YAMAHA
Revs Your Heart

NEW New functions were added.

Code recognition function

Automatic image saving/History image saving

Multiple camera connection (up to eight cameras)

RCX 3 Series **CONTROLLER** YAMAHA ROBOT VISION

RCXiVY2+ SYSTEM

Yamaha's own unique solution for integrated robot vision

Integrated Robot Vision System with

Simplicity

Sophistication

Assurance

- Easy Operation
- Wide range of applications
- Shorter startup time
- Comprehensive support of robot and vision by Yamaha

⚠ **Safety Precautions**

Read the instruction manual thoroughly to operate the robot in a correct manner.

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●Specifications and appearance are subject to change without prior notice.

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RCXiVY2+ SYSTEM

Camera	Parts registration	Search time reduced by	Maximum cable length	Monitoring
400,000 to **5** million pixels	**254** types	Approximately **50** % less	**20** m	**Monitor output is provided**

* Time depends on the workpiece.

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.

Solutions RCXiVY2+ can provide:

Reducing teaching process time

Robot teaching work requires a lot of labor and time. The RCXiVY2+ 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.

Conveyor tracking

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

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.

Yamaha's comprehensive support of Robot and Vision

Yamaha's integrated robot vision system. It means Yamaha supports both robot and vision system seamlessly.
Have any questions and don't know if it is robot or vision related? Simply contact 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.

Advanced RCX iVY2+ has been launched.

RCXiVY2+ features:

▌ **Adjusting parts orientation on the fly**

▌ **Conveyor follower**

▌ **Searching randomly placed parts**

▌ **Top/bottom judgement**

▌ **OK/NG judgement**

NEW Increased application features

▌ **Picking of irregular shape workpieces**

▌ **Presence inspection**

▌ **Multiple piece count**

NEW Enhanced performance

▌ **CPU capability is increased to improve the search speed 8 to 45%.**

▌ **Number of pixels is increased.**

▌ **Frame rate is increased.**

NEW Easy operation

▌ **Supports template function of RCX-Studio 2020**

Easy operation

New features for easy operation

NEW

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.

NEW

Detection time is shortened up to 45%.

CMOS camera

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.
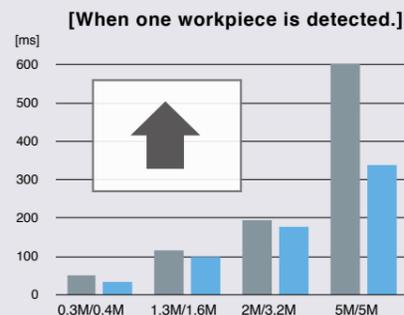
Improved camera pixels

Improved camera frame rate

Improved CPU

Comparison of search time

Time Up to 45% is shortened.

■ Conventional iVY2   *NEW* ■ RCXiVY2+

[When one workpiece is detected.]

[ms]
600
500
400
300
200
100
0
0.3M/0.4M   1.3M/1.6M   2M/3.2M   5M/5M

[When 50 workpieces are detected.]

[ms]
600
500
400
300
200
100
0
0.3M/0.4M   1.3M/1.6M   2M/3.2M   5M/5M
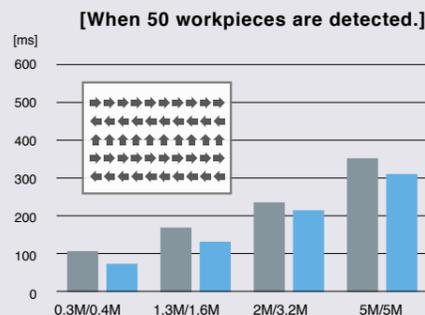
NEW

Suitable for parts detection and high volume parts count

Application examples
Subject to application and conditions.

■ 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

NEW

Overlap can be eliminated.

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

NEW

Detection with Speed

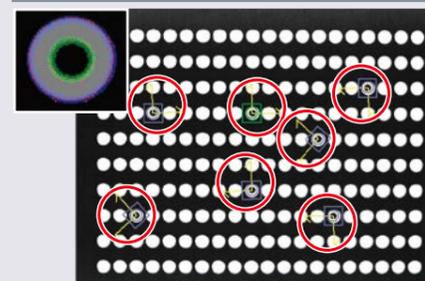Comparing with edge search, blob search speed is 2 to 10 times faster.
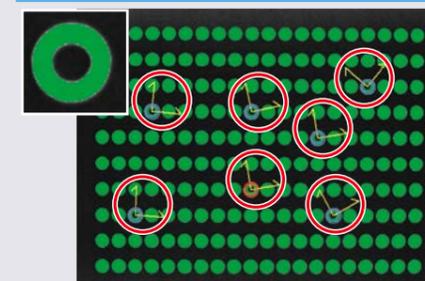
Search speed Up to 10 times faster

Comparison of edge search and blob search
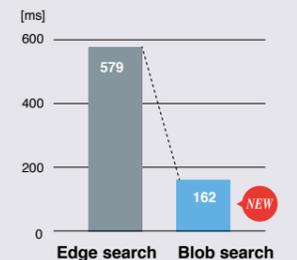
* Only doughnut shape workpieces are detected.

Edge search

Blob search

[Comparison of search speed]

[ms]
600
400
200
0

579   Edge search
162 *NEW*   Blob search

NEW

Suitable for traceability management

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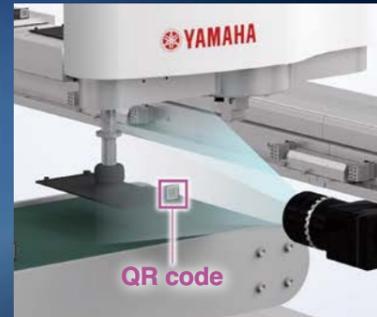
[Supported codes]	· QR code
	· Data matrix code
	· Barcode (JAN/EAN-13 JAN/EAN-8 ITF NW7 CODE39 CODE128)

* 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.)

QR code

NEW

Width of application is expanded.

Connection of multiple cameras

Up to eight cameras can be connected via HUB and support various applications such as addition of code recognition camera.

Workpiece is searched for.

Placing position is corrected.

Positioning and angle are corrected.

[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.

NEW

Convenient for checking captured images

Images are saved automatically and can be checked easily on an external monitor.

These functions are very convenient when you want to check the captured images retrospectively during operation or debugging or save the images for traceability purposes.

Automatic image save function

Images can be saved to a USB memory automatically. An SSD or HDD that can be connected to a USB port can also be used.

[Parameters]

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	327680
1.6 million pixels	1.6MB	81920
3.2 million pixels	3.2MB	40960
5 million pixels	5.0MB	26214
Reduced.	0.08MB	1638400

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.
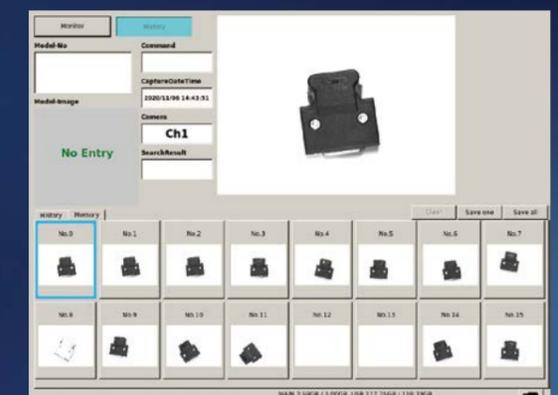
History image function

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.
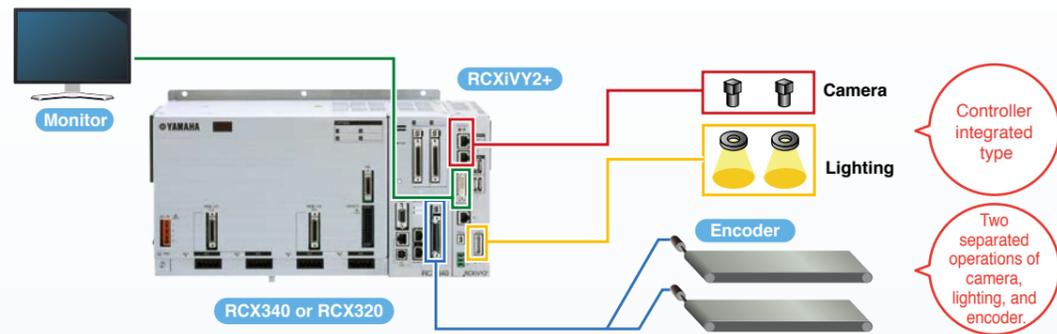
Images in the memories (Nos. 0 to 15) are checked.

[Number of images that can be saved]

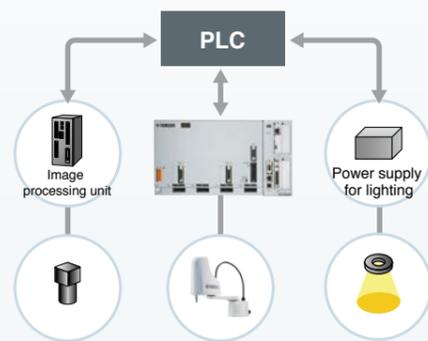| Number of camera pixels	Image size	Number of images that can be saved
0.4 million pixels	0.4MB	1250
1.6 million pixels	1.6MB	312
3.2 million pixels	3.2MB	156
5 million pixels	5.0MB	100

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

[Robot controller integrated type]

Monitor

RCXiVY2+

YAMAHA

RCX340 or RCX320

Camera

Lighting

Encoder

Controller integrated type

Two separated operations of camera, lighting, and encoder.

Typical Robot Vision setup

PLC

Image processing unit

Power supply for lighting

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.

✕

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

RCXiVY2+ system

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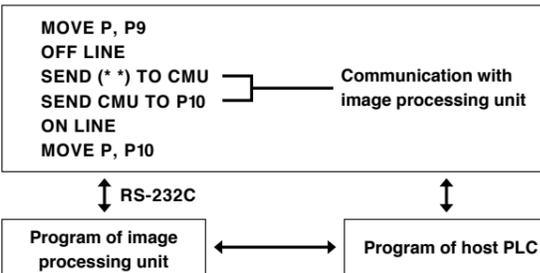
1 Simple calibration function is incorporated.
2 Coordinates are corrected automatically even when the camera moves.
3 High-speed connections through dedicated bus line.
4 Controller is incorporated to provide the central operation.
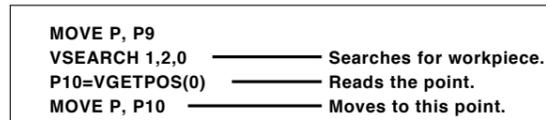5 Applicable to all models of YAMAHA robot lineup.

○

· 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
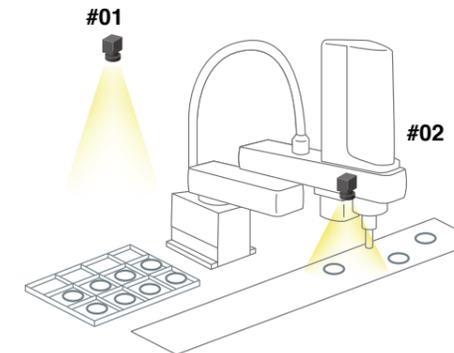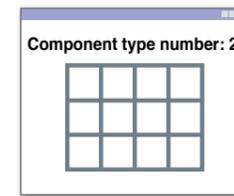
Centralized control using only the robot program

[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.
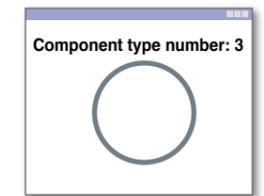
VSEARCH 1, 2, 1
· Camera: 1
· Component type number: 2
· Calibration data: 1

#01

#02

Component type number: 2

VSEARCH 2, 3, 2
· Camera: 2
· Component type number: 3
· Calibration data: 2

Component type number: 3

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

The search results can be substituted into the point coordinates directly.
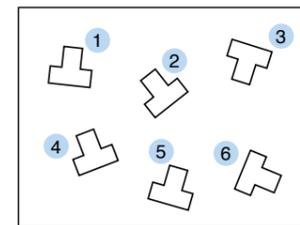
VSEARCH 1, 2, 1 · · · Detects the workpieces.
N = VGETCNT · · · Substitutes the number of detected workpieces.
FOR J = 0 TO N-1
P[J] = VGETPOS (J) · · · Acquires the workpiece coordinates.
NEXT J

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

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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
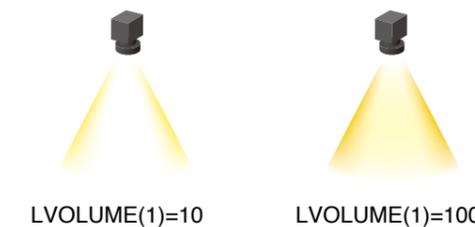
LVOLUME(1)=80
↓
VSEARCH
↓ NG   OK
LVOLUME(1)=100
↓
VSEARCH
↓ NG   OK
LVOLUME(1)=60
↓
VSEARCH
↓ NG   OK
Error process

To next process

[3 easy steps for parts registration]

Requires as little as **3** minutes

From image acquisition, registration takes just three steps.

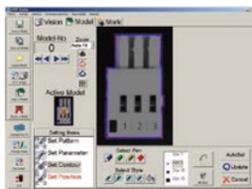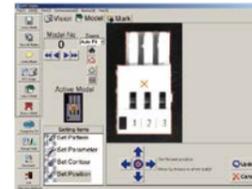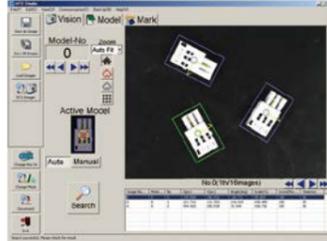| STEP. 1	STEP. 2	STEP. 3	Search results
Capture images.	**Set the contour.**	**Register the detection position.**	
Put the workpiece within the camera field-of-view and specify an image capturing range.	Contour is automatically extracted. Paint the necessary contour with a pen tool.	Specify the detection position with the mouse. Desired positions can be set.	

[Simple parts judgement process]
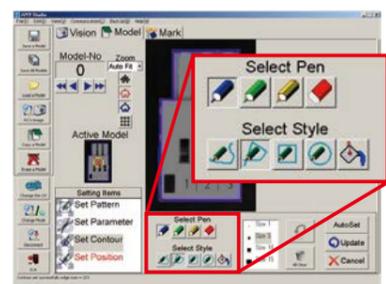
Contour setting pen
Paints the areas to be used from among the automatically detected edges.

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.

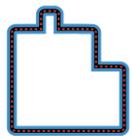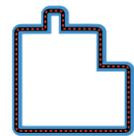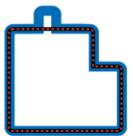**[Usage example]**

· Workpiece top or bottom judgement

ABC   **A C**

· 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.
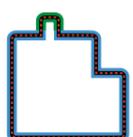
Green : Priority area setting

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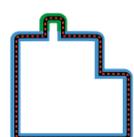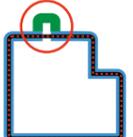
OK   NG

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.

[Simple calibration]

Requires as little as **5** minutes

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 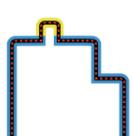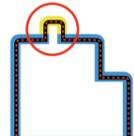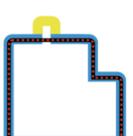perform the operation will complete the calibration easily within a short time. In addition, even when the setting position deviates, the calibration is executed and restored immediately.

STEP. 1	STEP. 2
Register the desired fiducial mark	**Select the camera mounting method**

Mounted on robot

Can be mounted on moving part

Camera   Camera

Fixed upward

Camera

Camera
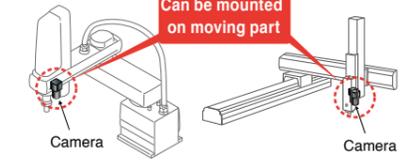
STEP. 3	Execute auto-calibration
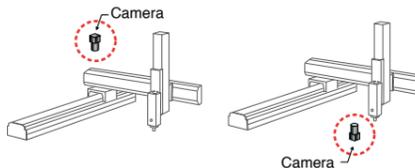
Align fiducial mark position

If camera is movable, move the robot
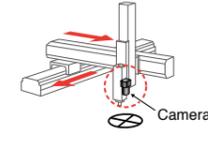
Camera

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

Camera

Fiducial mark
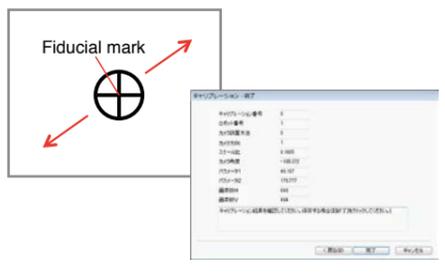
[Calibration is automated with the dedicated jig.]

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.

Man-hours such as hand data creation and teaching work can be shortened greatly.

Hand data creation
Teaching
Calibration
Result check
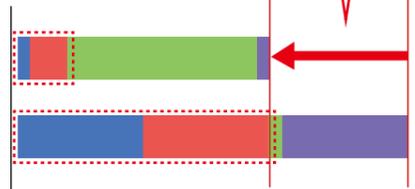
Advanced function — Approx. 20 min.

Manual operation — Approx. 30 min.

Work time

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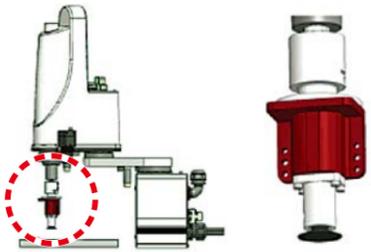
* This jig can be used only with the downward camera.

[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

RCXiVY2+ system

Setup time is shortened greatly

General-purpose vision

Setup time

Setup time reduced by up to **80%**

- Installation
- Calibration
- Pattern registration
- Parameter setting
- Communication setting
- Program setting
- Debug

[Easy link with peripheral equipment]

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

Robot vision: RCXiVY2+ System

Camera Light

Electric gripper: YRG series
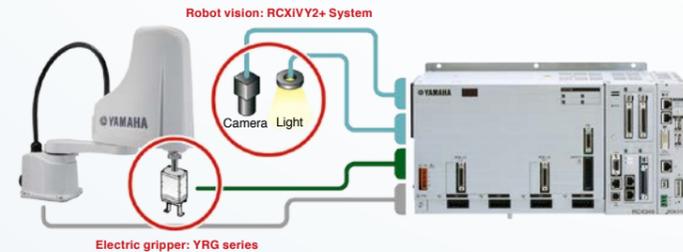
[System configuration illustration]

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

Programming box PBX

Monitor

RCXiVY2+ unit

Software RCXiVY2+ Studio

RCXiVY2+ Studio

DC12 V/24 V power supply (The power supply depends on the light specifications.)

Camera

24VDC power supply

Lighting

Photoelectric or proximity sensor, etc.

Robot

Encoder

Tracking board (when installed in option slot 4)

[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.

CMOS camera

Palletizing robot

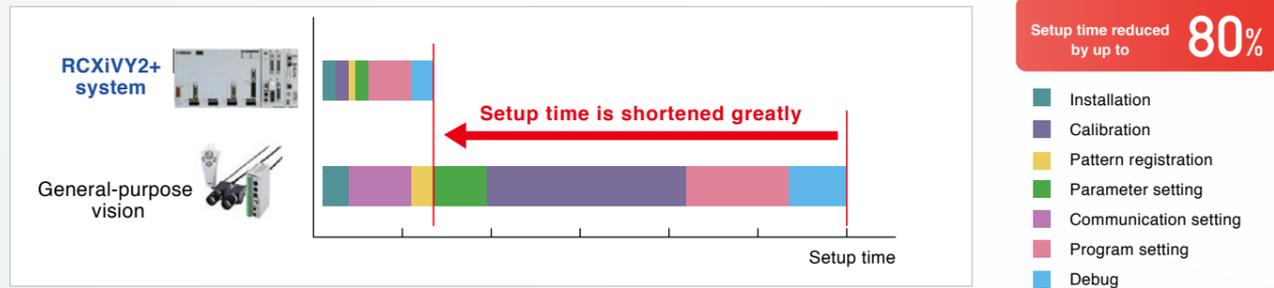Supply conveyor   Pallet   Collection conveyor

Example program

❶ New CTMOVE CTMOVE (1),Z=0.0,CTZ=10.0

Can be executed with a single command

Unify the move up command, follow workpiece command, move down command

Seamless movement from move up to move down

❶ Predict workpiece location and move directly

Conveyor direction

Tracking start position

Workpiece pickup location

Reduce movement distance

Workpiece position when tracking begins

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

[Improving productivity by controlling multiple robot systems]

RCX340＋RCXiVY2+

RCX340

Tracking board

YC-Link/E

Connect up to four units

100 CPM/unit x 4 units (maximum 400 CPM)

Shortened cycle time

Improve throughput

Parts sorting by program contributes productivity

Information from a single camera can be shared by multiple robots

Control two robots to let downstream robot handle missed items

Conveyor direction
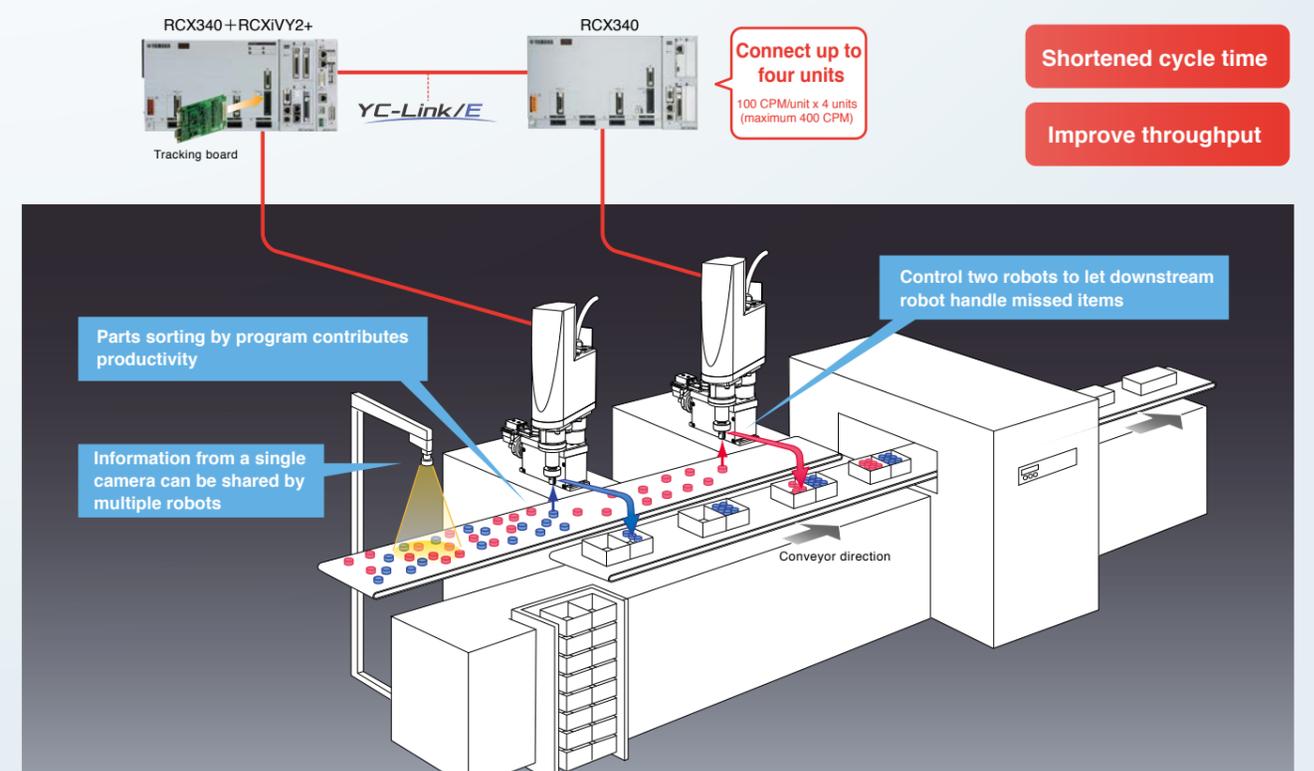
[Up to 254 types of parts registration]

254 types (0–253) can be registered

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

[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.
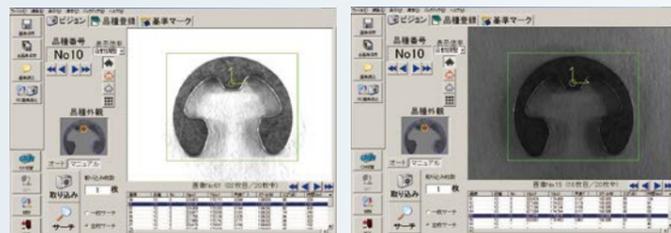
When lighting is sufficient

Accurate search even if lighting is insufficient

[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)

[Lens distortion and camera inclination correction function]

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

* Up to approx. 15 degrees

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.
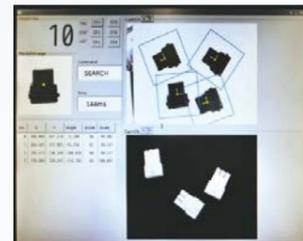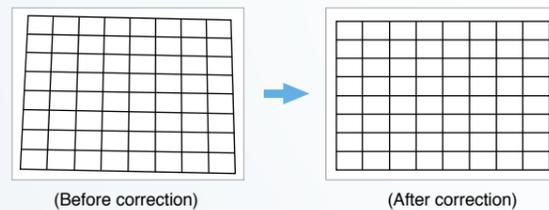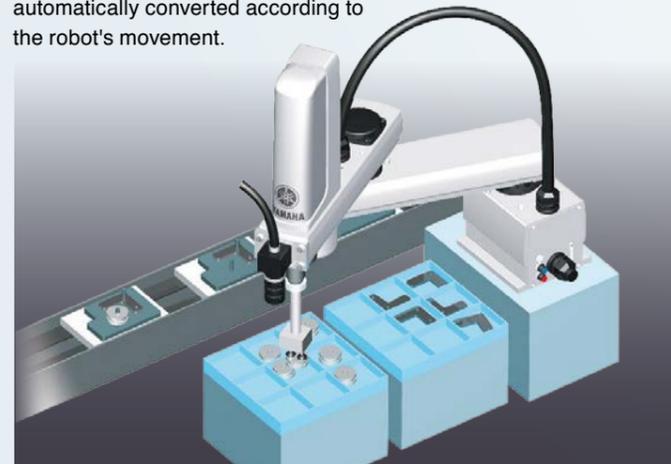
(Before correction)

(After correction)

[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.

Fixed camera   Fixed downward.   Fixed upward.

Movable camera   SCARA robots   Cartesian robots
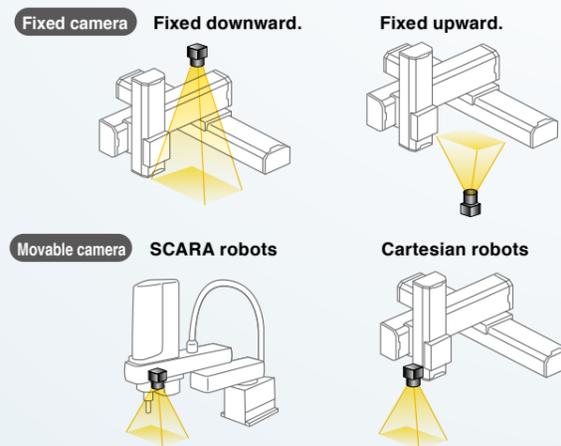
Even when the camera is moved, the coordinates are corrected automatically.

[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.

RCXiVY2+ Studio

Download from website (member site)

[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:
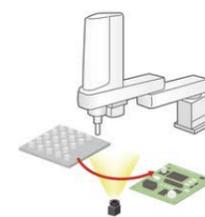
- Pallet picking using the vision
- Dispensing work using the vision
- Gripping deviation correction using the vision
- Gripping deviation and mounting position correction using the vision
- Gripping deviation and mounting position correction using the vision (without using any master)
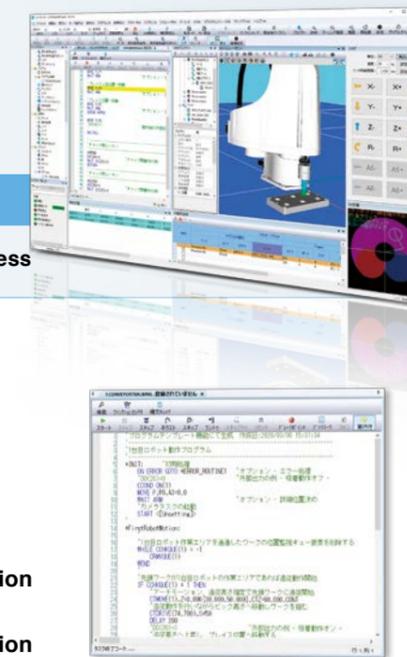
Wide variety of robot system to choose from most suitable and economical solution for robot vision system

XY-X Cartesian robots

YK-XG/XE SCARA robots

YK-TW orbit type robots

FLIP-X single-axis robots

* The YA series is not supported.

[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

Preliminary evaluation

Starting evaluation with actual sample piece

■ **Evaluation conditions (example)**

Lens: 8 mm
Lighting
Lighting height: 375 mm
WD: 400 mm
Workpiece
Background: black

Sample parts review

Actual Simulation

Actual machine test

Evaluation of application with robot and vision setup

Actual machine test

Recommendation

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

Advice regarding camera, lens, and lighting settings

Recommendation with evaluation report

Robot training

Robot training

Training is available upon request

Follow-up after delivery

▶ **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.

[Lot application examples]

Application 1 — 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.
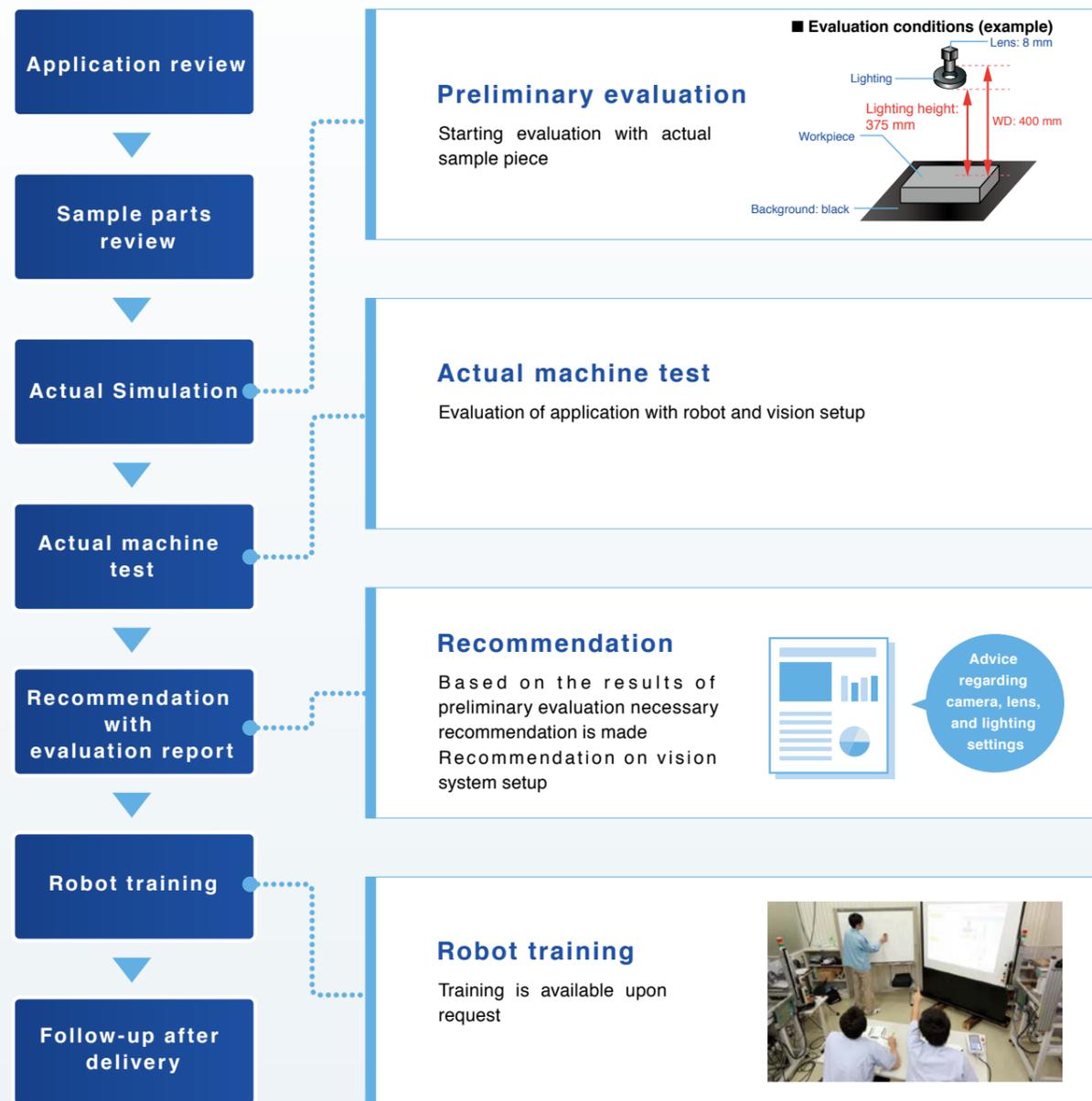
❸ The camera recognizes the position.
POINT
Even when the positions or orientations of workpieces that are flown are not aligned, the labels are adhered to the same positions.
❷ The positions, orientations, and clearances are not aligned.
❹ The label is adhered to the determined position.
❶ Workpieces are flown.

Application 2 — 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.
❷ The camera recognizes the workpiece position.
❸ The sealing is applied correctly.
❶ The workpiece is placed within the specified area.

Application 3 — Adjusting screw fastening position

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

❷ Camera recognizes tolerance **POINT**
❶ Wide tolerance of hole position even after parts are positioned
Even when there are variations in product accuracy such as resin mold product, the products can be assembled correctly.
❸ The screw is tightened correctly.

Application 4 — "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.
❸ Workpiece is assembled at the correct position.
❷ Camera corrects the workpiece position during transfer.
❶ Workpieces are positioned roughly in the tray.

Application 5 — Conveyor tracking

Pick-and-pace operation of randomly positioned parts on conveyor by SCARA robot. Position and orientation of parts are recognized by vision camera.
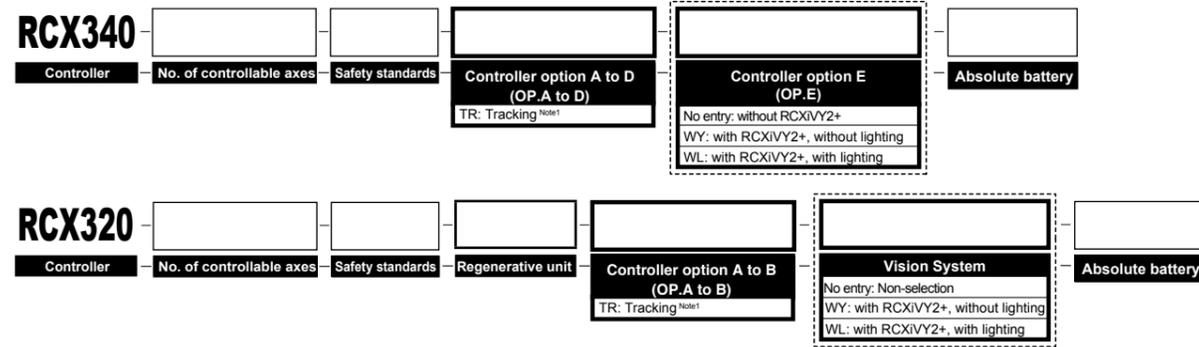
POINT
Handling process is reduced without teaching

Application 6 — 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

● 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 to B (OP.A to B) | Vision System | Absolute battery |

Controller option A to B (OP.A to B)
TR: Tracking Note1

Vision System
| No entry: Non-selection |
| WY: with RCXiVY2+, without lighting |
| WL: with RCXiVY2+, with lighting |

Note1. Only one tracking board can be selected.
● Refer to the comprehensive catalog for details on the order format.

●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	12VDC or 24VDC (external supply shared by both channels)
Lighting output	For 12VDC supply: Total of less than 40W for both channels. / For 24VDC 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)

●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, Ā, B, B̄, Z, Z̄
Max. response frequency	2MHz or less
Counter	0 to 65535
Multiplier	4x
Other	With disconnection detection function

Standard accessories

● RCXiVY2+ unit

The RCXiVY2+ unit adds robot vision to the RCX340/RCX320 robot controller.
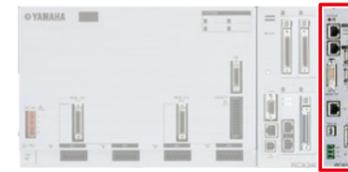
Model	No lighting	KFR-M4400-V0
	With lighting	KFR-M4400-L0

・ RCXiVY2+ unit accessories
Trigger input cable connector set

Model	KX0-M657K-00

24V power supply connector

Model	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)
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

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

Options

● CMOS camera

Model	400,000 pixel	720(H) × 540(V)	KFR-M6541-00
	1,600,000 pixel	1440(H) × 1080(V)	KFR-M6541-10
	3,200,000 pixel	2048(H) × 1536(V)	KFR-M6541-20
	5,000,000 pixel	2592(H) × 1944(V)	KFR-M6541-30

● 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

● Camera cable

Cable for connecting the camera to the RCXiVY2+ unit.

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

External diagram of camera cable

L+/-50   25.7   10.7   9.6   M2   20   26
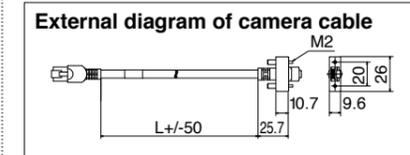
* Common to iVY2.

● Lighting control board

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

Model	KCX-M4403-L0

・ Lighting control board accessories
Lighting power cable connector

Model	KX0-M657K-10

● Tracking board

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

Model	KCX-M4400-T0

・ Tracking board accessories
Tracking encoder connector

Model	KX0-M657K-20

● Calibration jig (Large and small attachments are provided.)

Model	KCX-M7200-00

● LAN cable with shield cloth (5 m)

Model	KX0-M55G0-00

● Tracking encoder cable (10 m)

Model	KX0-M66AF-00

RCX340＋RCXiVY2+

RCX320＋RCXiVY2+

Calibration jig

Calibration jig
Model: KCX-M7200-00

Mark gripper dimension

Mark dimension

Body dimension
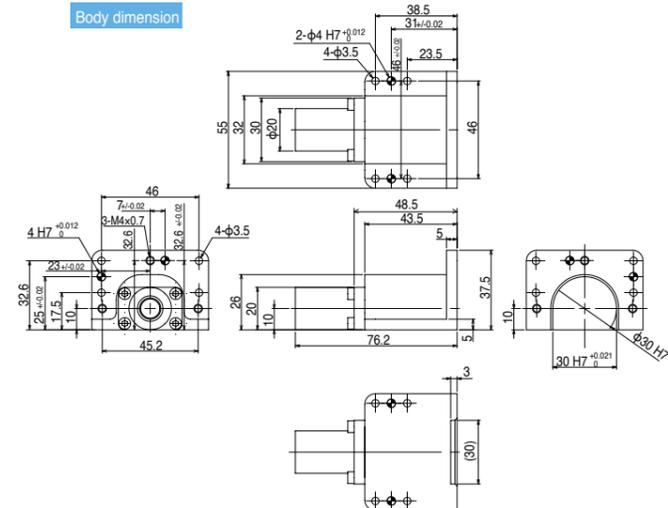
When using attachment (large)

When using attachment (small)
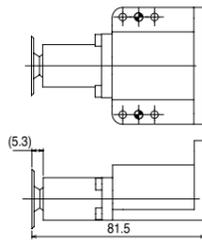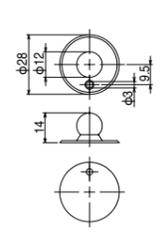
Camera

● **CMOS camera** (400,000 pixel / 1,600,000 pixel / 3,200,000 pixel / 5,000,000 pixel)

2-M3 depth 3.5

1"-32UNF (C-mount)

2-M2 depth 4

4-M3 depth 3.5
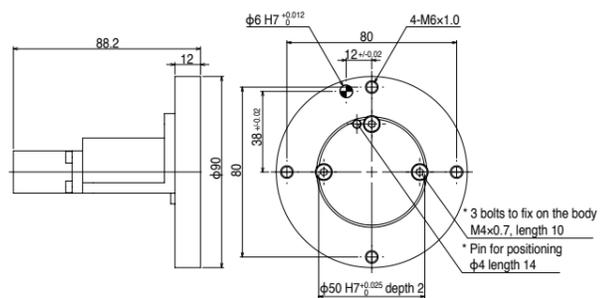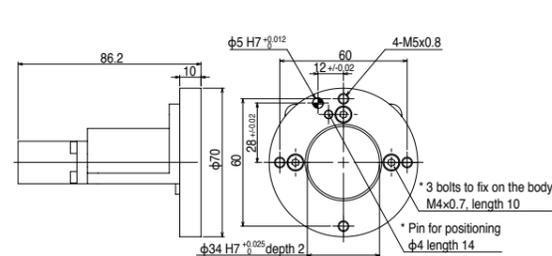
Lenses

8 mm lens
Model: KCX-M7214-00
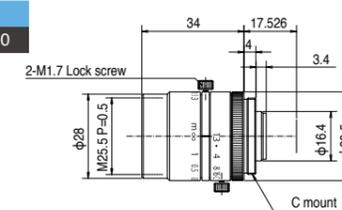
8 mm lens (megapixel support)
Model: KCX-M7214-40

12 mm lens
Model: KCX-M7214-10
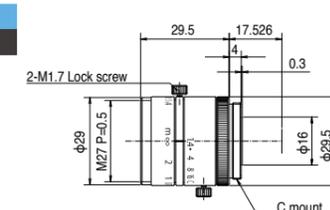
12 mm lens (megapixel support)
Model: KCX-M7214-50

16 mm lens
Model: KCX-M7214-20

16 mm lens (megapixel support)
Model: KCX-M7214-60

25 mm lens
Model: KCX-M7214-30

25 mm lens (megapixel support)
Model: KCX-M7214-70

MEMO

● Lens characteristics

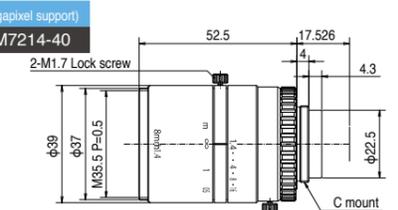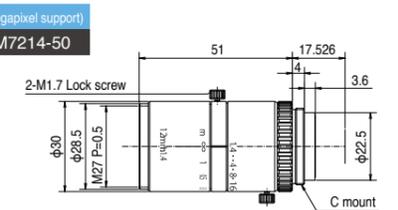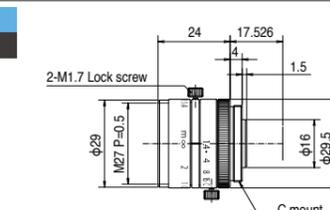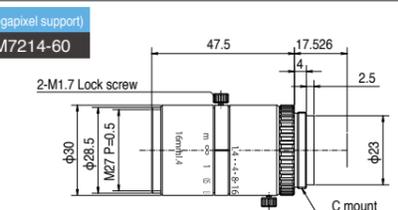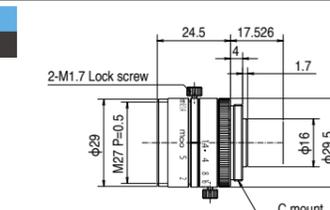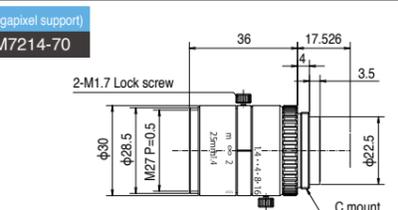| Lens	Model	Focal length [mm]	Aperture value [F No.]	Angle-of-view (degrees)								Closest approach distance [m]
				KFR-M6541-00 (400,000 pixel camera)		KFR-M6541-10 (1,600,000 pixel camera)		KFR-M6541-20 (3,200,000 pixel camera)		KFR-M6541-30 (5,000,000 pixel camera)		
				Vertical	Horizontal	Vertical	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.

● Angle-of-view size, WD(Work distance), and magnification when close-up ring is used

Close-up ring [mm]			Lens							
			8 mm KCX-M7214-00		12mm KCX-M7214-10		16mm KCX-M7214-20		25mm KCX-M7214-30	
None		WD[mm]	200		300		400		500	
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)	97.8 × 130.5		93 × 124		93 × 124		72.9 × 97.2	
		KFR-M6541-10 (1,600,000 pixels)	98.6 × 130.5		93.7 × 124		93.7 × 124		73.5 × 97.2	
		KFR-M6541-20 (3,200,000 pixels)	139.2 × 185.7		132.2 × 176.5		132.2 × 176.5		103.7 × 138.4	
		KFR-M6541-30 (5,000,000 pixels)	112.3 × 150		106.7 × 142.5		106.7 × 142.5		83.7 × 111.7	
		Optical magnification	0.038		0.040		0.040		0.051	
0.5		WD[mm]	69.5	118.6	143	296.8	222	524.1	358.5	1269.4
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)	37.2 × 49.6	60 × 80	46.5 × 62	93 × 124	52.3 × 69.8	120 × 160	53.1 × 70.8	186 × 248
		KFR-M6541-10 (1,600,000 pixels)	37.5 × 49.6	60.4 × 80	46.8 × 62	93.7 × 124	52.8 × 69.8	120.9 × 160	53.5 × 70.8	187.5 × 248
		KFR-M6541-20 (3,200,000 pixels)	52.9 × 70.6	85.3 × 113.8	66.1 × 88.2	132.2 × 176.5	74.5 × 99.4	170.6 × 227.7	75.5 × 100.8	264.5 × 353
		KFR-M6541-30 (5,000,000 pixels)	42.7 × 57	68.8 × 91.9	53.3 × 71.2	106.7 × 142.5	60.1 × 80.2	137.7 × 183.8	61 × 81.4	213.5 × 285
		Optical magnification	0.100	0.062	0.080	0.040	0.071	0.031	0.070	0.020
1.0		WD[mm]	38.7	53.8	91.3	142.3	152	257.1	280.8	635.9
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)	22.9 × 30.6	30 × 40	31 × 41.3	46.5 × 62	36.8 × 49.1	60.9 × 81.3	40.8 × 54.5	93 × 124
		KFR-M6541-10 (1,600,000 pixels)	23.1 × 30.6	30.2 × 40	31.2 × 41.3	46.8 × 62	37.1 × 49.1	61.4 × 81.3	41.2 × 54.5	93.7 × 124
		KFR-M6541-20 (3,200,000 pixels)	32.6 × 43.5	42.6 × 56.9	44 × 58.8	66.1 × 88.2	52.3 × 69.9	86.7 × 115.7	58.1 × 77.5	132.2 × 176.5
		KFR-M6541-30 (5,000,000 pixels)	26.3 × 35.1	34.4 × 45.9	35.5 × 47.5	53.3 × 71.2	42.2 × 56.4	70 × 93.4	46.9 × 62.6	106.7 × 142.5
		Optical magnification	0.162	0.124	0.120	0.080	0.101	0.061	0.091	0.040
1.5		WD[mm]			65.4	90.8	114.5	168.1	230.9	424.7
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)			23.1 × 30.8	30.7 × 40.9	28.1 × 37.5	40.4 × 53.9	33.5 × 44.6	62 × 82.6
		KFR-M6541-10 (1,600,000 pixels)			23.2 × 30.8	30.9 × 40.9	28.4 × 37.5	40.7 × 53.9	33.7 × 44.6	62.5 × 82.6
		KFR-M6541-20 (3,200,000 pixels)			32.8 × 43.8	43.7 × 58.3	40 × 53.4	57.5 × 76.7	47.6 × 63.6	88.1 × 117.6
		KFR-M6541-30 (5,000,000 pixels)			26.5 × 35.4	35.2 × 47.1	32.3 × 43.1	46.4 × 61.9	38.4 × 51.3	71.1 × 95
		Optical magnification			0.161	0.121	0.132	0.092	0.111	0.060
2.0		WD[mm]			50	65.1	91.2	123.6	196.3	319.1
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)			18.5 × 24.6	23.1 × 30.8	22.9 × 30.6	30.4 × 40.6	28.6 × 38.1	47 × 62.7
		KFR-M6541-10 (1,600,000 pixels)			18.6 × 24.6	23.2 × 30.8	23.1 × 30.6	30.7 × 40.6	28.8 × 38.1	47.4 × 62.7
		KFR-M6541-20 (3,200,000 pixels)			26.3 × 35.1	32.8 × 43.8	32.6 × 43.5	43.3 × 57.8	40.6 × 54.3	66.9 × 89.3
		KFR-M6541-30 (5,000,000 pixels)			21.2 × 28.3	26.5 × 35.4	26.3 × 35.1	35 × 46.7	32.8 × 43.8	54 × 72.1
		Optical magnification			0.201	0.161	0.162	0.122	0.130	0.079
5.0		WD[mm]							104.2	129
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)							14.8 × 19.8	18.6 × 24.9
		KFR-M6541-10 (1,600,000 pixels)							15 × 19.8	18.6 × 24.9
		KFR-M6541-20 (3,200,000 pixels)							21.1 × 28.2	26.5 × 35.4
		KFR-M6541-30 (5,000,000 pixels)							17 × 22.8	21.4 × 28.6
		Optical magnification							0.250	0.199

Note. WD is the lens tip reference.

Close-up ring [mm]			Lens							
			8 mm lens for megapixel KCX-M7214-40		12 mm lens for megapixel KCX-M7214-50		16 mm lens for megapixel KCX-M7214-60		25 mm lens for megapixel KCX-M7214-70	
None		WD[mm]	100		100		100		150	
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)	53.1 × 70.8		37.2 × 49.6		27.3 × 36.4		24.9 × 33.2	
		KFR-M6541-10 (1,600,000 pixels)	53.5 × 70.8		37.5 × 49.6		27.5 × 36.4		25.1 × 33.2	
		KFR-M6541-20 (3,200,000 pixels)	75.5 × 100.8		52.9 × 70.6		38.8 × 51.9		35.5 × 47.3	
		KFR-M6541-30 (5,000,000 pixels)	61 × 81.4		42.7 × 57		31.3 × 41.9		28.6 × 38.2	
		Optical magnification	0.070		0.100		0.136		0.149	
0.5		WD[mm]	46	113.6	66.1	283.2	77.8	505.4	130.3	1232.2
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)	28.1 × 37.5	59 × 78.7	25.8 × 34.4	90.7 × 120.9	22.4 × 29.8	120 × 160	22 × 29.3	186 × 248
		KFR-M6541-10 (1,600,000 pixels)	28.4 × 37.5	59.5 × 78.7	26 × 34.4	91.4 × 120.9	22.5 × 29.8	120.9 × 160	22.1 × 29.3	187.5 × 248
		KFR-M6541-20 (3,200,000 pixels)	40 × 53.4	83.9 × 112	36.7 × 49	129 × 172.1	31.8 × 42.5	170.6 × 227.7	31.3 × 41.7	264.5 × 353
		KFR-M6541-30 (5,000,000 pixels)	32.3 × 43.1	67.7 × 90.4	29.6 × 39.5	104.1 × 139	25.7 × 34.3	137.7 × 183.8	25.2 × 33.7	213.5 × 285
		Optical magnification	0.132	0.063	0.144	0.041	0.166	0.031	0.169	0.020
1.0		WD[mm]			47.2	131.9	62.6	243	114.6	607.2
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)			20.1 × 26.8	45.9 × 61.2	18.8 × 25.1	60 × 80	19.6 × 26.2	93 × 124
		KFR-M6541-10 (1,600,000 pixels)			20.2 × 26.8	46.2 × 61.2	19 × 25.1	60.4 × 80	19.8 × 26.2	93.7 × 124
		KFR-M6541-20 (3,200,000 pixels)			28.5 × 38.1	65.3 × 87.1	26.8 × 35.8	85.3 × 113.8	27.9 × 37.3	132.2 × 176.5
		KFR-M6541-30 (5,000,000 pixels)			23 × 30.8	52.7 × 70.3	21.6 × 28.9	68.8 × 91.9	22.5 × 30.1	106.7 × 142.5
		Optical magnification			0.185	0.081	0.197	0.062	0.189	0.040
1.5		WD[mm]			35.2	81.4	51.5	155.5	102	398.9
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)			16.5 × 22	33.2 × 44.2	16.3 × 21.7	40 × 53.3	17.7 × 23.7	62 × 82.6
		KFR-M6541-10 (1,600,000 pixels)			16.6 × 22	33.4 × 44.2	16.4 × 21.7	40.3 × 53.3	17.9 × 23.7	62.5 × 82.6
		KFR-M6541-20 (3,200,000 pixels)			23.5 × 31.3	47.2 × 63	23.2 × 30.9	56.8 × 75.9	25.3 × 33.7	88.1 × 117.6
		KFR-M6541-30 (5,000,000 pixels)			18.9 × 25.3	38.1 × 50.8	18.7 × 25	45.9 × 61.2	20.4 × 27.2	71.1 × 95
		Optical magnification			0.225	0.112	0.228	0.093	0.209	0.060
2.0		WD[mm]					43	111.7	91.5	294.7
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)					14.3 × 19.1	30.2 × 40.3	16.2 × 21.6	46.5 × 62
		KFR-M6541-10 (1,600,000 pixels)					14.4 × 19.1	30.4 × 40.3	16.3 × 21.6	46.8 × 62
		KFR-M6541-20 (3,200,000 pixels)					20.4 × 27.2	43 × 57.3	23.1 × 30.8	66.1 × 88.2
		KFR-M6541-30 (5,000,000 pixels)					16.4 × 22	34.7 × 46.3	18.6 × 24.8	53.3 × 71.2
		Optical magnification					0.259	0.123	0.229	0.080
5.0		WD[mm]							53.9	107.2
	Angle-of-view size X × Y [mm]	KFR-M6541-00 (400,000 pixels)							10.6 × 14.2	18.6 × 24.8
		KFR-M6541-10 (1,600,000 pixels)							10.7 × 14.2	18.7 × 24.8
		KFR-M6541-20 (3,200,000 pixels)							15.1 × 20.2	26.4 × 35.3
		KFR-M6541-30 (5,000,000 pixels)							12.2 × 16.3	21.3 × 28.5
		Optical magnification							0.349	0.200

Note. The above table shows the field of view when the standard lens and close-up ring are used. (Closest distance value is shown in No Close-up Ring column).
Note. If a close-up ring is not used, a WD less than the value shown in this table cannot be used.
Note. If a close-up ring is used, only WD in the region of this value can be used.
Note. Values in this table are for reference only; Actual values may vary.