UNIVERSAL ROBOTS

Connect UR with Keyence PLC(KV-7500) through EtherNet/IP

Version 1.0

Universal Robots

Contents

Purpose

Universal Root could support Ethernet IP(EIP) protocol as an adapter. Beside Rockwell's PLC, there are more and more PLC could support EIP protocol directly with an embedded industrial Ethernet port. Keyence PLC is popular in Asian market and the KV-7500 is a powerful model with the support of EIP scanner. This article is to guide how to connect Keyence PLC KV-7500 with UR robot(including CB3 and e-series).

Preparation

Download these files and documents

Download the EDS file(UniversalRobot.eds) and mapping file of registers (eip-iomessage) from the link below.

https://www.universal-robots.com/how-tos-and-faqs/how-to/ur-how-tos/ethernet-ip-guide-18712/

eip-iomessage

UniversalRobot.eds

Hardware environment

Communication role	Item	Description
Keyence EtherNet/IP: Scanner	CPU module KV-7500	CPU module with EtherNet/IP
	IO module KV-B8XTD	8 Input/8 Output (Sink)
	Power supply KV-PU1	Providing 24V DC to all PLC modules
Universal Robots EtherNet/IP: Adapter	UR5	CB3.1 or e-series
PC	T490	Laptop

Software environment

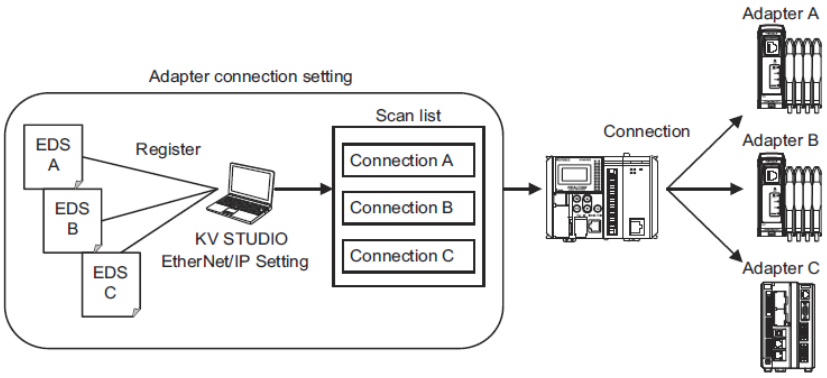
Communication role	Software	Description
Keyence EtherNet/IP: Scanner	KV-STUDIO 11.06 or higher	KV-H9G PC software for KV series
Universal Robots EtherNet/IP: Adapter	UR Software: 3.15.4 or 5.11.5 or higher	
Laptop	Windows10 Professional 64bit	

What is EDS file and its function?

Electronic Data Sheets (EDS) are simply ASCII files that describe how a device can be used on an EtherNet/IP network. It describes the objects, attributes and services available in the device.

At the minimum, an EDS file conveys the identity information required for a network tool to recognize the device.

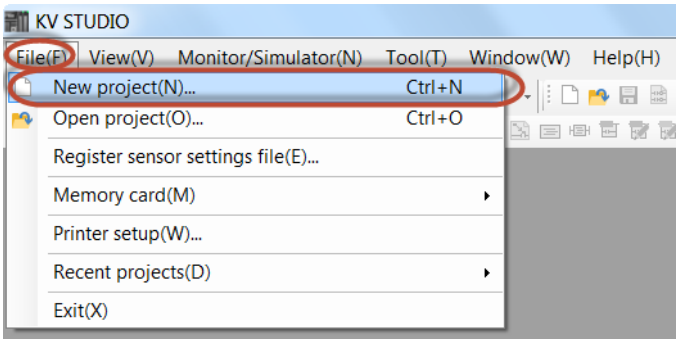
details please refer to https://www.rtaautomation.com/ethernetip-eds-update/

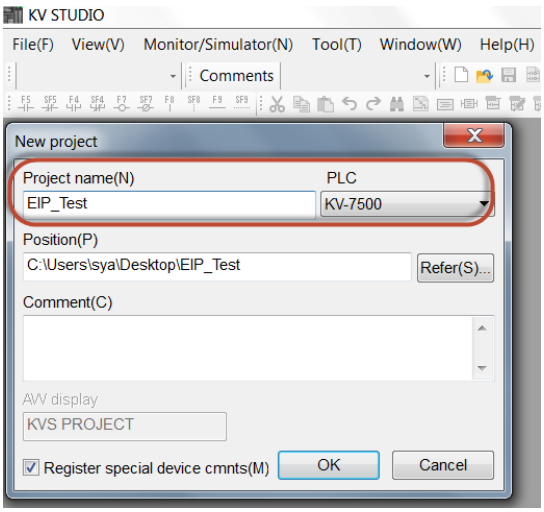


Setup procedure

Step1. Create a new project

- 1.1 Prepare a USB cable(USB A - USB B) to connect your laptop with the Keyence PLC.
- 1.2 Choose the saving path, project name, and PLC type KV-7500. Here the project name is “EIP_Test”.

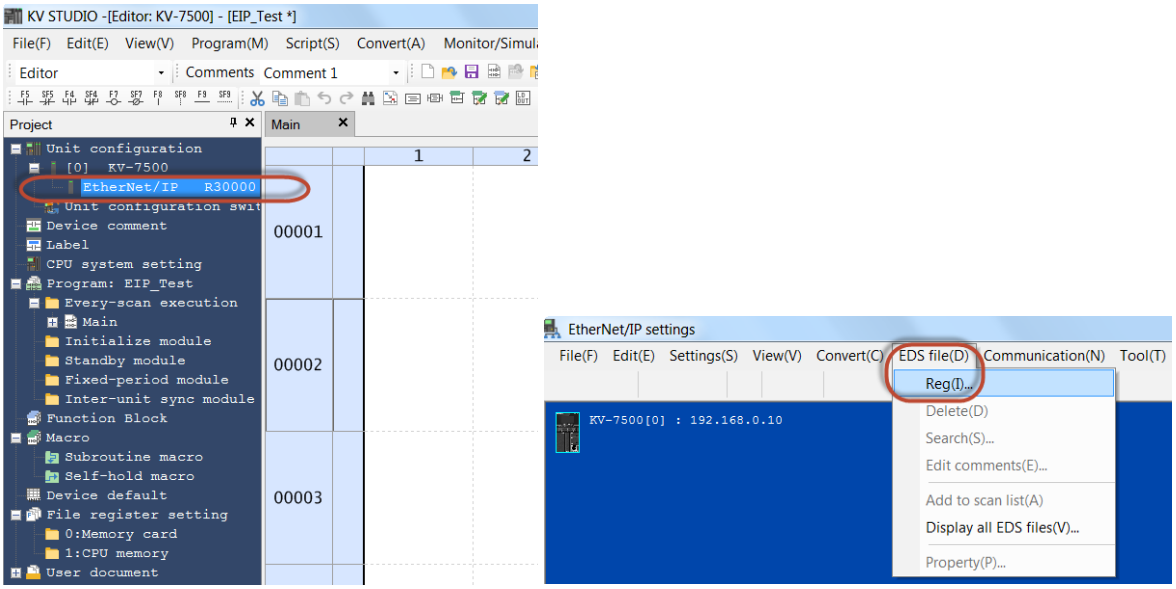




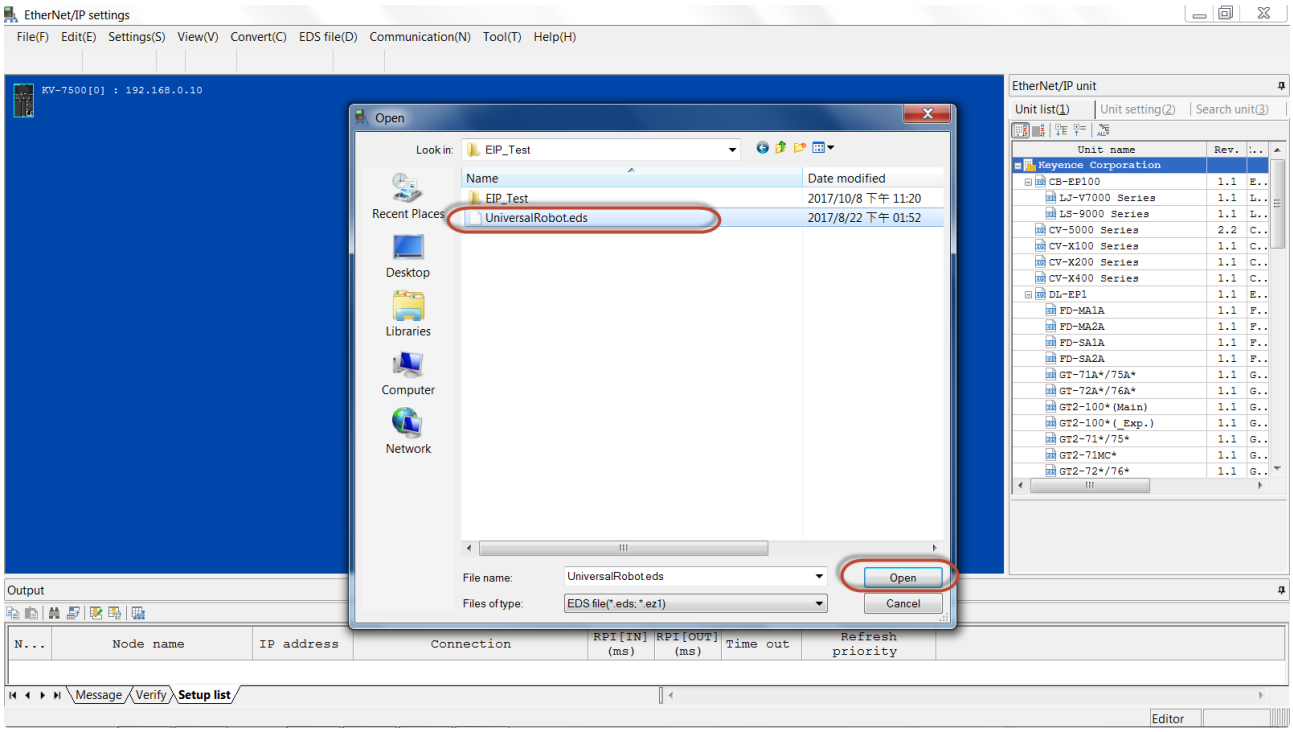
1.1

Step2. Import the UR EDS file into KV-STUDIO

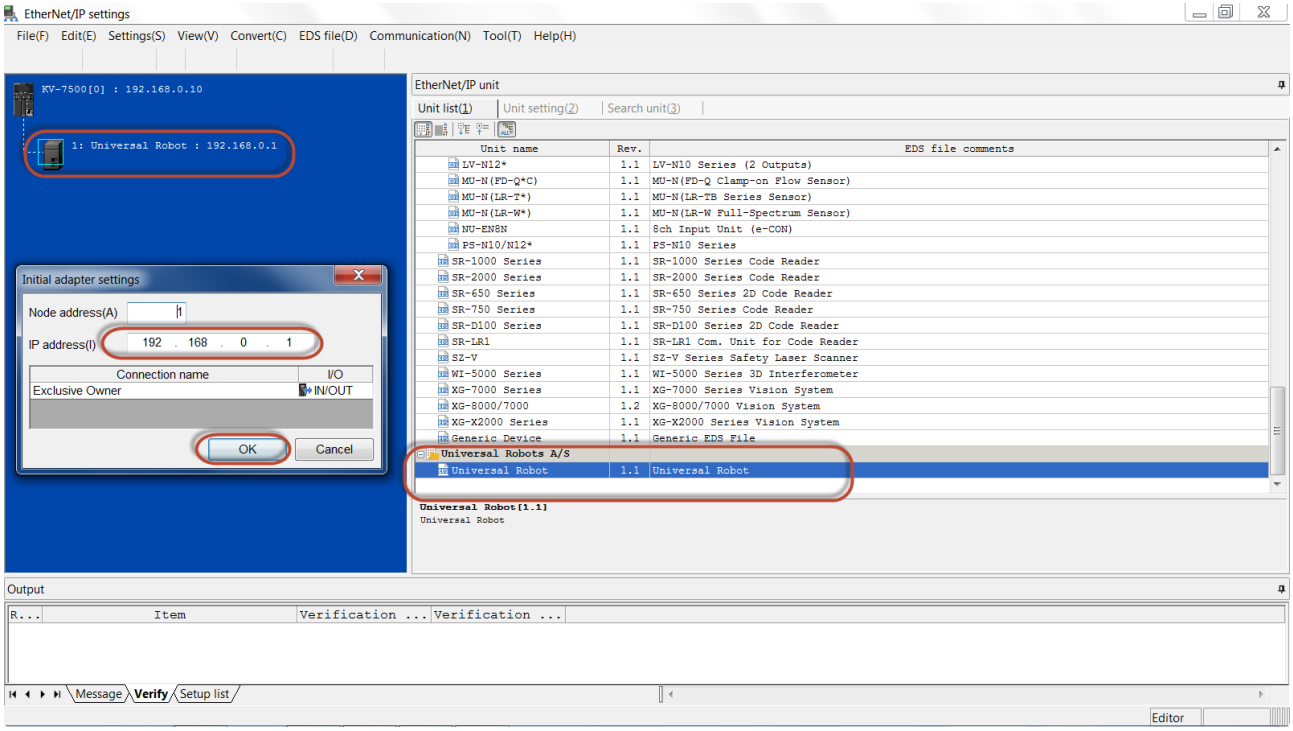
- 2.1 On the left-side of KV-STUDIO, double click the icon of EtherNet/IP
- 2.2 You will see two windows showing up and then import the EDS file of UR under EDS file->Reg
- 2.3 Drag and drop “Universal Robots” EDS icon from the right side to the left side. Configurate the Adapter’s IP (UR robot) as **192.168.0.1**
- 2.4 You can see the auto-mapping addresses **Input: W00-0EF, Output: W0F0-W015F on the PLC side**.



2.1



2.2



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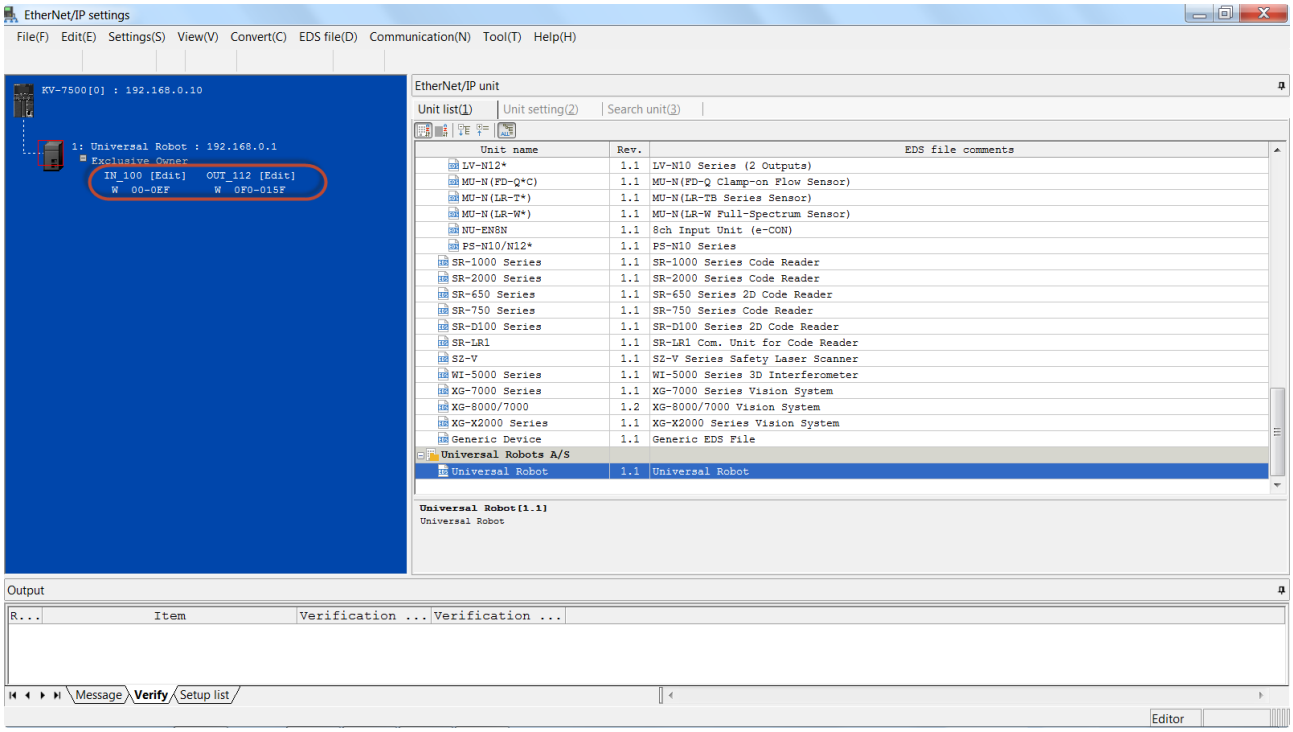


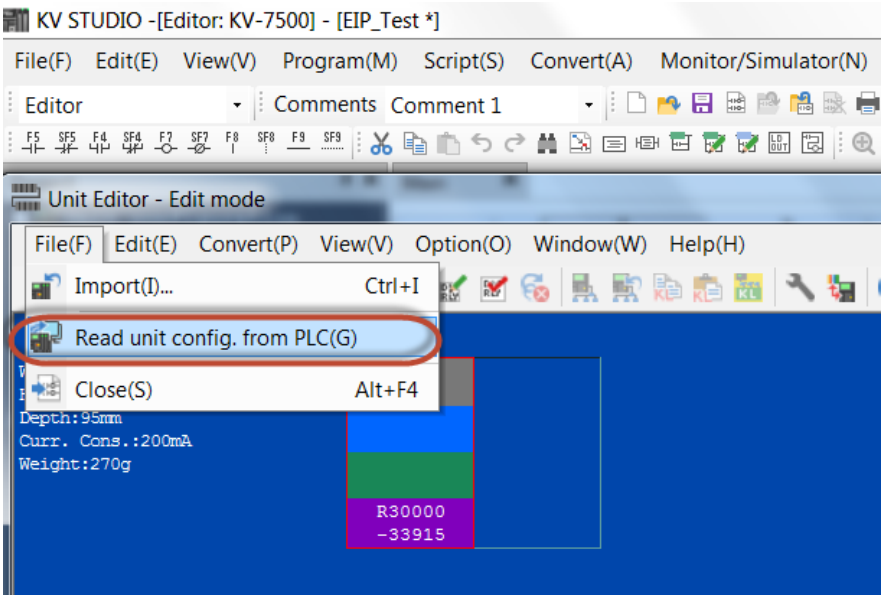
2.4

Step3. Set IP address for the PLC and the Robot in the same IP group

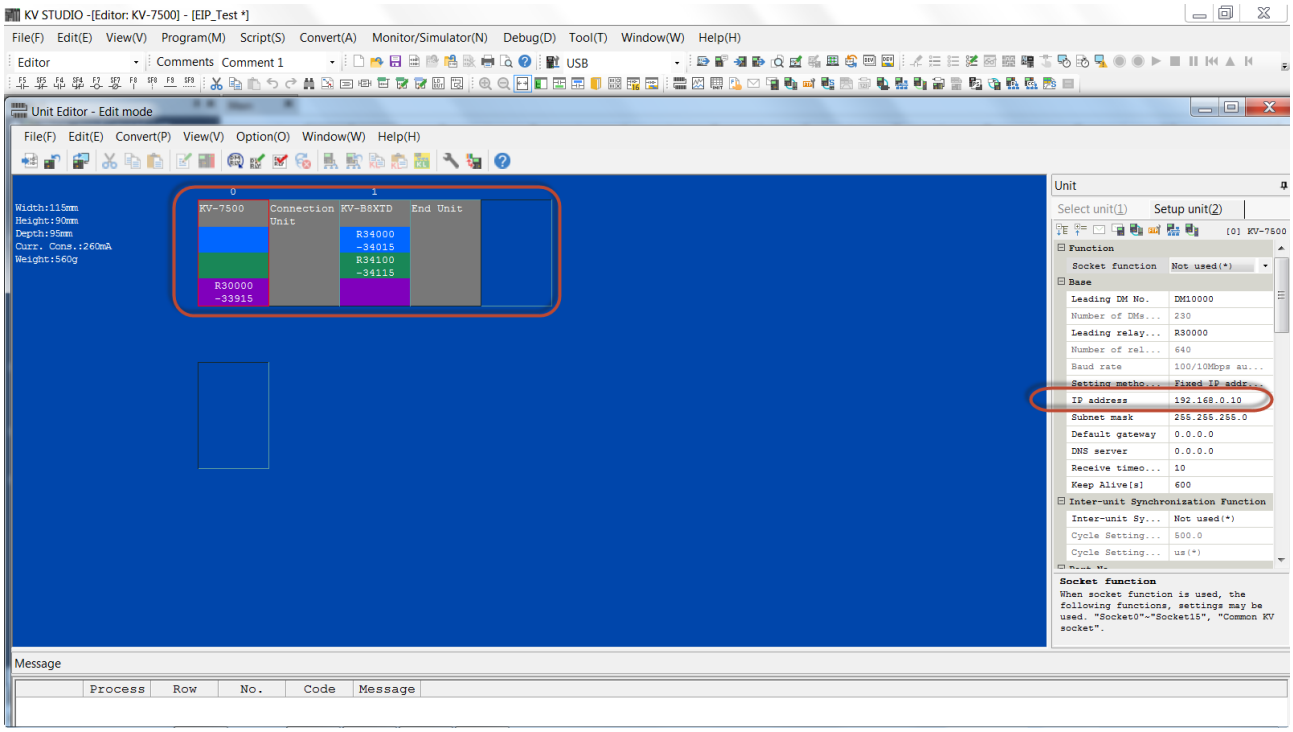
- 3.1 Read back the PLC's hardware configuration

- 3.2 Choose static method for the PLC and Robot as the IP addresses in the following table.
- 3.3 Transfer the configuration to the PLC and apply the IP configuration(192.168.0.1) to the robot.

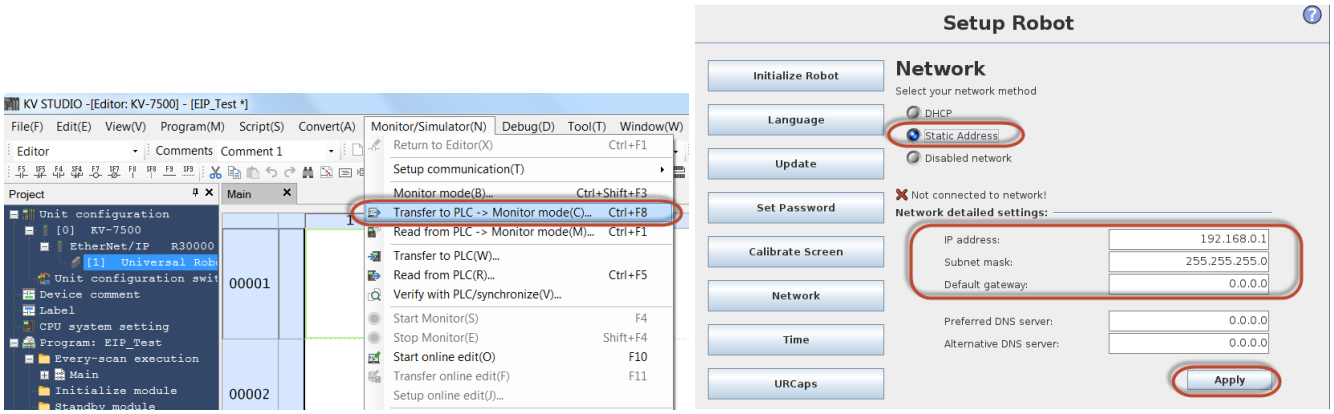
	PLC	Robot
IP address	192.168.0.10	192.168.0.1
Subnet mask	255.255.255.0	255.255.255.0



3.1



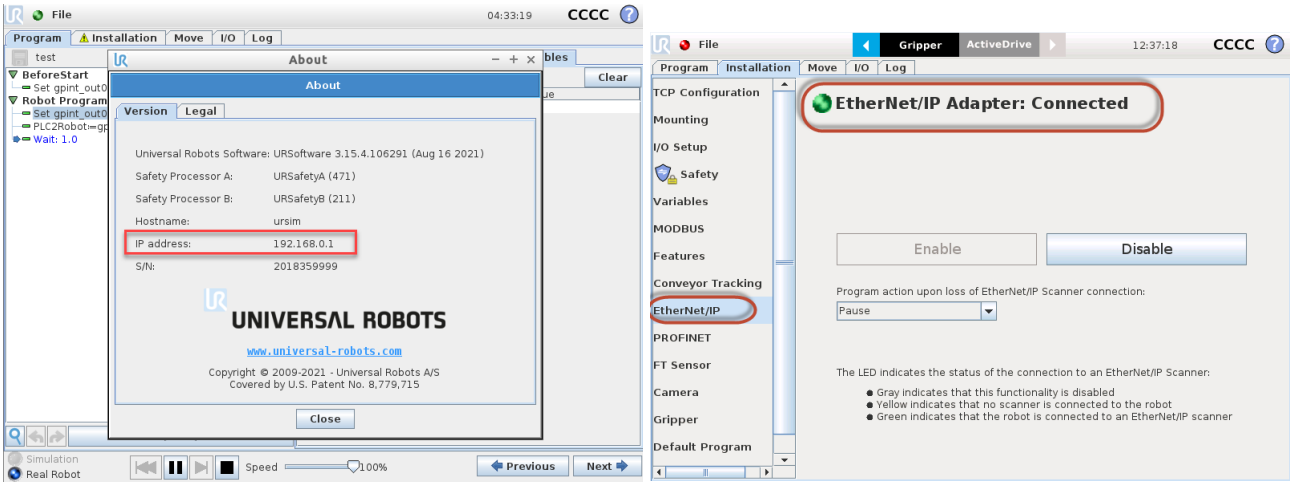
3.2



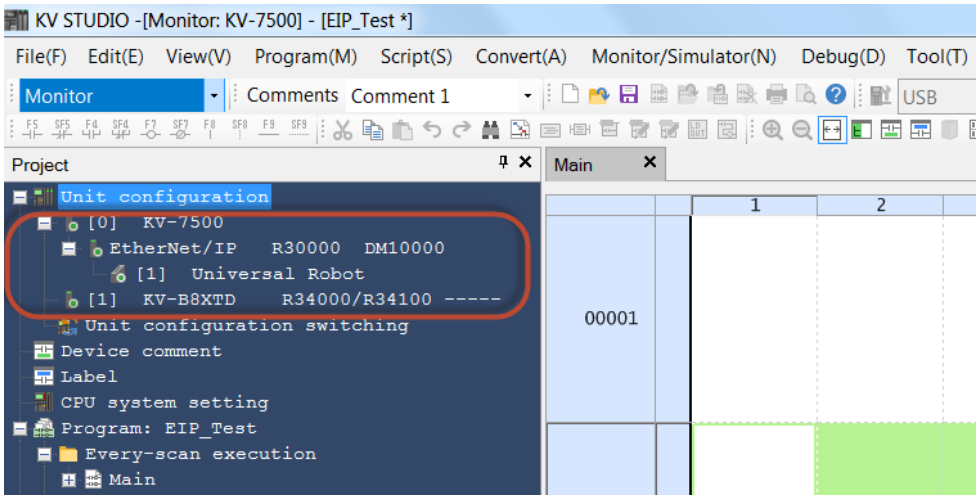
3.3

Step4. Confirm the connection

- 4.1 Plug an Ethernet cable between the PLC and the robot.
- 4.2 Confirm the successful connection from the PolyScope.
- 4.3 On the installation tab, confirm the EtherNet/IP Adapter: Connected
- 4.4 On the PLC, you can monitor the status of all the hardware devices read back and EtherNet/IP status.



4.1



4.2

Step5. Monitor and control the mapping registers on the PLC

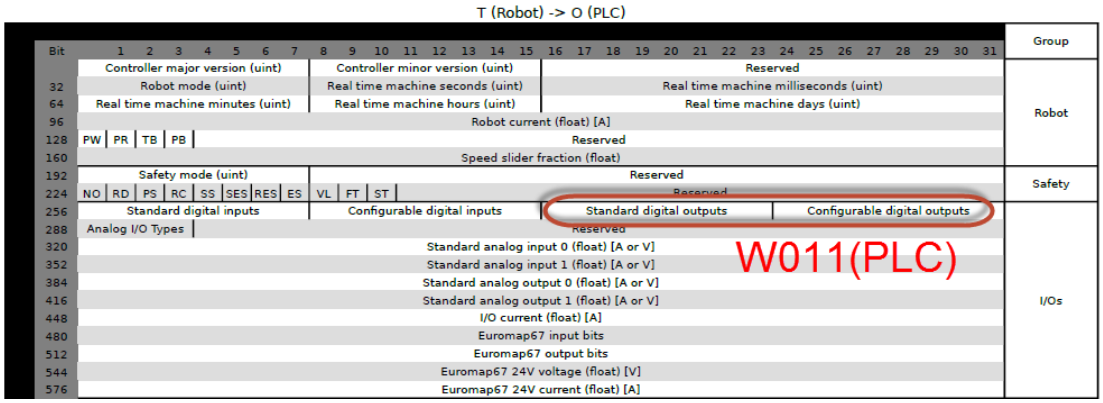
- 5.1 Open the “Batch monitor window” and key in W00 to start monitoring all sequential registers.
- 5.2 Refer to the ”eip-iomessage” file and your local PLC registers are mapping automatically as follows

PLC’s 16-bit registers from **W00-W0EF will be mapping to T (Robot) -> O (PLC)**

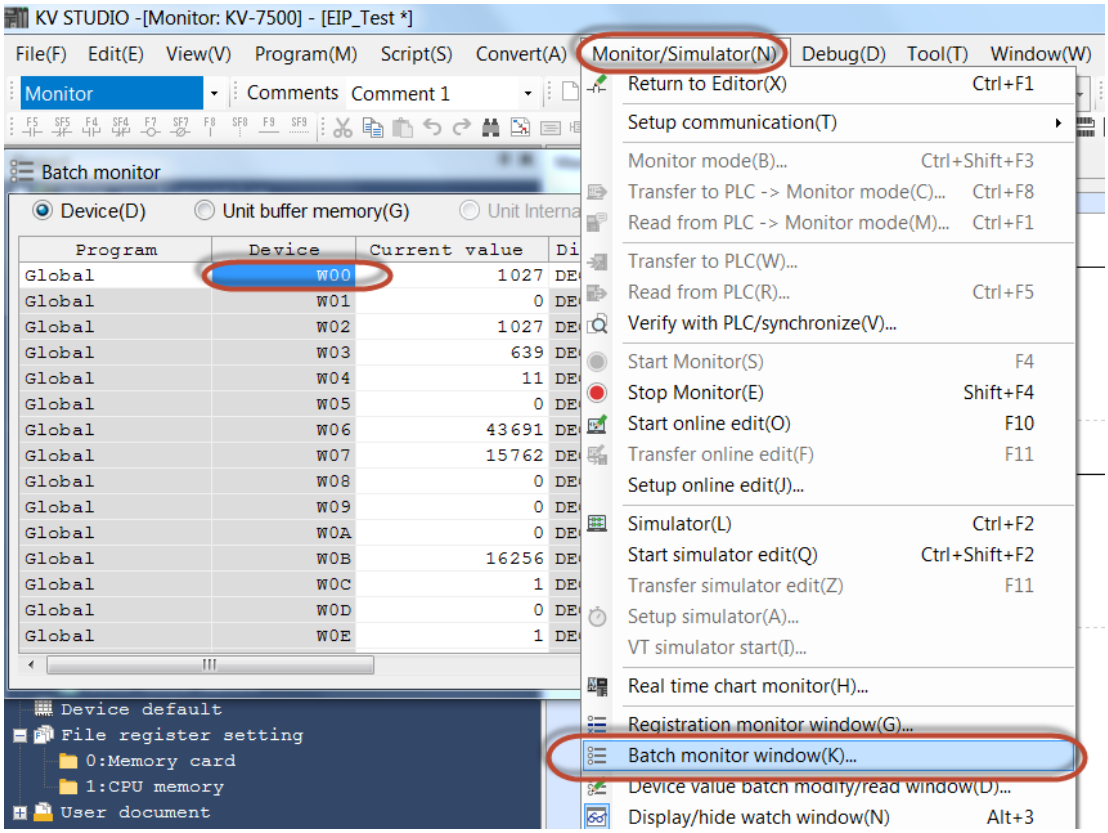
PLC’s 16-bit registers from **W0F0-W015F will be mapping to O (PLC) -> T (Robot)**

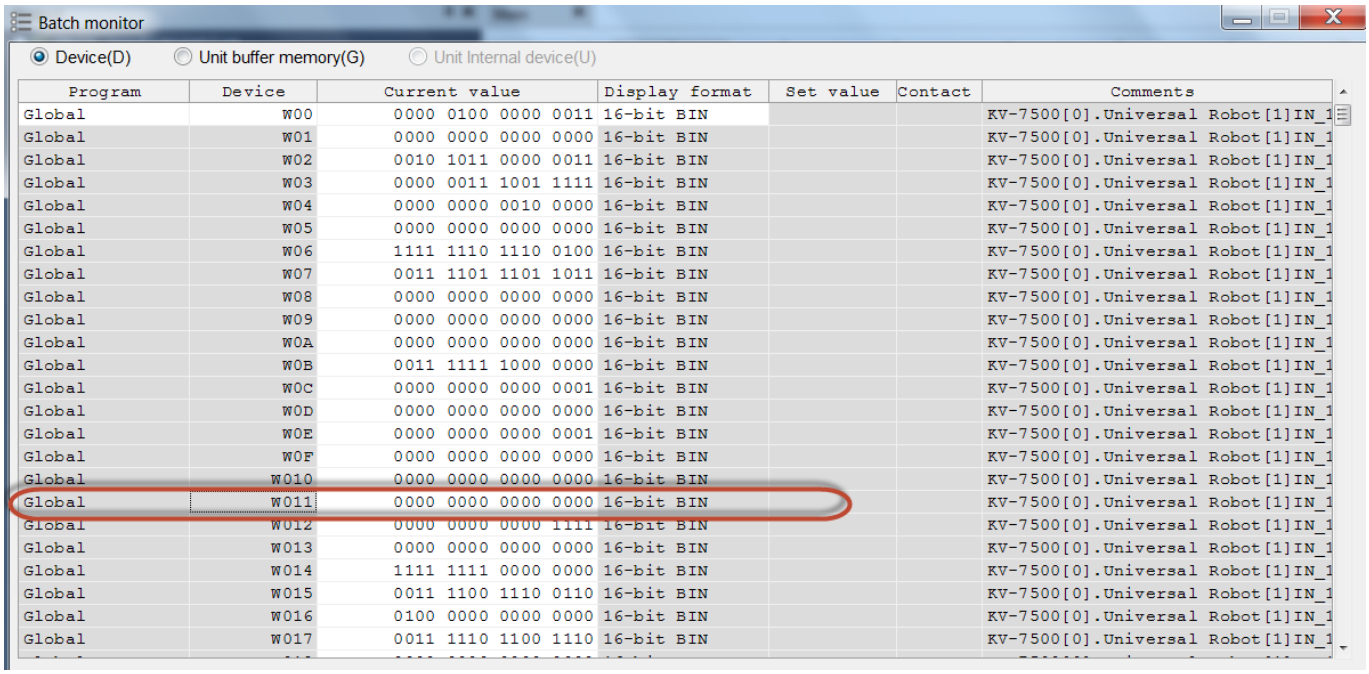
For example:

W011(16-bit) is mapping to ”Standard digital outputs + Configurable digital outputs” so you can control digital outputs on the robot and then check W011 status on the PLC.



5.1





Program	Device	Current value	Display format	Set value	Contact	Comments
Global	W00	0000 0100 0000 0011	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W01	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W02	0010 1011 0000 0011	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W03	0000 0011 1001 1111	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W04	0000 0000 0010 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W05	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W06	1111 1110 1110 0100	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W07	0011 1101 1101 1011	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W08	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W09	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W0A	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W0B	0011 1111 1000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W0C	0000 0000 0000 0001	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W0D	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W0E	0000 0000 0000 0001	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W0F	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W010	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W011	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W012	0000 0000 0000 1111	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W013	0000 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W014	1111 1111 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W015	0011 1100 1110 0110	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W016	0100 0000 0000 0000	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1
Global	W017	0011 1110 1100 1110	16-bit BIN			KV-7500[0].Universal Robot[1]IN_1

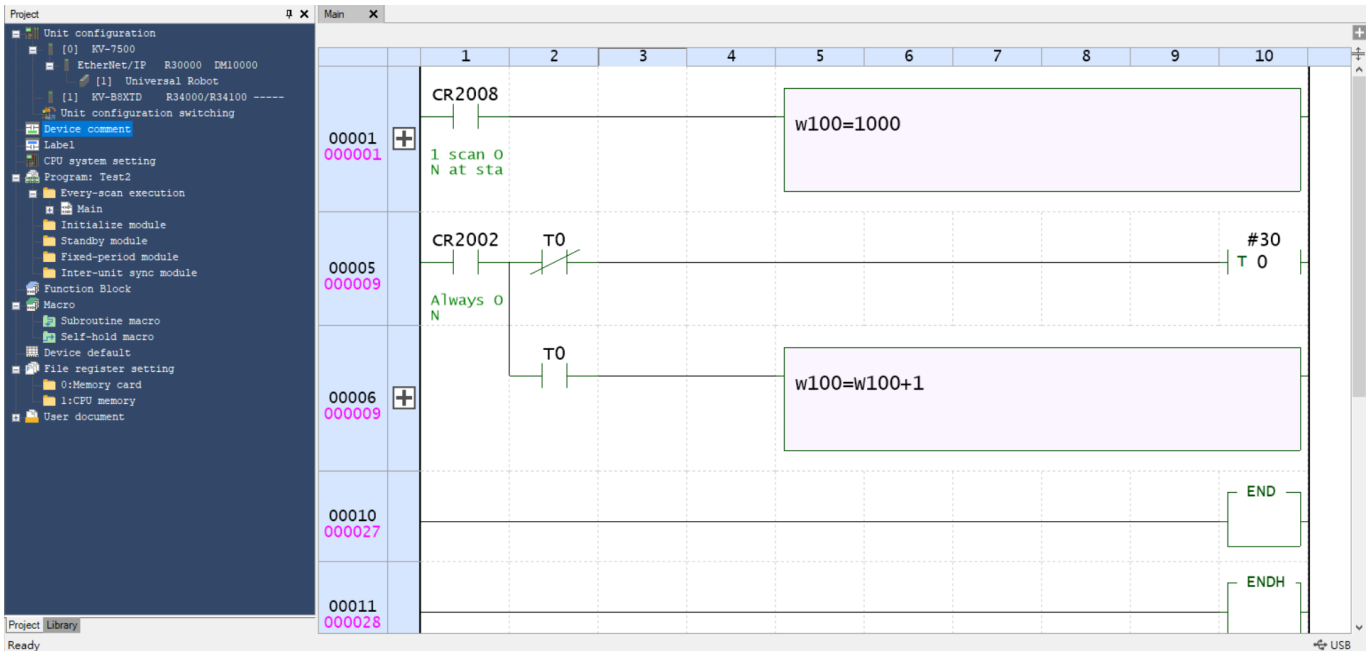
5.2

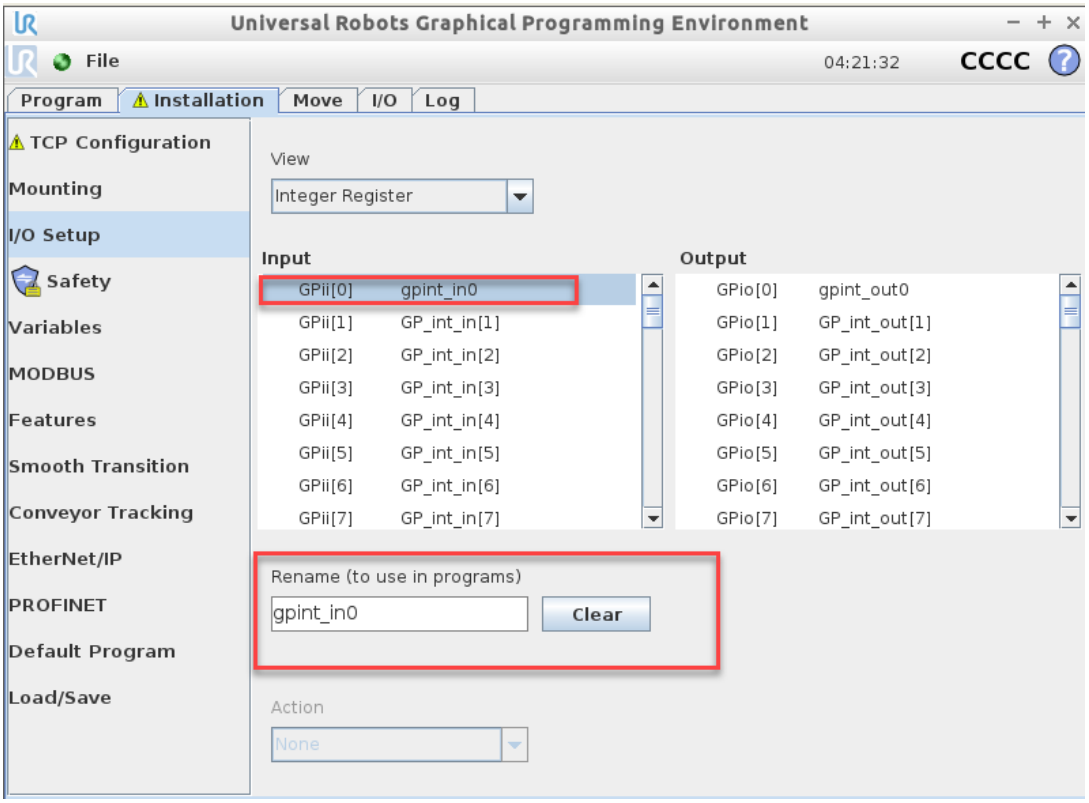
Example of accessing robot's GP registers

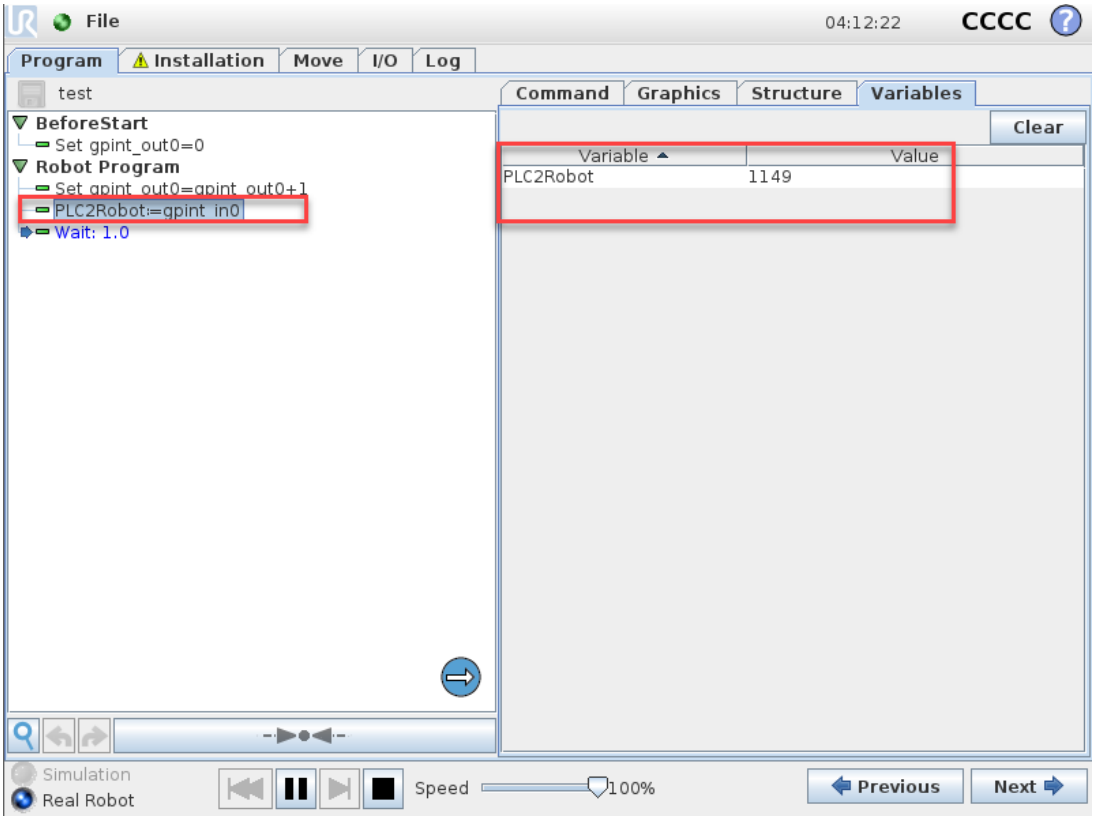
PLC write robot's input registers

According to the "eip-iomessage" file, "Int input register 0" is mapping to the PLC's W100 and W101 registers.

A PLC program like below to write register W100 **from value 1000 every 3 sec** and you can monitor this register on the robot program by naming GPii[0] in the installation tab to check whether the communication is successful. In this example, the variable name is gpint_in0.



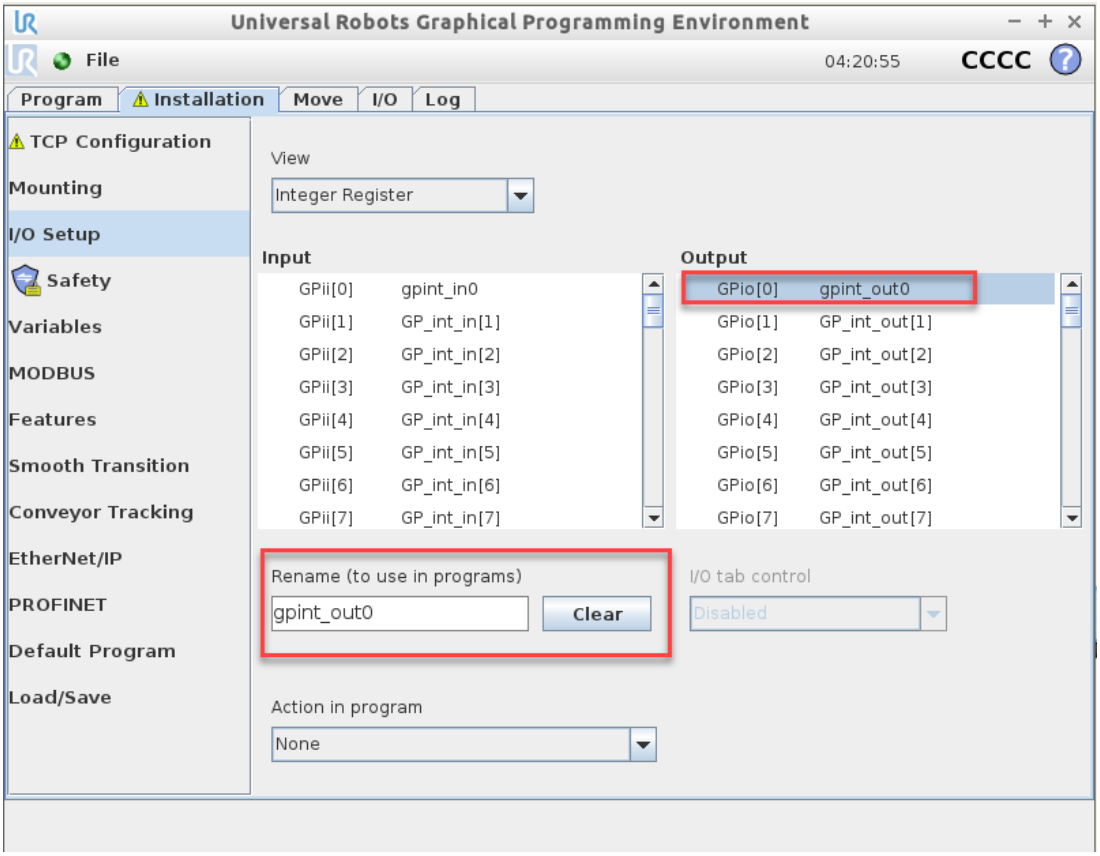


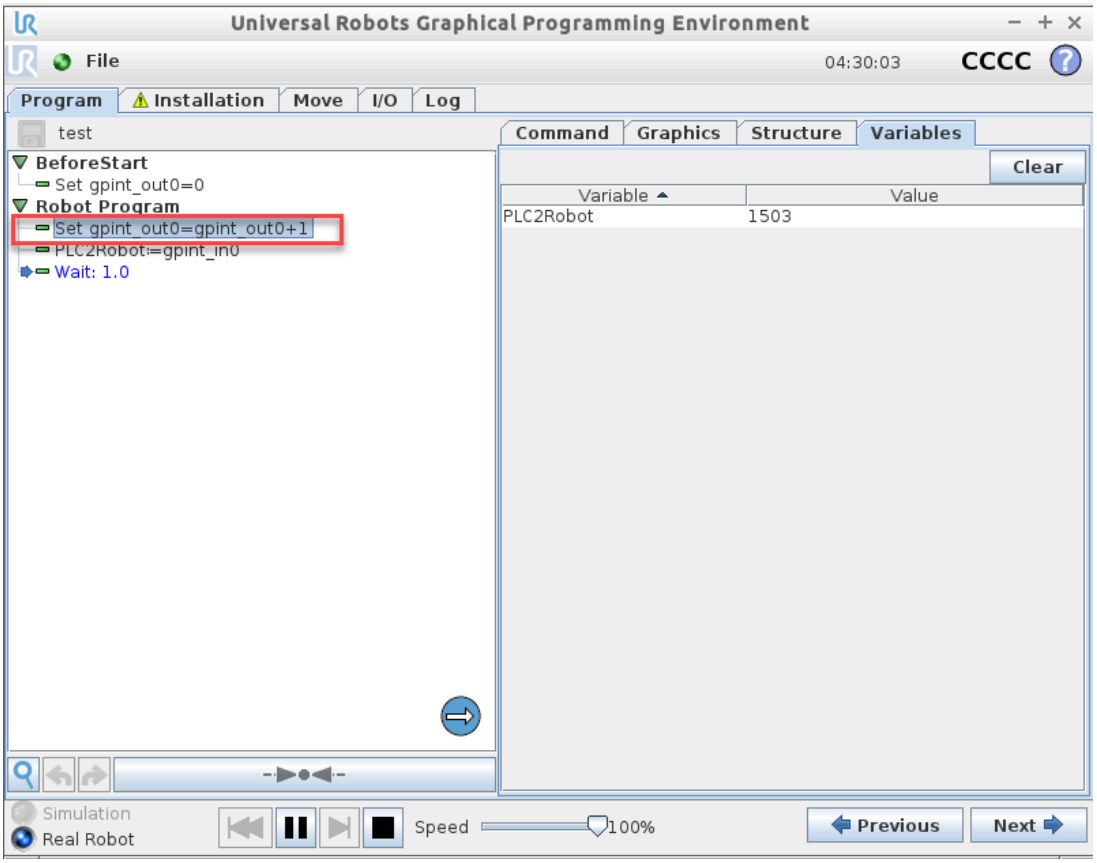


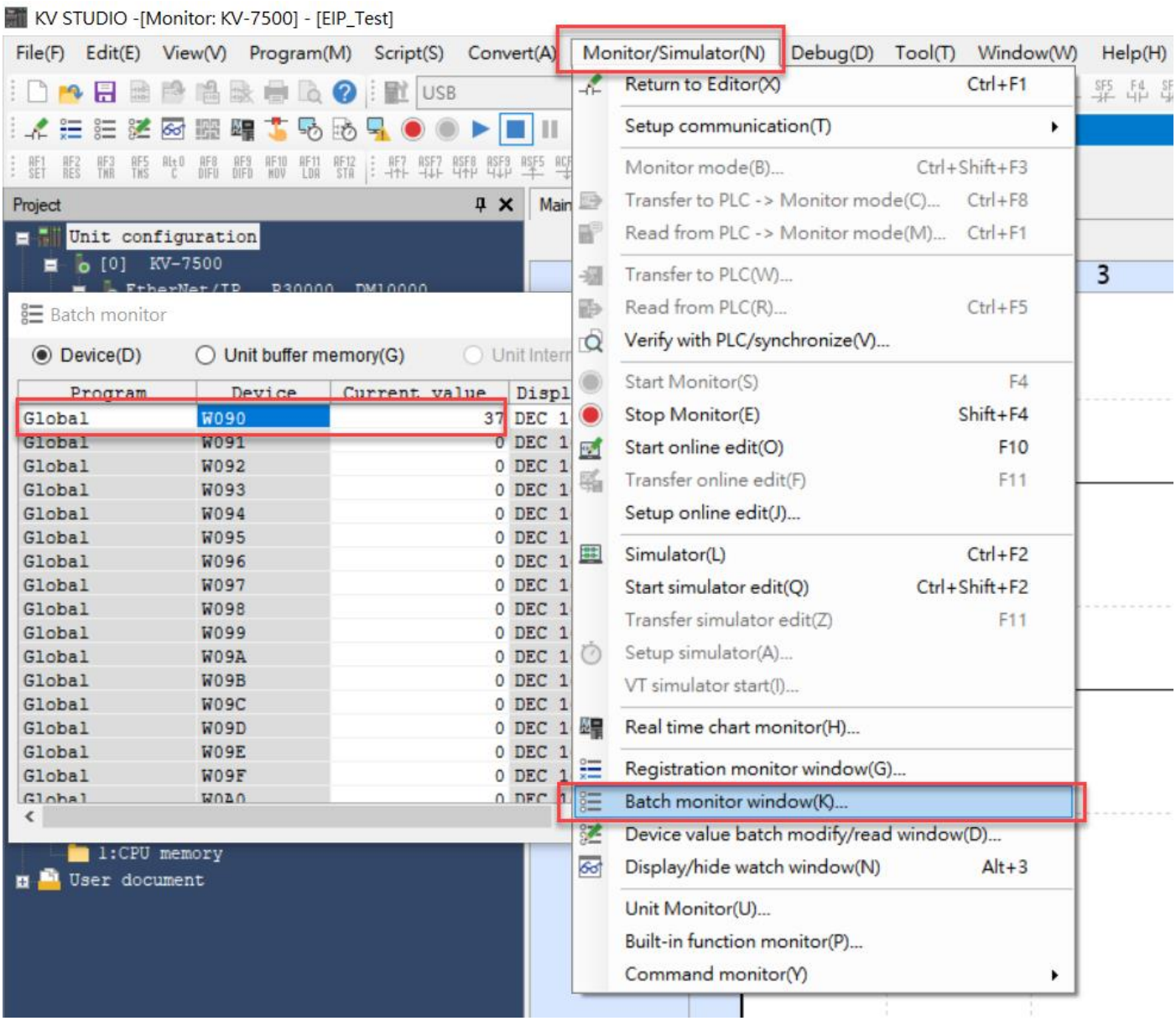
PLC read robot's output registers

According to the "eip-iomessage" file, Int output register 0 is mapping to the PLC's W90 and W91 registers.

Write a robot program like below to write to register W90 **from value 0 every 1 sec** by naming GPio[0] in the installation tab. In the example, the variable name is gpint_out0. Go to PLC's programming environment to monitor the value of W90 register by clicking the "Batch monitor window" and then key in W90 like below.






KV STUDIO -[Monitor: KV-7500] - [EIP_Test]
File(F) Edit(E) View(V) Program(M) Script(S) Convert(A) Monitor/Simulator(N) Debug(D) Tool(T) Window(W) Help(H)
Project
Unit configuration
[0] KV-7500
Batch monitor
Device(D)
Unit buffer memory(G)
Program Device Current value Displ
Global W090 37 DEC 1
Global W091 0 DEC 1
Global W092 0 DEC 1
Global W093 0 DEC 1
Global W094 0 DEC 1
Global W095 0 DEC 1
Global W096 0 DEC 1
Global W097 0 DEC 1
Global W098 0 DEC 1
Global W099 0 DEC 1
Global W09A 0 DEC 1
Global W09B 0 DEC 1
Global W09C 0 DEC 1
Global W09D 0 DEC 1
Global W09E 0 DEC 1
Global W09F 0 DEC 1
1:CPU memory
User document
Return to Editor(X) Ctrl+F1
Setup communication(T)
Monitor mode(B)... Ctrl+Shift+F3
Transfer to PLC -> Monitor mode(C)... Ctrl+F8
Read from PLC -> Monitor mode(M)... Ctrl+F1
Transfer to PLC(W)...
Read from PLC(R)... Ctrl+F5
Verify with PLC/synchronize(V)...
Start Monitor(S) F4
Stop Monitor(E) Shift+F4
Start online edit(O) F10
Transfer online edit(F) F11
Setup online edit(J)...
Simulator(L) Ctrl+F2
Start simulator edit(Q) Ctrl+Shift+F2
Transfer simulator edit(Z) F11
Setup simulator(A)...
VT simulator start(I)...
Real time chart monitor(H)...
Registration monitor window(G)...
Batch monitor window(K)...
Device value batch modify/read window(D)...
Display/hide watch window(N) Alt+3
Unit Monitor(U)...
Built-in function monitor(P)...
Command monitor(Y)