EECO

YASKAWA

Integration into EtherNet /IP Networks

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INTRODUCTION

OVERVIEW

The purpose of this guide is to help technicians and engineers integrate Yaskawa Variable Frequency Drives (VFD) into a new or existing EtherNet/IP network, specifically Rockwell Automation (RA) Programmable Logic Controllers (PLC). EtherNet/IP (EIP) is being used in a wide range of industries and is one of the fastest growing industrial protocols in the United States. EtherNet/IP is an open source implementation, thus allowing for the continuous development and support from industry leaders (such as Yaskawa), ensuring that this industrial application layer protocol support sustainability.

Instructions and examples will be based on Yaskawa Tag Generator, Yaskawa add-on instructions, RSLINX, and a Compact/ControlLogix™ PLC platform, configured with the RSLogix 5000 or Studio 5000 (RS5K) software environment. This guide will navigate, configure and explore the functionality of Yaskawa Tag Generator.

The Yaskawa Tag Generator was developed to allow technicians and engineers to select multiple Yaskawa EtherNet/IP products, their functions (pre-defined I/O assemblies), and then output the compiled data to a Comma Separated Value (CSV) file. Once imported into the RS5K environment, these tags are then aliased to generic tags created when adding the Yaskawa module[s], thus simplifying integration and reducing commissioning time.

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PRE-REQUISITE SKILLS

This document is written and intended for technicians and engineers who will be commissioning and/or supporting Yaskawa VFD[s] on the plant floor. The intended users should understand, at the very least, navigation through the RS5K software environment.

REQUIRED HARDWARE/SOFTWARE

1. Yaskawa VFD with Optional Communication Card- (CIMR-VU2A0001FAA - V1000 with the SI-EN3/V in our case)
2. PC with RSLINX and RS5K
3. Rockwell Logix PLC (1756-L71 ControlLogix in our case)

** Note: All Yaskawa EDS files and software may be downloaded from Yaskawa.com via links provided in the Appendices.*

COMMUNICATION

VFD COMM METHODS

Initial connection to the Yaskawa VFD can be accomplished in a couple of ways:

1. Direct connect via PLC to VFD
2. Common Switch or Router Connect via ports on the same switch
3. Network connection via multiple switches and/or wireless access points

VFD DEFAULT CONFIGURATION AND PREPARATIONS

Open DeviceNet Vendor Association (ODVA), the governing body of EtherNet/IP, which specifies that all EIP supporting devices, including Yaskawa VFD, by default must be set to use Dynamic Host Controller Protocol (DHCP) to get the network settings.

This corresponding requirement is reflected in parameter F7-13 (Address Mode at Startup: 2 by default). If a DHCP server does not exist within the network topology, proceed to change the network settings manually to a static setting.

Using the keypad or Drive Wizard Industrial software, the option card's network settings (IP Address, Subnet Mask and Default Gateway) can be configured under the F7 parameters. Additional User Setting Table information can be found within the Yaskawa AC Drive Technical Manual – SIEPC71060618: E.3 - page 491.

YASKAWA VFD NETWORK PARAMETERS:

- F7-01 Ethernet IP Address 1 — 192
- F7-02 Ethernet IP Address 2 —168
- F7-03 Ethernet IP Address 3 — 1
- F7-04 Ethernet IP Address 4 — 1-254
- F7-05 Subnet Mask 1 — 255
- F7-06 Subnet Mask 2 — 255
- F7-07 Subnet Mask 3 — 255
- F7-08 Subnet Mask 4 — 0
- F7-09 Gateway Address 1 — 192
- F7-10 Gateway Address 2 — 168
- F7-11 Gateway Address 3 — 1
- F7-12 Gateway Address 4 — 1
- F7-13 Address Mode at Startup — 0 from 2 to become static, then cycle power.

To confirm network settings after the power cycle, we can verify the settings under the Monitor parameters U6-80 to U6-91. Values are preset if the option card has a connection to another device.

The network LED (NS) should now transition to a solid green state.

ENABLE COMM CONTROLS CONFIGURATION

The following parameters must be changed to enable fieldbus controls.

- B1-01 to 3: Option PCB (Frequency Reference Selection 1) Default is = 1 Analog Input
- B1-02 to 3: Option PCB (Run Command Selection 1) Default is = 1 Digital Input

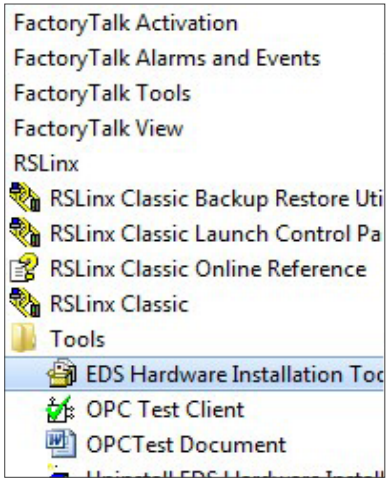
**New values will accept immediately without a Power Cycle*

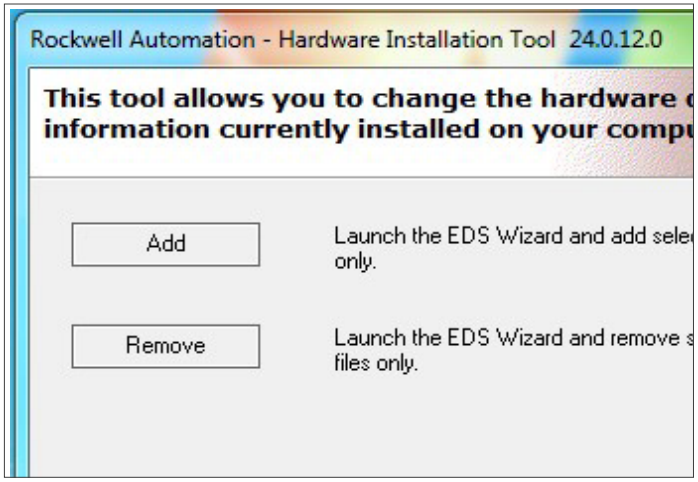
PC CONFIGURATION

1. Open **Network and Sharing Center** from the task bar or under Control Panel.
2. If no connection is present on your PC network port (RJ45), select **change adapter settings** on the left side bar.
3. Double click **Local Area Connection**, then **properties**, and double click on **(TCP/IPv4)**
4. Configure the PC's static network settings by selecting **"Use the following IP Address:"**
5. Input an **unused IP Address** that is on the same subnet as previously mentioned in the VFD configured option.
6. Input the same **Subnet mask** and **Default Gateway** as previously used in the VFD configuration.
7. Select **OK** and **OK** again on the Local Area Connection Properties window and the settings are ready.

ROCKWELL AUTOMATION ENVIORNMENTS

RSLINX



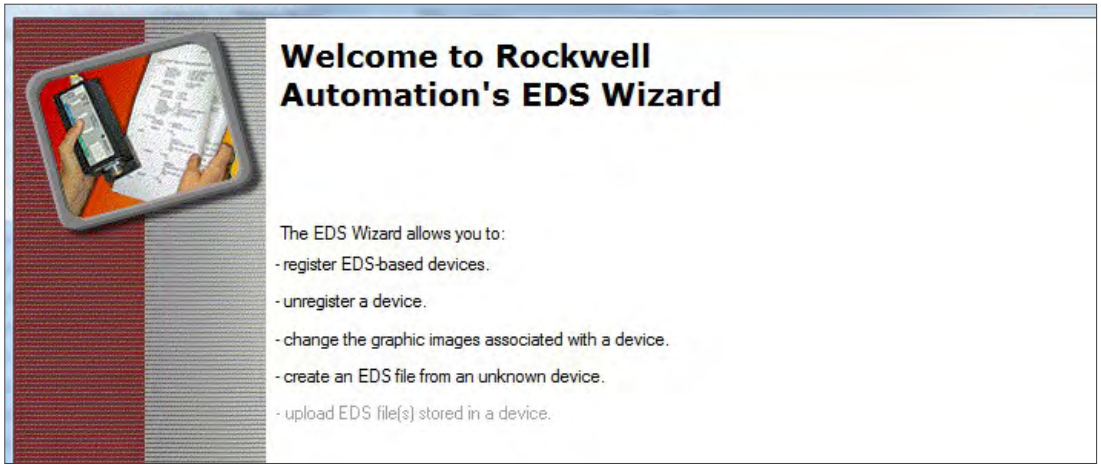


Let's start off by registering the EATON EDS files into RSLINX with the EDS Wizard.

Open the start menu and under RSLINX

STEP 1: Select the **EDS Hardware Installation Tool**

STEP 2: Select **add**

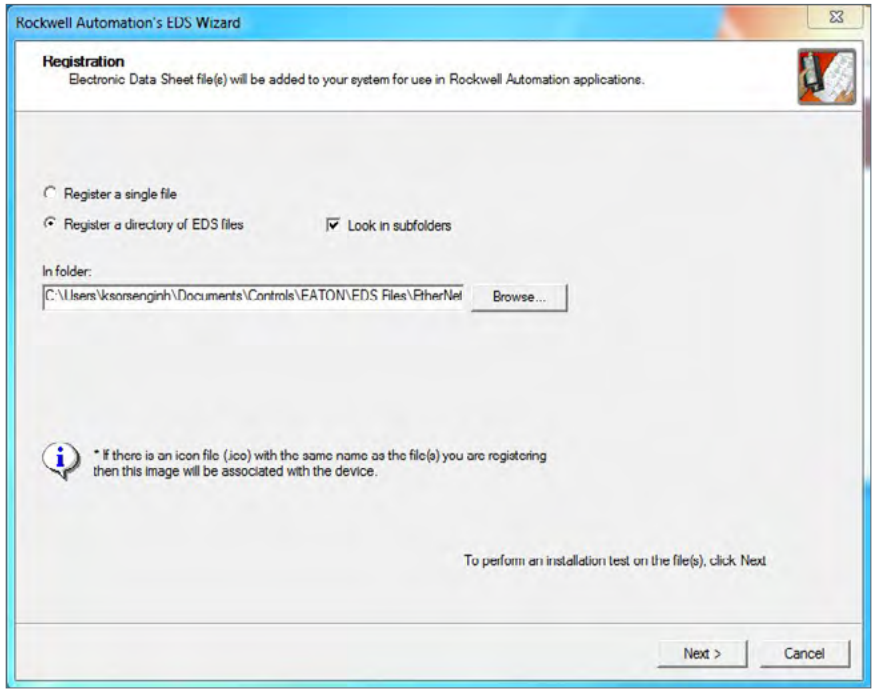


Beginning with **v20 of RS5K**, this may be accomplished with other additional options within the environment under the **Tools Menu**.

Select whether you would like to register a single or a directory of EDS files. If the latter, please tick **Look in subfolders** as well.

STEP 3: **Browse** to the folder directory containing the EDS[s]

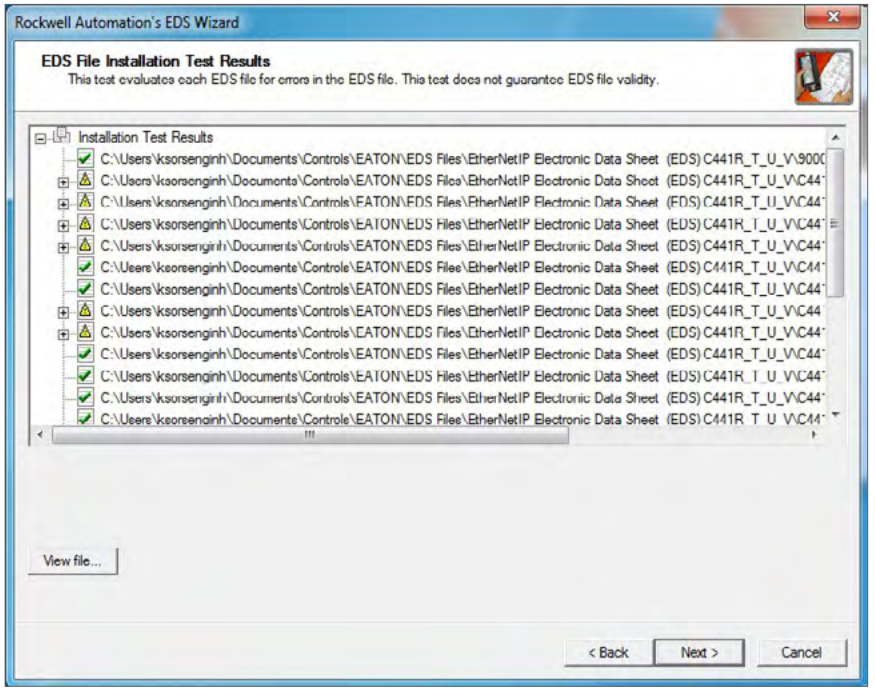
STEP 4: Click **next**



The system will do a scan and *populate a test result*.

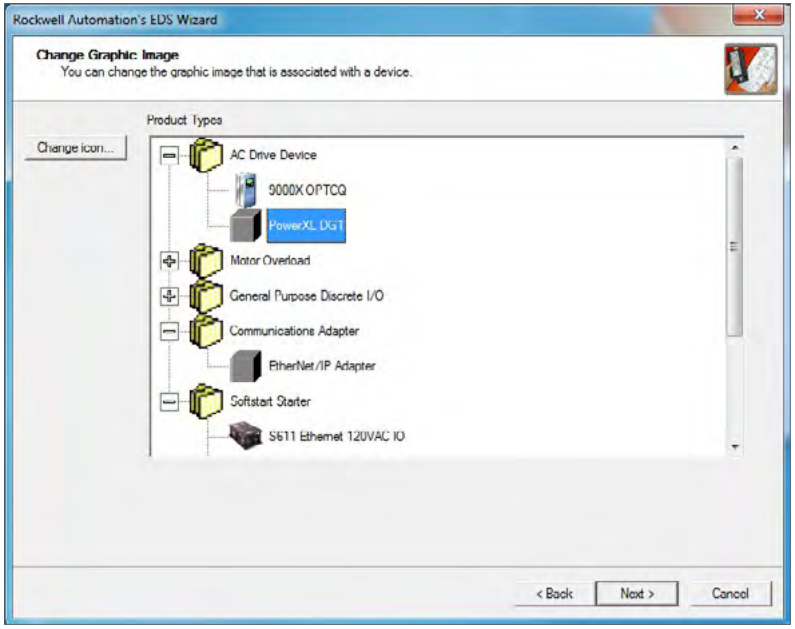
STEP 5: Select the desired file[s] to register

STEP 6: Click **next**



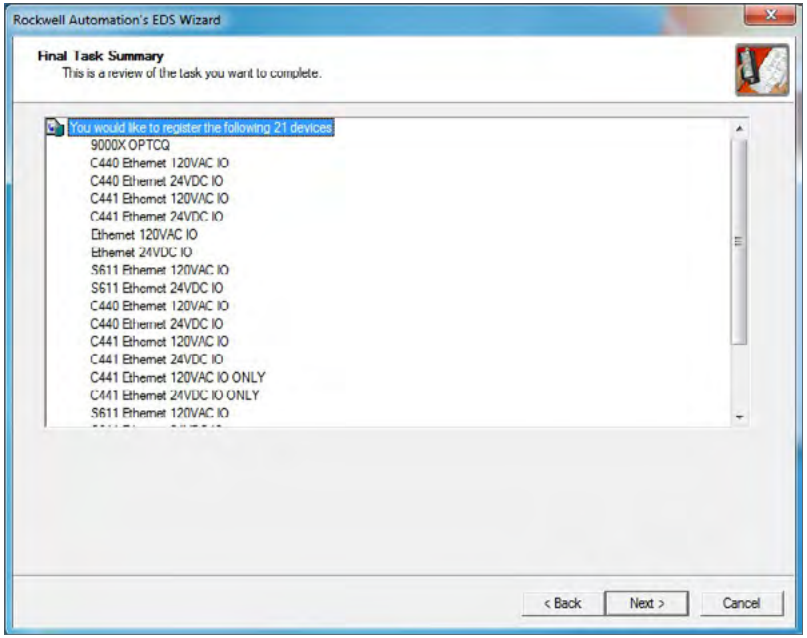
Change the icons if needed

STEP 7: Click **next**



A final task summary window will appear. *Ensure the information is correct.*

STEP 8: Click **next** to complete the EDS registration process



STUDIO 5000
PART 1

STEP 1: **Open** or **create** a new project in RS5K.

If starting a new project -

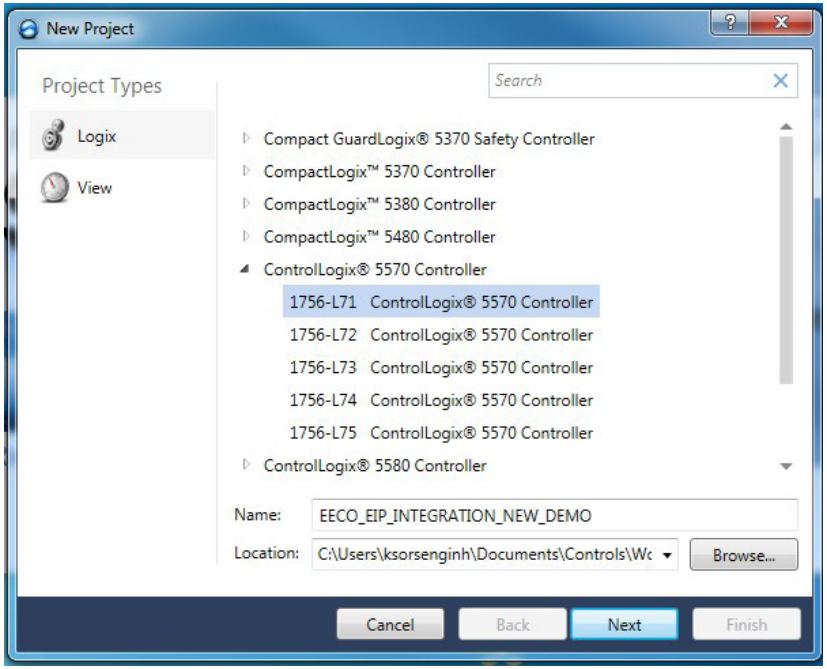
STEP 2: **Select** the processor and **name** your project

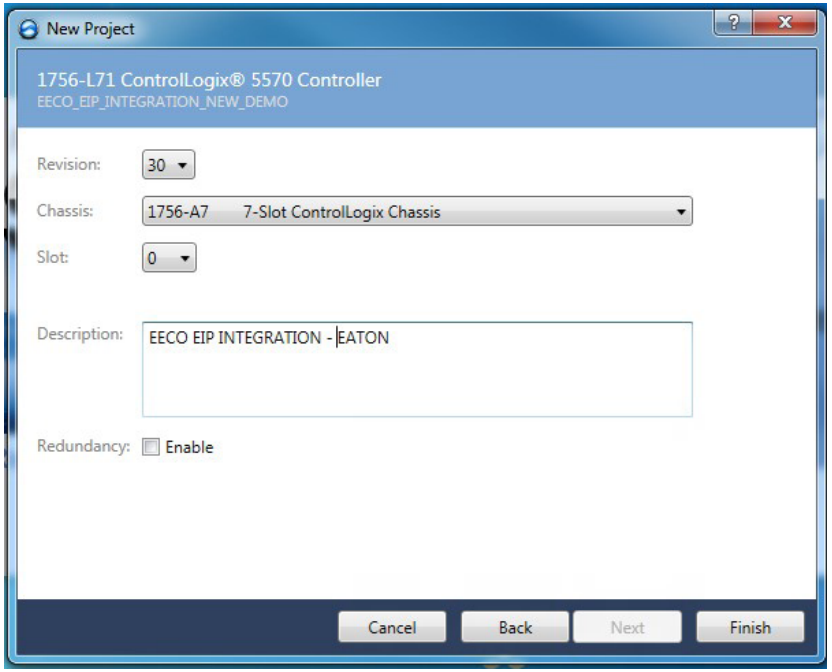
STEP 3: **Browse** to the desired project save location

STEP 4: Click **next**

STEP 5: Select the **chassis type**

STEP 6: **Click finish**





In the Controller Organizer -

STEP 7: **Right click** the processor Backplane (slot 0)

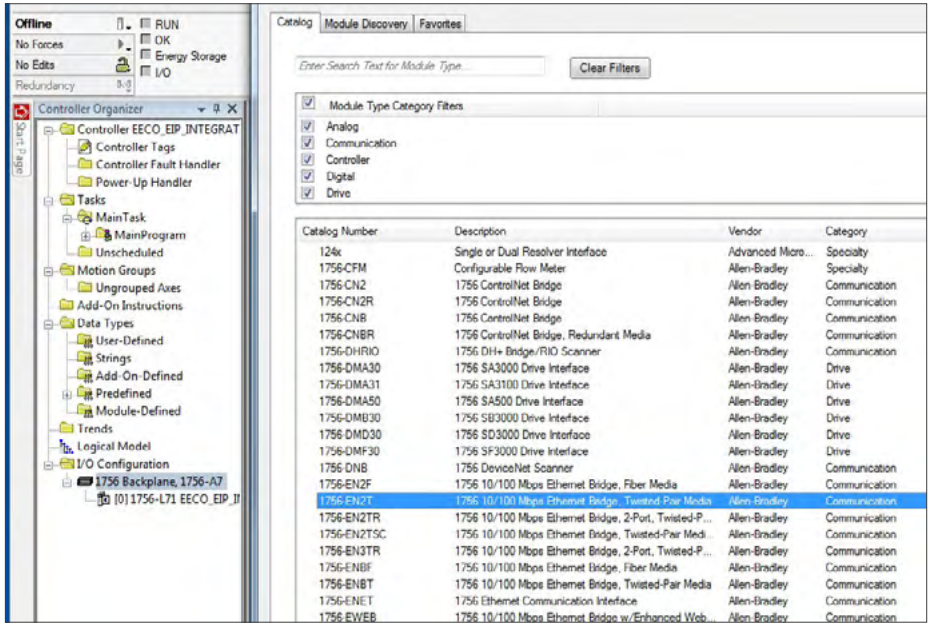
STEP 8: **Create a new** Ethernet module.

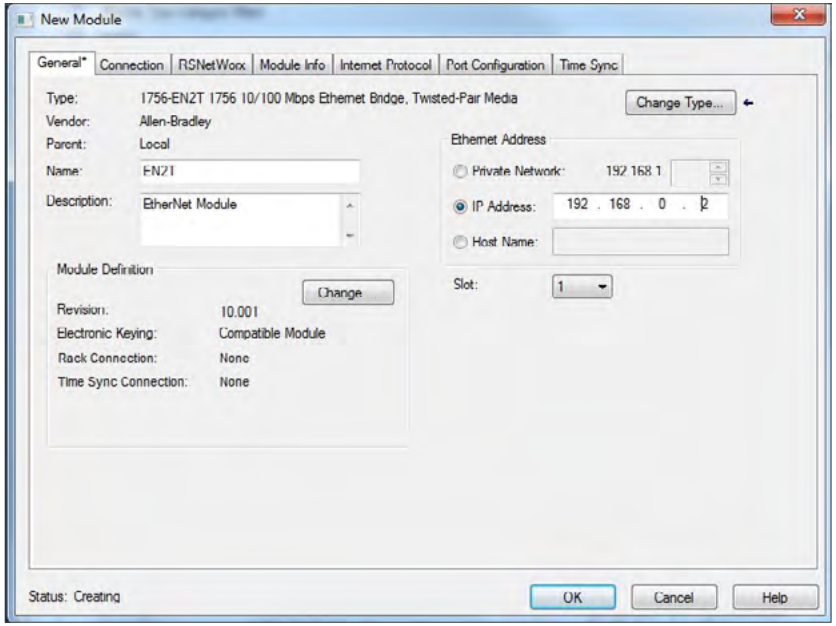
For this example, the 1756-EN2T will be used. Click **create**

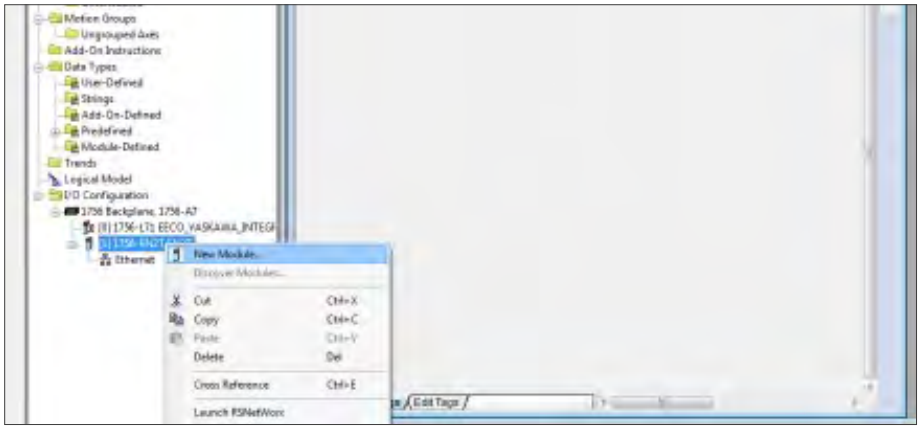
STEP 9: **Name the EN2T** and input an unused IP Address (192.168.0.2)

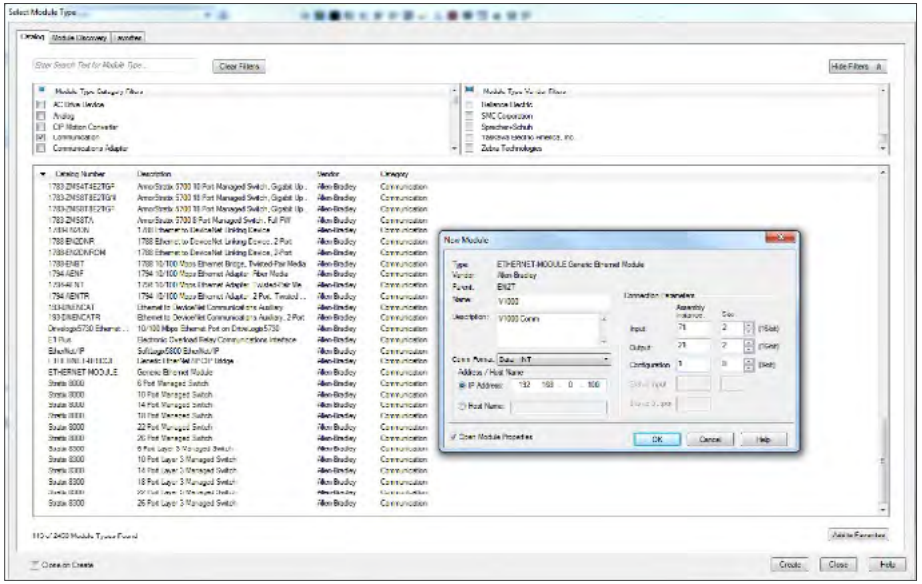
STEP 10: Click **OK**

An EN2T module (slot 1) now exists under the *Backplane*.









A Yaskawa V1000 VFD will be added to the RS5K project.

STEP 11: Right click on the **1756-EN2T module** and **select create new module**

The Select Module Type window appears. To enter the V1000 as a Generic Ethernet Module -

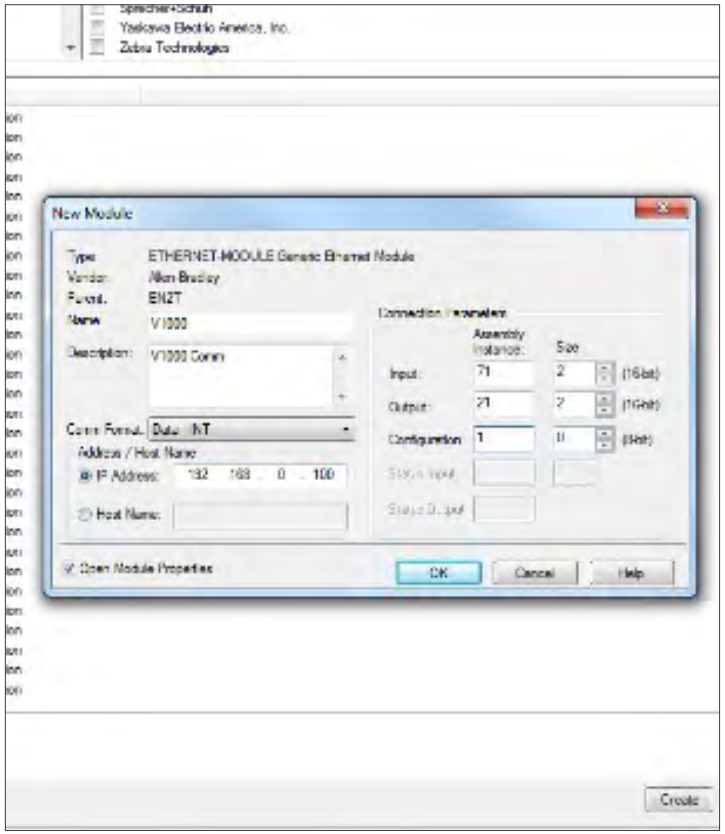
STEP 12: **Deselect both filters** for Category and Vendor

STEP 13: Select only **Communication** and **Allen Bradley**

STEP 14: Scroll down toward the bottom of the list and **select ETHERNET-MODULE Generic Ethernet Module**

STEP 15: Click **create**

STEP 16: A new module window appears



STEP 17: Input a name that is distinctive yet simple **(V1000)** as *you will need to reuse this identical name in the Tag Generator Software*

STEP 18: Change the Comm Format from **DINT >> INT**

STEP 19: Input an unused IP Address **(192.168.0.100)** that is on the same subnet as the EN2T, i.e. 192.168.0.x. {x = 2-254}.

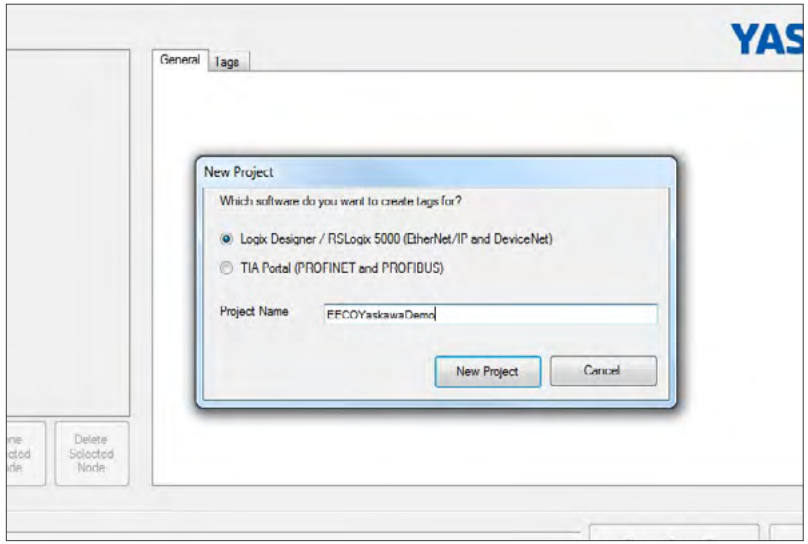
STEP 20: **Input 71** for the Input Assembly Instance, **size = 2 bytes (INT)** *(pg. 41 in TOBPC73060092 Manual)*

STEP 21: **Input 21** for the Output Assembly Instance, **size= 2 bytes (INT)** *(pg. 41 in TOBPC73060092 Manual)*

STEP 22: Configuration assembly is not used, but there must be a value there as a place holder so **input 1 for Configuration** Assembly Instance, **size = 0**

YASKAWA **TAG GENERATOR**

STEP 1: Install Yaskawa Tag Generator. Once installed, start the program by **double clicking the icon**



STEP 2: Click New Project in the top menu.

The new project window will pop up and ask which software do you want to create tags for.

STEP 3: Tick **Logix Designer/RSLogix 5000**

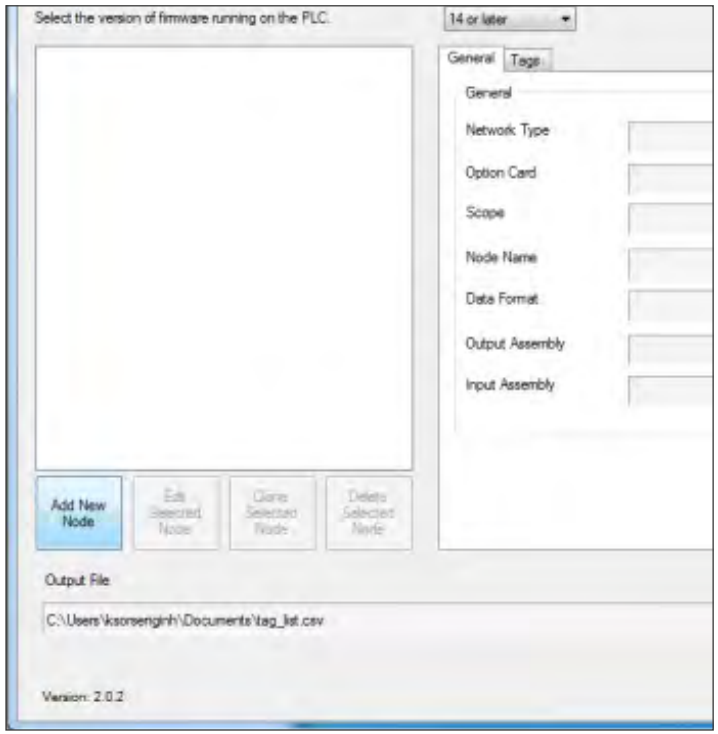
STEP 4: **Enter a project name** and **click New Project** to create the project.

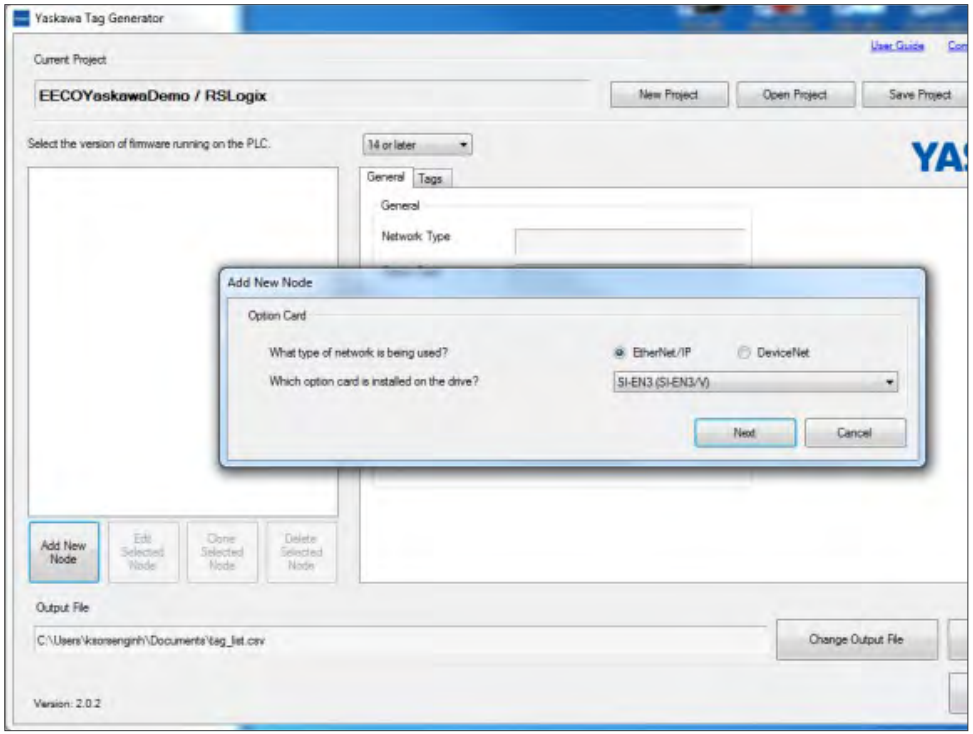
Once the project is created, select which firmware is running on the PLC.

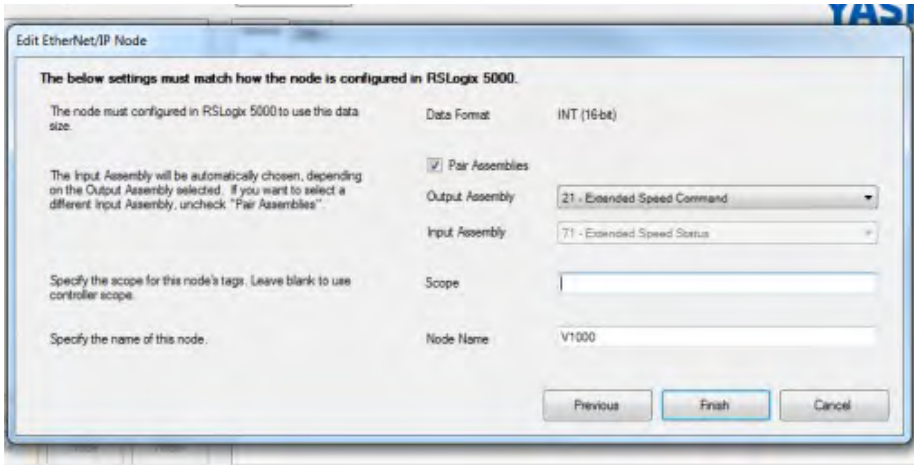
STEP 5: Click **Add New Node**

STEP 6: Select the **Option Card** on the next window

STEP 7: Click **next**







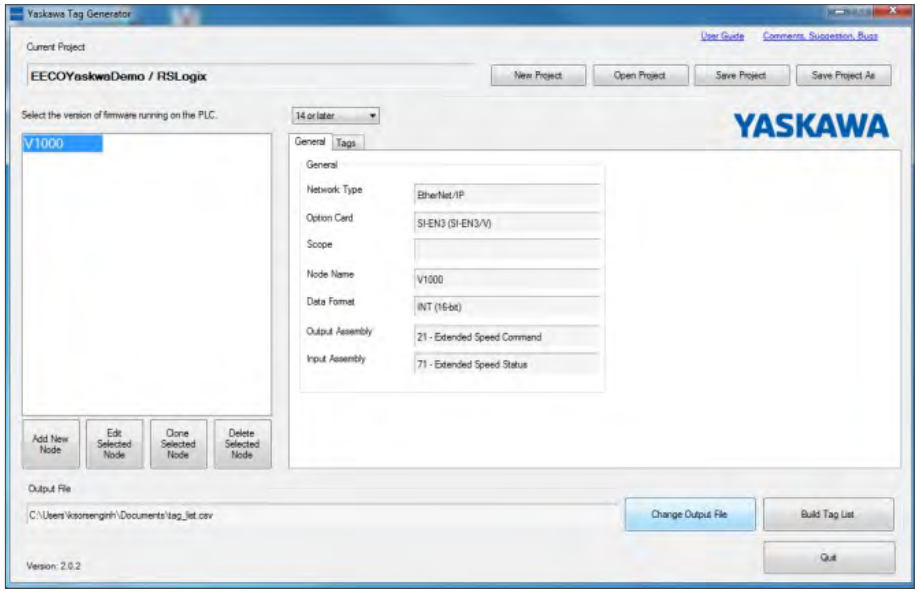
STEP 8: Select the I/O Assembly pair that was used in the RS5K project **(21-71)**

STEP 9: Delete the Scope field to make the tags accessible globally; otherwise, they will only be available in MainProgram

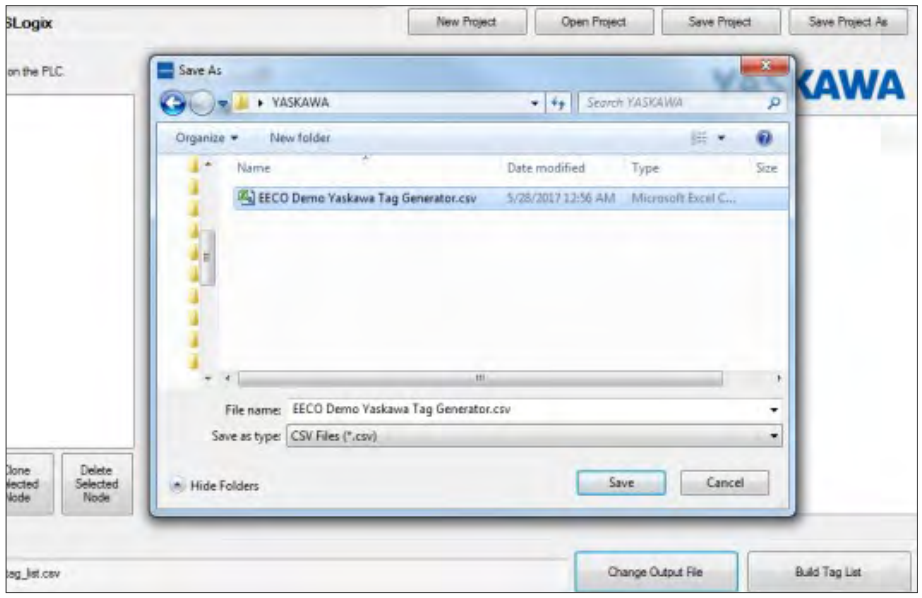
STEP 10: Enter a node name, V1000 in this case

***(MUST BE AN IDENTICAL NAME USED IN RS5K).**

STEP 11: Click **finish**

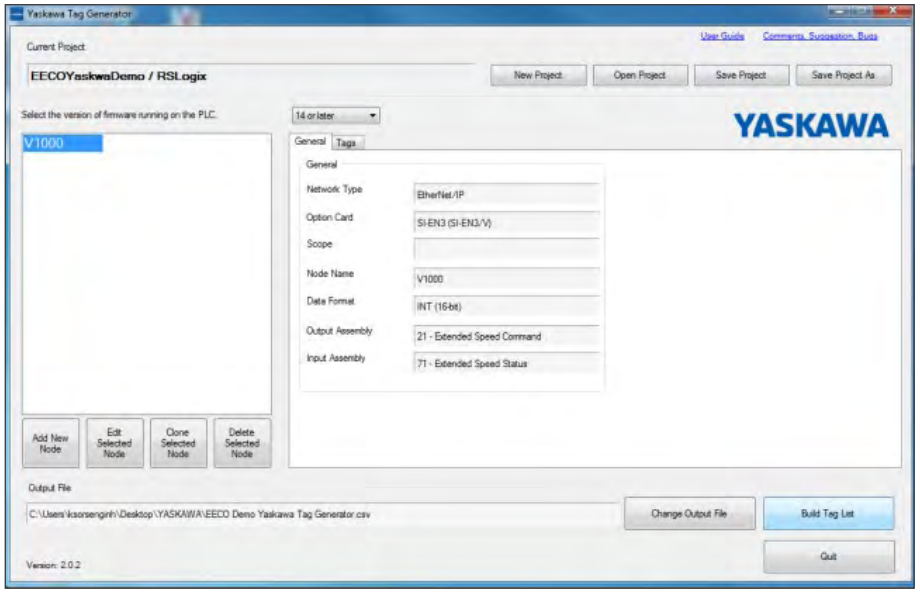


STEP 12: Click **Change Output File** and browse to a file location to save the CSV output file

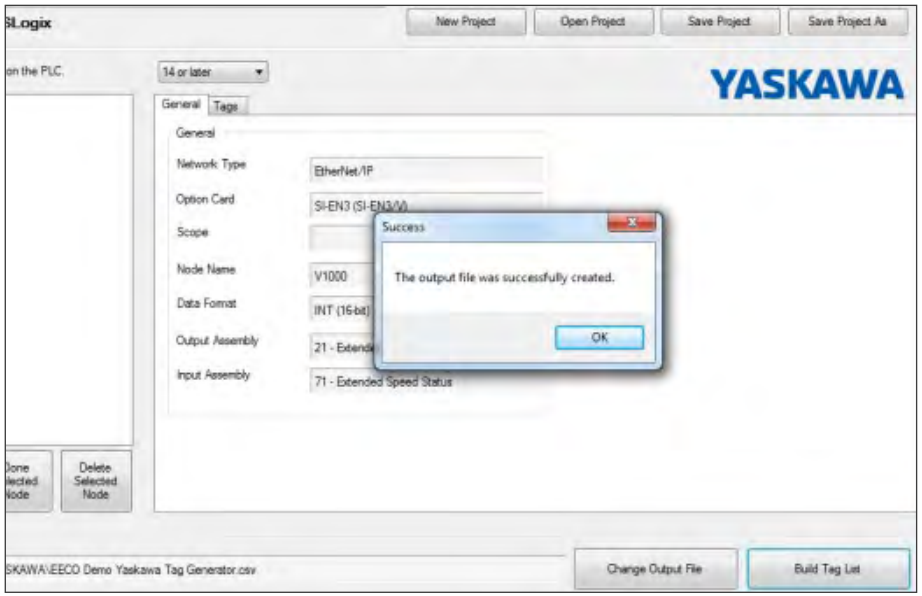


STEP 13: Name CSV file

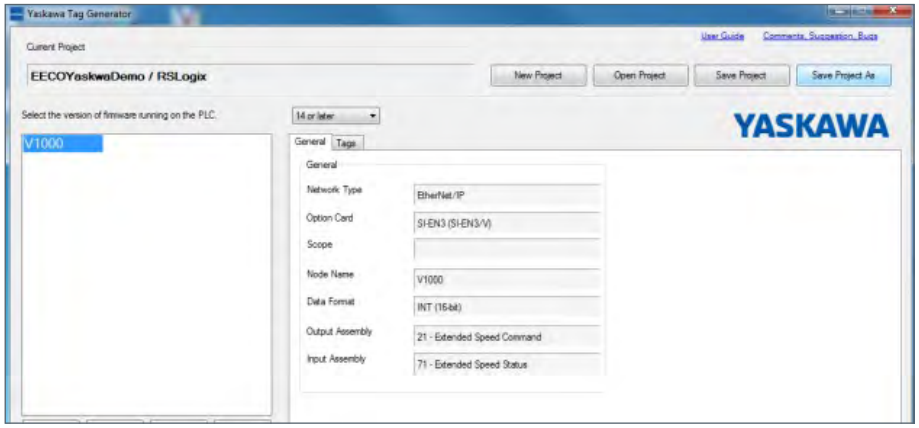
STEP 14: Click **save**



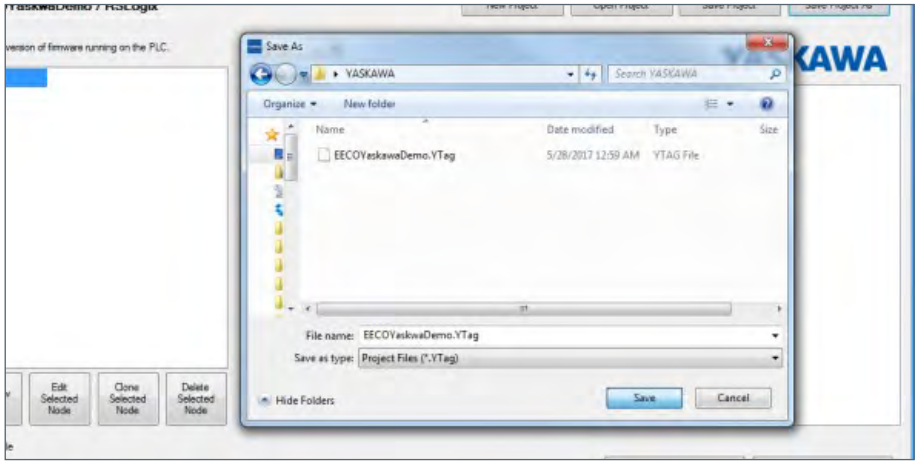
STEP 15: Click **Build Tag List** to generate



STEP 16: Click **OK** in the notification pop-up



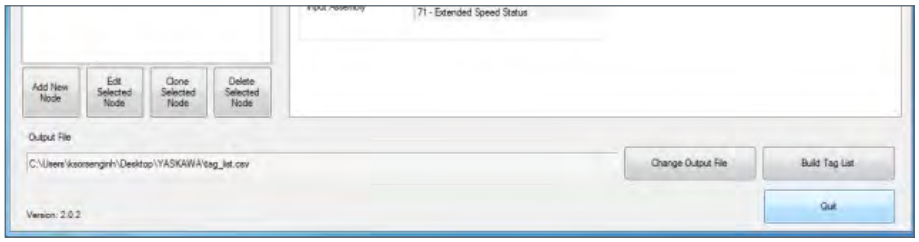
STEP 16: Click **Save Project As**



STEP 17: **Provide a name** for the project in the pop-up window

STEP 18: Click **Save**

STEP 19: The project may now be accessed at a later time for modificaton.



STEP 20: Click **Quit** and the task is completed.

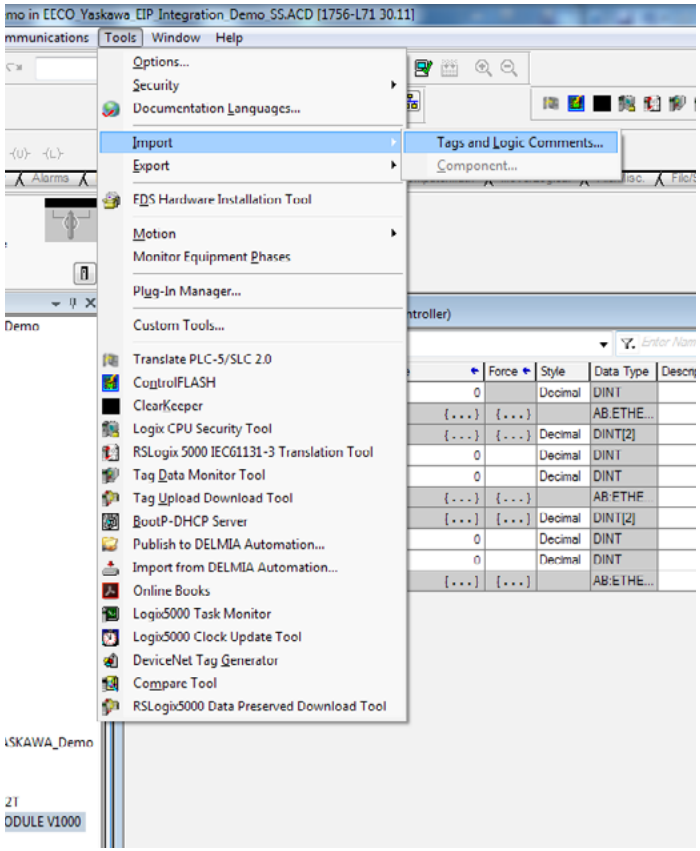
The remaining task will be completed in the RS5K environment.

EECO

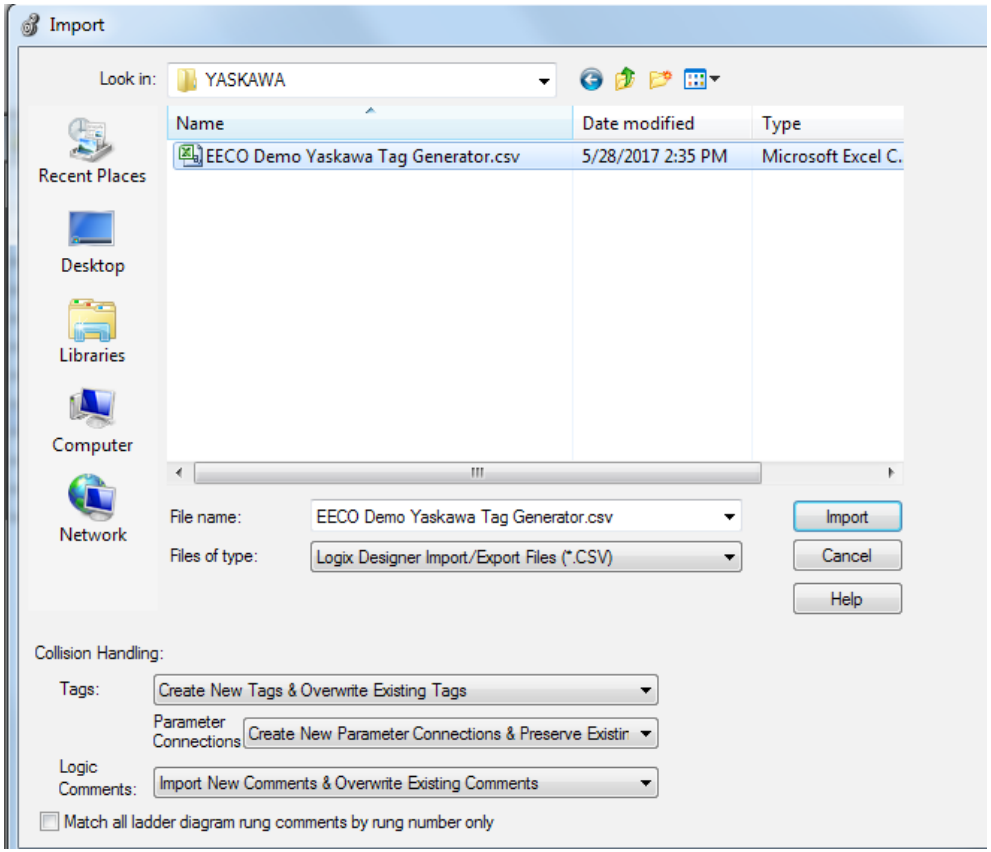
STUDIO 5000
PART 2

Navigate back to the RS5K environment -

STEP 1: Go to the **Tools Menu** > **Import** > **Tags and Logic Comments**



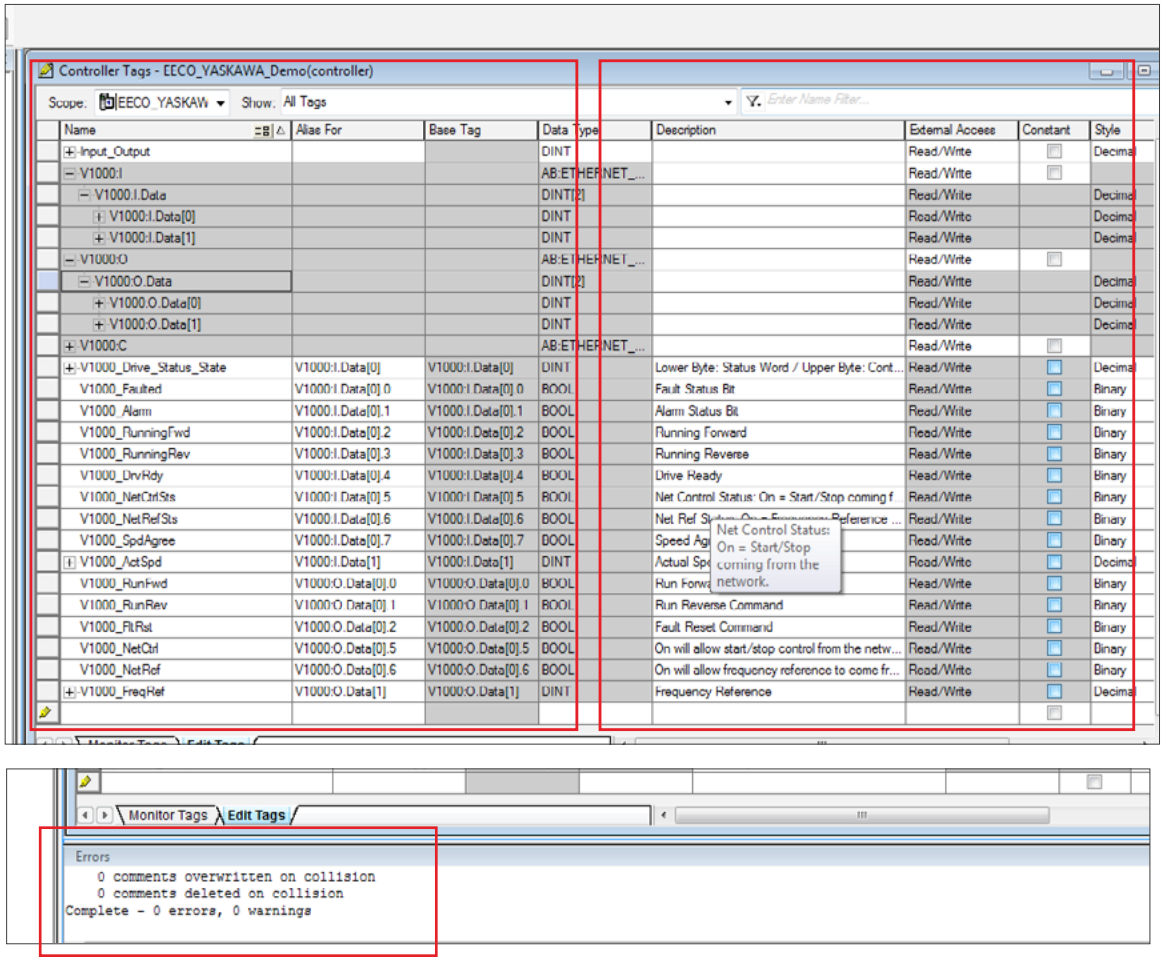
STEP 2: Browse to the previously saved CSV folder location, **select**, and **import**

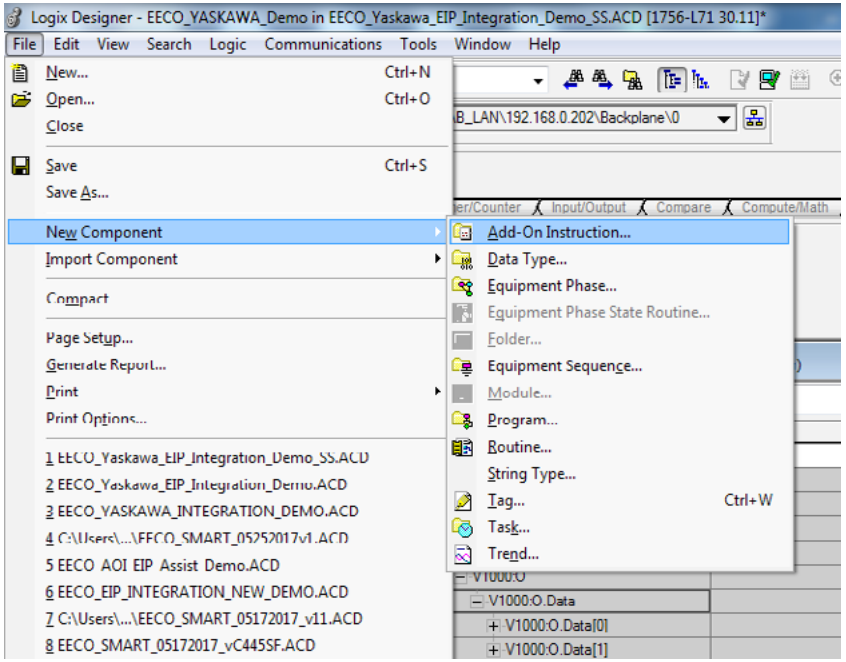


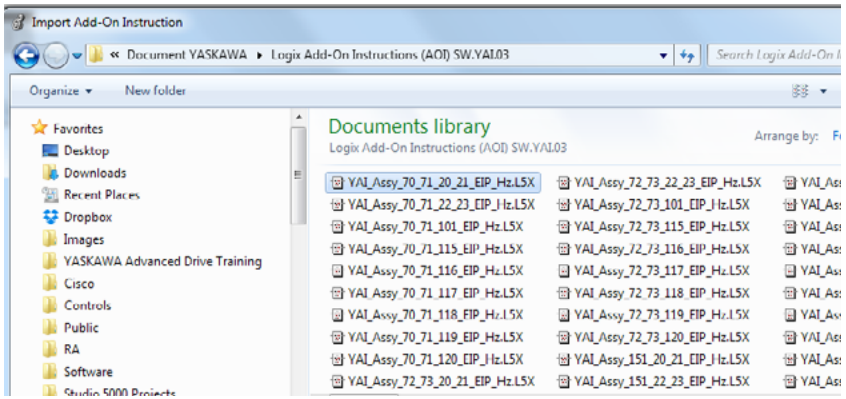
Once the import task is completed, you will notice that the lower Error plane provides feedback on how many tags were created, in addition to any errors and warnings.

***If there are error[s], ensure that the names specified in the RS5K project and Yaskawa Tag Generator were identical, or re-run Tag Generator with the correct nomenclature.**

Also notice that the description column is now automatically populated from the Tag Generator generated CSV. When Edit Tags is selected, RS5K will also show exactly where the new tags are alias to in the generic tags. The functionalities of the Tag Generator tool greatly contribute to the reduction of setup or commissioning time, ultimately reducing downtime and increasing productivity. *The import task is now completed.*







Yaskawa has taken additional steps to simplifying integration of its EtherNet/IP supported products by offering a wide range of VFD Add-On Instruction (AOI) in conjunction with Tag Generator. Let's proceed and explore how technicians and engineers can use Yaskawa's AOIs.

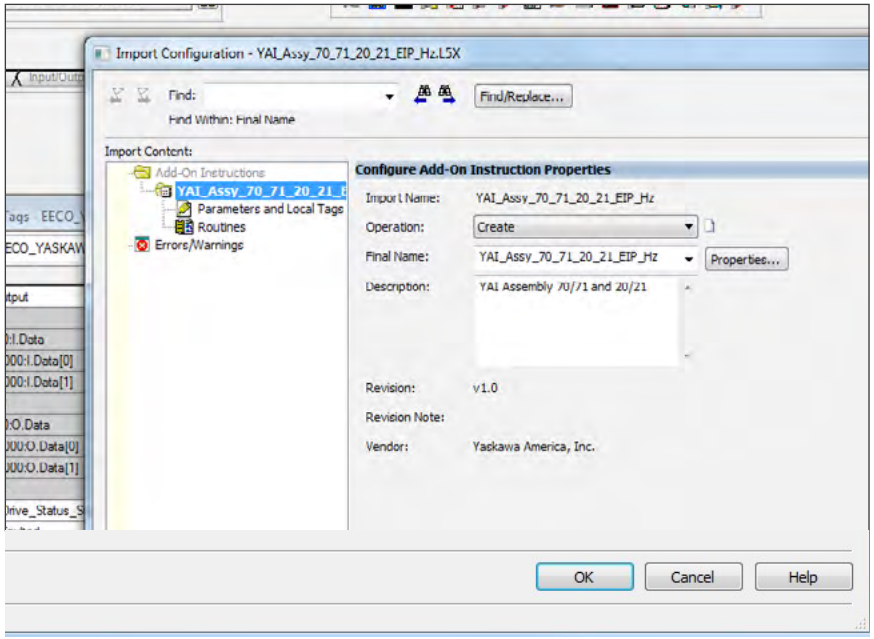
In RS5K -

STEP 3: Navigate to **File** > **Import Component** > **Add-On Instruction**

STEP 4: Browse to the **AOI provided by Yaskawa**

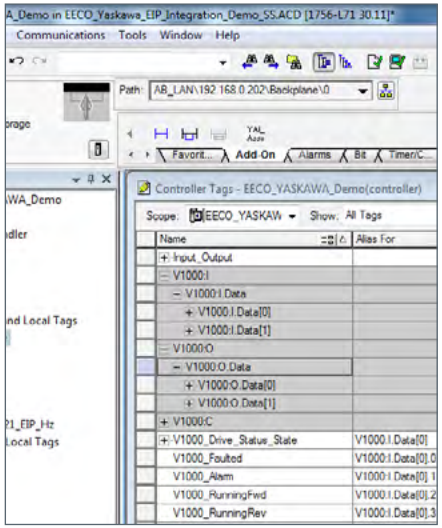
The extension of the file will be a **L5X**.

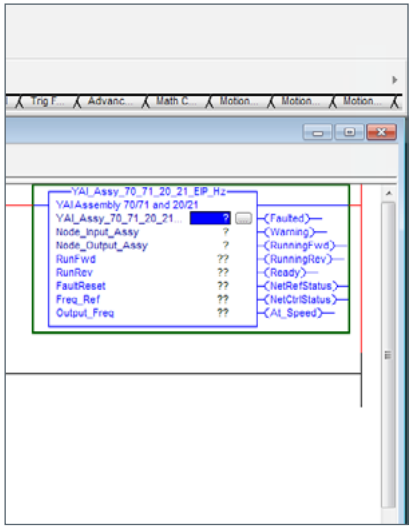
STEP 5: **YAI Assembly 71 21** is selected



The Import Configuration window appears.

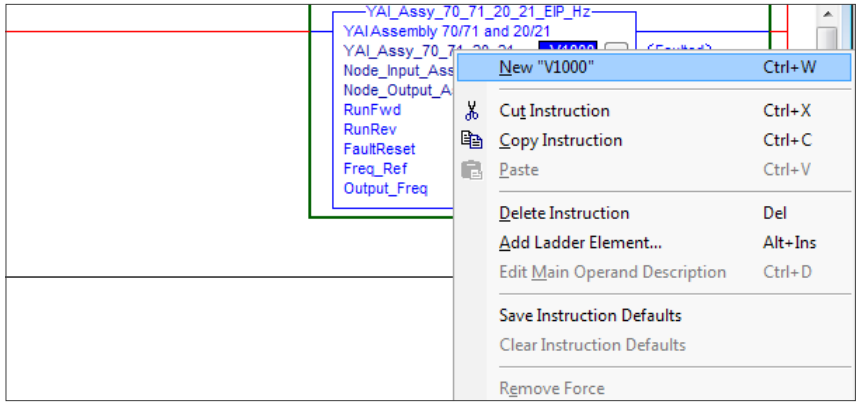
STEP 6: **Verify** and select **OK**

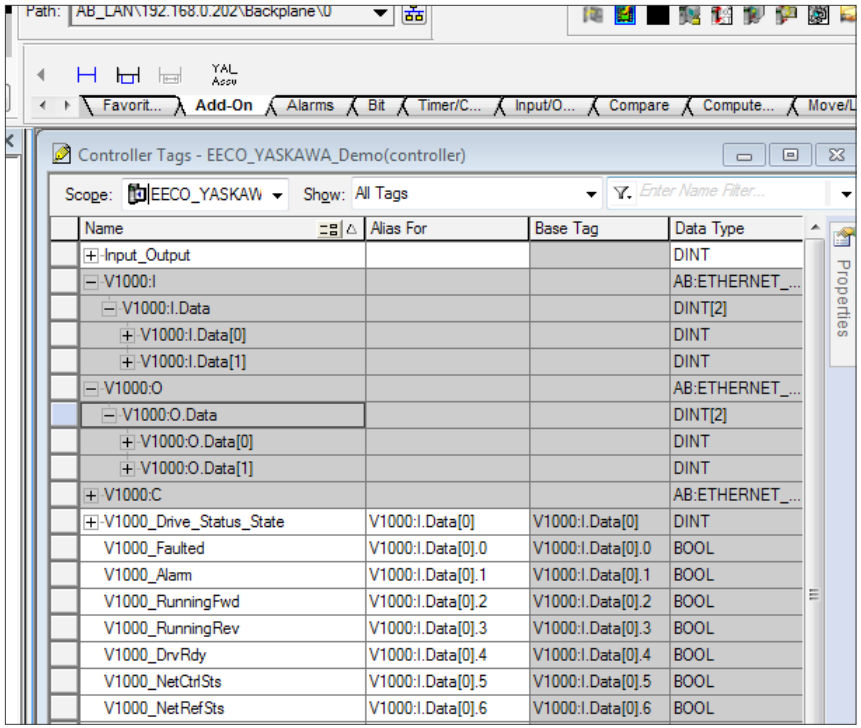




STEP 7: In the **Controller Organizer** > **Add- On Instruction**, the AOI has been successfully imported and is *now available for use in the Language Element Tool Bar > Add-On*

UTILIZING THE **AOI**





STEP 1: Next, open **MainProgram** – **MainRoutine**

STEP 2: **Add a rung**

STEP 3: Then in **Add-On,** drag the V1000 AOI to the rung 0

Once the V1000 AOI block is added to the rung, the top three parameters in the AOI block must be mapped to a specific module

Within the AOI block -

STEP 4: Double click the **top "?"** next to the View Configuration Dialog button

STEP 5: Input **V1000** > **right click** > select **"New V1000"**

STEP 6: A new Parameter or Tag window will appear

STEP 7: Confirm the name and scope

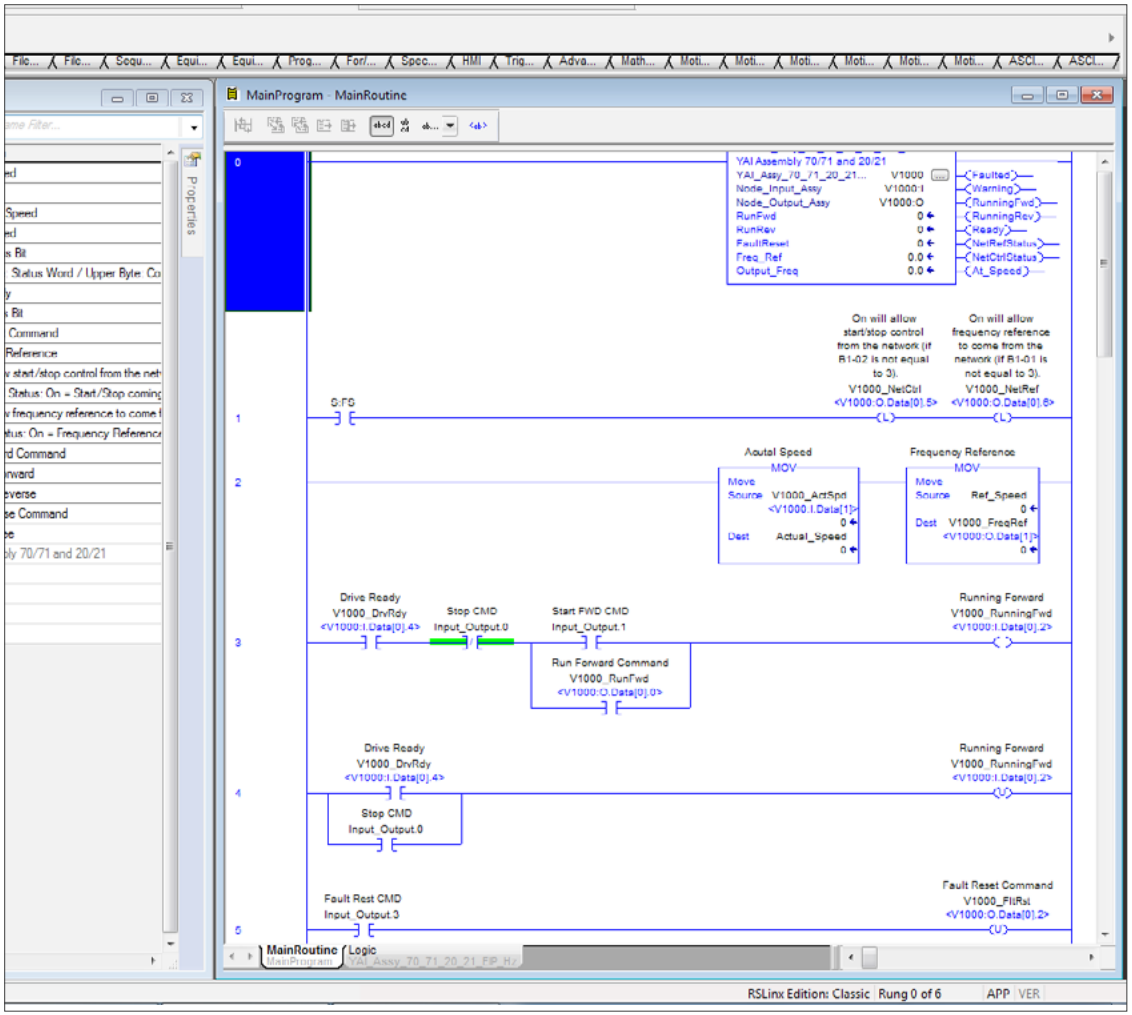
STEP 8: Click **create**

Ensure that the Controller Tags and MainProgram windows are open and side-by-side.

STEP 9: Select and drag **V1000:I1 to the "?"** in the Node_Input_Assy row

STEP 10: Select and drag **V1000:O1 to the "?"** in the Node_Output_Assy row

The setup of the AOI is now complete.



Let's create a **DINT tag** —

STEP 11: Name it **Input_Output.**

The Boolean within the DINT will be used as logical Push Buttons.

STEP 12: **Add a couple of rungs** to the project

STEP 13: Enable remote FieldBus control of the **V1000** by latching the **V1000_NetCtrl** and **V1000_NetRef bit**

To ensure that the PLC has control after a power loss, a First Scan bit is used for latching on a power-up condition.

STEP 14: Add a **start**, **stop** and **fault logic** to the program,

STEP 15: **Download** to the processor

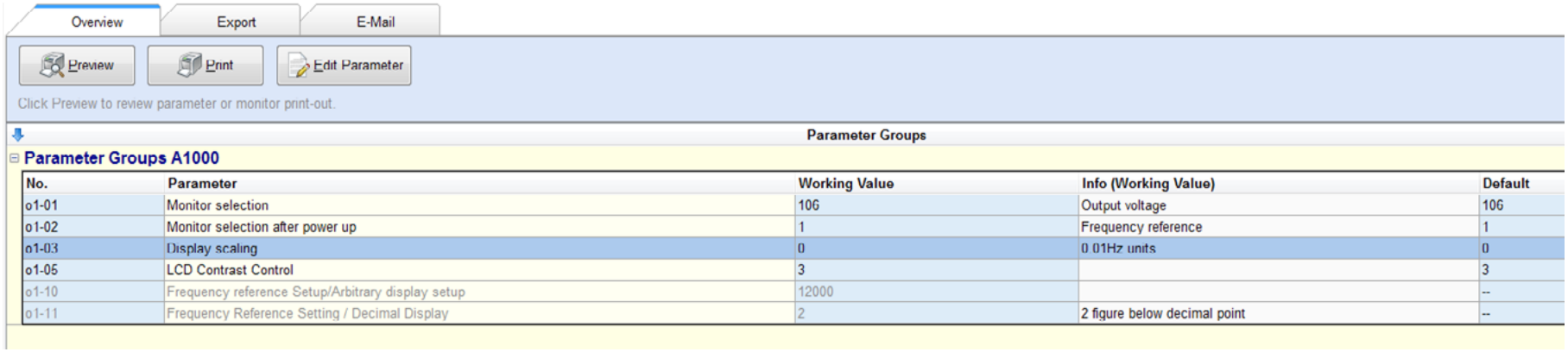
The V1000 VFD is ready to be operated.

MOTOR TESTING

- Page 42 of TOBPC73060092

SPEED REFERENCE

- Speed Command
- Sets drive speed reference
- Speed reference data:
  Frequency reference/2SS (SS: Speed scale)
- Setting range: 0 to 0xFFFF
- Example: setting a reference of 4096 with a speed scale of 2:
  Speed reference data = 4096/22 = 1024 = 0x0400 Hex or 10.24 Hz
- Unit depends on o1-03



No.	Parameter	Working Value	Info (Working Value)	Default
o1-01	Monitor selection	106	Output voltage	106
o1-02	Monitor selection after power up	1	Frequency reference	1
o1-03	Display scaling	0	0.01Hz units	0
o1-05	LCD Contrast Control	3		3
o1-10	Frequency reference Setup/Arbitrary display setup	12000		--
o1-11	Frequency Reference Setting / Decimal Display	2	2 figure below decimal point	--

APPENDICES
A, B, C

YASKAWA RESOURCE DOWNLOADS LINKS

- **YASKAWA DOWNLOADS**

https://www.YASKAWA.com/downloads

- **DRIVEWIZARD INDUSTRIAL**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/industrial-software-tools/drivewizard-industrial

- **ETHERNET/IP**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/industrial-network-communication-protocols/ethernet-ip

- **YASKAWA NETWORK SUPPORT FILES - DOWNLOADS**

https://www.YASKAWA.com/downloads?p_p_id=yasdocumentdownload_WAR_yasdocumentdownloadportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column1&p_p_col_count=1&_yasdocumentdownload_WAR_yasdocumentdownloadportlet_productGroup=Inverter+Drives&_yasdocumentdownload_WAR_yasdocumentdownloadportlet_productLine=Network+Comms-EtherNet-IP

- **CONFIGURED PRODUCT FOR A1000 DRIVE**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/general-purpose-drives/a1000-configured

- **U1000 INDUSTRIAL MATRIX DRIVE**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/general-purpose-drives/u1000-industrial-matrix-drive

- **G7 DRIVE**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/general-purpose-drives/g7-drive

- **G7 CONFIGURED**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/general-purpose-drives/g7-configured

- **DRIVEWORKS EZ SOFTWARE**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/industrial-software-tools/driveworks-ez-software

- **PROGRAMMING SIMULATOR**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/industrial-software-tools/programming-simulator

- **ENERGY SAVINGS PREDICTOR**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/industrial-software-tools/energy-savings-predictor

- **HARMONICS ESTIMATOR**

https://www.YASKAWA.com/products/drives/industrial-ac-drives/industrial-software-tools/harmonics-estimator

- **APPLICATION EXAMPLES**

https://www.YASKAWA.com/downloads?p_p_id=yasdocumentdownload_WAR_yasdocumentdownloadportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column1&p_p_col_count=1&_yasdocumentdownload_WAR_yasdocumentdownloadportlet_lookupType=Software%2FApplication+Examples

- **TRAINING DOCUMENTS**

https://www.YASKAWA.com/downloads?p_p_id=yasdocumentdownload_WAR_yasdocumentdownloadportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column1&p_p_col_count=1&_yasdocumentdownload_WAR_yasdocumentdownloadportlet_lookupType=Training+Documents

- **TRAINING: DRIVEWIZARD INDUSTRIAL TIPS AND TRICKS**

https://www.youtube.com/playlist?list=PLNAENIyEDCkxPasi-q_UbSCyqaU7Ryy0v

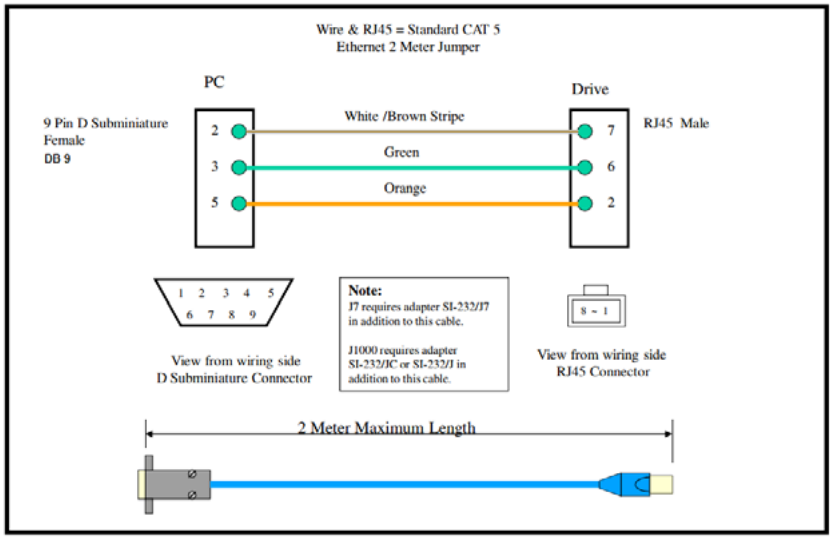
YASKAWA SUPPORTED DRIVE PRODUCT SERIES

- A1000
- D1000
- iQpump1000
- MV1000
- P1000
- R1000
- V1000
- V1000-4X
- U1000 Industrial Matrix
- U1000 Oil & Gas
- F7
- G7

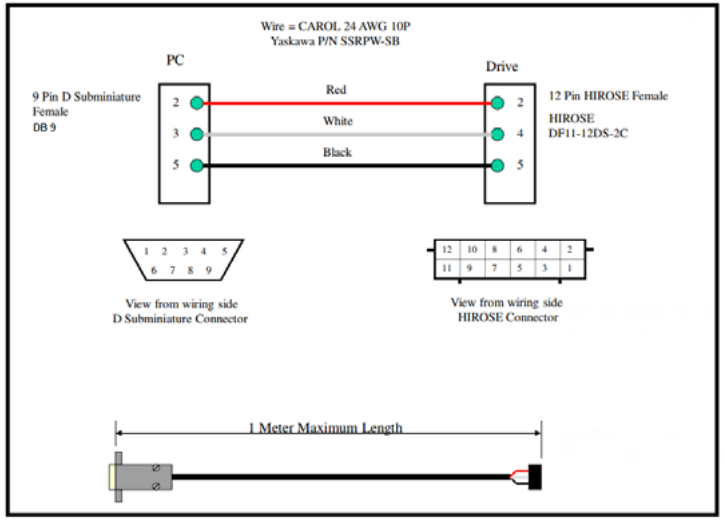
DIRECT CONNECT SERIAL PIN OUT

- Applicable to the A1000, J1000, V1000, V1000-4X, J7, V7, E7, P7, G5, G7, and F7 Drives

PC to Drive Connection Cable UWR00468-2



For G5 Drive
PC to Drive Connection Cable UWR00103-1



(Courtesy of YASKAWA)