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CAUTIONS TO BE TAKEN TO ENSURE SAFETY

● For those persons involved with the operation / service of your system, including Kawasaki Robot, they must strictly observe all safety regulations at all times. They should carefully read the Manuals and other related safety documents.

● Products described in this catalogue are general industrial robots. Therefore, if a customer wishes to use the Robot for special purposes, which might endanger operators or if the Robot has any problems, please contact us. We will be pleased to help you.

● Be careful as Photographs illustrated in this catalogue are frequently taken after removing safety fences and other safety devices stipulated in the safety regulations from the Robot operation system.
Kawasaki’s innovative dual-arm collaborative robot, duAro enables humans and robots to work together in the same workspace.

Features:

**Space-Saving**
With its two co-axial arms, duAro can fit into a single-person space, and provides a wide collaborative working range.

**Easy Introduction**
The wheeled base that accommodates the arms and controller enables the user to move the robot to any location.

**Easy Teaching**
Direct teaching with dedicated tablet software enables non-skilled operators to teach and operate the robot intuitively.

**Safety**
In the event of a collision with the worker, the collision detection function will stop the duAro safely. In addition, the soft materials on the arm surfaces also reduce shocks.

**Caution!**
This function can reduce damage in case of an accident, but will not prevent accidents from occurring. Users are required to carry out safety risk management before use.
**Easy to Use**
Standardized systems of peripheral equipment make the introduction of robots easier.

**Quick Installation**
Thanks to the pre-designed system packages, installation and startup are quicker, even when some items have to be customized.

**High Quality**
Pre-evaluated and tested systems provide stable quality.

**Low Cost**
The overall costs associated with system building can be reduced due to the use of common components.

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**Application Examples**

- Various parts insertion
- Circuit board loading/unloading
- Handling of FPCs (Flexible printed circuit boards)
- Screw tightening
- Gate cutting
- Box packing
- Liquid dispensing
- Rice ball tray packing
- Putting lids on lunch bowls

**Advantages of dual-arm robots**

- Handling of various types and sizes of workpieces is possible, unlike with single-arm robots.
- Each arm can perform different tasks simultaneously, shortening the cycle time considerably.
- Tightening screws with a screw driver
- Holding a workpiece

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**Package Software**

- **Package Software Applications for the System Packages**
- Various parts insertion
- Circuit board loading/unloading
- Handling of FPCs (Flexible Printed Circuit boards)
- Screw tightening
- Gate cutting
- Box packing
- Sealing
- Rice ball tray packing

**System Package Example (screw-tightening & assembling)**

- **Package Software**
- **Base chuck**
- **Screw feeder**
- **Electric screw driver**
- **Gripper for circuit board (customized)**
- **Work bench**
- **Workpiece setting (customized)**

**Programming Not Required**
A standard set of operations for tightening screws has been developed and is readily available. Users can choose it on the tablet screen.

**Easy Setting**
To carry out the operational setting, all you have to do is to input the parameters according to the specific screw to be handled. Tool changing can easily be made by changing the parameters only.

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**System Packages**

- **duArO**
- **Package**
- **Software**

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**Packageed Components:**
- Base chuck, screw feeder, electric screw driver, package software

**Customized parts:**
- Gripper for substrate transfer, workpiece setting.
duAro 1

Standard Specifications

Tasks such as part assembling and screw tightening can be performed on the same work bench and conveyors that human workers are using.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Horizontal articulated type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of freedom (axes)</td>
<td>4 × 2 arms</td>
</tr>
<tr>
<td>Max. payload (kg)</td>
<td>2 × 2 arms</td>
</tr>
<tr>
<td>Max. reach (mm)</td>
<td>760</td>
</tr>
<tr>
<td>Positional repeatability (mm)</td>
<td>±0.05</td>
</tr>
<tr>
<td>Motion range</td>
<td>Arm rotation (°)</td>
</tr>
<tr>
<td></td>
<td>Arm 1 (lower arm)</td>
</tr>
<tr>
<td></td>
<td>Arm 2 (upper arm)</td>
</tr>
<tr>
<td></td>
<td>-170 - +170 (JT1)</td>
</tr>
<tr>
<td></td>
<td>-140 - +140 (JT2)</td>
</tr>
<tr>
<td></td>
<td>-0 - +150 (JT1)</td>
</tr>
<tr>
<td></td>
<td>-0 - +150 (JT2)</td>
</tr>
<tr>
<td></td>
<td>Wrist swivel (°)</td>
</tr>
<tr>
<td></td>
<td>-360 - +360 (JT4)</td>
</tr>
<tr>
<td></td>
<td>-360 - +360 (JT6)</td>
</tr>
<tr>
<td>Moment (N·m)</td>
<td>Wrist axis (JT4) 0.05</td>
</tr>
<tr>
<td></td>
<td>Wrist axis (JT6) 0.2 or less</td>
</tr>
<tr>
<td>Max. mass (kg)</td>
<td>Approx. 230 (including controller. Excluding options)</td>
</tr>
<tr>
<td>Installation</td>
<td>Floor mount</td>
</tr>
<tr>
<td>Environmental conditions</td>
<td>Ambient temp. (°C) 5 - 40*</td>
</tr>
<tr>
<td></td>
<td>Relative humidity (%) 35 - 85 (no dew, nor frost allowed)*</td>
</tr>
<tr>
<td>Controller / Power requirements</td>
<td>F61 / 2kVA</td>
</tr>
</tbody>
</table>

* Please consult with Kawasaki for operations beyond these conditions.

duAro 2

Standard Specifications

Compared to duAro1, the vertical stroke (2-axis) has been extended to 550mm and the payload capacity to 3kg (each arm) Thanks to the long vertical stroke, packing into a deep box is possible with ease.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Horizontal articulated type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of freedom (axes)</td>
<td>4 × 2 arms</td>
</tr>
<tr>
<td>Max. payload (kg)</td>
<td>3 × 2 arms</td>
</tr>
<tr>
<td>Max. reach (mm)</td>
<td>785</td>
</tr>
<tr>
<td>Positional repeatability (mm)</td>
<td>±0.05</td>
</tr>
<tr>
<td>Motion range</td>
<td>Arm rotation (°)</td>
</tr>
<tr>
<td></td>
<td>Arm 1 (lower arm)</td>
</tr>
<tr>
<td></td>
<td>Arm 2 (upper arm)</td>
</tr>
<tr>
<td></td>
<td>-170 - +170 (JT1)</td>
</tr>
<tr>
<td></td>
<td>-140 - +140 (JT2)</td>
</tr>
<tr>
<td></td>
<td>-0 - +150 (JT1)</td>
</tr>
<tr>
<td></td>
<td>-0 - +150 (JT2)</td>
</tr>
<tr>
<td></td>
<td>Wrist swivel (°)</td>
</tr>
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<td></td>
<td>-360 - +360 (JT4)</td>
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<td></td>
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</tr>
<tr>
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<td>Wrist axis (JT4) 0.05</td>
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<td></td>
<td>Wrist axis (JT6) 0.2 or less</td>
</tr>
<tr>
<td>Max. mass (kg)</td>
<td>Approx. 236 (including controller. Excluding options)</td>
</tr>
<tr>
<td>Installation</td>
<td>Floor mount</td>
</tr>
<tr>
<td>Environmental conditions</td>
<td>Ambient temp. (°C) 5 - 40*</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>Controller / Power requirements</td>
<td>F61 / 2kVA</td>
</tr>
</tbody>
</table>

* Please consult with Kawasaki for operations beyond these conditions.

duAro 1 (Standard specification)

duAro 2 (Standard specification)
**Offline Programming Software**

**Kawasaki Robot’s offline programming tool**

**Enables a variety of production configurations**

The application can build 3D models of robots, peripherals, and products to verify various system configurations. Verification of operation time of robots and interference with surrounding objects ahead of introduction can reduce the risks associated with initial system launch. The tool also has rich support functionality to create motions and programs for the robots, thereby contributing to a reduction in working hours.

**Robot simulation technology**

- The virtual robot controller technology that Kawasaki has developed over the years can estimate motion trajectories and cycle times as accurately as the hardware robot controllers.
- The same tablet as one used for the real robot can be used.

**Layout design**

- Capture data from 3D-CAD to arrange the products (STL format).
- Interference check function allows for checking if there is a contact among models.
- Interactive wizard ensures reliable operations even for those who are unfamiliar with layout design.

**Operation environment**

- Available in Windows environments
- Supported OSs: Windows 7, 10 (x86, X64)
- On a 64-bit computer, it runs in the 32-bit compatible mode.
- Available in Japanese, English, German, and Chinese (simplified characters)

**Teaching and programming**

- Teach point modeling facilitates checking for working positions and moves robots to their working positions.
- Coordinated movement setting allows for teaching multiple arms easily.
- The status of robot operations and I/O signals can also be checked.

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**Hardware Options**

**Options for separated type**

The arms and cabinet cart can be separated and installed on user’s equipment individually.

**Arm extension adapter for duAro 1**

The arm length of duAro1 can be extended by 100mm, using an optional special extension adapter.

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**Tablet and Software**

**Tablet-based software for duAro offers easy programming with intuitive touch operation.**

User-friendly touch panel is used to teach and operate the robot. A wireless connection eliminates the need for complicated wiring. Switching between the cooperative and individual operations of the arms can also be done from the tablet.

**Tablet System Requirements**

*The following specifications do not guarantee the usability of all tablets.*

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Android 5.1.1 to 8.0</td>
</tr>
<tr>
<td>DP</td>
<td>Width of the smallest side of the 600 dp or greater**</td>
</tr>
<tr>
<td>Network</td>
<td>Wi-Fi</td>
</tr>
<tr>
<td>Processor</td>
<td>ARM (ARMv7)</td>
</tr>
</tbody>
</table>

**Interface Panel**

Using the tablet interface panel application, many functions can be performed from the tablet with ease, which in the past were only possible from a PC. These functions include displaying and setting robot program variables and executing robot monitor instructions.

Colors and layout of the screen icons, buttons and labels can be customized.

*One page of an interface panel application is available for trial. To use multiple pages, please purchase an option.*

**Call Functions for Macro Programs**

User-created AS language programs can be called from the tablet. This enables high level processing such as interruption processes to be executed.

**Speed Limit Override Function**

This function allows the user to set the limitation on the speed and acceleration/deceleration of the arms to values greater than 100%. This function may result in a shorter service life for the mechanical elements and reduced positional repeatability of the robot. The service life could be shortened by 20 to 30% depending on the operating condition.

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**Tablet System Requirements**

*The following specifications do not guarantee the usability of all tablets.*

- Available in Windows environments
- Supported OS: Windows 7, 10 (x86, X64)
- On a 64-bit computer, it runs in the 32-bit compatible mode.
- Available in Japanese, English, German and Chinese (simplified characters)
**Easy vision system setup using a tablet**

It is possible to carry out initial setup, calibration and programming using a tablet. The time required for setting up the vision system can be considerably reduced.

**Built-in Vision System (for the F Controller)**

The vision processing software can be installed inside the F controller, which eliminates the need for an external vision PC. This offers a low-cost, space-saving solution. The vision system can be operated from a tablet or PC.

- **High-end vision software using an external PC is also available.**

**Specifications for the F Controller vision system**

- Camera: 1.6 million pixels, monochrome/color
- Number of cameras: 1 to 4
- Detecting method: Over detection by pattern matching, Recognition of characteristics by binary detection
- Number of recognizable patterns: Up to 500
- Language: English, Japanese, Chinese (simplified characters)

**Mounting a hand-eye camera**

A camera can be mounted directly on the dura’s JT4 axis.

- Typical accessories such as a camera, lens, lighting equipment and bracket are purchased as a set.

**Mounting a fixed camera**

- This camera is mounted on a separate stand, not on the robot.

**Vision System Applications**

- An example of a 2-point measurement

**Before mounting the camera on the robot arm, pictures can be taken close to the workpiece (Standard camera: focal length 100mm, field of vision 30-60mm).**

**The mounting angle can be altered ±30° and ±60°.**

Depending on the position of the Z-axis (JT3), please be careful about possible interference with the other arm.

**System configuration**

- U/D board equipped with arms
- Standard U/D 16 points
- Optional U/D 16 points each
- Optional U/D 8 points each (2)

**Controller**

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>W425 × D445 × H130</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>Enclosed structure</td>
</tr>
<tr>
<td>Number of controlled axes</td>
<td>Max. 10 (standard 8, optional 2)</td>
</tr>
<tr>
<td>Type of motion control</td>
<td>Manual mode, Auto mode, Dual-arm cooperative operation, Single-arm individual operation</td>
</tr>
<tr>
<td>Programming</td>
<td>Direct teaching, simple teaching by tablet</td>
</tr>
<tr>
<td>Memory capacity (MB)</td>
<td>16</td>
</tr>
<tr>
<td>External signal</td>
<td>External emergency stop</td>
</tr>
<tr>
<td>Operation panel</td>
<td>Manual/Auto switch, Start/Stop switch, E-stop switch</td>
</tr>
<tr>
<td>Interface</td>
<td>Ethernet (1000BASE-T, 100BASE-TX/10BASE-T), 2 ports, USB 2.0, 2 ports (optional)</td>
</tr>
<tr>
<td>Power requirements</td>
<td>AC200~230V ±10%, 50/60Hz ±2%, Single phase, Max. 2kVA</td>
</tr>
<tr>
<td>Class D (Category3) earth connection, Smaller than 100Ω (robot-dedicated earth), Leakage current 10mA</td>
<td></td>
</tr>
</tbody>
</table>

**Environmental conditions**

- Ambient temperature (°C): 5 - 40°C
- Relative humidity (%): 35 - 85% (no dew, no frost allowed)*

**General purpose signals**

- 16 input and 16 output channels
- Separate harness (m): 5, 10, 15
- Each pendant cable (m): 1, 5, 10, 15
- Input 32/output 32, Max. 64/64
- Primary power cable (m): 2, 5, 10, 15

**Vision system (PC, camera, lighting, Monitor, mouse and keyboard are to be supplied by customer).**

**Tablet PC (Android OS) + Tablet software**

**Specifications for the F Controller vision system**

- Camera: 1.6 million pixels, monochrome/color
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**Mounting a fixed camera**

- This camera is mounted on a separate stand, not on the robot.

**Typical accessories such as a camera, lens, lighting equipment and bracket are purchased as a set.**

**The camera mounted at distance can capture wide angle pictures.**

(Standard camera: focal length 1,000mm, field of vision 30-60mm.)

**Safe Robot Operation Monitoring**

**Supervise Safety Smart**

By monitoring the robot operation, safety features can be configured for the human workers in the shared workspace.

- Space-saving is possible by controlling the robot workspace.
- The safety features can be altered according to safety signal inputs.
- Certifications: IEC61508 (SIL2), ISO10218-1 and 13849-1 (PLd/Category 3).

**Speed monitoring**

- Monitoring the speed of the robot at specified positions to ensure it is below a predetermined value.

**Force monitoring**

- Monitoring the force applied to the robot at specified positions to ensure it is below a predetermined value.

**Collision detection**

- Monitoring the impact applied to the robot at specified positions to ensure it is below a predetermined value.

**Danger of impact**

- Specifying potential areas where workers might be hit, so as to monitor the force and speed.

**Danger of collision**

- Monitoring for collisions and normal speed in all areas.

**Fieldbus**

- DeviceNet slave
- CC-Link slave
- PROFINET slave
- EtherCAT slave

**Cubic-S Smart**

(Work space/speed monitoring)