SI-EN3 and SI-EN3/V EtherNet/IP Option Product Demonstration Unit Technical Manual

1.0 <u>Introduction</u>

To effectively demo the EtherNet/IP kit requires three components:

- A1000 with SI-EN3 or V1000 with SI-EN3/V communication option card properly installed
- PC with DriveWizard® Industrial with an Internet browser.
- EtherNet/IP demo case.

Ensure that the components are located close enough to each other to allow easy connections using the supplied CAT-5 cables located in the EtherNet/IP demo. Plug the drive demo (EtherNet/IP card) into one of the open RJ-45 jacks on the EtherNet/IP demo case (vertical left side jacks). Plug your PC into another open RJ-45 jack. The specific jack does not matter. Plug both the drive demo and the EtherNet/IP demo into 120VAC wall outlets using their demo case power cables.

- *Make sure the pre-installed CAT-5 cable running from the PLC to an RJ-45 jack is still installed. If not, please replace it with the shortest length CAT-5 cable available.*

- *No "cross-over" cables are required as this EtherNet/IP demo has a built-in switch.*

- *Power must be applied to the EtherNet/IP demo case for the network switch to work. This is needed when trying to set up the PC in section 2.2.*

- *No EDS files should be required for this demo. The PLC programming is complete and operational as shipped from Yaskawa.*

- *Refer to the latest revision of application note AN.AFD.22 – dated 12/21/2010 for greater detail on setting up SI-EN3 and SI-EN3/V with ControlLogix and CompactLogix controllers from Allen-Bradley.*

- *APPENDIX A contains screen shots of some sections of these instructions that may prove helpful in demonstrating the demo.*

2.0 <u>Setup</u>

The setup will now be discussed in detail.

2.1 <u>Drive Demo Case</u>

This DEMO is intended to support and demonstrate A1000 (SI-EN3) or V1000 (SI-EN3/V) AC Drives with the EtherNet/IP option board properly installed. No special drive software is required. The HMI and CompactLogix L32E programs are loaded and operational as shipped from Yaskawa.

Note: The motor demo case (available separately) is not required but helpful in showing a large audience that the drive is actually being controlled by the PLC.

The SI-EN3 or SI-EN3/V EtherNet/IP option card should be installed per the instructions contained in TOEPYEACOM04 for the A1000 or TOEPYEACOM01 for the V1000.

Note: The card must have its default IP address (192.168.1.20) for the demo to work. If you are not sure, follow the instructions in section 6 of the Installation or Technical Manuals of the respective option card - F7-13 = 0 (IP Add Mode Sel "User Defined")..

» Lastly, set parameters *b1-01 = 3 (Ref Source "Option PCB") and b1-02 = 3 (Run Source "Option PCB")*
» This will allow the run command and frequency reference to come from the SI-EN3 or SI-EN3/V EtherNet/IP option card.

2.2 PC and an Internet Browser

Although a PC is not technically required to show EtherNet/IP communication with this demo, it is a perfect opportunity to demonstrate the EtherNet/IP card's webpage. Looking at the webpage also confirms that the card is properly functioning.

Configure the PC's IP address to be compatible with the EtherNet/IP card (use 192.168.1.19 as instructed). Please make sure to write down the existing IP settings so you can properly re-connect to your home/office network. You will have to return your PC's IP settings to their original settings after the EtherNet/IP demonstration.

Direct any Internet browser to the card by directly typing 192.168.1.20 into the search bar. The card's web page should pull up indicating a properly functioning PC and EtherNet/IP card.

Note: Do not re-configure the EtherNet/IP card. You should show the customer the configuration tab, but do not make changes. If changes are made, please reset the card.

While leaving the Internet browser connection open, launch DriveWizard® Industrial as this contains the latest features pertaining to Internet connections.

2.3 EtherNet/IP Demo Case

The EtherNet/IP demo case is designed to be very easy to operate. Make sure the drive demo is powered and its Cat-5 EtherNet cable is connected to the EtherNet/IP demo case. After power is applied to the EtherNet/IP demo case, the demo will need several minutes for the PLC and HMI touch screen to complete their boot-up routines. After boot-up is complete, the HMI touch screen should have no errors (should display "Drive Ready") and show several buttons: Start, Stop, FWD/REV, Running Status, and 3 Monitors. Section 3 of this manual will discuss the manipulation of the EtherNet/IP demo. Specific discussion points regarding EtherNet/IP will be discussed in section 4 of this manual.

3.0 Demonstrating EtherNet Connectivity

Use the HMI touch screen to set a frequency reference by tapping on the frequency reference numeric display. This will bring up a numeric keypad. Use the CLR button to zero out the existing reference. Next set a frequency reference between 2.0 and 60.0 Hz. Finish by tapping the ENT key.

You should now be able to start, stop and change the direction of the motor using the appropriate buttons on the touch screen. The monitors should reflect your actions. The customer needs to understand that the HMI is communicating your actions to the PLC using the EtherNet/IP protocol over standard EtherNet hardware (switch, CAT-5 cable, etc.). The PLC in turn is communicating your actions to the drive using the EtherNet/IP protocol.

While you are using the touch screen to control the drive, pull up the drive's webpage on the PC. Select the "Drive Diagnostics" button to display 15 of the drive's monitors. These monitors should reflect your actions of starting, stopping, and reversing the drive.

The latest rev of DriveWizard® Industrial software can also be opened up on your PC and connected to one of the four ports on the demo to demonstrate remote access as well. This ability to control and monitor remotely from multiple sources is radically different from all non-EtherNet interfaces. For the first time, it is practical (and relatively easy) to monitor drives located around the globe from a single office.

4.0 Specific Points to Get Across

When demonstrating the various components of this demo, please try to push the following points. These are listed in no order of importance.

4.1 Drive's Webpage

- Content is stored in the card itself.

- Any web browser can access the webpage.

- Web pages are in their infancy. Look for more powerful pages in the coming years.

- We are investigating adding a password to prevent the changing of the IP address remotely. This should alleviate some of the security concerns.

4.2 DriveWizard® Industrial – download the latest revision on your PC for this part of the demo

- You should familiarize yourself with the "Drive Selection & Communication Setup" tab/section of DriveWizard® Industrial before proceeding with this portion of the demonstration. See APPENDIX A screen shot.

- Like the webpage, DriveWizard® over EtherNet can connect to a drive anywhere in the world.

- DriveWizard® uses a spreadsheet to store multiple preset IP addresses seen in the drop-down box in the Communications $\Rightarrow$ Setup screen shown above. For ease of use, fill out the spreadsheet using MS Excel. The file is located in C:\Program Files\Yaskawa\Drive Wizard. The file is called IPList.csv. Make sure to leave the file in the ".csv" format.

- Using EtherNet, the graphing function supports a 100ms sample rate that is not present through the keypad port connection. Be aware that the 100ms sample rate is PC CPU intensive.

- You can open multiple instances of DriveWizard® on the same PC. This allows you to monitor multiple drives on the EtherNet network at the same time if so desired.

4.3 EtherNet/IP

- EtherNet/IP is based on CIP (**C**ommon **I**ndustrial **P**rotocol). This is the same backbone that DeviceNet and ControlNet are based on. This means that programmers familiar with DeviceNet or ControlNet will pick up EtherNet/IP quickly. It also allows a PLC connected to different networks (i.e. EtherNet/IP and DeviceNet) to pass data between the networks very quickly (act as a bridge).

- EtherNet/IP is a very fast network (100Mbps). Moreover, it is a scheduled network. Unlike PC networks and Modbus TCP/IP, EtherNet/IP is a scheduled network, which prevents collisions thus improving throughput.

- EtherNet/IP is becoming a dominant industrial network protocol. EtherNet/IP is very flexible and extremely fast. With CIP as its backbone, existing Allen-Bradley PLC users of DeviceNet and ControlNet can easily learn the EtherNet/IP protocol.

- Determinism. This is a tricky subject. Determinism is a guarantee that data will make it to its destination in a defined amount of time. The time might be 3 seconds or 5ms. The EtherNet/IP protocol is not deterministic in the sense that its scheduling algorithm is not based on a deterministic routine. Also, all EtherNet protocols can suffer from the nearly infinite network configurations. An industrial EtherNet network should not be on the same network as say an office print server. All this being said, however, EtherNet/IP is essentially deterministic for most implementations. Tests run at Yaskawa on a heavily loaded drive network show that EtherNet/IP was deterministic to under 5ms, which is faster than our drive can process network data. So while EtherNet/IP is not deterministic for the intrinsically safe definition, it is deterministic and extremely fast for most applications.

5.0 Network Comparison Table

Feature	Modbus TCP/IP	EtherNet/IP	DeviceNet
Part Number	SI-EM3	SI-EN3	SI-N3
Network Type	Request / Response	Produced / Consumed I/O	
Protocol Type	Controller Level		Device Level
Speed	10/100Mbps		125-500kpbs
Nodes	Unlimited		64
Number of Masters	Multiple		1
Webpage	Yes		No
Deterministic	No	Essentially	No
Configuration Files	No	EDS Files	
Simultaneous Connections	10	8	2
Automatic Node Replacement	None	Built-in	ADR
Parameter Access	MSTR Function	Explicit Messaging	

APPENDIX A

This section contains some helpful screen shots of details referenced above.

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Ethernet I/P Demonstration Unit

Set Up and Configuration

- Ethernet Demo Connections
- SI-EN3 Option
- Parameters To Adjust

  » b1-01 = 3 (Ref Source "Option PCB")
  » b1-02 = 3 (Run Source "Option PCB")
  » F7-13 = 0 (IP Add Mode Sel "User Defined")

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Ethernet I/P Demonstration Unit

Using the Ethernet Demo

- Start, Run drive Fwd at 60 Hz
- Touch Screen Input Switches

  » Switch 1, External Fault (EF3)
  » Switch 2, Fault Reset
  » Switch 3, Analog Input (A3 on A1000 Demo)
  » Switch 4, Freq Ref from A1000 (d1-03)
  » Switch 5, Jog Ref, 6Hz (d1-17)
  » Switch 6, Base Block

1000 Series Webpage (SI-EN3)

1000 Series Webpage (SI-EN3)

1000 Series Webpage (SI-EN3)