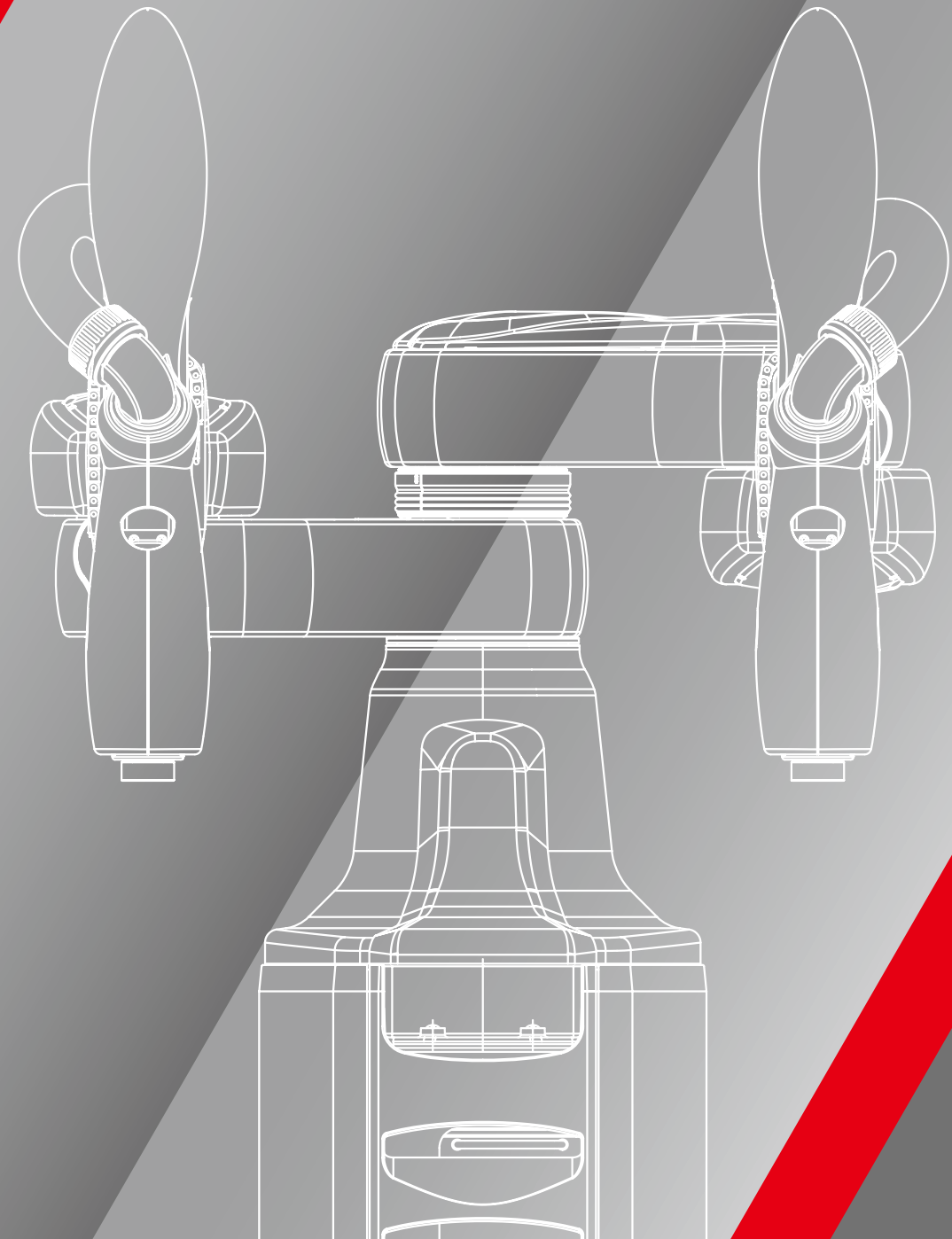


Kawasaki Robot

duAro Dual-arm SCARA Robot “duAro”



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Kawasaki Robot



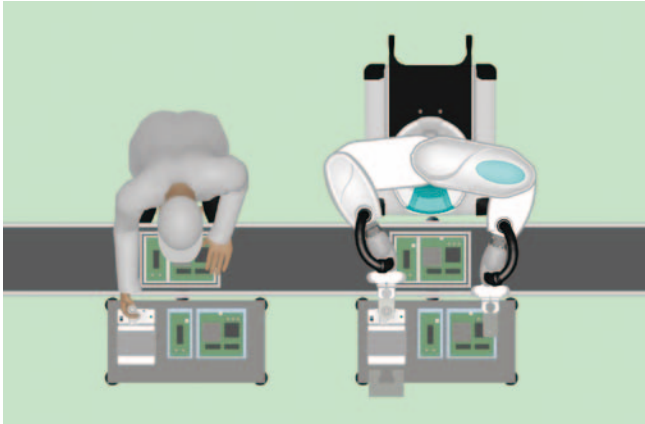
CAUTIONS TO BE TAKEN TO ENSURE SAFETY

- 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.



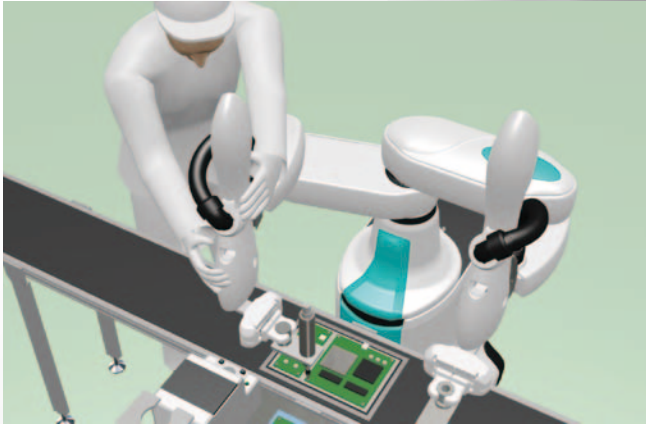
Kawasaki's innovative dual-arm collaborative robot, duAro enables humans and robots to work together in the same workspace.

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 Teaching

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



Easy Introduction

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



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.



duAro 1

duAro 2

A wide range of application fields

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

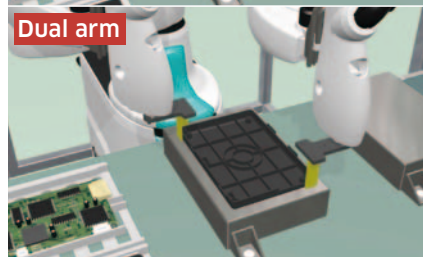
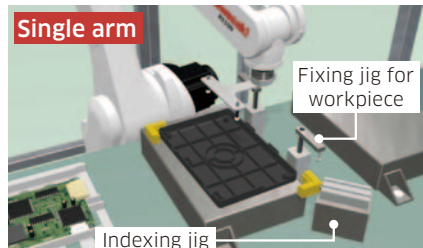


Putting lids on lunch bowls

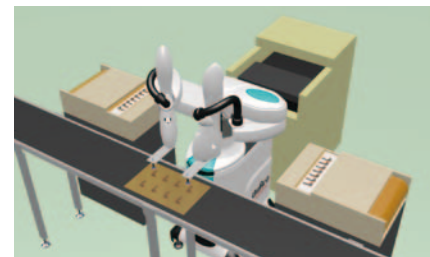


Advantages of dual-arm robots

Handling of various types and sizes of workpieces is possible, unlike with single-arm robots.



It is possible to handle various types and sizes of workpieces, which is not possible for single-arm robots. In addition, the coaxial construction enables the robot arms to reach around and work on the back side.



Each arm can perform different tasks simultaneously, shortening the cycle time considerably.

Tightening screws with a screw driver



System Packages

Easy to Use ... standardized systems of peripheral equipment make the introduction of robots easier.

For typical applications, including screw-tightening and packing rice balls in cases, Kawasaki has standardized useful system packages of peripheral equipment (hardware) and program modules (software).

System Package Advantages

Quick Installation

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

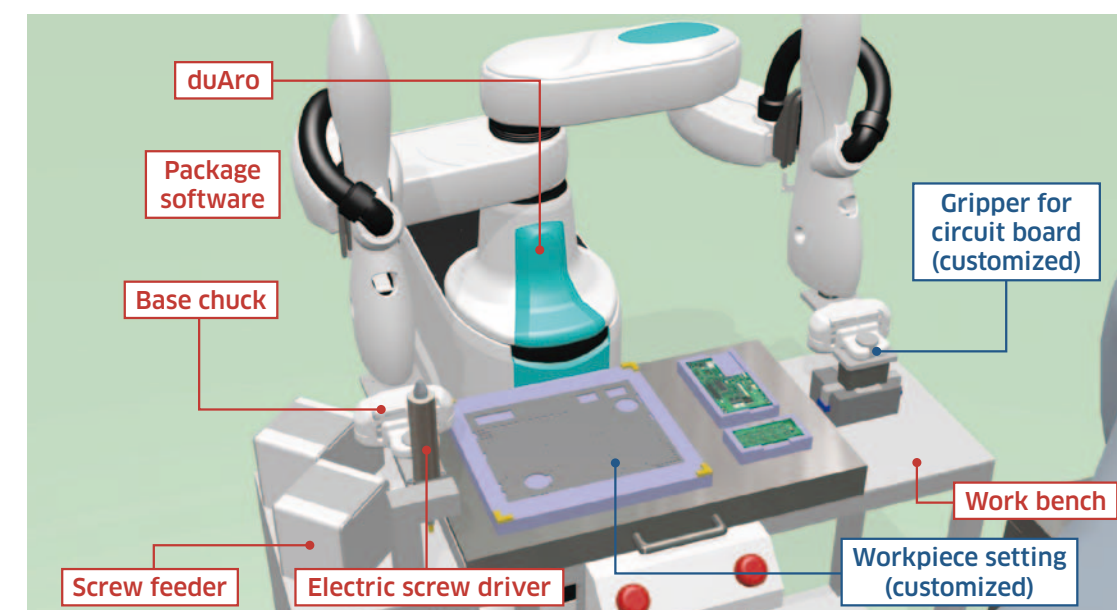
Low Cost

The overall costs associated with system building can be reduced due to the use of common components,

High Quality

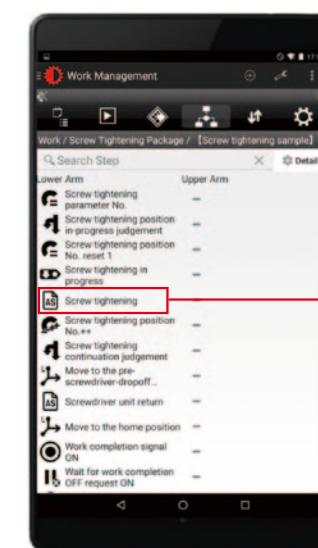
Pre-evaluated and tested systems provide stable quality.

System Package Example (screw-tightening & assembling)



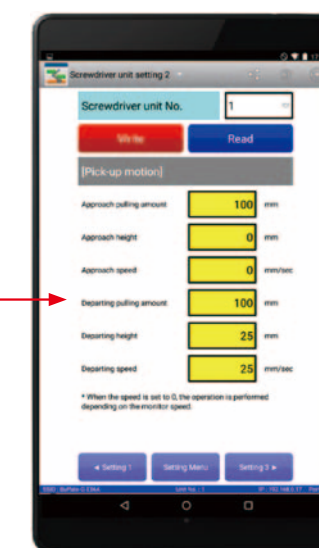
- ☐ **Packaged Components:**
Base chuck, screw feeder, electric screw driver, package software
- ☐ **Customized parts:**
Gripper for substrate transfer, workpiece setting.

Package Software



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.

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
- Putting lids on lunch bowls

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.



		duAro 1 Standard Specifications	
Structure		Horizontal articulated type	
Degree of freedom (axes)		4 × 2 arms	
Max. payload (kg)		2 × 2 arms	
Max. reach (mm)		760	
Positional repeatability (mm)		±0.05	
Motion range	Arm rotation (°)	Arm 1 (lower arm)	Arm 2 (upper arm)
		-170 - +170 (JT1)	-140 - +500 (JT1)
		-140 - +140 (JT2)	-140 - +140 (JT2)
	Arm up-down (mm)	0 - +150 (JT3)	0 - +150 (JT3)
	Wrist swivel (°)	-360 - +360 (JT4)	-360 - +360 (JT4)
Moment (N·m)	Wrist axis (JT4)	3.9	
Moment of inertia (kg·m²)	Wrist axis (JT4)	0.086	
Mass (kg)		Approx. 230 (including controller. Excluding options)	
Installation		Floor mount	
Environmental conditions	Ambient temp (°C)	5 - 40*	
	Relative humidity (%)	35 - 85 (no dew, nor frost allowed)*	
Controller / Power requirements		F61 / 2kVA	

* Please consult with Kawasaki for operations beyond these conditions

duAro 2

Standard Specifications

Compared to duAro1, the vertical stroke (Z-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.



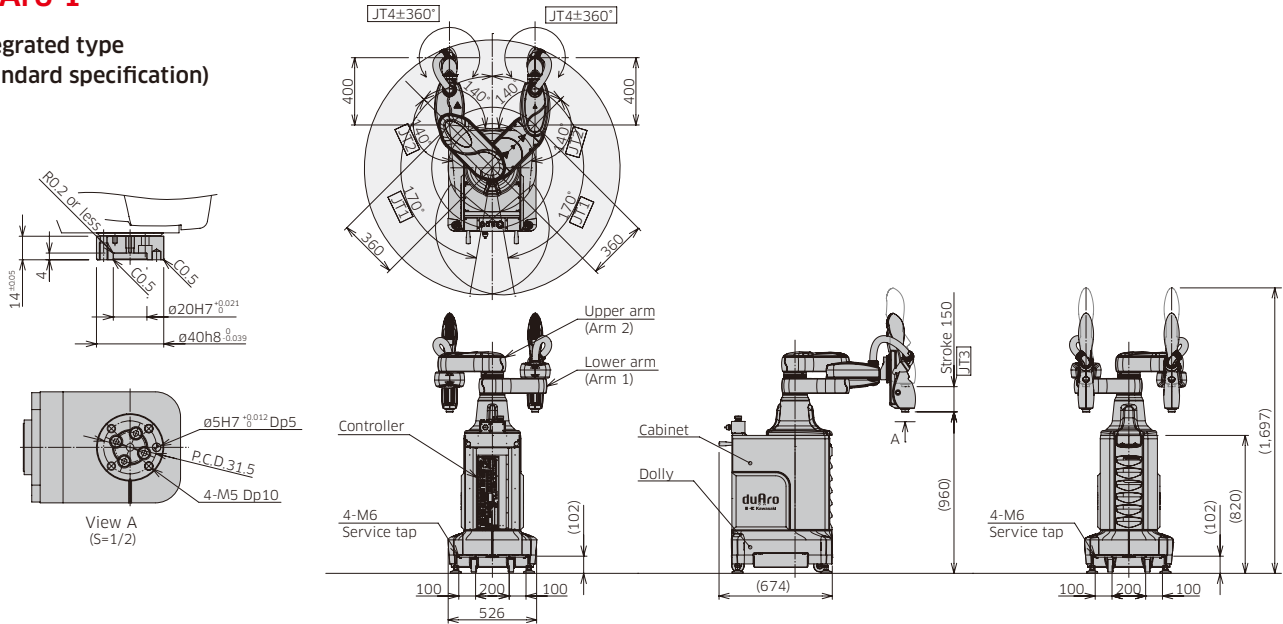
		duAro 2 Standard Specifications	
Structure		Horizontal articulated type	
Degree of freedom (axes)		4 × 2 arms	
Max. payload (kg)		3 × 2 arms	
Max. reach (mm)		785	
Positional repeatability (mm)		±0.05	
Motion range		Arm 1 (lower arm)	Arm 2 (upper arm)
	Arm rotation (°)	-170 - +170 (JT1)	-140 - +500 (JT1)
		-130 - +140 (JT2)	-140 - +130 (JT2)
	Arm up-down (mm)	0 - +550 (JT3)	0 - +550 (JT3)
	Wrist swivel (°)	-360 - +360 (JT4)	-360 - +360 (JT4)
Moment (N·m)	Wrist axis (JT4)	3.9	
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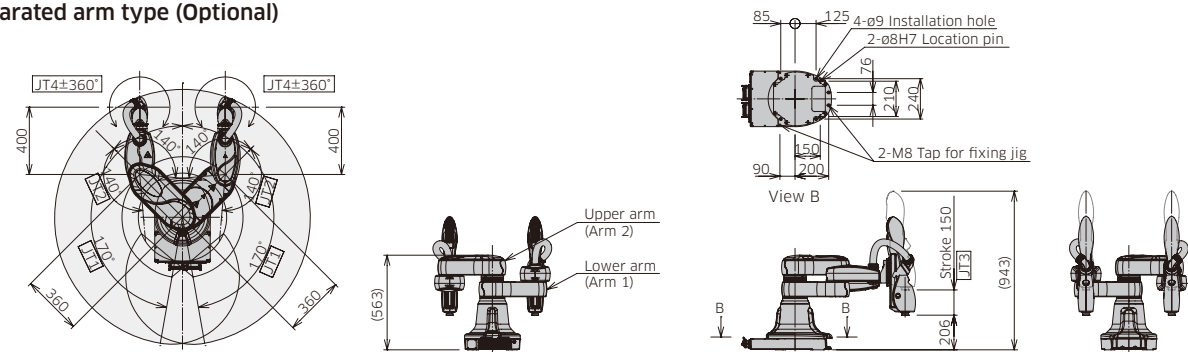
duAro 1

Integrated type
(Standard specification)

(mm)



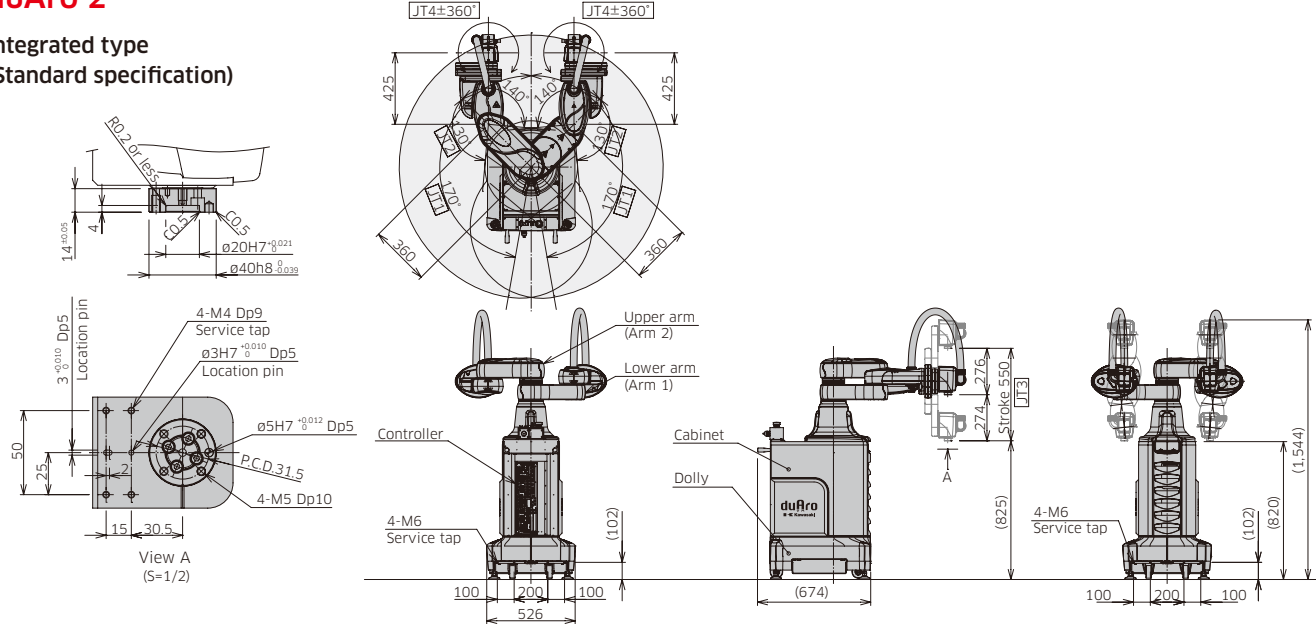
Separated arm type (Optional)



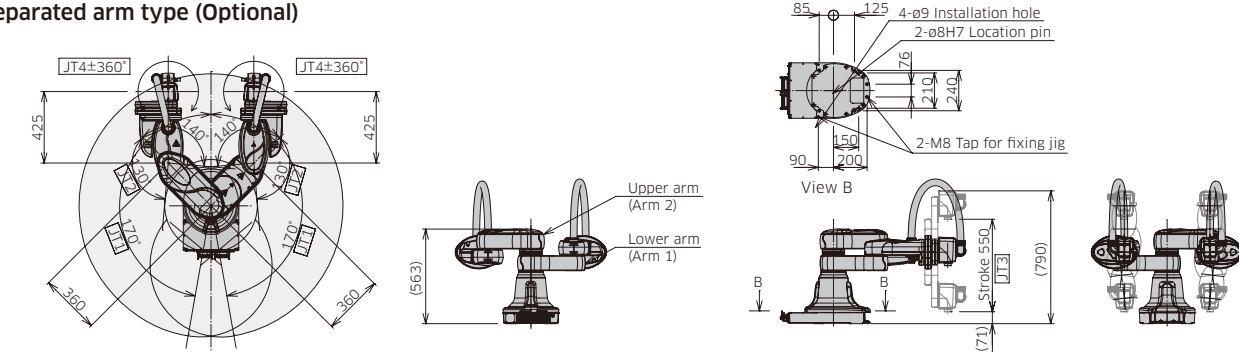
duAro 2

Integrated type
(Standard specification)

(mm)



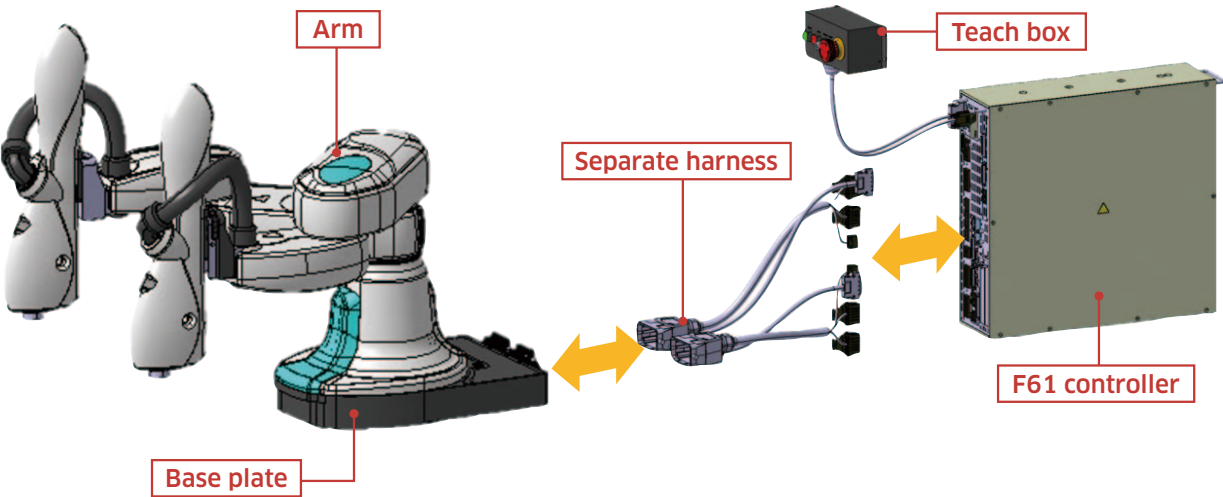
Separated arm type (Optional)



Hardware Options

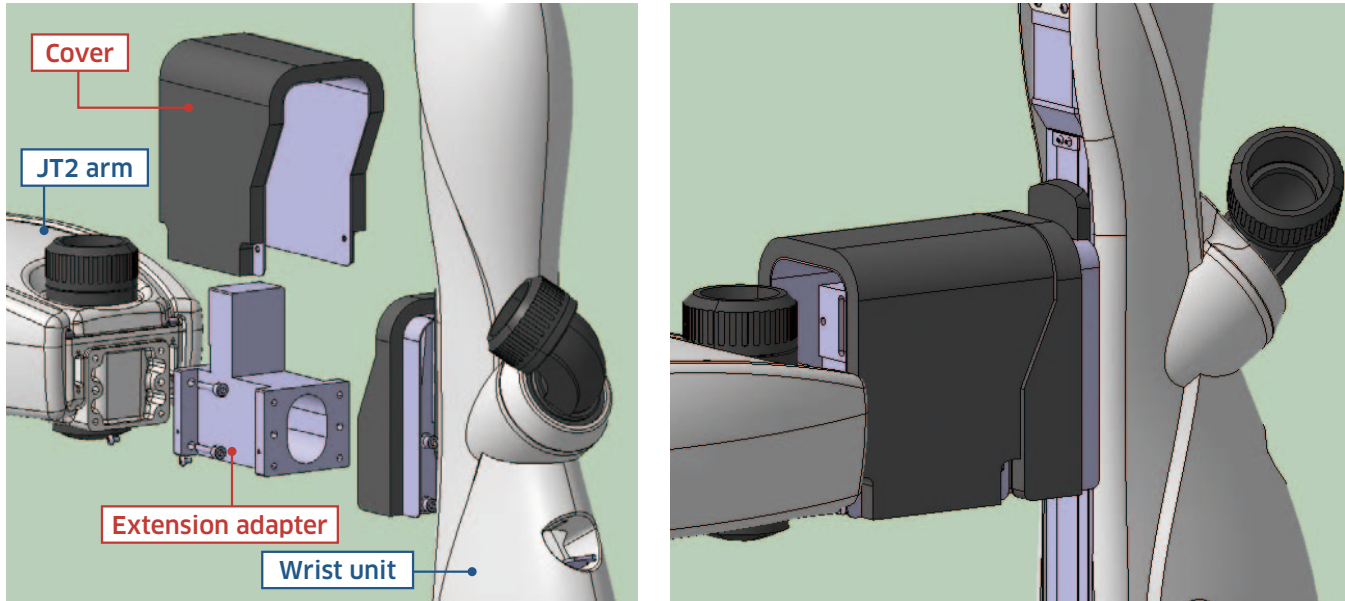
Options for separated type

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.



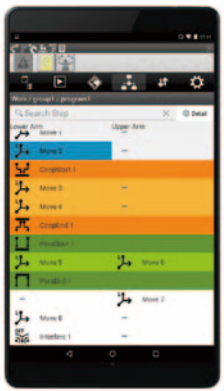
Assembling drawing

Finished drawing

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.

Item	Specification*1
OS	Android 5.1.1 to 8.0
dp*1	Width of the smallest side of the 600 dp or greater*2
Network	Wi-Fi
Processor	ARM (ARMv7)

*1: Refer to the Android Developer section of the Google website for further information about dp (Density-independent pixel).

*2: Supports Robot Teacher 2 Revision 7 or later.

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.)

Offline Programming Software



Kawasaki Robot's offline programming tool Enables a variety of production configurations

The application can built 3D models of robots, peripherals and products to verify various system configurations. Verification of operation time of of robots and interference with surrounding objects ahead of introduction can reduce the risks associated with the 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 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)

Teaching and programming

- Teach point modeling facilitates checks 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.




K-ROSET QR code

Vision System

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.



Measure 1 — Taking a picture

Move 2 — Go to detected position

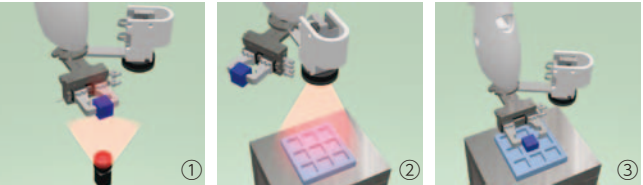
※Customer-specific third party vision systems can also be used. The optional macro PG call function that enables the use of customized programs is available for many applications in addition to positioning for inspection. (Please contact the supplier for details.)

Tablet-compatible vision systems

Keyence	CV-X series
Omron	FH series, FQ-M series

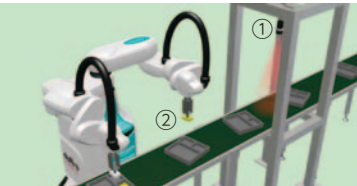
Vision System Applications

An example of a 2-point measurement



- ①Measurement by fixed camera of a gripped workpiece
- ②Measurement by hand-eye and calibration of the workpiece positions.
- ③Indexing after simultaneous calibration of both the gripping and positioning errors.

Using the optional conveyor tracking function



- ①Taking an upstream picture of a workpiece on the conveyor.
- ②Processing the workpiece at it passes by on the conveyor.

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	Up to 4
Detecting method	Shape recognition by pattern matching Recognition of characteristics by binary detection
Number of productsto be registered	Up to 999
License type	F controller MAC address recognition
Language	English, Japanese, Chinese (simplified characters)

Mounting a hand-eye camera

- A camera can be mounted directly on the duAro's JT4 axis.
 - Typical accessories such as a camera, lens, lighting equipment and bracket are purchased as a set.
 - By 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.



Mounting a fixed camera

- This camera is mounted on a separate stand, not on the robot.
- Typical accessories such as a camera, lens, and lighting equipment are purchased as a set.
- The camera mounted at distance can capture wide angle pictures. (Standard camera: focal length 1,000mm, field of vision: 250-370mm.)



Safe Robot Operation Monitoring



Speed monitoring

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

Force monitoring

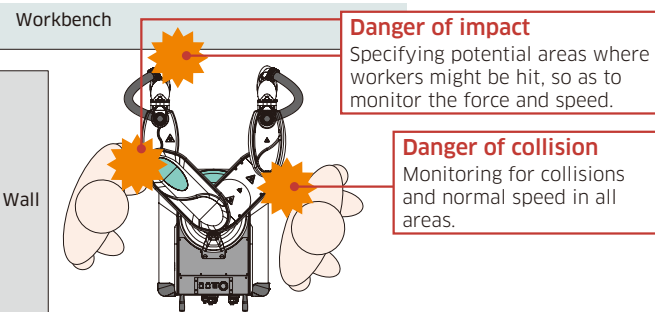
- Monitoring the force applied to the robot at specified positions to ensure it is below a predetermined value.

Collision detection

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

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).



Specifications

		F61
Dimensions (mm)		W429 × D445 × H130
Structure		Enclosed structure
Number of controlled axes		Max. 10 (standard 8, optional 2)
Type of motion control	Manual mode	Dual-arm cooperative operation, or Single-arm individual operation
	Auto mode	
Programming		Direct teaching, simple teaching by tablet
Memory capacity (MB)		16
External signal		External emergency-stop
Operation panel		Manual/Auto switch, Start/Stop switch, E-stop switch
Interface		Ethernet (1000BASE-T/100BASE-TX/10BASE-T) 2 ports
		RS-232C, 1 port
		USB 2.0, 2 ports (optional)
Power requirements		AC200-230V ±10%, 50/60Hz ±2%, Single phase, Max. 2.0kVA Class D (Category3) earth connection, Smaller than 100 Ω (robot-dedicated earth), leakage current 10mA
Environmental conditions	Ambient temperature (°C)	5 - 40*
	Relative humidity (%)	35-85 (No dew, nor frost allowed)*
General-purpose signals		16 input and 16 output channels
Options	Separate harness (m)	5, 10, 15
	Teach pendant cable (m)	1, 2, 5, 10, 15
	Add on I/O	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

* : Please contact Kawasaki for usage specified other than the above.

System configuration

