Cat. No. I208E-EN-02A

Delta 2 TWIN Robot
IP65 protection class

CR_UGD21000T Series

USER´S MANUAL

OMRON

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1. Attention

Information in this document can change without prior notice.

OMRON EUROPE B.V. cannot be hold responsible for any damage to the environment, to the machine or to the functioning of the machine occurred by errors or missing data in the illustrations, drawing or specifications.

No part of this manual and added documentation may be copied, reproduced or translated into another language without prior written approval.

Read and understand the material contained in this user's manual before you work on the CR_UGD21000T robot for the first time. This user's manual is supposed to help you use the capabilities of the CR_UGD21000T robot safely and properly.

2. Explanation of warnings and notes

This manual uses the following safety alert symbols and signal words to provide safety instructions that must be observed and to describe handling precautions, prohibited actions, and compulsory actions. Make sure you understand the meaning of each symbol and signal word and then read this manual.

DANGER

THIS INDICATES AN IMMEDIATELY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

WARNING

THIS INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

NOTE

Explains the key point in the operation in a simple and clear manner.

3. Safety information

3.1 General

This ´**3. Safety information**´ subchapter contains information regarding working with the CR_UGD21000T robot. Qualified personnel working with the CR_UGD21000T robot must have read and understood the CR_UGD21000T robot documentation, including the safety information chapter.

3.2 Qualified personnel

These are people who, due their specialist training, knowledge and experience, and their familiarization with the relevant standards, are able to assess the work to be carried out and detect any potential hazards.

3.3 Liability

The CR_UGD21000T robot is build using state-of-the-art technology and in accordance with the recognized safety rules. Nevertheless, misuse of the CR_UGD21000T robot may constitute a risk to life and limb or cause damage to the CR_UGD21000T robot and to other material property.

3.4 Installation and operating conditions

You may only use the components in accordance with the installation and operating conditions described in the documentation. The operating conditions at the installation location must be checked and maintained in accordance with the required technical data. Within the meaning of the Machinery Directive the CR_UGD21000T robot is an incomplete machine. Commissioning is prohibited until the usable machine or system in which the CR_UGD21000T robot is installed meets all requirements of the Machine directive 2006/42/EC.

For the CR_UGD21000T robot you have to observe the following standards, directives and regulations:

- EN ISO 10218-1:2011 Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots.
- EN ISO 10218-2:2011 Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration.

3.5 Residual risks

Safety and health risks arising from the robot mechanics have been reduced by means of safety technology and design engineering. However a residual risk remains, since the robot mechanics will be move by an automated control system.

The following are typical warnings concerning residual risks which cannot be assigned to a specific action. The expression of safety labels is identical to the safety information.

3.5.1 Release device

The robot mechanics are not supplied with an release switch to control the brakes of the motors.

WARNING

- MOUNT A RELEASE SWITCH ON THE MACHINE SO THE ARMS (MOTOR) OF THE ROBOT COULD BE MANUALLY MOVED.
- MOVING AN AXIS WITH AN IMPROPERLY WORKING RELEASE SWITCH CAN DAMAGE THE MOTOR BRAKE. THIS CAN RESULT IN PERSONAL INJURY AND MATERIAL DAMAGE.
- BEFORE RELEASING THE BRAKE, YOU HAVE TO BE SURE THAT NO ONE IS IN THE HAZARD AREA OF THE ROBOT.

3.5.2 Transport

The prescribed transport position of the robot must be observed. Transportation must be carried out in accordance with the transportation instructions or assembly instructions of the robot.

WARNING

- ONLY USE AUTHORIZED HANDLING EQUIPMENT WITH A SUFFICIENT LOAD-BEARING CAPACITY TO TRANSPORT THE ROBOT.
- WEAR SUITABLE PROTECTIVE CLOTHING IF NECESSARY.

3.5.3 Assembly and start-up

Before starting up systems and devices for the first time, a check must be carried out to ensure that the system and devices are completed and operational, that they can be operated safely and that any damage is detected.

The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety circuits must also be tested.

The following tests must be carried out before start-up and recommissioning. It must be ensured that:

- The robot is correctly installed and fastened in accordance with the specifications in the assembly instructions.
- There are no foreign bodies or loose parts on the robot.
- All required safety equipment is correctly installed and operational.

WARNING

- A WRONG INSTALLED ROBOT MAY DAMAGE HIS ARMS.
- WEAR SUITABLE PROTECTIVE CLOTHING IF NECESSARY.

3.5.4 Maintenance and repair

After maintenance and repair work, checks must be carried out to ensure the required safety level. The valid national or regional work safety regulations must be observed for this check. The correct functioning of all safety circuits must also be tested.

The purpose of maintenance and repair work is to ensure that the system is kept original or, in the event of a fault, to return the system to an operational state. Repair work includes troubleshooting in addition to the actual repair itself.

The following safety measures must be carried out when working on the robot:

- Switch of the machine (system) where the robot is built-in (e.g. with a padlock) to prevent it from being switched on again
- Label the machine (system) with a sign indication that work is in progress. This sign must remain in place, even during temporary interruptions to the work.
- The emergency stop from the machine (system) must remain active. If safety functions or safeguards are deactivated during maintenance or repair work, they must be reactivated immediately after the work is completed.

3.5.5 System integrator

The robot is safely integrated into a complete system by the system integrator. The system integrator is responsible for the following tasks:

- Installing the robot
- Performing risk assessment
- Implementing the required safety functions and safeguards
- Issuing the declaration of conformity
- Attaching the CE mark
- Creating the operating instructions for the complete system

Chapter 1 Introduction

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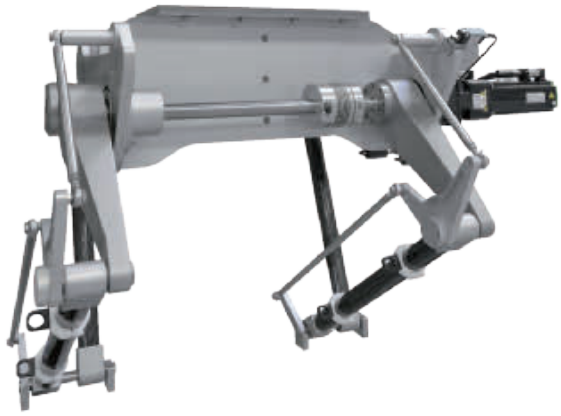
1. Introduction

Congratulations with the purchase of your high speed Delta robot.

This manual should be read before the commissioning of the robot. By mechanical engineers in the design phase during the integration of the robot in the machine and by software engineers to check the performance envelope of the robot.

This manual describes the main versions of the CR_UGD21000T robot, and all options. Where applicable check the appropriate data for your robot type, the type can be found on the identification tag of the robot.



1.1 Description of the robot

The CR_UGD21000T Delta robot is a high speed pick and place robot which uses carbon fiber, stainless steel and aluminum materials and the latest servo drive technology to be put in use in the most demanding pick and place applications. The robot is designed as a 2-axis Delta kinematic system.

Characteristics of the robot:
- Requires very low maintenance
- 2 degrees of freedom
- Compact design for mounting in a machine
- Low noise level < 70 dB (A)

1.2 Type code explanation

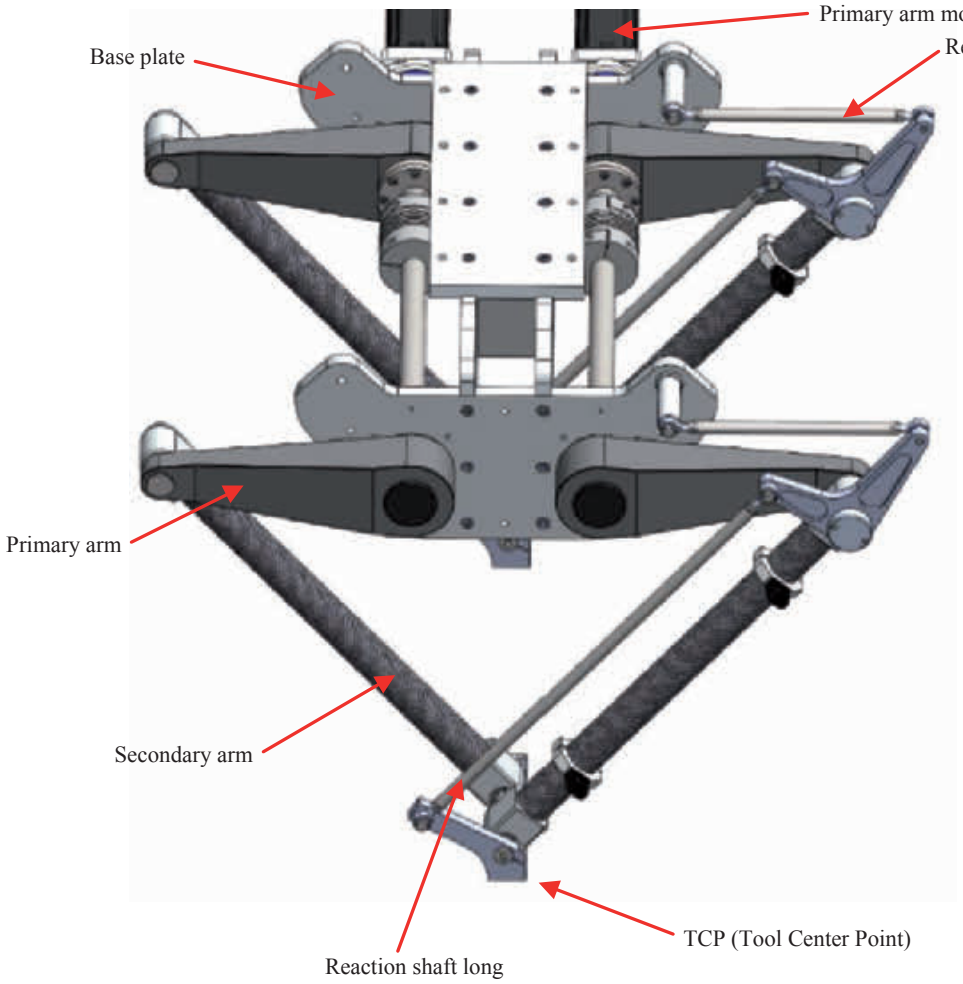
CR_UGD21000T_NR: 2 axes, 1000 mm working range, max. payload: 30 kg

2. Identification

On the robot base plate an identification tag is mounted, important data on this plate:
- Robot type
- Total weight of the robot
- Month and year of production
- Serial number, important for ordering spare parts

3. Part names

CR_UGD21000T series



Chapter 2 Model overview

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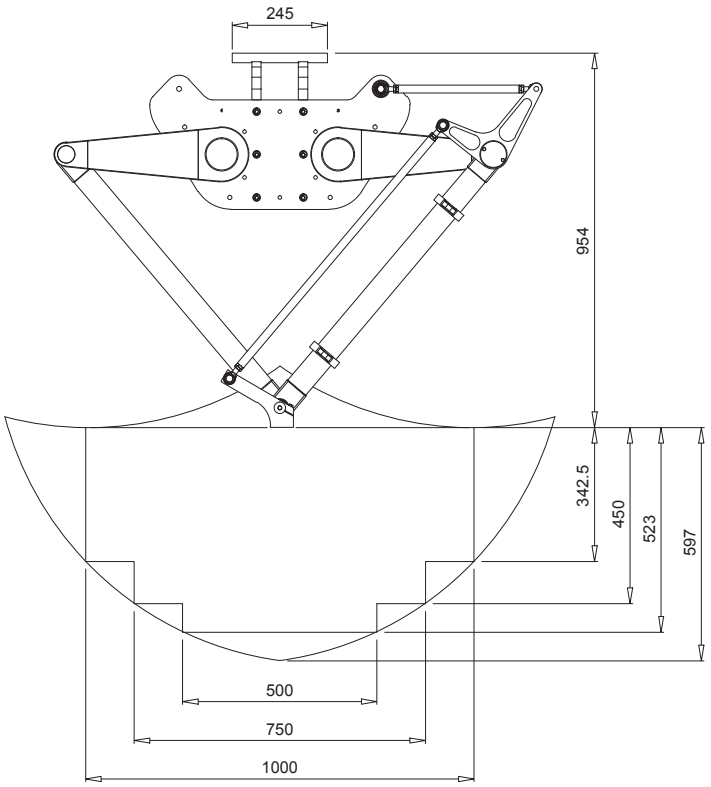
1. Overview

The CR_UGD21000T has a working range of 1000 mm. The specifications are given in the below figure, if specifications differ for models it is indicated in the specification list.

CR_UGD21000T (1000 mm)



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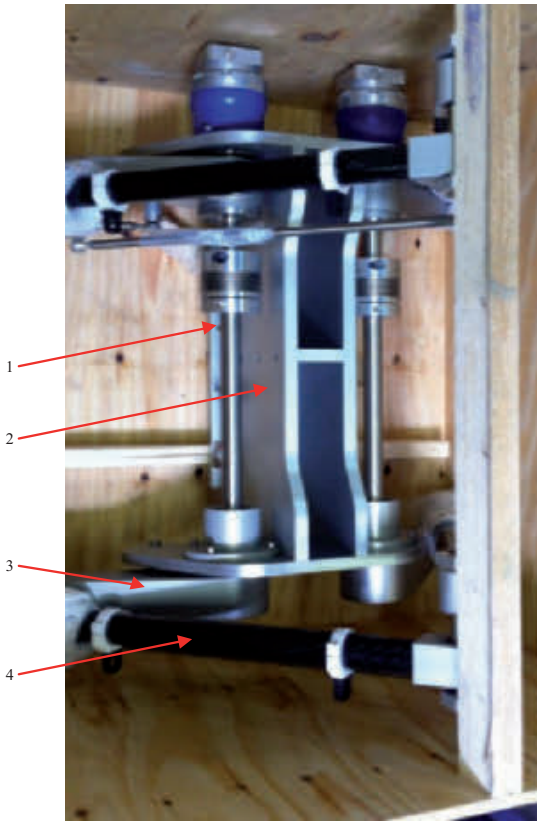
1. Unpacking

1.1 Unpacking the shipping box

The robot comes in a special shipping box.

The following step must be carried out to remove the cover from the box:
- Unscrew the screws from the cover of the wooden box
- Now remove the cover

The following illustration will show you the components and their description what's in the box:



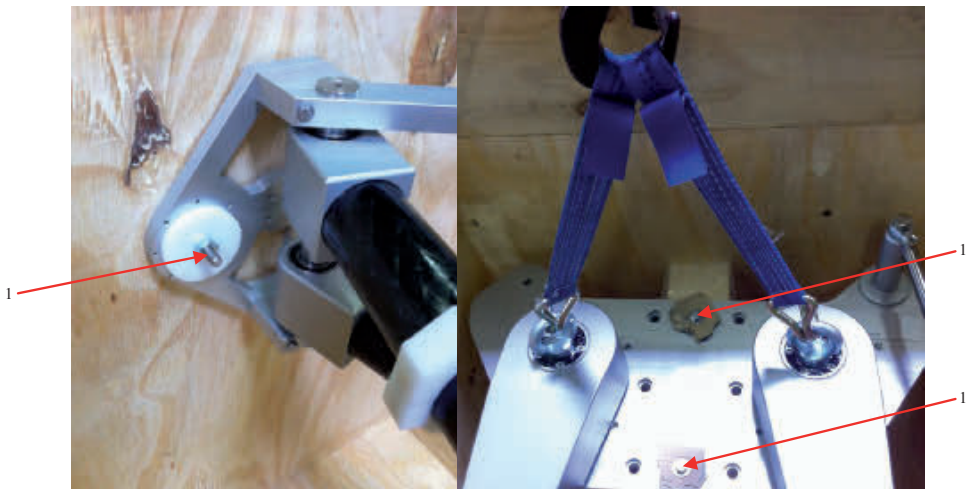
No.	Description
1	2 x eyebolts for lifting
2	Baseplate
3	Primary arms
4	Secondary arms

1.2 Check the damage

First take out the individual components from the package and check that everything is correct.
Check all the components and the robot for transportation damage.

1.3 Lifting and transportation

Before the robot is lifted, it must be ensured that it is free from obstructions.
Remove all the screws where the robot is mounted with in the box.

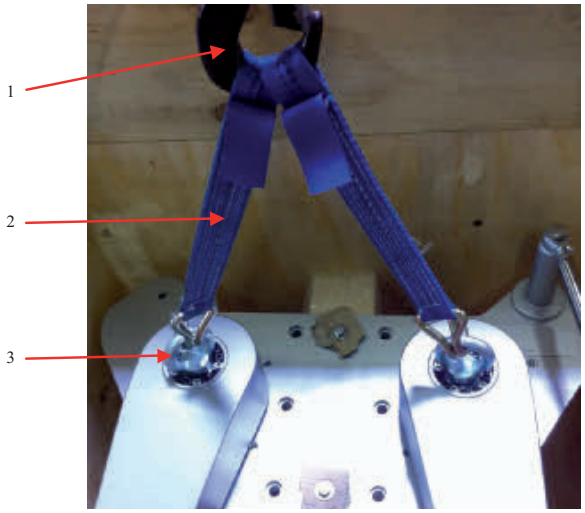


No.	Description
1	3 x screws with protection material

The robot must be lifted by at least 2 persons and transported by using lifting tackle or a forklift truck. Two lifting straps has to be attached into two eyebolts that are screwed into the gearbox shafts. The lifting straps has to be long enough and must be routed in such a way that the robot is not damaged.

WARNING

- THE ROBOT MAY TILT DURING TRANSPORTATION.
- ADDITIONAL SAFEGUARDING MEASURE MUST BE TAKEN.
- WEAR SUITABLE PROTECTIVE CLOTHING IF NECESSARY.
- WHEN USING A FORKLIFT TRUCK, DRIVE EXTREMELY SLOWLY AND CAREFULLY.

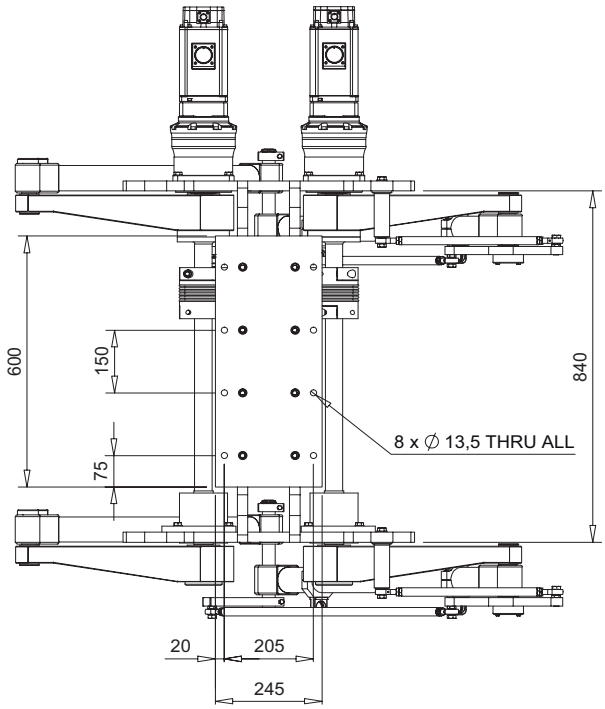


No.	Description
1	Lifting tackle
2	2 x lifting straps
3	2 x eyebolts

2. Mounting the robot

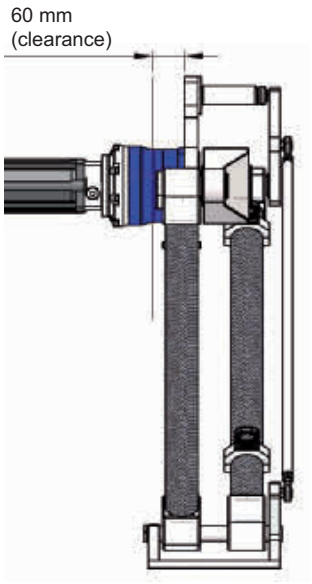
The mounting surface for the robot must be machined and of an appropriate quality. It's also possible to use a levelling element to align the robot.
Eight M12 bolts are needed to mounting the robot to the frame, exact bolt length depends on frame layout. The tightening torque of a M12 8.8 bolt is 100Nm.

The below figure shows the mounting pattern from the robot.



WARNING

- THE ROBOT MAY HIT THE FRAME.
- THE ROBOT COULD BE DAMAGED.
- MAINTAIN THE MINIMUM CLEARANCE OF 60 mm WHEN INSTALLING THE ROBOT.

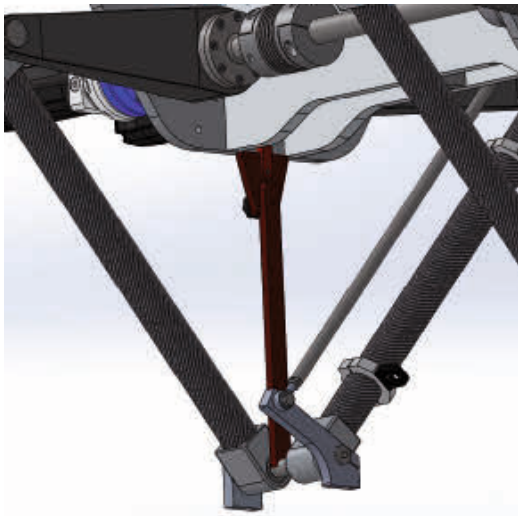


3. Calibration

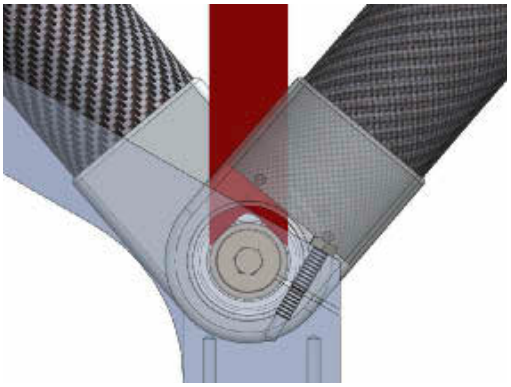
No every robot that is delivered is calibrated.
If you want to calibrate the robot by yourself, a calibration tool is available (shown in the below picture).
The calibration tool can be ordered as CR_AS-2798.

No.	Description
1	Calibration tool

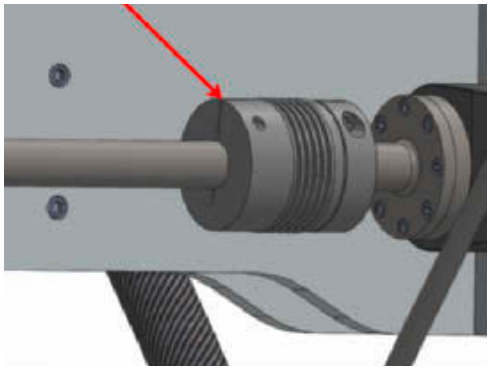
The following steps must be carried out to put the two upper arms from the robot in the zero position. Please see also the below pictures:



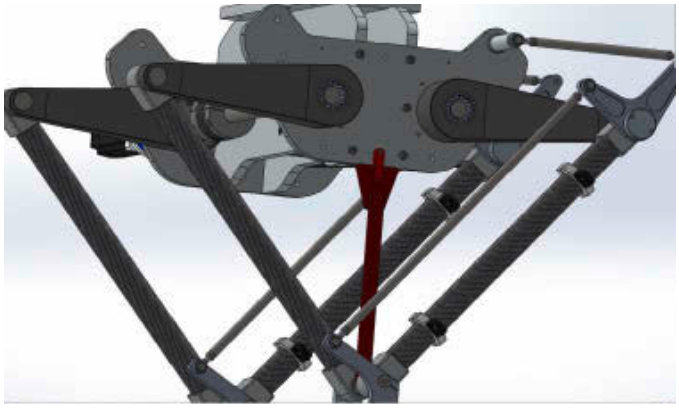
- Release the motor brake and make sure all the primary arms are rotated down far enough, so the calibration tool can be mounted
- Mount the calibration tool on the back baseplate (where the gearboxes are mounted)
- Release the motor brake from the motors and push the TCP axis against the calibration tool as shown in the next picture



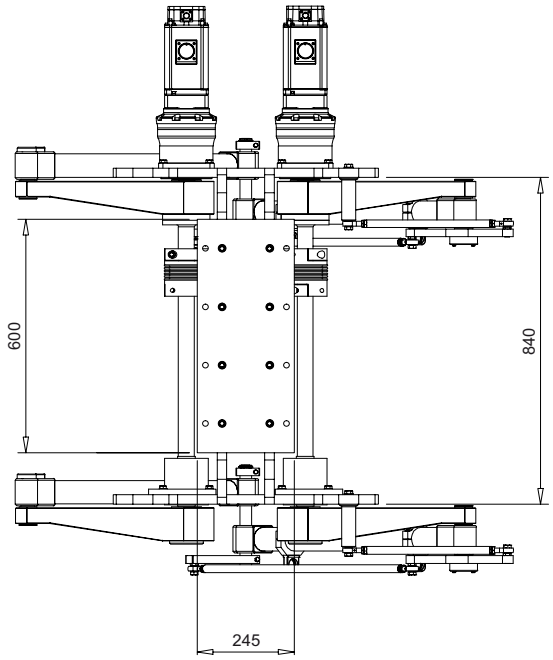
- Now fix the motor brake from the motors
- Remove the tool
- Release the 2 front bolts from the 2 bellow couplings as shown in the below picture



- Now mount the calibration tool on the front baseplate



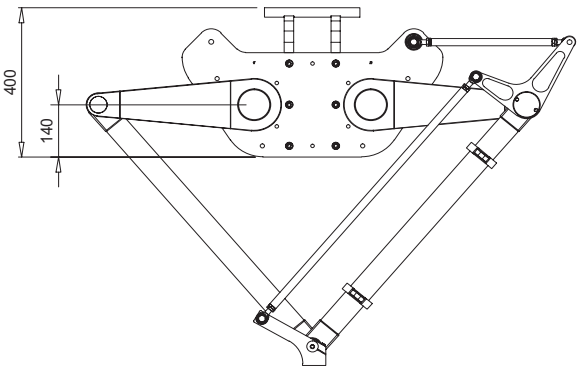
- Now push the TCP shaft against the calibration tool and tighten the 2 bolts from the bellow couplings with 190Nm (please be advised that the distance between the 2 arm sets needs to be 840mm, from the front side from the gripper mounting to the next front side from the gripper mounting, see the below picture)

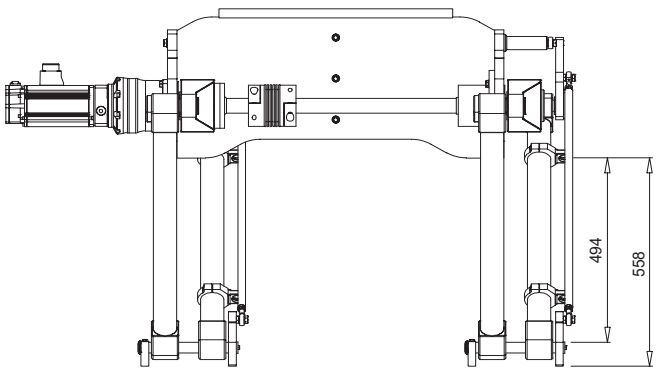


WARNING

- CALIBRATING THE ROBOT MUST BE CARRIED OUT BY QUALIFIED PROGRAMMING PERSONNEL ONLY, AS THIS REQUIRES AN EXCELLENT LEVEL OF KNOWLEDGE OF THE CONTROL SYSTEM.
- WHEN CARRYING OUT THE HOMING YOURSELF, THIS MUST BE CARRIED OUT EXACTLY IN THE WAY AND THE ORDER THAT THEY ARE DESCRIBED.

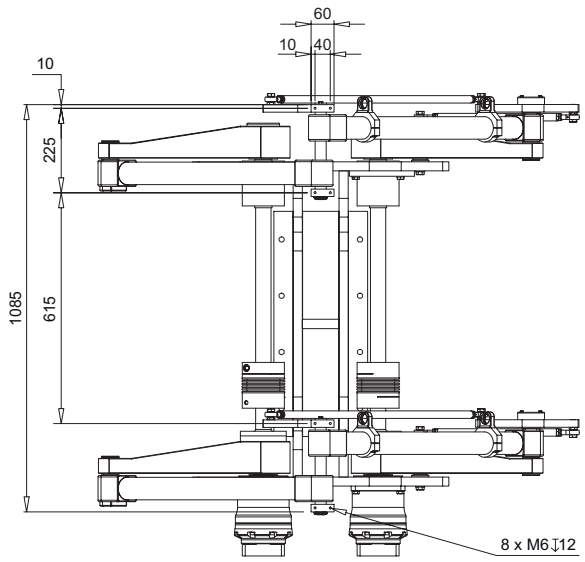
- Now all the primary arms are in zero position from the kinematic model
- Now put the encoder values from the servo motors in 0º
- Check that the angle indicated for the two motors is 0º (±0.1º)
- Your robot is now calibrated





4. Gripper interface

The below picture shows you the gripper connection sizes from the CR_UGD21000T robot.



Loading the gripper

The design of the gripper that is mounted under the robot have great influence on the performance of the robot. Both the weight of the gripper and the distance of the center of gravity of the gripper to the TCP base point have negative influence on the final performance of the robot.

If you need to install cabling for the gripper, please follow the following steps:

- Mount the cables on the baseplate or frame, near the turning point from the primary arm on the gearbox
- Mount the cables on the primary arm, with ty-raps or clamping parts
- Keep a big loop at the hinge point from the primary and secondary arm
- Mount the cables on the secondary arm, with ty-raps or clamping parts
- Keep a big loop from the lowest mounting point at the secondary arm till the connection on the gripper
- Pneumatic correction devices or centring fixtures on the gripper must work in both directions. Non-symmetrical mechanisms can cause vibration in the robot mechanics

Chapter 4 Maintenance

Contents

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1.1 Rod ends 4-1

2. Cleaning the robot 4-2

3. Spare parts 4-2

1. Periodic maintenance

Before working on the robot, please be ensured that the machine where the robot is built in, is totally switched off.

DANGER

- SWITCH OFF THE MACHINE (SYSTEM) WHERE THE ROBOT IS BUILT IN (E.G. WITH A PADLOCK) TO PREVENT IT FROM BEING SWITCHED ON AGAIN.
- LABEL THE MACHINE (SYSTEM) WITH A SIGN INDICATION THAT WORK IS IN PROGRESS. THIS SIGN MUST REMAIN IN PLACE, EVEN DURING TEMPORARY INTERRUPTIONS TO THE WORK.
- THE EMERGENCY STOP FROM THE MACHINE (SYSTEM) MUST REMAIN ACTIVE. IF SAFETY FUNCTIONS OR SAFEGUARDS ARE DEACTIVATED DURING MAINTENANCE OR REPAIR WORK, THEY MUST BE REACTIVATED IMMEDIATELY AFTER THE WORK IS COMPLETED.

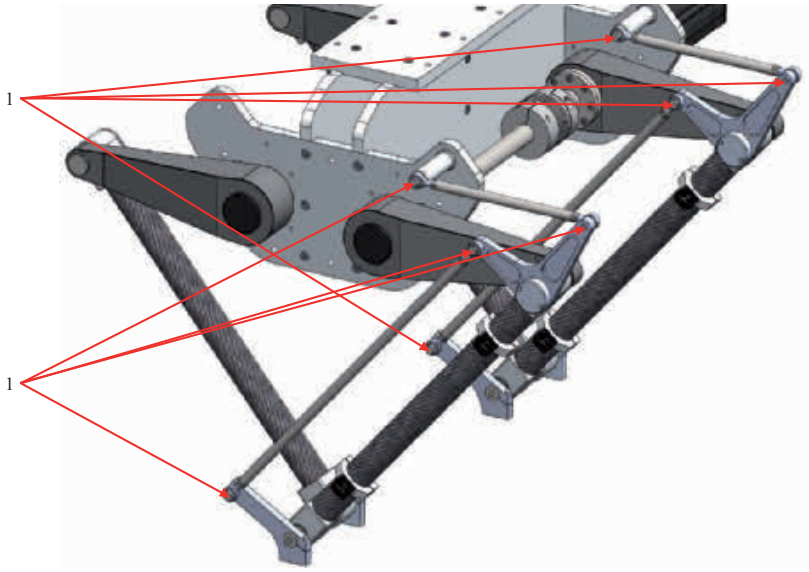
1.1 Rod ends

How to maintain the rod ends:

- The rod ends have to be checked every 6000 working hours or once a year. When there is less grease inside, refill them with Mobil Polyrex EP2
- For spare parts, see **Section 3 Spare parts** in this chapter

WARNING

- WEAR SUITABLE PROTECTIVE CLOTHING AND SAFETY GLASSES.



No.	Description
1	Rod ends

2. Cleaning the robot

Clean the robot by washing with soft cloth or sponge. Use soap or mild detergent and warm water followed by clear water rinse.
For oil and grease stains use alcohol with soft cloth.
Do not use a high pressure water cleaner, or any other high pressure cleaning device.

3. Spare parts

Robot part	Description	Quantity per robot	OMRON Part No. CR_UGD21000T_NR
Primary arm	1 x primary arm left	1	CR_AS-2998
	1 x primary arm right	1	CR_AS-2999
	1 x primary arm left mirror	1	CR_AS-3016
	1 x primary arm right mirror	1	CR_AS-3017
	1 x clamping hub 1	4	CR_CP-1044
	1 x clamping hub 2	4	CR_CP-1047
	1 x arm hole cover 1	2	CR_PT-05203

Robot part	Description	Quantity per robot	OMRON Part No. CR_UGD21000T_NR
Secondary arm	1 x secondary arm carbon	4	CR_AS-3005
	1 x secondary arm stainless	4	CR_AS-3006
	1 x reaction rod long	2	CR_LS-1009
	1 x bearing 4	4	CR_CP-1017
	1 x bearing 3	20	CR_CP-1015
	1 x cardan coupling	2	CR_CP-1043
	1 x cable clamp (60 mm)	4	CR_AS-3000
Primary arm & Secondary arm	1 x wishbone	2	CR_AS-2210
	1 x rod end bearing M12 L	4	CR_AS-3002
	1 x rod end bearing M12 R	4	CR_AS-3003
	1 x reaction rod short	2	CR_LS-1008
TCP - Tool Center Point	1 x TCP shaft	2	CR_AS-3007
	1 x swivel block	2	CR_PT-05215
Gearbox for primary arm	1 x gearbox	4	CR_GEARP-01
Calibration tool	1 x calibration tool	1	CR_AS-2798

Chapter 5 Robot settings

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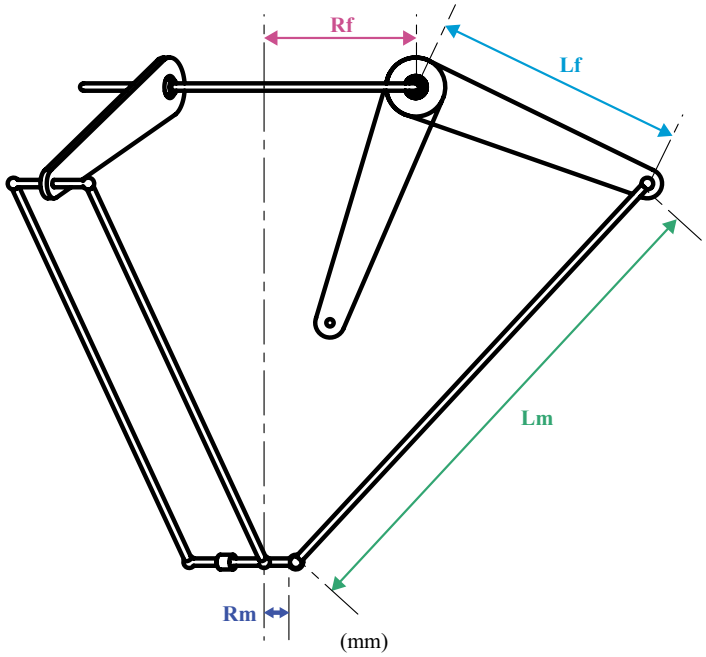
1. Kinematics

The kinematics parameters for the CR_UGD21000T robot are shown below. Set these parameters corresponding to the controller settings.

WARNING

IF THE KINEMATICS PARAMETERS ARE NOT SET PROPERLY, THIS MAY CAUSE THE ROBOT TO MALFUNCTION. SO, BE SURE TO SET THESE PARAMETERS CORRECTLY.

Kinematics parameters



Rf: 160 mm Distance (radius) from the center of the fixed frame to the motor of the axis
Rm: 0 mm Distance (radius) from the center of the moving frame to the connection point of Link 2
Lf: 400 mm Length of Link 1
Lm: 850 mm Length of Link 2

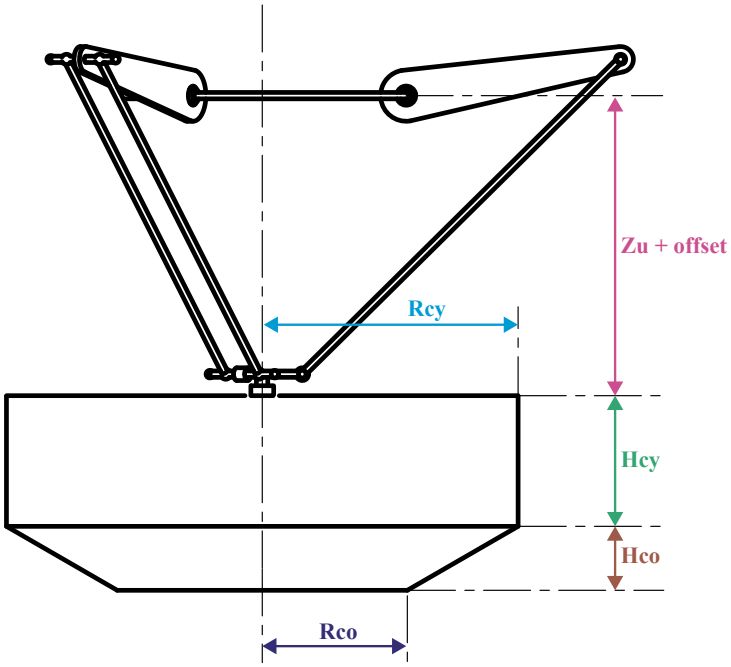
2. Workspace

The workspace parameters for the CR_UGD21000T robot are shown below. Set these parameters corresponding to the controller settings.

WARNING

IF THE WORKSPACE PARAMETERS ARE NOT SET PROPERLY, THIS MAY CAUSE THE ROBOT TO MALFUNCTION. SO, BE SURE TO SET THESE PARAMETERS CORRECTLY.

Workspace parameters



Zu + offset: -694 mm Distance from the Z-axis origin position to the tool flange

Rcy: 500 mm Radius of the cylinder

Hcy: 342.5 mm Height of the cylinder

Rco: Refer to "2. External view and dimensions" in Chapter 6 for detailed information about Rco parameter.

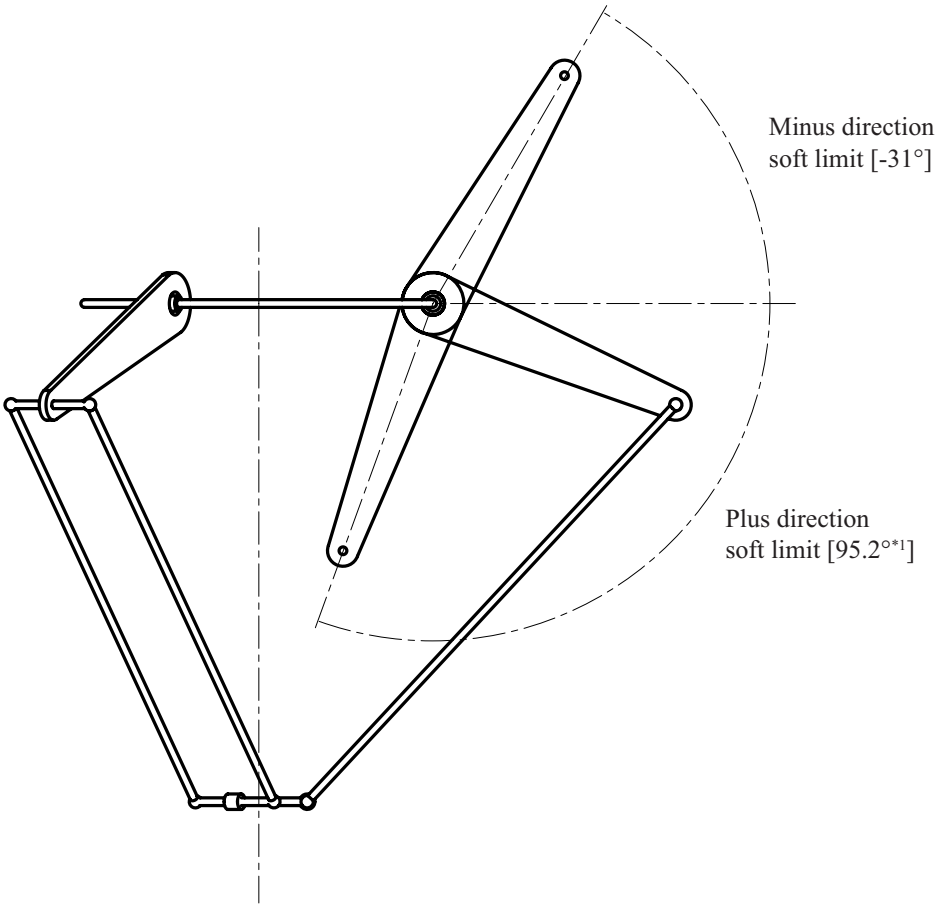
Hco: Refer to "2. External view and dimensions" in Chapter 6 for detailed information about Hco parameter.

3. Software limits

The software limits for the CR_UGD21000T robot are shown below.

WARNING

IF THE α-, β- OR γ- AXIS SOFT LIMIT IS SET INCORRECTLY, THE ARM MAY COLLIDE WITH THE ROBOT BASE OR BASE PREPARED BY THE USER, CAUSING BREAKAGE. SO, BE SURE TO SET THE SOFT LIMITS CORRECTLY.



*1. For the robots ordered before September 2023, the Positive software limit is 92°.

Chapter 6 Specifications

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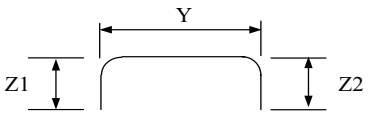
1. Basic specifications

Robot model			CR_UGD21000T_NR
Working volume	X axis	Stroke	1000mm
	Z axis	Stroke	342.5mm (max. 1000mm)
Servo motor		Arm 1, 2	2000W
Repeatability*1		X, Z axis	±0.4mm
Maximum through-put*2			50 CPM*3
Maximum payload			30kg
Gearbox ratio		X, Z axis	1:35
Travel limit			Soft limit
Noise level			< 70 dB (A)
Ambient temperature			5ºC to 45ºC
Relative humidity			Max. 90%
Protection class			IP65
Weight			220kg

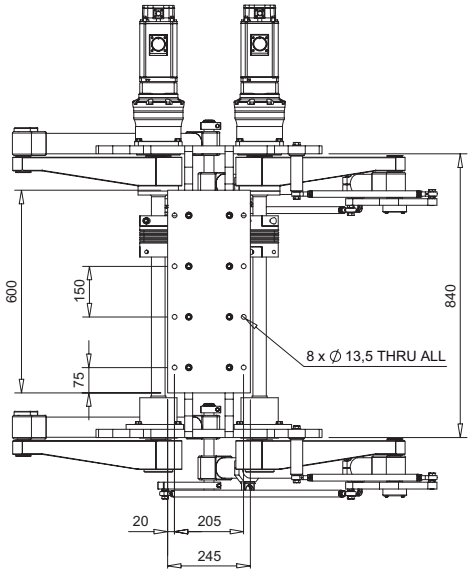
*1: This is the value at a constant ambient temperature.
*2: With 5kg payload. When reciprocating 500mm in vertical, 300mm in horizontal and 100mm in vertical directions.
*3: CPM: Cycle per minutes. Check the note 2 for the cycle definition.

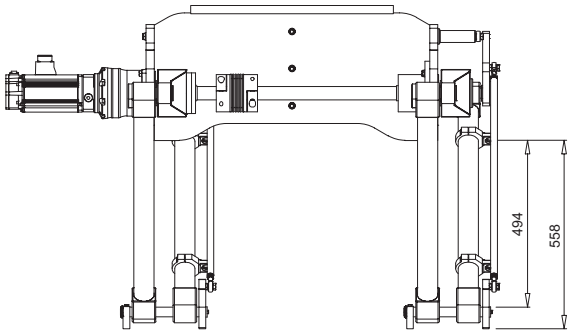
1.1 Cycle time

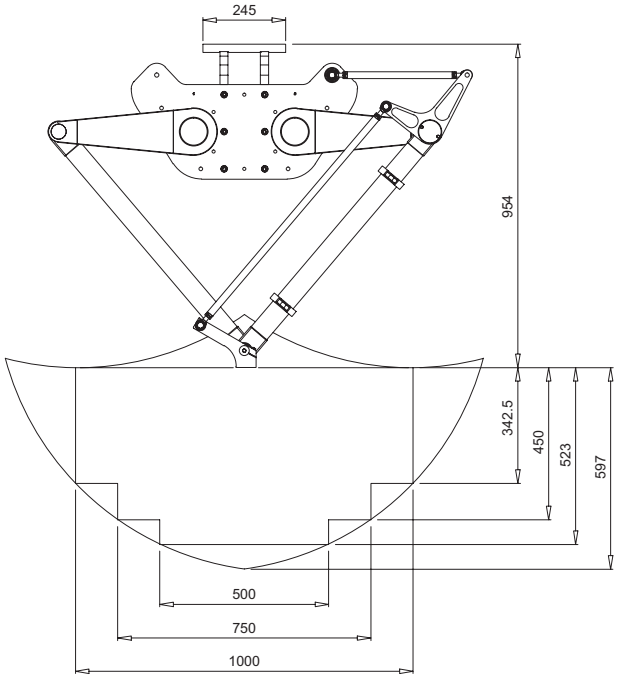


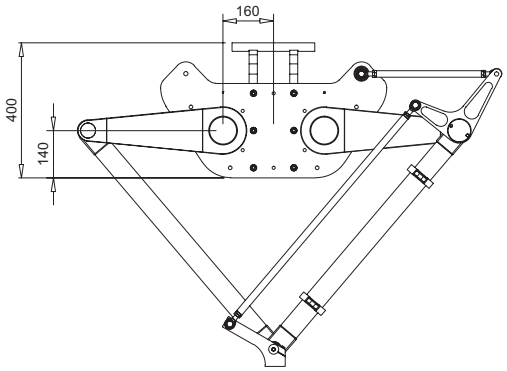
P&P path	Payload	Cycle time
500 x 300 x 100 mm (Z1 x Y x Z2)	5 kg	1.20 s
	10 kg	1.71 s
	30 kg	2.00 s
200 x 500 x 300 mm (Z1 x Y x Z2)	5 kg	1.71 s
	10 kg	2.40 s
	30 kg	2.73 s

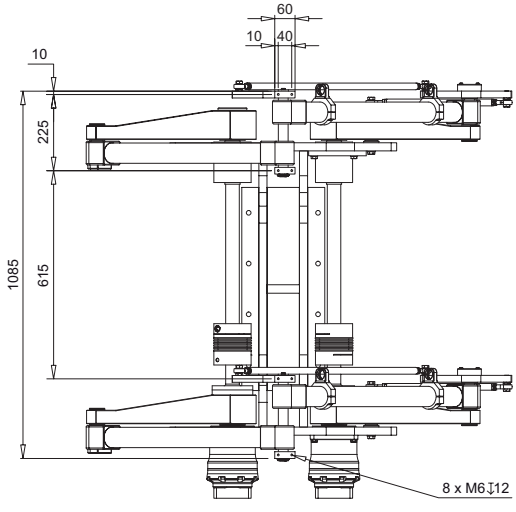
2. External view and dimensions



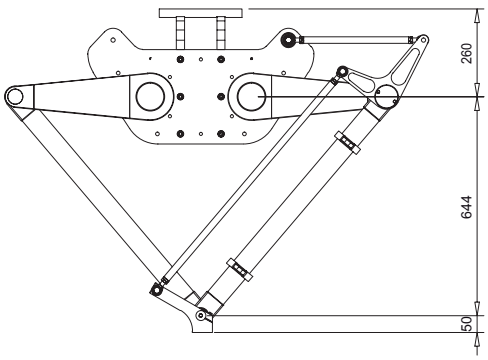








Gripper dimensions

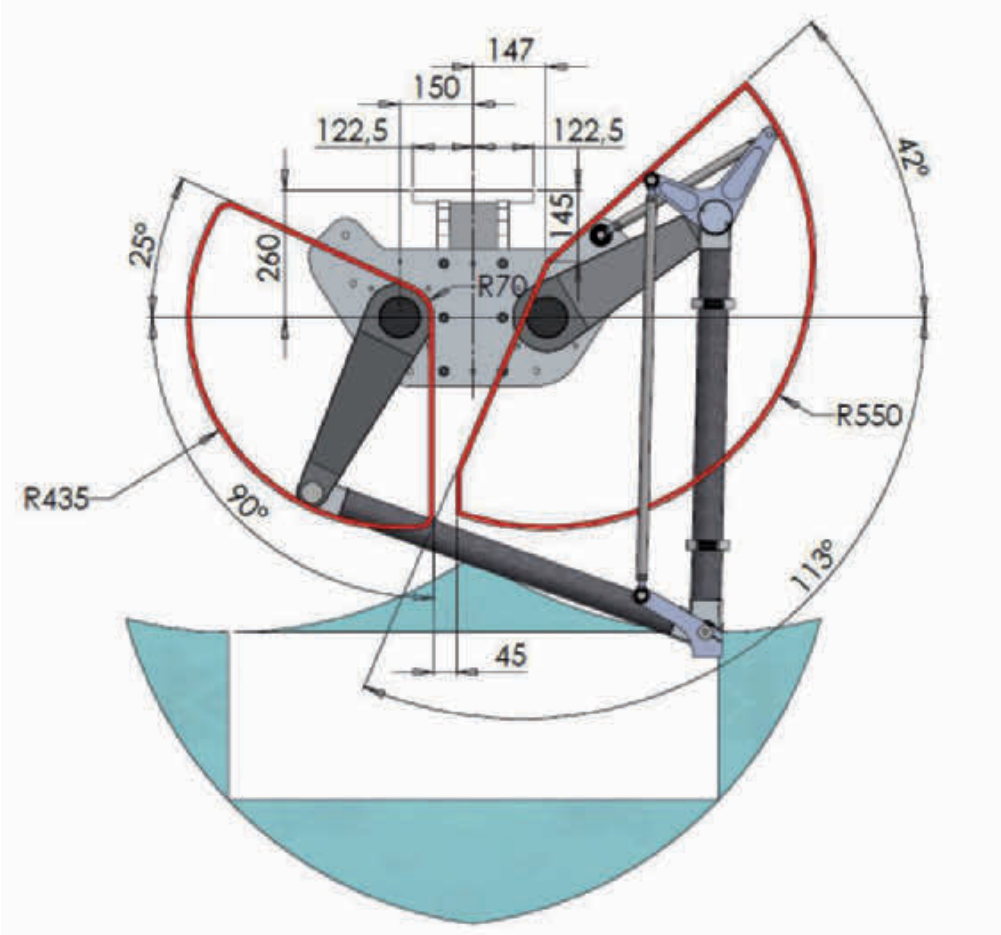


3. Design specifications

3.1 Occupation area of robot

If the robot is integrated into the machine it must be considered what the reach is of all robot parts to prevent collision with other parts in the machine.

When the TCP moves to its outer positions, the primary and secondary arms can rise above the baseplate, take care that no mechanical obstructions are in the areas indicated in the below picture.

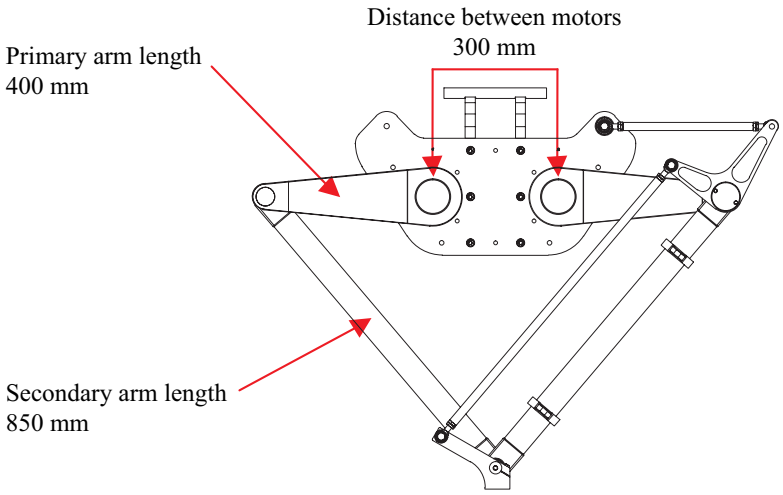


WARNING

IF MECHANICAL OBSTRUCTIONS ARE IN THE INDICATED AREAS, THE ROBOT OR THE OTHER MACHINE PARTS COULD BE DAMAGED.

3.2 Software design

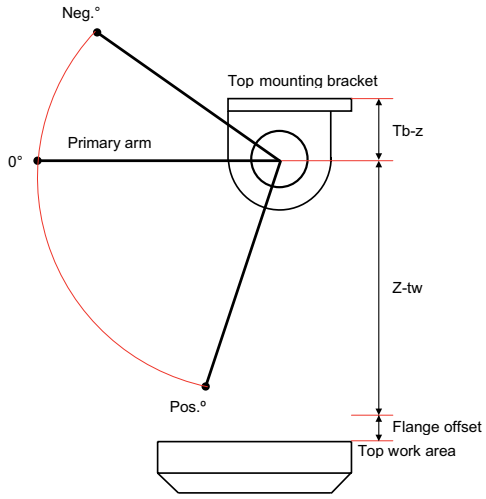
The arm lengths and distance between motors are shown in the below picture.



3.2.1 Dimensions and limits

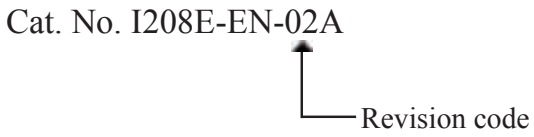
Description	Value
Negative software limit	-31°
Positive software limit	95.2°[*1]
Tb-z (top baseplate to zero position)	260 mm
Z-tw (zero position to ball bearings)	644 mm
Flange offset	50 mm

[*1] For the robots ordered before September 2023, the Positive software limit is 92°.



Revision history

A manual revision code appears as a suffix to the catalog number on the front cover manual.



The following table outlines the changes made to the manual during each revision.

Revision code	Date	Description
01	June 2017	Original production
01A	September 2017	Basic specifications section was updated
02	June 2018	Spare part references were modified
02A	June 2024	Positive limit of the robot was updated

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Note: Specifications subject to change without notice.

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