

● Lens characteristics

Lens	Model	Focal length [mm]	Aperture value [F No.]	Angle-of-view (degrees)		Angle-of-view (degrees)		Closest approach distance [m]
				With 1/3 inch sensor KCX-M6541-00 (300,000 pixel camera) KCX-M6541-10 (1,300,000 pixel camera)		With 1/1.8 inch sensor KCX-M6541-20 (2,000,000 pixel camera)		
				Vertical	Horizontal	Vertical	Horizontal	
8 mm	KCX-M7214-00	8	F1.3-CLOSE	25.21	33.2	37.08	47.59	0.2
12 mm	KCX-M7214-10	12	F1.4-CLOSE	16.48	21.86	24.51	31.88	0.3
16 mm	KCX-M7214-20	16	F1.4-CLOSE	12.57	16.71	18.77	24.51	0.4
25 mm	KCX-M7214-30	25	F1.4-CLOSE	8.18	10.89	12.25	16.06	0.5
8 mm (megapixel support)	KCX-M7214-40	8	F1.4-F16	25.36	33.4	37.3	47.86	0.1
12 mm (megapixel support)	KCX-M7214-50	12	F1.4-F16	16.65	22.08	24.76	32.2	0.1
16 mm (megapixel support)	KCX-M7214-60	16	F1.4-F16	12.68	16.85	18.92	24.72	0.1
25 mm (megapixel support)	KCX-M7214-70	25	F1.4-F16	8.24	10.97	12.33	16.16	0.15

\* 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, and magnification when close-up ring is used \* WD is the lens tip reference.

Close-up ring [mm]		WD [mm]	Lens			
			8 mm KCX-M7214-00	12 mm KCX-M7214-10	16 mm KCX-M7214-20	25 mm KCX-M7214-30
None	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	96.2 x 126.2	91.4 x 119.9	91.4 x 119.9	71.7 x 94.1
		KCX-M6541-10 (1,300,000 pixels)	95.4 x 126.4	90.6 x 120	90.6 x 120	71.1 x 94.2
		KCX-M6541-20 (2,000,000 pixels)	143.2 x 188.1	136 x 178.7	136 x 178.7	106.7 x 140.1
		KCX-M6541-30 (5,000,000 pixels)	112.6 x 150.1	106.9 x 142.6	106.9 x 142.6	83.9 x 111.9
	Optical magnification		0.038	0.040	0.040	0.051
0.5	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	36.6 x 48	59 x 77.4	45.7 x 60	91.4 x 119.9
		KCX-M6541-10 (1,300,000 pixels)	36.3 x 48	58.5 x 77.5	45.3 x 60	90.6 x 120
		KCX-M6541-20 (2,000,000 pixels)	54.4 x 71.5	87.8 x 115.3	68 x 89.4	136 x 178.7
		KCX-M6541-30 (5,000,000 pixels)	42.8 x 57.1	69 x 92	53.5 x 71.3	106.9 x 142.6
	Optical magnification		0.100	0.062	0.080	0.040
1.0	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	38.7	53.8	91.3	142.3
		KCX-M6541-10 (1,300,000 pixels)	22.6 x 29.6	29.5 x 38.7	30.5 x 40	45.7 x 60
		KCX-M6541-10 (1,300,000 pixels)	22.4 x 29.7	29.3 x 38.8	30.2 x 40	45.3 x 60
		KCX-M6541-20 (2,000,000 pixels)	33.6 x 44.2	43.9 x 57.7	45.4 x 59.6	68 x 89.4
	Optical magnification		0.162	0.124	0.120	0.080
1.5	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	65.4	90.8	114.5	168.1
		KCX-M6541-00 (300,000 pixels)	22.8 x 29.8	30.3 x 39.7	27.7 x 36.4	39.8 x 52.2
		KCX-M6541-10 (1,300,000 pixels)	22.5 x 29.9	30 x 39.7	27.5 x 36.4	39.4 x 52.2
		KCX-M6541-20 (2,000,000 pixels)	33.8 x 44.4	45 x 59.1	41.2 x 54.2	59.2 x 77.7
	Optical magnification		0.161	0.121	0.132	0.092
2.0	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	50	65.1	91.2	123.6
		KCX-M6541-00 (300,000 pixels)	18.2 x 23.9	22.8 x 29.8	22.6 x 29.6	30 x 39.4
		KCX-M6541-10 (1,300,000 pixels)	18.1 x 23.9	22.5 x 29.9	22.4 x 29.7	29.7 x 39.4
		KCX-M6541-20 (2,000,000 pixels)	27.1 x 35.6	33.8 x 44.4	33.6 x 44.2	44.6 x 58.6
	Optical magnification		0.201	0.161	0.162	0.122
5.0	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	104.2	129	172.2	229
		KCX-M6541-00 (300,000 pixels)	14.7 x 19.2	18.4 x 24.1	14.5 x 19.2	18.3 x 24.2
		KCX-M6541-10 (1,300,000 pixels)	14.5 x 19.2	18.3 x 24.2	14.5 x 19.2	18.3 x 24.2
		KCX-M6541-20 (2,000,000 pixels)	21.8 x 28.6	27.4 x 36	21.8 x 28.6	27.4 x 36
	Optical magnification		0.250	0.199	0.250	0.199

Close-up ring [mm]		WD [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	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	52.3 x 68.5	36.6 x 48	26.9 x 35.3	24.6 x 32.2
		KCX-M6541-10 (1,300,000 pixels)	51.8 x 68.6	36.3 x 48	26.7 x 35.3	24.4 x 32.3
		KCX-M6541-20 (2,000,000 pixels)	77.7 x 102.1	54.4 x 71.5	40 x 52.6	36.5 x 48
		KCX-M6541-30 (5,000,000 pixels)	61.1 x 81.5	42.8 x 57.1	31.5 x 42	28.7 x 38.3
	Optical magnification		0.070	0.100	0.136	0.149
0.5	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	46	113.6	66.1	283.2
		KCX-M6541-00 (300,000 pixels)	27.7 x 36.4	58.1 x 76.2	25.4 x 33.3	89.2 x 117
		KCX-M6541-10 (1,300,000 pixels)	27.5 x 36.4	57.5 x 76.2	25.2 x 33.4	88.4 x 117.1
		KCX-M6541-20 (2,000,000 pixels)	41.2 x 54.2	86.4 x 113.5	37.8 x 49.7	132.7 x 174.3
	Optical magnification		0.132	0.063	0.144	0.041
1.0	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	47.2	131.9	62.6	243
		KCX-M6541-00 (300,000 pixels)	19.8 x 26	45.2 x 59.2	18.6 x 24.4	59 x 77.4
		KCX-M6541-10 (1,300,000 pixels)	19.6 x 26	44.8 x 59.3	18.4 x 24.4	58.5 x 77.5
		KCX-M6541-20 (2,000,000 pixels)	29.4 x 38.7	67.2 x 88.3	27.7 x 36.3	87.8 x 115.3
	Optical magnification		0.185	0.081	0.197	0.062
1.5	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	35.2	81.4	51.5	155.5
		KCX-M6541-00 (300,000 pixels)	16.3 x 21.4	32.7 x 42.9	16.1 x 21.1	39.4 x 51.6
		KCX-M6541-10 (1,300,000 pixels)	16.1 x 21.4	32.4 x 42.9	15.9 x 21.1	39 x 51.7
		KCX-M6541-20 (2,000,000 pixels)	24.2 x 31.8	48.6 x 63.8	23.9 x 31.4	58.5 x 76.9
	Optical magnification		0.225	0.112	0.228	0.093
2.0	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	26.9	56.2	43	111.7
		KCX-M6541-00 (300,000 pixels)	13.8 x 18.1	22.5 x 29.5	14.2 x 18.6	29.8 x 39
		KCX-M6541-10 (1,300,000 pixels)	13.7 x 18.1	22.3 x 29.5	14 x 18.6	29.5 x 39.1
		KCX-M6541-20 (2,000,000 pixels)	20.5 x 26.9	33.4 x 43.9	21 x 27.6	44.3 x 58.1
	Optical magnification		0.266	0.163	0.259	0.123
5.0	Angle-of-view size X x Y [mm]	KCX-M6541-00 (300,000 pixels)	53.9	107.2	102	294.7
		KCX-M6541-00 (300,000 pixels)	10.5 x 13.8	18.3 x 24	10.4 x 13.8	18.2 x 24
		KCX-M6541-10 (1,300,000 pixels)	10.4 x 13.8	18.2 x 24	10.4 x 13.8	18.2 x 24
		KCX-M6541-20 (2,000,000 pixels)	15.6 x 20.5	27.2 x 35.8	15.6 x 20.5	27.2 x 35.8
	Optical magnification		0.349	0.200	0.349	0.200

\* 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).

\* If a close-up ring is not used, a WD less than the value shown in this table cannot be used.

\* If a close-up ring is used, only WD in the region of this value can be used.

\* Values in this table are for reference only; Actual values may vary.



Integrated Robot Vision System with  
"plug-and-play" simplicity

Yamaha's own unique solution  
for integrated robot vision



RCX340 CONTROLLER YAMAHA ROBOT VISION

ivy2 SYSTEM

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

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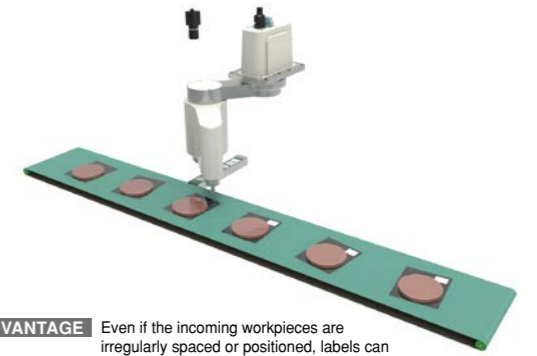
# RCX340 CONTROLLER YAMAHA ROBOT VISION iVY2 SYSTEM

A robot-integrated vision system that **only Yamaha could produce**

## Various application examples

### Labeling device (affixing labels to food packages)

■ Industry: food ■ Robot used: YK500TW omnidirectional robot



**ADVANTAGE** Even if the incoming workpieces are irregularly spaced or positioned, labels can be affixed at the same position.

### Sealant touch-up (engine block sealant)

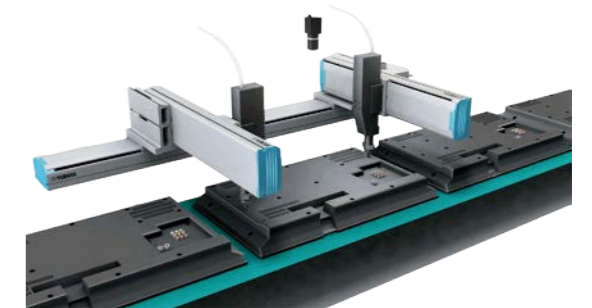
■ Industry: automotive ■ Robot used: SXYX Cartesian robot



**ADVANTAGE** Even if the workpiece is skewed from its correct position, the skew and angle are detected, and the application path is automatically compensated.

### Screw attachment position detection (television panel screw attachment)

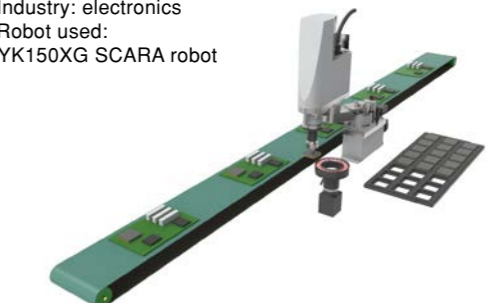
■ Industry: electronics ■ Robot used: NXY Cartesian robot



**ADVANTAGE** Hole position is detected, and screws are fastened accurately.

### Position compensation with upward-facing camera (installing irregularly-shaped parts on a circuit board)

■ Industry: electronics  
■ Robot used: YK150XG SCARA robot



**ADVANTAGE** The roughly-positioned circuit board connector is picked up, the upward-facing camera is used to apply position compensation, and the part is mounted directly on the circuit board.

## Simplicity

Setup is completed as little as eight minutes after power-on.

Auto-calibration makes setup easy.

» P4-5

## Sophistication

With up to five million pixels, a variety of workpieces can be supported.

Improve throughput to 100 CPM with conveyor tracking.

» P6-7

## 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.

» P8

## Easy to use, and reduces the number of steps

Adding "eyes" to a robot significantly expands the range of applications.

Basic specifications have been dramatically enhanced while retaining the current iVY system's ease of use.

Camera	Number of registered types	Shorter search time	Longer cables usable	Monitoring
Supports from 300,000 to <b>5</b> million pixels	Increased to <b>254</b> types	Approximately <b>50</b> % less	Cables can be as long as <b>20</b> m	<b>Monitor output is provided</b>
Megapixel camera support	Previously 40 types	With capture: 30–40% less Search only: approximately 50% less	Previously 9.5 m	Enables operating status to be monitored without a PC

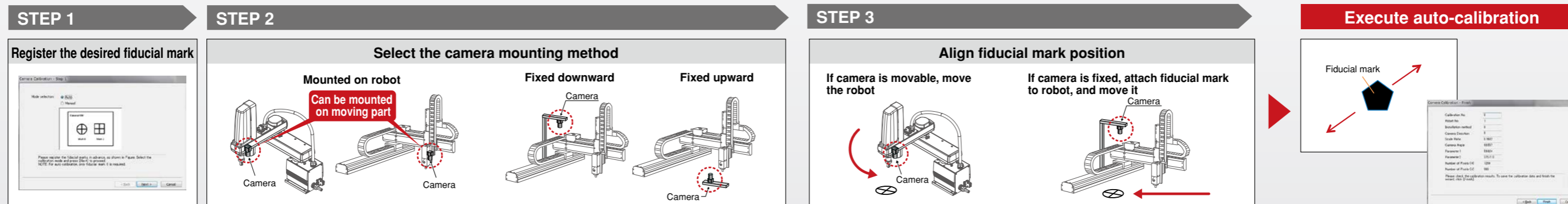
\* Time depends on the workpiece.

Our goal: "A vision system that anyone can use easily, even for the first time"

**SPEED UP**  
**Auto-calibration**

Requires as little as **5** minutes

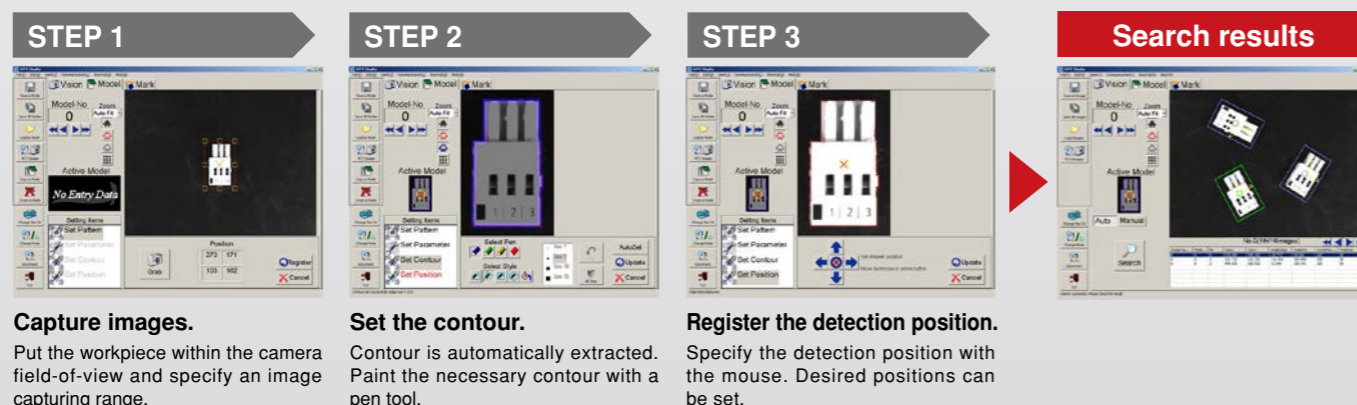
➤ Easily complete high-precision calibration just by following a wizard! Even if equipment becomes misaligned, execute auto-calibration and resume operation.



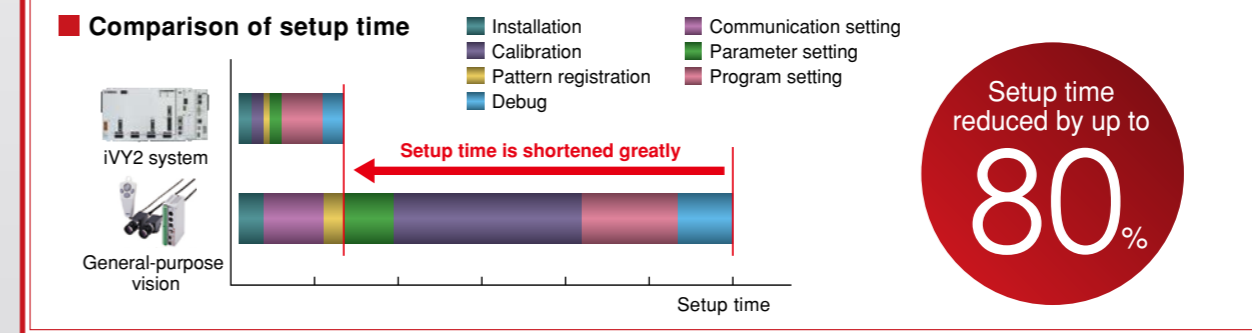
**SPEED UP**  
**Easy workpiece registration**

Requires as little as **3** minutes

➤ From image acquisition, registration takes just three steps.

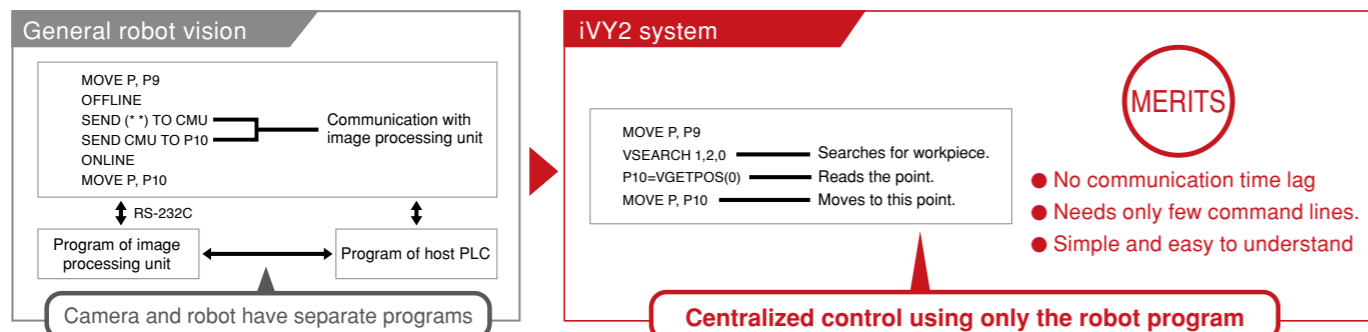


No need to make time-consuming connection settings. Dramatic reduction in setup time.



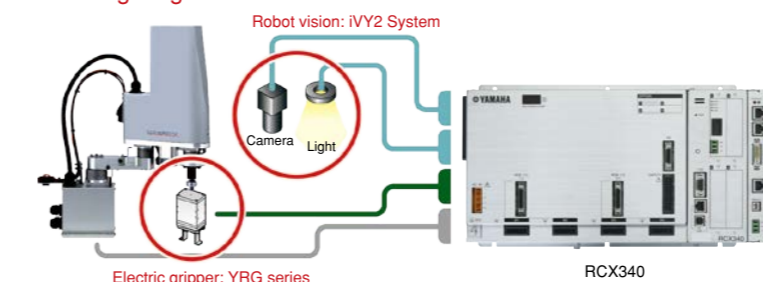
No need to create a coordinate conversion program.

➤ Dedicated robot language for vision is provided



Easy inter-operation with peripheral equipment

➤ The same controller provides unified control of robot, gripper, and lighting



Also supports moving camera

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



# Sophistication

IVY2 SYSTEM

Megapixel camera supports high precision and wide field of vision.

Conveyor tracking reaches 100 CPM.

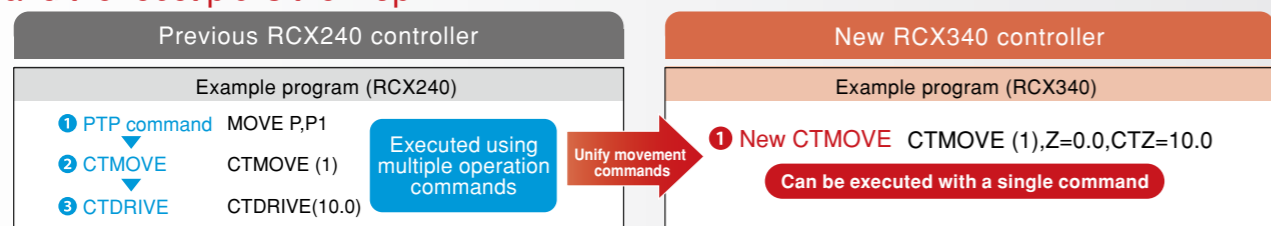


## Conveyor tracking

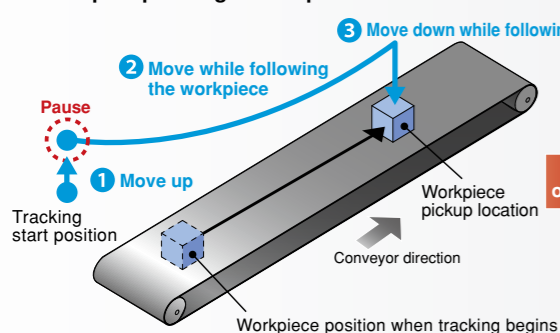
Ideal for high-speed packaging arrangement high-speed transport of multiple types of items such as pharmaceuticals, cosmetics, and food products.

Conveyor tracking reaches **100** CPM per unit

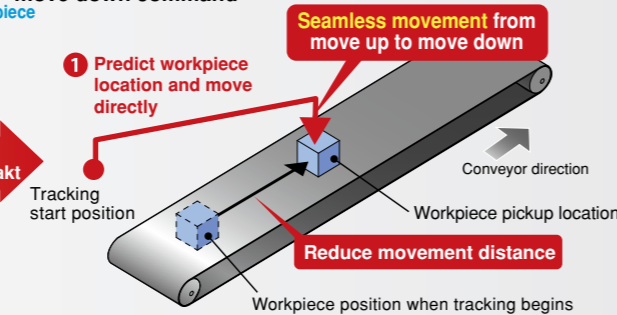
► The vision camera detects the position and orientation of parts moving on the conveyor, and the robot picks them up.



Multiple operating takt required



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



Reduce operating takt

Reduce movement distance

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

► Control multiple robots for even more improvement in production efficiency.

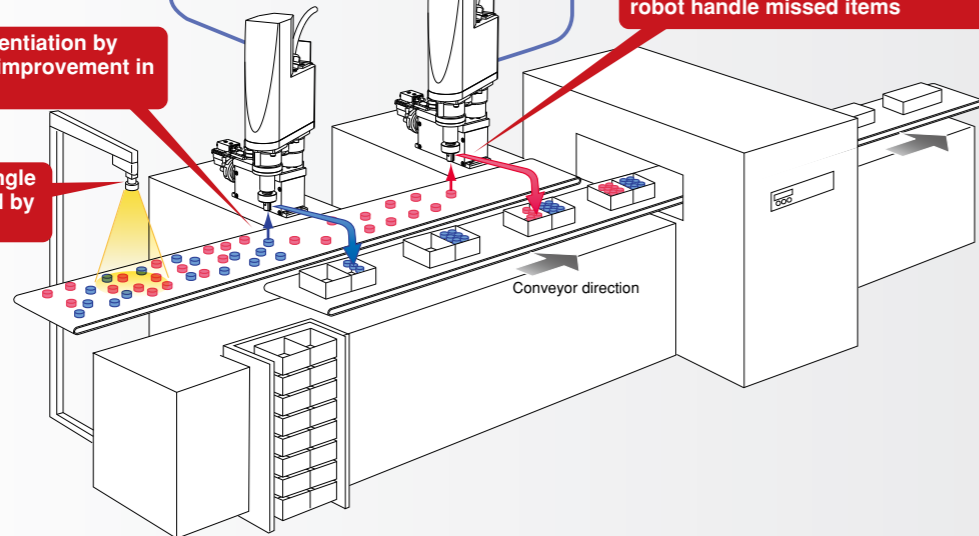
Shortened Improve cycle time throughput



Control two robots to let downstream robot handle missed items

Program allows differentiation by model for even more improvement in production efficiency

Information from a single camera can be shared by multiple robots

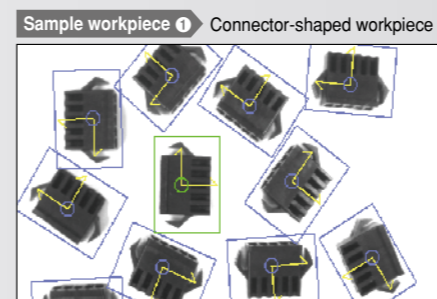


Approximately double the search speed (compared to previous model)

Approximately 50% reduction in search time

► Even numerous workpieces can be detected at high speed

The search speed is approximately double that of the previous model. Even a large number of workpieces can be detected at high speed. This can be used for a wide variety of applications, including molded plastic parts or food items.



RCX240 + iVY 158.7 ms → RCX340 + iVY2 83.8 ms



RCX240 + iVY 200.2 ms → RCX340 + iVY2 91.7 ms



RCX240 + iVY 149.8 ms → RCX340 + iVY2 91.1 ms

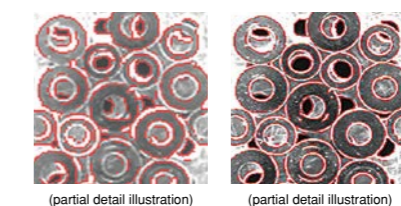
## Support for five-megapixel cameras

(Choose from 300,000 pixel, 1.3 megapixel, and 2 megapixel, and 5 megapixel)

► Stable workpiece detection

Detailed edge detection is possible even if workpieces are touching each other or have a complex shape.

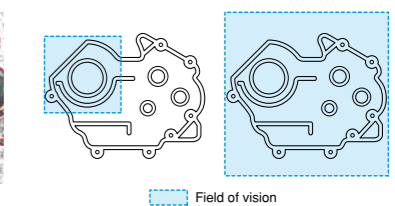
● Previous: 300,000 pixel camera ● New: 1.3 megapixel camera



► Decreased number of search detections

A single search allows detection even for a large workpiece, improving takt.

● Previous: 300,000 pixel camera ● New: two-megapixel camera



## 254 types can be registered

► Setup changes are easy

Setup changes require only that part numbers be changed.



## Monitor output is provided

► Monitor the operating status

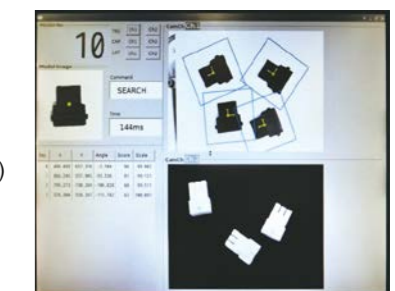
Monitor the search status while making calibration settings or during automatic operation.

Contents of output

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

Output method

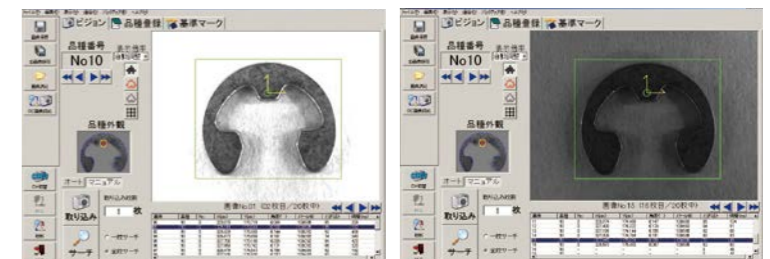
DVI-I (supports digital monitor or analog monitor)



## 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.

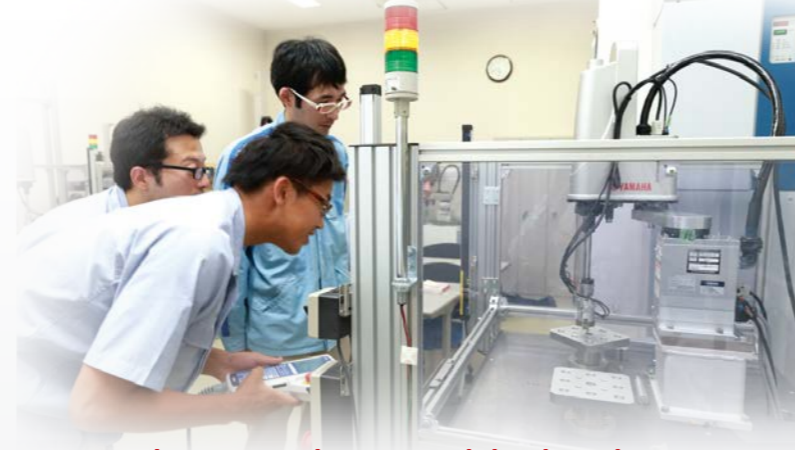


When lighting is sufficient

Accurate search even if lighting is insufficient

# Assurance

IVY2 SYSTEM



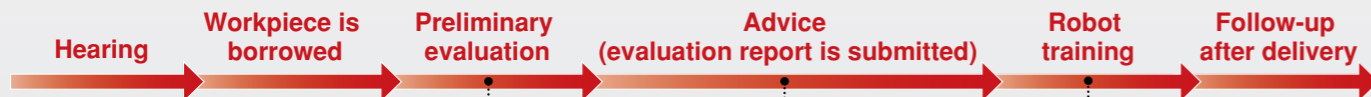
You have the assurance of support that can be provided only by Yamaha, the robot manufacturer.  
You can rely on us both before installation and after installation.

ADVICE



## Preparatory evaluation and advice give you peace of mind

We borrow the workpiece from you, evaluate it, and submit an evaluation report.  
In addition, we draw on our wealth of experience and evaluation results to provide advice and training regarding selection and installation of robots and peripheral equipment.



### Preliminary evaluation

■ Evaluation conditions (example)

We borrow a workpiece from you and conduct an evaluation.

### Advice (evaluation report is submitted)

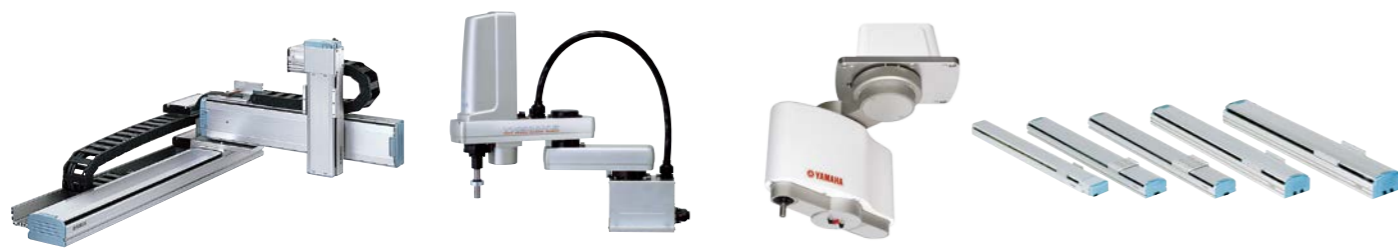
The results of our preliminary evaluation regarding camera, lens, lighting selection, and setup are summarized as a report and submitted.

### Robot training

Training can be performed according to the content of the customer's application.

## Choose freely from Yamaha's lineup of robots

A low-cost and convenient robot vision system can be constructed using the models that are optimal for the customer's application.



XY-X Cartesian robots

YK-XG SCARA robots

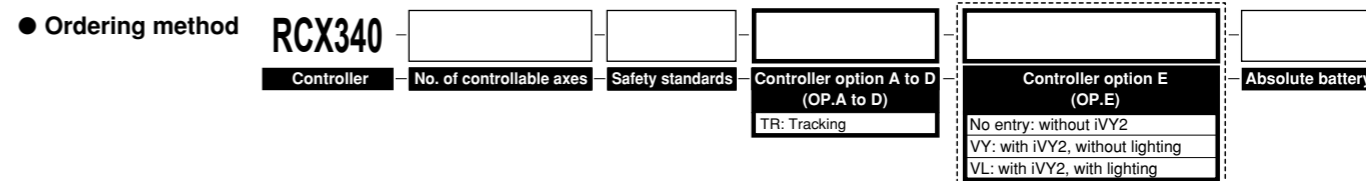
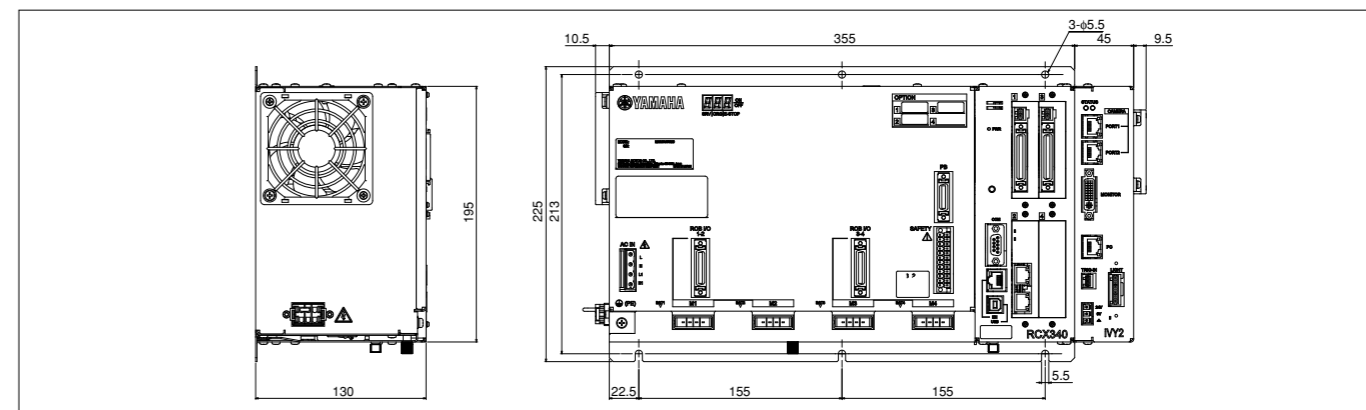
YK-TW orbit type robots

FLIP-X single-axis robots

\* The YA series is not supported.

## EXTERNAL VIEW

## RCX340 + iVY2



\* Refer to the comprehensive catalog for details on the order format.

## ● Robot vision basic specifications

Specification item	iVY2 unit	
Basic specifications	Supported controllers	RCX340
	Number of screen pixels	648(H) × 494(V) (300,000 pixels, VGA) 1280(H) × 966(V) (1,300,000 pixels, SXGA) 1624(H) × 1236(V) (2,000,000 pixels, UXGA) 2592(H) × 1944(V) (5,000,000 pixels, QSXGA)
	Model setting capacity	254 models
	Number of connectable cameras	Max. 2 cameras
	Connectable camera	GigE camera PoE support
	External interface	Ethernet (1000BASE-T) * For setting and monitor operations
	External monitor output	DVI-I * Also usable with an analog monitor by using a conversion adaptor. Monitor resolution: 1024 × 768
	Power supply	DC24V±10% 1.5A Max.
	Dimensions	W 45 × H 195 × D 130 (iVY2 unit only)
	Weight	0.8 kg (iVY2 unit only, when the lighting control board option is selected)
Search method	Edge search (correlated edge filter, Sobel filter)	
Image capturing	Trigger mode	S/W trigger, H/W trigger
	External trigger input	2 points
Function	Position detection, automatic point data generation	
Camera installation position	Fixed to the fixed camera (up, down) or robot (Y-axis, Z-axis). Perpendicular to the workpiece to be captured.	
Setting support function	Calibration, image save function, model registration*, fiducial mark registration*, monitor function* * iVY2 Studio function (requires a Windows PC)	
Lighting control options	Number of connectable lighting units	Max. 2 lighting units
	Modulated light format	PWM modulated light control (0 to 100%), PWM frequency switchable 62.5 kHz/125 kHz
	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.

## ● Tracking board basic specifications

Specification item	Tracking board	
Basic specifications	Supported controller	RCX340
	Number of connected encoders	up to two units
	Encoder power supply	DC5V (less than 500 mA total for two counters) (provided by controller)
	Applicable encoders	26LS31 / 26C31 equivalent line driver (RS422 compliant)
	Input phase	A, $\bar{A}$ , B, $\bar{B}$ , Z, $\bar{Z}$
	Highest response frequency	2 MHz or lower
	Counter	0-65535
	Multiplier	4 times
	Other	disconnection detection function is provided

## Accessories and part options

## Standard accessories

## ● iVY2 unit

The iVY2 unit adds robot vision to the RCX340 robot controller.

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



## ● Support software for PC iVY2 Studio

iVY2 Studio is support software for the iVY2 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.



Model KCX-M4988-00

## ● 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	16MB 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.

## ● iVY2 unit accessories

Camera trigger input cable connector

Model KX0-M657K-00

24V power supply connector

Model KCF-M5382-00

## Options

## ● CCD camera



Model	300,000 pixel	648 × 494 (VGA)	KCX-M6541-00
	1,300,000 pixel	1280 × 966 (SXGA)	KCX-M6541-10
	2,000,000 pixel	1624 × 1236 (UXGA)	KCX-M6541-20

## ● CMOS camera

Model	5,000,000 pixel	2592 × 1944 (QXGA)	KCX-M6541-30
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## ● Lens



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

## ● Lighting control board

This board adds lighting control functionality to the iVY2 system. (Installed in the iVY2 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 controller.

Model KCX-M4400-T0

## ● Tracking board accessories

AB phase input cable connector

Model KX0-M657K-20

## ● Recommended option cable\*

\* Not included.  
We can provide an option that is pre-wired to the AB phase input cable connector.

AB phase input cable (10 m, only for counter 1)

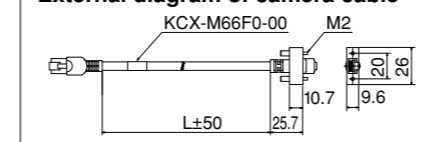
Model KX0-M66AF-00

## ● Camera cable

Cable for connecting the camera to the iVY2 board.

Model	5 m	KCX-M66F0-00
	10 m	KCX-M66F0-10
	15 m	KCX-M66F0-20

## External diagram of camera cable



## ● Close-up ring



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

## ● LAN cable with shield cloth (5 m)

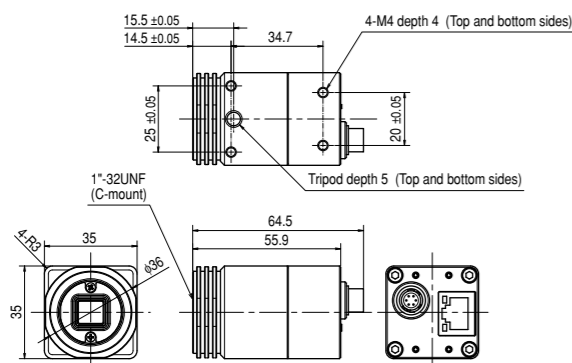
Model KX0-M55G0-00

## ● Tracking encoder cable (10 m)

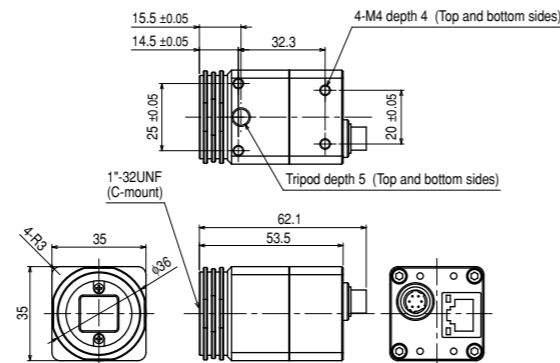
Model KX0-M66AF-00

## Camera

## ● CCD camera (300,000 pixel • 1,300,000 pixel • 2,000,000 pixel)



## ● CMOS camera (5,000,000 pixel)

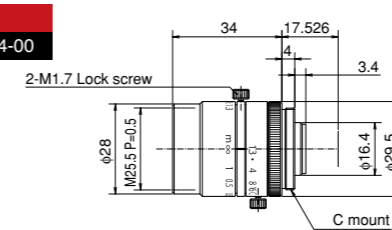


## Dimensional outlines

## Lenses

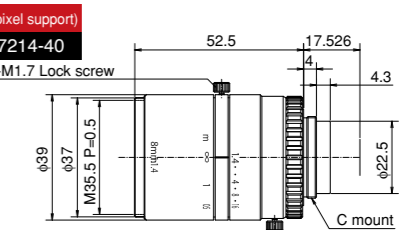
## 8 mm lens

Model: KCX-M7214-00



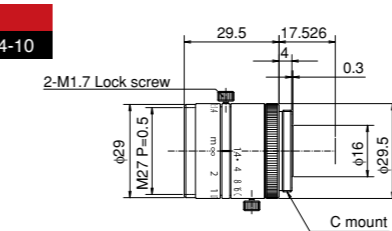
## 8 mm lens (megapixel support)

Model: KCX-M7214-40



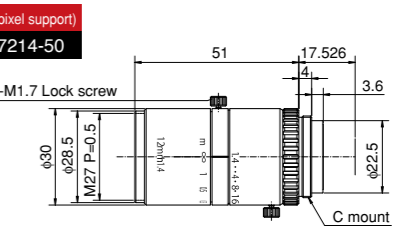
## 12 mm lens

Model: KCX-M7214-10



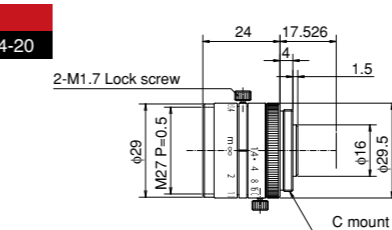
## 12 mm lens (megapixel support)

Model: KCX-M7214-50



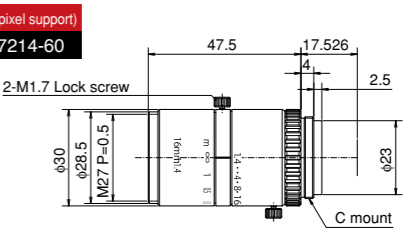
## 16 mm lens

Model: KCX-M7214-20



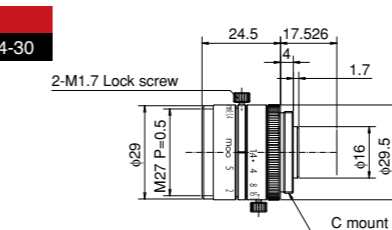
## 16 mm lens (megapixel support)

Model: KCX-M7214-60



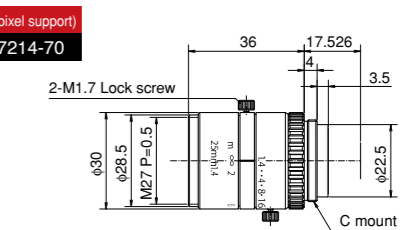
## 25 mm lens

Model: KCX-M7214-30



## 25 mm lens (megapixel support)

Model: KCX-M7214-70



## System configuration illustration

