





# Service Manual

Hardware version: 3.2  
Software version: 1.88  
Document version: 2.0  
Release date:2024-04-15

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 TECHMAN ROBOT INC.

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## Handling components that are sensitive to electrostatic discharge (ESD)



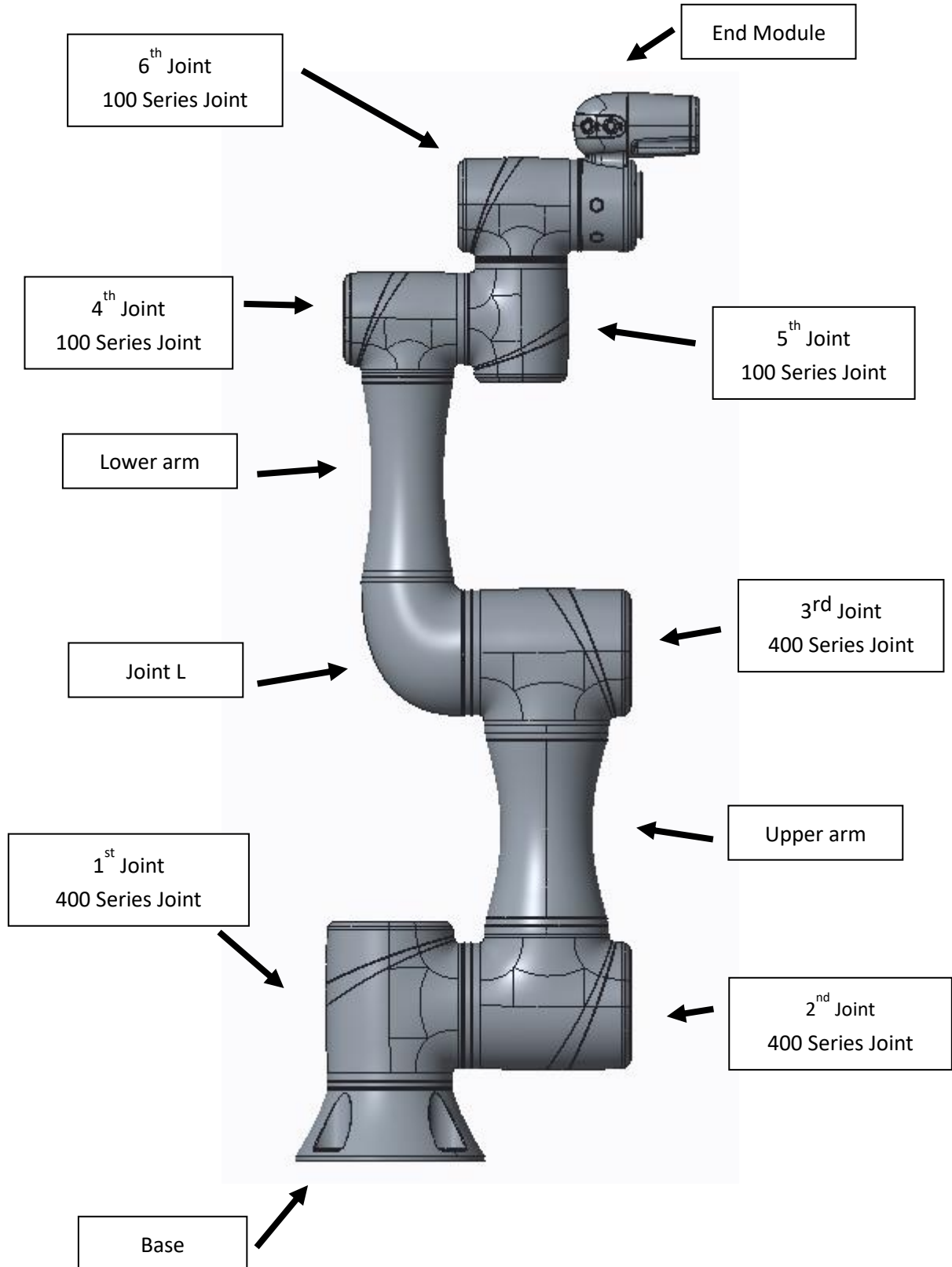
To prevent ESD-sensitive components (e.g., printed circuit boards) from being damaged, please handle the components in the following steps:

- 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.

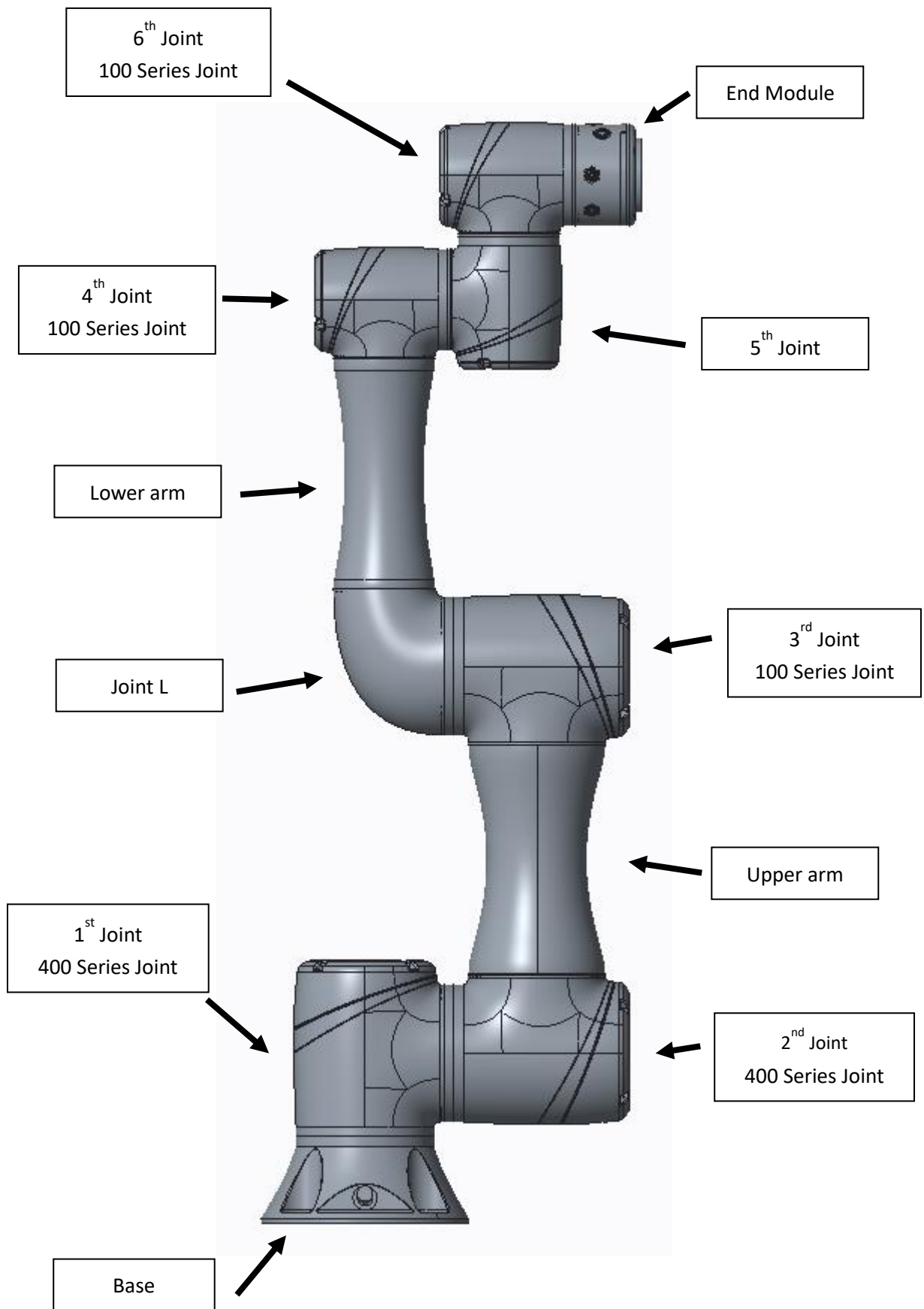


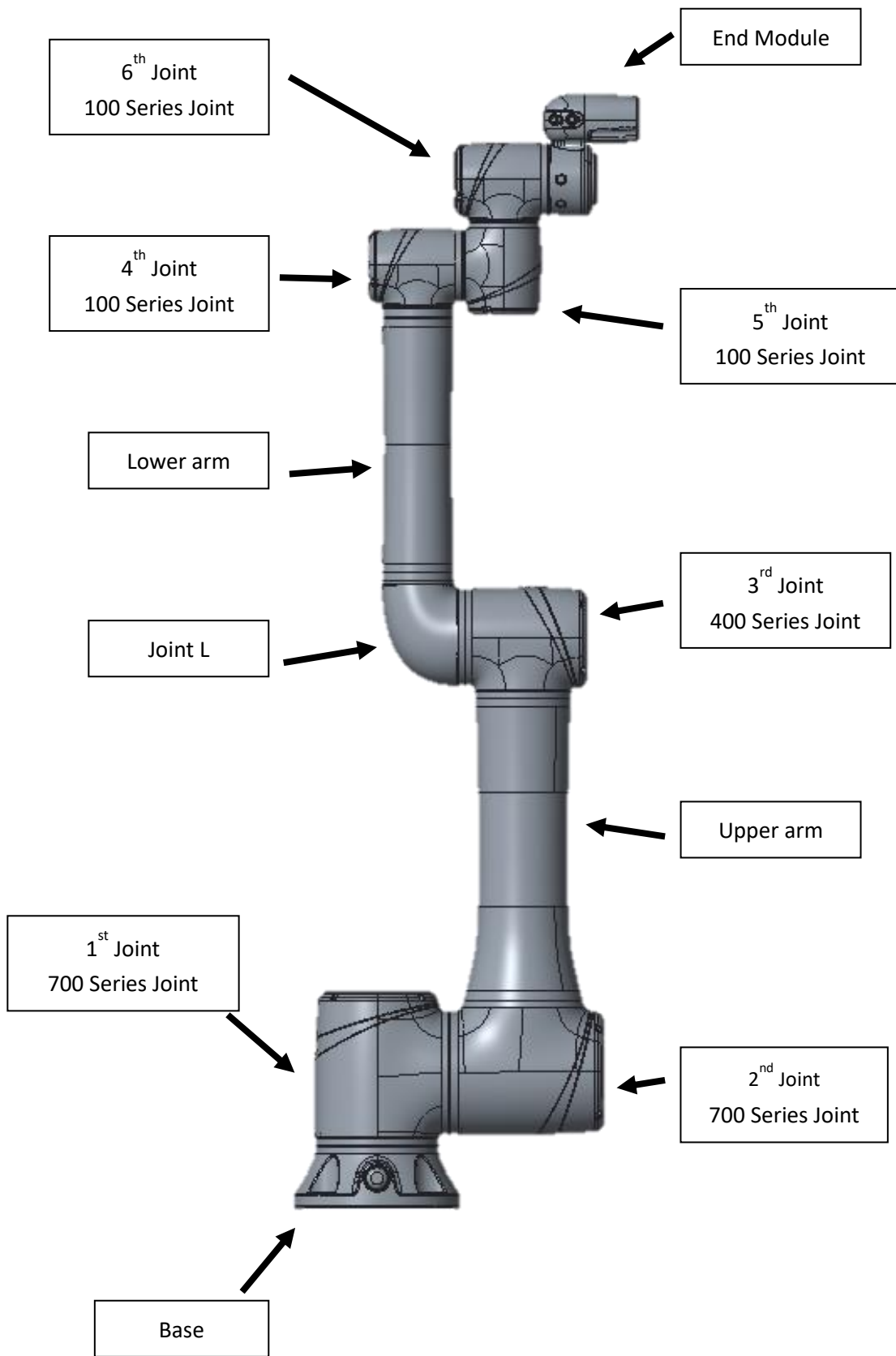
# 1. Components of different TM Robot models

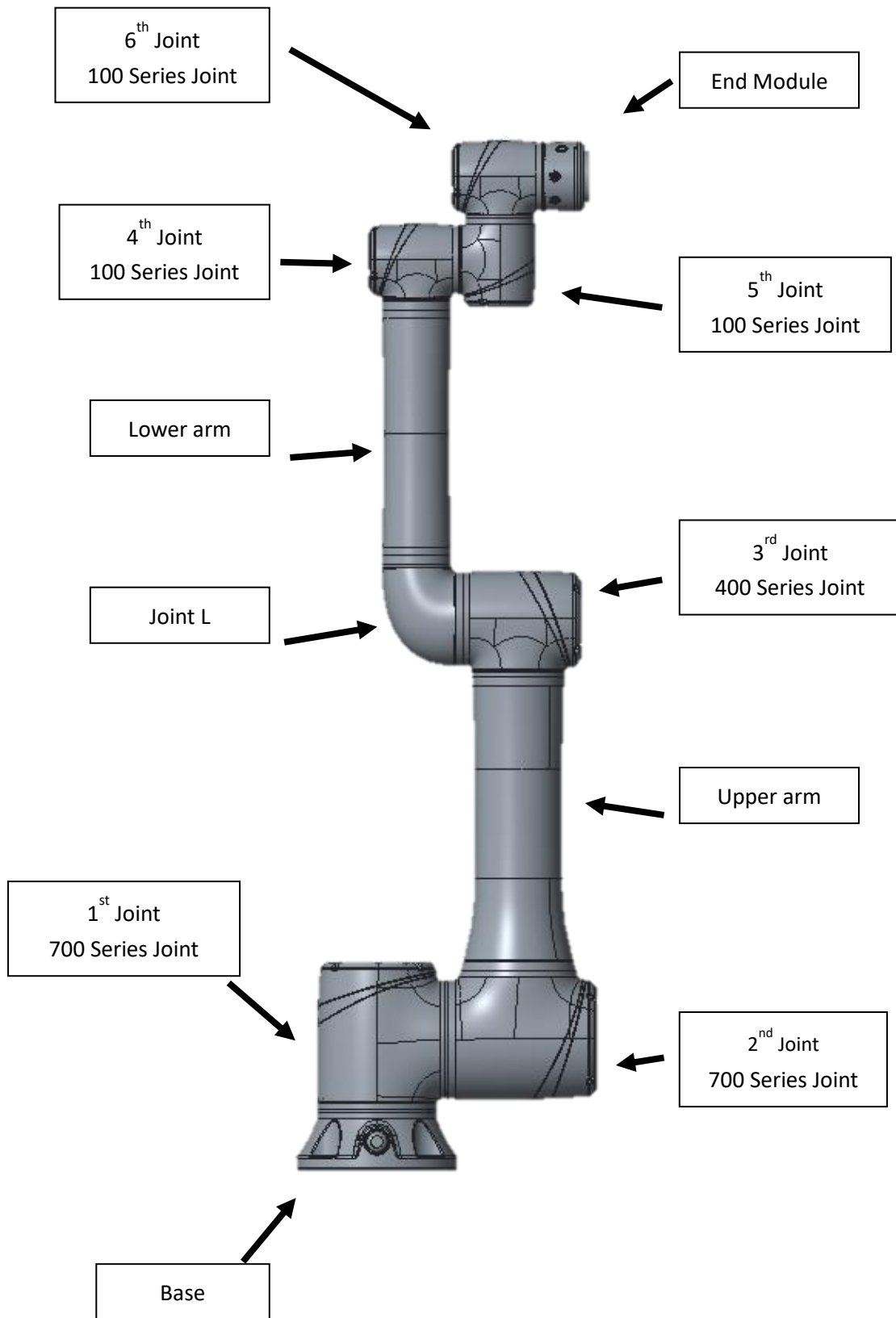
## 1.1 TM5A-700 & TM5A-900



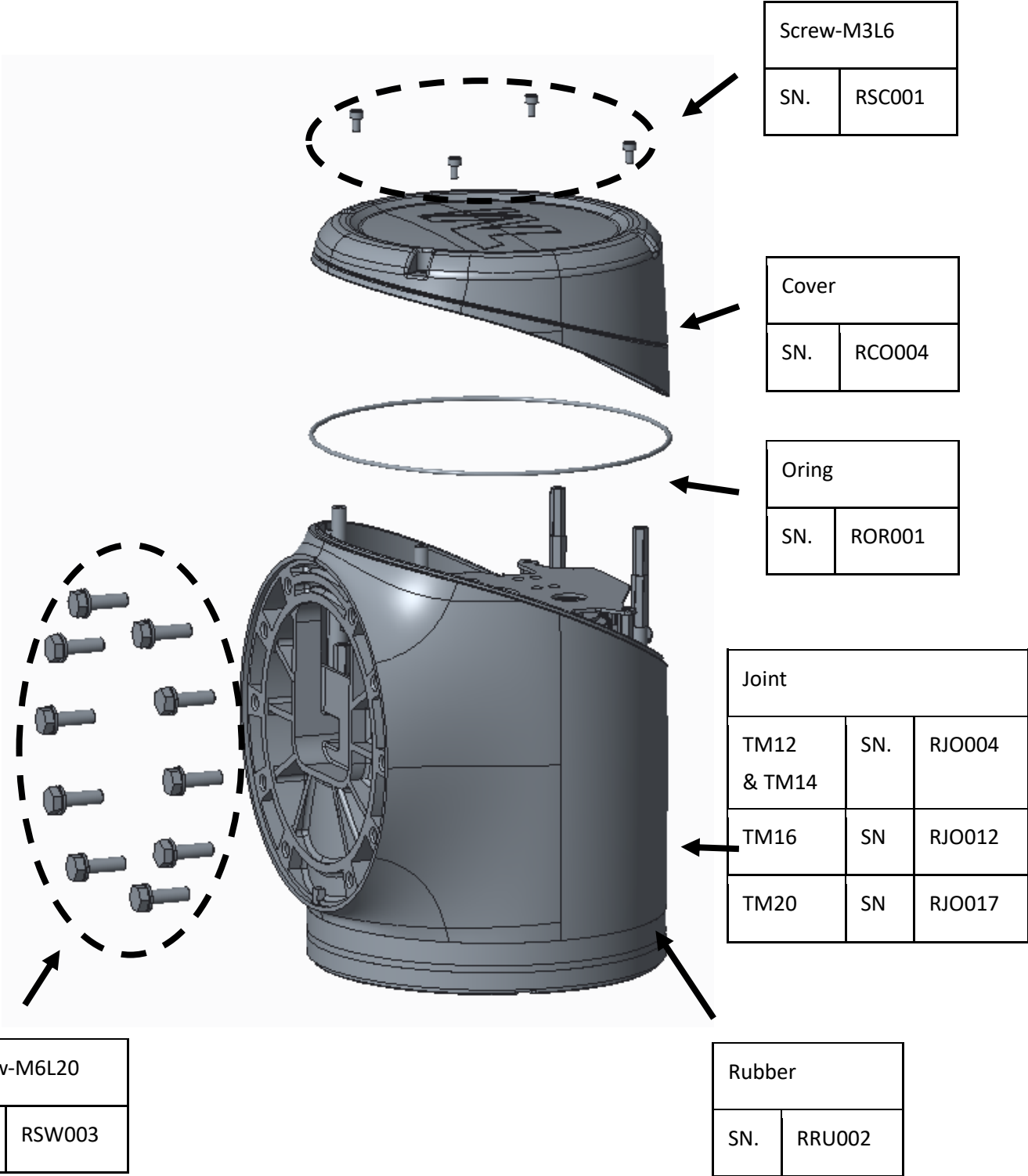
1.2 TM5AX-700 & TM5AX-900



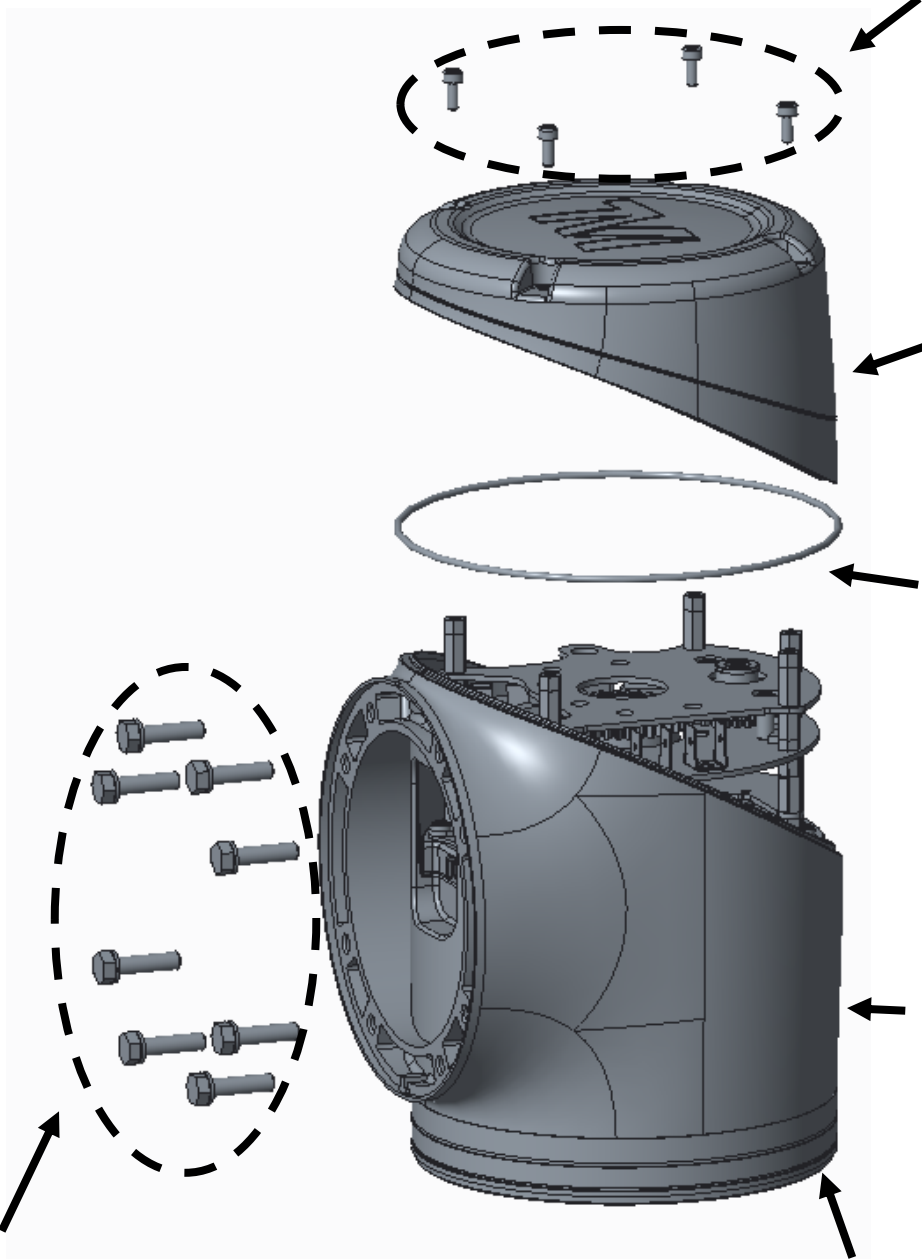




# 700 Series Joint



# 400 Series Joint



Screw-M3L6	
SN.	RSC001

Cover	
SN.	RCO004

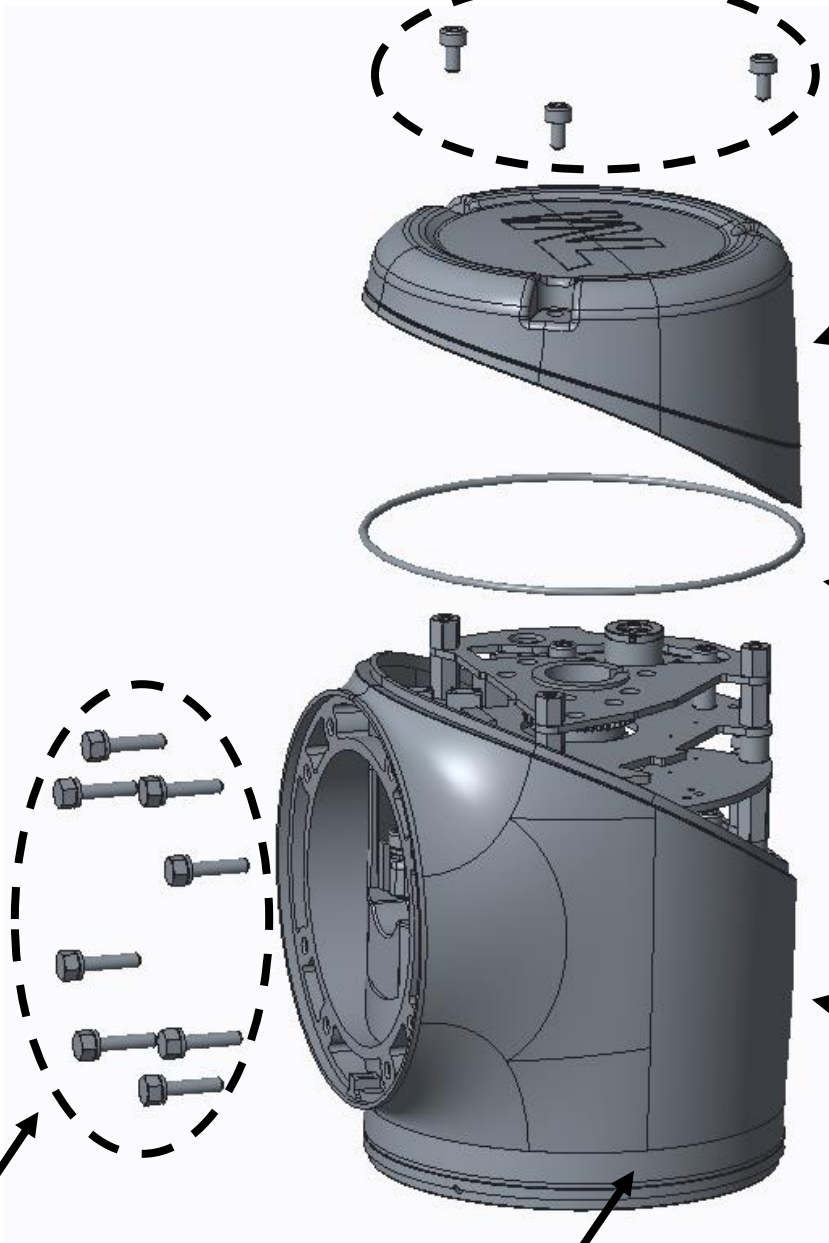
Oring	
SN.	ROR002

Joint		
TM5	SN	RJO002
TM12 & TM14	SN.	RJO003
TM16	SN	RJO011
TM20	SN	RJO016

Screw-M5L20	
SN.	RSW002

Rubber	
SN.	RRU002

# 100 Series Joint



Screw-M3L6	
SN.	RSC001

Cover		
4 <sup>th</sup>	SN.	RCO003
5 <sup>th</sup> 6 <sup>th</sup>	SN.	RCO002

Oring	
SN.	ROR003

Joint		
TM12/TM5	SN.	RJO001
TM14 4 <sup>th</sup> 5 <sup>th</sup>	SN.	RJO002
TM14 6 <sup>th</sup>	SN.	RJO001
TM16 4 <sup>th</sup> 5 <sup>th</sup>	SN	RJO010
TM16 6 <sup>th</sup>	SN	RJO009
TM20 4 <sup>th</sup>	SN	RJO015
TM20 5 <sup>th</sup>	SN	RJO014
TM20 6 <sup>th</sup>	SN	RJO013

Screw-M3L14	
SN.	RSW001

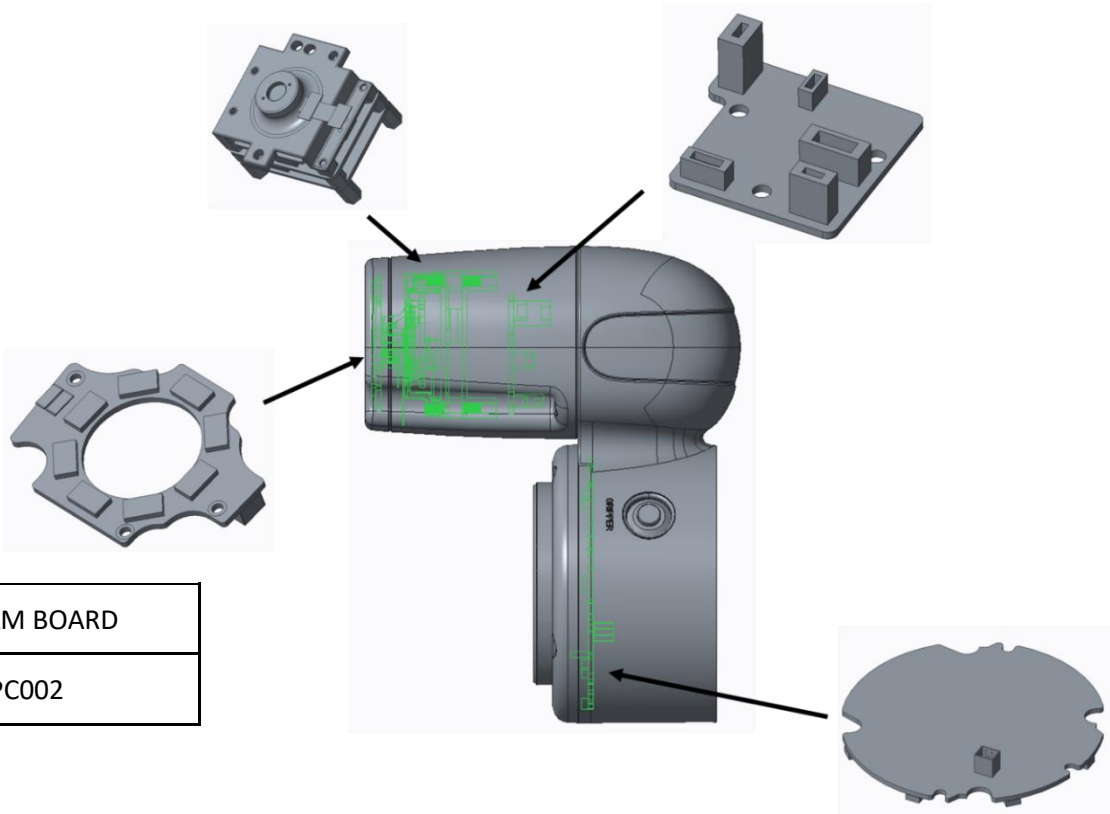
Rubber	
SN.	RRU001

# End Module

TM12&12M / 14&14M / 16&16M / 20&20M End Module

Camera Module		
Non HW3.2A	SN.	ICA001
HW3.2A	SN.	ICA002

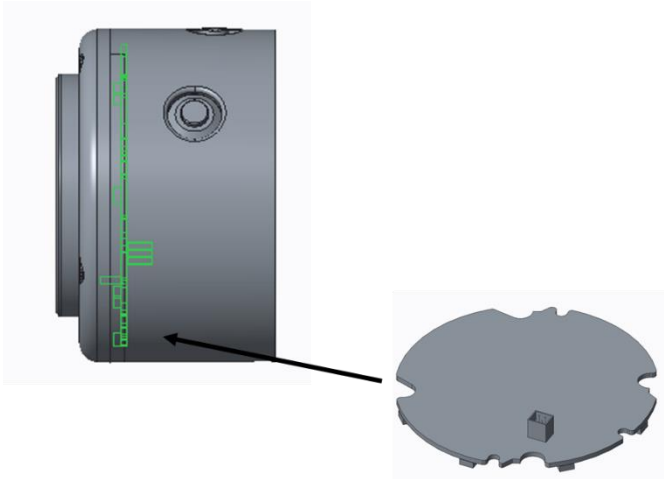
USB EXTENDER DEVICE BOARD	
SN.	IPC003



LIGHT CAM BOARD	
SN.	IPC002

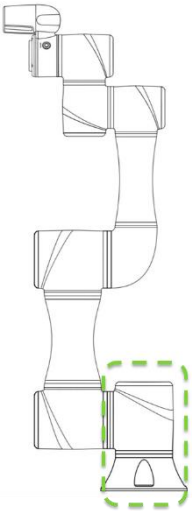



I/O MII Board	
SN.	IPC001

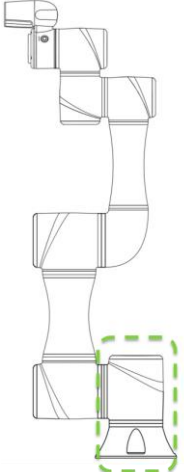


12X / 14X / 16X / 20X End Module

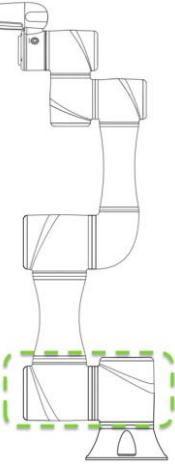




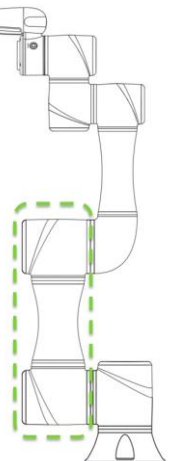



I/O MII Board	
SN.	IPC001



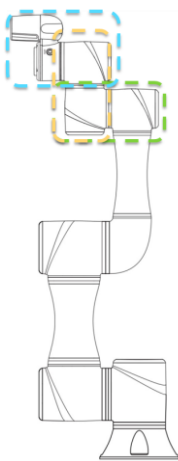


	<b>P/N Description</b> WIRE CABLE,19AWG,330MM,RED,TA TSUTA (NKD- P/F250M250/19AWG/R/330M M),[YUHON](ROHS)	<b>P/N Description</b> WIRE CABLE,19AWG,330MM,BLACK,TAT SUTA (NKD- P/F250M250/19AWG/B/330MM,[ YUHON](ROHS)	HOUSING CABLE,HOUSIN=2 L=440MM	
	<b>Product Description</b> Power Cable, connect base and joint 1	<b>Product Description</b> Power Cable, connect base and joint 1	<b>Product Description</b> MII Cable, connect base and joint 1	
	<b>SN.</b> RWC007	<b>SN.</b> RWC008	<b>SN.</b> RHC004	
	<b>Picture</b> 	<b>Picture</b> 	<b>Picture</b> 	

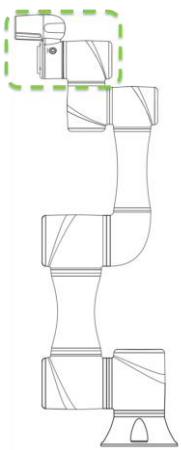

	<b>P/N Description</b> HOUSING CABLE,HOUSIN=2 L=400MM	<b>P/N Description</b> HOUSING CABLE, HOUSIN=2 L=430MM
	<b>Product Description</b> Camera cable, go through joint 1 and joint 2	<b>Product Description</b> Camera cable, go through base and joint 1
	<b>SN.</b> RHC009	<b>SN.</b> RHC008
	<b>Picture</b> 	<b>Picture</b> 

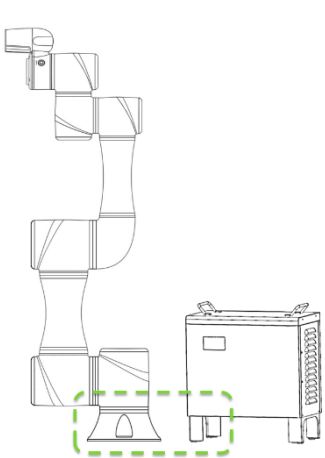

	<b>P/N Description</b>	WIRE CABLE,19AWG,400MM,BLACK	HOUSING CABLE,HOUSIN=2 L=440MM
	<b>Product Description</b>	Power Cable, connect joint 1 and joint 2	MII Cable, connect joint 1 and joint 2
	<b>SN.</b>	RWC002	RWC003
	<b>Picture</b>		

	<b>P/N Description</b>	WIRE CABLE,19AWG,730MM,RED	WIRE CABLE,19AWG,730MM,BLACK	HOUSING CABLE,HOUSIN=2 L=800MM
	<b>Product Description</b>	Power Cable, connect joint 2 and joint 3	Power Cable, connect joint 2 and joint 3	MII Cable, connect joint 2 and joint 3
	<b>SN.</b>	RWC003	RWC004	RHC003
	<b>Picture</b>			

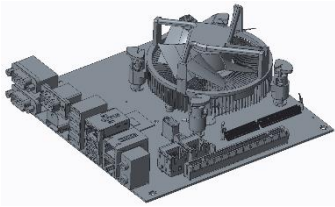
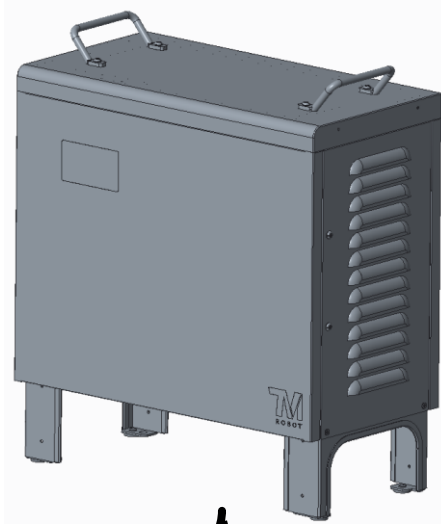
	<b>P/N Description</b>	WIRE CABLE,21AWG,900MM,RED- BLACK	HOUSING CABLE,HOUSIN=2 L=970MM	HOUSING CABLE,HOUSIN=2 L=860MM
	<b>Product Description</b>	Power Cable, connect joint 3 and joint 4	MII Cable, connect joint 3 and joint 4	Camera cable, go through joint 3 and joint 4
	<b>SN.</b>	RWC005	RHC002	RHC007
	<b>Picture</b>			

	<b>P/N Description</b>	WIRE CABLE,21AWG,260MM,RED- BLACK	HOUSING CABLE,HOUSIN=2 L=360MM
	<b>Product Description</b>	Power Cable, connect joint 4 and joint 5 ; connect joint 5 and joint 6	MII Cable, connect joint 4 and joint 5 ; connect joint 5 to joint 6 ; connect joint 6 to I/O module
	<b>SN.</b>	RWC006	RHC001
	<b>Picture</b>		

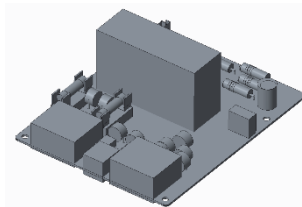
	<b>P/N Description</b>	WIRE CABLE,22AWG,300MM,RED-BLACK,TATSUTA,(NKD-P/C254HRS396/PVC22#RB/300MM)(ROHS)
	<b>Product Description</b>	Power Cable, connect joint 6 and I/O module
	<b>SN.</b>	IWC002
	<b>Picture</b>	

	<b>P/N Description</b>	HOUSING CABLE, COMPLEX, DRAG CHAIN, TMAA, DF62B+ETHERCAT+5C BLACK, L=3150MM, YOSHINNOGAWA
	<b>Product Description</b>	Robot Cable, connect robot and control box
	<b>SN.</b>	RHC010
	<b>Picture</b>	

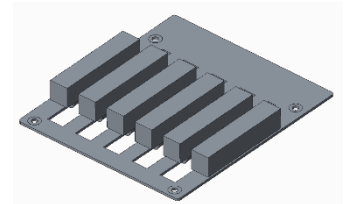
1.5 Control box components for TM12 & 12M / 14 & 14M / 16 & 16M / 20 & 20M



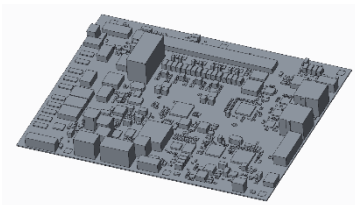
IPC	
SN.	CIP001



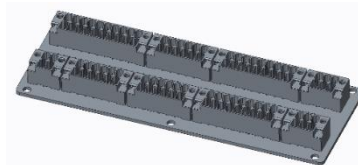
Relay Board		
AC	SN.	CPC004
DC	SN.	CPC007



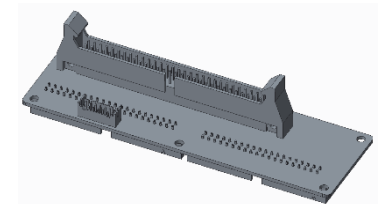
Power Eater	
SN.	CPC003



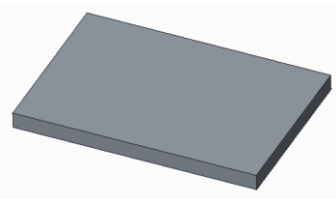
Power Control Board	
SN.	CPC005



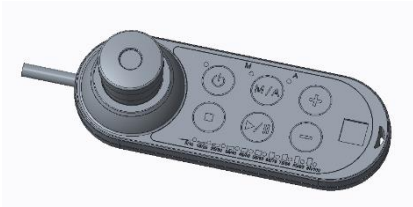
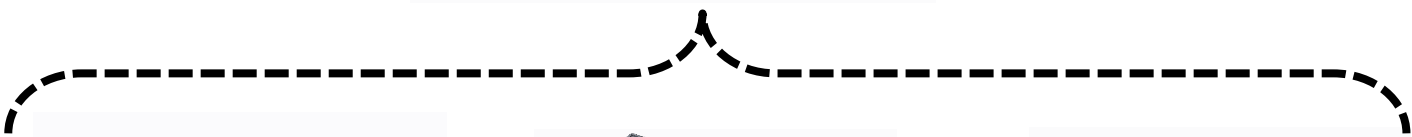
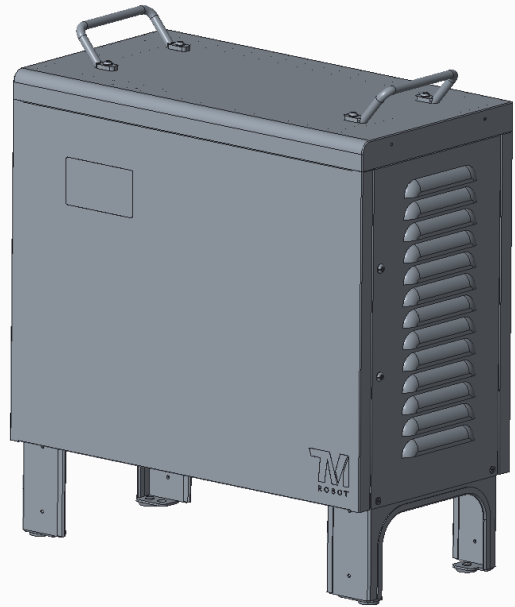
EX IO BOARD_OUTSIDE	
SN.	CPC002



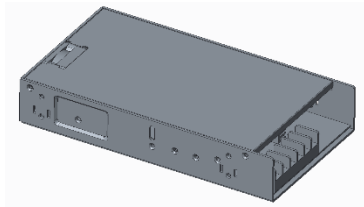
EX IO BOARD_INSIDE	
SN.	CPC001



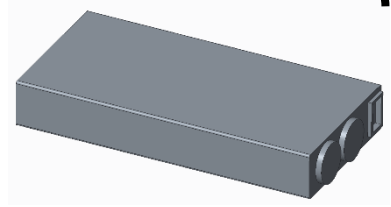
SSD	
SN.	CSS001



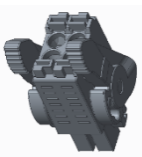
Stick	
SN.	CST001



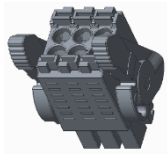
Power Supply 24V		
AC	SN.	CPS002
DC	SN.	CPS005



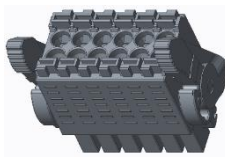
Power Supply 48V		
AC	SN.	CPS001
DC	SN.	CPS006



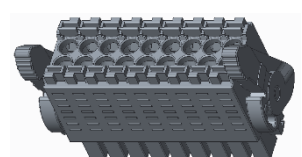
Jack 2P	
SN.	CJA001



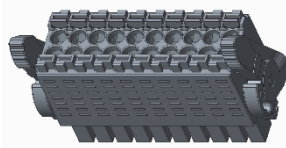
Jack 3P	
SN.	CJA002











Jack 6P	
SN.	CJA003








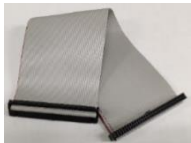


Jack 9P	
SN.	CJA004








Jack 10P	
SN.	CJA005

<b>P/N Description</b>	HOUSING CABLE, RJ-45 CABLE,CAT6 26AWG 4P 200MM	HOUSING CABLE,HOUSIN=2,RED- BLACK- BROWN,24AWG*3C,L=300MM	HOUSING CABLE,HOUSIN=2,8P,28AWG* 8C,L=300MM	HOUSING CABLE,HOUSIN=3,RED/BLACK- 18AWG*4C-L=170MM;YELLOW/BLACK- 18AWG*4C-L=300MM
<b>Product Description</b>	RJ45 Cable, connect IPC and Power Control Board (AC/DC)	Power Cable, connect PSU 48V and Relay Board (DC)	LCM Cable, connect LCM and Power Board (AC/DC)	Power cable, connect Power Control Board to IPC and VGA card (AC/DC)
<b>SN.</b>	CHC001	CHC002	CHC004	CHC006
<b>Picture</b>				
<b>P/N Description</b>	HOUSING CABLE,HOUSIN=2,YELLOW- WHITE,26AWG*2C,L=430MM	HOUSING CABLE,HOUSIN=2,DF60- 3EP-10.16C,DF22L-2S-7.92C,RED- BLACK,10AWG*2C,L=210MM	HOUSING CABLE,HOUSIN=1,DF63-2S- 3.96C,2P	HOUSING CABLE,HOUSIN=2,L=180MM
<b>Product Description</b>	Signal Cable, connect Power Control Board and IPC (AC/DC)	Power Cable, connect Control Box Case and Breaker (DC)	Power Cable, connect Relay Board and PSU 24V (DC)	Signal Cable, connect Relay Board and Power Control Board (AC/DC)
<b>SN.</b>	CHC007	CHC016	CHC008	CHC009
<b>Picture</b>				

<b>P/N Description</b>	HOUSING CABLE,HOUSIN=1,L=280MM,RED/BLACK	HOUSING CABLE,HOUSIN=1,DF22-2S-7.92C,2P,RED-BLACK,12AWG*2C,L=270MM	HOUSING CABLE,HOUSIN=2,RED-BLACK,14AWG*2C,L=350MM,270MM	HOUSING CABLE,HOUSING =1,DF22-1S-7.92C,14AWG,170MM,RED
<b>Product Description</b>	Power Cable, Connect PSU 24V and Power Control Board (DC)	Power Cable, Connect PSU 48V and Power Control Board (DC)	Power Cable, Connect DC breaker to Relay Board(red line) and Power Control Board (black line) (DC)	Power Cable, Connect Relay Board and Power Control Board (DC)
<b>SN.</b>	CHC010	CHC017	CHC011	CHC018
<b>Picture</b>				
<b>P/N Description</b>	HOUSING CABLE, RJ-45_FEMALE CABLE,TMAA,HW3.2,CAT5E 26AWG*4P,300MM	HOUSING CABLE,HW3.2,HOUSIN=2,14P,26AWG*14C,L=260MM (SLR-5A190327QS1)[SONGLIN](ROHS)	HOUSING CABLE,HW3.2,HOUSIN=2,2P,PITCH1.5MM,26AWG*2C,L=400MM	HOUSING CABLE,IDC SOCKET 2.54-60P CABLE,L=250MM (ST-1080618-1)[CHERNG WEEI](ROHS)
<b>Product Description</b>	Lan Cable, Connect to Power Control Board (AC/DC)	Signal Cable, Connect External IO Board and Power Control Board (AC/DC)	Power Cable, Connect Relay Board and Power Control Board (DC)	IDE Cable, Connect Power Control Board and EX IO Board (AC/DC)
<b>SN.</b>	CHC019	CHC020	CHC021	CHC023
<b>Picture</b>				



<b>P/N Description</b>	HOUSING CABLE,HOUSING =2,DF22L-1S-7.92C,10AWG,150MM,RED	WIRE CABLE,14AWG*2C-460MM-RED-BLACK,220MM-GREEN/YELLOW	WIRE CABLE,14AWG*2C-200MM-RED-BLACK	WIRE CABLE,14AWG,80MM,GREEN/YELLOW
<b>Product Description</b>	Power Cable, Jumper Wire on Relay Board (AC)	Power Cable Connect PSU 48V and Power Control Board (DC)	Power Cable, Connect PSU 48V to Power Control Board and Power Eater (AC/DC)	Ground Wire, Connect PSU 48V and Control Box Case (AC/DC)
<b>SN.</b>	CHC012	CWC001	CWC002	CWC006
<b>Picture</b>				
<b>P/N Description</b>	HOUSING CABLE,HOUSIN=1,BROWN-GREEN/YELLOW-BLUE,16AWG*3C,L=420MM	HOUSING CABLE,HOUSIN=1,CR-H423M-2X03,6P,18AWG*6C,L=280MM,RED/BLACK	HOUSING CABLE,HOUSIN=1,DF22-3S-7.92C,3P,BROWN-GREEN/YELLOW-BLUE,14AWG*3C,L=450MM	WIRE CABLE,10AWG,130MM,RED
<b>Product Description</b>	Power Cable, Connect PSU 24V and Relay Board (AC)	Power Cable, Connect PSU 24V and Power Control Board (AC)	Power Cable, Connect PSU 48V and Relay Board (AC)	Power Cable, Used in Relay Board and Power Relay (DC SEMI)
<b>SN.</b>	CHC003	CHC005	CHC015	CWC008
<b>Picture</b>				

<b>P/N Description</b>	WIRE CABLE,14AWG,200MM,GREEN/YELLOW	WIRE CABLE,14AWG,300MM,GREEN/YELLOW	WIRE CABLE,14AWG,110MM,GREEN/YELLOW	BUS CABLE,USB CABLE,TMAA,TM5A,USB TYPE A TO USB TYPE A,BLACK,L:260MM+/-20MM,(SLR-7B170815QS1)[SONGLIN](ROHS)
<b>Product Description</b>	Ground Wire, Connect Power Switch and Control Box Case (AC)	Ground Wire, Connect PSU 48V and Control Box Case (AC)	Ground Wire, Connect PSU 48V and Control Box Case (AC)	USB Cable, Connect Power Control Board and IPC (AC/DC)
<b>SN.</b>	CWC003	CWC004	CWC005	CUC001
<b>Picture</b>				
<b>P/N Description</b>	HOUSING CABLE,HOUSING =1,DF22L-3S-7.92C,2C,12AWG,235MM,FDF N5-250,CORE:K5B T 25*12*15	HOUSING CABLE,HOUSING=2,DF1E-2EP-2.5C,CP-H20-02,2P,RED-BLACK,24AWG*2C,L=230MM	HOUSING CABLE,TMAA,CONTROL BOX COMPLEX,HMN-012*2,(TMAA-AD55-1708-I05G)[H.C.Y](ROHS)	WIRE CABLE,14AWG*4C,460MM,RED*2,BLACK*2
<b>Product Description</b>	Power Cable, Connect Relay board and AC Adapter (AC)	Power Cable, Connect DC breaker and Relay Board (DC)	Robot Cable Connect Robot (AC/DC)	Power Cable, Connect PSU 48V and Power Control Board (AC)
<b>SN.</b>	CHC013	CHC014	CHC022	CWC007
<b>Picture</b>				

## 2. Preventive Maintenance

### 2.1 Robot


#### 2.1.1 Checking the Robot (when it is shut down)


See the table below for instructions on maintaining the Robot preventively when it is shut down:

Task	Area to check	Duration	Every month	Every 6 months	Every year
Visual inspection	<ol style="list-style-type: none"> <li>Joints</li> <li>Lower and upper arms</li> <li>Warning and safety labels</li> </ol>	5 min	✓		
Check wires and cables	<ol style="list-style-type: none"> <li>Surface</li> <li>Rubber bands</li> </ol>	5 min	✓		
Check inner parts of joints	<ol style="list-style-type: none"> <li>Power Cable's connection status</li> <li>SIGNAL Cable's connection status</li> <li>Camera Cable's connection status</li> <li>PCB and encoder of each joint</li> </ol>	15 min		✓	

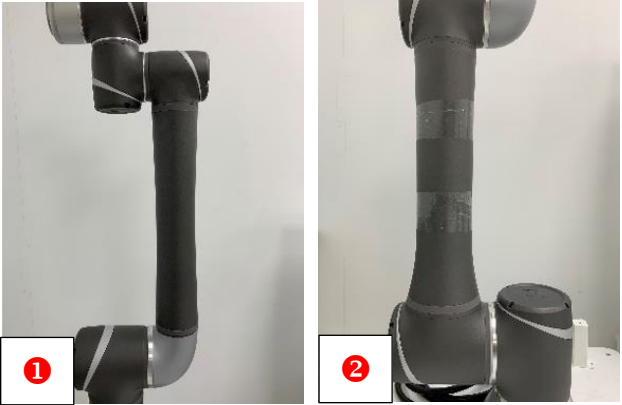
\*Please have your robot serviced by an authorized dealer or service center and avoid doing so on your own

#### 2.1.1.1 Visual check

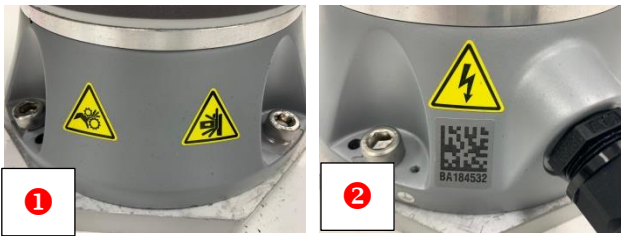
	Item	Remark	Qty.
Area to check	Joints	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>Check for impact marks on the End Module.</li> <li>Check for impact marks on the 6<sup>th</sup> Joint.</li> <li>Check for impact marks on the 5<sup>th</sup> Joint.</li> <li>Check for scratches on the 4<sup>th</sup> Joint.</li> <li>Check for scratches on the 3<sup>rd</sup> Joint.</li> <li>Check for scratches on the 2<sup>nd</sup> Joint.</li> <li>Check for scratches on the 1<sup>st</sup> Joint.</li> </ol>			

<p>Joint.</p> <p>8. If there is any issue you cannot solve, contact Techman Robot.</p> <p>*The presence of an impact mark on the Robot indicates the device has collided with something. In this case, you can check the joint with that mark.</p>	
--	--


● Lower arm & Upper arm

	Item	Remark	Qty.
Area to check	Lower and upper arms	N/A	N/A
Tool	Visual check	N/A	N/A
<p>1. Check for impact marks on the Lower Arm.</p> <p>2. Check for impact marks on the Upper Arm.</p> <p>3. If there is any issue you cannot solve, contact Techman Robot.</p> <p>*The presence of an impact mark on the Robot indicates the device has collided with something. In this case, you can check the joint with that mark.</p>			

- Warning and safety labels


	Item	Remark	Qty.
Area to check	Warning and safety labels	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check for scratches on the warning label.</li> <li>2. Check for scratches on the safety label.</li> <li>3. If there is any damage on the labels, contact Techman Robot for a replacement.</li> </ol>			

- QR code label on the Base


	Item	Remark	Qty.
Area to check	QR code label on the base	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check for scratches on the QR code label on the base.</li> <li>2. If there is any damage on the label, contact Techman Robot for a replacement.</li> </ol> <p>*A damaged QR code label may affect the Robot's calibration process and should be replaced with a new one.</p>			

### 2.1.1.2 Robot Cable


- Robot Cable

	Item	Remark	Qty.
Area to check	Surface of Robot Cable	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check for damage on the cable.</li> <li>2. If any part of this metal cable is exposed, change the cable.</li> <li>3. If there is any issue you cannot solve, contact Techman Robot.</li> </ol>			

- Rubber lock ring

	Item	Remark	Qty.
Area to check	Rubber lock ring	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check for damage on the rubber lock ring.</li> <li>2. Turn around the ring to see if it is tightened.</li> <li>3. If not, tighten it.</li> <li>4. If there is issue you cannot solve, contact Techman Robot.</li> </ol>			

● Connector

	Item	Remark	Qty.
Area to check	Connector	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check for damage on the connector.</li> <li>2. Check if the pin is tilted.</li> <li>3. If the pin is damaged or broken, change the Robot Cable.</li> <li>4. If there is any issue you cannot solve, contact Techman Robot.</li> </ol>			

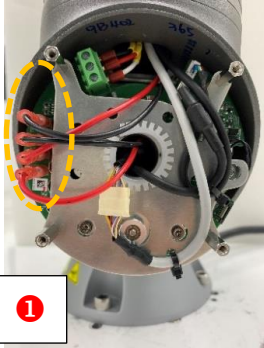
### 2.1.1.3 Checking inner parts of joints

This chapter describes how to check the inner parts and connection cables of the joint. To begin with, remove the cover of each joint, inspect the joint, and tighten the cover (with a torque of 6 kgf·cm). The joint should be inspected in the following areas:

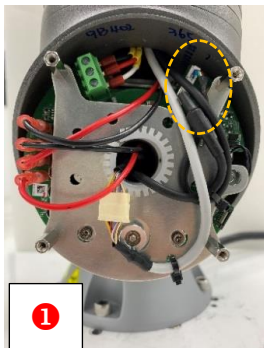
- The connection status of the Power Cable
- The connection status of the Signal Cable
- The connection status of the Camera Cable
- The PCB and Encoder of the joint
- Brake
- Use the following tools to remove or tighten the covers of the joints:

	Item	Specs	Qty.
Tool	1. Straight hex torque screwdriver 2. S2 Torx bit socket set	1. TOHNICHI 12RTD 2. S2 T10 x 50 mm	1

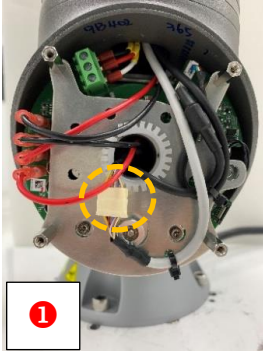
#### ● Surface and connection status of the Power Cable

	Item	Remark	Qty.
Area to check	Surface and connection status of the Power Cable	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check if the Power Cable is loose.</li> <li>2. If so, check if the connector is loose. If the connector is loose, change the Power Cable.</li> <li>3. If there is any issue you cannot solve, contact Techman Robot.</li> </ol>			

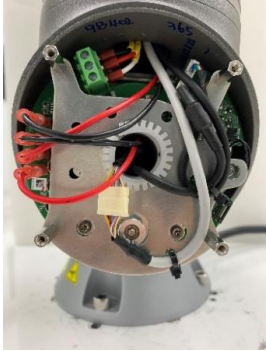
#### ● Surface and connection status of the Signal Cable

	Item	Remark	Qty.
Area to check	Surface and connection status of the Signal Cable	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check if the Signal Cable is loose.</li> <li>2. If so, check if the connector is loose. If the connector is loose, change the Signal Cable.</li> <li>3. If there is any issue you cannot solve, contact Techman Robot.</li> </ol>			

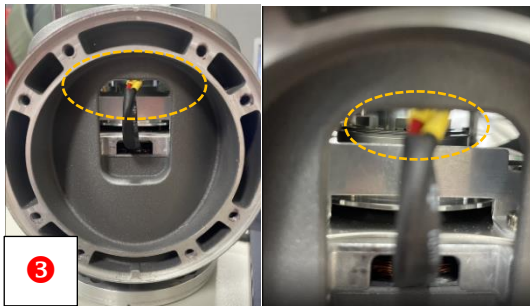
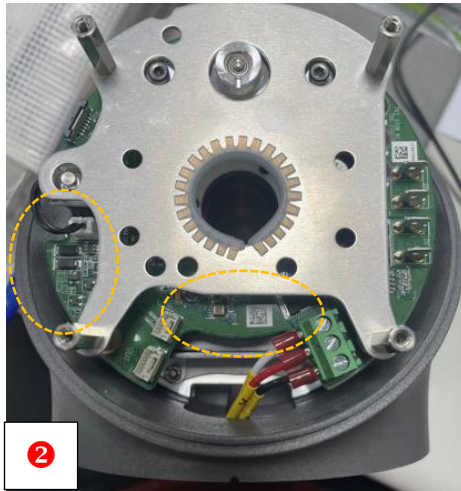
● Surface and connection status of the Camera Cable

	Item	Remark	Qty.
Area to check	Surface and connection status of the Camera Cable	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check if the Camera Cable is loose.</li> <li>2. If there is any issue you cannot solve, contact Techman Robot.</li> </ol>			


● Inner parts of joints

	名稱	備註	數量
Area to check	PCB and Encoder of joints	N/A	N/A
<ol style="list-style-type: none"> <li>1. Remove the cover of each joint.</li> <li>2. Check for dirt and oil stain on the PCB.</li> <li>3. Check for dirt or oil stain on the Encoder.</li> <li>4. If there is any dirt or oil stain on the PCB or Encoder of a joint, change the joint.</li> <li>5. If there is any issue you cannot solve, please contact Techman Robot.</li> </ol>			





● Brakes

	Item	Remark	Qty.
Area to check	Move the joints manually within $\pm 45^\circ$ to check how well their brakes would work	N/A	N/A
<ol style="list-style-type: none"> <li>1. Press the solenoid valve and rotate the joint you are examining. If the joint does not rotate, then its solenoid valve has been damaged. In this case, change the joint.</li> <li>2. Make sure the joint moves within <math>\pm 45^\circ</math> during inspection, and return the joint to its original position when you are finished.</li> <li>3. If there is any issue you cannot solve, contact Techman Robot.</li> </ol>			

### 2.1.2 Checking the Robot (when it is switched on)


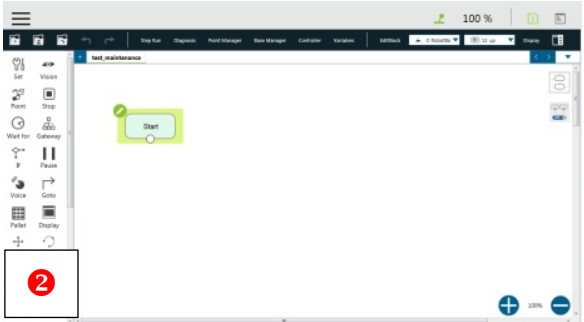

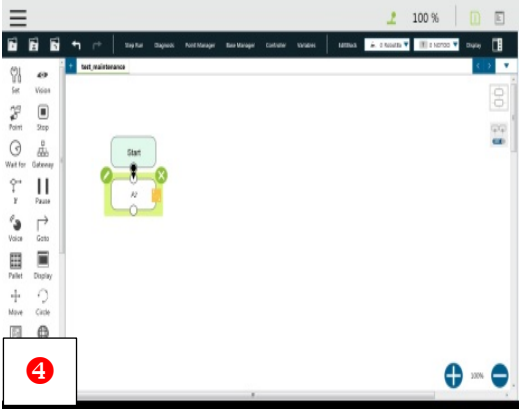
See the table below for instructions on maintaining the Robot preventively when it is switched on:

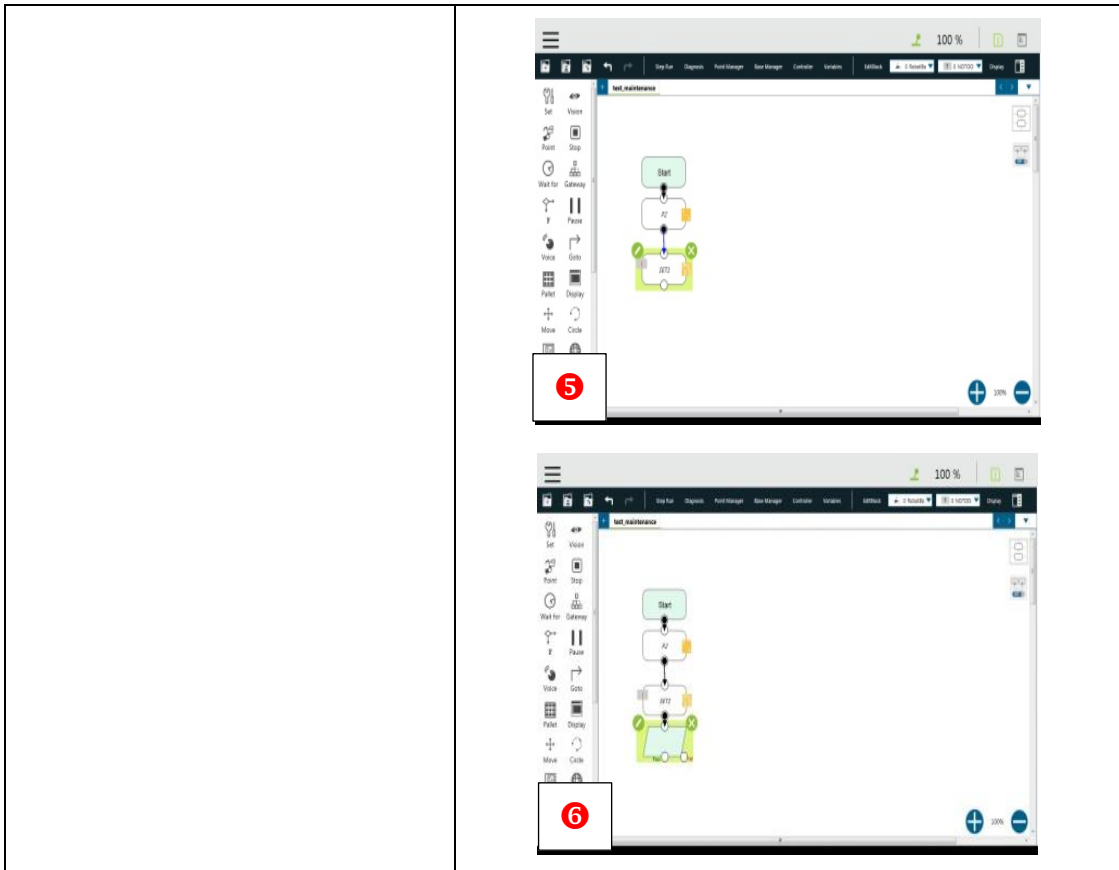
Task	Area to check	Duration	Every month	Every 6 months	Every year
End Module	<ol style="list-style-type: none"> <li>Buttons</li> <li>LED lights</li> <li>I/O ports</li> </ol>	10 min			✓
Camera	<ol style="list-style-type: none"> <li>Adjust the camera's parameters: Run an auto-focus test.</li> <li>Calibrate the camera with the calibration plate placed 30 cm away.</li> </ol>	10 min			✓
Robot flexibility	Run a snake-dance project for 10 min at a 50% speed, with points set as follows: P1: (260,90,-150,90,170,110) P2: (-260,-90,150,-90,-170,-110)	20 min			✓
Robot positioning*	<ol style="list-style-type: none"> <li>Check if the positioning hole on the bearing is aligned.</li> <li>The error in QR code scanning must be smaller than 3 pixels.</li> <li>Return the Robot to the zero position and check if it is tilted.</li> </ol>	15 min		✓	
Joint loading	<ol style="list-style-type: none"> <li>Check if the loading and speed at all the points reached exceed the joints' limits after the project is run.</li> </ol>	15 min		✓	


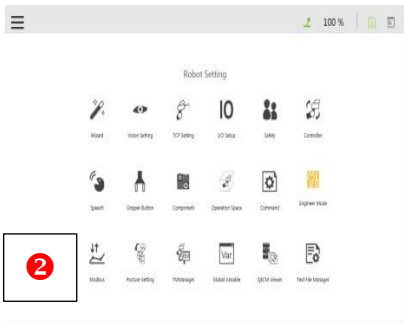
\*Please have your robot serviced by an authorized dealer or service center and avoid doing so on your own

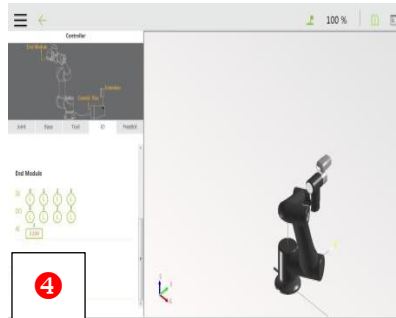
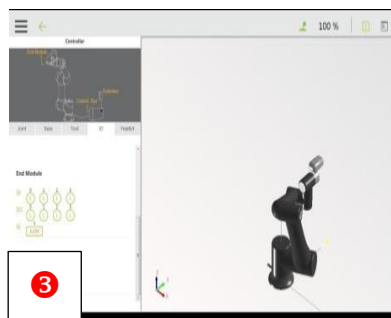
### 2.1.2.1 End Module

- Buttons

	Item	Remark	Qty.
Area to check	Buttons	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check for damage on the buttons.</li> <li>2. Create a TMflow project.</li> <li>3. Hold the FREE button to manipulate the Robot and check if the Robot can move easily.</li> <li>4. Press the POINT button and check if any Point node has been generated on the TMflow project.</li> <li>5. Press the IO button and check if any Set node has been generated on the TMflow project.</li> <li>6. Press the VISION button and check if any Vision node has been generated on the TMflow project.</li> </ol> <p>If any of the above buttons goes wrong, change the End Module.</p>	   		

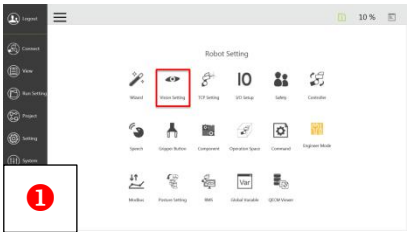
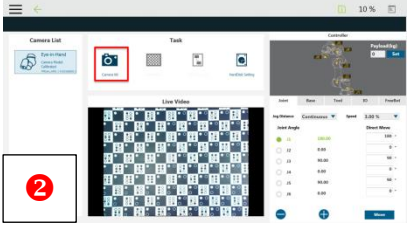
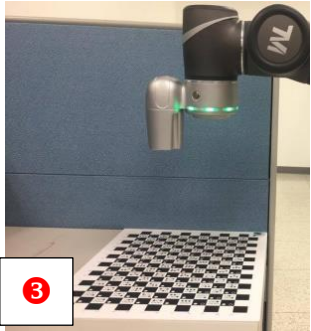
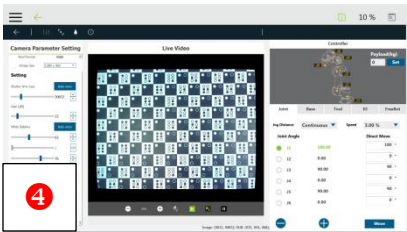
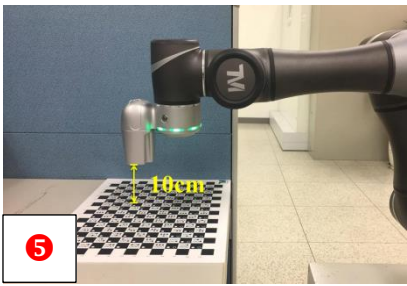
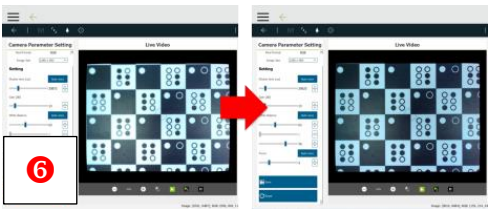


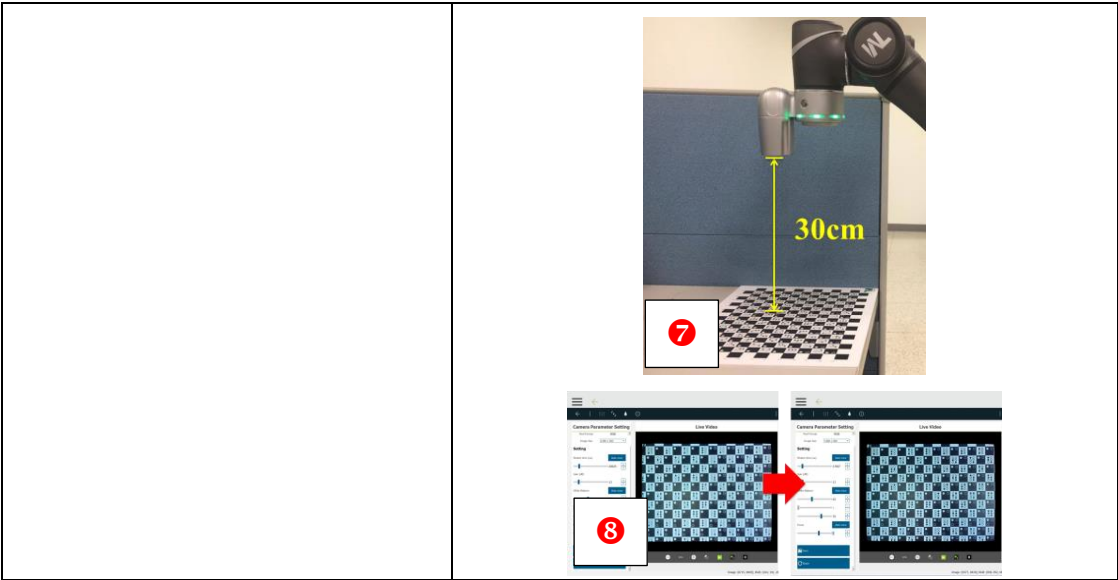
Area to check	LED light ring	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check for damage on the LED light ring.</li> <li>2. Click <b>Robot Setting</b> → <b>Vision Setting</b>.</li> <li>3. Click <b>IO</b> → <b>End Module</b>.</li> <li>4. Open the light ring.</li> <li>5. Check whether the light ring has been activated.</li> <li>6. If the light ring has not been activated, change it.</li> </ol>	 		



### 2.1.2.2 Camera

- Adjusting camera parameters: Auto-focus test

	Item	Remark	Qty.
Area to check	Adjust camera parameters: Auto-focus test	N/A	N/A
Tool	Visual check	N/A	N/A
1. Click <b>Robot Setting</b> → <b>Vision Setting</b>	     		
2. Click <b>Camera Kit</b> .			
3. Place the calibration plate within the camera's field of view, but because the camera needs to refocus, the image it produces is not clear enough.			
4. Use <b>Auto Once</b> to refocus, check if the camera focuses properly, and make sure the image is clear enough.			
5. Place the End Module 10 cm above the calibration plate.			
6. Check if the auto-focus function works normally.			
7. Place the End Module 30 cm above the calibration plate.			
8. Check if the auto-focus function works normally.			
9. If the camera fails to focus on its own, change it.			



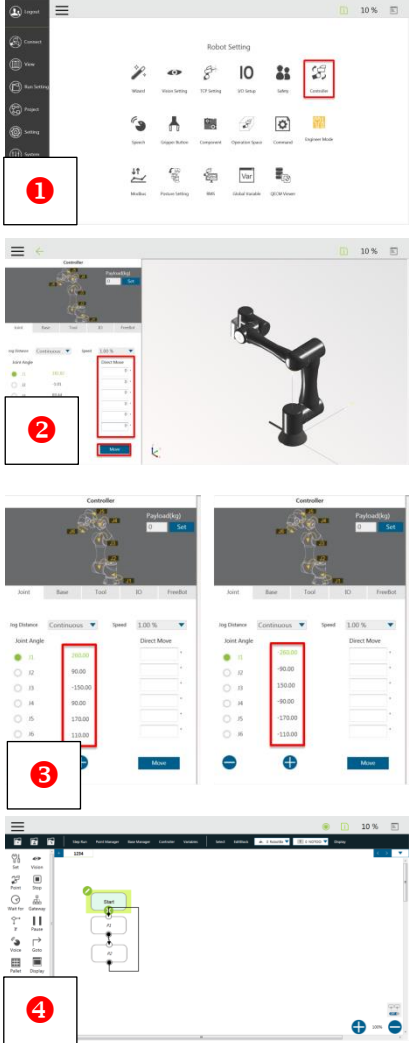


### 2.1.2.3 Robot flexibility

Run a snake-dance project for 10 min at a 50% speed, with points set as follows:


P1: (260, 90, -150, 90, 170, 110).

P2: (-260, -90, 150, -90, -170, -110).


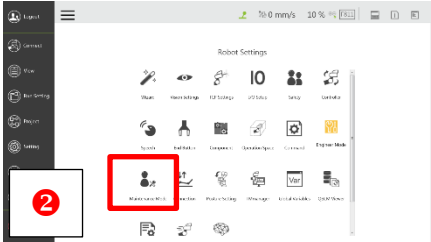
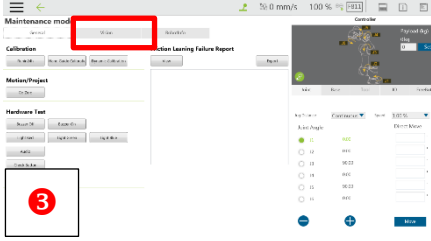
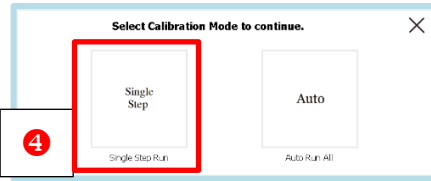
	Item	Remark	Qty.
Area to check	Test robot flexibility using a snake-dance project	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Click <b>Robot Setting</b> → <b>Controller</b>.</li> <li>2. Set (260°, 90°, -150°, 90°, 170°, 110°) and (-260°, -90°, 150°, -90°, -170°, -110°) as two separate points on the TMflow project.</li> <li>3. Create a snake-dance project that runs for 10 min at a 50% speed; this can make sure all the joints work properly.</li> </ol> <p>*The snake-dance project should only be run on the calibration platform or a stable base. Otherwise, do not run the project.</p>	 <p>The screenshots illustrate the configuration process in the robot control software:</p> <ul style="list-style-type: none"> <li><b>Step 1:</b> The 'Robot Setting' menu is shown with the 'Controller' option highlighted by a red box and a red circle with the number 1.</li> <li><b>Step 2:</b> The 'Controller' configuration screen is shown with a 3D model of the robot arm. A red box highlights the 'Position' field, and a red circle with the number 2 is placed next to it.</li> <li><b>Step 3:</b> Two 'Controller' configuration screens are shown side-by-side. Red boxes highlight the 'Joint Angle' settings for two different points, and a red circle with the number 3 is placed between them.</li> <li><b>Step 4:</b> The 'Snake Dance' project configuration screen is shown with a red box highlighting the 'Start' button and a red circle with the number 4 placed next to it.</li> </ul>		

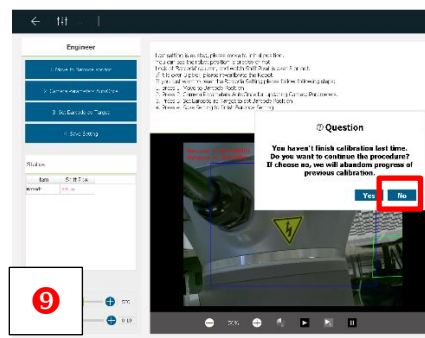
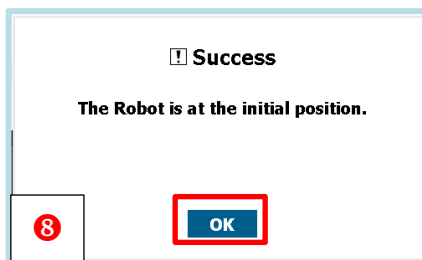
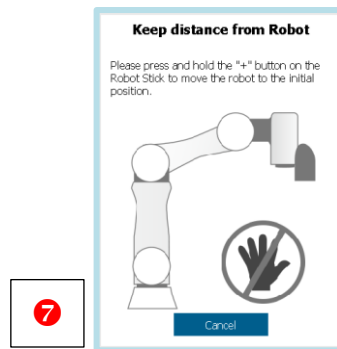
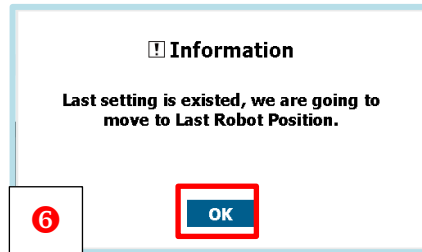
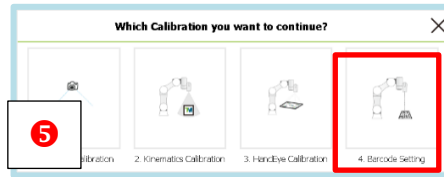
### 2.1.2.4 Check for collisions on joints

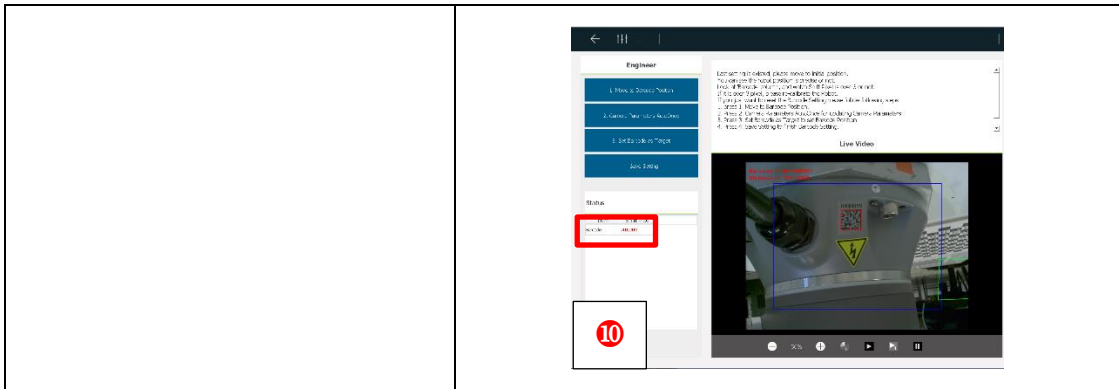
- Check if the positioning holes on the joints are aligned

	Item	Remark	Qty.
Area to check	Alignment of positioning holes on joints	N/A	N/A
Tool	Visual check	N/A	N/A
1. Check if the positioning hole on each joint is aligned.			
2. If the hole is not aligned, the joint might have collided with something. In this case, inspect the joint.			


- QR code scanning error must be smaller than 3 pixels\*

	Item	Remark	Qty.
Area to check	QR code scanning error must be smaller than 3 pixels*	N/A	N/A
Tool	Visual check	N/A	N/A
1. Before switching on the Control Box, insert the dongle into its USB port.	   		
2. Click Maintenance Mode.			
3. Click Vision.			
4. Click Single Step.			
5. Click Barcode Setting.			
6. Click OK!			
7. Hold the + button on the Robot Stick until the Robot returns to its initial position.			
8. Click OK.			
9. Click NO.			
10. Check the error in the scanning of the QR code on the base.			
11. If the error exceeds 3 pixels, the Robot might have collided with something. In this case, check all the joints.			





- Return the Robot to the zero position and check if it is tilted

	Item	Remark	Qty.
Area to check	Return the Robot to the zero position and check if it is tilted	N/A	N/A
Tool	Visual check	N/A	N/A
1. Manipulate all the joints to the 0° position.			
2. Check if the Robot is tilted.			
3. If the Robot is tilted, it might have collided with something. In this case, check all the joints.			

### 2.1.2.5 Joint Loading

	Item	Remark	Qty.
Area to check	All joints	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>Applicable before the Robot is disassembled for maintenance.</li> <li>Open the current project.</li> <li>View the frame color of the each node. Green: low risk Yellow: high risk Gray: unknown</li> <li>If a node has a yellow frame, edit the point posture or check if the TCP and payload are properly defined.</li> </ol>	  <p data-bbox="1002 1048 1248 1249"> <span style="color: green;">綠框：低</span>  <span style="color: orange;">黃框：高</span>  <span style="color: gray;">灰框：未知</span> </p>		

## 2.2 Control Box

### 2.2.1 Checking the Control Box (when it is shut down)

See the table below for instructions on maintaining the Control Box preventively when it is shut down:

Item	Area to check	Duration	Every month	Every 6 months	Every year
Visual check	<ol style="list-style-type: none"> <li>1. Shell</li> <li>2. Serial number label</li> <li>3. Warning and safety labels</li> <li>4. RTX certificate label</li> <li>5. Clean off dust</li> </ol>	10 min	✓		
External connection	<ol style="list-style-type: none"> <li>1. Power cord</li> <li>2. IO device</li> <li>3. Communication device</li> <li>4. External camera</li> </ol>	5 min	✓		
Filter	Change the filter	5 min		✓	
Internal connection*	<ol style="list-style-type: none"> <li>1. Power Control Board</li> <li>2. IPC</li> <li>3. Power eater</li> <li>4. Power Supply 24V</li> <li>5. Power Supply 48V</li> <li>6. Relay Board</li> <li>7. SSD</li> <li>8. Robot Stick</li> <li>9. LCM Display</li> </ol>	30 min			✓
Clean dust off the Control Box	<ol style="list-style-type: none"> <li>1. Exterior (clean all holes)</li> <li>2. Interior (including all PCBs)</li> </ol>	30 min		✓	
IPC*	<ol style="list-style-type: none"> <li>1. Change the button cell</li> <li>2. If the version of the IPC is C, you are recommended to remove the jumper.</li> </ol>	10 min			✓

\*Please have your robot serviced by an authorized dealer or service center and avoid doing so on your own

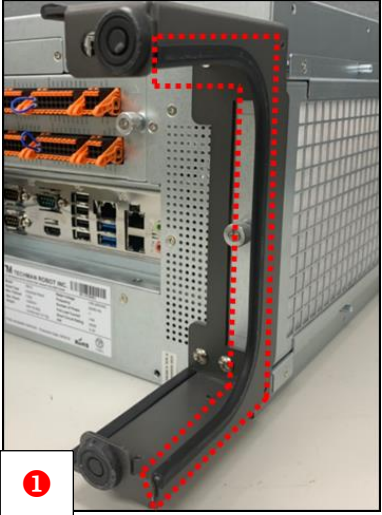
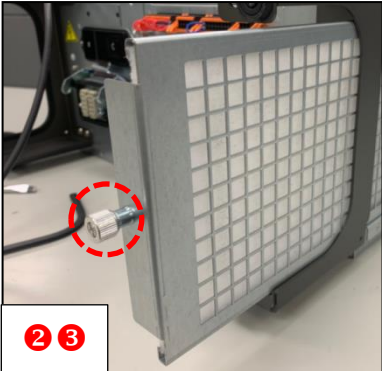
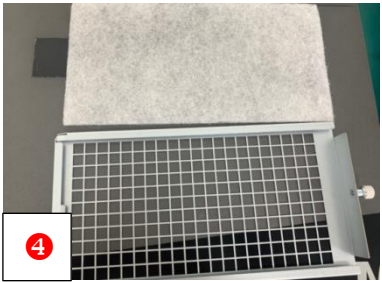
### 2.2.1.1 Visual check

	Item	Remark	Qty.
Area to check	Check the Control Box	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check for damage on the shell.</li> <li>2. Check for damage on the serial number label</li> <li>3. Check for damage on the warning and safety labels.</li> <li>4. Check for damage on the RTX certificate label.</li> </ol>	<p>The image shows the rear panel of a control box. Red arrows point to four specific areas: the top surface (labeled 'Shell Inspection Dust Cleaning'), a yellow warning triangle on the left (labeled 'Warning, Safety labels'), a license label at the bottom center (labeled 'RTX License Label'), and a serial number label at the bottom right (labeled 'S/N Label').</p>		

### 2.2.1.2 External connection

	Item	Remark	Qty.
Area to check	Check the connection status of the power cord and different devices	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check if the power cord is properly plugged.</li> <li>2. Check if the IO device is properly attached.</li> <li>3. Check if the communication device is properly attached.</li> <li>4. Check if the external camera is properly attached.</li> </ol>	<p>The image shows the rear panel of a control box with various external connections. Red arrows point to five specific areas: an Ethernet port at the top right (labeled 'Ethernet Slave'), a power cord on the left (labeled 'Power Cord'), a communication device in the center (labeled 'Communication Device'), an IO device on the right (labeled 'IO Device'), and an external camera at the bottom right (labeled 'External camera').</p>		

### 2.2.1.3 Filter

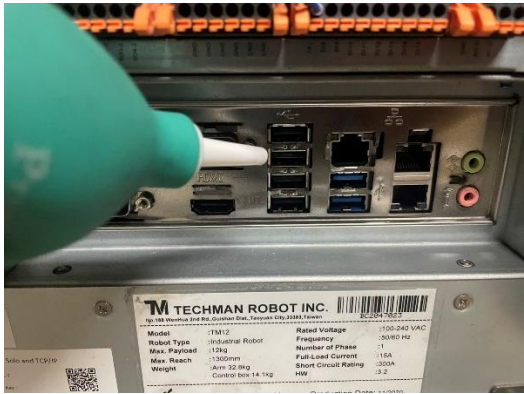
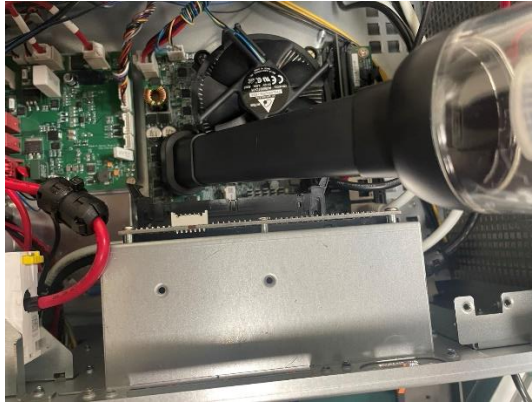
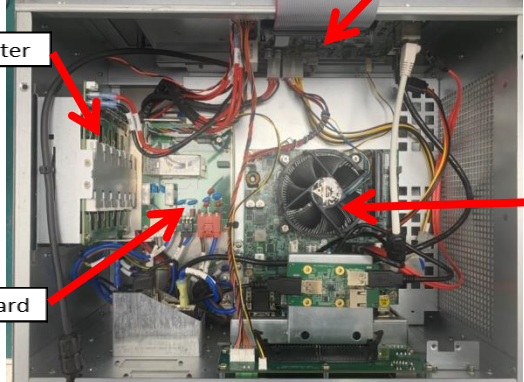
	Item	Remark	Qty.
Area to check	Change the filter	N/A	N/A
Tool	N/A	N/A	N/A
<ol style="list-style-type: none"> <li>1. Remove the rubber band.</li> <li>2. Remove the screws from the filter.</li> <li>3. Remove the filter along with the shell.</li> <li>4. Install a replacement filter.</li> <li>5. Contact Techman Robot for a replacement filter.</li> </ol>		  	



2.2.1.4 Internal connection\*

	Item	Remark	Qty.
Area to check	Check the connection status of different cables	N/A	N/A
Tool	T20 wrench	N/A	N/A
<ol style="list-style-type: none"> <li>1. Power Control Board °</li> <li>2. IPC °</li> <li>3. Power eater</li> <li>4. Power Supply 24V °</li> <li>5. Power Supply 48V °</li> <li>6. Relay Board °</li> <li>7. SSD °</li> <li>8. Stick °</li> <li>9. LCM Display °</li> </ol>	<p>The images show the internal components of a device with red arrows pointing to specific parts. The top image shows the LCM Display and SSD SATA Cable. The middle image shows the Power Eater, Relay Board, Power Control Board, Stick, and IPC. The bottom image shows the Power Supply 24V and Power Supply 48V.</p>		

### 2.2.1.5 Cleaning off dust

	Item	Remark	Qty.
Area to check	Cleaning the inner and outer parts of the Control Box	N/A	N/A
Tool	Mini vacuum or hand blower	N/A	N/A
1. Use a hand blower or mini vacuum to clean the dust off the inner parts of the Control Box			
2. Use hand blower or mini vacuum to clean the dust off the outer parts of the Control Box			
<ul style="list-style-type: none"> <li>● IPC (including the fan)</li> <li>● Power eater</li> <li>● Relay Board</li> </ul>			
Power Control Board			
			

2.2.1.6 IPC\*

	Item	Remark	Qty.										
Area to check	Change the button cell and remove the jumper	N/A	N/A										
Tool	T20 wrench	N/A	N/A										
<ol style="list-style-type: none"> <li>1. Open the top cover of the Control Box and find the IPC.</li> <li>2. Change the button cell (<i>i.e.</i>, the two-pin CR2032 cell).</li> <li>3. Check the IPC version: remove the jumper if the version is C or below, or keep the jumper if the version is D.</li> </ol>	<table border="1" data-bbox="678 817 790 907"> <thead> <tr> <th>HW Version</th> <th>Code</th> </tr> </thead> <tbody> <tr> <td>VER A</td> <td>10xx</td> </tr> <tr> <td>VER B</td> <td>20xx</td> </tr> <tr> <td>VER C</td> <td>30xx</td> </tr> <tr> <td>VER D</td> <td>40xx</td> </tr> </tbody> </table>			HW Version	Code	VER A	10xx	VER B	20xx	VER C	30xx	VER D	40xx
HW Version	Code												
VER A	10xx												
VER B	20xx												
VER C	30xx												
VER D	40xx												

### 2.2.2 Checking the Control Box (when it is switched on)

See the table below for instructions on maintaining the Control Box preventively when it is switched:

Item	Area to check	Duration	Every month	Every 6 months	Every year
Backup	Export projects, TCPs, commands, components, and global variables	10 min	✓		
Power supply	<ol style="list-style-type: none"> <li>1. Check if the LCM Display works at 48 V (in the operation mode)</li> <li>2. Check if the LCM Display works at 43 V (in the pre-operation mode)</li> </ol>	5 min	✓		
Robot Stick	Buttons	10 min	✓		
I/O ports	Check the I/O functionality of the Control Box	15 min		✓	

\*Please have your robot serviced by an authorized dealer or service center and avoid doing so on your own

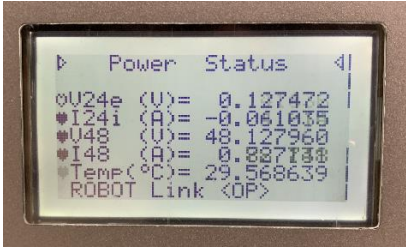
#### 2.2.2.1 Backup

- Export projects, TCPs, commands, components, and global variables

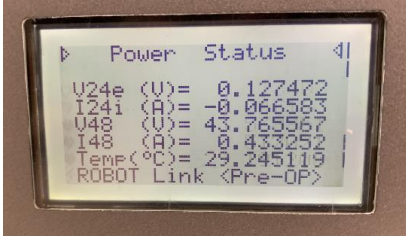
	Item	Remark	Qty.
Area to check	Export projects, TCPs, commands, components, and global variables	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Name a USB drive "TMROBOT" and format the drive in NTFS.</li> <li>2. Click <b>Robot Setting</b> → <b>Import/Export</b>.</li> <li>3. Export projects, TCPs, commands, components, and global variables.</li> <li>4. Select a file from <b>Select files</b>, add it to <b>Selected Files</b>, and click <b>Export</b> to export the file.</li> </ol>			

#### 2.2.2.1 Power supply

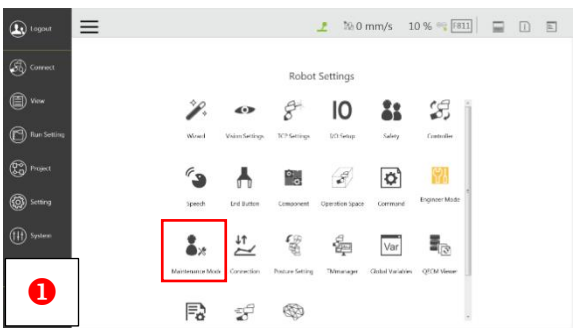
- Check if the LCM Display works at 48 V (in the operation mode)

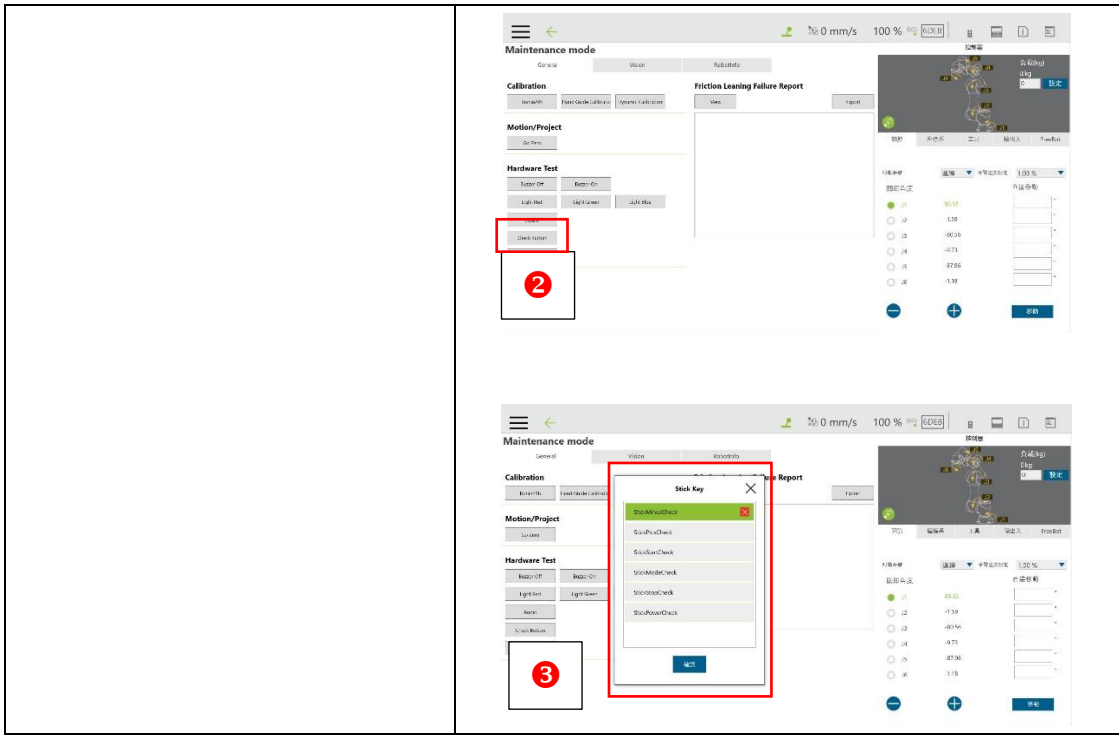
	Item	Remark	Qty.
Area to check	Check if the LCM Display works at 48 V (in the operation mode)	N/A	N/A
Tool	Visual check	N/A	N/A
<p>After the Robot starts up, check if the LCM Display works at 48 V (in the operation mode). Troubleshoot if the voltage is lower than 48 V or higher than 49 V.</p>			

- Check if the LCM Display works at 42–43 V (in the pre-operation mode)

	Item	Remark	Qty.
Area to check	Check if the LCM Display works at 42–43 V (in the pre-operation mode)	N/A	N/A
Tool	Visual check	N/A	N/A
<p>After the Robot starts up, check if the LCM Display works at 42–43 V (in the pre-operation mode). Troubleshoot if the voltage is lower than 42 V or higher than 43 V.</p>			

### 2.2.2.2 Robot Stick

	Item	Remark	Qty.
Area to check	Go to <b>Maintenance Mode</b> and use <b>Check Button</b> to examine if the buttons on the Robot Stick work properly.	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Go to <b>Maintenance Mode</b>.</li> <li>2. Click <b>Check Button</b>.</li> <li>3. Press the buttons on the Robot Stick in the order as instructed and check if the buttons work properly.</li> <li>4. If any of the buttons goes wrong, use a new Robot Stick.</li> </ol>			





### 2.2.2.3 I/O ports

	Item	Remark	Qty.
Area to check	I/O ports	N/A	N/A
Tool	Visual check	N/A	N/A
<ol style="list-style-type: none"> <li>1. Check for damage on I/O ports.</li> <li>2. Check if the safety I/O port is loose.</li> <li>3. Connect DI and DO ports.</li> <li>4. Open the Controller of TMflow.</li> <li>5. Click <b>IO</b>.</li> <li>6. Set DO ports to High and check if their corresponding DI ports have also been set to High.</li> <li>7. If not, check the signal input and output of IO ports.</li> </ol>			

## 2.3 Log Check

Log Check is a method of value-added analysis that allows the user to examine their use of the Robot and estimate the lifetime of its components. If you need to run Log Check, collect logs and contact Techman Robot.



**Warning:**

Before maintenance, keep in mind the Robot's configurations when it operates normally. After maintenance, make sure all the configurations are reverted and start using the Robot.







These configurations include but are not limited to the following:

- Safety software settings
- Safety IO
- Default project for execution
- TCP settings
- IO connection








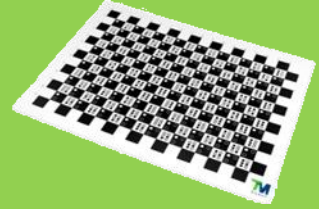

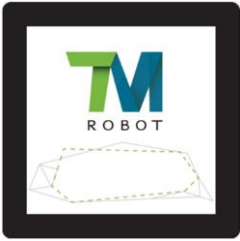

### 3. Tool list

Item	Photo	Specs	Unit	ID No.	Remark
Open-end wrench		5.5 mm	Pc.		Used to tighten the screws (M3L14) of the 100-series joints
Open-end wrench		8 mm	Pc.		Used to tighten the screws (M5L20) of the 400-series joints
Open-end wrench		10 mm	件		Used to tighten the screws (M6L20) of the 700-series joints
Hex socket screwdriver		5.5 mm	Pc.		Used to tighten hexagon screws (M3L14) with nylok patch (for the 100-series joints)
Hex socket screwdriver		8 mm	Pc.		Used to tighten hexagon screws (M5L20) with nylok patch (for the 400-series joints)
Hex socket screwdriver		10 mm	件		Used to tighten hexagon screws (M6L20) with nylok patch (for the 700-series joints)
Open torque wrench		5.5 mm 20 kgf-cm	Pc.	TOHNI CHI 50CL-MH	Used to tighten the hexagon screws (M3L14) of the 100-series joints
Open torque wrench accessory		SH8D × 5.5 5.5 mm	Pc.	TOHNI CHI SH8D*5.5	Used to tighten the hexagon screws (M3L14) of the 100-series joints
Open torque wrench		8 mm 92 kgf-cm	Pc.	TOHNI CHI 150CL-MH	Used to tighten the hexagon screws (M5L20) of the 400-series joints
Open torque wrench accessory		SH8D × 8 8 mm	Pc.	TOHNI CHI SH8D*8	Used to tighten the hexagon screws (M5L20) of the 400-series joints
Open torque wrench		10 mm 150 kgf-cm	件	TOHNI CHI 225CL-MH	Used to tighten hexagon screws (M6L20) with nylok patch (for the 700-series joints)

Item	Photo	Specs	Unit	ID No.	Remark
Open torque wrench accessory		SH10D × 10 10 mm	件	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	Pc.	TOHNICHI 12RTD	Used to fasten the cover and the Control Box
Torx socket torque screwdriver accessory		S2 T20 × 50 mm	Pc.	Alstrong BIT 50 mm	Torque screwdriver adapter (TM5II, 12, 14)
Torx socket torque screwdriver accessory		S2 T10 × 50 mm	Pc.	Alstrong BIT 50 mm	Torque screwdriver adapter (TM5II, 12, 14)
Straight hex torque driver		BIT 10 mm	Pc.	TOHNICHI BIT 100 mm	Torque screwdriver adapter (TM5)
Hex wrenches		M1.5–M10	Set		Used to secure the Robot Base
Pin gauge		∅1.9mm	Pc.		Used to check if joints are secured in the correct positions during assembly or maintenance
Philips		Common length	Pc.		Used to secure the inner parts of the Control Box
Diagonal pliers			Pc.		Used to cut cable ties

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

Item	Photo	Specs	Unit	ID No.	Remark
VGA to HDMI connector			Set		Used to connect the monitor
Roll-up tool bag		34.34*58.5	Pc.		Used to collect and organize tools
Portable screw box		135 × 200 × 39	Pc.		Used to store screws for maintenance
Spirit level		SPLA PTM520	Pc.		Used to measure the Robot's levelness
Precision screwdriver		T06151	Set		Used to remove screws
Tweezers			Pc.		Used to pick up cables and wires
Adjustable wrench		8"	Pc.		Used to secure the Robot to the calibration platform
Scissors			Pc.		Used to cut cable ties
Acetate cloth tape		18-mm-wide	Pc.		Used to wrap the connector of the Camera Cable
Flashlight			Pc.		Used to illuminate the inner parts of the Control Box or examine the inside of the joints

Item	Photo	Specs	Unit	ID No.	Remark
Hand blower			Pc.		Used to clean the inner parts of the Control Box
Security USB Robot Stick		Write protection	Pc.		For Windows system recovery
Dongle			Pc.	Techman Robot	Engineer mode included
E-Bus cable		792-0000101A-AR0 970 mm	Pc.	Techman Robot	Used to check joint connection errors
Large calibration board		40 cm × 30 cm	Sheet	Techman Robot	For camera calibration
Small calibration board		20 cm × 15 cm	Sheet	Techman Robot	For camera calibration
TM Landmark		Length: 5 cm Width: 5 cm Thickness: 5 mm	Sheet	Techman Robot	For Denavit–Hartenberg (DH) calibration
Hand-eye calibration board			Sheet	Techman Robot	For hand-eye calibration

## 4. Disassembling and Assembling the Robot

### 4.1 Quick maintenance 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.  
 X: No need to be done.

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

### 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:

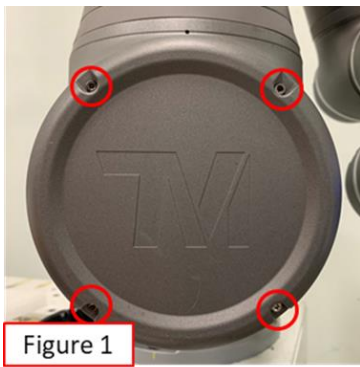
If tightened with less torque than needed, the joint covers cannot be adequately sealed. If tightened with more torque than needed, the covers may be broken.

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:

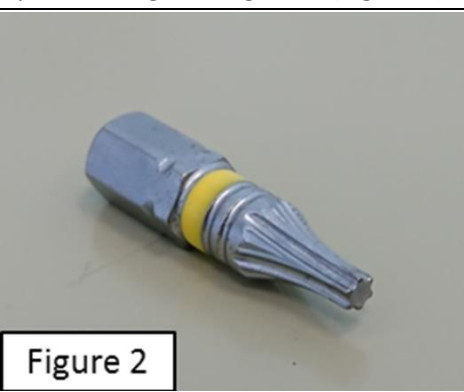
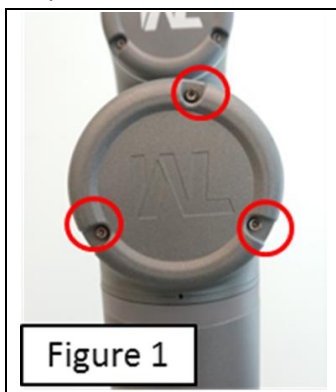
- Use the S2 Torx socket torque screwdriver (Figure 2) remove the four screws from the cover (Figure 1).
- Gently take off the cover and keep the O-ring in the groove (Figure 3).





#### 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).



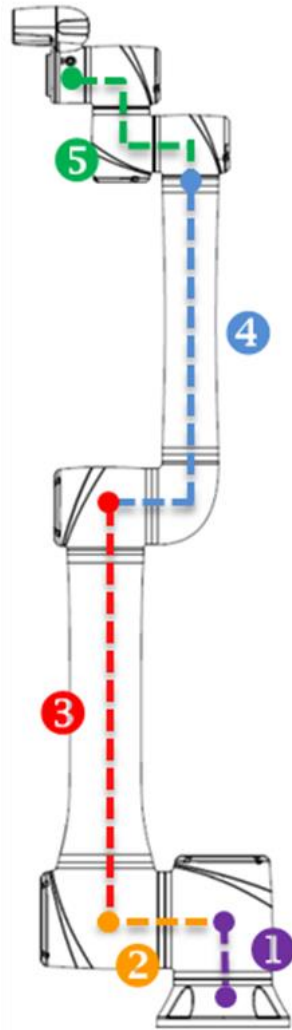
#### 4.7 Removing the rubber band

Use a tweezer to pry off the rubber band.

- Avoid damaging 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 tweezers (Figure 3) (Figure 4).



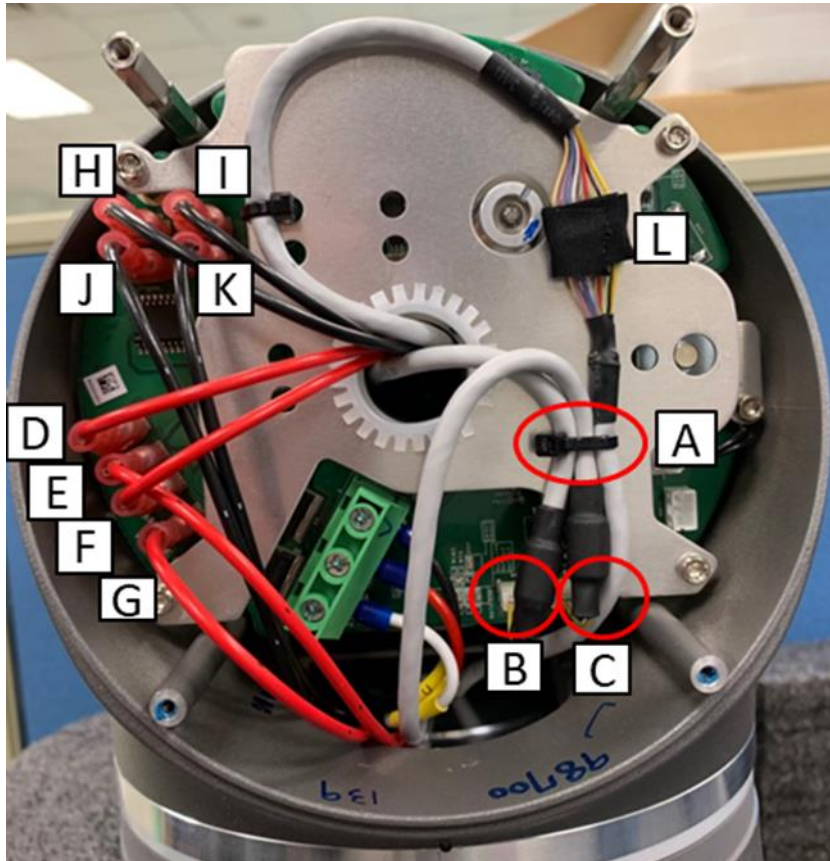
#### 4.8 Location of the Camera Cable





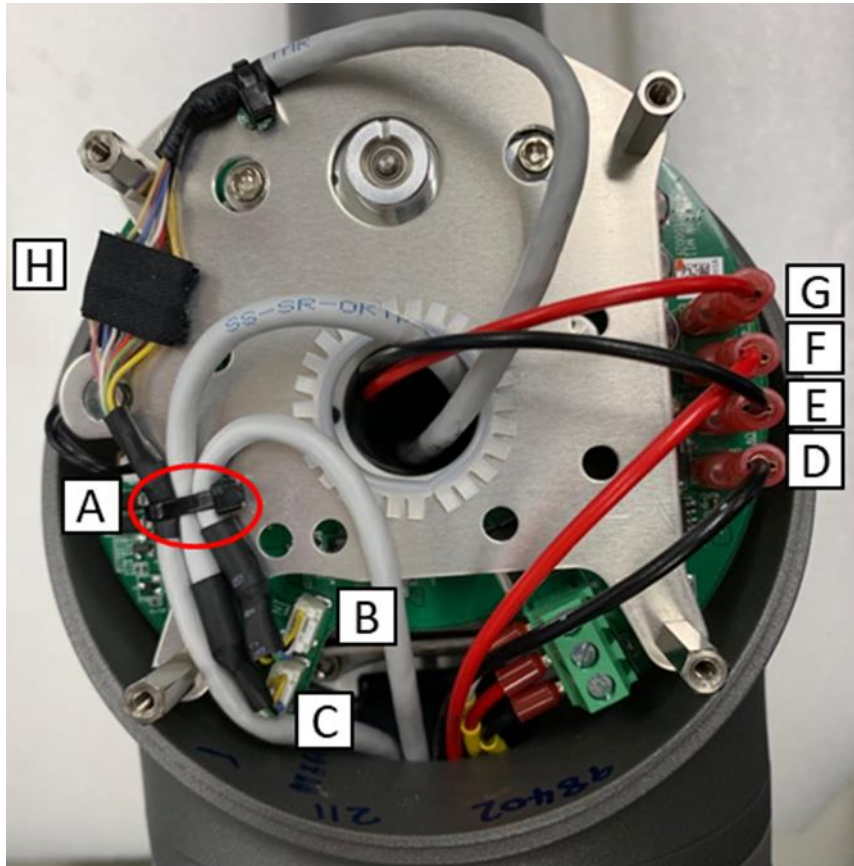
#### 4.9 Cables of the 700-series joint

- 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).



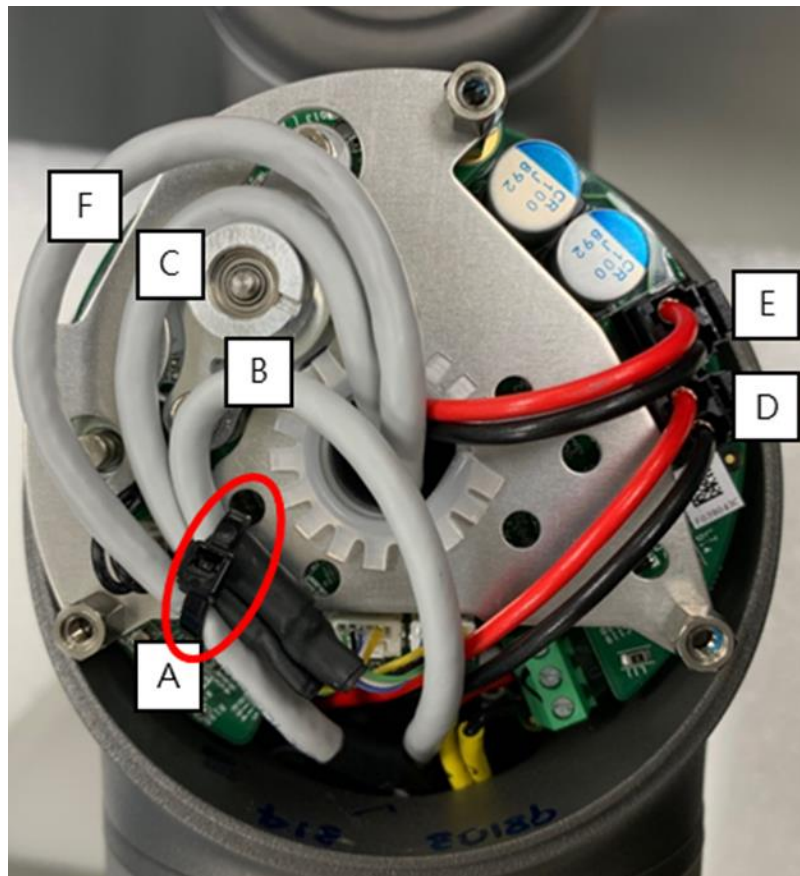
#### 4.10 Cables of the 400-series joint

- 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)



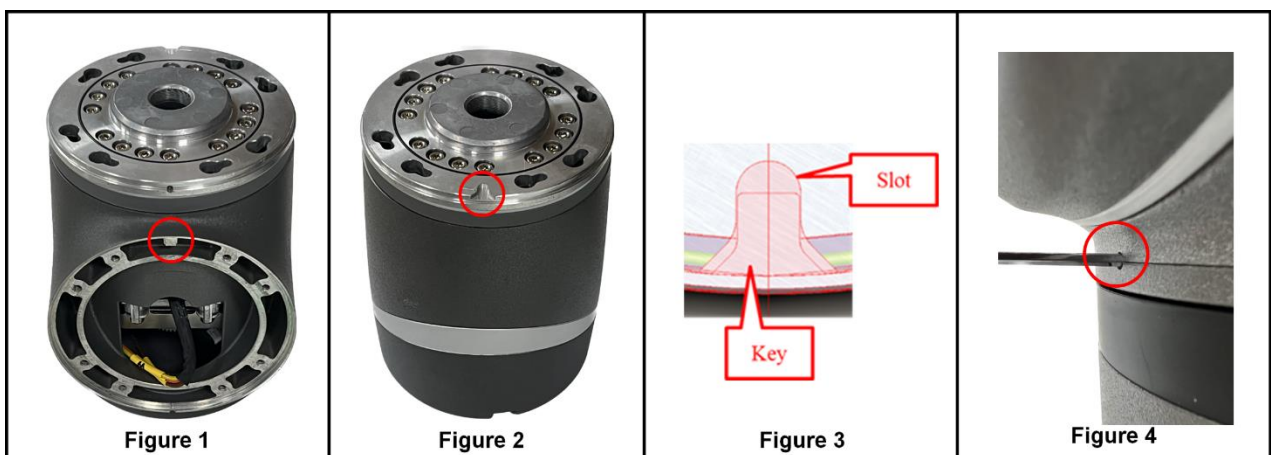
4.12.4 Repeated use of disassembled screws is prohibited, as the screw adhesive on the screws will become ineffective, and the repeated use will increase unforeseen risks.

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.



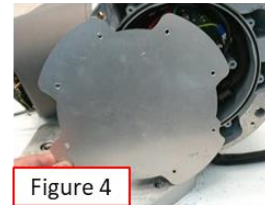
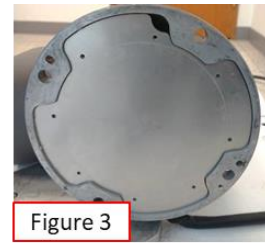


## 4.13 Disassembling/Assembling the Base

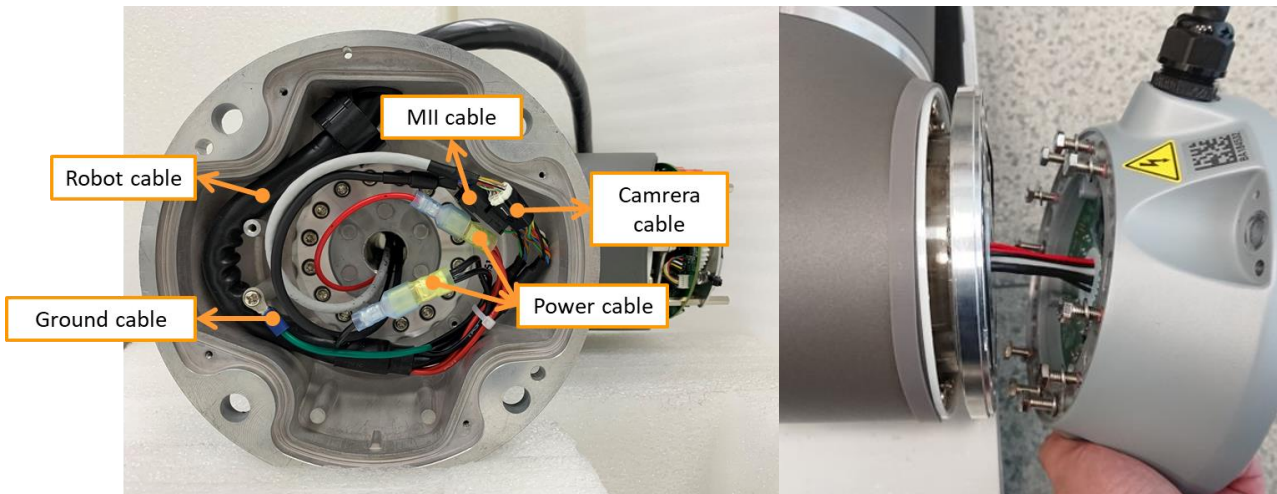
4.13.1 Put the Robot on the workstand (Figure 1)

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

4.13.3 Remove the Base cover (Figure 4)



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/Disassembling 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.



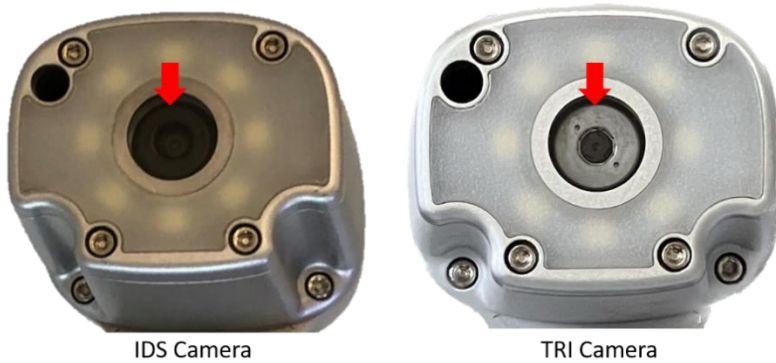
- 4.20.2 Unplug the power cable of the light source module and remove the light source module, being careful not to let the O-ring fall off.



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, disassembly, and assembly. The image below distinguishes between the two cameras.

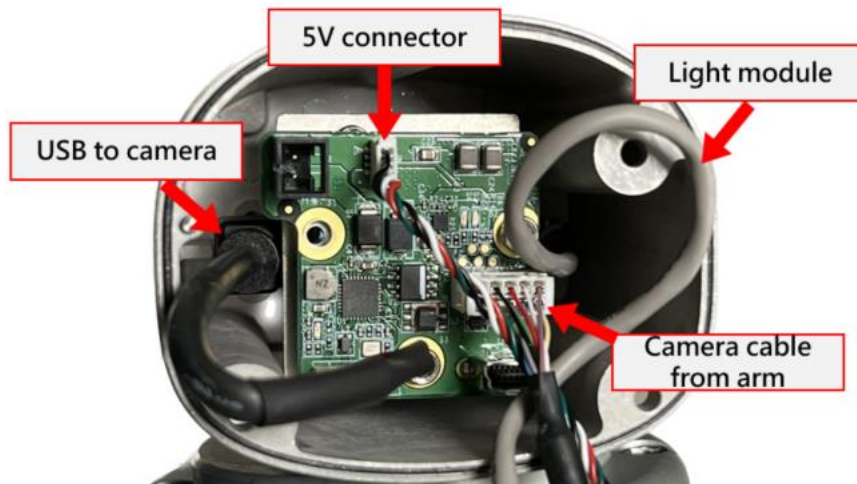


#### 4.22 Disassembling the IDS Camera

4.22.1 Disassembling 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.



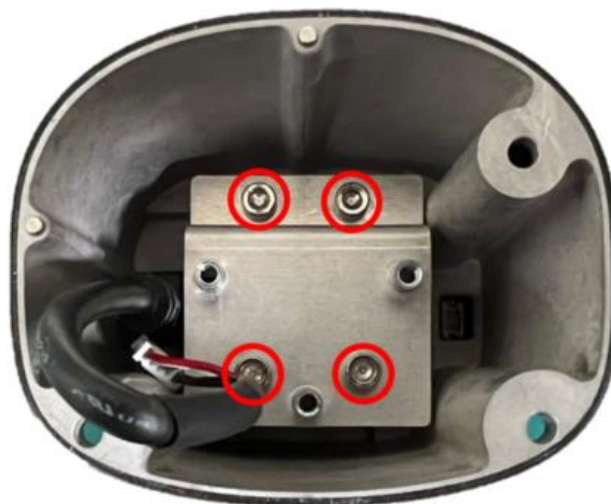
4.22.2 Disconnect all the cables shown in the image below.



4.22.3 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.



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



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



4.22.6 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.

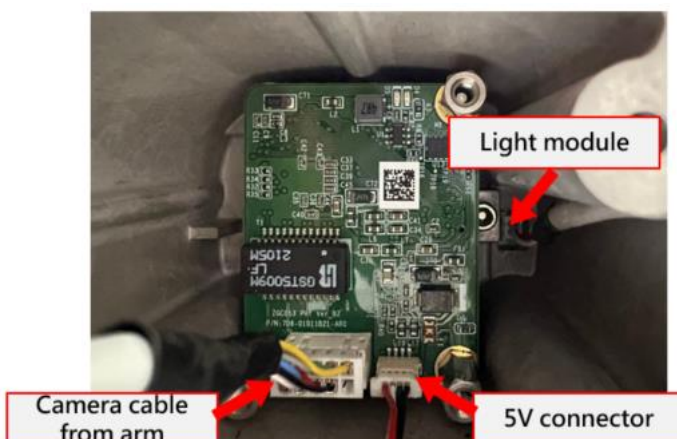


#### 4.23 Disassembling the TRI Camera

4.23.1 Disassembling 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.



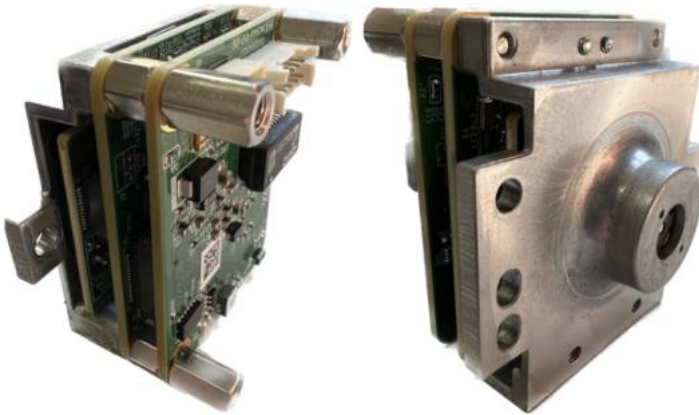
4.23.2 Disconnect all the cables shown in the image below.



4.23.3 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.



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

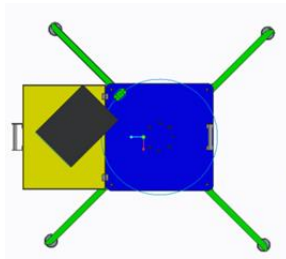
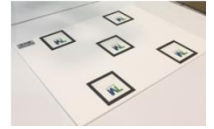
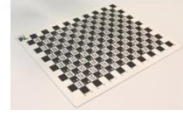


## 5. Calibrate the robot in maintenance mode

Note: If using hand-guide teaching points with the X version robots, it does not require calibration.

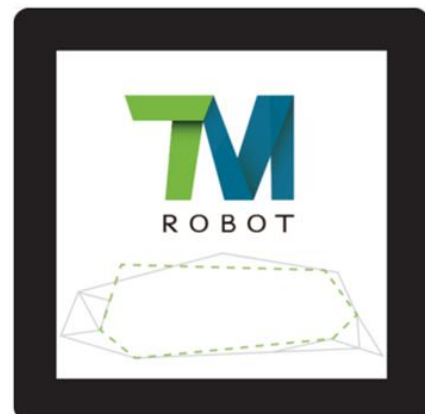
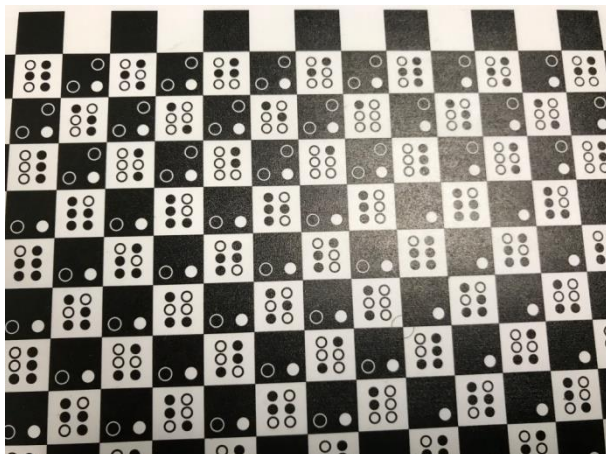
### 5.1 Required Tools

1. USB Dongle: For engineering mode activation.
2. Calibration Plate Set: The set comes with one large and one small calibration plate.
3. Landmark °
4. Landmark Calibration Plate
5. Calibration Platform



### 5.2 Inspect the Calibration Plate

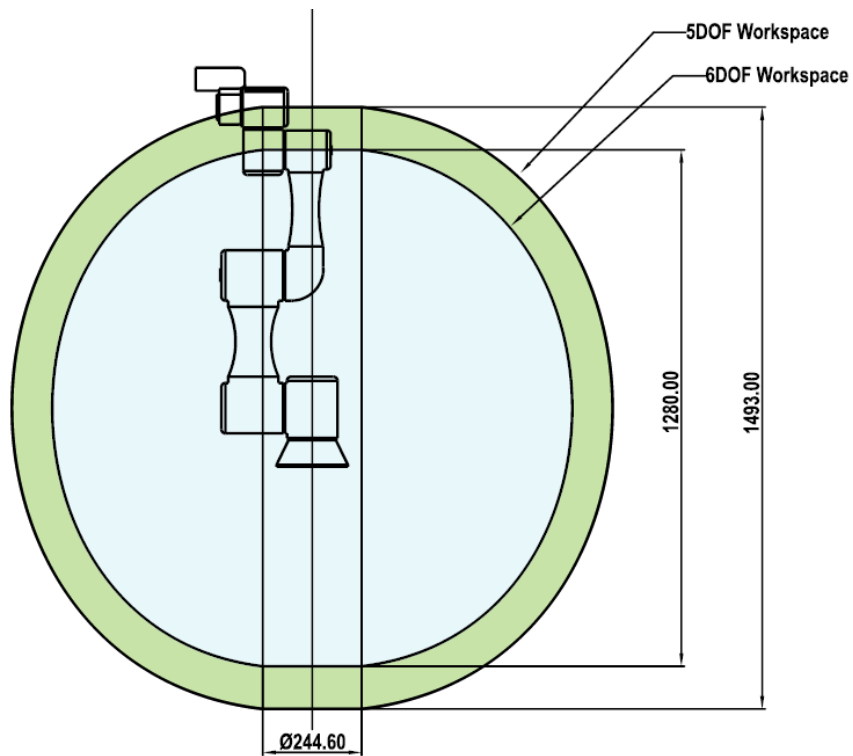
Inspect whether the frame of the calibration plate is intact or damaged.



### 5.3 Before Calibration

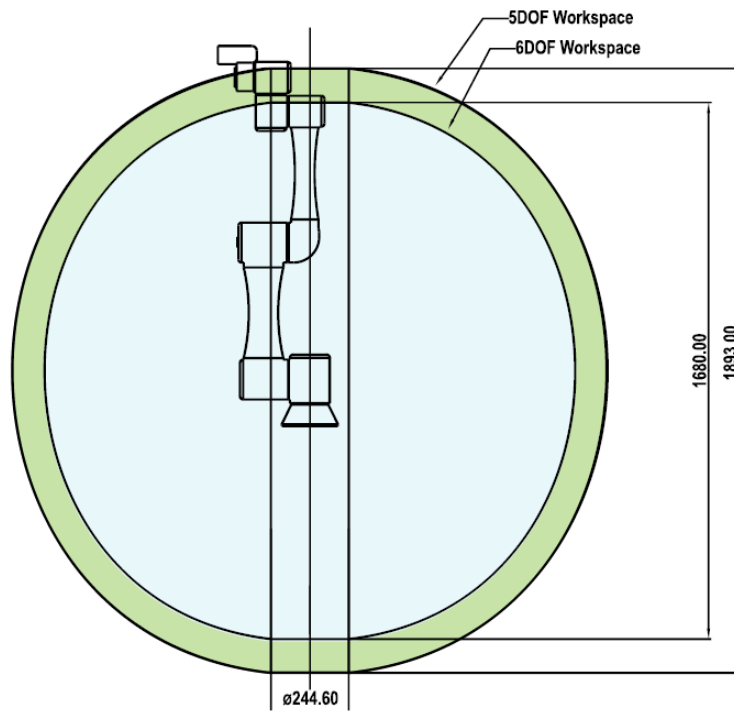
#### 5.3.1 TM12/TM12M

Remove the tools and the grip and ensure the workspace is clear.



#### 5.3.2 TM14/TM14M

Remove the tools and the grip and ensure the workspace is clear.

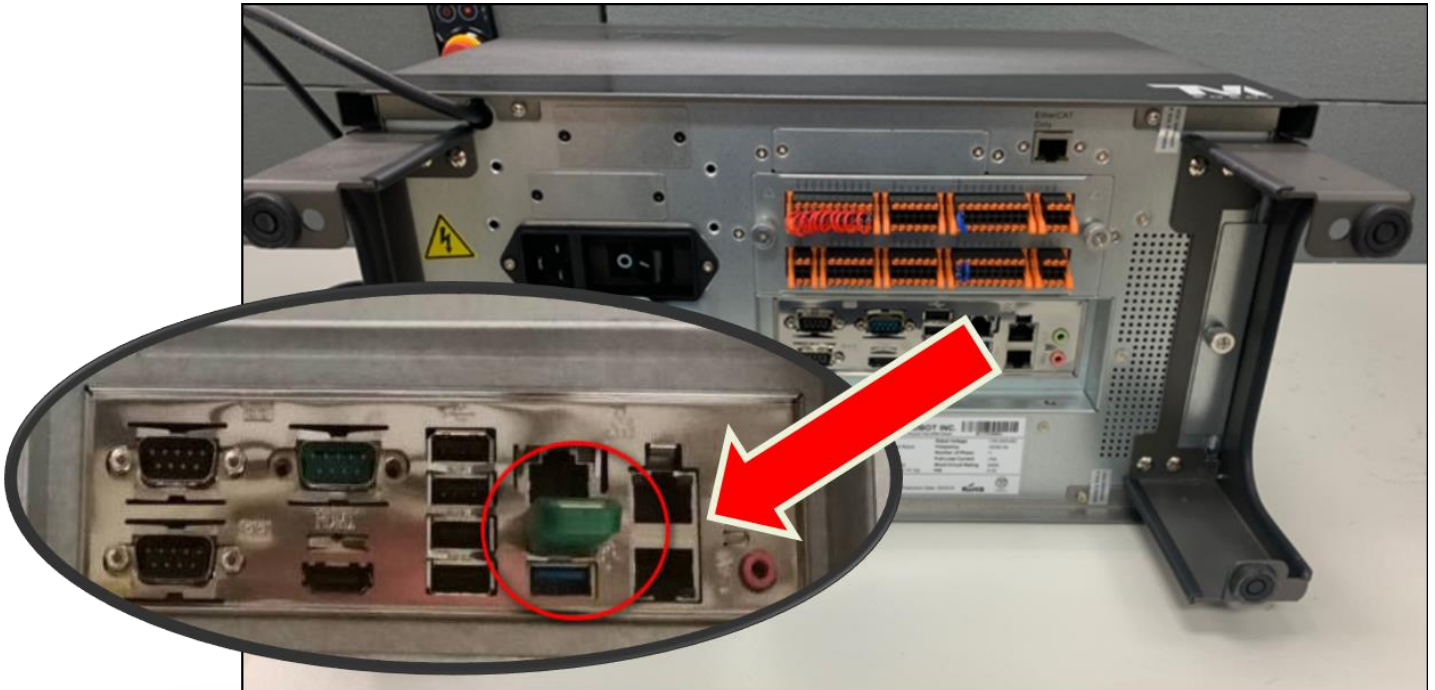


### 5.4 Maintenance Mode



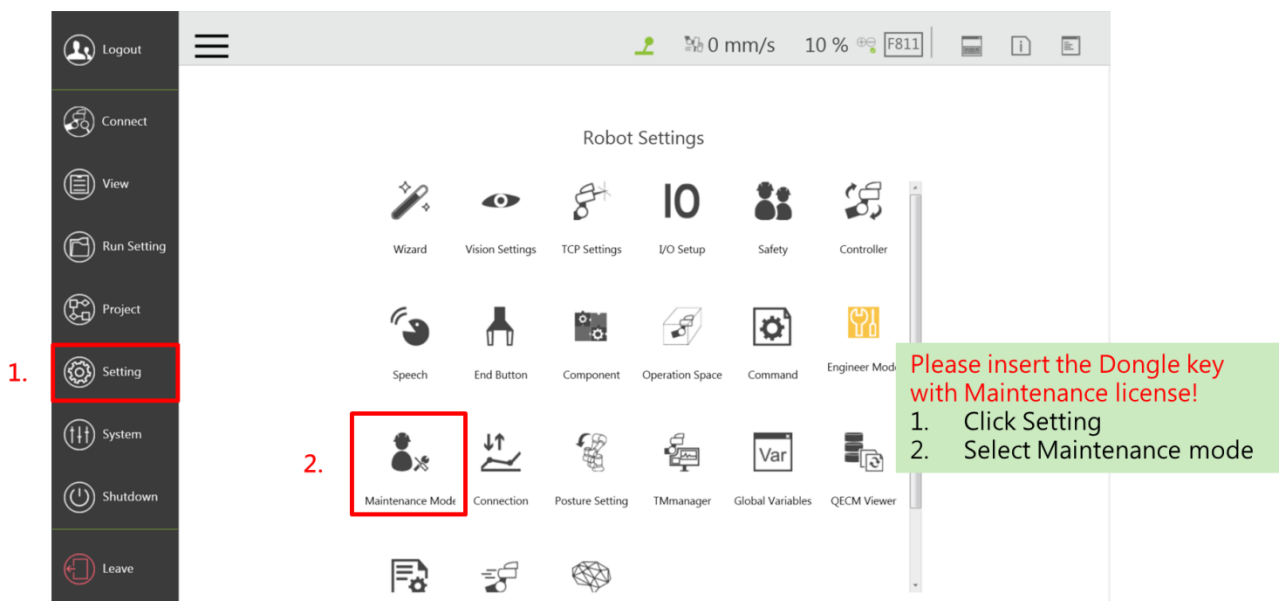
### 5.4.1 Maintenance Mode home page & Hardware Examination

- It requires a Techman Robot USB Dongle to activate the engineering mode.
- Insert the USB dongle into the USB port of the control box before turning it on.



### 5.4.2 Insert the USB dongle with the maintenance certificate

1. Click **Setting**.
2. Select **Maintenance Mode**.



### 5.4.3 Maintenance Mode Home Page

**Maintenance mode**

General | Vision | RobotInfo

**Calibration**

Runin24h | **Hand Guide Calibrat** | **Dynamic Calibration** | View | Export

**Motion/Project**

**Go Zero**

**Hardware Test**

Buzzer Off | Buzzer On

Light Red | Light Green | Light Blue

Audio

Check Button

Check DiskDrive

**Friction Learning Failure Report**

View | Export

**Controller**

Joint | Base | Tool | IO | FreeBot

Joint Angle

J1	0.00
J2	0.00
J3	90.00
J4	0.00
J5	90.00
J6	0.00

Direct Move

[-] [+] Move

0 mm/s 100 % F811

Payload (kg) 0 kg Set

Jog Distance Continuous Speed 1.00 %

### 5.4.4 Hardware Examination: Check Button

**Maintenance mode**

General | Vision | RobotInfo

**Calibration**

Runin24h | Hand Guide Calibrat | Dynamic Calibration | View | Export

**Motion/Project**

Go Zero

**Hardware Test**

Buzzer Off | Buzzer On

Light Red | Light Green

Audio

**Check Button**

Check DiskDrive

**Friction Learning Failure Report**

View | Export

**Stick Key**

- StickStopCheck
- StickStartCheck
- StickMinusCheck
- StickPlusCheck
- StickModeCheck
- StickPowerCheck

OK

**Controller**

Joint | Base | Tool | IO | FreeBot

Joint Angle

J1	0.00
----	------

Direct Move

[-] [+] Move

0 mm/s 100 % F811

Payload (kg) 0 kg Set

Jog Distance Continuous Speed 1.00 %

Power Indicator | Power Button | Mode Indicator Lights | M/A Mode Switch Button | Button | QR Code Label | Play/Pause Button | Stop Button | Speed Indicator | Emergency Switch

### 5.4.5 Robot Information

**Maintenance mode**

General | Vision | **RobotInfo**

**Robot ID**  
BC1943015

**Equipment Data**

```
Sys_48V_Voltage :48.11983
Sys_48V_Current :0.3938685
Sys_48V_Consumption :18.95289
Sys_24V_Voltage :24.1
Sys_24V_Current :0.0009155273
Sys_24V_Consumption :0.02206421
IO_24V_Voltage :0
IO_24V_Current1 :0.06346153
IO_24V_Current2 :0
IO_24V_Current3 :0
System_Temp :29.40688
Driver_Temp : j1[44.9] j2[43.4] j3[45.3] j4[40] j5[39.3]
Sys_Net_PacketTransmitted :561941
Sys_Net_PacketTime :1364
Sys_Net_PacketRate :1000
Sys_Net_PacketLostErrorCount :0
Sys_Net_PacketCorruptErrorCount :0
```

**Version information**

```
Power:SafePowerManager.0
Power_HW:20180205-G3-000C.0
Power_FW:20191119-0000125.0
Power_ESL_Revision:00000012.0
Power_ESL_SN:002903ff.0
J0:AC Servo Driver_1
J0_HW:JT402_10040503.1
J0_FW:DX0218_20201112_1
J0_ESL_Revision:00000006.1
J0_ESL_SN:d02907c0.1
J0_Chassis_SN:95402596.1
J1:AC Servo Driver_2
J1_HW:JT402_10040503.2
J1_FW:DX0218_20201112_2
J1_ESL_Revision:00000006.2
J1_ESL_SN:d029058a.2
J1_Chassis_SN:96402242.2
J2:AC Servo Driver_3
J2_HW:JT402_10040503.3
J2_FW:DX0218_20201112_3
J2_ESL_Revision:00000006.3
J2_ESL_SN:d02908d1.3
J2_Chassis_SN:97402278.3
J3:AC Servo Driver_4
J3_HW:JT102_09050402.4
J3_FW:DX0218_20201112_4
J3_ESL_Revision:00000006.4
J3_ESL_SN:f02907bb.4
J3_Chassis_SN:98102020.4
J4:AC Servo Driver_5
J4_HW:JT102_09050402.5
J4_FW:DX0218_20201112_5
```

Export to File

Display Robot information Such as:  
Robot ID  
Firmware version  
And the current status of each components

## 5.5 Hand Guide Calibration

### 5.5.1 Hand Guide Calibration in Progress

**Calibration**

Runin24h | **1. Hand Guide Calibrati** | Dynamic Calibration

449 mm/s 100 % 6C80

Display Board @TMField\_HandGuideCalibration.prog

**2. Friction\_Test -> Running!**

Robot ID=BC1938001  
Result=-1  
total\_time=85100.349

```
system_temperature=30.59312
drv_temperature={28.6,28.8,43.6,38.3,8.7,39.6,0,0}
48VInfo={48.19505,1.087536}
24VInfo={24.1,0.0005901868}
IO24VInfo={0.02783294,0}
NetPacketInfo={173954,1387,1000.00018310547,0,0}
```

Wait for 1st vision task...

**Job Start Time**

**Job Name**

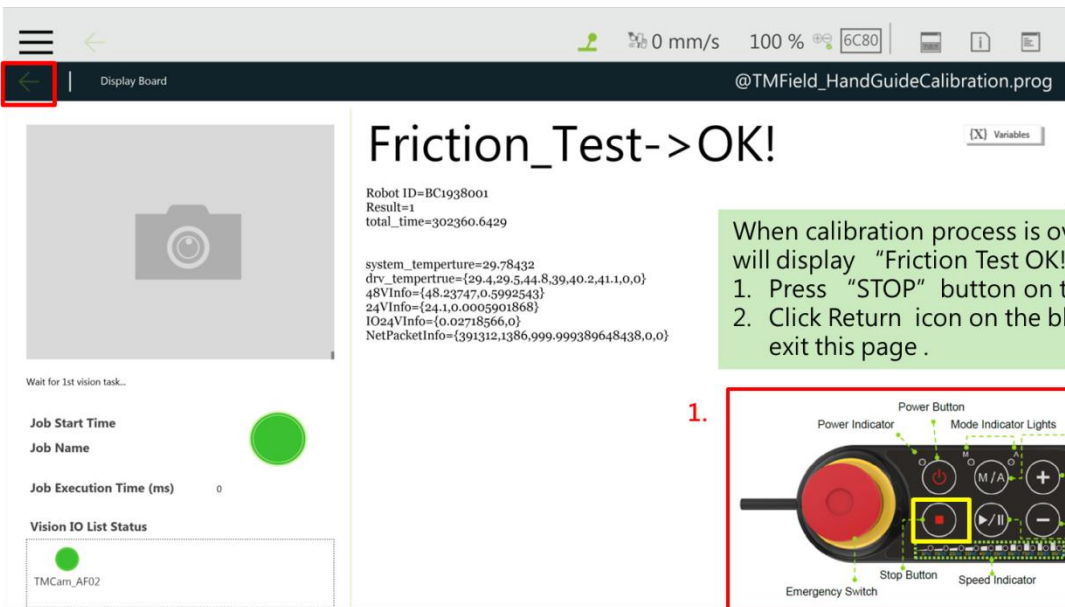
**Job Execution Time (ms)** 0

**Vision IO List Status**

TMCam\_AF02

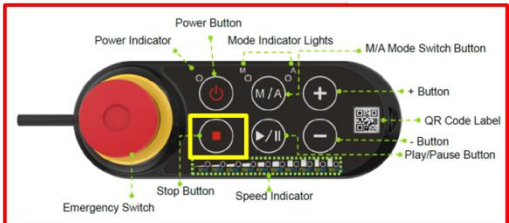
1. Select "Hand Guide calibration"  
2. Robot will executing "Hand Guide calibration project" and will switch to project page right away.

### 5.5.2 Hand Guide Calibration Finishes

2. 

When calibration process is over, project will display "Friction Test OK!"

1. Press "STOP" button on the stick.
2. Click Return icon on the black list to exit this page.

1. 

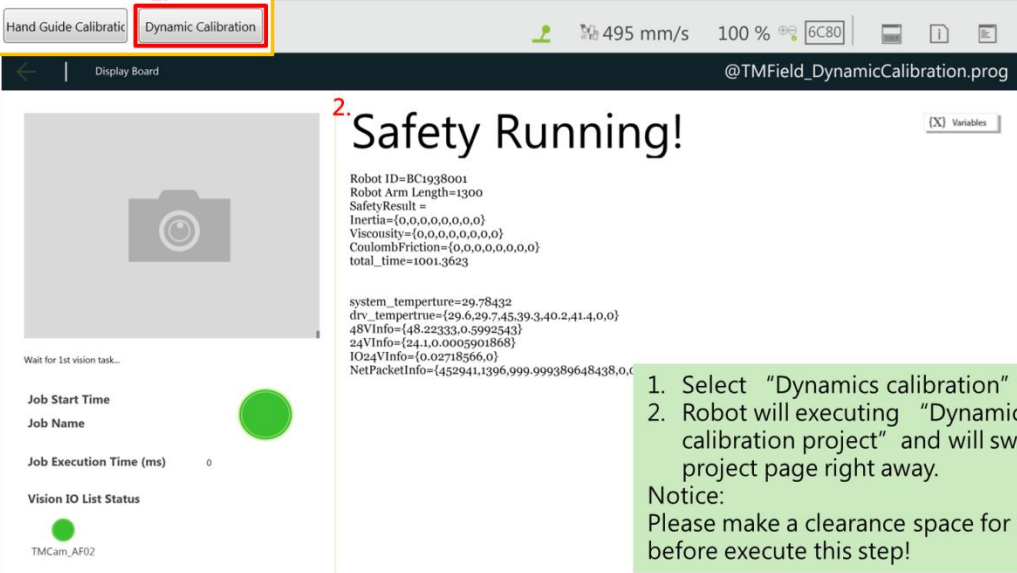
## 5.6 Dynamic Calibration

### 5.6.1 Dynamic Calibration in Progress

Calibration

Runin24h Hand Guide Calibratic **Dynamic Calibration** 1.

495 mm/s 100 % 6C80

2. 

1. Select "Dynamics calibration"

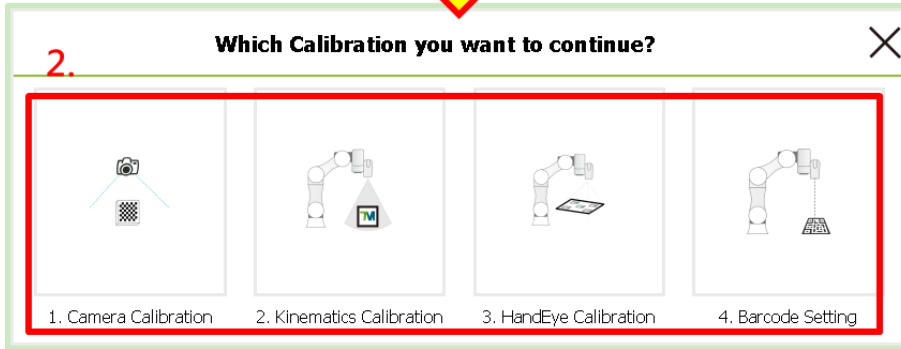
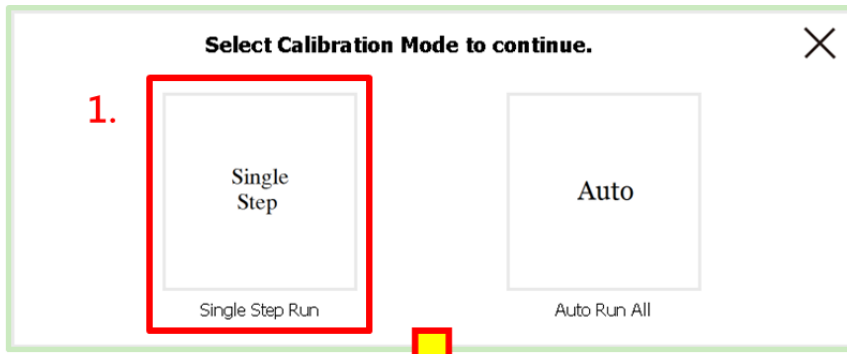
2. Robot will executing "Dynamics calibration project" and will switch to project page right away.

Notice:  
Please make a clearance space for robot before execute this step!

### 5.6.2 Dynamic Calibration Finishes

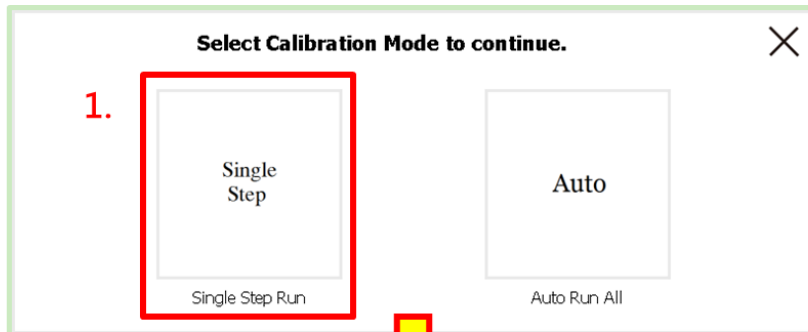






## 5.8 Camera Calibration

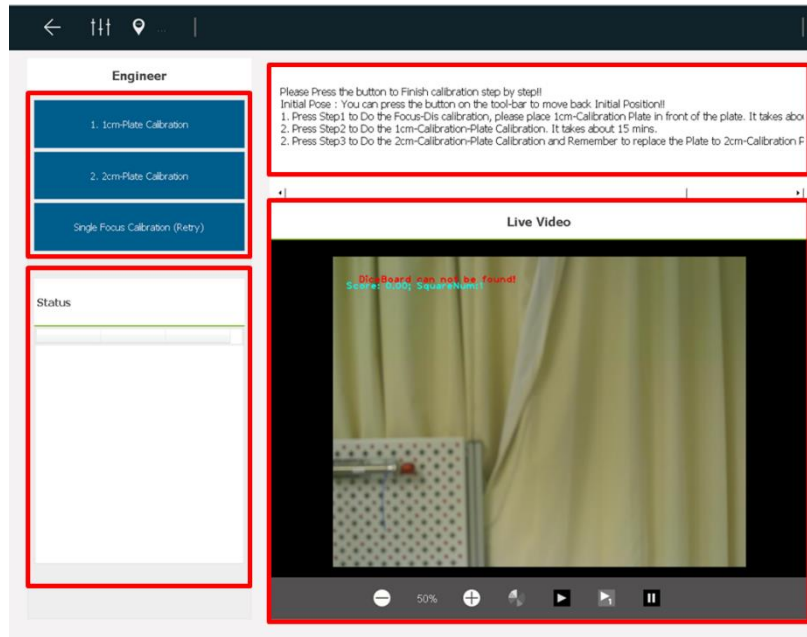
1. Select **Single Step**.
2. Select **1. Camera Calibration**.



### 5.8.1 Operation Interface Overview

操作項目

校正進度



步驟描述

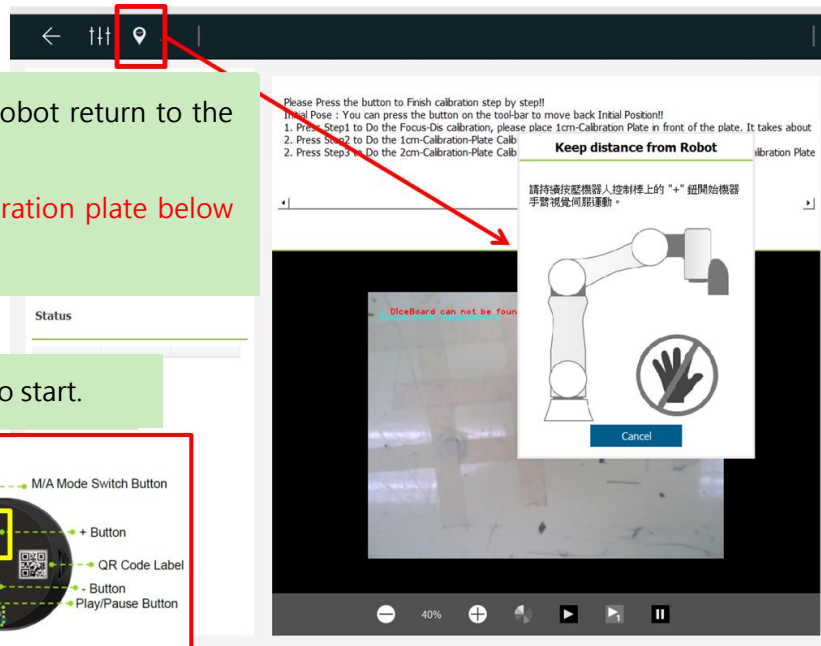
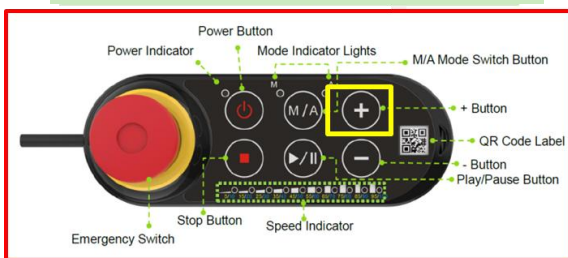
即時影像

### 5.8.2 Move to the Initial Pose

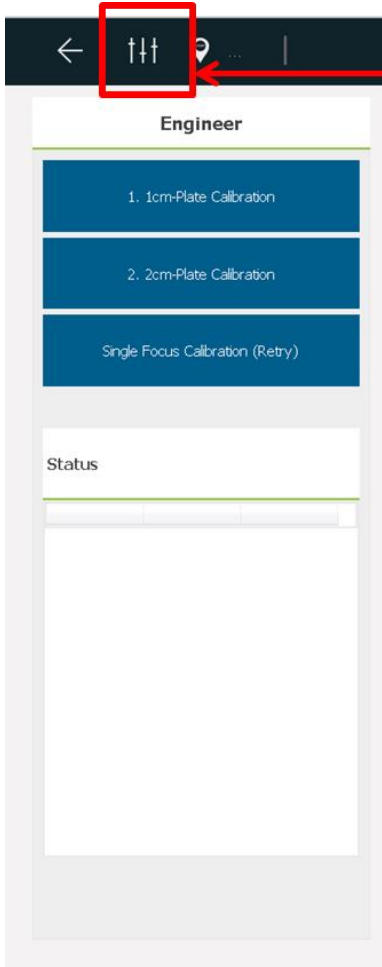
Click the icon to have the robot return to the initial pose immediately.

Please place the small calibration plate below the camera.

Press the + button to start.

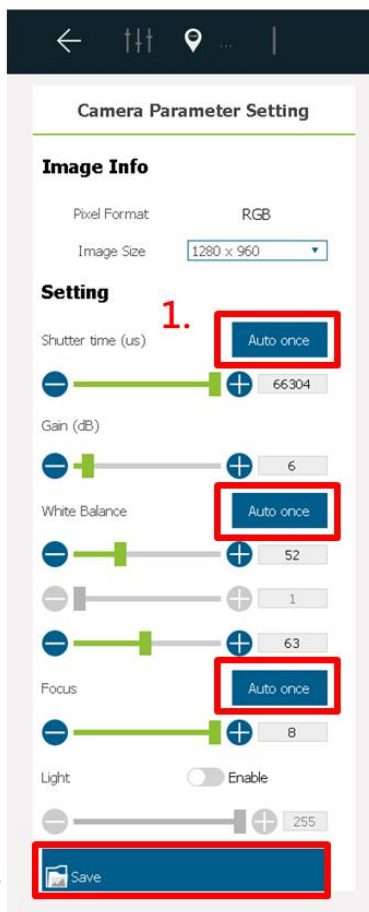
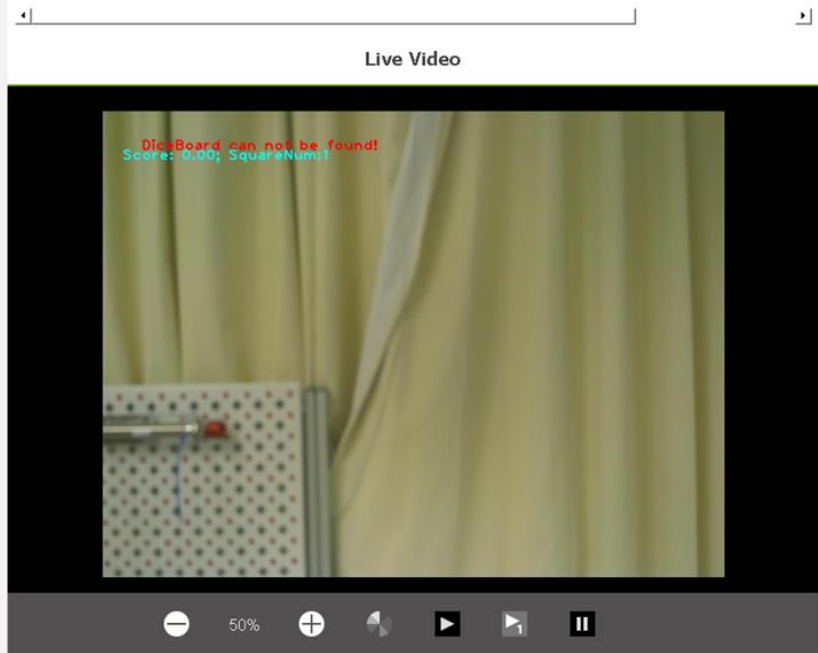


### 5.8.3 Set Camera Parameters



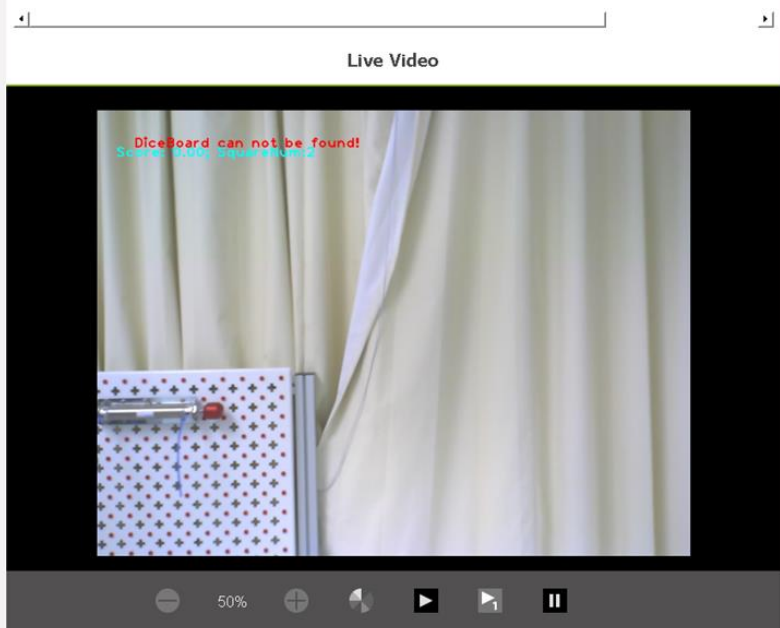
Before proceeding to calibration, users can set camera parameters.

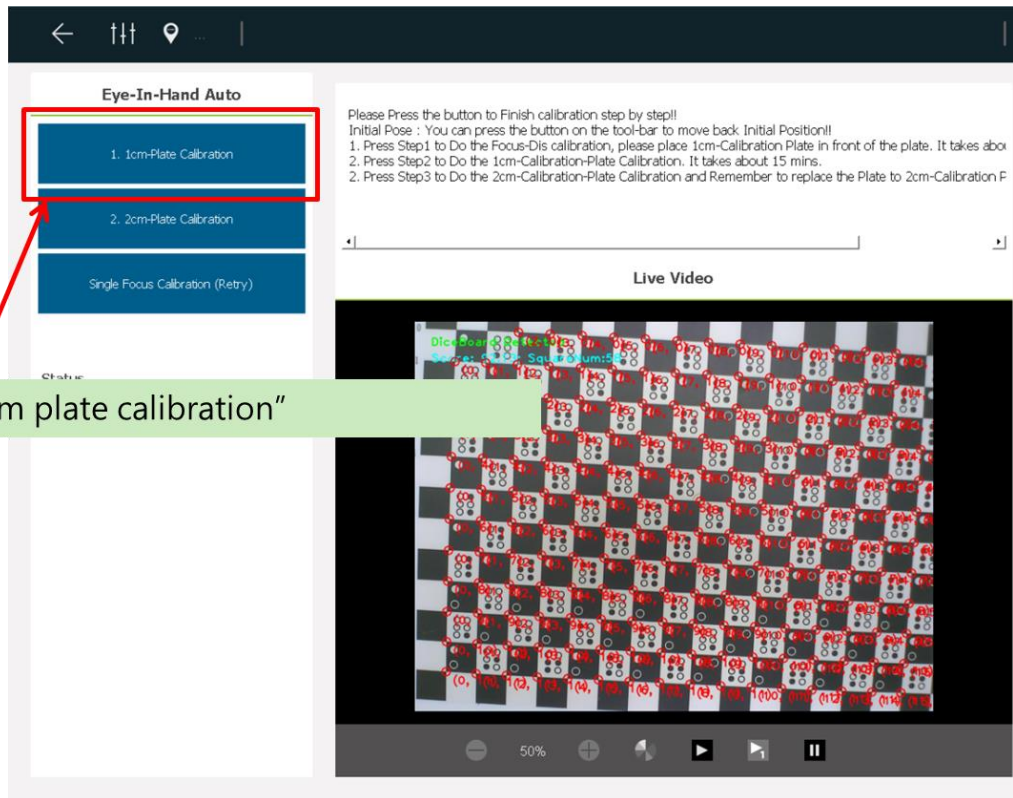
Please Press the button to Finish calibration step by step!!  
 Initial Pose : You can press the button on the tool-bar to move back Initial Position!!  
 1. Press Step1 to Do the Focus-Dice calibration, please place 1cm-Calibration Plate in front of the plate. It takes about 15 mins.  
 2. Press Step2 to Do the 1cm-Calibration-Plate Calibration. It takes about 15 mins.  
 2. Press Step3 to Do the 2cm-Calibration-Plate Calibration and Remember to replace the Plate to 2cm-Calibration P



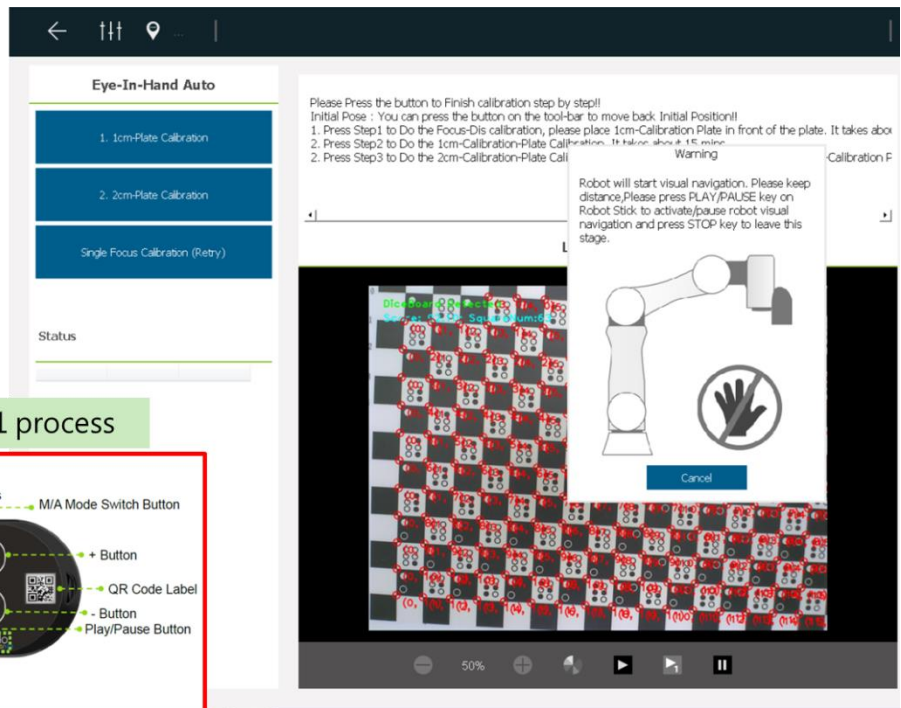
1. Click **Auto once** to set camera parameters automatically.
2. Click **Save** to save the setting.

1. Press Step1 to Do the Focus-Dice calibration, please place 1cm-Calibration Plate in front of the plate. It takes about 15 mins.  
 2. Press Step2 to Do the 1cm-Calibration-Plate Calibration. It takes about 15 mins.  
 2. Press Step3 to Do the 2cm-Calibration-Plate Calibration and Remember to replace the Plate to 2cm-Calibration P

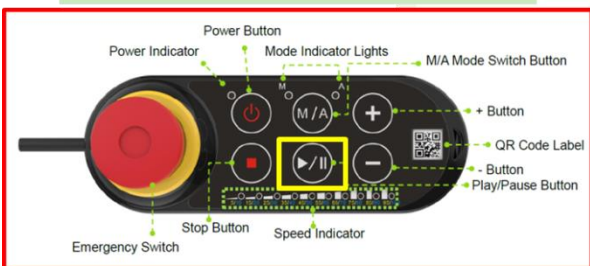




Select "1 cm plate calibration"



Press Play to start Step 1 process



Step 1: 1 cm plate calibration in progress

- 5M-Status: Proceed with dynamic calibration in 5M pixels.
- 1.2M-Status: Proceed with dynamic calibration in 1.2M pixels.

**Eye-In-Hand Auto**

1. 1cm-Plate Calibration
2. 2cm-Plate Calibration
- Single Focus Calibration (Retry)

Status

Height	5M-Status	1.2M-Status
8 cm	Not Finished	Not Finished
10 cm	Not Finished	Not Finished
12 cm	Not Finished	Not Finished
15 cm	Not Finished	Not Finished
20 cm	Not Finished	Not Finished
25 cm	Not Finished	Not Finished
30 cm	Not Finished	Not Finished
35 cm	Not Finished	Not Finished
40 cm	Not Finished	Not Finished

Please Press the button to Finish calibration step by step!  
 Initial Pose : You can press the button on the tool-bar to move back: Initial Position!!  
 1. Press Step1 to Do the Focus-Dis calibration, please place 1cm-Calibration Plate in front of the plate. It takes about 15 mins.  
 2. Press Step2 to Do the 1cm-Calibration-Plate Calibration. It takes about 15 mins.  
 2. Press Step3 to Do the 2cm-Calibration-Plate Calibration and Remember to replace the Plate to 2cm-Calibration P

**Warning**  
 Please press PLAY/PAUSE key on Robot Stick to pause/continue robot visual navigation and press STOP key to leave this stage.

0%

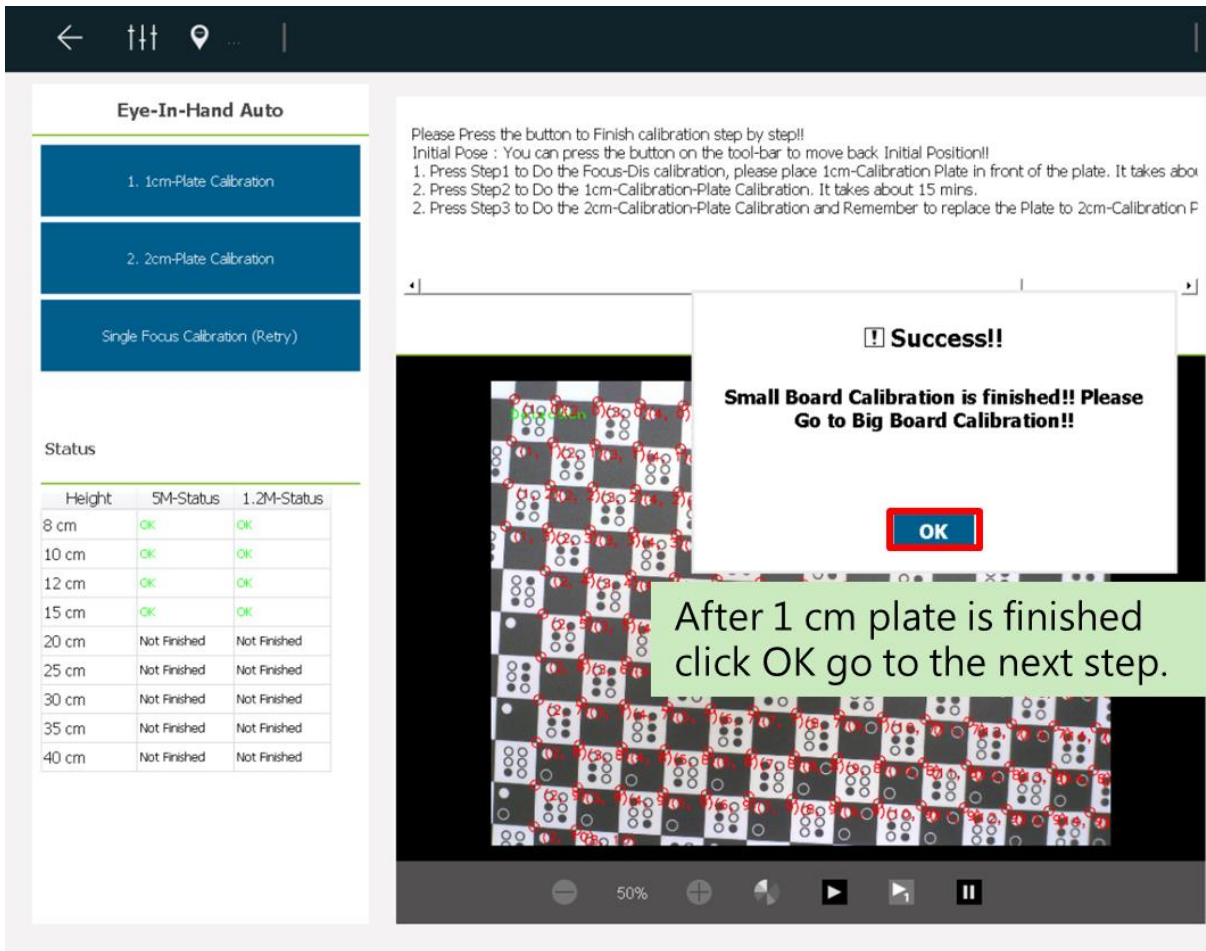
Direction: Disabled  
 Scale: 95.66  
 SquareNumber

Robot will start process from height 8cm to 15 cm (Distance of camera to the workspace)  
 This process will maintain approximate 20 mins.

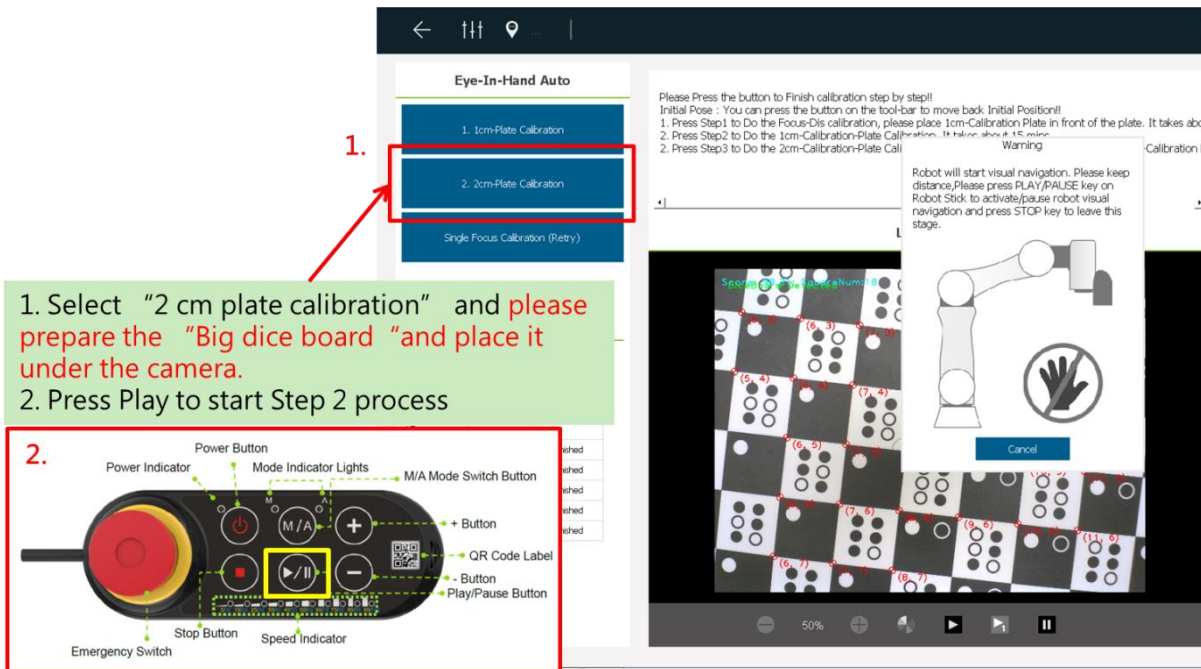
Step 1: 1 cm plate calibration finishes

- The **OK** in green denotes the calibration passed.
- The **Fail** in red denotes the calibration failed.
- The calibration continues even encountering any focal length calibration failure.
- Users can recalibrate the failed focal length after finishing all focal length calibrations.





Step 2: 2-cm plate calibration



Step 2: 2-cm plate calibration in progress

Please Press the button to Finish calibration step by step!!  
Initial Pose : You can press the button on the tool-bar to move back Initial Position!!  
1. Press Step1 to Do the Focus-Dls calibration, please place 1cm-Calibration Plate in front of the plate. It takes about 15 mins.  
2. Press Step2 to Do the 1cm-Calibration-Plate Calibration. It takes about 15 mins.  
2. Press Step3 to Do the 2cm-Calibration-Plate Calibration and Remember to replace the Plate to 2cm-Calibration F

**Warning**  
Please press PLAY/PAUSE key on Robot Stick to pause/continue robot visual navigation and press STOP key to leave this stage.

Height	5M-Status	1.2M-Status
8 cm	OK	OK
10 cm	OK	OK
12 cm	OK	OK
15 cm	OK	OK
20 cm	OK	OK
25 cm	Not Finished	OK
30 cm	Not Finished	Not Finished
35 cm	Not Finished	Not Finished
40 cm	Not Finished	Not Finished

Robot will start process from height 20cm to 40 cm (**Distance of camera to the workspace**)  
This process will maintain approximate 20 mins.

Step 2: 2-cm plate calibration finishes

click here to leave this page.

**Success!!**  
Big Board Calibration is finished!! Please check is there any NG Calibration!!

After 2cm plate is finished click OK go to close this window.

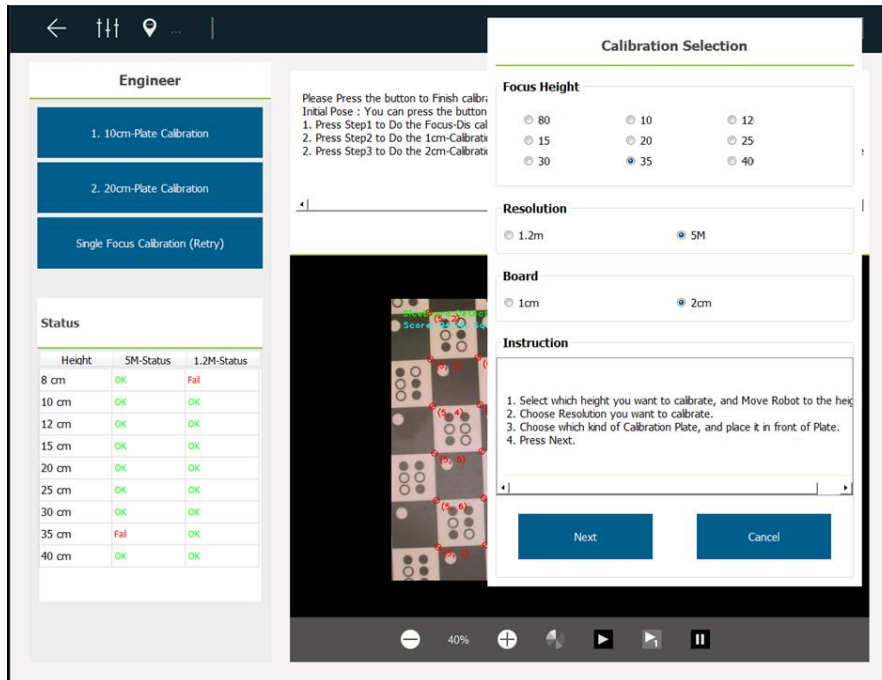
Height	5M-Status	1.2M-Status
8 cm	OK	OK
10 cm	OK	OK
12 cm	OK	OK
15 cm	OK	OK
20 cm	OK	OK
25 cm	OK	OK
30 cm	OK	OK
35 cm	OK	OK
40 cm	OK	OK

#### 5.8.4 After Calibration Fails: Recalibrate

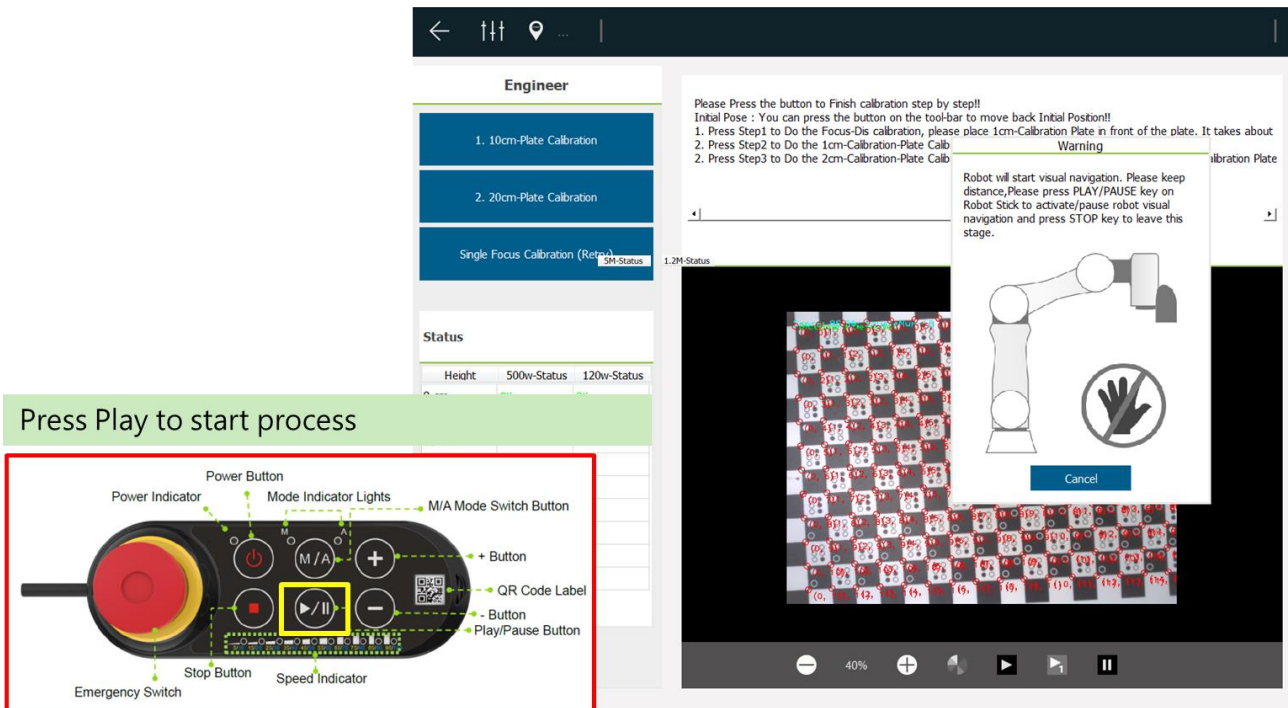
- If the calibration fails at some height, please click **Single Focus Calibration (retry)** to recalibrate.
- Take the height of 35 cm as an example:
  1. Select **35** in **Focus Height**.



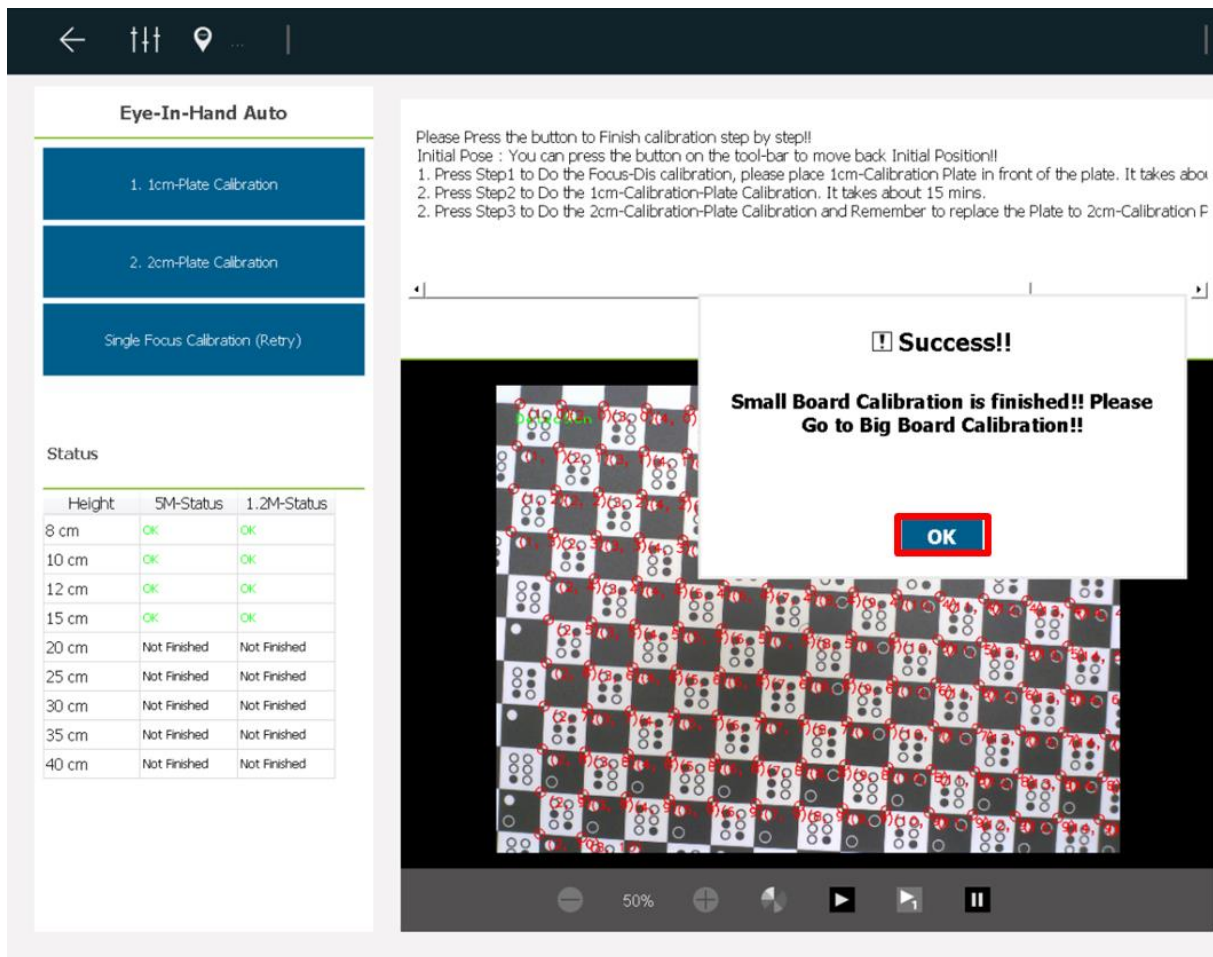
2. Select **5M** in **Resolution**.
3. Select **2cm** in **Board**.
4. Click **Next**.



### 5.8.5 Calibration Fails

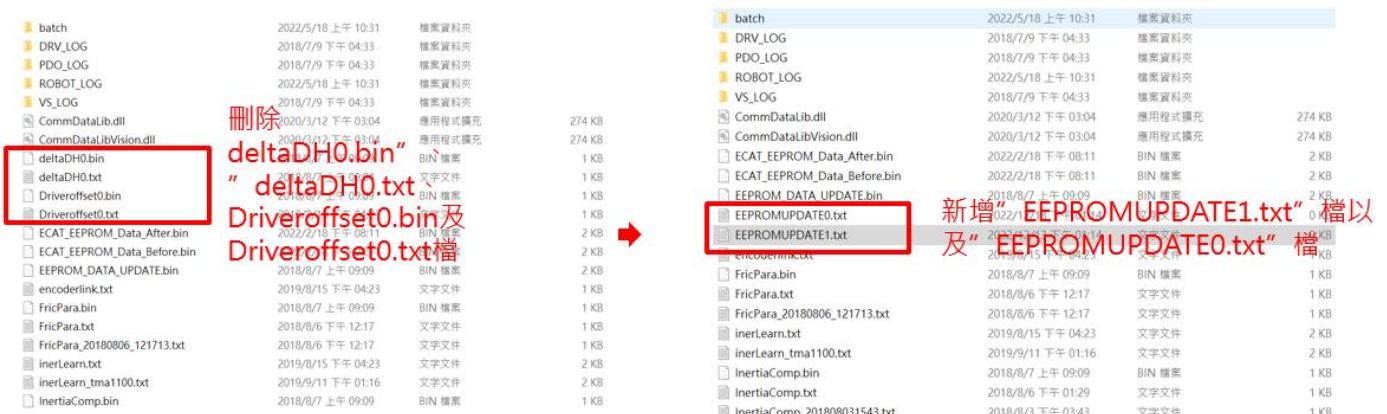


Recalibrate the focal length with failed calibration until all focal lengths are corrected.

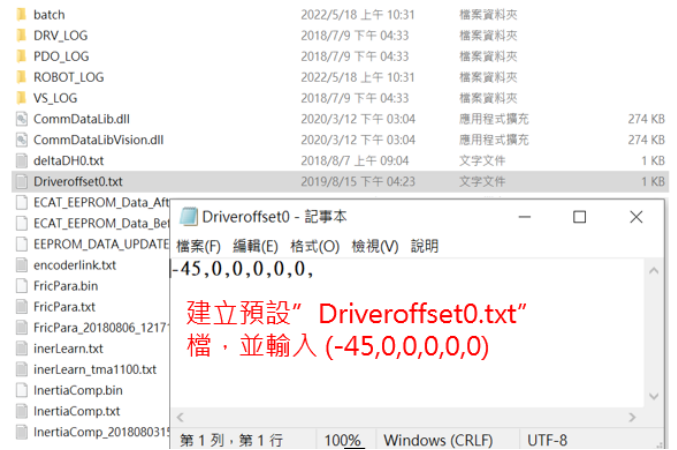
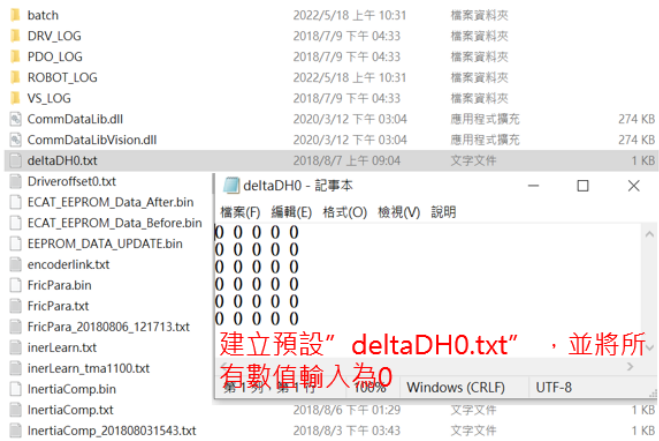


## 5.9 Kinematic calibration

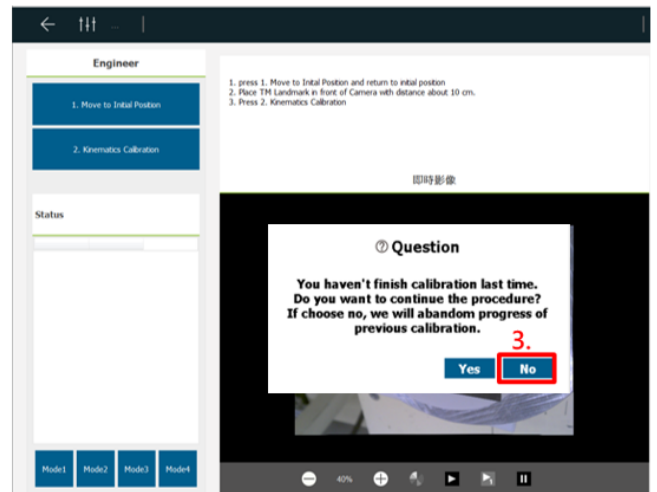
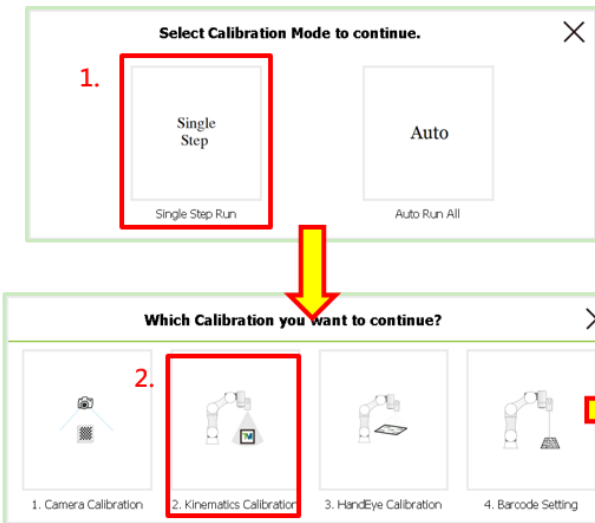
1. Go to D:\Robot file
2. Delete the files **deltaDH0.bin**, **deltaDH0.txt**, **Driveroffset0.bin**, and **Driveroffset0.txt** in the folder **Robotfile** as shown in Figure 1.
3. Create the files **EEPROMUPDATE1.txt** and **EEPROMUPDATE0.txt** in in the folder **Robotfile** as shown in Figure 2.



4. Create a preset file **deltaDH0.txt** and input all values as 0 as shown in the figure below.
5. Create a preset file **Driveroffset0.txt** and input (-45,0,0,0,0) as shown in the figure below.



1. Select Single Step Run.
2. Select Kinematics Calibration.
3. Click No to abandon the previous operation. (But all processes must be performed again.)



### 5.9.1 Move the Robot to the Initial Position

1. **1. Move to Initial Position**

2. Kinematics Calibration

Status

1. press 1. Move to Initial Position and return to initial position  
2. Place TM Landmark in front of Camera with distance about 10 cm.  
3. Press 2. Kinematics Calibration

**Keep distance from Robot**

請持續按壓機器人控制棒上的 "+" 鈕開始機器手監視幾何跟蹤運動。

Cancel

1. Click "1. Move to Initial Position"  
2. Press "+" let robot move to Initial Position

2.

Power Button  
Power Indicator  
Mode Indicator Lights  
M/A Mode Switch Button  
+ Button  
- Button  
Play/Pause Button  
QR Code Label  
Emergency Switch  
Stop Button  
Speed Indicator

### 5.9.2 Place the Landmark

Take the landmark in the center of the camera image, and make it locate 10 cm away from the camera.  
(Landmark pose Z value (90~110mm))

Tool Bar

Video

Landmark Img = 1206.51,1117.29 (pixel)  
Landmark Pose = -3.4788,4.7552, 02.8460,20.0891 -0.6390,-1.4630  
Scores: 0.93

Landmark pose Z值介於90~110mm

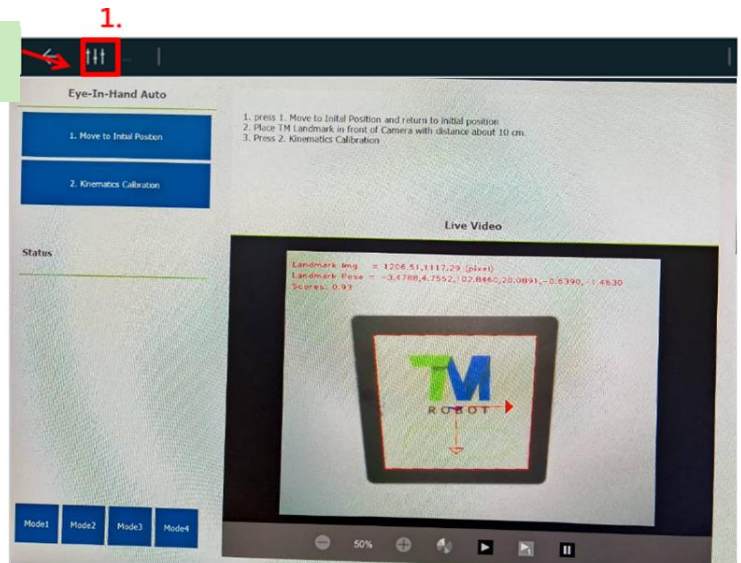
### 5.9.3 Notes on Landmark Placement



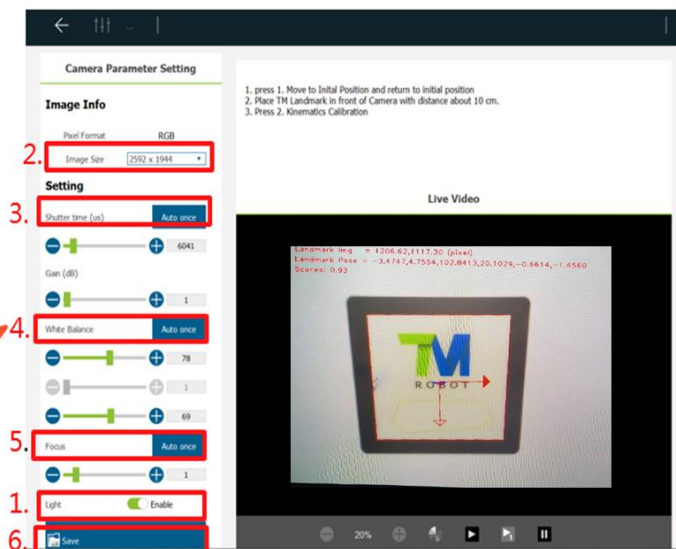
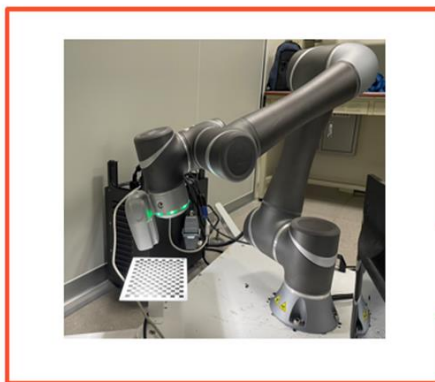
- Place the Landmark in the center of the camera image. (Ensure the Landmark center is in the center of the image)
- Place a plain white paper of size A4 beneath the landmark.

Camera parameter adjustment

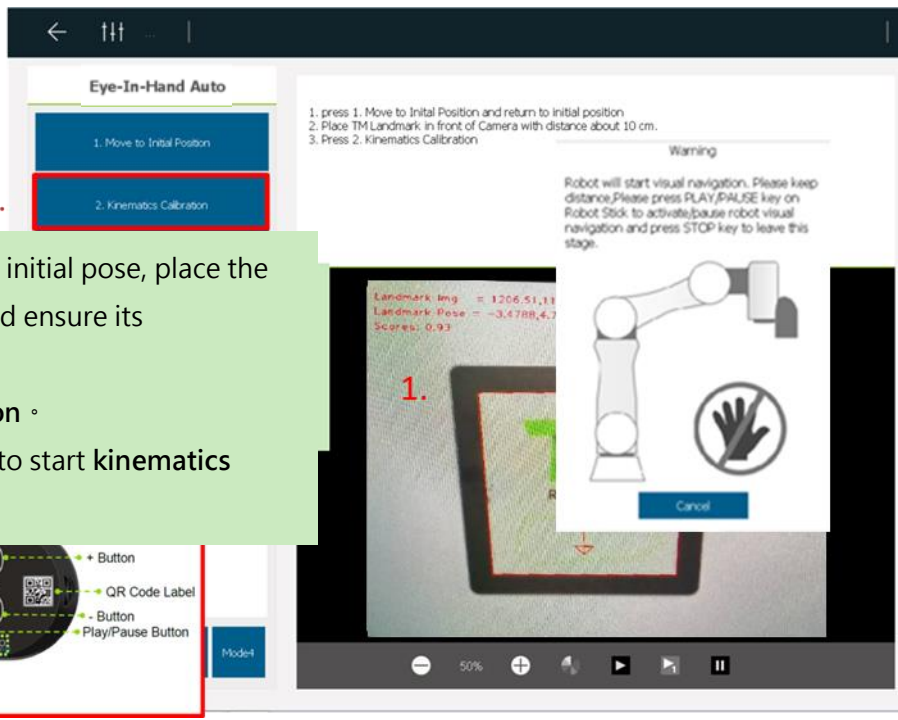
Set parameter



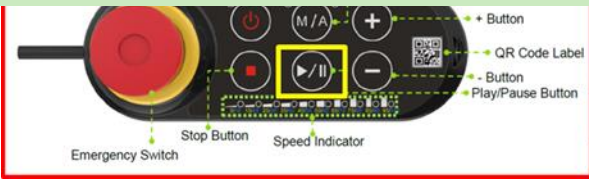
- Turn on the camera light of the robot.
- Set the image resolution to 2592\*1944 (The resolution must be 5MP at least or above.)
- Use **Auto once** to set the **Shutter time**.
- Whiter Balance: Place the small calibration plate, and click **Auto Once** to adjust.
- Use Auto once to set the **Focus**.
- Click **Save**.



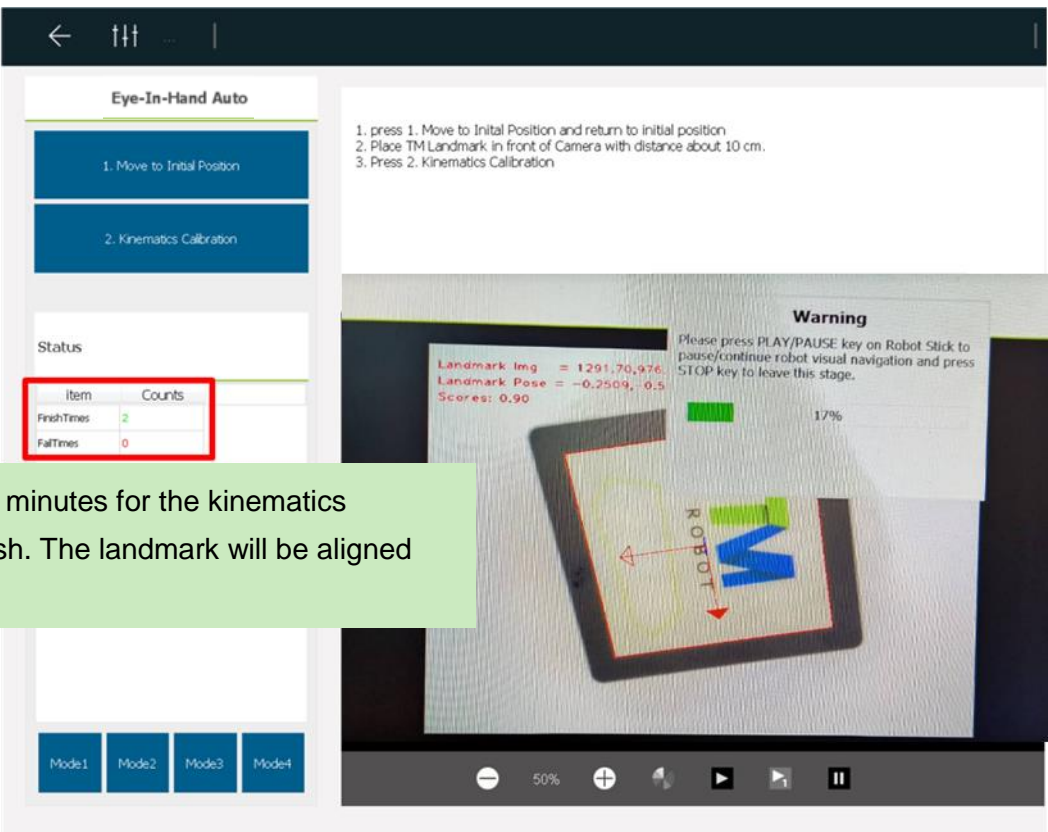
#### 5.9.4 Select Kinematics Calibration



1. After the robot moves to the initial pose, place the landmark below the camera and ensure its identifiability.
2. Click 2. Kinematics Calibration
3. Click the Play/Pause button to start kinematics calibration.



5.9.5 Kinematics Calibration in Progress (1/2)



It takes about 20 minutes for the kinematics calibration to finish. The landmark will be aligned 40 times.

### 5.9.6 Kinematics Calibration: Change the Robot Pose

**Eye-In-Hand Auto**

1. Move to Initial Position
2. Kinematics Calibration

Status

Item	Counts
FinishTimes	19
FailTimes	2

1. press 1. Move to Initial Position and return to Initial position.  
 2. Place TM Landmark in front of Camera with distance about 10 cm.  
 3. Press 2. Kinematics Calibration

**Keep distance from Robot**

Please press and hold the "+" button on the Robot Stick to move the robot to the initial position.

Can't find Landmark within the detection range

Cancel

Power Button, Power Indicator, Mode Indicator Lights, M/A Mode Switch Button, + Button, QR Code Label, - Button, Play/Pause Button, Stop Button, Speed Indicator, Emergency Switch

The robot stops when there are 20 times of calibration left to go and sends a request concurrently to users to change its pose by pressing and holding the + button.

### 5.9.7 Kinematics Calibration in Progress (2/2)

**Eye-In-Hand Auto**

1. Move to Initial Position
2. Kinematics Calibration

Status

Item	Counts
FinishTimes	18
FailTimes	2

1. press 1. Move to Initial Position and return to initial position  
 2. Place TM Landmark in front of Camera with distance about 10 cm.  
 3. Press 2. Kinematics Calibration

**Warning**

Can't find Landmark within the detection range

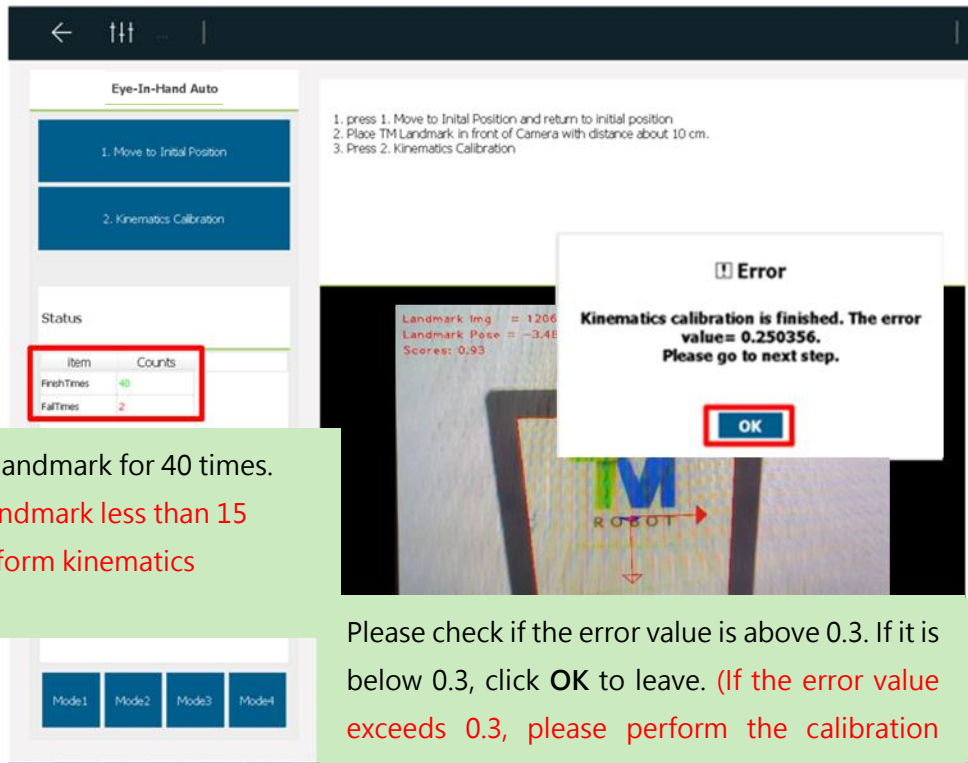
Please press PLAY/PAUSE key on Robot Stick to pause/continue robot visual navigation and press STOP key to leave this stage.

37%

Mode1 Mode2 Mode3 Mode4

50%

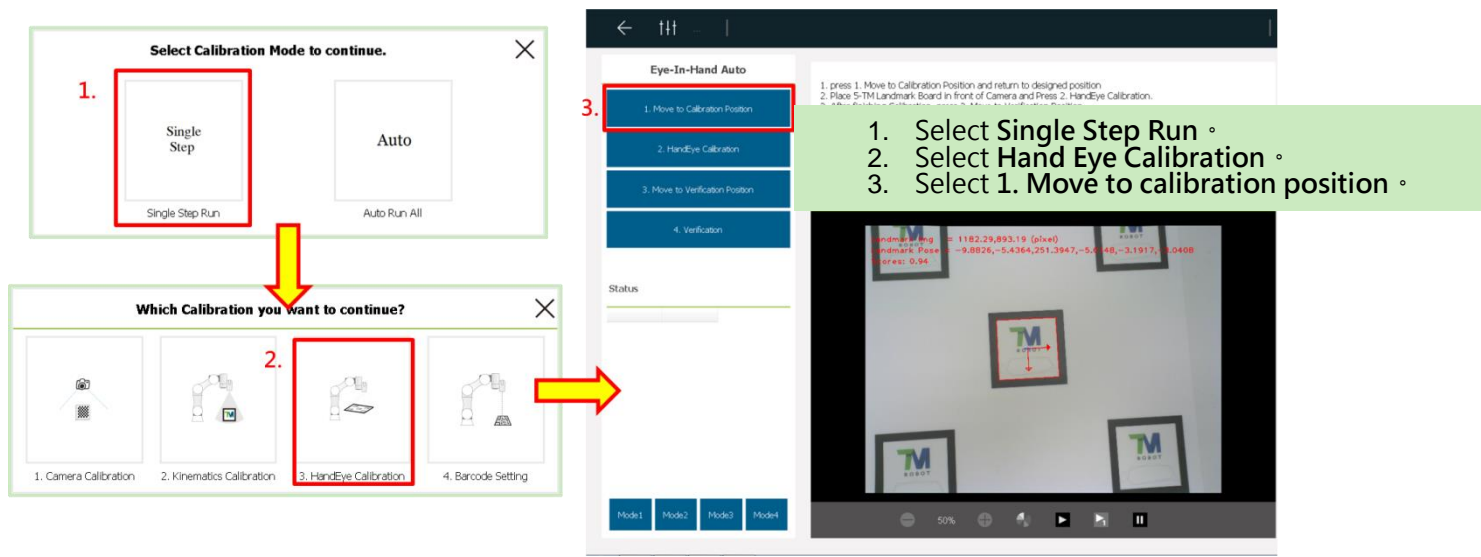
### 5.9.8 Kinematics Calibration Finishes



The robot will align the landmark for 40 times. If the robot aligns the landmark less than 15 times, users have to perform kinematics calibration again.

Please check if the error value is above 0.3. If it is below 0.3, click OK to leave. (If the error value exceeds 0.3, please perform the calibration again.)

### 5.10 Hand Guide Calibration





### 5.10.1 Hand Guide Calibration in Progress

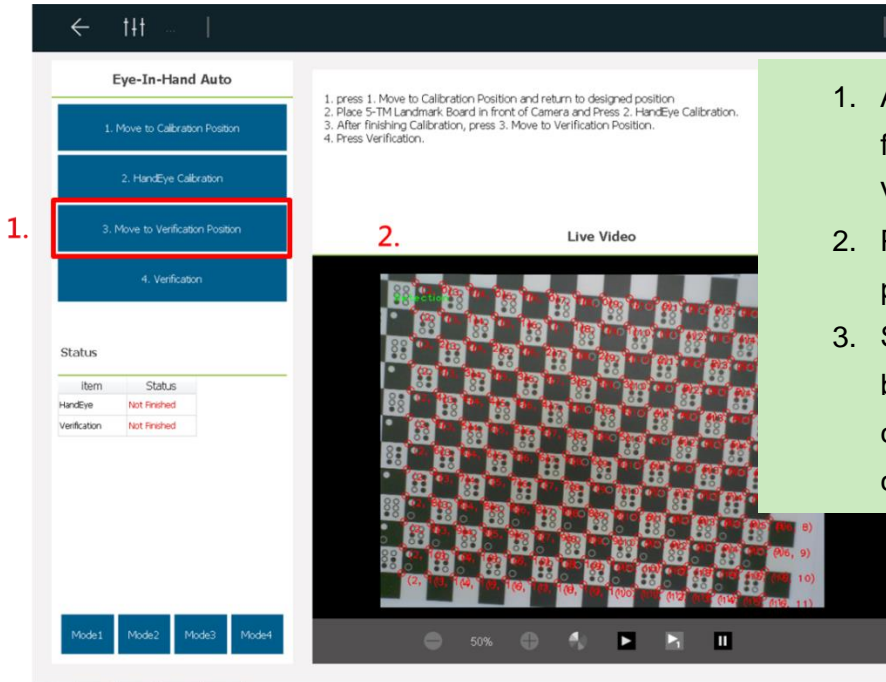
1. After moving the robot to the calibration pose, click 2. Hand Eye Calibration.

2. Click the Play/Pause button to start hand guide calibration. (It takes about 10 minutes to calibrate.)

### 5.10.2 Hand Guide Calibration Finishes

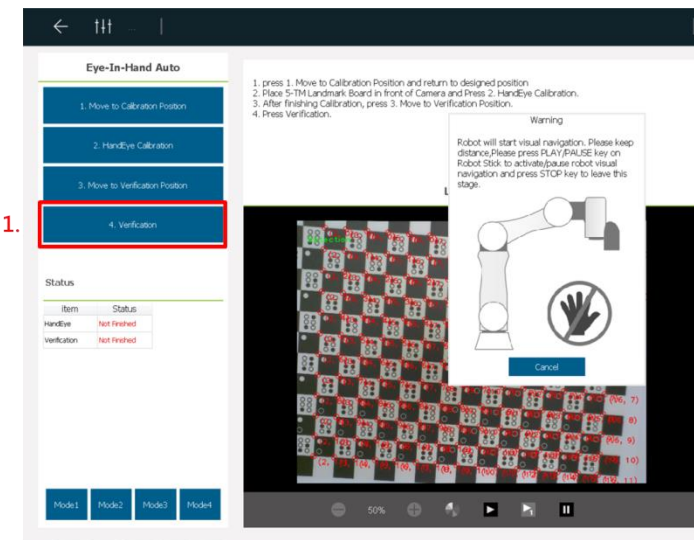
Please check if the error value is above 0.3. If it is below 0.3, click OK to leave. (If the error value exceeds 0.3, please perform the calibration again.)

### 5.10.3 Move to the Verification Position

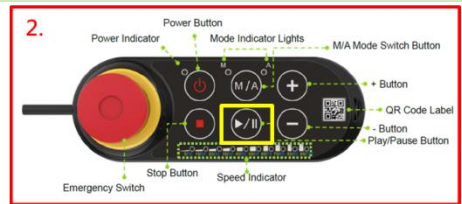


1. After hand guide calibration finishes, select 3. Move to Verification Position.
2. Place the small calibration plate below the camera.
3. Set the calibration clearance between the camera and the calibration plate to 10 to 15 cm.

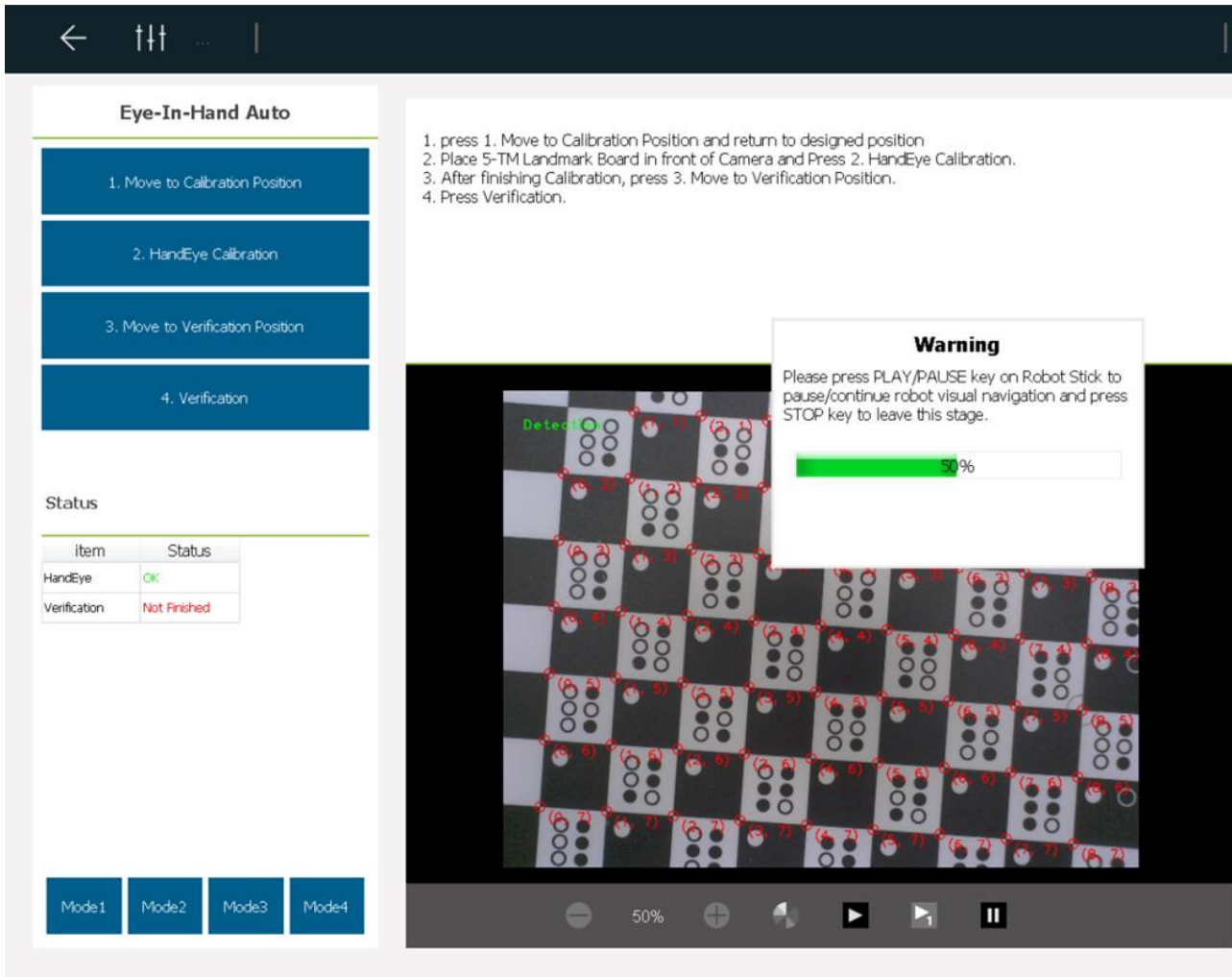
### 5.10.4 Start Verification



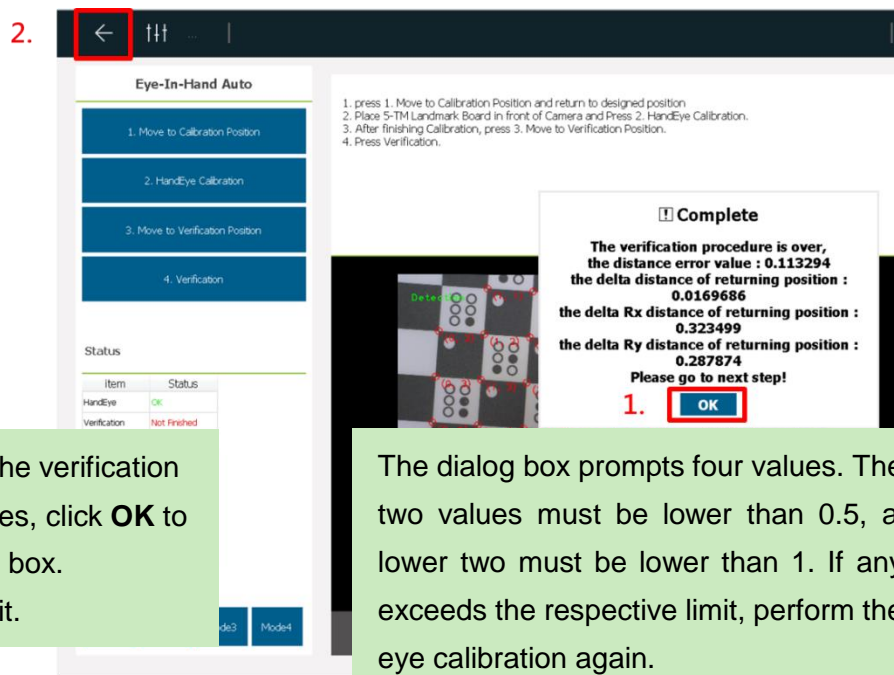
1. After the robot moves to the verification position, select **4. Verification**.
2. Click the **Play/Pause** button to start verification. (It takes about 10 minutes to verify.)



### 5.10.5 Verification in Progress



### 5.10.6 Verification Finishes



1. After checking the verification associated values, click **OK** to close the dialog box.
2. Click here to exit.

The dialog box prompts four values. The upper two values must be lower than 0.5, and the lower two must be lower than 1. If any value exceeds the respective limit, perform the hand-eye calibration again.

## 5.11 Barcode Setting

1. Select **Single Step Run**.
2. Select **Barcode Setting**.
3. Click **OK**.
4. Press the **+** button on the stick to move the robot back to the initial pose.
5. After the robot moves to the initial pose, click **OK**.

**Engineer**

1. Move to Barcode Position
2. Camera Parameters AutoOnce
3. Set Barcode as Target
4. Save Setting

Status

item	Shift Pixel
Barcode	701.06

TargetWidth 550  
Threshold 0.10

Barcode = 801288001  
Barcode = 701.06

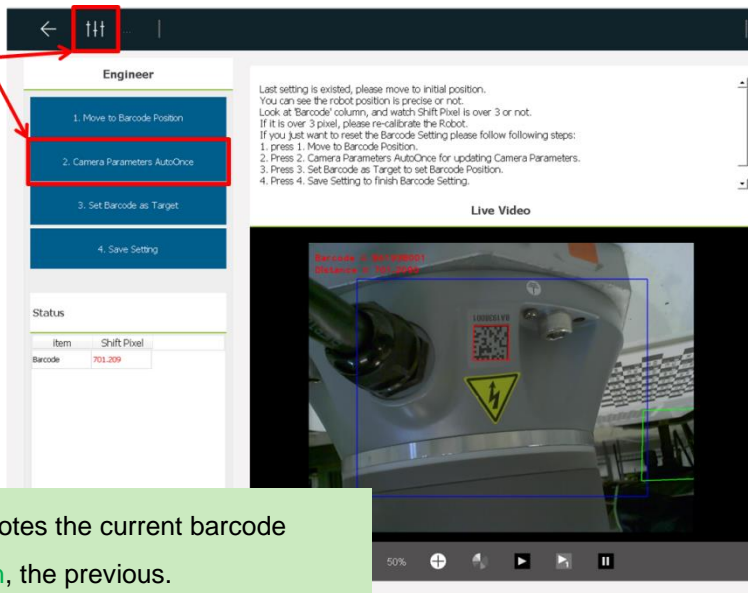
**Question**

You haven't finish calibration last time.  
Do you want to continue the procedure?  
If choose no, we will abandon progress of previous calibration.

Yes No

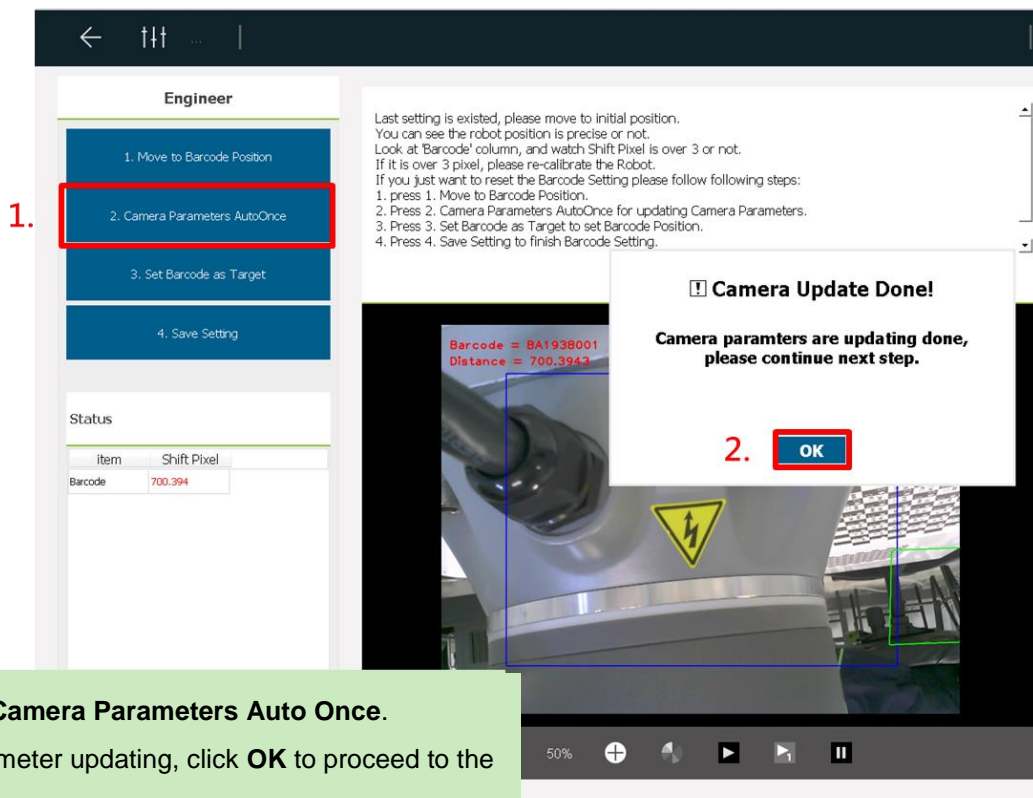
Click **No** to abandon the previous operation.  
(But all processes must be performed again.)

If the camera cannot identify the data matrix correctly, users can click the icon to enter the page to adjust camera parameters such as shutter time and focal length.



The frame in red denotes the current barcode position, and in green, the previous.

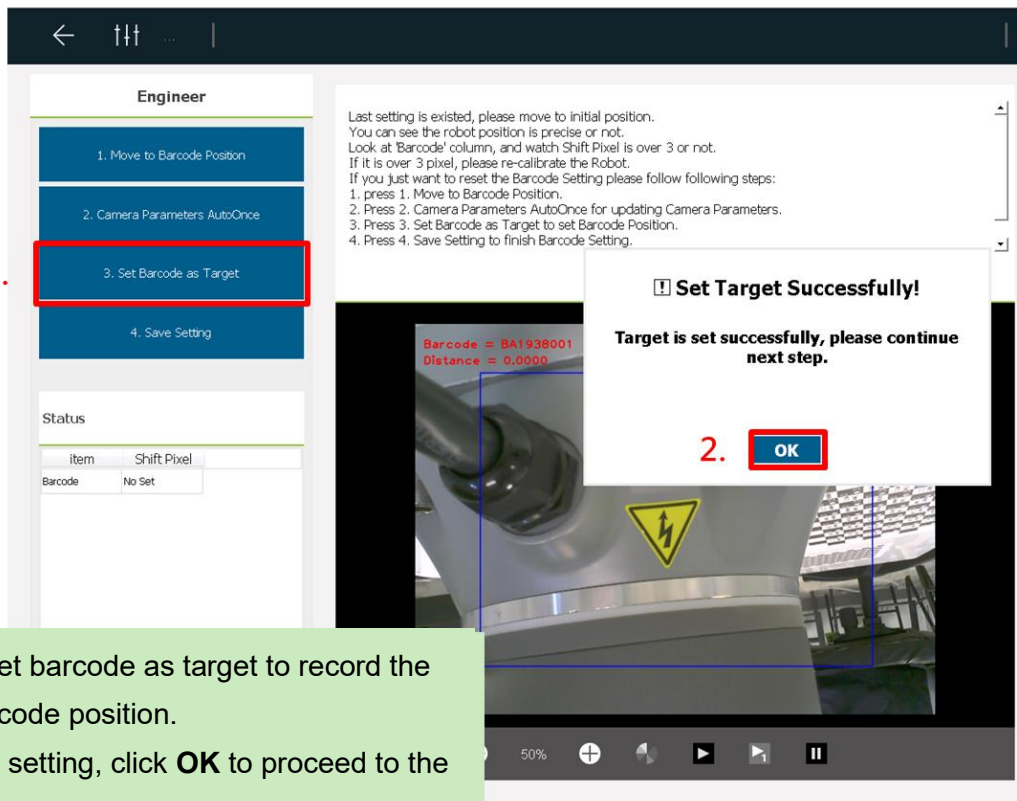
### 5.11.1 Update the Camera Parameters Automatically



1. Select **2. Camera Parameters Auto Once**.
2. After parameter updating, click **OK** to proceed to the

### 5.11.2 Set Barcode as Target



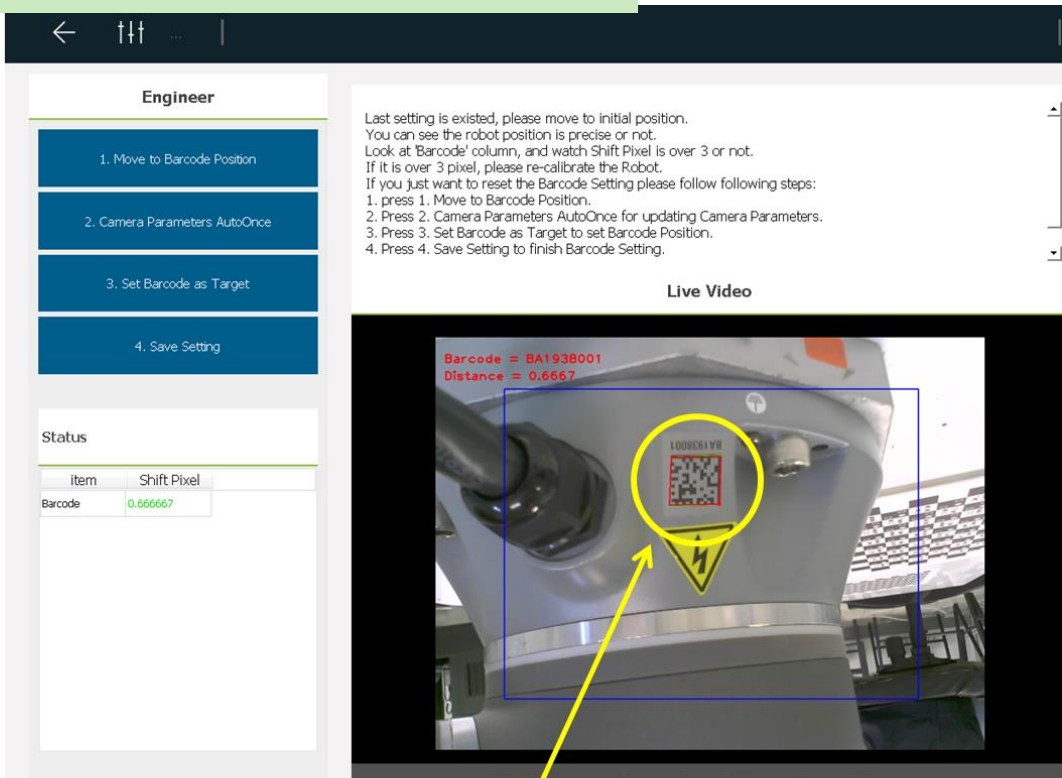


1.

2.

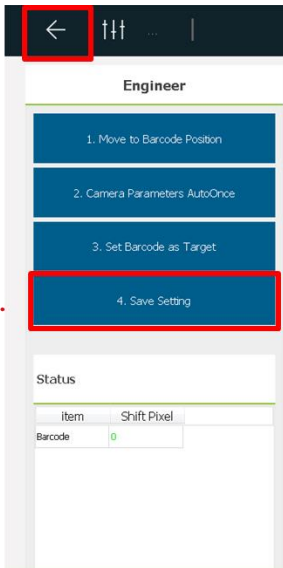
OK


1. Select 3. Set barcode as target to record the current barcode position.
2. After target setting, click OK to proceed to the next step.

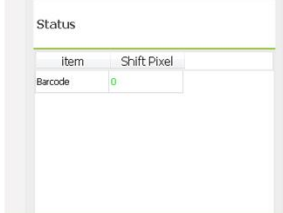


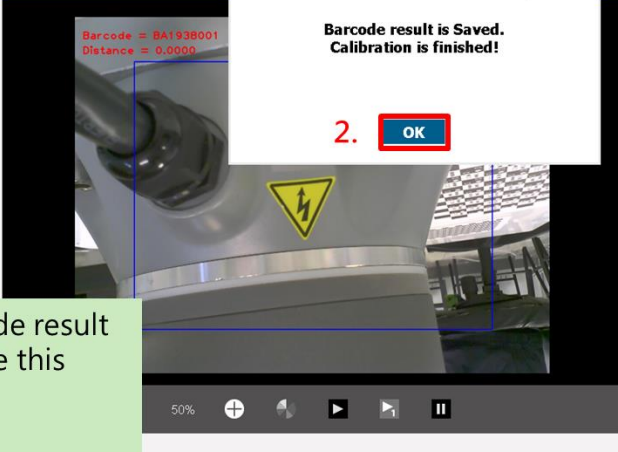
Then, the frame in green overlaps the one in red.

### 5.11.3 Save Setting

3. 

1. 

2. 

3. 

1. Click "4. Save Setting" to save the barcode result  
 2. Save Result Successfully, click "OK" to close this window  
 3. Click here to leave this page

**Note:**

The offset value of the robot is in pixels, and the standard value is 3 pixels.  
 If the offset value is more than 3 pixels, please recalibrate the robot.

3. Set Barcode as Target

4. Save Setting

**Status**

item	Shift Pixel
Barcode	1.79945

**Live Video**

Barcode = AA162206  
 Distance = 0.3428



### 5.11.4 All calibration processes finish

2.

1.

Please wait for loading image...

Select Calibration Mode to continue.

Single Step  
Single Step Run

Auto  
Auto Run All

1. Click "X" to close calibration mode  
2. Click here to Exit Vision main page  
Whole Vision calibration process were finished!

Controller

Payload (kg)  
0 kg

0 Set

Base Tool IO FreeBot

Continuous Speed 1.00 %

Angle

J1	0.94
J2	1.80
J3	93.33
J4	-0.72
J5	90.60
J6	-1.38

Direct Move

Move

### 5.11.5 Exit Maintenance Mode

Click here to exit

Maintenance mode

General Vision RobotInfo

Calibration

Runin24h Hand Guide Calibratic Dynamic Calibration

Motion/Project

Go Zero

Hardware Test

Buzzer Off Buzzer On

Light Red Light Green Light Blue

Audio

Check Button

Check DiskDrive

Friction Learning Failure Report

View Export

Controller

Payload (kg)  
0 kg

0 Set

Joint Base Tool IO FreeBot

Jog Distance Continuous Speed 1.00 %

Joint Angle

J1	0.00
J2	0.00
J3	90.00
J4	0.00
J5	90.00
J6	0.00

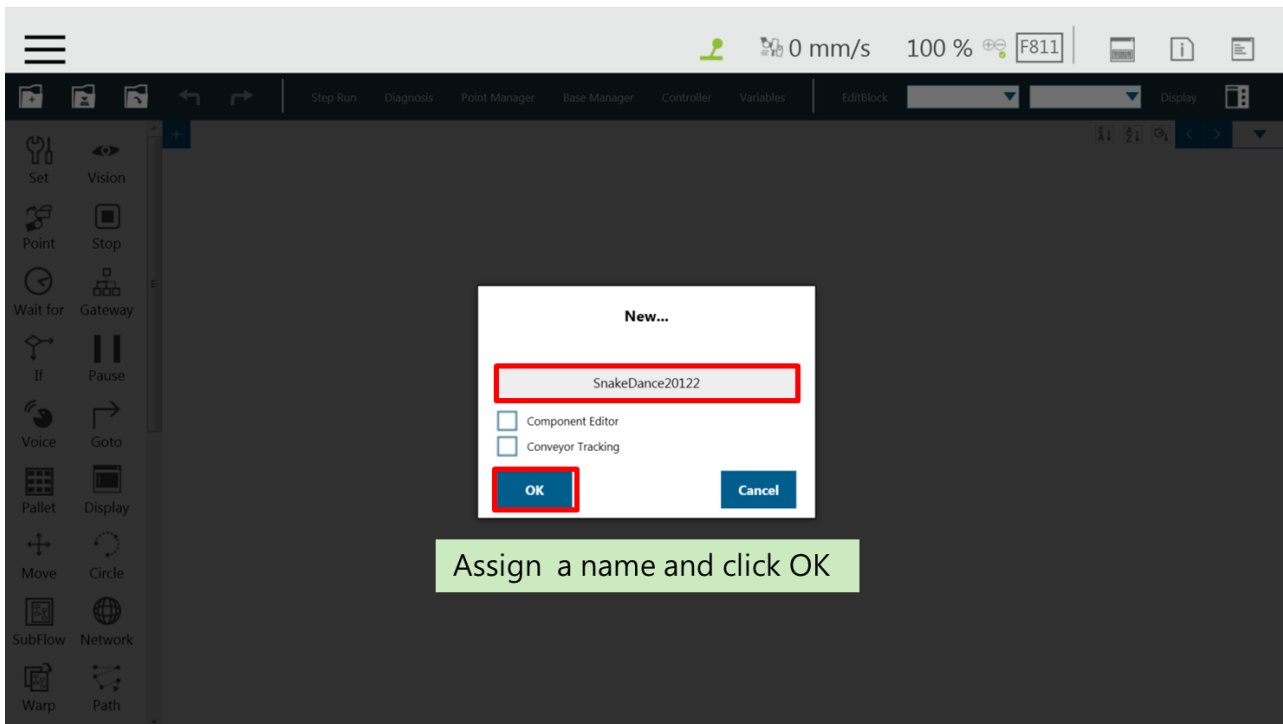
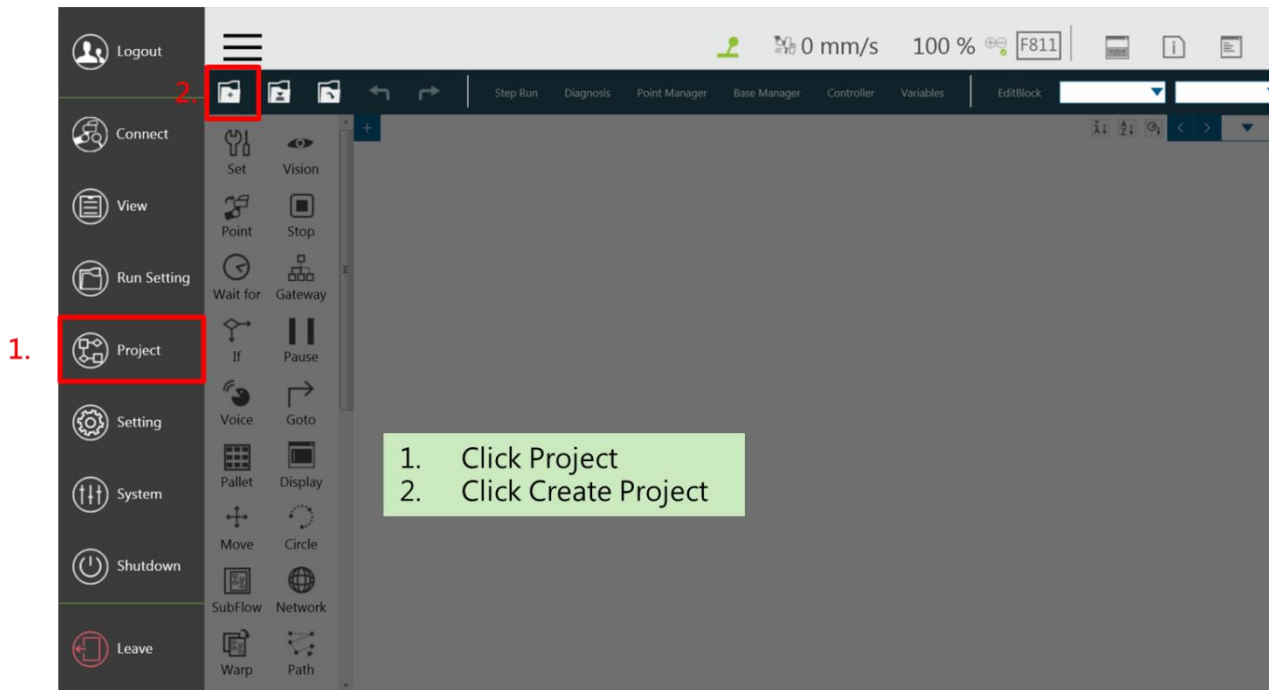
Direct Move

Move



## 5.12 The Robot Anaconda Project

### 5.12.1 Create a Project



### 5.12.2 Set Point 1 (P1)

1. Controller

2. Joint

3. Direct Move

4. Move

Here please use controller to teach the point

1. Select Controller
2. Use joint direct move
3. Input Joints digree  
 J1:260°  
 J2:90°  
 J3:-150°  
 J4:90°  
 J5:170°  
 J6:110°
4. After input these value Press and hold "Move" to move to this target.

Point

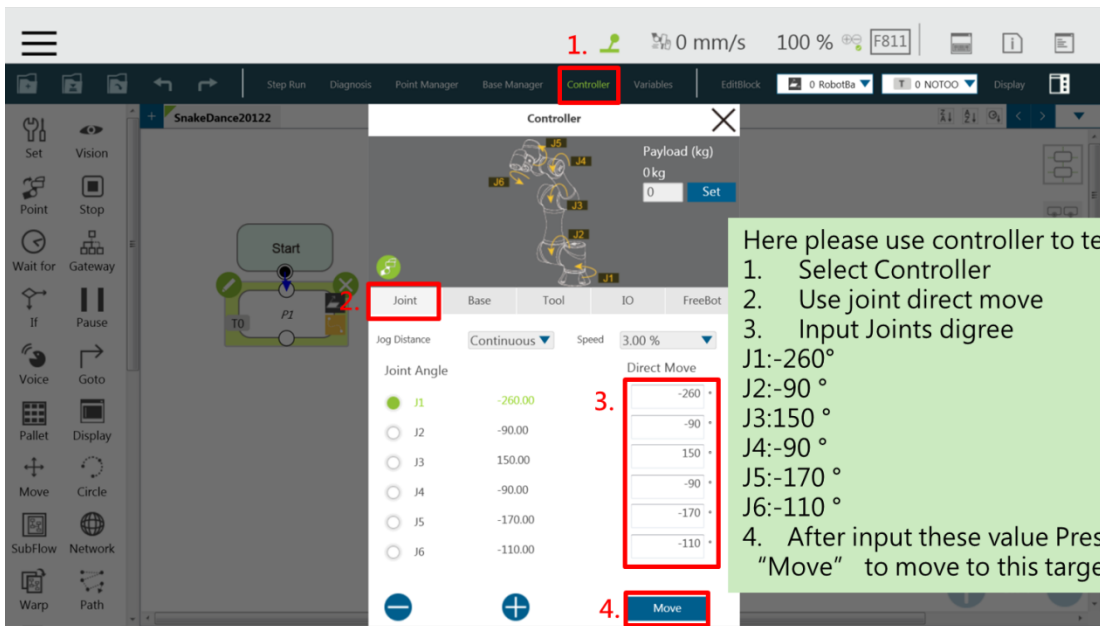
Start

T0

P1

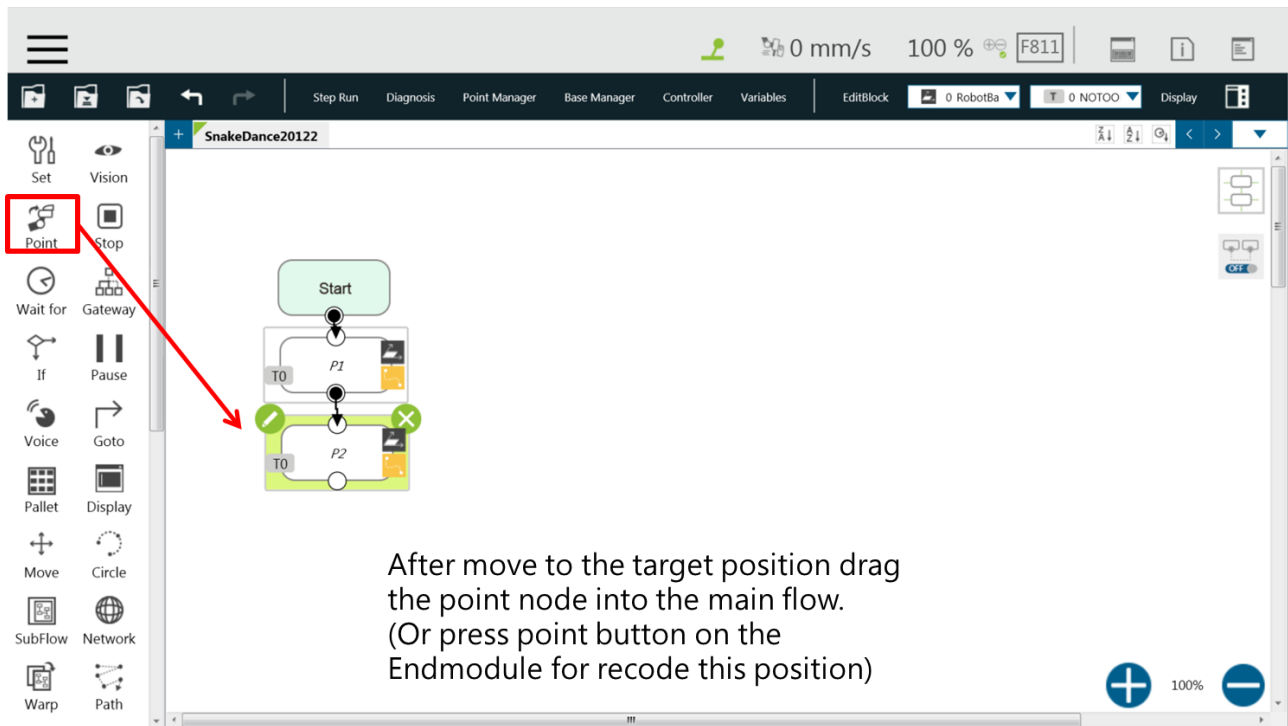
After move to the target position drag the point node into the main flow.  
(Or press point button on the Endmodule for recode this position)

### 5.12.3 Set Point 2(P2)



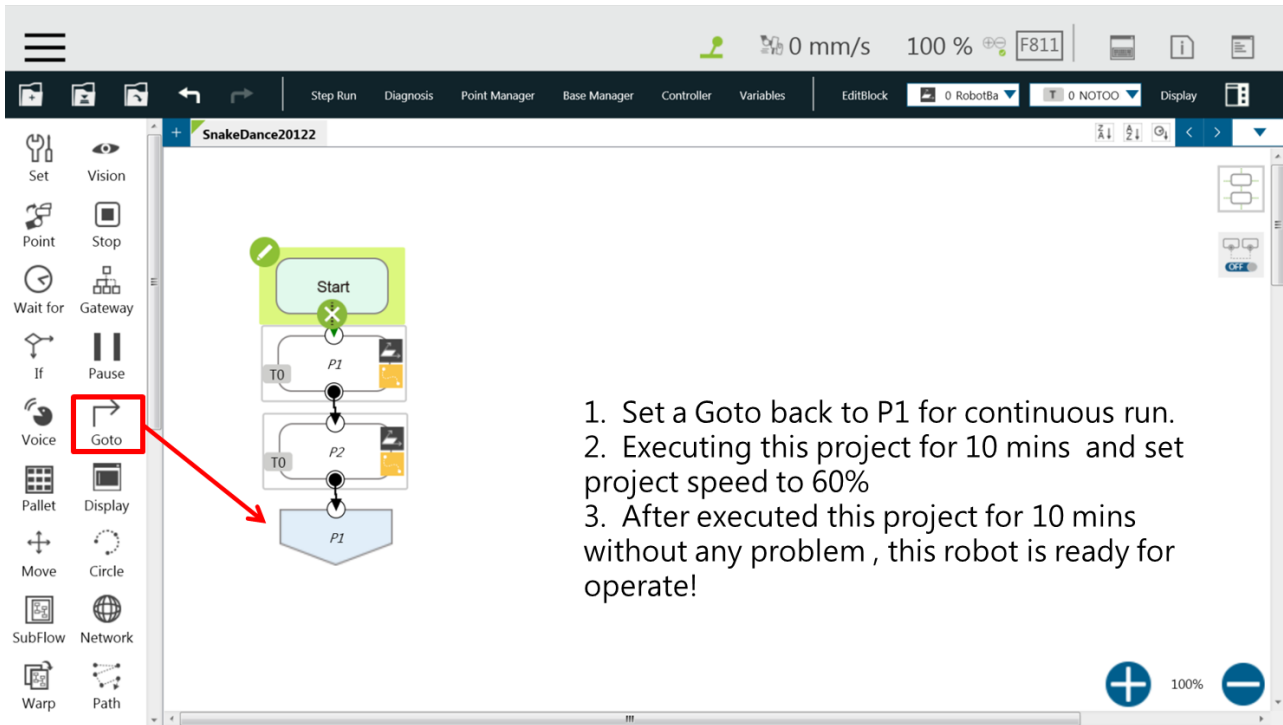
Here please use controller to teach the point

1. Select Controller
2. Use joint direct move
3. Input Joints digree
4. After input these value Press and hold "Move" to move to this target.



After move to the target position drag the point node into the main flow. (Or press point button on the Endmodule for recode this position)

## 5.12.4 Create a Loop



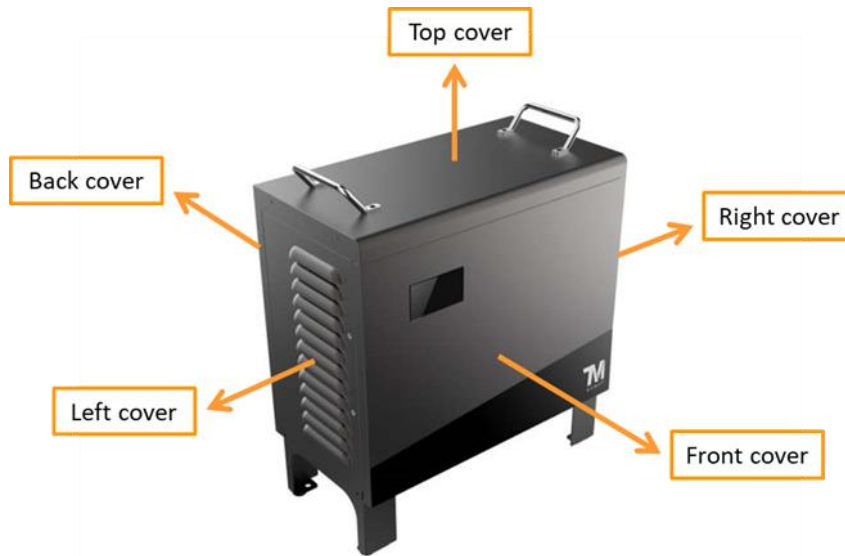
The screenshot shows a software interface for a robot project named "SnakeDance20122". The main workspace displays a sequence of points: a green "Start" block, followed by a "T0" timer, point "P1", another "T0" timer, point "P2", and finally point "P1" in a blue pentagon shape. A red box highlights the "Goto" block in the left-hand toolbar, with a red arrow pointing to the "P1" block at the end of the sequence. The top toolbar includes various icons for navigation and control, and the bottom right corner shows a speed control set to 100%.

1. Set a Goto back to P1 for continuous run.
2. Executing this project for 10 mins and set project speed to 60%
3. After executed this project for 10 mins without any problem , this robot is ready for operate!

## 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).

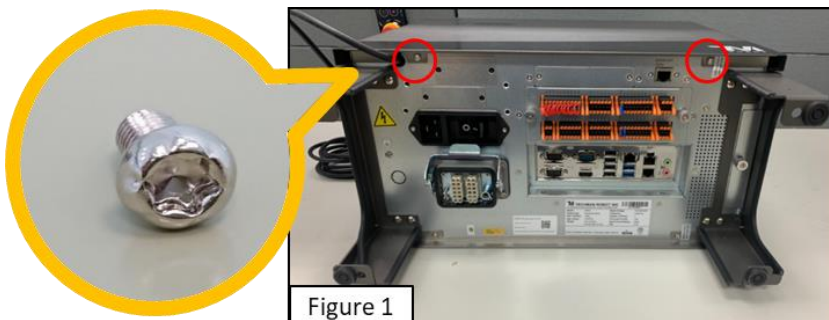


Figure 1

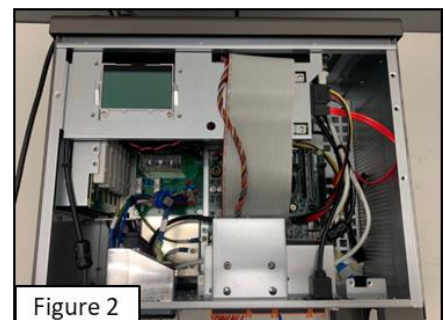


Figure 2

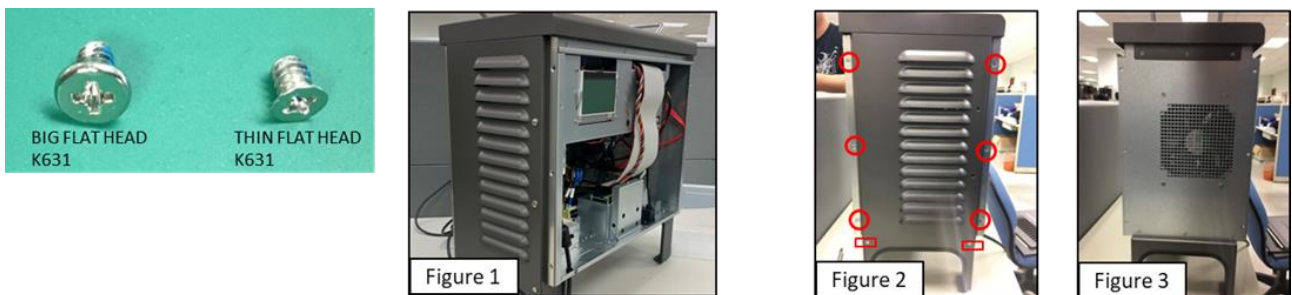
### Disassemble the Back cover

- 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).



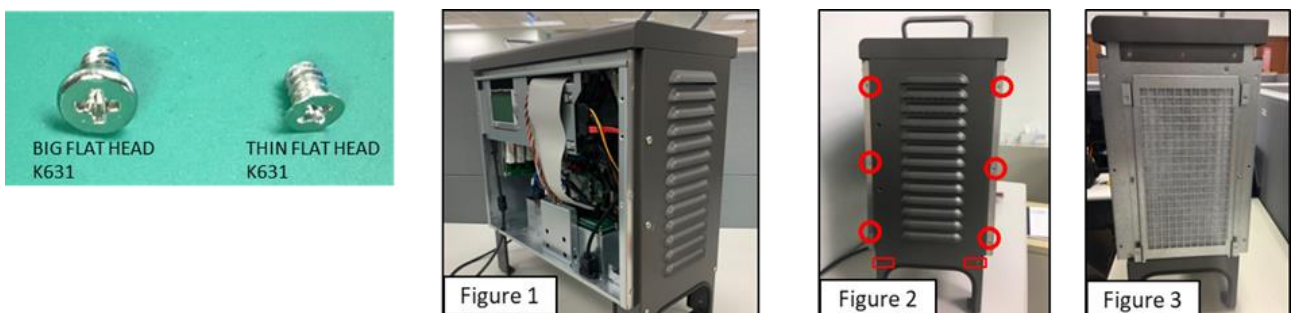
### Disassemble the Left cover

- 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).



### Disassemble Right 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 **Right cover** (as shown in Figure 2).
- Remove the **Right cover** (as shown in Figure 3).

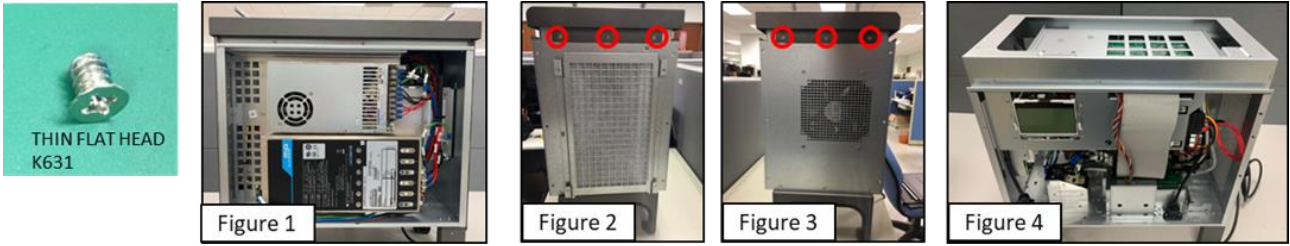


### Disassemble the Top cover

- 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).

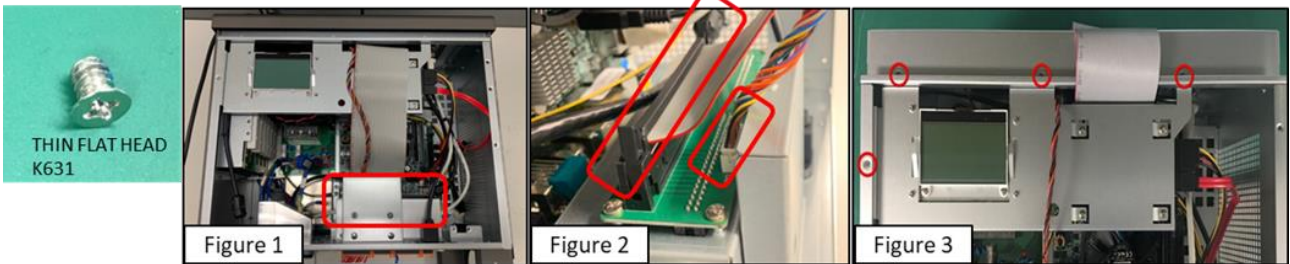


- Use the Phillips screwdriver to loosen the screw on the **Top cover** (as shown in Figure 2 and Figure 3).
- Remove the **Top cover** (as shown in Figure 4).



**Disassemble the LCD screen cover**

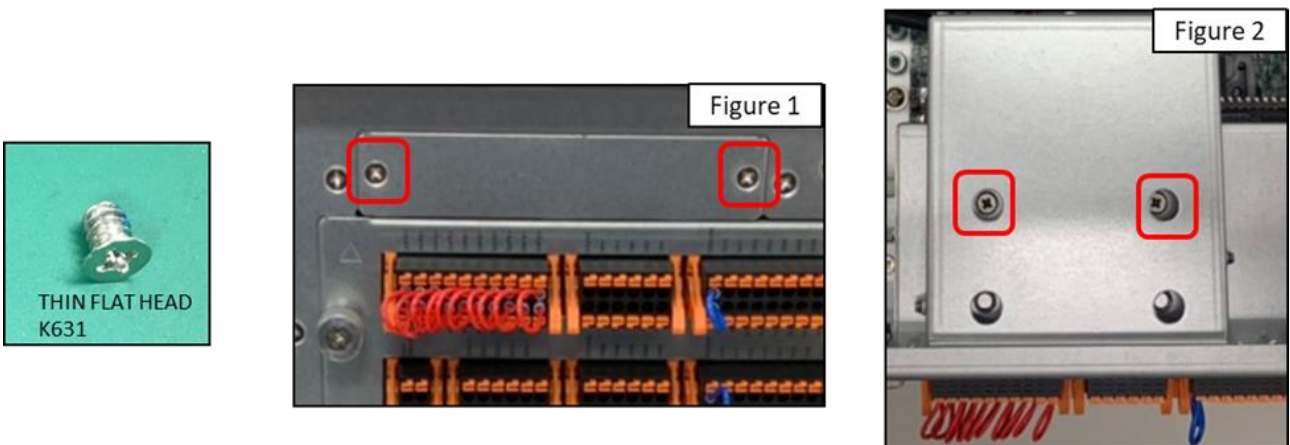
- Disassemble the **Front cover** ◦
- Refer to the previous operating steps to disassemble the **Front cover** ◦
- Remove the two cables (as shown in Figure 2).
- Use the Phillips screwdriver to loosen the four screws and remove the LCD screen cover (as shown in Figure 3).



6.2 Disassemble/Install the IPC cables

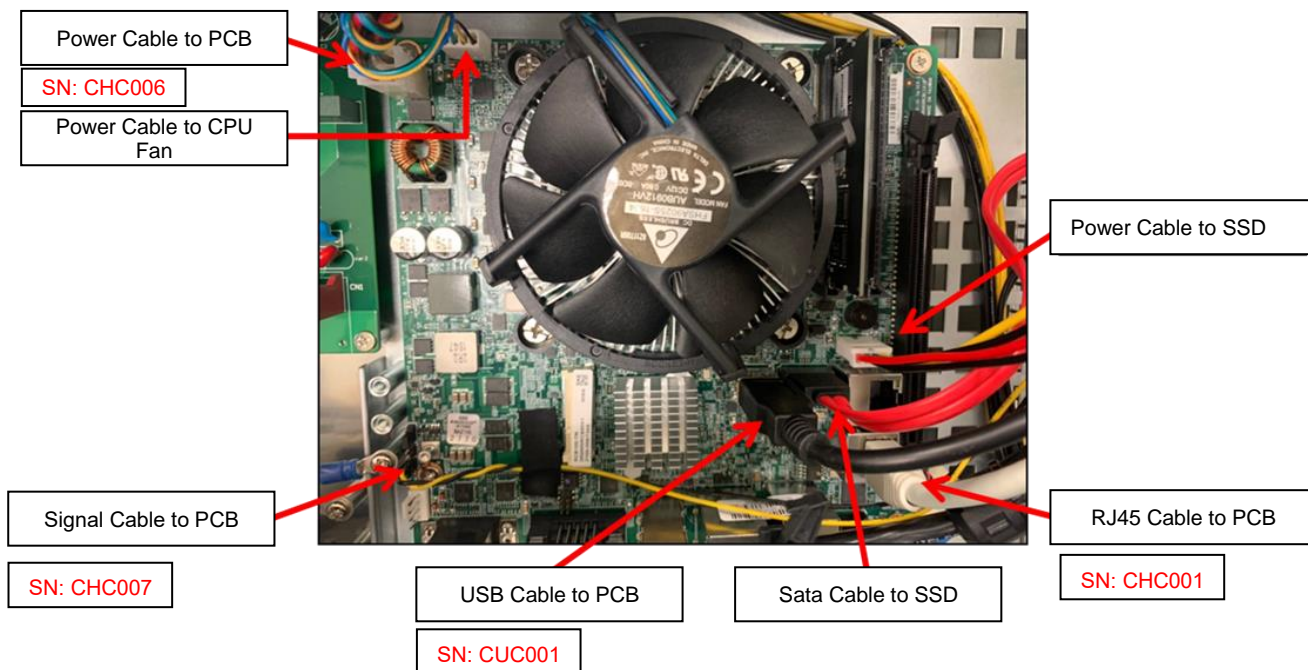
**Preparation**

- 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).

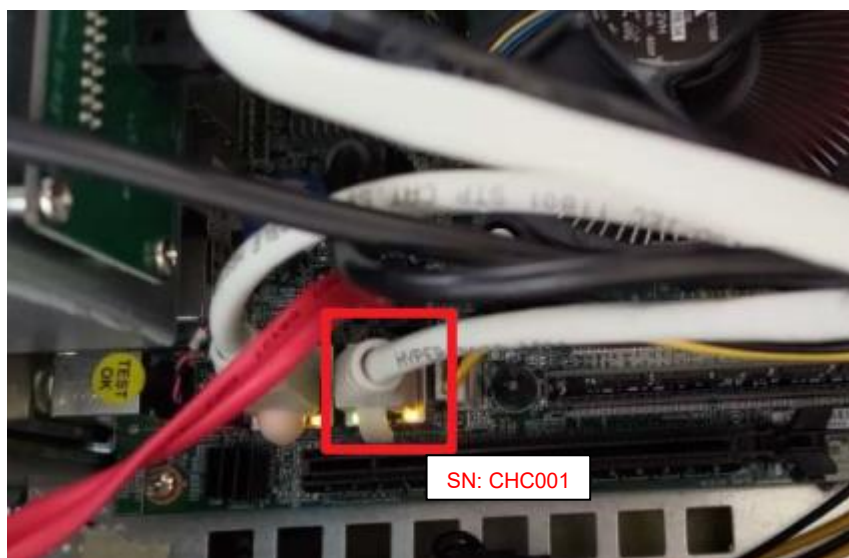


**IPC Cable Wiring**



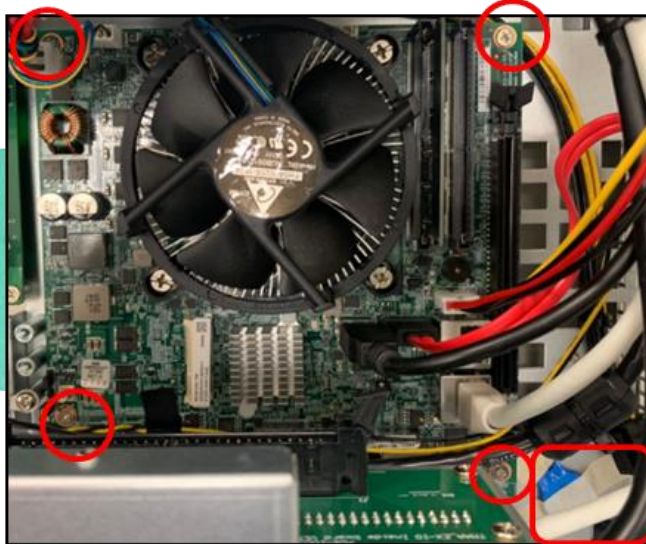


**If the robor is a TRI camera, it comes with an extra RJ-45 Cable (as shown below framing in red).**



### **Disassemble the IPC**

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

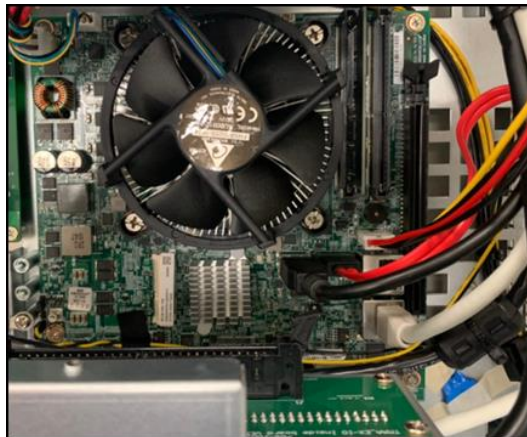


### Assemble IPC and reinstall the IPC cables

- 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.

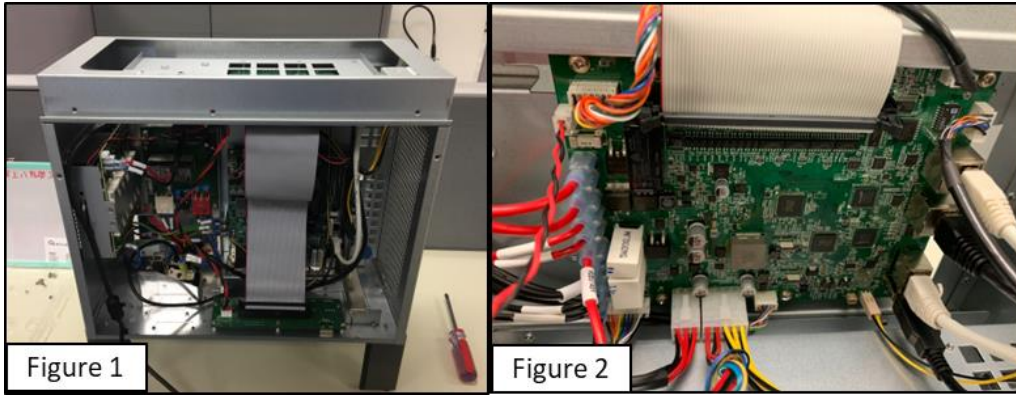


## 6.3 Disassemble/Assemble Power Control Board

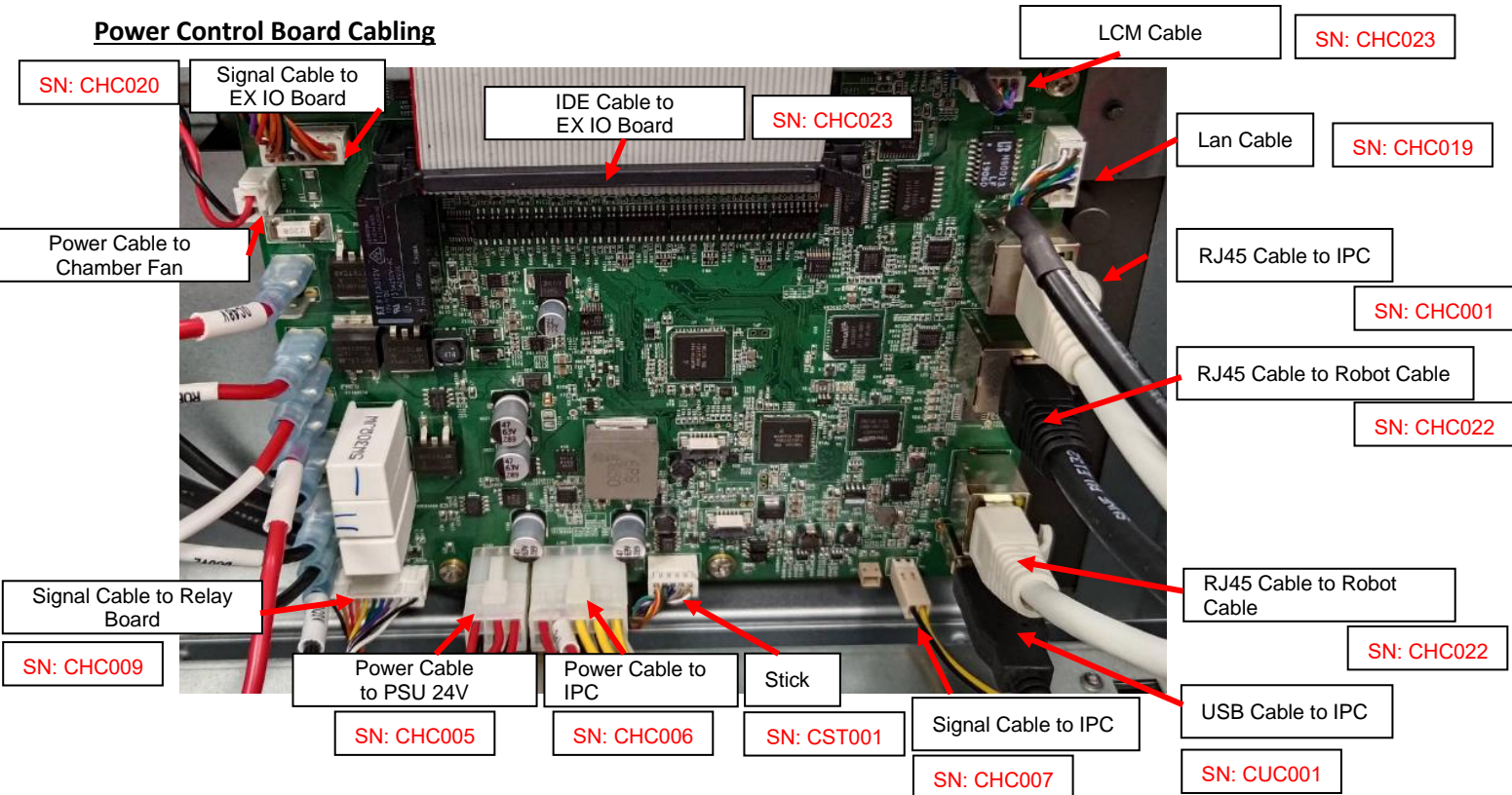
### Preparation

- 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).

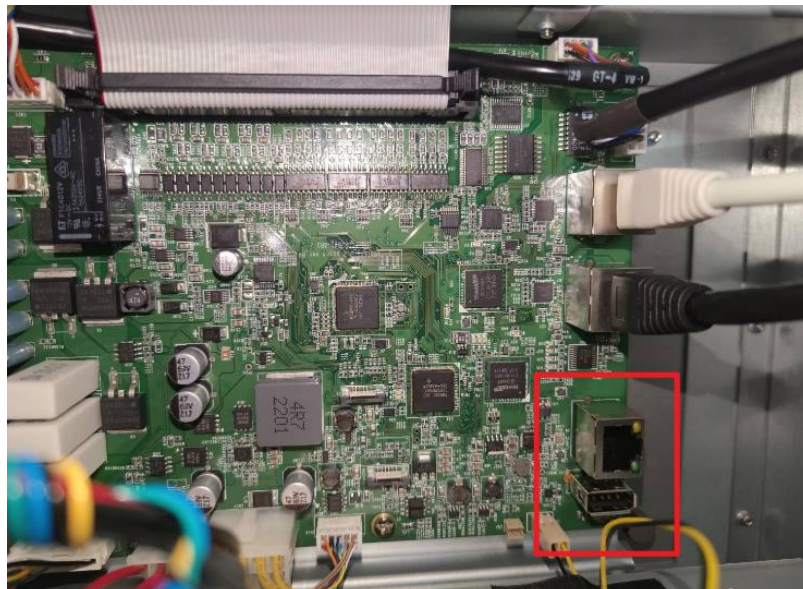


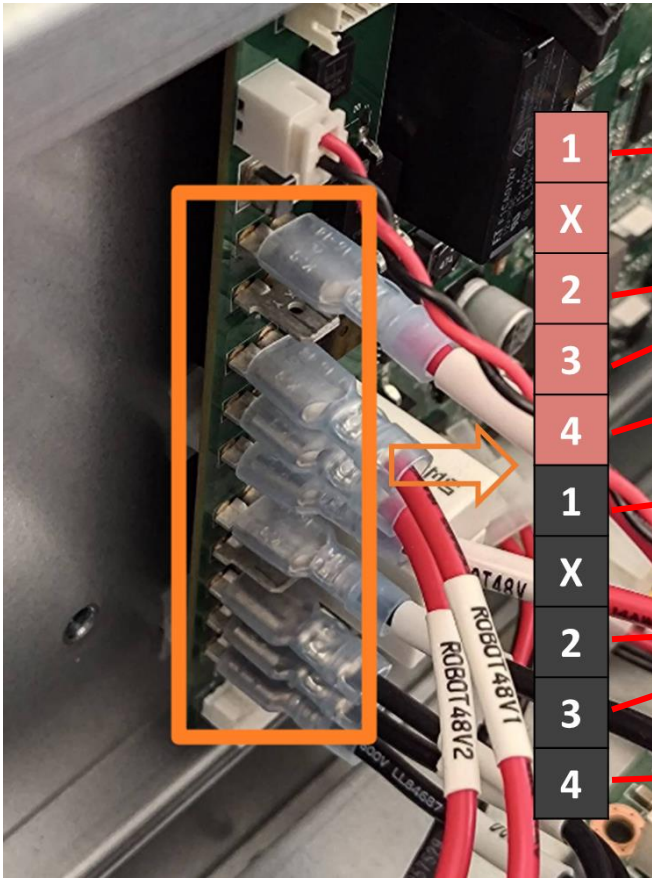


**Power Control Board Cabling**



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

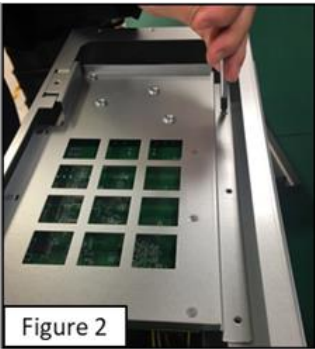
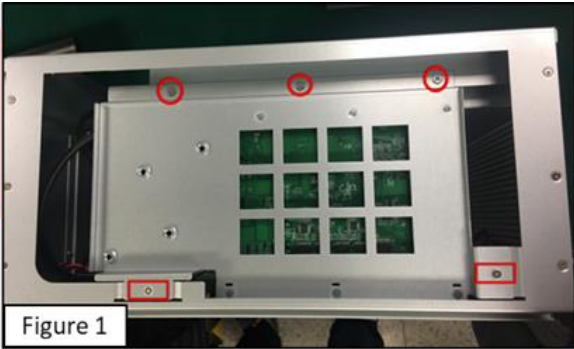




- 1 → Power Cable from PSU 48V (SN: CWC002)
- X
- 2 → Power Cable from Robot Cable (SN: CHC022)
- 3 → Power Cable to Power Eater (SN: CWC002)
- 4 → Power Cable from PSU 48V (SN: CWC002)
- 1
- X
- 2 → Power Cable from Robot (SN: CHC022)
- 3 → Power Cable to Power Eater (SN: CWC002)
- 4

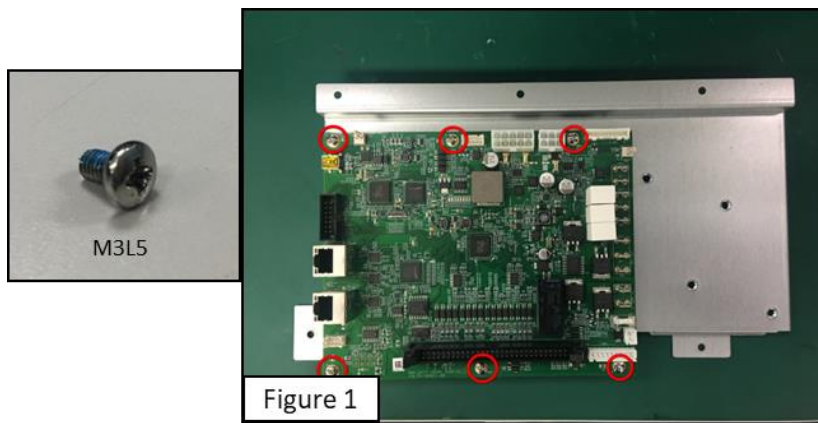
**Disassemble the Power Control Board**

- 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).





**Assemble the Power Control Board and install the Power Control Board cables**

- Operate the previous steps in reverse while assembling the Power Control Board.

After replacing the Power Control Board, please update the EEPROM, ESI, and firmware data by Chapter 25.3; otherwise, the robot will err.

**6.4 Disassemble/Assemble the Relay Board**

**Preparation**

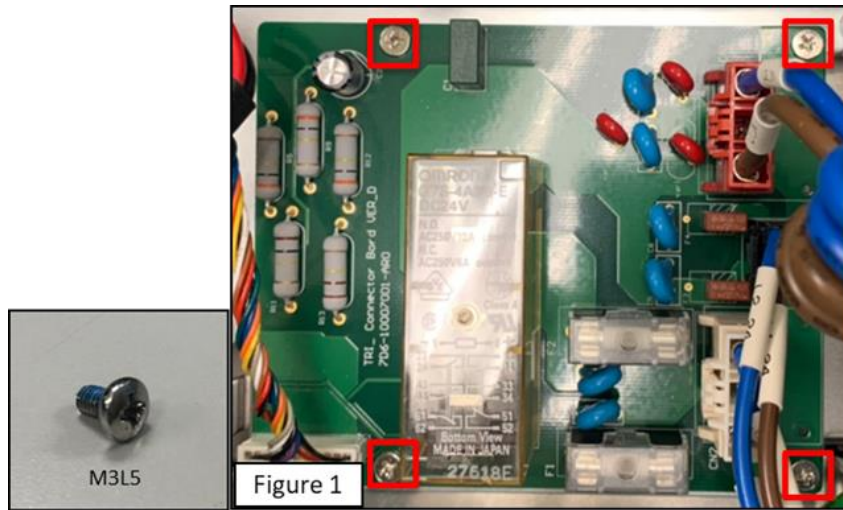
- Refer to the previous steps to disassemble the Front cover and the LCD screen cover.

**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.



**Assemble the Relay Board**

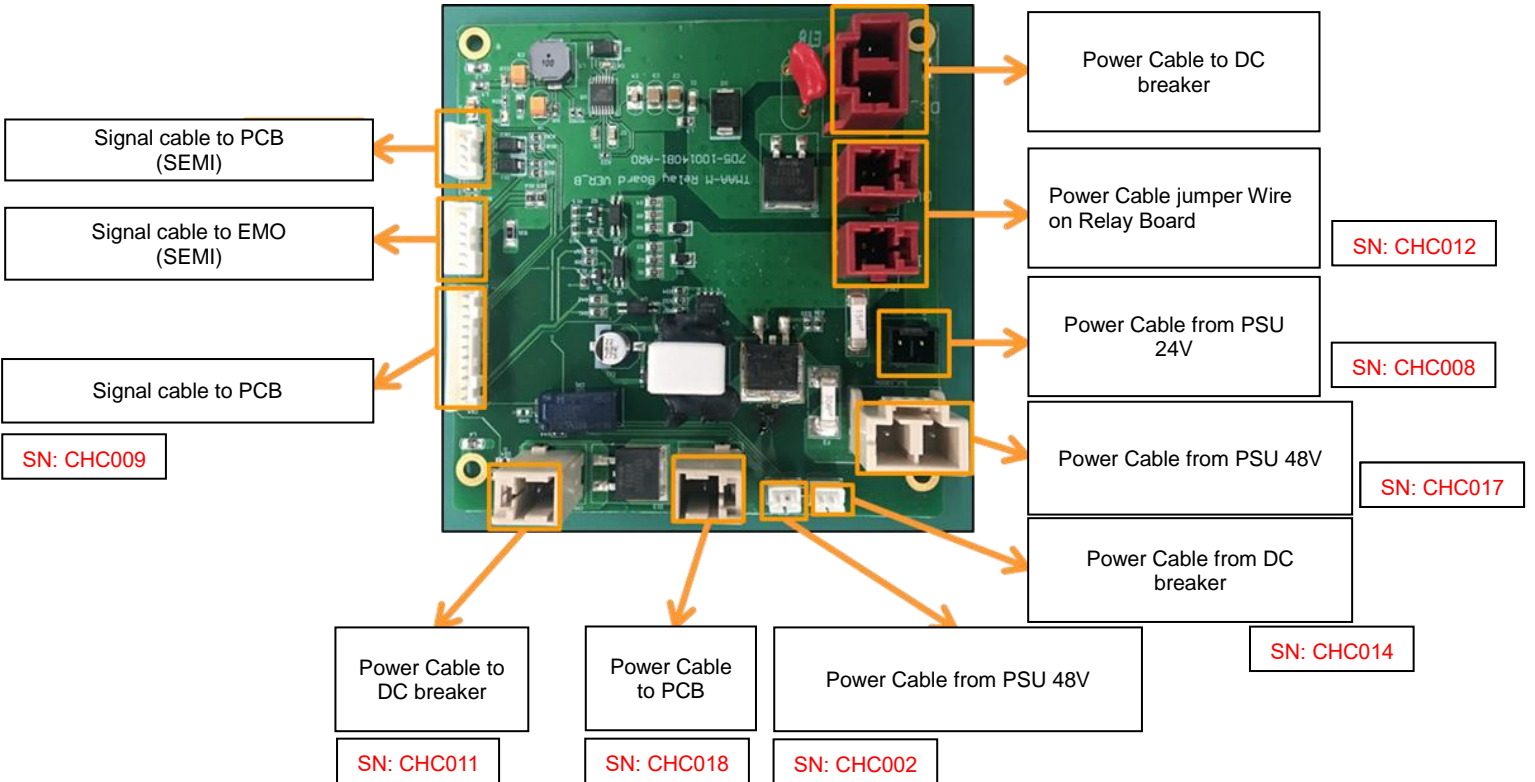
- Operate the previous steps in reverse while assembling the **Relay Board**

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

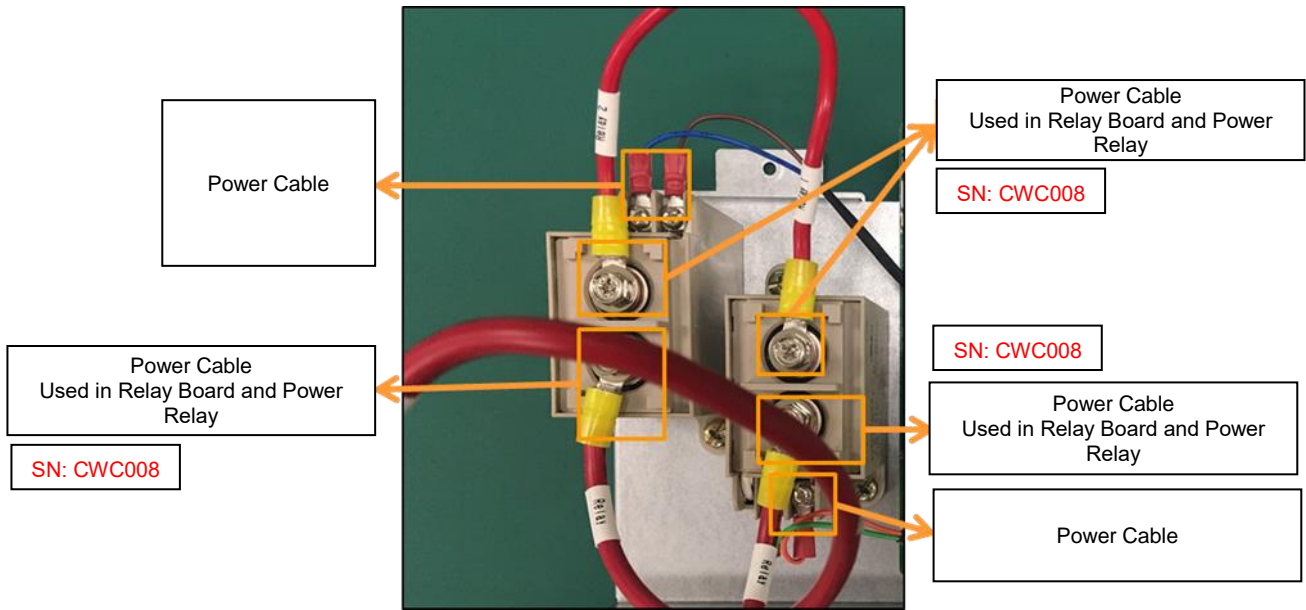
**Preparation**

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

**The Relay Board Wiring**

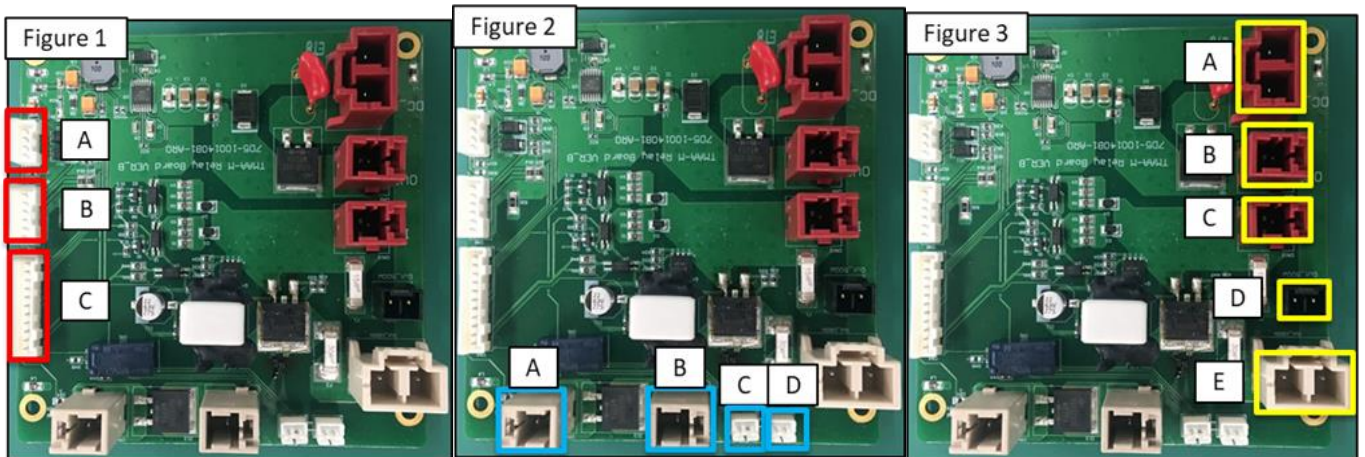


The SEMI Wiring



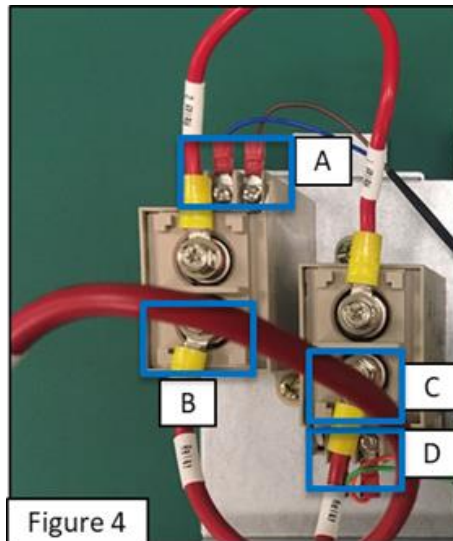
Disassemble the Relay Board

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

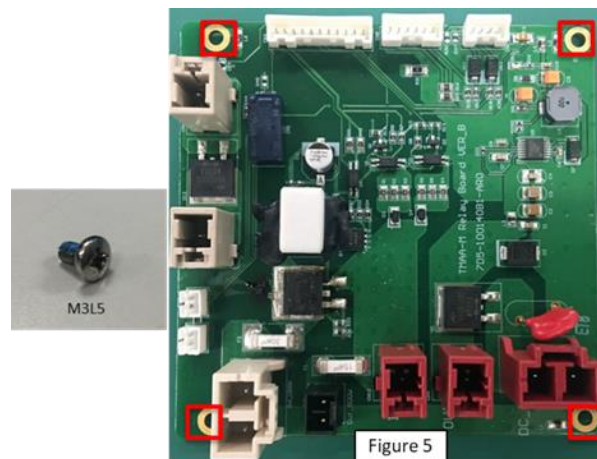


- Disconnect all cables on the Relay Board.





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



### **Assemble the Relay Board**

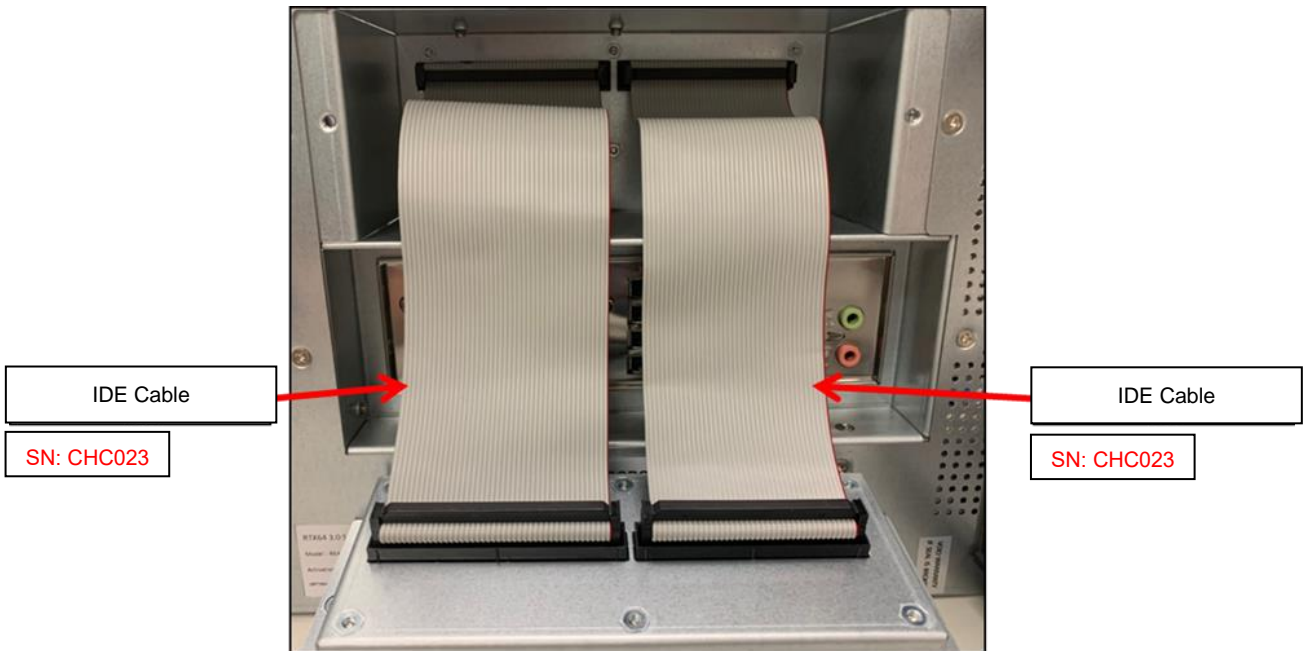
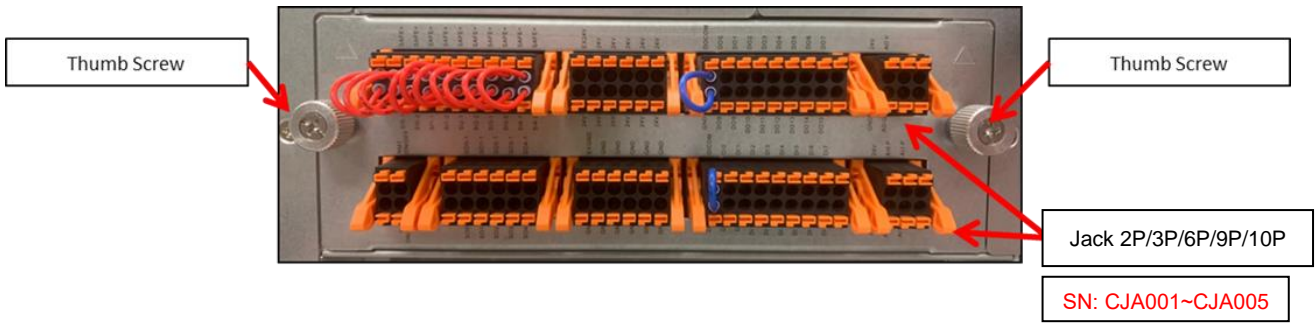
- Operate the previous steps in reverse while assembling the **Relay Board**.

## 6.6 Disassemble/Assemble the **EX IO BOARD**

### **Preparation**

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

### **The EX IO BOARD Introduction**



**Disassemble the EX IO BOARD**

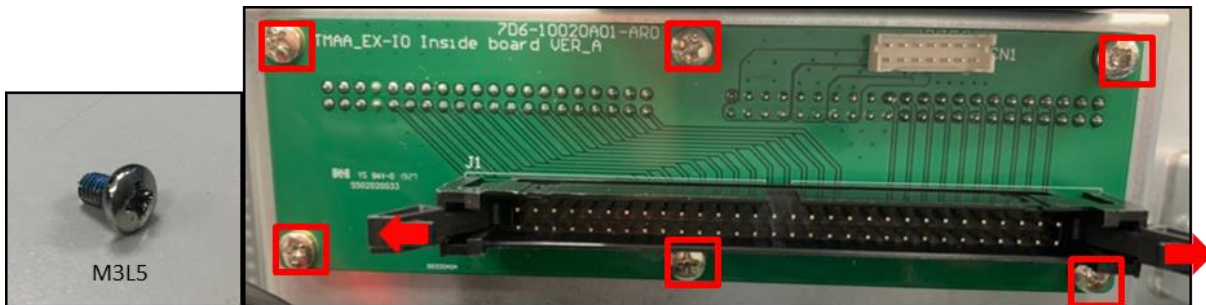
- Toggle the switch up to remove all I/O connectors from the EX I/O ports.



- 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.



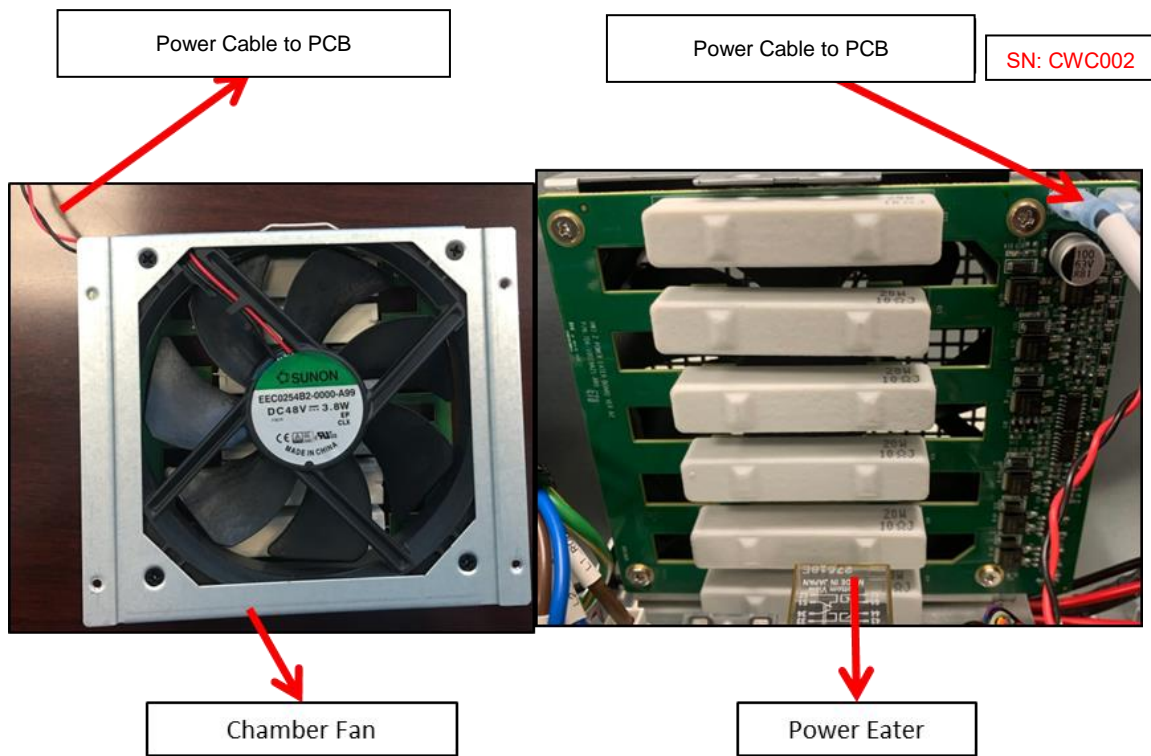
## 6.7 Disassemble/Assemble the Power Eater

### Preparation

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

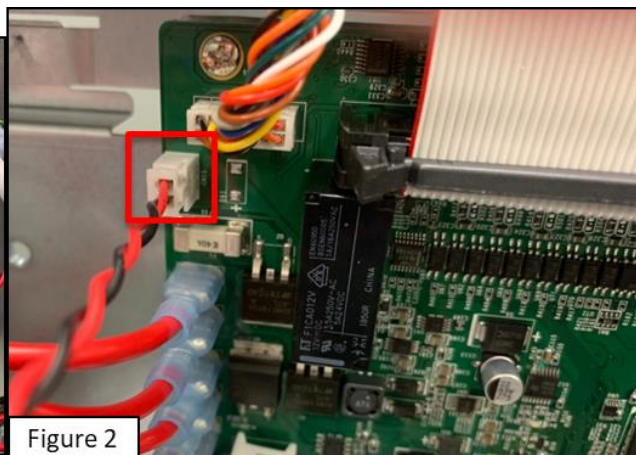
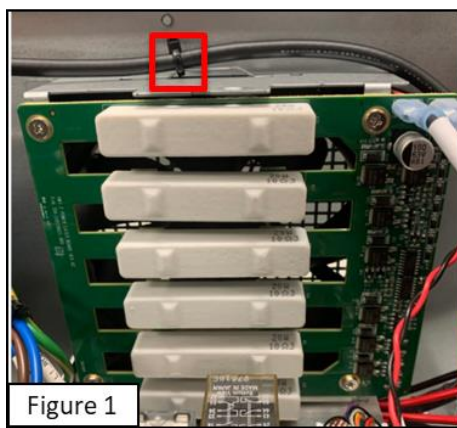
### The Power Eater Introduction



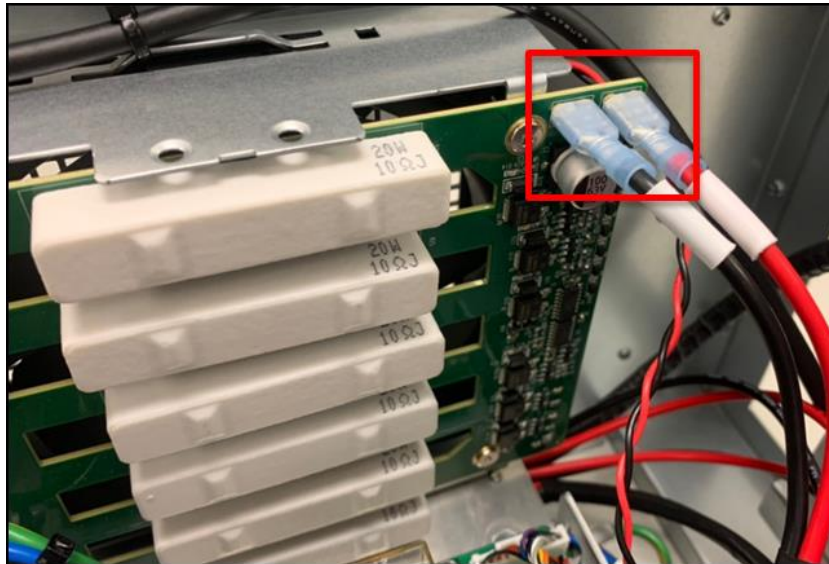


**Disassemble the Power Eater**

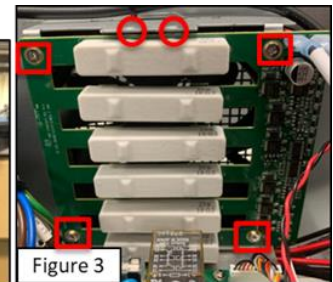
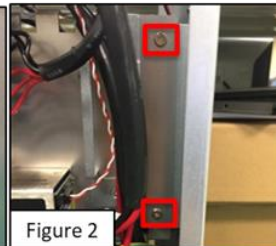
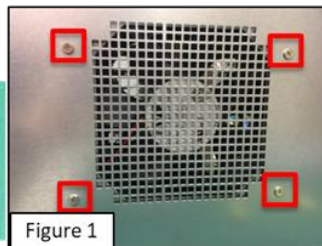
- Cut off the cable tie (as shown in Figure 1).
- Disconnect the fan power cable from the **Power Control Board** (as shown in Figure 2).



- 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**

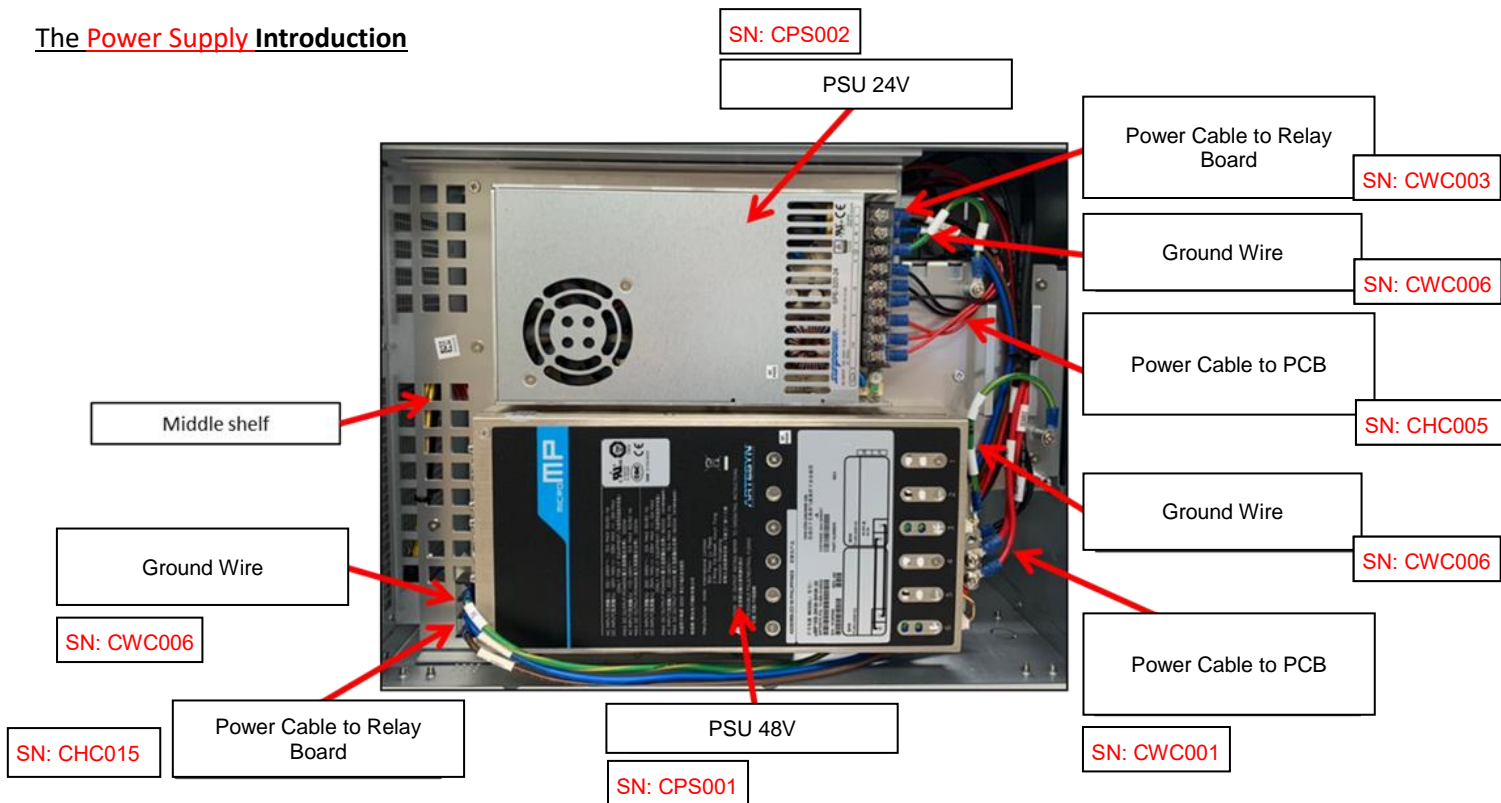
- Operate the previous steps in reverse while assembling.

## 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) ◦

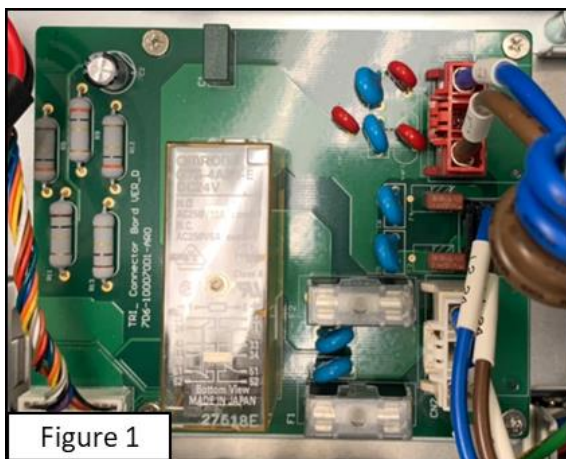


Figure 1

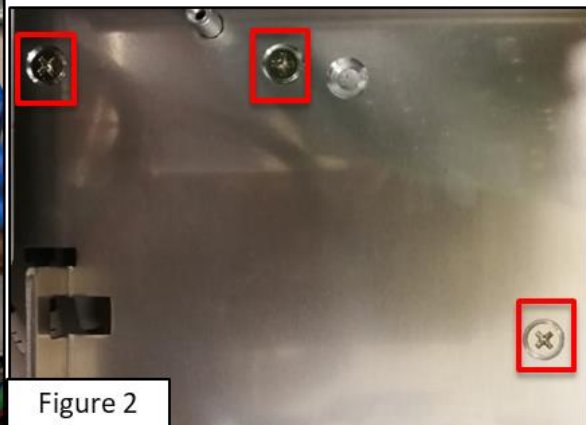


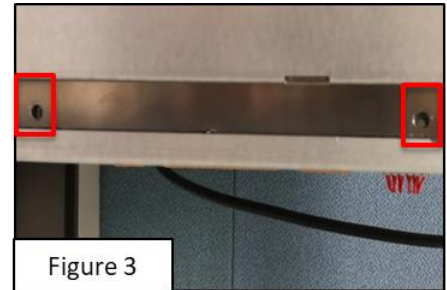
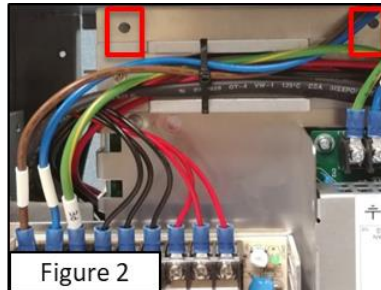
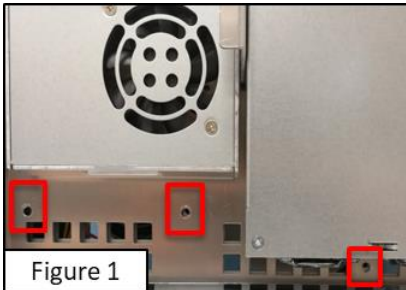
Figure 2

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

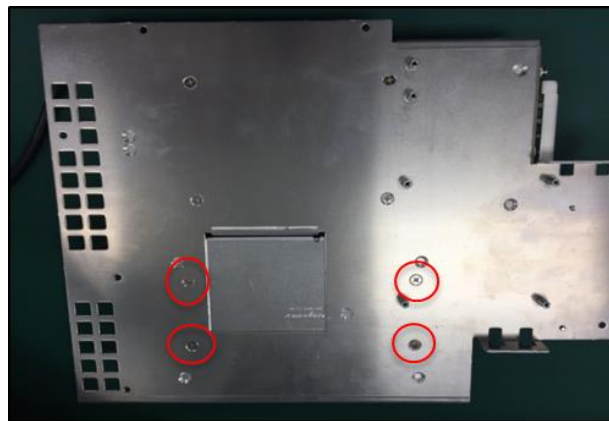




- Loosen the screw at the left of the **Power Supply** (as shown in Figure 1).
- Loosen the screw at the right of the **Power Supply** (as shown in Figure 2).
- Loosen the screw at the bottom of the **Power Supply** (as shown in Figure 3).

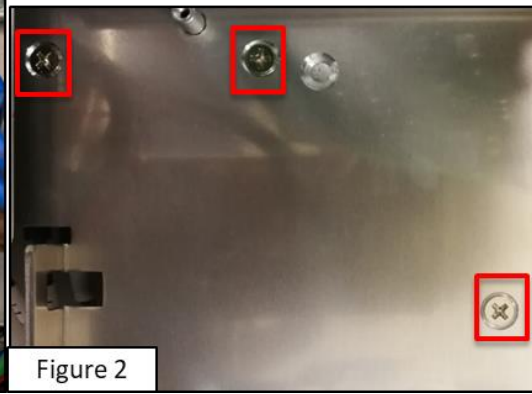


- Loosen the screws at the middle shelf behind the **Power Supply**.

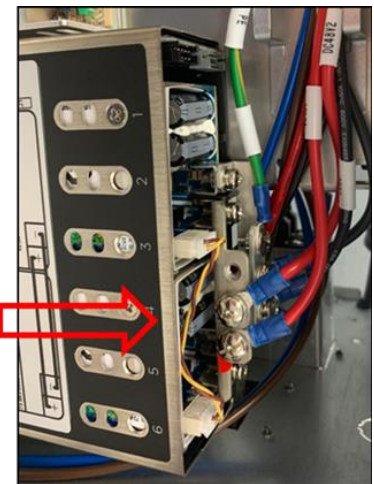


**Disassemble the Power Supply 48V**

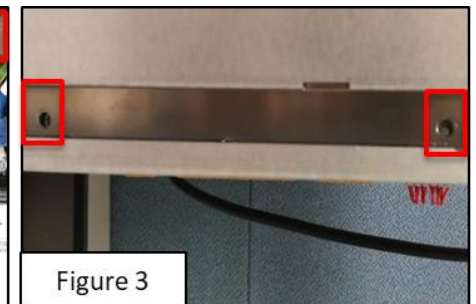
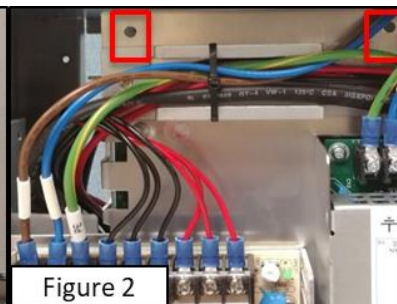
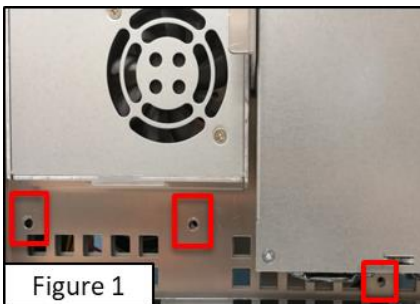
- Refer to the previous steps to disassemble the **Relay Board** (as shown in Figure 1).
- Loosen the screws the back of the **Relay Board** (as shown in Figure 2) ◦



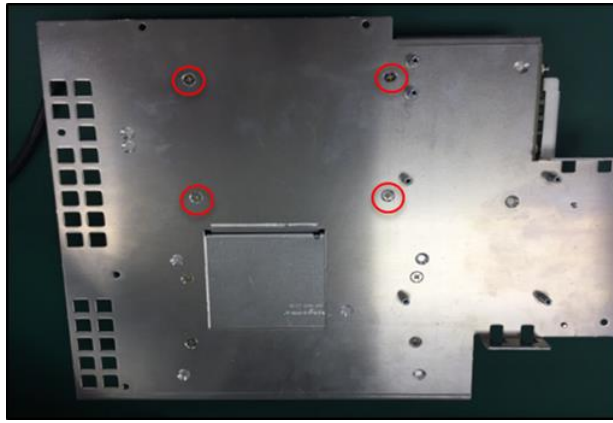
- Disconnect all the cables from the **Power Supply**.



- 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).



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



**Reassemble the Power Supply**

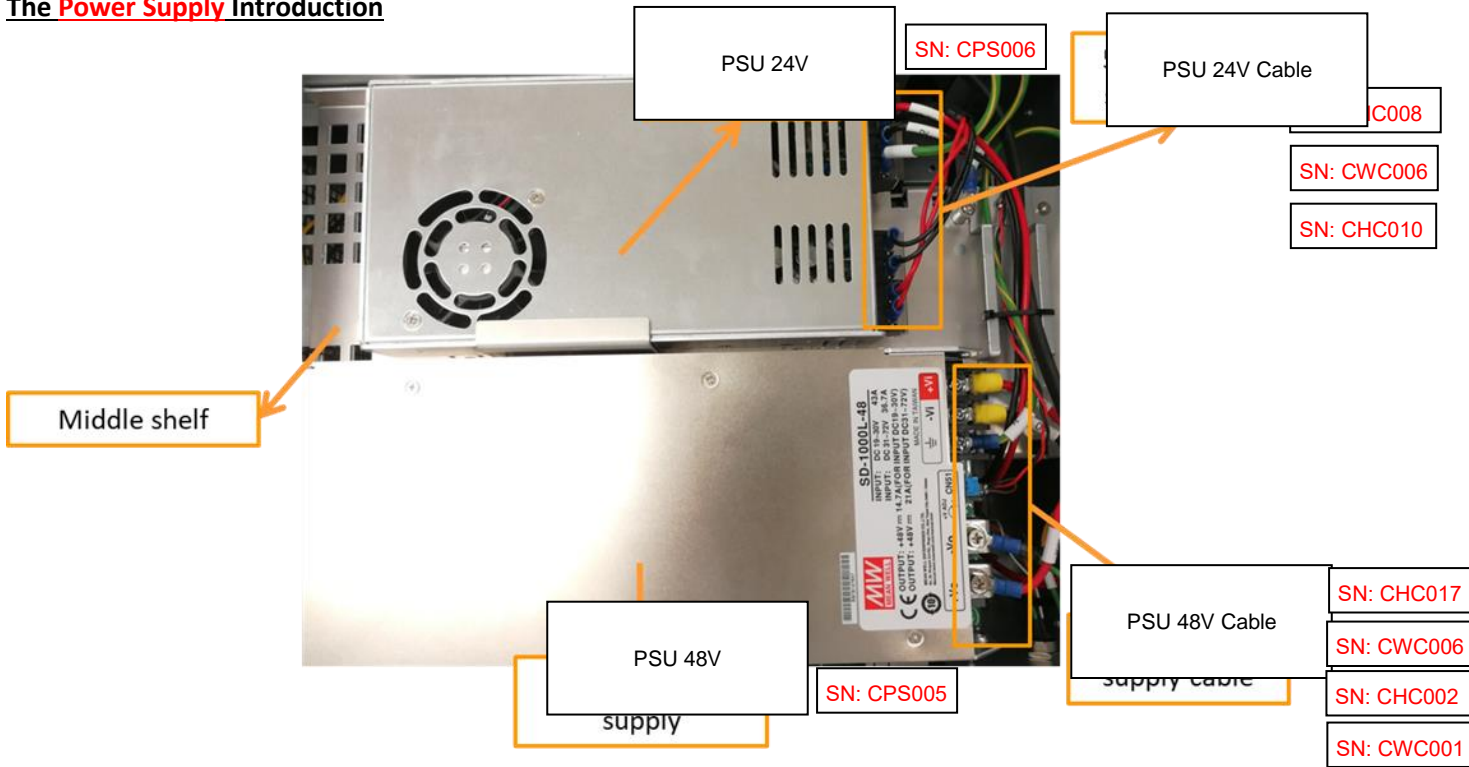
- Operate the previous steps in reverse while assembling.

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

**Preparation**

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

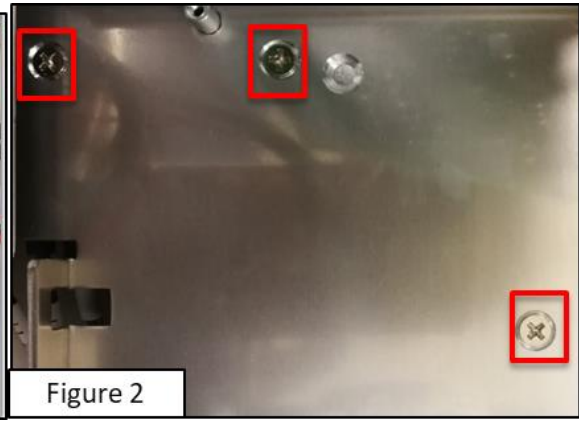
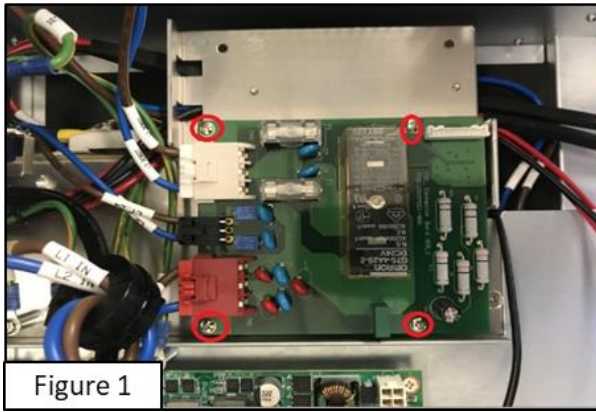
**The Power Supply Introduction**



**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) ◦

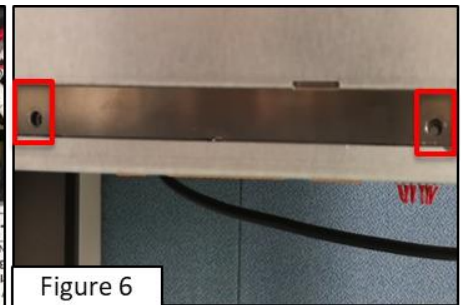
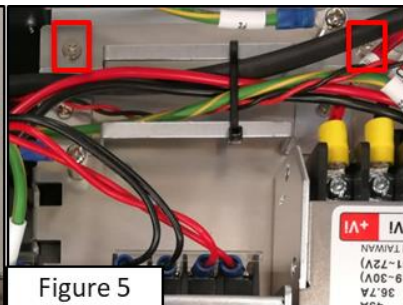
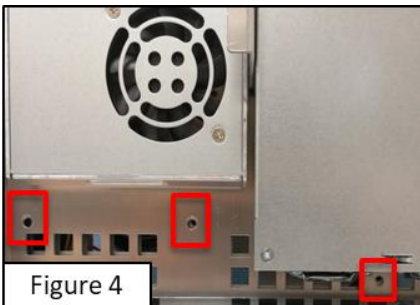




- Disconnect all the cables from the **Power Supply**.



- 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).



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

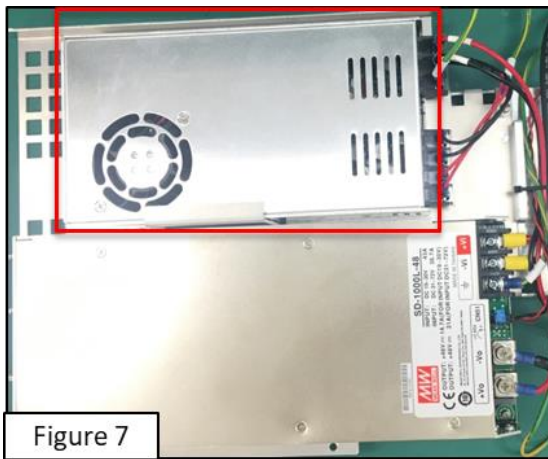


Figure 7

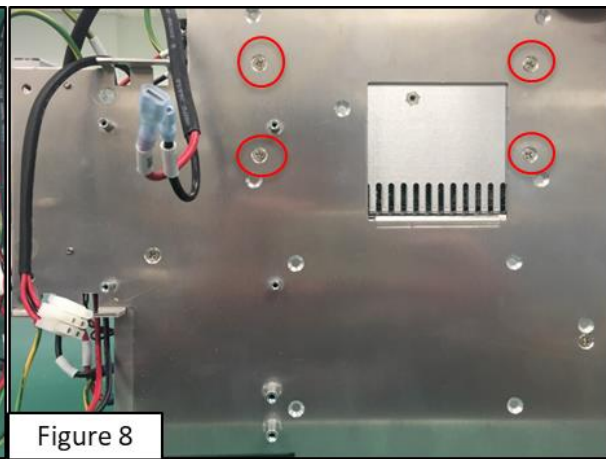


Figure 8

**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) ◦

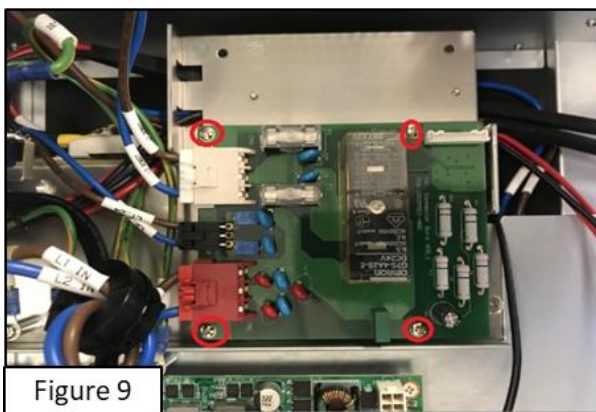


Figure 9

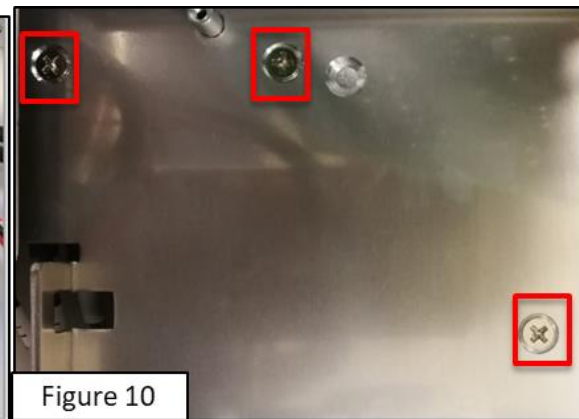


Figure 10

- 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).

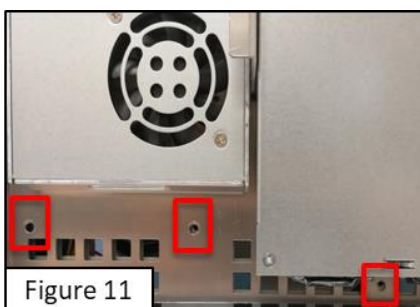


Figure 11

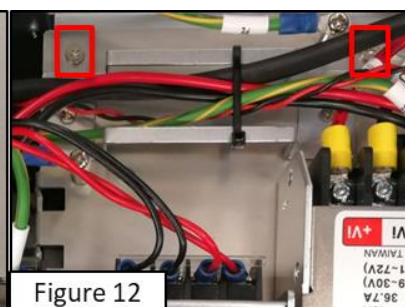


Figure 12



Figure 13

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

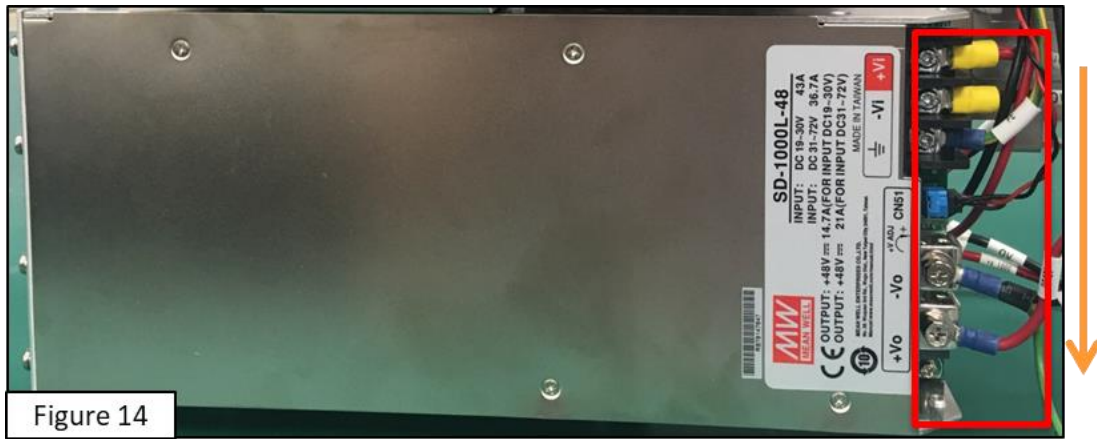


Figure 14

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

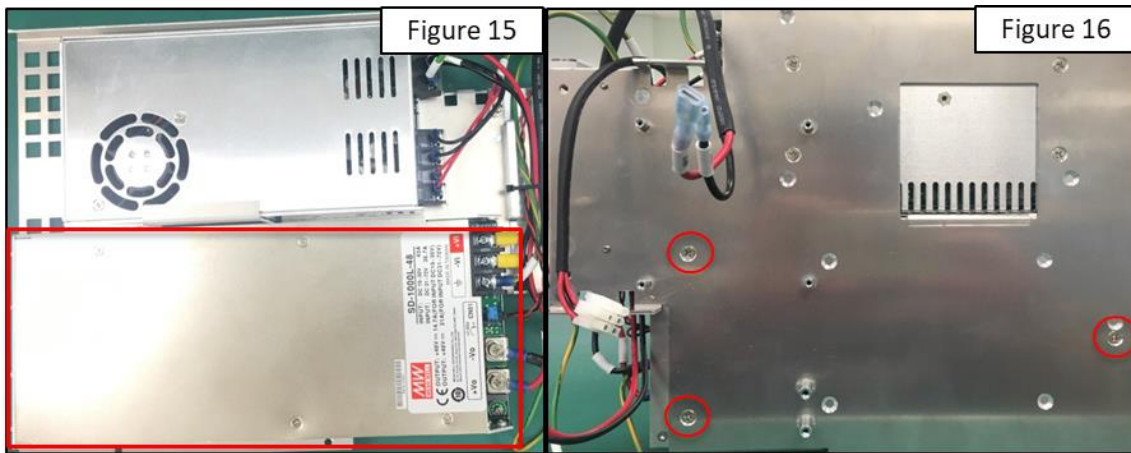


Figure 15

Figure 16

### Reassemble the **Power Supply**

- Operate the previous steps in reverse while assembling.

## 6.10 Disassemble/Assemble the **Stick**

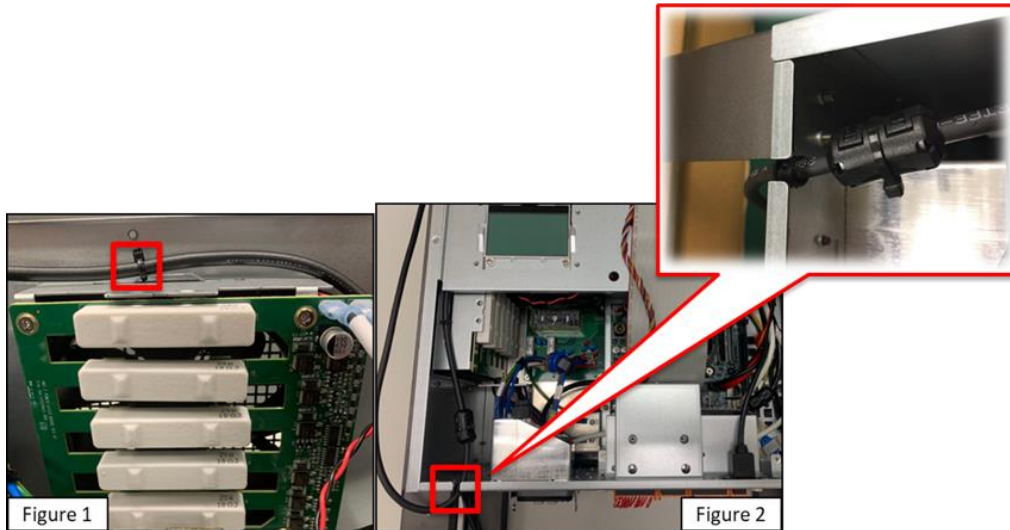
### Preparation

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

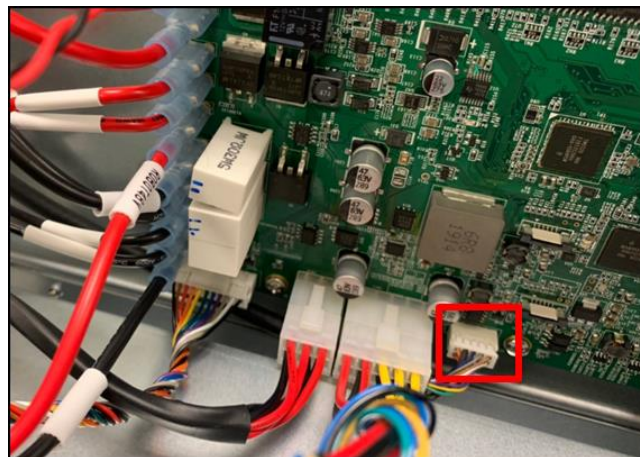
### Disassemble the **Stick**

- 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.

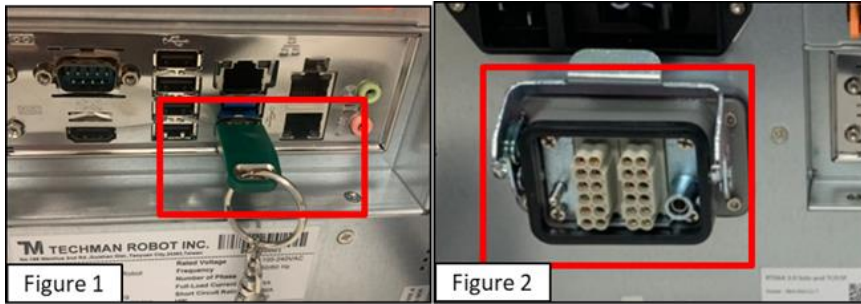
### **Reconfigure the Computer Name**

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

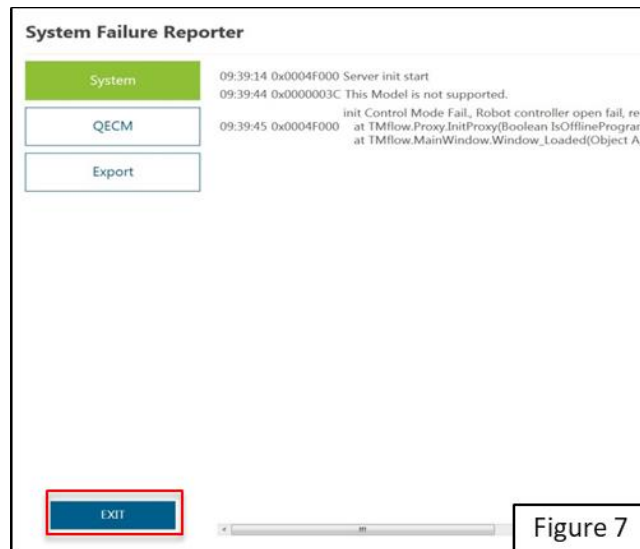


- In the dongle into the **Control Box** (as shown in Figure 1).

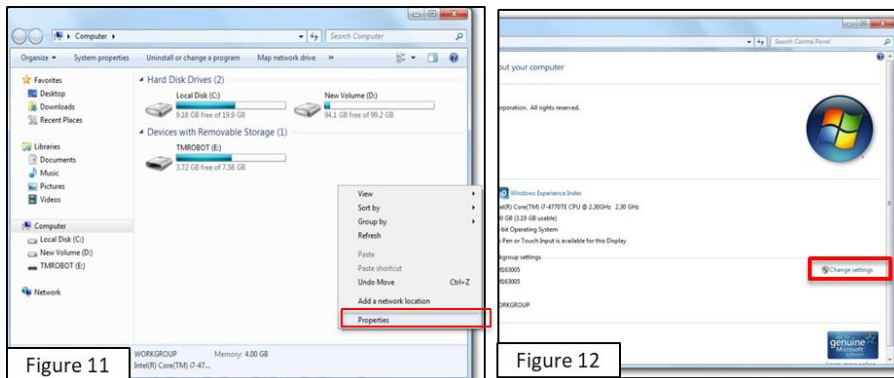
- Remove the robot cable from the **Control Box** and turn on the **Control Box** (as shown in Figure 2).



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



- 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).

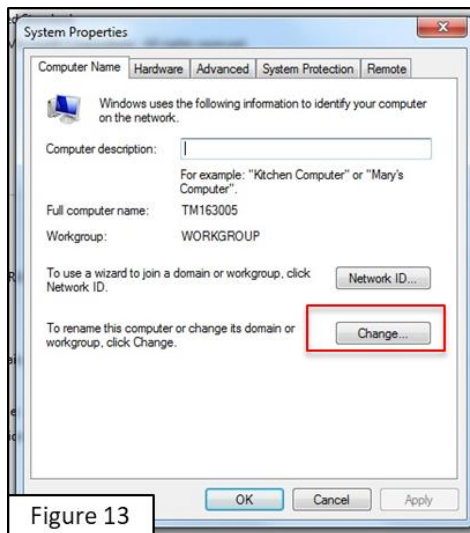


Figure 13

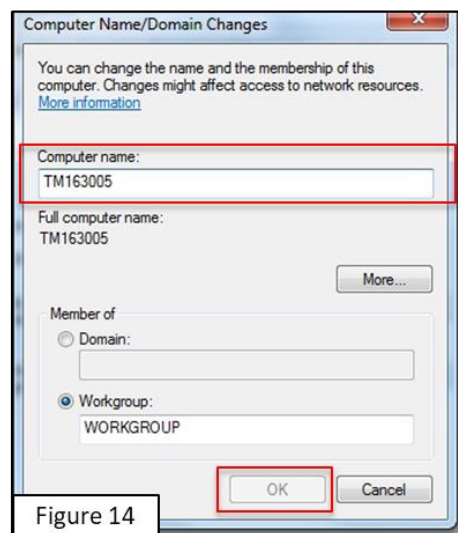


Figure 14

- 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

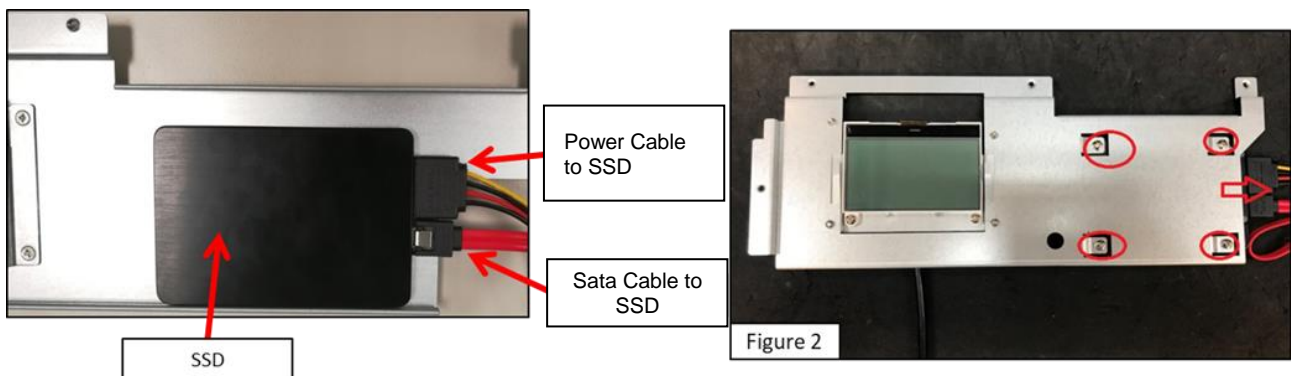
Refer to the previous steps to disassemble the **Front cover** and the LCD screen cover of the control box.

### 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.



### Assemble the SSD

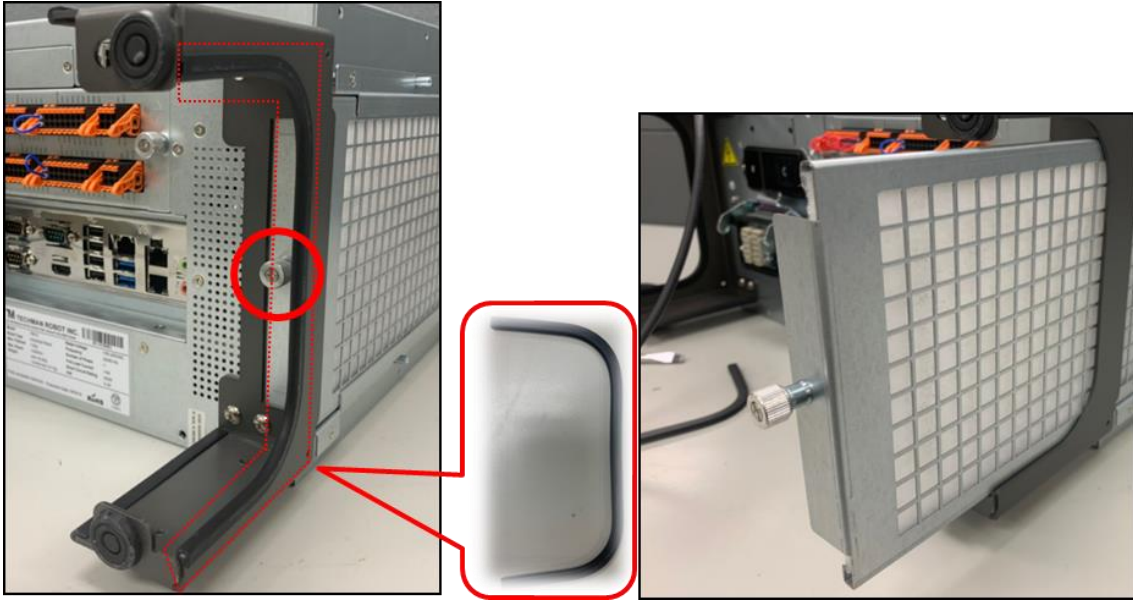
Assemble the SSD

- 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.



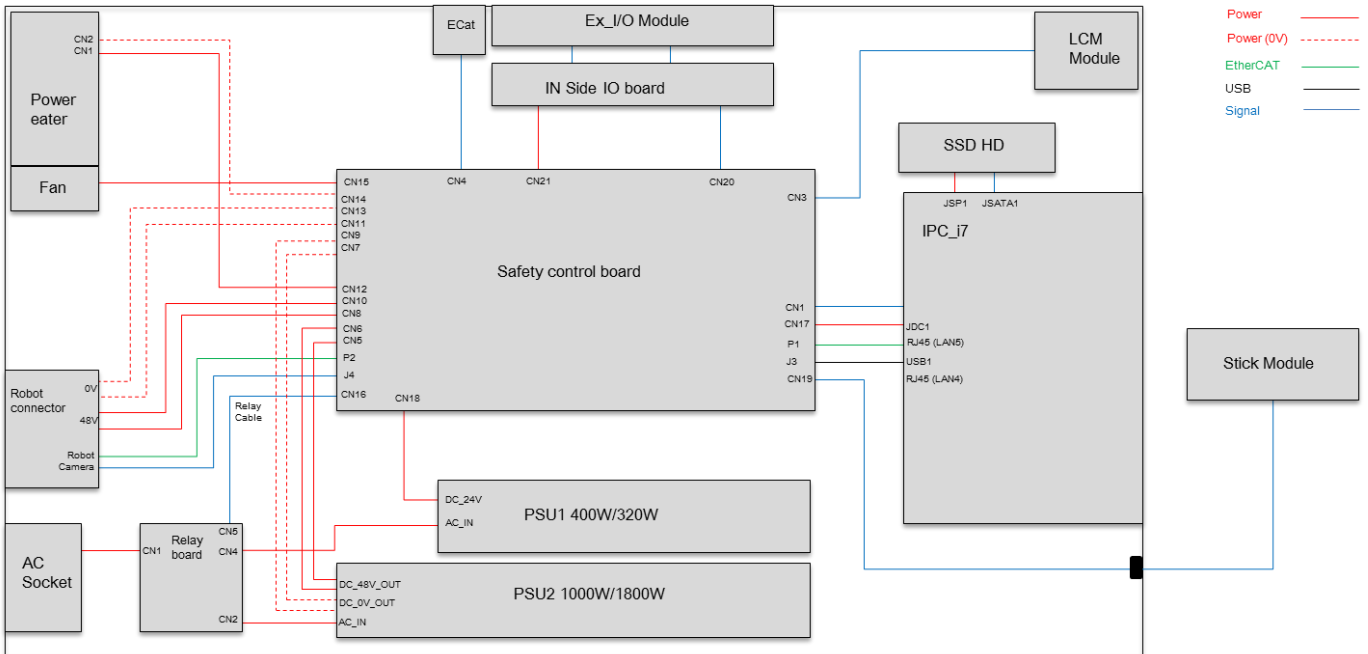
**Install the Air Filter**

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

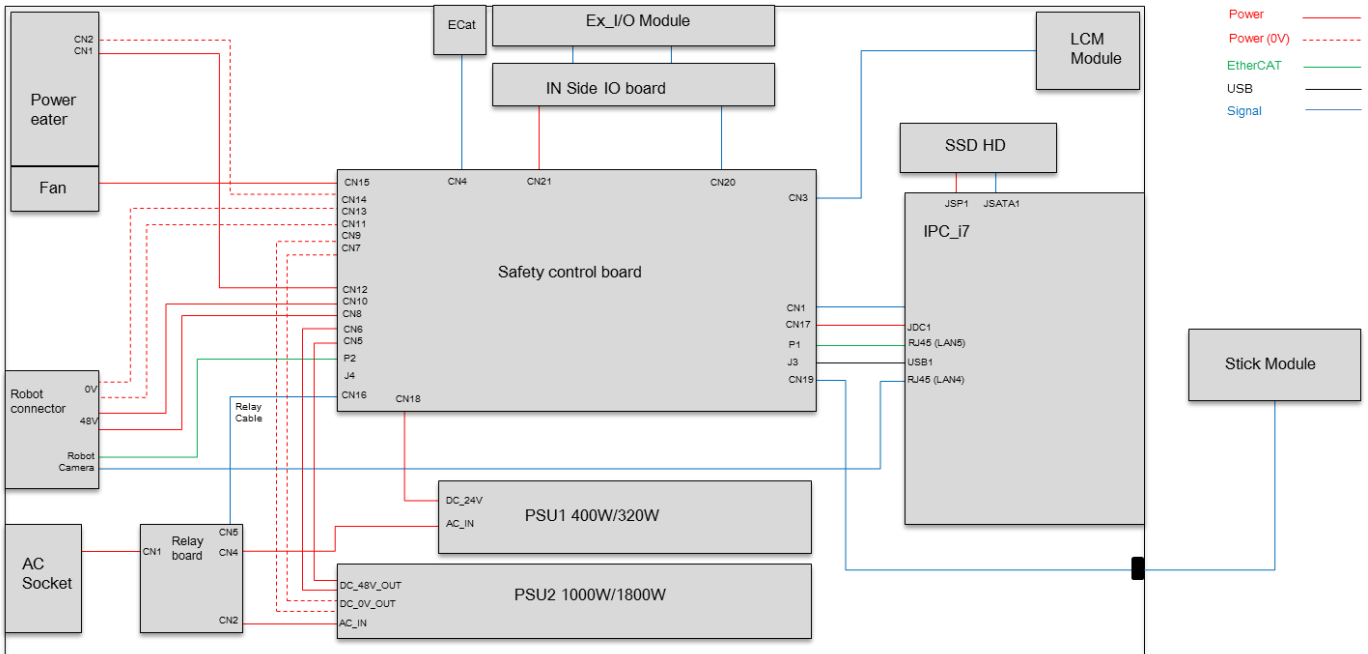


# 7. Circuit Diagram

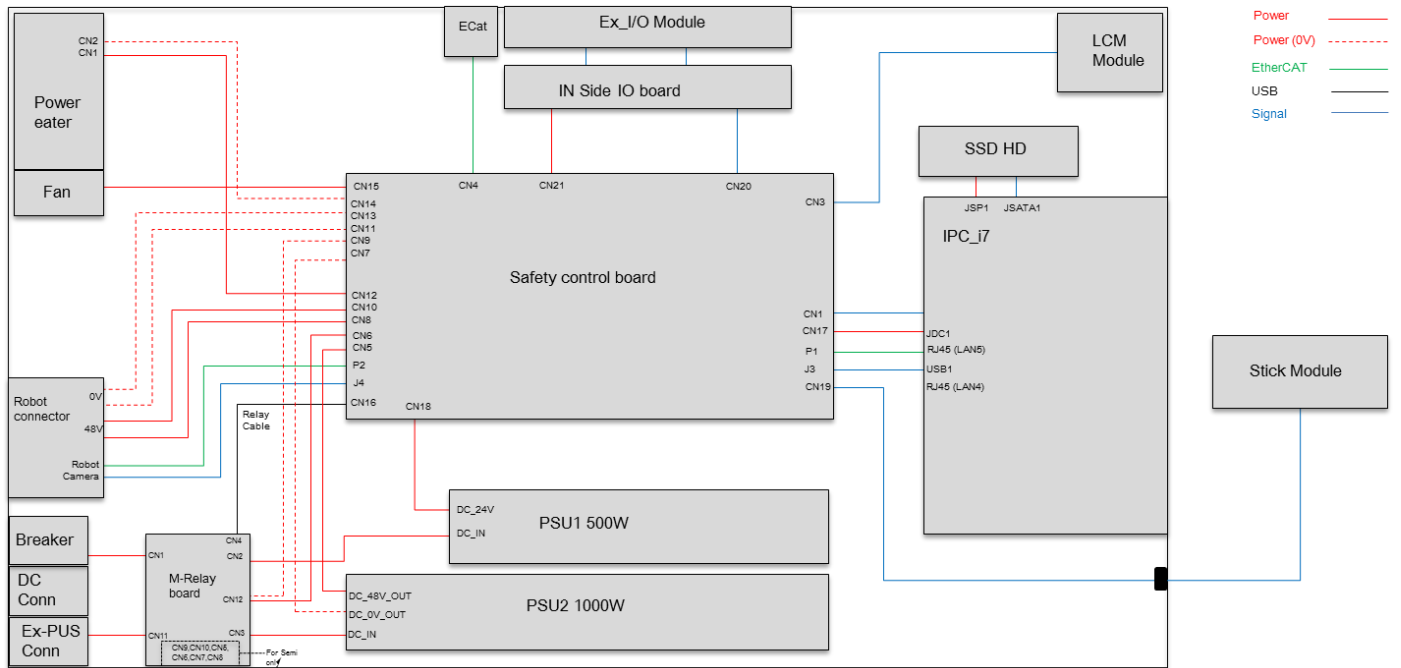
## 7.1 HW3.2 TM5A



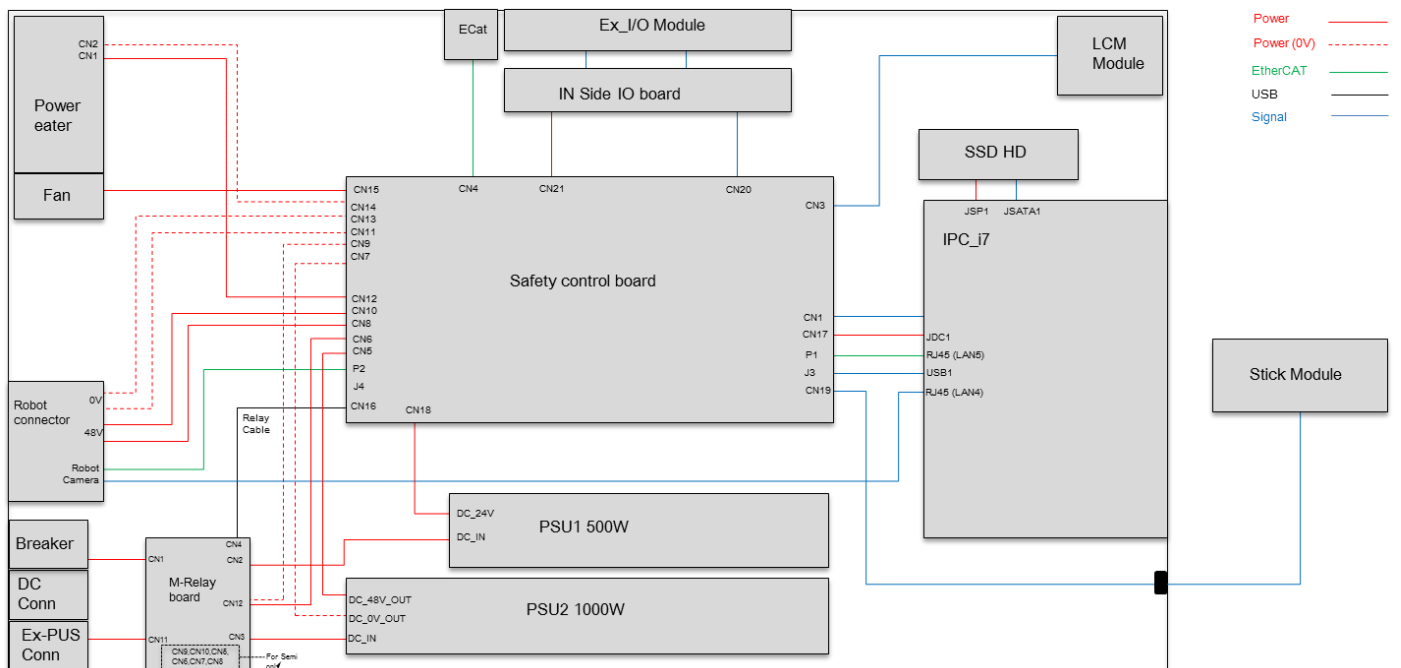
## 7.2 HW3.2A TM5A



### 7.3 HW3.2 TM5A-M



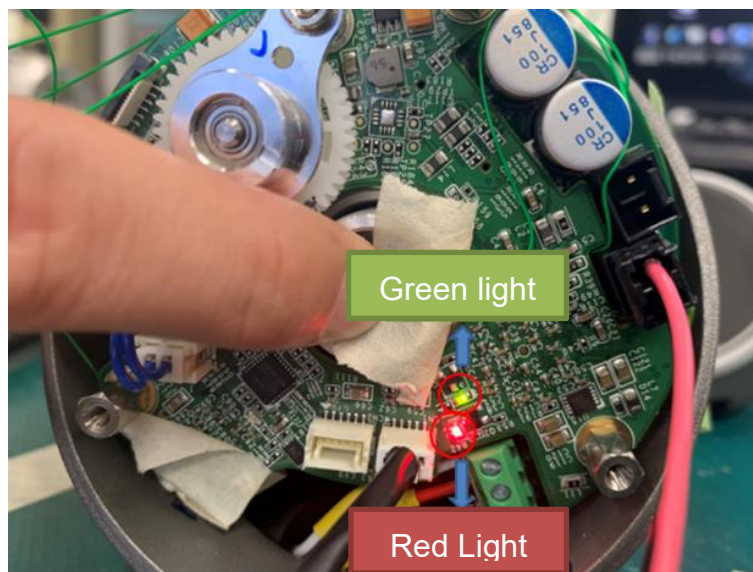
### 7.4 HW3.2A TM5A-M



## 8. Indication Light

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

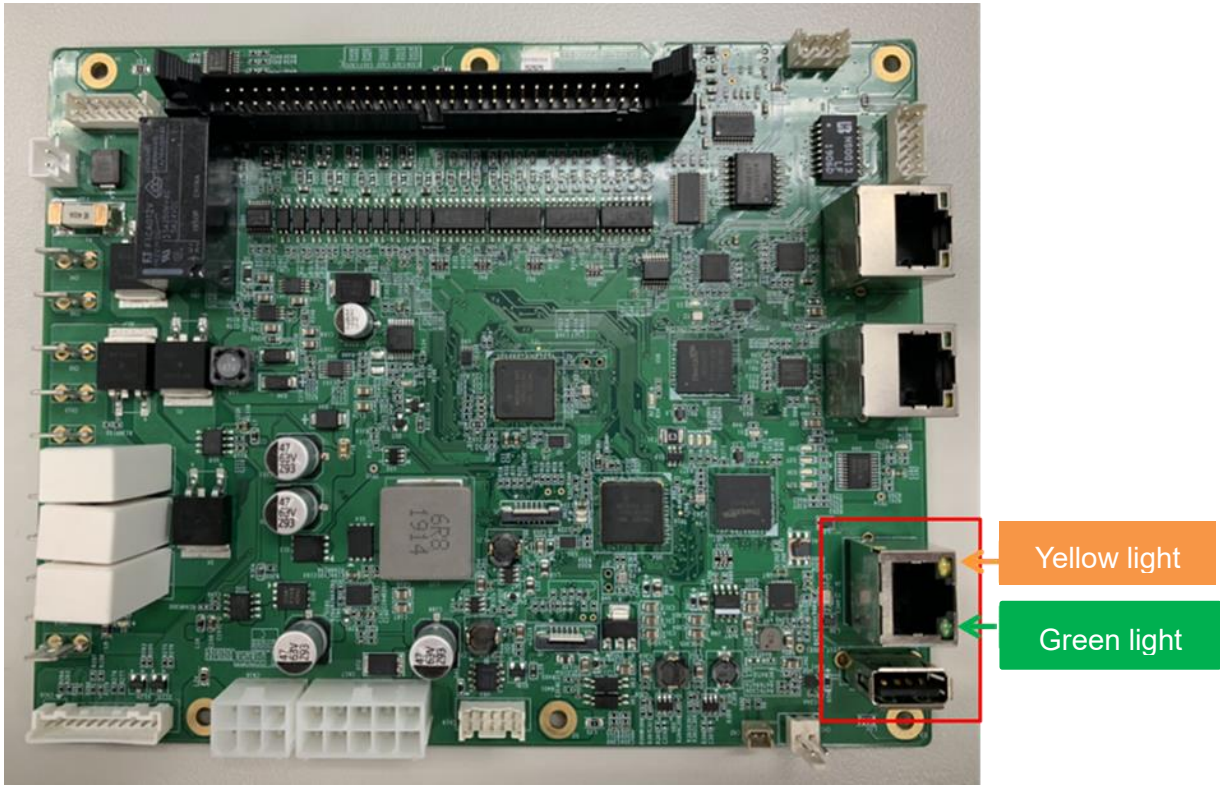
State \ Signal Color	Green	Red
MCU ON (normal state)	ON	ON
Error	X	random flashing
Firmware Error	Flashing: ON/OFF	Flashing: ON/OFF
No Firmware	ON	ON
Servo ON/OFF	fast/slow flashing	OFF



The Location of the Indication Light on the Robot Motherboard Assembly

### 8.2 Definitions of the Indication Light on the USB Signal Booster

State \ Signal Color	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**

### 8.3 Function Description of the End Module LED lights

Light color/state	Description
Solid Green Light	The project is running in manual mode.
Flashing green light	The project is running in manual mode.
Slow flashing green light	The project is running in manual mode.
Alternating between Green/Red light (with 2 beeps from buzzer)	The state of error in manual mode
Solid Blue Light	The robot is standing by in auto mode.
Flashing blue light	The project is running in auto mode.
Slow flashing green light	The project is paused in manual mode.
Alternating between Blue/Red light (with 2 beeps from buzzer)	The state of error in auto mode
Solid Blue Light	Recovery Mode
Flashing red light	The robot is on and initializing.
Flashing red light (Buzzer emits a short beep at the same time.)	Emergency Stop button pressed.
Solid Red Light	Fatal error
Buzzer emits a long beep.	



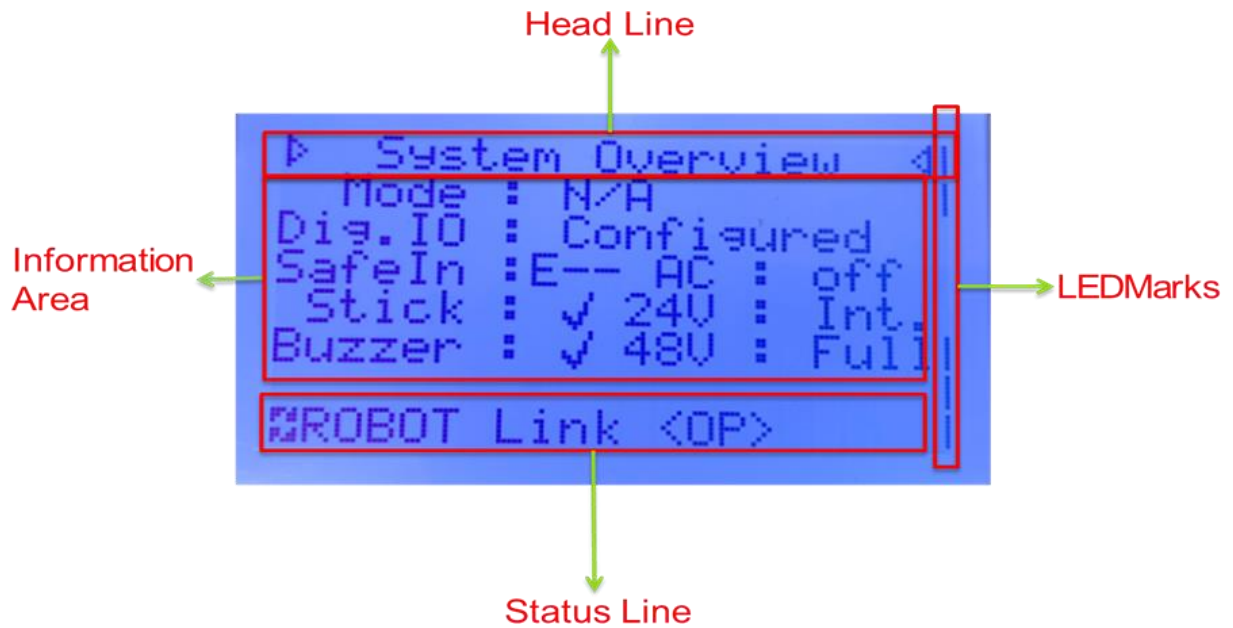


## 9. LCM

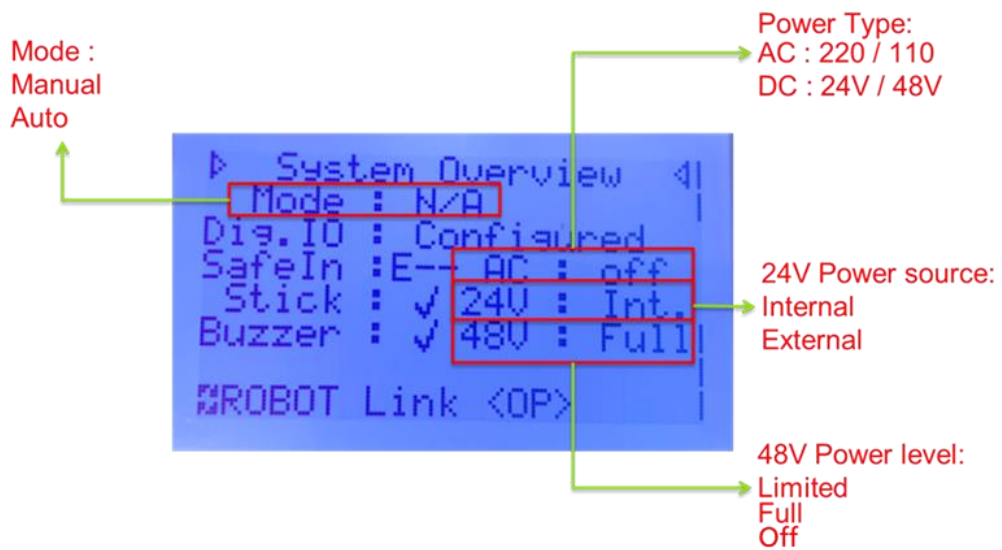
### 9.1 Overview

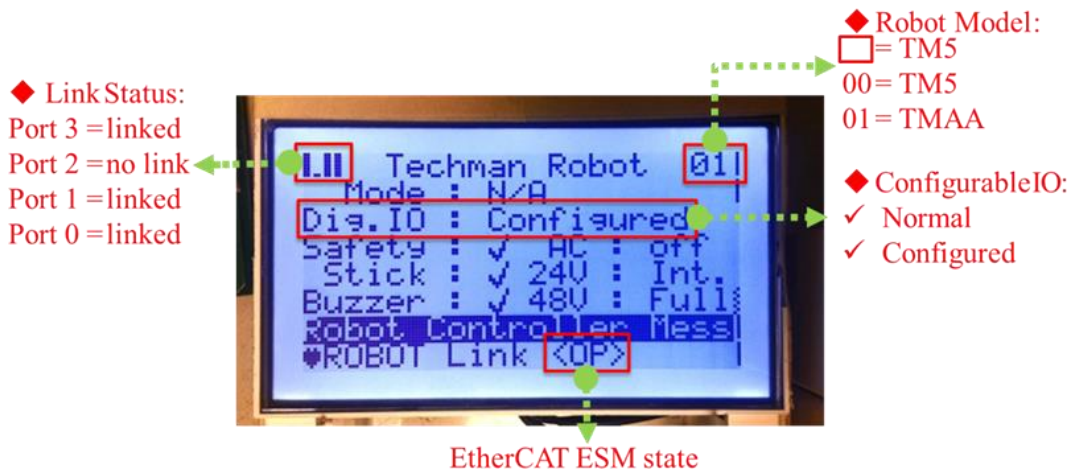
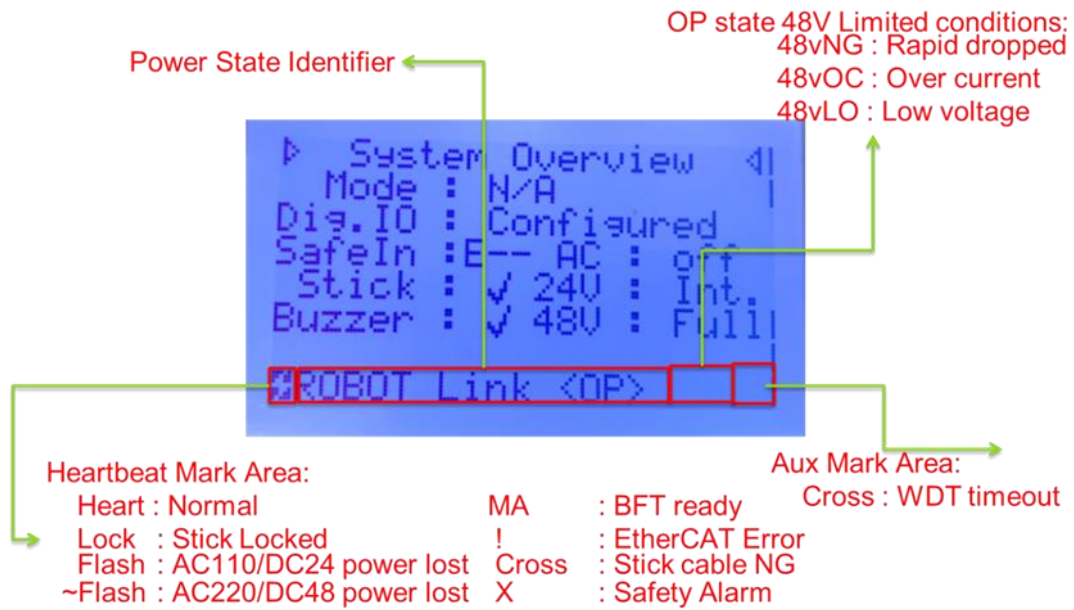
9.2 Note: Rapidly press the M/A button on the stick twice to switch pages.

#### LCD Module Screen Layout



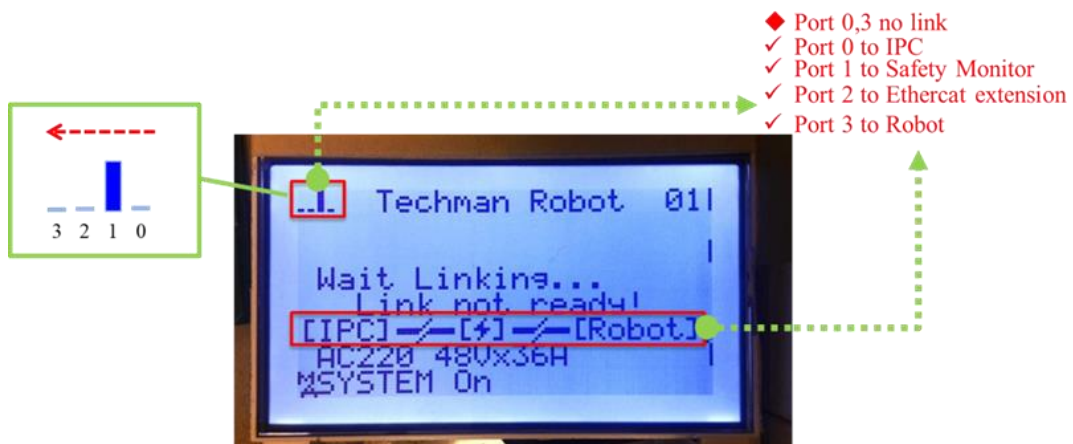
#### General Information





LCD Module Main Screen:

Check the connection status of the robot associated components



### Connect to the Network



### Connect to the EtherCAT Master

Waitfor "Robot Ready" command from Robot Controller

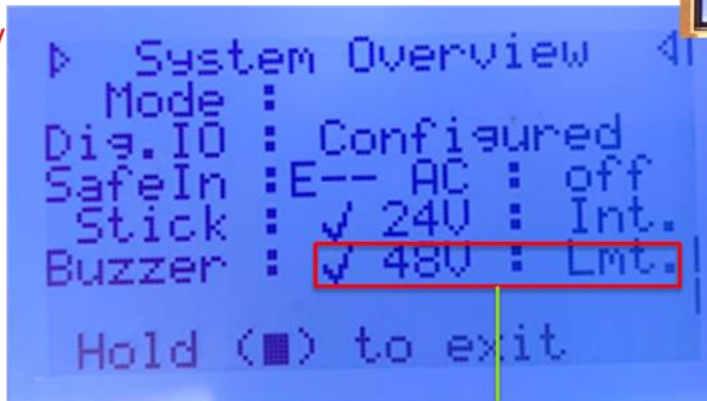


### Connected to the Robot Controller (Pre-Operation Status)

Robot not ready



Robot ready



After received "Robot Ready" command from Robot Controller

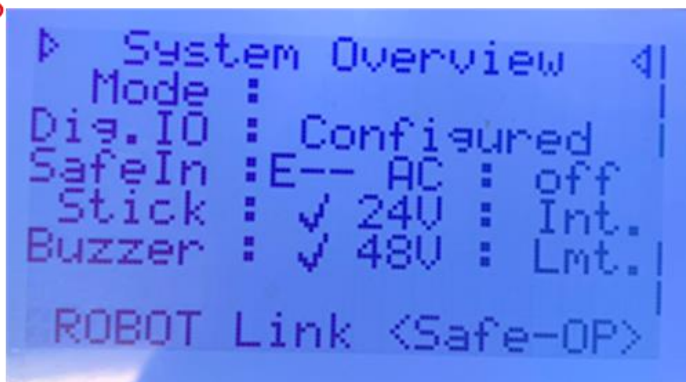
48V Power supplied to Robot : Limited current

Connected to the Robot Controller (Safe Operation Status)

Pre-OP



Safe-OP



ESM set to Safe-OP state, PDO input available

Connected to the Robot Controller (Operation Status)



Safe-OP

```

> System Overview <|
Mode :
Dia. IO : Configured
SafeIn : E-- AC : off
Stick : ✓ 24U : Int.
Buzzer : ✓ 48U : Lnt.
ROBOT Link <Safe-OP>

```

OP

```

> System Overview <|
Mode : N/A
Dia. IO : Configured
SafeIn : E-- AC : off
Stick : ✓ 24U : Int.
Buzzer : ✓ 48U : Full
ROBOT Link <OP>

```

ESM set to OP state, PDO input/output available

48V Power supplied to Robot : Full current

Robot Controller Information

```

||| Techman Robot 01|
Mode : N/A
Dia. IO : Configured
Safety : ✓ AC : off
Stick : ✓ 24U : Int.
Buzzer : ✓ 48U : Full
Robot Controller Mess
ROBOT Link <OP>

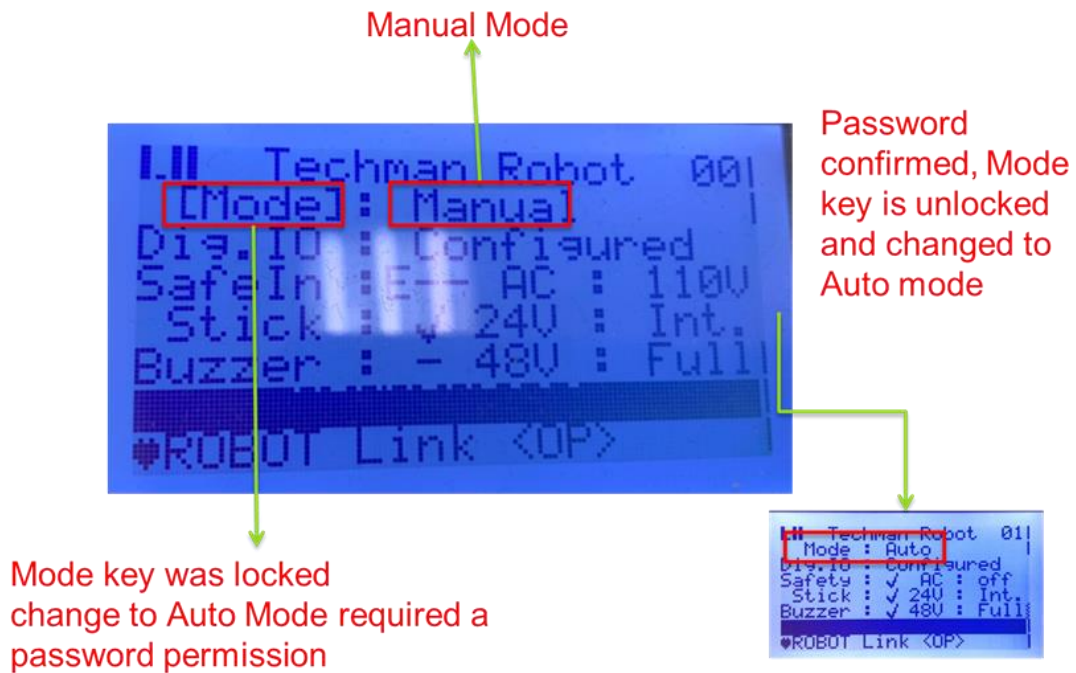
```

Robot Controller Message Line: Display Message/ErrorCode from Robot Controller

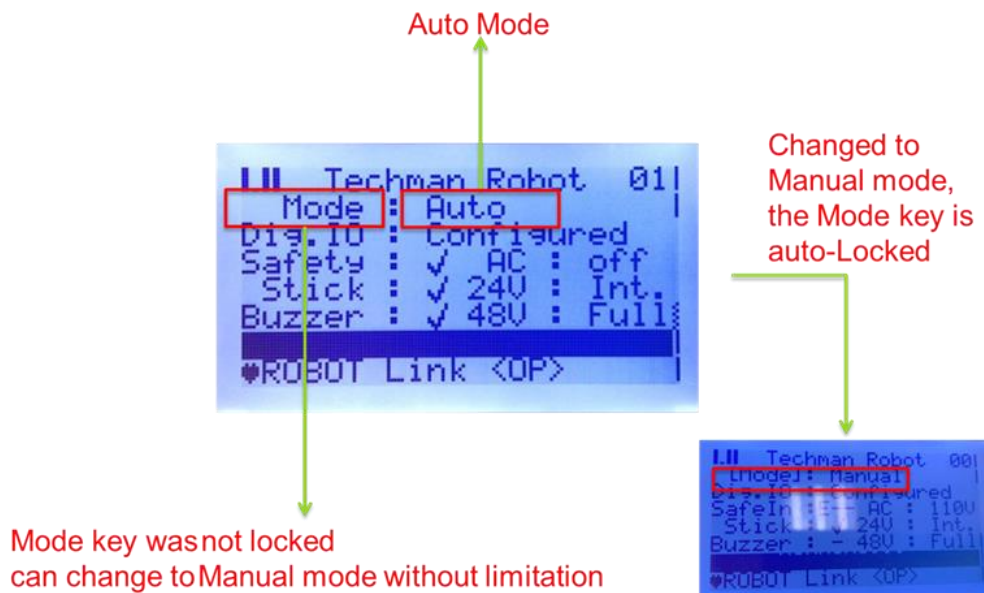


### 9.3 Key Locker:

#### Mode Lock (Manual Mode)

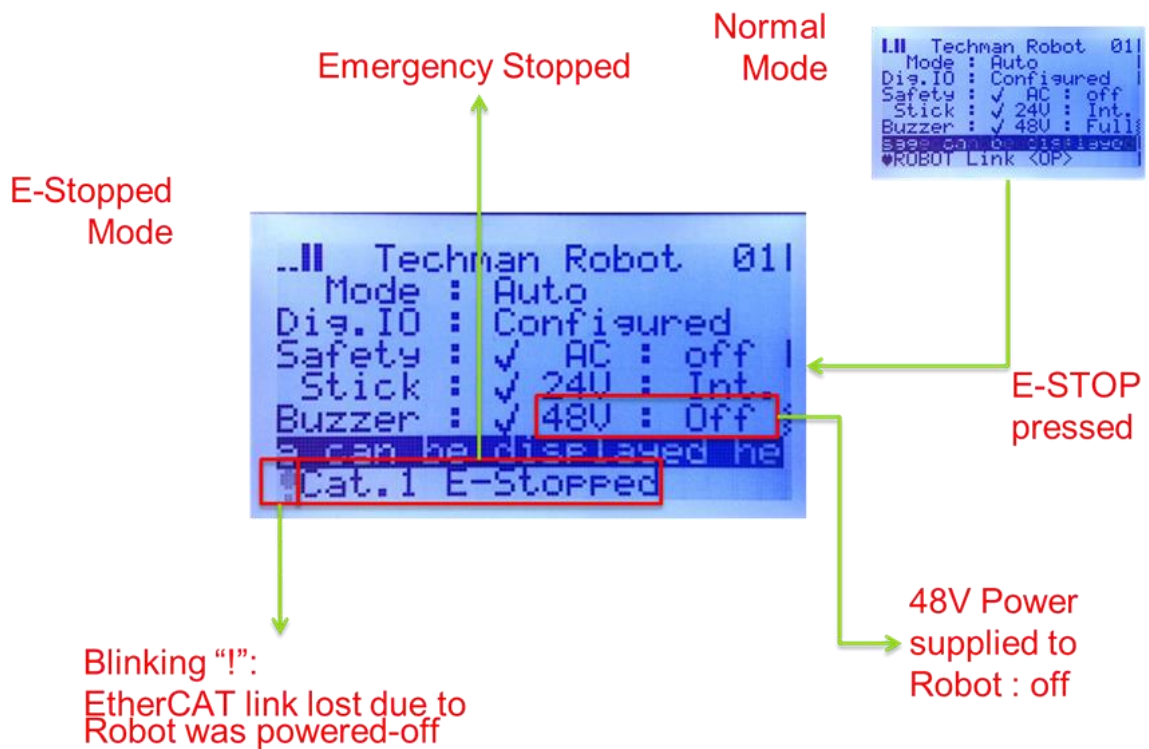


#### Mode Lock (Auto Mode)

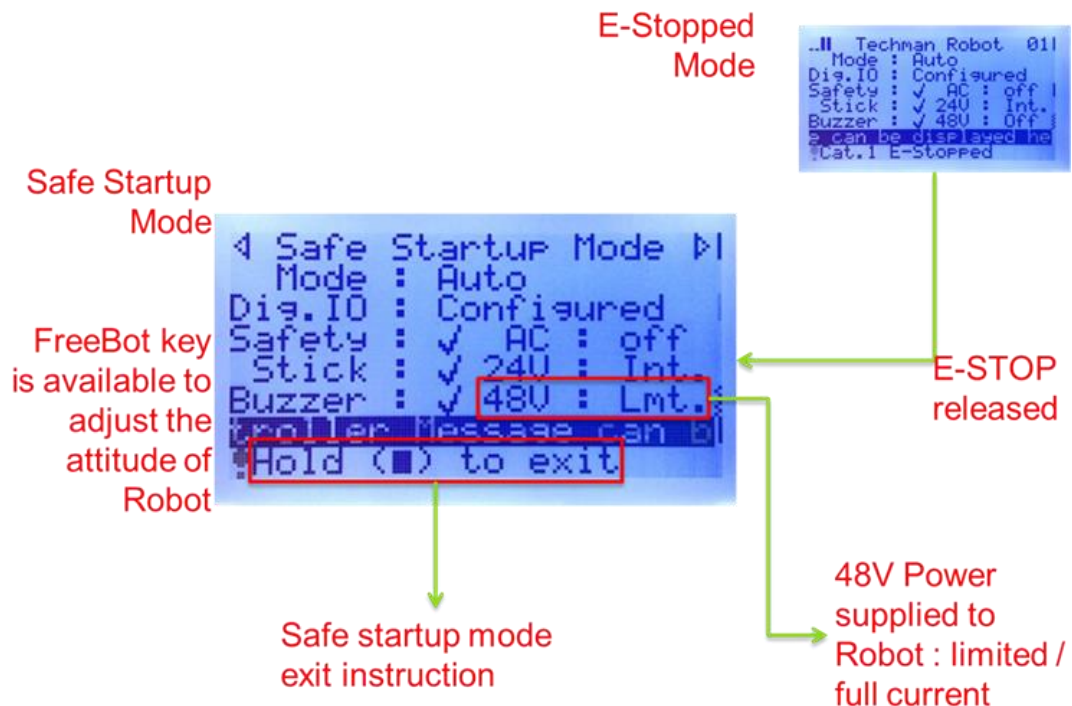


## 9.4 Emergency Stop

### Cat.1 E-Stopped mode

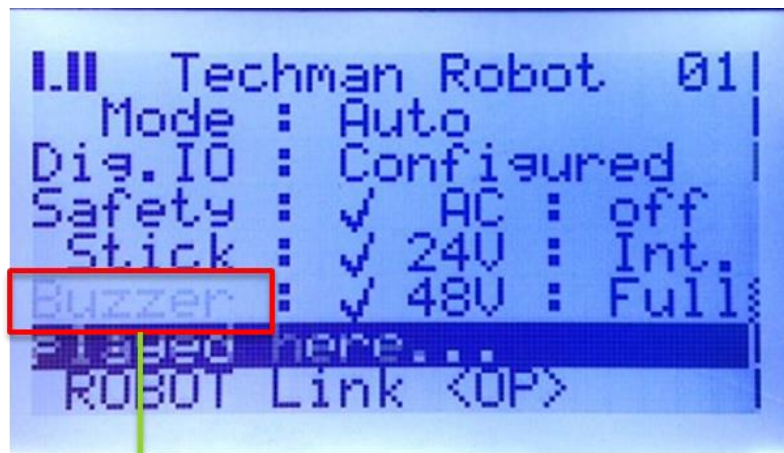


### Safe Startup Mode



**Buzzer:**

**Buzzer Beeping**



Blinking:  
Buzzer beeping

Mute Mode



Mute  
Mode

Buzzer Beep Muted

```

LIII Techman Robot 011
Mode : Auto
Dig.I/O : Configured
Safety : ✓ AC : off
Stick : ✓ 24V : Int.
Buzzer : ✗ 48V : Full
played here...
ROBOT Link <OP>

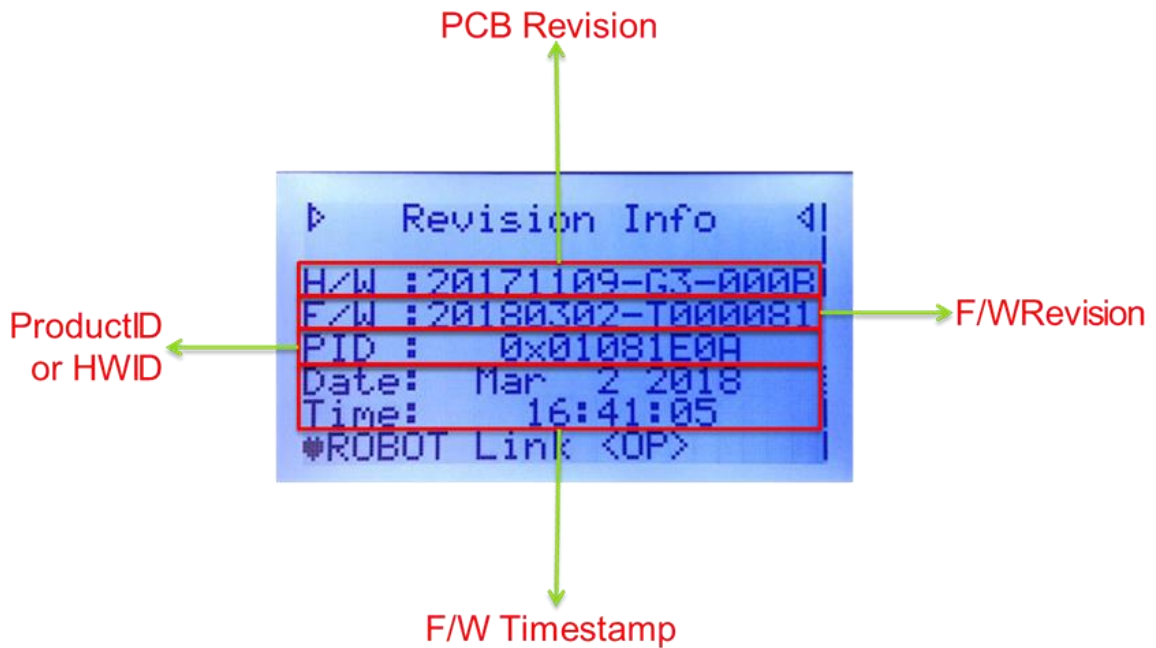
```

Blinking:  
Buzzer beeping  
but muted

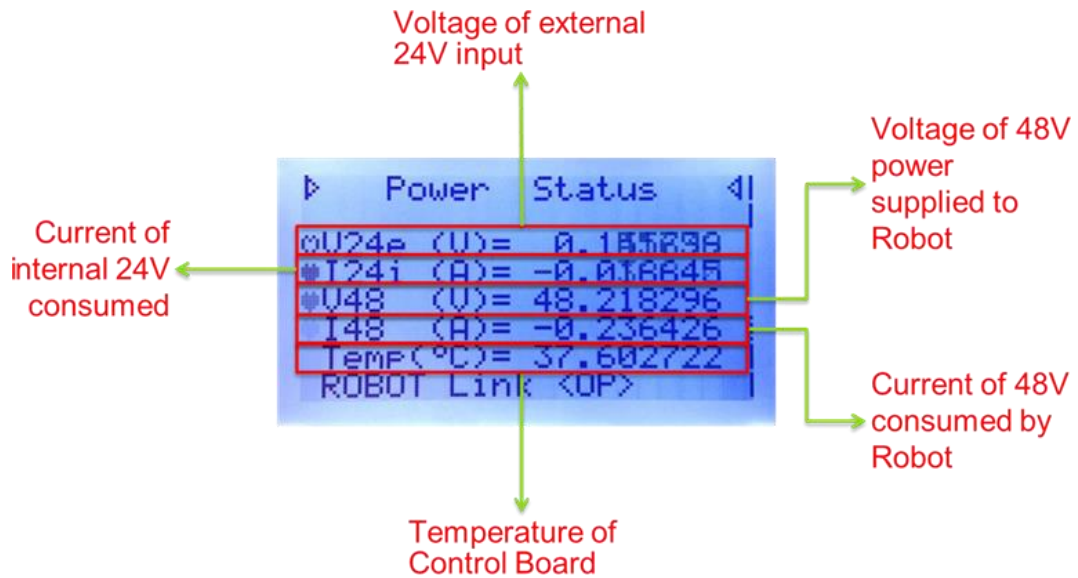
Mute  
Mode

9.5 Engineering Page

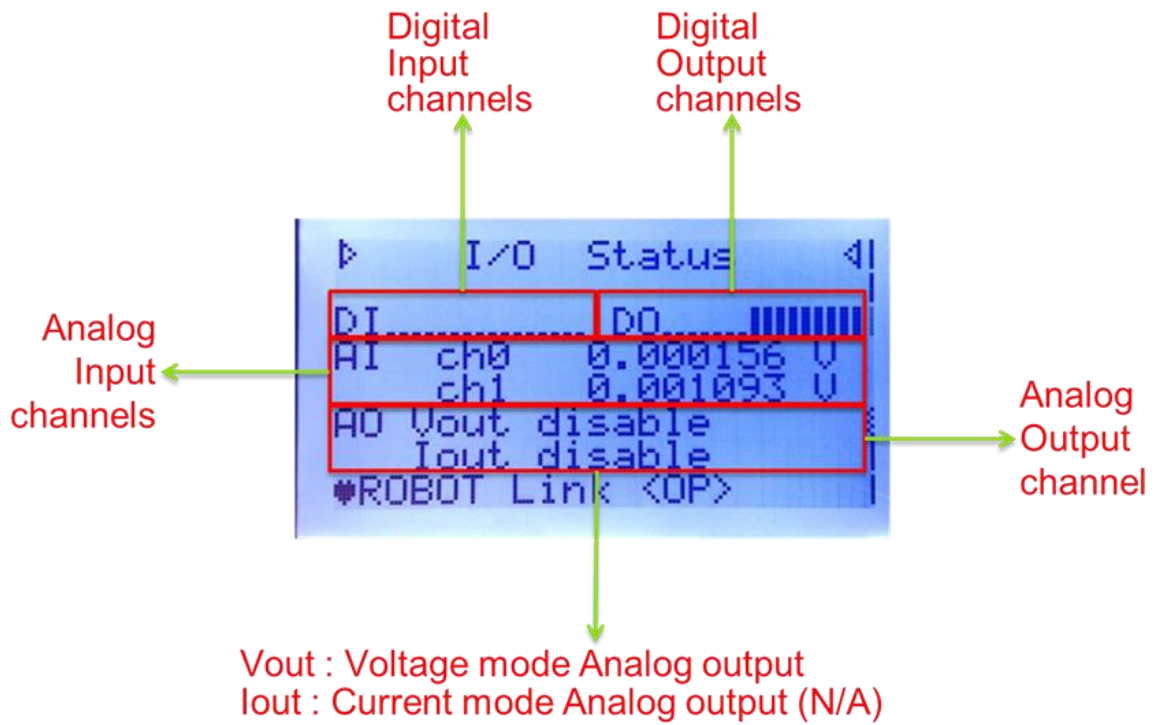
Revision Info



Power Status

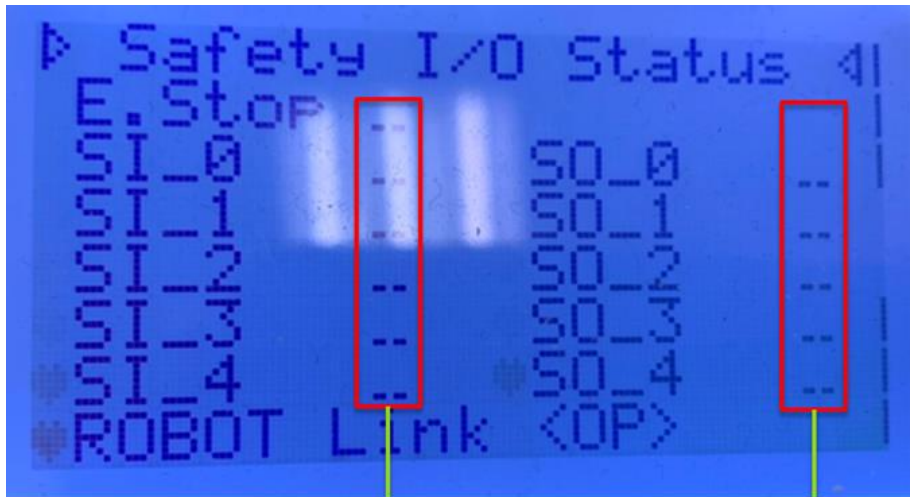


**I/O Status**



**Safety I/O Status**

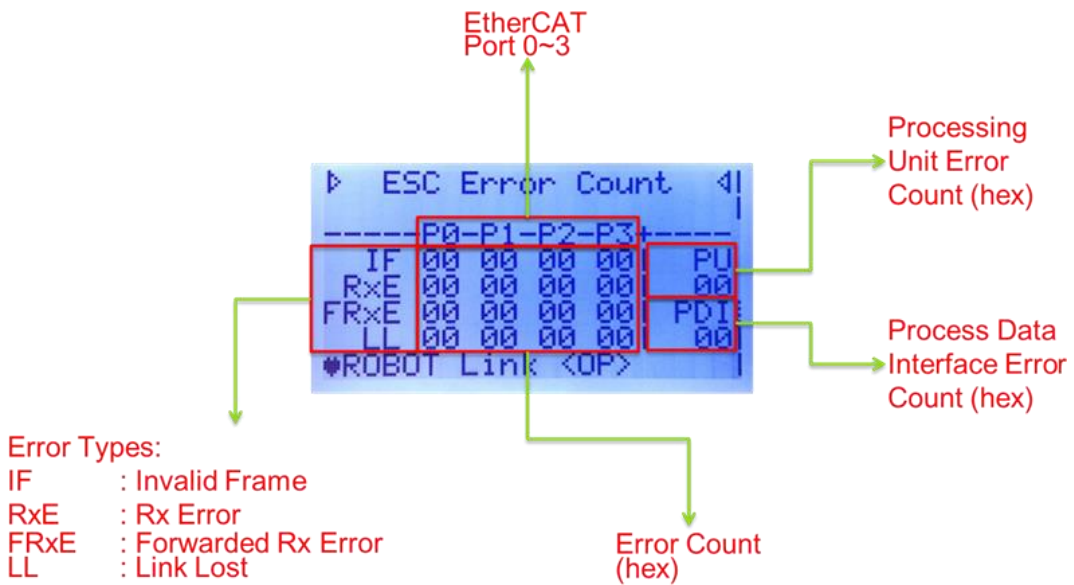




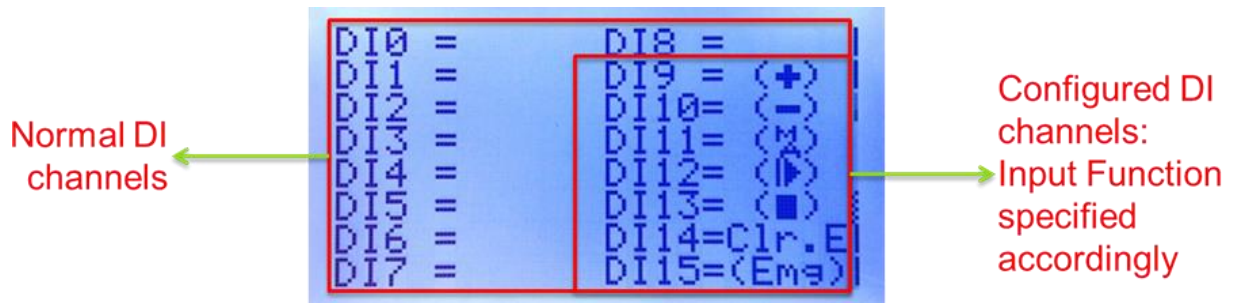
Input status

output status

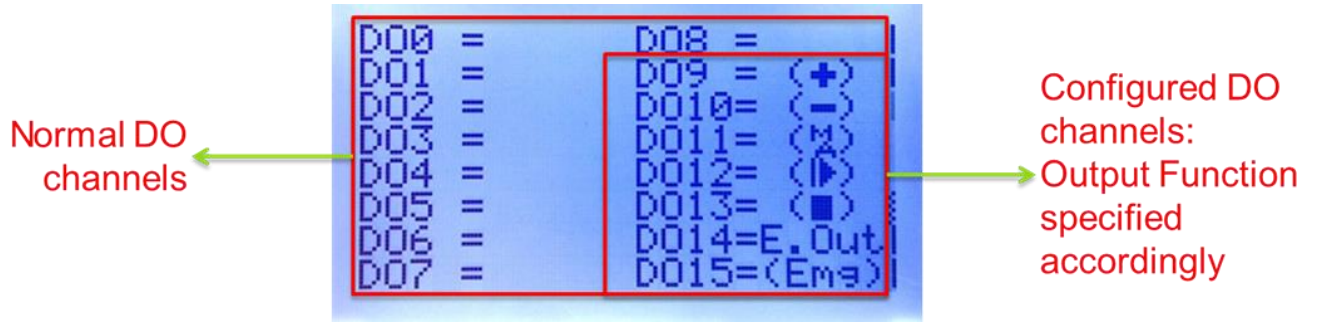
ESC Error Count



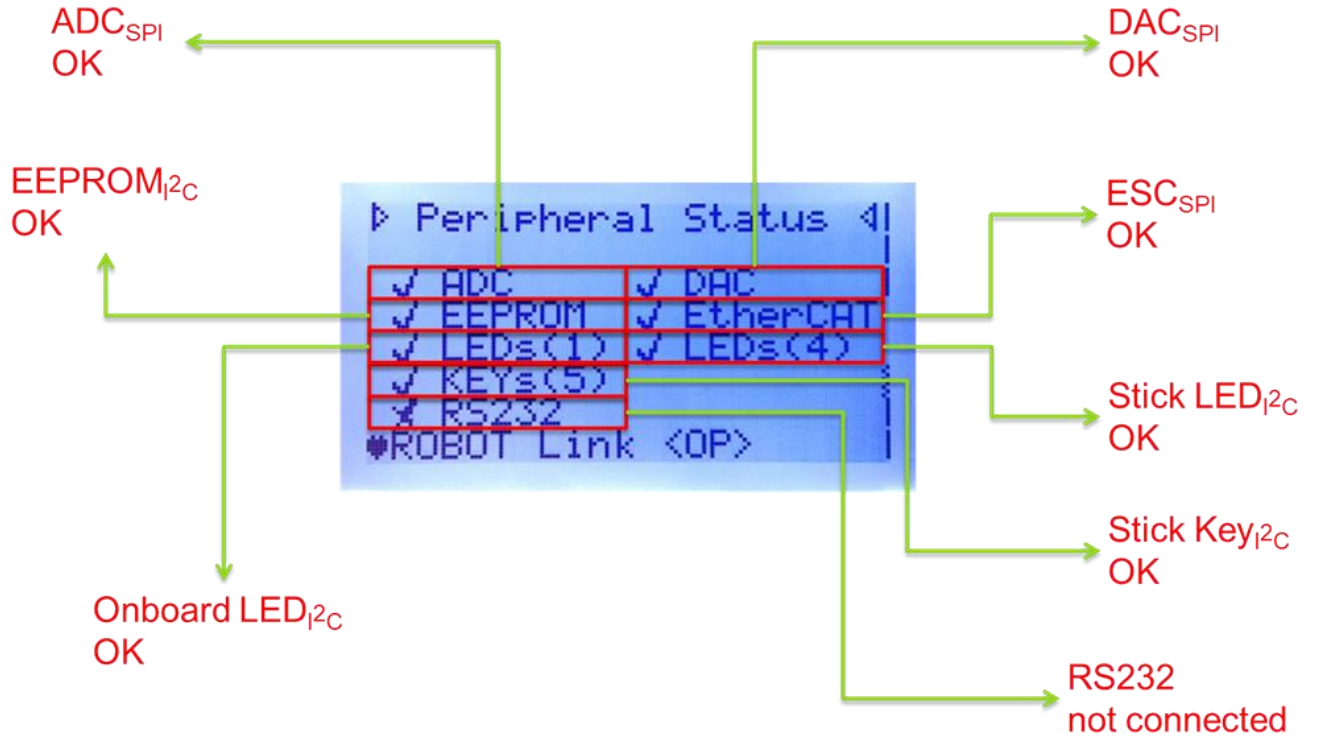
Configured DI Ports



Configured DO Ports



環境狀態



Power Failure Log

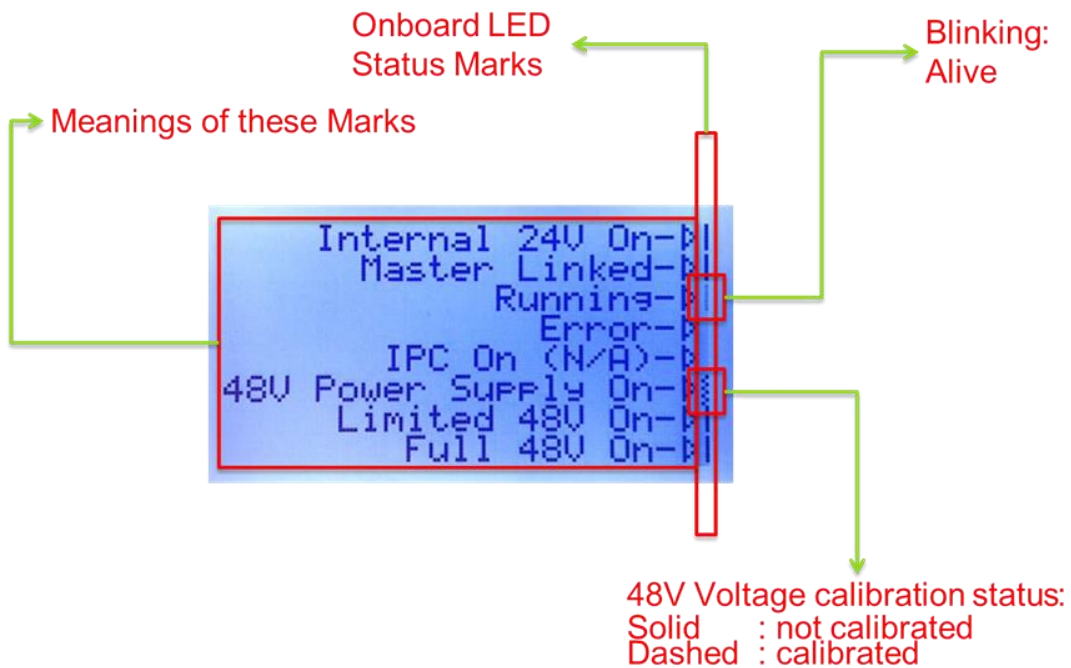
```

▶ Power Failure Log ◀
[Empty Log Area]
#ROBOT Link <OP>

```

Recoding of Voltage and Current value when Power Failure occurs (if any).

LED Status Indication



Master Log

```

▶ Master Log ◀|
0.00000000 5.00000000
1.00000000 6.00000000
2.00000000 7.00000000
3.00000000 8.00000000
4.00000000 9.00000000
ROBOT Link <OP>

```

Last 10 Tracking code records of Robot Controller Log for debug (if any). #0 is the latest log recorded

**Message Log**

Record index ←

Recorded Count (Max 30) →

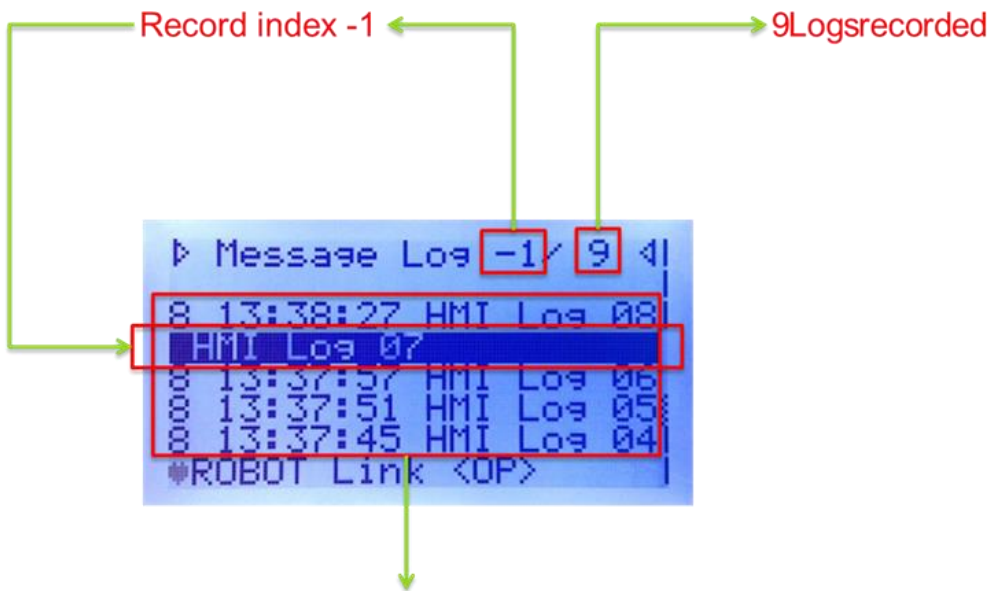
```

▶ Message Log 0/0 ◀|
-- No Message. --
ROBOT Link <OP>

```

Last 30 Error code records of HMI Log for debug (if any). #0 is the latest log recorded

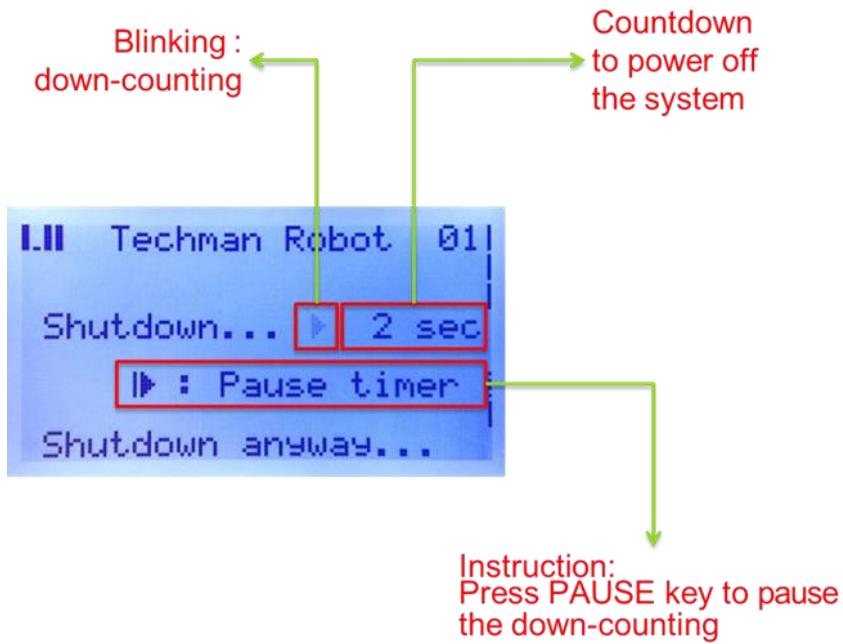
**Message Log (9 entries in total)**



Browsing Logs:  
 Double-clicked + : Up (next record)  
 Double-clicked - : Down (previous record)

## 9.6 Power Off Sequence

### Power Off Countdown Timer



### Power Off Countdown Paused



Blinking :  
down-counting paused

Countdown  
to power off  
the system

```
I. II Techman Robot 01 |
Shutdown... || 1 sec
▶ : Resume timer
Shutdown anyway...
```

Instruction:  
Press PLAY key to resume  
the down-counting

Power Off

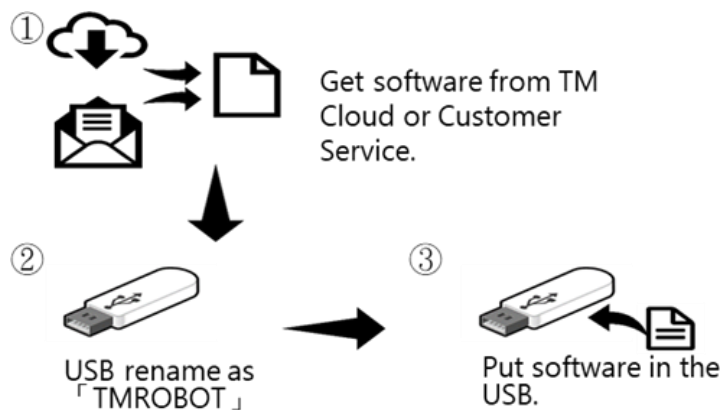


## 10. Software Application

### 10.1 Update the Robot Software

#### 10.1.1 Preparation

1. Retrieve the software from the official website of Techman Robot or customer service.
2. Label the USB drive **TMROBOT**.
3. Save the retrieved software on the USB drive.



#### 10.1.2 Update

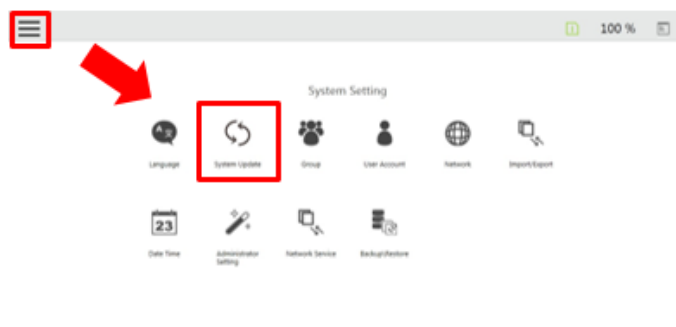
1. Turn the robot on. Navigate to the normal operation interface to confirm the current version.



2. Insert the USB drive into the USB port of the control box.

→Click ≡ > **System**.

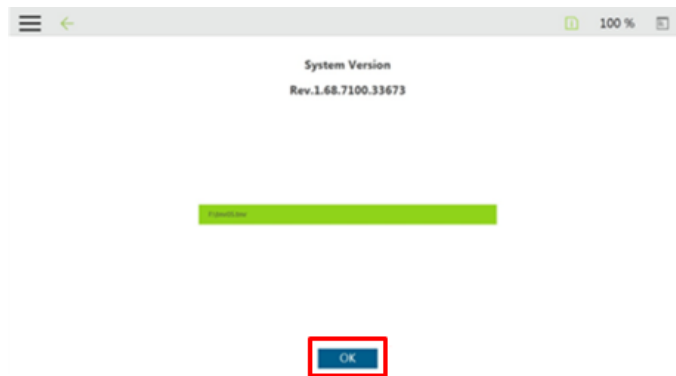
→Click **System Update** to open the automatic update page.



3. Check if the system finds the newer software version. If the software in the USB drive is newer than the current version, the message as below prompts.



4. Click **OK** to have the system run the update program.



5. The system restarts automatically after updating.



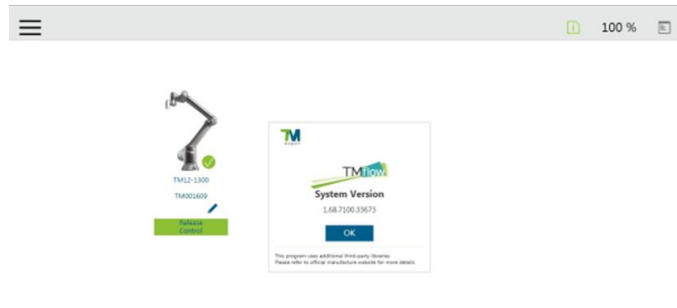
6. Ensure the robot is completely off and turn the control box off.



7. Restart the robot.



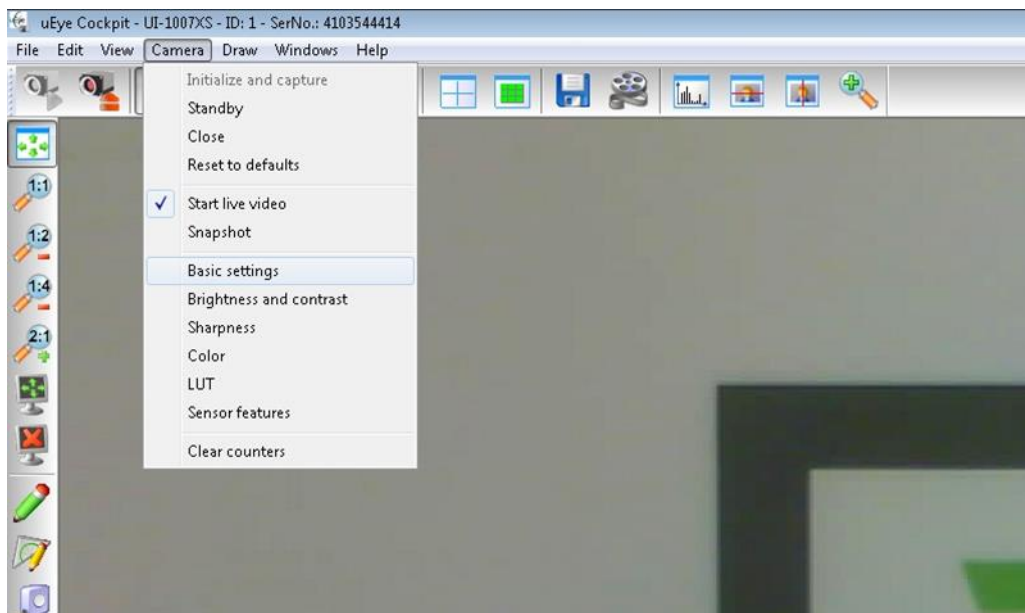
8. The message prompts as below if updated the software version.



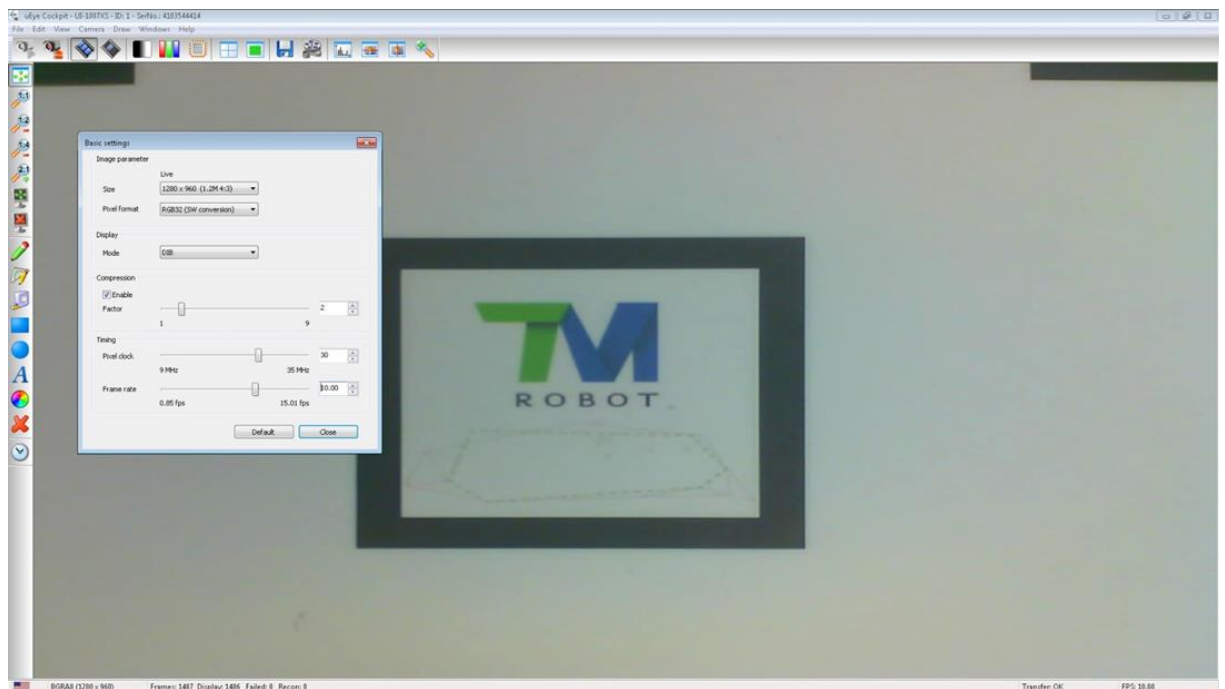
## 10.2 Configure IDS Ueye

### 10.2.1 Configuration

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

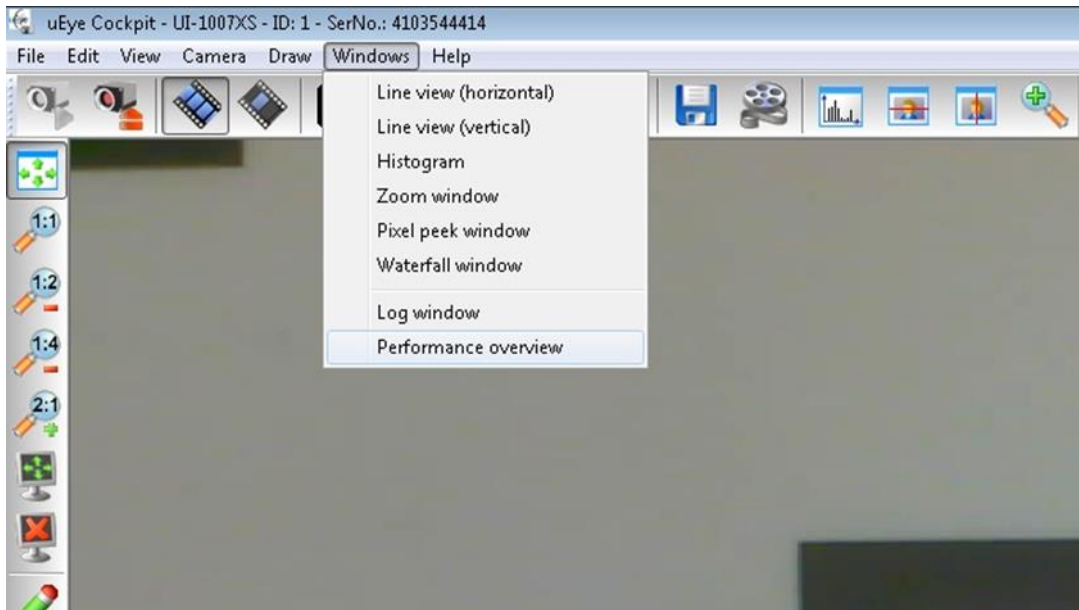


2. Set Size to 1280 x 960 and Frame rate to 10 FPS.

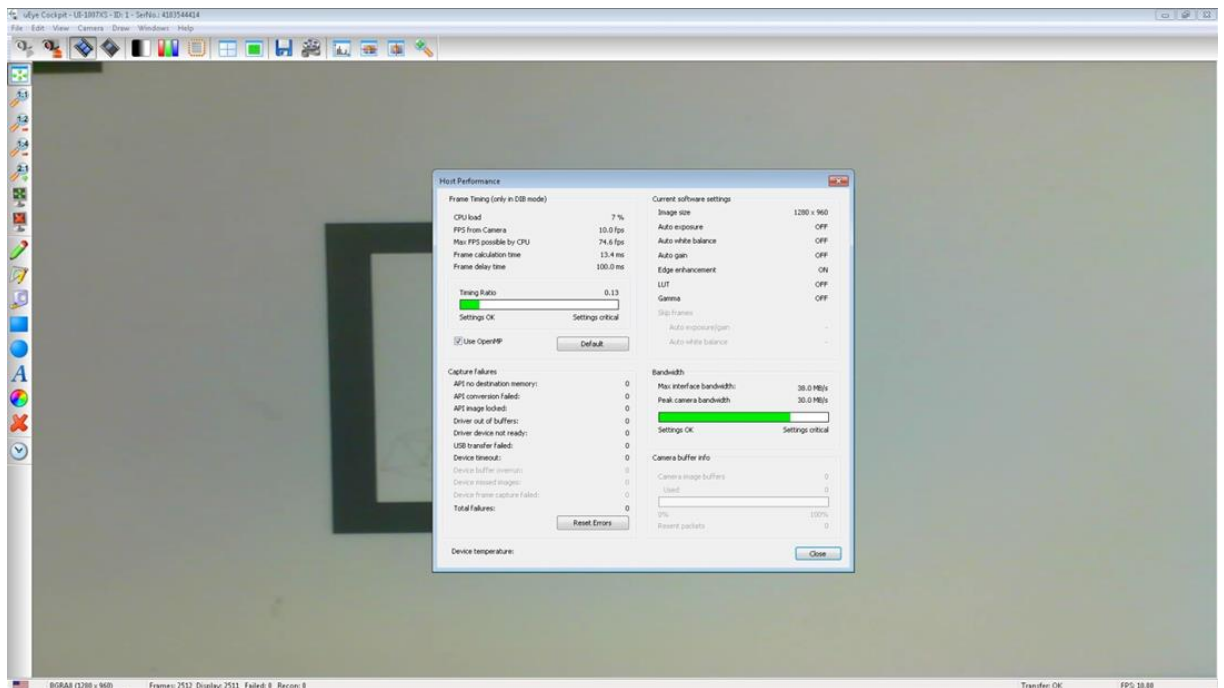


3. Click Window > Performance overview.





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.



### 10.3 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.

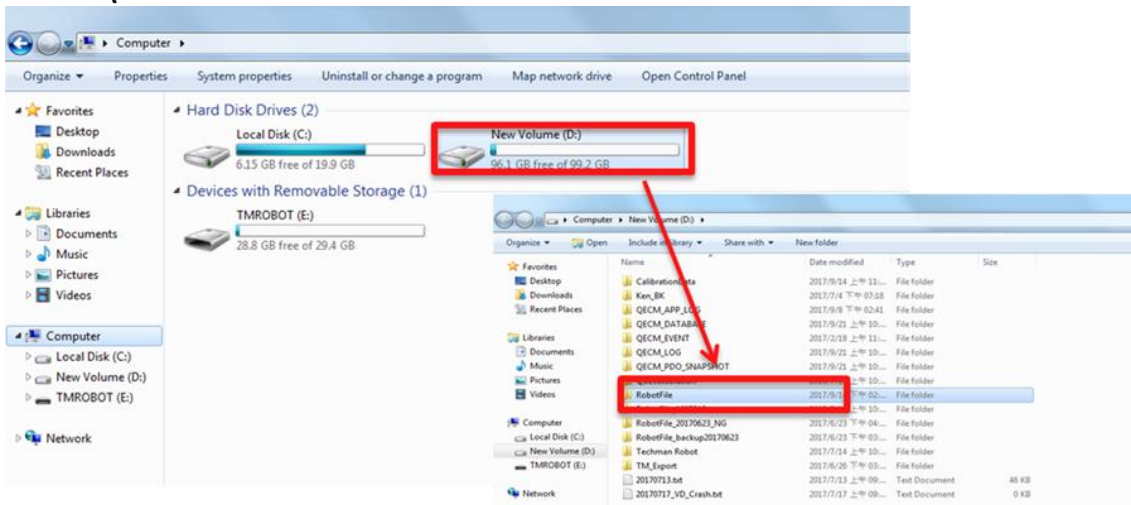


**Caution:**

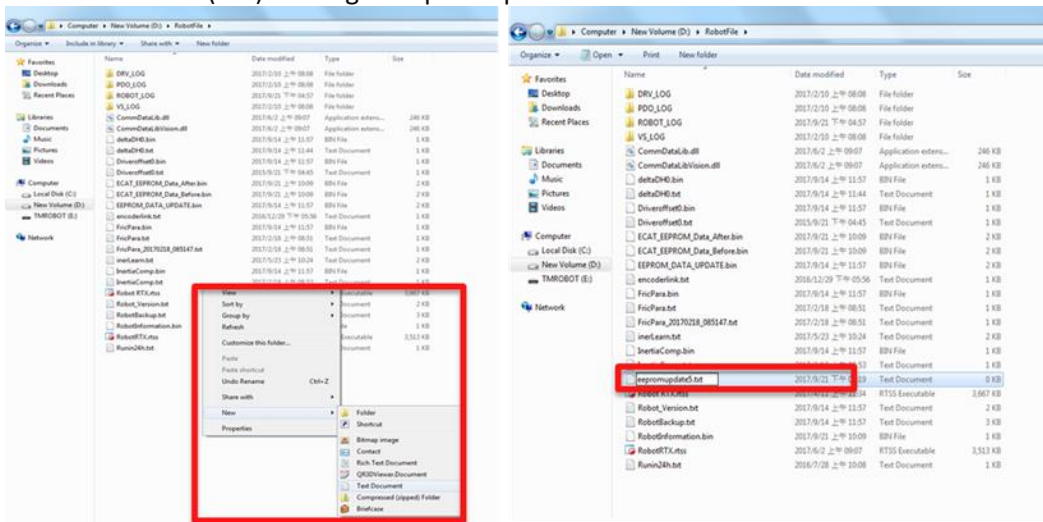
Before updating the EEPROM, ESI, and firmware, ensure turning on the robot correct. Operators can check if the robot is on by the indication light ring on the end module. Under normal circumstances, it is flashing in red now. Do not perform any updates and operations if it is off or not flashing in red.

**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.

<b>2. TM5</b>	Robot S/N : BAXXXXXX
<b>AC Type</b>	

<b>TM12/14</b>	Robot S/N : BAXXXXXX
<b>AC Type</b>	

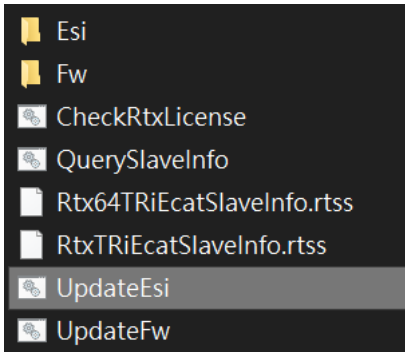
TM5-900	UpdateEsi_TM5_900ACA
TM5-700	UpdateEsi_TM5_700ACA
TM5X-900	UpdateEsi_TM5X900ACA
TM5X-700	UpdateEsi_TM5X700ACA
<b>DC Type</b>	
TM5-900	UpdateEsi_TM5_900ACM
TM5-700	UpdateEsi_TM5_700ACM
TM5X-900	UpdateEsi_TM5X700ACM
TM5X-700	UpdateEsi_TM5X700ACM

TM12	UpdateEsi_TMA_130ACA
TM14	UpdateEsi_TMA-110ACA
TM12X	UpdateEsi_TMAX130ACA
TM14X	UpdateEsi_TMAX110ACA
<b>DC Type</b>	
TM12	UpdateEsi_TMA-130ACM
TM14	UpdateEsi_TMA_110ACM
TM12X	UpdateEsi_TMAX130ACM
TM14X	UpdateEsi_TMAX110ACM

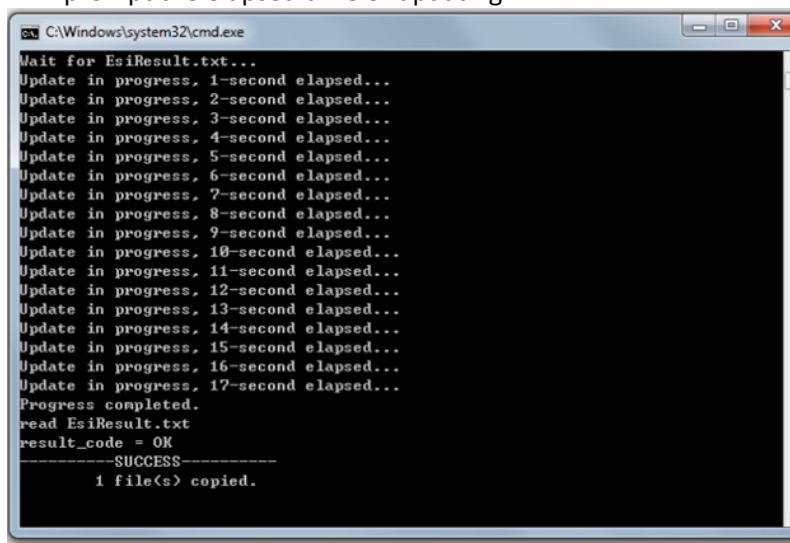
<b>TM16</b>	<b>Robot S/N : BAXXXXXX</b>
<b>AC Type</b>	
TM16	UpdateEsi_TMA-090ACA
TM16X	UpdateEsi_TMAX090ACA
<b>DC Type</b>	
TM16M	UpdateEsi_TMA-090ACM

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

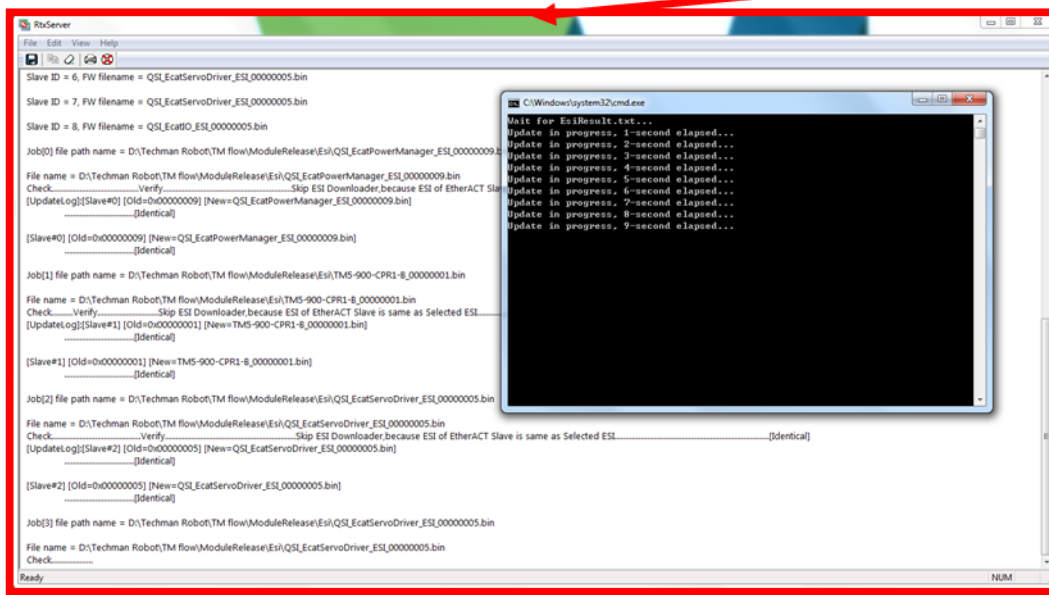
- Once the replacing part is the Joint or the Power Control Board, execute UpdateEsi.bat in the path **D:\Techman Robot\TM Flow\ModuleReleaes** as step 3 below to update ESI.
- Double-click the left mouse button to execute **UpdateEsi.bat**.



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



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



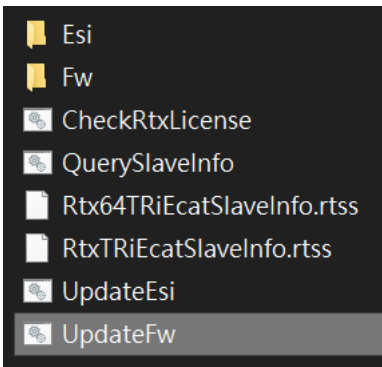
7. If the status says **Program terminated normally**, it denotes ESU updates successfully.

**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\ModuleRelease\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\ModuleRelease** 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.

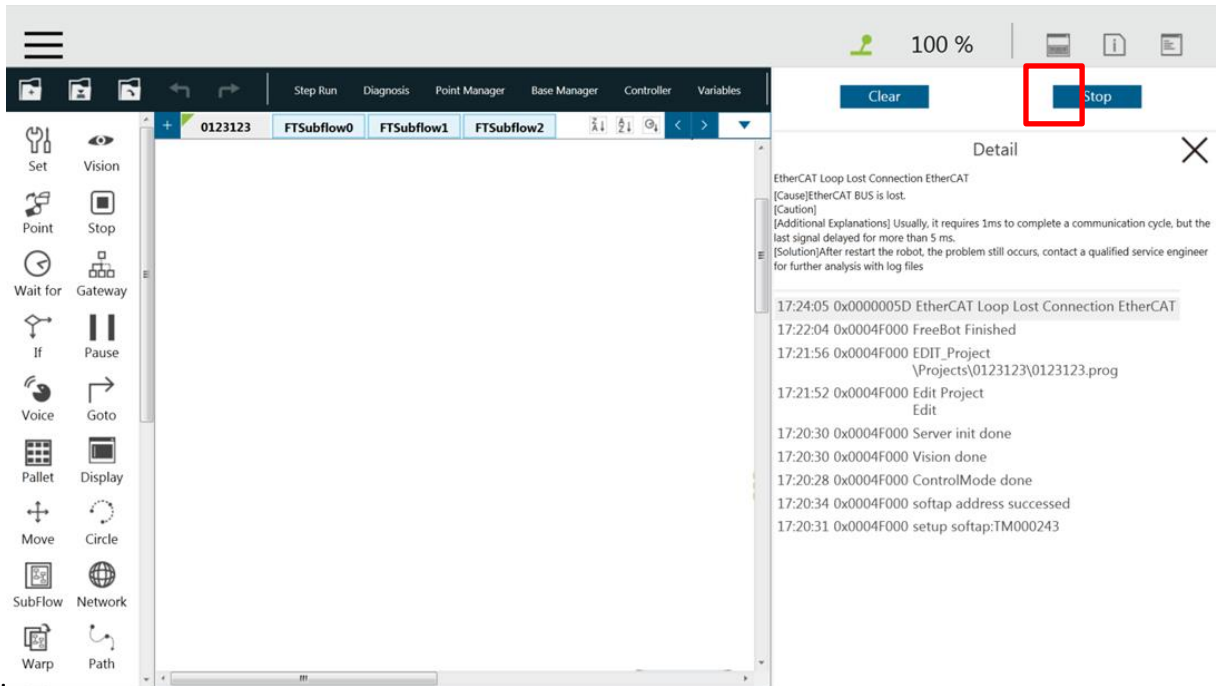




```
RtsServer
File Edit View Help
.....success.
Fw PID=0x01041E04 not match Slave PID=0x01041E05!
[Update Slave#8 FW].....
  Firmware integrity check
  .....success.
.....Verify BootCode
___consistent.
.....Erasing sectors
.....success.
.....Programming flash(0x007D0000,0x0001C000)
.....success.
[UpdateLog][Slave#8][SerialNum=0x201703D7][Old=0x01041E05-] [New=DSP28035_EcatIO_20170517_0000037_02.bin]
[OK]
[Slave#8][SerialNum=0x201703D7][Old=0x01041E05-] [New=DSP28035_EcatIO_20170517_0000037_02.bin]
[OK]
[UpdateLog]Jobs : 8
Skip : 0
NoCompatibleFW : 0
Updated : 8
Update Failed : 0
Jobs : 8
Skip : 0
NoCompatibleFW : 0
Updated : 8
Update Failed : 0
Please reset the EtherCAT Slave.
Program terminated normally.
Ready NUM
```

## 11. Look up detailed information on the error code in HMI

Users can click **Notice log** to learn the related details of the error code and troubleshoot the error by the instructions



of the log.

HMI prompts the error code and the related details once an error occurs during the robot booting up.

This error might result from hardware or mechanical issues. Refer to the instructions in **Troubleshooting** to correct it.

### System Failure Reporter

System Booting up failed due to the following errors. Please press "Exit" to turn off the power, and start again after troubleshooting.

System	17:26:37 0x0004F000 Server init start
QECM	17:27:07 0x0000FFAF [J1][Error][System]The communication of EtherCAT is timeout
Export	17:27:07 0x00040F84 SystemFile init Control Mode Fail, Robot controller open fail, reason:Error code: 35,msg:65455, 0, 0, 0, 0, 0
	17:27:07 0x0004F000 Server init fail init Control Mode Fail, Robot controller open fail, reason:Error code: 35,msg:65455, 0, 0, 0, 0, 0
	17:27:07 0x0004F000 at TMflow.MainWindow.Window_Loaded(Object A_0, RoutedEventArgs A_1) in d:\merging\Robot\TMflow\MainWindow.xaml.cs:line 352

Conti. Booting

EXIT

## 12. Troubleshooting

### 12.1 Common Issues

Issue	Error Code	Symptom	Possible Cause
<b>27.2 Unable to boot up the control box</b>	N/A	After pressing the power button on the Stick, there is no boot response in the IPC and nothing on the LCM	<ol style="list-style-type: none"> <li>1. There is damage to the power cord or no AC power.</li> <li>2. The power cord is loose.</li> <li>3. The Relay Board has no AC power input.</li> <li>4. Parts on the Relay Board are burnt out.</li> <li>5. Stick or IPC is damaged.</li> <li>6. The 24V power supply is damaged.</li> </ol>
<b>27.3 Connection error with the robot – EtherCAT</b>	0x0000003B 0x0000003C 0x0000004B 0x00000050 0x00000057	Failed to access the HMI screen, and the system log shows the error codes.	<ol style="list-style-type: none"> <li>1. Error with the Power control board</li> <li>2. Error with any of the joints</li> <li>3. Error with the end module</li> <li>4. Error with the internal connection of the control box or the robot.</li> </ol>
<b>27.4 Voltage error with the robot</b>	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.	<ol style="list-style-type: none"> <li>1. Pressing the emergency stop switch.</li> <li>2. The composite cable is loose.</li> <li>3. The cabling between the relay board and the Power Supply 48V is loose.</li> <li>4. The internal composite cable is loose.</li> <li>5. The power control board-related cables are loose.</li> <li>6. The power cables of each robot joint to the E-bus connection are loose.</li> <li>7. Error with the Power Supply 48V.</li> <li>8. Error with the joint or the end module.</li> </ol>
<b>27.5 Connection error with the camera</b>	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).	<ol style="list-style-type: none"> <li>1. System delay</li> <li>2. Camera error</li> <li>3. The USB Port fails to function properly in IPC.</li> <li>4. The camera cable fails to function well between J1 and J3.</li> <li>5. The camera cable fails to function well between J3 and J4.</li> <li>6. The camera cable fails to function well between J4 and the end module. The robot cables fail to function well.</li> <li>7. The internal USB Port fails to</li> </ol>

Issue	Error Code	Symptom	Possible Cause
			<p>function properly in IPC.</p> <ol style="list-style-type: none"> <li>Error with the robot composite cable</li> <li>Error with the power supply to the end module.</li> </ol>
<b>27.6 Digital I/O Error with the controller</b>	無	<p>There is a delay or no response in the signal output in the IPC.</p> <p>There is a delay or no response to the IPC signal output.</p>	<ol style="list-style-type: none"> <li>The external device's digital output current exceeds 300 mA making the output and input circuits burn out.</li> <li>There is a leakage in the IPC I/O circuit connected to the external device.</li> </ol>
<b>27.7 Joint error</b>	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	<ol style="list-style-type: none"> <li>Reported joint-related errors and unable to control the robot</li> <li>Error with the joint's internal mechanism making the shaft fail to rotate</li> <li>Queer noise along the robot operation</li> <li>After starting the project for a while, report 0x0000FF05 until the speed decreases.</li> </ol>	<ol style="list-style-type: none"> <li>Axis joint exceeds the functional limit</li> <li>Error with the joint's internal mechanism.</li> <li>Fault with the joint's circuit board.</li> </ol>
<b>27.8 Point offset</b>	N/A	The point of the project deviated after the collision.	<ol style="list-style-type: none"> <li>Set the robot back to the initial pose and check for distinct offsets.</li> <li>The joint positioning hole is deviated.</li> <li>The robot is not installed well on the base, or the base is shaking.</li> <li>The workspace deviated after the collision.</li> </ol>
<b>27.9 Error with the</b>	N/A	1. The project status	1. The buttons on the stick lose

Issue	Error Code	Symptom	Possible Cause
<b>stick</b>		<p>changes to "Paused" or "Automatically running" during execution.</p> <ol style="list-style-type: none"> <li>Enter emergency mode during project execution.</li> <li>No effect when pressing the button</li> <li>The robot will not start.</li> </ol>	<p>elasticity or are damaged.</p> <ol style="list-style-type: none"> <li>The stick cable is damaged.</li> <li>The cable between the stick and the printed circuit board is loose.</li> <li>The cable between the stick and the IPC is loose.</li> <li>There is static in the robot working area.</li> </ol>
<b>27.10 Connection error with the external device</b>	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.	<ol style="list-style-type: none"> <li>The connection cable between the robot and the external device is loose.</li> <li>The IP address of the external device is wrong.</li> <li>The IP address of the HMI is inconsistent with that of the external device.</li> <li>Error with the network interface controller driver</li> <li>Error with the IPC or the network interface controller</li> </ol>
<b>27.11 Error with the SSD</b>	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.	<ol style="list-style-type: none"> <li>The SSD connection cable is loose.</li> <li>Windows is scanning the drive.</li> <li>The SSD is damaged.</li> </ol>
<b>27.12 Insufficient CPU fan speed</b>	0x00040015	The HMI shows the error code 0x00040015, meaning the CPU fan speed is lower than 1000 rpm making the robot fail to function.	<ol style="list-style-type: none"> <li>The CPU fan is tangled with wires.</li> <li>The power cord of the fan is loose.</li> <li>The CPU fan does not function properly.</li> <li>The power supply failed to supply power to the IPC.</li> <li>Error with the software.</li> </ol>
<b>27.13 The robot restarts automatically</b>	N/A	After turning on the robot, the control box automatically turns on but will not turn off properly.	<ol style="list-style-type: none"> <li>Incompatible keyboard and mouse.</li> <li>The USB device does not function properly.</li> <li>The switch button of the robot stick does not function properly.</li> </ol>



Issue	Error Code	Symptom	Possible Cause
<b>27.14 The camera is not in focus.</b>	N/A	The camera cannot focus during the vision task operation.	<ol style="list-style-type: none"> <li>1. Error with the camera driver</li> <li>2. Faulty camera</li> </ol>
<b>27.15 Error with the joint's optical encoder</b>	0x000FFED 0x000FFCE 0x000FFCA 0x0005FFCE 0x0005FFCA	<ol style="list-style-type: none"> <li>1. Error with the encoder resolution</li> <li>2. Encoder overcompensation</li> <li>3. Error with the encoder signal detection</li> </ol>	<ol style="list-style-type: none"> <li>1. The disc surface of the encoder is stained</li> <li>2. Performing friction learning or safety calibration without rebooting made the encoder in a tightened state.</li> </ol>

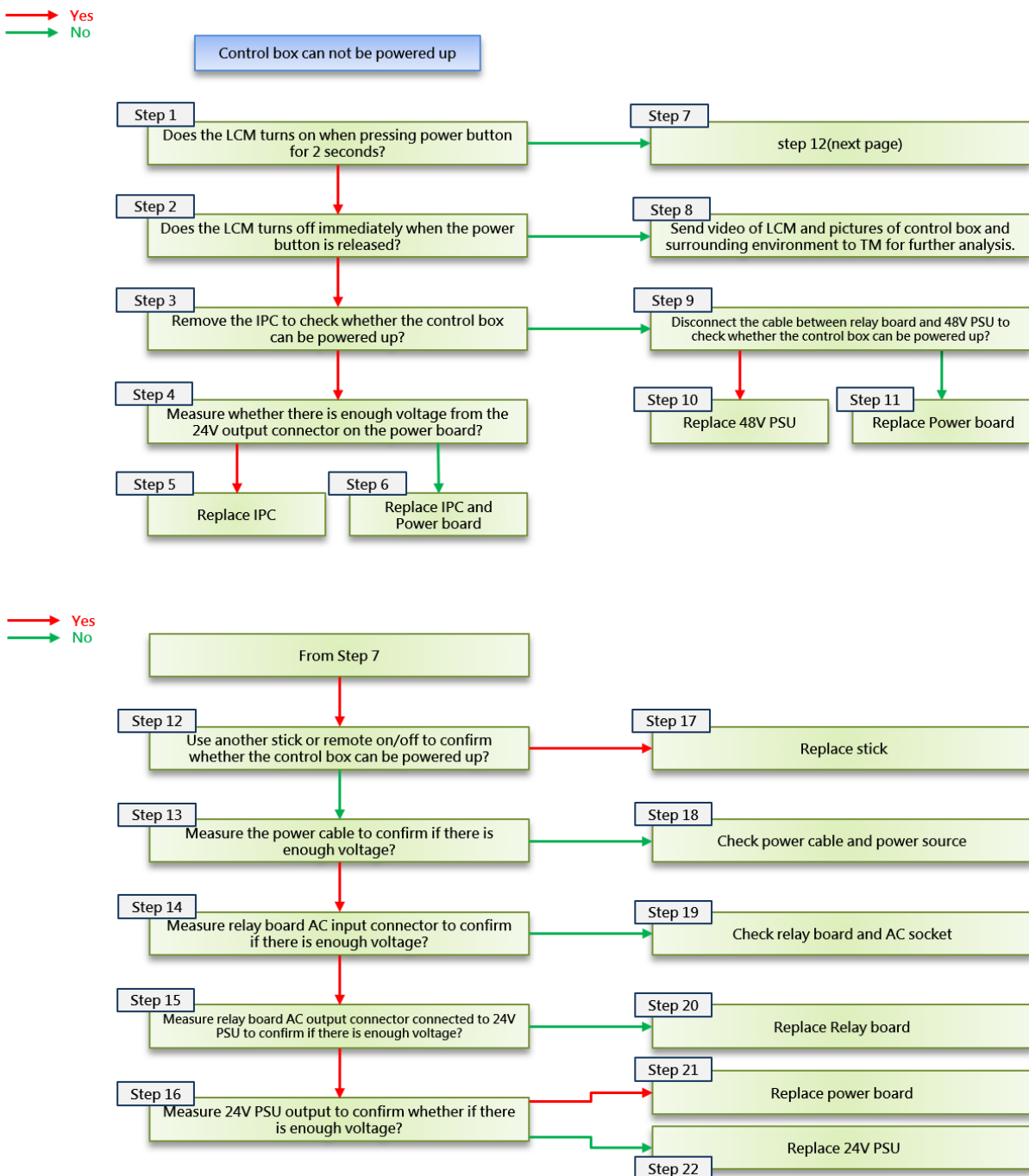
## 12.2 Unable to boot up the control box


**Case Description:** This section describes the possible causes and the recommended solutions to the robot being unable to boot up the control box.

**Symptom:** After pressing the power button on the Stick, there is no boot response in the IPC and nothing on the LCM

- Possible Cause:**
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.
- Error Code:**  
N/A

Troubleshooting Process:





Note: Refer to 22. The Circuit Diagrams for the points to measure the voltage of the control box.

### 12.3 Connection Error with the robot - EtherCAT

**Case Description** This section describes the possible causes and the recommended solutions to the connection error with the robot to the control box.

**Symptom:** Failed to access the HMI screen, and the system log shows the error codes.

<b>Possible Cause:</b>	1. Error with the Power control board	Error Code :
	2. Error with any of the joints	0x0000003B
	3. Error with the end module	0x0000003C
	4. Error with the internal connection of the control box or the robot.	0x0000004B
		0x00000050
		0x00000057

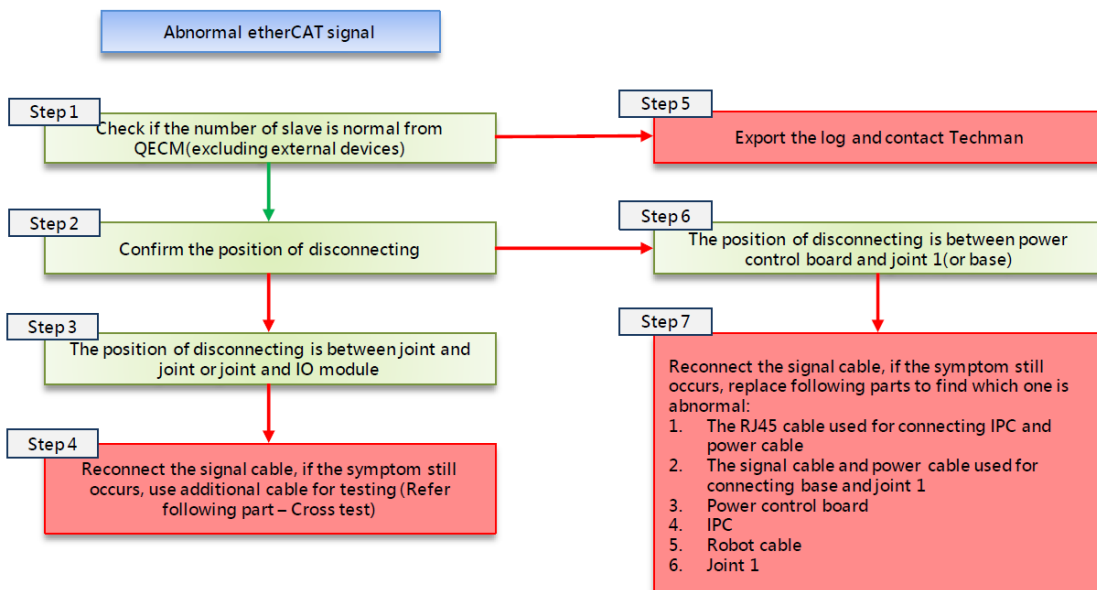
**Diagram:**



**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	-
1 <sup>st</sup> Joint	Slave 2	Slave 2	Slave 1
2 <sup>nd</sup> Joint	Slave 3	Slave 3	Slave 2
3 <sup>rd</sup> Joint	Slave 4	Slave 4	Slave 3
4 <sup>th</sup> Joint	Slave 5	Slave 5	Slave 4
5 <sup>th</sup> Joint	Slave 6	Slave 6	Slave 5
6 <sup>th</sup> Joint	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

→ Yes  
→ No



# Cross test -1

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

The screenshot shows the QECCM Viewer interface with a log window displaying EtherCAT connection status. The log includes the following key sections:

- Connection status:** A log entry showing status for all joints (0-6) as 'good', indicating normal status. A callout box notes: "Connection status : 0 means normal status".
- Power control board:** Log entry for Slave 0 (QSI Safety Power Manager).
- Joints: joint 1 ~ joint6 from top down:** Log entries for Slaves 1 through 6, all showing 'good' status.
- IO module:** Log entry for Slave 7 (TMA-130ACA).
- Safety monitor:** Log entry for Slave 8 (QSI Safety Monitor Module).
- Topology:** A tree view showing the network structure with joints p1-x through p2-x.

A note at the bottom states: "\*note : external etherCAT devices will be listed after safety monitor".

# 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. **System Failure Reporter**

The screenshot shows the System Failure Reporter interface with a log window displaying QECCM statistics and connection status. The log includes the following key sections:

- QECCM Statistics:** Log entries for network statistics such as Packet Traveling Time, Cyclic Timer, PDO Cycle Time, and Packet Rate.
- Connection status:** A log entry for Slave 1 (CoE AC Servo Driver) showing 'good' status. A callout box notes: "Only 1 joint is found".
- Topology:** A tree view showing the network structure with joints p1-x and p2-x.

The interface also features buttons for "Conti. Booting" and "EXIT".

## 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.

System

20221003\_163005.log

● Data Dump
 ○ Summary

OFCM

Export

Conti. Booting

EXIT

```

1003 8us 16:30:35.208 Dump EtherCAT network statistical information...
1003 10us 16:30:35.208 Packet Traveling Time(us): 26.9(min) / 56.4(max)
1003 8us 16:30:35.208 Cyclic Timer(us): 429496729.5(min) / 0.0(max)
1003 14us 16:30:35.208 PDO Cycle Time(us): 429496729.5(min) / 0.0(max)
1003 9us 16:30:35.208 PDO Callback Latency(us): 429496729.5(min) / 0.0(max)
1003 8us 16:30:35.208 Packet Transmitted: 23663
1003 12us 16:30:35.208 Packet Rate(Hz): 0.0000
1003 16us 16:30:35.208 EtherCAT bus utilization: 0.0000
1003 13us 16:30:35.208 Packet Lost Count: 1
1003 13us 16:30:35.208 Packet Corrupted Count: 0
1003 11us 16:30:35.208 Packet lost(1)/corrupt(0) error counted, check EtherCAT Error Counter registers below...

1003 10us 16:30:35.208 Dump EtherCAT Error Counter registers...
1003 11us 16:30:35.208 Slave[m] PUErr PDIErr PDIErrCode Port[n] (InvalidFrameRXErr,ForwardedRXErr,LinkLost)
1003 14us 16:30:35.208 S(0) 0 0 0 P[0] ( 0, 0, 0, 0) P[1] ( 0, 0, 0, 0) P[2] ( 0, 0, 0, 0) P[3] ( 0, 0, 0, 0)
1003 10us 16:30:35.208 S(1) 0 0 0 P[0] ( 0, 0, 0, 0) P[1] ( 0, 0, 0, 0) P[2] ( 0, 0, 0, 0) P[3] ( 0, 0, 0, 0)
1003 12us 16:30:35.208 S(2) 0 0 0 P[0] ( 0, 0, 0, 0) P[1] ( 0, 0, 0, 0) P[2] ( 0, 0, 0, 0) P[3] ( 0, 0, 0, 0)
1003 8us 16:30:35.208 S(3) 0 0 0 P[0] ( 0, 0, 0, 0) P[1] ( 0, 0, 0, 0) P[2] ( 0, 0, 0, 0) P[3] ( 0, 0, 0, 0)
1003 8us 16:30:35.208 S(4) 0 0 0 P[0] ( 0, 0, 0, 0) P[1] ( 0, 0, 0, 0) P[2] ( 0, 0, 0, 0) P[3] ( 0, 0, 0, 0)
1003 8us 16:30:35.208 S(5) 0 0 0 P[0] ( 0, 0, 0, 0) P[1] ( 0, 0, 0, 0) P[2] ( 0, 0, 0, 0) P[3] ( 0, 0, 0, 0)
1003 8us 16:30:35.208 S(6) 0 0 0 P[0] ( 0, 0, 0, 0) P[1] ( 0, 0, 0, 0) P[2] ( 0, 0, 0, 0) P[3] ( 0, 0, 0, 0)
1003 13us 16:30:35.208 Dump EtherCAT slaves and port status...
1003 8us 16:30:35.208 Slave(0) ESC Port Status=< good, good, -----, qcccd> Device Name="QSI Safety Power Manager"
1003 8us 16:30:35.208 Slave(1) ESC Port Status=< good, good, -----, -----> Device Name="CoE AC Servo Driver"
1003 8us 16:30:35.208 Slave(2) ESC Port Status=< good, good, -----, -----> Device Name="CoE AC Servo Driver"
1003 7us 16:30:35.208 Slave(3) ESC Port Status=< good, good, -----, -----> Device Name="CoE AC Servo Driver"
1003 13us 16:30:35.208 Slave(4) ESC Port Status=< good, good, -----, -----> Device Name="CoE AC Servo Driver"
1003 9us 16:30:35.208 Slave(5) ESC Port Status=< good, -----, -----, -----> Device Name="TMS-900A/C4"
1003 9us 16:30:35.208 Slave(6) ESC Port Status=< good, -----, -----, -----> Device Name="QSI safety Monitor Module"
1003 8us 16:30:35.208 Dump EtherCAT Topology...
1003 7us 16:30:35.208 S(0)p3->S(1)p3-x
1003 7us 16:30:35.208 | | | | p1->S(2)p3-x
1003 7us 16:30:35.208 | | | | | | p1->S(3)p3-x
1003 7us 16:30:35.208 | | | | | | | | p1->S(4)p3-x
1003 8us 16:30:35.208 | | | | | | | | | | p1-x
1003 8us 16:30:35.208 | | | | | | | | | | | | o2-x
          
```

4 Joints and 1 IO module



# Cross test -5

Example: In case there is no other joint after connecting J1 and J2, 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.

## System Failure Reporter

The screenshot shows the 'System Failure Reporter' interface. On the left, there are three tabs: 'System', 'QECM', and 'Export'. The 'System' tab is selected. At the top, there is a dropdown menu showing '20221003\_162449.log' and two radio buttons: 'Data Dump' (selected) and 'Summary'. The main area displays a log file with various system messages. A red box highlights a specific line: 'Slave(1) ESC Port Status <- good ..... Device Name="COE AC Servo Driver' with an arrow pointing to a grey box labeled 'Only 1 joint'. Below the log, there are three buttons: 'Conti. Booting', 'EXIT', and a partially visible 'EXIT' button.

```
1003 12us 16:25:19.130 Dump EtherCAT network statistical information...
1003 11us 16:25:19.130 Packet Traveling Time(us): 26.9(min) / 61.3(max)
1003 16us 16:25:19.130 Cyclic Timer(us): 429496729.5(min) / 0.0(max)
1003 14us 16:25:19.130 FDD Cycle Time(us): 429496729.5(min) / 0.0(max)
1003 11us 16:25:19.130 FDD CallBack Latency(us): 429496729.5(min) / 0.0(max)
1003 13us 16:25:19.130 Packet Transmitted: 20311
1003 11us 16:25:19.130 Packet Rate(Hz): 0.0000
1003 11us 16:25:19.130 EtherCAT bus utilization: 0.0000
1003 12us 16:25:19.130 Packet Lost Count: 0
1003 11us 16:25:19.130 Packet Corrupted Count: 0
1003 12us 16:25:19.130 Dump EtherCAT Error Counter registers...
1003 12us 16:25:19.130 Slave(m) PUErr PDIErr PDIErrCode PortIn (InvalidFrame,RXErr,ForwardedRXErr,LinkLost)...
1003 14us 16:25:19.130 S{0: 0 0 0 P{0}[ 0 0 0 0] P{1}[ 0 0 0 0] P{2}[ 0 0 0 0] P{3}[ 0 0 0 0]
1003 13us 16:25:19.130 S{1: 0 0 0 P{0}[ 0 0 0 0] P{1}[ 0 0 0 0] P{2}[ 0 0 0 0] P{3}[ 0 0 0 0]
1003 11us 16:25:19.130 S{2: 0 0 0 P{0}[ 0 0 0 0] P{1}[ 0 0 0 0] P{2}[ 0 0 0 0] P{3}[ 0 0 0 0]
1003 10us 16:25:19.130 Dump EtherCAT slaves and port status...
1003 11us 16:25:19.130 Slave(0) ESC Port Status <- good ..... Device Name="OSI Safety Power Manager"
1003 11us 16:25:19.130 Slave(1) ESC Port Status <- good ..... Device Name="COE AC Servo Driver"
1003 15us 16:25:19.130 Slave(2) ESC Port Status <- good ..... Device Name="OSI Safety Monitor Module"
1003 13us 16:25:19.130 Dump EtherCAT Topology...
1003 12us 16:25:19.130 S{0(p3->S{1}p3-x
1003 14us 16:25:19.130 | p1-x
1003 17us 16:25:19.130 | p2-x
1003 11us 16:25:19.130 p1->S{2}p3-x
1003 11us 16:25:19.130 | p1-x
1003 11us 16:25:19.130 | p2-x
1003 10us 16:25:19.130 p2-x
1003 10us 2766us OK
1003 11us 16:25:19.130 <Master Event> 2022-10-03T08:25:19.130+08:00[INFO]QsicatApi_Close[QECM disconnected etherCAT and dismissed]----
1003 8us 16:25:19.130 Quantia Storage Inc. EtherCAT Master Log Stopped.[2022-10-03]
```

## 12.4 Voltage error with the robot

**Case Description** This section describes the possible causes and the recommended solutions to the voltage error with the robot.

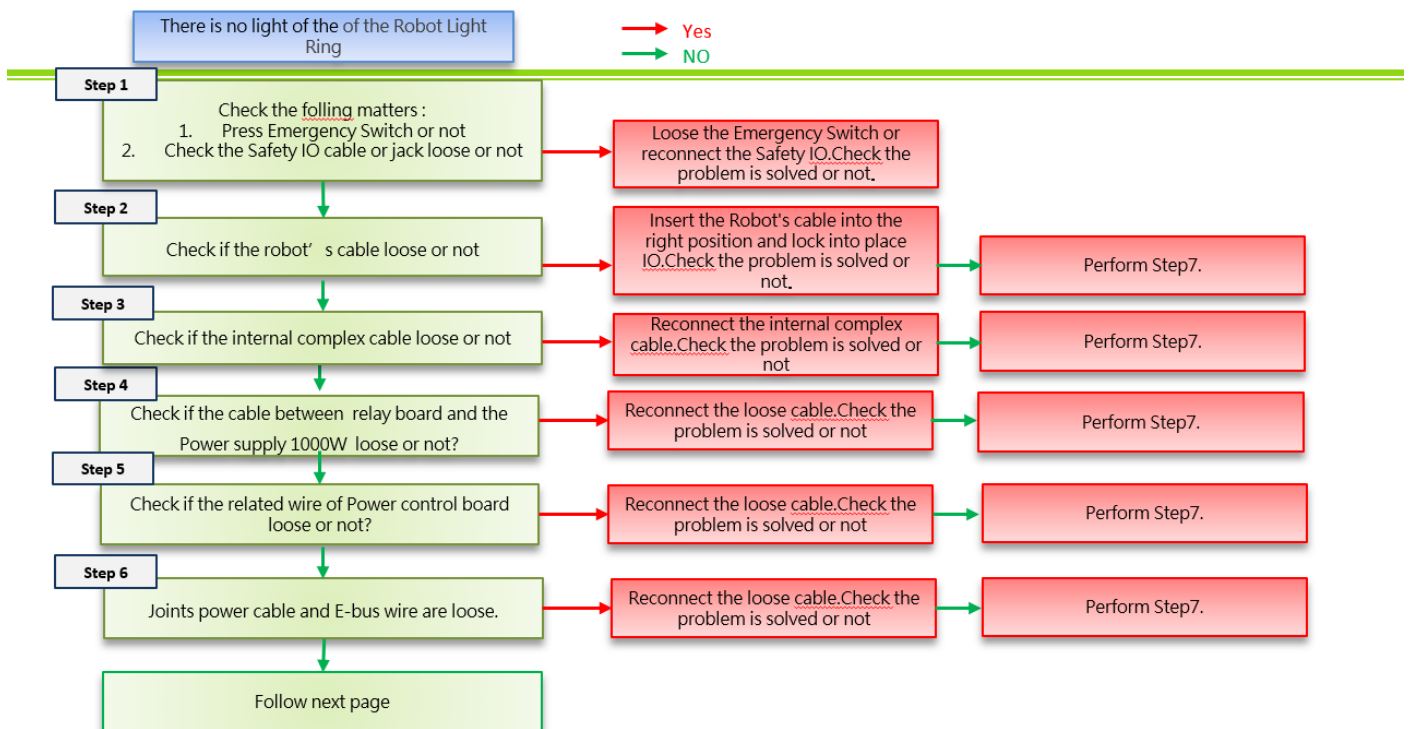
**Symptom :** Failed to access the HMI screen, no light from the end module, the LCM voltage decreased from 48V to below 40V, and the system log shows the error code.

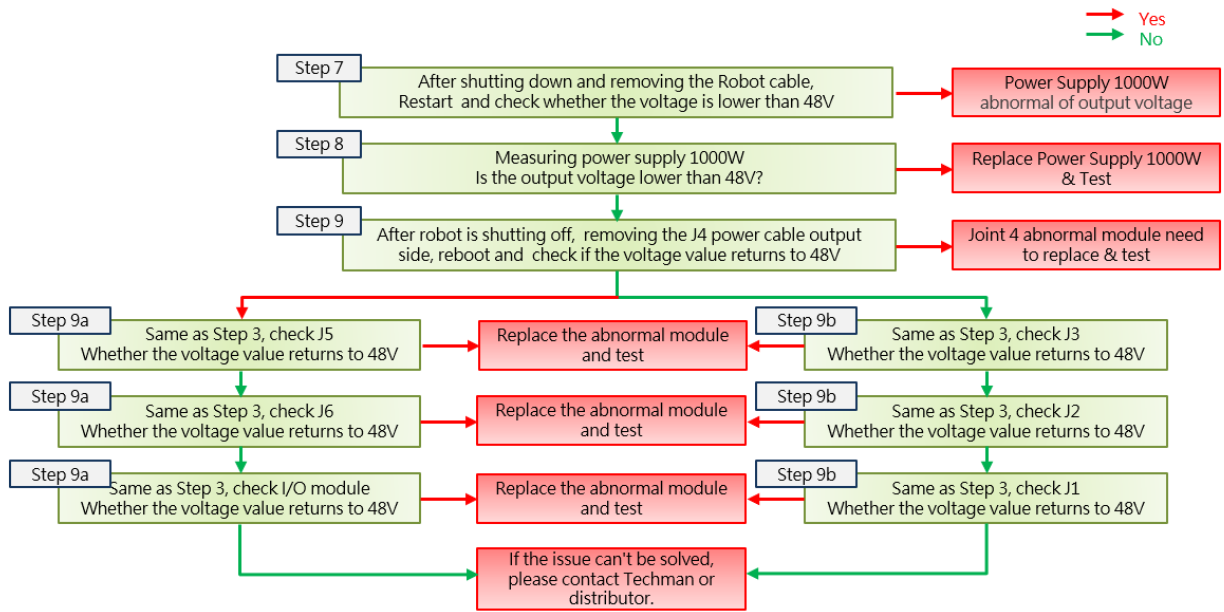
Possible Cause :	Possible Cause :
1. Pressing the emergency stop switch.	0x00000035
2. The composite cable is loose.	0x0000003C
3. The cabling between the relay board and the Power Supply 48V is loose.	0x0000003E
4. The internal composite cable is loose.	0x00000053
5. The power control board-related cables are loose.	0x0000FFE0
6. The power cables of each robot joint to the E-bus connection are loose.	0x00041002
7. Error with the Power Supply 48V.	
8. Error with the joint or the end module.	

**Diagram :**



**Troubleshooting Process:**





Note: Refer to 22. The Circuit Diagrams for the points to measure the voltage of the control box.

## 12.5 Connection error with the camera

**Case Description:** This section describes the possible causes and the recommended solutions to the connection error with the camera.

**Symptom :** 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).

<b>Possible Cause :</b>	1. System delay	
	2. Camera error	
	3. IPC error	
	4. The camera cable fails to function well between J1 and J2.	0x00020000
	5. The camera cable fails to function well between J2 and J3.	0x00020007
	6. The camera cable fails to function well between J3 and J4.	0x00042007
	7. The camera cable fails to function well between J4 the end module.	0x00043006
	8. Error with the robot composite cable	
	9. Error with the power supply to the end module.	

**Diagram :**

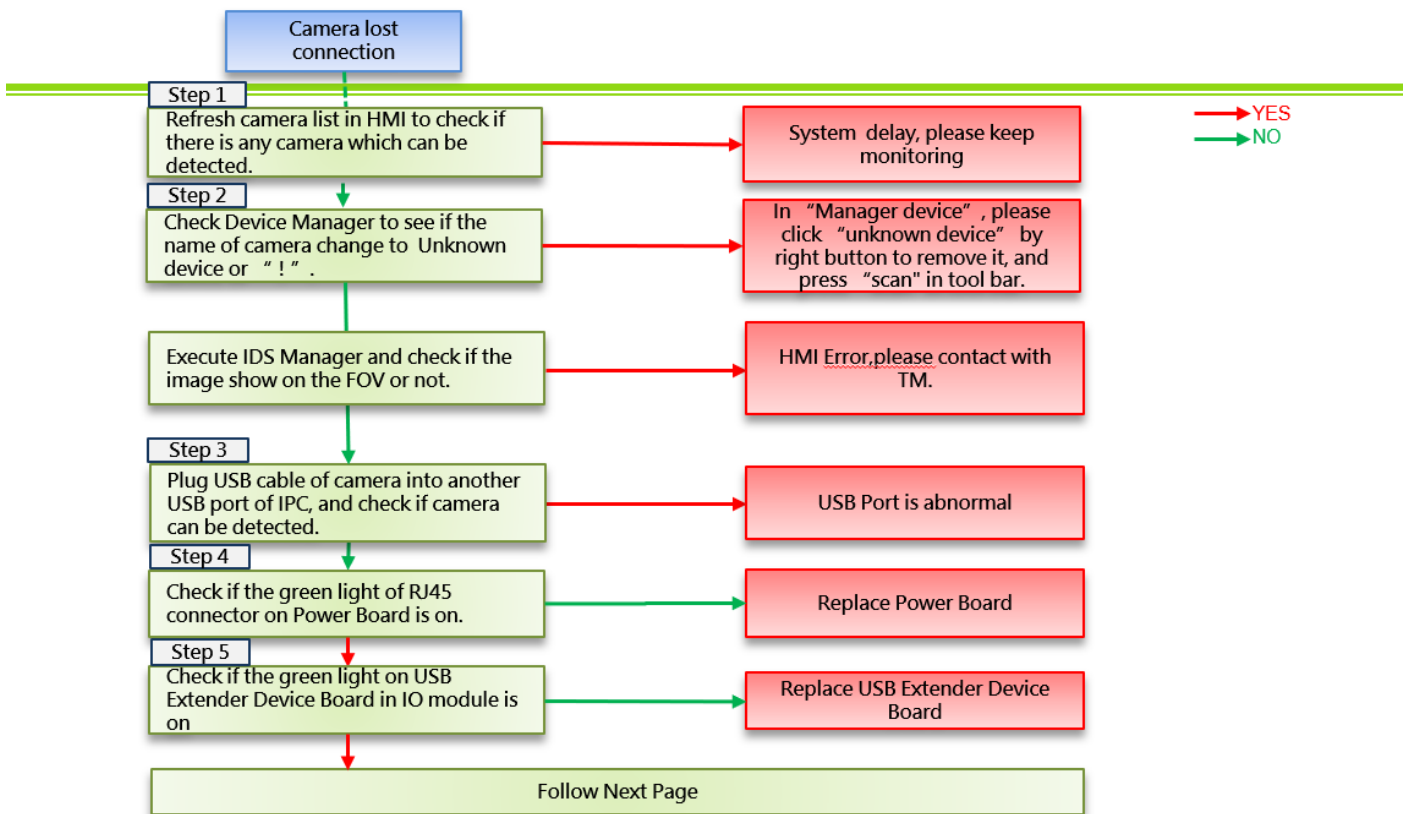


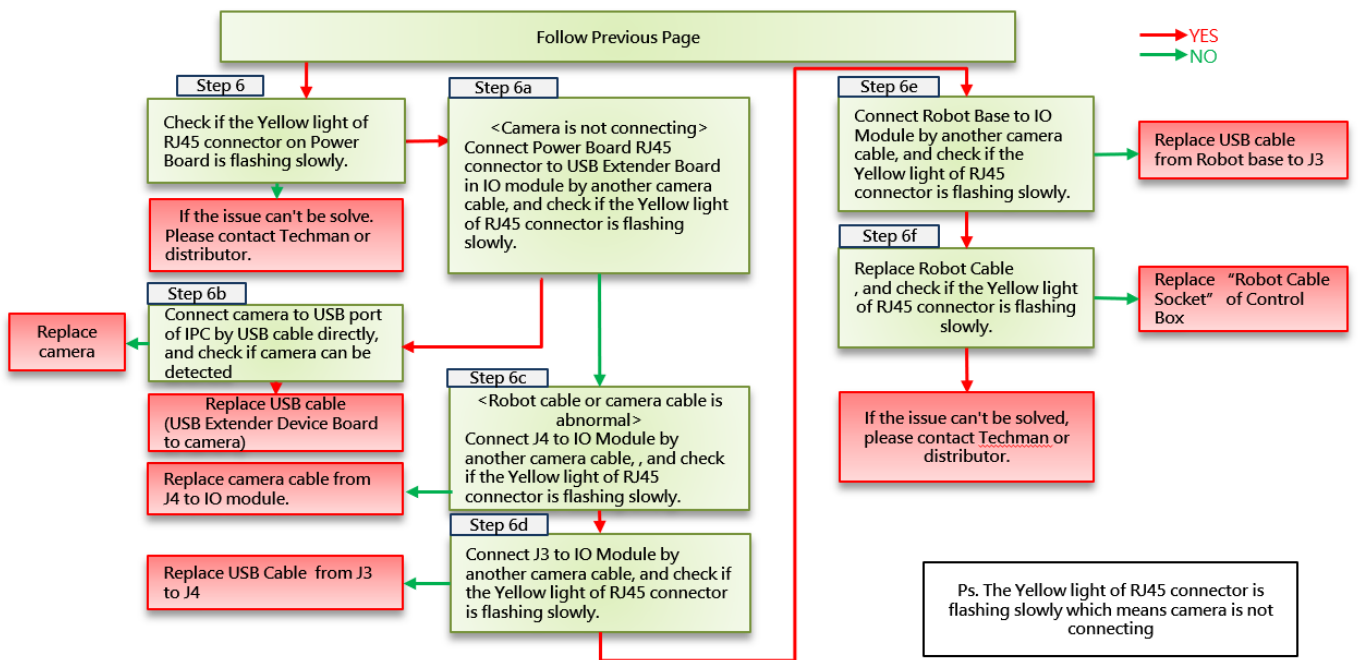
**Identifying cameras of IDS and TRI:**



Troubleshooting Process:

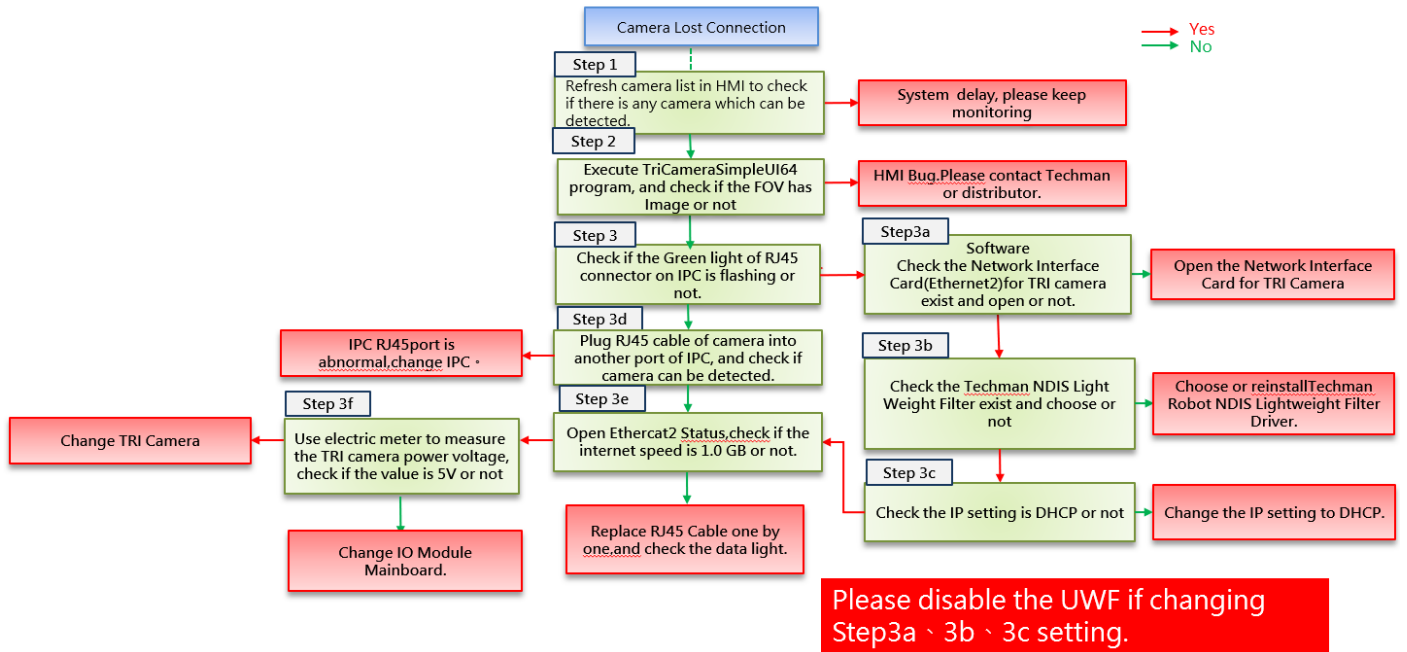
**Steps to inspect and repair IDS cameras:**







## Steps to inspect and repair TRI cameras:



### TRI camera examination instructions in Step2 :

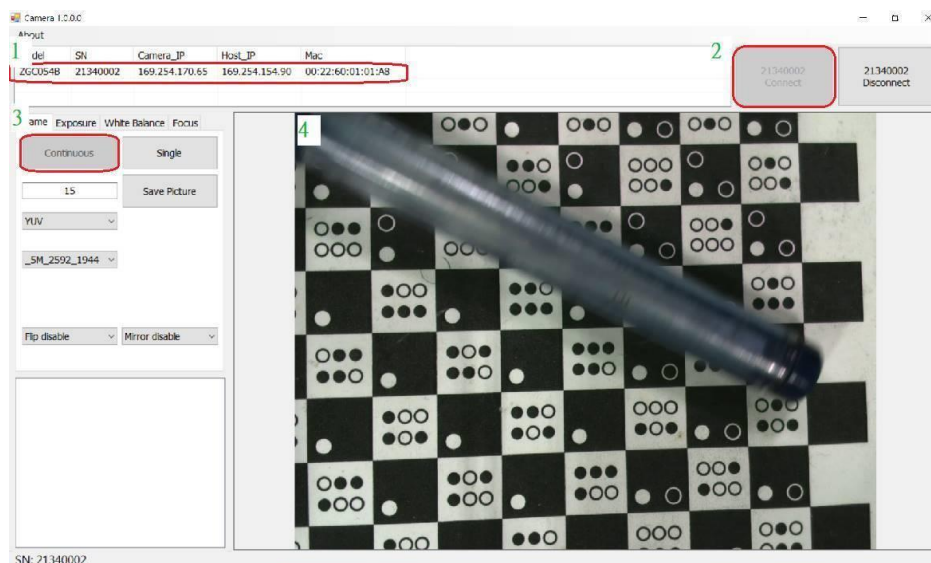
Please install TriCameraSimpleUI64. This executable is available to request from TM-Robot and built-in the robot with HMI 2.0 or above.

Execute the program in the path below.

D:\TRI\_Camera\TriCameraSimpleUI64.exe

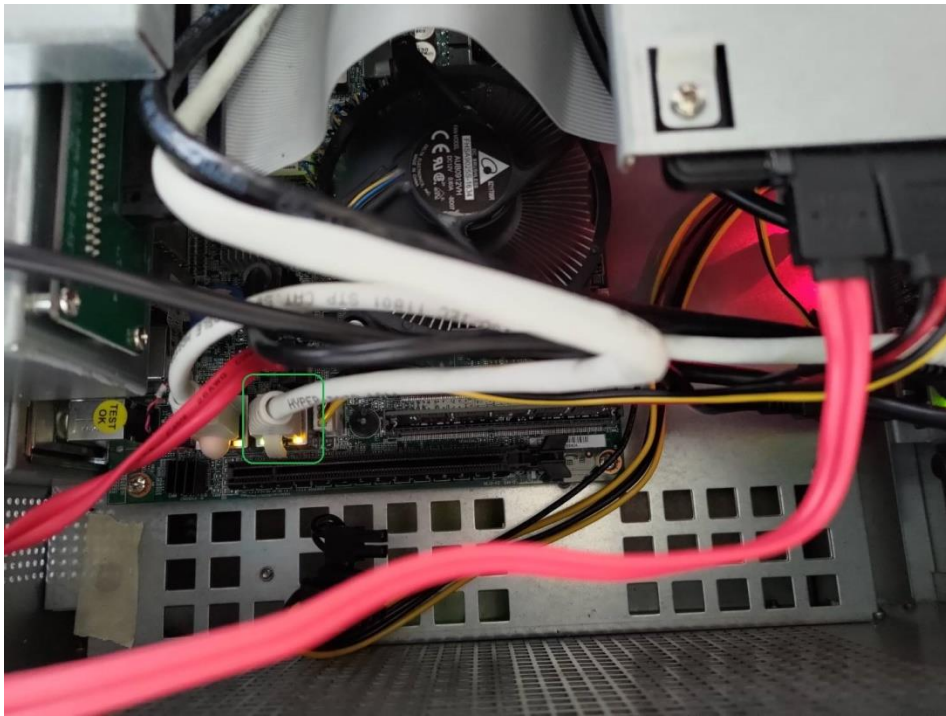
Follow the steps below to use.

1. Prompt the available camera.
2. Click the Connect button.
3. Click the button for continuous snapshots.
4. Display the active screen.



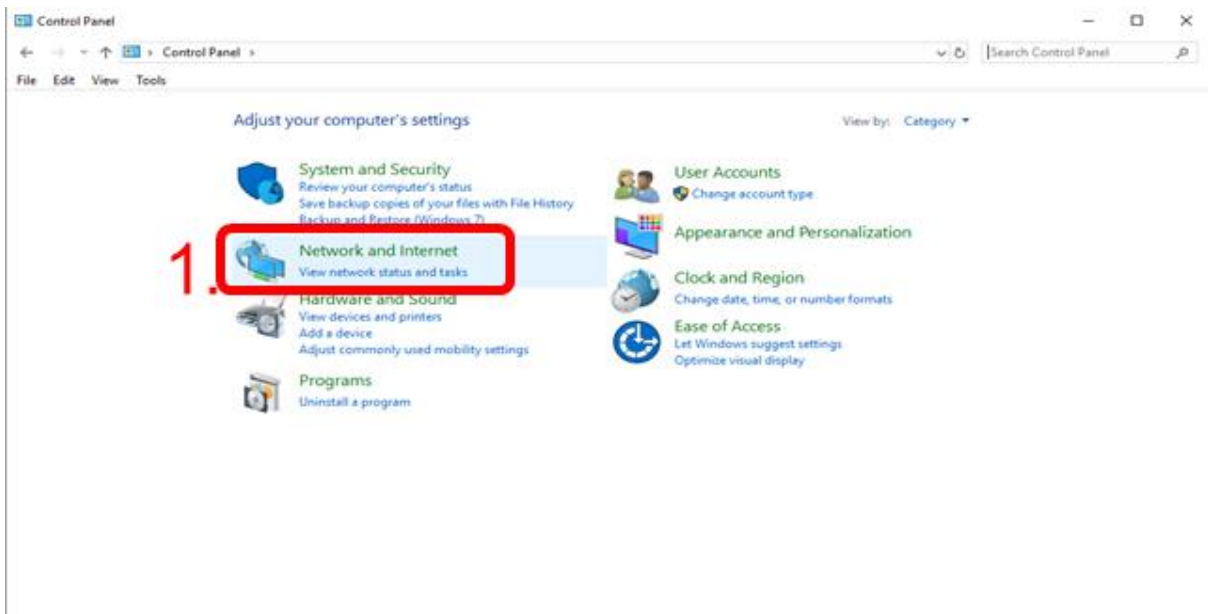
### TRI camera examination instructions in Step3 :

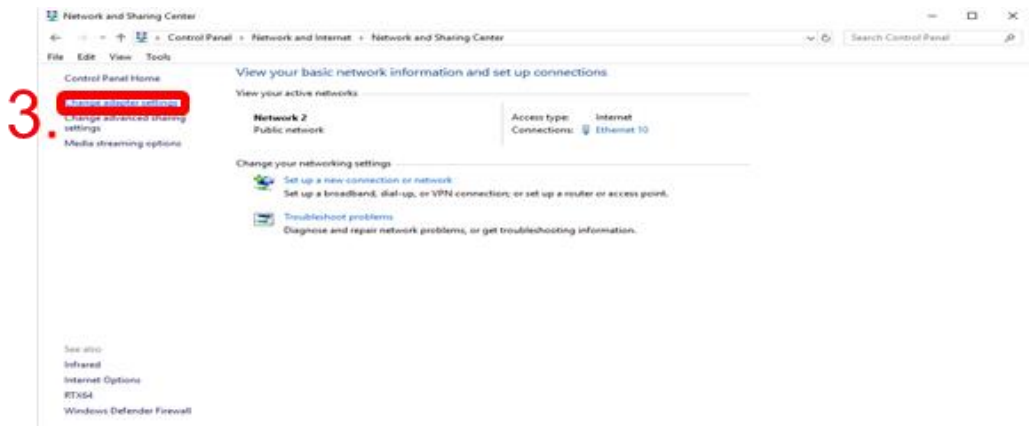
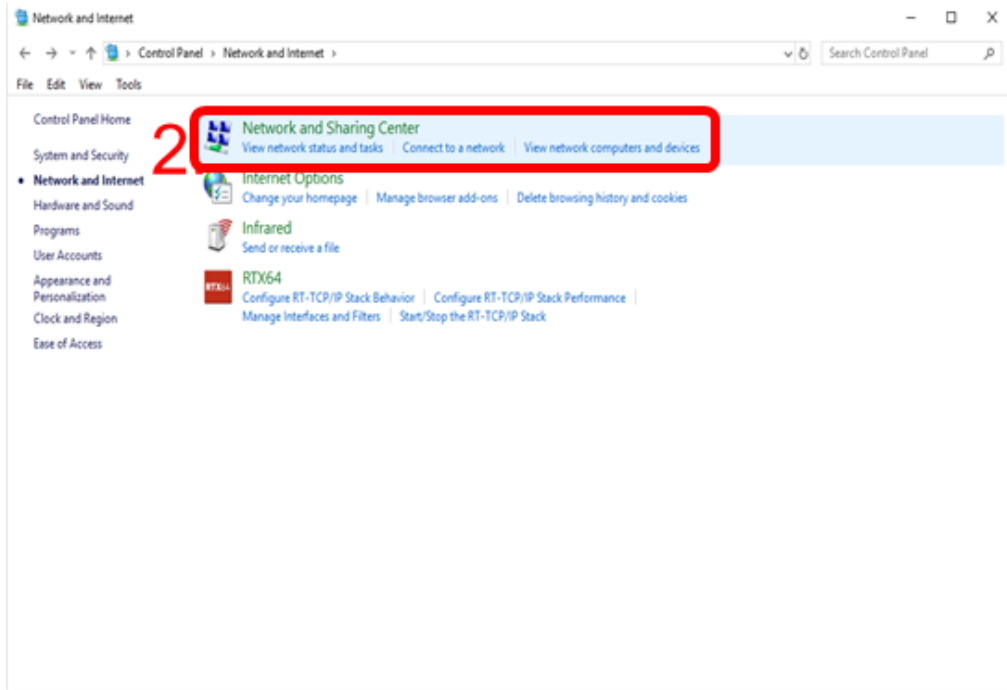
Confirm whether the RJ45 Cable light indicator turns on as shown in the green frame of the figure below.



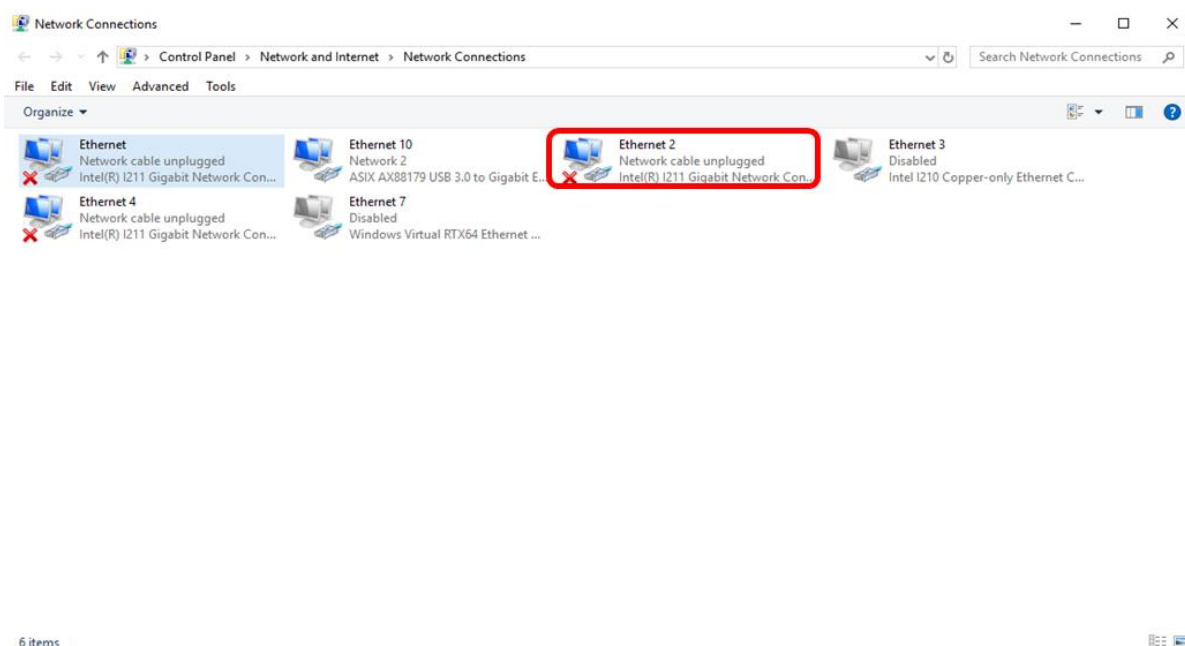
**TRI camera examination instructions in Step3a :**

- Launch the control panel and navigate to **Network and Internet**.
- Select **Network and Sharing Center**.
- Select **Change adapter settings**.
- As shown in steps 1, 2, and 3 in the red of the figures below.



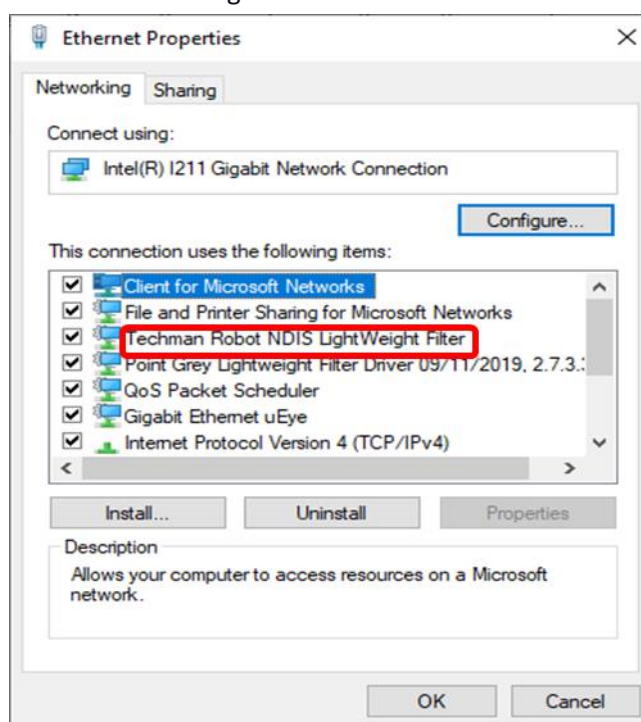


Confirm whether the TRI camera network interface card (Ethercat2) exists and turns on, as shown in the red frame of the figure below.

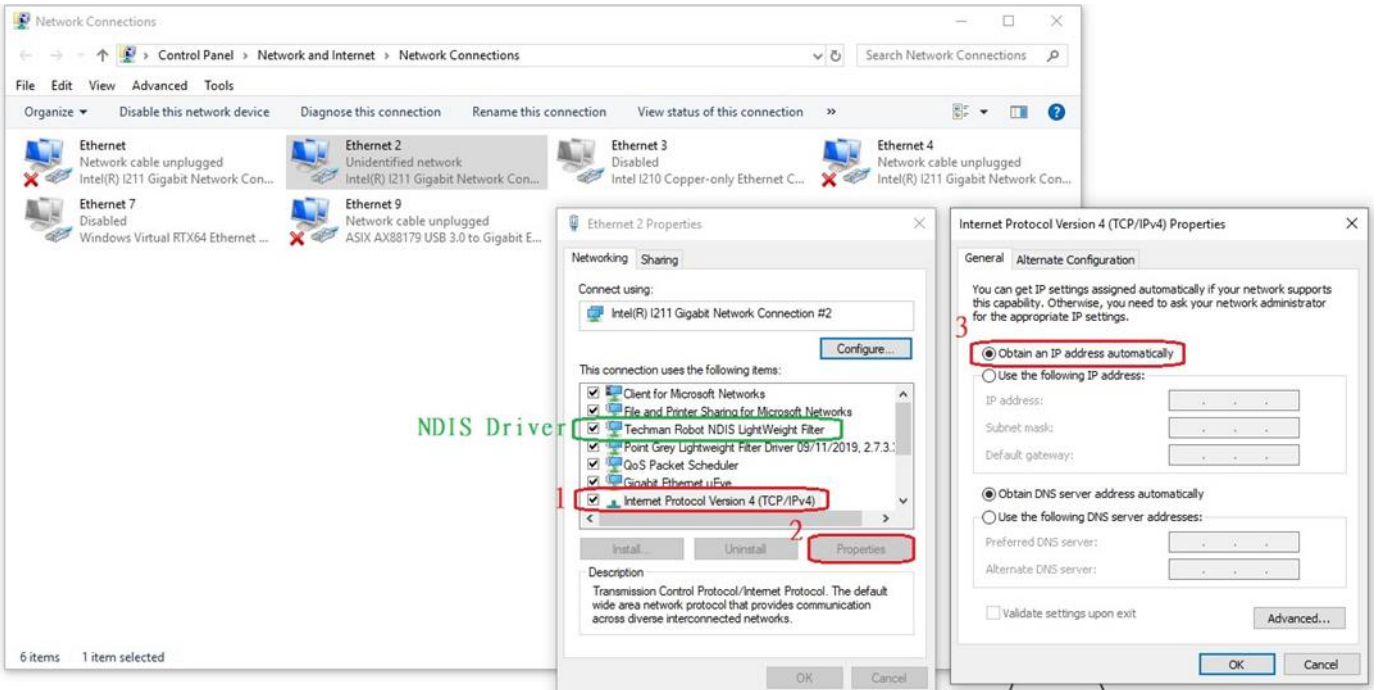


**TRI camera examination instructions in Step3b :**

Continue from Step3a, right-click on **Ethercat2**, and select **properties** to confirm whether the NDIS Driver exists and select it, as shown in the red frame of the figure below.

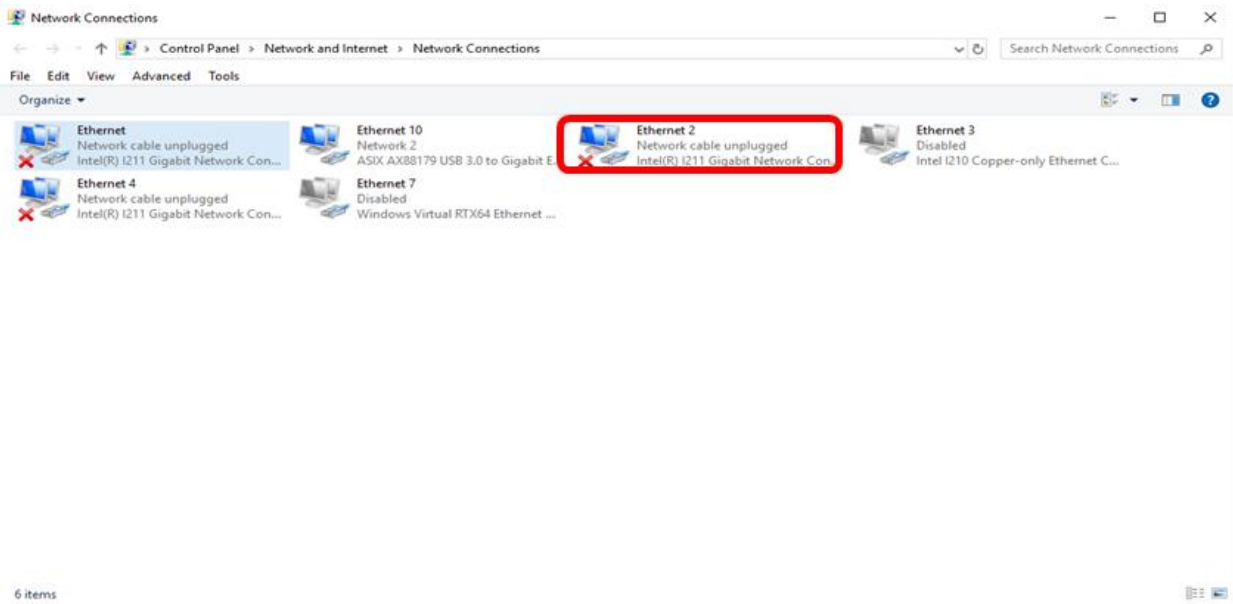


**TRI camera examination instructions in Step3c :**

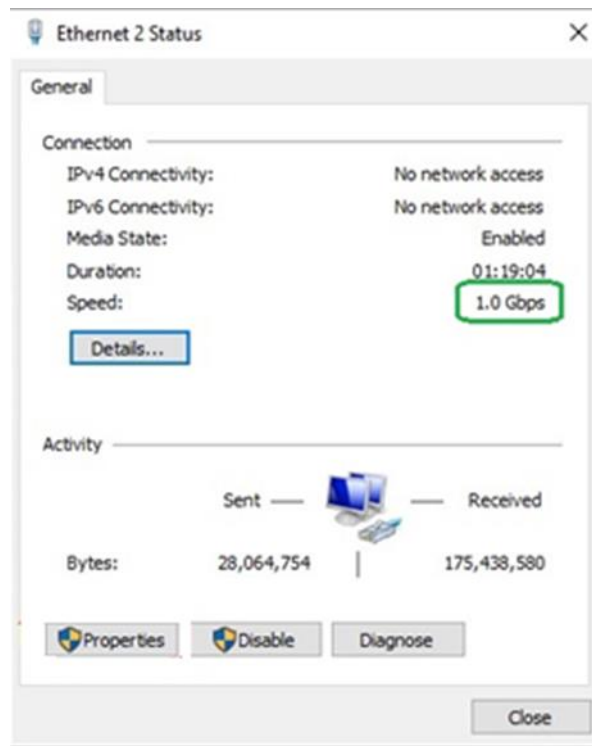


**TRI camera examination instructions in Step3e :**

Click **Ethernet2** to confirm whether the connection speed is 1.0Gb.







**TRI camera examination instructions in Step3f :**

Power light indicator examination

- Remove the camera module screws.
- Use an electric meter to measure whether the pin on the bottom right connector of the camera module outputs voltage at 5V.



**TRI camera network LED description:**

- The orange light at the left denotes linked meaning it will light up when the RJ45 at both ends are connected.
- The yellow light at the right denotes data meaning it will be on when there is data transmission. It flickers more slowly when there is no picture capturing, and, very quickly when there is a picture capturing.
- In principle, please take the data LED to assess whether the network is connected.





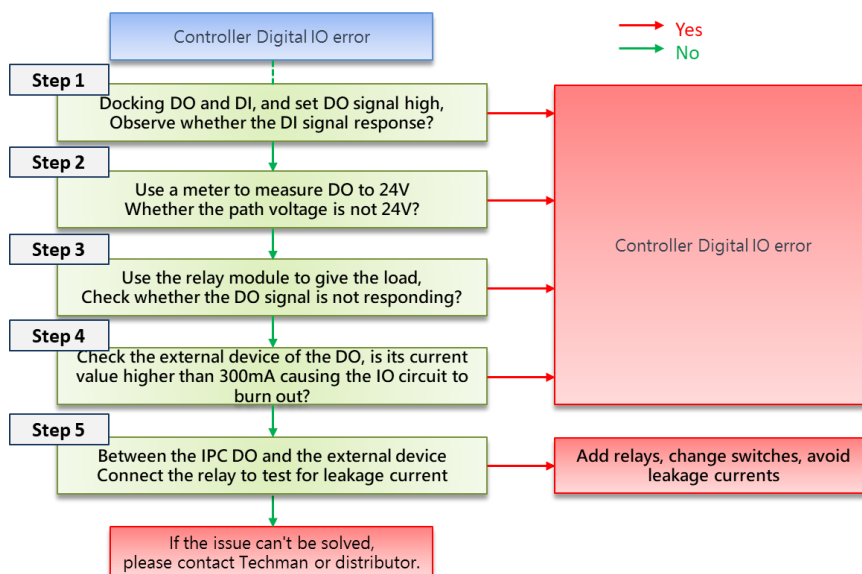
### 12.6 Digital I/O Error with the controller

**Case Description** This section describes the possible causes and the recommended solutions to the Digital I/O error with the controller.

**Symptom :** There is a delay or no response to the IPC signal output.

- |                         |   |                              |
|-------------------------|---|------------------------------|
| <b>Possible Cause :</b> | <ol style="list-style-type: none"> <li>1. The external device's digital output current exceeds 300 mA making the output and input circuits burn out.</li> <li>2. There is a leakage in the IPC I/O circuit connected to the external device.</li> </ol> | <b>Possible Cause :</b><br>無 |
|-------------------------|---|------------------------------|

#### Troubleshooting Process:





## 12.7 Joint Error

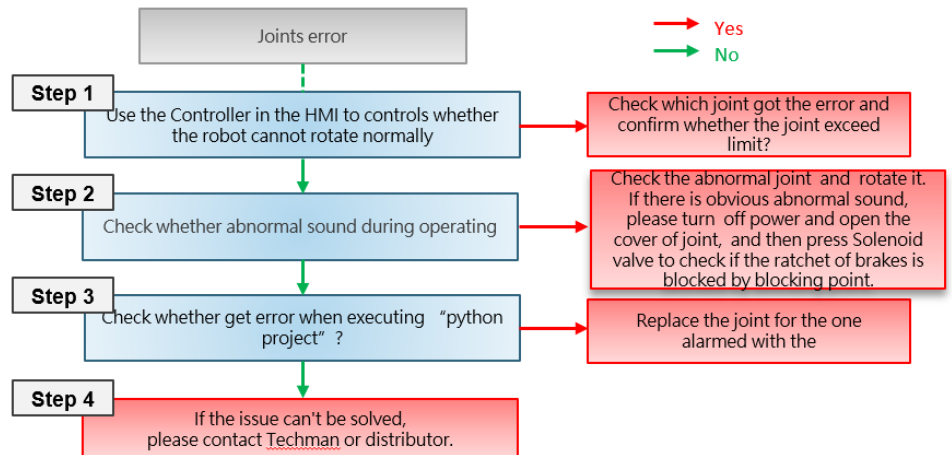
**Case Description** This section describes the possible causes and the recommended solutions to the joint error.

- Symptom :**
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.

**Possible Cause :**

1. Axis joint exceeds the functional limit	Error Code :	
2. Error with the joint's internal mechanism.	0x00000035	0x0000FF0D
3. Fault with the joint's circuit board.	0x0000003C	0x0000FF0E
	0x0000004B	0x0000FF0F
	0x0000FF01	0x0000FF10
	0x0000FF02	0x0000FF11
	0x0000FF04	0x0000FF12
	0x0000FF05	0x0000FF13
	0x0000FF06	0x0000FF14
	0x0000FF07	0x0000FF15
	0x0000FF08	0x0000FF16
	0x0000FF09	0x0000FF17
	0x0000FF0A	0x0000FFAB
	0x0000FF0B	0x0000FFCF
	0x0000FF0C	

Troubleshooting Process:



Point of "python project":  
 P1(260°,90°,-150°,90°,170°,110°)  
 P2(-260°,-90°,150°,-90°,-170°,-110°)

## 12.8 Point offset

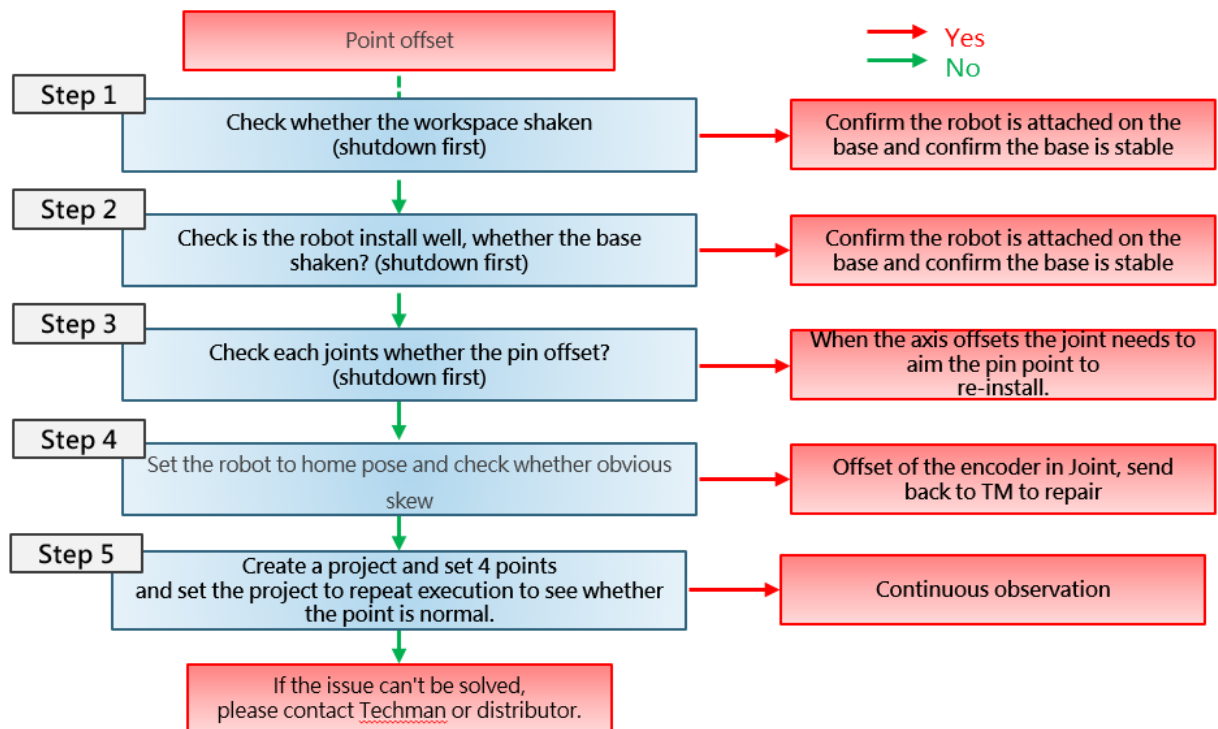
**Case Description** This section describes the possible causes and the recommended solutions to the point offset. The point of the project deviated after the collision.

**Symptom :**

<b>Possible Cause :</b>	1. Set the robot back to the initial pose and check for distinct offsets.	<b>Possible Cause :</b> 無
	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.	

- Notice :**
1. It is recommended that users check the function of the shaft joint after each collision and decide whether to replace it when the TM-Robot takes it as damaged.
  2. If the collision keeps occurring when the project is running after ruling the error out, please check the parameters below in the project flow:
    - i. Timings of input and output
    - ii. Flow logic
    - iii. Timing of communication
    - iv. Point-to-point mixing settings

Troubleshooting Process:



## 12.9 Error with the stick

**Case Description** This section describes the possible causes and the recommended solutions to the error with the stick.

**Symptom :**

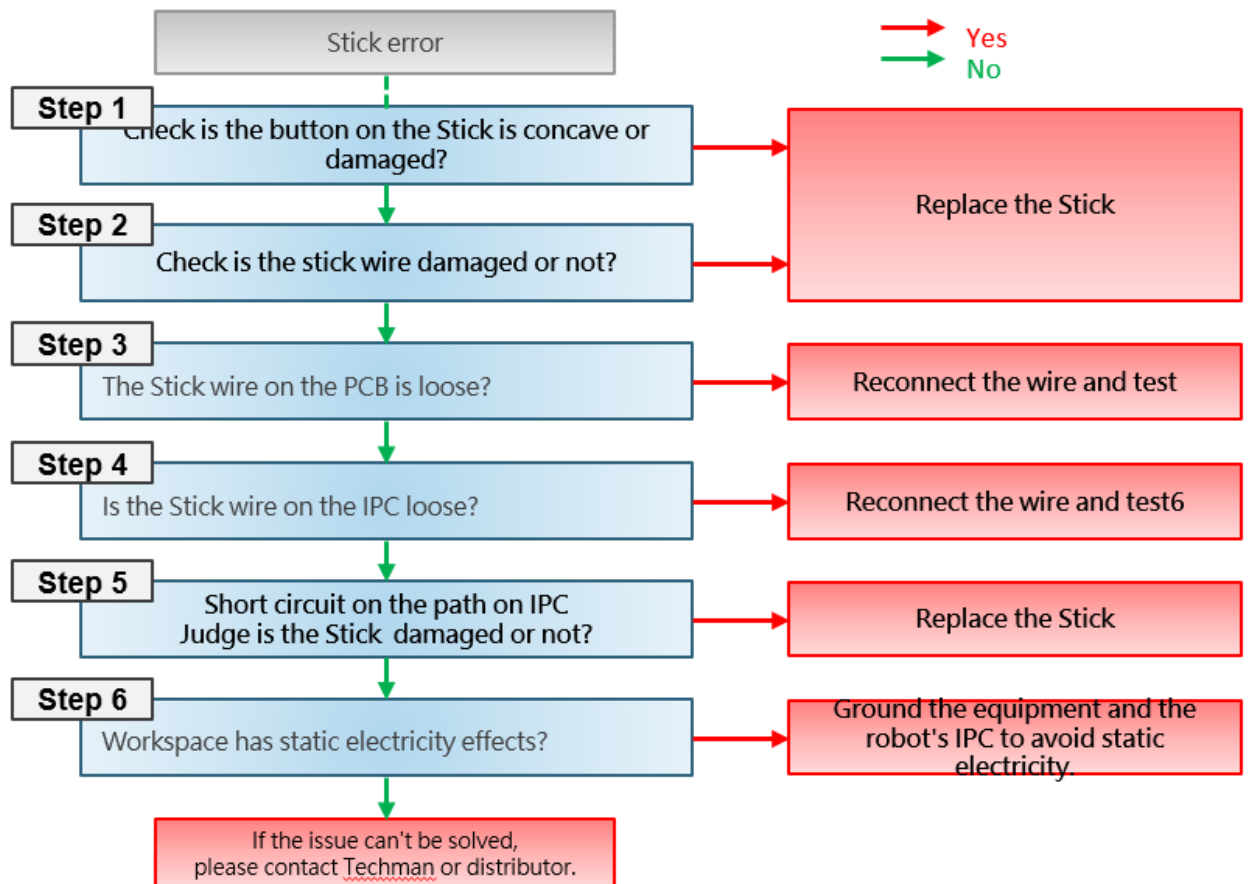
1. The project status changes to "Paused" or "Automatically running" during execution.
2. Enter emergency mode during project execution.
3. No effect when pressing the button
4. The robot will not start.

**Possible Cause :**

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.

**Error Code :**  
N/A

Troubleshooting Process:



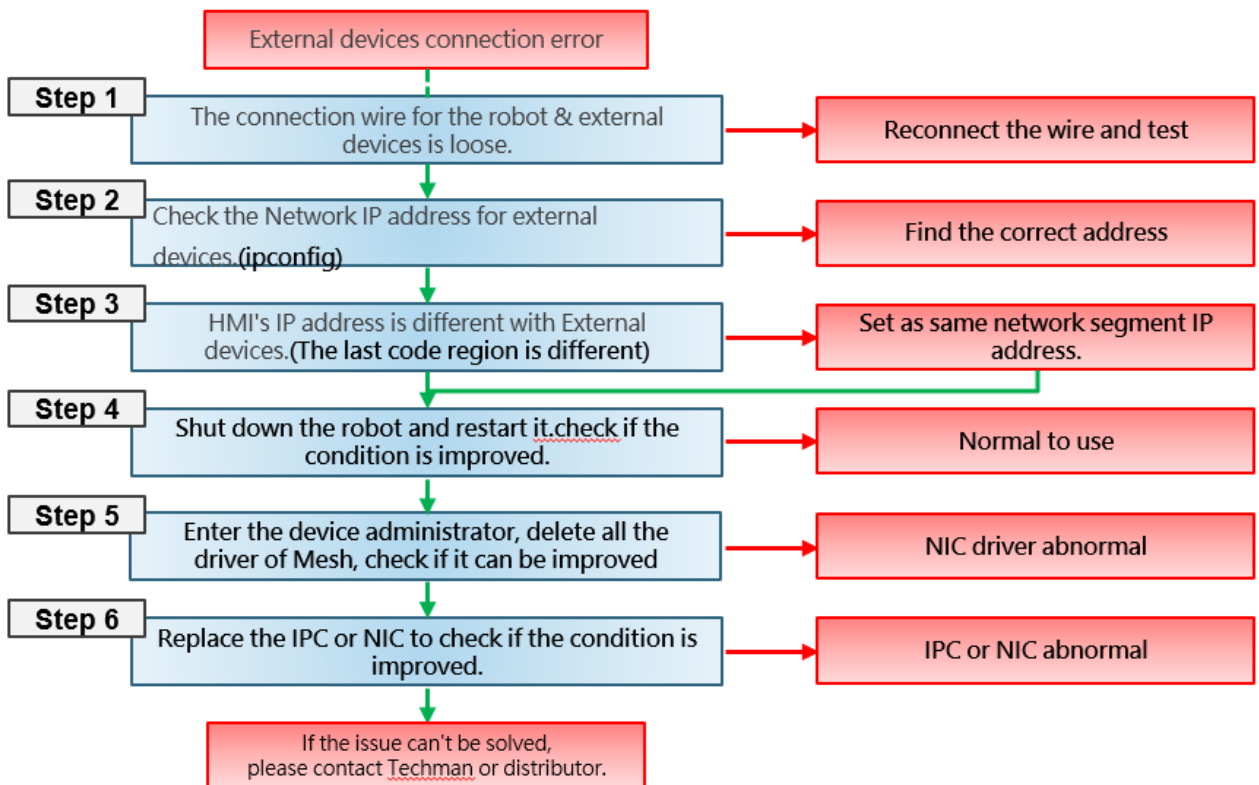
12.10 Connection error with the external device

**Case Description** This section describes the possible causes and the recommended solutions to the connection error with the external device.

**Symptom :** 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.

- |                         |  |                                |
|-------------------------|--|--------------------------------|
| <b>Possible Cause :</b> | <ol style="list-style-type: none"> <li>1. The connection cable between the robot and the external device is loose.</li> <li>2. The IP address of the external device is wrong.</li> <li>3. The IP address of the HMI is inconsistent with that of the external device.</li> <li>4. Error with the network interface controller driver</li> <li>5. Error with the IPC or the network interface controller.</li> </ol> | <p>Error Code :</p> <p>N/A</p> |
|-------------------------|--|--------------------------------|

Troubleshooting Process:





## 12.11 Error with the SSD

**Case Description** This section describes the possible causes and the recommended solutions to the error with the SSD.

**Symptom :** 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.

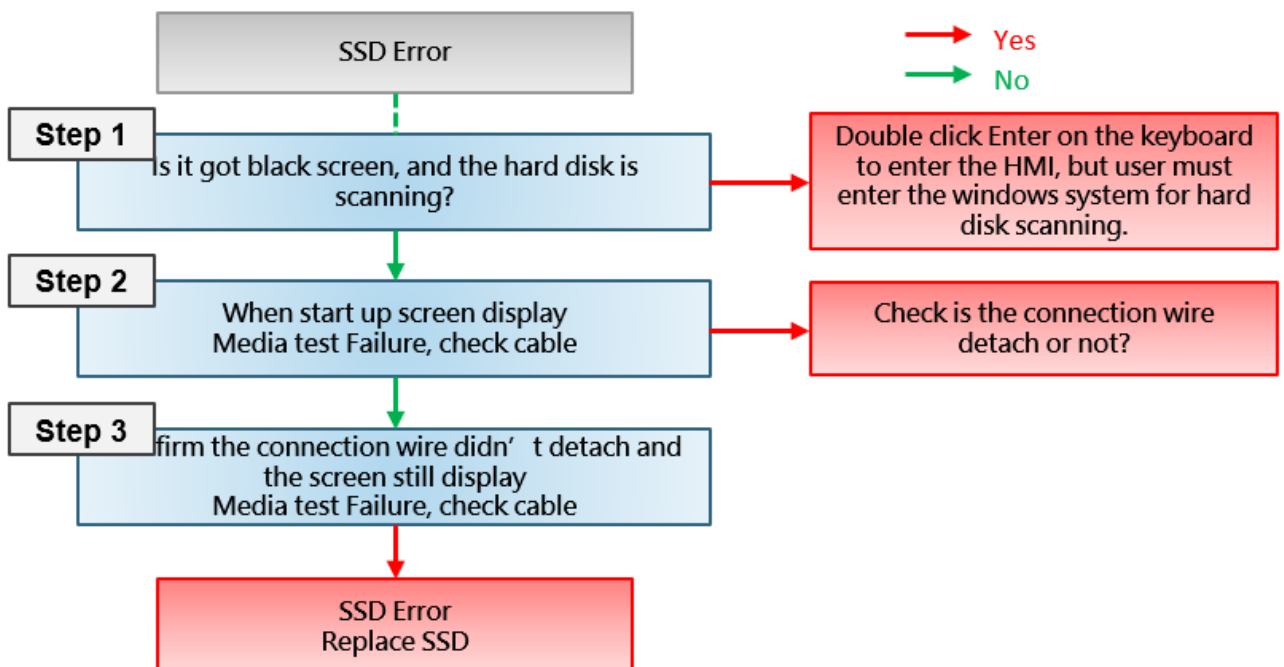
**Possible Cause :**

1. The SSD connection cable is loose. Error Code :
2. Windows is scanning the drive. N/A
3. The SSD is damaged.

**Diagram :**



Troubleshooting Process:



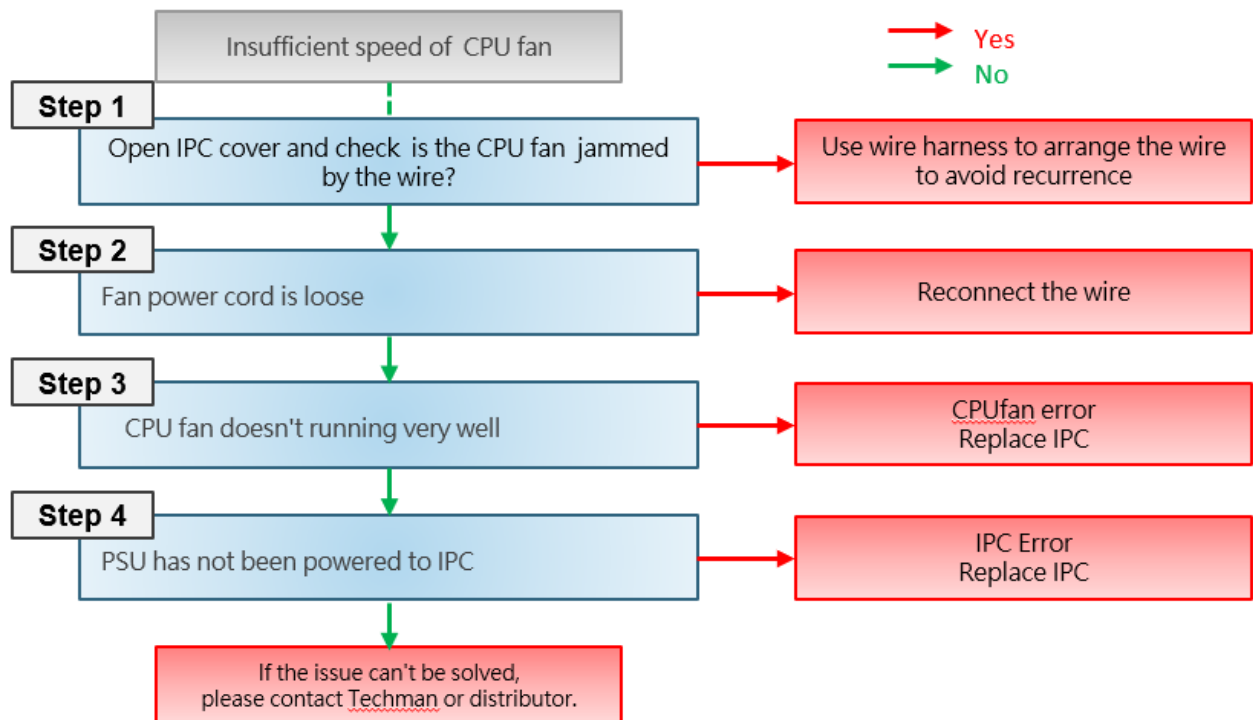
## 12.12 Insufficient CPU fan speed

**Case Description** This section describes the possible causes and the recommended solutions to insufficient CPU fan speed.

**Symptom :** The HMI shows the error code 0x00040015, meaning the CPU fan speed is lower than 1000 rpm making the robot fail to function.

- |                         |  |                         |            |
|-------------------------|--|-------------------------|------------|
| <b>Possible Cause :</b> | <ol style="list-style-type: none"> <li>1. The CPU fan is tangled with wires.</li> <li>2. The power cord of the fan is loose.</li> <li>3. The CPU fan does not function properly.</li> <li>4. The power supply failed to supply power to the IPC.</li> <li>5. Error with the software.</li> </ol> | <b>Possible Cause :</b> | 0x00040015 |
|-------------------------|--|-------------------------|------------|

Troubleshooting Process:



### 12.13 The robot restarts automatically

**Case Description** This section describes the possible causes and the recommended solutions for the robot restarting automatically.

After turning on the robot, the control box automatically turns on but will not turn off properly.

**Symptom :**

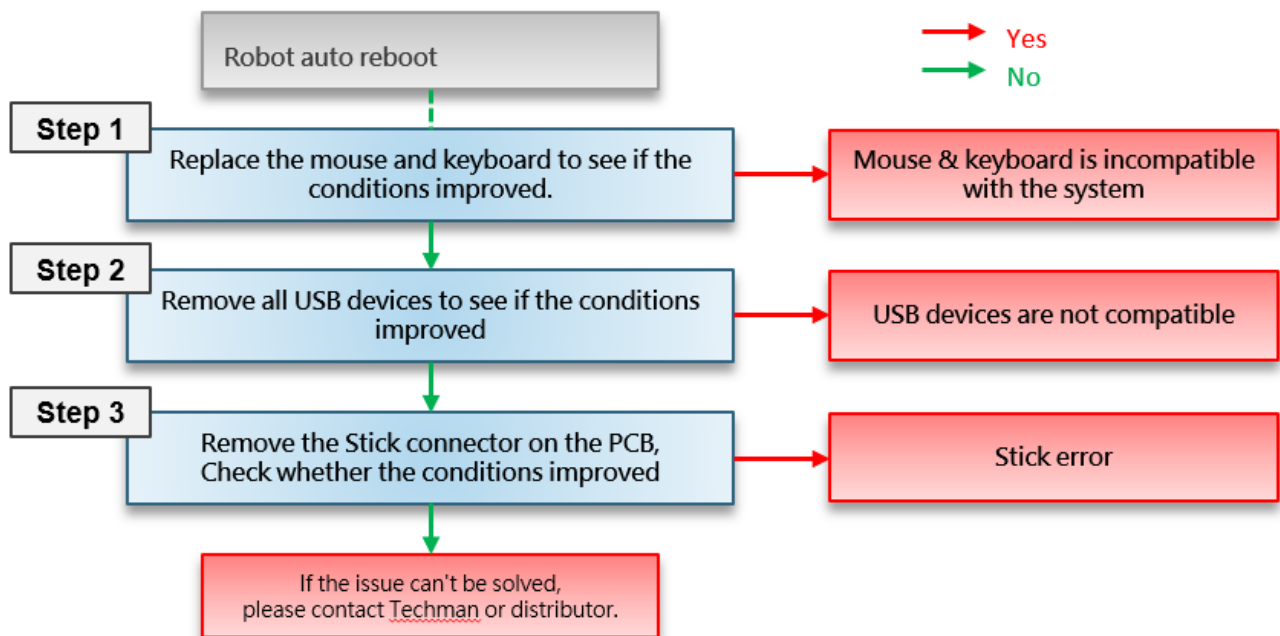
**Possible Cause :**

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.

**Possible Cause :**

無

Troubleshooting Process:



## 12.14 The Camera Is Not In Focus

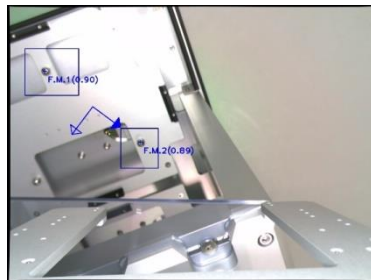
**Case Description** This section describes the possible causes and the recommended solutions for the camera not in focus.

**Symptom :** The camera cannot focus during the vision task operation.

**Possible Cause :**

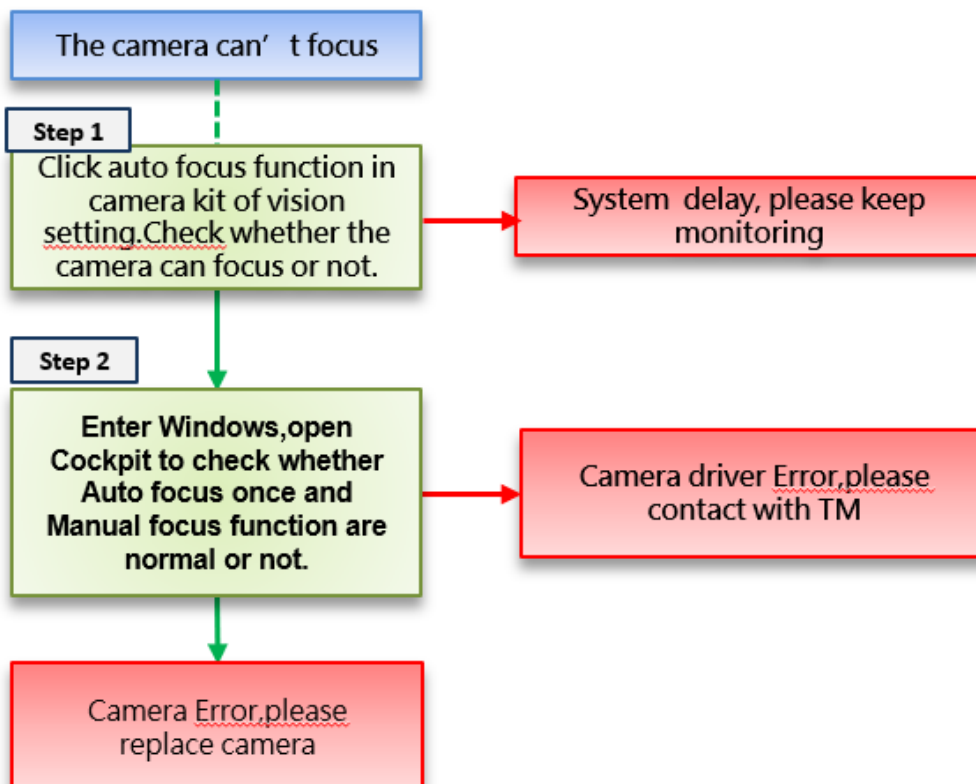
1. Error with the camera driver	Error Code :
2. Faulty camera	N/A

**Symptom Diagram :**



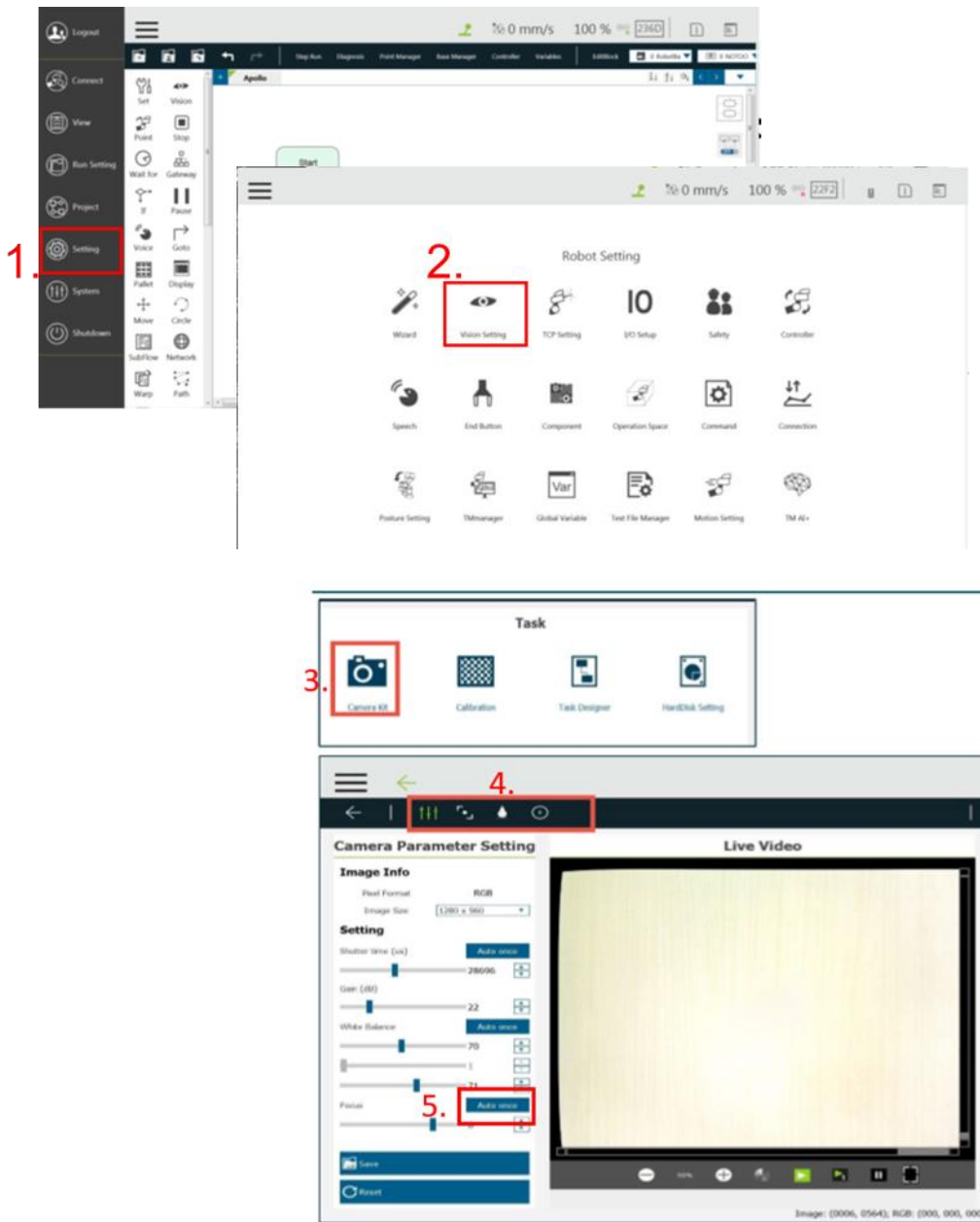
Troubleshooting Process:

→ Yes  
→ No



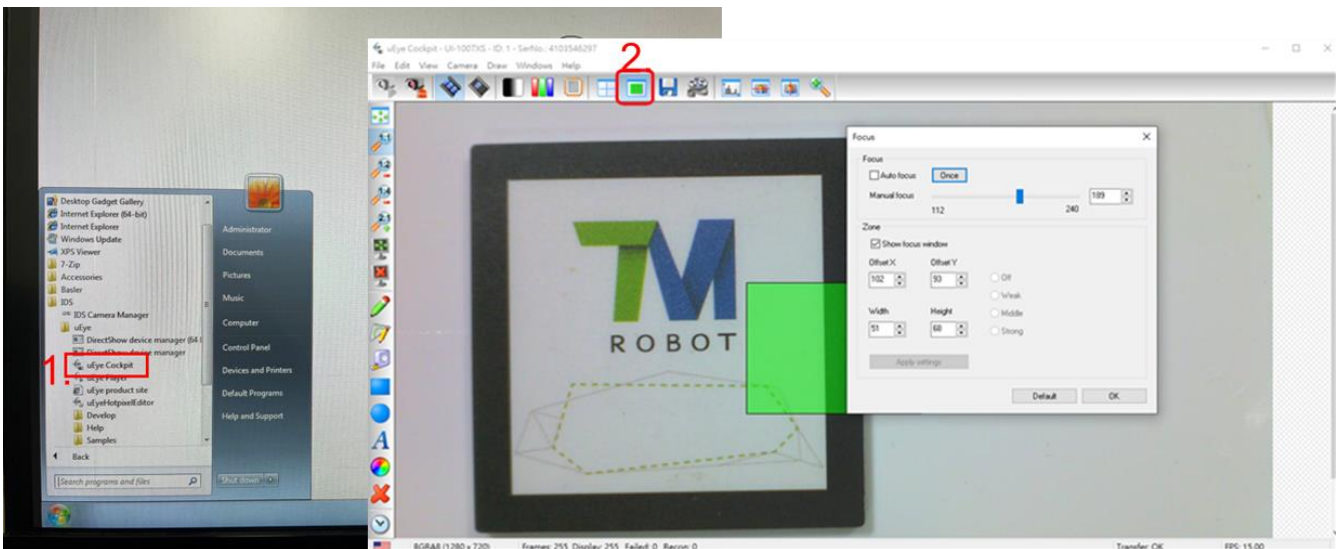
## Description of checking and repairing IDS cameras Step1 :

Follow the steps in the figures below to navigate to the **Camera Kit**. In the **Focus** segment, click **Auto Once** to confirm whether the camera can automatically focus.

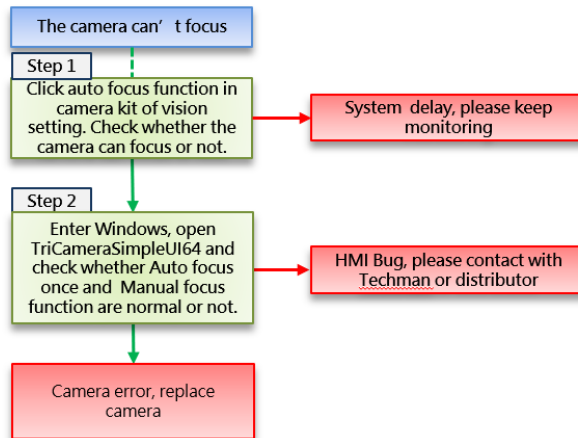


## Description of checking and repairing IDS cameras Step2 :

Launch the ueye Cockpit, connect the camera, and open the Focus adjustment page to check whether **Auto focus once** and **Manual focus** adjustment work.

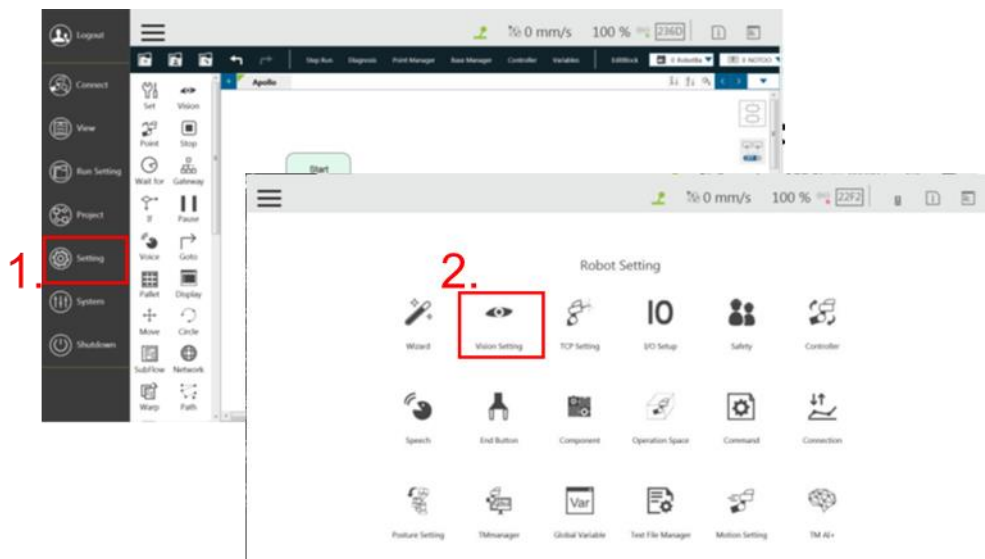


**inspect and repair TRI cameras:**

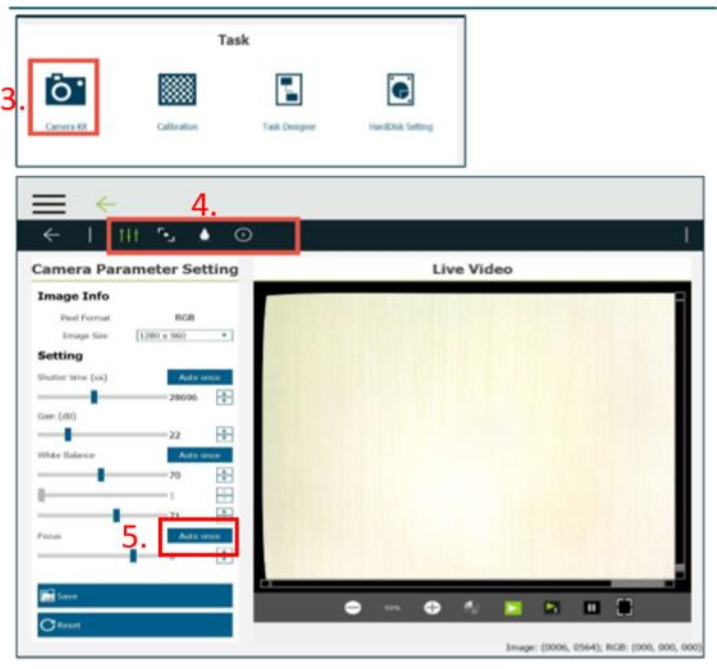


**Description of checking and repairing TRI cameras Step1 :**

Follow the steps in the figures below to navigate to the **Camera Kit**. In the **Focus** segment, click **Auto Once** to confirm whether the camera can automatically focus.







**Description of checking and repairing TRI cameras Step2 :**

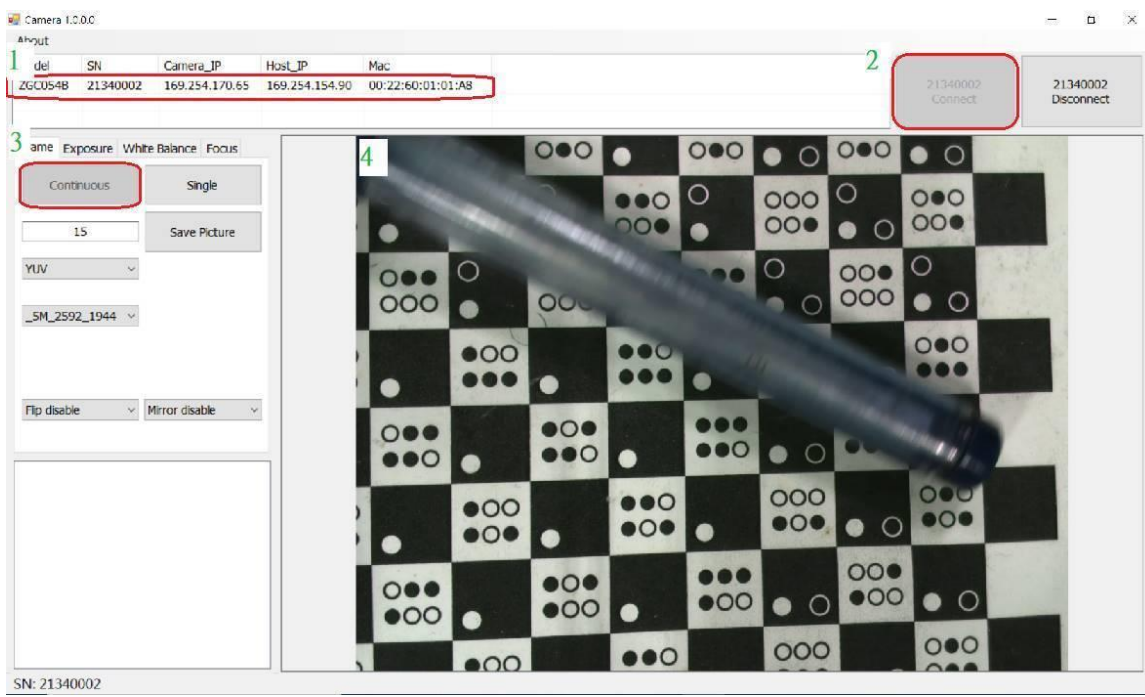
Please install TriCameraSimpleUI64. This executable is available to request from TM-Robot and built-in the robot with HMI 2.0 or above.

Execute the program in the path below.

D:\TRI\_Camera\TriCameraSimpleUI64.exe

Follow the steps below to use.

1. Prompt the available camera.
2. Click the Connect button.
3. Click the button for continuous snapshots.
4. Display the active screen.

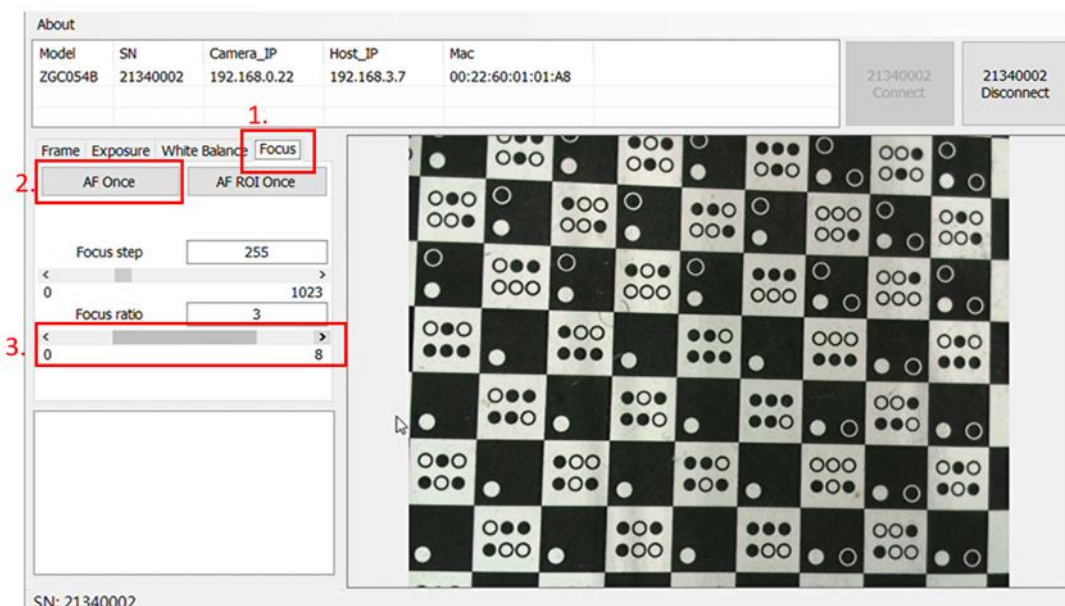


### Description of checking and repairing TRI cameras Step3 :

Go to the bottom layer, and launch TriCameraSimpleUI64 to confirm whether **Auto focus once** and **Manual focus** adjustment can be in focus as the steps in the figure below.

The steps in red are as follows:

1. Click the **Focus** tab.
2. Click **AF Once** to check whether the image is clear.
3. Click the left and the right direction buttons manually to change the focal length and check whether the image clarity has changed.



## 12.15 Error With The Joint Optical Encoder

**Case Description** This section describes the possible causes and the recommended solutions to the error with the joint optical encoder.

- Symptom :**
1. Error with the encoder resolution
  2. Encoder overcompensation
- 1) Error with the encoder signal detection

- Possible Cause :**
1. The disc surface of the encoder is stained
  1. Performing friction learning or safety calibration without rebooting made the encoder in a tightened state.

**Possible Cause :**

0x0000FFED  
 0x0000FFCE  
 0x0000FFCA  
 0x0005FFCE  
 0x0005FFCA

Troubleshooting Process:

