WOODWARD

APPLICATION NOTE
B37919_AN_MODBUS

EG3000XT

‘Modbus MasterMapper‘

Optional Supplementary Information

General Information

The following alert boxes can be used in this publication:

⚠DANGER	**“DANGER” indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
⚠WARNING	**“WARNING” indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
⚠CAUTION	**“CAUTION”, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**“NOTICE” is used to address practices not related to personal injury.**
IMPORTANT	**“IMPORTANT” is used to address practices not related to personal injury.**

Personnel

⚠WARNING

WARNING!
Hazards due to insufficiently qualified personnel!

If unqualified personnel perform work on or with the control unit hazards may arise which can cause serious injury and substantial damage to property.

Therefore, all work must only be carried out by appropriately qualified personnel.

Requirements

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Documentation

⚠WARNING

Read this entire application note and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.
Practice all plant and safety instructions and precautions.
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: constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and invalidate product certifications or listings.

⚠CAUTION

This publication may have been revised or updated since this copy was produced. If the cover of the publication states "Translation of the Original Instructions", the original source may have been updated since this translation was made.
Be sure to verify whether this translation is up to date. Always compare with the original for technical specifications and for proper and safe installation and operation procedures. To verify that you have the latest revision, check Technical Publications, on the publications page of the Woodward website:

https://wss.woodward.com/manuals/PGC/Forms/AllItems.aspx

The latest version of most publications is available on the publications page. If your publication is not there, please contact your customer service representative to get the latest copy.

Table of Contents

Introduction

The Modbus MasterMapper tool allows creating a setup file for EG3000XT, which allows this to communicate via Modbus/TCP to multiple slaves and read or write data from/to them.

About

The user can define devices to access, rates when the data transfer shall be done and addresses or address ranges where to write or from where to read. The tool will generate a SCP file which can be uploaded via Toolkit to a device from the MAIN menu choose LOAD APPLICATION and follow instruction.

The tool is designed for Windows 7 or higher.

1 Modbus Master mapping basics

Easygen devices starting with revision 2.10 have a functionality where the device can be configured to act as a Modbus/TCP master to communicate with up to 5 external devices.

The Easygen can be configured to:
Write to the devices in multiple configurable rate groups. It is possible to write different data in different rate groups to the same device.

Write Boolean or Analog data to them, either as single values or as group write. Function codes 5 and 16 are supported. These values can be selected from a pool of internal data the Easygen is providing, freely scaled and then written.

Read from the external devices in multiple configurable rate groups. Function codes 3 and 4 are supported. It is possible to read different data in different rate groups from the same device.

These read values can be freely scaled and then stored in 99 prepared Analog slots and 99 Boolean slots to be used further in the Easygen application.

Diagnosis function to detect whether external devices are communicating.

Test function to initiate communication to only one selected device and check the values read there.

Configuration is done by using this PC tool to create a mapping file. The tool will then create an upload file and the user can use Woodward Toolkit upload the configuration to the Easygen. After upload and restart, the Modbus master function is active. When an Easygen has no mapping file uploaded, the functionally is disabled. The Easygen also can be configured to have the function disabled.

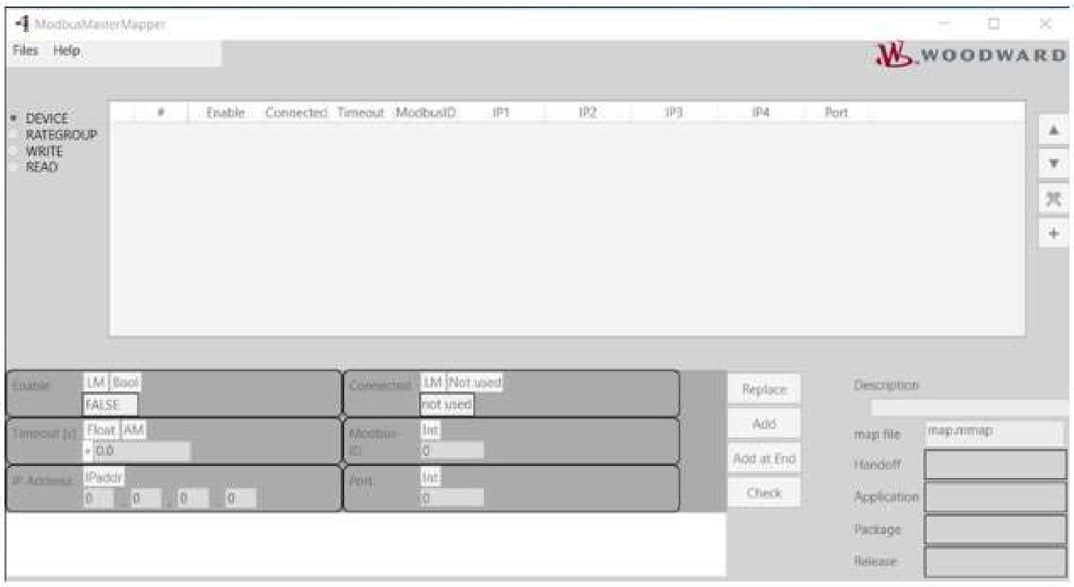
Warning:

It is possible to configure the master in a way that more messages are scheduled than the system can handle in the allocated rate groups. Transfer to different devices do not influence each other but one transfer to one device will take as a minimum 20msec, so scheduling more than 5 transactions to the same device in an overall rate of 100msec will result in the messages not being sent as fast as wished. Care should be taken to keep rate load low, and group messages to the same device as much as possible.

2 Installation and Starting

The tool has to be installed. In Windows 7 it will be installed under the “Woodward/Power Gen Tools” folder in the start menu, in Windows 8 or higher under the “Woodward folder”.

The tool, when started will come up with the main screen, like



Enable: LM Bool FALSE

Connected: LM Not used not used

Timeout [s]: Float AM + 0.0

Modbus-ID: Int 0

IP Address: IPaddr 0 . 0 . 0 . 0

Port: Int 0

Description

map file: map.mmap

Handoff

Application

Package

Release

To start a project, it has to be set up with a device description package as described below.

3 Menus

After a package was loaded, with the menu in the main window, a couple of supporting functions can be activated.

3.1 Menu item: Files / Set package

With this menu item the tool prompts for a device description package, and this package can be loaded. A package file, which is part of the deployment of each Woodward EG3000 application, contains descriptions of all necessary parameters and access points of the device where a Modbus master shall be set up. Without a loaded package this tool has no function and all further menus are grayed out. After having loaded a package, this menu item will disappear. This file is obtained from the Woodward website, https://wss.woodward.com/manuals/PGC/Forms/AllItems.aspx
The file will be in the form of this example: 8440-2088_D_Multilingual_Package.zip

3.2 Menu item: Files / Load mapping

This menu item permits the view or editing of an existing mapping file. This prompts for a filename and will load a mapping file (*.mmap) into the tool. The tool will check whether the mapping file fits to the selected package and issue a warning, if not. However, even with such a warning, the user can work on the mapping.

The mapping file is also the main project file and will be unchanged (except the file name) transferred to the device. The user shall archive this file when he plans to do later changes. When archiving was not done, there will be a way to retrieve this file also directly from the device where it was uploaded, but this is not a standard way and will need Woodward customer support involvement.

3.3 Menu item: Files / Save mapping

This menu item will prompt for a filename and will allow saving the current mapping as a file. The saved mapping will be linked to the firstly loaded package, even if it was originally from another package. So if you for example select a package for an EasyGen EG3500XTP2, then load a mapping for an EasyGen EG3200XTP2 and ignore the warning, and save again, the saved mapping will be for an EasyGen EG3200XTP2.

3.4 Menu item: Files / Create upload file

This prompts for a filename and will create a Toolkit update file (*.scp). Using Woodward Toolkit, the mapping can then be transferred to an EasyGen, and after restart of the device, will become active. The internal name of the mapping file (in the EasyGen) will be fixed as “map.mmap”. A new update file may be loaded without using a reset file. The new file will overwrite the old file.

3.5 Menu item: Files / Create reset file

This prompts for a filename and will create a Toolkit update file (*.scp) to reset an existing mapping in a device, by overwriting it with a mapping file with no commands. This is used when the Modbus master function is no longer needed. Using Woodward Toolkit, the mapping can then be transferred to an EasyGen, and after restart of the device, existing mapping will be overwritten and inactive. The internal name of the mapping file (in the EasyGen) will be fixed as “map.mmap”.

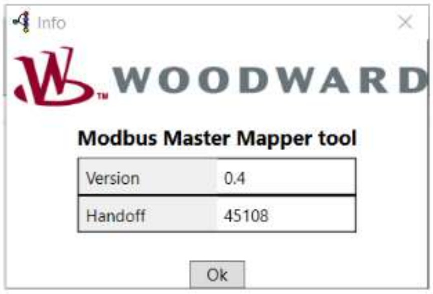
Before attempting update file creation, the tool will check integrity of the mapping. If an error is found, it will issue a warning and will not proceed. If there are multiple errors, only the first encountered one will be displayed.

3.6 Menu item: Help / Help

This shows this help document.

3.7 Menu item: Help / Info

This shows an information screen about revision of this application.



Modbus Master Mapper tool

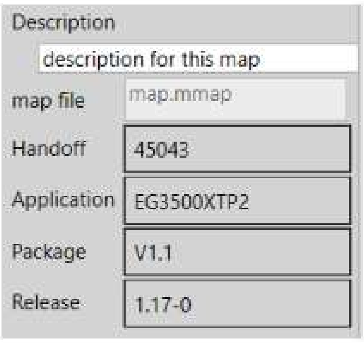
Version	0.4
Handoff	45108

The entries meanings are

- Version
  This is the software version of the application.
- Handoff
  This is a unique Woodward identification number of this application. This number suffices identifying the application completely.

4 Editing a mapping

After selecting a package, the tool will populate package information. Package information cannot be changed by the user.



Description
description for this map
map file map.mmap
Handoff 45043
Application EG3500XTP2
Package V1.1
Release 1.17-0

The entry definitions are

- **Map file**
  Name of the mapping file as it will be stored on the device. This is an internal information.
- **Handoff**
  Handoff # of the application, uniquely describing the application on the device
- **Application**
  Name of the application
- **Package**
  Version of the package. This is an internal information.
- **Release**
  Release and sub-release of the application

The line **Description** can be edited by the user. This is a description of the mapping file and can be used to identify it. I and will be part of the mapping file. Depending on the Easygen variant, this text will be displayed on the HMI or on the Toolkit tool on the Modbus status screen.

After loading the package, the tool now will provide four separate lists and associated editors.

4.1 Data types

Editors allow entry of different value types, sometimes a certain value can have multiple value types. The user can select the data type by clicking on the green selector above it. Different value types have different input methods and are handled differently.

4.1.1 Integer type Int

This selection is for defining a positive or negative integer value. It will be displayed in the list simply as the number.

4.1.2 Float type Float

This selection is for defining a positive or negative float value. Values shall be in a standard form like 0.12 or 3.1415. Decimal sign shall be the ‘.’. Sign shall be input by a separate sign button to the left. In the list it will be displayed simply as the number, with preceding ‘-‘, if necessary and a decimal point.

4.1.3 IP address type IPaddr

The fields are for entry of four positive integer values representing the IP address of the Modbus slave to be read from or written to. It will be displayed in the list as four separate numbers. The tool will provide error checking.

4.1.4 Scaling type *x+y

This selection is for defining a value scaling formula with a multiplier and offset. The values can be entered as float values in a standard form like 0.12 or 3.1415. Decimal sign shall be the ‘.’. Sign shall be input by a separate sign button to the left. In the list it will be displayed in a form similar like *-12.34+7.89.

4.1.5 String type String

This selection is for defining a string value. The tool will clip the string to maximum 48 characters. All Unicode characters are permitted. In the list it will be displayed as the text.

4.1.6 Logicsmanager type LM

This selection is for defining a Boolean Logicsmanager flag value. Depending where it is used, this can be either a readable or writeable flag from the device’s pool. In the list it will be displayed like L:xx.yy, where xx and yy are the group and position of the flag.

4.1.7 Analogmanager type AM

This selection is for defining a float Analogmanager value. Depending where it is used this can be either a readable or writeable value from the device’s pool. In the list it will be displayed like A:xx.yy, where xx and yy are the group and position of the value.

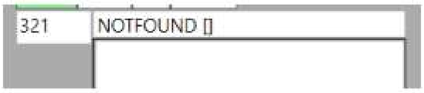
4.1.8 Index type Index

This selection is for defining an indexed value. It will be displayed in the list in a form similar like i:1234. All parameters and many measured values of the Easygens have a unique numeric index. Indices are mostly for internal purposes and not all are published. Parameter indices, however, ´can be seen in the Toolkit provided with the Easygen. Indexed values shall only be used for exceptional cases.

There are two ways to select an index

- Input it directly in the top left field of the input mask. When the system knows this index, it will display the English text for it, otherwise it will show “NOTFOUND”.

10110 Battery voltage [00.0V]



321 NOTFOUND []

- Search by inputting a search text in the top right field. The system will provide a list of all matches in a list below and by double clicking, an index can be selected.

4.1.9 IndexW type IndexW

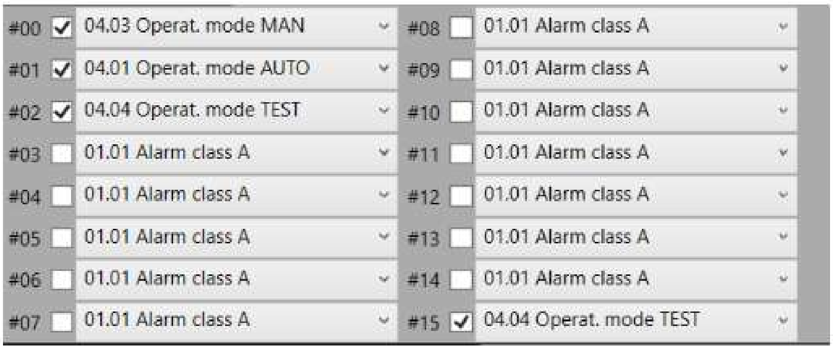
This selection provides a list of database indices of the Easygen which can be written to. It is in a form of an enumerated list. In the list it will be displayed in a form similar like i:1234.

4.1.10 Bitfield type Bitfield

A bitfield type has two functions. When writing via Modbus, it combines readable Logicsmanager flags into a 16-bit value which will be written to the Modbus slave.

When reading via Modbus, it takes the read 16-bit value and distributes its 16 bits to up to 16 writeable Logicsmanager flags in the system.

The specific box for the individual bits must be checked to read or write the value.



#00	☑	04.03 Operat. mode MAN	#08	☐	01.01 Alarm class A
#01	☑	04.01 Operat. mode AUTO	#09	☐	01.01 Alarm class A
#02	☑	04.04 Operat. mode TEST	#10	☐	01.01 Alarm class A
#03	☐	01.01 Alarm class A	#11	☐	01.01 Alarm class A
#04	☐	01.01 Alarm class A	#12	☐	01.01 Alarm class A
#05	☐	01.01 Alarm class A	#13	☐	01.01 Alarm class A
#06	☐	01.01 Alarm class A	#14	☐	01.01 Alarm class A
#07	☐	01.01 Alarm class A	#15	☑	04.04 Operat. mode TEST

4.1.11 Type value Type

This defines the data type and how it is transported via Modbus (whether it will take 1 Modbus address or 2 Modbus addresses). It can be changed by clicking on the value which then will toggle between UINT16, INT16, INT32, UINT32 and FLOAT. It will be displayed in the list as one of these texts.

4.1.12 Endianness value Endianness

This defines an endianness and how it is transported via Modbus. It can be changed by clicking on the value which then will toggle between bigEndian (most significant value in the sequence is stored at the lowest storage address) and littleEndian (least significant value in the sequence is stored at the lowest storage address). It will be displayed in the list as one of these texts.

4.1.13 Functioncode type FC

This defines the Modbus function code and how it is transported via Modbus. It can be changed by clicking on the value which then will toggle for WRITE commands between 16 and 5, and for READ command between 3 and 4. It will be displayed in the list as one of these numbers.

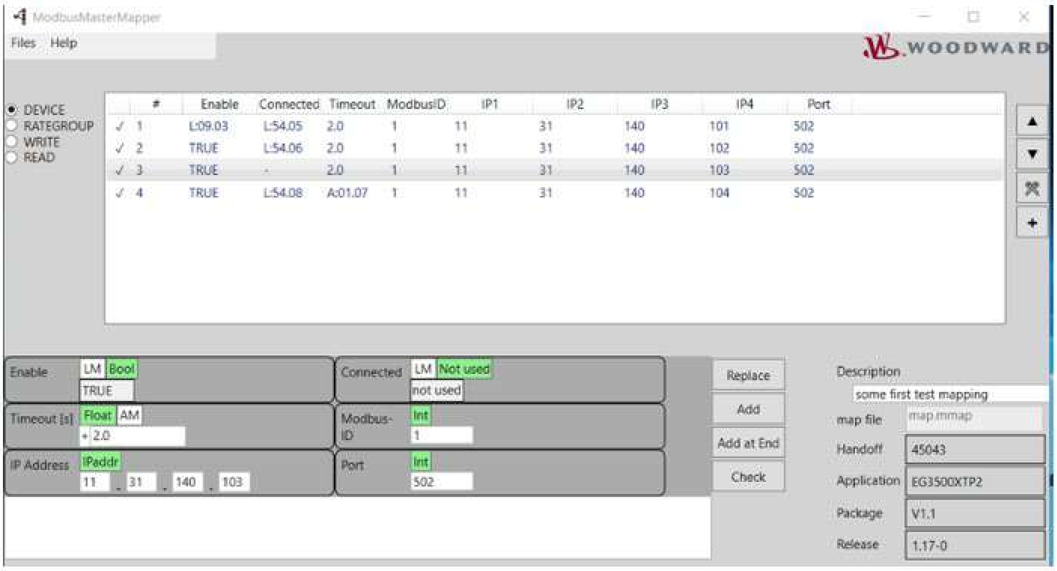
4.1.14 Not Used value Not used

This is a special value type with only one value, “not used”. This is needed for the DEVICE editor where it will be described. In the list it will be displayed as ‘-‘.

4.2 Device editor and list

This allows to define the external devices the Easygen can talk to as a Modbus Master. Up to 5 devices are possible.

Each line in the list describes one device.



	#	Enable	Connected	Timeout	ModbusID	IP1	IP2	IP3	IP4	Port
✓	1	L:09.03	L:54.05	2.0	1	11	31	140	101	502
✓	2	TRUE	L:54.06	2.0	1	11	31	140	102	502
✓	3	TRUE	-	2.0	1	11	31	140	103	502
✓	4	TRUE	L:54.08	A:01.07	1	11	31	140	104	502

Enable: LM Bool TRUE
Connected: LM Not used not used
Timeout [s]: Float AM + 2.0
Modbus-ID: Int 1
IP Address: IPaddr 11 . 31 . 140 . 103
Port: Int 502

Description: some first test mapping
map file: map.mmap
Handoff: 45043
Application: EG3500XTP2
Package: V1.1
Release: 1.17-0

- With the buttons ▲ ▼ the highlighted device can be shifted in the list.
- With the button ✖ the highlighted device can be deleted.
- With the button + a new device can be added (up to 5).

When clicking on a line, its content will be shown below on the editor region and can be edited.

- With the button Replace the content of the editor will be transferred to the selected line in the list.

- With the button Add the content of the editor will be inserted after the selected line in the list.

- With the button Add at End the content of the editor will be inserted after the last line in the list.

- With the button Check the content of the editor will be checked and, if there is an error, it will be described in the region below the editor.

4.2.1 Parameters for an entry

- Ok flag

  This is an automatically generated flag in the list, indicating that the entry is valid or invalid. It can be "✓" or "⚠". By selecting a line flagged with "⚠" and pressing , a diagnosis text will be displayed.

- Device #

  This is an identification number of the device. This is automatically generated. The device# will be referred to in the READ and WRITE entries.

- Enable

  This is an expression to enable the device. A boolean constant or a LogicsManager can be selected. If a device is set to disabled, the system will not perform Modbus/TCP communication with this device.

- Connected

  - This is to monitor connection. If a logics manager command value is selected, the system will write TRUE to it, when the device is connected. Connection is defined by having received a valid Modbus answer in the timeout defined below. If no READ or WRITE command is scheduled for this device, this flag will not be set.
  - Alternatively this can be set to “not used”. Then no flag will be produced.

- Timeout

  This is a timeout in [s] where a Modbus slave should answer. A Float constant or an Analogmanager value can be selected. The range will be internally clipped in the range [1..1000]s.

- Modbus ID

  The Modbus id of the slave. Range is limited to [0..255].

- IP1 Address

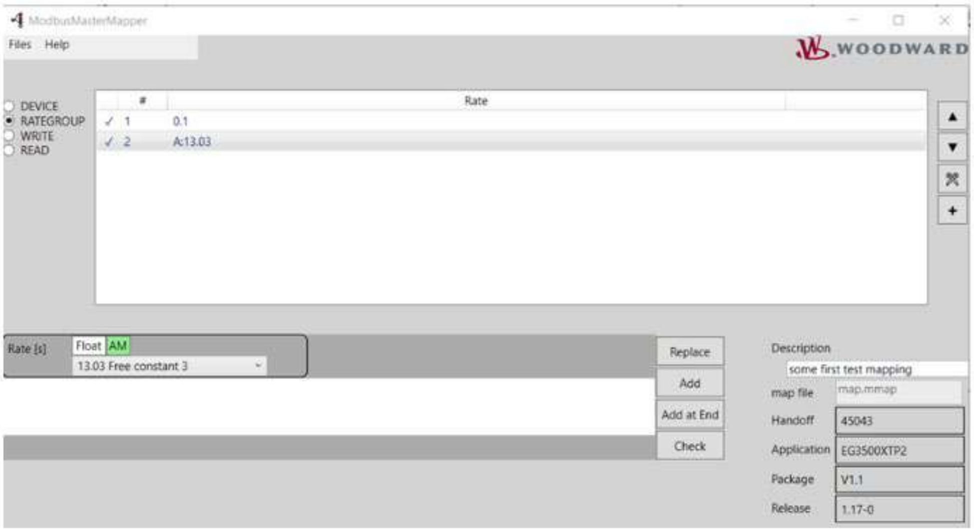
  This is the IP address (IPv4) of the device (the master address, not the slave). Range for each value is limited to [0..255].

- Port

  IP Port of the connection. Range is limited to [0..65535]. Usual port for Modbus is 502, the tool will default to that for new entries.

4.3 Rategroup editor and list

This allows to define rategroups, the Easygen uses to talk to devices as a Modbus Master.



	#	Rate
✓	1	0.1
✓	2	A:13.03

Rate [s] Float AM
13.03 Free constant 3

Description: some first test mapping
map file: map.mmap
Handoff: 45043
Application: EG3500XTP2
Package: V1.1
Release: 1.17-0

Each line in the list describes one rate group.

- With the buttons ▲ ▼ their sequence in the list can be shifted, with ⚒ deleted and with + a new rategroup can be added.

When clicking on a line, its content will be shown below on the editor region and can be edited.

- With the buttons Replace Add Add at End Check the content of the editor can be transferred to the

  selected line in the list, or inserted, or checked, as described in chapter 4.2.

4.3.1 Parameters for an entry

- Ok flag

  This is an automatically generated flag in the list, indicating that the entry is valid or invalid. It can be "✓" or "⚠". By selecting a line flagged with "⚠" and pressing , a diagnosis text will be displayed.

- Rate #

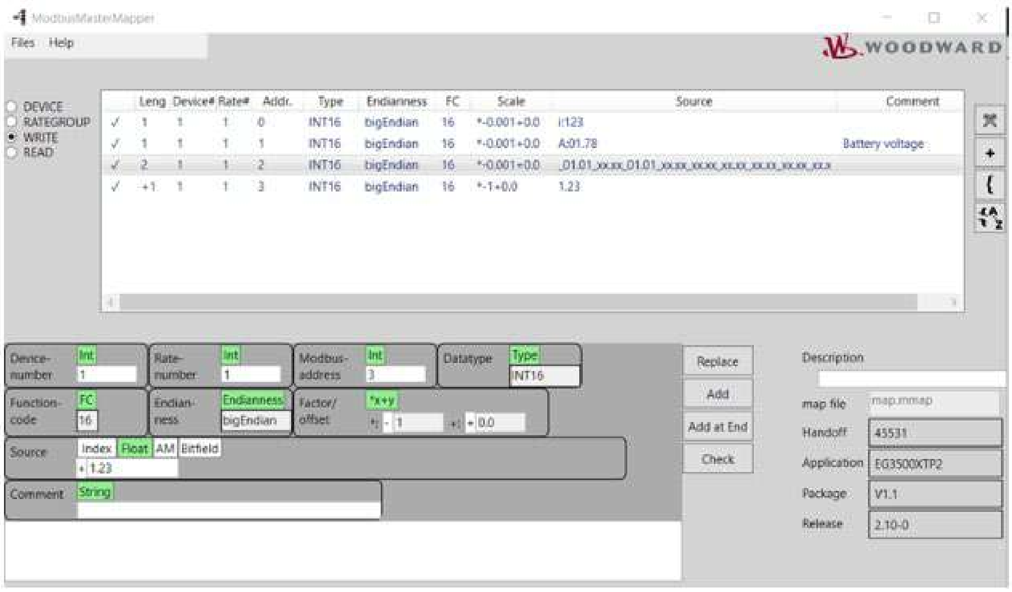
  This is an identification number of the rate group. This is automatically generated. The rate# will be referred to in the READ and WRITE entries.

- Rate

This is the rate time in [s]. A float constant or an Analogmanager value can be used. Range will be clipped to [0.1...100] s.

4.4 Write editor and list

This allows to define a Modbus write command. The Easygen will cyclically issue a Modbus command 16, “write multiple” to write data to a slave device. Lines can be grouped and will then be issued together in one command. The list is always automatically sorted by 1: device#, 2: rate# and 3: Modbus address.



○ DEVICE
○ RATEGROUP
● WRITE
○ READ

	Leng	Device#	Rate#	Addr.	Type	Endianness	FC	Scale	Source	Comment
✓	1	1	1	0	INT16	bigEndian	16	*-0.001+0.0	I:123	
✓	1	1	1	1	INT16	bigEndian	16	*-0.001+0.0	A:01.78	Battery voltage
✓	2	1	1	2	INT16	bigEndian	16	*-0.001+0.0	_01.01_xx.xx_01.01_xx.xx_xx.xx_xx.xx_xx.xx_xx.xx_xx.x	
✓	+1	1	1	3	INT16	bigEndian	16	*-1+0.0	1.23	

Device-number Int 1
Rate-number Int 1
Modbus-address Int 3
Datatype Type INT16
Function-code FC 16
Endian-ness Endianness bigEndian
Factor/offset *x+y *: - 1 +: + 0.0
Source Index Float AM Bitfield + 1.23
Comment String

Description
map file map.mmap
Handoff 45531
Application EG3500XTP2
Package V1.1
Release 2.10-0

- With the button ✂ a WRITE element can be deleted + and with a new WRITE element can be added.
- With the button { selected lines can be grouped. Grouping is only possible when the to be grouped lines have the same device# and the same rate#. See also chapter 4.4.2.
- With the button ⇅ all grouping in the whole list can be reverted. This also sorts all lines following device#, rate# and Modbus address.
- Additionally, a grouping error will be indicated by a "⚠" above the ▲ button. When moving a mouse to there, a textual error description will appear.

When clicking on a line, its content will be shown below on the editor region and can be edited.

- With the buttons Replace Add Check the content of the editor can be transferred to the selected line in the list, or inserted, or checked, as described in chapter 4.2.

4.4.1 Parameters for an entry

- Ok flag

This is an automatically generated flag in the list, indicating that the entry is valid or invalid. It can be "✓" or "⚠". By selecting a line flagged with "⚠" and pressing Check , a diagnosis text will be displayed.

- Length
  This is an automatically generated entry. It is "1" per default and can change when grouping (chapter 4.4.2).
  - If it is "1" this entry constitutes a single Modbus write command.
  - If it is "2", "3" etc. this entry constitutes the first element of a multiple Modbus write command concatenating 2, 3 etc. elements.
  - If it has the form +1, +2 etc. it means that this line is the 2nd, 3rd etc. member of concatenated group.
- Device#
  This is the device#, as defined in the DEVICE list. The range must be in [1 .. # of defined devices]. This defines to which Modbus slave device the here defined write command will be issued to.
- Rate#
  This is the rate# as defined in the RATEGOUP list. The range is [1 .. # of defined rate groups]. This defines in which rate group the here defined write command will be issued to.
- Modbus address
  This is the Modbus address as an integer constant. Zero base Modbus address is used.
- Data type
  This is the data type for the Modbus write like UINT16, INT16, INT32, UINT32 and FLOAT. This defines how the values to be written will be converted and whether the data will be written as 1 word for the 16 bit types or as 2 words else.
- Endianness
  This is the endianness of the 16 and 32 bit integers. This defined how the values will be written via Modbus. Modbus usually uses bigEndian, but there may be situation where littleEndian may be necessary.
- Functioncode
  This is the function code selected for the Modbus data transfer. Function codes 5 (write single coil) or 16 (write multiple holding registers) are supported. In the list it will have a "FC" header. The tool will check for plausibility and issue a warning if incorrect.
- Factor/offset
  This is a scaling formula. In the list it will have a "Scale" header. The system will take the source value and scale it before writing via Modbus. There is no additional checks for data overflow, so if a scaled value exceeds the limits given by the data type, this will be accepted.
- Source
  This is the source of the value to be written. Multiple value types are possible.
  - If it is an index type, the indexed value will be used, scaled and written.
  - If it is a Float type, the direct value will be used, scaled and written.
  - If it is an Analogmanager type, its value will be used, scaled and written.
  - If it is a bitfield type, a value will be constructed, scaled and written. Usually the scaling here shall be set to "*1+0", as it would make no sense otherwise.

- Comment
  This is an optional textual comment. It is only for documentation purposes and can be left empty.

4.4.2 Grouping

To save bandwidth, multiple READ or WRITE to the same device at the same rate group can be grouped to one Modbus command. This can be done by marking a group with shift-leftMouseClick and pressing the { button. The tool will check whether all selected lines have the same rate# and the same device# and, if possible, will group these together. The Length parameter for these will be corrected accordingly, indicating grouping.

Grouping can be reverted by pressing AZ .

Grouping shall be done after all other settings are set up correctly.

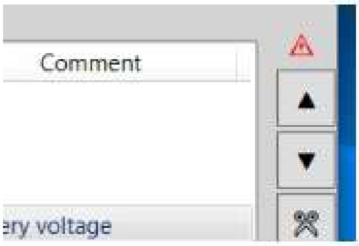
A grouped WRITE command will write all data in its address range. NOTE: As all addresses in the address range of the group will be written to, the gap addresses will be also written, and will be written with zeroes.

Grouping checks

The tool will do grouping checks as following

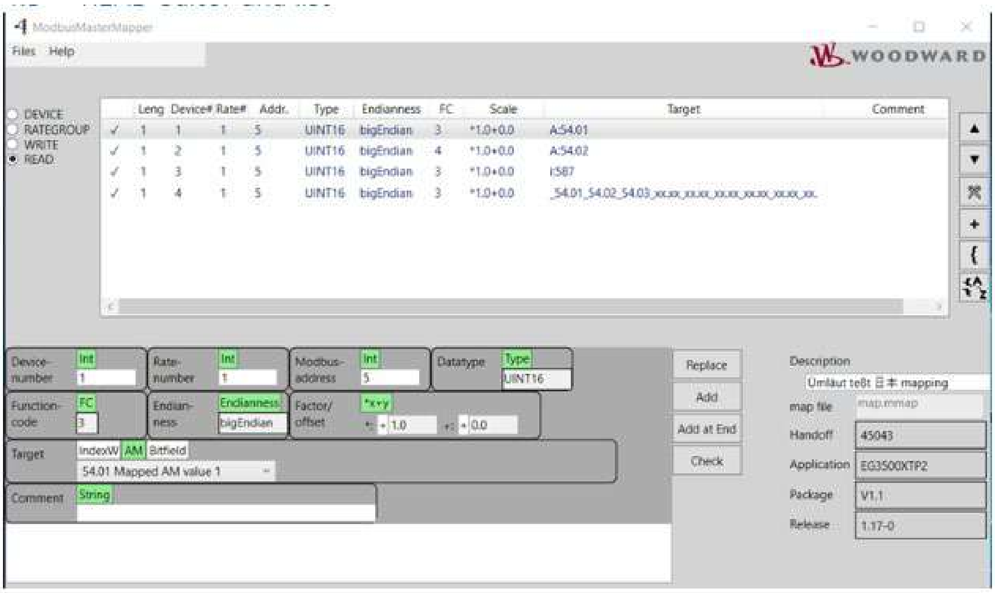
- Check for device# and rate# consistency
  All members in a group must have the same device# and rate#.
- Check for address overlap
  - The elements in a group must not have overlapping Modbus addresses.
  - There must be no overlapping of Modbus addresses to other groups or single elements with the same device#.
- Check for address sequence
  The elements in a group must have their Modbus addresses in ascending order.
- Check for message length
  A Modbus group must not have more than 120 addresses range.
- Check for function code
  The tool will check whether the function code selected fits to the data type. For example: a function code of 5 means a transport of a single data word, and there will be a warning if the command or group has a longer address range than that.

Grouping check will be done each time the list is changed. When the test fails, a ⚠ will appear on top of the buttons on the right of the list.



When moving a mouse to this ⚠, a textual description of the problem will appear.

4.5 Read editor and list



○ DEVICE
○ RATEGROUP
○ WRITE
● READ

	Leng	Device#	Rate#	Addr.	Type	Endianness	FC	Scale	Target	Comment
✓	1	1	1	5	UINT16	bigEndian	3	*1.0+0.0	A:54.01	
✓	1	2	1	5	UINT16	bigEndian	4	*1.0+0.0	A:54.02	
✓	1	3	1	5	UINT16	bigEndian	3	*1.0+0.0	I:587	
✓	1	4	1	5	UINT16	bigEndian	3	*1.0+0.0	_54.01_54.02_54.03_xx.xx_xx.xx_xx.xx_xx.xx_xx.xx_xx.	

Device-number Int 1
Rate-number Int 1
Modbus-address Int 5
Datatype Type UINT16
Function-code FC 3
Endian-ness Endianness bigEndian
Factor/offset *x+y *: 1.0 +: 0.0
Target IndexW AM Bitfield 54.01 Mapped AM value 1
Comment String

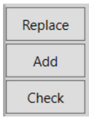
Description Umlaut teßt 日本 mapping
map file map.mmap
Handoff 45043
Application EG3500XTP2
Package V1.1
Release 1.17-0

This allows to define a Modbus write command. The Easygen will cyclically issue a Modbus command 3, “read” to read data from a slave device. Lines can be grouped and will then be issued together in one command. The list is always automatically sorted by 1: device#, 2: rate# and 3: Modbus address.

- With the ▲ ▼ buttons their sequence in the list can be shifted, with ✂ deleted and with + a new READ can be added.
- With the button { selected lines can be grouped. Grouping is only possible when the to be grouped lines have the same device# and the same rate#. See also chapter 4.4.2.

  With the AZ button all grouping in the whole list can be reverted. This also sorts all lines following device#, rate# and Modbus address.
- Additionally, a grouping error will be indicated by a "⚠" above the ▲ button. When moving a mouse to there, a textual error description will appear.

When clicking on a line, its content will be shown below on the editor region and can be edited.

- With the 

buttons the content of the editor can be transferred to the selected line in the list, or inserted, or checked, as described in chapter 4.2.

4.5.1 Parameters for an entry

- Ok flag
  This is an automatically generated flag in the list, indicating that the entry is valid or invalid. It can be "✓" or "⚠". By selecting a line flagged with "⚠" and pressing Check a diagnosis text will be displayed.

- Length
  This is an automatically generated entry. It is “1” per default and can change when grouping (chapter 4.4.2).
  - it is “1” this entry constitutes a single Modbus read command.
  - If it is “2”, “3” etc. this entry constitutes the first element of a multiple Modbus read command concatenating 2, 3 etc. elements.
  - If it has the form +1, +2 etc. it means that this line is the 2nd, 3rd etc. member of concatenated group.
- Device#
  This is the device#, as defined in the DEVICE list. The range must be in [1 .. # of defined devices]. This defines to which Modbus slave device the here defined write command will be issued to.
- Rate#
  This is the rate# as defined in the RATEGOUP list. The range is [1 .. # of defined rate groups]. This defines in which rate group the here defined write command will be issued to.
- Modbus address
  This is the Modbus address as an integer constant. Zero base Modbus address is used.
- Data type
  This is the data type for the Modbus write like UINT16, INT16, INT32, UINT32 and FLOAT. This defines how the values to be written will be converted and whether the data will be written as 1 word for the 16 bit types or as 2 words else.
- Endianness
  This is the endianness of the 16 and 32 bit integers. This defined how the values will be written via Modbus. Modbus usually uses bigEndian, but there may be situation where littleEndian may be necessary.
- Functioncode
  This is the function code selected for the Modbus data transfer. Function codes 3 (read holding register) or 4 (read input register) are supported. In the list it will have a “FC” header. The tool will check for plausibility and issue a warning if incorrect.
- Factor/offset
  This is a scaling formula. In the list it will have a “Scale” header. The system will take the source value and scale it before writing via Modbus. There are no

additional checks for data overflow, so if a scaled value exceeds the limits given by the data type, this will be accepted.

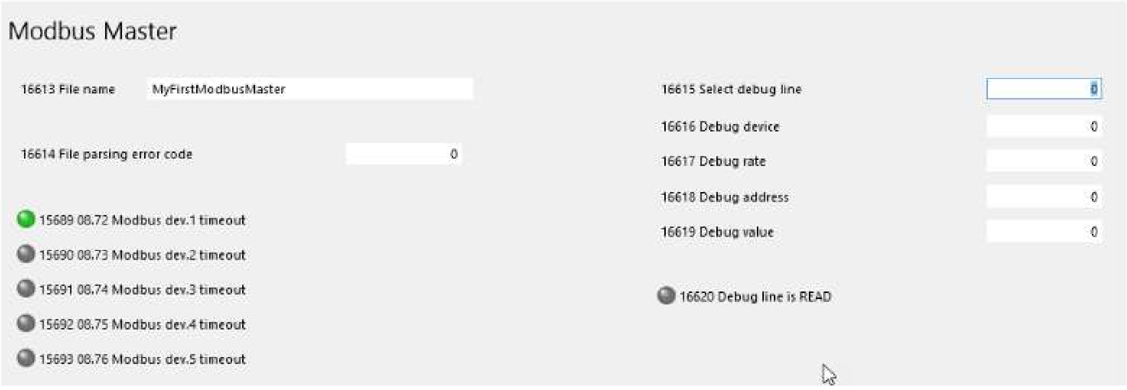
- Target
  This is the target of the value read via Modbus. Multiple value types are possible
  - If it is an indexW type, the read value will be scaled and then written to the indexed value. These indices are prepared to be written to.
  - If it is an Analogmanager type, the read value will be scaled and then written to the Analogmanager values. These Analogmanager values are prepared to be written to.
  - If it is a bitfield type, the read value will be scaled and then the lower 16 bits. Distributed to the selected Logicsmanager values. These Logicsmanager values are prepared to be written to. Usually the scaling here shall be set to “*1+0”, as it would make no sense otherwise.
- Comment
  This is an optional textual comment. It is only for documentation purposes and can be left empty

4.5.2 Grouping

Grouping is done similarly as in the WRITE case and described there (chapter 4.4.2). In the READ case, however, gaps in the Modbus addresses have no influence, the values in the gap addresses will be read but then discarded.

5 Toolkit connection and status

A device (like an Easygen3000) provides in its Toolkit a Modbus Master status screen. This status screen shows the following:



Modbus Master

16613 File name MyFirstModbusMaster

16614 File parsing error code 0

● 15689 08.72 Modbus dev.1 timeout

● 15690 08.73 Modbus dev.2 timeout

● 15691 08.74 Modbus dev.3 timeout

● 15692 08.75 Modbus dev.4 timeout

● 15693 08.76 Modbus dev.5 timeout

16615 Select debug line 0

16616 Debug device 0

16617 Debug rate 0

16618 Debug address 0

16619 Debug value 0

● 16620 Debug line is READ

The following information is available:

16613 File name

The field shows the file descriptor of the mapping description file as defined when creating it. This will be read in at startup. This mapping file defines all Modbus targets the Modbus master communicates to, the rates and the data read and written.

16614 File parsing error code

When the easYgen is booted up it parses and checks the loaded Modbus master mapping file. If a problem occurs an error code larger than 0 is indicated and the Modbus master will not work.

Possible issues are represented with an error number:

- **0:** No error
- **1:** File error: File was not found or could not be opened
- **2:** Not a mapping file: The file is not a Modbus master mapping file or a malformed one.
- **4:** Wrong version of mapping file: The version of the mapping file does not match. This can appear when the file was generated by an older version of the PC tool.
- **8:** Mapping file has wrong checksum: The mapping file was corrupted and is invalid. It has to be newly created.
- **16:** Wrong SIZES statement: This is an internal file error, this shall not happen when the file was correctly created by the PC tool.
- **32:** APPLICATION line wrong in file. The file was created for an application which does not match to the application running on the device. It has to be newly created for this application.
- **64:** RELEASE line wrong in file. The file was created for a software release which does not match to the application running on the device. It has to be newly created for this release.

Modbus Slave Devices 1-5 timeout

The Modbus master informs about slave device timeouts. The timeouts are available as LM command variables.

15689 08.72 Modbus dev.1 timeout
15690 08.73 Modbus dev.2 timeout
15691 08.74 Modbus dev.3 timeout
15692 08.75 Modbus dev.4 timeout
15693 08.76 Modbus dev.5 timeout

Timeouts can happen in the following cases:

- The slave is not answering
- The slave is answering but in a rate slower than defined in the mapping file. This can happen, when the slave is inherently slow or when the mapping was set up in a way that too many requests were scheduled in the scheduled rate time.

16615 Select debug line

This integer input activates a debug mode when a number is entered larger 0. Valid inputs are 0, 1001... and 2001... If set to 1000+x it will only execute the WRITE line x from the mapping file. If set to 2000+x... it will only execute the READ line x from the mapping file. All other reads and writes are suppressed.

This is to allow user in the field to test separately the connections to different targets.

16616 Debug device

This output shows the device number [1..] as defined in the mapping file of the selected debug line command. It is 0, if Select debug line set to 0.

16617 Debug rate

This output shows the rate in [s] of the selected debug line command. It is 0, if Select debug line set to 0.

16618 Debug address

This output shows the Modbus address of the selected debug line command. It is 0, if Select debug line set to 0.

16619 Debug value

This output shows the read or wrote value for the selected Debug line command. When multiple read or multiple write was selected, it shows the first value. It is 0, if Select debug line set to 0.

16620 Debug line is READ

This output is TRUE, if the selected Debug line command was a read, otherwise FALSE. It is FALSE, if Select debug line set to 0.

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