Estratto Catalogo Yamaha
Robot Vision System
ROBOT VISION iVY2

Integrated Robot Vision System with "plug-and-play" simplicity
Basic specifications have been dramatically enhanced while retaining the current iVY system's ease of use.

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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera</td>
<td>Supports from 300,000 to 5 million pixels</td>
</tr>
<tr>
<td>Number of registered types</td>
<td>Increased to 254 types</td>
</tr>
<tr>
<td>Shorter search time</td>
<td>Approximately 50% less</td>
</tr>
<tr>
<td>Longer cables usable</td>
<td>Cables can be as long as 20 m</td>
</tr>
<tr>
<td>Monitoring Monitor output is provided</td>
<td>Enables operating status to be monitored without a PC</td>
</tr>
</tbody>
</table>

**iVY2 System configuration illustration**

**POINT 1**

**Various application examples**

- **Labeling device** (affixing labels to food packages)
- **Sealant touch-up** (engine block sealant)
- **Screw attachment position detection** (television panel screw attachment)
- **Position compensation with upward-facing camera** (installing irregularly-shaped parts on a circuit board)

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- **Industry: food**
  - Robot used: YK500TW omnidirectional robot
  - Even if the incoming workpieces are irregularly spaced or positioned, labels can be affixed at the same position.

- **Industry: automotive**
  - Robot used: SXYX Cartesian robot
  - Hole position is detected, and screws are fastened accurately.

- **Industry: electronics**
  - Robot used: NYX Cartesian robot
  - 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.

- **Industry: electronics**
  - Robot used: YK150XG SCARA robot
  - 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.
**POINT 2**

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

**STEP 1**
Register the desired fiducial mark

**STEP 2**
Select the camera mounting method
- Mounted on robot
  - Can be mounted on moving part
- Fixed downward
- Fixed upward

**POINT 3**

**Easy workpiece registration**
From image acquisition, registration takes just three steps.

**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.

**POINT 4**

**No need to make time-consuming connection settings. Dramatic reduction in setup time.**
From image acquisition, registration takes just three steps.

**Comparison of setup time**

- **iVY2 system**
- **General-purpose vision**

Setup time is shortened greatly by up to **80%**
### POINT 2
Auto-calibration
Easily complete high-precision calibration just by following a wizard! Even if equipment becomes misaligned, execute auto-calibration and resume operation.

### POINT 5
No need to create a coordinate conversion program.
Dedicated robot language for vision is provided.

### 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

### POINT 6
Easy inter-operation with peripheral equipment
The same controller provides unified control of robot, gripper, and lighting.

### POINT 7
Also supports moving camera
Even if the camera is mounted on the robot, coordinates are automatically converted according to the robot's movement.

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**General robot vision**

<table>
<thead>
<tr>
<th>MOVE P, P9</th>
<th>OFF LINE</th>
<th>SEND (&quot; &quot;) TO CMU</th>
<th>SEND CMU TO P10</th>
<th>ON LINE</th>
<th>MOVE P, P10</th>
</tr>
</thead>
</table>

- Communication with image processing unit
- RS-232C

**iVY2 system**

<table>
<thead>
<tr>
<th>MOVE P, P9</th>
<th>VSEARCH 1,2,0</th>
<th>MOVES</th>
<th>P10=VGETPOS(0)</th>
<th>MOVES</th>
</tr>
</thead>
</table>

- Searches for workpiece.
- Reads the point.
- Moves to this point.

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

**Camera and robot have separate programs**

**Centralized control using only the robot program**

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**Robot vision: iVY2 System**

**Electric gripper: YRG series**

**Rcx340**
**POINT 8**

**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.

<table>
<thead>
<tr>
<th>Previous RCX240 controller</th>
<th>New RCX340 controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example program (RCX240)</td>
<td>Example program (RCX340)</td>
</tr>
<tr>
<td>① PTP command</td>
<td>① New CTMOVE CTMOVE (1), Z=0.0, CTZ=10.0</td>
</tr>
<tr>
<td>② CMOVE</td>
<td>Can be executed with a single command</td>
</tr>
<tr>
<td>③ CDRIVE</td>
<td>Unify movement commands</td>
</tr>
</tbody>
</table>

Multiple operating takt required

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 9**

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

- Shortened cycle time
- Improve throughput

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

Information from a single camera can be shared by multiple robots

Connect up to four units

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

Control two robots to let downstream robot handle missed items
POINT 10

Approximately double the search speed (compared to previous model)

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

- **Sample workpiece**
  - Connector-shaped workpiece
  - RCX240 + iVY: 158.7 ms
  - RCX340 + iVY2: 83.8 ms

- **Sample workpiece**
  - Washer-shaped workpiece
  - RCX240 + iVY: 200.2 ms
  - RCX340 + iVY2: 91.7 ms

- **Sample workpiece**
  - Food item workpiece
  - RCX240 + iVY: 149.8 ms
  - RCX340 + iVY2: 91.1 ms

POINT 11

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

POINT 12

254 types can be registered
Setup changes require only that part numbers be changed. Setup changes are easy.

- **Field of vision**
  - 254 types (0-253) can be registered

POINT 13

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)

POINT 14

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 15**

**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.

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**Hearing** | **Workpiece is borrowed** | **Preliminary evaluation** | **Advice (evaluation report is submitted)** | **Robot training** | **Follow-up after delivery**
---|---|---|---|---|---

---

**Preliminary evaluation**

- **Evaluation conditions (example)**
  - Lighting: Lens: 8 mm
  - Workpiece: Lighting height: 375 mm
  - Background: black

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.

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**POINT 16**

**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**

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Note. The YA series is not supported.
iVY2 System

Robot with image processing functions

Integrated Robot Vision System with “plug-and-play” simplicity.
Basic specifications have been dramatically enhanced while retaining the current iVY system’s ease of use.

Main functions ▶ P.70

Ordering method

<table>
<thead>
<tr>
<th>RCX340</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller</td>
<td>No. of controllable axes</td>
<td>Safety standards</td>
<td>Controller option A to D (OP.A to D)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Controller option E (OP.E)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Absolute battery</td>
</tr>
</tbody>
</table>

Note. For details on the various selection items, refer to P.521

Basic specifications

Robot vision basic specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>iVY2 unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable controllers</td>
<td>RCX340</td>
</tr>
<tr>
<td>Number of screen pixels</td>
<td>648(H) × 494(V) (300,000 pixels, VGA)</td>
</tr>
<tr>
<td></td>
<td>1280(H) × 966(V) (1,300,000 pixels, SXGA)</td>
</tr>
<tr>
<td></td>
<td>1624(H) × 1236(V) (2,000,000 pixels, UXGA)</td>
</tr>
<tr>
<td></td>
<td>2592(H) × 1944(V) (5,000,000 pixels, QSXGA)</td>
</tr>
<tr>
<td>Model setting capacity</td>
<td>254 models</td>
</tr>
<tr>
<td>Number of connectable cameras</td>
<td>Max. 2 cameras</td>
</tr>
<tr>
<td>Connectable camera</td>
<td>GigE camera (VGA, SXGA, UXGA)</td>
</tr>
<tr>
<td>Power supply</td>
<td>DC24V +/-10% 1.5A Max.</td>
</tr>
<tr>
<td>Dimensions</td>
<td>W45 × H195 × D130 (iVY2 unit only)</td>
</tr>
<tr>
<td>Weight</td>
<td>0.8kg (iVY2 unit only, when the lighting control board option is selected)</td>
</tr>
<tr>
<td>Search method</td>
<td>Edge search (correlated edge filter, Sobel filter)</td>
</tr>
<tr>
<td>Image capturing</td>
<td>Trigger mode</td>
</tr>
<tr>
<td></td>
<td>External trigger input</td>
</tr>
<tr>
<td>Function</td>
<td>Position detection, automatic point data generation</td>
</tr>
<tr>
<td>Camera installation position</td>
<td>Fixed to the fixed camera (up, down) or robot (Y-axis, Z-axis). Perpendicular to the workpiece to be captured.</td>
</tr>
<tr>
<td>Setting support function</td>
<td>Calibration, image save function, model registration, fiducial mark registration, monitor function</td>
</tr>
<tr>
<td>Lighting control options</td>
<td>Number of connectable lighting units</td>
</tr>
<tr>
<td></td>
<td>Modulated light format</td>
</tr>
<tr>
<td></td>
<td>Continuous light, strobe light (follows camera exposure)</td>
</tr>
<tr>
<td></td>
<td>Lighting power input</td>
</tr>
<tr>
<td></td>
<td>(external supply shared by both channels)</td>
</tr>
<tr>
<td></td>
<td>Lighting output</td>
</tr>
</tbody>
</table>
Instruction manuals can be downloaded from our company website. Please use the following for more detailed information.
http://global.yamaha-motor.com/business/robot/

## System configuration illustration

![System configuration illustration](image)

### Tracking board basic Specifications

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

### Dimensional outlines

![Dimensional outlines](image)

**RCX340+iVY2**

- Dimensions: 22.5 x 355 x 155 x 45 x 9.5
- Optional components: Tracking board, Encoder, Camera, Lighting, Software, Monitor, Programming box, PBX, Robot positioner, Pulse string driver, Robot controller, Camera, Tracking board, etc.
## Dimensional outlines

### CCD camera

![CCD camera diagram]

### Lenses

#### 8mm lens
- **Description:** (Model No. : KCX-M7214-00)
- **Dimensions:**
  - Objective diameter: 1.5
  - Focal length: 2.5

![8mm lens diagram]

#### 8mm lens (megapixel support)
- **Description:** (Model No. : KCX-M7214-40)
- **Dimensions:**
  - Objective diameter: 1.5
  - Focal length: 2.5

![8mm lens (megapixel support) diagram]

#### 12mm lens
- **Description:** (Model No. : KCX-M7214-10)
- **Dimensions:**
  - Objective diameter: 1.5
  - Focal length: 2.5

![12mm lens diagram]

#### 12mm lens (megapixel support)
- **Description:** (Model No. : KCX-M7214-50)
- **Dimensions:**
  - Objective diameter: 1.5
  - Focal length: 2.5

![12mm lens (megapixel support) diagram]

#### 16mm lens
- **Description:** (Model No. : KCX-M7214-20)
- **Dimensions:**
  - Objective diameter: 1.5
  - Focal length: 2.5

![16mm lens diagram]

#### 16mm lens (megapixel support)
- **Description:** (Model No. : KCX-M7214-60)
- **Dimensions:**
  - Objective diameter: 1.5
  - Focal length: 2.5

![16mm lens (megapixel support) diagram]

#### 25mm lens
- **Description:** (Model No. : KCX-M7214-30)
- **Dimensions:**
  - Objective diameter: 1.5
  - Focal length: 2.5

![25mm lens diagram]

#### 25mm lens (megapixel support)
- **Description:** (Model No. : KCX-M7214-70)
- **Dimensions:**
  - Objective diameter: 1.5
  - Focal length: 2.5

![25mm lens (megapixel support) diagram]
Lens characteristics

<table>
<thead>
<tr>
<th>Lens</th>
<th>Model</th>
<th>Focal length [mm]</th>
<th>Aperture value [F No.]</th>
<th>Angle-of-view (degrees)</th>
<th>Angle-of-view (degrees)</th>
<th>Closest approach distance [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8mm</td>
<td>KXC-M7241-00 8</td>
<td>F1.4–CLOSE</td>
<td>25.21</td>
<td>37.08</td>
<td>47.59</td>
<td>0.2</td>
</tr>
<tr>
<td>12mm</td>
<td>KXC-M7241-10 12</td>
<td>F1.4–CLOSE</td>
<td>21.86</td>
<td>24.31</td>
<td>31.88</td>
<td>0.3</td>
</tr>
<tr>
<td>16mm</td>
<td>KXC-M7241-20 16</td>
<td>F1.4–CLOSE</td>
<td>17.77</td>
<td>24.51</td>
<td>34.56</td>
<td>0.4</td>
</tr>
<tr>
<td>8mm (megapixel support)</td>
<td>KXC-M7241-40 25</td>
<td>F1.4–CLOSE</td>
<td>33.18</td>
<td>37.08</td>
<td>47.59</td>
<td>0.2</td>
</tr>
<tr>
<td>12mm (megapixel support)</td>
<td>KXC-M7241-40 25</td>
<td>F1.4–CLOSE</td>
<td>28.98</td>
<td>31.88</td>
<td>41.45</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Angle-of-view size, WD, and magnification when close-up ring is used

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>8 mm</td>
<td>25.21</td>
<td>143 × 188.1</td>
<td>0.016</td>
<td>52.4</td>
<td>272.9 × 357.3</td>
<td>0.004</td>
<td>104.8</td>
<td>524.1 × 702.1</td>
<td>0.001</td>
</tr>
<tr>
<td>0.5</td>
<td>8 mm</td>
<td>25.28</td>
<td>222 × 292</td>
<td>0.120</td>
<td>52.4</td>
<td>272.9 × 357.3</td>
<td>0.004</td>
<td>104.8</td>
<td>524.1 × 702.1</td>
<td>0.001</td>
</tr>
<tr>
<td>1.0</td>
<td>8 mm</td>
<td>25.30</td>
<td>222 × 292</td>
<td>0.120</td>
<td>52.4</td>
<td>272.9 × 357.3</td>
<td>0.004</td>
<td>104.8</td>
<td>524.1 × 702.1</td>
<td>0.001</td>
</tr>
<tr>
<td>2.0</td>
<td>8 mm</td>
<td>25.32</td>
<td>222 × 292</td>
<td>0.120</td>
<td>52.4</td>
<td>272.9 × 357.3</td>
<td>0.004</td>
<td>104.8</td>
<td>524.1 × 702.1</td>
<td>0.001</td>
</tr>
<tr>
<td>5.0</td>
<td>8 mm</td>
<td>25.35</td>
<td>222 × 292</td>
<td>0.120</td>
<td>52.4</td>
<td>272.9 × 357.3</td>
<td>0.004</td>
<td>104.8</td>
<td>524.1 × 702.1</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Note. WD is the lens tip reference.
Accessories and part options

**iVY2 System**

### Standard accessories

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

<table>
<thead>
<tr>
<th>Model</th>
<th>No lighting</th>
<th>With lighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>iVY2 unit</td>
<td>KCX-M4400-V0</td>
<td>KCX-M4400-L0</td>
</tr>
</tbody>
</table>

- **iVY2 unit accessories**

<table>
<thead>
<tr>
<th>Name</th>
<th>Individual model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera trigger input cable connector</td>
<td>KX0-M657K-00</td>
</tr>
<tr>
<td>24V power supply connector</td>
<td>KCF-M5382-00</td>
</tr>
</tbody>
</table>

### 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.

**Environment**

<table>
<thead>
<tr>
<th>Software model</th>
<th>KCX-M4988-00</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Microsoft Windows XP / Vista (32bit/64bit) / 7 (32bit/64bit) / 8, 8.1 (32bit/64bit)</td>
</tr>
<tr>
<td>CPU</td>
<td>Processor that meets or exceeds the suggested requirements for the OS being used.</td>
</tr>
<tr>
<td>Memory</td>
<td>Suggested amount of memory or more for the OS being used.</td>
</tr>
<tr>
<td>Hard disk capacity</td>
<td>16MB of available space required on installation drive.</td>
</tr>
<tr>
<td>Display</td>
<td>800 x 600 dot, or higher, 32768 colors (16bit High Color) or higher (recommended)</td>
</tr>
<tr>
<td>Communication Port</td>
<td>Ethernet Port of TCP/IP</td>
</tr>
</tbody>
</table>

**Note:** Microsoft, Windows XP, Windows Vista, Windows 7, Windows 8, 8.1 are registered trademarks of the Microsoft Corporation, USA.
Options

Camera

- CCD camera
  - 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: 5,000,000 pixel 2592×1944 (QXGA) KCX-M6541-30

- Linear motor single-axis robots
  - PHASER

- Cartesian robots
  - XY-X
  - SCARA

- Pick & place robots
  - YK-X

- Clean controller

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

Close-up ring

- Model
  - 0.5mm KX0-M7215-00
  - 1.0mm KX0-M7215-10
  - 2.0mm KX0-M7215-20
  - 5.0mm KX0-M7215-30

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 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 KX0-M657K-20

Recommended option cable

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

Camera cable

Cable for connecting the camera to the iVY2 board.

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

LAN cable with shield cloth (5 m)

- Model KX0-M55G0-00

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