San Telequip Pvt. Ltd.

505, Deron Heights,
Baner Road, Pune 411045

www.santelequip.com
info@santelequip.com

About the Document

Purpose

This user manual serves as a guide for using GW IEC series. This user manual describes the configuration details of the GW IEC devices. It also contains installation and configuration details for Easy Connect, the configuration utility provided to configure the GW IEC models. Please note that separate user manuals are available for each protocol which explain the configuration and mapping in detail.

Intended Audience

This user manual is intended for the GW IEC users and:
* Introduction to the Product
* Device Specific Configuration steps

Table of Contents

List of Figures

List of Tables

1

1   Overview of GW IEC Series

GW IEC series of products is a family of hardware solutions that provide any-to-any protocol conversions which can be used inside any End Device. This family of products can be used for wide range of applications including protection relays, Remote terminal units, Alarm Annunciators, Monitoring units etc. as automation and communication controller. The different product models vary in processing power, storage capabilities, number of channels and types of channels to suit different requirements. However, they present a singular front-end via the GW IEC configuration tool EasyConnect.

1.1 Configuration Utility

The GW IEC series of products can be fully configured using a software configuration utility called EasyConnect., This includes defining protocol attributes, mapping data, updating firmware, setting IP and viewing diagnostics.

EasyConnect can be used for:
- Mapping data specific point from device data to standard protocol format
- Update Module Configurations & Settings
- Update Module Firmware
- Monitoring and Diagnostics
- Troubleshooting

Note: Refer Easy Connect Configuration Utility Manual for details

2 Configuring GW IEC

GW IEC gateways can be configured offline using Easy Connect Configuration Utility.

The configuration for any protocol conversion function can be divided into a few logical steps. Master protocol configuration will be divided into the following sections, namely: Channel, Node, Profile and Row addition. For a slave; Profile, Channel and Node are configured. Once Master and slave channels and nodes are configured, master profile points need to be mapped to a slave point. The following steps explain how to configure protocol modules.

Steps to configure the module
  • Add Master Channel and Node
  • Add Slave Channels
  • Add Master to Slave Map
  • Slave to Slave Mapping (optional)

Steps 1, 2 and 3 explain configuration for the protocol conversion function of the GW IEC Gateways. The remaining steps elaborate additional/optional communication features of the device.

2.1. Add Master Channel and Node

1. Add Device either by selecting a model from Device configuration section or by right clicking on Devices in the left hand side tree view pane, as shown in Figure (Add Device) below:
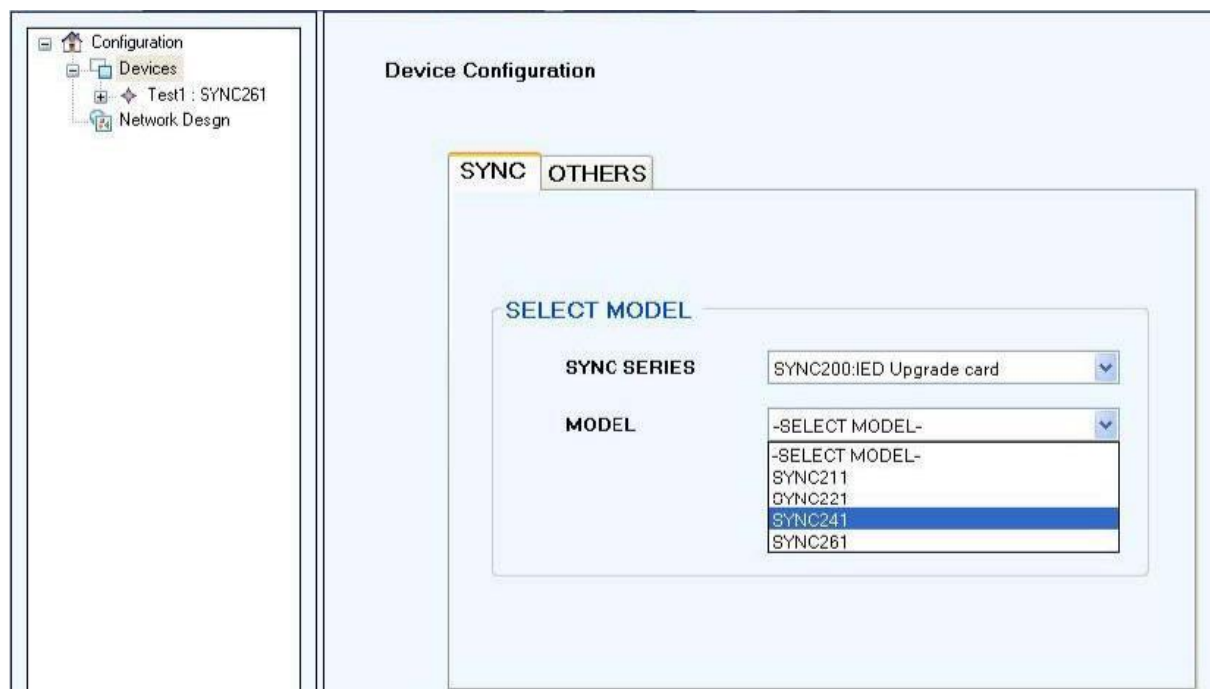
Figure 1: Add Device

2. To modify, an already created device model, right click the selected device model in the left pane of the application, choose the model from the sub menu of Modify device as shown in Figure (Modify Device) below.
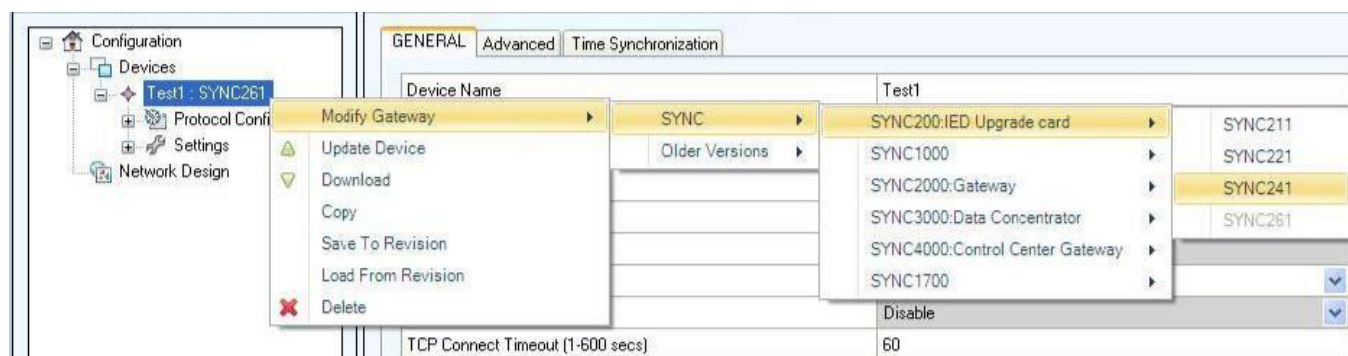
Figure 2: Modify Device

3. To delete the selected device, right click the selected device, and choose Delete as shown in the Figure (Delete device) below:
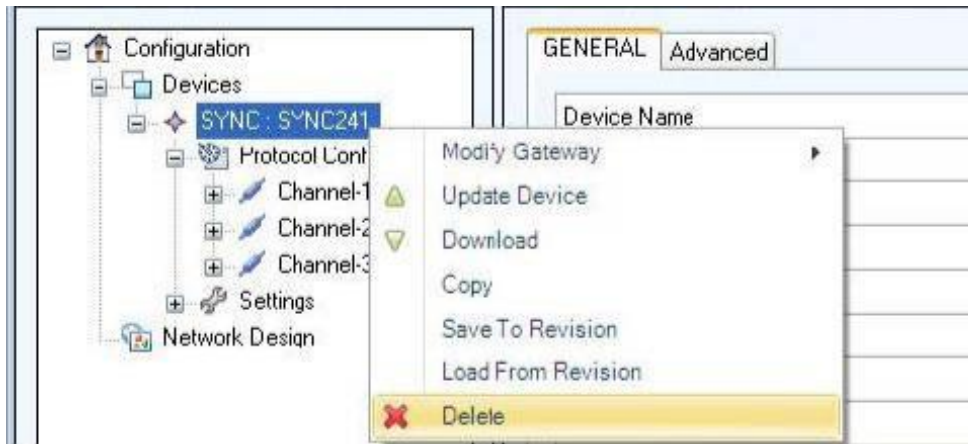
Figure 3: Delete device

4. Add Master channels to the device model as shown in the Figure (Add Master Protocol) below:
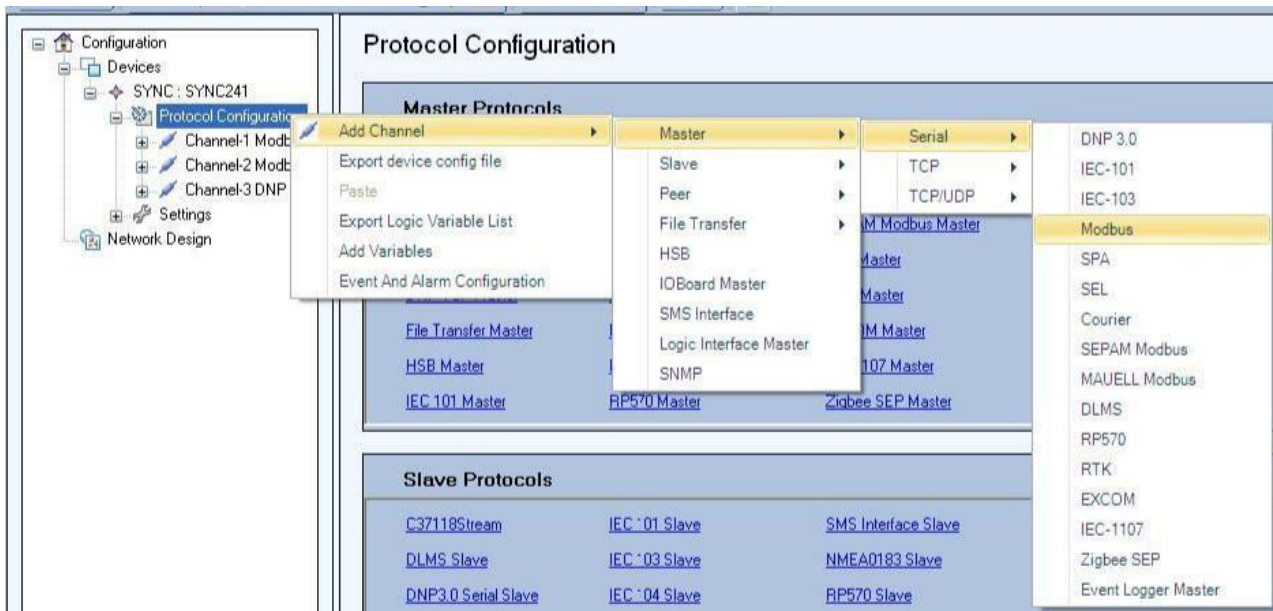
Figure 4: Add Master Protocol

5. To delete a protocol specific communication channel, select the Delete option from the menu on right clicking on the selected channel as shown in Figure (Delete Channel) below:
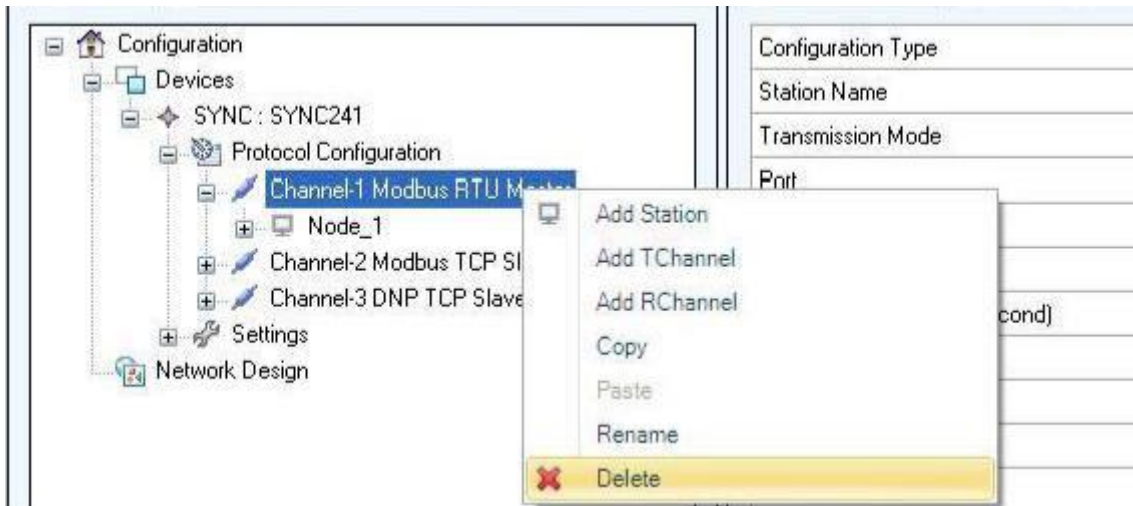
Figure 5: Delete Channel

6. Add Node or Station as shown in Figure (Add Station) below:
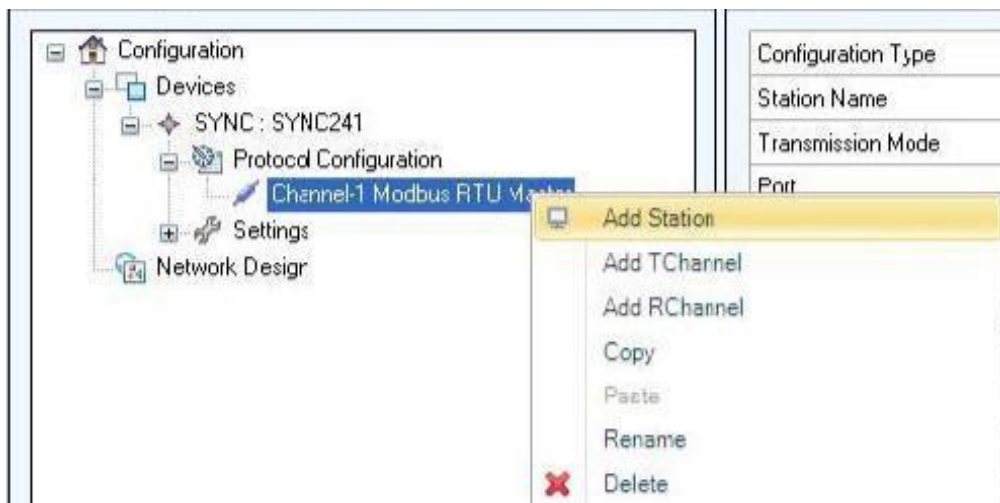
Figure 6: Add Station

7. Delete a station by selecting Delete from the menu displayed on right by clicking on selected station.
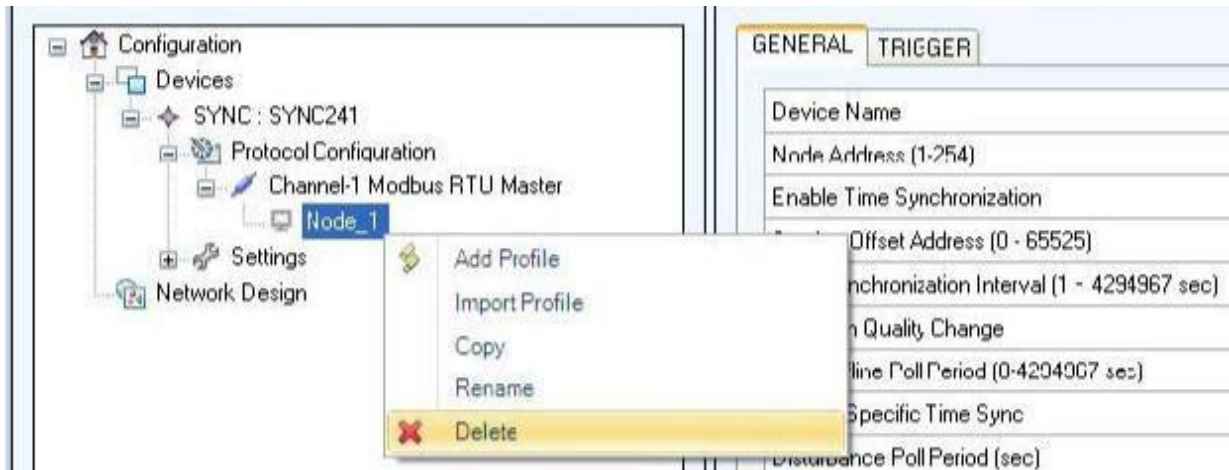
Figure 7: Delete Station

8. To add Master Profile, right click on Node and select Add Profile.
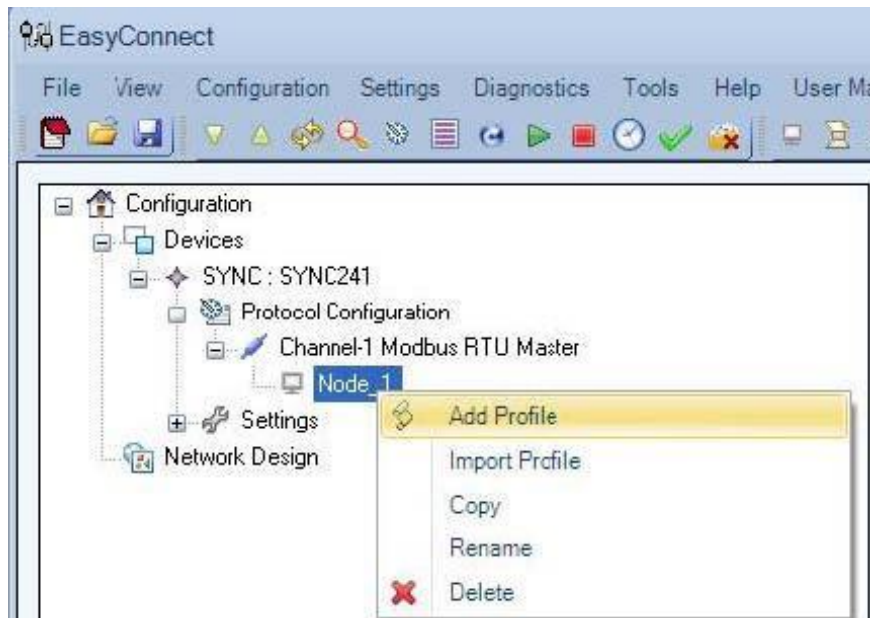
Figure 8: Add Profile

Profiles can be saved for reusing the same address configuration for different masters. To save a profile, right click a Profile tree node and select Export Profile. A Save File window will pop up. Save the profile with desired name in the desired location.
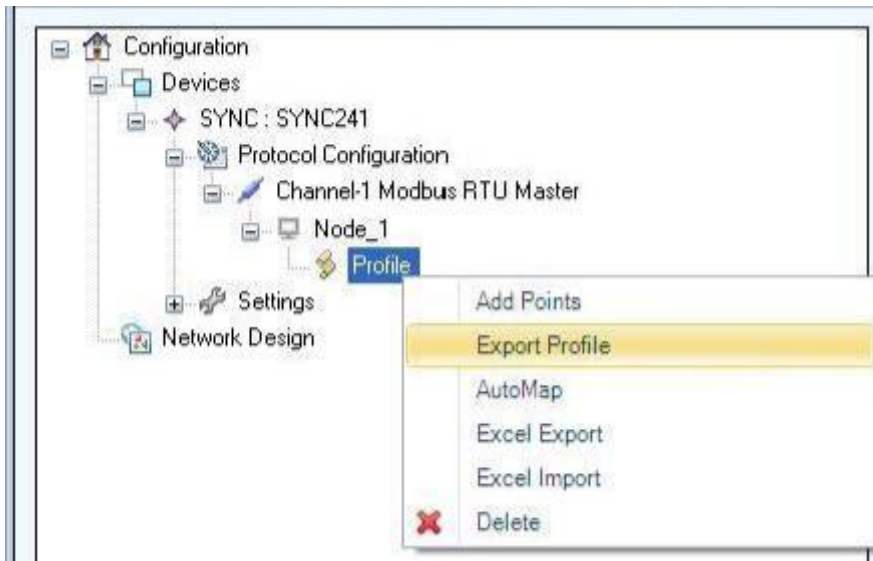
Figure 9: Export Profile

Instead of adding a new profile, a user can import a profile from previously saved profile data. Right click on a master station and select Import Profile option. An Open File window will pop up. Open a saved profile file. Refer to Figure (Import Profile) below:
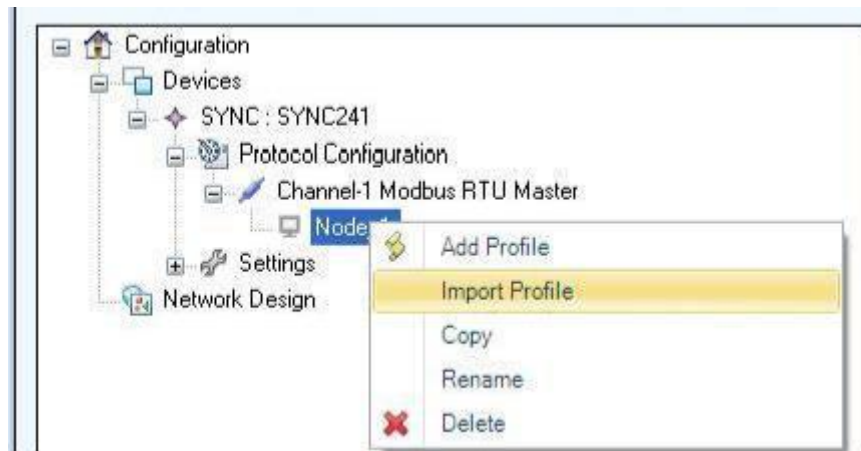
Figure 10: Import Profile

9. To delete a Profile, right click on the Profile and select Delete.
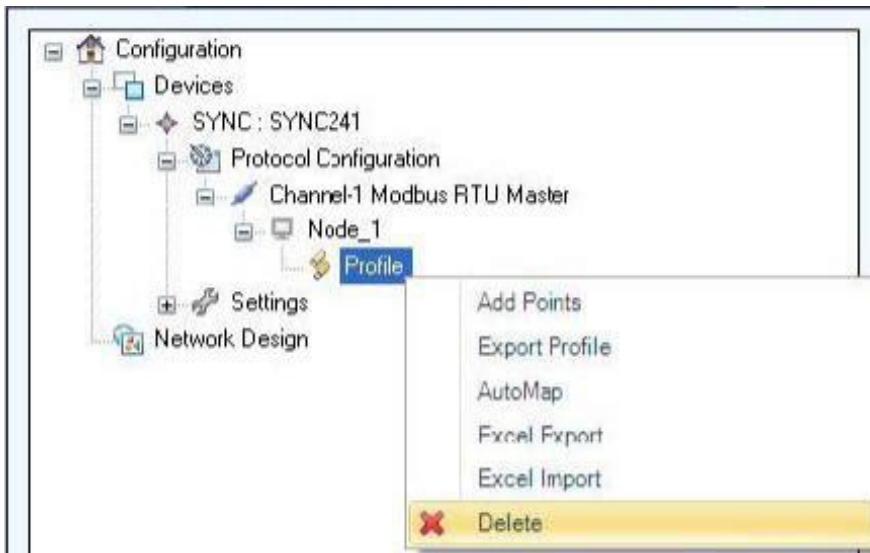
Figure 11: Delete Profile

10. To add Master Row, right click on Profile and select Add Points as shown in the Figure (Add Row) below:
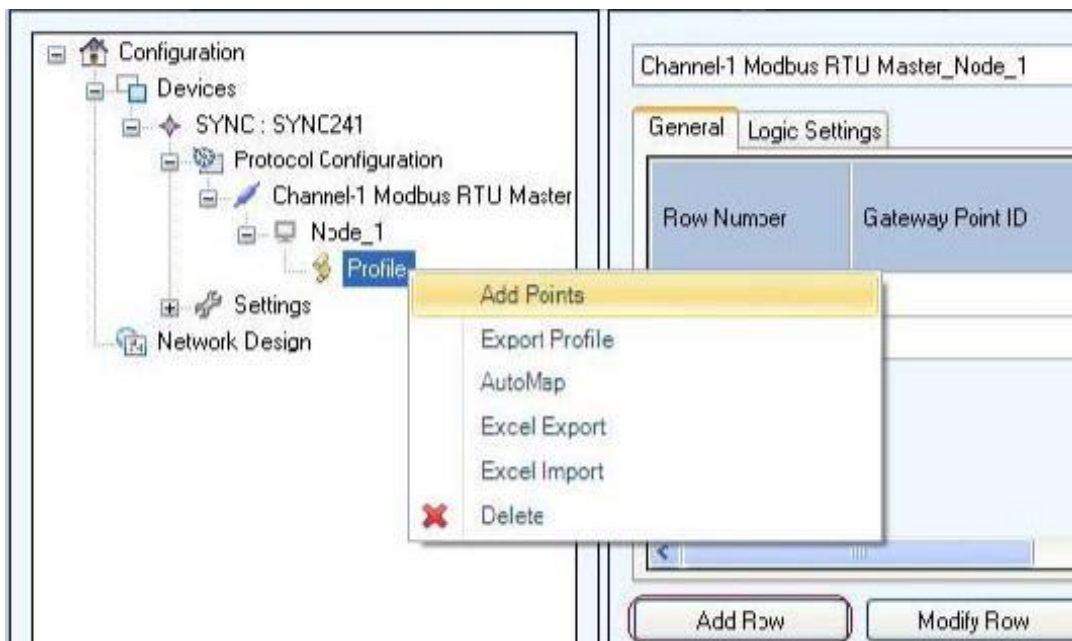
Figure 12: Add Row

11. To modify a row, select a row from the profile grid. Click on Modify Row button. A new window will pop up with values of selected row.
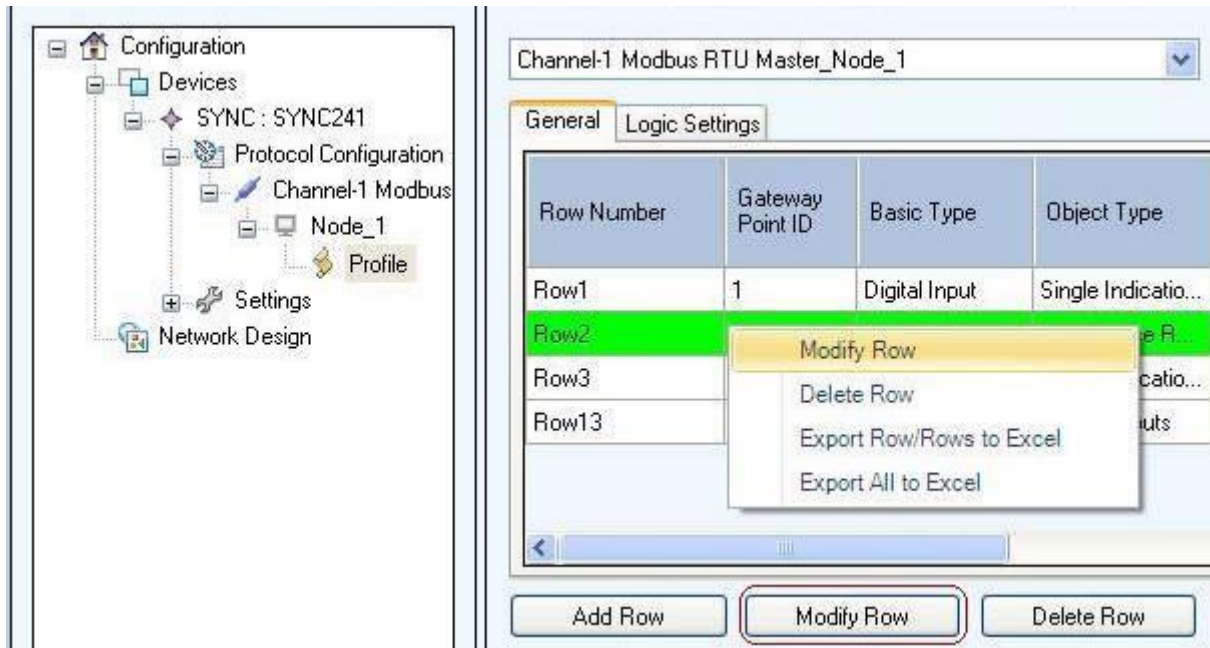
Figure 13: Modify Row

12. To delete rows, select rows from the profile grid and click Delete Row on the right pane.
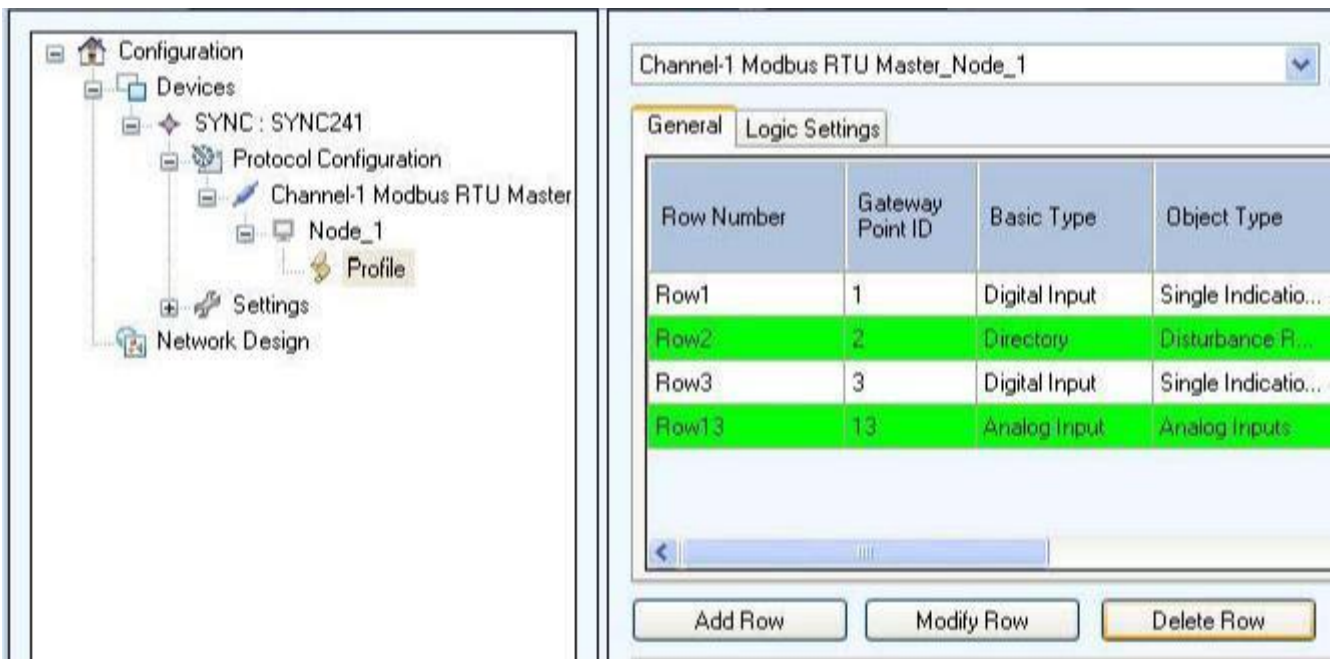
Figure 14: Delete Row

2.2. Add Slave Channel And Node

To add a slave channel and node follow the same procedure mentioned above on Addition of Master Channel and Node.

2.3. Master to slave Mapping

To add a Map, select the required row and the desired slave node and then click on Add Map.
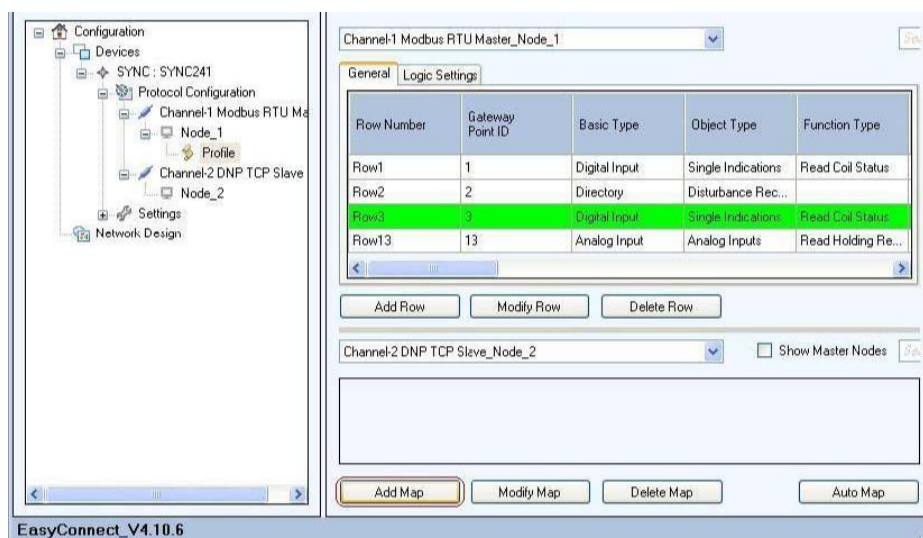
Figure 15: Add Map

> ⚠️ *Note: To Enable Master-to-Master mapping, select Show Master Nodes (Master-to-Master mapping is used when input data from host device is translated to a command/ output another external slave).*

To modify a mapped row, select a row from the destination unit and click on Modify Map button. A new window will open with added mapped values. Edit the parameter values. Click on Save to update the modified mapped point. Refer to Figure (Modify Map) below:
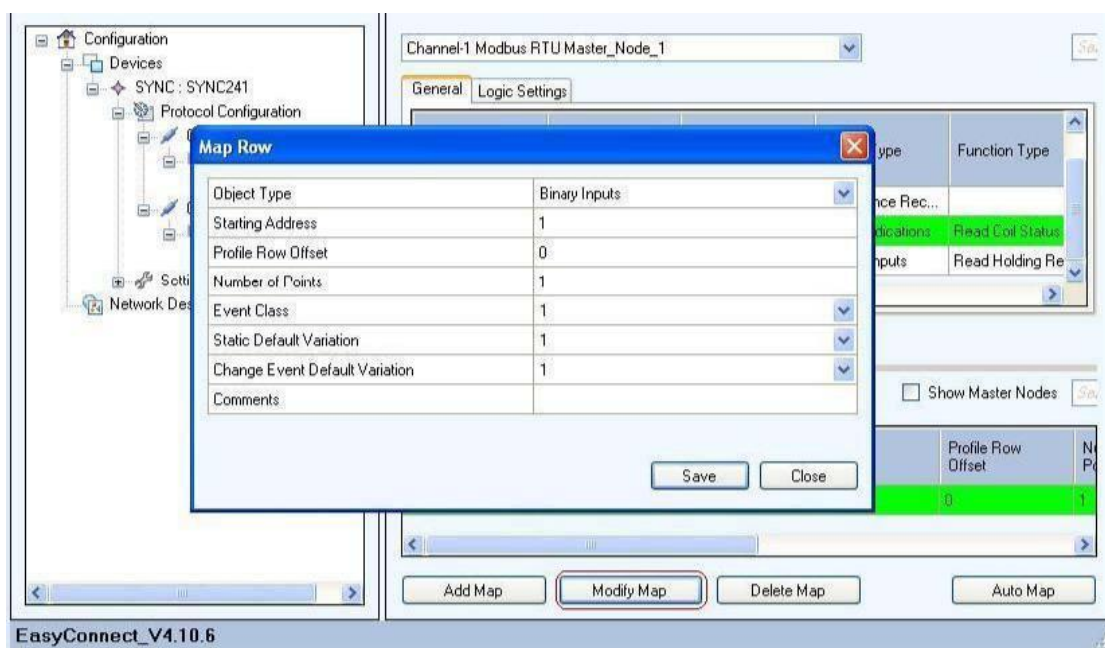
Figure 16: Modify Map

To delete a mapped row or group of rows from the conversion, select mapped row from the destination unit and click Delete Map. To delete destination unit profile, right click on mapping tree node under destination unit, select Delete. Refer to Figure (Delete Map):
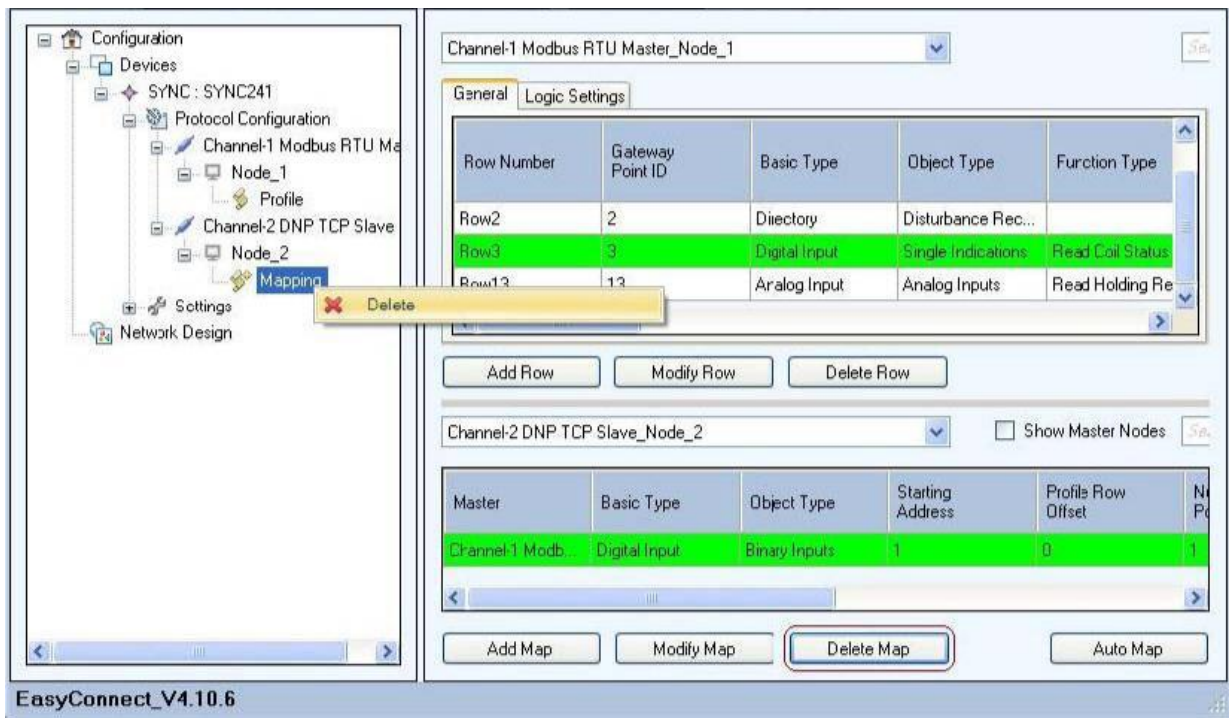
Figure 17: Delete Map

2.3.1 Auto Mapping – Master to Slave

EasyConnect provides options for mapping the master points automatically to a selected slave node. Users can either auto map the entire row or some selected rows that are configured in the master profile. The steps for automatic mapping are given below:

• Select the slave protocol to which the points are to be mapped.
• For mapping the entire rows in a profile, Right click on the corresponding profile and click the option Auto Map as shown in Figure (Auto Map Entire Profile Points):
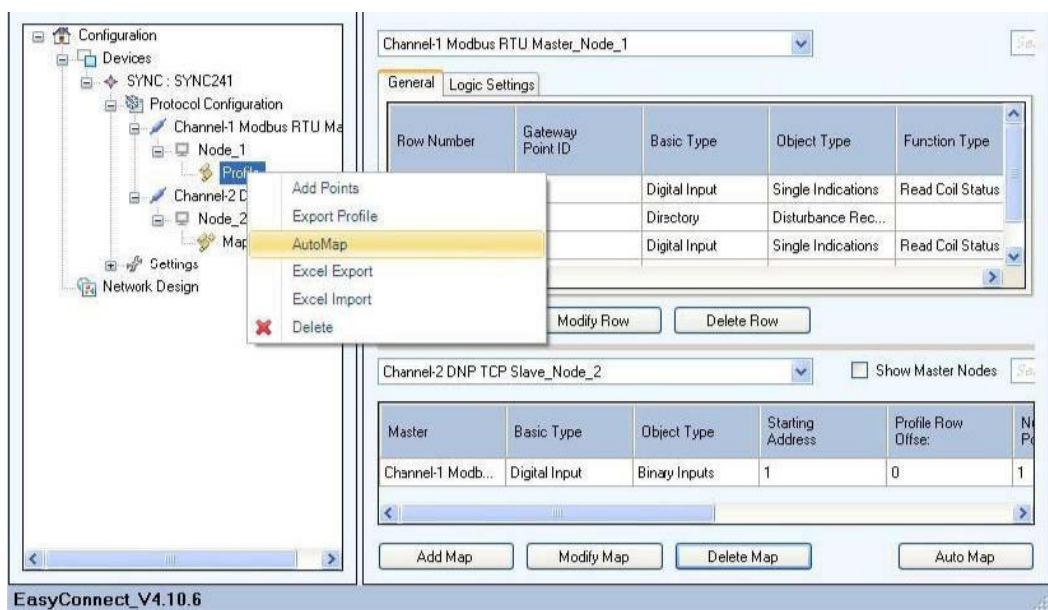
Figure 18: Auto Map Entire Profile Points

3. For mapping the selected rows in a profile, select the needed rows in the profile for which the automatic mapping is required. Click on Auto Map (slave/destination mapping part) as shown in the Figure (Auto Map Selected Profile Points):
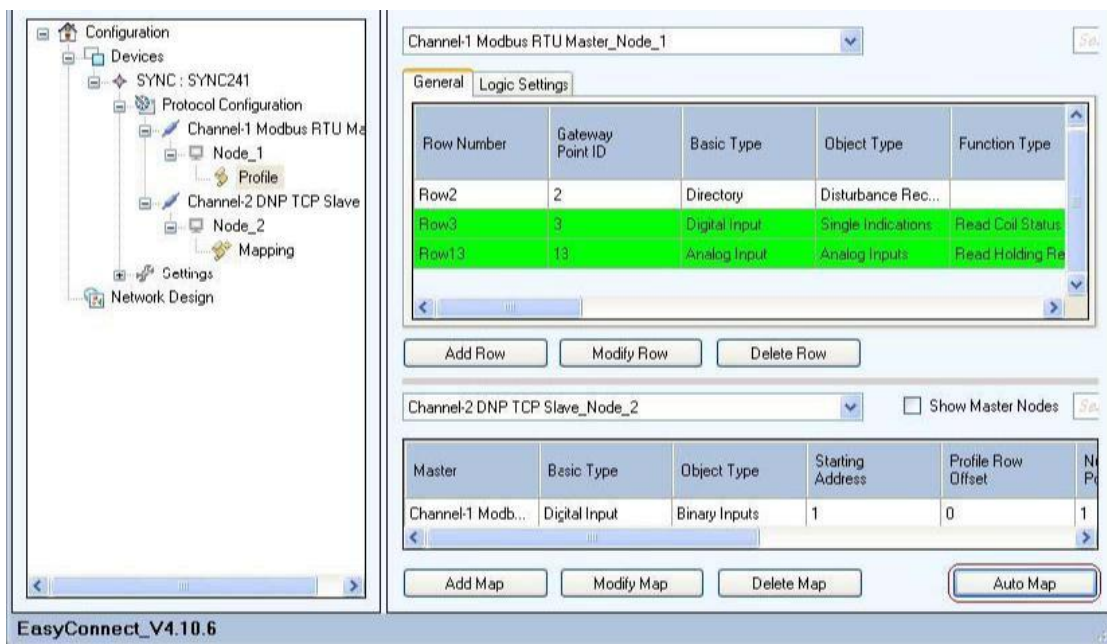
Figure 19: Auto Map Selected Profile Points

Step 2 or 3 will pop up the Auto Map window as shown in Figure (Auto Map Window) below. User can configure the details in the Auto Map window and generate auto mapping.
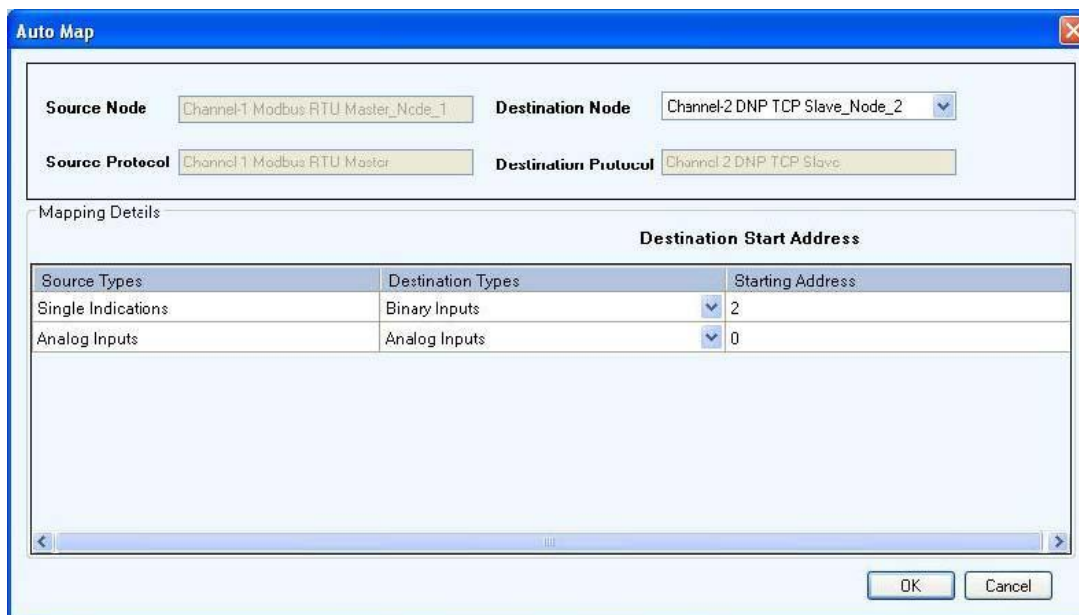
Figure 20: Auto Map Window

Auto Map window shows the master (source) types that are considered for automatic mapping, corresponding slave types automatically considered as mapping type (user can change using combo options) and corresponding start address in the slave. The parameter details of Auto Map window are given in table 3 (Auto map window) shown below.

Sl. No	Parameter	Details
1	Source Node	Indicates the node number whose profile needs to be mapped. This parameter is not editable.
2	Destination Node	Indicates the node to which the mapping needs to be done. The default will be the node selected in the mapping window. User will be able to change the same to any other node available in the configuration system.
3	Source Protocol	Protocol of the source node. This parameter is not
4	Destination Protocol	Protocol of the destination node. This parameter is not
5	Source Types	Indicates source data types from which mapping is carried out.
6	Destination Types	Indicates suggested destination data type for the specific source type to which mapping is carried out. This is a default suggestion and can be changed to any of the allowed types available in the combo box.
7	Destination Start Address	This indicates the destination start address for the specific destination type. This is generated after evaluating all the existing addresses, and last address + 1 of the already existing address is considered as default. User can change the start address but it will again undergo evaluation. There will be multiple address parameters based on the protocol used. For example, if it is IEC101/104, the same will have IOA but if it is IEC 103, it will have ftype and inumber as

Table 1: Auto map window

The following points will be applicable to the Auto Mapping Window:
- Only data types that have at least a point available for mapping to the current slave shall be displayed in the auto-mapping window.
- Similar source types will be grouped and displayed as a single row in the Auto Map window.
- For each protocol, the groupings of source types differ.
- All the types under the Basic type of the source type will be available as combo box options of Destination Types.
- In cases where destination address range is not sufficient to map all the points, an error message would be displayed in the validation stage after the 'OK' button is clicked
- Points will not be split and mapped for numerical address based protocols. A continuous address space large enough to hold the points in a single row (source) is found and the points are mapped to that range.
- Auto-map shall be provided for all Master protocols except 'HSB Master' and 'Logic Master'.
- On pressing OK from Auto-map window, points that can be successfully mapped are processed and an error message is displayed for those that could not be mapped. Note: All the other profile parameters will be their default values when auto mapped. User can modify the row if required.

2.4. Slave to Slave Mapping

The Slave to Slave mapping feature allows transfer of data point between two master stations.

To enable communication between masters, the corresponding source slave should be mapped to the destination slave. The source slave is the slave which receives data from the data point source master. The destination slave is the slave which transacts with the master to which the data has to be transferred. User can add profile and configure command points under the source slave nodes. These command points can be mapped to input points. A command received on the source slave will be sent as an event to the mapped destination slave. Depending on the command

type and protocol, a positive acknowledgment will be sent back to the source slave after sending the event notification. If the command point is not mapped, a negative acknowledgment will be sent back. For the protocols and specific data types which do not support event notifications, the data can be retrieved by polling.

> ⚠️ *Note: Slave-to-Slave mapping does not allow multiple mapping. In addition to this, a single row can only be mapped to a single node. For example, consider a row with three points. Each of these three points should be mapped to a single node. Splitting and mapping to different nodes is not permissible. The quality of the points configured will always be good. The time stamp of the event will be the time taken from the device when the command is processed.*

- Add slave channels and nodes (source and destination).
- Add Profile under source Slave and configure Points as shown in Figure (Adding Slave Profile) below:
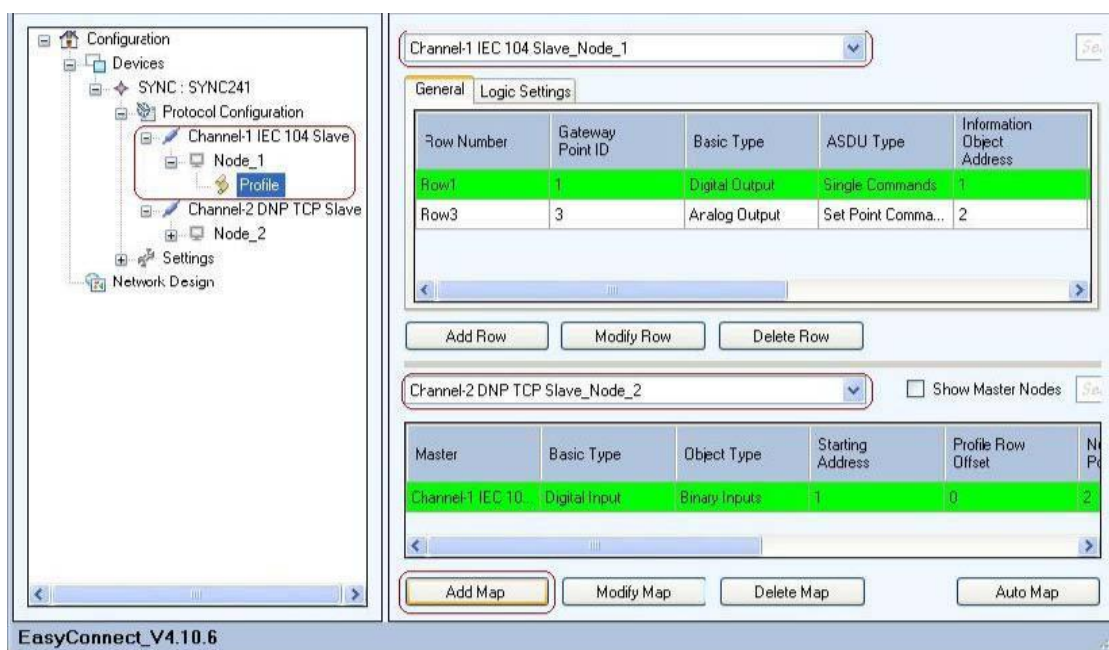
Figure 21: Adding Slave Profile

3. Select destination Slave and click on Add Map to add the mapping as shown in Figure (Adding Slave Profile) above. Modify Map and Delete Map functions are identical to their master- to-slave mapping counterparts.

2.5. Configuration Shortcuts

2.5.1. Copy/Paste

EasyConnect allows the user to copy and paste a device, a channel or a node. Depending on the protocol, the number of channels/nodes up to which it can be copied varies.

The Copy option is available by right clicking on a device, channel or a node. Consider the case of copying a node. In order to paste multiple copies of the node under a channel, right click on the channel and click Paste. Refer to Figure (Copy/Paste option on Right Click) given below:
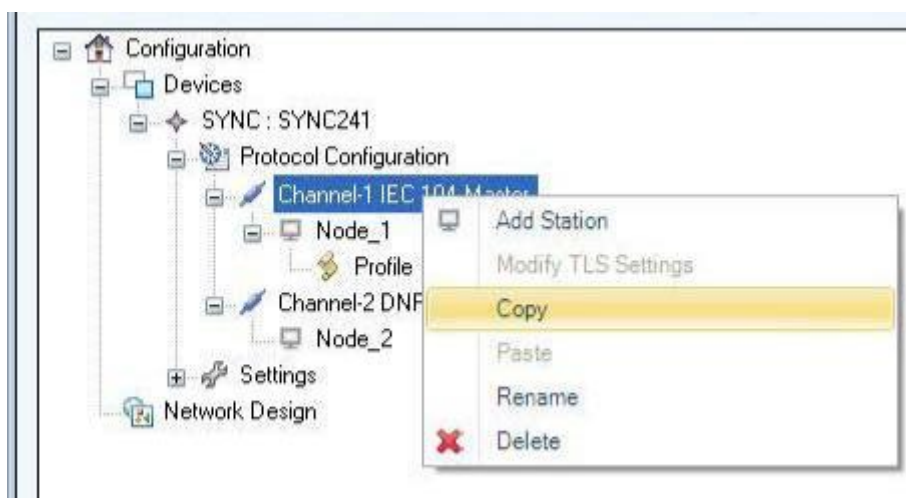
Figure 22: Copy/Paste option on Right Click

While choosing the paste option by right clicking on device, channel or node, a form pops up which gives the user an option to enter the number of copies required, as shown in Figure (Multiple Copies Form) below:
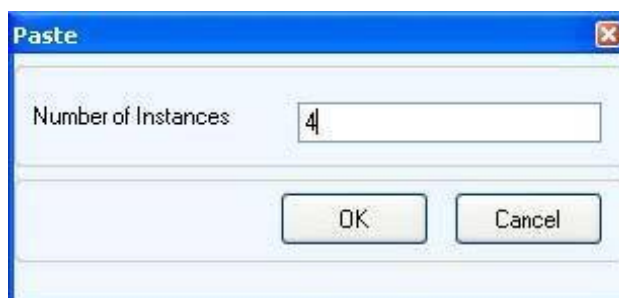
Figure 23: Multiple Copies Form

Copying a device copies all the information under that device including mapping and serial port settings. Dial up Settings, LAN Settings and SNMP Settings will not be copied.

2.5.2. Profile Row Options

EasyConnect allows the user to modify, delete a particular row by selecting the corresponding option by right clicking on that selected row.

A row can only be modified one at a time. The Delete row option is available for multiple selected rows. A single row or multiple rows can be exported to Excel by selecting single or multiple rows and right clicking the Export Row/ Rows to Excel option. The Export All to Excel option exports all the rows in the profile. Refer to Figure (Profile Row Option) given below:
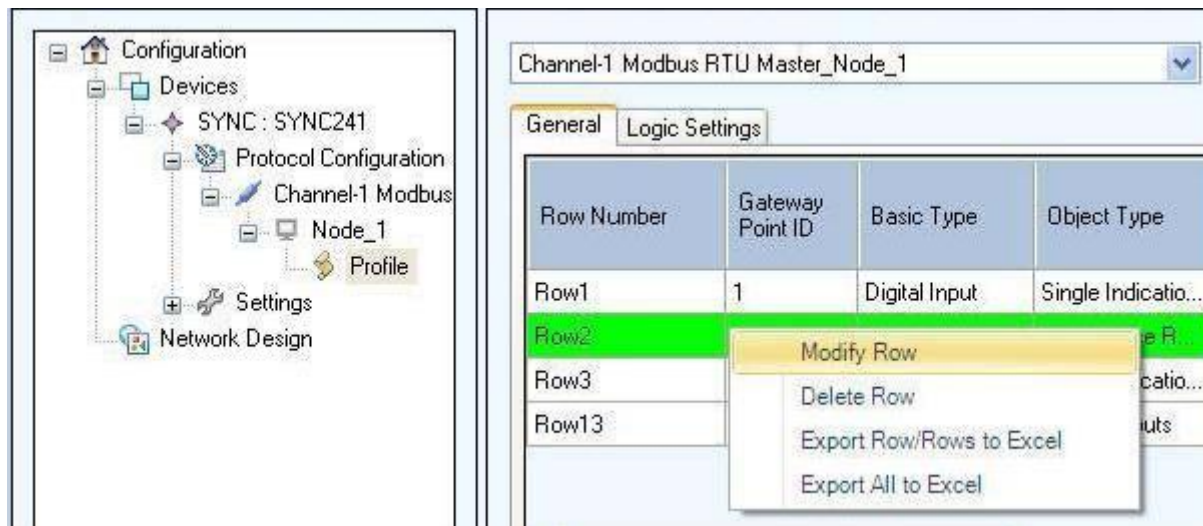
Figure 24: Profile Row Options

2.5.3. Multiple Row Modify Option

This feature allows user to modify properties of multiple rows together in profile and mapping. User can select the multiple rows of same basic type in the Profile/Mapping and click on the **"Modify Row/Modify Map"** option. In the pop up window, user can tick on the parameters, that need to be modified and change the values and then click on the "Save" button. This feature is only applicable to selected parameters in selected protocols. Refer to Figure (Multiple Row Modify Window) given below.
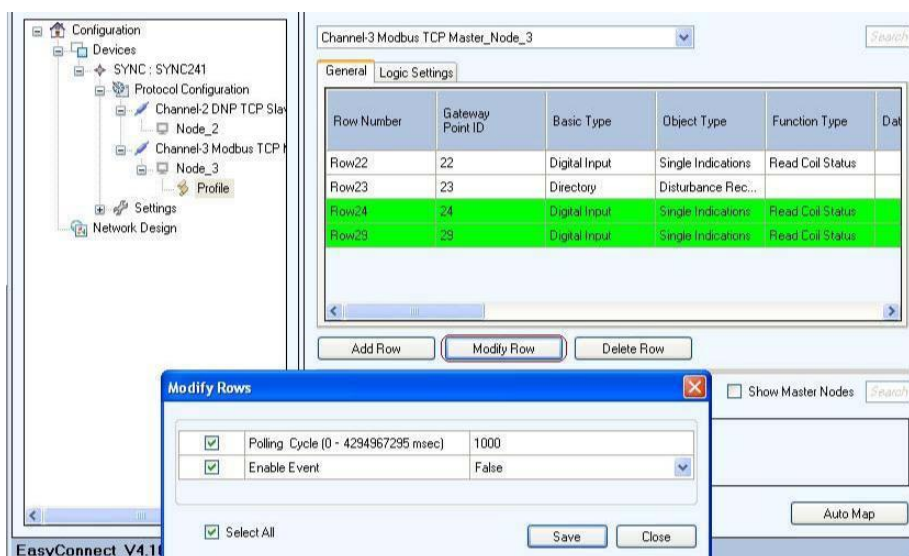
Figure 25: Multiple Row Modify Window

2.5.4. Search Option in profile and mapping

It provides an option to search the rows in profile and mapping. There are separate search boxes for profile and mapping. User can filter the displayed rows by providing a search key word in the specific search box.
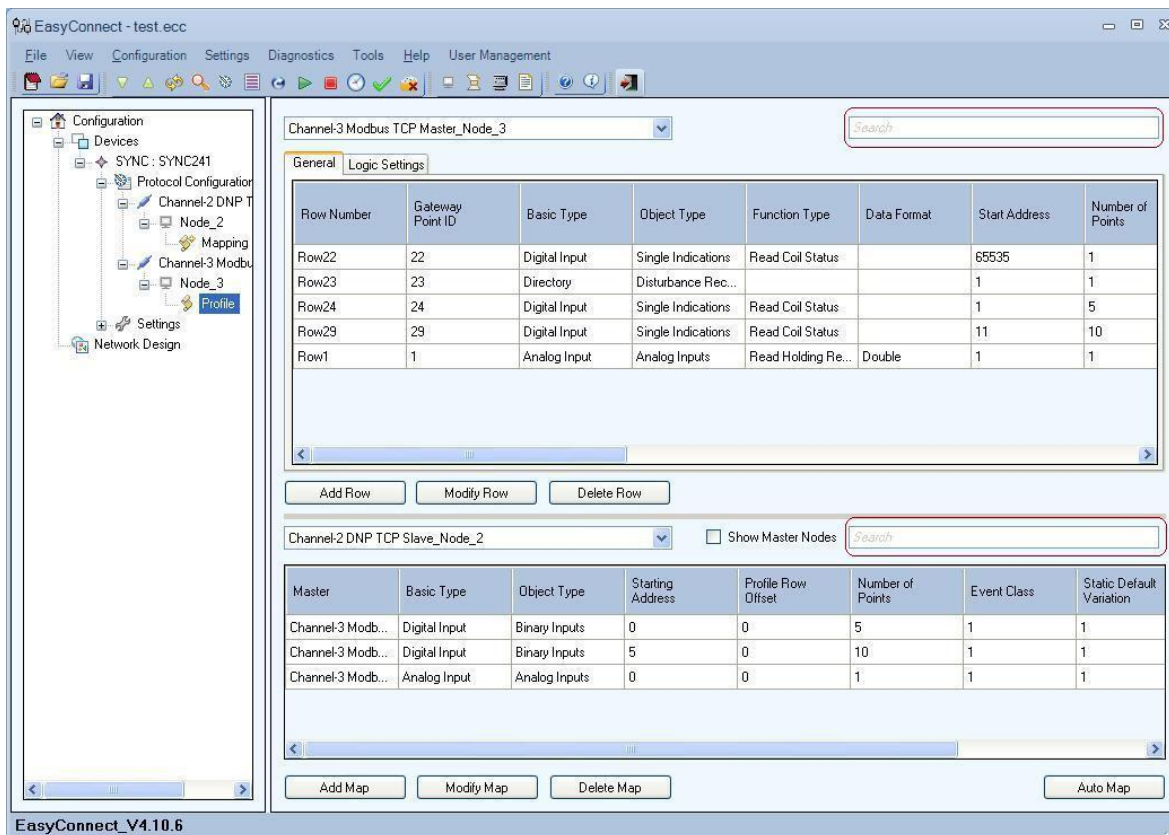
Figure 26: Search Option in Profile and Mapping
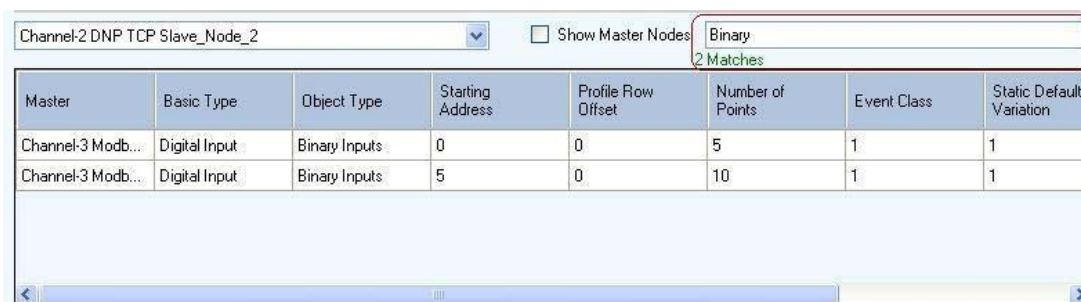
Figure 27: Search Option in Mapping

2.5.5. Excel Import/Export

Adding a large number of points to a profile using Add Row button in EasyConnect can be time consuming. EasyConnect configuration utility allows the user to export profile rows to an Excel worksheet and import the points from an Excel worksheet to the profile rows. The required points can be configured in an Excel worksheet and can be imported to the required profile.

2.5.5.1. Excel export

After adding the required rows in the profile, select Excel Export from the context menu as shown in Figure (Excel Export and Import) below:
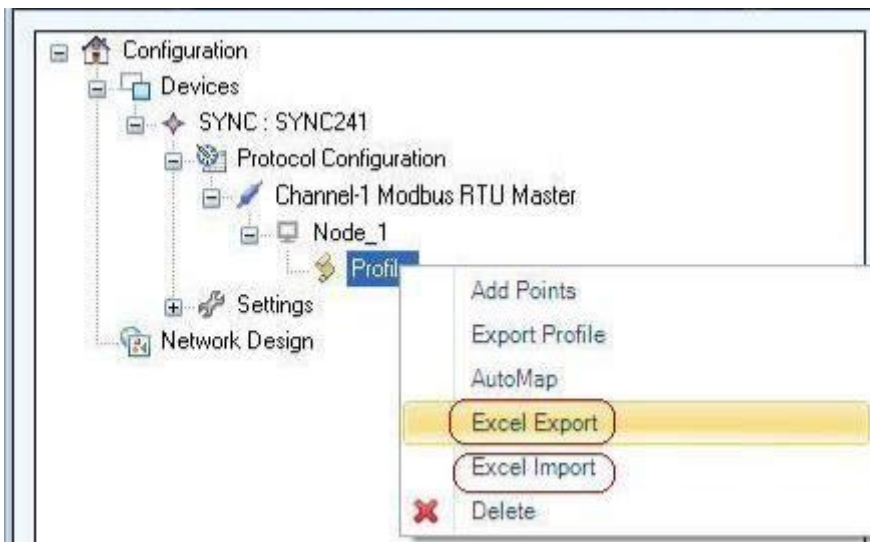
Figure 28: Excel Export and Import

The exported Excel worksheet format is shown in Figure (Excel Profile) below. The worksheet will contain the protocol name. All the configurable parameters in the Profile Row window of the specified protocol form individual columns. All the available options for a parameter will be available in the combo box independent of the type of point selected.

> **!** *Note: Excel export feature is not supported for communication diagnostic point and 61131 logic settings.*

Figure 29: Excel Profile

2.5.5.2. Excel Import:

Select Excel Import from the context menu of profile and choose the Excel worksheet to import. Refer to Figure (Excel Export and Import).

Certain conditions apply to the Excel Import functionality. Only worksheets previously exported from EasyConnect can be imported. User should add at least one point (other than communication diagnostic point) in the profile and use Excel Export to generate an Excel worksheet template. Configure required points in this file and save. Note that EasyConnect expects a specific format for the worksheet. Therefore, the user should refrain from modifying the format of the sheet in any manner. Only the contents may be changed. The protocol name in the Excel worksheet should match with the protocol of the profile to which it is imported. For example, an Excel worksheet exported from IEC104 Master can only be imported to a profile under an IEC104 Master Channel. EasyConnect validates all the parameters configured in the Excel worksheet before importing and will provide an error message if the validation fails. All the available options for a parameter will be available in the worksheet cells independent of the type of point selected. For example, in Modbus Master, Function Type 'Read Coil status' is not applicable for object type 'Analog Input'. But this option will be available in the Excel worksheet cell. User should select valid options while editing the worksheet. Any failure in validation will terminate Excel import.

- After validation, all the existing profile rows will be replaced by the points configured in the worksheet. For points that are already mapped to a destination protocol.
- For all the rows where the address parameters are not modified, the other parameter values are read in from the worksheet.
- If the address parameters are changed in the worksheet, EasyConnect will display a message as shown in the Figure (Excel Import Pop-up) below. On selecting Yes, the mapping will be deleted and the points in the worksheet will be imported. On selecting No, the Excel worksheet will not be imported.
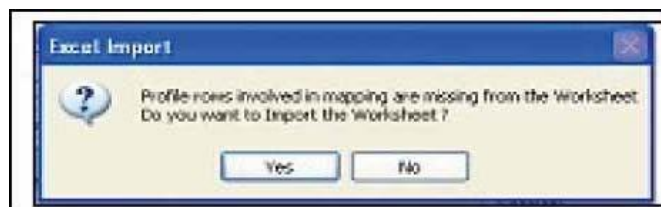
Figure 30: Excel Import Pop-up

3   DCCP Packaging

DCCP Packaging allows the user to update the DCCP firmware in the device with the latest EasyConnect compatible DCCP firmware.

From version 4.6.0 of EasyConnect onwards, the latest version of DCCP firmware is provided in the EasyConnect application folder. If the device has an older DCCP version, EasyConnect provides an option to automatically upgrade the DCCP firmware.

During various operations such as 'Download', 'Upload', 'Stop firmware' and 'Start firmware', EasyConnect I checks the DCCP firmware version in the device, and then prompts the user to download the latest version, if the DCCP version in the device is older.

To enable this DCCP version check, the 'Check for firmware updates' box in the Option window found under Tools must be checked as shown in the figure below. Then click Save.
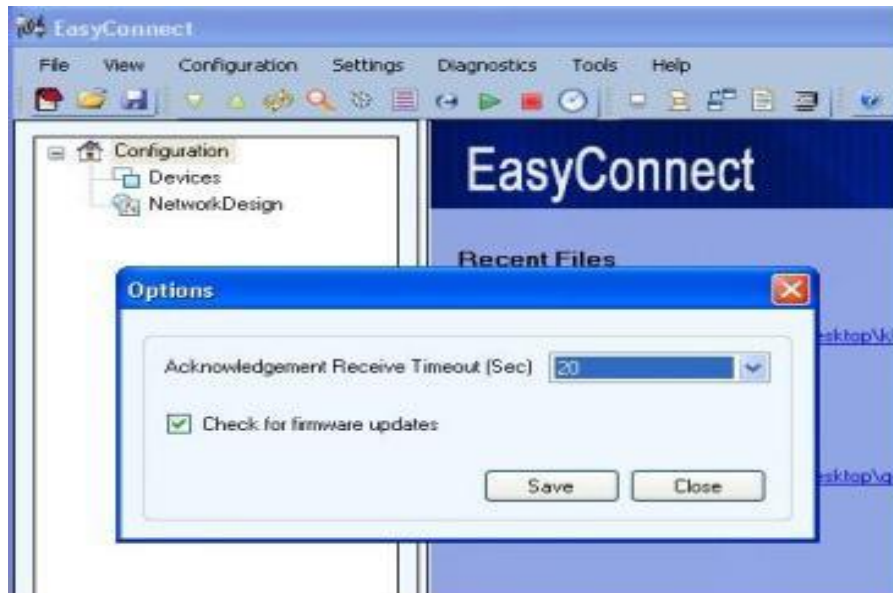
Figure 31: Enabling Check for Firmware Updates

To disable the version check, uncheck the Check for firmware updates box and click **Save**.

If the device has an older DCCP version, EasyConnect prompts the user to upgrade the DCCP firmware as shown in the figure (Pop-up for Automatic Up gradation) below. On clicking Yes, the device gets upgraded to the latest DCCP.

Figure 32: Pop-up for Automatic Up gradation

> *Note: On checking the 'Don't ask this again' box, the version check will be disabled for that EasyConnect instance even if the 'Check for firmware updates' box in the Option window under Tools is checked.*

For DCCP versions older than 2.9, EasyConnect prompts the user to upgrade to a compatible DCCP version, as shown in the figure (Model name prompt for older DCCP versions) below. On clicking Yes, the user is prompted to browse for the model name from the combo box, as shown in the second figure (Automatic upgrade prompt for incompatible DCCP version) below. On clicking OK, the DCCP firmware in the device gets automatically upgraded to the EasyConnect DCCP firmware version.

Figure 33: Model name prompt for older DCCP versions
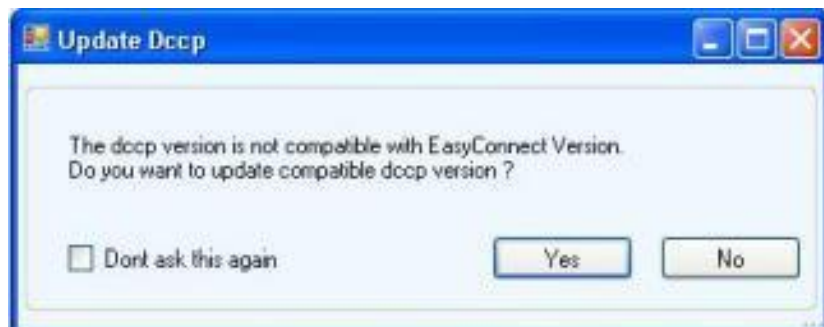
Figure 34: Automatic upgrade prompt for incompatible DCCP version

In the Version Information window, an option Click here to update is provided to update the DCCP version if the device uses an older DCCP version than the EasyConnect DCCP version, as shown in the figure (DCCP update Link in Version Info) below. This feature is available only for devices that support DCCP Packaging.
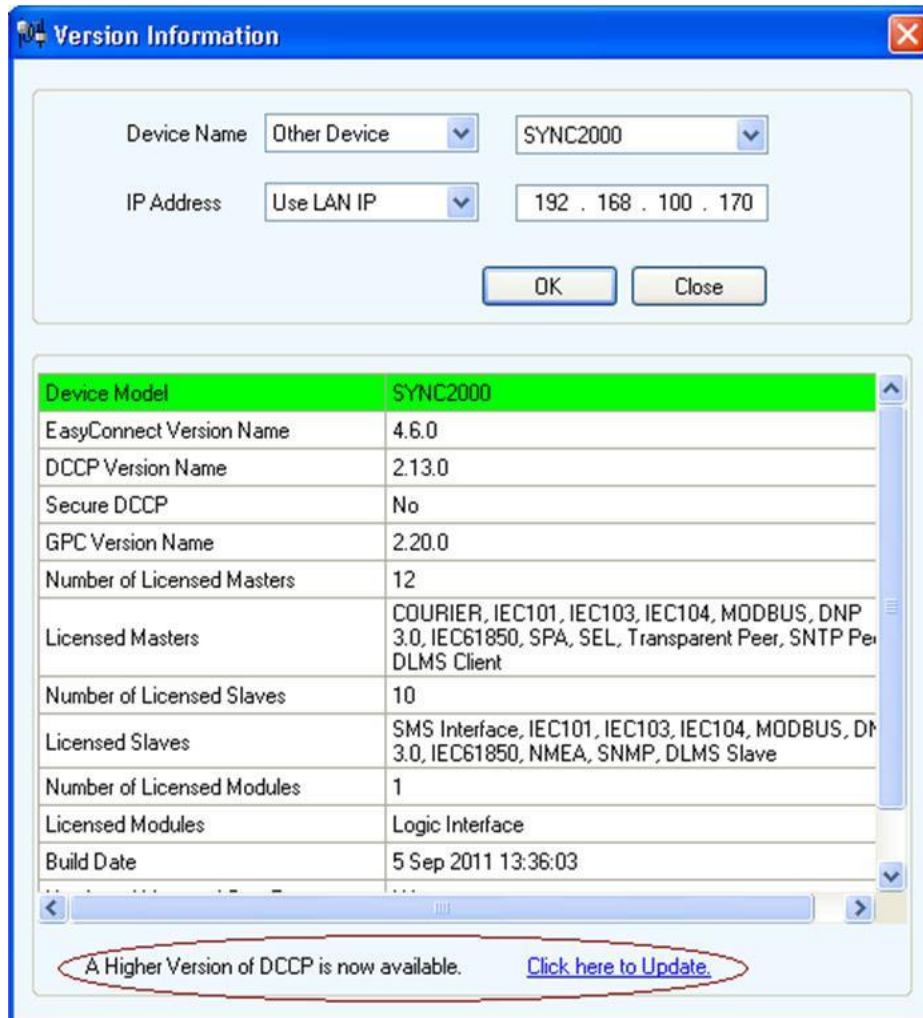
Figure 35: DCCP update Link in Version Info

> ⚠ *Note: This option is not available if the 'Check for firmware updates' box in the Option window found under Tools is unchecked.*

In case of older DCCP versions that have no version information (DCCP versions older than v2.9.0), the following message will be displayed on checking the version information as shown in the figure (Version Info for devices with older DCCP Versions) below.

> ⚠️ *Note: The DCCP Packaging feature is supported for all the devices listed in the SYNC tab in the devices list in EasyConnect.*
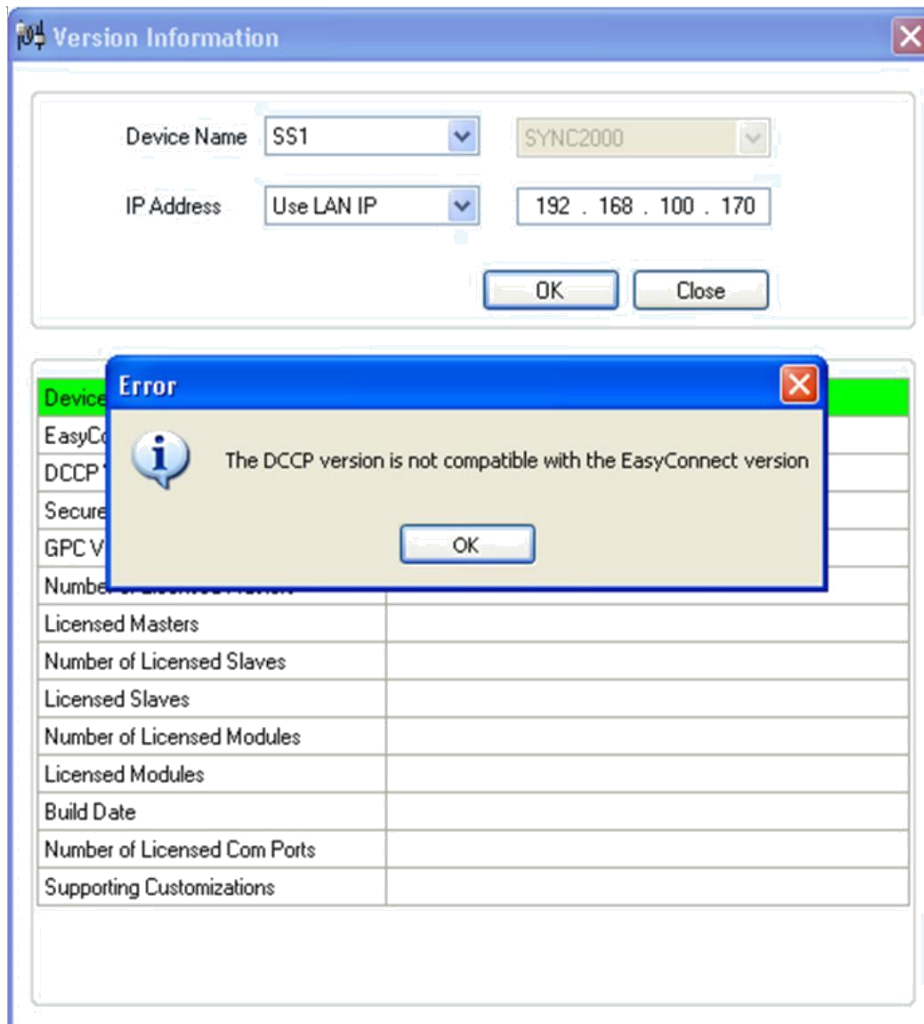
Figure 36: Version Info for devices with older DCCP Versions

A

Appendix A – Flag conversion in GW IEC

When a protocol conversion is achieved using GW IEC, the quality flag conversion between the protocols has to be defined. The table 13 (Flag Mapping) below is used to explain the quality flag translation between protocols inside GW IEC. The flags received in any of the GW IEC-Master Protocol (GW IEC Master) will be translated to a specific flag of GW IEC-Slave Protocol (GW IEC Slave) as described in the table shown

Master Protocol column groups: **IEC 101/104** (OV1 … On link failure), **DNP 3.0** (Roll-over2 … On link failure), **IEC 103** (OV3, ER3, On link failure), **Modbus** (On link failure), **IEC 61850** (Old data4 … On link failure).

| Slave group	Slave Protocol	OV1	BL1	SB1	NT1	IV1	EI1	On link failure (Not protocol flag) [101]	Roll-over2 (Counter)/Over-range2 (Analog)	Local forced data2	Communication lost2	On-line2 = 0	Restart2	Remote forced data2	Chatter filter2	Reference check2	On link failure (Not protocol flag) [DNP]	OV3	ER3 (MVAL invalid)	On link failure (Not protocol flag) [103]	On link failure (Not protocol flag) [Modbus]	Validity = Questionable & Detail quality = Old data4	Validity = invalid & Detail quality = Oscillatory4	Validity = invalid & Detail quality = Failure4	Validity = invalid & Detail quality = Bad Reference4	Validity = Questionable & Detail quality = Inaccurate4	Validity = Questionable & Detail quality = Inconsistent4	Source = Substituted4	Blocked4	Validity = invalid & Detail quality = Overflow4	Validity = invalid & Detail quality = Out of Range4	On link failure (Not protocol flag) [61850]
IEC 101/104	OV1	X							X									X													X	
	BL1		X																										X			
	SB1			X							X			X														X				
	NT1				X			X			X						X			X	X	X										
	IV1					X		X				X					X		X	X	X	X		X								X
	EI1						X																									
DNP 3.0	Roll-over2 (Counter)/Over-range2 (Analog)	X							X									X												X	X	
	Local forced data2		X							X																		X				
	Communication lost2			X							X						X			X		X										X
	On-line2 = 0				X												X			X	X											X
	Restart2												X																			
	Remote forced data2													X																		
	Chatter filter2														X												X					
	Reference check2															X										X						
IEC 103	OV3	X							X									X														
	ER3 (MVAL invalid)				X	X		X			X	X	X				X		X	X	X	X		X						X	X	X
IEC 61850	Validity = Questionable & Detail quality = Old data4			X				X			X						X			X	X	X										X
	Validity = invalid & Detail quality = Oscillatory4											X															X					
	Validity = invalid & Detail quality = Failure4					X		X									X			X	X	X		X								X
	Validity = invalid & Detail quality = Bad Reference4												X														X					
	Validity = Questionable & Detail quality = Inaccurate4															X										X						
	Validity = Questionable & Detail quality = Inconsistent4														X												X					
	Source = Substituted4			X						X				X														X				
	Blocked4		X																										X			
	Validity = invalid & Detail quality = Out of Range4	X							X									X												X	X	

Table 2: Flag Mapping

All flags described in the table are considered set and follow the applicable translation unless specified otherwise
- See quality description details in section 7.2.6.3 and 7.2.6.4 of IEC 60870-5-101.
- See DNP V3.00 Data Object Library – FLAG details given in each objects
- See details in section 7.2.6.8 of IEC 60870-5-103
- See details in section 6.2 of IEC 61850-7-3.

Glossary

List of Abbreviations

The following table 14 (List of abbreviations) shows the acronyms/abbreviations used in this document

Acronyms/Abbreviations	Description
CHAP	Challenge-Handshake Authentication Protocol
DCCP	Diagnostic and Converter Configuration
DPI	Enhanced Data rates for Global Evolution
EDGE	Dots Per Inch
GPC	Enhanced Data rates for Global Evolution
GPRS	Generic Protocol Conversion
HSB	General Packet Radio Service
IP	Internet Protocol
PPP	Point to Point Protocol
RAM	Random Access Memory
UDP	User Datagram Protocol
VPN	Virtual Private Network
SNMP	Simple Network Management Protocol
XML	Extensible Mark-up Language
RSA	Rivest - Shamir - Adleman
DES	Data Encryption Standard
AES	Advanced Encryption Standard
SHA	Secure Hash Algorithm
CBC	Cipher-block chaining
DHE	Diffie-Hellman ephemeral
RC4	Rivest Cipher 4
CA	Certificate Authority
ARP	Address Resolution Protocol

Table 3: List of abbreviations