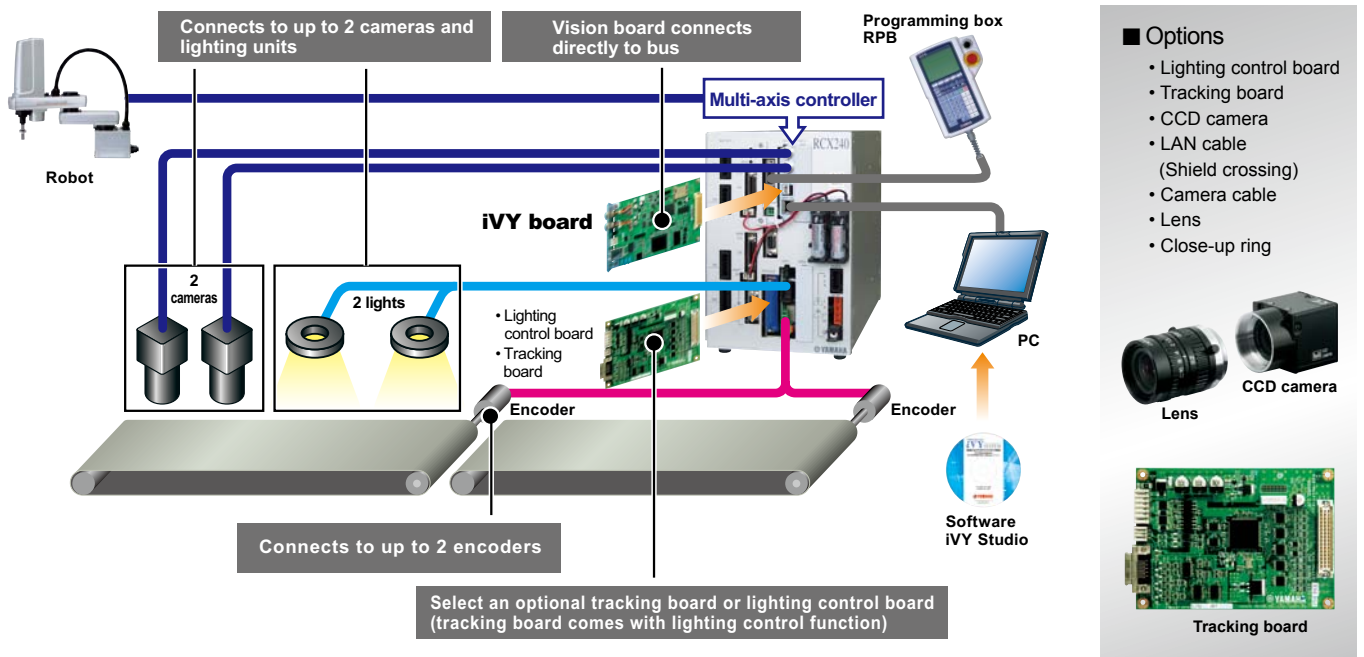# iVY System

ROBOT VISION

Simple to use and cuts the number of job steps!
"Finds and Takes" without teaching tasks

Many robot users might think, "We tried vision recognition but it seems to take a lot of work" or "we tried it before and making adjustments was a tough job". But the YAMAHA iVY System eliminates those problems. Anyone can make setups on the YAMAHA iVY System and it also cuts down on the number of job steps!

iVY system layout

Gives you a ready-to-go robot controller equipped with an image processing function by just setting an iVY board in your 4-axis robot controller RCX240 or RCX240S. Putting "eyes" in your robot allows you to search and take workpieces, find deviations in workpiece position and make corrections even in the case of large errors, expanding the range of applications.
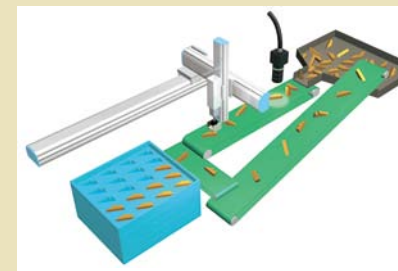

Connects to up to 2 cameras and lighting units

Vision board connects directly to bus

Programming box RPB

Multi-axis controller

Robot

iVY board

2 cameras

2 lights

• Lighting control board
• Tracking board

Encoder

Encoder

PC

Software iVY Studio

Connects to up to 2 encoders

Select an optional tracking board or lighting control board (tracking board comes with lighting control function)

■ Options
• Lighting control board
• Tracking board
• CCD camera
• LAN cable (Shield crossing)
• Camera cable
• Lens
• Close-up ring

Lens

CCD camera

Tracking board

■ Finds workpieces and positions them
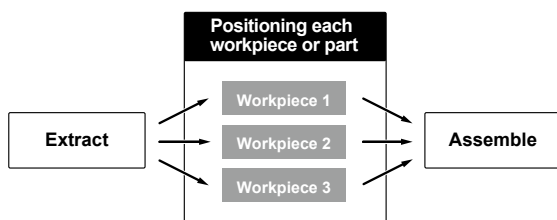

■ Makes corrections automatically even if camera moves

■ Performs tracking on conveyors

Ordinary system: No robot vision

Positioning each workpiece or part

Extract → Workpiece 1 / Workpiece 2 / Workpiece 3 → Assemble

Positioning jig replacement and other tasks are needed whenever the workpiece is changed. Costs for setups/changeover and jig fabrication/storage are especially high when dealing with a small lot of workpieces.

System with robot vision

Detect by camera and remove → **No positioning needed** → Assemble

Setups are easy to handle by just loading new model data even if changing the workpiece or part. No mechanical positioning is needed so costs are cut by equipment downsizing and lower jig tool expenses.

Point 1

Easy for anyone to use – supports wide spectrum of applications

Attempting to make system upgrades with robots combined with commercial image processing equipment took a great deal of time and trouble due to tasks such as aligning the conventional robot controller with the image processing equipment, exchanging data and messages, and offset processing, etc.

In the YAMAHA "iVY System" however the vision board is integrated into the robot controller, and operation is drastically simplified by limiting the functions to positioning and position correction. This makes the system incredibly easy to use compared to other vision systems used up until now. YAMAHA aimed for "a vision system anyone can easily use right from the start" and this is what they achieved so be sure to check out the YAMAHA robot vision for yourself!

Ordinary robot vision

❌
- Difficult to handle and work with
- Troublesome to actually use
- Expensive to install and startup
- Knowing where to ask for help is a problem

Requires getting expert knowledge which is a hassle

If using the iVY system

⭕
- Everything is easy and simple!
- Lower cost with fewer man-hours needed
- Simple to use so effective for diverse applications
- YAMAHA gives you total support

Easy for anyone to use and has an expanding range of applications!

Point 2

Register workpiece data in 3 easy steps!

YAMAHA wanted "A vision system that anyone can easily use". But image recognition itself has been around for a long time. However, up to now image recognition required complex tasks such as coordinate matching (calibration) or setting coordinate offsets for shifting cameras and so image recognition never became very popular with robot users. YAMAHA machine vision called the iVY System, however, can be operated by anyone including machine designers or the actual machine operators.
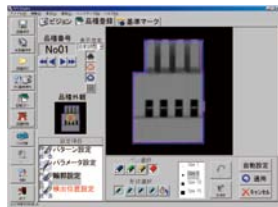
STEP. 1

Capture the image

Place the workpiece within the camera field-of-view and set the image capture range.

STEP. 2

Set the contour

The iVY System automatically finds the contour, so a pen tool can then fill in the required contour section.
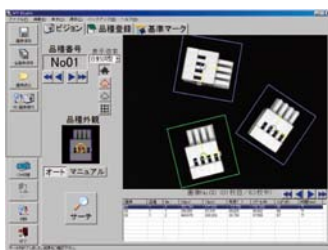
STEP. 3

Register the detection position

Use the mouse to specify the detection position.
Set the position wherever needed.

Search results

Point 3

Includes dedicated "iVY Studio" software

The iVY system also includes dedicated "iVY Studio" software. This single software registers the work (sets edges, sets all types of parameters, set data loading range) and reference marks used for calibration, and also performs all tasks involving vision including backup and restore, operation monitor control, etc.
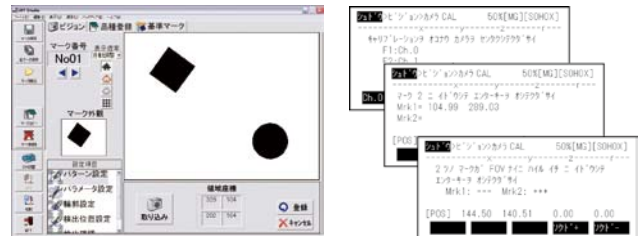
Support software iVY Studio

● **Makes searches, registers part types**
● **Registers reference marks (for calibration)**
● **Registers up to 40 workpieces**
● **Easily adds workpieces**
● **Detects up to 40 workpieces at the same time**
● **Data backup**
● **Functions as a monitor during program operation**

Point 4

Super simple calibration (Coordinate matching alignment tasks)

Conventional equipment combining "image processing equipment + robot" requires an extreme amount of time and trouble due to the task of "calibration" that aligns the camera coordinates with the robot coordinates. On the iVY system however the operator only has to follow conversation-type instructions from the programming box so operation is simple and finishes in a short time.

The iVY system also automatically corrects these coordinates even if the robot installation position has changed during tasks such as clamping upward, clamping downward, clamping robot Z axis, and clamping the Scara robot Y arm.

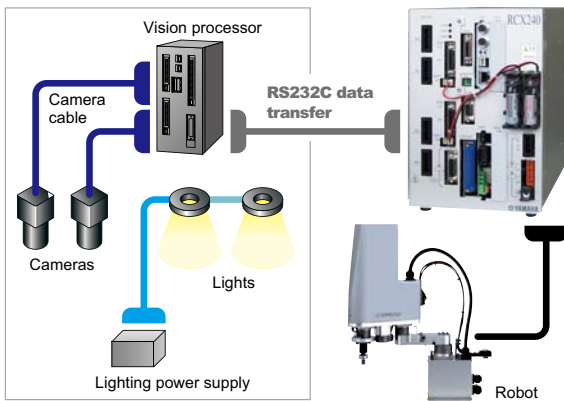Just follow instructions on the Wizard!

Point 5

Unified operation with integrated controller

Other machine vision products on the market use different formats so a coordinate conversion program had to be written into the controller.

The iVY system however has an integrated controller so robot point data is stored in one extremely and easy step. Camera control and lighting control are handled by integrated operation within the robot controller in an easy to understand operation that reduces the man-hours needed for equipment startup.

Ordinary robot vision

① **Aligning with the robot coordinates is a tough job**
② **Offset calculation is needed if the camera is moved**
③ **Operating delays occur between the camera and robot due to the communication time lag**
④ **Communication formats must be made to match each other**

Vision processor

Camera cable

RS232C data transfer
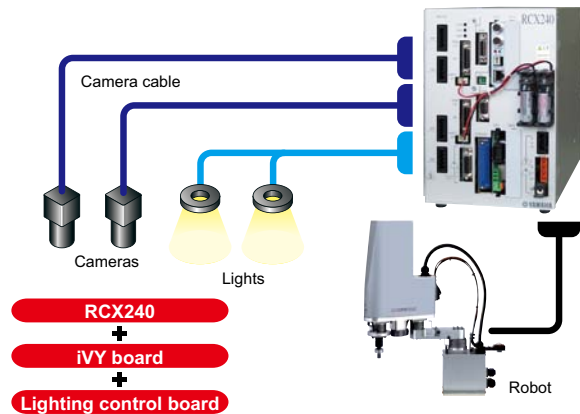
Cameras

Lights

Lighting power supply

Robot

Connecting an external camera to the robot controller requires tasks such as coordinate matching (calibration) and running a correction program so equipment startup can be difficult.
Ordinary equipment requires a lot of time and trouble even when using simple applications so the possible applications are limited.

If using the iVY system

① **Contains a simple calibration function**
② **Coordinates are automatically adjusted even if camera is moved**
③ **High-speed connections over a dedicated bus line**
④ **Integrated operation within controller**
⑤ **Supports all models of YAMAHA robot lineup**

Point

Camera cable

Cameras

Lights

RCX240
+
iVY board
+
Lighting control board

Robot

Calibration on the YAMAHA iVY system is simple! Moreover all coordinates are adjusted automatically when a camera is installed on the robot. Being easy to use also makes it ideal for a diverse range of applications.

Point 6

Select freely from the YAMAHA robot lineup

All YAMAHA robots are controllable on the RCX controller. Select from among the single-axis robot FLIP-X series, the linear single-axis robot PHASER series, the Cartesian robot XY-X, or the SCARA robot YK-XG according to your application needs.

A low-cost and light-weight robot vision system can be easily built up at a low cost with an optimal model selected to match the user's application.

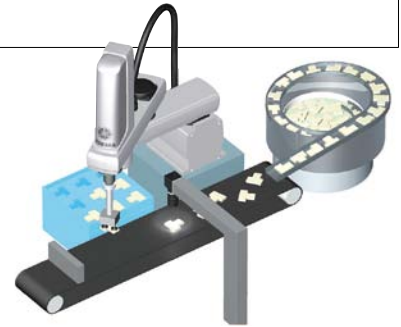■ Cartesian robots XY-X   ■ SCARA robots YK-XG   ■ Linear motor single-axis robots PHASER   ■ Single-axis robots FLIP-X

Point 7

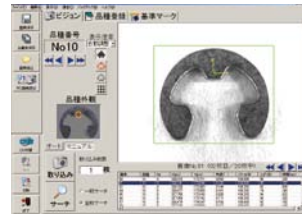### Handles workpice without teaching

Teaching an accurate position to the robot is essential when attempting to handle work by robot and if an offset or deviation occurs in the work position then correctly handling the work is impossible. In the iVY system however after rough positioning, image recognition is used to make an accurate position adjustment. The work can be moved without teaching so the man-hours needed for startup are reduced and flexible adjustments such as work piece changes or additions can be made.
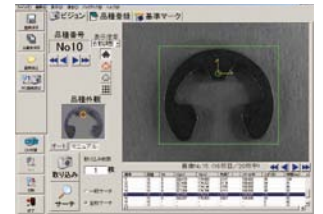
Point 8

Stable edge search for great results

Ordinary machine vision equipment uses gray search (normalized correlative search) which is easily affected by dirt, notches on the workpiece and lighting conditions which limit its usable applications and work environment. The iVY system however contains an edge search engine that makes searches using the contour shape of the part. This contour (edge) search is strongly resistant to outside effects and so instantly opens up a whole range of applications.
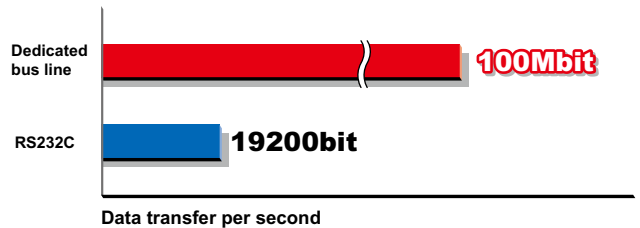
Search made with good lighting   **Search is accurate even with poor lighting**

Point 9

High-speed connections over a dedicated bus line

Connecting a bus line directly to the CPU board in the robot controller yields data transfer speeds some 5,000 times higher than serial data transfer on ordinary machine vision equipment!
Programming is also easy because the time lag occurring during communications or data transfer does not have to be considered. It also easily handles conveyor tracking tasks that require high-speed processing.
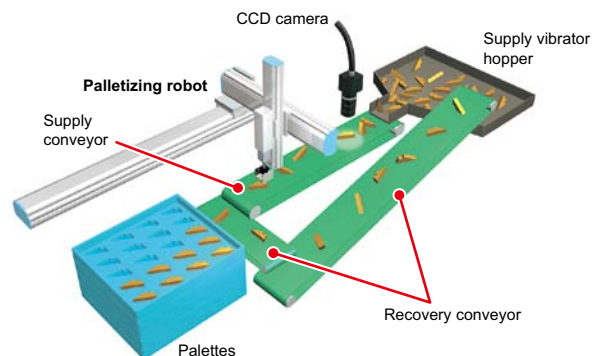
Dedicated bus line 100Mbit
RS232C 19200bit

Data transfer per second

Point 10

Conveyor tracking available

Just adding a conveyor tracking board allows handling of conveyor tracking tasks.
Pulse (AB phase) signals from an encoder installed on the conveyor are input to a tracking board to continuously recognize work positions and allow pick up of work without having to stop the conveyor.
Up to 2 cameras or lightings or conveyor encoder units can be connected to support movement between conveyors.

CCD camera
Supply vibrator hopper
Palletizing robot
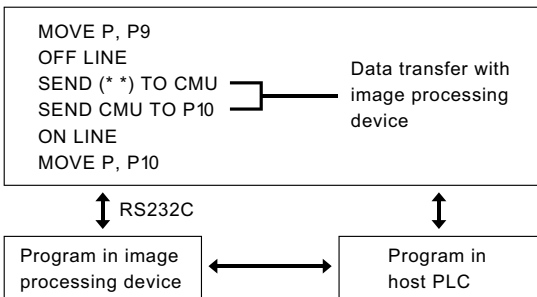Supply conveyor
Recovery conveyor
Palettes

Vision is also easily controllable on the robot program

The robot program executes all vision control tasks including camera switching, image loading, and work piece search. Writing programs is simple compared to ordinary vision systems because control is all-inclusive from robot movement to camera control. Moreover, debugging is also efficient so the total number of required man-hours can be drastically reduced.

■ Examples of Robot vision language

Command names	Functions
VCAPTURE	Load image from camera
VSEARCH	Search for the specified part type
VMONITOR	Switch the monitor mode ON or OFF
VGETCNT	Acquire the number of parts that were found
VGETPOS	Acquire the position data
VGETTIME	Acquire the time required by the executed search command
VGETSCR	Acquire judgment values for the detected work
VSAVEIMG	Store images in BMP format

Ordinary robot vision

```
MOVE P, P9
OFF LINE
SEND (* *) TO CMU        Data transfer with
SEND CMU TO P10          image processing
ON LINE                  device
MOVE P, P10
```

RS232C

| Program in image processing device | ⟷ | Program in host PLC |

Controls using different programs

If using the iVY system

```
MOVE P, P9
VSEARCH 1,2,0 ——————— make a work search
P10=VGETPOS(0) ——————— load the points
MOVE P, P10 ——————— move to that point
```

MERITS
- No data communication time lag
- Controllable with just the robot program
- Needs only a few lines of commands
- Simple and easy to understand

Controls with just one robot program

The iVY SYSTEM can eliminate these problems!

Must cut down on teaching man-hours

Robot teaching tasks require a lot of time and effort. The iVY system however acts as the "Eyes of the Robot" to drastically shorten the time usually required for teaching by automating the final fine adjustment step in during positioning.

Must simplify the positioning mechanism

Changing the setup such as for positioning tasks takes a lot of time when there are a large number of parts types and more and more work tends to involve small lot production with different parts. The iVY system can help to drastically lower costs for fabricating positioning jigs, monitoring and replacement tasks, etc.

Need to handle random work tasks

The iVY system can also assist in operations such as "placing the work directly after moving from the parts feeder" or "grip the work on the pallet and transport it". Using the position correction function on the iVY system can make performing these tasks simple.

Need to pickup work flowing on the conveyor

The iVY system also handles conveyor tracking tasks. Signals from an encoder installed on the conveyor are input to allow continuously recognize work positions in the process flow. So that work can be picked up without having to stop the conveyor.

Don't know where to find help when trouble occurs

Problems such as being unable to load images, or unable to write data, position errors tend to occur often in commercial image processing equipment used in combination with the robot. Those are the times when the YAMAHA iVY system will keep working well. The iVY system delivers total support for tasks ranging from loading of images from the camera to operating the robot.