

Addendum to Catalyst Owner's Manual How to configure a Catalyst EtherNet/IP with RSLogix 5000

Addendum 1.1



Document history

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Raco Manufacturing and Engineering continually makes improvements in the operation and functionality of its products. This addendum describes Catalyst Ethernet communication option that allows the Catalyst to connect directly on the PLC Ethernet networks. This addendum specifically addresses the ModbusTCP and EtherNet/IP protocols.

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Introduction

Are you familiar with the operation of the Catalyst Data Logger/Autodialer yet?

Changes to a few, very specific features of the Catalyst are described in this addendum. It is assumed that the reader of this addendum is already familiar with the basic operation and programming method of the Catalyst product and also is familiar with Alarmware software. If this is not the case, please take the time necessary to familiarize yourself with the Catalyst autodialer by reading the Owner's Manual.

Important Note: It is important to note that a user cannot use the front keys of the Catalyst to program or change any Ethernet settings. For this reason, it is crucial to use this addendum and Alarmware to configure the IP address of the Catalyst to identify and configure the device for Network traffics.

1. More info about the network and products

For further information about the Catalyst Ethernet Option products, please consult the RACO Mfg and Eng web pages at www.racomn.com. The latest manuals, Alarmware 2.0 software, and EDS-files (also included in the CD that is shipped with a new Catalyst Ethernet) etcetera can be downloaded from the online support sections of the web site.

For more information concerning the EtherNet/IP network the Open EtherNet/IP Vendor Organization has a webpage. Please visit www.odva.org for more information about EtherNet/IP.

For more information concerning the ModbusTCP network the Open Modbus Organization has a webpage. Please visit www.modbus.org for more information about ModbusTCP.

For information concerning the Allen Bradley PLC's refer to the Rockwell Automation homepage www.rockwellautomation.com

2. When should you use this addendum?

The information provided in this document helps the user setup the Ethernet communication between the Catalyst and the Ethernet network. It is assumed that the user has already connected the Catalyst to the Ethernet network and is ready to setup the remote channels (section 1.1.2 in the main Catalyst manual).

Please note that this addendum is in effect a new section to the Industrial Networks section of the manual (Section 1.9.1 in the main Catalyst user Manual). Therefore, the content of this addendum covers all the requirements of connecting to the Ethernet network, which also includes all testing and diagnostics.

The main purpose of connecting to the Ethernet network is to get the PLC data natively instead of connecting on other external network bridges.

3. Requirements

Description	Name / Type	Version
Rockwell PLC	ControlLogix5000	n.a.
PLC software	RSLogix 5000	13.04.00
RACO IPConfig tool	RACO IPConfig	2.1.1.1
Catalyst EtherNet/IP Network Interface Addendum	Catalyst EtherNet/IP Ethernet Network Interface Addendum	2.0
Catalyst EtherNet/IP User Manual	Catalyst User Manual	2.0
Alarmware	New Alarmware version for Ethernet	2.0

4. Determining Net Port Number & Protocol Identifier

The Catalyst Ethernet supports one communication port, named NET 1. In this version of the product, the Ethernet connectivity is found in the door of the module. The Factory provided Ethernet cable attaches to the communication card that is mounted on the inside of the door assembly.

This Ethernet version of the Catalyst supports equally the ModbusTCP **or** the EtherNet/IP networks over the Ethernet port.

5. Communication Registers

The Catalyst behaves in the same way in all of its programming as indicated in the main Catalyst user's manual except if desired the Catalyst also monitors the loss of Ethernet communication functions. When addressing the communication behaviors in Ethernet you should observe these guidelines.

The communication health bit is configured with a special logic to monitor network health of connecting PLCs – If Ethernet master loses connection, a health byte in address 40125 will go from 0 to 256 or a bit in address 01992 will go from 0 to 1 indicating that the communication with the network is impaired and if the Catalyst is programmed to look for this change. A bit flipping from 0 to 1 can report the loss of communication via an alarm to the users.

To program the loss of communication alarm follow the instructions in the main Catalyst manual and ensure that the register name space is set accordingly.

Program Channel 56 SNA: 1*2*01992 (channel 56 reads address 01992) ,Alarm on 1 Raw Value, 0 Reported as '0.'

You may choose any available channel for this function (shown here using channel 56). We recommend using a channel near the end, i.e., 56, 96 or 256 depending on your model.

Note that Normal means actually talking to the PLC. You would get an alarm if you are plugged into the Ethernet, but the PLC is not communicating, or if you are not plugged into the Ethernet.

Note also that this bit will use one of the available channels on the Catalyst (in this case channel 56).

6. Additional consideration

It is good to note these differences in looking for the changes in register values, coils, and bits:

- Sometimes different types of registers are mapped to different internal memory locations
30001 will go to a particular read-only input register (e.g. temperature), whereas 40001 will go to a different read/write holding register (e.g. set point).

- Catalyst with Ethernet autodialers don't work this way. All the different areas are mapped on top of one another.

30001 holds the same value as 40001.

Coil 00001 holds the same value as the first bit of 30001 or 40001

Registers 1-123 hold read only input data

Coils 1-1968(16-bit*123) hold input data

Registers 1025 to 1147 hold read/write output data

Coils 16385 (16-bit*1025) to 18353 (+16-bit*123) hold read/write output data

- This allows flexibility to look at data as input registers, holding registers, coils, etc., as many Modbus masters don't have all functions implemented
- Since Catalyst channels are completely compatible with the logical and I/O addressing scheme for the file structure of the Allen Bradley controllers (SLC series and newer) processors, the table below should look familiar.

• **TABLE #1**

Register Address	Description	Size/Limitation	Catalyst SNA
0xxxx	Coil number xxxx	1-bit	1*node*0xxxx
1xxxx	Input number xxxx	1-bit	1*node*1xxxx
2xxxx	Input register number xxxx	16-bit	1*node*3xxxx
3xxxx	Output register number xxxx	16-bit	1*node*4xxxx
4xxxx	Floating Point register	32-bit	1*node*5xxxx
Note: The 5x and 4x references share the same data space. That is, an address of the form 5nnnn takes the 32 bits beginning at location 4nnnn and extending through 4nnnn + 1. These 32 bits are then interpreted as an IEEE floating point number.			

Important:

Catalyst Ethernet SNA addresses have the form 1*2*(Register Address). 1 Table #1 illustrates the data file convention within the Catalyst and the link to PLC via SNA (Source Net Address).

Table #1 also shows the Allen-Bradley-supported address types available to link to Catalyst channels. Indirect, indexed and symbolic addressing schemes are not supported.

• **Table #2**

Register Address	Description	Size / Limitation
0xxxx	Coil number xxxx	1-bit
1xxxx	Input number xxxx	1-bit
3xxxx	Input register number xxxx	16-bit
4xxxx	Output register number xxxx	16-bit
5xxxx	Floating Point register	32-bit

Table #2 illustrates the Modbus data file convention within the Catalyst. These Modbus Register Addresses map to the Rockwell Automation controller's registers as per the Modbus Table File numbers, on the Channel Configuration form within RSLogix, illustrated above.

Important:

It should be noted that Output Register (4xxxx) and Holding Register (5xxxx) data types use the same data area at the Catalyst end. The Holding Register (5xxxx) uses two consecutive 16-bit addresses that are interpreted as a 32-bit floating point number (i.e. 5xxxx & 5xxxx+1). Not unlike the Holding Register, the Output Register (4xxxx) also reserves two consecutive 16 bit words; however the extended word is left blank.

Similarly, when addressing the input register (3xxxx), allow for two consecutive 16 bit words, keeping in mind the word is reserved but not used. Hence, consecutive addressing of both Input and Output Registers will appear as follows. For example, first Input Register address point 30001, second address point 30003, third address point 30005, etc.

7. Allen Bradley PLCs Solution overview

This application note describes how to configure Catalyst EtherNet/IP with a Rockwell PLC using RSLogix 5000. Below you can find an overview of the system described in this document. Other nodes may be attached to the network, but are not necessary.

The configuration is described in two steps.

1. At first the PLC and network configuration is explained.
2. Secondly the configuration of the IP-settings and the I/O data of the Catalyst EtherNet/IP are described.

The contents describe step by step how a configuration is done. This document assumes the reader is familiar with industrial communication, EtherNet/IP networks.

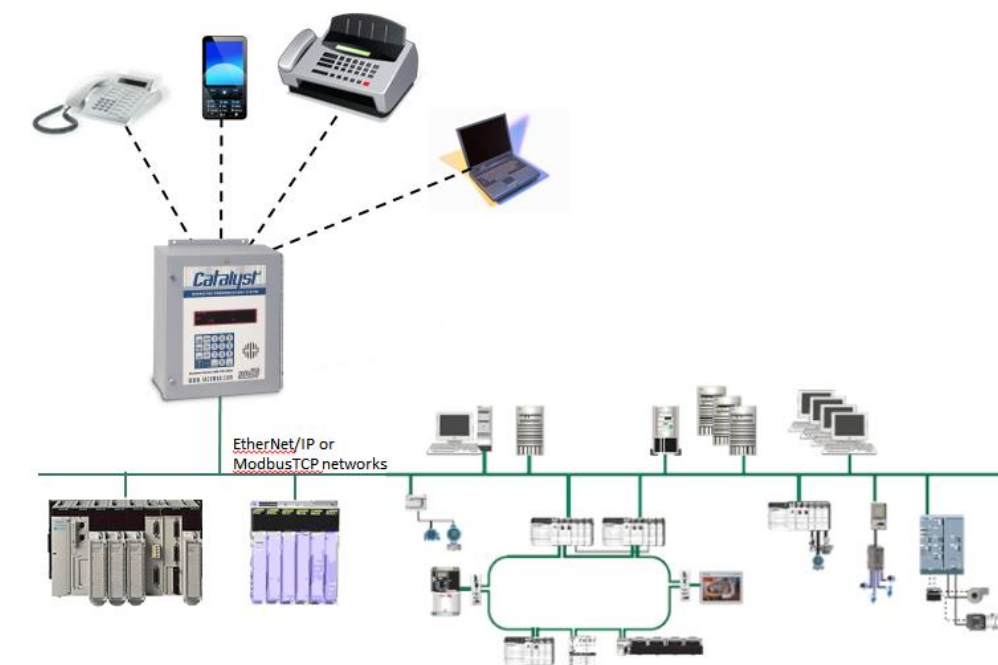


Figure 1 Hardware connection overview.

8. EtherNet/IP configuration

Before you begin: Ensure that the EDS file (Found on the “Ethernet IP Configuration Tools” CD that was shipped with the Catalyst) is copied to the RSLogix 5000 EDS directory (as indicated by Rockwell Automation Manual). The EDS file insures that the RSLogix controller can identify the RACO Ethernet autodialers in the Ethernet modules and tags.

To configure the PLC and the EtherNet/IP network the tool RSLogix 5000 is used. Firstly the PLC needs to be configured and secondly the EtherNet/IP network. Start the RSLogix 5000 program and follow the steps below.

8.1. PLC configuration

Either create a new project or use an existing. To create a new configuration, open the file menu and select new. In the appearing dialogue select the desired type of PLC, in this case the type 1756-L55 is used. Also enter a name for the controller and select chassis type, slot number and project path. To accept the settings press OK.

New Controller

Vendor: Allen-Bradley

Type: 1756-L55 ControlLogix5555 Controller

Revision: 13

☐ Redundancy Enabled

Name: CLOGIX5000

Description:

Chassis Type: 1756-A10 10-Slot ControlLogix Chassis

Slot: 0 Safety Partner Slot: <none>

Create In: C:\Program Files\Rockwell Software\RSLogix5000\Projects

OK Cancel Help

Browse...

Figure 2 Adding the PLC to the configuration.

Then add the Ethernet I/O module. Right click on the I/O configuration directory in the navigation list to the left as seen below.

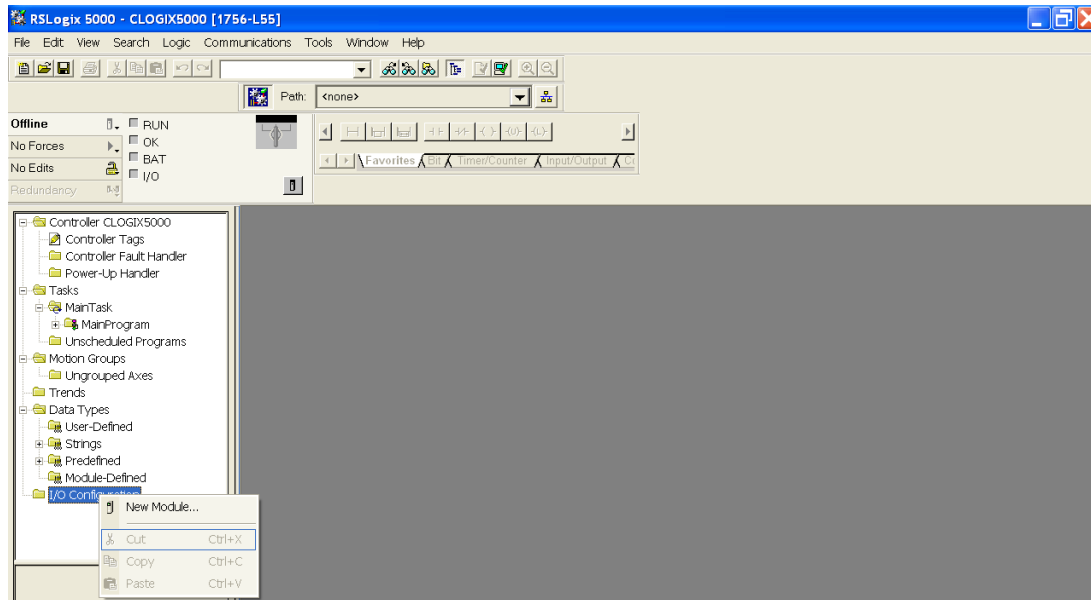


Figure 3 Adding the Ethernet module.

Click on new module and select the desired Ethernet module, in this case the Ethernet Bridge. This module is the scanner module in the PLC.

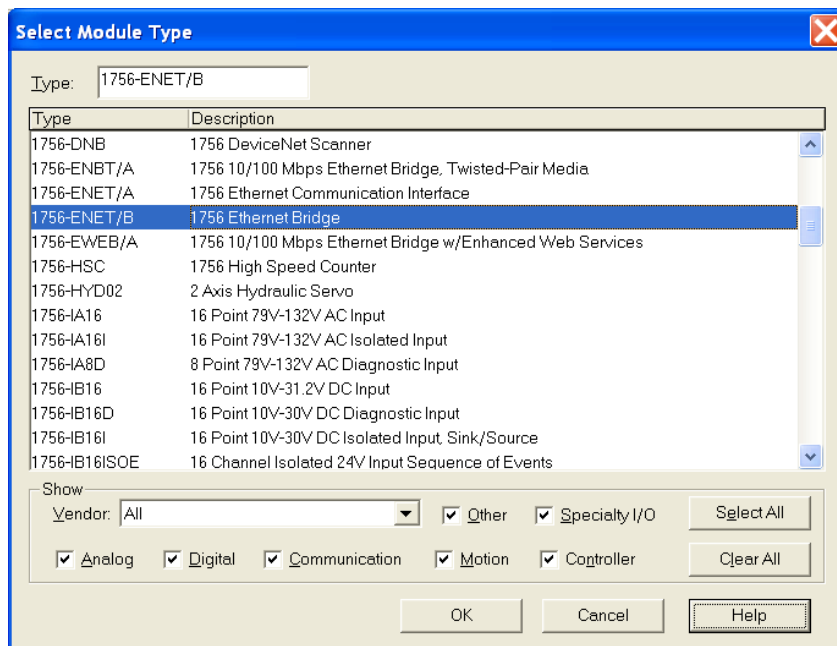


Figure 4 Selecting the type of module.

Then enter the desired settings and press finish.

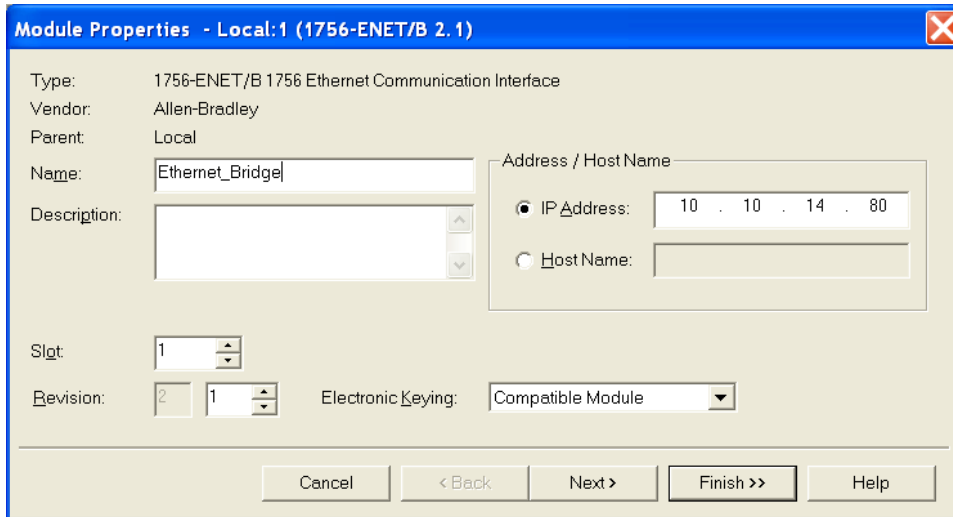


Figure 5 Configuring the settings for the Ethernet module.

8.2. EtherNet/IP network configuration

The second step is to configure the EtherNet/IP network and adding the RACO Catalyst EtherNet/IP module to the configuration in the PLC. Begin with setting the program in “Offline” mode❶. Then right click on the EtherNet/IP Bridge in the I/O configuration, and select “New Module”❷.

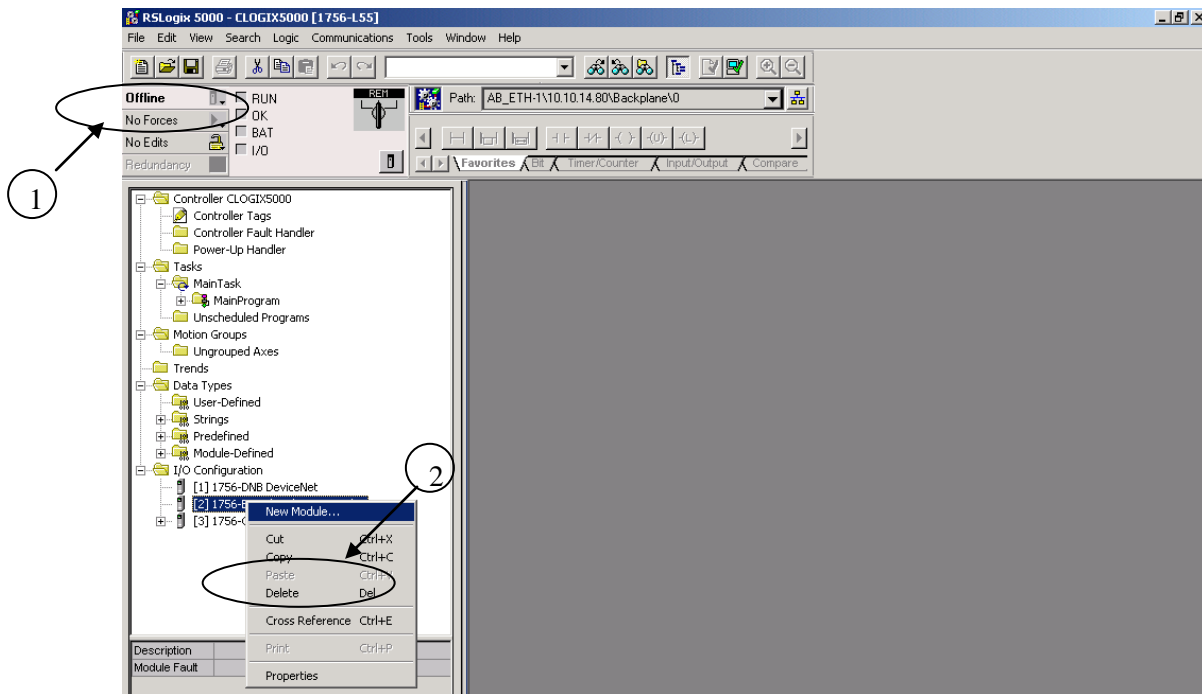


Figure 6 Adding the Catalyst module.

Now a dialogue window will appear. In this dialogue window, select “Generic Ethernet module” and press OK.

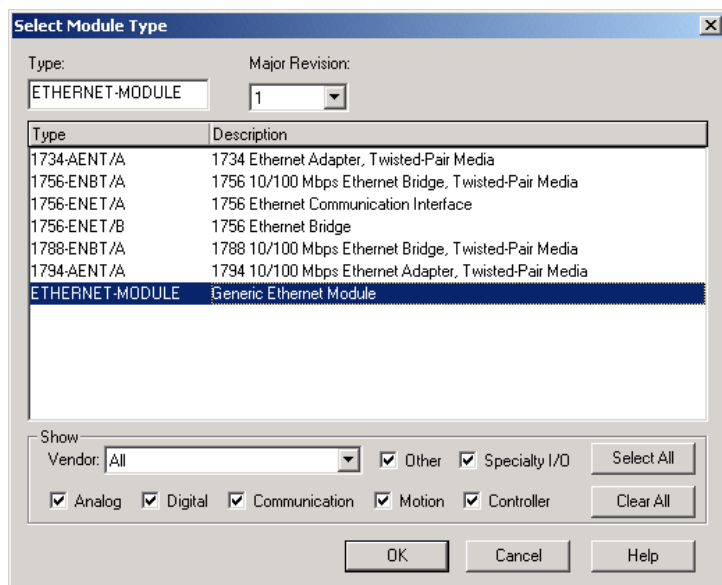


Figure 7 Selecting the Generic Ethernet Module.

In the next dialogue window, RSLogix 5000 will ask for information regarding the communication to the Catalyst module. First enter a name for the Catalyst module ❶. In the example below we call it “RACO Ethernet”. This name will create a tag in RSLogix 5000, which can be used to access the memory location in the PLCs memory where the data for the Catalyst module will be stored. A description can also be added, but that is optional.

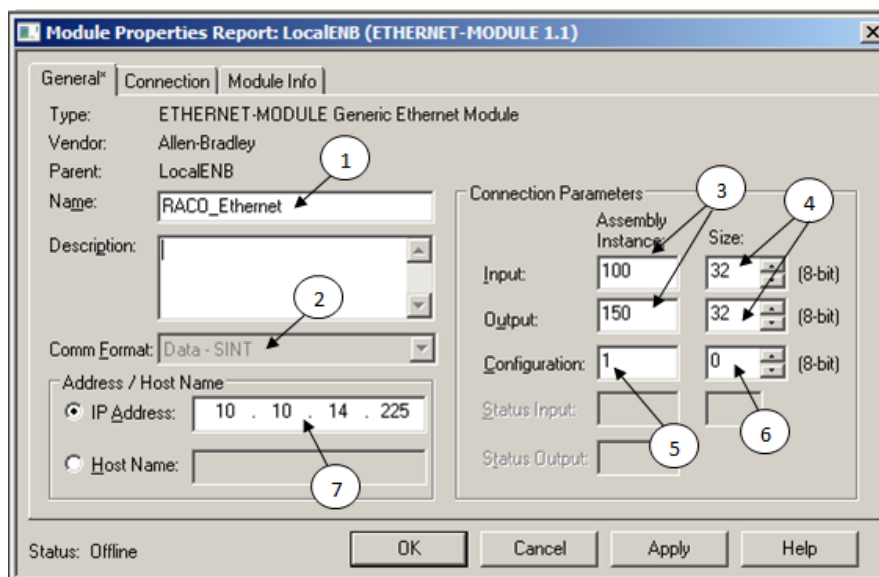


Figure 8 Configuring the module properties.

Next step is to select the “Com Format”, which tells RSLogix5000 the format of the data ❷. In our example, we have selected Data-SINT, which will represent the data in the Catalyst module as a field of 8-bit values. It is also

possible to select Data-INT, which will represent the data as 16-bit values, and Data-DINT, which will represent it as 32 bit values.

I/O data is accessed in input instance 100 and output instance 150, so these values have to be entered as the instance values for input and output ⑤. The size of the input connection and the output connection shall correspond to the size that we have configured the Catalyst module for. In our case we are using 32 8-bit values of input and output data, so that is the size that we enter ④. 32 in this case stands for 32 instances of 8 bits. If we had been using Data-INT or Data-DINT, we would have to recalculate the size to match the data type, so Data-INT would have been 16 16-bit values, and Data-DINT would have been 8 32-bit values.

The Catalyst module does not have a configuration assembly instance by default, but RSLogix5000 requires a value for this anyway. An instance value of 0 is not a valid instance number, but any non-zero value will work, here we have selected the value 1 ⑥. The data size of the configuration instance has to be set to 0, otherwise the configuration instance will be accessed and the connection will be refused ⑥. As a final step we enter the IP address that we have configured for the module, here 10.10.14.225 ⑦.

The next step is to press next.

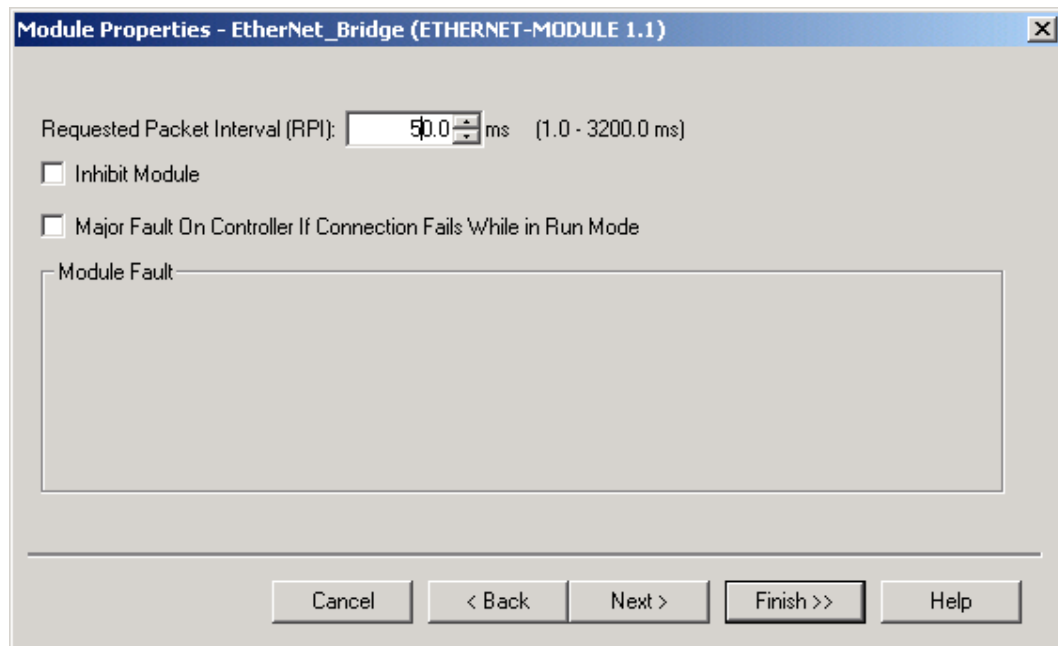


Figure 9 Configuring the scan interval.

In this dialogue we will enter a value for the time between each scan of the module. In this example, we have set the interval to 50 ms to reduce the network load. Make sure that “Inhibit Module” isn’t checked. After this, press finish.

Now the Catalyst has been added to the I/O configuration in RSLogix 5000. The main screen will look as follows.

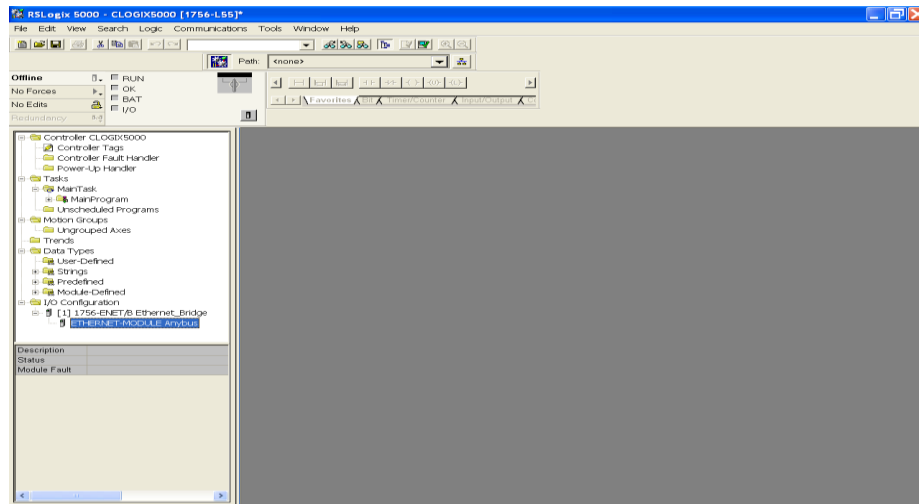


Figure 10 The main screen when the configuration is completed.

8.3. Downloading the configuration to the PLC

First select the communication path. This can be done by opening the Communications menu and selecting the Who Active command. Select the desired communication path as seen below.

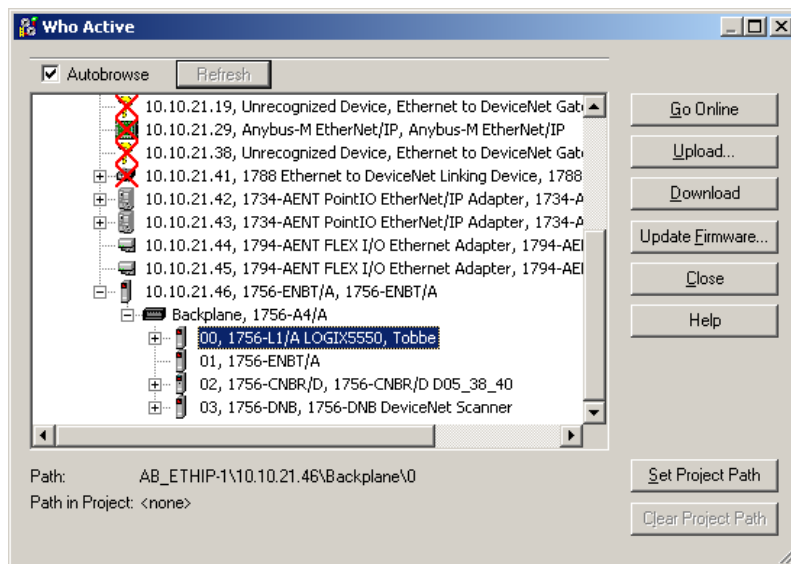


Figure 11 Configuring the communication path.

Select “Go Online” from the “Communications” menu.

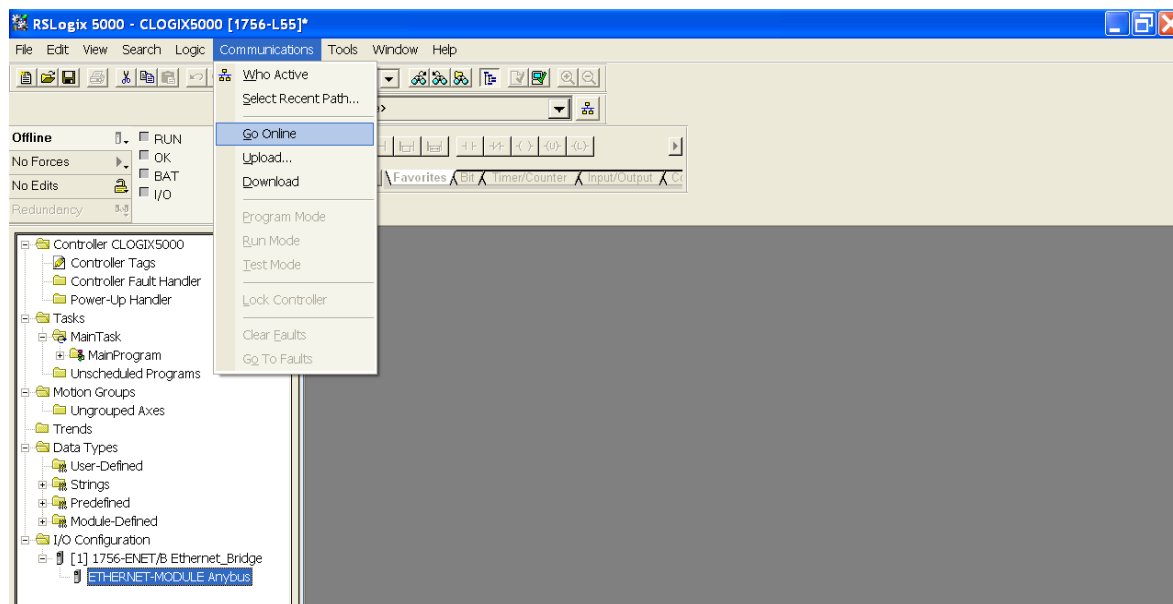


Figure 12 Opening the online window.

A new window appears, select “Download”.

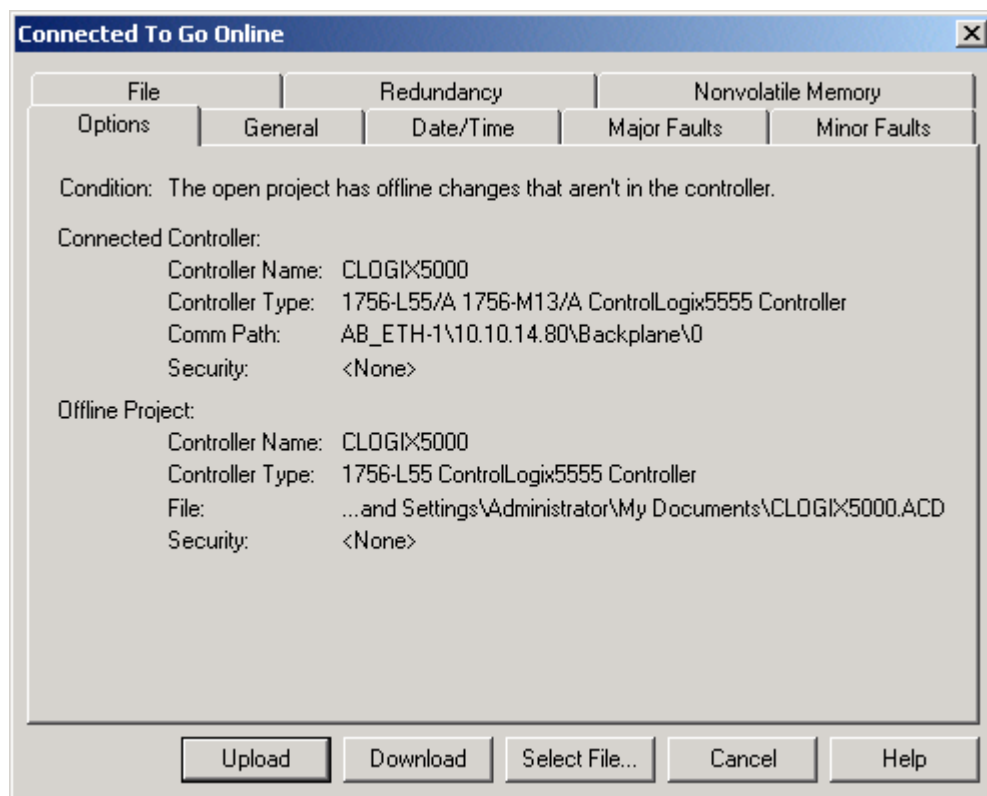


Figure 13 The download window.

A new window will popup with the question if you actually want to download the configuration, select “Download”. The configuration will now be downloaded to the PLC.

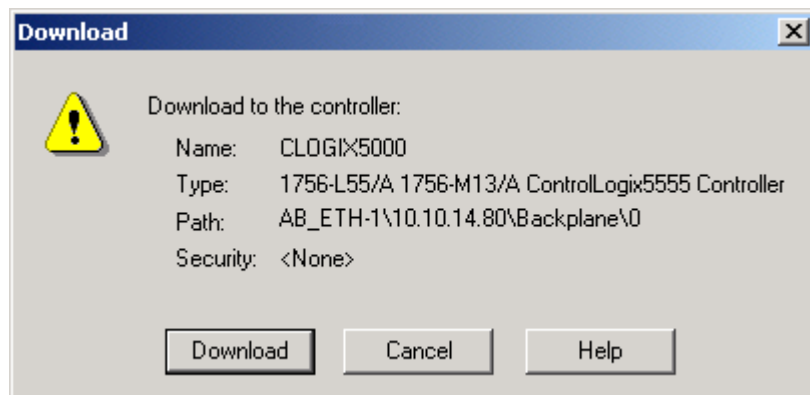


Figure 14 Downloading the configuration to the PLC.

If there are any errors, a warning triangle will be present on the Catalyst in the I/O configuration listing. Double click the module to view any error that is reported.

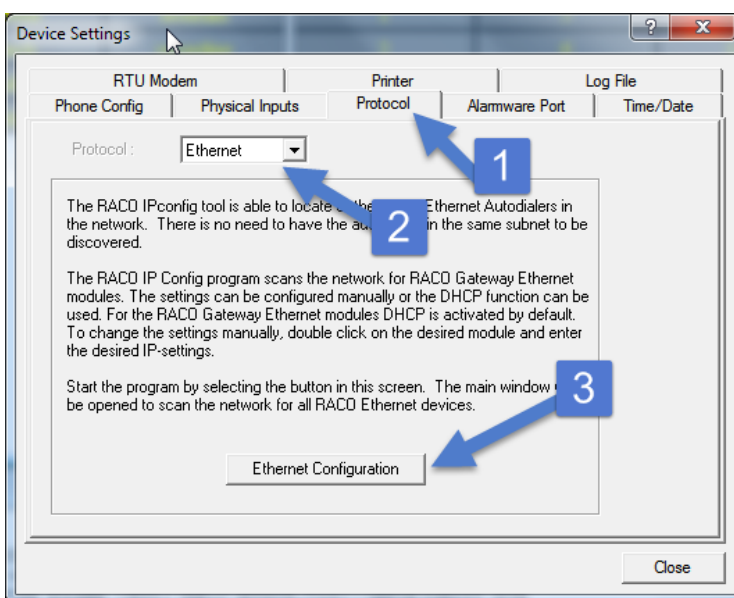
9. Catalyst configuration

The Catalyst module has to be configured for the same I/O size and IP-settings as in the PLC configuration. The configuration of the IP-settings and the I/O sizes is described in the two following chapters. In the subsequent two chapters the configuration of the Catalyst Communicator and Catalyst EtherNet/IP is explained in detail.

9.1. IP settings

Make sure each node on the network has a unique IP address. The IP settings of the Catalyst EtherNet/IP modules can be configured in various ways. It is recommended to use the “Device Settings” menu that appear in the Alarmware software and follow the steps that are highlighted in the following image below

1. Open the Protocol menu
2. Select Ethernet from the drop down menu
3. Run the RACO IPConfig application by selecting the “Ethernet Configuration” Button



The RACO IPConfig tool runs independently of Alarmware and search the network to find the RACO Autodialers that are present in the network.

The RACO IPConfig program can be downloaded at racoman.com website¹. Start the program and the main window will be opened (see image below)

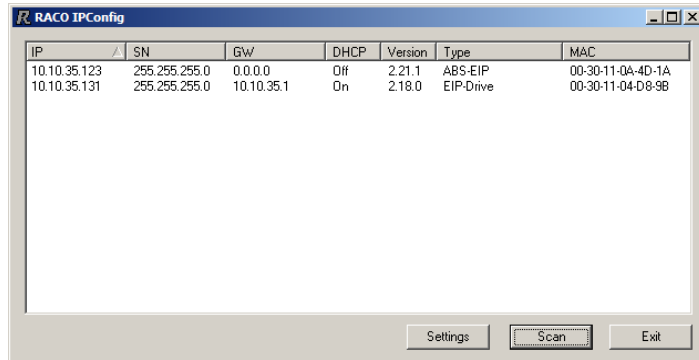


Figure 15 The RACO IPConfig tool.

The program scans the network for RACO Gateway Ethernet modules. The settings can be configured manually or the DHCP function can be used. For the RACO Gateway Ethernet modules DHCP is activated by default. To change the settings manually, double click on the desired module and enter the desired IP-settings as seen below.

Note: The RACO IPConfig tool is able to locate all the RACO Ethernet Autodialers in the network. There is no need to have the Autodialers in the same subnet to be discovered.

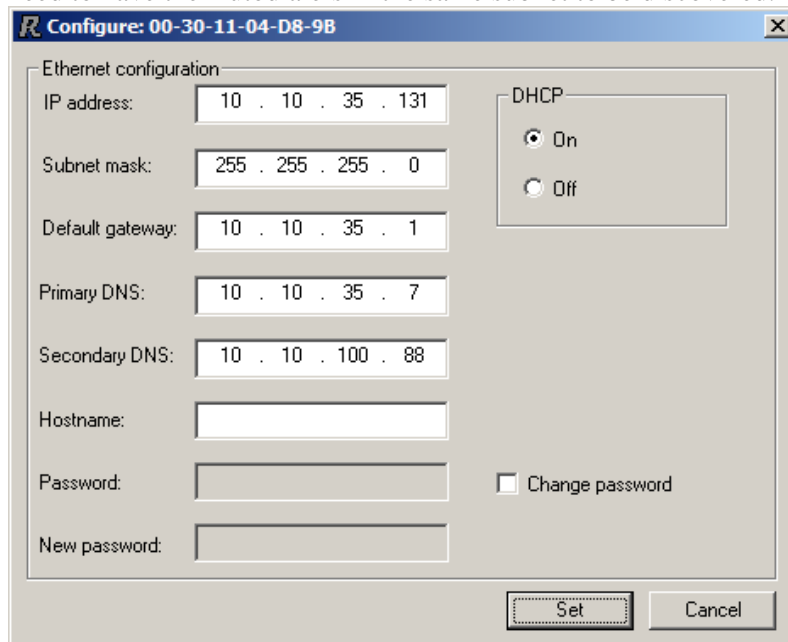


Figure 16 Configuring the IP settings.

9.2. Setting Catalyst Remote Channels

Setting up the remote channels in the Alarmware application is described clearly in the main Catalyst manual (Ref: 1.1.2 Net Addresses). Setting up the communication nodes and channels in Ethernet is seamless. The Catalyst Ethernet node once declared and identified in the ControlLogix controller will become an active node in the network.

10. Testing

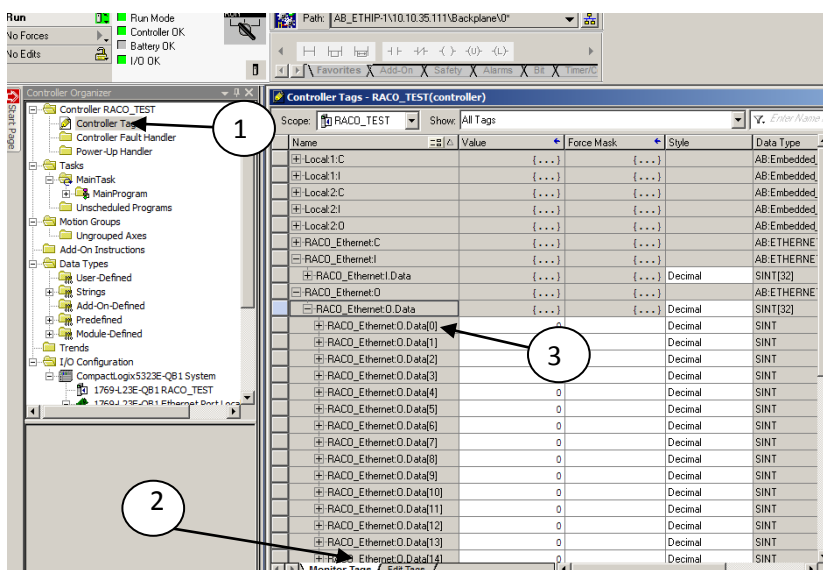
When connected to ControlLogix controller, it is possible to access the data exchanged by the ControlLogix 5000 and the Catalyst module. By writing data to the tags the communication between the PLC and the Catalyst it is possible to ensure that the corresponding data bytes have changed on the Modbus RTU side of the network.

10.1. Monitoring the tags

First go online and switch to “Remote Run” on the PLC. To monitor the tags, open the “Controller Tags” window **1** and go to monitor tags **2**. Three tags named “RACO_Ethernet:C”, “RACO_Ethernet:I” and “RACO_Ethernet:O” should be visible, representing the three instances configuration, input and output. The configuration instance is created even if we selected its size as zero. The RACO_Ethernet:I tag is data going from the Catalyst and RACO_Ethernet:O tag holds data going to the Catalyst.

First enter 01 02 03 04 (for the sake of example) in the Output Tag, so there is some “data” to read. This can be done just by entering values for the Output tags **3**. If the network is correctly configured the corresponding data bytes will obtain the respective value if polled by the Catalyst.

Note on the Catalyst side you should be hearing alarms being announced when the alarm conditions are triggered. Test all the conditions before you complete your deployment...



11. Quick Start

1) Set up Catalyst:

(Note that although some Catalyst parameters can be configured with the front panel keys, Catalyst Ethernet will need to be configured with Alarmware)

Install Alarmware

Connect to the Alarmware port of the Catalyst

Add a new RTU within Alarmware, using the corresponding model number

Select that RTU and click the “Connect COM Port” button

Go to the Configuration/Devices/Protocol menu. MBMaster should show 9600 baud, 1 stop bit, even parity, and Catalyst node 1.

2) Set up Ethernet side of Catalyst

- Plug Ethernet cable into Ethernet outlet
- Select protocol Ethernet, then click “Ethernet Configuration.” This will bring up RACO IPConfig (which must be in the same directory as Alarmware).
- Use Raco IPConfig tool to determine current IP of Catalyst Ethernet card, and change it if necessary. You’ll want the Catalyst Ethernet to be on the same net as the PLC.
 - Example: PLC is at 192.168.1.123 , then Catalyst Ethernet might be 192.168.1.125

3) Set up PLC

- Use the information to configure the addressing tags and communication in RSLogix (Follow starting section 7 of this addendum)

4) Set up Network remote channels

Channels are set up under Configuration/Channel Settings

For a remote digital (bit) channel

use SNA 1*2*0XXXX where XXXX is the bit address.

Example: 1*2*00001 for Modbus address 00001

Set the alarm condition under channel settings, Alarm Violation Criteria

For a remote analog (16-bit) channel

Use SNA 1*2*40XXX where XXX is the 16-bit register

Example: 1*2*40101 for Modbus register 40101

Set the alarm condition under channel settings, Alarm Violation Criteria

Set up a “heartbeat” channel to monitor communications (recommended)

Select a channel (for example, channel 56)

SNA 1*2*01992

Alarm on 1 Raw Value, 0 reported as 0

Note:

To reset Catalyst to Factory Defaults

Turn unit off.

Locate jumper JP3 at the very top of the unit. It is just to the right of the crystal.

With the unit still off, short these two pins together and turn the unit on.

When the front panel lights begin to step through the numbers sequentially, release the short and let the unit continue until it finishes booting.