GEFRAN

GFX4-ETH1

INSTALLATION AND OPERATION MANUAL

Software Version: **1.1**

Code: **80409E** / Edition **05** - **01-2021 ENG**

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1 • Introduction

This Manual describes the mapping functionality of the GFX4-ETH1 EthernetIP Adapter to ModbusRTU Master via acyclic CIP messages.
This functionality is realized in a separate Firmware/Hardware connected to the standard Gefran GFX4 controller.
For all general GFX4 functionalality refer to manuals availables for download at Gefran web site www.gefran.com

Referenced Documentations

The following documentation overview gives information, for which items you can find further information in which manual.

Manual	Contents	Document name
Vol7_1.0.pdf	Integration of Modbus Devices into the CIP Architecture	THE CIP NETWORKS LIBRARY Vol. 7 Edition 1.0

2 • Configuration

The Firmware for the GFX4-ETH1 (EthernetIP-RTUMaster) does not need any configuration to operate.
All necessary settings are fix and predefined. After power up the GFX4-ETH1 sends DHCP requests to obtain an IP address.
Therfore a running DHCP server is required. .

TCP/IP:

- DHCP disable
- Baud rates 10 and 100 MBit/s
- Data transport layer Ethernet II, IEEE 802.3
- default IP 192.168.1.100, NM 255.255.255.0, gw 0.0.0.0
- CH0 and CH1 con switch integrato

MODBUS RTU

- Baud rate = 19200
- Parity = NONE
- Stop Bits = 1
- Data Bits = 8

System Requirements

- EthernetIP Master / Scanner
- GFX4-ETH1 with EthernetIp board
- DHCP server (optional)

System Overview

The “GFX4 EthernetIP ” (GFX4-ETH1) is a Gateway between the EthernetIP Protocoll and the serial protocol Modbus RTU.

On one side the GFX4-ETH1 is a EthernetIP Slave on the other side it is a Modbus RTU Master with the aim to connect Modbus RTU Slaves to the EthernetIP protocol.

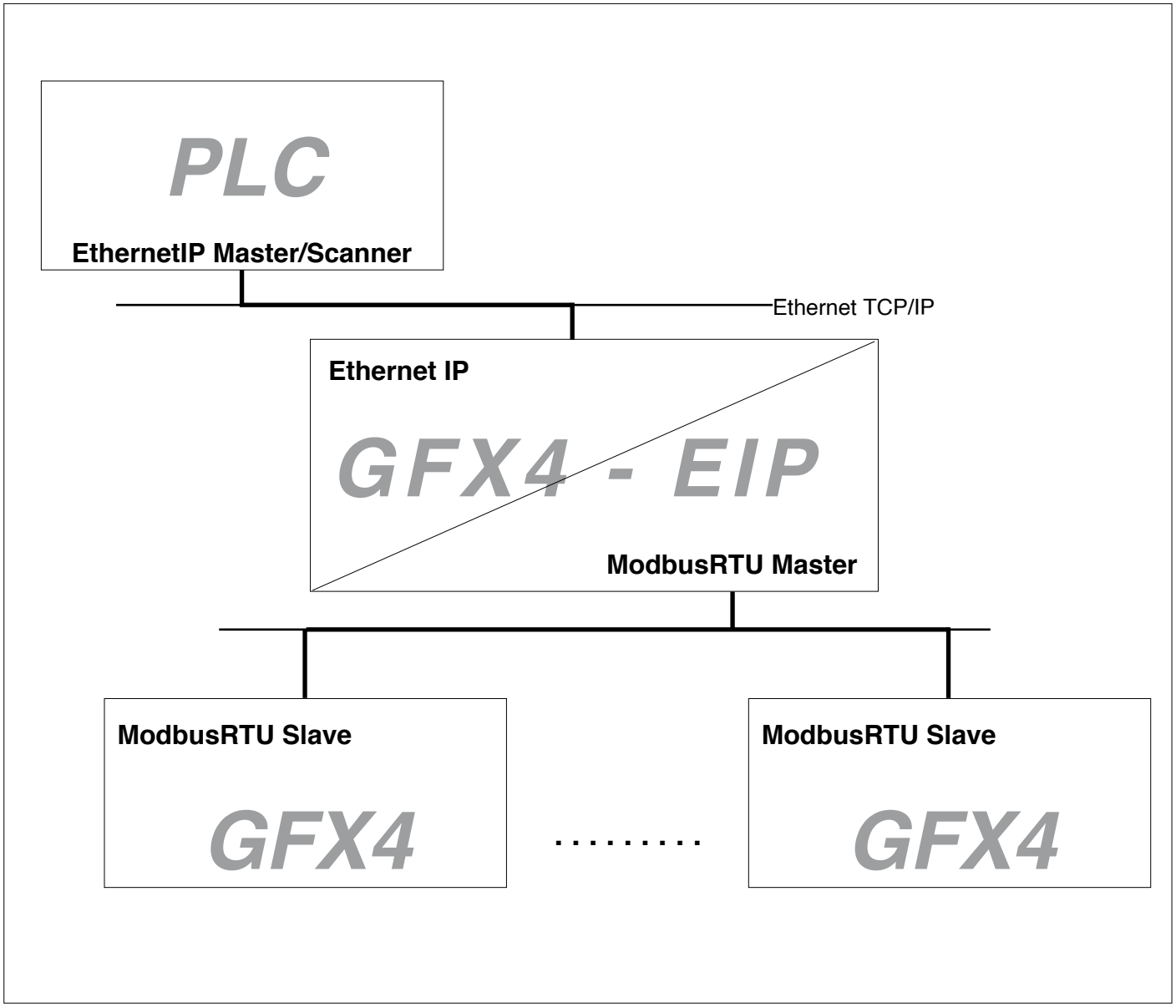


Figure 1: GFX4-ETH1 network overview

Mapping Function EthernetIP to ModbusRTU

The Gateway functionality follows the specification for “Integration of Modbus Devices into the CIPArchitecture” which can be found in the “THE CIP NETWORKS LIBRARY Volume 7”.
Follwing this specification the GFX4-ETH1 Firmware contains the “CIP Modbus Object” (Class Code 44hex).
This object is responsible for receiving acyclic Class services from the EthernetIP protocol and convert them into ModbusRTU requests and returning the correspong confirmation.

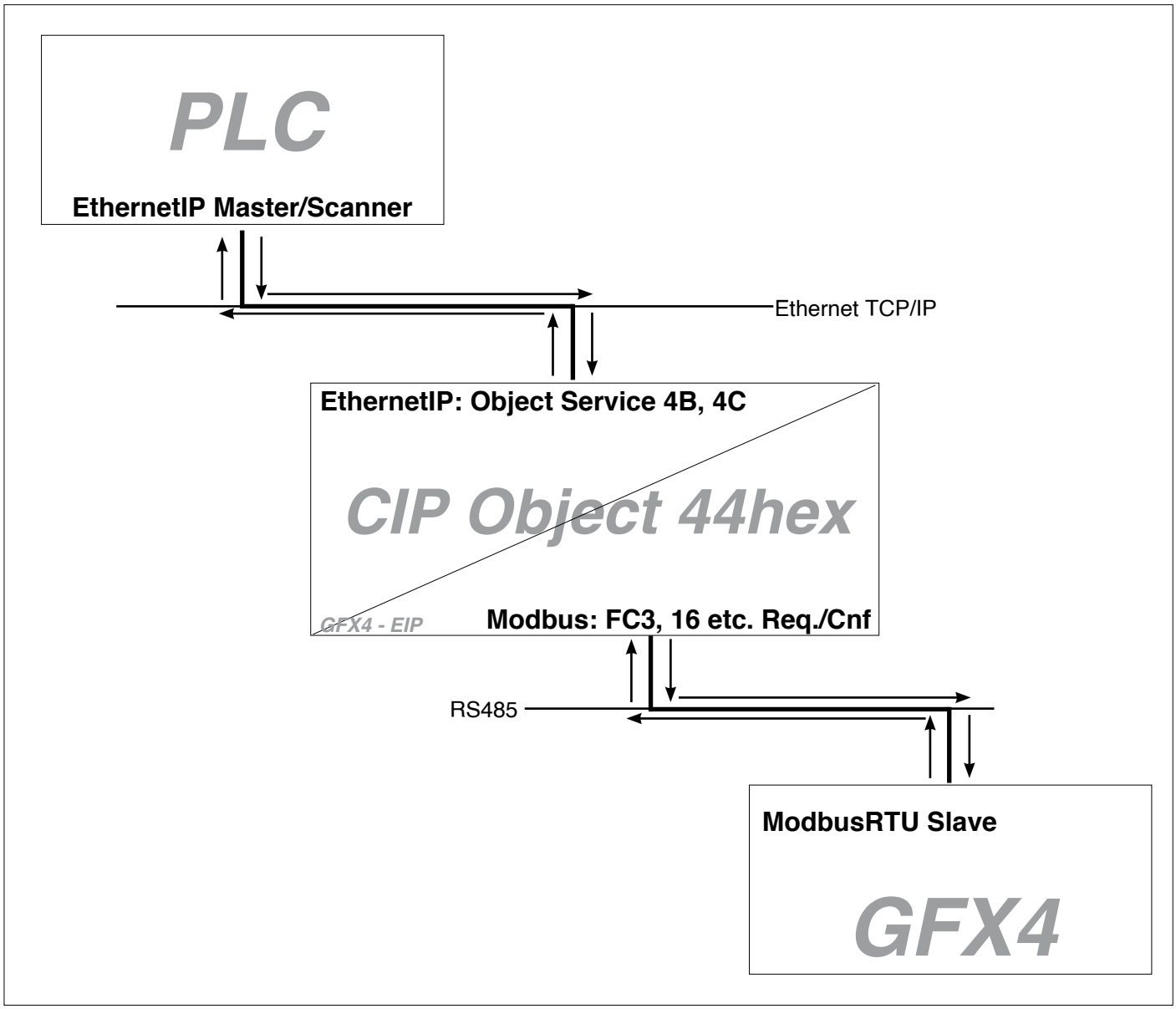


Figure 2: GFX4-ETH1 overview

According the Modbus Object Services following functions are supported. Each Modbus command is represented by a CIP service code of the Modbus Object (0x44).
The list of predefined functions from the specification and the supported services by the GFX4-ETH1 are defined in the tables below.

List of Modbus Object Services

Service code	Need in Implem		Service Name	Description of service
	Class	Instance		
0x4B	N/A	Required	Read Discrete Inputs	Reads one or more contiguous discrete input(s)
0x4C	N/A	Required	Read Coils	Reads one or more contiguous coil(s)
0x4D	N/A	Required	Read Input Registers	Reads one or more contiguous input register(s)
0x4E	N/A	Required	Read Holding Registers	Reads one or more contiguous holding register(s)
0x4F	N/A	Required	Write Coils	Write one or more contiguous coil(s)
0x50	N/A	Required	Write Holding Registers	Write one or more contiguous holding register(s)
0x51	N/A	Required	Modbus Passthrough	Provides encapsulation of any public or private Modbus function

List of supported Modbus Object Services

CIP Service	Corresponding Modbus Function code	Supported	Remark
0x4B	FC 2	Yes	FC 1 and 2 are synonymous
0x4C	FC 1	Yes	
0x4D	FC 4	Yes	FC 3 and 4 are synonymous
0x4E	FC 3	Yes	
0x4F	FC 15	Yes	
0x50	FC 16	Yes	
0x51	FC XX	No	

Serial communication time constraints in Modbus RTU

The following time constraints must be complied with in order to allow correct serial data exchange with the device:
Reading Word/Register parameters: Reading N consecutive parameters, with N from 1 to 16, requires a time of almost 50 ms. In this case the following read and write Modbus command, to the same node, must be sent after this interval time.
Writing Word/Register parameters: Writing N consecutive parameters, with N ranging from 1 to 16, if all values (maximum 16) on the device are updated, will take a time of: 50ms + N x 80ms(*) with N from 1 to 16. The times reported refer to the case in which the Baudrate of the serial line (parameter bAu Modbus address 45) is 19200.

(*) If STATUS_W parameters (Modbus address 305) are included in the write request and their value is different from the one currently present in the slave, the time required to write each one will be 240ms (instead of 80ms).

SETTING THE IP ADDRESS

You can change the device's IP address by using the Gefran SetIPTools utility.

To install the tool, launch the executable and follow the instructions.

You can set:

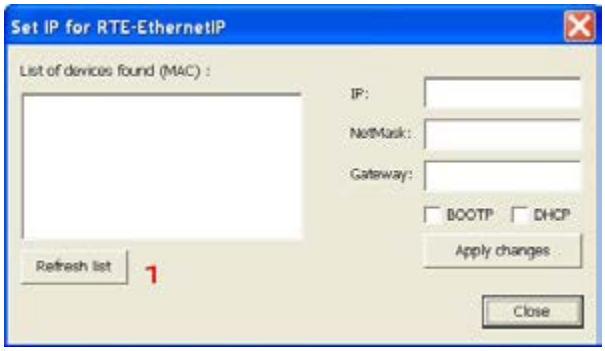
- IP address
- NetMask
- Gateway address
- DHCP or BOOTP functionalities

Note: it is essential that the utility NOT be blocked by the Firewall and that UDP broadcast traffic be allowed in the network.

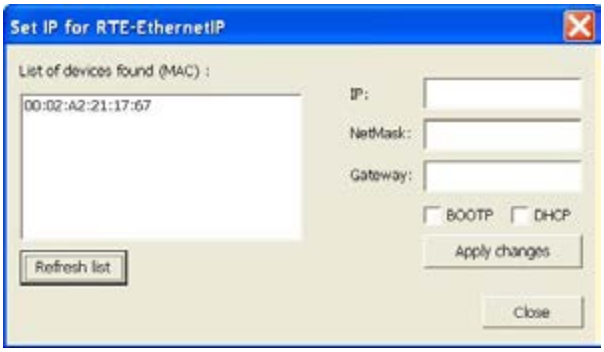
When installation is done, you can launch the program by clicking the desktop icon.

The following screen is shown:

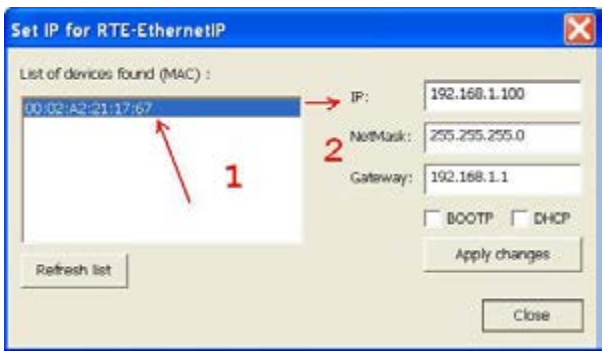
Step 1: click the ***Refresh list*** button



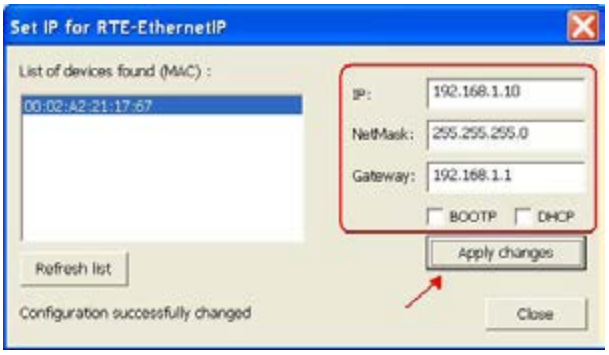
Step 2: the ***List of devices found (MAC)*** :) window shows the Mac addresses of the devices connected to the network



Step 3: click on the Mac address found to display the values currently set on the device



Step 4:set the appropriate values for your network and click the ***Apply changes*** button

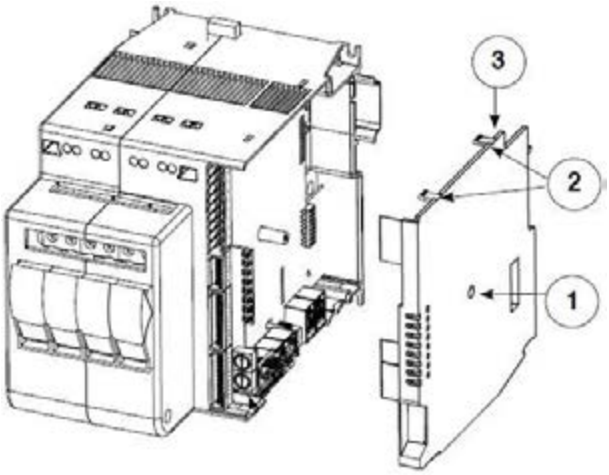


Note: if you do not know or do not want to set the Gateway address, set the IP and Gateway the same.

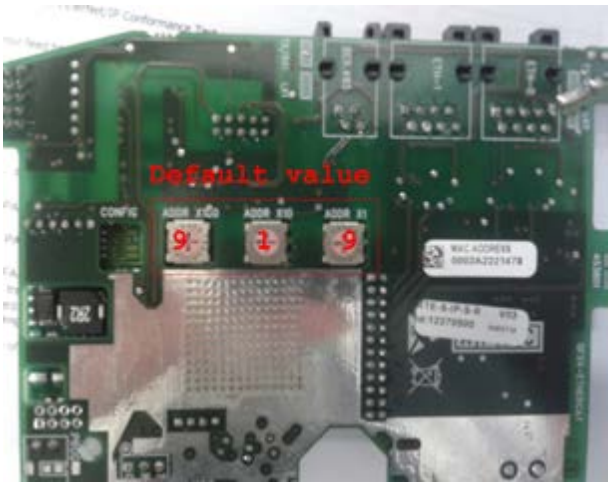
SETTING THE DEFAULT IP ADDRESS

You can set the default IP address whenever necessary.
This is done as follows:

- Switch off the device
- Unscrew screw 1, gently pry at points 2 and remove cover 3



- Set the rotary switches addr x100 = 9, addr x10 = 1, addr x1 = 9

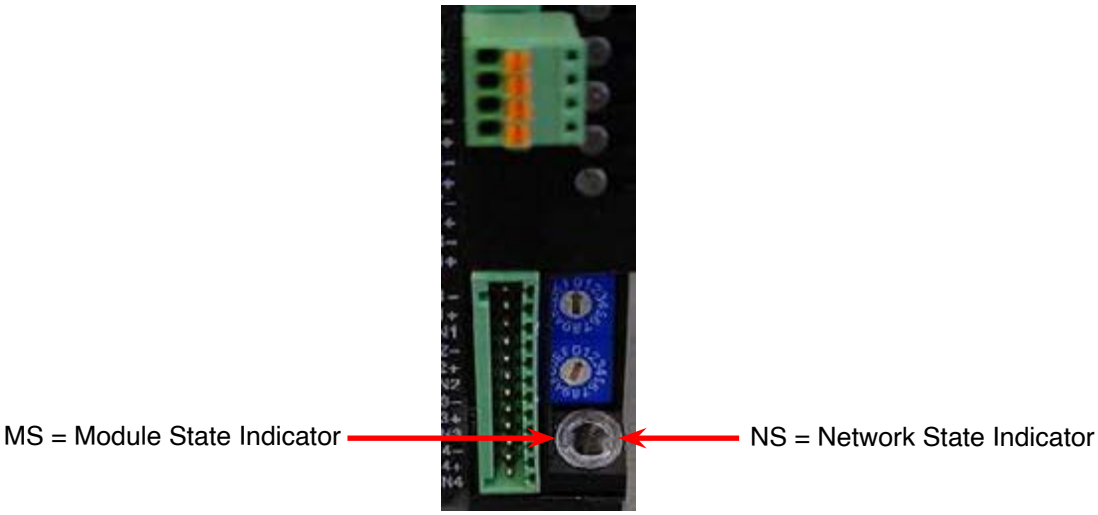


- Switch the device on and wait about 30 seconds
- Switch the device off again
- Change the rotary switches by setting a value other than 919
- Put the cover back on
- Switch the device on with the new values:

  Ip = 192.168.1.100
  Nm = 255.255.255.0
  Gw = 0.0.0.0

MEANING OF THE LEDS

The device has LEDs that indicate the state of the module and of the network connections.



BEHAVIOR OF LEDS AT POWER-ON				
Time	**MS Green**	**MS Red**	**NS Green**	**NS Red**
t = 0 ms	Off	Off	Off	Off
t = 250 ms	On	Off	Off	Off
t = 500 ms	Off	On	Off	Off
t = 750 ms	Off	Off	On	Off
t = 1000 ms	Off	Off	Off	On
t = 1250 ms	Off	Off	Off	Off

The following table shows the behavior of the green and red MS (module state) LEDs:

MEANING OF MS (MODULE STATE) LEDS			
Stato	**MS Green**	**MS Red**	**Notes**
No-power	Off	Off	
Device Standby	On/Off	Off	Green LED flashes 500 ms On/Off
Device Operational	On	Off	Green LED steady ON
Minor Fault	Off	On/Off	Red LED flashes 500 ms On/Off
Major Fault	Off	On	Red LED steady ON
Duplicate IP address	Off	On/Off	Red LED flashes 500 ms On/Off

The following table shows the behavior of the green and red NS (network state) LEDs:

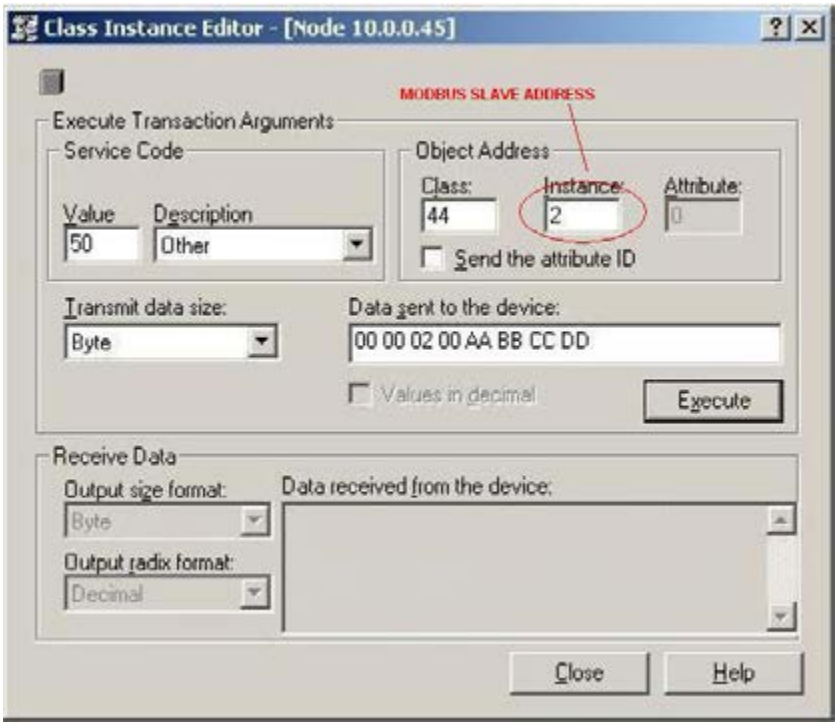
SIGNIFICATO LED NS (NETWORK STATE)			
Stato	**NS Green**	**NS Red**	**Notes**
No-power o Nessun IP	Off	Off	
No Connection	On/Off	Off	Green LED flashes 500 ms On/Off
Device Connesso	On	Off	Green LED steady ON
Connection time-out	Off	On/Off	Red LED flashes 500 ms On/Off
Duplicate IP	Off	On	Red LED steady ON

SENDIG CIP MESSAGES

The following pictures demonstrate how to send ModbusRTU requests via EthernetIP using CIP messages.
The screenshot only demonstrate how to setup the CIP message parameter correctly.

Finaly it depends on the used EthernetIP scanner (PLC etc.) how to formulate and send CIP requests.

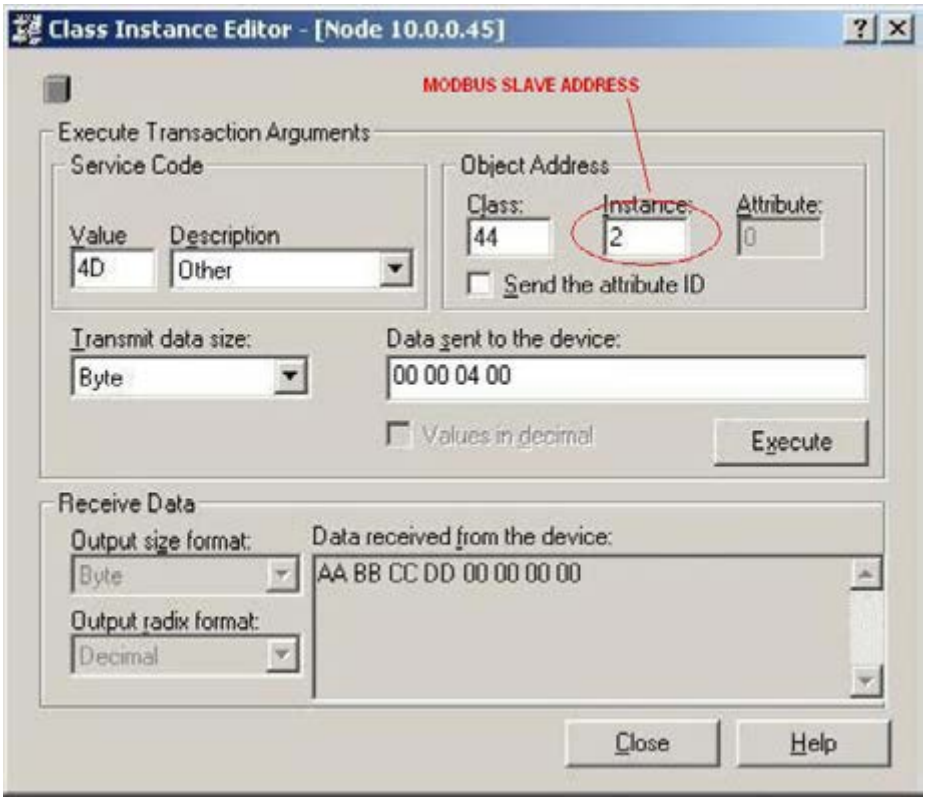
Example: write multiple register



Example CIP to function code 16

Parameter	Value	Description
Send to	192.168.30.30	GFX4-ETH1 address
Service	0x50	CIP service for Modbus FC 16
Class	0x44	The Modbus Object number
Request Data	00 00 02 00 aa bb cc dd ee	Register Address Quantity of registers Data to write
Instance	1-n	Modbus RTU Slave address
Attribute,Member	0	

Example FC4/FC3 Read Input/Holding Register

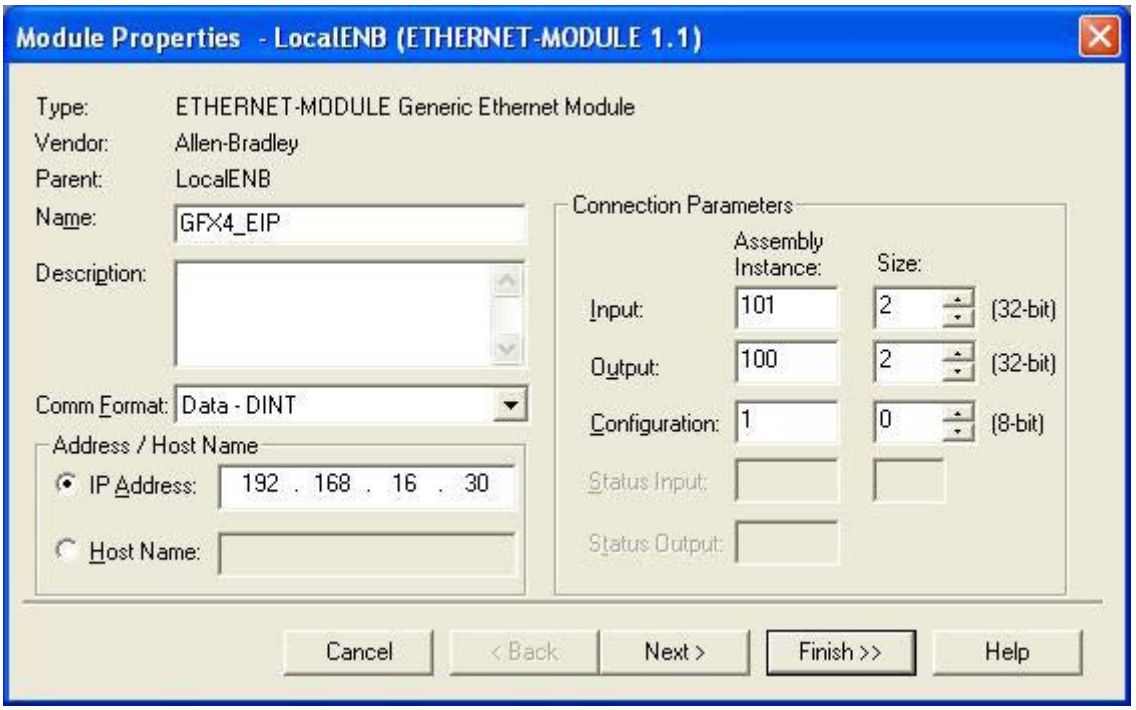


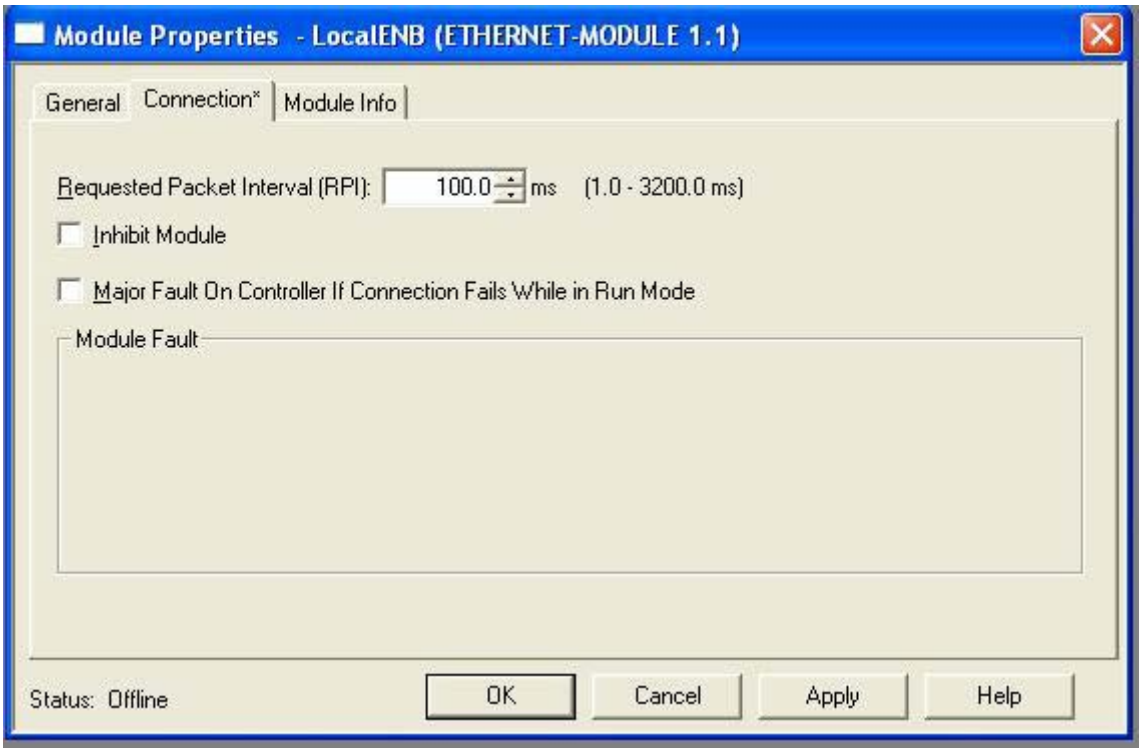
Example CIP to function code 3/4

Parameter	Value	Description
Send to	192.168.30.30	GFX4-ETH1 address
Service	0x4d	CIP Service for modbus FC 4
Class	0x44	The Modbus Object number
Request Data	00 00 00 04	Register Address Quantity of registers to read
Instance	1-n	Modbus RTU Slave address
Attribute,Member	0	Unused, must be0
Response data	AA BB CC DD 00 00 00 00	Register values

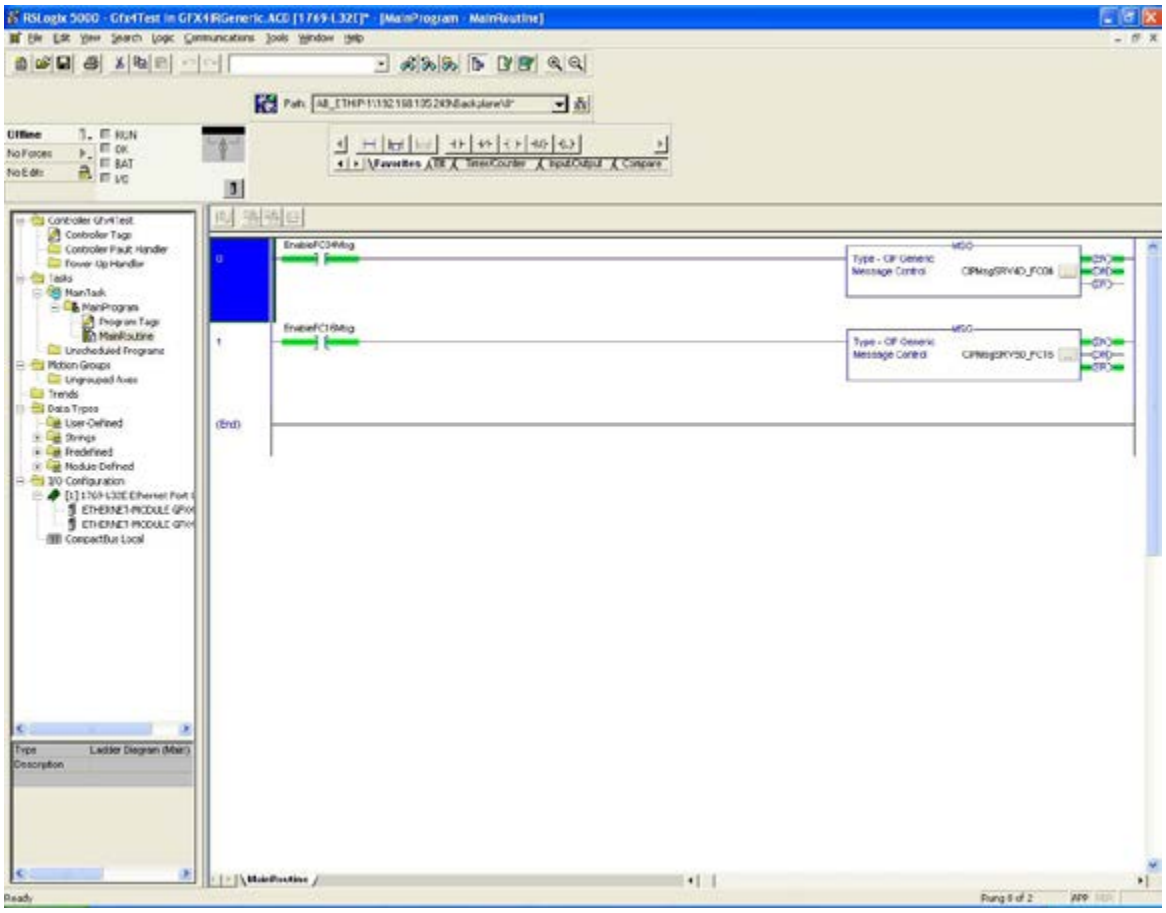
Ex: GFX4-ETH1 TEST

The Gfx4Test is an read/write data example with RSLogix 5000 enviroment.
Module I/O configuration

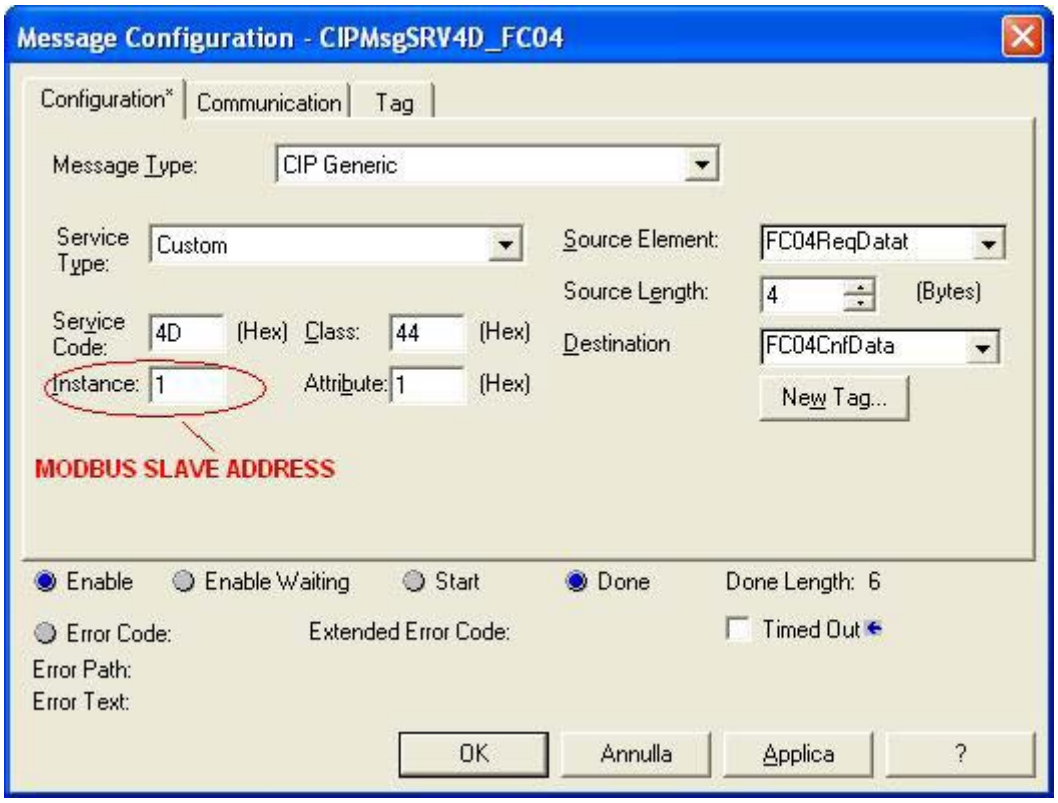




This is an example of main program



MESSAGE CONFIGURATION FOR CIPMsgSRV4D_FC04

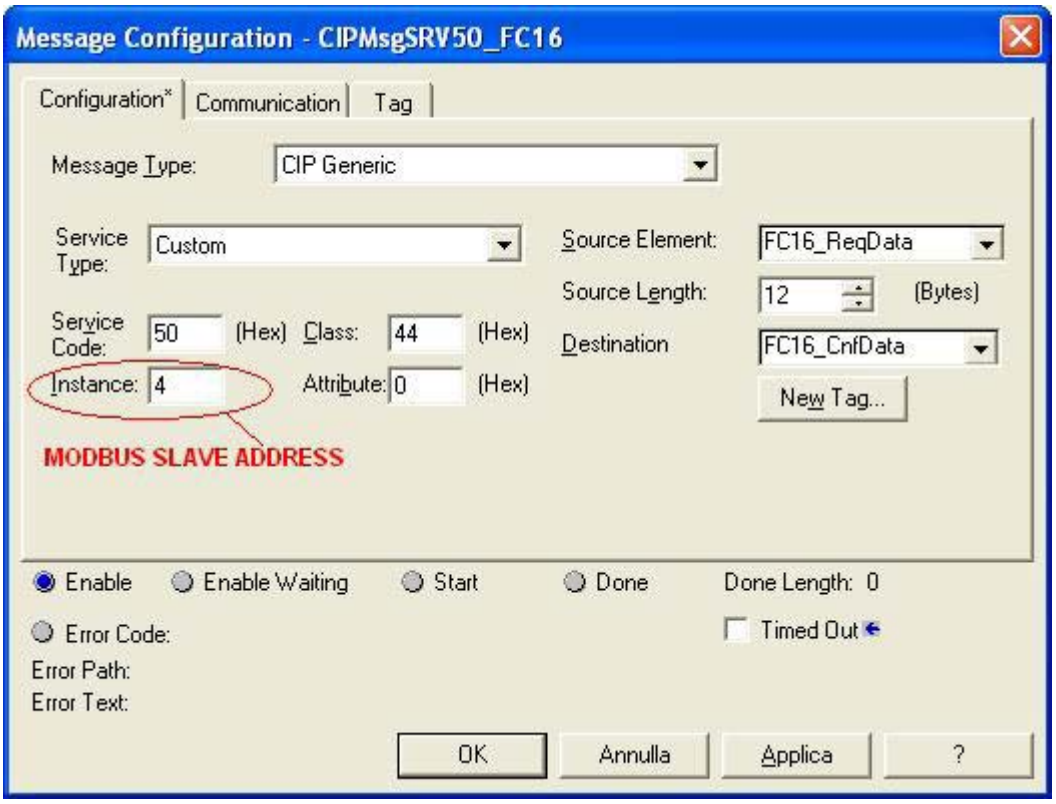


In this example we want to read one register at adrress 402
Register read value is stored in FC04CnfData

Controller tag name	Value	Remark
FC04_ReqData[0]	402	Address of GFX4 Controller parameter HI.S
FC04_ReqData[1]	1	Quantity
FC04_ReqData[2]	Value	Data

MESSAGE CONFIGURATION FOR CIPMsgSRV50_FC16

In this example we want to write one register at adrress 402 with value in Fc16_ReqData



Controller tag name	Value	Remark
FC16_ReqData[0]	402	Address of GFX4 Controller parameter HI.S
FC16_ReqData[1]	1	Quantity
FC16_ReqData[2]	Value	Data