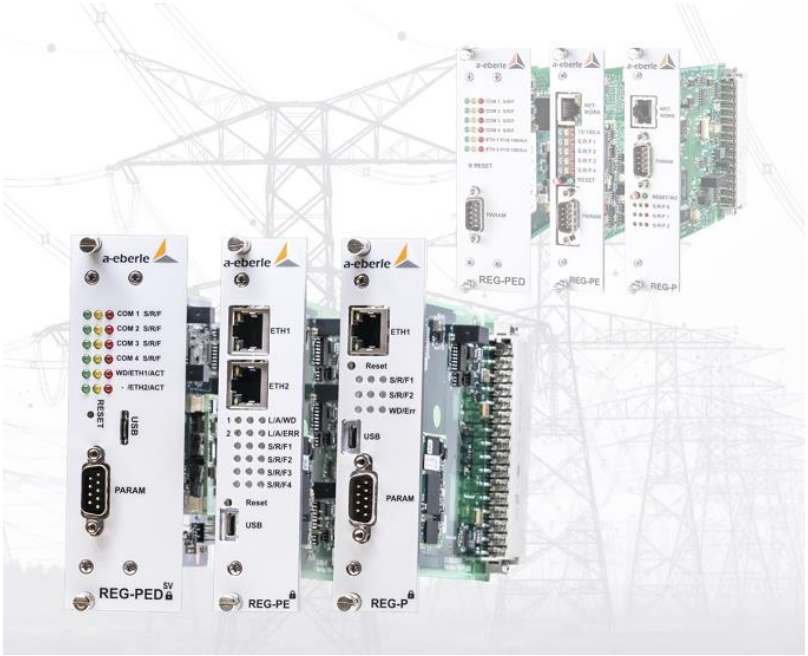
# User Instruction Manual



| Author | Department | Changes | Version | Date |
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| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | Initial release | 0.1 | 15.02.2009 |
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| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | MODBUS modifications | 0.6 | 18.05.2009 |
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| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | Extension to PRP V1 | 10.5.3 | 12.12.2013 |
| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | Extension to Cyber Security Version | 11.0.0 | 23.12.2013 |
| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | Extension with IEC 60870-5-101 | 11.0.1 | 23.05.2014 |

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| | | | | |
|---|---|---|---|---|
| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | Cyber Security adjustable, IEC 61850 Ed. 2 | 11.0.2 | 23.07.2013 |
| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | Extension of IEC 61850 client functionality, Grouping in IEC 60870-5-104 | 11.0.3 | 10.09.2014 |
| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | Various modifications | 11.0.6 | 08.08.2015 |
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| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | RSTP | 11.2.0 | 7.1.2015 |
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| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | REG-P serial transfer hints, extension of IEC104 (GI) | 11.2.1 | 30.3.2015 |
| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | Synchronous time stamps for REG-D log entries and IEC 61850 events, SPA-Bus ring topology | 11.2.2 | 24.11.2016 |
| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | IEC104 modifications, TK28 | 13.0.1 | 11.08.2018 |
| Wolfgang Borchers | wolfgang.borchers@a-eberle.de | IEC104 time synch extension | 13.3.2 | 14.05.2019 |
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# 1. User Guidance

Read the User Manual in its entirety and do not use the product unless you have understood the User Manual.

## 1.1 Warnings

**Structure of the warnings**

Warnings are structured as follows:

| | |
|---|---|
| ⚠ SIGNAL WORD | **Nature and source of the danger.**<br>Consequences in the event of non-observance.<br>Actions to avoid the danger. |

**Types of warnings**

Warnings are distinguished by the type of danger they are warning against:

| | |
|---|---|
| ⚠ DANGER! | Warns of an immediately impending danger that can result in death or serious injuries when not avoided. |

| | |
|---|---|
| ⚠ WARNING! | Warns of a potentially dangerous situation that can result in death or serious injuries when not avoided. |

| | |
|---|---|
| ⚠ CAUTION! | Warns of a potentially dangerous situation that can result in fairly serious or light injuries when not avoided. |

| | |
|---|---|
| NOTICE: | Warns of a potentially dangerous situation that if not avoided could result in material or environmental damage. |

## 1.2 Tips

Tips on the appropriate device use and recommendations.

## 1.3 Other Symbols

**Instructions**

Structure of the instructions:

➲ Instructions for an action.

↳ Indication of an outcome, if necessary.

**Lists**

Structure of unnumbered lists:

- List level 1
  - List level 2

Structure of numbered lists:

1) List level 1
2) List level 1
   1. List level 2
   2. List level 2

## 1.4 Scope of Delivery

- WinConfig Software, available on FTP: ftp://a-eberle-user:eberle@ftp.a-eberle.de/public/SCADA/WinConfig_11/ or at the Download Centre of our Homepage: http://www.a-eberle.de
- User Manual
- RS232 cable
- RPL Loader Software, available on FTP: ftp://a-eberle-user:eberle@ftp.a-eberle.de/public/SCADA/REG-PE(X)-Loader/

# 2. Supported Software

Table 1: Topical software state at the 2017-11-27

| Name | Definitions | |
|---|---|---|
| Date | 27.11.2017 | |
| REG-PE version TK860 | Supported XML settings from WinConfig | |
| Settings can be found in directory /mnt/jffs2/param | XML settings file | settings.xml |
| | other files and directories are only temporary generated from settings.xml after each restart | |
| Images: | Firmware ramdisk:<br>uRamdisk (BusyBox, common libraries and utilities) | |
| | Kernel:<br>kernel.tgz<br>(Linux kernel for TK860) | |
| | TK860_DNP3.tgz<br>TK860_IEC104.tgz<br>TK860_IEC103.tgz<br>TK860_IEC101.tgz<br>TK860_MODBUS.tgz<br>TK860_CSO.tgz<br>TK860_C37118.tgz<br>TK860_IEC61850.tgz<br>TK860_DDAKO.tgz<br>TK860_SPABUS.tgz<br>(protocol specific applications and web pages) | |

| Name | Definitions | |
|---|---|---|
| Date | 27.11.2017 | |
| REG-PED version TK885 | Supported XML settings from WinConfig | |
| Settings set in directory /mnt/jffs2/param | XML settings file | settings.xml |
| | others files and directories are only temporary generated after each start from set-tings.xml | |
| Images: | Firmware ramdisk:<br>uRamdisk (BusyBox, common libraries and utilities) | |
| | Kernel:<br>kernel_16MB.tgz<br>kernel_16MB_SCC4.tgz<br>kernel_32MB.tgz<br>kernel_32MB_SCC4.tgz<br>(Linux kernel for TK885D board with 16 and 32 MB flash) | |
| | TK885_DNP3.tgz<br>TK885_IEC104.tgz<br>TK885_IEC103.tgz<br>TK885_IEC101.tgz<br>TK885_MODBUS.tgz<br>TK885_CSO.tgz<br>TK885_C37118.tgz<br>TK885_IEC61850.tgz<br>TK885_SPABUS.tgz<br>(protocol specific applications and web pages) | |

| REG-PED version TK102 | Supported XML settings from WinConfig | |
|---|---|---|
| Settings set in directory /data/param | XML settings file | settings.xml |
| | others files and directories are only temporary generated after each start from set-tings.xml | |
| Images: | System firmware image:<br>System.fit (kernel, BusyBox, common libraries and utilities) | |
| | TK102_CSO.tgz<br>TK102_DNP3.tgz<br>TK102_IEC101.tgz<br>TK102_IEC103.tgz<br>TK102_IEC104.tgz<br>TK102_IEC61850.tgz<br>TK102_MODBUS.tgz<br>(protocol specific applications and web pages) | |
| | | |

| REG-PE version TK28-4 | Supported XML settings from WinConfig | |
|---|---|---|
| Settings set in directory /data/param | XML settings file | settings.xml |
| | others files and directories are only temporary generated after each start from set-tings.xml | |
| Images: | System firmware image:<br>System.fit (kernel, BusyBox, common libraries and utilities) | |
| | TK28-4_CSO.tgz<br>TK28-4_DNP3.tgz<br>TK28-4_IEC101.tgz<br>TK28-4_IEC103.tgz<br>TK28-4_IEC104.tgz<br>TK28-4_IEC61850.tgz<br>TK28-4_MODBUS.tgz | |
| | | |

| REG-PE version TK28-6 | Supported XML settings from WinConfig | |
|---|---|---|
| Settings can be found in directory /mnt/jffs2/param | XML settings file | settings.xml |
| | other files and directories are only temporary generated from settings.xml after each restart | |
| Images: | Firmware ramdisk:<br>uRamdisk (BusyBox, common libraries and utilities) | |
| | Kernel:<br>kernel.tgz<br>(Linux kernel for TK28-6) | |
| | TK28-6_CSO.tgz<br>TK28-6_DNP3.tgz<br>TK28-6_IEC101.tgz<br>TK28-6_IEC103.tgz<br>TK28-6_IEC104.tgz<br>TK28-6_IEC61850.tgz<br>TK28-6_MODBUS.tgz<br>(protocol specific applications and web pages) | |

| REG-P version TK28-8 | Supported XML settings from WinConfig | |
|---|---|---|
| Settings set in directory /data/param | XML settings file | settings.xml |
| | others files and directories are only temporary generated after each start from settings.xml | |
| Images: | System firmware image:<br>System.fit (kernel, BusyBox, common libraries and utilities) | |
| | TK28-8_CSO.tgz | |
| | | |

Table 2: Firmware REG-P

| Firmware REG-P | | | |
|---|---|---|---|
| REG-P Version TK509 | IEC101 balanced | 25-01-2011 | asciireg101B509V4215.hex<br>Version 42.15 |
| | IEC101 unbalanced | 25-01-2011 | asciireg101U509V4215.hex<br>Version 42.15 |
| | IEC103 | 04-03-2010 | asciireg103_509V4211.hex<br>Version 42.11 |
| | DNP3 | 16-11-2009 | DNP3.hex |
| REG-P version TK517 | IEC101 balanced | 25-01-2011 | asciireg101BEXTV4215.hex<br>Version 42.15 |
| | IEC101 balanced | 25-01-2011 | asciireg101BINTV4215.hex<br>Version 42.15 |
| | IEC101 unbalanced | 25-01-2011 | asciireg101UEXTV4215.hex<br>Version 42.15 |
| | IEC101 unbalanced | 25-01-2011 | asciireg101UINTV4215.hex<br>Version 42.15 |
| | IEC103 | 03-03-2010 | asciireg103_EXTV4211.hex<br>Version 42.11 |
| | IEC103 | 10-03-2010 | asciireg103_INTV4211.hex<br>Version 42.11 |
| | DNP3 | 02-10-2012 | DNP3EXT.hex |
| | DNP3 | 02-10-2012 | DNP3INT.hex |
| REG-P version TK400 | IEC101 balanced | 25-01-2011 | ASCIIReg101B400V5213.hex<br>Version 52.13 |
| | IEC101 unbalanced | 25-01-2011 | ASCIIReg101U400V5213.hex<br>Version 52.13 |
| | IEC103 | 12-01-2012 | ASCIIReg103_400V5216.hex<br>Version 52.16 |
| | DNP3 | 23-07-2012 | DNP3.hex |
| | CSO | 16-11-2009 | CSOv6007.hex<br>Version 60.07 |
| PQI-DA (TK400) | CSO | 16-11-2009 | CSOv6007.hex<br>Version 60.07 |

# 3. Introduction

The *User instruction manual* is focused to the configuration of telecontrol boards REG-P / REG-PE / REG-PED / PQI-DA using DNP3, IEC101, IEC103, IEC104, Modbus, 61850, C37.118 communication protocols and Ethernet/COM in connection with XXXSysTM devices (e.g. REGSys™ or EORSys devices) of a.eberle company. For security and other information see the *Administrator manual*.

To understand the ideas and techniques described, you should already be familiar with general concepts concerning the above stated protocols and serial communication settings.

Two methods of configuration may be used: either “online” with connection to the REG-PE, REG-PED and TK28-8, or “offline” using a PC-tool called WinConfig Tools.

The web server is a permanent part of the firmware of the REG-PE / REG-PED devices and requires no special installation.

Web server is also part of the WinConfig offline version.

# 4. Glossary

| | |
|---|---|
| Combo-Box | A text box combined with a List Box within a software program |
| FTP | File Transfer Protocol |
| Group-box | A named rounded box typically enclosing a group of one or more buttons |
| GUI | Graphical User Interface |
| HTTPS | Hypertext Transfer Protocol Secure |
| IOA | Information Object Address |
| SCADA | Supervisory Control And Data Acquisition |
| VM | Virtual Machine |
| TSDU | Telegram Service Data Unit |
| XML | Extensible Markup Language |

# 5. WinConfig REG-P / REG-PE / REG-PED /REG-PEDSV

## 5.1 WinConfig Software introduction

WinConfig is software for managing of firmware and communication protocol settings of telecontrol boards and modules: REG-P / REG-PE / REG-PED / REG-PEDSV placed into a.eberle device racks. WinConfig is a web-based program for creation and management of files containing protocol settings, for two way transfer of settings and firmware from a user PC to REG-P / REG-PE / REG-PED / REG-PEDSV boards and modules, and for identification of REG-P / REG-PE / REG-PED / REG-PEDSV devices connected to the network.

Telecontrol board firmware has to be equipped with COM-Server to identify itself within the network. COM-Server is part of all IEC101, IEC103, and IEC104 protocols installed as firmware and accessible by the WinConfig environment. COM-Server cannot work in TK519 and TK509 REG-P types, because Ethernet connections are not available with these board types.

WinConfig program equipment consists of web server Mohican equipped with active pages for GUI and libraries developed in C# .NET software development environment for communication with telecontrol boards, file services and additional auxiliary functions.

WinConfig prepares settings for REG-P / REG-PE / REG-PED / REG-PEDSV with IEC101, IEC103, IEC104, DNP3 , Modbus, C37118 and IEC61850 protocols and COM-Server on a local host (local web server) and stores them in a standard file format - .XML file. The settings file can then be transferred via HTTPS to board flash memory in the case of board types containing Linux. WinConfig creates binary data files in Intel HEX format and transfers them into the board memory in the case of non-Linux boards. Serial transfer via a.eberle device or Ethernet transfer can be used according to the REG-P type.

A part of configuration software is also transferred to the telecontrol board and this *online* part provides a system functions focused to the management of telecontrol board system software, user management etc. with high level of security. The functionality of this part of WinConfig is described in the Administrator manual.

WinConfig splits into two main parts: the local web server and the local Web site with application libraries. Settings may be prepared, stored and retrieved for various configurations without a direct link to the device.

Settings are saved in .xml file types. WinConfig launches a local web server and a default web browser on your PC.

Should one of the expressions used in this document be unclear to you, you may refer to the glossary chapter for an explanation of it. Otherwise please feel free to contact us with your technical questions at this email address: info@a-eberle.de.

## 5.2 REG-PEX Loader software

The REG-PEX loader (RPL) is software tool for transfer of Linux Kernel and RAM disk into the REG-PE(D) and PQI-DA telecontrol boards equipped only with U-Boot software. Such boards cannot cooperate directly with WinConfig. The RPL also allows change of board IP settings and selection of kernel with/without the bonding feature.

| NOTICE: | The RPL is low-level software tool and should be used by advanced users only. |
|---|---|

The RPL software is contained in the WinConfig installation package and can be launched from *Transfer from PC* page by the *Run RPL* button. The WinConfig also offers launch of RPL in the case when no REG-PE(D) telecontrol board is detected.

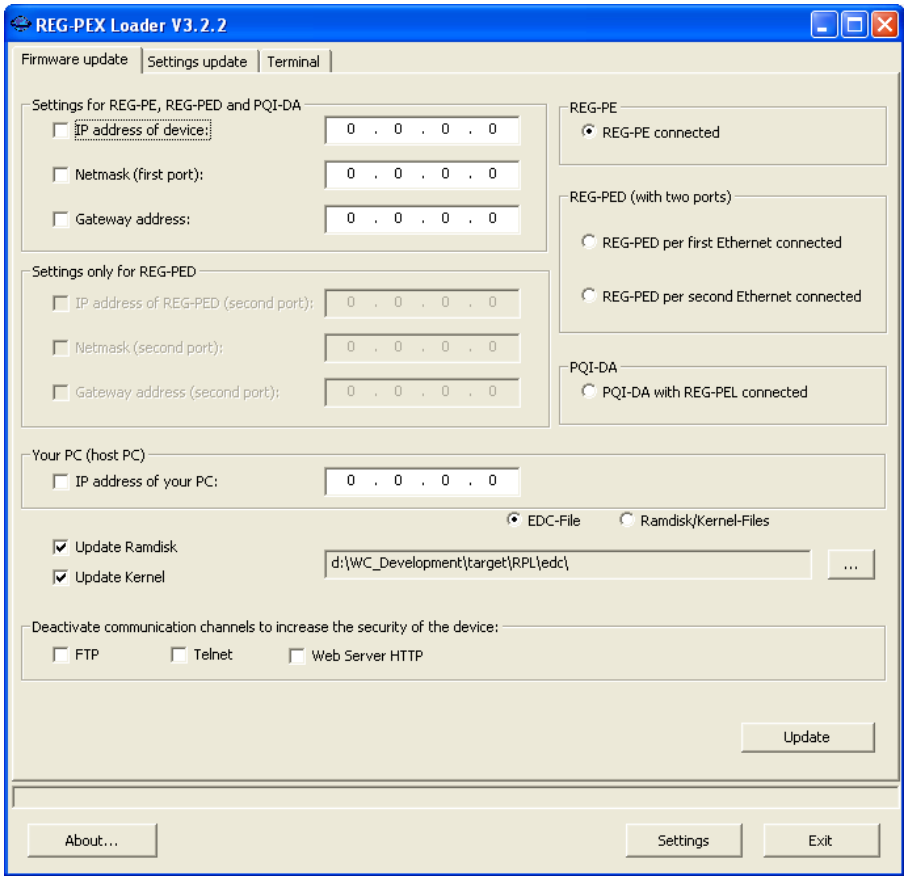



*Figure 1: The RPL window*

To transfer Linux Kernel and RAM disk into the REG-PE(x) follow these steps:

- Connect the PARAM connector of REG-PE(x) board and your computer with the RS232 cable supplied with the eberle device or with any serial null modem cable.
- Connect your computer and the REG-PE(x) board by Ethernet cable. Some Ethernet adapters do not switch to the correct mode automatically, so please use preferably a crosslink patch cable.
- Fill the IP address lines in RPL window.
- Use the (...) button to browse the edc file placed in the WinConfig installation folders. There are two edc files distributed in the WinConfig setup, the difference is in the versions of Kernel - with/without support of bonding. Select whatever of the two files as bonding and related features can be set later using the *Change of IP settings for REG-PE(D) telecontrol boards* WinConfig function.
- Press the *Update* button. The update process can be seen in the RPL tab *Terminal*.

## 5.3 Communication with REG-PE(D) telecontrol board in WinConfig 13

A higher level of security for data transfer and communication with REG-PE(D) telecontrol board is used in WinConfig v.13. The online WinConfig (www pages placed in the board memory) can be disabled in the *Transfer settings from PC* page in offline WinConfig or in the *REG-PE(D) board IP settings* page in online WinConfig or in user menu.

The new firmware supports several functions as described below.

The following secured communication technologies are used in WinConfig 13:

- SFTP (SSH file transfer protocol) replaced the online WinConfig. The v.11 firmware supports several functions focused to file transfer. The file transfer via SFTP protocol is encrypted and protected by user login and password; *remoteuser* login can be used with *remoteuser* password (factory default).
- SSH is used instead of former telnet for remote access to console. This access is typically used for basic board configuration. A SSH client (e.g. PUTTY) is necessary for this type of connection.
- HTTPS (HTTP over SSL) together with SSL certificates is used for communication between off-line WinConfig and telecontrol board.

*Note on HTTPS accounts functionality when upgrading/downgrading from/to WinConfig 10*

When user upgrades from WinConfig 10 to 13 using offline WinConfig, one of the HTTPS accounts (username and password) from version 10 (passwords coded by XOR, not by SHA2 hash) is used. The accounts defined in the version 10 coded by XOR remain in the upgraded version 13. The individual account is changed to the new SHA2 coding version in the moment when user changes this account in the WinConfig 13.

The file with SHA2 coded accounts remains in the telecontrol board when downgrading from version 13 to version 10. Offline WinConfig 10 using XOR password coding will not work in such case. To solve such situation, the user can change the accounts using FTP or serial PARAM port or to delete the account file /mnt/jffs2/config/webs_users.conf. When the file is deleted, the default account will be used.

### 5.3.1 SFTP access

A SFTP (SSH file transfer protocol) client program has to be used for connection with telecontrol board and for transfer of files between board and PC computer, e.g. WinSCP for MS Windows, GFTP for MS Windows and Linux or, possibly, SFTP (PSFTP) for the command line mode.

The following files can be found in the board memory and transferred to PC:

- current XML settings
- ICD file for 61850 protocol
- files with information about hardware, SW version, system kernel log etc.

The XML settings and ICD file are placed in the */xload/actual* folder and files with information about HW etc. are placed in the folder */xload/info.*

The XML settings and ICD file can be replaced and thus new configuration can be installed using SFTP. It is also possible to transfer SSL certificates with key that are used for HTTPS communication with WinConfig or to change debugging (logging) parameters as defined in the *Supervisory* page of WinConfig. The debugging (logging) parameters can be changed without need of board restart. However, the most of parameter changes require restart of board that can be also done via SFTP.

Use always the */xload/new* folder when transferring files from PC to board. The */xload/new* folder is scanned by firmware approximately every 20 seconds and firmware starts required action in the case when relevant files are found in the folder.

### 5.3.2 Actions supported by firmware and their usage:

**Restart of board**

- Prepare empty file named *reboot* and copy it in the */xload/new* folder.
- Wait approx. 20 s for the automatic restart of board.

**Installation of new XML settings and ICD file**

- Prepare new settings file named *settings.xml* and copy it in the */xload/new* folder.
- Prepare new ICD file (if ICD change is required) and copy it to the folder.
- Prepare empty file named move and copy it.
- Wait approx. 20 s for the automatic move and installation of the files.
- Prepare empty file named *reload* and copy it.
- Wait approx. 20 s for the automatic reload of files transferred in the previous sequence. Reload can be used if there was change in the supervisory parameters only. Otherwise use *restart*, see item.

### 5.3.3 SSH access

SSH is used for remote access to console. The file transfer is encrypted and protected by user login and password; *remoteuser* login can be used with *remoteuser* password.

The access is driven by sequence of user menu that allow user to show and/or change the board settings of to show logs of kernel, system and applications.

#### 5.3.3.1 Menu and meaning of individual items:

The configuration of menu depends on the logged user and his rights.

**Main menu**

1) Network menu

➲ *Go to menu for network setting and diagnostic*

2) Services menu

➲ *Go to menu administration of network services (SSH/SFTP, HTTPS)*

3) Log menu

➲ *Go to menu showing logs*

4) Change terminal password

➲ *Change of SSH and SFTP passwords. Change is applied to the currently logged user. Program asks for entering of old password and two times new password.*

| NOTICE: | *Attention, a change is applied immediately.* |
|---|---|

5) HTTPS users management

➲ *Go to administration of HTTPS users (off-line WinConfig)*

6) Logout

➲ *Terminal logout*

7) Reboot

➲ *Restart telecontrol board*

8) Recovery menu

➲ *Go to recovery mode. This menu item is shown only in the case of access via local serial port. Another condition is that the board has to be prepared for the recovery mode (the R key is pressed in the moment or recovery notification during the card restart).*

9) Start root shell

➲ *The root shell is determined only for administrators and is not available for remoteuser and localuser.*

**Network menu**

1) Ping ICMP

➲ *The ICMP ping is determined for the diagnostic of network connection. The system asks for counterparty IP. The ICMP echo-request packet is used. The user network interface is determined by routing table.*

2) Ping ARP

➲ *The ARP ping is determined for the diagnostic of network connection within one subnet. The system asks for counterparty IP and, if there is more network interfaces (TK885), it asks also for the interface to be used. This ping usually passes through firewall. The ARP protocol is not routed to other networks.*

3) Show routing table

➲ *Shows current routing table.*

4) Show interfaces

➲ *Shows current list of network interfaces with parameters (IP address, mask, MAC address and statistics of sent and received data).*

5) Show saved network parameters (IP addresses, bonding)

➲ *Shows network parameters (IP address, mask, gateway, state of bonding) saved in the flash memory. These parameters will be used after board restart.*

6) Set network parameters (IP addresses, bonding)

➲ *Setting of network parameters (IP address, mask, gateway, state of bonding) solved as a series of questions and answers. Possible options of bonding parameters:*

   1. Disabled
   2. PRP V1
   3. Broadcast mode
   4. Bridge with RSTP

7) Back

➲ *Go to main menu.*

**Services menu**

1) Services state

➲ *Shows the state of SSH/SFTP and HTTPS services (enabled or disabled).*

2) Enable SSH/SFTP

➲ *Enables SSH/SFTP service. The change takes effect after board restart.*

3) Disable SSH/SFTP

➲ *Disables SSH/SFTP service. The change takes effect after board restart.*

4) Enable WinConfig (https, network detect)

➲ *Enables services necessary for the communication with off-line WinConfig. The change takes effect after board restart.*

5) Disable WinConfig (https, network detect)

➲ *Disables services necessary for the communication with off-line WinConfig. The change takes effect after board restart.*

6) Enable WinConfig WWW pages

➲ *Enables WinConfig WWW pages.*

7) Disable WinConfig WWW pages

➲ *Disables WinConfig WWW pages.*

8) Back

➲ *Go to main menu.*

| NOTICE: | **Attention:**<br>When both SSH/SFTP and HTTPS accesses are disabled, it is not possible to connect the board remotely. The local access via PARAM port only is possible in such case. |
|---|---|

**Log menu**

1) Application and system log

➲ *Shows log with messages from system and from user applications.*

2) Kernel log

➲ *Shows log with messages from system kernel.*

3) Back

➲ *Go to main menu.*

**HTTPS users management menu**

1) List users

➲ *Shows list of user accounts for HTTPS service (users of off-line WinConfig).*

2) Change user password

➲ *Changes user password. The service asks for old password and two time for the new password. The change takes effect after board restart.*

3) Add new user

➲ *Adds a new user account. The service asks for new account name and two times password. The change takes effect after board restart.*

4) Delete user

➲ *Deletes existing user account. The service asks for existing user account name. The change takes effect after board restart.*

5) Back

➲ *Go to main menu.*

**Recovery menu**

1) Reboot and format applications part of firmware

➲ *Sets the formatting flag and performs board reset. Attention, this service formats the jffs2 area without possibility of recovery. This service is determined for emergency situations only, when the board stuck and there is no other possibility of fix. The off-line WinConfig can be consequently used for transfer of new firmware.*

2) Back

➲ *Go to main menu.*

## 5.4 Communication with telecontrol boards type TK28x and TK102

Communication with these board types utilizes special security measures using Radius and Active Directory. For more information see Administrator manual.

## 5.5 Time synchronization

Time synchronization methods available for telecontrol boards and communication protocols consist of the following possibilities and options:

- synchronization by communication protocol
- synchronization using NTP server
- synchronization using Precision Time Protocol (PTP)

### 5.5.1 Synchronization by communication protocol

If the communication protocol used in telecontrol board allows time synchronization messages then such option is available in protocol parameters.

Protocols with time synchronization availability: DNP3, IEC101, IEC103

### 5.5.2 Synchronization using NTP (Network Time Protocol) server

Synchronization using NTP server is available in the case Ethernet protocols:

IEC104, MODBUS, IEC61850, C37.118. The IEC61850 and C37.118 has also DCF77 synchronization available in certain cases.

### 5.5.3 Synchronization using PTP

The time synchronization using PTP is implemented for the boards type TK28x and TK102.The default configuration file is prepared to set up the profile according to the standard IEEE P37.238, PTP Power Profile. The characteristic properties of this profile are set this way:

- Slave only, one-step
- Delay Mechanism: Peer-to-Peer
- Transport Mechanism: Layer 2
- PTP Domain: 0
- Sync Interval: 1s (= 2^0 s)
- Min pdelay request interval: 1s (= 2^0 s)
- Announce Interval: 1s (= 2^0 s)
- Announce receipt timeout: 3s

- Priority 1: 255 (Slave clock)
- Priority 2: 255 (Slave clock)

The PTP parameters are available in the Time synchronization settings for the above mentioned boards and network protocols.

For more information about PTP see the IEEE 1588 standard.

#### 5.5.3.1 Reported status of PTP

The current PTP status can be shown in the *Time synchronization* tree branch.

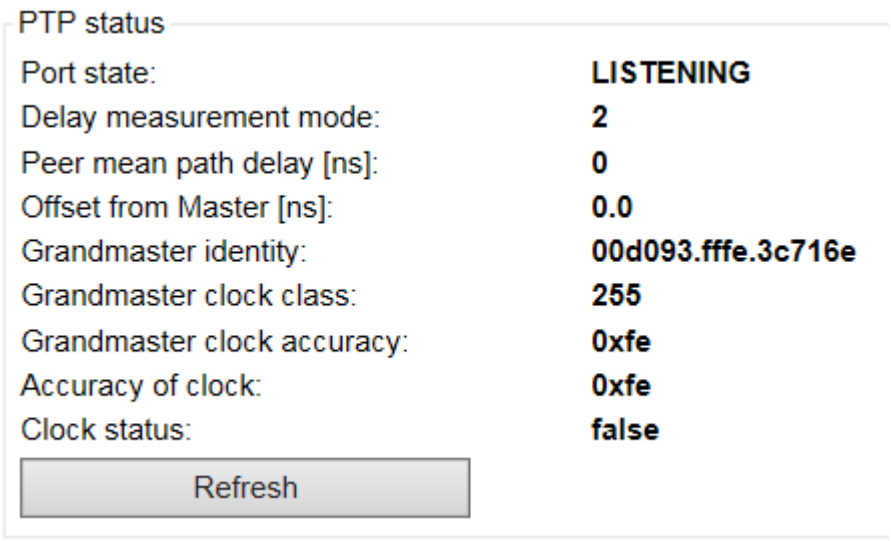



*Figure 2: PTP status*

Table 3: Port states

| State | Description |
|---|---|
| **slave** | Configures the 1588v2 interface to be in the slave state. That is, the 1588v2 device keeps track of external time information. There can be only one slave port in a 1588v2 device. |
| **passive** | Configures the 1588v2 interface to be in the passive state. That is, the 1588v2 device neither keeps track of external time information, nor advertises time information. The port shall not place any messages on its communication path except for Pdelay_Req, Pdelay_Resp, Pdelay_Resp_Follow_Up, or signaling messages, or management messages that are a required response to another management message. If more than one master ports have been detected in the domain, the best one will be selected to be master. The corresponding local port will be slave, and other local ports will be passive to backup for slave ports. |
| **master** | Configures the 1588v2 interface to be in the master state. That is, the 1588v2 device advertises time information to other devices. |

| State | Description |
|---|---|
| **premaster** | Configures the 1588v2 interface to be in the premaster state. The port shall not place any messages on its communication path except for Pdelay_Req, Pdelay_Resp, Pdelay_Resp_Follow_Up, or signaling messages, or management messages that are a required response to another management message. |
| **listening** | Configures the 1588v2 interface to be in the listening state. That is, the 1588v2 device neither keeps track of external time information, nor advertises time information. (If a device originally functioning as a master clock is configured to be an OC working in slave-only mode, or if the device becomes faulty, the status of the 1588v2 interface on the device changes from master to listening.) |
| **faulty** | Indicates that the 1588v2 interface is Down. The port shall not place any messages on its communication path except for response messages to some management messages. |
| **disabled** | Configures the 1588v2 interface to be in the disabled state. The port shall not place any messages on its communication path. A port in this state shall discard all received 1588v2 messages except for management messages. |
| **initializing** | Configures the 1588v2 interface to be in the initializing state. While a port is in the initializing state, the port initializes its data sets, hardware, and communication facilities. No port of the clock shall place any 1588v2 messages on its communication path. |

The desired PTP port state when the PTP is switched ON and correctly synchronized is ***slave***. Other states that can appear indicate other than synchronized state.

# 6. Serial ports assignment

The Serial ports assignment tree branch is tool for management of telecontrol board serial ports for boards type TK860 and newer. The serial ports available in telecontrol board are well-arranged in table together with the information about their usage in protocols and COM-Server channels. The page contains also internal checks to avoid conflicts in usage of COM ports. At the same time, the table also allows to switch ON/OFF individual protocols or COM-Server channels.

The assignment of serial ports differs for telecontrol boards type TK28x and TK102 due to addition of WebREG functionality.

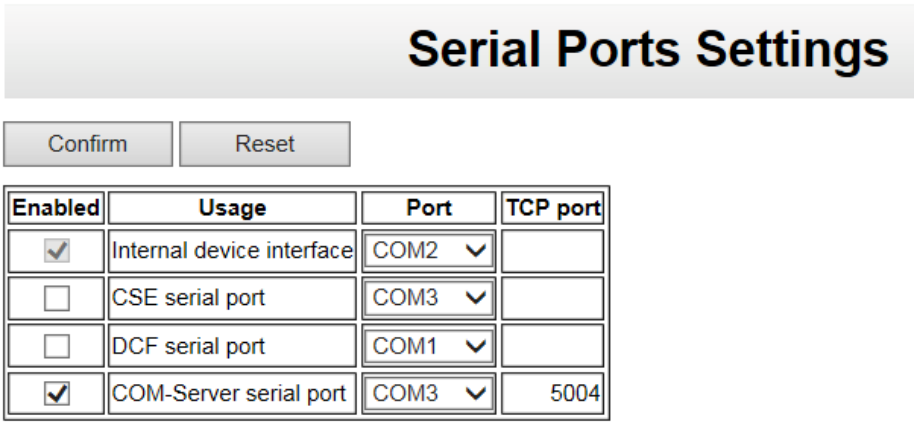



*Figure 3: Serial Ports Settings REG-PE(D)(IEC61850)*

Table 4: REG-PE(D) Serial Ports Settings (IEC61850)

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Enabled | checkbox | ON/OFF | | Checkbox enables/disables corresponding protocol (COM-Server channel) |
| Usage | text | - | | Definition of corresponding protocol /COM-Server channel (read only) |
| Port | - | Selection of val-ues in combo box | | Selection of corresponding COM port |
| TCP port | - | - | | TCP port used by CS channels (read only) |

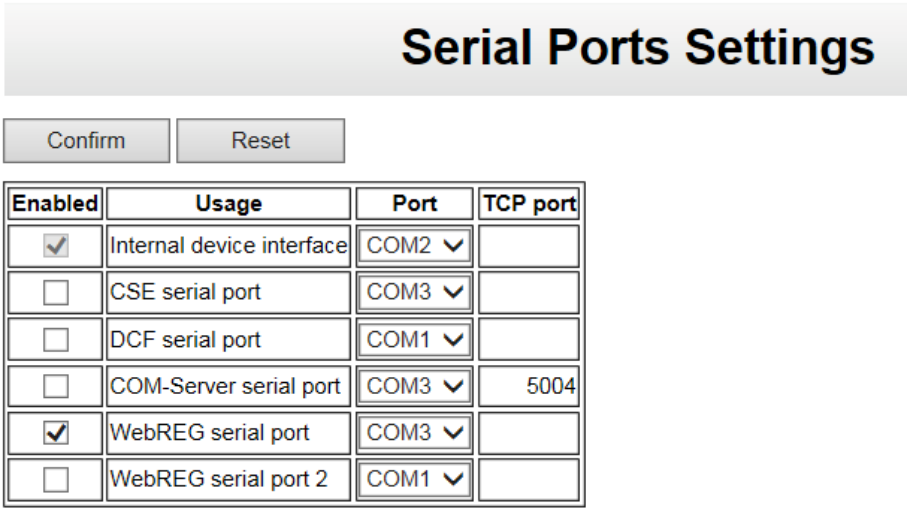



*Figure 4: Serial Ports Settings TK28x, TK102 (IEC61850)*

# 7. Supported protocols and telecontrol board types

Table 5: Supported protocols and telecontrol board types

| Telecontrol board types | Available protocols | Protocols Accessible via |
|---|---|---|
| REG-PE(D) (TK860, TK885) | IEC104; DNP3; Modbus; IEC103; IEC61850; ComServer only (CSO); C37.118, SPA-BUS | |
| PQI-DA(TK885-1) | CSO, IEC61850, IEC104, IEC104 | |
| REG-P (TK509, TK517) | IEC101 balanced; unbalanced; IEC103, DNP3 | Serial (Write only) |
| REG-P (TK400) | IEC101 balanced, unbalanced; IEC103; DNP3; CSO | Serial *(Write only) and Com Server (Read and Write) |
| REG-P (TK28-4) | CSO<br>DNP3<br>IEC101<br>IEC103<br>IEC104<br>IEC61850<br>MODBUS | Serial *(Write only) and COM-Server (Read and Write) |
| REG-PE (TK28-6) | CSO<br>DNP3<br>IEC101<br>IEC103<br>IEC104<br>IEC61850<br>MODBUS | |
| REG-PE (TK28-8) | CSO | |

| Telecontrol board types | Available protocols | Protocols Accessible via |
|---|---|---|
| REG-PEDSV (TK102) | CSO<br>DNP3<br>IEC101<br>IEC103<br>IEC104<br>IEC61850<br>MODBUS | |
| PQI-DA (TK400) | CSO | Serial *(Write only) and COM-Server (Read and Write) |

Further protocols can be implemented on demand, please contact: info@a-eberle.de.

# 8. Introductory window

The following introductory window should appear on your screen after WinConfig is started. The following user actions are available from this screen:

- Select WinConfig language from the combo box in the upper right corner of the window.
- Run the standard setting and data transfer wizard from the *Step-by-Step* button.
- Run complete WinConfig from the *Advanced* button.
- Quit WinConfig using the *Quit* button.

*Figure 5: Introductory window*

| NOTICE: | **Important note:**<br>If user tries to run WinConfig from read-only medium (CD, DVD), a warning message appears instead of the introductory window. |
|---|---|

# 9. Work with protocol settings

WinConfig can be used for creation and modification of communication protocol settings. If the settings file was created by a previous version of generator (e.g. GenReg, INI file) then WinConfig can be used also for conversion of INI file to the XML file of settings used by WinConfig.

The communication protocol settings file can be transferred into the memory of the tele-control board. WinConfig always appends corresponding firmware code to the settings thus the matching pair of settings and code is always transferred as a pair.

The user can also read the settings from the telecontrol boards and show the settings in the WinConfig window using the transfer to PC function. This function is not available for TK509 telecontrol boards.

## 9.1 Settings tree

WinConfig can have more than one settings open; all settings are shown in tree structure in the left frame of WinConfig window.

The selected settings have an orange background.

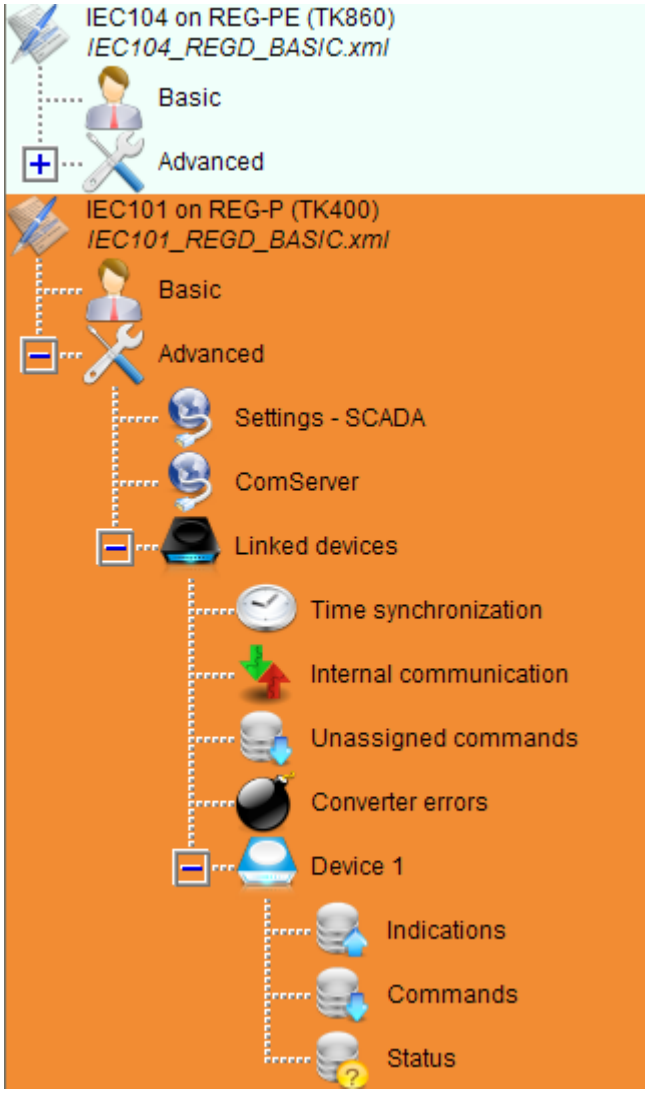



*Figure 6: Settings tree*

Each setting can be drilled down to sets of editable pages. Clicking the text in the tree structure selects the corresponding page in the right frame of WinConfig window.

## 9.2 Main menu buttons

- *New* – create new settings based on a default template. User has to enter desired telecontrol board type, protocol, SCADA and device template. WinConfig creates new settings according to the selected options. If the selected SCADA and device template are not defined in WinConfig, a default template will be used instead. (Default settings are based on successful experience in the field and should only be changed if there is good reason to do so).
- *Open* – open existing XML settings file or open then convert an existing INI settings file to the newer XML settings format. User has to enter/browse the required settings file and enter the target type of the telecontrol board in case of conversion from the older INI format.

- *Remove* – remove selected settings from the tree in the WinConfig window. Selected settings are marked with an orange background. To select settings click the root node of the settings in the tree (e.g. DNP3 on REG-P (TK400))
- *Save* – save the selected settings to the XML file on local disk.
- *Compare* – comparison of settings in XML files with results stored in Microsoft Excel XLS file.
- *Export* – export of selected settings to a Microsoft Excel XLS file.
- *Transfer to PC* – transfer settings from a connected telecontrol board to WinConfig as described above.
- *Transfer from PC* – transfer selected settings from WinConfig to the connected telecontrol board as described above.

*Figure 7: Main menu buttons*

### 9.2.1 New settings

To create new settings from an existing template, please click *new* button. Select board type, protocol, SCADA template and devices template from combo boxes shown below then click the *Add* button. These newly created settings will appear in the settings tree.

The setting templates are divided into two editions in the case of IEC 61850 protocol. The edition of template can be chosen in the *Template edition* listbox. This listbox is disabled in the case of other protocols.

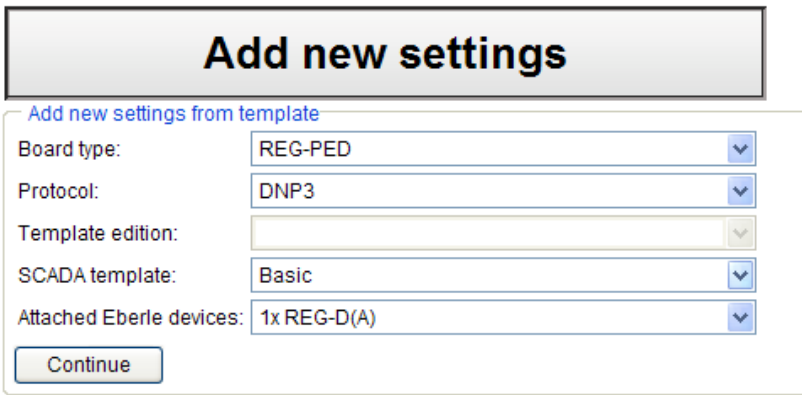



*Figure 8: Add new settings*

**Predefined templates**

Valid workable combinations of board type / protocol / SCADA_template / Devices template are pre-defined in WinConfig. However, the default template files, which can be created, exist only for valid combinations already used and known.

If a template for a given combination is not available, a warning message will appear onto the screen:

**Template file isn't implemented for chosen combination protocol/SCADA/Eberle devices! Default template will be used!**

If the Continue button is pressed apart from invalid combinations, a default template will be used to create the new set of settings. Default templates typically contain basic configurations without pre-defined data points or commands.

### 9.2.2 Open, conversion from INI, import from Excel

**Open Settings from file (XML settings)**

In Order to open an existing XML settings file, convert an existing INI file or import a WinConfig-exported Excel file, please click the Open button. To open existing settings please browse the settings file by using the Browse button and then click the Open button in the Open settings from file Group-box

**Convert settings from GenReg "*.ini" file**

To convert settings from GenReg INI format, browse the file by using the Browse button, select required telecontrol board type from combo box and click the Convert button in the Convert settings from GenReg “*.ini” file frame. WinConfig will automatically detect the protocol described in the INI file and converts the settings to a suitable format for the required board type.

**Import settings from WinConfig-exported Excel file**

To import settings from WinConfig-exported Excel file, browse the file by using the Browse button and click Import button in the Import settings, from WinConfig-exported Excel file frame.

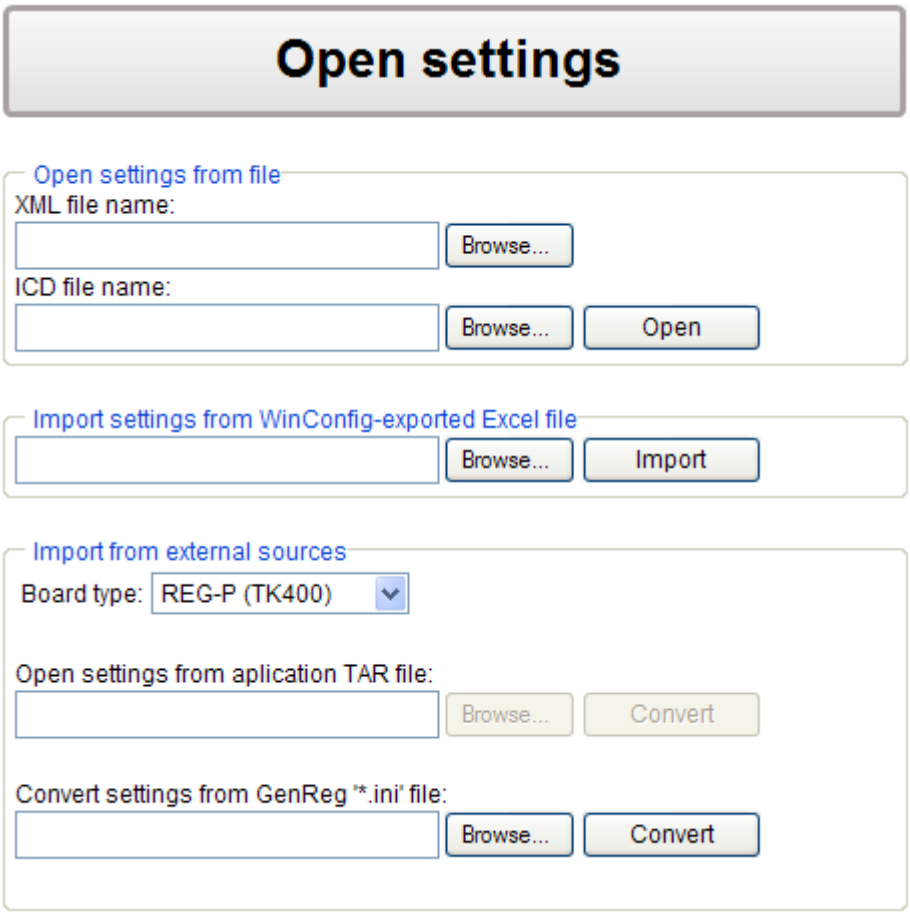



*Figure 9: Open settings*

### 9.2.3 Remove, Save

- Click the Remove button to remove the selected settings from the settings tree.
- Click the Save button to save selected settings to a WinConfig XML settings file. Select folder and type the settings file name in the dialog box.

## 9.3 Compare settings function

Two compare modes can be found on the WinConfig Compare settings page. Select the desired mode in the Compare mode frame.

**Compare selected settings with settings file**

➲ To compare a pair of settings browse two xml setting files to compare, and then click the Compare button.

**Compare two settings files**

➲ To compare a currently selected settings with an xml setting file browse this file and click the *Compare* button.

Results of the comparisons are available in a Microsoft Excel xls file that is created from this comparison. Individual sets of settings are arranged in individual sheets in Excel workbook. Differences can be seen colored in the Excel sheets. Black fonts are used for matching pairs of settings, magenta fonts for different pairs and red fonts for missing settings.

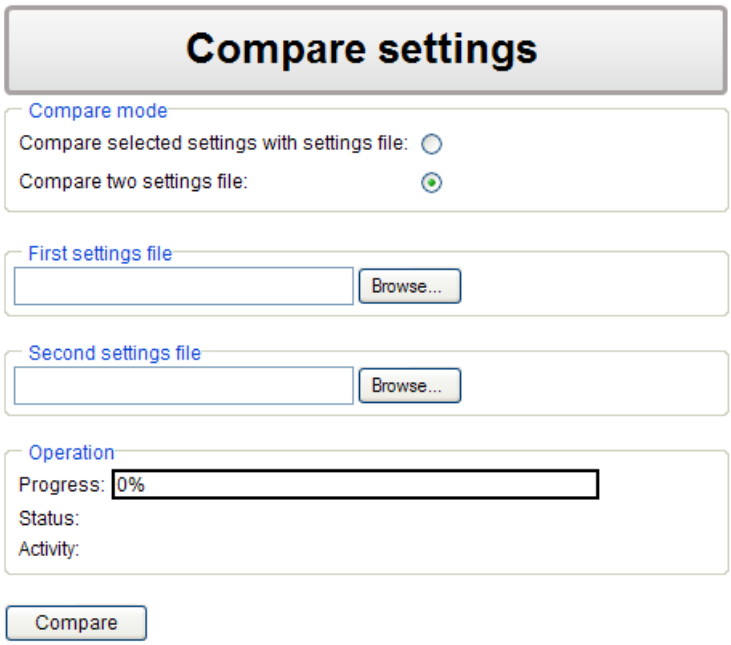



*Figure 10: Compare settings*

The third compare mode implemented in WinConfig is comparison of the selected settings with settings contained in the connected telecontrol board. This function is available in the Transfer settings to PC page as Compare to selected settings button. It is necessary to detect the board first in the case of remote mode. The rules of comparison are same as described above. This functionality cannot be used with TK509 telecontrol boards where Transfer settings to PC functionality are not available.

## 9.4 Rules for export/import using Microsoft Excel

### 9.4.1 Export to Excel

**Ways of export:**

- Commands only of selected device from *Commands* page
- Indications only of selected device from *Indications* page
- Entire selected settings using *Export* icon in the main menu.

Data is exported into the new file winconfig-exportxx.xls placed in the system temp folder.

Individual parts of exported data are placed in individual sheets of Excel workbook, i.e. commands of each device and indications of each device are placed in corresponding sheets, e.g. sheet of indications of device A: is named *x. device A indications* and commands sheet is named *x. device A commands* (where x is the device order number). The character ":" in device name is skipped as Excel doesn't allow usage of this character in the sheet name.

Data is arranged in lines. First line represents heading with settings names according to the corresponding XML template.

The exported sheets also contain plain text describing setting names. This information can be found in the second row of the table-based sheets and in second columns of the other sheets.

### 9.4.2 Import from Excel

**Ways of import:**

- Commands from selected sheet to *Commands* page of selected device.
- Indications from selected sheet to *Indications* page of selected device.

Import is performed from the Excel file with valid .xls extension. The file has to contain corresponding sheet with appropriate name and heading line with names of settings according to the corresponding XML template (see Export). Import function uses topical settings as target and replaces existing data in the target settings.

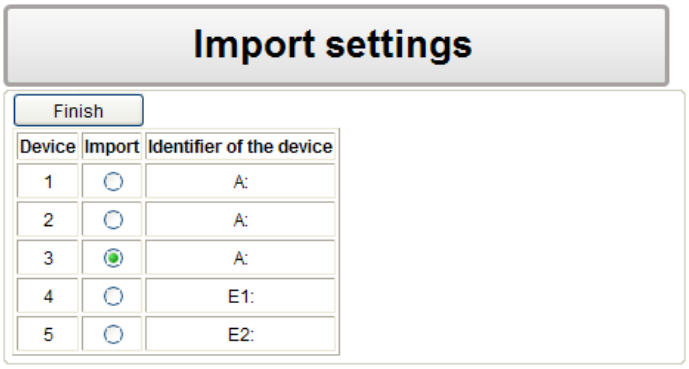



*Figure 11: Import settings*

## 9.5 Migration of settings

WinConfig can migrate settings between different versions of telecontrol boards. The migration can be done in several ways:

- Convert GenReg INI file with REG-P board type selected in the *Open settings* page (other than the telecontrol board for which INI file was originally created, e.g. INI file created for TK517 and IEC101 protocol can be open as IEC101 for TK400 telecontrol board).
- Using Migrate button on Basic settings page. Available migrations are stated in the table below.

First step of migration and INI file conversion implemented in WinConfig is to check for completion and correctness of settings data. This has to be done due to some hardware differences that exist between some REG-P boards.

The *Missing/incorrect values* page provides user interaction possibility during the check process and default values are suggested for changing and confirmation.

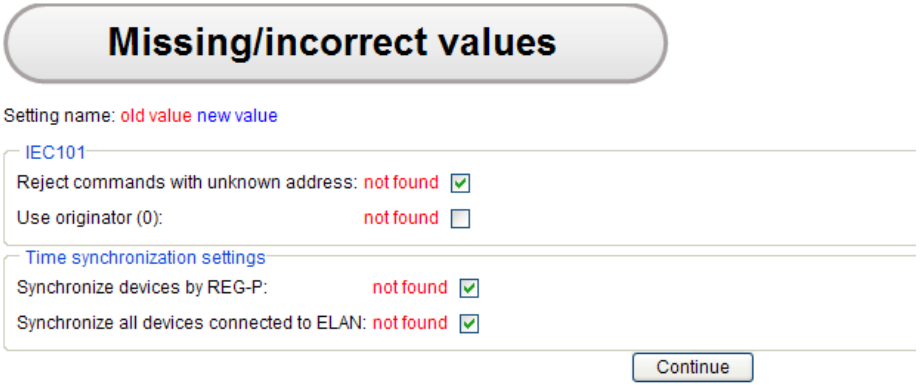



*Figure 12: Missing/incorrect values*

### 9.5.1 Available migrations

The migrations available in WinConfig v13.3.3. can be seen in the following table.

Table 6: Available migrations

| Board | Target board | Protocols |
|---|---|---|
| TK400 | TK28-4 | DNP3<br>IEC101<br>IEC103 |
| TK860 | TK28-4 | DNP3<br>IEC101<br>IEC103<br>IEC104<br>MODBUS<br>SPABUS |
| | TK28-6 | IEC101<br>IEC103<br>SPABUS |
| TK885 | TK28-6 | DNP3<br>IEC101<br>IEC103<br>IEC104<br>MODBUS<br>SPABUS |
| | TK102 | IEC101<br>IEC103<br>SPABUS |

| NOTICE: | In the case of IEC103 protocol it is desirable to check if data points type TI3 or TI6 are present in data ponts table. These types might require manual adjustment according to the IEC103 standard:<br>7.3.1.3 TYPE IDENTIFICATION 3: Measurands I<br>7.3.1.8 TYPE IDENTIFICATION 9: Mesures II |
|---|---|

## 9.6 Checking of entered values

WinConfig pages containing tables (values are organized in tabular format, e.g. indications, commands) also contain online internal checking of individual cells. The check runs when the user leaves cell. Entered values are checked on valid limits. If limits are broken, the last or default value is automatically entered and cell is marked by red color. Correctly changed values are not marked. User cannot leave the page without confirmation or resetting of the changed values.

There is also additional integrity test of values present within the confirmation procedure. This test checks three basic rules:

- Test of non-zero values of object addresses,
- Existence of non-empty command strings in command tables,
- Test of uniqueness of object address, which is performed entirely for all addressable objects in the settings, i.e. comparison of each address with other addresses. Uniqueness of devices text IDs is not tested. There are some exceptions from the rule e.g. in IEC103/TK8xx where TK3 type data points are tested on uniqueness together with measurement value type.

# 10. IEC104 settings

IEC 104 settings are available for TK860, TK885D, TK28x and TK102 telecontrol boards. Chapter IEC104 settings describes only settings not described above.

## 10.1 Basic

The *basic settings* tree branch contains table of 20 available IEC104 channels. Each IEC104 channel can be operated in client or server modes, the channel mode assumes corresponding remote side with corresponding remote IP addresses and remote ASDUs, i.e. IEC104 remote client for server mode and IEC104 server for client mode.

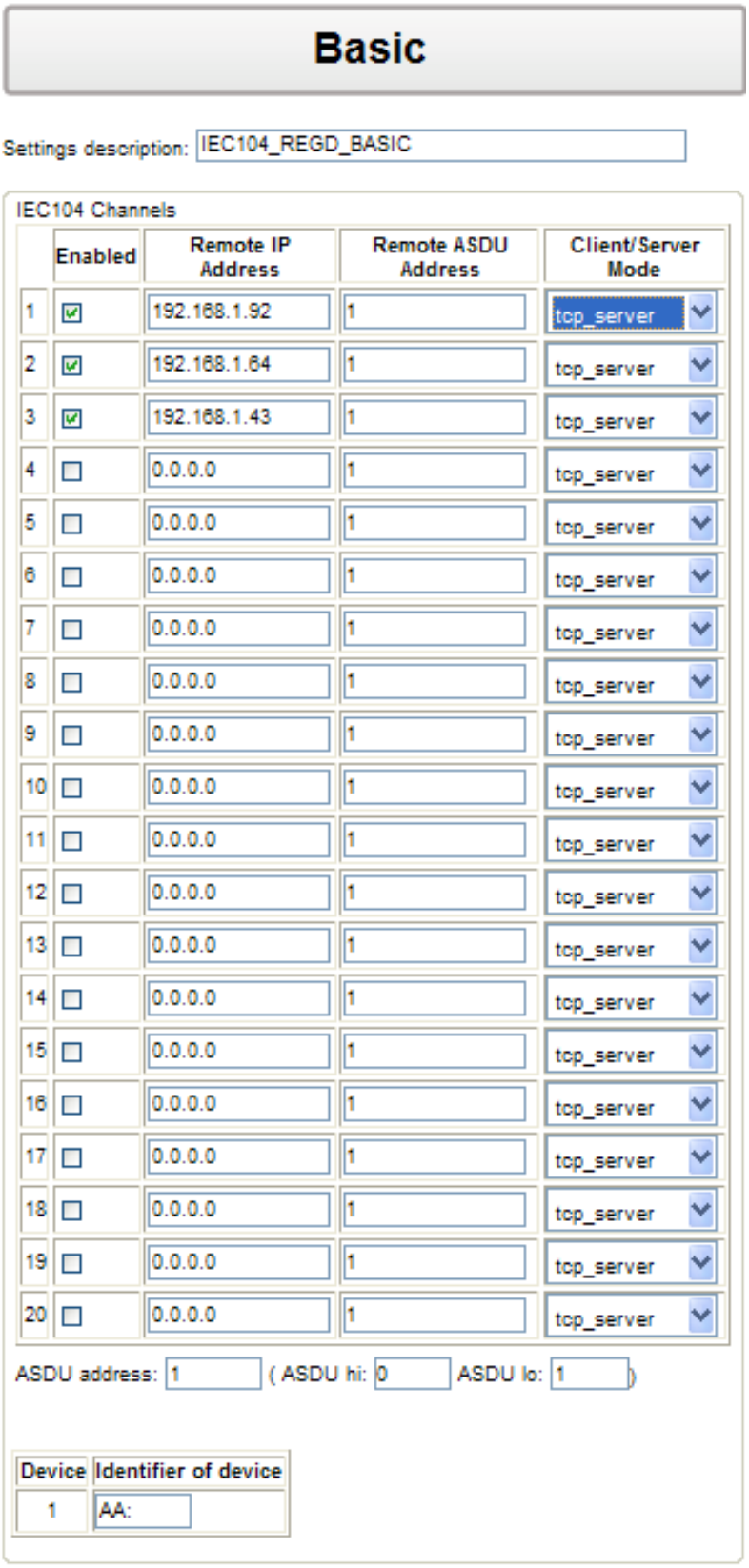



*Figure 13: IEC104 basic settings*

Table 7: IEC104 settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Settings description | text | 50 characters | Filename of open settings | Short user description of settings file or name of settings file. |
| Enabled | - | checkbox | unchecked | Option to enable/disable the corresponding IEC104 channel |
| Remote IP address | - | 4x 0 to 255 | 192.168.1.68<br>192.168.1.64<br>192.168.1.43 | IP addresses of remote station authorized for connection with telecontrol board |
| Remote ASDU address | - | 0 to 65534 | 1 | ASDU address of remote station authorized for connection with telecontrol board |
| ASDU address (ASDU2, ASDU1) | - | 0 to 65534<br>or 0 to 255 | 1 | ASDU address |
| Identifier of device | text | AA: or A(1 to 9): to Z(1 to 4): | AA: | Identifier of device |

## 10.2 Advanced

### 10.2.1 Settings - SCADA

IEC104 Settings - SCADA tree branch contains complete IEC104 specific settings.

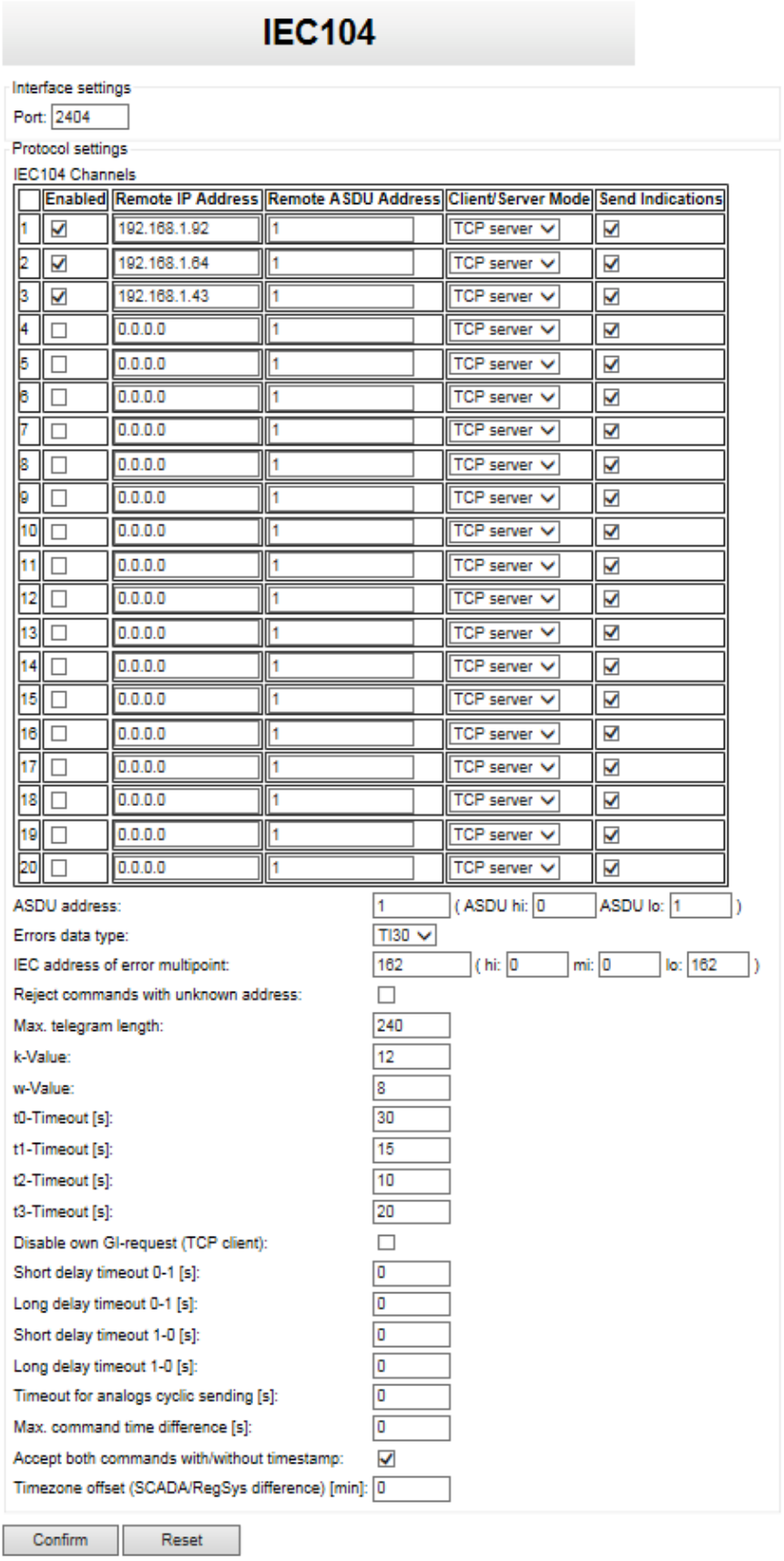



*Figure 14: IEC104 Settings - SCADA*

Table 8: IEC104 settings - SCADA

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Port | - | 1 to 65535 | 2404 | TCP port for IEC104 connection |
| Enabled | - | checkbox | unchecked | Option to enable/disable the corresponding IEC104 channel |
| Remote IP address | - | 4x 0 to 255 | 192.168.1.68<br>192.168.1.64<br>192.168.1.43 | IP addresses of remote station authorized for connection with telecontrol board |
| Remote ASDU address | - | 0 to 65534 | 1 | ASDU address of remote station authorized for connection with telecontrol board |
| | | | | |
| ASDU address (ASDU2, ASDU1) | - | 1 to 65534<br>or 0 to 255 | 62166 | ASDU address |
| Errors data type | - | selection of values in combo box | TI30 | IEC data type of errors |
| IEC address of error multipoint | - | 0 to 16777215<br>or<br>3x 0 to 255 | 0/0/162 | IEC address (IOA) of multipoint for errors |
| Reject commands with unknown address | - | option box | Not selected | Reject commands with unknown address (otherwise ignore) |
| Port | - | 1 to 65535 | 2404 | TCP Port |
| Max. telegram length | - | 1 to 249 | 240 | Maximum telegram length |
| k-Value | - | 1 to 32767 | 12 | Max. No. of invalidated APDUs |
| w-Value | - | 1 to 32767 | 8 | Acknowledge latest after this number of APDUs, w <= 2/3k |
| t0-Timeout | s | 1 to 255 | 30 | Timeout for connection establishment |
| t1-Timeout | s | 1 to 255 | 15 | Timeout for send or test APDUs |
| t2-Timeout | s | 1 to 255 | 10 | Timeout for acknowledgement in the case of no messages t2 < t1 |
| t3-Timeout | s | 1 to 255 | 20 | Timeout for sending test frames in case of idle state |
| Disable own GI-request | - | option box | Not selected | Enabling/disabling of initial GI sent from converter in TCP client mode. Option is valid for all IEC104 channels. |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Short delay timeout 0-1 | S | 0 to 60 | 0 | Short delay timeout for delayed indications and 0-1 change direction |
| Long delay timeout 0-1 | S | 0 to 60 | 0 | Long delay timeout for delayed indications and 0-1 change direction |
| Short delay timeout 1-0 | S | 0 to 60 | 0 | Short delay timeout for delayed indications and 1-0 change direction |
| Long delay timeout 1-0 | S | 0 to 60 | 0 | Long delay timeout for delayed indications and 1-0 change direction |
| Timeout for analogue cyclic sending | s | 0 to 650 | 0 | Timeout for analogue (measurements) cyclic sending (0 = disable) |
| Max. command time difference | S | 0 to 60 | 0 | Maximal difference between command time and regulator time. The command is refused if the time difference is bigger. |
| Accept both commands with/without timestamp | | checkbox | checked | Compatibility reasons when TIs with/without timestamp are separated. If checked, IEC104 accepts both variants. |
| Timezone offset (SCADA/RegSys difference) | Min | -1440 to 1440 | 0 | Definition of timezone offset. This parameter is used for calculation of time difference of commands. |

### 10.2.2 ComServer settings

IEC104 advanced settings tree branch contains ComServer specific settings.

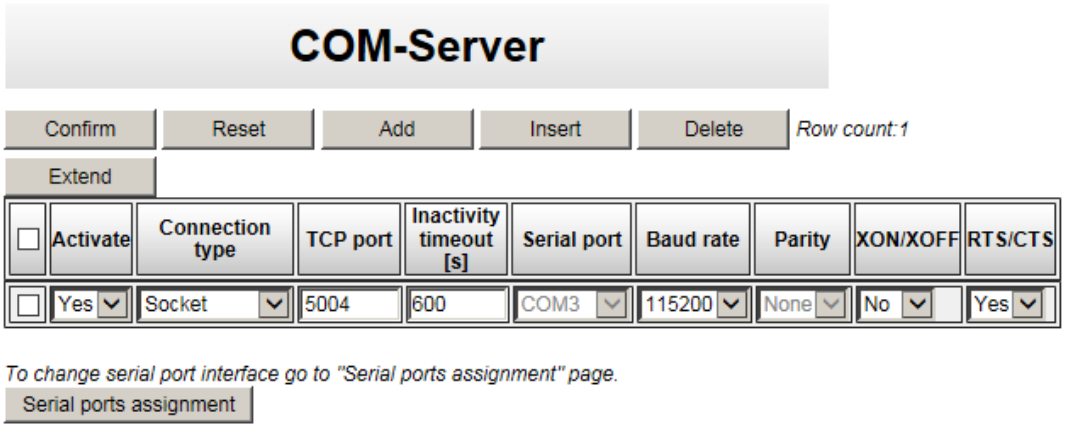



*Figure 15: IEC104 ComServer settings*

Table 9: IEC104 ComServer settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Activate | - | Yes/No | No | Option to disable the channel |
| Connection type | - | Selection of values in combo box | RAW | State of channel.<br>(SOCKET, Serial Direct, Telnet, Shared with IEC, OFF) |
| IP address | - | 4x 0 to 255 | | IP address |
| TCP port | - | 0 to 65535 | 3003 | TCP port |
| Inactivity timeout | S | | 180 | Timeout after which the serial device is closed if data transfer does not occur. By default is 0. It means that serial device is closed only by closing TCP-Port. |
| Serial port | - | Selection of values in combo box | COM2 | Selection of serial port |
| Baud rate | Bd | Selection of values in combo box | 115200 | Baud rate |
| Parity | - | Selection of values in combo box | Even | Parity |
| Stop bits | - | Selection of values in combo box | 1 | Stop bits |
| Data bits | - | Selection of values in combo box | 8 | Data bits |
| XON/XOFF | - | Selection of values in combo box | No | Option to select XON/XOFF handshaking |
| RTS/CTS | - | Selection of values in combo box | No | Option to select RTS/CTS hand-shaking |
| RTS/CTS inverted | - | Selection of values in combo box | No | Option to select inversion of RTS, CTS signals |
| Rxd/TxD inverted | - | Selection of values in combo box | No | Option to select inversion of RxD, TxD signals |
| Interface type | - | Selection of values in combo box | RS232 | Option to select type of inter-face |
| Max. message length | - | 0 to 65535 | 0 | Max. message length |
| Tx blocking time | ms | 0 to 65535 | 0 | Tx blocking time |

### 10.2.3 Supervisory settings

The Supervisory settings tree branch can be used for activation and configuration of debug logs.

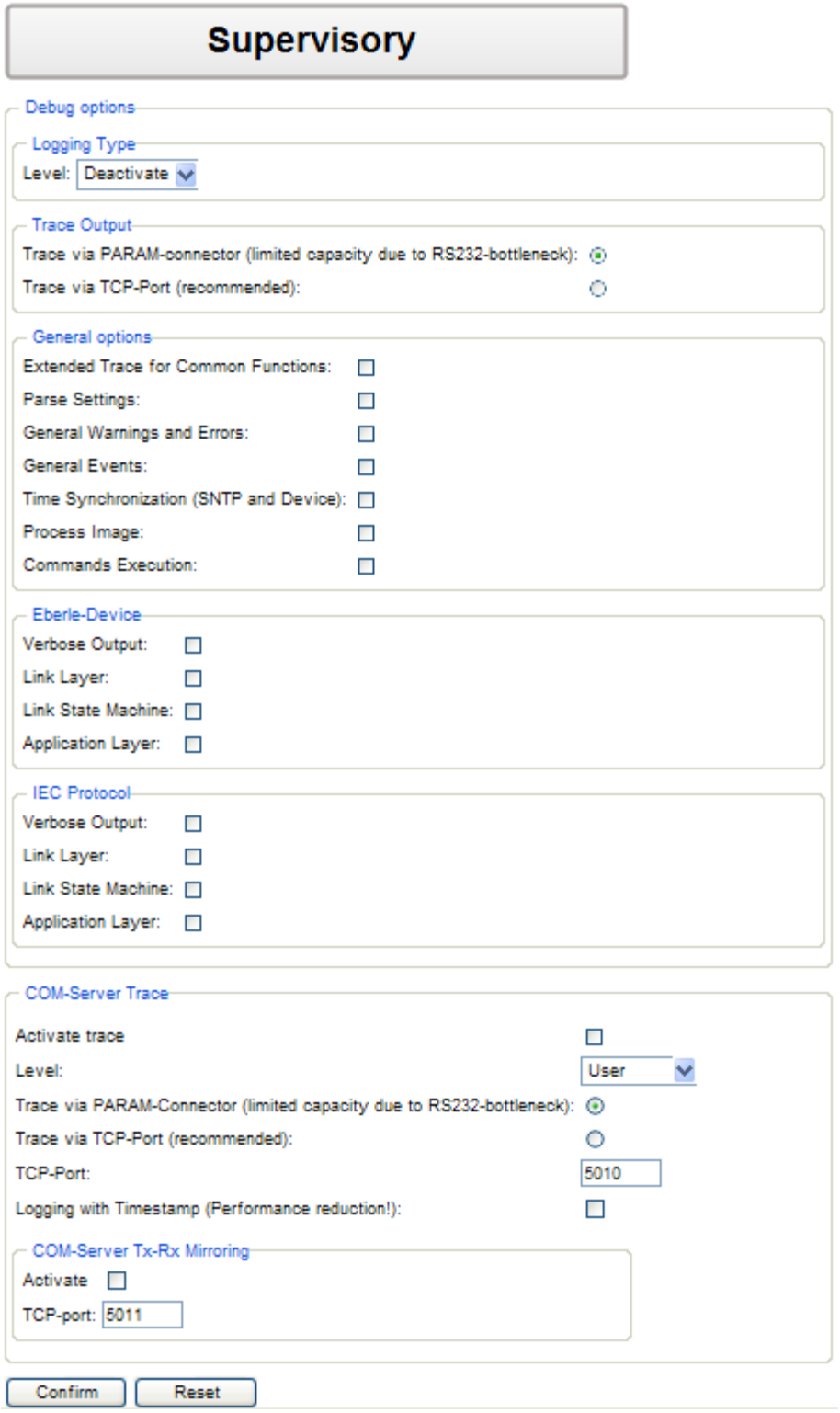



*Figure 16: IEC104 Supervisory settings*

Table 10: IEC104 Supervisory settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Level | - | Selection of values in combo box | Deactivate | Level of Log messages |
| Trace output | - | radio button | PARAM-connector | Option to trace via PARAM connector or via TCP |
| General options: Extended Trace | - | checkbox | unchecked | Extended Trace for Common Functions |
| General options: Parse Settings | - | checkbox | unchecked | Parse Settings |
| General options: General Warnings | - | checkbox | unchecked | General Warnings and Errors |
| General options: General Events | - | checkbox | unchecked | General Events |
| General options: Time Synchroniza-tion | - | checkbox | unchecked | Time Synchronization (SNTP and Device) |
| General options: Process Image | - | checkbox | unchecked | Process Image |
| General options: Commands Exe-cution | - | checkbox | unchecked | Commands Execution |
| Eberle-Device: Verbose output | - | checkbox | unchecked | Verbose output |
| Eberle-Device: Link Layer | - | checkbox | unchecked | Link layer log |
| Eberle-Device: Link State ma-chine | - | checkbox | unchecked | Link State machine log |
| Eberle-Device: Application Layer | - | checkbox | unchecked | Application layer log |
| IEC protocol: Verbose output | - | checkbox | unchecked | Verbose output |
| IEC protocol: Link Layer | - | checkbox | unchecked | Link layer log |
| IEC protocol: Link State machine | - | checkbox | unchecked | Link State machine log |
| IEC protocol: Application Layer | - | checkbox | unchecked | Application layer log |
| COM-Server Trace: Activate trace | | checkbox | checked | Protocol debug option activa-tion |
| Level | - | Selection of values in combo box | user | Option to select lever of super-visory messages (user, developer) |
| Trace via PARAM-Connector) | - | radio button | checked | Logging to PARAM-Connector |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Trace via TCP-Port | - | radio button | unchecked | Logging to TCP port |
| TCP port | - | 1 to 65535 | 5010 | TCP port |
| Logging with Timestamp | - | checkbox | checked | Logging with Timestamp |
| Mirroring: Acti-vate | - | checkbox | checked | Activation |
| TCP-port | - | 1 to 65535 | 5011 | TCP port |

### 10.2.4 Supervisory settings for boards type TK28-4, TK28-6, TK102

For detailed description of Supervisory parameters see the Supervisory settings chapter in IEC103 protocol. Note that usage of Syslog server is available only for COM-Server logging in IEC104 firmware.

## 10.3 Linked Devices

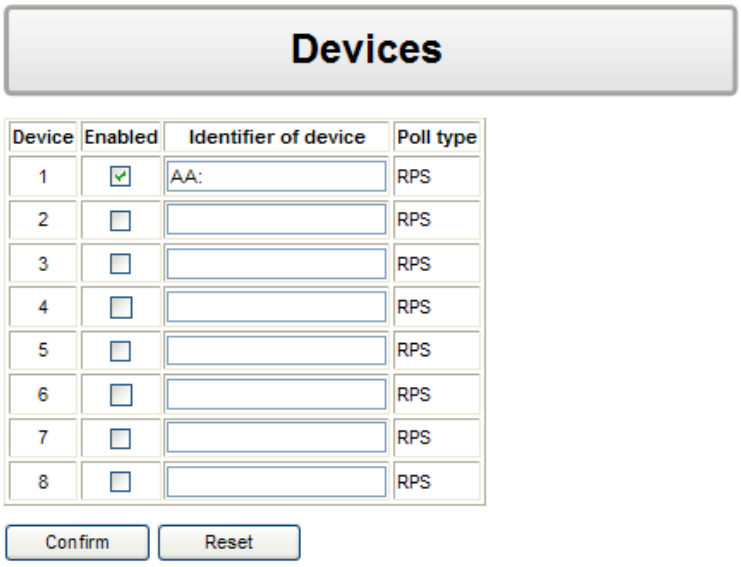



*Figure 17: IEC104 Linked devices*

### 10.3.1 Time synchronization

IEC104 time synchronization tree branch contains IEC104 specific settings for time synchronization.

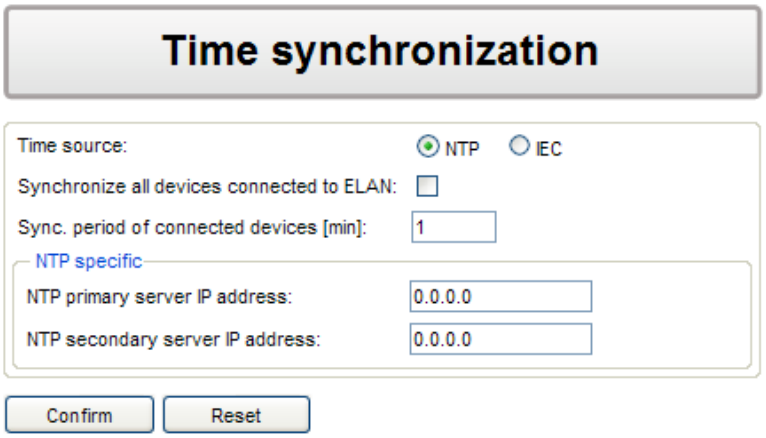



*Figure 18: IEC104 time synchronization settings*

Table 11: IEC104 time synchronization

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Time source | - | option box | NTP | Time source selection |
| Sync. all devices connected to ELAN | - | option box | Not selected | Sync. all devices connected to ELAN |
| Sync. period of connected devices | min | 0 to 999 | 1 | Sync. period of connected devices (0 = disabled) |
| NTP primary server IP address | - | 4x 0 to 255 | 0.0.0.0 | NTP primary server IP address |
| NTP secondary server IP address | - | 4x 0 to 255 | 0.0.0.0 | NTP secondary server IP address |

### 10.3.2 Time synchronization for boards type TK28-4, TK28-6 and TK102

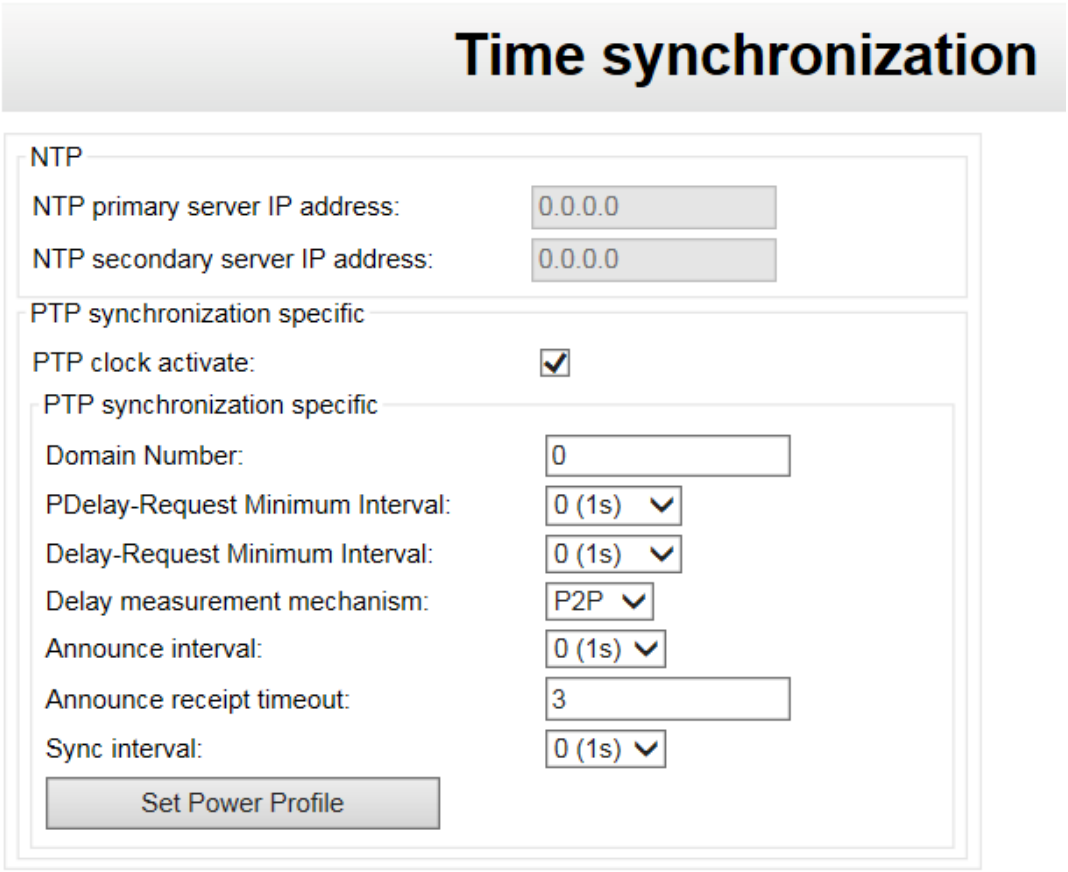



*Figure 19: IEC104 time synchronization for boards TK28-4, TK28-6, TK102*

Table 12: Time synchronization for boards type TK28-4, TK28-6 and TK102

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| NTP primary server IP address | IPV4 | 4x 0 to 255 | 0.0.0.0 | NTP primary server IP address |
| NTP secondary server IP address | IPV4 | 4x 0 to 255 | 0.0.0.0 | NTP secondary server IP address |
| PTP specific: VLAN ID | | | 0 | VLAN ID |
| PTP specific: Domain Number | | 0 to 255 | 0 | Domain Number |
| PTP specific: PDelay-Request Minimum Interval | | Selection of values from listbox | 0 | PDelay-Request Minimum Interval, 0 to 5 |
| PTP specific: Delay-Request Minimum Interval | | Selection of values from listbox | 0 | Delay-Request Minimum Interval, 0 to 5 |
| PTP specific: Delay measure-mennt | | Selection of values from listbox | Auto | Delay measurement mechanism |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| mechanism | | | | |
| PTP specific:<br>Announce interval | | Selection of values from listbox | 1 | Announce interval, 0 to 3.<br>All PTP nodes in network should have the same value |
| PTP specific:<br>Announce receipt timeout | | 2 to 10 | 3 | Announce receipt timeout, all PTP nodes in network should have the same value |
| PTP specific:<br>Sync. interval | | Selection of values from listbox | none | Synchronization interval, 0 to 2 |

### 10.3.3 Internal Communication

Communication settings tree branch contains communication settings of devices for TK8xx board types and IEC104 protocol conversion.

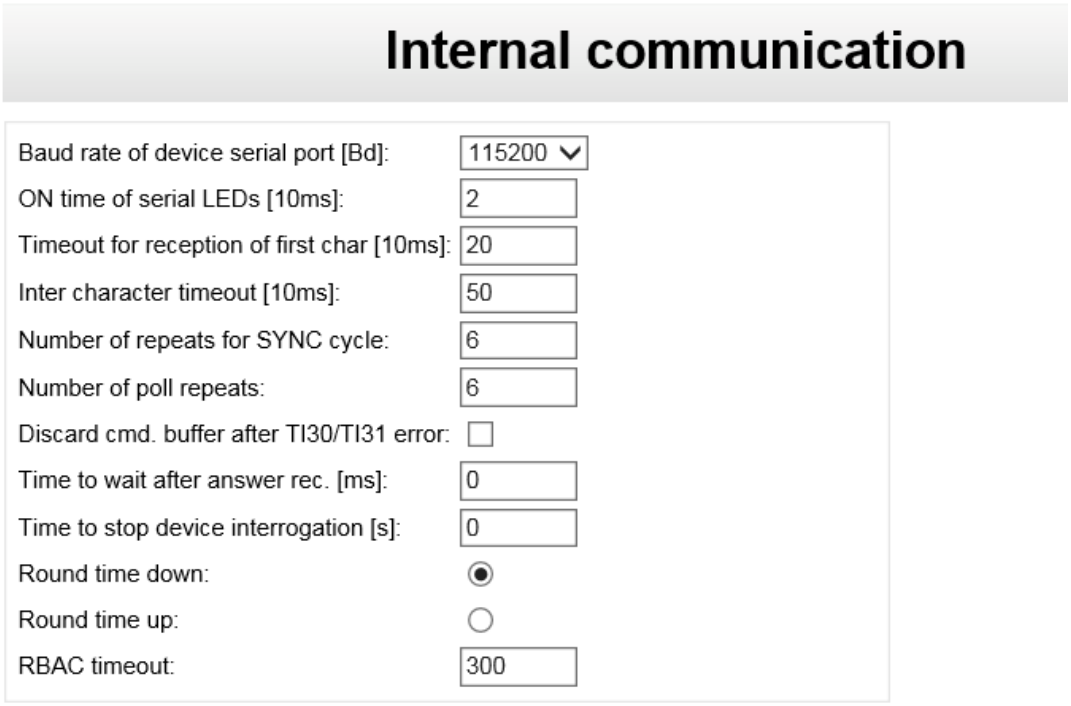



*Figure 20: Internal communication settings*

Table 13: IEC104 Device communication settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Baud rate of device serial | Bd | 1200-115200 | 115200 | Baud rate of device serial port |
| ON time of serial LEDs | 10 ms | 1 to 100 | 2 | ON time of serial LEDs |
| Timeout for reception of first char | 10 ms | 1 to 255 | 50 | Timeout for reception of first character |
| Inter character timeout | 10 ms | 1 to 255 | 20 | Timeout between two characters in telegram |
| Number of repeats for SYNC cycle | - | 1 to 255 | 10 | Number of repeats for SYNC cycle |
| Number of command repeats | - | 1 to 255 | 3 | Number of command (poll) repeats |
| TX blocking | ms | 0 to 255 | 0 | Time to wait when answer was received |
| | | | | |
| Time to stop reg. interrogation | s | 0 to 650 | 0 | Time to stop regulator interrogation after IEC communication break |
| Round time down / up | - | option box | round down | Rounding time selection |
| RBAC timeout | s | 30 to 600 | 300 | RBAC timeout for RegSys firmware supporting user roles and rights and telecontrol boards TK8x and TK102 |

### 10.3.4 IEC104 Commands

The IEC104 commands table contains commands and also data points transmitted in the direction toward to the REG-PE(D) board.

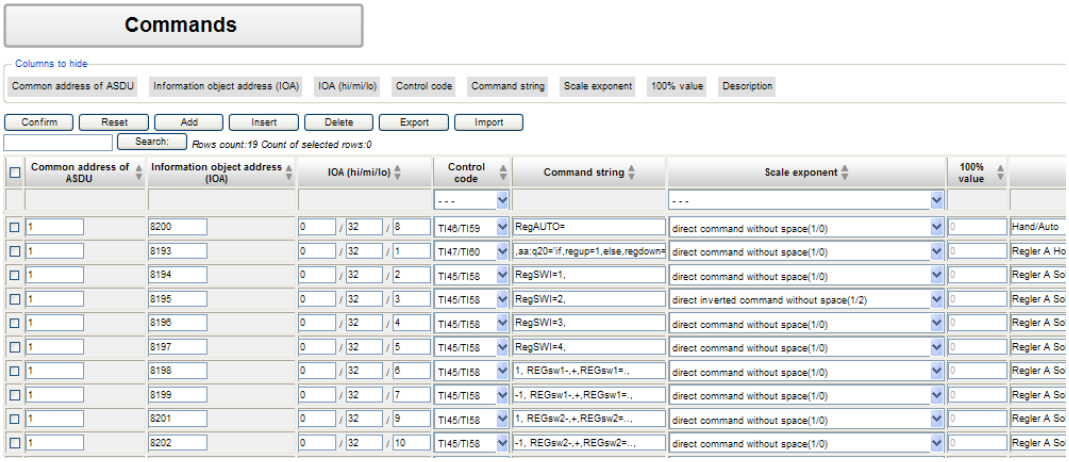



*Figure 21: IEC104 commands*

Table 14: IEC104 commands

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Common address of ASDU | - | 0 to 65534 | 1 | ASDU address of remote station authorized for connection with telecontrol board |
| Information object address (IOA) | - | 0 to 16777215 or 3x 0 to 255 | 0 | IOA of the corresponding data point |
| Control code | | Selection of values in listbox | TI45/TI58 | Type of information object |
| Command string | text | 50 characters | | Command string |
| Scale exponent | - | Selection of values in listbox | 1/0 | Addition command parameter according to the available list |
| 100% value | - | 0 to 65535 | 0 | 100% value, available for TI48 only |
| Description | text | 50 characters | | User description |
| Range min. | - | -32768 to 32767 | 0 | Command value range – minimal value |
| Range max. | - | -32768 to 32767 | 0 | Command value range – maximal value |

#### 10.3.4.1 Command parameters not available in GUI

Some command parameters available cannot be set via GUI. User has to edit such parameters directly in the XML template using suitable text editor. A care has to be taken in such case, as text editor cannot check correctness of such input.

The parameters>

```
<protocol type="IEC104">
  <params t0="30" k="12" error_datatype="30" us_asdu_address="1" max_tlg_len="240" t1="15" port="2404" t3="20"
  error_iec_addr="0/0/162" t2="10" w="8" reject_unknown_addr="1" cmd_actterm_delay="2000" initial_GI_off="0"
  delay_short_up_tmout="5" delay_long_up_tmout="7" delay_short_down_tmout="9" delay_long_down_tmout="11"
  use_locrem="1" cmd_time_diff="60" offset_tapdown="5" bit_pos_tapdown="3" offset_tapup="5" bit_pos_tapup="2"
  cmd_accept_both_tk="1" timezone_offset="0" lauflampe_offset="5" lauflampe_bit="1"/>
```

are placed in the *params* section of the IEC104 protocol.

Another parameters are place directly in the command definition:

```
<cmd asdu="1" descr="Hand/Auto" ioa="0/32/8" control_code="46" command_str="RegAUTO=" scale_exp="0" value100="0"
offset="3" bit_pos="5" min_val="0" max_val="0" act_term_delay="2000" offset_2="0" bit_pos_2="0" value_2="0"
offset_watch="0" reg_type_watch="0" bit_watch="0" tap_pos_timeout_sec="0"/>
```

The modifications are focused to the modification of command behaviour.

**Parameters and meaning:**

- ***use_locrem*** – the software will take into account the value of local/remote indication when accepting/refusing command.
- ***cmd_time_diff*** *[s] – max. time difference between command time and regulator time. This parameter is processed by GUI, see Settings - SCADA.*
- ***offset_tapdown, bit_pos_tapdown, offset_tapup, bit_pos_tapup*** – a special parameters for the tap change command. The parameters allow to use a different indication for the tap change in direction up and down. The appropriate indication has to go UP before expiration of the timeout defined by ***acctterm_delay***. Otherwise the command is refused. These indications act as additional condition for the ***lauflampe*** parameter.
- ***lauflampe_offset, lauflampe_bit*** - the running tap is indicated by a special indication and the entire process has to finish before the expiration of ***tap_pos_timeout_sec*** timeout. Otherwise, the command is refused.
- ***cmd_accept_both_tk*** – option to accept both commands with/without timestamp. This option is processed by WinConfig GUI where it is represented by checkbox, see Settings - SCADA.
- ***delay short_up_tmout, delay long_up_tmout, delay short_down_tmout, delay long_down_tmout*** *[s]* – parameters dedicated to the delay of indications. These pa-

rameters are processed by WinConfig GUI and are not related to commands (see Settings - SCADA ).

- ***cmd_acctterm_delay*** *[ms]* – definition of delay of command activation termination. This is valid for all commands except of the TAP command.
- ***min_val, max_val*** – these parameters are dedicated for check of valid range of the bound data point. The command is refused if the data point is out of range. The command is also refused if the command value is the same as the data point value. These parameters are functional only in the case when the *max_val* is bigger than *min_val.*
- ***acctterm_delay*** *[ms]* – definition of additional delay of command activation termination. This is valid for individual commands. Another function of *acctterm_delay* is to act as additional timeout in the case of TAP command. The additional timeout defines the time, when the indication of Tap running up or down has to go ON. Otherwise the command is finished by negative activation termination.
- ***tap_pos_timeout_sec*** *[s]* – definition of special delay for TAP command. Non-zero value also defines valid TAP command. The TAP command doesn't use *acctterm_delay* and *cmd_acctterm_delay.*
- ***offset, bit_pos*** – meaning of these parameters in command is definition of data point that is bound to the command and the value of this data point is checked first before the command execution. If the value is the same as the one contained in command, the command is refused.
- ***value_2, offset_2, bit_pos_2*** – definition of 2nd data point that is bound to the command and the value of this data point is checked first before the command execution. The expected value is defined by *value_2*.
- ***offset_watch, reg_type_watch*** – definition of additional setpoint (analog value) that is supposed to change during the command execution. The negative activation termination is issued, if the setpoint didn't change during the command execution. Possible values of *reg_type_watch* are "byte", "word", "dword", "float", "sbyte" according to the type of analog value in RPS structure.

Another meaning of these parameters is watching the single bit indication. In such case the *reg_type_watch* value is "bit" and another parameter *bit_watch* is used for position of the bit within the byte defined by *offset_watch* parameter. The negative activation termination is issued, if the bit being watched didn't change during the command execution. The positive activation termination is issued immediately when the change is detected.

Meaning of zero values is *NOT USED*.

### 10.3.5 IEC104 indications

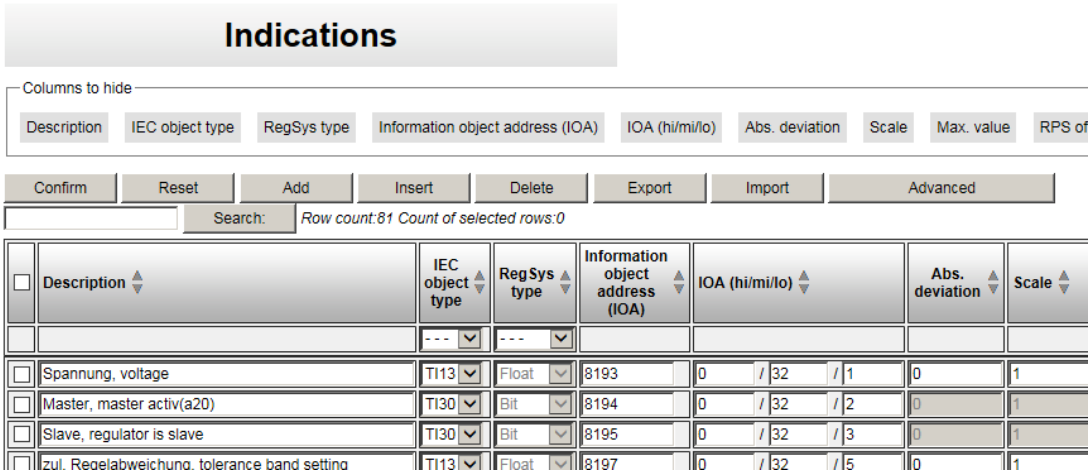



*Figure 22: IEC104 indications*

Table 15: IEC104 indications

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Description | text | 50 chars | empty | Description |
| IEC object type | - | selection of values in list box | TI1 | Indication type in IEC communication |
| RegSys type | - | selection of values in list box | Bit | Indication type in device communication |
| Information object address (IOA)<br>(IOA (hi/mi/lo)) | - | 0 to 16777215<br>or<br>3x 0 to 255 | 0 | IEC address (IOA) of indication |
| Abs. deviation | float | | 0 | Absolute deviation value |
| Scale | float | | 0 | Scale value |
| Max. value | - | 0 to 65535 | 32767 | Max. value |
| RPS offset | - | 0 to 255 | 0 | RPS offset |
| RPS bit | - | selection of values in list box | 0 | RPS bit |
| IV RPS offset | - | 0 to 255 | 0 | RPS offset of additional indication bearing the invalidity information |
| IV RPS bit | - | selection of values in list box | 0 | RPS bit of additional indication bearing the invalidity information |
| IV RPS bit inverted | - | selection of values in list box | No | Indication flag for inversion of invalidity information |
| Cyclic | - | selection of | No | Flag to indicate cyclic data point |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| | | values in list box | | transmission. The period is defined in the *Internal communication* section. |
| Delayed | - | selection of values in list box | No | Flag to delay transmission of the data point change. The delay defined in *Settings - SCADA* page will be applied. |
| Range min. and Range max. | float | - | 0 | Definition of valid range of the data point. The data point will be marked as OVERFLOW if out of the range. 0 means that this property is switched off. |
| Use in GI | - | selection of values in list box | Yes | Usage of indication in General Interrogation |
| Gr. 0 | - | selection of values in list box | Yes | Group 0 in general interrogation |
| Gr. 1 | - | selection of values in list box | No | Group 1 in general interrogation |
| Gr. 2 | - | selection of values in list box | No | Group 2 in general interrogation |
| Gr. 3 | - | selection of values in list box | No | Group 3 in general interrogation |
| Gr. 4 | - | selection of values in list box | No | Group 4 in general interrogation |

**The available types of information objects are stated in the following list:**

- TI30
  - Single-point information with time tag
- TI31
  - Double-point information with time tag
- TI9/TI34
  - Measured value, normalized value/ Measured value, normalized value with time tag
- TI13/TI36
  - Measured value, short floating point value/ Measured value, short floating point value with time tag
- TI45/TI58
  - Single command/ Single command with time tag
- TI46/TI59
  - Double command/ Double command with time tag
- TI47/TI60
  - Regulating step command/ Regulating step command with time tag
- TI48/TI61
  - Set point command, normalized value/ Set point command, normalized value with time tag
- TI49/TI62
  - Set point command, scaled value/ Set point command, scaled value with time tag
- TI50/TI63
  - Set point command, short floating point value/ Set point command, short floating point value with time tag

# 11. DNP3 settings (REG-PE(D), REG-PEDSV, TK28-4, TK28-6, TK102)

## 11.1 Basic

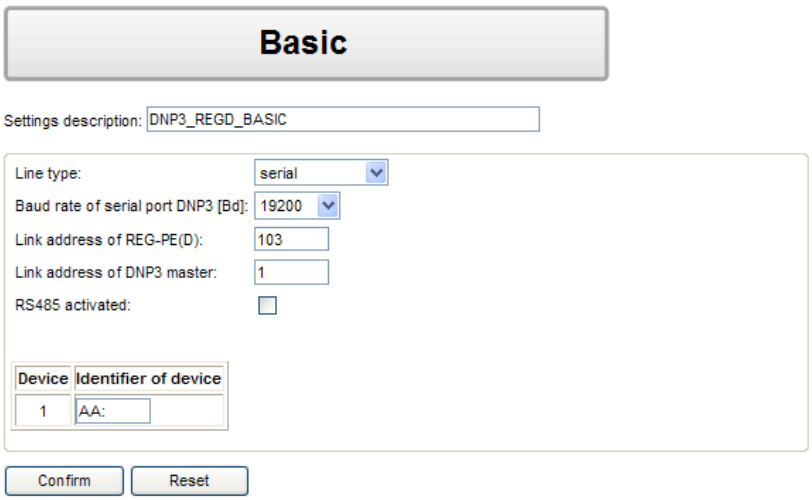



*Figure 23: DNP3 basic settings REG-PE(D) ), REG-PEDSV, TK28-6*

Table 16: DNP3 basic settings REG-PE(D) ), REG-PEDSV, TK28-6

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Settings description | text | 50 characters | Identification if the template source | Short user description of settings file. |
| Line type | - | selection of values in combo box | serial | Type of communication line – serial, Ethernet TCP, Ethernet UDP |
| Authorized central stations IP addresses | - | 4x 0 to 255 | 192.168.1.68<br>192.168.1.64<br>192.168.1.43 | IP addresses of central stations authorized to connect to telecontrol board |
| Baud rate of serial port DNP3 | Bd | selection of values in combo box | 19200 | Baud rate of serial port DNP |
| Link address of REG-P | - | 0 to 65535 | 103 | Link address of REG-P |
| Link address of DNP3 master | - | 0 to 65535 | 1 | Link address of DNP master |
| RS485 activated | - | option box | not selected | RS485 activated |
| Identifier of device | text | AA: or A(1 to 9): to Z(1 to 4): | AA: | Identifier of device |

## 11.2 Advanced

### 11.2.1 Settings SCADA

The advanced tree branch SCADA setting contains complete DNP3 specific communication settings.

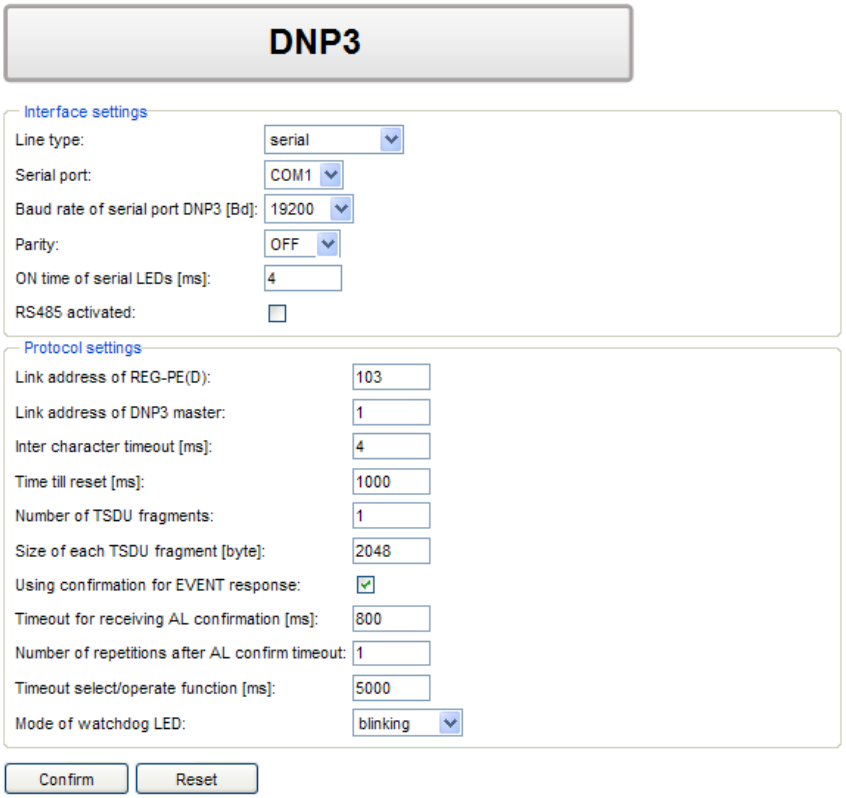



*Figure 24: Advanced settings SCADA REG-PE(D)*

Table 17: DNP3 advanced settings REG-PE(D) ), REG-PEDSV, TK28-6

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Line type | - | selection of values in combo box | serial | Type of communication line – serial, Ethernet TCP, Ethernet UDP |
| Authorized central stations IP addresses | - | 4x 0 to 255 | 192.168.1.68<br>192.168.1.64<br>192.168.1.43 | IP addresses of central stations authorized to connect to telecontrol board |
| Port | - | 1 to 65535 | 20000 | TCP or UDP Port |
| Serial port | - | selection of values in combo box | COM1 | Selection of DNP3 COM port |
| Baud rate of serial port DNP3 | Bd | selection of values in combo box | 19200 | Baud rate of serial port DNP |
| Parity | - | selection of values in combo box | Off | Parity of serial port DNP |
| ON time of serial LEDs | ms | 0 to 255 | 4 | ON time of serial LEDs |
| Link address of REG-PE(D) | - | 0 to 65535 | 103 | Link address of REG-P |
| Link address of DNP3 master | - | 0 to 65535 | 1 | Link address of DNP master |
| Inter character timeout | ms | 2 to 1000 | 4 | Timeout between two characters in telegram |
| Time till reset | ms | 1 to 65535 | 1000 | Time until reset after cold restart |
| RS485 activated | - | option box | Not selected | RS485 activated |
| Number of TSDU fragments | - | 1 to 128 | 1 | Number of TSDU fragments |
| Size of each TSDU fragment | - | 64 - 2048 | 2048 | Size of each TSDU fragment |
| Using confirmation for EVENT response | - | option box | selected | Using confirmation for EVENT response |
| Timeout for receiving AL confirmation | ms | 1 to 65535 | 800 | Timeout for receiving AL confirmation |
| Number of repetitions after AL confirm timeout | - | 0 to 255 | 1 | Number repetitions after AL confirm timeout |
| Timeout select/operate function | ms | 1 to 65535 | 5000 | Timeout select/operate function |

### 11.2.2 COM-Server

The COM server tree branch contains parameters for COM-Server functionality of DNP3 firmware. For detailed description of COM Server parameters see the COM-Server chapter in IEC104 protocol.

### 11.2.3 Supervisory settings

For detailed description of Supervisory parameters see the Supervisory settings chapter in IEC103 protocol. Note that usage of Syslog server is available only for COM-Server logging in DNP3 firmware.

### 11.2.4 Linked devices – time synchronization

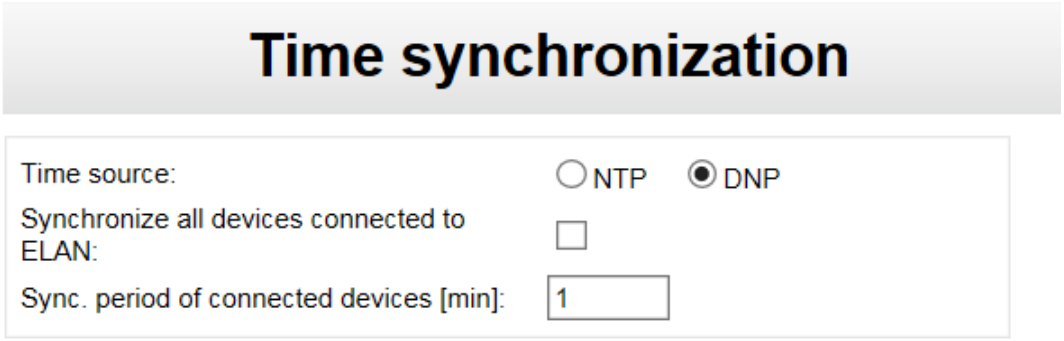



*Figure 25: Time synchronization*

Table 18: Time synchronization

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Time source | option | NTP/DNP | DNP | Time source |
| Synchronize all devices connected to ELAN | - | checkbox | unchecked | Synchronize all devices connected to ELAN |
| Sync. period of connected devices | min | 1 to 999 | 1 | Synchronization period of connected devices |

### 11.2.5 Time synchronization for boards type TK28-4, TK28-6 and TK102

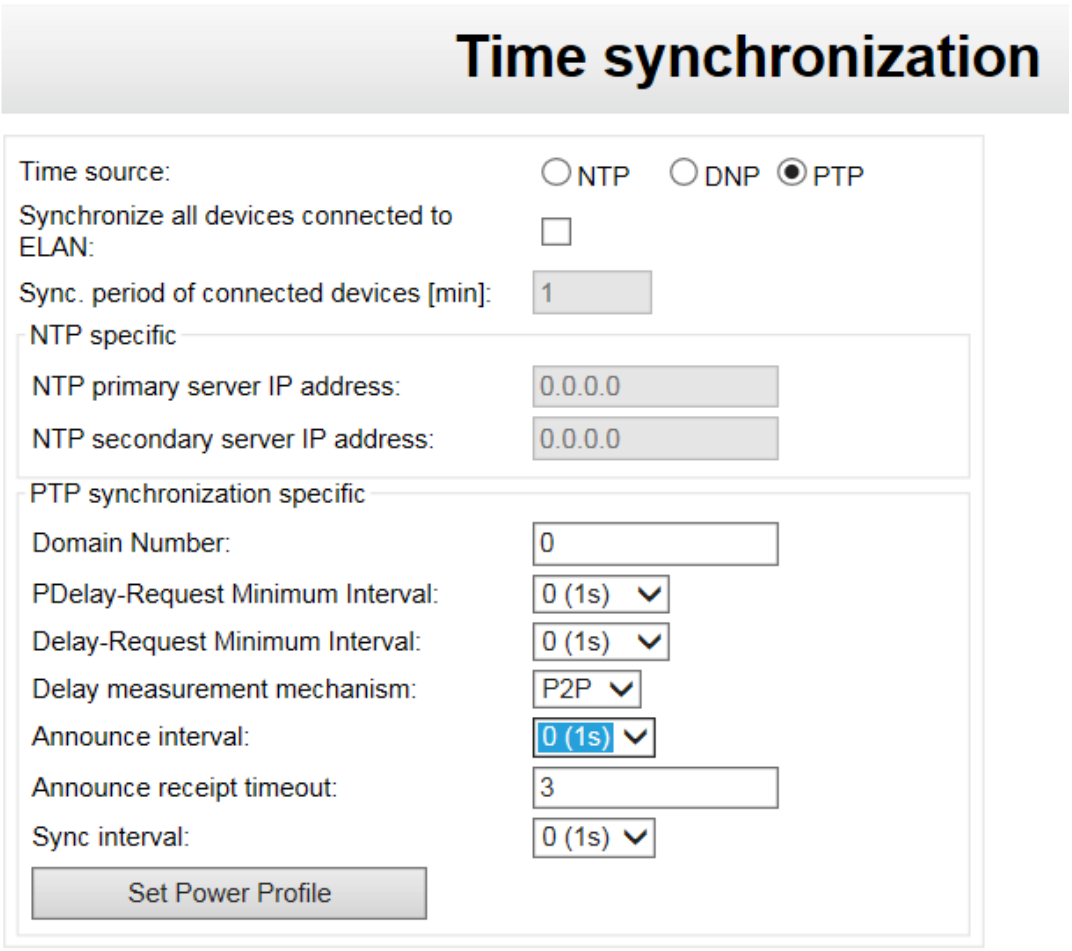



*Figure 26: Time synchronization for boards type TK28-4, TK28-6 and TK102*

Table 19: Time synchronization for boards type TK28-4, TK28-6 and TK102

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Time source | option | NTP/DNP/PTP | DNP | Time source |
| Synchronize all devices connected to ELAN | - | checkbox | unchecked | Synchronize all devices connected to ELAN |
| Sync. period of connected devices | min | 1 to 999 | 1 | Synchronization period of connected devices |
| NTP primary server IP address | IPV4 | 4x 0 to 255 | 0.0.0.0 | NTP primary server IP address |
| NTP secondary server IP address | IPV4 | 4x 0 to 255 | 0.0.0.0 | NTP secondary server IP address |
| PTP specific:<br>VLAN ID | | | 0 | VLAN ID |
| PTP specific:<br>Domain Number | | 0 to 255 | 0 | Domain Number |
| PTP specific:<br>PDelay-Request Minimum Interval | | Selection of values from listbox | 0 | PDelay-Request Minimum Interval, 0 to 5 |
| PTP specific:<br>Delay-Request Minimum Interval | | Selection of values from listbox | 0 | Delay-Request Minimum Interval, 0 to 5 |
| PTP specific:<br>Delay measuremennt mechanism | | Selection of values from listbox | Auto | Delay measurement mechanism |
| PTP specific:<br>Announce interval | | Selection of values from listbox | 1 | Announce interval, 0 to 3.<br>All PTP nodes in network should have the same value |
| PTP specific:<br>Announce receipt timeout | | 2 to 10 | 3 | Announce receipt timeout, all PTP nodes in network should have the same value |
| PTP specific:<br>Sync. interval | | Selection of values from listbox | none | Synchronization interval, 0 to 2 |

## 11.3 Device X

### 11.3.1 Device request settings

Device request settings tree branch contains device specific settings.

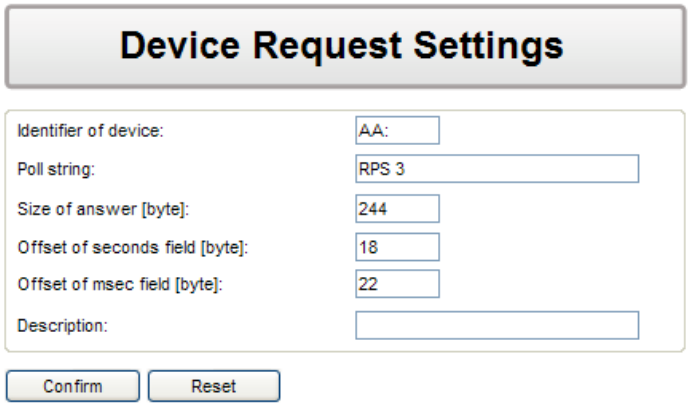



*Figure 27: DNP3 device request settings REG-PE(D)*

Table 20: DNP3 device settings REG-PE(D)

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Identifier of device | text | AA: or A(1 to 9): to Z(1 to 4): | AA: | Identifier of device as appears in the device communication |
| Poll string | text | 23 chars | fread RPS 3 | Device poll string |
| Size of answer | byte | 1 to 255 | 244 | Size of answer |
| Offset of seconds field | byte | 0 to 255 | 18 | Offset of seconds field |
| Offset of msec field | byte | 0 to 255 | 22 | Offset of msec field |
| Description | string | 30 characters | Empty string | User description |

### 11.3.2 Indications

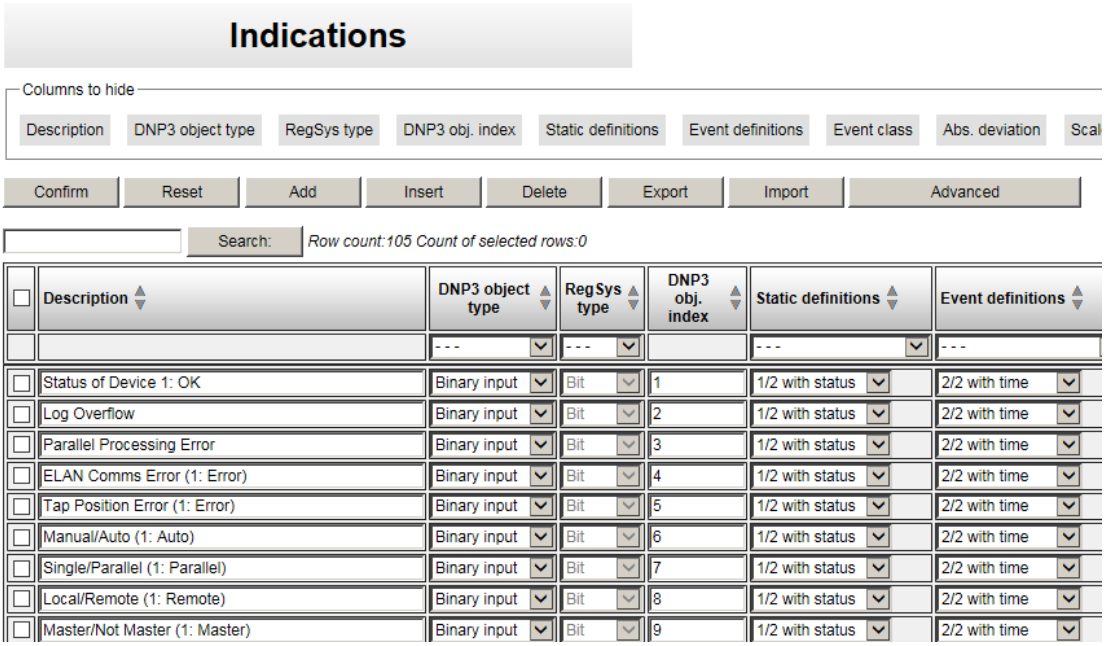



*Figure 28: DNP3 indications REG-PE(D)*

Table 21: DNP3 indications REG-PE(D)

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| DNP3 object type | - | selection of values in combo box | Binary input | DNP3 object type |
| REG data type | - | selection of values in combo box | Bit | REG data type |
| DNP3 obj. index | - | 0 to 65535 | 0 | DNP object index |
| Static definitions | - | selection of values in combo box | no class 0 point | Static definitions |
| Event definitions | - | selection of values in combo box | no events | Event definitions |
| Event class | - | selection of values in combo box | 1 | Event class |
| Abs. deviation | float | | 0 | Absolute deviation |
| Scale | float | | 1 | Scale |
| RPS offset | | 0 to 255 | 0 | RPS offset |
| RPS bit | - | selection of values in combo box | 0 | RPS bit |
| Description | text | 50 characters | empty | User description |
| Simulation | | selection of values in combo box | No | Option whether the data point value can be simulated |
| Simulation value | | according to the data | 0 | Simulated data point val- |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| | | type | | ue |

Simulation of the data point value is new feature in WinConfig version starting from 11.0.6. User can allow simulation and prepare simulation values of individual data points. The simulation can be consequently launched by *Run simulation* button in the online WinConfig in REG-PE(D) telecontrol board.

### 11.3.3 Commands

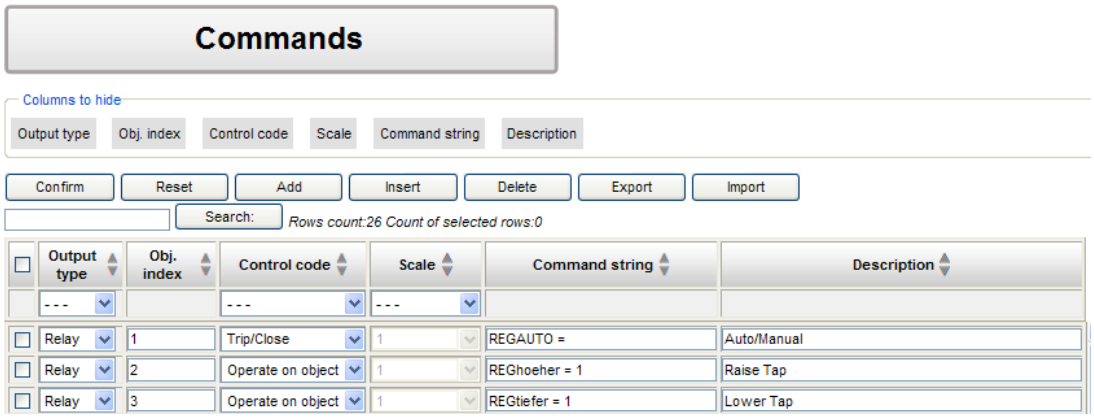



*Figure 29: DNP3 commands REG-PE(D)*

Table 22: DNP3 commands REG-PE(D)

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Output type | - | selection of values in combo box | Relay | Output type |
| Obj. index | - | 0 to 255 | 1 | Object index |
| Control code | - | selection of values in combo box | Operate on object | Control code |
| Scale | - | selection of values in combo box | 1 | Scale, valid for analog data type |
| Command string | text | 50 characters | empty | Command string |
| Description | text | 50 characters | empty | User description |

### 11.3.4 Information about installed DNP3 version

The DNP3 firmware contains a special function to facilitate the access to the information about installed DNP3 firmware version. This information can be seen on the Regsys screen for a short period of time during the telecontrol board start.

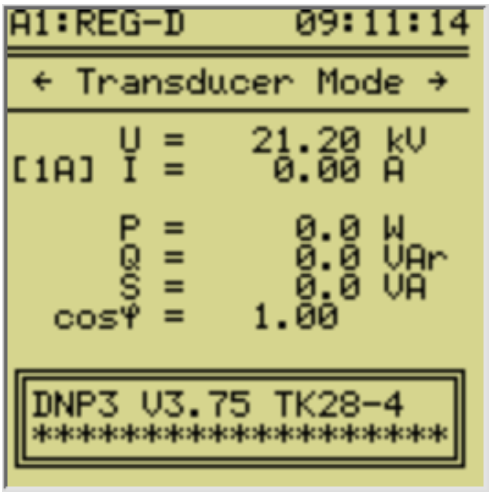



*Figure 30: Information about the DNP3 firmware version*

## 11.4 MODBUS Collector for DNP3/TKxx

DNP3 comes additionally with Modbus-Collector-Functionality, which provides a MODBUS-RTU Master to retrieve information from Modbus-slaves to be processed in a-eberle-device.

The MOBUS Master can receive pre-defined analogue values from up to 32 MODBUS-RTU server and to be processed in a-eberle devices. Usage of MODBUS-RTU using is optional.

Basic settings tree branch form contains common settings of MODBUS-RTU.

Extended settings shall be done by a-eberle staff.

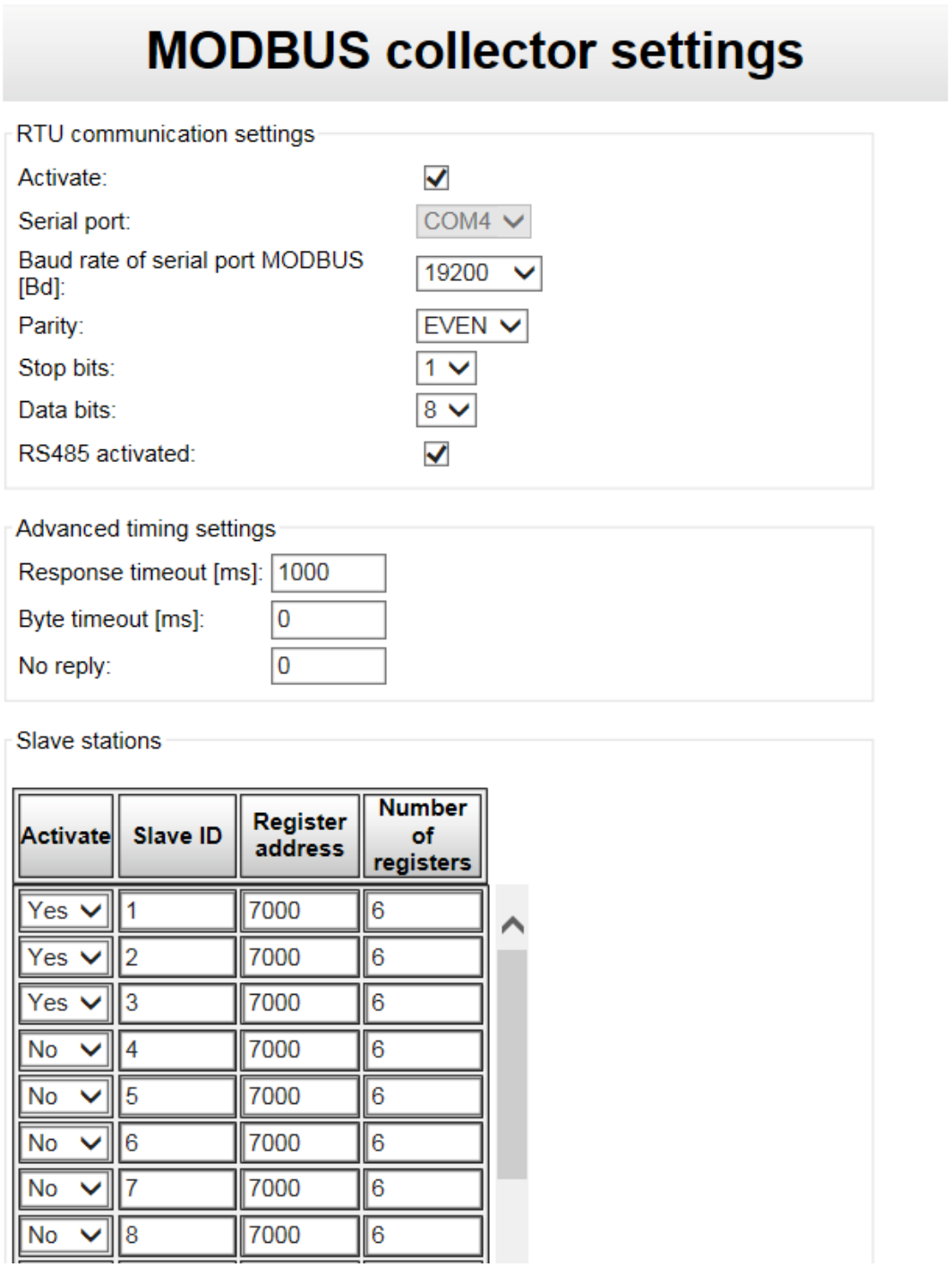



*Figure 31: MODBUS collector basic settings*

Table 23: MODBUS collector settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Activate | Checkout | Yes/no | no | Activate MODBUS-RTU extension. |
| Serial Port | - | Selection of values in combo box | COM1 | Selection of available COM ports for MODBUS-RTU communication – read only |
| Baud Rate | - | Selection of values in combo box | 19200 | Data transfer rate. 19200 b/s is default. |
| Parity | - | Selection of values in combo box | EVEN | Even parity is required |
| Stop bits | - | Selection of values in combo box | 1 | Stop bits |
| Data bits | - | Selection of values in combo box | 8 | Data bits |
| RS485 activated | | checkbox | checked | Activation of RS485 |
| Response timeout | ms | 0..65535 | 1000 | The master is configured by the user to wait for a predetermined timeout interval ( Response time-out) before aborting the transaction |
| Byte timeout | - | 0..65535 | 0 | The maximum timeout interval in ms. between two consecutive bytes of the same message |
| No reply | - | 0..65535 | 0 | Idle timeout after “no replay” from slave up to a next query. |

Table 24: MODBUS collector slaves settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Activate | Checkout | Yes/no | no | Activate MODBUS-RTU slave use. |
| Slave ID | - | 1..254 | 1 | Modbus slave address. The address must be unique on a MODBUS serial bus |
| Register address | - | 2 Bytes 0x0000 to 0xFFFF | 7000 | The starting register address |
| Number of registers | - | 1 to 500 | 6 | The number of registers |

### 11.4.1 Modbus collector – supervisory settings

Modbus collector – supervisory settings tree branch contains usual settings for supervising the Modbus communication. Settings are similar to the available in other protocols available in WinConfig.

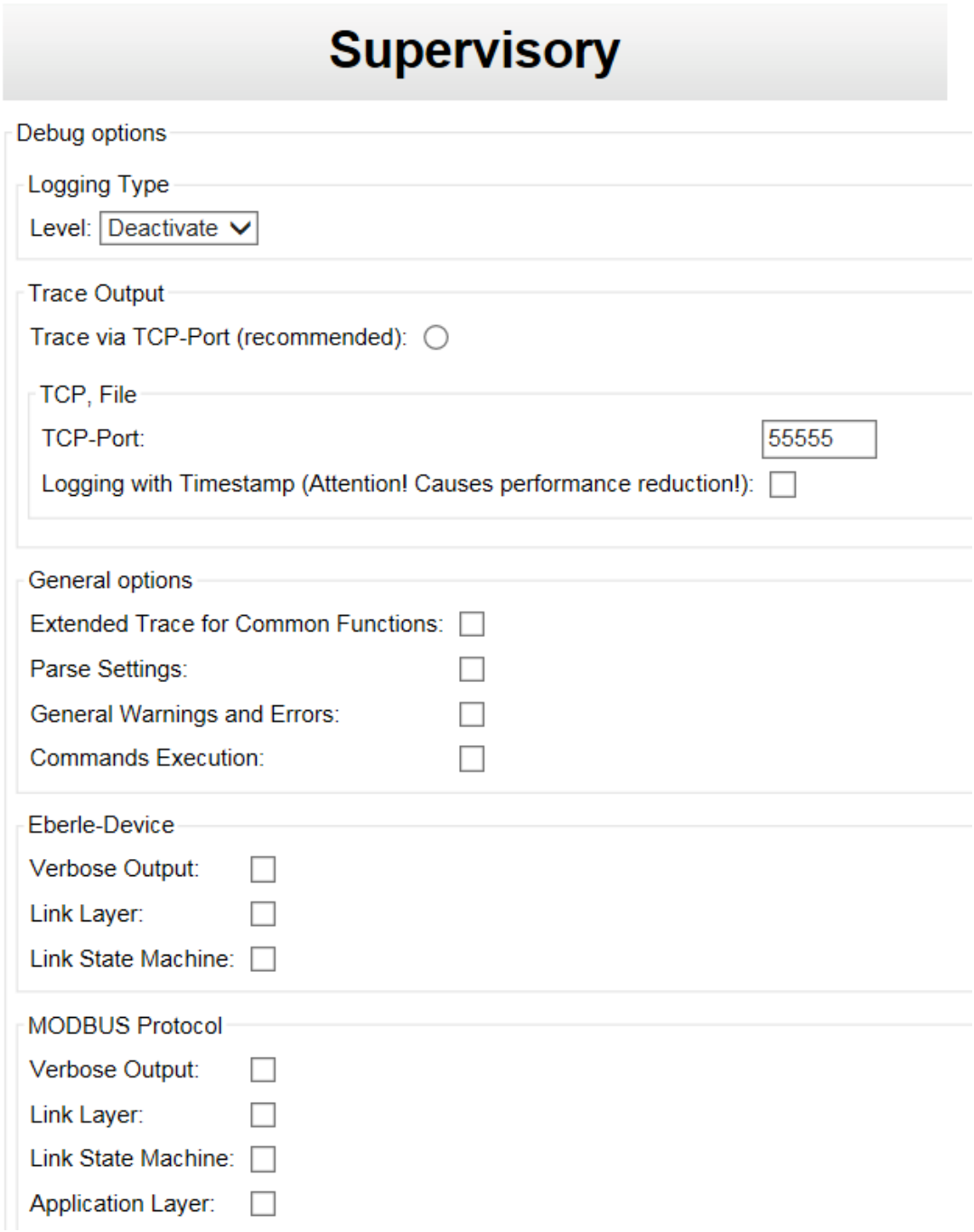



*Figure 32: MODBUS collector supervisory settings*

### 11.4.2 Modbus collector – internal communication

Modbus collector – internal settings tree branch contains options for internal communication between the device and telecontrol board.

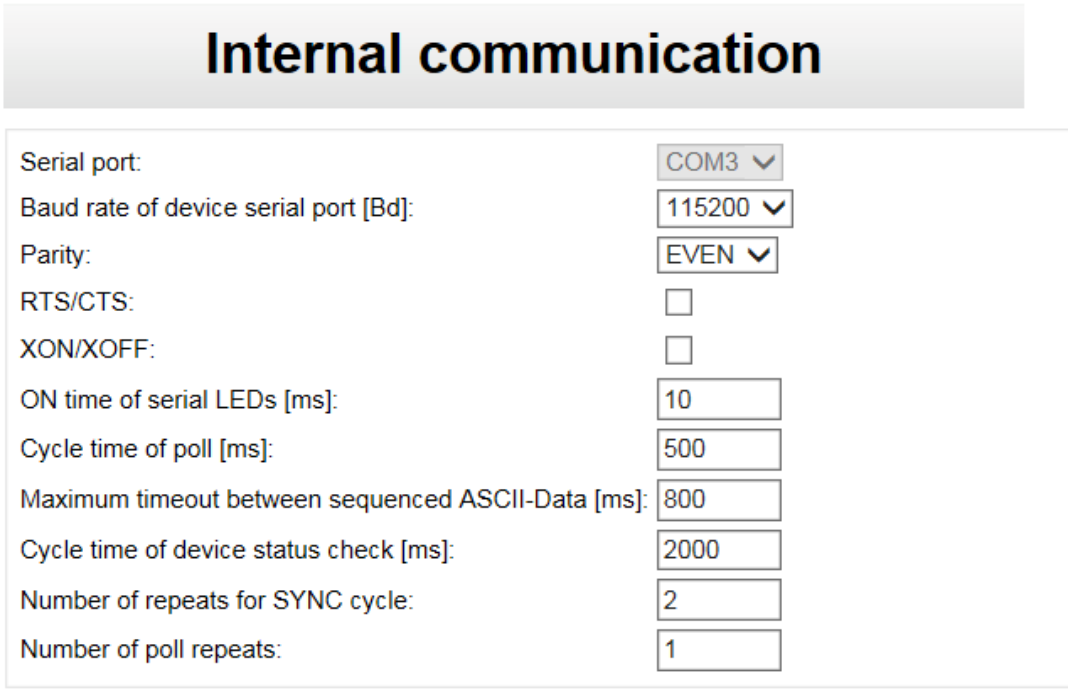



*Figure 33: MODBUS collector – internal communication*

Table 25: MODBUS collector – internal communication

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Serial Port | - | Selection of values in combo box | COM3 | Selection of available COM ports for MODBUS-RTU communication – read only |
| Baud Rate of device serial port | - | Selection of values in combo box | 115200 | Data transfer rate |
| Parity | - | Selection of values in combo box | EVEN | Even parity is required |
| RTS/CTS | - | Checkbox | unchecked | RTS/CTS handshaking |
| XON/XOFF | - | Checkbox | unchecked | XON/XOFF handshaking |
| ON time of serial LEDs | ms | 1..65535 | 10 | ON time of serial LEDs |
| Cycle time of poll | ms | 0..65535 | 500 | Cycle time of poll |
| Maximum timeout between sequenced ASCII-Data | ms | 0..65535 | 800 | Maximum timeout between sequenced ASCII-Data |
| Cycle time of device status check | ms | 0..65535 | 2000 | Cycle time of device status check |
| Number of repeats for SYNC cycle | - | 1..255 | 2 | Number of repeats for SYNC cycle |
| Number of poll repeats | - | 0..255 | 1 | Number of poll repeats |

# 12. CSO settings (REG-P)

CSO settings are used for COM-Server Only firmware type. Only one tree branch with setting is available. Changes of Communication settings of REG-P are recommended for advanced user only.

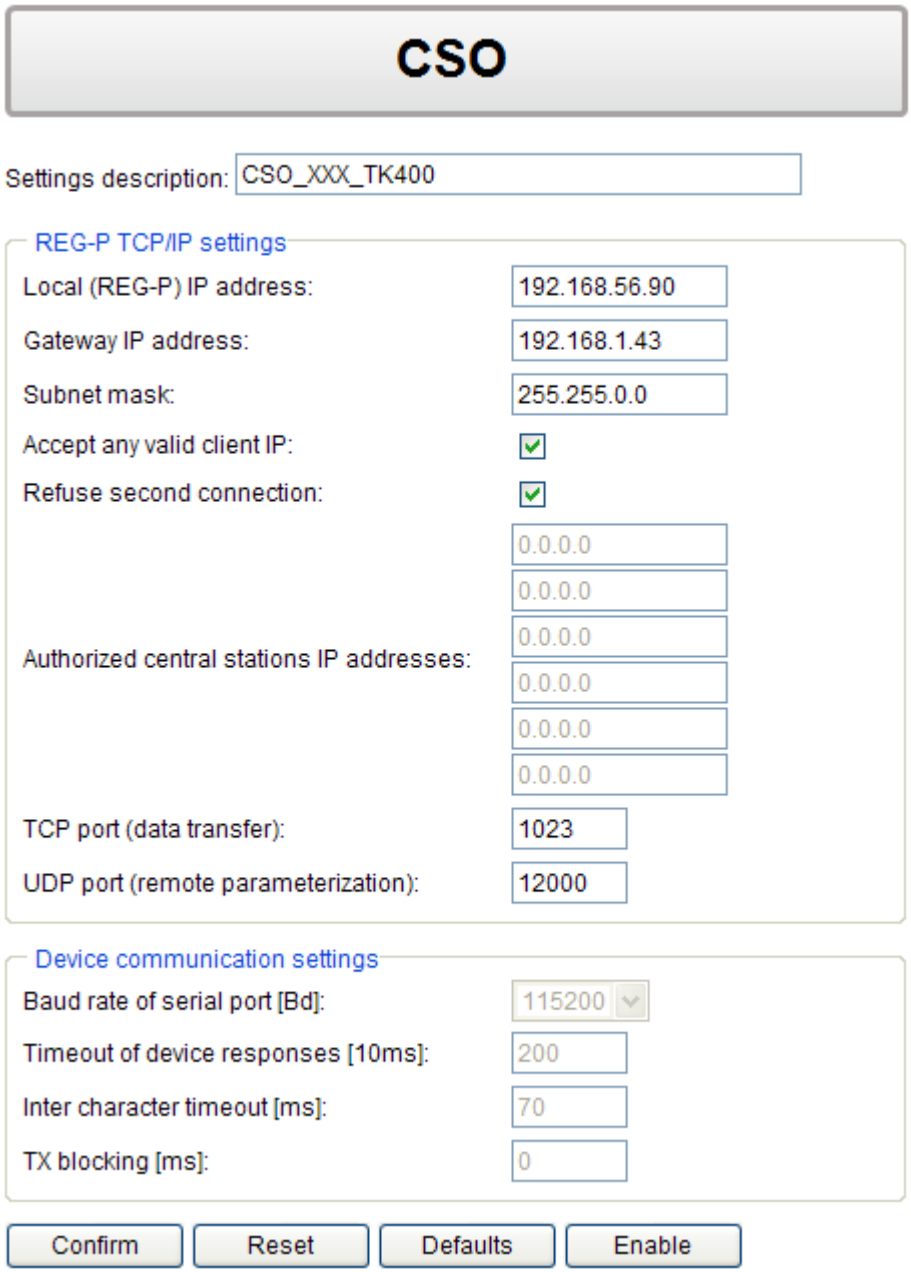



*Figure 34: CSO settings REG-P*

Table 26: CSO settings REG-P

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Settings description | text | 50 characters | Filename of open settings | Short user description of settings file or name of settings file. |
| Local (REG-P) IP address | - | 4x 0 to 255 | 192.168.56.90 | Local (REG-P) IP address |
| Gateway IP address | - | 4x 0 to 255 | 192.168.1.43 | IP address of default gateway |
| Subnet mask | - | 4x 0 to 255 | 255.255.0.0 | Subnet mask |
| Accept any valid client IP | - | checkbox | checked | Accept any valid client IP |
| Refuse second connection | - | checkbox | checked | Refuse second connection if other connection is already set. Otherwise the current connection is closed and the new one established. |
| Authorized central stations IP addresses | - | 4x 0 to 255 | 0.0.0.0 | IP address of authorized central stations, 6 available addresses |
| TCP port (data transfer) | - | 1 to 65535 | 1023 | TCP port for data transfer. Changing of this value is not recommended. |
| UDP port (remote parameterization) | - | 1 to 65535 | 12000 | UDP port for remote parameterization. Changing of this value is not recommended. |
| Baud rate of device serial | Bd | selection of values in combo box | 115200 | Baud rate of device serial communication. Device settings are accessible after clicking the Enable button. Experienced staff should do changing of device settings only. |
| Timeout of REG-P responses | 10ms | 1 to 255 | 200 | Timeout of REG-P responses |
| Inter character timeout | ms | 1 to 255 | 70 | Timeout between two characters in device communication |
| Time to wait after REG-P response | ms | 0 to 255 | 0 | Timeout after message reception |

# 13. CSO settings TK28-8

CSO parameters for TK28-8 board are similar to those for TK400 – see CSO settings REG-P. However, as the TK28-8 is linux-based board, there are also another functions available.

TK28-8 board can run also supervisory settings using Sysylog with parameters defined e.g. in protocol *IEC103: Supervisory settings for boards type TK28-4, TK28-6, TK102.*

Also a time synchronization is defined using NTP server or PTP (Precission Time Protocol) as defined in protocol *DNP3: Time synchronization for boards type TK28-4, TK28-6 and TK102.*

# 14. CSO settings REG-PE(D), REG-PEDSV (TK102), TK28-6, TK28-4

## 14.1 CSO channels

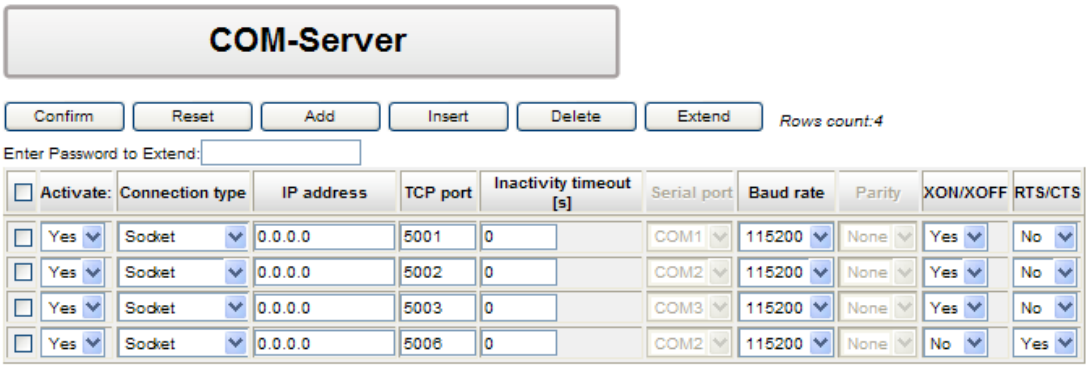



*Figure 35: CSO channels REG-PE(D) , REG-PEDSV, TK28-6*

Table 27: CSO settings REG-PE(D) , REG-PEDSV, TK28-6 - Channels

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Disabled | - | Yes/No | No | Option to disable the channel |
| State | - | Selection of values in combo box | RAW | **State of channel**<br>0 OFF disables the port from accepting connections. It can be turned on later.<br>0 RAW enables the port and transfers all data as-is between the port and the device.<br>0 RAWLP enables the port and transfers all input data to device; device is open without any POSIX setting or directly.<br>0 TELNET enables the port and runs the telnet protocol on the port to set up telnet settings. This is most useful for using telnet.<br>0 USD enables the shared port and transfers all datas between port and the device |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| | | | | vie shared serial.<br>0 USD mode used for global-resource sharing from Network and IEC control center |
| IP address | - | 4x 0 to 255 | 0.0.0.0 | IP address |
| TCP port | - | 0 to 65535 | 3003 | TCP port |
| Inactivity timeout | s | | 180 | Inactivity timeout |
| Serial port | - | Selection of values in combo box | COM2 | Selection of serial port |
| Baud rate | Bd | Selection of values in combo box | 115200 | Baud rate |
| Parity | - | Selection of values in combo box | Even | Parity |
| Stop bits | - | Selection of values in combo box | 1 | Stop bits |
| Data bits | - | Selection of values in combo box | 8 | Data bits |
| XON/XOFF | - | Selection of values in combo box | No | Option to select XON/XOFF handshaking |
| RTS/CTS | - | Selection of values in combo box | No | Option to select RTS/CTS handshaking |
| RTS inverted | - | Selection of values in combo box | No | Option to select inversion of RTS signal |
| TxD inverted | - | Selection of values in combo box | No | Option to select inversion of TxD signal |
| Interface type | - | Selection of values in combo box | RS232 | Selection of interface type |

## 14.2 CSO Supervisory settings

The *Supervisory settings* tree branch can be used for activation and configuration of debug logs.

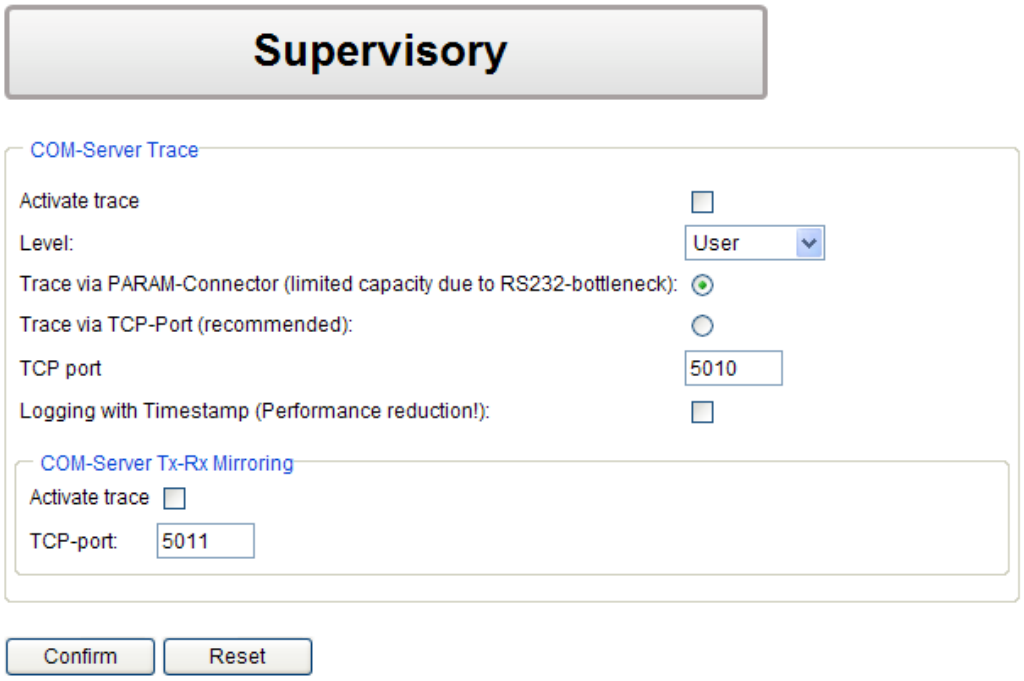



*Figure 36: CSO channels REG-PE(D)*

Table 28: CSO Supervisory settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Activate | | checkbox | checked | Protocol debug option activation |
| Level | - | Selection of values in combo box | user | Option to select lever of supervisory messages (user, developer) |
| Verbose Output | - | checkbox | unchecked | Verbose Output |
| Trace via PARAM-Connector) | - | radio button | checked | Logging to PARAM-Connector |
| Trace via TCP-Port | - | radio button | unchecked | Logging to TCP port |
| TCP port | - | 1 to 65535 | 55555 | TCP port |
| Logging with Timestamp | - | checkbox | checked | Logging with Timestamp |
| Mirror port: Activate trace | - | checkbox | checked | Mirror port: Activate |
| TCP-port | - | 1 to 65535 | 55444 | TCP port |

# 15. CSO Time synchronization

The *Time synchronization* tree branch is available for telecontrol boards type TK28-4, TK28-6 and TK102.

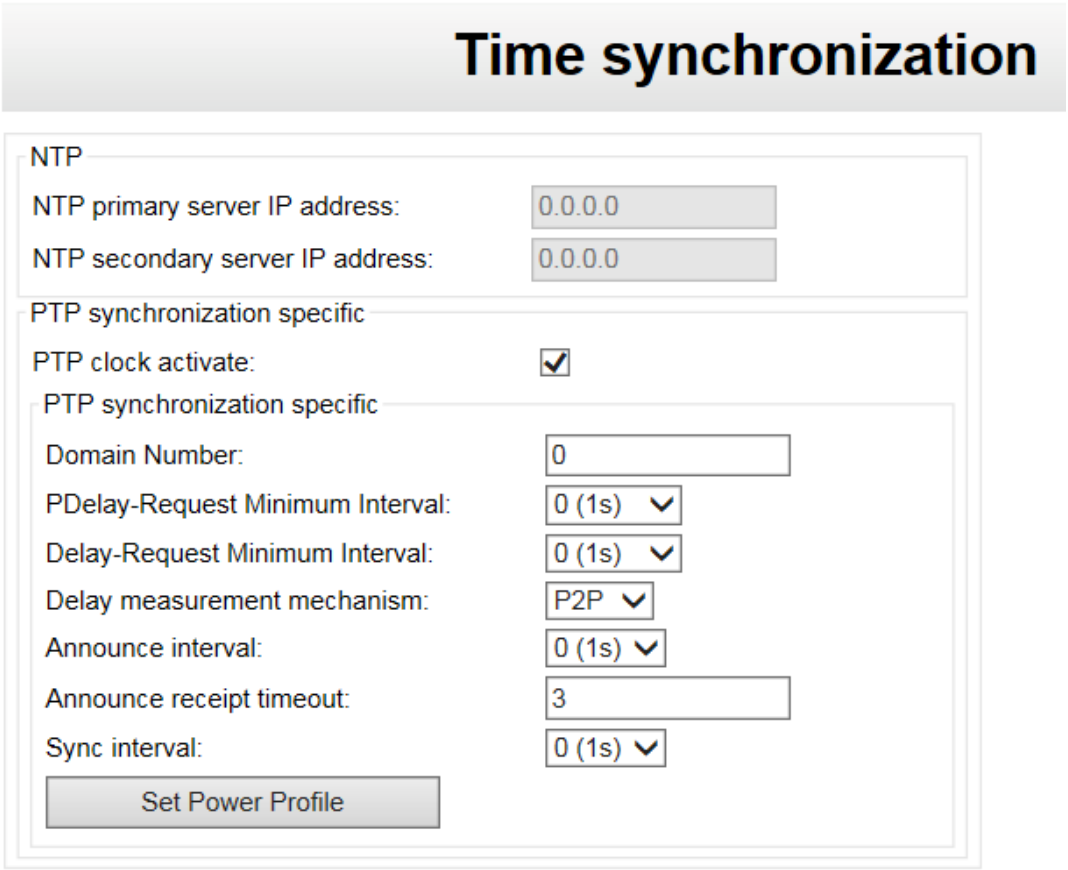



*Figure 37: CSO time synchronization for boards TK28-4, TK28-6, TK102*

Table 29: CSO Time synchronization for boards type TK28-4, TK28-6 and TK102

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| NTP primary server IP address | IPV4 | 4x 0 to 255 | 0.0.0.0 | NTP primary server IP address |
| NTP secondary server IP address | IPV4 | 4x 0 to 255 | 0.0.0.0 | NTP secondary server IP address |
| PTP specific: VLAN ID | | | 0 | VLAN ID |
| PTP specific: Domain Number | | 0 to 255 | 0 | Domain Number |
| PTP specific: PDelay-Request Minimum Interval | | Selection of values from listbox | 0 | PDelay-Request Minimum Interval, 0 to 5 |
| PTP specific: Delay-Request Minimum Interval | | Selection of values from listbox | 0 | Delay-Request Minimum Interval, 0 to 5 |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| PTP specific:<br>Delay measure-mennt mechanism | | Selection of values from listbox | Auto | Delay measurement mecha-nism |
| PTP specific:<br>Announce interval | | Selection of values from listbox | 1 | Announce interval, 0 to 3.<br>All PTP nodes in network should have the same value |
| PTP specific:<br>Announce receipt timeout | | 2 to 10 | 3 | Announce receipt timeout, all PTP nodes in network should have the same value |
| PTP specific:<br>Sync. interval | | Selection of values from listbox | none | Synchronization interval, 0 to 2 |

The time synchronization in CSO synchronizes only the telecontrol board system due to correct functionality of LDAP services. The connected Regsys device is not time-synchronized.

# 16. Modbus settings

You are able to select of either two connection type “serial” or “TCP”.

## 16.1 Basic settings MODBUS RTU

Basic settings tree branch form contains common settings of MODBUS protocol – selection of available Baud rates, Slave address and identifier if device (devices). Basic settings also contain use definable description - name of the entire settings.

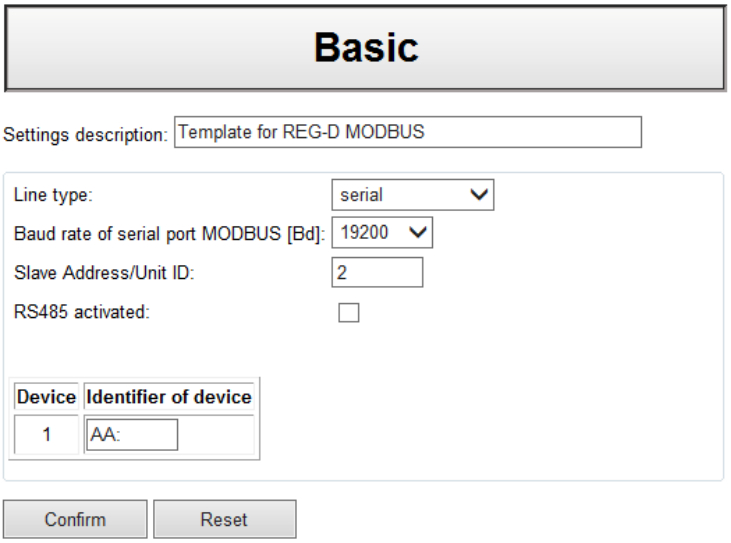



*Figure 38: MODBUS RTU basic settings*

Table 30: MODBUS basic settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Settings description | Text | 50 characters | Filename of open settings | Short user description of settings file or name of settings file |
| Slave address | - | 1-247 | 2 | Address of slave |
| RS485 activated | Bd | Checkbox | unchecked | If unchecked then RS232 or fiber optic mode is selected. |
| Identifier of device | text | AA: or A(1 to 9): to Z(1 to 4): | defaults defined in the Devices tree branch | Device identifier string as appears in the device protocol |

## 16.2 Basic settings MODBUS TCP

Basic settings tree branch form contains common settings of MODBUS TCP protocol – selection of Unit ID and identifier if device (devices). Basic settings also contain user definable description - name of the entire settings.

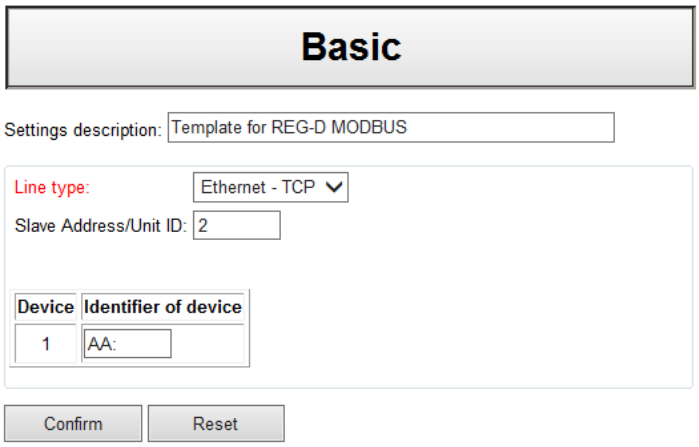



*Figure 39: Modbus TCP basic settings*

Table 31: MODBUS TCP basic settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Settings description | Text | 50 characters | Filename of open settings | Short user description of settings file or name of settings file. |
| Unit Id | - | 1-247 | 2 | Slave Address (same as the Unit ID used in MODBUS TCP/IP). |
| Identifier of device | text | AA: or A(1 to 9): to Z(1 to 4): | defaults defined in the Devices tree branch | Device identifier string as appears in the device protocol |

The port number is default 502.

## 16.3 Advanced - Settings - SCADA

*Advanced settings* tree branch contains the complete range of MODBUS settings:

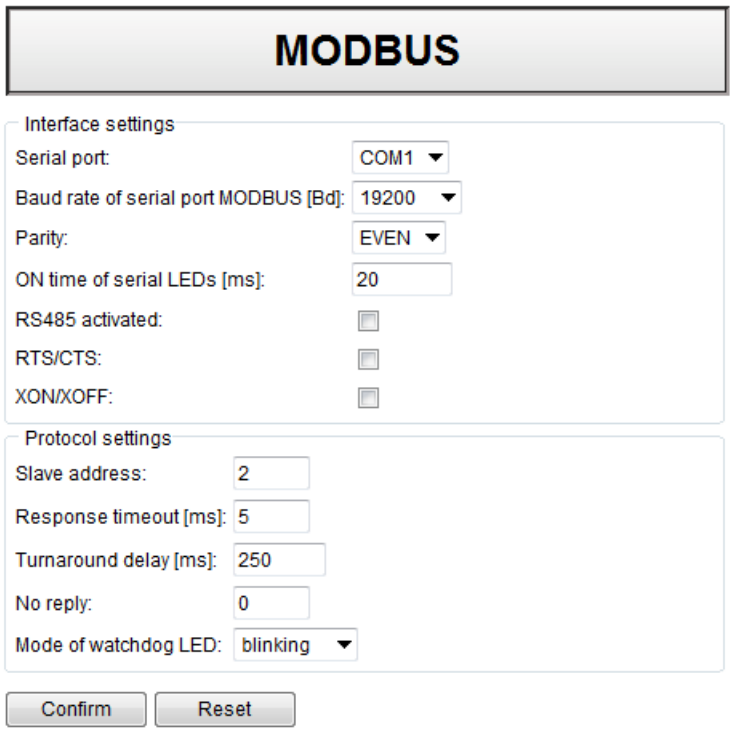



*Figure 40: MODBUS SCADA settings*

Table 32: MODBUS advanced settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Serial port | - | Selection of values in combo box | COM1 | Selection of available COM ports for Modbus communication |
| Baud rate of serial [Bd] | Bd | Selection of values in combo box | 19200 | Baud rate of Modbus serial port |
| Parity | - | Selection of values in combo box | Even | Parity of Modbus serial port |
| ON time of serial LEDs | ms | 0 to 65535 | 20 | ON time of serial LEDs indicating activity on the Modbus serial interface |
| Slave address | - | 1-247 | 2 | Address of slave |
| RS 485 activated | - | checkbox | Not checked | Activation of RS485 interface |
| **RTS/CTS** | **-** | **checkbox** | **Not checked** | **RTS/CTS handshaking** |
| XON/XOFF | - | checkbox | Not checked | XON/XOFF handshaking |
| **Response timeout** | **ms** | **2 to 100** | **5** | **SCADA response timeout** |
| Turnaround delay | ms | 0 to 65535 | 250 | Turnaround delay |
| No reply | - | 0 to 255 | 0 | No reply |
| Mode of watchdog LED | - | Selection of values in combo box | blinking | Mode of watchdog LED (blinking/switched off) |

## 16.4 Devices

*Devices* tree branch is the same as for IEC101 protocol. See chapter 11.2.

### 16.4.1 Time synchronization

*Time synchronization* tree branch is the same as for IEC101 protocol. See chapter 11.2.2.

### 16.4.2 Internal communication settings

Device communication settings contain the following options:

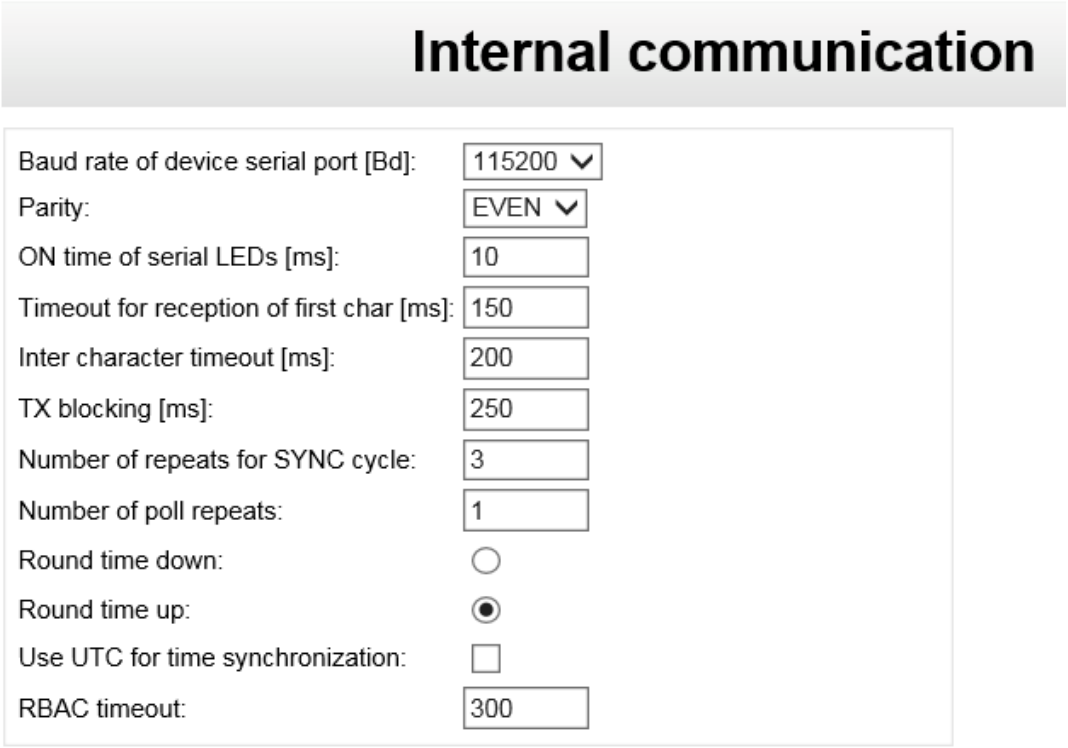



*Figure 41: Device internal communication settings*

Table 33: Device communication settings for MODBUS

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Baud rate of device serial | Bd | Selection of values in combo box | 115200 | Baud rate of device serial port |
| Parity | - | Selection of values in combo box | Even | Parity of device serial port |
| ON time of serial LEDs | ms | 0 to 65535 | 10 | ON time of serial LEDs for indication of device communication |
| Timeout for reception of first char | ms | 0 to 65535 | 90 | Timeout for reception of first character |
| Inter character timeout | ms | 0 to 65535 | 80 | Timeout between two characters in telegram |
| TX blocking | ms | 0 to 65535 | 30 | Timeout to wait when answer was received |
| Number of repeats for SYNC cycle | - | 0 to 255 | 3 | Number of repeats for SYNC cycle |
| Number of command repeats | - | 0 to 255 | 1 | Number of command (poll) repeats |
| Round time down / | - | option box | round down | Rounding time selection |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Round time up | | | | |
| Use UTC for time synchronization | - | check box | unchecked | Selection of usage UTC for time synchronization |
| RBAC timeout | s | 30 to 600 | 300 | RBAC timeout for RegSys devices firmware supporting user roles and rights and telecontrol boards TK8xx and TK102 |

## 16.5 Device x

### 16.5.1 Device settings

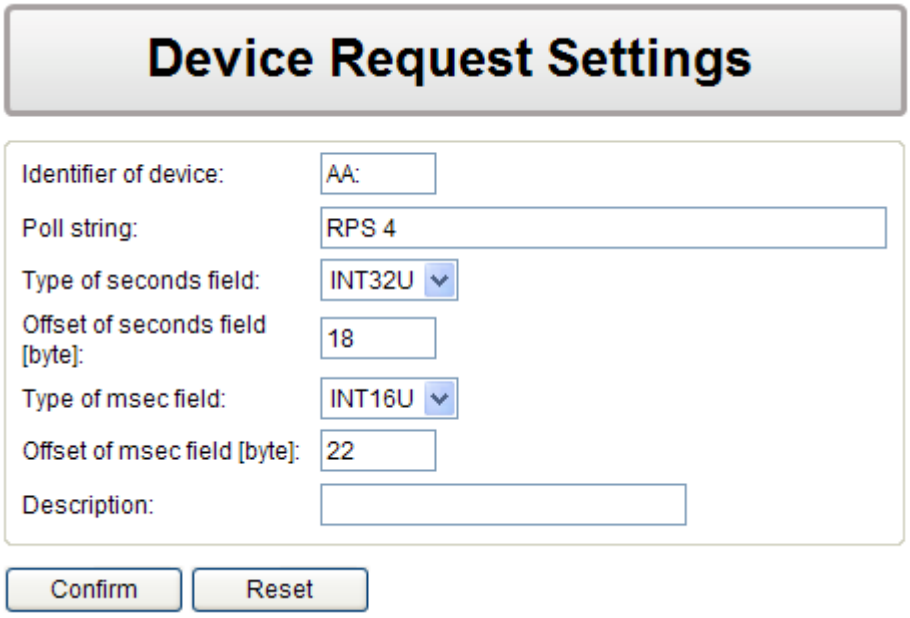



*Figure 42: MODBUS device request settings*

Table 34: MODBUS device settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Identifier of device | text | 3 chars | AA: | Identifier of device as appears in the device communication |
| Poll string | text | 63 chars | RPS 4 | Device poll string |
| Type of seconds field | - | Selection of values in combo box | INT32U | Type of “seconds” field |
| Offset of seconds field | byte | 0 - 65535 | 18 | Offset of seconds field |
| Type of msec field | - | Selection of values in combo box | INT32U | Type of “milliseconds” field |
| Offset of msec field | byte | 0 - 65535 | 22 | Offset of “milliseconds” field |
| Description | text | 30 chars | empty | User description |

### 16.5.2 Indications

Indications tree branch describes indications of individual device.

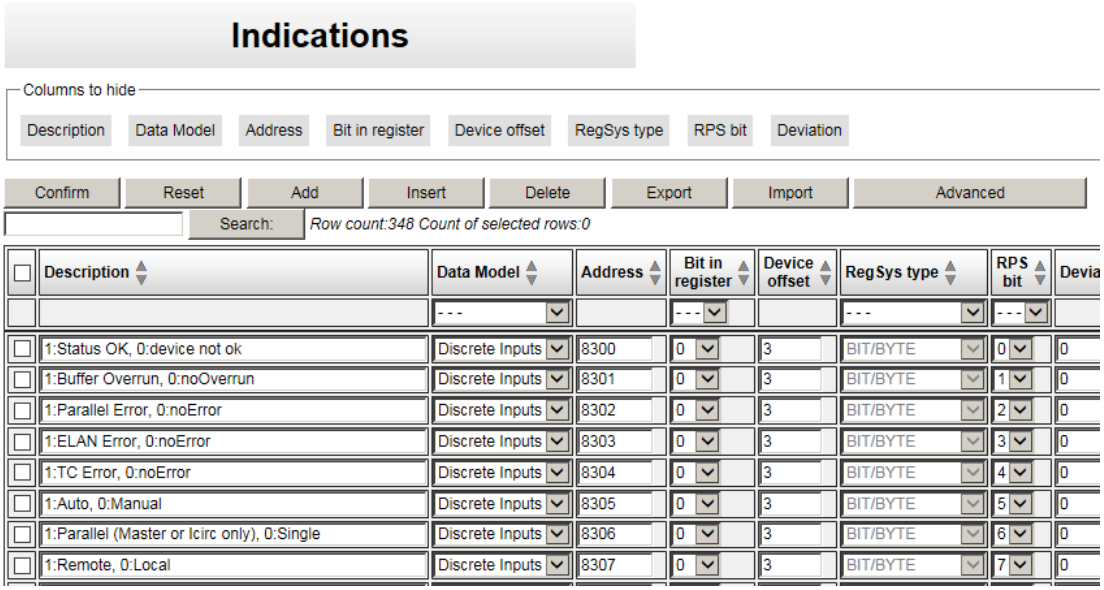



*Figure 43: MODBUS indications*

Table 35: MODBUS indications

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Function | - | 0 to 999 | 0 | Function number |
| Address | - | 0 to 65535 | 0 | Address |
| Class | - | 0 to 65535 | 0 | Class |
| Device offset | | 0 to 999 | 0 | Indication device offset |
| Dev type | - | 0 to 999 | 0 | Indication device type |
| Deviation | float | | 0 | Absolute deviation value |
| Scale | float | | 0 | Scale value |
| Max. value | float | 0 to 65535 | 0 | Max. value |
| Description | text | 50 chars | empty | User description |

### 16.5.3 Commands

Table of settings of individual commands represents command settings. This table is common for all a.eberle devices connected to the telecontrol board.

The upper line contains execution buttons for work with the individual command lines and for export/import of the entire table of commands.

Selected line in the table is marked by yellow background. All changes have to be confirmed by using the *Confirm* button.

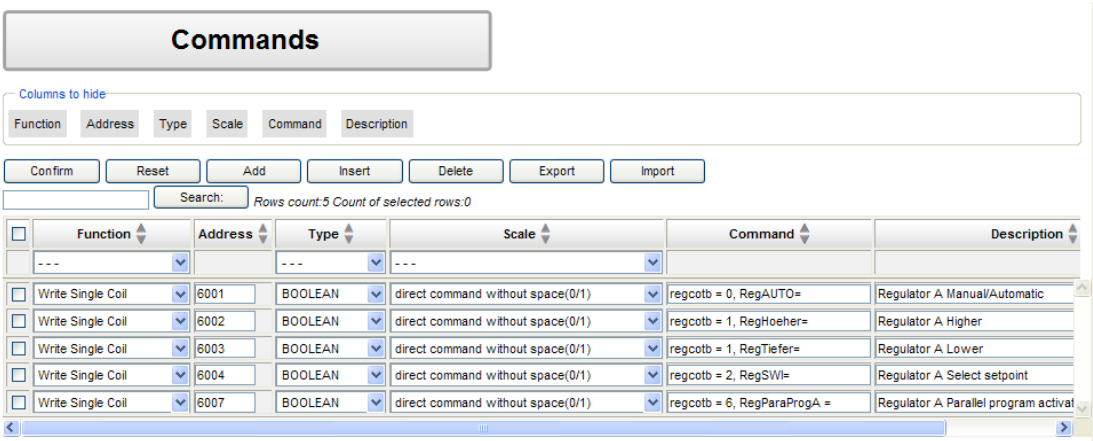



*Figure 44: MODBUS commands*

Table 36: MODBUS Commands

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Function | - | 1 to 128 | 1 | Function number |
| Address | - | 1 to 128 | 0 | Information address |
| Type | - | 1 to 128 | 0 | Data type |
| Scale | - | 1 to 128 | 0 | Scale |
| Max value | - | 1 to 128 | 0 | Maximum value |
| Command | text | 50 chars | empty | Command string |
| Description | text | 50 chars | empty | User description |

# 17. C37.118 Settings

## 17.1 Basic

Basic settings tree branch form contains common settings of for C37.118 protocol.

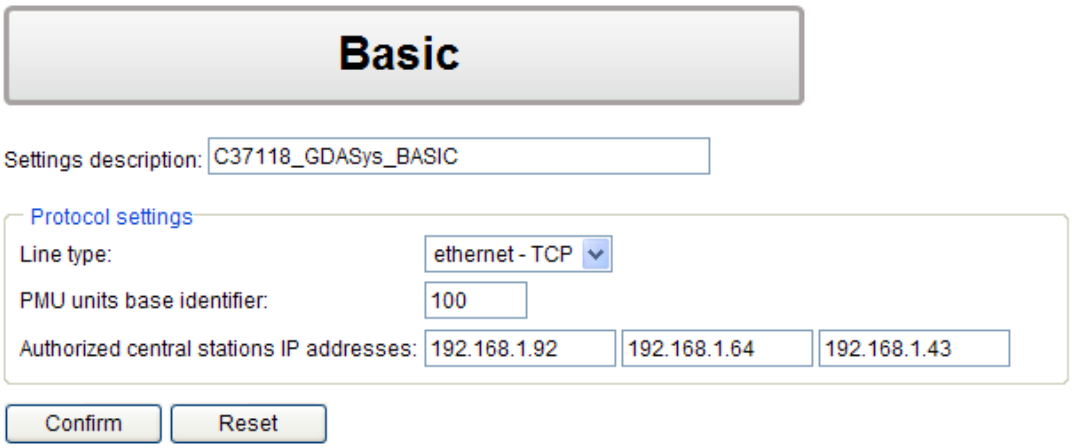



*Figure 45: C37.118 basic settings*

Table 37: C37.118 basic settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Settings description | Text | 50 characters | Filename of open settings | Short user description of settings file or name of settings file. |
| Line type | - | Selection of values in combo box | Ethernet - TCP | Type of line for C37.118 protocol (Ethernet, serial line) |
| PMU base identifier | - | 1 to 65535 | 100 | Base identifier of virtual PMU devices defined by firmware; individual PMU identifiers are defined as Base Identifier + PMU Order Number (e.g. Base Identifier = 100, PMU identifiers are 101, 102 …). |
| Authorized central stations IP addresses | - | 4x 0 to 255 | As defined in the template | IP address of central stations (SCADAs) authorized to communicate with telecontrol board using C37.118 protocol. |

## 17.2 Advanced

### 17.2.1 Settings – SCADA

Settings – SCADA tree branch form contains settings of SCADA-related parameters, namely important communication parameters of the C37.117 protocol.

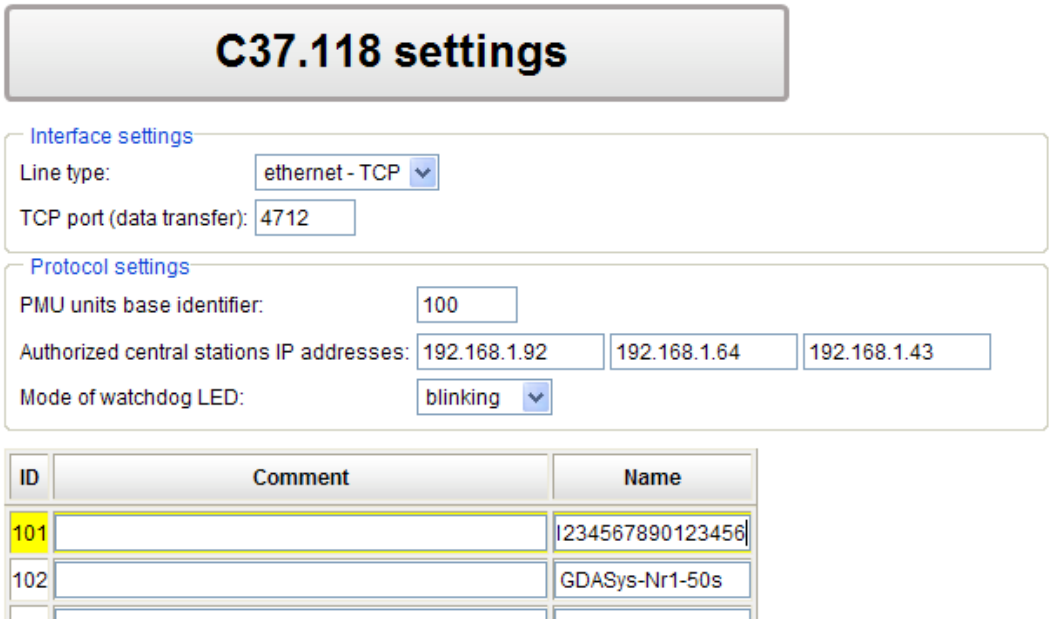



*Figure 46: C37.118 SCADA Settings*

Table 38: C37.118 SCADA Settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Line type | - | Selection of values in combo box | Ethernet - TCP | Type of line for C37.118 protocol (Ethernet, serial line) |
| TCP port (data transfer) | - | - | - | Explanation of usage of the corresponding port. |
| Port | - | 1 to 65535 | 4712 | TCP port used for C37.118 protocol. |
| PMU base identifier | - | 1 to 65535 | 100 | Base identifier of virtual PMU devices defined by firmware; individual PMU identifiers are defined as Base Identifier + PMU Order Number (e.g. Base Identifier = 100, PMU identifiers are 101, 102 …). |
| Authorized central stations IP addresses | - | 4x 0 to 255 | 192.168.1.92<br>192.168.1.64<br>192.168.1.43 | IP address of central stations (SCADAs) authorized to communicate with telecontrol board using C37.118 protocol. |
| ID | - | - | - | Read-only ID of virtual PMU in C37.118 communication; ID is defined by PMU base identifier |
| Comment | text | 50 characters | “” | User comment |
| Name | Text | 50 characters | As defined in template | Name of virtual PMU in C37.118 communication |

### 17.2.2 ComServer

ComServer tree branch form contains settings of ComServer -related parameters.

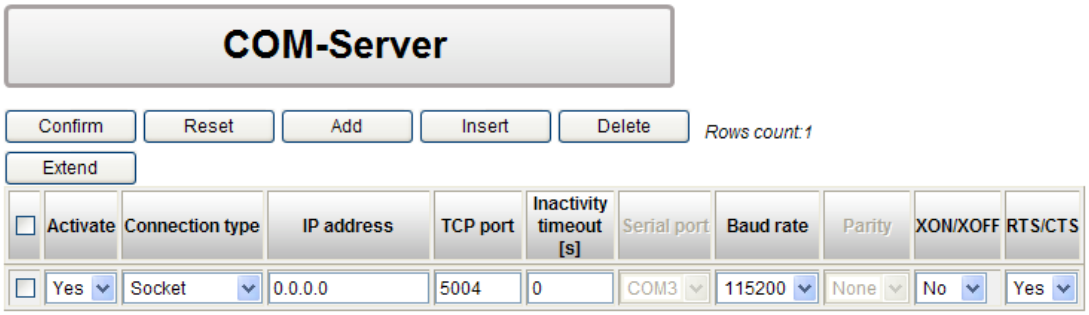



*Figure 47: C37.118 ComServer Settings*

Table 39: C37.118 ComServer Settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Activate | - | Selection of values in combo box | Yes | Activation |
| Connection type | - | Selection of values in combo box | Socket | Connection type |
| IP address | - | 4x 0 to 255 | 0.0.0.0 | IP address |
| TCP port | - | 1 to 65535 | 1023 | CS TCP port. |
| Inactivity timeout | s | 1 to 65535 | 60 | Inactivity timeout |
| Serial port | - | - | COM3 | Read only; CS serial port defined in Serial Ports Assignment page |
| Baud rate of serial port | - | Selection of values in combo box | 115200 | Baud rate of serial port |
| Parity | - | - | NONE | Read only; Parity |
| Stop bits | - | - | 1 | Read only; Stop bits |
| Data bits | - | - | 8 | Read only; Data bits |
| XON/XOFF | - | Selection of values in combo box | Yes | XON/XOFF handshaking |
| RTS/CTS | - | Selection of values in combo box | No | RTS/CTS handshaking |
| Interface type | - | - | RS232 | Read only; interface type |
| Max. message length | - | 0 to 65535 | 0 | Max. message length |
| Tx blocking time | ms | 0 to 65535 | 0 | Tx blocking time |

### 17.2.3 Supervisory settings

Supervisory settings allow user to define logging options to see log of C37.118 conversion operation.

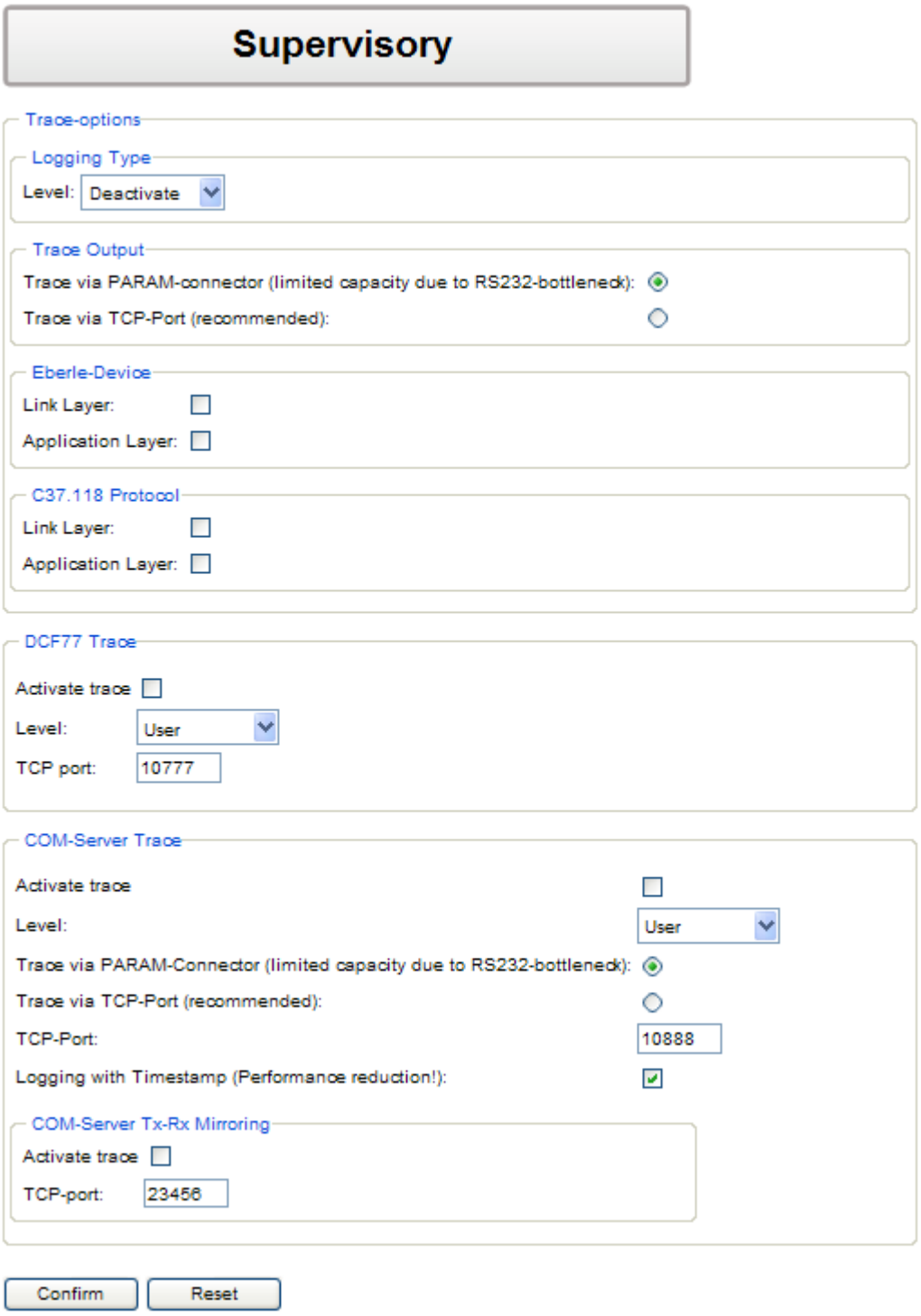



*Figure 48: C37.118 Supervisory settings*

Table 40: C37.118 Supervisory settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Level | - | Selection of values in combo box | Deactivate | Level of Log messages |
| | | | | |
| Trace output | - | radio button | PARAM-connector | Option to trace via PARAM connector or via TCP |
| Eberle-Device: Link Layer | - | checkbox | unchecked | Level of Log in device communication |
| Eberle-Device: Application Layer | - | checkbox | unchecked | Level of Log in device communication |
| C37.118 protocol: Link Layer | - | checkbox | unchecked | Level of Log in C37.118 protocol communication |
| C37.118 protocol: Application Layer | - | checkbox | unchecked | Level of Log in C37.118 protocol communication |
| DCF77: Activate trace | | checkbox | unchecked | Trace activation |
| DCF77: Level | - | Selection of values in combo box | Deactivate | Level of Log messages |
| DCF77: TCP port | - | 1 to 65535 | 10777 | TCP port |
| COM-Server Trace: Activate trace | | checkbox | checked | Protocol debug option activation |
| Level | - | Selection of values in combo box | user | Option to select lever of supervisory messages (user, developer) |
| Trace via PARAM-Connector) | - | radio button | checked | Logging to PARAM-Connector |
| Trace via TCP-Port | - | radio button | unchecked | Logging to TCP port |
| TCP port | - | 1 to 65535 | 10888 | TCP port |
| Logging with Timestamp | - | checkbox | checked | Logging with Timestamp |
| Mirroring: Activate trace | - | checkbox | checked | Mirror port: Activate |
| TCP-port | - | 1 to 65535 | 23456 | TCP port |

### 17.2.4 Linked Devices

Linked Devices page allows user to define virtual devices from the point of view of the RegSys internal communication.

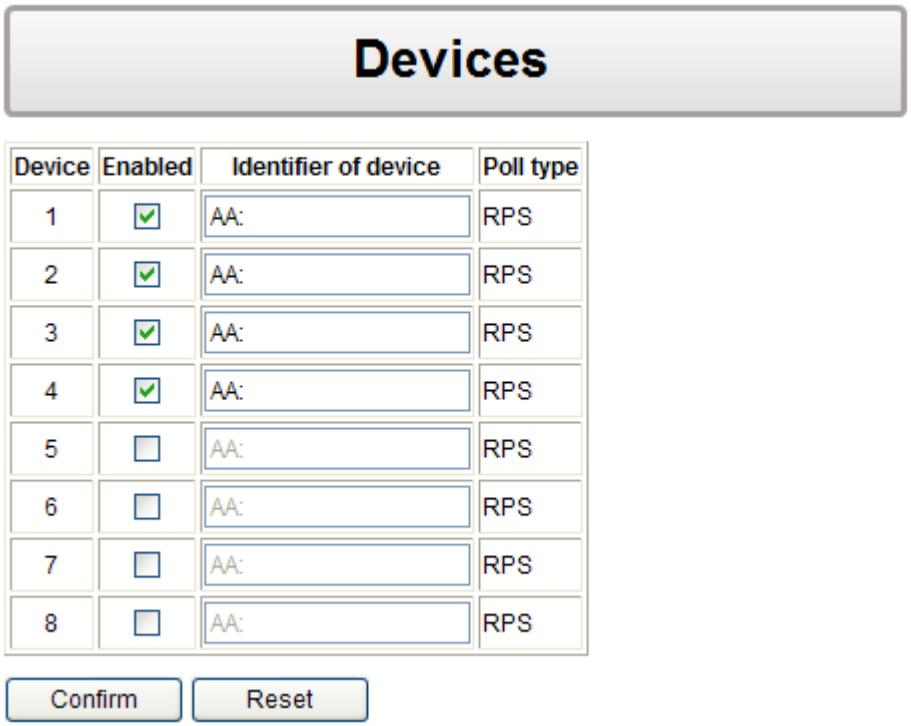



*Figure 49: C37.118 Linked Devices*

Table 41: C37.118 Linked Devices

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Device | - | - | - | Read only; order number of device from the point of view of RegSys communication |
| Enabled | - | checkbox | Checked/ unchecked | Option whether the corresponding device is enabled |
| Identifier of device | text | checkbox | AA: | Identifier of the device in RegSys communication |
| Poll type | - | - | RPS | Read only; Poll type |

### 17.2.5 Time Synchronization

Time Synchronization page sets time synchronization options.

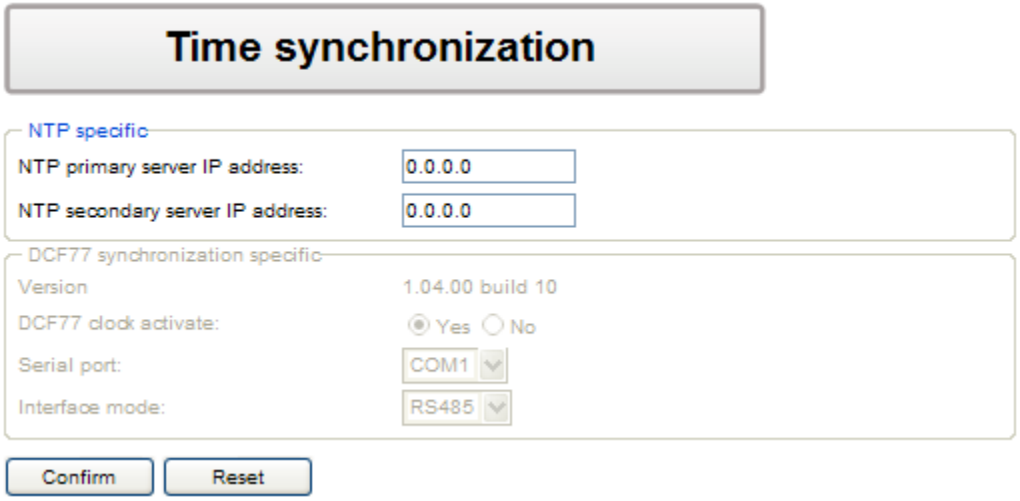



*Figure 50: C37.118 Time Synchronization*

Table 42: C37.118 Time synchronization

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Time source | - | checkbox | NTP | Read only; NTP time source |
| Synchronize all devices connected to ELAN | - | checkbox | Unchecked | Option whether synchronize all devices connected to ELAN |
| Sync. period of connected devices | min | 0 to 999 | 1 | Synchronization period of connected devices |
| NTP primary server IP address | - | 4x 0 to 255 | 0.0.0.0 | NTP primary server IP address |
| NTP secondary server IP address | - | 4x 0 to 255 | 0.0.0.0 | NTP secondary server IP address |

### 17.2.6 Internal communication

Internal communication page allows user to set parameters of internal communication with RegSys device.

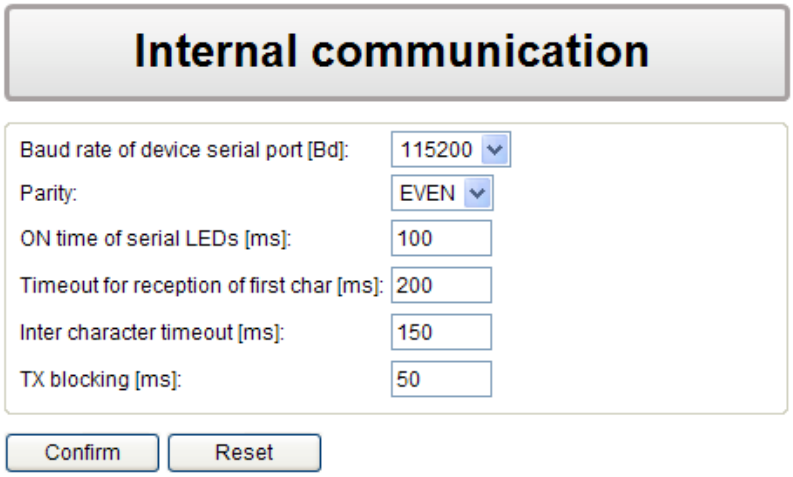



*Figure 51: C37.118 Internal communication*

Table 43: C37.118 Internal communication

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Baud rate of device serial port | Bd | Selection of values in combo box | 115200 | Baud rate of device serial port |
| Parity | - | Selection of values in combo box | EVEN | Parity of device serial port |
| ON time of serial LEDs | ms | 1 to 65535 | 100 | ON time of serial LEDs |
| Timeout for reception of first char | ms | 1 to 65535 | 200 | Timeout for reception of first char |
| Inter character timeout | ms | 1 to 65535 | 150 | Inter character timeout |
| TX blocking | ms | 0 to 255 | 50 | TX blocking |

### 17.2.7 Device x

Device *x* page sets device-related parameters of internal communication.

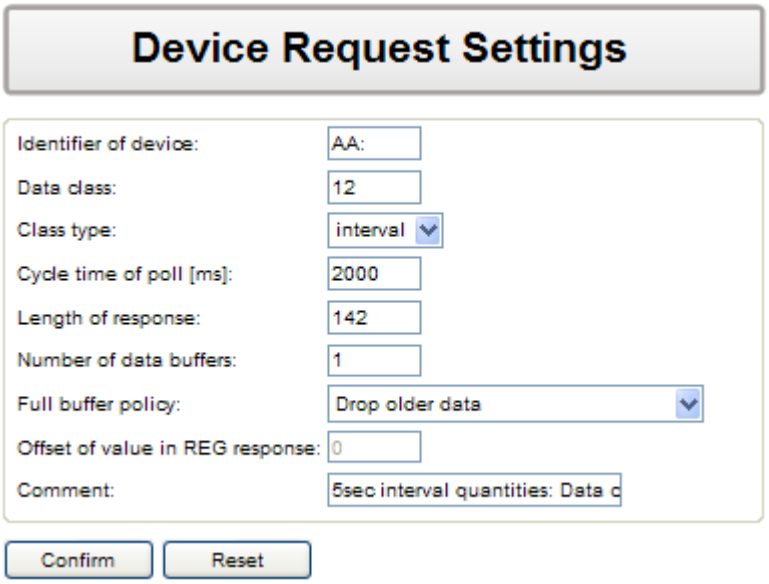



*Figure 52: C37.118 Device x*

Table 44: C37.118 Device Request Settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Identifier of device | - | - | AA: | Read only: Identifier of device |
| Data class | - | 1 to 255 | As defined in template | Device data class |
| Class type | - | Selection of values in combo box | As defined in template | Class type |
| Cycle time of poll | ms | 1 to 65535 | 2000 | Cycle time of poll |
| Length of response | - | 1 to 65535 | 142 | Length of response |
| Data buffers | - | 1 to 255 | As defined in template | Data buffers |
| Offset of priority value in REG response | - | 1 to 65535 | - | Offset of priority value in REG response |
| Comment | string | 50 characters | As defined in template | User comment |

### 17.2.8 Indications

Indications page sets parameters of individual data points.

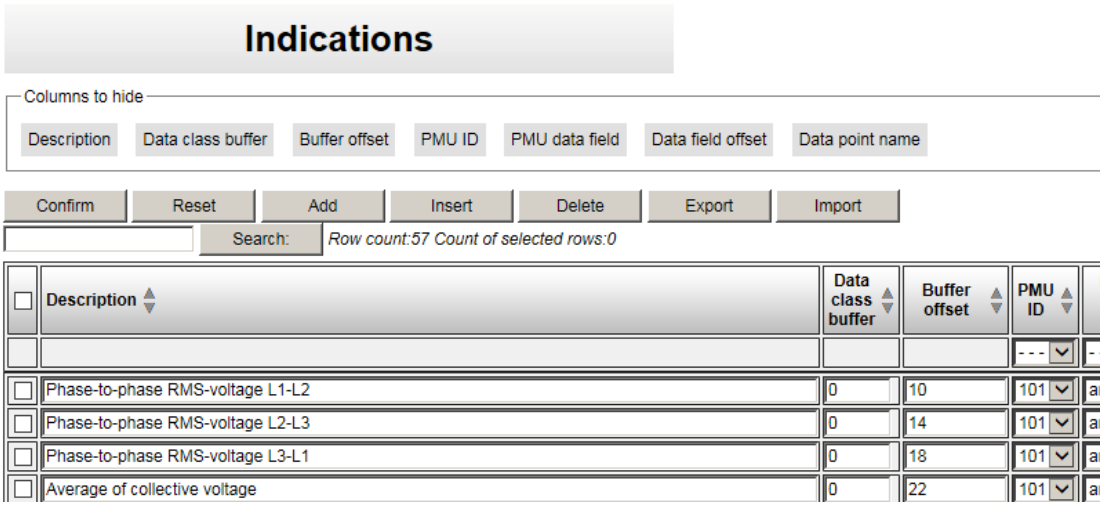



*Figure 53: C37.118 Indications*

Table 45: C37.118 Indications

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Description | string | 100 characters | As defined in template | Description |
| Data class buffer | - | 0 to 254 | As defined in template | Data class buffer |
| Buffer offset | - | 0 to 65535 | As defined in template | Buffer offset |
| PMU ID | - | Selection of values in combo box | As defined in template | PMU ID in C37.118 communication |
| PMU data field | - | Selection of values in combo box | As defined in template | PMU data field in C37.118 communication |
| Data field offset | - | 0 to 65534 | As defined in template | Data field offset in C37.118 communication |
| Data point name | - | 16 characters | As defined in template | Data point name in C37.118 communication |

# 18. IEC61850

## 18.1 General Information

The firmware, according to IEC 61850-6, imports an SCL file with name space definitions. The contents of described attributes are used to generate a project specific MMS-context from SCL file. The project specific file with extension .ICD is located in settings with *.xml file.

WinConfig and SCL_Config engineering Tool represent for REG-PE / REG-PED all data attributes as product (IED) model.

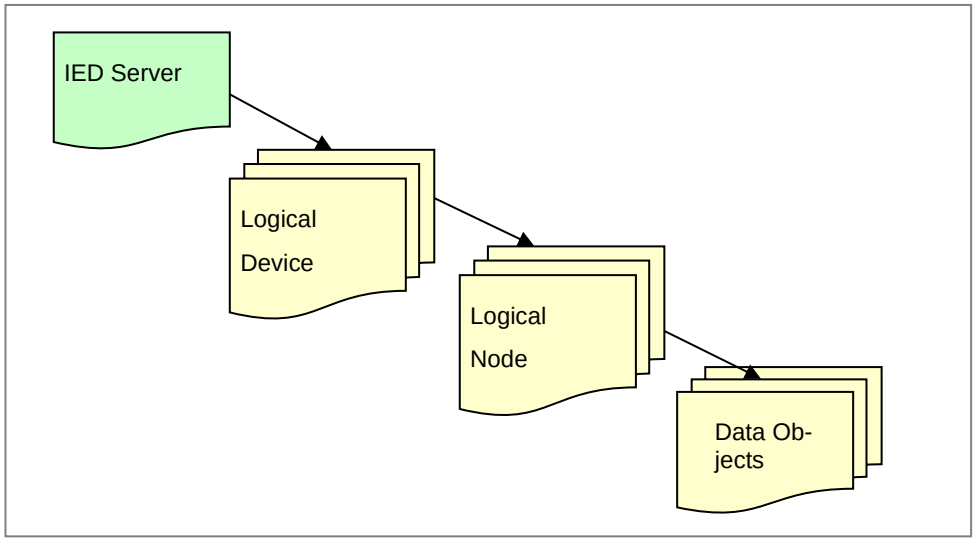



*Figure 54: Product (IED) Model*

- IED - substation automation (SA) device performing SA functions by means of logical nodes (LNs). It allows access via the communication system and is the only access point to the data of the logical devices and logical nodes contained in the server.
- LDevice - a logical device (LD), according to IEC 61850-7-2, that is contained in the server of IED.
- LNode - a logical node (LN). The LN contains Data (DO), which other logical nodes request, and it may need DOs contained in other LNs to perform its function. The offered DOs (server capability) are described in ICD - file.
- DO - the DATA contained in the LNs.

The tree view sub-entries of the server are directly resolved from the name space of the ICD file.

## 18.2 SCL_Config engineering Tool

This Tool lets you do the following:

- creating new project of WinConfig settings with ICD-file,
- creating new project of archive jffs2.tar with ICD-file from a template project or other archive,
- creating new project of WinConfig settings from archive jffs2.tar,
- viewing the ICD-file in a tree structure,
- using this tool as project-independent basis to edit objects and nodes of ICD-file in a comfortable way for project specific use. I.e. a common base can be modified to fit your project depending settings,
- viewing and editing the GOOSE publishers and subscribers.

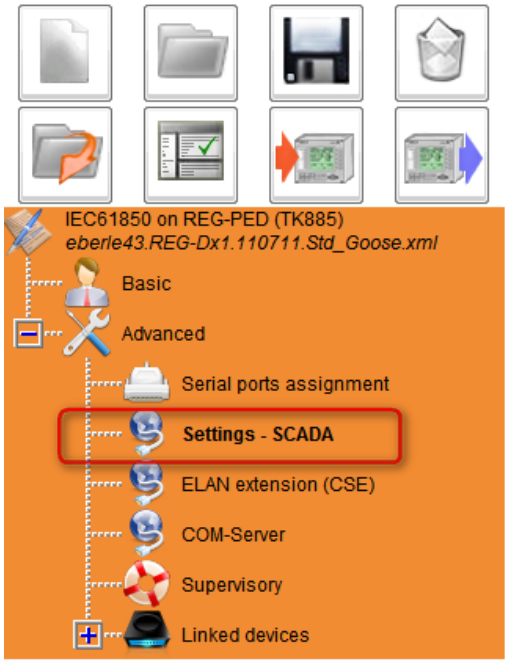



*Figure 55: SCADA Settings*

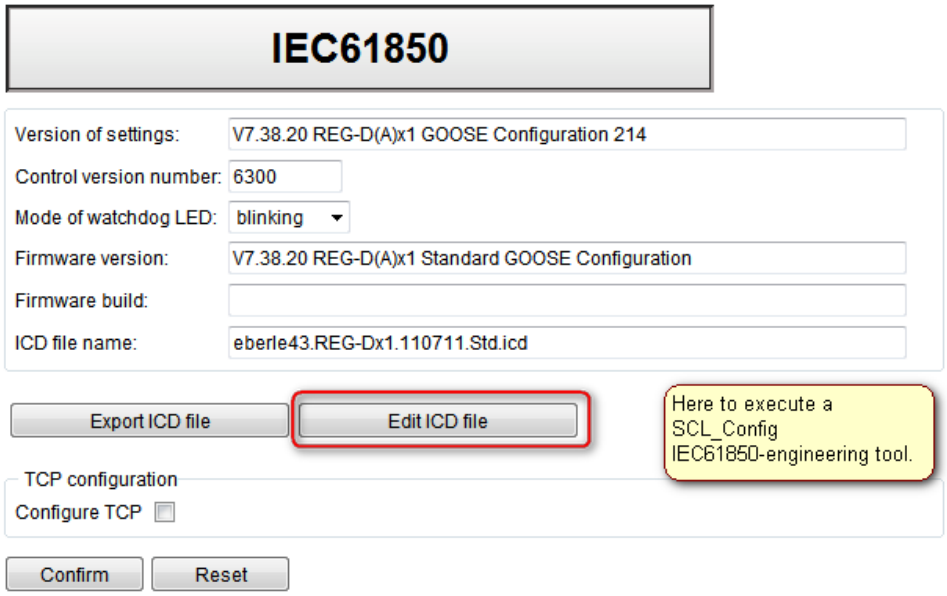



*Figure 56: Execute SCL_Config engineering Tool*

After adjustment and saving in SCL_Config engineering Tool, all changes have to be activated in WinConfig automatically.

The tree view subentries of the server are directly resolved from the name space of the ICD file. This defines that there may be different names for the logical devices and their subordinated Nodes and their subordinated attributes.

That's why only an example can be discussed in the description.

### 18.2.1 Displaying project configuration and properties of nodes

ICD-file is shown as the logical structure tree on page "Configuration". On the right panel of the page section "IED" parameters are shown, as well as options of the configuration logical object and options of the field sAddr, if exists in the chosen object DAI.

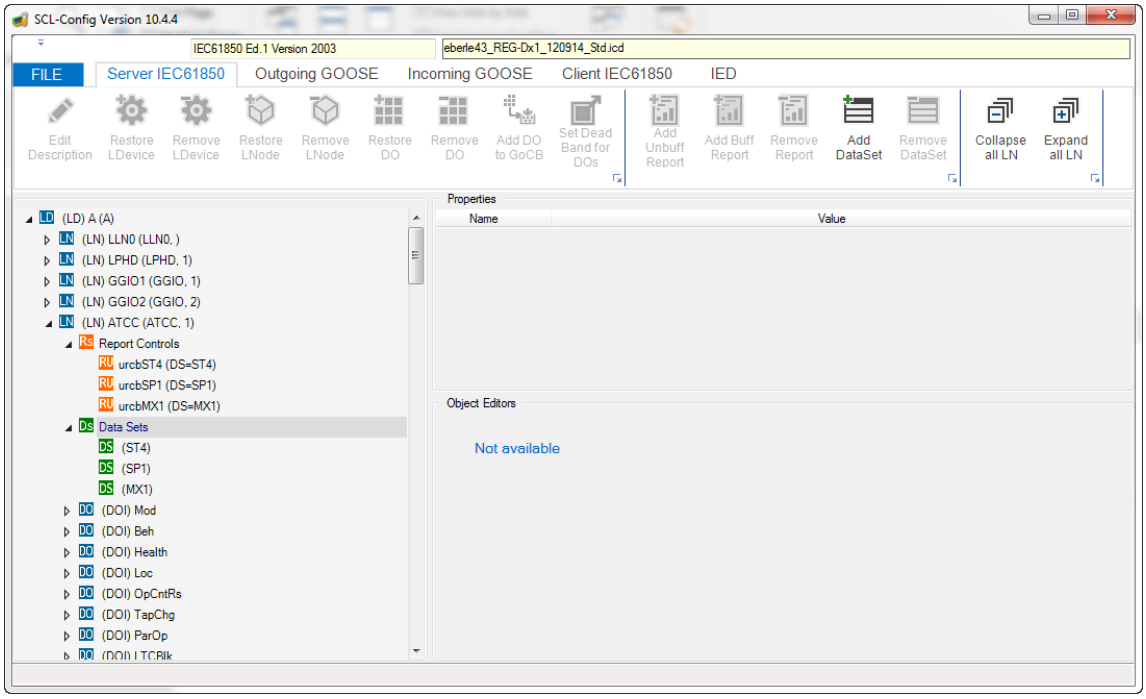



*Figure 57: Displaying the project configuration*

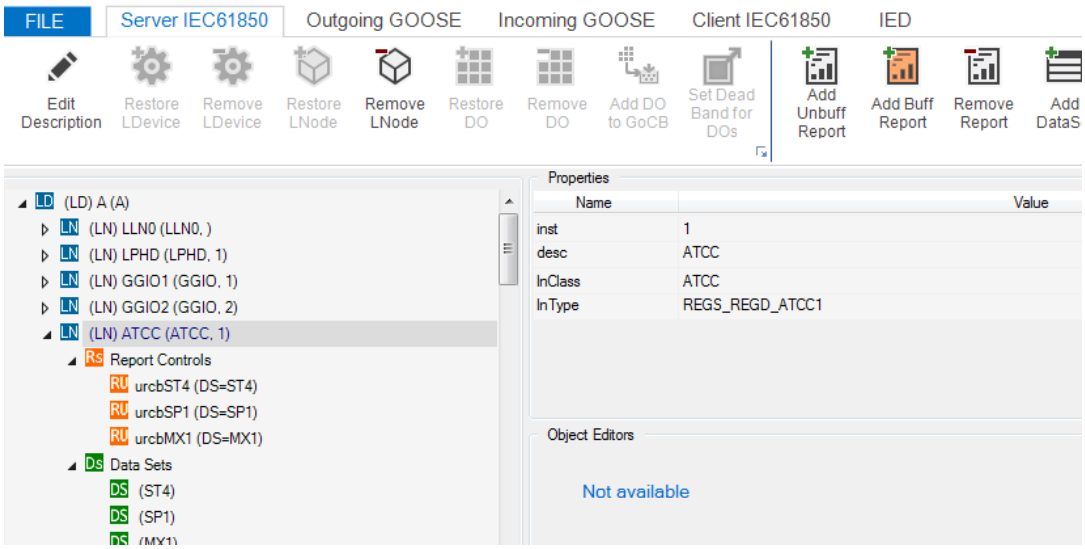



*Figure 58: Displaying the properties of nodes*

### 18.2.2 Adding, deleting and renaming devices

Configuration change is done on the page "Configuration". To change the content of the device and its name use hot-keys and popup menu panel "Device".

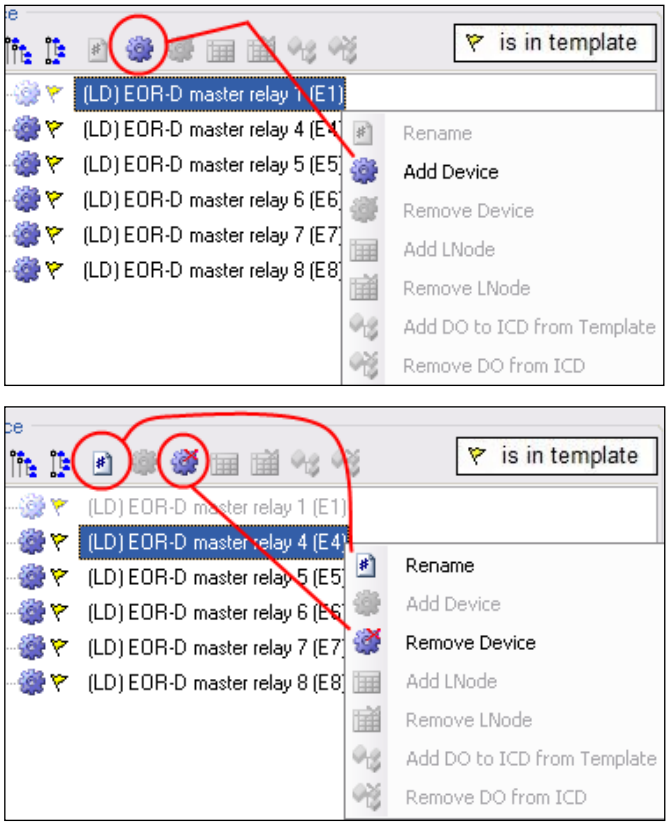



*Figure 59: Adding and deleting devices*

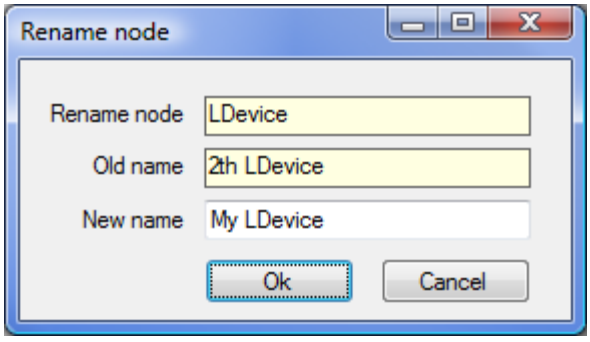



*Figure 60: Renaming device*

### 18.2.3 Adding, deleting and renaming logical nodes

To add new logical nodes of the necessary type, to rename or delete from the configuration use hot-keys and popup menu of the panel “Device”.

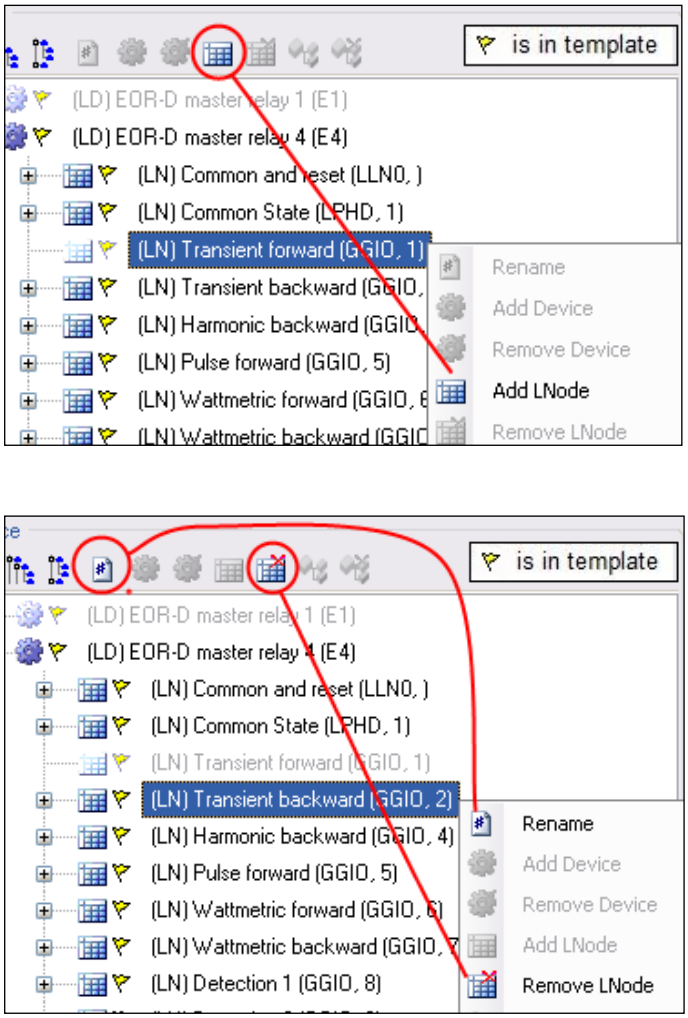



*Figure 61: Adding, deleting and renaming logical nodes*

## 18.2.4 Editing sAddr

### 18.2.4.1 ST/MX Data Object

Upon choosing DAI “stVal” on the right panel “sAddr Editing” parameters’ editor of sAddr field is available. To accept changes of the parameters press OK, to cancel the changes press Cancel.

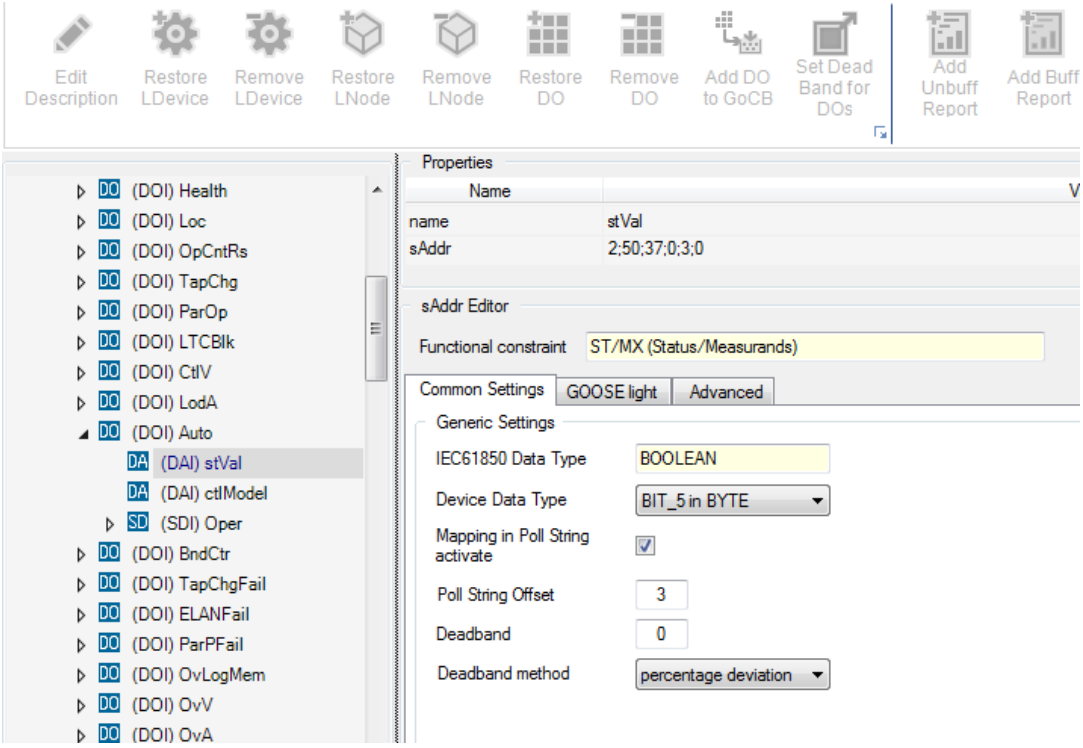



*Figure 62: Editing sAddr*

**Such editors are accessible for the use:**

ICD Template (sAddr) Type = “ASCIIx61850”, Record Type = “ST” (Status\Measured)

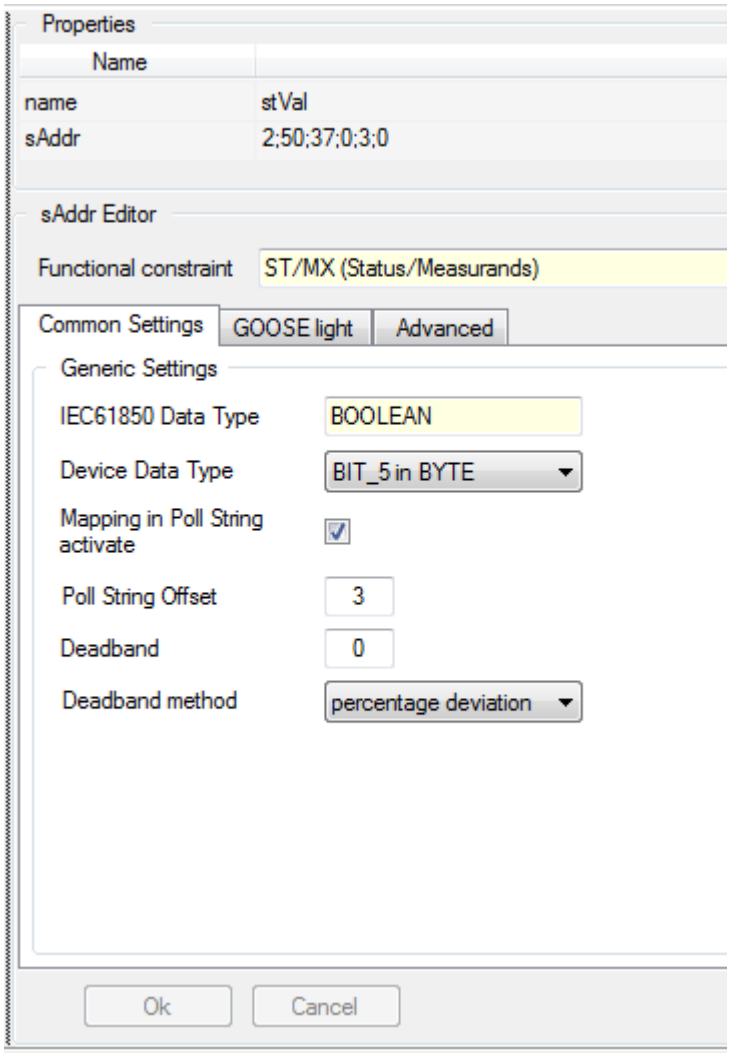



*Figure 63: Common Settings for ST/MX DO.*

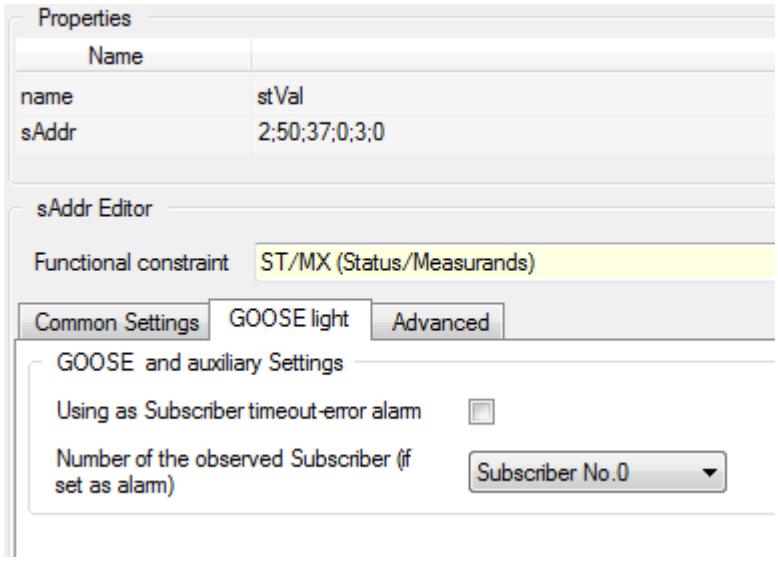



*Figure 64: GOOSE Subscribing Alarm.*

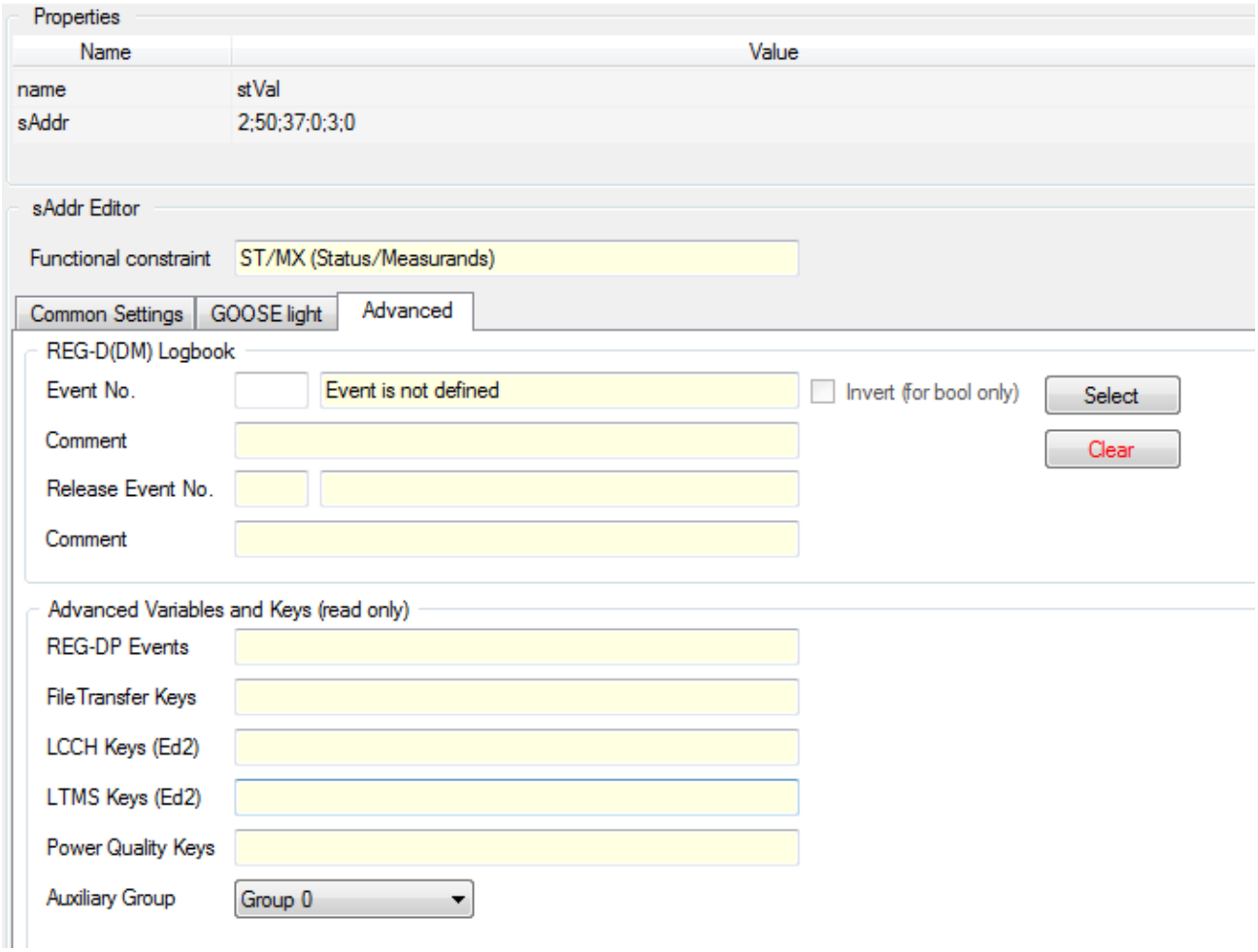



*Figure 65: Advanced Settings for ST/MX DO*

All fields here are read-only except for Event Number and Invert (if logbook acquisition is activated)

### 18.2.4.2 REG-D(A) Logbook Acquisition Settings for Status DO

All important events are stored in the log together with the respective time and date. Up to 2000 events can be stored in total. The LOG memory is a FIFO rotating memory, i.e. if the memory is full, the oldest entry will be replaced with the newest event.

A data object status event can be monitored by acquisition events from REG-D logbook.

For example, data object “Auto” will be monitored by events from REG-D logbook. The figures below show the settings data object “Auto” that will be monitored by acquisition events AUTO from Logbook.

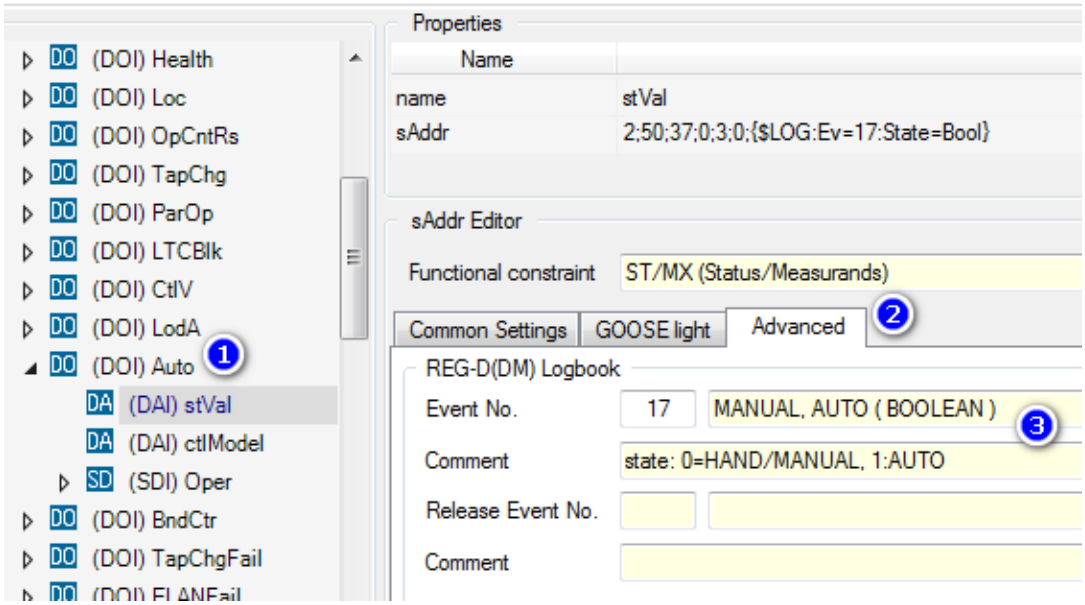



*Figure 66: DO status is monitored by logbook events*

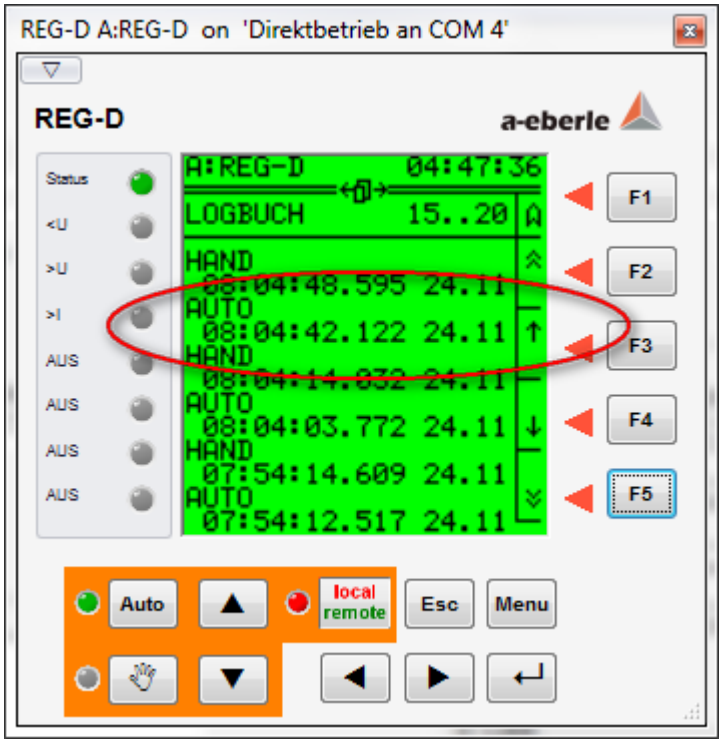



*Figure 67: Event "Auto" in the Logbook*

You can select monitored event from a list of Events or enter a number of event in the field "Event No." (Advanced Settings).

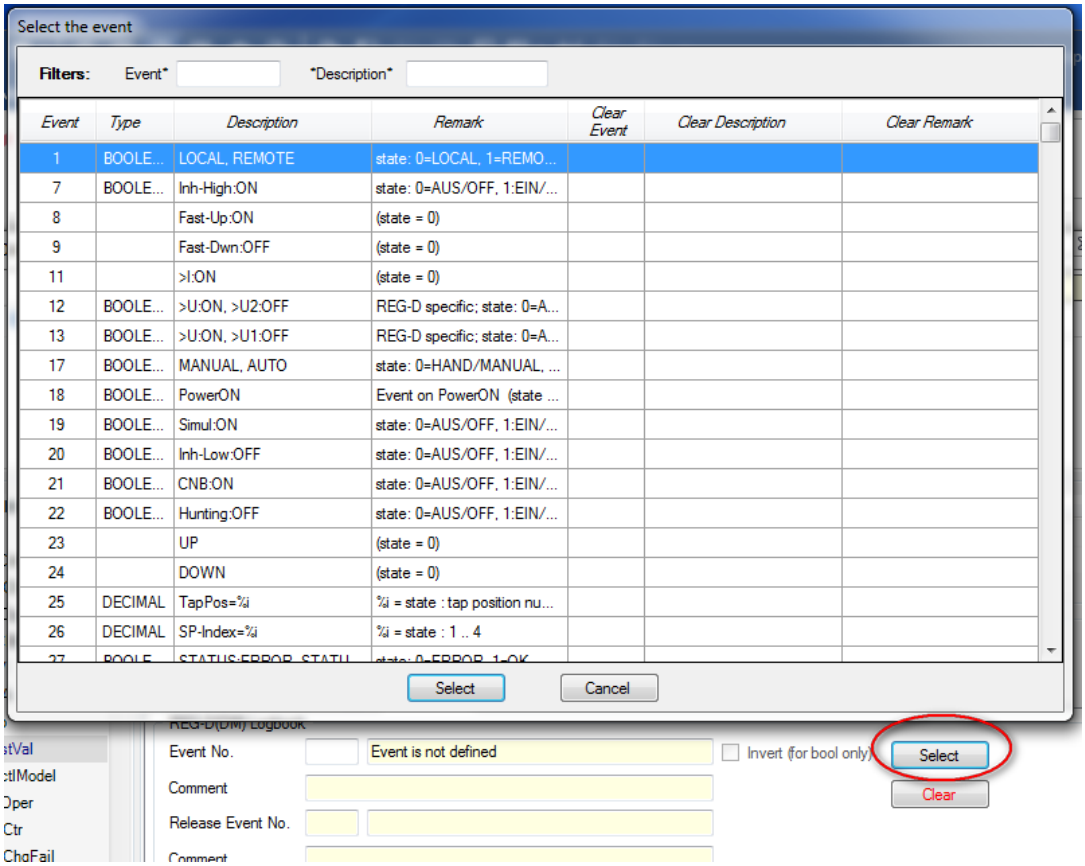



*Figure 68: REG-D Logbook Events List*

The filters by number and description are available in a list of events.

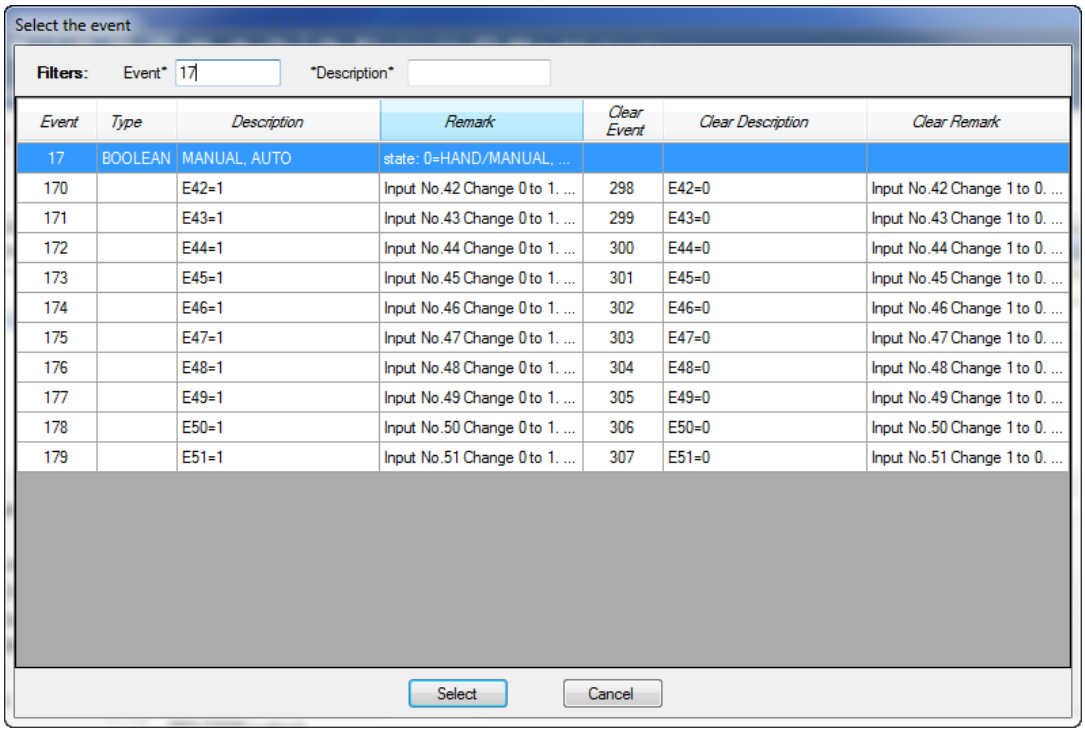



*Figure 69: Filter by Event Number*

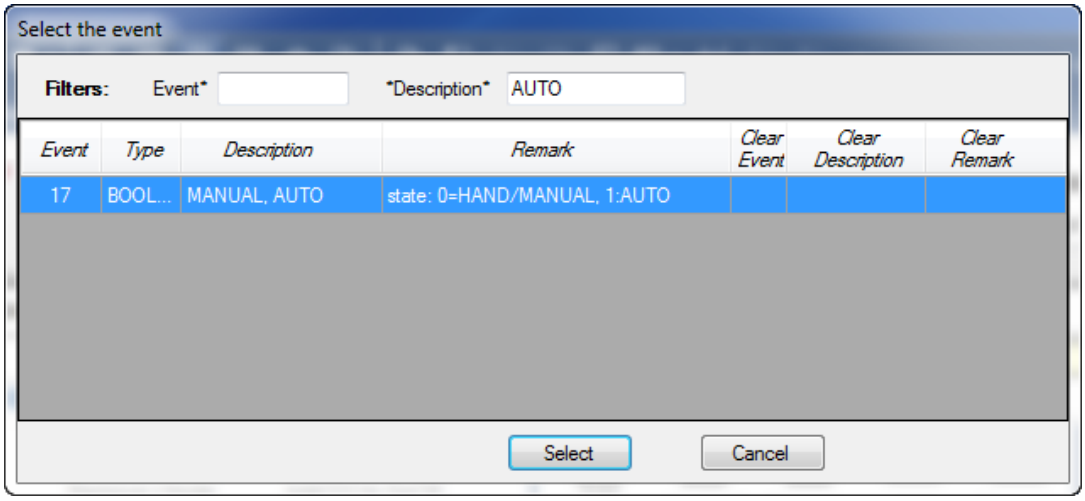



*Figure 70: Filter by Text, Remark*

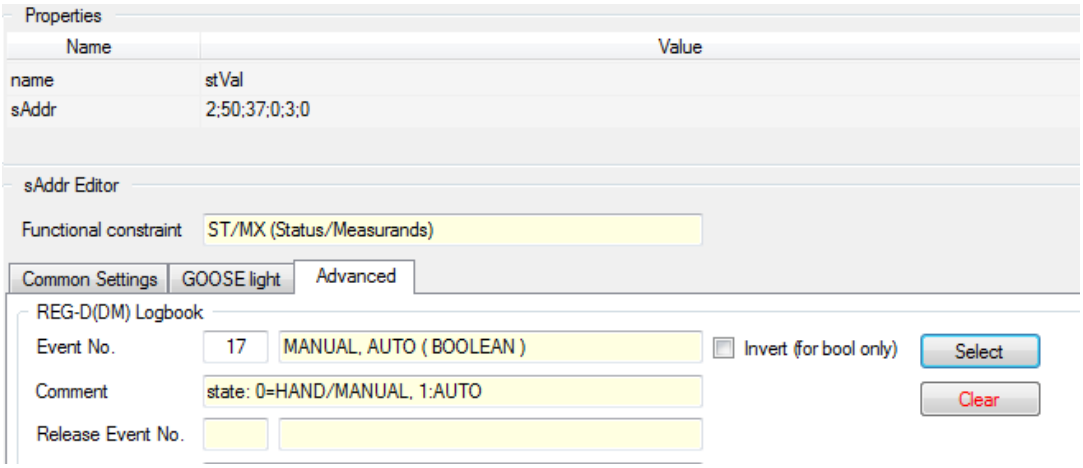



*Figure 71: Logbook Event accepted for DO*

The Clear button cancels a logbook monitoring and clear the dialog box for REG-D Logbook.

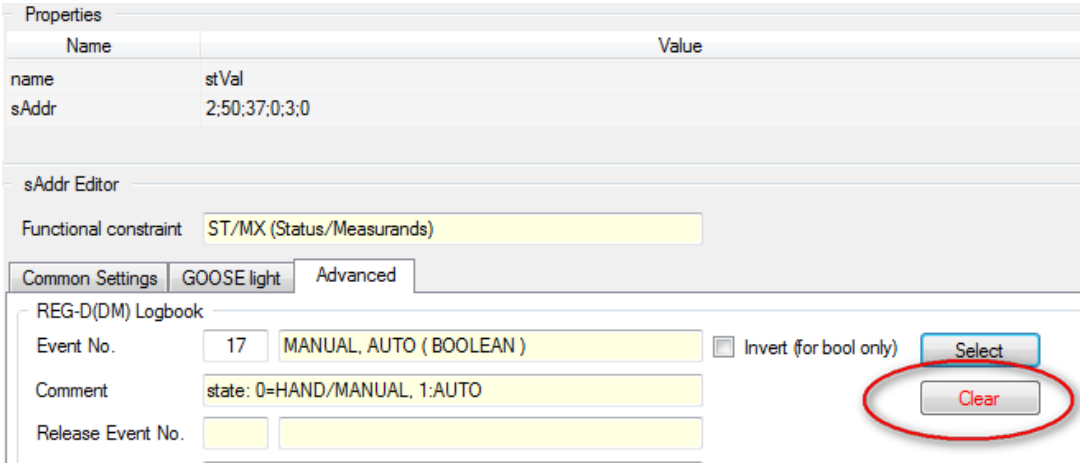



*Figure 72: Clear Logbook Acquisition for DO*

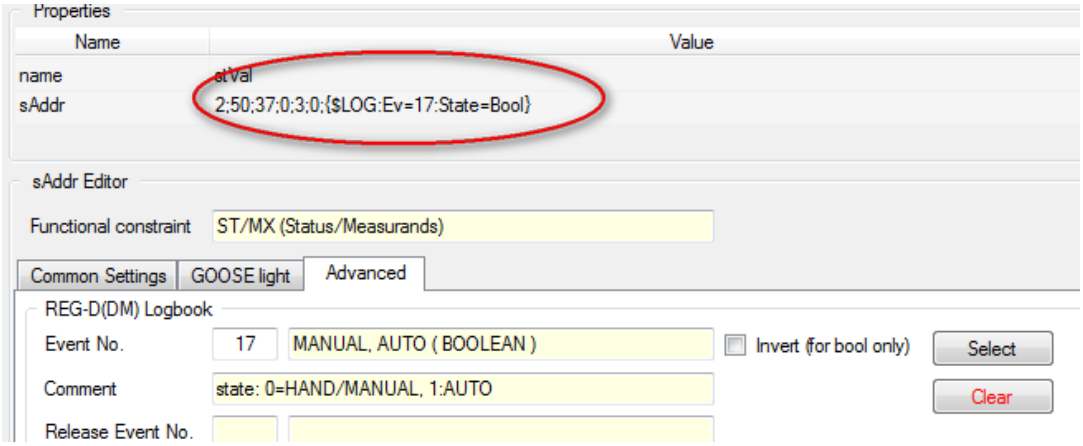



*Figure 73: sAddr with Logbook Event Acquisition*

### 18.2.4.3 Control (CO) Data Object

ICD Template (sAddr) Type = "ASCIIx61850", Record Type = "CO" (Control). The behavior of "scale" setting for DoublePoint, Boolean and other types is different.

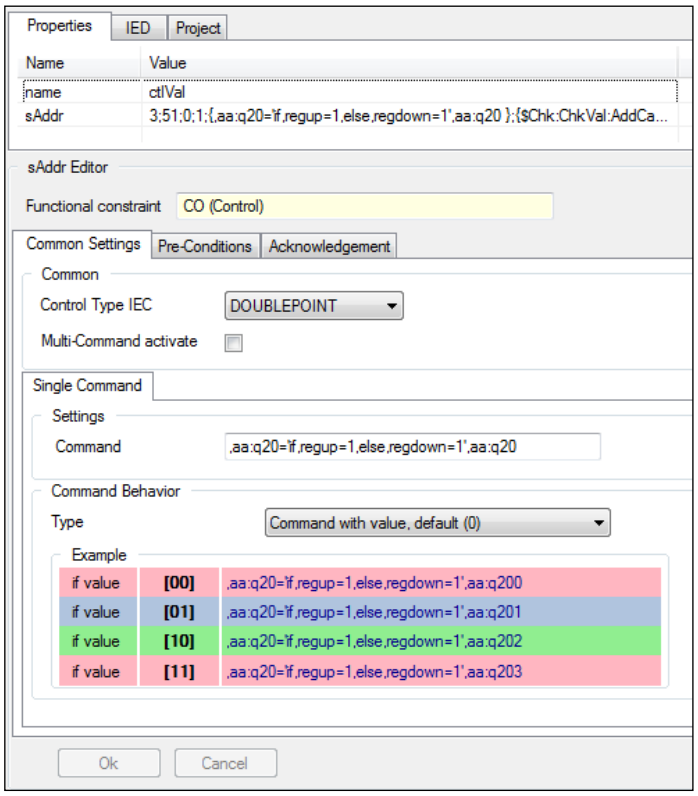



*Figure 74: Behavior of "scale" setting for Double Point, Record Type="CO"*

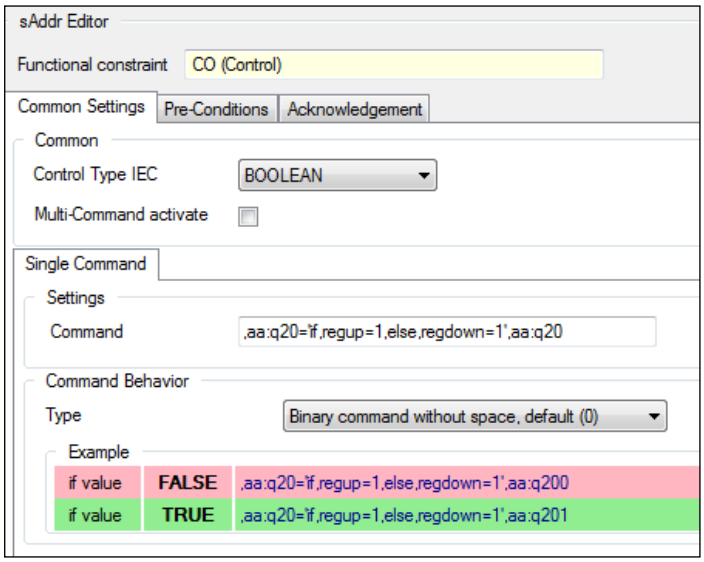



*Figure 75: Behavior of "scale" setting for Boolean, Record Type="CO"*

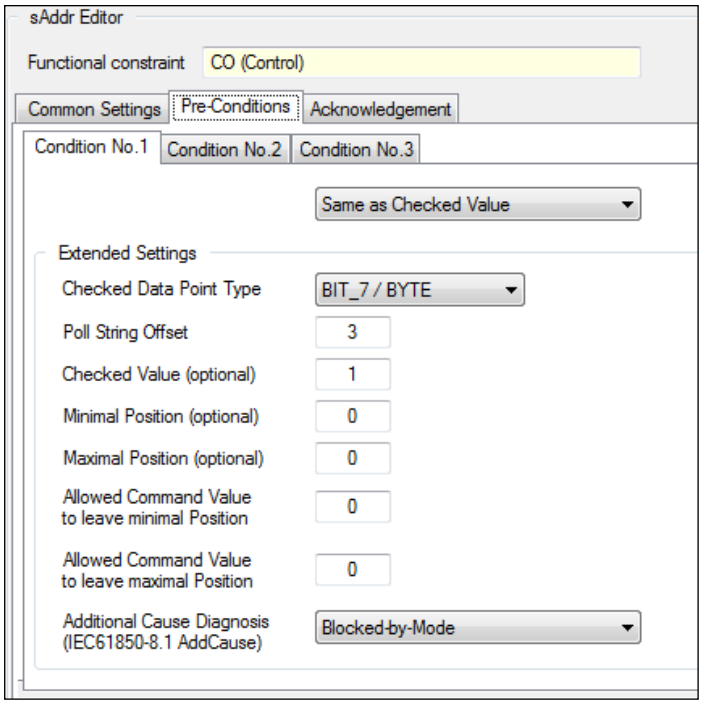



*Figure 76: Behavior of "scale" setting for BIT_7 / Byte, Record Type="CO"*

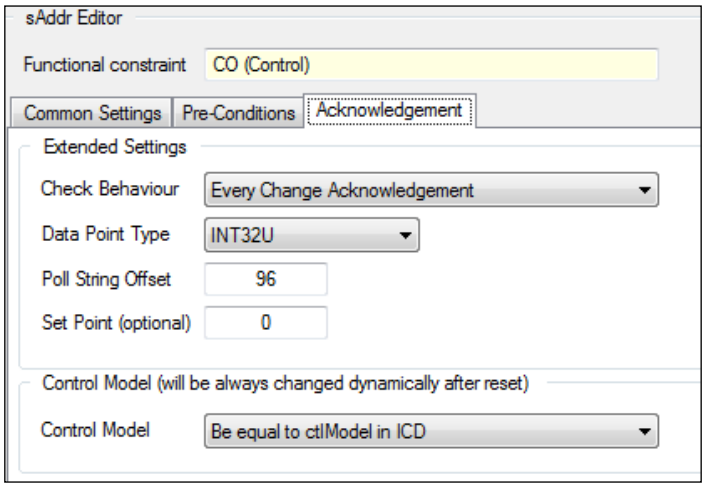



*Figure 77: Behavior of "scale" setting for Int32U, Record Type="CO"*

ICD Template (sAddr) Type = "ASCIIx61850", Record Type = "SP" (Setpoint\Setting group). The behavior of "scale" setting for DoublePoint, Boolean and other types is different.

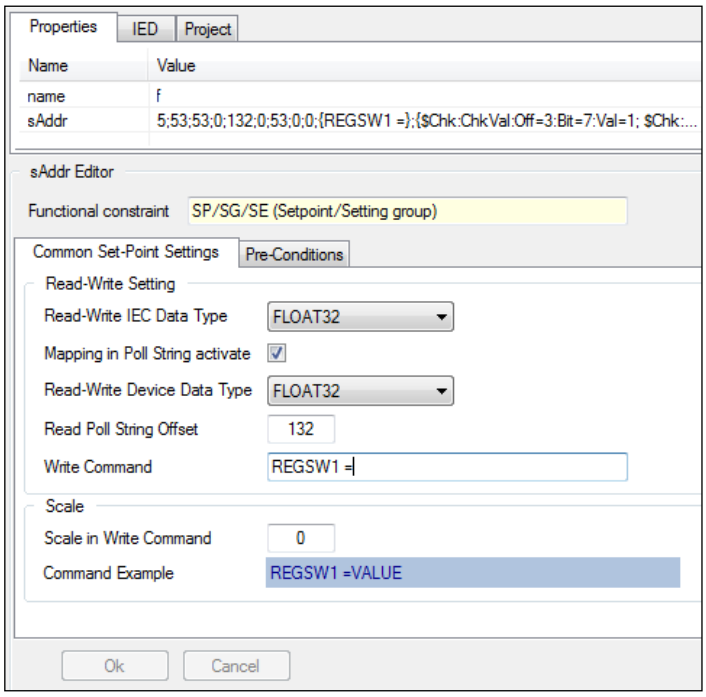



*Figure 78: Behavior of "scale" setting for Float32, Record Type="SP"*

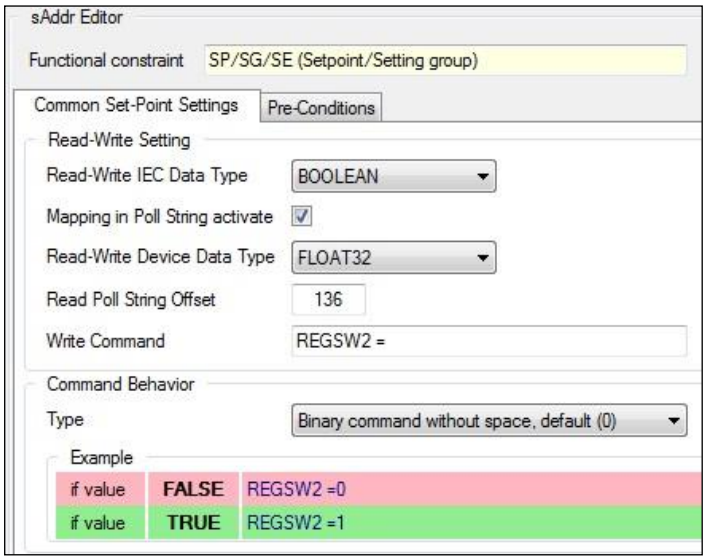



*Figure 79: Behavior of "scale" setting for Boolean and Float32, Record Type="SP"*

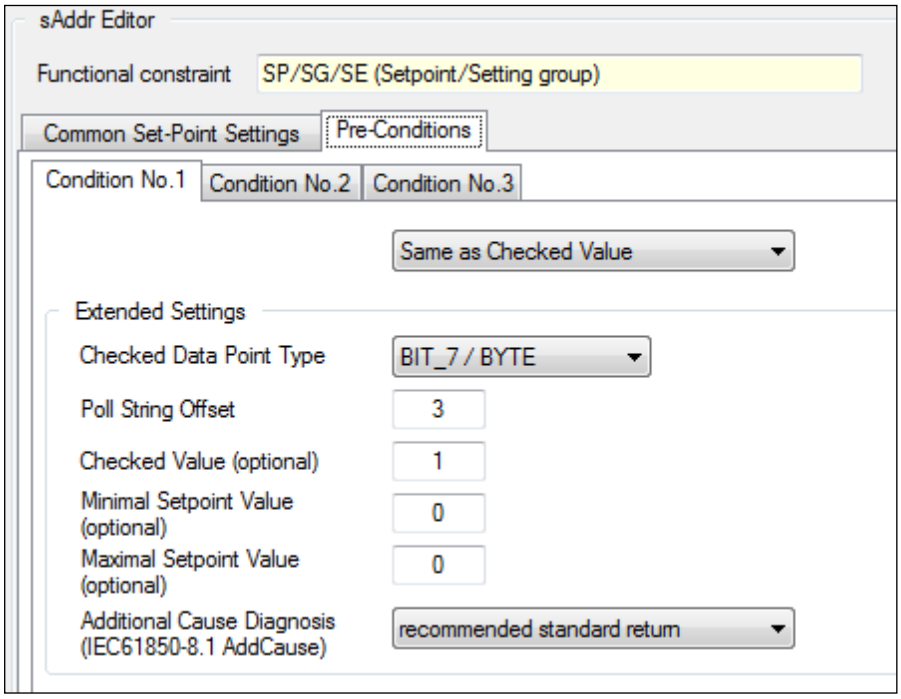



*Figure 80: Behavior of "scale" setting for Bit_7 / Byte, Record Type="SP"*

ICD Template (sAddr) Type = “PQIx850”, Record Type = “ST” (Status\Measurands)

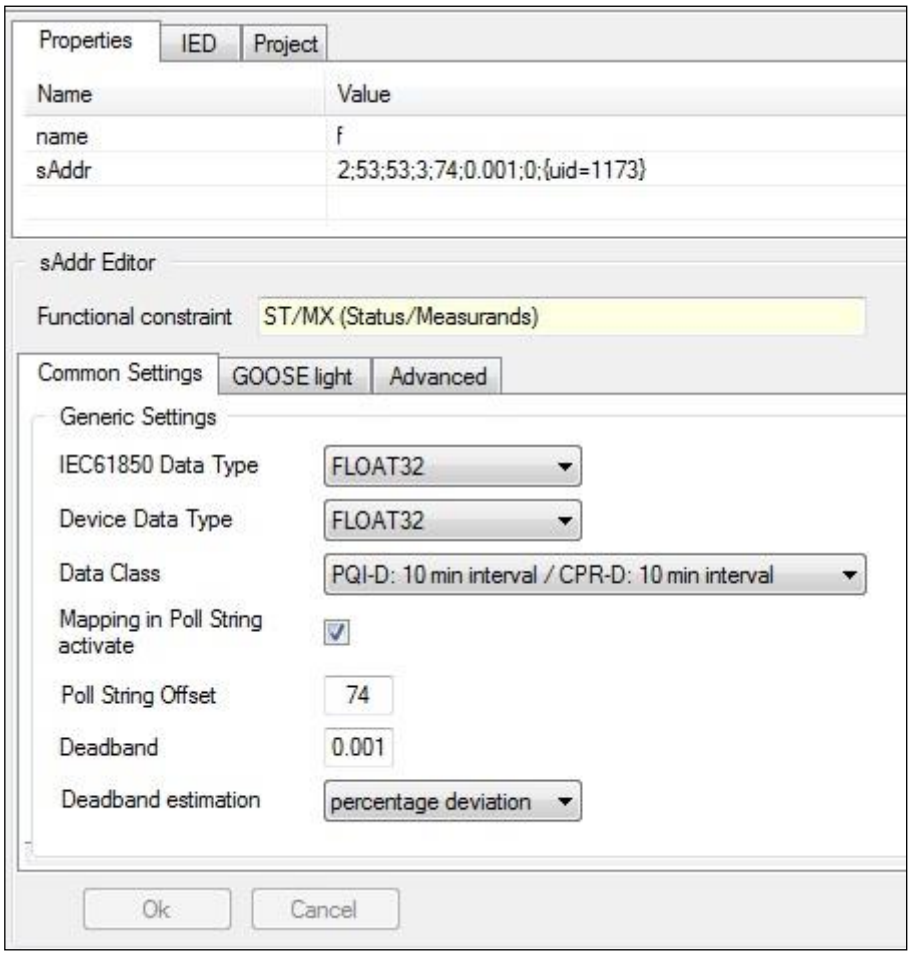



*Figure 81: Behavior of “scale” setting for Float32, Record Type=”ST”*

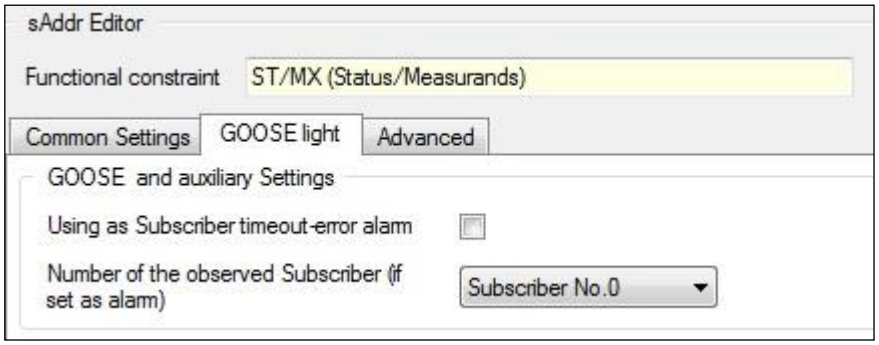



*Figure 82: GOOSE and auxiliary Settings, Record Type=”ST”*

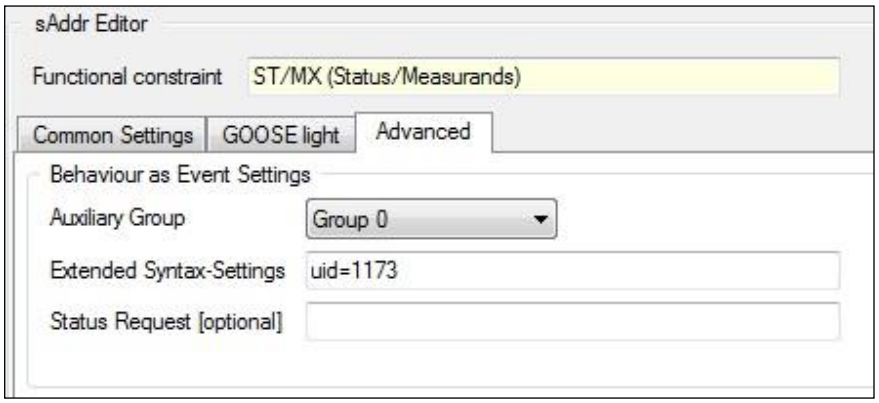



*Figure 83: Behaviour as Event Settings, Record Type="ST"*

ICD Template (sAddr) Type = "PQIx850", Record Types "CO" (Control) & "SP" (Set-point\Setting group) are not supported.

### 18.2.5 Removing Data Objects

Removing of DO is executed in two steps:

1) when a user executes the function "Remove DO" in application:
   - verifications of name
   - mandatory DO list for LPHD Logical Node - "PhyNam", "PhyHealth", "Proxy", for other - "Mod", "Beh", "Health", "NamPlt". A removing the DO is blocked.
   - if DO is system, confirmation of operation is required. A not system DO has a DA with name "dataNs"
   - ICD can have more than one of Logical Node same type, that means all these DO will be removing. List of LN will be shown and confirmation of operation is re-quired
   - removing DOI from LNode
   - excluding empty Data Sets
   - excluding Reports without data set.
2) when a user closes project - removing unused DO's types from the section "DataTypeTemplates"

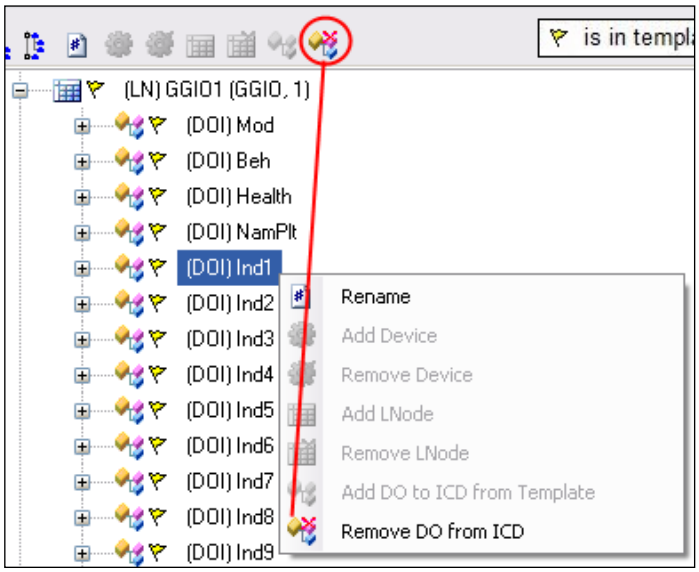



*Figure 84: Removing Data Objects*

### 18.2.6 Restore Data Objects from Template

Restoring of DO is executed when an user executes the function “Restore DO” in application. Based on a template (original ICD-file) is created:

- in the section “DataTypeTemplates” - DO Type and DO for LNodeType, if they are not exists
- DOI for all LNode of the LNodeType
- DataSet and Report, if they are not exists

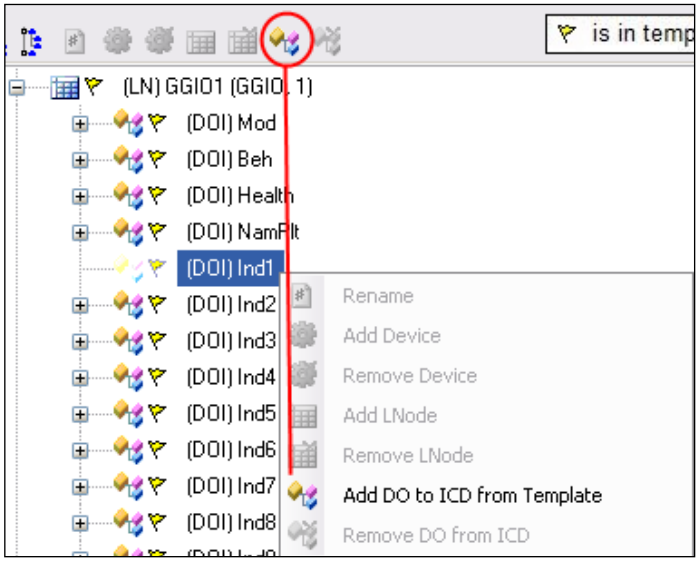



*Figure 85: Restore Data Objects from template*

### 18.2.7 Renaming Data Objects

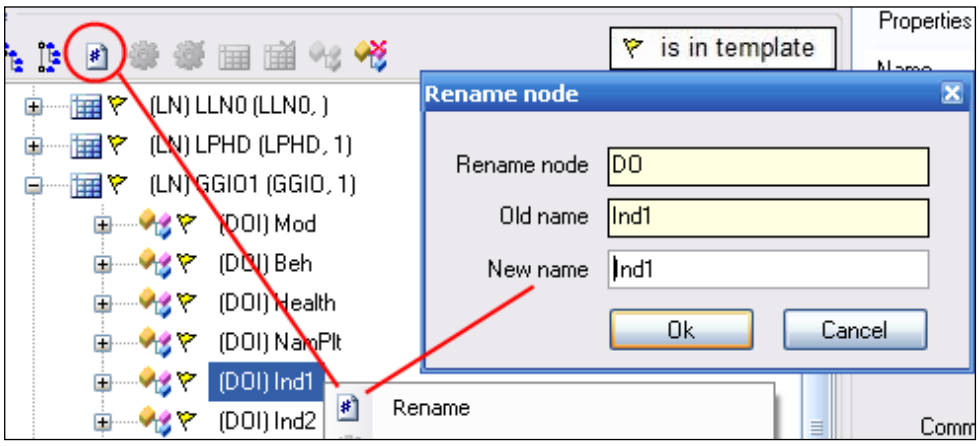



*Figure 86: Renaming the Data Objects*

**Algorithm of renaming DO**

1) verifications of old name

   - Mandatory DO list for LPHD Logical Node - "PhyNam", "PhyHealth", "Proxy", for other - "Mod", "Beh", "Health", "NamPlt". A change the name is blocked.
   - If DO is system, confirmation of operation is required. A not system DO has a DA with name “dataNs”.
   - ICD can have more than one of Logical Node same type, that means all these DO will be renamed.

**List of LN will be shown and confirmation of operation is required**

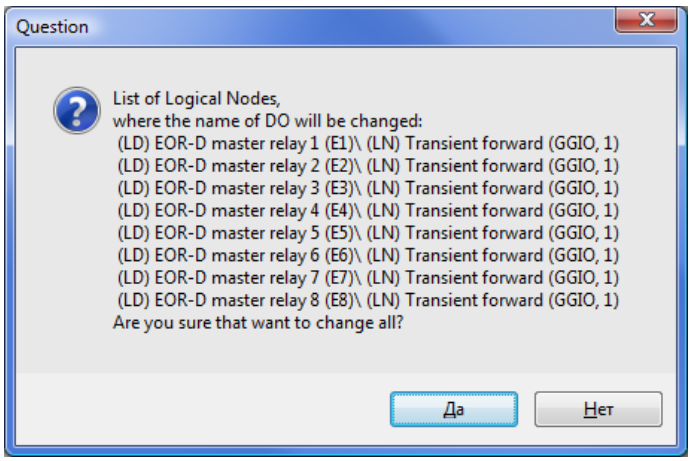



*Figure 87: Confirmation to rename DO list*

1) verifications of new name

   - A change the name from mandatory DO list is blocked.
   - If the new name exists, renaming is canceled

2) Rename DO in LNodeType from section “DataTypeTemplates”
3) Rename DOI in Logical Node

4) Rename FCDA in DataSets of Logical Node

### 18.2.8 Changing of DO Data Class

Changing of DO Data Class is accessible for changing “SPC” to “DPC” and vice versa. In this case DO Editor is displaying on editor panel.

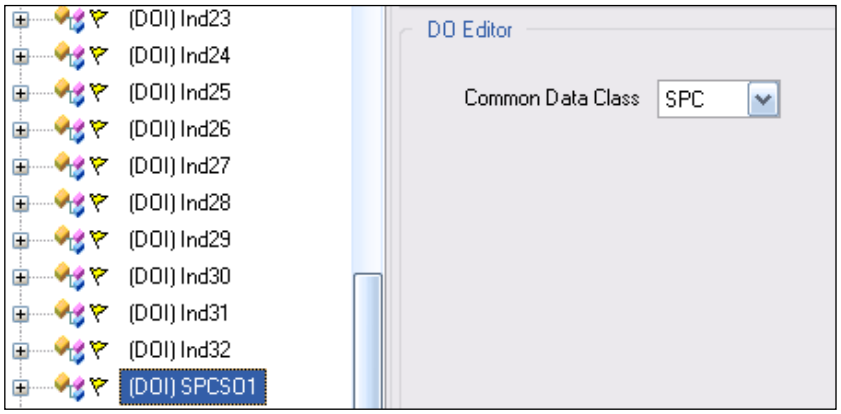



*Figure 88: Changing of DO Data Class*

**Algorithm of changing of DO Data Class:**

1) Changing of DO Data Class is accessible for changing “SPC” to “DPC” and vice versa
2) Search DOType in LNodeType from section “DataTypeTemplates” where:
   - “id” = new type (“SPC” or “DPC”)
   - DOType has not DA with name ”SBOw”
   - If DOType has DA with name ”dataNs”, it is preferring
3) Setting the new value of Type Id for DO
4) DO will to have new Data Class
5) If new DOType is not searched, then changing is canceled

### 18.2.9 Changing the control model for controllable data objects

**For “Status only” Data Objects a control model does not change.**

Changing of DO Data Class is accessible for four control models:

- Direct with normal security
- SBO with normal security
- SBO with enhanced security
- Direct with enhanced security

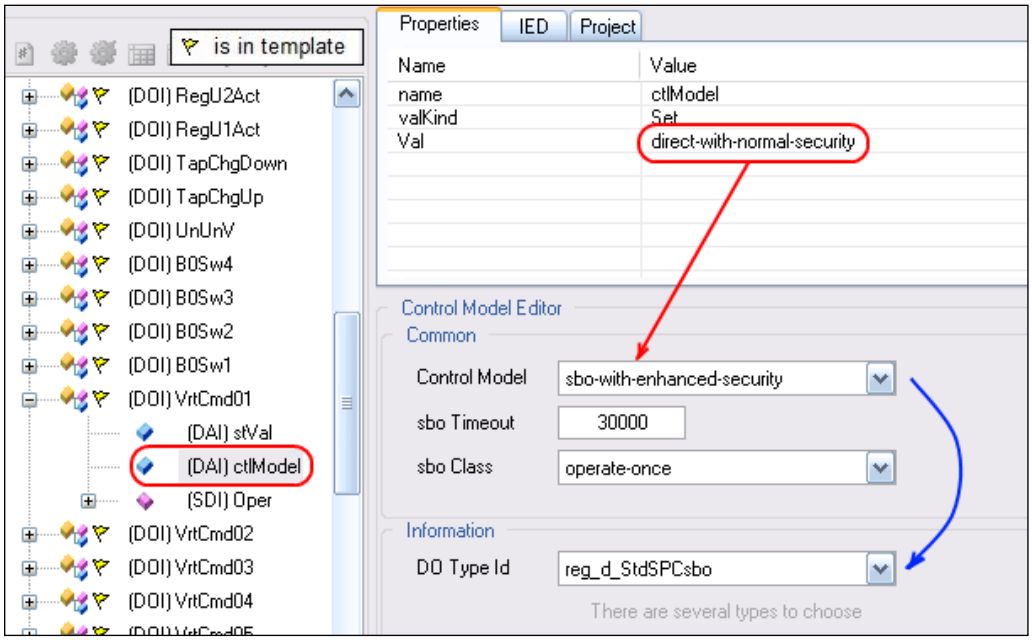



*Figure 89: Changing the control model for controllable data objects*

User is able to select a control model from the drop-down list “Control Model”. The program finds new DO type for selected model by algorithm:

1) New DO type has the same Data Class;
2) Direct with normal security requires mandatory Data structure Oper;
3) SBO with normal security requires mandatory Data attribute SBO, mandatory Data structure Oper and optional Data structure Cancel. Cancel can be omitted if cancel service is unsupported;
4) SBO with enhanced security requires mandatory Data structure SBOw, mandatory Data structure Oper and optional Data structure Cancel. Cancel can be omitted if cancel service is unsupported;
5) Direct with enhanced security requires mandatory Data structure Oper and optional Data structure Cancel. Cancel can be omitted if cancel service is unsupported;

Can be searched several types. In this case user can select from choose one.

If “sbo” type is selected, the user is able to edit “sboTimeout” and “sboClass” DAs.

After a confirmation a program changes a type of DO and brings all DAs conformably with selected DO type (fig. 29 & 30).

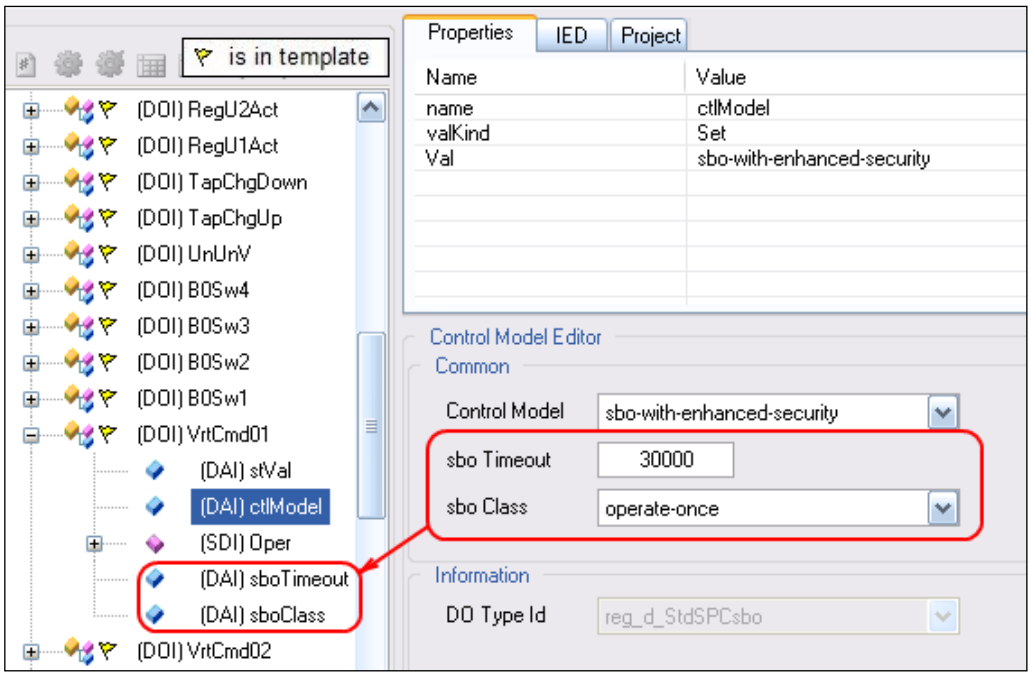



*Figure 90: New attributes for selected "sbo" control model*

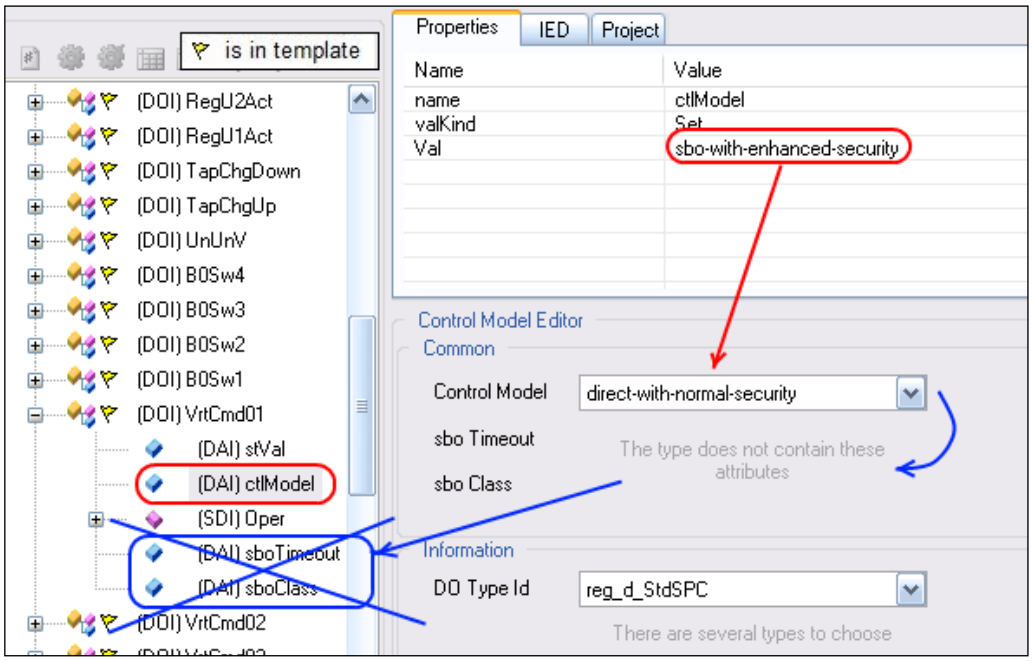



*Figure 91: Excluded attributes for selected "direct" control model*

### 18.2.10 GOOSE*light* Support

GOOSE*light* contains the settings for Publisher and Subscriber sides. These are different and perform different functions. SCL_Config provides the ability to create, to edit, to adjust and to save all settings for both sides. All functions are available on “GOOSE*light*” page of application.

All GOOSE settings are saved in form of “param” files:

- for project type “Archive Tar” inside archive (jffs2.tar)
- for project type “WinConfig” in settings file (xml) as CData sections

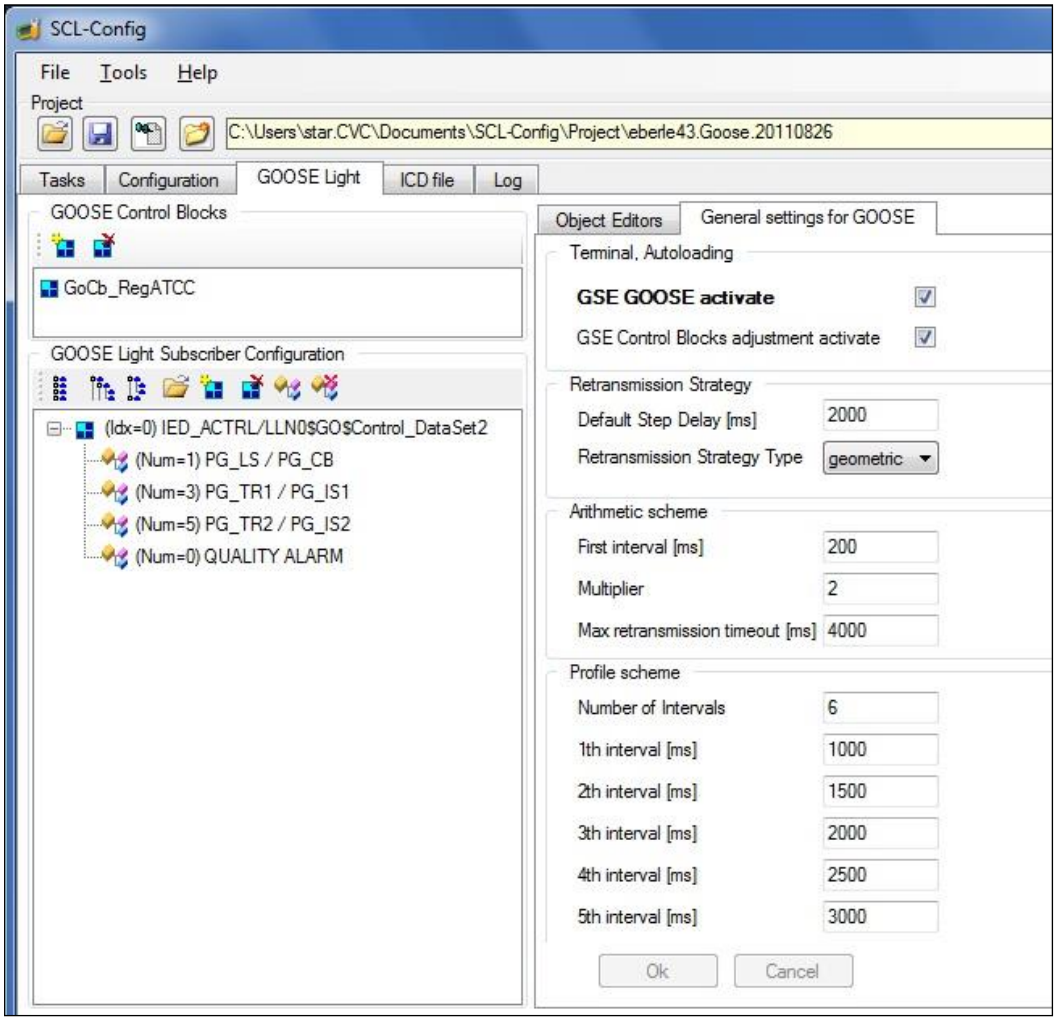



*Figure 92: GOOSE settings page*

#### 18.2.10.1 Limitations and scope

The GOOSE features are applied only for sAddr type "ASCIIx61850".

Attributes that can be added to the GOOSE publisher Data Set :

- “stVal”,
- “mag.f”,

- “valWTr.transInd”,
- “valWTr.posVal”,
- “q”

### 18.2.10.2 Common GOOSE Settings for Publisher side

Editor “General Settings for GOOSE” provides editing common settings - activation, timing strategy, and timing settings.

### 18.2.10.3 GOOSE Publisher Control Block functions

The GOOSE Publisher Control Block List is available on the “GOOSE Control Blocks” box.

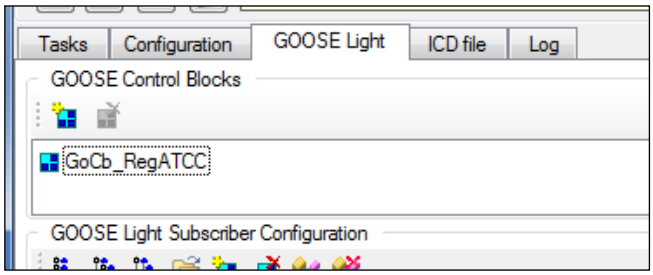



*Figure 93: GOOSE Control Blocks list*

Selected block can be removed using function “Remove GOOSE Control Block”. When user deletes a block, the ICD sections for this block are removed – “GSE”, “GSEControl”, “DataSet”.

Function “Add GOOSE Control Block” will prompt to define the required parameters for the new block. The new block will be shown in the list. The maximum number of blocks is 4.

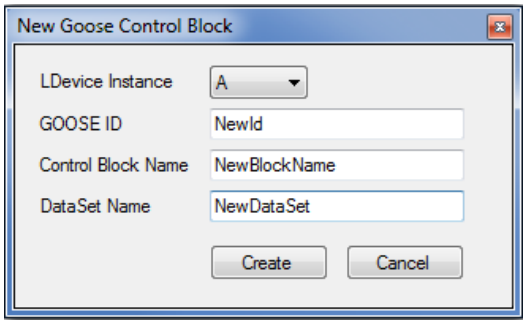



*Figure 94: Parameters for the new GOOSE Control Block*

### 18.2.10.4 GOOSE Publisher Control Block settings

For the selected in the list GOOSE control block is available to view and edit the parameters of this block. The properties editor has 3 pages of settings.

Page “Common Settings” allows defining names and descriptions of main sections.

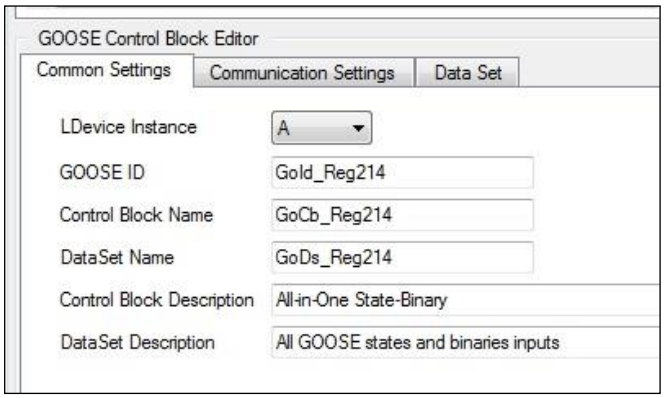



*Figure 95: Common settings of the GOOSE Control Block*

Page "Communication Settings" allows defining MAC address.

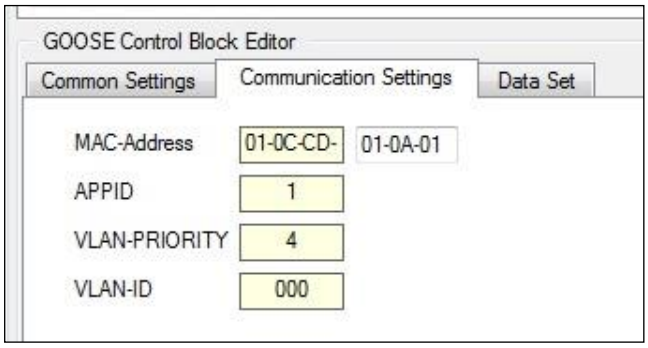



*Figure 96: Communication settings of the GOOSE Control Block*

Page "Data Set" shows the Data Set of the Control Block and allows editing it. Functions "Data Object Up", "Data Object Down" and "Remove Data Object" are processing all Data Attributes records for current Data Object. Functions "Data Attribute Up" and "Data Attribute Down" are changing order of Data Attributes records for current Data Object.

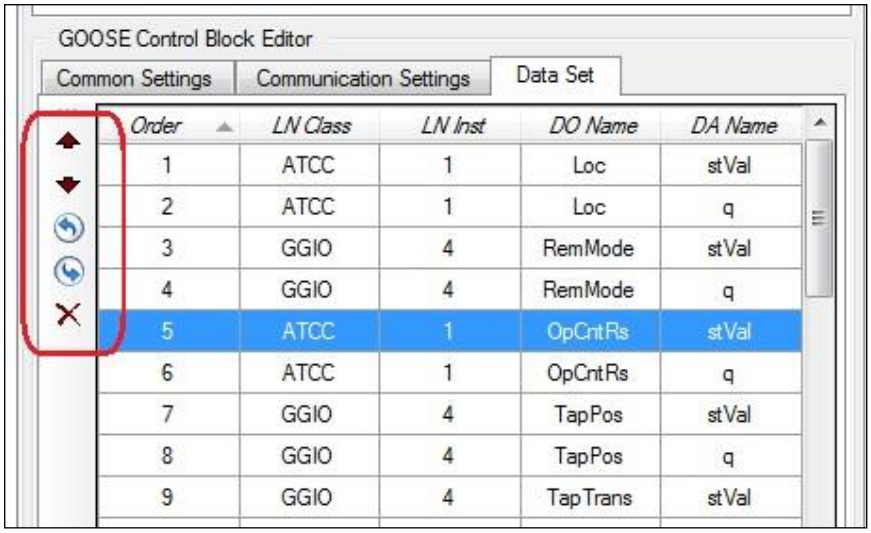



*Figure 97: Data Set of the GOOSE Control Block*

Adding the Data Object to Data Set of GOOSE Control Block is done in a device tree. For the selected Data Object is used function "Add DO to GOOSE Control Block".

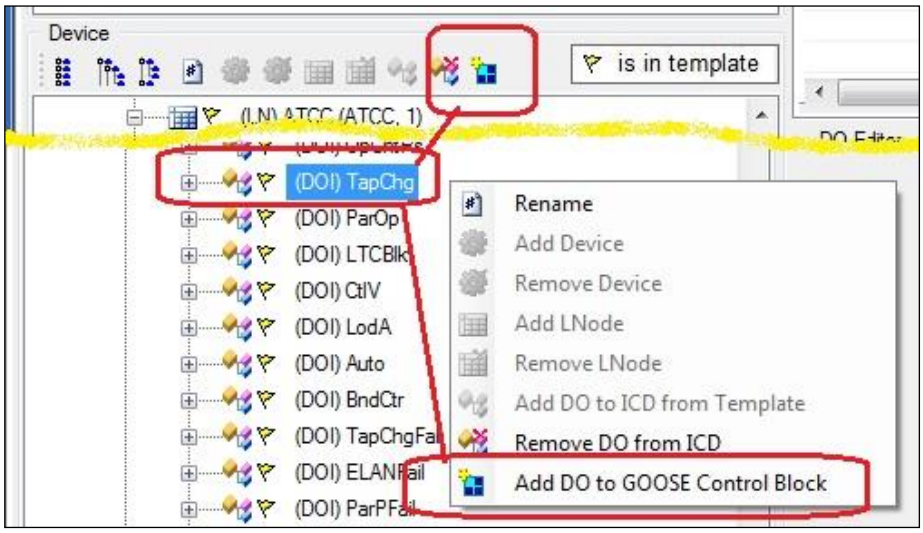



*Figure 98: Adding the Data Object to Data Set of GOOSE Control Block*

Before adding it will be necessary to select a Control Block and Data Attributes. Attributes list is defined by a Data Object type from template section of ICD.

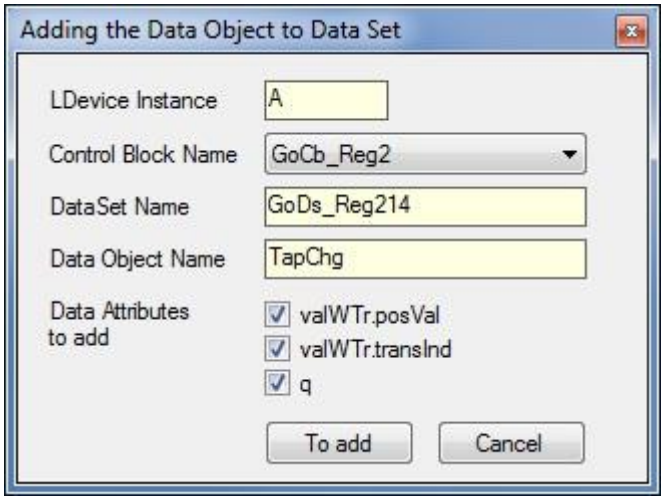



*Figure 99: Adding the Data Object to Data Set of GOOSE Control Block*

Note: For structure “valWTr” data attribute “q” will be added twice – for each attribute. To Data Set will be added 4 records.

| LN Inst | DO Name | DA Name |
|---|---|---|
| 1 | TapChg | valWTr.posVal |
| 1 | TapChg | q |
| 1 | TapChg | valWTr.transInd |
| 1 | TapChg | q |

*Figure 100: Adding structure “valWTr” to Data Set of GOOSE Control Block*

### 18.2.10.5 GOOSE External Publisher – Internal Subscriber Side

The application contains up to 16 internal subscribers. They are able to receive GOOSE messages from external GOOSE Publisher. Each subscriber can receive the messages from one Publisher. Each subscriber contains a list of the external data objects, which are included in messages from conformed external publisher. Subscribers and data objects are shown as the logical structure tree on box “GOOSE *Light* Subscriber Configuration”.

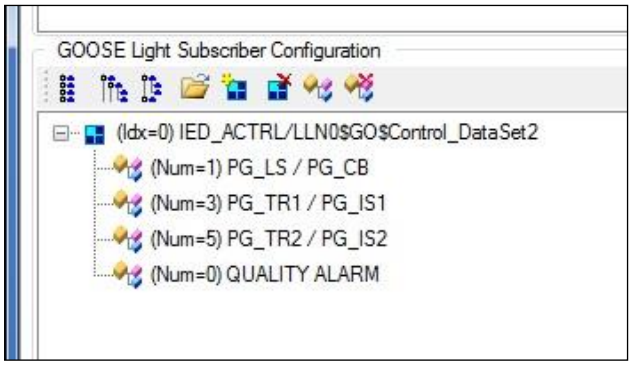



*Figure 101: External Publishers List*

### 18.2.10.6 Adding and deleting Subscribers and Data Objects

Use hot-keys and popup menu of the top panel to add new Subscribers and Data Objects or to delete them.

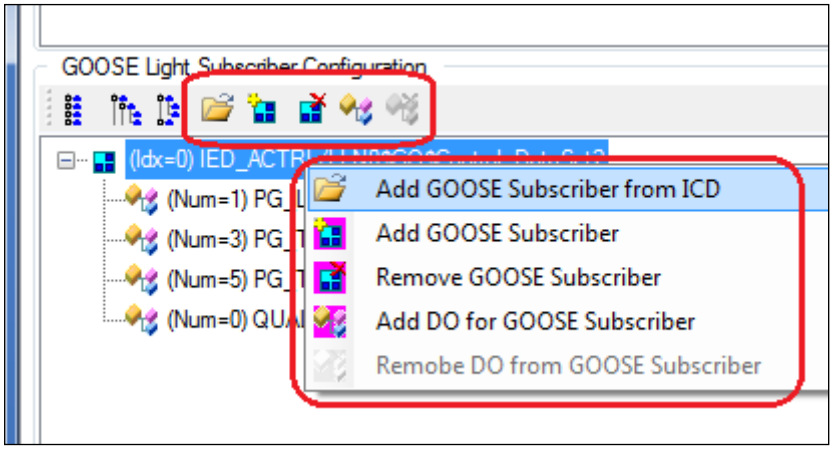



*Figure 102: Adding and deleting Subscribers and Data Objects*

Communication and GOOSE publisher settings may be got from external ICD. After select this function the new form will be shown. It is need to select ICD-file and GOOSE Control Block from it, to check necessary data objects. Selected control block and data objects will be added as new Subscriber.

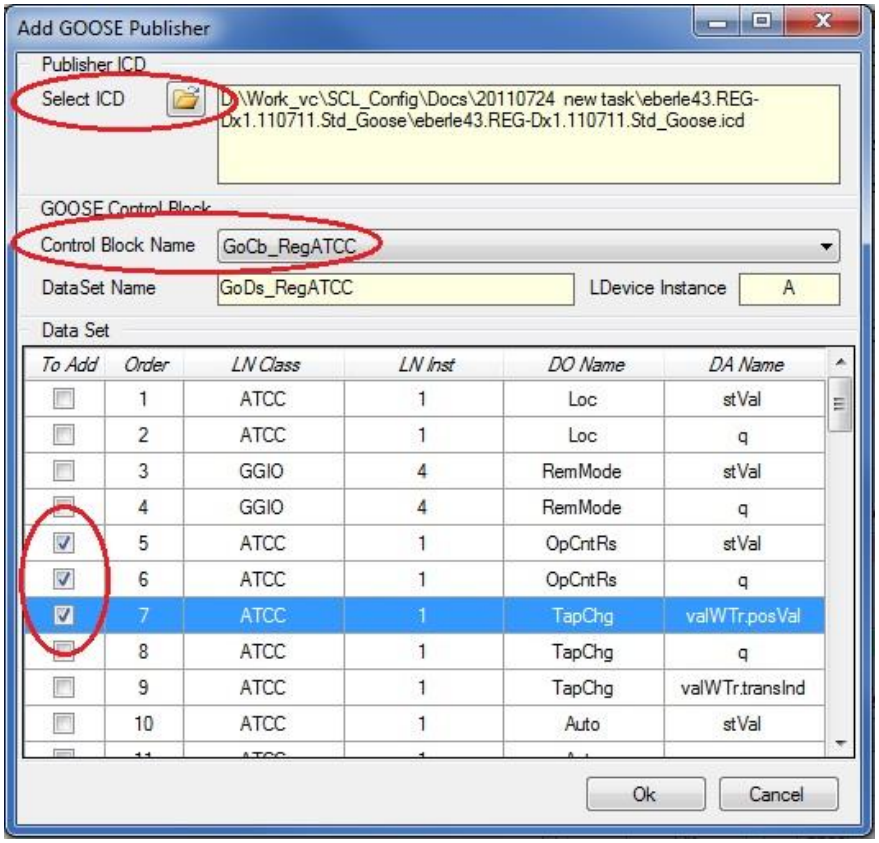



*Figure 103: Adding Subscribers and Data Objects from ICD-file*

### 18.2.10.7 External Publisher Settings

For selected Subscriber is available settings editor. Logical Devices list contains Logical Devices from ICD of project. If publisher was loaded from external ICD, then GOOSE ID, Control Block and DataSet names, MAC-address will be filled from it.

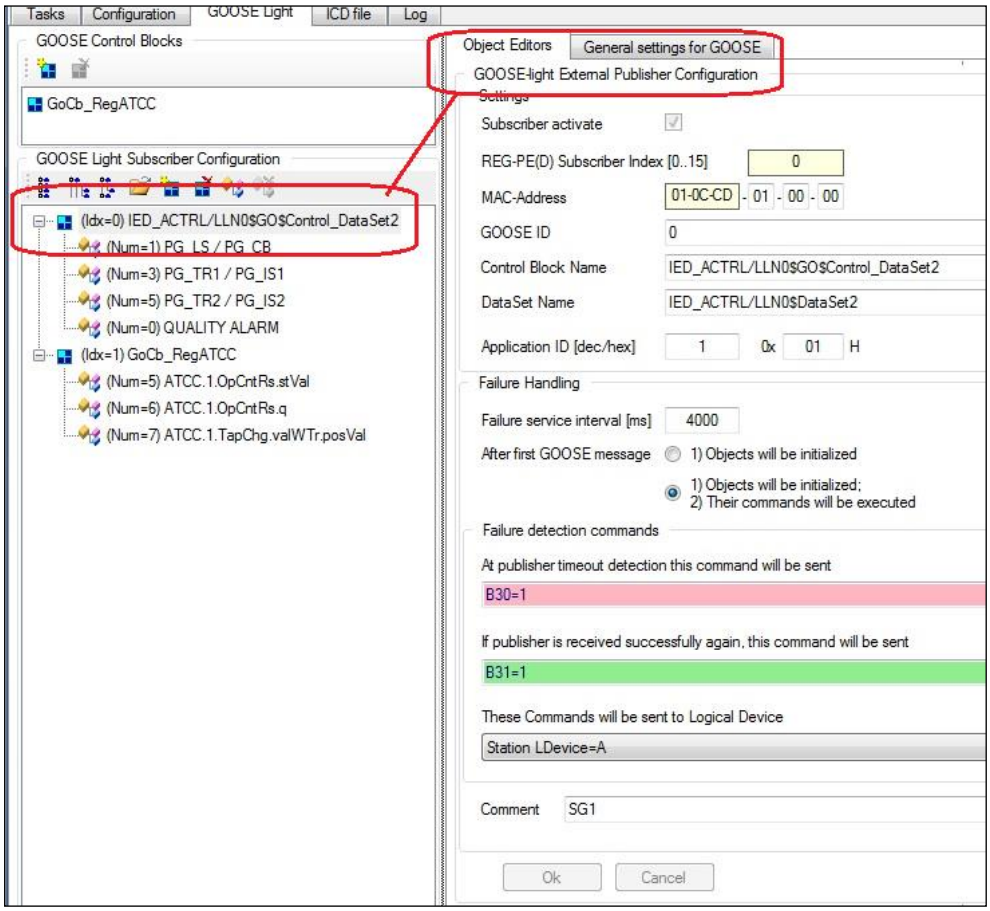



*Figure 104: External Publisher Settings*

### 18.2.10.8 External Dataset Object Settings

For selected Data Object is available settings editor. Locked data in form is defined by Subscriber. The behavior of “scale” setting for DoublePoint, Boolean, Quality and other command types is different.

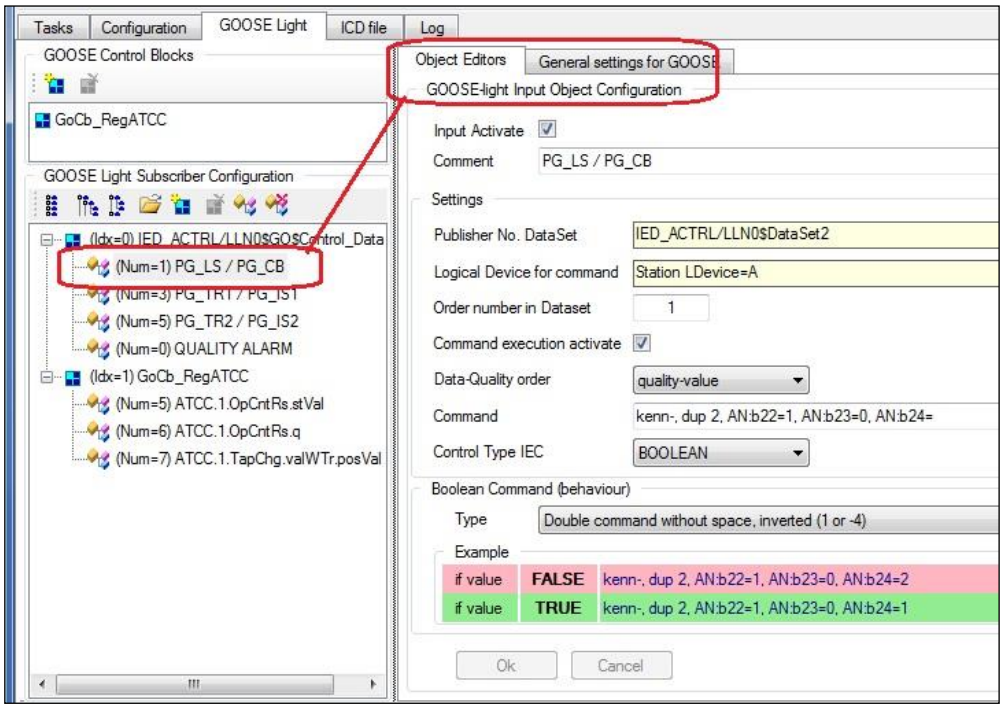



*Figure 105: External Dataset Object Settings*

### 18.2.11 Actions log

All events open and save files, add and delete nodes, change sAddr stored in the log file and displayed on the page "Log". Log files saved in "Log" application folder.

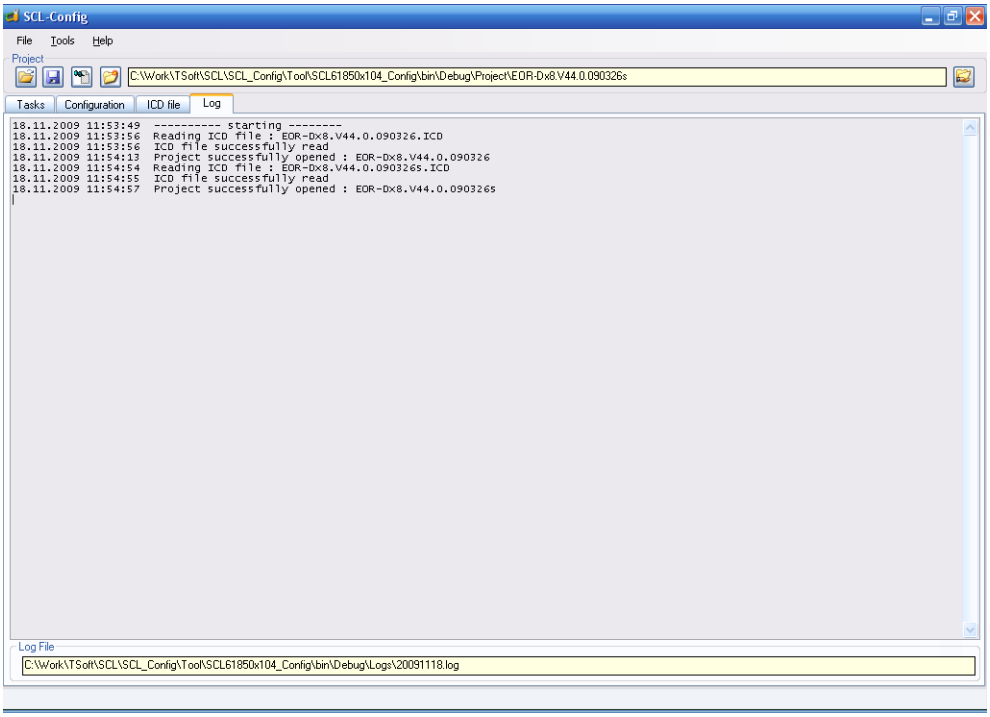



*Figure 106: Actions log*

## 18.3 IED-Server Configuration

Within IED-Server Configuration, the IED name and the description can be changed.

The tree view subentries of the server are directly resolved from the name space of the ICD file. This defines that there may be different names for the logical devices and their subordinated Nodes and their subordinated attributes.

That's why only an example can be discussed in the description.

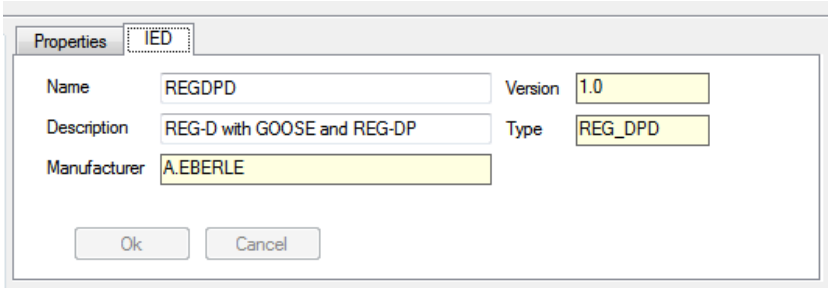



*Figure 107: IED Server Description*

The length of the IED Name shall be at least one, at maximum 64 characters. It starts with an alpha character, and contains only alphanumeric characters and the underscore character.

Note that there might be more restrictions in other parts of this standard, in IEDs implemented according to previous versions of this standard, or due to usage of this name at engineering time.

## 18.4 Logical Device Configuration

At the moment only the description of the logical device can be changed. Depending on the ICD file, there are normally two logical devices. The numeric part at the end of the instance name results in the instance number. This instance number has to be related to the physical device in the menu “Devices”. To do this, the field “Device relocation” in the menu “Devices” has to have the same numeric value.

## 18.5 Logical Node Configuration

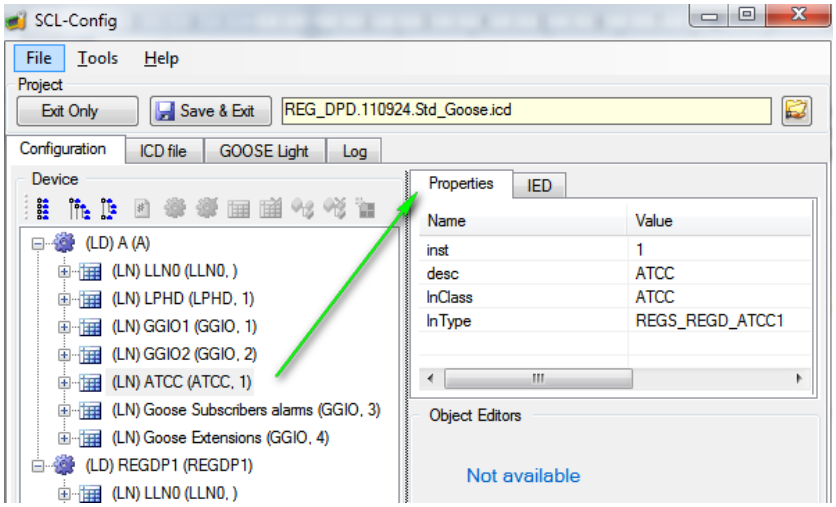



*Figure 108: Logical Node Configuration*

Topically logical node settings are read only. Depending on the ICD file, all nodes having attributes are shown.

## 18.6 Common Data Attribute Configuration

The data attributes, which can be parameterized, are passed by the ICD file. These attributes have a private data record of type “sAddr” in field of IED DOI. Since this data record it is already default, e.g. an IEC61850 status value or control value can be parameterized.

There is no user support for directly editing the ICD file. That’s why only the interface of the web server is described. Special courses on ICD file editing for engineers are available at a-Eberle on demand.

### 18.6.1 Status Value Configuration

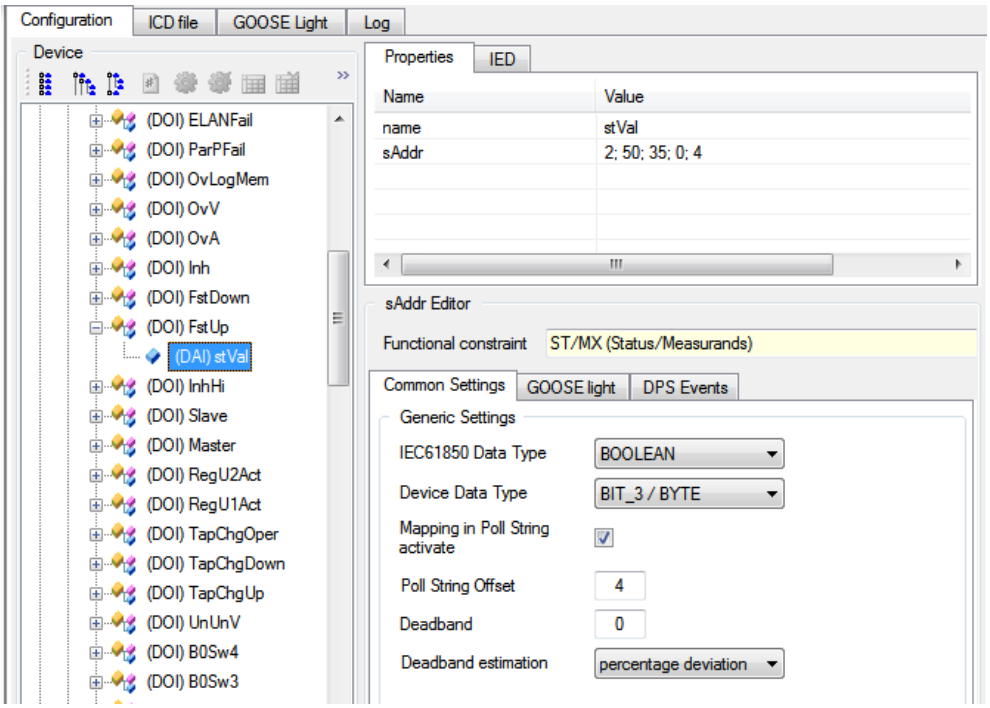



*Figure 109: Status Data mapped in device data*

IEC-Data point REGD1/LLN0.Mod is not mapped in internal device data (only for example)

The interface changes versus the setting of “Data mapping in device” set or cleared.

For example, in REGSys™ documentation displayed OpCntRs data attribute is described as follow:

| | | | OFFSET | IEC 61850 object |
|---|---|---|---|---|
| REG-D™/DA measured | unit | REG-Data type | RPS 4 | LN ATCC1, Attr .mag.f |
| Common Tap counter | 1 | double word | **96** | **OpCntRs** |

OptCntRs data object is mapped in data of the device and can be imaged in other outside tool or program.

However not mapped *Mod* data attribute is displayed as follows:

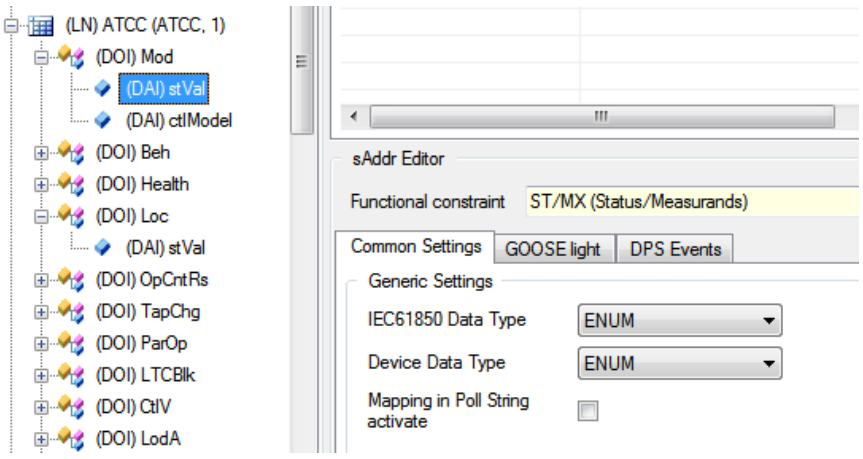



*Figure 110: Status Data Point not mapped in device data.*

Table 46: Status Data Configuration Data

| Form entry | Description |
|---|---|
| Common | |
| *IEC61850 Data Type:* | Defines the corresponding IEC data type. |
| *Mapping in Poll String activate:* | The parameter defines the using of data attribute in internal device data. If “No (not mapped in internal data)” has been selected, there is not corresponding offset in internal poll device data. |
| **GOOSE*light*** | |
| *Using as Subscriber timeout-error alarm* | The parameter defines the using of data attribute for reporting about timed-out GOOSE telegram, which occurs with waiting timeout expiration. |
| *Number of the observed Subscriber (if set as alarm)* | The parameter defines the subscriber index for timeout error reporting |
| **DPS Events** | |
| *Auxiliary Group* | The parameter defines any auxiliary flag for future using. It is not applicable now |
| *Extended Syntax-Settings* | Defines the complex behavior rules and event processing for status object. |

#### 18.6.1.1 Extended Lexical Elements Format

To define the complex behavior rules and event processing for status objects there are additional lexical elements, which are used by means of additional extended syntax-settings setting. Any new rule must start with the lexical element.

The character ";" works as a separator between lexical elements. The space character is ignored.

It is necessary to note, that syntactically all language rules are case-insensitive.

**The following is a list of used Lexical elements:**

1) Lexical element $EVN. It defines data status behavior, if a current event occurs.
2) Lexical element$CMD. **Not used yet**.

Each Lexical element may be composed of keywords, types and values. The character “:” is a delimiter between the separate keywords, types or values.

**The three possible keyword groups are:**

Table 47: Keyword group for definition the position in poll-string:

| Keyword | Description | Values range |
|---|---|---|
| Off | offset in poll-string | |
| Bit | bit-offset begin with offset in poll-string (it is applied only for binary or for Boolean types) | |

Table 48: Keyword group for event type definition:

| Keyword | Description | Values range |
|---|---|---|
| Bool | Boolean or binary type | 0,1 |
| Char | Character or signed character type | -128... +127 |
| Byte | Unsigned character type | 0.. +255 |
| Unt16 | Unsigned two bytes or unsigned short. | 0…65535 |
| Word | Signed two bytes or Signed short. | -32768…+32767 |
| ULong | Unsigned four bytes or unsigned long. | 0…0xFFFFFFFF |
| Long | Signed four bytes or signed long. | -0x7FFFFFFF…0x7FFFFFFF |
| Float | IEEE 754: floating point | bytes |

Table 49: Keyword group for definition the directed-behaviour in directional protection activation information (ACD)

| Keyword | Description | Values range |
|---|---|---|
| Back | Backward from IEC61850 enumeration “dir”. | Without value |
| For | Forward from IEC61850 enumeration “dir”. | Without value |
| Both | Both from IEC61850 enumeration “dir”. | Without value |

Table 50: Keywords group for definition complex data object behaviour

| Keyword | Description | Values range |
|---|---|---|
| Clear | Event clears the status object ( to 0 ) | Without value |
| Set | Event sets the status object ( to one ) | Without value |
| Value | Event sets encapsulated value to the status object | Without value |
| DpHi | Event answers to the purpose “Higher” in complex DPS data status. It sets anyway its TRUE as [10] by means “any or all gate” | Without value |
| DpLo | Event answers to the purpose “Lower” in complex DPS data status. It sets anyway its TRUE as [01] by means “any or all gate” | Without value |

#### 18.6.1.2 Mapping with Extended Lexical Elements

Here there are some examples shortly of the different ways to use this notification.

0 Example: DPS complex status object mapping

Extended syntax-setting is:

**$Evn:Bool:Off=19:Bit=0:DpHi; $Evn:Bool:Off=19:Bit=1:DpLo**

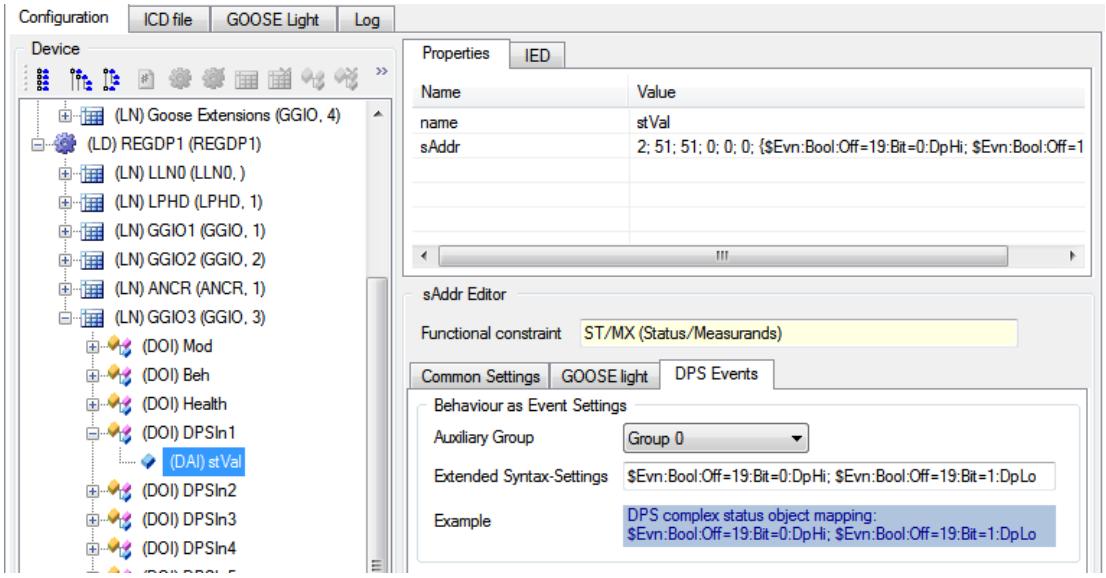



*Figure 111: Example of DPS-complex status*

- IEC61850 type is “DoublePoint” (enumeration DPos);
- Device internal type is inapplicable, because this status is not mapped in internal data and is not arranged in the poll-string;
- First Event**( $Evn:Bool:Off=19:Bit=0:DpHi )** defines internal SPS-data: offset 19, bit offset 0. Its behavior fits with DPS-Higher request. If this SPS (status point) is set to TRUE, value [10] will be set by means “any or all gate” after clear of high byte. If this SPS (status point) is set to FALSE, high bit will be cleared.
- Second Event**( $Evn:Bool:Off=19:Bit=1:DpLo )** defines internal SPS-data: offset 19, bit offset 1. Its behavior fits with DPS-Lower request. If this SPS (status point) is set to TRUE, value [01] will be set by means “any or all gate” after clear of lower bit. If this SPS (status point) is set to FALSE, low bit will be cleared.

0 Example: Status object by means directional protection activation

Extended syntax-setting is:

**$Evn:Bool:Off=19:Bit=0:Forw; $Evn:Bool:Off=19:Bit=1:Back; $Evn:Bool:Off=19:Bit=3:Both**

- IEC61850 type is “DoublePoint” (enumeration “dir”);

```
<EnumType id="dir">
        <EnumVal ord="0">unknown</EnumVal>
        <EnumVal ord="1">forward</EnumVal>
        <EnumVal ord="2">backward</EnumVal>
        <EnumVal ord="3">both</EnumVal>
</EnumType>
```

- Device internal type is inapplicable, because this status is not mapped in internal data and is not arranged in the poll-string;
- First Event**( $Evn:Bool:Off=19:Bit=0:Forw )** defines internal SPS-data event: offset 19, bit offset 0. Its behaviour fits with Dir-enumeration type in IEC61850. If this SPS (status point) is set to TRUE, value 1 will be set. Value FALSE ignored.
- Second Event**( $Evn:Bool:Off=19:Bit=1:Back )** defines internal SPS-data event: offset 19, bit offset 1. Its behaviour fits with Dir-enumeration type in IEC61850. If this SPS (status point) is set to TRUE, value 2 will be set. Value FALSE ignored.
- Third Event**( $Evn:Bool:Off=19:Bit=2:Both )** defines internal SPS-data event: offset 19, bit offset 2. Its behaviour fits with Dir-enumeration type in IEC61850. If this SPS (status point) is set to TRUE, value 3 will be set. Value FALSE ignored.

0 Example: Triggered status object

Extended syntax-setting is:

**$Evn:Bool:Off=19:Bit=0:Set; $Evn:Bool:Off=19:Bit=1:Clear**

- IEC61850 type is BOOLEAN
- Device internal type is inapplicable, because this status is not mapped in internal data and is not arranged in the poll-string;
- First Event**( $Evn:Bool:Off=19:Bit=0:Set )** defines internal SPS-data event: offset 19, bit offset 0. If this SPS (status point) is set to TRUE, value 1 will be set. Value FALSE ignored.
- Second Event**( $Evn:Bool:Off=19:Bit=1:Clear )** defines internal SPS-data event: offset 19, bit offset 0. If this SPS (status point) is set to TRUE, value 0 will be set. Value FALSE ignored.

## 18.6.2 Control Value Configuration

The operate request is performed through the use of a **Write.request** of the appropriate **Oper** structure.

The Oper$ctlVal settings and executing behaviour are defined in “Control Value Configuration” section.

The parameter Oper$Check specifies the kind of checks a control object and is defined only in ICD file. All conditional tests before and after the control operations are adjustable and defined below.

### 18.6.2.1 Single Command

Here “*Multi-Command*” is not checked. If it is checked, the mode will be changed to “*Multi Command*”.

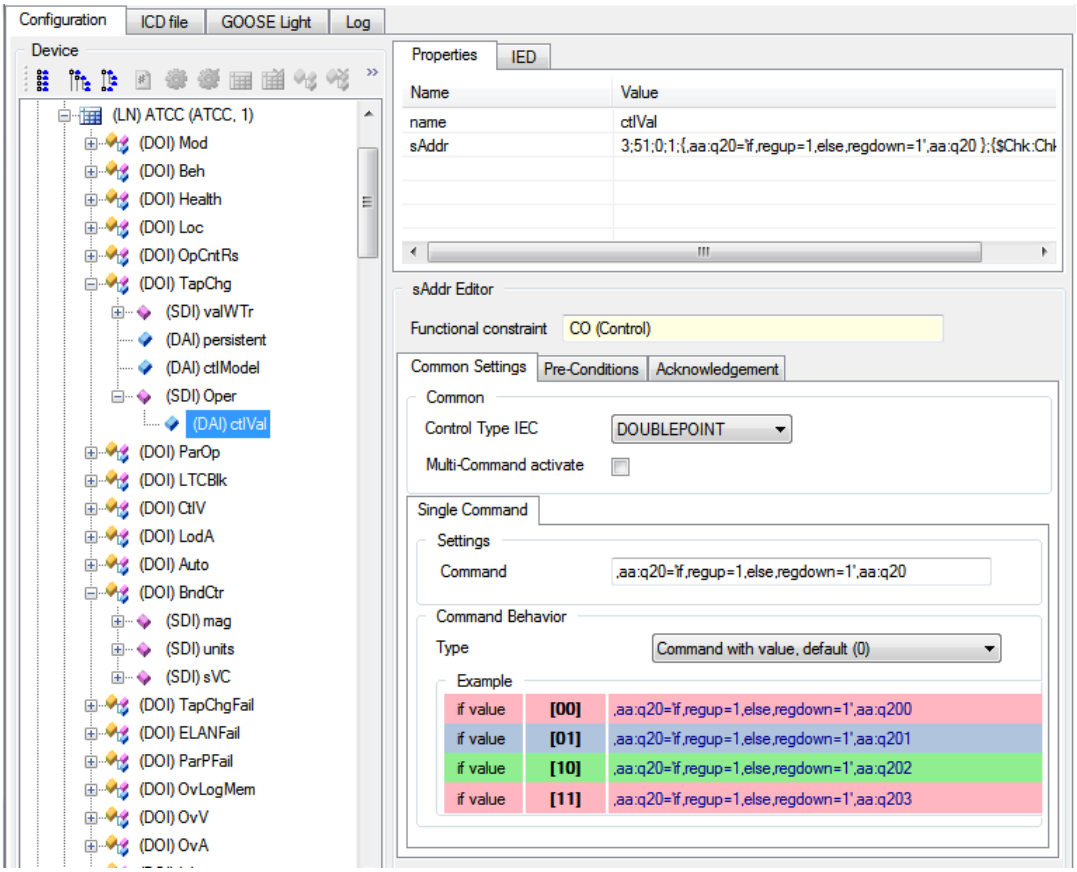
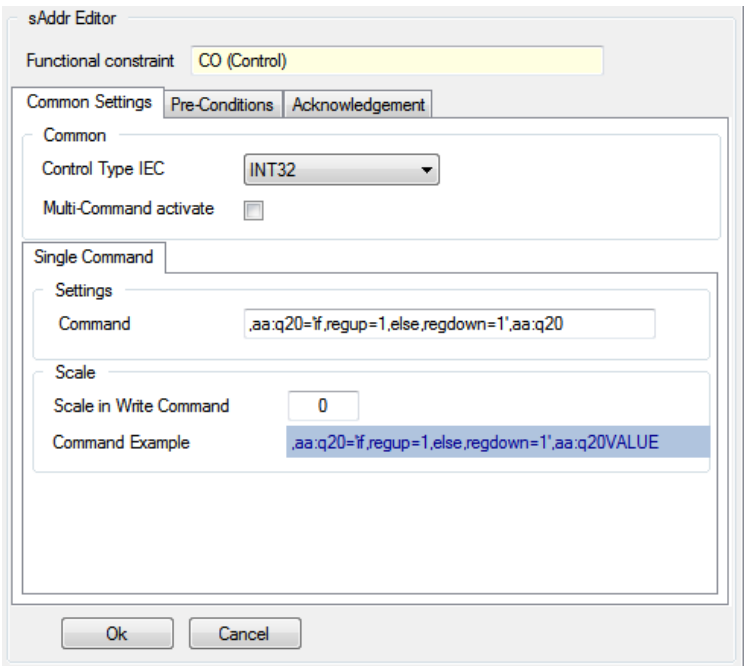



*Figure 112: Control Value Configuration (Single Command)*

Table 51: Control value settings

| Form entry | Description |
|---|---|
| Common | |
| Control Type IEC | Defines the corresponding IEC control data type. |
| Multi-command | The parameter defines using of the multi command CO-data attribute. Leave unchecked for single command |
| Single command | |
| Field Section "XXXX-Command" | Normally, this parameter is used as exponent with single commands. If a Boolean or DoublePoint IEC control data type is used, scale has special meaning. (See below)<br>The parameter can be adjusted from -127…128. By default set to 0. |

| Form entry | Description |
|---|---|
|  | |
| Command | Defines the command string, which is assigned with converted IEC control value of scale rule. The result is sent to XXXSysTM – device. |

If IEC-Type of command is BOOLEAN, scale parameter will be used as shown below:

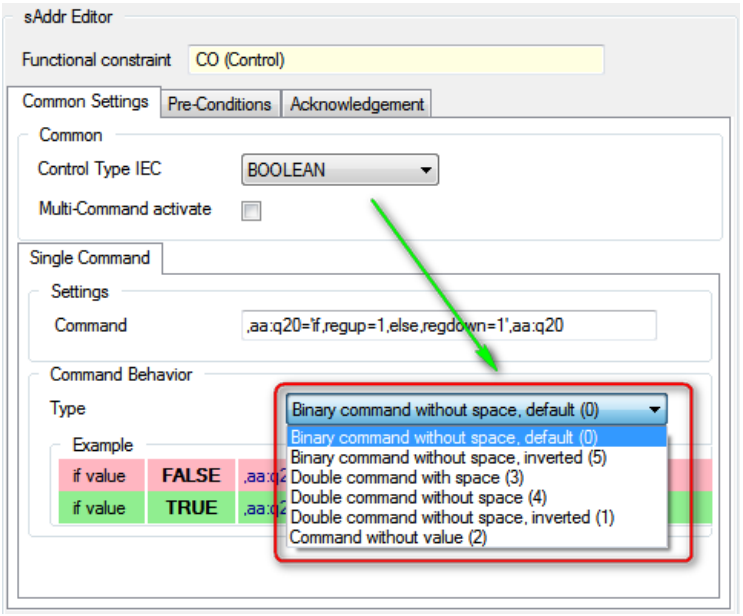
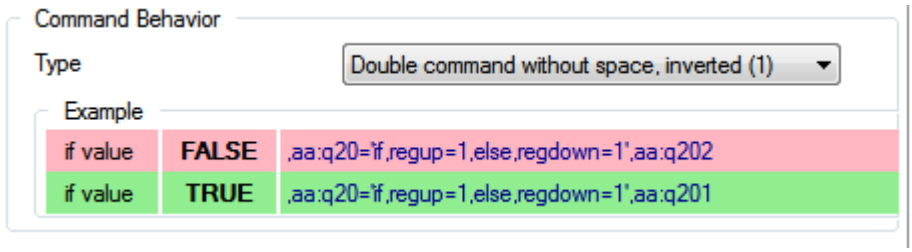
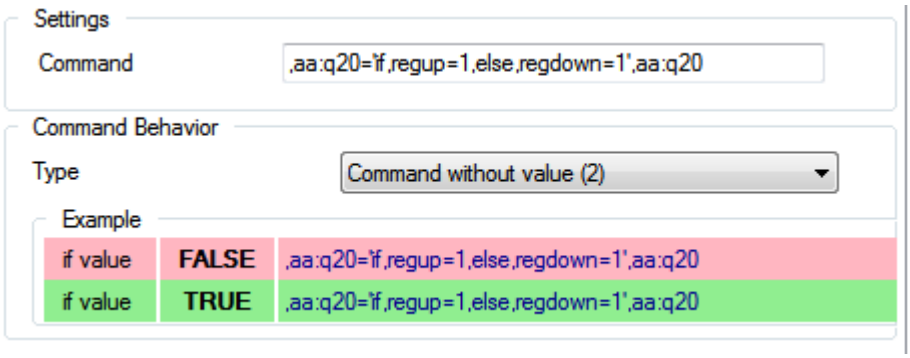


Table 52: Boolean conversion rules for *[command] [convert (ctlVal)]*

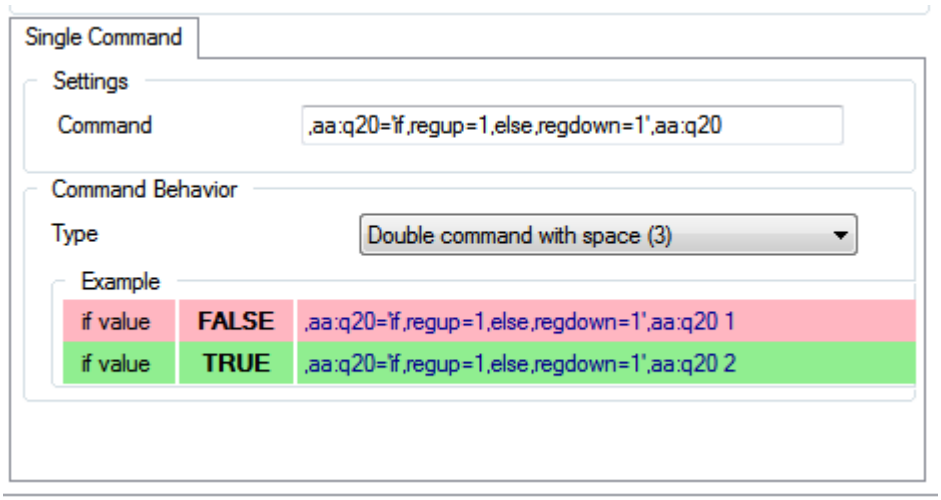
| Scale | IEC Value | Conversion |
|---|---|---|
| 1 | False | [command][2] |
| 1 | True | [command][1] |



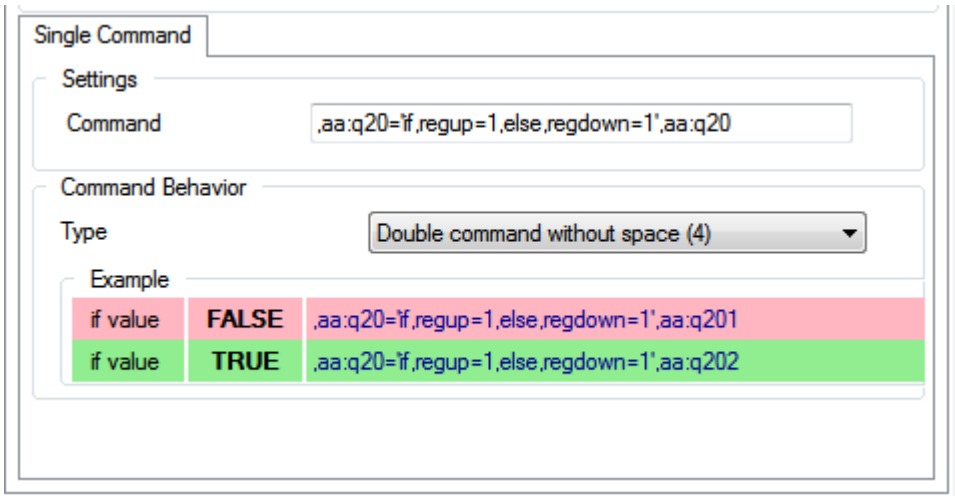

| | | |
|---|---|---|
| 2 | False/True | [command] |



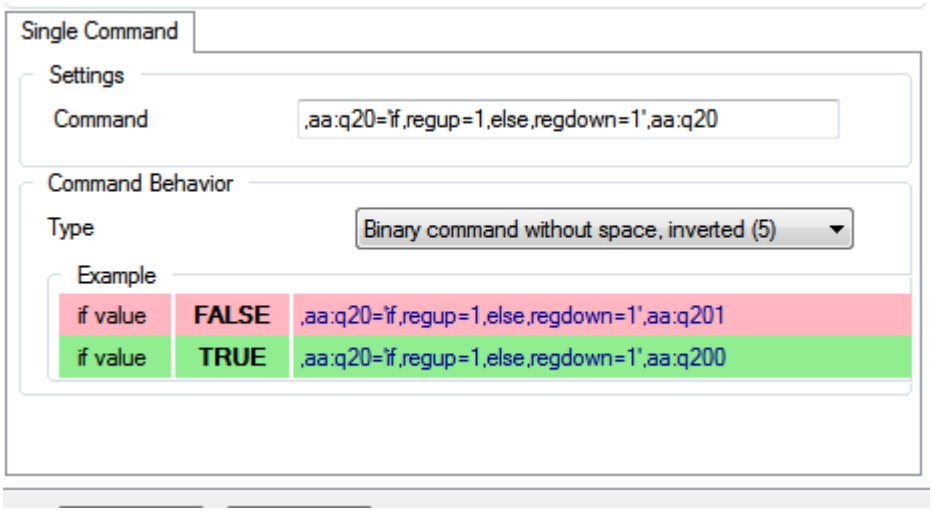

| | | |
|---|---|---|
| 3 | False | [command][space][1] |
| 3 | True | [command][space][2] |



| Scale | IEC Value | Conversion |
|---|---|---|
| 4 | True | [command][2] |
| 4 | False | [command][1] |

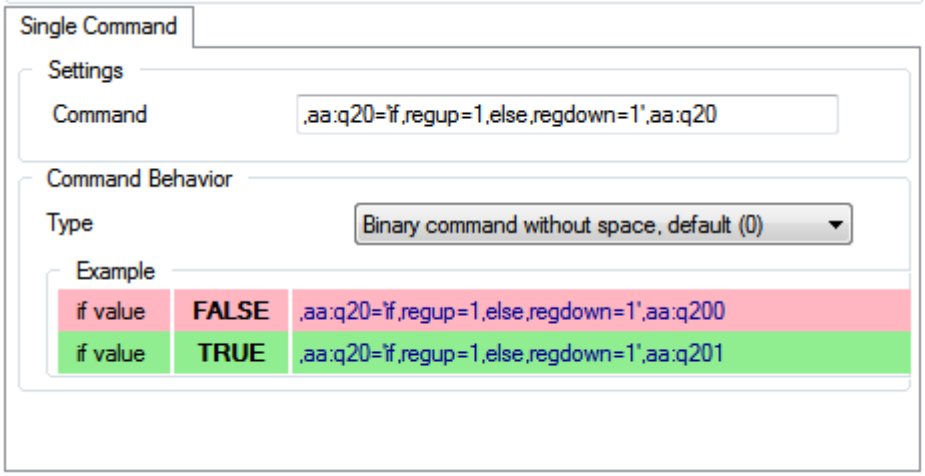



| 5 | False | [command][1] |
|---|---|---|
| 5 | True | [command][0] |



| Scale | IEC Value | Conversion |
|---|---|---|
| | | |

| | | |
|---|---|---|
| Default 0 | False | [command][0] |
| Default 0 | True | [command][1] |




If IEC-Type of command is DOUBLEPOINT, scale parameter will be used as shown below:

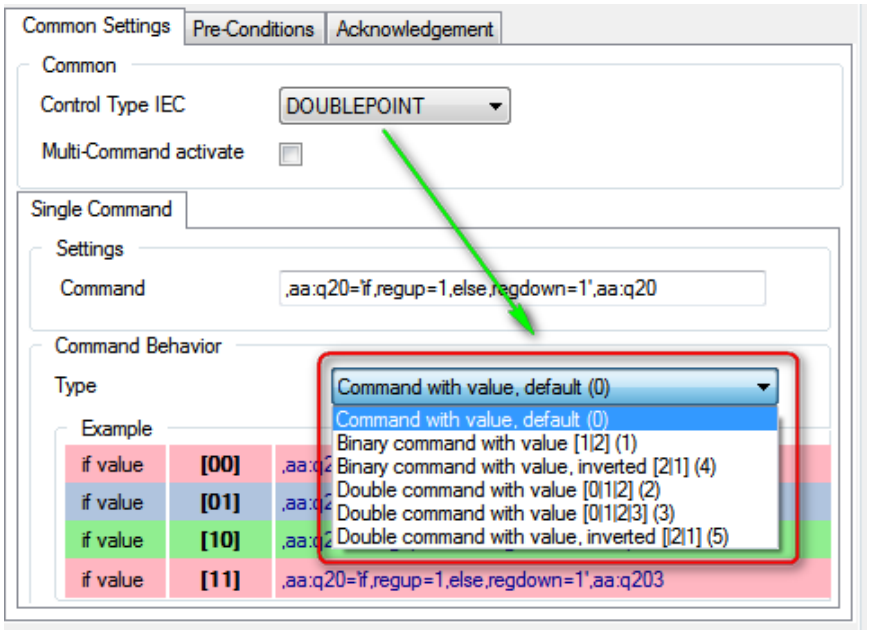


Table 53: Double Point conversion rules for *[command][convert(ctlVal)]*

| Scale | IEC Value | Conversion |
|---|---|---|
| 1 | [00] | Negative response. |
| 1 | [01] | [command][0] |
| 1 | [10] | [command][1] |
| 1 | [11] | Negative response. |
| | | |
| 2 | [00] | [command][0] |
| 2 | [01] | [command][1] |
| 2 | [10] | [command][2] |
| 2 | [11] | Negative response. |
| | | |
| 3 ( unused value. Instead of this a default value is used) | [00] | [command][0] |
| | [01] | [command][1] |
| | [10] | [command][2] |
| | [11] | [command][3] |
| | | |
| 4 | [00] | Negative response. |
| 4 | [01] | [command][1] |
| 4 | [10] | [command][0] |
| 4 | [11] | Negative response. |
| | | |
| 5 | [00] | Negative response. |
| 5 | [01] | [command][2] |
| 5 | [10] | [command][1] |
| 5 | [11] | Negative response. |
| | | |
| Default | value | [command][value] |

### 18.6.2.2 Multi Command

Here the check box for “Multi-command” is checked. If it gets unchecked, the mode will be changed to “Single Command”.

This mode is only available for Boolean and DoublePoint commands.

**Multi-command mode has been left for backward compatibility and will not be supported in future.**

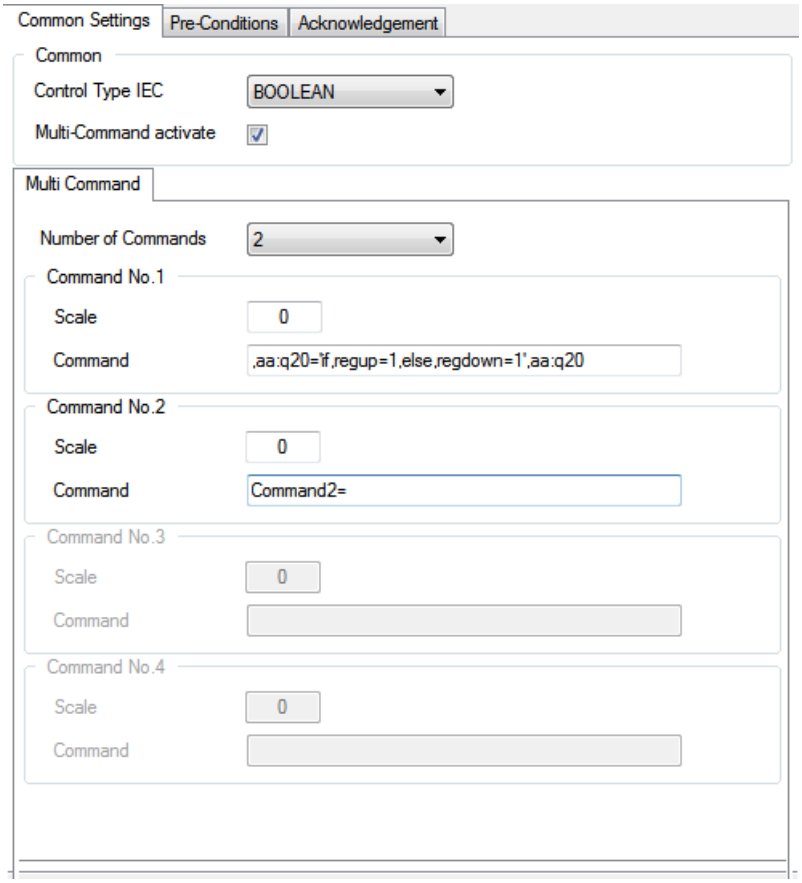



*Figure 113: Control Value Configurations (Multi Command)*

Multi commands are built, as a chain of the comma-separated commands. For example, commands No.1 and No.2 create the multi-command:

**A: regAUTO=1, ,aa:q20='if,regup=1,else,regdown=1', aa:q20'**

Table 54: Multi command control value settings

| Form entry | Description |
|---|---|
| Common | |
| *IEC-type of control* | Defines the corresponding IEC control data type. |
| *Multi-Command activate* | The parameter defines using of the multi command CO-data attribute. Leave unchecked for single command |
| Single command | |
| *Scale* | Normally, scale is used as exponent with single commands. If a Boolean/Double IEC control data type is selected, scale has special meaning. (See following tables.)<br>The parameter can be adjusted from -127…128. By default set to 0. |
| *Command* | Defines the command string, which is assigned with converted IEC control value of scale rule. The result is sent to XXXSys™ – device. |

### 18.6.2.3 Pre-Conditions

Command pre-conditions define the behavior of check before the control operation.

They are checked each time before control operation.

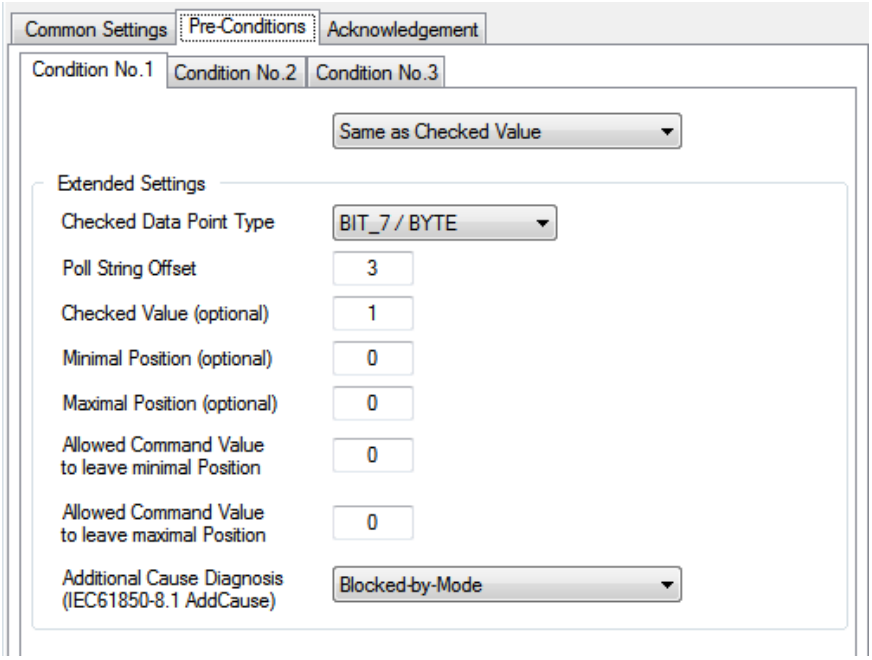



*Figure 114: Executing Command Pre-Conditions*

- If predicable condition check finished successful, control operation continues and command will be sent to device.
- If predicable condition check faulted, application sends “response-“ and an information report with Last Error cod to client according to a selected control model in ICD file.

Even if a part of checks finished successful, command will be never sent, if at least one condition faulted.

Selector “Condition” defines a predicable type by mean of test-behavior.

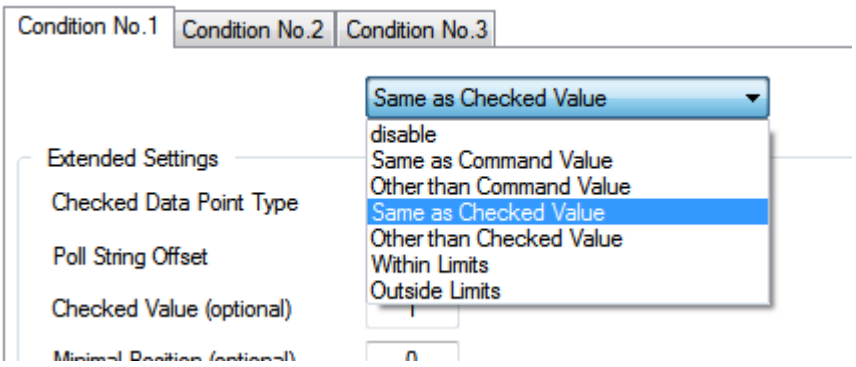



*Figure 115: Condition Type (behavior)*

Extended Settings define test behavior and data point, which will be checked. The maximal and minimal limit position can be defined too.

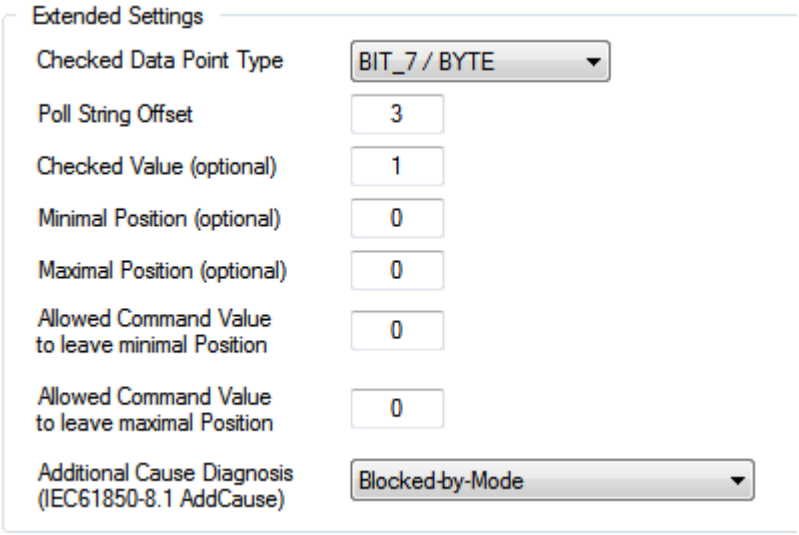



*Figure 116: Condition extended Settings*

Table 55: Predicable Condition Extended Settings

| Form entry | Description |
|---|---|
| Checked data Point Type | Defines a checked Data Point type in Poll string. |
| Poll String Offset | Defines a checked Data Point Poll string offset. |
| Checked Value(optional) | Defines a checked value as FLOAT32 value |
| Minimal Position (optional) | Defines minimal position by “Limit condition” |
| Maximal Position (optional) | Defines maximal position by “Limit condition” |
| Allowed Command Value to leave minimal Position | Defines command value, that permitted at minimal position by “Limit condition” |
| Allowed Command Value to leave maximal Position | Defines command value, that permitted at maximal position by “Limit condition” |

### 18.6.2.4 Command Acknowledgement

Command Acknowledgement condition defines a check behavior after command executing.

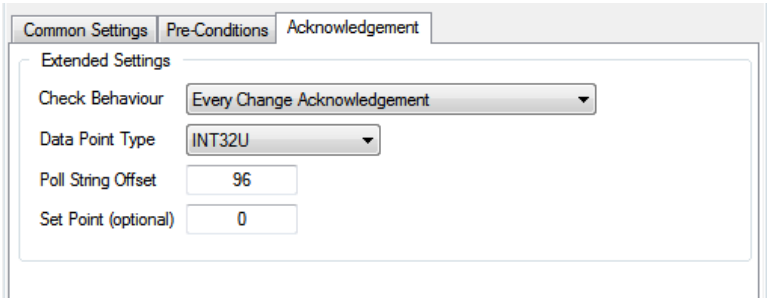



*Figure 117: Acknowledgement Condition Settings*

Table 56: Command Acknowledgement

| Form entry | Description |
|---|---|
| Check Behavior | Defines the estimation behavior |
| Data Point Type | Defines test data point type in poll string |
| Poll String Offset | Defines test data point offset in poll string |
| Set Point (optional | Optional defines the test value. For example 0 for reset command. |

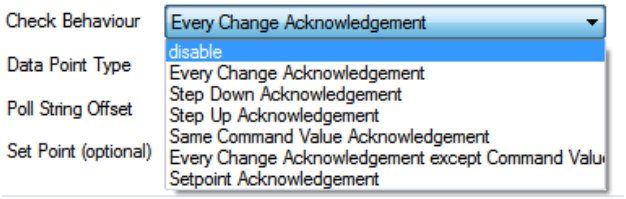



*Figure 118: ACK-NACK test behavior*

The check behaviors are same as in predicable condition. However, there is “Setpoints..” condition, which literal meaning same with name.

#### 18.6.2.5 Control Model

Parameter ctlModel specifies the control model of IEC 61850-7-2 that corresponds to the behavior of the data. The configured value for ctlModel becomes effective as soon as the real device has been configured. The values may be overwritten in Webserver if the conditions and acknowledgment allow overwriting this value. If a data instance of a control class has no status information associated, then the attribute stVal does not exist. In that case, the value range for ctlModel is restricted to direct-with-normal-security and sbo-with-normal-security.

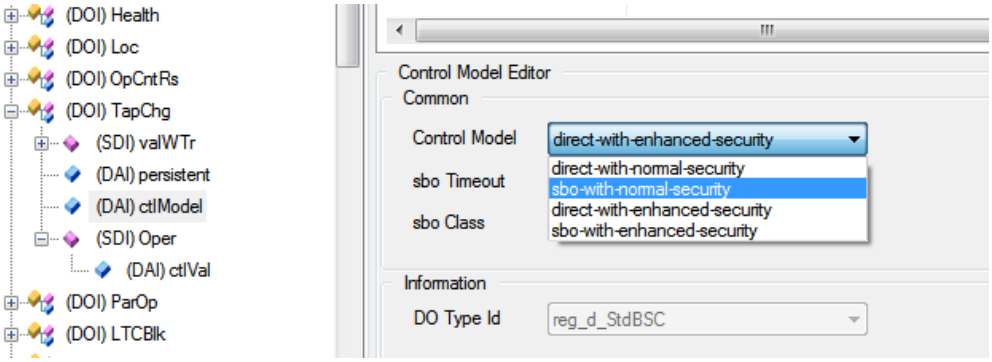



*Figure 119: Control Model Parameter*

### 18.6.3 Set point Value Configuration (Single Command)

Set point values are to be configured as a mixed form of a status value and a command.

Here the check box “Multi Line” is not checked. If it gets checked, the mode will be changed to “Multi Command”.

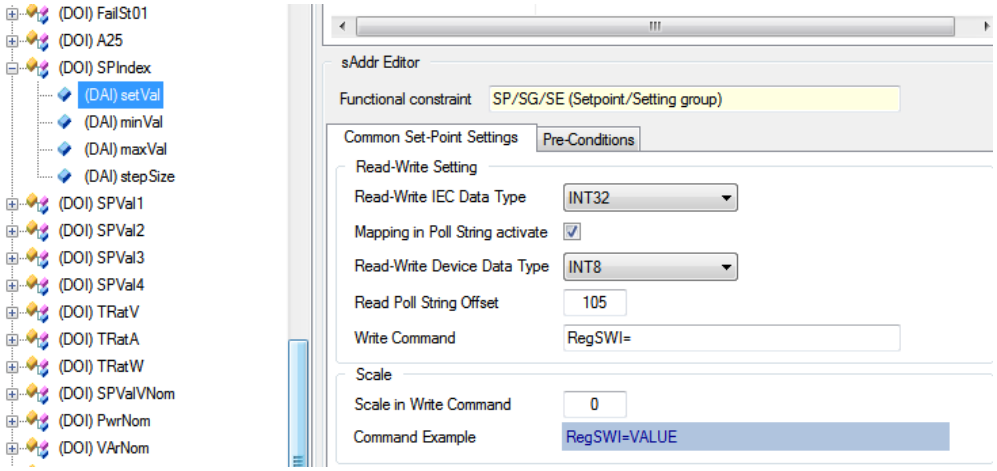



*Figure 120: Set point Value Configuration (only with Single Command)*

Table 57: Single command Set point settings

| Form entry | Description |
|---|---|
| Common (Status and Measured) | |
| *Read-Write IEC Data Type* | Defines the corresponding IEC control data type. |
| *Mapping in Poll String activate:* | The parameter defines using this data attribute in internal device data. If "No (not mapped in internal data)" has been selected, there is not corresponding offset in internal poll device data. |
| *Read-Write Device Data Type:* | Defines the corresponding XXXSysTM – device data type. If "IGNORE" is selected or "Deviation and offset are used" is not checked, this data point is not allocated. Device data type determines the interpretation of "Deviation" |
| *Read Poll String Offset* | Defines offset of the device answer string, where this data is located. If -1, the data point will not be mapped to the answer string. The parameter can be adjusted from -1…255. By default it is -1. |
| *Scale in Write Command* | Normally, scale is used as exponent with single commands. If a Boolean IEC control data type is selected, scale has special meaning. (See following tables.)<br>The parameter can be adjusted from -127…128. By default set to 0. |
| *Write Command:* | Defines the command string, which is assigned with converted IEC control value of scale rule. The result is sent to XXXSysTM – device. |
| GOOSE *light* | |
| *Subscriber Number ( if activated ):* | The parameter defines any auxiliary flag for future using. It is not applicable now. |
| Pre-Conditions | |
| *Checked data Point Type* | Defines a checked Data Point type in Poll string. |
| *Poll String Offset* | Defines a checked Data Point Poll string offset. |
| *Checked Value(optional)* | Defines a checked value as FLOAT32 value |
| *Minimal Position (optional)* | Defines minimal position by "Limit condition" |
| *Maximal Position (optional)* | Defines maximal position by "Limit condition" |
| *Allowed Command Value to leave minimal Position* | Defines command value, that permitted at minimal position by "Limit condition" |
| *Allowed Command Value to leave maximal Position* | Defines command value, that permitted at maximal position by "Limit condition" |

## 18.7 GOOSE *light* Settings

### 18.7.1 IEC GOOSE *light* Architecture

The implementation of the IEC 61850 GOOSE services provides a mechanism for sending and receiving the standardized GOOSE telegrams. The settings and architectures are quite similar for publisher and subscribers.

It is assumed that the reader is familiar with the GOOSE *light* architecture.

### 18.7.2 GOOSE *light* Control Blocks Settings

```
<Communication>
        <SubNetwork name="SUBNETWORK1" type="8-MMS">
                <BitRate unit="b/s">100</BitRate>
                <ConnectedAP iedName="REGDA" apName="P1">
                        <Address>
                                <P type="OSI-PSEL">00000001</P>
                                <P type="OSI-SSEL">0001</P>
                                <P type="OSI-TSEL">0001</P>
                        </Address>
                        <GSE ldInst="A" cbName="GoCb_Bin">
                                <Address>
                                        <P type="MAC-Address" xsi:type="tP_MAC-Address">01-0C-CD-01-01-01</P>
                                        <P type="APPID">1</P>
                                        <P type="VLAN-PRIORITY">4</P>
                                        <P type="VLAN-ID">000</P>
                                </Address>
                                <MinTime unit="s" multiplier="m">10</MinTime>
                                <MaxTime unit="s" multiplier="m">1000</MaxTime>
                        </GSE>
                        <GSE ldInst="A" cbName="GoCb_State">
                                <Address>
                                        <P type="MAC-Address" xsi:type="tP_MAC-Address">01-0C-CD-01-01-0A</P>
                                        <P type="APPID">1</P>
                                        <P type="VLAN-PRIORITY">4</P>
                                        <P type="VLAN-ID">000</P>
                                </Address>
                                <MinTime unit="s" multiplier="m">10</MinTime>
                                <MaxTime unit="s" multiplier="m">1000</MaxTime>
                        </GSE>
                        <PhysConn type="Plug">
                                <P type="Type">FOC</P>
                                <P type="Plug">ST</P>
                        </PhysConn>
                </ConnectedAP>
        </SubNetwork>
</Communication>
```

*Figure 121: GOOSE light Control Blocks Configuration*

In this case, application transmits data from GoDsUI dataset in Goose Output telegrams.

The content of a GOOSE *light* message is defined with a dataset. The GOOSE *light* message is sent as multicast messages over the communication network.

**One example of SCL configuration shown below:**

```
<ConnectedAP iedName="REGD159" apName="P1">
<GSE ldInst="REGD1" cbName="GoCbUI_REGD1">
        <Address>
                <P type="MAC-Address" xsi:type="tP_MAC-Address">01-0C-CD-01-00-00</P>
                <P type="APPID">0BB8</P>
                <P type="VLAN-PRIORITY">4</P>
                <P type="VLAN-ID">000</P>
        </Address>
        <MinTime unit="s" multiplier="m">10</MinTime>
        <MaxTime unit="s" multiplier="m">1000</MaxTime>
</GSE>
</ConnectedAP>
```

**The captured fragment of the GOOSE *light* output telegram illustrated below.**

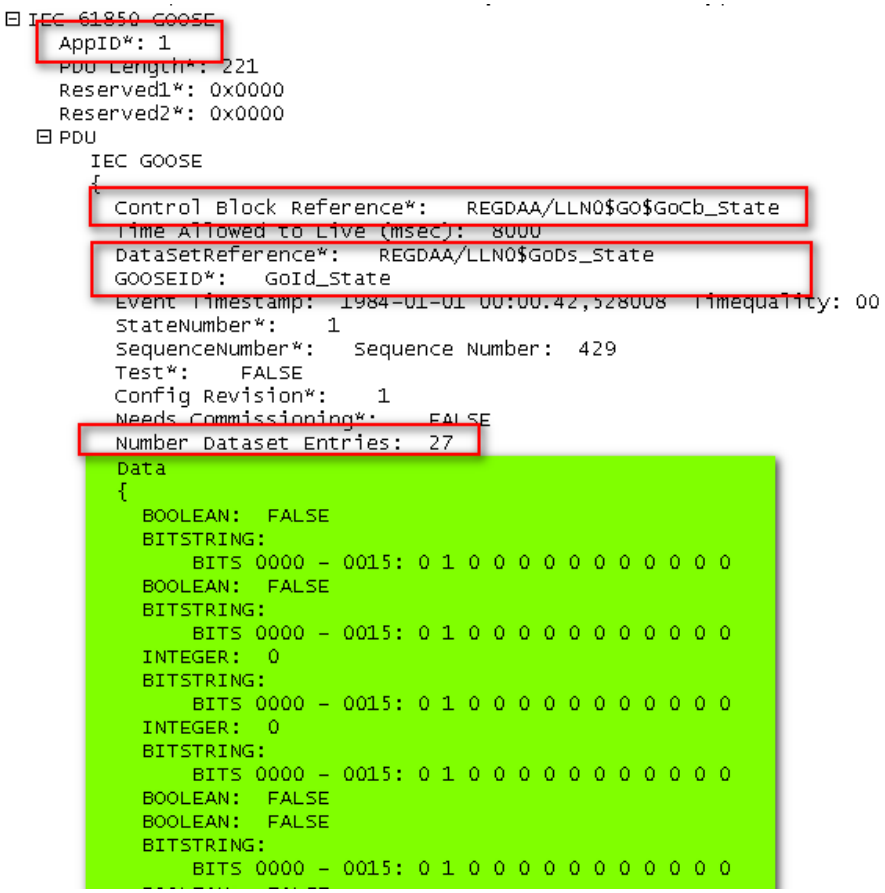



*Figure 122: Capture fragment of GOOSE light telegram*

### 18.7.3 GOOSE *light* Input Streams (Inner Subscribers)

The application allows the configuration of up to 15 GOOSE *light* input streams.

The architecture of GOOSE *light* subscribing is shown in Figure 123: .

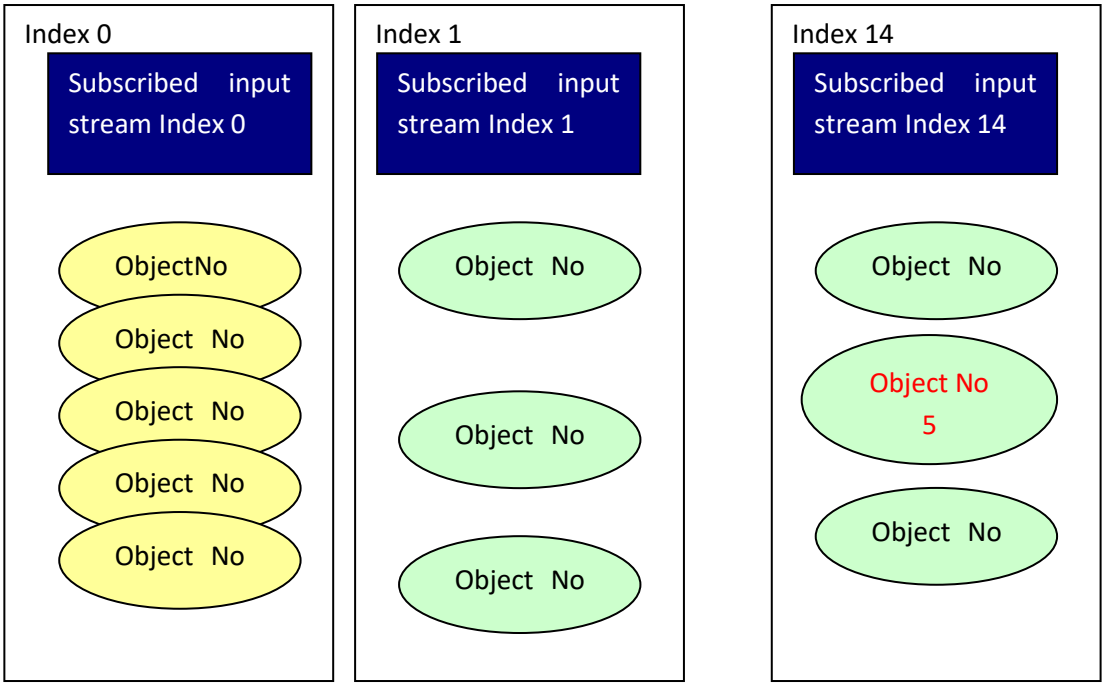



*Figure 123: GOOSE light Input architecture*

Each subscriber holds one set of objects in sequence order. Each object of the subscribed set is given a particular number in received GOOSE *light* telegram. If the subscriber has not been configured in numerical order, its input telegrams cannot be handled in an application. More detailed information is available below.

### 18.7.4 Publisher Side

The current paragraph illustrates the generic Object Oriented Substation Event configuration within the MMS server and SCL which defined in ICD file in your settings.

The GOOSE *light* configuration database contains settings with the following data elements:

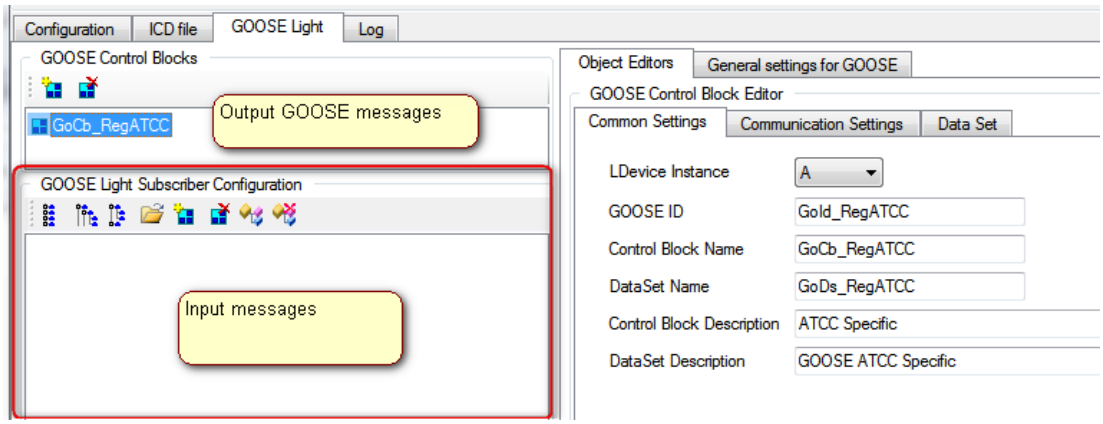



*Figure 124: Publisher and Subscriber sides*

Adjusted GOOSE settings will be saved to file goose.param. At the same time an ICD-file contains the factory GOOSE settings. You should also take that into account.

All changed parameters are available only after resetting the REG-PE/REG-PED.

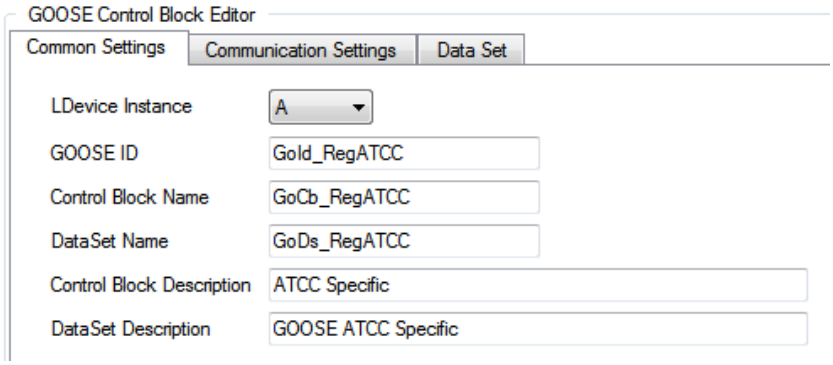



*Figure 125: "Common Options" Tab*

There are two Timing strategy types: arithmetic and profile.

The arithmetic scheme has three parameters: first interval, multiplier, and maximum interval. The first retransmission occurs after the first interval time. Each subsequent interval is the product of the last interval times the multiplier, until the maximum interval is reached. Thus, for first interval = 400, multiplier = 2, and maximum interval = 3200, the retransmissions will occur at intervals beginning at 2, and doubling each time until the maximum interval is reached (400, 800, 1600, 3200). If any changes of GOOSE data occur the application immediately sends GOOSE data and then resets the retransmission time to interval to first interval.

The profile scheme allows for a specific set of intervals to be specified. Each interval (specified in milliseconds) is used in sequence of GOOSE *light* telegrams. When the last specified interval has been used, the parameters of the arithmetic scheme are then used for subsequent intervals (including the maximum retransmission interval).

If any changes of GOOSE *light* data occur, the application immediately sends GOOSE data and then resets the retransmission time to interval to first interval.

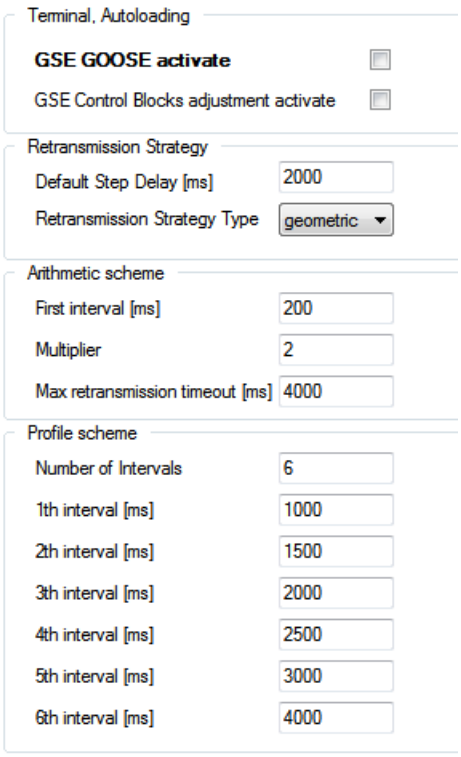


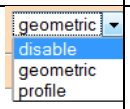

*Figure 126: GOOSE Retransmission Settings Tab*

Firmware supports up to 4 Control Blocks. Their number is defined of ICD Communication Section. For example, if an ICD file contains the 3 GOOSE GSEs, only these GOOSE Control blocks will be shown here.

**The settings data elements are described in the table below.**

Table 58: Settings of GOOSE *light*

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| Common | | | | |
| GSE GOOSE activate | Used/ Not used | | Used | Parameter activates/deactivates IEC GOOSE service. If GOOSE won`t be used, the service will be deactivated. It can reduce a network busy schedule.<br>Setting “No” switches off all GOOSE services. |
| GSE Control Blocks ad-justment activate | Y/N | Yes/ No (use only MMS-Goose Control Blocks) | No | Parameter activates/deactivates an adjustment of the published IEC GOOSE Control Blocks, which have been described in the ICD file. If “No” is selected, REG-PE/REG-PED publishes all GOOSE Control Blocks as this has been described in ICD-file.<br>**If the adjustment has been deactivated, all following APPID and VLAN settings won´t be applied.** |

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| MAC Address (destination of GOOSE messages) | hex | 6 octet | IEC61850-8 | Parameter defines the multicast data link destination address for a first IEC GOOSE Control Block from GSE-Section in ICD file. |
| Application ID | Hex/ dec | From 0 up to $2^{32}$ | 0x3ED or 1001 in decimal notation | The parameter defines VLAN APPLD which identifies a using the VLAN (802.1q) for a first IEC GOOSE Control Block from GSE-Section in ICD file.<br>For detailed information see please IEC61850-8-1 |
| VLAN ID | Hex/ dec | From 0 up to $2^{32}$ | 0 | The parameter defines the unique identified of VLAN ID (802.1q)<br>0 - indicates that the tag header contains only user priority information, no VLAN ID.<br>1 - Default PVID value used for classifying frames on ingress through a bridge port.<br>FFF - Reserved for implementation use. |
| VLAN Priority | dec | From 0 up to 7 | 4 | The parameter defines the VLAN Priority as 3-bit binary number representing 8 priority levels, 0-7 (802.1q). |
| **GOOSE Retransmission Strategy** | | | | |
| Default Step Delay | ms | 0…65535 | 500 | Parameter defines minimal timeout for IEC Goose service. Service function checks all changes in a poll of the Goose published Data Points and activates Goose transmission in any case. It activates retransmission even if the settings of retransmission strategies are not set. |
| Retransmission Strategy Type | list |  | geometric ( other name is arithmetic) | Selection of the Goose strategy type: arithmetic and profile.<br>“Disabled” option enables the. application to send new GOOSE telegrams after changes or by expiring default step delay timeout. |
| First interval: | ms | 0… up to 65535 | 1000 | The parameter defines the first interval in milliseconds in arithmetic retransmission scheme.<br>Zero will be ignored and the application sets default value 1000 ms. |
| Multiple (arithmetic) | dec | 0… up to 255 | 2 | The setting defines the multiplier the for **arithmetic** retransmission scheme.<br>Zero will be ignored and the application sets default value 2. |
| Max Interval | ms | 0… up to | 4000 | The setting defines the maximal interval in milli- |

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| (arithmetic) | | 65535 | | seconds in **arithmetic** retransmission scheme.<br>Zero will be ignored and the application sets default value 4000 ms. |
| Number of Intervals | dec | up to 6 | 6 | The setting defines a number of intervals in the **profile** retransmission scheme |
| Interval timeouts | dec | Up to 255 | 1000<br>1500<br>2000<br>2500<br>3000<br>4000 | The intervals in milliseconds in profile retransmission schema. If any changes of Goose data occur, the application sends Goose data and then resets the retransmission time to value of first interval. |

## 18.7.5 Subscribe Side

### 18.7.5.1 List of GOOSE light External Publishers

The application allows subscribing from 1 up to 16 external publishers as GOOSE partners for REG-PE / REG-PED. The external GOOSE *light*publishers are complying with a specification of REG-PE / REG-PED inner Subscribers.

**The GOOSE *light*Subscribers List pane contains full information about the subscribed GOOSE streams:**

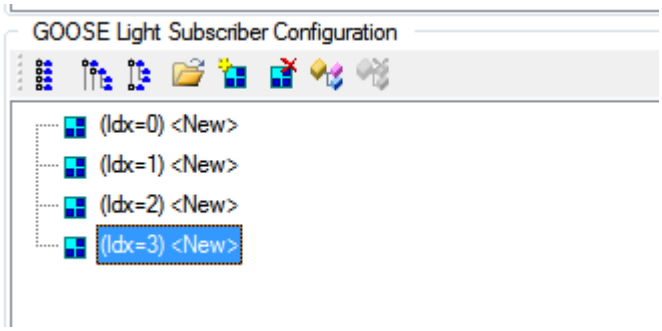
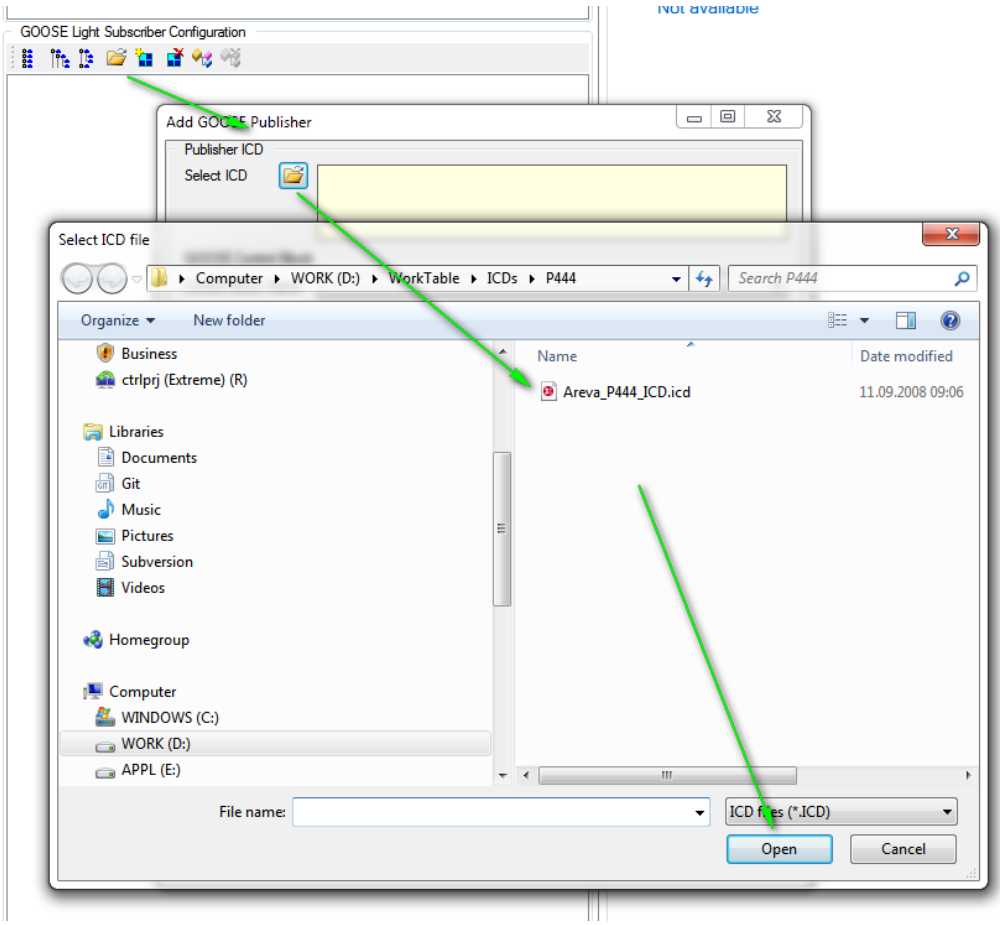
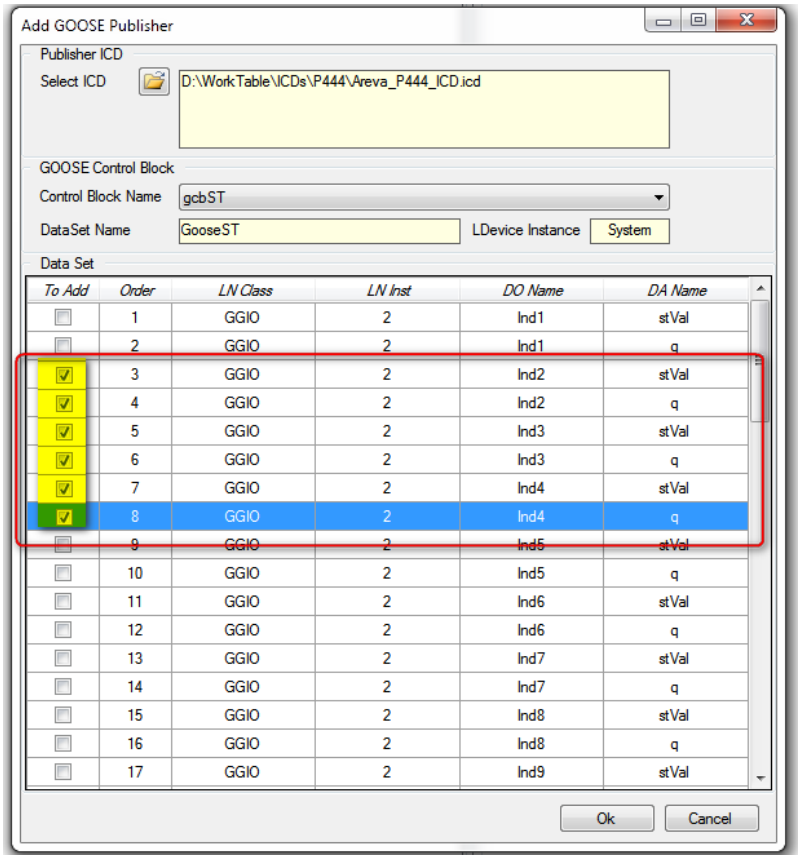



*Figure 127: GOOSE light Subscribers pane*

SCL_Config is able to create Publisher from ICD file, as shown below.


GOOSE Light Subscriber Configuration
Not available
Add GOOSE Publisher
Publisher ICD
Select ICD
Select ICD file
Computer ▸ WORK (D:) ▸ WorkTable ▸ ICDs ▸ P444
Search P444
Organize
New folder
Business
ctrlprj (Extreme) (R)
Libraries
Documents
Git
Music
Pictures
Subversion
Videos
Homegroup
Computer
WINDOWS (C:)
WORK (D:)
APPL (E:)
Name
Date modified
Areva_P444_ICD.icd
11.09.2008 09:06
File name:
ICD files (*.ICD)
Open
Cancel


Add GOOSE Publisher
Publisher ICD
Select ICD
D:\WorkTable\ICDs\P444\Areva_P444_ICD.icd
GOOSE Control Block
Control Block Name
gcbST
DataSet Name
GooseST
LDevice Instance
System
Data Set
To Add | Order | LN Class | LN Inst | DO Name | DA Name
1 GGIO 2 Ind1 stVal
2 GGIO 2 Ind1 q
3 GGIO 2 Ind2 stVal
4 GGIO 2 Ind2 q
5 GGIO 2 Ind3 stVal
6 GGIO 2 Ind3 q
7 GGIO 2 Ind4 stVal
8 GGIO 2 Ind4 q
9 GGIO 2 Ind5 stVal
10 GGIO 2 Ind5 q
11 GGIO 2 Ind6 stVal
12 GGIO 2 Ind6 q
13 GGIO 2 Ind7 stVal
14 GGIO 2 Ind7 q
15 GGIO 2 Ind8 stVal
16 GGIO 2 Ind8 q
17 GGIO 2 Ind9 stVal
Ok
Cancel

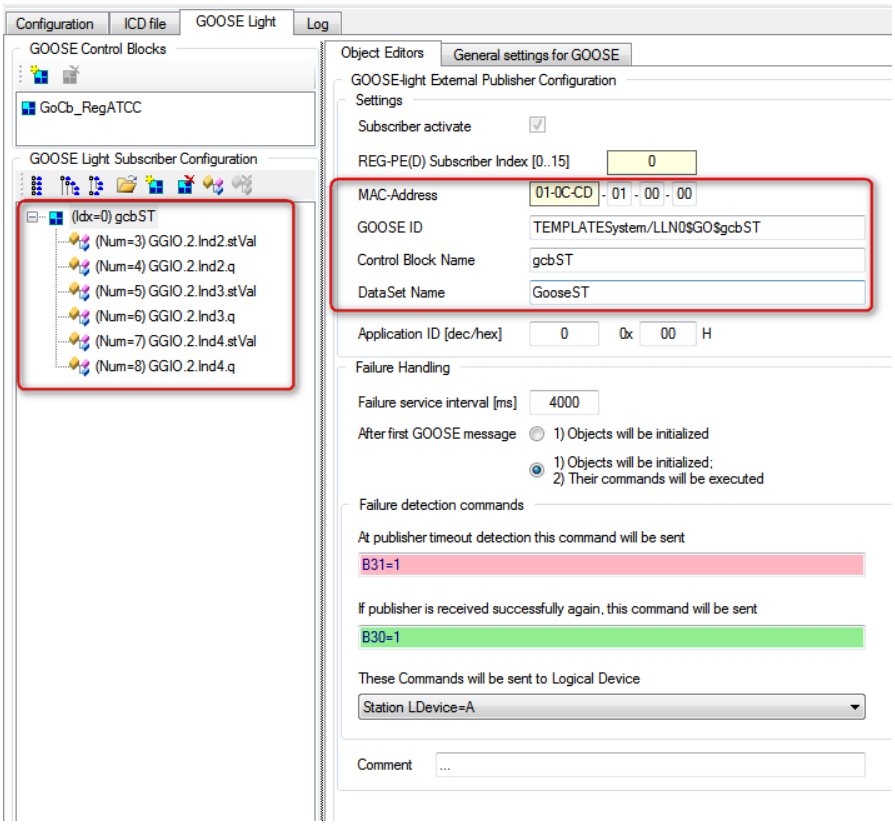
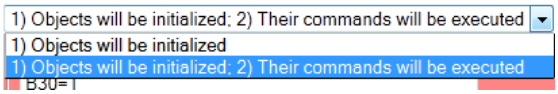
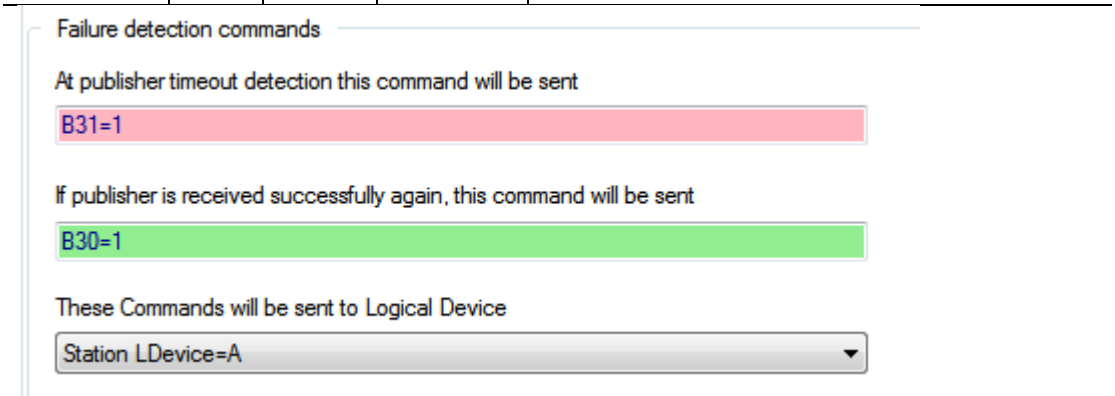



*Figure 128: Add Subscriber from other ICD file*

The detailed settings of one subscriber described below.

Table 59: GOOSE subscribed stream settings

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| Order No. (input number to select): | dec | From 1 up to 16 | - | It defines selected number and used to quick select a subscriber. |
| Description | | | | |
| REG-PE(D) Subscriber Index [0..15]: | dec | From 0 up to 15 | 0 | Defines the unique index which operates as a primary key for the extern bonded objects. Read only parameter. |
| Subscriber activate: | check box | On/Off | off | It activates subscriber. |
| GOOSE MAC Address: | hex | 6 octet | IEC61850-8 | The parameter defines the multicast data link address of the IEC GOOSE Input telegrams. |
| GOOSE ID: | string | up to 64 symbols | Test_GoID_A | The parameter defines the GOOSE light identifier string of GOOSE input telegram. It shall be set identical to a unique identifier publisher. |
| GOOSE Control | string | up to 64 | Test_GoRe | The parameter defines the full name of the Goose control block for IEC GOOSE Publishing without |

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| Block: | | sym-bols | f_A | MMS-Control Blocks.<br>It shall have a unique name in one GOOSE. |
| *GOOSE Data Set:* | string | up to 64 sym-bols | Test_GoDs_A | The parameter defines the name of the dataset being sent in IEC GOOSE. |
| *Application ID [dec/hex]:* | Hex/ dec | From 0 up 16383 (3FFF) | 0x3ED or 1001 in decimal notation | The parameter defines the VLAN AppId, which identifies the application using the VLAN (802.1q) |
| Failure ser-vice interval [ms] | ms | 0…999 99 | 4000 | The parameter defines maximal timeout (ms) for the first message. It is used to set a maximum time to wait for the first message in a subscribed GOOSE *light*stream. If an input GOOSE message is not received before the timer expires, the sub-scriber's alarm status value will be set. |
| After first GOOSE message: | list | list | executed |  <br>The parameter defines the handling of first GOOSE telegram.<br>1)After start-up of REG-PEX the process image will be filled with topical value. Only if the value changes it will be sent to eberle device. This makes sense e.g. at auto/man command.<br>2)After start-up of REG-PEX the first reception of a GOOSE message will lead to an immediate com-mand to eberle device. This makes sense e.g. at trip/close information of relays for programmer use, since the eberle device needs an up-to-date-information right from the beginning. |
| Failure de-tection commands: | | | | Defines behaviour and commands in case:<br>At publisher timeout detection<br>If publisher is received successfully again |
| | | | |  |
| Comment | string | up to 64 sym- | Not de-fault | User commentary for subscriber stream |

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| | | bols | | |

### 18.7.5.2 Binding to External Inputs

0 List of GOOSE light External Input Objects

The application allows flexible to set properties of external Input Objects (partial data objects from a published GOOSE).

The GOOSE *light*External Input Objects pane contains the information about the subscribed objects and commands, which will be executed after any changing of object's value.

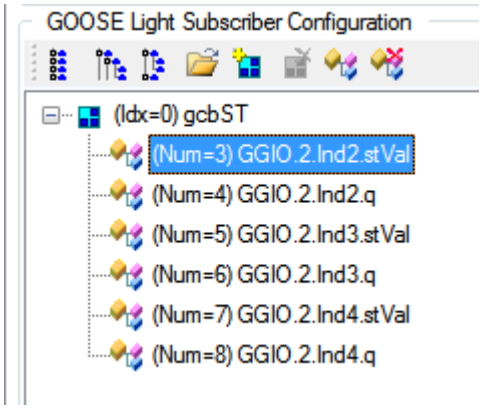



*Figure 129: List of GOOSE lightexternal Input Objects*

0 Input Object Configuration

➲ Double click on an item "Object Configuration" in the left-hand menu.

↳ The GOOSE *light*Input Object Configuration pane contains settings of one object and allows to adjust it's for a particular structure of GOOSE telegrams.

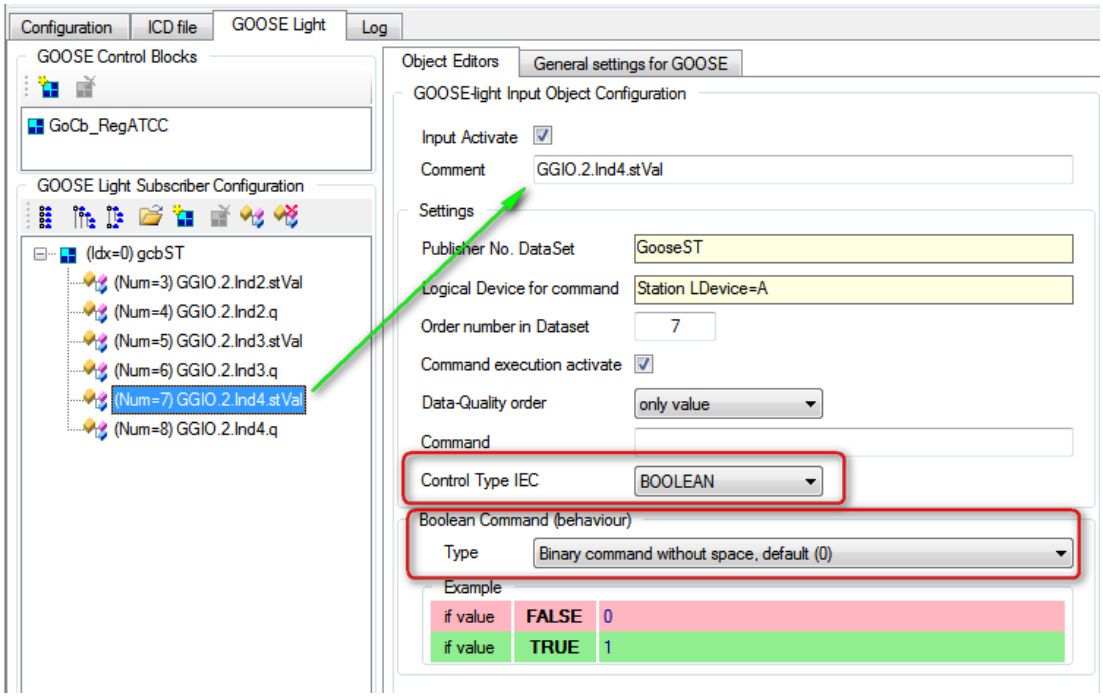
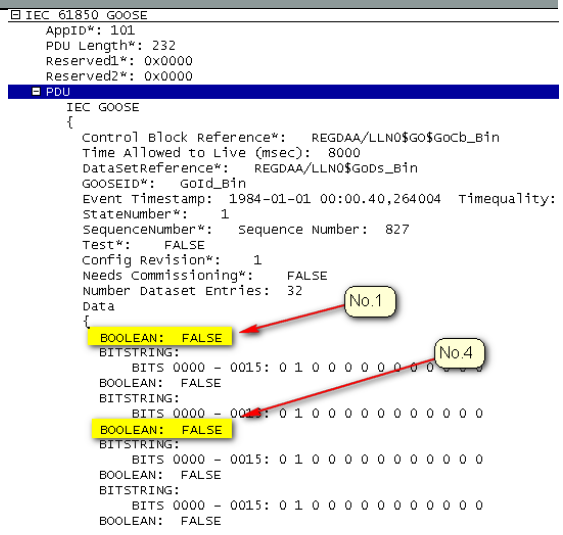
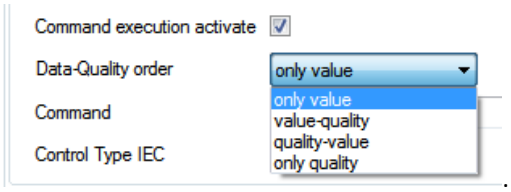



*Figure 130: External GOOSE lightobject configuration.*

Table 60: External GOOSE *light*object settings

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| Order No. (input number to select): | dec | Up to 300 | 1 | It defines selected number and used to quick select a data object. |
| Description | | | | |
| GOOSE ID and DataSet: | text | Drop down list with 16 subscribers | 0 | The parameter defines a subscriber which contains this data object. |
| Order number in Dataset: | dec | From 0 up to 300 | 0 | The parameter defines an order number of the data object in data set.<br>For more information see IEC61850 Standards. |

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| | | | |  |
| Input activate: | string | | checked | The parameter defines the use of the object. Parameter allows not delete set object from settings file, although it won´t be used in firmware. |
| Command execution activate: | check box | | checked | The parameter defines kind of handling of object in data set. If “not checked” will be set, the object will be passed for GOOSE command. |
| Logical Device for command: | string | Up to 64 symbols | A | It defines a name of Logical Device IEC 61850 in Structure "Server". The GOOSE command will be applied for defined device only. The name must contain no white space. The naming rules conform to IEC61850 part 6. |
| Data Type: | list | INT8<br>INT8U<br>INT16<br>INT16U<br>INT32<br>INT32U<br>BOOLEAN<br>DOUBLEPO<br>ENUM | BOOLEAN | It defines the IEC61850 data type. For example, it has been marked on the screenshot above.<br>All possible choices are listed in the drop-down list.<br>For example,<br>GOOSE bit string [10] can be executed as double point [2] command. |
| Maximal Value [ex. SP,DC] | float | | 1 | Nowadays it isn’t supported for GOOSE commands. The parameter is leaved only for compatibility with the previous versions. |
| Scale | dec | -128…127 | 0 | The parameter defines scale of command value. Normally, scale is used as exponent with single commands. If a Boolean or Bitstring IEC control data type is selected, scale has special meaning. (See following tables.). The parameter can be adjusted from -127…128. By default set to 0.<br>Behavior and types of scale shown below |
| Command | string | REG-L command | B20= | Command string according to RGL-settings of REG-D™ |
| Data-Quality | list | Values | Value- | The parameter defines a kind of quality rating of |

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| order: | | are listed in the pull-down list. | quality | object in data set. Possible choices are listed in the pull-down list.<br>  <br>Executing types with quality enable to handle the object dependent on of their quality. The object with quality should be represented in GOOSE dataset as two-part data attribute with value and its quality (as Bitstring 13 [0000000000000]). The quality can be located instant before or after value data attribute.<br>Only value:<br>Command must be executed after change of object value, regardless of whether quality is invalid or valid.<br>Value-quality (quality is located instant after value)<br>Object will be accepted only, if its quality is valid. Object quality must be instant follow. If quality is valid and value of the object was changed, command will be executed. Otherwise object will be ignored.<br>Quality-value (quality is located instant before value)<br>Object will be accepted only, if its quality is valid. Object quality must be instant before value. If quality is valid and value of the object was changed, command will be executed. Otherwise object will be ignored.<br>Only Quality<br>Special type. It is used for handling of the quality triggering. If quality will change, a corresponded command will be sent to REGSYS.<br>This type is applicable only for data type QUALITY. |
| Comment | string | Up to 64 symbols | No | Commentary for configuration. |

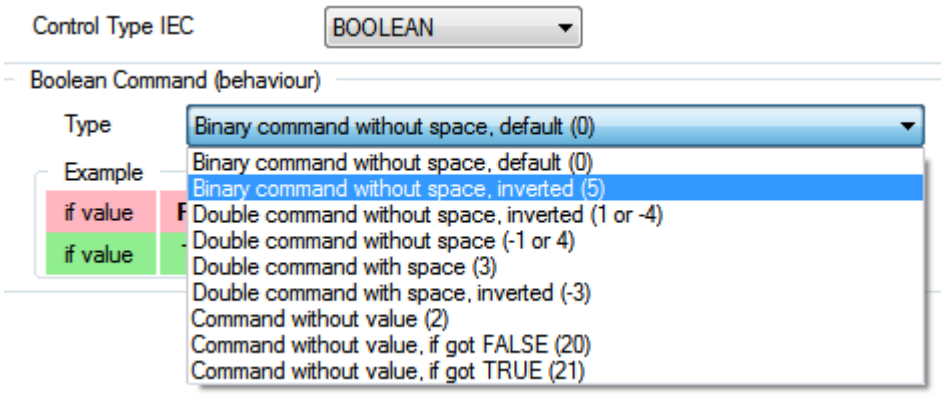



*Figure 131: Boolean conversion rules for GOOSE command*

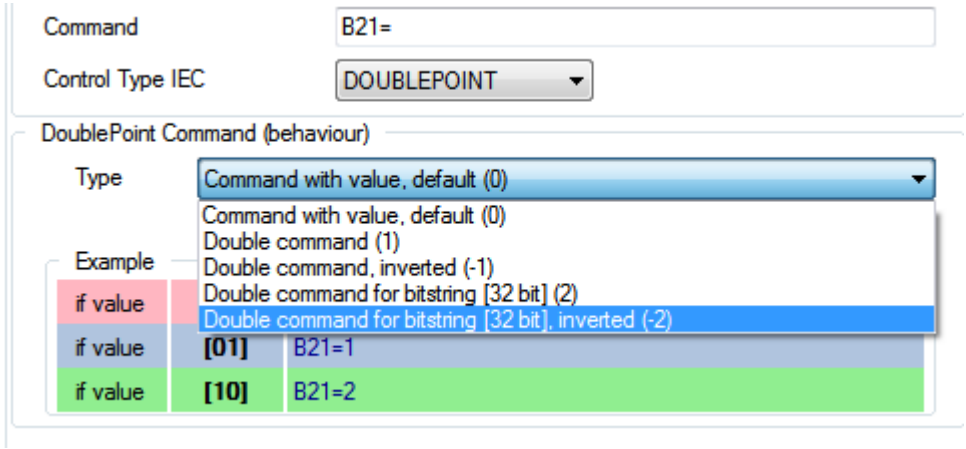
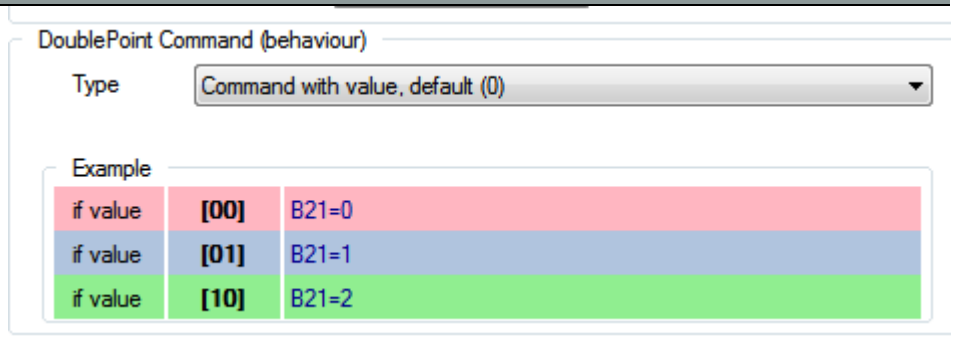
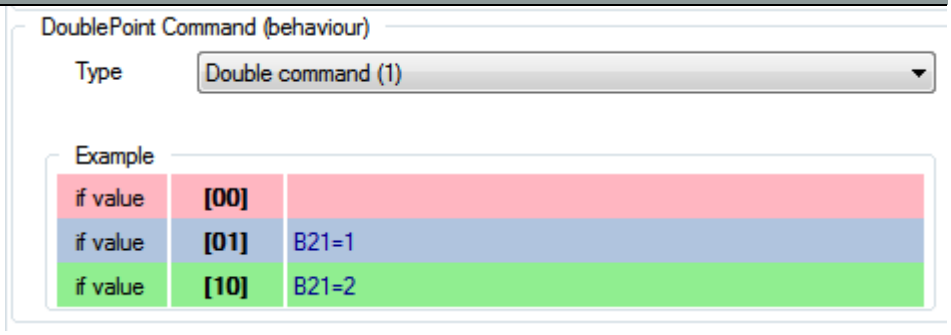
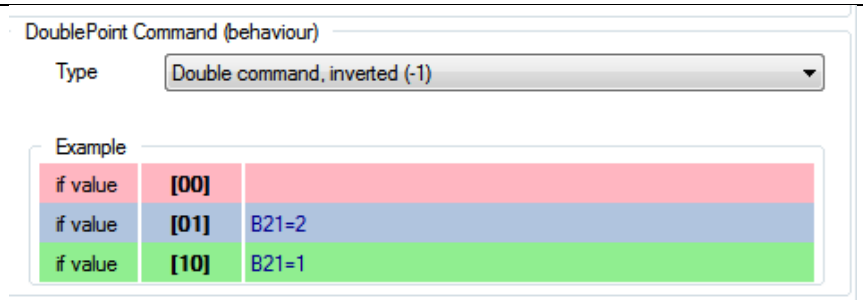
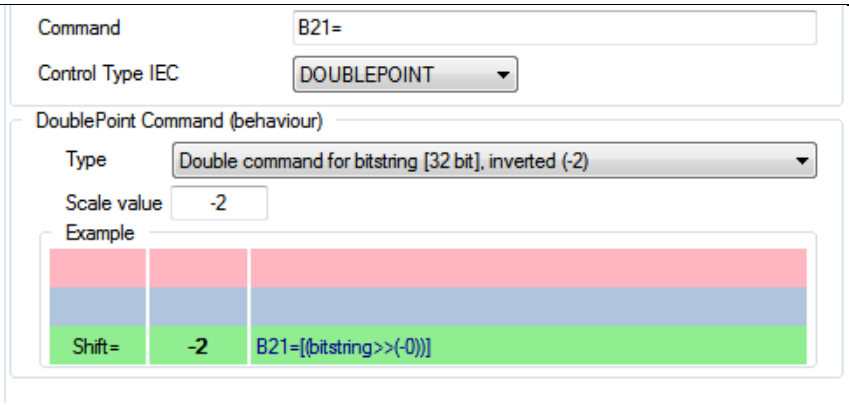



*Figure 132: Double Point conversion rules for GOOSE command*

Table 61: Conversion and commands

| Scale | Conversion and commands those will be sent |
|---|---|
| 0 (default) |  |

| Scale | Conversion and commands those will be sent |
|---|---|
| 1 |  |
| -1 |  |
| 2…31 | *Direct Command Rule*:<br>First, CMD will be calculated conform with:<br>*CMD = (Bitstring & 0xC0000000)>>(scale-2)*<br>Then, if CMD is 1, command looks same *[command][0]*. If CMD is 2, command looks same *[command][1]*<br><br>For example:<br>1) GOOSE input is *[0100000000000]*.<br>Scale is 13.<br>Command will be completed as *[command]0*<br>2) GOOSE input is *[1000001110000000]*.<br>Scale is 16.<br>Command will be completed as *[command]1* |
| -31..-2 |  <br>Inverse Command Rule:<br>First CMD will be calculated conform with:<br>CMD = (Bitstring & 0xC0000000)>>(2-scale)<br>Then, if CMD is 1, command looks same [command][1]. If CMD is 2, command looks same [command][0] |

| Scale | Conversion and commands those will be sent |
|---|---|
| | For example:<br>1) GOOSE input is [0100000000101].<br>Scale is -13.<br>Command will be completed as [command]1<br>2) GOOSE input is *[1000000111110000]*.<br>Scale is -16.<br>Command will be completed as *[command]0* |

## 18.7.6

### 18.7.7 Incoming Command Behavior

Command execution of GOOSE commands is different for floating and other types of dataset members. Firmware supports a check of dead band, the deviation from zero, range of values for floating types.

A processing diagram is shown below.

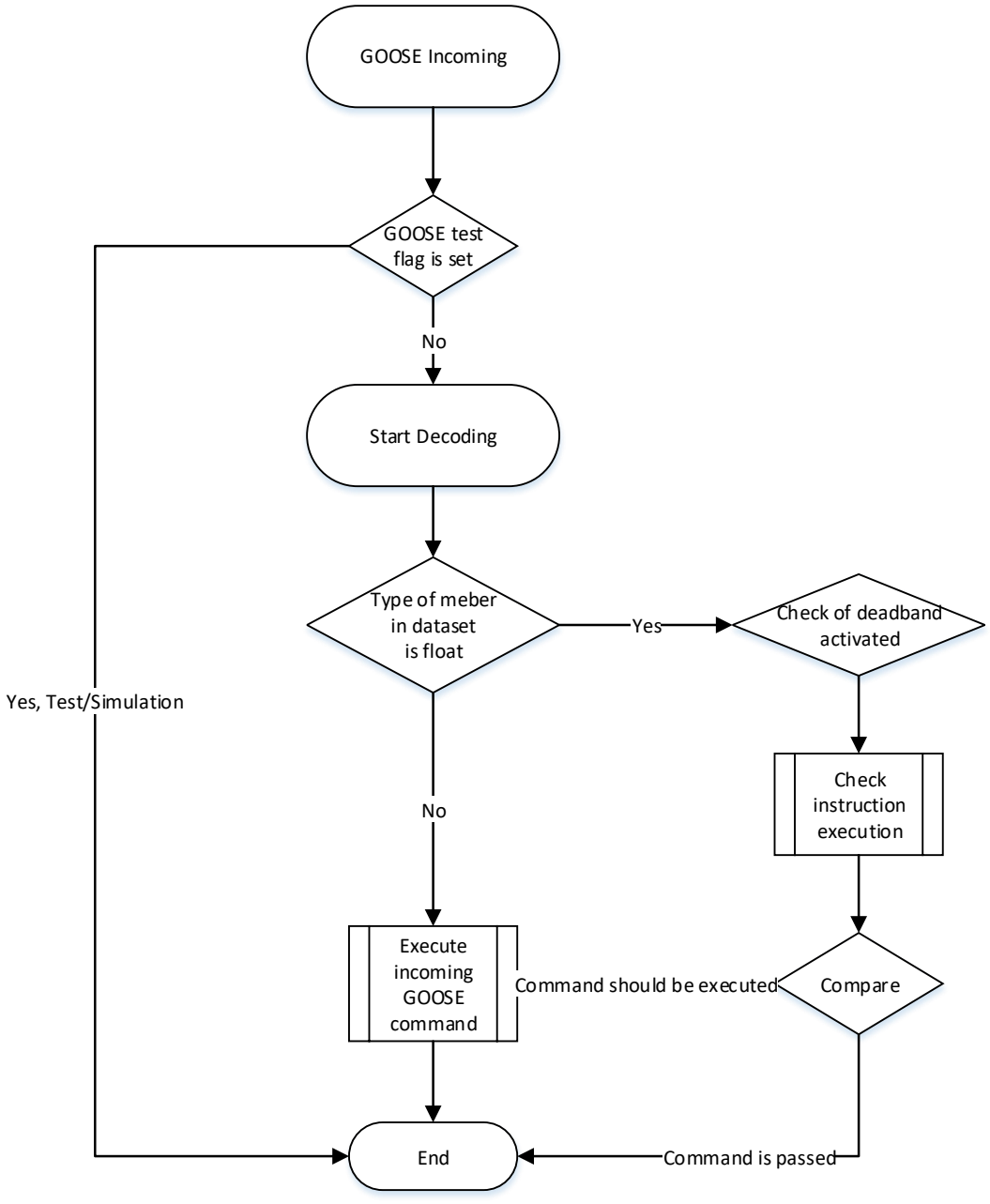



*Figure 133: Execution of GOOSE commands.*

The transmission status of the command will be checked before the execution only if that activated for this command.

A "deadband" section is shown on SCL-Config Input Object Configuration below.

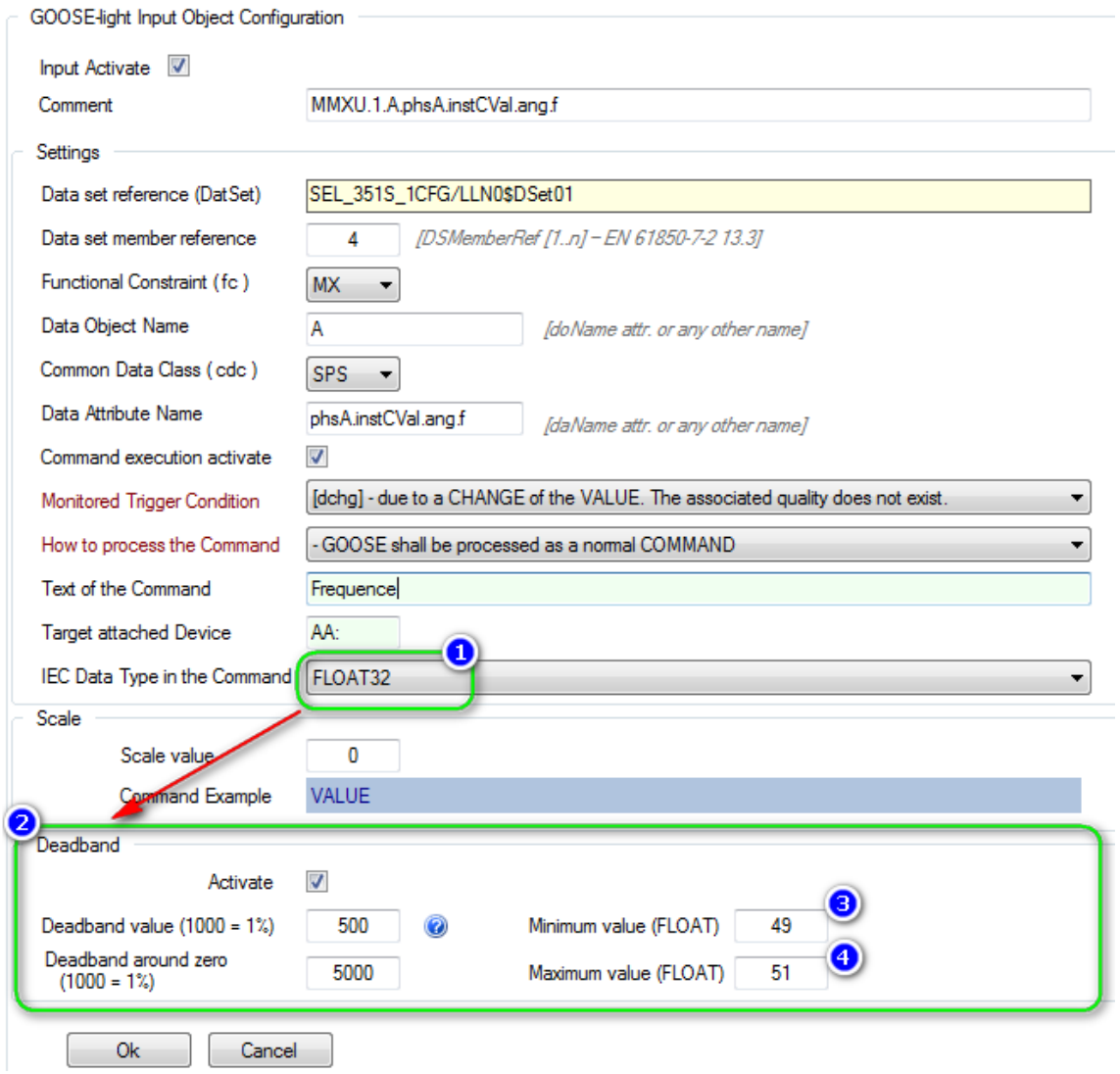



*Figure 134: SCL-Config Input Object Configuration.*

Table 62: Incoming Command Behavior

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Activate | Checkbox | True/false | deactivated | Activate a check of command. |
| Deadband value | Integer | INT32 range of value IEC61850 | 0 | Deadband. Shall represent a configuration parameter used to calculate all deadbanded attributes (for example mag attribute in the CDC MV). The value shall represent the percentage of difference between max. and min. in units of 0,001 %. If an integral calculation is used to determine the deadbanded value, the value shall be |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| | | | | represented as 0,001 % s.<br>A dB value of 0 shall suppress reporting events on the analog value, so that only changes of the range value will lead to events. |
| Deadband around zero | Integer | INT32 range of value IEC61850 | 0 | Configuration parameter used to calculate the range around zero, where the analogue value will be forced to zero. The value shall represent the percentage of difference between max and min in units of 0,001 %. |
| Minimum value | Float | FLOAT range of value IEC61850 | 0 | Minimum process measurement for which values of i or f are considered within process limits. |
| Maximum value | Float | FLOAT range of value IEC61850 | 0 | Maximum process measurement for which values of i or f are considered within process limits. |

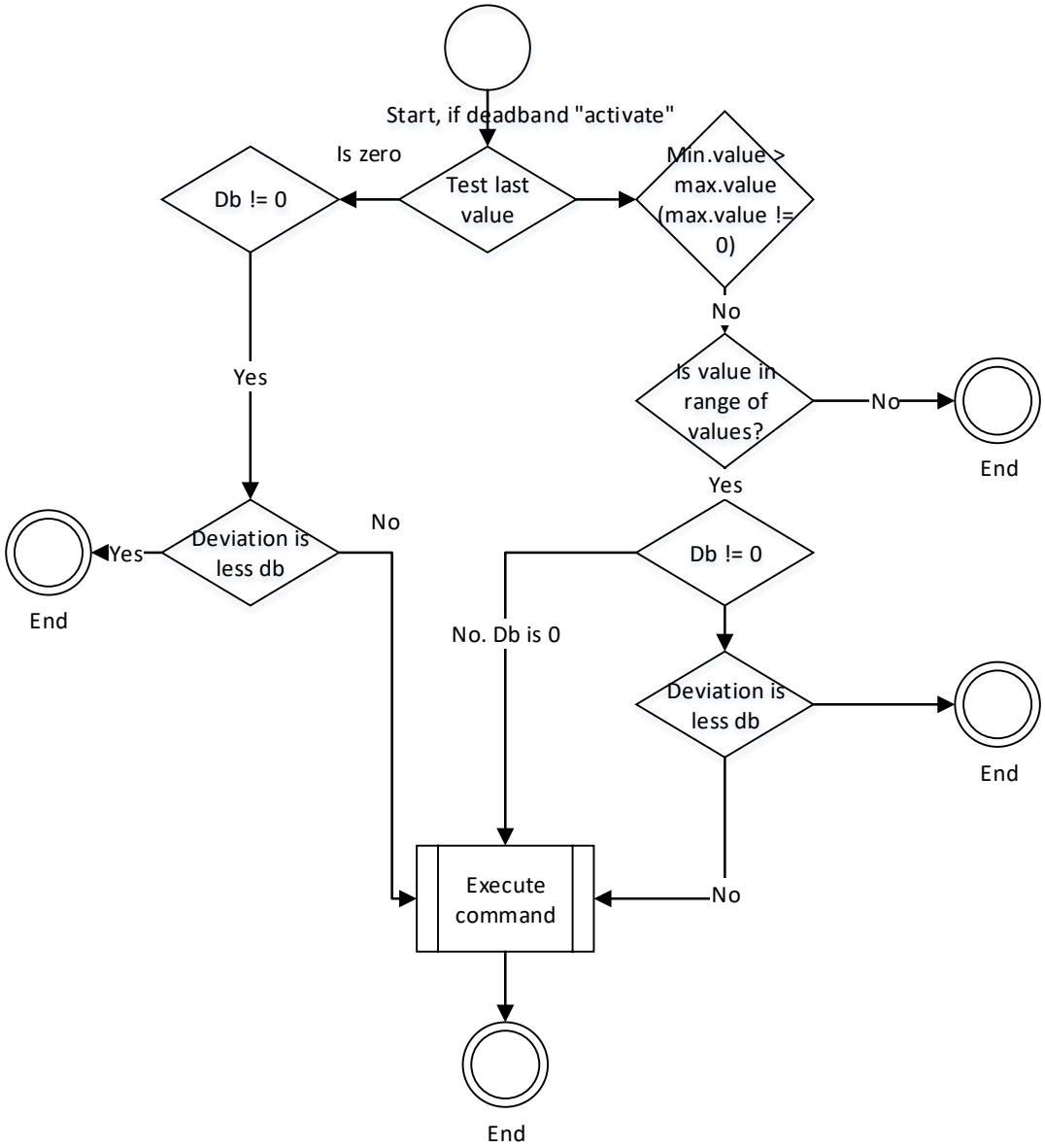



*Figure 135: The check of float command execution.*

## 18.8 Client IEC61850 Support

The firmware IEC 61850 is supplied with the internal functions of client IEC 61850. The internal client IEC 61850 can receive the defined up-to-date measures from protective device and a current position of a tap changer. A data using from tap changer is optional. On the contrary, the data from the protective device are mandatory in "Client IEC61850" mode of operation.

SCL-Config Tool contains all necessary settings for "Client IEC61850" mode of operation. The advanced facilities and settings are described below.

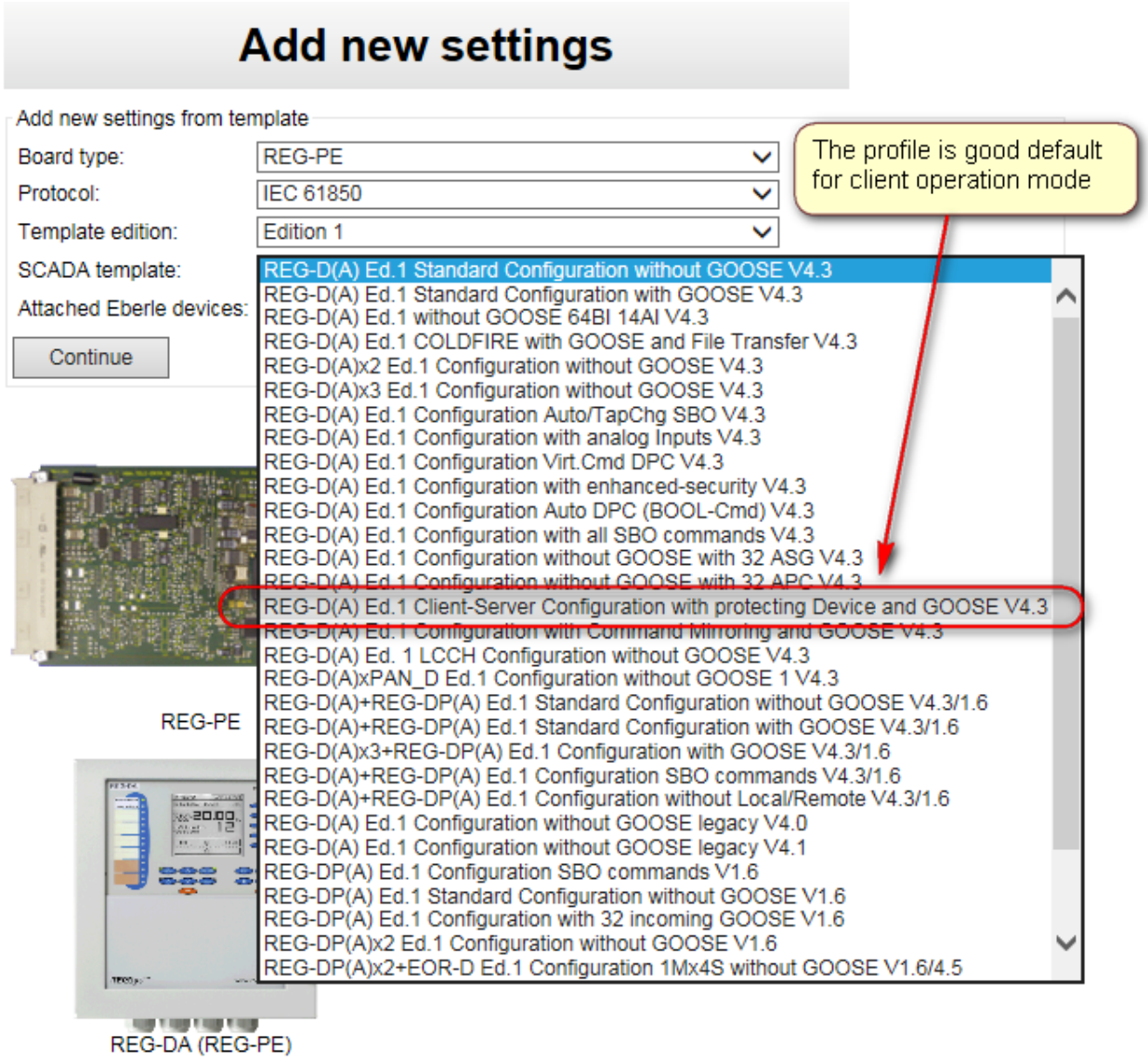



*Figure 136: Profile for Client operation mode.*

You can modify the client settings in the tab “Client IEC 61850”. All the settings are collected here, from connect settings up to the settings of data handling.

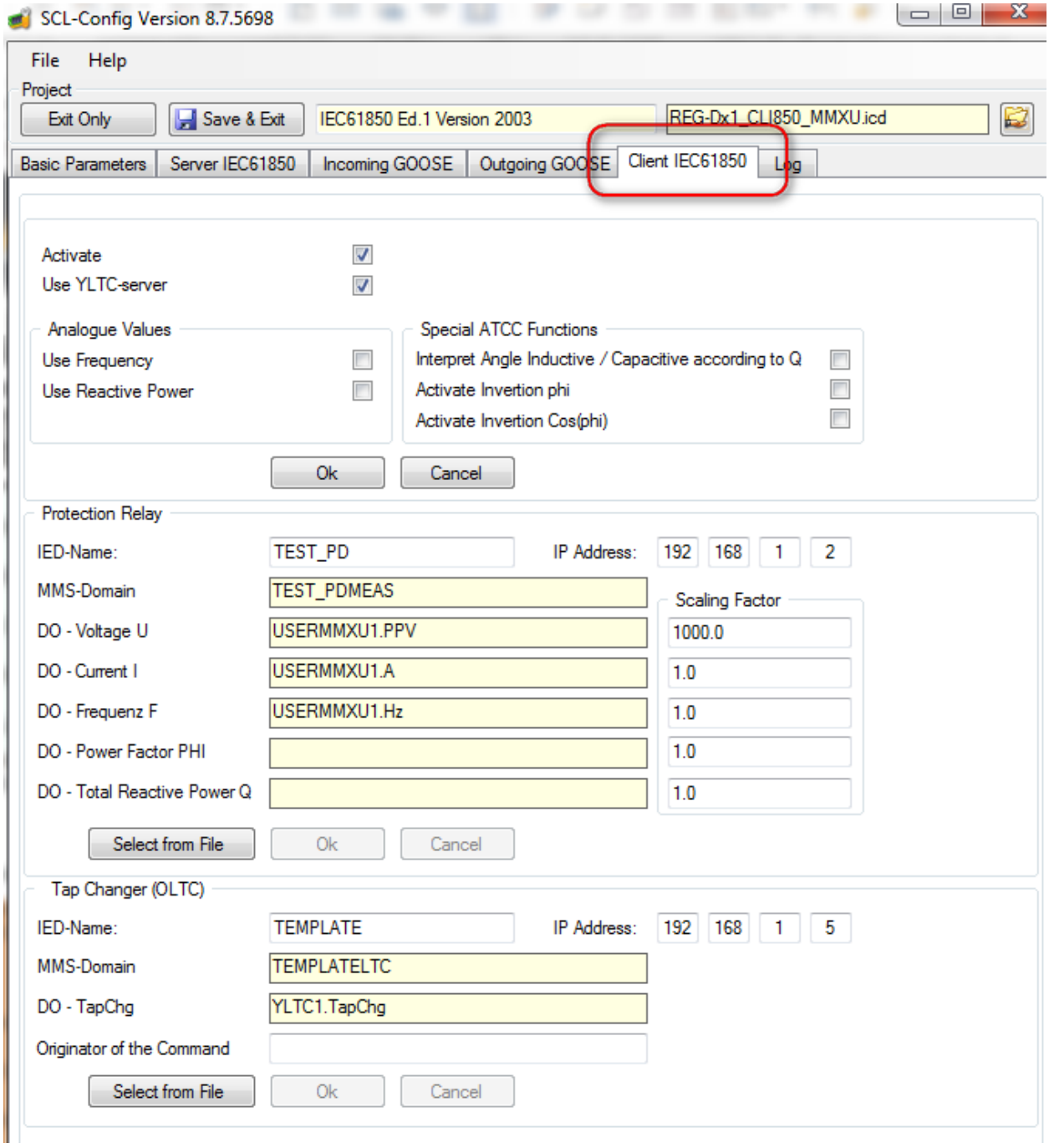



*Figure 137: SCL-Config, Client IEC61850*

Table 63: Client IEC61850 Support

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| Activate | Check -Box | On/off | Off | Activate of the client operation mode. |
| Use of YLTC-server | Check -Box | On/Off | Off | Define an operation mode with use of a tap changer position and transient mode |
| Analogue Values Group | | | | Define an application the measured frequency and |

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| | | | | reactive power from protective device. |
| Special ATCC Functions Group | | | | Adjusting of REG-D handling with received measures. |
| Protection Relay Group | | | | All settings for protective device connection and data acquisition. |
| Tap Changer (OLTC) Group | | | | All settings for protective device connection and data acquisition. |

### 18.8.1 Analogue Values Group of Settings

Table 64: Analogue Values Group of Settings

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| Use Frequency | Check-Box | On/Off | Off | This setting defines how to use a frequency measure (F) from protective device.<br>0 ON – data object should be parameterized and is used in client operation mode. The measure will be transferred to REG-D;<br>0 OFF - data object is not used in client operation mode. |
| Use Reactive Power | Check-Box | On/Off | Off | This setting defines how to use a reactive power measure (Q) from protective device.<br>0 ON – data object should be parameterized and is used in client operation mode. The measure will be transferred to REG-D;<br>0 OFF - data object is not used in client operation mode. |

### 18.8.2 Special ATCC Functions Group of Settings

By specifying these settings the following changes of calculation will occur:

0 For cos (phi):

- cos (phi) = [- 1..0], P < 0 (output active power);
- cos (phi) = [0..1] means P> 0 (effective power);

If active power direction does not correspond to REG-D setting, the active power measure can be inverted.

0 Interpret angle inductive / capacitive according to Q:

- ON - inductive load, the angle phi should be a negative value;
- OFF - capacitive loading, the angle phi should be positive value;

Inversion of the angle in the case of capacitive load, or always the case that Q >= 0 is used for capacitive load. In general, the angle phi should be in the range from -180 to +180 degrees. Whereby angle from -180 to 0 degrees means the inductive load.

The case Q = 0 (cos (phi) = 1) may be occur. However, the angle phi = 0 does no influence.

Table 65: Special ATCC Functions Group of Settings

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| Interpret Angle Inductive / Capacitive according to Q | Check-Box | On/Off | Off | Defines the interpretation of the angle inductive / capacitive according to Q:<br>0 ON - inductive load, the angle phi should be a negative value;<br>0 OFF - capacitive loading, the angle phi should be positive value; |
| Activate Inversion phi | Check-Box | On/Off | Off | Means the inversion of the power factor. |
| Activate Inversion Cos(phi) | Check-Box | On/Off | Off | Means the inversion of COS (PHI). |

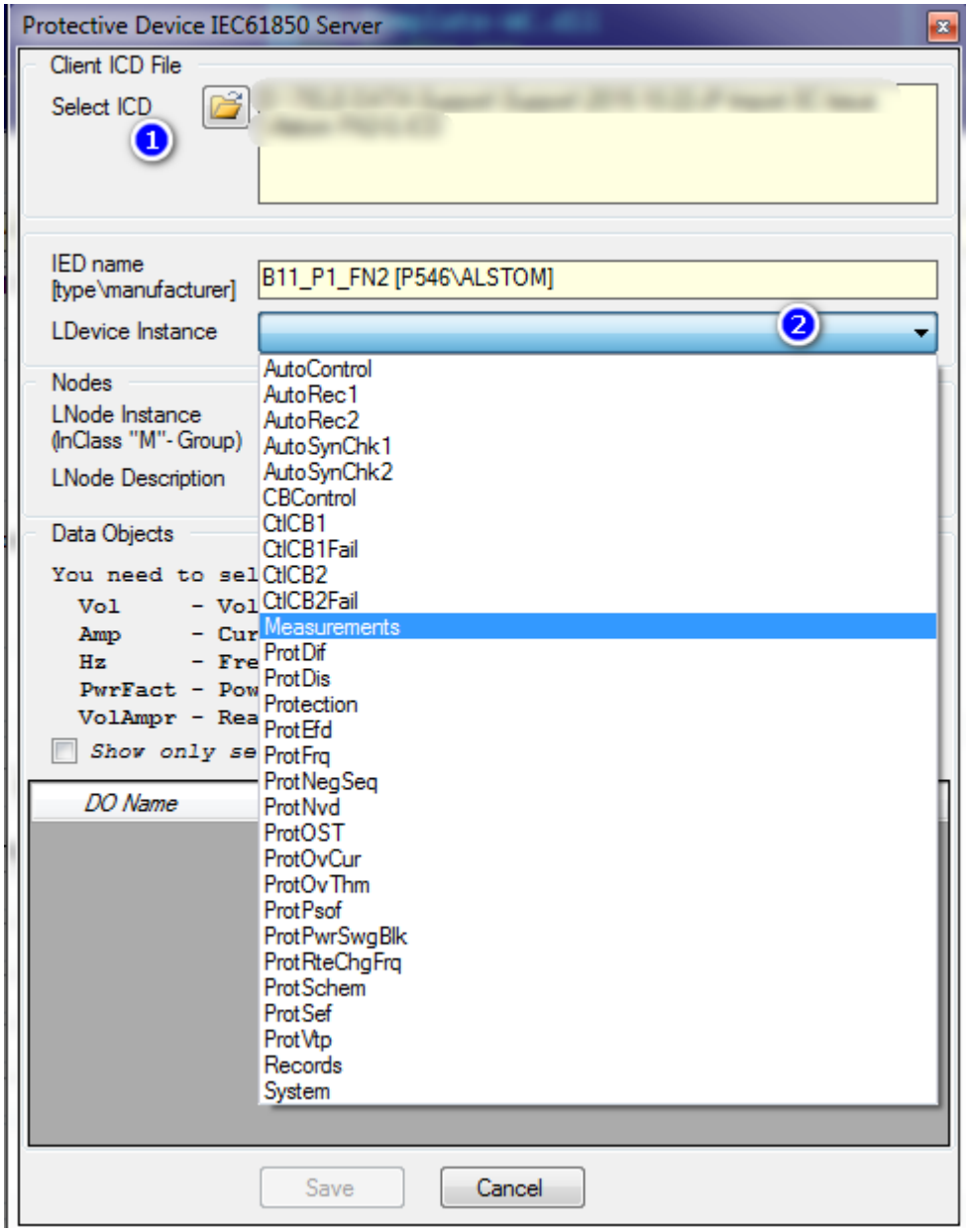
## 18.8.3 Protection Relay Group of Settings

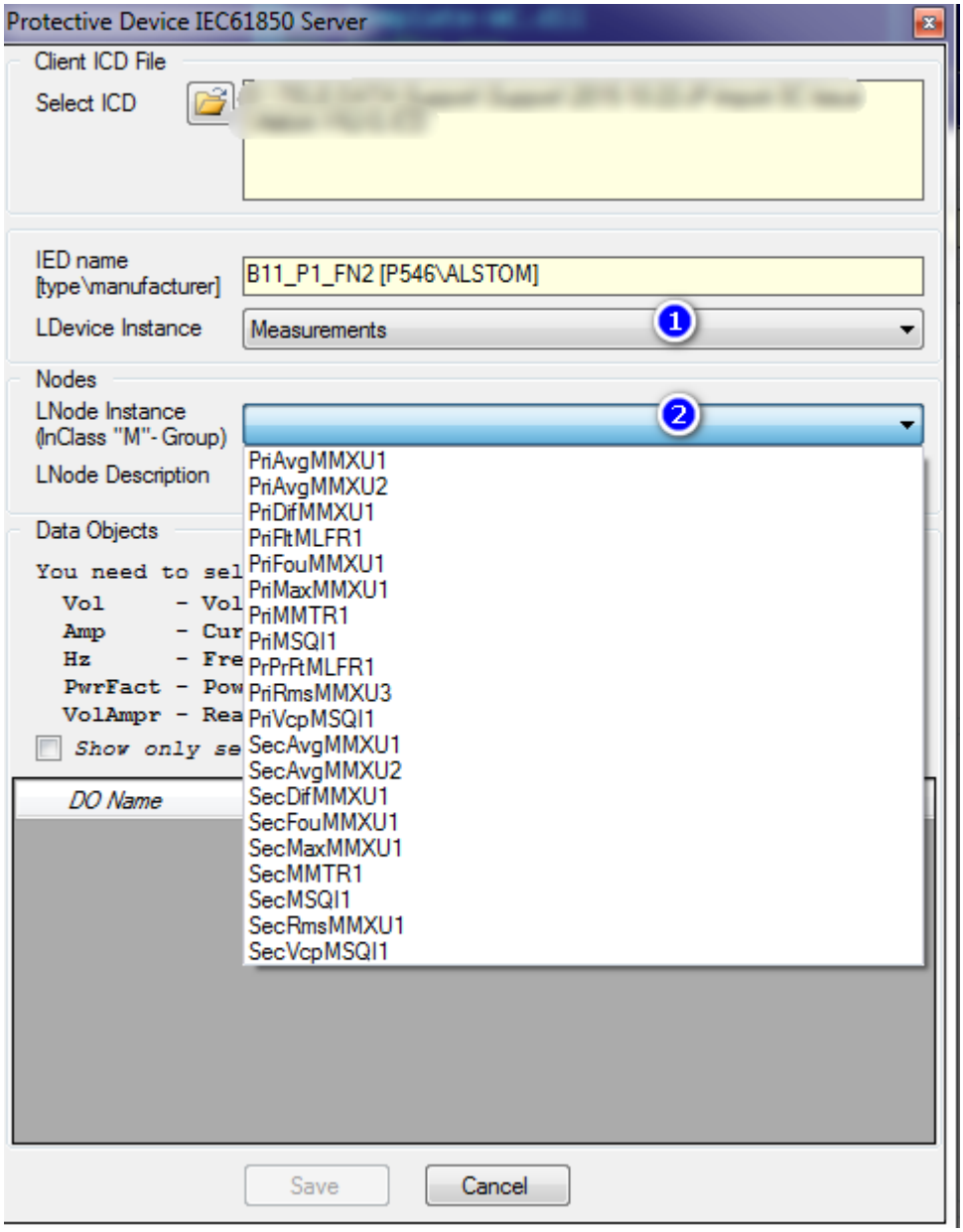
Table 66: Protection Relay Group of Settings

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| IED-Name | Text | According with IEC61850 | TEMPLATE | IED name of the remote server |
| IP Address | IP address | RFC1006 | 0.0.0.0 | IP address of the remote server |
| DO – Voltage U | Text | MMS path | Mandatory | Defines MMS-path to Data object. The value is read-only and can be adjusted only via “Select from File” facility |
| Scaling Factor | 32-bit IEEE 754 floating point format. | floating point | 1.0 | Scaling recalculation factor for the measure value from server. If the factor is not equal to 1, the scale factor will be applied. |
| DO – Current I | Text | MMS path | Optional, empty | |
| Scaling Factor | 32-bit IEEE 754 floating point format. | floating point | 1.0 | Scaling recalculation factor for the measure value from server. If the factor is not equal to 1, the scale factor will be applied. |
| DO – Frequency F | Text | MMS path | Optional, empty | Defines MMS-path to Data object. The value is read-only and can be adjusted only via “Select from File” facility |
| Scaling Factor | 32-bit IEEE 754 floating point | floating point | 1.0 | Scaling recalculation factor for the measure value from server. If the factor is not equal |

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| | format. | | | to 1, the scale factor will be applied. |
| DO – Power Factor PHI | Text | MMS path | Optional, empty | Defines MMS-path to Data object. The value is read-only and can be adjusted only via “Select from File” facility |
| Scaling Factor | 32-bit IEEE 754 floating point format. | floating point | 1.0 | Scaling recalculation factor for the measure value from server. If the factor is not equal to 1, the scale factor will be applied. |
| DO – total reactive Power Q | Text | MMS path | Optional, empty | Defines MMS-path to Data object. The value is read-only and can be adjusted only via “Select from File” facility |
| Scaling Factor | 32-bit IEEE 754 floating point format. | floating point | 1.0 | Scaling recalculation factor for the measure value from server. If the factor is not equal to 1, the scale factor will be applied. |

The MMS-path for data object can be filled only via “Select from File” feature.


Protective Device IEC61850 Server
Client ICD File
Select ICD
1
IED name [type\manufacturer]
B11_P1_FN2 [P546\ALSTOM]
LDevice Instance
2
Nodes
LNode Instance (InClass "M"- Group)
LNode Description
Data Objects
You need to sel
Vol - Vol
Amp - Cur
Hz - Fre
PwrFact - Pow
VolAmpr - Rea
Show only se
DO Name
AutoControl
AutoRec1
AutoRec2
AutoSynChk1
AutoSynChk2
CBControl
CtlCB1
CtlCB1Fail
CtlCB2
CtlCB2Fail
Measurements
ProtDif
ProtDis
Protection
ProtEfd
ProtFrq
ProtNegSeq
ProtNvd
ProtOST
ProtOvCur
ProtOvThm
ProtPsof
ProtPwrSwgBlk
ProtRteChgFrq
ProtSchem
ProtSef
ProtVtp
Records
System
Save
Cancel


Protective Device IEC61850 Server
Client ICD File
Select ICD
IED name
[type\manufacturer]
B11_P1_FN2 [P546\ALSTOM]
LDevice Instance
Measurements
1
Nodes
LNode Instance
(lnClass "M"- Group)
2
LNode Description
Data Objects
You need to sel
Vol - Vol
Amp - Cur
Hz - Fre
PwrFact - Pow
VolAmpr - Rea
Show only se
DO Name
PriAvgMMXU1
PriAvgMMXU2
PriDifMMXU1
PriFltMLFR1
PriFouMMXU1
PriMaxMMXU1
PriMMTR1
PriMSQI1
PrPrFtMLFR1
PriRmsMMXU3
PriVcpMSQI1
SecAvgMMXU1
SecAvgMMXU2
SecDifMMXU1
SecFouMMXU1
SecMaxMMXU1
SecMMTR1
SecMSQI1
SecRmsMMXU1
SecVcpMSQI1
Save
Cancel

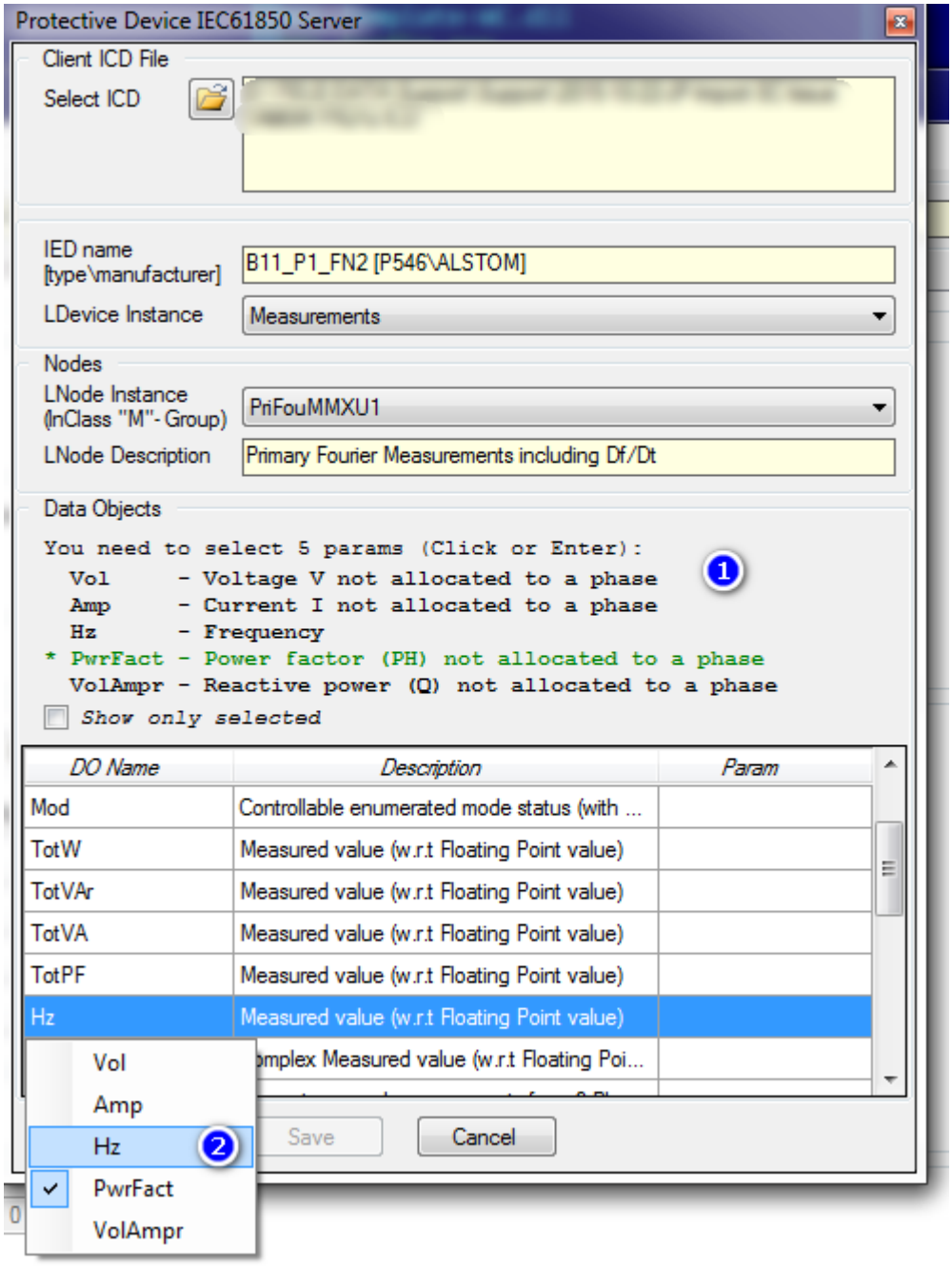



*Figure 138: Select the Data Objects for Protective Device*

To select a data object, click on the object in the table and move the cursor to the position in the list where the object is placed.

### 18.8.4 Tap Changer (OLTC) Group of Settings

Table 67: Tap Changer (OLTC) Group of Settings

| Name | Unit | Range | Standard value | Description |
|---|---|---|---|---|
| IED-Name | Text | According with IEC61850 | TEM-PLATE | IED name of the remote server |
| IP Address | IP address | RFC1006 | 0.0.0.0 | IP address of the remote server |
| DO – TapChg | Text | MMS path | Mandatory | Defines MMS-path to Data object. The value is read-only and can be adjusted only via “Select from File” facility |

The MMS-path for data object can be filled only via “Select from File” feature.

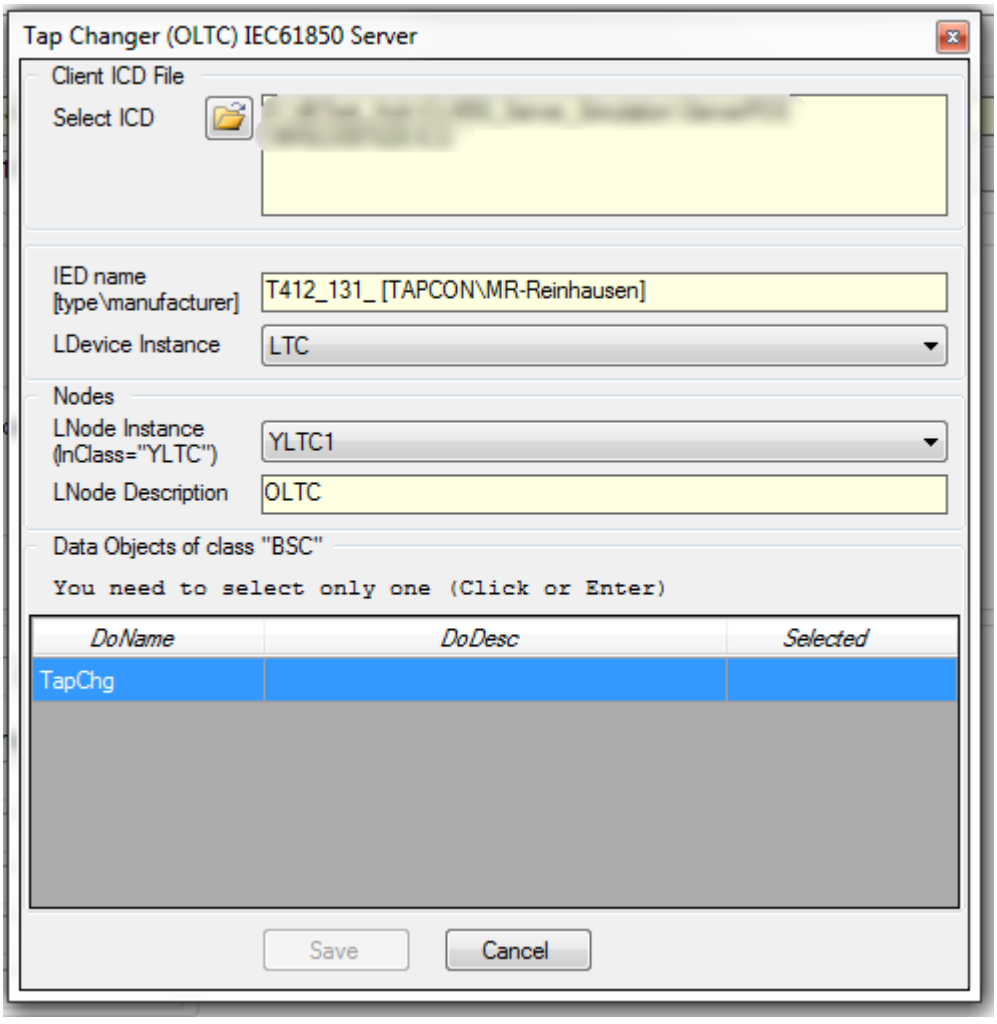



*Figure 139: Select the Data Objects for Tap Changer*

To select a data object, click on the TapChg object in the table and press a save button.

## 18.9 WinConfig Settings

IEC61850 settings are available for TK860 and TK885D telecontrol boards.

Settings for IEC61850 protocol consists of XML template and corresponding ICD file. Both files are contained in WinConfig and corresponding ICD file is automatically selected together with IEC61850 template. Data points and commands are defined in ICD file.

ICD file editor SCL_Config is also part of WC. SCL-Config and WinConfig share the *IED name* parameter (Intelligent Electronic Device). SCL-Config can be run from the *Settings – SCADA* tree branch using the *Edit ICD file* button. IED name is automatically transferred back to WinConfig when edit in SCL-Config is finished.

## 18.10 Basic

The *Basic* tree branch contains basic settings for IEC61850.

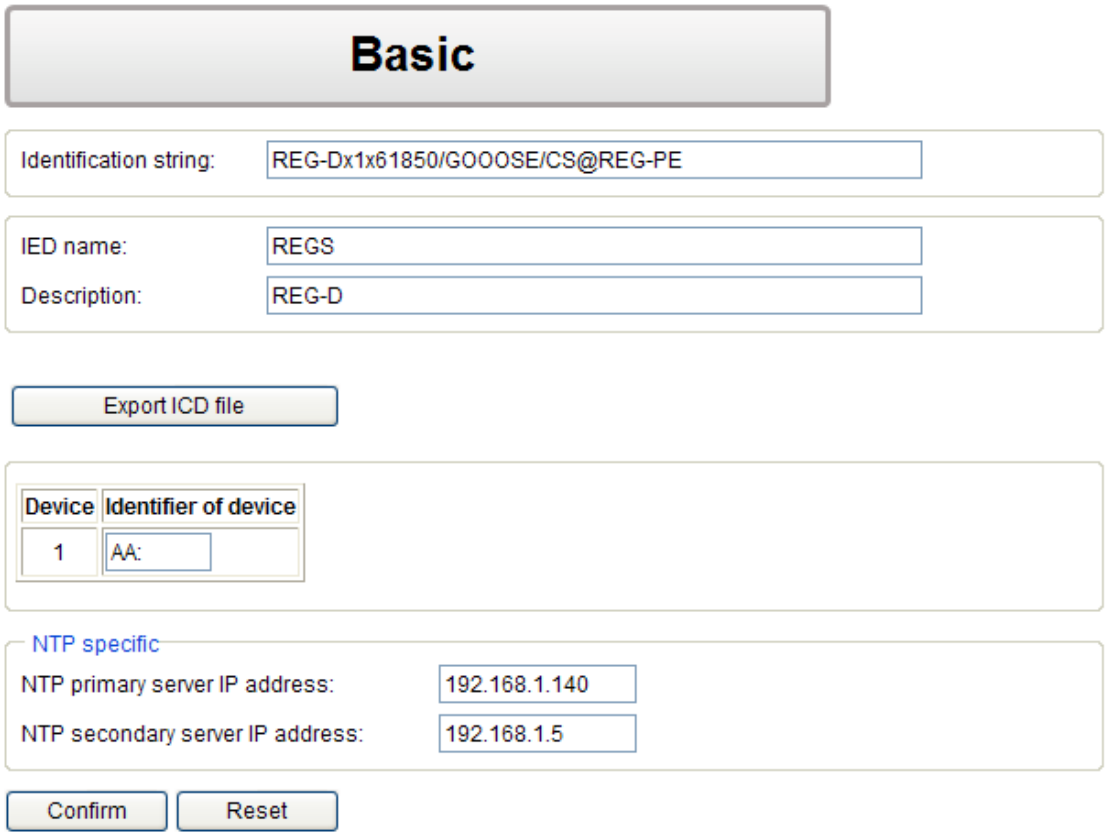



*Figure 140: IEC61850 Basic Settings*

Table 68: IEC61850 Basic Settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Identification string | Text | 64 characters | Identification string of open settings | Identification string of open settings |
| IED name | Text | 10 characters | IED name defined in settings | IED (Intelligent Electronic Device) name defined in settings, capital letters only |
| Description | Text | 64 characters | User description defined in settings | User description |
| Identifier of device | - | 3 characters | defaults defined in the Devices tree branch | Identifier of device as appears in the device communication |
| NTP primary server IP address | - | 4x 0 to 255 | 0.0.0.0 | NTP primary server IP address |
| NTP secondary server IP address | - | 4x 0 to 255 | 0.0.0.0 | NTP secondary server IP address |

## 18.11 Advanced

### 18.11.1 Settings - SCADA

Under this Item you can Export ICD-file. Default values should only be changed if you received an explicit instruction. During the System engineering phase some settings regarding the SCL ICD file might have to be adjusted (like the IED Server name for example.). This setting can be done offline with WinConfig.

The naming of the ICD-file is flexible. The import ICD-file with name xxx.icd changes SCL name in parameter from current name to xxx.icd.

Settings – SCADA tree branch shows information concerning IEC61850 protocol and allows TCP configuration. The button Export ICD file can be used for corresponding export and the button Edit ICD file runs the SCL-Config for ICD file edit.

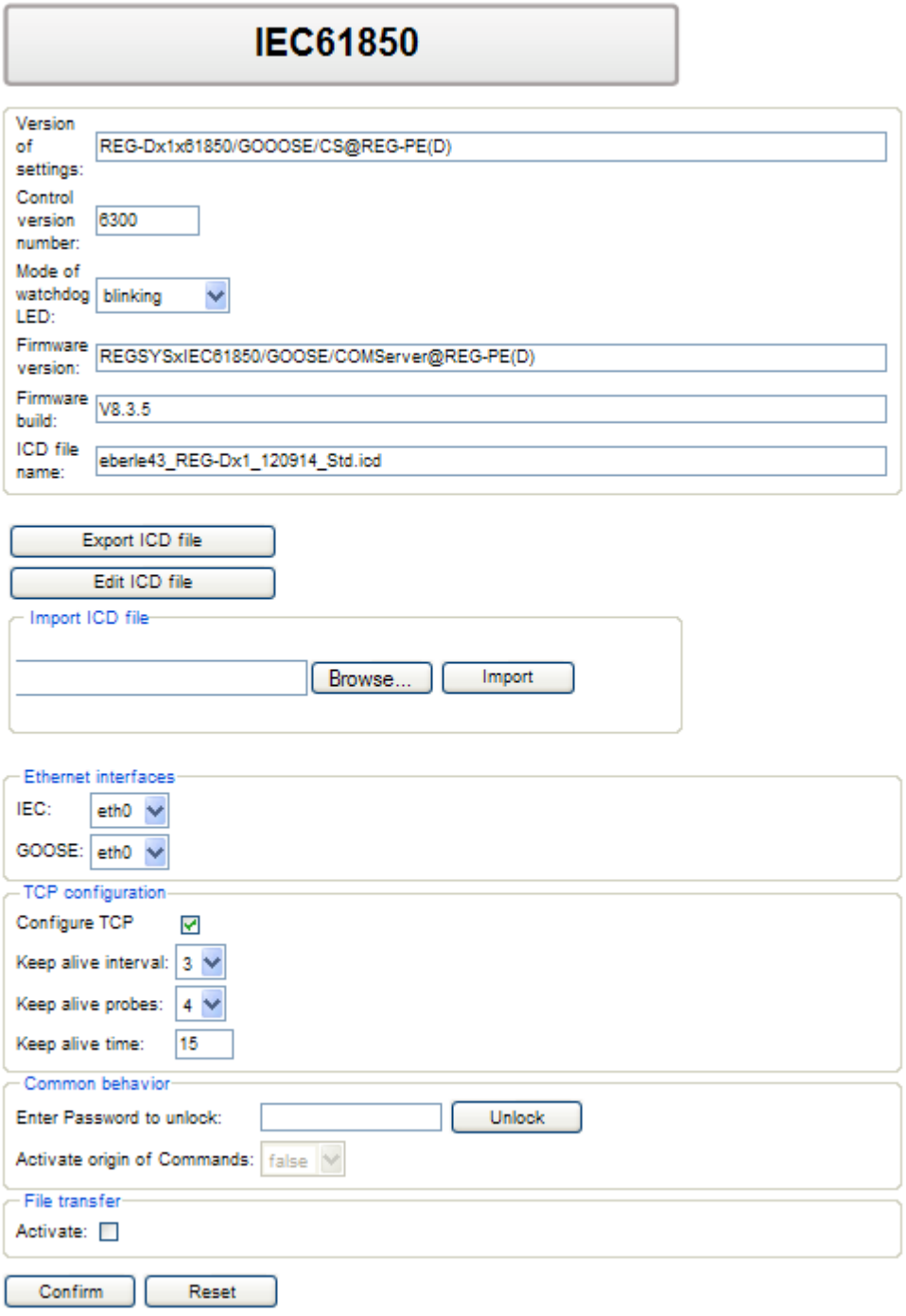



*Figure 141: IEC61850 Settings - SCADA*

Table 69: IEC61850 Settings - SCADA

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Version of settings | - | - | | Version of settings (read only) |
| Control version number | - | - | | Control version number (read only) |
| Mode of watchdog LED | - | Selection of values in | | Mode of watchdog LED, blinking or switch off |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| | | combo box | | |
| Firmware version | - | - | | Firmware version (read only) |
| Firmware build | - | - | | Firmware build (read only) |
| ICD file name | - | - | | ICD file name (read only) |
| IEC | | Selection of values in combo box | Eth0 | Selection of Ethernet interface for IEC protocol |
| GOOSE | | Selection of values in combo box | Eth0 | Selection of Ethernet interface for GOOSE |
| Configure TCP | | checkbox | unchecked | Configure TCP |
| Keep alive interval | | Selection of values in combo box | 3 | Keep alive interval |
| Keep alive probes | | Selection of values in combo box | 4 | Keep alive probes |
| Keep alive time | | 0 to 20 | 15 | Keep alive time |
| Common behaviour: Password | textbox | | | Password to unblock the following option |
| Common behaviour: activate origin of commands | | Selection of values in combo box | false | activate origin of commands |
| File transfer: Activate | | checkbox | unchecked | Activation of file transfer |

### 18.11.2 ELAN extension (CSE)

The *ELAN extension (CSE)* tree branch can be used for activation and configuration of CSE.

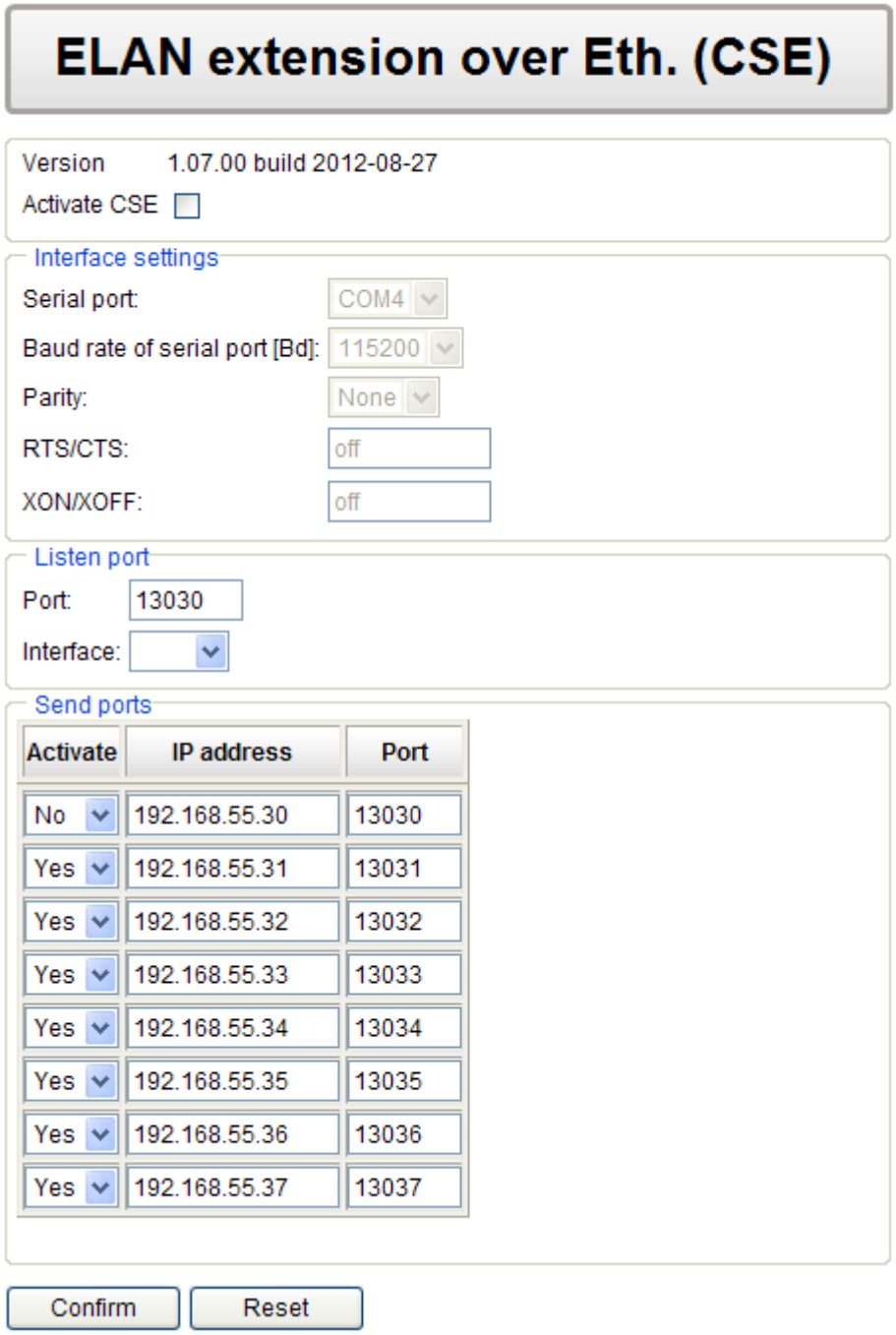



*Figure 142: ELAN extension over Ethernet (CSE)*

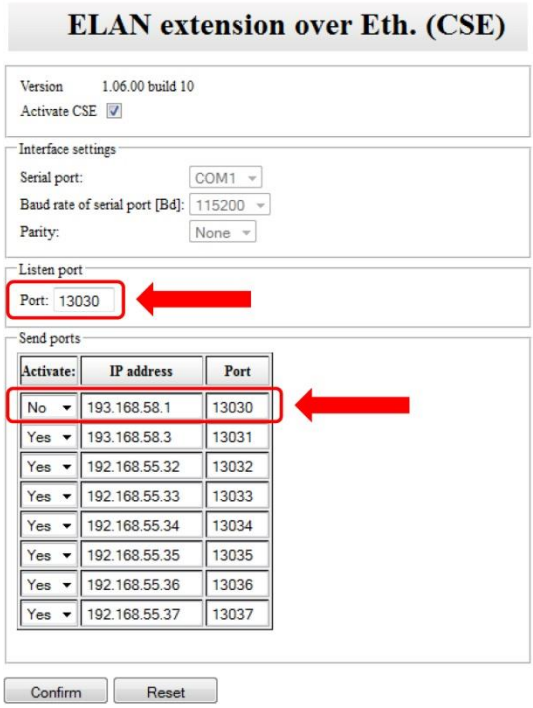
Table 70: ELAN extension over Ethernet (CSE)

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Version | - | - | | CSE version (read only) |
| Activate CSE | checkbox | ON/OFF | | CSE switch ON/OFF |
| Serial port | - | - | COM4 | Selection of CSE serial port (Read only). To change CSE serial port go to Serial ports assignment tree branch |
| Baud rate of serial port | Bd | - | 115200 | Baud rate of serial port (read only) |
| Parity | - | - | none | Parity (read only) |
| RTS/CTS | - | ON/OFF | off | RTS/CTS (read only) |
| XON/XOFF | - | ON/OFF | off | XON/XOFF (read only) |
| Port | - | 1 to 65535 | | TCP listen port |
| Interface | - | Selection of values in combo box | | Selection of Ethernet interface |
| Activate | - | Selection of values in combo box | | Activation of TCP send port (Yes/No) |
| IP address | | 4x 0 to 255 | | IP address |
| Port | | 0 to 65535 | | TCP port |

### 18.11.2.1 Use case: Setting for two REG-PE(X) connected via CSE

In the following example, two REG-PEDs were used, where the first REG-PED had the IP 193.162.58.1 and the second 193.168.58.3. The channel of the device has to be set to non-activated. In the following use case port addresses 130030 till 130037 were predefined and the first two used.

Configuration of the first REG-PED




Configuration of the second REG-PED

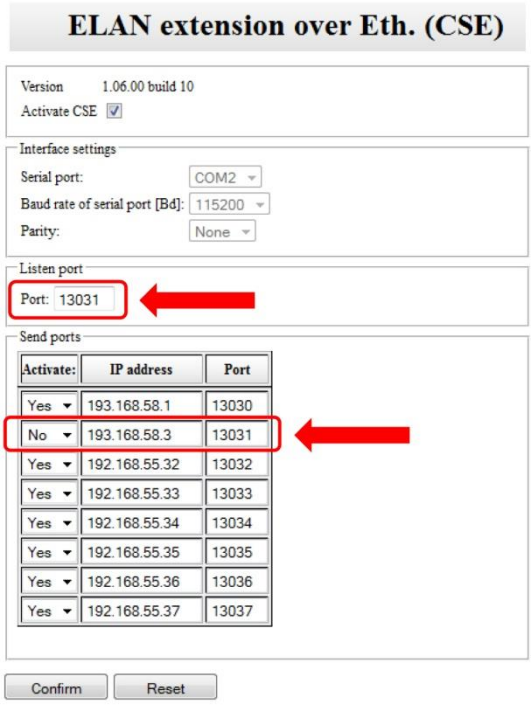
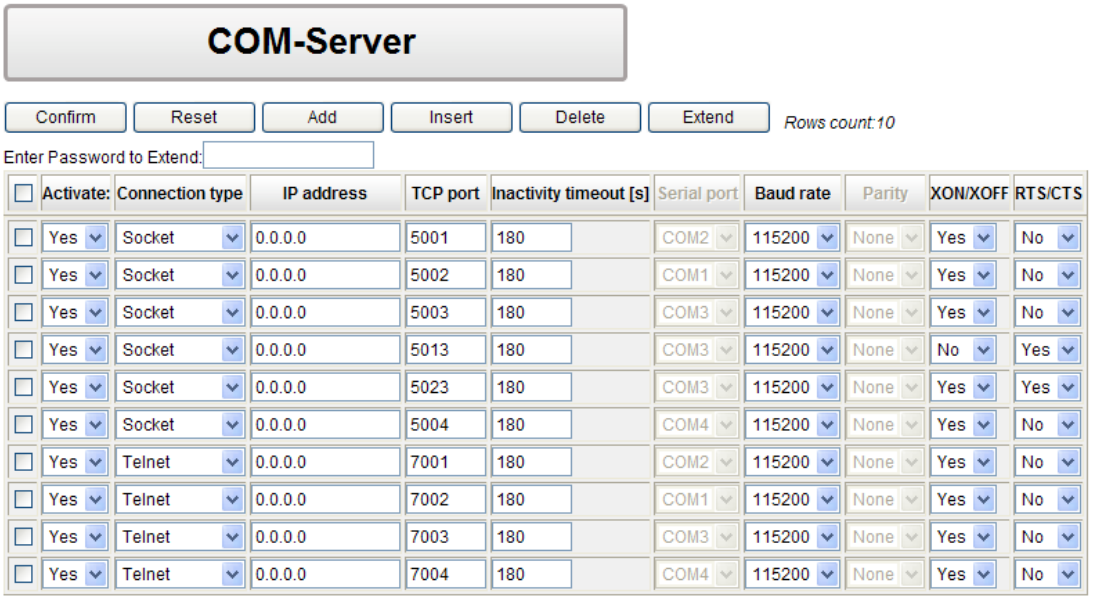


*Figure 143: Configuration of first and second REG-PED*

### 18.11.3 COM-Server

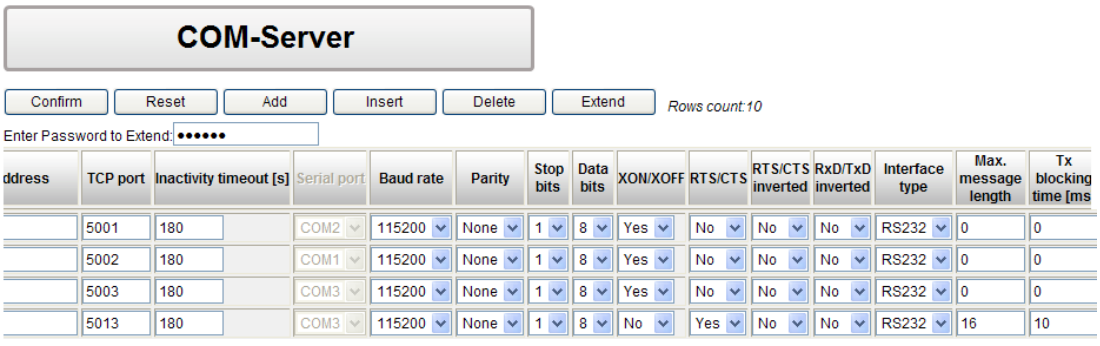
The *COM-Server* tree branch can be used for activation and configuration of COM-Server channels.

The table of COM-Server channels shows basic parameters. To show all channel parameters press the *Extend* button. For changing the serial port number go to *Serial ports assignment* tree branch.




| Activate: | Connection type | IP address | TCP port | Inactivity timeout [s] | Serial port | Baud rate | Parity | XON/XOFF | RTS/CTS |
|---|---|---|---|---|---|---|---|---|---|
| Yes | Socket | 0.0.0.0 | 5001 | 180 | COM2 | 115200 | None | Yes | No |
| Yes | Socket | 0.0.0.0 | 5002 | 180 | COM1 | 115200 | None | Yes | No |
| Yes | Socket | 0.0.0.0 | 5003 | 180 | COM3 | 115200 | None | Yes | No |
| Yes | Socket | 0.0.0.0 | 5013 | 180 | COM3 | 115200 | None | No | Yes |
| Yes | Socket | 0.0.0.0 | 5023 | 180 | COM3 | 115200 | None | Yes | Yes |
| Yes | Socket | 0.0.0.0 | 5004 | 180 | COM4 | 115200 | None | Yes | No |
| Yes | Telnet | 0.0.0.0 | 7001 | 180 | COM2 | 115200 | None | Yes | No |
| Yes | Telnet | 0.0.0.0 | 7002 | 180 | COM1 | 115200 | None | Yes | No |
| Yes | Telnet | 0.0.0.0 | 7003 | 180 | COM3 | 115200 | None | Yes | No |
| Yes | Telnet | 0.0.0.0 | 7004 | 180 | COM4 | 115200 | None | Yes | No |

*Figure 144: IEC61850 - COM-Server*




| ddress | TCP port | Inactivity timeout [s] | Serial port | Baud rate | Parity | Stop bits | Data bits | XON/XOFF | RTS/CTS | RTS/CTS inverted | RxD/TxD inverted | Interface type | Max. message length | Tx blocking time [ms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5001 | 180 | COM2 | 115200 | None | 1 | 8 | Yes | No | No | No | RS232 | 0 | 0 |
| | 5002 | 180 | COM1 | 115200 | None | 1 | 8 | Yes | No | No | No | RS232 | 0 | 0 |
| | 5003 | 180 | COM3 | 115200 | None | 1 | 8 | Yes | No | No | No | RS232 | 0 | 0 |
| | 5013 | 180 | COM3 | 115200 | None | 1 | 8 | No | Yes | No | No | RS232 | 16 | 10 |

*Figure 145: IEC61850 - COM-Server Extended*

Table 71: IEC61850 - COM-Server

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Activate | - | Selection of values in combo box | | Option to activate the CS channel (Yes/No) |
| Connection type | - | Selection of values in combo box | | Type of connection.<br>*OFF* disables the port from accepting connections. It can be turned on later.<br>*Socket* enables the port and transfers all data as-is between the port and the device.<br>*Serial direct* enables the port and transfers all input data to device, device is open without any POSIX setting or directly.<br>*Telnet* enables the port and runs the telnet protocol on the port to set up telnet settings. This is most useful for using telnet. |
| IP address | - | 4x 0 to 255 | | IP address |
| TCP port | - | 0 to 65535 | 3003 | TCP port |
| Inactivity timeout | S | | 180 | Inactivity timeout |
| Serial port | - | Selection of values in combo box | | Serial port (read only). To change serial port go to *Serial ports assignment* tree branch |
| Baud rate | Bd | Selection of values in combo box | 115200 | Baud rate |
| Parity | - | Selection of values in combo box | None | Parity (read only) |
| Stop bits | - | Selection of values in combo box | 1 | Stop bits |
| XON/XOFF | - | Selection of values in combo box | No | XON/XOFF handshaking |
| RTS/CTS | - | Selection of values in combo box | No | RTS/CTS handshaking |
| RTS/CTS inverted | - | Selection of values in combo box | No | RTS/CTS inverted |
| Interface type | - | Selection of values in combo box | RS232 | Interface type (RS232, RS485) |
| Max. message length | - | 0 to 65535 | 0 | Max. message length |
| Tx blocking time | ms | | 0 | Tx blocking time |

### 18.11.4 Supervisory settings

The *Supervisory settings* tree branch can be used for activation and configuration of debug logs.

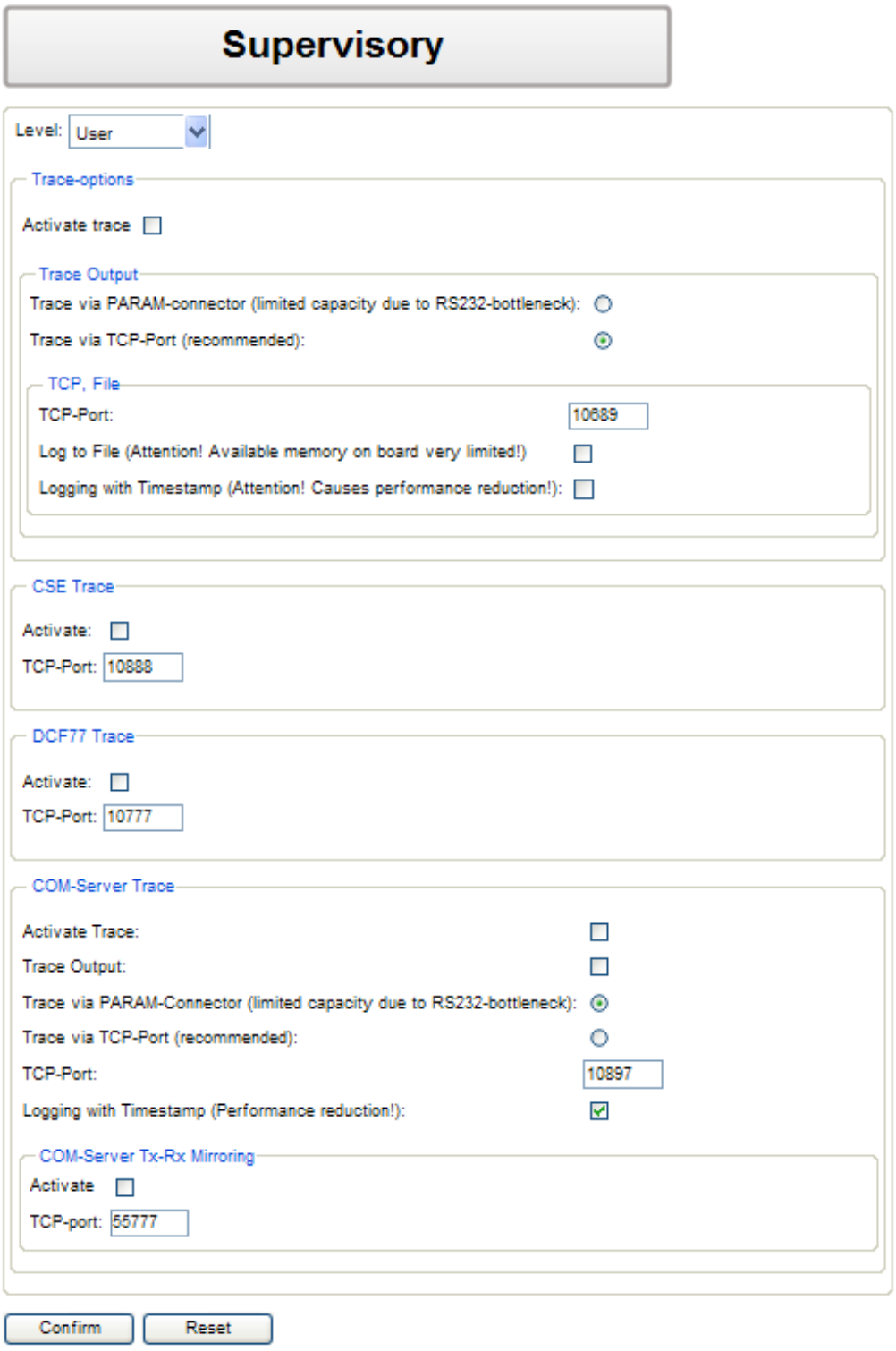



*Figure 146: IEC61850 Supervisory settings*

Table 72: IEC61850 Supervisory settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Level | - | Selection of values in combo box | user | Option to select lever of supervisory messages (user, developer) |
| Activate trace | | checkbox | checked | Protocol debug option activation |
| | | | | |
| Trace output | - | radio button | TCP port | Selection of trace output, PARAM connector or TCP port |
| TCP-Port | - | 1 to 65535 | 10689 | TCP port |
| Log to file | - | checkbox | unchecked | Log to file |
| Logging with timestamp | - | checkbox | unchecked | Logging with timestamp |
| CSE trace: Activate | - | checkbox | unchecked | CSE trace activation |
| CSE trace: TCP port | - | 1 to 65535 | 10888 | TCP port |
| DCF77 trace: Activate | - | checkbox | unchecked | DCF77 trace activation |
| DCF77 trace: TCP port | - | 1 to 65535 | 10777 | TCP port |
| COM-Server Trace: Activate Trace | - | checkbox | unchecked | COM-Server Trace activation |
| COM-Server Trace: Trace Output | - | checkbox | unchecked | COM-Server Trace: Verbose Output |
| COM-Server Trace:Trace via PARAM-Connector | - | radio button | checked | Radio button to select PARAM-Connector or TCP port as output interface for COM-Server debug messages |
| COM-Server Trace: Trace via TCP Port: | - | radio button | unchecked | |
| COM-Server Trace: TCP port | - | 1 to 65535 | 10897 | COM-Server Trace: TCP port |
| COM-Server Trace:Logging with Timestamp | - | checkbox | checked | COM-Server Trace:Logging with Timestamp |
| Mirroring: Activate | - | checkbox | unchecked | Mirror port debug option activation |
| Mirroring: TCP port | - | 1 to 65535 | 55777 | Mirror port: TCP port |

### 18.11.5 Supervisory settings for boards type TK28-4, TK28-6, TK102

For parameters of Supervisory settings in IEC61850 for boards type TK28-4, TK28-6, TK102 see the *IEC103 for REG-PE(D)* chapter in this manual.

### 18.11.6 SV supervisory for TK102 board

SV supervisory tree branch can be used for activation of debug logs for *Sampled Values* functionality.

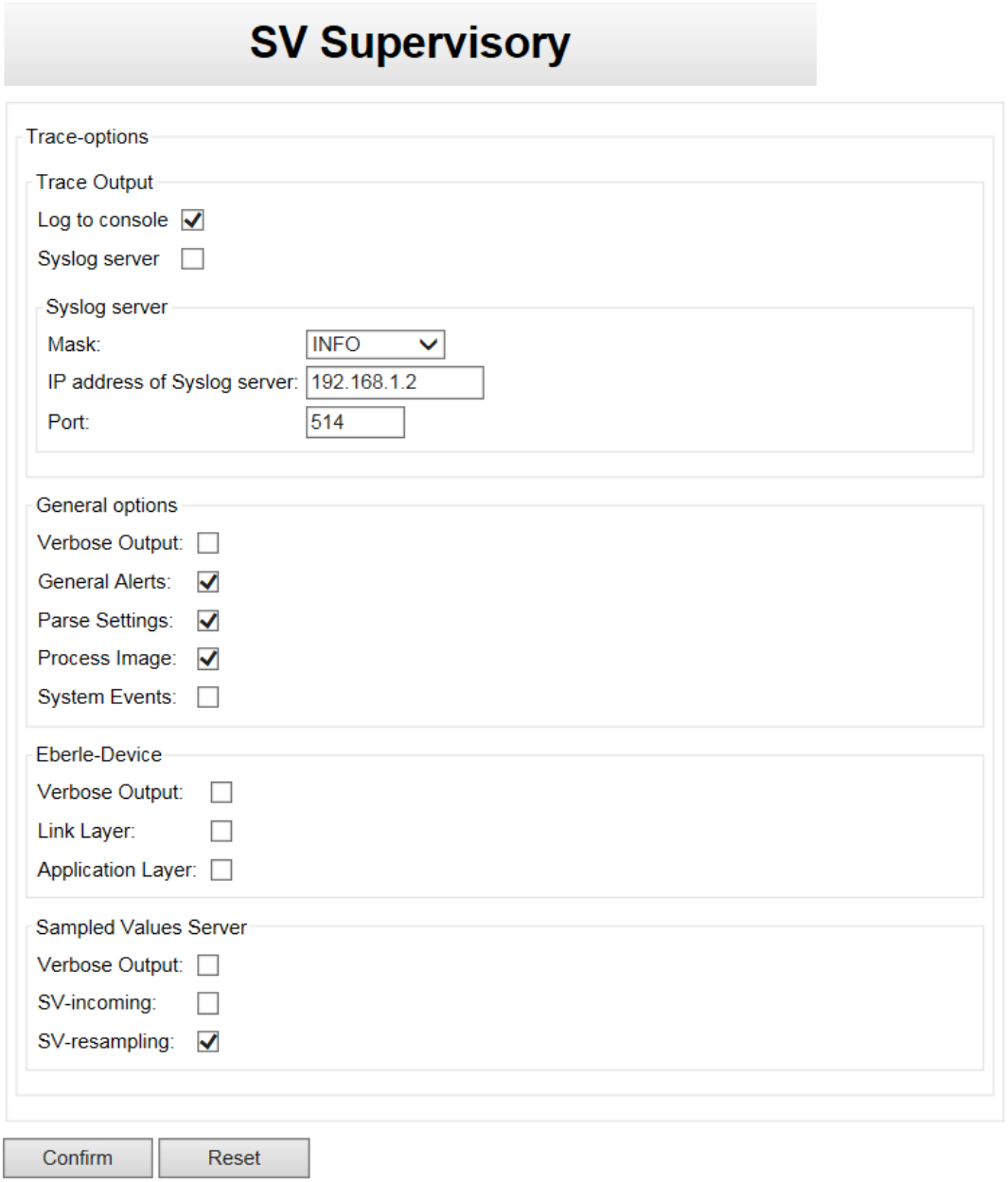



*Figure 147: TK102 SV supervisory*

Table 73: TK102 SV supervisory

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Trace output: Log to console | - | checkbox | checked | Selection of console for log output |
| Trace output: Syslog server | - | checkbox | unchecked | Selection of Syslog server for log output |
| Syslog server: Mask | - | listbox | INFO | Choice of message types for logging. Selection is always valid for the item selected in the listbox and all items above the selection.<br>Log types to select: EMERG (emergency), ALERT, CRIT (critical), ERR (error), WARNING, NOTICE, INFO (informative), DEBUG |
| IP address of Syslog server | IPv4 | IPv4 | 192.168.1.2 | IP address of Syslog server |
| Port | - | 1 to 65535 | 514 | Port of Syslog server |
| General options: Verbose output | - | checkbox | unchecked | Verbose output |
| General options: General alerts | - | checkbox | checked | General alerts |
| General options: Parse settings | - | checkbox | checked | Parse settings |
| General options: Process image | - | checkbox | checked | Process image |
| General options: System events | - | checkbox | unchecked | System events |
| Eberle-Device: Verbose output | | checkbox | unchecked | Verbose output |
| Eberle-Device: Link Layer | | checkbox | unchecked | Link Layer |
| Eberle-Device: Application Layer | | checkbox | unchecked | Application Layer |
| Sampled Values Server: Verbose output | | checkbox | unchecked | Verbose output |
| Sampled Values Server: SV-incoming | | checkbox | unchecked | Sampled Values incoming |
| Sampled Values Server: SV-resampling | | checkbox | checked | Sampled Values resampling |

### 18.11.7 Time synchronization

The NTP (Network Time Protocol) Configuration is used for time synchronization.

The SNTP client is implemented as a single thread which periodically requests NTP servers or listens for NTP broadcasts and Ipv4 multicasts, and optionally sends SNTP unicast requests to defined NTP servers. The SNTP-client will be automatically started by the start of the application, if it receives a list of NTP servers (main and secondary) from the sntp.param file. Otherwise time is not synchronized by the user with NTP- server.

REG-PE / REG-PED use these servers for installation of system time at real time.

The current SNTP settings provide one or two IP addresses of the NTP servers available for time synchronization. One server acts as primary server and the other as a backup server. The NTP servers must be listed in the order of preference. You can choose your preferred NTP servers (on default – *Main NTP server*). REG-PE / REG-PED analyses the availability of servers, their priority, and also their switching.

If the main NTP-Server does not work or is not defined, time is set by the secondary NTP-Server.

NTP-Servers provide first time synchronization at the start of the application. If your NTP-Servers support broadcast request-responses, a first time synchronization can proceed up to 10 seconds before.

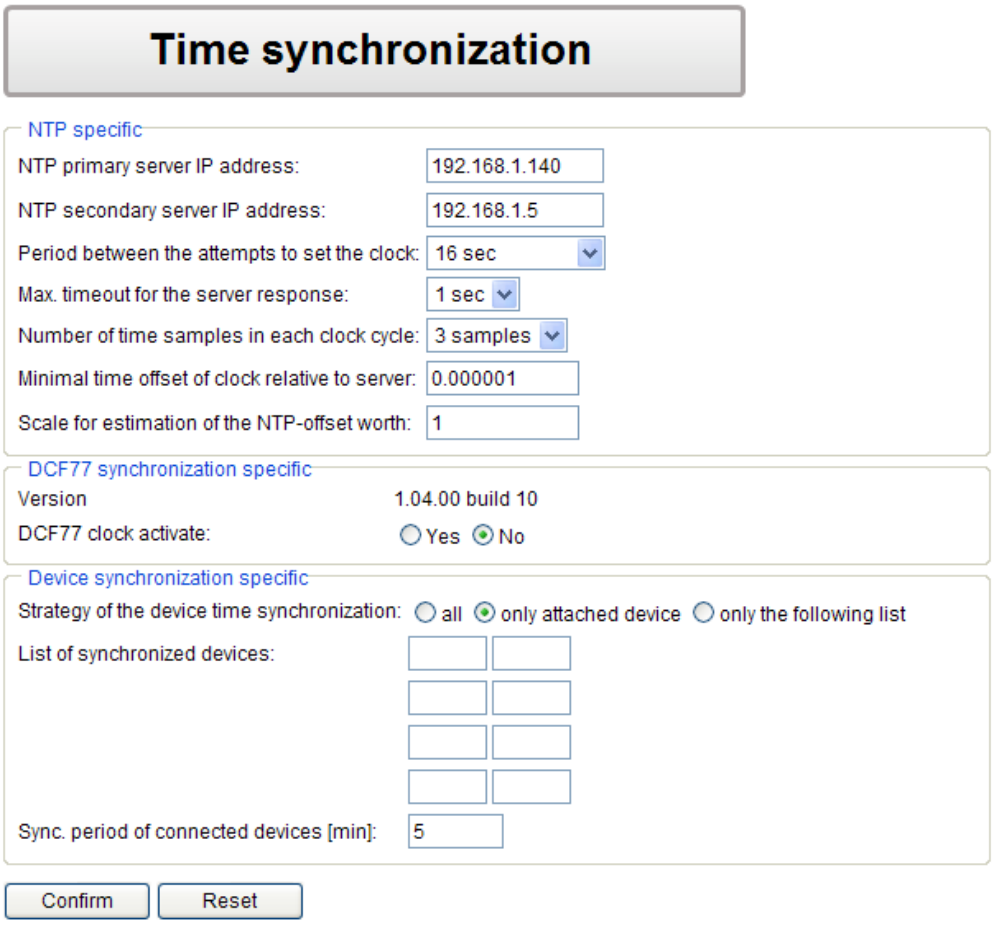



*Figure 148: IEC61850 Time synchronization*

Table 74: IEC61850 Time synchronization

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| NTP primary server IP address | - | 4x 0 to 255 | 192.168.1.140 | NTP primary server IP address |
| NTP secondary server IP address | - | 4x 0 to 255 | 192.168.1.5 | NTP secondary server IP address |
| Period between the attempts to set the clock | sec | Selection of values in combo box | 16 sec | Period between the attempts to set the clock |
| Max. timeout for the server response | sec | Selection of values in combo box | 1 sec | Max. timeout for the server response |
| Number of time samples in each clock cycle | - | Selection of values in combo box | 3 samples | Number of time samples in each clock cycle |
| Minimal time offset of clock relative to server | sec | float | 0.000001 | Minimal time offset of clock relative to server |
| Scale for estimation of the NTP-offset worth | - | | 1 | Scale for estimation of the NTP-offset worth |
| DCF77: Version | - | - | | DCF77: Version (Read only) |
| DCF77 clock activate | - | Radio button | No | DCF77 clock activate |
| Strategy of device time synchronization | - | Selection of check-boxes | Only attached device | The Firmware includes a very flexible yet simple mechanism for time synchronization schemes for attached devices. There are three strategy types: all devices, only device, device-list and DCF77. The all devices scheme allows for a synchronizing of the all devices in E-LAN or per Time-Bus.<br>The only device scheme allows for a time synchronization of the only first device. In standard settings a first device is master in E-LAN.<br>The device-list scheme allows for a specific time synchronization of the devices specified in the “List of the synchronized devices” fields. Each field specifies the A-Eberle ID-device.<br>The DCF77 scheme: the firmware sends DCF77 time to device, which can be set in 3 modes. The REG-L time synchronization command via COM2 is not used here.<br>DCF77 device modes: |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| | | | | SINGLE: via COM1/2 can be synchronized the system time in the DCF mode. The time synchronization bus is not supported.<br>SLAVE: the time synchronization bus synchronizes the device system time.<br>MASTER: device receives the time via COM1 in the DCF mode, the DCF signal is switched directly to the synchronization bus. Otherwise the device sends his system time as DCF telegram via the synchronization bus. |
| Sync. period of connected devices | min | 1 to 65535 | 5 | The parameter determines an interval time between the sequential time synchronizations by NTP servers. It is applied for the all attached devices according to the selected "Strategy of the device time synchronization ". Value is configurable in the range 0…255. The default value is 5. |

#### 18.11.7.1 IEC61850 time synchronization for TK28-4, TK28-6, TK102 boards

Time synchronization in IEC61850 for TK102 board utilizes also PTP (Precission Time Protocol) as time synchronization source.

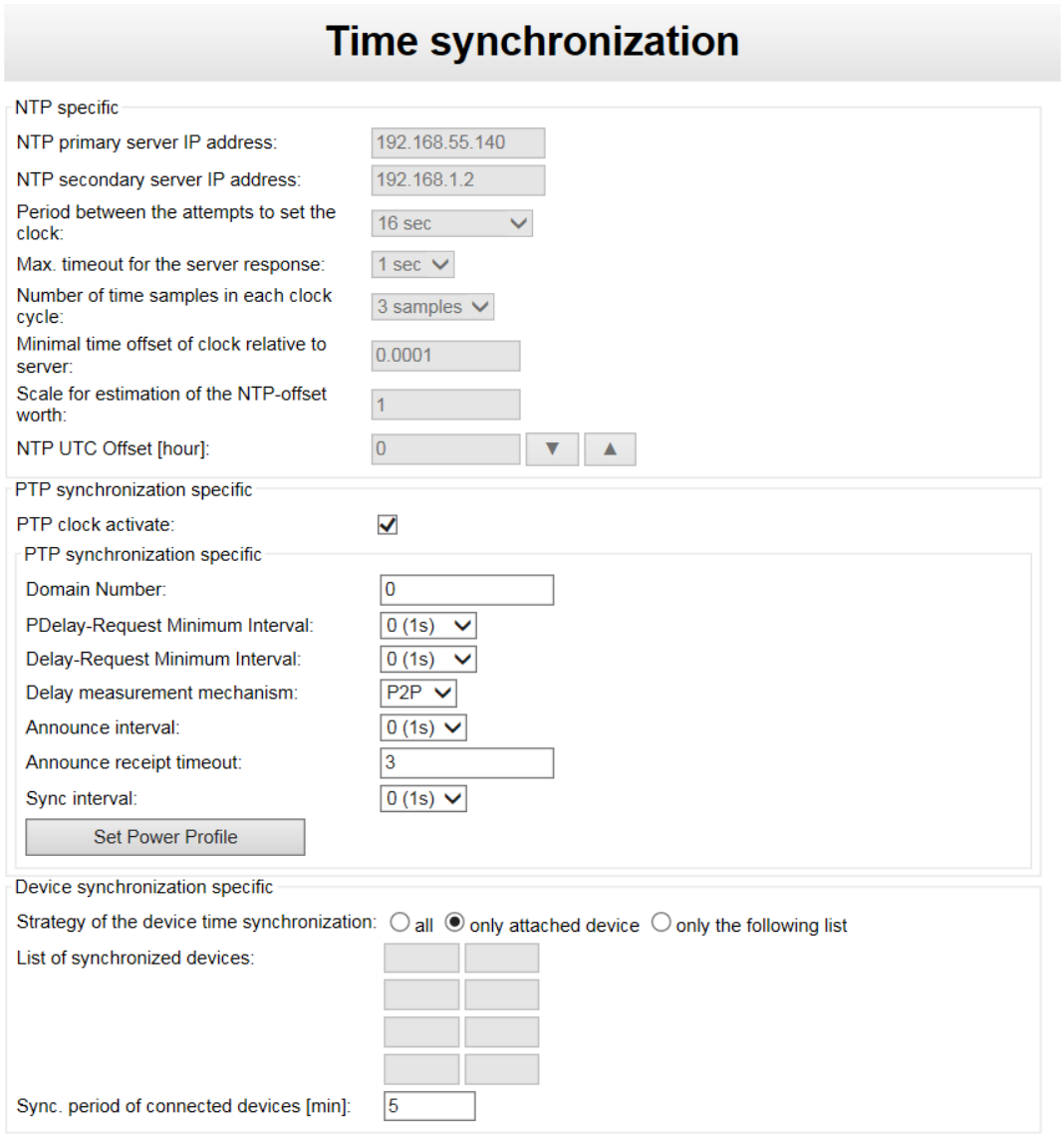



*Figure 149: IEC61850 time synchronization for TK28-4, TK28-6, TK102 boards*

Table 75: Time synchronization for boards type TK28-4, TK28-6 and TK102

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| NTP primary server IP address | IPV4 | 4x 0 to 255 | 0.0.0.0 | NTP primary server IP address |
| NTP secondary server IP address | IPV4 | 4x 0 to 255 | 0.0.0.0 | NTP secondary server IP address |
| Period between the attempts to set the clock | | Selection of values from listbox | 16 | Period between the attempts to set the clock |
| Max. timeout for the server response | | Selection of values from listbox | 1s | Max. timeout for the server response |
| Number of time samples in each clock cycle | | Selection of values from listbox | 3 samples | Number of time samples in each clock cycle |
| Minimal time offset of clock relative to server | | float | 0.0001 | Minimal time offset of clock relative to server |
| Scale for estimation of the NTP-offset worth | | 0 to 100000000 | 0 | Scale for estimation of the NTP-offset worth |
| NTP UTC Offset | | +/- 24 | 0 | NTP UTC Offset |
| PTP specific:<br>VLAN ID | | | 0 | VLAN ID |
| PTP specific:<br>Domain Number | | 0 to 255 | 0 | Domain Number |
| PTP specific:<br>PDelay-Request Minimum Interval | | Selection of values from listbox | 0 | PDelay-Request Minimum Interval, 0 to 5 |
| PTP specific:<br>Delay-Request Minimum Interval | | Selection of values from listbox | 0 | Delay-Request Minimum Interval, 0 to 5 |
| PTP specific:<br>Delay measure-mennt mechanism | | Selection of values from listbox | Auto | Delay measurement mechanism |
| PTP specific:<br>Announce interval | | Selection of values from listbox | 1 | Announce interval, 0 to 3.<br>All PTP nodes in network should have the same value |
| PTP specific:<br>Announce receipt timeout | | 0 to 255 | 3 | Announce receipt timeout, all PTP nodes in network should have the same value |
| PTP specific:<br>Sync. interval | | Selection of values from listbox | none | Synchronization interval, 0 to 2 |

### 18.11.7.2 UTC-Settings by REG-Sys equipment

Connect the REG-Sys (REG-D, REG-DP, PQI-D and EOR-D) IED COM1 by using the delivered RS-232 Null Modem Cable with your PC. Use a terminal-program, e.g. WinReg, for the UTC-settings.

If the regulator has the station-ID A: you will see after pressing the ↵ button:

<A>

Afterwards you can take following time zone settings:

| | | | |
|---|---|---|---|
| utcTZ | [= <time zone>] | Time Zone: | -12..0..+12 hours (part of an hour (e.g. 9.75) |
| utcDST | [= <use dst>] | Daylight Saving Time: | 0=not used, 1=used |
| utcSH | [= <south hemisphere>] | Hemisphere: | 0:north, 1:south |

The system is now adjusted for correct time synchronization.

Example settings for Germany, time zone 1, daylight saving time and north hemisphere:

| | |
|---|---|
| utcTZ = 1 | TimeZone = 1 |
| utcDST = 1 | Daylight Saving Time = Yes |
| utcSH = 0 | South Hemisphere = No |

### 18.11.8 Internal communication

This tree branch contains settings concerning the internal communication between telecontrol board and the device.

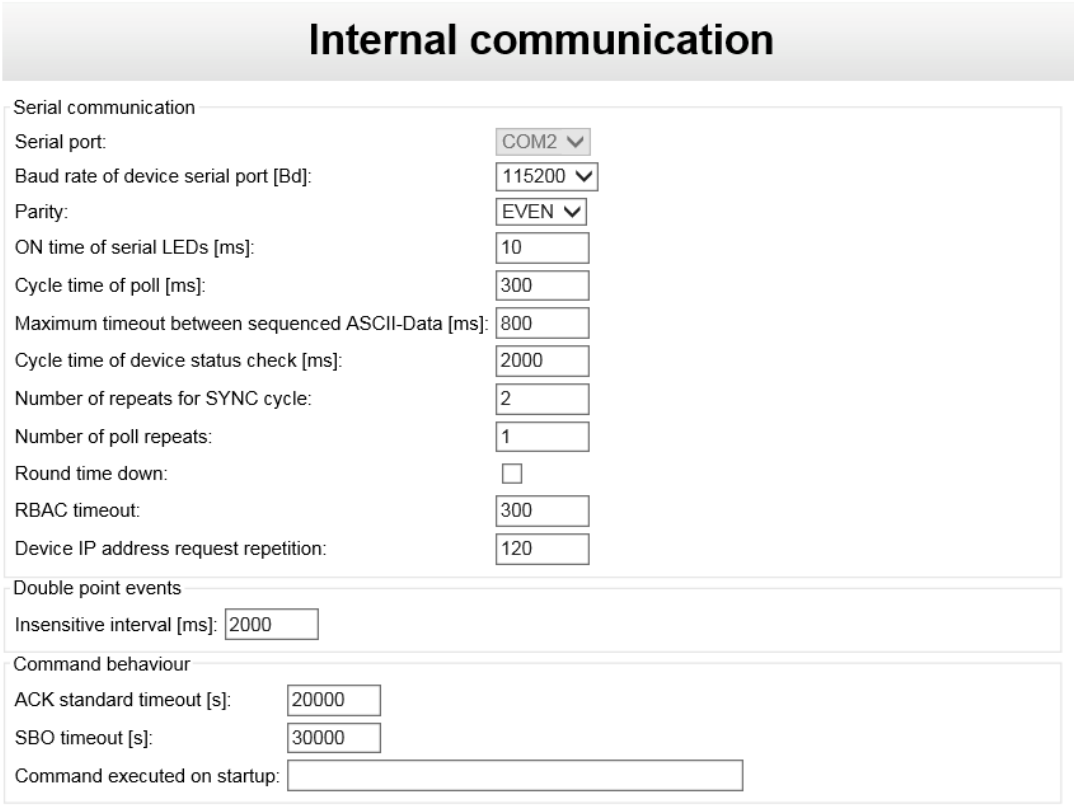



*Figure 150: IEC61850 Internal communication*

Table 76: IEC61850 Internal communication

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Serial port | - | - | COM2 | Serial port for internal communication with device (read only). To change serial port go to Serial ports assignment tree branch |
| Baud rate of device serial port | Bd | Selection of values in combo box | 115200 | Baud rate of device serial port |
| Parity | - | Selection of values in combo box | EVEN | Serial port parity |
| ON time of serial LEDs | ms | 1 to 65535 | 10 | ON time of serial LEDs |
| Cycle time of poll | ms | 0 to 65535 | 300 | The parameter determines the cycle time of the substation call. If you set the parameter to zero, the call is executed as soon as possible. Value is configurable in the range 0…65535. The default value is 150. |
| Maximum timeout between sequenced ASCII-Data | ms | 0 to 65535 | 800 | This parameter specifies how long the program waits for sequenced next frame (data > 2000 Bytes) or the acknowledgement for command. The wait time is dependent on the baud rate and the maximum message length.<br>Value is configurable in the range 0…65535. The default value is 800. |
| Cycle time of device status check | ms | 0 to 65535 | 2000 | This parameter specifies the cycle time with which the program checks the link status of the device is polling in the case of error in serial or frame. Value is configurable in the range 0…65535. The default value is 1500... |
| Number of repeats for SYNC cycle | - | 1 to 255 | 2 | Defines a maximal count of synchronization requests, if serial communication with XXXSysTM-Device fails. The parameter can be adjusted from 0…255. By default it is 2. |
| Number of poll repeats | - | 0 to 255 | 1 | Defines a maximal number of repetitions of one command. Default value is 2. |
| Round time down | | checkbox | unchecked | If value equals “No”, time stamps are rounded up in scale of one second to prevent time inconsistencies with substation. If value equals “Yes”, time stamps are rounded down in scale of one second. Default value is “Yes”. |
| RBAC timeout | s | 30 to 600 | 300 | RBAc timeout for RegSys firmware supporting user roles and rights and telecontrol boards TK8xx and TK102 |
| Device IP address request repetition | | 0 to 65535 | 120 | Defines number of polls after which IP-address, netmask and gateway are requested from a-Eberle device. They will are set then in the loader environment. The feature is supported only for REGSys devices. |

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| | | | | Value is configurable in the range 0…255. The default value is 0. |
| ACK standard timeout | s | 100 to 65535 | 20000 | Maximal waiting time of the changes caused by the command. Value is configurable in the range 0…65535. The default value is 8000. |
| SBO timeout | s | 100 to 65535 | 30000 | Maximal waiting time of the Operate request after receipt of a Select request. Value is configurable in the range 0…65535. The default value is 10000. |
| Command executed on startup | text | 64 characters | empty | Command that will be executed once after startup. |

### 18.11.9 Attached Devices

Special device settings are valid for each individual attached device. The default values must be adjusted to the respective device. A complete data record describes an attached device. Up to eight A-Eberle devices can be attached.

This tree branch contains specific device settings.

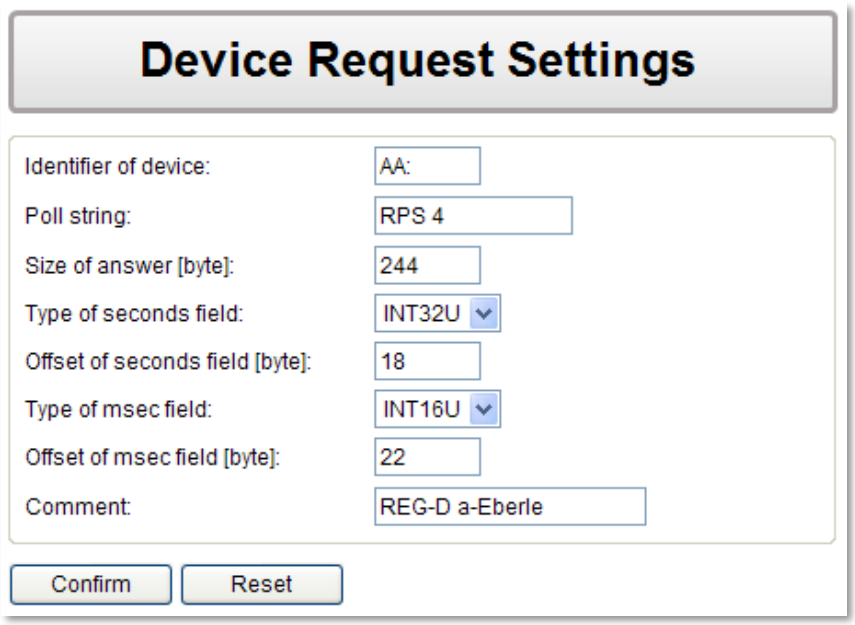



*Figure 151: IEC61850 Device x*

Table 77: IEC61850 Device x

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| LDevice Instance in ICD-file | text | Uppercase up to 10 char | no | The parameter defines device identification by its number. It must be the same as the IEC61850 Logical Device (LD) instance number (e.g., logical device name REG2 must have value 2 for "Device relocation"). |
| Identifier of device | text | AA: or A(1 to 9): to Z(1 to 4): | AA: | The parameter defines an XXXSysTM-Device name. The name should consist of 2 or 3 characters. A template of the name is: [A-Z] [empty or 0-9] [:]. (E.g., "F:""A8:""V7".) By default it is "A:" for regulators. |
| Poll string | text | 24 characters | RPS 4 | The parameter defines a poll string for a serial request. By default it is "RPS 4" for attached regulators, for other devices it is preconfigured in a different way. |
| Size of answer | byte | 1 to 255 | 244 | The parameter defines a size of answer corresponding to selected poll string. |
| Type of seconds field | - | Selection of values in combo box | Int32U | The parameter defines type of a second's value in defined poll string. Default value REGSys™ - "INT32". |
| Offset of seconds field | byte | 0 to 255 | 18 | The parameter defines the byte offset in defined poll string which includes a second's part of time. Default value is 18. |
| Type of msec field | - | Selection of values in combo box | Int32U | The parameter defines type of a milliseconds part of time in poll string. Default value for REGSys™ - "INT16". |
| Offset of msec field byte | byte | 0 to 255 | 22 | The parameter defines the byte offset in defined poll string which includes a milliseconds part of time. Default value is 22. |
| Comment | text | 23 characters | | User comment |

### 18.11.10 Saving of settings in IEC61850

As the settings for IEC61850 protocol consist of XML template and ICD file, the Save selected settings to file icon offers separately saving of settings and saving of ICD file.

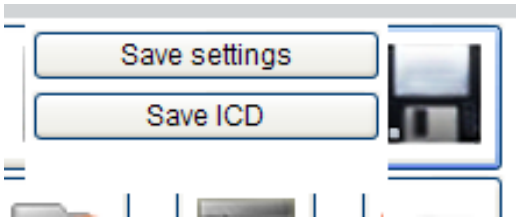



*Figure 152: Saving of settings in IEC61850*

## 18.12 MODBUS Collector

IEC 61850 comes additionally with Modbus-Collector-Functionality, which provides a MODBUS-RTU Master to retrieve information from Modbus-slaves to be processed in A-Eberle-device as well as being routed to IEC 61850 client.

The MOBUS Master can receive pre-defined analogue values from up to 32 MODBUS-RTU server and to be processed in A-Eberle devices. Usage of MODBUS-RTU using is optional. On the contrary, the MODBUS-RTU must be used only without activation of IEC 61850 Client or GOOSE incoming commands contemporarily on account of CPU load.

Basic settings tree branch form contains common settings of MODBUS-RTU.

Extended settings shall be done by A-Eberle staff.

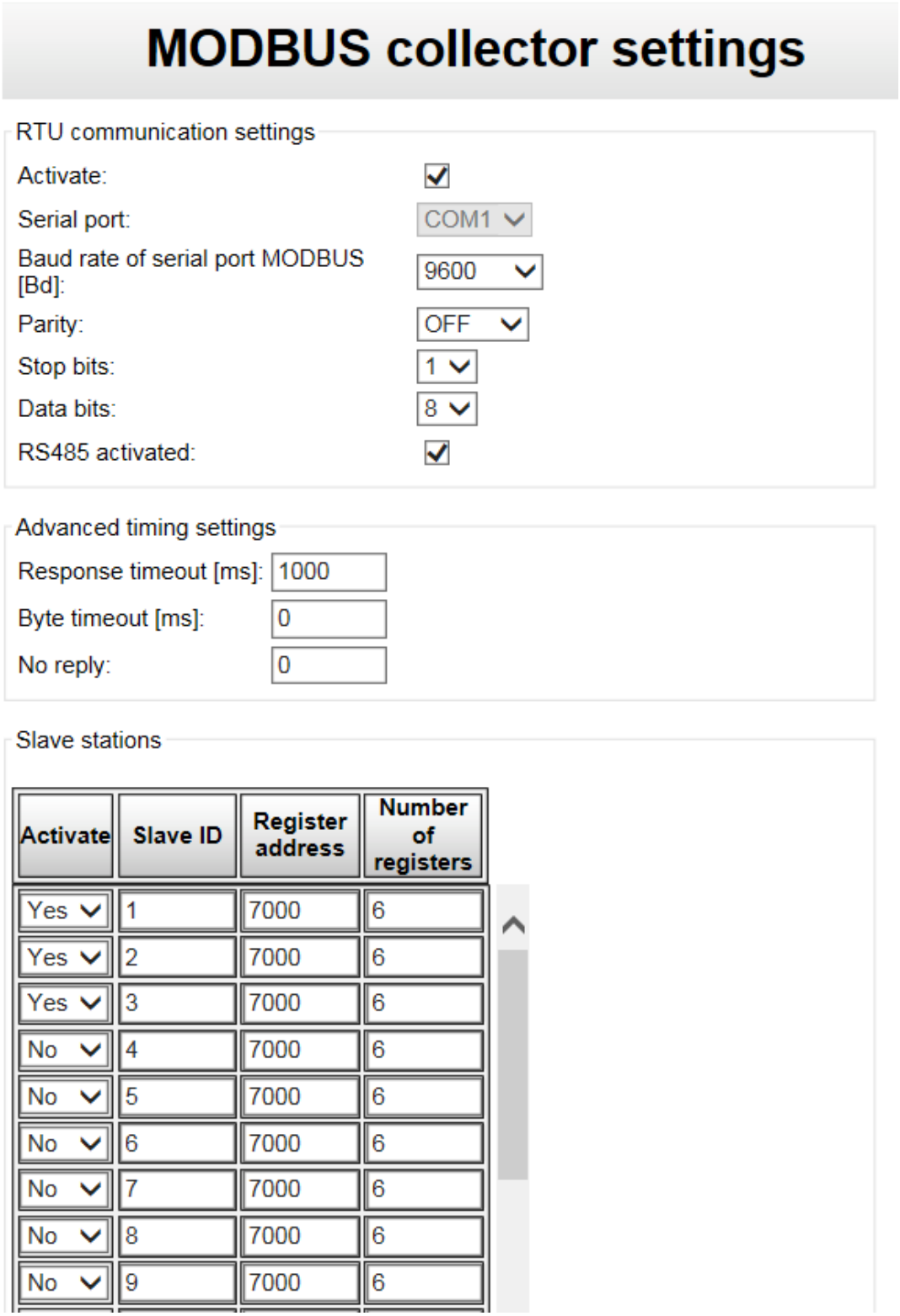



*Figure 153: MODBUS collector basic settings*

Table 78: MODBUS collector basic settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Activate | Checkout | Yes/no | no | Activate MODBUS-RTU extension. |
| Serial Port | - | Selection of values in combo box | COM1 | Selection of available COM ports for MODBUS-RTU communication |
| Baud Rate | - | Selection of values in combo box | 19200 | Data transfer rate. 19200 b/s is default. |
| Parity | - | Selection of values in combo box | EVENT | Even parity is required |
| Stop bits | - | Selection of values in combo box | 1 | Stop bits |
| Data bits | - | Selection of values in combo box | 8 | Data bits |
| RS485 activated | | checkbox | checked | Activation of RS485 |
| Response timeout [ms]: | - | 0..65535 | 200 | The master is configured by the user to wait for a predetermined timeout interval ( Response time-out) before aborting the transaction |
| Byte timeout | - | 0..65535 | 0 | The maximum timeout interval in ms. between two consecutive bytes of the same message |
| No reply | - | 0..65535 | 0 | Idle timeout after “no replay” from slave up to a next query. |

Table 79: MODBUS collector slaves basic settings

| Setting | Format | Range | Default | Description |
|---|---|---|---|---|
| Activate | Checkout | Yes/no | no | Activate MODBUS-RTU slave use. |
| Slave ID | - | 1..254 | 1 | Modbus slave address. The address must be unique on a MODBUS serial bus |
| Register address | - | 2 Bytes 0x0000 to 0xFFFF | 7000 | The starting register address |
| Number of registers | - | 1 to 500 | 6 | The number of registers |

### 18.12.1 Extended Settings in XML-file

The settings in XML file shown below:

```
<!--
        Master Modbus settings
-->
<protocol type="modbus" activate="1">
        <!--
                        device - Linux device - for Modbus
                        tmo_resp - response timeout;
                        tmo_byte - bit timeout;
                        tmo_idle - idle timeout ( query interval for the slaves, those do not replayed )

                        attributes are not shown in GUI :
                                -       tmo_master_interval - idle interval for master.
                                -       flowControl - serial flow control : 0 - off, 1 - hardware, 2 - software
        -->
        <params device="/dev/ttyS2" baud="19200" parity="2" rs485="0"
                        flowControl="0" led_time="20" tmo_resp="200" tmo_byte="50"
                         tmo_idle="4000" tmo_master_interval="250"/>
        <Slaves>
                <!--
                        These attributes will be shown in GUI:
                                -       slaveId - Slave ID
                                -       reg_address - register start address
                                -       reg_quantity  - register quantity

                        Other attributes are not shown in GUI :
                                -       reg_type -
                                        : 4 - read out input registers
                                        : 3 - read out holdings registers
                                -       Cmd - query measures (commands for REG-D).
                                                Number is variabled.
                                -       db  - dead band in %
                                -       type is float, int32, uint32
                -->
                <Slave order="1" activate="1" slaveId="1" reg_address="7000" reg_quantity="6"
                        reg_type="3">
                        <Cmd activate="1" reg_address="7000" db="0.1" type="float"
                                inverted="0" cmd="a1="/>
                        <Cmd activate="1" reg_address="7002" db="0.1" type="float"
                                inverted="0" cmd="a2="/>
                        <Cmd activate="1" reg_address="7004" db="0.1" type="float"
                                inverted="0" cmd="a3="/>
                </Slave>
```

Table 80: MODBUS-RTU extended settings

| Attribute name | Format | Range | Default | Description |
|---|---|---|---|---|
| reg_type | decimal | 3 or 4 | 3 | 3- Read Holding Registers<br>4 – Read Input Register |
| Cmd | - | | | Modbus command node in response. |
| db | Float | Float 32 bits | 0.0 | Dead band % |
| type | text | Float, int32, int32u | Float | Type of value |
| swapActivate | decimal | 0..1 | 0 | Activate swapping algorithm for 1 or 2 registers values from Modbus frame |
| swapByte | decimal | 0..1 | 0 | Value is swapped. 2 registers are used. Bytes swapped. |
| swapWord | decimal | 0..1 | 0 | Value is swapped. 2 registers are used. Words swapped. |
| cmd | Text | Text command | a1= | Command |

#### 18.12.1.1 Data Encoding

MODBUS uses a 'Big-Endian' representation for addresses and data items. This means that when a numerical quantity larger than a single byte is transmitted, the most significant byte is sent first. So for example:

Register size value

16 - bits 0x1234 the first byte sent is 0x12 then 0x34

32 – bits float 1000.1 will be sent as 44 7a 06 66

Or a capture a log from communication process:

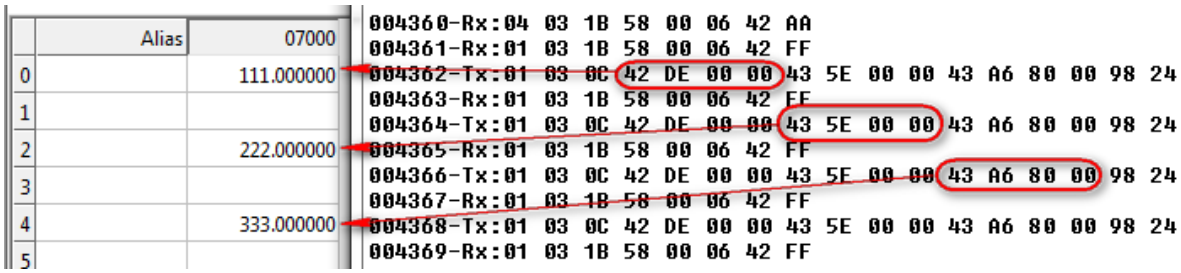



*Figure 154: Data Encoding*

Examples for byte-ordering:

**Modbus Byte-Ordering (Big-Endian)**

Byte ordering for float 1000.1 : 44 7a 06 66

Byte ordering for float 111 : 42 de 00 00

Byte ordering for float 222 : 43 5e 00 00

Byte ordering for float 333 : 43 a6 80 00

**IBM – Big-Endian:**

Byte ordering for float 1000.1 : 44 7a 06 66

Byte ordering for float 111 : 42 de 00 00

Byte ordering for float 222 : 43 5e 00 00

Byte ordering for float 333 : 43 a6 80 00

**INTEL – Little-Endian**

Byte ordering for float '1000.1' : 66 06 7a 44

Byte ordering for float '111.000000' : 00 00 de 42

Byte ordering for float '222.000000' : 00 00 5e 43

Byte ordering for float '333.000000' : 00 80 a6 43

### 18.12.1.2 Adjusting Data Swapping

Data from Modbus slave may be swapped.

The swapping is activated in an attribute swapActivate="1", if a value is 1.

The settings of the algorithm are adjusted in the following arguments:

- swapByte: 2 registers or 1 register are used. If a value is 1, bytes in register(s) will be swapped;
- swapWord: 2 registers are used. If a value is 1, words will be swapped.

F.e: Float value is: 230.55 or Hex value: 0x43668CCD.

Abbreviation for hex-form is: A=43 B=66 C=8C D=CD.

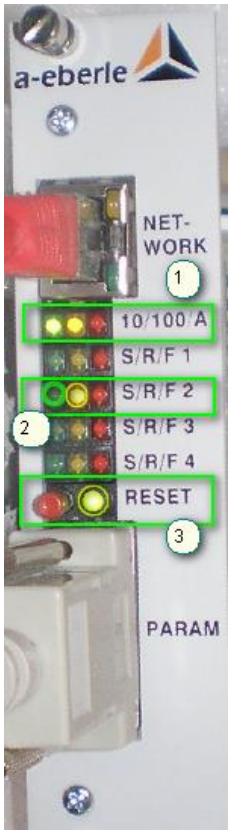
- Swapping OFF: Float AB CD value will be parsed in floating point. 2 registers are used. Value=230.55 in Modbus;
- Word swapped is ON: Float CD AB Value will be parsed in floating point. 2 registers are used. Value= -3.16258e-031;
- Byte swapped is ON: Float BA DC Value will be parsed in floating point. 2 registers are used. Value= -2.94439e+008;

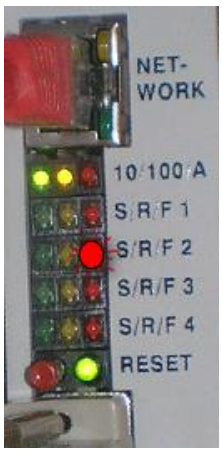
0 Byte and word swapped are ON: Float DC BA will be parsed in floating point. 2 registers are used. Value= 2.31163e+023;

# 19. Diagnostic Functions in the Context of the REG-P / REG-PE / REG-PED Device

The subject of this section is troubleshooting problems with the settings of REG-PE / REG-PED device and XXXSys™-Device interconnection.

Table 81: Diagnostic functions in the context of the device

| LED's status of REG-PE/ REG-PED device | Indication |
|---|---|
|  | Normal operation:<br>1. Indication of Ethernet activity, depends on current activity on Ethernet line<br>2. Indication of communication on serial ports 1 to 4 (S – send data, R – receive data, F - error)<br>3. Watchdog indication |

| | |
|---|---|
| | Hardware or application fault.<br>➲ First of all check please network connection and power supply.<br>➲ Then follow the instructions described above. |
|  | Communication REG-PE – REG-D™ faults.<br>➲ Check please device settings<br>➲ Check communication settings of REGSys™ (baud rate, parity etc.) |

**Note:**
If the problems persist, please ask your system administrator first. For further assistance please contact a.eberle product support at
http://www.a-eberle.de

| LED's status of REG-P version TK400 board | Indication |
|---|---|

| | |
|---|---|
| | Normal operation:<br>1. Reset button<br>2. Indication of watchdog or COM-Server running<br>3. Indication of transmit, receive and error in communication between REG-P and external device using the topical protocol<br>4. Indication of transmit, receive and error in internal communication between REG-P and a.eberle device<br>All LEDs blinking – invalid combination of firmware and settings |
| | Ethernet booter operation:<br>1. Ethernet booter is waiting for connection (LEDs alternately blinking)<br>2. Ethernet booter finished data transfer and stores data in the internal memory<br>“Running light” indicates data transfer |
| | Serial booter operation:<br>0 Serial booter is waiting for connection. |
| **LED’s status of REG-P version TK517 board** | **Indication** |

| | |
|---|---|
| | Normal operation:<br>1. Indication of transmit, receive and error in communication between REG-P and external device using the topical protocol<br>2. Indication of transmit, receive and error in internal communication between REG-P and a.eberle device<br>3. Indication of power supply voltage and running watchdog<br>All LEDs blinking – invalid combination of firmware and settings. |
| | Parallel booter operation:<br>0 Parallel booter for data transfer via parallel Param port is running. This way of data transfer is not supported by WinConfig. |
| | Serial booter operation:<br>0 Serial booter is running. Alternate blinking of some LEDs indicates data transfer. |

# 20. Related Documentation

| Document | Author |
|---|---|
| "REG-PE Firmware Update IEC61850.v1.2.doc" | a-Eberle |
| "REG-PE Quick Guide for technicians IEC61850 1.2.doc" | a-Eberle |
| "REG-PE User Management IEC61850.v1.4.doc" | a-Eberle |
| Installation instructions COM-Server functionality of PQI-DA.doc | a-Eberle |
| PQI-DA_loader_mode.MOV | a-Eberle |

# 21. Maintenance/Cleaning

This unit is maintenance-free for customers.

| | |
|---|---|
| ⚠ DANGER! | **Danger of electric shock!**<br>Do not open the unit.<br>Maintenance of the equipment can only be carried out by A-Eberle. |

For service, contact A-Eberle.

**Service address:**

A. Eberle GmbH & Co. KG

Frankenstraße 160

D-90461 Nuremberg

# 22. Disposal

To dispose of the device and its accessories, send all components to A-Eberle.

# 23. Product Warranty

A-Eberle guarantees that this product and accessories will remain free of defects in material and workmanship for a period of three years from the date of purchase. This warranty does not cover damage caused by accident, misuse or abnormal operating conditions.

To obtain service during the warranty period, please contact A-Eberle GmbH & Co KG in Nuremberg.

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# Notes

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