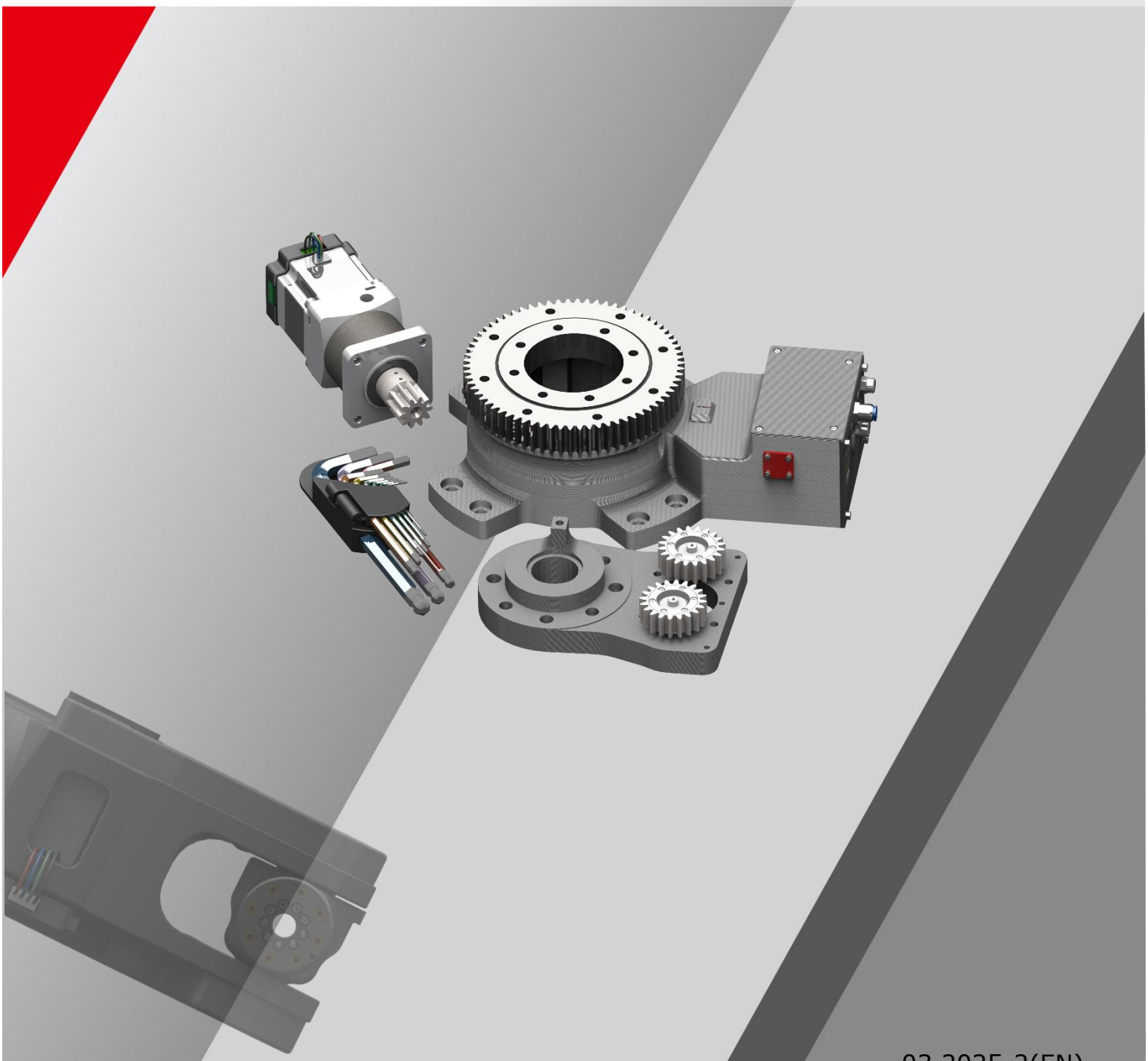
Kawasaki Robotics

ASTORINO

Troubleshooting Manual



03.2025-2(EN)

Preface

This manual describes the troubleshoot of the 6-axis robot “astorino" and the associated "astorino" software. This is an original documents and is not translated.

The ASTORINO is a learning robot specially developed for educational institutions. Pupils and students can use the ASTORINO to learn robot-assisted automation of industrial processes in practice.

This manual is valid from firmware version 3.8.9 and astorino software version 1.9.6 and B – version of the robot.

1. The "astorino" software included with the ASTORINO is licensed for use with this robot only and may not be used, copied or distributed in any other environment.
2. Kawasaki shall not be liable for any accidents, damages, and/or problems caused by improper use of the ASTORINO robot.
3. Kawasaki reserves the right to change, revise, or update this manual without prior notice.
4. This manual may not be reprinted or copied in whole or in part without prior written permission from Kawasaki.
5. Keep this manual in a safe place and within easy reach so that it can be used at any time. If the manual is lost or seriously damaged, contact Kawasaki.

Symbols

Items that require special attention in this manual are marked with the following symbols.

Ensure proper operation of the robot and prevent injury or property damage by following the safety instructions in the boxes with these symbols.

⚠ WARNING

Failure to observe the specified contents could possibly result in injury or, in the worst case, death.

[**ATTENTION**]

Identifies precautions regarding robot specifications, handling, teaching, operation, and maintenance.

⚠ WARNING

1. **The accuracy and effectiveness of the diagrams, procedures and explanations in this manual cannot be confirmed with absolute certainty. Should any unexplained problems occur, contact Kawasaki Robotics GmbH at the above address.**
2. **To ensure that all work is performed safely, read and understand this manual. In addition, refer to all applicable laws, regulations, and related materials, as well as the safety statements described in each chapter. Prepare appropriate safety measures and procedures for actual work.**

Paraphrases

The following formatting rules are used in this manual:

- For a particular keystroke, the respective key is enclosed in angle brackets, e.g. <F1> or <Enter>.
- For the button of a dialog box or the toolbar, the button name is enclosed in square brackets, e.g. [Ok] or [Reset].
- Selectable fields are marked with a square box ☐.
  If selected a check mark is shown inside the symbol ☑.

Change log:

Date	Change Description
2025/03/06	Document created
2025/03/26	Added Electrical connections Added Light Indicator Added compressed air warning

List of contents

1 Nomenclature in this manual

The author of the manual tries to use generally valid terminology while achieving the greatest possible logical sense. Unfortunately, it must be noted that the terminology is reversed depending on the point of view when considering one and the same topic. Also it is to be stated that in the course of the computer and software history terminologies developed in different way. One will find therefore in a modern manual no terminologies, which always satisfy 100% each expert opinion.

2 Overview of ASTORINO

The ASTORINO is a 6-axis learning robot developed specifically for educational institutions such as schools and universities. The robot design is based to be 3D printed with PET-G filament. Damaged parts can be reproduced by the user using a compatible 3D printer.

Programming and control of the robot is done by the "astorino" software.

The latest software version and 3D files can be downloaded from the KAWASAKI ROBOTICS FTP server:

https://ftp.kawasakirobot.de/Software/Astorino/

Just like Kawasaki's industrial Robots the ASTORINO is programmed using AS language. Providing transferable programing skills from the classroom to real industrial applications.

3 Technical specifications

Characteristics		ASTORINO
Type		6-axis robot
Max. lifting capacity		1 kg
Number of axes		6
Max. range		578 mm
Repeatability		±0.2 mm
Motion range	Axis 1 (JT1)	±158°
	Axis 2 (JT2)	-90°÷127°
	Axis 3 (JT3)	0°÷168°
	Axis 4 (JT4)	±240°
	Axis 5 (JT5)	±120°
	Axis 6 (JT6)	±360°
Max. single axis speed	Axis 1 (JT1)	38°/s
	Axis 2 (JT2)	26°/s
	Axis 3 (JT3)	26°/s
	Axis 4 (JT4)	67.5°/s
	Axis 5 (JT5)	67.5°/s
	Axis 6 (JT6)	128.5°/s
Allowable moment	Axis 4 (JT4)	6.2 Nm
	Axis 5 (JT5)	1.45 Nm
	Axis 6 (JT6)	1.1 Nm
Working environment	Temperature	15–35°C
	Humidity	35–60%
Controller		Teensy 4.1
Inputs/Outputs		8/8 (PNP 8 mA, NPN 15 mA)
		2/2 (24V PNP on the JT3)
Max. current consumption		144 W
Power supply		100–240 V, 50–60 Hz
Max. emitted acoustic pres.		< 85 dB(A)
Weight		11 kg
Mounting position		Floor
Material		PET-G
Colour		Black
Communication		MODBUS TCP, TCP/IP, UDP, SERIAL
Collision detection		Accelerometer
Power loss safety		Brakes on JT2 and JT3
Options	24V I/O-module	8 × Inputs / Outputs
	7^{th} axis	Linear Track
	Vision system	OpenMV
	Belt tracking	Max. 2 Encoder

4 Safety instructions

4.1 General information on safety

Always ensure the personal safety of users and others when operating the robot arm or starting the robot cell!

• In its basic version, the robot has no safety-related components for the robotic workstation. Such components may be required, depending on the target application. The basic version of the robot is provided with an emergency stop button.

• The robot controller includes a 24 V power supply that must be supplied with mains voltage (100/240 V). Please check the label on the power supply. Only qualified personnel can connect the power supply to the mains and put it into operation.

• Works carried out on the robot's electronic components should only be performed by qualified personnel. Check current guidelines for electrostatic discharges (ESD).

• Always disconnect the robot from the power supply (100/240 V) when working on the robot base (controller) or any electronic components connected to the robot controller.

• Hot-plugging is forbidden! It could lead to a permanent damage to motor modules. Do not install or remove any modules or plug/disconnect connectors (e.g. emergency stop button, DIO modules, motor connectors) while the power is on.

• The robot arm must be placed on a stable surface and bolted or otherwise secured.

• Use and store the robot only in a dry and clean place.

• Use the system only in a room temperature (15° to 32°C) — recommended.

- Please note that:
  - The robot can only be used under the proper technical conditions, for its intended uses, while taking into consideration potential hazards;
  - the robot must be used in accordance with the instructions in this manual;
  - Kawasaki Robotics or Astor is not liable for any modification made to the software or physical characteristics of the robot by the user.
  - We shall not be liable for any damage caused if it is used in a way that does not comply with the instructions given in this manual.

WARNING

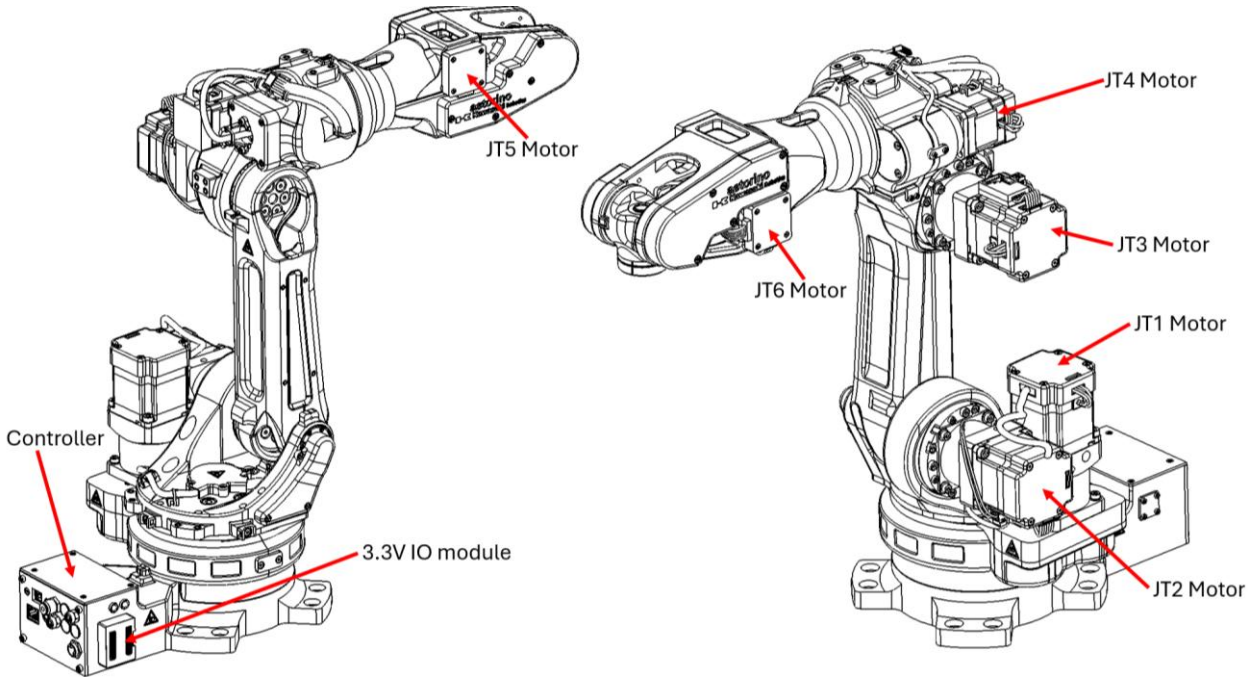
All listed below operations must be performed by authorized and trained personnel. Please read Safety Manual and make sure that the robot is firmly installed on a solid surface

Authorized personnel must be approved by Astor or Kawasaki Robotics company or their partners. Authorized personnel should also be trained how to deal with electronic equipment and must have all necessary legislations to work with electric equipment.

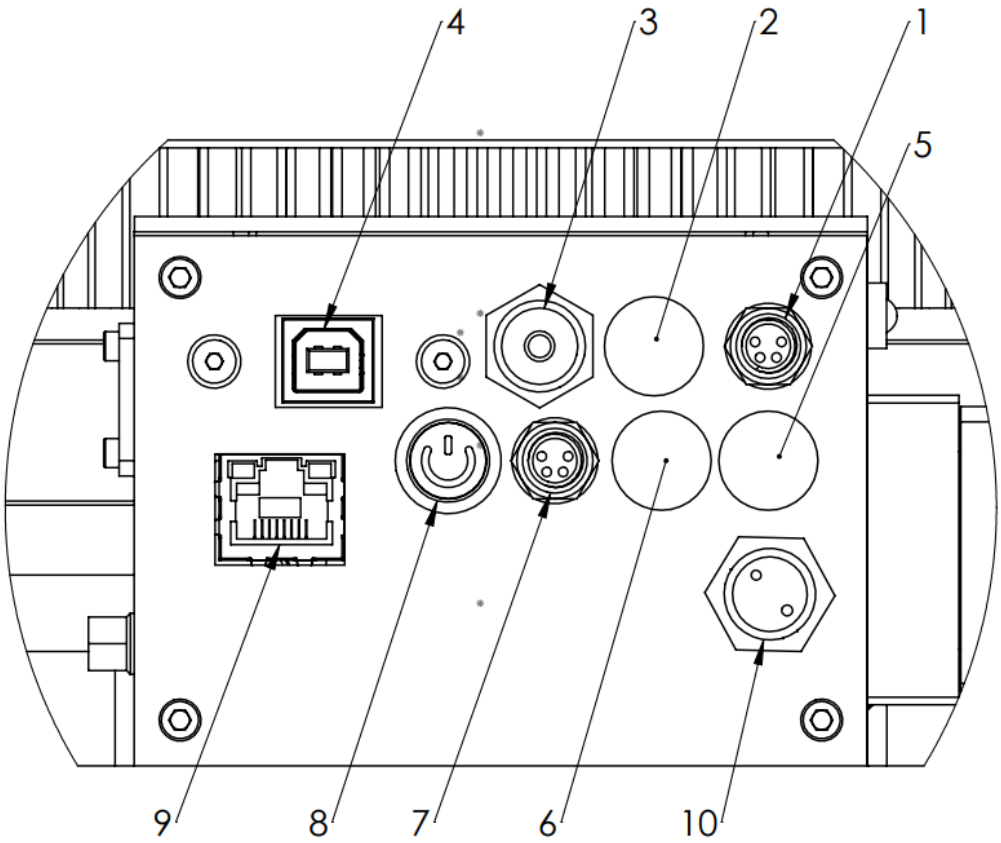
WARNING

Do not unplug pressure inlet without bleeding off pressure source first!

5 Composition of astorino robot

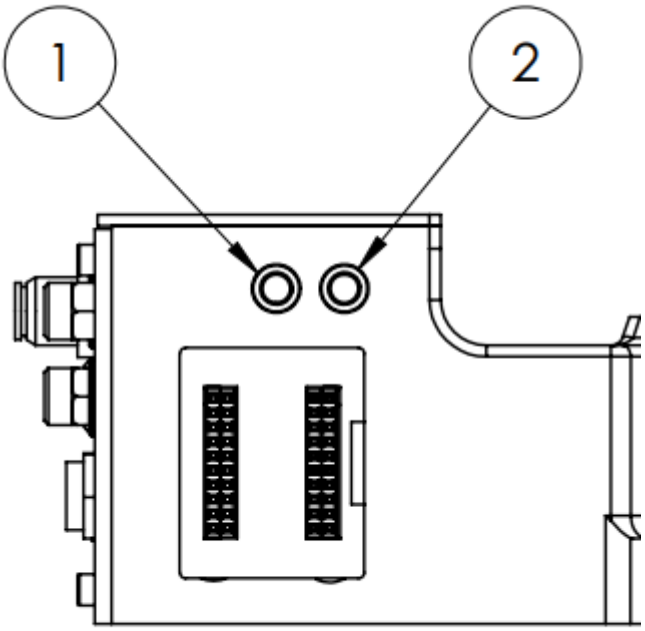


5.1 Electrical connections



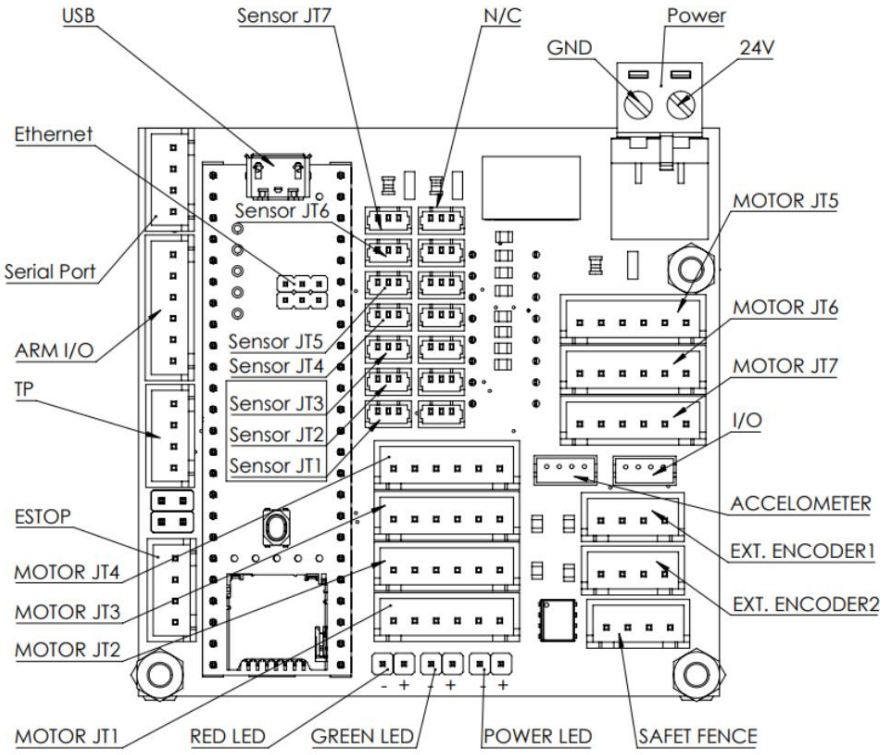
1.	M8 socket 4-Pin – external emergency stop (E-Stop)
2.	*Safety Fence (OPTION)*
3.	*Pressure inlet Ø4.0 mm*
4.	USB-B port
5.	*OPTION 2 (Encoder 2 – Conveyor 2/JT7)*
6.	*OPTION 1 (Encoder 1 – Conveyor 1)*
7.	*Vision-System/Serial-Communication*
8.	Power ON/OFF switch
9.	Ethernet port (RJ45)
10.	Power supply

5.2 Light indicator

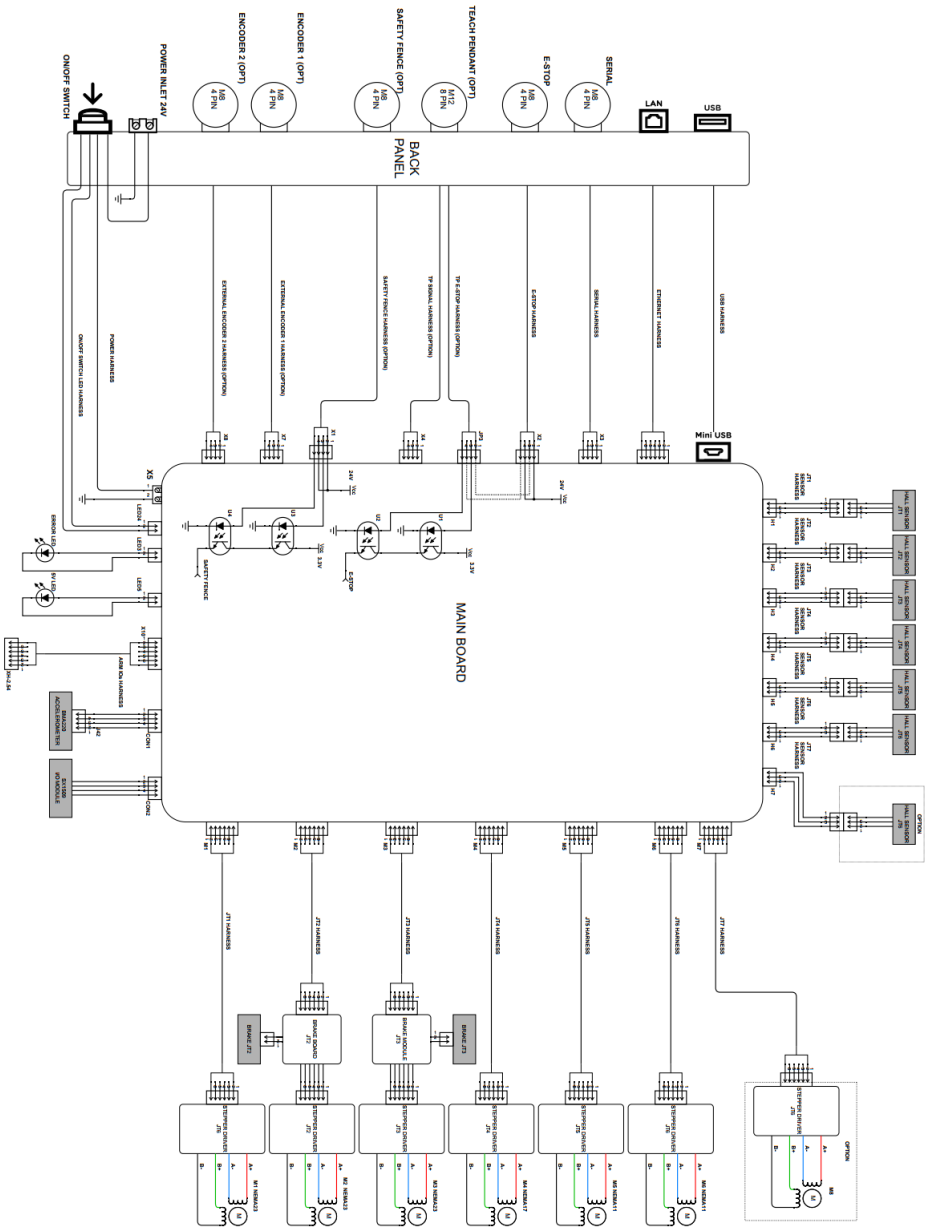


1	Green LED - Power ON (5V indicator for logic circuit)
2	*Red LED - Error*

5.3 Internal connection to the mainboard



5.4 Electric schematic of astorino robot

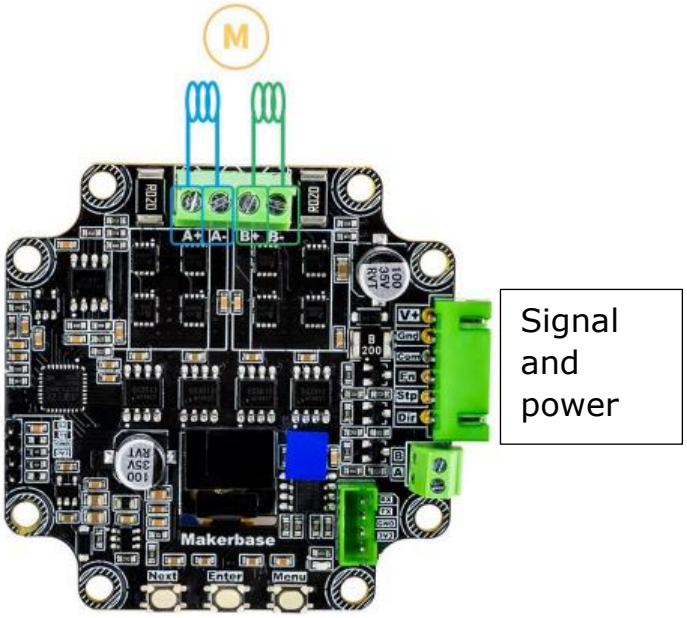


6 Motor drivers

All stepper drivers installed on astorino robot are closed-loop and use 14-bit magnetic encoders.

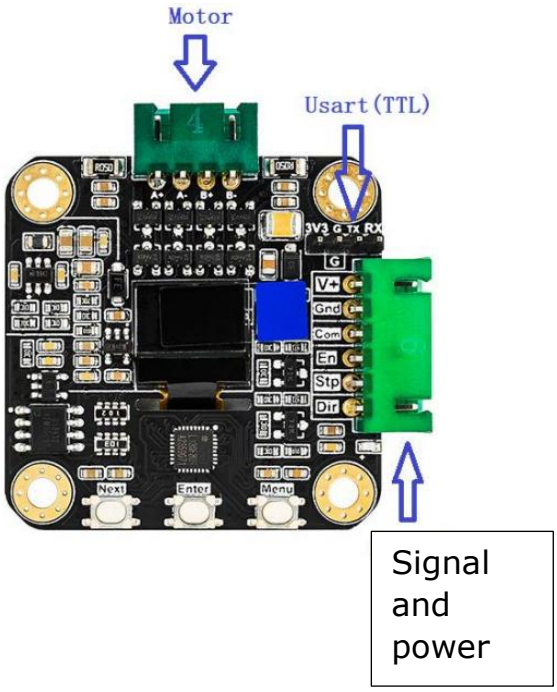
6.1.1 JT1-JT3

JT1-JT3 motors are controlled by MKS Servo57C closed-loop stepper driver.



6.1.2 JT4-JT7

JT4 – JT7 motors are controlled by MKS Servo42C closed-loop stepper driver.



6.2 Stepper motor drivers basic settings

JT	Parameter				
	Mode	Ma	MStep	EN	Dir
1	CR_CLOSE	800	32	H	CW
2	CR_CLOSE	800	32	H	CW
3	CR_CLOSE	800	32	H	CW
4	CR_vFOC	1200	32	H	CW
5	CR_vFOC	600	32	H	CW
6	CR_vFOC	600	32	H	CW
7	CR_vFOC	1200	32	H	CW

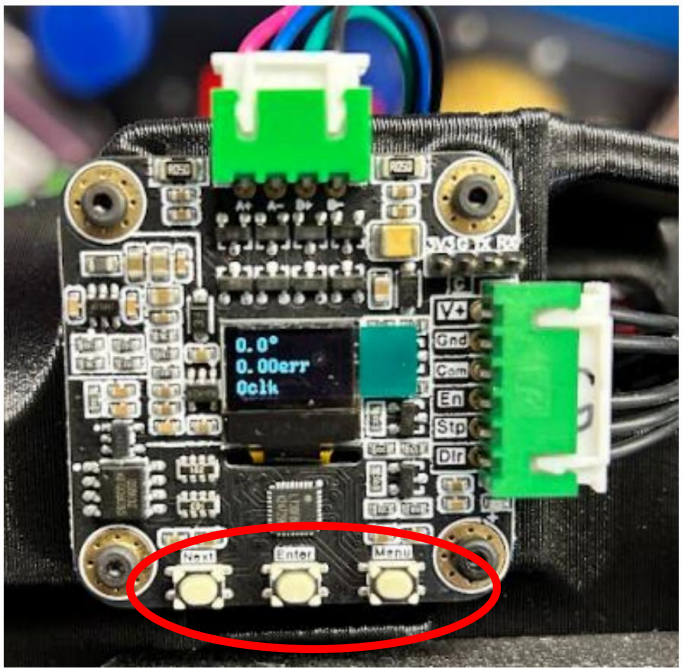
6.3 Stepper motor drivers configuration

6.3.1 Overview

Each driver is equipped with 3 buttons:

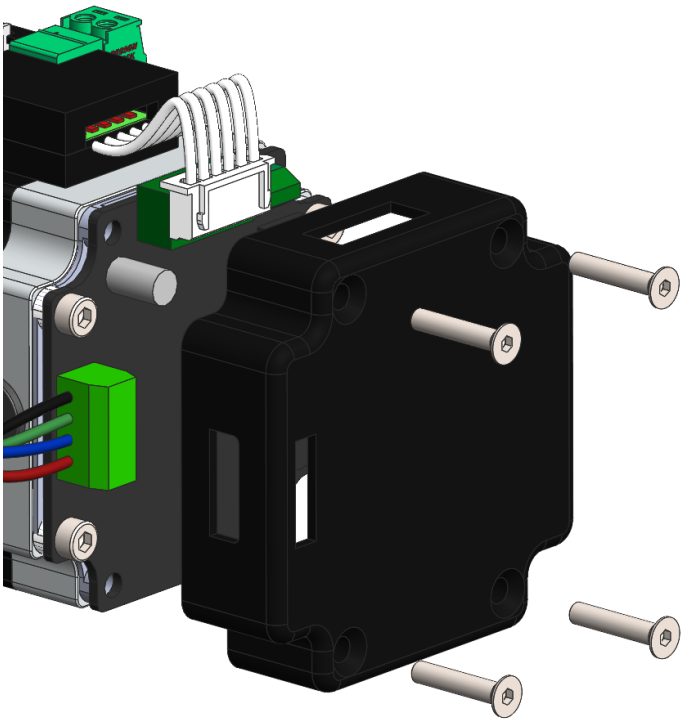
- NEXT,
- ENTER,
- MENU.

Which allows to navigate through menu and set/save driver parameters



6.3.2 Protective cover disassembly

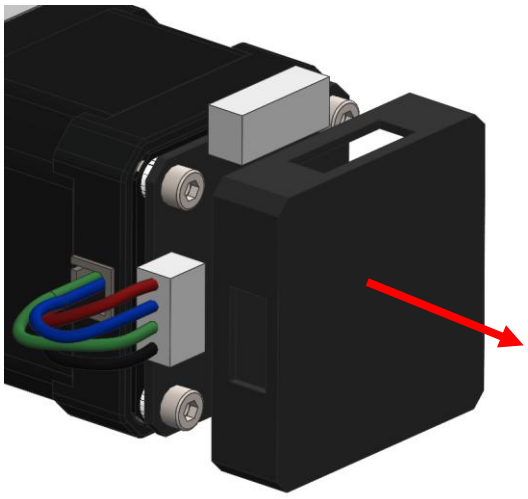
JT1-JT3 – remove four M3 screws that hold protective cover. Then remove plastic cover.



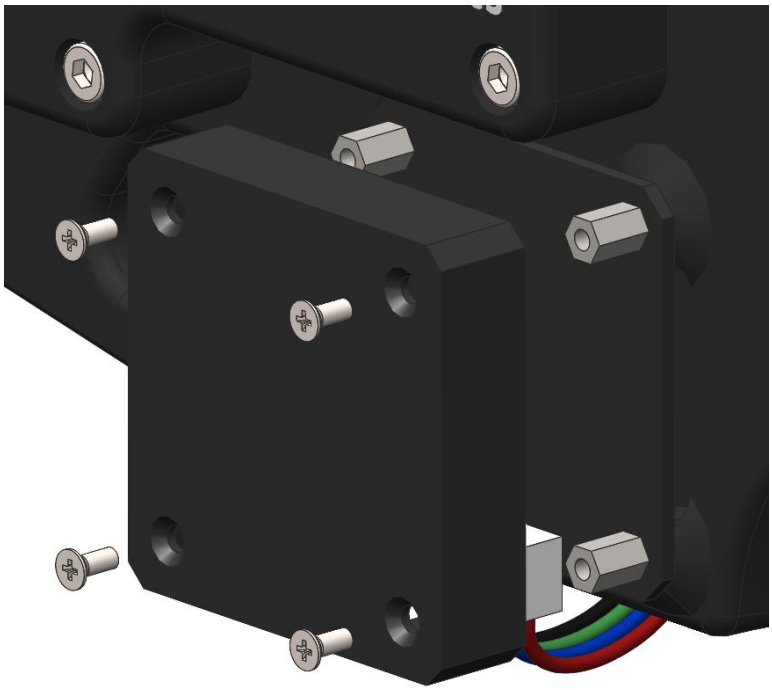
⚠ WARNING

During assembly of the cover make sure not overtighten the M3 screws. Overtightening may result in electric short circuit and damage the stepper motor driver!

JT4 – pull the cover by hand, it is hold by interference fit.



JT5-JT6 remove four M2 screws that hold protective cover. Then remove plastic cover.



6.3.3 Menu descriptions:

1. CAL : Calibrate the motor.

Make sure the MotType is Configure correctly.(default 1.8 °)

2. MotType :Select stepper motor type.

0.9 ° ：The motor is a 0.9 degree stepper motor

1.8 ° ：The motor is a 1.8 degree stepper motor

(Default: 1.8 °)

3. Mode : Work mode selection.

CR_OPEN ：Open mode, the motor run without encoder

CR_vFOC ：FOC mode, pulse(En,Stp,Dir) interface.

CR_UART ：FOC mode, serial interface.

(Default: see 6.2 Parameters table)

4. Ma :Set the operating current in CR_OPEN mode.

Attention: The CR_vFOC and CR_UART mode will automatically adjust the current according to the load.

(Default: see 6.2 Parameters table)

5. MStep : Set subdivisions.

Supports subdivision from 1 to 256.

(Default: see 6.2 Parameters table)

6. En : Set the effective level of EN pin.

H ：High level is valid.

L ：Low level is effective.

Hold ：the driver board is always enabled.

(Default: see 6.2 Parameters table)

7. Dir : Set the positive direction of motor rotation.

CW ：Clockwise rotation is positive

CCW ：Counterclockwise rotation is positive

(Default: see 6.2 Parameters table)

8. AutoSDD :Set the oled screen sleep mode.

Note ：If this option is enabled, the OLED screen will automatically

turn off without any key operation within seven seconds, and the

display can be waked up by pressing any button.

(Default: Disable)

9. Protect : Set the motor shaft locked-rotor protection function.

Disable: disable protection

Enable: enable protection

(Default: Disable)

10. MPlyer : Set internal 256 subdivision.

(Default: Enable)

Note: After this option is Enabled, it automatically enable internal 256 subdivision, it can reduce the vibration and noise when the motor at low speed.

11. UartBaud ：Set the baud rate of serial.

(Default: 38400)

Note: The baud rate must be configured Before using serial communication.

12. UartAddr :Set the ID of the motor for serial command.

(Default: 0xe0)

Note：If connected to multiple motors, the ID of each motor must be different.

13. 0_Mode :The motor will go back to zero point when power on.

Disable ：do not go back to zero point.

DirMode ：go back to zero point with direction of CW or CCW (the direction is set in O_Dir menu).

NearMode ：go back to zero point with minimum angle.

(Default: Disable)

14. Set 0 : Set the zero point for go back when power on.

(O_Mode must not be Disable)

15. 0_Speed : Set the speed of go back to zero point.

0 : fastest.

...

4 : slowest.

16. 0_Dir : Set the direction of go back to zero point.

CW : Clockwise.

CCW : Counterclockwise.

(Default: CW)

17. Goto 0: go back to zero point.

("O_Mode" must not be Disable and "Set 0" has been done.)

18. ACC:Set the acceleration of the motor.

Disable

286

…

1042

(Default: Disable)

19. Restore : Reload the default parameters.

After restored the default parameters, it needs to restart the motor.

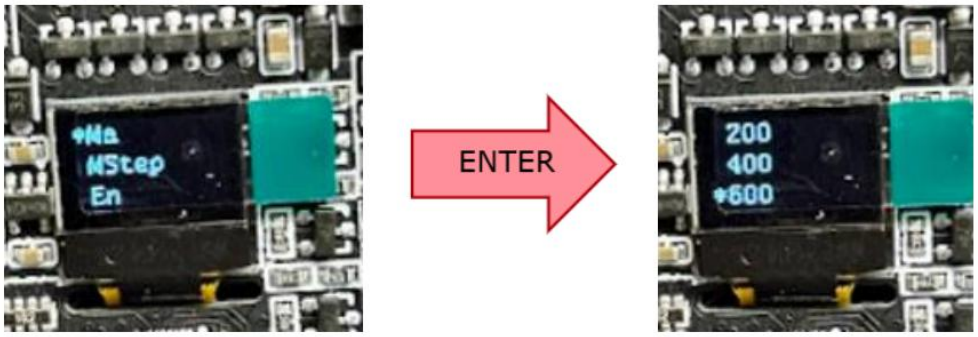
20. Exit :Exit the parameter setting menu.

6.3.4 Setting correct parameters

Press MENU button and navigate to correct submenu using NEXT button, enter submenu by pressing ENTER. Set correct parameter using NEXT button and then confirm by pressing ENTER button. Pressing MENU button will navigate back to main menu.

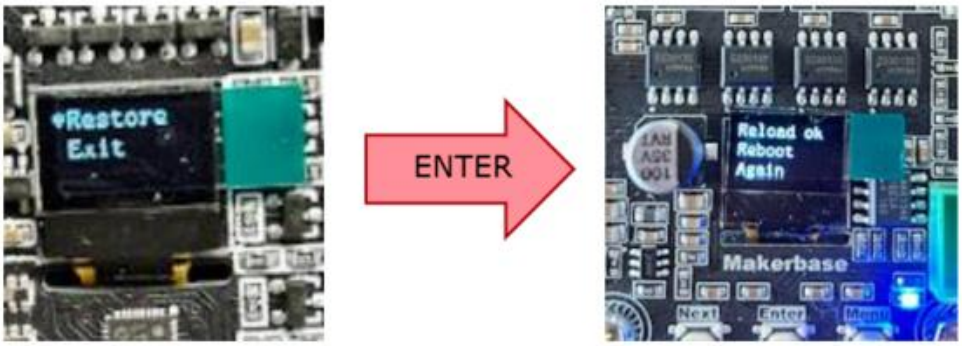
For example:

- **Ma:**



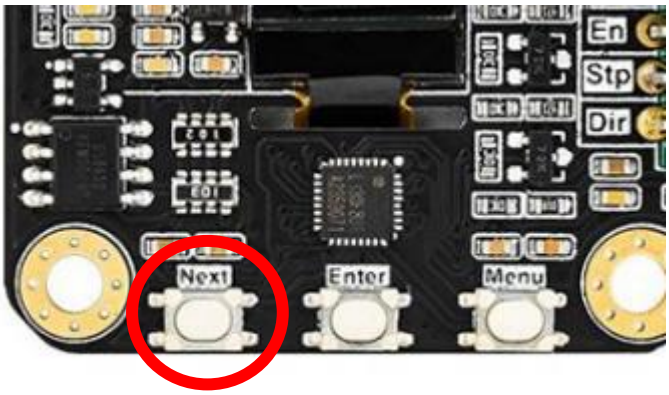
6.3.5 Factory reset

If factory reset is needed please navigate to RESTORE position in the menu, then press ENTER button. This procedure will reset all settings to factory default setting but will not delete encoder calibration data. After this procedure power reset is required.

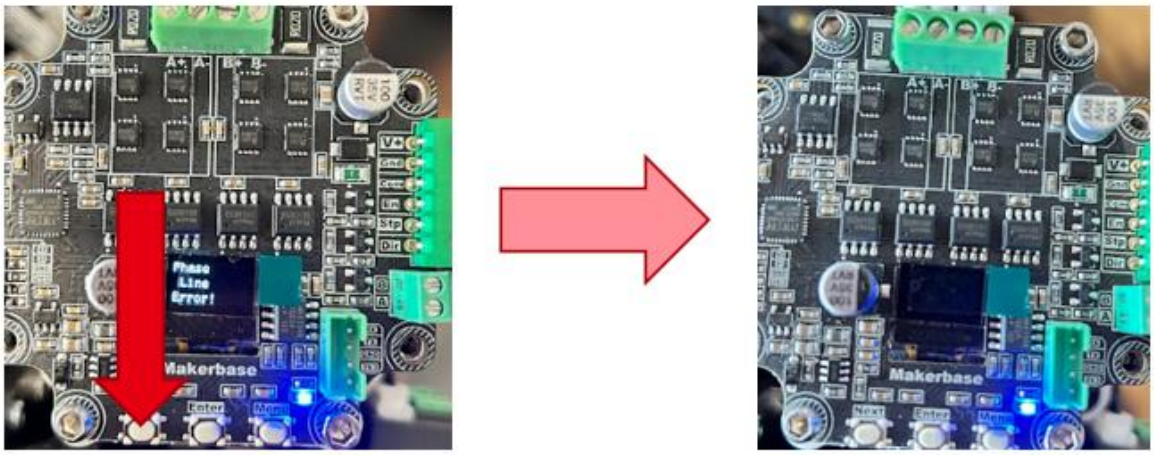


6.3.6 Hard factory reset

If hard factory reset is required. Turn off the power, then PRESS and HOLD NEXT button.



While holding the NEXT button turn ON the power. Blue LED will start to blink on the driver module. After 5s restart the power. This procedure deletes all data, also calibration data.

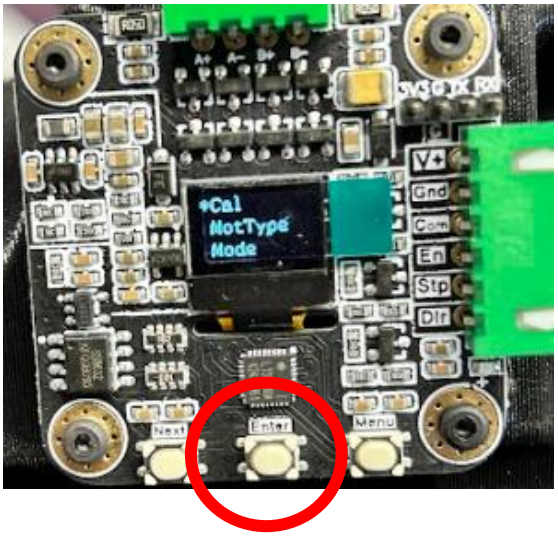


6.3.7 Motor calibration

[**ATTENTION**]

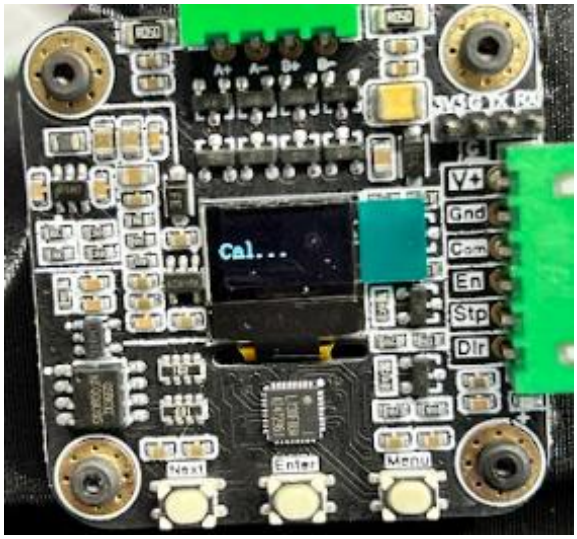
Before starting this procedure make sure that calibrated axis can move freely in both directions.

To calibrate the motor navigate to CAL menu and then press ENTER.



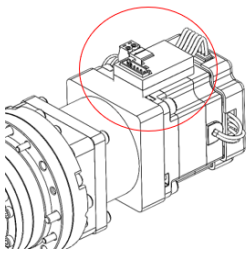
The driver calibration process begins. The axis of the robot will make some movements!

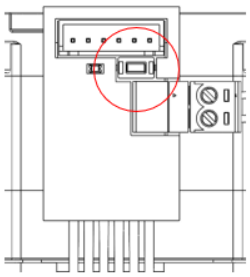
For example JT5



[ATTENTION]

When calibrating JT2 or JT3 make sure that BRAKE RELEASE switch is pressed.

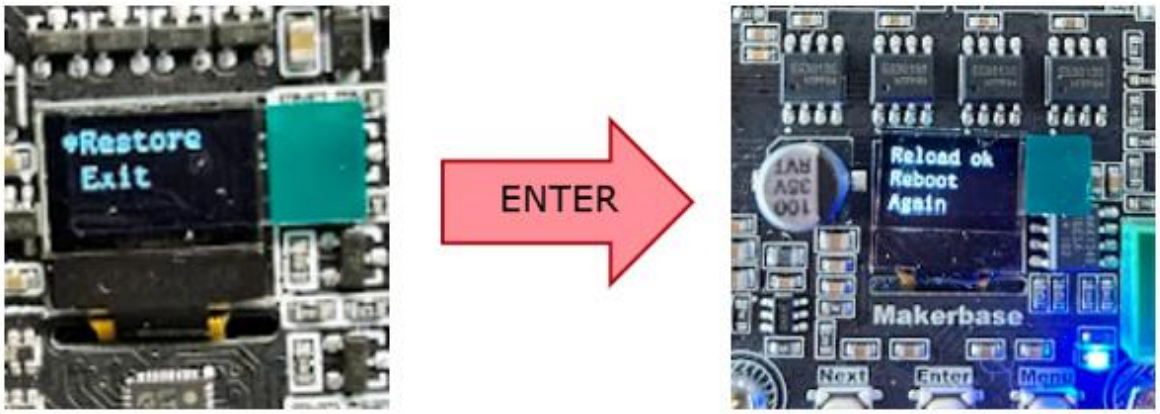




6.3.8 Errors

No	Error	Solution
1	Not Cal	Calibrate the motor
2	Waiting V+ Power!	Check input voltage – 24V
3	Phase Line Error!	The motor line sequence is wrong or hard factory reset is needed to be done.
4	Reverse Lookup Error!	Check magnet or see if shaft is not blocked
5	Magnet Loss!	The magnet is not installed or is loose
6	Magnet Error!	The magnet is not installed or is loose
7	Motor Type Error!	Check motor type or see if shaft is not blocked
8	Offset Current Error!	Hardware error – Do hard factory reset or replace driver
9	Wrong Protect!	Locked-rotor protection

If, despite the calibration and correctly entered parameters, the motor of the axis does not behave in the expected way, a possible option is to restore its initial settings and perform the configuration again. To do this, select the "Restore" option from the controller interface, and then reset (turn off and on) the robot's power supply.



6.3.9 Stepper Driver replacement

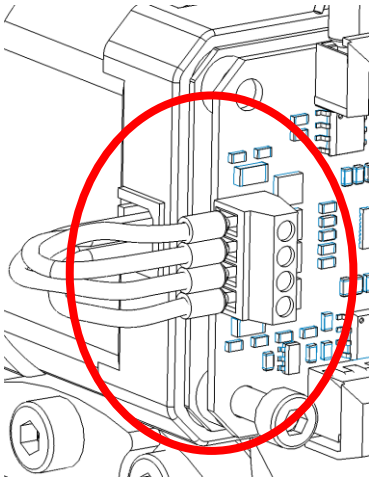
⚠ WARNING

Before replacing the stepper motor driver make sure that the power is turned off!

To replace the motor driver follow below steps:

1. Remove protective cover,
2. Remove connectors that are plugged into the driver,

3. In case of JT1-JT3, using flat small screw driver remove 4 cables that goes to the motor (remember cable order),



4. Remove four screws that hold the driver to the motor, be careful not to lose distance washers.
5. Install new driver using the same washers and screws,
6. Connect all the connectors and cables,
7. Turn on the power, calibrate the driver and set correct parameters,
8. Install the protective cover.

⚠ WARNING

After installing new driver first calibration procedure may end up in sudden robot movement. This is normal because not all parameters are set yet correctly. User more attention is advised!

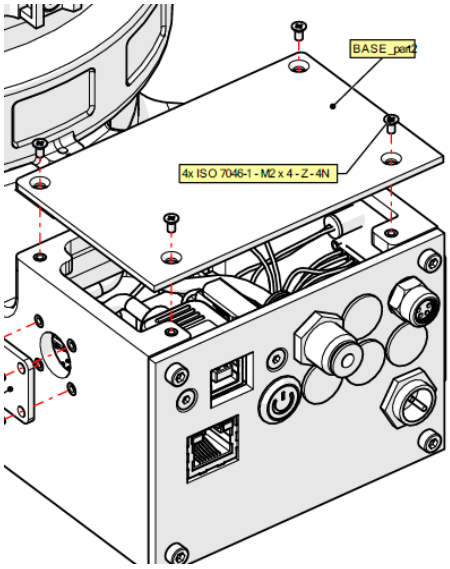
7 Main board

⚠ WARNING

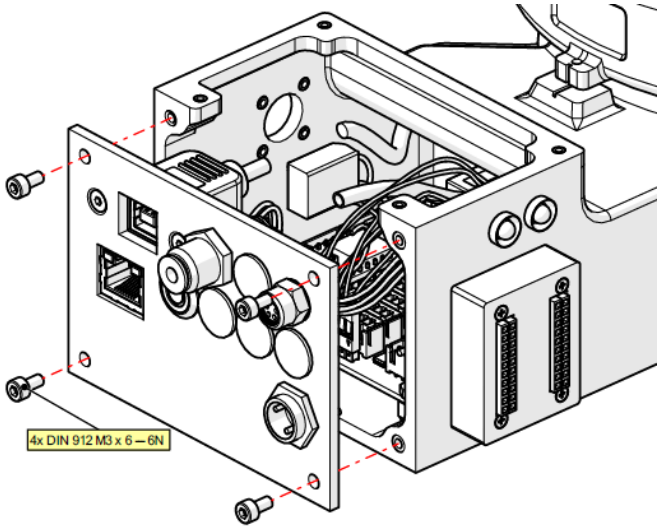
Before replacing any electronic component make sure that the power is turned off!

7.1 CPU board replacement

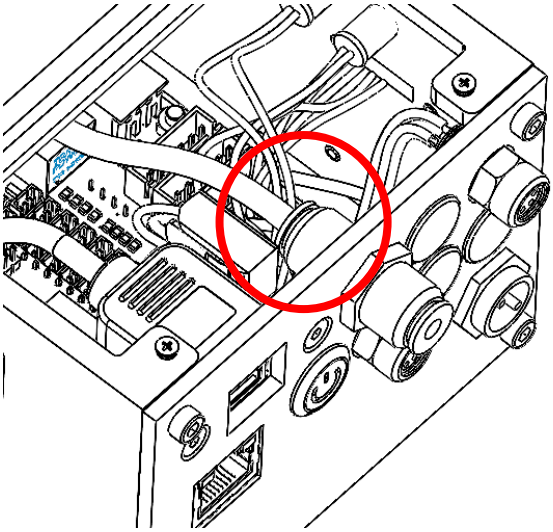
1. Turn the power off,
2. Unplug any connected cables to the base of the robot,
3. Open top base cover using a screw driver.



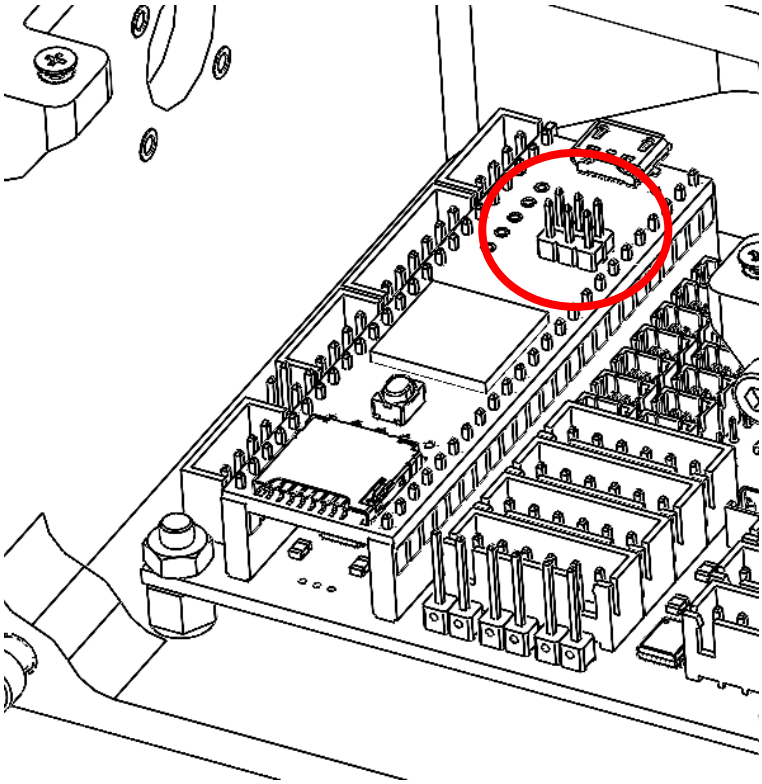
4. Open back cover using Allen wrench.



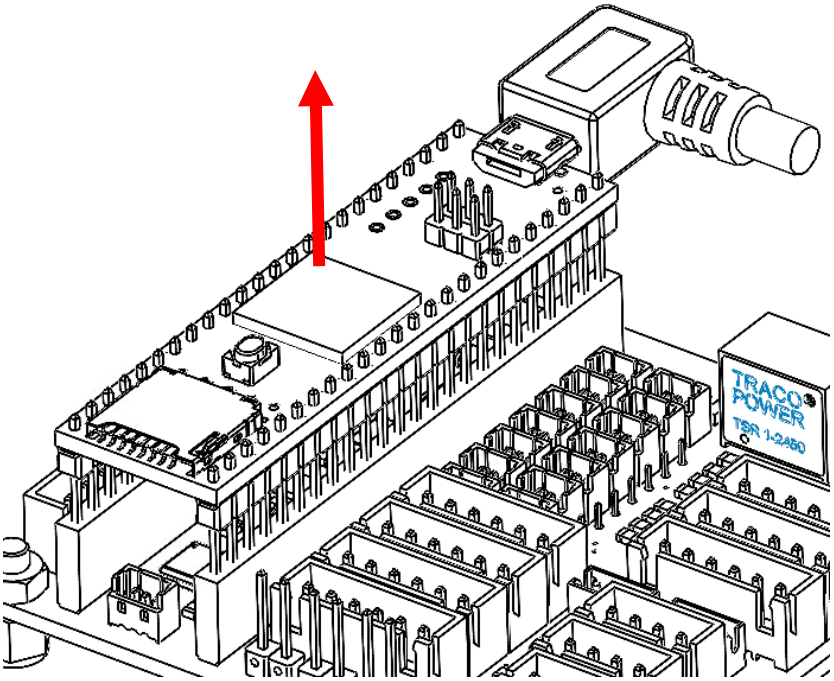
5. Unplug the pneumatic tube from the back plate,



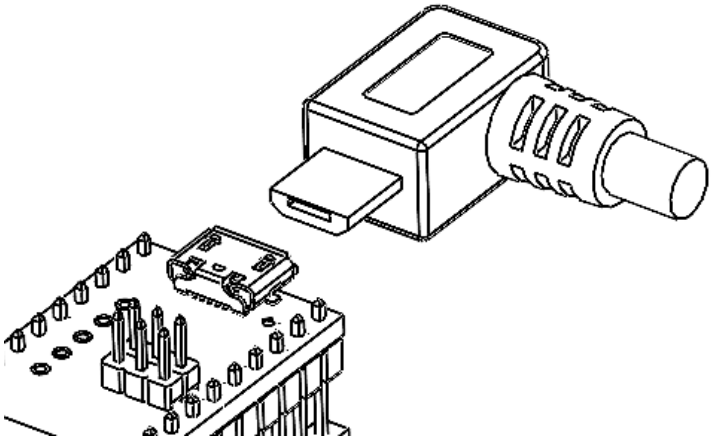
6. Remove the SD card from SD card slot,
7. Unplug ethernet connection ribbon cable from CPU unit



8. Pull CPU unit up,



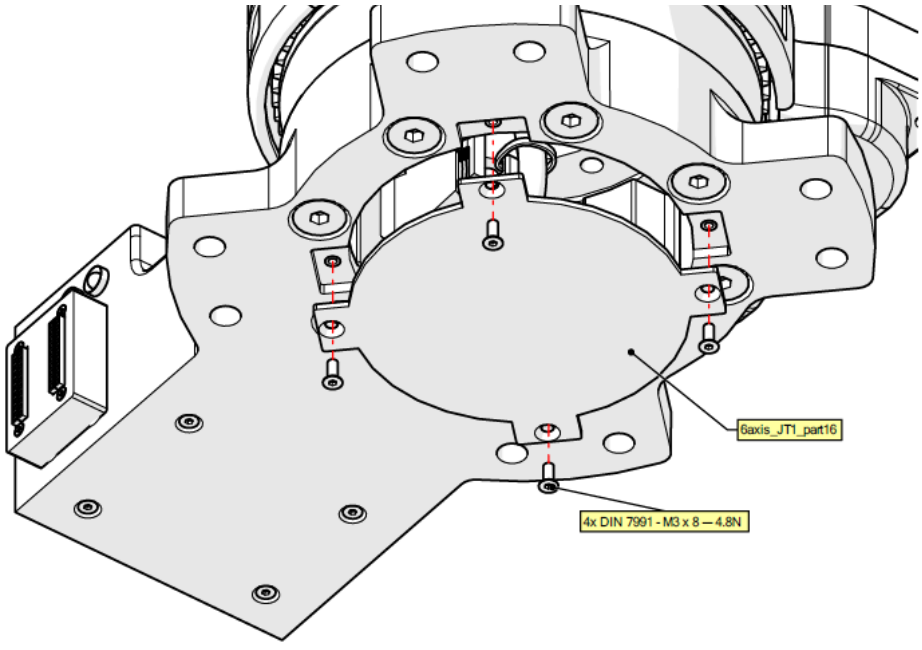
9. Unplug microUSB cable.



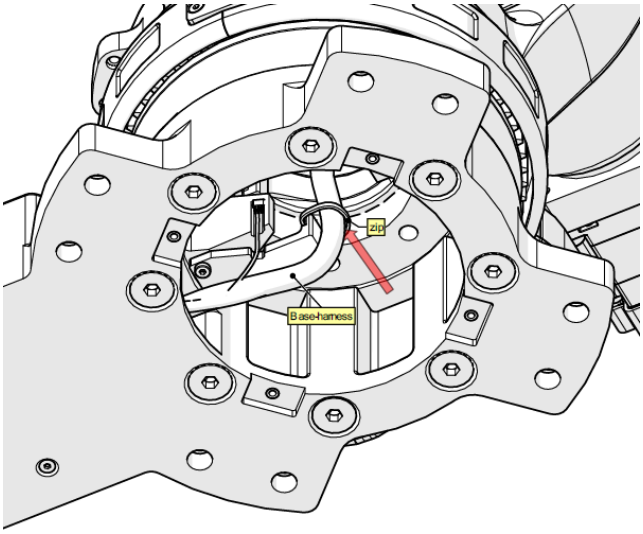
10. Install new CPU unit in reverse order:
    a. Connect microUSB cable,
    b. Put CPU unit in the mainboard,
    c. Connect ethernet ribbon cable,
    d. Put SD card into SD card slot,
    e. Close back panel and put back pneumatic tube,
    f. Close top cover,
11. Turn on power, RED led will blink once every second,
12. Using PC and astorino application upload firmware to the CPU unit.

7.2 Main board replacement

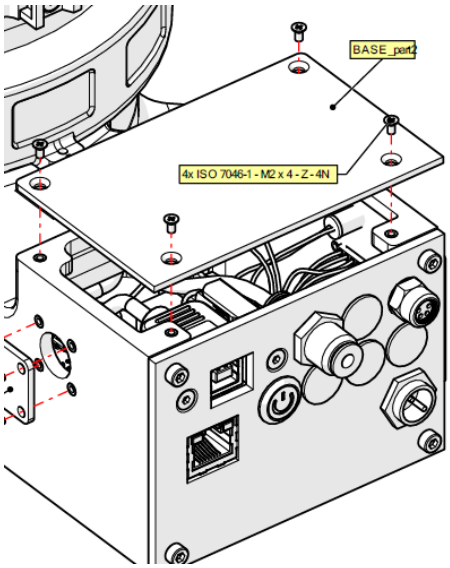
1. Turn the power down,
2. Unplug any connected cables to the base of the robot,
3. Unfasten the robot and put it on the side and remove bottom cover



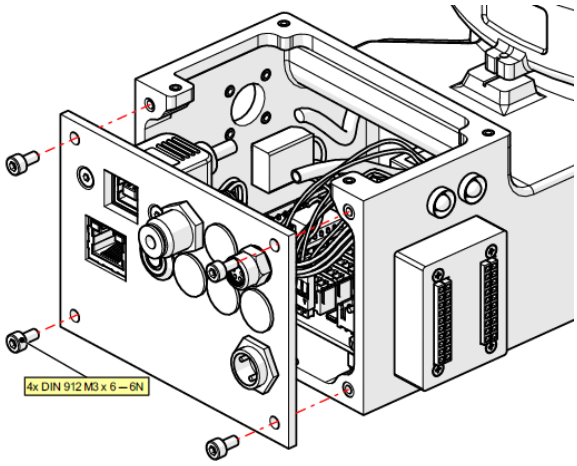
4. Cut the zip tie and loosen the internal harness,



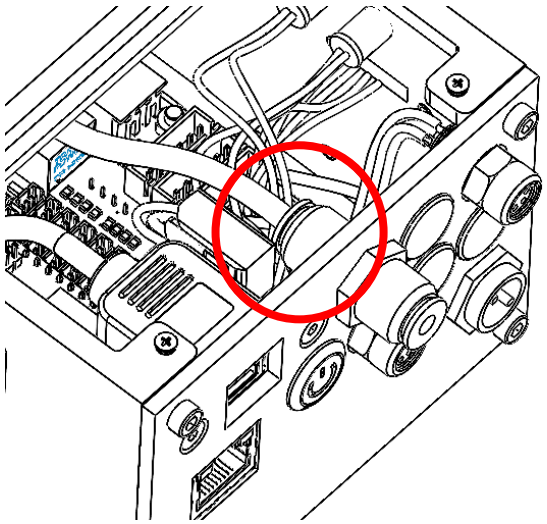
5. Open top base cover using a screw driver.



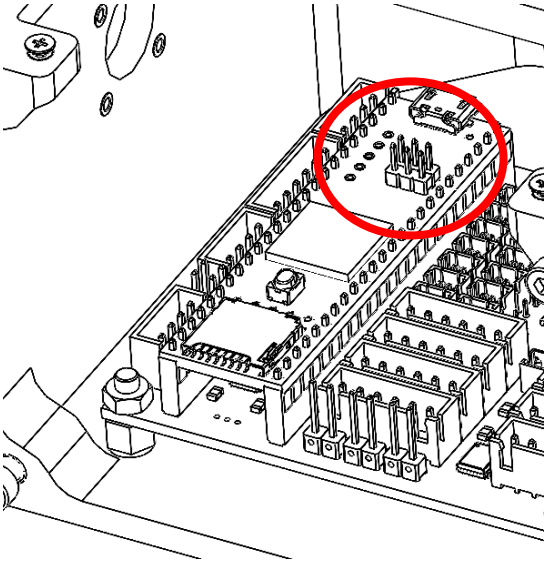
6. Open back cover using Allen wrench.



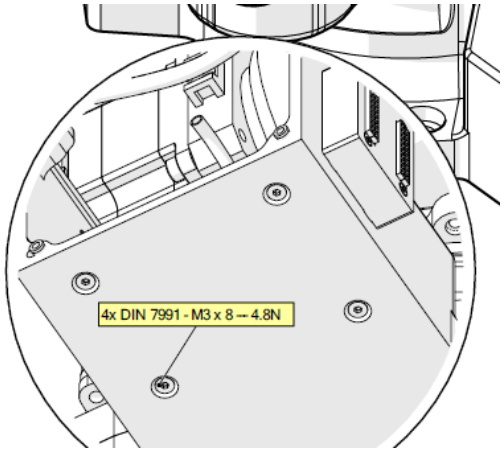
7. Unplug the pneumatic tube from the back plate,



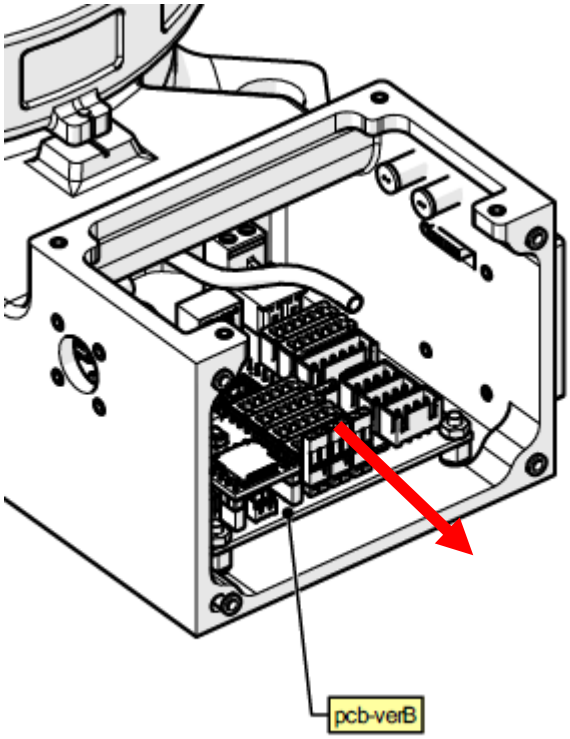
8. Remove the SD card from SD card slot,
9. Unplug ethernet connection ribbon cable from CPU unit



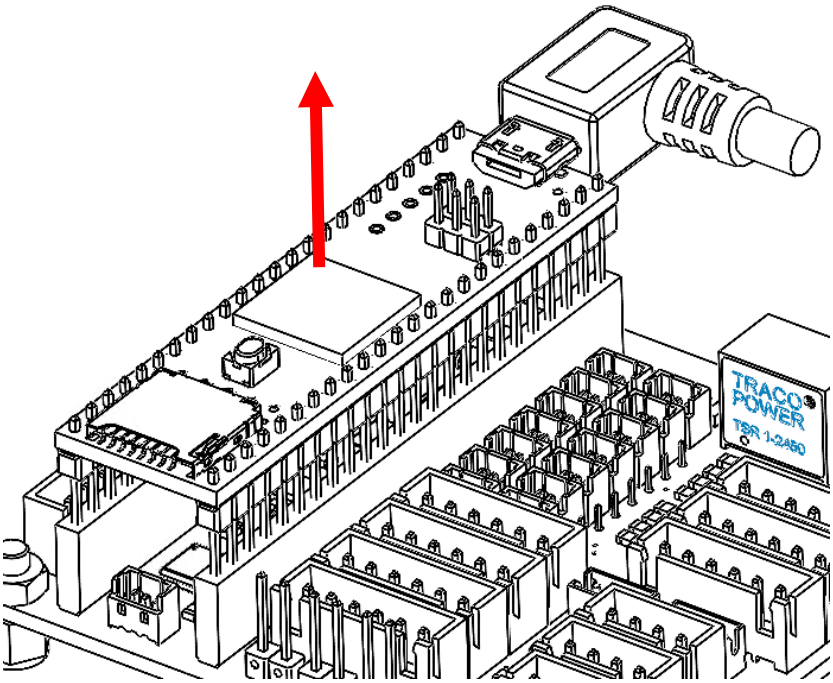
10. Unscrew the mainboard from underneath the base of the robot



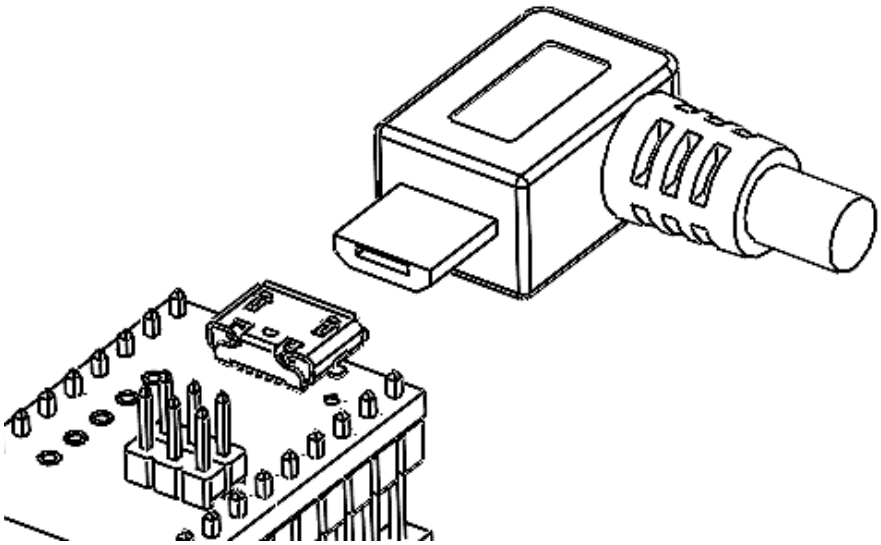
11. Unplug all connectors from mainboard unit and pull it out



12. Pull CPU unit up,



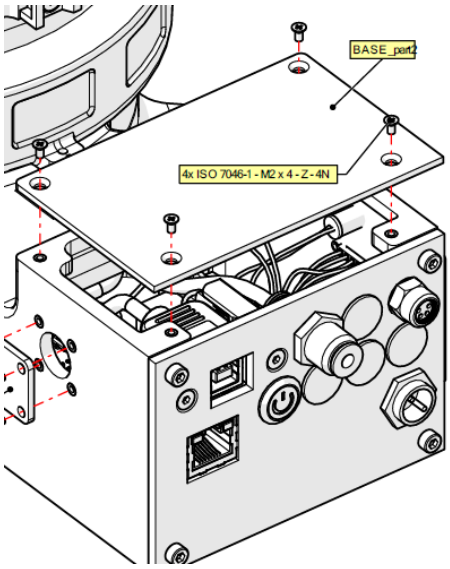
13. Unplug microUSB cable.



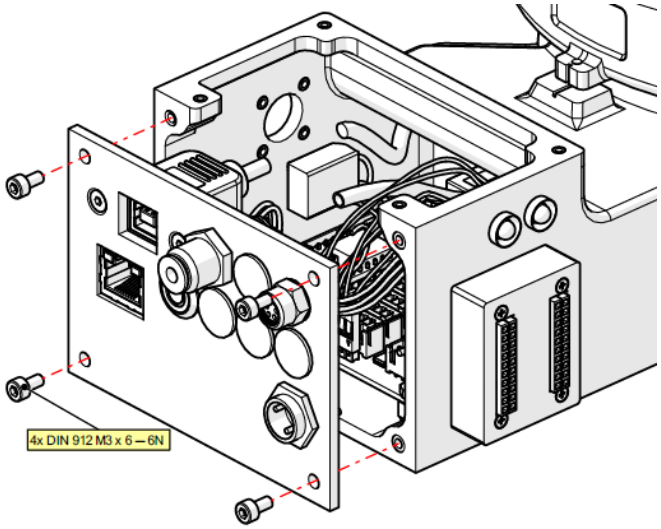
14. Install new CPU unit,
15. Install new mainboard unit in reverse order:
    a. Connect microUSB cable,
    b. Put mainboard back into base and connect all the harness,
    c. Connect ethernet ribbon cable,
    d. Put SD card into SD card slot,
    e. Close back panel and put back pneumatic tube,
    f. Close top cover,
16. Turn on power and check for any abnormal activities.

7.3 3.3V IO module replacement

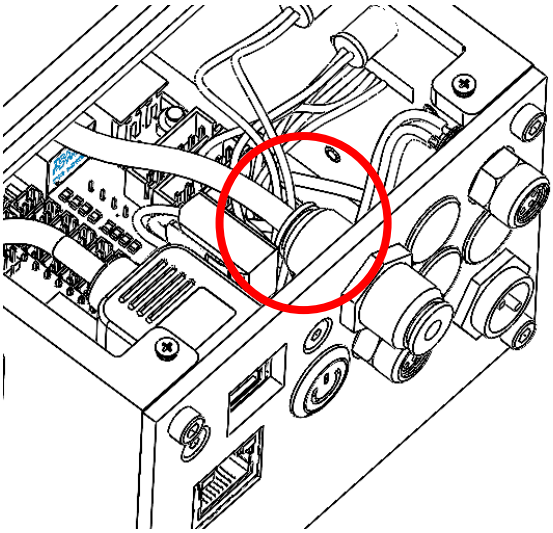
1. Turn the power off,
2. Unplug any connected cables to the base of the robot,
3. Open top base cover using a screw driver.



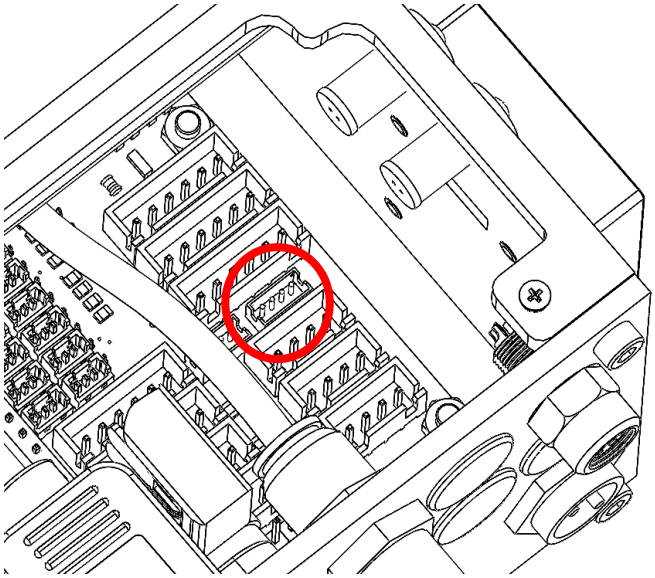
4. Open back cover using Allen wrench.



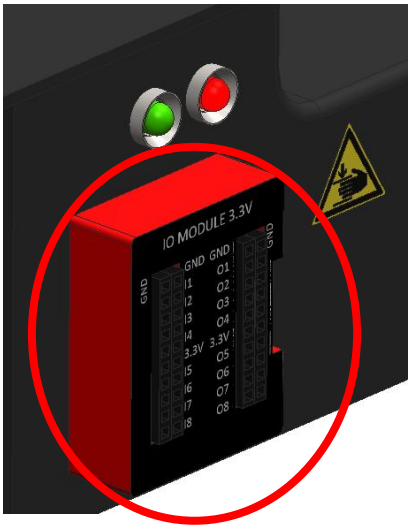
5. Unplug the pneumatic tube from the back plate,



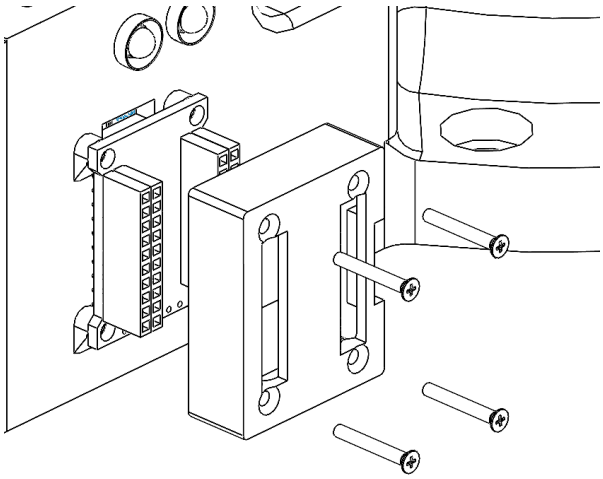
6. Unplug the 3.3V IO connector



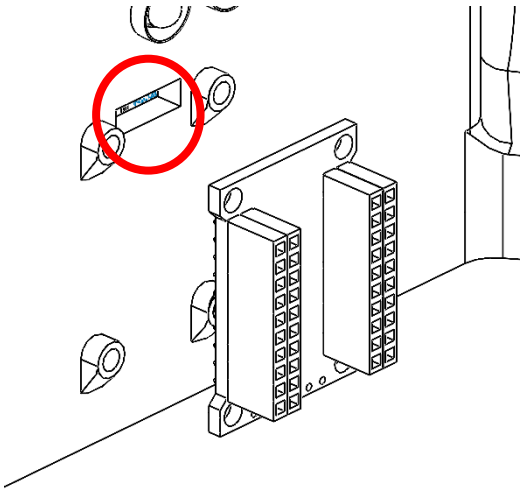
7. Remove the protective sticker



8. Remove four M2 screws and cover



9. Replace 3.3V IO module – put wires through the hole between mounting points



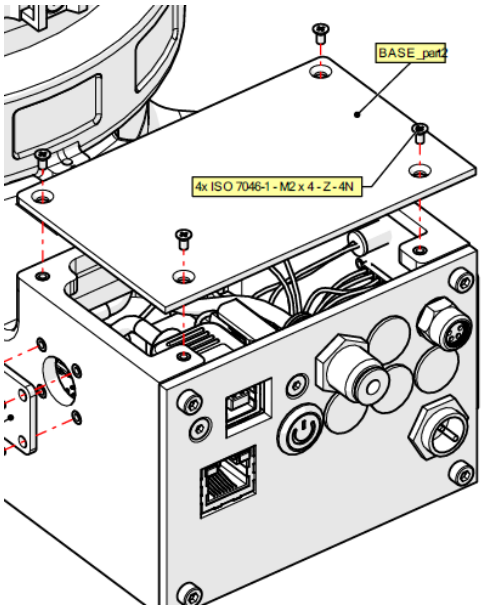
10. Connect the IO module connector to the mainboard
11. Close all covers and connect air tube,
12. Put back the protective sticker,
13. Connect power and turn on the robot,
14. Connect to astorino application and in the Terminal type in command: “ZIOACTIVE 1”

```
>zioactive 1
>
>W105: IO Module activated!
>
```

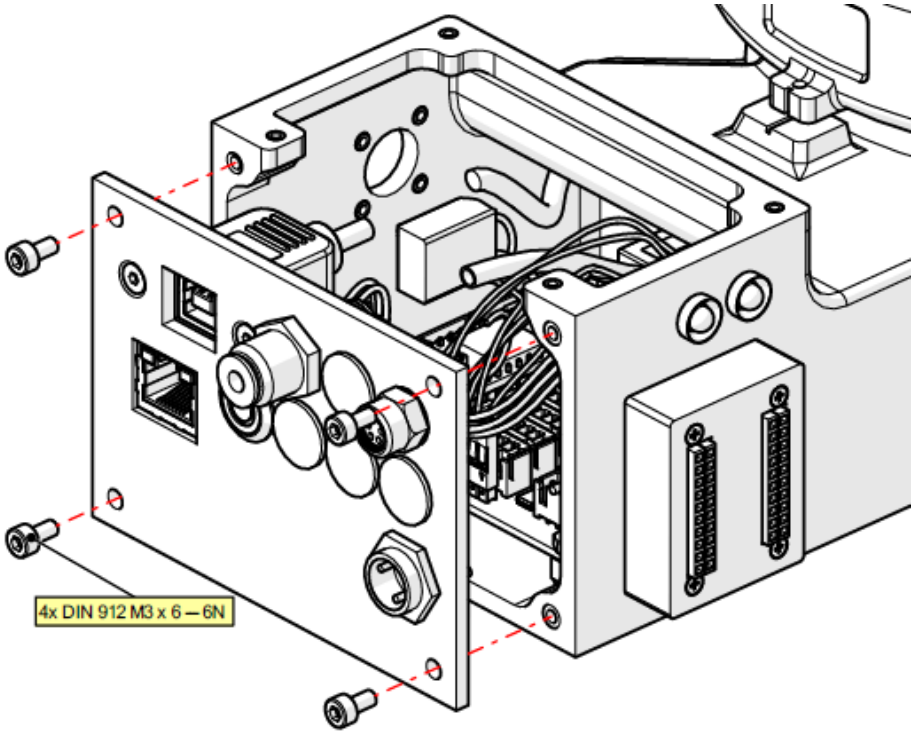
15. Test functionality of 3.3V IO module.

8 SD card replacement

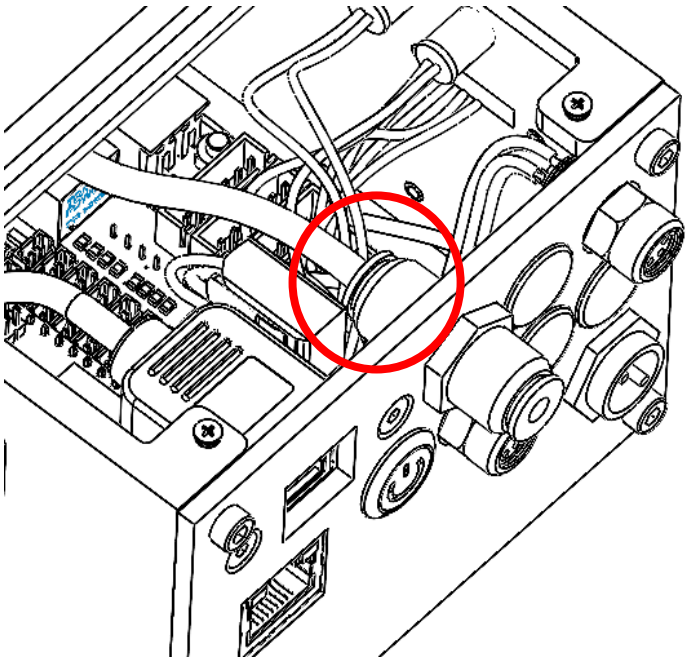
1. Turn the power off,
2. Unplug any connected cables to the base of the robot,
3. Open top base cover using a screw driver.



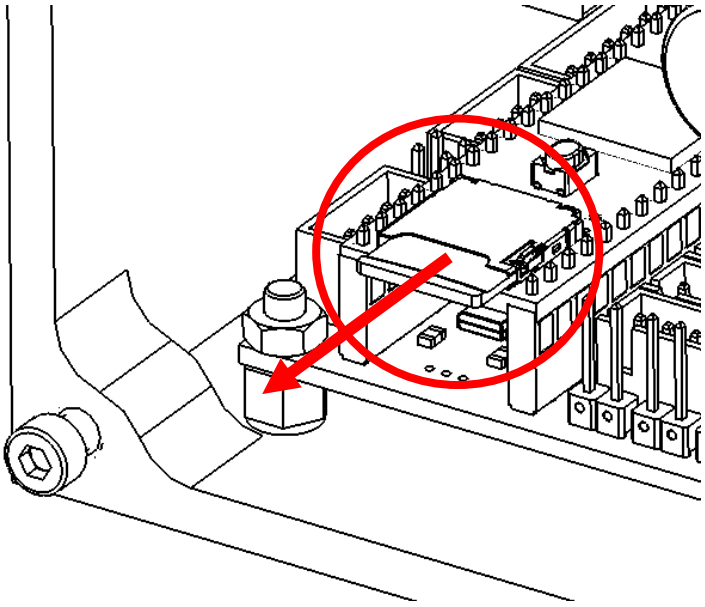
4. Open back cover using Allen wrench.



5. Unplug the pneumatic tube from the back plate,

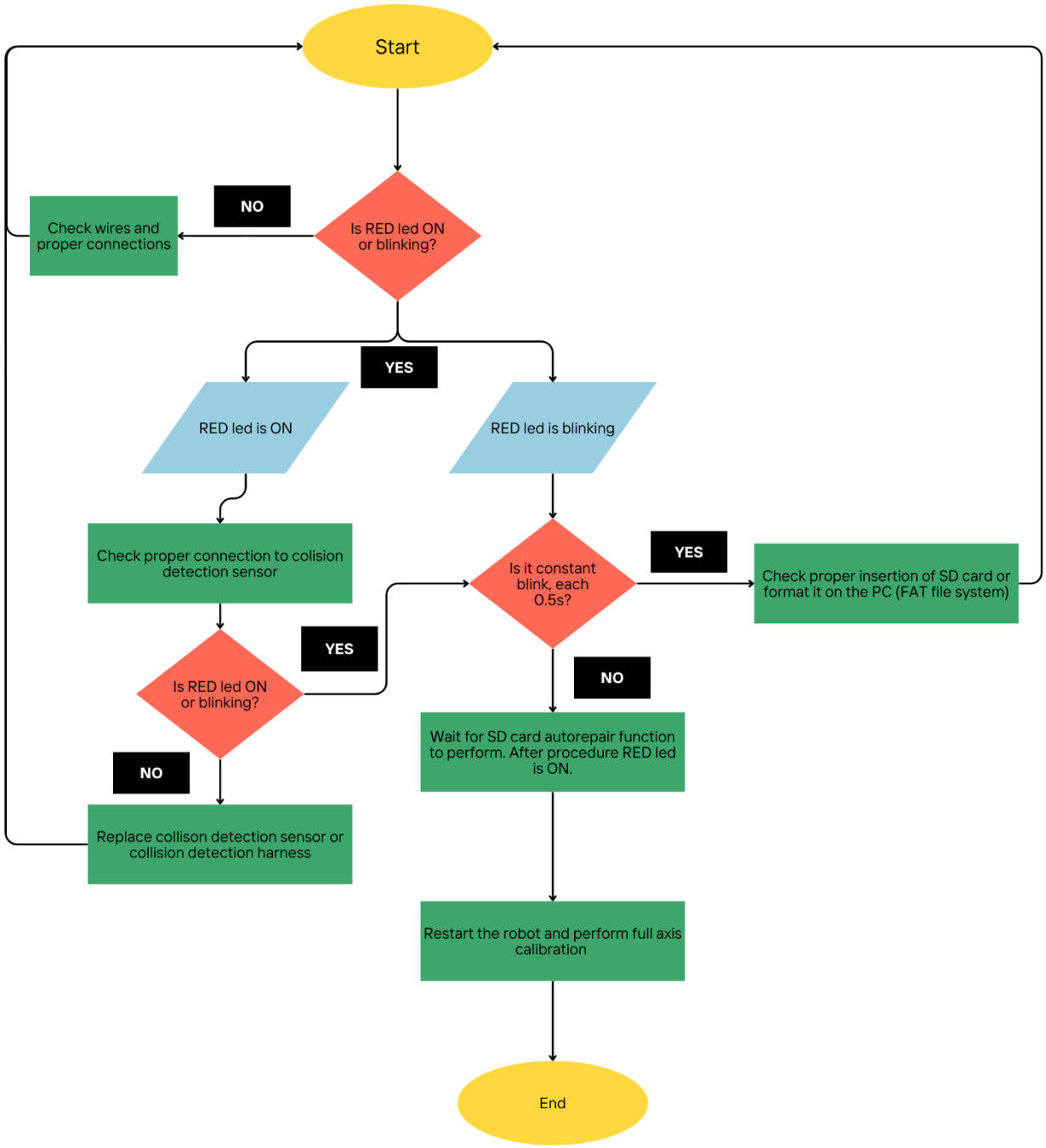


6. Remove the SD card from SD card slot,



7. Put in new SD card
8. Close all covers and connect air tube,
9. Connect power and turn on the robot,

Follow listed below steps:

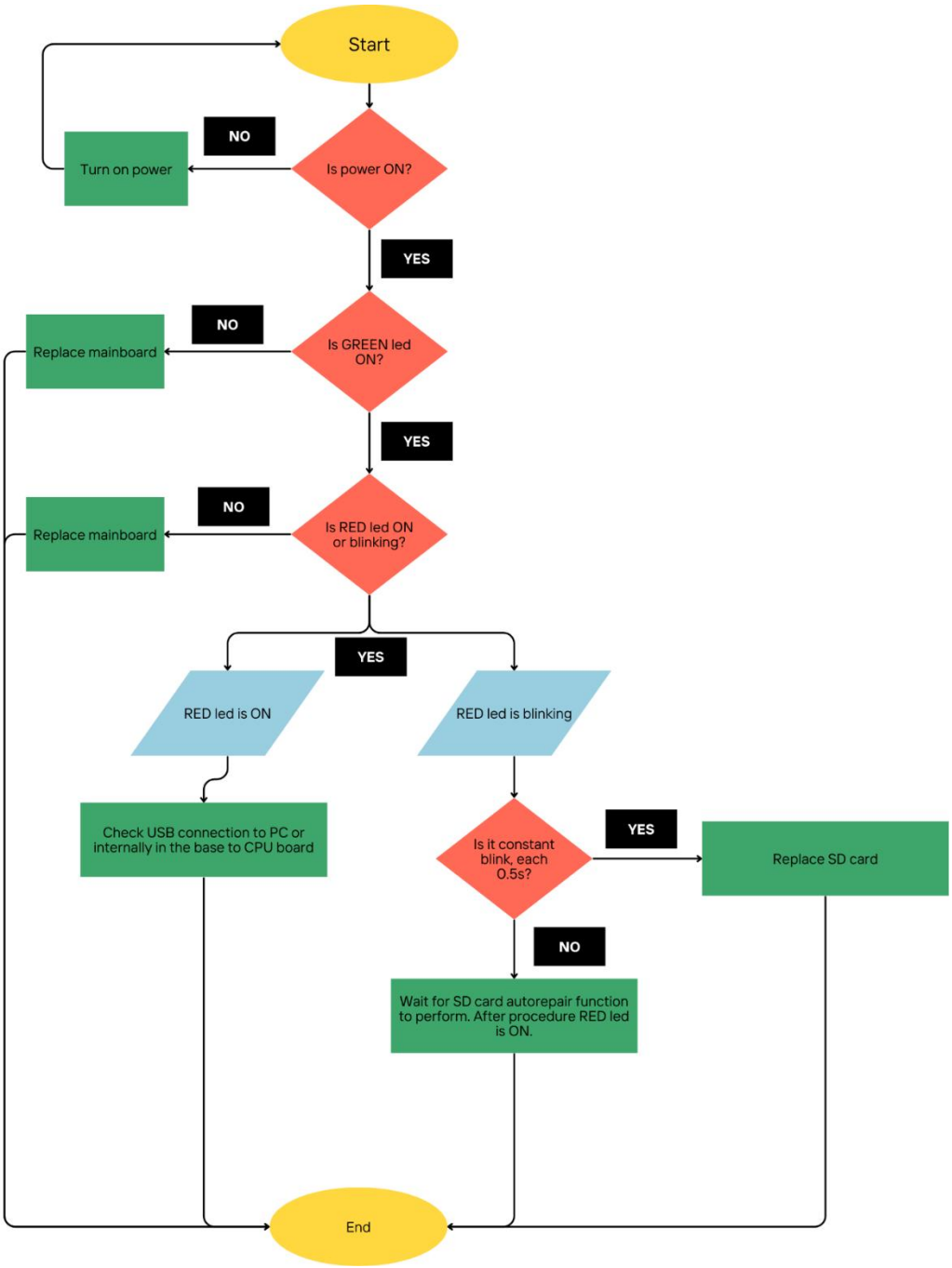

Start
Is RED led ON or blinking?
NO
Check wires and proper connections
YES
RED led is ON
RED led is blinking
Check proper connection to colision detection sensor
Is it constant blink, each 0.5s?
YES
Check proper insertion of SD card or format it on the PC (FAT file system)
YES
Is RED led ON or blinking?
NO
Wait for SD card autorepair function to perform. After procedure RED led is ON.
NO
Replace collison detection sensor or collision detection harness
Restart the robot and perform full axis calibration
End

9 Electrical and connection problems

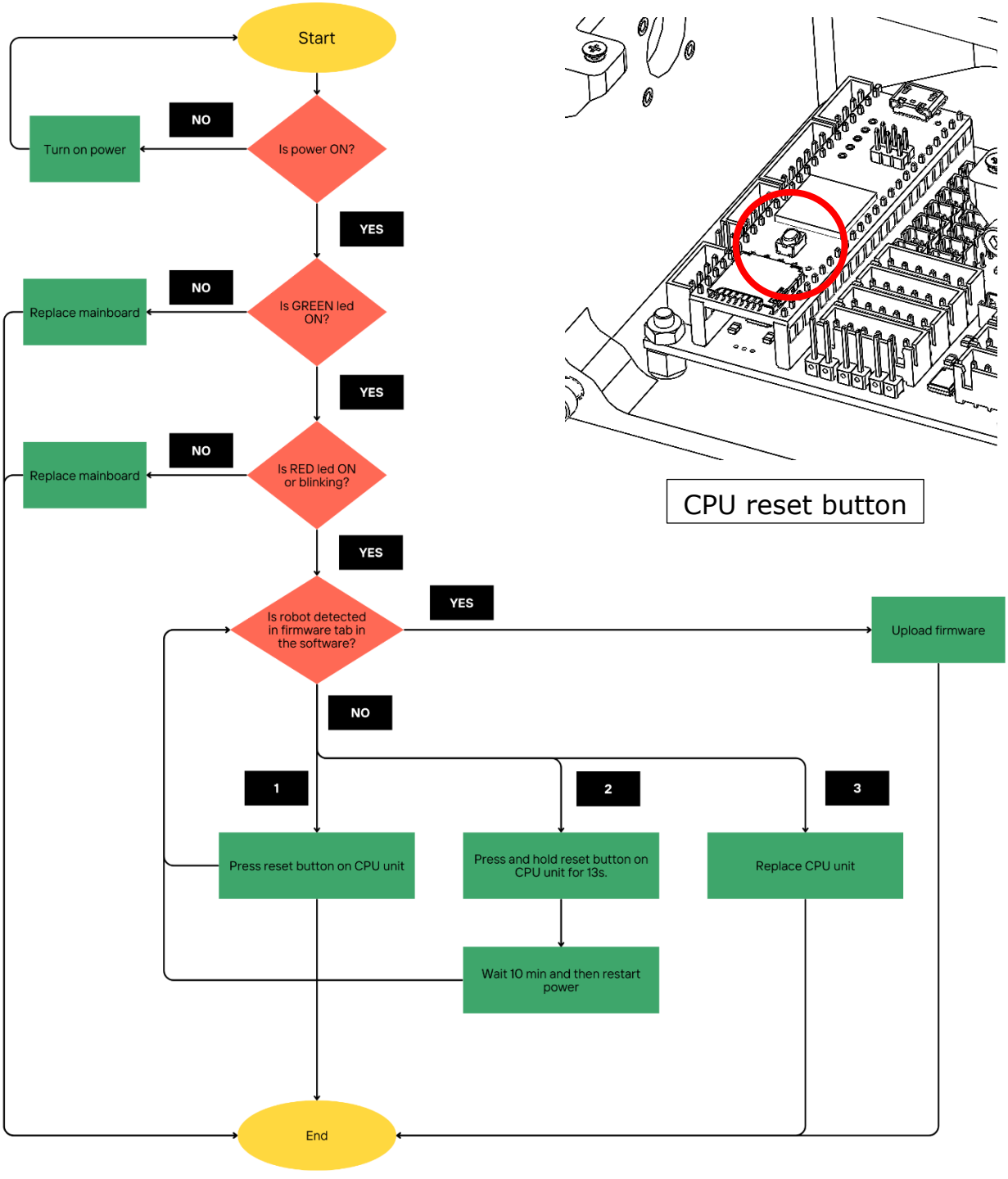
[**ATTENTION**]

Before any further actions please check if power supply is energized and connected to proper power source!

9.1 Robot cannot connect to PC



9.2 Robot is not detected by COM port



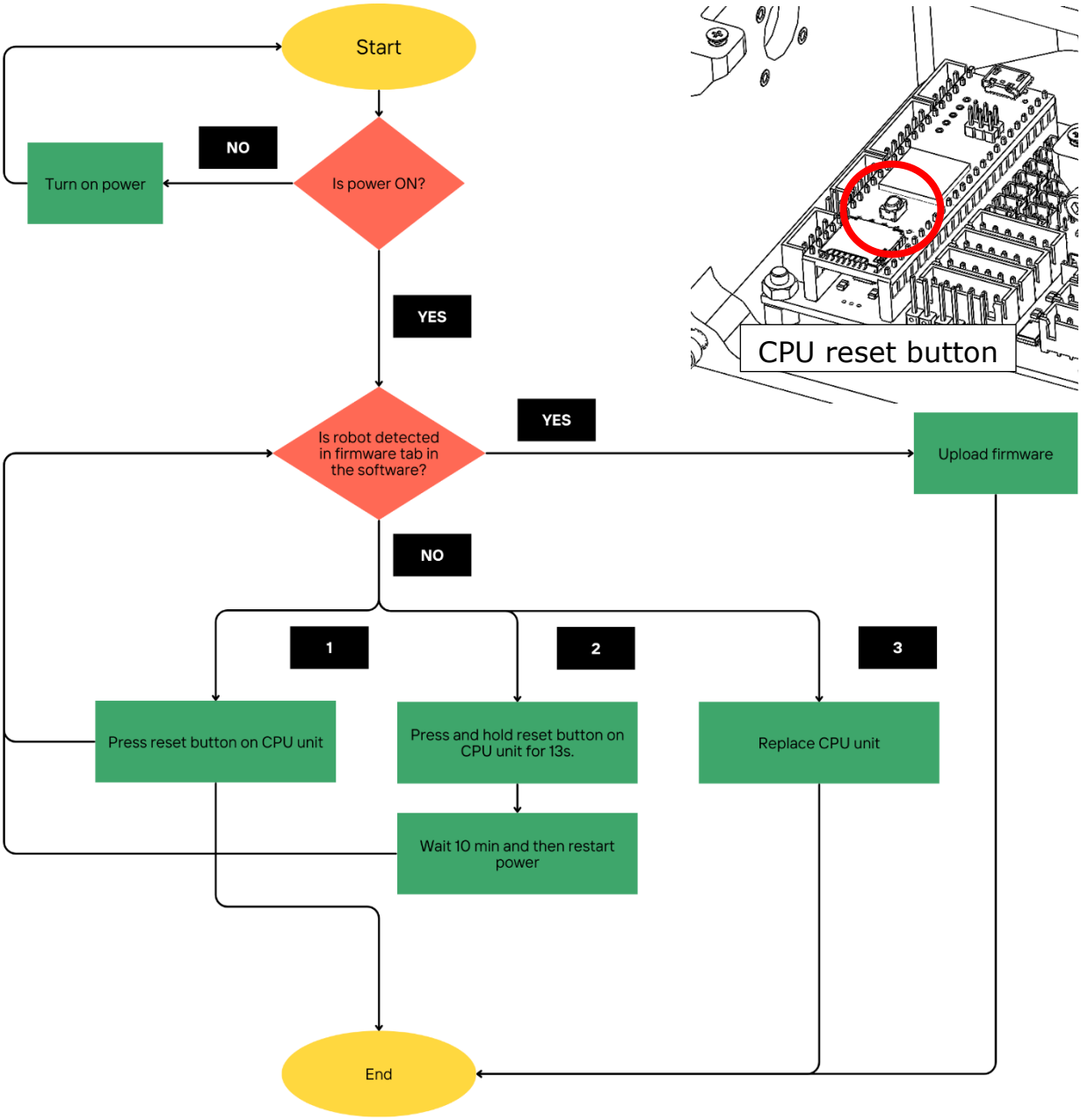
CPU reset button

9.3 Software shuts down after connection

Solution:

Update software or firmware to correct version.

9.4 Firmware upload failed



9.5 3.3V IO Module is not active

Solutions:

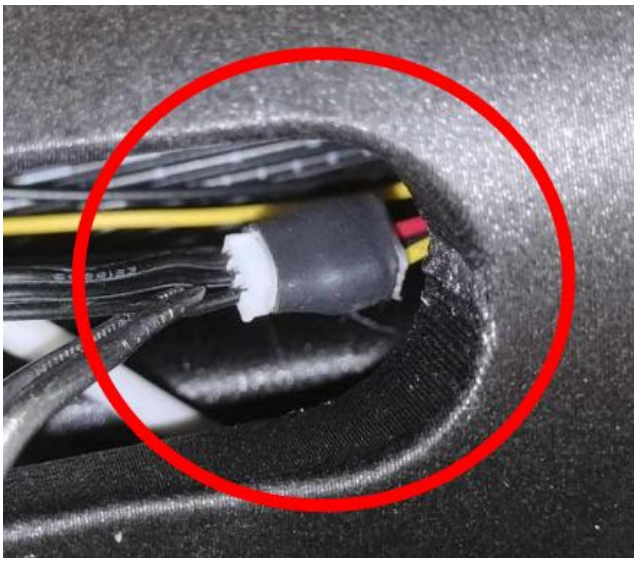
1. Connect to the robot and type in the Terminal: **ZIOACTIVE 1**
2. Check connection wires between mainboard and IO module board
3. Replace 3.3V IO module board.

9.6 Zeroing sensor is not responding

Solution:

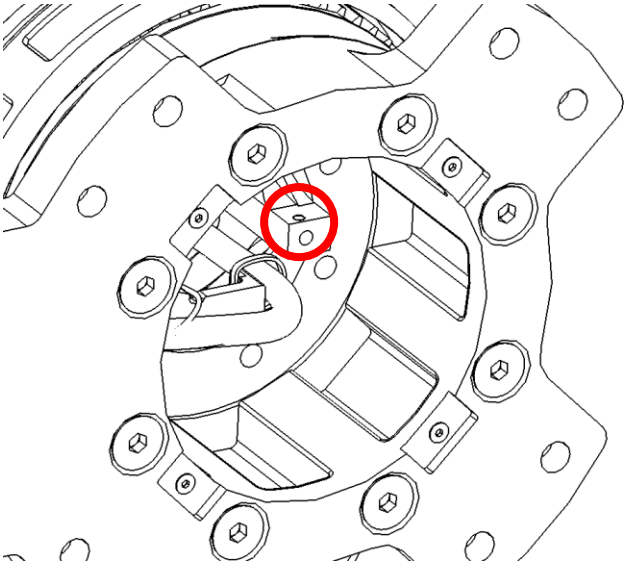
1. Check connection of wires.

2. Check proper connection of wires in the connector

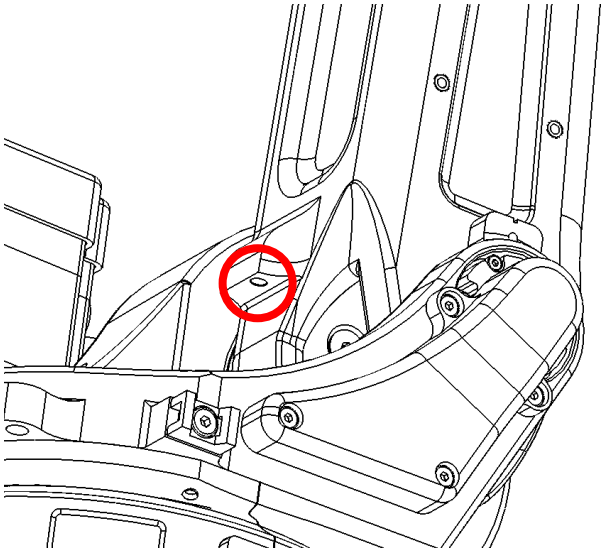


3. Check the presence of magnet on corresponding JOINT

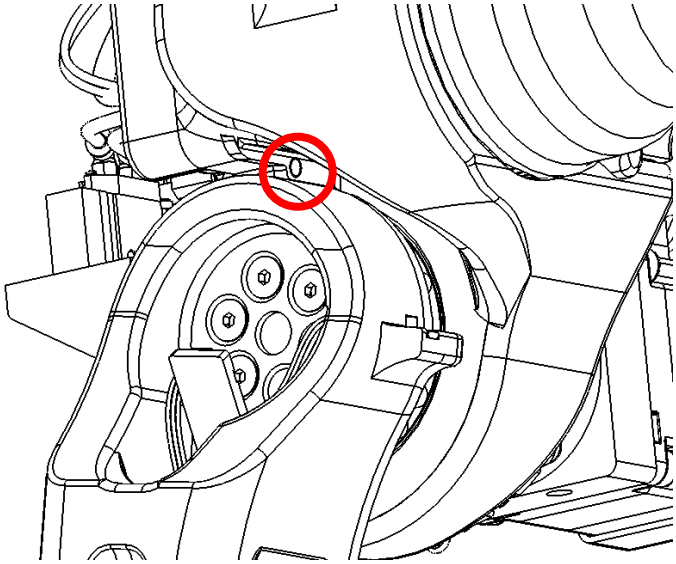
JT1



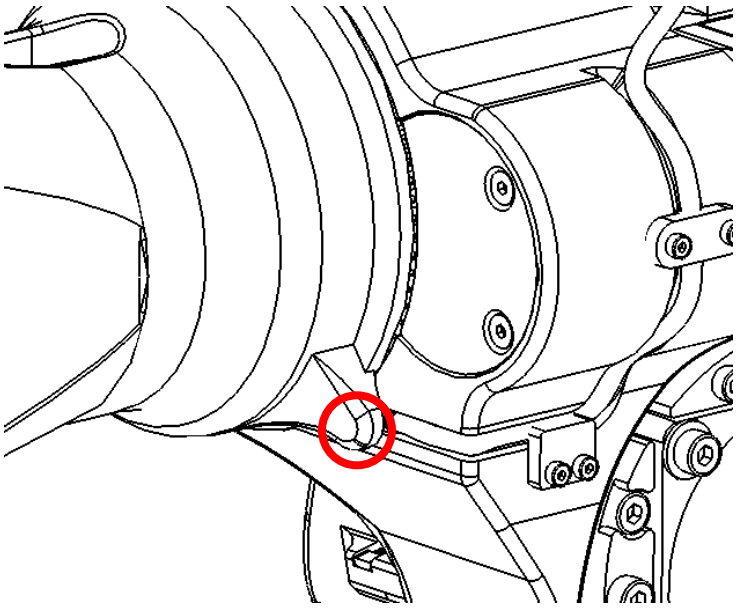
JT2



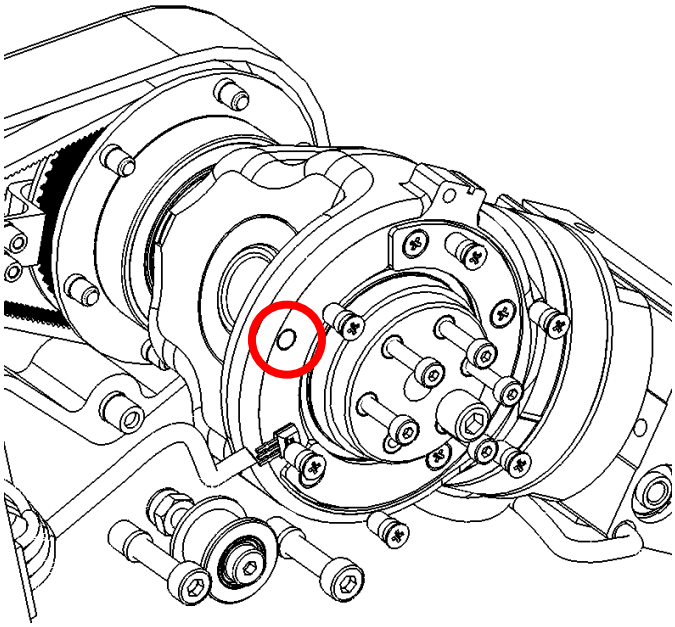
JT3



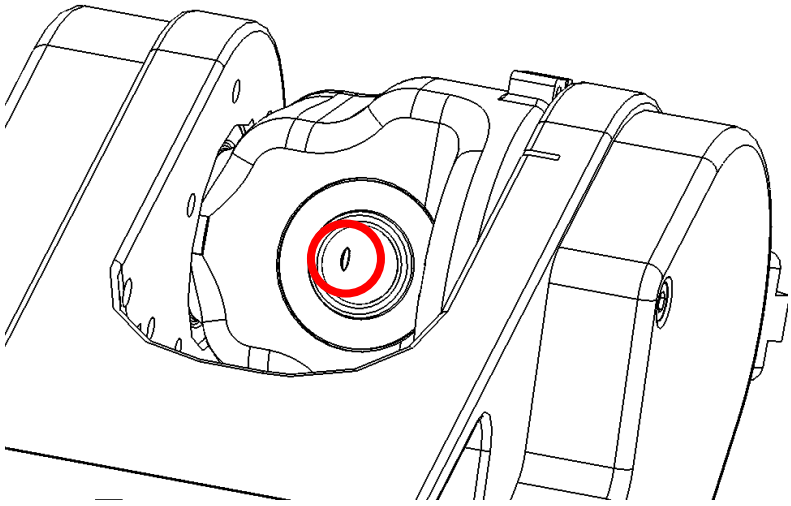
JT4



JT5



JT6



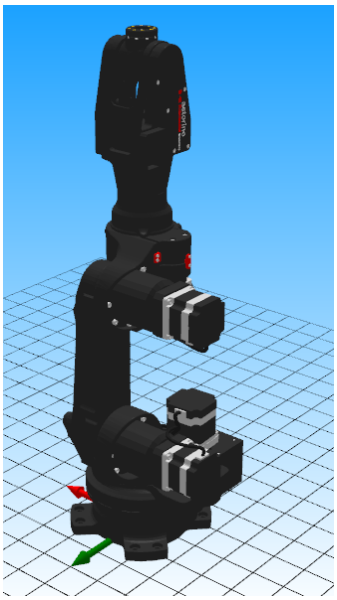
10 Motion problems

10.1 Robot do not move

Check if DryRun is active

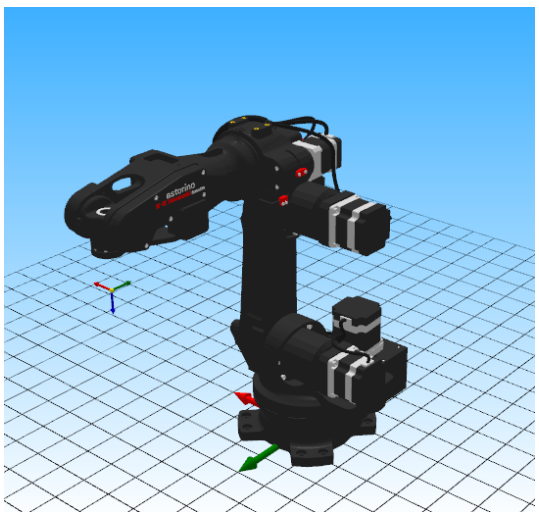
10.2 Error E099 – out of motion range

Check if robot is not in straighten vertical position



In this configuration linear motion is not possible

Move robot in JOINT mode to other position, for example:



11 Mechanical problems

11.1 JT5 or JT6 belt skips

Follow Maintenance Manual to properly tension the JT5 and JT6 belts.

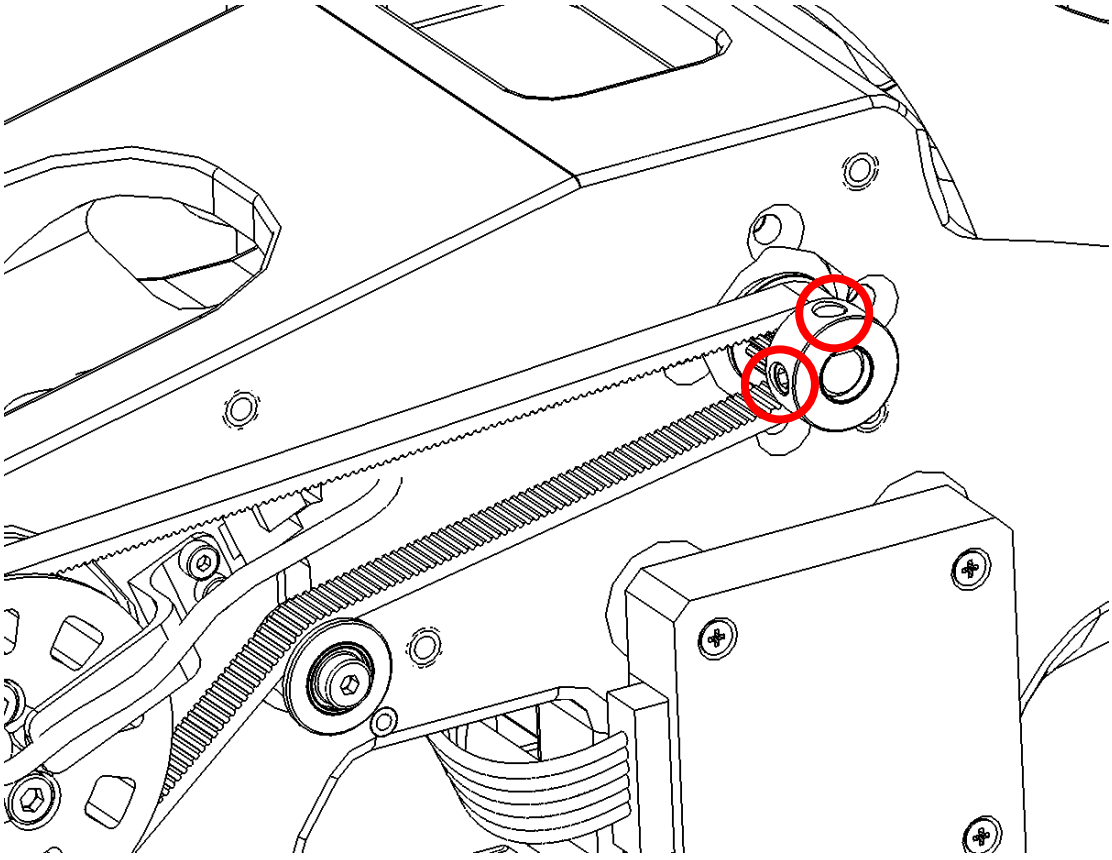
11.2 JT5 or JT6 – position inaccuracy

Check the correct tightening of the set screws in JT5 and JT6 pulleys.

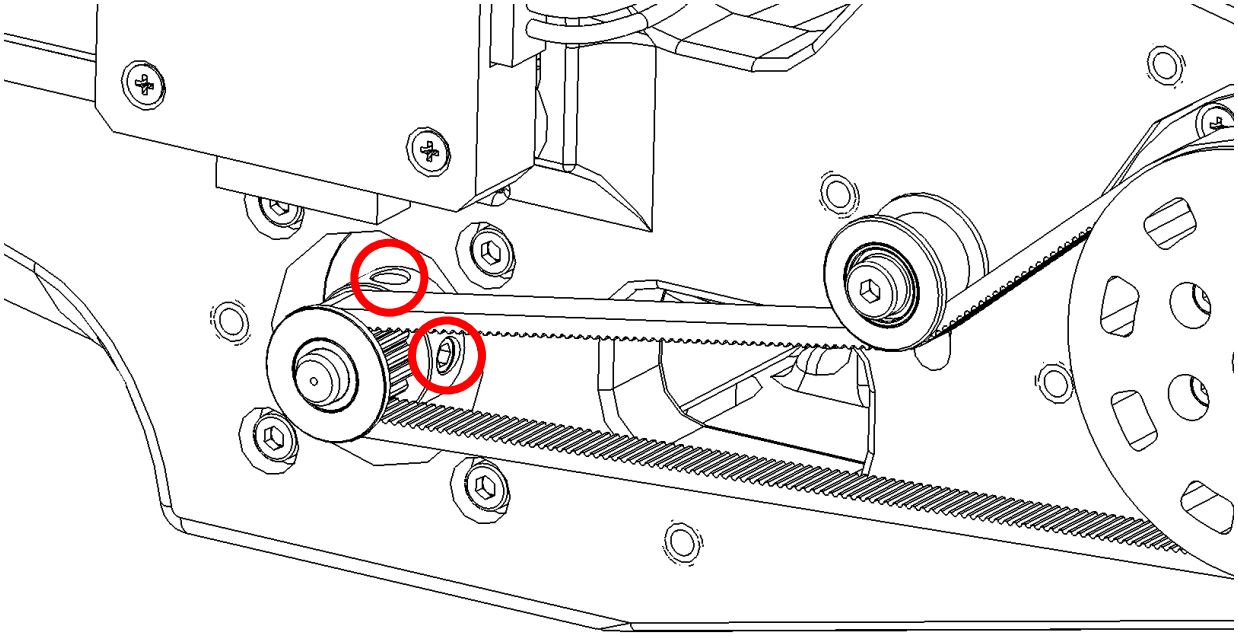
[**ATTENTION**]

Allen wrench with a ball end advised. Size 1.5mm

11.3 JT5



11.4 JT6



11.5 Backlash on any Joint

Follow Maintenance manual.

11.6 Robot do not move in a straight line and position differs from Visualisation window

To solve this problem:

- check for mechanical backlash or loosen clutches and gearboxes screws.
- If there is a backlash fallow Maintenance manual to solve this problems.
- Correct zeroing data by calibrating the arm according to 13. Calibration chapter,

12 Program Error Codes

Error Code:	E001		
Error message:	Program xxxx does not exist!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Called program do not exist		
Main cause:	Program do not saved SD card error		
Countermeasure:	Save and upload program Check SD card		

Error Code:	E002		
Error message:	Program file corrupted!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Called program file is broken		
Main cause:	Program save was interrupted SD card error		
Countermeasure:	Save and upload program Check SD card		

Error Code:	E003		
Error message:	IO module initialization failed!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	3.3V IO module response timeout		
Main cause:	Broken 3.3V IO module Internal harness disconnected		
Countermeasure:	Replace 3.3V IO module Check internal harness connection Replace CPU unit		

Error Code:	E004		
Error message:	Out off dynamic memory! Restart robot to free RAM		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	RAM memory is full		
Main cause:	Very long program code >2000 lines Lots of variables Firmware error		
Countermeasure:	Restart the robot Split long programs to multiple subroutines Optimize the use of variables Report error to KHI		

Error Code:	E005		
Error message:	Cannot nest more programs		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Too many nested subroutines		
Main cause:	Too many nested CALL subroutines		
Countermeasure:	Change programs layout		

Error Code:	E006		
Error message:	Program not found!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Called program was not found		
Main cause:	Program do not saved SD card error		
Countermeasure:	Save and upload program Check SD card		

Error Code:	E007		
Error message:	Cannot call running program		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Called program was already in execution		
Main cause:	Program do not saved SD card error		
Countermeasure:	Save and upload program Check SD card		

Error Code:	E008		
Error message:	Cannot call running program		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Called program was already in execution		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E009		
Error message:	Too many bits!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	BITS function was called with incorrect number of bits		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E010		
Error message:	Value for BITS must be positive!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	BITS function was called with incorrect values		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E011		
Error message:	$DECODE: No delimiter found in string!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	#DECODE function error		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E012		
Error message:	Point does not exist!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Called point was not saved		
Main cause:	Programming error SD card error		
Countermeasure:	Change program code Reteach correct positions Change SD card		

Error Code:	E013		
Error message:	Serial RECEIVE timeout		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Data timeout on serial port		
Main cause:	Programming error Internal harness damage Incorrect settings of an external device		
Countermeasure:	Change program code Check internal harness Check settings of an external device		

Error Code:	E014		
Error message:	Over minimum signal number!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Called signal number was out of range		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E015		
Error message:	Over maximum signal number!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Called signal number was out of range		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E016		
Error message:	Frame points too close!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	FRAME points are incorrect		
Main cause:	Programming error		
Countermeasure:	Change program code Reteach points		

Error Code:	E017		
Error message:	Cannot use dedicated signals!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Signal number used in code is set as a dedicated signal		
Main cause:	Programming error Settings error		
Countermeasure:	Change program code Change robot dedicated signals settings		

Error Code:	E018		
Error message:	Illegal signal number!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Signal number used in code is invalid		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E019		
Error message:	SDCard corrupted! Check memory card!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Signal number used in code is invalid		
Main cause:	SD card error		
Countermeasure:	Replace SD card		

Error Code:	E020		
Error message:	SDCard files error! Error Code: x		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	SD card file error, x: file code		
Main cause:	SD card error SD card file update required after firmware change		
Countermeasure:	Replace SD card Wait for auto repair function to finish		

Error Code:	E021		
Error message:	Collision detection hardware fault - Function disabled.		
Error processing :	Cycle Stop/Display	Error Reset:	Non-Acceptable
Content:	Collision detection sensor communication timeout		
Main cause:	Collision detection sensor damage, Collision detection sensor harness disconnection		
Countermeasure:	Replace collision detection sensor Check collision detection sensor harness		

Error Code:	E022		
Error message:	Collision detected. Threshold:		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Collision was detected		
Main cause:	Collision was detected Collision detection thresholds are too low		
Countermeasure:	Change program code Recalibrate collision detection thresholds		

Error Code:	E023		
Error message:	zeroing failed! Check the harness, sensor or Motor Direction!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Zeroing procedure failed		
Main cause:	Wrong calibration data Wrong motor drivers settings Zeroing sensor damage Zeroing sensor harness disconnection Zeroing magnet lost		
Countermeasure:	Recalibrate (13. Calibration)		

	Check motor drivers settings Check zeroing sensor harness Change zeroing sensor Check the presence of a magnet

Error Code:	E024		
Error message:	Conveyor cooperation data invalid		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Cooperation data is invalid		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E025		
Error message:	Time cannot be negative		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Time set in function was invalid		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E026		
Error message:	JTx calibration failed! Check the harness, sensor or Motor Direction!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Calibration procedure failed		
Main cause:	Wrong motor drivers settings Zeroing sensor damage Zeroing sensor harness disconnection Zeroing magnet lost		
Countermeasure:	Recalibrate (13. Calibration) Check motor drivers settings Check zeroing sensor harness Change zeroing sensor Check the presence of a magnet		

Error Code:	E027		
Error message:	Illegal Timer number!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Timer number set in program was invalid		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E028		
Error message:	Calibration data is missing. Cannot zero		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Timer number set in program was invalid		
Main cause:	SD card error Calibration procedure was not done		
Countermeasure:	Calibrate (13. Calibration) Replace SD card		

Error Code:	E029		
Error message:	Timer value cannot be negative!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Timer number set in program was invalid		
Main cause:	Programming error		
Countermeasure:	Change program code		

Error Code:	E030		
Error message:	Point xxxx not found!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Called point variable was not found		
Main cause:	Programming error SD card error		
Countermeasure:	Change program code Reteach correct positions Change SD card		

Error Code:	E031		
Error message:	The points are coplanar!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Points used in TOOL wizard are invalid		
Main cause:	Teaching error		
Countermeasure:	Reteach positions		

Error Code:	E032		
Error message:	Tool radius too small!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Points used in TOOL wizard are invalid		
Main cause:	Teaching error		
Countermeasure:	Reteach positions		

Error Code:	E033		
Error message:	No Points recorded!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Points used in TOOL wizard are invalid		
Main cause:	Teaching error		
Countermeasure:	Reteach positions		

Error Code:	E033		
Error message:	No Points recorded!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Points used in TOOL wizard are invalid		
Main cause:	Teaching error		
Countermeasure:	Reteach positions		

Error Code:	E034		
Error message:	No Points recorded!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Points used in TOOL wizard are invalid		
Main cause:	Teaching error		
Countermeasure:	Reteach positions		

Error Code:	E035		
Error message:	Program code error: xxxxx Line: xxxxx		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Program code error		
Main cause:	Programming error		
Countermeasure:	Correct program code		

Error Code:	E036		
Error message:	Ethernet Mode is not set to TCP/IP & UDP. Cannot use this function!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Program code error or settings error		
Main cause:	Programming error Settings error		
Countermeasure:	Correct program code Correct robot settings		

Error Code:	E037		
Error message:	Port number out of numeric range!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Program code error		
Main cause:	Programming error in TCP/IP communication programs		
Countermeasure:	Correct program code		

Error Code:	E038		
Error message:	Socket out of numeric range!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Program code error		
Main cause:	Programming error in TCP/IP communication programs		
Countermeasure:	Correct program code		

Error Code:	E039		
Error message:	IP address out of numeric range!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Program code error		
Main cause:	Programming error in TCP/IP communication programs		
Countermeasure:	Correct program code		

Error Code:	E040		
Error message:	Robot is not ready, cannot run cycle.		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Robot is not ready for work		
Main cause:	Motors are OFF Error is ON Zeroing is not done Safety circuit is open		
Countermeasure:	Check all necessary working conditions		

Error Code:	E041		
Error message:	Cannot use this function in Terminal		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Program code error		
Main cause:	Command used in Terminal is not allowed		
Countermeasure:	Correct program code		

Error Code:	E042		
Error message:	Program loading error!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Program save to SD card failed		
Main cause:	Communication error EMI interference SD card error		
Countermeasure:	Try to load again Move robot to other location Change SD card		

Error Code:	E043		
Error message:	Program not selected! Cannot load!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Program is not selected and cannot be loaded		
Main cause:	Settings error User error		
Countermeasure:	Correct current robots settings		

Error Code:	E044		
Error message:	Program is empty! Cannot load!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Empty program		
Main cause:	Programming error User error		
Countermeasure:	Correct program code		

Error Code:	E045		
Error message:	No '.END' statement, cannot load program!		
Error processing :	Cycle Stop/Display	Error Reset:	Acceptable
Content:	Program code is not complete		
Main cause:	Programming error		
Countermeasure:	Correct program code		

Error Code:	E046		
Error message:	Communication Error!		
Error processing :	Cycle Stop/Display	Error Reset:	Non-Acceptable
Content:	PC lost communication to the robot		
Main cause:	USB/Ethernet cable disconnection EMI Interference CPU damage Internal harness connection problem Firmware Error		
Countermeasure:	Check proper connection to the robot		

	Check for EMI sources near robot Change CPU unit Check internal harness connection – USB and Ethernet		
Error Code:	E047		
Error message:	Communication Errror! Connect again!		
Error processing :	Cycle Stop/Display	Error Reset:	Non-Acceptable
Content:	PC lost communication to the robot		
Main cause:	Ethernet cable disconnection EMI Interference CPU damage Internal harness connection problem		
Countermeasure:	Check proper connection to the robot Check for EMI sources near robot Change CPU unit Check internal harness connection – USB and Ethernet		
Error Code:	E048		
Error message:	Firmware update error! Try again! If the problem repeats follow the manual!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Error during firmware update		
Main cause:	USB cable disconnection PC usb error CPU damage Internal harness connection problem		
Countermeasure:	Check proper connection to the robot Try again and follow 9.4 Change CPU unit Check internal harness connection – USB and Ethernet		
Error Code:	E049		
Error message:	Firmware Mismatch!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Firmware file is corrupted Wrong firmware file		
Main cause:	Firmware file is corrupted		
Countermeasure:	Download firmware again		
Error Code:	E050		
Error message:	Reboot Error!		
Error processing :	Display	Error Reset:	Acceptable
Content:	CPU did not restart after firmware update		
Main cause:	CPU problem		
Countermeasure:	Restart power		
Error Code:	E051		
Error message:	Reset Error!		
Error processing :	Display	Error Reset:	Acceptable
Content:	CPU did not respond to reset signal		
Main cause:	CPU problem		
Countermeasure:	Restart power		

Error Code:	E052		
Error message:	HIDCom Error!		
Error processing :	Display	Error Reset:	Acceptable
Content:	PC did not detect USB device		
Main cause:	PC USB driver problem		
Countermeasure:	Restart PC		

Error Code:	E053		
Error message:	Upload Timeout!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Timeout during upload		
Main cause:	PC USB driver problem PC USB HUB problem		
Countermeasure:	Restart PC Connect directly to the PC without USB HUB		

Error Code:	E054		
Error message:	Serial blocked!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Serial port is blocked by other process		
Main cause:	Robot is connected to other PC or program		
Countermeasure:	Disconnect from PC or application		

Error Code:	E055		
Error message:	No Serial!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Serial port is blocked by other process		
Main cause:	Robot is connected to other PC or program CPU unit is damaged		
Countermeasure:	Disconnect from PC or application Restart PC Restart astorino		

Error Code:	E056		
Error message:	Unexpected Error!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Other problem, not recognised		
Main cause:	PC USB driver failure		
Countermeasure:	Restart PC Restart astorino		

Error Code:	E057		
Error message:	File does not exist!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Firmware file is corrupted		
Main cause:	Firmware file is corrupted		
Countermeasure:	Download firmware again		

Error Code:	E058		
Error message:	Zeroing is not done - cannot change position!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Cannot change power off position because zeroing is not done		
Main cause:	Zeroing is not done		
Countermeasure:	Start zeroing process		

Error Code:	E059		
Error message:	Program loading error - '.END' not found!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Error in downloading program from robot to PC		
Main cause:	USB/Ethernet cable disconnection EMI Interference CPU damage Internal harness connection problem SD card error		
Countermeasure:	Check proper connection to the robot Check for EMI sources near robot Change CPU unit Change SD card Check internal harness connection – USB and Ethernet		

Error Code:	E060		
Error message:	Incompatible firmware! Please update the PC software!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Firmware and software version do not match		
Main cause:	Firmware and software version do not match		
Countermeasure:	Update software or firmware		

Error Code:	E061		
Error message:	Program is not selected. Cannot start Cycle!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Cannot start Cycle, no program is seleted		
Main cause:	Settings error Programming error User error		
Countermeasure:	Select program		

Error Code:	E062		
Error message:	DeadMan trigger released!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	DeadMan switch was released during motion		
Main cause:	User action		
Countermeasure:	User training		

Error Code:	E063		
Error message:	Frame angle too narrow or too big! (90deg +/-3)		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Programming error in FRAME function		
Main cause:	Programming error		
Countermeasure:	Reteach points Fix robot code User training		

Error Code:	E064		
Error message:	Not all Frame points recorded! Cannot calculate!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Programming error in FRAME function		
Main cause:	Programming error		
Countermeasure:	Reteach points Fix robot code User training		

Error Code:	E065		
Error message:	Mode was switched during movement!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Teach/Repeat switch was changed during movemnts		
Main cause:	User intervention		
Countermeasure:	User training		

Error Code:	E066		
Error message:	7th axis is not activated!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	7^{th} axis action was requested but it is not enabled		
Main cause:	Settings error Programming error		
Countermeasure:	Fix settings Correct program code		

Error Code:	E067		
Error message:	RECEIVE buffer overflow - max 128 bytes!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Too much data was send to serial port		
Main cause:	Programming error External device settings error		
Countermeasure:	Correct program code Correct external device settings		

Error Code:	E068		
Error message:	FRAME point error, use only cartesian points!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Programming error in FRAME function		
Main cause:	Programming error		
Countermeasure:	Reteach points Fix robot code User training		

Error Code:	E069		
Error message:	Incompatible firmware! Please check the file again!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Incompatible firmware file		
Main cause:	Incompatible firmware file Mixed files between TP and robot		
Countermeasure:	Select correct firmware file		

Error Code:	E070		
Error message:	Incompatible firmware! Please check the file again!		
Error processing :	Display	Error Reset:	Acceptable
Content:	Incompatible firmware file		
Main cause:	Incompatible firmware file Mixed files between TP and robot		
Countermeasure:	Select correct firmware file		

Error Code:	E071		
Error message:	IO module communication error!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	IO module communication timeout		
Main cause:	3.3V IO module damage Internal harness disconnection		
Countermeasure:	Check internal harness Replace 3.3V IO module		

Error Code:	E072		
Error message:	Trajectory error! Acceleration too big!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Requested path results in too big accelerations		
Main cause:	Programming error		
Countermeasure:	Correct program code Reteach points		

Error Code:	E073		
Error message:	Channel is not selected!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Wrong configuration of Modbus settings		
Main cause:	Settings error		
Countermeasure:	Correct settings		

Error Code:	E074		
Error message:	Too many registers!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Wrong configuration of Modbus settings		
Main cause:	Settings error		
Countermeasure:	Correct settings		

Error Code:	E075		
Error message:	Buffer overflow - max 128 bytes!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable

Content:	Data received overflow the receive buffer – Serial & TCP/IP		
Main cause:	Data too large External device configuration problem Programming error		
Countermeasure:	Correct settings Correct code		

Error Code:	E076		
Error message:	Too many ONI interrupts!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	ONI command used more that 3 times		
Main cause:	Programming error		
Countermeasure:	Correct settings Correct code		

Error Code:	E087		
Error message:	Motion command was cancelled!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Motion was canceled by dedicated signal external user of function		
Main cause:	User intervention		
Countermeasure:	User training		

Error Code:	E088		
Error message:	Emergency stop triggered by external user!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Emergency stop command was sent by external user via communication protocol		
Main cause:	User intervention		
Countermeasure:	User training		

Error Code:	E089		
Error message:	Safety fence is open!		
Error processing :	Cycle stop/Display	Error Reset:	Non-Acceptable
Content:	Safety fence inputs are open		
Main cause:	Hardware fault		
Countermeasure:	Fix safety inputs Replace motherboard		

Error Code:	E090		
Error message:	Emergency Stop!		
Error processing :	Cycle stop/Display	Error Reset:	Non-Acceptable
Content:	Emergency stop inputs are open		
Main cause:	Hardware fault		
Countermeasure:	Fix safety inputs Replace motherboard		

Error Code:	E091		
Error message:	Use C1MOVE first		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable

Content:	Programming error in an arc motion
Main cause:	Programming error
Countermeasure:	Correct program code

Error Code:	E092		
Error message:	TOOL number out of range!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Programming error in Tool selection		
Main cause:	Programming error		
Countermeasure:	Correct program code		

Error Code:	E093		
Error message:	Cannot create arc path!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Robot cannot create arc path		
Main cause:	Programming error		
Countermeasure:	Correct program code Reteach points Move the robot in Teach mode to other position using JOINT mode		

Error Code:	E094		
Error message:	Cannot create line path!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Robot cannot create linear path		
Main cause:	Programming error		
Countermeasure:	Correct program code Reteach points Move the robot in Teach mode to other position using JOINT mode		

Error Code:	E095		
Error message:	Cannot create an ARC! Points too close!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Robot cannot create arc path		
Main cause:	Programming error		
Countermeasure:	Correct program code Reteach points Move the robot in Teach mode to other position using JOINT mode		

Error Code:	E097		
Error message:	JT command suddenly changed!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Robot cannot create arc path		
Main cause:	Programming error Fast movement close to singularity point		

	Firmware error		
Countermeasure:	Correct program code Reteach points		

Error Code:	E098		
Error message:	Out of Working Space range!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Robots TCP point is out of set working space		
Main cause:	Programming error User error		
Countermeasure:	Correct program code Reteach points Move the robot in Teach mode to other position		

Error Code:	E099		
Error message:	Out of motion range!		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	Robots TCP point is out of motion range		
Main cause:	Programming error User error		
Countermeasure:	Correct program code Reteach points Move the robot in Teach mode to other position		

Error Code:	E100-139		
Error message:	Appendix I		
Error processing :	Cycle stop/Display	Error Reset:	Acceptable
Content:	AS language parser error		
Main cause:	Programming error		
Countermeasure:	Correct program code		

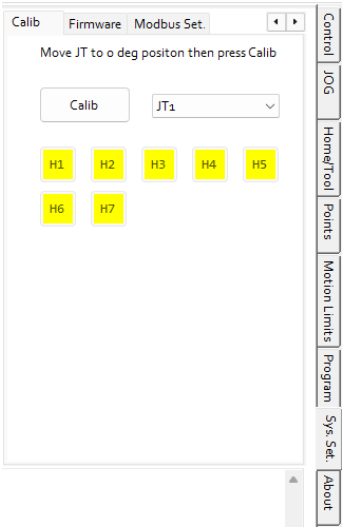
13 Calibration

⚠ WARNING

Calibration of axes must be done only after changing the 3d printed parts or after the first assembly. This procedure must be done by authorized personnel!

Calibration is critical for the robot to function properly!

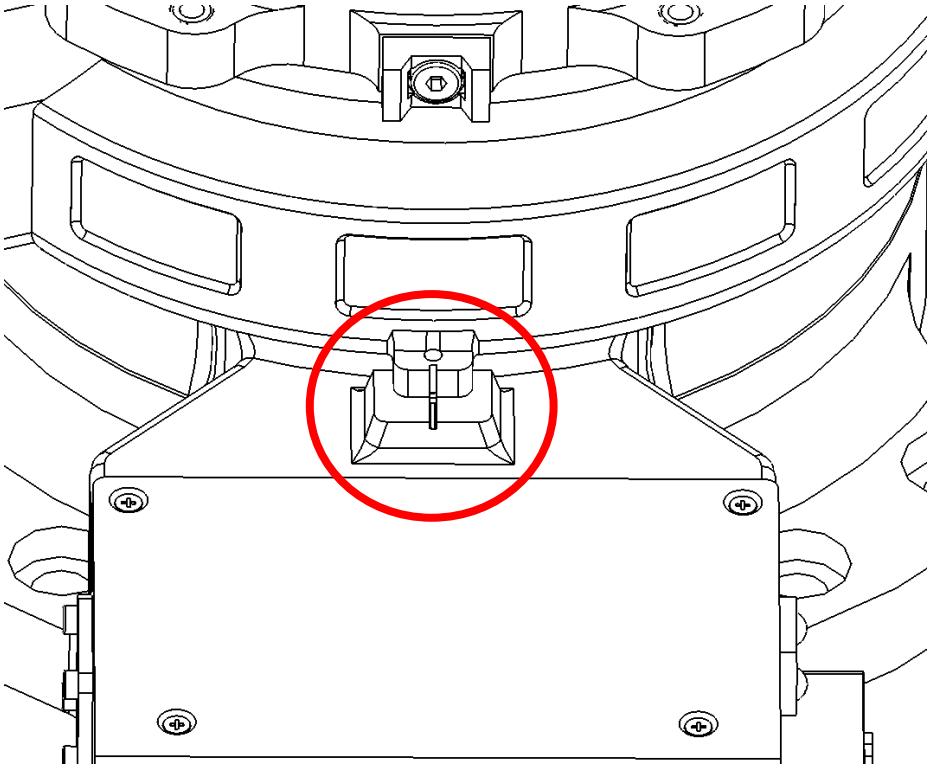
Preparation:



1. Turn on the robot
2. Connect to the robot via PC
3. Go to Sys. Set tab page
4. Type in in the Terminal command: **z_user 3**

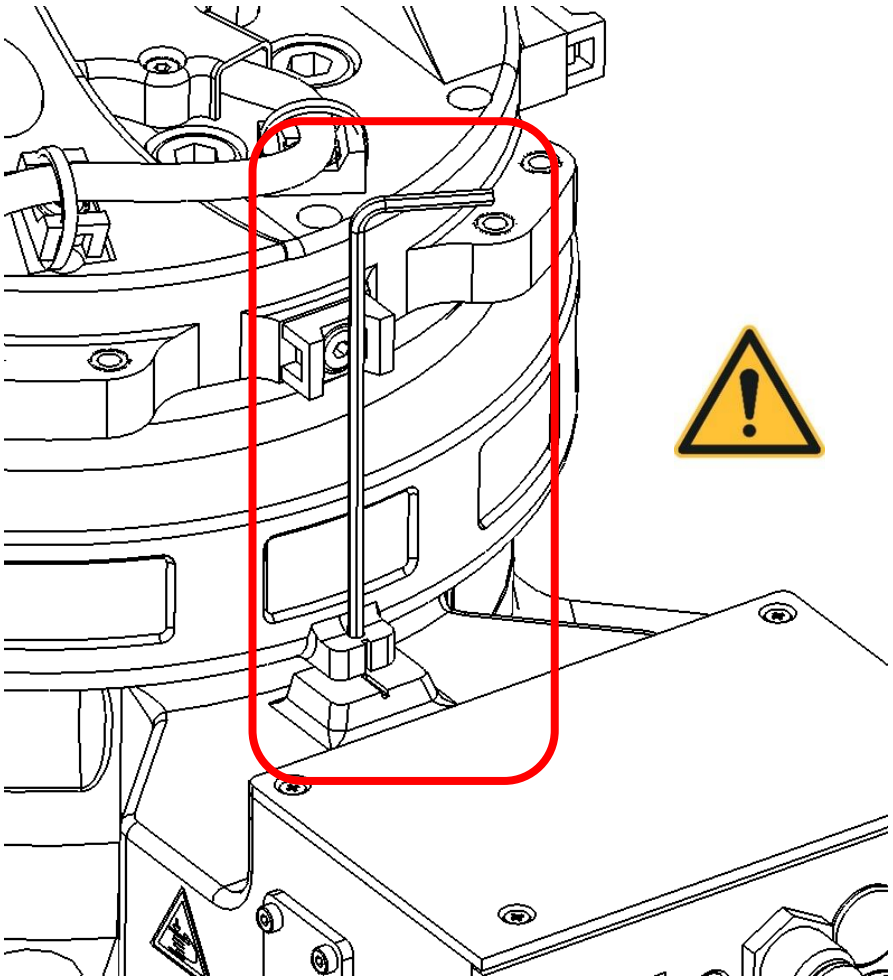
13.1 JT1

1. Move JT1 to zero position by hand:



[**HINT**]

You can use 2.5mm drill or 2mm hex Allen wrench to find zeroing position (increases the zeroing accuracy)



2. Turn on the motors and press RESET – Zeroing should be flashing

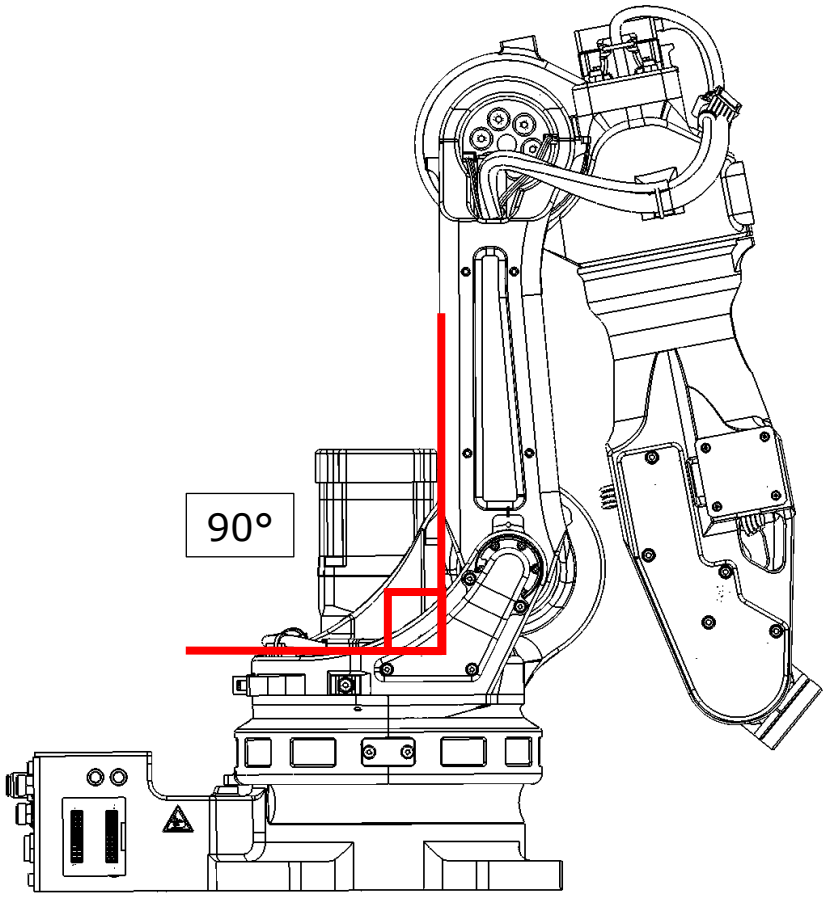
[**ATTENTION**]

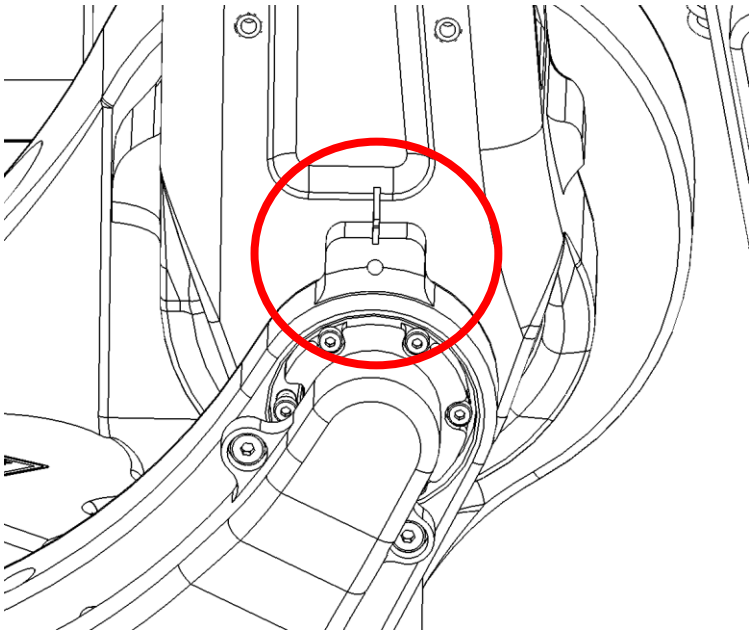
If you used drill or Allen wrench remove it before pressing CALIB

3. From calibration menu choose JT1, then press CALIB. Robot will move slowly to the zeroing sensor.
4. Hold the robot and turn off the motors.
5. Calibration of JT1 is done.

13.2 JT2

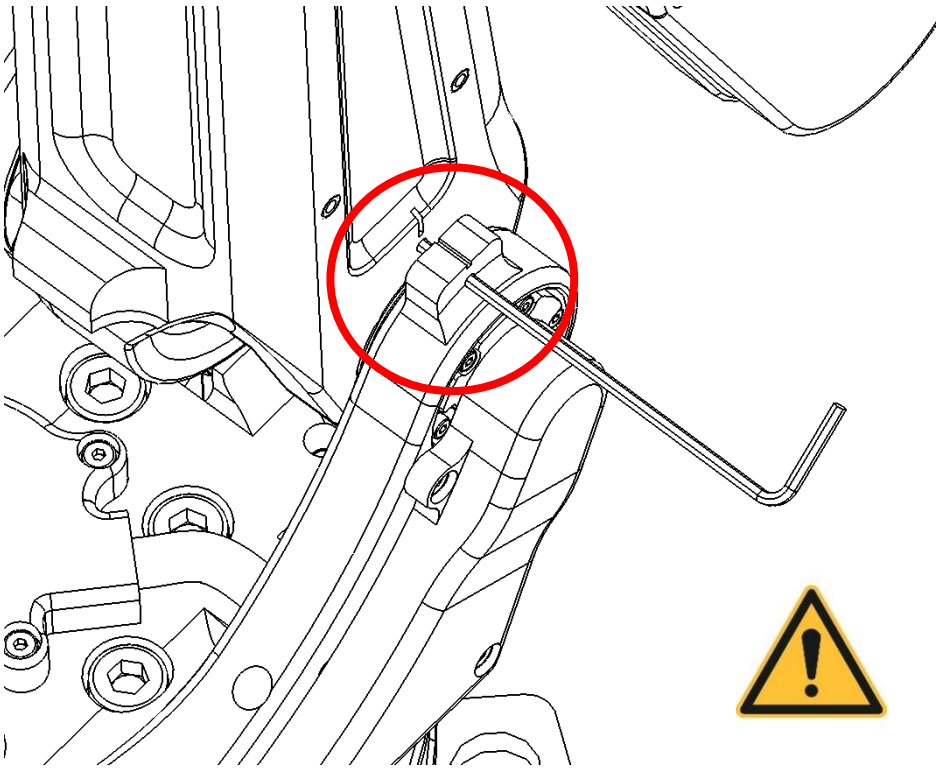
1. Move JT2 to zero position by hand:

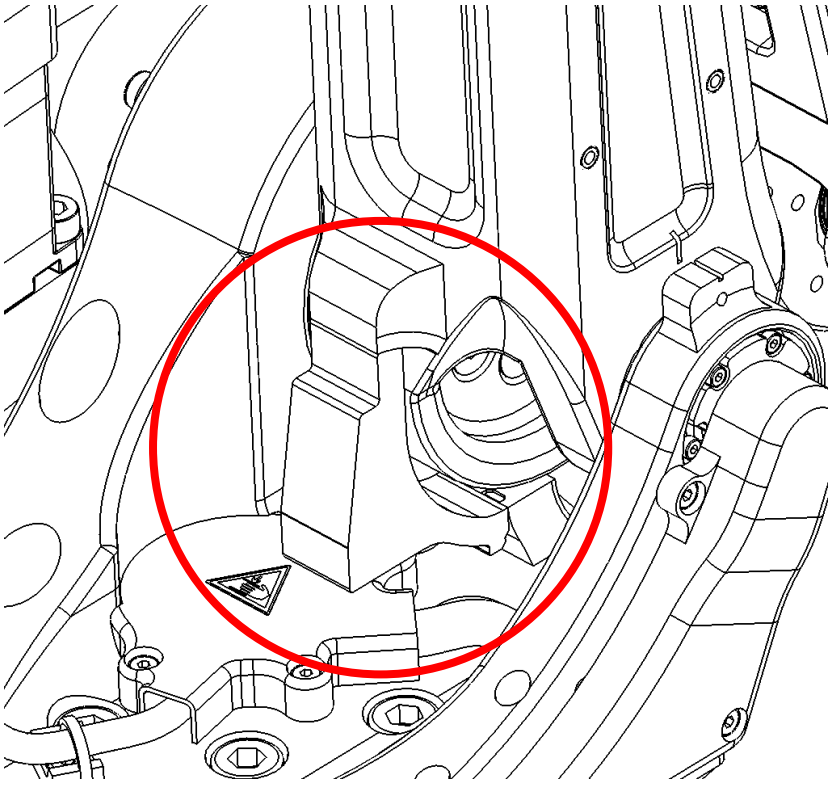




[**HINT**]

You can use 2.5mm drill or 2mm hex Allen wrench or zeroing 3D printed JIG to find zeroing position (increases the zeroing accuracy)





2. Turn on the motors and press RESET – zeroing should be flashing

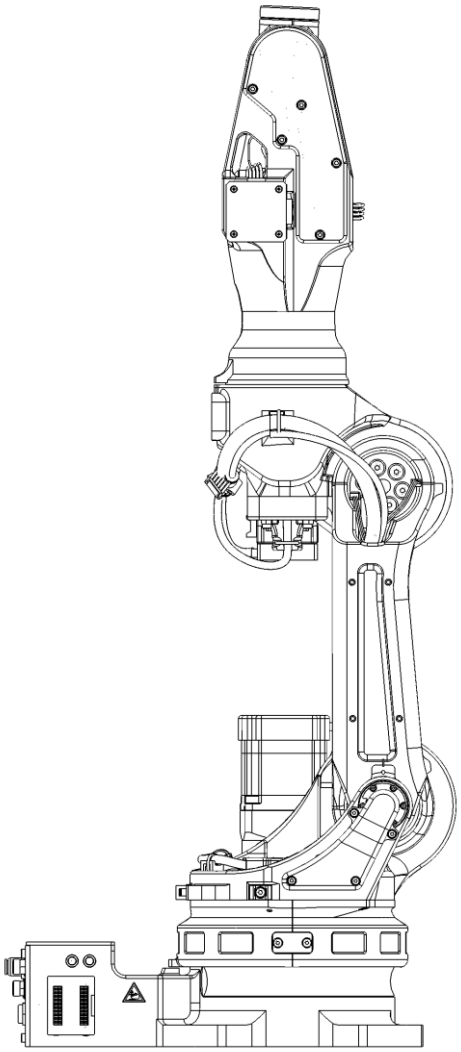
[**ATTENTION**]

If you used drill or Allen wrench or zeroing JIG remove it before pressing CALIB

3. From calibration menu choose JT2, then press CALIB. Robot will move slowly to the zeroing sensor.
4. Hold the robot and turn off the motors.
5. Calibration of JT2 is done.

13.3 JT3

1. Move JT3 to zero position by hand:



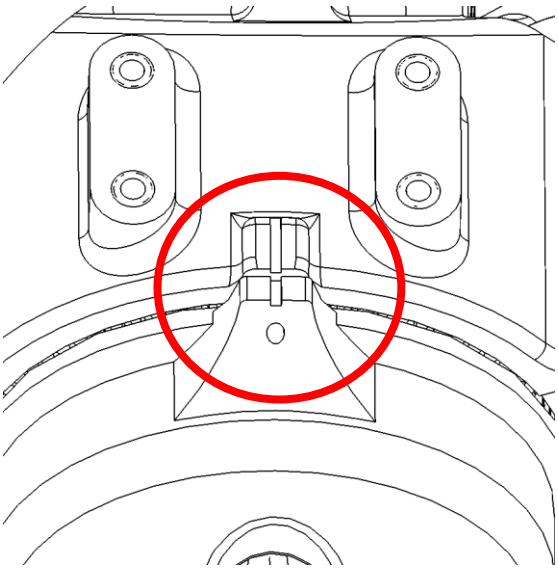
[**ATTENTION**]

JT3 should touch the limit stop

2. Turn on the motors and press RESET – zeroing should be flashing
3. From calibration menu choose JT3, then press CALIB. Robot will move slowly to the zeroing sensor.
4. Hold the robot and turn off the motors.
5. Calibration of JT3 is done.

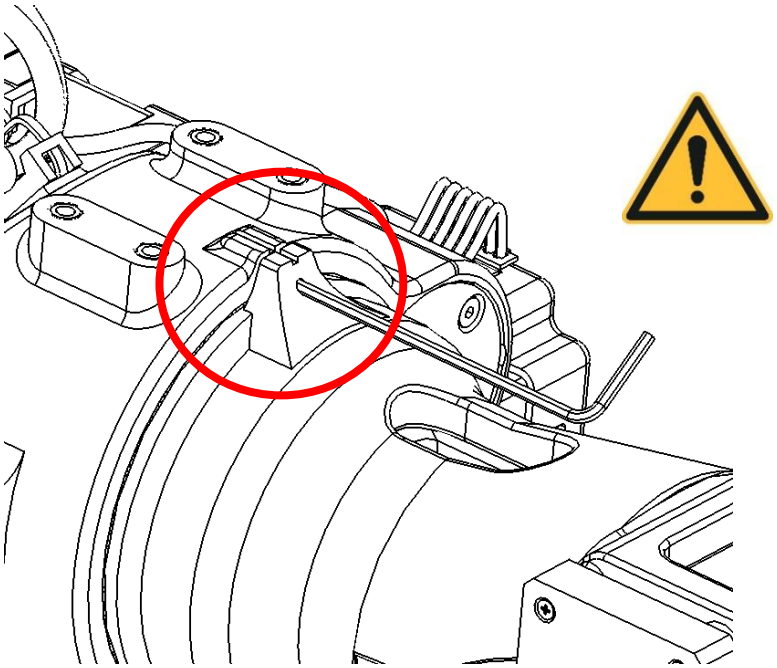
13.4 JT4

1. Move JT4 to zero position by hand:



[HINT]

You can use 2.5mm drill or 2mm hex Allen wrench to find zeroing position (increases the zeroing accuracy)



2. Turn on the motors and press RESET – zeroing should be flashing

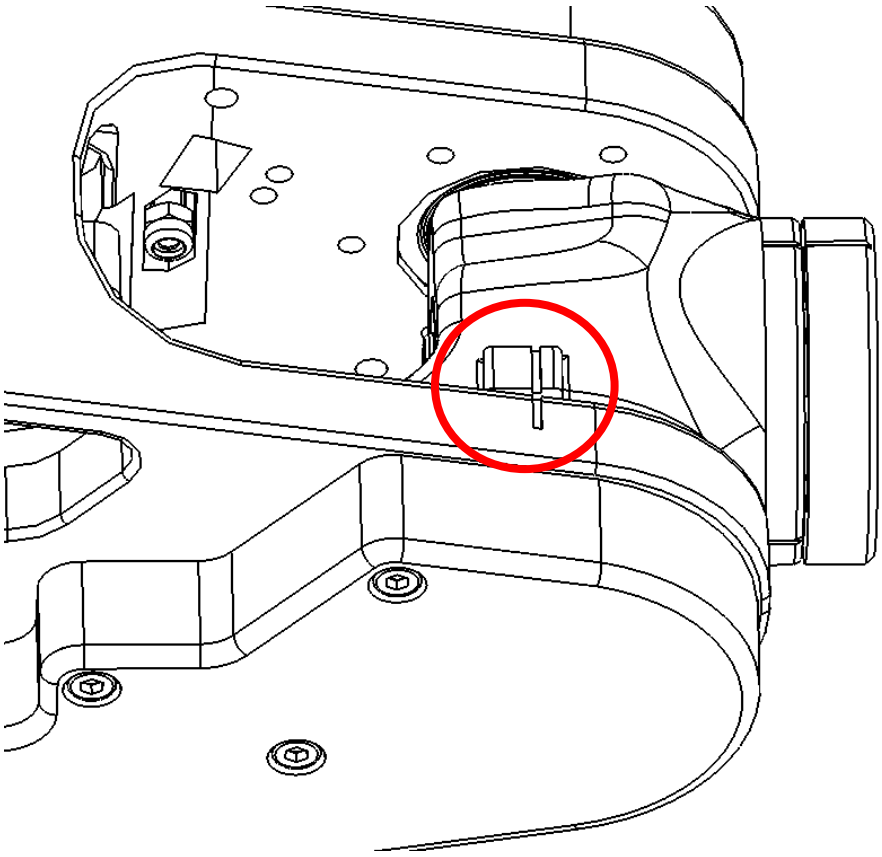
[**ATTENTION**]

If you used drill or Allen wrench remove it before pressing CALIB

3. From calibration menu choose JT4, then press CALIB. Robot will move slowly to the zeroing sensor.
4. Hold the robot and turn off the motors.
5. Calibration of JT4 is done.

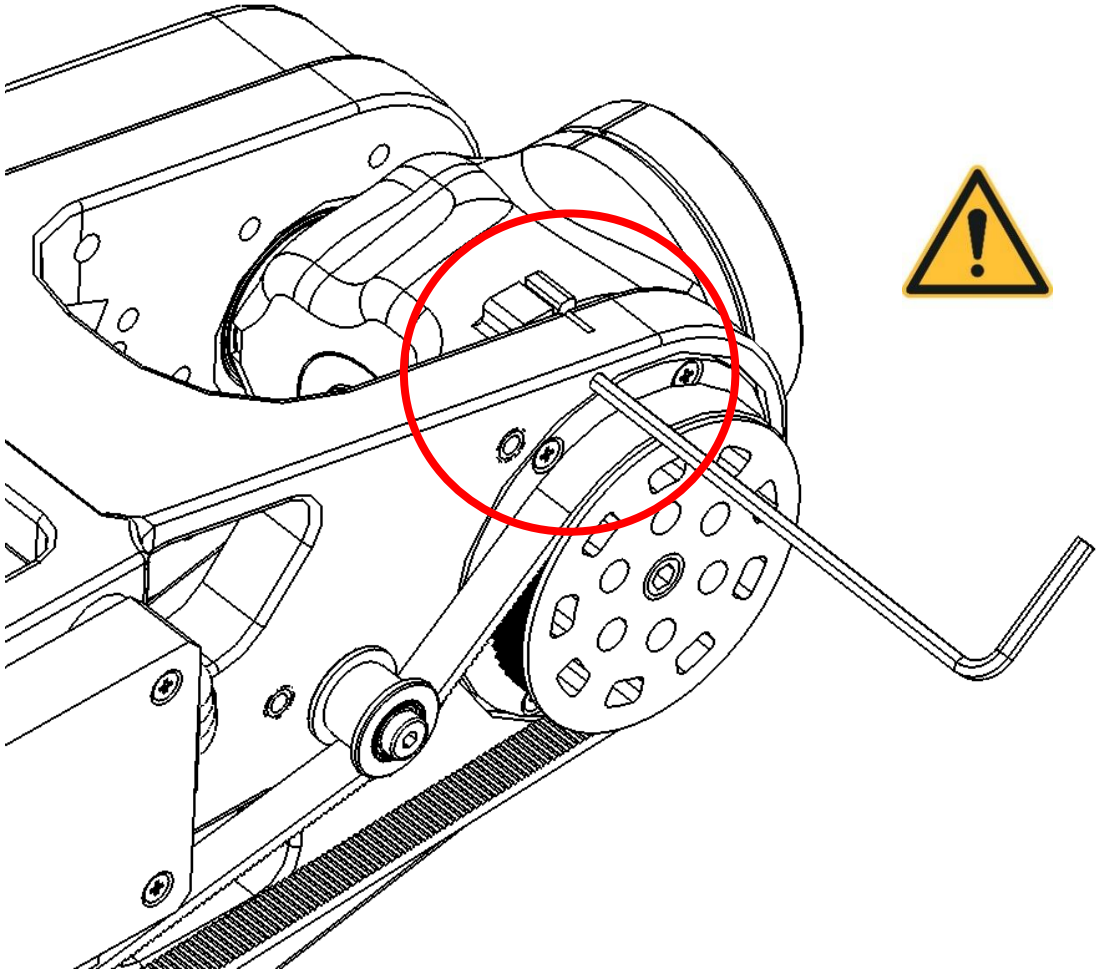
13.5 JT5

1. Move JT5 to zero position by hand:



[HINT]

You can use 1 or 1.5mm drill or 1.5mm hex Allen wrench to find zeroing position – remove the JT6 motor cover



2. Turn on the motors and press RESET – zeroing should be flashing

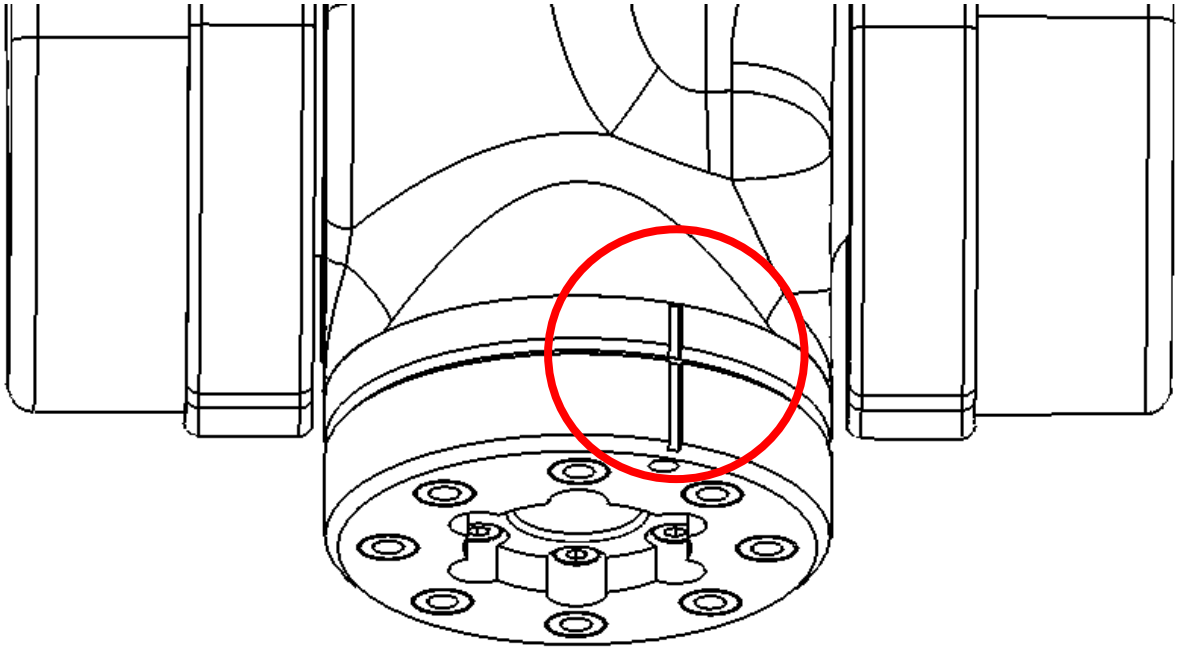
[ATTENTION]

If you used drill or Allen wrench remove it before pressing CALIB

3. From calibration menu choose JT5, then press CALIB. Robot will move slowly to the zeroing sensor.
4. Hold the robot and turn off the motors.
5. Calibration of JT5 is done.

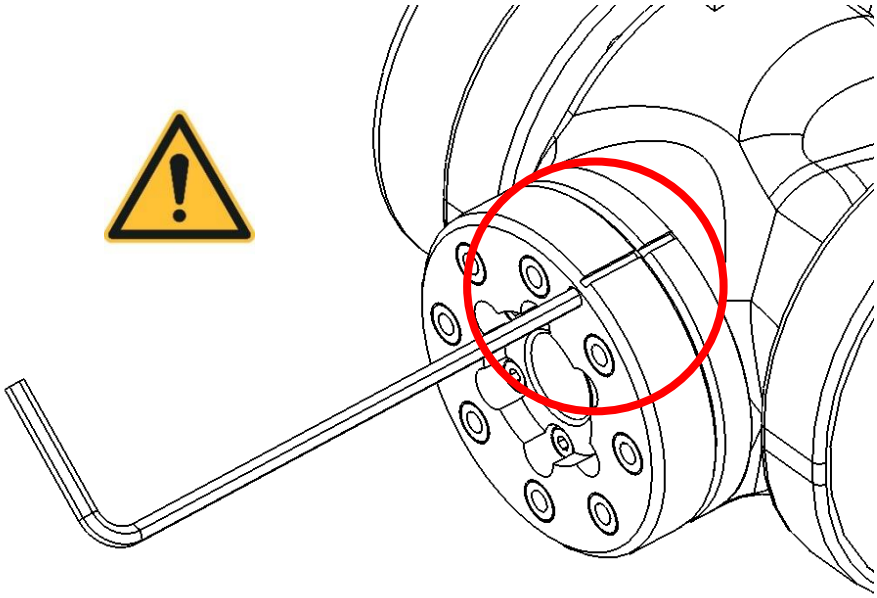
13.6 JT6

1. Move JT6 to zero position by hand:



[HINT]

You can use 1 or 1.5mm drill or 1.5mm hex Allen wrench to find zeroing position – remove the JT6 motor cover



2. Turn on the motors and press RESET – zeroing should be flashing

[**ATTENTION**]

If you used drill or Allen wrench remove it before pressing CALIB

3. From calibration menu choose JT6, then press CALIB. Robot will move slowly to the zeroing sensor.
4. Hold the robot and turn off the motors.
5. Calibration of JT6 is done.

13.7 Post Calibration

After calibration please restart the robot. And run standard zeroing procedure

[**ATTENTION**]

If you used drill or alan wrench remove it before pressing CALIB

13.8 Error Handling

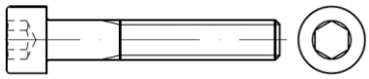
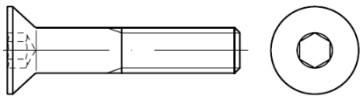
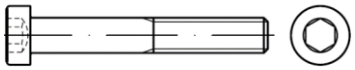
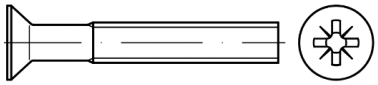
Error	Solution
Calibration data is missing or data is incorrect. Cannot zero!	Calibrate axis again – check for mechanical backlash
JTx calibration failed! Check the harness, sensor or Motor Direction!	Check proper motor driver settings, check sensor connection

14 Spare parts list

Norm/name		BASE	JT1	JT2	JT3	JT4	JT5/ JT6	SUM
Threaded sleeve 	BN1936 M2	12	7			33	6	58
	BN1936 M3	8	15	4	5	19	13	64
	BN1936 M4		20		16	5		41
Magnets 	3x2						2	2
	4x3		1	1	1	1		4
Hall sensor	Hall Sensor Honey-well SS41 	1	1	1	1	1	1	6
M2 screws	DIN 965 M2x5 ST	4				20		24
	DIN 912 M2x5						2	2
	DIN 912 M2x6	16			4	9	9	38
	DIN 912 M2x8			6				6
	DIN 912 M2x12					2	6	8
	DIN 7991 M2X16 ST	4						4
	DIN 912 M2x20	1					9	10
M2.5 screws	DIN 912 M2.5x10					4		4
M3 screws	DIN 912 M3x6	6		2	3	4		15
	DIN 7991 M3X6 ST	3						3
	DIN 7984 M3x6		4		2			6
	DIN 912 M3X8		4					4
	DIN 7991 M3x8 ST	6			2			8
	DIN 912 M3x10		3	2				5
	DIN 7984 M3x12		2					2
	DIN 912 M3x16		6			10		16
	DIN 7991 M3x18 ST		4	4	4			12
	DIN 912 M3x20						5	5
	DIN603 M3X20 „GRZYBEK"						2	2
	DIN 912 M3X25			4	4			8
	DIN 7991 M3x35 ST					9		9

Norm/name		BASE	JT1	JT2	JT3	JT4	JT5/ JT6	SUM
M4 screws	DIN 912 M4x12		4	8	8			20
	DIN 7991 M4X12 ST		1					1
	DIN 912 M4X14		4					4
	DIN 912 M4x20				3			3
	DIN 7991 M4x20 ST					5		5
	DIN 912 M4X25			4	4			8
	DIN 912 M4x35		2					2
M5 screws	DIN 7991M5x25 ST			6	6			12
	DIN 912 M5X10			4	4			8
M8 screws	DIN 912 M8x20		1					1
	DIN 912 M8x50		7					7
	DIN 7991 M8x70 ST	8						8
Set screw	ISO 4026 M3x4-N 						2	2
Self locking nut	ISO 7040-M3-N 					2		2
Threaded spacer sleeve	211x06 DREMEC 					8		8
Washer M4	ISO 7089-4 		4					4
Washer M3							2	2

14.1 Screws description

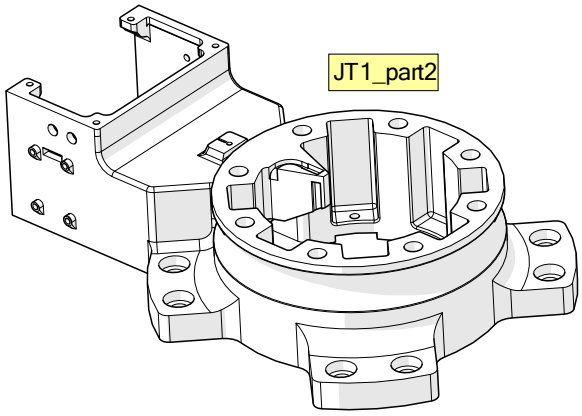
Norm	Description
DIN 912	Hexagon socket head cap screw 
DIN 7991	Hexagon socket countersunk head screw 
DIN 7984	Hexagon socket cap screw with depressed head 
DIN 965	Countersunk head screw with Phillips recess 

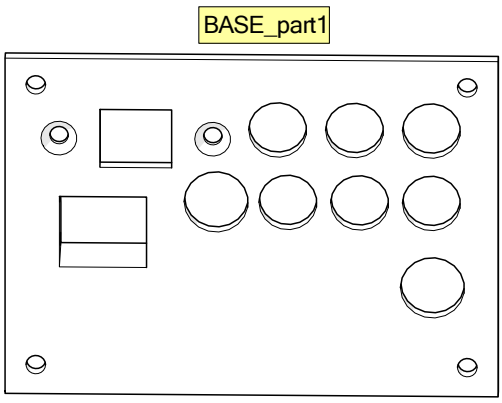
14.2 Bearings

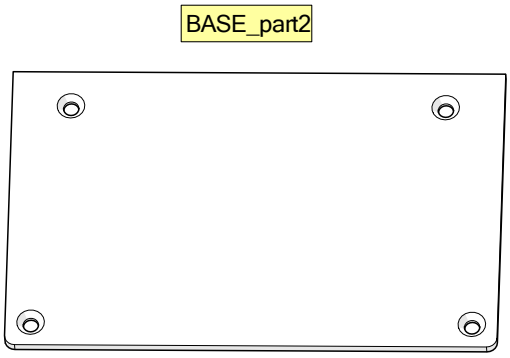
Bearing type	BASE	JT1	JT2	JT3	JT4	JT5/ JT6	SUM
6802-RS		2					2
61804-2RZ			1				1
61807-2RS					1		1
61810-2RS					1		1
618042 RS1						2	2
618052 RS1						2	2
011.10.100	1						1

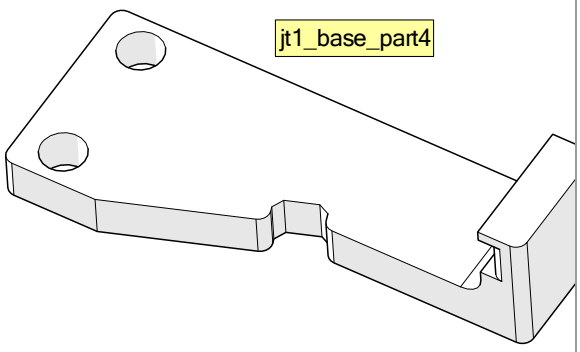
14.3 3D printed parts

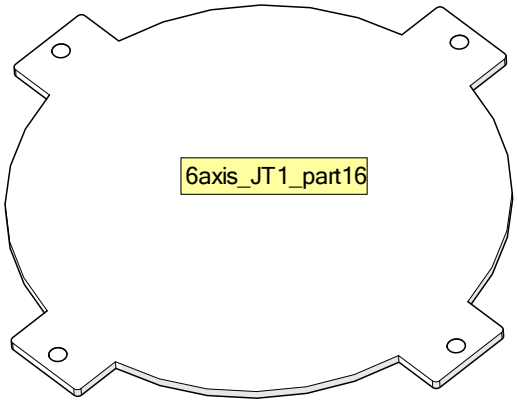
Base

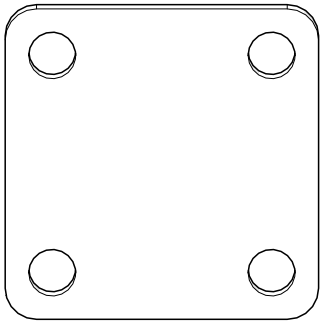


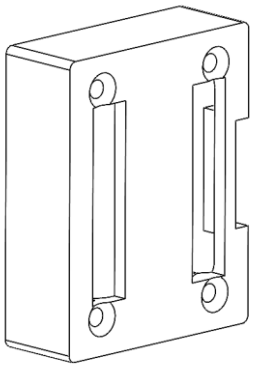




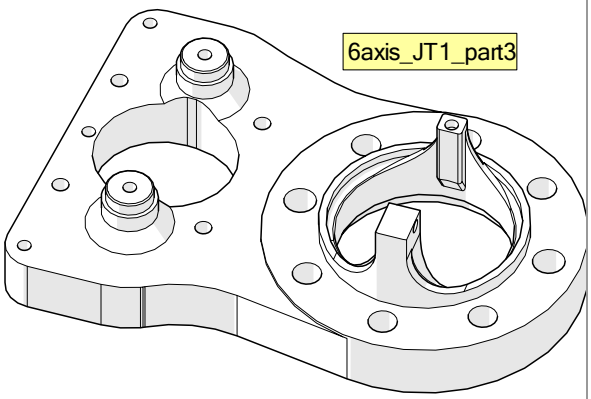

jt1_base_part4

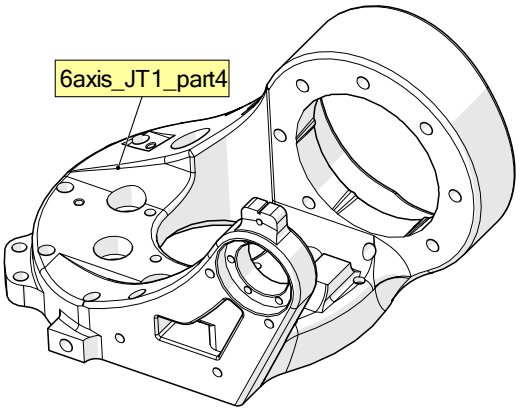

6axis_JT1_part16

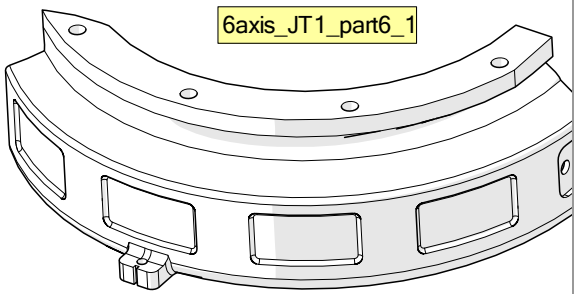

tp_cover

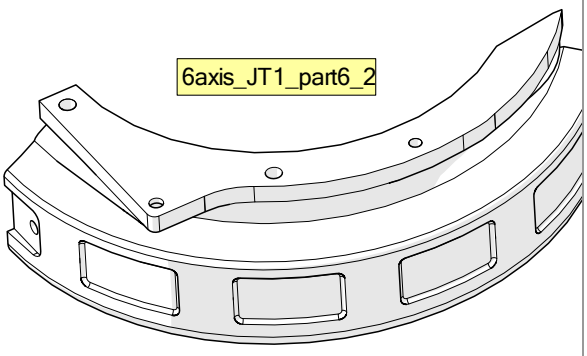

IO module cover

JT1

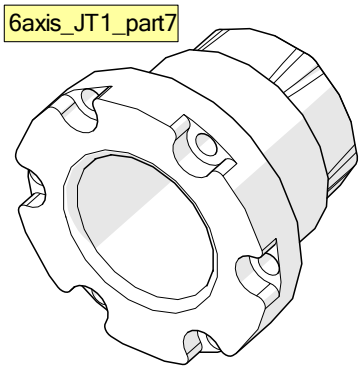

6axis_JT1_part3


6axis_JT1_part4

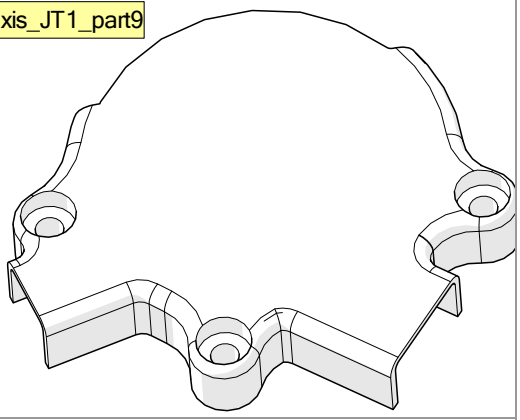

6axis_JT1_part6_1


6axis_JT1_part6_2

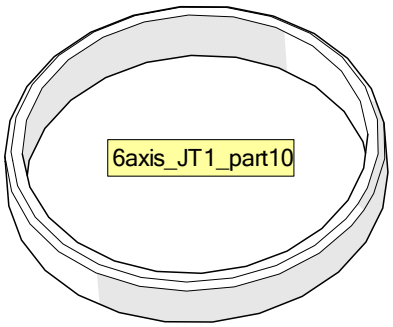
6axis_JT1_part7



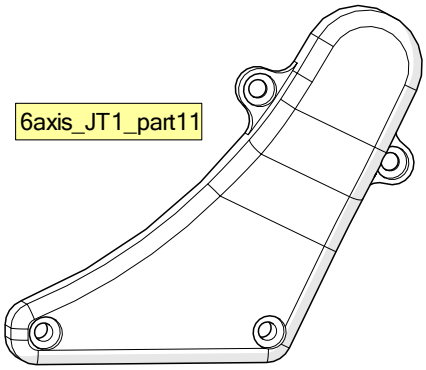
6axis_JT1_part9



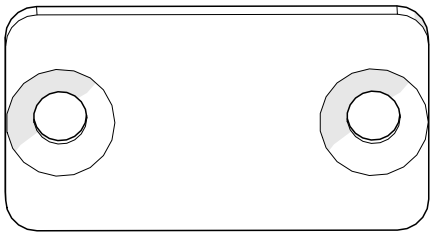
6axis_JT1_part10



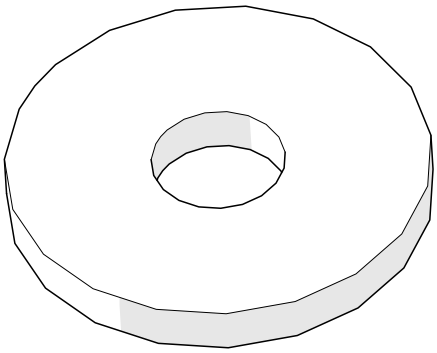
6axis_JT1_part11



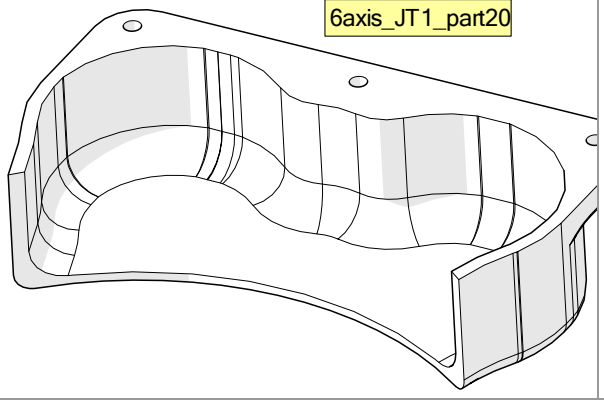
6axis_JT1_part14



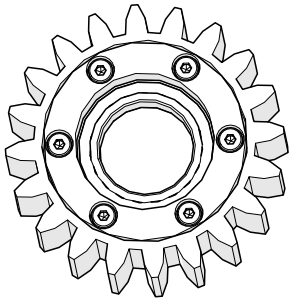
6axis_JT1_part18



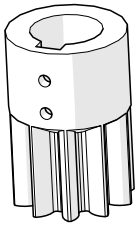
6axis_JT1_part20



20T_spur_gear

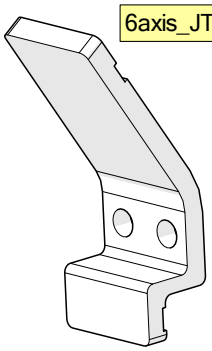


DIN - Spur gear 2M 10T 14mm-1

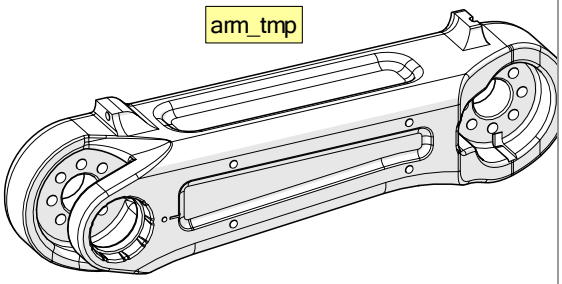


JT2

6axis_JT2_part3

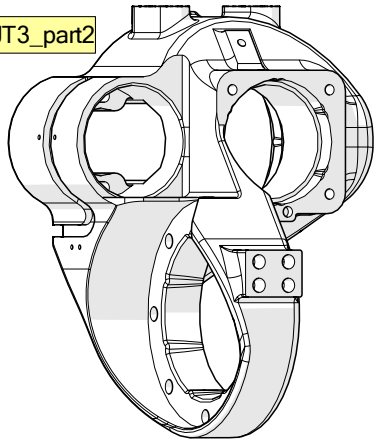


arm_tmp

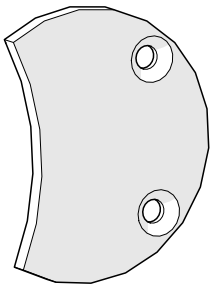


JT3

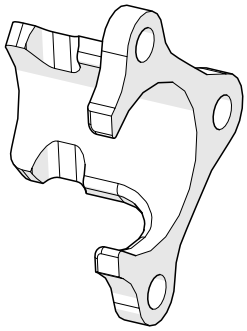
6axis_JT3_part2

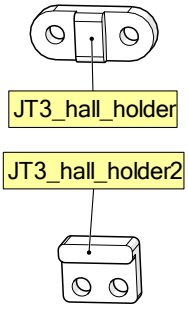


6axis_JT3_part5

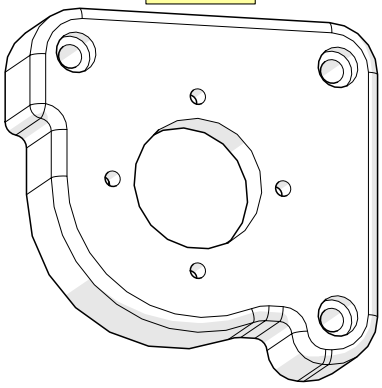


6axis_JT3_part9



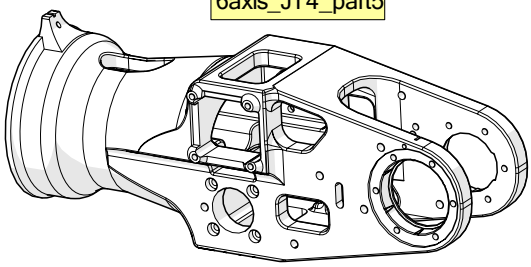


JT4_part5

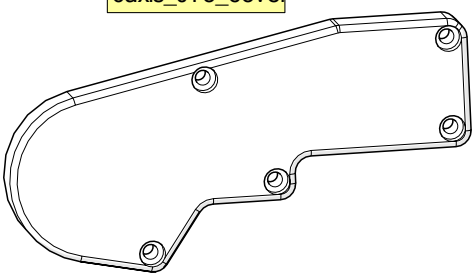


JT4

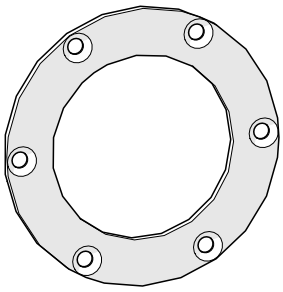
6axis_JT4_part5



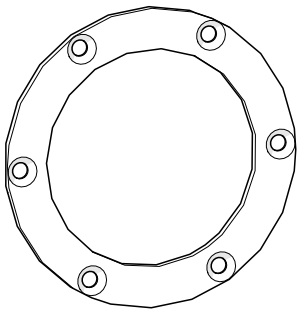
6axis_JT5_cover



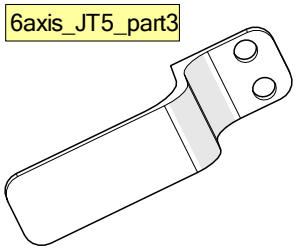
6axis_JT5_part1



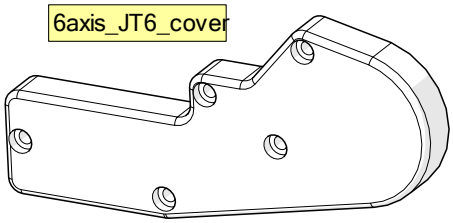
6axis_JT5_part2



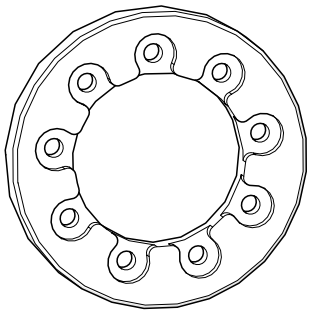
6axis_JT5_part3



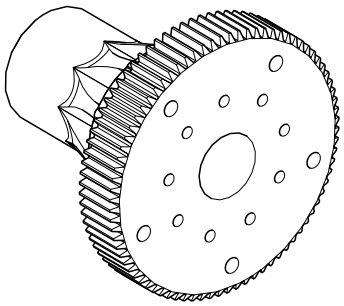
6axis_JT6_cover



JT4_part2

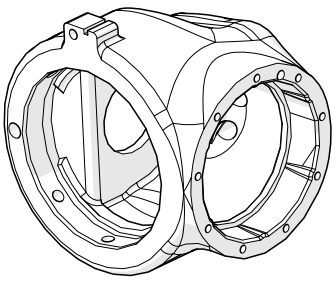


DIN - Spur gear 1M 80T-1

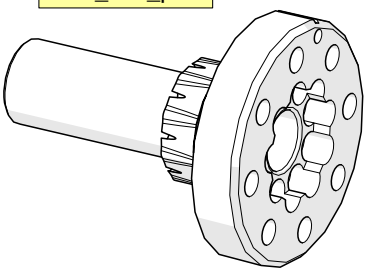


JT5/JT6

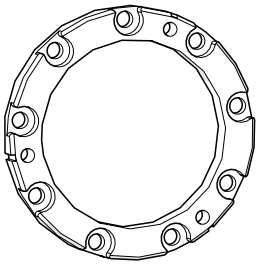
6axis_JT6



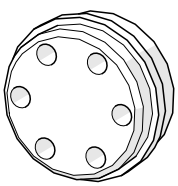
6axis_JT6_part2

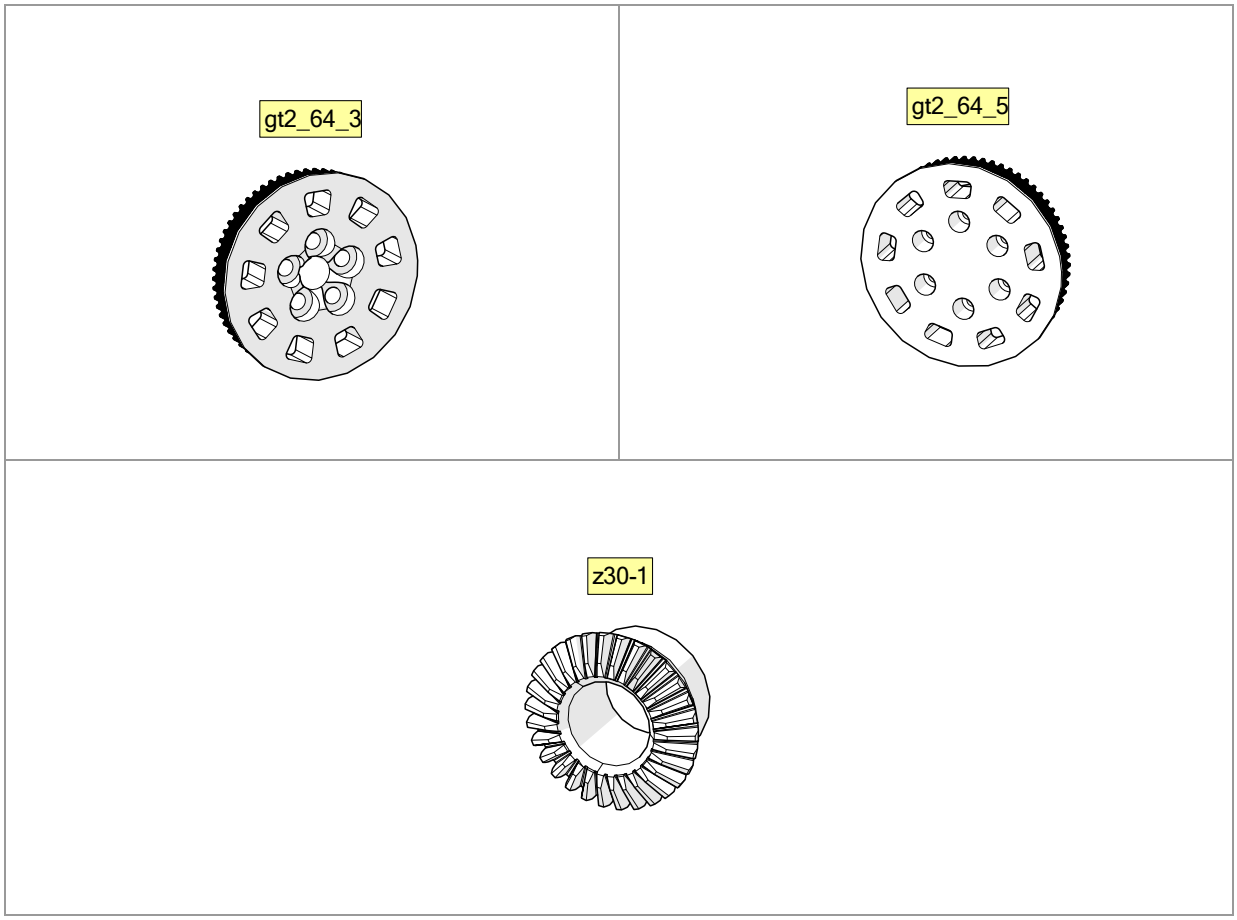


6axis_JT6_part3



bevel2





14.4 Electronic compoments

Robot part	Part	Qt
Base	Astorino mainboard – pcb rev.2	1
	3.3V IO module	1
	Zeroing sensor	1
	Green LED	1
	Red LED	1
	M8 connector	1
	Ethernet port	1
	USB plug	1
	Power switch	1
JT1	Nema23 motor driver (MKS servo57C)	2
	Brakes control board	1
	Zeroing sensor	1
	JT1 motor harness	1
	JT2 motor harness	1
	JT1/JT2 sensor harness	2
JT2	Zeroing sensor	1
	JT3/4 sensor harness	1
JT3	Nema23 motor driver (MKS servo57C)	1
	Nema17 motor driver (MKS servo42C)	1

	Zeroing sensor	1
	Brakes control board	1
	JT3 motor harness	1
	JT4 motor harness	1
	ARM ID harness	1
	JT3/JT4 sensor harness	1
JT4	Nema17 motor driver (MKS servo42C)	2
	Zeroing sensor	1
	JT5/JT6 sensor harness	1
	JT5/JT6 motor harness	2
	Collision detection module	1
	Collision detection module harness	1
JT5	Zeroing sensor	1
JT6	-	

14.5 Mechanical parts – motors and brakes

Robot part	Part	Qt
JT1	Nema23 (23HS16-0884S)	1
	JT1_Gear (EG23-G5-D6)	1
JT2	Nema23 (23HS16-0884S)	1
	Nema23_Brake (MPC023-24-032_P1)	1
JT3	Nema23 (23HS16-0884S)	1
	Nema23_Brake (MPC023-24-032_P1)	1
JT4	Nema17 geared motor (17HS15-1684S-HG5)	1
JT5	Nema11 geared motor (11HS12-0674S-PG5-C1)	1
JT6	Nema11 (11HS20-0674S-C9)	1

15 Manufacturer information

For further questions, contact Kawasaki Robotics support.

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Kawasaki Robot
Troubleshooting Manual

2025-03: 2nd Edition

Publication: KAWASAKI Robotics GmbH

Appendix I – List of Error code

E001	Program xxxx does not exist!
E002	Program file corrupted!
E003	IO module initialization failed!
E004	Out off dynamic memmory! Restart robot to free RAM
E005	Cannot nest more programs
E006	Program not found!
E007	Cannot call running program
E008	Signal out of numeric range!
E009	Too many bits!
E010	Value for BITS must be possitive!
E011	$DECODE: No delimeter found in string!
E012	Point does not exist!
E013	Serial RECEIVE timeout
E014	Over minimum signal number!
E015	Over maximum signal number!
E016	Frame points too close!
E017	Cannot use dedicated signals!
E018	Illegal signal number!
E019	SDCard corrupted! Check memmory card!
E020	SDCard files error! Error Code:
E021	Collision detection hardware fault - Function disabled.
E022	Collision detected. Threshold:
E023	zeroing failed! Check the harness, sensor or Motor Direction!
E024	Conveyor cooperation data invalid
E025	Time cannot be negative
E026	JTx calibration failed! Check the harness, sensor or Motor Direction!
E027	Illegal Timer number!
E028	Calibration data is missing. Cannot zero
E029	Timer value cannot be negative!
E030	Point xxxx not found!
E031	The points are coplanar!
E032	Tool radius too small!
E033	No Points recorded!
E034	Points B or C too close!
E035	Program code error: xxxxx Line: xxxxx
E036	Ethernet Mode is not set to TCP/IP & UDP. Cannot use this function!
E037	Port number out of numeric range!
E038	Socket out of numeric range!
E039	IP adress out of numeric range!
E040	Robot is not ready, cannot run cycle.
E041	Cannot use this function in Terminal
E042	Program loading error!
E043	Program not selected! Cannot load!

E044	Program is empty! Cannot load!
E045	No '.END' statment, cannot load program!
E046	Communication Error!
E047	Communication Errror! Connect again!
E048	Firmware update error! Try again! If the problem repeats follow the manual!
E049	Firmware Mismatch!
E050	Reboot Error!
E051	Reset Error!
E052	HIDCom Error!
E053	Upload Timeout!
E054	Serial blocked!
E055	No Serial!
E056	Unexpected Error!
E057	File does not exist!
E058	Zeroing is not done - cannot change postion!
E059	Program loading error - '.END' not found!
E060	Incompatible firmware! Please update the PC software!
E061	Program is not selected. Cannot start Cycle!
E062	DeadMan trigger released!
E063	Frame angle too narrow or too big! (90deg +/-3)
E064	Not all Frame points recorded! Cannot calculate!
E065	Mode was switched during movement!
E066	7th axis is not activated!
E067	RECEIVE buffer overflow - max 128 bytes!
E068	FRAME point error, use only cartesian points!
E069	Incompatible firmware! Please update the PC software!
E070	External user connected - cannot use this function!
E071	IO module communication error!
E072	Trajectory error! Acceleration too big!
E073	Channel is not selected!
E074	Too many registers!
E075	Buffer overflow - max 128 bytes!
E076	Too many ONI interrupts!
E077	---reserved---
E078	---reserved---
E079	---reserved---
E080	---reserved---
E081	---reserved---
E082	---reserved---
E083	---reserved---
E084	---reserved---
E085	---reserved---
E086	---reserved---
E087	Motion command was canceled!
E088	Emergency stop triggered by external user!

E089	Safety fence is open!
E090	Emergency Stop!
E091	Use C1MOVE first
E092	TOOL number out of range!
E093	Cannot create an arc path!
E094	Cannot create line path!
E095	Cannot create an ARC! Points too close!
E096	---reserved---
E097	JT command suddenly changed!
E098	Out of Working Space range!
E099	Out of motion range!
E100	Out of space!
E101	Array size is too big. Maximal size is %d elements
E102	Table overflow -> too many elements to assign
E103	Can't create array with zero or negative number of elements!
E104	Maximum signal number reached! To read more use BITS32(to be added) function.
E105	Too many arguments.
E106	Parser error: Unexpected hash map type when trying to delete.
E107	Parser error: Unexpected raxis dir type.
E108	Parser error: Unexpected node type while trying to free memory.
E109	Parser error: Unexpected node type while trying to evaluate numeric element.
E110	Parser error: Unexpected node type while trying to evaluate string element.
E111	Parser error: Unexpected node type while trying to evaluate string function.
E112	Parser error: Unexpected node type while trying to evaluate point element.
E113	Parser error: Unexpected node type while trying to evaluate function.
E114	Parser error: Unexpected node type while trying to evaluate point table element.
E115	Parser error: Unexpected node type while trying to evaluate numeric table element.
E116	Parser error: Unexpected node type while trying to evaluate string table element.
E117	Parser error: Numeric table - array index out of range.
E118	Parser error: String table - array index out of range.
E119	Parser error: Tabpoint - number out of range.
E120	Parser error: Tabpoint to point - array index out of range.
E121	Parser error: Function - array index out of range.
E122	Lexer error: Unexpected symbol.
E123	Parser error: Out of RAM2.
E124	Parser error: Memory leak detected.
E125	Parser error: Unexpected null pointer.
E126	Parser error: Null is a keyword.
E127	Parser error: Point type mismatch.
E128	Parser error: Maximum signal number reached.
E129	Parser error: Delimiter not found in decoded string.
E130	Parser error: atoi/atof - invalid number.

E131	Parser error: Garbage collector reached size limit.
E132	Parser error: Division by 0.
E133	Parser error: Maximum number of variables in hash map reached.
E134	Parser error: Trying to overwrite hash map element.
E135	Parser error: Invalid argument type.
E136	Parser error: Variable used was not defined.
E137	Parser error: Point variable has the same name as numeric variable.
E139	Lexer error: Whitespace before bracket detected.

W001	Unknown command
W002	Out of Working Space range
W003	Cycle started, cannot turn off motors!
W004	Cannot use this command. Turn off cycle!
W005	Cannot continue, program is stopped by extIT
W006	File deleted. Restart robot.
W007	File not found.
W008	OUTPUTS set to source. Restart robot!
W009	OUTPUTS set to sink. Restart robot!
W010	INPUTS pull-up resistor ON. Restart robot!
W011	INPUTS pull-up resistor OFF. Restart robot!
W012	JT7 enabled.
W013	JT7 disabled.
W014	SAFETY FENCE INPUTS enabled.
W015	SAFETY FENCE INPUTS disabled.
W016	Communication via Modbus TCP stopped - client disconnected
W017	Communication via Modbus TCP error - client not connected
W018	Communication via Modbus TCP established - client connected
W019	Communication via Modbus TCP stoped - cable disconnect
W020	Communication via Modbus TCP established - connected to server
W021	Communication via Modbus TCP stoped - server lost
W022	Zeroing started
W023	Robot is not ready!
W024	Cycle started, cannot zero!
W025	Cannot stop cycle. Hold first!
W026	Cannot stop cycle. Program is not running!
W027	Program not found!
W028	Initialization started!
W029	xxxxx created!
W030	xxxxx already exist!
W031	SD Card initialization done! Restart robot!
W032	SDcard formated!
W033	Zeroing is not done!
W034	Not allowed in Repeat Mode

W035	Cycyle On - cannot turn off motors!
W036	Zeroing not done! Turning off motors will make the robot to collapse. Do you want to turn off motors?
W037	Robot will move to power off save position and turn off the motors!
W038	Robot is not ready!
W039	Cannot load program in Repeat Mode!
W040	Robot already in HOME position!
W041	Port does not exist!
W042	Main program data not loaded!
W043	Cycle in ON, stop Cycle to load all data!
W044	Load HOME Data?
W045	Load Tool
W046	Varaible in not defined!
W047	Value is not valid!
W048	Cannot load program. Turn off cycle!
W049	Delete program?
W050	Save all data to file? Warning! This will download all data from robots's memory!
W051	Load all data from file? Warning! This will upload all data to robot's internal memory!
W052	User Level too low, cannot load data to the robot's memory!
W053	Cannot load data to the robot's memory! Use USB connection!
W054	Program Tool cannot select!
W055	Delete Point: P
W056	Delete Point: #P
W057	Cannot start Cycle. Zeroing is not done!
W058	Program is running - HOLD it first!
W059	Program is not selected!
W060	Program is not loaded!
W061	Robot is not ready! Cannot run cycle!
W062	Zeroing is done - Zero again?
W063	User Level too low, cannot calibrate!
W064	You cannot duplicate output numbers!
W065	You cannot duplicate input numbers!
W066	Ready to upload Firmware:
W067	Continue?
W068	Firmware update
W069	Disconnect from the robot!
W070	Ready to change Network settings. Continue?
W071	Ready to change power off position. Continue?
W072	Program already loaded. Load it again?
W073	Program already exist!
W074	Program running - Hold it first!
W075	Cannot change DryRun. Turn off Cycle!
W076	Initialize all data? Warning! This will delete all data to robot's internal memory!
W077	Calculate new Tool?
W078	Zeroing JT5 and JT6 at the same time is prohibited!

W079	Zeroing JT6 before JT5 is prohibited!
W080	Turn off Cycle!
W081	Position A1 already thought - reteach?
W082	Position A2 already thought - reteach?
W083	Position A3 already thought - reteach?
W084	Position A4 already thought - reteach?
W085	Position B already thought - reteach?
W086	Position C already thought - reteach?
W087	Not all positions recorded - teach all positions!
W088	Robot's serial number and backup serial number mismatch! Continue loading?
W089	Program is modified but not loaded! Upload the program?
W090	Zeroing already done!
W091	Turn on Motors!
W092	Switch to Teach Mode!
W093	DeadMan Trigger is off!
W094	HOLD is active!
W095	Not allowed in Teach Mode!
W096	Data Saved!
W097	Turn on Cycle!
W098	Alt key is not pressed!
W099	Working Space Data Saved!
W100	Step Distance Data Saved!
W101	Home Position Data Saved!
W102	Program Saved as StartUp!
W103	Robot is moving! Cannot change!
W104	SD card autorepair done! Check all settings!
W105	IO Module activated!
W106	IO Module disabled!
W107	Cycle in ON, stop Cycle to change program code!
W108	Wrong point data!
W109	Power Off Position Data Saved!
W110	Conveyor Settings Data Saved!
W111	Collision Detection Settings Data Saved!
W112	Clamp Settings Data Saved!
W113	Joint Range Data Saved!
W114	Click Sound Data Saved!
W115	CTRL button is not pressed!
W116	Point already exist, reteach?
W117	Ethernet Settings Data Saved! Restart robot!
W118	Cycle is Onm stop Cycle to change program code!
W119	Position O already thought - reteach?
W120	Position X already thought - reteach?
W121	Position Y already thought - reteach?
W122	Back up file created on an A-version of astorino. Cannot load!
W123	Back up file created on an B-version of astorino. Cannot load!

W124	External user connected!
W125	Robot is in motion! Cannot execute!
W126	Load Zeroing Order Data?
W127	Robot already connected!
W128	TP is not connected!