Application Note

Using the Yaskawa V1000 AC Drive and SI-N3/V DeviceNet Option Kit with AB CompactLogix Programmable Controller

Applicable Product:

SI-N3/V DeviceNet Option Kit

Contents

Introduction

The following document describes the configuration of Allen Bradley CompactLogix PLCs for communicating with the SI-N3/V DeviceNet option kits for the Yaskawa 1000-series AC drives. In this example, the information describes the use of the programming tools to configure and control the AC drive for operation, and defines the requirements for access to additional parameters in the drive. In general it defines the I/O configuration requirements and PLC ladder used.

IMPORTANT! - DOCUMENT APPLICABILITY
This application example uses the Yaskawa V1000 drive. Illustrations may not depict your specific Yaskawa drive. Other Yaskawa drives may be used. Since each system application is typically different, the following may be accomplished in different ways using different Yaskawa AC drives. The basic principles shown herein can be built upon for specific system application requirements.

Intended Audience

This document assumes that the reader is familiar with Yaskawa AC drives, DeviceNet and DeviceNet technical terminology and operation, and with PLC programming.

References

TOEPC71060614	V1000 Quick Start Guide
TOEPC71060622	V1000 Technical Manual
TOBPC73060028A	SI-N3/V Installation Manual
SIEPC73060028A	SI-N3/V Technical Manual

DeviceNet Option Switch Settings

The SI-N3/V DeviceNet Option does not contain any of the onboard switches that are found on earlier DeviceNet option kits, rather the switch settings are stored as parameters in the drive itself.

Drive Parameter Settings

In order to control the drive from the DeviceNet network drive parameters b1-01 and b1-02 need to be set to a value of '3 – Option Card'. Set the drive to the desired MAC or Node address convenient for your network by adjusting parameter F6-50 (In this example application the node address will be 3). To enable automatic network baud rate determination (auto-baud) set drive parameter F6-51 to a value of '4-Autobaud'.

Table 1, Drive Parameter Settings

Parameter No/Name	Setting	Description
B1-01 Frequency Reference Selection	3	Option PCB
B1-02 Run Command Selection	3	Option PCB
F6-50 MAC Address	3	Node Address
F6-51 Baud Rate	4	Auto Baud Rate Detection
F6-52 Polled Consuming Connection Path	21	DN Extended Speed Control
F6-53 Polled Producing Connection Path	71	DN Extended Speed Status

System

The following example describes the process of configuring a simple system with RS Logix 5000 used to program a CompactLogix PLC and to control the Yaskawa AC drives. See Figure 1 for a diagram of the example system.
The system consists of the following:

- Yaskawa V1000 AC Drive
- SI-N3/V DeviceNet Option Kit
- 24VDC/2.5A Power Supply
- AB 1770-KFD DeviceNet RS-232 Interface
- CompactLogix L32E PLC with a 1769-SDN DeviceNet Scanner Module Installed
- DeviceNet Connectors and Cables
- PC Running Windows XP
- RSLinx Classic, RSNetworx for DeviceNet, RSLogix 5000

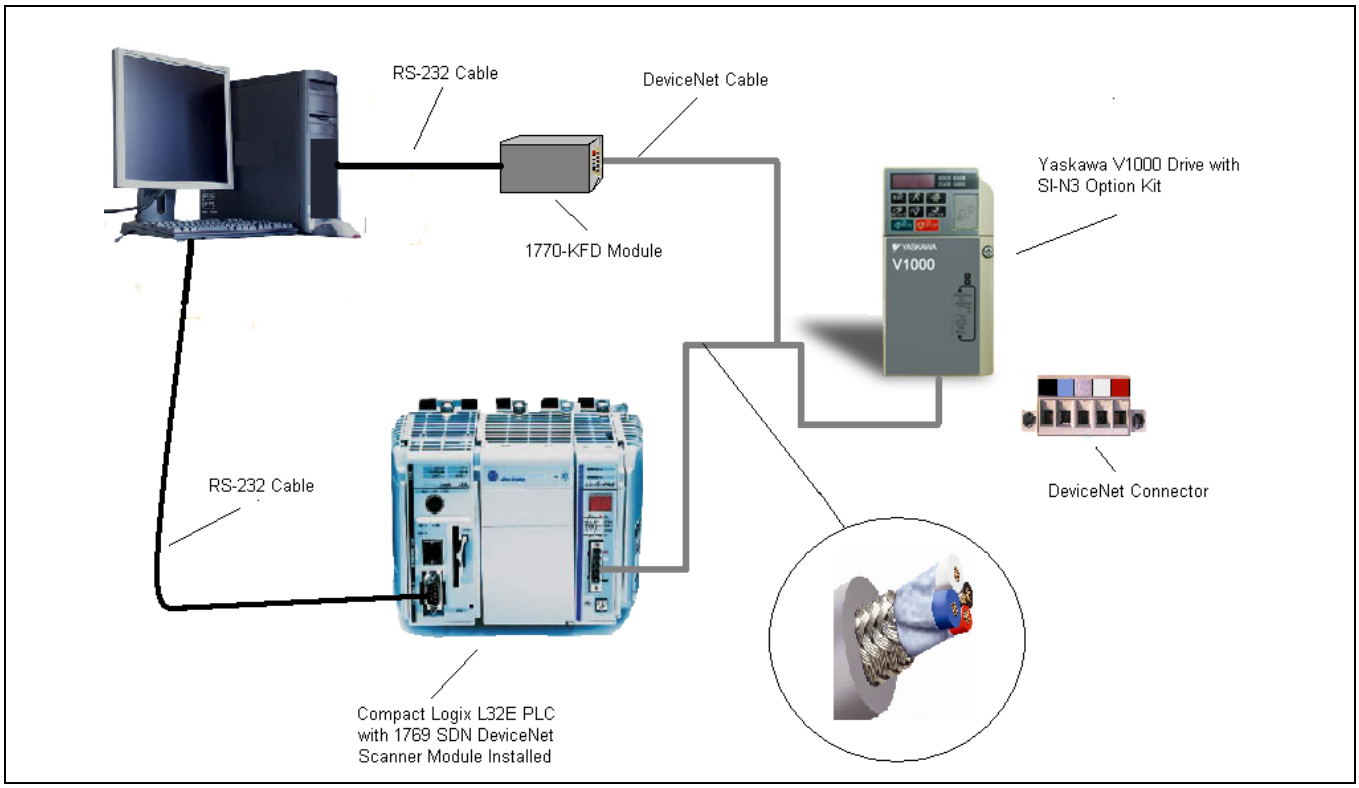


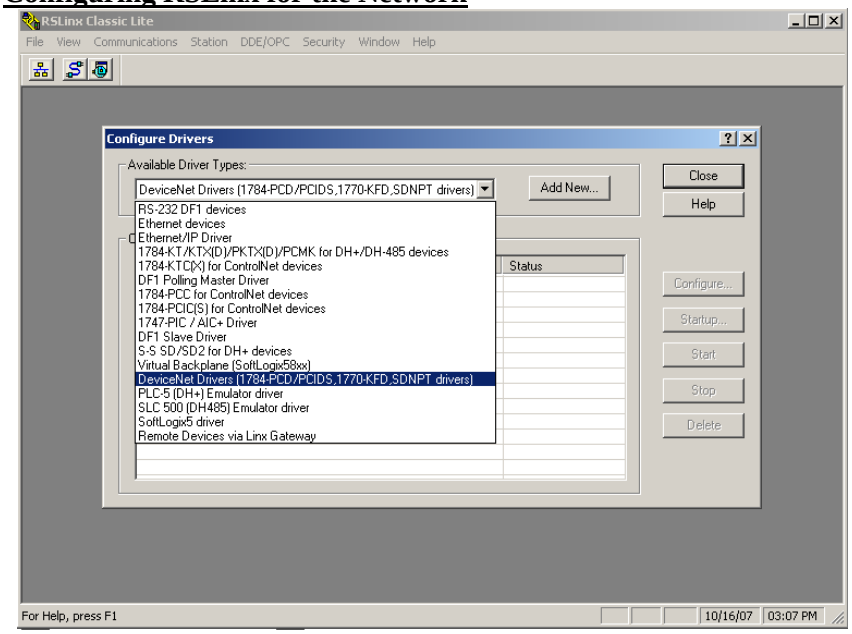
Figure 1, System Diagram

Drive Configuration

Install the SI-N3/V DeviceNet option on the V1000 drive as indicated in the option technical manual.
Apply power to the network components.

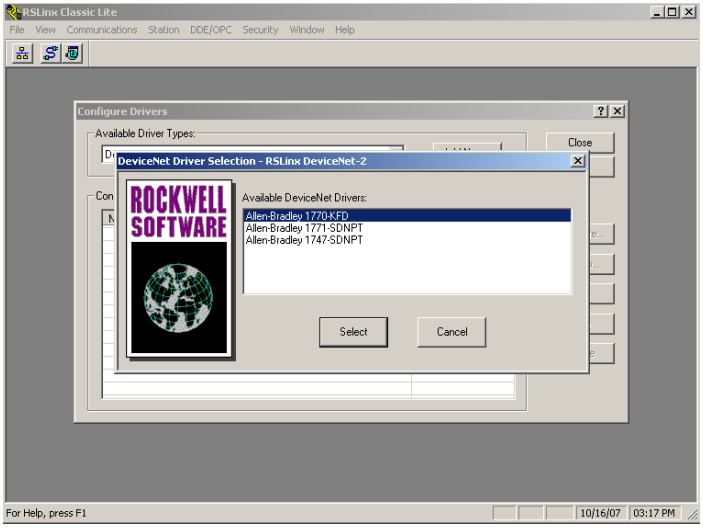
PLC Polled Message Example

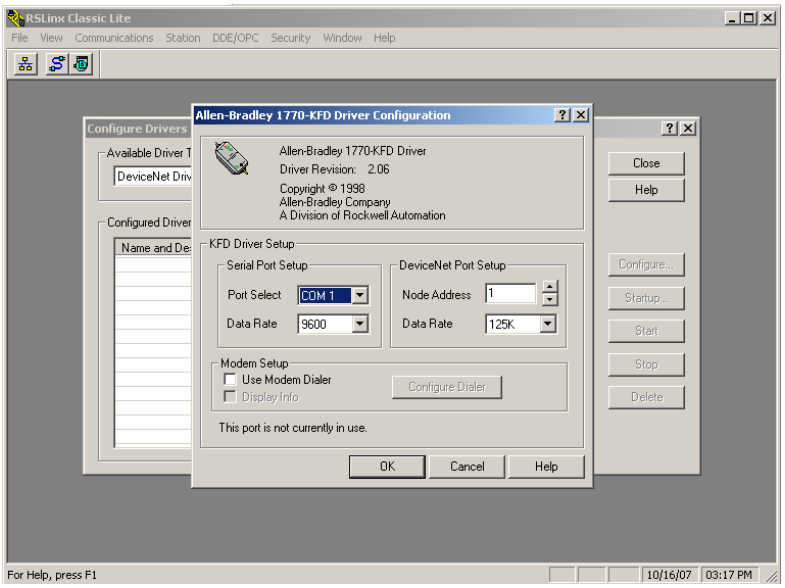
Configuring RSLinx for the Network



Start RS Linx Classic and begin by selecting and starting the DeviceNet Driver.

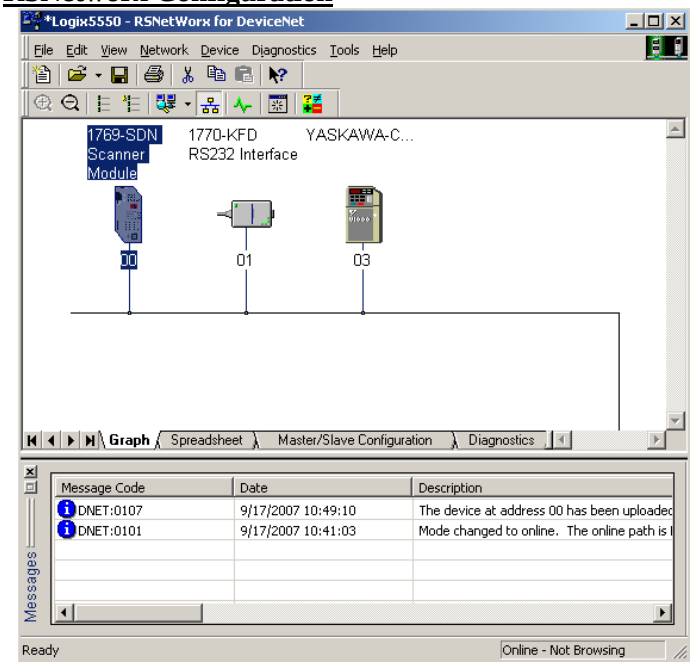
Select the appropriate DeviceNet driver from the list (in this example 1770-KFD).





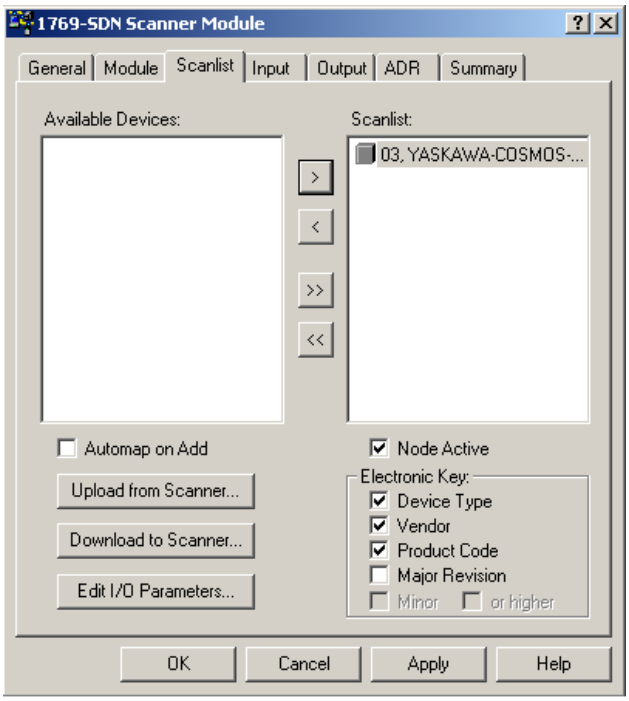
Choose the correct serial communications port as well as the baud rate that your DeviceNet network will be running. Make your Node address either 0 or 1. Click ok. In the message box that pops up leave the name of the RSLinx driver at the default "1770-KFD-1" and click OK.

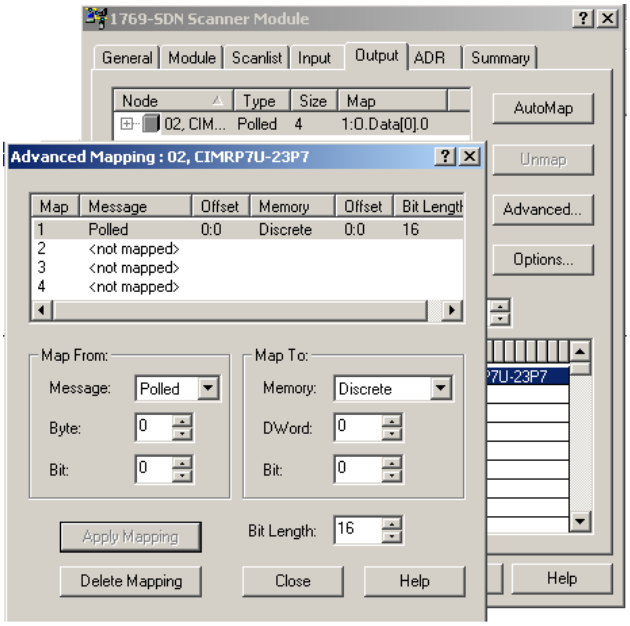
RSNetworx Configuration



Start RSNetWorx for DeviceNet and click on "Network" -> "Online" and select the communications path from the list (in this example, 1770-KFD-1) then click OK. If all the devices are at the correct baud rate then they will be displayed in the Graph window.

Double click on the scanner icon and then click on the "Scanlist" tab. Make sure that the box labeled "Automap on Add" is unchecked. Highlight node 3 and click the > button to move the node into the scanlist.



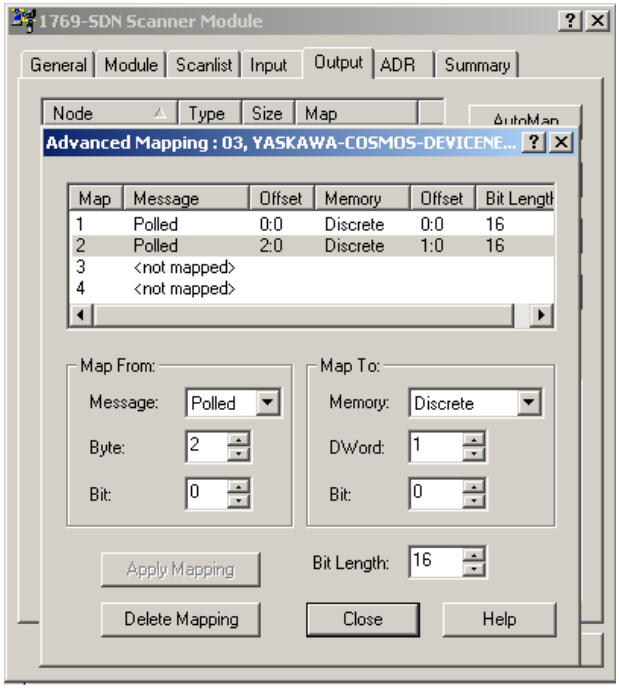


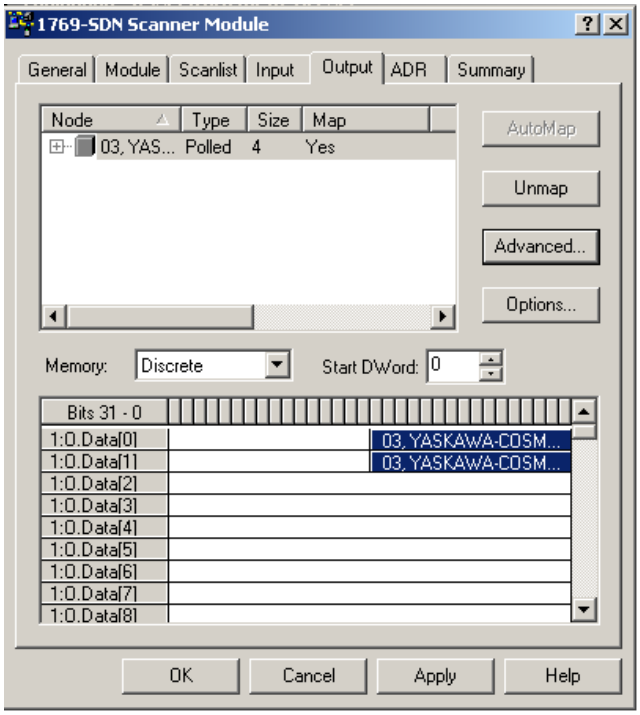
Click on the **Output** tab. On the output dialogue box click on the **Advanced** button to format the I/O into two sixteen bit words. Select **Polled** from the dropdown list in the **Map From:⇨Message:** section and **Discrete** in the **Map To:⇨Memory:** section. The value in the **Bit Length** box should be equal to sixteen (16).

Map the first sixteen bit I/O word by highlighting selection **1** in the **MAP** column of the text window. Set **Map From: ⇨Byte:** to 0. Set **Map To:⇨DWord:** to 0.

Map the second sixteen bit I/O word by highlighting **2** from the **Map** column of the text box. Set **Map From:⇨Message:** to **Polled**, **Map To:⇨Memory:** to **Discrete**, **Map From:⇨Byte:** to **2**, and **Map To:⇨DWord:** to **1** as shown.

When Finished click on **Apply Mapping.** Click Close.





When you have applied the mapping, the output should look like this.

Map the input exactly the same as the output, by selecting the “Input” tab -> “Advanced” and completing the steps outlined in the Output configuration section.

Click OK when finished and select “Download configuration to scanner…” in the window that pops up. Download the changes to the scanner, save the network configuration, and close RSNetWorx.

The assembly mapping will be as follows in Table 2, Tag Mapping for the Example Drive.

Set the value of the *Drive Command Tag* labeled ”Local1:O.Data[0]”.

To access the frequency command to the drive, modify the value for the *Frequency Reference Command Tag*, labeled “Local1:O.Data[1]” corresponding to the example in this application note

The associated response or monitor data from the drive is:

- Local1:I.Data[0] = Drive Status,
- Local1:I.Data[1] = Actual Speed.

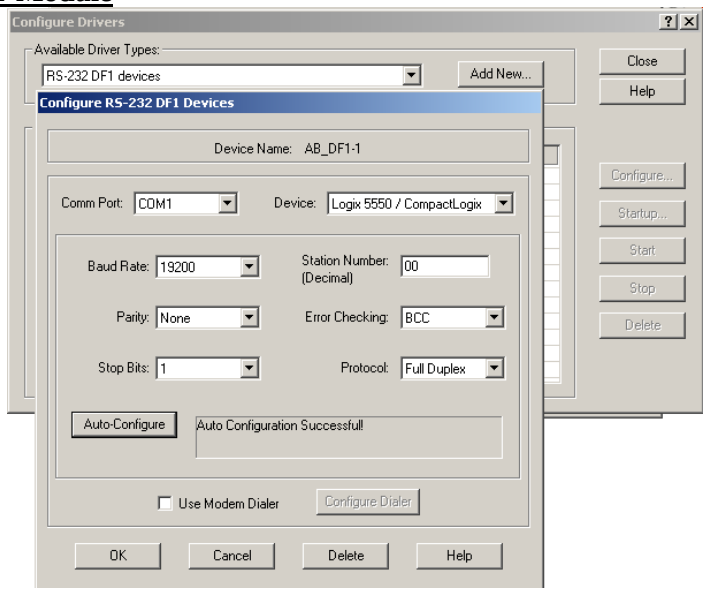
Table 2, Tag Mapping for the Example Drive

Controller Tag Name (Example)	Assembly Data	Description
Local1:I:Data[0]	Assembly 71 (Bytes 1 & 2)	Drive Status Word: Bit 0: Faulted Bit 1: Warning Bit 2: Running Forward Bit 3: Running Reverse Bit 4: Drive Ready Bit 5: Controlling from Network Bit 6: Frequency Reference from Network Bit 7: At Speed Commanded Bit 8-15: Not Used
Local1:I:Data[1]	Assembly 71 (Bytes 3 & 4)	Actual Speed Example (3000 = 30.00 Hz),
Local1:O:Data[0]	Assembly 21 (Bytes 1 & 2)	Drive Command Word: Bit 0: Run Forward Command Bit 1: Run Reverse Command Bit 2: Fault Reset Bit 3: Not Used Bit 4: Not Used Bit 5: Network Control Bit 6: Network Frequency Reference Bit 7: Not Used Bit 8-15: Not Used
Local1:O:Data[1]	Assembly 21 (Bytes 3 & 4)	Commanded Speed Example (3000 = 30.00 Hz),

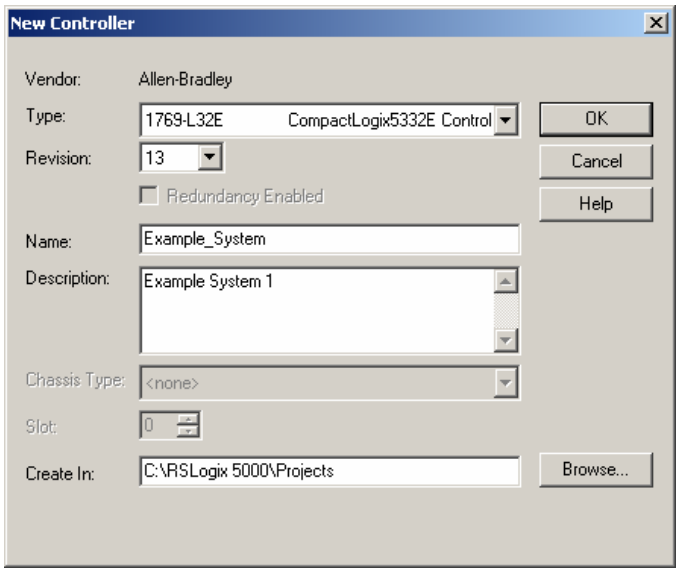
Configuring RSLinx for the Scanner Module

Open RSLinx Classic and select the RS-232 DF1 devices driver then click on 'Add New'. Leave the network name at the default value of "AB_DF1-1" In the "Configure RS-232 DF1 Devices" window select "Auto Configure" then OK.

Close RSLinx.



RS Logix 5000 I/O Configuration



To control the drive from the DeviceNet network configure the I/O in RS Logix 5000.

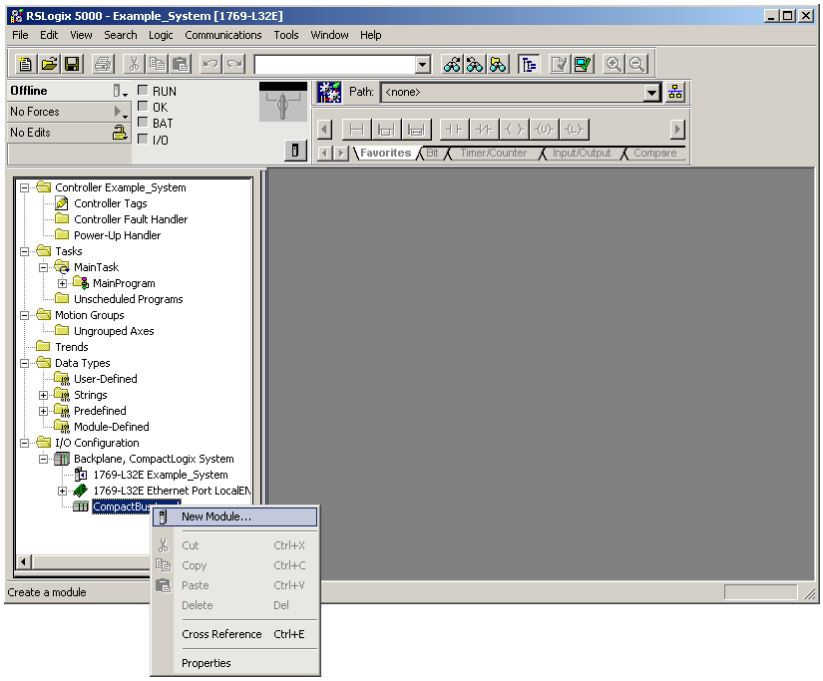
Start RS Logix 5000 and begin a new project by selecting 'File' and ->'New'.

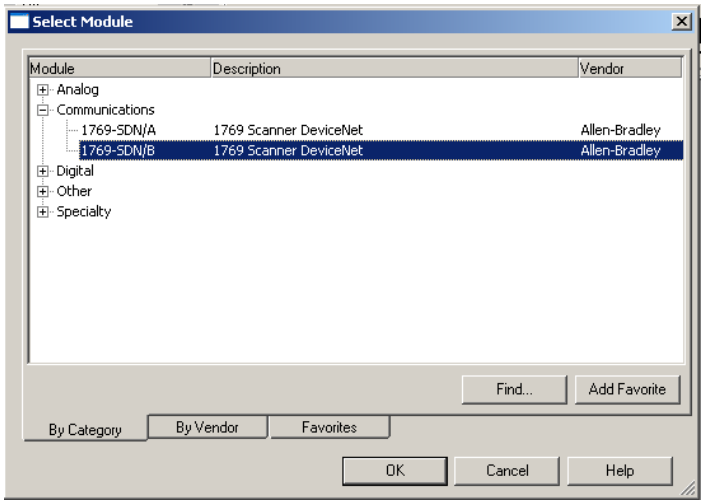
In the Type field select the correct PLC/Controller and system descriptions for the system being created.

Click OK to create the project database for the system.

Add the DeviceNet Scanner to the I/O configuration: Refer to the I/O Configuration folder in the project tree and highlight the CompactBus port used in the project.

Right click and select 'New Module…'



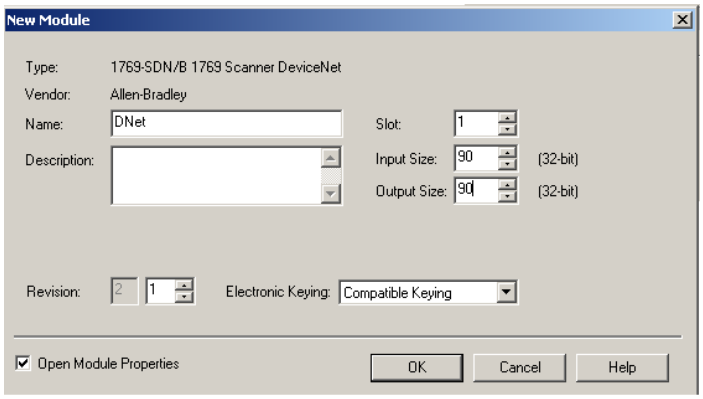


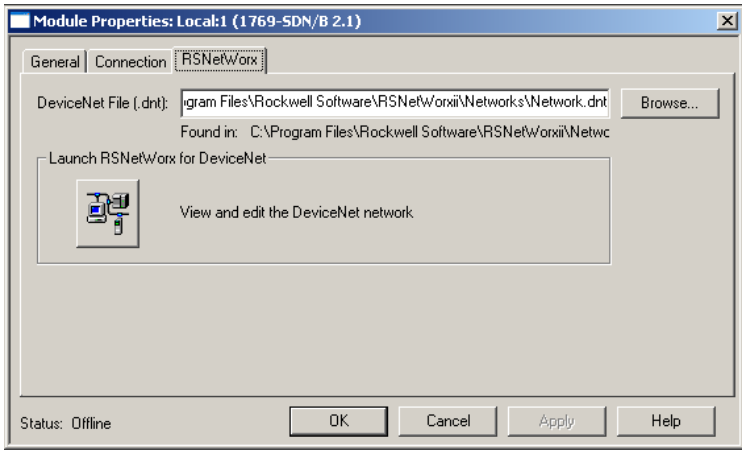
Select the correct DeviceNet scanner from the communications module list. The DeviceNet scanner module model number is listed on the module itself.

Click OK.

In the New Module Dialog that pops up enter a name for the DeviceNet scanner (in this example it is 'DNet').

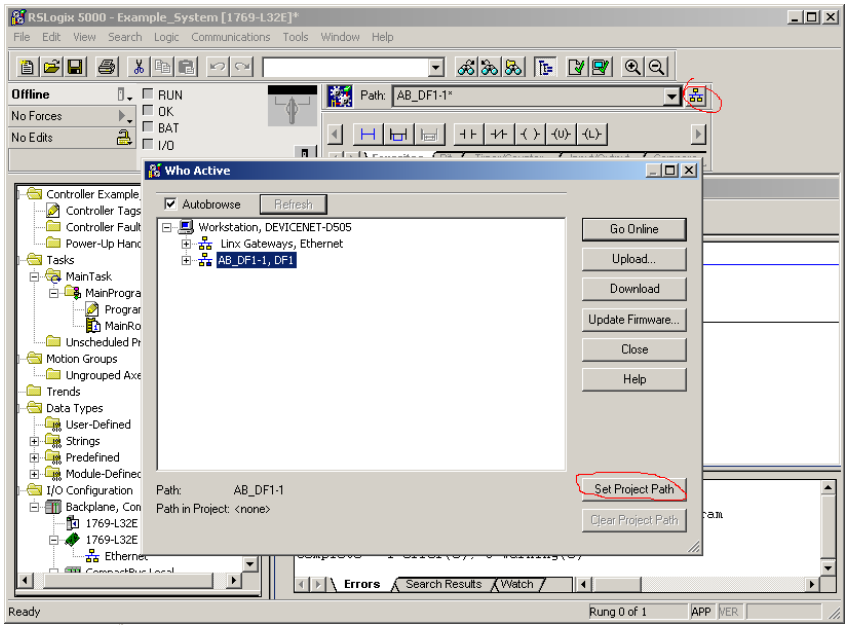
Click OK.





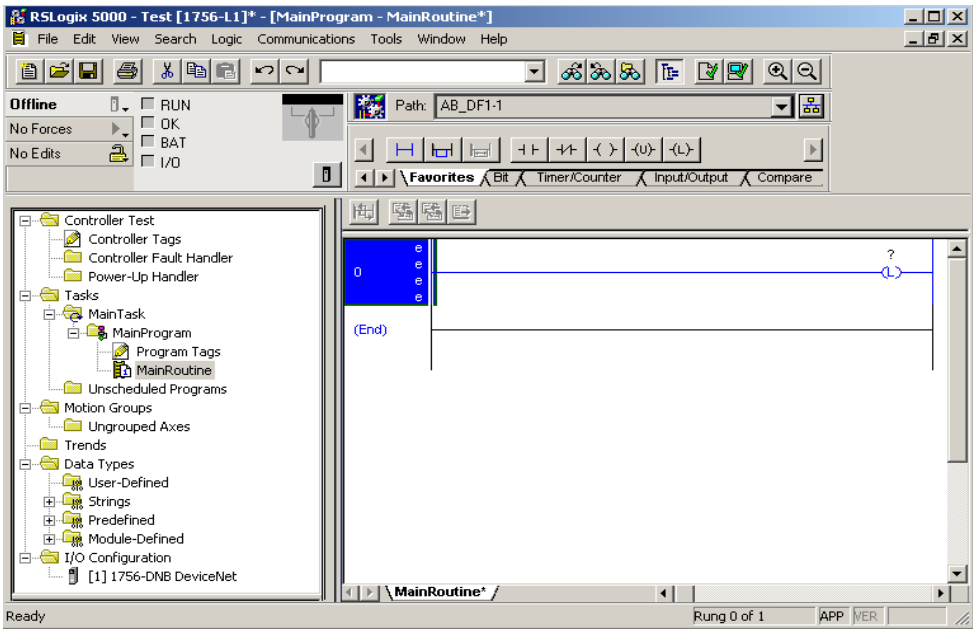
In the next dialog click on the RSNetWorx tab set the path to the saved DeviceNet file from RSNetWorx.

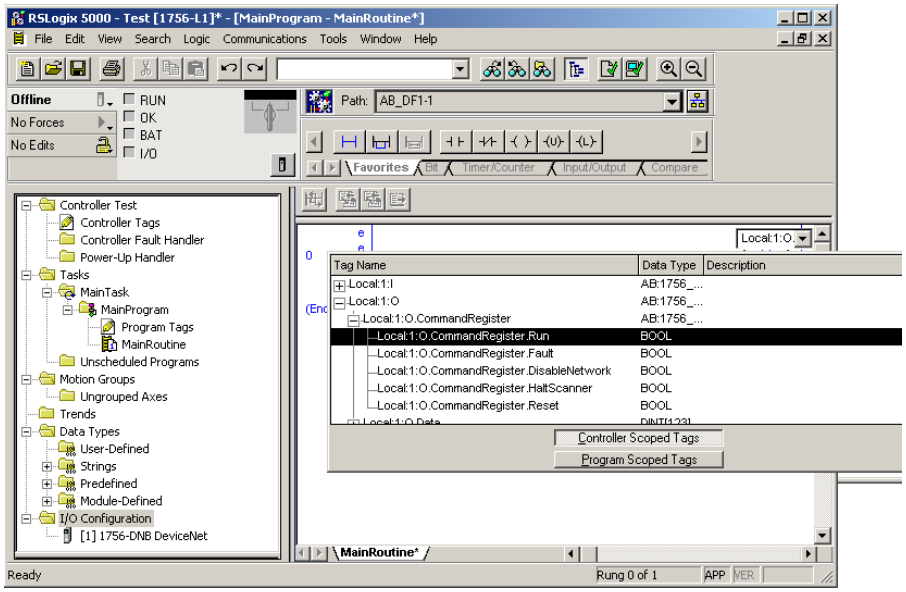
Click OK.



Set the project path with RSWho by clicking on the icon. In the Who Active box highlight AB_DF1-1,DF1 and click 'Set Project Path'

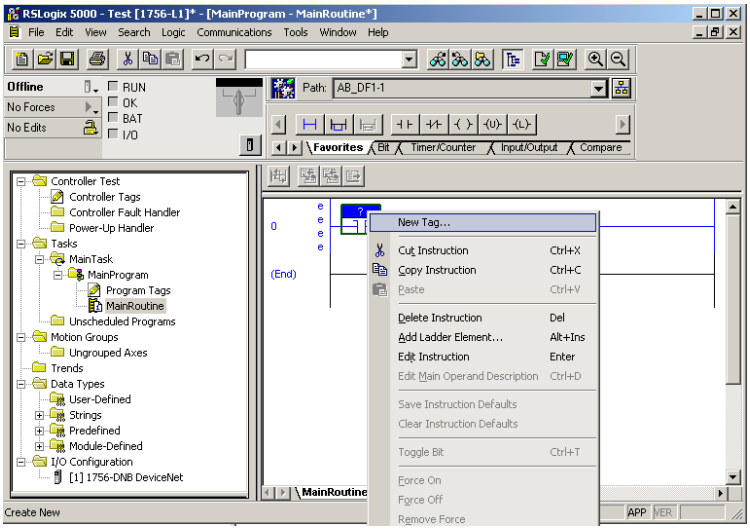
Under the Task folder select 'MainTask' then 'MainRoutine'.
Add a latch to the Main Routine by dragging the icon over to the first rung in the program.

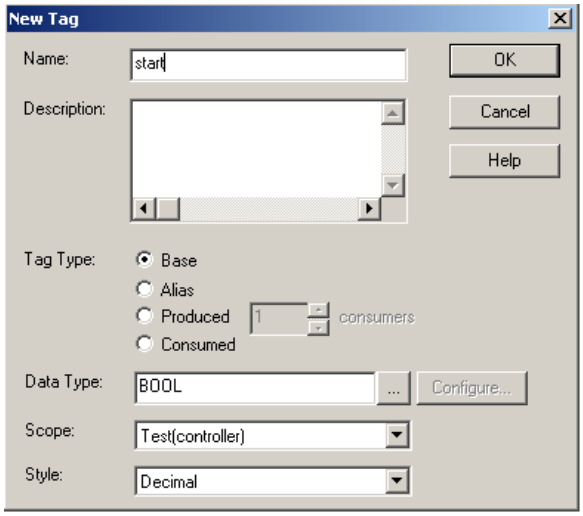




Name the Latch by selecting it and clicking on the icon to open a dropdown menu.
In the dropdown menu expand the dropdown list under Local1:O.CommandRegister then select Local1:O.CommandRegister.Run to initialize the scanner.

Add another rung to the Main routine and on the new rung add a normally open bit by dragging the icon over to the rung. Name the bit by right clicking on the '?' and selecting 'New Tag…'.

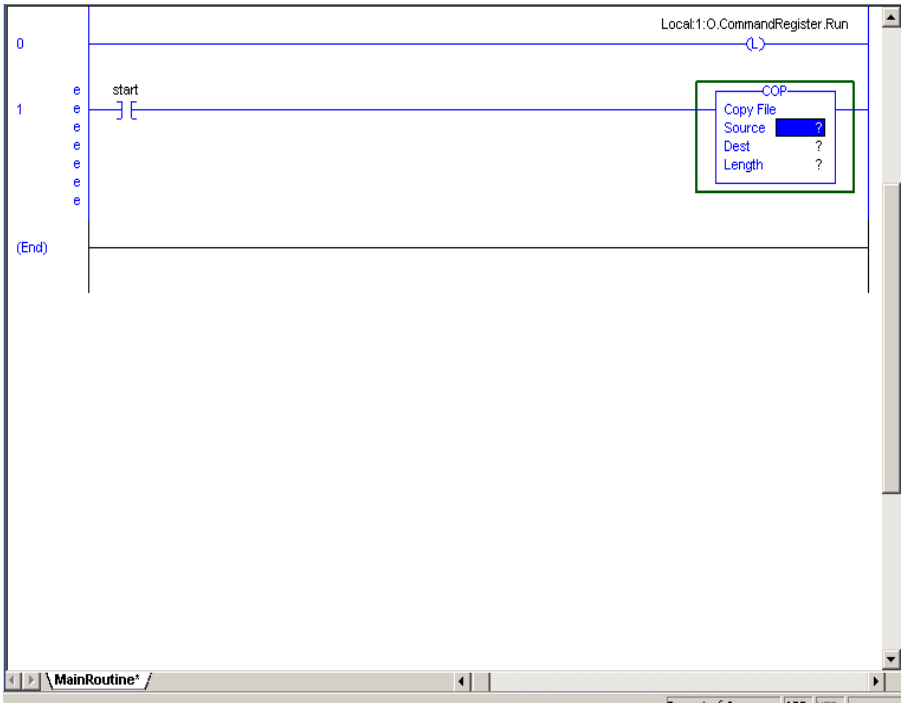


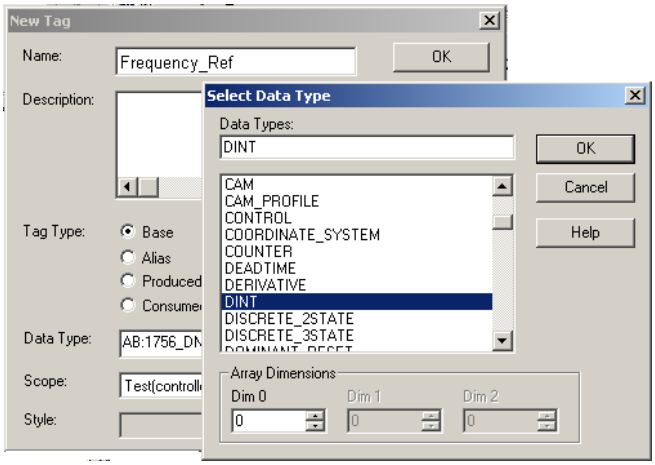


In the New Tag dialog enter the name of the tag as “start”. Leave the data type at the default of “BOOL”.

Click OK

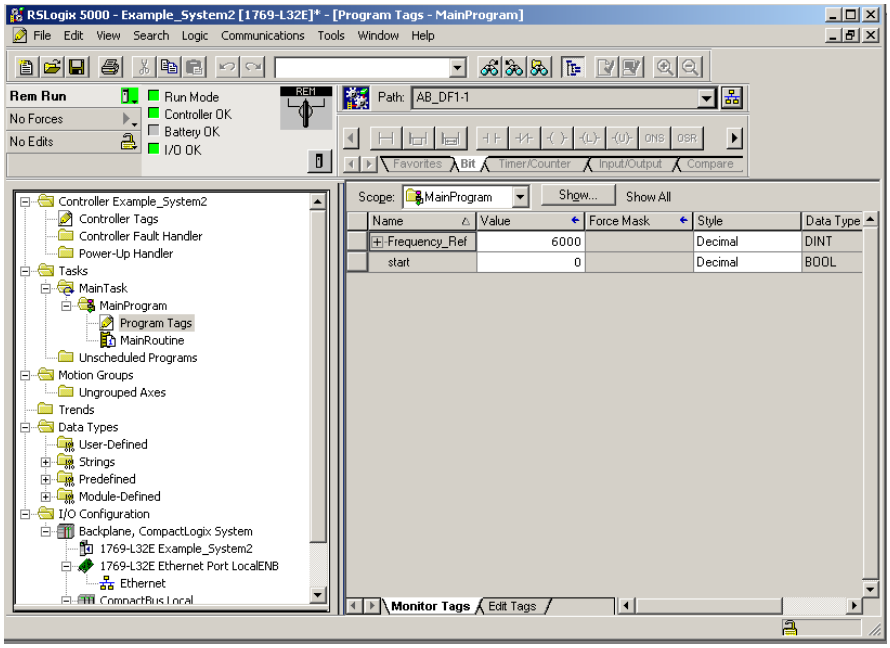
Add a COP function by dragging the COP icon under the ‘File/Misc.’ tab. The COP instruction will send the frequency reference to the drive. Length = 1

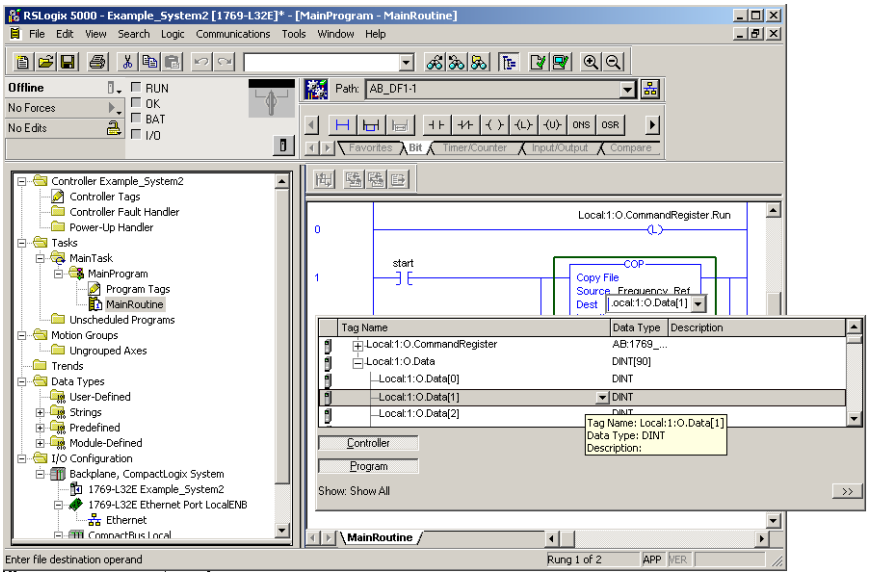




Name the source by selecting a new tag and naming it "Frequency_Ref", its data type should be DINT.

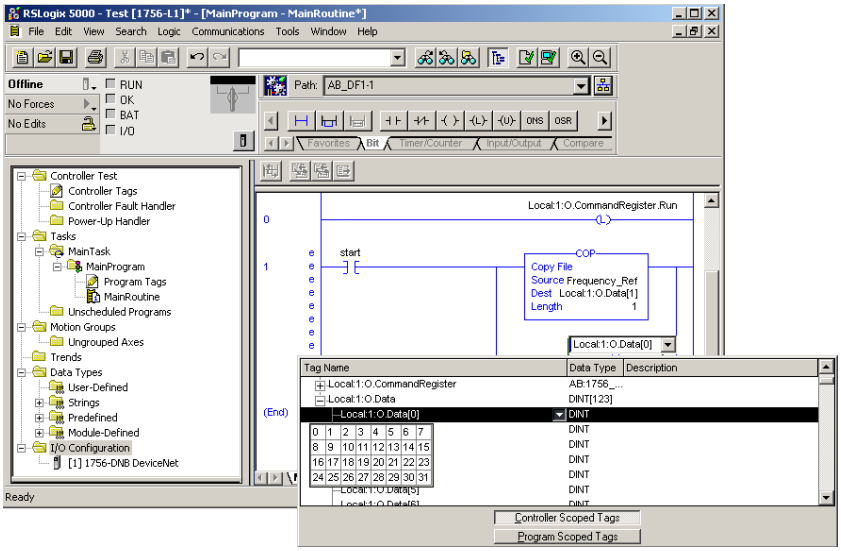
By highlighting the 'Program Tags' in the project tree it is possible to view the newly added Yaskawa AC drives and tags. Frequency reference value can be set here. Set Frequency_Ref value to 6000 or 60.00Hz

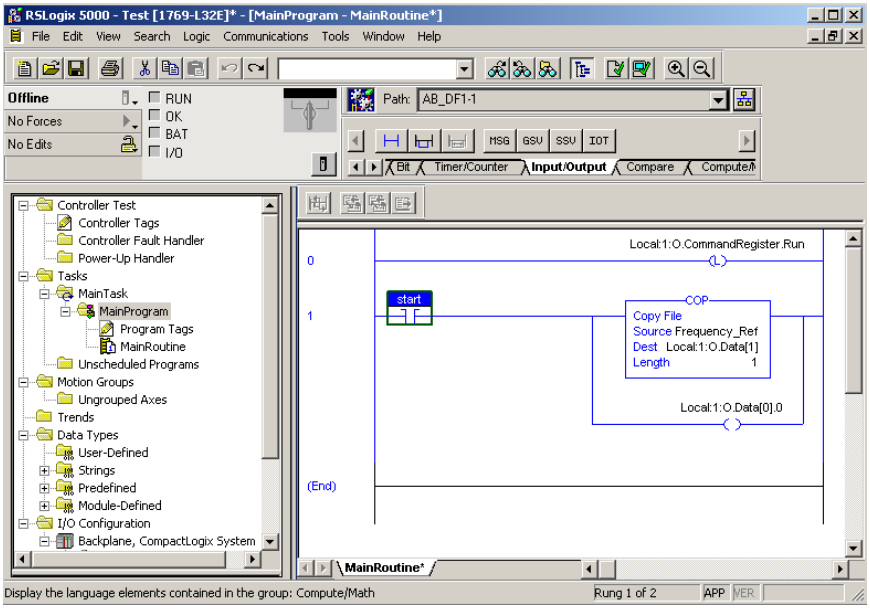




Name the destination by clicking on the "?" and clicking on the icon to open the drop menu. From the Local1:O.Data dropdown list select Local1:O.Data[1] to send the frequency reference to the drive via the assemblies.

Configure the run/stop command by first dragging the icon over to the rung and placing it across the COP command. Add a latch to the branch and name it: Local:1:O.Data[0]





start

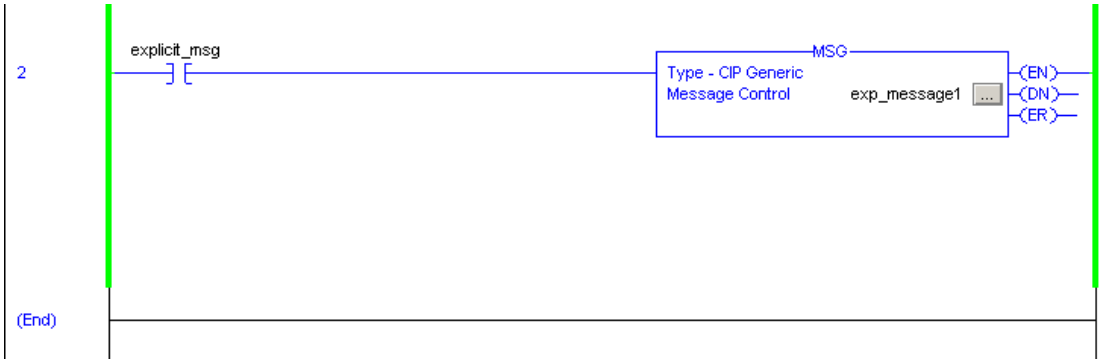
When ┤ ├ is toggled the drive will run forward at the frequency stored in the "Frequency_Ref" tag. To change the frequency value click on 'Program Tags' and enter the new value in the "Frequency_Ref" data section.

Additional AC drives in a system can be added and accessed similarly.

PLC Explicit Message Example

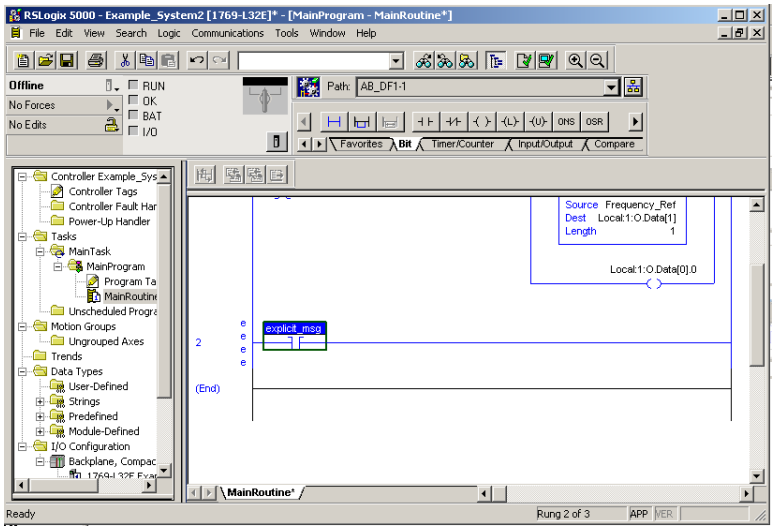
The following is a sample of a PLC ladder that can be used to implement Explicit Message parameter access to the drive. Six connections can be activated for accessing parameter data in the Yaskawa AC drives. They are accessed based on the CIP path associated with the parameter. Refer to the SI-N3/V Technical Manual for more information.

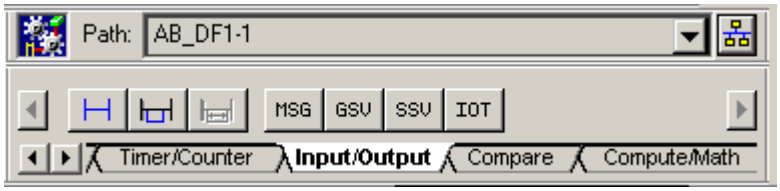
In this example, the PLC will access the Acceleration time in the AC/DC drive object (Class 42 (0x002A), Instance 1, Attribute 18 (0x0012). The value in Acceleration time sets the time to accelerate the motor from 0 to maximum frequency. In order to set the acceleration time, use a “Message” function in the PLC. See the figure below for an example of the ladder logic used.



The Message instruction is activated by a contact called “explicit_msg”, which will command the drive in the example system to set its accleration to a specified value. The ‘Message’ function is configured based upon two dialog interfaces.

Add a new rung and to it add a normally open bit named “explicit_msg” its data type should be BOOL.

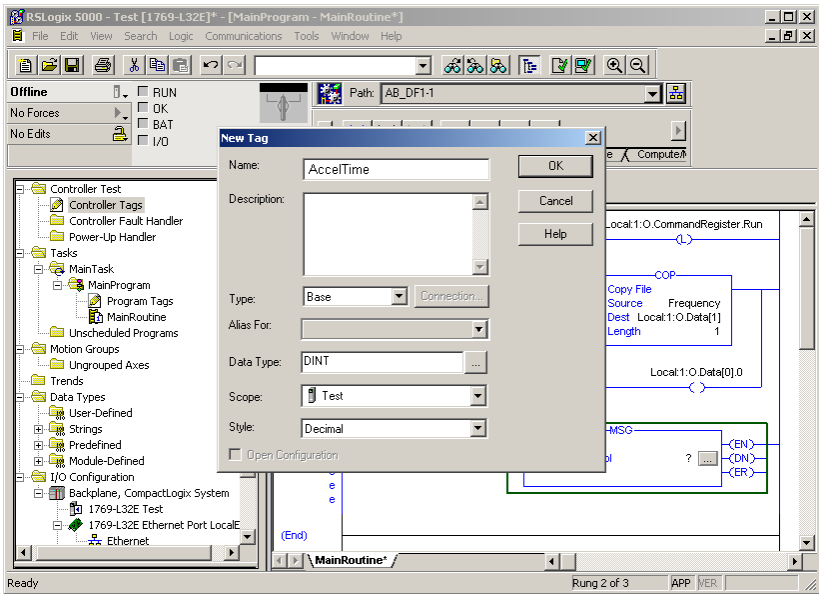


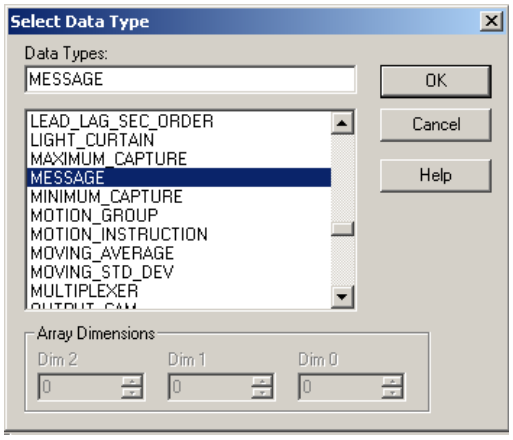


From the element group “Input/Output” select MSG and drag it over to the new rung.

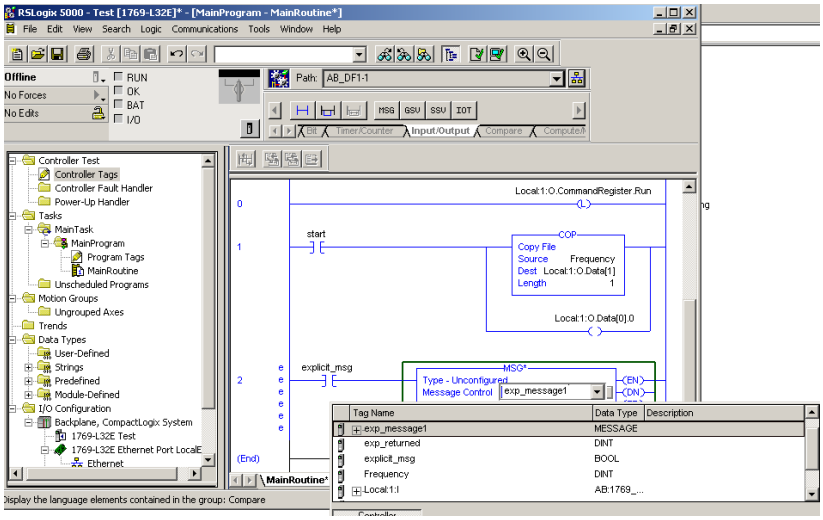
Right click on ‘Controller Tags’ and select ‘New Tag’. In the new tag window make the name AccelTime and make the data type DINT.

Click OK





Right click on ‘Controller Tags’ again and select ‘New Tag’. In the new tag window make the name exp_message1 and make the data type MESSAGE.



Next to ‘Message Control’ click on the blue “?” to open a drop down menu and select exp_message1.

Under I/O configuration double click on 1756-DNB Scanner. Make sure that the scanner has a name for this example *“DNet”*.

Click on box next to exp_message1 to configure the Set command. Set the Message Configuration.

Service Type: Service Code of 10 Hex
SET_ ATTRIBUTE _SINGLE

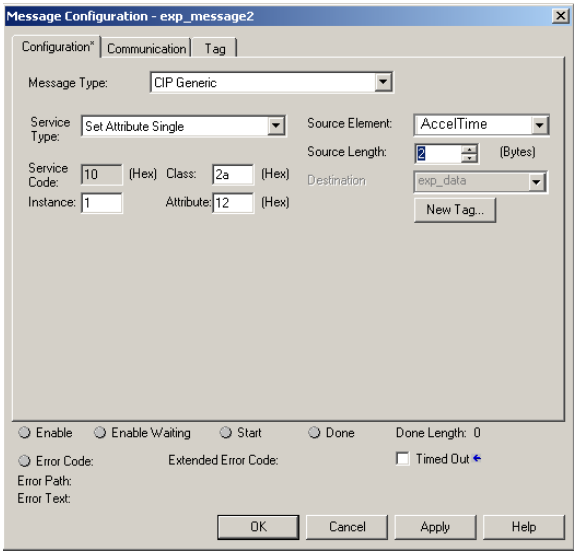
Class: 2A Hex is the AC/DC drive object.

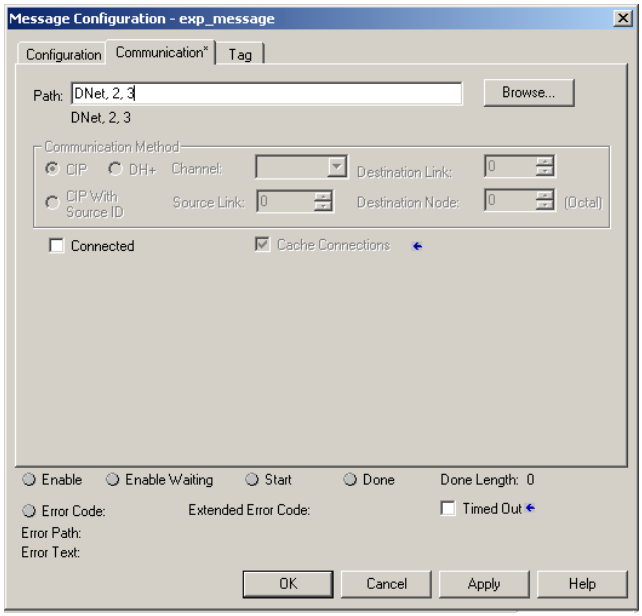
Instance: 1 is the Instance.

Attribute: 12 Hex is the Acceleration Time of the drive.

Source Element: AccelTime is the data that will be sent to the drive.

Source Length: 2 (Bytes)





Click on the Communication tab to add the path to the drive.

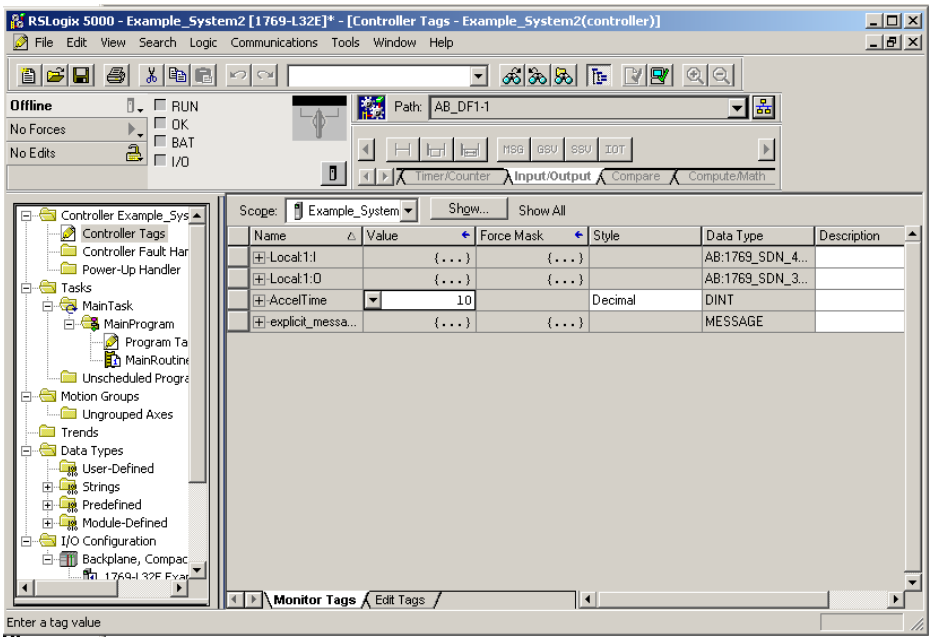
DNet is the name of 1756-DNB Scanner.

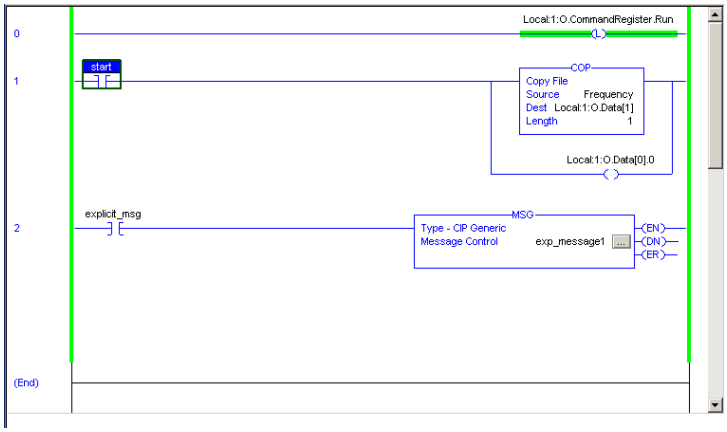
2 is a fixed number representing the DeviceNet scanner port.

3 is the MAC address of the AC drive.

Click Apply and OK

To set the acceleration time to 1 second, click on Controller Tags and enter 10 in the AccelTime "Value" column.





Download the program to the PLC and go online. When the start bit is toggled the drive will run at the specified frequency, and when the explicit_msg bit is toggled it will change the drive acceleration to that specified by the AccelTime controller tag.

The information and example shown here indicate how Yaskawa AC drives can be controlled by utilizing the SI-N3/V DeviceNet option interface. The descriptions indicate how to configure, control and monitor the drives through a CompactLogix PLC, and how to access other associated drive parameters through explicit messaging.

For questions or comments regarding this example, feel free to contact Yaskawa Electric America, Inc.

For support please call: 1-800-YASKAWA.