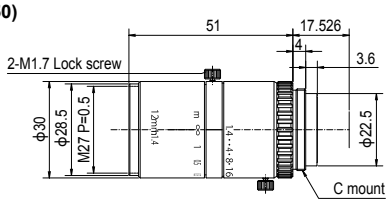
12mm lens

(Model: KCX-M7214-10)



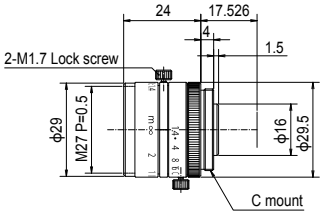
12mm lens (megapixel support)

(Model: KCX-M7214-50)



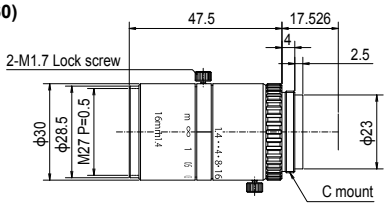
16mm lens

(Model: KCX-M7214-20)



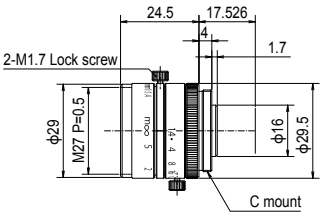
16mm lens (megapixel support)

(Model: KCX-M7214-60)



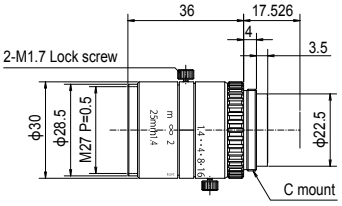
25mm lens

(Model: KCX-M7214-30)



25mm lens (megapixel support)

(Model: KCX-M7214-70)



RCXiVY2+ System

Lens characteristics

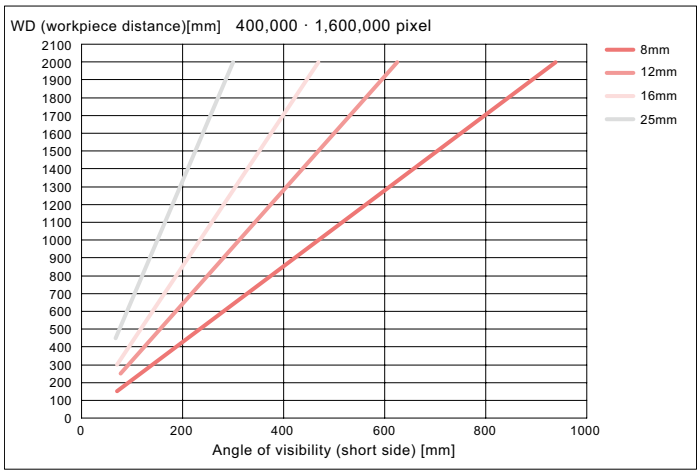
Lens	Model	Focal length [mm]	Aperture value [F No.]	Angle-of-view (degrees)								Closest approach distance [m]
				KFR-M6541-01 (400,000 pixel camera)		KFR-M6541-11 (1,600,000 pixel camera)		KFR-M6541-21 (3,200,000 pixel camera)		KFR-M6541-32 (5,000,000 pixel camera)		
				Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	
8mm	KCX-M7214-00	8	F1.3–CLOSE	27.13	36.09	26.85	35.69	37.57	49.23	30.72	40.60	0.2
12mm	KCX-M7214-10	12	F1.4–CLOSE	17.23	23.01	17.05	22.74	24.11	31.95	19.57	26.03	0.3
16mm	KCX-M7214-20	16	F1.4–CLOSE	13.17	17.50	13.03	17.30	18.48	24.44	14.97	19.83	0.4
25mm	KCX-M7214-30	25	F1.4–CLOSE	8.57	11.42	8.47	11.29	12.05	16.01	9.74	12.95	0.5
8mm (megapixel support)	KCX-M7214-40	8	F1.4–F16	26.47	34.83	26.20	34.44	36.68	47.61	29.97	39.21	0.1
12mm (megapixel support)	KCX-M7214-50	12	F1.4–F16	17.49	23.19	17.31	22.92	24.47	32.19	19.86	26.23	0.1
16mm (megapixel support)	KCX-M7214-60	16	F1.4–F16	13.28	17.69	13.14	17.48	18.64	24.69	15.09	20.04	0.1
25mm (megapixel support)	KCX-M7214-70	25	F1.4–F16	8.62	11.48	8.52	11.34	12.12	16.09	9.80	13.02	0.15

Note. This table shows the angle-of-view for Yamaha's standard lenses. If the angle-of-view is greater, there might be more distortion at the edge of the image.

Contact angle ⇔ WD (workpiece distance) table

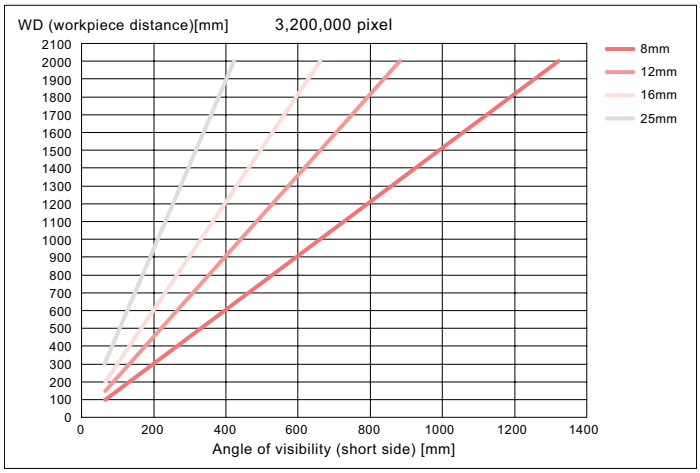
400,000 pixel (KFR-M6541-01) • 1,600,000 pixel (KFR-M6541-11)

	Lens							
	8mm KCX-M721-40		12mm KCX-M721-50		16mm KCX-M721-60		25mm KCX-M721-70	
WD[mm]	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
100	63	47	42	31	31	23		
150	94	70	63	47	47	35	30	23
200	126	94	84	63	63	47	40	30
250	157	117	105	78	78	59	50	38
300	188	141	126	94	94	70	60	45
350	220	164	146	109	110	82	70	53
400	251	188	167	125	126	94	80	60
450	282	211	188	141	141	105	90	68
500	314	234	209	156	157	117	100	75
550	345	258	230	172	173	129	110	83
600	377	281	251	188	188	141	120	90
650	408	305	272	203	204	152	131	98
700	439	328	293	219	220	164	141	105
750	471	352	314	234	235	176	151	113
800	502	375	335	250	251	188	161	120
850	533	398	356	266	267	199	171	128
900	565	422	377	281	282	211	181	135
950	596	445	397	297	298	223	191	143
1000	628	469	418	313	314	234	201	150
1500	941	703	628	469	471	352	301	225
2000	1255	938	837	625	628	469	402	300



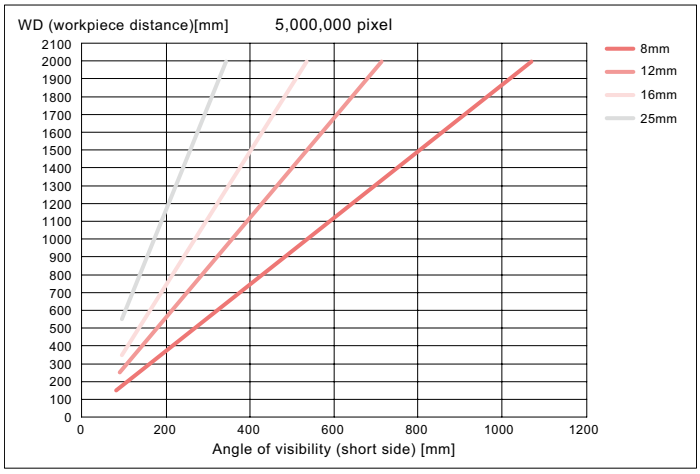
3,200,000 pixel (KFR-M6541-21)

	Lens							
	8mm KCX-M721-40		12mm KCX-M721-50		16mm KCX-M721-60		25mm KCX-M721-70	
WD[mm]	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
100	88	66	59	44	44	33		
150	132	99	88	66	66	50	42	32
200	177	132	118	88	88	66	56	42
250	221	165	147	110	110	83	71	53
300	265	198	177	132	132	99	85	63
350	309	231	206	154	154	116	99	74
400	353	265	235	176	177	132	113	85
450	397	298	265	198	199	149	127	95
500	441	331	294	220	221	165	141	106
550	485	364	324	242	243	182	155	116
600	530	397	353	265	265	198	169	127
650	574	430	382	287	287	215	184	138
700	618	463	412	309	309	231	198	148
750	662	496	441	331	331	248	212	159
800	706	529	471	353	353	265	226	169
850	750	562	500	375	375	281	240	180
900	794	595	530	397	397	298	254	190
950	838	628	559	419	419	314	268	201
1000	883	661	588	441	441	331	282	212
1500	1324	992	883	661	662	496	424	317
2000	1765	1323	1177	882	883	661	565	423



5,000,000 pixel (KFR-M6541-32)

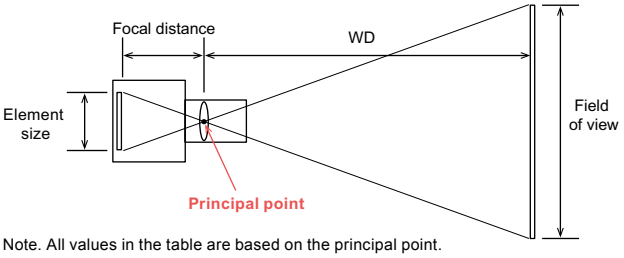
	Lens							
	8mm KCX-M721-40		12mm KCX-M721-50		16mm KCX-M721-60		25mm KCX-M721-70	
WD[mm]	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
100	71	54	48	36	36	27		
150	107	80	71	54	53	40	34	26
200	143	107	95	71	71	54	46	34
250	178	134	119	89	89	67	57	43
300	214	161	143	107	107	80	68	51
350	249	187	166	125	125	94	80	60
400	285	214	190	143	143	107	91	68
450	321	241	214	161	160	120	103	77
500	356	268	238	178	178	134	114	86
550	392	294	261	196	196	147	125	94
600	428	321	285	214	214	161	137	103
650	463	348	309	232	232	174	148	111
700	499	375	333	250	249	187	160	120
750	534	401	356	268	267	201	171	128
800	570	428	380	285	285	214	182	137
850	606	455	404	303	303	227	194	146
900	641	482	428	321	321	241	205	154
950	677	508	451	339	338	254	217	163
1000	713	535	475	357	356	268	228	171
1500	1069	803	713	535	534	401	342	257
2000	1425	1070	950	713	713	535	456	342



Minimum WD (workpiece distance) when close-up ring is used.

Close-up ring [mm]	Lens							
	8mm KCX-M721-40		12mm KCX-M721-50		16mm KCX-M721-60		25mm KCX-M721-70	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
None	100	∞	100	∞	100	∞	150	∞
0.5	46	114	67	284	78	506	131	1233
1.0			48	132	63	243	115	608
1.5			36	82	52	116	102	399
2.0					43	112	92	295
5.0							54	108

Note. The values in this table are for reference only and are not absolute indexes.



Note. All values in the table are based on the principal point.

Accessories and part options

RCXiVY2+ System

Standard accessories

RCXiVY2+ unit

The RCXiVY2+ unit adds robot vision to the RCX340/RCX341/RCX320 robot controller.

RCXiVY2+ unit

Model	No lighting	KFR-M4400-V0
	With lighting	KFR-M4400-L0

RCXiVY2+ unit accessories

Name	Model
Trigger input cable connector set	KX0-M657K-00
24V power supply connector	KCF-M5382-00

Support software for PC RCXiVY2+ Studio

RCXiVY2+ Studio is programming software for the RCXiVY2+ system that allows registering part types and reference marks as well as monitoring the work search status during automatic robot operation by connecting to the robot controller.

Download from website (member site)

Environment

OS	Microsoft Windows XP / Vista (32 bit / 64 bit) / 7 (32 bit / 64 bit) / 8, 8.1 (32 bit / 64 bit) /10 (32 bit / 64 bit) / 11 (Supported version: V.3.06.03.00 or later)
CPU	Processor that meets or exceeds the suggested requirements for the OS being used.
Memory	Suggested amount of memory or more for the OS being used.
Hard disk capacity	30MB of available space required on installation drive. * Additional vacant space is required for saving images and data.
Display	800 x 600 dot, or higher, 32768 colors (16bit High Color) or higher (recommended)
Communication Port	Ethernet Port of TCP/IP

Note. Microsoft, Windows XP, Windows Vista, Windows 7, Windows 8, 8.1, and Windows 10 are registered trademarks of the Microsoft Corporation, USA.
Note. Ethernet is a registered trademark of the XEROX Corporation, USA.

Options

CMOS camera

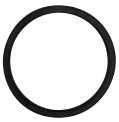
Model	400,000 pixel	720(H) × 540(V)	KFR-M6541-01
	1,600,000 pixel	1440(H) × 1080(V)	KFR-M6541-11
	3,200,000 pixel	2048(H) × 1536(V)	KFR-M6541-21
	5,000,000 pixel	2592(H) × 1944(V)	KFR-M6541-32

Lens

Model	8mm	KCX-M7214-00
	12mm	KCX-M7214-10
	16mm	KCX-M7214-20
	25mm	KCX-M7214-30
	8mm (megapixel support)	KCX-M7214-40
	12mm (megapixel support)	KCX-M7214-50
	16mm (megapixel support)	KCX-M7214-60
	25mm (megapixel support)	KCX-M7214-70

* Common to iVY2.

Close-up ring



Model	0.5mm	KX0-M7215-00
	1.0mm	KX0-M7215-10
	2.0mm	KX0-M7215-20
	5.0mm	KX0-M7215-40

Lighting control board

This board adds lighting control functionality to the RCXiVY2+ system. (Installed in the RCXiVY2+ unit when shipped)

Lighting control board

Name	Model
Lighting control board	KCX-M4403-L0

Lighting control board accessories

Name	Model
Lighting power cable connector set	KX0-M657K-10

Tracking board

This board adds conveyor tracking functionality to the RCX340/RCX320 controller.

Tracking board

Name	Model
Tracking board	KCX-M4400-T0

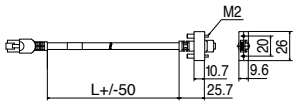
Tracking board accessories

Name	Model
Tracking encoder connector	KX0-M657K-20

Camera cable

Cable for connecting the camera to the RCXiVY2+ board.

External diagram of camera cable



Cable length (L)	Model
5m	KCX-M66F0-00
10m	KCX-M66F0-10
15m	KCX-M66F0-20

* Common to iVY2.

LAN cable with shield cloth (5 m)

Model	KX0-M55G0-00

Tracking encoder cable (10 m)

Model	KX0-M66AF-00

Calibration jig (Large and small attachments are provided.)

Model	KCX-M7200-00