HART TO MODBUS CONVERTER

EGW1-MB-HT
User's Manual
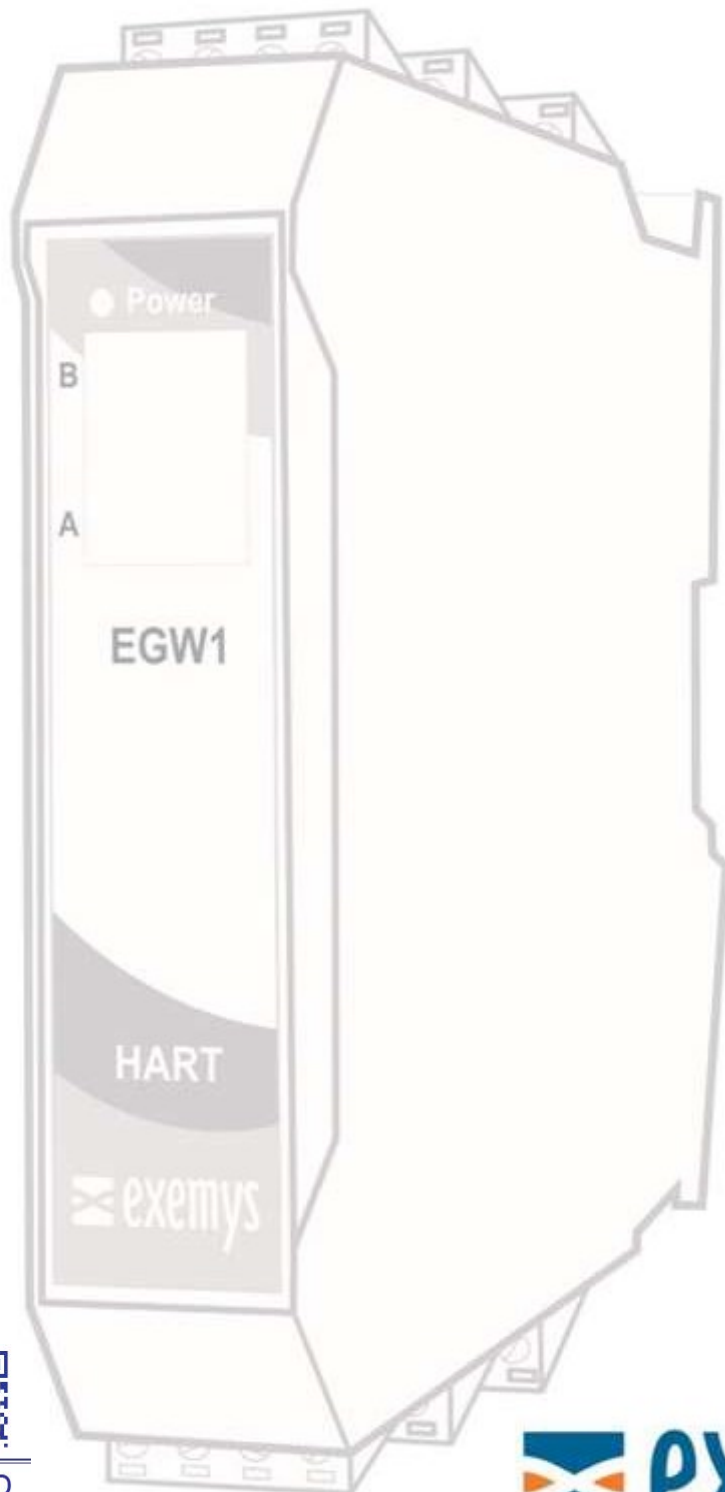
Power

B

A

EGW1

HART

exemys

exemys

www.exemys.com

INDEX

1   INTRODUCTION

1.1   Purpose of the manual

This manual provides the instructions for easy and quick installing and operating of the **EGW1-MB-HT**. The manual starts with a general description of the product, following the instructions for the correct hardware installation. Configuration and operation of the device is detailed below.

1.2   Product Overview

EGW1-MB-HT module is a device used to connect any instrument with HART communication to one or more Modbus Masters, Modbus TCP or Modbus Serial (RTU / ASCII).

Device has 3 independent Modbus ports. One Ethernet for Modbus TCP, one RS232 and the other RS485 opto-isolated for Modbus RTU / ASCII

1.3   Ordering Codes

Ordering Code	Description
EGW1-110-1-IA3-MB-HT	(1) HART port / (1) RS232 port / (1) RS485 opto-isolated port (1) Ethernet port 10/100 Mbps
EGW1-110-3-IA3-MB-HT	(3) HART ports / (1) RS232 port / (1) RS485 opto-isolated port (1) Ethernet port 10/100 Mbps

1.4 Technical Specifications

Technical Specification	
Network Protocols	Modbus TCP, TCP / IP, DNS, HTTP, DHCP, ICMP, ARP, SNMP
Network Port	Ethernet 10 / 100 Mbps, RJ45 Connector
Serial Protocol	Modbus RTU, Modbus ASCII
Serial Port	(1) RS232 port / (1) RS485 opto-isolated port Pluggable Terminal Block connection
Supported devices	Any HART Device
Device Management	HTTP Server, password protected RS-232 Serial Console
Firmware Update	From Web Page
Led Indicators	Status, Data / Link
Measurements	100mm x 22,5mm x 112mm (Height x Width x Length)
Power Supply	10 to 30 V_{DC}
Consumption	12V_{DC} 80mA/ 24V_{DC}50mA
Temperatures	Operation Temperature: -15°C to 65 °C Storage Temperature: -40°C to 75 °C
Warranty	1 Year Technical Support Included

2   INSTALLATION

2.1   Connecting the power supply

EGW1-MB-HT allows a power supply from +10 to 30 V_{DC}. Positive power supply must be connected to terminal N° 1 and negative power supply to terminal No. 2 as shown in the following figure:
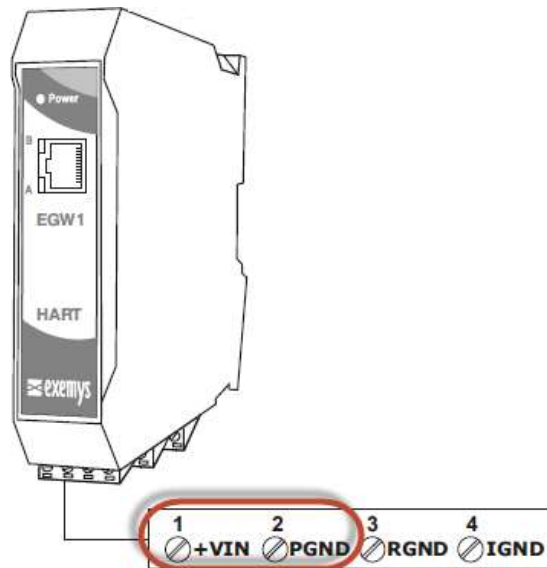
2.2   Serial Port Wirings

EGW1-MB-HT has two serial ports; one of them is RS232 (Port A), used as a Modbus slave and as a configuration port through the serial (Appendix A), and other one RS485 (Port B) used as Modbus Slave.

2.2.1.   RS232 port wiring (Port A)

To connect the device RS232 serial port to PC serial port or any other serial device to set and monitor, it must be connected as can be shown in the following figure. You should consider EGW1-MB-HT is a DTE device, that means it must cross wire with those of the PC.
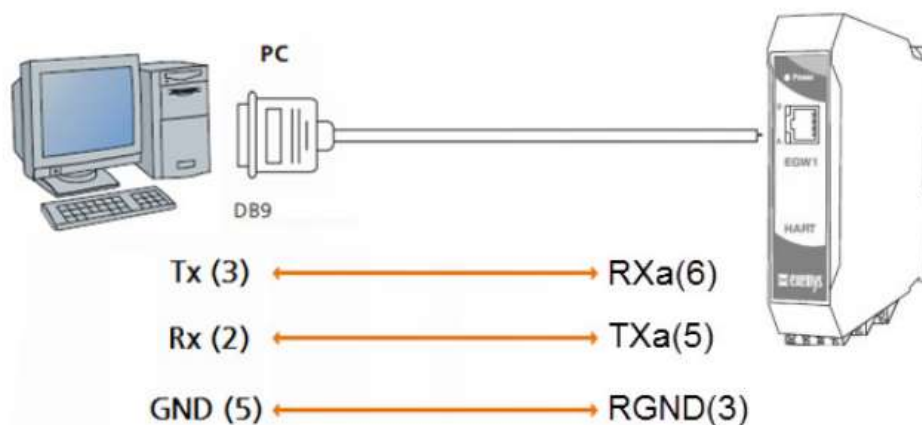
2.2.2.   RS485 port wiring (Port B)

To connect the device RS485 opto-isolated serial port to any serial device, it must be connected as can be shown in the following figure. The operation of this port is independent of the RS232. An isolated GND terminal is available in the terminal if an RS485 cable with mesh wire is used.
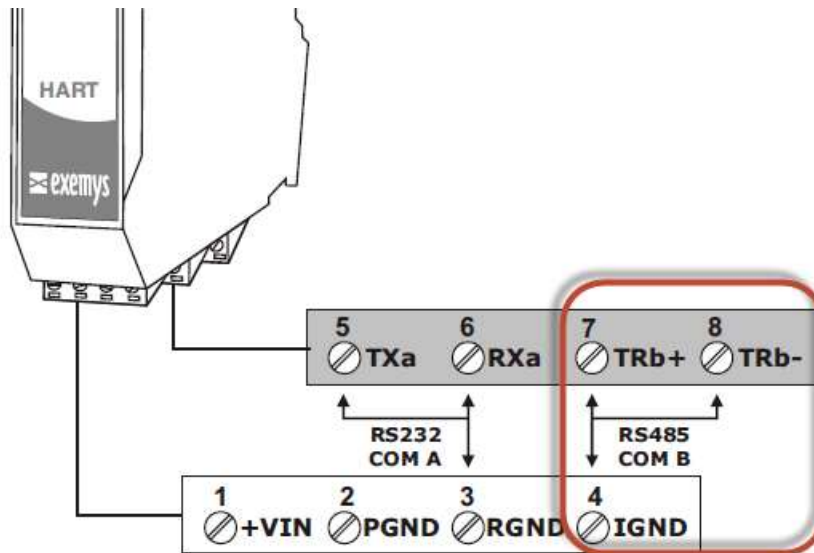
2.3. HART Ports

EGW1-MB-HT has one or three HART ports (model depending): *HTa, HTb* and *HTc.* All the three ports share the HGND terminal to close the loop.

One or more HART instruments can be connected to each port. To connect two or more instruments, they must be configured in MULTIDROP mode and denote a different HART address to each one.

Each loop <u>must be</u> closed with an <u>external</u> resistance of 250 ohms. The resistance must dissipate a power equivalent to the square of the maximum current of each instrument multiplied by the value of the resistance.

$$P = (N \ x \ I_{max})^2 \ x \ 250 \ ohms$$

Example, for 3 instruments generating up to 4 mA in Multidrop mode:

$$P = (3 \ x \ 4mA)^2 \ x \ 250 \ ohm = 36mW$$

Connection diagram for3 transmitters in Multidrop mode to the *HTa* port

Three 250 ohm 250 mW resistors of are provided to the user together with the device

2.2.1 **One passive** transmitter to HTa port wiring diagram

Rev. 5
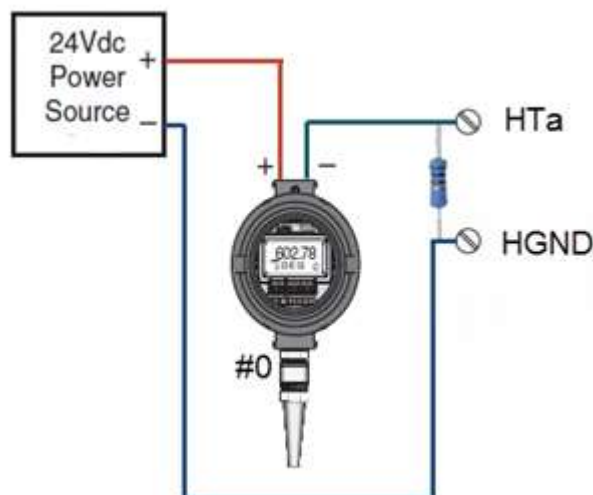
2.2.2 **One active** transmitter to HTa port wiring diagram
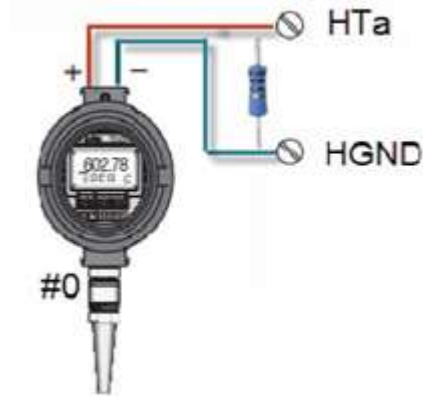
2.2.3 **Three passive** transmitters to HTa port in **Multidrop** mode wiring diagram
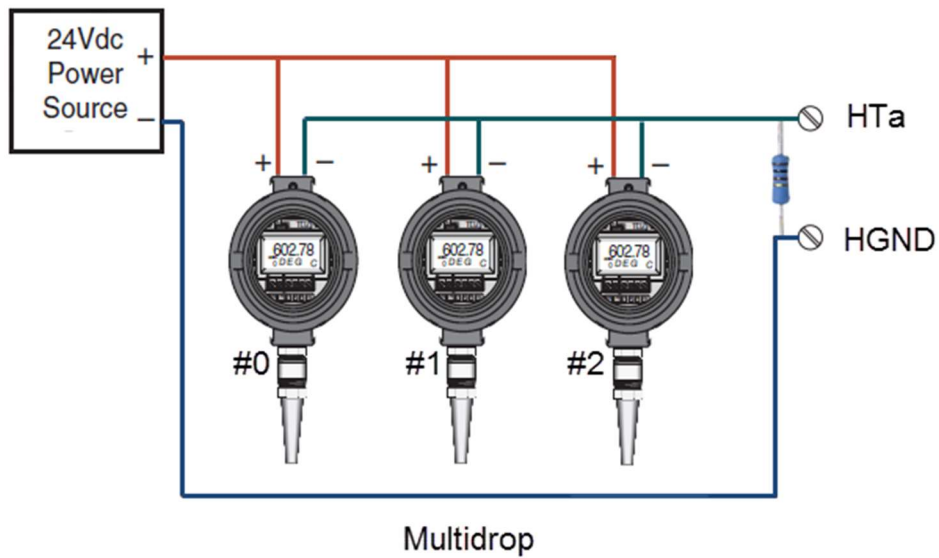
2.2.4 **Three active** transmitters to HTa port in **Multidrop** mode wiring diagram
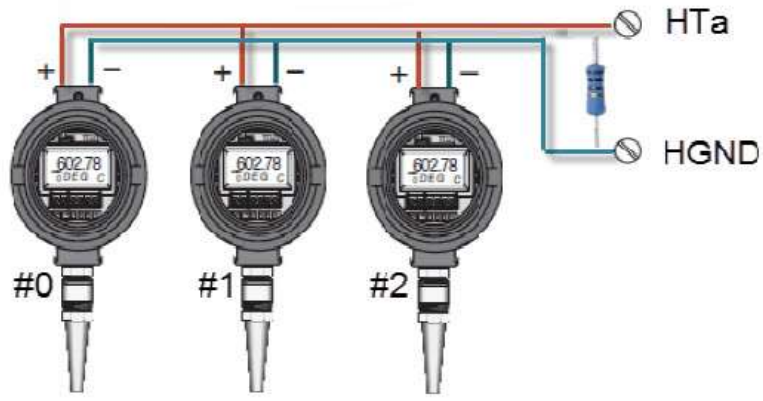
Multidrop

2.2.5 **Three passive** transmitters to in **NO Multidrop** mode to ports HTa, *HTb and HTc* wiring diagram (3 HART ports model only)

Rev. 5

2.4. LEDS Indicators

EGW1-MB-HT has three LEDs, two of them on the Ethernet connector, the yellow one shows the connection to the network, while the green one indicates the status of the Modbus TCP connection.

The Power LED indicates device is on.

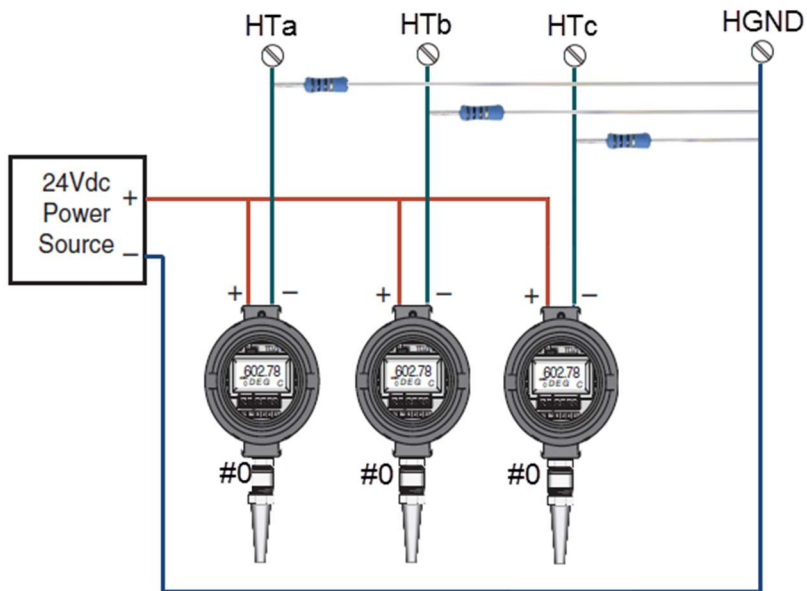| Green	Yellow	Description
-	Continuously on	Looking for a DHCP server.
-	1/2 second on and 1/2 second off.	Waiting for configuration ping and / or waiting serial console.
-	90% of a second off and the remaining time on.	Device has an IP address and a connection bearer link. This is the normal operating state
-	10% of a second off and the remaining time on.	It has no IP address and cannot find the DHCP server. It will search the DHCP server for in 60 seconds.
-	Flashing very fast	Lack of Ethernet link (Cable disconnected).
On	-	Modbus TCP connection set.
Flashing off	-	Transmission or reception of data.
Flashing alternatively with Yellow LED	Flashing alternately with the Green LED	Critical Failure. Contact technical support

3   CONFIGURATION

3.1 Network Configuration

EGW1-MB-HT configuration is done through a configuration web page connecting the device to the Ethernet network on which it is going to work.

To access to the configuration web page, you must connect EGW1-MB-HT to ethernet network and install *Exemys Device Locator* software.
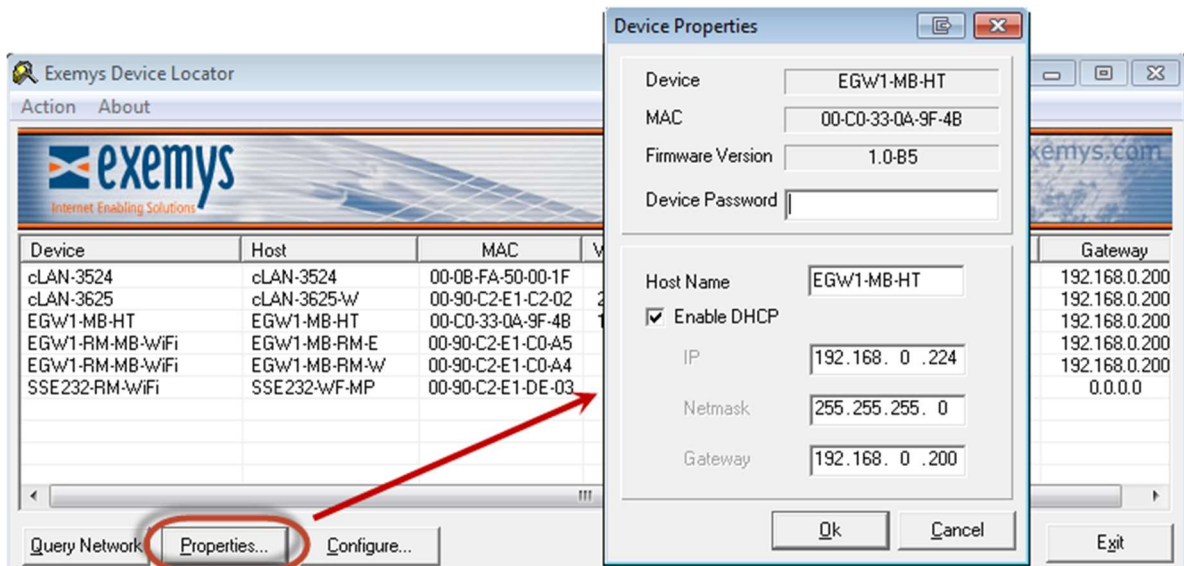
Download the *Exemys Device Locator*:
http://www.exemys.com/beta/software/edl_setup.exe

Once the device is connected, this will search for a DHCP server to obtain an IP address automatically. We will search for it using the *Exemys Device Locator* software, which allows us searching, identifying and configuring the basic network parameters. The rest of the configuration is done from the configuration web page of the device.

> In case you do not have a DHCP server, the *Exemys Device Locator* will find the device with IP address 0.0.0.0, as shown in the figure below.
>
> If you do not have a DHCP server, give it an IP address using the *Exemys Device Locator* button or using the methods explained in **Appendix B**.

The *Exemys Device Locator* buttons are:

Query Network: Searches for all connected EXEMYS devices on the same network.
Properties ...: Configuring Network Parameters (IP Address, Network Mask, Gateway)
Configure...: Direct access to the configuration web page.

3.2 Configuration web page

Once the EGW1-MB-HT has a valid IP address, you can access the web page to configure the other parameters (If your web browser is configured to search for a proxy server, disable this option)

Type the EGW1-MB-HT IP address in the address field of your browser or from the *Exemys Device Locator*, press the Configure button.

| | If you configured a password, the computer will ask for it when entering the web page. In this case, you must enter "**admin**" as the user and then the password that was set. If you want to change it, you can do it from the **Administrator** menu |

3.3 Modbus Configuration

EGW1-MB-HT has an internal Modbus slave containing the values of all HART devices configured.
This slave can be accessed by multiple means of communication: Ethernet (Modbus TCP), RS232 and RS485 (Modbus RTU or ASCII)

Modbus TCP

The only possible configuration is to define the connection port of the Modbus TCP slave. The TCP slave responds to all IDs and responds to exceptions

Modbus TCP

Port	502

Serial Ports RS232/RS485

COM A - RS232

Modbus Device ID	1
Modbus Mode	RTU ▾
Exceptions	Enabled ▾
Baud rate	9600 ▾
Data bits	8 ▾
Parity	NO ▾
Stop bits	1 ▾

COM B - RS485

Modbus Device ID	2
Modbus Mode	RTU ▾
Exceptions	Enabled ▾
Baud rate	9600 ▾
Data bits	8 ▾
Parity	NO ▾
Stop bits	1 ▾

Advance Configuration

It is possible to determine some specific parameters of the Modbus map so that it adapts to our needs.

Advanced configuration

Modbus Floating Point	Standard ▾
On error HART value	Preset to ▾
Preset to	0.00000

Among the different configurations we have, the order of the floating-point values, if they are placed in one direction or another.

Another characteristic is to define the behavior in case of failure, if the connected device has a malfunction, we can determine in the values of the Modbus map a behavior that is defined in 3 options: Keep the last value read, show NaN or a predefined value that is useful.

3.4   HART Configuration

Basic Configuration

Here you can configure how many tries the HART master will do before indicating a communication error.

Since firmware 1.3 the EGW1-MB con work along another HART master (Multimaster mode).
Once you enable this option you must select weather the EGW1 will be the primary or the secondary master.

In Multimaster mode only HART A port will be available.

Table of device

It is the table that tells us which devices we have connected and which short address they have.

Each port has its table. It is important not to repeat addresses in the same port.

3.5.   Administrator Settings

In the **Administrator** menu you can find device administration tools.

Password

The web page and the configuration by *Exemys Device Locator* can be protected with a password. This password can also be set from the *Exemys Console* (see **Appendix A**).

It only admits alphanumeric characters. The user to enter when asked is "*admin*".

To delete the password, only an empty password must be saved.

Restart

If necessary, the device can be restarted. In this way all your connections will be closed and all your tasks will start again as if the device had just been energized.

Restore factory settings

The user can return the device to its original factory settings. This option can be executed from the web page or from the Exemys Console (see **Appendix A**).

Firmware Update

The device's firmware can be updated in case new versions with improvements arise.

By pressing the **Update** button, the web page will request you select the update file.
Then press the **Download** button and through informative messages you can follow the update process.
The device will restart and be ready to operate again after the download.

3.6. WEB Monitoring

It allows to show the status of the HART variables; this is possible by blocks of 4 sensors according to port and sensors.

Colors indicate the status, gray inactive, red is active but in failure (communication problems) and white indicates that the sensor is responding correctly.

Table of values

Device	Current	1st Variable	2nd Variable	3rd Variable	4th Variable
1	3.55	0.00	20.45	-10.00	-214748.00
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0

4   MODBUS REGISTERS

4.1 Modbus primary map (float 32)

The values read from HART devices are available in HOLDING REGISTER and INPUT REGISTER area.

For each HART device, 20 registers are reserved.

Registers of the HART PORT A first device

Holding Register	Input Register	Value	Format
40001	30001	Estado	0: fail or disabler disabled 1: HART OK
40002	30002	reserved	-
40003 – 40004	30003 – 30004	Current [mA]	Float 32
40005 – 40006	30005 – 30006	1st variable	Float 32
40007 – 40008	30007 – 30008	2nd variable	Float 32
40009 – 40010	30009 – 30010	3rd variable	Float 32
40011 – 40012	30011 – 30012	4th variable	Float 32
40013 – 40020	30013 – 30020	reserved	-

The registers of HART PORT A second device can be found from the register 40021/30021

The registers of HART PORT B firstdevice can be found from the register 40321/30321

The registers of HART PORT C firstdevice can be found from the register 40641/30641

Status Registers of each HART device in each port

HART Address	HART A	HART B	HART C
1	40001	40321	40641
2	40021	40341	40661
3	40041	40361	40681
4	40061	40381	40701
5	40081	40401	40721
6	40101	40421	40741
7	40121	40441	40761
8	40141	40461	40781
9	40161	40481	40801
10	40181	40501	40821
11	40201	40521	40841
12	40221	40541	40861
13	40241	40561	40881
14	40261	40581	40901
15	40281	40601	40921
16	40301	40621	40941

Value to add to the Status Register address of each device

Add	Value	Format
+0	Status*	0 / 1
+3	Current [mA]	Float 32
+5	1st variable	Float 32
+7	2nd variable	Float 32
+9	3rd variable	Float 32
+11	4th variable	Float 32

Example:

To read the 2nd variable of the device number 8 connected to the HART Port C

40781+7=40788

4.2   Modbus alternative map (32 bits integer)

Since firmware version 1.2 a new Modbus map is added where HART variables are presented in int32 format instead of float 32

The integer values is equal to the floating point value times 100.

To get the Modbus integer address you have to add 1000 to the floating point value address.

An example below:

```
40003:   123.0000     41003: <        0>
40004:                41004: <12300>
40005:    40.0000     41005: <        0>
40006:                41006: < 4000>
40007:     0.0000     41007: <        0>
40008:                41008: <        0>
40009:     0.0000     41009: <        0>
40010:                41010: <        0>
```

5   MONITORING, MANUAL SENDING, HART OVER TCP

7.1   Data Monitoring

EGW1-MB-HT allows to monitor the communication between the device and the HART transmitters connected to its ports.

For this you must set a TCP connection to port **999** with some TCP client terminal software (for example Putty or HyperTerminal)

Once the connection is established, you will see the data sent by the device through its three ports (A>, B>, C>) and the responses of the transmitters (<) expressed in hexadecimal. In the event that a HART transmitter does not respond, the text "*Timeout*" will be displayed.

```
A> FF FF FF FF FF FF FF 02 00 00 00 02
<-Timeout
C> FF FF FF FF FF 82 62 E6 D7 18 49 03 00 83
<- FF FF FF FF FF 86 22 E6 D7 18 49 03 15 00 41 40 63 33 34 2D 00 00 00 00 20 41 95 33 30 29 C1 20 00 00 A5
```

7.2   Manual sending of HART commands

This function allows to send HART frames manually. This allows to make adjustments in the configuration of the HART transmitters once they are already installed in the field.

For this you must establish a TCP connection to port **998** with some TCP client terminal software (for example Putty or HyperTerminal)

When connecting to port 998, the user must select the HART port to which it wishes to send the manual command by pressing the letters A, B or C.

```
Select HART port A, B or C
```

Then the user must write the frame to be sent in **hexadecimal text and press ENTER** (ASCII 13) upon completion. It is not necessary to write the 0xFF codes of the preamble or add the CRC at the end because it is calculated automatically.

The frame sent will be sandwiched between regular read queries.

Example 1: Send the command 00 (read unique identifier) to a HART transmitter with short address 00 on the HART port C.

```
Select HART port A, B or C
Port C
02 00 00 00 ->
<- FF FF FF FF FF 06 00 00 0E 00 41 FE 62 E6 05 05 01 01 08 00 D7 18 49 BD
```

Example 2: Send command 15 (read output information) to a HART transmitter with long address 62E6-D71849 on the HART port A.

```
Select HART port A, B or C
Port A
```

```
82 62 E6 D7 18 49 OF 00 ->
```

```
<- FF FF FF FF FF 86 22 E6 D7 18 49 0F 13 00 41 01 00 2D3F 80 00 003F 00 00 0100
0000 00FB 62 AD
```

7.3   Transparent Mode (HART over TCP)

This function allows the EGW1-MB-HT to be used as a HART converter over TCP to HART. This allows the configuration software of each transmitter to be used remotely, arriving at the location through a TCP connection. Probably it is necessary to use a virtual COM port software (such as Serial IP) to get from the software to EGW1-MB-HT.

- Each device HART port has an assigned TCP port assigned to the transparent mode. Port HART A: **10001**, Port HART B: **10002**, Port HART C: **10003**

- The device will stop sending its own HART queries, while the connection to this port lasts

- The communication in transparent mode cannot be monitored on port 999

- No additional byte type is added to the frame

Please refer to Appendix E to see how to do it using PACTware.
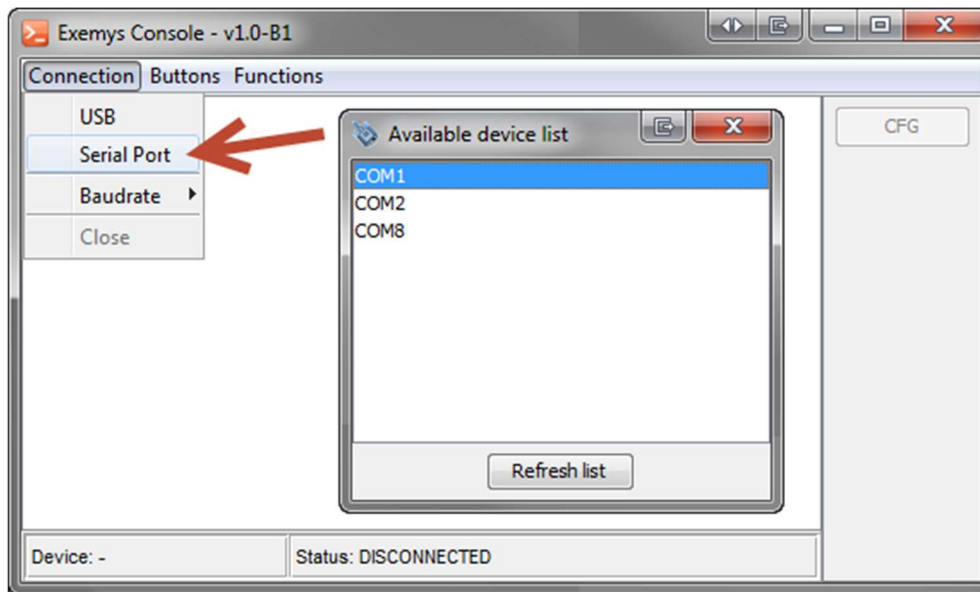
A. COMMAND CONSOLE

EGW1-MB-HT can be set through a command console connecting the device to a serial port on the PC.

To access the command console, you must connect the **EGW1-MB-HT** to a RS232 port on a PC and you must install an Exemys serial terminal program, called *Exemys Console.*
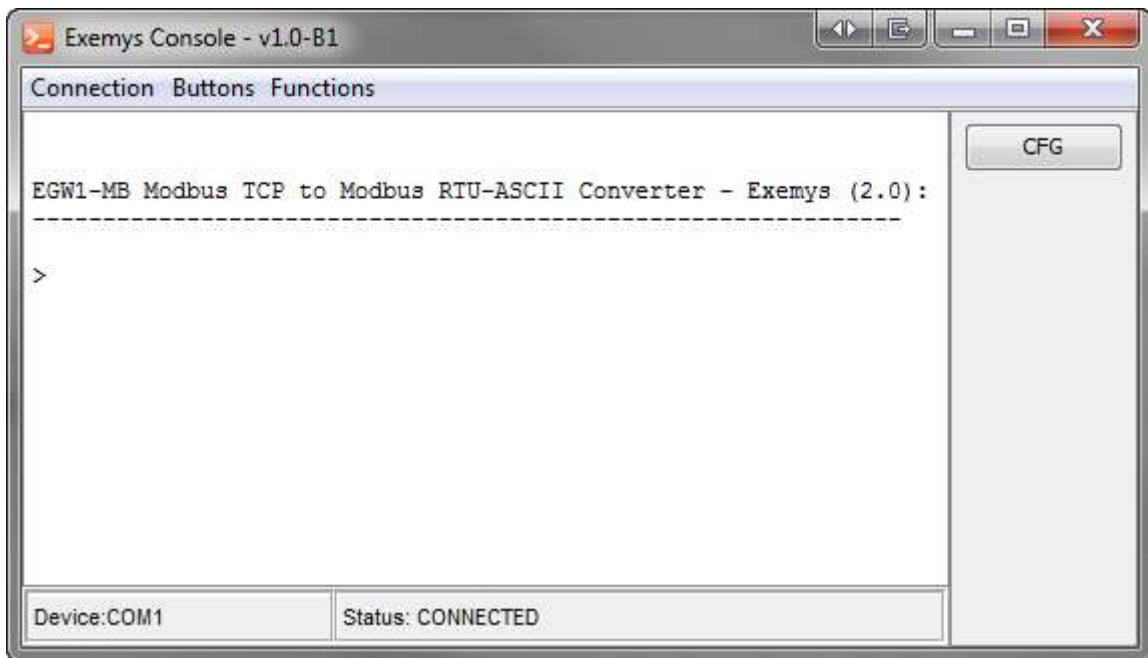
Download the *Exemys Console*:
http://www.exemys.com/console

Once the serial terminal program is installed, connect the **EGW1-MB-HT** to a RS232 port on the PC and execute the *Exemys Console*.

1. Click on Connection -> Serial Port, it will open a window with name of all COM Serial port. Select with double click the port where device is connected. Verify Baud rate in the serial por is 9600.

2. Turn on the **EGW1-MB-HT** and in the first 7 seconds type CFG and press ENTER or press the CFG button. **EGW1-MB-HT** will display a welcome message on the configuration command console.

Exemys Console - v1.0-B1

Connection Buttons Functions

CFG

EGW1-MB Modbus TCP to Modbus RTU-ASCII Converter - Exemys (2.0):

>

Device:COM1   Status: CONNECTED

3. Type the configuration command according to the following table.

Command	Description
NETWORK: Ip, netmask, gateway	Change the basic parameters of the network Example: NETWORK:192.168.0.212,255.255.255.0,192.168.0.200
PASSWORD: password	Change the configuration password. Password must have a maximum of 10 characters or empty to delete it.
LIST	Request the current device configuration.
HELP	Displays the list of all available commands with syntax and descriptive text.
FACTRESET	Reset to the factory settings. This command must be entered 2 times for this to begin working.
END	It saves the changes made and it ends the command console.

To finish and save all the changes, type the END command, after which device will restart and return to normal operation.

Appendix Appendix B

B. IP ADDRESS USING ARP PROTOCOL

If for some reason you cannot set an IP address using the *Exemys Device Locator,* you can use the method described below. This method is complex and is only recommended as an alternative method.

1. On *Microsoft Windows*, open the Command Prompt with Administrator permissions
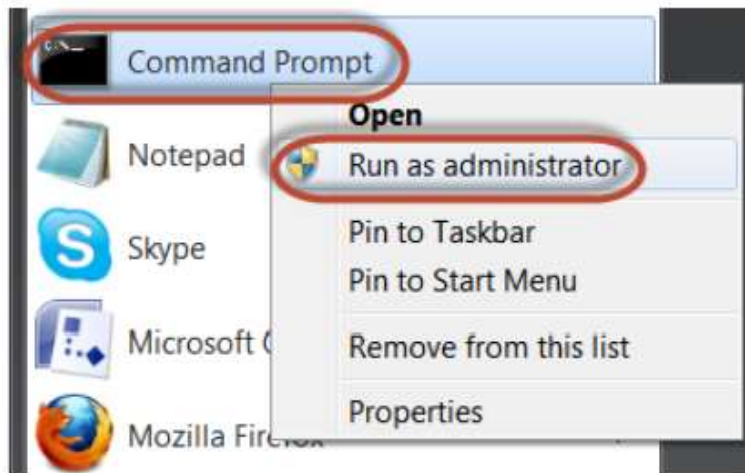
2. Enter an ARP table with the following command:
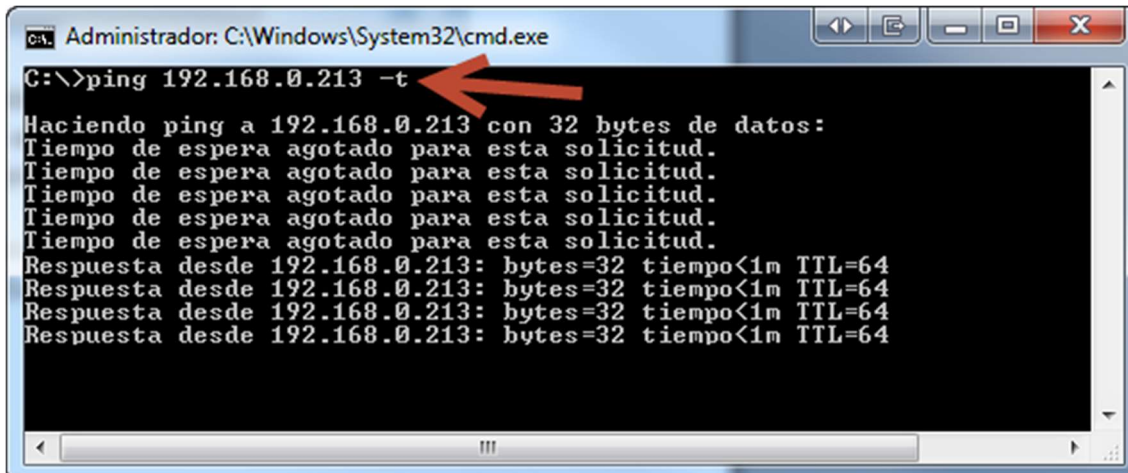
arp -s 192.168.0.213 00-90-C2-XX-XX-XX

Where **192.168.0.213** is the Device IP address to set and **00-90-C2-XX-XX-XX** is the Device MAC address (you can find the address on the label that is located on the back of the device). With **arp -a** you can check the new entry.
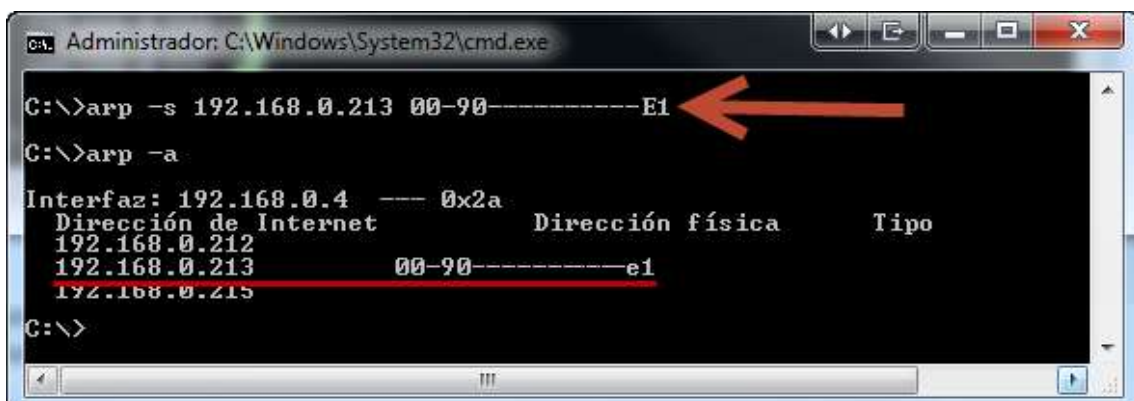
3. On command prompt, request a PING to the device IP address (The *-t* option will cause the command to be sent continuously)

4. Wait for a few seconds until the PINGs start responding

Once the IP address has been set, enter the Configuration web page to set the other parameters.

C. FACTORY SETTINGS

| Parameters	Value
Network	
IP Address	0.0.0.0 (DHCP)
Netmask	0.0.0.0
Gateway	0.0.0.0
DNS 1	0.0.0.0
DNS 2	0.0.0.0
Modbus – Modbus TCP	
Modbus TCP - Port	502
Modbus – COM A – RS232	
ID Modbus	247
Modbus Protocol	RTU
Exceptions	Enable
Baud rate	9600
Data Bits	8
Parity	No
Stop Bits	1
Modbus – COM B – RS485	
ID Modbus	247
Modbus Protocol	RTU
Exceptions	Enable
Baud rate	9600
Data Bits	8
Parity	No
Stop Bits	1
Modbus – Advanced	
Modbus Floating-point	standard
Valuewith HART in failure	Last value
Predefined Value	0.0000
HART – Basic Configuration	
Retries	2
HART – Ports A, B y C	
All disable	

D. DIN RAIL MOUNTING

Device can be mounted on a DIN rail. To assembly the module to the rail, make the upper side of the device fit the DIN rail and then push gently until you hear a Click! As shown in the figure.
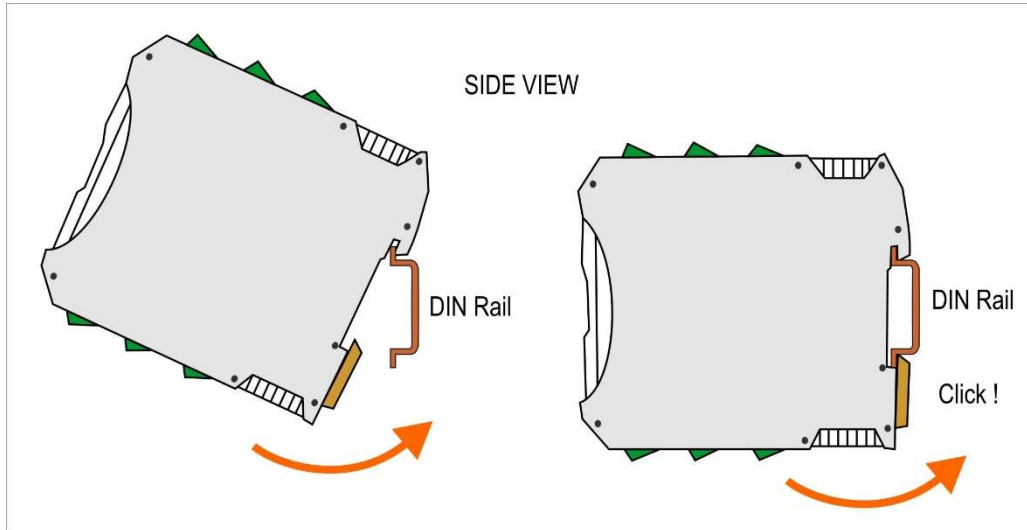
To disassemble the device of the rail DIN, pull down the metallic clip and then remove it as shown in the figure.
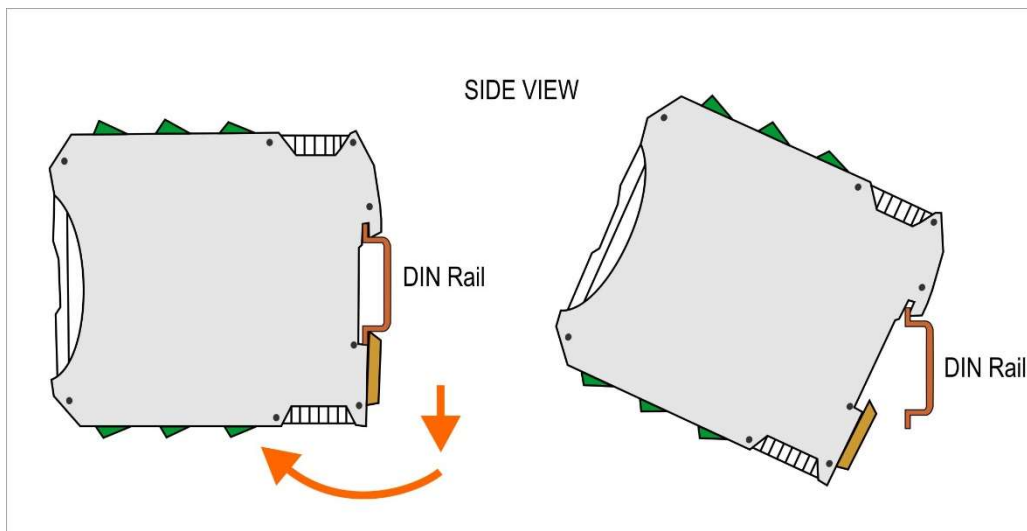
Appendix E

# E. EGW1-MB-HT with PACTware© in transparent mode

Here you we'll describe how to configure PACTware software to configure HART devices remotetly using the EGW1-MB-HT in transparent mode.

Before proceeding read section 5.3 on this manual.

For this example we'll use the PACTware software, the CodeWrights *HART Communication FDT 1.2 DTM (V1.0.52)* and the serial port redirector software SerialIP.
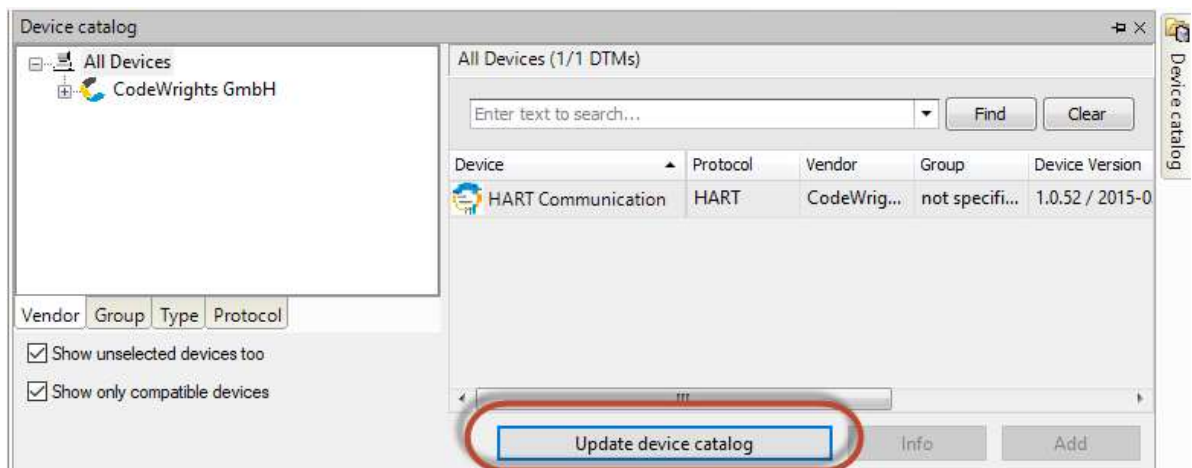
Steps

1) Install the SerialIP redirector, add a COM port and configure the EGW1-MB-HT IP address the TCP port (10001, 10002 o 10003 for ports A,B or C) in *Raw TCP Connection* mode
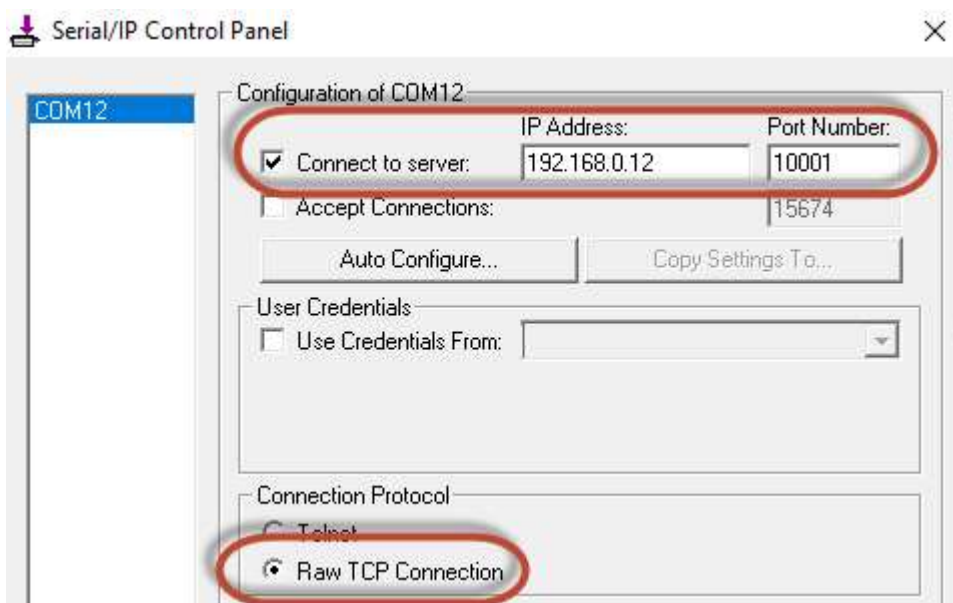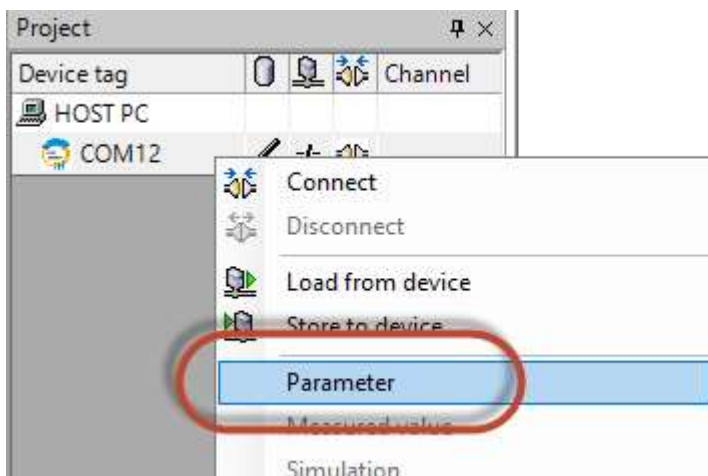

2) Install the CodeWrights *HART Communication FDT 1.2 DTM (V1.0.52)*

3) Open PACTware and update de device catalog to see the new DTM

4) Add a new port using the new DTM and open the Paramenter tab

5) Select the COM port previously added in SerialIP.
In the Address scan section change the Start and End address in case you have multiple devices with different addresses connected to the EGW1-MB-HT port.
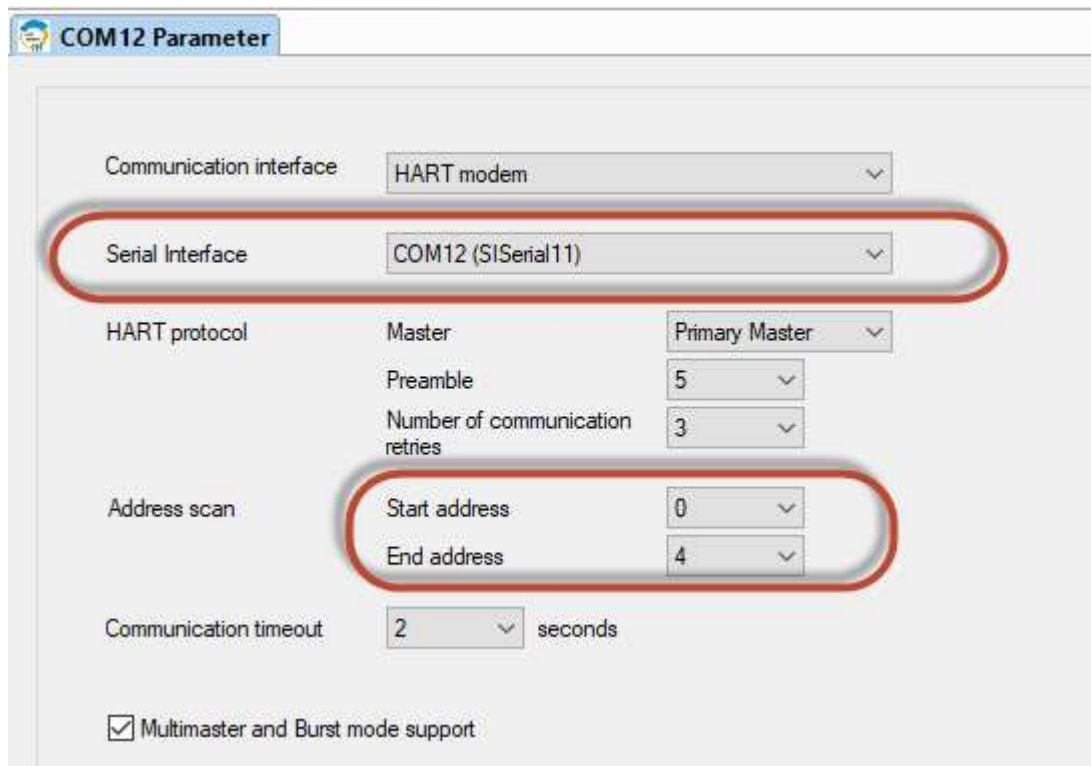
6) Add the the HART devices to the new COM port on PACTware. Then you will be able to monitor and configure the devices remotely.