An optimal controller can be selected from various command input formats. As servo parameters and deceleration patterns suitable for robots are pre-registered, robots can be operated quickly without complex settings.
High performance controllers supporting YAMAHA robots

<table>
<thead>
<tr>
<th>Axis</th>
<th>TRANSERVO</th>
<th>FLIP-X</th>
<th>PHASER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stepping motor</td>
<td>[T4L/T5L] Small type servomotor (24 V・30 W)</td>
<td>General-purpose servomotor (30 to 600 W)</td>
</tr>
<tr>
<td>1 axis</td>
<td>TS-S2</td>
<td>TS-X</td>
<td>TS-P</td>
</tr>
<tr>
<td></td>
<td>TS-SH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 axis</td>
<td>TS-SD</td>
<td>RDV-X</td>
<td>RDV-P</td>
</tr>
<tr>
<td>3, 4 axes</td>
<td>TS-SH/TS-S2 TS-X/TS-P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 to 8 axes</td>
<td>TS-SH/TS-S2 TS-X/TS-P</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **I/O point trace**
- **Remote command**
- **Online command**
- **Pulse train**
- **Program** (YAMAHA SRC language)
- **Program** (YAMAHA BASIC language)
- **Program** (YAMAHA BASIC language) *Note 1*
- **Program** (YAMAHA BASIC language) *Note 2*
- **Program** (YAMAHA BASIC language) *Note 3*
- **I/O command**
- **I/O command** *Note 1*
- **I/O command** *Note 2*

---

**Note 1**: The RCX340 uses YAMAHA BASIC2 language.
**Note 2**: The I/O command is not applicable to the RCX340.
**Note 3**: For details about YC-Link of the RCX340, refer to P.64.

---

**Up to four SR1 series controllers can be connected to the RCX2 series controller.**
Selectable from various control methods

An optimal YAMAHA controller suitable for applications can be selected from various control methods, such as programming, point trace, and pulse train control.

Program input

The single-axis robot controllers use the YAMAHA SRC language which is simple yet contains all required functions, such as I/O outputs and conditional branching, etc. The multi-axis controller RCX series uses the YAMAHA BASIC language capable of more sophisticated programming and includes all types of arithmetic operations, flexible variable settings, and various conditional branching, etc. Both are easy to use robot language conforming to the BASIC. These languages support various needs from simple operations to expert user’s sophisticated work.

<table>
<thead>
<tr>
<th>Single-axis robot controller</th>
<th>YAMAHA SRC language &lt;Example&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOVA 1, 100</td>
<td>Moves to point number 1 at 100 % speed.</td>
</tr>
<tr>
<td>DO 1, 1</td>
<td>Turns on general-purpose output number 1.</td>
</tr>
<tr>
<td>WAIT 2, 1</td>
<td>Waits until general-purpose input number 2 turns on.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multi-axis robot controller</th>
<th>YAMAHA BASIC language &lt;Example&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF DO(10)=1 THEN *END</td>
<td>Jumps to &quot;END if general-purpose input number 10 turns on. Otherwise, moves to the next line.</td>
</tr>
<tr>
<td>MOVE P, P2, STOPON DI(1)=1</td>
<td>Moves to point number 2. Stops when general-purpose input number 1 turns on during movement.</td>
</tr>
<tr>
<td>WAIT ARM</td>
<td>Waits until the robot arm operation ends.</td>
</tr>
<tr>
<td>P3=WHERE</td>
<td>Writes the current position into point number 3.</td>
</tr>
<tr>
<td>“END;”</td>
<td>Defines the label named &quot;END&quot;.</td>
</tr>
<tr>
<td>HOLD</td>
<td>Pauses the program.</td>
</tr>
</tbody>
</table>

I/O point trace

The host unit specifies a point number in binary format and the robot moves to the specified point when the start signal is input. The controller can operate only by teaching the point data without programs.

Remote command

The word function of the CC-Link or DeviceNet™ is used to issue various commands or data to the robot. The expandability of the word function from simple operation instructions to point data writing is fully utilized to freely use the robot controller functions from the host unit.

Note. This function is enabled when selecting an option network board.

<table>
<thead>
<tr>
<th>PLC Controller</th>
<th>Field bus CC-Link DeviceNetTM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start signal</td>
<td>Point data</td>
</tr>
<tr>
<td>Di 1 (2) ON</td>
<td>Di 2 (2) OFF</td>
</tr>
<tr>
<td>Di 3 (2) ON</td>
<td>Specifies P5.</td>
</tr>
</tbody>
</table>

Pulse train

The robot is controlled using pulse trains sent from the positioning unit. The controller does not need to have programs or point data. This pulse train is convenient when the control is centralized to the host unit.

Online command

The PC can issue various commands or data to the controller or receive the data or status through the RS-232C or Ethernet. All executable operations from the teaching pendant can be executed from the PC.

Note. Ethernet is enabled when selecting an option network board.

For the RCX340, Ethernet is provided as standard function.

<table>
<thead>
<tr>
<th>Positioning unit</th>
<th>Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse train</td>
<td>Controller</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLC Controller</th>
<th>CC-Link DeviceNet™</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 0064 007 B 0109</td>
<td>Word function of PLC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Positioning unit</th>
<th>Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller</td>
<td>PC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MOVA1, 100 c/r t/f</th>
<th>Controller</th>
</tr>
</thead>
</table>
POINT 2

Easy optimal setup

Parameter settings are easy

Robot controllers are specially designed for YAMAHA robots. Optimal values for servo parameters required for robot operation, such as gain are already registered beforehand. The operation can be started without complicated settings, knowledge about control, or experiences.

Easy acceleration/deceleration settings

The acceleration/deceleration is an important factor that affects the service life of the machine. If too high acceleration is set, this may cause the service life of the machine to shorten. If the acceleration is too low, the motor power cannot be used effectively, causing the tact time to lower. The acceleration/deceleration setting of YAMAHA robot controller is determined finely by load weight. Setting only payload parameters will automatically set optimal acceleration/deceleration by taking the service life of the machine and motor capability into consideration. Detailed robot knowledge from YAMAHA is what makes this possible. (Note: For the pulse train input, the customer may need to set the acceleration/deceleration.)

Concept of speed and acceleration

Speed

"Acceleration" = 100 (%)  
"Speed" = 100 (%)  
"Speed" = 50 (%)  
"Deceleration" = 100 (%)  
Specify a ratio (%) to the maximum speed of each robot.

Time

Specify a ratio (%) to the acceleration that is optimized according to the movement amount or movement speed based on the acceleration upper limit value automatically set by the payload setting.

Zone control (= Optimal acceleration/deceleration automatic setting) function

The SCARA robot also incorporates a zone control function that always operates the robot at its maximum performance level by considering changes in inertia due to the arm posture. Therefore, the robot does not exceed the tolerance value of the motor peak torque or speed reducer allowable peak torque only by entering the initial payload to bring out the full power of the motor and keep the high acceleration/deceleration.

For X-axis of YK500XG

The torque in the arm folded state is 5 or more times different from that in the arm extended state.

This may greatly affect the service life, vibration during operation, and controllability.

If the motor torque exceeds the peak value

→ This may adversely affect the controllability and mechanical vibration, etc.

If the torque exceeds the tolerable peak torque value of the speed reducer

→ This may cause early breakage or shorten the service life extremely.
**POINT 3**

Multi-function and expandability

- Multi-axis controllers support up to 30,000 points (10,000 points for the RCX2 series, 1,000 points for the single-axis controller (255 points for the TS series)). Up to 100 programs can be created on each controller.
- Various field networks, CC-Link, DeviceNet™, PROFIBUS, and EtherNet/IP™ are supported. Note: Some models do not support all networks.
- The TS series, RD series, SR1 series, and RCX series use a dual-power supply system with separate control power supply and power supply.
- As the controllers conform to the CE marking that is safety standards in EU (Europe), they can be used safely even overseas. The TS series (except for TS-S), SR1 series, and RCX series conform to up to safety category 4.

For details about functions of each controller, refer to controller details pages from P.447.

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Number of points</th>
<th>Number of programs</th>
<th>CC-Link</th>
<th>DeviceNet™</th>
<th>Ethernet</th>
<th>EtherNet/IP™</th>
<th>PROFIBUS</th>
<th>PROFINET</th>
<th>Compliance with CE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS-S2/TS-SH</td>
<td>1 axis robot positioner</td>
<td>255</td>
<td>-</td>
<td>○</td>
<td>○</td>
<td>-</td>
<td>○</td>
<td>-</td>
<td>-</td>
<td>○</td>
</tr>
<tr>
<td>TS-X/TS-P</td>
<td></td>
<td>255</td>
<td>-</td>
<td>○</td>
<td>○</td>
<td>-</td>
<td>○</td>
<td>-</td>
<td>-</td>
<td>○</td>
</tr>
<tr>
<td>TS-SD</td>
<td>1 axis robot driver</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>○</td>
</tr>
<tr>
<td>RDV-X/RDV-P</td>
<td>1 axis robot controller</td>
<td>1,000</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>○</td>
</tr>
<tr>
<td>ERCD</td>
<td></td>
<td>1,000</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>○</td>
</tr>
<tr>
<td>SR1-X/SR1-P</td>
<td></td>
<td>1,000</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>○</td>
</tr>
<tr>
<td>RCX221/RCX222</td>
<td>1 to 2 axes controller</td>
<td>10,000</td>
<td>100</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>-</td>
<td>○</td>
<td>-</td>
<td>○</td>
</tr>
<tr>
<td>RCX240</td>
<td>1 to 4 axes controller</td>
<td>10,000</td>
<td>100</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>-</td>
<td>○</td>
</tr>
<tr>
<td>RCX340</td>
<td></td>
<td>30,000</td>
<td>100</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

**RDV-X/RDV-P** [Robot driver]

- **Dedicated pulse train control**
  
  Driver functions by dedicated pulse train control which yields a compact body and a low price.

- **Cost reduction to a large extent is possible in designing the system**
  
  Driver easily assembles into automated equipment so a drastic amount of effort needed for tasks such as design, part selection and settings can be eliminated and a huge cost reduction achieved.

- **Compact**
  
  Compact design of H 160 × W 40 × D 140 mm. Side-by-side installation can be made.

- **Command input**: Line driver signal (2Mpps)  
  Open collector (200kpps)

- **Command output**: ABZ phase output  
  (with divider function)

- **Analog monitor output function**
  
  Monitor can show analog outputs such as for speed or electrical current giving the operator a real-time look at operating status. Dedicated support software RDV-Manager can be used to show fully graphic displays.

- **Main power supply**:  
  **Applicable to both single phase and 3-phase**  
  (200V)
  
  The controller with full specifications can be operated even by the single-phase power supply.

---

**Operation method**: Pulse train  

**Input power**: Main power  

Single-phase  

3-phase AC 200 V  

**Control power**:  

Single-phase AC 200 V  

**Position detection**: Incremental  

**Dedicated pulse train control**

Driver functions by dedicated pulse train control which yields a compact body and a low price.

**Cost reduction to a large extent is possible in designing the system**

Driver easily assembles into automated equipment so a drastic amount of effort needed for tasks such as design, part selection and settings can be eliminated and a huge cost reduction achieved.

**Compact**

Compact design of H 160 × W 40 × D 140 mm. Side-by-side installation can be made.

**Command input**: Line driver signal (2Mpps)  

Open collector (200kpps)
Usable for all TRANSERVO series models

Pulse train input driver dedicated to "TRANSERVO"
A robot driver dedicated to the pulse train input for "TRANSERVO".

Torque decrease in high-speed area is suppressed
As a vector control method is used, the torque decrease in high-speed area is small and high-speed operation even with high payload can be performed. This greatly contributes to shortening of the tact time.

Excellent silence
High-pitched operation sounds unique to the stepping motor are suppressed to achieve silent operation sounds similar to the AC servo.

Easy operation with support software TS-Manager
In the same manner as the robot positioner TS series, the operation can be performed with the TS-Manager (Ver.1.3.0 or later) having various convenient functions, such as robot parameter setting, backup, and real-time trace (The handy terminal "HT1" cannot use this TS Manager).

Applicable to a wide variety of pulse train command inputs
This robot driver can be made applicable to the open collector method or line driver method using the parameter setting and signal wiring. In the open collector method, a wide voltage range from 5 V to 24 V is supported. So, the robot driver can be matched to the specifications of the host unit to be used.

TS-Manager: Real-time trace function
The current position, speed, load factor, current value, and voltage value, etc. can be traced at real-time. Additionally, as trigger conditions are set, the data when the conditions are satisfied can be automatically acquired. Furthermore, as a range is specified from the monitor results, the maximum value, minimum value, and average value can be calculated. So, this is useful for the analysis if a trouble occurs.

Real-time traceable items (up to four items)

<table>
<thead>
<tr>
<th>Voltage type</th>
<th>Command position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command speed</td>
<td>Current position</td>
</tr>
<tr>
<td>Command current value</td>
<td>Internal temperature</td>
</tr>
<tr>
<td>Input/output I/O state</td>
<td>Motor load factor</td>
</tr>
<tr>
<td>Word input/output state</td>
<td>Movement pulse count</td>
</tr>
</tbody>
</table>

Note: 1. TS-SD only  Note: 2. TS controller only

Daisy chain function
As multiple TS series controllers and drivers are connected in a daisy chain, the data of a desired unit can be edited from the personal computer (up to 16 units).
[Robot positioner]

### Main operation patterns

#### Normal operation

- **ABS operation**: Moves to a target position based on the origin and performs the positioning.
- **INC operation**: Moves by pitch movement amount from the current position and performs the positioning.
- **Pushing operation**: Performs the pushing operation with set pushing thrust.
- **Pushing operation after deceleration**: Pushes after decelerated from the target position to the distance N of the position near width.

#### Merge operation

- Changes the speed without deceleration.
- Performs the continuous operation through multiple points.
- If the set speed is different, the continuous operation is performed by changing the speed without deceleration stop.

#### Output pattern

- I/O output range to the outside can be set individually for each point.
- Position near width that outputs the movement complete signal can be set for each position.

### Detailed setting by point

The speed, acceleration/deceleration, zone output range, and position near width can be set for each point. By combining the operation patterns shown above, various operations can be performed easily.

#### List of setting items

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Operation type</td>
</tr>
<tr>
<td>2</td>
<td>Position/pitch movement amount</td>
</tr>
<tr>
<td>3</td>
<td>Speed</td>
</tr>
<tr>
<td>4</td>
<td>Acceleration</td>
</tr>
<tr>
<td>5</td>
<td>Deceleration</td>
</tr>
<tr>
<td>6</td>
<td>Pushing force</td>
</tr>
<tr>
<td>7</td>
<td>Zone -</td>
</tr>
<tr>
<td>8</td>
<td>Zone +</td>
</tr>
<tr>
<td>9</td>
<td>Position near width</td>
</tr>
<tr>
<td>10</td>
<td>Branch</td>
</tr>
<tr>
<td>11</td>
<td>Flag</td>
</tr>
</tbody>
</table>

#### Note

For the speed and acceleration, input in % steps (standard) or SI unit input (custom setting) that is easy to calculate the cycle time can be selected.

### Maximum acceleration automatic setting

The acceleration is an important factor that determines the service life of the robot. If too high acceleration is set, the robot may be broken in a short period in the worst case. For the TS series, the maximum acceleration is set finely by taking the motor output and the service life of the guide by model or payload into consideration. There is no worry about setting an excessive acceleration by mistake.

### Applicable to EtherNet/IP™

According to the specifications of the host control unit, the input/output can be selected from five types shown below. Since all field networks are incorporated into the main body, the wiring is also easy.

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPN</td>
<td>Input 16 points DC 24 V +/- 10 % 4mA/point Plus common</td>
</tr>
<tr>
<td></td>
<td>Output 16 points DC 24 V +/- 10 % 50mA/point Slave</td>
</tr>
<tr>
<td>PNP</td>
<td>Input 16 points DC 24 V +/- 10 % 4mA/point Minus common</td>
</tr>
<tr>
<td></td>
<td>Output 16 points DC 24 V +/- 10 % 50mA/point Source type</td>
</tr>
<tr>
<td>CC-Link</td>
<td>Applicable to CC-Link Ver. 1.10, Remote device station (1 station)</td>
</tr>
<tr>
<td>DeviceNet™</td>
<td>DeviceNet™ slave</td>
</tr>
<tr>
<td>EtherNet/IP™</td>
<td>EtherNet/IP™ adapter (2 ports)</td>
</tr>
</tbody>
</table>

### Cautions on TS-S2/TS-SH

For the RF type sensor specifications, the controllers “TS-S2” and “TS-SH” become “TS-S2S” and “TS-SHS”, respectively.

- **“BK” label is affixed to the front of the controller.**
- **“SENSOR” label is affixed to the front of the controller.**
  (Be aware that “TS-S2S” is affixed to the front of the controller.)
Simple operation only by specifying point number

The TS series are robot positioners that operate only by specifying a point number and inputting the START signal. The positioning and pushing operations can be performed without making programs. Additionally, as the merge operation is performed, the speed can be changed during movement.

Two kinds of payload parameters can be registered

Two kinds of payload parameters can be registered in one transfer process. Therefore, as an optimal acceleration is automatically set in each of processes with different payloads, such as processes with and without mounting transfer workpieces, the cycle time can be shortened.

Direct positioning command

“Direct positioning command” is provided that performs the positioning operation by specifying the position and speed data directly for the remote command. The positioning data can be handled by the control unit and the positioning operation can be performed by one command. The programming of the control unit can be constructed simply.

Powerful support software: TS-Manager

Low-cost and high-performance support software “TS-Manager” was newly developed for the TS series. All operations, such as the point data setting, edit, backup, and teaching can be performed only with this software. Furthermore, this software incorporates the real-time trace functions for the current value, speed, load factor, current value, and voltage value.

Free speed change even during movement

This robot positioner incorporates a merge operation function and can easily change the speed (acceleration/deceleration) even during movement. Additionally, when multiple points are merged and the same speed is set for each point, the signal can be output to the host unit every time the robot passes through each point.

TS-Monitor allowing understanding of operation state at a glance.

For the TS-X/P, a main body integrated type LCD monitor is provided as an option. The operation state, current position, speed, and load factor can be understood at a glance. If an error occurs, the back light turns red, allowing you to understand the error contents at a glance. Even field operator or maintenance engineer can understand the current state.

Daisy chain function

As multiple TS series controllers and drivers are connected in a daisy chain, the data of a desired unit can be edited from the personal computer (up to 16 units).

Applicable to Pro-face

The status can be checked easily from the touch panel display, and basic operations, such as JOG operation, inching operation, return-to-origin, and error reset can also be performed from the display. Additionally, even when there is no manual, an alarm that has occurred and detailed explanation on alarm can be checked immediately.

Handy terminal: HT1/HT1-D

An easy-to-see graphic LCD with a back light is used. The robot manual operation, point data edit, teaching, and parameter setting can be performed.

### Payload setting example

<table>
<thead>
<tr>
<th>Number</th>
<th>Operation type</th>
<th>Position [mm]</th>
<th>Speed [%]</th>
<th>Acceleration [%]</th>
<th>Deceleration [%]</th>
<th>Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>ABS</td>
<td>200.00</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>P2</td>
<td>ABS</td>
<td>1500.00</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

Payload 1: 30 kg (Acceleration upper limit value 1: 1.60 m/s²)
Payload 2: 3 kg (Acceleration upper limit value 2: 4.00 m/s²)

### Speed

- Operation 1 (Moves to P1.)
- Operation 2 (Moves to P2.)

Operation when the payload is set at 3kg. Operation when the payload is set at 35kg.

### Daisy chain and gateway function

Reduce the network cost by connecting multiple units in a daisy chain. The network board is required for each controller.

- Daisy chain connection cable (300mm)
- Control unit
- LAN
- RS-422
- RS-232C
- Pro-face GP4000 series
**Controllers Product Lineup**

**SR1-X/SR1-P**

**[Single-axis robot controller]**

**ERCD**

**[Single-axis robot controller]**

**Various command methods**

An optimal method can be selected from various command methods, such as program, point trace, remote command, and online command. The program uses the YAMAHA SRC language that is similar to the BASIC. Various operations, such as I/O output and conditional branching, etc. can be executed using simple operations.

**Applicable to complete absolute position system**

The SR1-X is applicable to complete absolute position system. No return-to-origin is needed. (The backup period is one year in the non-energizing state.)

**Compact design**

Compact box size of W 44 × H 142 × D 117mm is achieved with the functions improved. The volume ratio of the robot controller is downsized to approximately 62 % when compared to YAMAHA's conventional model ERCX. The flexibility of the installation space is improved.

**Various input/output functions**

As a feedback pulse output function is provided, the host control unit can easily manage the current position. Additionally, as the movement point number can be output in binary format during point trace, the operation can be checked easily. As a teaching function using the I/O is added, the flexibility and usability of the system configuration are further improved. This output is enabled in the program or point trace operation and the number of outputs can be changed to a desired level using the division setting.

**I/O assignment function**

As the I/O assignment is changed, the point trace operation, point teaching, and trace operation by specifying coordinate values can be selected in addition to the normal program operation. Since the JOG movement through the I/O is possible in the point teaching mode, the point teaching can be performed from the host unit without the HPB.

**Current position output function**

The position data is output as feedback pulse or binary data. This allows the host unit to understand the current robot position at real-time. Furthermore, functions, zone output or point zone output to output near point number are incorporated.

**Torque limiting**

As this function limits the maximum torque command value at desired timing, it is effective in operations such as pushing and workpiece gripping operations. Furthermore, in addition to the torque limiting by the parameter data value, the torque limiting by the analog input voltage can be performed.

**Four command formats**

A desired command format can be selected from four command formats, program operation using various commands, point trace operation only by instructing a point number, online command, and pulse train input.

**Various monitor functions**

The controller status can be checked using the input/output status monitor, duty monitor, and LED status display.

**Error history and alarm history**

The error or alarm history that occurred in the past can be displayed and checked on the HPB or personal computer screen.

**Robot number management**

As the controller is initialized by the robot number of the robot to be controlled, parameters suitable for each robot model are automatically registered and no complicated servo adjustment is needed.

**Torque limiting control**

The torque limiting control can be performed using the program command. The axis can be stopped with the torque applied. This torque limiting control can be used for continuous positioning of workpieces with different sizes, press-fitting work, and workpiece holding operation.

**Zone output function**

The general-purpose output on/off setting between desired points can be performed using the parameter setting. The positive logic/negative logic setting can be made and the axis position can be easily judged by an external unit. Up to four patterns can be set.
### Position data output function

**Zone output**
Outputs whether or not the robot position is within the specified range.

**Point zone output**
Outputs the point number near the robot position in binary format.

**Binary output**
Outputs the current robot position in 16-bit binary format. (This function is available only in the SR1.)

**Feedback pulse output**
Outputs the current position counter value of the robot through the A/B-phase line driver.

### Point teaching

The JOG movement of the robot and the point reaching can be performed from the host unit.

**Concept**
- The robot is moved to the teaching position using the JOG+/JOG- command.
- The current position is registered into the point number specified by the PSET input.

### Torque limiting function

As the torque limiting is performed during operation, the operation, such as pushing and workpiece gripping can be performed.

**Concept**
- Host unit manages the limiting time using the TLM input.
- Limiting status is understood using the torque limiting status output (TLON).
- Torque limit value is changed (up to 4 patterns) using the input.
- Torque can be limited using the program command.
- Torque can be limited using the analog input (0 to +10 V / 12 bit).

**Features**
- ERCD
  - Torque can be limited using the T program command.

### Movement data change function

The movement speed or target position can be changed during movement. (This function is available only in the SR1.)

**Concept**
- Host unit manages the limiting time using the movement command input.
- Movement command is ABS-PT (absolute movement command) or ABS-BN (binary specified movement command).
- Change speed can be specified in a range of 1 to 100 % (up to 4 patterns).
- Changing is disabled in the deceleration zone.

### Multi-task function

This function can execute multi tasks, such as robot peripheral units in parallel at the same time. Up to four tasks can be executed. With the multi-task function combined with JMPP command, the I/O signals can be output when the robot passes through the specified point during movement.

### Conditional stop function during movement

The arm can be decelerated and stopped using I/O conditions of the MOVF command while it is moving. This function is useful when searching for the target position with the sensor.
Applicable to all YAMAHA robot models

The RCX series is applicable to all YAMAHA robot models, such as PHASER, FLIP-X, and XY-X, etc. As the single-axis robot (FLIP-X/PHASER) can be combined with the Cartesian robot freely, various applications can be supported (except for some compact single-axis robots).

Complete absolute position system

The RCX uses complete absolute specifications that need no return-to-origin when the power turns on. The completely same system can be applicable to the incremental specifications. (When the PHASER series uses the magnetic scale, it is applicable to the semi-absolute or incremental specifications.)

Extension of absolute data backup time

As the backup circuit is improved to the energy saving, the absolute position data retention period in the non-energizing state is greatly extended. The maximum one month of the conventional model is extended to approximately one year. The current position information is monitored during long vacations, equipment storage, or even during transportation, and no return-to-origin is needed when energized again. This allows quick production start.

Area check output function

This function can output the I/O signals when the robot enters a set area during operation. Up to eight check areas can be set.

Applicable to dual-drive

A dual-drive function is incorporated that controls two axes synchronously. This function is effective for heavy workpiece transfer or Y-axis long stroke of the Cartesian robot. The function can perform the operation using the high-speed and high acceleration/deceleration of YAMAHA robots.

Note. The dual-drive is supported as a custom order. For detail, please consult YAMAHA.

Example of dual-drive

Applicable to robot vision "iVY System"

The RCX series also supports the YAMAHA robot vision "iVY System" that is capable of easy setup and applicable to a wide variety of applications. As the vision board is incorporated into the controller main body, the calibration work requiring a long time and labor is then greatly simplified. As the position is corrected by the image recognition, the versatility and applicability of the equipment is widened greatly (only supported by the RCX240).

Double-carrier anti-collision function

When using the double-carrier, collisions between both carriers can be prevented by the control in the controller. Collision preventions by the zone judgments or external sensors are no longer needed to make the double-carrier easier to use.

3D linear/circular interpolation control

2D and 3D linear and circular interpolation controls are possible. This ensures the smooth and highly accurate operations suitable for the sealing work. (The 3D interpolation is not available in the RCX221/222.)
### Hand definition

This function operates the robot based on coordinates of the offset tool tip when the tool is attached to the tip of the robot axis in the offset state. Particularly, this function is effective during tool rotation of SCARA robots or robots including the rotation axis.

![Hand definition diagram](image)

- **No hand definition**
- **Hand definition**

### Shift coordinates

A deviation may occur in the coordinate system when re-installing or replacing the robot during maintenance work. In this case, the coordinate system can be corrected using the shift coordinate function. So, the point data can be used as it is. No re-teaching is needed.

![Shift coordinates diagram](image)

- **Original coordinates**
- **Coordinates after reinstallation**
- **Correction with shift coordinates**

### Palletizing function

This function can easily define up to 20 kinds of pallets only by entering four corner positions on the pallet as the teaching points. When entering the teaching point in the height direction, even three-dimensional pallets are supported. When specifying the defined pallet number and executing the movement command, the palletizing work is then performed. Various operations, one point → pallet, pallet → one point, and pallet → pallet, can be performed using the programs.

![Palletizing function diagram](image)

### Passing point output control

The general-purpose output on/off can be controlled by specified points without stopping the axis operation during interpolation operation. The dispense can be turned on or off with the axis operated during sealing to allow smooth and stable dispensing.

![Passing point output control diagram](image)

### Torque limiting function

The motor torque can be limited during gripping or press-fitting.

### Multi-task function

This function can execute multi tasks (up to eight tasks), such as robot peripheral units in parallel at the same time. When there are multiple tasks, the task can be changed by means of the time sharing method and a priority can be put on the task. Additionally, the priority can also be changed while the task is running. The multi-task function simplifies the control configuration of the entire system to improve the operation efficiency.

### Task scheduling

The top of the task with the highest priority transits to the RUN state.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Task 1</th>
<th>Task 2</th>
<th>Task 3</th>
<th>Task 4</th>
<th>Task 5</th>
<th>Task 6</th>
<th>Task 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Task 1</td>
<td>Task 3</td>
<td>Task 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Task 5</td>
<td>Task 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Task 2</td>
<td>Task 6</td>
<td>Task 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Order, in which READY state transits.

### Sequence program

In addition to the normal task, a task to individually control the input/output (parallel, serial, memory, timer) can be executed. As the sequence program can be enabled even in the manual mode, this is effective to construct a safety system linked with peripheral units.
2-robot control

Two robots that are assigned to the main and sub robots can be simultaneously controlled using one controller. As this function is used together with the multi-task, advanced and smooth linking of two robots can be performed using one controller.

Applicable to auxiliary axis addition function "YC-Link system"

This YC-Link is a system that controls the single-axis robot controller SR1 from the multi-axis controller RCX series through the serial communication. By installing the YC-Link system, the RCX series can be easily linked with the SR1 series. As multiple controllers can be linked as required, up to eight axes (up to six axes for simultaneous control) can be controlled.

Powerful support software: VIP+ (plus)

This application software allows you to easily and visually operate the robot, create and edit programs, and teach points. The user interface is greatly improved and made easier to use when compared to the conventional support software VIP.

Applicable to electric gripper "YRG series"

All grippers can be controlled using one RCX240 controller. Data exchanging with the host unit, such as PLC is not needed. The setup or startup is very easy.

RCX240/RCX340 POINT

RCX240 and RCX340 are applicable to all single-axis, Cartesian, SCARA, and P&P robots

The 4-axis robot controller RCX240 and RCX340 are applicable to all robot models including single-axis, Cartesian, SCARA, and Pick & Place robots. As the mixed control of the ball screw type FLIP-X series and linear motor type PHASER series can be performed, the robots can be combined freely according to the applications. Additionally, when preparing the robot controllers for the maintenance work of multiple robots, it is enough to prepare only one robot controller. This robot controller can be used for any model only by changing the setting.

Note. Except for 24 V specification models.

Robot configuration examples

RCX240 and RCX340 are applicable to all single-axis, Cartesian, SCARA, and P&P robots
Advanced functionality allowing construction of high-level equipment

Multiple robots can be operated synchronously through the high-speed communication. Use of linking among controllers makes it possible to store programs into only one controller. Use of a newly developed algorithm achieves shortening of the positioning time and improvement of the tracking accuracy.

The control of multiple robots can be managed using one master controller

The RCX340 controller allows high-speed communication among the controllers. As the operation command can be sent to the controller of each slave from the master controller, the programs or points can be managed only using the host master controller. Additionally, as this controller supports multi tasks flexibly, data exchanging with the PLC can be simplified. Simultaneous start and simultaneous arrival of each robot can be controlled freely. Complicated and precision robot system using many axes can be constructed at a low cost.

Smooth movement is achieved by greatly improving motion functions

As a new servo motion engine is incorporated, various operations can be merged. Use of a newly developed algorithm achieves shortening of the positioning time and improvement of the tracking accuracy.

- **Expansion of CONT option function**
  Different type operations, such as PTP, interpolation operation, and conveyor tracking, etc. are merged to improve the speed.

- **Improvement of operation speed**
  All operations can be merged as much as possible using the merge PTP. As even operations with different acceleration or deceleration time are merged at maximum level with priority put on the operation time, the movement time is shortened greatly.

- **Proper use according to application**
  When performing the continuous operation, an optimal operation can be selected according the application, like traditional PATH is used for constant-speed operation, such as sealing and merge PTP is used for operation with priority put on the movement time.

Conventional method

- All controllers are controlled using one PLC.
- Programs are set for each controller. Operation is performed while synchronizing the robots through I/O.

RCX340

- Up to four robots or 16 axes can be managed with one master RCX340.
- Simultaneous start and arrival of each robot can be controlled freely.

Controllers without program settings

- Connectable using LAN cable.
- YC-Link/E

RCX340

- All programs and settings are managed using the master.

Conventional method

- Operation starts without stopping.

RCX340

- The PTP1/PTP2 operation pattern is calculated as the merge is preconditioned.
- Maximum merge can be made regardless of operation types to be merged. So, the merge effect is large.

Note: It is necessary to upgrade the firmware to its latest version.
Arch motion can be specified more intuitively

As the arch motion route designation method is changed and the designation method is simplified, the arch motion can be specified more intuitively.

**Conventional method**

- All axes need to specify parameters.
- Route is difficult to adjust.

Specify using Z parameters.

2nd operation (X&Y)

1st operation (Z)

3rd operation (Z)

**RCX340**

- Only the arch axis needs to specify parameters.
- Route adjustment is easy.

Specify using Z parameters.

2nd operation (X&Y)

1st operation (Z)

3rd operation (Z)

Free axis configuration is applicable to a wide variety of applications

**Example: Interpolation operation in dual-lane**

Use of multi-coordinate axis setting and CP command applicable to the axis designation makes it possible to perform the interpolation operation in the dual-lane. The cycle time of the robot with multiple axes having the same coordinate attribute can be shortened.

**Conventional method**

- Only the target axis is specified for the sealing.
- Other axes can be execute another operation in parallel in other task.

As A4 also becomes the specified axis, another operation is impossible. A4 waits at the target position.

**RCX340**

- Only the target axis is specified for the sealing.
- Other axes can be execute another operation in parallel in other task.

A4 sealing starts immediately after completion of movement to the A1/A2 sealing position.

A4 moves to the sealing position in task 2.

A3 moves to the workpiece setting position in task 2.

Sealing by specifying A1/A2/A3


Operation is impossible during A3 sealing. A3/A4 is swapped after completion of sealing.

Improvement of tracking accuracy

Use of visualization with servo analyze function and high responsiveness with new servo function makes it possible to increase the follow-up ability and improve the tracking accuracy when compared to the conventional models.

**RCX240**

- Tracking deviation is reduced greatly.

15 mm/sec.

500 mm/sec.

**RCX340**

- Tracking deviation is reduced greatly.

15 mm/sec.

500 mm/sec.
**POINT 2**

**Improved basic performance**

Functions, such as robot language, multi-task, sequence function, communication, and field bus are improved and made easier to use.

**Motion optimization**

The optimization of the motion to meet the operation pattern is further strengthened to bring out the robot performance at its maximum level. Higher quality robot operations, such as shortening of the operation time and suppression of vibrations during stopping are achieved.

- **Optimal acceleration/deceleration motion**
  
  Acceleration/deceleration motion is generated that can perform the high-speed operation while suppressing vibrations.

**Compact design**

The outside dimensions are approximately 355 mm (W) × 195 mm (H) × 130 mm (D). The volume ratio is reduced to approximately 85% and the body size is made compact when compared to the conventional 4-axis controllers so as to make the installation inside the control panel easy.

**User memory capacity increase**

- **Number of points is greatly increased.**
  - RCX240: 10,000
  - RCX340: 30,000

- **Total capacity of program and point**
  - RCX240: 364 KB
  - RCX340: 2.1 MB

**Built-in regenerative unit**

As the regenerative unit (equivalent to RGU3) is built-in, no additional regenerative unit is needed when connecting to the existing robot.

**Support tool with visibility and operability improved**

New support software RCX-Studio

The program debug function is strengthened to support the multi-task. Use of convenient operability and program input support function makes it possible to perform the quick setup.

- **YAMAHA robot becomes easier to use, faster setup, efficient maintenance**

**RCX240**

**RCX340**

**Downsized approximately 15 % when compared to the RCX240.**

**Example: YK400XG**

- **Standard cycle time operation**
  - RCX340: 0.49 sec
  - RCX240: 0.45 sec

**Support tool with visibility and operability improved**

New support software RCX-Studio

The program debug function is strengthened to support the multi-task. Use of convenient operability and program input support function makes it possible to perform the quick setup.

- **YAMAHA robot becomes easier to use, faster setup, efficient maintenance**

**New programing box PBX**

This programming box is applicable to three languages, "Japanese", "English", and "Chinese". Use of a color display makes it possible to improve the visibility.

Work to add or edit functions becomes easy, allowing even personnel without programming skill to operate this programming box.

A function to save the controller data into the USB memory is incorporated.
Enhanced expandability

RS-232C and Ethernet ports are provided as standard equipment. A wide variety of high-speed and large capacity field networks, such as CC-Link, DeviceNet™, and EtherNet/IP™ are supported as options. Connections with general-purpose servo amplifier or other company’s VISION are easy. So, the RCX340 is called “connectable controller”.

Applicable to various field buses/centralized control of robots through connections of up to four controllers

RS-232C and Ethernet ports are provided as standard equipment. Additionally, fulfilling field buses, such as CC-Link, EtherNet/IP™, DeviceNet™, PROFIBUS, and PROFINET can be supported to connect and control a wide variety of devices. For 5 or more axes, use of YC-Link/E makes it possible to connect up to four RCX340 controllers so as to perform the centralized control of multiple robots. Additionally, when using YC-Link/E® Note 1, multiple robots can be handled as if they are operated using one controller. This ensures very easy robot programming and management. Therefore, this robot controller contributes to reduction of unseen costs, such as labor cost necessary for the setup work.

Note 1. When ordering YC-Link/E, please specify what robot is connected to what number controller.

More flexible robot configuration is also possible by connecting other company’s servo amplifier

The RX340 can be operated as robot axis by connecting a servo amplifier to it. The RCX340 controller can set the coordinate attribute freely to support various robot configurations.

Note 1. For detail about applicable models, please consult YAMAHA.