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DNP 3.0 Serial (RS232/RS485) and Ethernet (TCP/IP) SCADA Interface For IUPS Systems with S2A-383S communication cards.
Option 21P

Setup Instructions

This manual is only valid for IUPS Systems equipped with the following:

Option 21P – TCP/IP and RS-232-485 serial provided on 383s Communication Board

Rectifier Section
Default Settings

The LaMarche Communications Card is shipped with the following default settings:

Serial Port Settings
Port: RS232
Node Address: 4
Baud Rate: 9600
Data Bits: 8
Stop Bits: 1
Parity: None

TCP Port Settings
Protocol: DNP 3.0
Node Address: 4
IP Address: 192.168.0.6
Subnet: 255.255.255.0
Gateway: 192.168.0.1
TCP Port Number: 20000

Required Equipment/Software

PC/Laptop.

CAT 5/Ethernet Null-Modem/Crossover cable to connect PC/Laptop to Ethernet Port on Communications Card.

To change settings it is necessary to load and install the EasyConnect Software provided by Kalki Communications from the following URL onto your PC/Laptop:

https://kalkitech.com/support/downloads/softwares/

Setting changes are made through the Ethernet connector on the 383s card.

EasyConnect Software Operation

EasyConnect is the software that will be used to accomplish the following setting changes.

Link Layer Settings (Source Address, Destination Address)

SCADA Port Settings (Port Type, Baud Rate, Data Bits, Parity, etc.)

**Setting the Modbus Address of the Chargers Control Card**

The communications board utilizes Modbus RTU to read and write settings from the Chargers control board. The settings are polled every 5 seconds. By default they are set as follows:

Modbus Address (ID): 0
Modbus Baud Rate: 115200
Modbus Parity Type: None
Data Bits: 8
Stop Bits: 1
Modbus Port Type: RTU, RS232

These settings are required for the two cards to communicate properly. If for some reason the Communications Card is unable to obtain readings from the Control Card the points will go to the "offline" state.

*Changing the DNP 3.0 Link Layer Settings*

When you have completed the installation of EasyConnect and run it you will be greeted with the following screen:
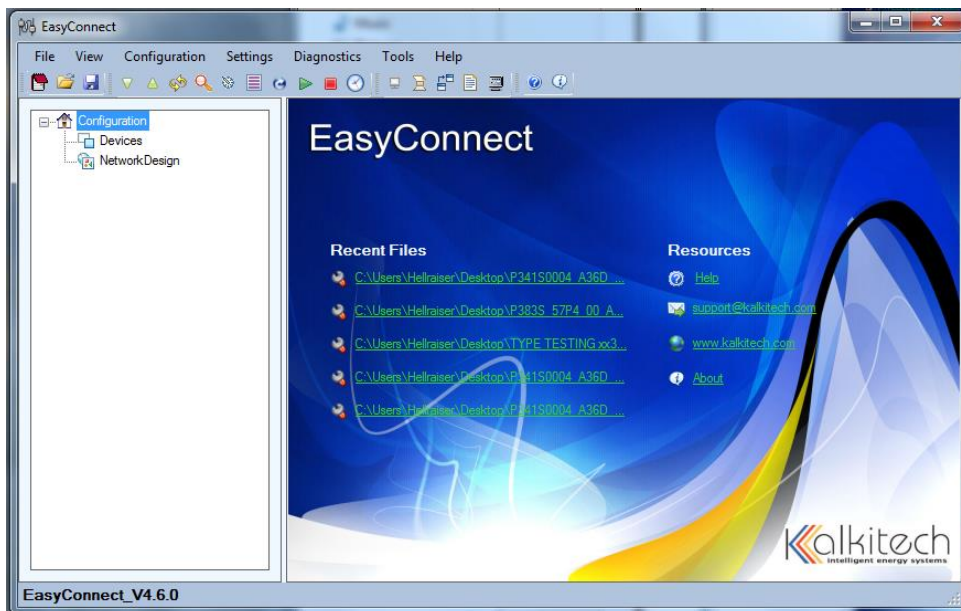

The first step is to upload the settings from the communications board into EasyConnect for modification. Connect the PC/Laptop to the Ethernet Port on the Communications Board. The communications board must

be powered. Please note it may take up to 1 minute from the time the board is powered to when it will receive commands.
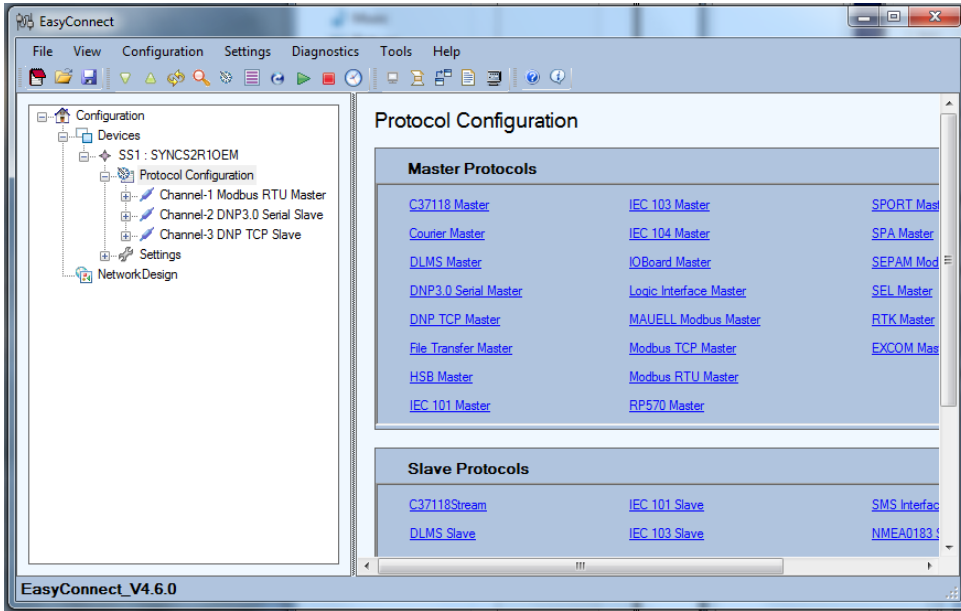
Select Upload as shown below:
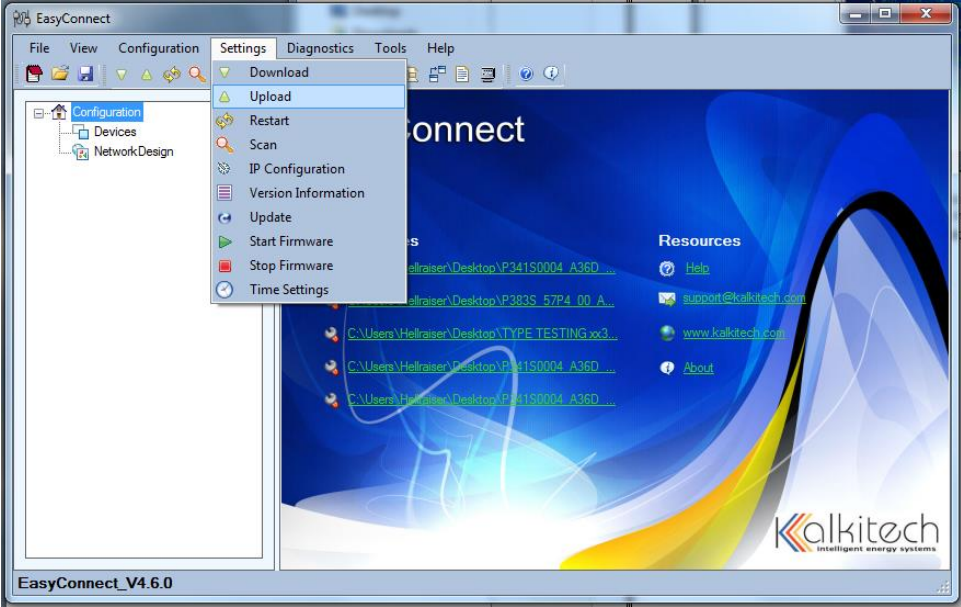
Select Import to the Configuration (Add as a new device) and the Model should be SYNCS2R1OEM. If you have modified the IP Address of the module to one other than the factory default of 192.168.0.6 you must enter it in the IP Address box. Press Upload to begin the process.
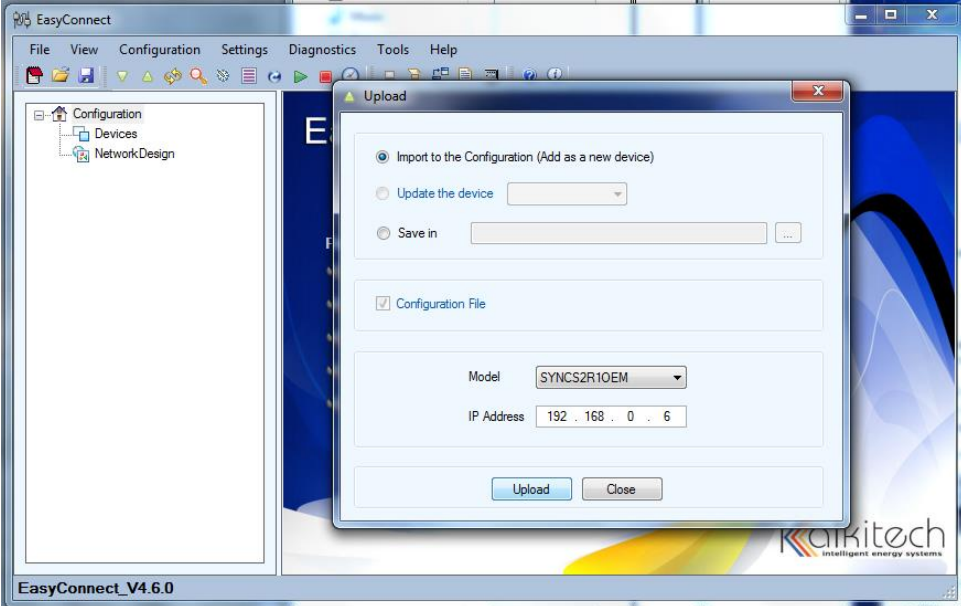
Once the Upload is complete you will see a screen as shown below:

The above screen shows 3 Channels in the tree view pane. Your application will determine which channel you set up. If you are using RS232 or RS485 to communicate you will interested in Channel-2 DNP 3.0 Serial Slave settings. If you are using TCP to communicate you will be interested in Channel-3 DNP TCP Slave settings. IT IS NOT ADVISED TO MODIFY ANY Channel-1 Modbus RTU Master Settings UNLESS DIRECTED BY LAMARCHE. Channel-1 is used to communicate with the LaMarche Control Card and unintended modification of these settings may prevent the Communications card from receiving and transmitting data to the control card.

Communications Board Configuration

When using the Serial Ports you must check the 383S card switch settings and either confirm or select SW4 (light blue) to either RS232 or RS485. SW3 (red) selects the RS485 biasing and termination resistor configuration. The silkscreen on the board shows the switch positions for various settings. J2A is the RS232 connection and this port is wired as DTE. TS1 is the RS485 connection. Only one Serial port is active at a time. The Ethernet Port on the small daughter board is the configuration port.
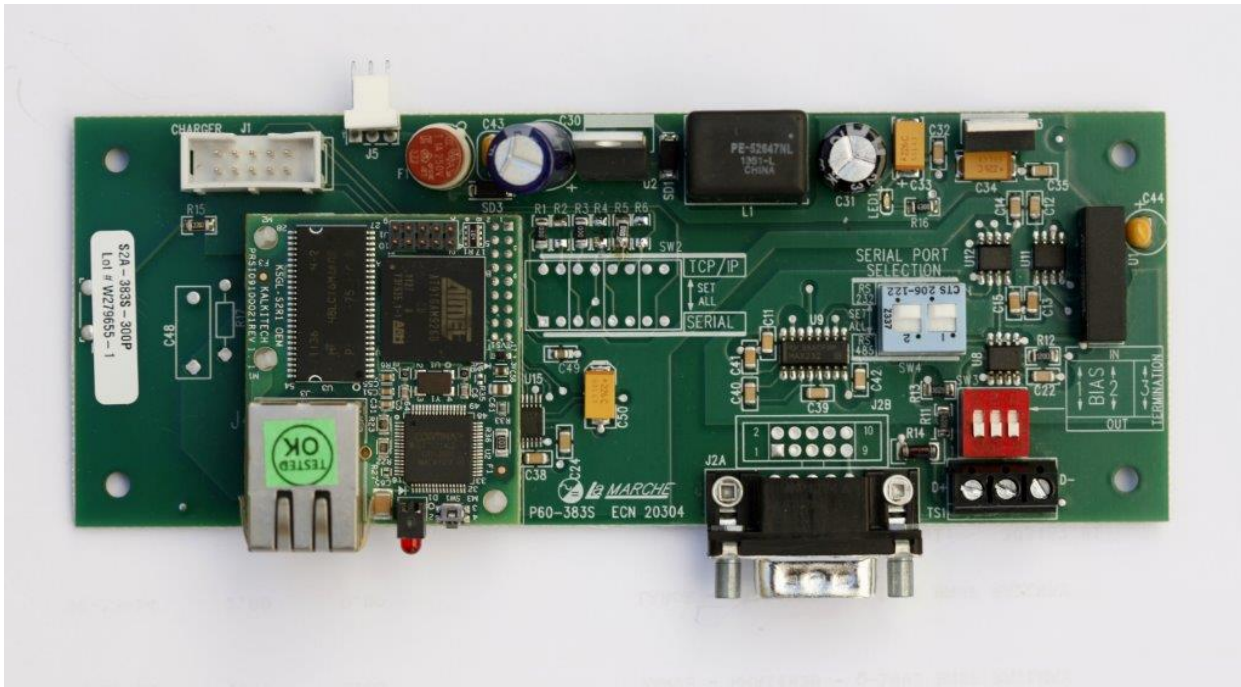
Serial Port Configuration (RS232/RS485, Baud Rate, Parity, Data Bits, Stop Bits)

Using the mouse point and click on Channel-2 DNP 3.0 Serial Slave in the tree view as shown below.   In this view you can select the Channel Type, RS485/RS422 mode, Baud Rate, Data Bits, Stop Bits, Parity and Flow Control. It is not advisable to change any other settings without first consulting with LaMarche or your SCADA Department.   ALSO PLEASE LEAVE the "Port" SETTING ON Com2.

Recommended Settings:

RS232:

Channel Type: RS232

Baud Rate: 9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: None

RS485:

Channel Type: RS485

RS485/RS422 mode: RS485

Baud Rate: 9600

Data: Bits: 8

Stop Bits: 1

Parity: None

Flow Control: Hardware
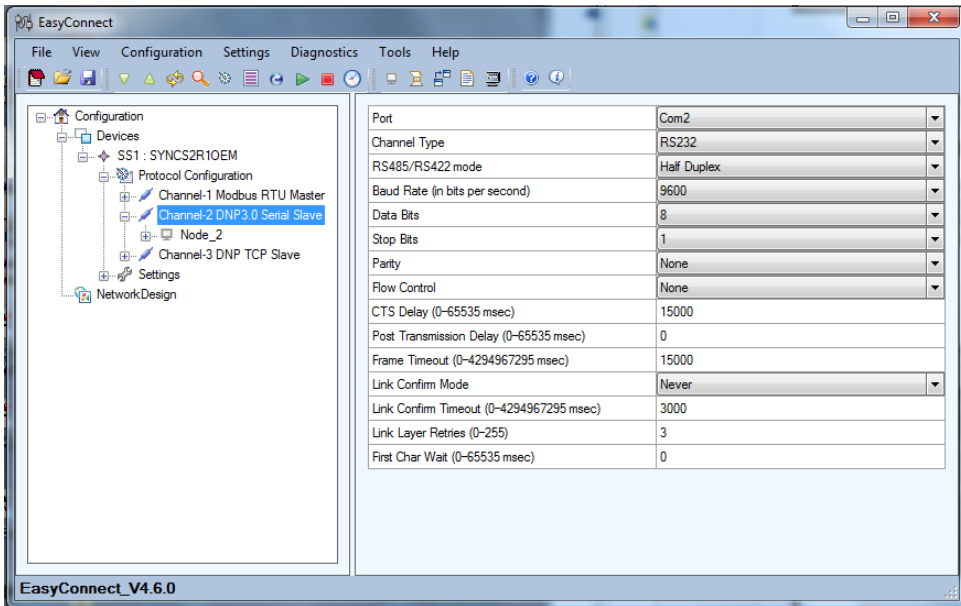
DNP Link Layer Configuration (Source & Destination Address)
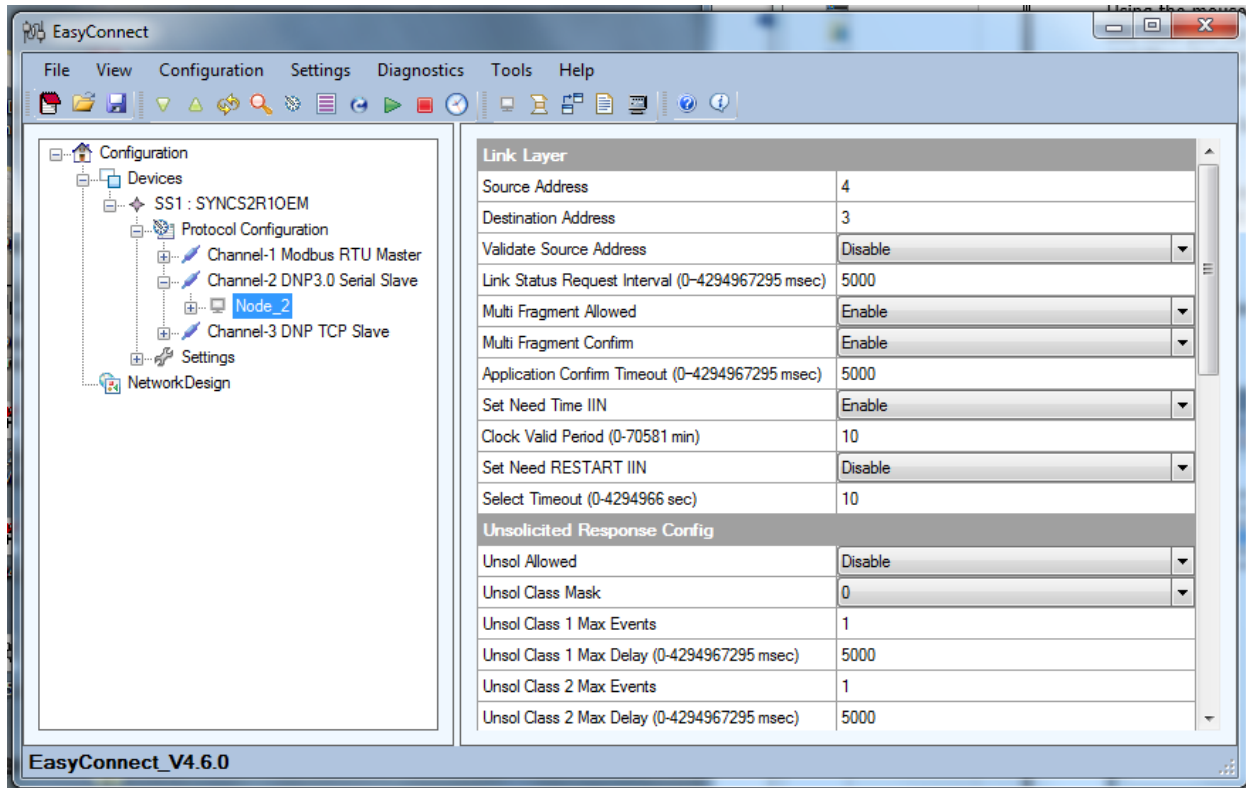
Using the mouse point and click on Node_2 in the tree view as shown below. In this view you can select the Source Address and Destination Address. Other settings are available however it is not advisable to change any other settings without first consulting with LaMarche or your SCADA Department.

Note: The Source Address is the address the Communications card is to reside at. The Destination Address would be that of the Master Station and is not always required unless source validation is utilized.

Once you have configured the Serial Port and Link Layer settings you may proceed to the Download Settings to Communications Card section of this manual.

Channel-3 DNP TCP Slave Configuration

Communications Board Configuration

When using the TCP you do not need to concern yourself with the switch settings on the 383S card shown below.

DNP Link Layer Configuration (Source & Destination Address)

Using the mouse point and click on Node_3 in the tree view as shown below.   In this view you can select the Source Address and Destination Address. Other settings are available however it is not advisable to change any other settings without first consulting with LaMarche or your SCADA Department.

Note: The Source Address is the address the Communications card is to reside at. The Destination Address would be that of the Master Station and is not always required unless source validation is utilized.
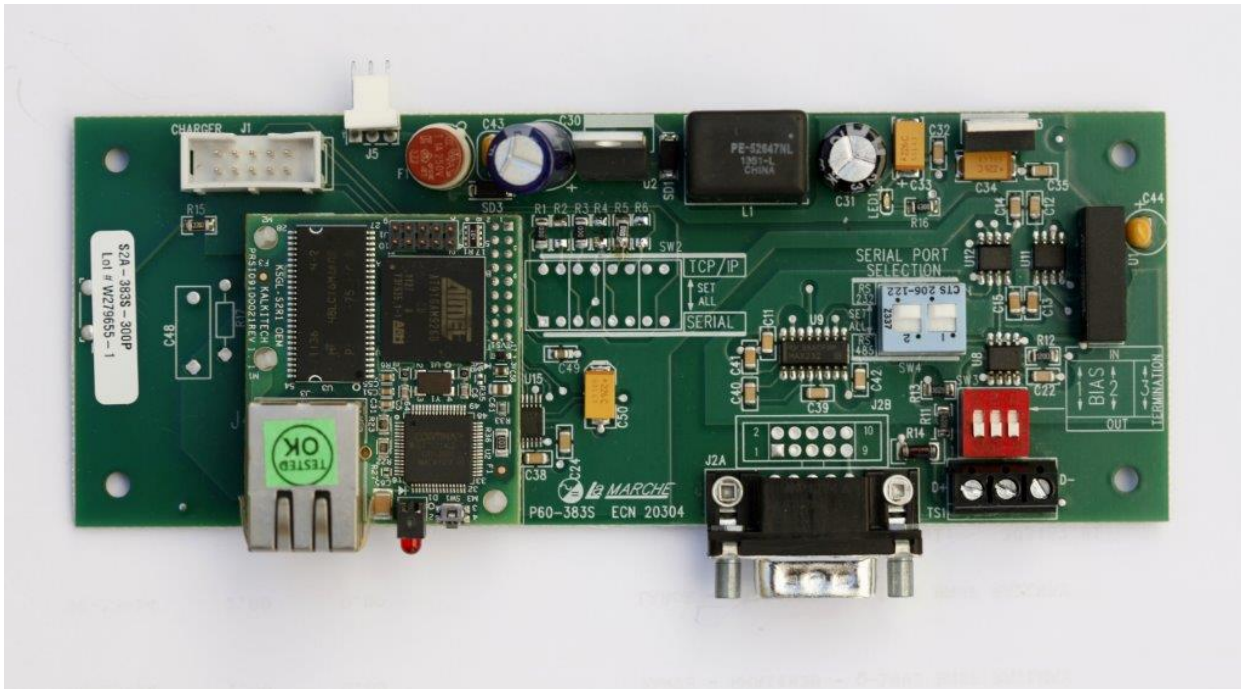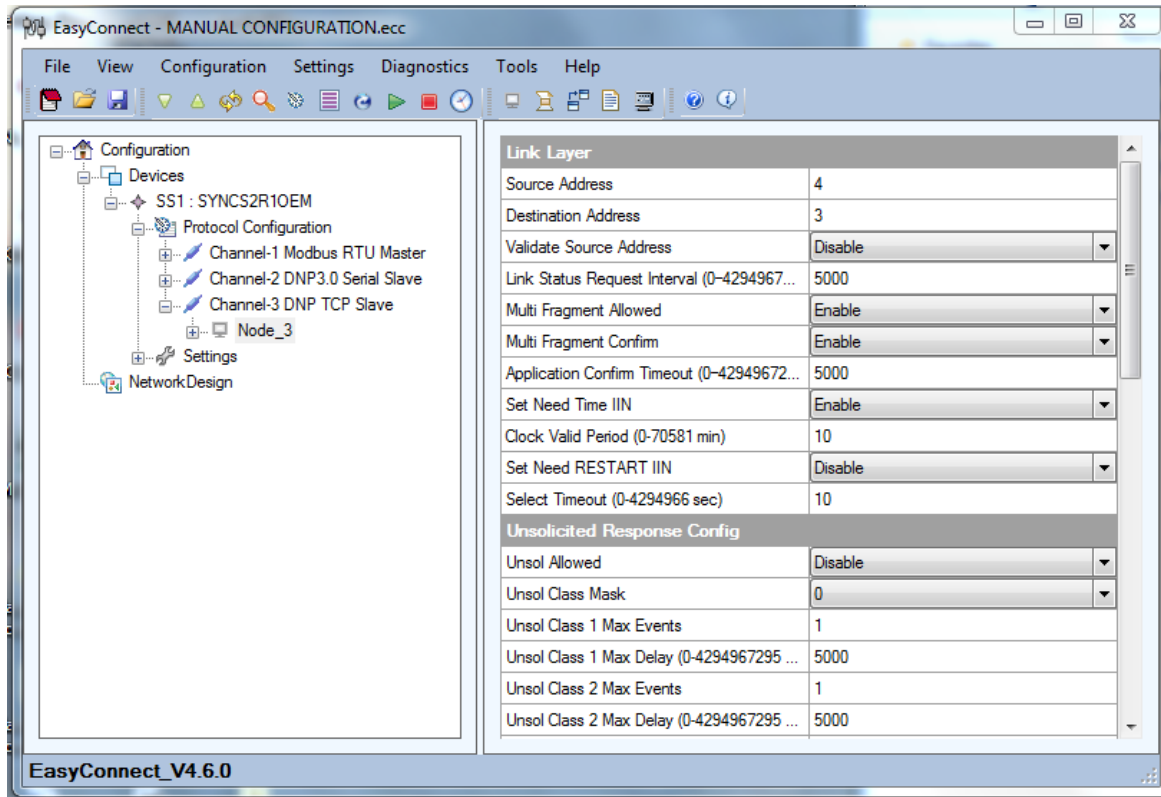
DNP Channel Configuration (TCP Port Number)

Using the mouse point and click on Channel-3 DNP TCP Slave in the tree view as shown below. In this view you can select the Port Number. Other settings are available however it is not advisable to change any other settings without first consulting with LaMarche or your SCADA Department.
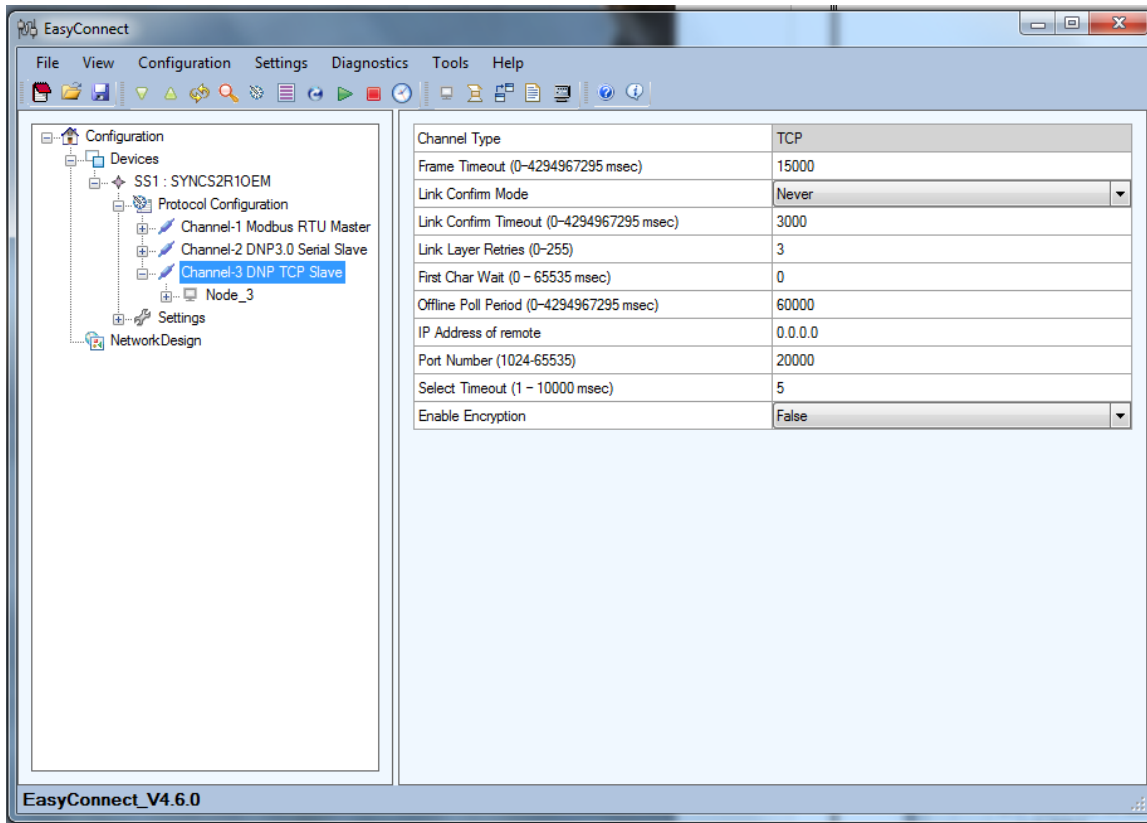
To change the IP, Subnet and Gateway please refer to the section titled "Changing the IP Settings."

Once you have configured the settings you may proceed to the Download Settings to the Communications Card section of this manual.

Downloading the Settings to the Communication Card

Step 1: Use the mouse and click on SS1: SYNCHS2R1OEM in the tree view pane.
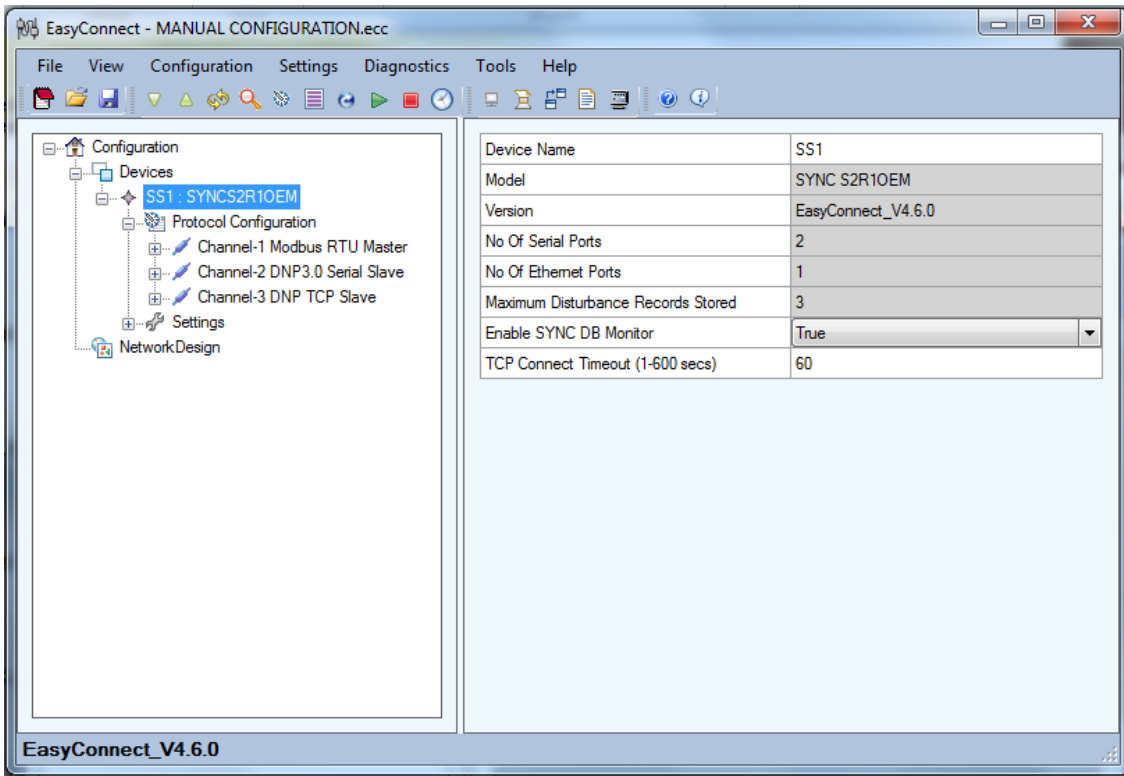
Step 2: Select Download for the Settings menu.
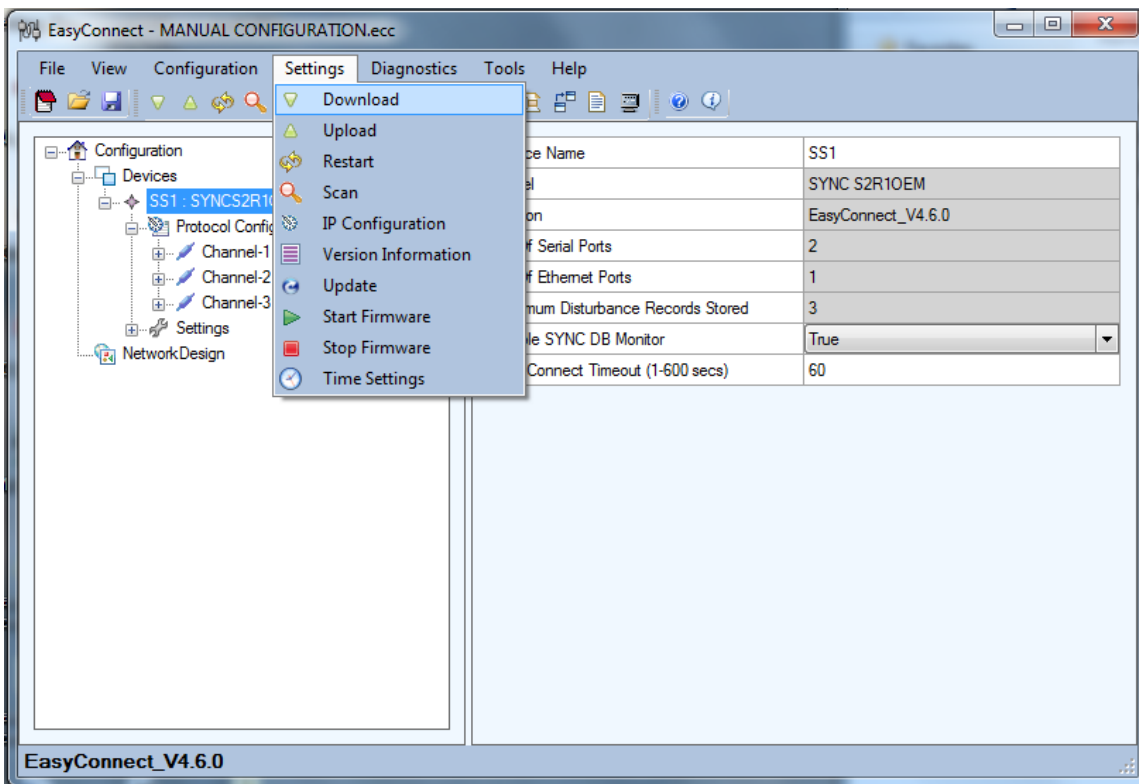
Step 3: After you select Download the following dialog will appear. Check the "Configuration File"

Check Box as shown. In the IP Address box enter the IP address of the module if it has been changed to something other than the default of 192.168.0.6. Press the Download button.
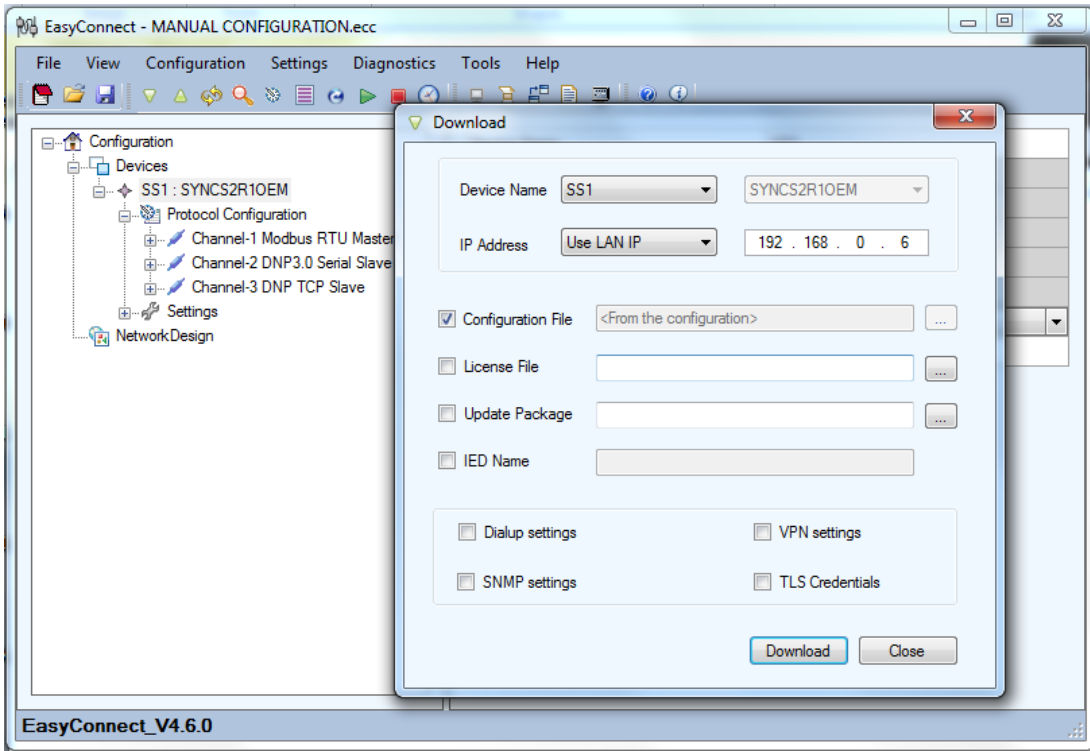
Step 4: The following dialog should appear when the download is successful. Press the OK button. A Restart is required and is described in the next step.
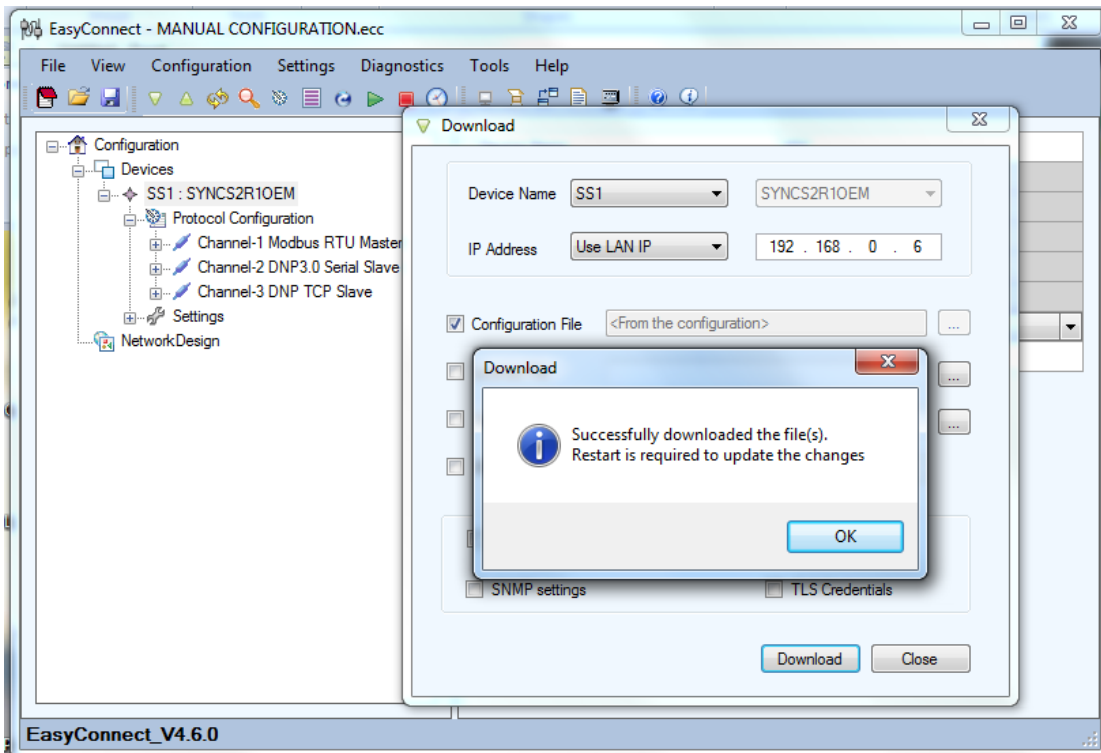
Step 5: Select Restart from the Settings menu as shown below.
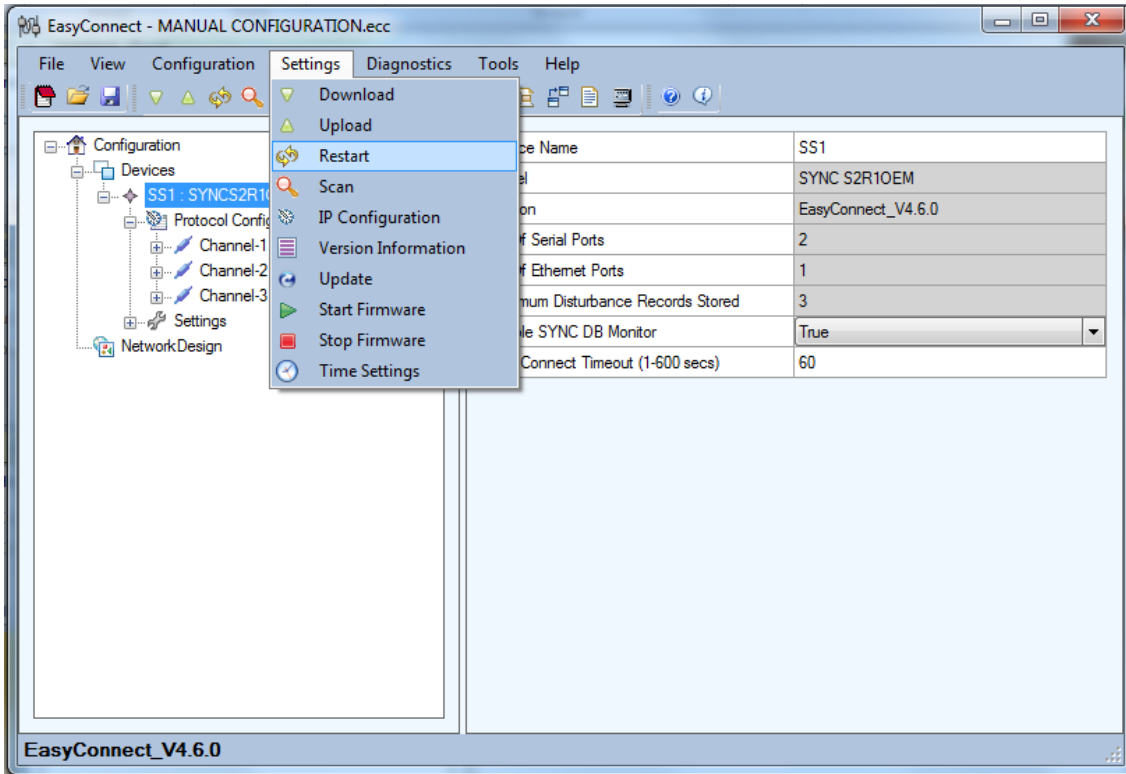
Step 6: In the IP Address box enter the IP address of the module if it has been changed to something other than the default of 192.168.0.6. Press the Restart button.
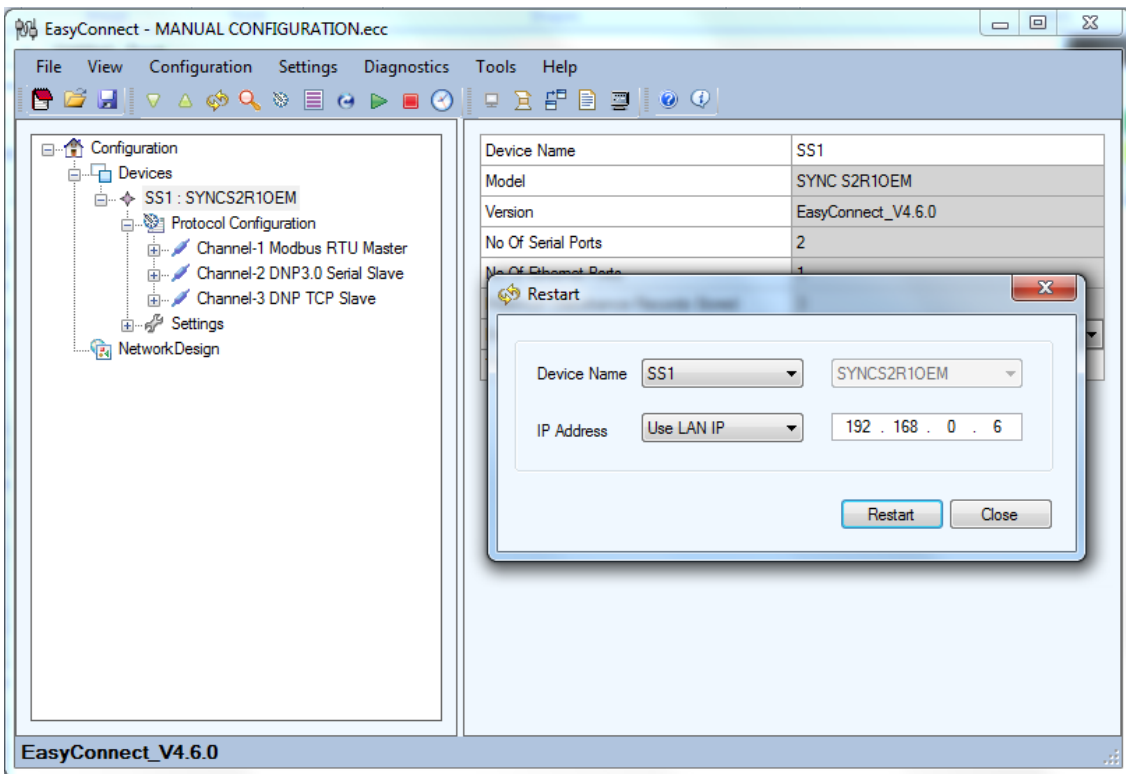
Step 7: Once the Restart has begun a dialog box as shown below will appear indicating the device is about to restart. Press the OK button. At this point the configuration is now stored on the card and the configuration process is complete. For those that desire to change the IP Settings of the card please refer to the section titled "Changing the IP Setting."
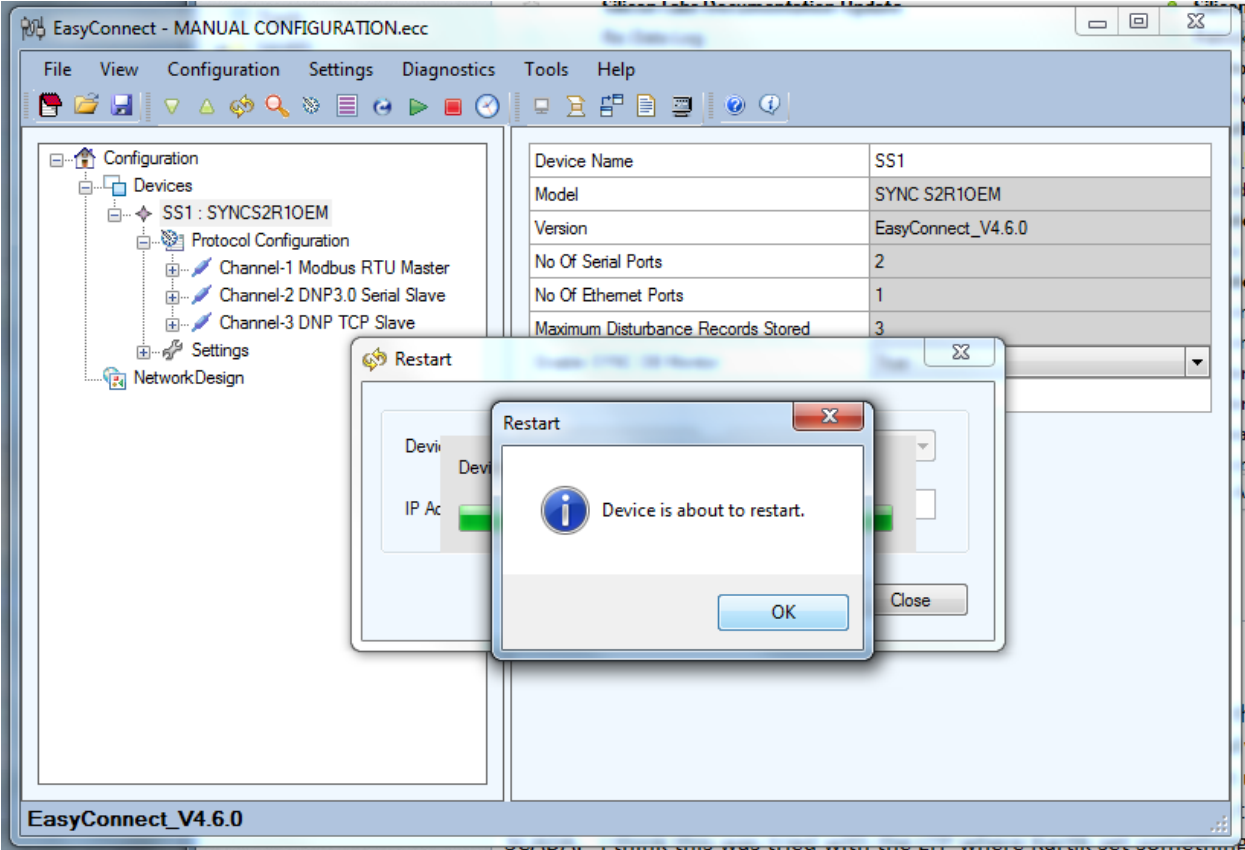
Changing the IP Settings

Step 1: Select IP Configuration from the Settings menu as shown below.
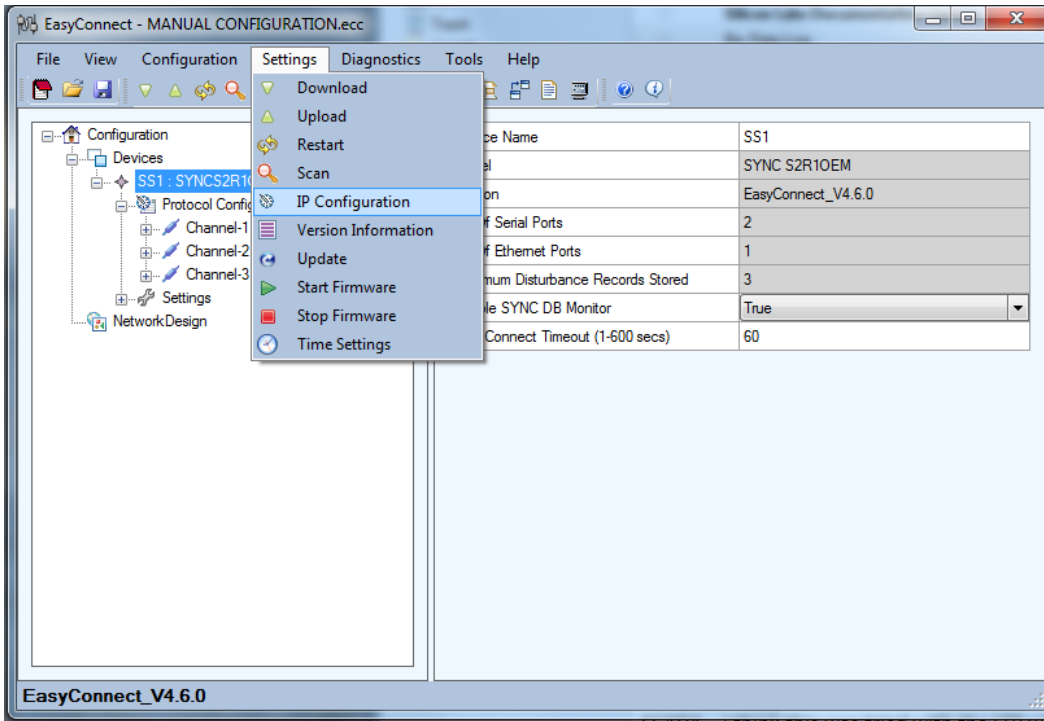
Step 2: In the Lan Settings dialog shown below you enter the present IP address in the box just below the SYNCS2R1OEM drop down box. In this case the card is at IP 192.168.0.6. In the IP Address, Subnet and Gateway under the eth0 label you enter the settings you would like the card to take on. In this case the module is presently at 192.168.0.6 and will be changed to an IP of 192.168.0.121 with a Subnet of 255.255.255.0 and a Gateway of 192.168.0.1. Press the OK button when you are done making changes.
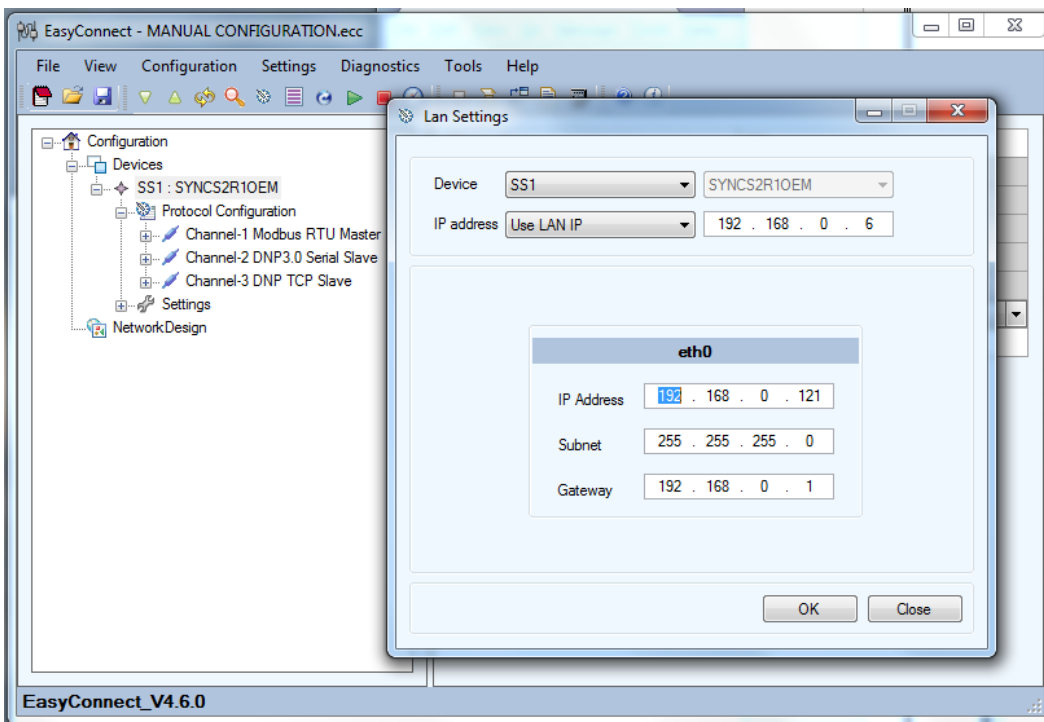
Step 3: The card is now at the new IP settings. Press the OK button and the board will be restarted automatically and will now be at the new settings. Note: If you have changed them to a different subnet you will have to modify your network adapter card settings to reconnect to the card.
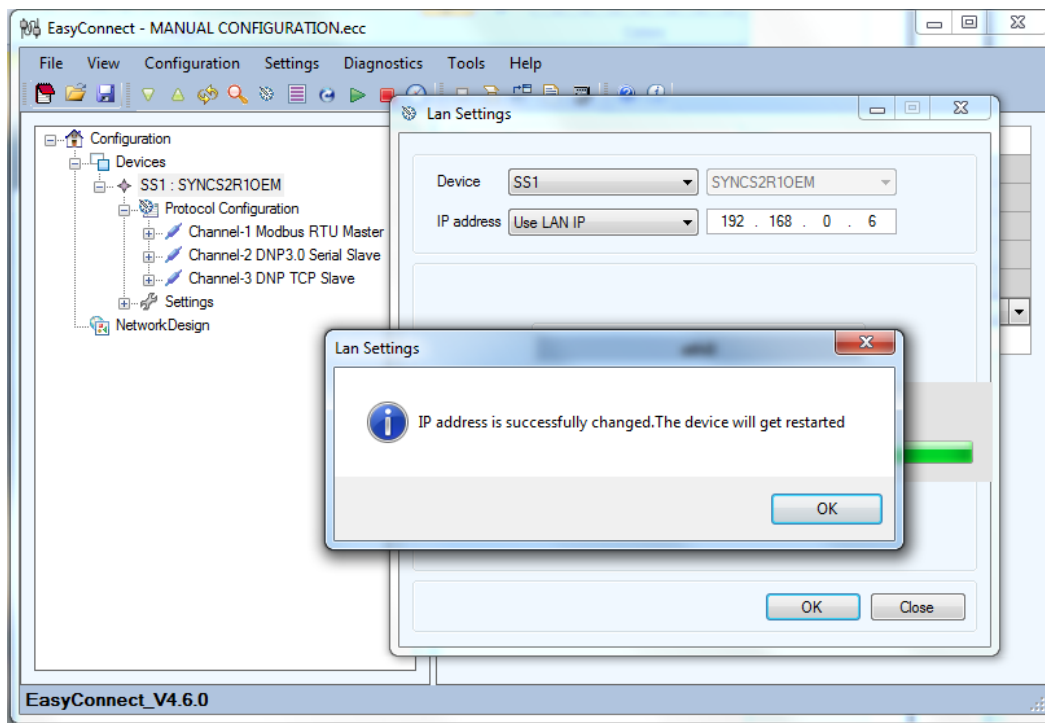
A

Appendix A - DNP 3.0 Slave Interface Interoperability

This document in conjunction with the DNP 3.0 Basic 4 Document Set and the DNP Subset Definitions Document provides complete information on how to communicate via the DNP 3.0 Slave protocol Interface in SYNC.

The following table provides a "Device Profile Document" in the standard format defined in the DNP 3.0 Subset Definitions Document. While it is referred to in the DNP 3.0 Subset Definitions as a "Document," it is in fact a table, and only a component of a total interoperability guide. The table, in combination with the Implementation Table, and the Point List Tables should provide a complete configuration/interoperability guide for communicating with SYNC DNP3 Slave Interface.

DNP 3.0 Device Profile

DNP V3.0
DEVICE PROFILE DOCUMENT (Also see the DNP 3.0 Implementation Table.)
Vendor Name: **Kalki Communication Technologies Ltd. [Kalkitech]**
Device Name: **SYNC - DNP3 Slave Interface**

Highest DNP Level Supported:
 	
    For Requests: **Level 2**
    For Responses: **Level 2**   Device Function:
 	
    ☐   Master
    ☒   **Slave**

Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported: **For static (non-change-event) object requests, request qualifier codes 07 and 08 (limited quantity), and 17 and 28 (index) are supported. Static object requests sent with qualifiers 07, or 08, will be responded with qualifiers 00 or 01.**

16-bit, 32-bit and Floating Point Analog Change Events with Time may be requested. Floating Point Analog Output Status and Output Block Objects 40 and 41 are supported.

Maximum Data Link Frame Size (octets):	Maximum Application Fragment Size (octets):
Transmitted: **292** Received **292**	Transmitted: **2048** Received **2048**

Maximum Data Link Re-tries:	Maximum Application Layer Re-tries:
☐ None ☐ Fixed ☒ **Configurable from 0 to 255**	☒ **None** ☐ Configurable

Requires Data Link Layer Confirmation:

    ☐ Never
    ☐ Always
    ☐ Sometimes
    ☒ **Configurable as: Never, Only for multi-frame messages, or Always**

Requires Application Layer Confirmation:

    ☐ Never
    ☐ Always
    ☐ When reporting Event Data (Slave devices only)
    ☐ When sending multi-fragment responses (Slave devices only)
    ☐ Sometimes
    ☒ **Configurable as: "Only when reporting event data", or "When reporting event data or multi-fragment messages."**

Timeouts while waiting for:

Data Link Confirm:	☐	None	☐	Fixed at ____	☐	Variable	☒	**Configurable.**
Complete Appl. Fragment:	☒	**None**	☐	Fixed at ____	☐	Variable	☐	Configurable
Application Confirm:	☐	None	☐	Fixed at ____	☐	Variable	☒	**Configurable.**
Complete Appl. Response:	☒	**None**	☐	Fixed at ____	☐	Variable	☐	Configurable

Others: **Transmission Delay, configurable**
      Select/Operate Arm Timeout, configurable
      Need Time Interval, configurable
      Need Restart IIN, configurable as 'Set on device restart' / 'Not to set on device restart'

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Unsolicited Notification Delay, configurable
Unsolicited Response Retry Delay, configurable
Unsolicited Offline Interval, configurable

Sends/Executes Control Operations:

WRITE Binary Outputs Configurable	☒ **Never**	☐ Always	☐ Sometimes	☐
SELECT/OPERATE Configurable	☐ Never	☐ **Always**	☐ Sometimes	☒
DIRECT OPERATE Configurable	☐ Never	☐ **Always**	☐ Sometimes	☒
DIRECT OPERATE – NO ACK Configurable	☐ Never	☐ **Always**	☐ Sometimes	☒
Count > 1 Configurable	☒ **Never**	☐ Always	☐ Sometimes	☐
Pulse On Configurable	☐ Never	☒ **Always**	☐ Sometimes	☐
Pulse Off Configurable	☐ Never	☒ **Always**	☐ Sometimes	☐
Latch On Configurable	☐ Never	☒ **Always**	☐ Sometimes	☐
Latch Off Configurable	☐ Never	☒ **Always**	☐ Sometimes	☐
Queue Configurable	☒ **Never**	☐ Always	☐ Sometimes	☐
Clear Queue Configurable	☒ **Never**	☐ Always	☐ Sometimes	☐

Attach explanation if 'Sometimes' or 'Configurable' was checked for any operation.

The control points shall be configured as 'Select required' or 'Select not required', while configuring the database. Control points configured with 'Select required' option shall accept SELECT/OPERATE, and for other points DIRECT OPERATE and DIRECT OPERATE – NO ACK will be accepted.

Reports Binary Input Change Events when no specific variation requested:	Reports time-tagged Binary Input Change Events when no specific variation requested:
☐	☐
Never	Never
☐	☐

Only time-tagged ☐ Only non-time-tagged ☒ **Configurable to send one or the** **other**	Binary Input Change With Time ☐ Binary Input Change With Relative Time ☒ **Configurable**
Sends Unsolicited Responses: ☐ Never ☒ **Configurable** ☐ Only certain objects ☐ Sometimes (attach explanation) ☒ **ENABLE/DISABLE UNSOLICITED Function codes supported**	Sends Static Data in Unsolicited Responses: ☒ **Never** ☐ When Device Restarts ☐ When Status Flags Change No other options are permitted.
Default Counter Object/Variation: ☐ No Counters Reported ☒ **Configurable** ☐ Default Object Default Variation: ☒ **Point-by-point list attached**	Counters Roll Over at: ☐ No Counters Reported ☐ Configurable (attach explanation) ☐ 16 Bits ☒ **32 Bits** ☐ Other Value: _____ ☐ Point-by-point list attached

Sends Multi-Fragment Responses:

☐ Yes

☐ No

☒ **Configurable**

Sequential File Transfer Support:

Append File Mode	☐ **Yes**	☒ No
Custom Status Code Strings	☐ Yes	☒ **No**
Permissions Field	☐ **Yes**	☒ No
File Events Assigned to Class	☐ **Yes**	☒ No
File Events Send Immediately	☐ **Yes**	☒ No
Multiple Blocks in a Fragment	☐ Yes	☒ **No**
Max Number of Files Open		

Table 6: DNP 3.0 Device Profile

DNP 3.0 Implementation Table

The following table identifies which object variations, function codes, and qualifiers the SYNC DNP 3.0 Slave Interface supports in both request messages and in response messages. For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. Requests sent with qualifiers 17 or 28 will be responded with qualifiers 17 or 28. For change-event objects, qualifiers 17 or 28 are always responded.

In the table below, text shaded as 00, 01 (start stop) indicates Subset Level 3 functionality (beyond Subset Level 2).

In the table below, text shaded as 07, 08 (limited qty) indicates functionality beyond Subset Level 3.

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OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
1	0	Binary Input – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
1	1 (default – see note 1)	Binary Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
1	2	Binary Input with Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
2	0	Binary Input Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
2	1	Binary Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	2 (default – see note 1)	Binary Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	3	Binary Input Change with Relative Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
3	0	Double Bit Input – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
3	1 (default – see note 1)	Double Bit Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 1)
3	2	Double Bit Input with Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 1)
4	0	Double Bit Input Change – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
4	1	Double Bit Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
4	2 (default – see note 1)	Double Bit Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
4	3	Double Bit Input Change with Relative Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
10	0	Binary Output – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		

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OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
10	1	Binary Output	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 1)
			1 (write)	00, 01 (start-stop)		
10	2 (default – see note 1)	Binary Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
12	1	Control Relay Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index)	129 (response)	echo of request
20	0	Binary Counter – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
			7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty)		
20	1	32-Bit Binary Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20	2	16-Bit Binary Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20	5 (default – see note 1)	32-Bit Binary Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20	6	16-Bit Binary Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	0	Frozen Counter – Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
21	1	32-Bit Frozen Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)

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OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
21	2	16-Bit Frozen Counter (with Flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	5	32-Bit Frozen Counter with Time Of Freeze	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 1)
21	6	16-Bit Frozen Counter with Time Of Freeze	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 1)
21	9 (default – see note 1)	32-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	10	16-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
22	0	Counter Change Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
22	1 (default – see note 1)	32-Bit Counter Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
22	2	16-Bit Counter Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
22	5	32-Bit Counter Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
22	6	16-Bit Counter Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
23	0	Frozen Counter Event (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
23	1 (default – see note 1)	32-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17,28 (index)
23	2	16-Bit Frozen Counter Event	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17,28 (index)
23	5	32-Bit Frozen Counter Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
23	6	16-Bit Frozen Counter Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)

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OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
30	0	Analog Input - Any Variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
30	1	32-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	2	16-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index –see note 2)
30	3 (default – see note 1)	32-Bit Analog Input without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	4	16-Bit Analog Input without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	5	short floating point	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	6	long floating point	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 1)
32	0	Analog Change Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
32	1 (default – see note 1)	32-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	2	16-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	3 (default – see note 1)	32-Bit Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	4	16-Bit Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	5	short floating point Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	6	long floating point Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	7	short floating point Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)

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OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
32	8	long floating point Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
40	0	Analog Output Status	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
40	1	32-Bit Analog Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
40	2 (default – see note 1	16-Bit Analog Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
40	3	short floating point Analog Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
40	4	long floating point Analog Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
41	1	32-Bit Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index) 27 (index)	129 (response)	echo of request
41	2	16-Bit Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index) 27 (index)	129 (response)	echo of request
41	3	short floating point Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 27, 28 (index)	129 (response)	echo of request
41	4	long floating point Analog Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 27, 28 (index)	129 (response)	echo of request
43	8	long floating point Analog Output Command Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
50	0	Time and Date				
50	1 (default – see note 1)	Time and Date	1 (read)	07, (limited qty = 1)	129 (response)	07 (limited qty = 1)
			2 (write)	07 (limited qty = 1)		

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
50	3	Time and Date Last Recorded Time	2 (write)	07 (limited qty)		
51	1	Time and Date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
51	2	Unsynchronized Time and Date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
52	1	Time Delay Coarse			129 (response)	07 (limited qty) (qty = 1)
52	2	Time Delay Fine			129 (response)	07 (limited qty) (qty = 1)
60	0	Not Defined				
60	1	Class 0 Data	1 (read)	06 (no range, or all)		
60	2	Class 1 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
60	3	Class 2 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
60	4	Class 3 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
80	1	Internal Indications	1 (read)	00, 01 (start-stop)	129 (response)	00, 01 (start-stop)
			2 (write) (see note 3)	00 (start-stop) index=7		
		No Object (function code only)	13 (cold restart)			
		No Object (function code only)	14 (warm restart)			
		No Object (function code only)	23 (delay meas.)			
		No Object (function code only)	24 (record current time)			

Table 7: DNP 3.0 Implementation Table

Note 1: A Default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. Default variations are configurable; however, default settings for the configuration parameters are indicated in the table above.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. (For change-event objects, qualifiers 17 or 28 are always responded.)

Note 3: Writes of Internal Indications are only supported for index 7 (Restart IIN1-7).

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LaMarche DNP 3.0 Implementation

M -> Data from Main Controller
S -> Data from Static Switch Controller
P -> Data from Perpheral
Card

	Binary Input Points Static (Steady-State) Object Number: **1** Static Variation reported when variation 0 requested: **1 (Binary Input 2 without status)**	
Point Index	**MAIN CARD**	**UNIT**
0	M_HT_TEST_LOAD_KVA	kva
1	M_HT_TEST_START_VOL	volt/cell
2	M_HT_TEST_END_VOL	volt/cell
3	M_BATT_HEALTH_STATUS	%
4	M_CT_TEST_LOAD_KVA	kva
5	M_CT_TEST_START_VOL	volt/cell
6	M_CT_TEST_END_VOL	volt/cell
7	M_CT_TEST_PERCENTAGE	%
8	M_BATT_ test _RESULTS	NA
9	M_CONFIG_ACKNOWLEDGEMENT	NA
10	M_PHASE_SHIFT	NA
11	M_BATT DISCHARGE ELAPSED TIME	SECONDS
12	M_REMOVED AH	AH
13	M_BATTERY SOC	%
14	M_AH RATING	AH
15	M_VERSION	NA
16	M_GRID_VOLTAGE_PH1	V
17	M_GRID_CURRENT_PH1	A
18	M_GRID_FREQUENCY_PH1	Hz

19	M_GRID_VOLTAGE_PH2	V
20	M_GRID_CURRENT_PH2	A
21	M_GRID_FREQUENCY_PH2	Hz
22	M_GRID_VOLTAGE_PH3	V
23	M_GRID_CURRENT_PH3	A
24	M_GRID_FREQUENCY_PH3	Hz
25	M_GRID_TOTAL_ENERGY (SCALING 0.1)	KWh
26	M_GRID_TOTAL_POWER	KW
27	M_GRID_AVG_POWER_FACTOR	NA
28	M_BATTERY_VOLTAGE	V
29	M_BATTERY_CHG_CURRENT M_BATTERY_DISCHG_CURRENT	A
30	M_BATTERY_CKWH	KWh
31	M_BATTERY_DKWH	KWh
32	M_RECTIFIER_VOLTAGE	V
33	M_RECTIFIER_CURRENT	A
34	M_INVERTER_VOLTAGE	V
35	M_INVERTER_LOAD	A
36	M_INVERTER_FREQUENCY	Hz
37	M_INVERTER_ENERGY	KWh
38	M_INVERTER_POWER	KW
39	M_INVERTER_POWER_FACTOR	NA
40	M_BYPASS_VOLTAGE	V
41	M_BYPASS_FREQUENCY	Hz
42	M_SYSTEM_TEMP	*C
43	M_TEMPERATURE2	*C
44	M_CHARGER_STATUS[0]	NA
45	M_CHARGER_STATUS[1]	NA
46	M_CHARGER_STATUS[2]	NA
47	M_INVERTER_STATUS[0]	NA
48	M_INVERTER_STATUS[1]	NA
49	M_SYSTEM_STATUS[0]	NA
50	M_SYSTEM_STATUS[1]	NA
51	M_SYSTEM_STATUS[2]	NA
52	M_BYPASS_STATUS[0]	NA
53	P_BATTERY_TEMP	*C
54	P_AMBIENT_TEMP	*C
55	P_COMMUNICATION_STATUS	
56	S_INVERTER_VOLTAGE,	V

57	S_INVERTER_LOAD,	A
58	S_INVERTER_FREQUENCY,	Hz
59	S_UPS_OUTPUT_ACTIVE POWER	KWh
60	S_UPS_OUTPUT_APPARENT POWER	KW
61	S_UPS_OUTPUT_POWER_FACTOR,	NA
62	S_BYPASS_VOLTAGE,	V
63	S_BYPASS_LOAD,	A
64	S_BYPASS_FREQUENCY,	Hz
65	S_FINAL_OUTPUT_VOLTAGE,	V
66	S_FINAL_OUTPUT_CURRENT,	%
67	S_FINAL_OUTPUT_FREQUENCY,	Hz
68	S_TEMPERATURE1,	*C
69	S_TEMPERATURE2,	*C
70	S_VERSION,	NA
71	S_CONFIG_ACKNOWLEDGEMENT	NA
72	P_Peripheral_version	NA
73	S_INVERTER_STATUS[0],	NA
74	S_SYSTEM_STATUS[0],	NA
75	S_SYSTEM_STATUS[1],	NA
76	S_BYPASS_STATUS[0],	NA
77	S_BYPASS_STATUS[1],	NA

FLAG BYTE	DESCRIPTION	BIT NO
M_CHARGER_STATUS[0]	ChargerFlags.Charger_off_OPEN_CKT	Bit 8
	ChargerFlags.Charger_off_SHORT_CKT	Bit 7
	ChargerFlags.Charger_off_CV_HIGH	Bit 6
	ChargerFlags.Charger_off_MAINS_FAULT	Bit 5
	ChargerFlags.Charger_off_OVERHEAT	Bit 4
	ChargerFlags.MAINS_ABSENT	Bit 3
	ChargerFlags.MAINS_1_PHASE_ABSENT	Bit 2
	ChargerFlags.ALARM_CHARGER_OVERHEAT	Bit 1

M_CHARGER_STATUS[1]	ChargerFlags.CHARGER_ON_STATUS	Bit 8
	ChargerFlags.FREQ_OUT	Bit 7
	ChargerFlags.MAINS_HIGH_PH3	Bit 6
	ChargerFlags.MAINS_HIGH_PH2	Bit 5
	ChargerFlags.MAINS_HIGH_PH1	Bit 4
	ChargerFlags.MAINS_LOW_PH3	Bit 3
	ChargerFlags.MAINS_LOW_PH2	Bit 2
	ChargerFlags.MAINS_LOW_PH1	Bit 1

M_CHARGER_STATUS[2]	ChargerFlags.BATTERY_CAPACITY_TEST_RESULT	Bit 8
	ChargerFlags.BATTERY_CAPACITY_TEST	Bit 7
	ChargerFlags.BATTERY_HEALTH_TEST_RESULT	Bit 6
	ChargerFlags.BATTERY_HEALTH_TEST	Bit 5
	ChargerFlags.FLOAT_EQ_MODE	Bit 4
	ChargerFlags.CHARGING_DONE_STATUS	Bit 3
	ChargerFlags.BATTERY_CAPACITY_END	Bit 2
	ChargerFlags.Rectifier_Drive_is_on	Bit 1

M_INVERTER_STATUS[0]	InverterFlags.Inv_off_OPEN_CKT	Bit 8
	InverterFlags.Inv_off_SHORT_CKT	Bit 7
	InverterFlags.Inv_off_OVERLOAD	Bit 6

	InverterFlags.Inv_off_OUTPUT_HIGH	Bit 5
	InverterFlags.Inv_off_OUTPUT_LOW	Bit 4
	InverterFlags.Inv_off_BATT_HIGH	Bit 3
	InverterFlags.Inv_off_BATT_LOW	Bit 2
	InverterFlags.Inv_off_OVERHEAT	Bit 1

M_INVERTER_STATUS[1]	InverterFlags.Alarm_OVERLOAD	Bit 8
	InverterFlags.Alarm_BATT_HIGH	Bit 7
	InverterFlags.Alarm_BATT_LOW	Bit 6
	InverterFlags.ALARM_INVERTER_OVERHEAT	Bit 5
	InverterFlags.INVERTER_ON_STATUS	Bit 4
	InverterFlags.OutputZeroXingError	Bit 3
	SWFlag.SwitchIsON	Bit 2
	End_of_discharge	Bit 1

M_SYSTEM_STATUS[0]	Flags2.FinalVoltageRefOK	Bit 8
	Flags2.BypassVoltageRefOK	Bit 7
	Flags2.InvCurrentRefOK	Bit 6
	Flags2.InvFBVoltageRefOK	Bit 5
	Flags2.MainsVoltageRefOK	Bit 4
	Flags2.MainsCurrentRefOK	Bit 3
	Flags2.LoadCurrentRefOK	Bit 2
	INVERTER NTC OPEN	Bit 1

M_SYSTEM_STATUS[1]	Flags2.DC_AUX_SWITCH	Bit 8
	flage2.Flag reset done	Bit 7
	Flags2.INPUT_AUX_SWITCH	Bit 6
	Flags2.DC_contractor_ON	Bit 5
	Flags2.UPPER_INV_FAN_FAIL	Bit 4
	Flags2.LOWER_INV_FAN_FAIL	Bit 3
	Flags2.FUSE_FAIL	Bit 2

	Flags2.PhaseInSync	Bit 1

	Flags2.SYSTEM_3PH_1PH_OUT (0-3Phase, 1-1Phase)	Bit 8
M_SYSTEM_STATUS[2]	Flags2.VOLTAGE_220V_OR_120V (0-220, 1-120)	Bit 7
	Flags2.FREQUENCY_50HZ_OR_60HZ (0-50, 1-60)	Bit 6
	Battery_not_connected (1 if battery not connected)	Bit 5
	Inverter_output_breaker	Bit 4
	HT_IN_PROGRESS	Bit 3
	ABORT_HT	Bit 2
	START_HT	Bit 1

M_BYPASS_STATUS[0]	ChargerFlags.BYPASS_FREQ_OUT	Bit 8
	ChargerFlags.BYPASS_HIGH	Bit 7
	ChargerFlags.BYPASS_LOW	Bit 6
	ChargerFlags.BYPASS_ABSENT	Bit 5
	NA	Bit 4
	Battery test in Progress	Bit 3
	Battery Test Complete	Bit 2
	Start_CT	Bit 1

S_INVERTER_STATUS[0]	Flags2.INVERTER_FAULT	Bit 8
	InverterFlags.Inv_off_OVERLOAD	Bit 7
	Flags2.INVERTER_FAULT_FAST_SENSE	Bit 6
	Flags2.INVERTER_FREQ_OUT	Bit 5
	Flags2.INVERTER_VOLTAGE_HIGH	Bit 4
	Flags2.INVERTER_VOLTAGE_LOW	Bit 3
	Flags2.INVERTER_ABSENT	Bit 2
	Flags2.system in inverter	Bit 1

S_SYSTEM_STATUS[0]	Flags2.OPCurrentRefOK	Bit 8

	Flags2.OPVoltageRefOK	Bit 7
	Flags2.BypassCurrentRefOK	Bit 6
	Flags2.BypassVoltageRefOK	Bit 5
	Flags2.InvFBVoltageRefOK	Bit 4
	TransferTestResult[2]	Bit 3

M_BATT_HEALTH_STATUS	Value -0 to 100	
	Load Insufficient - 155	
	Battery Low During Test - 156	
	Utility Absent During Test - 157	
	Rectifier Fail - 158	
	Inverter Fail - 159	
	Battery Over Heat - 160	
	162- Operation Manualy Aborted	
	163 - Load Change	
M_BATT_CT_RESULTS	Fail -0 Pass -1	
	Load Insufficient - 155	
	Battery Low During Test - 156	
	Utility Absent During Test - 157	
	Rectifier Fail - 158	
	Inverter Fail - 159	
	Battery Over Heat - 160	
TransferTestResult >	0- Successful	
	1- Inverter Fail	
	2- bypass source fail	

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