TM ROBOT

Service Manual

Hardware version: 3.2

Software version: 2.18

Document version: 1

Release date:2024-12-12

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TECHMAN ROBOT INC.

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目錄

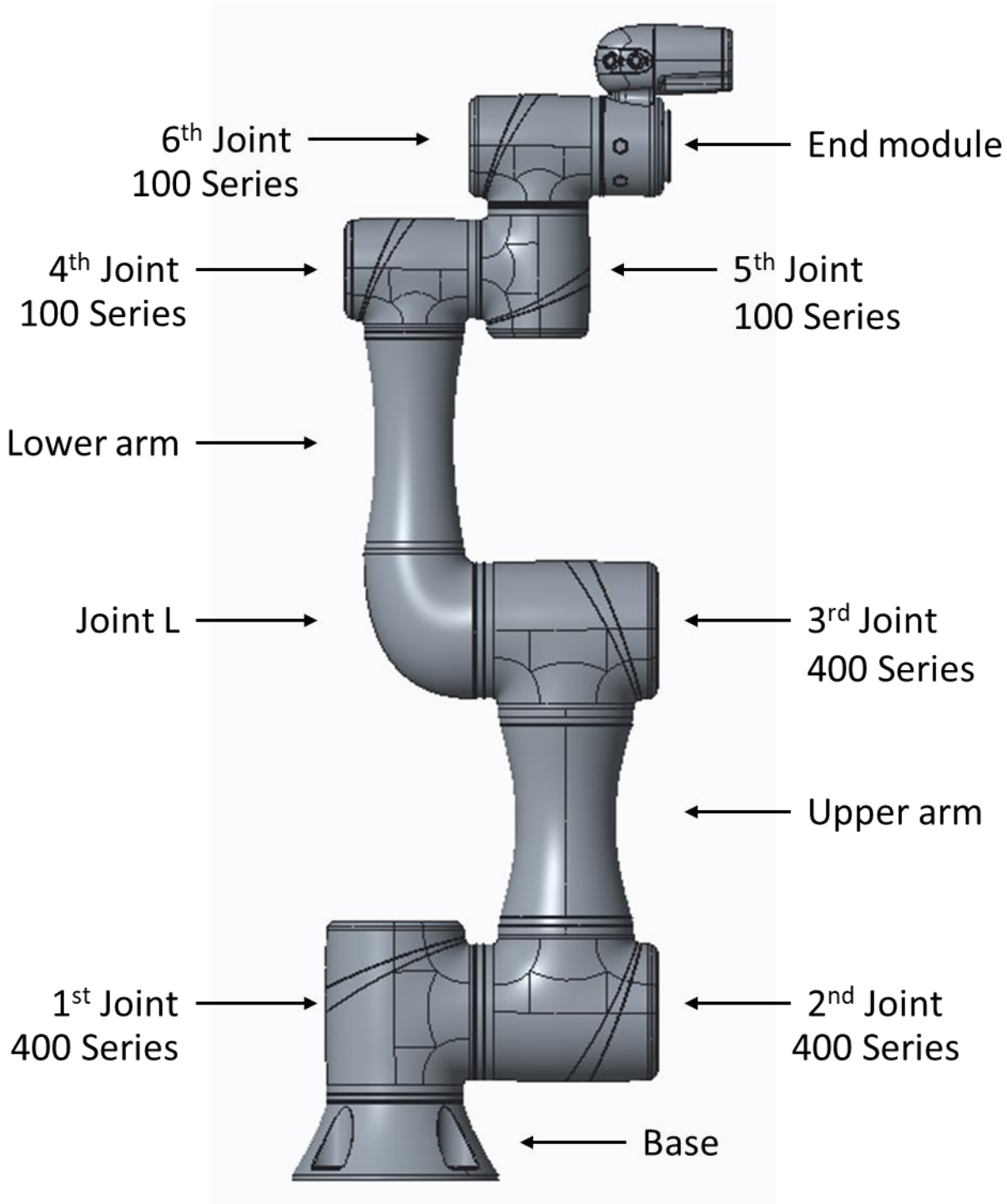
Handling components that are sensitive to electrostatic discharge (ESD)

To prevent ESD-sensitive components (e.g., printed circuit boards) from being damaged, please handle the components in the following steps:

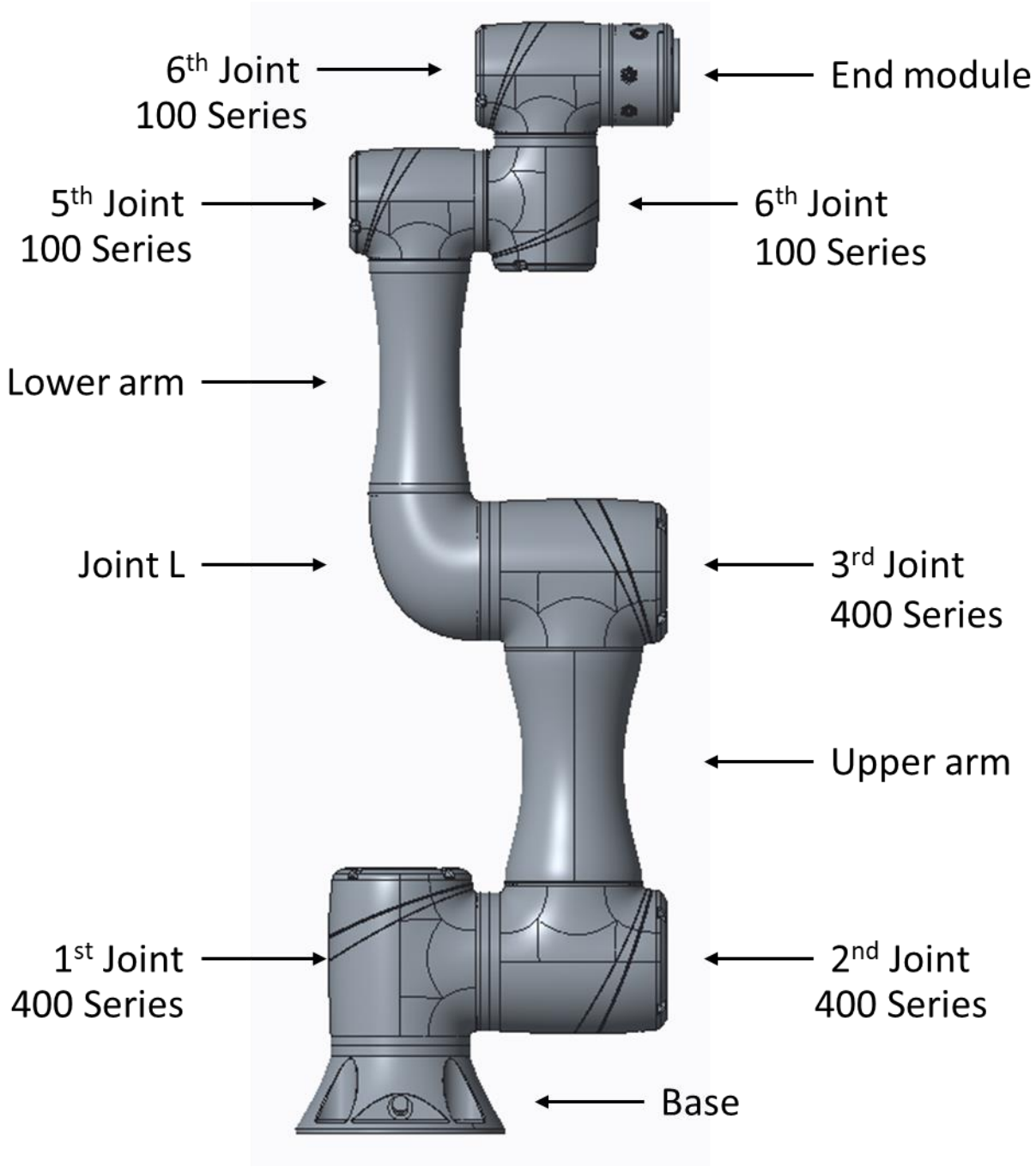
- Wear an antistatic bracket before replacing an ESD-sensitive component and make sure the bracket stays connected to the ground while you're replacing the component.
- Hold the protective cover for the component's edge connect and avoid touching any exposed part.
- Drop the replaced component into an antistatic bag.

1. Components of different TM Robot models

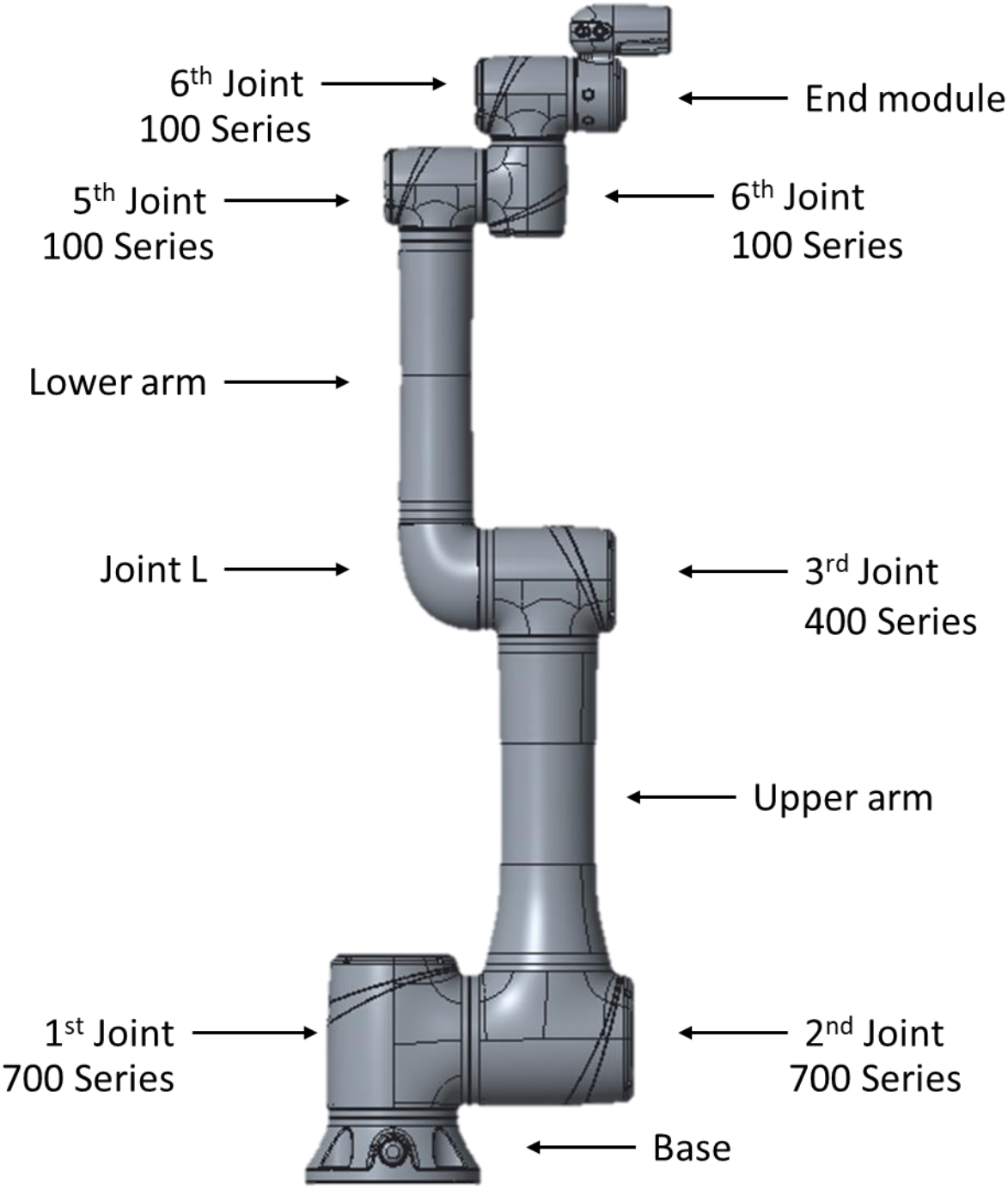
1.1 TM5A



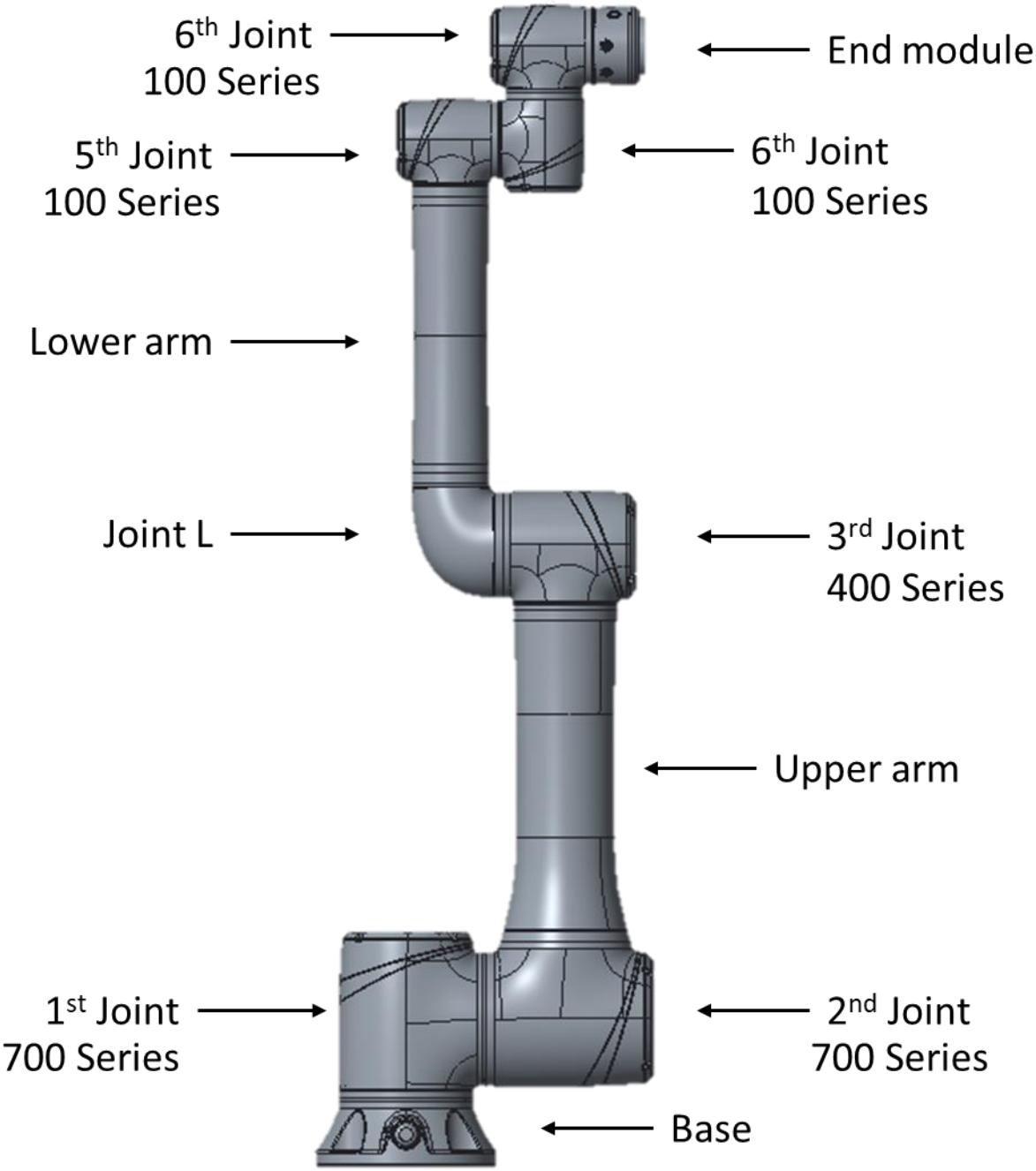
1.2 TM5AX


6th Joint
100 Series
End module
5th Joint
100 Series
6th Joint
100 Series
Lower arm
Joint L
3rd Joint
400 Series
Upper arm
1st Joint
400 Series
2nd Joint
400 Series
Base

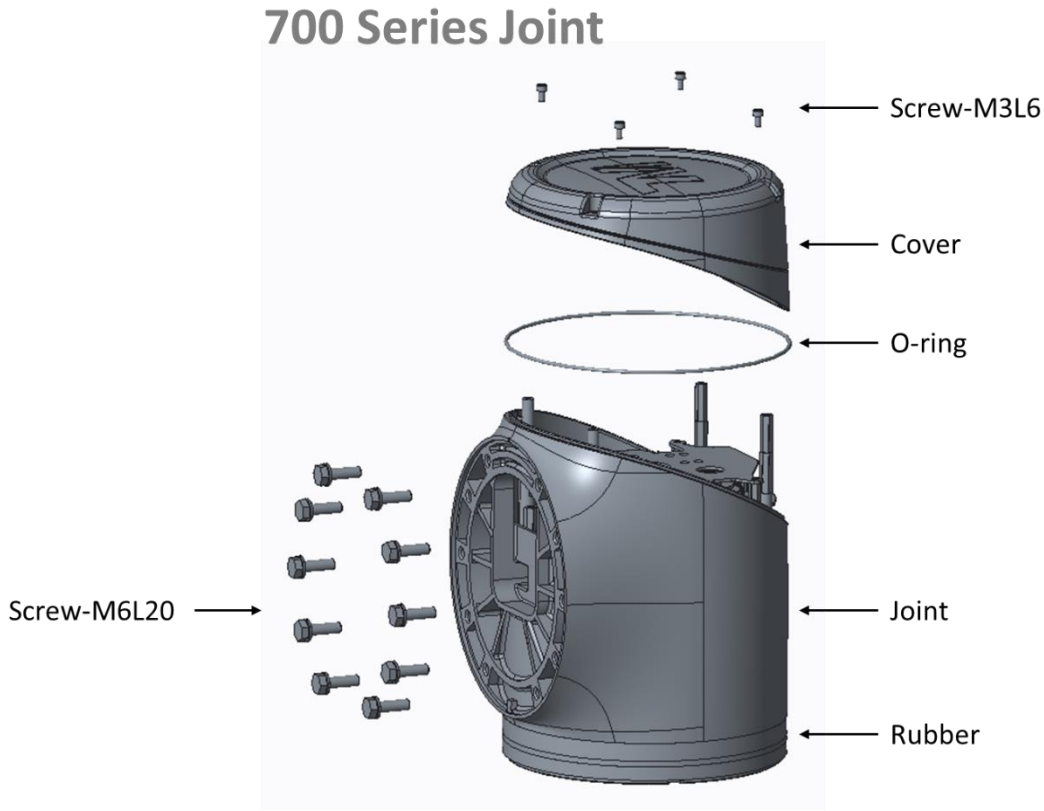
1.3 TM12 / TM14 / TM16 / TM20

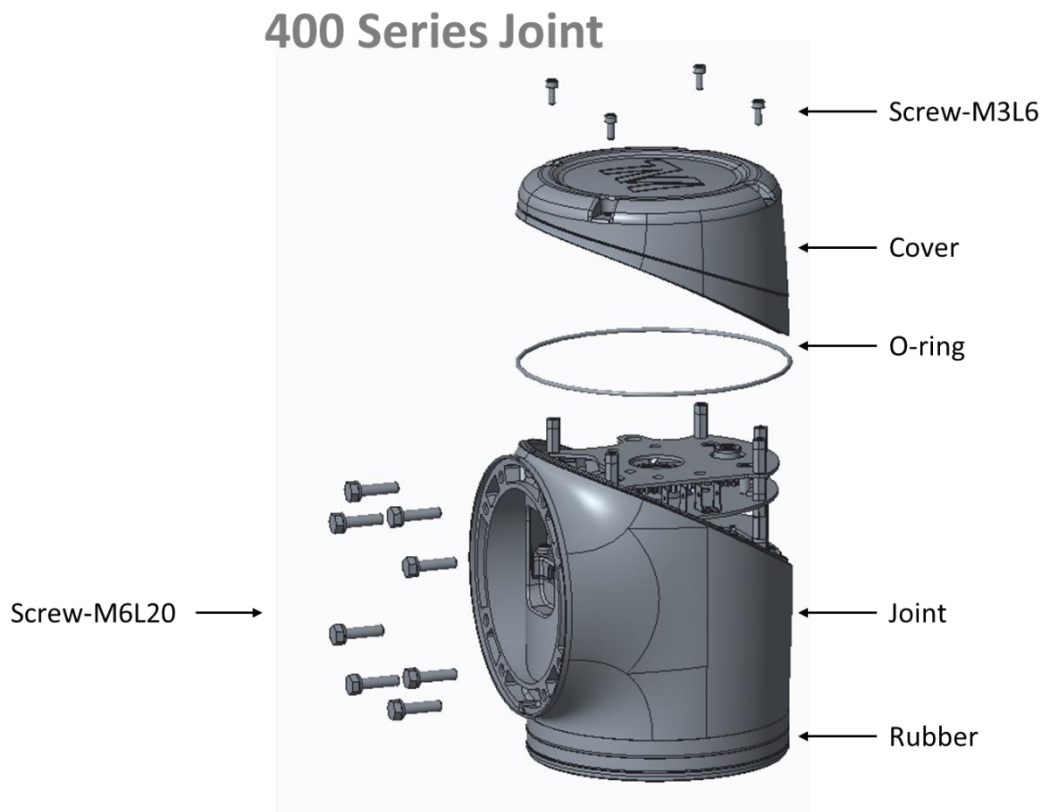


1.4 TM12X / TM14X / TM16X / TM20X

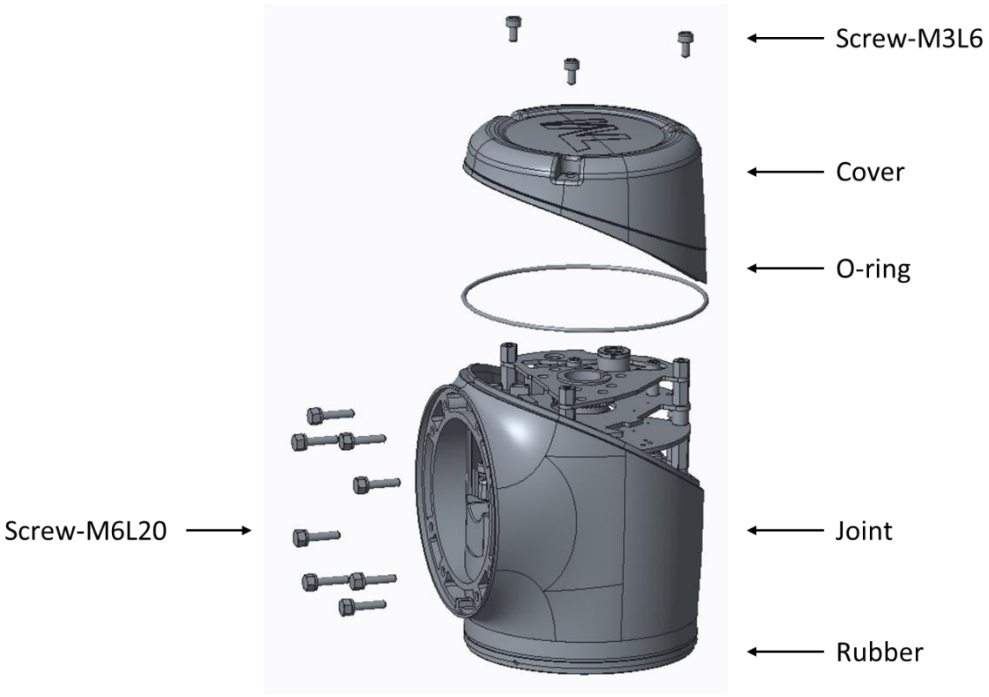


1.5 Joint type

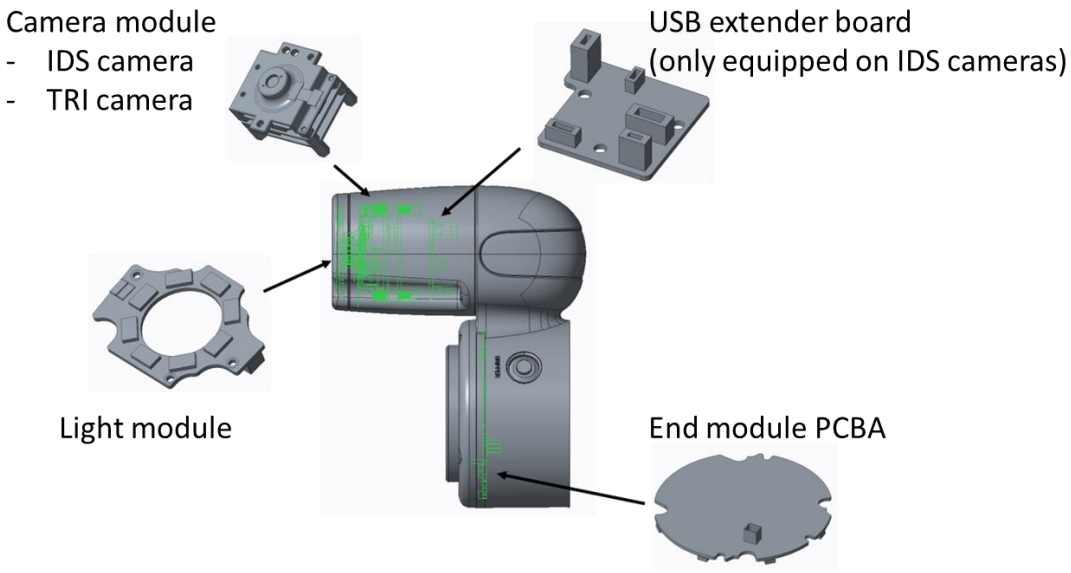




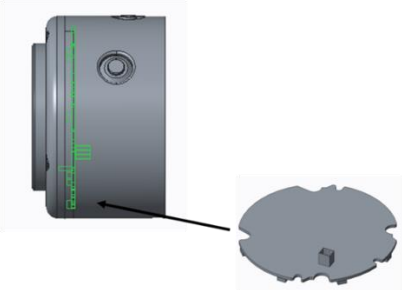
100 Series Joint



End module with camera

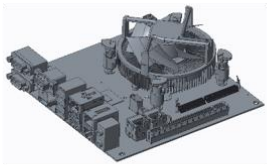
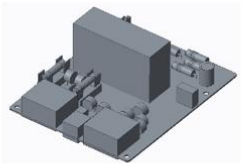
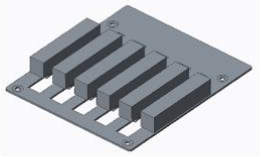
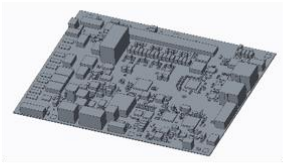
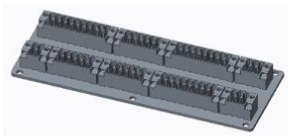
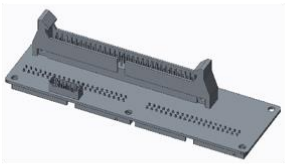
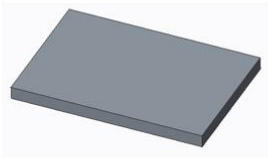
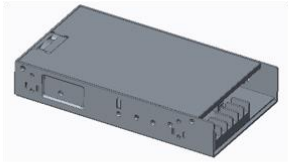
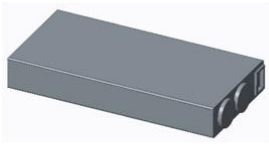
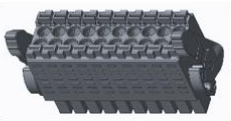
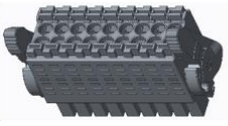


End module for X-type robot



End module PCBA

1.6 Control box components

Control box			
	IPC	Relay board	Power eater
			
	Power control board	EX IO board_outside	EX IO board_inside
			
	SSD	24V Power supply	48V Power supply
			
	Stick	Jack 2P	Jack 3P
			
	Jack 6P	Jack 9P	Jack 10P

2. Preventive Maintenance

2.1 Inspection of robot arm while power is off

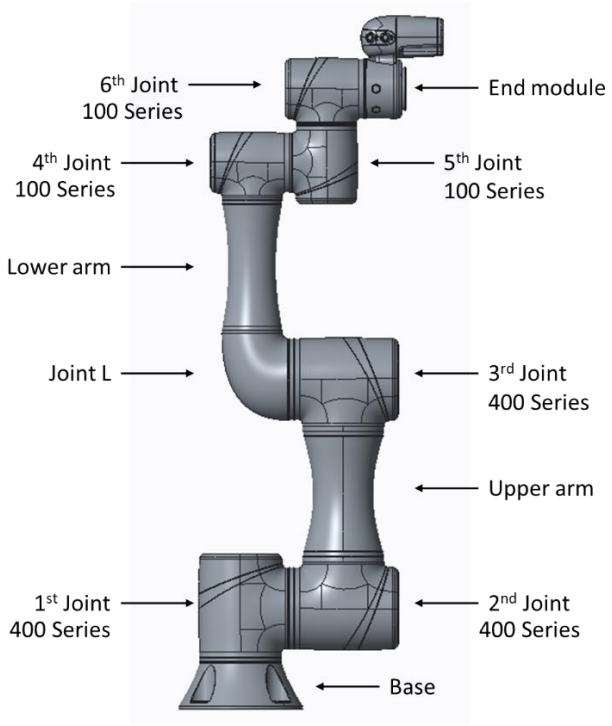
No	Item	Description	Period	Time
1	Visual inspection	Ensure the following components and lables are in good condition: 1. Joint 2. Upper arm & Lower arm 3. Safety labels 4. Barcode label	6 months	10 mins
2	Robot Cable	Ensure the robot cable's surface, rubber lock ring, and connector are in good condition.	6 months	10 mins
3	Joint screws	Ensure the screw torque value meets standard.	6 months	30 mins
4	Joint connection	Ensure the power cable, signal cable, and camera cable work properly.	6 months	30 mins
5	Joint brake	Ensure the joint brake system works properly.	6 months	10 mins

Visual inspection

Joint Module

	Name	Product ID	Qty
Inspection Place	Joint Module	All	N/A
Tools	Visual inspection		N/A

1. Check for any damage or scratches on the surface of end module, each joint, upper arm, lower arm and base.
2. If there is any problem that cannot be resolved, contact Techman.



Warning, Safety labels

	Name	Product ID	Qty
Inspection Place	Warning, Safety labels	All	N/A
Tools	Visual inspection		N/A
1. Check if the barcode and safety labels can be clearly identified. 2. If there is any problem that cannot be resolved, contact Techman.			

Robot Cable

Surface

	Name	Product ID	Qty
Inspection Place	surface	All	N/A
Tools	Visual inspection		N/A
1. Check for any damage on the robot cable. 2. If there is any problem that cannot be resolved, contact Techman.			

Rubber lock ring

	Name	Product ID	Qty
Inspection Place	Rubber lock ring	All	N/A
Tools	Visual inspection		N/A
1. Check for any damage on the rubber lock ring. 2. Make sure the lock is tightened and not loose. 3. If there is any problem that cannot be resolved, contact Techman.			

Connector

	Name	Product ID	Qty
Inspection Place	Connector	All	N/A
Tools	Visual inspection		N/A
1. Check for any damage or bending on the connector and connector pins. 2. If there is any problem that cannot be resolved, contact Techman.			

Check Robot Mounting screws

Joint cover

	Name	Product ID	Qty
Inspection Place	Joint cover	all	N/A
Tools	Refer to Service manual		N/A
1. Use designated tool to ensure the torque value of joint covers meets the standard. 2. Torque value for the joint cover: 6 kgf.cm. 3. If there is any problem that cannot be resolved, contact Techman.			

Joint

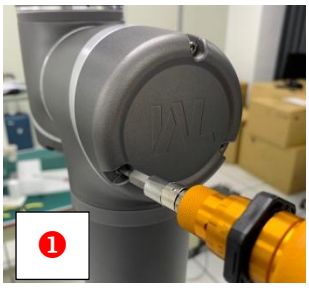
	Name	Product ID	Qty
Inspection Place	Joint	all	N/A
Tools	Refer to Service manual and Hardware manual		

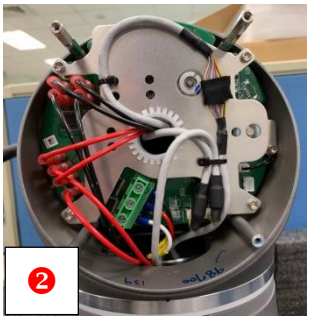
1. Use designated tool to ensure the torque value of joint meets the standard.
2. Torque value of 700 series joint: 150 kgf.cm.
3. Torque value of 400 series joint: 92 kgf.cm.
4. Torque value of 100 series joint: 20 kgf.cm.
5. If there is any problem that cannot be resolved, contact Techman.

Check joint connection

	Name	Product ID	Qty
Inspection Place	Joint	all	N/A
Tools	Refer to Service manual		N/A

1. Remove the joint cover and check if the appearance and connection stauts of 48V, EtherCAT and camera cable are in good condition.
2. If there is any problem that cannot be resolved, contact Techman.

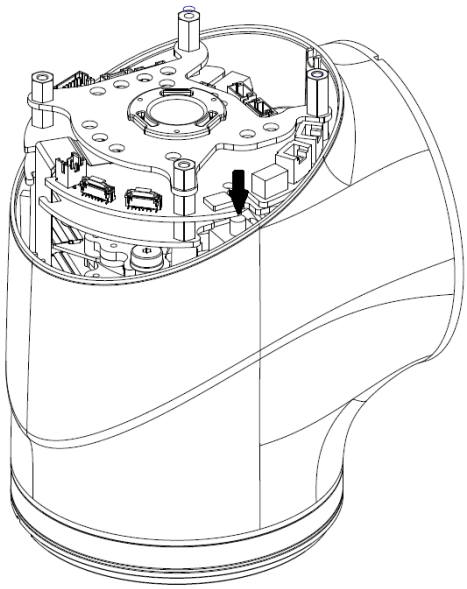




Check joint Brake components

	Name	Product ID	Qty
Inspection Place	Joint	all	N/A
Tools	Refer to Service manual and Hardware manual		N/A

1. Push or rotate the joint when the robot power is off or when the ESTOP is applied to check if the brake works properly.
2. Manually release the brake pin to check if the brake works properly. **Warning: the joint must not be rotated beyond ±45 degrees when the robot power is off, as it may cause unexpected errors.**
3. If there is any problem that cannot be resolved, contact Techman.



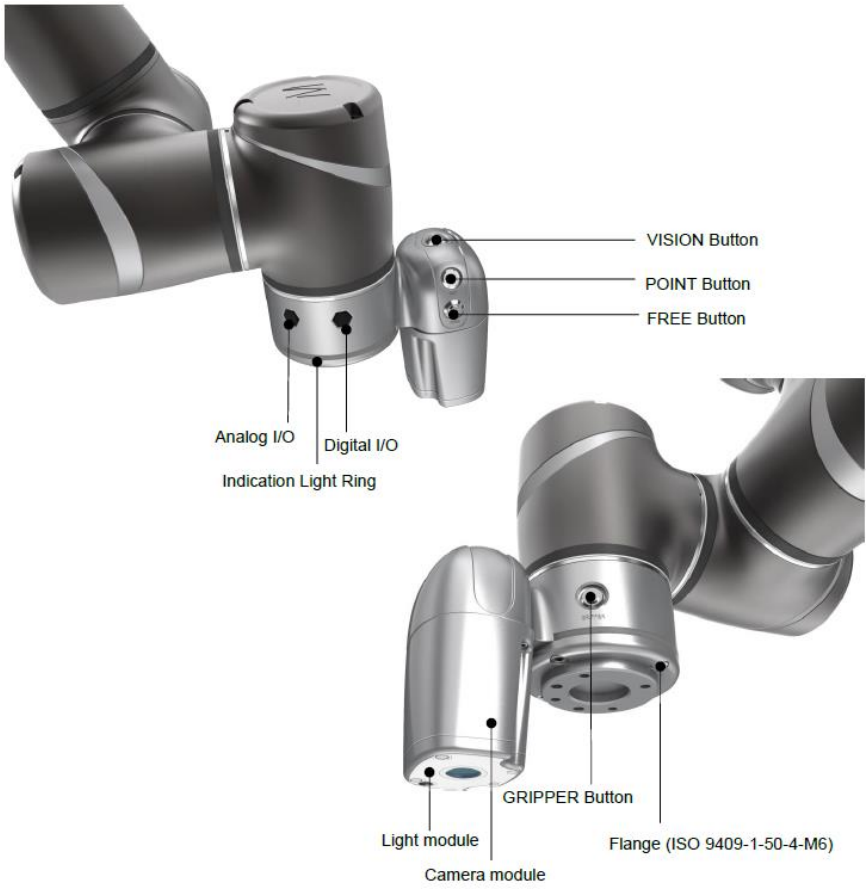
2.2 Inspection of robot arm while power is on

No	Item	Description	Period	Time
1	IO module	Ensure the following funtions work properly: buttons, light module.	6 months	10 mins
2	Camera	Ensure the camera works properly.	6 months	10 mins
3	Flexibility	Ensure the joints work properly.	6 months	150 mins

IO Module

Button

	Name	Product ID	Qty
Inspection Place	Button	all	N/A
Tools	Visual inspection		N/A

1. Check for damage or dirt on the buttons. 2. Create a new project and press the free button, gripper button, point button, and vision button to ensure they work properly. 3. If there is any problem that cannot be resolved, contact Techman.	

LED light

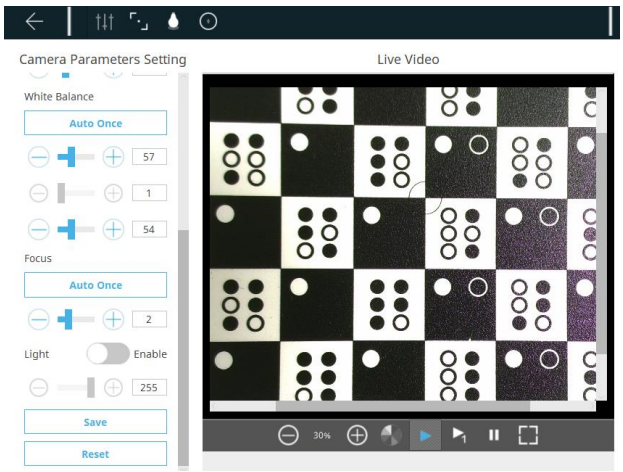
	Name	Product ID	Qty
Inspection Place	LED light	all	N/A
Tools	Visual inspection		N/A

1. Check for any damage or dirt on light module.
2. Go to Vision settings → Camera kit, enable LED to check if the function works properly.
3. If there is any problem that cannot be resolved, contact Techman.

Camera

	Name	Product ID	Qty
Inspection Place	Camera parameter adjust - Autofocus test	all	N/A
Tools	Visual inspection	N/A	N/A

1. Into Robot Setting→Vision Setting
2. Place a dice board within the camera's field of view.
3. Select ''Auto Once' to adjust the focus automatically and check if the image becomes clear.
4. Move the end module to a position 10 cm above the dice Board.
5. Select 'Auto Once' to adjust the focus automatically and check if the image becomes clear.
6. Move the end module to a position 30 cm above the dice Board.
7. Select 'Auto Once' to adjust the focus automatically and check if the image becomes clear.



Flexibility

	Name	Product ID	Qty
Inspection Place	Joint rotation	all	N/A
Tools	Visual inspection		N/A

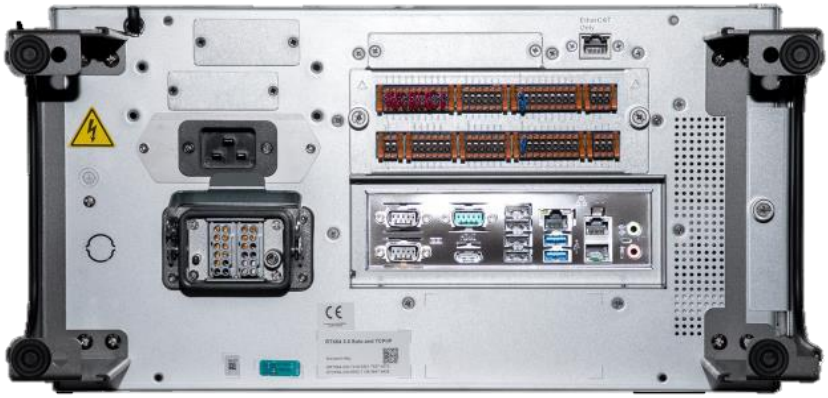
1. Set the robot to the zero position and check if the robot arm is straight.
2. Check the pin on the joint to ensure the joint is in the correct position.
3. Set up a project to make all joints rotate to limits.
4. Start the project, run at 10% speed for 10 minutes, then run at 30% speed for 1 hour, then run at 60% speed for 1 hour.
5. If there is any problem that cannot be resolved, contact Techman.

2.3 Inspection of control box while power is off

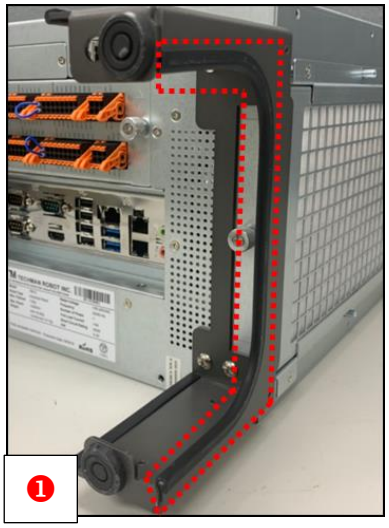
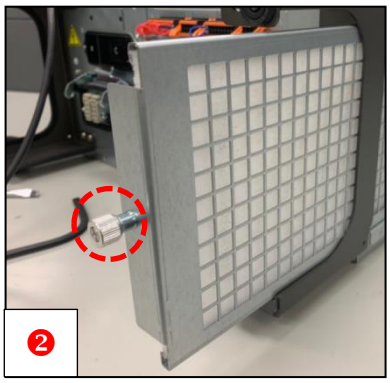
No	Item	Description	Peirod	Time
1	Visual inspection	Ensure the labels are present and legible. Replace them if necessary.	6 months	10 mins
2	Filter	Check filter every month, replace filter every 3 months or when it is necessary	3 months	10 mins
3	Interal connection	Check the cables and wires inside the control box	6 months	30 mins
4	Battery	Replace IPC battery	12 months	10 mins

Visual inspection

	Name	Product ID	Qty
Inspection Place	Checking labels	all	N/A
Tools	Visual inspection		N/A

Check for any damage or dirt on the safety label and product label and replace them if necessary.	

Filter

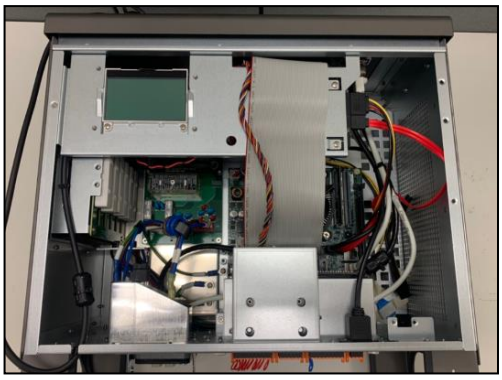
	Name	Product ID	Qty
Inspection Place	Replace Filter	all	N/A
Tools	Visual inspection		N/A
Check Check filter every month, replace filter every 3 months or when it is necessary	  		

Internal connection*

	Name	Product ID	Qty
Inspection Place	Checking Cable Connections	all	N/A
Tools	Refer to Service manual		N/A

Check the cables and wires of following components:

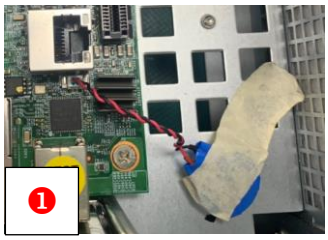
1. Power control board
2. IPC
3. Power Eater
4. Power Supply 24V
5. Power Supply 48V
6. Relay Board
7. SSD
8. Stick
9. LCM



Battery*

	Name	Product ID	Qty
Inspection Place	Replace Mercury battery	all	N/A
Tools	Refer to Service manual		N/A

1. Open Control Box top cover and find the IPC.
2. Replace the mercury battery. CR2032 with 2Pin connector.



2.4 Inspection of control box while power is on

No	Item	Description	Peirod	Time
1	Backup	Periodically backup the project and related settings.	1 month	10 mins
2	Stick function	Check stick funtion	1 month	10 mins
3	External connection	Check functions of external connections	6 months	30 mins

4	Power Supply	Check voltage of 48V PSU in OP mode and PreOP mode	6 months	10 mins

Backup

	Name	Product ID	Qty
Inspection Place	Periodical backup	All	N/A
Tools	Refer to software manual		N/A
Periodically backup the project and related settings.			

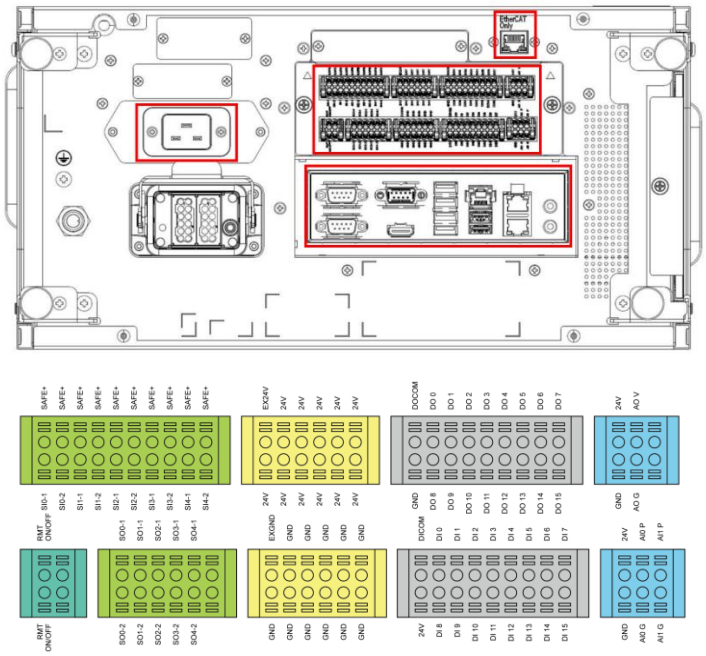
Stick function

	Name	Product ID	Qty
Inspection Place	Stick	All	N/A
Tools	Refer to software manual		N/A
1. Check for any damage on the stick. 2. Create a project to test all stick functions.			

External connection

	Name	Product ID	Qty
Inspection Place	IO port	All	N/A
Tools	Refer to hardware manual		N/A

1. Check for any damage or dirt on the I/O ports, and test them to ensure the functions work properly.
2. Check for any damage or dirt on the external EtherCAT port, IPC I/O and power socket, and test them to ensure the functions work properly.

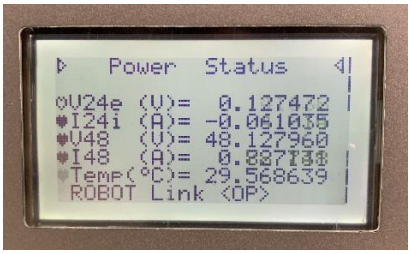


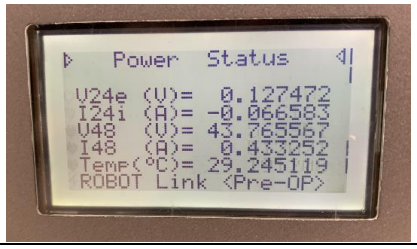
Power Supply

Checking Voltage value in LCM Display is 48 V (OP mode)

	Name	Product ID	Qty
Inspection Place	Checking Voltage value in LCM Display is 48 V	All	N/A
Tools	Visual inspection	N/A	N/A

Checking Voltage value in LCM Display is 48 V when the robot is already launch (OP mode: 48V; PreOP mode:43V)





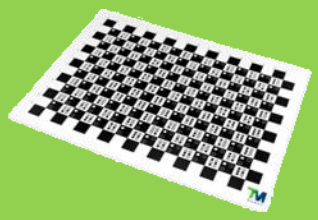
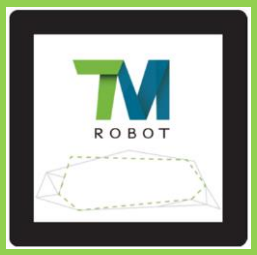
3. Tool list

Item	Photo	Specs	ID No.	Remark
Open-end wrench		5.5 mm		Used to tighten the screws (M3L14) of the 100-series joints
Open-end wrench		8 mm		Used to tighten the screws (M5L20) of the 400-series joints
Open-end wrench		10 mm		Used to tighten the screws (M6L20) of the 700-series joints
Hex socket screwdriver		5.5 mm		Used to tighten hexagon screws (M3L14) with nylok patch (for the 100-series joints)
Hex socket screwdriver		8 mm		Used to tighten hexagon screws (M5L20) with nylok patch (for the 400-series joints)
Hex socket screwdriver		10 mm		Used to tighten hexagon screws (M6L20) with nylok patch (for the 700-series joints)
Open torque wrench		5.5 mm 20 kgf·cm	TOHNICHI 50CL-MH	Used to tighten the hexagon screws (M3L14) of the 100-series joints
Open torque wrench accessory		SH8D × 5.5 5.5 mm	TOHNICHI SH8D*5.5	Used to tighten the hexagon screws (M3L14) of the 100-series joints
Open torque wrench		8 mm 92 kgf·cm	TOHNICHI 150CL-MH	Used to tighten the hexagon screws (M5L20) of the 400-series joints
Open torque wrench accessory		SH8D × 8 8 mm	TOHNICHI SH8D*8	Used to tighten the hexagon screws (M5L20) of the 400-series joints

Item	Photo	Specs	ID No.	Remark
Open torque wrench		10 mm 150 kgf·cm	TOHNICHI 225CL-MH	Used to tighten hexagon screws (M6L20) with nylok patch (for the 700-series joints)
Open torque wrench accessory		SH10D × 10 10 mm	TOHNICHI SH10D*10	Used to tighten hexagon screws (M6L20) with nylok patch (for the 700-series joints)
Straight hex torque screwdriver		M2.5 6 kgf·cm	TOHNICHI 12RTD	Used to fasten the cover and the Control Box
Torx socket torque screwdriver accessory		S2 T20 × 50 mm	Alstrong BIT 50 ㎜	Torque screwdriver adapter (TM5II, 12, 14)
Torx socket torque screwdriver accessory		S2 T10 × 50 mm	Alstrong BIT 50 ㎜	Torque screwdriver adapter (TM5II, 12, 14)
Straight hex torque driver		BIT 10 mm	TOHNICHI BIT 100 ㎜	Torque screwdriver adapter (TM5)
Hex wrenches		M1.5–M10		Used to secure the Robot Base
Philips		Common length		Used to secure the inner parts of the Control Box
Diagonal pliers				Used to cut cable ties

Item	Photo	Specs	ID No.	Remark
Needle-nose pliers				Used to pick up cables and wires
Cable ties		120 × 2.5 mm^2		Used to secure cables and wires
Cable ties		150 × 3.6 mm^2		Used to secure cables and wires
Multimeter			M3460	Used to diagnose and troubleshoot issues with voltage and the PCB
USB A to Mini USB		Male-to-male		Used to troubleshoot issues with the camera
Mini USB OTG connector		Female-to-male		Used to troubleshoot issues with the camera

Item	Photo	Specs	ID No.	Remark
VGA to HDMI connector				Used to connect the monitor
Roll-up tool bag		34.34*58.5		Used to collect and organize tools
Portable screw box		135 × 200 × 39		Used to store screws for maintenance
Precision screwdriver		T06151		Used to remove screws
Tweezers				Used to pick up cables and wires
Adjustable wrench		8"		Used to secure the Robot to the calibration platform
Scissors				Used to cut cable ties
Acetate cloth tape		18-mm-wide		Used to wrap the connector of the Camera Cable
Flashlight				Used to illuminate the inner parts of the Control Box or examine the inside of the joints

Item	Photo	Specs	ID No.	Remark
Hand blower				Used to clean the inner parts of the Control Box
Security USB Robot Stick		Write protection		For Windows system recovery
Dongle			Techman Robot	Engineer mode included
Large calibration board		40 cm × 30 cm	Techman Robot	For camera calibration
Small calibration board		20 cm × 15 cm	Techman Robot	For camera calibration
TM Landmark		Length: 5 cm Width: 5 cm Thickness: 5 mm	Techman Robot	For Denavit–Hartenberg (DH) calibration

4. Dissembling and Assembling the Robot

4.1 Quick maintance Guide

4.1.1 To ensure the safe operation, at least two people should work together to disassembly it.

4.1.2 Before disassembly, ensure that the robot is powered off completely and that the external power cord and robot cable have been removed.

4.1.3 Before disassembly, remove the robot from the platform and place it horizontally on a non-hard surface (e.g., blanket or sponge pad).

4.1.4 Before disassembly, take photos to record the status and wiring method when not disassembled for reference during reassembly process.

4.1.5 Follow the right-hand rule when disassembling and installing screws.

4.2 Updates and calibration items after replacing component

✓: Need to be done.

✓*: Need to be done manually.

✗: No need to be done.

	Software updating			Calibration						
	EEPROM	ESI	FW	Hand guide	Dynamic	Vision	Kinematics	Hand eye	Barcode	Snake dance
Joint	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓
End module	✓	✓*	✓*	✓	✓	✓	✓	✓	✓	✓
Camera	✗	✗	✗	✗	✗	✓	✓	✓	✓	✗
Power control board	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗

4.3 Joint types

Position & SN	TM5	TM12	TM14	TM16	TM20
1st Joint	402	700	700	700	706
2nd Joint	402	700	700	700	706
3rd Joint	402	402	402	402	406
4th Joint	102	103	104	104	115
5th Joint	102	103	104	104	112
6th Joint	102	103	103	103	111

4.4 Assembling the joint covers:

If tightened with less torque than needed, the joint covers cannot be adequately sealed. If tightened with more torque than needed, the covers may be broken.

Joint type	Screw type	Torque (Kgf.cm)	Torque (Nm)	No. of screws
100 series	M3L6 Torx socket head cap	6	0.6	3
400 series	M3L6 Torx socket head cap	6	0.6	4
700 series	M3L6 Torx socket head cap	6	0.6	4

4.5 Removing the 700 series joint cover:

- Use the S2 Torx socket torque screwdriver (Figure 2) remove the four screws from the cover (Figure 1).
- Gently take off the cover and keep the O-ring in the groove (Figure 3).


Figure 1

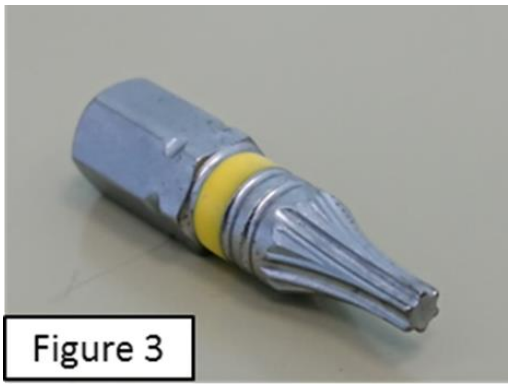


Figure 3


Figure 3

4.6 Removing the 100, 400 series joint cover

- Use the S2 Torx socket torque screwdriver (Figure 2) remove the four screws from the cover (Figure 1).
- Gently take off the cover and keep the O-ring in the groove (Figure 3).

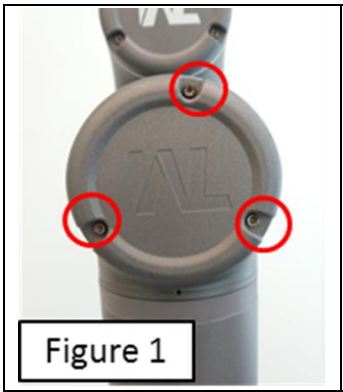


Figure 1

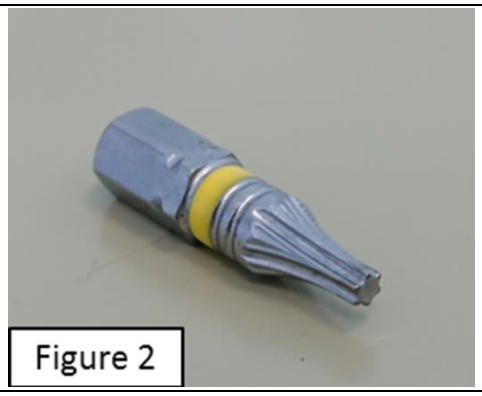


Figure 2


Figure 3

4.7 Removing the rubber band

Use a tweezer to pry off the rubber band.

- Avoid daming the rubber band (Figure 1).
- Use the forefinger and thumb to pull out the rubber band (Figure 2).
- Remove the rubber band gently by hand or tweezer (Figure 3) (Figure 4).

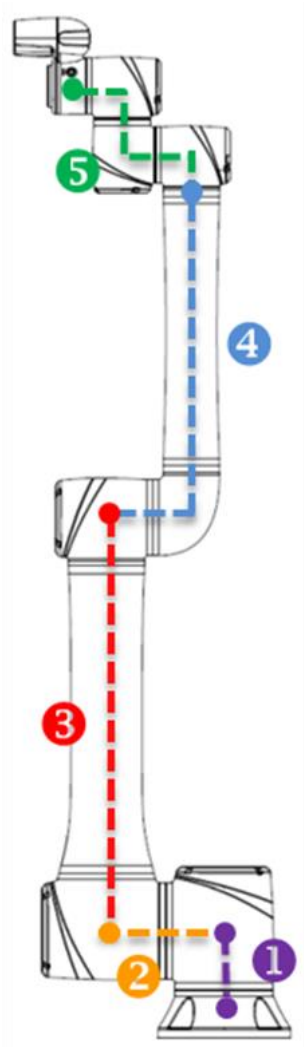

Figure 1


Figure 2


Figure 3

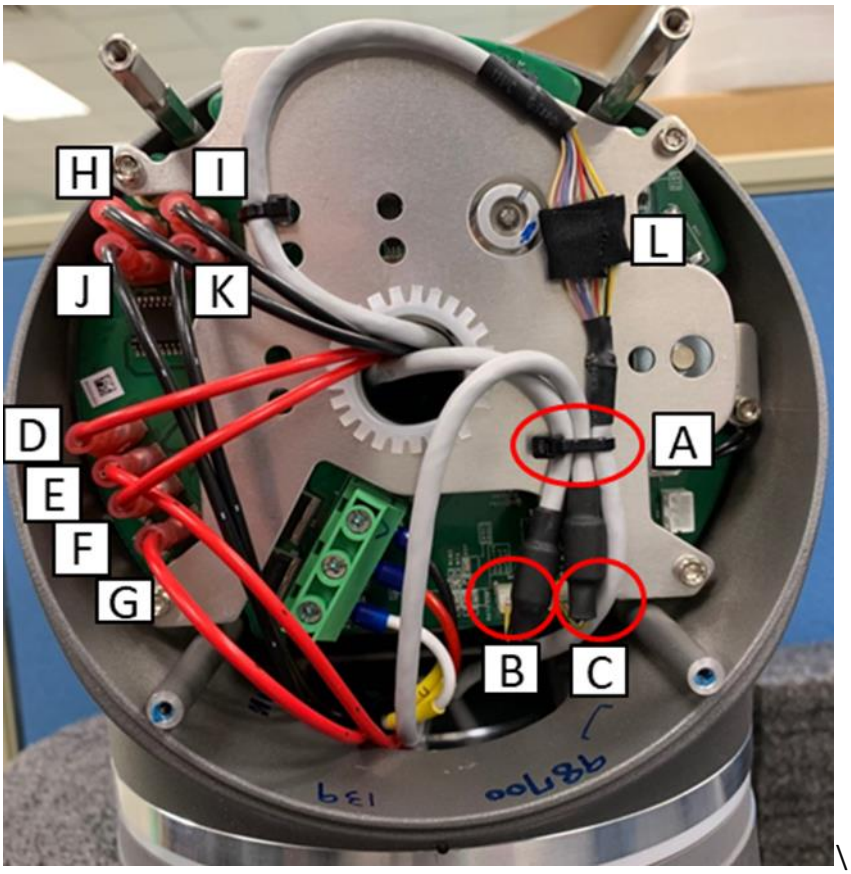

Figure 4

4.8 Location of the Camera Cable



4.9 Cables of the 700-series joint

- cable tie (point A).
- IN MII Cable (point B).
- OUT MII Cable (point C).
- IN Power Cable (points J, K, E and G).
- OUT Power Cable (points D, F, H and I).
- Camera Cable (point L).



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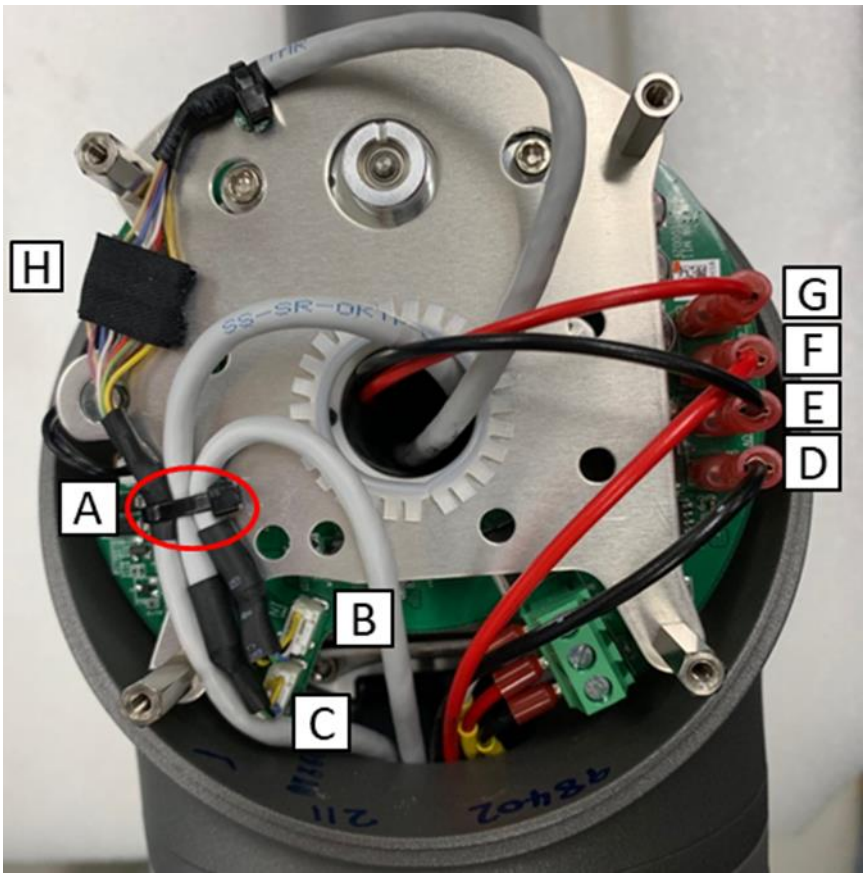
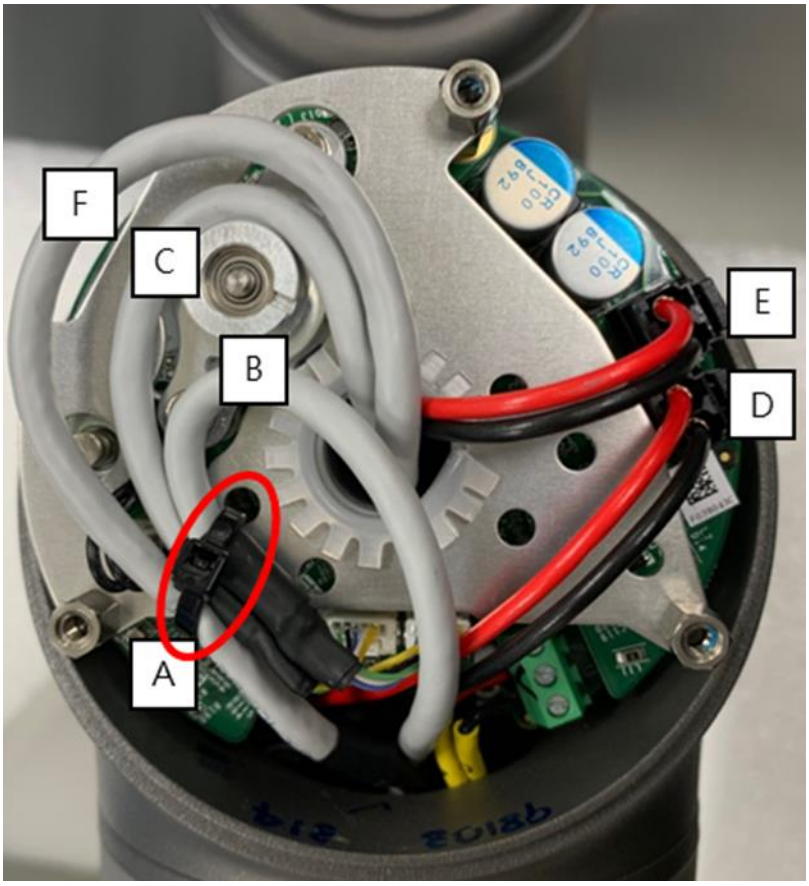
4.10 Cables of the 400-series joint

- Cut the cable tie (point A).
- IN MII Cable (point B).
- OUT MII Cable (point C).
- IN Power Cable (points D and F).
- OUT Power Cable (points E and G).
- Camera Cable (point H).



4.11 Removing the cables of the 100-series joint

- cable tie (point A).
- IN MII Cable (point B).
- OUT MII Cable (point C).
- IN Power Cable (points D and F).
- OUT Power Cable (points E and G).
- Camera Cable (point H).



4.12 Removing Joint Screws

4.12.1 Before remove Joint screws, ensure the Joint cable and connectors are disconnected; failure to disconnect the cable may result in damage to the Joint cable or components due to pulling or interference when removing the Joint.Unplug the cables of joints

4.12.2 Before remove Joint screws, remove Joint Cover and Joint Rubber.

4.12.3 Remove Joint screws (Fig. 2)

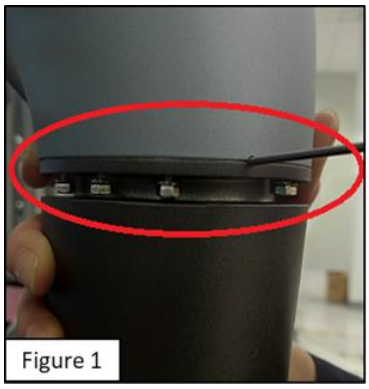


Figure 1

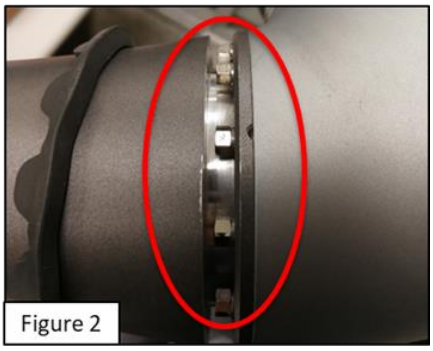


Figure 2

4.12.4 Repeated use of disassembled screws is prohibited, as the screw adhesive on the screws will become ineffective, and the repeated use will increase unforeseen risks.

4.12.5 Tighten the joint screws according to the specified torque value provided below.

Joint type	Screw type	Torque (Kgf.cm)	Torque (Nm)	Qty.
100 series	M3L12 HEX HEAD CAP	20±1	2.0±0.1	8
400 series	M5L20 HEX HEAD CAP	92±4.5	9.0±0.5	8
700 series	M6L20 HEX HEAD CAP	150±7.5	14.7±0.8	10

4.12.6 Loosen the screws in a diagonal order, allowing their stress to spread evenly across all modules.

4.12.7 To tighten the screws in the correct direction, make sure the key (Figure 1) is inserted into the slot (Figure 2) for each module (Figure 3). Insert the Ø1.9-mm pin gauge into the positioning hole (Figure 4) to check if the screws are tightened in the correct direction. However, any subsequent step for robot assembly should be paused, if the positioning holes of two modules that are assembled together are not aligned and the pin gauge cannot be inserted into the holes, or if the holes are too way off to insert the gauge.

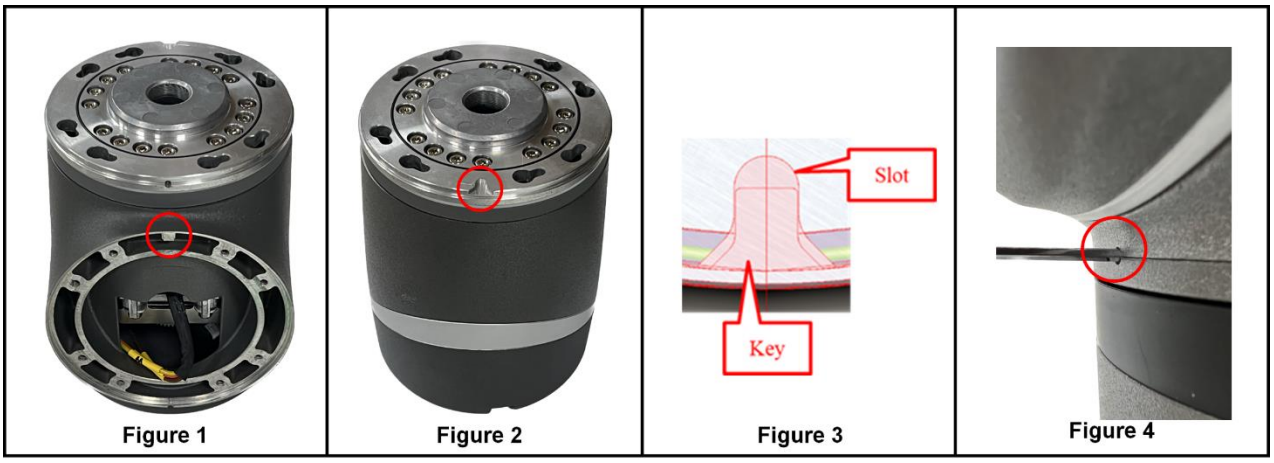


Figure 1 Figure 2 Figure 3 Figure 4

4.13 Disassembling/Assembling the Base

4.13.1 Put the Robot on the workstand (Figure 1)

4.13.2 Loosen the screws on the Base (Figure 2) (Figure 3)

4.13.3 Remove the Base cover (Figure 4)

Figure 1

Figure 2

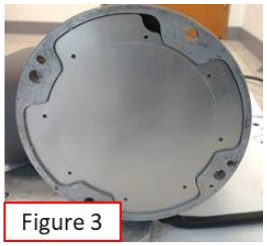


Figure 3

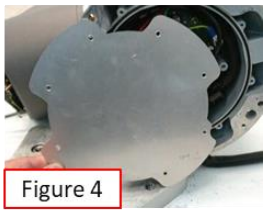
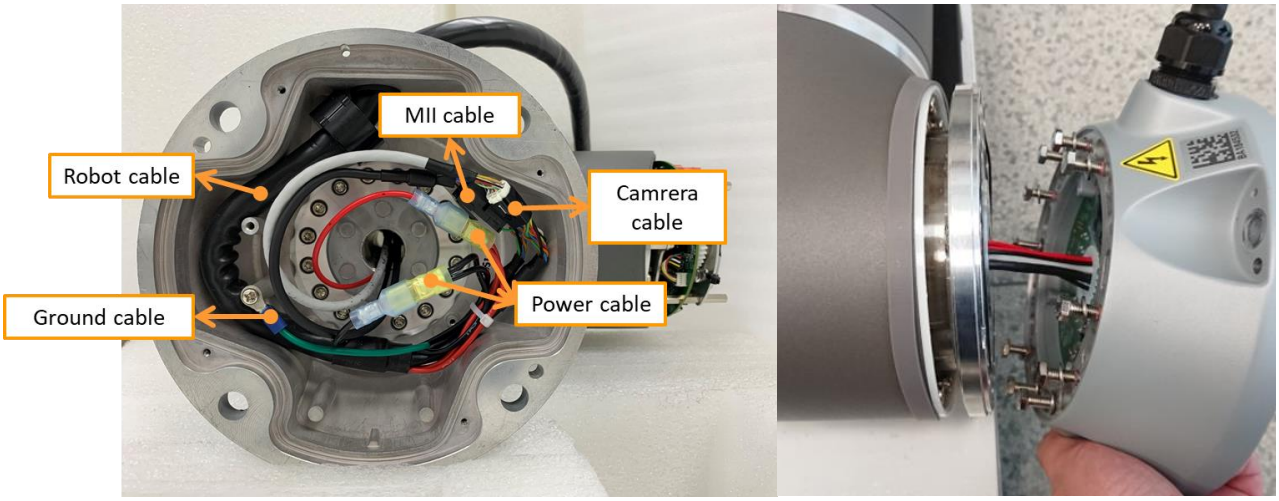


Figure 4

4.13.4 Disconnect the cables inside the cables and loosen the screws between base module and Joint 1, the base module can be removed.



4.13.1 Disconnect the cables inside the cables and loosen the screws between base module and Joint 1, the base module can be removed.

4.13.2 Do the reverse steps to assemble the Base.

4.14 Disassembly and assembly 700 Series Joint

4.14.1 Remove the Joint cover and Joint rubber.

4.14.2 Remove the Joint cable from the Joint。

4.14.3 Remove the screws connecting the Joint to other Joints or the Arm, then detach the Joint.

4.14.4 During assembly, follow the reverse steps of the previously mentioned procedure.

4.15 Disassembly and assembly 400 Series Joint

4.15.1 Remove the Joint cover and Joint rubber.

4.15.2 Remove the Joint cable from the Joint。

4.15.3 Remove the screws connecting the Joint to other Joints or the Arm, then detach the Joint.

4.15.4 During assembly, follow the reverse steps of the previously mentioned procedure.

4.16 Disassembly and assembly 100 Series Joint

4.16.1 Remove the Joint cover and Joint rubber.

4.16.2 Remove the Joint cable from the Joint。

4.16.3 Remove the screws connecting the Joint to other Joints or the Arm, then detach the Joint.

4.16.4 During assembly, follow the reverse steps of the previously mentioned procedure.

4.17 Disassembly and assembly Upper arm

4.17.1 Remove Joint cover and Joint rubber which in Joint 2 & Joint 3

4.17.2 Remove Joint cable which in Joint 2 & Joint 3

4.17.3 Remove the screws connecting the Upper arm to Joint 2 and Joint 3, then detach the Upper arm.

4.17.4 During assembly, follow the reverse steps of the previously mentioned procedure.

4.18 Disassembly and assembly Lower arm

4.18.1 Remove Joint cover and Joint rubber which in Joint 3 & Joint 4

4.18.2 Remove Joint cable which in Joint 3 & Joint 4

4.18.3 Remove the connecting screws between the Lower arm and Joint 4.

4.18.4 Remove the connecting screws between Joint L and Joint 3.

4.18.5 After removing the Lower arm, remove the screws connecting the Lower arm to Joint L, then remove the Lower arm.Assembling/Dissembling the End Module

4.19 Disassembly and assembly End module

4.19.1 Remove Joint cover and Joint rubber which in Joint 6

4.19.2 Remove Joint cable which in Joint 6.

4.19.3 Remove the connecting screws between Joint 6 and the End module, then detach the End module.

4.19.4 During assembly, follow the reverse steps of the previously mentioned procedure.

4.20 Disassembly and assembly Light module

4.20.1 Refer to the picture below to remove the four screws securing the camera light source module.

4.20.2 Unplug the power cable of the light source module and remove the light source module, being careful

not to let the O-ring fall off.

4.20.3 During the assembly of the End module, please follow the reverse steps of the previously mentioned procedure.

4.21 Changing the Camera

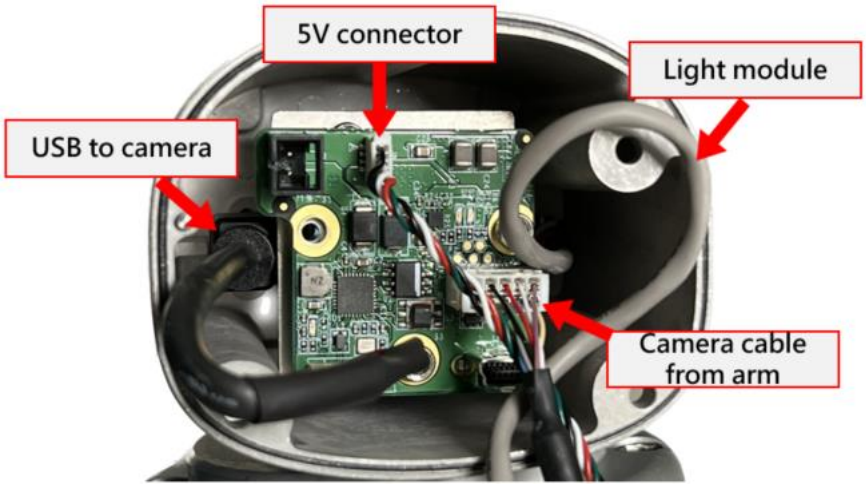
4.21.1 Confirming the camera type: Before maintenance begins, the operator should check whether the Robot is mounted with the IDS or TRI Camera. Both cameras are different with respect to their appearance, color, dissembly, and assembly. The image below distinguishes between the two cameras.

IDS Camera TRI Camera

4.1 Dissembling the IDS Camera

4.1.1 Dissembling the End module: Remove the three M3L10 screws on the camera and separate the camera's cover from the End Module. The screws should be tightened with a torque of 10 kgf·cm.

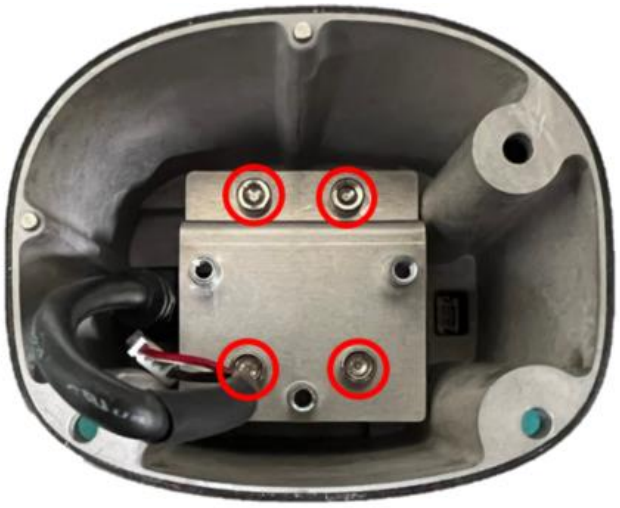
4.1.2 Disconnect all the cables shown in the image below.



4.1.3 After the camera is removed, loosen the three M3L6 screws on the extender device board. The screws should be tightened with a torque of 10 kgf·cm.

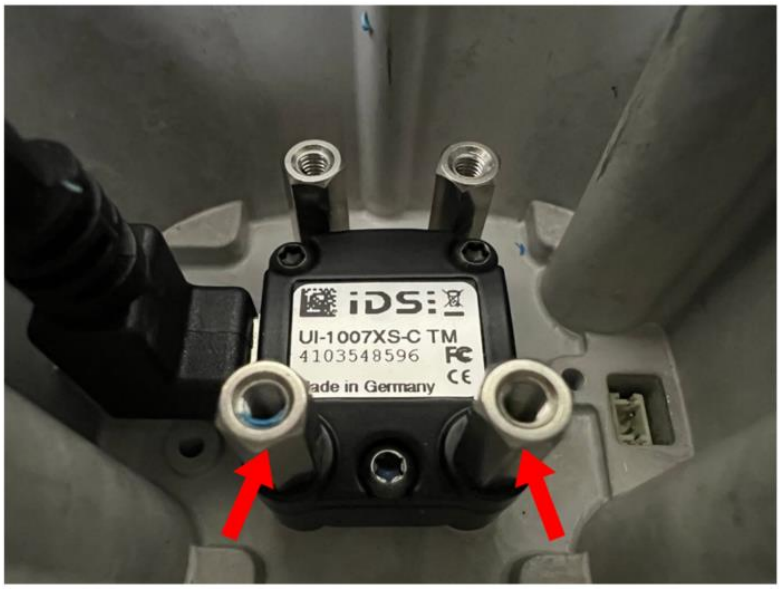
4.1.4 Remove the four M3L6 screws on the extender device board bracket. The screws should be tightened

with a torque of 10 kgf·cm.



4.1.5 Remove the four M3L6 screws on the extender device board bracket. The screws should be tightened with a torque of 10 kgf·cm.

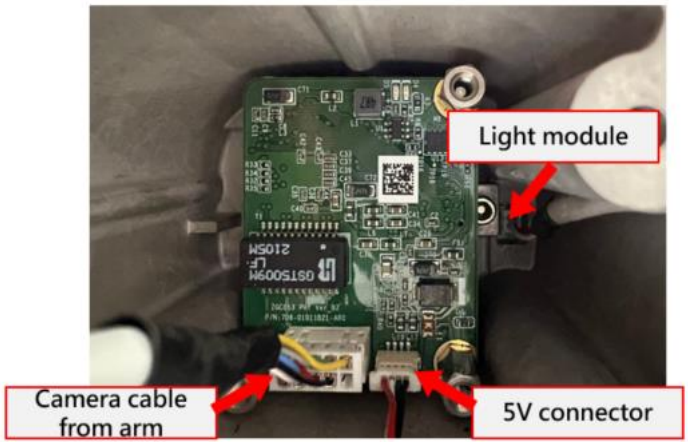
4.1.6 After taking off the extender device board bracket, remove the two hex screws that secure the camera. Then pick up the camera. The screws should be tightened with a torque of 10 kgf·cm.



4.2 Dissembling the TRI Camera

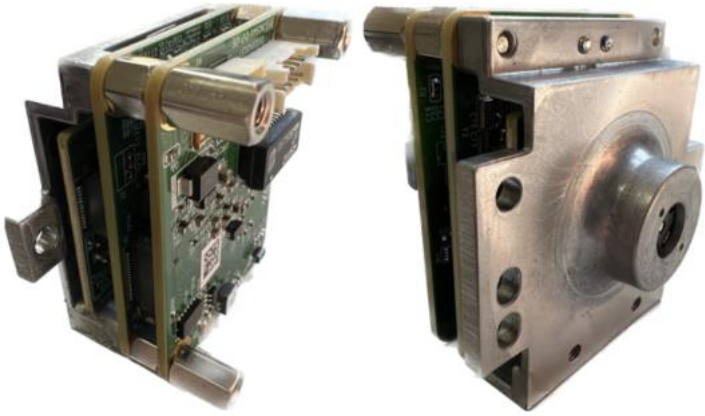
4.2.1 Dissembling the End module: Remove the three M3L10 screws on the camera and separate the camera's cover from the End Module. The screws should be tightened with a torque of 10 kgf·cm.

4.2.2 Disconnect all the cables shown in the image below.



4.2.3 After taking off the camera, remove the three M3L6 screws that secure the camera. The screws should be tightened with a torque of 10 kgf·cm.

4.2.4 After the camera is removed (see the image below), install the new one. Do not remove and modify any components of the camera.



5. Calibrate the robot in maintenance mode

5.1 Tools and space

5.1.1 To avoid collisions, the gripper, external cables, and external equipment must be removed before performing calibration.

5.1.2 For the X-version robot without a camera, only Dynamic Calibration and Hand-Guide Calibration need to be performed.

5.1.3 Camera Calibration is required only when replacing the End Module or camera. If a Joint is replaced, perform Kinematic Calibration, Hand-Eye Calibration, Verification, and Barcode Setting.

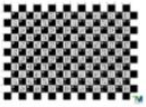
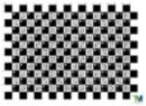
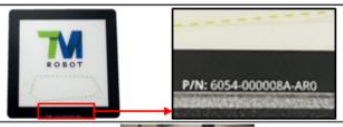
5.1.4 Before calibration, ensure the robot is securely mounted to the platform, and that the platform remains stable without any shaking during arm movement.

5.1.5 Move the robot to the Home Pose while powered on and confirm there is no backlash or misalignment in any joint.

5.1.6 During calibration, use standard indoor lighting as the primary light source. Additional lighting is unnecessary unless in special environments with insufficient or unstable lighting.

5.1.7 To maintain stability in the relative position between the robot and the calibration plate, both must be mounted on the same platform.

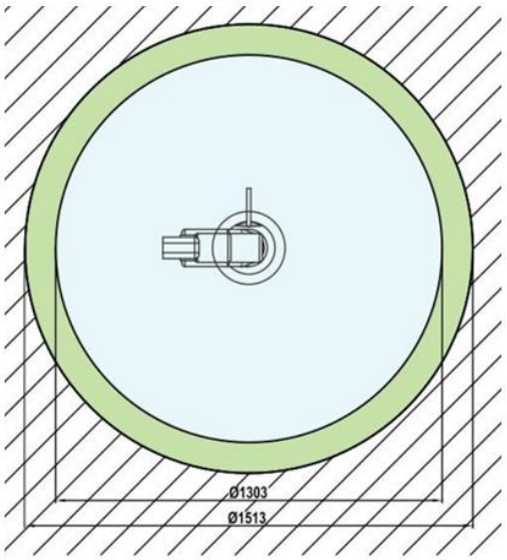
Tools and space

1	Maintenance dongle	
2	Small dice board *Only the new calibration plate can be used (the new version has a smooth touch, whereas the old version has noticeable printed texture when touched).	
3	Big dice board *Only the new calibration plate can be used (the new version has a smooth touch, whereas the old version has noticeable printed texture when touched).	
4	Landmark *Only the new aluminum anti-reflective version of the Landmark (with part number 6054-000008A-AR0 at the base) can be used, and ensure the protective film on top has been removed.	
5	Calibration plateform	

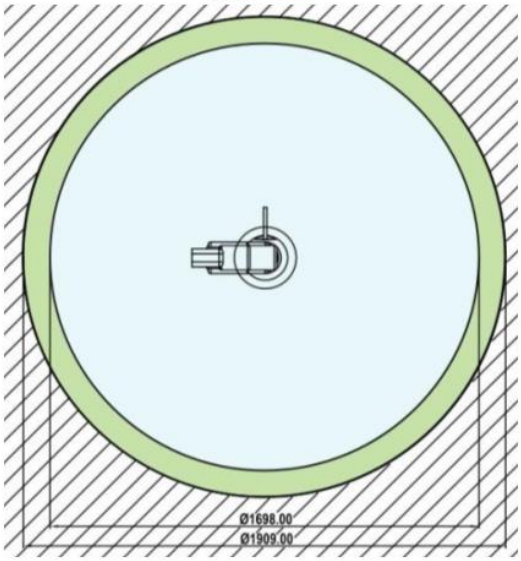
Tools and space

Ensure that there is enough space to perform the calibration.

TM5-700



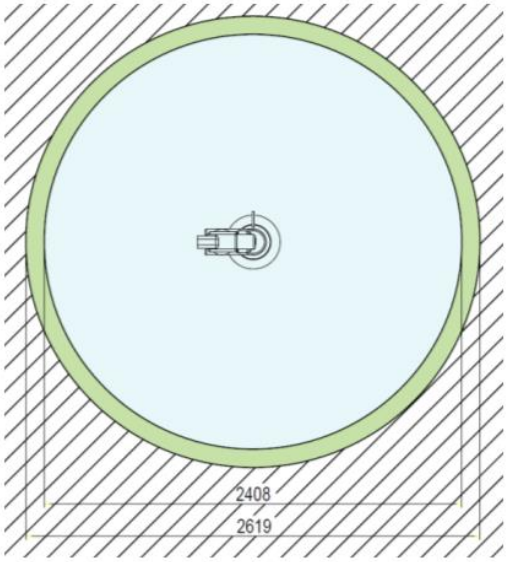
TM5-900



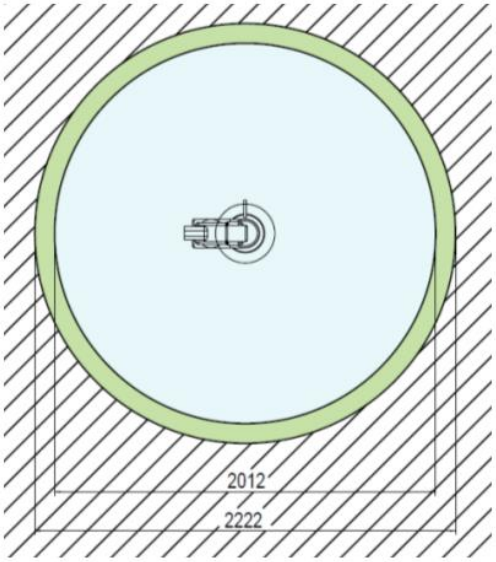
Tools and space

Ensure that there is enough space to perform the calibration.

TM12 / TM20

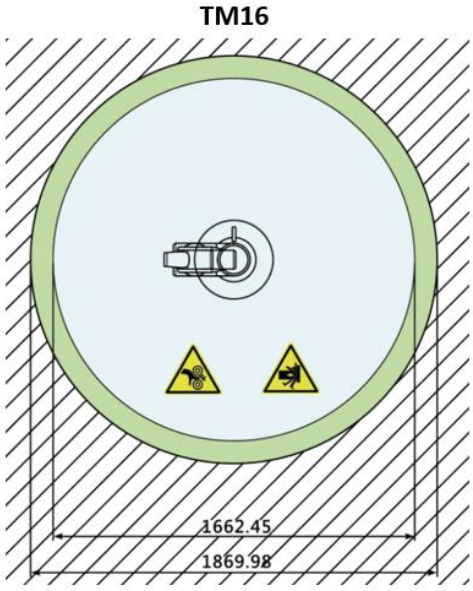


TM14



Tools and space

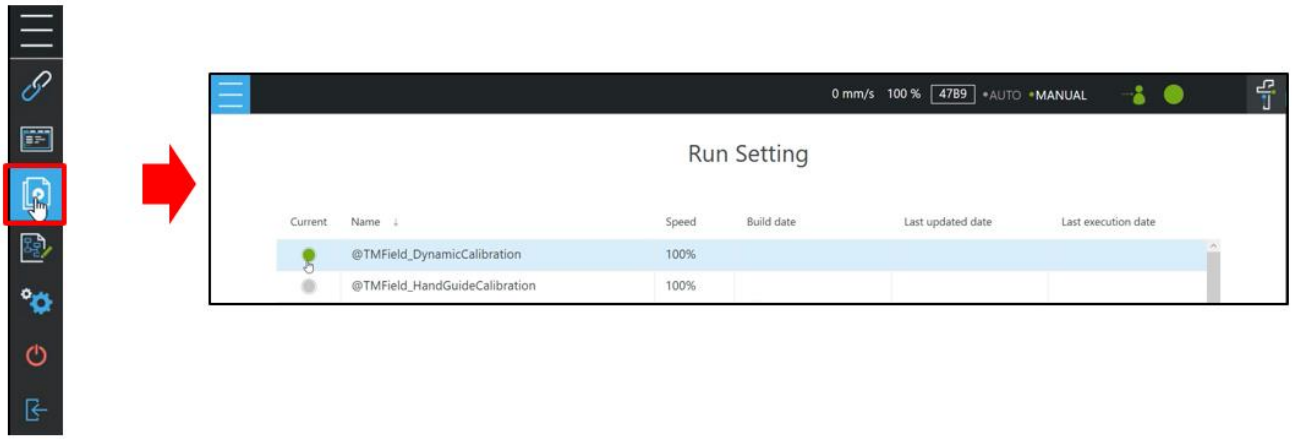
Ensure that there is enough space to perform the calibration.



5.2 Dynamic calibration and Hand-guide calibration

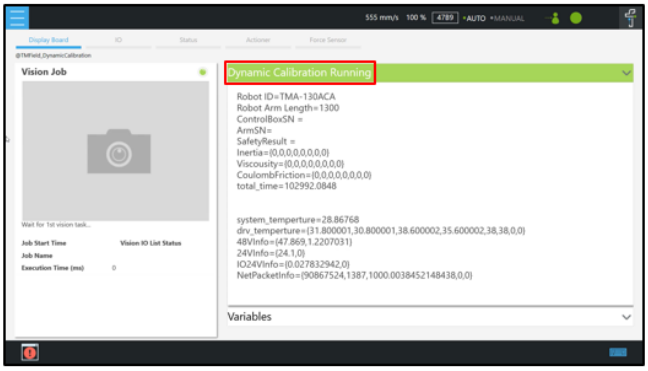
Dynamic calibration and Hand-guide calibration – Dynamic calibration

1. Select the @TMField_DynamicCalibration
2. Switch the robot into auto mode and run the project.

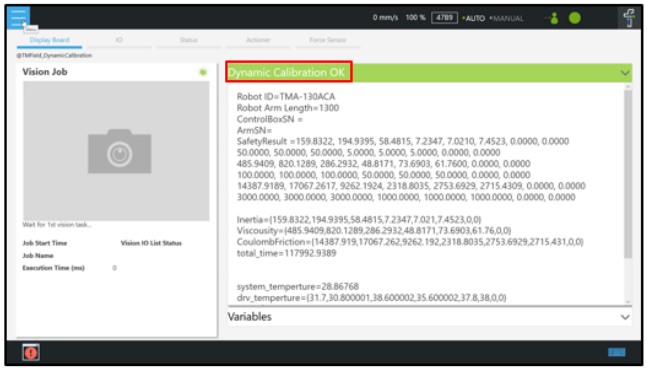


Dynamic calibration and Hand-guide calibration – Dynamic calibration

Dynamic calibration is running

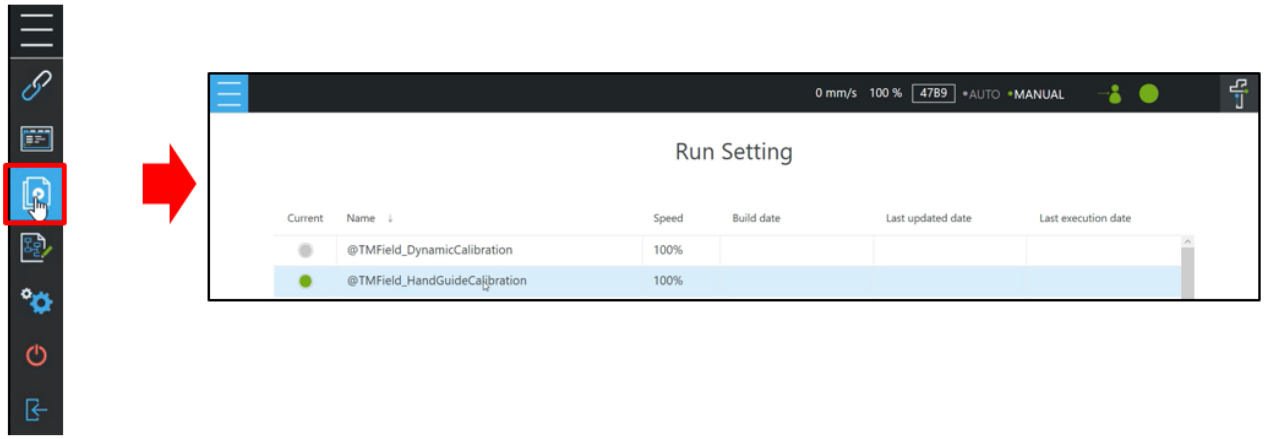


Dynamic calibration completed



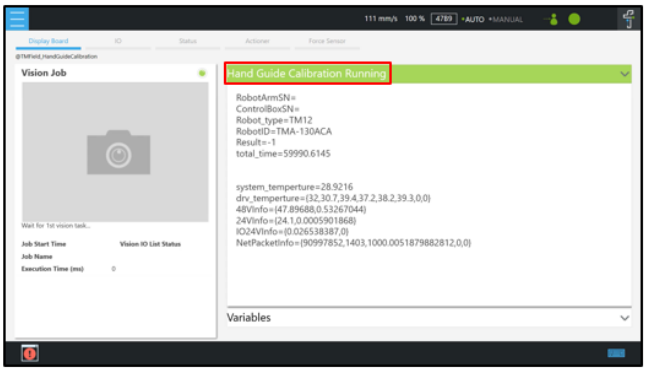
Dynamic calibration and Hand-guide calibration – Hand-guide calibration

1. Select the @TMField_HandGuideCalibration
2. Switch the robot into auto mode and run the project.

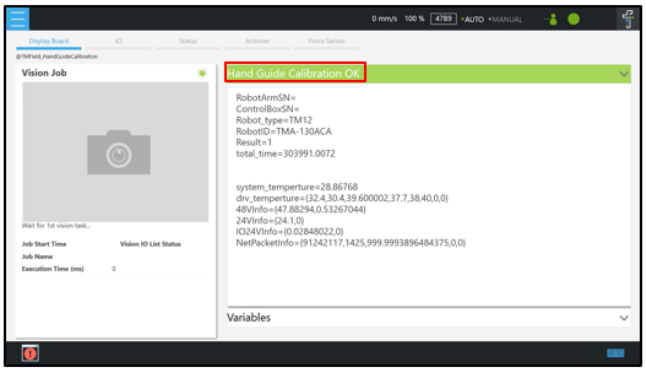


Dynamic calibration and Hand-guide calibration – Hand-guide calibration

Hand-guide calibration is running

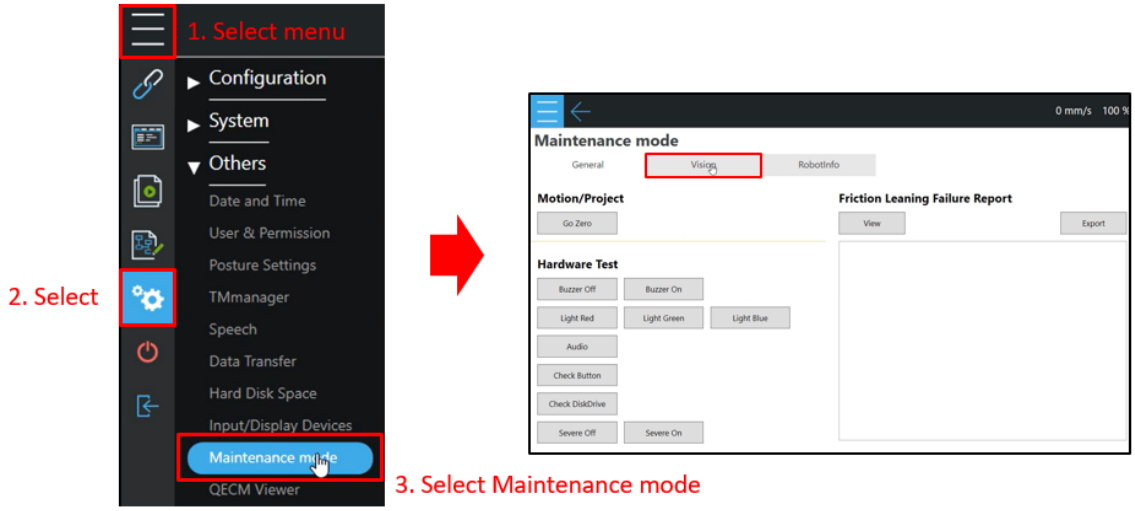


Hand-guide calibration completed

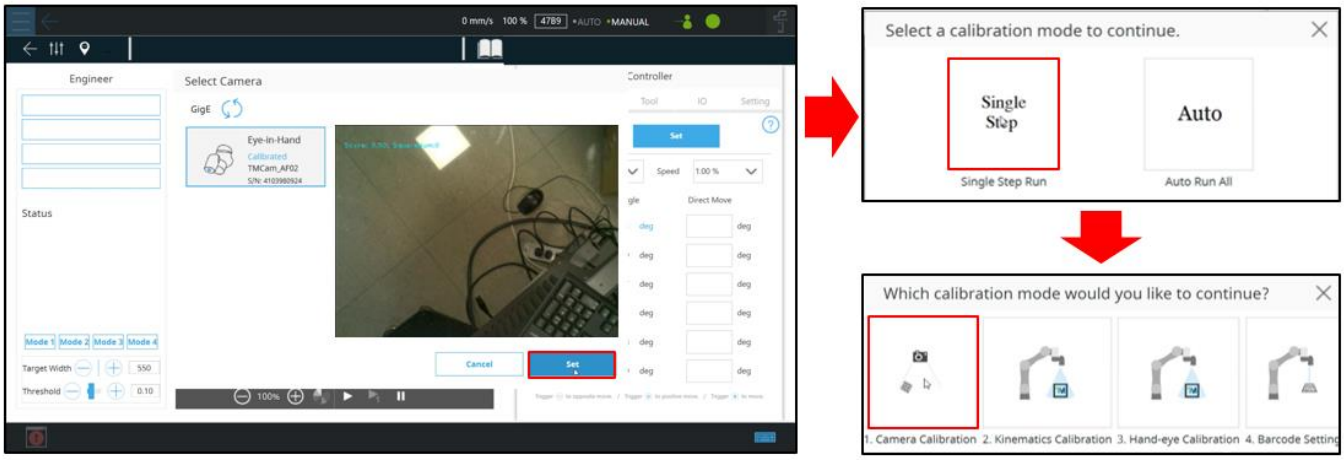


5.3 Camera calibration

Camera calibration

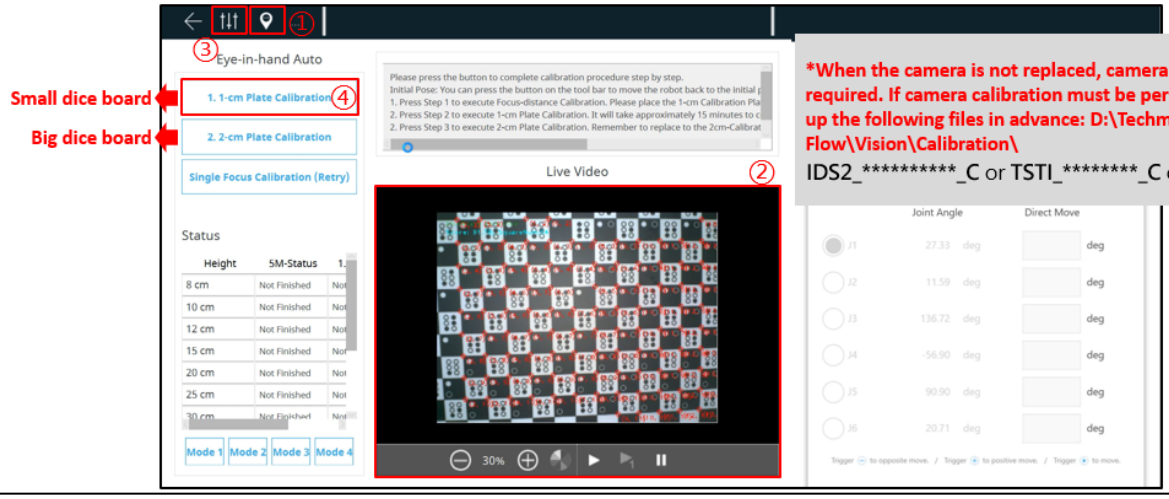


Camera calibration



Camera calibration

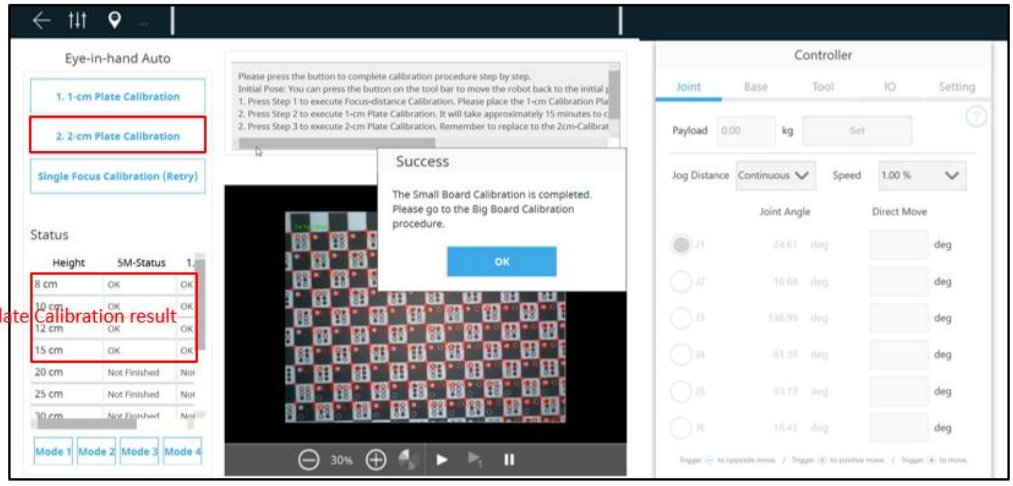
1. Use ① to move the robot to the designated position, then place the **small dice board** and make sure the camera can see the entire dice board as shown in ②
2. Use ③ to adjust the parameters (Activate the built-in light and set the values as 255; for other settings, click Auto once)
3. After setting up, click ④1-cm Plate Calibration to start the calibration



***When the camera is not replaced, camera calibration is not required. If camera calibration must be performed, please back up the following files in advance: D:\Techman Robot\TM Flow\Vision\Calibration**
IDS2_**********_C or TSTI_********_C or TRI_********_C

Camera calibration

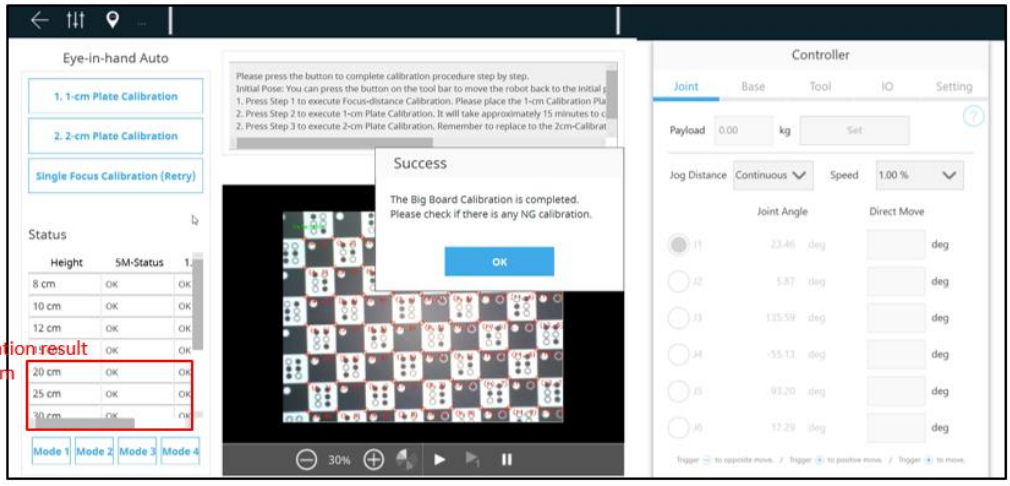
1. Setting up the **big dice board** properly after 1-cm Plate Calibration(small dice board) is completed.
2. Run 2-cm Plate Calibration.



1-cm Plate Calibration result

Camera calibration

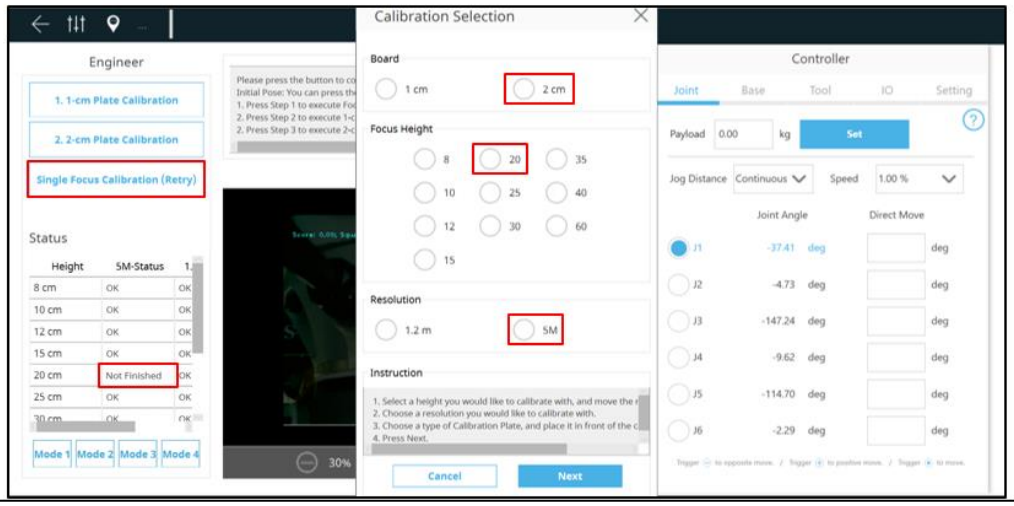
2-cm Plate Calibration completed.



2-cm Plate Calibration result from 20cm to 60cm

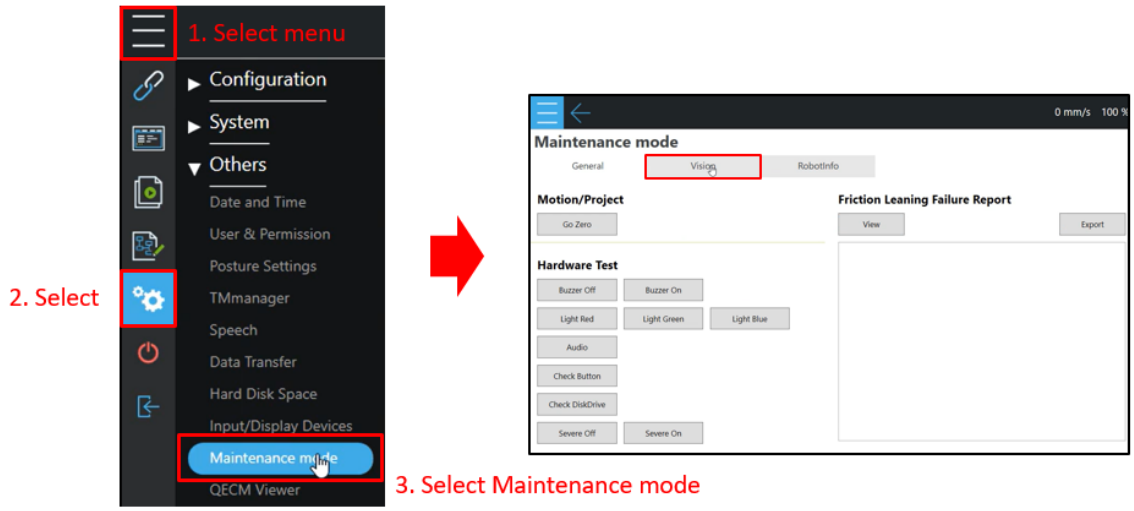
Camera calibration

1. If there is any status showing 'not finished' after completing the 2-cm Plate Calibration, use 'Single Focus Calibration' for re-calibrating.
2. E.g. 20cm 5M-Status failed. So the 'Board' setting would be 2cm, 'Focus height' would be 20, 'Resolution' would be 5M. Put the big dice board on the camera FOV and click Next.

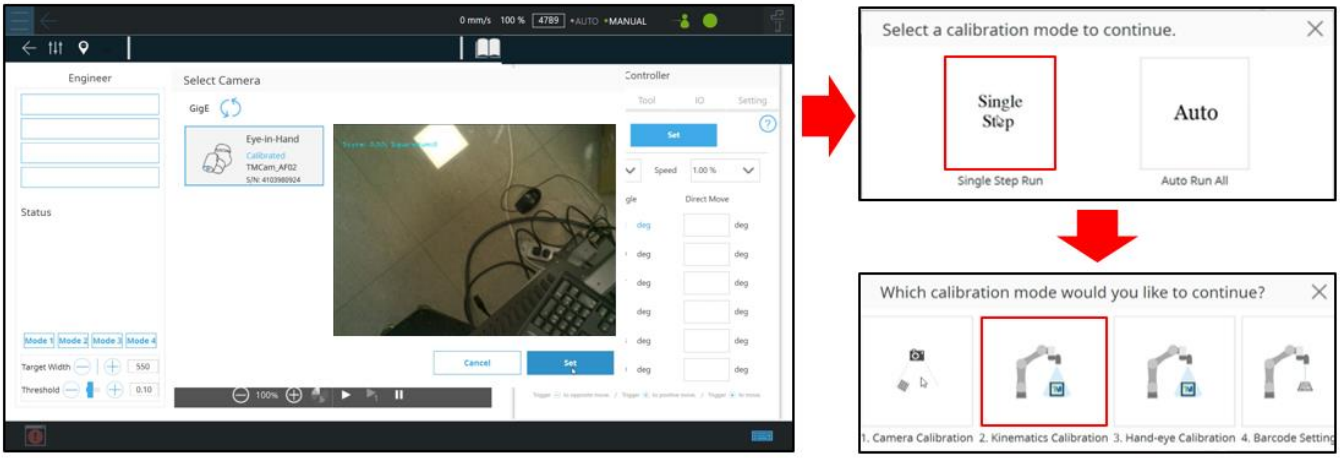


5.4 Kinematics calibration

Kinematic calibration

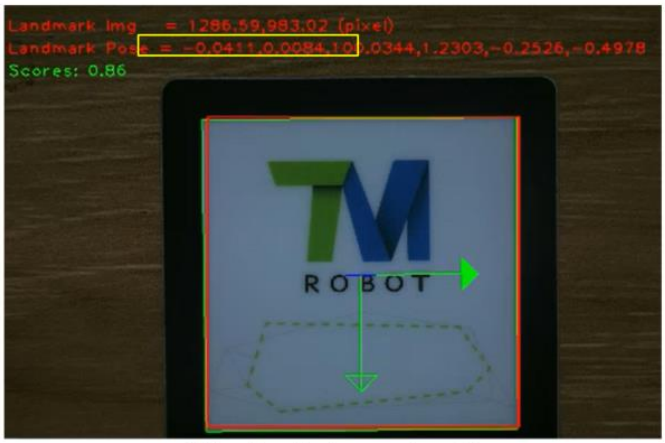


Kinematic calibration

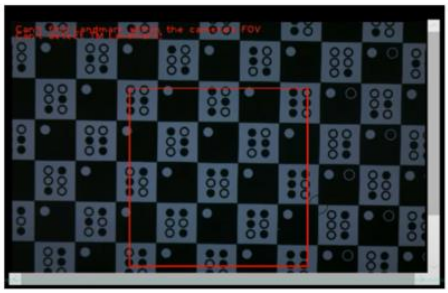


Kinematic calibration

1. Click "Move to Initial Position" to move the robot to its initial position.
2. First, place the Landmark at position (0, 0, 100) relative to the camera (Figure A). Then, remove the Landmark and replace it with the 1 cm calibration plate, ensuring the entire camera view is covered by the calibration plate (Figure B).
3. Set the camera parameters sequentially (Figure C) and save the settings.
4. After completing the parameter setup, remove the 1 cm calibration plate and place the Landmark back at position (0, 0, 100) relative to the camera (Figure A, or align the red and green frames in the camera view). Click "Kinematic Calibration" to start the calibration process.



(A)Landmark placement position



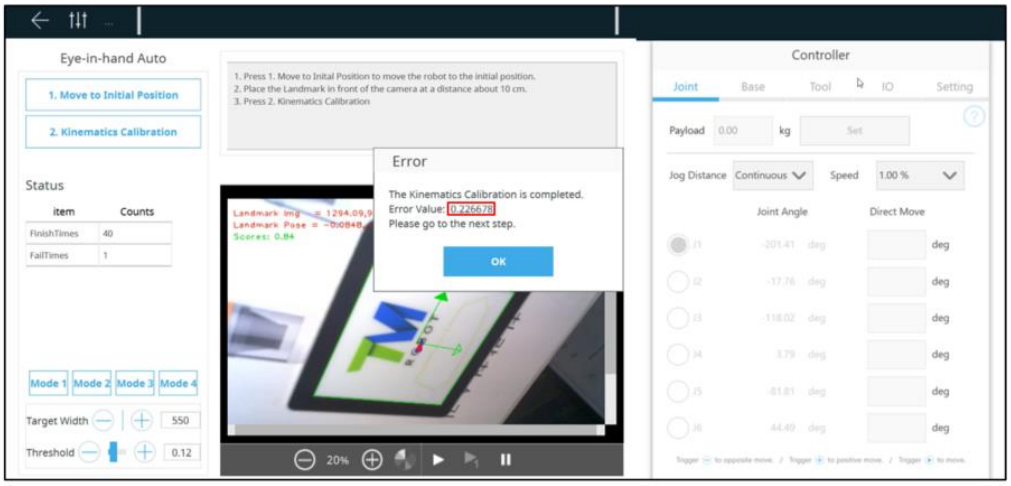
(B)Place 1 cm calibration plate

1. Built-in lighting: Enable and set the value to 255
2. Shutter Time: Set to 5000. Increase the value only if the light source is unstable or insufficient.
3. Gain: Set to 0
4. White balance: Press "Auto once
5. Focus: Set to 3

(C)Set camera parameter

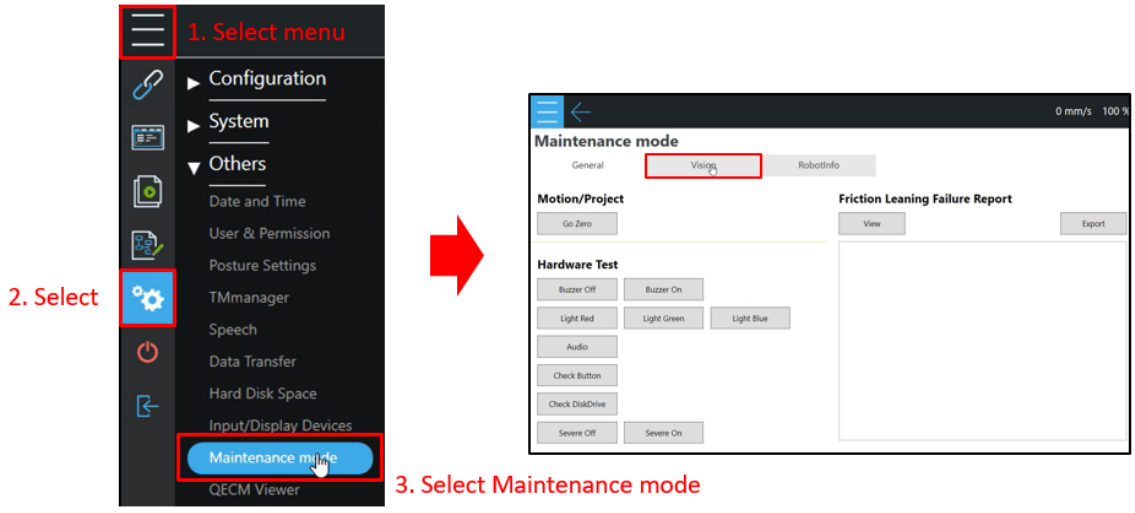
Kinematic calibration

1. Calibration will terminate after completing 40 successful calibrations (FinishTimes) or 15 failed calibrations (FailTimes).
2. After calibration, if the error value is below 0.3, the calibration is considered successful. If the error value exceeds 0.3 or the calibration fails, provide the following to Techman: **Camera view images, photos of the environment, video of the calibration process, Logs from the same day.**

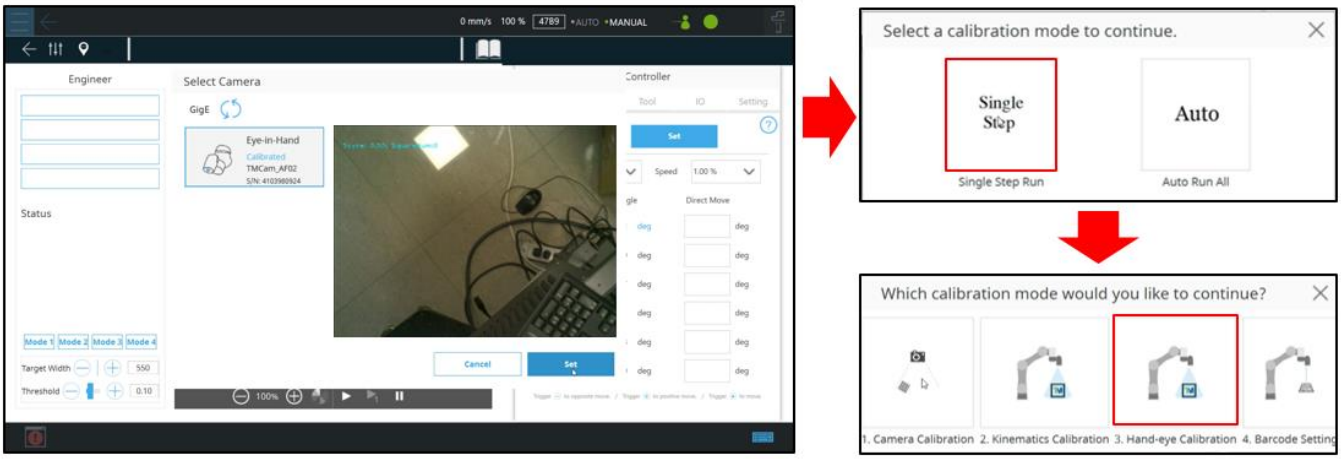


5.5 Hand-eye calibration and Verification

Hand-eye calibration & Verification

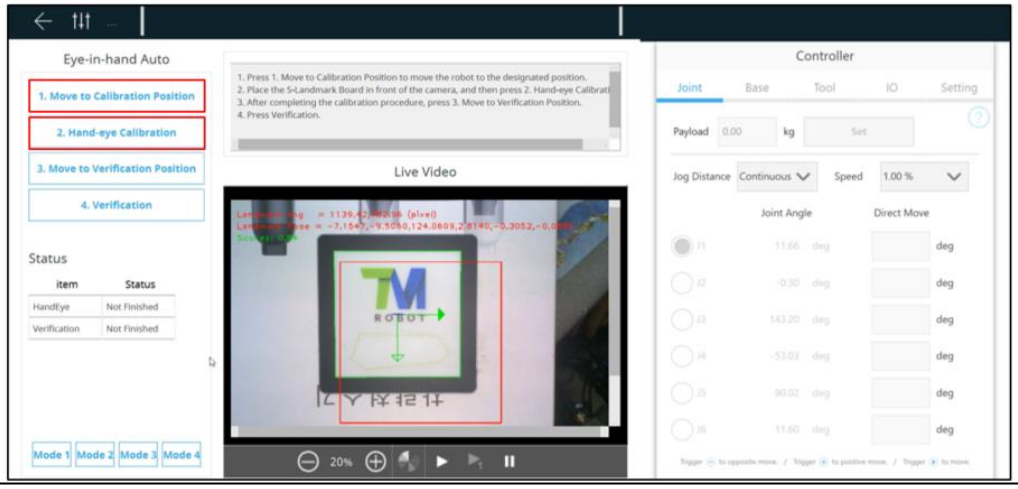


Hand-eye calibration & Verification



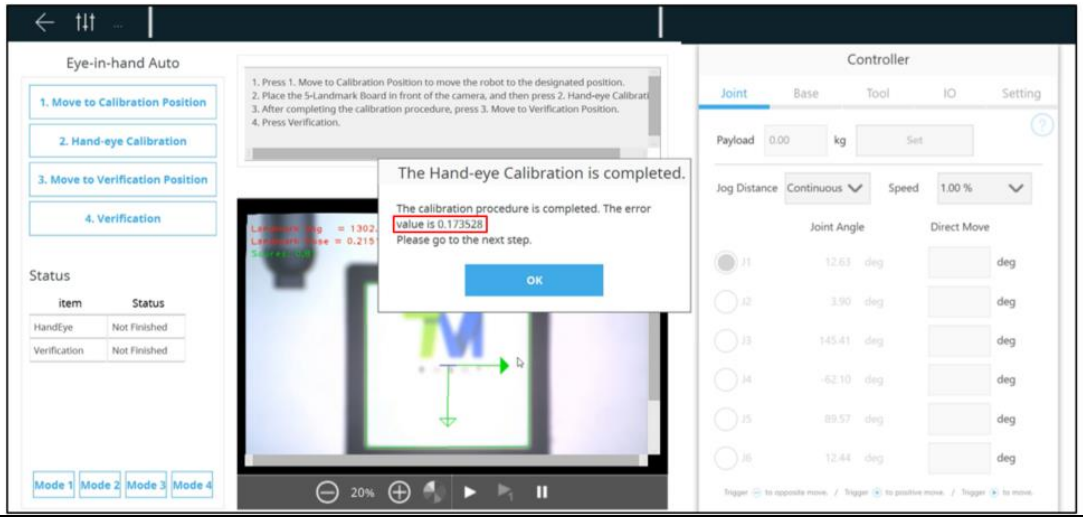
Hand-eye calibration & Verification

1. Press 'Move to Calibration Position' to move the robot to the designated position.
2. Continue using the calibration position and camera parameters from the Kinematic Calibration.
3. Press 'Hand-eye Calibration'.



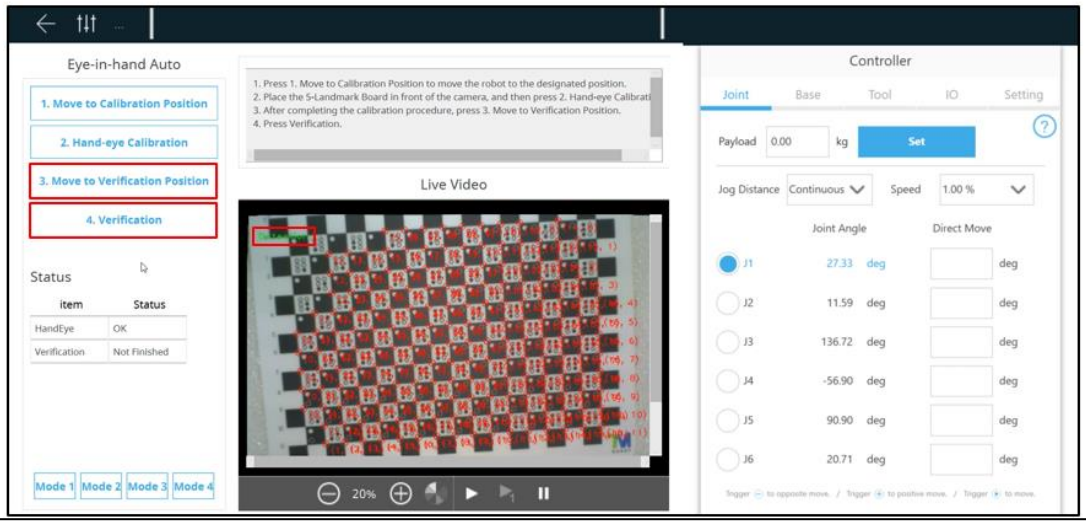
Hand-eye calibration & Verification

1. After completing the calibration, if the error value is below 0.3, the calibration is considered successful.
2. If the error value exceeds 0.3 or the calibration fails, send the following to Techman: **Camera view images, photos of the environment, video of the calibration process, Logs from the same day**



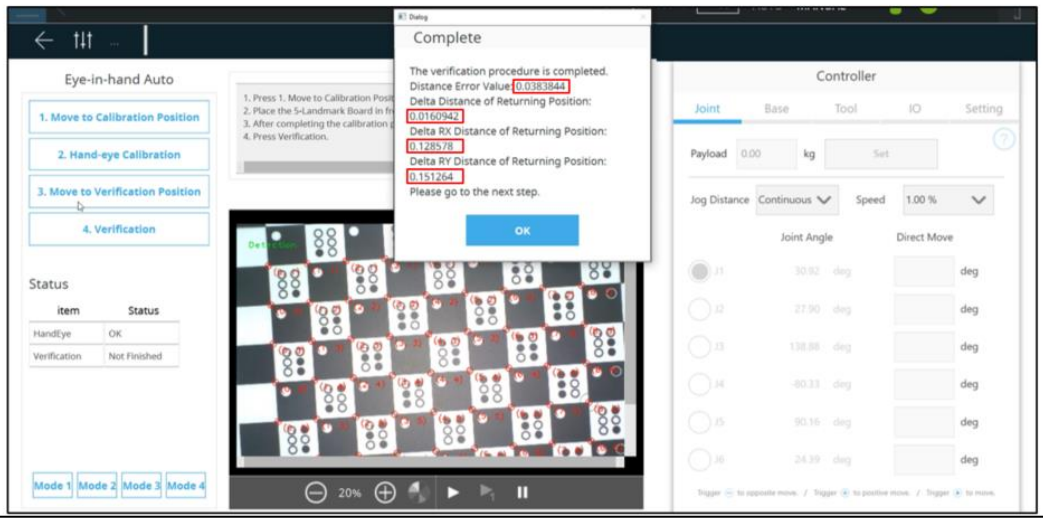
Hand-eye calibration & Verification

1. Press 'Move to Verification Position' to move the robot to the designated position after completing the hand-eye calibration.
2. Place the **small dice board**, turn on the camera light, and adjust camera parameters to ensure the small dice board can be detected. Then press 'Verification'.



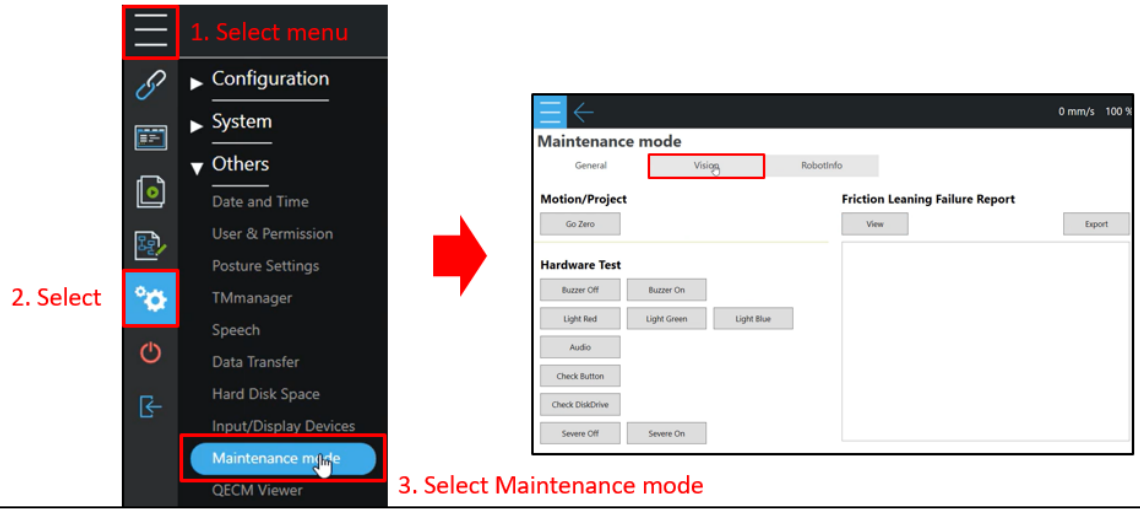
Hand-eye calibration & Verification

1. After calibration is complete, please ensure that the first and second values are below 0.5, and the third and fourth values are below 1.
2. If any of the values exceed the specified limits, please redo the Hand-eye calibration and Verification.
3. If the error value exceeds 0.3 or the calibration fails, send the following to Techman: **Camera view images, photos of the environment, video of the calibration process, Logs from the same day**

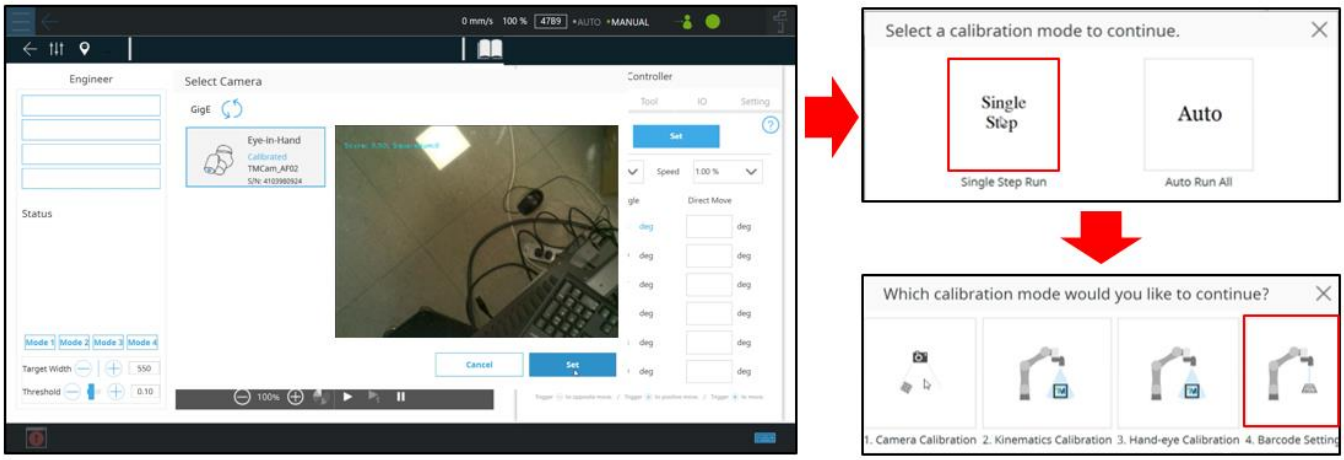


5.6 Barcode setting

Barcode setting

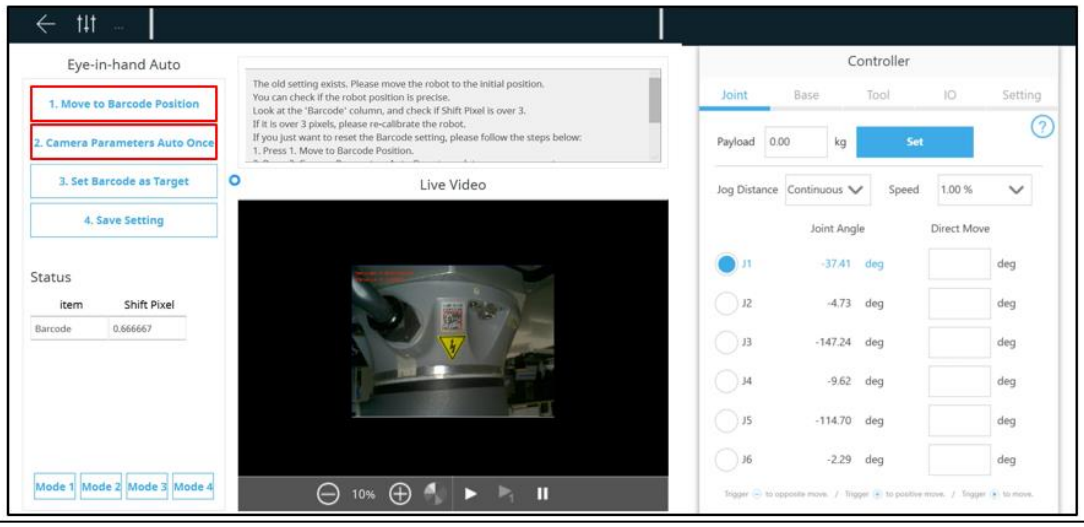


Barcode setting



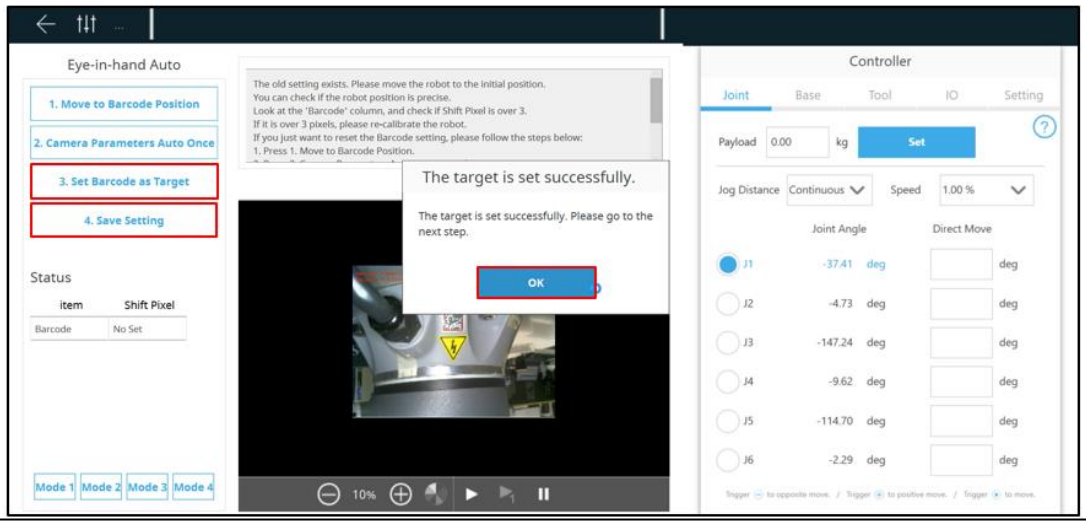
Hand-eye calibration & Verification

1. Press 'Move to Barcode Position' to move the robot to the initial position.
2. Press 'Camera Parameter Auto Once' to set the camera parameter automatically.



Hand-eye calibration & Verification

1. Press ‘Set Barcode as Target’ to save the present barcode location.
2. Press ‘Save setting’ and finish the calibration.



5.7 Snake dance project

Snake dance

1. Create 2 nodes, each with following joint angles:

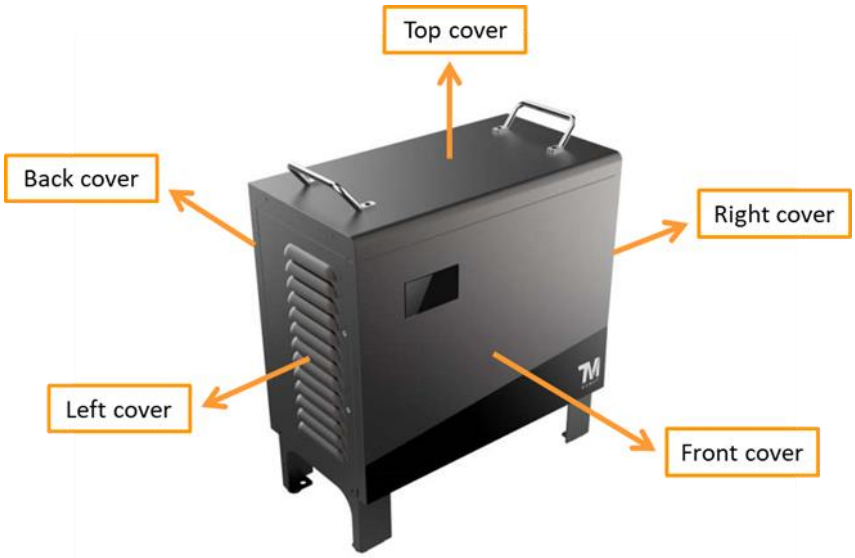
	Node 1	Node 2
J1	260	-260
J2	90	-90
J3	-150	150
J4	90	-90
J5	170	-170
J6	110	-110

1. Make the 2 nodes run in a loop, run at 10% speed for 10 minutes, then run at 30% speed for 1 hour, then run at 60% speed for 1 hour.
2. During the project, if there is any error codes appear, or any abnormalities occur (e.g. noise, jittering…), contact the FAE or refer to the error code list first.
3. If there is no abnormality after the test, the robot is ready for use.

6. Disassemble/Assemble the Control Box

6.1 Disassemble/Assemble the Control Box

- Disassemble the Front cover。
- Disassemble the Back cover。
- Disassemble the Left cover。
- Disassemble the Right cover。
- Disassemble the Top cover。
- Disassemble the LCD screen cover。



Required Tools

- a Phillips screwdriver
- a T20 Torx screwdriver

Disassemble the Front cover

- Put the Control Box in a clean working space (laying a blanket in the spread is recommended to avoid scratching the control box) and loosen the two Torx screws (as shown in Figure 1).
- Carefully pull the Front cover out along the track (as shown in Figure 2).

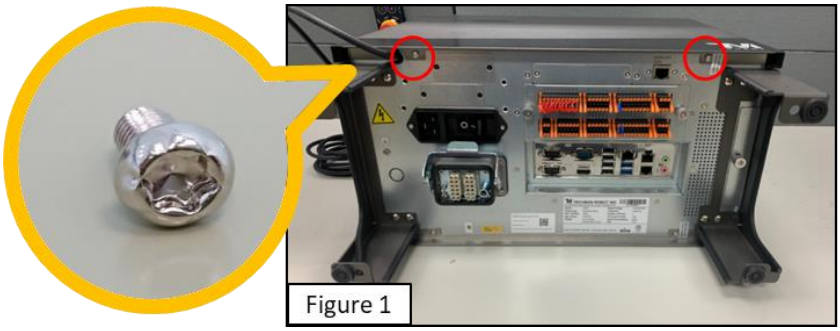


Figure 1

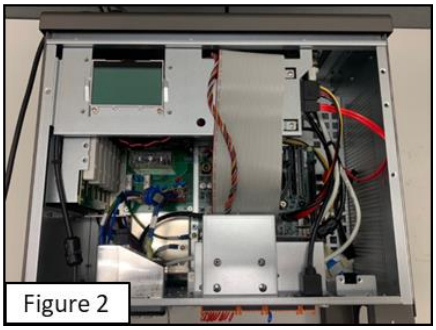


Figure 2

Disassemble the Back cover

- Put the Control Box in a clean working space and loosen the two Torx screws (as shown in Figure 1).
- Carefully pull the Back cover out along the track (as shown in Figure 2).

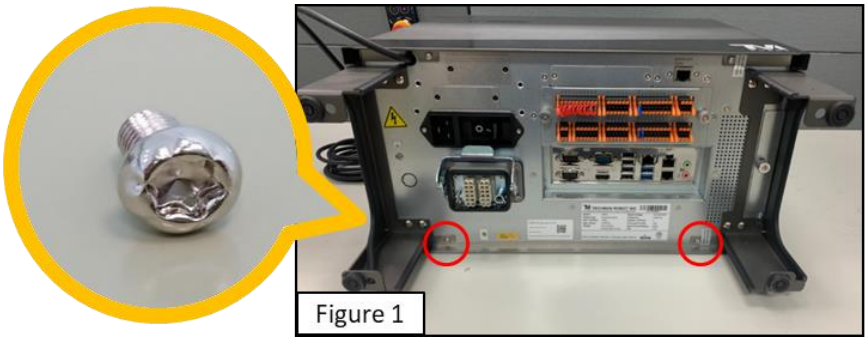


Figure 1

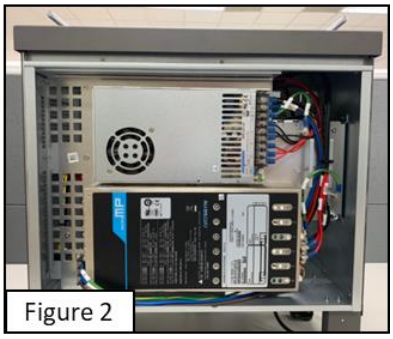


Figure 2

Disassemble the Left cover

- Refer to Disassemble the Front cover and disassemble the Back cover for relevant operating instructions (as shown in Figure 1).
- Use the Phillips screwdriver to loosen the screw on the Left cover (as shown in Figure 2).
- Remove the Left cover (as shown in Figure 3).

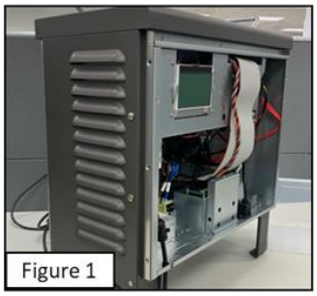


Figure 1

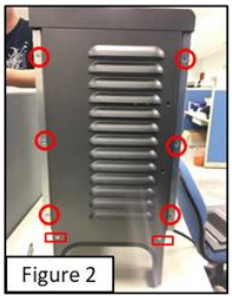


Figure 2


Figure 3

Disassemble Right cover

- Refer to Disassemble the Front cover and disassemble the Back cover for relevant operating instructions (as shown Figure 1).
- Use the Phillips screwdriver to loosen the screw on the Right cover (as shown in Figure 2).
- Remove the Right cover (as shown in Figure 3).

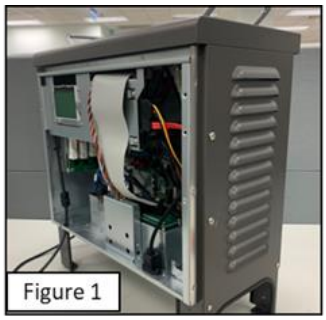


Figure 1

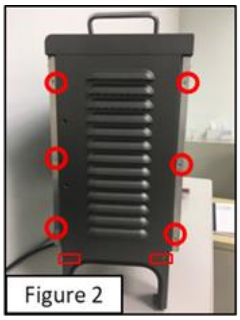


Figure 2


Figure 3

Disassemble the Top cover

- Refer to the previous operating steps to disassemble the Front cover, the Back cover, the Left cover, and the Right cover of the control box (as shown in Figure 1).
- Use the Phillips screwdriver to loosen the screw on the Top cover (as shown in Figure 2 and Figure 3).
- Remove the Top cover (as shown in Figure 4).

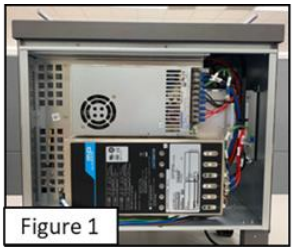


Figure 1

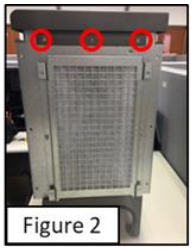


Figure 2

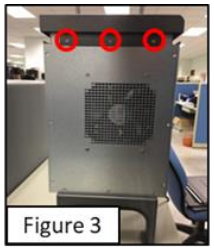


Figure 3

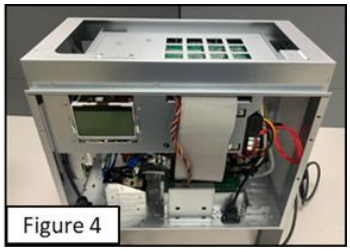


Figure 4

Disassemble the LCD screen cover

- Disassemble the Front cover。
- Refer to the previous operating steps to disassemble the Front cover。
- Remove the two cables (as shown in Figure 2).
- Use the Phillips screwdriver to loosen the four screws and remove the LCD screen cover (as shown in Figure 3).

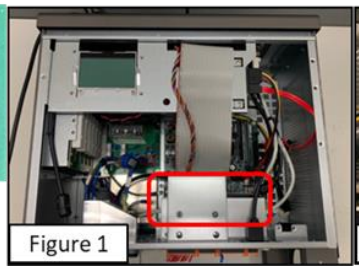


Figure 1

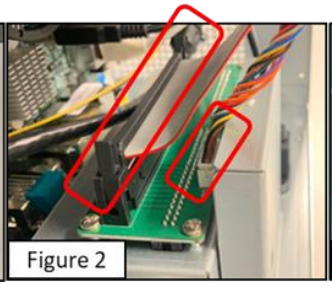


Figure 2

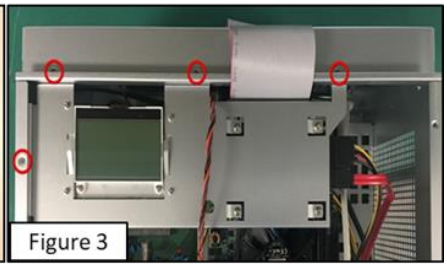
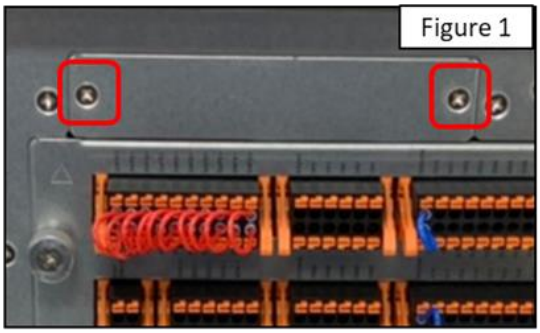


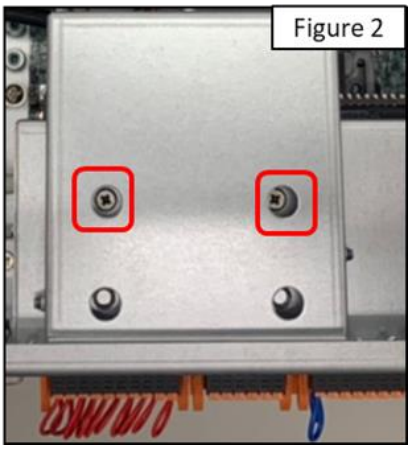
Figure 3

6.2 Disassemble/Install the IPC cables

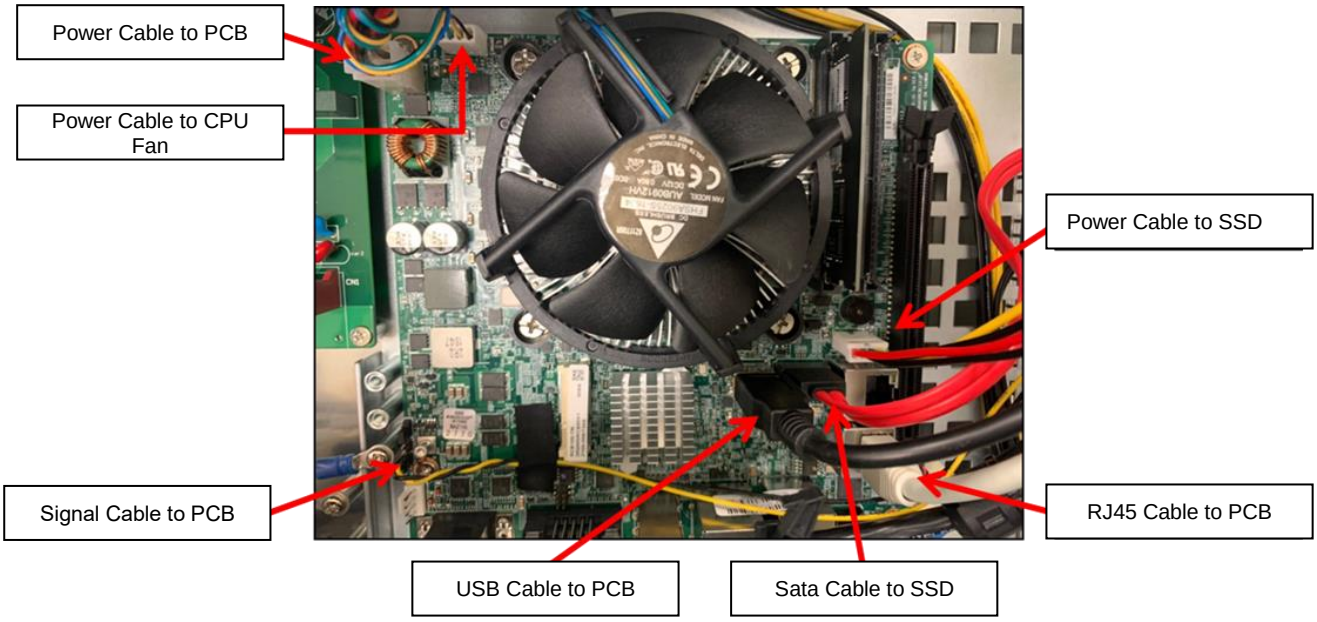
Preparation

- Refer to the previous operating steps to disassemble the Front cover。
- Loosen the external SSD rack and remove the rack (as shown in Figure 1 and Figure 2).

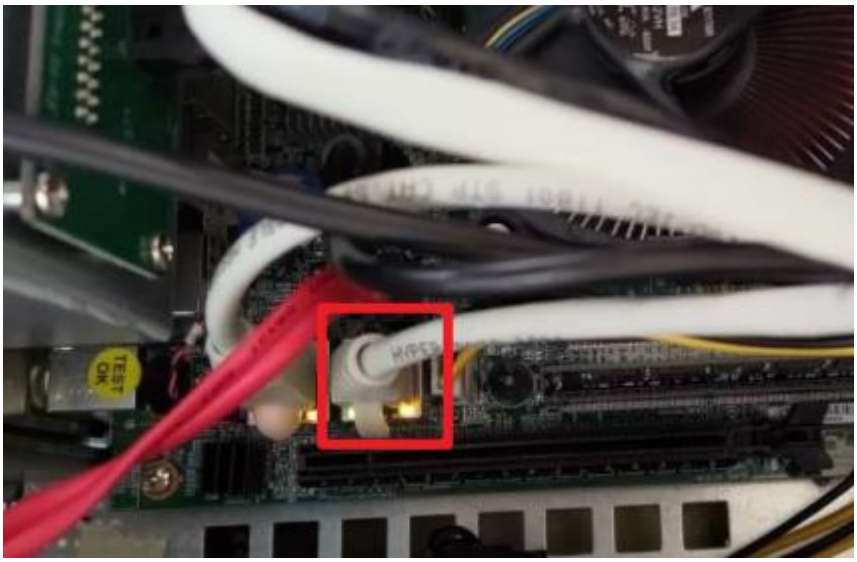




IPC Cable Wiring

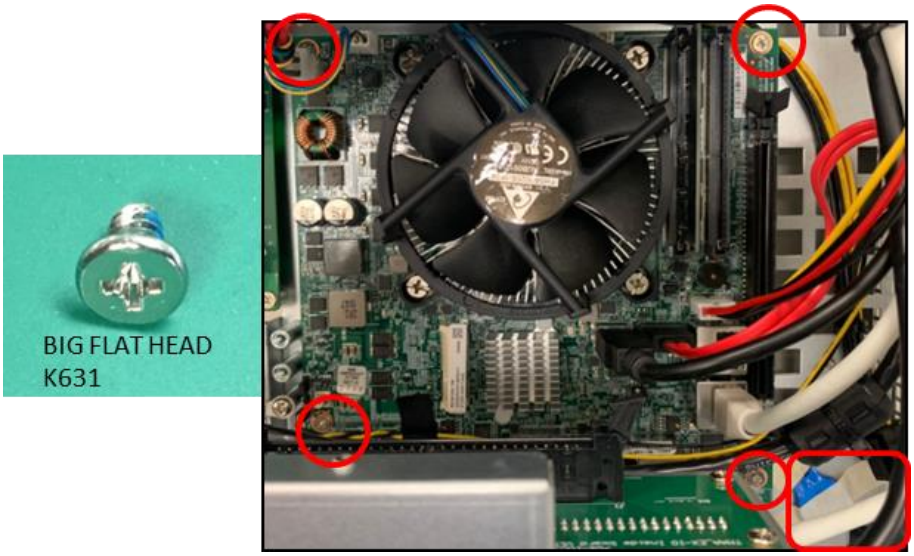


If the robor is TRI camera version, it comes with an extra RJ-45 Cable (as shown below framing in red).



Disassemble the IPC

- Disconnect all the cable on the IPC.
- Loosen the four screws on the IPC and remove the battery.

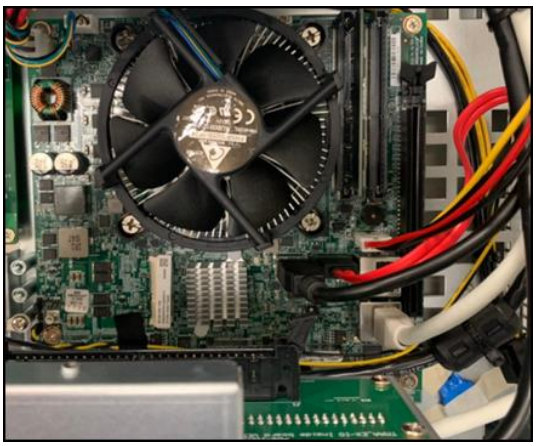


Assemble IPC and reinstall the IPC cables

- Operate the previous steps in reverse while assembling the IPC.

Items to check:

- The battery must adhere to the control box.
- The power cable of the CPU fan is wrapped around the IPC power cable to prevent the fan from being damaged by it.
- The black and yellow conduits install correctly.
- The RJ-45 cable connects to the Ethernet port of the IPC correctly.



6.3 Disassemble/Assemble Power Control Board

Preparation

- By the previous operating steps, disassemble the Front cover, the Back cover, the Left cover, the Right cover, the Top cover, and the LCD screen cover respectively and locate all the circuits of the Power Control Board (as shown in Figure 1 and Figure 2).

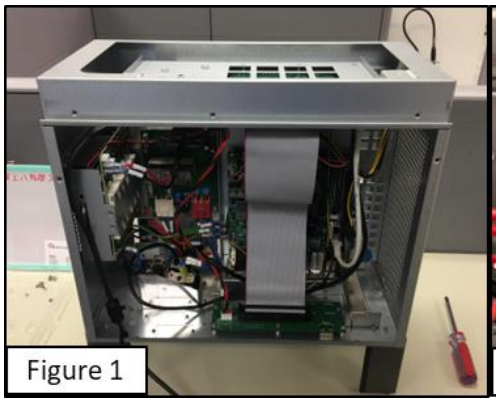


Figure 1

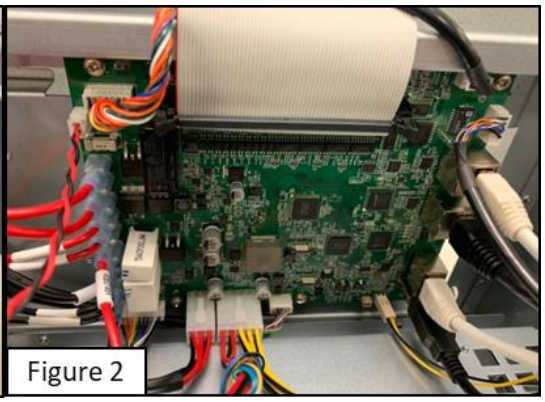
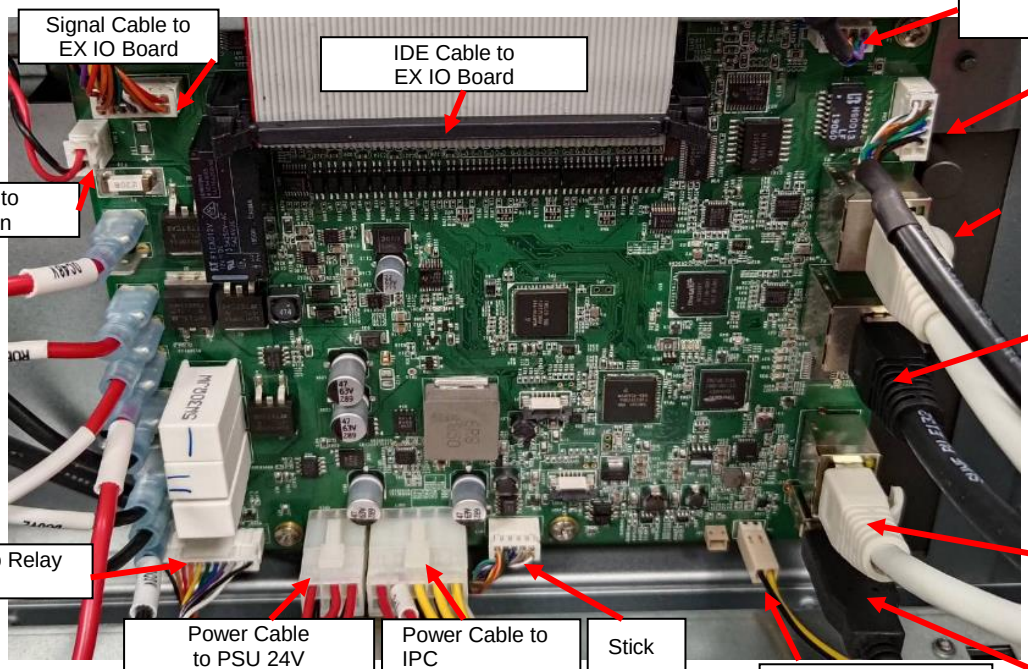
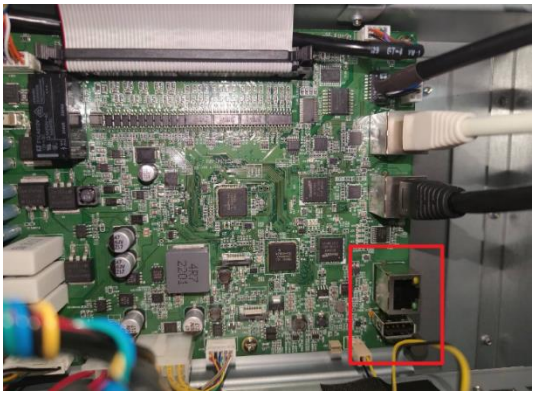


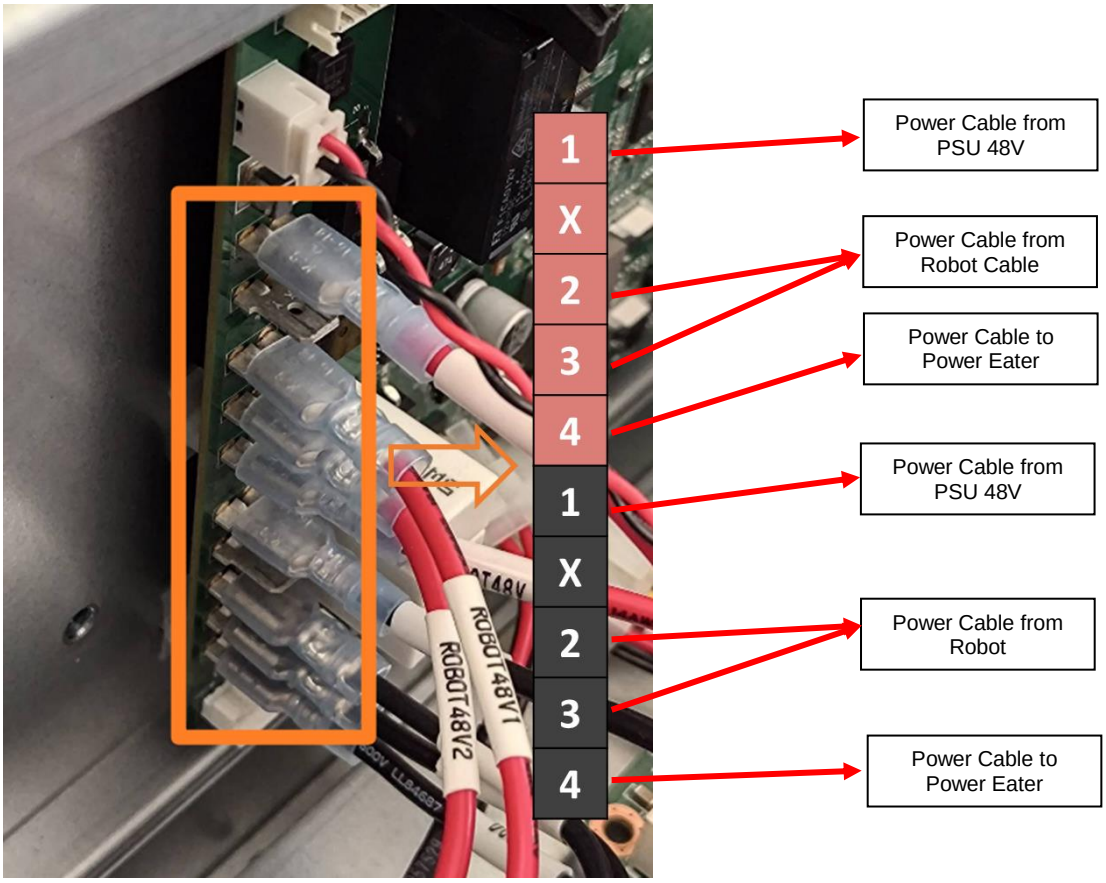
Figure 2

Power Control Board Cabling



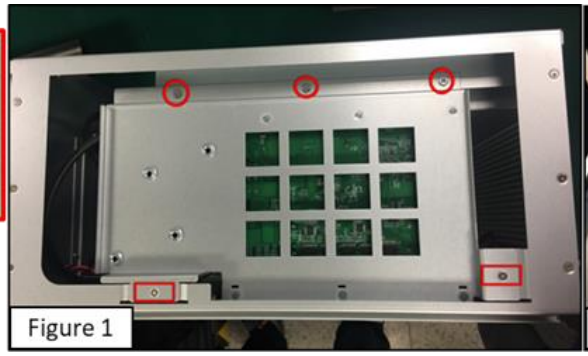
If the robor is a TRI camera, the configuration comes as below. (The cable in the frame in red is cancel).

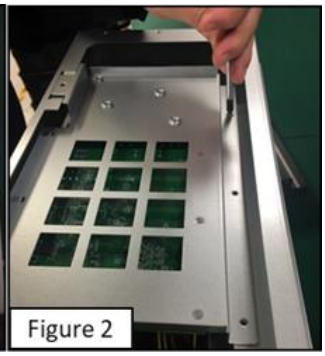




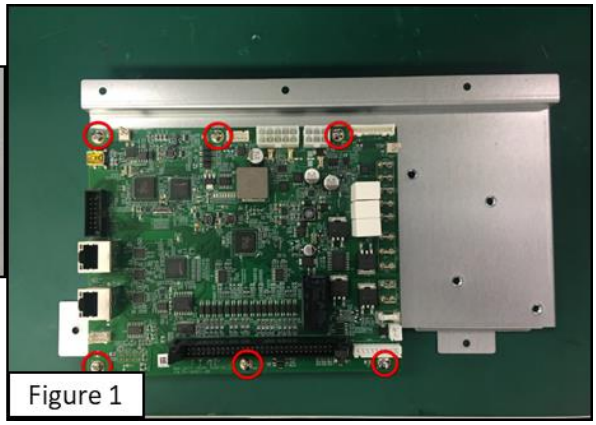
Disassemble the Power Control Board

- disconnect all the cable on the Power Control Board.
- Loosen the screws on the Power Control Board rack to remove the Power Control Board cover (as shown in Figure 1 and Figure 2).





- Loosen the screws on the Power Control Board and disassemble the Power Control Board cover (as shown in Figure 1).

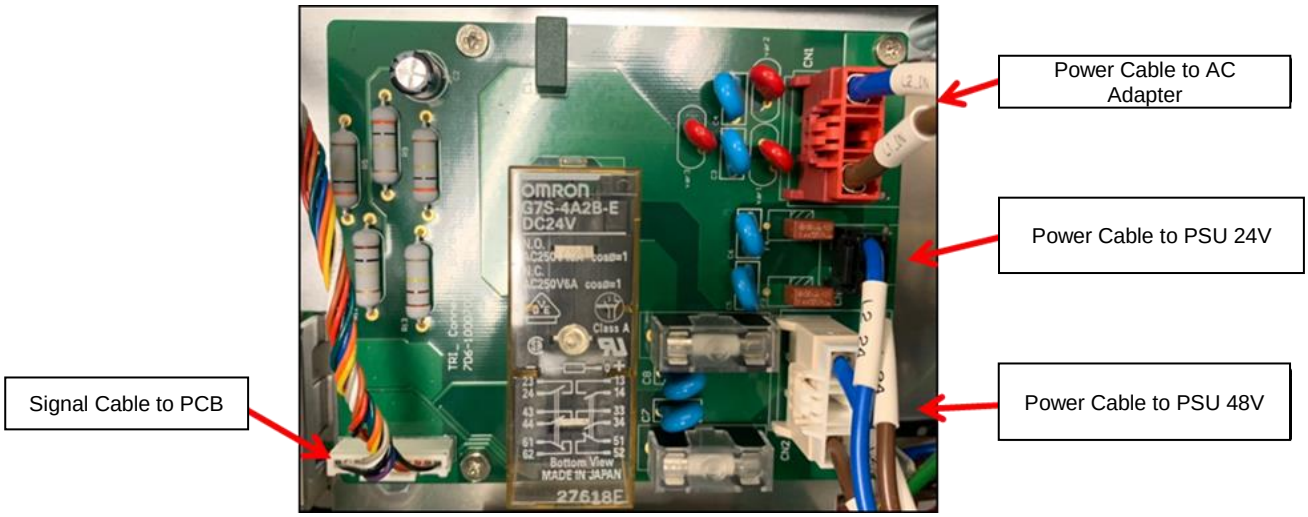


6.4 **Disassemble/Assemble the Relay Board**

Preparation

- Refer to the previous steps to disassemble the Front cover and the LCD screen cover.

Relay Board Wiring



Disassemble the Relay Board

- Disconnect the cables on the Relay Board.

- Loosen the screws on the Relay Board and disassemble Relay Board.

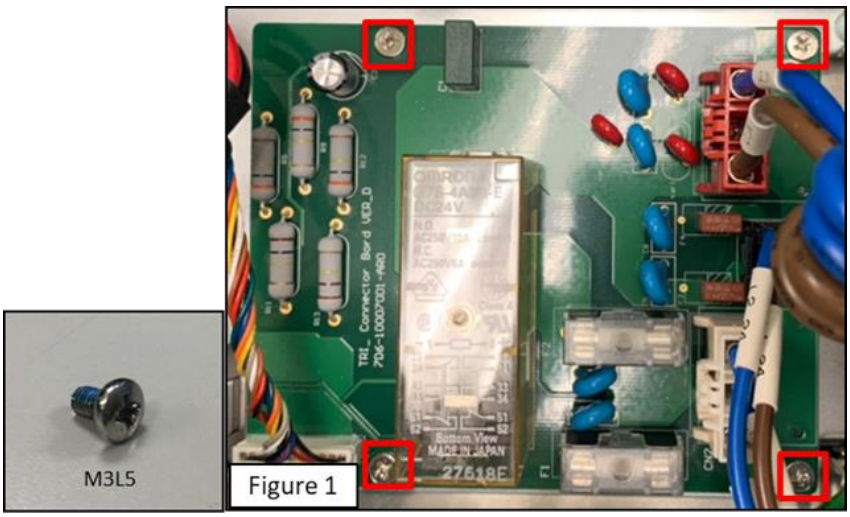


Figure 1

Assemble the Relay Board

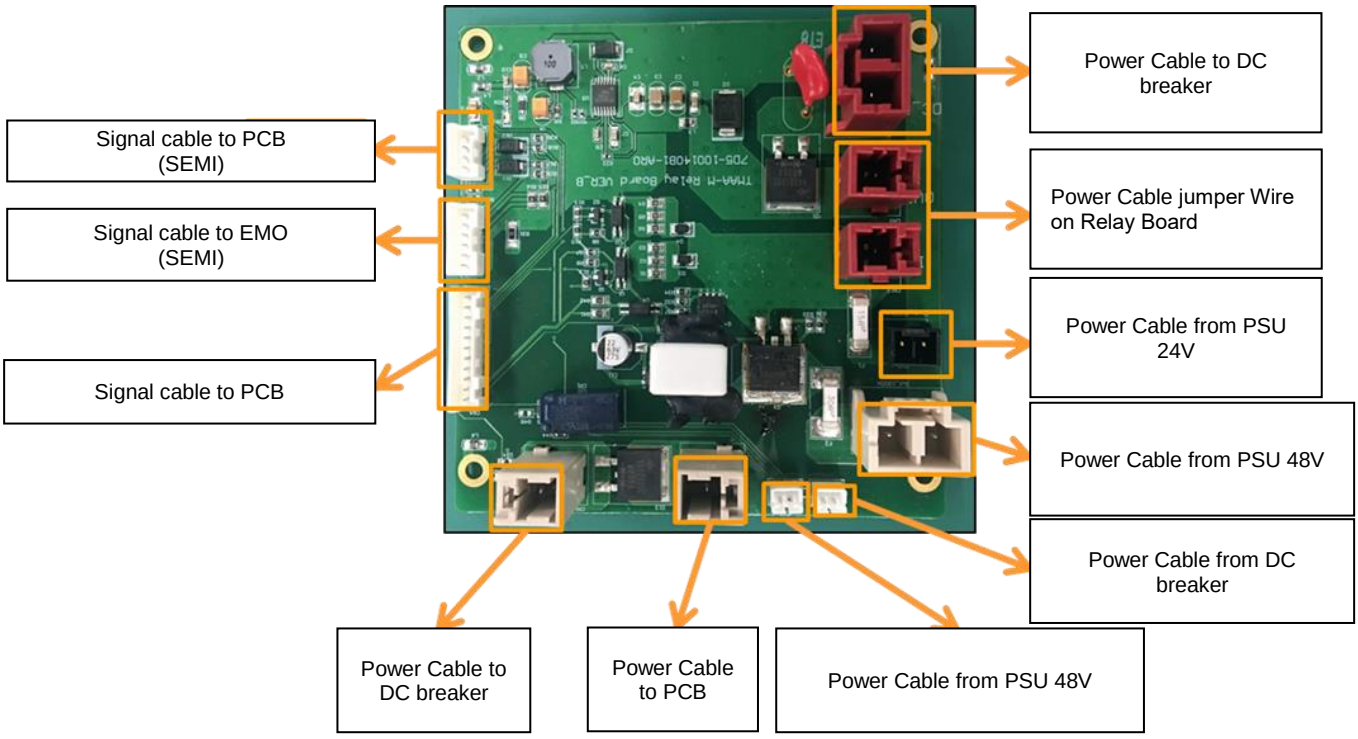
- Operate the previous steps in reverse while assembling the Relay Board

6.5 Disassemble/Assemble the Relay Board (DC & SEMI)

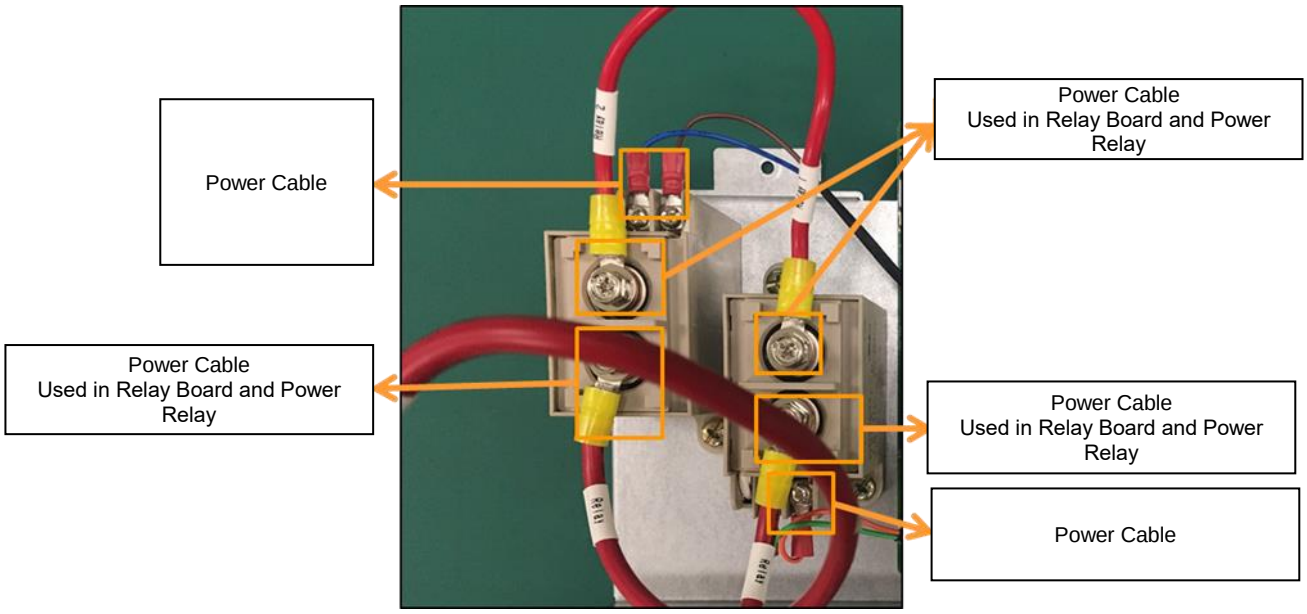
Preparation

- Refer to the previous steps to disassemble the Front cover and the LCD screen cover on the control box.

The Relay Board Wiring

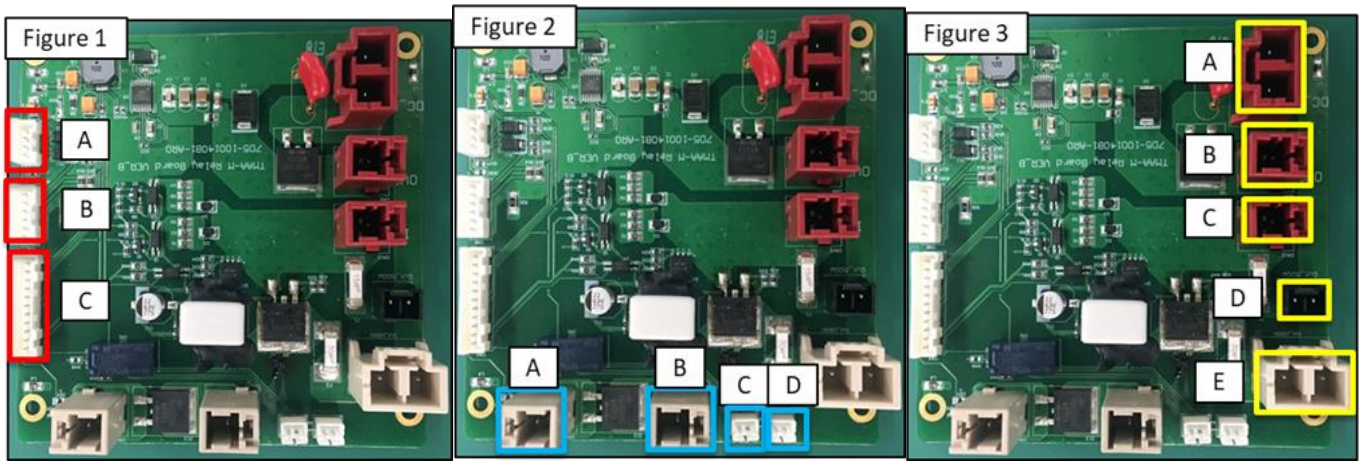


The SEMI Wiring



Disassemble the Relay Board

- Disconnect all cables on the Relay Board (as shown in Figure 1、Figure 2、Figure 3).



- Disconnect all cables on the Relay Board.

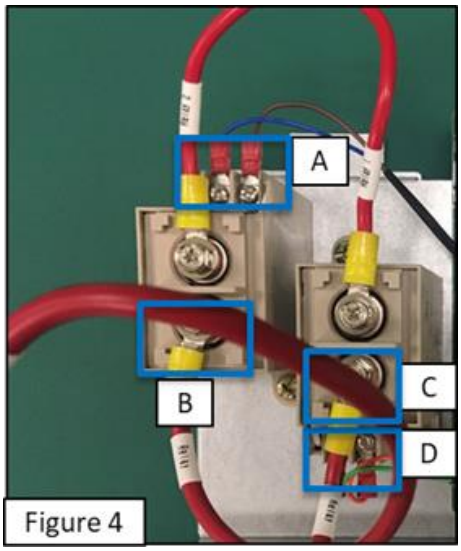


Figure 4

- Loosen the screws on the Relay Board and disassemble the Relay Board.

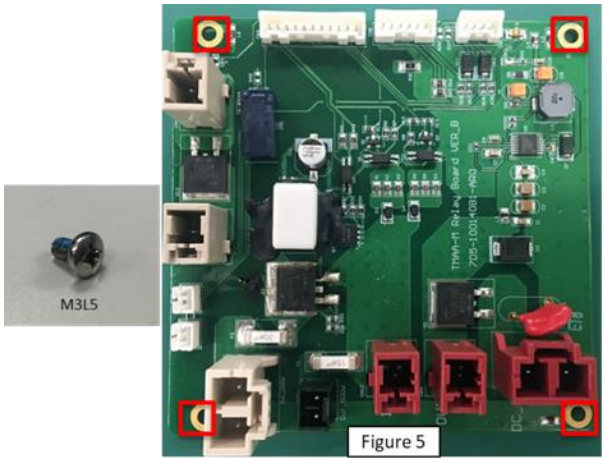


Figure 5

Assemble the Relay Board

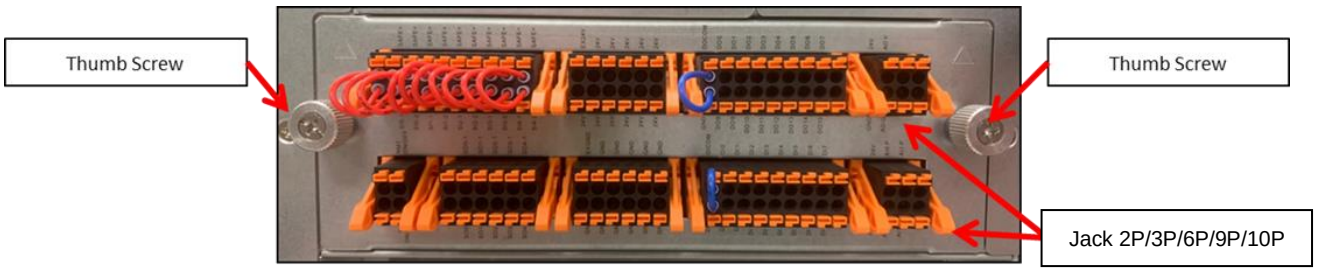
- Operate the previous steps in reverse while assembling the Relay Board.

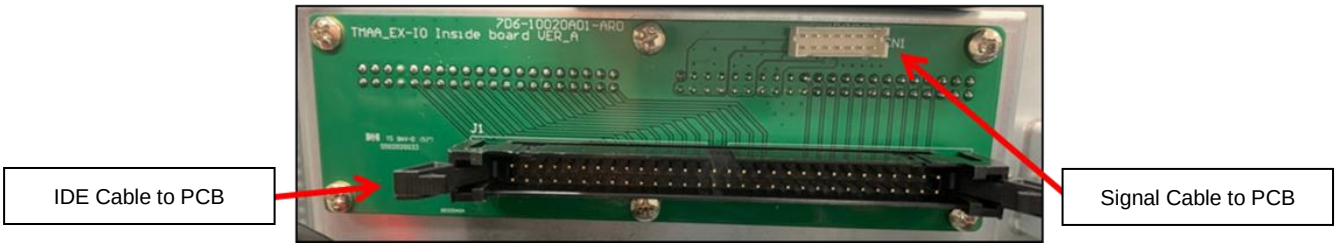
6.6 Disassemble/Assemble the EX IO BOARD

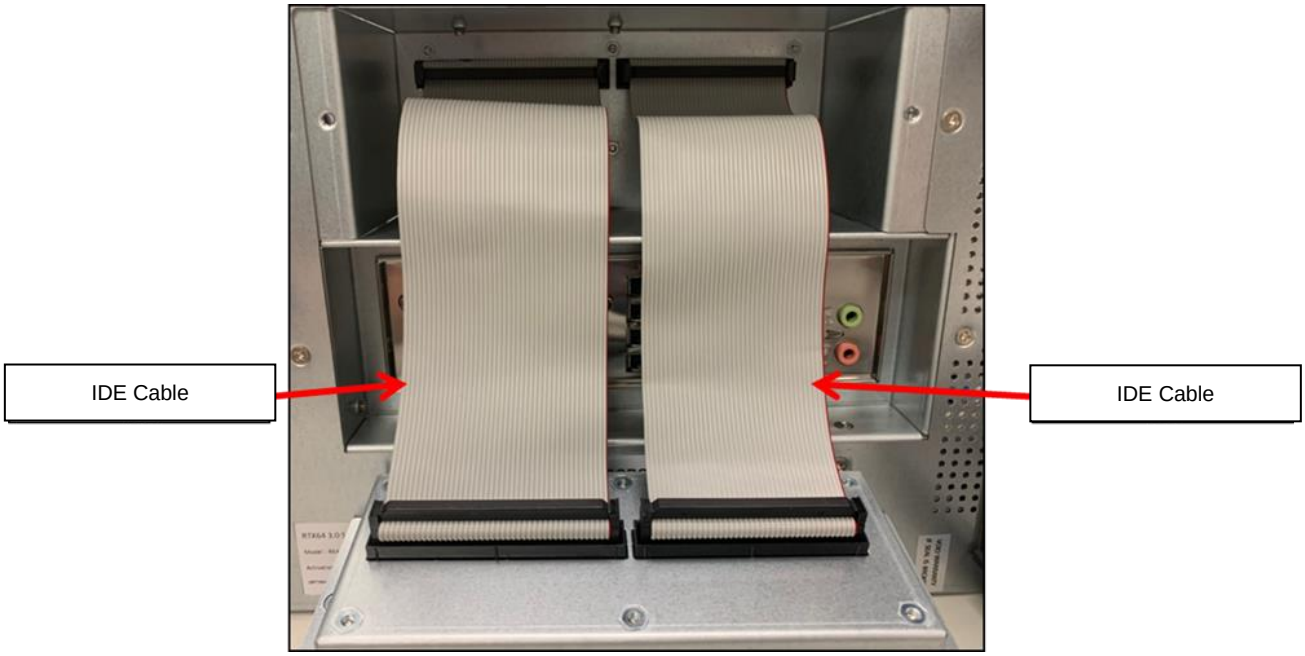
Preparation

- Refer to the previous steps to disassemble the Front cover.

The EX IO BOARD Introduction







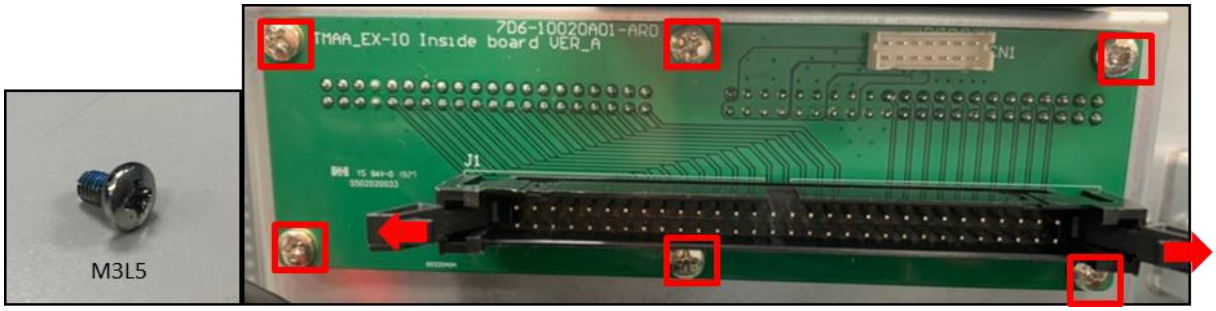
Disassembel the EX IO BOARD

- Toggle the switch up to remove all I/O connectors from the EX I/O ports.

- Loosen the two thumb screws and separate the EX I/O port modules.

- Remove the two flat-blade conduits.

- Disconnect all the cables on the EX IO BOARD.
- Pull up the hooks on both sides of the EX IO BOARD and then unplug the I/O cable.
- Loosen the screws on the EX IO BOARD and disassemble the EX IO BOARD.

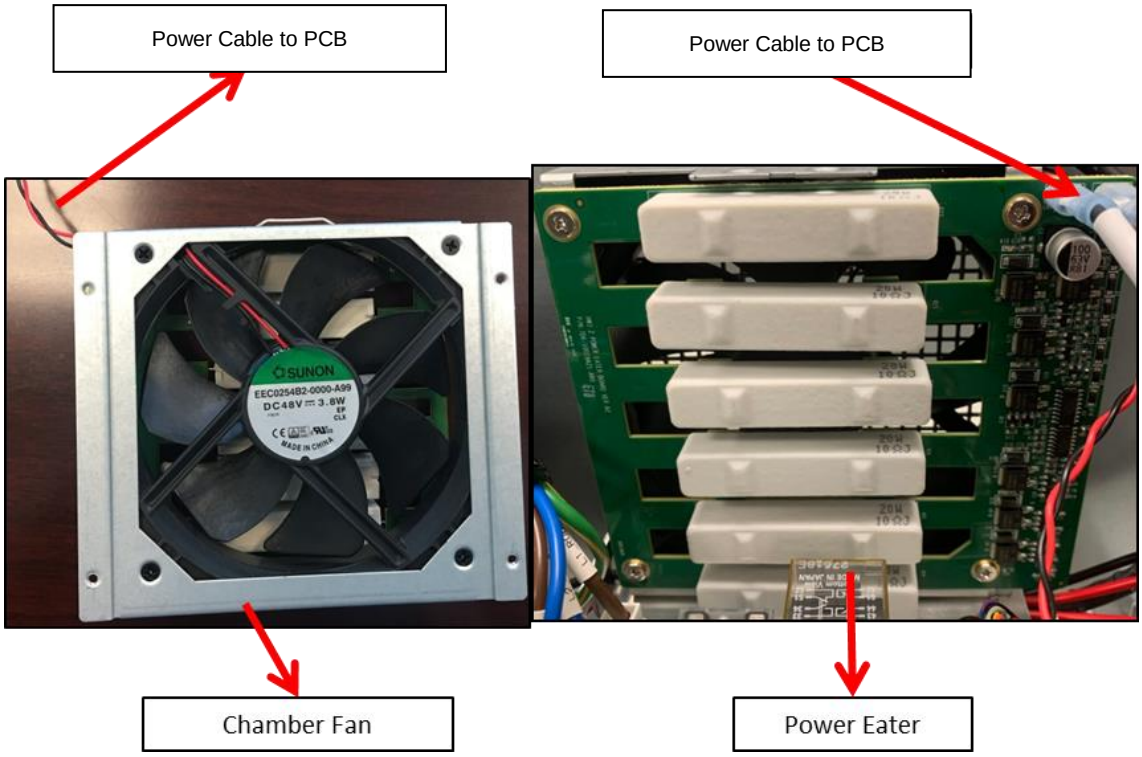


6.7 Disassemble/Assemble the Power Eater

Preparation

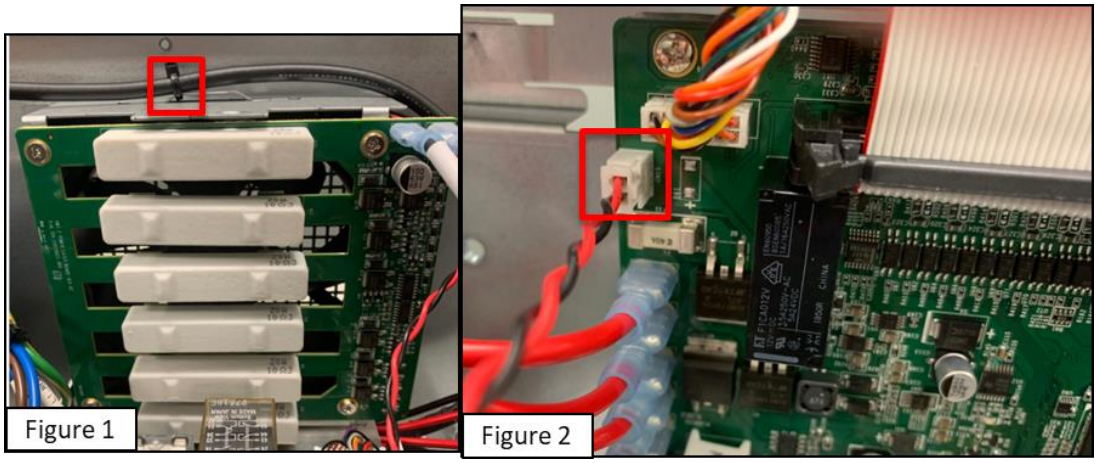
- Refer to the previous steps to disassemble the Front cover, the Back cover, and the Left cover.

The Power Eater Introduction

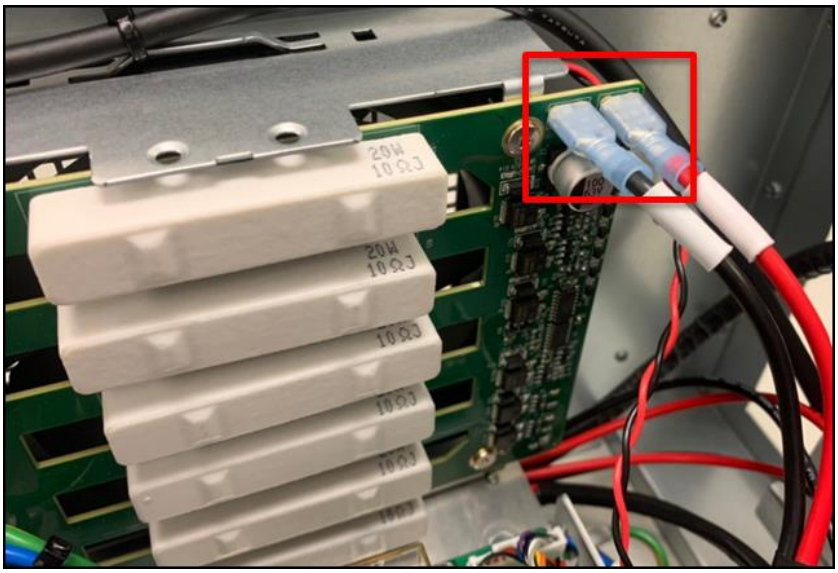


Disassemble the Power Eater

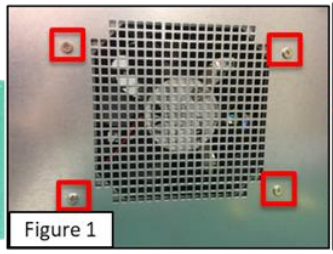
- Cut off the cable tie (as shown in Figure 1).
- Disconnect the fan power cable from the Power Control Board (as shown in Figure 2).

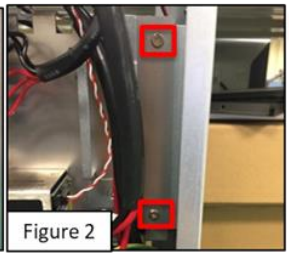


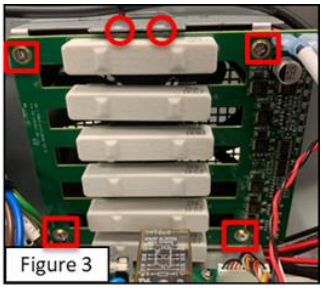
- Disconnect all the cables.



- Loosen the screw of the Power Eater at the left of the control box (as shown in Figure 1).
- Loosen the screw of the Power Eater at the back of the control box (as shown in Figure 2).
- Loosen the screw of the Power Eater at the front of the control box (as shown in Figure 3).







Assemble Power Eater

Reassemble the Power Eater

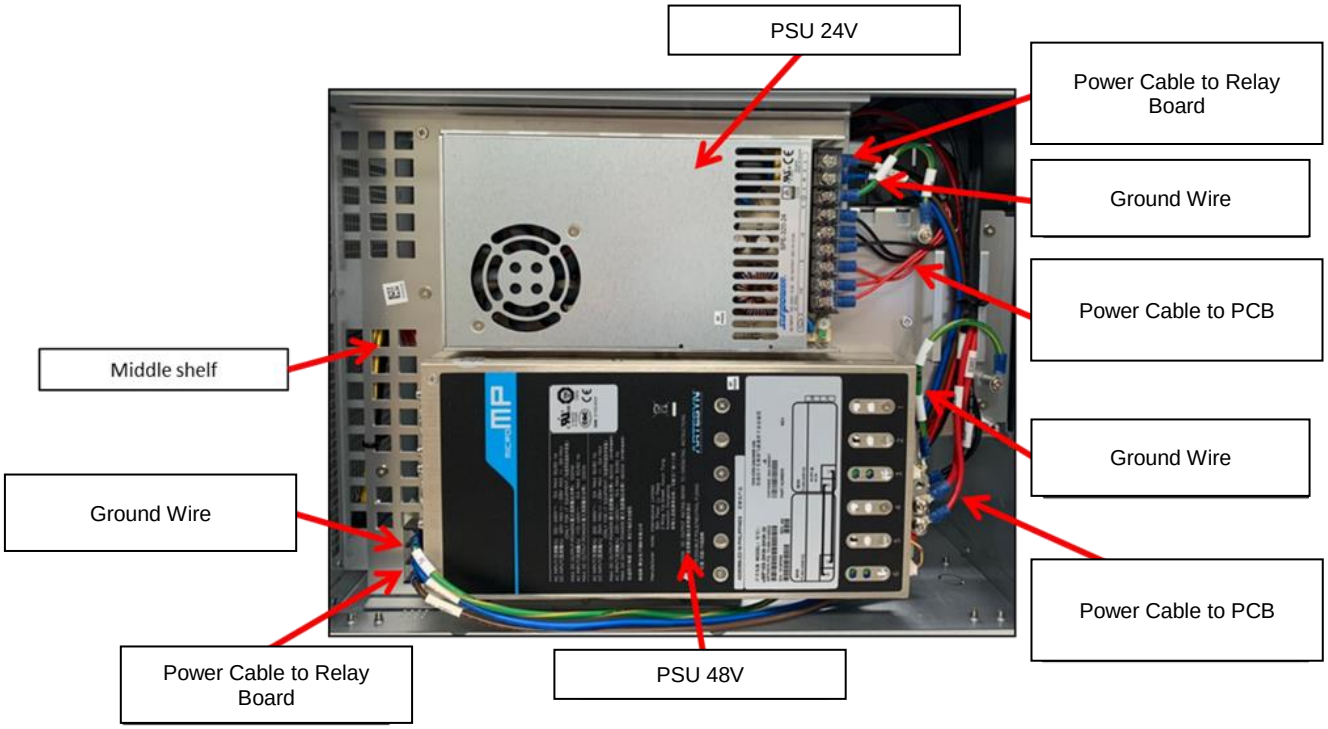
- Operate the previous steps in reverse while assembling.

6.8 Disassemble/Assemble Power Supply

Preparation

- Refer to the previous steps to disassemble the Front cover and the Back cover.

The Power Supply Introduction



Disassemble the Power Supply 24V

- Refer to the previous steps to disassemble the Relay Board (as shown in Figure 1).
- Loosen the screws the back of the Relay Board (as shown in Figure 2) ◦

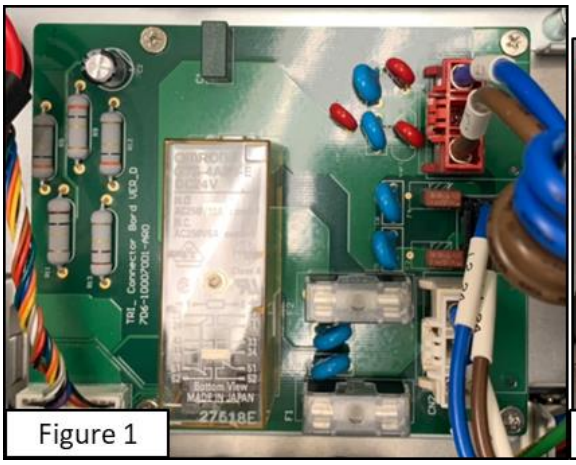


Figure 1

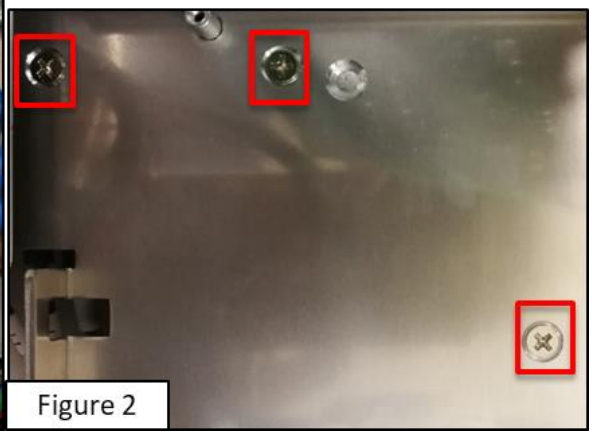


Figure 2

- Disconnect all the cables from the **Power Supply**.

- Loosen the screw at the left of the **Power Supply** (as shown in Figure 1).
- Loosen the screw at the right of the **Power Supply** (as shown in Figure 2).
- Loosen the screw at the bottom of the **Power Supply** (as shown in Figure 3).

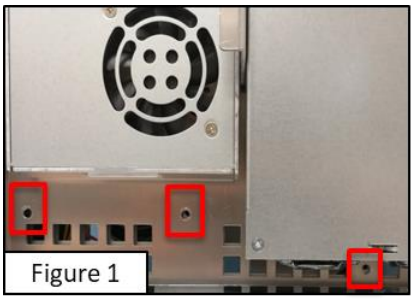


Figure 1

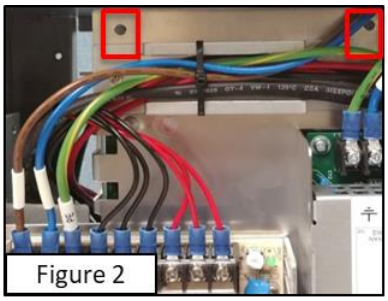


Figure 2

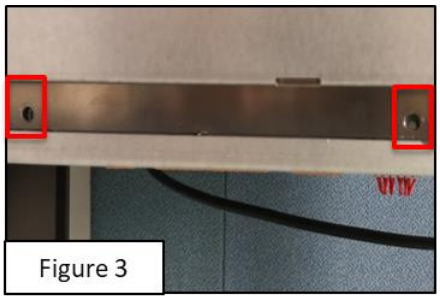
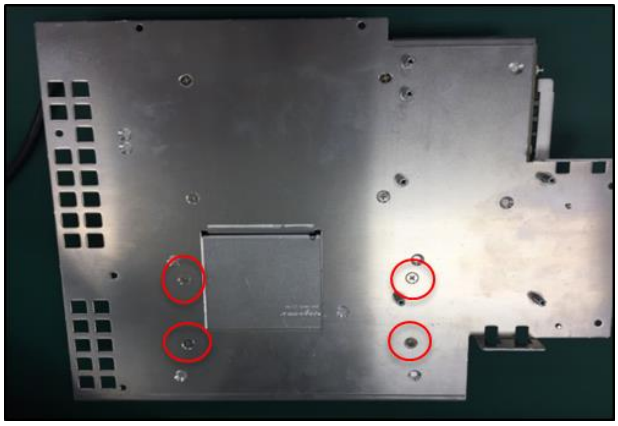


Figure 3

- Loosen the screws at the middle shelf behind the **Power Supply**.



Disassemble the Power Supply 48V

- Refer to the previous steps to disassemble the Relay Board (as shown in Figure 1).
- Loosen the screws the back of the Relay Board (as shown in Figure 2) ◦

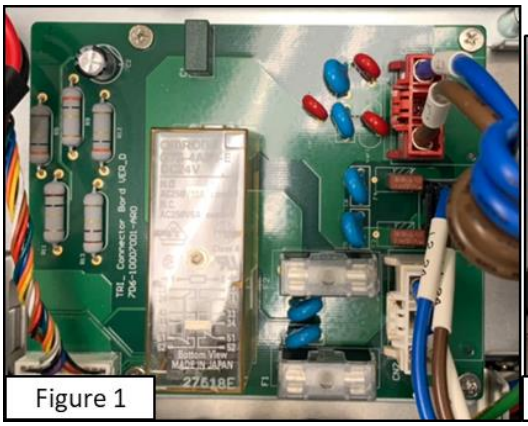


Figure 1

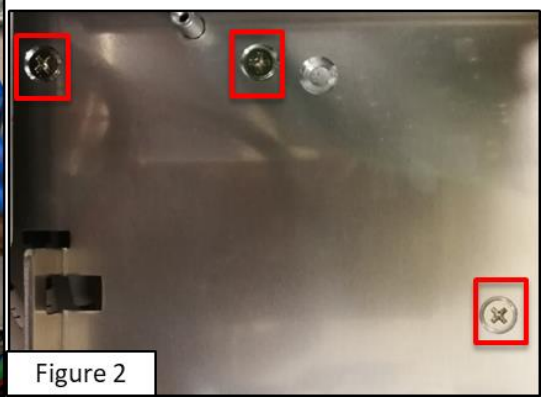


Figure 2

- Disconnect all the cables from the **Power Supply**.

- Loosen the screw at the left of the **Power Supply** (as shown in Figure 1).
- Loosen the screw at the right of the **Power Supply** (as shown in Figure 2).
- Loosen the screw at the bottom of the **Power Supply** (as shown in Figure 3).

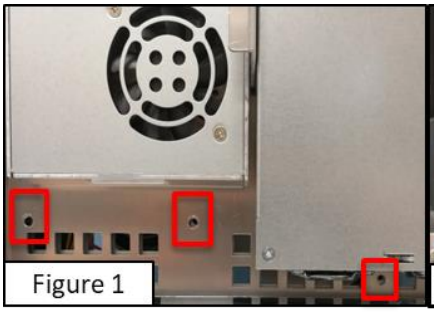


Figure 1

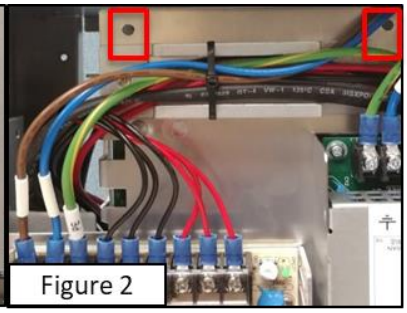


Figure 2

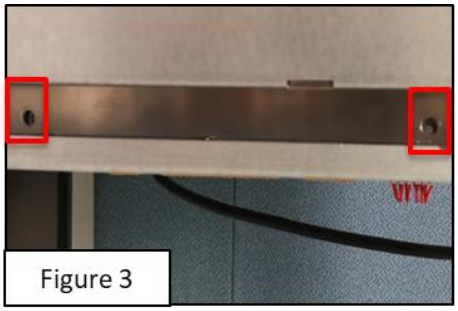
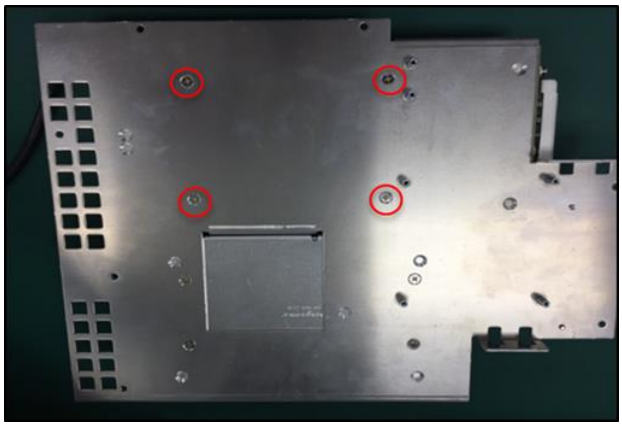


Figure 3

- Loosen the screws at the middle shelf behind the **Power Supply**.



Reassemble the Power Supply

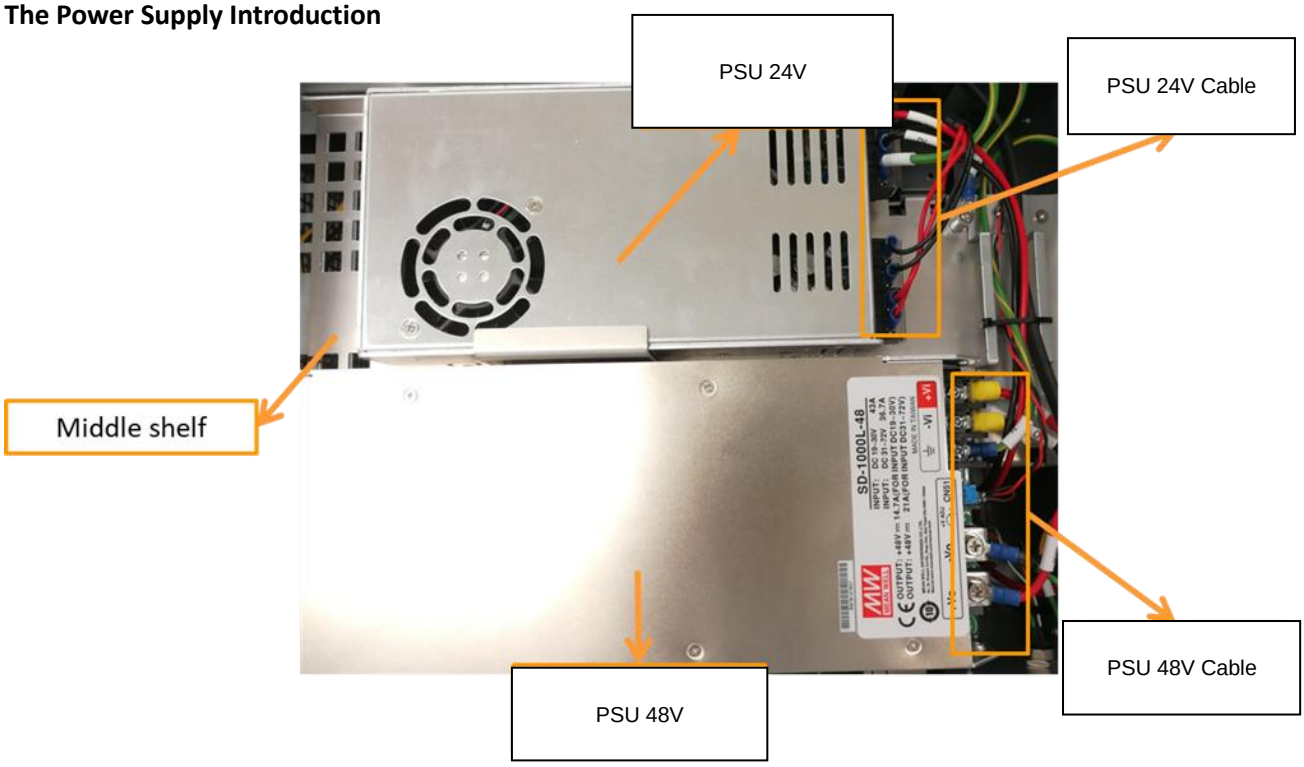
- Operate the previous steps in reverse while assembling.

6.9 Disassemble/Assemble the Power Supply (DC & SEMI)

Preparation

- Refer to the previous steps to disassemble the Front cover and the Back cover.

The Power Supply Introduction



Disassemble the Power Supply 24V

- Refer to the previous steps to disassemble the Relay Board (as shown in Figure 1).
- Loosen the screws the back of the Relay Board (as shown in Figure 2)。

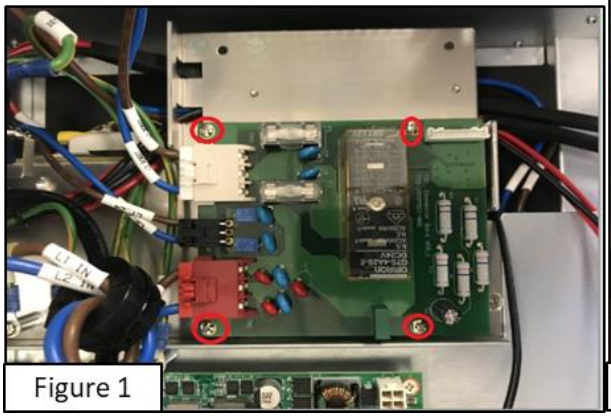


Figure 1

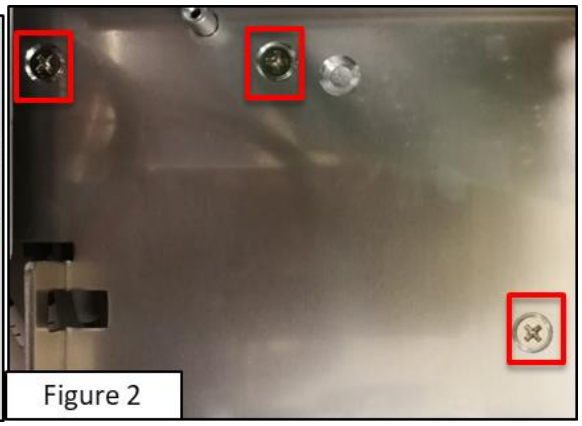


Figure 2

- **Disconnect all the cables from the Power Supply.**


Figure 3

- Loosen the screw at the left of the **Power Supply** (as shown in Figure 4).
- Loosen the screw at the right of the **Power Supply** (as shown in Figure 5).
- Loosen the screw at the bottom of the **Power Supply** (as shown in Figure 6).

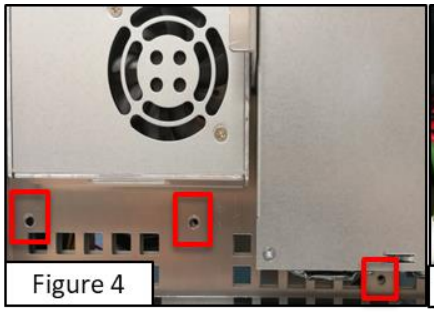


Figure 4

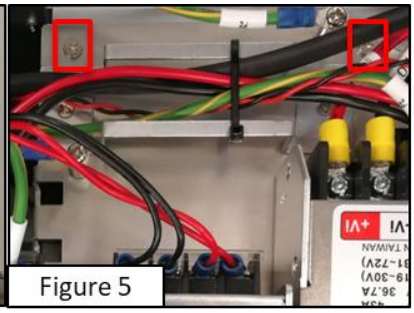


Figure 5

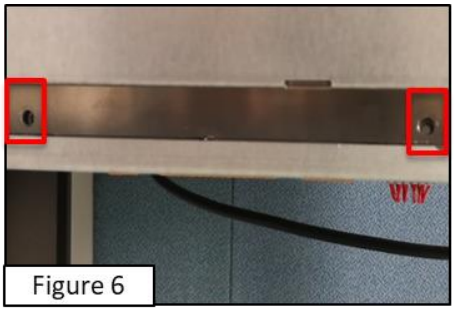


Figure 6

- Loosen the screws at the middle shelf behind the **Power Supply**.

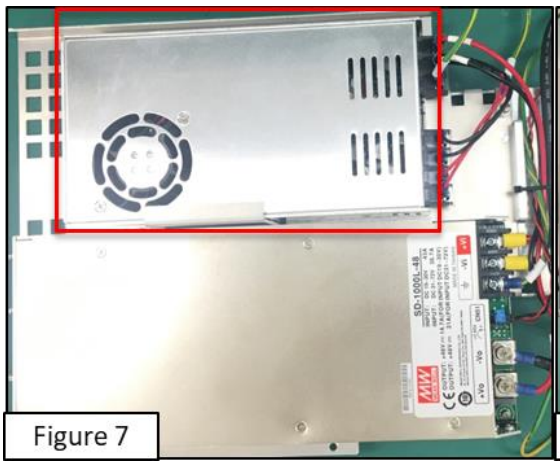


Figure 7

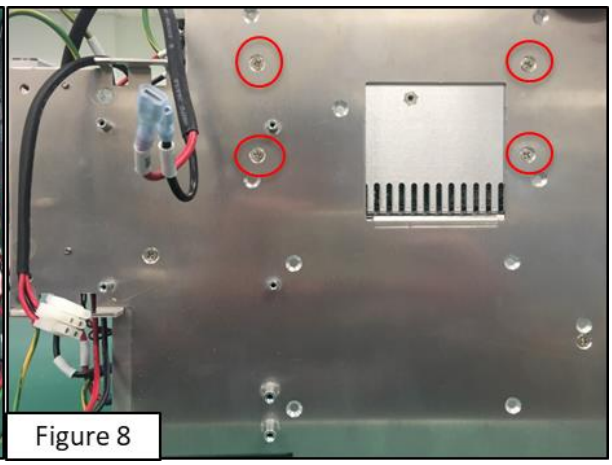


Figure 8

Disassemble the Power Supply 48V

- Refer to the previous steps to disassemble the Relay Board (as shown in Figure 9).
- Loosen the screws the back of the Relay Board (as shown in Figure 10) ◦

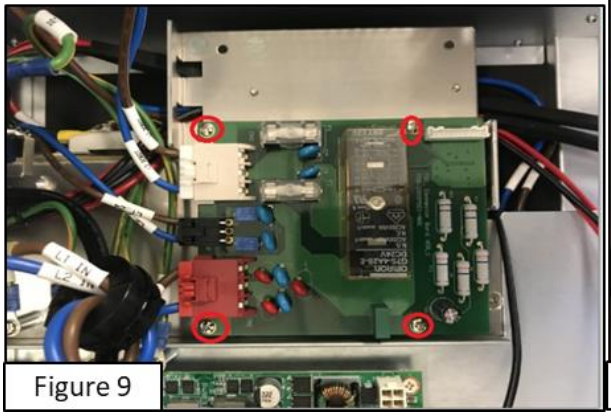


Figure 9

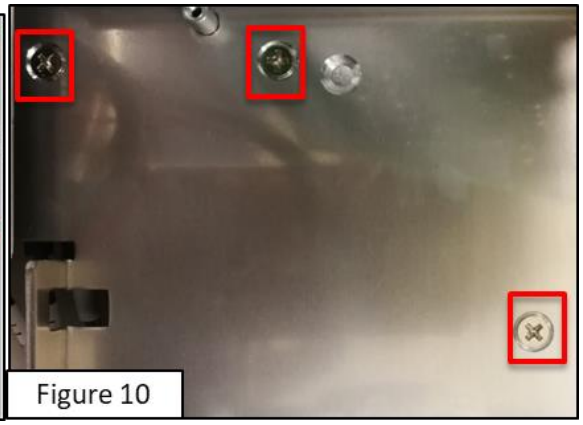


Figure 10

- Loosen the screw at the left of the **Power Supply** (as shown in Figure 11).
- Loosen the screw at the right of the **Power Supply** (as shown in Figure 12).
- Loosen the screw at the bottom of the **Power Supply** (as shown in Figure 13).

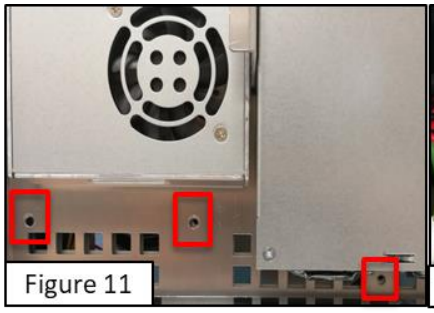


Figure 11

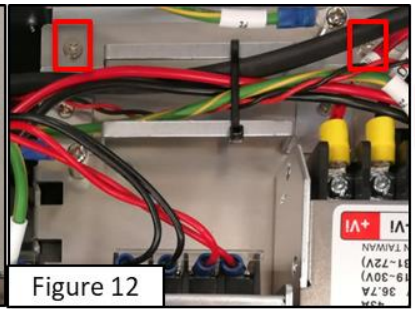


Figure 12

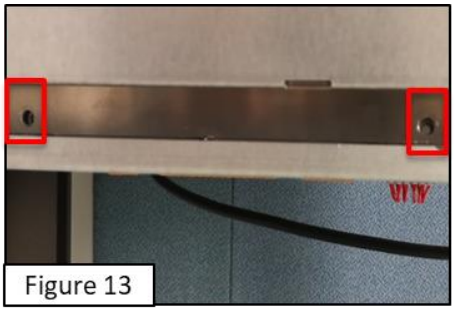


Figure 13

- Disconnect all the cables from the **Power Supply**.

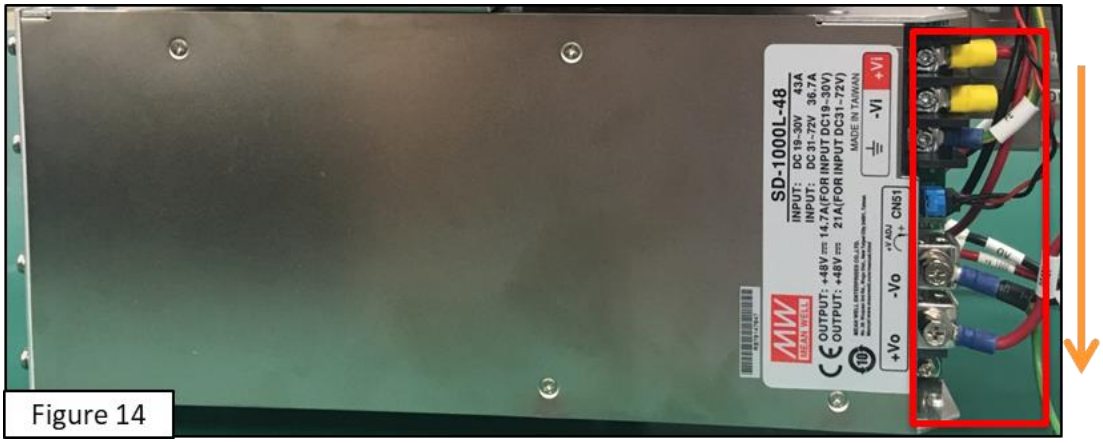


Figure 14

- Loosen the screws at the middle shelf behind the **Power Supply**.

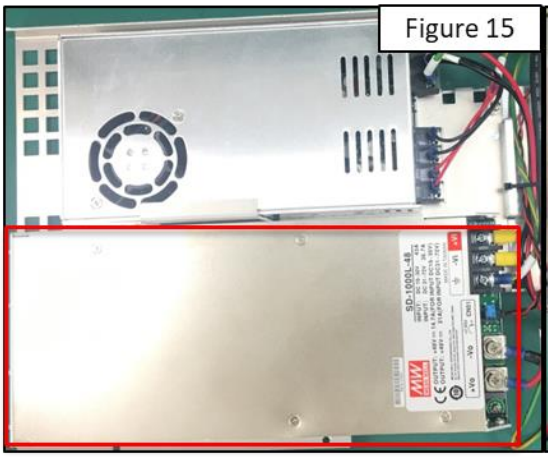


Figure 15

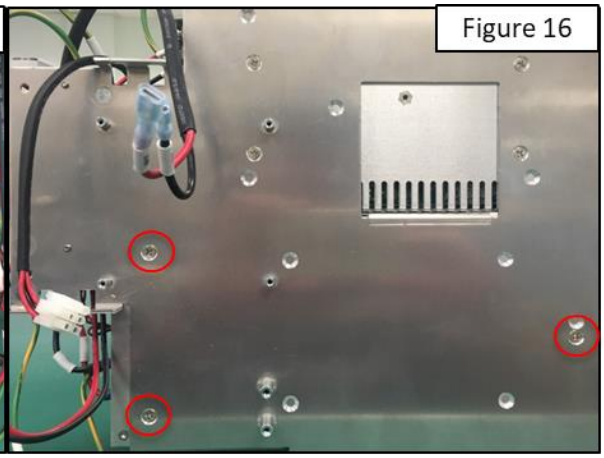


Figure 16

Reassemble the Power Supply

- Operate the previous steps in reverse while assembling.

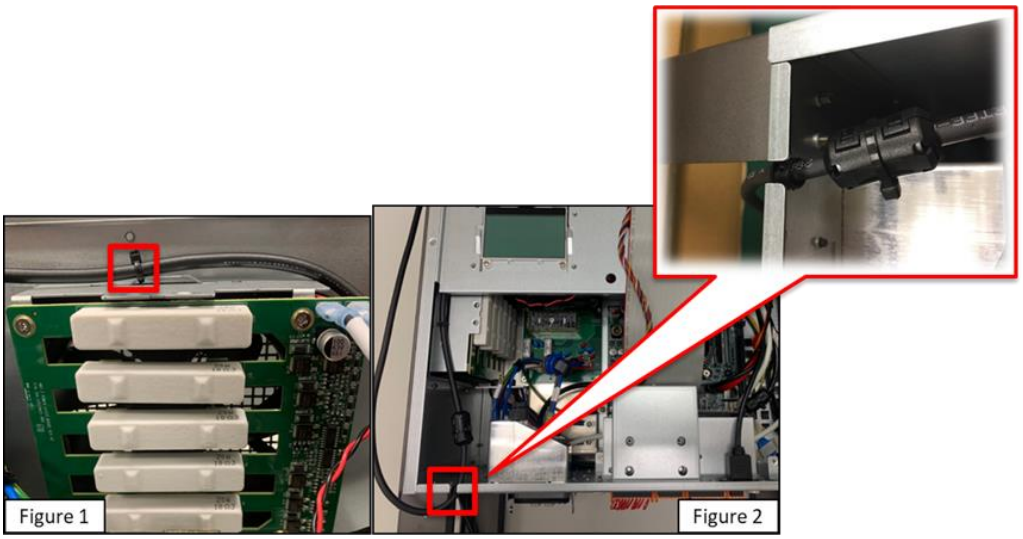
6.10 Disassemble/Assemble the Stick

Preparation

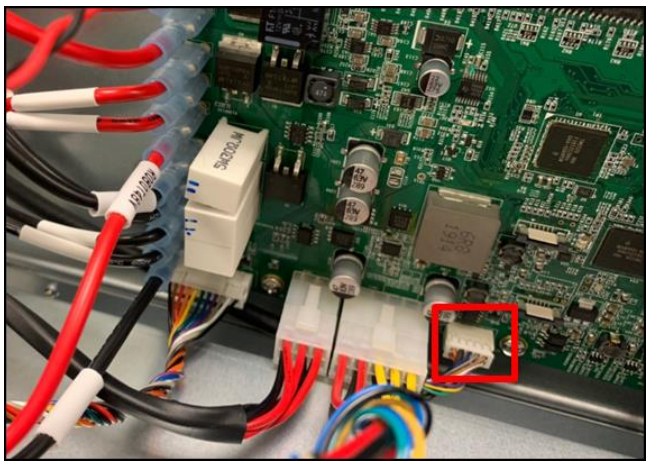
- Refer to the previous steps to disassemble the Front cover and the Back cover.

Disassemble the Stick

- Cut off the cable tie (as shown in Figure 1).
- Pull out the C-shaped buckle on the Stick (as shown in Figure 2).



- Disconnect the Stick cable from the Power Control Board.



Assemble the Stick

Operate the previous steps in reverse while assembling.

Reconfigure the Computer Name

- The computer name must be the same as the name under the Stick QR code.

- In the dongle into the Control Box (as shown in Figure 1).
- Remove the robot cable from the Control Box and turn on the Control Box (as shown in Figure 2).

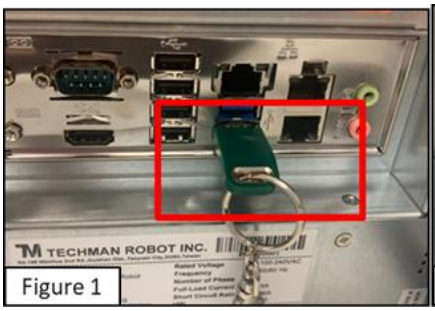


Figure 1

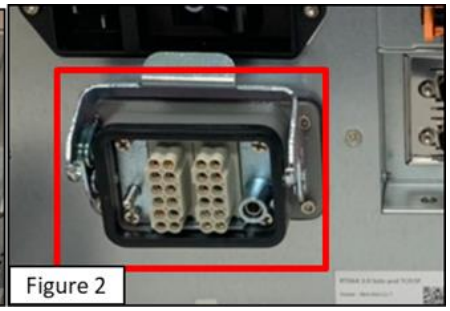


Figure 2

- Enter the HMI system screen and see the error code **0x0000003C**.
- Click **EXIT** to go back to Windows (as shown in Figure 7).

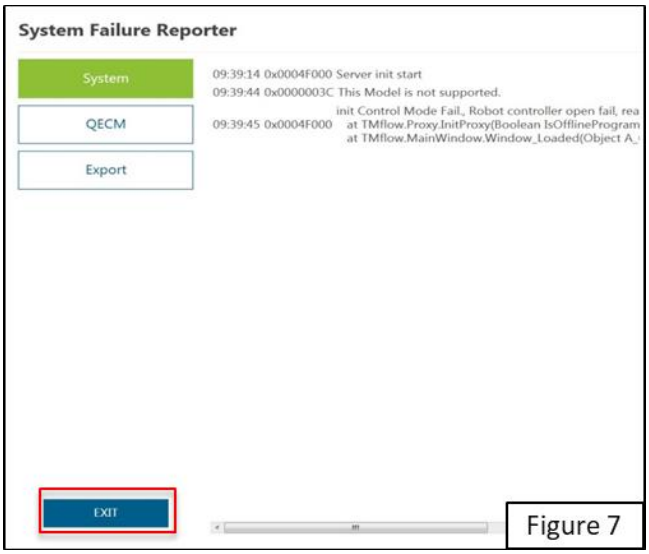


Figure 7

- Disable the Windows recovery function (contact with TM Robot for the relevant method to operate).
- Launch **File Explorer**.
- Right-click on **This PC**.
- Click **Properties** (as shown in Figure 11) > **Rename this PC** (as shown in Figure 12).

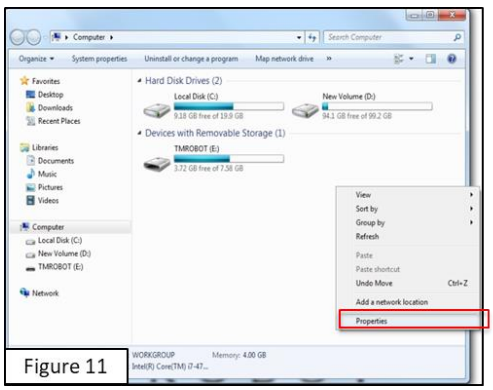


Figure 11

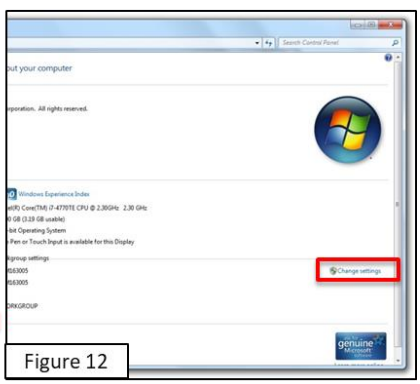


Figure 12

- Click **Rename this PC** (as shown in Figure 13)。
- Input the name below the Stick QR code in the field of computer name and click **OK** (as shown in Figure 14).

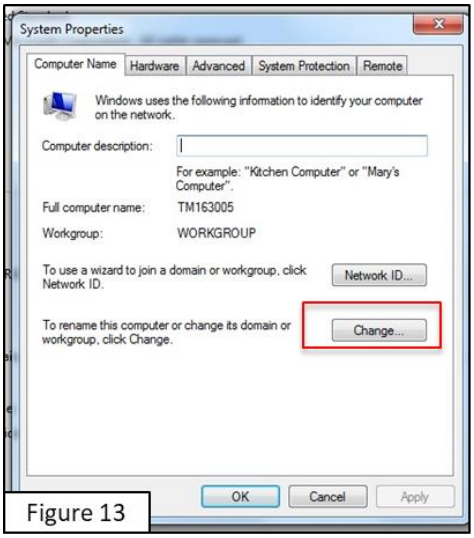


Figure 13

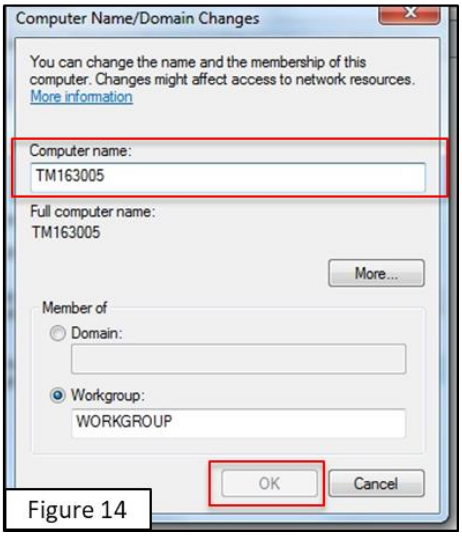


Figure 14

- Insert the robot cable back to the control box, and turn on the robot.
- Launch the HMI page, and ensure the computer name is the same as the name below the Stick QR code (as shown in Figure 15).

Figure 15

- Shut the system down and remove the robot cable.
- After configuring the computer name, enable the Windows recovery function.

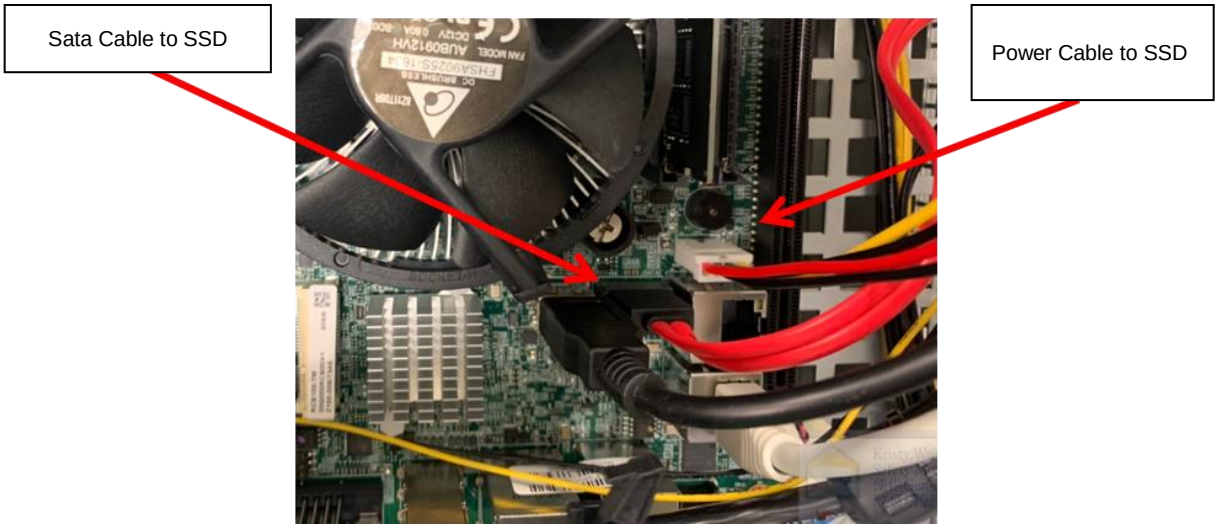
6.11 Disassemble/Assemble the SSD

Preparation

Refer to the previous steps to disassemble the Front cover and the LCD screen cover of the control box.

Disassemble the SSD

- Disconnect the wire and the SATA cable from the IPC.



- Disconnect the wire and the SATA cable from the SSD.
- Loosen the screws on the back cover of the SSD.

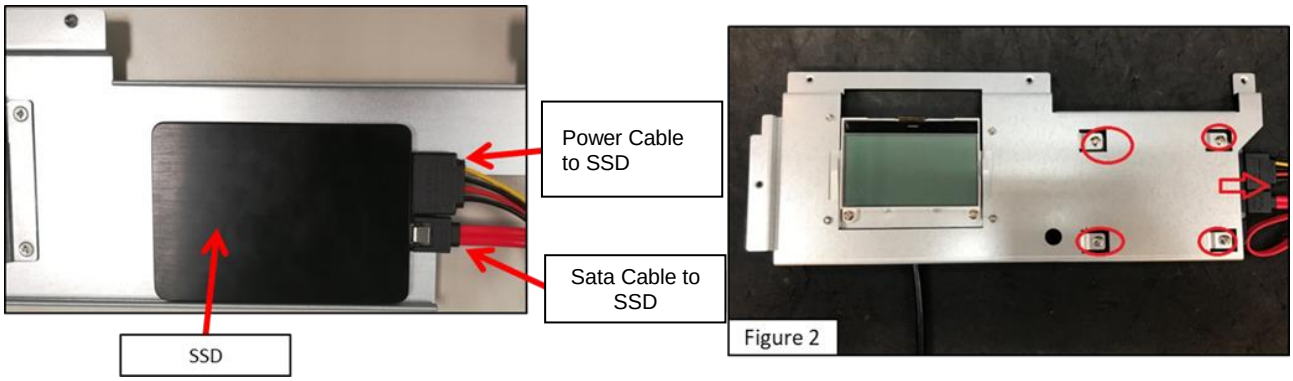


Figure 2

Assemble the SSD

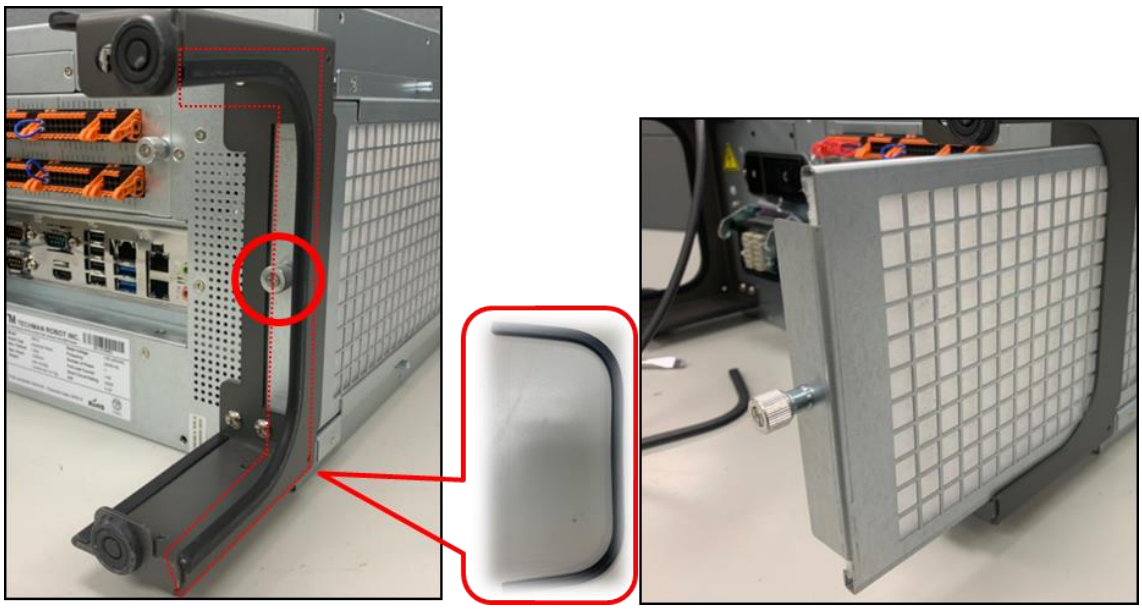
Assemble the SSD

- Operate the previous steps in reverse.
- Refer to the previous steps to configure the computer name again.

6.12 Change the Air Filter

Disassemble the Air Filter

- Remove the rubber edge.
- Loosen the thumbscrew and pull out the air filter and the tray at the same time.

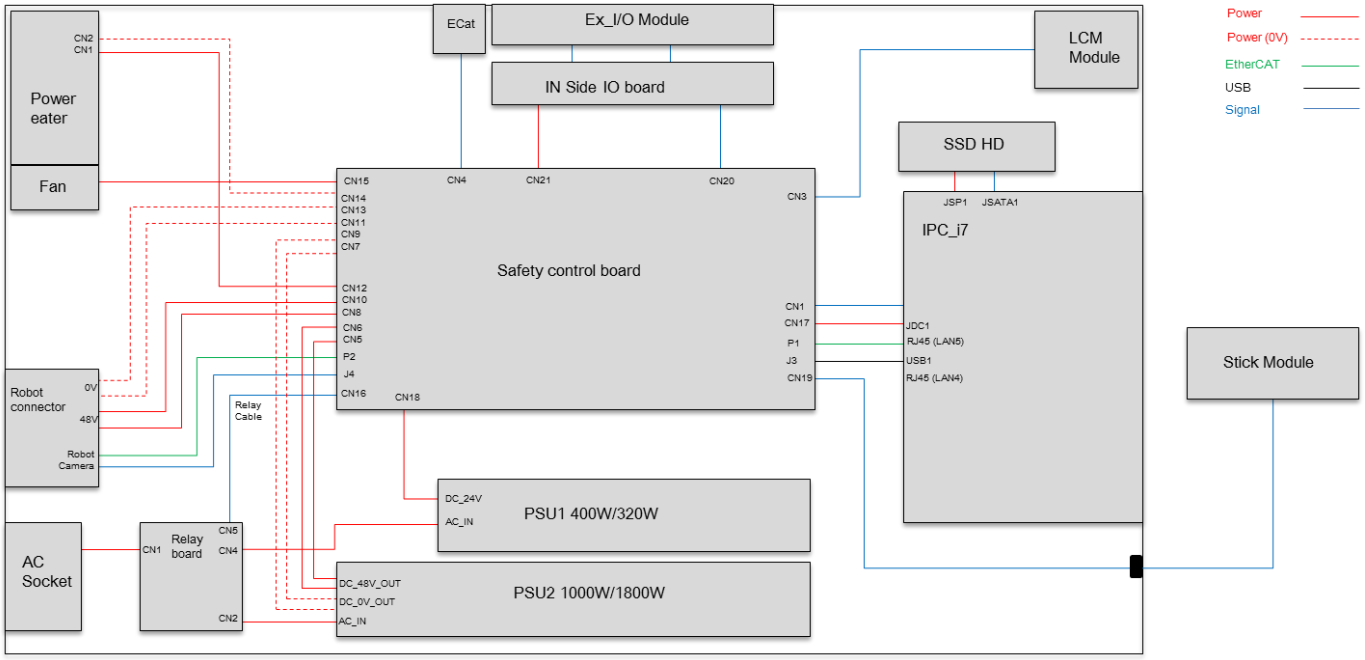


Install the Air Filter

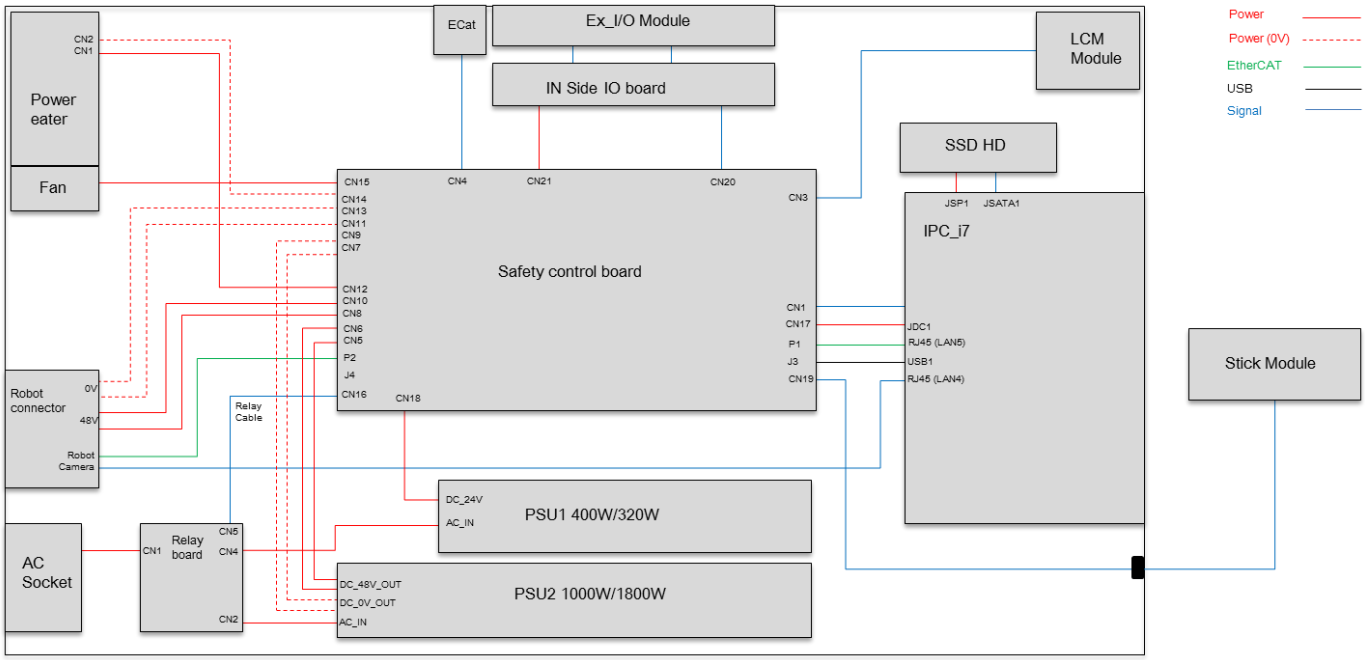
- Change the filter (if necessary) Operate the previous steps in reverse.

7. Circuit Diagram

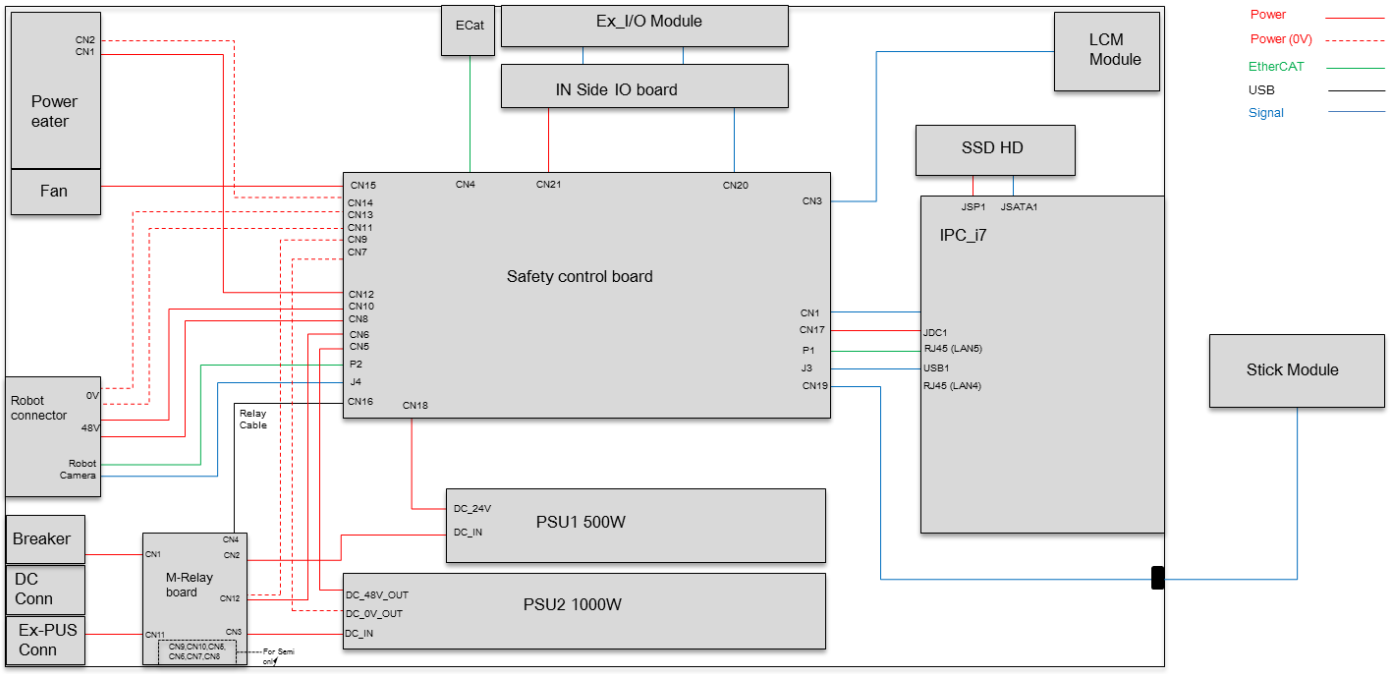
7.1 HW3.2 TM5A



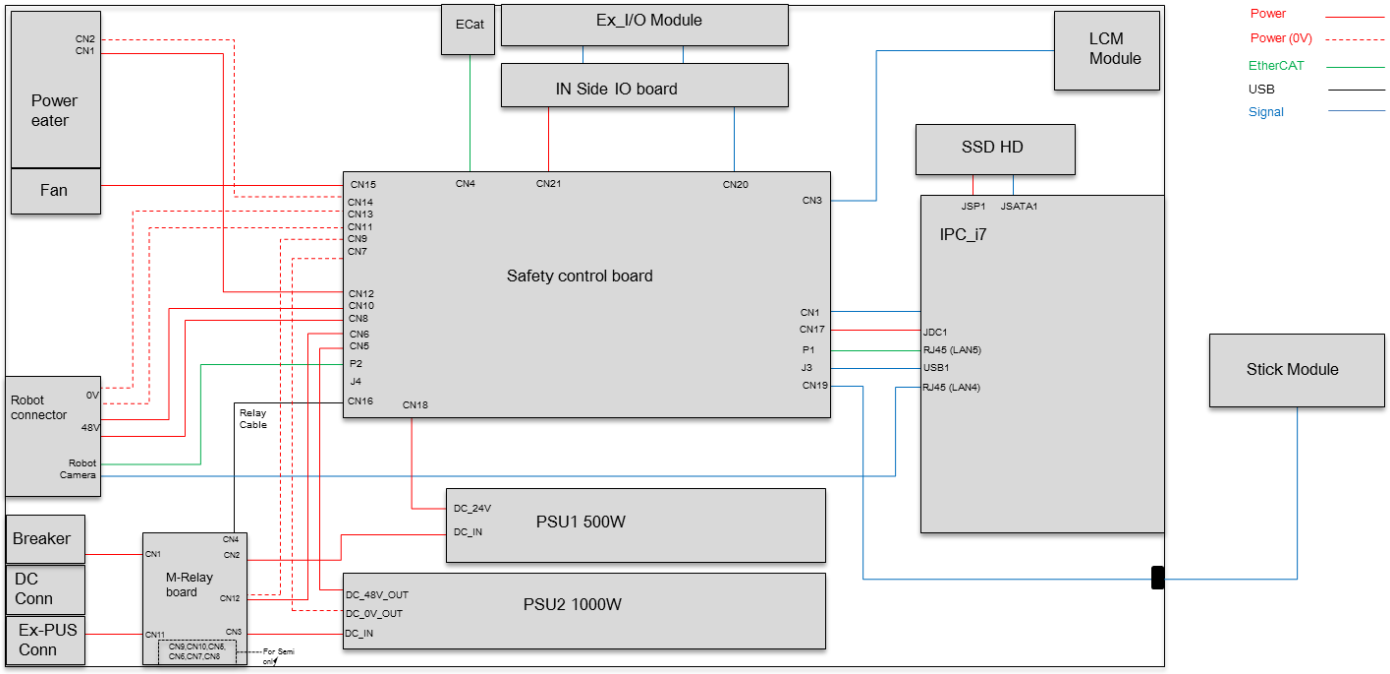
7.2 HW3.2A TM5A



7.3 HW3.2 TM5A-M



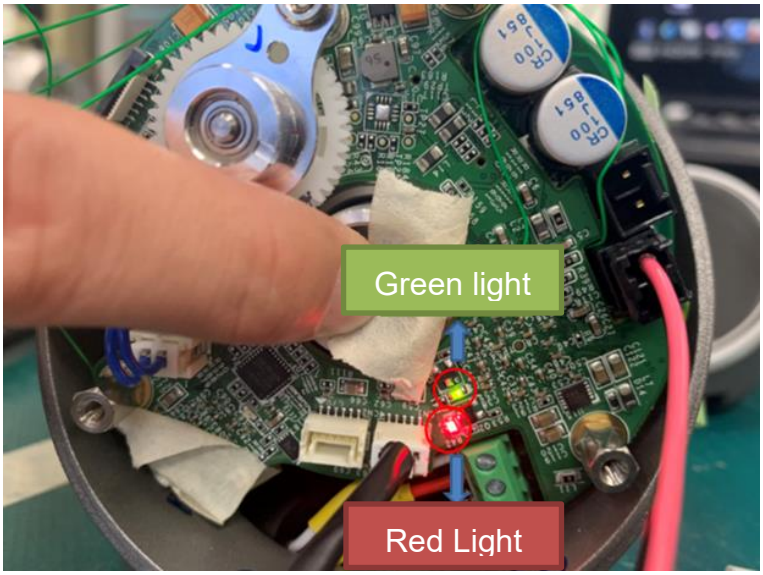
7.4 HW3.2A TM5A-M



8. Indication Light

8.1 Definitions of the Indication Light on the Robot Motherboard Assembly:

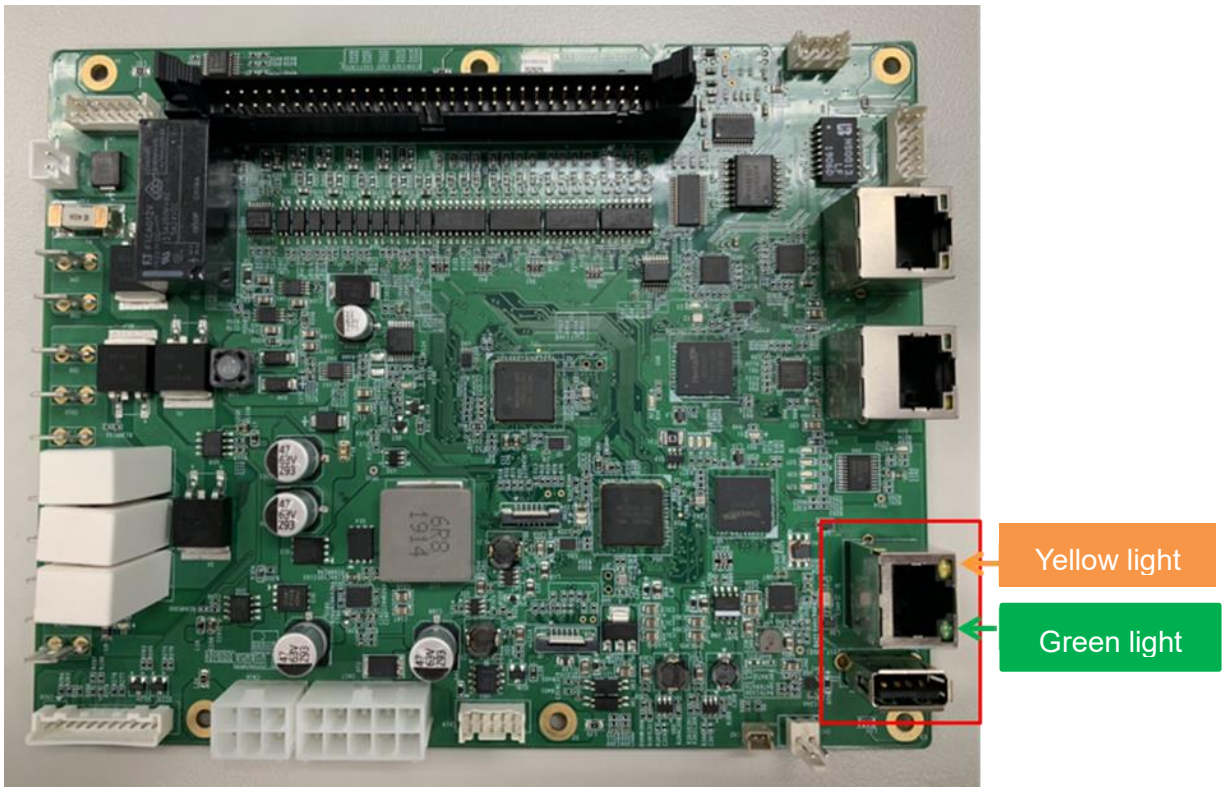
Signal Color / State	Green	Red
MCU ON (normal state)	ON	ON
Error	X	random flashing
Firmware Error	Flashing: ON/OFF	Flashing: ON/OFF
No Firmware	ON	ON
Servo ON/OFF	fast/slow flashing	OFF



The Location of the Indication Light on the Robot Motherboard Assembly

8.2 Definitions of the Indication Light on the USB Signal Booster

Signal Color / State	Yellow	Green
Power ON	ON	slow flashing
Error	ON	random flashing
USB Connecting	ON	ON after 3 seconds of fast flashing
Data Transferring	ON	fast flashing



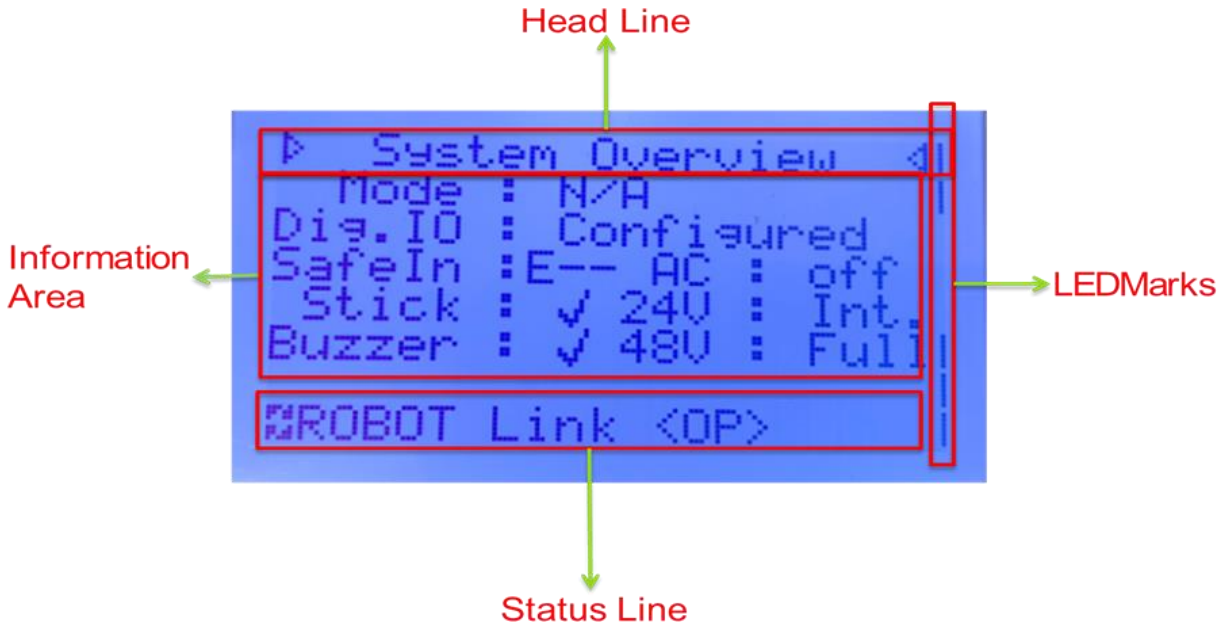
Definitions of the Indication Light on the USB Signal Booster

9. LCM

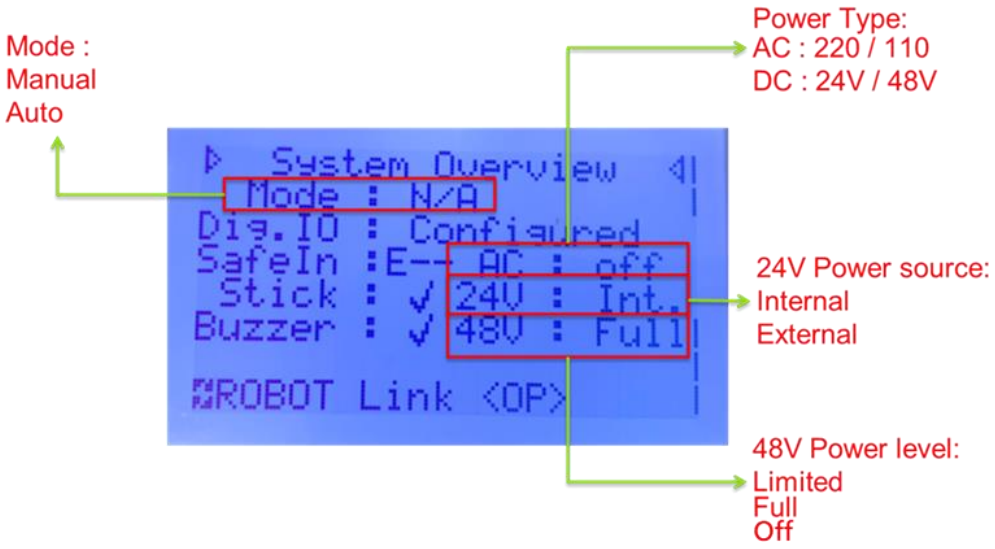
9.1 Overview

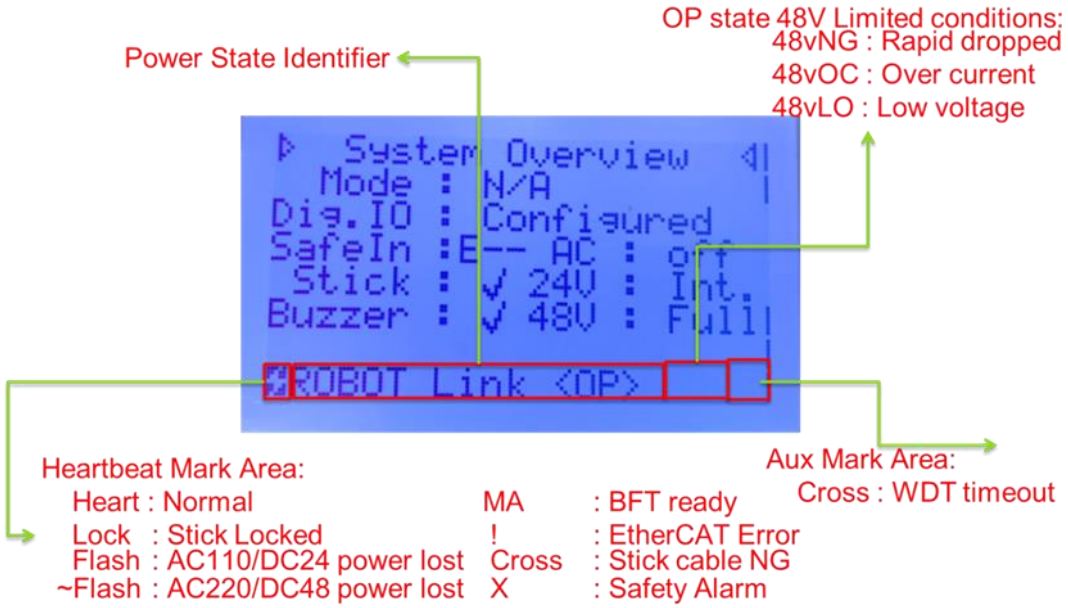
9.2 Note: Rapidly press the M/A button on the stick twice to switch pages.

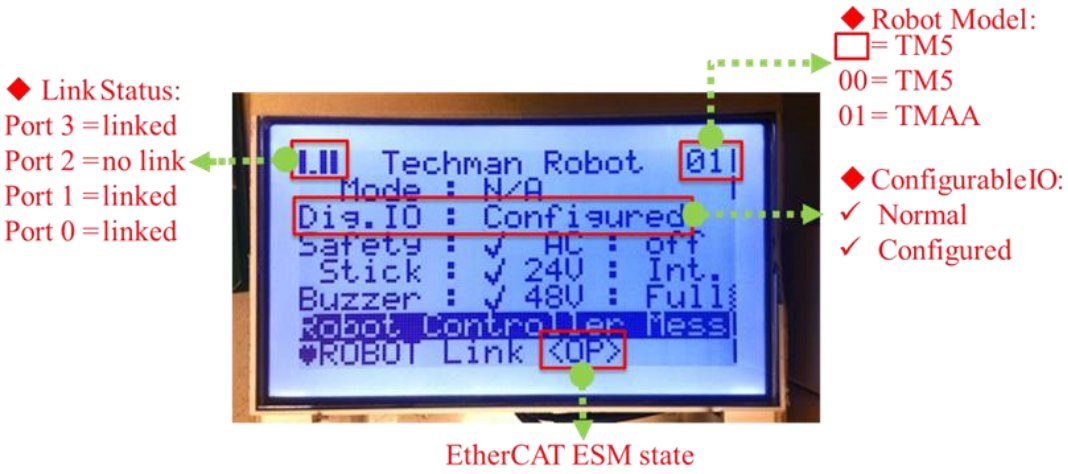
LCD Module Screen Layout



General Information

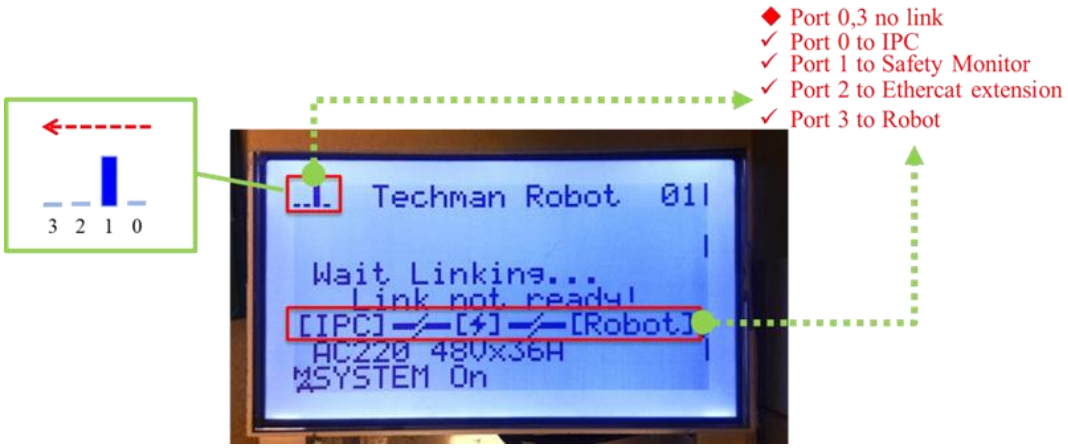






LCD Module Main Screen:

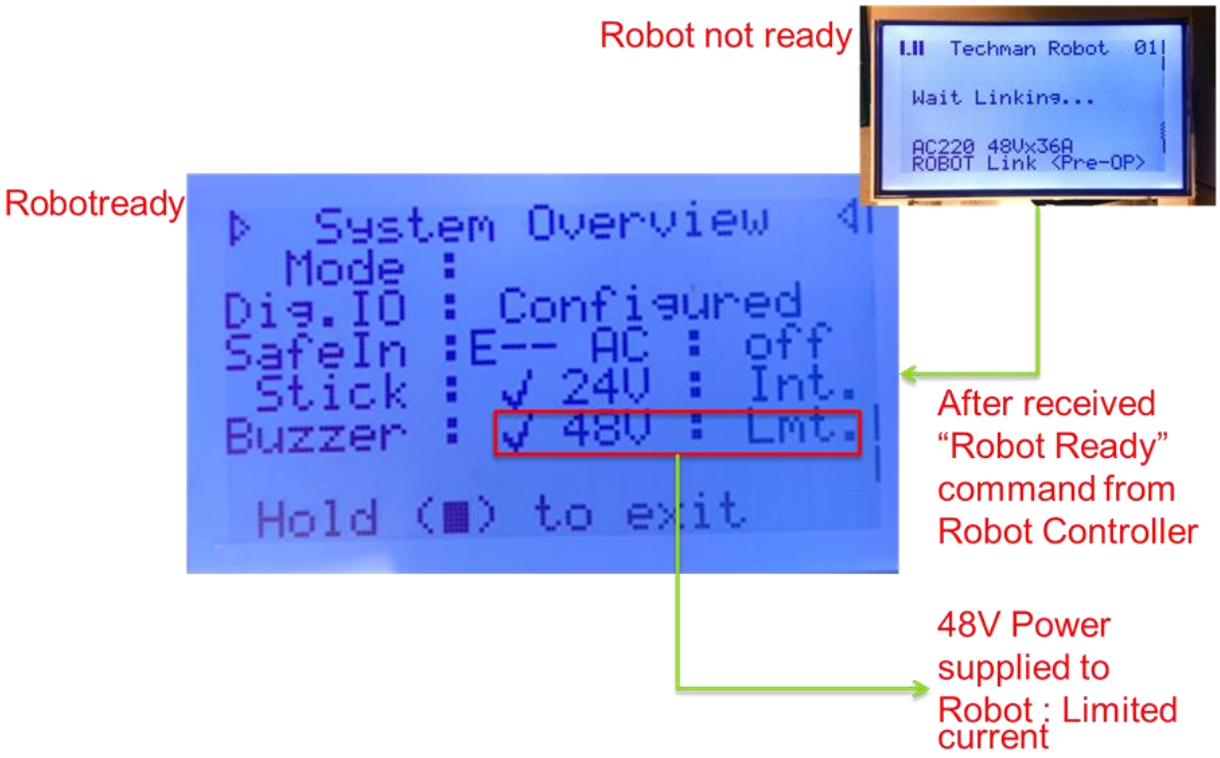
Check the connection status of the robot associated components



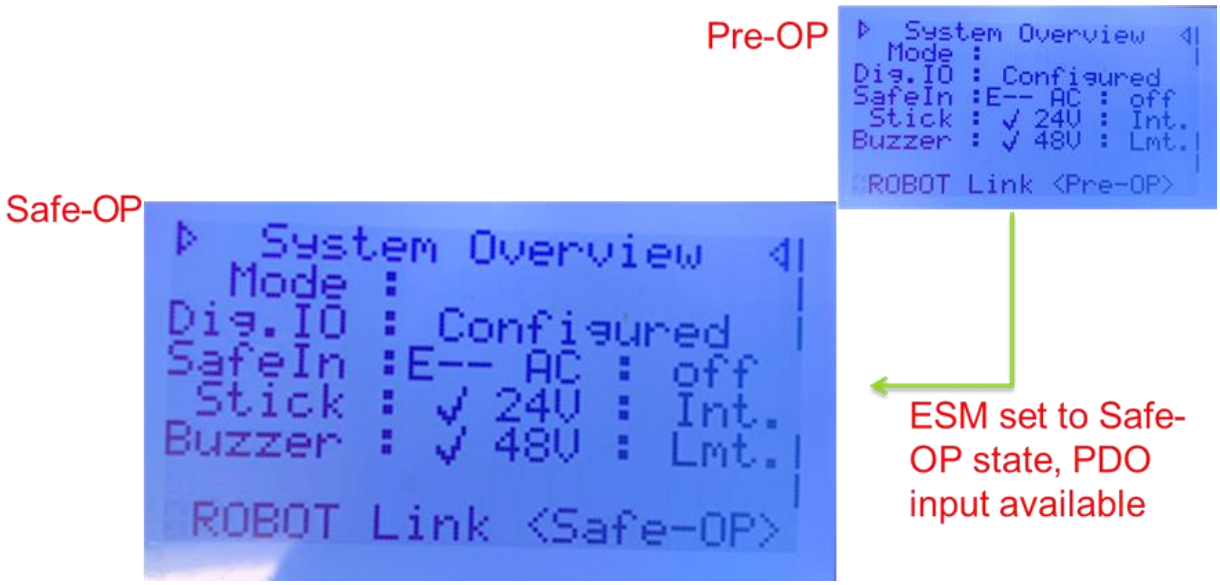
Connect to the Network

Connect to the EtherCAT Master

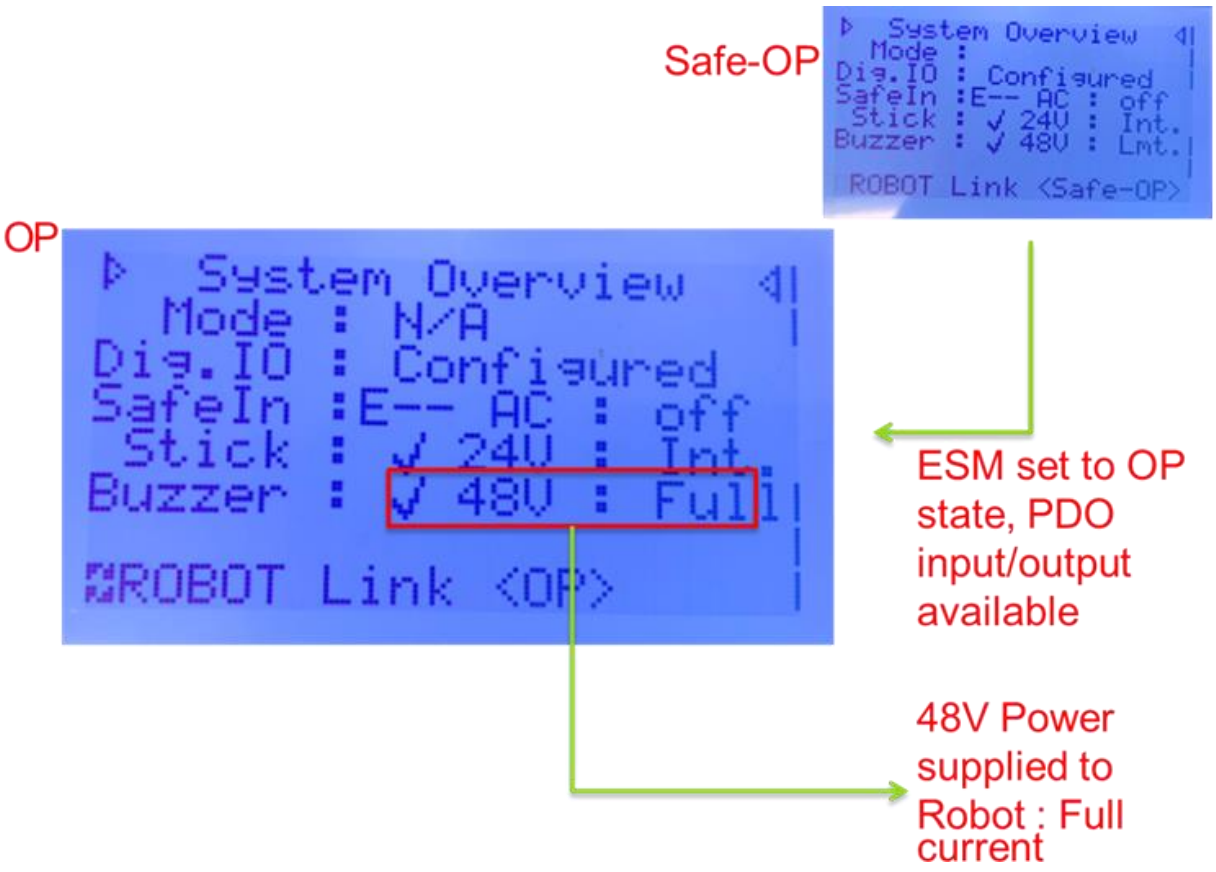
Connected to the Robot Controller (Pre-Operation Status)



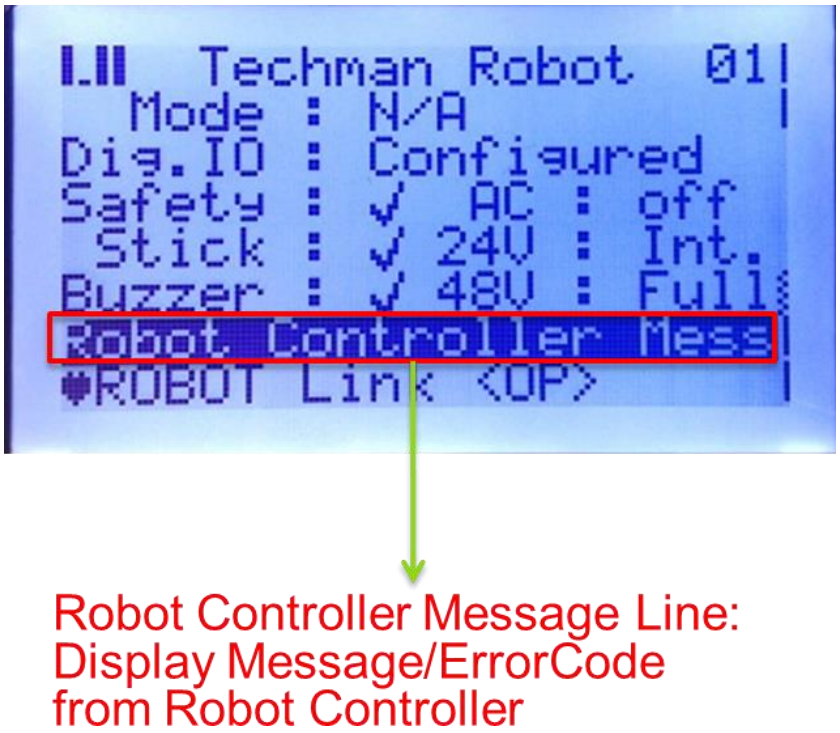
Connected to the Robot Controller (Safe Operation Status)



Connected to the Robot Controller (Operation Status)

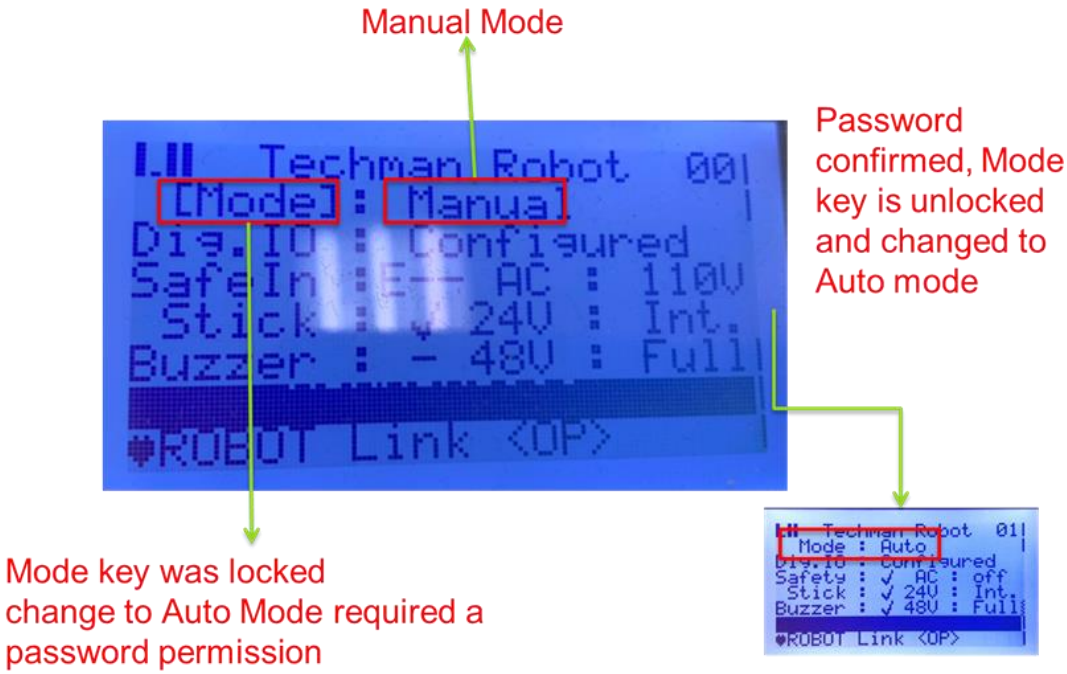


Robert Controller Information

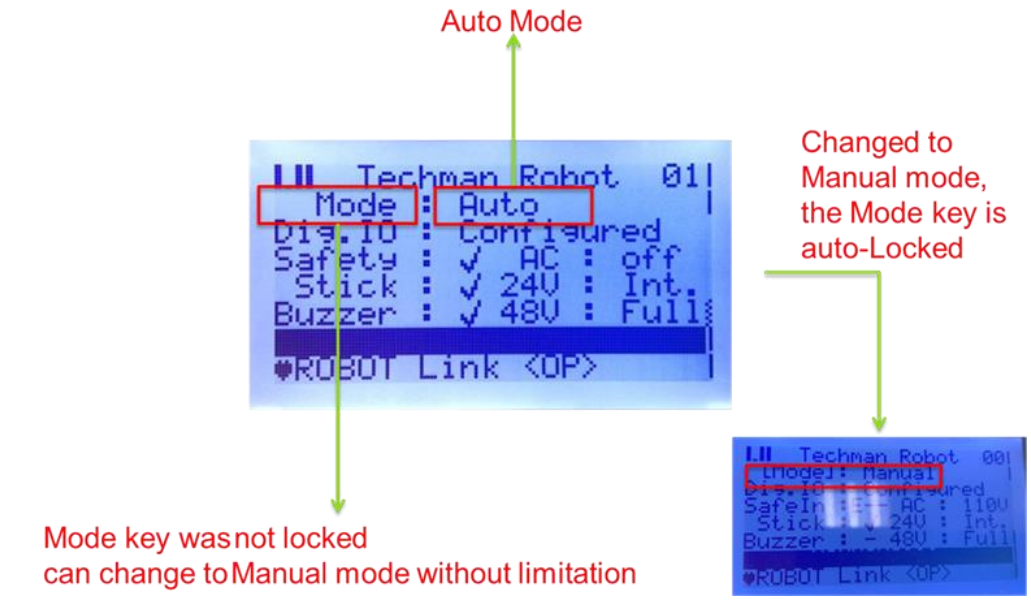


9.3 Key Locker:

Mode Lock (Manual Mode)

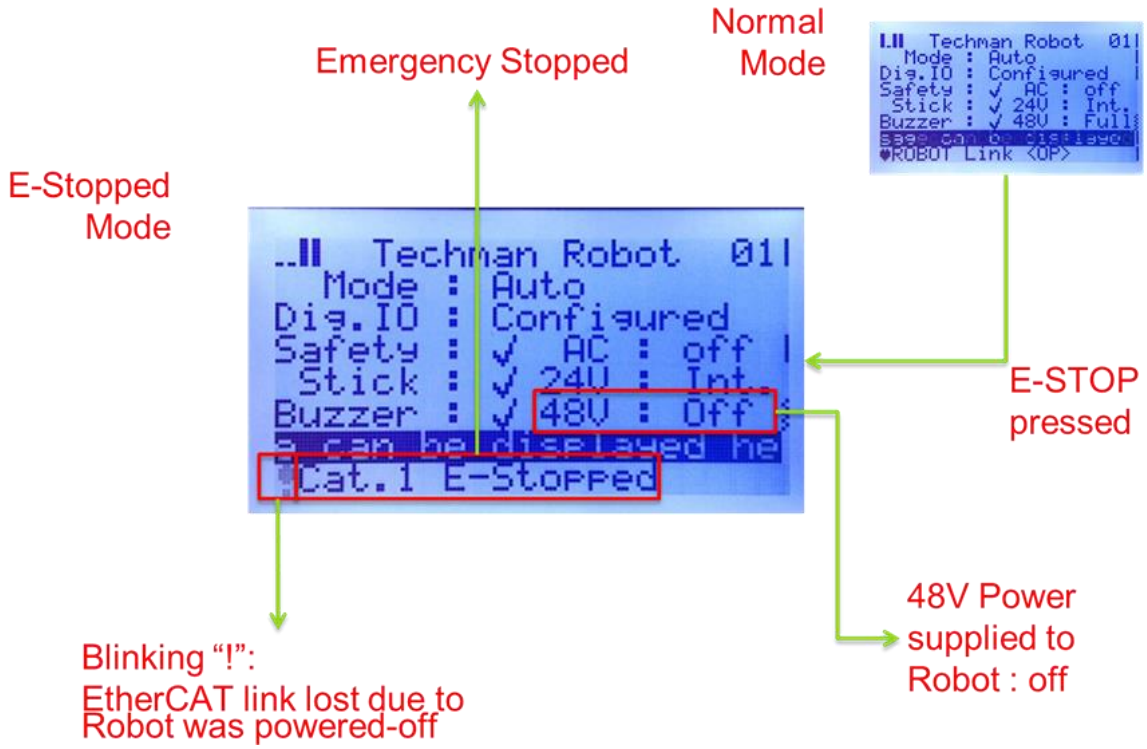


Mode Lock (Auto Mode)

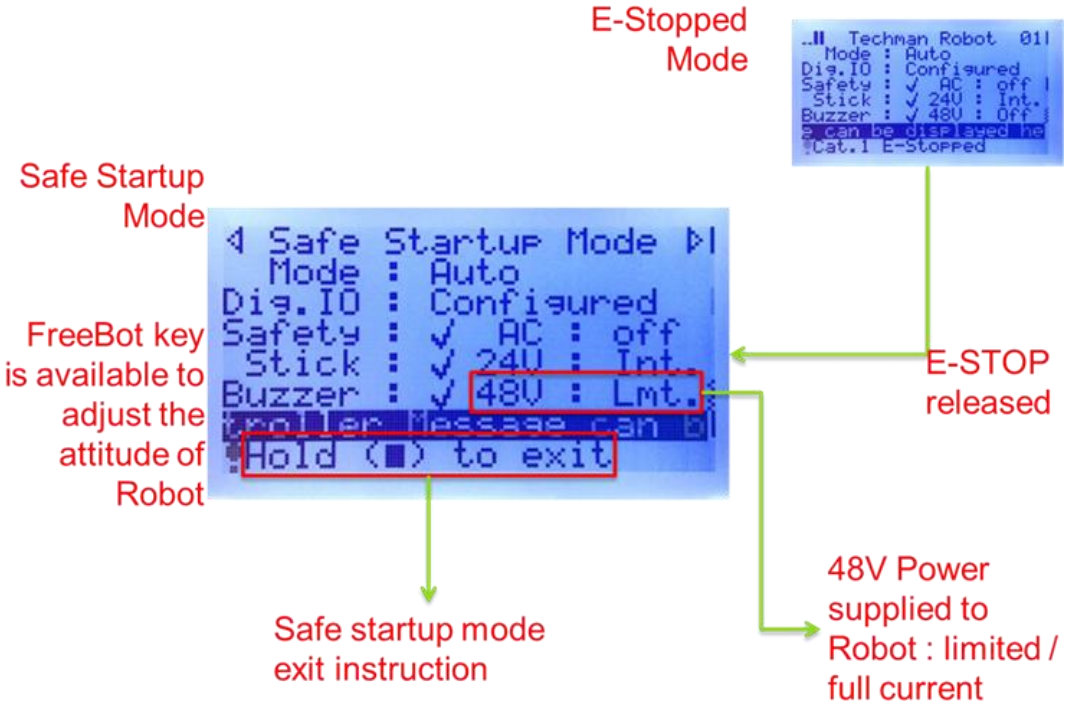


9.4 Emergency Stop

Cat.1 E-Stopped mode

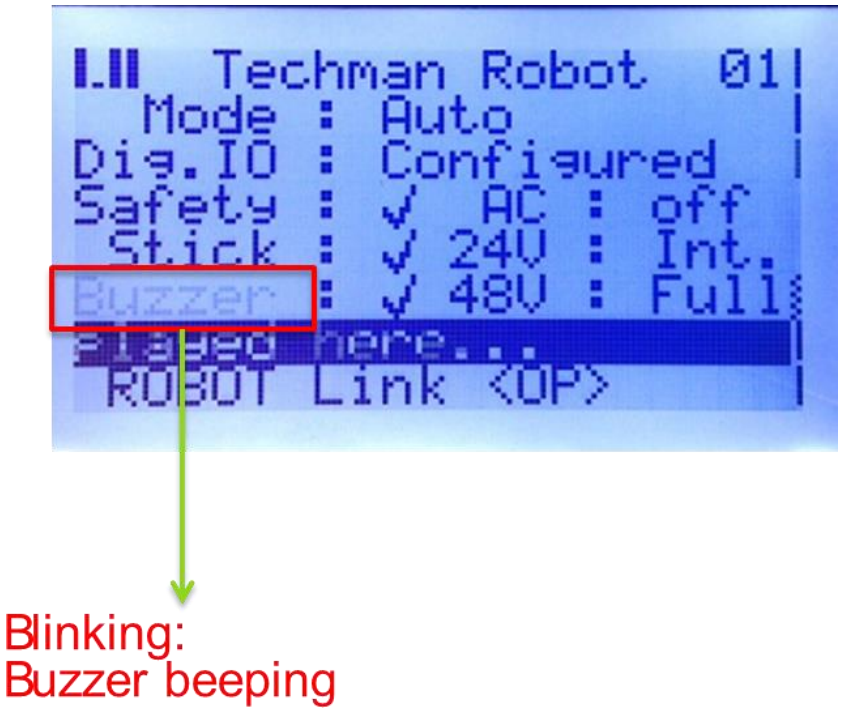


Safe Startup Mode

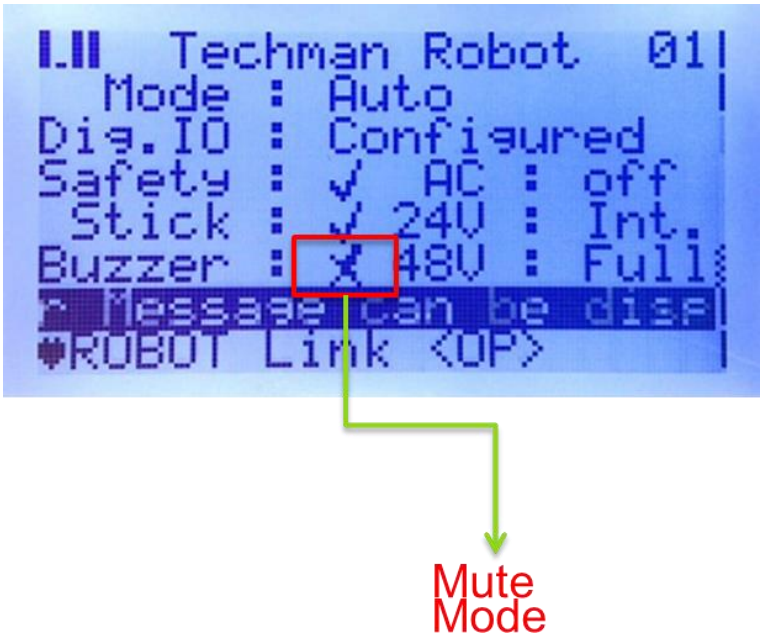


Buzzer:

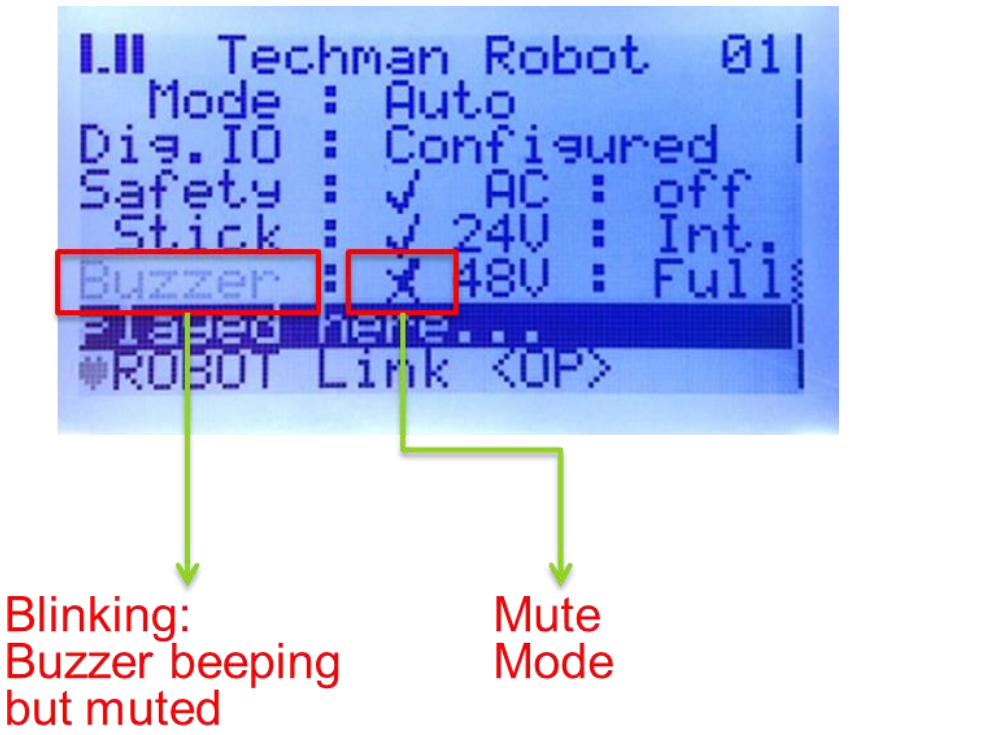
Buzzer Beeping



Mute Mode

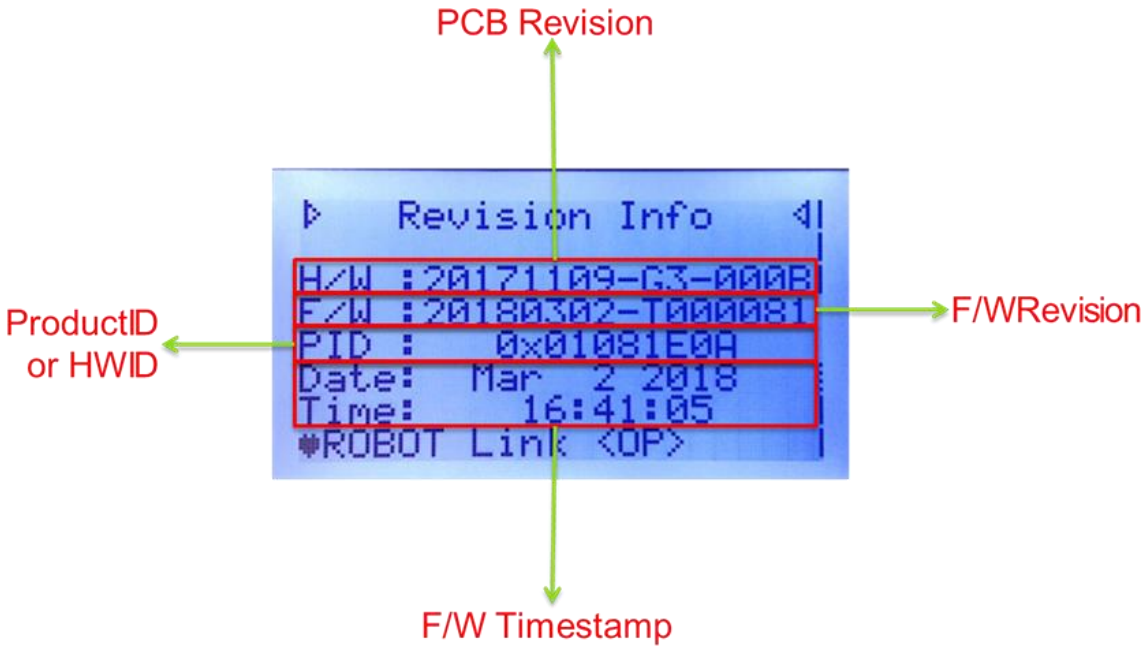


Buzzer Beep Muted

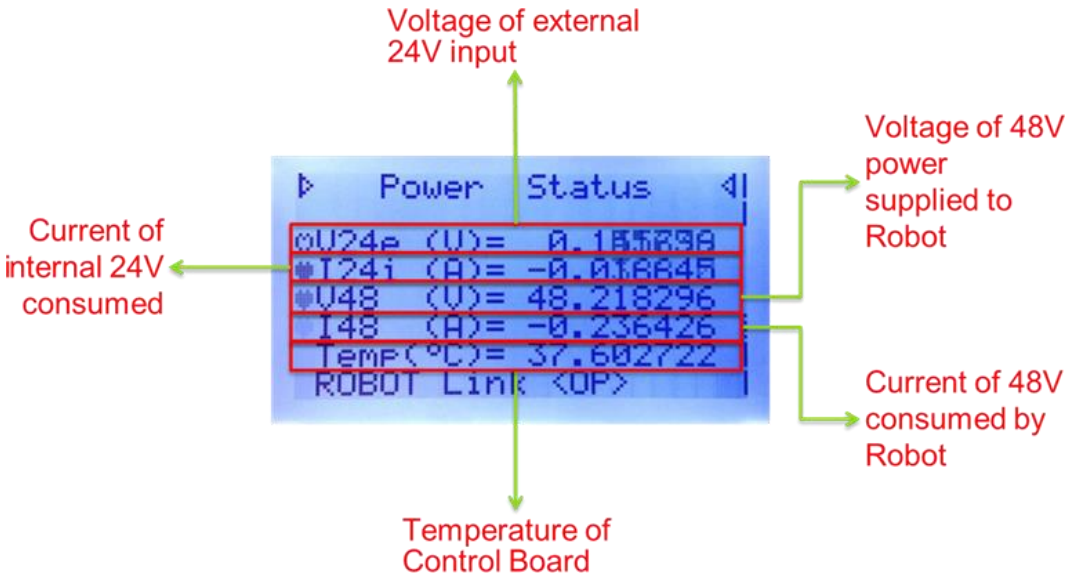


9.5 Engineering Page

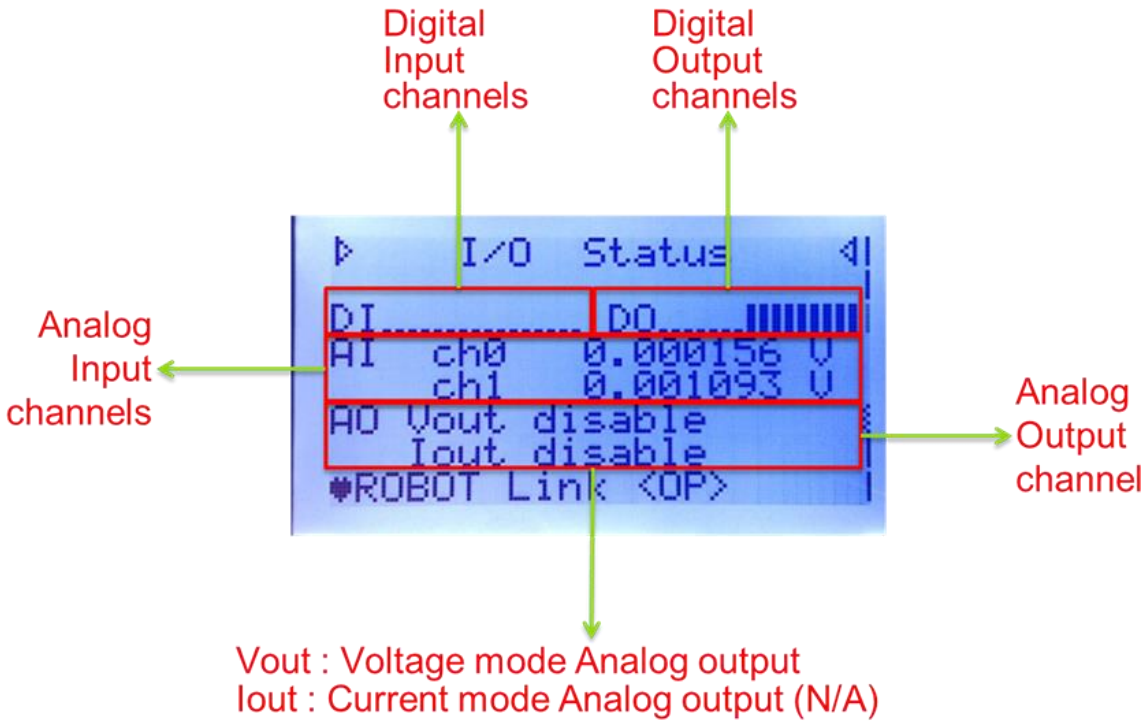
Revision Info



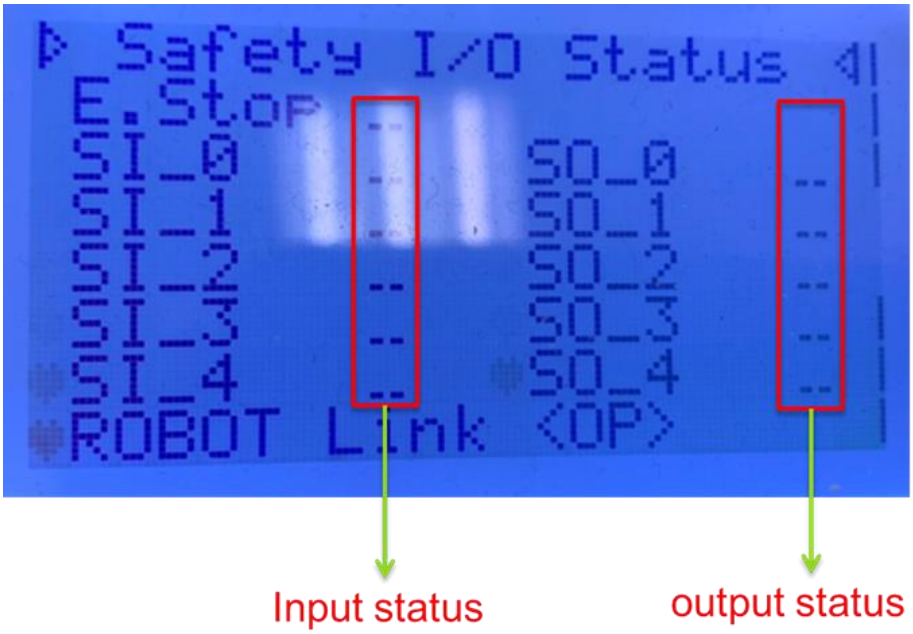
Power Status



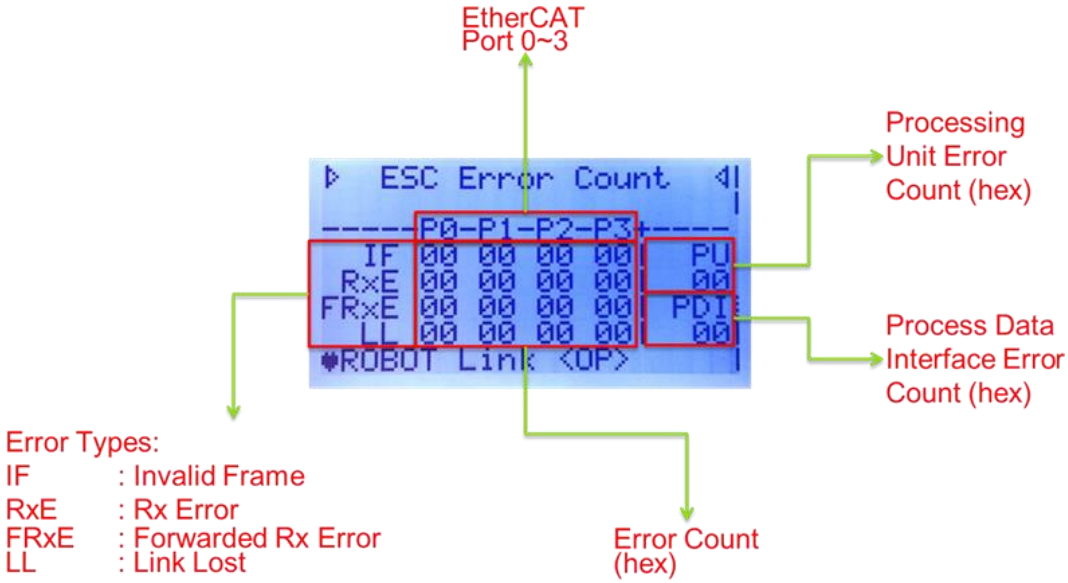
I/O Status



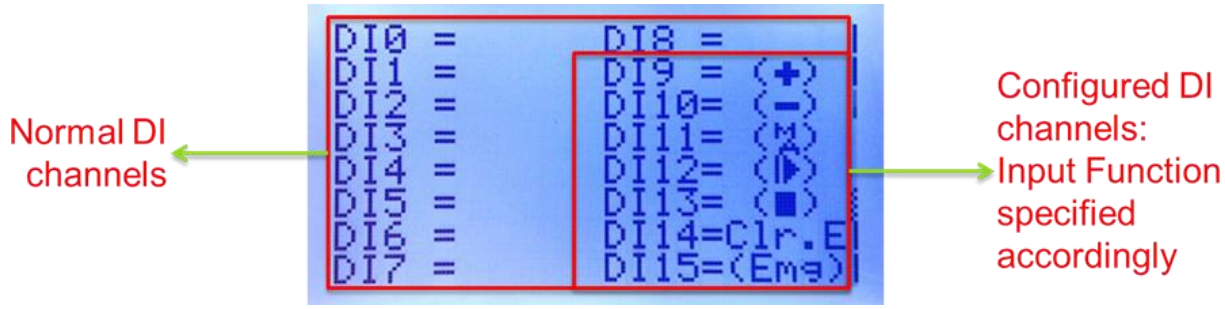
Safety I/O Status



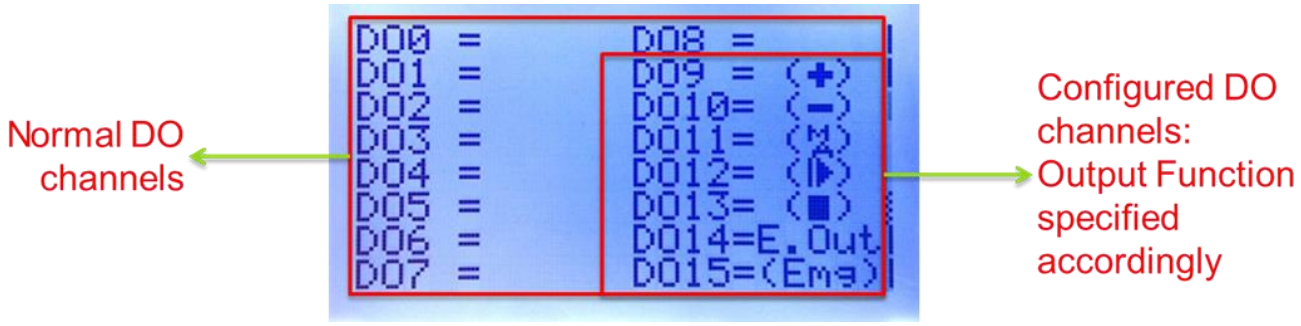
ESC Error Count



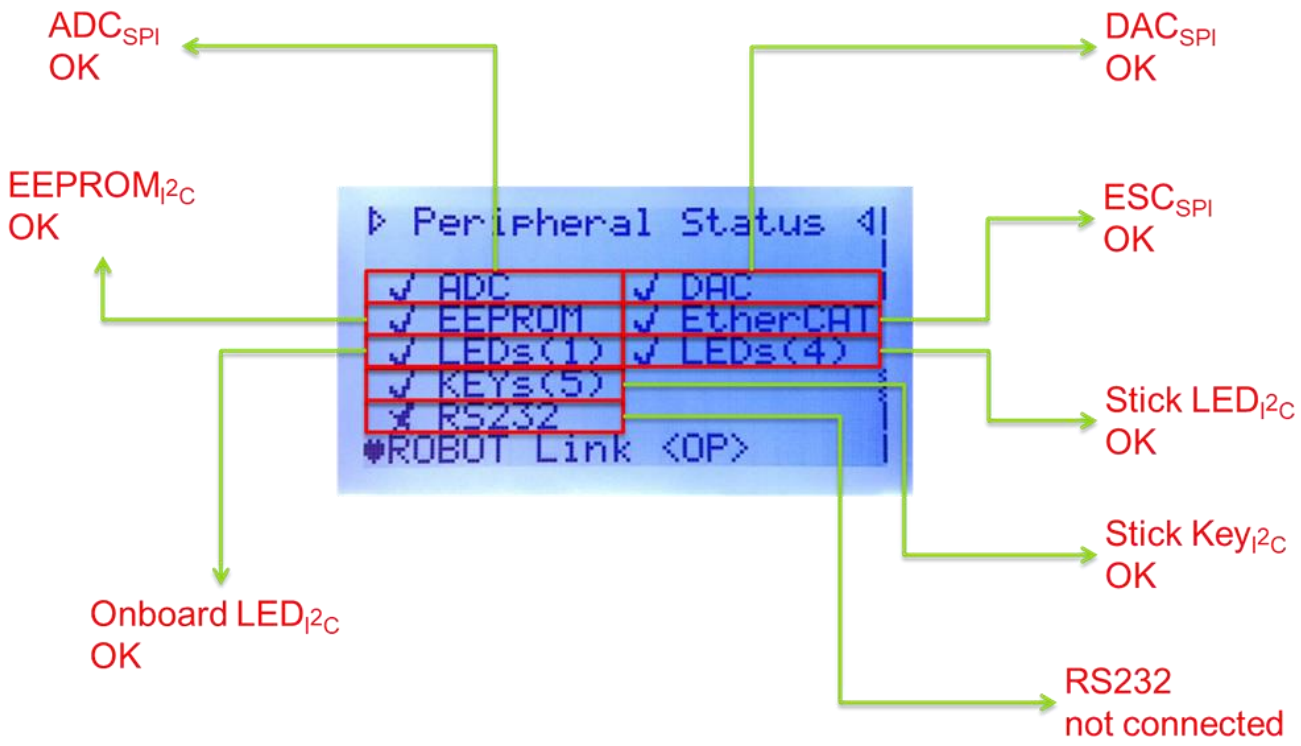
Configured DI Ports



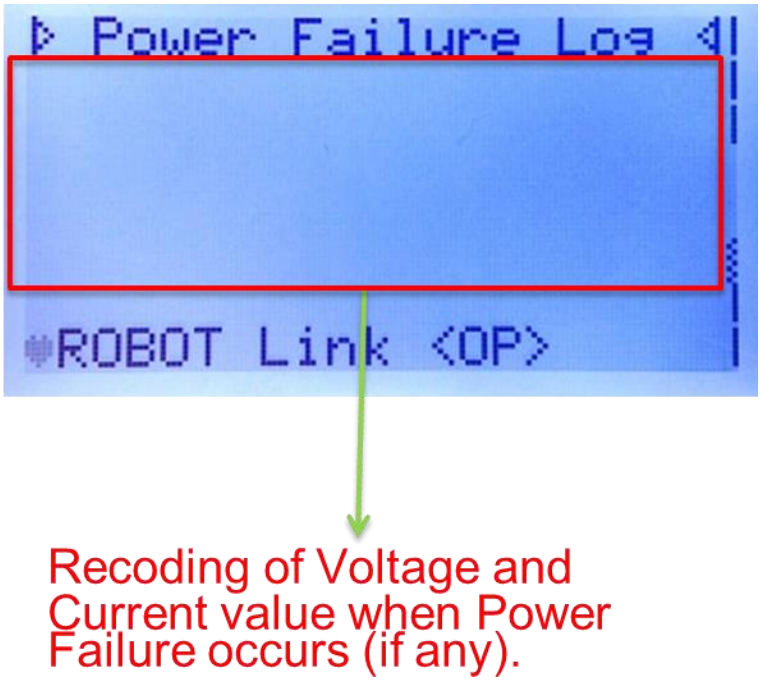
Configured DO Ports



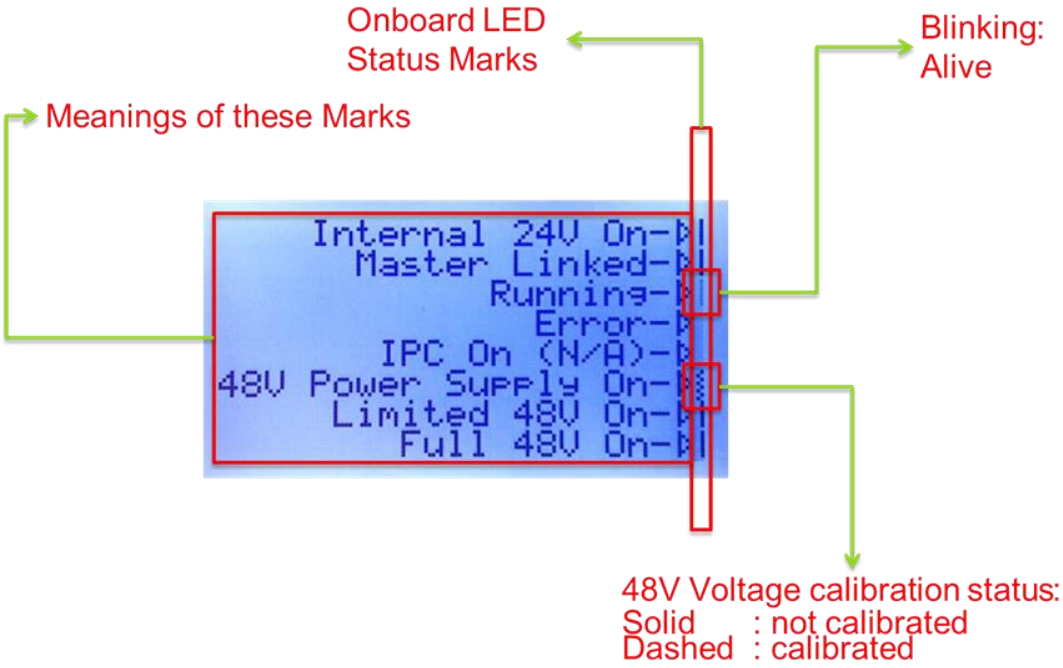
環境狀態



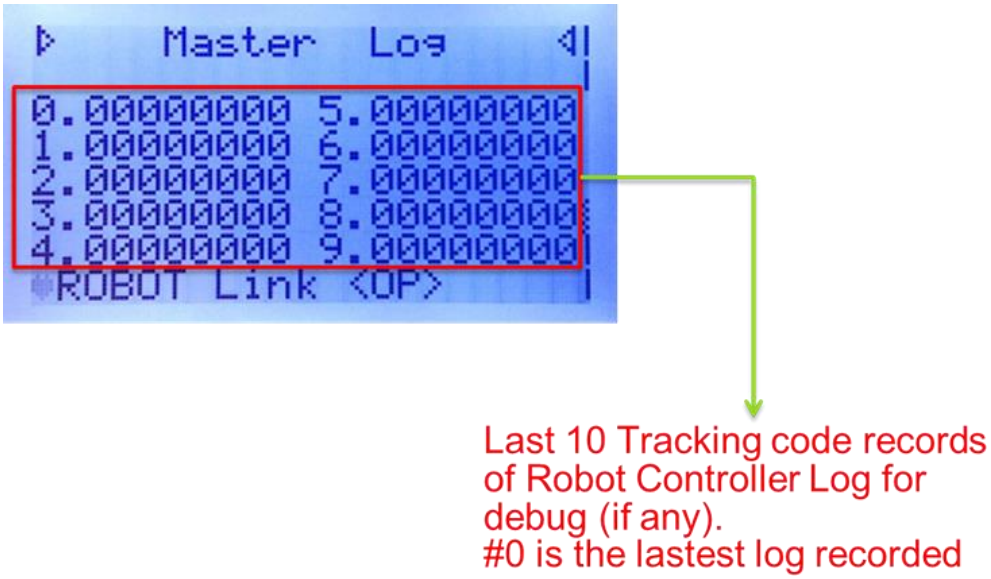
Power Failure Log



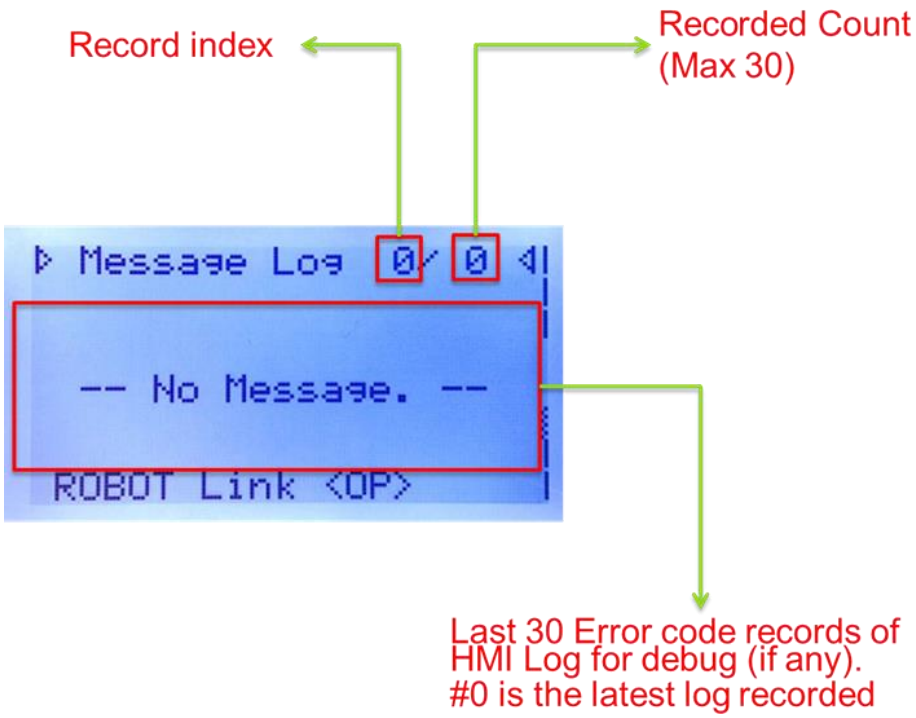
LED Status Indication



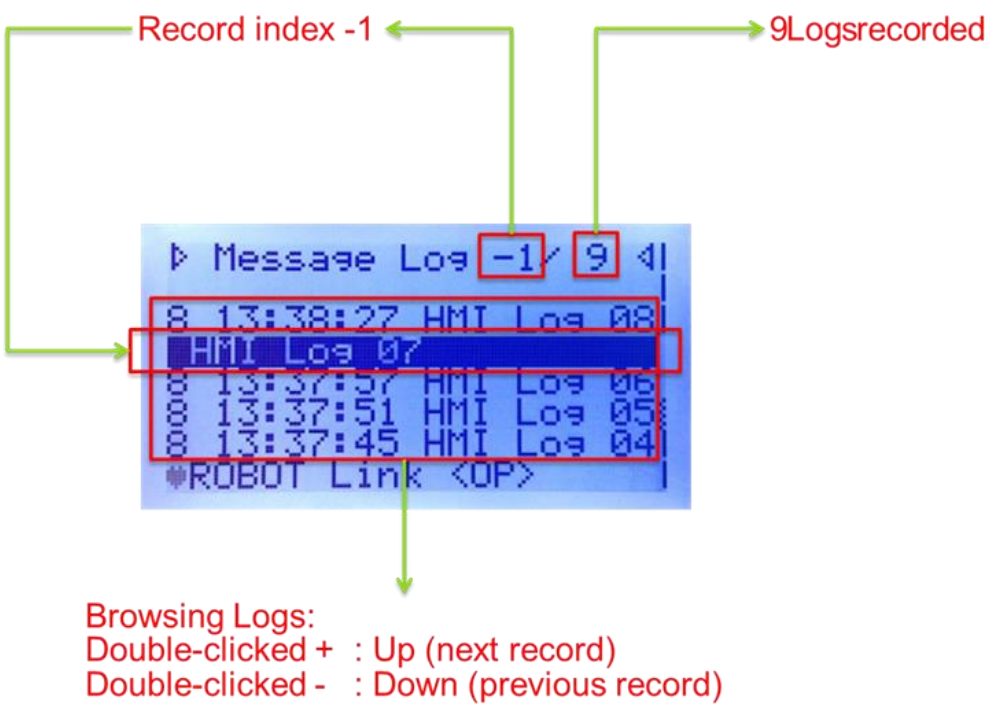
Master Log



Message Log

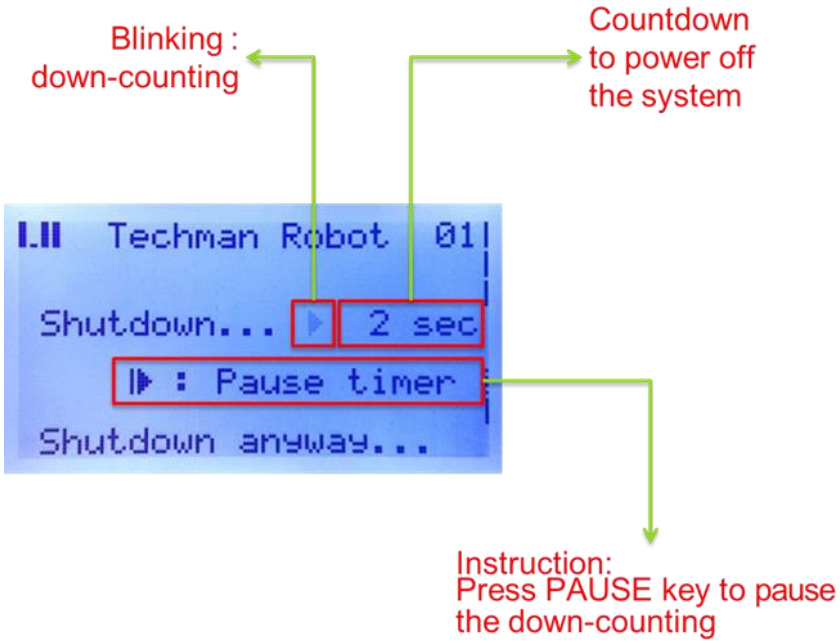


Message Log (9 entries in total)

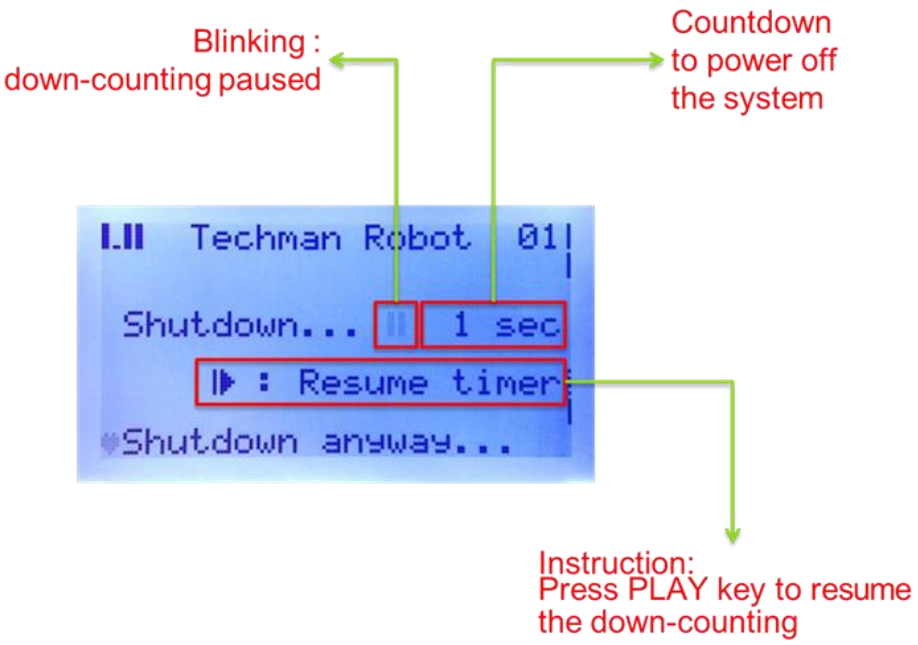


9.6 Power Off Sequence

Power Off Countdown Timer



Power Off Countdown Paused


Blinking :
down-counting paused
Countdown
to power off
the system
Techman Robot 01
Shutdown... 1 sec
: Resume timer
Shutdown anyway...
Instruction:
Press PLAY key to resume
the down-counting

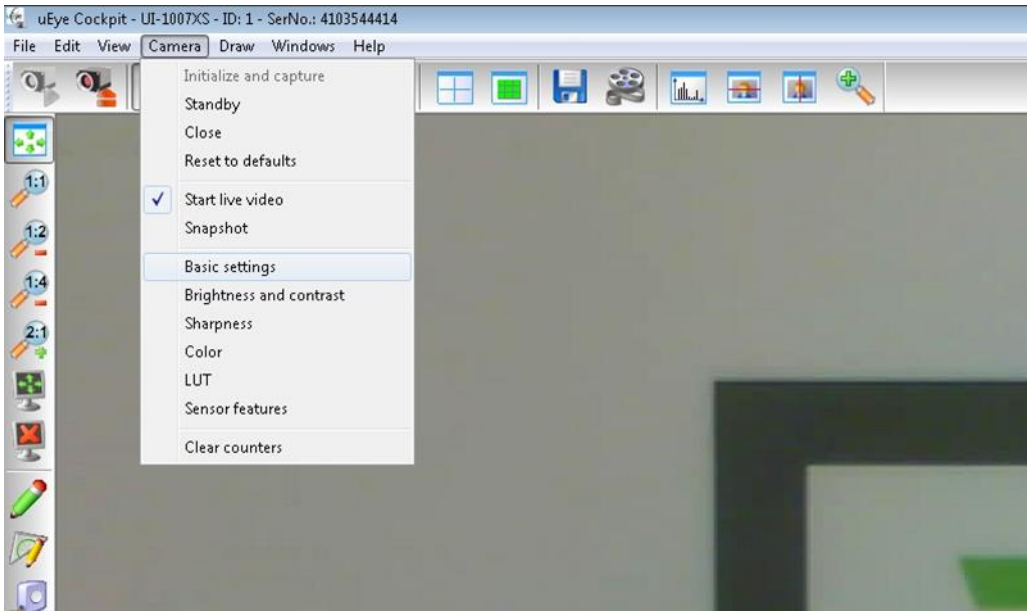
Power Off

10. Software Application

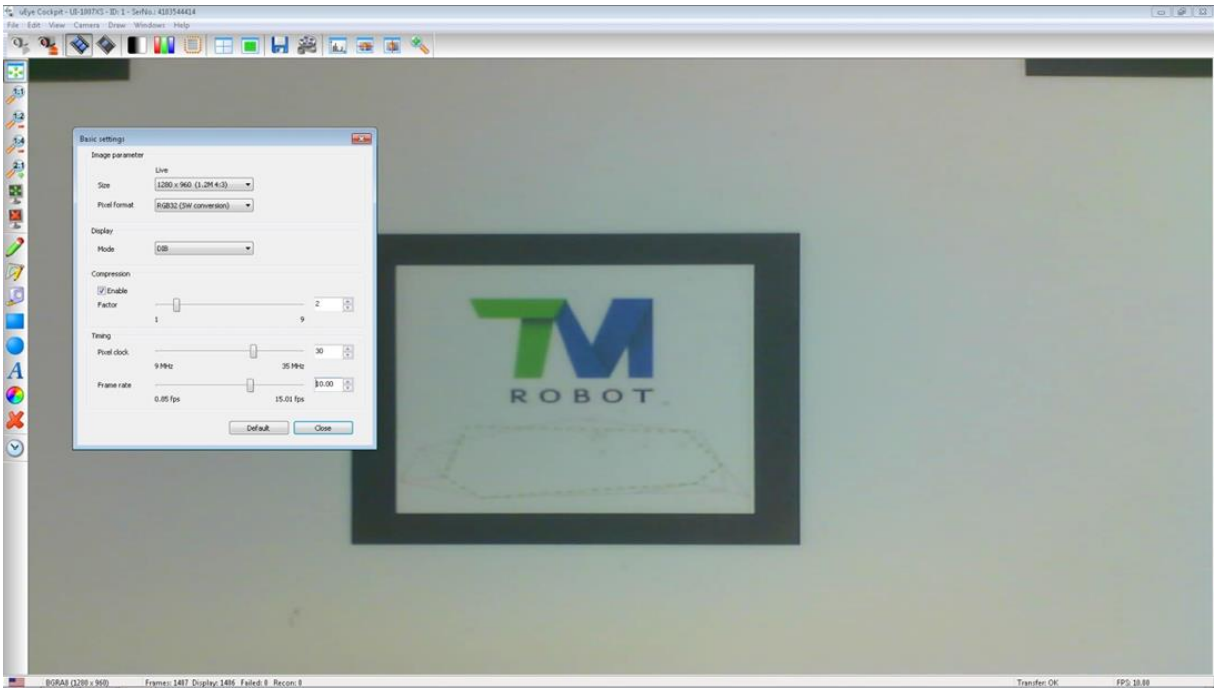
10.1 Configure IDS Ueye

10.1.1 Configuration

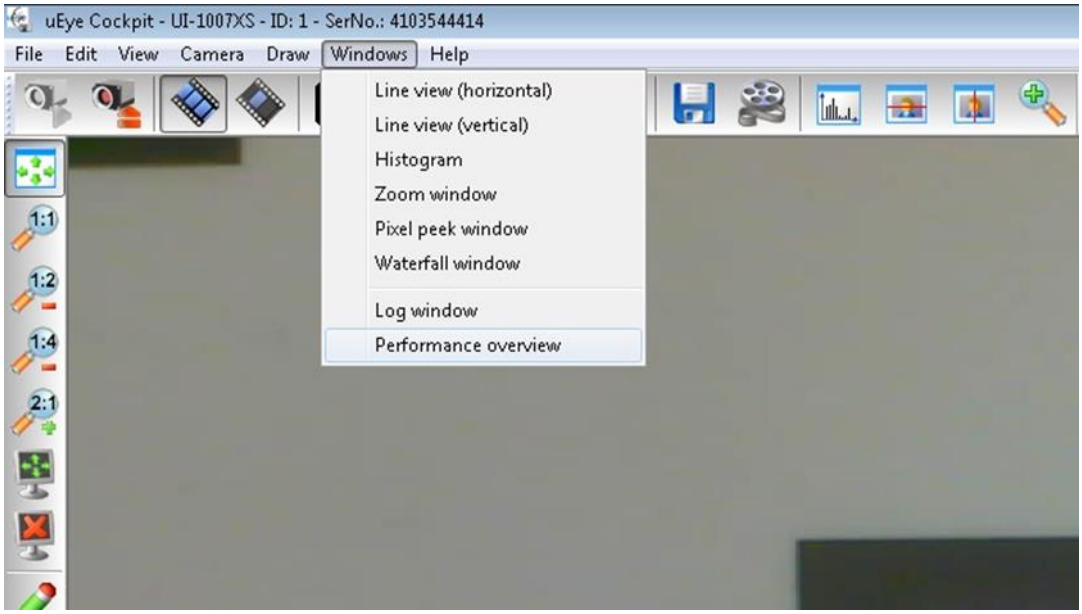
1. Click **Camera** > **Basic settings**.



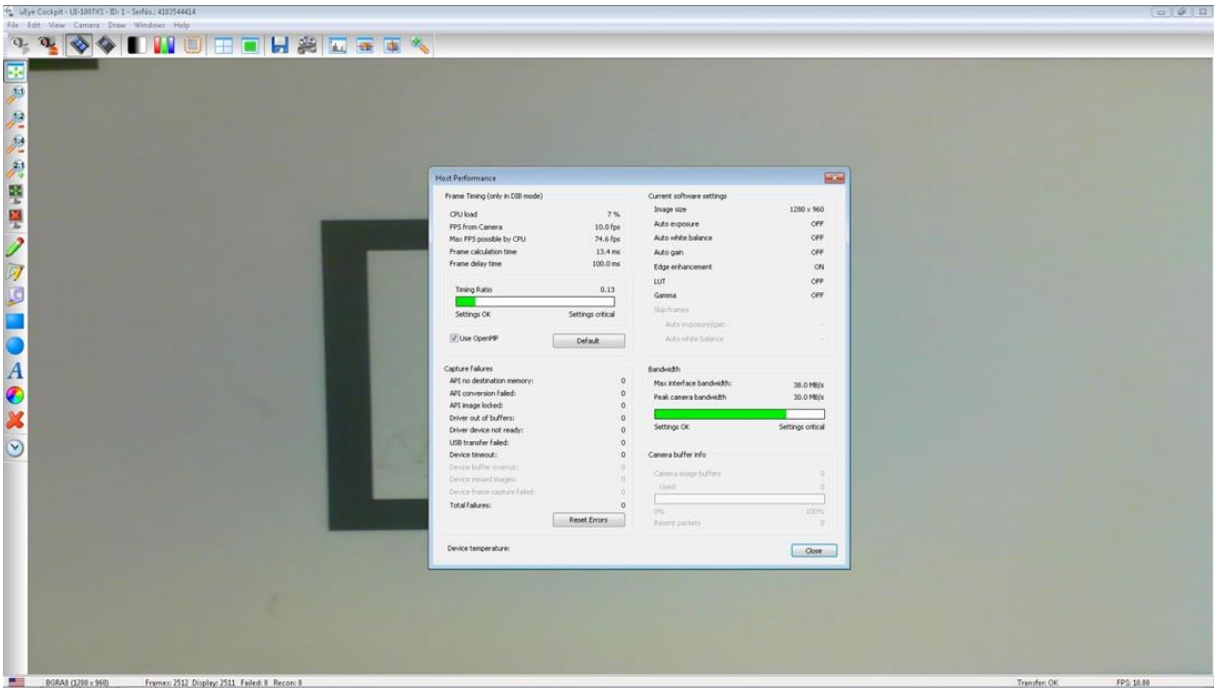
2. Set **Size** to**1280 x 960** and **Frame rate** to **10 FPS**.



3. Click **Window** > **Performance overview**.



4. The abnormality of cameras is shown as the table below. This table lists the categories and the occurrences of each camera abnormality. Please approach TM Robot and submit the table screenshot if anomaly.



10.2 Update EEPROM, ESI, and Firmware Data

After replacing the robot joint, the power control board, or the end module, it is required to update EEPROM, ESI, and Firmware Data in the slave. Otherwise, users will receive warnings with error codes such as 0x4E and 0x3C.

Access to the lower-level system operation:

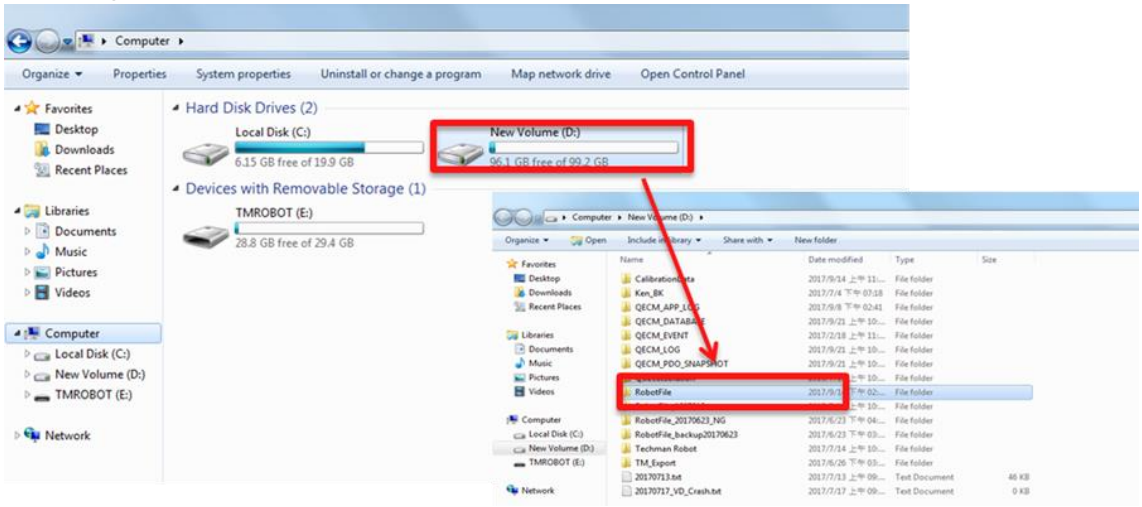
1. Turn off the control box and the robot.
2. Press and hold the emergency switch on the robot stick and insert the dongle into the USB port of the control box.
3. Turn on the system.
4. While proceeding to TMflow, warning messages with error codes prompt for the disconnection between the robot and the control box by the initiation of the emergency switch. At the moment, click **Exit** at the bottom left to enter the lower-level system.
5. Press and release the emergency switch on the robot stick after entering the lower-level system.

Caution:

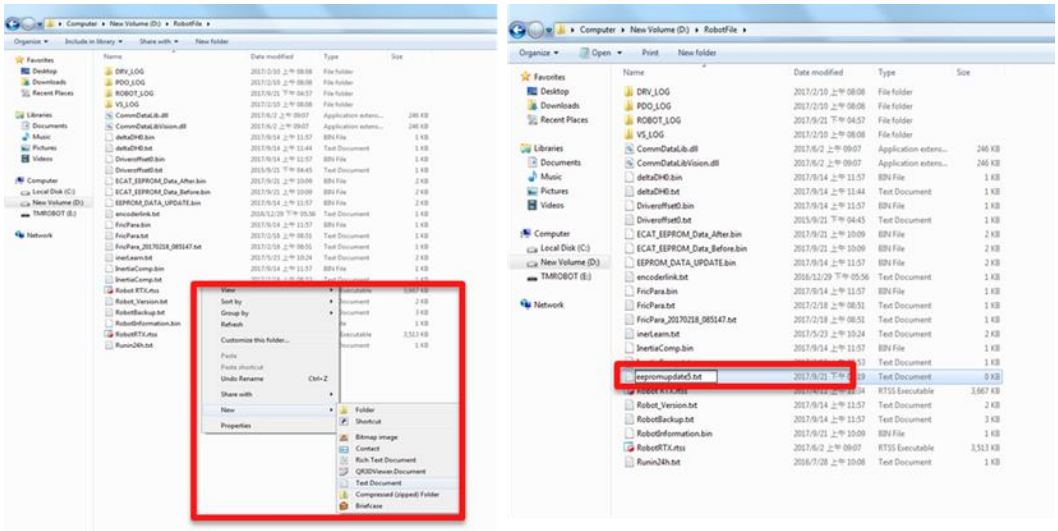
Before updating the EEPROM, ESI, and firmware, ensure turning on the robot correct. Operators can check if the robot is on by the indication light ring on the end module. Under normal circumstances, it is flashing in red now. Do not perform any updates and operations if it is off or not flashing in red.

Update EEPROM

1. Go to **D:\RobotFile**.



2. Create a text file (.txt) naming in eepromupdate5.txt.



3. After the robot shuts down completely, restart the system to finish the update.

Update the ESI

1. Once the replacing part is the End module, select the respective robot batch file in the path list below following the path **D:\Techman Robot\TM Flow\ModuleReleaes\ESI** to update ESI.

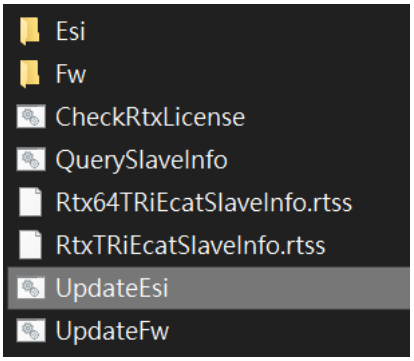
TM5	Robot S/N : BAXXXXXX
AC Type	
TM5-900	UpdateEsi_TM5_900ACA
TM5-700	UpdateEsi_TM5_700ACA
TM5X-900	UpdateEsi_TM5X900ACA
TM5X-700	UpdateEsi_TM5X700ACA
DC Type	
TM5-900	UpdateEsi_TM5_900ACM
TM5-700	UpdateEsi_TM5_700ACM
TM5X-900	UpdateEsi_TM5X700ACM
TM5X-700	UpdateEsi_TM5X700ACM

TM12/14	Robot S/N : BAXXXXXX
AC Type	
TM12	UpdateEsi_TMA_130ACA
TM14	UpdateEsi_TMA-110ACA
TM12X	UpdateEsi_TMAX130ACA
TM14X	UpdateEsi_TMAX110ACA
DC Type	
TM12	UpdateEsi_TMA-130ACM
TM14	UpdateEsi_TMA_110ACM
TM12X	UpdateEsi_TMAX130ACM
TM14X	UpdateEsi_TMAX110ACM

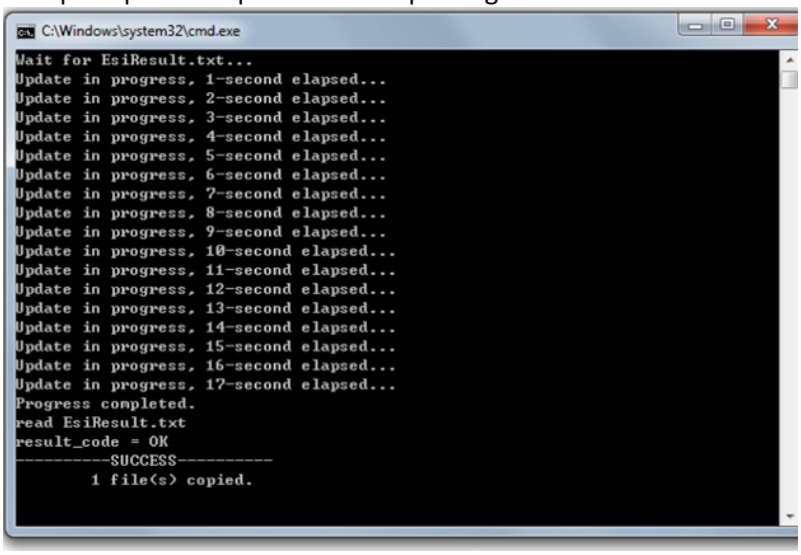
TM16	Robot S/N : BAXXXXXX
AC Type	
TM16	UpdateEsi_TMA-090ACA
TM16X	UpdateEsi_TMAX090ACA
DC Type	
TM16M	UpdateEsi_TMA-090ACM

TM20	Robot S/N : BAXXXXXX
AC Type	
TM20	UpdateEsi_TMA-13AACA
TM20X	UpdateEsi_TMAX13AACA
DC Type	
TM20M	UpdateEsi_TMA-13AACM

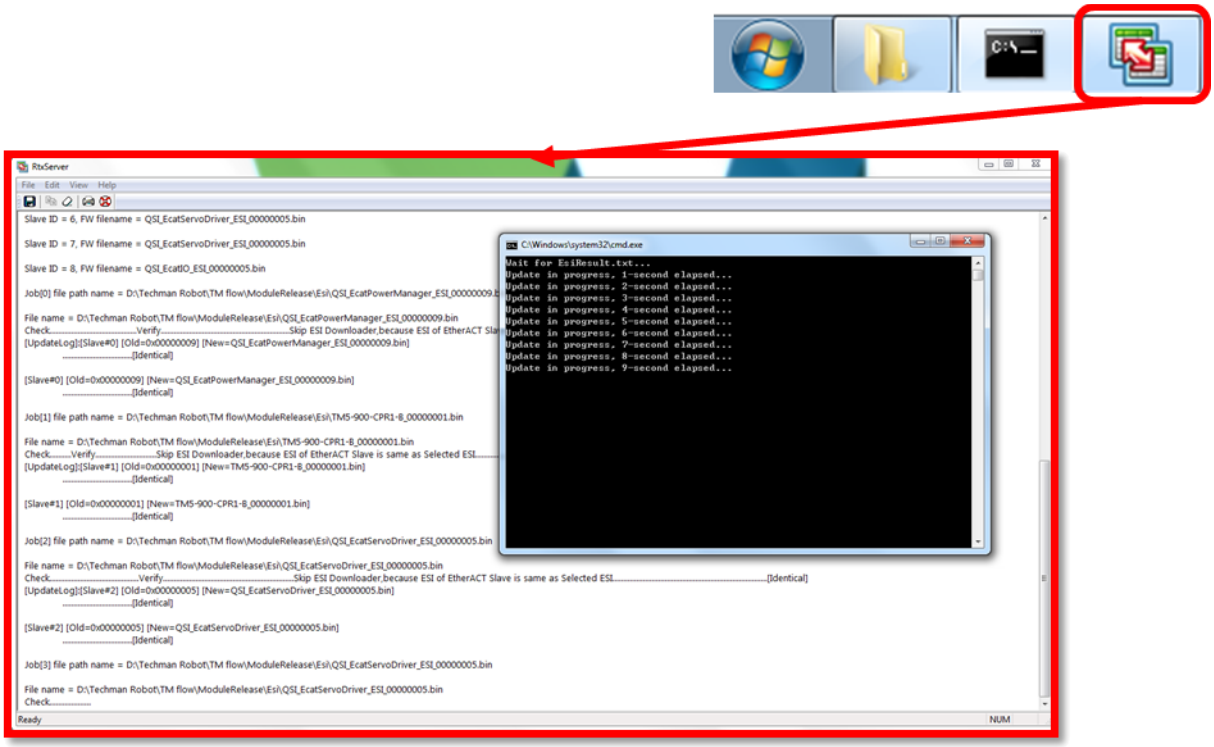
3. Once the replacing part is the Joint or the Power Control Board, execute UpdateEsi.bat in the path **D:\Techman Robot\TM Flow\ModuleReleaes** as step 3 below to update ESI.
4. Double-click the left mouse button to execute **UpdateEsi.bat**.



5. A message window will prompt the elapsed time of updating.



6. To check the update status, click the icon in the taskbar at the bottom right of the screen, as shown below, and launch RtxServer.



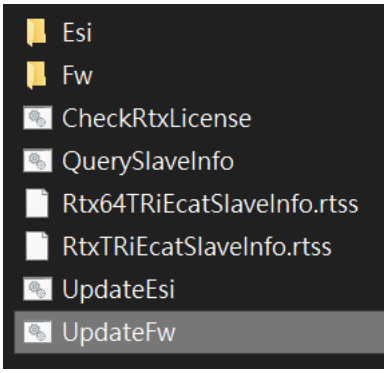
7. If the status says **Program terminated normally**, it denotes ESI updates successfully.

Update the Firmware

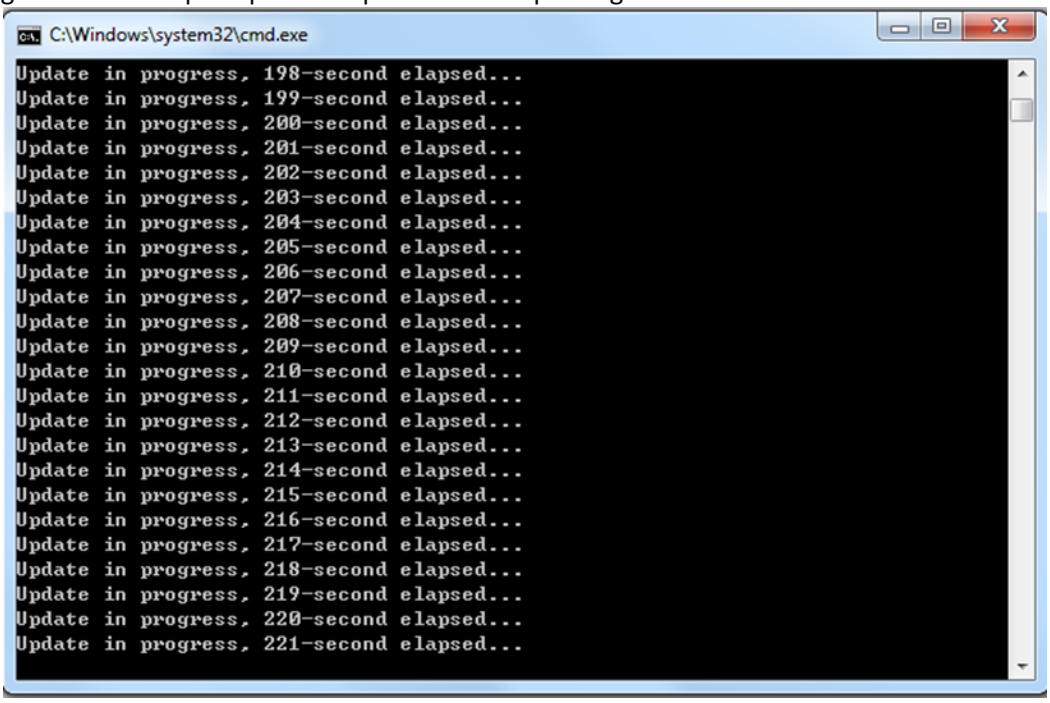
1. Once the replacing part is the End module, select the respective robot batch file in the path list below following the path **D:\Techman Robot\TM Flow\ModuleReleaes\Fw** to update the firmware

TM5A	Robot S/N : BAXXXXXXX	TMAA	Robot S/N : BAXXXXXXX
UpdateFw_TM5A		UpdateFw_TMAA	

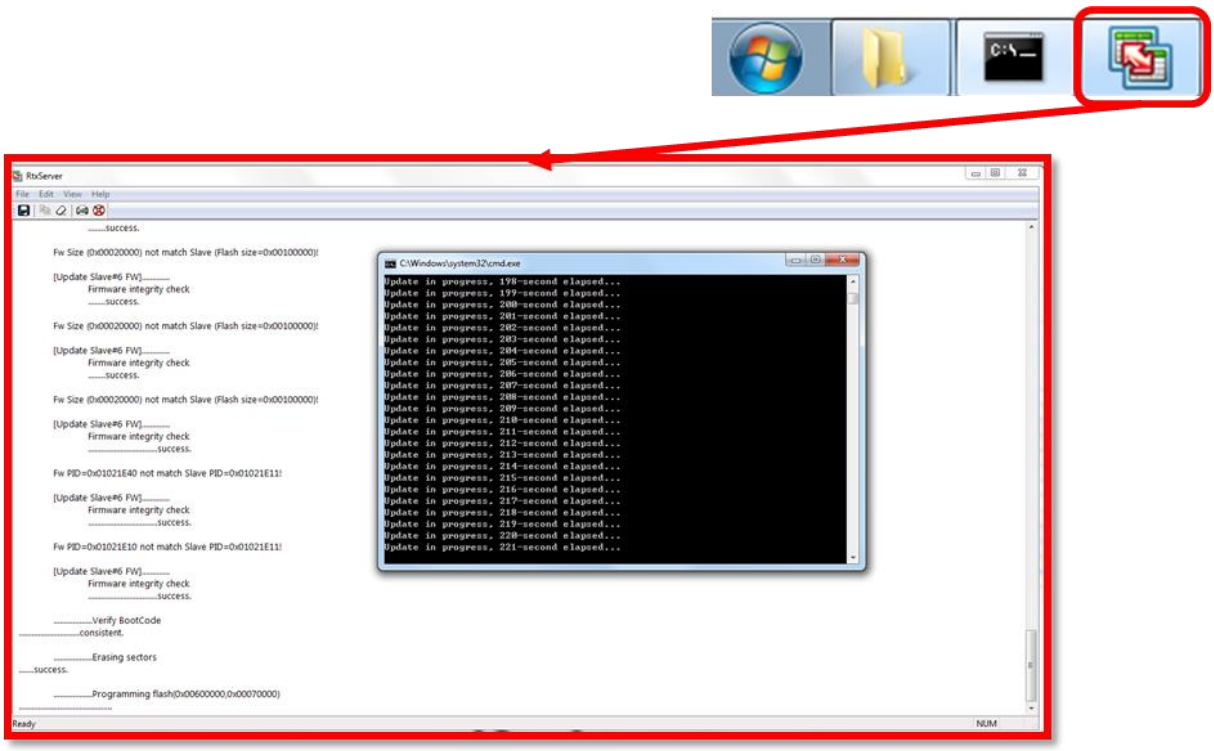
2. Once the replacing part is the Joint or the Power Control Board, execute UpdateFw.bat in the path **D:\Techman Robot\TM Flow\ModuleReleaes** as step 3 below to update the firmware.
3. Double-click the left mouse button to execute **UpdateFw.bat**.



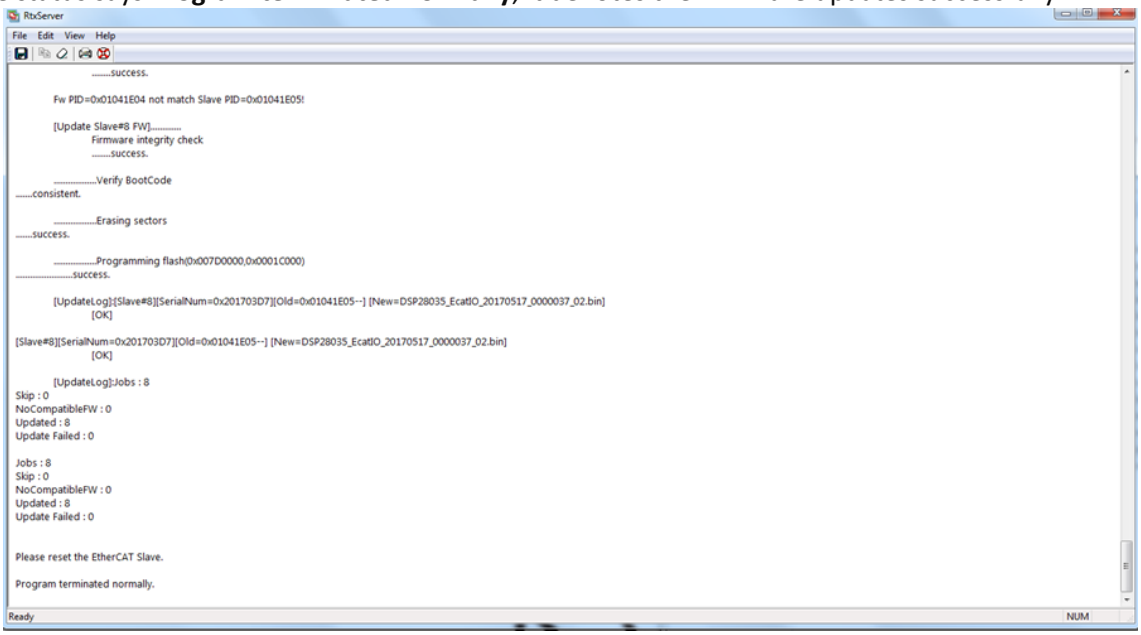
4. A message window will prompt the elapsed time of updating.



5. To check the update status, click the icon in the taskbar at the bottom right of the screen, as shown below, and launch RtxServer.
6. After updating the firmware, the LCD and the end module LEDs will flash rapidly. Users can turn the control box off completely and turn on the power to eliminate it.



7. If the status says **Program terminated normally**, it denotes the firmware updates successfully.



11. Troubleshooting

11.1 Common Issues

Issue	Error Code	Symptom	Possible Cause
27.2 Unable to boot up the control box	N/A	After pressing the power button on the Stick, there is no boot response in the IPC and nothing on the LCM	1. There is damage to the power cord or no AC power. 2. The power cord is loose. 3. The Relay Board has no AC power input. 4. Parts on the Relay Board are burnt out. 5. Stick or IPC is damaged. 6. The 24V power supply is damaged.
27.3 Connection error with the robot – EtherCAT	0x0000003B 0x0000003C 0x0000004B 0x00000050 0x00000057	Failed to access the HMI screen, and the system log shows the error codes.	1. Error with the Power control board 2. Error with any of the joints 3. Error with the end module 4. Error with the internal connection of the control box or the robot.
27.4 Voltage error with the robot	0x00000035 0x0000003C 0x0000003E 0x00000053 0x0000FFE0 0x00041002	Failed to access the HMI screen, no light from the end module, the LCM voltage decreased from 48V to below 40V, and the system log shows the error code.	1. Pressing the emergency stop switch. 2. The composite cable is loose. 3. The cabling between the relay board and the Power Supply 48V is loose. 4. The internal composite cable is loose. 5. The power control board-related cables are loose. 6. The power cables of each robot joint to the E-bus connection are loose. 7. Error with the Power Supply 48V. 8. Error with the joint or the end module.
27.5 Connection error with the camera	0x00020000 0x00020007 0x00042007 0x00043006	The eye-in-hand camera icon disappears when the system displays a camera connection error or the vision settings of the camera list (during vision task preparation or execution).	1. System delay 2. Camera error 3. The USB Port fails to function properly in IPC. 4. The camera cable fails to function well between J1 and J3. 5. The camera cable fails to function well between J3 and J4. 6. The camera cable fails to function well between J4 and the end module. The robot cables fail to function well.

Issue	Error Code	Symptom	Possible Cause
			7. The internal USB Port fails to function properly in IPC. 8. Error with the robot composite cable 9. Error with the power supply to the end module.
27.6 Digital I/O Error with the controller	無	There is a delay or no response in the signal output in the IPC. There is a delay or no response to the IPC signal output.	1. The external device's digital output current exceeds 300 mA making the output and input circuits burn out. 2. There is a leakage in the IPC I/O circuit connected to the external device.
27.7 Joint error	0x00000035 0x0000003C 0x0000004B 0x0000FF01 0x0000FF02 0x0000FF04 0x0000FF05 0x0000FF06 0x0000FF07 0x0000FF08 0x0000FF09 0x0000FF0A 0x0000FF0B 0x0000FF0C 0x0000FF0D 0x0000FF0E 0x0000FF0F 0x0000FF10 0x0000FF11 0x0000FF12 0x0000FF13 0x0000FF14 0x0000FF15 0x0000FF16 0x0000FF17 0x0000FFAB 0x0000FFCF	1. Reported joint-related errors and unable to control the robot 2. Error with the joint's internal mechanism making the shaft fail to rotate 3. Queer noise along the robot operation 4. After starting the project for a while, report 0x0000FF05 until the speed decreases.	1. Axis joint exceeds the functional limit 2. Error with the joint's internal mechanism. 3. Fault with the joint's circuit board.

Issue	Error Code	Symptom	Possible Cause
27.8 Point offset	N/A	The point of the project deviated after the collision.	1. Set the robot back to the initial pose and check for distinct offsets. 2. The joint positioning hole is deviated. 3. The robot is not installed well on the base, or the base is shaking. 4. The workspace deviated after the collision.
27.9 Error with the stick	N/A	1. The project status changes to "Paused" or "Automatically running" during execution. 2. Enter emergency mode during project execution. 3. No effect when pressing the button 4. The robot will not start.	1. The buttons on the stick lose elasticity or are damaged. 2. The stick cable is damaged. 3. The cable between the stick and the printed circuit board is loose. 4. The cable between the stick and the IPC is loose. 5. There is static in the robot working area.
27.10 Connection error with the external device	N/A	The robot does not connect to the external camera, the computer host, or the communication device. The network port indicator light has no function. Or, there is only one colorway to the indicator light (orange or green). Note: Ensure the external device connects to the "EtherCAT Only" port.	1. The connection cable between the robot and the external device is loose. 2. The IP address of the external device is wrong. 3. The IP address of the HMI is inconsistent with that of the external device. 4. Error with the network interface controller driver 5. Error with the IPC or the network interface controller
27.11 Error with the SSD	N/A	If the HMI is out of access, the screen is black, or the USB flash drive is out of reach when inserted, please confirm whether the SSD cable is loose.	1. The SSD connection cable is loose. 2. Windows is scanning the drive. 3. The SSD is damaged.
27.12 Insufficient CPU fan speed	0x00040015	The HMI shows the error code 0x00040015, meaning the CPU fan speed is lower than 1000 rpm making the robot fail to function.	1. The CPU fan is tangled with wires. 2. The power cord of the fan is loose. 3. The CPU fan does not function properly. 4. The power supply failed to supply

Issue	Error Code	Symptom	Possible Cause
			power to the IPC. 5. Error with the software.
27.13 The robot restarts automatically	N/A	After turning on the robot, the control box automatically turns on but will not turn off properly.	1. Incompatible keyboard and mouse. 2. The USB device does not function properly. 3. The switch button of the robot stick does not function properly.
27.14 The camera is not in focus.	N/A	The camera cannot focus during the vision task operation.	1. Error with the camera driver 2. Faulty camera
27.15 Error with the joint's optical encoder	0x0000FFED 0x0000FFCE 0x0000FFCA 0x0005FFCE 0x0005FFCA	1. Error with the encoder resolution 2. Encoder overcompensation 3. Error with the encoder signal detection	1. The disc surface of the encoder is stained 2. Performing friction learning or safety calibration without rebooting made the encoder in a tightened state.

11.2 CONTROL BOX CAN NOT BE STARTED UP

Case description

This section describes possible faults during start up of the IPC and suggested actions for each type of fault.

Result

After pressing the power button on the Stick, there is no boot response in the IPC, and the LCM has no screen.

Possible reason

The following are possible reasons that the IPC cannot be turned on. :

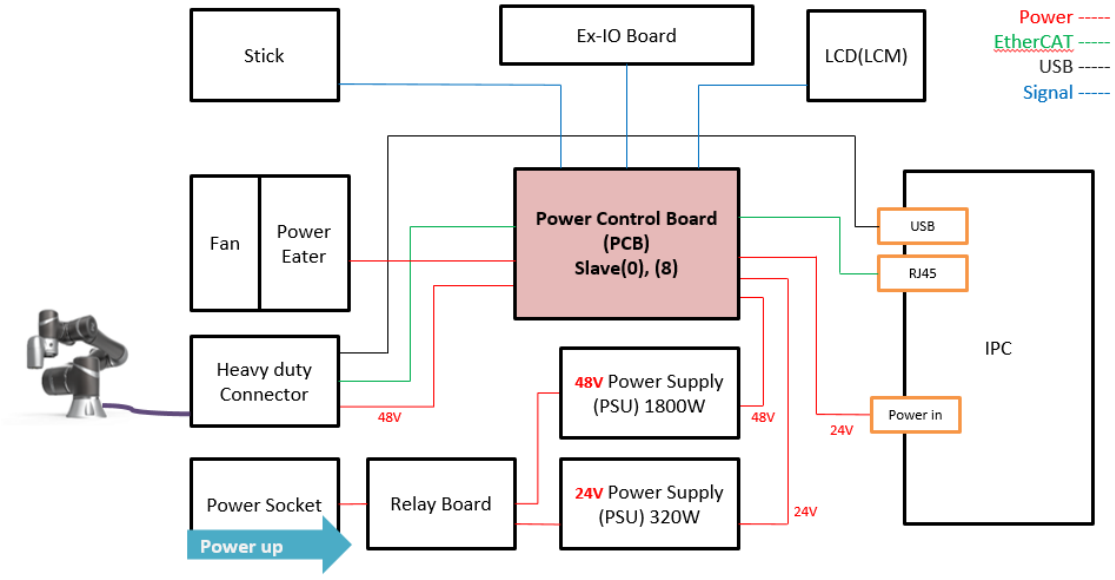
- ✓ AC has no power or power cord damage
- ✓ The power cable is loose
- ✓ AC power input to the relay board is loose
- ✓ Relay Board damaged
- ✓ Stick damaged
- ✓ Power control board damaged
- ✓ IPC damaged
- ✓ 24V power supply damaged
- ✓ 48V power supply damaged

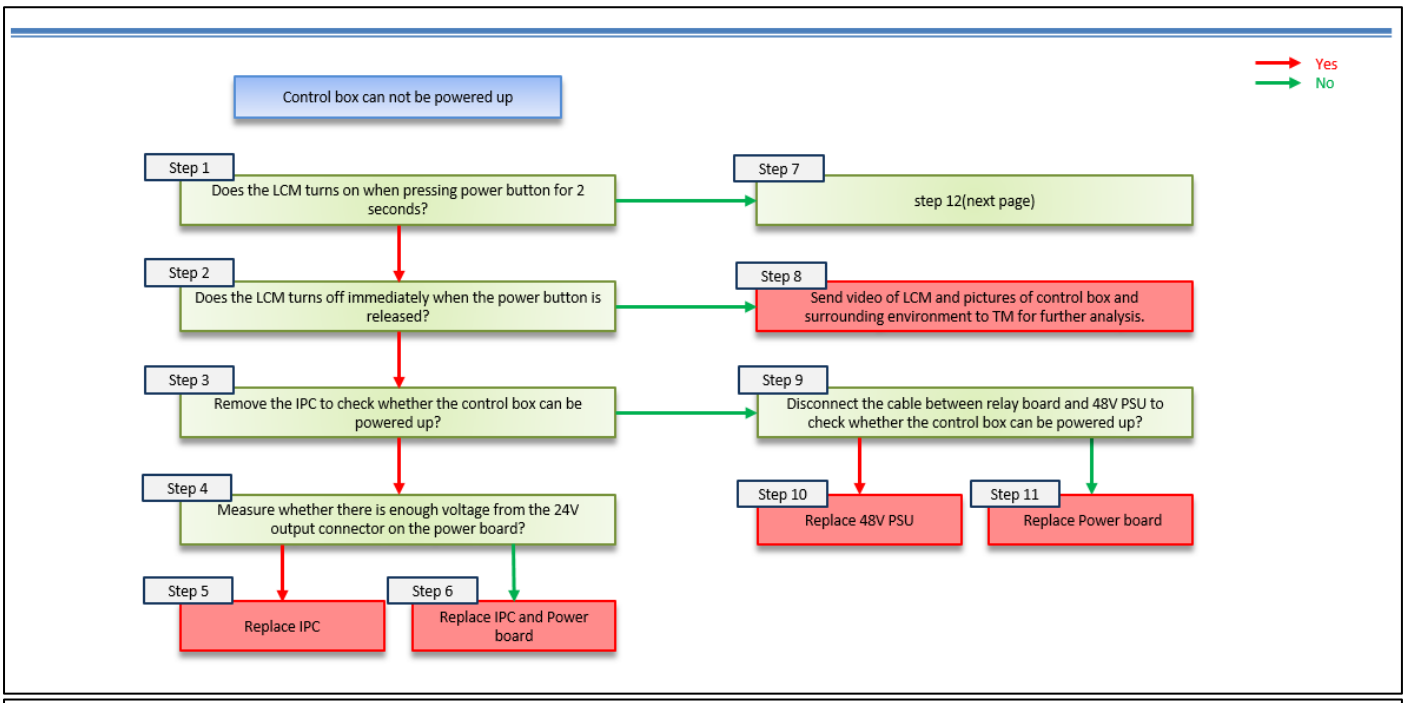
Common error code

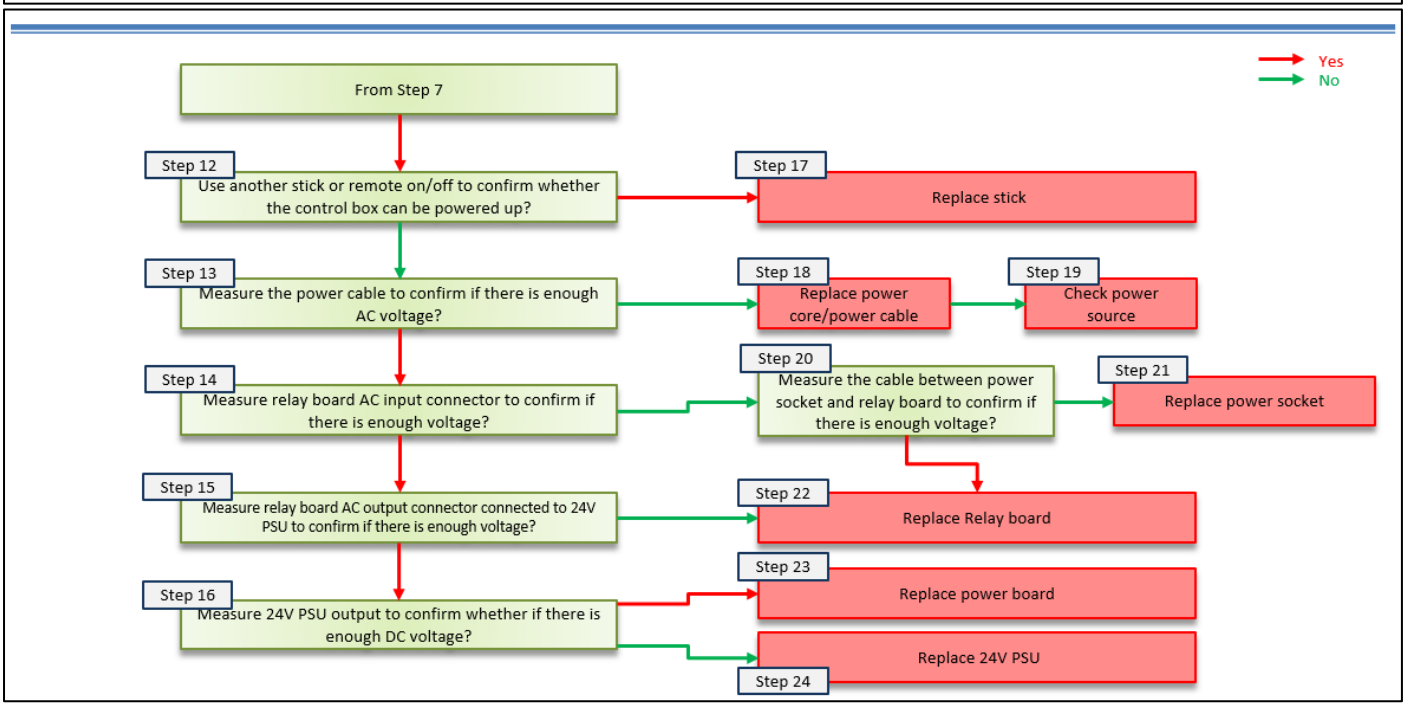
NA

Symptom

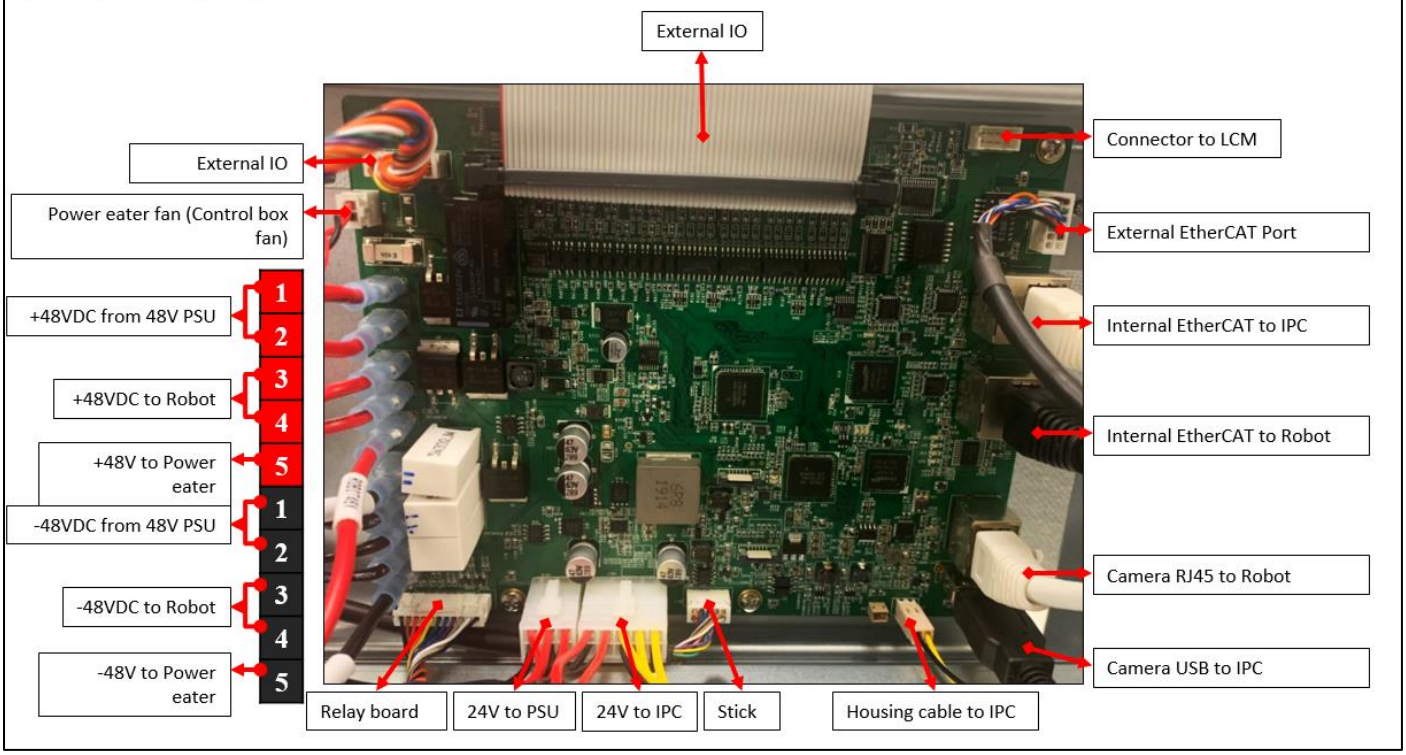
Control Box Block Diagram (HW3.0 3.1 3.2)



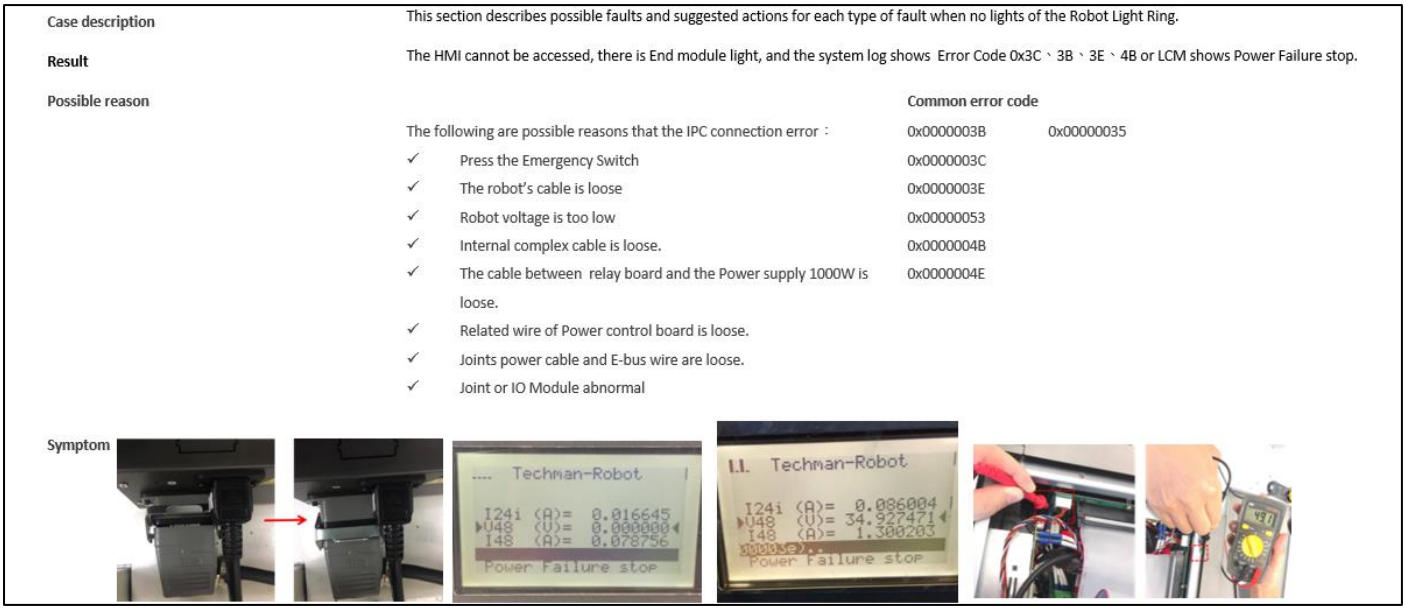

Yes
No
Control box can not be powered up
Step 1
Does the LCM turns on when pressing power button for 2 seconds?
Step 7
step 12(next page)
Step 2
Does the LCM turns off immediately when the power button is released?
Step 8
Send video of LCM and pictures of control box and surrounding environment to TM for further analysis.
Step 3
Remove the IPC to check whether the control box can be powered up?
Step 9
Disconnect the cable between relay board and 48V PSU to check whether the control box can be powered up?
Step 4
Measure whether there is enough voltage from the 24V output connector on the power board?
Step 10
Replace 48V PSU
Step 11
Replace Power board
Step 5
Replace IPC
Step 6
Replace IPC and Power board

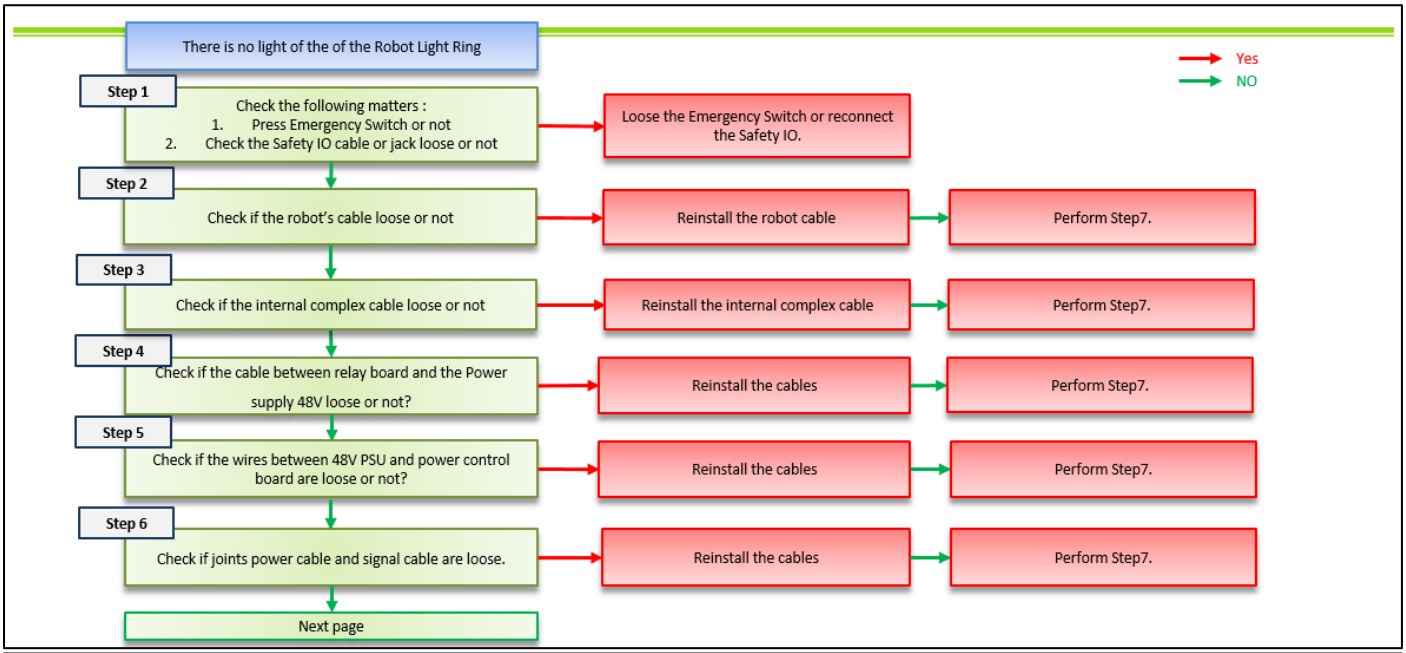

Yes
No
From Step 7
Step 12
Use another stick or remote on/off to confirm whether the control box can be powered up?
Step 17
Replace stick
Step 13
Measure the power cable to confirm if there is enough AC voltage?
Step 18
Replace power core/power cable
Step 19
Check power source
Step 14
Measure relay board AC input connector to confirm if there is enough voltage?
Step 20
Measure the cable between power socket and relay board to confirm if there is enough voltage?
Step 21
Replace power socket
Step 15
Measure relay board AC output connector connected to 24V PSU to confirm if there is enough voltage?
Step 22
Replace Relay board
Step 16
Measure 24V PSU output to confirm whether if there is enough DC voltage?
Step 23
Replace power board
Replace 24V PSU
Step 24

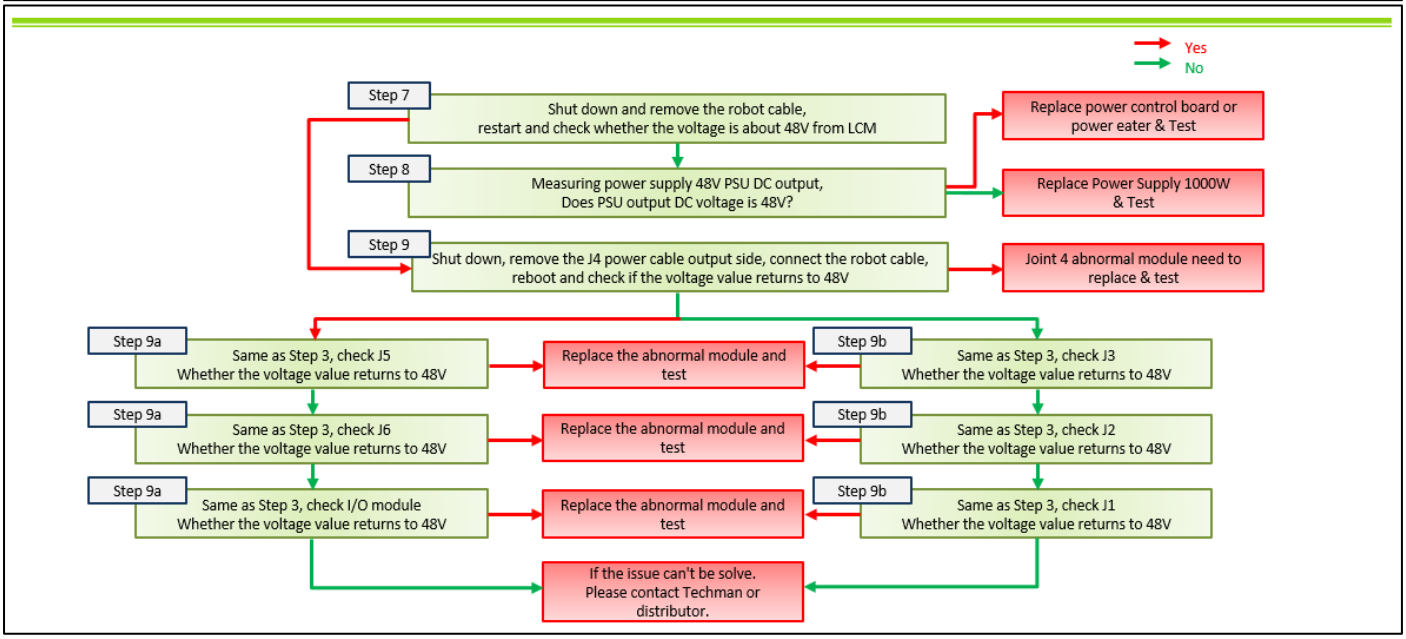
◆ **Example: Wiring diagram of HW3.2**



11.3 **No lights of the Robot Light Ring**







11.4 **Abnormal EtherCAT signal**

Case description

This chapter illustrates how to deal with the problem related to abnormal EtherCAT signal.

Result

Robot stopped due to related error code.

Possible reason

- ✓ Abnormal power control board
- ✓ Abnormal Joint
- ✓ Abnormal IO Module
- ✓ Abnormal signal cables or power cables

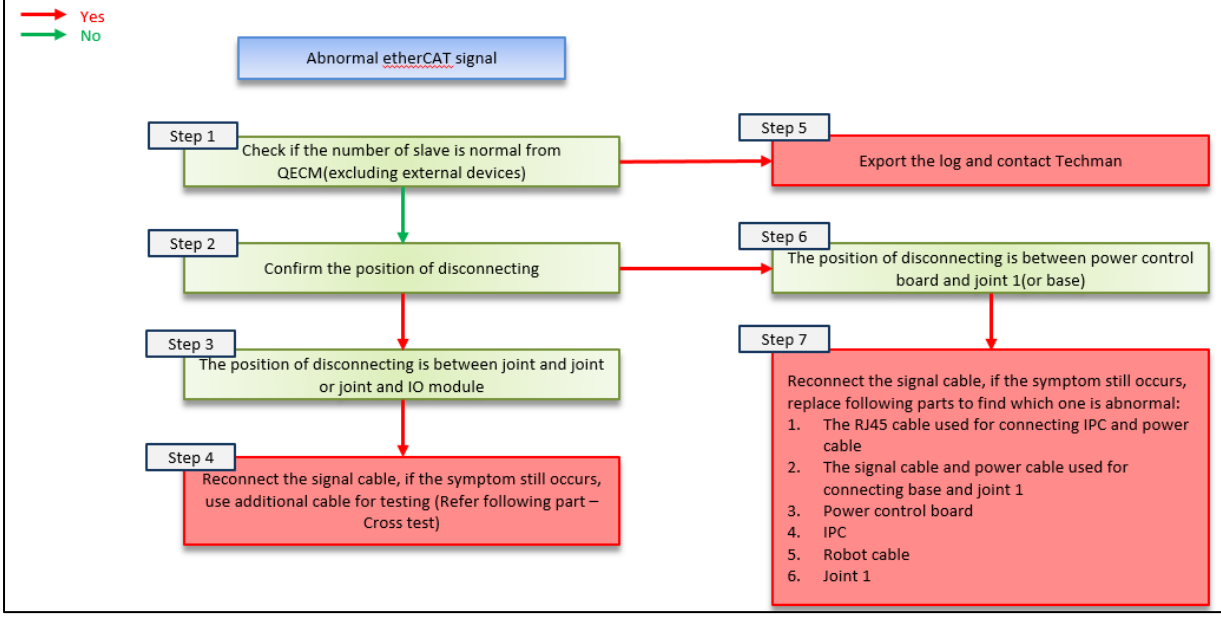
常見故障碼

0x0000003B
0x0000003C
0x0000004B
0x00000050
0x00000057

Symptom

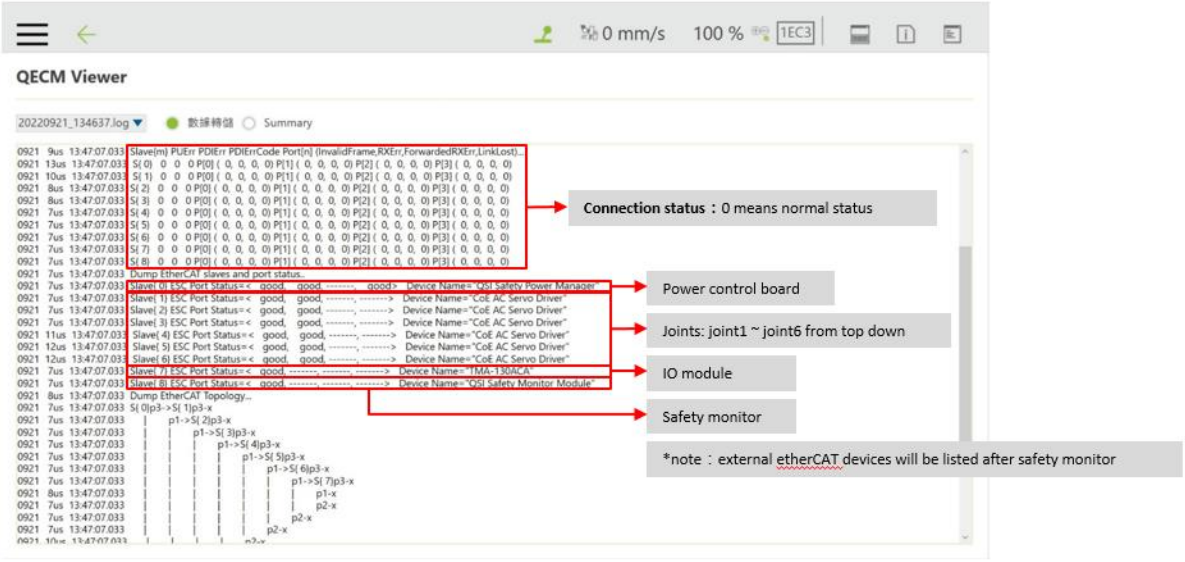
Slave

Component	HW1.0	HW2.0	HW3.0 & 3.1 & 3.2
Power Control Board	Slave 0	Slave 0	Slave 0
Base	Slave 1	Slave 1	-
Joint 1	Slave 2	Slave 2	Slave 1
Joint 2	Slave 3	Slave 3	Slave 2
Joint 3	Slave 4	Slave 4	Slave 3
Joint 4	Slave 5	Slave 5	Slave 4
Joint 5	Slave 6	Slave 6	Slave 5
Joint 6	Slave 7	Slave 7	Slave 6
End Module	Slave 8	Slave 8	Slave 7
Safety Monitor	-	Slave 9	Slave 8
Total Slave	9	10	9



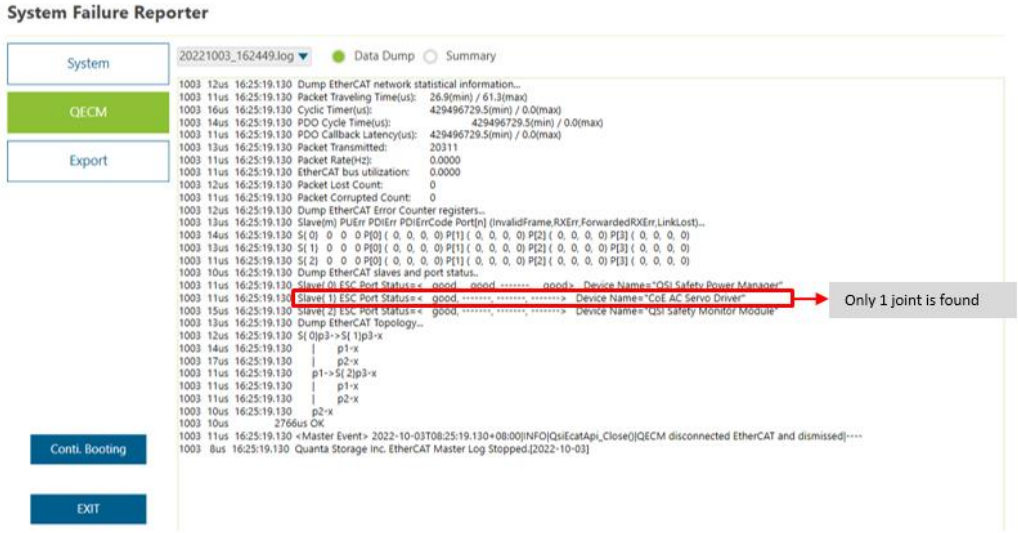
Cross test -1

When EtherCAT related problems occurred during the process of using or booting up, user may check the EtherCAT connection status from QECM view, following is an example of HW3.2:



Cross test -2

Example: The following is an example of EtherCAT abnormality when booting up. Comparing to normal status, the system only detect one joint, which means the connection between J1 and J2 is probably abnormal and the possible defective parts include J1, J2 and the cables between them.



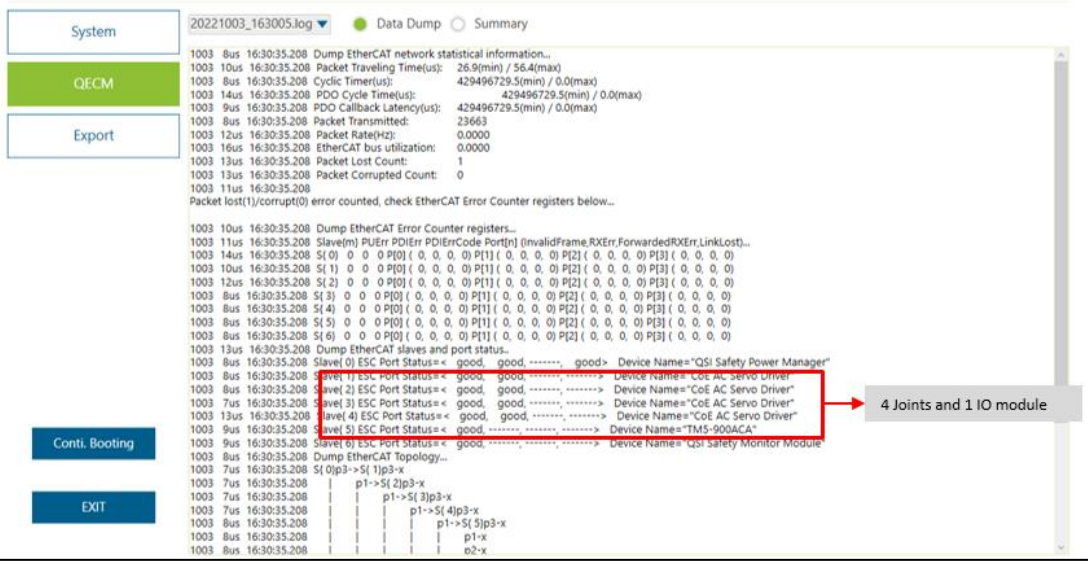
Cross test -3

Example：Connecting J1 and J4 with an additional signal cable, and the result is expected to have 6 slaves including power control board, J1, J4, J5, J6, IO module and safety monitor. Before performing test, check whether the LED of IO module will flash or not. Once the light did not flash, the power cable need to be test because there is no power to IO module.

Use additional signal cable or cable dissembled from other joints

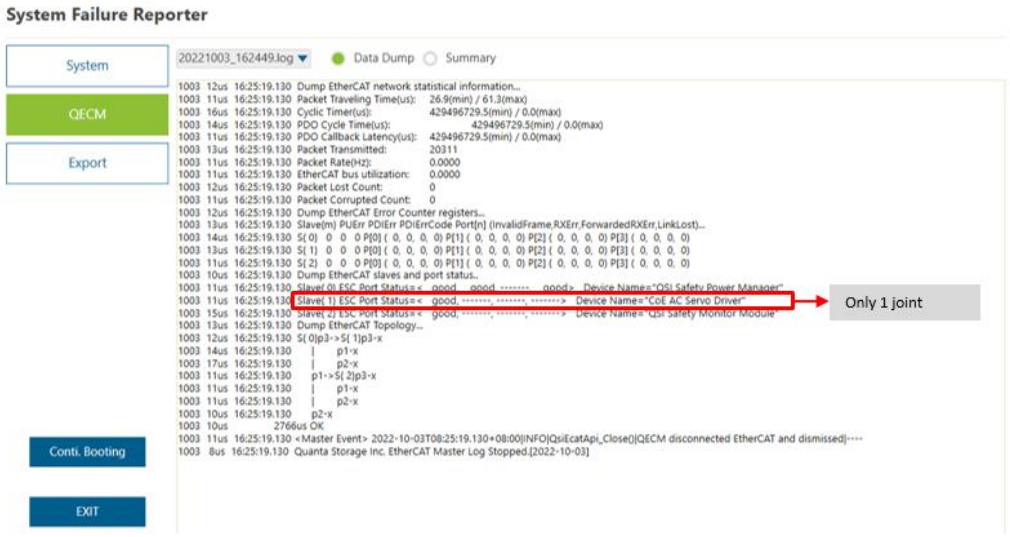
Cross test -4

Example: After connecting J1 and J4, reboot the control box and check the slaves. From following example, there are 4 joint(including J1, J4, J5 and J6) and 1 IO module, the result indicates the J2 is abnormal.



Cross test -5

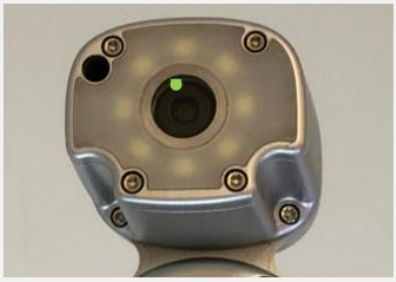
Example: In case there is no other joint after connecting J1 and J4, the result means the possible defective parts are J1 or signal cable. User may use another signal cable or connect J2 with the base to find out the defective part.



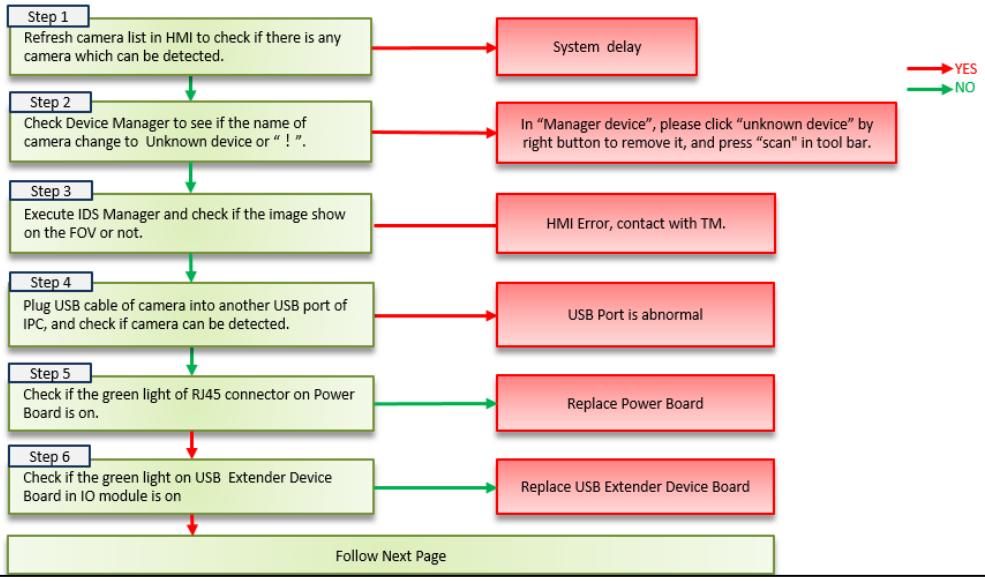
11.5 Camera connection error

Case description	This section describes possible faults and recommended actions for each type of fault when the camera is disconnected.
Result	The EIH camera item disappears when the system displays a camera connection abnormality or vision settings in the camera list during standby and operation of the vision task.
Possible reason	**Common error code** The following are possible symptoms of camera connection abnormalities： 0x00020000 0x00020007 ✓ System delay ✓ Camera Error ✓ USB Port abnormal in IPC ✓ J1-J3 Cable abnormal ✓ J3-J4 Cable abnormal ✓ J4~IO module Cable abnormal ✓ Robot Cable abnormal ✓ IPC internal USB connection abnormal
Symptom	

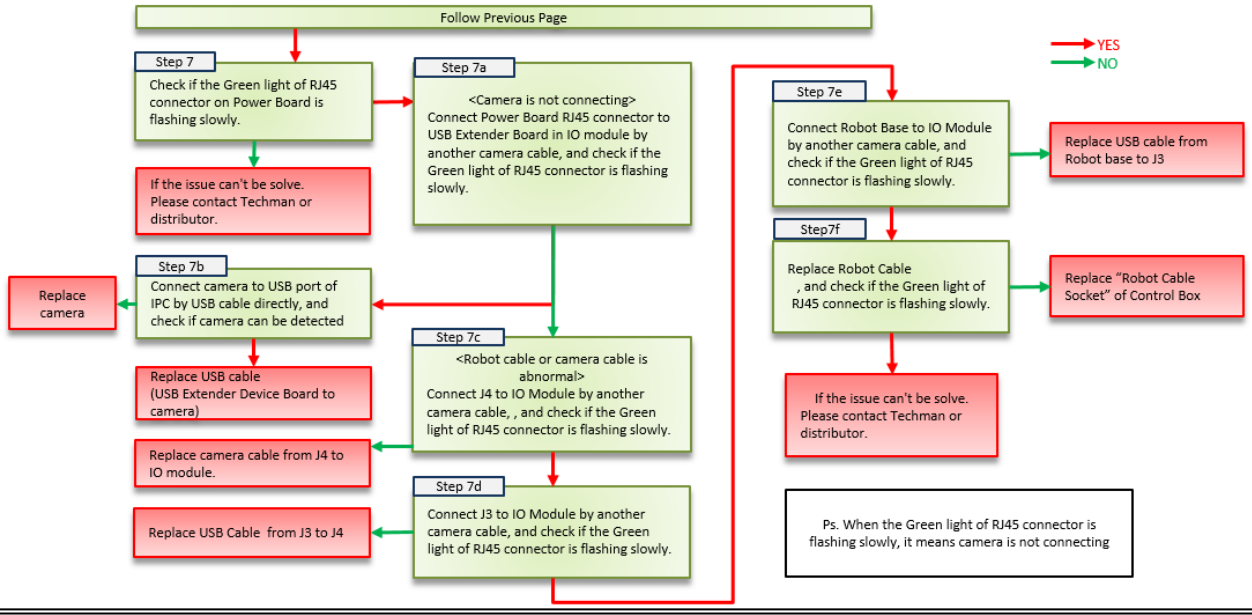
IDS Camera VS TRI Camera(Appearance)

TRI Camera	IDS
Silver	Black
	

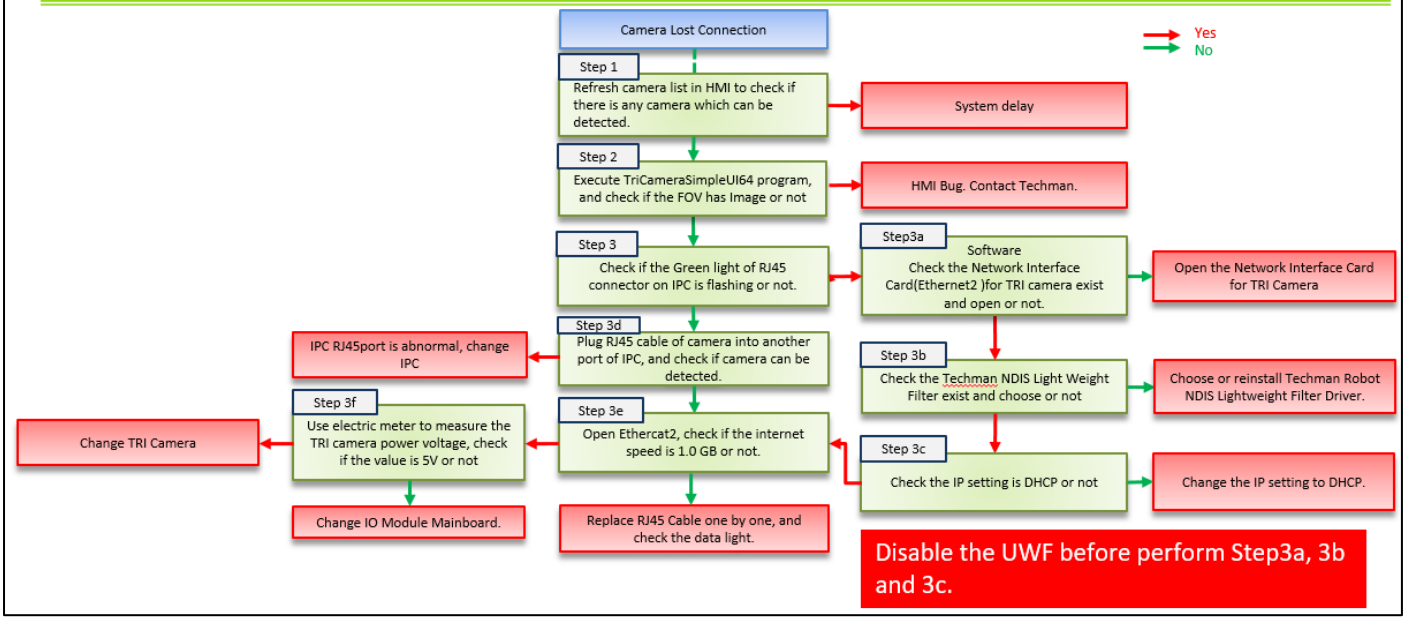
IDS Camera



IDS Camera



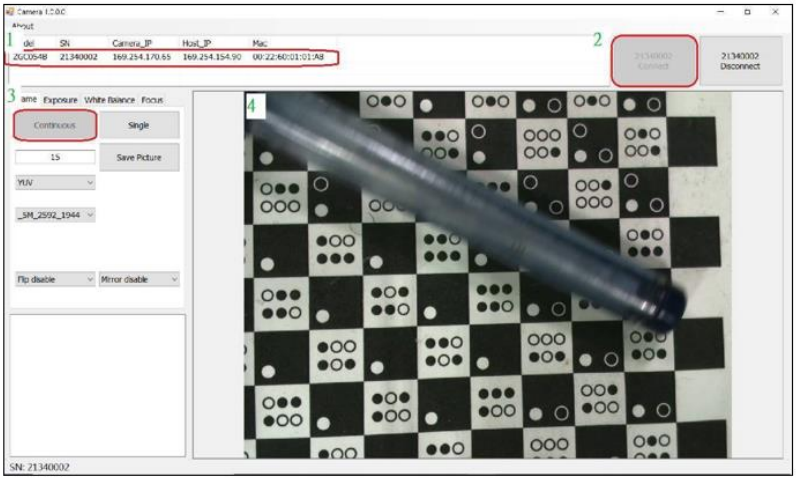
TRI Camera



TRI Camera Checking point-Step2

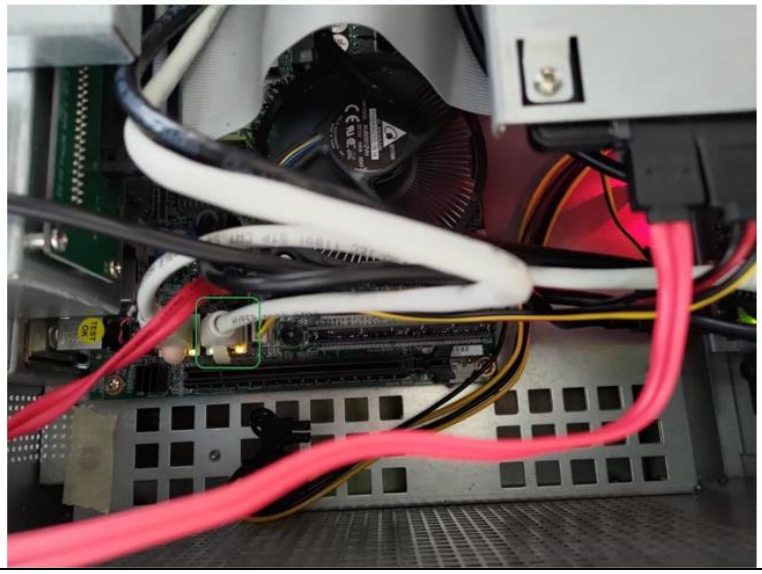
Please install TriCameraSimpleUI64。
Please inform with Techman to get executable file.
*The TriCameraSimpleUI64 executable file is on the Control Box above HMI Vesion2.0.
Execute the following path file
D:\TRI_Camera\TriCameraSimpleUI64.exe

Step
1. Showing the camera
2. Connect (click)
3. Continuous(click)
4. The FOV image



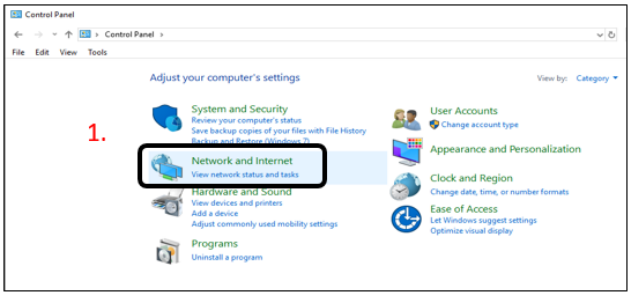
TRI Camera Checking point-Step3

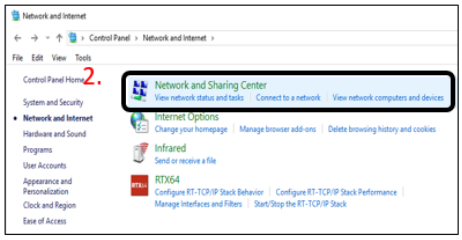
Check if the RJ45 Cable port from IPC is lightening or not, like following green box side of IPC。

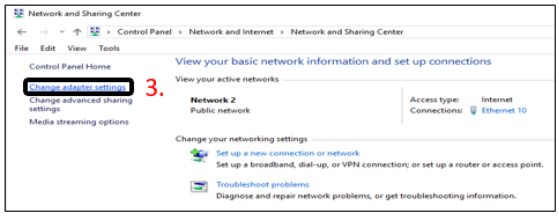


TRI Camera Checking point-Step3a

- 1. Control Panel → Network and Internet
- 2. Choose Network and Sharing Center
- 3. Choose Change adapter settings

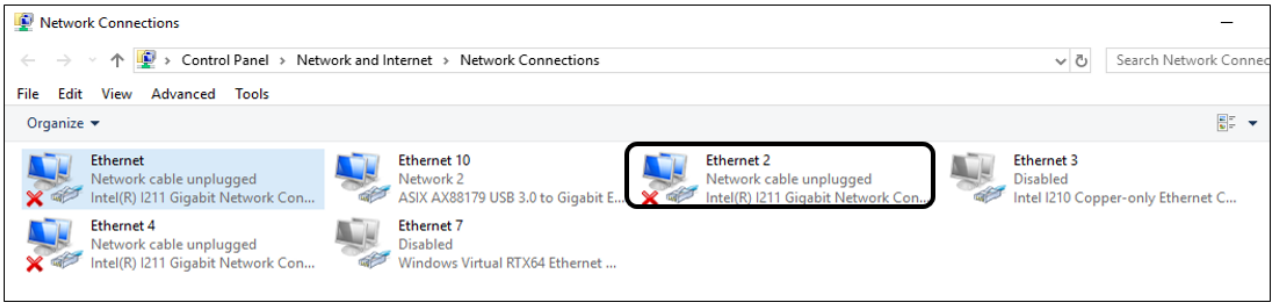






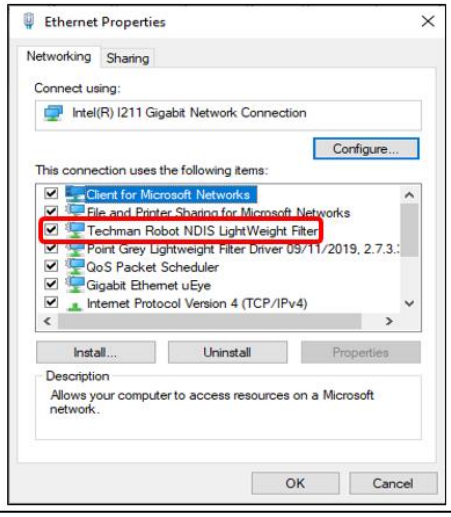
TRI Camera Checking point-Step3a

Check if the Network Interface Card(Ethernet2) for TRI camera activates or not



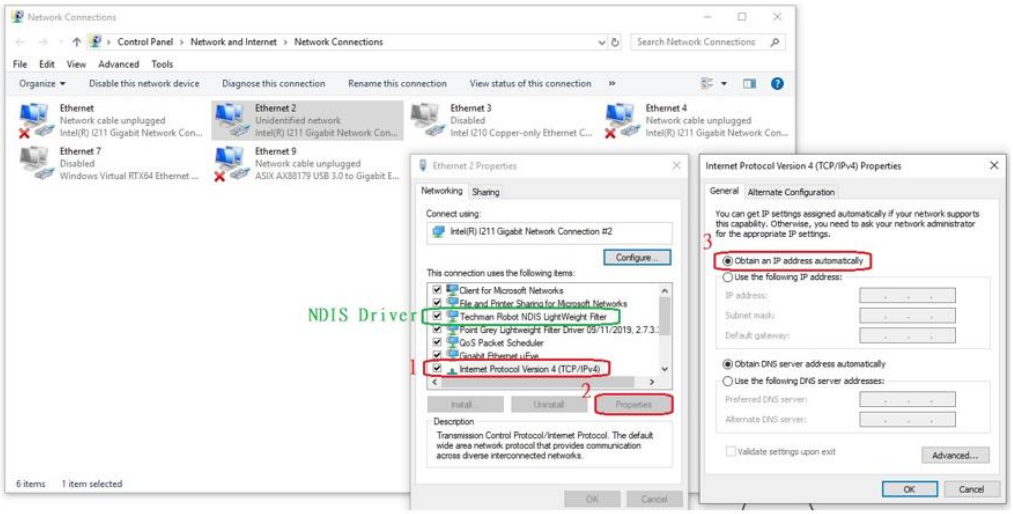
TRI Camera Checking point-Step3b

Following the step3a, Right click the Ethernet2 and choose properties, check if the Techman NDIS Light Weight Filter exists and being activated. Following picture indicates a correct setting.



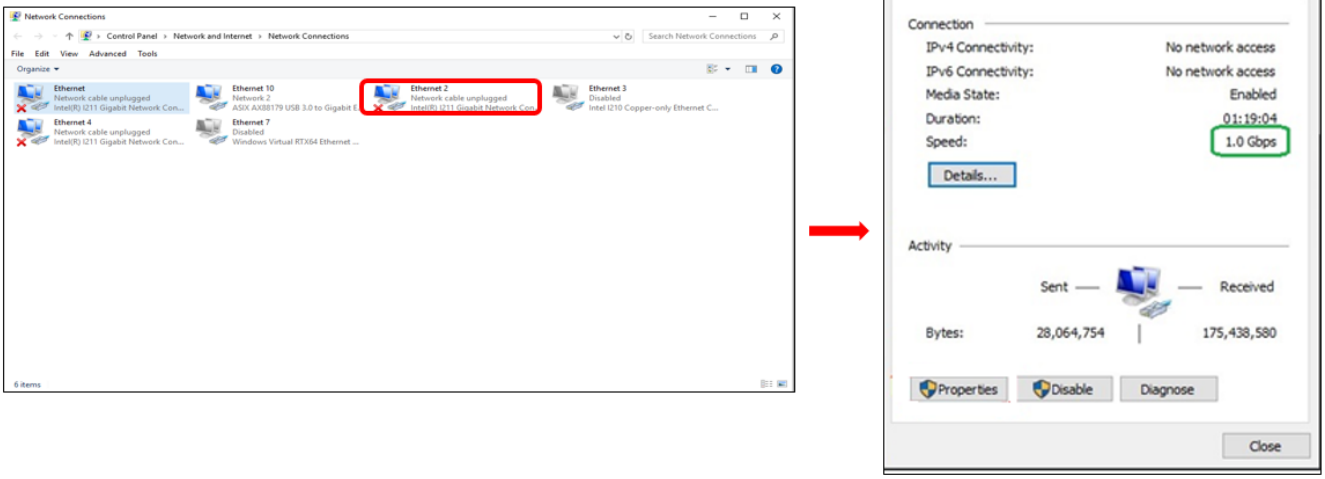
TRI Camera Checking point-Step3c

Following the step3b，choose Internet Protocol version4 and then choose properties.
Check if the IP setting is DHCP, as the step 1、2、3 of the below picture.



TRI Camera Checking point-Step3e

Click if the network speed is 1.0 Gbps.

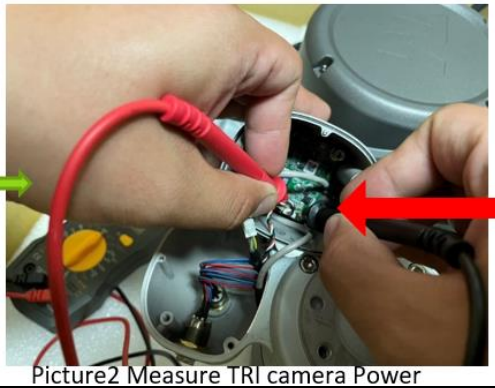


TRI Camera Checking point-Step3f

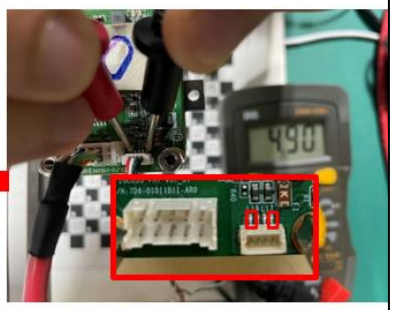
TRI Camera power checking point

- Remove the Camera module screw like following picuture1 ◦
- Use electric meter to measure the TRI camera power voltage, check if the value is 5V or not as below pciture2

Picture1 Remove camera module screw



Picture2 Measure TRI camera Power



Picture3 Measuring pin point

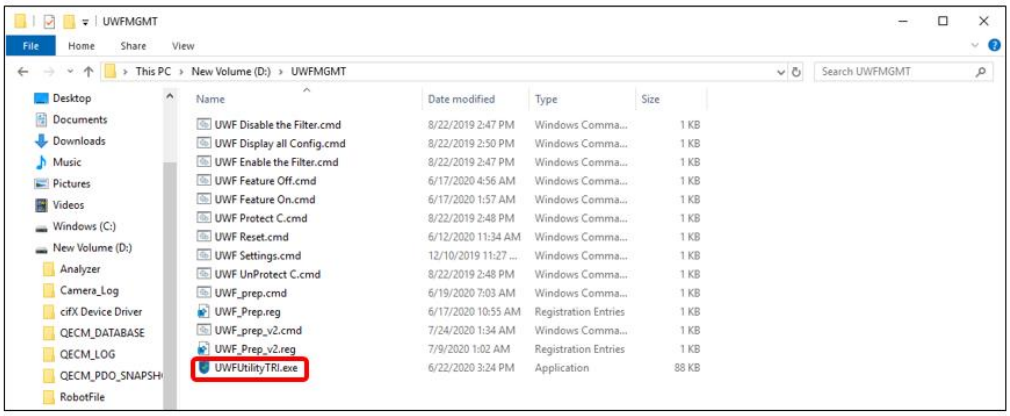
TRI Camera Checking point: the LED Light information

TRI Camera Ethernet LED information :

- The orange light on the left side indicates a *link*, meaning that the RJ45 connection on both ends is established.
- The yellow light on the right side indicates *data activity*. This light will be on when data is being transmitted, and it will blink faster when capturing an image.
- To check if the TRI camera Ethernet connection is active, refer primarily to the yellow data light.

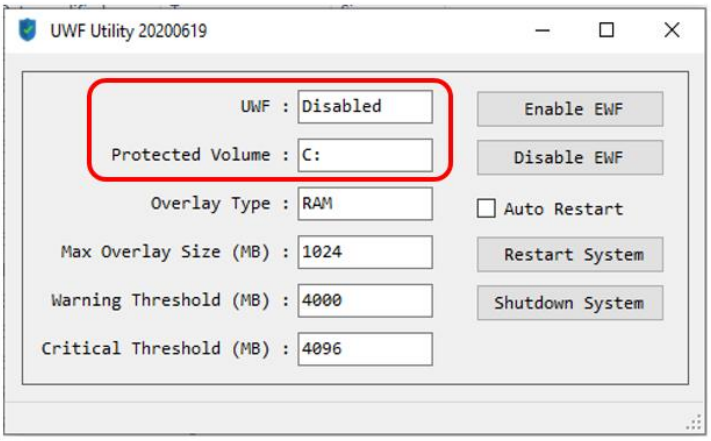
PS:UWF disable

- D:\UWFMGMT→UWFUtility.exe(double click)



PS:UWF Disable

- Check C drive if Enabled or Disabled
- After changing setting. please open the EWF again.



11.6 **The camera can’t focus**

Case description

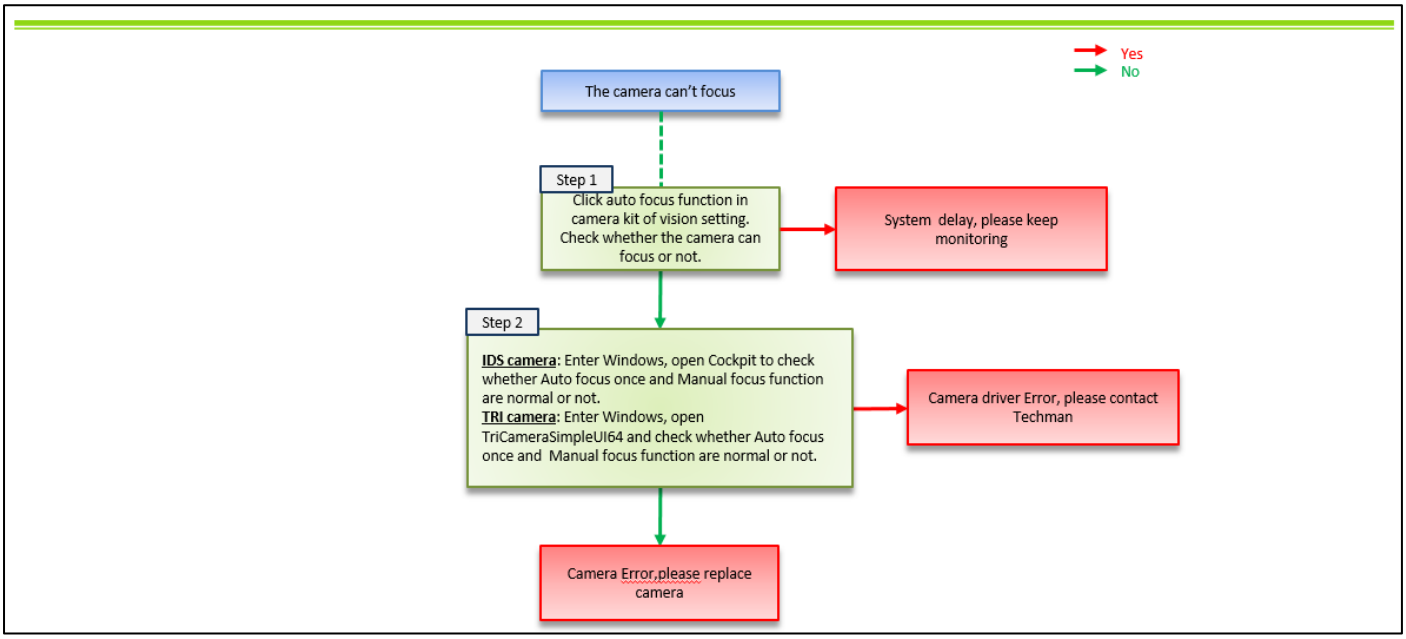
This section describes possible faults and recommended actions for each type of fault when the camera can’t focus.

Result

The camera can’t focus when doing vision job

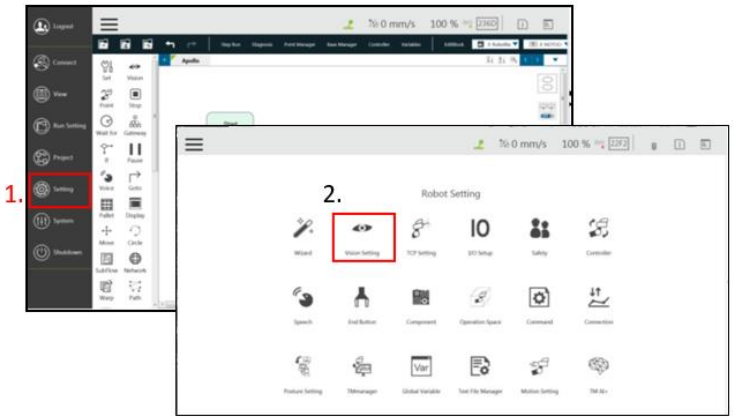
Possible reason	**Common error code**
1. The camera driver can’ match with the HMI.	NA
2. Camera Error	

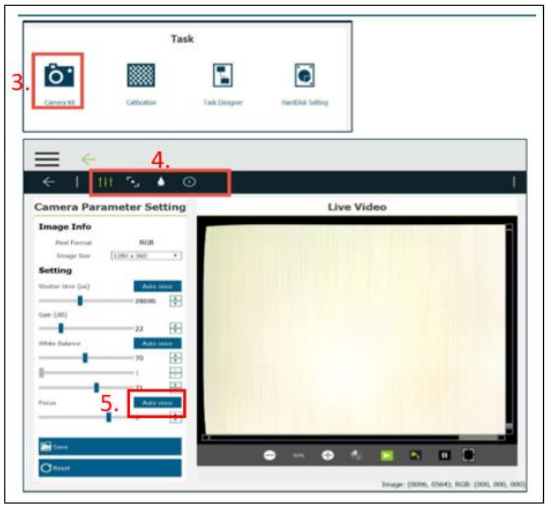
Symptom



IDS Camera Checking Point Step1

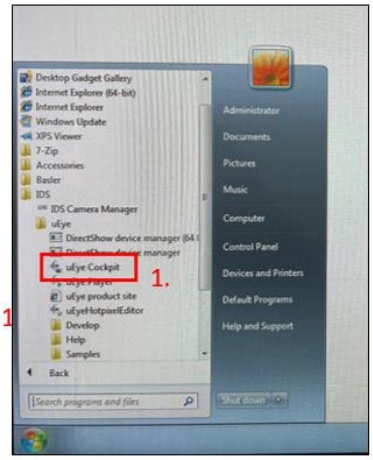
Follow below steps to enter Vision Camera Kit.
Click Auto once in Focus part and check whether the camera can auto focus or not.

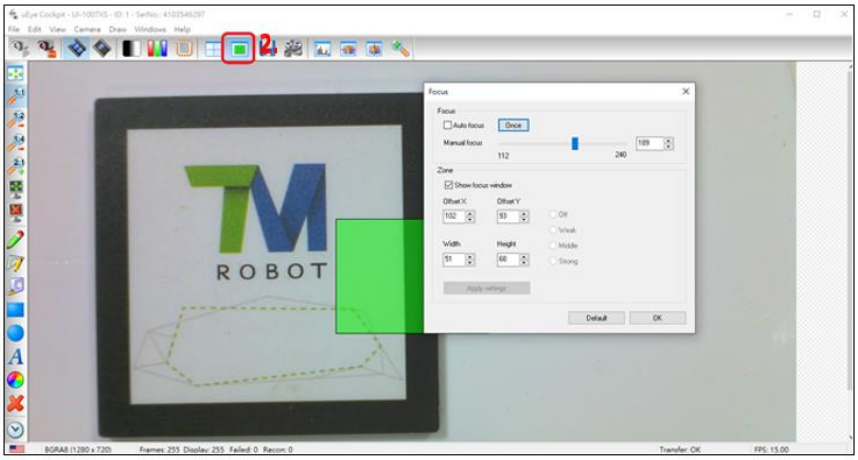




IDS Camera Checking Point Step2

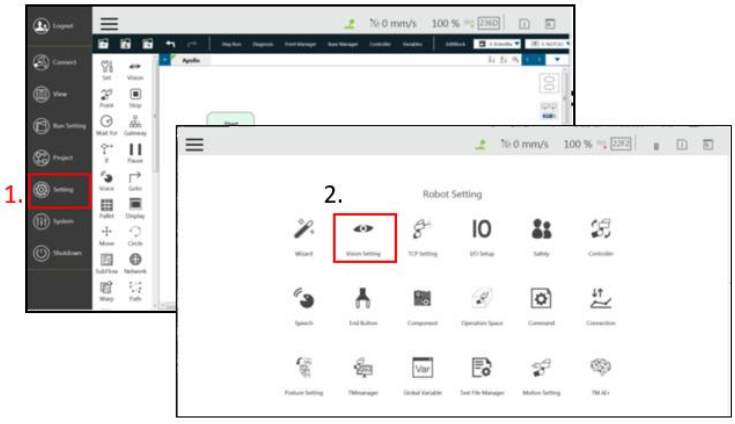
- Open Ueye Cockpit and connect camera.
- Click Focus and change focus value.
- Check whether Auto focus once and Manual focus can use or not. Like the step of the below picture 。

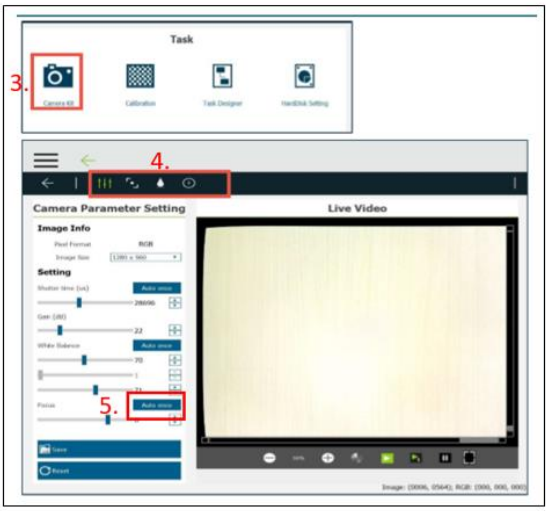




IDS Camera Checking Point Step1

Follow below steps to enter Vision Camera Kit.
Click Auto once in Focus part and check whether the camera can auto focus or not.

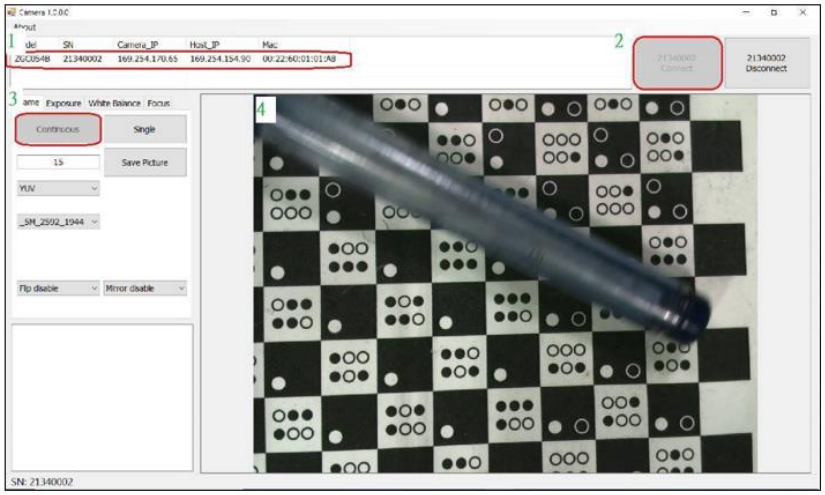




TRI Camera Checking Point Step2

Please install TriCameraSimpleUI64。
Please inform with Techman to get executable file.
*The TriCameraSimpleUI64 executable file is on the Control Box above HMI Vesion2.0.
Execute the following path file
D:\TRI_Camera\TriCameraSimpleUI64.exe

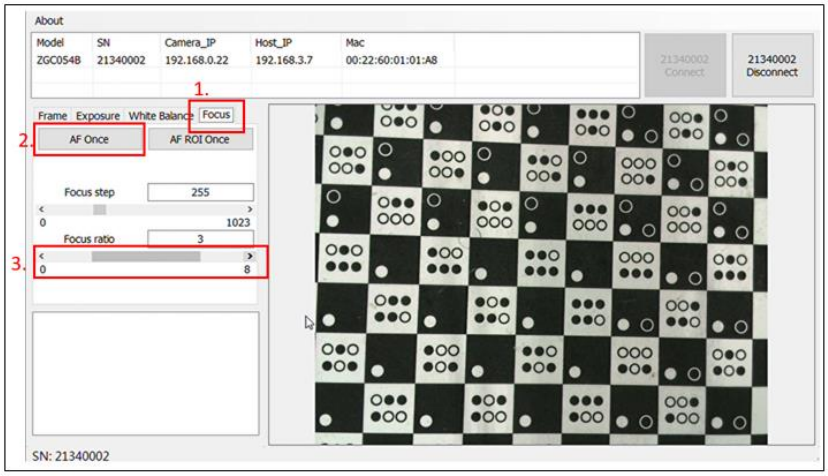
Step
1. Showing the camera
2. Connect (click)
3. Continuous(click)
4. The FOV image



TRI Camera Checking Point Step2

Enter windows, open TriCameraSimpleUI64 to check whether the Auto focus once and Manual focus function are normal or not.

1. Click Focus
2. Click AF Once，check the image is clear or not
3. Click left or right arrow to change focal length and check the image clarity change or not.



11.7 **Controller Digital IO error**

Case description

This section describes possible faults and suggested actions for each fault when Controller Digital IO error.

Result

There is delay or no respond on the signal output in the IPC.

Possible reason

The following are possible symptoms of IPC that cannot be start up: :

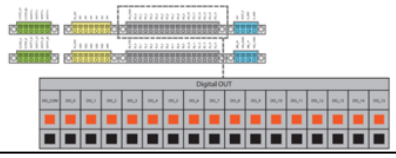
- ✓ DO's external device, whose current value is higher than 100mA, causing the IO circuit to burn out
- ✓ The leakage current between the circuits of the IPC IO connected to the external device

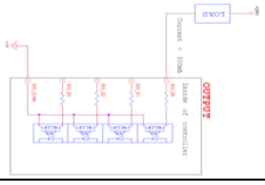
Common error code

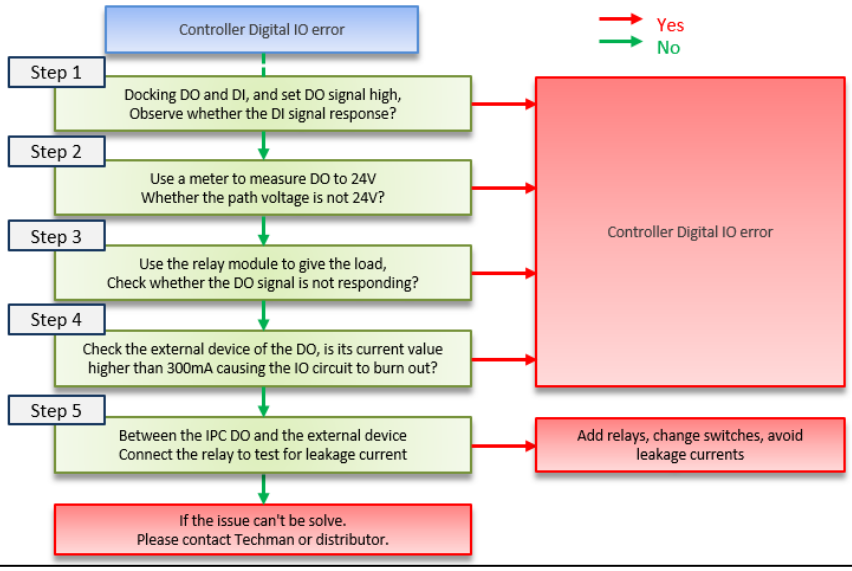
NA

Symptom

The maximum drive current per channel is **300mA for TM5A/TMAA** and **100mA for TM5**. If the load exceeds maximum drive current, a relay should be used to drive it.







11.8 **Joints error**

Case description

This section describes possible faults and suggested actions for each fault when the joint is abnormal.

Result

1. System report Error code 0x00FFCF , cannot control robot.
2. Joints internal mechanism are abnormal, causing the Axis fail to rotate.
3. Have abnormal sound during operating.

Possible reason

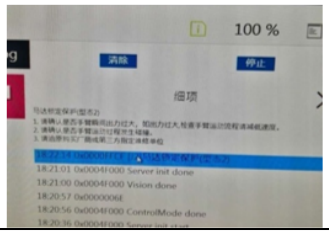
The following are possible symptoms that the IPC cannot be start up. :

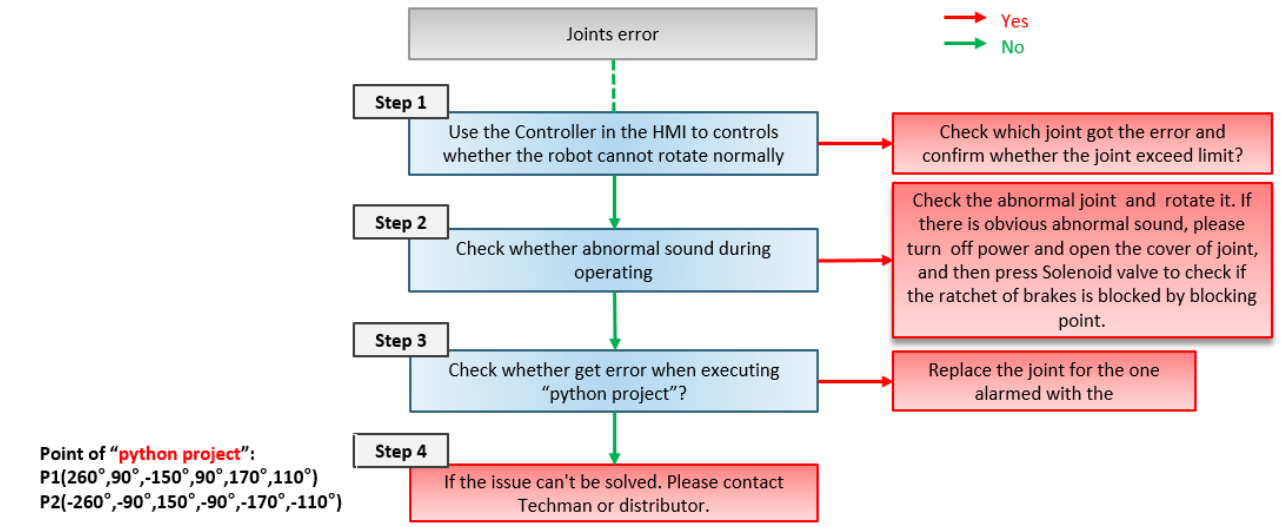
- ✓ Joint exceed limit
- ✓ Joint internal mechanism are abnormal

Common error code

0x00000035	0x0000FF09	0x0000FF13
0x0000003C	0x0000FF0A	0x0000FF14
0x0000004B	0x0000FF0B	0x0000FF15
0x0000FF01	0x0000FF0C	0x0000FF16
0x0000FF02	0x0000FF0D	0x0000FF17
0x0000FF04	0x0000FF0E	0x0000FFAB
0x0000FF05	0x0000FF0F	0x0000FFCF
0x0000FF06	0x0000FF10	
0x0000FF07	0x0000FF11	
0x0000FF08	0x0000FF12	

Symptom





11.9 **Encoder error**

Case description

This section describes possible fault and suggestion for encoder error issue.

Result

1. The compensation of encoder signal is too high in ABS mode.
2. The compensation of encoder signal is too high
3. Multi Z index happened in encoder output

Possible reason

The following are possible reasons of the encoder errors:

- ✓ The dust or contamination on the disk of encoder.
- ✓ No reboot the robot after executing the friction learning or safety calibration. The encoder is still in strict status.

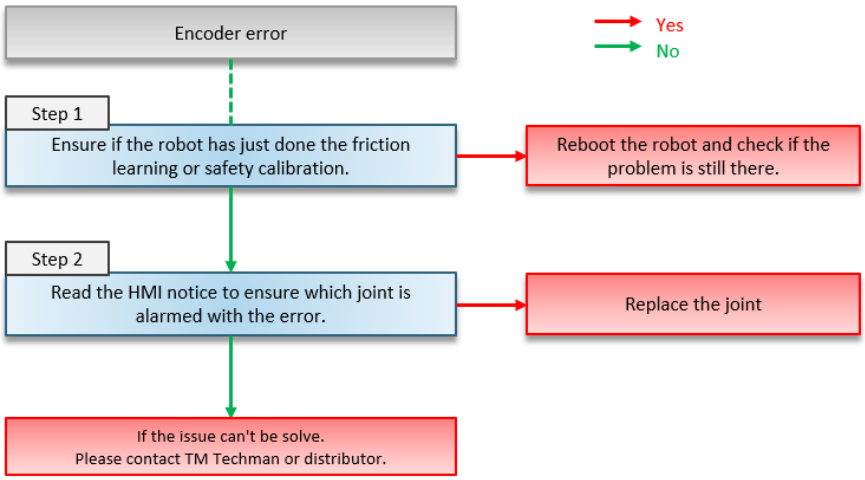
Common error code

0x0000FFED 0x0005FFCA 0x0000FFCE 0x0000FFE4 0x0000FFCA 0x0005FFCE

Symptom

[07:13:24:446][0x00020007]["Designer error: Camera is disconnected. Please check if the connection of camera is broken or the USB slots are overloaded."]
[07:13:24:977][0x00042007]["Vision9 vision report error."]
[07:15:06:601][0x00020007]["Designer error: Camera is disconnected. Please check if the connection of camera is broken or the USB slots are overloaded."]
[07:15:07:132][0x00042007]["Vision9 vision report error."]

[07:16:56:331][0x0000FFED]["[J2]The compensation of encoder signal is too high in ABS mode"]
[07:20:03:396][0x0000FFCE]["[J2]인코더 보상 신호가 너무 높음"]
[08:06:54:592][0x0000FFED]["[J2]The compensation of encoder signal is too high in ABS mode"]



11.10 **Point offset**

Case description

This section describes possible faults and suggested actions for each fault when the point offset.

Result

Project's points offset due to the collision

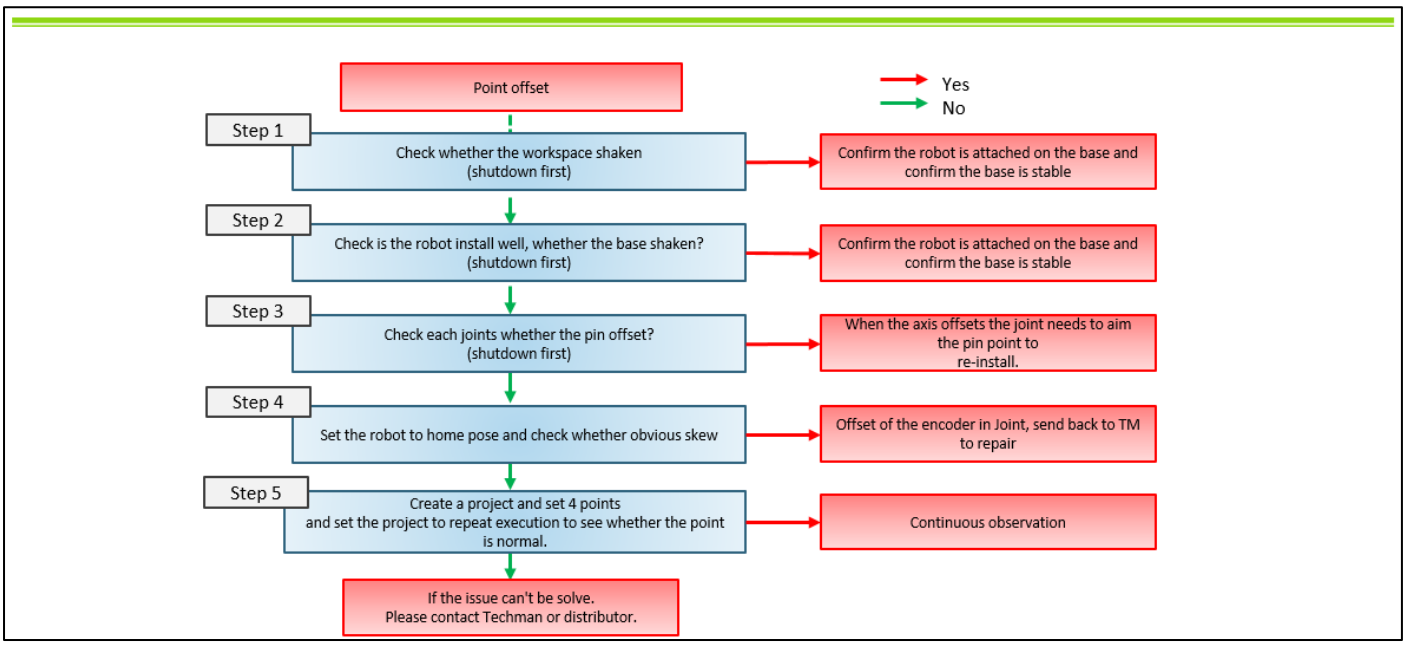
Possible reason

The following are possible symptoms of IPC that cannot be start up:

- ✓ Set the robot to home pose and check for obvious skew
- ✓ Pin offset at the joint
- ✓ The robot is not install well to the base or the base is shaken
- ✓ Workspace offset due to the collision

Common error code

NA



11.11 **Stick error**

Case description

This section describes possible faults and recommended actions for each fault when the Stick is abnormal.

Result

1. When the project is executed, it will be changed by paused or automatically with random.
2. When the project is executed, it will automatically enter the Emergency mode.
3. Buttons have no response
4. Robot can not start up

Possible reason

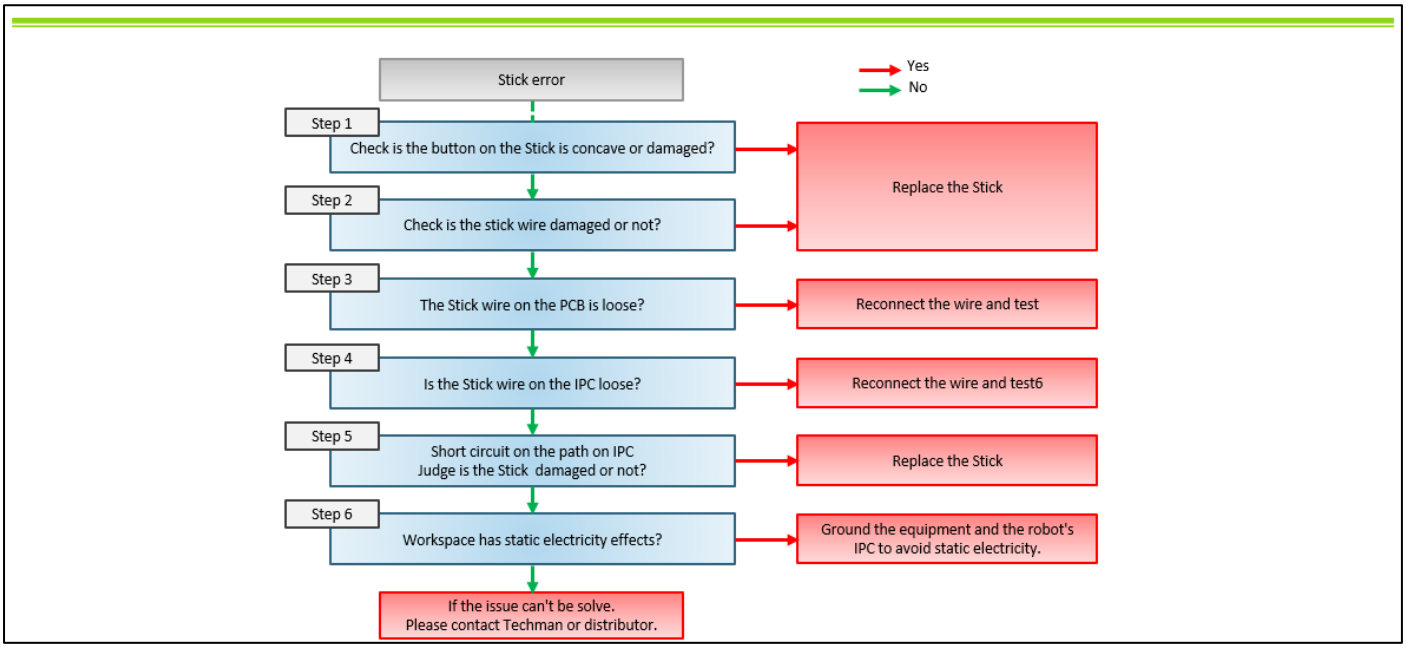
The following are possible symptoms of the Stick exception:

- ✓ The button on the Stick is concave or damaged
- ✓ Stick wire Damaged
- ✓ The Stick wire on the PCB is loose
- ✓ Is the Stick wire on the IPC loose
- ✓ Workspace has static electricity effects

Common error code

NA

Symptom



11.12 **External devices connection error**

Case description

This section describes possible faults and recommended actions for each fault when the external device is connected abnormally.

Result

The Robot disconnected to the external camera, PC, communication connection device , the port position light is not bright or only the monochrome light (orange or green). note: Need to use the port beside USB port of robot.

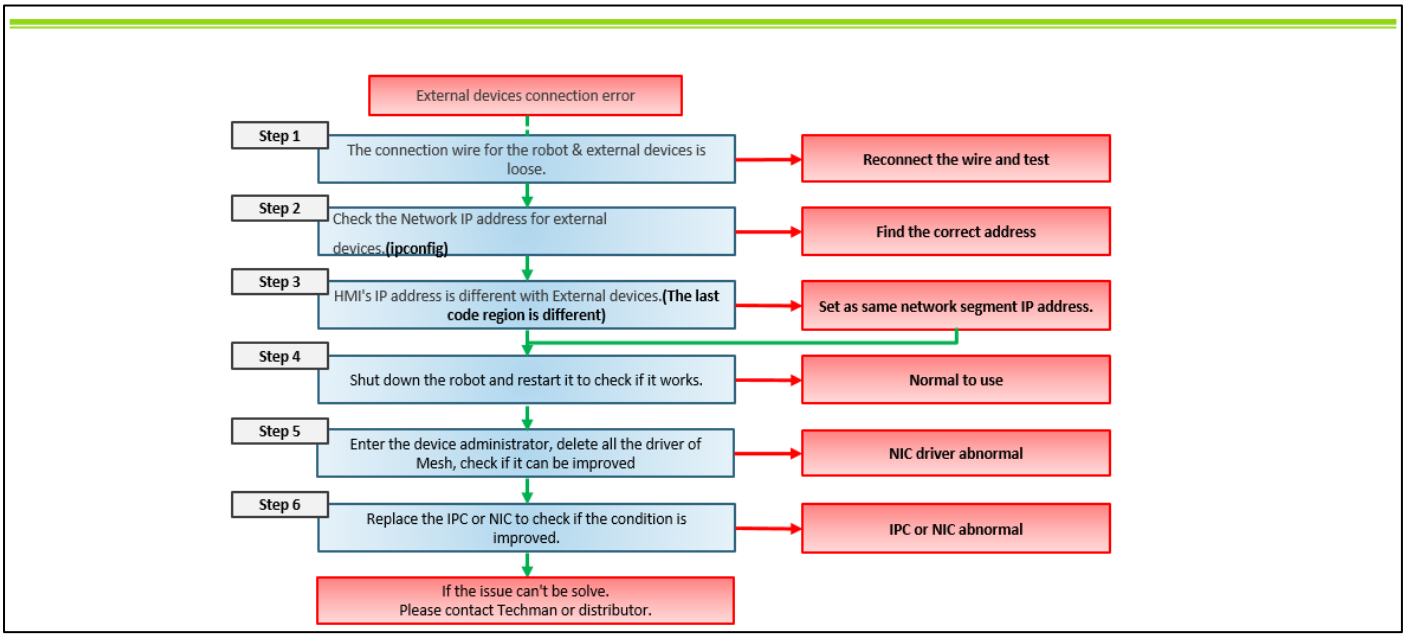
Possible reason

The following are possible symptoms about electric control box which cannot be connect to another equipment:

- ✓ The connection wire for the robot & external devices is loose.
- ✓ Incorrect Network IP address for external devices.
- ✓ HMI's IP address is different with External devices.
- ✓ NIC driver abnormal
- ✓ IPC or NIC abnormal

Common error code

NA



11.13 **SSD Error**

Case description

This section describes possible faults and suggested actions for each fault when the SSD is abnormal.

Result

Unable to enter the HMI system, the screen displays a black screen or Media test Failure, check cable.

Possible reason

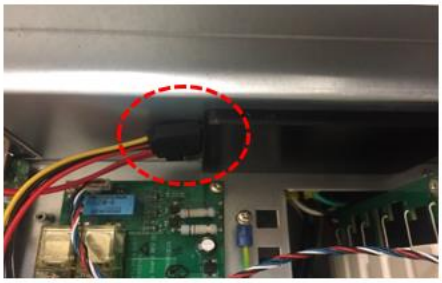
The following are possible symptoms of SSD that cannot be use:

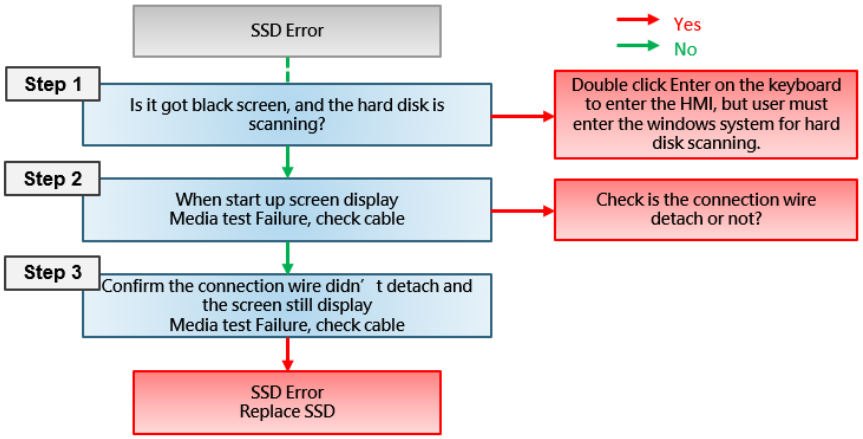
- ✓ The Connection wire of SSD is loose
- ✓ Hard disk scan settings
- ✓ SSD Damaged

Common error code

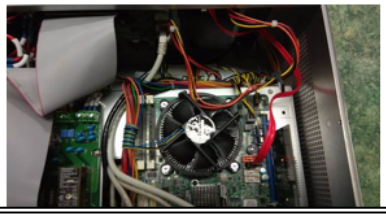
NA

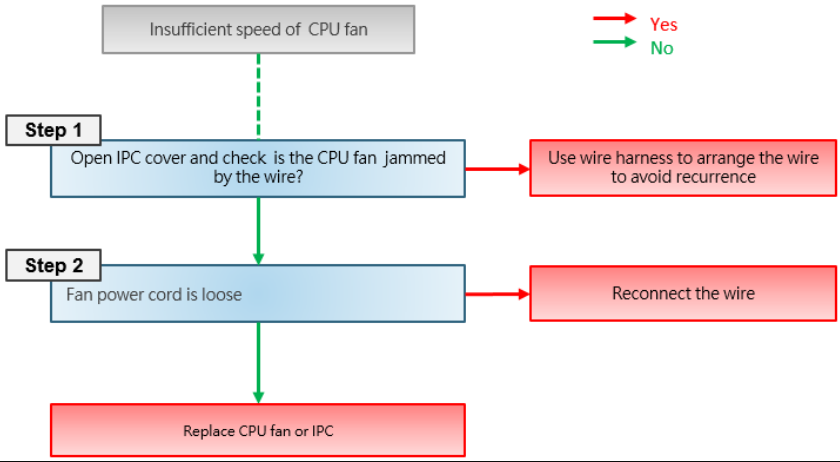
Symptom





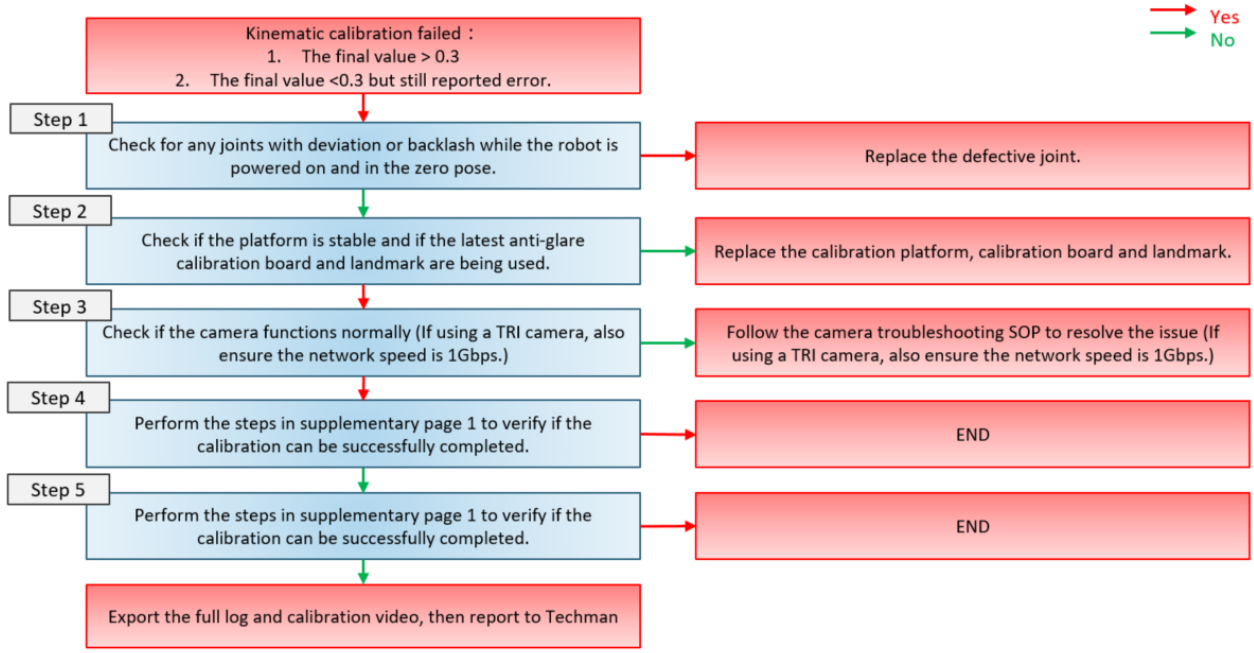
11.14 **Insufficient speed of CPU fan**

Case description	
	This section describes possible faults and recommended actions for each fault when the CPU fan speed is insufficient.
Result	
	When the HMI shows 0x00040015: The fan is below 1000 rpm, causing the robot unavailable to operate.
Possible reason	Common error code
The following are possible symptoms of CPU fan that Insufficient speed: ✓ CPU fan is jammed caused by the wire ✓ Fan power cord is loose ✓ CPU fan doesn't running very well ✓ PSU has not been powered to IPC ✓ Software bug	0x00040015
Symptom	



11.15 **Kinematic calibration failed**

Description	Kinematic calibration failed
Possible causes	1. Camera malfunction. 2. Landmark abnormality. 3. Joint malfunction or incorrect joint assembly.
Error code	NA



1. Navigate to the path: D:\Robotfile
2. Back up the following files and delete them: deltaDH0.bin, deltaDH0.txt, Driveroffset0.bin, Driveroffset0.txt
3. In the D:\Robotfile directory, create the following files: EEPROMUPDATE1.txt & EEPROMUPDATE0.txt
4. Create a new file named DeltaDH0.txt, and enter the required values:

*deltaDH0.txt - 記事本

檔案(F) 編輯(E) 格式(O) 檢視(V) 說明

0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

5. Create a new Driveroffset0.txt and input the following values:
   HW1 – HW3.2: -45.00000000,0.00000000,0.00000000,0.00000000,0.00000000,0.00000000
   HW5: 90.00000000,0.00000000,0.00000000,0.00000000,0.00000000,0.00000000,
6. Reboot the system and perform the calibration again.

1. Navigate to the path: D:\CalibrationData
2. Open deltaDH.txt and check if any values are greater than 1. If any values are greater than 1, reassemble the corresponding joint. (For example, in the case of following image, Joint 4 needs to be reassembled.)

deltaDH.txt

Joint 1	-0.003149186972800168	0.1392254194127215	-0.02514824434198333	0	0.004770973866235578
2	-0.5606850167150973	0.07594204264349236	-0.001980917280764245	-0.021819257730282753	0.030170313925675523
3	0.3988731198697471	0.0630060729213901	-0.03202971999803101	-0.021790900621221247	0.19557266457500003
4	1.2823517580393933	-0.03215698429689577	-0.018274183592860326	-0.02186865094659517	1.282096519688967
5	0.24182153522446984	-0.015102512717908564	0.04208346732263671	0.012609854936419475	0.24154341906525897
Joint 6	0.12278237527348104	0.20022730706237252	0.13348181496454042	0.014299245287531168	0.08578382846352955

1. If the calibration still fails after reassembling, and the value at that position is still greater than 1, replace the joint.

11.16 **Hand-eye calibration failed**

Description	Hand-eye calibration failed
Possible causes	1. Landmark abnormality. 2. Camera parameter abnormality
Error code	NA