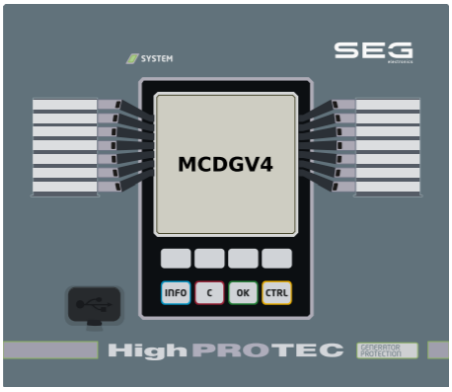
APPLICATION NOTE

Connecting an easYgen-3200XT via ModbusTCP master to a HighPROTEC Protection relay to visualize relay's data on easYgen's HMI



Introduction

This application note describes the procedure how to setup a Modbus master data link between easYgen-3000XT and HighPROTEC protection relays

About easYgen Modbus master Tool:

Download: https://wss.woodward.com/manuals/PGC/easYgen-3000XT_series/SW_Tools/ModbusMasterMapper
Configures multiple Modbus masters on a EG-3000XT, starting firmware version 2.10

System Requirements:
Pentium® PC, 32 MB of RAM, Windows® 2000, XP, Vista, 7 or greater

About Woodward Toolkit:

Download: https://wss.woodward.com/manuals/PGC/SW_Tools/ToolKit

Microsoft Windows® 10, 8.1, 7, Vista (32- & 64-bit)
Microsoft .NET Framework 4.6.2
1GHz or faster x86 or x64 processor, 1GB of RAM
Minimum 1024 by 768 pixel screen resolution
Appropriate communication hardware (e.g. Serial Port, CAN adapter, Ethernet)
IXXAT or Kvaser CAN adapter and driver as appropriate
ToolKit requires that the Microsoft .NET Framework be installed. The ToolKit installation will attempt to install the .NET Framework from the Internet; but you can also obtain the .NET Framework Redistributable package from the link below.

About HighPROTEC SmartView

Download: https://docs.segelectronics.de/library/smart_view/

SAFETY MESSAGES

Important Definitions

The types of messages shown below serve the safety of life and limb as well as for the appropriate operating life of the device.

DANGER

DANGER! indicates an immediately dangerous situation that will result in death or serious injury if it is not avoided.

WARNING

WARNING! indicates a hazardous situation that can result in death or serious injury if it is not avoided.

CAUTION

CAUTION! indicates a possibly hazardous situation that can result in minor or moderate injuries if it is not avoided.

NOTICE

NOTICE! is used to address practices not related to personal injury.

PREREQUISITES

This Application Note demonstrates the settings that have to be made at the HighPROTEC and at the Modbus-Master of the easYgen.

WARNUNG

Read this Application Note and all other documents that are required for a safe installation, operation and maintenance of the products. All safety aspects and messages and all national standards – if applicable – must be followed.

Failure to follow instructions can cause personal injury and/or property damage.

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment.

Any such unauthorized modifications: (1) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (2) invalidate product certifications or listings.

HINWEIS

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http://wss.woodward.com/manuals

If your document cannot be found there, please contact Woodard and ask for the latest copy.

GENERAL INFORMATION

easYgen-3000XT Modbus master mapper ↔ HighPROTEC:

As of version 2.10, easYgen devices support being operated as a Modbus/TCP-Master.
With this functionality they can communicate with up to 5 external devices.

Woodward makes available the software tool “ModbusMasterMapper”. It is compatible with Windows 7 or higher, and it can be used to create a setup file for any easYgen-XT device (as of SW version 2.10-0). With this setup file, the easYgen-XT can communicate via Modbus/TCP with several slave devices, i.e. it can read or write data.
The user defines the devices to be accessed, the type of data transfer and the Modbus address ranges to be transferred.

The ModbusMasterMapper generates an SCP file that can be uploaded to an easYgen-XT via the software “Toolkit”.

This way the easYgen-XT can be configured in a way such that measurement values are transferred from the HighPROTEC (slave) onto the easYgen-XT (master).

The Modbus function codes 3 and 4 are supported. It is possible to read different values from a device, such as currents, voltages and temperatures.

These read values can be scaled freely and stored in 99 available slots for analog data or 99 Boolean values. The easYgen application can use these data in various ways via AnalogManager and LogicsManager.

The easYgen-XT offers a function for communication diagnosis, so that the user can check easily which external devices are available for communication.

Additionally, easYgen-XT has two special user-defined screens available for display. Each of these two screens can display up to 9 analog measurement values.

DEVICE VARIANTS (EXAMPLE)

easYgen-3200XT

For this kind of application one needs a generator control device of type easYgen-XT (with a recent firmware version, 2.10-0 or higher).

In the following we use an **easYgen 3200XT-P1** as an example.

EASYGEN 3000XT		easYgen-3000XT Series		
	Model	3100XT	3200XT	
	Package	P1	P1	P1-LT
Measuring				
Generator voltage (3-phase/4-wire)			✓	
Generator current (3x true r.m.s.)				
Mains voltage (3-phase/4-wire)				
Mains or ground current (1x true r.m.s.; Mains or ground current selectable)				
Busbar voltage (1-phase/2-wire)				
Control				
Breaker control logic (open and closed transition <100 ms)	*FlexApp™*	2		
Automatic, Manual, Stop, and test operating modes		✓		
Mains parallel multiple-unit operation (up to 32 units)		✓		
AMF (auto mains failure) and stand-by operation		✓		
Solar and diesel support		✓		
Critical mode operation		✓		
GCB and MCB synchronization (±slipping / phase matching)		✓		
Import / export control (kW and kvar)		✓		
Load-dependent start/stop		✓		
n/f, V, P, Q, and PF control via analog input or interface		✓		
Load/var sharing for up to 32 gensets		✓		
Freely configurable PID controllers		3		
HMI				
Color Display with Softkey operation	*DynamicsLCD™*	-	✓	
Start/stop logic for diesel / gas engines		✓		
Counters for operating hours / starts / maintenance / active/reactive energy		✓		
Configuration via PC (serial connection and ToolKit software (included))		✓		
Event recorder entries with real time clock (battery backup)		1000		
Operating Temperature		-40 to 70 °C	-20 to 70 °C	-40 to 70 °C
Protection	Equivalent ANSI#			
Generator: voltage / frequency	59 / 27 / 81O / 81U		✓	
Generator: overload, reverse/reduced power	32 / 32R / 32F			
Generator: Synch Check	25			
Generator: unbalanced load	46			
Generator: instantaneous overcurrent	50			
Generator: time-overcurrent (IEC 255 compliant)	51 / 51 V			
Generator: ground fault (measured ground current)	50G			
Generator: power factor	55			
Generator: Pole slip monitor	78 PS			
Engine: overspeed / underspeed	12 / 14			
Engine: speed / frequency mismatch				
Engine: D+ auxiliary excitation failure				
Engine: Cylinder temperature				
Mains: voltage / frequency / synch check	59 / 27 / 81O / 81U / 25			
Mains: phase shift / rotation field / ROCOF (df/dt)	78			
I/Os				
Speed input: magnetic / switching; Pickup		✓		
Discrete alarm inputs (configurable)		12 (10)		
Discrete outputs, configurable	*LogicsManager™*	max. 12		
External discrete inputs / outputs via CANopen		32 / 32		
Analog inputs #1, configurable	*FlexIn™*	3		
Analog outputs: +/- 10V, +/- 20mA, PWM; configurable		2		
External analog inputs / outputs via CANopen		16/4		
Display and evaluation of J1939 analog values, "supported SPNs"		100		
CAN bus communication interfaces #2, #3	*FlexCAN™*	2		
Ethernet Modbus TCP Slave interface #3		1		
USB Serial interface		1		
RS-485 Modbus RTU Slave interface		1		
Listings/Approvals				
UL / cUL Listing (61010 ,6200), VDE, EAC, VDE-AR-N 4105/ 4110			✓	
CSA (USA and Canada)				
LR, ABS Marine				
CE Marked				
Part Numbers				
Front panel mounting with display #4		-	**8440-2082**	**8440-2083**
Cabinet back mounting w/o display		**8440-2081**	-	-
Spare connector kit		**8923-2318**	**8923-2318**	**8923-2318**

HighPROTEC

Select a HighPROTEC that meets your protection needs. For the Modbus Master application described here, it is important to select a device with TCP/IP interface.

Every HighPROTEC device with Ethernet/TCP/IP also makes the Modbus TCP protocol available.

In the following we will use a HighPROTEC MCDGV4-2A0ACA as an example.

Generator Protection										
MCDGV4						**-2**	**#**	**#**	**#**	**#**	**#**
Housing	**Display**	**DigitalInputs**	**Binaryoutputrelays**	**AnalogInputs / Outputs**	**Interf.for ext.RTD Box**						
B2	LCD, 128x 128pixel	16	11	0/0	-		**A**				
B2	LCD, 128x 128pixel	8	11	2/2	-		**B**				
B2	LCD, 128x 128pixel	24	11	0/0	-		**C**				
B2	LCD, 128x 128pixel	16	16	0/0	-		**D**				
Hardware variant 2										
Phase Current 5 A/1 A, Ground Current 5 A/1 A								**0**			
Phase Current 5 A/1 A, Sensitive Ground Current 5 A/1 A								**1**			
Housing and mounting											
Housing suitable for door mounting									**A**		
Housing suitable for 19" rack mounting									**B**		
Communication protocol (*)											
Without protocol										**A**	
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | *RS485 / terminals*										**B**	
Modbus TCP, DNP3.0 TCP/UDP, IEC60870-5-104 | *Ethernet 100 MB / RJ45*										**C**	
Profbus-DP | *optic fber / ST connector*										**D**	
Profbus-DP | *RS485 / D-SUB*										**E**	
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | *optic fber / ST connector*										**F**	
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | *RS485 / D-SUB*										**G**	
IEC61850, Modbus TCP, DNP3.0 TCP/UDP, IEC60870-5-104 | *Ethernet 100MB / RJ45*										**H**	
IEC60870-5-103, Modbus RTU, DNP3.0 RTU | *RS485 / terminals* Modbus TCP, DNP3.0 TCP/UDP, IEC60870-5-104 | *Ethernet 100 MB/RJ45*										**I**	

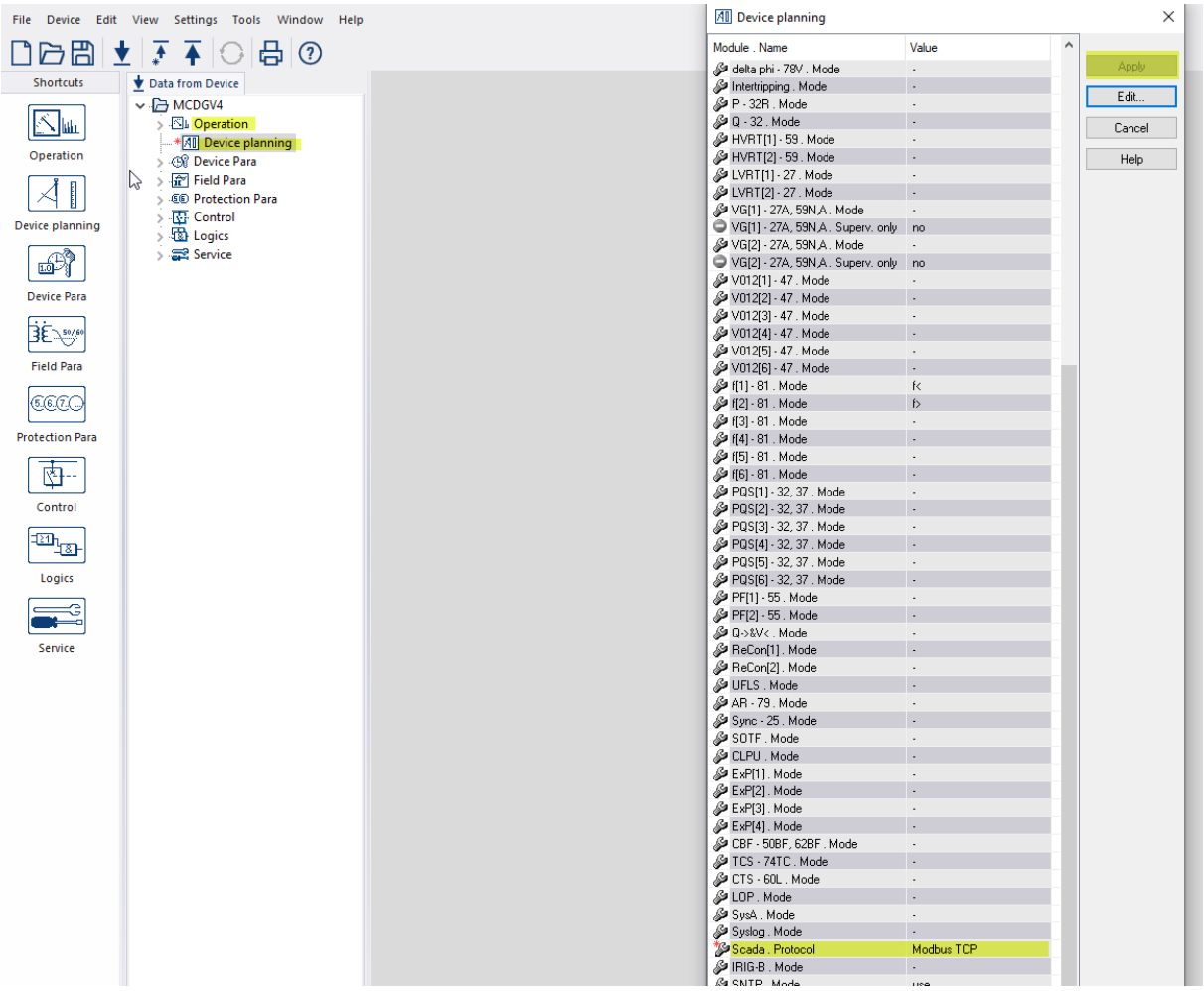
Generator Protection						
MCDGV4	**-2**	**#**	**#**	**#**	**#**	**#**
IEC61850, Modbus TCP, DNP3.0 TCP/UDP, IEC60870-5-104 | *Optical Ethernet 100MB / LC duplex connector*					**K**	
Modbus TCP, DNP3.0 TCP/UDP, IEC60870-5-104 | *Optical Ethernet 100MB / LC duplex connector*					**L**	
IEC60870-5-103, Modbus RTU, DNP3.0 RTU | *RS485 / terminals* IEC61850, Modbus TCP, DNP3.0 TCP/UDP, IEC60870-5-104 | *Ethernet 100 MB / RJ45*					**T**	
Harsh Environment Option						
None						**A**
Conformal Coating						**B**
Available menu languages English (USA) / German / Spanish / Russian / Polish / Portuguese (BR) / French / Romanian						
Miscellaneous Functions Control functions for up to 6 switchgears and logic up to 80 equations.IRIG-B interface for time synchronization.						

SETTINGS

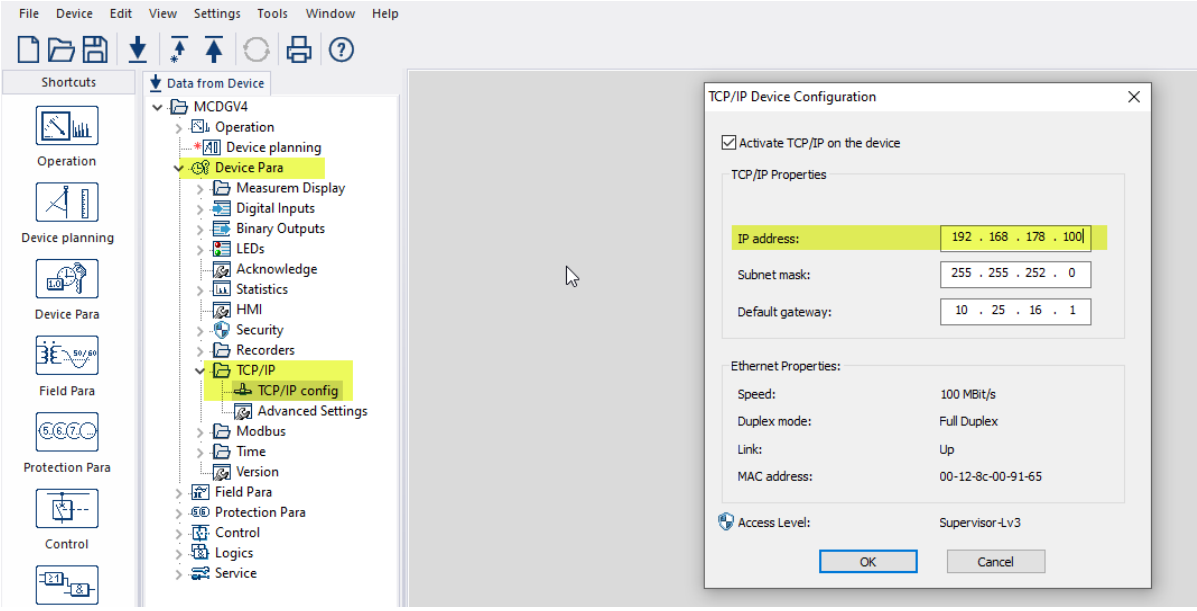
HighPROTEC MCDGV4-2A0ACA

The setting and operating software *Smart view* can be downloaded here:
http://docs.segelectronics.de/smart_view

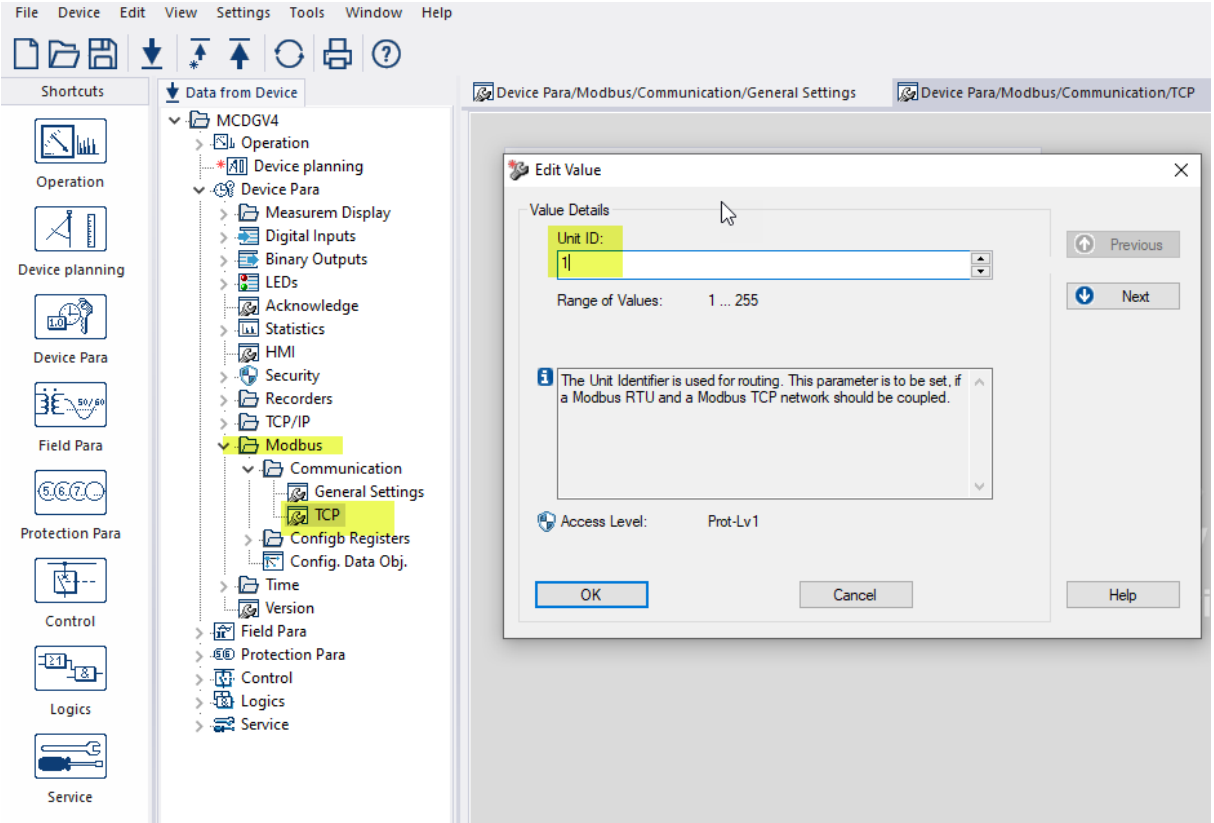
Launch *Smart view* and select the menu item [Device planning]. There you can double-click the parameter *»Scada . Protocol«* and set it to “Modbus TCP”.



Enter the menu branch [Device Para] and set »TCP/IP config« to a valid IP address (with subnet mask and gateway).



Enter [Device Para / Modbus / TCP] and set the »Unit ID«.
In the following we will use the example setting »Unit ID« = 1.
(Note that this requires the same setting Modbus-ID = 1 within the Modbus-Master-settings of the easYgen-XT, see **Error! Reference source not found.** on page **Error! Bookmark not defined.**.)

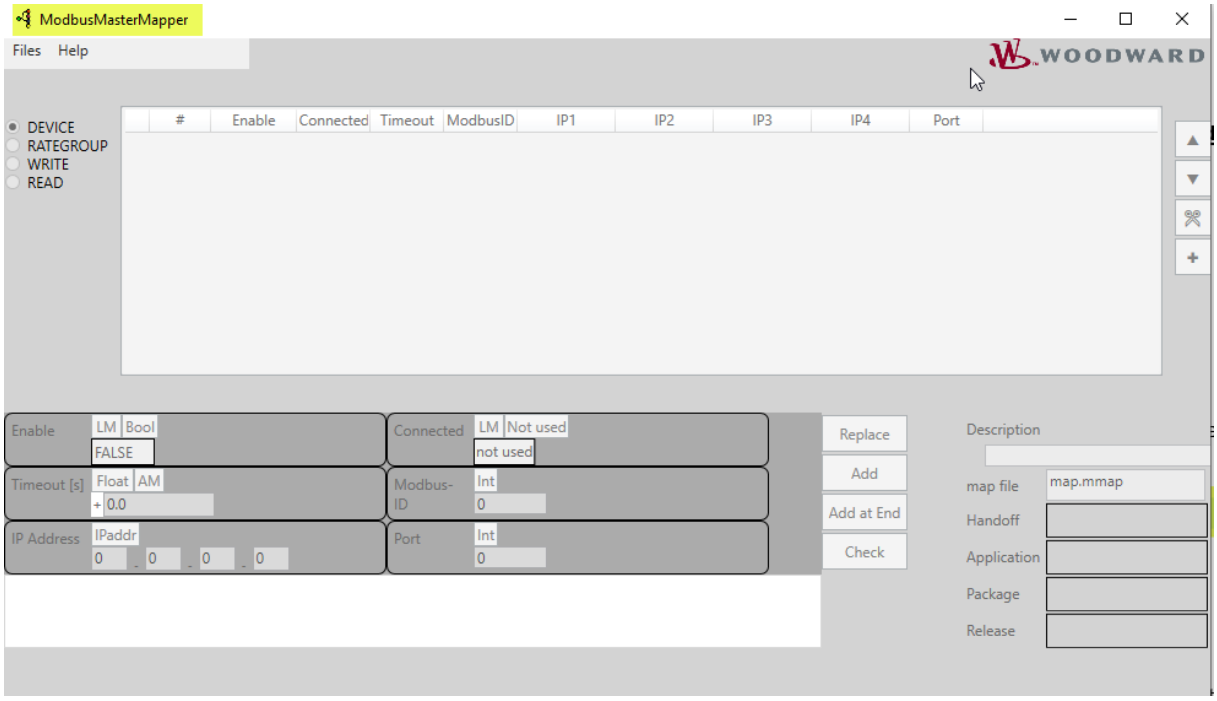


easYgen / Modbus-Master

The software ModbusMasterMapper can be downloaded here:

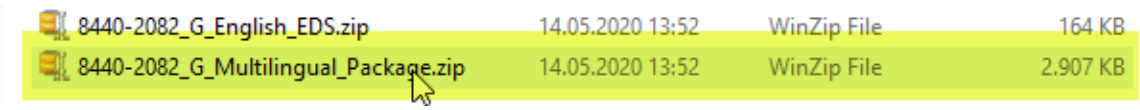
https://wss.woodward.com/manuals/PGC/easYgen-3000XT_series/SW_Tools/ModbusMasterMapper

Main dialog window looks like this:



Every new project requires a device description package to be set up.

The package contains settings for all necessary parameters and access points of the device that shall operate as a Modbus Master. Without loading a package the tool is not functional, i.e. all menu items are inactive.

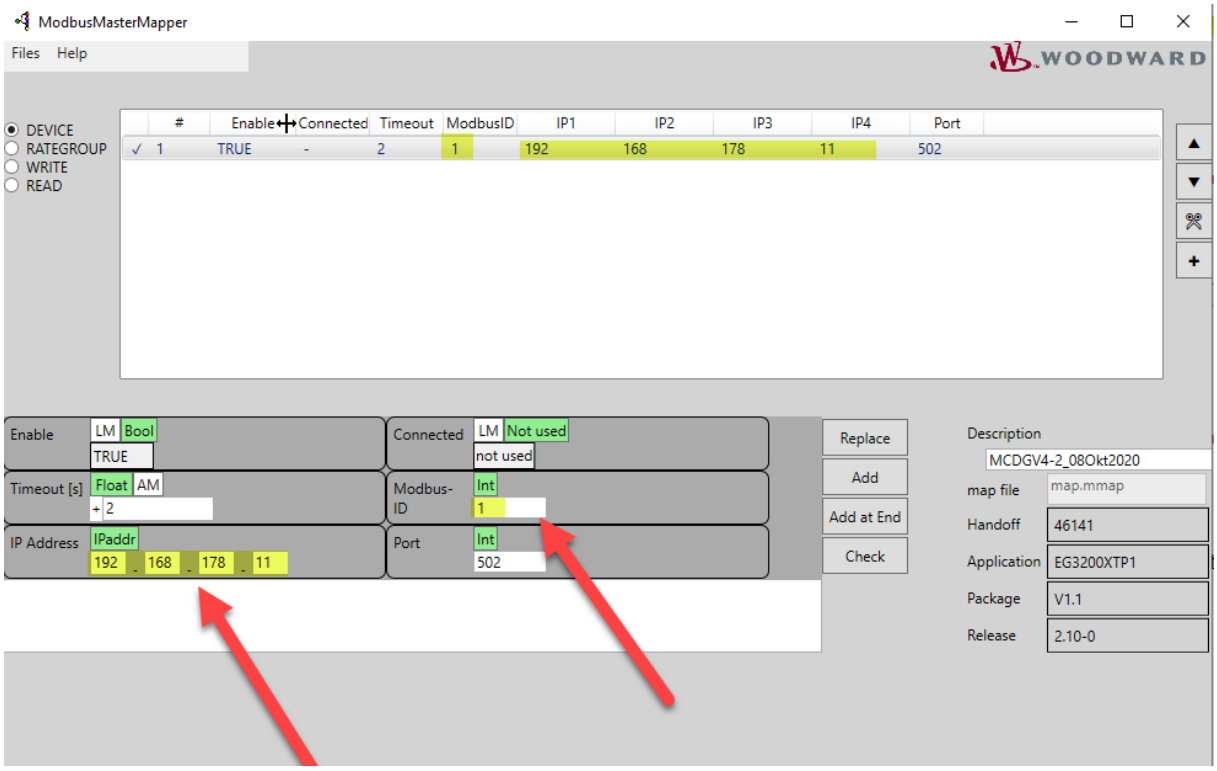


The package file is also available at the documentation server,

https://wss.woodward.com/manuals/PGC/easYgen-3000XT_series/easYgen-3100XT-3200XT-P1/02_Config_Files_/8440-2082_J

Note: The package file is updated with every firmware release. Make sure to use the package file that matches with your easYgen firmware version.

After a package has been loaded the main dialog window shows menu items for several categories.

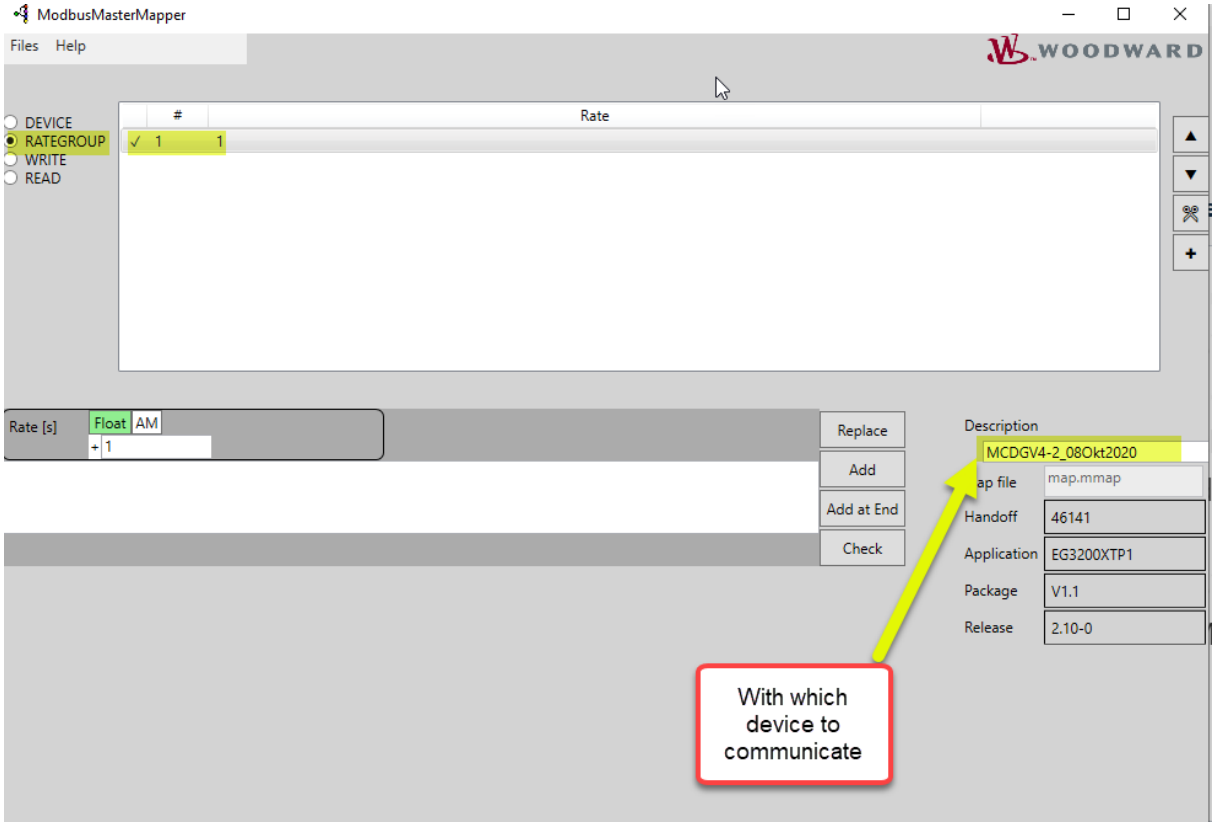


The “Device” menu defines external devices, to which the easYgen-XT as Modbus Master will connect.

Every line in the list describes a device, and up to 5 devices are supported. In our example shown above the HighPROTEC MCDGV4 has already been defined.

First the IP address (of the Modbus-Master, i.e. of the easYgen-XT) and the Modbus-ID (of the Modbus-Slave, i.e. of the HighPROTEC device) have to be set.

The Modbus-ID (Slave-ID) has to be equal to the HighPROTEC setting, i.e. in our case: = 1.



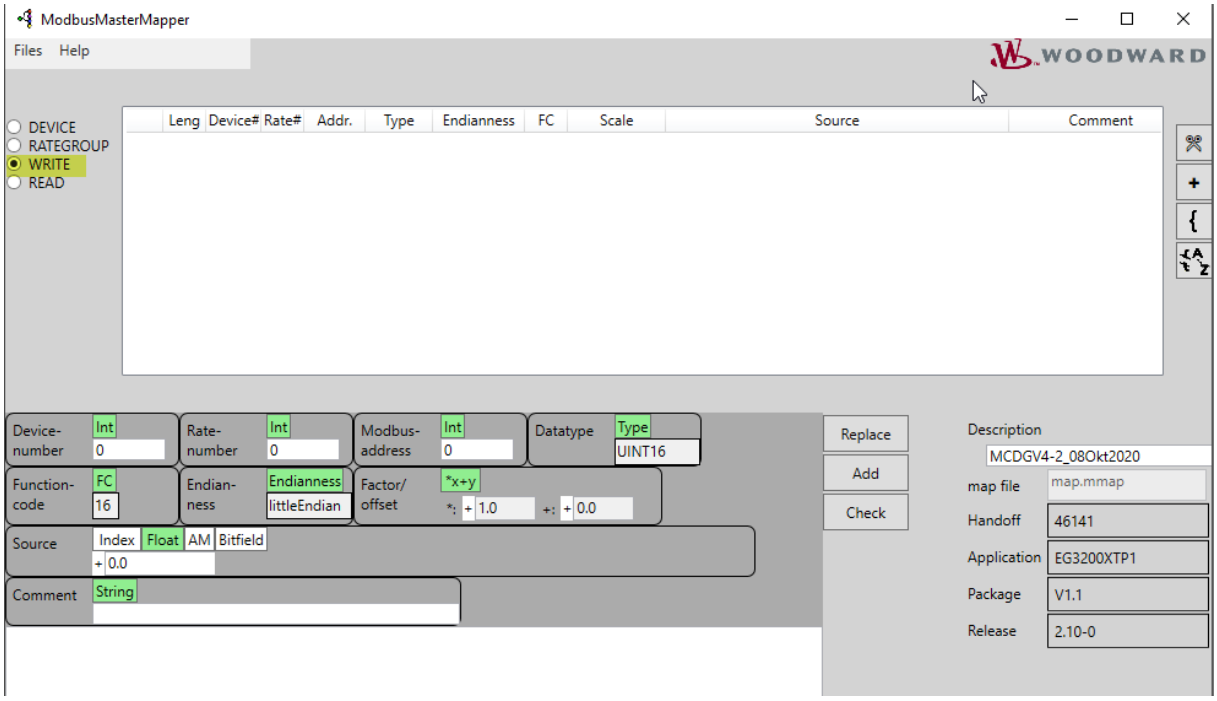
The “Rategroup” menu defines groups that collect devices to be connected to by the easYgen-XT. In our case, the MCDGV4 is defined as the sole group member.

Every line in the list describes such a communication group.

-  – The buttons move the position of an entry in the list.
-  – This button deletes an entry from the list.
-  – This button adds a new group.

- A click onto a line selects the respective group, and its settings are shown in the editing panel underneath, where they can be modified.
- 

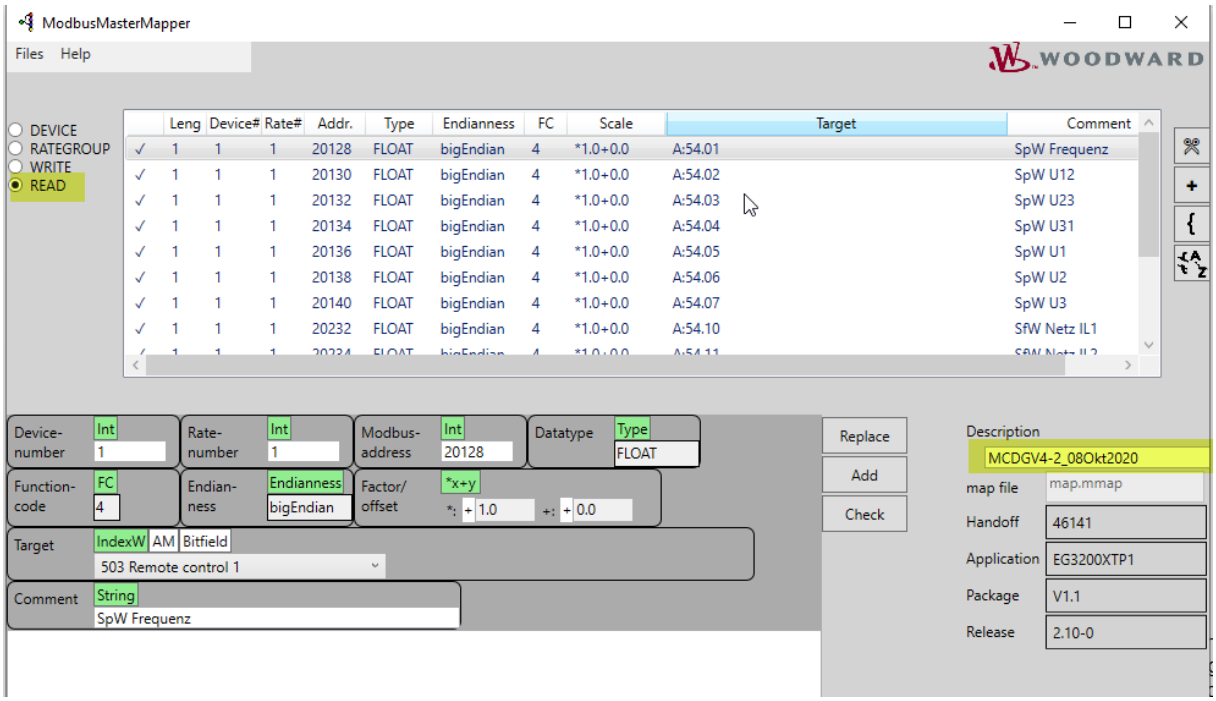
– This button transfers / inserts / checks the settings of the editing panel into the currently selected line of the list.



The “Write” menu defines a Modbus command to be transmitted. The easYgen-XT periodically sends a Modbus-command 16 “write multiple” to transfer data to the MCDGV4.

The lines can be grouped, so that they get transmitted within one command.
The list is always displayed sorted as follows:

1. Device,
2. Rate,
3. Modbus address.



The “Read” menu allows for defining a Modbus read command.

The easYgen-XT periodically sends a Modbus-command 3 “read” to get data from the MCDGV4.

The functionality of the Modbus addresses, as defined within the MCDGV4, i.e. the assignment of Modbus addresses to MCDGV4 parameters, is listed in a separate document, the MCDGV4 Modbus Datapoint List. This document is available here:

https://docs.segelectronics.de/library/HighPROTEC/MCDGV4-2/04_SCADA_Communication/Modbus/

The lines can be grouped, so that the data get transmitted within one command.
The list is always displayed sorted as follows:

1. Device,
2. Rate,
3. Modbus address.

-  – This button deletes an entry from the list.
-  – This button adds a new line (i.e. a new analog value).
-  – This button ungroups all groups within the whole list.
-  – This button collects the selected lines in a new group. This is only possible if the lines to be grouped have the same Modbus-ID and the same Baud rate.
- 

– This button transfers / inserts / checks the settings of the editing panel into the currently selected line of the list.

After all, the easYgen periodically reads measurement values from the HighPROTEC and displays them.