

Smart Robot Box

User Manual

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Version records

Version	Modifications
0.1	Draft released
0.4	Add YASKAWA
0.45	Modify Ch2.2 & Ch2.3
0.5	Add Ch1 & Ch2.1, Modify Ch4
0.5.4	Add ABB network IP setting
0.5.5	Add CH2.3.7 and CH4.6 for Fanuc
0.5.6	Modify Ch2.2 & Ch4.6 Delete Ch3.4.3.1 Modify Ch4.4.1
0.5.7	Add Ch2.3.8, Ch4.7 for Epson robot Add Ch4.5.2 and 4.5.3 for ABB robot
0.5.8	Modify Ch4.5.2, Ch4.5.3, Ch4.6.3





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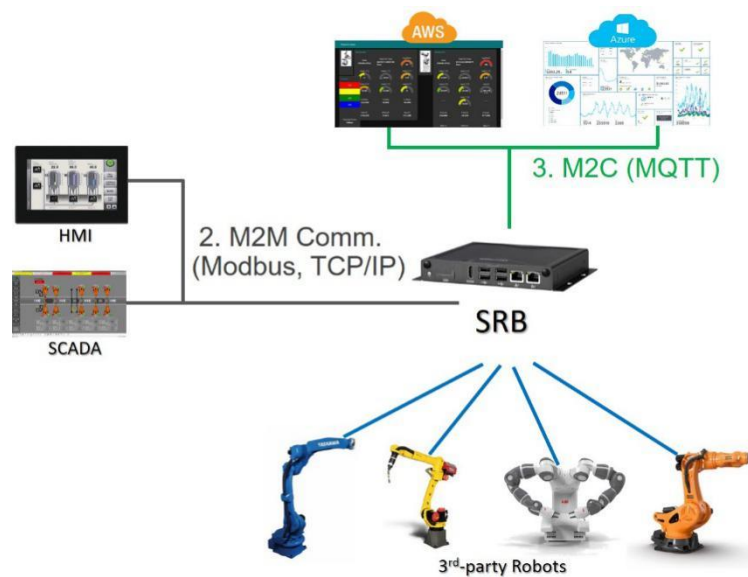


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1 Product Overview

NexCOBOT's robot gateway product (SRB, Smart Robot Box) can connect to the major industrial robot controllers on the market, such as YASKAWA, KUKA, Fanuc, ABB and UR Robot, and read important information in the controller. After SRB reads the relevant data of industrial robot controller, it can communicate with HMI or SCADA via Modbus TCP or database. In addition, SRB can also use MQTT to interoperate controller-related data with cloud systems such as Amazon Web Service (AWS).



SRB System Architecture


SRB also provides a function that allows users to log in to the SRB webpage through a browser on a computer or any handheld devices so that users can configure the connection of the robot controller and view the controller data directly on the webpage.



SRB Webpage Operation

2 Specifications

2.1. SRB Hardware Specification

Model Name	SRB100
Photo	
Processor	Intel® Atom™ Processor E3826. (1M Cache, 1.46 GHz)
Memory	On board 4GB DDR3L 1866 RAM
Storage	On board 32GB EMMC (optional mSATA module)
Display	1 x HDMI display
I/O Interface-Front	ATX power on/off switch 1 x Storage/2 x GPO programmable LED 1 x SIM card holder 2 x Intel® I210-AT GbE LAN ports; support WoL, teaming and PXE 1 x HDMI display output 4 x USB 2.0 (500mA per each) 2 x Antenna holes for optional Wi-Fi/3.5G antenna
I/O Interface-Rear	3 x DB9 for COM1 & COM2 & COM3 - COM1: full RS232 signal - COM2: RS-232, only support Tx/Rx/GND - COM3: RS422/485 auto flow control 1 x Line-out Support 24V DC input
Power Requirements	Power input: 24V DC +/-20% 1 x Optional 24V, 60W power adapter
Dimensions	162mm (W) x 26mm (H) x 150mm (D) without wall-mount bracket
Environment	Operating temperature: Ambient with air flow: -5°C to 55°C (according to IEC60068-2-1, IEC60068-2-2, IEC60068-2-14) Storage temperature: -20°C to 75°C Relative humidity: 10% to 95% (non-condensing) Shock protection: mSATA/EMMC: 50G, half sine, 11ms, IEC60068-2-27 Vibration protection w/ mSATA or EMMC condition:

	- Random: 2Grms @ 5~500 Hz, IEC60068-2-64 - Sinusoidal: 2Grms @ 5~500 Hz, IEC60068-2-6
Certifications	CE FCC Class A

Model Name	SRB200/SRB201
Photo	
Processor	SRB200: Intel® 6th Gen Core™ i5-6500, 3.20 GHz SRB201: Intel® 6th Gen Core™ i7-6700, 3.40 GHz
Memory	SRB200: 8GB DDR4 2400 RAM SRB201: 16 GB DDR4 2400 RAM
Storage	SRB200: 128GB 2.5" SATA3 MLC SSD SRB201: 256 GB 2.5" SATA3 MLC SSD
Display	1 x HDMI display 1 x VGA
I/O Interface-Front	1 x Power switch 2 x USB2.0 2 x LAN port
I/O Interface-Rear	2 x DB9 for RS232/422/485 1 x HDMI 4 x USB2.0 1 x DB15 for VGA 2 x LAN port (1 x PoE, IEEE 802.3af compliant) 1x 3 pin Terminal block for DC24V in
Expansion Slots	1 x PCIe16 1 x Mini PCIe
AI Inference Engine	Optional AIBooster-L1/L2 (Intel® Movidius™ Myriad™ X MA2485 Accelerator Card)
Power Requirements	Power input: 24V DC +/-10%



Dimensions	312.5 X 286.1 X 75.8 mm (without mounting bracket) 354.18 x 286.1 x 83.8 mm (with mounting bracket)
Environment	Board level operation temperature: 0°C to 50°C Storage temperature: -20°C to 80°C Relative humidity: - 10% to 90% (operating, non-condensing) - 5% to 90% (non-operating, non-condensing) Vibration protection w/ HDD or SSD condition: - Random: 2Grms @ 5~500 Hz, IEC60068-2-64 - Sinusoidal: 2Grms @ 5~500 Hz, IEC60068-2-6
Certifications	CE FCC Class A

2.2. Supported Robot Controller Brands and Models

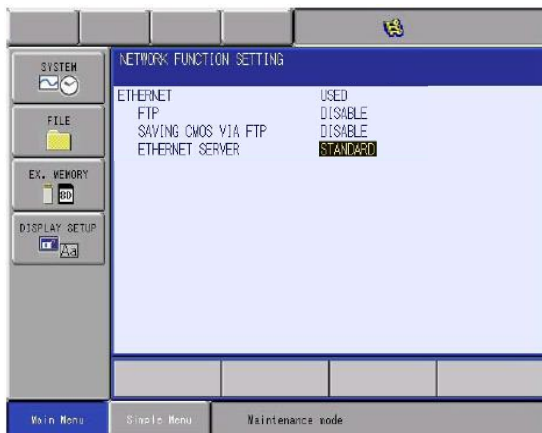
2.2.1. Supported brands and models

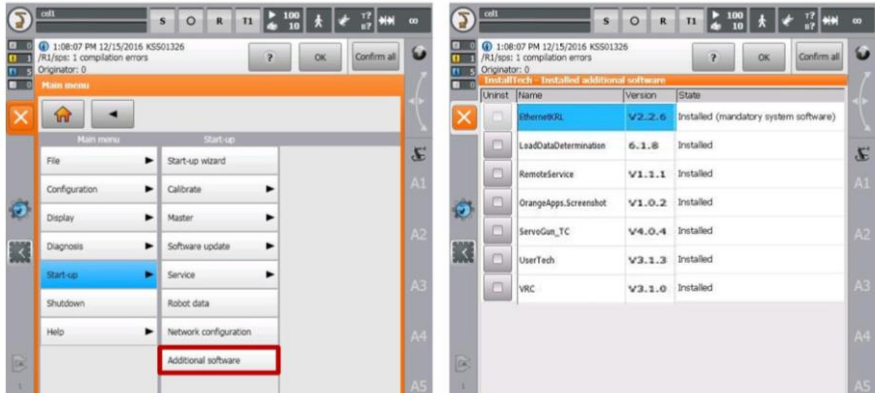
Below is the list of supported robot brands and controller models

Controller	Model
YASKAWA	Controller:YRC1000 、YRC1000micro 、DX200
KUKA	Hardware: KR C4 Compact Software Version: KUKA System Software 8.2 or 8.3
UR	Hardware : UR5 、UR10 Software Version : URSoftware 3.10.1.76190
NEXCOBOT	RCS100 、RCS200
ABB	Hardware: IRB 120 Software Version: RobotWare 6.07.01.00
Fanuc	Controller: R-30iB Compact
Epson	RC7.0+

2.2.2. Communication enable check

Please follow the instruction to check the communication of each robot controller is enable or not :

Controller	Description
YASKAWA	<p>Refer to 4.1.2 Step1 ~ Step3 , Confirm that Ethernet is “USED” on SYSTEM->SETUP->NETWORK FUNCTION SETTING. If not, contact the local YASKAWA distributor for purchase.</p> 

KUKA	<p>Refer to 4.2.2 Step1 ~ Step2 and confirm that EthernetKRL is in the software list on Main Menu->Start up->Additional software. If not, contact the local KUKA distributor for purchase.</p> 
UR	Universal Robot network communication function is standard
NEXCOBOT	NEXCOBOT network communication function is standard
ABB	Refer to 4.5.2 Step1 and confirm the option of PC Interface and Multitasking are enabled. If not, contact the local ABB distributor for purchase.
Fanuc	Refer to 4.6.2 的 Step2 and confirm the option of R651 or R650+R533 is enabled. If not, contact the local FANUC distributor for purchase.
Epson	Epson Robot network communication function is standard

2.3. Robot Controller Readable Data

SRB readable data and robot controller brand comparison table.(●:Current support ○:TBD NA: Unsupported)

YSAKAWA, KUKA, UR and NEXCOBOT

Item	Description	YASKAWA		KUKA		UR		NEXCOBOT	
		R	W	R	W	R	W	R	W
1	Robot status	●	NA	●	NA	●	NA	●	NA
2	Operating mode	●	○	●	NA	○	○	●	○
3	Script list / name	●	NA	●	NA	●	NA	○	NA
4	Script running mode	●	○	●	NA	●	○	○	○
5	TCP terminal position	●	NA	●	NA	●	NA	●	NA
6	Axis angle	●	NA	●	NA	●	NA	●	NA

7	Axis speed	NA	NA	●	NA	●	NA	●	NA
8	Axis torque	●	NA	●	NA	●	NA	NA	NA
9	Current Tool number	●	○	○	○	NA	NA	○	○
10	Current Base number	●	○	○	○	NA	NA	○	○
11	Current alarming time/information/message	●	NA	○	NA	○	NA	○	NA
12	Software version	●	NA	●	NA	●	NA	○	NA
13	Servo status	○	○	○	○	○	○	○	○
14	Script selection / execution	NA	○	NA	NA	NA	○	NA	○
15	Script upload /download/delete	NA	○	NA	NA	NA	○	NA	○
16	Tracking error value of each axis	○	NA	○	NA	NA	NA	○	NA
17	External axis angle	○	NA	○	NA	○	NA	○	NA
18	Cartesian coordinates motion(Absolute / Incremental)	NA	○	NA	NA	NA	○	NA	NA
19	P2P motion (Absolute / Incremental)	NA	○	NA	NA	NA	○	NA	NA
20	External axis motion (Absolute / Incremental)	NA	○	NA	NA	NA	○	NA	NA
21	Current Tool name	NA	NA	NA	NA	NA	NA	NA	NA
22	Tool information	○	○	○	NA	○	○	○	○
23	Current Base name	NA	NA	NA	NA	NA	NA	NA	NA
24	Base information	○	○	○	NA	○	○	○	○
25	I/O information	○	○	○	○	○	○	○	○
26	Point information	○	○	NA	NA	○	○	○	○
27	Register	○	○	NA	NA	○	○	○	○
28	Historical alarm time/information/message	○	NA	○	NA	○	NA	○	NA
29	Alarm reset	NA	○	NA	NA	NA	○	NA	○
30	Boot time information	○	NA	NA	NA	○	NA	○	NA

ABB, FANUC and EPSON

Item	Description	ABB		Fanuc		Epson	
		R	W	R	W	R	W

1	Robot status	●	NA	●	NA	●	NA
2	Operating mode	●	○	●	NA	●	○
3	Script list / name	●	NA	●	NA	●	NA
4	Script running mode	●	NA	●	NA	●	NA
5	Robot end effector position	●	NA	●	NA	●	NA
6	Axis angle	●	NA	●	NA	●	NA
7	Axis speed	●	NA	NA	NA	NA	NA
8	Axis torque	●	NA	NA	NA	●	NA
9	Current Tool number	NA	NA	●	NA	●	NA
10	Current Base number	NA	NA	●	NA	NA	NA
11	Current alarming time/information/message	○	○	●	NA	●	NA
12	Software version	○	NA	●	NA	NA	NA
13	Servo status	NA	NA	NA	NA	NA	NA
14	Script selection / execution	NA	NA	NA	NA	NA	NA
15	Script upload /download/delete	NA	NA	NA	NA	NA	NA
16	Tracking error value of each axis	NA	NA	○	NA	NA	NA
17	External axis angle	●	NA	○	NA	NA	NA
18	Cartesian coordinates motion(Absolute / Incremental)	NA	○	NA	○	NA	○
19	P2P motion (Absolute / Incremental)	NA	○	NA	○	NA	○
20	External axis motion (Absolute / Incremental)	NA	○	NA	○	NA	○
21	Current Tool name	●	NA	○	NA	NA	NA
22	Tool information	○	NA	○	○	NA	NA
23	Current Base name	●	NA	○	NA	NA	NA
24	Base information	○	NA	○	○	NA	NA
25	I/O information	○	NA	○	○	○	NA
26	Point information	NA	NA	○	○	NA	NA
27	Register	NA	NA	○	○	NA	NA
28	Historical alarm time/information/message	○	NA	○	NA	○	NA
29	Alarm reset	NA	○	NA	NA	NA	○
30	Boot time information	○	NA	○	NA	○	NA

Item	Description	YASKAWA		KUKA		UR		NEXCOBOT		ABB		Fanuc	
		R	W	R	W	R	W	R	W	R	W	R	W
1	Robot status	●	NA	●	NA	●	NA	●	NA	●	NA	●	NA
2	Operating mode	●	○	●	NA	○	○	●	○	●	○	●	NA
3	Script list / name	●	NA	●	NA	●	NA	○	NA	●	NA	●	NA
4	Script running mode	●	○	●	NA	●	○	○	○	●	NA	●	NA
5	Robot end effector position	●	NA	●	NA	●	NA	●	NA	●	NA	●	NA
6	Axis angle	●	NA	●	NA	●	NA	●	NA	●	NA	●	NA
7	Axis speed	NA	NA	●	NA	●	NA	●	NA	●	NA	NA	NA
8	Axis torque	●	NA	●	NA	●	NA	○	NA	●	NA	NA	NA
9	Current Tool number	●	○	○	○	NA	NA	○	○	NA	NA	●	NA
10	Current Base number	●	○	○	○	NA	NA	○	○	NA	NA	●	NA
11	Current alarming time/information/message	●	NA	○	NA	○	○	○	NA	○	○	●	NA
12	Software version	●	NA	●	NA	●	NA	●	NA	○	NA	●	NA
13	Servo status	○	○	○	○	○	○	○	○	NA	NA	NA	NA
14	Script selection / execution	NA	○	NA	NA	NA	○	NA	○	NA	NA	NA	NA
15	Script upload /download/delete	NA	○	NA	NA	NA	○	NA	○	NA	NA	NA	NA
16	Tracking error value of each axis	○	NA	○	NA	NA	NA	○	NA	NA	NA	○	NA
17	External axis angle	○	NA	○	NA	○	NA	○	NA	●	NA	○	NA
18	Cartesian coordinates motion(Absolute / Incremental)	NA	○	NA	NA	NA	○	NA	○	NA	○	NA	○
19	P2P motion (Absolute / Incremental)	NA	○	NA	NA	NA	○	NA	○	NA	○	NA	○
20	External axis motion (Absolute / Incremental)	NA	○	NA	NA	NA	○	NA	○	NA	○	NA	○
21	Current Tool name	NA	NA	NA	NA	○	○	NA	○	●	NA	○	NA
22	Tool information	○	○	○	NA	○	○	○	○	○	NA	○	○
23	Current Base name	NA	NA	NA	NA	○	○	○	○	●	NA	○	NA
24	Base information	○	○	○	NA	○	○	○	○	○	NA	○	○
25	I/O information	○	○	○	○	○	○	○	○	○	NA	○	○
26	Point information	○	○	NA	NA	○	○	○	○	NA	NA	○	○

27	Register	○	○	NA	NA	○	○	○	○	NA	NA	○	○
28	Historical alarm time/information/message	○	NA	○	NA	○	NA	○	NA	○	NA	○	NA
29	Alarm reset	NA	○	NA	NA	NA	○	NA	○	NA	○	NA	NA
30	Boot time information	○	NA	NA	NA	○	NA	○	NA	○	NA	○	NA

2.3.1. SRB Supported Information

2.3.1.1. Robot status

Alarm: Alarm state.

Idle: Idle state, Servo status is Servo Off.

Standby: Ready state, Servo status is Servo ON.

Running: In operation, Servo status is Servo ON and the robot is running.

2.3.1.2. Operation Mode

Operation modes include T1, T2, and Auto.

T1: Slow manual mode

T2: Quick manual mode

Auto: Automatic mode

2.3.1.3. Script List / Name

Saved script list and running script name.

2.3.1.4. Script Running Mode

Script running mode includes Program Running and Program Stop.

Program Running: Script is running

Program Stop: Script stops

2.3.1.5. End effector position

Robot end effector position, which contains X, Y, Z(unit :mm) and Rx, Ry, Rz(unit :deg).

2.3.1.6. Angle of Each Axis

Angle of each axis, which contains Axis1–8 values, unit: deg

2.3.1.7. Speed of Each Axis

Speed of each axis, which contains Axis1–8 values, unit: 0.1%

2.3.1.8. Torque of Each Axis

Current value of each axis, unit :0.1%, range :-100—+100.

2.3.1.9. Current Tool Number

Current Tool number used by the controller. The quantity and number range of Tool need refer to the definition of each robot controller.

2.3.1.10. Current Base Number

Current Base number used by the controller. The quantity and number range of Base need refer to the definition of each robot controller.

2.3.1.11. Current Alarm Time / Information / Message

Controller alarms current time, Alarm Code and alarm message, the Alarm Code needs refer to the definition of each robot controller.

2.3.1.12. Software Version Information

Controller software system version, the software system version needs refer to the definition of each robot controller.

2.3.2. YASKAWA

2.3.2.1. Robot Status

According to the alarming bit, servo_on bit, running bit and EMG bit information transmitted by YASKAWA, the status corresponds to the following:

- ➔EMG: If EMG bit is true, the robot status is EMG.
- ➔Alarm: If EMG bit is false, alarming bit is true, the robot status is Alarm.
- ➔Idle: If all bits are false, the robot status is Idle.
- ➔Standby: In Idle state, if the servo_on bit is true, the robot state is switched to Standby.
- ➔Running: In Standby state, if the running bit is true, the robot status is switched to Running.

	alarming bit	servo_on bit	running bit	EMG bit
EMG	X	X	X	●
Alarm	●	X	X	○
Idle	○	○	○	○

Standby	○	●	○	○
Running	○	●	●	○
● → Status is True , ○ → Status is False , X → Not reference				

2.3.2.2. Operation Model

According to the step bit, cycle bit, auto_and_continuous bit information transmitted by YASKAWA, the SRB status corresponds to the following:

→T1: If step bit is true, the operation model is T1.

→T2: If cycle bit is true, the operation model is T2.

→AUTO: If auto_and_continuous bit is true, the operation model is AUTO.

	step bit	cycle bit	auto_and_continuous bit
T1	●	○	○
T2	○	●	○
AUTO	○	○	●
● → Status is True , ○ → Status is False , X → Not reference			

2.3.2.3. Script List / Name

Saved script list and running script name.

2.3.2.4. Script Running Mode

According to the play bit, servo_on bit and running bit information transmitted by YASKAWA, the script running mode corresponds to the following:

→Program Running: If play bit, servo_on bit and running bit are true, the script running mode is Program running.

→Program Stop: If one of the play bit, servo_on bit, and running bit is false, the script runs in Program Stop mode

2.3.2.5. End effector position

Robot end effector position, which contains X, Y, Z(unit :mm) and Rx, Ry, Rz(unit :deg).

2.3.2.6. Angle of Each Axis

Angle of each axis, which contains Axis1–8 values, unit: deg

2.3.2.7. Torque of Each Axis

Current value of each axis, unit :0.1%, range :-100—+100.

2.3.2.8. Current Tool Number

Current Tool number used by the controller. The total number of Tool is 64, the number range is 0–63. Users can use 63 groups, the number range is 1–63.

2.3.2.9. Current Base Number

Current Base number used by the controller. The total number of Base that users can use is 128 , the number range is 0–127.

2.3.2.10. Current Alarm Time / Information / Message

Controller alarms current time, Alarm Code and alarm message, the Alarm Code needs refer to the definition of YASKAWA.

2.3.2.11. Software version information

Controller software system version, the software system version needs refer to the definition of YASKAWA controller.(ex: DS2.07.00A).

2.3.3. KUKA

2.3.3.1. Robot status

According to the alarm status, Servo status, script status, and EMG status transmitted by KUKA, the status corresponds to the following:

➔EMG : If the EMG status is true, the robot status is EMG.

➔Alarm: If the EMG status is false and the alarm status is true, the robot status is Alarm.

➔Idle: If all states are false, the robot state is Idle.

➔Standby: In Idle state, if the Servo state is true, the robot state is switched to Standby.

➔Running: In Standby state, the script state is true, and the robot state is switched to Running.

	Alarm state	Servo state	Script state	EMG state
EMG	X	X	X	●
Alarm	●	X	X	○

Idle	○	○	○	○
Standby	○	●	○	○
Running	○	●	●	○
● → State is True, ○ → State is False , X → Not inference				

2.3.3.2. Operation Mode

According to the operation mode transmitted by KUKA, the modes include T1, T2 and Auto.

2.3.3.3. Script List / Name

Executing script list / name.

2.3.3.4. Script Running Mode

According to the \$ PRO_STATE information transmitted by KUKA, the script operation mode corresponds to the following:

→ Program Running: If \$PRO_STAT is ACTIVE, the script running mode is Program Running.

→ Program Stop: If \$PRO_STAT is not ACTIVE the script running mode is Program Stop.

2.3.3.5. End effector position

Robot end effector position, which contains X, Y, Z(unit :mm) and Rx, Ry, Rz(unit :deg).

2.3.3.6. Angle of Each Axis

Angle of each axis, which contains Axis1–8 values, unit: deg.

2.3.3.7. Speed of Each Axis

Speed of each axis, which contains Axis1–8 values, unit: 0.1%, range :-100–+100.

2.3.3.8. Torque of Each Axis

The torque value of each axis, unit: Nm.

2.3.3.9. Current Tool Number

Current Tool number used by the controller, range: 1–64.

2.3.3.10. Current Base Number

Current Base number used by the controller, range: 1–32.

2.3.3.11. Current Alarm time / Information / Message

Controller Alarm Code, the Alarm Code needs refer to the definition of KUKA controller.

2.3.3.12. Software version information

Controller software system version, the software system version needs refer to the definition of KUKA controller.

2.3.4. Universal Robot

2.3.4.1. Robot Status

According to the robotmode, safetymode, and running states transmitted by the UR controller, the states correspond to the following:

- ➔EMG : If the safetymode is one of Protective Stop / Safeguard Stop / System Emergency Stop / Robot Emergency Stop, the robot status is EMG.
- ➔Alarm: If it is not in EMG state and the safety mode is Fault, the robot status is Alarm.
- ➔Running: In the status other than the above, if the running state is true, the robot state is switched to Running.
- ➔Standby: In the status other than the above, If safety mode is NORMAL, the robot status is Standby.
- ➔Idle: In the status other than the above, if robot mode is IDLE, the robot status is Idle.

	robot mode➔IDLE	safety mode➔NORMAL	Running bit	safety mode➔Fault	safety mode➔Stop
EMG	X	X	X	X	●
Alarm	X	X	X	●	○
Running	X	X	●	○	○
Standby	X	●	○	○	○
Idle	●	○	○	○	○
● ➔ Status is True , ○ ➔ Status is False , X ➔ Not reference					

2.3.4.2. Script List / Name

Current script name and storage path information.

2.3.4.3. End effector position

Robot end effector position, which contains X, Y, Z(unit :mm) and Rx, Ry, Rz(unit :deg).

2.3.4.4. Angle of Each Axis

Angle of each axis, which contains Axis1–6 values, unit: deg

2.3.4.5. Speed of Each Axis

Speed of each axis, which contains Axis1–6values, unit: mrad/s

2.3.4.6. Torque of Each Axis

torque value of each axis, unit: N/rad

2.3.4.7. Software Version

Controller software system version, the software system version needs refer to the definition of UR controller.

2.3.5. NexCOBOT

2.3.5.1. Robot Status

The robot status of NEXCOBOT's robot include 5 different status as below:

Disable : System is in forbidden state.

Error : System is in error state.

Ready : System is ready to use.

Enable : All device is activated (Motor is servo on).

Program Run : NexCOBOT Real-Time Programing Language(NRPL) is running.

	disable	Ready	Alarm	Enable	Program Run
Alarm	○	○	●	○	○
Running	X	X	○	●	●
Standby	X	X	○	●	○

Idle	○	●	○	○	○
● → Status is True , ○ → Status is False , X → Not reference					

2.3.5.2. Operation Mode

According to the operation mode transmitted by NexCOBOT, the modes include T1, T2 and Auto.

2.3.5.3. Script List / Name

Current script name and storage path information.

2.3.5.4. End effector position

Robot end effector position, which contains X, Y, Z(unit :mm) and Rx, Ry, Rz(unit :deg).

2.3.5.5. Angle of Each Axis

Angle of each axis, which contains Axis1–6 values, unit: deg

2.3.5.6. Current Tool Number

Current Tool number used by the controller, range: 1–16.

2.3.5.7. Current Base Number

Current Base number used by the controller, range: 1–16.

2.3.5.8. Current Alarm time / Information / Message

Controller Alarm Code, the Alarm Code needs refer to the definition of TPUI controller.

2.3.5.9. Software version information

Controller software system version, the software system version needs refer to the definition of TPUI controller.

2.3.6. ABB

2.3.6.1. Robot Status

	Motors On State == Low	Motors On State == High	Mechanical Unit Not Moving != High	Execution Error== High	Emergency Stop == High
--	---------------------------	----------------------------	---	------------------------------	------------------------------



EMG	X	X	X	X	●
Alarm	X	X	X	●	○
Running	X	X	●	○	○
Standby	X	●	○	○	○
Idle	●	○	○	○	○
● → Status is True , ○ → Status is False , X → Not reference					

2.3.6.2. Operation Mode

According to the OpMode states transmitted by the ABB's RAPID, the states correspond to the following:

T1: OpMode states is OP_UNDEF or OP_MAN_TEST

T2: OpMode states is OP_MAN_PROG

AUTO: OpMode states is AUTO

2.3.6.3. Script List / Name

Call GetTaskName to get the name of the currently running task

2.3.6.4. End effector position

Robot end effector position, which contains X, Y, Z(unit :mm) and Rx, Ry, Rz(unit :deg).

2.3.6.5. Angle of Each Axis

Angle of each axis, which contains rax_1 ~ rax_6 values, unit: deg

2.3.6.6. Speed of Each Axis

Speed of each axis , which contains rax_1 ~ rax_6 values, unit: deg/sec

2.3.6.7. Software version information

Call GetSysInfo to get Software version information .

2.3.7. Fanuc

2.3.7.1. Robot Status

According to the BrkRdy bit、 Move bit、 Alarm bit and EMG bit transmitted by Fanuc, the status corresponds to the following:

- ➔Idle: If all bits are false, the robot status is Idle.
- ➔Standby: In Idle state, if the BrkRdy bit is true, the robot state is switched to Standby.
- ➔Running: In Standby state, if the Move bit is true, the robot status is switched to Running.
- ➔Alarm: If EMG bit is false, alarming bit is true, the robot status is Alarm.
- ➔EMG: If EMG bit is true, the robot status is EMG.

	BrkRdy bit	Move bit	Alarm bit	EMG bit
EMG	X	X	X	●
Alarm	X	X	●	○
Running	●	●	○	○
Standby	●	○	○	○
Idle	○	○	○	○
● ➔ Status is True , ○ ➔ Status is False , X ➔ Not reference				

2.3.7.2. Operation Mode

According to the operation mode transmitted by Fanuc, the modes include T1, T2 and Auto

2.3.7.3. Script List / Name

Executing script list / name.

2.3.7.4. Script Running Mode

The Script Running Mode includes: Program Running and Program Stop

2.3.7.5. End effector position

Robot end effector position, which contains X, Y, Z(unit :mm) and Rx, Ry, Rz(unit :deg).

2.3.7.6. Angle of Each Axis

Angle of each axis, which contains Axis1–8 values, unit: deg

2.3.7.7. Current Tool Number

Current Tool number used by the controller

2.3.7.8. Current Base Number

Current Base number used by the controller

2.3.7.9. Current Alarm Time / Information / Message

Controller alarms current time, Alarm Code and alarm message, the Alarm Code needs refer to the definition of Fanuc.

2.3.7.10. Software version information

Controller software system version, the software system version needs refer to the definition of Fanuc controller (ex : HandlingTool V8.30P/33)

2.3.8. Epson

2.3.8.1. Robot Status

	Alarm Status	Servo Status	Moving Status*	EMG status
EMG	X	X	X	●
Alarm	●	X	X	○
Idle	○	○	○	○
Standby	○	●	○	○
Running	○	●	●	○
● → Status is True , ○ → Status is False , X → Not reference				

*Moving status: Robot is moving

2.3.8.2. Operation Mode

T1: Manual low speed mode

Auto: Auto mode

2.3.8.3. Script List/Name

Executing script list / name

2.3.8.4. Script Running Mode

Program Running and Program Stop.

2.3.8.5. Robot end effector position

Robot end effector position, which contains X, Y, Z(unit :mm) and Rx, Ry, Rz(unit :deg).

2.3.8.6. Angle of each Axis

Angle of each axis, which contains Axis1–8 values, unit: deg

2.3.8.7. Current Tool Number

Current Tool number used by the controller

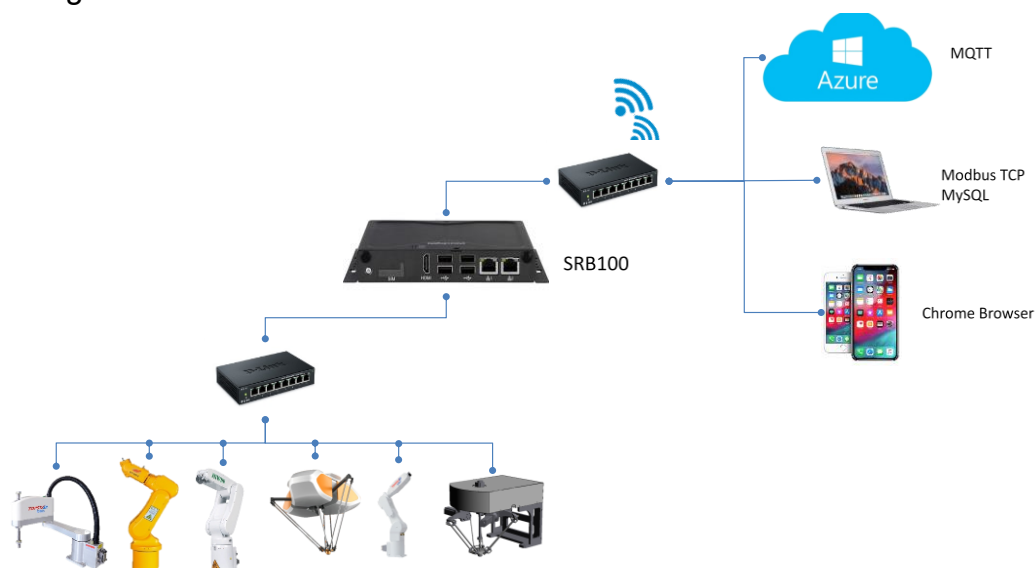
2.3.8.8. Current Alarm Time/Information/Message

Controller alarms current time, Alarm Code and alarm message, the Alarm Code needs refer to the definition of Fanuc.

3 SRB Operating Instructions

3.1. SRB100 network settings

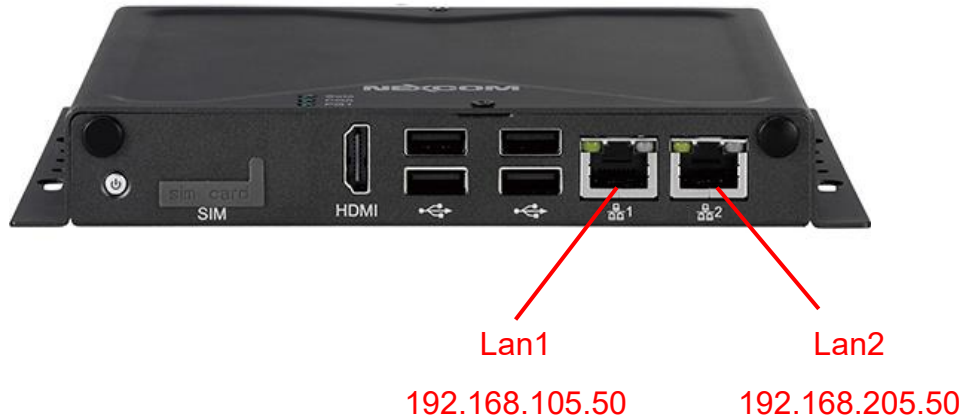
SRB100 has 2 Lan ports, please refer to the picture below for ethernet cable wiring.



The usage of these 2 Lan ports of SRB100 are pre-defined as below list:

Lan NO.	IP	Usage
Lan1	192.168.105.50	For external computer to connect to SRB100 and can monitor the status of robot controller.

Lan2 192.168.205.50 Connect to each robot controller.



Lan1:

External computer can use ethernet cable to connect to Lan1 port, and then user can open the webpage of SRB for operation (please refer to Ch3.2.2). Also, user can connect to MySQL database through Lan1 port to get the information of each robot status (please refer to Ch3.4.1). If user would like to use Modbus TCP to connect to SRB100, users also need to use Lan1 port for Modbus TCP communication (please refer to Ch3.4.2).

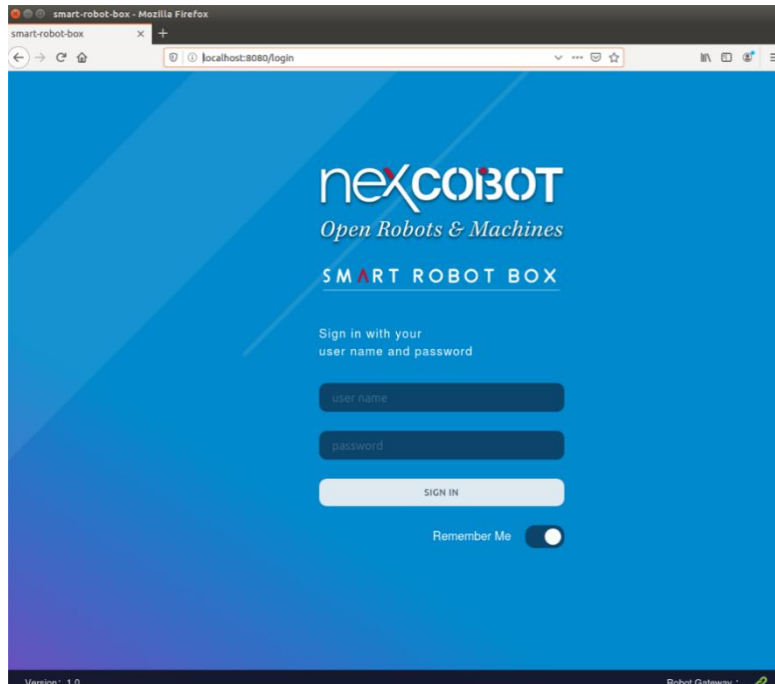
Lan2:

Lan2 is for connecting to external robot controller. Before connecting to robot controller, user must make sure Lan2 of SRB100 and the connecting Lan port of robot controller is at the same domain, otherwise the connection between SRB100 and robot controller can't establish successfully. If user use the pre-defined IP address of Lan2, the IP address of robot must be different with SRB100, for example the IP address of robot controller should be 192.168.205.XXX.

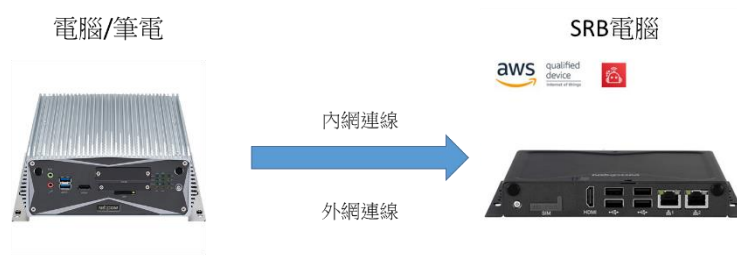
3.2. Connect to SRB

3.2.1. Local connection to SRB

Launch the web browser on SRB, enter <http://localhost:8080/> in the URL, it will jump to the SRB user login page, and you can operate after login.



3.2.2. External connection to SRB



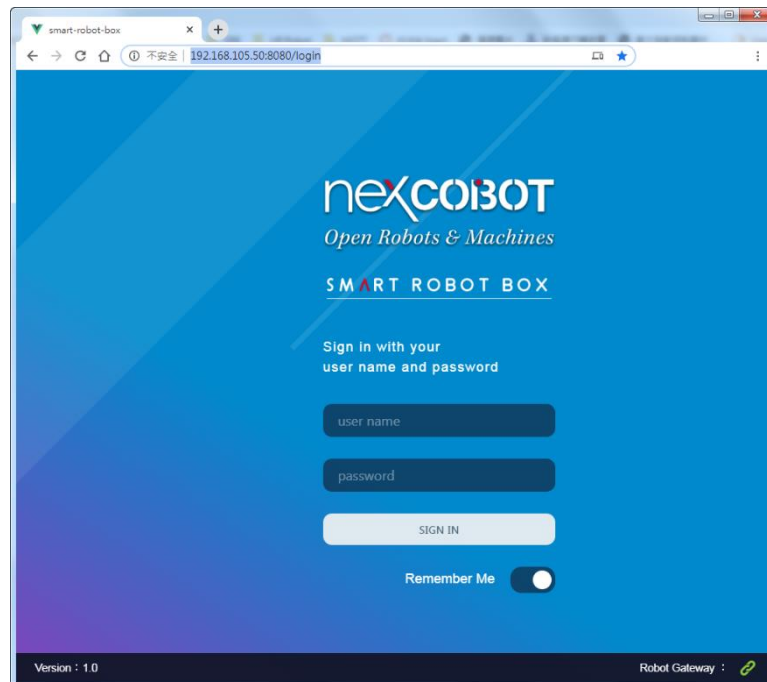
Intranet Connection to SRB

Make sure that the connected computer and the SRB computer are in the same domain. Set the IP address of the SRB computer, launch the browser of the connected computer, and enter `http://(IP address): 8080 /` in the URL, it will connect to the SRB system. For example, the IP of the SRB is 192.168.105.50, enter `http://192.168.105.50:8080/` in the URL.

Extranet Connection to SRB

SRB needs a set of fixed IP, and connects to the external network through the mesh, make sure the connected computer is also connected to the external network, launch the browser of the connected computer, enter `http:// (SRB IP): 8080 /` in the URL, it will connect to the SRB system. For example, the

fixed IP of SRB is 192.168.105.50, enter <http://192.168.105.50:8080/> in the URL.



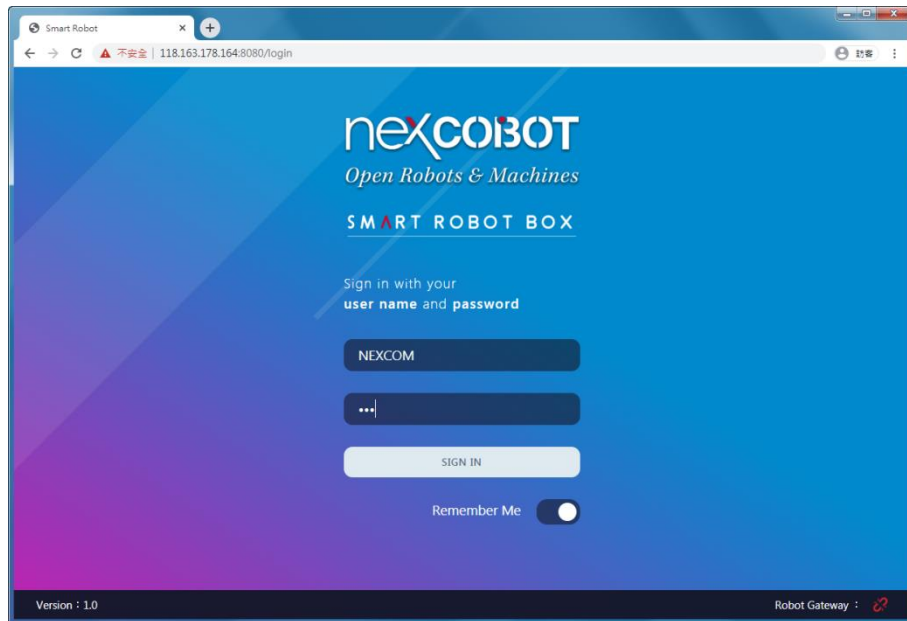
3.3. SRB Operating Instructions(Web UI)

SRB user permissions are divided into three types: admin, manager and viewer. Default user name: admin , Default password: admin

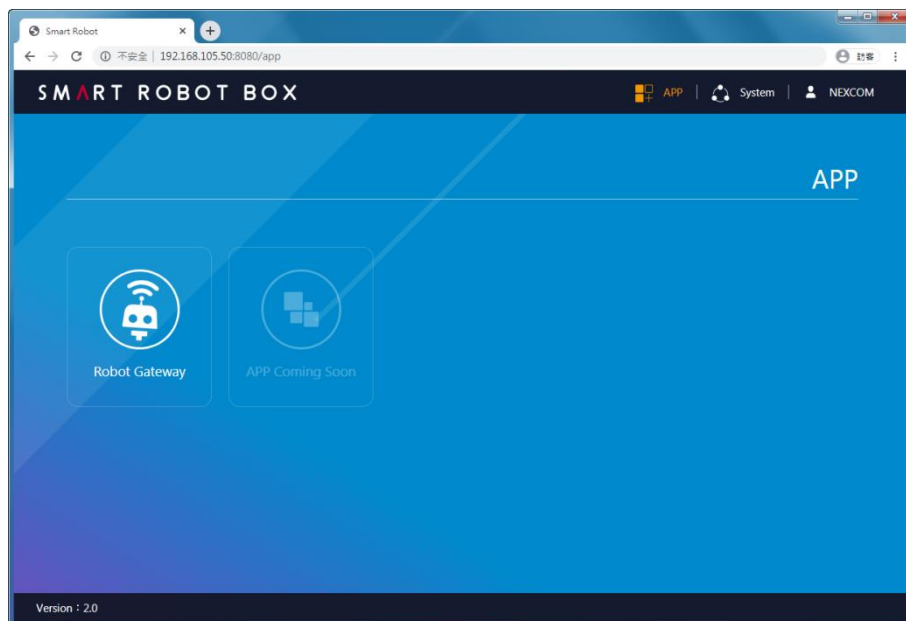
- A. admin: Able to add / remove three types of users and view robot status, preset a group.
- B. manager: Able to use the add / delete / connect / disconnect and other commands to operate the robot and watch the robot status.
- C. viewer: Only able to view the robot status.

For the user first time login to SRB, user must use admin account to login, and create a manager account. After that, user can use manager account to login SRB, and then user can use the add/delete/connect/disconnect command.

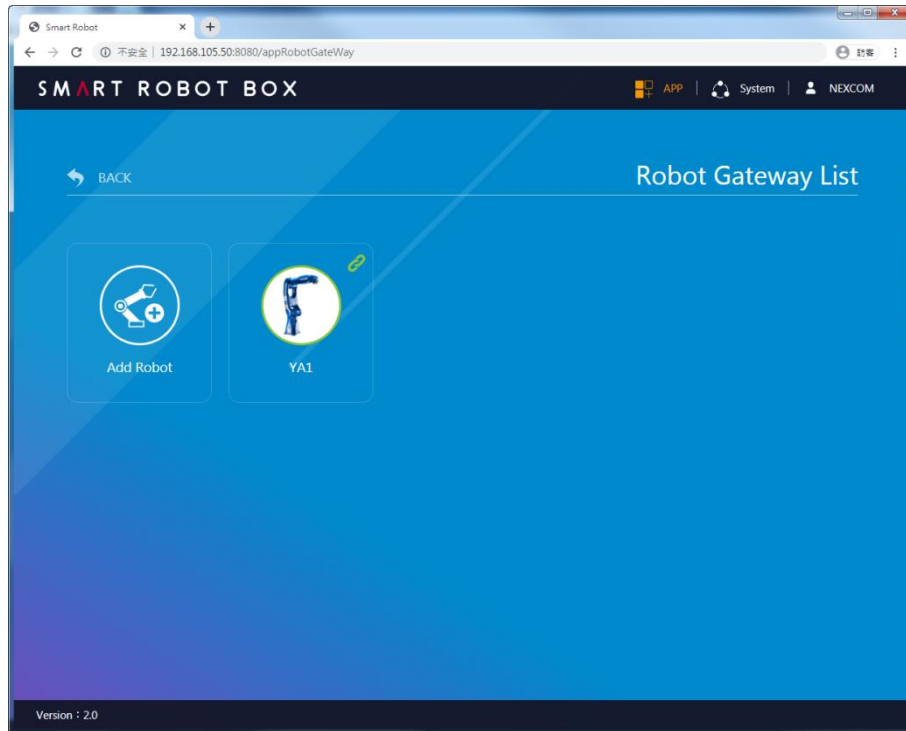
(1) User login (Supported permissions: A, B, C)



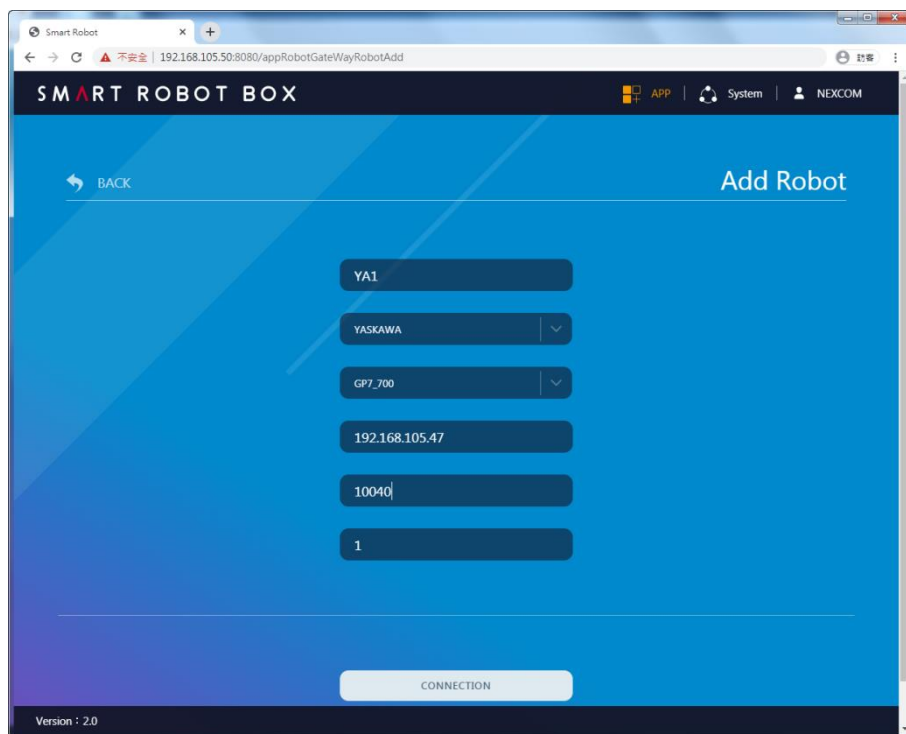
(2) After login, the page will jump to the application list. (Supported permissions: A, B, C)

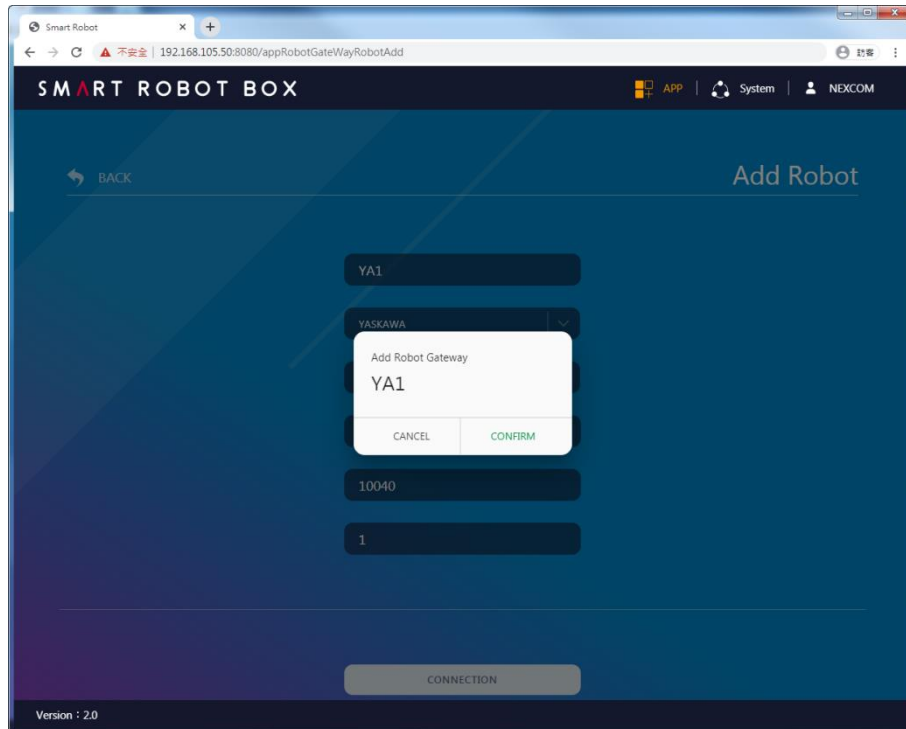


(3) Click **Robot Gateway App**. Enter **Robot Gateway List** page, you can see the list of currently established robot connections and **Add Robot** options. (Supported permissions: A, B, C)

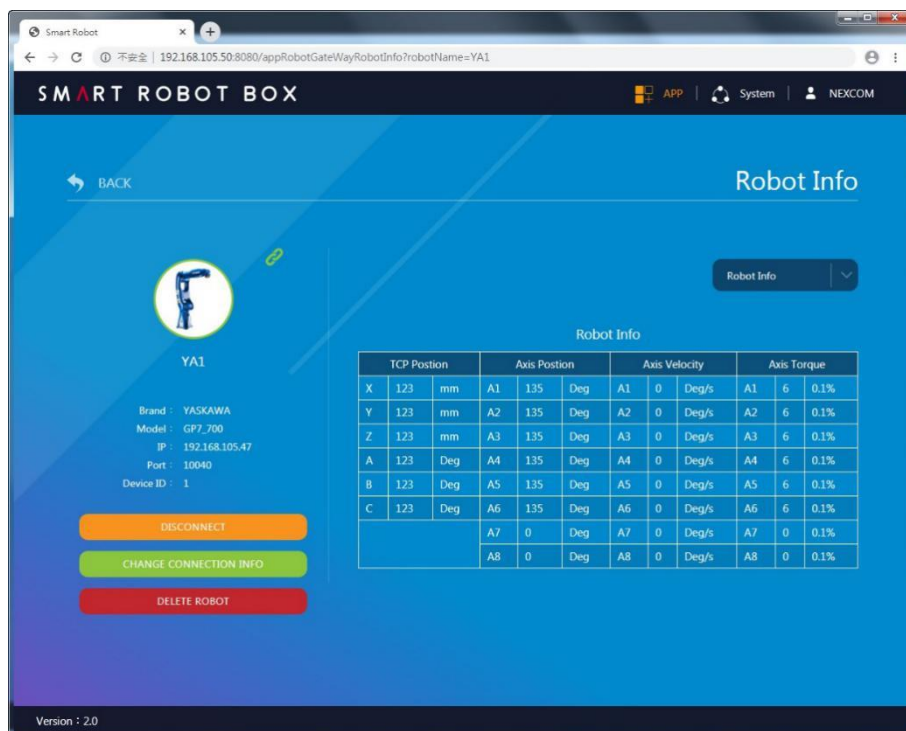


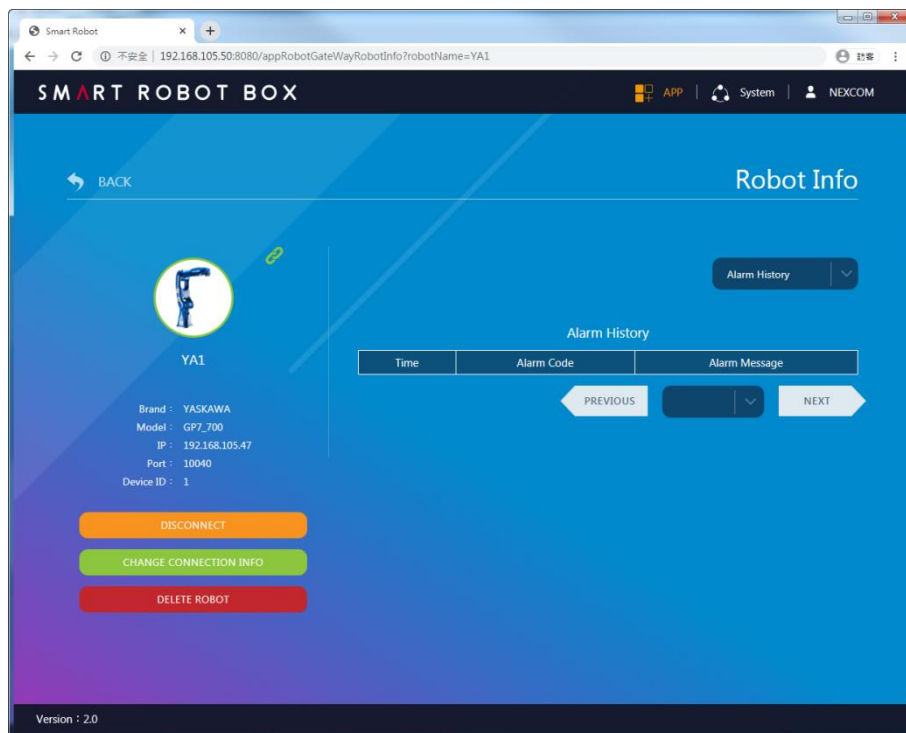
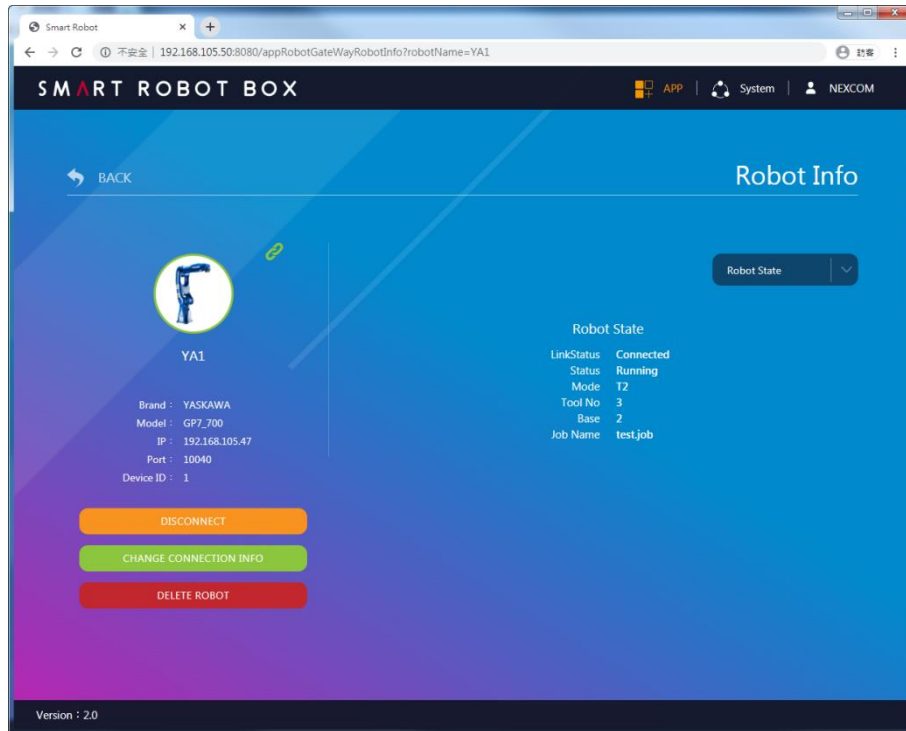
(4) If you need to create a robot, click **Add Robot** and type the information of the robot you want to connect to, and then click **Connect** to confirm the addition. The page will return to the **Robot Gateway List** page (Supported permission: B)

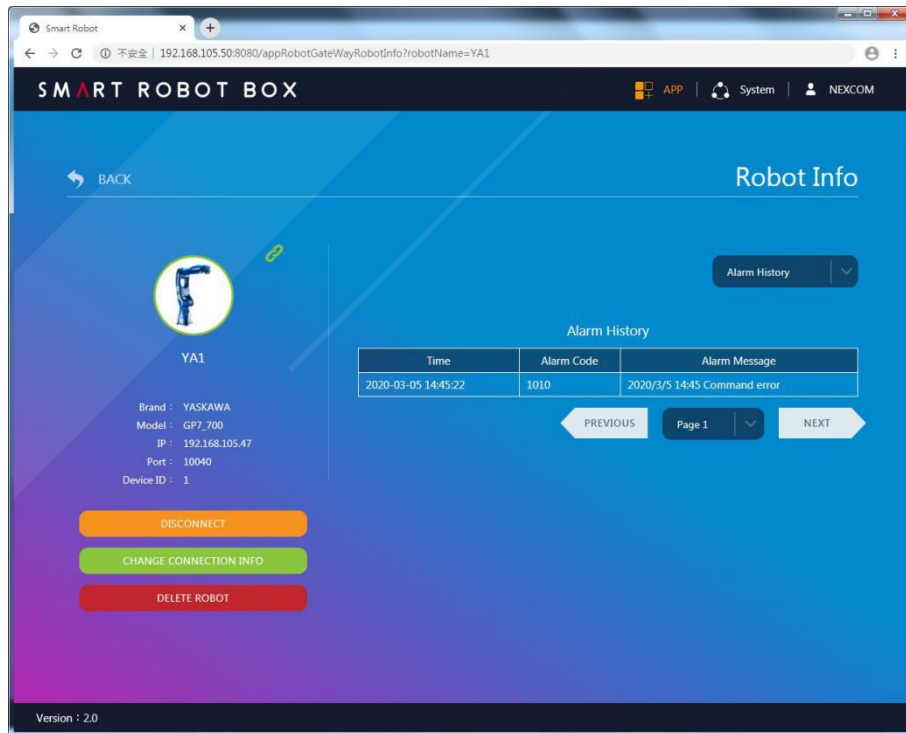




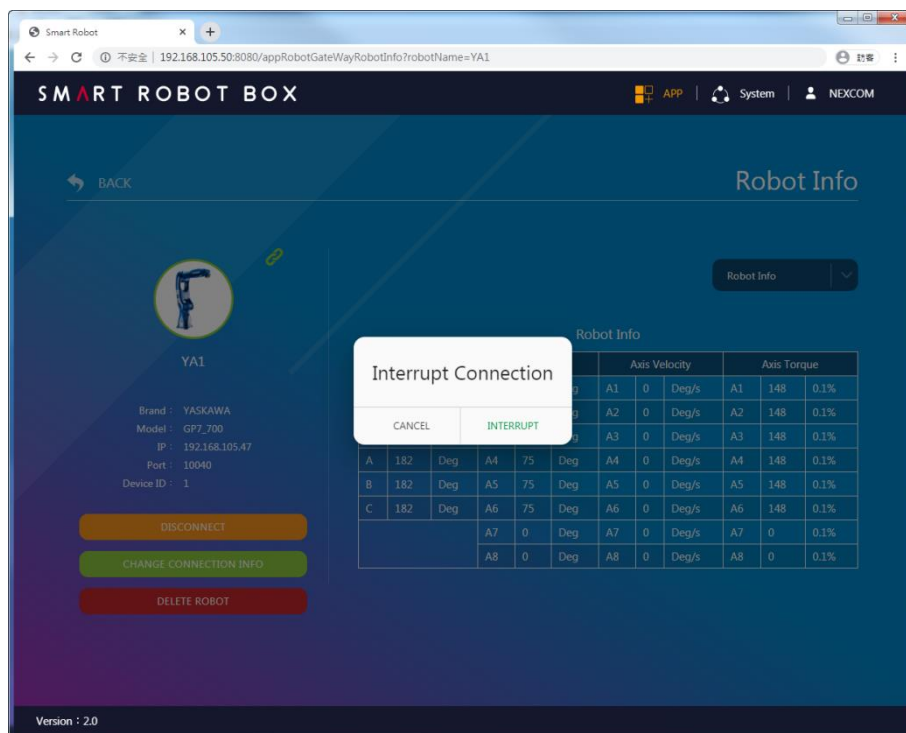
(5) Click on the robot you want to view on **Robot Gateway List** page to enter **Robot Info** page. Through the drop-down menu in the upper right corner, you can choose to view all the information, status and alarm information of the robot. (Supported permissions: A, B, C)



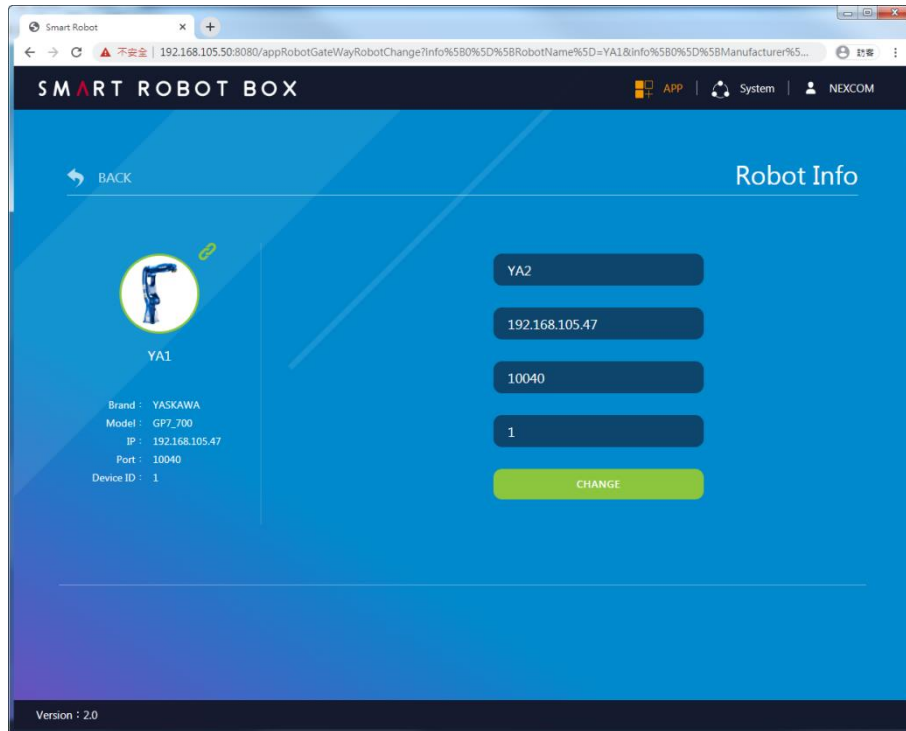




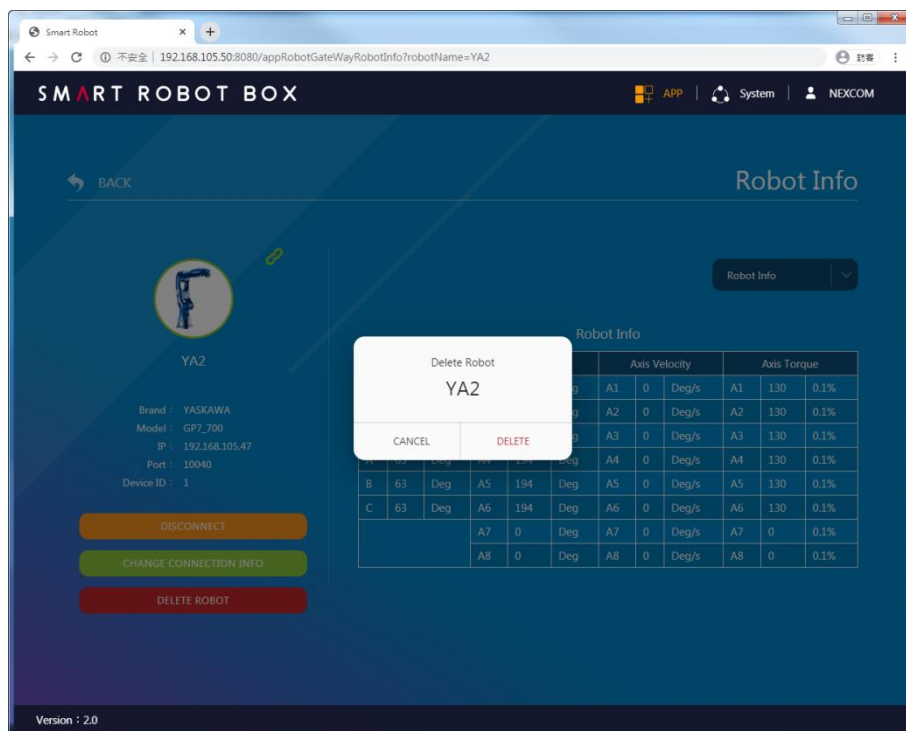
(6) **Robot Info.**”page allows you to interrupt connection, update robot information and delete robot. (Supported permission: B)



Interrupt Connection

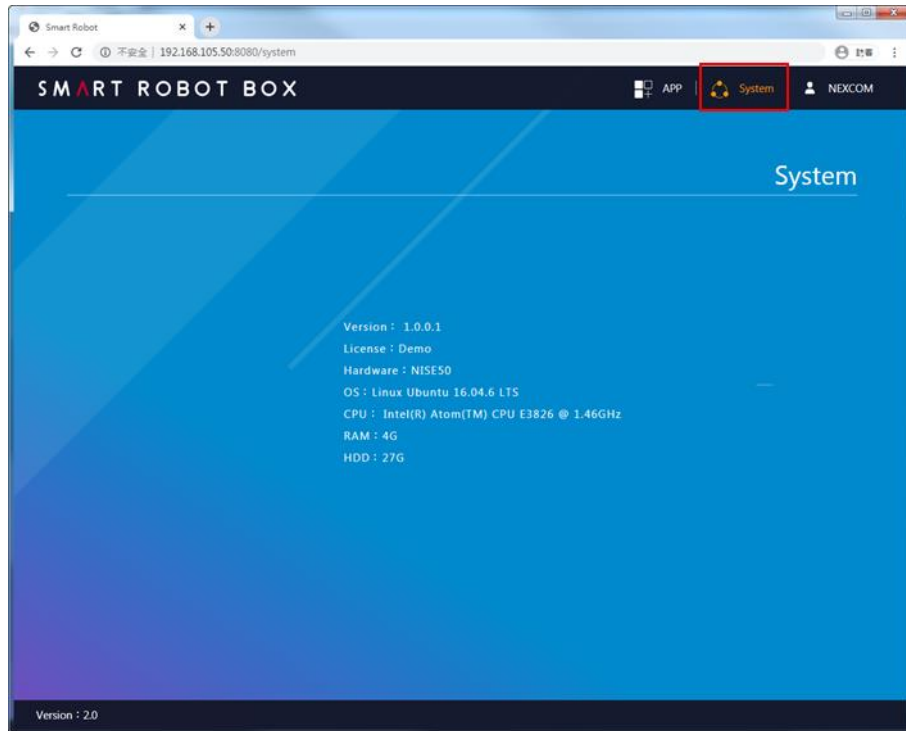


Update Robot Information

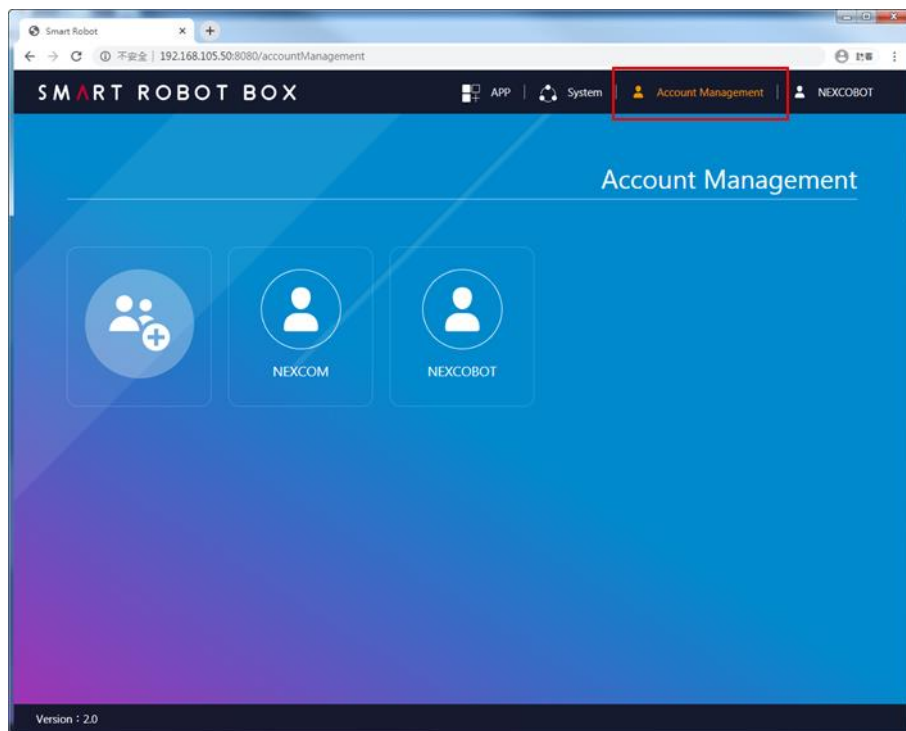


Delete Robot

(7) Click **System** at the top to view the SRB system specifications, such as version number, serial number, hardware platform, operating system, CPU and other information (Supported permissions: A, B, C)



(8) **Account Management** page displays a list of all current users. You can also add user through admin permissions. Click on user name to change the password or delete the user (Supported permission: A)

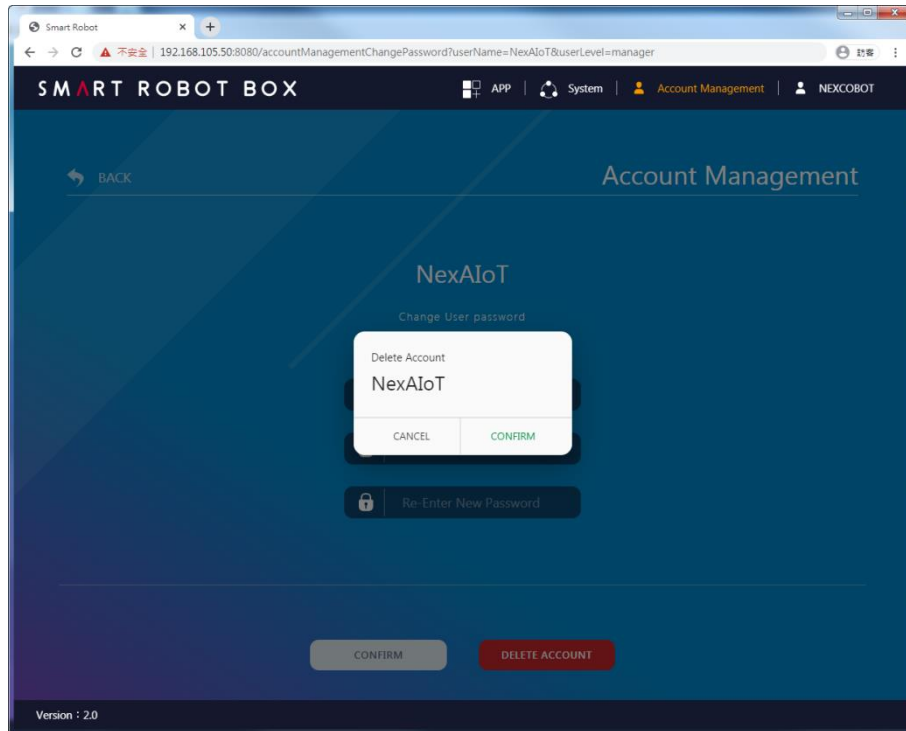


The screenshot shows a web browser window with the URL `192.168.105.50:8080/accountManagementAdd`. The page title is "SMART ROBOT BOX" and the navigation bar includes "APP", "System", "Account Management", and "NEXCOBOT". The main heading is "Account Management" with a "BACK" link. The form is titled "Add User" with the instruction "Join your New user name and password". It contains three input fields: a username field with "NexAIoT", a password field with "123", and a role dropdown menu set to "manager". A "JOIN" button is at the bottom. The footer indicates "Version : 2.0".

Add User

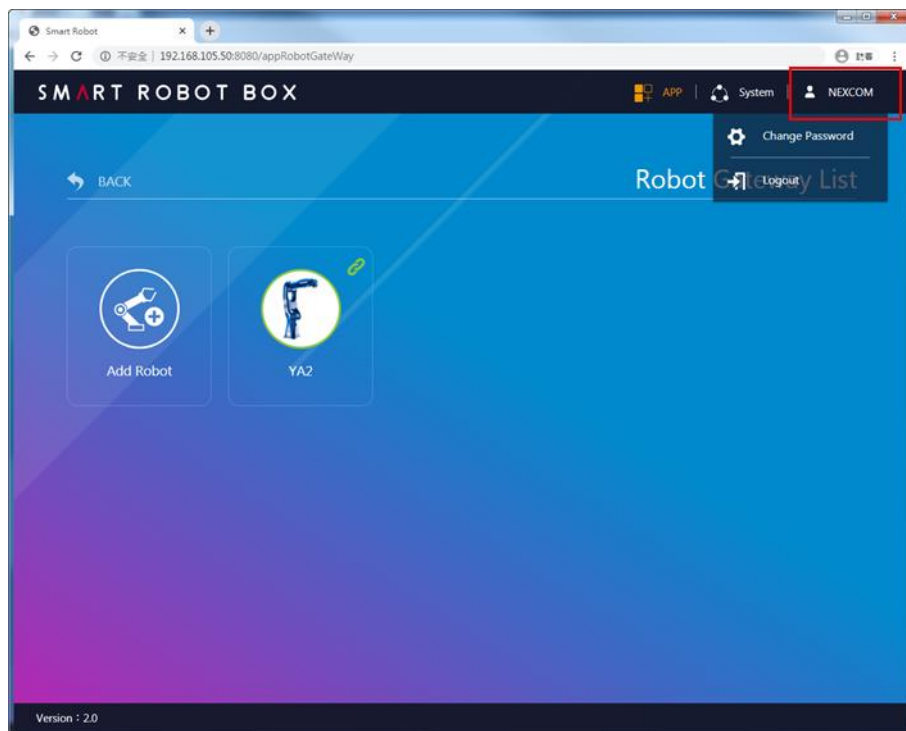
The screenshot shows a web browser window with the URL `192.168.105.50:8080/accountManagementChangePassword?userName=NexAIoT&userLevel=manager`. The page title is "SMART ROBOT BOX" and the navigation bar includes "APP", "System", "Account Management", and "NEXCOBOT". The main heading is "Account Management" with a "BACK" link. The form is titled "NexAIoT" with the instruction "Change User password". It contains three password input fields: the first with "123", and the next two with "234". At the bottom, there are "CONFIRM" and "DELETE ACCOUNT" buttons. The footer indicates "Version : 2.0".

Change Password



Delete User

(2) Click the user icon in the upper right corner to log out or change password (supported permissions: A, B, C)



3.4. SRB Data Transmission

3.4.1. Database

All SRB data will be recorded in the MySQL database. Users must create a MySQL Client (connected computer) to visit the Server (SRB computer). MySQL Client should be under the local connection area, and set the IP address, port number of database, the name of connecting database, username and password. After a successful connection, user can directly enter the database to read the data according to the MySQL syntax.

Item	Set valu	Description
IP	192.168.105.50 (default)	
Port	3306	
Database Name	SRB_Data	
User Name	guest	
Password	guest	
Encoding	UTF-8	

Datasheet	Column	Mode(Length)	Description
System_Info	Robot_App_Ver	char(30)	SRB software version
	License	char(60)	SRB serial number
	Platform	varchar(100)	Hardware platform name
	OS	char(50)	Operating system
	RAM	char(50)	Memory size
	HardDisk	char(50)	Hard drive capacity
	CurrentLevel	varchar(50)	Current user permissions
	CurrentUser	varchar(50)	Current user name
Robot_Info	RobotName	char(30)	Robot name
	Manufacturer	char(30)	Robot manufacturer
	Brand	char(30)	Robot brand
	Model	char(30)	Robot model
	IP	char(30)	Robot IP Address
	Port	int(10)	Robot port
	DeviceID	int(10)	Robot device ID
	LinkStatus	char(30)	Robot link status
	Status	char(30)	Robot status



	Mode	char(30)	Robot operation mode
	ToolNo	int(10)	Current tool number
	BaseNo	int(10)	Current base number
	JobName	char(20)	Current executing job name
	X	double	Robot end effector position info.
	Y	double	
	Z	double	
	A	double	
	B	double	
	C	double	
	Axis_Ang1	double	Angle of each robot axis.If there are only six axis, Axis_Ang7 & Axis_Ang8 are 0.
	Axis_Ang2	double	
	Axis_Ang3	double	
	Axis_Ang4	double	
	Axis_Ang5	double	
	Axis_Ang6	double	
	Axis_Ang7	double	
	Axis_Ang8	double	
	Axis_Vel1	double	Speed of each robot axis. If there are only six axis, Axis_Vel7 & Axis_Vel8 are 0.
	Axis_Vel2	double	
	Axis_Vel3	double	
	Axis_Vel4	double	
	Axis_Vel5	double	
	Axis_Vel6	double	
	Axis_Vel7	double	
	Axis_Vel8	double	
	Axis_Tor1	double	Torque of each axis of the robot. If there are only six axis, Axis_Tor7 and Axis_Tor8 are 0.
	Axis_Tor2	double	
	Axis_Tor3	double	
	Axis_Tor4	double	
	Axis_Tor5	double	
	Axis_Tor6	double	
	Axis_Tor7	double	
	Axis_Tor8	double	
(RobotName)_Robot_Alarm_History	TimeStamp	timestamp	Alarm time

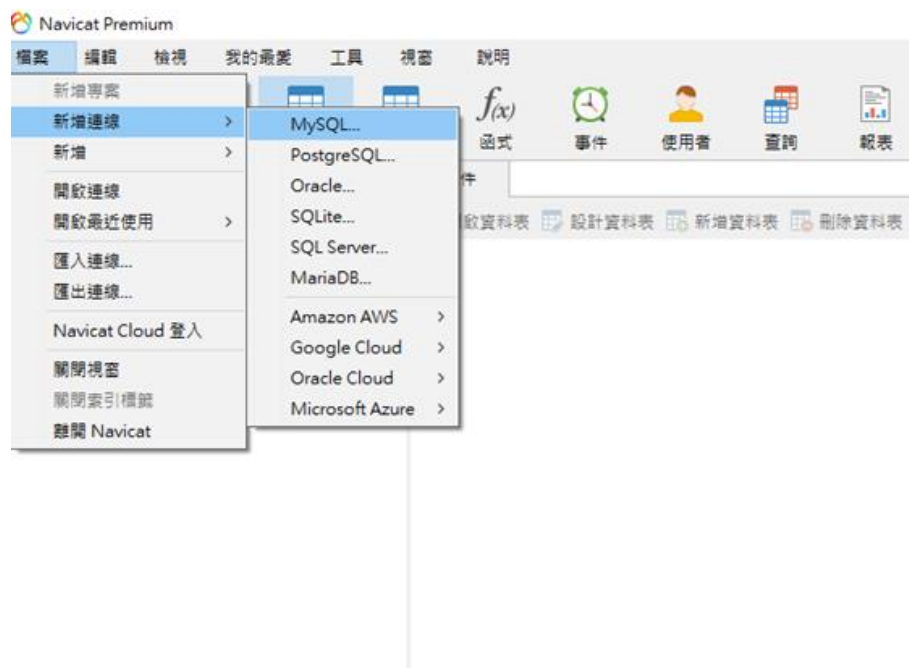
Alarm_Info	Alarm_Code	int(10)	Alarm code
	Alarm_Msg	text	Alarm message

Reading data from MySQL:

Example: Using NavicatPortable for reading robot information

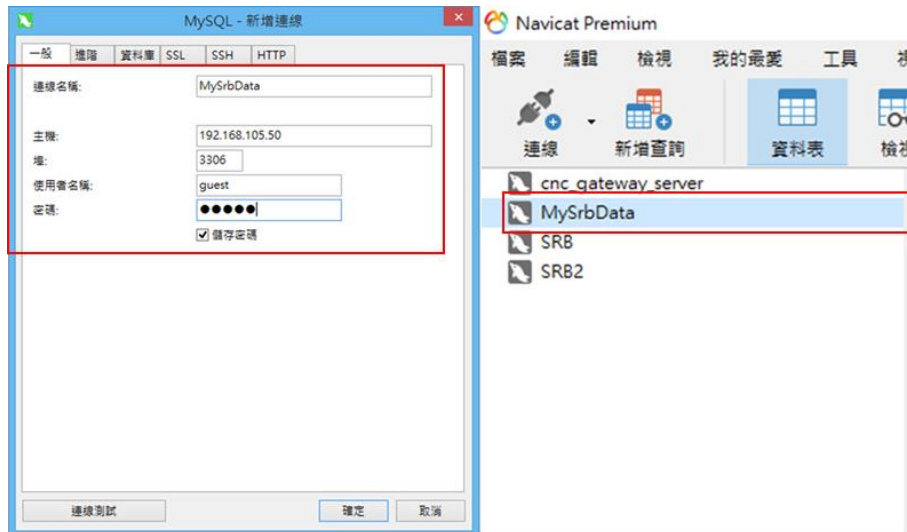
Step1 Open NavicatPortable application program , file→new connection

→MySQL

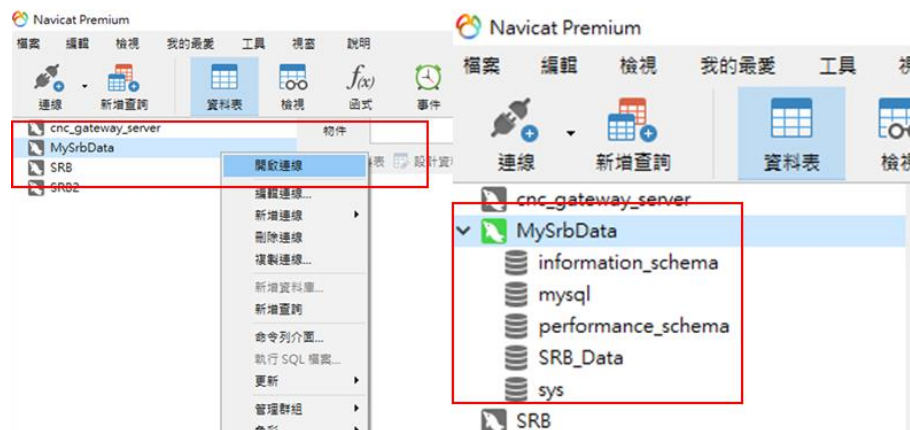


Step2 Input the following information

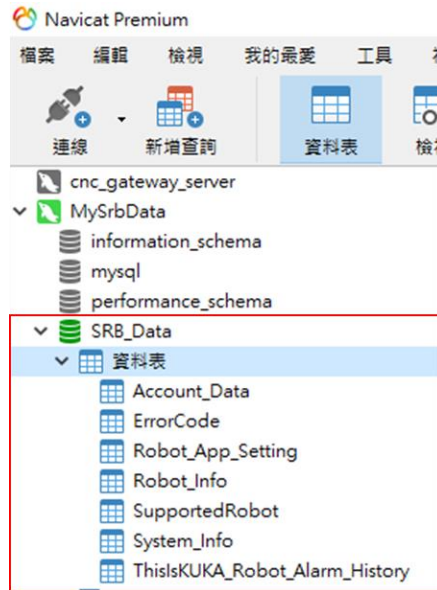
Name	MySrbData(Self define)
IP	192.168.105.50
Port	3306
User Name	guest
Password	guest



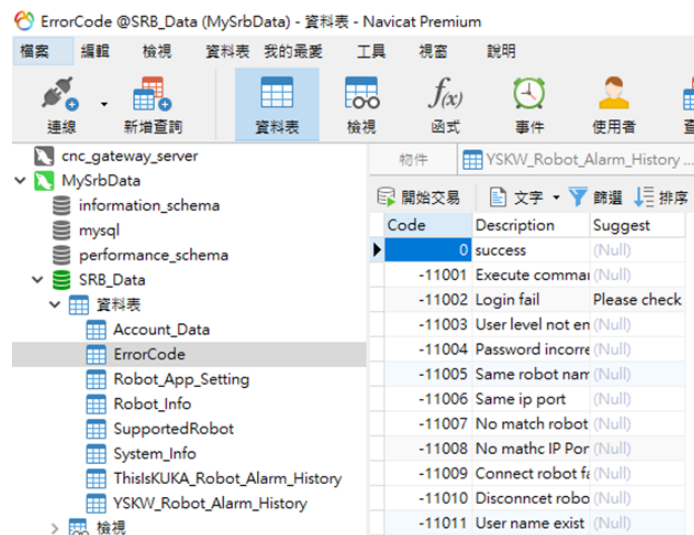
Step3 Select the database and right click, if successful connection, user can see green picture of database name and each data list



Step4 Select SRB_Data -> Data list, user can see all data list, select the desire data can get the value.



ErrorCode : User can check the definition of SRB Alarm code



Robot info : User can search all the data of connected robot

Robot_Info @SRB_Data (MySrbData) - 資料庫 - Navicat Premium

檔案 編輯 檢視 資料庫 我的最愛 工具 視窗 說明

連線 新增查詢 資料庫 檢視 函式 事件 使用者 查詢 報表 備份

cnc_gateway_server

- MySrbData
 - information_schema
 - mysql
 - performance_schema
 - SRB_Data
 - 資料庫
 - Account_Data
 - ErrorCode
 - Robot_App_Setting
 - Robot_Info
 - SupportedRobot
 - System_Info
 - ThisIsKUKA_Robot_Alarm_History
 - YSKW_Robot_Alarm_History

物件 YSKW_Robot_Alarm_... Robot_Info @SRB_Da... Acc...

開始交易 文字 篩選 排序 匯入 匯出

Manufacturer	Brand	Model	IP	Port	DeviceID	Li
YASKAWA	YASKAWA	GP7	125.22	10040	1	C

Supported Robot : the list of supported robot

SupportedRobot @SRB_Data (MySrbData) - 資料庫 - Navicat Premium

檔案 編輯 檢視 資料庫 我的最愛 工具 視窗 說明

連線 新增查詢 資料庫 檢視 函式 事件 使用者 查詢 報表 備份

cnc_gateway_server

- MySrbData
 - information_schema
 - mysql
 - performance_schema
 - SRB_Data
 - 資料庫
 - Account_Data
 - ErrorCode
 - Robot_App_Setting
 - Robot_Info
 - SupportedRobot
 - System_Info
 - ThisIsKUKA_Robot_Alarm_History
 - YSKW_Robot_Alarm_History

物件 Robot_Info @SRB_... Account_Data @SR...

開始交易 文字 篩選 排序 匯入 匯出

Brand	Model	PicPath
YASKAWA	GP7	YASKAWA_GP7.jpg
KUKA	KR6_R900	KUKA_KR6_R900.jpg
NEXCOBOT	MiniBOT_6R	NEXCOBOT_MiniBOT_6R.j
UR	UR5	UR_UR5.jpg
KUKA	KR6_R1100	KUKA_KR6_R1100.jpg
UR	UR10	UR_UR5.jpg
KUKA	KR10_R900	KUKA_KR10_R900.jpg
KUKA	KR10_R1100	KUKA_KR10_R1100.jpg
KUKA	KR3_R540	KUKA_KR3_R540.jpg
YASKAWA	MotoMini	YASKAWA_MotoMini.jpg

System info : SRB system info

System_Info @SRB_Data (MySrbData) - 資料庫 - Navicat Premium

檔案 編輯 檢視 資料庫 我的最愛 工具 視窗 說明

連線 新增查詢 資料庫 檢視 函式 事件 使用者 查詢 報表 備份 自動執行

cnc_gateway_server

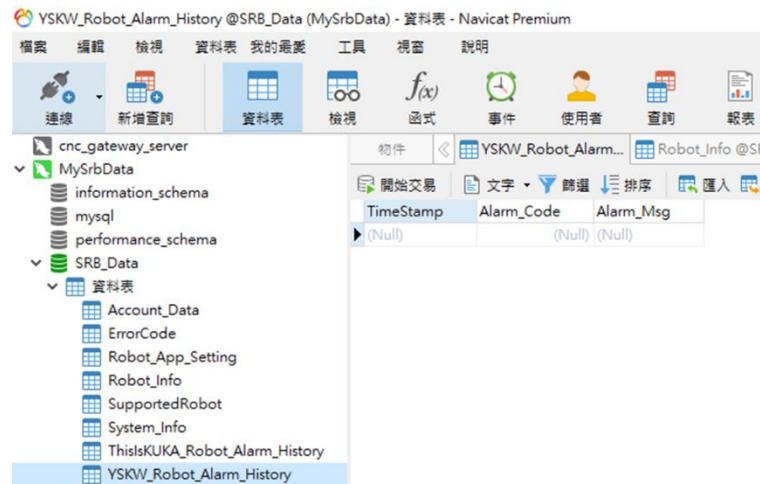
- MySrbData
 - information_schema
 - mysql
 - performance_schema
 - SRB_Data
 - 資料庫
 - Account_Data
 - ErrorCode
 - Robot_App_Setting
 - Robot_Info
 - SupportedRobot
 - System_Info
 - ThisIsKUKA_Robot_Alarm_History
 - YSKW_Robot_Alarm_History

物件 Account_Data @SR... ErrorCode @SRB_D... Robot_App_Se

開始交易 文字 篩選 排序 匯入 匯出

Robot_App_Ver	License	Platform	OS	CPU
0.1.3.1	Demo	NISE105	Linux Ubuntu 16.04.6 LTS	Intel(R) Atom

Alarm_History : Alarm code and alarm message



3.4.2. Modbus TCP

In addition to the MySQL database, SRB also provides Modbus TCP communication functions. Users must establish a Client (connected computer) to visit the Server (SRB computer) to obtain robot status information through Modbus communication. In order to let Modbus TCP Client connect to SRB, users must set the right IP address and the right port number of SRB to have a successful connection.

Item	Set value	Description
Server/Client	Server	Modbus TCP Server
IP	192.168.105.50(Default)	
Port	502	
Maximum supported robots	10	
Read position	Input Register	Address 1~65536
Number of single robot address	5000	Robot1:5001~10000 Robot2:10001~15000.....

Input register definition

SRB Data

Data Type	Address (Input Register)	Information	Description
Word	1~10	SRB app. Version	20 char
Word	11~60	license	100 char
Word	61	Number of robots	

Robot Data

The initial address of first connected robot is 5001, every robot has 5000 memory space. For example, the parameter 「robot name」 of first connected robot is at the address of 5001~5010, the same parameter of the second connected robot is at the address of 10001~10010. All the parameters of single are defined as below:

Data Type	Address (Input Register)	Information	Description
Word	1~10	RobotName	20 char
Word	11~20	Manufacturer	20 char
Word	21	IP1	Note 1
Word	22	IP2	Note 1
Word	23	IP3	Note 1
Word	24	IP4	Note 1
Word	25	PORT	0~65535
Word	26	DEVICE_ID	
Word	27~36	Model	20 char
Word	37	Link-Status	0:Idle 1:connecting 2:connected 3:retry 4:disconnect 5:error
Word	38	Operator Mode	0:T1 1:T2 2:Auto
Word	39~48	JobName	20 char
Word	60	Tool no	
Word	61~70	Tool Name	20 char
Word	71	Base No	
Word	72~81	Base Name	20 char
Word	82	Number of execution lines	
Word	83~102	Line Script ex: movj P0...	40 char
Word	103	Robot status	0:idle 1:standby 2:running

			3:alarm 4:EMG
Dword	501	Current coordinate X_Low	Type: float, unit: mm
	502	Current coordinate X_High	
Dword	503	Current coordinate Y	Type: float, unit: mm
	504		
Dword	505	Current coordinate Z	Type: float, unit: mm
	506		
Dword	507	Current coordinate A	Type: float, unit: deg
	508		
Dword	509	Current coordinate B	Type: float, unit: deg
	510		
Dword	511	Current coordinate C	Type: float, unit: deg
	512		
Dword	521	A1 degree	Type: float, unit: deg
	522		
Dword	523	A2 degree	Type: float, unit: deg
	524		
Dword	525	A3 degree	Type: float, unit: deg
	526		
Dword	527	A4 degree	Type: float, unit: deg
	528		
Dword	529	A5 degree	Type: float, unit: deg
	530		
Dword	531	A6 degree	Type: float, unit: deg
	532		
Dword	533	A7 degree	Type: float, unit: deg
	534		
Dword	535	A8 degree	Type: float, unit: deg
	536		
Dword	541	A1 speed	Type: float, unit: deg/s
	542		
Dword	543	A2 speed	Type: float, unit: deg/s
	544		
Dword	545	A3 speed	Type: float, unit: deg/s
	546		
Dword	547	A4 speed	Type: float, unit: deg/s

	548		
Dword	549	A5 speed	Type: float, unit: deg/s
	550		
Dword	551	A6 speed	Type: float, unit: deg/s
	552		
Dword	553	A7 speed	Type: float, unit: deg/s
	554		
Dword	555	A8 speed	Type: float, unit: deg/s
	556		
Word	571	Current TOOL NO.	Type: ushort
	572		
Dword	573	Tool coordinate X	Type: float, unit: mm
	574		
Dword	575	Tool coordinate Y	Type: float, unit: mm
	576		
Dword	577	Tool coordinate Z	Type: float, unit: mm
	578		
Dword	579	Tool coordinate A	Type: float, unit: deg
	580		
Dword	581	Tool coordinate B	Type: float, unit: deg
	582		
Dword	583	Tool coordinate C	Type: float, unit: deg
	584		
Word	591	Current BASE NO.	Type: ushort
	592		
Dword	593	BASE coordinate X	Type: float, unit: mm
	594		
Dword	595	BASE coordinate Y	Type: float, unit: mm
	596		
Dword	597	BASE coordinate Z	Type: float, unit: mm
	598		
Dword	599	BASE coordinate A	Type: float, unit: deg
	600		
Dword	601	BASE coordinate B	Type: float, unit: deg
	602		
Dword	603	BASE coordinate C	Type: float, unit: deg
	604		

Word	1001	Alarm Code	Type: ushort 0xFFFF
Word	1002~1041	Alarm Message	80 char

Note1: IP sorted as IP1.IP2.IP3.IP4, ex: 127.0.0.1

The Dword information is according to IEEE754 rules , convert float value to two ushort and put it into address.

1 address has 2 bytes , which can mapping to High byte and Low byte, each byte is mapping to 1 character, the example is shown as below:

Address	讀回數值	16 進位 → ASCII 碼	資訊
5001	16729	0x4159 → "A" "Y"	YA2
5002	50	0x0032 → "null" "2"	
10001	21835	0x554B → "U" "K"	KUKA
10002	16715	0x414B → "A" "K"	

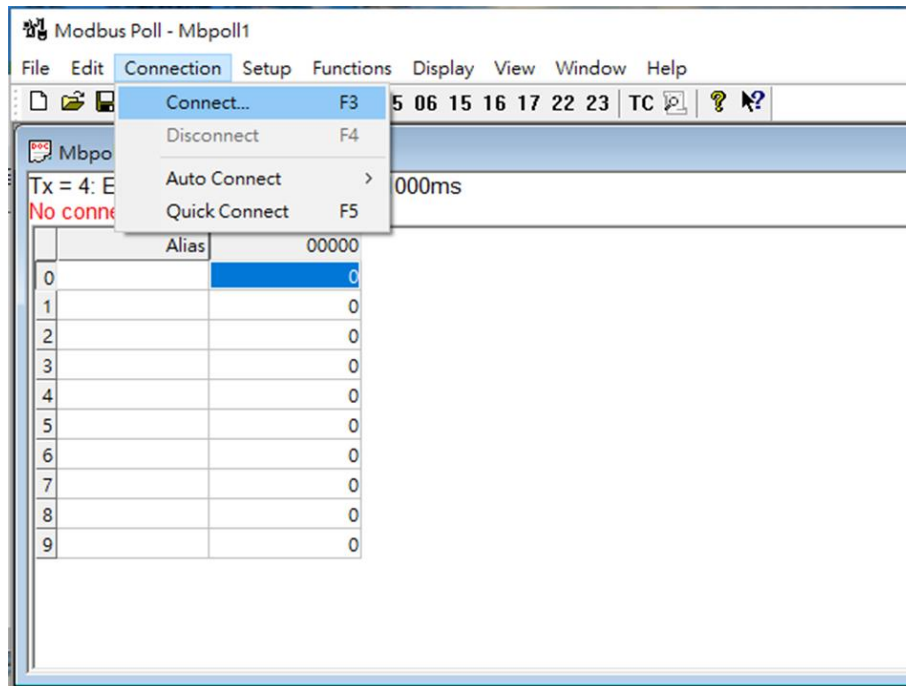
1 Dword has 4 bytes , Dword definition is followed by IEEE754, which is using Little-Endian sorting to float number, the example is shown as below:

Address	讀回數值	2 進位(2bytes * 2)	Float 數值
5501	49447	(A)1100 0001 (B)0010 0111	Float(CDAB) =485.509
5502	17394	(C)0100 0011 (D)1111 0010	

Modbus TCP example:

Example: Using ModbusPoll utility for reading robot information

Step1 Open ModbusPoll utility, Click Connection → Connect



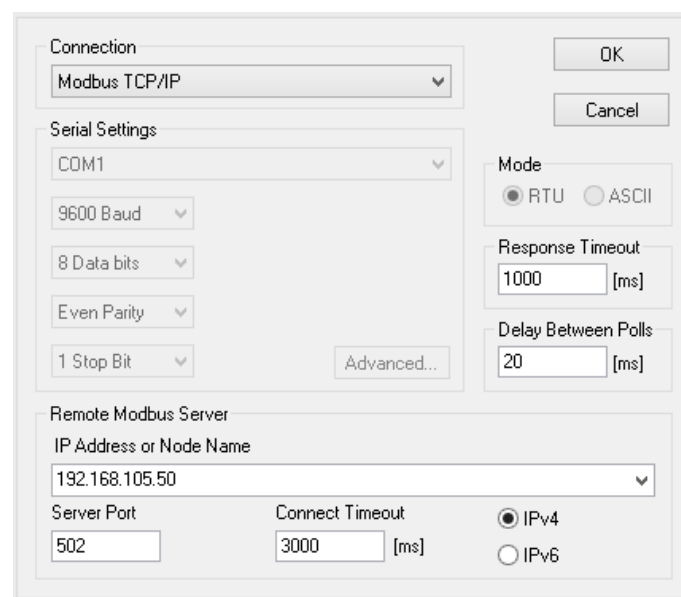
Step2 Input the following information

Connection Modbus TCP/IP

IP Address 192.168.105.50

Server Port 502

IPv4



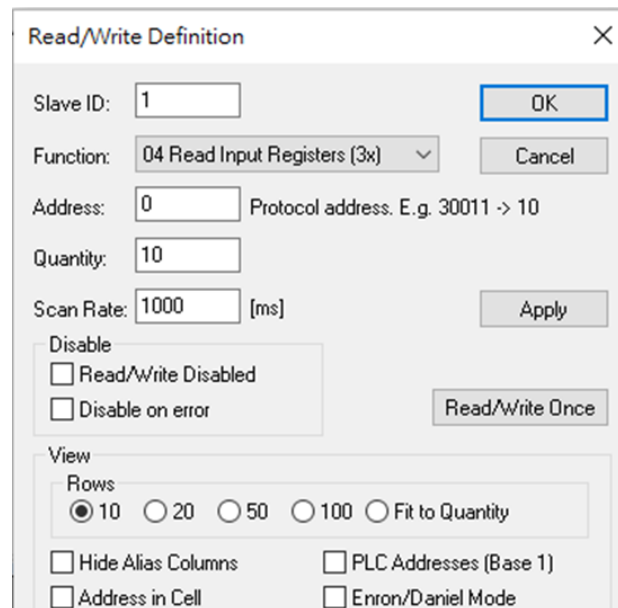
Step3 Click Read/write definition, and set the data reading method and scope, and click OK

Slave ID : 1

Function: 04 Read Input Register

Address : follow the definition of SRB Modbus TCP function

Quantity : Self-define the number of data for reading



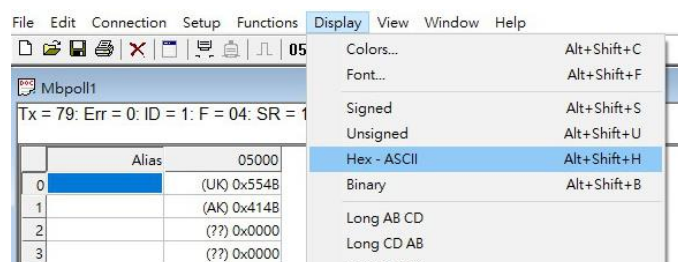
The 'Read/Write Definition' dialog box contains the following fields and options:

- Slave ID: 1
- Function: 04 Read Input Registers (3x)
- Address: 0 (Protocol address. E.g. 30011 -> 10)
- Quantity: 10
- Scan Rate: 1000 [ms]
- Buttons: OK, Cancel, Apply, Read/Write Once
- Disable section:
 - ☐ Read/Write Disabled
 - ☐ Disable on error
- View section:
 - Rows: ☒ 10, ☐ 20, ☐ 50, ☐ 100, ☐ Fit to Quantity
 - ☐ Hide Alias Columns
 - ☐ PLC Addresses (Base 1)
 - ☐ Address in Cell
 - ☐ Enron/Daniel Mode

Step4 Click Display, user can choose the data format for different display model

Text → Select ASCII

Example:



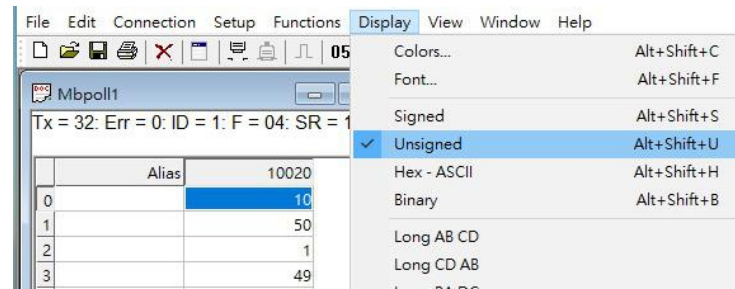
The screenshot shows the 'Display' menu with the following options and shortcuts:

- Colors... (Alt+Shift+C)
- Font... (Alt+Shift+F)
- Signed (Alt+Shift+S)
- Unsigned (Alt+Shift+U)
- Hex - ASCII (Alt+Shift+H) - This option is highlighted.
- Binary (Alt+Shift+B)
- Long AB CD
- Long CD AB

Address	Readings	Hex → ASCII code	Text
5001	21835	0x554B → "U" "K"	KUKA
5002	16715	0x414B → "A" "K"	

Integral → Select Unsigned

Example:

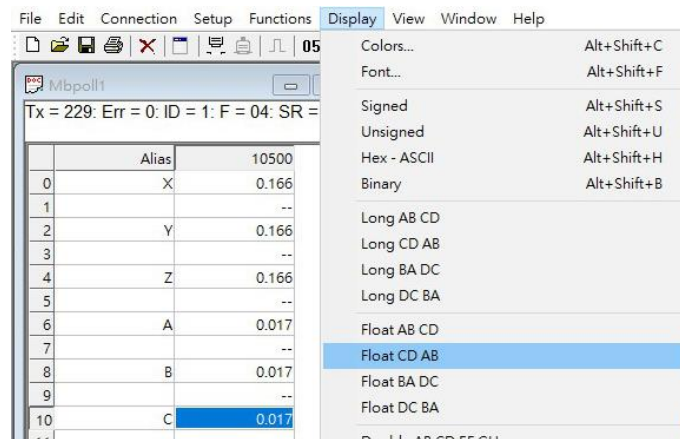


The sequence of IP address is IP1.IP2.IP3.IP4

ex : 10.50.1.49 °

Float → Select Float CD AB

Example:



Address	Readings	Binary (2bytes * 2)	Float number
5501	2097	(A)0000 1000 (B)0011 0001	Float(CDAB) =0.166
5502	15916	(C)0011 1110 (D)0010 1100	

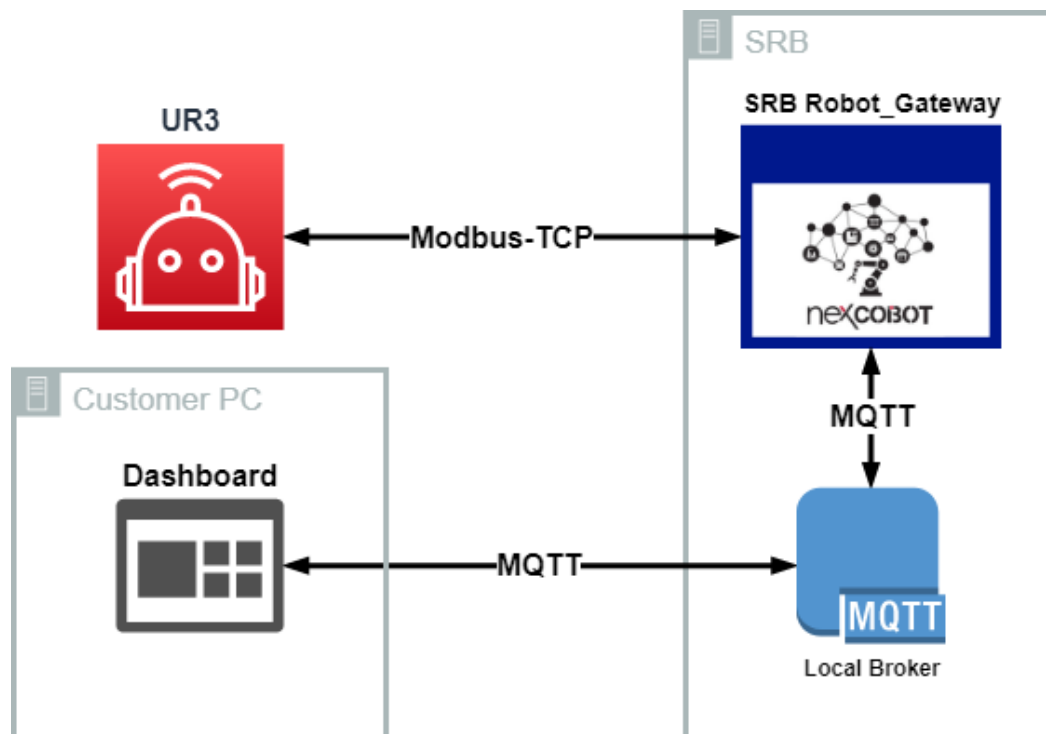
3.4.3. MQTT (AWS IoT Core)

SRB provides MQTT data transmission for machine to machine communication and machine to cloud communication. The subscribe data format is json:

Item	Set value	Description
Robot list	SRB/RobotList	Established robot list, post back {“RobotList”:[“name1”,“name2”,...]}
Robot info.	SRB/Robot_Info/(Robot Name)/data	Post back

		<pre>{ "A":179.9980010986328,"Ang_A1":12.307000160217285,"Ang_A2":16.30299949645996,"Ang_A3":22.46500015258789,"Ang_A4":0.039000000804662704,"Ang_A5":56.79800033569336,"Ang_A6":12.26099967956543,"B":0.014000000432133675,"Brand":"YASKAWA","C":0.004000000189989805,"IP":"125.227.203.170","LinkStatus":"Connected","Model":"GP7","OpMode":"AUTO","Port":10040,"SalveID":1,"Status":"Running","Vel_A1":0.0,"Vel_A2":0.0,"Vel_A3":0.0,"Vel_A4":0.0,"Vel_A5":0.0,"Vel_A6":0.0,"X":508.5299987792969,"Y":125.00599670410156,"Z":59.375999450683594} }</pre>
--	--	---

3.4.3.1. MQTT Machine to machine application

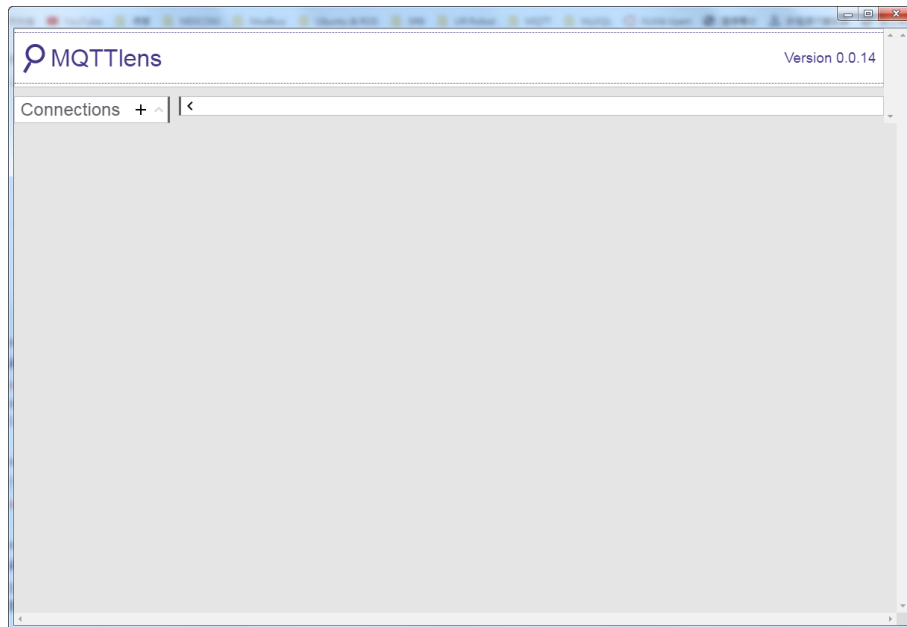


The default IP address of SRB of MQTT broker is 192.168.105.50:1883, customer PC can connect to SRB and subscribe related topic to retrieve data from robot controller.

MQTT machine to machine application example:

Example: Using the “MQTTlens” chrome plugin to retrieve data from robot controller

Step1 Open MQTTlens plugin



Step2 Create a new connection and user can self-define the connection name. For the Hostname column, please fill in the IP address of SRB, the default value is 192.168.105.50 and the default port number is 1883. Finally, click the” CREATE CONNECTION” button.

Add a new Connection

Connection Details

Connection name: SRB

Connection color scheme: [Green bar]

Hostname: tcp:// 192.168.105.50

Port: 1883

Client ID: lens_ZOoLkr5D0LN3cH1TEoyC0iCTEeD

Generate a random ID

Session: ☒ Clean Session

Automatic Connection: ☒ Automatic Connection

Keep Alive: 120 seconds

Credentials

Username: Enter username

Password: Enter password

Last-Will: [Dropdown arrow]

CANCEL CREATE CONNECTION

Step3 For the information which user would like to subscribe, user can fill the information to Subscribe column. For example, user need to fill "SRB/Robot_List" is the Subscribe column and click the SUBSCRIBE button.

MQTTlens Version 0.0.14

Connections: + -

SRB

Connection: SRB

Subscribe

SRB/Robot_List

0 - at most once

SUBSCRIBE

Publish

topic

0 - at most once

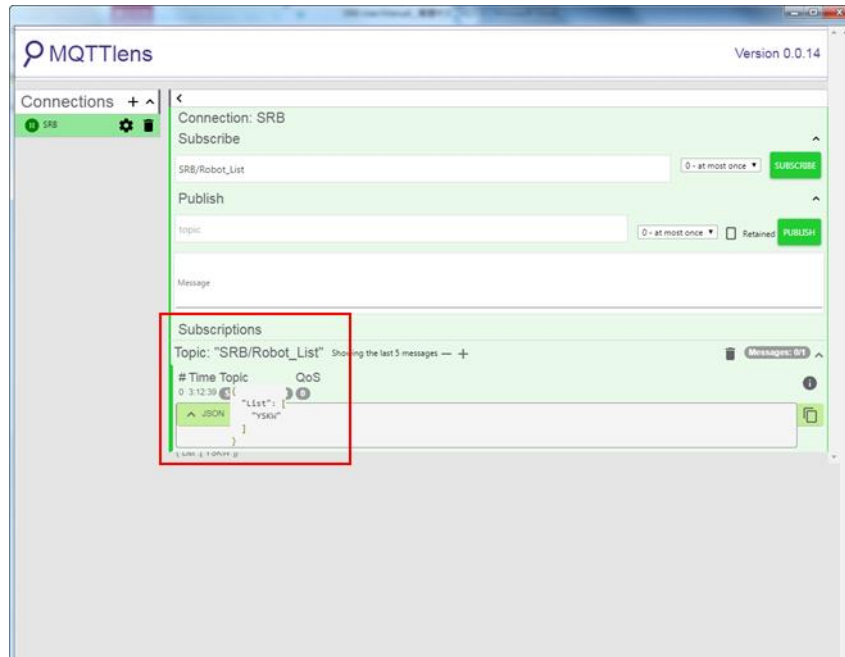
Retained

PUBLISH

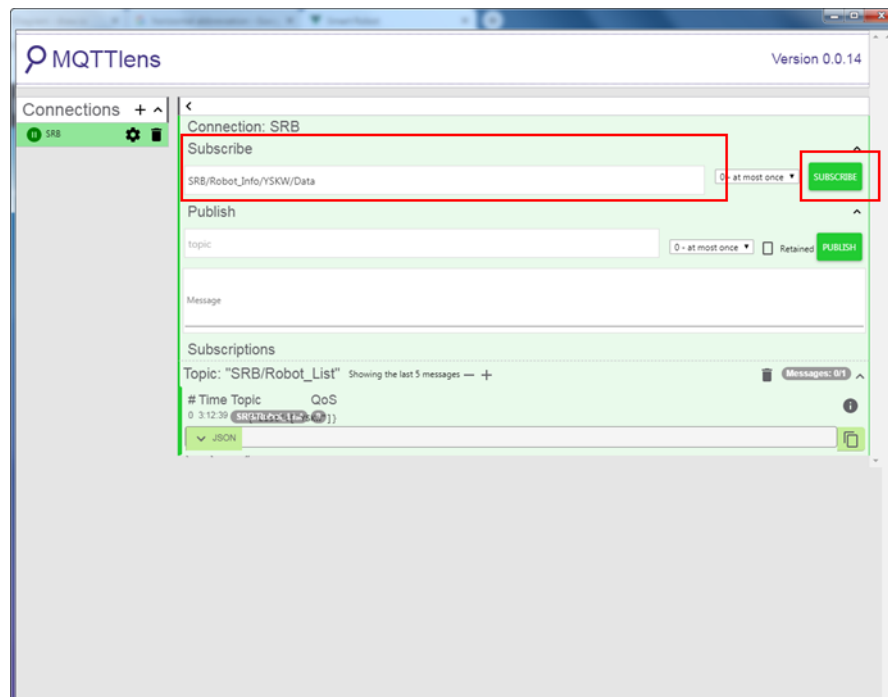
Message

Subscriptions

Step4 The Subscriptions column will show the data which user subscribe from SRB, and the data will show in JSON format.

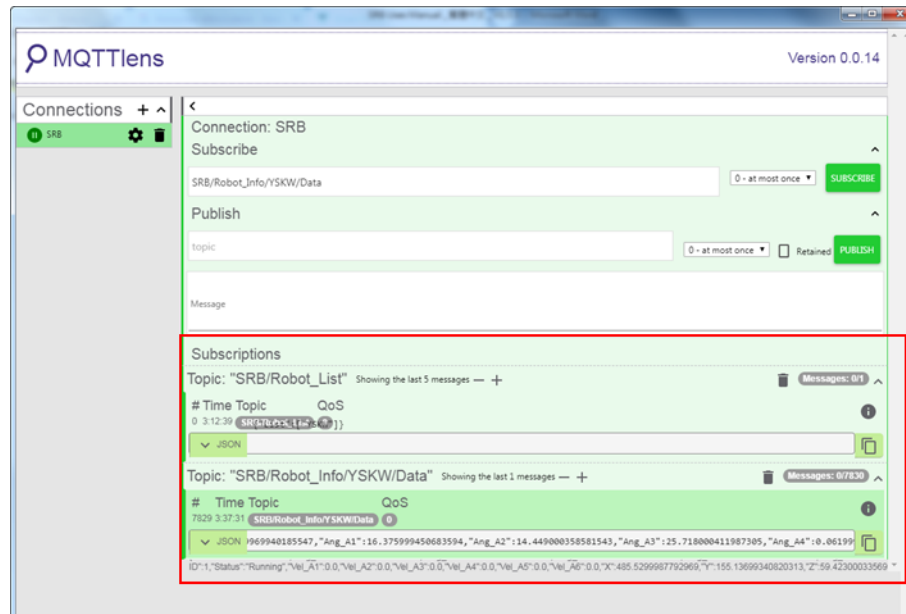


Step5 Using the robot name which was subscribed from last step, and subscribe this robot information. For example, subscribe the robot which has the name “YSKW”, and fill in “SRB/Robot_Info/YSKW/Data” into Subscribe column, and click the SUBSCRIBE button.



Step6 After Subscription, SRB will start to return the current status of robot controller. MQTTlens is default to show the latest five information, if

user wants to add or delete the number of information, user can click the “+” and “-“ button.



The return Information was shown as below:

```
{
  "A":179.9949951171875,
  "Ang_A1":8.241999626159668,
  "Ang_A2":15.121000289916992,
  "Ang_A3":24.54400062561035,
  "Ang_A4":0.03400000184774399,
  "Ang_A5":56.42900085449219,
  "Ang_A6":8.291000366210938,
  "B":0.0109999999940395355,
  "Brand":"YASKAWA",
  "C":0.0049999999888241291,
  "IP":"125.227.203.170",
  "LinkStatus":"Connected",
  "Model":"GP7",
  "OpMode":"AUTO",
  "Port":10040,
  "SalveID":1,
  "Status":"Running",
  "Vel_A1":0.0,
  "Vel_A2":0.0,
  "Vel_A3":0.0,
  "Vel_A4":0.0,
  "Vel_A5":0.0,
  "Vel_A6":0.0,
  "X":506.8269958496094,
  "Y":86.58100128173828,
  "Z":59.375999450683594
}
```

4 Robot controller connection setting instructions

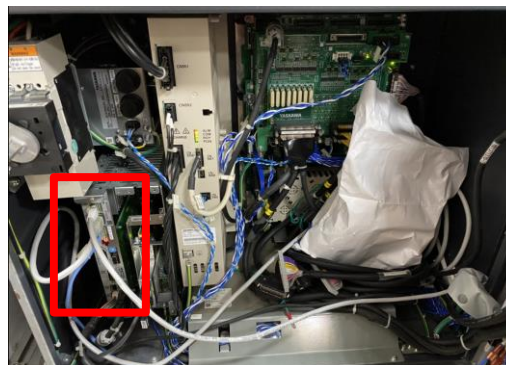
4.1. YASKAWA

4.1.1. YASKAWA LAN port location

The YASKAWA controllers which are supported by SRB are YRC1000micro, YRC1000 and DX200. The LAN port location of each different model of controller is different:



Open the metal sheet door of YRC1000 and DX200, the controller main machine has three LAN port(LAN1 : For Programing Pendant ; LAN2 : High Speed Ethernet ; LAN3 : FTP). SRB use LAN2 only, for the reference of setup guide of LAN2, please refer to chapter 4.1.2, the wiring example is shown as below picture:



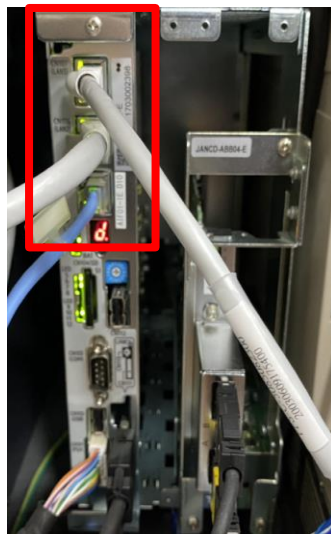
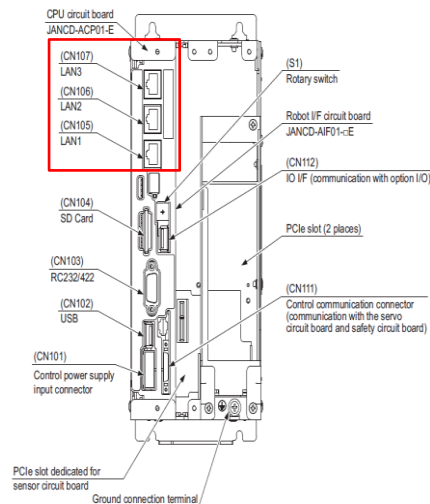
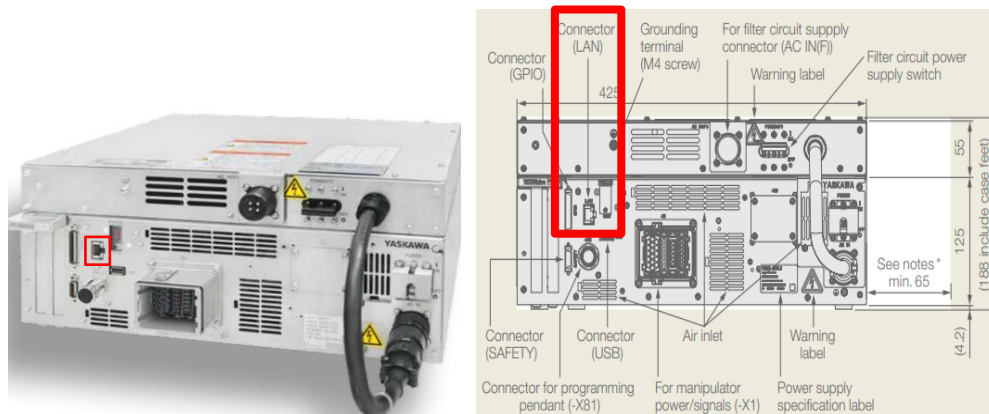


Fig. 6-7: Front View of CPU Rack



For YRC1000mirco, this controller has only one LAN port, for the reference of setup guide of this LAN port, please refer to chapter 4.1.2, the wiring example is shown as below picture:



4.1.2. YASKAWA network IP Setting

Step1 User need to let the system to be maintenance mode. First, keep pressing the “Main Menu” button and turn off the power of controller, and then turn on the power of controller, until it enters the “Maintenance Mode” page, user can release “Main Menu” button.

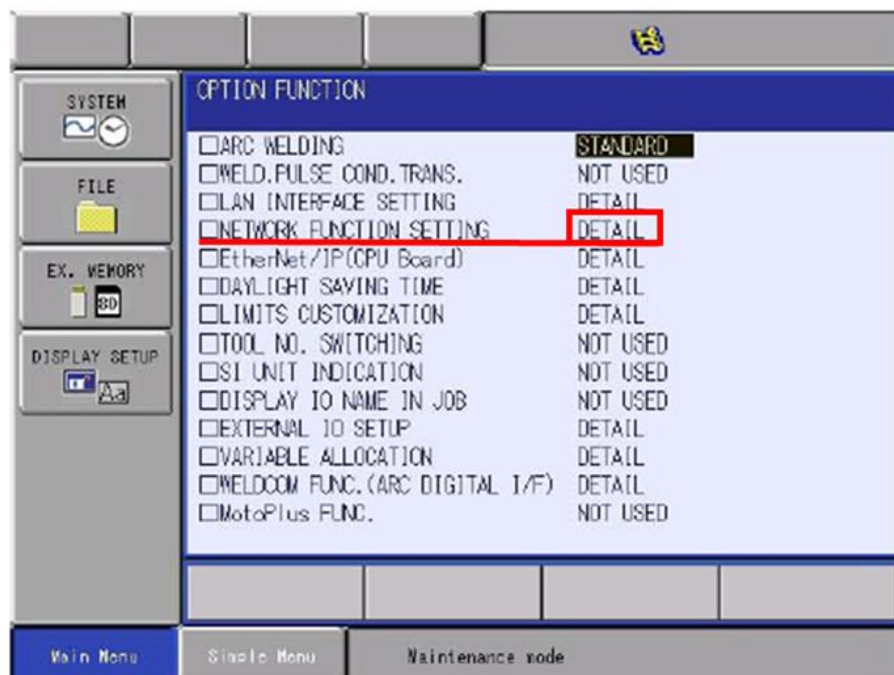


Step2 Enter "SYSTEM", select "SECURITY" and set as "MANAGEMENT MODE", The password is 8888888888888888 (Press 8 until it cannot be entered), there will be three keys in the upper right corner of the screen after successful entry.

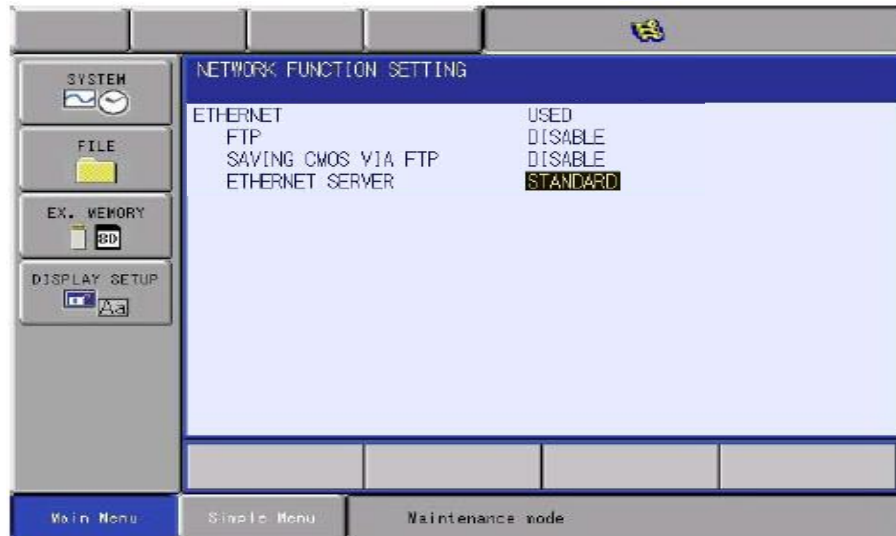


Step3 Check the internet function is enabled or not

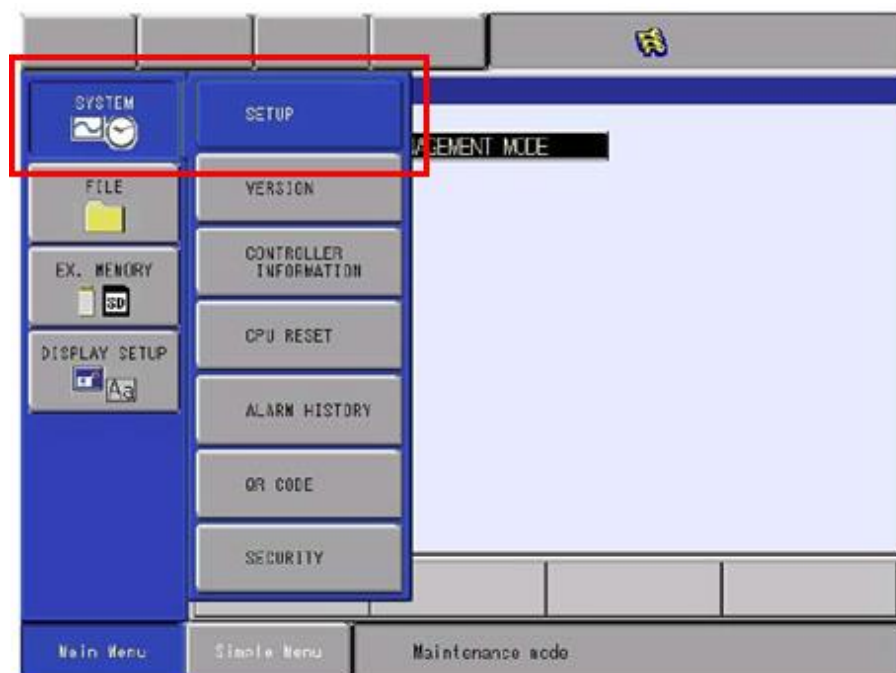
SYSTEM→SETUP→OPTION FUNCTION , Select DETAIL of
“NETWORK FUNCTION SETTING”



Check the ETHERNET should be USED and ETHERNET SERVER is STANDARD, if ETHERNET is NO USED or ETHERNET SERVER is DISABLE, please contact your local contact of YASKAWA redistributor to purchase this optional.



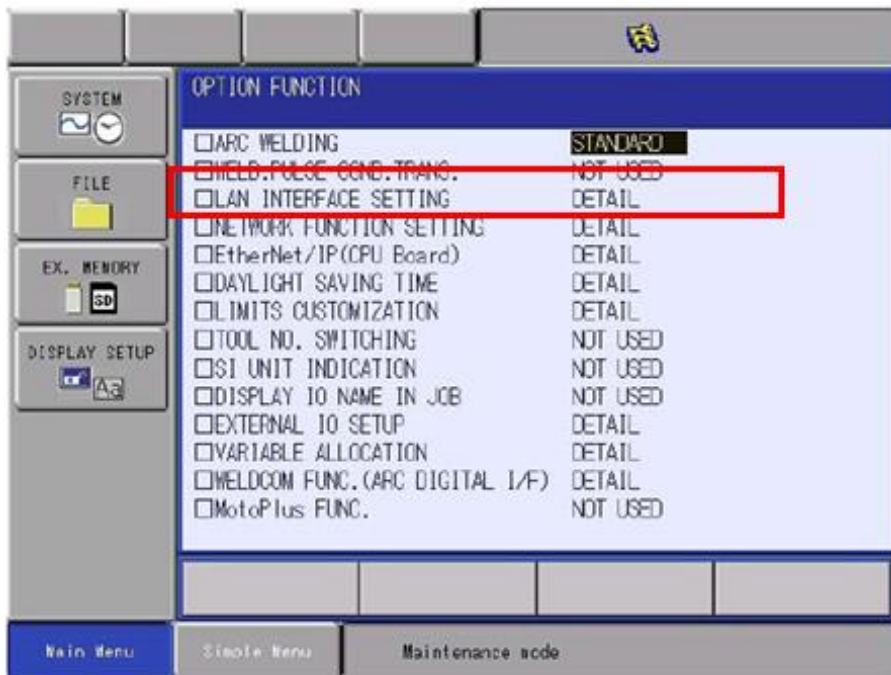
Step4 Set **HOST IP** on **SYSTEM->SETUP->OPTION FUNCTION->LAN INTERFACE SETTING**



SYSTEM->SETUP



SETUP->OPTION FUNCTION



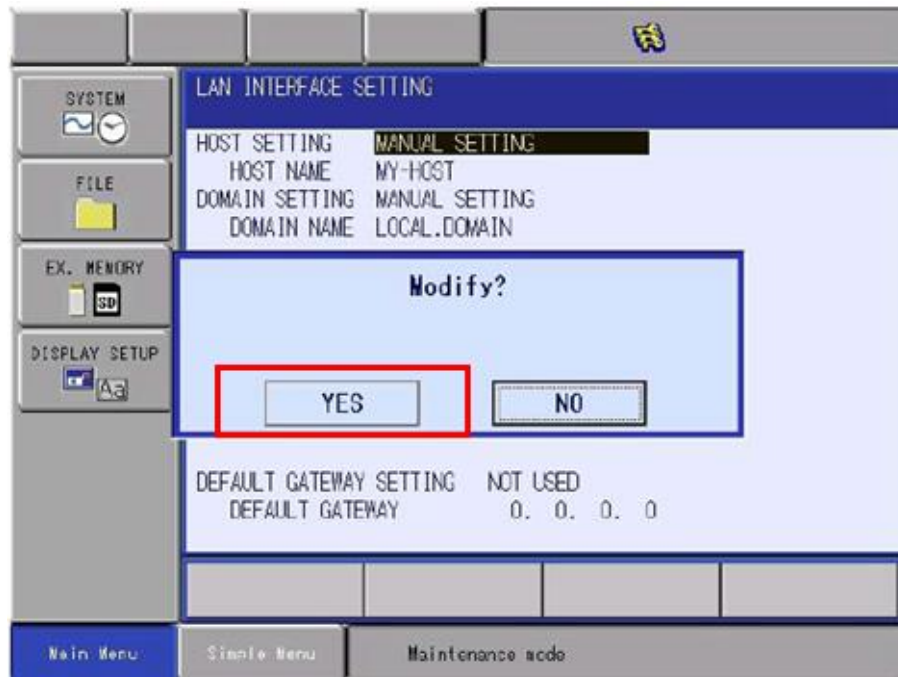
OPTION FUNCTION->LAN INTERFACE SETTING



LAN INTERFACE SETTING -> LAN2 SETTING(Default LAN2 is High speed Ethernet)



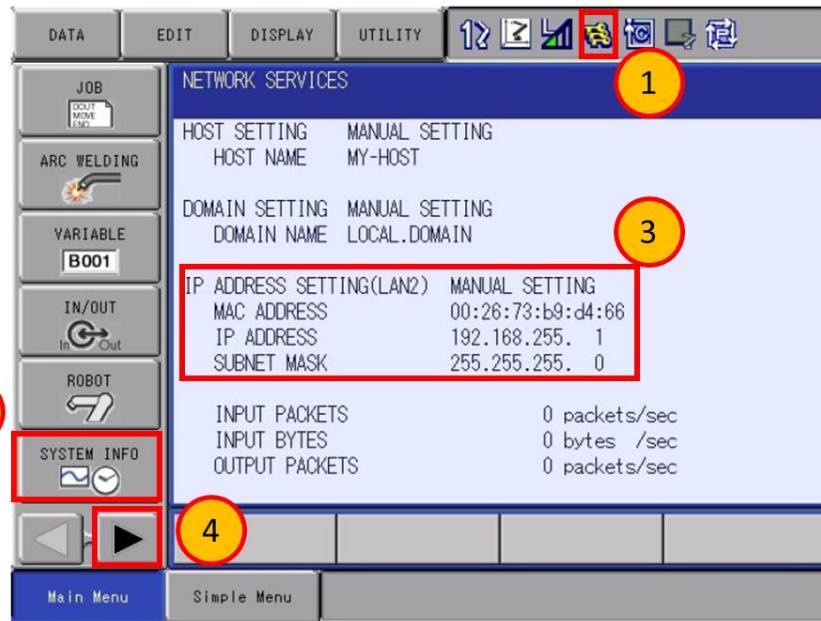
Set LAN2 IP



Confirming modification

Step5 Confirm the IP Address

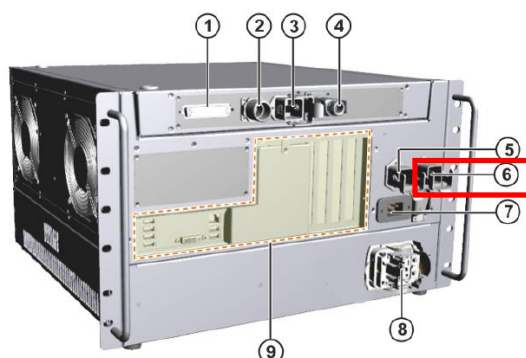
- (1) There will be three keys after setting security as "MANAGEMENT MODE".
- (2) Enter **SYSTEM INFO->NETWORK SERVICES** and you can see the IP
- (3) Please press the arrow to cut the page if you can't see **SYSTEM INFO**.



4.2. KUKA

4.2.1. KUKA LAN port location

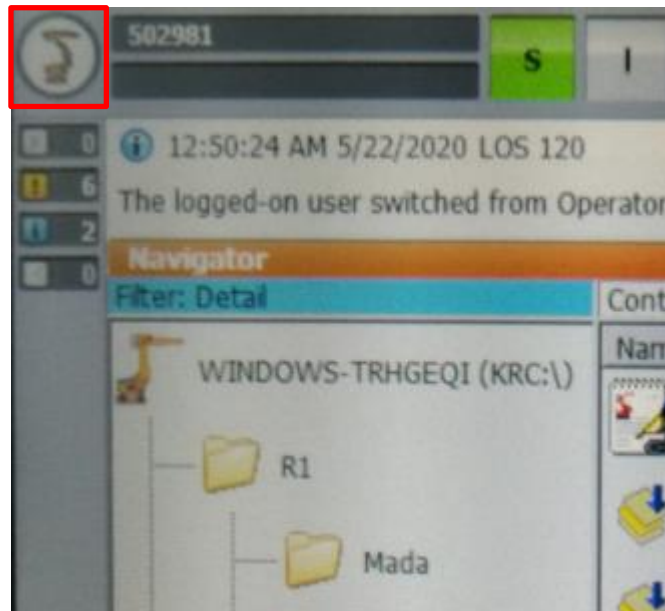
KUKA KRC4 compact's X66 is Ethernet Safety Interface, the location is shown as below picture:



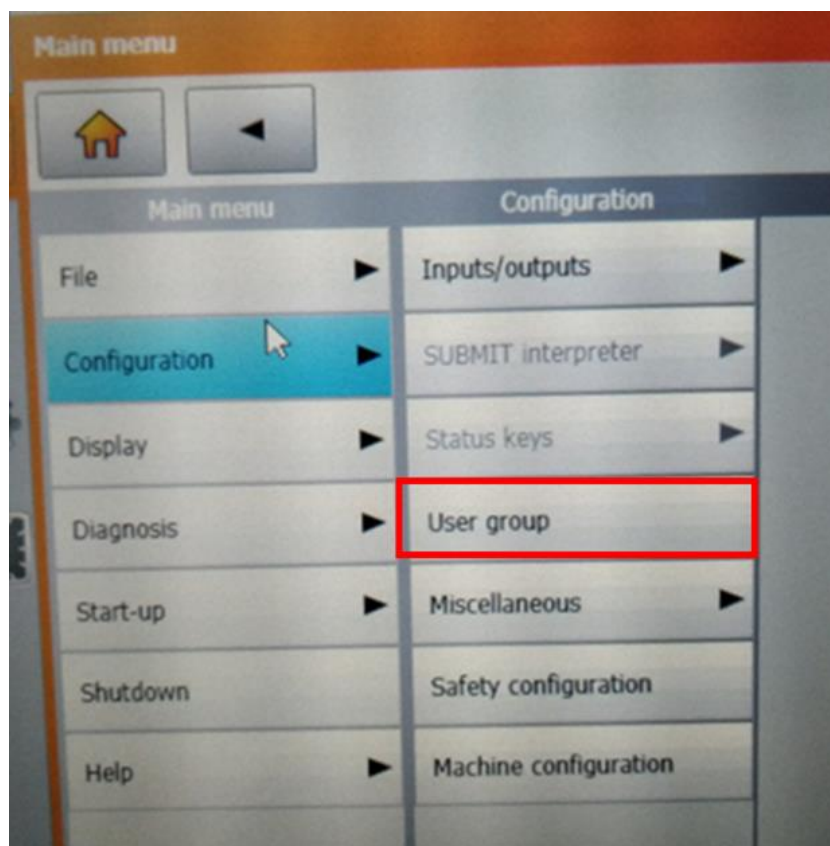
- 1 X11 Safety interface (option)
- 2 X19 smartPAD connection
- 3 X65 Extension interface
- 4 X69 Service interface
- 5 X21 Manipulator interface
- 6 X66 Ethernet safety interface**
- 7 X1 Power supply connection
- 8 X20 Motor connector
- 9 Control PC interfaces

4.2.2. KUKA network IP Setting

Step1 Turn on KUKA controller and start to setup the user group. First user needs to click the left-up corner KUKA logo:

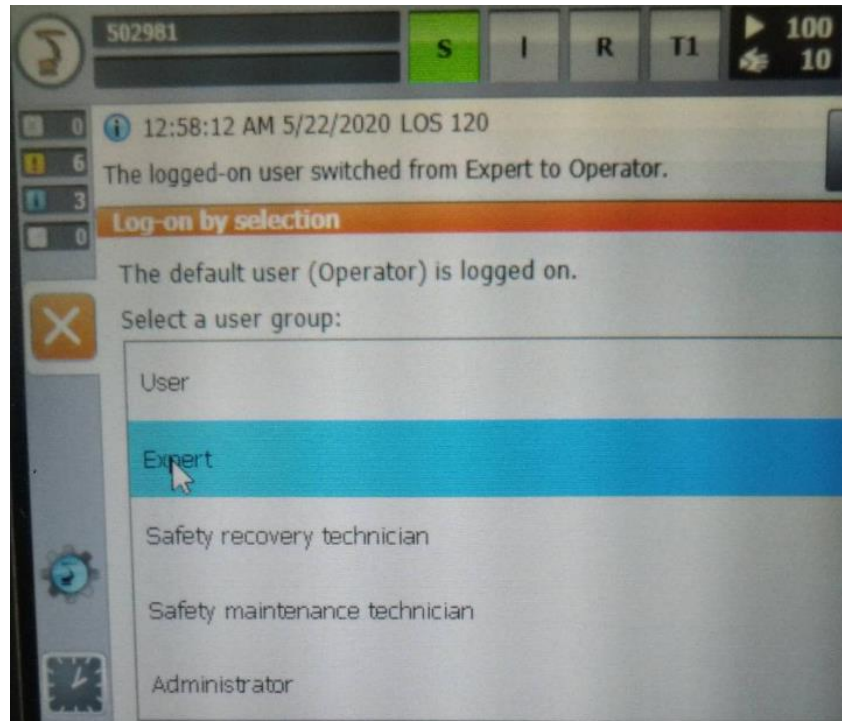


Configuration → User group



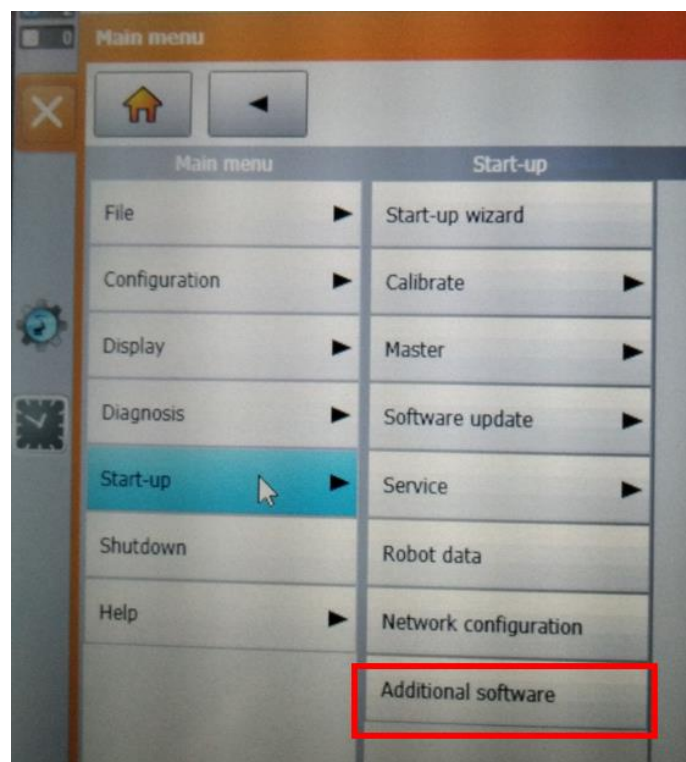
Select Expert and enter password

*note: for the password please contact your local KUKA distributor. Usually, the default password is "kuka".

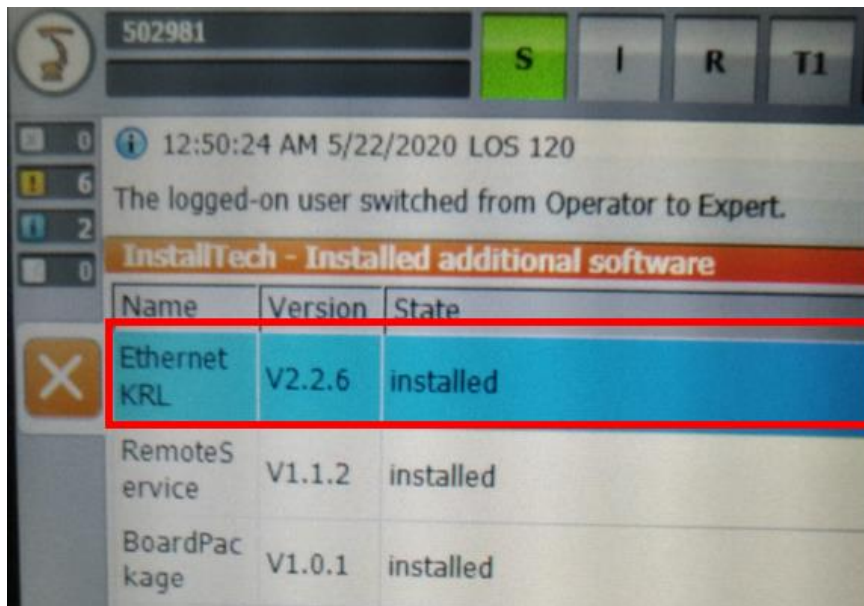


Step2 Check the ethernet option:

Start-up → Additional Software

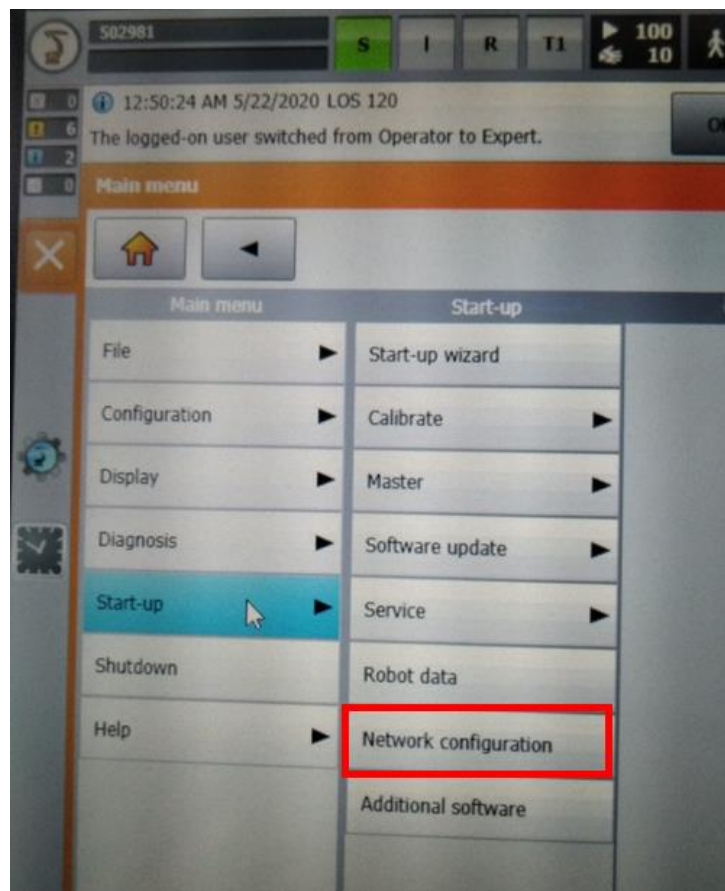


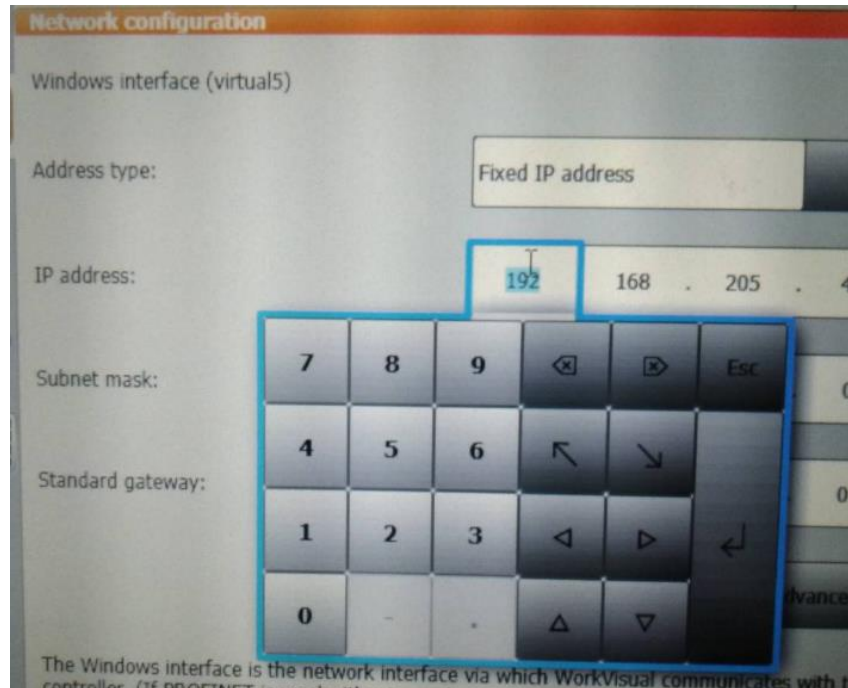
Check the "Ethernet KRL" option has been installed. If not, please contact your local KUKA distributor to purchase this option.



Step3 Setting Network IP

Start KUKA controller and enter **Start-up-> Network Configuration** to set the network IP





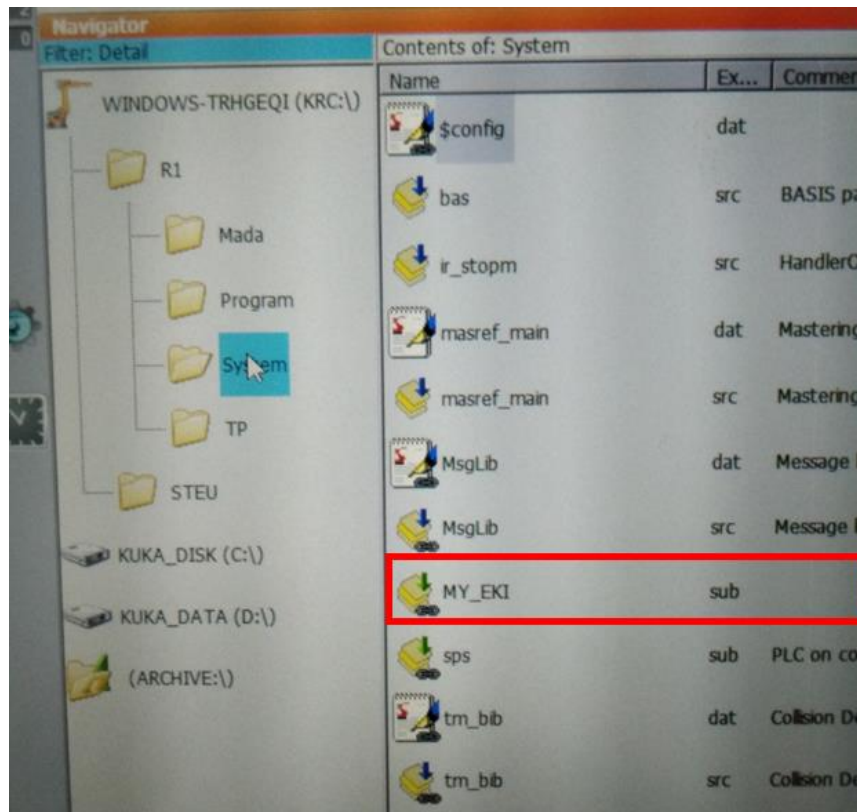
Step4 Place the *Xml SubServer.xml* provided by SRB into the controller C: \ KRC \ ROBOTER \ Config \ User \ Common \ EthernetKRL and confirm that the IP is consistent.

```

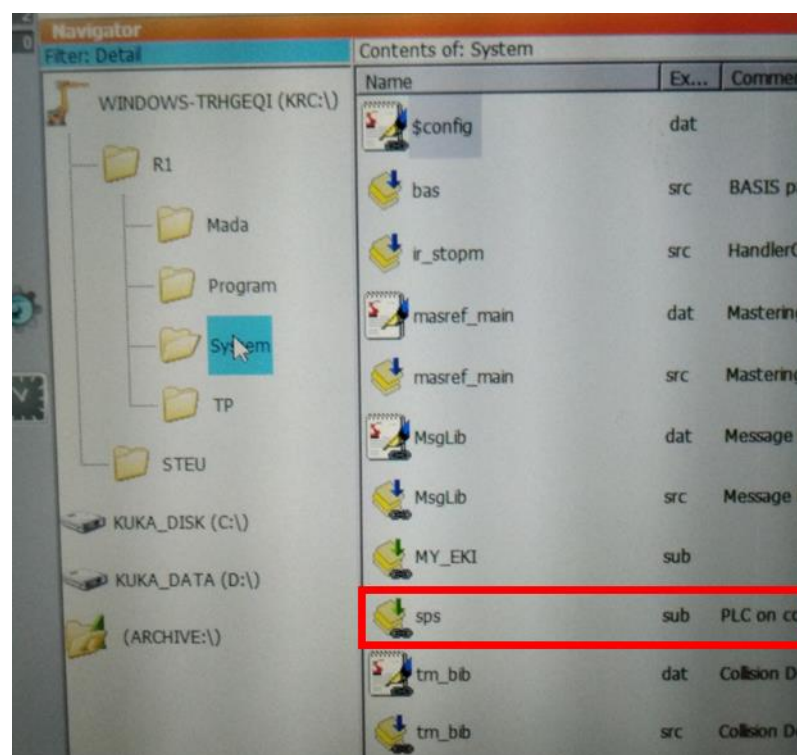
1 <ETHERNETKRL>
2   <CONFIGURATION>
3     <EXTERNAL>
4       <TYPE>Client</TYPE>
5     </EXTERNAL>
6     <INTERNAL>
7       <IP>192.168.1.3</IP>
8       <PORT>54600</PORT>
9       <ALIVE Set_Flag="1"/>
10      <ENVIRONMENT>Submit</ENVIRONMENT>
11      <MESSAGES Logging="disabled" Display="disabled"/>
12    </INTERNAL>
13  </CONFIGURATION>
14  <RECEIVE>
15    <XML>
16      <ELEMENT Tag="PC/Message" Type="STRING"/>
17    </XML>
18  </RECEIVE>
19  <SEND>
20    <XML>
21      <ELEMENT Tag="Status/Info/@Version"/>
22      <ELEMENT Tag="Status/Info/@SerialNo"/>
23      <ELEMENT Tag="Status/Info/@RobName"/>
24    </XML>
  </SEND>
</ETHERNETKRL>

```

Step5 Place *my_eki.sub* provided by SRB into the controller KRC: \ R1 \ System.



Step6 Access the controller *KRC: \ R1 \ System* and modify the *sps.sub* program. *sps.sub* is a built-in file. After opening, please refer to the figure below to add a red frame and blue text to the corresponding location. Please be careful not to change it to other places to avoid errors.



```

DEF sps()
  DECLARATIONS
    USER DECL ;使用者定義的變數
    DECL EKI_Status RET ;接受 EKI 函式的回傳值
    DECL BOOL EKIConnectionExisted ;表示是否存在連線
    DECL INT EKICounter ;用來控制傳輸頻率的計數

  INI
    USER INIT ;使用者定義的初始化
    RET=EKI_Init( "XmlSubServer" ) ;初始化一個通道。
    RET=EKI_Open( "XmlSubServer" ) ;打開通道
    EKIConnectionExisted =FALSE ;存在連線初始值=否
    EKICounter=0 ;counter初始值=0

  LOOP ; 12ms 一次迴圈

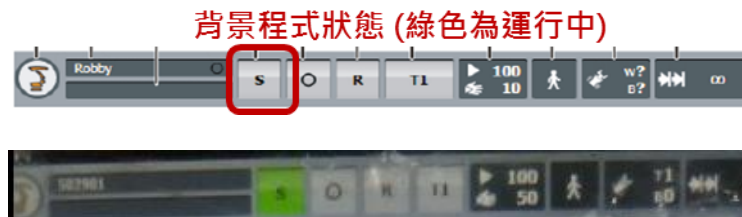
  USER PLC ;使用者定義的迴圈執行內容
  My_EKI_Set(EKIConnectionExisted, EKICounter) ;呼叫副函式

  ENDLOOP

END

```

Step7 After modifying *sps.sub* program in Step 4, make sure the background program icon is green. Otherwise, it may be a compilation error. If an error occurs, reconfirm Step4.

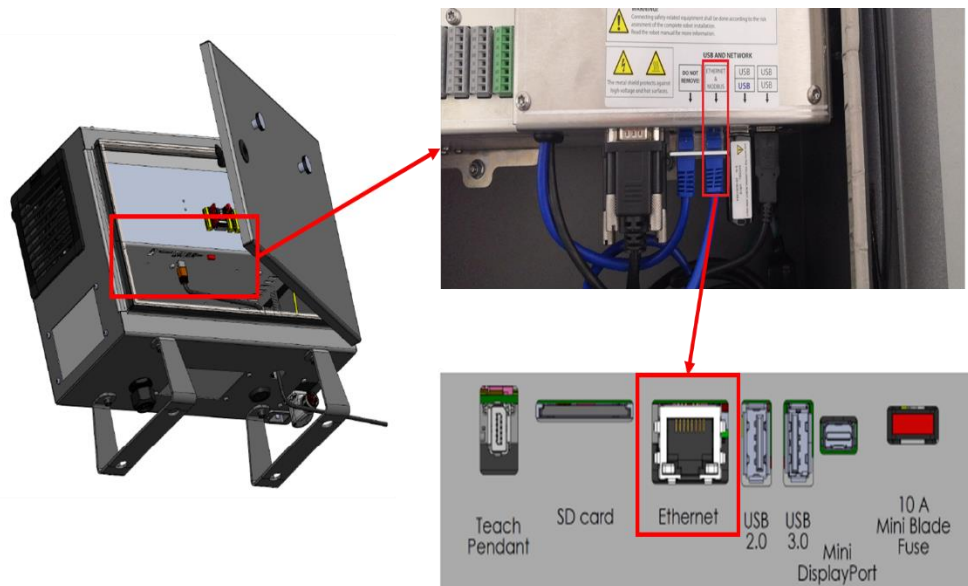


Step8 Connect the controller and PC with a network cable, launch **Socket Client** on the PC, and confirm that the connection is successful.

4.3. Universal Robot

4.3.1. Universal Robot LAN port location:

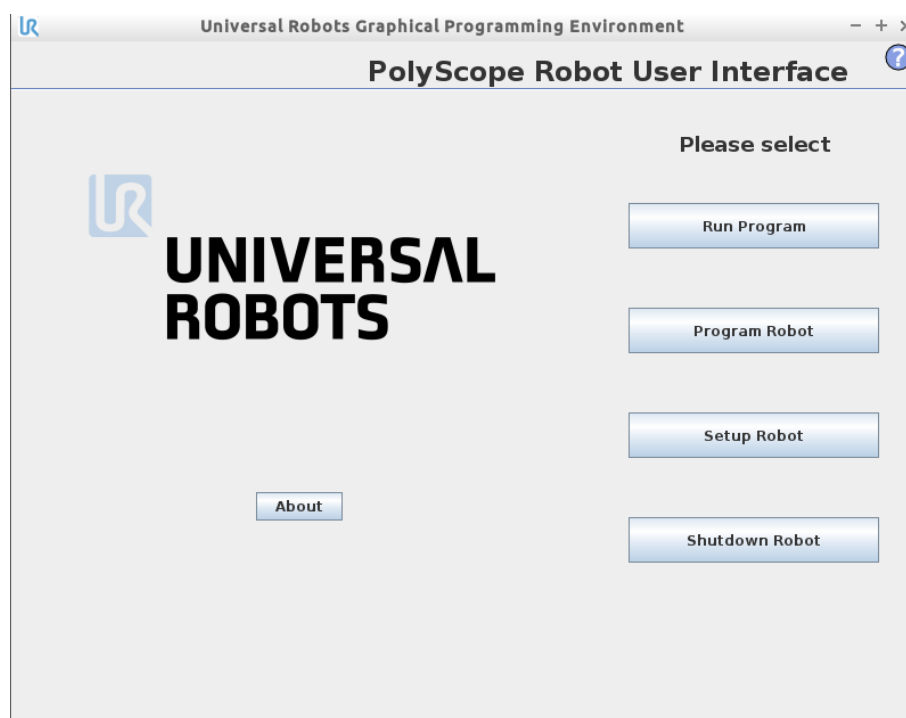
Open the UR controller, the LAN port location is on the controller PC as below picture:



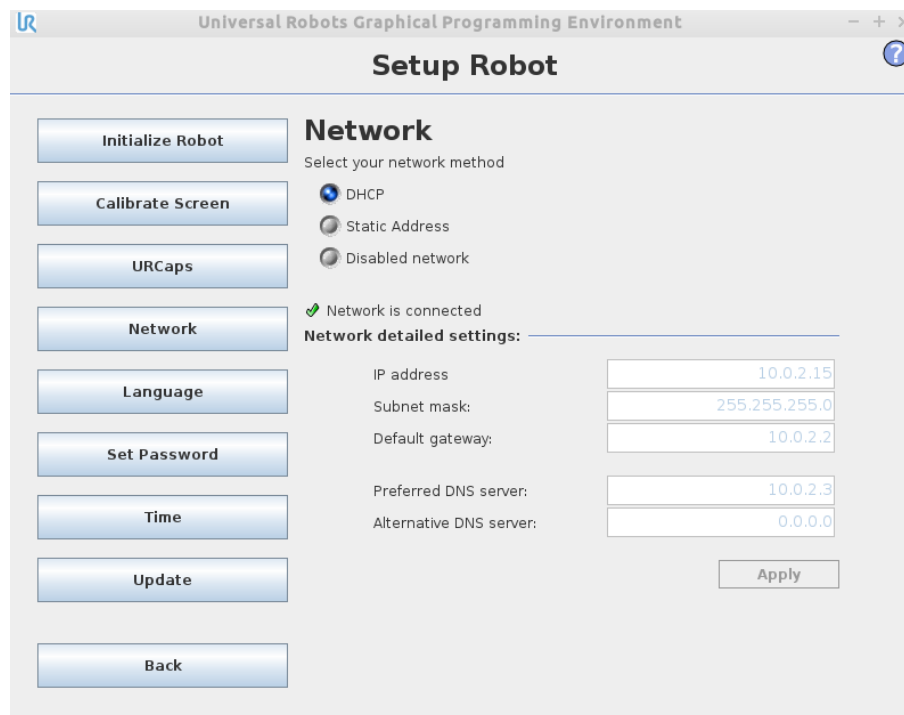
4.3.2. Universal Robot network IP Setting

Step1 Connect the controller and PC with a network cable, launch Socket Client on the PC, and confirm that the connection is successful.

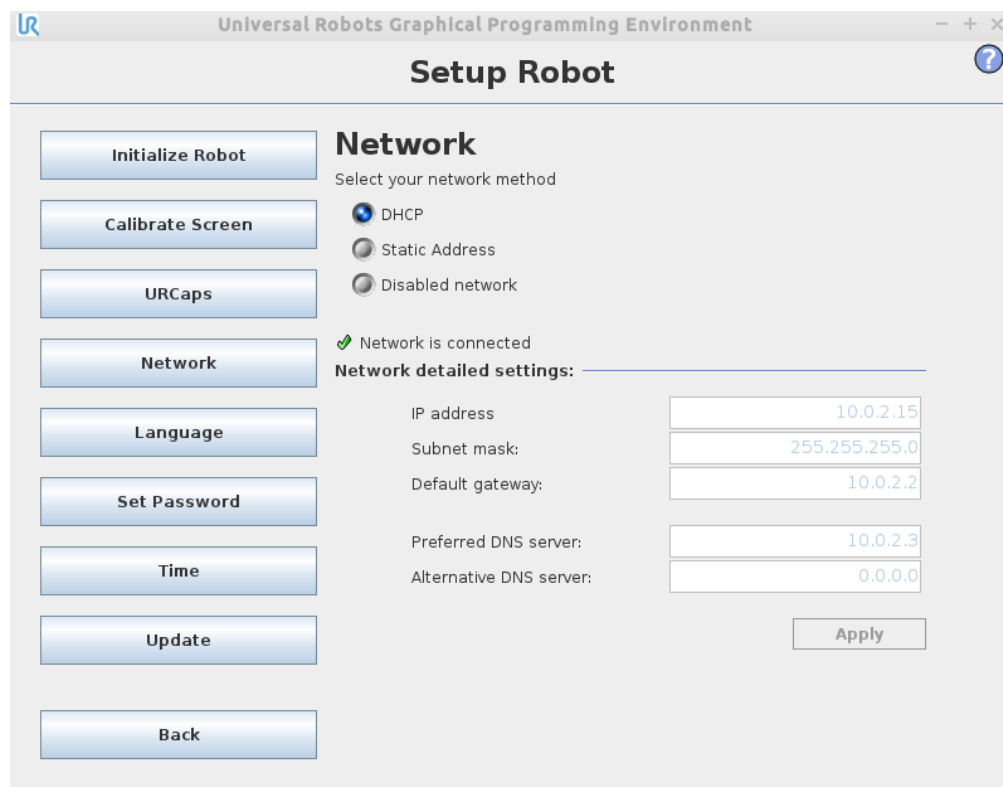
Step2 Press the power button when the controller is off. After startup ,you will see the following page.

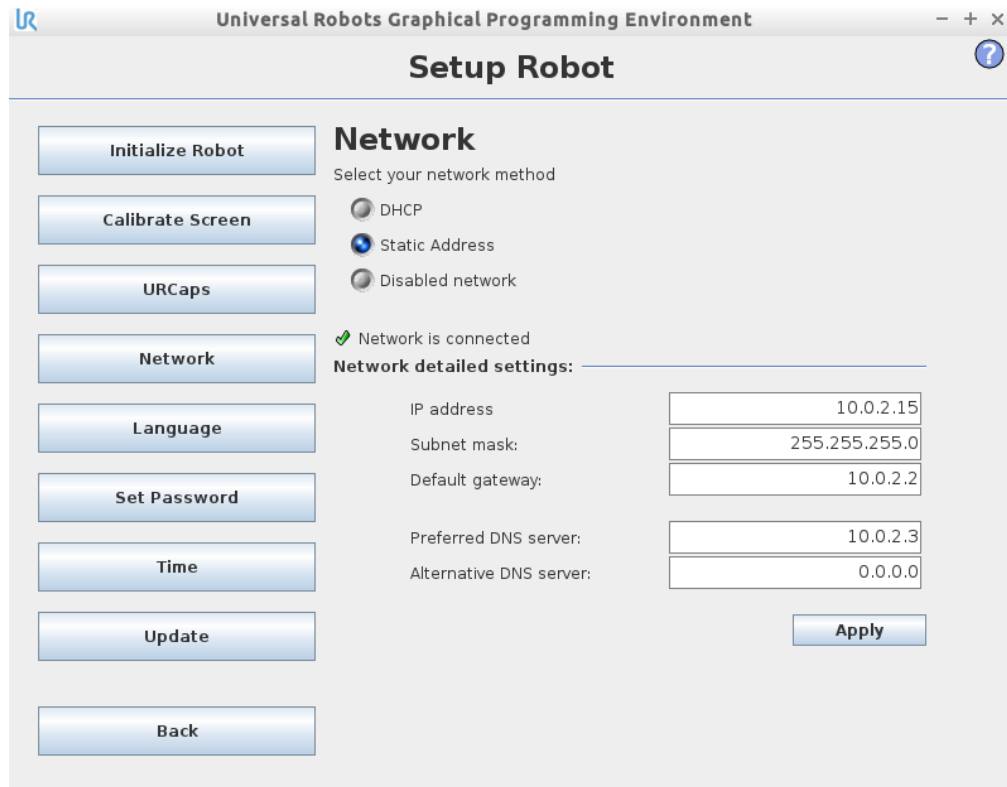


Step3 Click Setup Robot→Network, you will see the following page.



Step4 If the computer needs to be connected is in the same domain, you only choose DHCP; if you need to set or modify the IP, choose Static Address to modify.





Step5 After modification, press Apply.

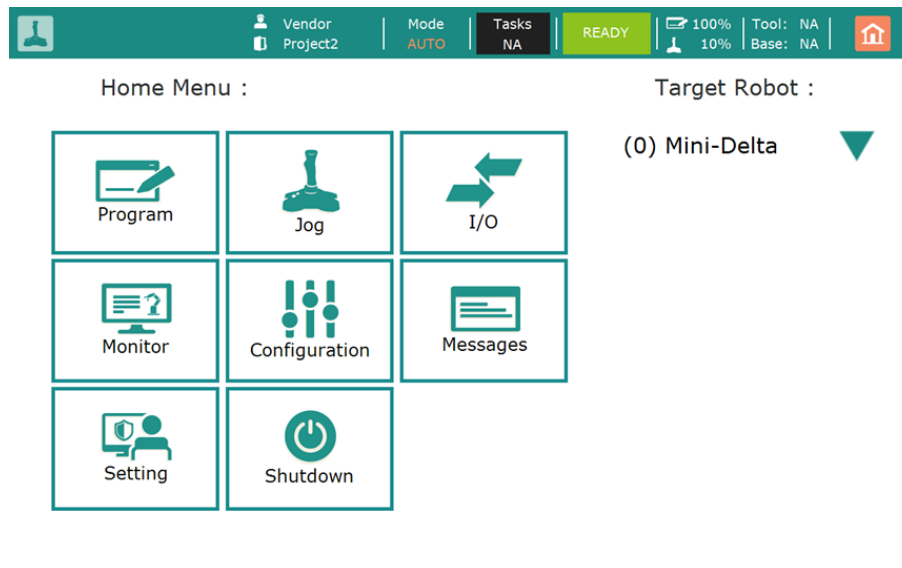
4.4. NexCOBOT

4.4.1. NexCOBOT LAN port location

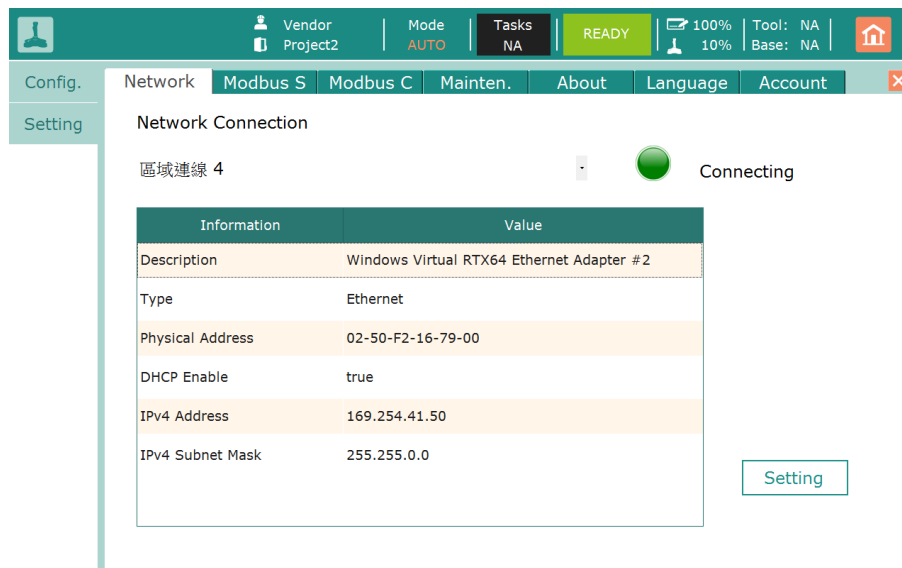


4.4.2. NexCOBOT network IP Setting

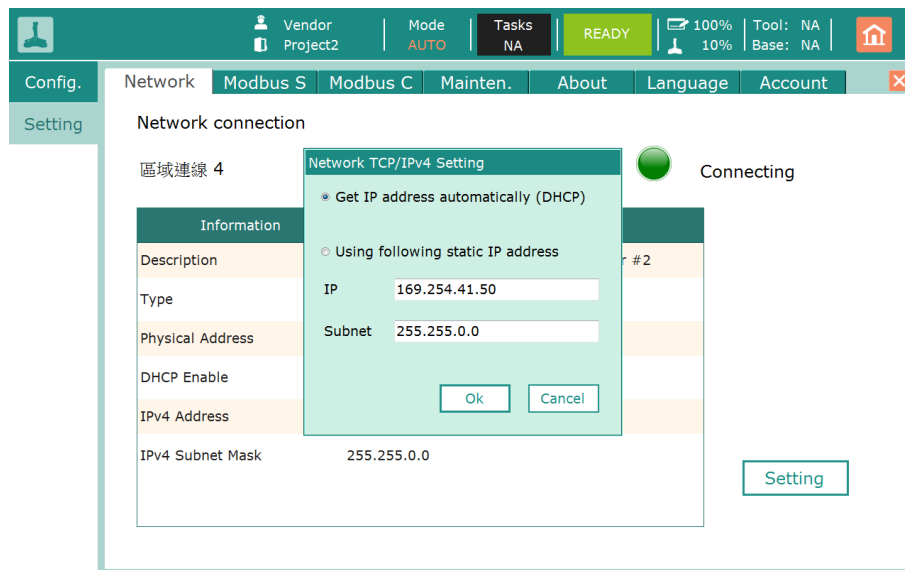
Step1 Launch the controller until enter the TUPI homepage.



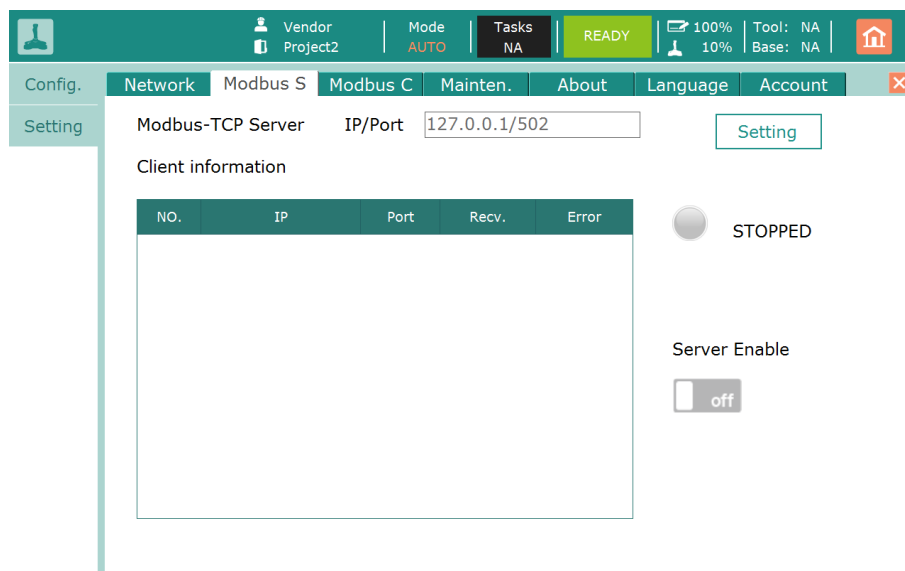
Step2 Enter the Setting page.



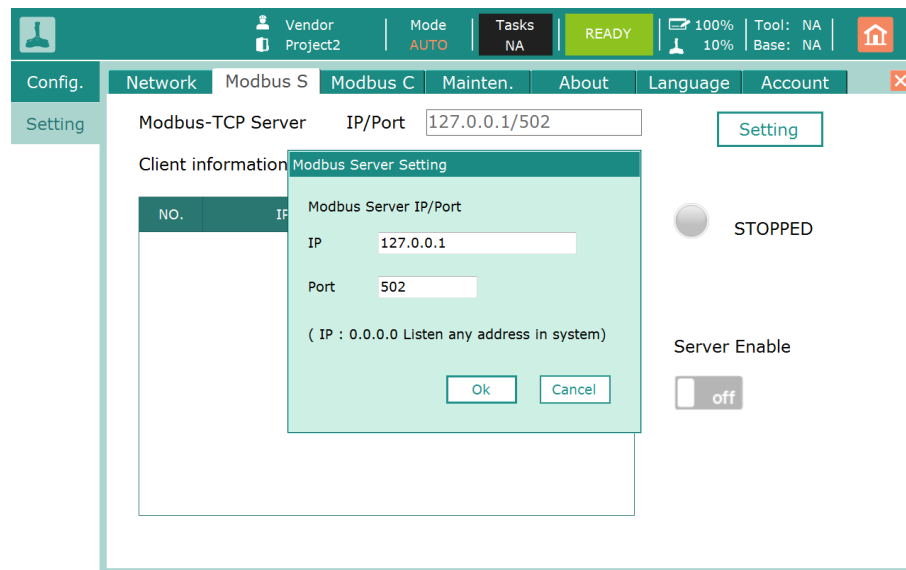
Step3 Set controller IP address.



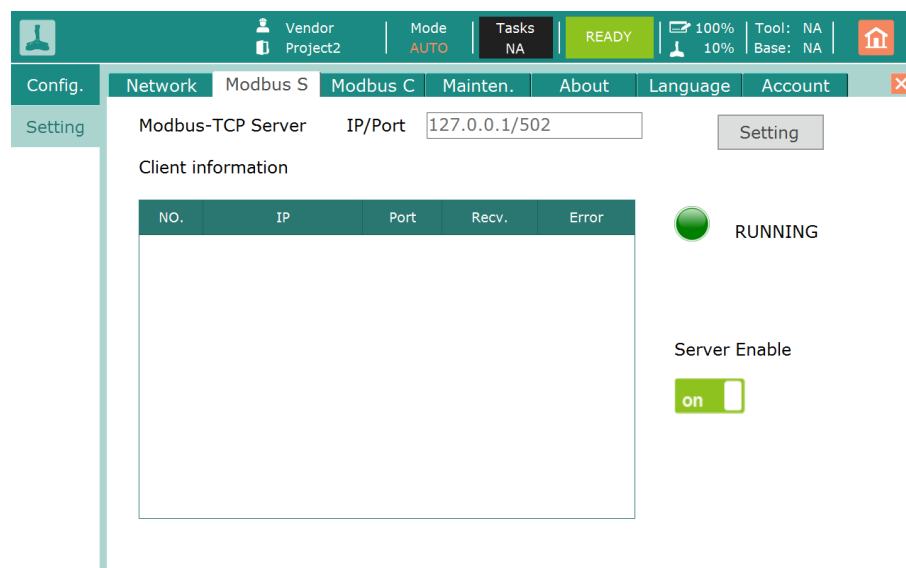
Step4 Enter Modbus Server



Step5 Click Setting, and modify Modbus Server IP and PORT.



Step6 Click Server Enable and make sure the state is green.(Running)



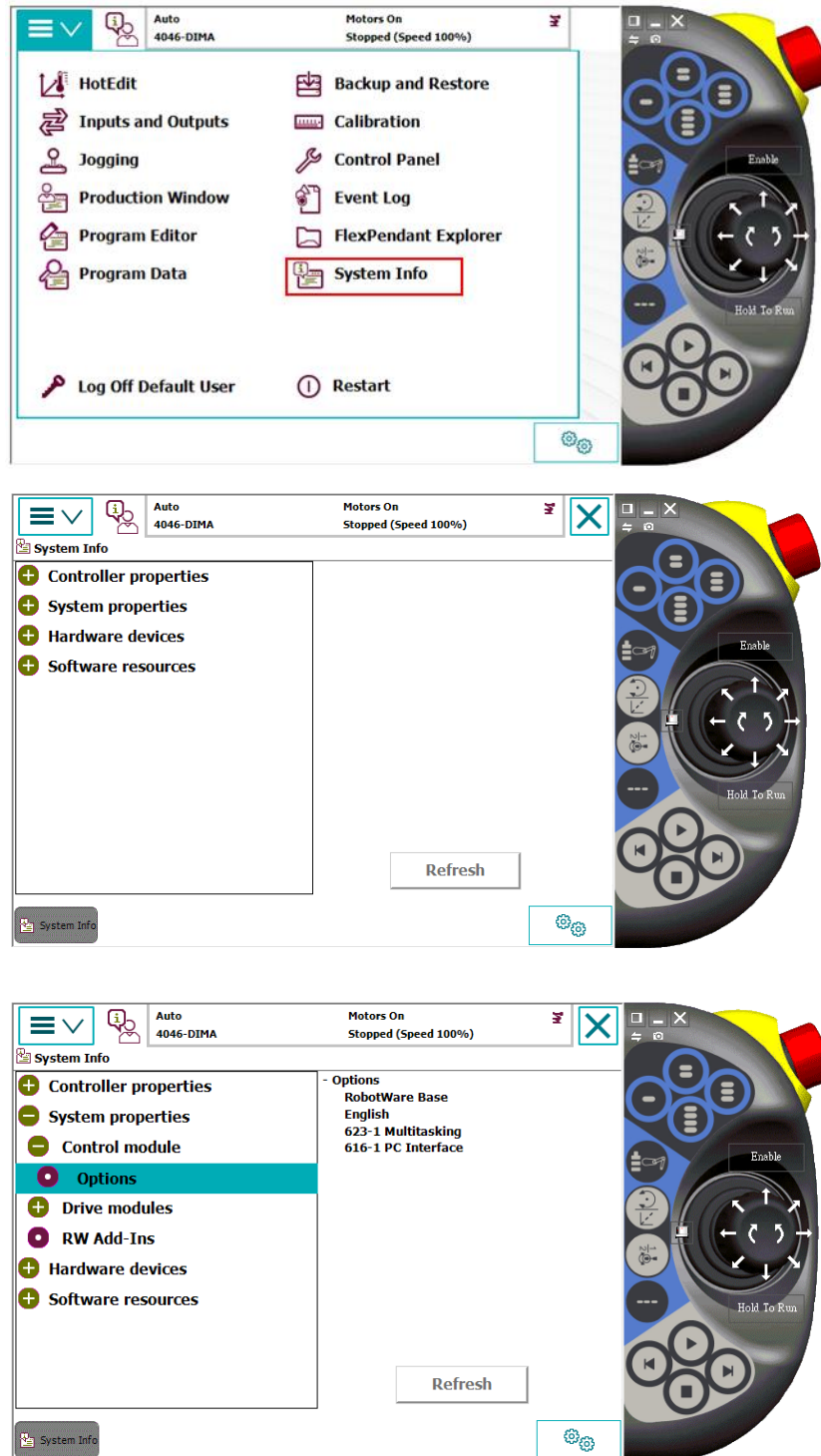
4.5. ABB

4.5.1. ABB LAN port location

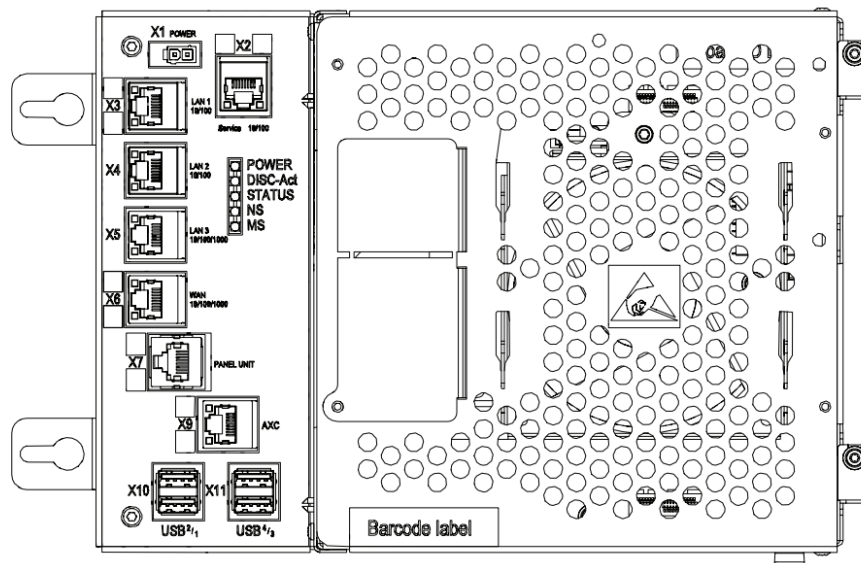
User need to use LAN port(X2) with RobotStudio for configuring the environment of using SRB with ABB robot controller. After configuration is done, user need to use LAN port(X6) to connect SRB with ABB robot controller.

Step1 Confirm the option modules

Check the option in System Info-> System properties->Control module->Options, SRB connect to ABB robot controller by using the options of PC Interface & Multitasking.

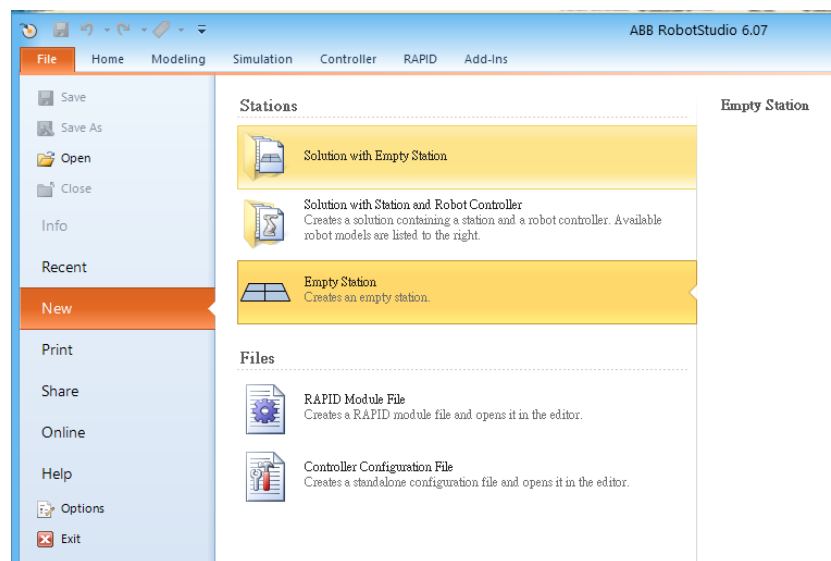


Find the LAN port X2 and X6 inside of ABB controller cabinet as below picture, using LAN port X2 to configure ABB robot controller with RobotStudio, using LAN port X6 to connect SRB to ABB robot controller after configuration.

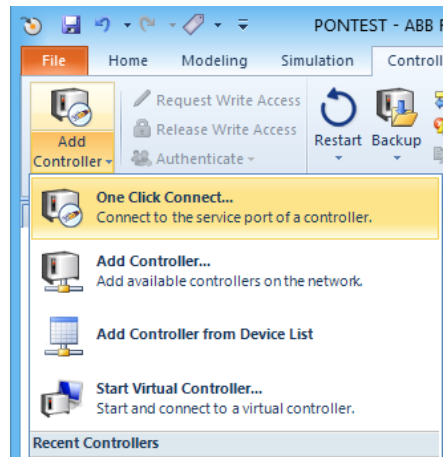


4.5.2. Configure ABB robot controller

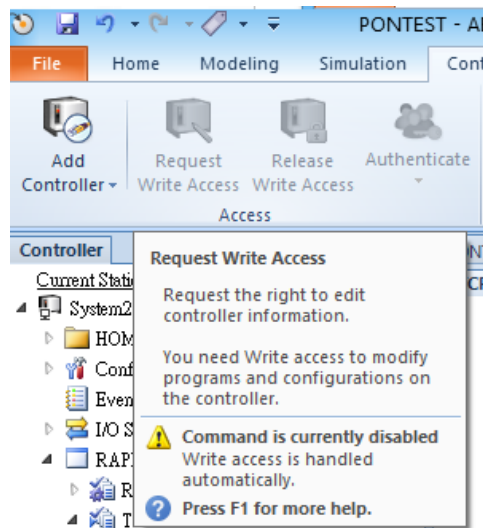
Step1 Open RobotStudio software, create empty station



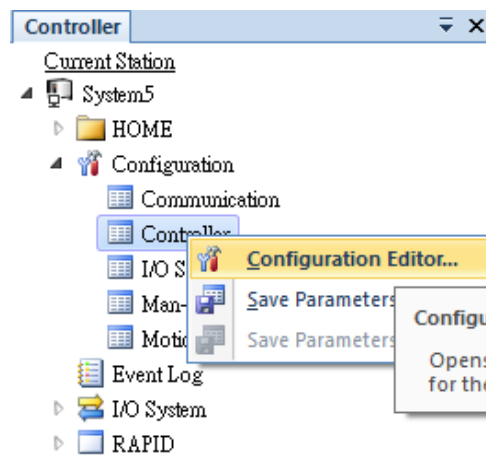
Step2 Controller->Add Controller->One Click Connect



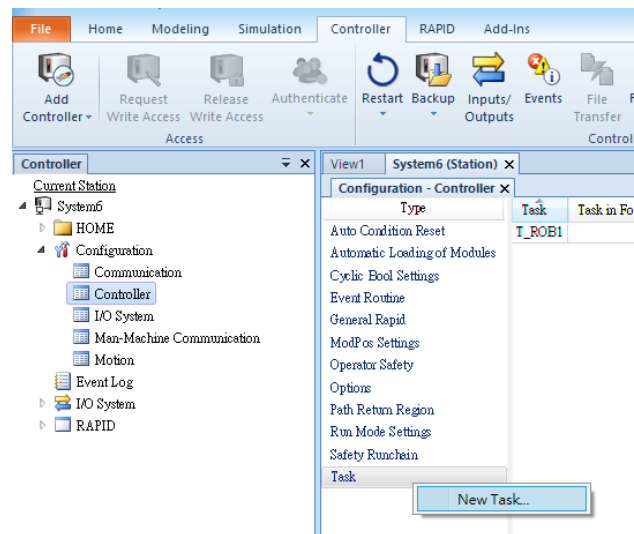
Step3 Requests Write access



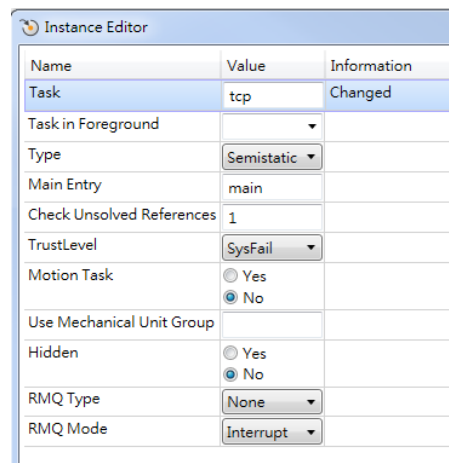
Step4 Controller->Controller (right click)->Configuration Editor



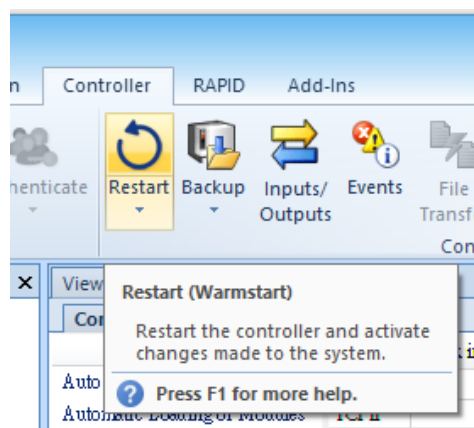
Step5 Task (right click), select New Task.



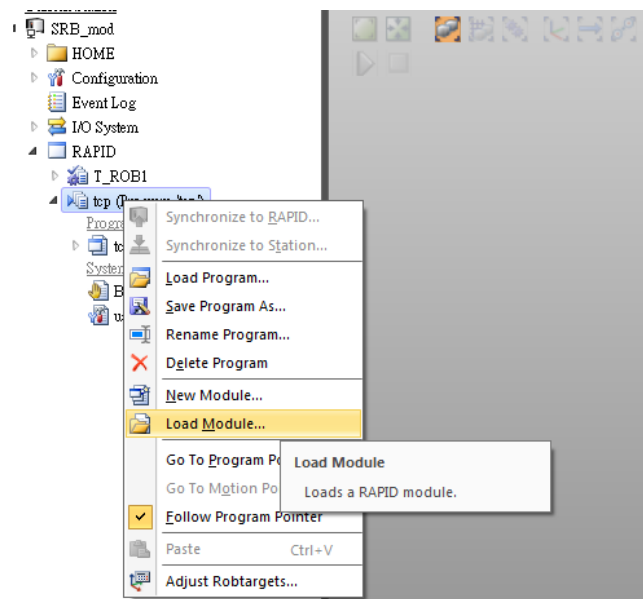
Step6 Create Task tcp , Type 選取 Static



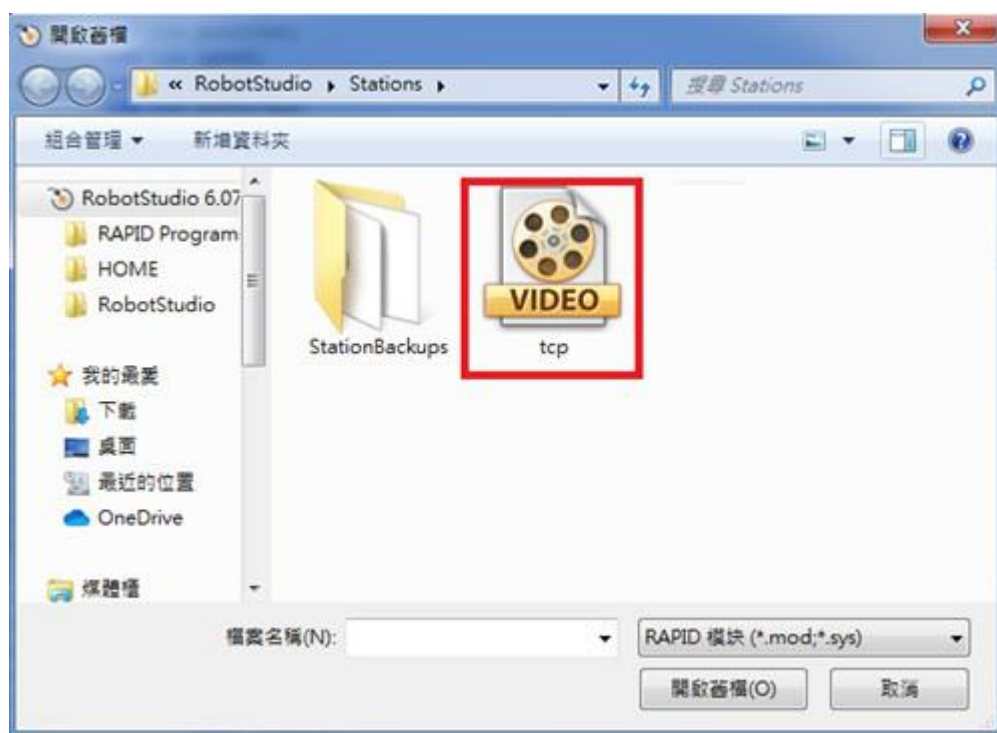
Step7 Restart Controller



Step8 Select the task and select 「Load Module」



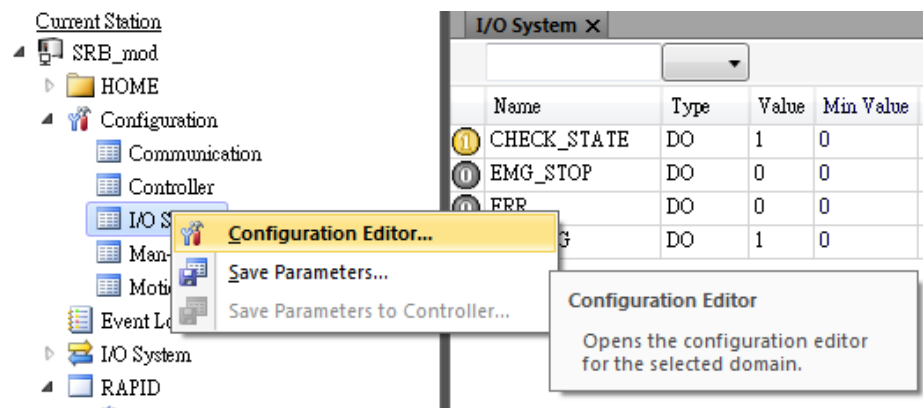
Step9 Select the RAPID module provided with SRB



4.5.3. ABB controller status setting

SRB read the ABB robot controller status by mapping the simulation I/O to robot status.

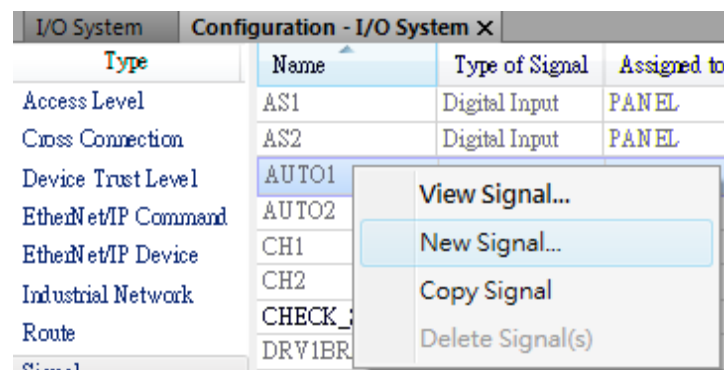
Step1 Open RobotStudio software,Create Empty Station



Step2 Select Signal

Type	Name	Type of Signal
Access Level	AS1	Digital Input
Cross Connection	AS2	Digital Input
Device Trust Level	AUTO1	Digital Input
EtherNet/IP Command	AUTO2	Digital Input
EtherNet/IP Device	CH1	Digital Input
Industrial Network	CH2	Digital Input
Route	CHECK_STATE	Digital Output
Signal	DRV1BRAKE	Digital Output
Signal Safe Level	DRV1BRAKEFB	Digital Input
System Input	DRV1BRAKEOK	Digital Input
System Output	DRV1CHAIN1	Digital Output
	DRV1CHAIN2	Digital Output
	DRV1EXTCOMT	Digital Input

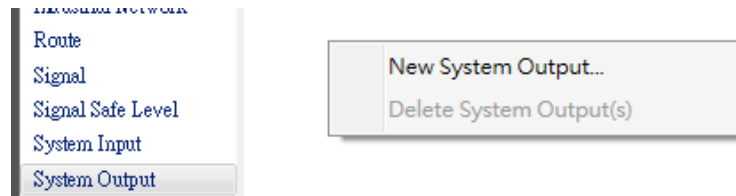
Step3 Signal (Right click)->New Signal



Step4 Please create 4 new items listed as below table. Assigned to Device 的 I/O 裝置，會依使用者的控制器有所不同，請選擇一個未使用 I/O 進行配置

Name	EMG_STO P	CHECK_ST ATE	MOVING	ERR
Type of Signal	Digital Output			
Assigned to Device	(Device I/O)			
Device Mapping	0	1	2	3
Access Level	ALL			
Default Value	0			
Invert Physical Value	NO			
Safe Level	DefaultSafeLevel			

Step5 Select System Output (right click)->New System Output



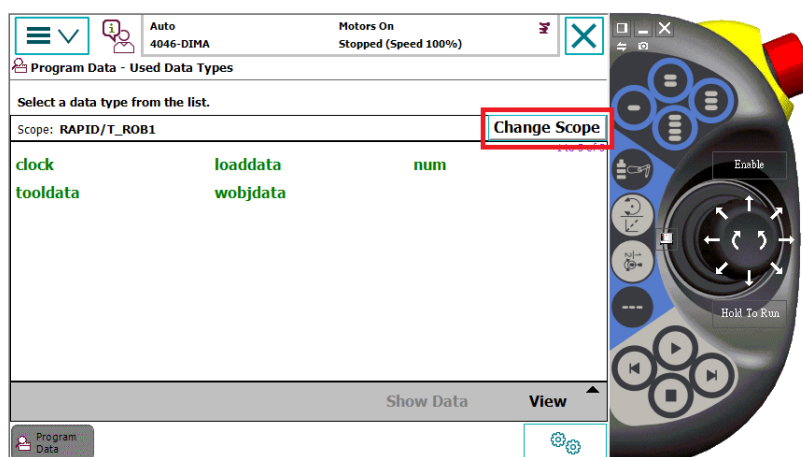
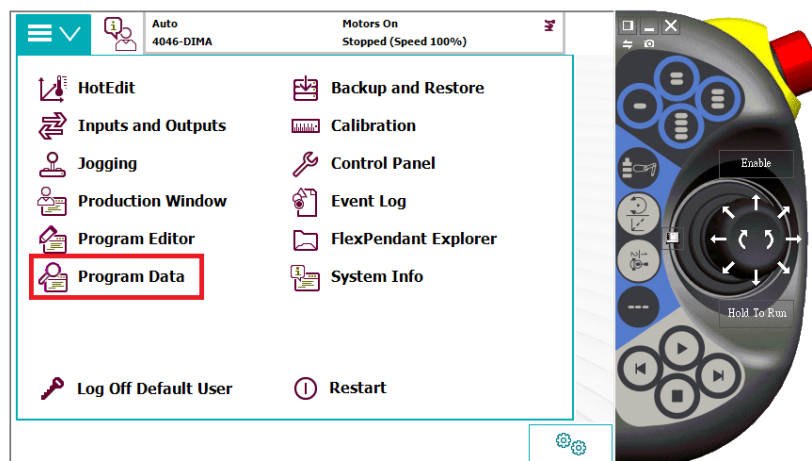
Signal Name	Status	Argument
EMG_STOP	Emergency Stop	-
CHECK_STATE	Motors On State	-
MOVING	Mechanical Unit Not Moving	(Script Name)
ERR	Execution Error	(Script Name)

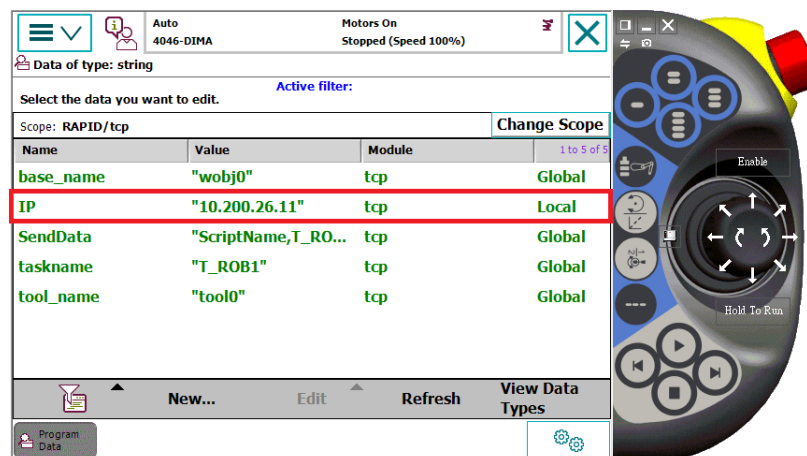
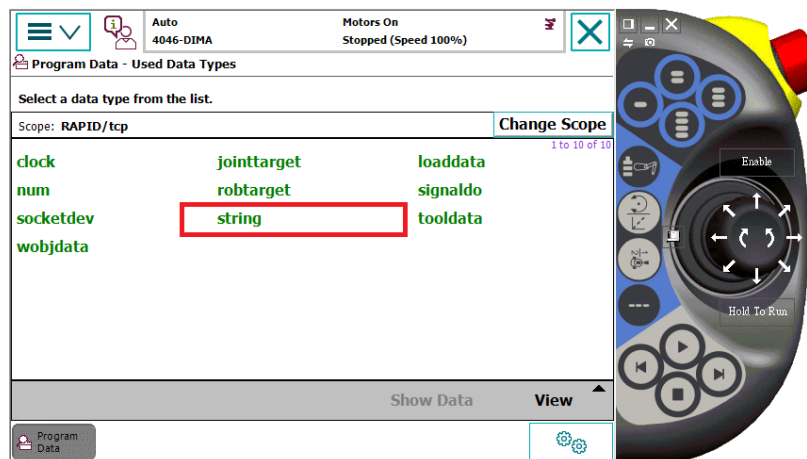
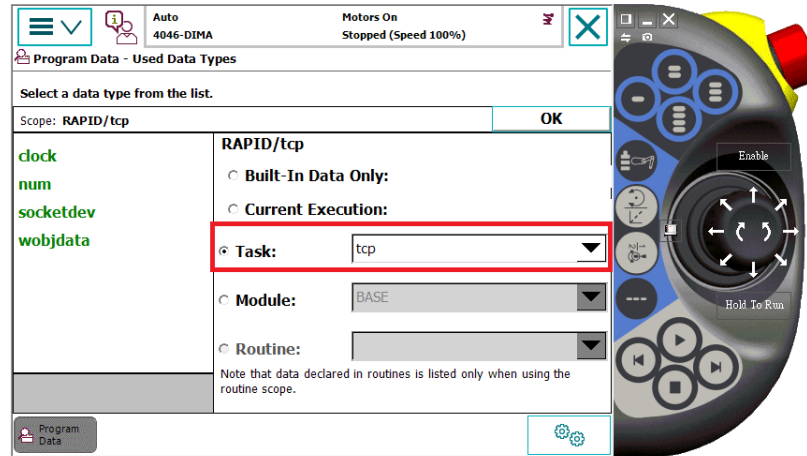
4.5.4. ABB network IP Setting

Before setting network IP address for connecting SRB with ABB robot controller, make sure all the steps from 4.5.1 to 4.5.3 are done. This chapter describe how to setting the LAN port (X6) to connect SRB with ABB robot controller.

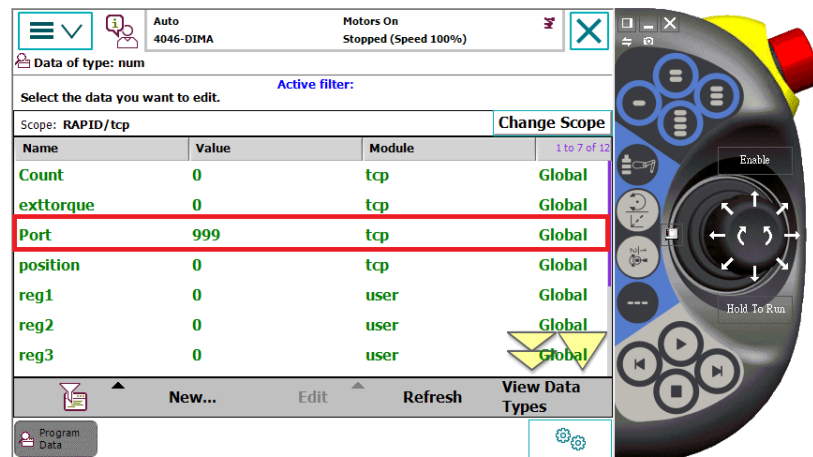
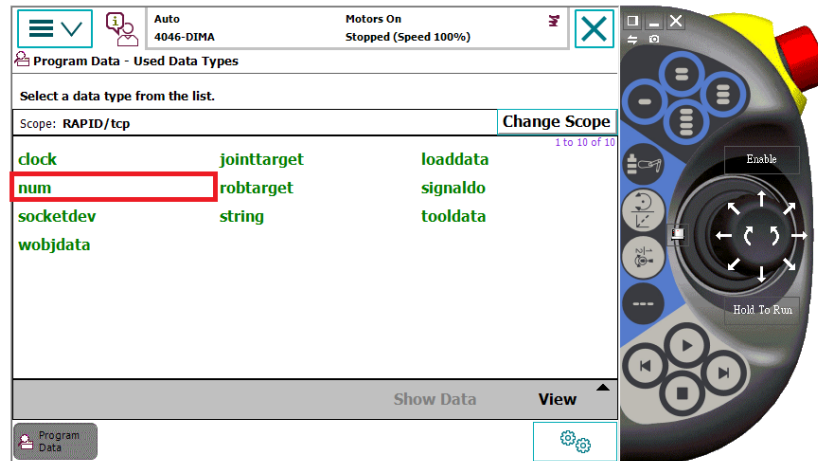
Step1 Use ABB FlexPendant to set IP address

Menu-> Program Data->Change Scope->Select tcp->Select string->Modify IP address



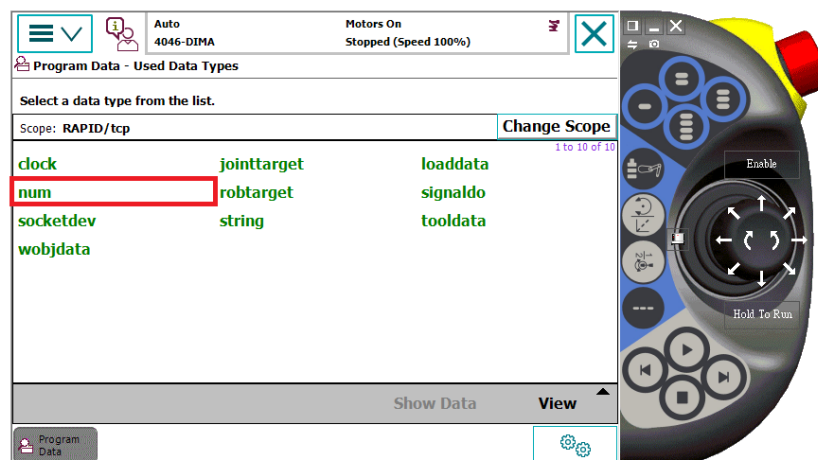


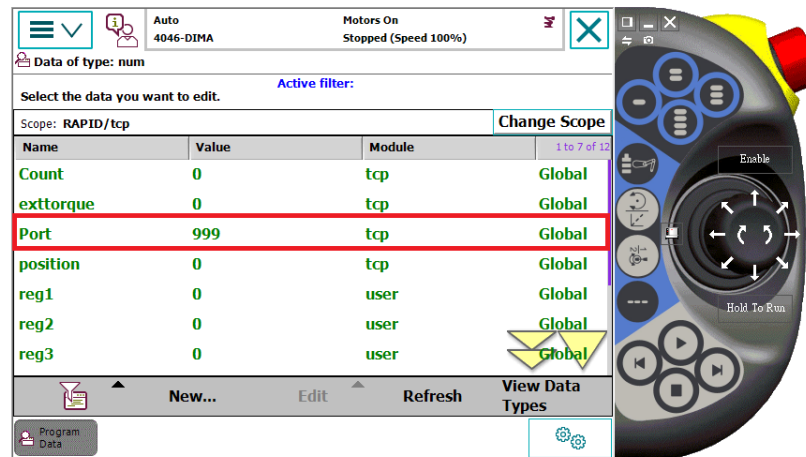
Step2 Modify Port number by select 「num」.



Step3 Port Setting

Select num to set the port number





4.6. Fanuc

4.6.1. Fanuc LAN port location

The LAN port location of Fanuc controller(R-30iB 、R-30iB Mate 、R-30iA 、R-30iA Mate) are listed as below pictures. For the controller which has two LAN ports, user can choose any one of them to use. (Need setup the IP address)

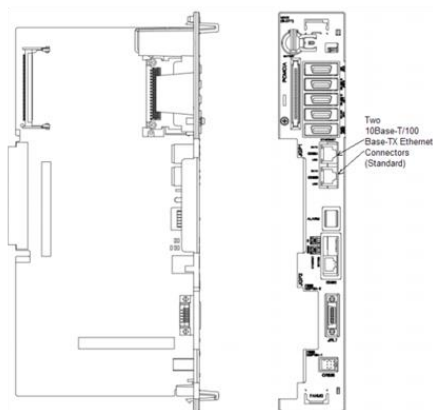


Fig. 2.2.2(a) Main board (R-30iB) ethernet connectors

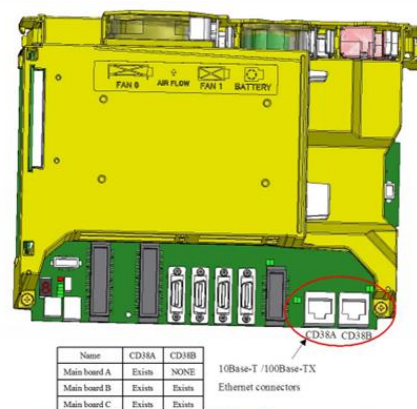


Fig. 2.2.2(b) Main board (R-30iB Mate) Ethernet connectors

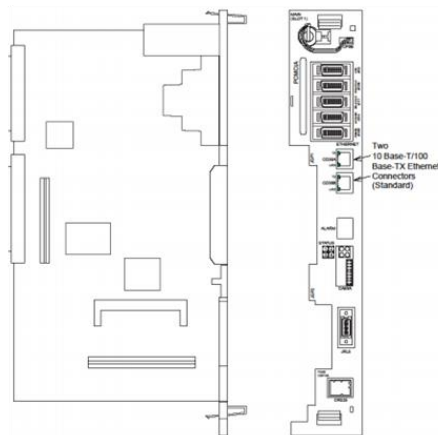


Fig. 2.2.2(c) Main board (R-30iA controller) ethernet connectors

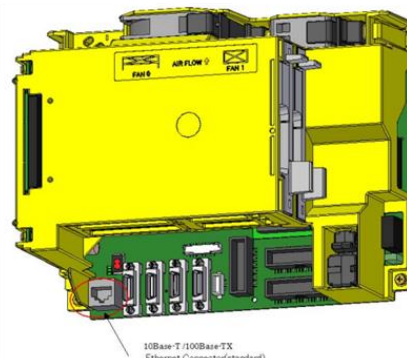


Fig. 2.2.2(d) Main board (R-30iA Mate) ethernet connectors

4.6.2. Fanuc network IP Setting

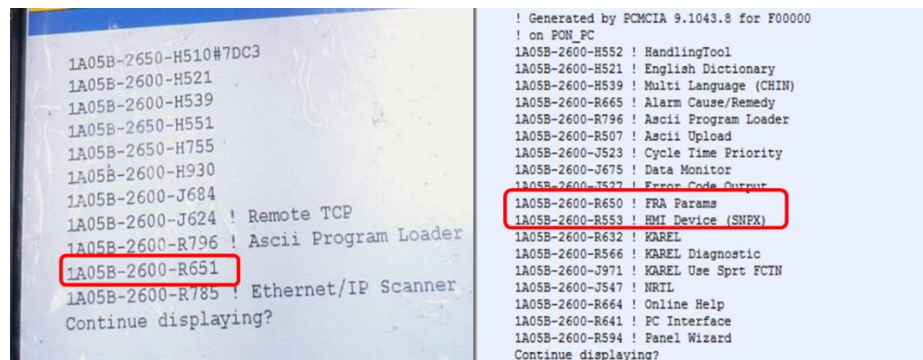
Step1 Confirm the option modules

MENU-> 0 **[NEXT]**-> **[Enter]**

4 **[STATUS]**->2 **[Version ID]** -> **[Enter]**

[NEXT] **[>]**->**[F3]** **[ORDER FI]**

Currently SRB support FANUC controller which has the option modules of R651 or R650+R533.

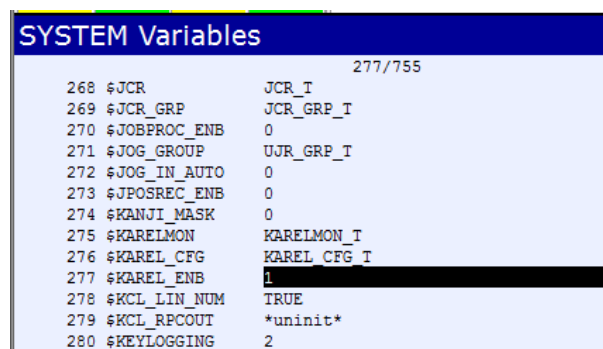


Step2 Enable KAREL

MENU->0 **[NEXT]**-> **[Enter]**

6 **[SYATEM]**-> 2 **[Variables]** -> **[Enter]**

[\$KAREL_ENB]-> Set the value to 1.



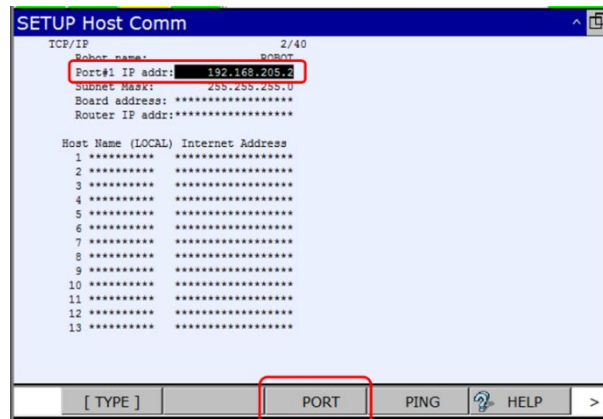
Step3 IP Setting

MENU->6 **[SETUP]**-> 0 **[NEXT]**-> **[Enter]**

[Host Comm] -> **[Enter]**

1**[TCP/IP]** -> **[Enter]**

Confirm the LAN port location is Port#1 or Port#2 in chapter 4.6.1, users can switch the port number by click **F3[PORT]** and set the IP address to Port#1 or #2 IP addr.

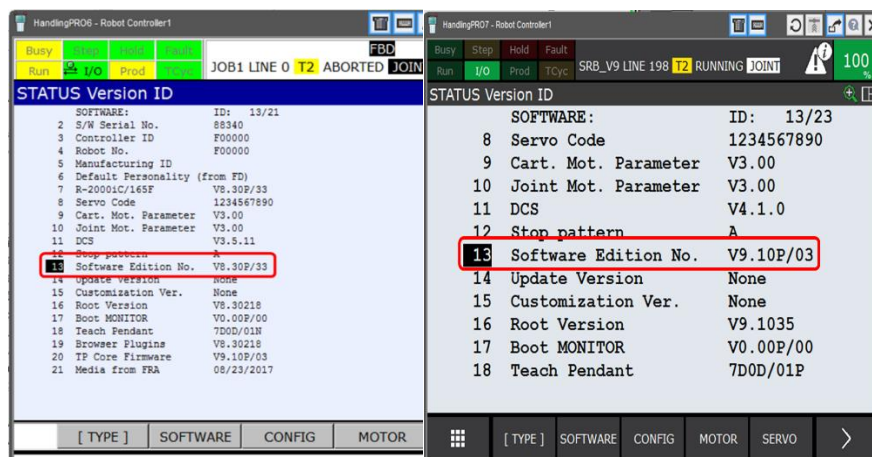


Step4 Check the software edition NO.

MENU -> 0 **[NEXT]** -> **Enter**

4 **[STATUS]** -> 2 **[Version ID]** -> **Enter**

Check the value of **[Software Edition No.]**.



Step5 Load srb_vX program

According to Step4, load the corresponding srb_vX.pc.pc to the robot controller.

Software Edition V8 → srb_v8.pc

Software Edition V9 → srb_v9.pc

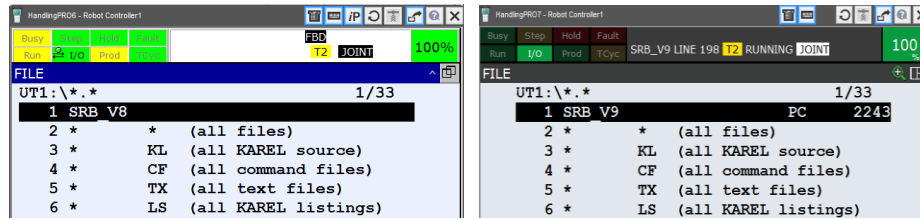
MENU -> 7 **[FILE]** -> 1 **[File]** -> **Enter**

F5 **[UTIL]** -> 1 **[Set Device]** -> **Enter**

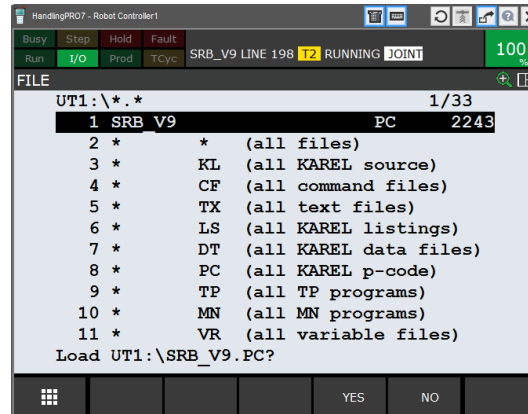
8 **[next page]** -> **Enter**

1 **[USB on TP]** -> **Enter**

1 **[all files]** -> **Enter**



Select the corresponding srb_vX.pc file->[F3][LOAD]->[F4][YES] , Load UT1:\ srb_vX.pc



Step6 Execute srb_vX program

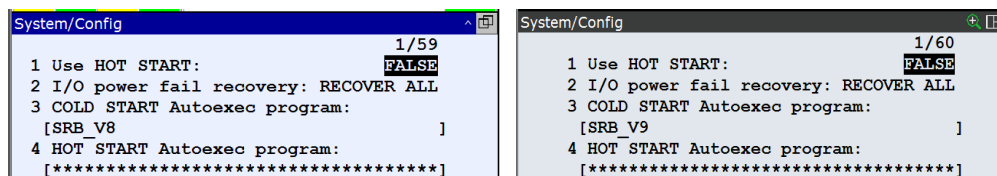
[MENU]->0 [NEXT] -> [Enter]

6 [SYSTEM]->5 [Config] -> [Enter]

Check the value of 1[Use HOT START] is FALSE, and select 3[COLD START Autoexec program]

Check the value of 1[Use HOT START] is TRUE, and select 4[HOT START Autoexec program]

[F4] [CHOICE]->[F3] [KAREL], select srb_vX program and then restart controller, after restart the srb_vX program will be executed.



Step7 Check the status of srb_vX program

[MENU]->0 [NEXT] -> [Enter]

4 [STATUS]-> 9 [Program] -> [Enter]

Check the status program by selecting [F2] [PREV] and [F3] [NEXT], the status of srb_vX program should be RUNNING .



STATUS Program		STATUS Program	
1 Task number:	1	1 Task number:	1
2 Task name:	SRB_V8	2 Task name:	SRB_V9
3 Program:	SRB_V8	3 Program:	SRB_V9
4 Routine:	SRB_V8	4 Routine:	SRB_V9
Line number:	198	Line number:	198
Status:	RUNNING	Status:	RUNNING

4.6.3. Notice

- SRB only support two kind of configuration of option modules as below:
 - 1.R651
 - 2.R650 + R553
- SRB using the standard MODBUS TCP communication to communicate with FANUC robot controller. If user would like to also enable MODBUS TCP Server (R800) option of FANUC robot controller, user need to change the value of system variable \$SNPX_PARAM.MODBUS_PORT from 502 to any other value(recommend to change to 501).
- SRB use the system variable \$SNPX_ASG for setting the standard MODBUS TCP communication. The assignment between Robot data and Holding Registers is defined by setting of \$SNPX_ASG. The \$SNPX_ASG is 80 arrays of \$SNPX_ASG[1]~[80],and SRB already use \$SNPX_ASG[1] ~ \$SNPX_ASG[40]. Besides, the address range of \$SNPX_ASG is from 1 to 16384, and SRB already use the range from 1 to 5000. If user would like to also enable MODBUS TCP Server (R800) option of FANUC robot controller, user can only use the \$SNPX_ASG from \$SNPX_ASG[41] to \$SNPX_ASG [80], and the address range from 5001 to 16384.
- Make sure loading the correct version of srb_vX.pc program with the corresponding software edition version of Fanuc robot controller.

Software Edition V8→ srb_v8.pc

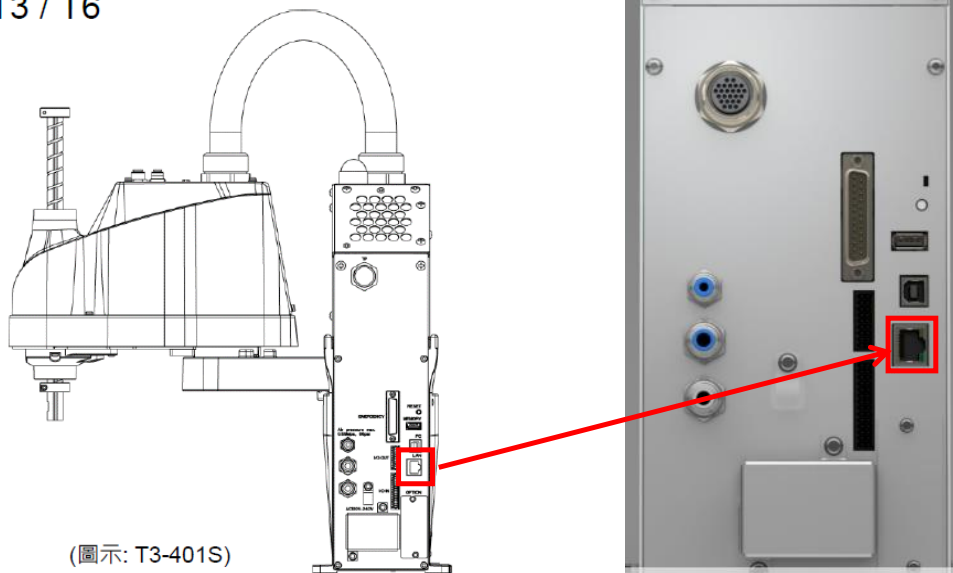
Software Edition V9→ srb_v9.pc

4.7. EPSON

4.7.1. Epson LAN port location

Two kind of Epson Robot controller: (1) T3/T6 series (2) RC90

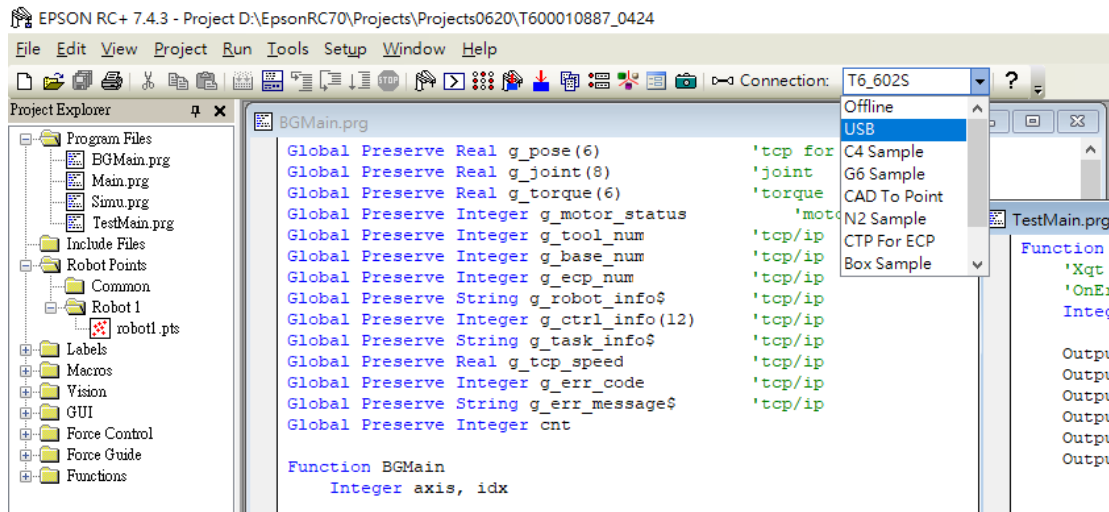
T3 / T6



4.7.2. Epson network IP Setting

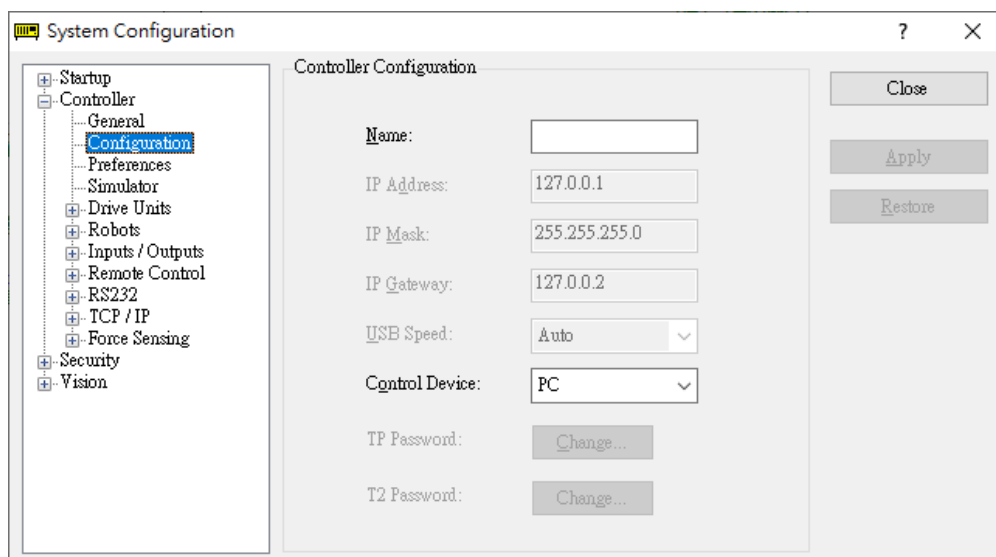
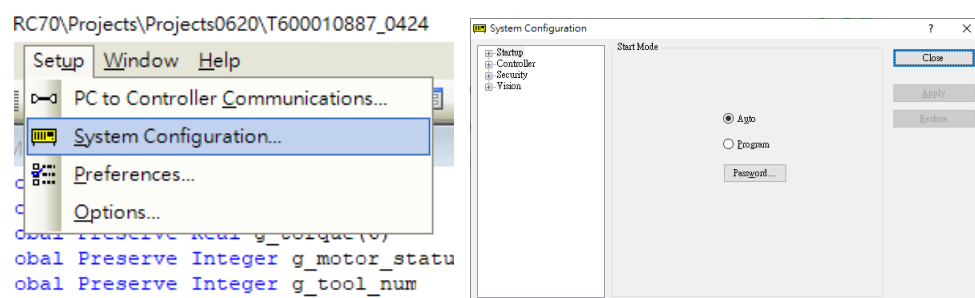
Step1 Connect to controller

Using communication cable (USB to PCL-06) to connect PC with Epson robot controller. PC should install Epson RC+ 7.0 software(https://epson.com/Support/Robots/Software/Epson-RC%2B-7-0/s/SPT_R12N793031), after install Epson RC+ 7.0, open the software and select USB connect.

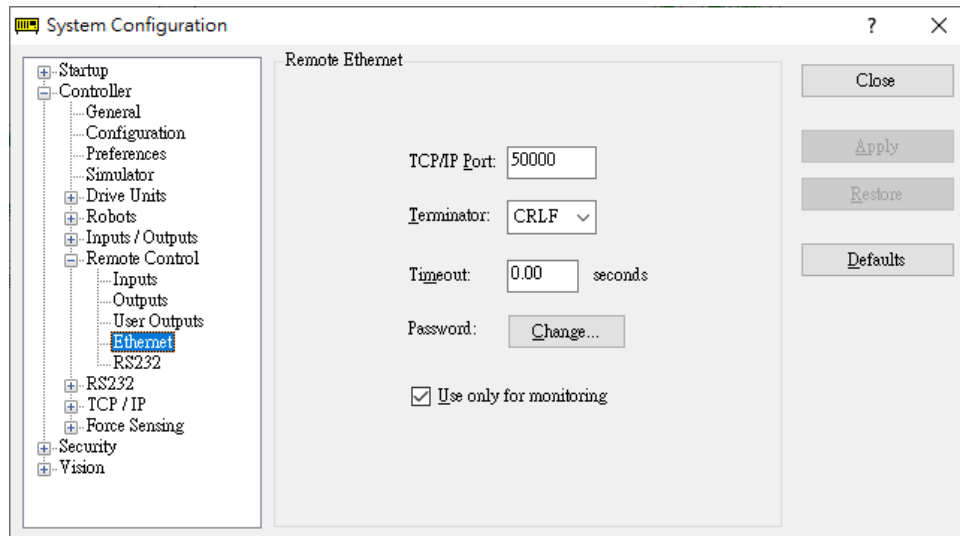


Step2 IP and Port setting

Setup->System Configuration->Controller->Configuration, enter the correct IP Address and then click Apply.



Controller->Remote Control->Ethernet, setting the correct TCP/IP Port and change the value of Timeout to 0. Select 「Use only for monitoring」 and then click apply.



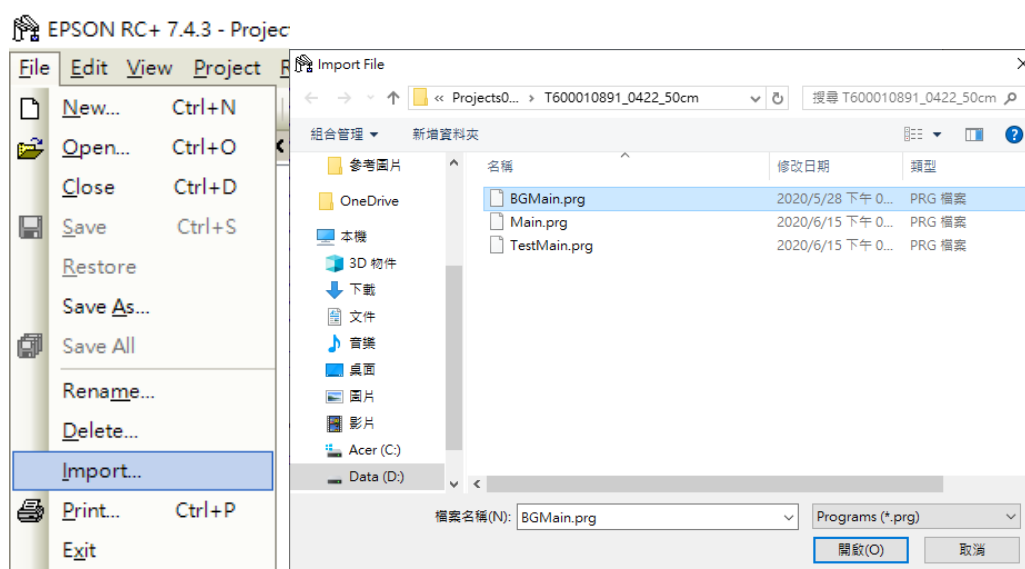
Note : If user would like to set the control Device to 「Remote Ethernet」, then user need to cancel the selection of 「Use only for monitoring」.

Step3 Epson Ethernet connection

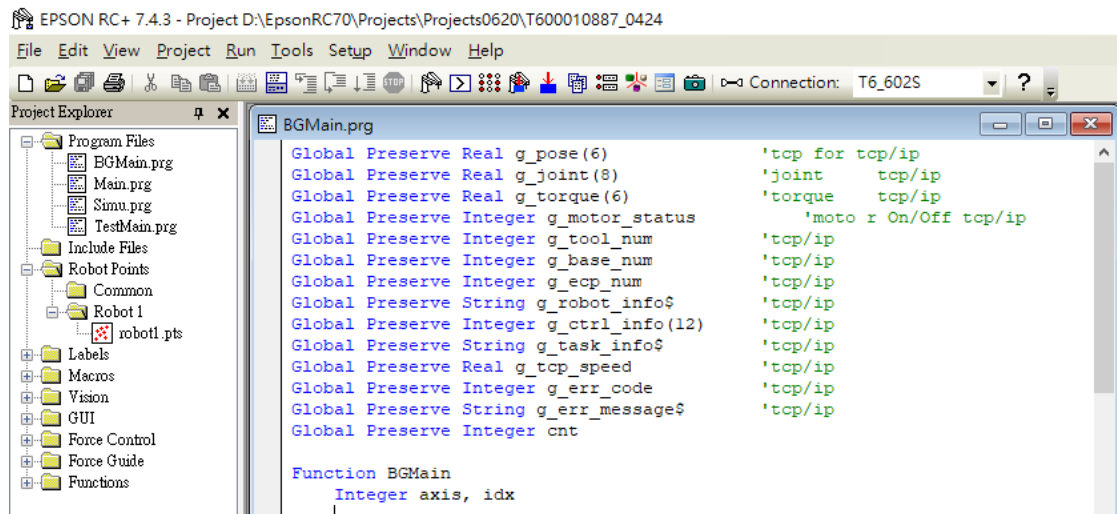
After configuration of Epson IP address, user need to restart the Epson robot controller, and use Ethernet cable to connect SRB and Epson robot controller(refer 3.1 and 4.7.1 for LAN port location).

4.7.3. Load Epson background program

Step1 File->Import , select 「BGMain.prg」

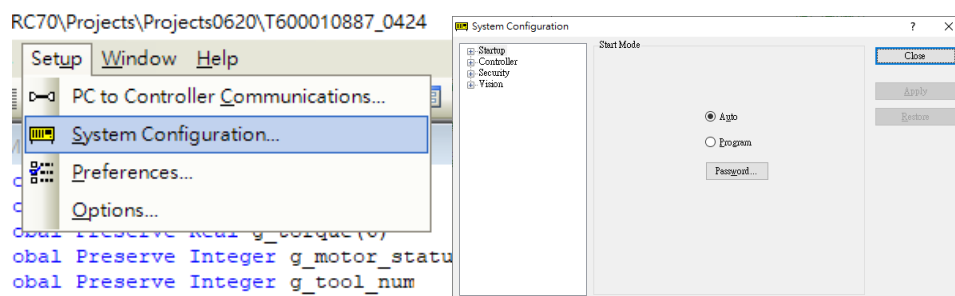


Step2 Confirm loading BGMain.prg program successfully.



Step3 Setting the program running in background.

Setup->System Configuration



Step4 Controller->Preferences, select 「Enable background tasks」 and click apply.

