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1. Introduction

1.1 User manual

This document is a helpful resource for electric engineers who design, implement, commission, and test or provide daily service to the substations with Enilit RTU (remote terminal unit). It is intended for the readers who have the knowledge of substation automation equipment and applications.

This document provides a detailed technical manual of the remote terminal unit 'Enilit RTU' – hereinafter referred to as Enilit RTU.

The document is organized as follows:

1. Contents: this section outlines the contents of this document.
2. Introduction: this section provides a short overview of this document and introduces the main functions and possible applications of Enilit RTU.
3. Safety: this section introduces safety instructions of working with Enilit RTU system.
4. Hardware: this section elaborates the constituents of Enilit RTU hardware.
5. Software: this section provides an overview of Enilit RTU software.

Note. The user manual for this device gives instructions for its installation, commissioning, and operation. However, the user manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact UAB Enilit support and request the necessary information. Please see contact information.

SUPPORT CONTACT:

Tel. +370 655 53155

support@enilit.lt

www.enilit.com

1.2 Enilit RTU

The automation technology is rapidly advancing. New communication techniques, devices and standard protocol interfaces combined with the immense computing power of today's hardware components open the way to new concepts in automation. At the same time, the growing demands of utility owners for more cost-effective control systems must be met.

Enilit RTU is our solution for automation applications. The modular, scalable and open structure of Enilit RTU system sets a wide range of applications:

- Electric power generation plants;
- Electricity transmission and distribution networks;
- Monitoring and control of chemical and petrochemical plants, pipelines and other large industries.

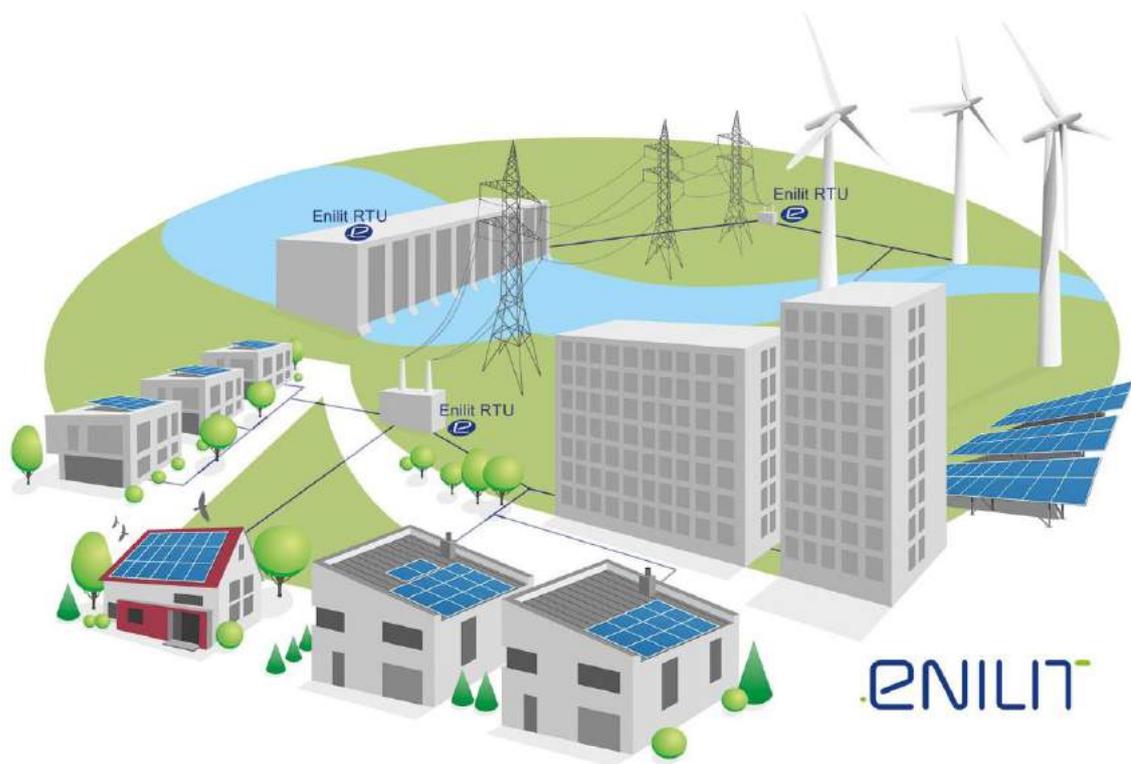


Figure 1. Control of electric power supply with Enilit RTU

Main functions of Enilit RTU:

- Control and monitoring of a system from a control centre via reliable remote data transmission protocols;
- Multitude of communication possibilities via various transmission media (LAN, radio relay system and etc.);
- Fast time-sequential processing of digital and analogue process data with high resolution time marking (1 millisecond);
- Secure process inputs / outputs with high isolation voltage (2,5 kV);
- Pre-processing and compressing of acquired process data (e.g. metered value formation, threshold value processing, initiation delay, debouncing, signal damping);
- Optimized flow of remote data transmission (spontaneous, cyclic or on-demand transmission, differentiated interrogation lists, priority improvement, general interrogation, selective message repeat command);
- Time-saving, user-optimized parameterization with minimum efforts due to Configuration and Management Software Enilit CMS based on Microsoft Windows operating system (currently supported version) or Linux;
- Open interfaces that permit the connection of peripheral units (e.g. printer or operator panel).

2. Safety

2.1 Introduction

This documentation includes information for qualified technical personnel. It describes the safety, handling, packing and unpacking procedures applicable to Enilit RTU hardware and software tools.

2.2 Health and safety

THIS SAFETY SECTION SHOULD BE READ BEFORE COMMENCING ANY WORK ON THE EQUIPMENT.

The information in the Safety section of the product documentation is intended to ensure that the products are properly installed and handled in order to maintain them in a safe condition. It is assumed that everyone who will be associated with the equipment will be familiar with the contents of the Safety section.

To preclude the possibility of personal danger, the following safety requirements must be fulfilled at any time:

1. The operating voltage specified in technical documentation must never be exceeded.
2. Always disconnect the device before changing the system or signalling wiring.
3. The housing does not contain any operation-relevant elements. The device must never be opened.
4. Do not operate the device in explosive or inflammable environments.
5. Do not expose the device to rain or humidity.
6. With regard to the location of the installation, take care that the ventilation is sufficient to make sure that the permissible operating temperature is not exceeded.
7. For wiring, please make sure that the cables used are able to withstand temperatures of at least 85°C.
8. Please ensure that non-isolated line ends are not exposed in order to minimize the danger of electric shocks or short circuits.

2.2.1 Service and maintenance

The device should be installed in a dry, clean environment. To ensure its proper functioning, it is necessary to make sure that the specified ambient conditions are fulfilled.

If there is an unlocked access to the rear of the equipment, care should be taken by all personnel to avoid electrical shock or energy hazards.

The device is maintenance-free and has no rotating parts. It is not necessary to clean the device after installation. But if cleaning is necessary, the device must be switched off and wiped off with a soft, clean and dry piece of cloth. Any detergents for cleaning must not be used.

2.2.2 Electrical connections

Connections should be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety. To ensure that wires are correctly terminated, the correct crimp terminal and tool for the wire size should be used.

2.2.3 Earthing

Before energizing the equipment, it must be earthed using the protective earth terminal, or the appropriate termination of the supply plug in case of plug-connected equipment.

Omitting or disconnecting the equipment, the earth may cause a safety hazard.

In terms of safety and EMC protection, it is important to pay attention that the connection must be as short as possible to a system earth. The recommended minimum size of the earth wire is 2.5 mm².

2.2.4 Power supply connection

This device does not have its own mains switch and starts operation immediately after the application of system voltage. Hence, a switch must be included in the wiring scheme which must be labelled appropriately and which must be installed in the vicinity of the device and within the operator's reach. The switch has to fulfil the requirements according to the standards IEC 947-1 and IEC 947-3.

The recommended maximum rating of the external protective fuse for this equipment is in the table 2.1 below.

Table 1. Maximum rating of the external protective fuse

SUPPLY VOLTAGE	FUSE, A
48VDC	10
110VDC	6
220VDC	4
230VAC	4

Cables with 1.5 mm² cross section are to be used for the supply of the feeder voltage.

2.2.5 Terminals

Terminals exposed during installation, commissioning and maintenance may present a hazardous voltage unless the equipment is electrically isolated. For the clamping range of wires that can be used for the connection in the terminals, please refer in the table below.

Table 2. Clamping range

TERMINALS	WIRE, mm ²
Power supply module	0.5 ... 2.5
Central processor unit module	0.2 ... 2.5
Input, output modules	0.2 ... 2.5

2.2.6 Data transmission cables

Telecommunications cables made of twisted-pair double-core cables with braided shielding (effective core diameter: 0.6/0.8 mm², optical cover of the screen > 80%) according to VDE0815/ VDE0816 shall be used for data transmission. The cable shield has to be laid planar on a bonding jumper / earth circuit connector (central earthing point).

2.3 Decommissioning and disposal

2.3.1 Decommissioning

The auxiliary supply circuit in Enilit RTU may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, the supplies to Enilit RTU (both poles of any DC supply) must be completely isolated then the capacitors should be safely discharged via the external terminals prior to decommissioning.

2.3.2 Disposal

It is recommended that incineration and disposal to watercourses is avoided. The product should be disposed of in a safe manner. Any products containing batteries must have them removed before disposal, in order to avoid short circuits. Particular regulations within the country of operation may apply to the disposal of lithium batteries.

2.4 Declaration of conformity

The device being the subject of this instruction was constructed, prepared and manufactured for the purpose of use in the industrial environment. The design and manufacturing process of the device complies with the norms that ensure the realization of specific rules and precautions, provided that the user obeys the given guidelines of the device installation, start, and operation. This device complies with the following EU directive resolutions provided in the table below.

Table 3. EU directive resolutions

NAME	DESCRIPTION
2014/30/EU	Electromagnetic Compatibility Directive (EMC)
2014/35/EU	Compliance with Low Voltage Directive (LVD)

The compliance to the above-mentioned directives was confirmed by measurement and research laboratories and development centres independent from the manufacturer.

Table 4. EU directive resolutions and tests.

NAME	DESCRIPTION
Low Voltage Directive:	
EN 60950-1:2006/A1 1:2009	Information technology equipment – Safety Part 1:General requirements
Electromagnetic disturbances:	
EN 55022:2010 (CISPR 22:2008)	Conducted disturbance at the mains ports
	Conducted disturbance at the telecommunication ports
	Radiated disturbance to 1 GHz
EN 61000-3-2:2006 EN 61000-3-2:2006/A1:2009 EN 61000-3-2:2006/A2:2009	Harmonic current emission
Electromagnetic immunity:	
EN 61000-4-3:2006 EN 61000-4-3:2006/A1:2008 EN 61000-4-3:2006/A2:2010	Radiated RF electromagnetic field immunity test
EN 55024:2010 EN 61000-4-2:2009	Electrostatic discharge immunity test
EN 55024:2010 EN 61000-4-4:2012	Electrical fast transients/burst immunity test (power port)
EN 55024:2010 EN 61000-4-4:2012	Electrical fast transients/burst immunity test (signal ports)
EN 55024:2010 EN 61000-4-5:2006	Surges immunity test (power port)
EN 55024:2010 EN 61000-4-5:2006	Surges immunity test (signal ports)
EN 55024:2010 EN 61000-4-6:2014	Conduced disturbances, induced by radio-frequency fields (power ports)
EN 55024:2010 EN 61000-4-6:2014	Conduced disturbances, induced by radio-frequency fields (signal ports)
EN 55024:2010 EN 61000-4-8:2010	Power frequency magnetic field immunity test
EN 61000-4-16:2016	Main frequency voltage (power ports)
EN 61000-4-17:2011	Ripple on d. c. power supply (power ports)
EN 61000-4-18:2011	Damped oscillatory wave (power ports) Common mode Differential mode
EN 61000-4-29:2004	Voltage dips (power ports)
Environmental tests:	

NAME	DESCRIPTION
EN 60068-2-2:2007	Dry heat (70°C for 24h)
EN 60068-2-6:2008	Vibration (2g, 10-500Hz, 1octave/min, 10 sweep cycles)
EN 60068-2-78:2013	Damp heat, steady state (95% RH and 40°C for 48h)
Control Management Software (CMS) tested by DNV GL:	
IEC 61850 Edition 2 Parts 6, 7-1, 7-2, 7-3, 7-4 and 8-1	Communication networks and systems for power utility automation
IEC 60870-5-104 Edition 2 (IS 2006)	Network Access for IEC 60870-5-104 using standard transport profiles in Standard direction and the Enilit default Protocol Implementation Document for IEC 60870-5-104 v.3.
IEC 60870-5-101 Edition 2 (IS 2003)	Companion Standard for basic telecontrol tasks in Standard direction and the UAB Enilit IEC 60870-5-101 Master and Slave Station Unbalanced Interoperability Checklist (Version 1.2, 2019).

2.5 Handling of electronic equipment

A person's normal movements can easily generate electrostatic potentials of several thousand volts.

The discharge of these voltages into semiconductor devices when handling circuits can cause serious damage which often may not be immediately apparent but the reliability of the circuit will have been reduced.

The electronic circuits of UAB Enilit products are immune to the relevant levels of electrostatic discharge when housed in their cases. Do not expose them to the risk of damage by withdrawing modules unnecessarily.

Each module incorporates the highest practicable protection for its semiconductor devices.

However, if it becomes necessary to withdraw a module, the following precautions should be taken in order to preserve high reliability and long life for which the equipment has been designed and manufactured.

1. Before removing a module, ensure the user is of the same electrostatic potential as the equipment by touching the case.
2. Handle the module by its front-plate, frame, or edges of the printed circuit board. Avoid touching the electronic components, printed circuit track or connectors.
3. Do not pass the module to any person without first ensuring that both persons are at the same electrostatic potential. Shaking hands achieves equipotential.
4. Place the module on an antistatic surface or conducting surface which is at the same potential as the user.
5. Store or transport the module in a conductive bag.

If measurements are being made on the internal electronic circuitry of any equipment in service, it is preferable that the user is earthed to the case with a conductive wrist strap.

Wrist straps should have a resistance to ground between 500k–10M Ohms. If a wrist strap is not available, a regular contact with the case should be maintained to prevent the build-up of static. Instrumentation which may be used for making measurements should be earthed to the case whenever possible.

More information on safe working procedures for all electronic equipment can be found in IEC 60147-0F and BS5783.

2.6 Warnings regarding the use of UAB Enilit products

UAB Enilit products are not designed with components tested for the level of reliability suitable for the use in connection with surgical implants or as critical components in any life support systems, whose failure to perform can reasonably be expected to cause significant injuries to a human.

In any application including the above, the reliability of operation of the software products can be impaired by adverse factors, including – but not limited – to fluctuations in electrical power supply, computer hardware malfunctions, computer operating system, software fitness, fitness of compilers and development software used to develop an application, installation errors, software and hardware compatibility problems, malfunctions or failures of electronic monitoring or control devices, transient failures of electronic systems (hardware and/or software), unanticipated uses or misuses, or errors from a user or applications designer (adverse factors such as these are collectively termed 'System failures').

Any application where a system failure would create a risk of harm to property or persons (including the risk of bodily injuries and death) should not be reliant solely upon one form of electronic system due to the risk of system failure to avoid damage, injury or death. The user or application designer must take reasonable steps to protect against system failure, including – but not limited – to back-up or shut-down mechanisms, not because end-user system is customized and differs from UAB Enilit testing platforms but also the user or application designer may use UAB Enilit products in combination with other products.

These actions cannot be evaluated or contemplated by UAB Enilit; Thus, the user or application designer is ultimately responsible for verifying and validating the suitability of UAB Enilit products whenever they are incorporated in a system or application, even without the limitation of the appropriate design, process and safety levels of such a system or application.

2.7 Guarantees

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3. Enilit RTU hardware

3.1 System conception

Enilit RTU is a modular, freely scalable remote control and automation device.

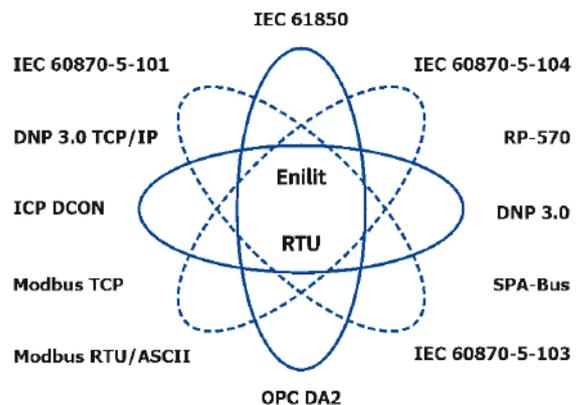
The field of its application covers fully automatic monitoring and control of decentralized process stations or RTUs (e.g. in medium voltage switch bays). Plug-in I/O modules serve for process connection, and communication modules are available for the additional connection of subsystems (e.g. for serial connection of sensors and actuators).

Communication between different RTUs and between RTUs and the control centre can take place via different media, for instance:

- dedicated lines (private or leased lines) based on copper cables or glass FO cables;
- dial-up connections via analogue telephone network, digital ISDN network and GSM networks (900 MHz, e.g. D1 or D2);
- serial interfaces V.24/V.28 in combination with transmission systems like PCM30, PDH or SDH systems, or with private radio networks;
- LAN/WAN connections via 10/100/1000 MB/s-Ethernet and TCP/IP.

It supports the following communication protocols:

- IEC 60870-5-101
- IEC 60870-5-103
- IEC 60870-5-104
- DNP3 serial
- DNP3 TCP/IP
- IEC 61850
- Modbus RTU/ASCII
- Modbus TCP
- RP-570
- OPC DA2
- SPA-Bus
- ICP DCON



In its standard form, data transmission takes place via IEC 60870-5-101 protocol (symmetrical and asymmetrical procedure). Protection equipment can be connected via IEC 60870-5-103, Modbus RTU, DNP3, IEC 61850, SPA-Bus and RP570 protocols.

Network interfaces enable communication via IEC 60870-5-104, DNP3 (possibility to use DNP3 with secure authentication) and Modbus TCP protocol.

It is possible to use secure connections (SSL/TLS). Enilit RTU can use X.509 certificates for authentication. The functionalities of RADIUS and LDAP are constituent parts of OS Windows and both of them are enabled by default or could be disabled, if unnecessary.

Enilit RTU has the integrated firewall and possibility to install security updates for better protection against internal and external damage.

Enilit RTU supports Syslog protocol what allows event logs to be sent to a remote Syslog server. The feature can be activated by the manufacturer upon the customer's request.

Automation tasks are integrated by the means of the optional PLC functionality according to IEC 61131-3.

Configuration and management can be carried out either locally via the software or via the network from a remote computer.

3.2 Rack mounting and frame

The frame of Enilit RTU consists of the components of a metal housing, an internal bus system and a plug-in system. A standard RTU includes at least a power supply module and a central processor module. The maximum number of 12 slots for I/O and communication modules is available.

More I/O modules can be achieved by connecting two frames. The extension frame should have a power supply and can have 16 I/O or communication modules of any type. The frames are connected with an external cable for communication between the CPU and the modules of the extension frame. Expanding Enilit RTU with the extension frame, it can be achieved up to 28 I/O modules.

For smaller installations where the CPU and a single I/O card are needed, a small frame could be used. In the table below, possible frame configurations are shown.

Table 5. Frame sets

RACK TYPE	SLOTS FOR POWER SUPPLY	SLOTS FOR CPU	SLOTS FOR I/O or COMMUNICATION MODULES
Standard	2 pcs.	1 pcs.	12 pcs.
Extended	2 pcs.	0 pcs.	16 pcs.
Small	2 pcs.	1 pcs.	1 pcs.

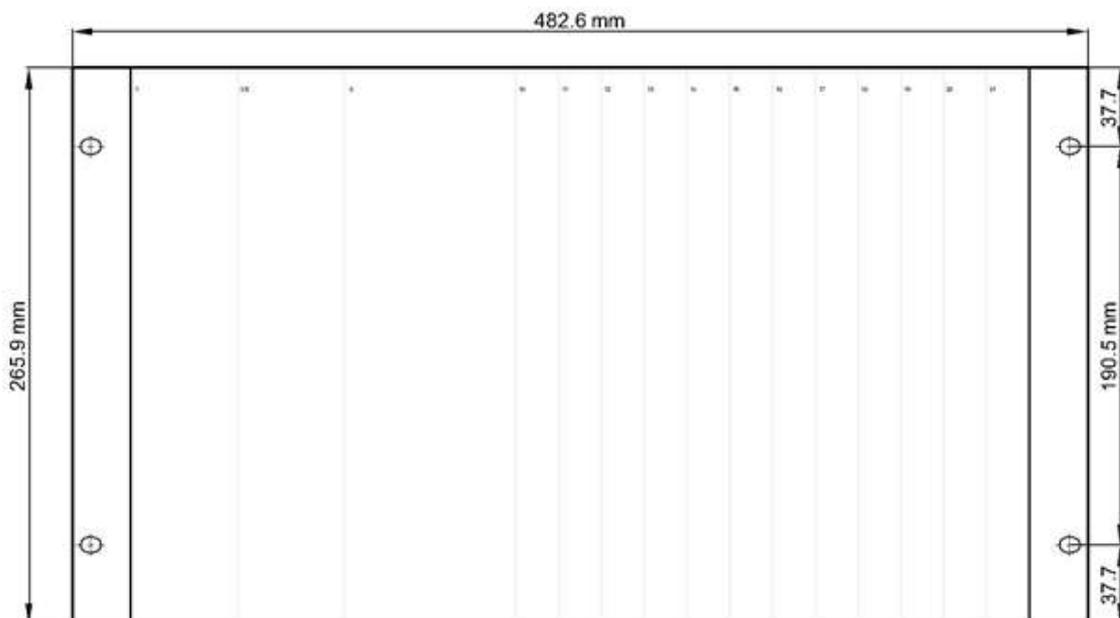


Figure 2. Standard or extended frame, Front view

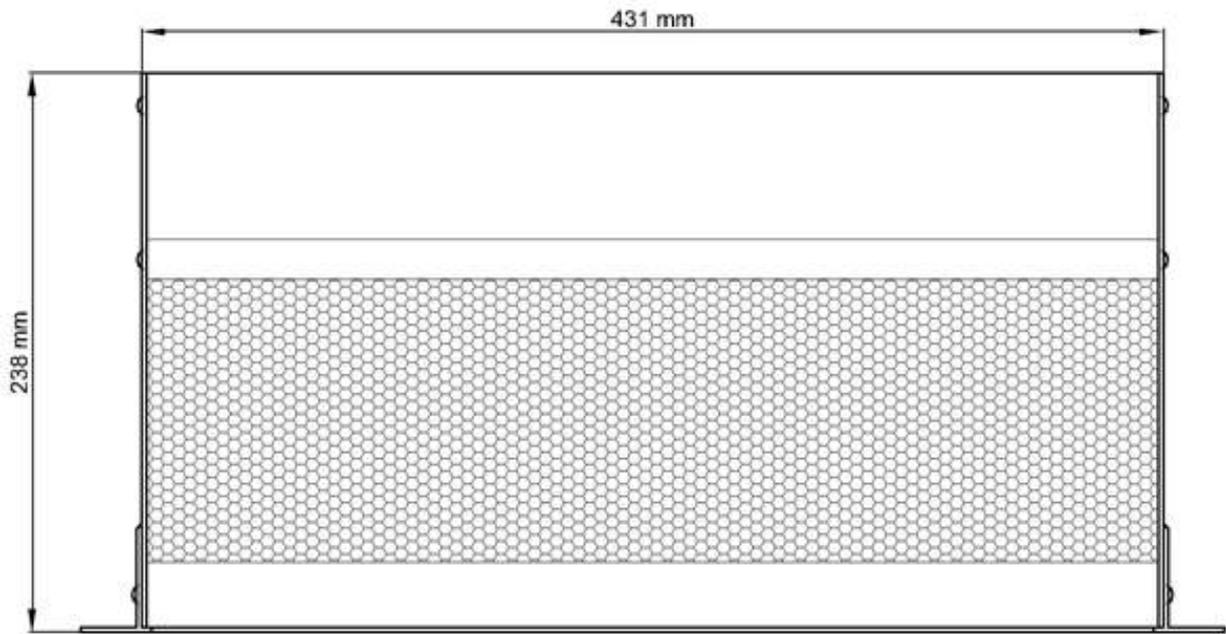


Figure 3. Standard or extended frame, Top view

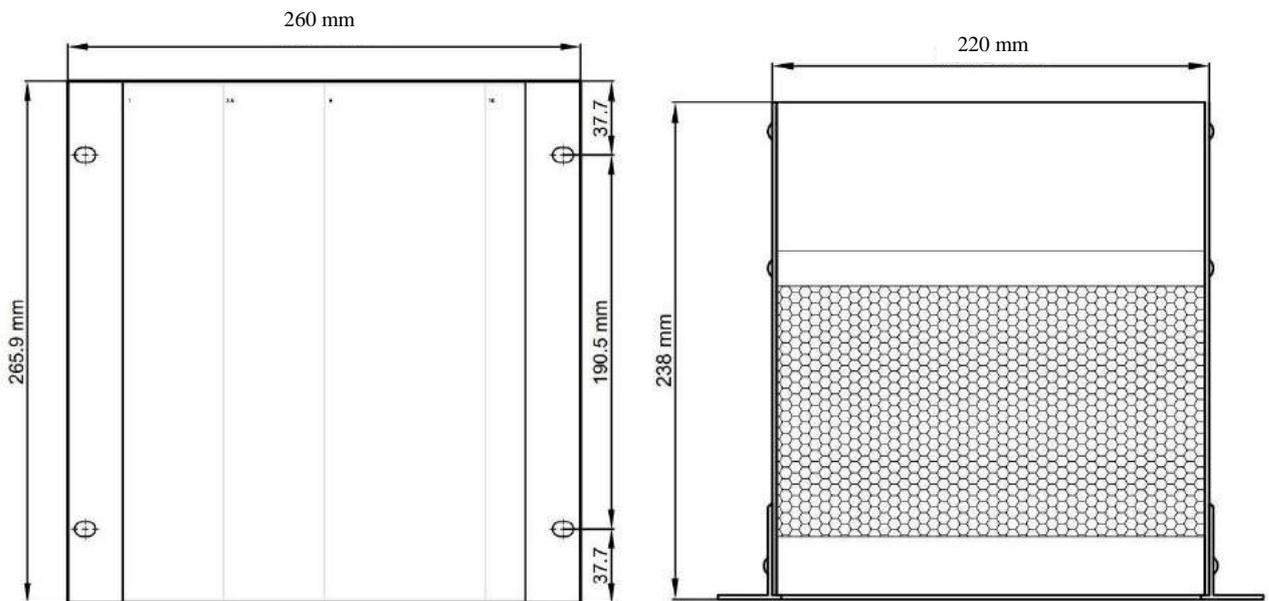


Figure 4. Small frame, Front and top view

3.3 Short hardware review

The remote terminal unit Enilit RTU comes in a standard 6U frame system under the protection class IP-20. A single frame can include:

- two power supply modules,
- a central processor module,
- 12 slots for I/O and communication modules (the maximum number of 12 modules could be installed inside the rack. There is no difference for Enilit RTU in which sequence or type (DI, DO, AI, AC, ST, PL, CD, CK or LAN) the modules are installed in the rack.

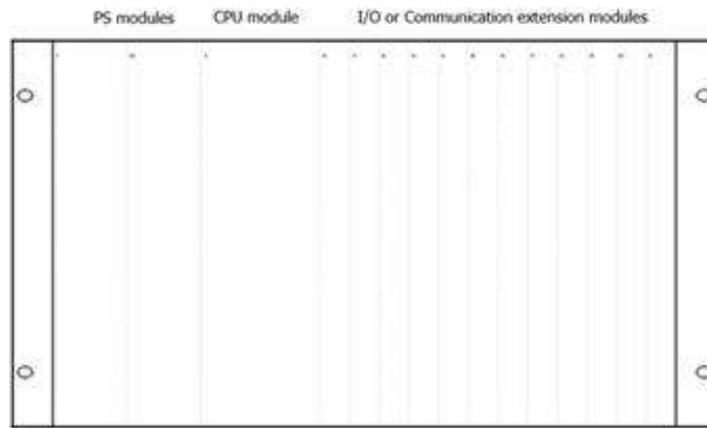


Figure 5. Enilit RTU, Front view

3.3.1 Power supply module

The types of power supply modules available are listed in the table below.

Table 6. Types of power supply modules

APPLICATION	MODULE
Input voltage 230V AC/DC	PS-21
Input voltage 110V DC	PS-31
Input voltage 48V DC	PS-51

Note: A power supply module of any range of AC or DC input is available on special request.

3.3.2 Central processor module

The central processor module is in charge of the operation of the communication interface, I/O modules, the acquisition and archiving of process information and the execution of PLC programs.

The following central processor module available in the standard version is provided in table 3.3 below.

Table 7. Central processor module

MODULE	COMMUNICATION INTERFACES
CPU-4x	4 Ethernet (RJ45), 12 Serial links (RJ45)

3.3.3 I/O modules

Depending on the scope of process data, it is possible to fit free slots with the necessary I/O modules irrespectively of the signal type.

The I/O modules available are listed in the table below.

Table 8. I/O modules

APPLICATION	MODULE	I/O	DESCRIPTION
Digital input module	DI-11	24	24VDC
Digital input module	DI-21	24	48VDC
Digital input module	DI-31	24	110VDC
Digital input module	DI-41	24	220VDC
Digital output module	DO-31	24	DC13, 250VDC, 0.2A
Analogue input module	AI-31	12	-20mA ... +20mA or -10V ... 10V
Direct measurements module	AC-31	12	6xCT & 6xVT

3.3.4 Communication extension modules

Depending on the scope of process data, it is possible to fit free slots with the necessary communication extension modules. The communication extension modules available are listed in table 3.5 below.

Table 9. Communication extension modules

APPLICATION	MODULE	PORTS	DESCRIPTION
Glass fibre optic module	ST-61	6	6 x FO (ST type)
Plastic fibre optic module	PL-61	6	6 x FO (PL type)
Communication module	CD-61	6	6 x RS-232
Communication module	CK-61	6	6 x RS-485
Ethernet communication module	LAN-21	2/4	2xLAN or 4xLAN

3.4 Additional features

An external VGA compatible monitor, keyboard and mouse or can be used for monitoring, management and configuration of Enilit RTU.



An external touch screen monitor can be used for visualization and control of one or several feeders (HMI).

A computer with SCADA can be used for local substation management.

Enilit RTU can be used as a protocol converter (gateway).

3.5 Central processor unit (CPU) module

There are four types of central processor unit (CPU) modules available as shown in the table below.

Table 10. Types of central processor units (CPU)

MODULE	COMMUNICATION INTERFACES
CPU-41	4 x Ethernet (RJ45), 12 x RS485 Serial links(RJ45)
CPU-42	4 x Ethernet (RJ45), 4 x RS232 Serial links (RJ45), 8 x RS485 Serial links (RJ45)
CPU-43	4 x Ethernet (RJ45), 8 x RS232 Serial links (RJ45), 4 x RS485 Serial links (RJ45)
CPU-44	4 x Ethernet (RJ45), 12 x RS232 Serial links (RJ45)

The CPU module serves for the operation of communication interfaces, the control of I/O and communication extension modules, the acquisition and archiving of process information, and the execution of PLC programs.

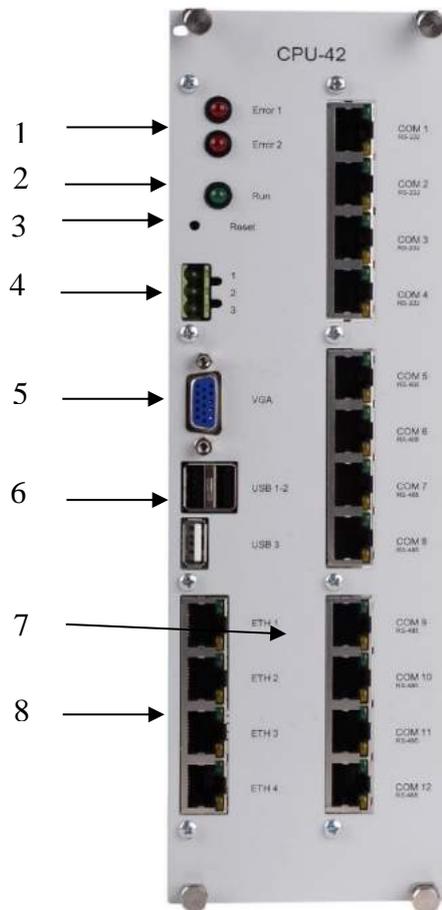


Figure 6. Central processor module, Front view

Table 11. Constituents of central processor unit module and their assignment

No.	EXPLANATION	NOTE	FUNCTION	LED INDICATION
1	LED indicator	Error1	Hardware configuration status	LED is blinking – there is a mistake in the hardware configuration.
		Error2	User defined	
2	LED indicator	Run	CPU status	LED is blinking – the device is running alright.
3	Push button	Reset	Manually reset device by pushing	
4	Connection terminals		Watchdog	
5	VGA socket	VGA	Socket to connect LCD monitor	
6	USB socket	USB1-USB4	Socket to connect keyboard, mouse, USB stick and etc.	
7	Serial communication interface socket RJ-45	COM1-COM12	Connect other RTUs, IEDs or protection devices.	
8	Ethernet communication interface socket RJ-45	ETH1-ETH4	Connect control centres or protection devices.	

Note. If Error1 and Error2 LEDs light up and the RUN LED is OFF, it means the CPU module is in failure or the system is in the starting up mode.

3.5.1 Serial communication interface (RJ-45)

CPU-4x has 12 serial communication ports. The serial communication interfaces (RS232 or RS422/485) are designed as 8-pole RJ45 connectors with integrated LEDs.

Table 12. CPU module RJ-45 (COM) connector pin assignment for RS232/422/485

PIN	DESIGNATION			
	RS-232	RS-422	RS-485 (4 WIRE)	RS-485 (2 WIRE)
1	Not used	Not used	Not used	Not used
2	RX	RX +	RB +	DB +
3	TX	TX +	TB +	DB +
4	Not used	GND	GND	GND
5	GND	RX -	RA -	DA -
6	Not used	TX -	TA -	DA -
7	Not used	Not used	Not used	Not used
8	Not used	Not used	Not used	Not used

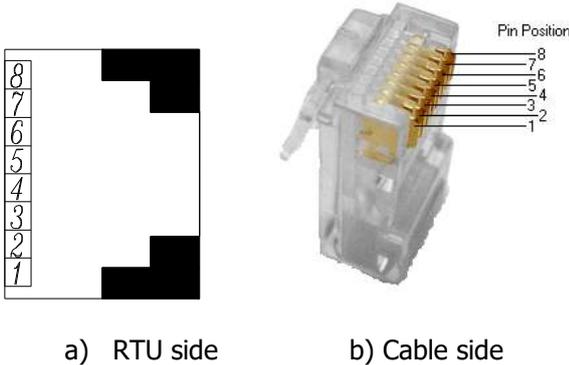


Figure 7. RJ45 connector

The status of each communication interface is shown via the two software-controlled LEDs that are installed in the connectors.

The yellow LED is activated during the transmission of data in the transmission direction. The green LED is activated during the transmission of data in the receive direction.

3.5.2 Ethernet interface (RJ-45)

Ethernet communication interfaces are designed as 8-pole RJ45 connectors with integrated LEDs.

Table 13. Pin assignment

PIN	DESIGNATION
1	-TX
2	+TX
3	+RX
4	BI_DC+
5	BI_DC-
6	-RX
7	BI_DD+
8	BI_DD-

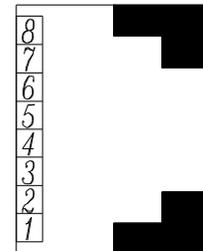


Figure 8. RJ45 connector

The status of each communication interface is shown via the two software-controlled LEDs that are installed in the connectors:

The green LED lights up if there is a physical connection to the device, i.e. if the connection layer is in operation. The yellow LED is activated during the transmission of data in the transmission or the receive direction.

3.5.3 Parallel Redundancy Protocol (PRP)

Parallel Redundancy Protocol (PRP) is supported by Enilit RTU and no additional equipment is required. PRP is a network protocol standard for the Ethernet that provides a seamless failover against a failure of any network component.

3.5.4 Technical data

Table 14. Technical data of central processor unit

FEATURE	VALUE
Processor	64-bit microprocessor – 1.6 ... 1.8GHz; internal watchdog; 2048 MB Dynamic memory DRAM; 32 GB Solid State Drive (for software, databases, events, waveforms, parameters);
Communication interfaces	RS232 RS485 / RJ45 socket (8-pin socket); DTE / max. speed: 115,2Kb;

FEATURE	VALUE
Ethernet interface	Ethernet (10/100/1000 Base-TX) / RJ45 socket (8-pin socket) Twisted-pair cable CAT5 / speed: 10/100/1000Mbps
Working temperature	-25 ~ +85°C, the range can be extended on request
Working humidity	0 ~ 95% RH non-condensing

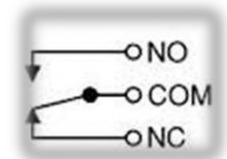
3.5.5 Watchdog

Table 15. Watchdog functioning of Enilit RTU

WATCHDOG STATE	DESCRIPTION
Normal	Device is turned on, Enilit CMS is working, RTU hardware configuration state has no abnormal card states.
Normal	Device is starting. The period of timeout in the watchdog relay has not expired yet.
Error	Device is turned off.
Error	Configuration and management software Enilit CMS is closed and the period of timeout in the watchdog relay has expired.
Error	RTU hardware configuration window shows abnormal card states.
Error	RTU has detected a hardware error.

Table 16. Contacts of watchdog relay

TERMINAL	FUNCTION
1	NO
2	COM
3	NC



3.6 Power supply module

There are five types of power supply modules available as listed in the table below.

Table 17. Power supply modules

APPLICATION	MODULE
Input voltage 230VAC/DC	PS-21
Input voltage 110VDC	PS-31
Input voltage 48VDC	PS-51

In one Enilit RTU, two power supply modules can be installed, one of which can be supplied from different voltage sources: e.g., one from an AC and another from a DC supply voltage at the same time.



Figure 9. Power supply module, Front view

Table 18. Constituents of PS module and their assignment

No	EXPLANATION	NOTE	FUNCTION	LED INDICATION
1	LED indicator	5V	PS output voltage status	LED is ON – voltage is OK
2	LED indicator	12V	PS output voltage status	LED is ON – voltage is OK
3	LED indicator	48VDC 110VDC 230VAC 220VDC	PS input voltage status	LED is ON – voltage is OK
4	Input voltage connection terminals			

3.6.1 Wiring

Table 19. Pin assignment of input socket in PS module

TERMINAL	FUNCTION	
	AC Voltage	DC Voltage
L(+)	L1	+
N(-)	N	-
PE	Ground	Ground

3.6.2 Technical data

Table 20. Technical data of PS module

FEATURE	VALUE
Input voltage range: - Input voltage range PS 21 - Input voltage range PS 31 - Input voltage range PS 51	176 ~ 264VAC/176 ~ 264VDC 43 ~ 160VDC 16.5 ~ 75VDC
Frequency range	47 ~ 63Hz
Maximum power consumption	70W
Working temperature	-25 ~ +85°C
Working humidity	0 ~ 95% RH non-condensing
Removable Internal fuses: -PS 21 -PS 31 -PS 41 -PS 51	2A 4A 2A 6A

3.7 Digital input (DI) module

Digital input (DI) module serves for the processing of up to 24 digital input signals.

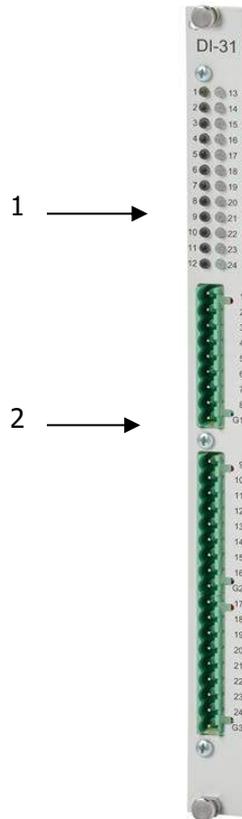


Figure 10. Digital input (DI) module, Front view

Table 21. Constituents of DI module and their assignment

No.	EXPLANATION	FUNCTION	LED INDICATION
1	LED indicators for each digital input	Digital input status	LED is ON – the input is active; LED is OFF – the input is inactive; ALL LEDS are blinking together – there is no connection with CPU or there is an error at the digital input module.
2	Connection terminals	See table 10 and wiring diagram in Fig. 11	-

3.7.1 Wiring diagram

Table 22. Pin assignment of DI module

TERMINAL	FUNCTION
1	DI 1
2	DI 2
3	DI 3
4	DI 4
5	DI 5
6	DI 6
7	DI 7
8	DI 8
G1	COM
9	DI9
10	DI10
11	DI11
12	DI12
13	DI13
14	DI14
15	DI15
16	DI16
G2	COM
17	DI17
18	DI18
19	DI19
20	DI20
21	DI21
22	DI22
23	DI23
24	DI24
G3	COM

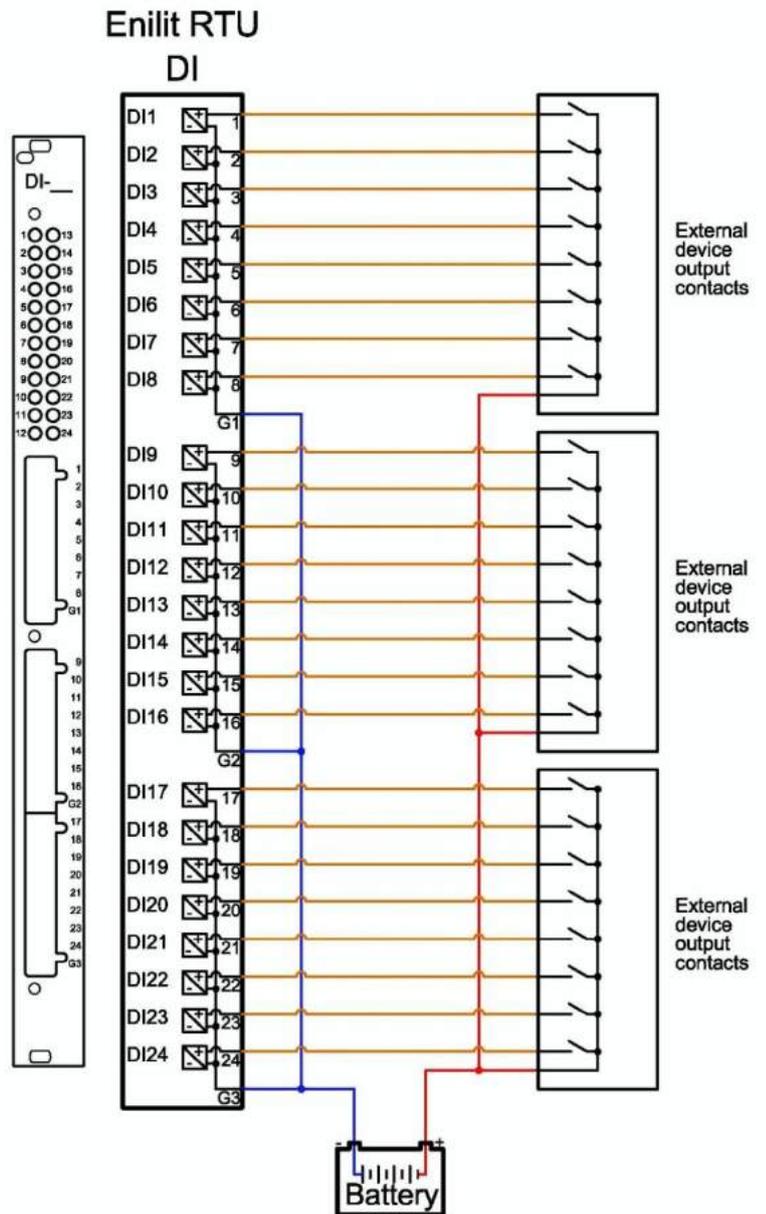


Figure 11. Digital input module, Wiring diagram

3.7.2 Technical data

Table 23. Technical data of DI module

FEATURE	VALUE
Number of inputs	24
Time tag	1ms
Galvanic isolation - from system electronics - of the channels from one another	Yes (optocoupler) No (groups of 8 channels share a common ground)
Signalling-circuit voltage - Input voltage range DI 11 - Input voltage range DI 21 - Input voltage range DI 31 - Input voltage range DI 41	16 ... 30VDC 34 ... 72VDC 80 ... 150VDC 150 ... 264VDC
Increased insulation resistance according to IEC 60255-5 - power-frequency withstand voltage - surge voltage	2.5kV; 50Hz; 1min 4.4kV; 1.2/50µs; 0.5J
Power consumption for active binary input ^v	1 – 3mA (depending on the used voltage)

3.8 Digital output (DO) module

Digital output (DO) module serves for the processing of up to 24 digital outputs.

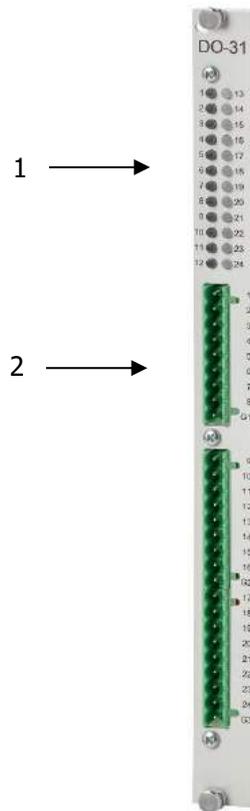


Figure 12. Digital output (DO) module, Front view

Table 24. Constituents of DO module and their assignment

No.	DESCRIPTION	FUNCTION	LED INDICATION
1	LED indicators for each digital output	Digital output status	LED is ON – output is active; LED is OFF – output is inactive; ALL LEDS are blinking together – no connection with CPU or digital output board error.
2	Connection terminals	See table 13 and wiring diagram in Fig. 13 below.	-

3.8.1 Wiring diagram

Table 25. Pin assignment of DO module

TERMINAL	FUNCTION
1	DO1
2	DO2
3	DO3
4	DO4
5	DO5
6	DO6
7	DO7
8	DO8
G1	COM
9	DO9
10	DO10
11	DO11
12	DO12
13	DO13
14	DO14
15	DO15
16	DO16
G2	COM
17	DO17
18	DO18
19	DO19
20	DO20
21	DO21
22	DO22
23	DO23
24	DO24
G3	COM

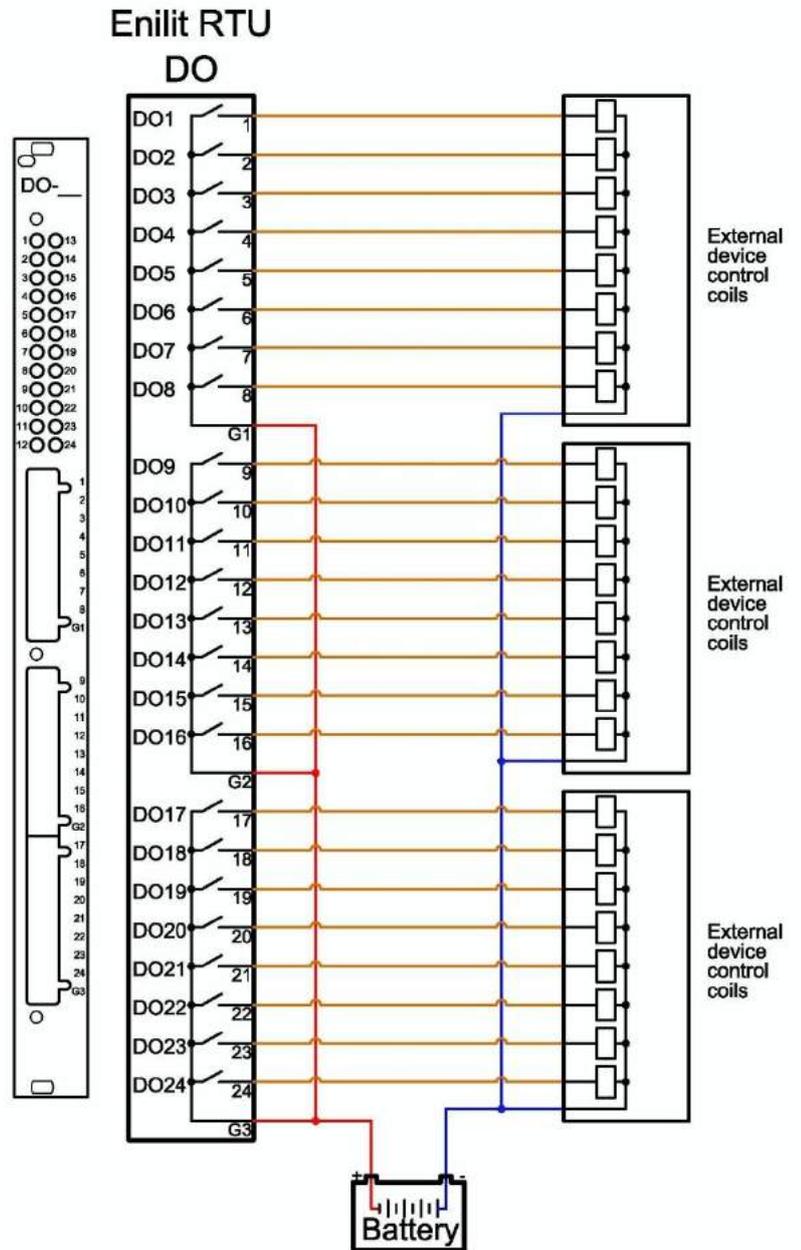


Figure 13. Digital output module, Wiring diagram

3.8.2 Technical data

Table 26. Technical data of DO module

FEATURE	VALUE
Number of outputs	24
Galvanic isolation: - from system electronics; - of channels from one another.	Yes (optocoupler) Yes
Switching capacity by default: AC1 AC15 AC3 DC1 DC13	8A / 250VAC 3A / 120V; 1,5A / 240V (B300) 0,37kW; 240VAC (single-phase motor) 8A / 24VDC 0,22A / 120V; 0,1A / 250V (R300)
Voltage (control circuit of the relay): - rated value; - operating range.	12VDC 3 ... 220V
Increased insulation resistance according to IEC 60255-5: - power-frequency withstand voltage; - surge voltage.	2.5kV; 50Hz, 1min 4.4kV; 1.2/50µs; 0.5J

Note: Any auxiliary relays with larger disconnection capacity can be installed on customer request.

3.9 Analogue input module AI-31

Analogue input module AI-31 serves for the processing of up to twelve analogues, current or voltage input signals.

Note. Measuring current or voltage can be selected for each input separately by the internal jumper position.



Current -20mA to +20mA measuring



Voltage -10V to +10V measuring

Figure 14. Analogue input switch position

Table 27. Constituents of analogue input module AI-31 and their assignment

No.	EXPLANATION	FUNCTION	LED INDICATION
1	LED indicators for each analogue input	Analogue input status	LED is OFF – normal measured value; LED is ON – measured value is under or over range; ALL LEDS are blinking together – there is no connection with CPU or there is an error in the analogue input module.
2	Connection terminals	See table 16 and wiring diagram in Fig. 15 below	-

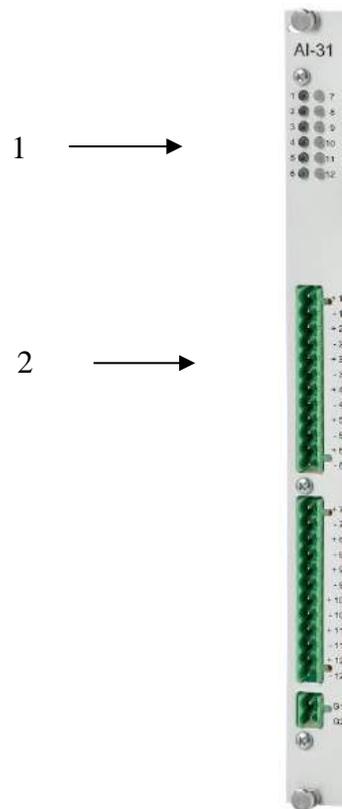


Figure 15. Analogue input module, Front view

3.9.1 Wiring diagram

Table 28. Pin assignment of AI-31 module

TERMINAL	FUNCTION
+1	Analogue input 1+
-1	Analogue input 1-
+2	Analogue input 2+
-2	Analogue input 2-
+3	Analogue input 3+
-3	Analogue input 3-
+4	Analogue input 4+
-4	Analogue input 4-
+5	Analogue input 5+
-5	Analogue input 5-
+6	Analogue input 6+
-6	Analogue input 6-
+7	Analogue input 7+
-7	Analogue input 7-
+8	Analogue input 8+
-8	Analogue input 8-
+9	Analogue input 9+
-9	Analogue input 9-
+10	Analogue input 10+
-10	Analogue input 10-
+11	Analogue input 11+
-11	Analogue input 11-
+12	Analogue input 12+
-12	Analogue input 12-
G1	Ground
G2	Ground

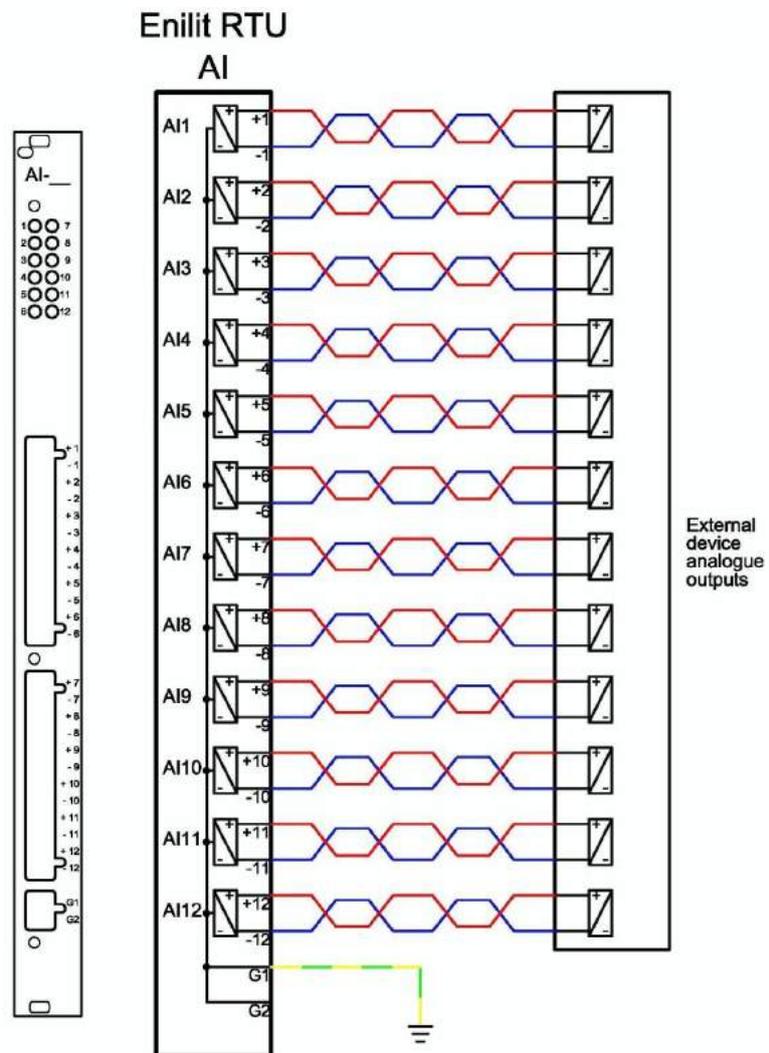


Figure 16. Analogue input module AI-31, Wiring diagram

3.9.2 Technical Data

Table 29. Technical data of analogue input module AI-31

FEATURE	VALUE
Number of inputs	12
Galvanic isolation: -from system electronics; -of the channels from one another.	Yes (optocoupler) Yes
Measuring ranges (standard fitting)	Configurable via switch
Resolution in all ranges	16 bit
Acquisition cycle maximum	100ms
Increased insulation resistance according to IEC 60255-5: -power-frequency withstand voltage; -surge voltage.	2.5kV; 50Hz, 1min 4.4kV; 1.2/50 μ s; 0.5J

3.10 Direct measurements module AC-31

Direct measurement module AC-31 serves for the processing of up to 6 ($I_{nom.}=1A$) direct current transformer inputs and up to 6 ($U_{nom.}=100V$) direct voltage transformer inputs.

Note: AC-31 module is produced on customer request and can be ordered with different nominal values.

Table 30. Constituents of direct measurements module AC-31 and their assignment

No.	EXPLANATION	FUNCTION	LED INDICATION
1	LED indicators for each input	Measurement input status	LED is OFF – normal measured value or other value on customer request; LED is ON – measured value is under or over range, ALL LEDS are blinking together – there is no connection with CPU or there is an error in the analogue input module.
2	Connection terminals	See table 19 and wiring diagram in Fig. 17 below	-

3.10.1 Wiring diagram

Table 31. Pin assignment of AC-31 module

TERMINAL	FUNCTION
+1	I1 Current input L1
-1	I1 Current input N1
+2	I2 Current input L2
-2	I2 Current input N2
+3	I3 Current input L3
-3	I3 Current input N3
+4	V1 voltage input V1
-4	V1 voltage input 01
+5	V2 voltage input V2
-5	V2 voltage input 02
+6	V3 voltage input V3
-6	V3 voltage input 03
+7	I4 Current input L4
-7	I4 Current input N4
+8	I5 Current input L5
-8	I5 Current input N5
+9	I6 Current input L6
-9	I6 Current input N6
+10	V4 voltage input V4
-10	V4 voltage input 04
+11	V5 voltage input V5
-11	V5 voltage input 05
+12	V6 voltage input V6
-12	V6 voltage input 06
G1	Ground
G2	Ground

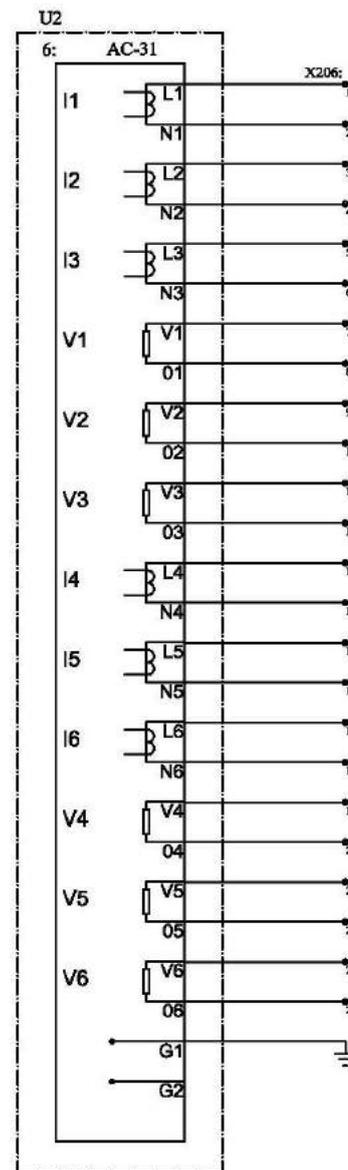


Figure 17. Measurement input module AC-31, Wiring diagram

3.10.2 Technical data

Table 32. Technical data of direct measurements module AC-31

FEATURE	VALUE
Number of inputs	12
Galvanic isolation: -from system electronics; -of the channels from one another.	Yes (optocoupler) Yes
Measuring ranges (standard fitting)	
Resolution in all ranges	16 bit
Acquisition cycle maximum	100ms
Increased insulation resistance according to IEC 60255-5: -power-frequency withstand voltage; -surge voltage.	2.5kV; 50Hz, 1min 4.4kV; 1.2/50 μ s; 0.5J

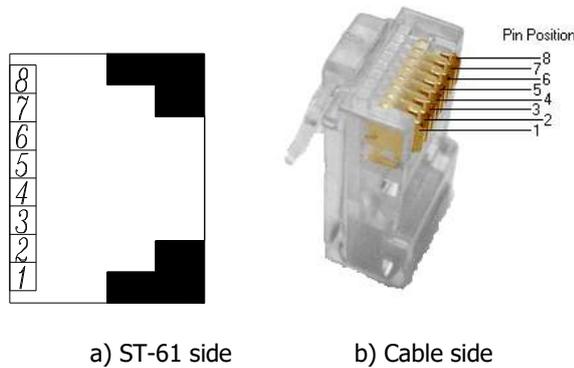
3.11 Glass fibre optic module ST-61

Glass fibre optic module ST-61 is designed to provide communication from six glass fibre optic ports to one RS-422/RS-485 serial port for communication with the CPU module. External jumper cable is used for this.

ST-61 uses a separate LED emitter and photo-detector operating at an 820nm wavelength. Almost any multimode glass fibre can be used including 50/125µm, 62.5/125µm, 100/140µm, and 200µm with ST type connectors. Two fibres are required between the two devices, one for each direction of data. The serial communication interfaces (RS-422 or RS-485) are designed as 8-pole RJ45 connectors.

Table 33. ST-61 module RJ-45 (COM) connector pin assignment for RS422/485

Pin	DESIGNATION		
	RS-422	RS-485 (4 wire)	RS-485 (2 wire)
1	Not used	Not used	Not used
2	RX +	RB +	DB +
3	TX +	TB +	DB +
4	GND	GND	GND
5	RX -	RA -	DA -
6	TX -	TA -	DA -
7	Not used	Not used	Not used
8	Not used	Not used	Not used



a) ST-61 side b) Cable side
Figure 18. RJ45 connector

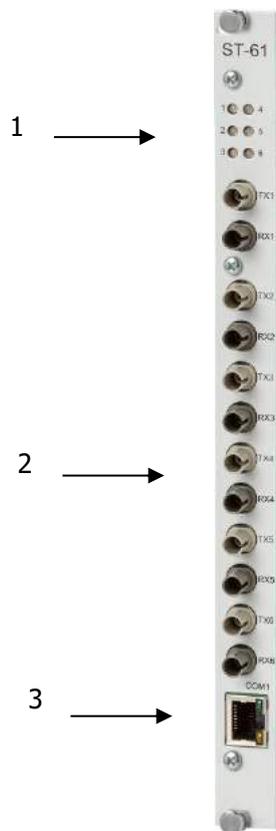


Figure 19. Glass fibre optic module, Front view

Table 34. Constituents of glass fibre optic module ST-61 and their assignment

No.	EXPLANATION	FUNCTION	LED INDICATION
1	LED indicators for each glass fibre optic port	Glass fibre optic port status	LED is blinking – the port is transmitting or receiving data; LED is OFF – the input is inactive; ALL LEDS are blinking together – there is no connection with CPU or there is an error at the glass fibre optic module.
2	LED emitters and photo-detectors	Communicates with IEDs by fibre optic multimode cable	-
3	RS-422/RS-485 serial port	Communicates with the CPU module	-

3.12 Plastic fibre optic module PL-61

Plastic fibre optic module PL-61 is designed to provide communication from six plastic fibre optic ports to one RS-422/RS-485 serial port for communication with the CPU module. External jumper cable is used for this.

PL-61 uses a separate LED emitter and photo-detector operating at a 660nm wavelength. Two fibres are required between the two devices, one for each direction of data.

The serial communication interfaces (RS-422 or RS-485) are designed as 8-pole RJ45 connectors.



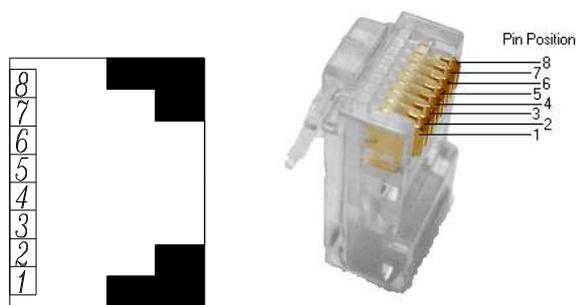
Figure 20. Figure 3.19 Plastic fibre optic module, Front view

Table 35. Constituents of plastic fibre optic module PL-61 and their assignment

No.	EXPLANATION	FUNCTION	LED INDICATION
1	LED indicators for each plastic fibre optic port	Plastic fibre optic port status	LED is blinking – the port is transmitting or receiving data; LED is OFF – the input is inactive; ALL LEDS are blinking together – there is no connection with CPU or there is an error at the glass fibre optic module.
2	LED emitters and photo-detectors	Communicates with IEDs by plastic optic multimode cable	-
3	RS-422/RS-485 serial port	Communicates with the CPU module	-

Table 36. Plastic fibre optic module PL-61 RJ-45 (COM) connector pin assignment for RS422/485

Pin	DESIGNATION		
	RS-422	RS-485 (4 wire)	RS-485 (2 wire)
1	Not used	Not used	Not used
2	RX +	RB +	DB +
3	TX +	TB +	DB +
4	GND	GND	GND
5	RX -	RA -	DA -
6	TX -	TA -	DA -
7	Not used	Not used	Not used
8	Not used	Not used	Not used



a) PL-61 side b) Cable side

Figure 21. RJ45 connector

3.13 Communication modules CD-61 and CK-61

Communication extension modules CD-61 and CK-61 are designed to provide communication from six RS-232 ports in CD-61 case and from six RS-485 ports in CK-61 case to one RS-422/RS-485 serial port for communication with the CPU module. External jumper cable is used for this.

The serial communication interfaces (RS-422 or RS-485) are designed as 8-pole RJ45 connectors.

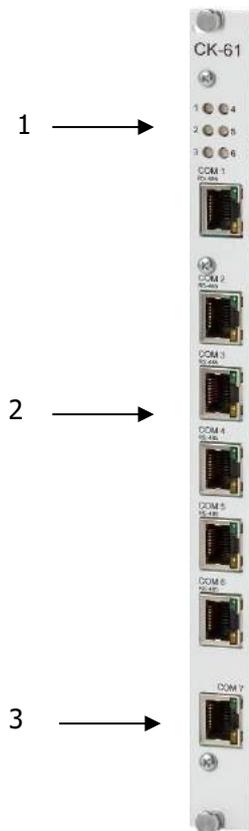


Figure 22. Communication module CK-61, Front view

The view of CD-61 module is identical.

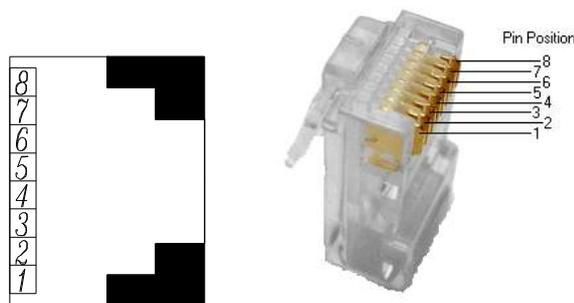
Table 37. Constituents of communication modules CK-61, CD-61 and their assignment

No.	EXPLANATION	FUNCTION	LED INDICATION
1	LED indicators for each RS-232 or RS-485 port	RS-232 or RS-485 port status	LED is blinking – the port is transmitting or receiving data; LED is OFF – the input is inactive; ALL LEDS are blinking together – there is no connection with CPU or there is an error at the glass fibre optic module.

No.	EXPLANATION	FUNCTION	LED INDICATION
2	RS-422/RS-485	Communicates with IEDs by Ethernet type of cable	-
3	RS-422/RS-485 serial port	Communicates with the CPU module	-

Table 38. Communication extension modules CK-61 and CD-61 RJ-45 (COM1) connector pin assignment for RS-232/485

PIN	DESIGNATION	
	RS-232	RS-485 (4 wire)
1	Not used	Not used
2	RX	RB +
3	TX	TB +
4	Not used	GND
5	GND	RA -
6	Not used	TA -
7	Not used	Not used
8	Not used	Not used



a) RTU side b) Cable side

Figure 23. RJ45 connector

The status of each communication interface is shown via the six software-controlled LEDs that are installed on the top of the card.

The yellow LED is activated during the transmission of data in the transmission direction. The green LED is activated during the transmission of data in the receive direction.

3.14 Ethernet communication module LAN-21

Ethernet communication extension module LAN-21 is designed to provide communication from two Ethernet ports to one USB port for communication with the CPU module. External jumper cable is used for this (USB to USB).

The Ethernet interfaces are designed as 8-pole RJ45 connectors. There is an option with four Ethernet ports available on request. Each Ethernet port has a separate MAC address.

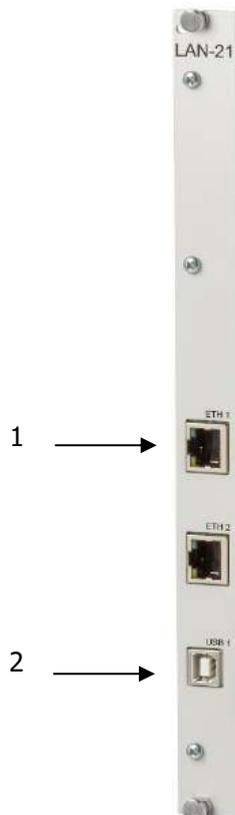


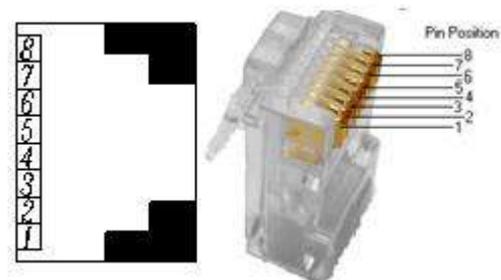
Figure 24. Ethernet communication module LAN-21, Front view

Table 39. Constituents of Ethernet communication modules LAN-21 and their assignment

No.	EXPLANATION	FUNCTION	LED INDICATION
1	Ethernet ports	Communicates with IEDs by Ethernet	The status of each communication interface is shown via the two software-controlled LEDs that are installed in the connectors: <ul style="list-style-type: none"> • green LED lights up if there is a physical connection to a device, i.e. if the connection layer is in operation; • yellow LED is activated during the transmission of data in the transmission or the receive direction.
3	USB port	Communicates with the CPU module	-

Table 40. Pin assignment of Ethernet communication module LAN-21

PIN	DESIGNATION
1	-TX
2	+TX
3	+RX
4	BI_DC+
5	BI_DC-
6	-RX
7	BI_DD+
8	BI_DD-



a) RTU side b) Cable side

Figure 25. RJ45 connector

3.15 Installation of system housing

Multi-frame systems of RTUs are usually installed in a cabinet (horizontal installation). The height between two pieces of equipment must be six height units (U), i.e. 266mm. It is important to leave the empty space of one U between two devices in order to allow for sufficient ventilation.

Another possibility is to install RTUs in a swing frame or on a mounting plate.

Note. RTUs should be installed in a dry, clean environment with an ambient temperature range of 0 ... + 60°C (standard) and air humidity of 0 ... 95% (non-condensation).

3.16 Order-book

3.16.1 Frame

Order number		Enilit RTU 12-5-111155CC6600-11110-0																				
Order number	Frame size	Small****										Standard										
		1	3	6	10	11	12	13	14	15	16	17	18	19	20	21	1	1	1	1	0	0
	Slot No.	1	2	5	1	1	1	1	5	5	C	C	6	6	0	0	1	1	1	1	0	0
	Choice row	1	2	5	1	1	1	1	5	5	C	C	6	6	0	0	1	1	1	1	0	0
	Power supply																					
1	PS-21 (input voltage 230VAC/DC)	x																				
2	PS-31 (input voltage 110VDC)		x																			
4	PS-51 (input voltage 48VDC)																					
0	Without redundant power supply																					
	CPU module																					
5	CPU-41 (4xEthernet RJ45, 12x RS485 serial links)		x																			
6	CPU-42 (4xEthernet RJ45, 4xRS232 serial links, 8xRS485 serial links)																					
7	CPU-43 (4xEthernet RJ45, 8x RS232 serial links, 4xRS485 serial links)																					
8	CPU-44 (4xEthernet RJ45, 12x RS232 serial links)																					
	Input / output or communication extension modules																					
1	DI-11 (24xDI, operating voltage 24VDC)				x	x	x	x														
2	DI-21 (24xDI, operating voltage 48VDC)																					
3	DI-31 (24xDI, operating voltage 110VDC)																					
4	DI-41 (24xDI, operating voltage 220VDC)																					
5	DO-31 (24xDO) *								x	x												
6	AI-31 (12xAI)												x	x								
7	AC-31 (12xAC) **																					
A	CD-61 (6xRS232)																					
B	CK-61 (6xRS485)																					
C	ST-61 (6xFO, fiber optic connector type-ST)											x	x									
D	PL-61 (6xFO, fiber optic connector type-plastic)																					
E	LAN-21 (2 Ethernet RJ45)																					
0	Without modules																				x	x
	Communications																					
1	IEC 60870-5-101 (serial communication protocol to upper or lower levels)																					x
1	IEC 60870-5-104 (Ethernet-based communication protocol to upper or lower levels)																					x
1	IEC 61850 (Ethernet-based communication protocol to upper or lower levels)																					x
1	IEC 60870-5-103 (legacy IED communication protocol to lower levels)																					x
1	DNP3, Modbus, SPA-Bus, RP-570																					
0	Without communication protocol																					x
	Logic																					
1	Included ISaGRAF for Programmable Logic.																					
0	Internal programmable logic																					x

* If the outputs with larger disconnection capacity are ordered, please define necessary values in the order.

** If AC-31 module is ordered, please define the nominal value in the order.

*** Any additions of modules for already in-service Enilit RTU must be aligned with the manufacturer.

**** No extensions can be added to configurations with small frame.

3.16.2 Extension

Order number		Enilit RTU 12-1111111555CC6600																			
Order number	Frame size	Extension																			
	Slot No.	1	3	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
	Choice row	1	2	1	1	1	1	1	1	1	5	5	5	C	C	6	6	0	0		
	Power supply																				
1	PS-21 (input voltage 230VAC/DC)	x																			
2	PS-31 (input voltage 110VDC)		x																		
4	PS-51 (input voltage 48VDC)																				
0	Without redundant power supply																				
	Input / output or communication extension modules																				
1	DI-11 (24xDI, operating voltage 24VDC)			x	x	x	x	x	x	x											
2	DI-21 (24xDI, operating voltage 48VDC)																				
3	DI-31 (24xDI, operating voltage 110VDC)																				
4	DI-41 (24xDI, operating voltage 220VDC)																				
5	DO-31 (24xDO) *											x	x	x							
6	AI-31 (12xAI)															x	x				
7	AC-31 (12xAC) **																				
A	CD-61 (6xRS232)																				
B	CK-61 (6xRS485)																				
C	ST-61 (6xFO, fiber optic connector type - ST)													x	x						
D	PL-61 (6xFO, fiber optic connector type - plastic)																				
E	LAN-21 (2 Ethernet RJ45)																				
0	Without modules																	x	x		

4. Enilit RTU software

4.1 Introduction

Enilit Configuration and Management Software (CMS) is the tool for simple and straightforward configuration, maintenance, management.

In the course of RTU configuration, the user can specify communication protocols and define the relationships between master and slave protocols. Also, it allows defining the relationships between hardware connections and slave protocols. The supported protocols are as follows:

- control direction:
 - IEC 60870-5-101
 - IEC 60870-5-103
 - IEC 60870-5-104
 - DNP3 serial
 - DNP3 TCP
 - IEC 61850
 - Modbus RTU/ASCII
 - Modbus TCP
 - SPA-BUS
 - RP-570
 - ICP DCON
- monitor direction:
 - IEC 60870-5-101

- IEC 60870-5-104
- DNP3 serial
- DNP3 IP
- SPA-BUS
- RP-570
- ICP DCON

Enilit RTU can be used as a gateway between the IEC61850 substation bus and SCADA protocols IEC 60870-5-101 and -104.

4.2 System capabilities

Enilit CMS capabilities include:

- the database of not less than 50000 information objects;
- not less than 1000 events per second;
- up to 96 serial slave devices.

4.3 Licensing

Enilit CMS software is included by default. Linux or Windows operating system license is included in the price of Enilit RTU. ISaGRAF license can be added on customer request.

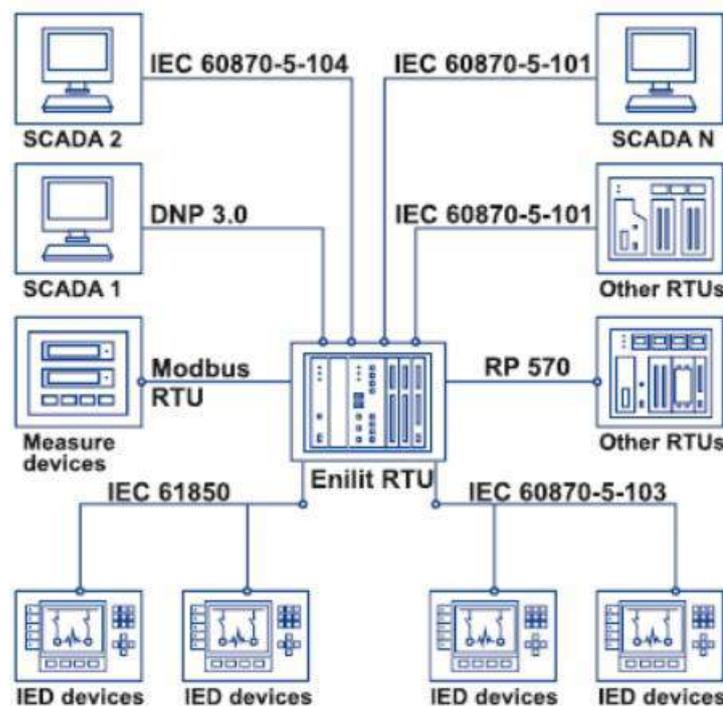


Figure 26. Concept of Enilit RTU Substation and SCADA system

4.4 User interface

The figure below shows the main window of Enilit CMS.

The user can choose one of the buttons to configure master protocols, slave protocols, hardware, own logic, ISaGRAF logic, enter TAG manager or tag states. The main architectural concept is realized in such a sequence that firstly the user creates some points in the master protocols from the IED devices. Then, tags are created with TAG Manager and connected to the master protocols points. After that, the user can create points in the slave protocols and connect them to the tags which have been created before. As a result, some points from the controlled device will go to SCADA or some other controlling device.

One of the main advantages of Enilit CMS is that adding or making changes in protocols (like adding points) or tag manager can be done on line, so the user does not need to upload the configuration or restart the device. Changes can be made on a working system without losing connection to other systems. In the main window, Enilit RTU configuration can be saved to the hard disk.

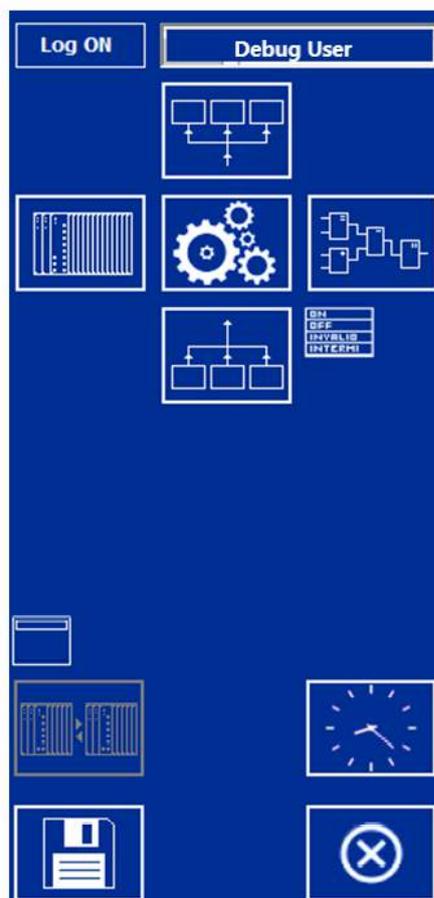
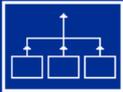
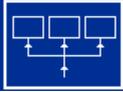
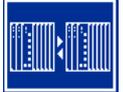


Figure 27. Main window of Enilit CMS

Table 41. Functional icons on the main window

MENU ITEM	DESCRIPTION
	Click to log on as a user.
	Click to open Hardware manager.
	Click to open Master protocols.
	Click to open Slave protocols.
	Click to open PLC programming interface.
	Click to open TAG manager.
	Click to open TAG states window.
	Click to open Redundancy management window (the button is visible only if Redundancy is used).
	Click to open Time management window.
	Click to open Console window.
	Click to save a configuration.
	Click to close Enilit CMS software.

The following figure shows a standard perspective of the program window of Enilit CMS. The display and work area is subdivided into several views. As it is usual with all Windows applications, all windows can be resized, moved or closed.

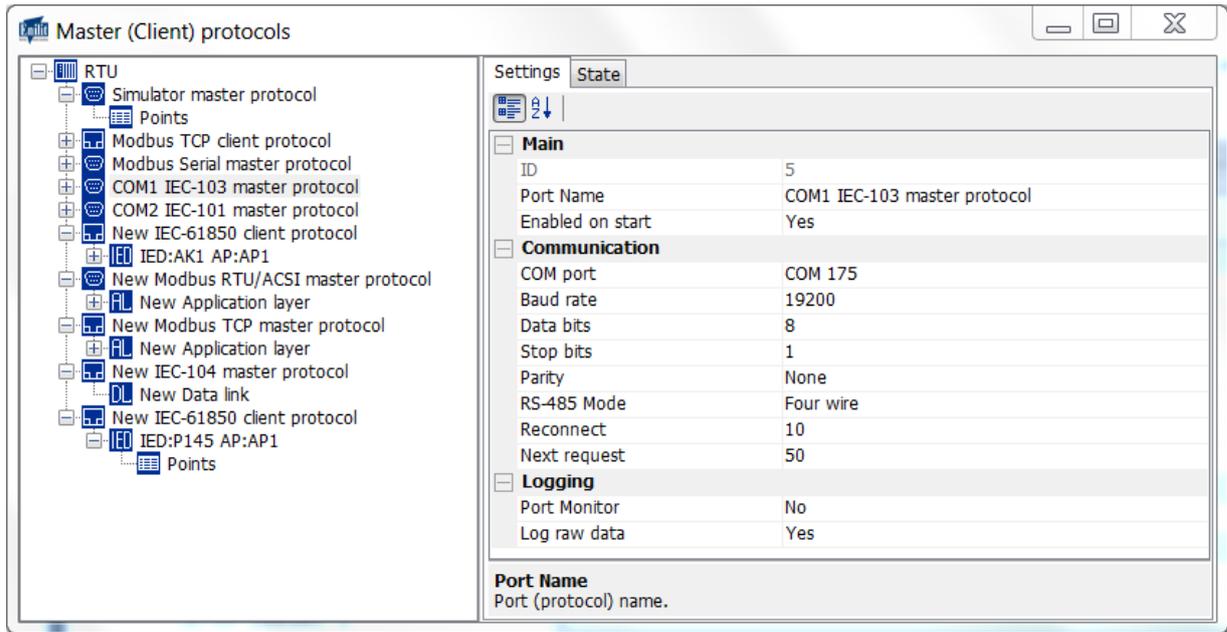


Figure 28. Standard application window

Table 42. Description of the program window

SIDE	DESCRIPTION
Left side	<p>Communications tree. RTU of a project and its respective communications are shown in the form of a structured tree diagram.</p> <p>In this view, '+' and '-' characters can be used, respectively, to open and close different branches of the tree.</p> <p>By clicking the left button of the mouse on a tree item, the user opens the settings window in the right side of the application.</p> <p>When clicking on a tree item with the right button of the mouse, a corresponding popup menu enables the access to further functions available for this tree item.</p>
Right side	<p>Settings Table When clicking on a tree item on the left side of the window, the corresponding Settings table is opened, enabling the user to view and edit the settings.</p>
Help section	<p>Help section is located at the bottom of the right side. The help section contains information about the parameter on which the cursor is currently positioned.</p>

Table 43. Popup menu of the first tree item (CPU)

MENU ITEM	DESCRIPTION
Expand All	Expand all tree branches
Collapse All	Collapse all tree branches
Create New Communication Port	Shows the window in which a protocol can be chosen. The keyboard shortcut is <i>Ctrl+N</i> .



Figure 29. CPU popup menu

The menu item *Create New Communication Port* opens the following figure. Then, the user can select a protocol. The new tree item will appear in the communications tree. The Popup menu helps to create RTU communications fast and simple.

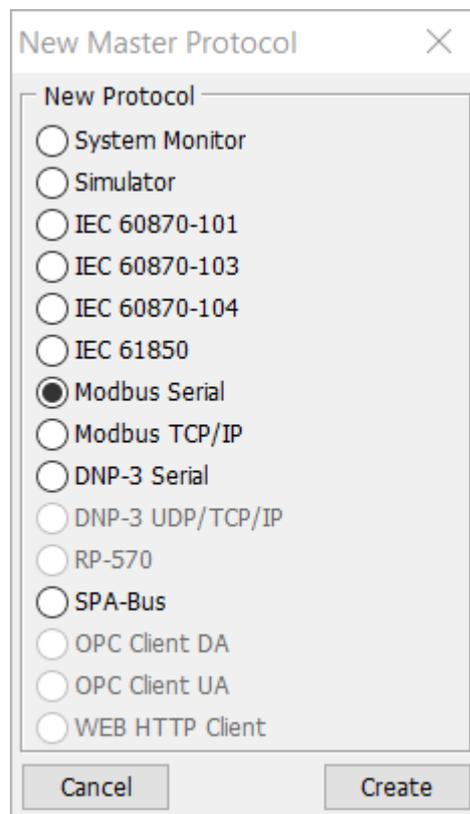


Figure 30. *New Master Protocol* window

The following *New Slave Protocol* window allows selecting a protocol.

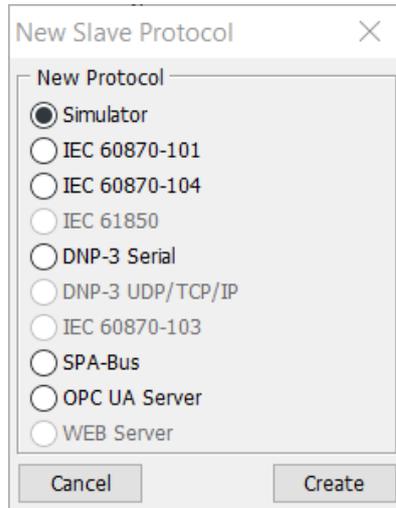


Figure 31. *New Slave Protocol* window

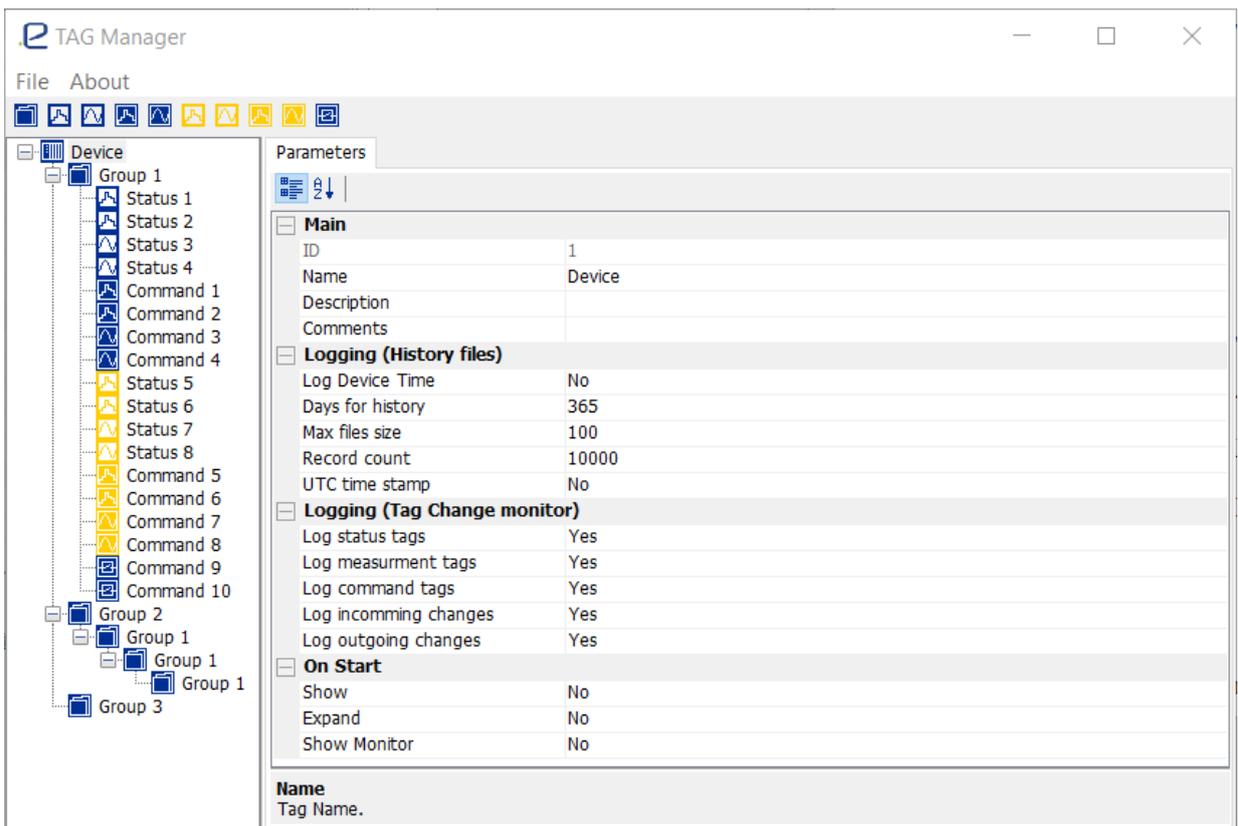


Figure 32. *TAG Manager* window

4.5 Configurator

With the help of *Enilit Configurator*, initial system parameters can be changed which manage the functions of CPU, Serial ports, Ethernet ports, OPC, IsaGRAF, Redundancy Service, Graphics, Logs, Debug and other.

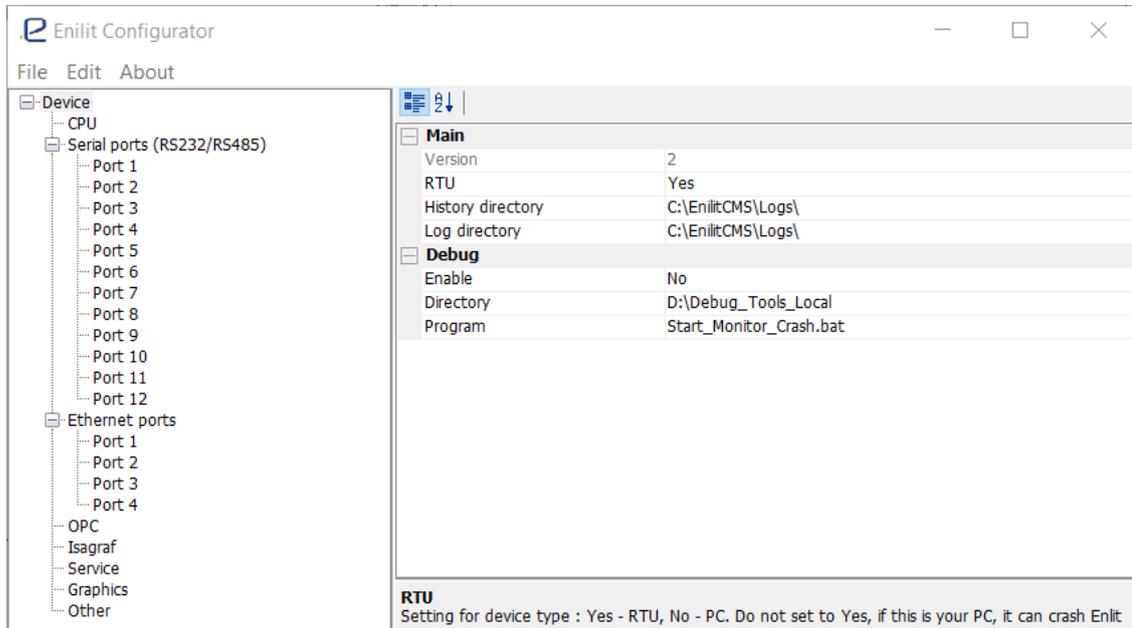


Figure 33. *Configurator* window

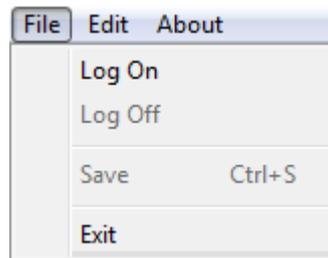


Figure 34. *File* menu

Table 44. Menu of *Configurator* window

MENU ITEM	DESCRIPTION
Log On	Log on as a user
Log Off	Log off the currently logged user
Save (Ctrl+S)	Save configuration
Exit	Exit Configurator

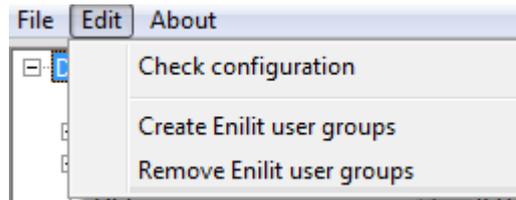


Figure 35. File menu

Table 45. User group management menu

MENU ITEM	DESCRIPTION
Check configuration	Checks RTU description file
Create Enilit user groups	Creates Enilit user groups in the list of Windows user groups
Remove Enilit user groups	Removes Enilit user groups from the list of Windows user groups

4.5.1 User groups

-  Enilit Allow Control Allows users to simulate controls in Enilit CMS.
-  Enilit Allow Edit Allows users to edit Enilit CMS configuration.
-  Enilit Users Users must belong to this group if they want to work with Enilit CMS.

Figure 36. Created user groups in the list of Windows user groups

Table 46. Groups of users

MENU ITEM	DESCRIPTION
Enilit Users	Users must belong to this group if they want to work with Enilit CMS
Enilit Allow Control	Allows users to simulate controls in Enilit CMS
Enilit Allow Edit	Allows users to edit Enilit CMS configuration

4.5.2 Create user groups

The first step to start working with Enilit CMS software is to *Create Enilit user groups* from *Enilit Configurator*.

It is advised to use *Enilit Configurator* to create *Enilit user groups* in *Windows user group list*. Run *Enilit Configurator* program and select from the menu *Edit*, then *Create Enilit user groups*. Successful creation shows the following figure. This function can be used without log in.

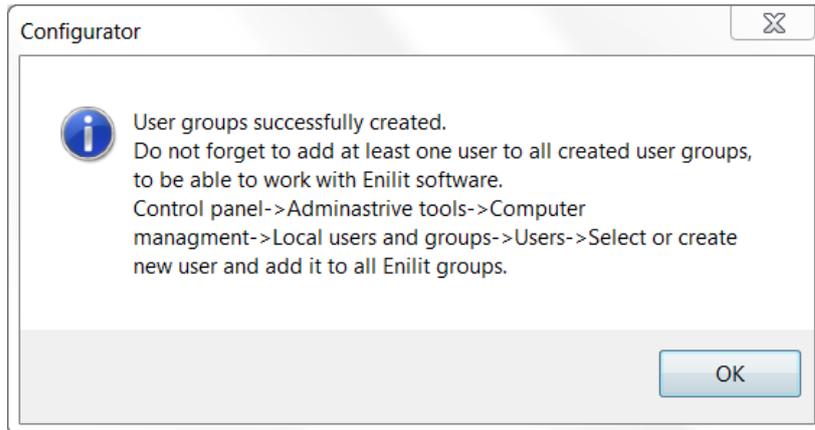


Figure 37. Successfully created User groups

4.5.3 Create a user with rights

At the second step, open *Computer Management* tool from *Control Panel, Administrative Tools*. Go to *Local Users and Groups*. Create a new user in the *Users* folder, like shown in following figure.

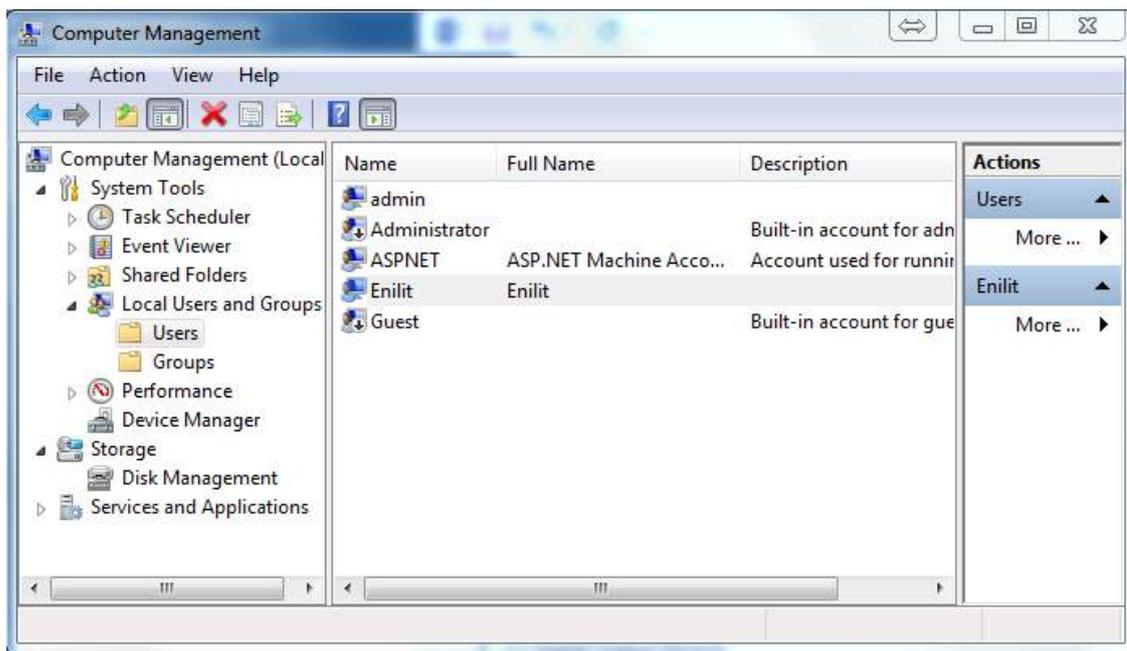


Figure 38. Computer Management window

In the General tab of *Enilit User* properties, uncheck the checkbox *User must change password at next logon* and check the checkbox *Password never expires*.

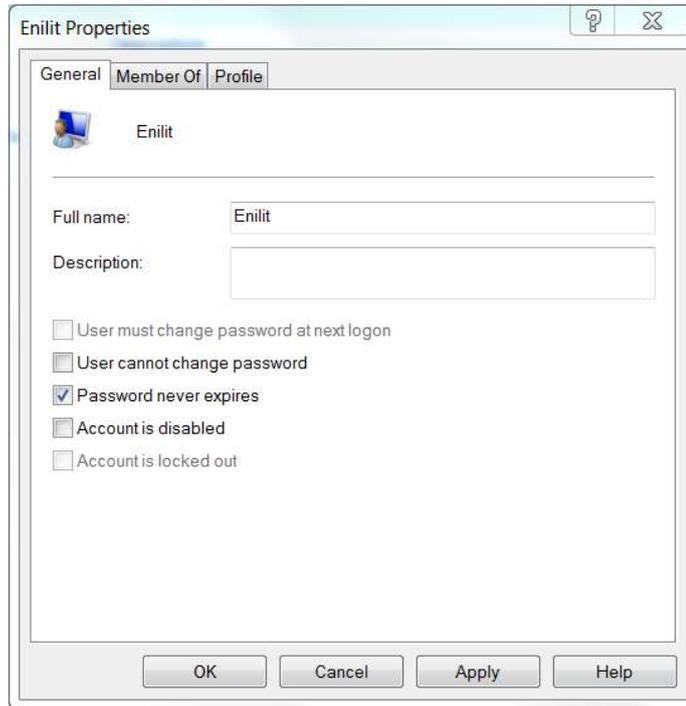


Figure 39. Enilit user password options

After that, open the created window *User Properties* and click the tab *Member Of*, then click *Add* which will allow adding new groups.

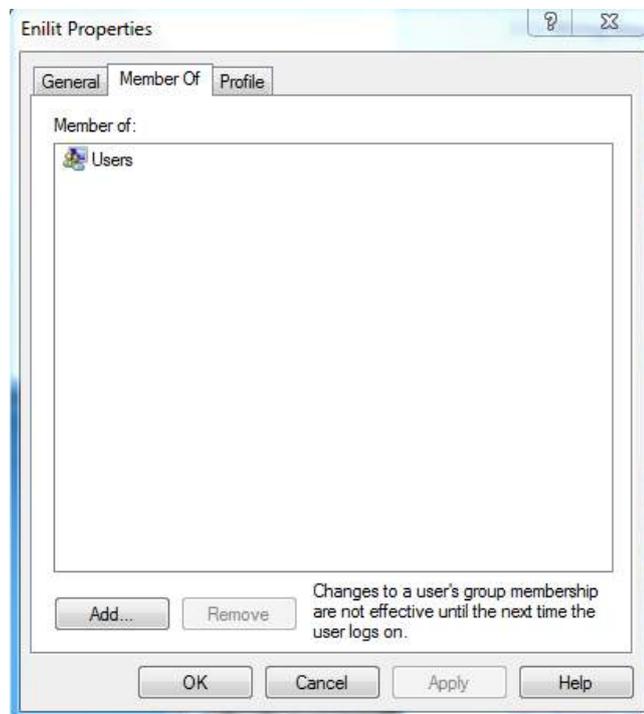


Figure 40. Enilit User Properties window

Then, click *Advanced*.

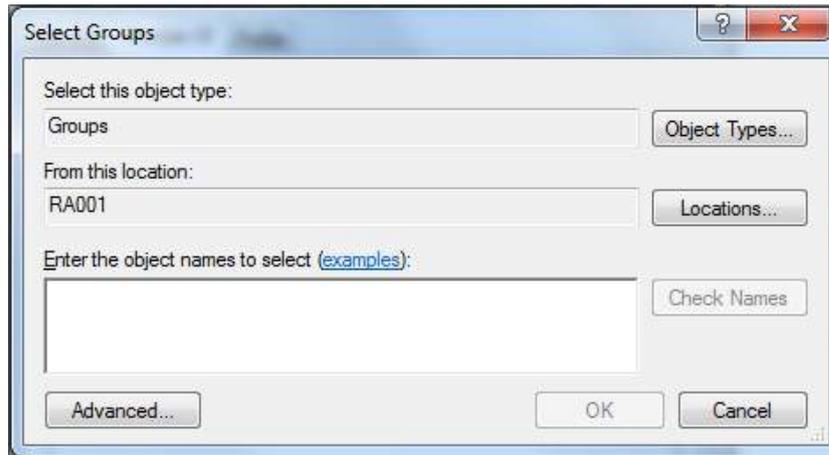


Figure 41. *Select Groups* window

Select all Enilit user groups and click *OK*.

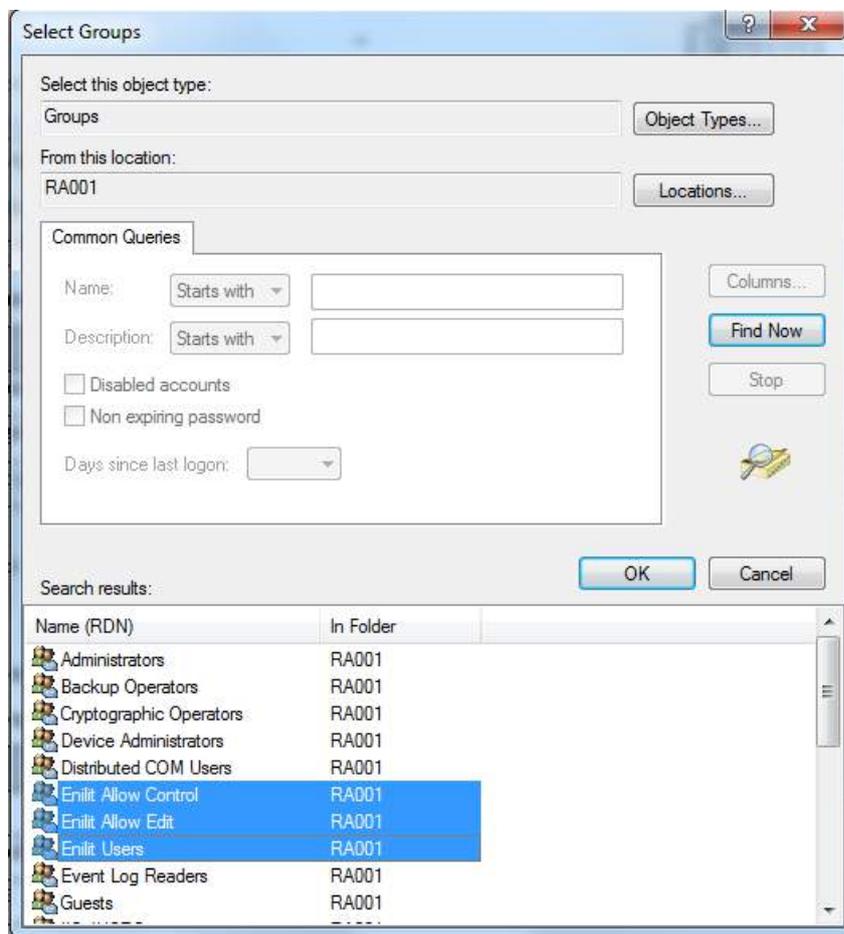


Figure 42. *Advanced Select Groups* window

The following figure shows how the *Member Of* tab should look in the last step. Clicking *OK* will finalise the creation of the user with the rights to log in, configure and control *Enilit Configurator*, *Enilit Project Manager* and *Enilit CMS*. The user with all three groups will have full access to Enilit CMS software. However, if the users with different access level are necessary, *Enilit Users* or *Enilit Allow Edit* can be added.

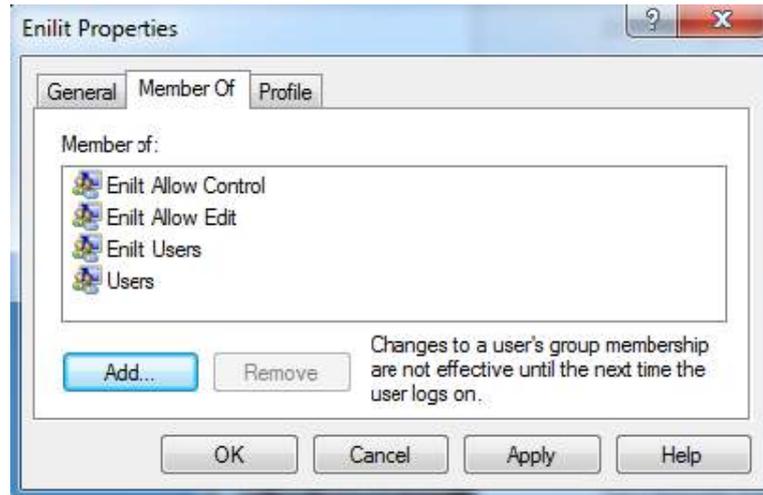


Figure 43. User *Member Of* tab

4.6 User authentication

After running of *Enilit Configurator*, *Project Manager* or *CMS*, a user must authenticate oneself with the personal user name and password.

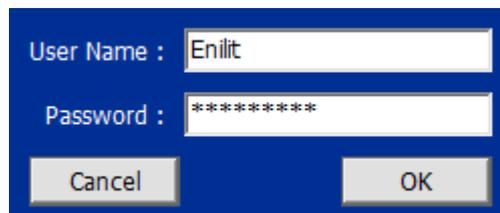


Figure 44. *Log on* window

Without the registration, a user can only review a configuration but will not be able to perform any action. Without logging on, a user cannot manually start or stop RTU with the current configuration. After logging on, the name of the user will be shown in the Main window.

The following figure shows the logged on user – Enilit.



Figure 45. Logged on user

4.7 Project manager

4.7.1 Information

Enilit Project Manager helps the user to manage Enilit RTU configurations. It allows importing/exporting projects of Enilit RTU configuration. It is possible to have here many projects and start Enilit CMS with a specific RTU configuration.

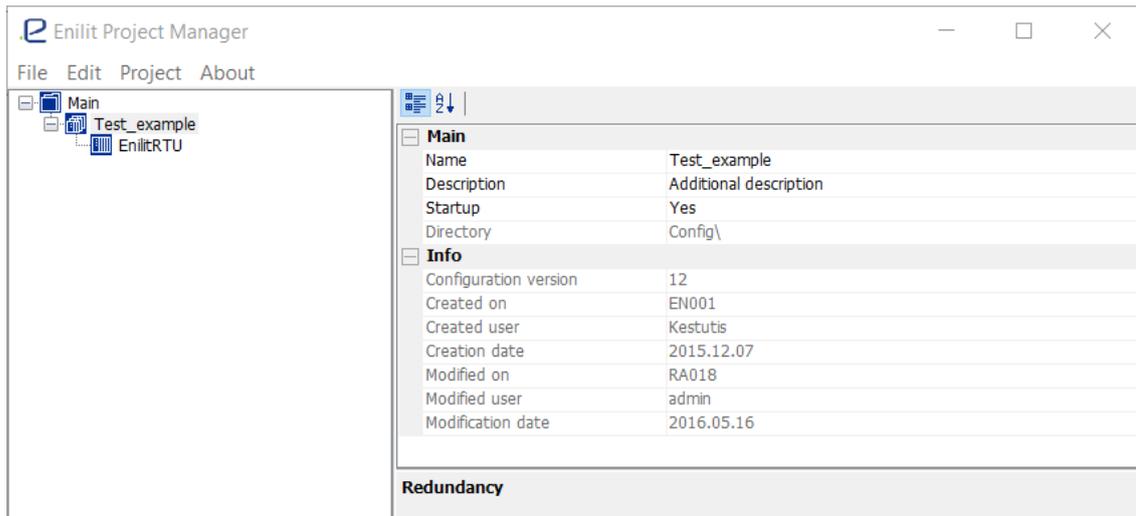


Figure 46. Project parameters in *Enilit Project Manager* window

Table 47. Fields of *Enilit Project Manager* window

MENU ITEM	DESCRIPTION
Name	Project name
Description	Additional project description
Startup	If the value is 'yes', then a project is a startup project
Directory	Project's directory (read-only). Change is possible only in Projects.xml file in the <i>Enilit CMS</i> directory.
Configuration version	Version of project configuration
Created on	Computer name on which the project was created
Created user	User who created the project
Creation date	Date when the project was created
Modified on	Computer name on which the last modification was made
Modified user	User who made the last modification
Modification date	Date when the last modification was made

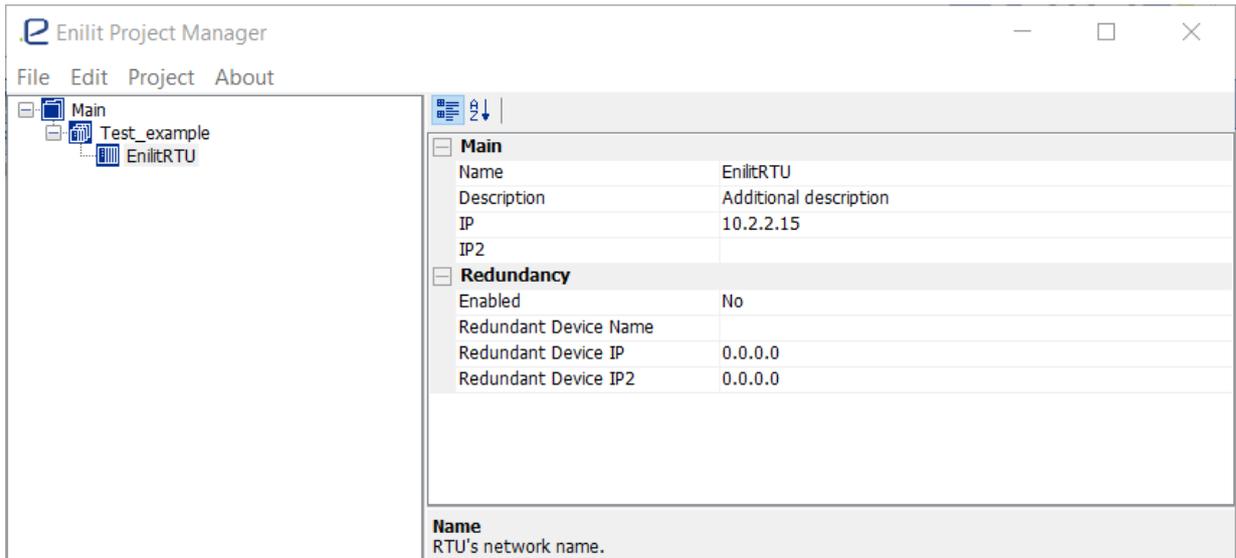


Figure 47. RTU parameters in *Enilit Project Manager* window

Table 48. Fields of RTU parameters in *Enilit Project Manager* window

MENU ITEM	DESCRIPTION	DEFAULT VALUE
Name	Name of RTU	EnilitRTU
Description	Additional description	Additional description
IP	IP address to connect to RTU	127.0.0.1
IP2	Second IP address to connect to RTU	Empty
Enabled	The function enables redundancy.	No
Redundant RTU Name	Name of the redundant RTU	Empty
Redundant RTU IP	IP address of the redundant RTU	Empty
Redundant RTU IP2	Second IP address of the redundant RTU	Empty

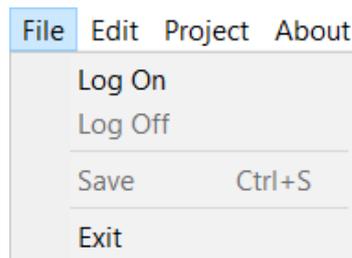


Figure 48. Figure 4.23 *Enilit Project Manager*<File menu

Table 49. Table 4.9 Fields of *Enilit Project Manager File* window

MENU ITEM	DESCRIPTION
Log On	Log on as a user
Log Off	Log off the currently logged user
Save (Ctrl+S)	Save Project Manager configuration
Exit	Exit Project Manager

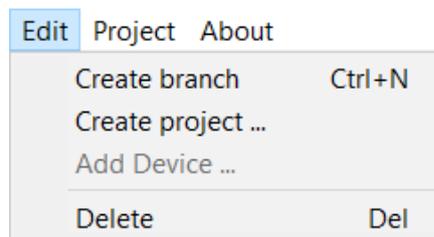


Figure 49. *Enilit Project Manager <Edit menu*

Table 50. Fields of *Enilit Project Manager Edit* window

MENU ITEM	DESCRIPTION
Create branch (<i>Ctrl+N</i>)	In this field a branch in the tree is created.
Create project...	Create a project in the selected branch
Add RTU...	Add RTU to the selected project
Delete	Delete a branch, project or RTU

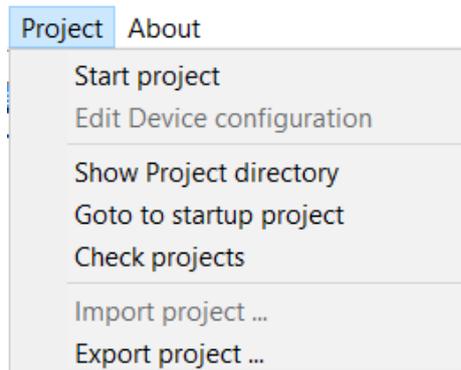


Figure 50. *Enilit Project Manager*<Project menu

Table 51. Fields of *Enilit Project Manage Project* menu

MENU ITEM	DESCRIPTION
Start project	Starts Enilit CMS with the selected project
Edit RTU configuration	Edits Enilit RTU configuration with CMS
Show Project directory	Opens a project directory
Go to startup project	Selects startup RTU in the projects tree
Check projects	Validates projects
Import project	Imports a project from an ezip file (Enilit ZIP)
Export project	Exports a project to an ezip file (Enilit ZIP)

4.7.2 Import project

Import project feature allows importing a project from an external network or other storage.

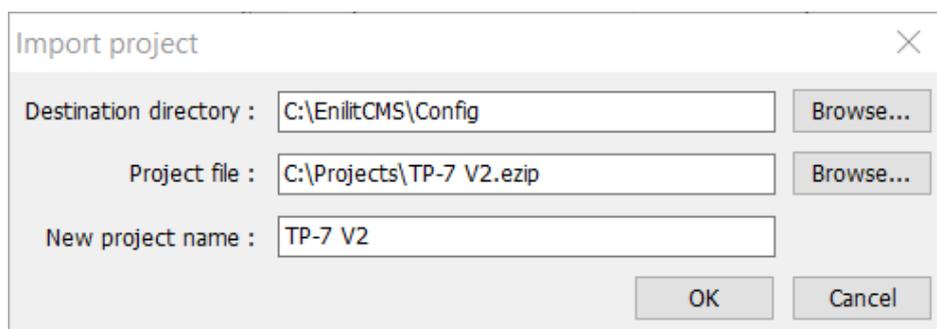


Figure 51. *Enilit Project Manager*<Project<Import project window

Table 52. Fields of *Import project* window

MENU ITEM	DESCRIPTION
Destination directory	Directory in which the imported projects are saved
Project file	Ezip file of the imported projects
New project name	Name of a newly imported project

4.7.3 Export project

Export project feature is designed to export a project to an external network or other storage for configuration backup.

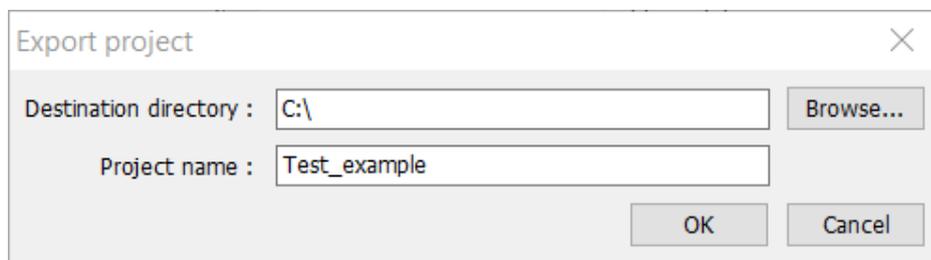


Figure 52. *Enilit Project Manager*<Project<*Export project* window

Table 53. Fields of *Export project* menu

MENU ITEM	DESCRIPTION
Destination directory	Directory in which the exported projects are saved
Project name	File name of the exported project (in the example above: Test_example)

4.8 Main configuration

Enilit RTU can have Windows Operating System. The user can configure the parameters of the network configuration with default Windows applications without the need of any additional applications.

Note: Windows Operating System is used to provide exclusively Enilit RTU functionality.

4.8.1 IP addresses

Enilit RTU has four Network adapters by default. The Network adapters are independent and each has its own MAC address. In this case, all Network adapters can have a different IP address with a different gateway. The user can also choose a Static IP address or obtain it by DHCP. To configure a Static IP address for one of the four Enilit RTU Network adapters, work through the following steps:

1. Launch *Control Panel*.



2. Click on *Network and Internet*.
3. Click on *Network and Sharing Center*.



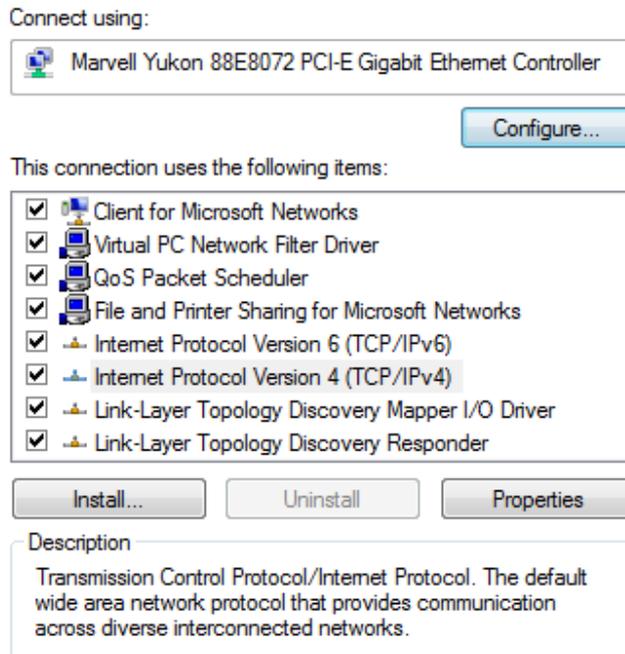
4. On the left pane, click on *Change adapter settings*.

Manage wireless networks
Change adapter settings
Change advanced sharing settings

5. Click on the right button of the mouse on the icon of the targeted network adapter and select *Properties*.



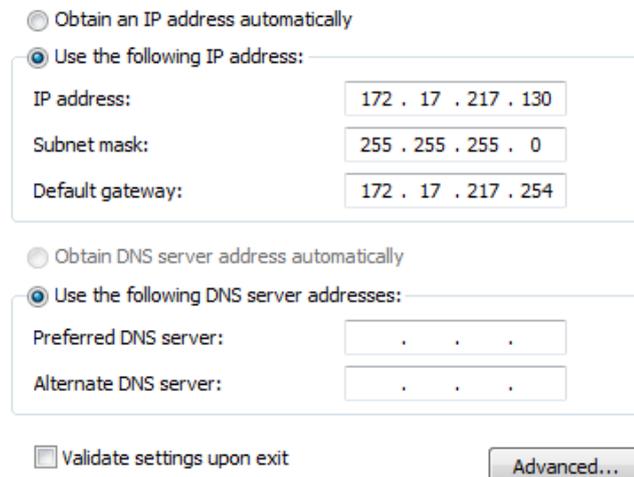
6. Select *Internet Protocol Version 4 (TCP/IPv4)* and click on *Properties*.



7. Select *Use the following IP address* and enter the following IP address and subnet mask:

IP address:	172.17.217.130
Subnet mask:	255.255.255.0
Gateway:	172.17.217.254

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.



4.8.2 Remote management

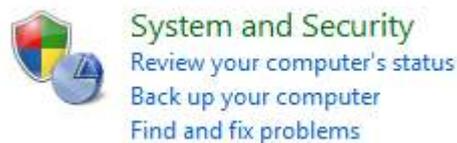
Enilit RTU can be configured and managed not only locally but also remotely. If the user has TCP/IP connection to Enilit RTU, he or she can connect to it with Remote Desktop Connection application from Windows Operating System or using Web Browser (Internet Explorer, Google Chrome etc.) when UltraVNC server or similar software is installed in Enilit RTU. Remotely the user can do everything what can be done locally: Enilit RTU self-control and diagnosis, change the configuration, import/export a project, and configure Windows OS. In order to establish even more secure connection to the RTU unit, VPN (virtual private network) services can be used. However, a VPN client and server is already a built-in service in Windows OS.

Remote Desktop is not enabled by default. The user has to enable it to allow remote access to the Enilit RTU. When it is enabled, the configured member of the Administrators group can connect to the Enilit RTU.

4.8.2.1 To configure Windows based remote access

To configure remote access, work out the following steps:

1. In *Control Panel*, click *System and Security*.



2. Then click *System*.



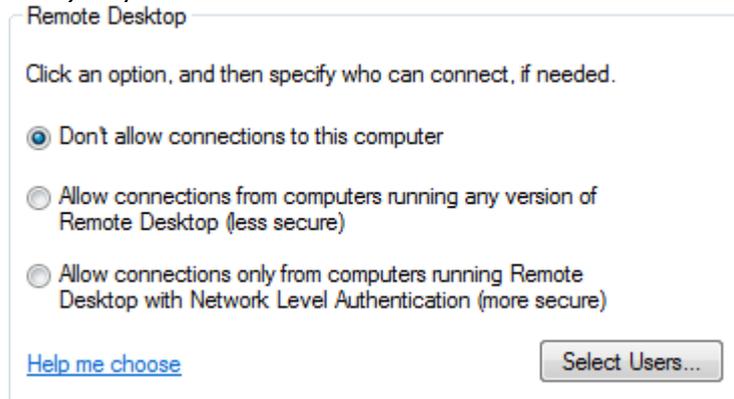
3. On the *System* page, click *Remote Settings* in the left pane. This opens the *System Properties* dialog box to the *Remote* tab.



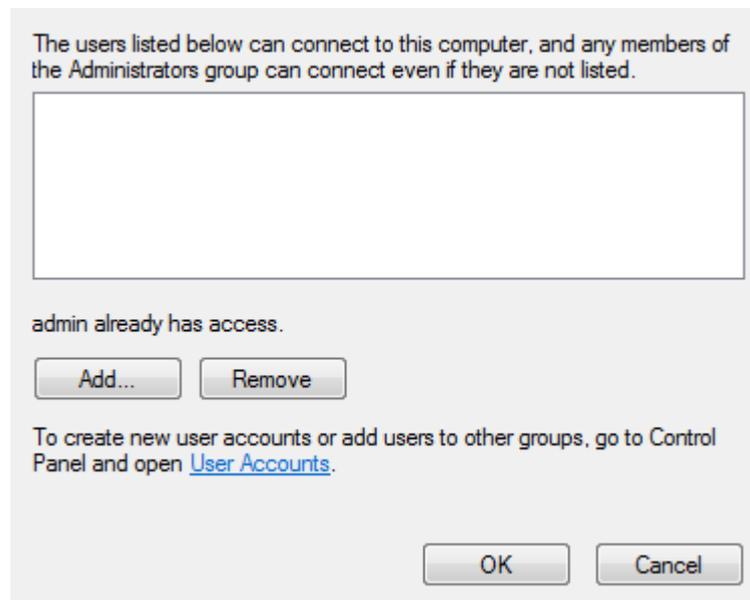
4. To enable *Remote Desktop*, there are two options:

- Select *Allow Connections from Computers Running Any Version of Remote Desktop* to allow connections from any version of Windows.

- Select *Allow Connections Only from Computers Running Remote Desktop with Network Level Authentication* to allow connections from Windows 7 or later computers (and computers with secure network authentication) only.



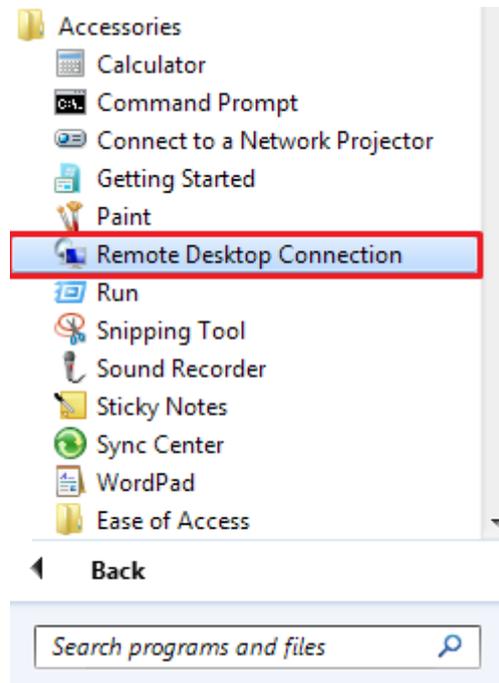
5. Click *Select Users*. This displays the dialog box *Remote Desktop Users*.
6. To grant *Remote Desktop* access to a user, click *Add*. This opens the dialog box *Select Users*. In the *Select Users* dialog box, click *Locations* to select the computer or domain in which the users you want to work with are located. Type the name of a user you want to work within the field *Enter the Object Names to Select*, and then click *Check Names*. If matches are found, select the account you want to use and then click *OK*. If no matches are found, update the name you entered and try searching again. Repeat this step as necessary, and then click *OK*.



7. Click *OK* twice to finish the configuration of remote access.

4.8.2.2 To connect to Enilit RTU

1. Go to *Start>All Programs>Accessories>Remote Desktop Connection*



2. Enter the *Computer Name* or *IP address* of the Enilit RTU you wish to connect to.



3. For more connection options, click on *Show Options*. Here the user can save the connection profile, adjust display properties, run specified programs upon connection, adjust connection bandwidth, etc. For more information on specific tabs, click on *Help*.



4. Click on *Connect*.

5. Enter the log in credentials of a user account on the Enilit RTU that is allowed to do a remote desktop connection.



Default username: EnilitRemote
 Default password: Enilit123

4.8.3 Hardware configuration

The main Hardware configuration window is shown in the figure below. On the left side, *RTU Card Slots* and *Hardware Tags* trees are displayed. The *RTU Card Slots* and *Hardware Tags* can be configured automatically or manually. If an automatic configuration was selected, the RTU will check its slots and configure the slot according to the found module. After that, RTU creates Hardware points with default names.

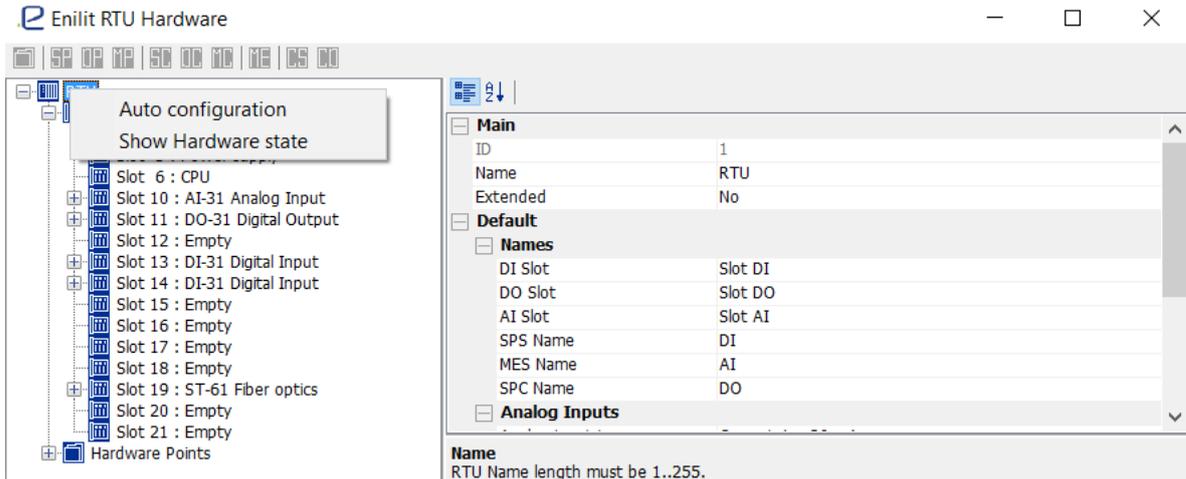


Figure 53. Hardware Auto configuration

There is another possibility to create hardware configuration manually. In the *Card Slots*, it is possible to configure which module is mounted on the particular slot. *Hardware Tags* enables to configure signal, measurement, command, and counter items and connect them to the RTU hardware. In the right pane, the parameters of the selected branch items are displayed.

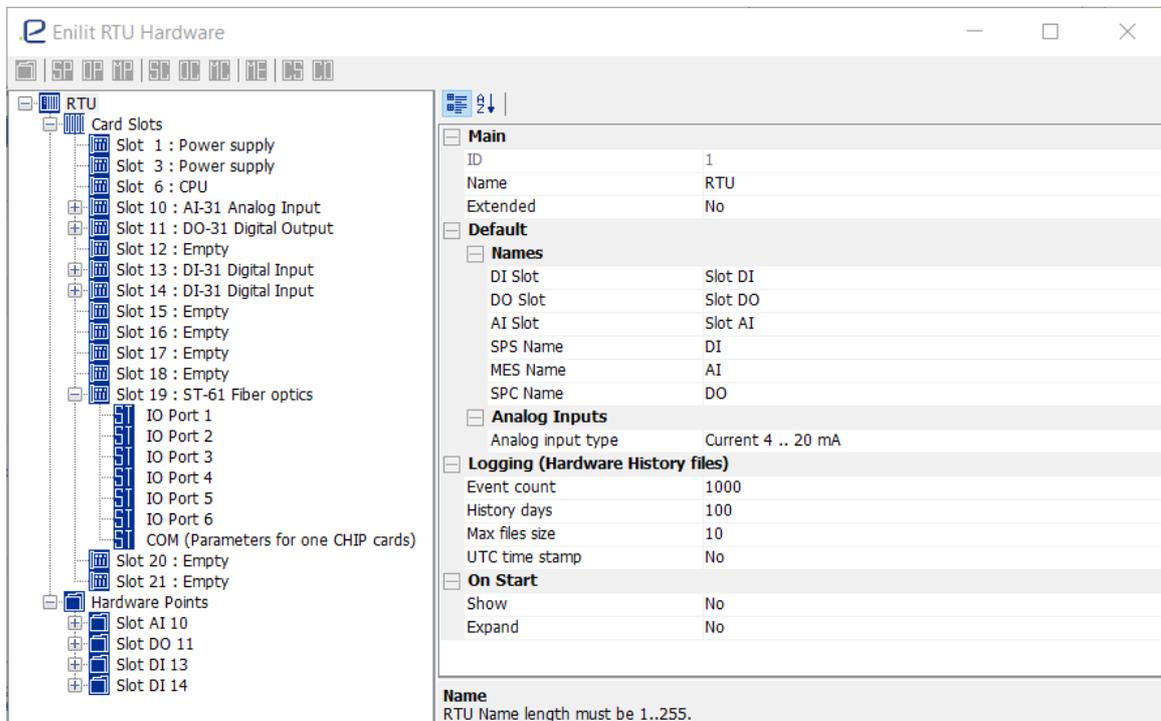


Figure 54. Enilit RTU Hardware configuration window

Table 54. Fields of *Enilit RTU Hardware* configuration window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	Unique identification number of RTU Range of values: 1 ... 65535	1
Name	Name of RTU, for example, 'Substation 1'	RTU
Extended	Defines if RTU contains an extension rack	No
DI Slot	Default DI slot name created in the <i>Hardware Points</i> branch	Slot DI
DO Slot	Default DO slot name created in the <i>Hardware Points</i> branch	Slot DO
AI Slot	Default AI slot name created in the <i>Hardware Points</i> branch	Slot AI
SPS Name	Default SPS name created in the <i>Hardware Points</i> branch	DI
MES Name	Default MES name created in the <i>Hardware Points</i> branch	AI
SPC Name	Default SPC name created in the <i>Hardware Points</i> branch	DO
Analogue input type	Configuration allows setting the analogue input type to the measuring range. Range of values: Current 0 ... 1mA Current -1 ... 1mA Current 0 ... 5mA Current -5 ... 5mA Current 0 ... 10mA Current -10 ... 10mA Current 4 ... 20mA Current 0 ... 20mA Current -20 ... 20mA Voltage -10 ... 10V Voltage -5 ... 5V Voltage -2,5 ... 2,5V Voltage -1,25 ... 1,25V	Current 4 ... 20mA
Event count	Number of events to keep in a file Range of values: 100 ... 100000	1000
History days	Number of days to keep files in history Range of values: 1 ... 1000	100
Max files size	Maximum size of log files Range of values: 1 ... 100Mb	10
UTC time stamp	Allows choosing the time stamp used in the log files Values: No, Yes	No
Show	Shows this window on startup	No
Expand	Expands all <i>Tree Nodes</i> on startup	No

4.8.4 Power supply

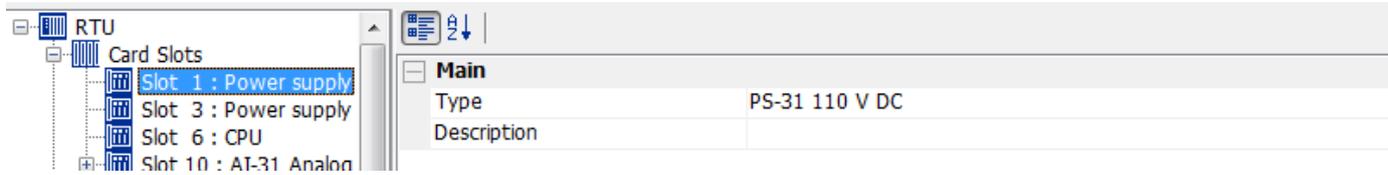


Figure 55. Power supply parameters

Table 55. Fields of *Power supply* card slot window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	Configuration allows setting the type of power supply. Range of values: Not used PS-11 110 V AC PS-21 230 V AC PS-31 110 V DC PS-41 220 V DC PS-51 48 V DC	Not used
Description	Description or comment of the user	

4.8.5 Central Processing Unit (CPU)

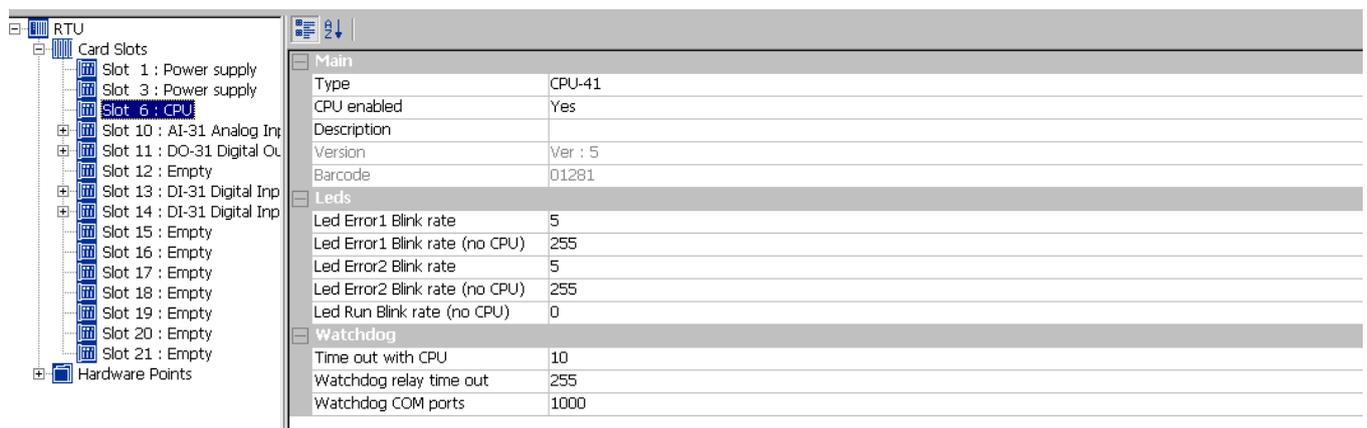


Figure 56. CPU parameters

Table 56. Fields of *Central Processor Unit* window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	Configuration allows setting the type of CPU. Range of values: CPU-31, CPU-32, CPU-33, CPU-34, CPU-41, CPU-42, CPU-43, CPU-44	CPU-31
CPU enabled	Enables CPU on the system startup Values: No, Yes	Yes
Description	Description or comment of the user	
Version	Hardware and software version of the module	
Barcode	Barcode of the installed module	
Led Error1 Blink rate	Led Error1 blink rate in 100ms Range of values: 1 ... 254	5
Led Error1 Blink rate (no CPU)	Led Error1 blink rate in 100ms when there is no communication with CPU Range of values: 0 ... 255 0 – means always OFF	255
Led Error2 Blink rate	Led Error2 blink rate in 100ms Range of values: 1 ... 254	5
Led Error2 Blink rate (no CPU)	Led Error2 blink rate in 100ms when there is no communication with CPU Range of values: 0 ... 255 0 – means always OFF	255
Led Run Blink rate (no CPU)	Led Run blink rate in 100ms when there is no communication with CPU Range of values: 0 ... 255 0 – means always OFF	0
Time out with CPU	Communication time out with CPU in 100ms. The period of time when no activity was received from the main CPU. Range of values: 10 ... 255	10
Watchdog relay time out	Watchdog relay time out in seconds. The period of time when no activity was received from the main CPU (Operating system or Enilit CMS is not running or loading). Range of values: 1 ... 255	20
Watchdog COM ports	COM communication ports will be disabled after the set time of milliseconds. Range of values: 0 ... 65535 0 – communication ports will never be disabled	3000

4.8.6 Card slots

The following figure shows the tree of *Card Slots*. Here the user can assign hardware modules to a particular slot. The type of the module is written on the top of the front panel of the module.

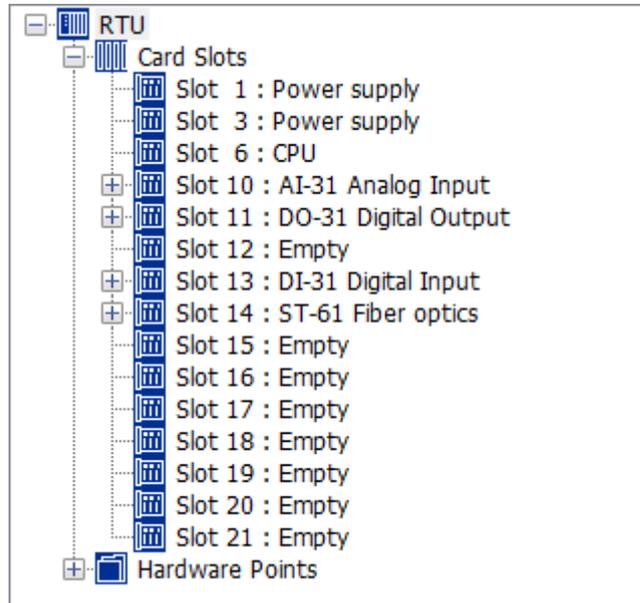


Figure 57. RTU Slots tree

Main	
Slot Number	11
Card Type	DI-31 Digital Input
Description	
Version	
Barcode	
Configuration	
Card enabled	Yes
LED brightness	100

Figure 58. Slot parameters pane

Table 57. Fields of *Card Slots* window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Slot number	Number of RTU slot for internal use only	Depends on the slot number
Card enabled	Enables the card	Yes
Card Type	Selects the type of the module Values: DI-31 Digital Input, DO-31 Digital Output, AI-31 Analogue Input, ST-61 Fibre optics	Empty
Description	Description of the card	
Version	Hardware and software version of the card	
Barcode	Barcode of the installed card	
LED brightness	Regulates LED brightness on a particular module Range of values: 0 ... 100 %	100

4.8.7 Hardware items parameters

4.8.7.1 Digital input

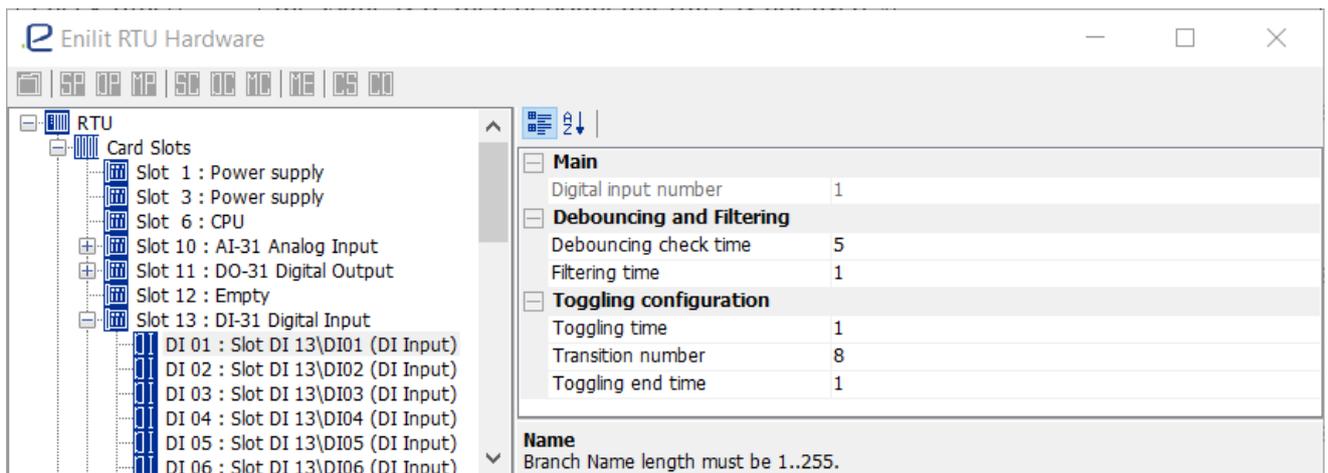


Figure 59. Digital input parameters

Table 58. Fields of *Digital input* card slot window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Digital input number	Number of digital input for internal use only	Depends on digital input
Debouncing check time	Debouncing checking time in milliseconds. If the value is 0, then debouncing filter is not used. Range of values: 0 ... 255ms	5
Filtering time	Filter checking time in milliseconds. If the value is 0, then filtering is not used. Range of values: 0 ... 255ms	1
Toggling time	Toggling checking time. If the value is 0, then toggling is not used. Range of values: 0 ... 60s	1
Transition number	Counting transitions in toggling time to set the quality of the binary input to <i>Not Topical</i> . Range of values: 2 ... 60	8
Toggling end time	Time delay period after which no changes are detected. Range of values: 0 ... 60s	1

4.8.7.2 Digital output

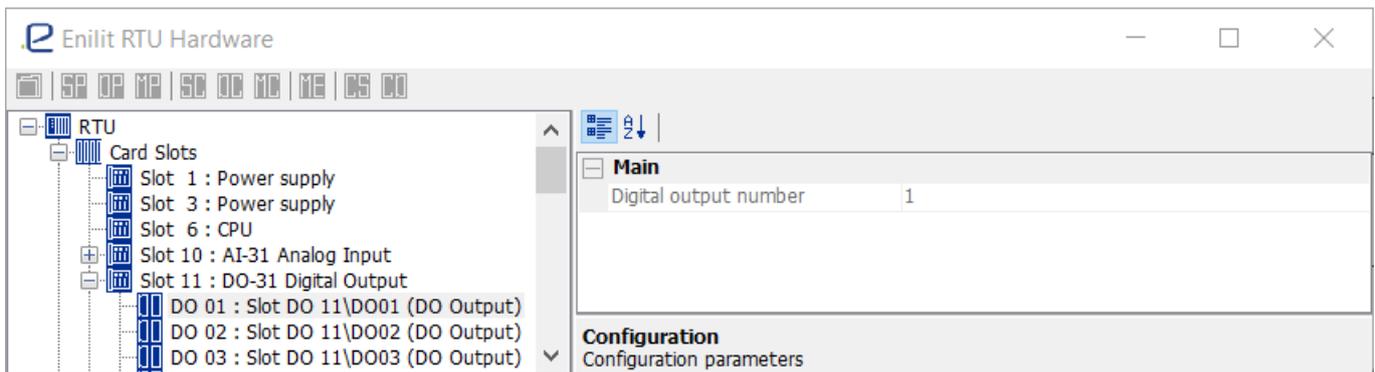


Figure 60. Digital output parameters

Table 59. Fields of *Digital output* card slot window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Digital output number	Number of digital output for internal use only, for example: 1 ... 24	Depends on digital output

4.8.7.3 Analogue input

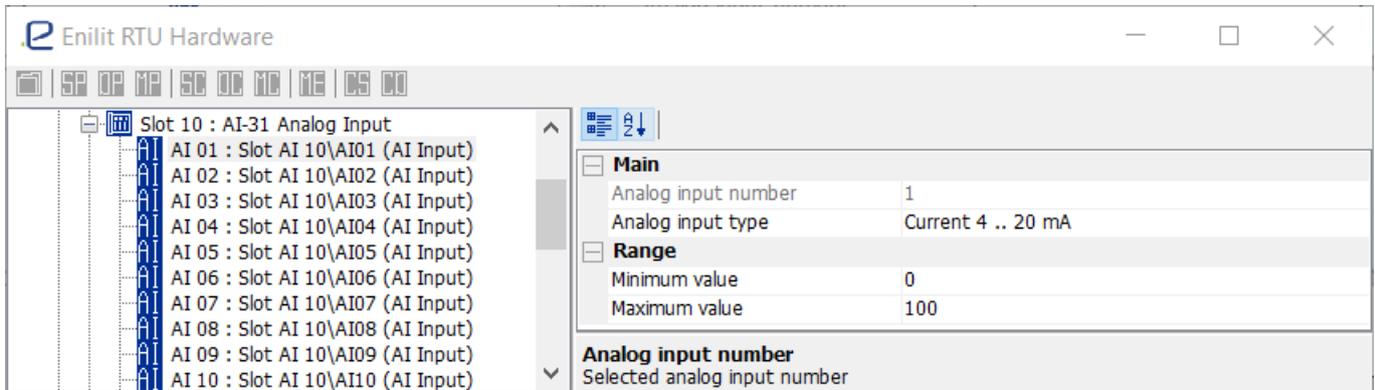


Figure 61. Analogue input parameters

Table 60. Fields of *Analogue input* card slot window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Analogue input number	Number of analogue input, for internal use only.	Depends on analogue input
Analogue input type	Configuration allows setting the type of analogue input to the measuring range. Range of values: Current 0 ... 1mA Current -1 ... 1mA Current 0 ... 5mA Current -5 ... 5mA Current 0 ... 10mA Current -10 ... 10mA Current 4 ... 20mA Current 0 ... 20mA Current -20 ... 20mA Voltage -10 ... 10V Voltage -5 ... 5V Voltage -2,5 ... 2,5V Voltage -1,25 ... 1,25V	Current 4 ... 20mA
Maximum value	Maximum raw value of analogue input for the conversation to normalized measured value. Range of values: - 9999999999999999 ... 9999999999999999	100
Minimum value	Minimum raw value of analogue input for the conversation to the normalized measured value. Range of values: - 9999999999999999 ... 9999999999999999	0

4.8.7.4 Fibre optics

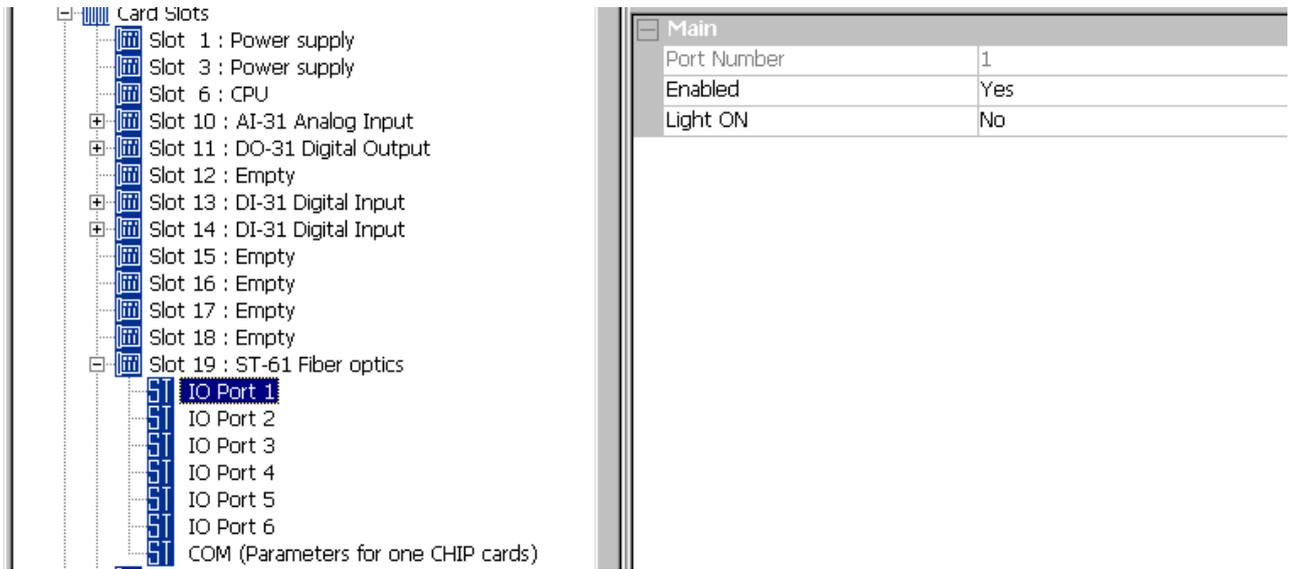


Figure 62. Fibre optics *IO Port* parameters

Table 61. Fields of *IO Ports* in *Fibre optics* card slot window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Port Number	Physical port number from the top of the module Range of values: 1 ... 6	Depends on <i>IO Port</i> number
Enabled	Turns on or off fibre optic port Values: No, Yes	Yes
Light ON	Lights on or off fibre optic port Values: No, Yes	No

In the following window the baud rate of COM (parameters for one CHIP card) should be the same as of the communication port connected from CPU to ST-61 module.

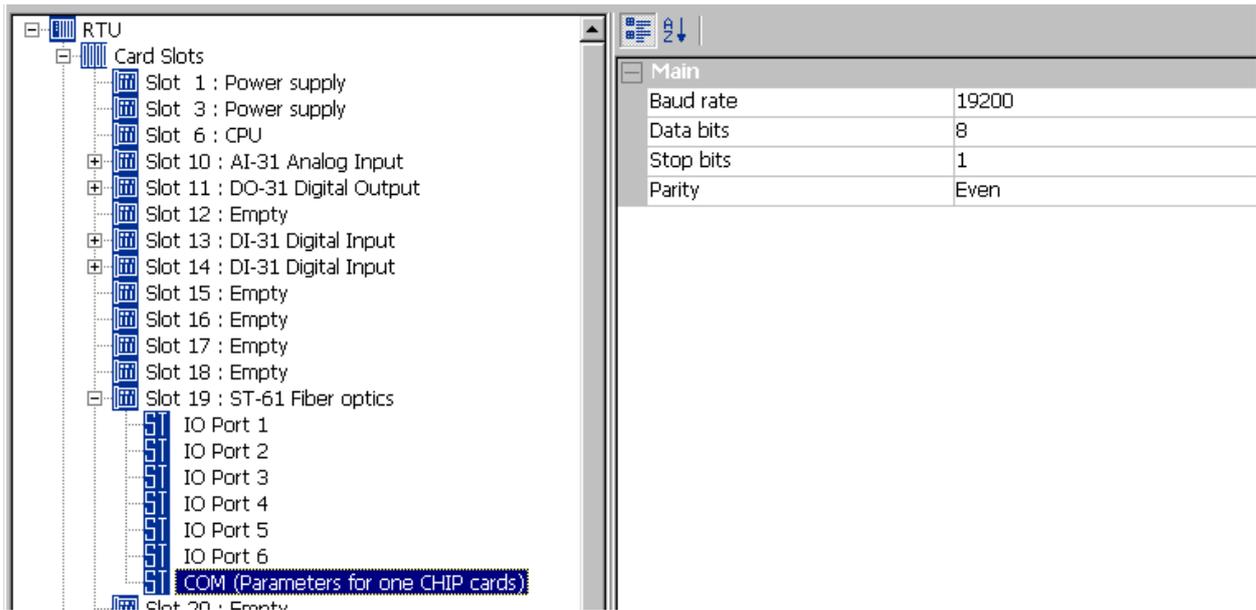


Figure 63. COM (Parameters for one CHIP cards)

Table 62. Fields of *COM* in *Fibre optics* card slot window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Baud rate	Serial port baud rate Range of values: 110 ... 921600	19200
Data bits	Serial port data bits Values: 7,8 bits	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2 bits	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None

4.8.8 Hardware points

In the window of Enilit RTU *Hardware Points*, the user creates points, which are to be connected to hardware digital inputs, analogue inputs, and command outputs.

The following figure shows the popup menu of *Hardware Points*, which allows creating *Hardware Points* tree. After that, tags can be created like a single point status, double point status, multi point status, single commands, double commands, multi point commands, measurements, and counter single, counter doubles.

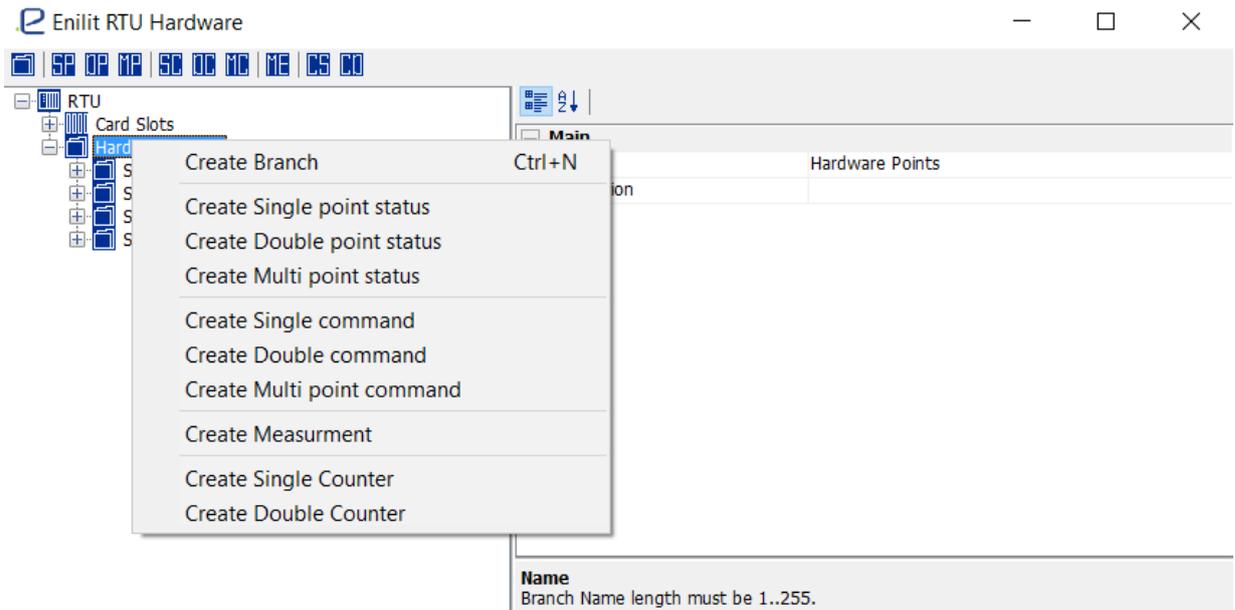


Figure 64. Popup menu of *Hardware Points*

4.8.8.1 Single point parameters

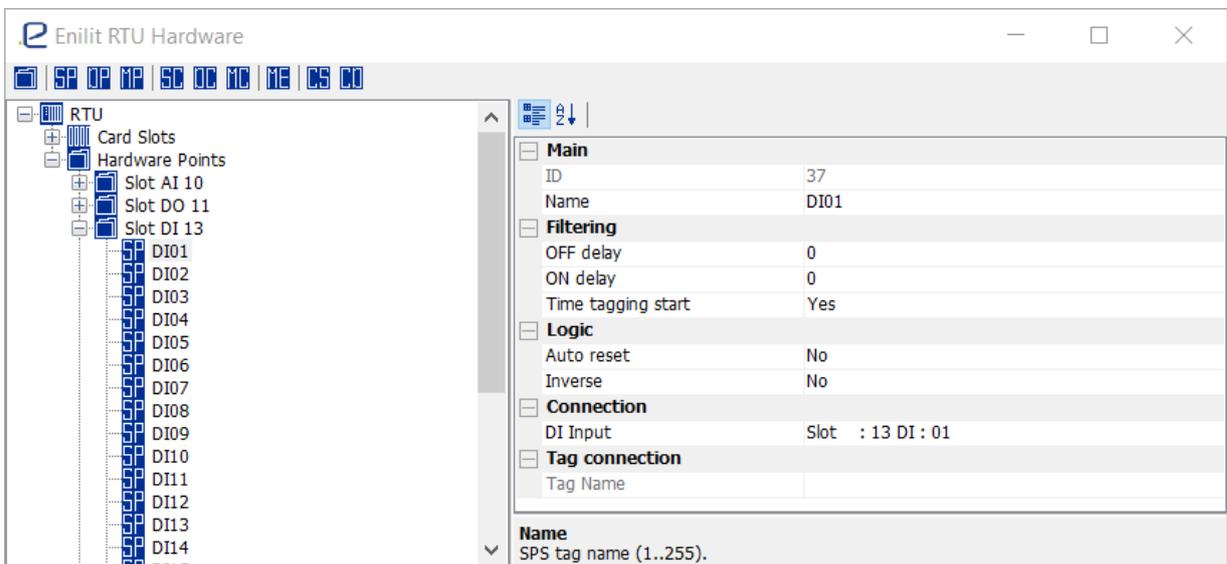


Figure 65. *Hardware Points* tree and single point parameters

Table 63. Fields of single point parameters window in *Hardware Points* card slot

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	Identification number of a hardware tag for internal use only Range of values: 1 ... 65535	Depends on tag
Name	Hardware tag name, for example, 'IED fault' Length: 1 ... 255	Item SPS1
DI input	Allows connecting a hardware tag to the binary input. For example, Slot : 13 DI : 01	Not set
OFF delay	Delay on a stable state after which the hardware tag is set to OFF. (100ms) Range of values: 0 ... 1000	0
ON delay	Delay on a stable state after which the hardware tag is set to ON. (100ms) Range of values: 0 ... 1000	0
Time tagging start	Type of a tag timestamp. An event can be with the start or end of filtering timestamp. Values: Yes, No	Yes
Auto reset	Automatic resetting of a hardware tag from ON to OFF Values: No, Yes	No
Inverse	Invert of a hardware tag Values: No, Yes	No
Tag Name	Hardware tag connection to <i>TAG Manager</i> . <i>TAG Manager</i> tag name.	-

4.8.8.2 Double point parameters

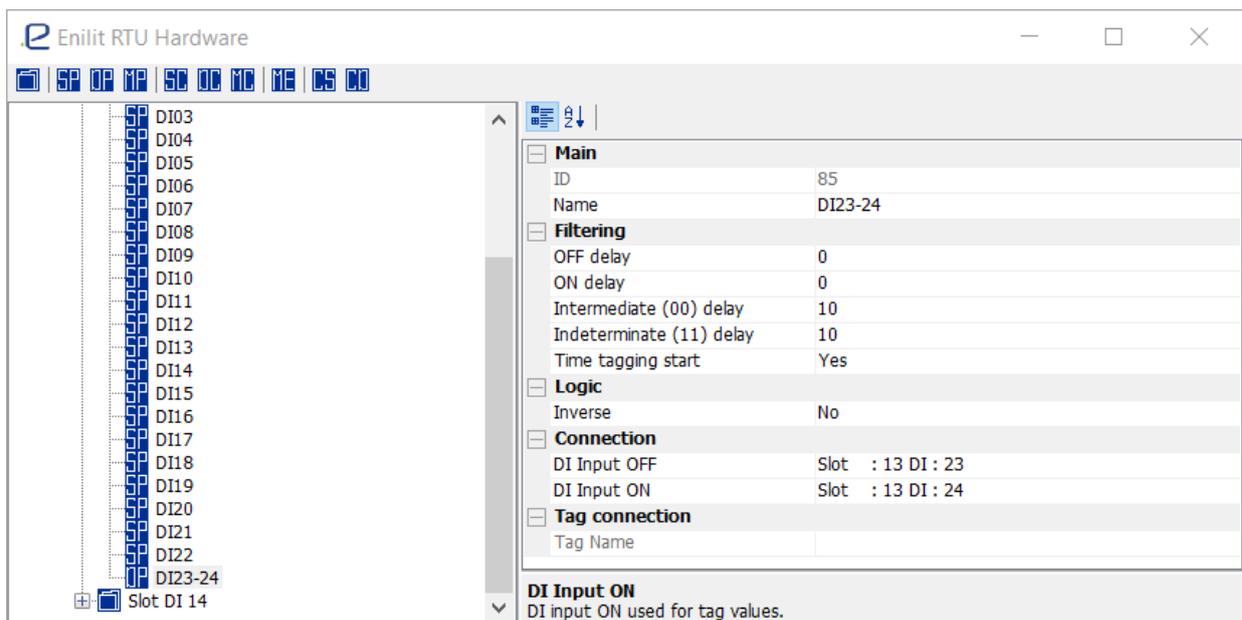


Figure 66. *Hardware Points* tree and double point parameters

Table 64. Fields of double point parameters window in *Hardware Points* card slot

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	Identification number of a hardware tag, for internal use only Range of values: 1 ... 65535	Depends on a tag
Name	Hardware tag name, for example, 'Item DPS1' Length: 1 ... 255	Item DPS1
DI input OFF	The function allows connecting a hardware tag to the binary input, for example, Slot: 13 DI: 04	Not set
DI input ON	Allows connecting a hardware tag to a binary input, for example, Slot: 13 DI: 05	Not set
Intermediate (00) delay	Delay on stable state after which the hardware tag is set to Jammed (both inputs are not active). (100ms) Range of values: 0 ... 1000	0
OFF delay	Delay on the stable state after which the hardware tag is set to OFF. (100ms) Range of values: 0 ... 1000	0
ON delay	Delay on the stable state after which the hardware tag is set to ON. (100 ms) Range of values: 0 ... 1000	0
Indeterminate (11) delay	Delay on the stable state after which the hardware tag is set to Undefined (both inputs are active). (100ms) Range of values: 0 ... 1000	0
Time tagging start	Type of a tag timestamp. An event can be with the start or end of a filtering timestamp. Range of values: Yes, No	Yes
Inverse	Invert of a hardware tag Range of values: Yes, No	No
Tag Name	Hardware tag connection to <i>TAG Manager</i> . <i>TAG Manager</i> tag name.	-

4.8.8.3 Multipoint status

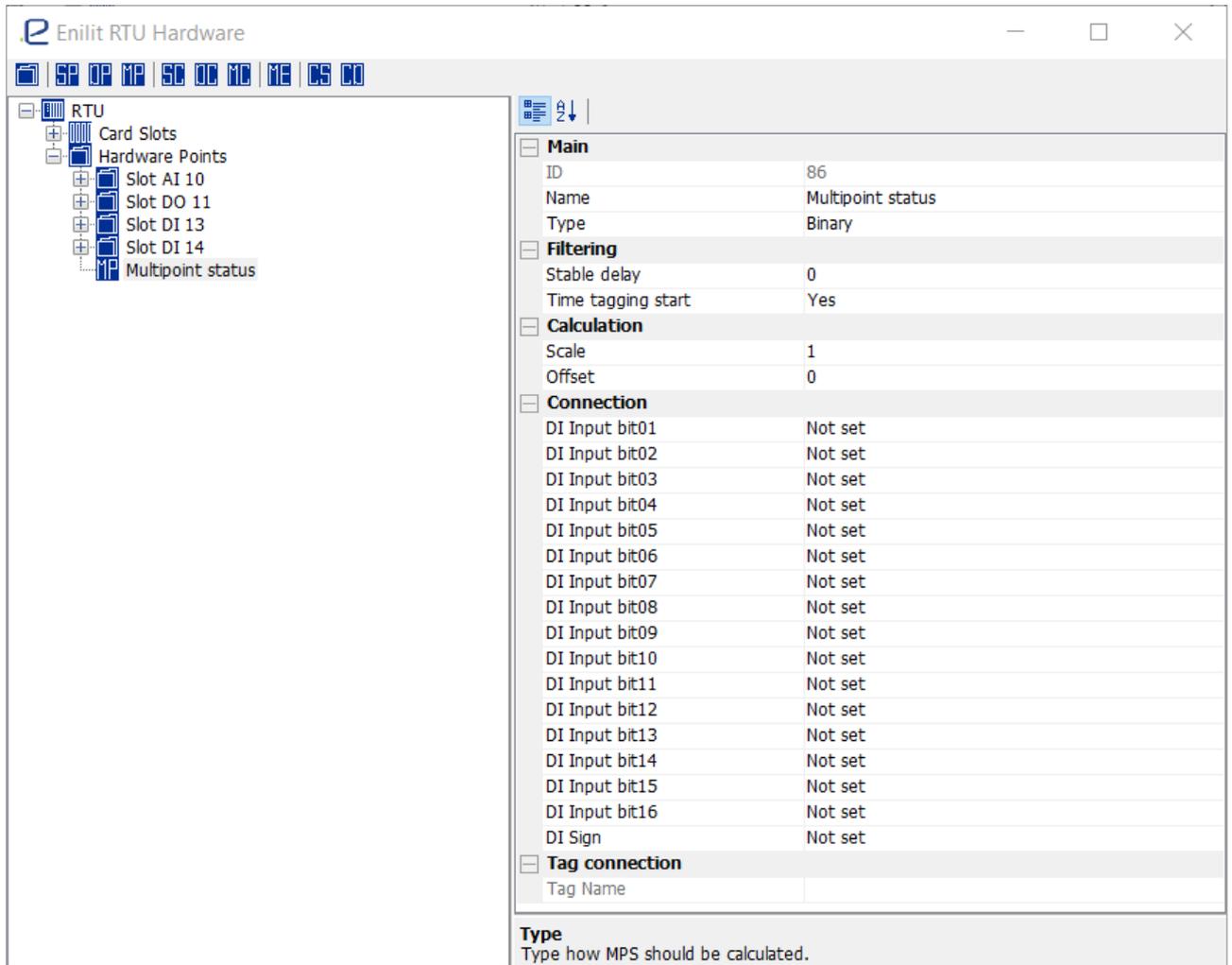


Figure 67. Hardware Points tree and multipoint status parameters

Table 65. Fields of multipoint status parameters window in Hardware Points card slot

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	Identification number of a hardware tag, for internal use only Range of values: 1 ... 65535	Depends on tag
Name	Hardware tag name, for example, 'Item MPS1' Length: 1 ... 255	Item MPS1
Type	Selects the type of the multipoint status Range of values: Binary, BCD, 1 from N bits, Gray	Binary

FIELD NAME	DESCRIPTION	DEFAULT VALUE
DI Input bit01 ... DI Input bit16	Allows connecting one of the multipoint status items to the binary input, for example, Slot: 13 DI: 04	Not set
DI Sign	Allows connecting the binary input used for the multipoint status sign. For example, Slot : 13 DI : 04	Not set
Stable delay	Delay on the stable state before changing the tag's value in 100 ms. Range of values: 0 ... 1000	0
Time tagging start	Type of a tag timestamp. An event can be with the start or end of the filtering timestamp. Range of values: Yes, No	Yes
Offset	Offset value for conversion Range of values: 0 ... 100	0
Scale	Scale value for conversion Range of values: 0 ... 100	1
Tag Name	Hardware tag connection to <i>TAG Manager</i> . <i>TAG Manager</i> tag name	-

4.8.8.4 Single command parameters

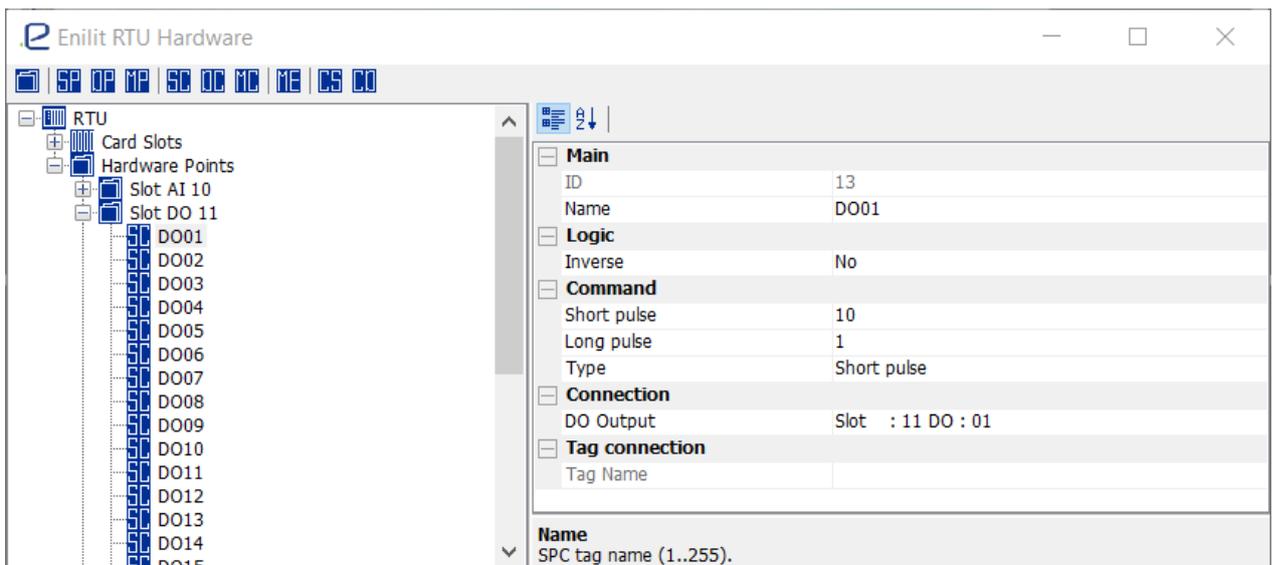


Figure 68. Hardware Points tree and single command parameters

Table 66. Fields of single command parameters window in *Hardware Points* card slot

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Long pulse	Length of the long pulse in seconds Range of values: 1 ... 600s	1
Short pulse	Length of the short pulse in 10 milliseconds Range of values: 10 ... 6000ms	10
Type	If a command was received with an unknown or undefined type, it will be overridden with this type of pulse. Range of values: Pulse short, Pulse long, Persistent	Pulse short
ID	Identification number of a hardware tag, for internal use only Range of values: 1 ... 65535	Depends on tag
Name	Hardware tag name, for example, 'Item SPC1' Length: 1 ... 255	Item SPC1
DO output	Allows connecting a hardware tag to the digital output For example, Slot : 11 DO : 01	Not set
Inverse	Invert of a hardware tag Range of values: Yes, No	No
Tag Name	Hardware tag connection to <i>TAG Manager</i> . <i>TAG Manager</i> tag name	-

4.8.8.5 Double command parameters

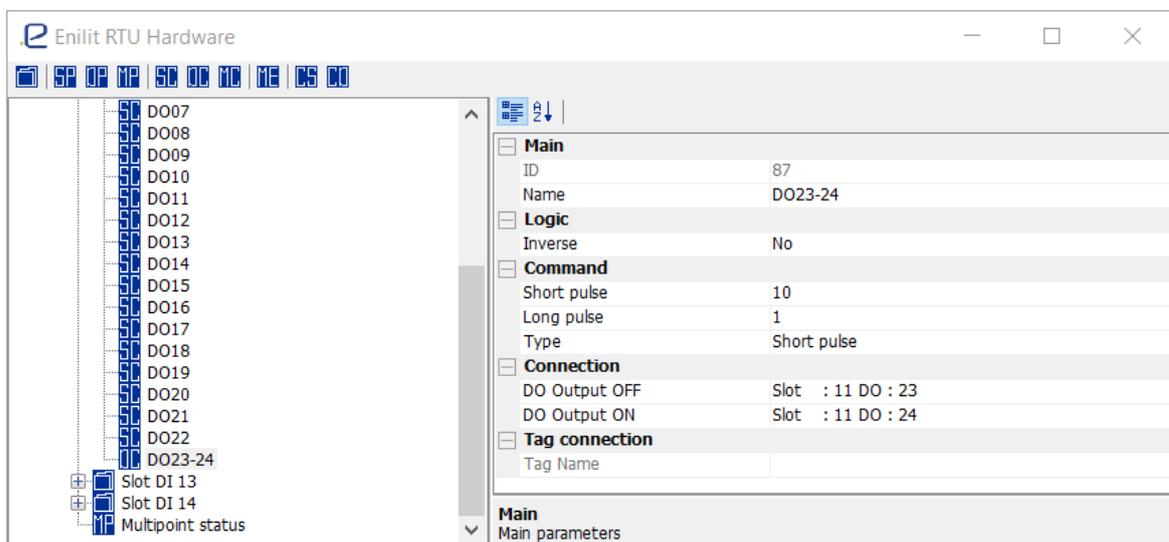


Figure 69. *Hardware Points* tree and double command parameters

Table 67. Fields of double command parameters window in *Hardware Points* card slot

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Long pulse	Length of the long pulse in seconds Range of values: 1 ... 600s	1
Short pulse	Length of the short pulse in 10 milliseconds Range of values: 10 ... 6000ms	10
Type	If a command was received with an unknown or undefined type, it will be overridden with this type of pulse. Range of values: Pulse short, Pulse long, Persistent	Pulse short
ID	Identification number of a hardware tag, for internal use only Range of values: 1 ... 65535	Depends on tag
Name	Hardware tag name, for example, 'Item DPC1' Length: 1 ... 255	Item DPC1
DO output OFF	Allows connecting a hardware tag to the digital output, for example, Slot: 11 DO: 04	Not set
DO output ON	Allows connecting a hardware tag to the digital output, for example, Slot: 11 DO: 05	Not set
Inverse	Invert of a hardware tag Range of values: Yes, No	No
Tag Name	Hardware tag connection to <i>TAG Manager</i> . <i>TAG Manager</i> tag name.	-

4.8.8.6 Multipoint command

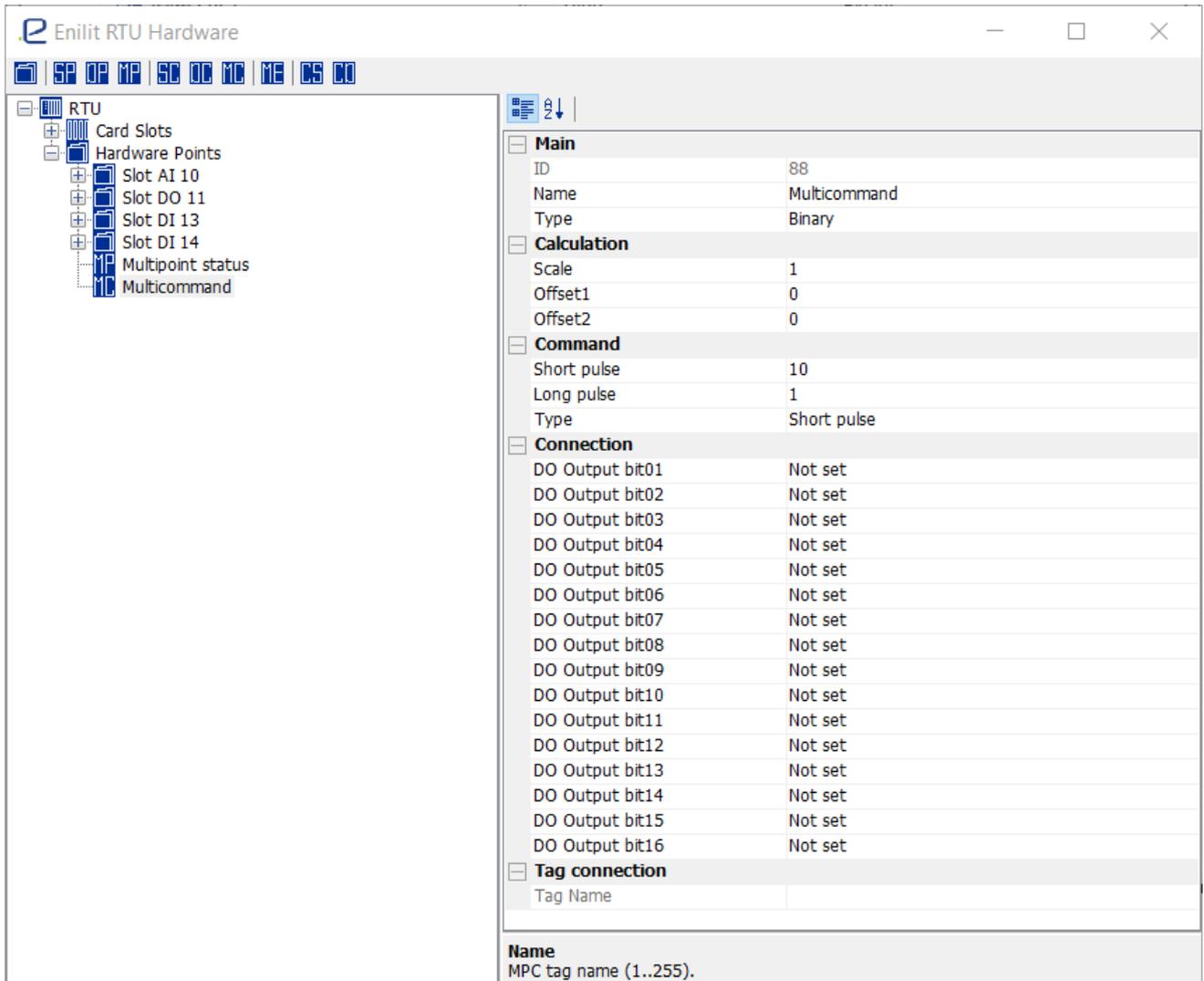


Figure 70. Hardware Points tree and multipoint command parameters

Table 68. Fields of multipoint command parameters window in Hardware Points card slot

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Long pulse	Length of the long pulse in seconds Range of values: 1 ... 600s	1
Short pulse	Length of the short pulse in 10 milliseconds Range of values: 10 ... 6000ms	10

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	Identify the type of pulse which will be overwritten on a command received of an unknown or undefined type. Range of values: Pulse short, Pulse long, Persistent	Pulse short
ID	Identification number of a hardware tag, for internal use only Range of values: 1 ... 65535	Depends on tag
Name	Hardware tag name, for example, 'Item MPC1' Length: 1 ... 255	Item MPC1
Type	Select the type of a multipoint command Range of values: Binary, BCD, 1 from N bits, Gray	Binary
DO Output bit01 ... DO Output bit16	Allows connecting one of the multipoint command items to the binary output, for example, Slot: 13 DO: 04	Not set
Offset1	Offset value for conversion Range of values: 0 ... 100	0
Offset2	Offset value for conversion Range of values: 0 ... 100	0
Scale	Scale value for conversion Range of values: 0 ... 100	1
Tag Name	Hardware tag connection to <i>TAG Manager</i> . <i>TAG Manager</i> tag name	-

4.8.8.7 Measurement parameters

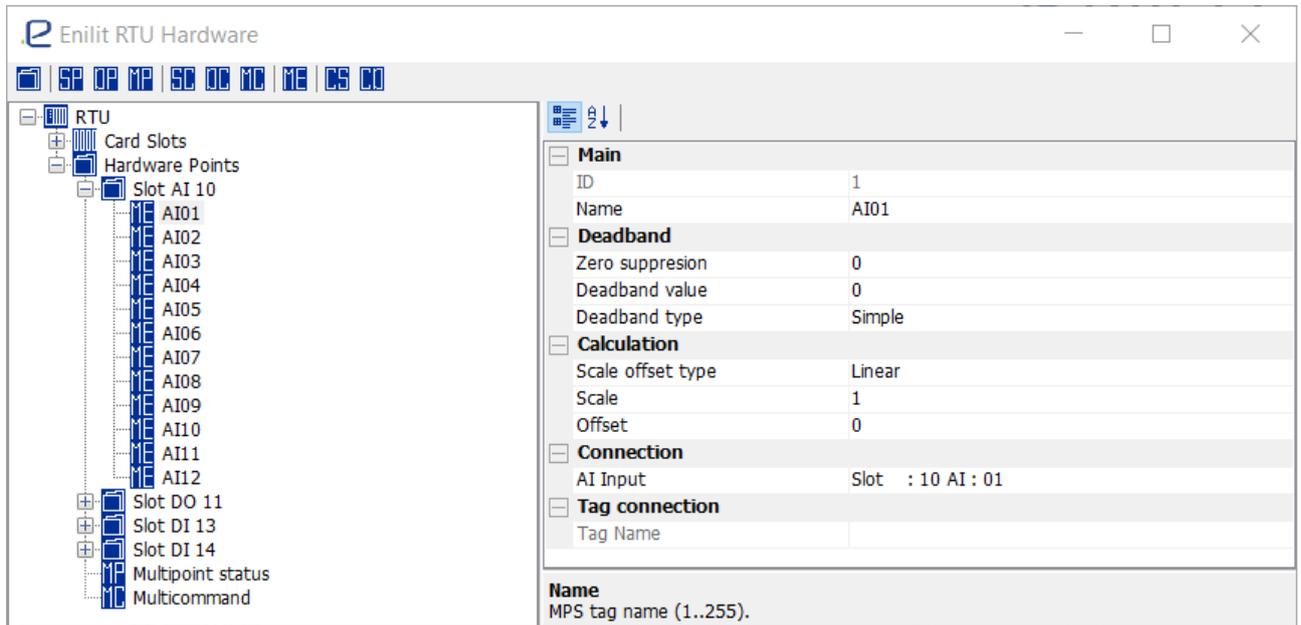


Figure 71. Hardware Points tree and measurement parameters

Table 69. Fields of measurement parameters window in Hardware Points card slot

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	Identification number of a hardware tag, for internal use only Range of values: 1 ... 65535	Depends on tag
Name	Hardware tag name, for example, 'Voltage U1' Length: 1 ... 255	Item MV1
AI input	Allows connecting a hardware tag to the analogue input, for example, Slot: 15 AI: 01	Not set
Deadband type	Type of a measurement dead band Range of values: Simple, Integrated Type 1, Integrated Type 2	Simple
Deadband value	Change of the measurement is sent if a new value exceeds the deadband value. If the value is 0, then all changes are sent. Range of values: 0 ... 32767	0

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Zero suppression	Set measurement to zero if it reaches below this parameter's value. Range of values: 0 ... 32767	0
Offset	Offset value for conversion Range of values: 0 ... 100	0
Scale	Scale value for conversion Range of values: 0 ... 100	1
Scale offset type	Type of conversion Range of values: Linear, Quadratic	Linear
Tag Name	Hardware tag connection to <i>TAG Manager</i> . <i>TAG Manager</i> tag name	-

4.8.8.8 Single counter parameters

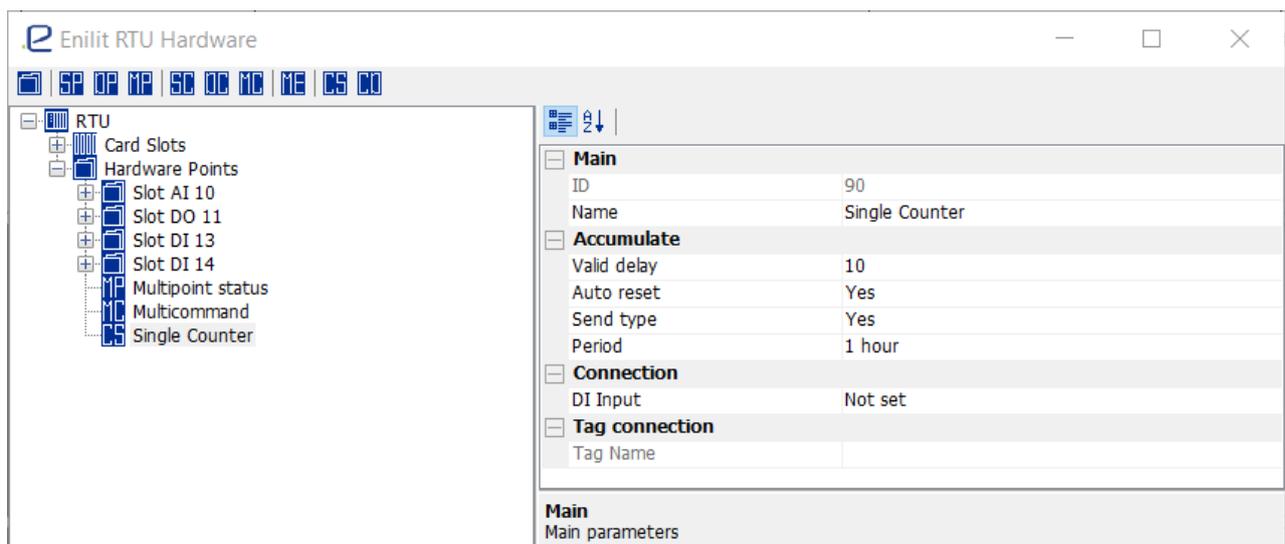


Figure 72. Hardware Points tree and single counter parameters

Table 70. Fields of single counter parameters window in Hardware Points card slot

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Auto reset	Automatically reset counter value after the accumulation period Values: Yes, No	Yes
Period	Period during which the accumulation has to be proceeded Range of values: 1 min ... 12h	1 hour

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Send type	Yes – the counter value is sent only at the end of the period No – the counter value is sent at the end of the period and every second Values: Yes, No	Yes
Valid delay	Stable ON delay before increasing a tag's value Range of values: 0 ... 1000ms	10
ID	Identification number of a hardware tag, for internal use only Range of values: 1 ... 65535	Depends on tag
Name	Hardware tag name, for example, 'Counter C1' Length: 1 ... 255	Item SCT1
DI input	Allows connecting a hardware tag to the digital input, for example, Slot: 12 DI: 01	Not set
Tag Name	Hardware tag connection to <i>TAG Manager</i> . <i>TAG Manager</i> tag name	-

4.8.8.9 Double counter parameters

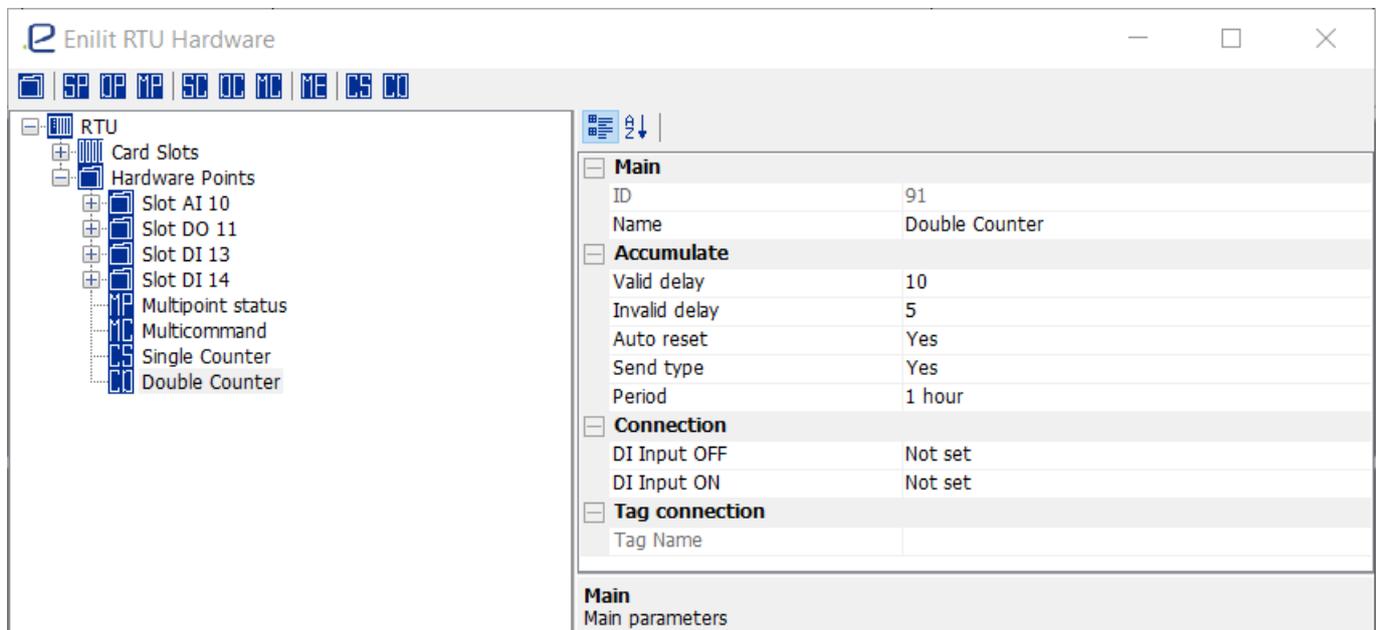


Figure 73. *Hardware Points* tree and double counter parameters

Table 71. Fields of double counter parameters window in *Hardware Points* card slot

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Auto reset	Automatically reset counter value after the accumulation period Values: Yes, No	Yes
Invalid delay	Delay after which binary inputs do not return to the normal state. The tags' value is not increased. Range of values: 0 ... 1000 ms	5
Period	Period during which the accumulation has to be proceeded Range of values: 1 min ... 12 h	1 hour
Send type	Yes – the counter value is sent only at the end of the period No – the counter value is sent at the end of the period and every second Values: Yes, No	Yes
Valid delay	Stable ON delay before increasing a tag's value Range of values: 0 ... 1000 ms	10
ID	Identification number of a hardware tag, for internal use only Range of values: 1 ... 65535	Depends on tag
Name	Hardware tag name, for example, 'Counter C1' Length: 1 ... 255	Item DCT1
DI input OFF	Allows connecting a hardware tag to the digital input. DI input used for OFF counting, for example, Slot: 12 DI: 01	Not set
DI input ON	Allows connecting a hardware tag to the digital input. DI input used for ON counting, for example, Slot: 12 DI: 01	Not set
Tag Name	Hardware tag connection to <i>TAG Manager</i> . <i>TAG Manager</i> tag name	-

4.9 Master protocols

4.9.1 IEC 60870-5-103 configuration

4.9.1.1 Communication port parameters

<input type="checkbox"/> Main	
ID	5
Port Name	COM1 IEC-103 master protocol
Enabled on start	Yes
<input type="checkbox"/> Communication	
COM port	COM 175
Baud rate	19200
Data bits	8
Stop bits	1
Parity	None
RS-485 Mode	Four wire
Reconnect	10
Next request	50
<input type="checkbox"/> Logging	
Port Monitor	No
Log raw data	Yes

Figure 74. *Communication port parameters in IEC 60870-5-103 protocol*

Table 72. *Fields of Communication port parameters window in IEC 60870-5-103 protocol*

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port name	Name of the port and protocol, for example, 'COM1 IEC103 master protocol'	New IEC-103 master protocol
Enabled on start	Port enabled on the system startup Values: No, Yes	No
Com port	Communication port number	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7,8 bits	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2 bits	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None
RS-485 Mode	If two wires are used, the mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Range of values: four wires, two wires	Four wire
Reconnect	Time interval of reconnection attempt while communication is not established Range of values:1 ... 600 s	10
Next request	Time interval before sending the next request Range of values: 0 ... 1000 ms	50
Port Monitor	Shows the port monitor on the system startup Values: No, Yes	No
Log raw data	Logs raw communication data Values: No, Yes	Yes

4.9.1.2 Data link layer parameters

Main	
ID	6
Data Link Name	Feeder 1
Enabled on start	Yes
IEC-103	
Main	
Data Link address	1
Frame size	255
Time Outs	
Broken link	5
Priority	1
Class1 Count	1
Class1 Time	0
Reconnect	10
Answer timeout	500
Other	
Allow E5	Yes
Use Status link	Yes
User Data with confirm	Yes
Use CU	No
Use CU timeout	0
Ignore DFC bit	Yes
Logging	
Log header	Yes
Log Answer TimeOut	First Time

Figure 75. Data link layer parameters in IEC 60870-5-103 protocol

Table 73. Fields of Data link layer parameters window in IEC 60870-5-103 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Data link name	Data link layer name, for example, 'Feeder 1'	New Data Link
Enabled on start	Enables or disables data link on start Values: No, Yes	No
Data link address	Data link address Range of values: 0 ... 254	0
Frame size	Maximum frame length Range of values: 50 ... 255 bytes	255

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Broken link	Number of retries to determine if the connection is broken Range of values: 1 ... 10	3
Priority	Requests data at every cycle. Relevant only if more than one data link layer exists Range of values: 1 ... 255	1
Class1 Count	Number of requests for the same data link layer, if there are Class1 events. 0 – requests until no Class1 events or Class1 timer expires Range of values: 0 ... 255	1
Class1 Time	Time interval of requesting for the same data link layer, if there are Class1 events. 0 – time is not checked. Range of values: 0 ... 255000ms	0
Reconnect	Time interval of reconnection attempt while communication is not established Range of values: 1 ... 600s	10
Answer timeout	Time period for response from the controlled device Range of values: 50 ... 30000ms	500
Allow E5	Enables or disables E5 response from the controlled device. Values: No, Yes	Yes
Use Status link	Enables or disables using the Status of link frame before the Reset Link is sent. Values: No, Yes	Yes
User Data with confirm	Sends User Data with the confirmation request. Values: No, Yes	Yes
Use CU	Enables to use the Reset Communication Unit. Values: No, Yes	No
Use CU timeout	Uses the Reset CU command if there is no link more than this timeout. This parameter has no effect if 'Use CU' is disabled. Range of values: 0 ... 43200 minutes	0 – always use
Ignore DFC bit	Enables to ignore DFC bit. Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Log header	Logs data link header. Values: No, Yes	Yes
Log Answer Timeout	Logs data link answer timeouts to the system log. Values: Never, First time, Always	First Time

4.9.1.3 Application layer parameters

<input type="checkbox"/> Main	
ID	7
Application Name	Feeder 1
Enabled on start	No
<input type="checkbox"/> IEC-103	
<input type="checkbox"/> Main	
Common address	1
General Interrogation	600
Auto add	Yes
Reconnect	600
<input type="checkbox"/> Time	
Time synchronization	600
Day of Week	No
Summer time	No
Allow synchronization	Yes
UTC time	Yes
<input type="checkbox"/> Other	
Generic Command	2000
<input type="checkbox"/> Logging	
Log header	Yes
Log IO	Yes
Log IO Not configured	Yes

Figure 76. Application layer parameters in IEC 60870-5-103 protocol

Table 74. Fields of Application layer parameters window in IEC 60870-5-103 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application layer name	Application layer name, for example, 'Feeder 1'	New Application
Enabled on start	Enables or disables the application layer on start Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Common address	Common address of a data unit Range of values: 1 ... 254	1
General Interrogation	Cycle time of the general interrogation to the controlled device Range of values: 1 ... 86400s	1800
Auto add	Automatically adds all data points received after general interrogation responses from the controlled device. Values: No, Yes	Yes
Reconnect	Time interval of reconnection to the remote application. The application is considered as connected, after receiving any application data from the remote device. Range of values: 1 ... 3600s	600
Time synchronization	Cycle time of the clock synchronization to the controlled device Range of values: 1 ... 86400s	600
Day of Week	In requests with a timestamp, use Day of Week bit. Values: No, Yes	No
Summer time	In requests with a timestamp, use Summer time bit. Values: No, Yes	No
Allow synchronization	Yes – always synchronize, No – synchronize only if RTU internal clock is synchronized	Yes
UTC time	In requests and responses, use UTC time. Values: No, Yes	Yes
Generic command	Refresh rate of the generic data request Range of values: 500 ... 600000ms	2000
Log header	Logs the headers of frames in the protocol log. Values: No, Yes	Yes
Log IO	Logs the configured information objects to the protocol log. Values: No, Yes	Yes
Log IO not configured	Logs non-configured points to the protocol log. Values: No, Yes	Yes

4.9.1.4 Points

The application layer has the branch *Points* where signals and measurements are managed from the controlled device and the commands can be sent to the controlled device. Points can be added manually or using the function *Auto Add* in the application layer, which will add all data points to the list. However, commands must be added manually anyway, hence commands are not included in the *General Interrogation*.

The following figure shows the *Points* popup menu which can be run with the right mouse button. The user can perform the following actions: *Add Status point*, *Edit Status point*, *Delete Status point*, *Select All* status points or commands. Also it allows to *Connect to Tag* or *Remove connection to the Tag*. Removing the connection to the source is possible from the *TAG Manager*. All menu items have keyboard shortcuts which simplify and quicken the work with the software.

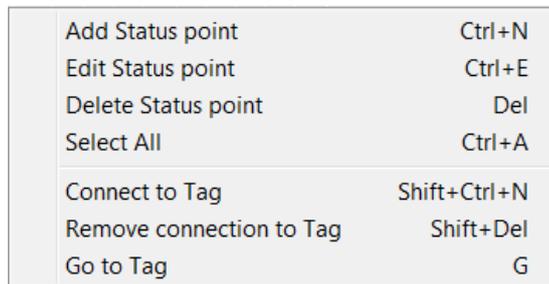


Figure 77. *Points* popup menu

The following figure shows the dialog window *Create new status point*. The parameters which can be specified on the IEC 60870-5-103 protocol are proposed in the figure below.

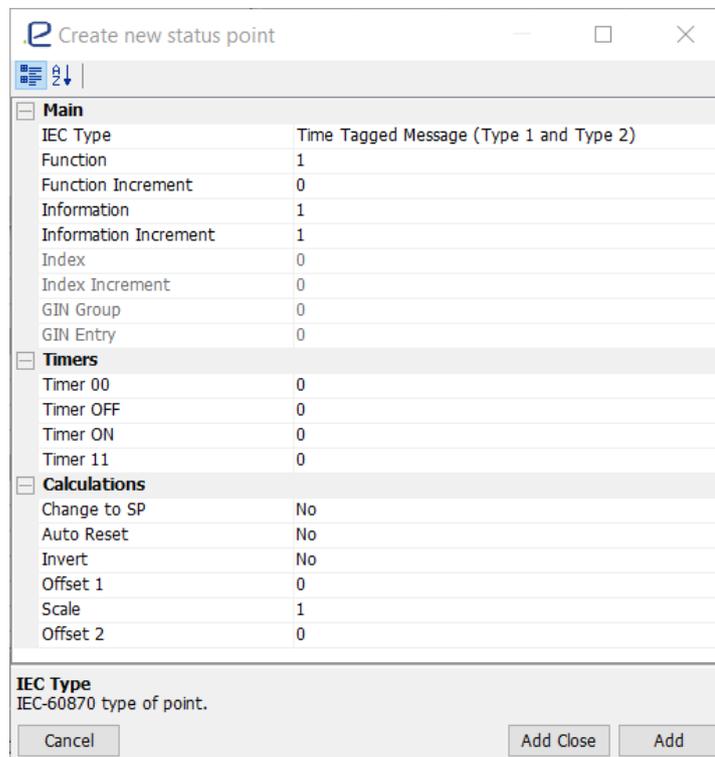


Figure 78. *Create new status point*

Table 75. Fields of *Create new status point* window in IEC 60870-5-103 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IEC Type	Type of data in IEC 60870-5-103 protocol Values: Time Tagged Message (Type 1 and Type 2), Measurement (Type 3 and Type 9), Measurement (Type 4), Time Tagged Message (Type 1 and Type 2) Double, Generic Command.	Time Tagged Message (Type 1 and Type 2)
Function	Defines the function type of the employed protection equipment. The list below provides the meaning of some of the function types: 128: Distance protection 160: Overcurrent time protection 176: Transformer-differential protection 192: Line differential protection 254: Generic function type 255: Global function type For a complete list of all function types, please refer to the IEC 60870-5-103 norm Range of values: 0 ... 255	1
Function Increment	Used only for configuration. After adding a new status point function, it will be automatically incremented by the set value.	0
Information	Specifies the information number. Ranges for information numbers in the monitoring direction: 0 ... 15 System functions 16 ... 31 Status 32 ... 47 Monitoring 48 ... 63 Earth faults 64 ... 127 Short circuits 128 ... 143 Automatic reclosing 144 ... 159 Measured values 240 ... 255 Generic functions Ranges for information numbers in the control direction: 0 ... 15 System functions 16 ... 31 General commands 240 ... 255 Generic functions For a complete list of all information numbers, please refer to the IEC 60870-5-103 norm. Range of values: 0 ... 255	1
Information Increment	Used only for configuration. After adding a new status point, the function will be automatically incremented by the set value.	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Index	Parameter is relevant only with IEC Type Measurement (Type 3 and Type 9). Range of values: 0 ... 255	1
Index Increment	After adding a new point, the Index will be automatically incremented by the set value.	
GIN Group	Generic Identification Number Group Range of values: 0 ... 255	0
GIN Entry	Generic Identification Number Entry Range of values: 0 ... 255	0
Timer 00	This parameter is relevant only if IEC Type is Time Tagged Message (Type 1 and Type 2) Double. If the received value is intermediate and the timer is set to the value other than zero, it will be delayed for the set time, and if some data change occurs, it will be ignored. Range of values: 0 ... 3600s, 0 – not used	0
Timer OFF	This parameter is relevant only if IEC Type is Time Tagged Message (Type 1 and Type 2) Double. If the received value is OFF and the timer is set to the value other than zero, it will be delayed for the set time, and if some data change occurs, it will be ignored. Range of values: 0 ... 3600s, 0 – not used	0
Timer ON	This parameter is relevant only if IEC Type is Time Tagged Message (Type 1 and Type 2) Double. If the received value is ON and the timer is set to the value other than zero, it will be delayed for the set time, and if some data change occurs, it will be ignored. Range of values: 0 ... 3600s, 0 – not used	0
Timer 11	This parameter is relevant only if IEC Type is Time Tagged Message (Type 1 and Type 2) Double. If the received value is indeterminate and the timer is set to the value other than zero, it will be delayed for the set time, and if some data change occurs, it will be ignored. Range of values: 0 ... 3600s, 0 – not used	0

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Change to SP	In the IEC-60870-5-103 protocol, all status signals are double points. If a single point signal in the upper direction (IEC 60870-5-101 or IEC 60870-5-103 slave protocols) is to be used, then this checkbox must be checked. Values: Checked, Unchecked	Unchecked
Auto reset	In the IEC 60870-5-103 protocol, the data Type 2 are transient signals, which means that the slave device transmits only the start of a signal but never transmits the end of it. In case, the transmission of the end of the signal is important, you must check this checkbox. Values: Checked, Unchecked	Unchecked
Invert	Inversion of the signals of Type 1 and Type 2 Values: Checked, Unchecked	Unchecked
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0

The following figure shows the list of the status points and commands. A double click allows editing data or a command point. The user can select many points as well and then edit them using the keyboard shortcut Ctrl+E.

Status points		Command points						Value	Time	Cause	Tag
..	..	IEC Type		.	.						
1	160	148	1	Measurands (Type 3 and Type 9)							
2	160	148	2	Measurands (Type 3 and Type 9)							
3	160	148	3	Measurands (Type 3 and Type 9)							
4	160	148	4	Measurands (Type 3 and Type 9)							
5	160	148	5	Measurands (Type 3 and Type 9)							
6	160	148	6	Measurands (Type 3 and Type 9)							
7	160	148	7	Measurands (Type 3 and Type 9)							
8	160	148	8	Measurands (Type 3 and Type 9)							
9	255	10		Time Tagged Message (Type 1 and Type 2)							
10	255	11		Time Tagged Message (Type 1 and Type 2)							
11	255	12		Time Tagged Message (Type 1 and Type 2)							
12	255	13		Time Tagged Message (Type 1 and Type 2)							
13	255	14		Time Tagged Message (Type 1 and Type 2)	Yes	Yes					
14	255	15		Time Tagged Message (Type 1 and Type 2)	Yes						
15	255	16		Time Tagged Message (Type 1 and Type 2)	Yes						
16	255	17		Time Tagged Message (Type 1 and Type 2)	Yes						
17	255	18		Time Tagged Message (Type 1 and Type 2)	Yes						

Figure 79. List of Status points

The columns between the *Function* and *Offset 2* are the status point configuration parameters. *Value*, *Time*, *Quality*, and *Cause* show real-time data from the controlled device.

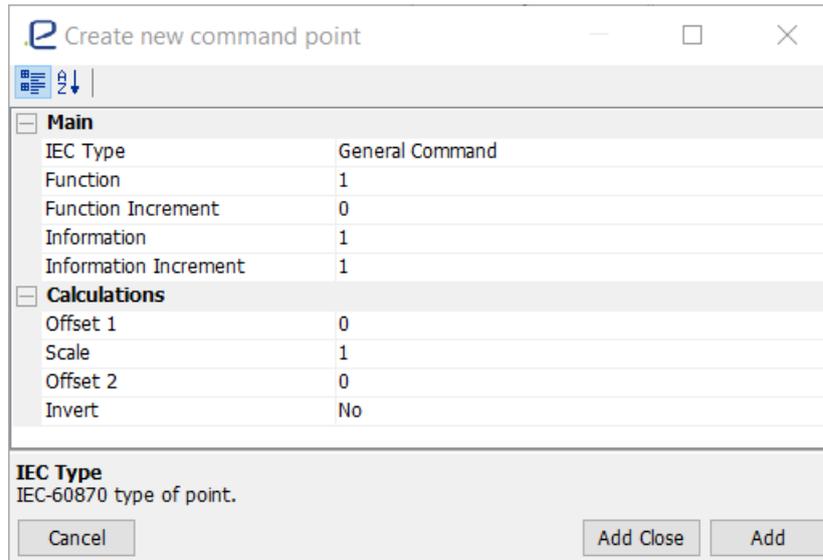


Figure 80. Create new command point window

Table 76. Fields of *Create new command point* window in IEC 60870-5-103 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IEC Type	Type of data in IEC 60870-5-103 protocol Values: General Command General Command Double (composed from to General Commands addressed in a row)	General Command
Function	The function type of the employed protection equipment should be defined. For a complete list of all function types, please refer to the IEC 60870-5-103 standard. Range of values: 0...255	1
Function Increment	Used only for configuration. After adding a new command, the function will be automatically incremented by the set value.	0
Information	Specifies the information number. Ranges for information numbers in the monitoring direction: 0 ... 255	1
Information Increment	Used only for configuration. After adding a new command, the function will be automatically incremented by the set value.	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of the signals of Type 1 and Type 2 Values: No, Yes	No

Status points		Command points							
..	IEC Type	Scale	Offset 2	Invert	Value	Time	Result	Tag ID	Tag
20	242 69 General Command				0				
19	242 67 General Command				0				
18	242 65 General Command				0				

Figure 81. List of *Command points*

In the *Command points* window the columns of *Value*, and *Time* show the last transmitted command data. The column of *Result* shows the response from the controlled device.

4.9.1.5 Calculation of the measured information coefficient

Sometimes it is hard to understand how the Scale parameter is calculated to get the real value of the measurement. Most of relays use coefficients 1.2 or 2.4 for the measurement transmission (according to IEC-60870-103 standard). Later in the text, it is referred to as COF.

According to the IEC-60870-103 standard, measurements are transmitted in range from -4096 to 4096.

$$\text{ScaleI} = \text{Inom} * \text{COF} / 4096;$$

$$\text{ScaleU} = \text{Unom} * \text{COF} / 4096;$$

$$\text{ScaleUL} = \text{Unom} * \text{COF} * \sqrt{3} / 4096;$$

$$\text{ScaleP} = \text{Inom} * \text{Unom} * \text{COF} * \sqrt{3} / 4096;$$

$$\text{ScaleQ} = \text{Inom} * \text{Unom} * \text{COF} * \sqrt{3} / 4096.$$

Remember if kilovolts are used in equations, then kilowatts will be used for power and so on.

4.9.2 IEC 60870-5-101 configuration

4.9.2.1 Communication port parameters

Main	
ID	3
Port Name	New IEC-101 master (client) protocol
Enabled on start	No
Communication	
Listen Mode	No
COM port	Not assigned
Baud rate	9600
Data bits	8
Stop bits	1
Parity	None
RS-485 Mode	Four wire
Reconnect	10
Next request	50
IEC-101	
Data Link address size	1
Logging	
Port Monitor	No
Log raw data	Yes

Figure 82. *Communication port parameters in IEC 60870-5-101 protocol*

Table 77. Fields of *Communication port* parameters window in IEC 60870-5-101 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port name	Name of the port and protocol, for example, 'COM2 IEC-101 master protocol'	New IEC-101 master protocol
Enabled on start	Port enabled on the system startup Values: No, Yes	No
Listen Mode	Communication port will only receive data but it will not make any transmits. Use it only for testing proposes. Values: No, Yes.	No
Com port	Communication port number	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7, 8	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None
RS-485 Mode	If two wires are used, mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Range of values: Four wires, Two wires	Four wire
Reconnect	Time interval of reconnection attempt while communication is not established. Range of values: 1 ... 600s	10
Next request	Wait time before sending the next request Range of values: 0 ... 1000ms	50
Data link address size	Data link layer address size in bytes Range of values: 0 ... 2 bytes	1
Port monitor	Shows the port monitor on the system startup Values: No, Yes	No
Log raw data	Logs raw communication data Values: No, Yes	Yes

4.9.2.2 Data link layer parameters

Main	
ID	7
Data Link Name	New Data link layer
Enabled on start	No
IEC-101	
Main	
Data Link address	1
COT size	1
CAA size	2
Frame size	255
Time Outs	
Broken link	5
Priority	1
Class1 Count	1
Class1 Time	0
Reconnect	10
Answer timeout	500
Other	
Allow E5	Yes
Use Status link	Yes
User Data with confirm	Yes
Logging	
Log header	Yes
Log Answer TimeOut	First Time

Figure 83. Data link layer parameters in IEC 60870-5-101 protocol

Table 78. Fields of Data link layer parameters window in IEC 60870-5-101 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Data link name	Data link layer name, for example, 'Measurements data controller'	New Data Link
Enabled on start	Enables or disables data link on start Values: No, Yes	No
Data link address	Data link address Range of values: 1 ... 65534 (if Data link address length is set to 2), 1 ... 254 (if Data link address length is set to 1), If Data link address length is set to 0, this parameter is not used	1
COT size	Size of cause of transmission Range of values: 1 ... 2 bytes	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
CAA size	Size of common address Range of values: 1 ... 2 bytes	2
Frame size	Maximum frame length Range of values: 50 ... 255 bytes	255
Broken link	Number of retries to determine if the connection is broken. Range of values: 1 ... 10	3
Priority	Data is requested every cycle. It is relevant only if more than one data link layer exists. Range of values: 1 ... 255	1
Class1 Count	Number of requests for the same data link layer, if there are Class1 events. 0 – requests are sent until no Class1 events, or Class1 timer expires. Range of values: 0 ... 255	1
Class1 Time	Time intervals for the request to be sent for the same data link layer, if there are Class1 events. 0 – time is not checked. Range of values: 0 ... 255000ms	0
Reconnect	Time interval of reconnection attempt while communication is not established. Range of values: 1 ... 600s	10
Answer timeout	Time period for response from the controlled device Range of values: 50 ... 30000ms	500
Allow E5	Enables or disables E5 response from the controlled device. Values: No, Yes	Yes
Use Status link	Enables or disables using the Status of link frame before the Reset Link is sent. Values: No, Yes	Yes
User Data with confirm	Sends User Data with confirmation request. Values: No, Yes	Yes
Log header	Logs data link header. Values: No, Yes	Yes
Log Answer Timeout	Logs data link answer timeouts to the system log. Values: Never, First time, Always.	First Time

4.9.2.3 Application layer parameters

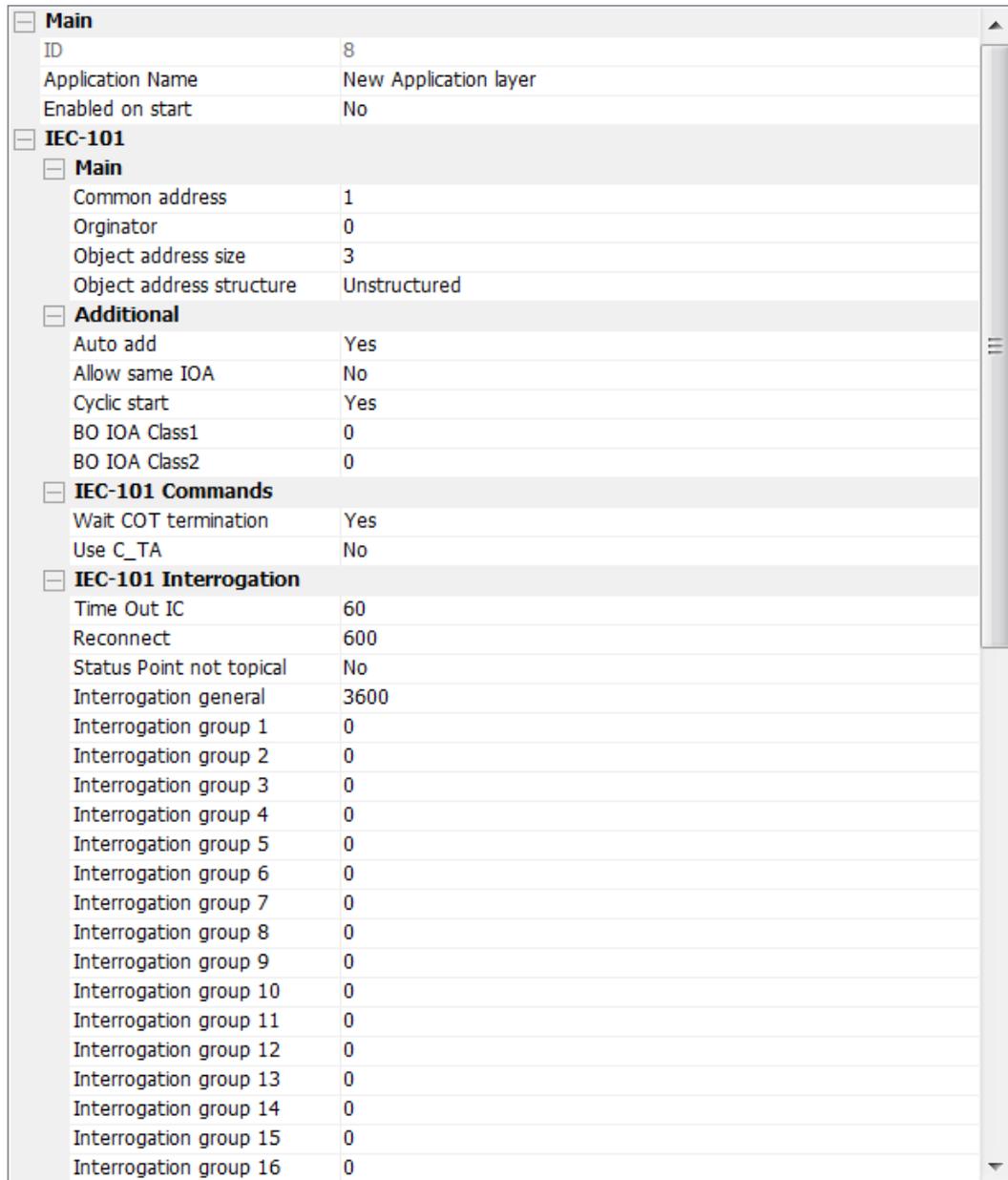


Figure 84. Application layer parameters in IEC 60870-5-101 protocol

Table 79. Fields of Application layer parameters window in IEC 60870-5-101 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application name	Name of the application link layer, for example, 'Measurements data controller'	New Application
Enabled on start	Enables or disables application on start Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Common address	Common address of a data unit Range of values: 1 ... 254	1
Originator	Originator Range of values: 0 ... 255	0
Object address size	Size of the information object address Range of values: 1 ... 3	3
Object address structure	Structure of the object address shows the format in which the information object address is entered in the configuration. Range of values: Unstructured, Structured 8.8.8, Structured 8.16, Structured 16.8, Structured 8.8	Unstructured
Auto add	Automatically adds all data points received after the General Interrogation to the controlled device. Values: No, Yes	Yes
Allow same IOA	Allows having the same information object address for the status and command points. Values: No, Yes	No
Cyclic start	Yes – the next cyclic operation time is calculated at the end of the operation. No – the next cyclic operation time is calculated at the start of the operation. Values: No, Yes	Yes
BO IOA Class1	Information object address of the buffer overflow for Class1 Range of values: 0 - 16777215	0 – not used
BO IOA Class2	Information object address of the buffer overflow for Class2 Range of values: 0 - 16777215	0 – not used
Wait COT termination	Wait for the response of the activation termination for the set points Values: No, Yes	Yes
Use C_TA	Enables to use commands with a timestamp. Values: No, Yes	No
Timeout IC	Timeout for the interrogation commands Range of values: 1 ... 3600s	60
Reconnect	Time interval of reconnection attempt while the application layer is not connected Range of values: 1 ... 3600s	10

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Interrogation general	Cycle time of General Interrogation to the controlled device Range of values: 1 ... 86400s	3600
Interrogation group 1 ... 16	Cycle time of Group Interrogation to the controlled device Range of values: 0 ... 86400s	0 – disabled Group Interrogation

<input type="checkbox"/> IEC-101 Counter Interrogation	
Time Out CI	60
Counter Interrogation general	0
Counter Interrogation group 1	0
Counter Interrogation group 2	0
Counter Interrogation group 3	0
Counter Interrogation group 4	0
<input type="checkbox"/> IEC-101 Clock	
Time Out CS	10
Allow synchronization	No
Clock synchronization	1800
UTC time	Yes
Day of Week	No
Summer time	No
<input type="checkbox"/> IEC-101 Delay Acquisition	
Acquisition delay	No
Time Out CD	10
<input type="checkbox"/> IEC-101 Test	
Use for test C_TS_TA_1	Yes
Test	0
FBP	21930
Time Out TS	10
<input type="checkbox"/> IEC-101 Reset Process	
Time Out RP	10
<input type="checkbox"/> IEC-101 File Transfer	
Enabled	No
Dir on connect	Yes
Receive files	No
Segment size	0
<input type="checkbox"/> Logging	
Log header	Yes
Log IO	Yes
Log IO Not configured	Yes

Figure 85. Application layer parameters in IEC 60870-5-101 protocol

Table 80. Fields of *Application layer* parameters window in IEC 60870-5-101 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Timeout CI	Timeout for Counter Interrogation requests Range of values: 0 ... 3600s	60
Counter Interrogation general	Cycle time of Counter Interrogation to the controlled device Range of values: 0 ... 86400s	0 – disabled Counter Interrogation
Counter Interrogation group 1 ... 4	Cycle time of Counter Interrogation group to the controlled device Range of values: 0 ... 86400s	0 – disabled Counter Interrogation
Timeout CS	Timeout for the clock synchronization Range of values: 1 ... 3600s	10
Allow synchronization	Yes – always synchronize, No – synchronize only if the internal clock of RTU is synchronized	Yes
Clock synchronization	Cycle time of the clock synchronization to the controlled device Range of values: 1 ... 86400s	600
UTC time	Enables to use UTC time in requests and responses Values: No, Yes	Yes
Day of Week	In request with a timestamp, use Day of Week bit. Values: No, Yes	No
Summer time	In request with a timestamp, use Summer time bit. Values: No, Yes	No
Acquisition delay	Uses the acquisition delay before sending the clock synchronization. (C_CD_NA_1) Values: No, Yes	No
Timeout CD	Timeout for the delay acquisition Range of values: 1 ... 3600s	10
Use for test C_TS_TA_1	Uses the test frame format C_TS_TA_1 Values: No, Yes	Yes
Test	Cycle time of the test frame. This parameter is not used when the value of <i>Is test frame used</i> is 'No'. Range of values: 1 ... 86400s	0 - disabled
FBP	Fixed test bit pattern Range of values: 0 ... 32768	21930
Timeout TS	Timeout for the test command Range of values: 1 ... 3600s	10

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Timeout RP	Timeout for reset process Range of values: 1 ... 3600s	10
Enabled	Enables the file transfer function. Values: No, Yes	No
Dir on connect	Requests the directory after the connection starts. Values: No, Yes	Yes
Receive files	After receives the list of files, downloads all files from the controlled device. Values: No, Yes	No
Segment size	Segment size to be used in the file transfer. 0 – the segment size is calculated from maximum frame length. If the segment size plus headers makes more than maximum frame length, the segment size will be calculated from the maximum frame length. Range of values: 0 ... 255 bytes	0
Log header	Logs application layer header Values: No, Yes	Yes
Log IO	Logs information objects Values: No, Yes	Yes
Log IO not configured	Logs not configured information objects Values: No, Yes	Yes

4.9.2.4 Points

The following figure shows the Status points of the IEC 60870-5-101 protocol.

Status points		Command points									
№	IEC Type	Invert	Offs...	Scale	Offs...	Val...	Time	Qu...
1	1001 Single point										
2	1002 Single point										
12	1003 Double point	Yes									
13	1004 Double point	Yes									
5	1005 Measured value, normalised value										
6	1006 Measured value, normalised value										
7	1007 Measured value, scaled value										
8	1008 Measured value, scaled value										
9	1009 Measured value, short floating point value										
10	1010 Measured value, short floating point value										
11	1011 Step position										

Figure 86. Status points table in IEC 60870-5-101 protocol

Status points		Command points	
I...	IEC Type		
14	10001	Single command	0
15	10002	Single command	0
16	10003	Double command	0
17	10004	Double command	0

Figure 87. Command points table in IEC 60870-5-101 protocol

The following figure shows how to add new data points of the IEC 60870-5-101 protocol. The function of the *IOA Increment* can be employed to do that. For example, if the user needs to configure a few points with the information addresses in the interval between 1001 and 1010, then the user configures the first point with 1001 address and then changes *IOA Increment's* value to 1. Then, click the button *Add*, which will not close the dialog but automatically configure the information address with 1002. In this way, it is possible to get 10 points with only 10 mouse clicks.

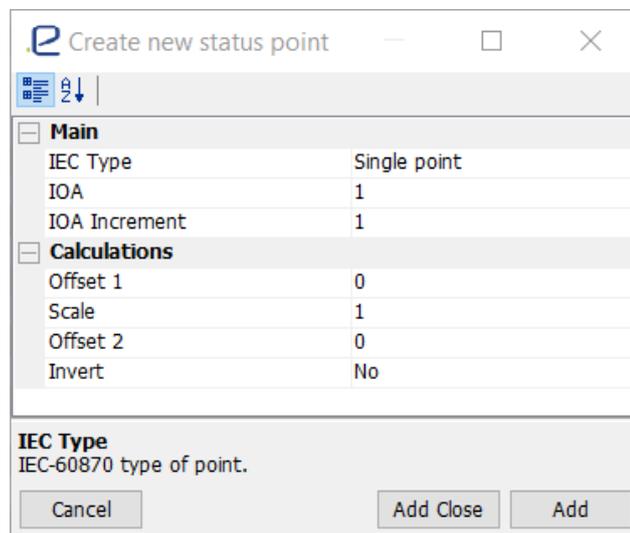


Figure 88. Create new data point in IEC 60870-5-101 protocol

Table 81. Fields of *Create new data point* window in IEC 60870-5-101 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IEC Type	Type of data in IEC 60870-5-101 protocol Values: Single point Double point Step position Bit string of 32 bits Measured value, normalized value Measured value, scaled value Measured value, short floating point value	Single Point
IOA	Specifies the information address. The range of information address depends on the length of the information object address in the application layer parameter. Range of values: 0 ... 16777215	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IOA Increment	After adding a new point, IOA will be automatically incremented by the set value.	1
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of the signals of Type 1 and Type 2 Values: No, Yes	No

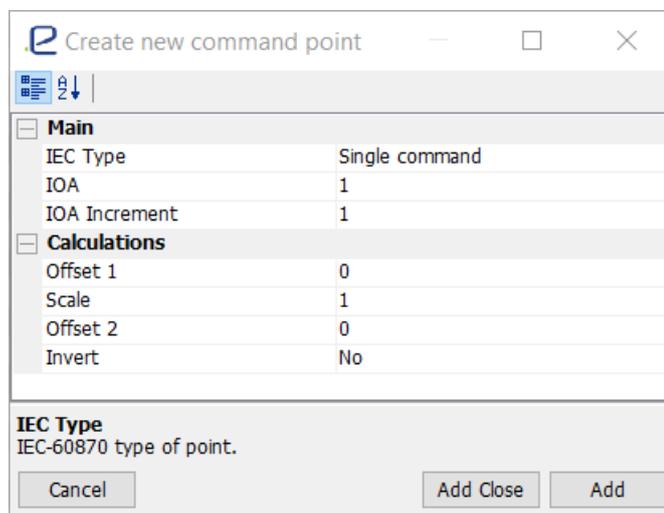


Figure 89. Create new command point in IEC 60870-5-101 protocol

Table 82. Fields of Create new command point window in IEC 60870-5-101 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IEC Type	Type of command in IEC 60870-5-101 protocol Values: Single command Double command Regulating step command Setpoint normalized command Setpoint scaled command Setpoint short float command Bitstring command	Single Command
IOA	Specifies the information address. The range of information address depends on the length of the information object address in the application layer parameter. Range of values: 0 ... 16777215	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IOA Increment	After adding a new point, IOA will be automatically incremented by the set value.	1
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of a command Values: No, Yes	No

4.9.3 IEC 60870-5-104 configuration

4.9.3.1 Communication port parameters

<input type="checkbox"/> Main	
ID	10
Port Name	New IEC-104 master protocol
Enabled on start	No
<input type="checkbox"/> Communication	
Ethernet port	All ETH
Server Name or IP	127.0.0.1
TCP port	2404
<input type="checkbox"/> Redundancy	
Redundancy Enabled	No
Ethernet port	All ETH
Server Name or IP	
TCP port	
TCP Keep Alive	0
TCP No delay	Yes
Connect Time Out	30
Reconnect	10
Next request	50
<input type="checkbox"/> Logging	
Port Monitor	No
Log raw data	Yes

Figure 90. *Communication port* parameters in IEC 60870-5-104 protocol

Table 83. Fields of *Communication port* parameters window in IEC 60870-5-104 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port name	Port name, for example, 'IEC-104 master 172.29.37.113'	New IEC-104 master protocol
Enabled on start	Enables or disables a communication port on start. Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Ethernet port	Specifies the Ethernet port to be used for the connection to the server. Values: All ETH, ETH1, ETH2, ETH3, ETH4	All ETH
Server name or IP	Name or IPv4 address of the host	127.0.0.1
TCP port	TCP port Range of values: 1 ... 65535	2404
Redundancy enabled	Enables or disables redundant communication. Values: No, Yes	No
Ethernet port	Redundant Ethernet port to be used for the connection to the server Values: All ETH, ETH 1, ETH 2, ETH 3, ETH4	All ETH
Server name or IP	Name or IPv4 address of the redundant host	
TCP port	Redundant TCP port Range of values: 1 ... 65535	
TCP Keep Alive	It is not advised to set low values because it will add overhead to communication. Range of values: 0 ... 2147483647ms; 0 – disabled	10000
TCP No delay	TCP No delay disables the Nagle Algorithm. Values: No, Yes	No
Connect Timeout	Time interval to establish connection Range of value: 1 ... 255s	30
Reconnect	Time interval of reconnection attempt while communication is not established. Range of values: 1...600s	10
Next request	Time interval before sending the next request Range of values: 0 ... 2000ms	0
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes

4.9.3.2 Data link layer parameters

Main	
ID	0
Data Link Name	New Data link
Enabled on start	No
Time outs	
T1	15
T2	10
T3	20
k	12
w	8
No frame I	Not used
No frame I timeout	60
Sizes	
Common address size	2
Cause of transmission size	2
Frame size	255
Logging	
Log APCI	Yes

Figure 91. *Data link layer* parameters in IEC 60870-5-104 protocol

Table 84. Fields of *Data link layer* parameters window in IEC 60870-5-104 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Data link name	Data link name, for example, 'Data link'	New Data link
Enabled on start	Enables or disables the communication port on start. Values: No, Yes	No
T1	Acknowledgement timeout 1 Range of values: 1...600s	15
T2	Acknowledgement timeout 2 Range of values: 1...600s	10
T3	Connection test timeout Range of values: 1...600s	20
k	Maximum number of unacknowledged ADPUs Range of values: 1...32,767	12
w	Maximum number of the received ADPUs for acknowledgment Range of values: 1...32,767	8
No frame I	Changes behaviour of frame I. Values: Not used, Send STOP DT, Disconnect	Not used

FIELD NAME	DESCRIPTION	DEFAULT VALUE
No frame I timeout	Timeout of frame I Range of values: 1...600 s	60
Common address size	Common address size Range of values: 1 ... 2 bytes	2
Cause of transmission size	Cause of transmission size Range of values: 1 ... 2 bytes	2
Frame size	Maximum frame size. All start, stop, checksum and other bytes are included. Range of values: 50 ... 255 bytes	255
Log APCI	Log Application Protocol Control Information Values: No, Yes	Yes

4.9.3.3 Application layer parameters

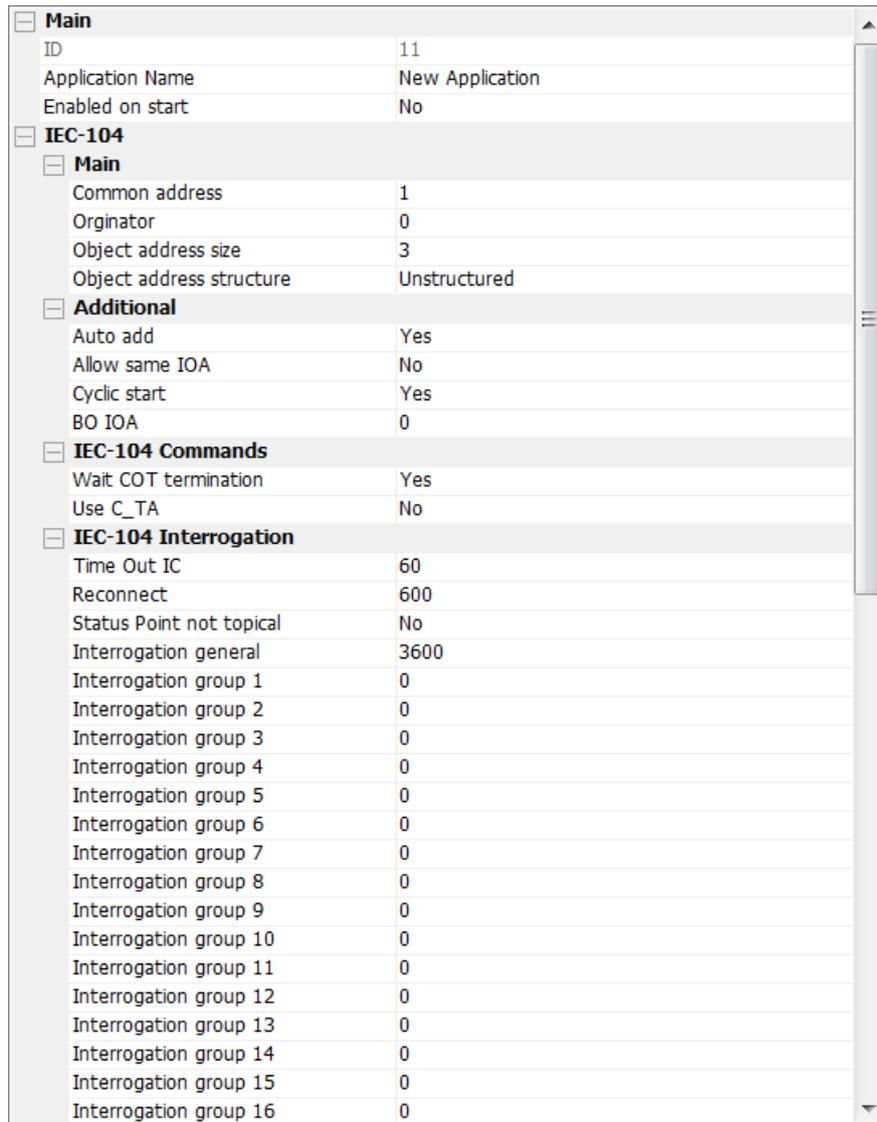


Figure 92. Application layer parameters in IEC 60870-5-104 protocol

Table 85. Fields of Application layer parameters window in IEC 60870-5-104 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application name	Application layer name, for example, 'Other RTU'	New Application
Enabled on start	Enables or disables application on start. Values: No, Yes	No
Common address	Common address of a data unit Range of values: 1 ... 65534	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Originator	Originator Range of values: 0 ... 255	0
Object address size	Size of the information object address Range of values: 1 ... 3	3
Object address structure	Structure of the object address shows the format in which the information object address is entered in the configuration. Range of values: Unstructured, Structured 8.8.8, Structured 8.16, Structured 16.8, Structured 8.8	Unstructured
Auto add	Automatically adds all data points received after the General Interrogation to the controlled device. Values: No, Yes	Yes
Allow same IOA	Allows having the same information object address for status and command points. Values: No, Yes	No
Cyclic start	Yes – the next cyclic operation time is calculated at the end of the operation. No – the next cyclic operation time is calculated at the start of the operation. Values: No, Yes	Yes
BO IOA	Information object address of a buffer overflow Range of values: 0 - 16777215	0 – not used
Wait COT termination	Wait for the response of activation termination for the set points Values: No, Yes	Yes
Use C_TA	Enables to use commands with a timestamp. Values: No, Yes	No
Timeout IC	Timeout for interrogation commands Range of values: 1 ... 3600s	60
Reconnect	Time interval of reconnection attempt while the application layer is not connected Range of values: 1 ... 3600s	10
Status Point not topical	Point will be set to the state <i>not topical</i> , if it was not found in the response list of the general interrogation. Values: No, Yes	No
Interrogation general	Cycle time of the general interrogation to the controlled device Range of values: 1 ... 86400s	3600
Interrogation group 1 ... 16	Cycle time of the group interrogation to the controlled device Range of values: 0 ... 86400s	0 – disabled Group Interrogation

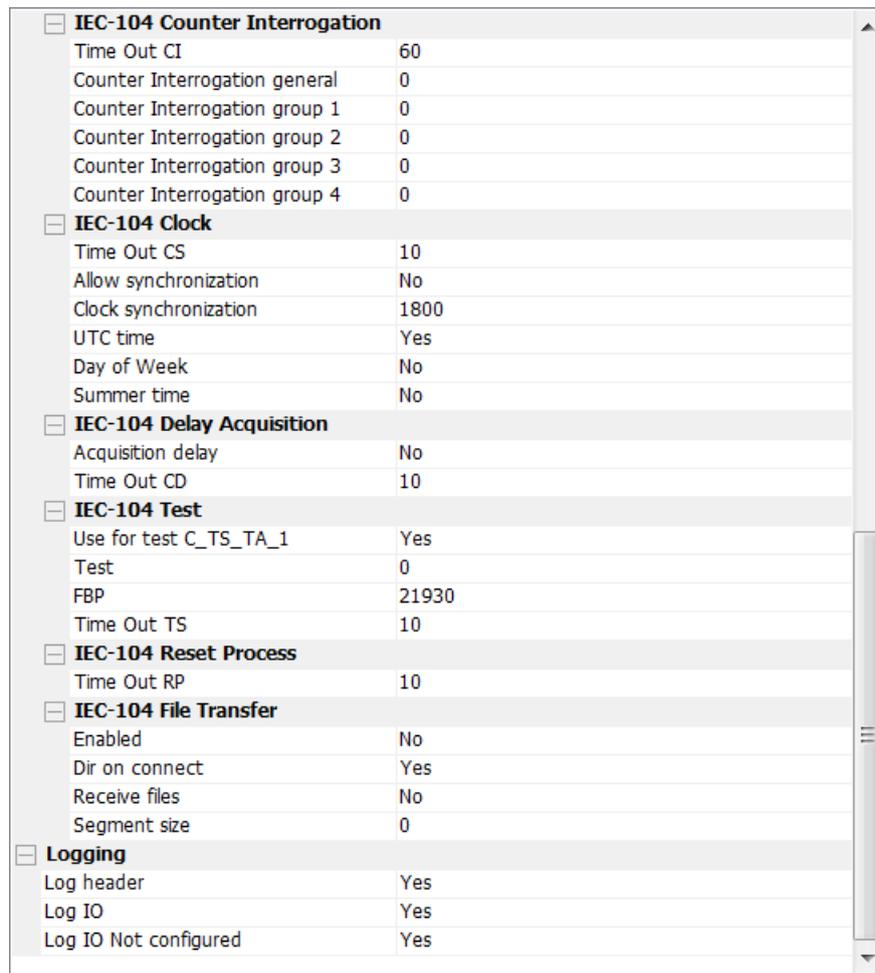


Figure 93. Application layer parameters in IEC 60870-5-104 protocol

Table 86. Fields of Application layer parameters window in IEC 60870-5-104 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Timeout CI	Timeout for the counter interrogation requests Range of values: 0 ... 3600s	60
Counter Interrogation general	Cycle time of counter interrogation to the controlled device Range of values: 0 ... 86400s	0 – disabled Counter Interrogation
Counter Interrogation group 1 ... 4	Cycle time of the counter interrogation group to the controlled device Range of values: 0 ... 86400s	0 – disabled Counter Interrogation
Timeout CS	Timeout for the clock synchronization Range of values: 1 ... 3600s	10
Allow synchronization	Yes – always synchronize, No – synchronize only if the internal clock of RTU is synchronized.	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Clock synchronization	Cycle time of the clock synchronization to the controlled device Range of values: 1 ... 86400s	1800
UTC time	Enables to use UTC time in requests and responses. Values: No, Yes	Yes
Day of Week	In request with a timestamp, use Day of Week bit. Values: No, Yes	No
Summer time	In request with a timestamp, use Summer time bit. Values: No, Yes	No
Acquisition delay	Use the acquisition delay before sending the clock synchronization (C_CD_NA_1). Values: No, Yes	No
Timeout CD	Timeout for the delay acquisition Range of values: 1 ... 3600s	10
Use for test C_TS_TA_1	Use test frame format C_TS_TA_1 Values: No, Yes	Yes
Test	Cycle time of the test frame. This parameter is not used when <i>Is test frame</i> is set to the value 'No'. Range of values: 1 ... 86400s	0 - disabled
FBP	Fixed test bit pattern Range of values: 0 ... 32768	21930
Timeout TC	Timeout for the test command Range of values: 1 ... 3600s	10
Timeout RP	Timeout for the reset process Range of values: 1 ... 3600s	10
Enabled	Enables the file transfer function. Values: No, Yes	No
Dir on connect	Requests the directory after connection starts. Values: No, Yes	Yes
Receive files	After receives the list of files, downloads all files from the controlled device. Values: No, Yes	No
Segment size	Segment size to be used in the file transfer. 0 – segment size is calculated from the maximum frame length. If the segment size plus headers makes more than the maximum frame length, the segment size will be calculated from the maximum frame length.	0

FIELD NAME	DESCRIPTION	DEFAULT VALUE
	Range of values: 0 ... 255 bytes	
Log header	Enables to log application layer header. Values: No, Yes	Yes
Log IO	Enables to log information objects. Values: No, Yes	Yes
Log IO not configured	Enables to log not configured information objects. Values: No, Yes	Yes

4.9.3.4 Points

Status points												Command points											
ID	IOA	IEC Type		Inv...	Offs...	Sc...	Offs...	Val...	Ti...	Quali...	Ca...	Tag ID											
1	900	Single point																					
2	901	Single point																					
3	902	Double point																					
4	903	Double point																					
5	904	Measured value, normalised value																					
6	905	Measured value, normalised value																					
7	906	Measured value, scaled value																					
8	907	Measured value, scaled value																					
9	908	Measured value, short floating point value																					
10	909	Measured value, short floating point value																					

Figure 94. Status points table in IEC 60870-5-104 protocol

Status points												Command points											
ID	IOA	IEC Type		Offs...	Scale	Offs...	Invert	Val...	Time	Result	Tag ID	Tag											
11	5001	Single command						0															
12	5002	Single command						0															
13	5003	Double command						0															
14	5004	Double command						0															
15	5005	Set point short float co...						0															
16	5006	Regulating step command						0															

Figure 95. Command points table in IEC 60870-5-104 protocol

Configuration of IEC 60870-5-104 protocol data and command points is the same like in IEC 60870-5-101 protocol. Refer to chapter 4.9.2.4. Points.

4.9.4 IEC 61850 client

Enilit RTU also supports IEC 61850 client protocol. It is possible to connect IED devices via 61850 protocol standard. The main requirement is the need to extract the SCD (Substation Configuration Description) file from the IED device configuration software. The SCD file is a part of the Substation Configuration Language (SCL).

4.9.4.1 Communication port



Figure 96. *Communication port* parameters in IEC 61850 protocol

Table 87. Fields of *Communication port* parameters window in IEC 61850 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port name	IEC 61850 port name, for example, 'IEC-61850 client protocol'	New IEC 61850 client protocol
Enabled on start	Enables or disables the port on start. Values: No, Yes	No
Client Name	Name to be used for the client in IEC61850 communication	
Ethernet port	Specifies the Ethernet port to be used for the connection to the server. Values: All ETH, ETH1, ETH2, ETH3, ETH4	All ETH
SCD file	SCD file of the substation. The file can be browsed with <i>Open file</i> dialog button  . Values: File name and path	
SCD	Enilit CMS saves the file in the Projects SCD folder.	

When the user selects a SCD file, the main parameters like *IP address, Gateway, Subnet mask* are taken from the SCD file automatically. After that, the following figure with the IEDs in use will be seen.

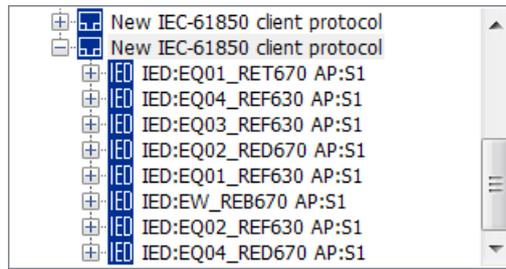


Figure 97. Imported IED devices from a SCD file

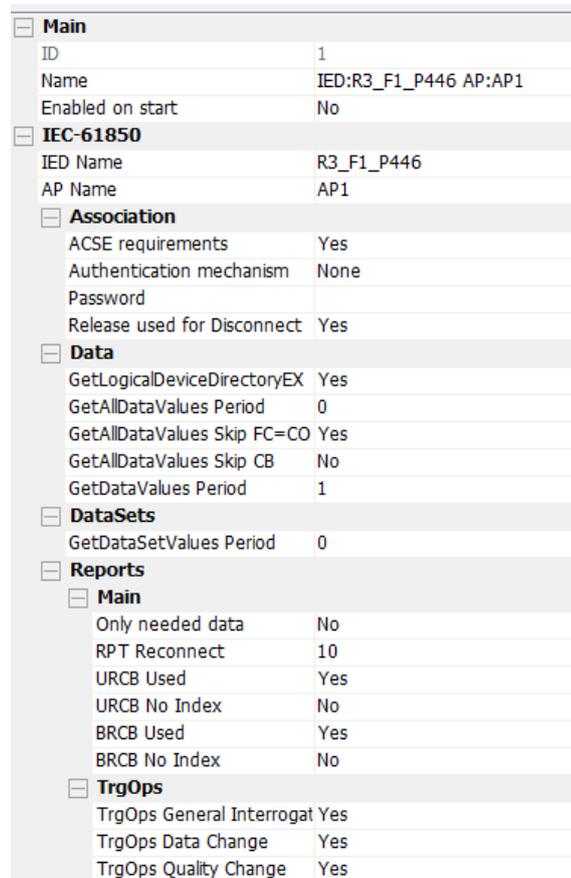


Figure 98. IED device parameters window in IEC 61850 protocol

Table 88. Fields of IED device parameters window in IEC 61850 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	Read only
Name	Name of IED	After import from SCD file name will be concatenated from IED Name and AP Name

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Enabled on start	IED is enabled on the system startup. Values: No, Yes	No
IED Name	IED name in the SCD file	
AP Name	Access point name in the SCD file	
ACSE requirements	ACSE requirements are used. (some IEDs do not support them, disable when necessary)	Yes
Authentication mechanism	Authentication mechanism is used for connection to IED.	None
Password	Password used for connection to IED	
Release used for Disconnect	Release used for Disconnect. In other case, use Abort.	Yes
GetLogicalDeviceDirectoryEX	Use the extended GetLogicalDeviceDirectoryEX function instead of lots of GetLogicalNodeDirectory calls	Yes
GetAllDatsValues Period	Warning: use only for testing purpose – select other methods for data polling. 0 – the function is not used.	0
GetAllDataValues Skip FC=CO	Do not read data for functional constrains CO.	Yes
GetAllDataValues Skip CB	Do not read data for control blocks like SGCB, GoCB, LCB and etc.	No
GetDataValues Period	If some status points do not belong to any report control block, GetDataValues function will be executed at the set interval of 0 ... 3600s. 0 – the function is not used.	1
GetDataSetValues Period	If a DataSet does not belong to any report control, the GetDataSetValues function will be executed at the set interval of 0 ... 3600s. 0 – the function is not used.	0
Only needed data	Starts only the buffered and unbuffered reports which contain the needed data.	No
RPT Reconnect	Time interval of reconnection attempt to the report control while communication is not established Range of values: 1 ... 60s	10
URCB Used	Set this parameter to the value 'No', if you do not want to use the unbuffered reports.	Yes

FIELD NAME	DESCRIPTION	DEFAULT VALUE
URCB No Index	In SCL configuration file, it is set that it is indexed, but there are no index appended in IED. Use the same instance of URCB for all indexes.	No
BRCB Used	Set this parameter to the value 'No', if you do not want to use the buffered reports.	Yes
BRCB No Index	In SCL configuration file, it is set that it is indexed, but there are no index appended in IED. Use the same instance of BRCB for all indexes.	No
TrgOps General Interrogation	If a SCL file does not set General Interrogation Bit, overwrite this setting with the value 'TRUE'. General Interrogation is needed for normal communication.	Yes
TrgOps Data Change	If a SCL file does not set Data Change Bit, overwrite this setting with the value 'TRUE'. Data Change is needed for normal communication.	Yes
TrgOps Quality Change	If a SCL file does not set Quality Change Bit, overwrite this setting with the value 'TRUE'. Quality Change is needed for normal communication.	Yes

<input type="checkbox"/> OptFlds	
URCB OptFlds BufferOverflow	Yes
URCB OptFlds EntryID	Yes
BRCB OptFlds BufferOverflow	Yes
BRCB OptFlds EntryID	Yes
<input type="checkbox"/> Controls	
Select Positive not NULL	Yes
APC	f only
<input type="checkbox"/> Check	
Synchrocheck	No
Interlock	No
<input type="checkbox"/> Control Model	
No SCL	Reject Control
Different in IED and SCL	Reject Control
<input type="checkbox"/> Origin	
Origin Type	Enilit CMS
Originator	Client Name
<input type="checkbox"/> Time Activated Operate	
Time Difference	0
<input type="checkbox"/> Logs	
Logs Read on connect	No
<input type="checkbox"/> Gooses	
Gooses Read on connect	No
<input type="checkbox"/> Files	
Wildcard '*'	No
Separator	/
<input type="checkbox"/> Communication	
IP in SCL	10.221.11.107
TCP port in SCL	102
IP override	
TCP port override	
Mac	
TCP Keep Alive	1000
TCP No delay	Yes

Figure 99. IED device parameters window in IEC 61850 protocol

Table 89. Fields of IED device parameters window in IEC 61850 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
URCB OptFlds BufferOverflow	If a SCL file specifies for URCB BufferOverflow, try to overwrite this setting with the value 'FALSE'. BufferOverflow is not needed for the Unbuffered Reports.	Yes
URCB OptFlds EntryID	If a SCL file specifies for URCB EntryID, try to overwrite this setting with the value 'FALSE'. EntryID is not needed for the Unbuffered Reports.	Yes
BRCB OptFlds BufferOverflow	If a SCL file does not specify BRCB BufferOverflow, try to overwrite this setting with the value 'TRUE'. It is not mandatory but BufferOverflow should be used for the Buffered Reports.	Yes

FIELD NAME	DESCRIPTION	DEFAULT VALUE
BRCB OptFlds EntryID	If a SCL file does not specify BRCB EntryID, try to overwrite this setting with the value 'TRUE'. It is not mandatory but EntryID should be used for the Buffered Reports.	Yes
Select Positive not NULL	Yes – if the received normal security select response does not bear the value 'NULL', it is considered as successful (for the backward compatibility). NO – if the received response <CO_CtrlObjectRef> is considered as a positive response, everything else is negative (Tissue 1178 – future implementation guidance).	Yes
APC	Control type for APC commands	F only
Synchrocheck	Synchrocheck value for controls. Select individual values for controls in the Point configuration.	No
Interlock	Interlock value for controls. Select individual values for controls in the Point configuration.	No
No SCL	Action taken when the Control Model is not set in the SCL.	Reject Control
Different in IED and SCL	Action taken when the Control Model in the IED and SCL are different.	Reject Control
Origin Type	Enables to control the Origin Type while executing control.	Enilit CMS
Originator	Originator to be used for control commands	Client Name
Time Difference	Value of Time Activated Operate in milliseconds. Use negative values only for testing purpose. Range of values: -3600000 ... 3600000ms	0
Logs Read on connect	Checks values and state on connect for LCB and Log control blocks.	No
Gooses Read on connect	Checks values and state on connect for GOOSE control blocks.	No
Wildcard '*'	Use the Wildcard '*' in the GetServerDirectory (FILE) request.	No
Separator	Separator is used in a directory and file names.	/
IP in SCL	IP Address of IED in the SCL configuration file	
TCP port in SCL	TCP port of IED in the SCL configuration file	

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IP override	Field is used if you want to overwrite the IP address of IED from an SCL file. In other cases, leave the field empty, the SCL value will be used.	
TCP port override	Field is used, if you want to overwrite the TCP port of IED from a SCL file. In other cases, leave the field empty, the SCL value will be used.	
Mac	Used for PRP1 communication monitoring on which LANs IED is visible.	
TCP Keep Alive	Do not set low values, because it will add overhead to communication. Range of values: 0 ... 2147483647ms 0 – disabled	1000
TCP No delay	Disables the Nagle Algorithm.	Yes

Connect Time Out	10
Reconnect	10
<input type="checkbox"/> Logging	
Port Monitor	No
Log MMS	No
Log SCSM	Yes
<input type="checkbox"/> Errors	
<input type="checkbox"/> ICD Errors	
ICD not found DA	No
ICD not found DA ctlModel	No
ICD not found DA sboTimeuot	No
ICD not found DA sboClass	No
ICD not found SDI	No
ICD Enum type empty	No
ICD Enum type empty change to Dpos	No
IED Dataset members wrong	No
IED Report unknwon	No
<input type="checkbox"/> MMS Errors	
MMS wrong invokeID in IED request	No
<input type="checkbox"/> IEC Errors	
Report wrong SEQ	No
IEC INT8U overflow	No
IEC sqNum Value overflow	No
IEC Report not started	No
IEC Report TrgOps QualitChange not set	No
<input type="checkbox"/> IEC Control Errors	
Operate negative missing Last Appl Error	Yes
Cancel negative missing Last Appl Error	No

Figure 100. IED device parameters window in IEC 61850 protocol

Table 90. Fields of IED device parameters window in IEC 61850 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Connect Timeout	Time interval of attempt to establish connection Range of values: 1 ... 255s	10
Reconnect	Time interval of reconnection attempt to IED while communication is not established Range of values: 1 ... 60s	10
Port Monitor	Shows the port monitor on the system startup.	No
Log MMS	Partially logs MMS communication.	No
Log SCSM	Logs SCSM communication.	Yes
ICD not found DA	Disable this error, if this error message is not important for the user.	No
ICD not found DA CtlModel	Disable this error, if this error message is not important for the user.	No
ICD not found DA sboTimeuot	Disable this error, if this error message is not important for the user.	No
ICD not found DA sboClass	Disable this error, if this error message is not important for the user.	No
ICD not found SDI	Disable this error, if this error message is not important for the user.	No
ICD Enum type empty	Disable this error, if this error message is not important for the user.	No
ICD Enum type empty change to Dpos	Disable this error, if this error message is not important for the user.	No
IED Dataset members wrong	Disable this error, if this error message is not important for the user.	No
IED Report unknown	Disable this error, if this error message is not important for the user.	No
MMS wrong invokeID in IED request	Disable this error, if this error message is not important for the user.	No
Report wrong SEQ	Disable this error, if this error message is not important for the user.	No
IEC INT8U overflow	Disable this error, if this error message is not important for the user.	No
IEC sqNum Value overflow	Disable this error, if this error message is not important for the user.	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IEC Report not started	Disable this error, if this error message is not important for the user.	No
IEC Report TrgOps QualitChange not set	Disable this error, if this error message is not important for the user.	No
Operate negative missing Last Appl Error	For the enhanced security controls only. Disable this error, if this error message is not important for the user.	Yes
Cancel negative missing Last Appl Error	For the enhanced security controls only. Disable this error, if this error message is not important for the user.	No

4.9.4.2 Points

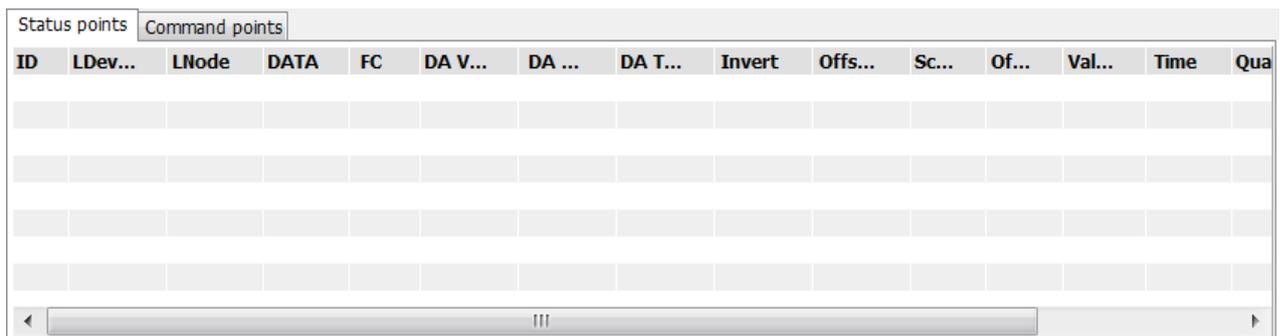


Figure 101. Status points window in IEC 61850 protocol

The following figure shows the popup menu of *Add data point*. With it the user can *Browse ICD*, *Add data point*, *Edit data point*, *Delete data point*, *Select All* data points and *Remove connection to Tag*, *Import* and *Export points*.

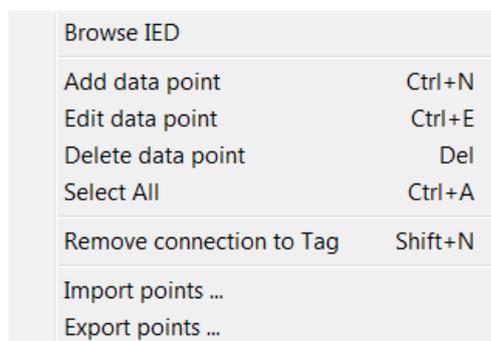


Figure 102. Data points popup menu in IEC 61850

If you select from the above menu the *Browse IED* file, the IED file window, as shown in the following figure, will open. In this window, it is possible to choose which data point to add to the data points list. This is an automated way to create data points in the IEC 61850 protocol. The user has to browse the data point needed and to double click to add it to the points list.

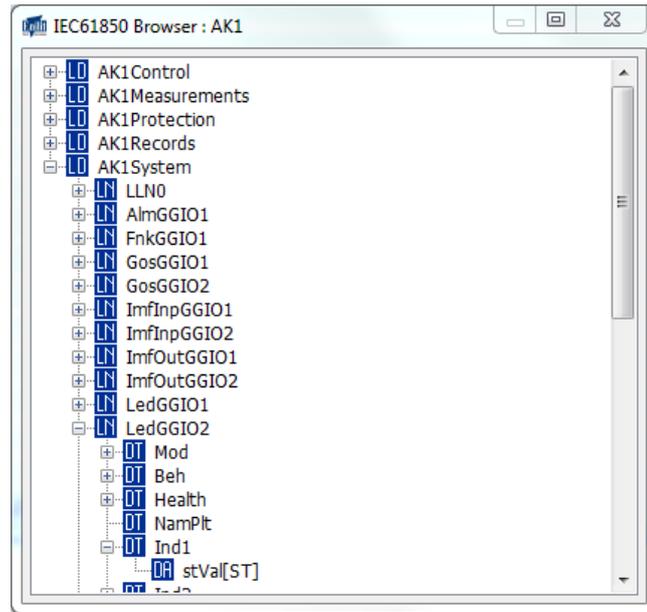


Figure 103. Add new data points from IEC 61850 ICD file

If the user chooses to *Add data point* manually, the following dialog box will be displayed. It is necessary to enter information in the fields like *Logical device*, *Logical node*, *Data object*, *Functional constraint*, *Data attribute*, *Time attribute*, *Quality attribute*, *Invert* and *Value variables*.

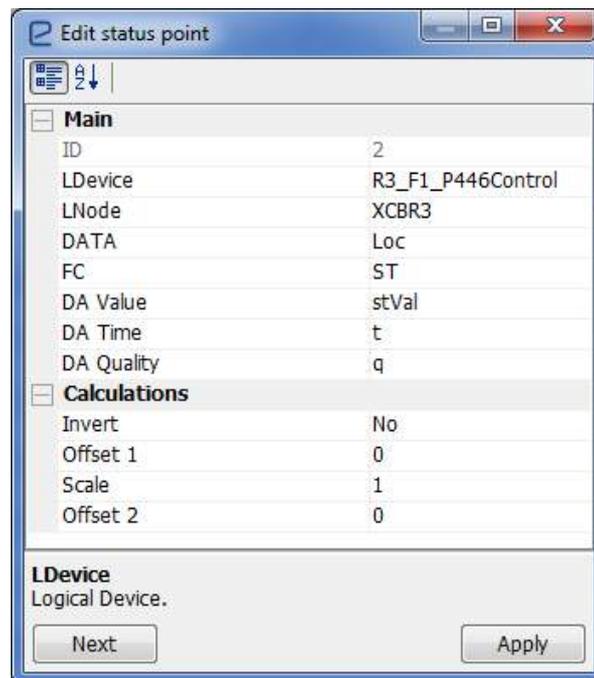


Figure 104. Add new data points manually in IEC 61850 protocol

Table 91. Fields of *Add new data points* manually window in IEC 61850 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
LDevice	Logical device name of IEC 61850 structure, for example, 'System'	
LNode	Logical device node of IEC 61850 structure. Each logical device contains one or more logical nodes. A logical node is a named grouping of data and associated services that are logically related to some function of the power system, for example, 'LLN0'.	
DATA	Data object name of IEC 61850 structure. Each logical node contains one or more elements of data. Each element of data has a unique name. These data names are determined by the standard and are functionally related to the purpose of the power system, for example, 'DPC'.	
FC	Functional constraints for status (ST) attributes, substituted value (SV) attributes, description (DC) attributes, measurement attributes (MX), and extended definition (EX) attributes Values: MX, ST	
DA Value	Data attribute for Value, for example, 'stVal'	
DA Time	Data attribute for Time, for example, 't'	
DA Quality	Data attribute for Quality, for example, 'q'	
Offset 1	$\text{New value} = (\text{Old value} + \text{Offset1}) * \text{Scale} + \text{Offset2}$	0
Scale		1
Offset 2		0
Invert	Inversion of command Values: No, Yes	No

The following figure shows the manual creation of new command points for the IEC 61850 protocol.

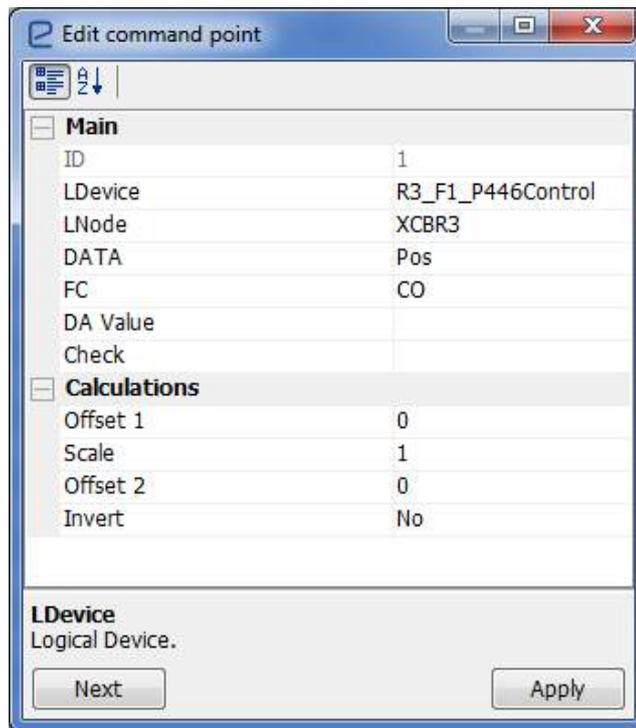


Figure 105. Creation of *Edit command point* manually in IEC 61850 protocol

Table 92. Fields of *Edit command point* window in IEC 61850 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
LDevice	Logical device name of IEC 61850 structure, for example, 'System'	
LNode	Logical device node of IEC 61850 structure. Each logical device contains one or more logical nodes. A logical node is a named grouping of data and associated services that are logically related to some function of the power system, for example 'LLN0'.	
DATA	Data object name of IEC 61850 structure. Each logical node contains one or more elements of data. Each element of data has a unique name. These Data Names are determined by the standard and are functionally related to the purpose of the power system, for example, 'DPC'.	

FIELD NAME	DESCRIPTION	DEFAULT VALUE
FC	Functional constraints for status (ST) attributes, substituted value (SV) attributes, description (DC) attributes, measurement attributes (MX), extended definition (EX) attributes and command (CO) attributes. Values: MX, ST, CO	
DA Value	Data attribute for Value, for example, 'Oper'	
Check	Specifies the bits to be checked in a command. Values: Default, None, Synchrocheck, Interlock-check, Synchrocheck and Interlock-check	Default
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of a command Values: No, Yes	No

4.9.5 Modbus RTU/ASCII

4.9.5.1 Communication port parameters

Main	
ID	4
Port Name	New Modbus RTU/ASCII master protocol
Enabled on start	No
Modbus	
Protocol Type	RTU
Communication	
COM port	Not assigned
Baud rate	9600
Data bits	8
Stop bits	1
Parity	None
RS-485 Mode	Four wire
Reconnect	10
Next request	50
Logging	
Port Monitor	No
Log raw data	Yes

Figure 106. *Communication port parameters in Modbus RTU/ASCII protocol*

Table 93. Fields of *Communication port* parameters window in Modbus RTU/ASCII protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Port name	Name of the port and protocol, for example, 'COM1 Modbus master'	New Modbus RTU/ASCII master protocol
Enabled on start	Port enabled on the system startup. Values: No, Yes	No
Protocol type	Enables to select a protocol version. Values: RTU, ASCII	RTU
Com port	Communication port number Range of values: COM 1 ... 255	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7,8	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None
RS-485 mode	If two wires are used, the mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Values: Two wires, Four wires	Four wires
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Next request	Time interval before sending the next request Range of values: 0 ... 1000ms	10
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes

4.9.5.2 Application layer parameters

Main	
ID	5
Application Name	New Application
Enabled on start	No
Modbus	
Main	
Device address	0
Frame size	255
Timeouts	
Pooling time	1000
Broken link	3
Priority	1
Reconnect	10
Answer timeout	1000
Logging	
Log header	Yes
Log IO	Yes
Log IO Not configured	Yes
Log Answer TimeOut	First Time

Figure 107. *Application layer* parameters in Modbus RTU/ASCII protocol

Table 94. Fields of *Application layer* parameters window in Modbus RTU/ASCII protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application name	Application layer name, for example, 'Application layer'	New Application
Enabled on start	Enables or disables the application layer on start. Values: No, Yes	No
Device address	Device link address Range of values: 0 ... 255	0
Max PDU Size	Specifies the maximum PDU size in bytes. Range of values: 20 ... 260	255
Pooling time	The time to pool the data Range of values: 0 ... 65535ms	1000
Answer timeout	Time interval to wait for response after sending a request Range of values: 10 ... 65535ms	1000
Broken link	Determines the connection as broken after the set number of retries. Range of values: 1 ... 255	3
Priority	Data is requested every cycle. Relevant only if more than one application layer exists. Range of values: 1 ... 255	1
Reconnect	Time interval of reconnection attempt while communication is not established Range of values: 1 ... 3600s	10

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Answer timeout	Time interval to wait for response after sending a request Range of values: 50 ... 30000ms	1000
Log header	Enables to log headers in the port monitor. Values: No, Yes	Yes
Log IO	Enables to log data and command points' information. Values: No, Yes	Yes
Log IO Not configured	Enables to log not configured information objects. Values: No, Yes	Yes
Log Answer Time Out	Enables to log application link answer timeouts to the system log. Values: Never, First Time, Always	First Time

4.9.5.3 Points

To create a new data or command point to the points list, it is necessary to call the popup menu in the Points window. With the following menu items it is possible to *Add, Edit or Delete data points, Select all or Remove connection to the Tag*. *Import* and *Export* functionalities are included as well.

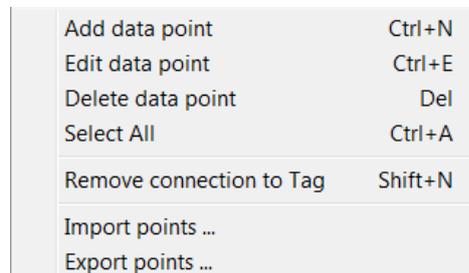


Figure 108. *Points* window popup menu

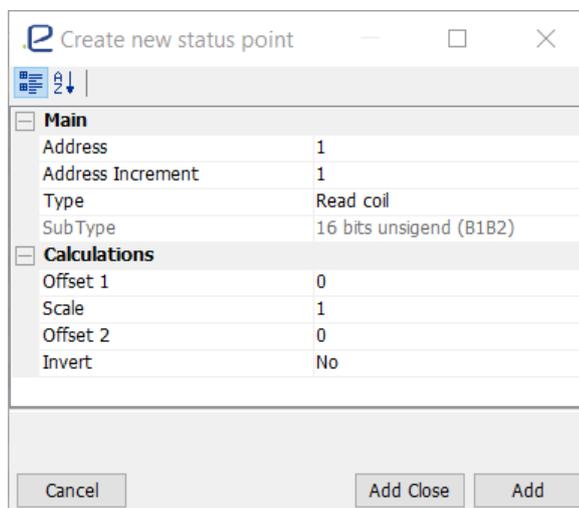


Figure 109. *Create new status point* window

Table 95. Fields of *Create new status point* window in Modbus RTU/ASCII protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Address	Information address Range of values: 0 ... 65535	1
Address Increment	After adding a new point, the address will be automatically incremented by the set value.	1
Modbus type	Modbus data type Values: Read coil Read discrete input Read holding register Read input register	Read coil
Data subtype	Available only if Modbus type is Read holding register or Read input register Available data subtypes: 16 bits unsigned (B1B2), 16 bits unsigned (B2B1), 16 bits signed (B1B2), 16 bits signed (B2B1), 32 bits unsigned in one register (B1B2B3B4), 32 bits unsigned in one register (B4B3B2B1), 32 bits signed in one register (B1B2B3B4), 32 bits signed in one register (B4B3B2B1), 32 bits unsigned in two register (B1B2B3B4), 32 bits unsigned in two register (B4B3B2B1), 32 bits signed in two register (B1B2B3B4), 32 bits signed in two register (B4B3B2B1), 32 bits float in one register (B1B2B3B4), 32 bits float in one register (B4B3B2B1), 32 bits float in two register (B1B2B3B4), 32 bits float in two register (B4B3B2B1)	
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of a status Values: No, Yes	No

Status points		Command points										
ID	Addr...	Type	Sub...	Invert	O...	S...	O...	Value	Time	Quali...	Cause	Tag
1	100	Read coil		Yes				0		0x00000...	Not defi...	
2	200	Read discrete input						0		0x00000...	Not defi...	
3	300	Read holding register	16 bits u...					0		0x00000...	Not defi...	
4	400	Read input register	16 bits u...					0		0x00000...	Not defi...	

Figure 110. Data points window

The columns between *Function* and *Offset 2* are data point configuration parameters. *Value*, *Time*, and *Quality* will show real-time data from the controlled device.

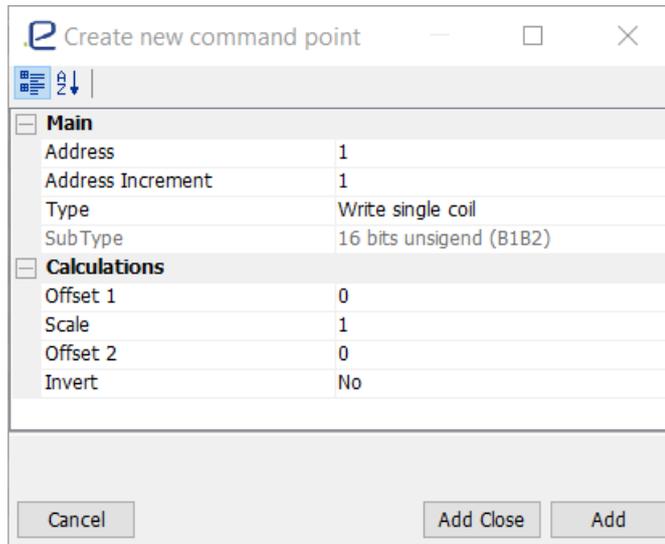


Figure 111. *Create new command point* window

Table 96. Fields of *Create new command point* window in Modbus RTU/ASCII protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Address	Information address Range of values: 0 ... 65535	1
Address Increment	After adding a new point, the Address will be automatically incremented by the set value.	1
Modbus type	Modbus data type Values: Write single coil Write single register Write multiple coil Write multiple register	Write single coil
Data subtype	Available only if Modbus type is Write single register or Write multiple register. Available data subtypes: 16 bits unsigned (B1B2), 16 bits unsigned (B2B1), 16 bits signed (B1B2), 16 bits signed (B2B1)	
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of a command Values: No, Yes	No

Status points									
Command points									
ID	Addr...	Type	SubType	Scale	Invert	Value	Time	Result	Tag
5	1000	Write single coil				0			
6	1001	Write single register	16 bits signed (B1B2)			0			

Figure 112. Command points window

In the *Command points* window *Value*, and *Time* will show the last transmitted command data. *Result* will show a response from the controlled device.

4.9.6 Modbus TCP client

4.9.6.1 Communication port parameters

Main	
ID	10
Port Name	New Modbus TCP master protocol
Enabled on start	No
Modbus	
Max transactions	16
Communication	
Ethernet port	All ETH
Server Name or IP	127.0.0.1
TCP port	502
TCP Keep Alive	10000
TCP No delay	No
Connect Time Out	30
Reconnect	10
Next request	0
Logging	
Port Monitor	No
Log raw data	Yes
Log MBAP header	Yes

Figure 113. *Communication port* parameters in Modbus TCP protocol

Table 97. Fields of *Communication port* parameters window in Modbus TCP protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port name	Name of the port and protocol for example, 'TCP Modbus client'	New Modbus TCP master protocol
Enabled on start	Port enabled on the system startup. Values: No, Yes	No
Max transactions	Maximum transactions running at the same time Range of values: 1 ... 16	16
Ethernet port	Specifies the Ethernet port to be used for connection to the server. Values: All ETH, ETH1, ETH2, ETH3, ETH4	All ETH

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Server Name or IP	Server name or IP address Values: xxx.zzz.yyy.nnn	127.0.0.1
TCP Port	TCP port for TCP/IP connection. There must be the same port on the server side. Values: 1 ... 65535	502
TCP Keep Alive	Forces the TCP activity when idling is too long. Do not set low values because it will add overhead to communication. Range of values: 0 ... 2147483647	10000
TCP No delay	Enables or disables the Nagle algorithm. Values: No, Yes	Yes
Connect Timeout	TCP connect timeout Range of values: 1 ... 60s	30
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1... 600s	10
Next request	Time interval before a new request is transmitted Range of values: 1 ... 2000ms	0
Port Monitor	Shows the port monitor on the system startup.	No
Log raw data	Enables to log raw data in the port monitor. Values: No, Yes	Yes
Log MBAP header	Enables to log Modbus application headers in the port monitor. Values: No, Yes	Yes

4.9.6.2 Application layer parameters

Main	
ID	11
Application Name	New Application
Enabled on start	No
Modbus	
Main	
Unit identifier	0
Frame size	265
Timeouts	
Pooling time	1000
Priority	1
Reconnect	10
Answer timeout	1000
Logging	
Log header	Yes
Log IO	Yes
Log IO Not configured	Yes

Figure 114. *Application layer* parameters in Modbus TCP protocol

Table 98. Fields of *Application layer* parameters window in Modbus TCP protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application Name	Application layer name, for example, 'Application layer'	New Application
Enabled on start	Enables or disables the application layer on start. Values: No, Yes	No
Unit identifier	Slave Address (255 if not used) Range of values: 0 ... 255	1
Frame size	Maximum frame size in bytes. All start, stop, checksum and other bytes are included. Range of values: 30..264 bytes	265
Pooling time	The time to pool the data Range of values: 50 ... 65535ms	1000
Priority	Data is requested every cycle. Relevant only if more than one application layer exists. Range of values: 1 ... 255	1
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1..3600s	10
Answer timeout	Answer timeout when there is no link Range of values: 50..30000ms	1000

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Log header	Enables to log headers in the port monitor. Values: No, Yes	Yes
Log IO	Enables to log data and command point information in the port monitor. Values: No, Yes	Yes
Log IO not configured	Enables to log not configured point information in the system log. Values: No, Yes	Yes

4.9.6.3 Points

Refer to chapter 4.9.5.3 'Points' in Modbus RTU/ASCII protocol.

4.9.7 DNP3 serial master configuration

4.9.7.1 Communication port parameters

Main	
ID	1
Port Name	New DNP3 master protocol
Enabled on start	No
Communication	
COM port	Not assigned
Baud rate	9600
Data bits	8
Stop bits	1
Parity	None
RS-485 Mode	Four wire
Reconnect	10
Next request	50
Logging	
Port Monitor	No
Log raw data	Yes

Figure 115. *Communication port parameters in DNP3 serial protocol*

Table 99. Fields of *Communication port* parameters window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	Read only
Port name	Name of the port and protocol, for example, 'COM1 DNP3 master'	New DNP3 master protocol
Enabled on start	Port enabled on the system startup. Values: No, Yes	No
Com port	Communication port number Range of values: COM 1 ... 255	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7,8	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None
RS-485 mode	If two wires are used, the mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Values: Two wires, Four wires	Four wires
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Next request	Time interval before sending the next request Range of values: 0 ... 2000ms	50
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes

4.9.7.2 Data link layer parameters

Main	
ID	7
Data Link Name	New Data link
Enabled on start	No
DNP-3	
Main	
Data Link address	1
Outstation address	1
Use Self Address	No
Frame size	292
Timers	
Response timeout	500
Confirmation	No
Broken link	3
Reconnect	10
Priority	1
Link Status	0
Link Status DFC	1
Logging	
Log header	Yes
Log Answer TimeOut	First Time

Figure 116. *Data link layer* parameters in DNP3 serial protocol

Table 100. Fields of *Data link layer* parameters window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	Read only
Data Link Name	Data link name, for example, 'Data link'	'New Data link'
Enabled on start	Port enabled on the system startup. Values: No, Yes	No
Data Link address	RTU's master address Range of values: 0 ... 65519	1
Outstation address	IED slave address Range of values: 0 ... 65519	1
Use Self Address	DNP3 specification recommends using self-address only to obtain the outstation address. In most cases, it should not be used. Values: No, Yes	No
Frame size	Maximum size of the data link frame Range of values: 14 ... 292 bytes	292
Response timeout	Timeout interval of response from the controlled device Range of values: 50 ... 60000ms	500

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Confirmation	Data link uses confirmations Values: No, Yes	No
Broken link	Number of retries to determine if the connection is broken Range of values: 1 ... 255	3
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 3600s	10
Priority	Data is requested every cycle. Relevant only if more than one application layer exists. Range of values: 1 ... 255	1
Link Status	Time interval of request attempt for the link status, if there is no data. Range of values: 0 ... 86400s 0 – Link status is not used.	0
Link Status DFC	Time interval of checking attempt for DFC=0, if the value of DFC has been 1. Range of values: 1 ... 86400 s	1
Log header	Enables to log headers in the port monitor. Values: No, Yes	Yes
Log Answer TimeOut	Enables to log application link answer timeouts to the system log. Values: Never, First Time, Always.	First Time

4.9.7.3 Transport layer parameters

Main	
ID	3
Transport Name	New Transport
Enabled on start	No
Logging	
Log header	Yes

Figure 117. *Transport layer* parameters in DNP3 serial protocol

Table 101. Fields of *Transport layer* parameters window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	Read only
Transport Name	Transport layer name, for example, 'Transport layer'	'New Transport'
Enabled on start	Port enabled on the system startup. Values: No, Yes	No
Log header	Enables to log headers in the Port Monitor. Values: No, Yes	Yes

4.9.7.4 Application layer parameters

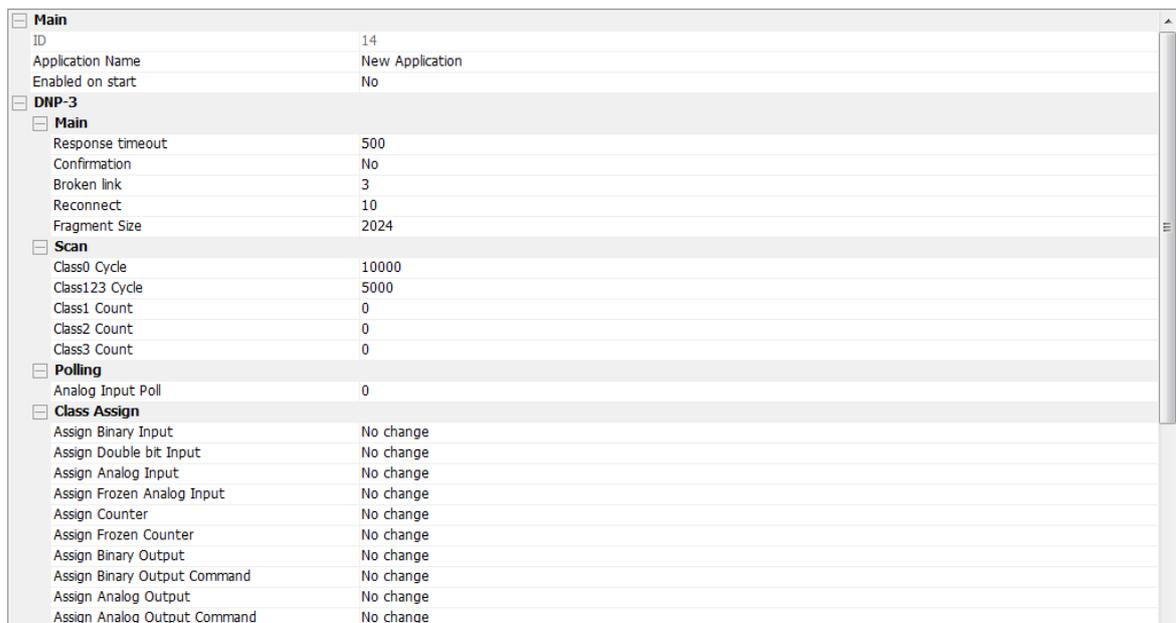


Figure 118. *Application layer* parameters in DNP3 serial protocol

Table 102. Fields of *Application layer* parameters window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	Read only
Application Name	Application layer name, for example, 'Application layer'	'New Application'
Enabled on start	Port enabled on the system startup. Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Response timeout	Response timeout Range of value: 50 ... 60000ms	500
Confirmation	If the setting is 'Yes', the application layer must request confirmations. Values: No, Yes	No
Broken link	Number of retries to determine if the connection is broken. Range of values: 1 ... 255	3
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 3600s	10
Fragment Size	Maximum allowed size of the application layer fragment Range of values: 249 ... 65535 bytes	2024
Class0 Cycle	Time interval of request attempt for static objects Range of values: 0 ... 86400000ms 0 – only on connect or lost events	10000
Class123 Cycle	Time interval of request attempt for event objects Range of values: 0 ... 86400000ms 0 – not used	5000
Class1 count	Number of event request in Class1. Range of values: 0 ... 16777216 0 – request all events of this class.	0
Class2 count	Number of event request in Class2. Range of values: 0 ... 16777216 0 – request all events of this class.	0
Class3 count	Number of event request in Class3. Range of values: 0 ... 16777216 0 – request all events of this class.	0
Analogue input Poll	Time interval of request attempt for Analogue input data, if the slave device does not support the point assignment to classes Range of values: 0 ... 86400000ms 0 – disabled	0
Assign Binary Input	Class assignment on connection for the Binary input. There must be at least one point of such type in the configuration. Values: No change, Class0, Class1, Class2, Class3	No change

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Assign Double bit Input	Class assignment on connection for Double bit Input. There must be at least one point of such type in the configuration. Values: No change, Class0, Class1, Class2, Class3	No change
Assign Analogue Input	Class assignment on connection for Analogue Input. There must be at least one point of such type in the configuration. Values: No change, Class0, Class1, Class2, Class3	No change
Assign Frozen Analogue Input	Class assignment on connection for Frozen Analogue Input. There must be at least one point of such type in the configuration. Values: No change, Class0, Class1, Class2, Class3	No change
Assign Counter	Class assignment on connection for Counter. There must be at least one point of such type in the configuration. Values: No change, Class0, Class1, Class2, Class3	No change
Assign Frozen Counter	Class assignment on connection for Frozen Counter. There must be at least one point of such type in the configuration. Values: No change, Class0, Class1, Class2, Class3	No change
Assign Binary Output	Class assignment on connection for Binary Output. There must be at least one point of such type in the configuration. Values: No change, Class0, Class1, Class2, Class3	No change
Assign Binary Output Command	Class assignment on connection for Binary Output Command. There must be at least one point of such type in configuration. Values: No change, Class0, Class1, Class2, Class3	No change
Assign Analogue Output	Class assignment on connection for Analogue Output. There must be at least one point of such type in configuration. Values: No change, Class0, Class1, Class2, Class3	No change

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Assign Analogue Output Command	Class assignment on connection for Analogue Output Command. There must be at least one point of such type in configuration. Values: No change, Class0, Class1, Class2, Class3	No change

<input type="checkbox"/> Unsolicited	
Unsolicited Outstation	No
Unsolicited on connect	Yes
Class1	Yes
Class2	Yes
Class3	Yes
<input type="checkbox"/> Clock	
Allow synchronization	No
Clock Cycle	3600
UTC time	Yes
Clock request from slave	Yes
Delay Measurement	Yes
<input type="checkbox"/> Deadbands	
Deadbands on connect	No Used
Deadbands Variation Read	Default Variation
Deadbands Variation Write	32-Bit Float
<input type="checkbox"/> Other	
Double bit over two single	No
<input type="checkbox"/> Logging	
Log DO	Yes
Log header	Yes
Log IO	Yes
Log IO Not configured	Yes
Log Answer TimeOut	First Time

Figure 119. Application layer parameters in DNP3 serial protocol

Table 103. Fields of Application layer parameters window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Unsolicited Outstation	Set to the value 'Yes', if the outstation device supports unsolicited messages. According to the specification, after the device restart, the first message should disable unsolicited messages. Values: No, Yes	Yes
Unsolicited on connect	On connect, set classes to configured enabled or disabled unsolicited (spontaneous) messages. Values: No, Yes	Yes
Class1	Class1 events enabled for unsolicited messages. It is relevant only if 'Unsolicited on connect' is set to 'Yes'. Values: No, Yes	Yes

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Class2	Class2 events enabled for unsolicited messages. It is relevant only if 'Unsolicited on connect' is set to 'Yes'. Values: No, Yes	Yes
Class3	Class3 events enabled for unsolicited messages. It is relevant only if 'Unsolicited on connect' is set to 'Yes'. Values: No, Yes	Yes
Allow synchronization	Yes – always allow synchronizing, No – synchronize only if the internal clock of RTU is synchronized.	No
Clock Cycle	Cycle time of the clock synchronization to the controlled device Range of values: 0 ... 86400s 0 – synchronization is disabled	3600
UTC time	Enables to use UTC time in requests and responses. Values: No, Yes	Yes
Clock request from slave	Sends the clock synchronization when the slave sets its internal indications. Values: No, Yes	Yes
Delay Measurement	Use communication path delay calculation before time synchronization. Values: No, Yes	Yes
Deadbands on connect	Operation will be performed with deadbands on connection to the outstation device. Values: Not Used, Only Read, Write All, Read and Write All, Read and Write only different	Not Used
Deadbands Variation Read	Variation used for deadband read operations Values: Default Variation, 16-Bit, 32-Bit, 32-Bit Float	Default Variation
Deadbands Variation Write	Variation used for deadband write operations Values: 16-Bit, 32-Bit, 32-Bit Float	32-Bit
Double bit over two single	If the master station does not support Double Bit inputs, use the Binary input (Double) point type. This parameter sets which bit should be first transferred. If the values are set to 'NO' – the first is 'OFF', if it is set to 'YES' – the first is 'ON'.	No
Log DO	Enables to log Data Object information. Value: No, Yes	Yes

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Log header	Enables to log headers in the port monitor. Values: No, Yes	Yes
Log IO	Enables to log status and command point information. Values: No, Yes	Yes
Log IO Not configured	Enables to log not configured information objects. Values: No, Yes	Yes
Log Answer Time Out	Log application link answer timeouts to the system log Values: Never, First Time, Always	First Time

4.9.7.5 Points

To add a new data or command point to the points list, it is necessary to call the popup menu in the Points window. With the following menu items it is possible to *Add Status point*, *Edit Status point*, *Delete Status point*, *Select all*, *Remove connection to the TAG Manager*, *Connect to the Tag* or *Go to Tag*. All the functions have keyboard shortcuts which will simplify and quicken the work with the software.

Add Status point	Ctrl+N
Edit Status point	Ctrl+E
Delete Status point	Del
Select All	Ctrl+A
Connect to Tag	Shift+Ctrl+N
Remove connection to Tag	Shift+Del
Go to Tag	G

Figure 120. *Points* window popup menu in DNP3 serial protocol

The following figure shows the Create new status point dialog window. The parameters which can be specified on the DNP3 protocol are proposed in the next table.

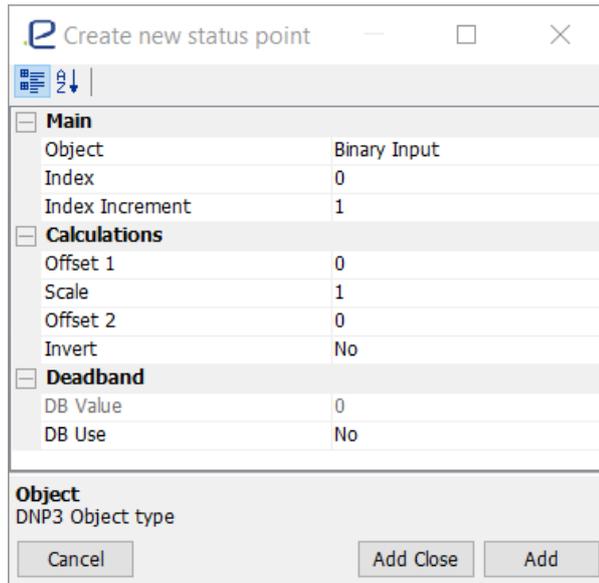


Figure 121. Create new status point window in DNP3 serial protocol

Table 104. Fields of Create new status point window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Object	DNP3 object type Values: Binary Input, Binary Input (Double), Double Bit Input, Binary Output, Analogue Input, Analogue Output	Binary Input
Index	Object index Range of values: 0 ... 2147483647	1
Index Increment	After adding a new point, the Index will be automatically incremented by the set value.	1
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of status Values: No, Yes	No
DB Value	Deadband value used to configure the outstation Range of values: 0 ... 2147483647	0
DB Use	Use deadband value to set the outstation configuration. Value: No, Yes	No

Status points		Command points										
	Object type	Invert	Offset 1	Scale	Offset 2	Deadband Value	Deadband Used	Deadband Value Received	Value	Time	Quality	Cause
1	0 Binary Input											
2	1 Double Bit Input											
3	2 Binary Output											
4	3 Analog Input											
5	4 Analog Output											

Figure 122. Status points window

The columns between Object type and Offset 2 are data point configuration parameters. Value, Time, Quality and others will show real-time data from the controlled device.

ENILIT Create new command point
✖

Main

Object	Binary Output Command
Variation	Control Relay Outout Block
Index	0
Index Increment	1

Parameters

Command Type	Select Operate
Count	1
On Timer	0
Off Timer	0

Calculations

Offset 1	0
Scale	1
Offset 2	0
Invert	No

Object
DNP3 Object type

Cancel
Add Close
Add

Figure 123. Create new command point window

Table 105. Fields of Create new status point window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Object	DNP3 object type Values: Binary Input, Double Bit Input, Binary Output, Analogue Input, Analogue Output	Binary Output Command
Variation	DNP3 Object Variation type Values: Control Relay Output Block, 32-Bit Integer, 16-Bit Integer, 32-Bit Float, 16-Bit Float	Control Relay Output Block

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Index	Object index Range of values: 0 ... 2147483647	1
Index Increment	After adding a new point, the Index will be automatically incremented by the set value.	1
Command Type	Command Type sent to the slave device Values: Select Operate, Direct Operate, Direct Operate No Acknowledgment, Write	Select Operate
Count	Number of cycles to execute the command Range of values: 0 ... 255 0 – Cancel Command will be executed.	1
On Timer	Length of the pulse ON timer Range of values: 0 ... 2147483647 ms	0
Of Timer	Length of the pulse OFF timer Range of values: 0 ... 2147483647ms	0
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of status Values: No, Yes	No

4.9.8 DNP3 UDP/TCP/IP client configuration

4.9.8.1 Communication port parameters

Main	
ID	12
Port Name	New DNP3 LAN client protocol
Enabled on start	No
Communication	
Ethernet port	All ETH
Server Name or IP	127.0.0.1
TCP port	20000
TCP Keep Alive	10000
TCP No delay	No
Connect Time Out	30
Reconnect	10
Next request	0
Logging	
Port Monitor	No
Log raw data	Yes

Figure 124. *Communication port* parameters in DNP3 UDP/TCP/IP protocol

Table 106. Fields of *Communication port* parameters window in DNP3 UDP/TCP/IP protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use only	
Port name	Name of the port and protocol, for example, 'DNP3 master'	'New DNP3 LAN client protocol'
Enabled on start	Port enabled on the system startup Values: No, Yes	No
Ethernet port	Specifies the Ethernet port to be used for connection to the server. Values: All ETH, ETH1, ETH2, ETH3, ETH4	All ETH
Server Name or IP	Server name or IP address Values: xxx.zzz.yyy.nnn	127.0.0.1
TCP Port	TCP port Range of values: 1 ... 65535	20000
TCP Keep Alive	Force TCP activity when idling is too long. Do not set low values because it will add overhead to communication. Range of values: 0 ... 2147483647	10000
TCP No delay	Enables or disables the Nagle algorithm. Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Connect Timeout	TCP connect timeout Range of values: 1 ... 60s	30
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Next request	Time interval before a new request is transmitted Range of values: 1 ... 2000ms	0
Port Monitor	Shows the port monitor on the system startup.	No
Log raw data	Enables to log raw data in the port monitor. Values: No, Yes	Yes

4.9.8.2 Data link layer parameters

Refer to chapter 4.9.7.2 'Data link layer parameters' in DNP3 serial protocol. The configuration is very similar.

4.9.8.3 Transport layer parameters

Refer to chapter 4.9.7.3 'Transport layer parameters' in DNP3 serial protocol. The configuration is very similar.

4.9.8.4 Application layer parameters

Refer to chapter 4.9.7.4 'Application layer parameters' in DNP3 serial protocol. The configuration is very similar.

4.9.8.5 Points

Refer to chapter 4.9.7.5 'Points' in DNP3 serial protocol. The configuration is very similar.

4.9.9 Simulator master configuration

Simulator interface is employed to simulate data points to the upper level protocols. It is very useful in testing environment. It is possible to use it to test SCADA system without IED devices.

4.9.9.1 Port parameters

<input type="checkbox"/> Main	
ID	1
Port Name	Simulator master protocol
Enabled on start	No
<input type="checkbox"/> Logging	
Port Monitor	No

Figure 125. Simulator port parameters

Table 107. Fields of Simulator port parameters window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use only	
Port name	Simulator port name, for example, 'Simulator'	New Simulator master
Enabled on start	Enables or disables port on start. Values: No, Yes	No
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No

4.9.9.2 Points

Status points		Command points											
ID	Name	Type	Min	Max	Step	Cha...	Period	Va...	Time	Qu...	Ca...	Tag ID	Tag
2	Name	Integer	0	1000	1	Manual	50					14	To Isagr...
6	Name_Float	Float	0	1000	0.5	Manual	100					15	To Isagr...
11	mano	Integer	0	1	1	Increment	300					16	iec104

Figure 126. Simulator Status points window

The following figure shows the *Add new simulation point dialog* window. The user can specify some parameters like *Name*, *Value type*, *Change type*, *Min value*, *Max value*, *Step*, *Change every*.

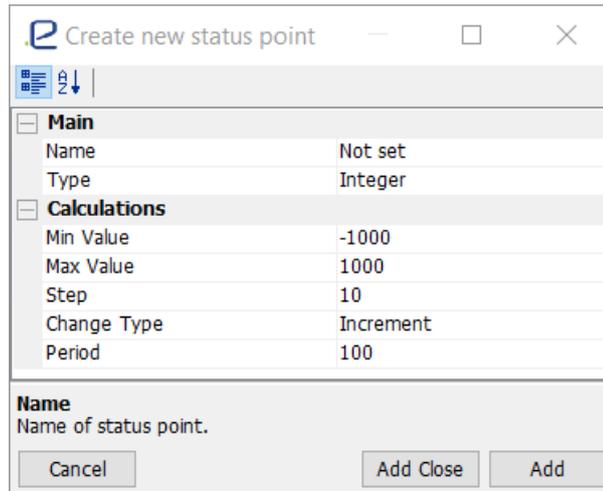


Figure 127. Create new simulation status point

Table 108. Fields of Create new simulation status point window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Name	Name of status point, or example, 'Data Point 1'	Not set
Type	Type of data point Range of values: Integer, Float	Integer
Min value	Minimum value of a simulation data point Range of values: -100000 ... 1000000	-1000
Max value	Maximum value of a simulation data point Range of values: -100000 ... 1000000	1000
Step	Step size to change a simulation data point between Minimum and Maximum values Range of values: -100000 ... 1000000	10
Change type	Type of the data point simulation Range of values: Increment, Decrement, Random, Manual	Increment
Period	Cycle time of data point change Range of values: 0 ... 10000ms	100

If the user has configured *manual data point change type*, then he or she can change data points manually by entering the *Manual set value* dialog from the data point popup menu. The following figure shows this menu.

Add Status point	Ctrl+N
Edit Status point	Ctrl+E
Delete Status point	Del
Select All	Ctrl+A
Connect to Tag	Shift+Ctrl+N
Remove connection to Tag	Shift+Del
Go to Tag	G
Manually set value ...	

Figure 128. Simulator *Points* popup menu

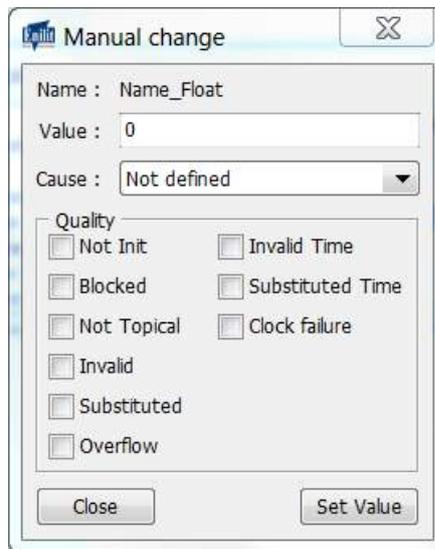


Figure 129. *Manual change* type dialog

With *Manual change* type it is also possible to simulate *Cause of transmission* and *Quality of data point*.

Cause of transmission can be: *Not defined, Initialize, Periodic, Background, Spontaneous, General Interrogation, Requested, Control local, Control remote, Disconnected source, Disabled source, Deleted source, Test mode, Calculated.*

The values of *Quality of data point* can be in the range: *Not Init, Blocked, Not Topical, Invalid, Substituted, Overflow, Invalid Time, Substituted time, Clock failure.*

4.9.10 RP-570 configuration

4.9.10.1 Communication port parameters

Main	
ID	13
Port Name	New RP-570 master protocol
Enabled on start	No
Communication	
COM port	Not assigned
Baud rate	9600
Data bits	8
Stop bits	1
Parity	Even
RS-485 Mode	Four wire
Reconnect	10
Next request	50
Application Broadcasts	
Time	
Time synchronization	0
Time synchronization short	0
Allow synchronization	Yes
UTC time	Yes
Logging	
Port Monitor	No
Log raw data	Yes

Figure 130. *Communication port parameters in RP-570 protocol*

Table 109. Fields of *Communication port parameters window in RP-570 protocol*

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	Read only
Port name	Name of the port and protocol, for example, 'COM1 RP-570 master'	New RP-570 master protocol
Enabled on start	Port enabled on the system startup Values: No, Yes	No
Com port	Communication port number Range of values: COM 1 ... 255	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7,8	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None
RS-485 mode	If two wires are used, the mirrored data check should be used. If the	Four wires

FIELD NAME	DESCRIPTION	DEFAULT VALUE
	serial port is RS-232, the parameter is not important. Values: Two wires, Four wires	
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Next request	Time interval before sending the next request Range of values: 0 ... 2000ms	50
Time synchronization	Use time synchronization type every set interval of time. Range of values: 0 ... 86400s 0 – synchronization is disabled.	0
Time synchronization short	Use short time synchronization type every set interval of time. Range of values: 0 ... 600000ms 0 – synchronization is disabled.	0
Allow synchronization	Yes – always allow time synchronization False – only if the internal clock is synchronized	Yes
UTC time	In request UTC time is used	Yes
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes

4.9.10.2 Application layer parameters

Main	
ID	14
Application Name	New Application
Enabled on start	No
RP-570	
Main	
Address	1
Frame size	255
Priority	1
Broken link	3
Reconnect	10
Response timeout	500
Commands	
Select Cancel With Value	Yes
Time	
Allow synchronization	Yes
UTC time	Yes
Time synchronization	600
Other	
RB Only	Yes
ERM Priority 1	Yes
Logging	
Log header	Yes
Log IO	Yes
Log IO Not configured	Yes

Figure 131. Application layer parameters in RP-570 protocol

Table 110. Fields of Application layer parameters window in RP-570 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application Name	Application layer name, for example, 'Application layer'	New Application
Enabled on start	Enables or disables the application layer on start. Values: No, Yes	No
Address	Slave address Range of values: 1 ... 999, 900 – broadcast	1
Frame size	Maximum frame length Range of values: 48 ... 255 bytes	255
Priority	Data is requested every cycle. Relevant only if more than one application layer exists. Range of values: 1 ... 255	1
Broken link	Number of retries to determine if the connection is broken. Range of values: 1 ... 255	3

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Reconnect	Time interval of reconnection attempt to the remote device while communication is not established Range of values: 1 ... 600s	10
Response timeout	Timeout interval of response from the controlled device Range of values: 50 ... 60000ms	500
Select Cancel With Value	Some master devices do not send the value with select and cancel commands. In this case, set this parameter to 'NO'.	Yes
Allow synchronization	Yes – always synchronize, No – synchronize only if the RTU internal clock is synchronized.	Yes
UTC time	Use UTC time in communication Values: No, Yes	Yes
Time synchronization	Cycle time of the clock synchronization to the controlled device Range of values: 1 ... 86400s 0 - synchronization is disabled.	600
RB Only	For data request, use only RB. RA is a request for priority 1 data but for RB request, it is also allowed to resend with priority 1 data.	Yes
ERM Priority 1	Allows ERM event message responses to RequestA (Priority 1) requests.	Yes
Log header	Enables to log application layer header. Values: No, Yes	Yes
Log IO	Enables to log information objects. Values: No, Yes	Yes
Log IO not configured	Enables to log not configured information objects. Values: No, Yes	Yes

4.9.10.3 Point

Application layer has the branch *Points* where the user can manage signals, measurements from the controlled device and commands to the controlled device. The following figure shows the *Points* popup menu which can be run with the right mouse button. It is possible to *Add data point*, *Edit data point*, *Delete data point*, *Select All data points* or *commands*, and *Remove connection to the Tag*. The user can *Remove connection to source* also from the *TAG Manager*. All menu items have keyboard shortcuts which will simplify and quicken the work with the software.

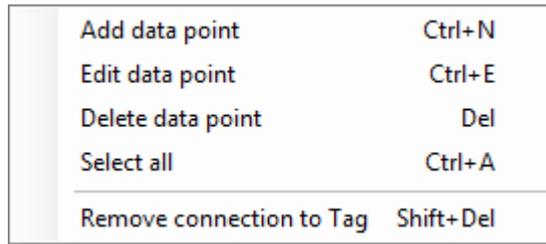


Figure 132. *Points* popup menu

The following figure shows *Create new status point* dialog window. The parameters which the user can specify on the RP-570 protocol are proposed in the next figure.

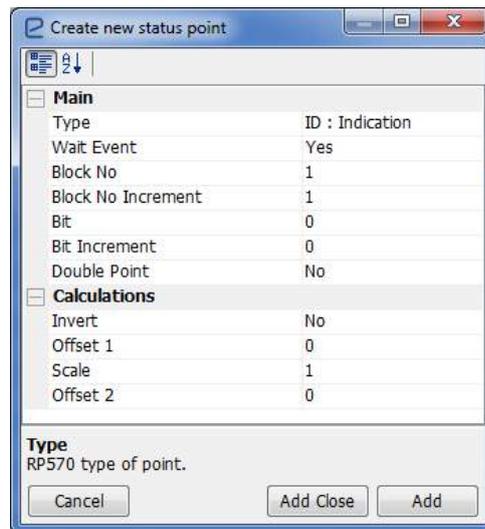


Figure 133. *Create new status point* window

Table 111. Fields of *Create new status point* window in RP-570 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	Type of a point under RP-570 protocol Range of values: ID: Indication, AV: Analogue Value, DV: Digital Value, FD: Fault Distance	ID: Indication
Wait Event	Set to 'NO' if the slave device does not support event transmission. By default only indications are supported.	Yes
Block No	Block number Range of values: 0 ... 255	1
Block No Increment	After adding a new point, Block No will be automatically incremented by the set value.	1
Bit	Bit Number Range of values: 0 ... 15	0

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Bit Increment	After adding a new point, Bit Number will be automatically incremented by the set value.	1
Double Point	Indication double point	No
Invert	Inversion of status Values: No, Yes	No
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0

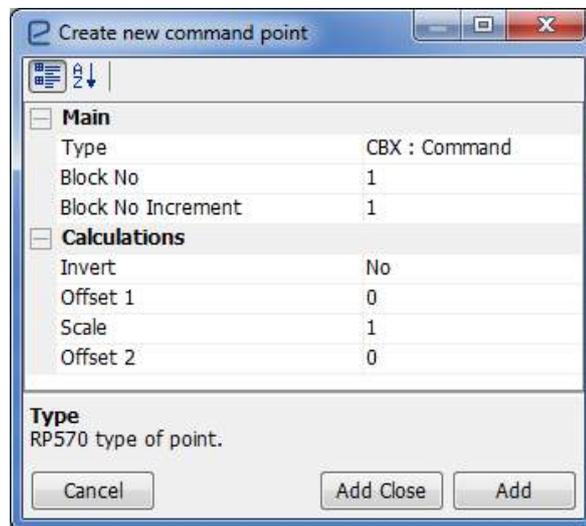


Figure 134. Create new command point window

Table 112. Fields of Create new command point window in RP-570 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	Type of a command under RP-570 protocol Range of values: CBX: Command, SPM: SetPoint, GOM: General Output	CBX: Command
Block No	Block number Range of values: 0 ... 255	1
Block No Increment	After adding a new point, Block No will be automatically incremented by the set value.	1
Invert	Inversion of status Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0

4.9.11 SPA-Bus configuration

4.9.11.1 Communication port parameters

Main	
ID	9
Port Name	New SPA-Bus master (client) protocol
Enabled on start	No
Communication	
COM port	Not assigned
Baud rate	9600
Data bits	7
Stop bits	1
Parity	Even
RS-485 Mode	Four wire
Reconnect	10
Next request	50
Application Broadcasts	
Time	
Time synchronization	0
Time synchronization short	0
Allow synchronization	Yes
UTC time	Yes
Logging	
Port Monitor	No
Log raw data	Yes

Figure 135. *Communication port* parameters in SPA-Bus protocol

Table 113. Fields of *Communication port* parameters window in SPA-Bus protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port name	Name of the port and protocol, for example, 'COM1 SPA-Bus master'	New SPA-Bus master protocol
Port enabled	Port enabled on the system startup Values: No, Yes	No
Com port	Communication port number Range of values: COM 1 ... 255	Not assigned

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7, 8 bits	7
Stop bits	Serial port stop bits Values: 1, 1.5, 2 bits	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	Even
RS-485 mode	If two wires are used, the mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Values: Two wires, Four wires	Four wires
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Next request	Time interval before sending the next request Range of values: 0 ... 2000ms	50
Time synchronization	Broadcast. Cycle time of the clock synchronization to the controlled device Range of values: 1 ... 86400s 0 - synchronization is disabled	0
Time synchronization short	Broadcast. Cycle short time of the clock synchronization to the controlled device Range of values: 1 ... 86400s 0 - synchronization is disabled	0
Allow synchronization	Yes – always synchronize, No – synchronize only if the RTU internal clock is synchronized.	Yes
UTC time	Use UTC time in communication Values: No, Yes	Yes
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes

4.9.11.2 Application layer parameters

Main	
ID	10
Application Name	New Application
Enabled on start	No
SPA-Bus	
Main	
Address	1
Frame size	255
Priority	1
Broken link	3
Reconnect	10
Response timeout	500
Data Count	10
Requests	
Poll	0
Status	10
Reset	Yes
Request Alarms	0
Request Events	Yes
Request Events Count	0
Request Events Time	500
Time synchronization	600
Time synchronization short	10000
Time	
Allow synchronization	Yes
UTC time	Yes
Logging	
Log header	Yes
Log IO	Yes
Log IO Not configured	Yes

Figure 136. Application layer parameters in SPA-Bus protocol

Table 114. Fields of Application layer parameters window in SPA-Bus protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application Name	Application layer name, for example, 'Application layer'	New Application
Enabled on start	Enables or disables the application layer on start. Values: No, Yes	No
Address	Slave address Range of values: 1 ... 999 900 – broadcast.	1
Frame size	Maximum frame length Range of values: 48 ... 255 bytes	255

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Priority	Data is requested every cycle. Relevant only if more than one application layer exists. Range of values: 1 ... 255	1
Broken link	Number of retries to determine if the connection is broken Range of values: 1 ... 255	3
Reconnect	Time interval of reconnection attempt to the remote device while communication is not established Range of values: 1 ... 600s	10
Response timeout	Timeout interval of response from the controlled device Range of values: 50 ... 60000ms	500
Data Count	Request maximum data count Range of value: 1 ...200	10
Poll	Request of data every time period Range of values: 0 ... 600000ms	0
Status	Request of slave status every time period Range of values: 0 ... 86400s 0 – use only while connecting	10
Reset	Reset status bit in the slave device. Set this parameter to 'NO' only if the slave device does not support such commands.	Yes
Request Alarms	Cycle of request alarms Range of values: 0 ... 86400s 0 – disabled.	0
Request Events	Request events from the slave device. Set this parameter to 'NO' only if the slave device does not support such commands.	Yes
Request Events Count	Relevant only if there is more than one application layer (from the remote device). Number of requests for events from the same application layer (from the remote device) if there are events Range of values: 0 ... 255 0 – until there is any event.	0

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Request Events time	Relevant only if there is more than one application layer (remote device). Cycle time of request events from the same application layer (from the remote device) Range of values: 0 ... 60000ms 0 – this parameter is ignored.	500
Time synchronization	Cycle time of the clock synchronization to the controlled device Range of values: 1 ... 86400s 0 - synchronization is disabled.	600
Time synchronization short	Cycle short time of the clock synchronization to the controlled device Range of values: 1 ... 86400s 0 - synchronization is disabled.	10000
Allow synchronization	Yes – always synchronize, No – synchronize only if the RTU internal clock is synchronized	Yes
UTC time	Use UTC time in communication Values: No, Yes	Yes
Log header	Enables to log application layer header. Values: No, Yes	Yes
Log IO	Enables to log information objects. Values: No, Yes	Yes
Log IO not configured	Enables to log not configured information objects. Values: No, Yes	Yes

4.9.11.3 Points

Application layer has the branch of *Points* where the user can manage signals, measurements from the controlled device and commands to the controlled device. The following figure shows the points popup menu which can be run with the right mouse button. It is possible to *Add data point*, *Edit data point*, *Delete data point*, *Select All data points or commands*, and *Remove connection to the Tag*. The user can *Remove connection to source* also from the *TAG Manager*. All menu items have keyboard shortcuts which will simplify and quicken the work with the software.

Add data point	Ctrl+N
Edit data point	Ctrl+E
Delete data point	Del
Select all	Ctrl+A
Remove connection to Tag	Shift+Del

Figure 137. *Points* popup menu

The following figure shows *Create new status point* dialog window. The parameters which can be specified on the SPA-BUS protocol are proposed in the next figure.

Main	
Type	I : Input Data
SubType	Single Point
Channel	0
Channel Increment	0
Data Number	1
Data Number Increment	1
Events	
EVO Channel	
EVO Number	
EV1 Channel	
EV1 Number	
EV2 Channel	
EV2 Number	
EV3 Channel	
EV3 Number	
Analog Events	
Analog Channel	
Analog Number	
Alarms	
Alarm Channel	
Alarm Number	
Calculations	
Invert	No
Offset 1	0
Scale	1
Offset 2	0

Alarm Channel
Channel (0-999) or empty. Leave empty to use same channel as data.

Cancel Add Close Add

Figure 138. *Create new status point* window

Table 115. Fields of *Create new status point* window in SPA-Bus protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	Type of a point under SPA-Bus protocol Range of values: I: Input Data, O: Output Data, S: Setting Values, V: Variables, M: Memory Data	I: Input Data
SubType	Subtype of a point under SPA-Bus protocol Range of values: Single Point, Double Point, Integer, Float	Single Point
Channel	Channel Range of values: 0 ... 999	0
Channel Increment	After adding a new point, Channel will be automatically incremented by the set value. Range of values: 0 ... 999	0
Data Number	Data Number Range of values: 0 ... 999999	1
Data Number Increment	After adding a new point, Data Number will be automatically incremented by the set value. Range of values: 0 ... 999999	1
EV0 Channel	Leave empty to use the same channel as data. Range of values: Empty, 0 ... 999	
EV0 Number	Leave empty to ignore events. Range of values: Empty, 0 ... 64	
EV1 Channel	Leave empty to use the same channel as data. Range of values: Empty, 0 ... 999	
EV1 Number	Leave empty to ignore events. Range of values: Empty, 0 ... 64	
EV2 Channel	Leave empty to use the same channel as data. Range of values: Empty, 0 ... 999	
EV2 Number	Leave empty to ignore events. Range of values: Empty, 0 ... 64	
EV3 Channel	Leave empty to use the same channel as data. Range of values: Empty, 0 ... 999	

FIELD NAME	DESCRIPTION	DEFAULT VALUE
EV3 Number	Leave empty to ignore events. Range of values: Empty, 0 ... 64	
Analogue Channel	Leave empty to use the same channel as data. Range of values: Empty, 0 ... 999	
Analogue Number	Leave empty to ignore events. Range of values: Empty, 0 ... 64	
Alarm Channel	Leave empty to use the same channel as data. Range of values: Empty, 0 ... 999	
Alarm Number	Leave empty to ignore alarms. Range of values: Empty, 0 ... 64	
Invert	Inversion of status Values: No, Yes	No
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0

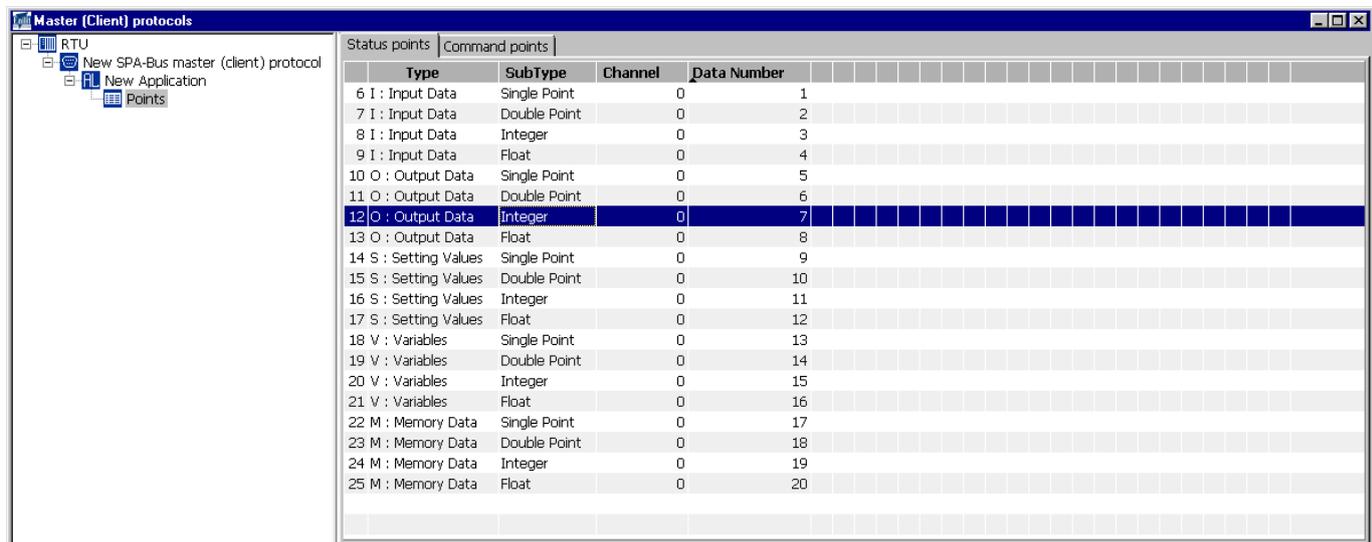


Figure 139. Data points

Columns *Value*, *Time*, *Quality*, *Cause* show real-time data from the controlled device.

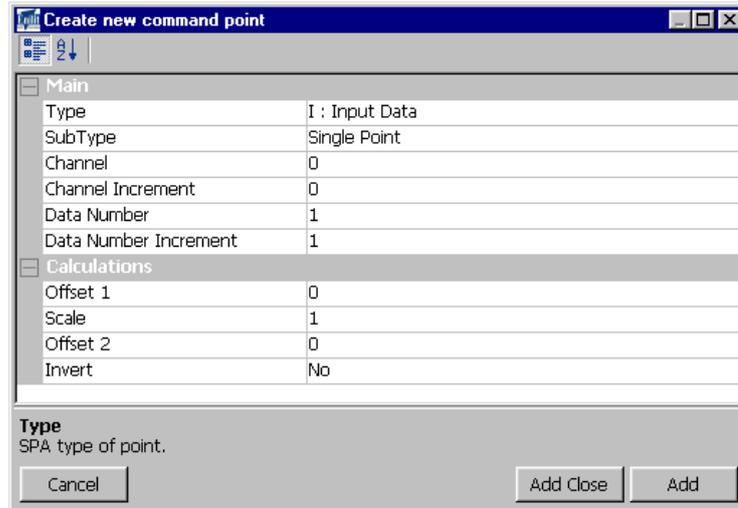


Figure 140. Create new command point in SPA-Bus protocol

Table 116. Fields of Create new command point window in SPA-Bus protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	Type of a point under SPA-Bus protocol Range of values: I: Input Data, O: Output Data, S: Setting Values, V: Variables, M: Memory Data	I: Input Data
SubType	Subtype of a point under SPA-Bus protocol Range of values: Single Point, Double Point, Integer, Float	Single Point
Channel	Channel Range of values: 0 ... 999	0
Channel Increment	After adding a new point, the Channel will be automatically incremented by the set value. Range of values: 0 ... 999	0
Data Number	Data Number Range of values: 0 ... 999999	1
Data Number Increment	After adding a new point, the Data Number will be automatically incremented by the set value. Range of values: 0 ... 999999	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of status Values: No, Yes	No

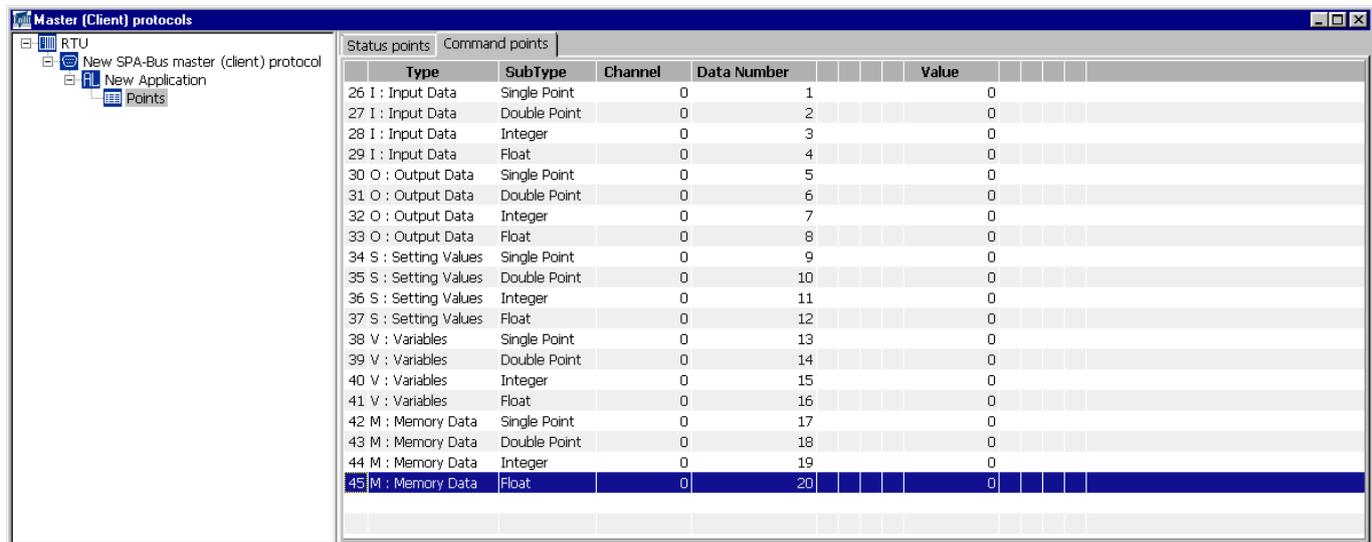


Figure 141. Command points window

4.9.12 System monitor

4.9.12.1 System monitor

Main	
ID	1
Port Name	New System monitor
Enabled on start	No
Logging	
Port Monitor	No

Figure 142. System monitor parameters

Table 117. Fields of System monitor parameters window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Port (protocol) name, for example, 'System monitor'	New System monitor
Enabled on start	Enables or disables the application layer on start. Values: No, Yes	No
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No

4.9.12.2 Points

Port name layer has the branch of *Points*. This protocol is used for the functions of RTU *Cyber security* and *Self diagnostic*. It receives data from the RTU hardware, Operating system and Enilit CMS. Points are created automatically. There is a possibility to change some parameters like *failed logon count*. If needed, there can be added additional features or points free of charge.

..	Categ...	Group	Name	Description				
101	Security	Operating System	Log On Failure					
102	Security	Operating System	Log On Failure Total					
103	Security	Operating System	Log On Failure in a series			5		
104	Security	Operating System	Logged On					
105	Security	Operating System	Logged On Total					
106	Security	Operating System	Is Logged On					
107	Security	Operating System	User created					
108	Security	Operating System	User deleted					
109	Security	Operating System	Log deleted					
111	Security	Enilit CMS	Log On Failure					
112	Security	Enilit CMS	Log On Failure Total					
113	Security	Enilit CMS	Log On Failure in a series			5		
114	Security	Enilit CMS	Logged On					
115	Security	Enilit CMS	Logged On Total					
116	Security	Enilit CMS	Is Logged On					
117	Security	Enilit CMS	Configuration saved					
201	Diagnostics	RAM	Low	Max is limit for used memory i...		80		
211	Diagnostics	CPU	High 90 %	Max is showing time (s) for w...		30		
221	Diagnostics	Clock	Not synchronized					
251	Diagnostics	Disks	Low C:	Max is limit for used used disk ...		90		
252	Diagnostics	Disks	Low D:	Max is limit for used used disk ...		90		
253	Diagnostics	Disks	Low E:	Max is limit for used used disk ...		90		
254	Diagnostics	Disks	Low F:	Max is limit for used used disk ...		90		
301	Diagnostics	NIC Status	ETH1					
302	Diagnostics	NIC Status	ETH2					
303	Diagnostics	NIC Status	ETH3					
304	Diagnostics	NIC Status	ETH4					
305	Diagnostics	NIC Status	ETH5					
306	Diagnostics	NIC Status	ETH6					
401	Diagnostics	NIC Not Working	ETH1					
402	Diagnostics	NIC Not Working	ETH2					
403	Diagnostics	NIC Not Working	ETH3					
404	Diagnostics	NIC Not Working	ETH4					
405	Diagnostics	NIC Not Working	ETH5					
406	Diagnostics	NIC Not Working	ETH6					

Figure 143. System monitor *Status points*

Table 118. Fields of System monitor *Status points* window

CATEGORY	GROUP	NAME	DESCRIPTION
Security	Operating System	Log On Failure	Failed user log on to the Operating system. Type Status. The signal activates and goes to normal
Security	Operating System	Log On Failure Total	Count of Failed user logons to the Operating system. Type Integer
Security	Operating System	Log On Failure in series	Count of Failed user logons to the Operating system in series. Type Status
Security	Operating System	Logged On	User is logging to the Operating system. Type Status. The signal activates only on logging to the Operating system and then goes to normal.
Security	Operating System	Logged On Total	Count of the users logging to the Operating system. Type Integer
Security	Operating System	Is Logged On	User is logged on to the Operating system. Type Status. The signal is active till a user is logged to the Operating system.
Security	Operating System	User created	Created a new user in the Operating system. Type Status. The signal activates on a new user creation and then goes to normal.
Security	Operating System	User deleted	Deleted user from the Operating system. Type Status. The signal activates on deletion of a user and then goes to normal.
Security	Operating System	Log deleted	Deleted Operating system log. Type Status. The signal activates on deletion of Operating system logs and then goes to normal.
Security	Enilit CMS	Log On Failure	Failed user log on to Enilit CMS. Type Status. Signal activates and goes to normal
Security	Enilit CMS	Log On Failure Total	Count of Failed user logons to Enilit CMS. Type Integer
Security	Enilit CMS	Log On Failure in series	Count of Failed user logons to Enilit CMS in series. Type Integer
Security	Enilit CMS	Logged On	User is logging to Enilit CMS. Type Status. The signal activates only on logging to Enilit CMS and then goes to normal.

CATEGORY	GROUP	NAME	DESCRIPTION
Security	Enilit CMS	Logged On Total	Count of users logging to Enilit CMS. Type Integer
Security	Enilit CMS	Is Logged On	User is logged on to Enilit CMS. Type Status. The signal is active till a user is logged to Enilit CMS.
Security	Enilit CMS	Configuration saved	Enilit CMS configuration saved. Type Status. The signal activates on Enilit CMS configuration saving process.
Diagnostics	RAM	Low	Limit for the used memory in percent. Limit range is configurable. Range of value: 0 ... 100 Default value: 80
Diagnostics	CPU	High 90%	Time for which CPU is using too much of resources (90%). Time is configurable. Range value: 0 ... 1000000s Default value: 30
Diagnostics	Clock	Not synchronized	RTU internal clock is not synchronized.
Diagnostics	Disks	Low C:	Limit for the used disk space in percent. Limit range is configurable. Range of value: 0 ... 100
Diagnostics	Disks	Low D:	Limit for the used disk space in percent. Limit range is configurable. Range of value: 0 ... 100
Diagnostics	Disks	Low E:	Limit for the used disk space in percent. Limit range is configurable. Range of value: 0 ... 100
Diagnostics	Disks	Low F:	Limit for the used disk space in percent. Limit range is configurable. Range of value: 0 ... 100
Diagnostics	NIC Status	ETH1 ... 6	Ethernet Network interface controller status. Type Integer. Descriptions of status are in the table below.
Diagnostics	NIC Not Working	ETH1 ... 6	Ethernet Network interface controller is disconnected.

Table 119. Ethernet Network interface controller (NIC) status table

NAME	DESCRIPTION	VALUE
NCS_DISCONNECTED	The connection is disconnected.	0
NCS_CONNECTING	The connection is in the process of connecting.	1
NCS_CONNECTED	The connection is in the connected state.	2
NCS_DISCONNECTING	The connection is in the process of disconnecting.	3
NCS_HARDWARE_NOT_PRESENT	The hardware for the connection, for example network interface card (NIC), is not present.	4
NCS_HARDWARE_DISABLED	The hardware for the connection is present, but is not enabled.	5
NCS_HARDWARE_MALFUNCTION	A malfunction has occurred in the hardware for the connection.	6
NCS_MEDIA_DISCONNECTED	The media, for example, the network cable, is disconnected.	7
NCS_AUTHENTICATING	The connection is waiting for authentication to occur.	8
NCS_AUTHENTICATION_SUCCEEDED	Authentication has succeeded on this connection.	9
NCS_AUTHENTICATION_FAILED	Authentication has failed on this connection.	10
NCS_INVALID_ADDRESS	The address is invalid.	11
NCS_CREDENTIALS_REQUIRED	Security credentials are required.	12

4.10 Slave protocols

4.10.1 IEC 60870-5-101 protocol configuration

4.10.1.1 Communication port parameters

Main	
ID	2
Port Name	New IEC-101 slave (server) protocol
Enabled on start	No
Communication	
COM port	Not assigned
Baud rate	9600
Data bits	8
Stop bits	1
Parity	None
RS-485 Mode	Four wire
Reconnect	10
Init time	0
IEC-101	
Data Link address size	1
Logging	
Port Monitor	No
Log raw data	Yes

Figure 144. *Communication port* parameters in IEC 60870-5-101 protocol

Table 120. Fields of *Communication port* parameters window in IEC 60870-5-101 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Name of the port and protocol, for example, 'COM3 IEC-101 slave'	New IEC_101 slave protocol
Enabled on start	Port enabled on the system startup. Values: No, Yes	No
COM port	Communication port number Range of values: COM 1 ... COM 255	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7, 8	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None

FIELD NAME	DESCRIPTION	DEFAULT VALUE
RS-485 Mode	If two wires are used, the mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Values: Two wires, Four wires	Four wires
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Init time	Protocol initialization time on startup. During this time no events will be generated. Range of values: 0 ... 600s 0 – Not used	0
Data Link address size	Data link address size Range of values: 0 ... 2 bytes	1
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes

4.10.1.2 Data link layer parameters

Main	
ID	4
Data Link Name	New Data link
Enabled on start	No
IEC-101	
Main	
Data Link address	0
COT size	1
CAA size	2
Frame size	255
Disconnect No requests	0
Other	
Status Link	No
Allow E5	Yes
Class1 answers to Class2	Yes
Class2 answers to Class1	Yes
Logging	
Log header	Yes

Figure 145. Data link layer parameters in IEC 60870-5-101 protocol

Table 121. Fields of *Data link layer* parameters window in IEC 60870-5-101 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Data Link Name	Data link layer name, for example, 'Measurements data controller'	New Data Link
Enabled on start	Enables or disables data link on start. Values: No, Yes	No
Data link address	Data link address Range of values: 0 ... 65534 (if the length of Data link address is set to 2), 0 ... 254 (if the length of Data link address is set to 1), If the length of Data link address is set to 0, this parameter is not used.	0
COT size	Cause of transmission size Range of values: 1 ... 2 bytes	1
CAA size	Common ASDU address size Range of values: 1 ... 2 bytes	2
Frame size	Maximum frame size. All start, stop, checksum and other bytes are included. Range of values: 50 ... 261 bytes	255
Disconnect No requests	Disconnect the data link layer, if no requests are received from the master for a specified time period. Range of values: 0 ... 3600s 0 – disabled	0
Status Link	If status link is needed before reset link Values: No, Yes	No
Allow E5	Enables or disables E5 response to the controlling device. Values: No, Yes	Yes
Class1 answers to Class2	Enables or disables Class1 data response to Class2 requests. Values: No, Yes	Yes
Class2 answers to Class1	Enables or disables Class2 data response to Class1 requests. Values: No, Yes	Yes
Log header	Enables to log data link layers header Values: No, Yes	Yes

4.10.1.3 Application layer parameters

Main	
ID	5
Application Name	New Application
Enabled on start	No
IEC-101	
Main	
Common address	1
Object address size	3
Object address structure	Unstructured
End of init	Yes
Interrogation	
Interrogation command response	No
Interrogation over Class2	No
Commands	
Time difference	10000
C SE ActTerm	Yes
C SE Cause Allow	No
Time	
Allow synchronization	No
UTC	Yes
Time difference	1000
Day of Week	Yes
Summer time	Yes
Hour change	No
Cycles	
Periodic	10
Background	60
Event Buffers	
Event buffer Class1 size	1000
Event buffer Class1 overflow	Remove First
Overflow IOA Class1	0
Event buffer Class2 size	1000
Event buffer Class2 overflow	Remove First
Overflow IOA Class2	0
Not Event NotTopical Disconnected	No
Other	
SQ	Yes
Logging	
Log header	Yes
Log IO	Yes

Figure 146. Application layer parameters in IEC 60870-5-101 protocol

Table 122. Fields of Application layer parameters window in IEC 60870-5-101 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application Name	Application layer name, for example, 'SCADA 1'	New application

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Enabled on start	Enables or disables data link on start. Values: No, Yes	No
Common address	Common address of data unit Range of values: 1 ... 254	1
Object address size	Size of the information object address field Range of values: 1 ... 3	3
Object address structure	The structure of Object address shows the format in which the information object address is entered in the configuration. Range of values: Unstructured, Structured 8.8.8, Structured 8.16, Structured 16.8, Structured 8.8	Unstructured
End of init	Enables or disables the station initialization frame transmission to the controlled station. Values: No, Yes	Yes
Interrogation command response	Specifies the command if a general interrogation command request is received but the general interrogation is already going. No – general interrogation is restarted. Values: No, Yes	No
Interrogation over Class2	Interrogation response will have higher priority than Class2 events Values: No, Yes	No
Time difference	Time difference to discard the execution of the command Range of values: 1 ... 60000ms	10000
C SE ActTerm	Activation termination is used for set point commands. Values: No, Yes	Yes
C SE Cause Allow	Allows setting the local or remote command cause of transmission, in case the measurement point was changed by a command. Values: No, Yes	No
Allow synchronization	Allows the clock synchronization from the controlled station. Values: No, Yes	No
UTC	Time synchronization with the UTC timestamp Values: No, Yes	Yes

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Time difference	Time difference to synchronize the internal RTU clock Range of values: 20 ... 10000ms	1000
Day of Week	In responses with a timestamp, use Day of Week bit. Values: No, Yes	Yes
Summer time	In responses with a timestamp, use Summer time bit. Values: No, Yes	Yes
Hour change	Transmits the spontaneous clock synchronization command on hourly change. It is used only for the events with the CP24Time2a timestamp. Values: No, Yes	No
Periodic	Cycle time of data marked with Cyclic/Periodic COT Range of values: 10 ... 10000s	10
Background	Cycle time of data marked with Background COT Range of values: 10 ... 10000s	60
Event buffer Class1 size	Spontaneous Events buffer of Class 1 size. Change takes effect only after the system restart. Range of values: 10 ... 10000 events	1000
Event buffer Class1 overflow	If the buffer of class 1 events overflows, with this parameter the user can select the event to remove from the queue. Range of values: Remove first, Remove all	Remove first
Overflow IOA Class1	Overflows the information object address for Class1. On the buffer, overflow IOA will be set to 1, and when there are free places in the buffer, it will be set to 0. When the value changes to 0, the controlling device should initiate general interrogation.	0 – not used
Event buffer Class2 size	Spontaneous Events buffer of Class 2 size. Change takes effect only after the system restart. Range of values: 10 ... 10000 events	1000
Event buffer class2 overflow	If the buffer of class 2 events overflows, with this parameter the user can select the event to remove from the queue. Range of values: Remove first, Remove all	Remove first

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Overflow IOA Class2	Overflows the information object address for Class2. On the buffer overflow IOA will be set to 1, and when there are free places in the buffer it will be set to 0. When the value changes to 0, the controlling device should initiate general interrogation.	0 – not used
Not Event NotTopical Disconnected	If the event received from the main module has quality setting to 'Not Topical' and the cause of change is the Disconnected source, than no event will be generated to the upper system. Values: No, Yes	No
SQ	Use SQ bit. Recommended to use only if the most of information object addresses are incremented by one. Values: No, Yes	Yes
Log header	Enables to log application layer header. Values: No, Yes	Yes
Log IO	Enables to log information objects. Values: No, Yes	Yes

4.10.1.4 Points

Data points and command points are freely configurable in the monitoring direction. The user will connect all the configured data and command points to the tag which has already been connected to the data sources.

ID	Add...	IEC Type	Time Type	Inte...	On Cha...	Back...	Offs...	Scale
1	104410	Single-point information	Long Time (7 by...	General	Class1 Event			
2	104411	Single-point information	Long Time (7 by...	General	Class1 Event			
3	104412	Double-point information	Long Time (7 by...	General	Class1 Event			
4	104413	Double-point information	Long Time (7 by...	General	Class1 Event			
5	104414	Step position information	Long Time (7 by...	General	Class1 Event			
6	104415	Bitstring of 32 bits	Long Time (7 by...	General	Class1 Event			
7	104416	Measured value, normalized value	No time	General	Class1 Event			
8	104417	Measured value, normalized value	No time	General	Class1 Event			
9	104418	Measured value, scaled value	No time	General	Class1 Event			
10	104419	Measured value, scaled value	No time	General	Class1 Event			
11	104420	Measured value, short floating point ...	No time	General	Class1 Event			
12	104421	Measured value, short floating point ...	No time	General	Class1 Event			

Figure 147. Status points for IEC 60870-5-101 slave

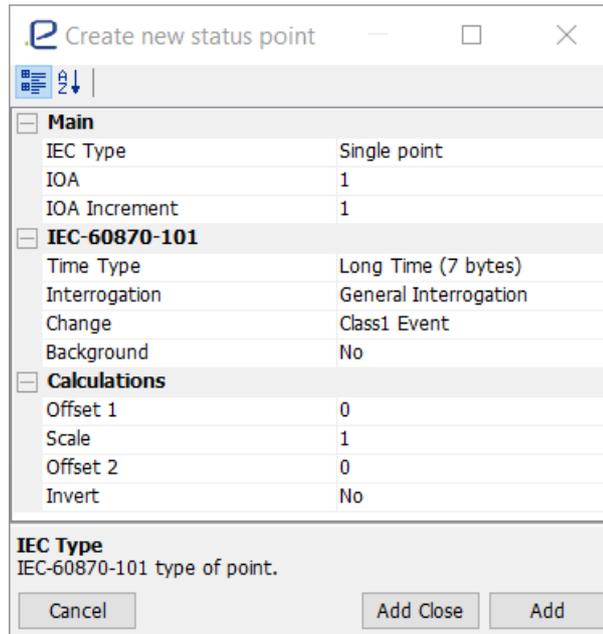


Figure 148. Create new status point dialog for IEC 60870-5-101 slave protocol

Table 123. Fields of Create new status point window in IEC 60870-5-101 slave protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IEC Type	Type of data under IEC 60870-5-101 protocol Values: Single point Double point Step position Bit string of 32 bits Measured value, normalized value Measured value, scaled value Measured value, short floating point value	Single Point
IOA	Information address Range of information address depends from the length of the Application layer parameter in the Information object address. Range of values: 0 ... 16777215	1
IOA Increment	After adding a new data point, the address will be automatically incremented by the set value. It is used only for configuration.	1
Time type	Timestamp of a data point. Range of values: No time, Short time (3 bytes) Long time (7 bytes)	Long Time (7 bytes)

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Interrogation	Assign data point to the specific interrogation group. Range of values: General Interrogation, Interrogation Group 1 ... 16	General Interrogation
Change	The user can specify the data point class or cause of transmission. If the user chooses Class1 Event or Class2 Event, the data point will be marked with the Spontaneous cause of transmission. Range of values: Class1 Event, Class1 Event, not buffered when there is no link, Class2 Event, Class2 Event, not buffered when there is no link, Send only on general interrogation request, Periodic	Class1 Event
Background	Data point is included in the background scan. Values: No, Yes	No
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of status Values: No, Yes	No

Status points Command points											
ID	Add...	IEC Type	I...	O...	Scale	Offs...	Value	Time	Result	Tag	
1	100001	Single command					0				
2	100002	Double command					0				
3	100003	Regulating step command					0				
4	100004	Set point command, normalised value					0				
5	100005	Set point command, scaled value					0				
6	100006	Set point command, short floating p...					0				
7	100007	Bitstring of 32 bit					0				

Figure 149. Command points for IEC 60870-5-101 slave protocol

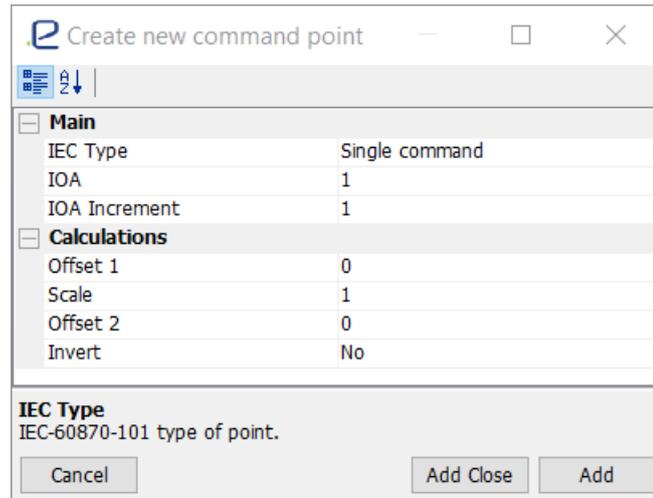


Figure 150. Create a new command point dialog for IEC 60870-5-101 slave protocol

Table 124. Fields of Create new command point window in IEC 60870-5-101 slave protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IEC Type	Type of a command under IEC 60870-5-101 protocol Values: Single command Double command Regulating step command Setpoint normalized command Setpoint scaled command Setpoint short float command Bitstring command	Single Command
IOA	Information address The range of information address depends from the length of the Application layer parameter in the Information object address. Range of values: 0 ... 16777215	1
IOA Increment	After adding a new data point, the address will be automatically incremented by the set value. It is used only for configuration.	1
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of commands Values: No, Yes	No

The user can select some data points and then press *Ctrl+Shift+N* to connect all the selected data points to the tags in a row. If the tag icon is greyed out, it is not possible to connect to the slave status point or command point. It means if the user has to choose a Status point in the slave protocol; it is possible to connect only to the status tag. And if the user has to choose a Command point in the slave protocol, it is possible to connect only to the command tag.

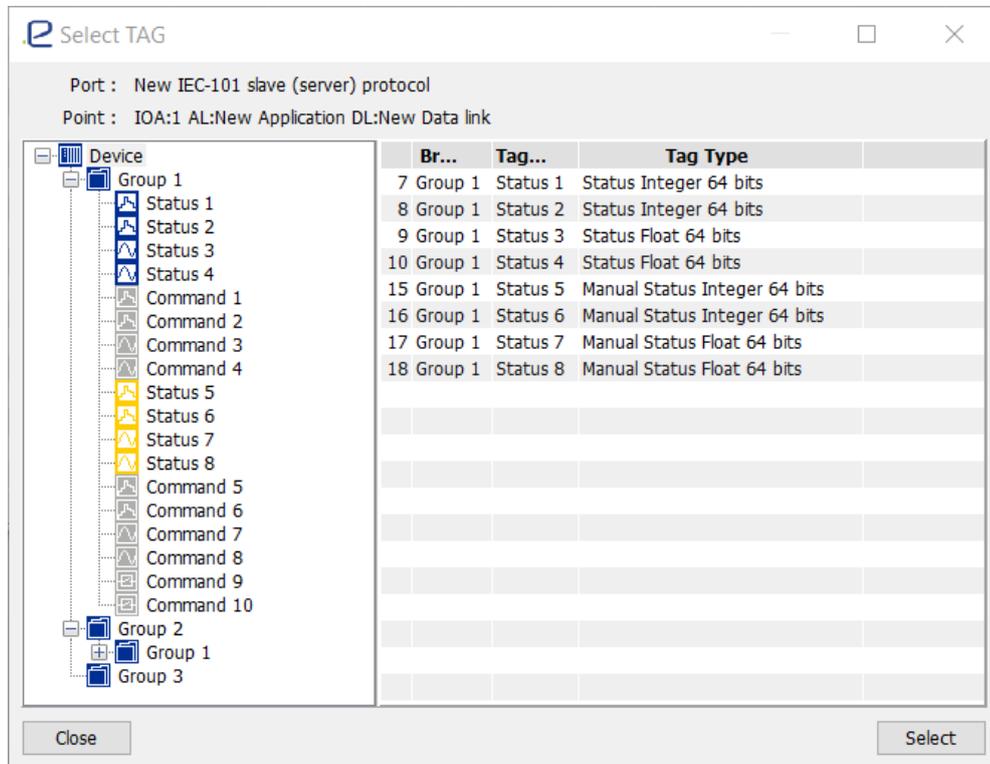


Figure 151. Status point connection to the tag dialog box

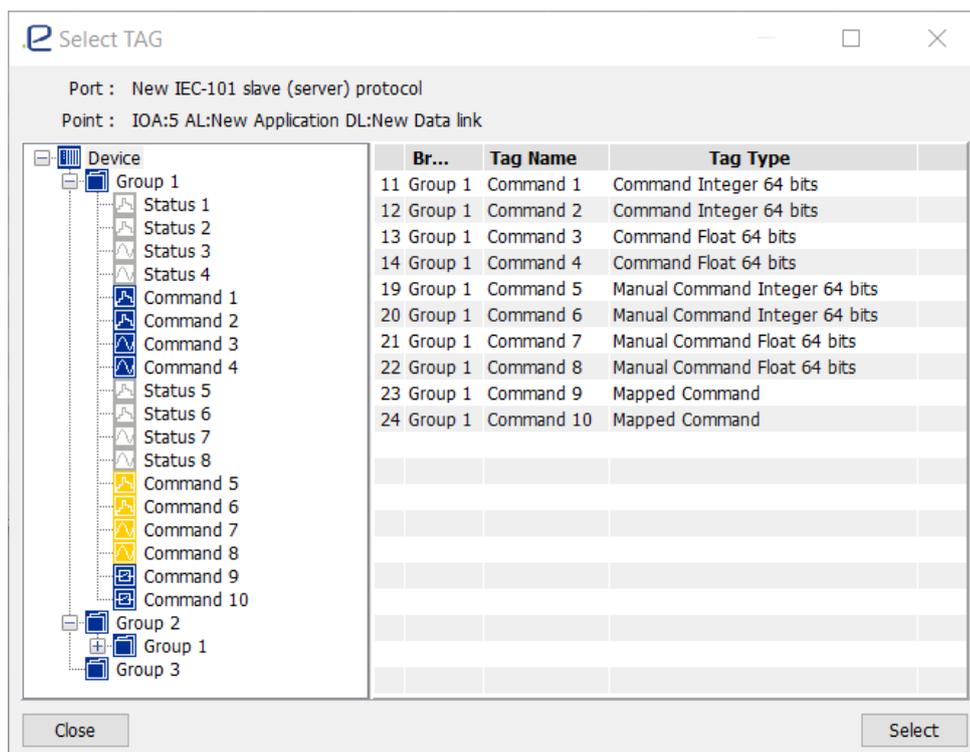


Figure 152. Command point connection to the tag dialog box

4.10.2 IEC 60870-5-104 protocol configuration

4.10.2.1 Communication port parameters

Main	
ID	4
Port Name	New IEC-104 slave (server) protocol
Enabled on start	No
Communication	
Ethernet port	All ETH
TCP port	2404
TCP Keep Alive	10000
TCP No delay	No
Reconnect	10
Init time	0
Logging	
Port Monitor	No
Log raw data	Yes

Figure 153. *Communication port* parameters in IEC 60870-5-104 slave protocol

Table 125. Fields of *Communication port* parameters window in IEC 60870-5-104 slave protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Port name, for example, 'IEC-104 slave'	New IEC-104 slave protocol
Enabled on start	Enables or disables the communication port on start. Values: No, Yes	Yes
Ethernet port	Specifies the Ethernet port to be used to create the server. Values: All ETH, ETH 1, ETH 2, ETH 3, ETH4.	All ETH
TCP Port	TCP port Range of values: 1 ... 65535	2404
TCP Keep Alive	Checks the connected socket and determines whether the connection is still up and running or if it has broken. Range of values: 1 ... 2147483647ms 0 – disabled	10000
TCP No delay	Controls TCP packet batching Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Init time	Protocol initialization time on startup. During this time no events will be generated. Range of values: 1 ... 60	0
Port Monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes

4.10.2.2 Data link parameters

Main	
ID	5
Data Link Name	New Data link
Enabled on start	No
IEC-104	
Time Outs	
T1	15
T2	10
T3	20
k	12
w	8
Sizes	
COT size	2
CAA size	2
Frame size	255
Other	
StartTD	Ignore
No ACK	No
Communication	
Client's Nr. 1 IP	127.0.0.1
Client's Nr. 2 IP	192.168.1.63
Client's Nr. 3 IP	192.168.1.34
Client's Nr. 4 IP	
Client's Nr. 5 IP	
Client's Nr. 6 IP	
Client's Nr. 7 IP	
Client's Nr. 8 IP	
Client's Nr. 9 IP	
Logging	
Log header	Yes

Figure 154. Data link layer parameters in IEC 60870-5-104 slave protocol

Table 126. Fields of *Data link layer* parameters window in IEC 60870-5-104 slave protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Data Link Name	Data link layer name, for example, 'IEC-104 client'	New Data link
Enabled on start	Enables or disables a client on start. Values: No, Yes	No
T1	Acknowledgement timeout 1 Range of values: 1...255 s	15
T2	Acknowledgement timeout 2 Range of values: 1...255 s	10
T3	Connection test timeout Range of values: 1...255 s	20
k	Maximum number of unacknowledged I format ADPU's Range of values: 1...32767	12
w	Maximum number of I frame APDU's after which the acknowledgment is needed Range of values: 1...32767	8
COT size	Cause of transmission size Values: 1, 2 bytes	2
CAA size	Common size of ASDU address Values: 1, 2 bytes	2
Frame size	Maximum frame size. All start, stop, checksum and other bytes are included. Range of values: 50 ... 261 bytes	255
StartTD	Action taken when the second StartTD has been received from another client Values: Ignore, Connect new client	Ignore
No ACK	Keep all sent but not acknowledged I frames after disconnection. All unacknowledged frames will be transmitted to a new connected client. Values: No, Yes	No
Clients Nr. 1 ... 9 IP	Access list of clients IPs Range of values: xxx.xxx.xxx.xxx	127.0.0.1
Log header	Enables to log ACPI header values. Values: No, Yes	Yes

4.10.2.3 Application layer parameters

Main	
ID	6
Application Name	New Application
Enabled on start	No
IEC-104	
Main	
Common address	1
Object address size	3
Object address structure	Unstructured
End of init	Yes
Interrogation	
Interrogation command response	No
Commands	
Time difference	10000
C SE ActTerm	Yes
C SE Cause Allow	No
Time	
Allow synchronization	No
UTC	Yes
Time difference	1000
Day of Week	Yes
Summer time	Yes
Hour change	No
Cycles	
Periodic	10
Background	60
Event Buffers	
Event buffer size	1000
Event buffer overflow	Remove First
Overflow IOA	0
Not Event NotTopical Disconnected	No
Other	
SQ	Yes
Logging	
Log header	Yes
Log IO	Yes

Figure 155. Application layer parameters in IEC 60870-5-104 slave protocol

Table 127. Fields of Application layer parameters window in IEC 60870-5-104 slave protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application Name	Application layer name, for example, 'SCADA 1'	New Application
Enabled on start	Enables or disables the data link on start. Values: No, Yes	No
Common address	Common address of a data unit Range of values: 1 ... 254	1
Object address size	Size of information object address field Range of values: 1 ... 3	3

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Object address structure	The structure of the object address shows the format in which the information object address is entered in the configuration. Range of values: Unstructured, Structured 8.8.8, Structured 8.16, Structured 16.8, Structured 8.8	Unstructured
End of init	Enables or disables station initialization frame transmission to the controlled station. Values: No, Yes	Yes
Interrogation command response	Specifies the command if general interrogation command request has been received but the general interrogation is already going. No – general interrogation is restarted. Values: No, Yes	No
Time difference	Time difference to discard the execution of a command Range of values: 1 ... 60000 ms	10000
C SE ActTerm	Activation termination is used for the set point commands. Values: No, Yes	Yes
C SE Cause Allow	Allows setting the local or remote command cause of transmission, in case the measurement point was changed by the command. Values: No, Yes	No
Allow synchronization	Allows the clock synchronization from the controlled station. Values: No, Yes	No
UTC	Time synchronization with the UTC timestamp. Values: No, Yes	Yes
Time difference	Time difference to synchronize the internal RTU clock Range of values: 20 ... 10000ms	1000
Day of Week	In responses with a timestamp, use Day of Week bit. Values: No, Yes	Yes
Summer time	In responses with a timestamp, use Summer time bit. Values: No, Yes	Yes

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Hour change	Transmit spontaneous clock synchronization command on hourly change. It is used only for the events with the CP24Time2a timestamp. Values: No, Yes	No
Periodic	Cycle time of the data marked with Cyclic/Periodic COT Range of values: 10 ... 10000s	10
Background	Cycle time of the data marked with Background COT Range of values: 10 ... 10000s	60
Event buffer size	Spontaneous Events buffer size. The change takes effect only after the system restart. Range of values: 10 ... 10000 events	1000
Event buffer overflow	If the buffer of events overflows, with this parameter the user can select the event to remove from the queue. Range of values: Remove first, Remove all	Remove first
Overflow IOA	Overflow information object address. On buffer overflow, IOA will be set to 1 and when there are free places in the buffer it will be set to 0. When the value changes to 0, the controlling device will initiate general interrogation.	0 – not used
Not Event NotTopical Disconnected	If the event received from the main module has quality setting to 'Not Topical' and the cause of change is the Disconnected source, than no event will be generated to the upper system. Values: No, Yes	No
SQ	Use SQ bit. It is recommended to use it only if the most of the information object addresses are incremented by one. Values: No, Yes	Yes
Log header	Enables to log application layer header. Values: No, Yes	Yes
Log IO	Enables to log information objects. Values: No, Yes	Yes

4.10.2.4 Points

ID	Addr...	IEC Type	Time Type	Inte...	On C...	Back...	Offs...	Scale	Offs...
2	1	Single-point information	Short time (3 by...	General	Event				
5	55	Single-point information	No time	General	Event				
6	1000	Single-point information	Long Time (7 by...	General	Event				
7	1001	Single-point information	Long Time (7 by...	General	Event				
8	1002	Single-point information	Long Time (7 by...	General	Event				
9	1003	Single-point information	Long Time (7 by...	General	Event				
10	1004	Single-point information	Long Time (7 by...	General	Event				
11	1005	Double-point information	Long Time (7 by...	General	Event				
12	1006	Double-point information	Long Time (7 by...	General	Event				
13	1007	Step position information	Long Time (7 by...	General	Event				
14	1008	Measured value, normalized value	Long Time (7 by...	General	Event				
15	1009	Measured value, normalized value	Long Time (7 by...	General	Event				
16	1010	Measured value, scaled value	Long Time (7 by...	General	Event				
17	1011	Measured value, scaled value	Long Time (7 by...	General	Event				
18	1012	Measured value, short floating poi...	Long Time (7 by...	General	Event				
19	1013	Measured value, short floating poi...	Long Time (7 by...	General	Event				

Figure 156. Status points window in IEC-60870-5-104

e Create new status point _ □ ×

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Main	
IEC Type	Single point
IOA	1
IOA Increment	1
IEC-60870-104	
Time Type	Long Time (7 bytes)
Interrogation	General Interrogation
Change	Event
Background	No
Calculations	
Offset 1	0
Scale	1
Offset 2	0
Invert	No

IEC Type
IEC-60870-104 type of point.

Cancel
Add Close
Add

Figure 157. Create new status point dialog for IEC 60870-5-104 slave protocol

Table 128. Fields of *Create new status point* window in IEC 60870-5-104 slave protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IEC Type	Type of data under IEC 60870-5-104 protocol Values: Single point Double point Step position Bit string of 32 bits Measured value, normalized value Measured value, scaled value Measured value, short floating point value	Single Point
IOA	Information address Range of the information address depends from the length of the Application layer parameter in the Information object address. Range of values: 0 ... 16777215	1
IOA Increment	After adding a new data point, the address will be automatically incremented by the set value. It is used only for configuration.	1
Time type	Timestamp of a data point Range of values: No time, Short time (3 bytes) Long time (7 bytes)	Long time (7 bytes)
Interrogation	Assigns a data point to the specific interrogation group. Range of values: General Interrogation, Interrogation Group 1 ... 6.	General Interrogation
On change	Specifies the data point cause of transmission. Range of values: Event, Event, not buffered when no link, Send only on general interrogation request, Periodic	Event
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of status Values: No, Yes	No

ID	Add...	IEC Type	Invert	Offs...	Scale	Offs...	Value	Time	Result	Tag
20	410410	Double command					0			
21	410411	Double command					0			
22	410412	Double command					0			

Figure 158. Command points for IEC 60870-5-104 slave

Create new command point

Main

IEC Type	Single command
IOA	1
IOA Increment	1

Calculations

Offset 1	0
Scale	1
Offset 2	0
Invert	No

IEC Type
IEC-60870-104 type of point.

Cancel Add Close Add

Figure 159. Create new command point dialog for IEC 60870-5-104 slave protocol

Table 129. Fields of Create new command point window in IEC 60870-5-104 slave protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IEC Type	Type of command under IEC 60870-5-104 protocol Values: Single command, Double command, Regulating step command, Setpoint normalized command, Setpoint scaled command, Setpoint short float command, Bitstring command	Single Command
IOA	Information address Range of the information address depends from the length of the Application layer parameter in the Information object address. Range of values: 0 ... 16777215	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IOA Increment	After adding a new data point, the address will be automatically incremented by the set value. It is used only for configuration.	1
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of a command Values: No, Yes	No

4.10.3 DNP3 serial slave configuration

4.10.3.1 Communication port parameters

<input type="checkbox"/> Main	
ID	4
Port Name	New DNP3 slave protocol
Enabled on start	No
<input type="checkbox"/> Communication	
COM port	Not assigned
Baud rate	9600
Data bits	8
Stop bits	1
Parity	None
RS-485 Mode	Four wire
Reconnect	10
Init time	0
<input type="checkbox"/> Logging	
Port Monitor	No
Log raw data	Yes

Figure 160. *Communication port parameters in DNP3 serial protocol*

Table 130. *Fields of Communication port parameters window in DNP3 serial protocol*

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Name of the port and protocol, for example, 'COM3 DNP3 slave'	New DNP3 slave protocol
Enabled on start	Port enabled on the system startup Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
COM port	Communication port number Range of values: Not assigned, COM 1 ... 255	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7, 8	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None
RS-485 Mode	If two wires are used, the mirrored data checks should be used. If the serial port is RS-232, the parameter is not important. Values: Four wire, Two wire	Four wire
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Init time	Protocol initialization time on startup. During this time no events will be generated. Range of values: 1 ... 600 0 – Not used	0
Port Monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes
Log Unknown Data Link	Always set this parameter to 'No' in the multiple slave systems.	Yes

4.10.3.2 Data link layer parameters

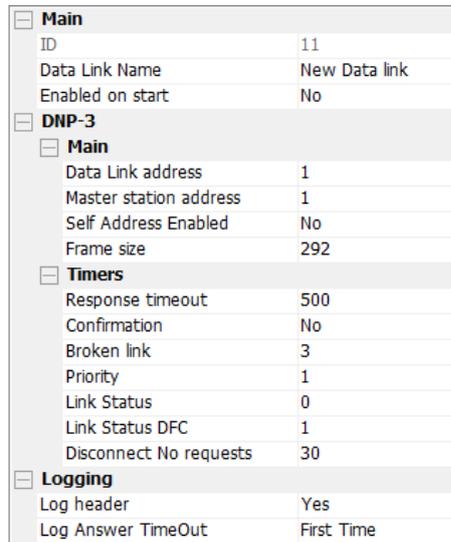


Figure 161. Data link layer parameters in DNP3 serial protocol

Table 131. Fields of Data link layer parameters window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Data Link Name	Data link layer name, for example, 'DNP3 client'	New Data link
Enabled on start	Enables or disables a client on start. Values: No, Yes	No
Data Link address	RTU's slave address Range of values: 0 ... 65519	1
Master station address	Master station address Range of values: 0 ... 65519	1
Self Address Enabled	Set this parameter to 'Yes' only for testing purpose when the master does not know the outstation address. Values: No, Yes	No
Fragment Size	Maximum size of a data link fragment Range of values: 14 ... 292 bytes	292
Response timeout	Response timeout Range of values: 50 ... 60000 ms	500
Confirmation	Data link uses confirmations. Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Broken link	Number of retries to determine if the connection is broken. Range of values: 1 ... 255	3
Priority	Data is requested every cycle. It is relevant only if more than one data link layer exists. Range of values: 1 ... 255	1
Link Status	Time interval of request attempt for the link status, if there is no data. Range of values: 0 ... 86400s 0 – Link Status is not used.	0
Link Status DFC	Time interval of checking attempt for DFC=0, if the value of DFC has been 1. Range of values: 1 ... 86400s	1
Disconnect No requests	Disconnects the data link layer, if no requests are received from the master for the specified time. Range of values: 0 ... 3600s 0 – Not used.	30
Log header	Enables to log data link header. Values: No, Yes	Yes
Log Answer Time Out	Enables to log data link answer timeouts to the system log. Values: Never, First Time, Always	First Time

4.10.3.3 Transport layer parameters

Main	
ID	6
Transport Name	New Transport
Enabled on start	No
Logging	
Log header	Yes

Figure 162. *Transport layer* parameters in in DNP3 serial protocol

Table 132. Fields of *Transport layer* parameters window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Transport Name	Transport layer name, for example, 'Transport Layer'	'New Transport'

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Enabled on start	Enables or disables a client on start. Values: No, Yes	No
Log header	Enables to log Transport layer header. Values: No, Yes	Yes

4.10.3.4 Application layer parameters

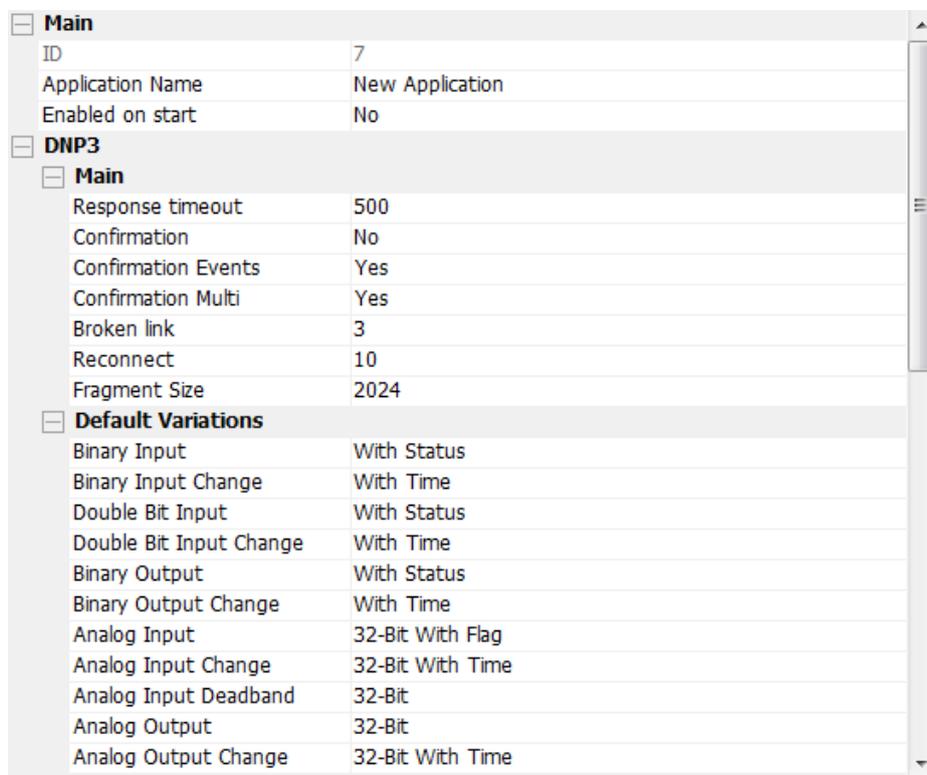


Figure 163. Application layer parameters in DNP3 serial protocol

Table 133. Fields of Application layer parameters window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	Read only
Application Name	Application layer name, for example, 'Application layer'	New Application
Enabled on start	Port enabled on the system startup. Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Response timeout	Response timeout Range of value: 50 ... 60000ms	500
Confirmation	Application layer requests confirmations Values: No, Yes	No
Confirmation Events	Application layer requests confirmations for the responses which contain event data. Values: No, Yes	Yes
Confirmation Multi	Application layer requests confirmations for multi fragment responses (The last fragment does not count). Values: No, Yes	Yes
Broken link	Number of retries to determine if the connection is broken. Range of values: 1 ... 255	3
Reconnect	Time interval of reconnection attempt while communication is not established. Unsolicited NULL response will be sent at the specified time period. Range of values: 0 ... 3600 s 0 – Unsolicited NULL is disabled.	10
Fragment Size	Maximum allowed size of the application layer fragment Range of values: 249 ... 65535 bytes	2024
Binary Input	Default variation for a binary input Values: Single-Bit, With Status	With Status
Binary Input Change	Default variation for a binary input change Values: Without Time, With Time, Relative Time	With Time
Double Bit Input	Default variation for a double bit input Values: No Flags, With Status	With Status

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Double Bit Input Change	Default variation for a double bit input change Values: Without Time, With Time, Relative Time	With Time
Binary Output	Default variation for a binary output Values: Single-Bit, With Status	With Status
Binary Output Change	Default variation for a binary output change Values: Without Time, With Time	With Time
Analogue Input	Default variation for an analogue input Values: 32-Bit With Flag, 16-Bit With Flag, 32-Bit Without Flag, 16-Bit Without Flag, 32-Bit Float With Flag, 64-Bit Float With Flag	32-Bit With Flag
Analogue Input Change	Default variation for an analogue input change Values: 32-Bit With Time, 16-Bit With Time, 32-Bit Without Time, 16-Bit Without Time, 32-Bit Float With Time, 64-Bit Float With Time	32-Bit With Time
Analogue Input Deadband	Default variation for an analogue input deadband Values: 16-Bit, 32-Bit, 32-Bit Float	32-Bit
Analogue Output	Default variation for an analogue output Values: 16-Bit, 32-Bit, 32-Bit Float, 64-Bit Float	32-Bit
Analogue Output Change	Default variation for an analogue output change. Values: 32-Bit With Time, 16-Bit With Time, 32-Bit Without Time,	32-Bit With Time

FIELD NAME	DESCRIPTION	DEFAULT VALUE
	16-Bit Without Time, 32-Bit Float With Time, 64-Bit Float With Time, 32-Bit Float Without Time, 64-Bit Float Without Time	

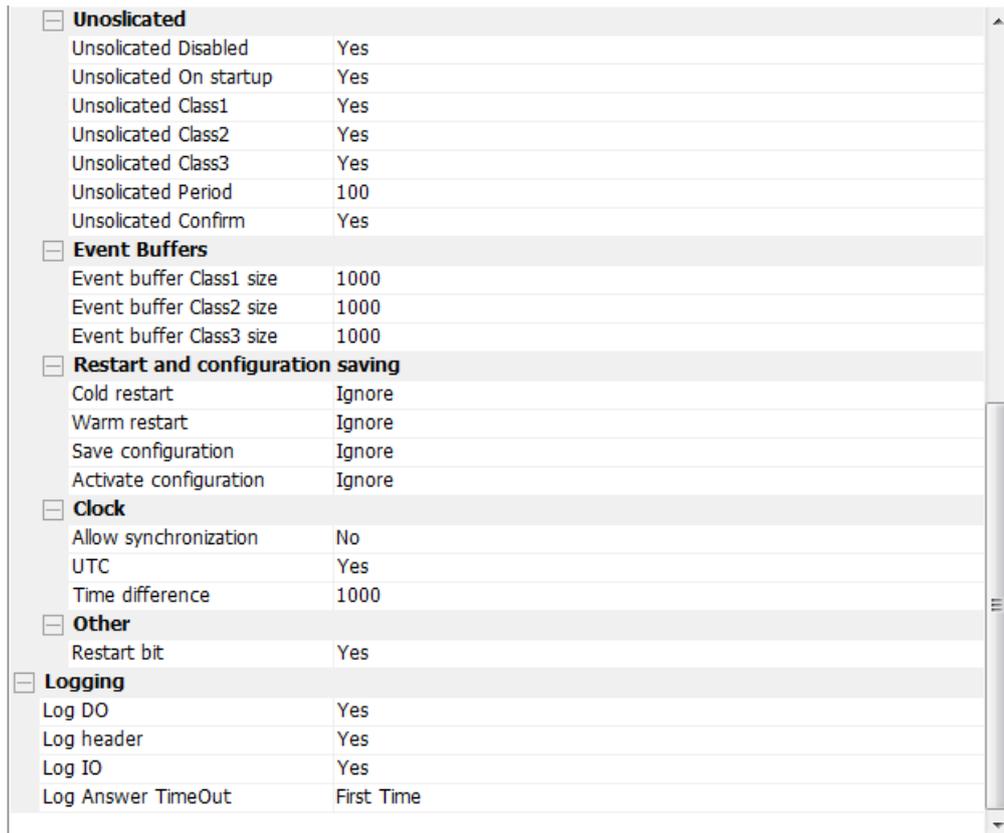


Figure 164. Application layer parameters in DNP3 serial protocol

Table 134. Fields of Application layer parameters window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Unsolicited Disable	Unsolicited messages are totally disabled. Values: No, Yes	Yes
Unsolicited On startup	Send unsolicited 'NULL' response on startup, restart or enabling. Values: No, Yes	Yes
Unsolicited Class1	Unsolicited messages enabled for Class1 after startup or restart. Values: No, Yes	Yes

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Unsolicited Class2	Unsolicited messages enabled for Class2 after startup or restart. Values: No, Yes	Yes
Unsolicited Class3	Unsolicited messages enabled for Class3 after startup or restart. Values: No, Yes	Yes
Unsolicited Period	Cycle of the transmission of unsolicited messages Range of values: 0 ... 60000ms	100
Unsolicited Confirm	Requests confirmation for unsolicited messages. Values: No, Yes	Yes
Event buffer Class1 size	Event buffer size of Class1. The change takes effect only after the system restart. Range of value: 10 ... 10000	1000
Event buffer Class2 size	Event buffer size of Class2. The change takes effect only after the system restart. Range of value: 10 ... 10000	1000
Event buffer Class3 size	Event buffer size of Class3. Change takes effect only after the system restart. Range of value: 10 ... 10000	1000
Cold restart	Action performed on the received request FC13 cold restart. Values: Ignore, Discard, Software restart, Full Device restart	Ignore
Warm restart	Action performed on the received request FC14 warm restart. Values: Ignore, Discard, Restart	Ignore
Save configuration	Action performed on the received request FC19 save configuration. Values: Ignore, Discard, Save configuration	Ignore

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Activate configuration	Action performed on the received request FC31 activate configuration. Values: Ignore, Discard, Save configuration	Ignore
Allow synchronization	Allows time synchronization from the DNP3 master. Values: No, Yes	No
UTC	Received clock synchronization APDU has UTC time. Values: No, Yes	Yes
Time difference	Time difference to allow synchronization. Range of values: 20 ... 10000ms	1000
Restart bit	Sets the restart bit after the RTU restart or on enabling the DNP3 application layer. Values: No, Yes	Yes
Double bit over two single	If the master station does not support double bit inputs, use binary input (double) point type. This parameter specifies which bit should be first transferred. If the value is 'No' – the first is OFF, if 'Yes' – the first is ON.	No
Log DO	Enables to log data object information. Value: No, Yes	Yes
Log header	Enables to log headers in the port monitor. Values: No, Yes	Yes
Log IO	Enables to log data and command point information. Values: No, Yes	Yes
Log Answer Time Out	Enables to log application link answer timeouts to the system log. Values: Never, First Time, Always	First Time

4.10.3.5 Points

Status points		Command points						
	Object type	Event Class	Event Class From Master	Unsolicated	Unsolicated From Master	Offset 1	Scale	Offset 2
1	0 Binary Input	No Event	No Event	Yes				
2	1 Double Bit Input	Class 1	Class 1	Yes				
3	2 Binary Output	Class 2	Class 2	Yes				
4	3 Analog Input	Class 3	Class 3	Yes				
5	4 Analog Output	Class 3	Class 3	Yes				

Figure 165. Object points for DNP-3 slave

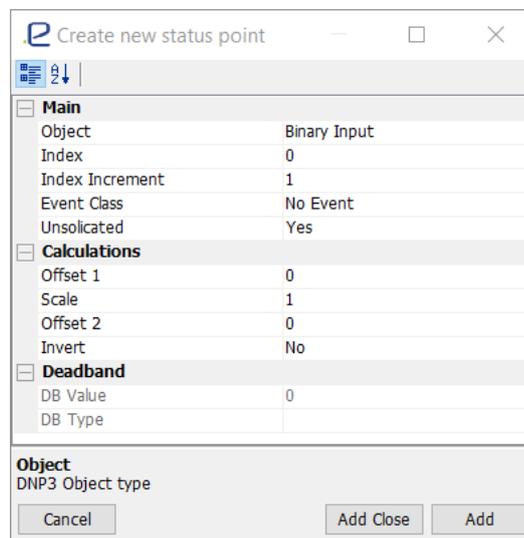


Figure 166. Create new status point window

Table 135. Fields of Create new status point window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Object	Type of object under DNP3 protocol Values: Binary Input, Binary Input (Double), Double Bit Input, Binary Output, Analogue Input, Analogue Output	Binary Input
Index	Object index Range of values: 0 ... 2147483647	1
Index Increment	After adding a new point, the Index will be automatically incremented by the set value.	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Event Class	Specifies which event class the data object belongs to. Values: No event, Class 1, Class 2, Class 3	No Event
Unsolicited	Unsolicited messages enabled for this point. If a/the class is disabled, this parameter is not important. Values: No, Yes	Yes
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of status Values: No, Yes	No
DB Value	Deadband value used for calculation Range of values: 0 ... 2147483647	0
DB Type	Deadband type used for calculation. Value: Not used, Simple, Integrated	

Status points		Command points									
ID	Index	Object type	Invert	Offs...	Scale	Offs...	Value	Time	Result	Tag ID	Tag
	6	0 Binary Output Command					0				
	7	1 Analog Output Command					0				

Figure 167. Command points for DNP-3 slave

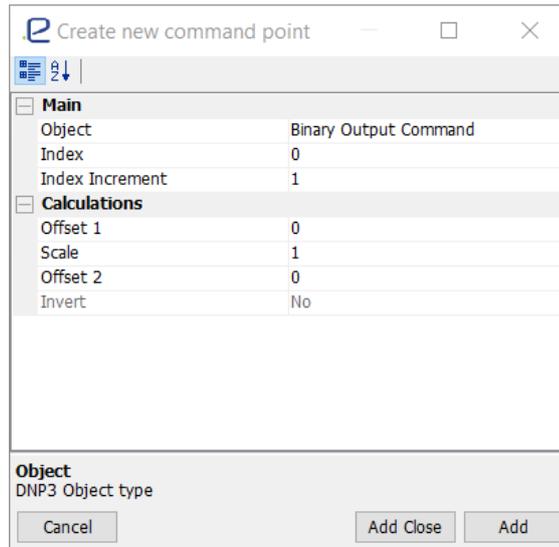


Figure 168. Create new command point window

Table 136. Fields of Create new command point window in DNP3 serial protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Object	DNP3 object type Values: Binary Output Command, Analogue Output Command	Binary Output Command
Index	Object index Range of values: 0 ... 2147483647	1
Index Increment	After adding a new point, the Index will be automatically incremented by the set value.	1
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of status Values: No, Yes	No

4.10.4 DNP3 UDP/TCP/IP server configuration

4.10.4.1 Communication port parameters

<input type="checkbox"/> Main	
ID	16
Port Name	New DNP3 LAN server protocol
Enabled on start	No
<input type="checkbox"/> Communication	
Ethernet port	All ETH
TCP port	20000
TCP Keep Alive	10000
TCP No delay	No
Reconnect	10
Init time	0
<input type="checkbox"/> Logging	
Port Monitor	No
Log raw data	Yes
Log Unknown Data Link	Yes

Figure 169. *Communication port* parameters in DNP3 UDP/TCP/IP protocol

Table 137. Fields of *Communication port* parameters window in DNP3 UDP/TCP/IP protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Name of the port and protocol, for example, 'DNP3 slave'	New DNP3 LAN server protocol
Enabled on start	Port enabled on the system startup Values: No, Yes	No
Ethernet port	Specifies the Ethernet port to be used to create the server. Values: All ETH, ETH 1, ETH 2, ETH 3, ETH4	All ETH
TCP Port	TCP port Range of values: 1 ... 65535	20000
TCP Keep Alive	Checks the connected socket and determines whether the connection is still up and running or if it has broken. Range of values: 1 ... 2147483647ms 0 – disabled	10000
TCP No delay	Controls TCP packet batching Values: No, Yes	No

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Init time	Protocol initialization time on startup. During this time no events will be generated. Range of values: 1 ... 60	0
Port Monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes
Log Unknown Data Link	Always set this parameter to 'No' in multiple slave systems.	Yes

4.10.4.2 Data link layer parameters

Main	
ID	17
Data Link Name	New Data link
Enabled on start	No
DNP-3	
Main	
Data Link address	1
Master station address	1
Self Address Enabled	No
Frame size	292
Timers	
Response timeout	500
Confirmation	No
Broken link	3
Priority	1
Link Status	0
Link Status DFC	1
Disconnect No requests	30
Communication	
Client's Nr. 1 IP	127.0.0.1
Client's Nr. 2 IP	
Client's Nr. 3 IP	
Client's Nr. 4 IP	
Logging	
Log header	Yes
Log Answer TimeOut	First Time

Figure 170. Data link layer parameters in DNP3 UDP/TCP/IP protocol

Table 138. Fields of *Data link layer* parameters window in DNP3 UDP/TCP/IP protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Data Link Name	Data link layer name, for example, 'DNP3 client'	New Data link
Enabled on start	Enables or disables a client on start Values: No, Yes	No
Data Link address	RTU's slave address Range of values: 0 ... 65519	1
Master station address	Master station address Range of values: 0 ... 65519	1
Self Address Enabled	Set this parameter to 'Yes' only for testing purpose when the master does not know the outstation address. Values: No, Yes	No
Fragment Size	Maximum size of a data link fragment Range of values: 14 ... 292 bytes	292
Response timeout	Response timeout Range of values: 50 ... 60000ms	500
Confirmation	Data link uses confirmations Values: No, Yes	No
Broken link	Number of retries to determine if the connection is broken. Range of values: 1 ... 255	3
Priority	Data is requested every cycle. It is relevant only if more than one data link layer exists. Range of values: 1 ... 255	1
Link Status	Time interval of request attempt for the link status, if there is no data. Range of values: 0 ... 86400s 0 – Link Status is not used	0
Link Status DFC	Time interval of checking attempt for DFC=0, if the value of DFC has been 1. Range of values: 1 ... 86400s	1
Disconnect No requests	Disconnect from the data link layer, if no requests are received from the master for the specified time. Range of values: 0 ... 3600s 0 – Not used	30

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Client's Nr. 1 IP ..4 IP	Access the list of clients' IPs Range of values: xxx.xxx.xxx.xxx	127.0.0.1
Log header	Enables to log data link header. Values: No, Yes	Yes
Log Answer Time Out	Enables to log data link answer timeouts to the system log. Values: Never, First Time, Always	First Time

4.10.4.3 Transport layer parameters

Refer to chapter 4.10.3.3 'Transport layer parameters' in DNP3 serial protocol. The configuration is very similar.

4.10.4.4 Application layer parameters

Refer to chapter 4.10.3.4 'Application layer parameters' in DNP3 serial protocol. The configuration is very similar.

4.10.4.5 Points

Refer to chapter 4.10.3.5 'Points' in DNP3 serial protocol. The configuration is very similar.

4.10.5 SPA-Bus configuration

4.10.5.1 Communication port parameters

Main	
ID	5
Port Name	New SPA-Bus slave protocol
Enabled on start	No
Communication	
COM port	Not assigned
Baud rate	9600
Data bits	7
Stop bits	1
Parity	Even
RS-485 Mode	Four wire
Reconnect	10
Init time	0
Logging	
Port Monitor	No
Log raw data	Yes

Figure 171. *Communication port parameters in SPA-Bus protocol*

Table 139. *Fields of Communication port parameters window in SPA-Bus protocol*

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port name	Name of the port and protocol, for example, 'COM1 SPA-Bus slave'	New SPA-Bus slave protocol
Port enabled	Port enabled on the system startup Values: No, Yes	No
COM port	Communication port number Range of values: COM 1 ... 255	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7, 8 bits	7
Stop bits	Serial port stop bits Values: 1, 1.5, 2 bits	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	Even

FIELD NAME	DESCRIPTION	DEFAULT VALUE
RS-485 mode	If two wires are used, the mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Values: Two wires, Four wires	Four wires
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established. Range of values: 1 ... 600s	10
Init time	Protocol initialization time on startup. During this time no events will be generated. Range of values: 1 ... 60	0
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes

4.10.5.2 Application layer parameters

Main	
ID	6
Application Name	New Application
Enabled on start	No
SPA-Bus	
Main	
Address	1
Frame size	255
Disconnect No requests	0
Time	
Allow synchronization	No
UTC	Yes
Time difference	1000
Logging	
Log header	Yes
Log IO	Yes

Figure 172. Application layer parameters in SPA-Bus protocol

Table 140. Fields of *Application layer parameters* window in SPA-Bus protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application Name	Application layer name, for example, 'Application layer'	New Application
Enabled on start	Enables or disables the application layer on start. Values: No, Yes	No
Address	Slave address Range of values: 1 ... 999 900 – is broadcast	1
Frame size	Maximum frame length Range of values: 48 ... 255 bytes	255
Disconnect No requests	Disconnects the data link layer, if no requests are received from the master for the specified time. Range of values: 0 ... 3600s 0 – not used	0
Allow synchronization	Yes – always synchronize, No – synchronize only if the RTU internal clock is synchronized.	Yes
UTC time	Use UTC time in communication Values: No, Yes	Yes
Time difference	Time difference to synchronize the internal RTU clock Range of values: 20 ... 10000ms	1000
Log header	Enables to log application layer header. Values: No, Yes	Yes
Log IO	Enables to log information objects. Values: No, Yes	Yes

4.10.5.3 Points

Application layer has the branch of *Points* where the signals, measurements and commands are managed. The following figure shows the Points popup menu which can be run with the right mouse button. It is possible to *Add data point*, *Edit data point*, *Delete data point*, *Select All* data points or commands. The user can *Connect to Tag*, *Remove connection to the Tag*, *Go to Tag* in the *TAG Manager* as well. *Remove connection to source* is possible from the *TAG Manager*. All menu items have keyboard shortcuts which will simplify and quicken the work with the software.

Add Status point	Ctrl+N
Edit Status point	Ctrl+E
Delete Status point	Del
Select All	Ctrl+A
<hr/>	
Connect to Tag	Shift+Ctrl+N
Remove connection to Tag	Shift+Del
Go to Tag	G
<hr/>	
Export for master (client) protocol ...	

Figure 173. *Points* popup menu

The following figure shows *Create new status point* dialog window. The parameters which the user can specify on the SPA-Bus protocol are proposed in the next Table

Figure 174. *Create new status point* window

Table 141. Fields of *Create new status point* window in SPA-Bus protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	SPA type of point Range of values: I: Input Data, O: Output Data, S: Setting Values, V: Variables, M: Memory Data	I: Input Data
SubType	SPA sub type of point Range of values: Single Point, Double Point, Integer, Float	Single Point
Channel	Channel Range of values: 0 ... 999	0
Channel Increment	After adding a new point, the Channel will be automatically incremented by the set value. Range of values: 0 ... 999	0
Data Number	Data Number Range of values: 0 ... 999999	1
Data Number Increment	After adding a new point, the Data Number will be automatically incremented by the set value. Range of values: 0 ... 999999	1
EV0 Channel	Leave the field empty to use the same channel as data. Range of values: Empty, 0 ... 999	
EV0 Number	Leave the field empty to ignore events. Range of values: Empty, 0 ... 64	
EV1 Channel	Leave the field empty to use the same channel as data. Range of values: Empty, 0 ... 999	
EV1 Number	Leave the field empty to ignore events. Range of values: Empty, 0 ... 64	
EV2 Channel	Leave the field empty to use the same channel as data. Range of values: Empty, 0 ... 999	

FIELD NAME	DESCRIPTION	DEFAULT VALUE
EV2 Number	Leave the field empty to ignore events. Range of values: Empty, 0 ... 64	
EV3 Channel	Leave the field empty to use the same channel as data. Range of values: Empty, 0 ... 999	
EV3 Number	Leave the field empty to ignore events. Range of values: Empty, 0 ... 64	
Analogue Channel	Leave the field empty to use the same channel as data. Range of values: Empty, 0 ... 999	
Analogue Number	Leave the field empty to ignore events. Range of values: Empty, 0 ... 64	
Alarm Channel	Leave the field empty to use the same channel as data. Range of values: Empty, 0 ... 999	
Alarm Number	Leave the field empty to ignore alarms. Range of values: Empty, 0 ... 64	
Invert	Inversion of status Values: No, Yes	No
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0

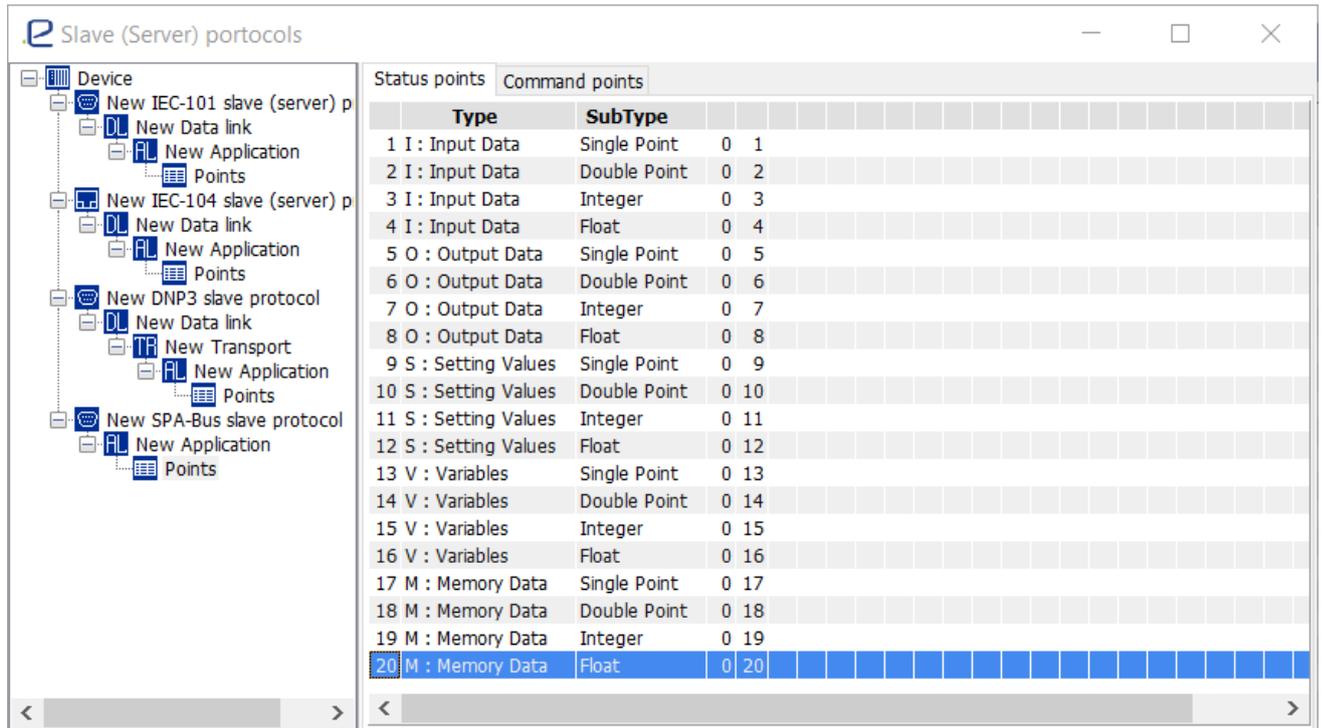


Figure 175. *Status points* window in SPA-Bus protocol

Columns *Value*, *Time*, *Quality*, *Cause* will show real-time data.

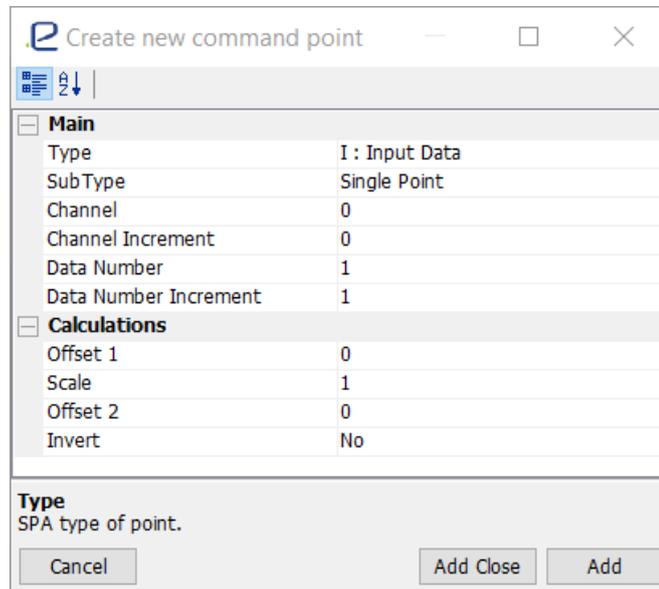


Figure 176. *Create new command point* in SPA-Bus protokol

Table 142. Fields of *Create new command point* window in SPA-Bus protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	SPA type of point. Range of values: I: Input Data, O: Output Data, S: Setting Values, V: Variables, M: Memory Data	I: Input Data
SubType	SPA sub type of point. Range of values: Single Point, Double Point, Integer, Float	Single Point
Channel	Channel Range of values: 0 ... 999	0
Channel Increment	After adding a new point, the Channel will be automatically incremented by the set value. Range of values: 0 ... 999	0
Data Number	Data Number Range of values: 0 ... 999999	1
Data Number Increment	After adding a new point, the Data Number will be automatically incremented by the set value. Range of values: 0 ... 999999	1
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of status Values: No, Yes	No

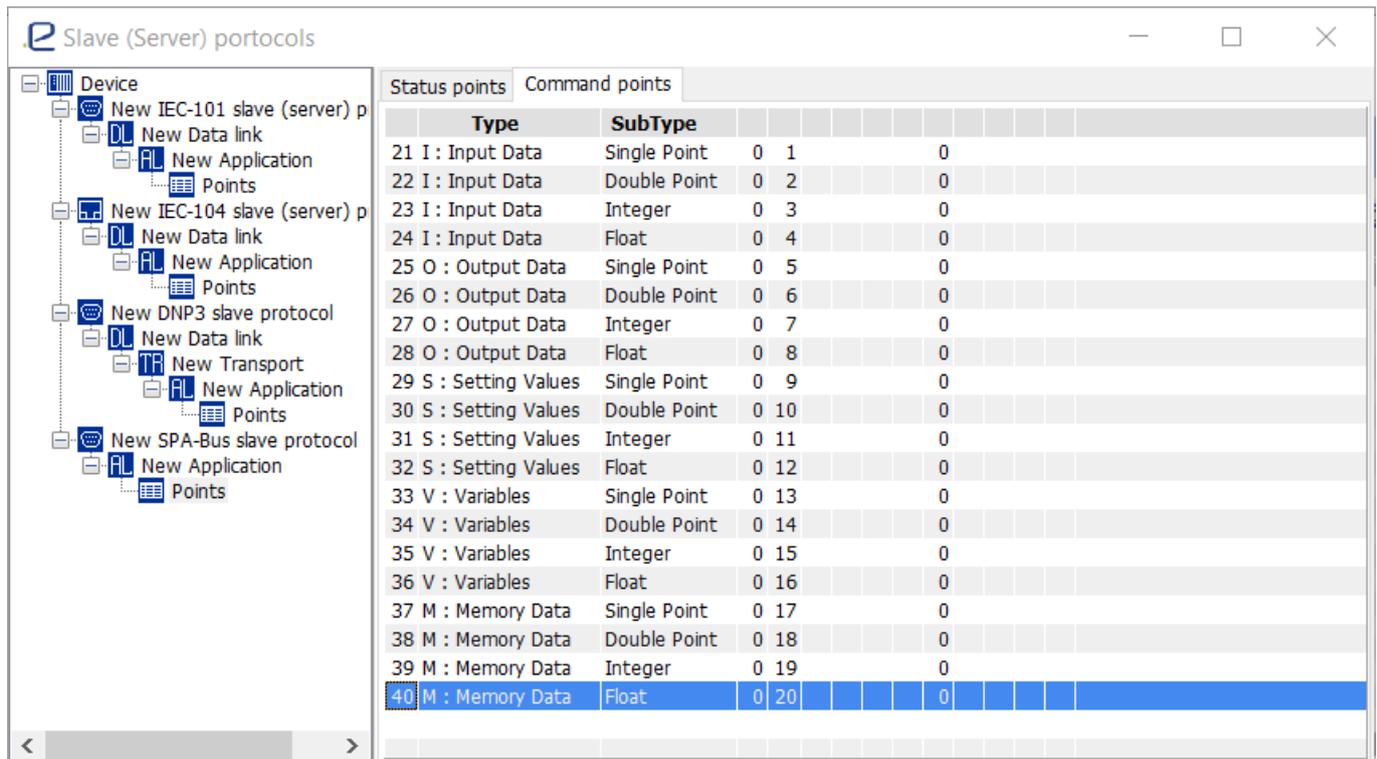


Figure 177. *Command points* window in SPA-Bus protocol

4.10.6 RP-570 configuration

4.10.6.1 Communication port parameters

Main	
ID	17
Port Name	New RP-570 slave protocol
Enabled on start	No
Communication	
COM port	Not assigned
Baud rate	9600
Data bits	8
Stop bits	1
Parity	Even
RS-485 Mode	Four wire
Reconnect	10
Init time	0
Logging	
Port Monitor	No
Log raw data	Yes
Log Unknown Application Layer	Yes

Figure 178. *Communication port parameters* in RP-570 protocol

Table 143. Fields of *Communication port parameters* window in RP-570 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port name	Name of the port and protocol, for example, 'COM1 RP-570 slave'	New RP-570 slave protocol
Port enabled	Port enabled on the system startup. Values: No, Yes	No
COM port	Communication port number Range of values: COM 1 ... 255	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7, 8 bits	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2 bits	1
Parity	Serial port parity. Values: None, Odd, Even, Mark, Space	Even
RS-485 mode	If two wires are used, the mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Values: Two wires, Four wires	Four wires
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 1 ... 600s	10
Init time	Protocol initialization time on startup. During this time no events will be generated. Range of values: 1 ... 60	0
Port monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes
Log Unknown Application Layer	Always set this parameter to 'No' in the multiple slave system.	Yes

4.10.6.2 Application layer parameters

Main	
ID	10
Application Name	New Application
Enabled on start	No
RP-570	
Main	
Address	1
Frame size	255
Disconnect No requests	30
Commands	
Select Cancel With Value	Yes
Time	
Allow synchronization	No
UTC	Yes
Time difference	1000
FCOM Function Commands	
Unknown Positive	No
FCOM1 Restart	No
FCOM1 Restart Device	No
FCOM2 Activate	No
FTAB Function Table	
Unknown Positive	Yes
System Messages	
TSTA, TEV after SCI	No
TSTA, TEV after FCOM13	No
Other	
Events With Time same Priors	Yes
Events before SCI	Yes
AVM Multi	Yes
CCR with Data	No

Figure 179. Application layer parameters in RP-570 protocol

Table 144. Fields of Application layer parameters window in RP-570 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Application Name	Application layer name, for example, 'Application layer'	New Application
Enabled on start	Enables or disables the application layer on start. Values: No, Yes	No
Address	Slave address Range of values: 1 ... 999. 900 – is broadcast	1
Frame size	Maximum frame length Range of values: 48 ... 255 bytes	255

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Disconnect No requests	Disconnects the data link layer, if no requests are received from the master for the specified time. Range of values: 0 ... 3600s 0 – not used	0
Select Cancel With Value	Some master devices do not send a value with select and cancel commands. In this case, set this parameter to 'No'.	Yes
Allow synchronization	Yes – always synchronize, No – synchronize only if the RTU internal clock is synchronized.	Yes
UTC	Use UTC time in communication. Values: No, Yes	Yes
Time difference	Time difference to synchronize the internal RTU clock Range of values: 20 ... 10000 ms	1000
Unknown Positive	Responds to an unknown positive FCOM request	No
FCOM1 Restart	Allows the device to restart after receiving a FCOM1 Restart request.	No
FCOM1 Restart Device	Yes – fully restart the device. No – restart only CMS.	No
FCOM2 Activate	User data is transmitted only after a FCOM2 Activate request.	No
Unknown Positive	Unsupported or unknown FTAB messages will be acknowledged positive.	Yes
TSTA, TEV after SCI	Sends system messages after a SCI (General Interrogation) request.	No
TSTA, TEV after FCOM13	Sends system messages after a FCOM13 Device In/Out of service request.	No
Events With Time same Priority	Events with Time will be sent with the same priority as events with status; in other case the priority level will be lower. If the master supports RequestA, it will not possibly support this function.	Yes
Events before SCI	Event messages have higher priority than SCI responses.	Yes

FIELD NAME	DESCRIPTION	DEFAULT VALUE
AVM Multi	Allows multiple analogue values with the incrementing block number transmitting with the incrementing NCB.	Yes
CCR with Data	Allows setting CCR bit in responses with data to inform that there is no more data of the requested priority. Older masters may not support this feature.	No

<input type="checkbox"/> Points	
<input type="checkbox"/> Status	
IDM	0
IDS	0
AVM	0
AVS	0
DVM	1
<input type="checkbox"/> Events	
IDM	1
IDS	1
AVM	1
AVS	1
DVM	1
ERMI	1
ERMA	1
ERMD	1
Logging	
Log header	Yes
Log IO	Yes

Figure 180. *Application layer parameters* in RP-570 protocol

Table 145. *Fields of Application layer parameters* window in RP-570 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
IDM	Maximum count in one response (0..255). 0 – unlimited	0
IDS	Maximum count in one response (0..255). 0 – unlimited	0
AVM	Maximum count in one response (0..255). 0 – unlimited	0
AVS	Maximum count in one response (0..255). 0 – unlimited	0
DVM	Maximum count in one response (0..255). 0 – unlimited	1

IDM	Maximum count in one response (0..255). 0 – unlimited	1
IDS	Maximum count in one response (0..255). 0 – unlimited	1
AVM	Maximum count in one response (0..255). 0 – unlimited	1
AVS	Maximum count in one response (0..255). 0 – unlimited	1
DVM	Maximum count in one response (0..255). 0 – unlimited	1
ERMI	Maximum count in one response (0..255). 0 – unlimited	1
ERMA	Maximum count in one response (0..255). 0 – unlimited	1
ERMD	Maximum count in one response (0..255). 0 – unlimited	1
Log header	Enables to log application layer header. Values: No, Yes	Yes
Log IO	Enables to log information objects. Values: No, Yes	Yes

4.10.6.3 Points

Application layer has the branch *Points* where the user can manage the signals, measurements and commands. The following figure shows the *Points* popup menu which can be run with the right mouse button. It is possible *Add data point*, *Edit data point*, *Delete data point*, *Select All* data points or commands. The user can *Connect to Tag*, *Remove connection to the Tag*, *Go to Tag* in TAG Manager as well. *Remove connection to source* is possible from the *TAG Manager*. All menu items have keyboard shortcuts which will simplify and quicken the work with the software.

Add Status point	Ctrl+N
Edit Status point	Ctrl+E
Delete Status point	Del
Select All	Ctrl+A
Connect to Tag	Shift+Ctrl+N
Remove connection to Tag	Shift+Del
Go to Tag	G
Export for master (client) protocol ...	

Figure 181. *Points* popup menu

The following figure shows the *Create new status point* dialog window. The parameters which the user can specify on the RP-570 protocol are proposed in the next Table

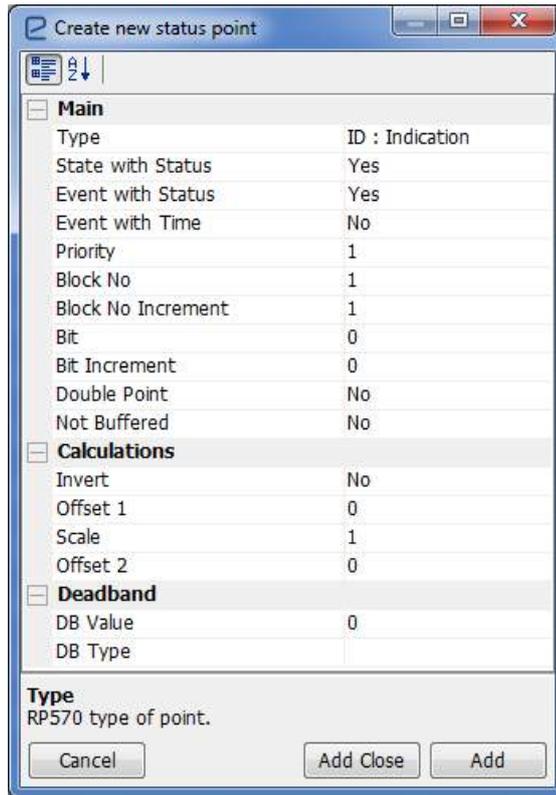


Figure 182. *Create new status point* window

Table 146. Fields of *Create new status point* window in RP-570 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	Select the type of points of RP-570 protocol. Range of values: ID: Indication, AV: Analogue Value, DV: Digital Value, FD: Fault Distance	ID: Indication
State with Status	Responses to SCI requests are transmitted with the Status flag.	Yes
Event with Status	Events are transmitted with the Status flag.	Yes
Event with Time	Events are additionally transmitted with time. Some master devices may not support this function for AV and DV messages.	No
Priority	RP-570 priority of point	1
Block No	Block Number Range of values: 0 ... 255	1

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Block No Increment	After adding a new point, the Block No will be automatically incremented by the set value. Range of values: 0 ... 255	1
Bit	Bit Number Range of values: 0 ... 15	0
Bit Increment	After adding a new point, the Bit number will be automatically incremented by the set value. Range of values: 0 ... 255	1
Double Point	Indication of a double point	No
Not Buffered	Events are not buffered while the device is disconnected.	No
Invert	Inversion of status Values: No, Yes	No
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
DB Value	Deadband value used for calculation	0
DB Type	Deadband type used for calculation Values: Not used, Simple, Integrated	Not used

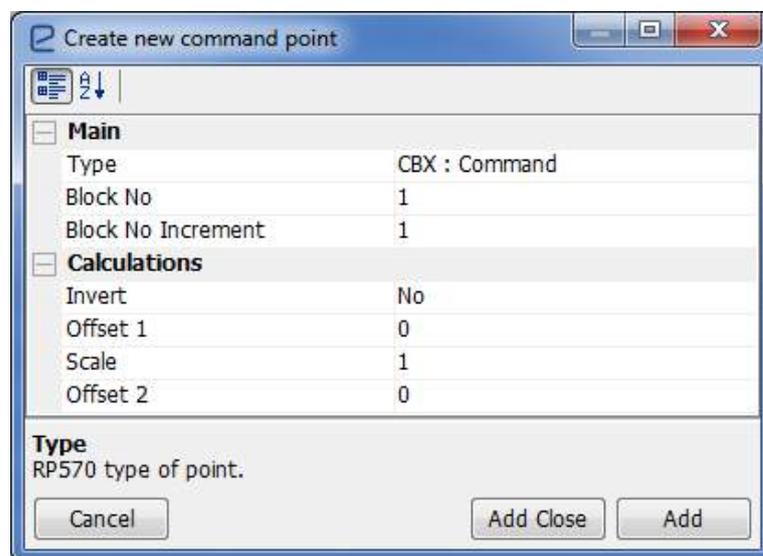


Figure 183. Create new command point in RP-570 protocol

Table 147. Fields of *Create new command point* window in RP-570 protocol

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Type	Type of a point under RP-570 protocol Range of values: CBX: Command, SPM: SetPoint, GOM: General Output	CBX: Command
Block No	Block Number for CBX (0 ... 047), for SPM and GOM (0 ... 255)	0
Block No Increment	After adding a new point, the Block number will be automatically incremented by the set value. Range of values: 0 ... 999	0
Offset 1	New value = (Old value + Offset1) * Scale + Offset2	0
Scale		1
Offset 2		0
Invert	Inversion of status Values: No, Yes	No

4.11 TAG Manager

TAG Manager is an intermediate software part which connects status and command points from the master to slave protocols or connects hardware tags to slave protocols. Either the user can create tags for internal logic or IsaGRAF programming. With the help of the tree structure, it is possible to create the structure of the substation for easier work with tags.

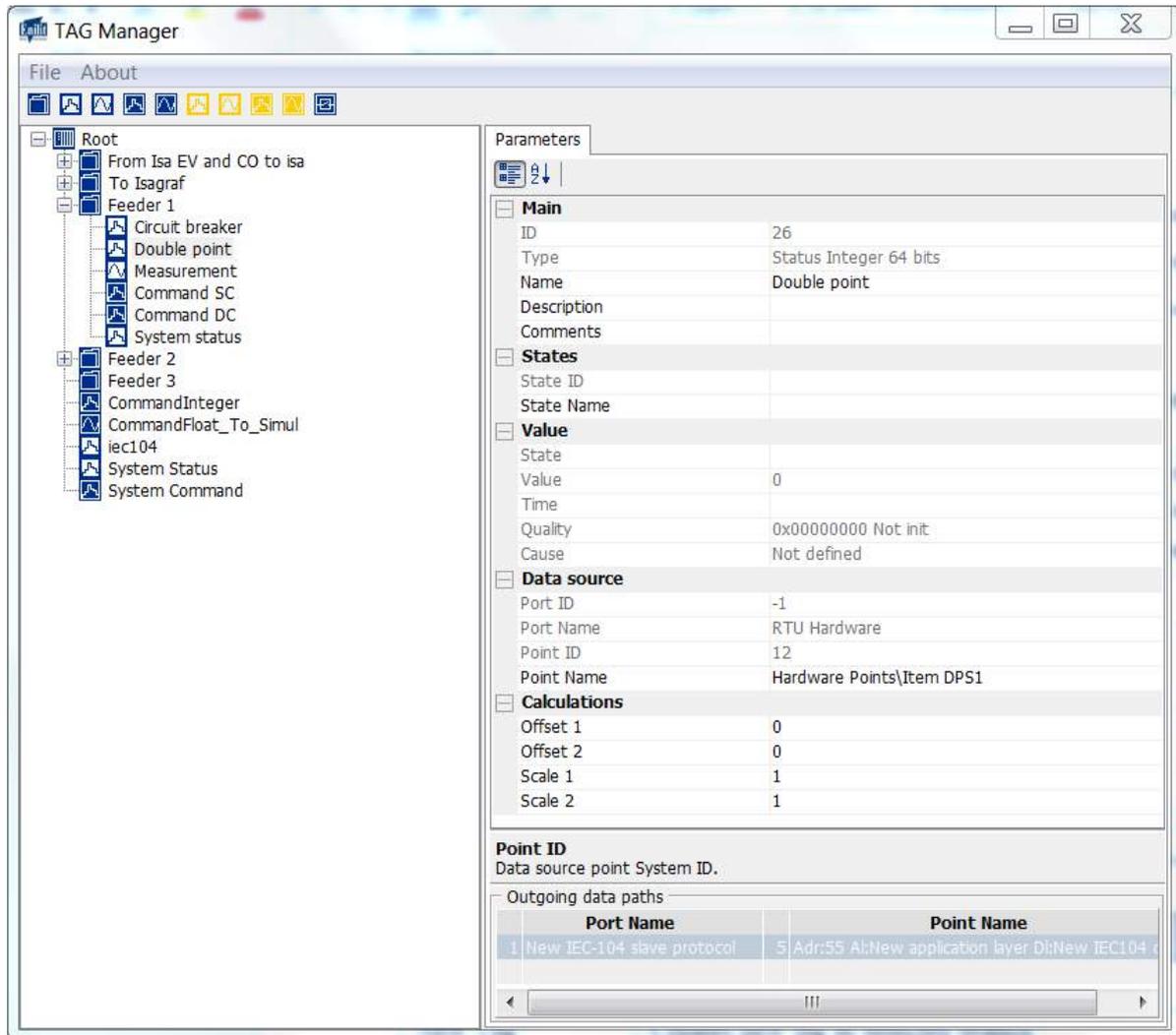


Figure 184. Main window of the *TAG Manager*

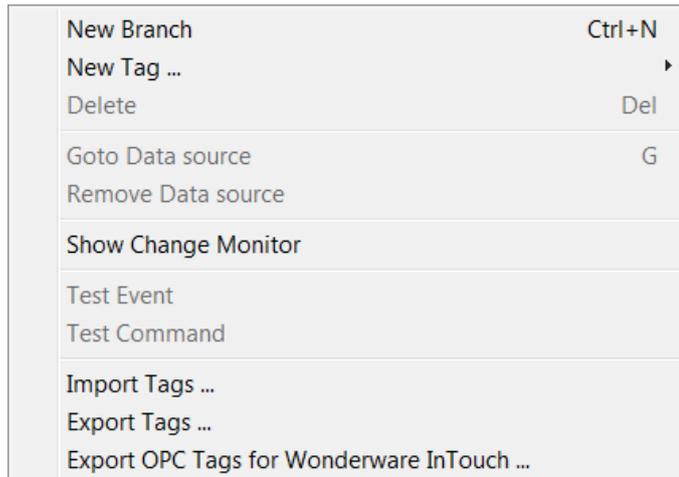


Figure 185. Active popup menu when a tree branch is selected

Table 148. Fields of the tree branch in the TAG Manager

NAME	DESCRIPTION	KEYBOARD SHORTCUT
New Branch	Creates a new branch in the tree structure.	Ctrl+N
New Tag	Creates a new tag in the selected branch. There are the following types of Tags for selection: <div style="border: 1px solid #ccc; padding: 5px; margin: 5px 0;"> <ul style="list-style-type: none"> New Status Integer 64 bits New Status Float 64 bits New Command Integer 64 bits New Command Float 64 bits New Manual Status Integer 64 bits New Manual Status Float 64 bits New Manual Command Integer 64 bits New Manual Command Float 64 bits New Mapped </div>	
Delete	Deletes the selected branch.	Del
Go to Data source	If the Tag is selected, the user can reach the data source of the Tag.	G
Remove Data source	Disconnects the Data source from the Tag.	
Show Change Monitor	Opens the Change monitor window.	
Test event	Tests an event with the forced value and quality.	
Test command	Tests a command with the forced value and quality.	
Import Tags	Imports tags from the CSV file.	

NAME	DESCRIPTION	KEYBOARD SHORTCUT
Export Tags	Exports tags to the CSV file.	
Export OPC Tags for Wonderware InTouch	Exports tags to the CSV file for Wonderware InTouch FSGateway software.	

Main	
ID	35
Type	Status Integer 64 bits
Name	Status 1
Description	
Comments	
States	
State ID	
State Name	
Value	
State	
Value	0
Time	
Quality	0x00000000 Not init
Cause	Not defined
Data source	
Port ID	
Port Name	
Point ID	
Point Name	
Calculations	
Offset 1	0
Offset 2	0
Scale 1	1
Scale 2	1

Figure 186. Status Tag edit window

Table 149. Fields of Status Tag edit window in the TAG Manager

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	ID number. For internal use only	Automatically increment value
Type	Tag data type. This value cannot be edited. The tag must be deleted first and then a new one can be created with the necessary type. Values: Status Integer 64 bits, Status Float 64 bits, Manual Status Integer 64 bits, Manual Status Float 64 bits	
Name	Name of the tag	Status 1
Description	Additional user description	
Comments	Additional user comments	

FIELD NAME	DESCRIPTION	DEFAULT VALUE
State ID	Tag states configuration ID.	Not connected
State Name	Tag states configuration Name.	Not connected
State	Real time state of the Tag	
Value	Real time value of the Tag	0
Time	Time of the last change	
Quality	Quality of the last change	0x00000000 Not init
Cause	Cause of transmission of the last change	Not defined
Port ID	Data source Port ID	Not connected
Port Name	Data source Port Name	Not connected
Point ID	Data source Point ID	Not connected
Point Name	Data source Point Name	Not connected
Offset 1	With these parameters the user can change the value from the data source. NewValue=((OldValue+Offset1)*Scale 1+Offset2)*Scale2	0
Offset 2		0
Scale 1		1
Scale 2		1

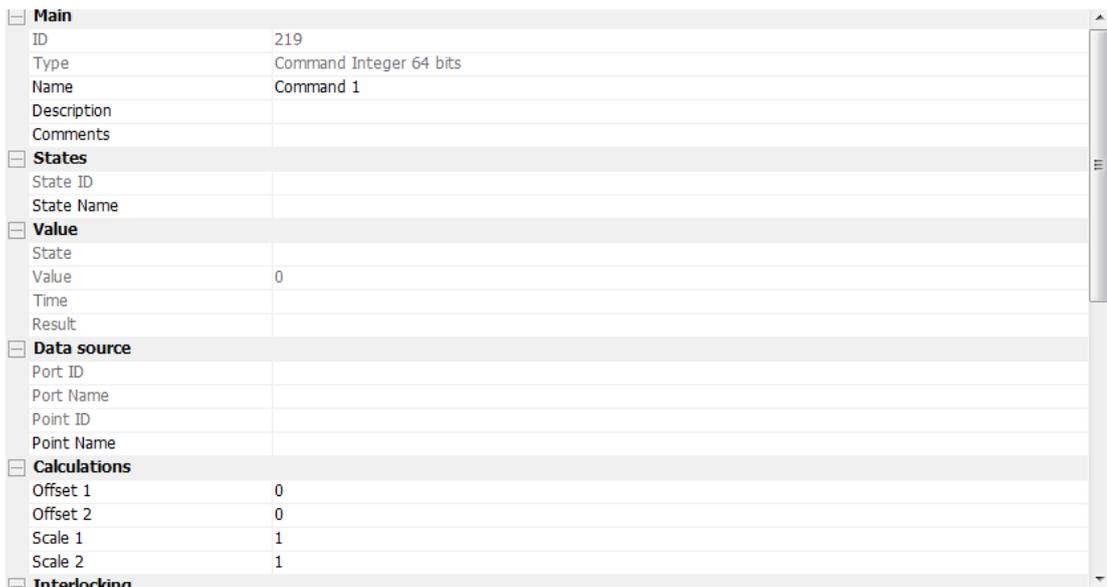


Figure 187. Command Tag edit window

Table 150. Fields of *Command Tag* edit window in the *TAG Manager*

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	ID number. For internal use only	Automatically increment value
Type	Tag data type. This value cannot be edited. The tag must be deleted first and then a new one can be created with the necessary type. Values: Status Command Integer 64 bits, Command Float 64 bits, Manual Command Integer 64 bits, Manual Command Float 64 bits, Mapped Command	
Name	Name of the tag	Command 1
State ID	Tag states configuration ID	Not connected
State Name	Tag states configuration Name	Not connected
State	Real time state of Tag	
Value	Real time value of Tag	0
Time	Time of the last change	
Quality	Quality of the last change	
Result	Result of the last command	
Port ID	Data source Port ID	Not connected
Port Name	Data source Port Name	Not connected
Point ID	Data source Point ID	Not connected
Point Name	Data source Point Name	Not connected
Offset 1	With those parameters the user can change the value from the data source. NewValue=((OldValue+Offset1)*Scale1+Offset2)*Scale2	0
Offset 2		0
Scale 1		1
Scale 2		1
ITag ID	Interlocking Tag ID	
Interlocking TAG	Tag used for the command interlocking	
Interlocking Type	Interlocking type. Range of values: ==, <>, <=, <, >=, >	Not used
Interlocking Value	Interlocking value. Range of values: -2147483648 ... 2147483648	0

FeedBack	
FTag ID	
FeedBack TAG	
FeedBack timeout	30
FeedBack Offset	0
Command	
Timeouts	
Select Timeout	10
Select-Execute Timeout	30
Execute Timeout	10
Cancel Timeout	10
Select Execute Cancel	
Select Accept	Yes
Cancel Accept	Yes
Select needed	No
Select To Master	No
Cancel To Master	No
Select Force To Master	No

Figure 188. *Command Tag* edit window

Table 151. Fields of *Command Tag* edit window in the *TAG Manager*

FIELD NAME	DESCRIPTION	DEFAULT VALUE
FTag ID	FeedBack Tag ID	
FeedBack TAG	Tag used for checking the command feedback	
FeedBack timeout	Feedback timeout in seconds. If the value is set to 0 – the feedback is not used. Range of values: 0 ... 600	30
FeedBack Offset	The value received as the feedback will be overwritten with the offset value for checking the result. Range of values: -2147483648 ... 2147483647	0
Select Timeout	Select the command timeout in seconds. Range of values: 1 ... 3600	10
Select-Execute Timeout	Command timeout between the select and execute commands in seconds. Range of values: 1 ... 3600	30
Execute Timeout	Execute command timeout in seconds. Range of values: 1 ... 3600	10
Cancel Timeout	Cancel command timeout in seconds. Range of values: 1 ... 3600	10
Select Accept	Select command will be confirmed with a positive result. Values: Yes, No	Yes

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Cancel Accept	Cancel command will be confirmed with a positive result. Values: Yes, No	Yes
Select needed	Execute command will be executed only after selecting a command. Values: Yes, No	No
Select To Master	Received the select command will be sent to the master port. Values: Yes, No	No
Cancel to Master	Received command 'Cancel' will be sent to the master port. Values: Yes, No	No
Select Force To Master	In case the slave communication port does not have the command 'Select', it will be created and sent to the master port. Values: Yes, No	No

The following figure shows the *Connect Tag to data source* window. On the left side, the structure is displayed, which the user has created in the master protocols. The user can expand the tree and find a particular data point from the master protocols points. It is allowed to connect only one data or command point to the tag.

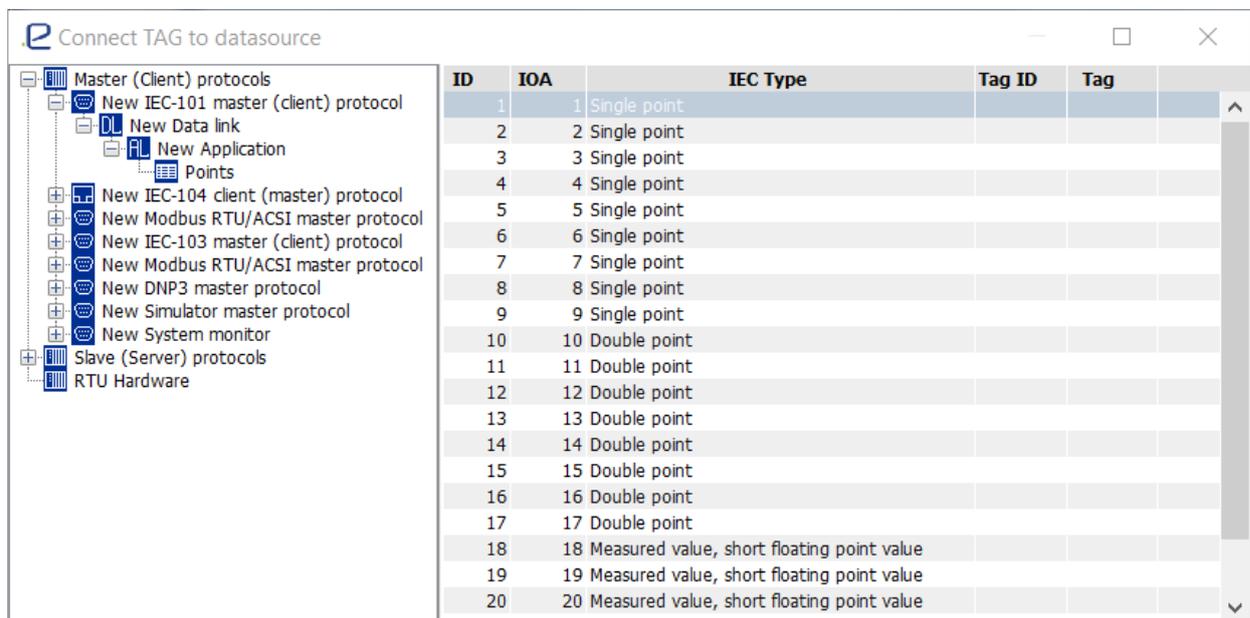


Figure 189. *Connect TAG to data source* window

In the figure above, in the right top corner, the user can choose a primary data source. It is possible to connect tags to the communication ports, RTU hardware points or PLC.

If the user has connected a tag to the data source and connected it also to the slave protocol, all the information regarding the linkage will be seen in the tag configuration of window. Also, the real-time value, state, timestamp, quality and cause of transmission of the selected tag will be displayed in this window.

Value	
State	Norma
Value	0
Time	2015.02.11 13:59:50.323
Quality	Ok
Cause	Spontaneous

Figure 190. Signal monitoring

4.11.1 Tag states

Tag states configuration tool allows configuring a description to the tag values. If it is configured, then in the *Change Monitor*, the user can see the state of a signal or command, not only value. For example, it is possible to configure the description 'SET' if the value is 1 and 'RESET' if the value is 0.

Tag States dialogue has two types of states: 'Status State' and 'Command State'.

New Branch	Ctrl+N
New Status States	
New Command States	
Delete	Del

Figure 191. New Tag State window

The following figure shows the *Initial Tag States* window.

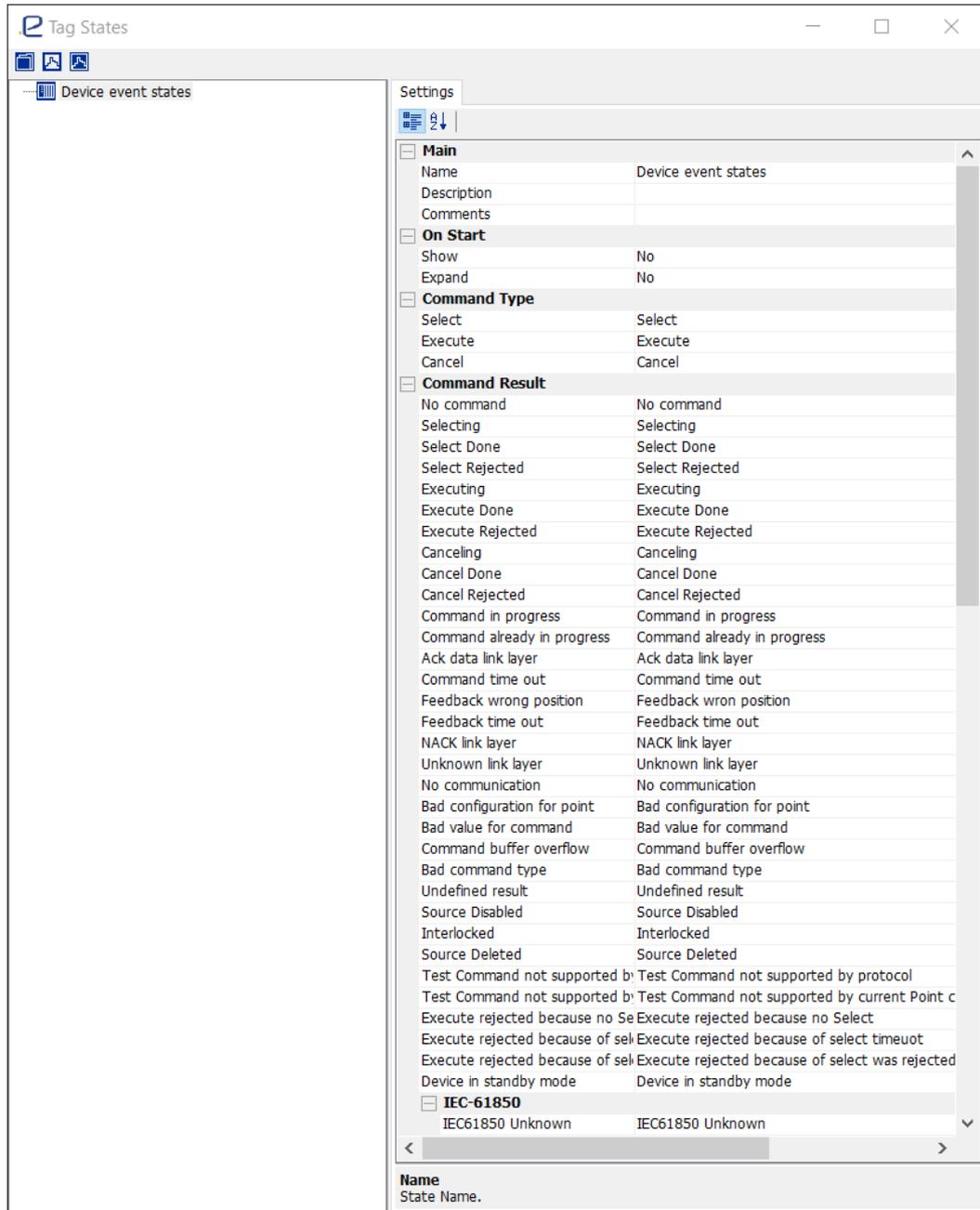


Figure 192. Initial Tag states window

When the user starts to configure a state for a status signal, it needs to add the priority '0', the type 'irrelevant' and the quality 'Not topical' with the value 'Yes'. Then normal states have to be added: like Reset = 0 and Set = 1. The following figure shows this configuration.

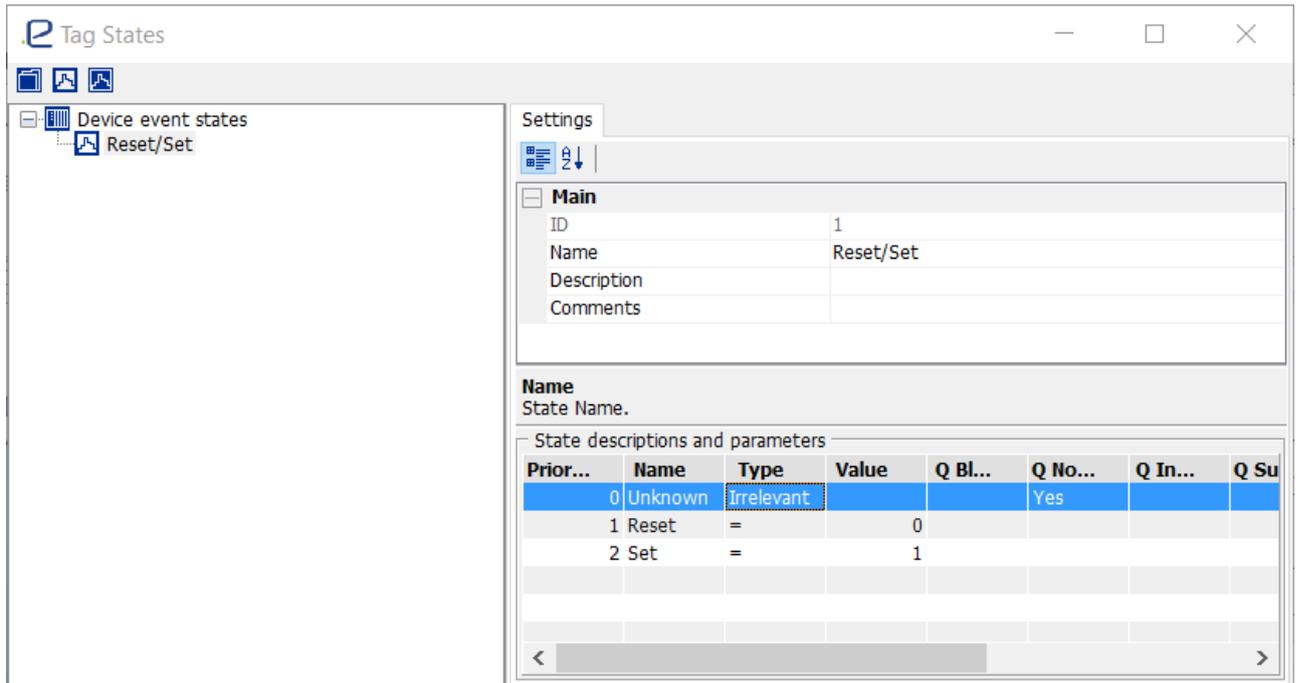


Figure 193. Configured status state Reset/Set

If the state is configured properly, then it is possible to assign the state to the signal or command in the *TAG Manager* window, like in the following picture.

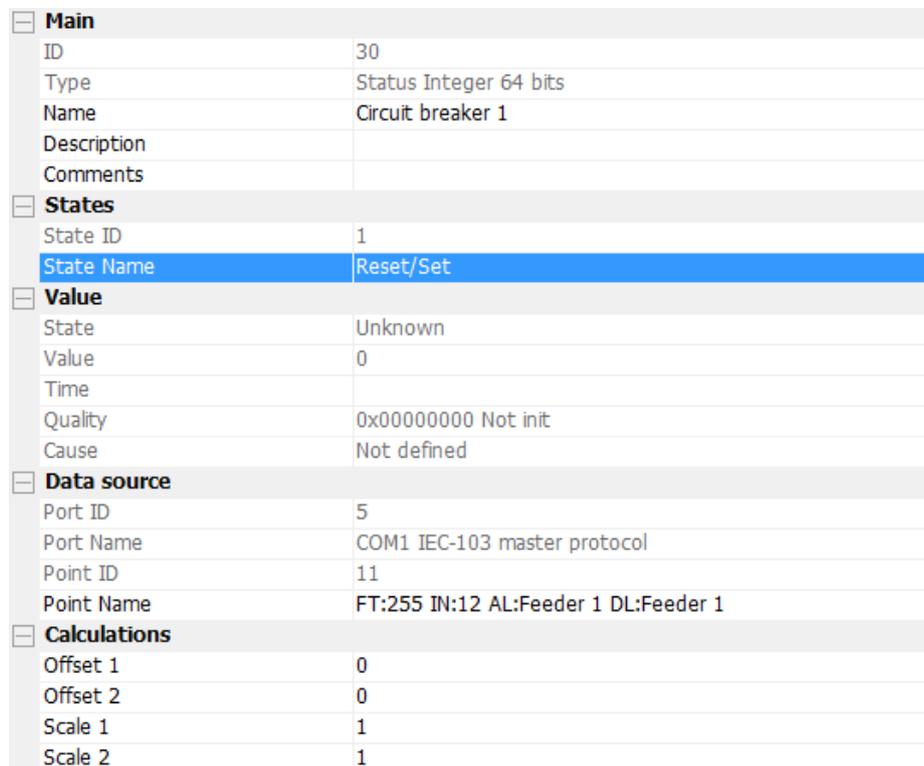


Figure 194. Configured tag with the assigned state

4.12 Internal programmable logic

Internal programmable logic is included in Enilit Configuration and Management Software (CMS) by default. It provides the opportunity to use fast and simple programmable logic. To use it, it is necessary to create tags of Manual Status Integer 64 bits or Manual Status Float 64 bits. After the creation of a manual tag, the user will see the Logic calculation area like in the following figure.

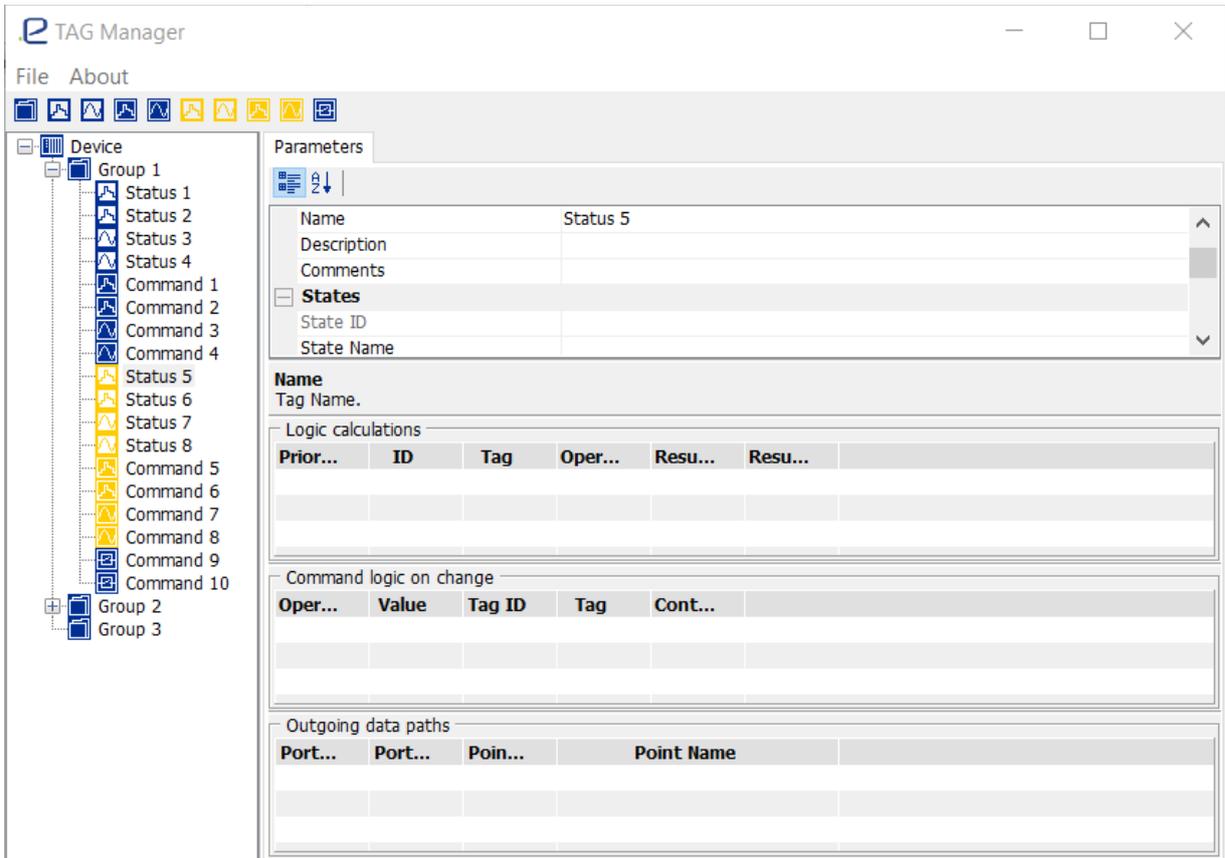


Figure 195. Manual status tag with logic calculations area

To create some logic, it is needed to add *Logic calculations* with the help of the right mouse button on the *Logic calculation* window like in the following figure.

Add Logic element	Ctrl+N
Edit Logic element	Ctrl+E
Delete Logic element	Del
Priority Up	Num +
Priority Down	Num -

Figure 196. *Logic calculation* context menu

After clicking on *Add Logic element*, the user will get the following window.

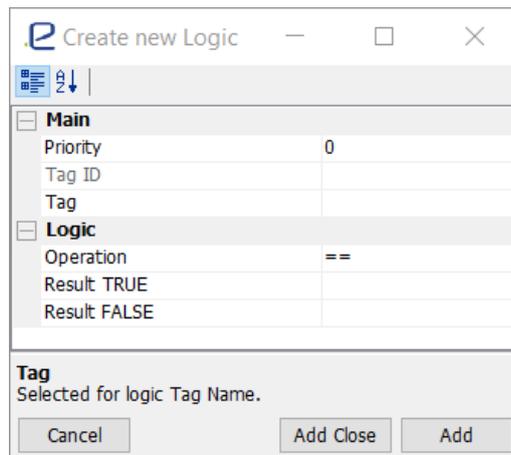


Figure 197. *Create new Logic calculation*

It requires to assign a tag from the *TAG Manager and Operation*, then, if the result is 'TRUE', it will give the value '1' to the next calculation; else if the result is 'FALSE', it will output the value '0' to the next calculation. With the parameters 'Result TRUE' and 'Result FALSE', it is possible to change the result values to the next logic calculation. The operation can be one of: = (assign), == (equal), <> (not equal), < (less), <= (less or equal), > (more), >= (more or equal), OR, OR bits, AND, AND bits, XOR, XOR bits, + (addition), - (subtraction), *(multiplication), / (division).

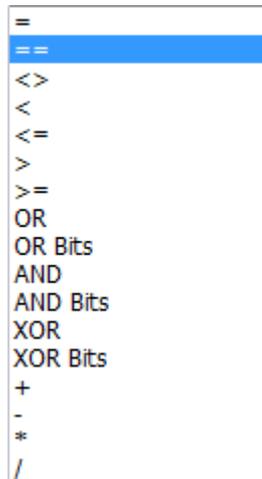


Figure 198. *Integer type logic operations*

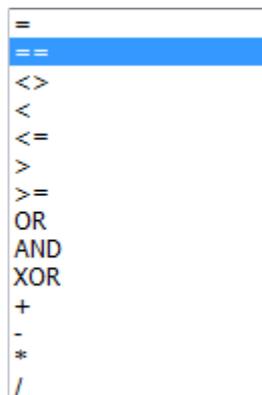


Figure 199. *Float type logic operations*

Main	
ID	34
Type	Manual Status Integer 64 bits
Name	Status 1
Description	
Comments	
States	
State ID	
State Name	
Value	
State	
Value	0
Time	
Quality	0x00000000 Not init
Cause	Not defined
Calculations	
Offset 1	0
Offset 2	0
Scale 1	1
Scale 2	1
Startup	
Start Value	0

Figure 200. Integer type manual tag parameters

Table 152. Fields of Integer type manual tag parameters

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Type	Type of a Manual tag	
Name	Name of a Manual tag	Status 1
Description	Description of a Manual tag	Empty
Comments	Additional user comments	Empty
State ID	Tag state ID	
State Name	Assigned Tag State name	Not assigned
State	Actual state	
Value	Actual value	0
Time	Date/Time of the last change	
Quality	Actual quality	0x00000000 Not init
Cause	Actual cause	Not defined
Offset 1	With those parameters the user can change the value taken from the data source.	0
Offset 2		0
Scale 1	NewValue=((OldValue+Offset1)*Scale1+Offset2)* Scale2	1
Scale 2		1
Start Value	Initial Value of a logic calculation with the first operation	0

4.13 Programmable logic IsaGRAF

Enilit CMS provides an interface to the IsaGRAF programming tool for the programming of an additional function for Enilit RTU. The following figure shows the interface which enables to create inputs and outputs for the programmable logic IsaGRAF.

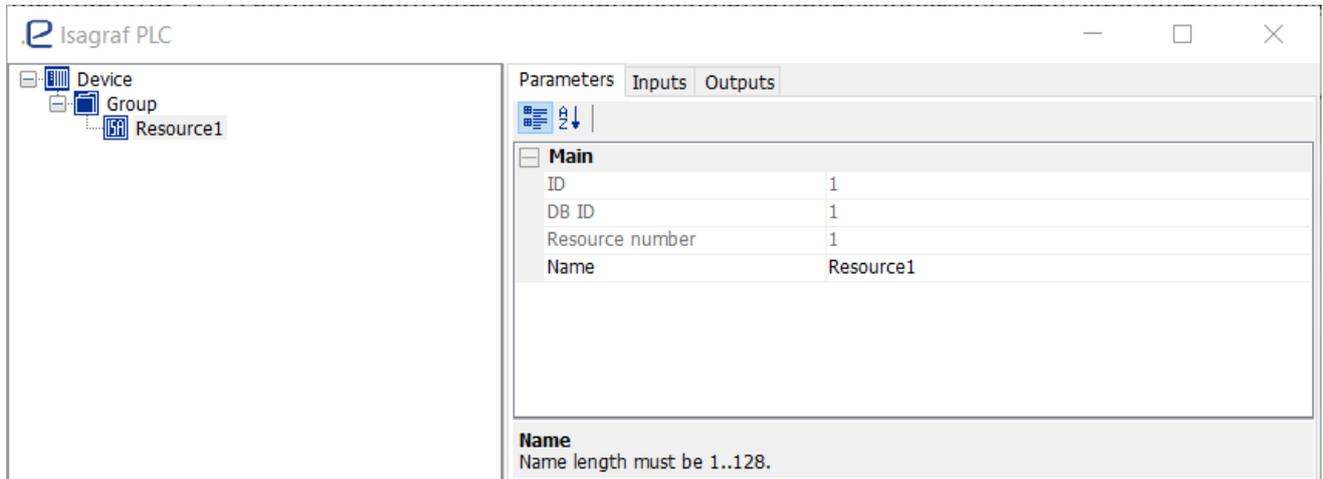


Figure 201. *IsaGRAF PLC* programming window

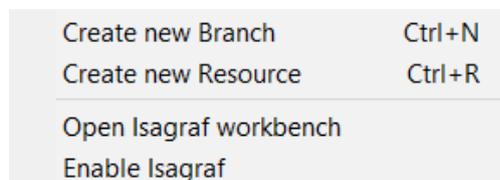


Figure 202. Popup menu

Table 153. Fields of *IsaGRAF PLC* popup menu

FIELD NAME	DESCRIPTION	ACTIVE
Create new Branch	Creates a new branch.	Branches
Create new Resource	Creates a new resource.	Branches
Open IsaGRAF workbench	Open the integrated programmable logic environment IsaGRAF by selecting this menu item.	Everywhere
Enable <i>IsaGRAF</i>	Enables IsaGRAF runtime.	Everywhere

IsaGRAF is IEC 61131 open control software for automation. For more information on all operating functions of IsaGRAF, please refer to the IsaGRAF User Manual which can be called up via IsaGRAF software.

4.13.1 IsaGRAF function blocks

Functional blocks are designed specifically for Enilit RTU. With these functional blocks, the user can manipulate events and commands.

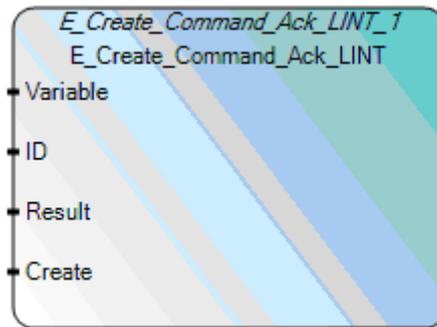


Figure 203. *E_Create_Command_Ack_LINT*

Creating an integer command acknowledgement.

Table 154. Fields of *E_Create_Command_Ack_LINT* window

FIELD NAME	DESCRIPTION
Variable	Input of a command Data type: ENILIT_OUT_COACK_LINT
ID	Command's identification number Data type: UDINT
Result	Command acknowledgement type: positive, negative, termination. Data type: BYTE
Create	Enables or disables acknowledgement. Data type: BOOL

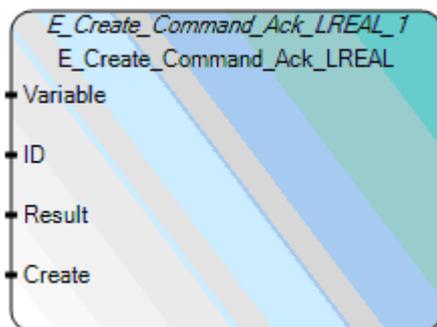


Figure 204. *E_Create_Command_Ack_LREAL*

Creating a float command acknowledgement.

Table 155. Fields of *E_Create_Command_Ack_LREAL* window

FIELD NAME	DESCRIPTION
Variable	Input of a command Data type: ENILIT_OUT_COACK_LREAL
ID	Command's identification number Data type: UDINT
Result	Command acknowledgement type: positive, negative, termination. Data type: BYTE
Create	Enables or disables acknowledgement. Data type: BOOL

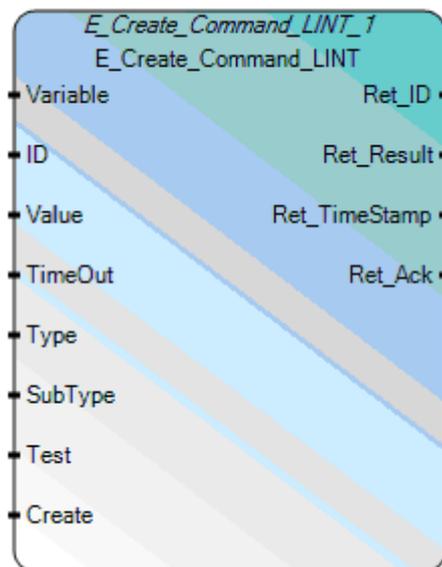


Figure 205. *E_Create_Command_LINT*

Creating an integer command.

Table 156. Fields of *E_Create_Command_LINT* window

FIELD NAME	DESCRIPTION
Variable	Output of a command to RTU Data type: ENILIT_IN_COACK_LINT
ID	Command's identification number Data type: UDINT
Value	Value of a command Data type: LINT
TimeOut	Time interval of a command acknowledgement Data type: TIME

FIELD NAME	DESCRIPTION
Type	Type of a command: single, double Data type: BYTE
SubType	Type of a command: activation, deactivation Data type: BYTE
Test	Command with the test flag Data type: BOOL
Create	Enables or disables acknowledgement. Data type: BOOL
Ret_ID	Identification number of a command acknowledgement Data type: UDINT
Ret_Result	Result of a command acknowledgement Data type: BYTE
Ret_TimeStamp	Timestamp of a command acknowledgement Data type: LINT
Ret_Ack	Acknowledgement positive or negative Data type: BOOL

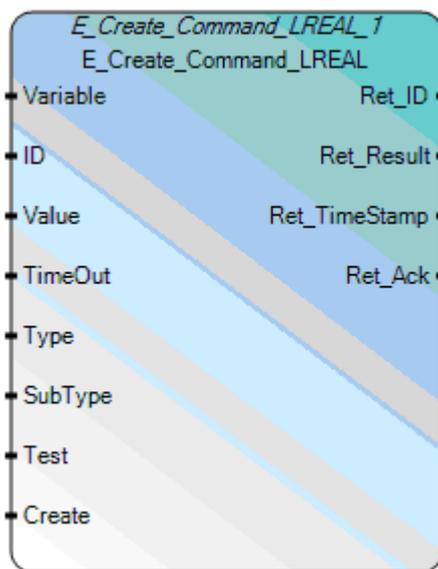


Figure 206. *E_Create_Command_LREAL*

Creating a float command.

Table 157. Fields of *E_Create_Command_LREAL* window

FIELD NAME	DESCRIPTION
Variable	Output of a command to RTU Data type: ENILIT_IN_COACK_LREAL
ID	Commands identification number Data type: UDINT
Value	Value of a command Data type: LREAL
TimeOut	Time interval of a command acknowledgement Data type: TIME
Type	Type of a command Data type: BYTE
SubType	Type of a command: activation, deactivation. Data type: BYTE
Test	Command with the test flag Data type: BOOL
Create	Enables or disables acknowledgement. Data type: BOOL
Ret_ID	Identification number of a command acknowledgement Data type: UDINT
Ret_Result	Result of a command acknowledgement Data type: BYTE
Ret_TimeStamp	Timestamp of a command acknowledgement Data type: LINT
Ret_Ack	Acknowledgement positive or negative Data type: BOOL



Figure 207. *E_Create_Event_LINT*

Creating an integer event.

Table 158. Fields of *E_Create_Event_LINT* window

FIELD NAME	DESCRIPTION
Variable	Output of an event to RTU Data type: ENILIT_OUT_EV_LINT
Value	Value of an event Data type: LINT
Quality	Quality of an event Data type: UINT
Create	Enables or disables creation of an event Data type: BOOL



Figure 208. *E_Create_Event_LREAL*

Creating a float event.

Table 159. Fields of *E_Create_Event_LREAL* window

FIELD NAME	DESCRIPTION
Variable	Output of an event to RTU Data type: ENILIT_OUT_EV_LREAL
Value	Value of an event Data type: LREAL
Quality	Quality of an event Data type: UINT
Create	Enables or disables creation of an event Data type: BOOL

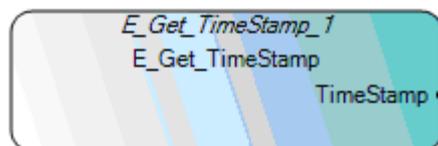


Figure 209. *E_Get_TimeStamp*

Getting a timestamp of RTU.

Table 160. Fields of *E_Get_TimeStamp* window

FIELD NAME	DESCRIPTION
TimeStamp	TimeStamp of RTU Data type: LINT

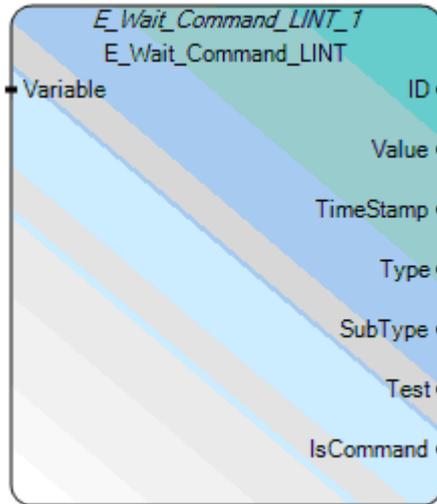


Figure 210. *E_Wait_Command_LINT*

Waiting for an integer command.

Table 161. Fields of *E_Wait_Command_LINT* window

FIELD NAME	DESCRIPTION
Variable	Input of a command from RTU Data type: ENILIT_OUT_COACK_LINT
ID	Commands identification number Data type: UDINT
Value	Value of a command Data type: LINT
TimeStamp	TimeStamp of a command Data type: LINT
Type	Type of a command Data type: BYTE
SubType	Type of a command: activation, deactivation Data type: BYTE
Test	Command with the test flag Data type: BOOL
IsCommand	If 'Yes', then a Command is active. Data type: BOOL

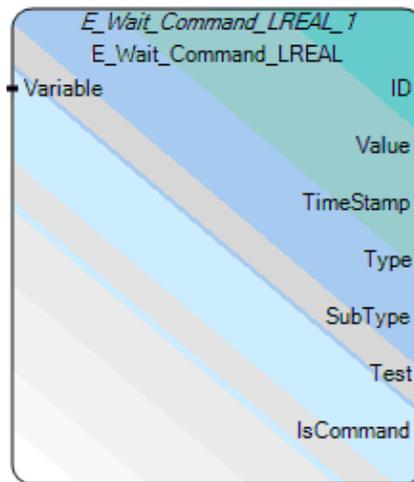


Figure 211. *E_Wait_Command_LREAL*

Waiting for an integer command.

Table 162. Fields of *E_Wait_Command_LREAL* window

FIELD NAME	DESCRIPTION
Variable	Input of a command from RTU Data type: ENILIT_OUT_COACK_LREAL
ID	Commands identification number Data type: UDINT
Value	Value of a command Data type: LREAL
TimeStamp	TimeStamp of a command Data type: LINT
Type	Type of a command Data type: BYTE
SubType	Type of a command: activation, deactivation Data type: BYTE
Test	Command with the test flag Data type: BOOL
IsCommand	If 'Yes', then a Command is active Data type: BOOL



Figure 212. *E_Wait_Event_LINT*

Waiting for an integer event.

Table 163. Fields of *E_Wait_Event_LINT* window

FIELD NAME	DESCRIPTION
Variable	Input of an event from RTU Data type: ENILIT_IN_EV_LINT
Value	Value of an event Data type: LINT
TimeStamp	TimeStamp of an event Data type: LINT
Quality	Quality of an event Data type: UDINT
IsEvent	If 'Yes', then an Event is active. Data type: BOOL



Figure 213. *E_Wait_Event_LREAL*

Waiting for a float event.

Table 164. Fields of *E_Wait_Event_LREAL* window

FIELD NAME	DESCRIPTION
Variable	Input of an event from RTU Data type: ENILIT_IN_EV_LREAL
Value	Value of an event Data type: LREAL
TimeStamp	TimeStamp of an event Data type: LINT
Quality	Quality of an event Data type: UDINT
IsEvent	If 'Yes', then an Event is active. Data type: BOOL

4.13.2 IsaGRAF data types

Table 165. Types of IsaGRAF data

FIELD NAME	DESCRIPTION
Command type	
E_CO_CANCEL	Deactivation
E_CO_EXECUTE	Execute
E_CO_SELECT	Select
E_CO_SELECT_EXECUTE	Select before Operate (SBO)
Command acknowledgement	
E_COACK_BAD_COMMAND_TYPE	Bad command type
E_COACK_BAD_CONFIGURATION	Bad configuration
E_COACK_BAD_VALUE	Bad value
E_COACK_CANCEL_DONE	Deactivation confirmation
E_COACK_CANCEL_REJECTED	Deactivation rejected
E_COACK_COMMAND_ALREADY_IN_PROGRESS	Command already in progress
E_COACK_COMMAND_IN_PROGRESS	Command in progress
E_COACK_COMMAND_QUEUE_FULL	Command queue full
E_COACK_EXECUTE_DONE	Activation confirmation
E_COACK_EXECUTE_REJECTED	Activation rejected
E_COACK_INTELOCKED	Interlocked
E_COACK_LINK_DISABLED	Link disabled
E_COACK_LINKLAYER_ACK	Link layer acknowledgement
E_COACK_LINKLAYER_NACK	Link layer no acknowledgement
E_COACK_LINKLAYER_UNKNOWN	Link layer unknown acknowledgement
E_COACK_NO_COMMAND	No command
E_COACK_NO_LINK	No link
E_COACK_SELECT_DONE	Select confirmation
E_COACK_SELECT_REJECTED	Select rejected
E_COACK_TIME_OUT	Command time out

E_COACK_UNDEFINED_RESULT	Command execution undefined result
Command quality	
E_COSUB_LONG_PULSE	Long pulse
E_COSUB_NOT_DEFINED	Not defined
E_COSUB_PERSISTENT	Persistent
E_COSUB_SHORT_PULSE	Short pulse
Quality of event	
E_QUAL_BLOCKED	Blocked
E_QUAL_GOOD	Good
E_QUAL_INVALID	Invalid
E_QUAL_INVALIDTIME	Invalid time
E_QUAL_NOTINIT	Not initialized
E_QUAL_NOTTOPICAL	Not topical
E_QUAL_OVERFLOW	Overflow
E_QUAL_SUBSTITUTED	Substituted

4.14 Time management

4.14.1 SNTP client

In the *Time management* window the user can create a new SNTP client to synchronize RTU date and time with an external SNTP server.

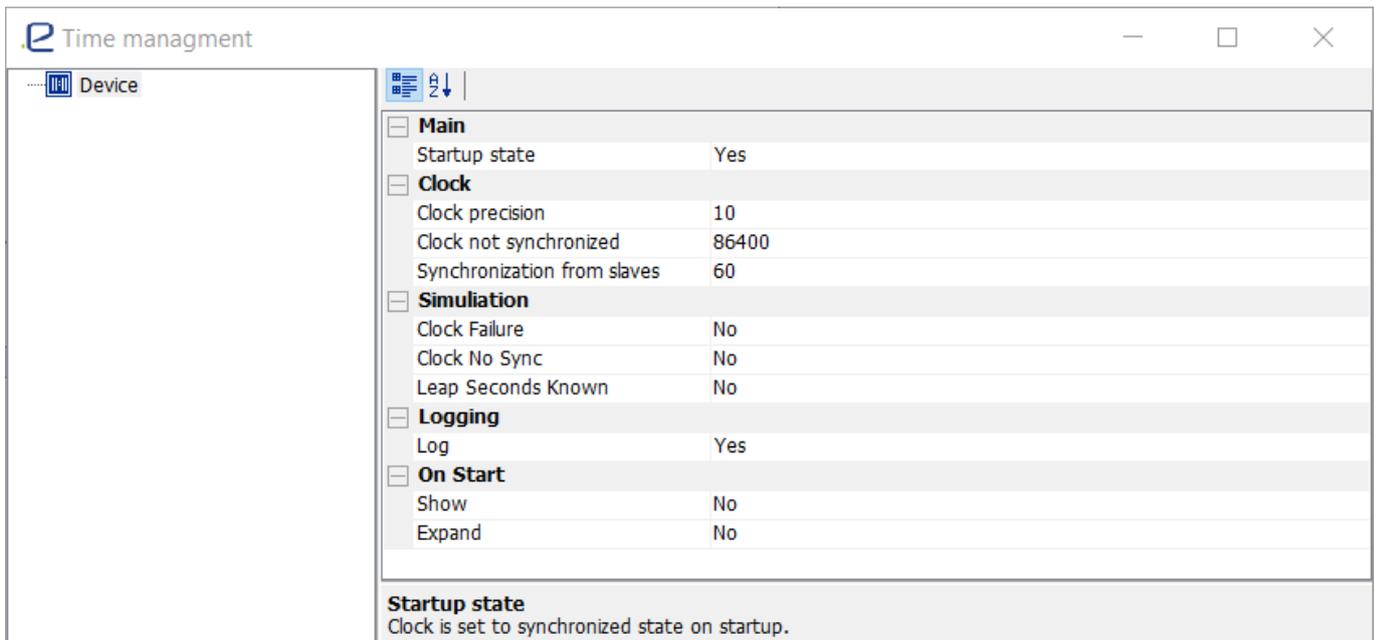


Figure 214. *SNTP client* window

Table 166. Fields of *SNTP client* window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Startup state	Clock is synchronized on startup. Values: No, Yes	Yes
Clock precision	Clock will be synchronized only if the time offset is larger than the requested precision. Range of value: 1 ... 60000ms	10
Clock not synchronized	If there was no clock synchronization for a particular time, it will be considered that the clock is not synchronized. Range of values: 1 ... 86400s	86400

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Synchronization from slaves	Time interval after which synchronization is allowed from the slave communication protocols 0 – means always allow synchronizing, 1 – 86400s – when there was no time for synchronization from SNTP clients. Range of values: 1 ... 86400s	60
Clock Failure	Simulates the clock failure. Use only for protocol testing or commissioning.	No
Clock No Sync	Simulates an unsynchronized clock. Use only for protocol testing or commissioning.	No
Leap Seconds Known	Simulates Leap Seconds Known. Use only for protocol testing or commissioning.	No
Log	Logs clock synchronizations from the slave communication protocol Values: No, Yes	Yes
Show	Shows this window on startup. Values: No, Yes	No
Expand	Expands all tree nodes on startup. Values: No, Yes	No

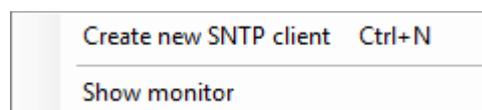


Figure 215. *Create new SNTP client*

If the user has created a new SNTP client, the following window with default parameters will be displayed.

Other opportunity is to run *Show monitor* window. The monitoring window will show the log data which the user has enabled in the SNTP client configuration with the parameters *Log Data*, *Log IP*, *Log Raw*.

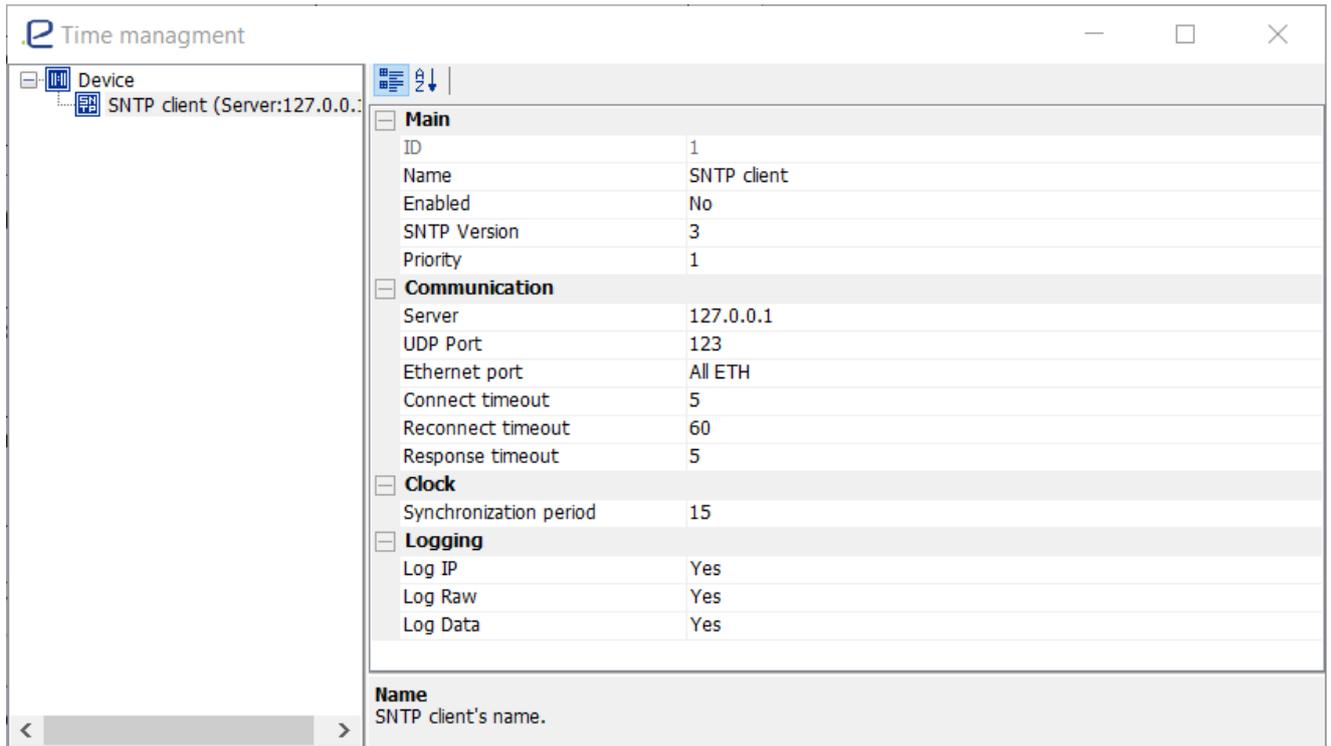


Figure 216. *SNTP client* window

Table 167. Fields of *SNTP client* window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Name	Name of SNTP client, for example, 'SNTP1'	SNTP client
Enabled	Enables or disables a SNTP client Values: No, Yes	No
SNTP Version	Version of SNTP Values: 3, 4	3
Priority	If the user will configure more than one SNTP server, it is possible to rank servers in your order. Range of values: 1 ... 255	1
Server	SNTP server IP address Values: xxx.zzz.yyy.nnn	127.0.0.1
UDP Port	UDP port to connect with the server Range of values: 1 ... 65535	123

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Ethernet port	Information address Range of values: All ETH, ETH1 ... ETH4	All ETH
Connect timeout	Connect timeout to the SNTP server Range of values: 1 ... 60s	5
Reconnect timeout	Reconnect timeout if the connection failed Range of values: 1 ... 86400s	60
Response timeout	Response timeout after the request has been sent Range of values: 1 ... 86400s	5
Synchronization period	The time period to make synchronization Range of values: 1 ... 86400s	15
Log IP	Enables to view an IP log Values: No, Yes	Yes
Log Raw	Enables to view a raw log Values: No, Yes	Yes
Log Data	Enables to view a data log Values: No, Yes	Yes

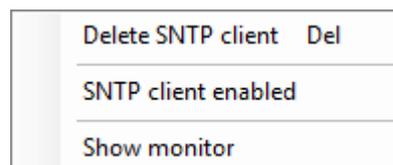


Figure 217. *SNTP client* popup menu window

With the *Show monitor*, it is possible to open the diagnostic tool for communication with the SNTP server. The following window shows *Time management monitor* window.

4.15 Self-control and diagnosis

Enilit CMS also provides diagnostic facilities which enable the user to view the hardware status of RTU with its configuration, to analyze and view serials and TCP protocols data, to monitor the current status of information objects, to test it and commands with the test values, to view and keep saved the system and events log.

4.15.1 Hardware monitoring

With the popup menu in *Enilit RTU Hardware* configuration window the user can run *Enilit RTU Hardware state* monitoring.

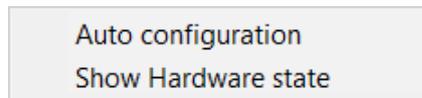


Figure 219. *Hardware* popup menu

When the user clicks *Show Hardware state*, the following figure will be seen. With this window the user can check if the hardware is well configured and working. In this hardware monitoring window, the following parameters are displayed: the current states of all modules, the output voltage of the power supply, CPU temperature, Watchdog status, binary inputs and command outputs states, measurements: current (mA) or voltage (V).

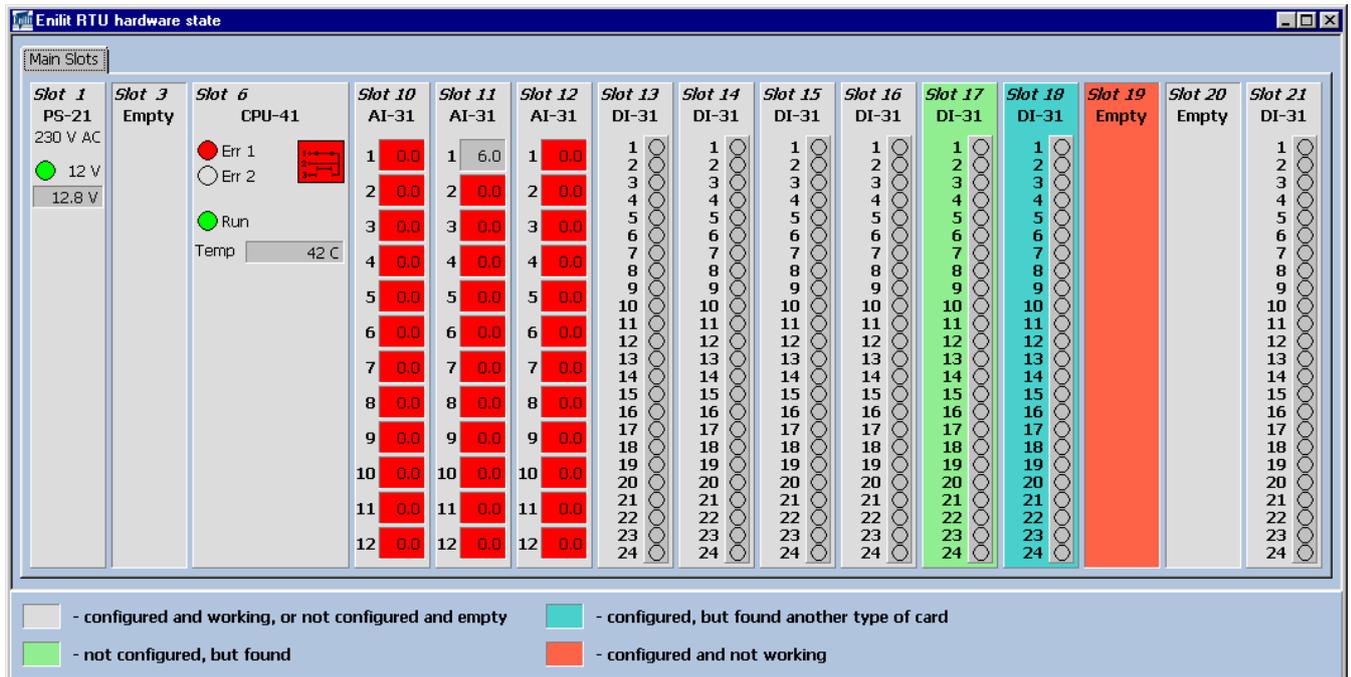


Figure 220. *Hardware state* window

- Configured and working, or not configured and empty.
- Not configured but found.
- Configured but found another type of module.
- Configured and not working.

4.15.1.1 Status signals, commands and measurements

Hardware status can be monitored via communication protocols. The user can connect hardware status signals to tags with the *TAG Manager*, also control hardware with the commands from SCADA. The following figure shows Hardware status signals, commands and measurements window.

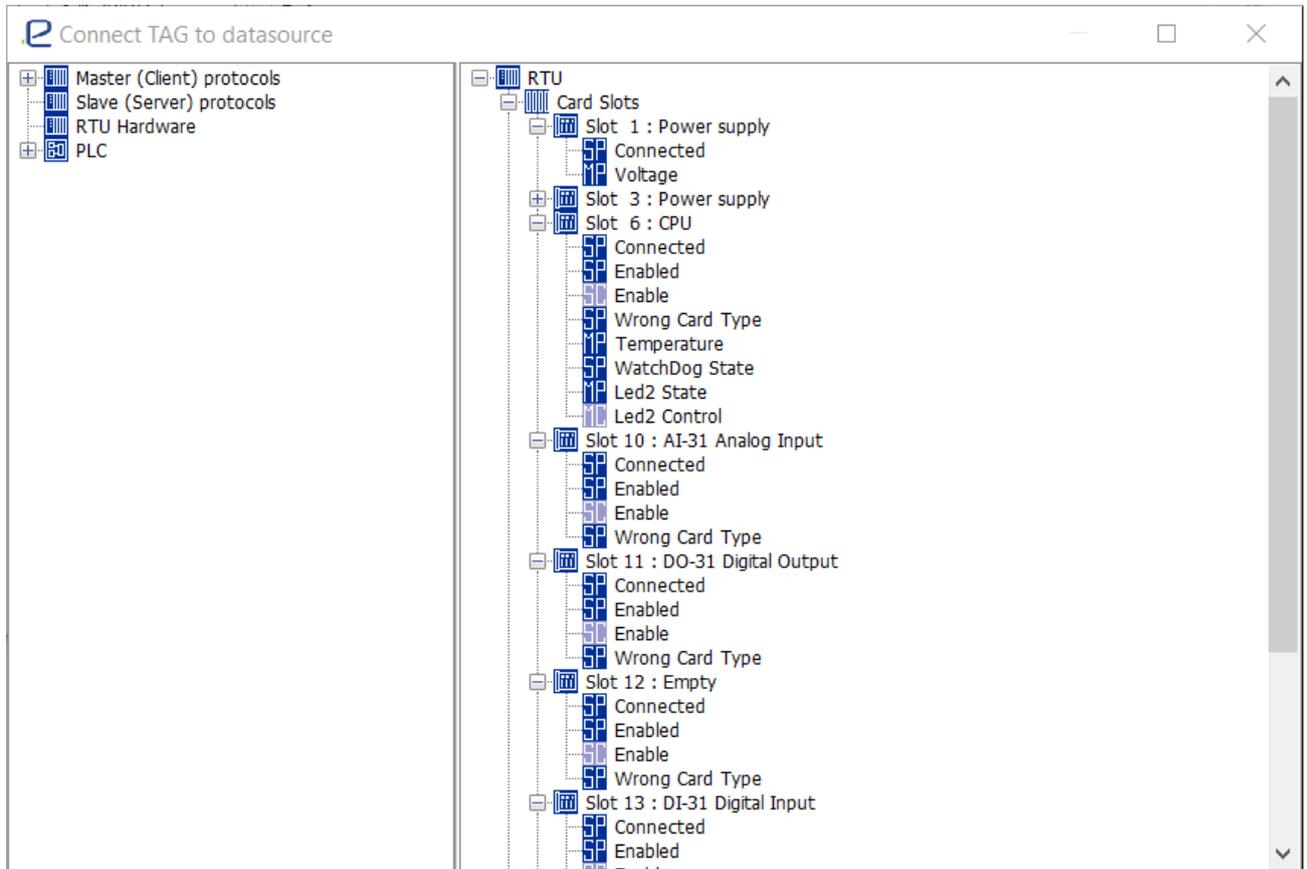


Figure 221. *Hardware status signals, commands and measurements*

Table 168. States and parameters of *Hardware status*

FIELD NAME	DESCRIPTION	CARD TYPES
Connected	Central processor communicates with the card. The card works without an error. Type: Status item 0 – Normal 1 – Fault	All
Voltage	Power supply voltage measurement Type: Status item	PS
Enabled	Enabled or disabled the card Type: Status item 0 – Enabled 1 – Disabled	All

FIELD NAME	DESCRIPTION	CARD TYPES
Enable	Enables or disables communication of the central processor with the card. Type: Command item 0 – Disable command 1 – Enable command	All
Wrong Card Type	Central processor detects a wrong card type. Type: Status item 0 – Ok, 1 – Fault	AI31, DI31, DO31, CPU
Temperature	Central processor temperature measurement Type: Status item	CPU
Watchdog state	Watchdog state 0 – Ok, 1 – Fault.	CPU
Led2 State	Central processor Led2 state Type: Status item 0 – Led2 off 1 – Led2 on	CPU
Led2 Control	Control of the central processor Led2 state Type: Command item 0 – Off 1 – On	CPU

4.15.2 Protocol monitoring and supervision

4.15.2.1 Monitoring

The following figure shows the communication port popup menu. With this popup menu the user can run the protocol monitoring tool 'Port monitor'.

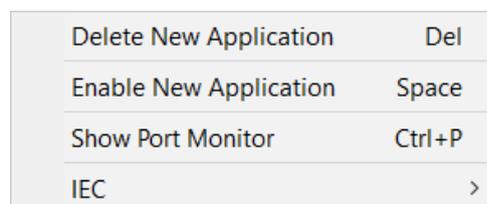


Figure 222. *Communication port popup menu*

The next figure shows the window in which the received and transmitted data through the communication port can be viewed. This window is for IEC 60870-5-103 protocol, but it is possible to use it for all serial or TCP protocols even for SNMP.

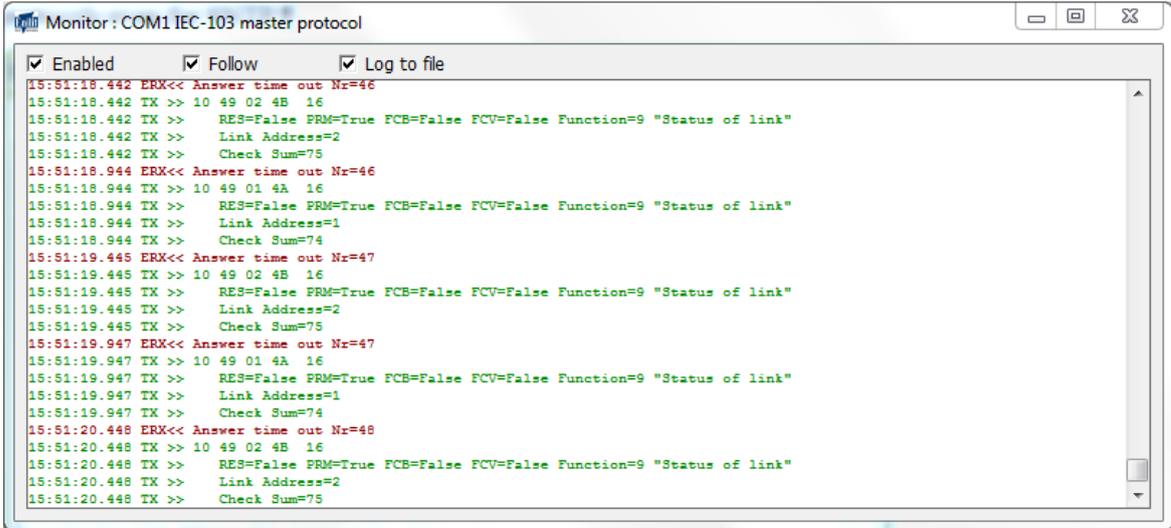


Figure 223. Standard *Master Protocol* monitor

Table 169. Types of data viewed in the standard *Master Protocol* monitor

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Enabled	Enables to view communication data. Values: Checked, Unchecked	Unchecked
Follow	Enables to follow the last communication data. Values: Checked, Unchecked	Unchecked
Log to file	Enables to log all data to the log file. Values: Checked, Unchecked	Unchecked

The next figure shows the communication data in monitoring direction either serial or TCP/IP between RTU and SCADA.

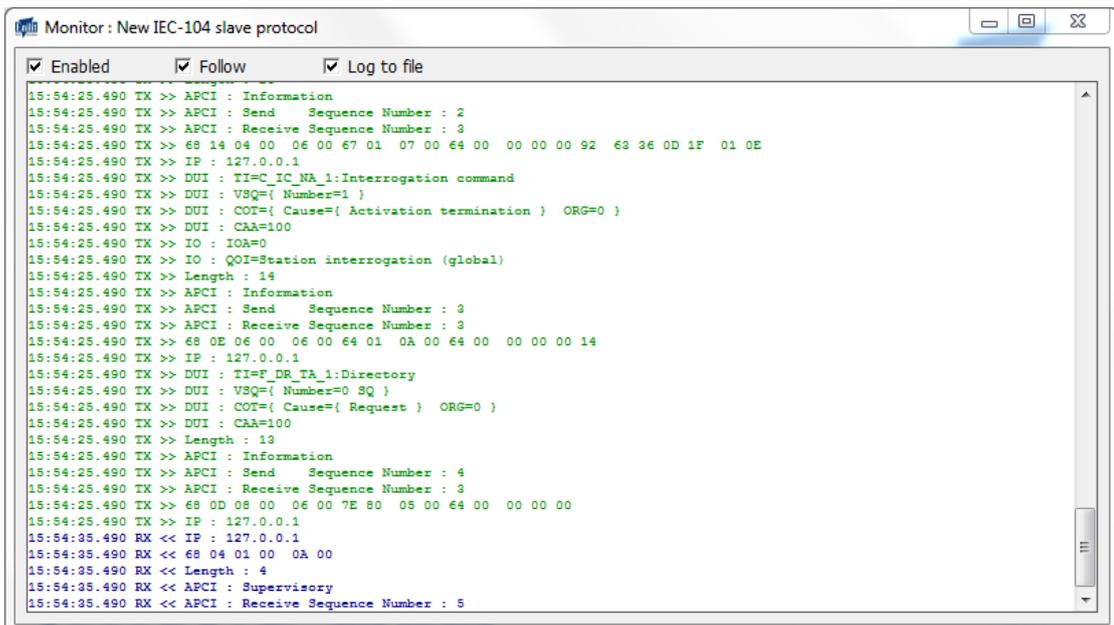


Figure 224. Standard *Slave Protocol* window

Table 170. States of standard *Slave Protocol* monitor window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Enabled	Enables to view communication data. Values: Checked, Unchecked	Checked
Follow	Enables to follow the last communication data. Values: Checked, Unchecked	Checked
Log to file	Enables to log all data to the log file. Values: Checked, Unchecked	Checked

This communication port monitoring tool is very useful at the stage of commissioning of the substation. A commissioning engineer does not need any additional testing software, or even additional hardware for the port monitoring and so on.

4.15.2.2 Supervision

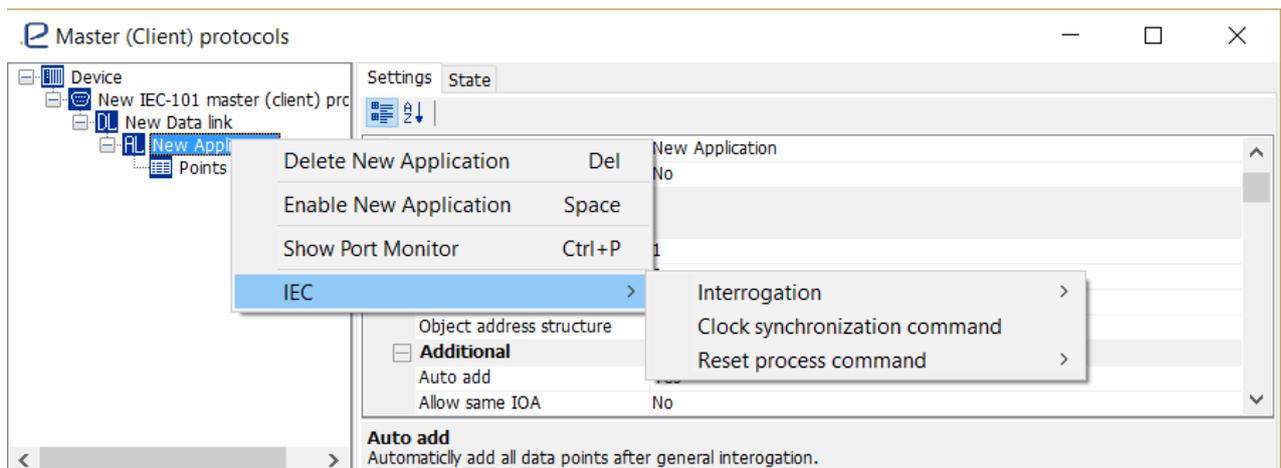


Figure 225. Protocol supervision popup window

For every IEC protocol in the controlling direction, the user can send commands like General Interrogation, Clock synchronization, and Reset to process manually. It is very useful in the commissioning stage.

4.15.2.3 Status signals, commands and measurements

From every protocol in the controlling direction, the status signals and measurements of protocols can be used for monitoring in SCADA or HMI. The commands of protocols can be used as well for the protocol supervision.



Figure 226. Standard protocol status items for master protocols

Table 171. Standard protocol status items for master protocols

FIELD NAME	DESCRIPTION	PROTOCOLS
Connected	Connected to the slave device. Type: Status item 0 – Normal 1 – Communication error	All
Enabled	Enabled or disabled communication protocol. Type: Status item 0 – Enabled 1 – Disabled	All
TX Bytes	Count of protocol transmitted bytes Type: Float	All
TX Packets	Count of protocol transmitted packets Type: Float	All
RX Bytes	Count of protocol received bytes Type: Float	All
RX Packets	Count of protocol received packets Type: Float	All
RX Err Answer Timeout	Type: Float	All serial protocols

FIELD NAME	DESCRIPTION	PROTOCOLS
RX Err First Char	Type: Float	All serial protocols
RX Err Last Char	Type: Float	All serial protocols
RX Err Check Sum	Type: Float	All serial protocols
RX Err Length	Type: Float	All serial protocols
RX Err Mirrored	Type: Float	All serial protocols
PRP-1 device is visible on Lan A	RTU has connection to the device over PRP-1 Lan A.	IEC 61850 Client
PRP-1 device is visible on Lan B	RTU has connection to the device over PRP-1 Lan B.	IEC 61850 Client

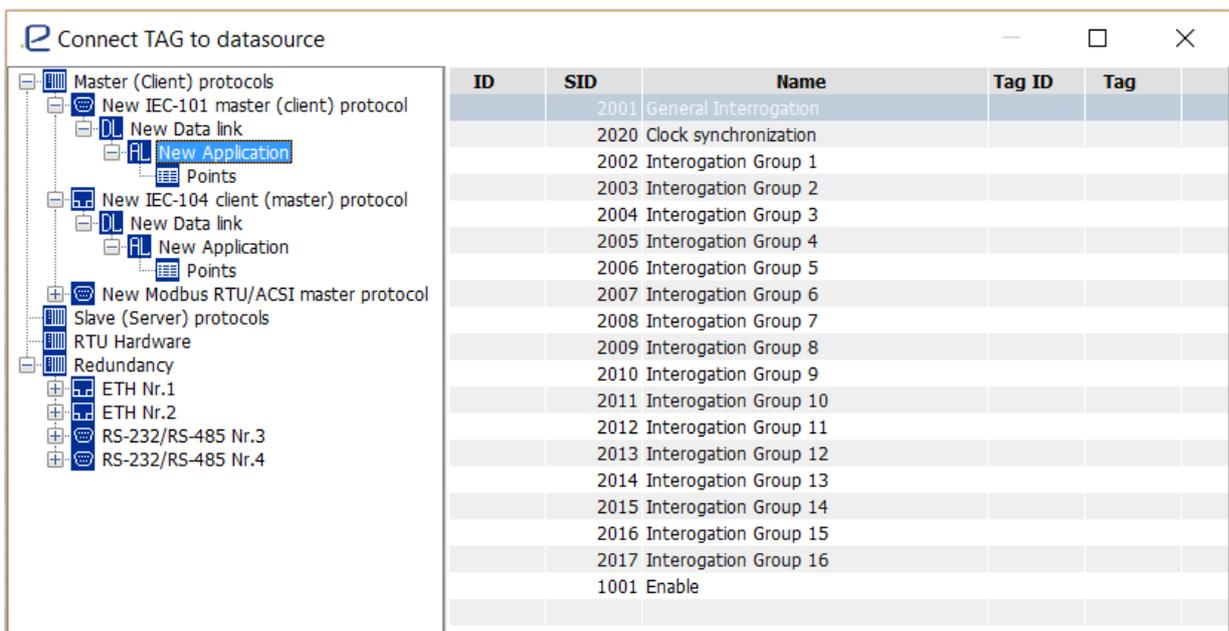


Figure 227. Standard protocol control items for IEC master protocols

4.15.3 System log

When Enilit CMS is started, the first window is *System log* window. The information in this window is also written to a file. The location of logs is described in the RTU description file.

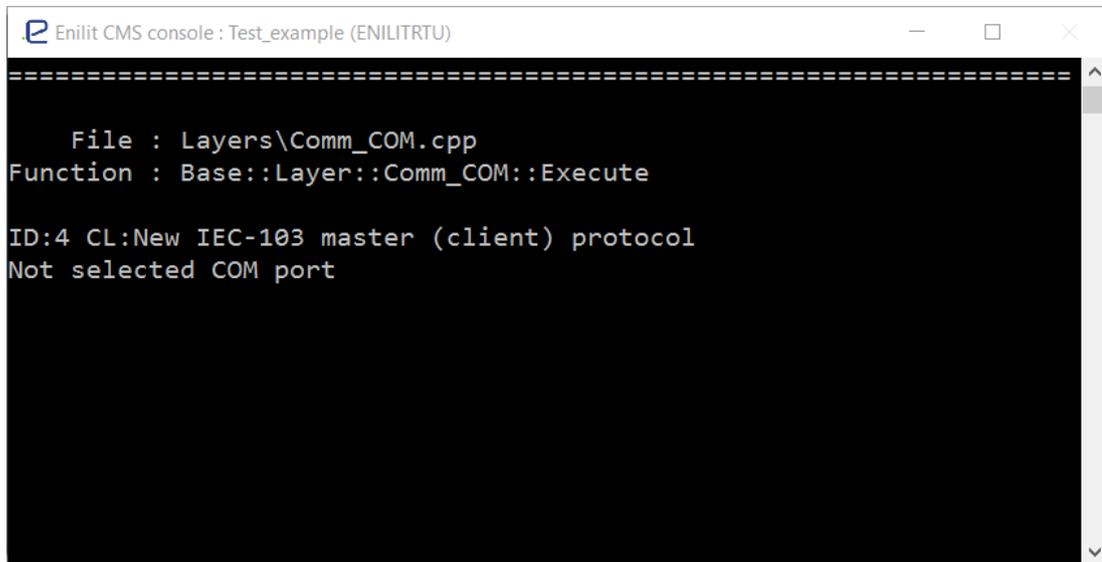


Figure 228. System log window

4.15.4 Events log

In the *TAG Manager* tool, the user can configure *Events log*. This window is also written to the file. By default *Events log* files are stored in the RTU configuration directory *Logs*. The location of logs is described in the RTU description file.

To quickly open the *Events log*, the *TAG Manager* menu *File* and *Open Tag history file* can be used.

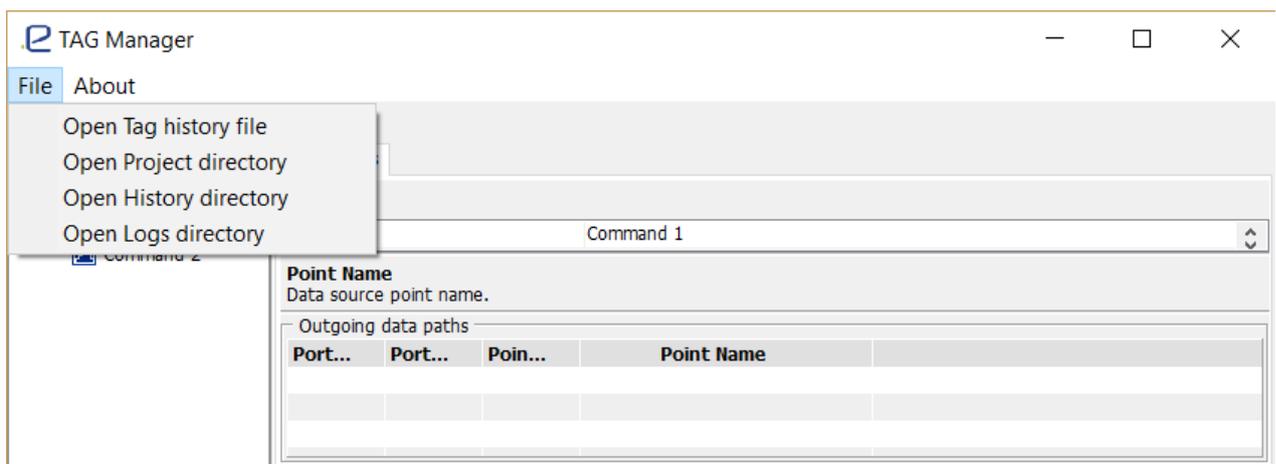


Figure 229. TAG Manager menu File

The configuration parameters for *Logs* can be found in the main branch *Device* of the *TAG Manager*.

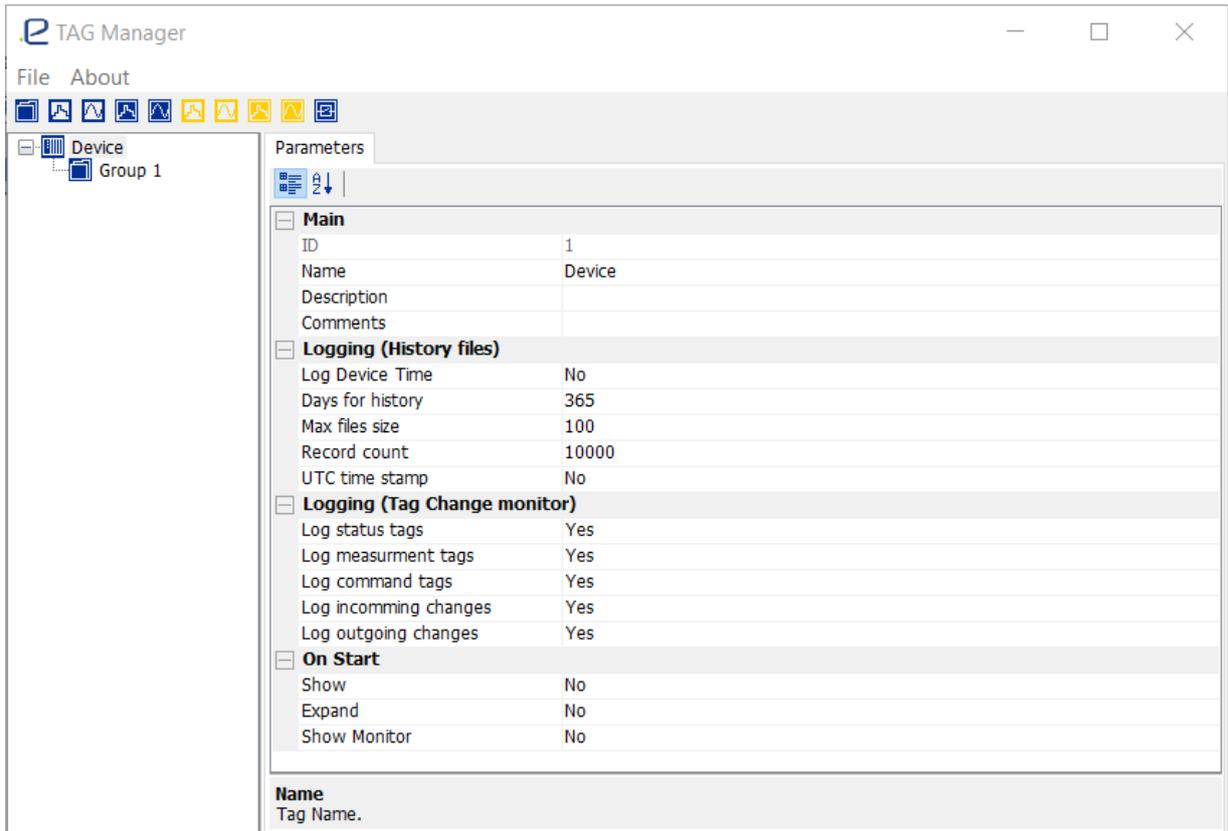


Figure 230. Main TAG manager window with Logging parameters

Table 172. Logging parameters of the branch Device in the main TAG manager window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Name	Name of RTU, for example, 'Substation 1'	Device
Description	Free user description	
Comments	Free user comments	
Log RTU Time	Additional column will be added to history files which show the <i>event received time</i> in the TAG Manager. Values: No, Yes	No
Days for history	Number of days to keep events in Events list. Range of values: 10 ... 1000 days	365
Max file size	Maximum size of all Events list files Range of values: 10 ... 1000Mb	100
Record count	Record count in one Events list file Range of values: 1000 ... 100000	10000

FIELD NAME	DESCRIPTION	DEFAULT VALUE
UTC time stamp	Time stamp of events to be saved in <i>Events list</i> . Values: No, Yes	No
Log status tags	Log status changes to Events list files. Values: No, Yes	Yes
Log measurements tags	Log measurements changes to Events list files. Values: No, Yes	Yes
Log command tags	Log commands changes to Events list files. Values: No, Yes	Yes
Log incoming changes	Log incoming changes to Events list files. Values: No, Yes	Yes
Log outgoing changes	Log outgoing changes to Events list files. Values: No, Yes	Yes
Show	Shows this window on startup.	No
Expand	Expand all tree nodes on startup.	No
Show Monitor	Shows the tag state change monitor on startup.	No

4.16 Redundancy

4.16.1 Redundancy support

Safety, reliability, high availability, and functionality are vital components of every control system in today's world. Enilit system utilizes dual RTUs and power supplies redundancy.

The system provides the automatic monitoring of primary and hot standby RTU. Failures are detected automatically and trigger a switchover from the Main RTU to hot Standby RTU. All communication channels are automatically switched to the Main RTU. The switchover and data transfer is fast, thereby, ensuring that there is no interruption in the process control.

4.16.2 Redundancy types

4.16.2.1 Cold-Standby

Cold-Standby is a method of redundancy in which the secondary RTU system is only called upon when the primary system fails. The system on cold standby receives scheduled data backups but less frequently than a warm standby. Cold standby systems are used for non-critical applications or in cases where data is changed infrequently.

4.16.2.2 Warm-Standby

Warm-Standby is a method of redundancy in which the secondary RTU system runs in the background of the primary system. The data is mirrored to the secondary RTU at regular intervals, which means that there are times when both servers do not contain the same data.

4.16.2.3 Hot-Standby

Hot-Standby is a method of redundancy in which the primary RTU and secondary RTU systems run simultaneously. The data is mirrored to the secondary RTU in real time so that both systems contain identical information. This method lets fast switchover from the Main to Standby RTU, because both of RTUs have the same data. Hot-standby redundancy is used in Enilit RTU by default but on customer request it can be changed to Cold-Standby or Warm-Standby. Further description is mostly about this type of redundancy.

4.16.3 Connection diagram

To support redundancy, RTU's must be connected one with other using LAN or/and RS-485 or/and RS-232 interfaces. These communication paths are used to exchange real time data between the active and standby RTU. It is possible to use the maximum of 4 redundant connections between RTU's.

- RS-485 or RS-232 (COM1-COM12)
- RS-485 or RS-232 (COM1-COM12)
- LAN (ETH1-ETH4)
- LAN (ETH1-ETH4)



Figure 231. Example of connections between redundant RTUs

Only one of these connections is used for data exchange. Others are used for health monitoring of the active RTU. In case of broken data communication path, other active connection will be selected. Ethernet connections are much faster so the first one of these connections will be used for data exchange. In case when there are no Ethernet connections, a serial will be selected. Even if the serial selected, by default 115,200 kbs speed it is possible to transfer about 500 events per second between RTUs. On request, speed can be increased for serial connections.

4.16.4 Enilit RTU redundancy principles

Enilit redundancy system consists of two RTUs. One of them is called the Main RTU and another is the Standby RTU. At any time there can be only one Main RTU. The Main RTU is responsible for:

- data acquisition from the slave and server devices,
- command transmission to the slave and server devices,
- PLC logic,

- process information transmission to the upper communication levels,
- process information transmission to the Standby RTU.

The Standby RTU is responsible for:

- data acquisition from the Main RTU,
- process information transmission to the upper communication levels,
- monitoring of connections to the Main RTU.

If the Standby RTU is healthy and running, it receives all process information from the Main RTU so it can transmit all necessary data to the upper communication levels. No matter how many redundant connections are configured between the Active and Standby RTUs, if there is at least one connection healthy, the Standby RTU knows that the Main RTU is running correctly. If there is no connection between the Standby and Main RTU, the Standby RTU changes its state to the Main. The switchover can be also executed manually. In this case the Standby RTU will change to the Active RTU, and the Active RTU will change to the Standby RTU. As the Standby RTU always acquires process information from the Active RTU, the switchover is fast.

4.16.5 Monitored fault locations

This section describes what can be monitored and used for the automatic switchover from the Standby to Main RTU. Most of this monitored information is user selectable from the system self-control and diagnosis Tags (See description about 4.13 Self-control and diagnosis). Monitored information:

- Communication paths between the Main and Standby RTUs (this is done by default and is not user selectable),
- RS-485, RS-232 port hardware errors and state,
- Ethernet port hardware errors and state,
- Cards hardware errors and state,
- Inner voltages and temperatures.
- Main CPU state,
- Power supply state,
- Main Watchdog relay on the CPU card (Digital Input type card will be needed on both of RTUs to check the relay state),
- Other specifics can be added on customer request.

All this monitored information can be used for the configuration of automatic switchovers, according to user needs.

4.16.6 Redundancy configuration

For Redundancy configuration the user should use the *Redundancy Manager*.

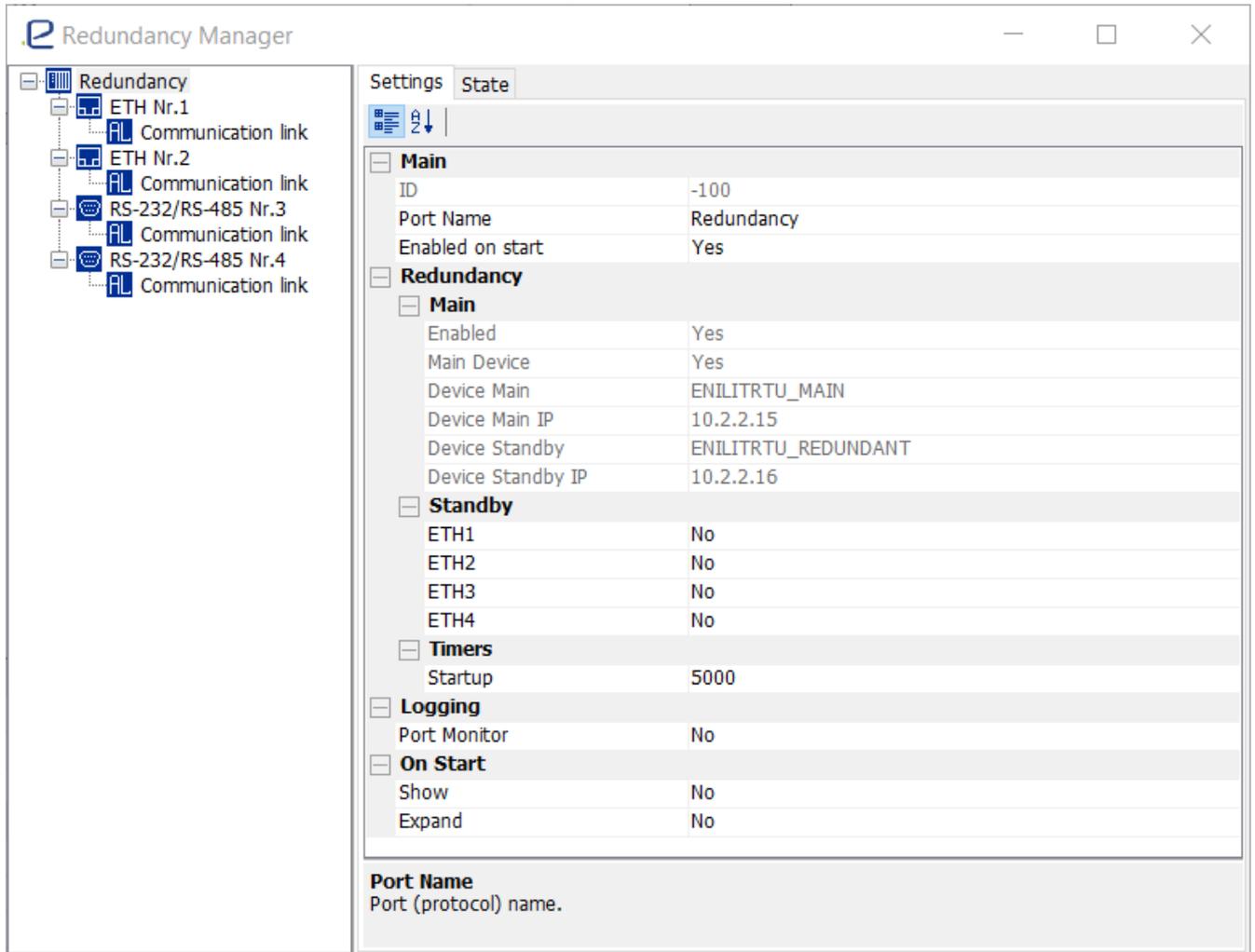


Figure 232. Redundancy parameters

Table 173. Fields of *Redundancy manager* window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Port name	Redundancy
Enabled on start	Enables or disables redundancy on start. Values: No, Yes	No
Enabled	Shows if redundancy is enabled. To change this parameter, use <i>Enilit Project Manager</i> .	No
Main Device	Shows if this device is the Main device.	No
Device Main	Main device name. To change this parameter, use <i>Enilit Project Manager</i> .	

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Device Main IP	Main device IP address. To change this parameter, use <i>Enilit Project Manager</i> .	
Device Standby	Standby device name. To change this parameter, use <i>Enilit Project Manager</i> .	
Device Standby IP	Standby device IP address. To change this parameter, use <i>Enilit Project Manager</i> .	
ETH1 ... ETH4	If the device is going to the standby state, the communication port can be disabled with this parameter.	No
Startup	On startup the device waits for connections from the redundant device, if there are no connections for the specified time, this device will be set to the main mode. Range of values: 100...60000ms	5000
Port Monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Show	Shows this window on startup.	No
Expand	Expands all <i>Tree Nodes</i> on startup.	No

4.16.7 Communication channel configuration

4.16.7.1 Redundancy Connection LAN1 parameters

<input type="checkbox"/> Main	
ID	-101
Port Name	ETH Nr.1
Enabled on start	Yes
<input type="checkbox"/> Communication	
Ethernet port	ETH_ALL
TCP port	5404
TCP Keep Alive	500
TCP No delay	No
Connect Time Out	500
Reconnect	500
<input type="checkbox"/> Logging	
Port Monitor	No
Log raw data	Yes
Log Length	Yes

Figure 233. Redundancy connection LAN1 parameters

Table 174. Parameters of redundancy connection LAN1 in the *Redundancy manager* window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Port Name	ETH Nr.1
Enabled on start	Enables or disables connection on start. Values: No, Yes	No
Ethernet port	Choose the RTU Ethernet port. Values: ETH1, ETH2, ETH3, ETH4	Not assigned
TCP Port	TCP/IP communication port.	5404
TCP Keep Alive	TCP Keep Alive. Do not set low values because it will add overhead to communication. Range of values: 0 ... 2147483647ms 0 – disabled	500
TCP No delay	TCP No delay disables the Nagle Algorithm. Values: No, Yes	No
Connect Time Out	Communication timeout. In case if this is the last connection between RTUs and it is timed out, then switchover from the Standby RTU to Active happens.	500
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 50...60000ms	500
Port Monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes
Log Length	Enables to log sent packet length. Values: No, Yes	Yes

4.16.7.2 Redundancy Connection LAN2 parameters

<input type="checkbox"/> Main	
ID	-102
Port Name	ETH Nr.2
Enabled on start	No
<input type="checkbox"/> Communication	
Ethernet port	Not assigned
TCP port	5404
TCP Keep Alive	500
TCP No delay	No
Connect Time Out	500
Reconnect	500
<input type="checkbox"/> Logging	
Port Monitor	No
Log raw data	Yes
Log Length	Yes

Figure 234. Redundancy connection LAN2 parameters

Table 175. Parameters of redundancy connection LAN2 in the *Redundancy manager* window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Port Name	ETH Nr.2
Enabled on start	Enables or disables connection on start. Values: No, Yes	No
Ethernet port	Choose RTU Ethernet port. Values: ETH1, ETH2, ETH3, ETH4	Not assigned
TCP Port	TCP/IP communication port	5404
TCP Keep Alive	TCP Keep Alive. Do not set low values, because it will add overhead to communication. Range of values: 0 ... 2147483647ms 0 – disabled	500
TCP No delay	TCP No delay disables the Nagle Algorithm. Values: No, Yes	No
Connect Time Out	Communication timeout. In case if this is the last connection between RTUs and it is timed out, then the switchover from the Standby RTU to Active happens.	500

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Reconnect	Time interval of reconnection attempt to the communication port while communication is not established Range of values: 50...60000ms	500
Port Monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes
Log Length	Enables to log sent packet length. Values: No, Yes	Yes

4.16.7.3 Redundancy Connection RS-232/RS-485 No. 3 parameters

Main	
ID	-103
Port Name	RS-232/RS-485 Nr.3
Enabled on start	No
Communication	
COM port	Not assigned
Baud rate	9600
Data bits	8
Stop bits	1
Parity	None
RS-485 Mode	Four wire
Reconnect	10
Logging	
Port Monitor	No
Log raw data	Yes

Figure 235. Redundancy connection RS-232/RS-485 No. 3 parameters

Table 176. Parameters of redundancy connection RS-232/RS-485 No. 3 in the *Redundancy manager* window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Port Name	RS-232/RS-485 No. 3
Enabled on start	Enables or disables connection on start. Values: No, Yes	No
Com port	Communication port number.	Not assigned

FIELD NAME	DESCRIPTION	DEFAULT VALUE
Baud rate	Serial port baud rate. Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7,8 bits	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2 bits	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None
RS-485 Mode	If two wires are used, the mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Range of values: Four wires, Two wires	Four wire
Reconnect	Time interval of reconnection attempt while communication is not established. Range of values: 1 ... 600s	10
Port Monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data Values: No, Yes	Yes

4.16.7.4 Redundancy Connection RS-232/RS-485 No. 4 parameters

<input type="checkbox"/> Main	
ID	-104
Port Name	RS-232/RS-485 Nr.4
Enabled on start	No
<input type="checkbox"/> Communication	
COM port	Not assigned
Baud rate	9600
Data bits	8
Stop bits	1
Parity	None
RS-485 Mode	Four wire
Reconnect	10
<input type="checkbox"/> Logging	
Port Monitor	No
Log raw data	Yes

Figure 236. Redundancy connection RS-232/RS-485 No. 4 parameters

Table 177. Parameters of redundancy connection RS-232/RS-485 No. 4 in the *Redundancy manager* window

FIELD NAME	DESCRIPTION	DEFAULT VALUE
ID	For internal use	
Port Name	Port Name	RS-232/RS-485 No. 4
Enabled on start	Enables or disables connection on start. Values: No, Yes	No
Com port	Communication port number	Not assigned
Baud rate	Serial port baud rate Range of values: 110 ... 921600	9600
Data bits	Serial port data bits Values: 7,8 bits	8
Stop bits	Serial port stop bits Values: 1, 1.5, 2 bits	1
Parity	Serial port parity Values: None, Odd, Even, Mark, Space	None
RS-485 Mode	If two wires are used, the mirrored data check should be used. If the serial port is RS-232, the parameter is not important. Range of values: Four wires, Two wires	Four wire
Reconnect	Time interval of reconnection attempt while communication is not established. Range of values: 1 ... 600s	10
Port Monitor	Shows the port monitor on the system startup. Values: No, Yes	No
Log raw data	Enables to log raw communication data. Values: No, Yes	Yes

4.16.8 Status signals, commands and measurements

The user can connect every system status signal for redundancy to the upper communication link and send to SCADA. The control of the main and standby devices can be issued from SCADA as well.

4.16.8.1 Status items for redundancy

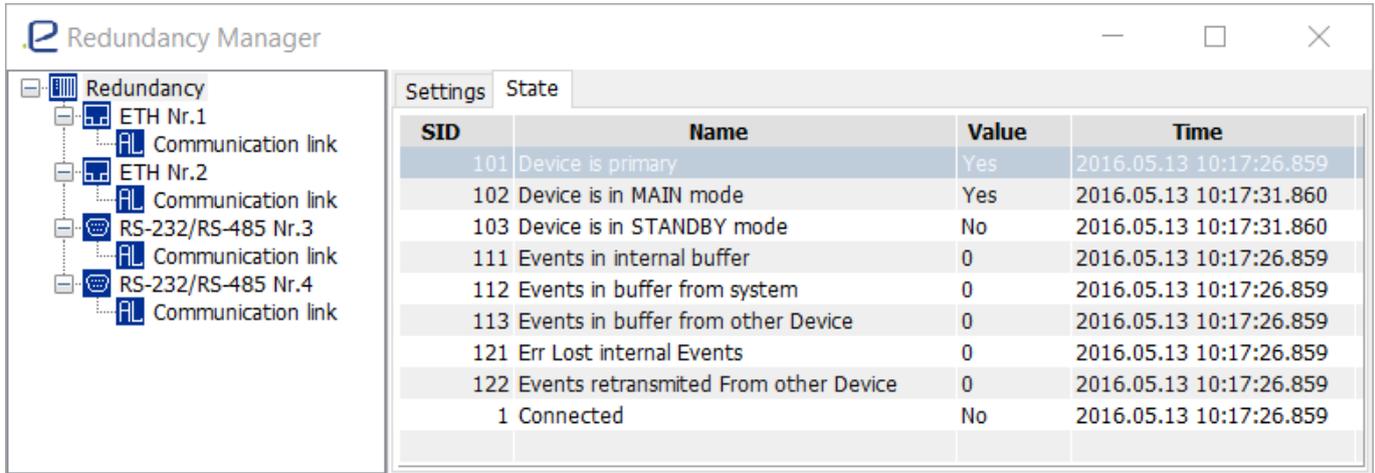


Figure 237. System status items for redundancy

Table 178. System status items for *Redundancy* in the *Redundancy Manager* table 'State'

FIELD NAME	DESCRIPTION
Device is primary	Device is primary. The name of the Device in your project shows that this device is primary.
Device is in MAIN mode	Current Device is now in the MAIN mode.
Device is in STANDBY mode	Current Device is now in the STANDBY mode.
Events in internal buffer	Total events in the internal buffer.
Events in buffer from system	Total events in the system buffer.
Events in buffer from other device	Total events in the buffer from the other Device.
Err Lost internal Events	Total error lost internal events.
Events retransmitted from other device	Events retransmitted from the other Device.
Connected	Redundant connection is connected.

4.16.8.2 Status items for ETH connections

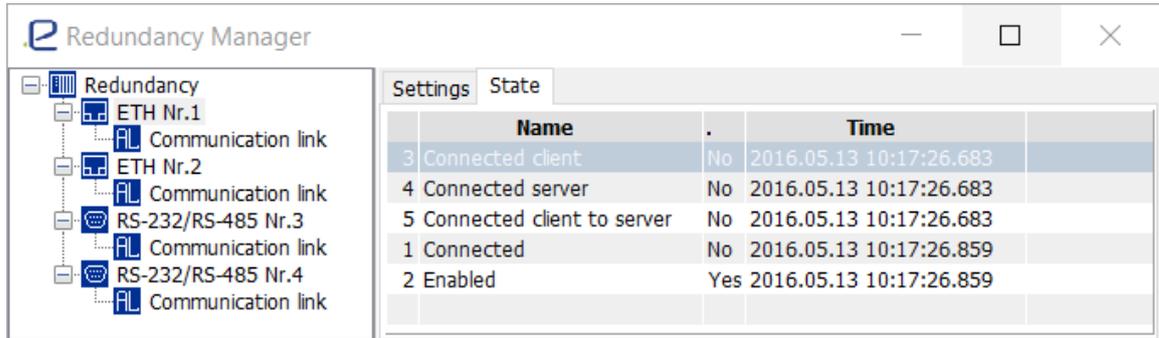


Figure 238. Status items for ETH connections

Table 179. Status items for ETH connections in the *Redundancy Manager* table 'State'

FIELD NAME	DESCRIPTION
Connected client	Other device is connected to this device
Connected server	Device redundancy server is ready for connections from the client.
Connected client to server	Device connected to the other device.
Connected	Redundancy communication link is working.
Enabled	Communication port is enabled.

4.16.8.3 Status items for RS-232/RS-485 connections

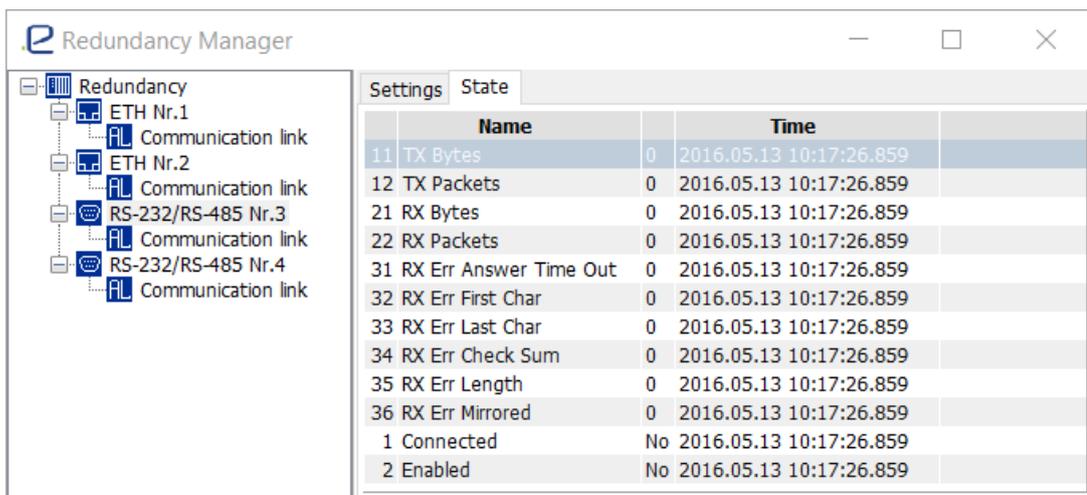


Figure 239. Status items for RS-232/RS-485 connections

Table 180. Status items for RS-232/RS-485 connections in the *Redundancy Manager* table 'State'

FIELD NAME	DESCRIPTION
TX Bytes	Protocol transmitted bytes.
TX Requests	Protocol transmitted packets.
RX Bytes	Protocol received bytes.
RX Packets	Protocol received packets.
RX Err Answer Time Out	Error: Answer Time out
RX Err First Char	Error: Wrong first character
RX Err Last Char	Error: Wrong last character
RX Err Check Sum	Error: Wrong Check sum
RX Err Length	Error: Wrong Packet Length
RX Err Mirrored	Error: Got Mirrored data
Connected	Redundancy communication link is working.
Enabled	Communication port is enabled.

4.16.8.4 System status items for communication links

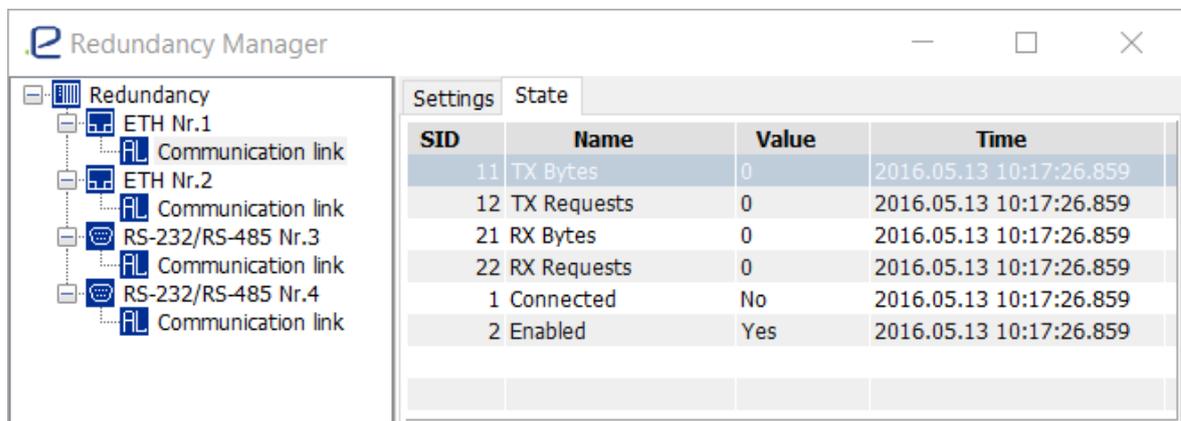


Figure 240. Communication link status items for redundant connection

Table 181. Communication link status items for redundant connection in the *Redundancy Manager* table 'State'

FIELD NAME	DESCRIPTION
TX Bytes	Protocol transmitted bytes
TX Requests	Protocol transmitted packets

FIELD NAME	DESCRIPTION
RX Bytes	Protocol received bytes
RX Packets	Protocol received packets
Connected	Connected to the redundant RTU. Values: 1 – Normal, 0 – Communication error
Enabled	Enabled or disabled redundant connection Values: 1 – Enabled, 0 – Disabled

4.17 Cyber security capabilities

4.17.1 Introduction

Cyber data security is a vital element of the system's reliability. It decreases cyber-crimes and increases the security and availability of the system's communication network.

The systems where RTUs are being used (e.g. power, water, and oil supply systems) are usually considered critical infrastructure. Security threats generally consist of attacks against the assets. These assets may not only be physical facilities, but also cyber information, databases, and software applications. Targets such as IEDs, SCADA (Supervisory Control and Data Acquisition) systems, EMS (Energy Management Systems), databases, applications, and web services can be attacked. Even if the network is completely isolated and no remote equipment is connected, attacks may even be initiated by operational personnel who lack special training and awareness. In order to prevent from such attacks Enilit RTU has data cyber security capabilities according to the standard IEEE 1686-2013 (revision of IEEE 1686-2007), IEEE Standard for Substation Intelligent Electronic Devices (IEDs) Cyber Security Capabilities, December 2013.

IEEE 1686-2013 is a security standard for IEDs. It establishes the requirements for IED security in accordance with NERC CIP. This standard defines the functions and features to be provided in the substation IEDs to accommodate critical infrastructure protection programs.

The main cyber security capabilities of Enilit RTU are described in the chapters below. If some extra security functions are required, they could be added based on the client's request.

4.17.2 Electronic access control

All electronic access to Enilit RTU, either locally through a communication/diagnostic port with a test set or personal computer, or remotely through the communications media, is password protected. It is not possible to gain access to the device without a proper password that has been generated by the user.

4.17.2.1 Password defeat mechanisms

Enilit RTU has no means whereby the user-created password control can be defeated or circumvented. This includes such mechanisms and techniques such as:

- Vendor-embedded master password;
- Chip-embedded diagnostic routines made accessible by hardware or software failures;
- Hardware bypass capabilities such as jumpers and switch settings.

UAB Enilit guarantees that no such mechanisms exist, which would allow circumvention of the user-created password control.

4.17.2.2 Number of individual passwords supported

Thousands of unique user-access passwords could be created.

4.17.2.3 Password construction

User-created passwords follow a set of rules which must be adhered to in the creation of each password. A minimum of 8 characters is used. The password characters should contain the following:

- At least one uppercase and one lower case letter;
- At least one number;
- At least one non-alphanumeric character (e.g., @%&*).

Any attempt to create a password that violates these rules is captured at the time of attempted creation and the user will be notified and prompted to choose another password that conforms to the rules.

For more information about user passwords see paragraph 4.5.3 of this document.

4.17.2.4 Authorization levels by password

Enilit RTU supports the ability to assign authorization to utilize Enilit RTU's functions and features based on the individual user-created passwords. At a minimum, the following functions and features shall have this assignability available:

- View Data – the ability to view operational data (voltage, current, power, energy, status, alarms, etc.);
- View Configuration Settings – the ability to view configuration settings of the Enilit RTU such as scaling, communications addressing, programmable logic routines;
- Force Values – the ability to manually overwrite real data with manually inputted data and/or the ability to cause a control output operation to occur;
- Configuration Change – the ability to download and upload configuration files to the unit and/or effect changes to the existing configuration;
- Password Management – the ability to create, delete or modify passwords and/or password authorization levels;
- Audit Log – the ability to view and download the audit log.

For more information about User groups (Roles of Users) see paragraph 4.5.2 of this document.

4.17.2.5 Password display

It is not possible to cause Enilit RTU access passwords to be displayed through any means, including configuration software connection and terminal access.

4.17.2.6 Access timeout

Enilit RTU has a timeout feature that revokes all access levels granted through password entry after a period of user inactivity. Inactivity shall be defined as the absence of input keystroke activity on a computer connected to the port of Enilit RTU. The period before the timeout feature activates is settable between 1 and 60 minutes by the user in the configuration of Enilit RTU.

4.17.3 Audit trail

Enilit RTU records events in the order in which they occur. This audit trail is in the form of a file which can be viewed on a computer attached to the diagnostic/maintenance port of Enilit RTU.

4.17.3.1 Storage capability

The audit trail facility has the capability to store more than 10 000 events before the circular buffer begins to overwrite the oldest event with the newest event. There is no capability to erase or modify the audit trail. It is not possible to remove the storage media of the audit trail without permanently damaging Enilit RTU beyond the capability of field repair.

4.17.3.2 Storage record

For each audit trail event, the following information is recorded:

- Event Record Number;
- Time & Date – Time and date of the event will be recorded in a yy/mm/dd/hh/mm format;
- User Identification – the user ID logged into Enilit RTU at the time of the event;
- Event Type.

4.17.3.3 Audit trail event types

The following events shall cause an entry into the Audit Trail record

- Log In – Successful log in;
- Manual Log Out – User Initiated;
- Timed Log Out – Log out of User after defined period of inactivity elapses;
- Value forcing – Operator action that overwrite real data with manual entry and/or causes a control operation;
- Configuration Access – Download of the configuration file;
- Configuration Change – Upload a new configuration file or keystroke entry of a new configuration parameter to Enilit RTU;

- Password Creation – Creation of a new password or modification of the password level of authorization;
- Password Revocation – Revocation of a password;
- Audit Log Access – User access of audit log for viewing or file download;
- Time/Date Change – User request to change time and date.

Keywords	Date and Time	Source	Event ID	Task Category
Audit Success	2013.12.04 08:24:56	Microsoft Windows securi...	4672	Special Logon
Audit Success	2013.12.04 08:24:56	Microsoft Windows securi...	4624	Logon
Audit Success	2013.12.04 08:24:55	Microsoft Windows securi...	4672	Special Logon
Audit Success	2013.12.04 08:24:55	Microsoft Windows securi...	4624	Logon
Audit Success	2013.12.04 08:24:54	Microsoft Windows securi...	4672	Special Logon
Audit Success	2013.12.04 08:24:54	Microsoft Windows securi...	4624	Logon
Audit Success	2013.12.04 08:24:51	Microsoft Windows securi...	4738	User Account Management
Audit Success	2013.12.04 08:24:51	Microsoft Windows securi...	4725	User Account Management
Audit Success	2013.12.04 08:24:47	Microsoft Windows securi...	4672	Special Logon
Audit Success	2013.12.04 08:24:47	Microsoft Windows securi...	4624	Logon
Audit Success	2013.12.04 08:24:46	Microsoft Windows securi...	4672	Special Logon
Audit Success	2013.12.04 08:24:46	Microsoft Windows securi...	4624	Logon
Audit Success	2013.12.04 08:24:47	Eventlog	1102	Log clear

Figure 241. *Audit Trial* log

Policy	Security Setting
Audit account logon events	Success, Failure
Audit account management	Success, Failure
Audit directory service access	Success, Failure
Audit logon events	Success, Failure
Audit object access	Success, Failure
Audit policy change	Success, Failure
Audit privilege use	Success, Failure
Audit process tracking	Success, Failure
Audit system events	Success, Failure

Figure 242. Settings of *Audit Trial*

Enilit CMS, independently from Linux or Windows operating systems, stores some of events in the System Log file. This is important if there is a need to send Security events through IEC or DNP communication protocols to SCADA.

4.17.4 Supervisory monitoring and control

In addition to the Audit Trail capability, Enilit RTU monitors security-related activity and makes the information available, through a real-time communication protocol, for transmission to a supervisory system. If serial communications are used for the configuration of Enilit RTU and the supervisory communications port, separate serial communication ports are provided for configuration and supervisory monitoring.

Configuration port activity neither interferes nor disables the supervisory monitoring port with the exception of a configuration. The information to be monitored and transmitted falls into two groups: Events and Alarms.

4.17.4.1 Events

Events are defined as authorized activities which can be expected to occur in the routine use and maintenance of Enilit RTU. All events can be monitored and transmitted to the supervisory system.

Event points have the momentary capability to detect changes so that the occurrence of an event will be reported on the next scan of Enilit RTU by the supervisory system. Enilit RTU reports each occurrence as an individual event.

4.17.4.2 Alarms

Alarms are defined as activities which may indicate an unauthorized activity. The following activities will cause an Alarm occurrence:

- Unsuccessful login attempt – defined as configured incorrect password entries in succession;
- Reboot;
- Attempted use of unauthorized configuration software.

4.17.5 Configuration software

Enilit RTU has an authentic configuration software. Enilit RTU could not be configured with any software except for those supported by UAB Enilit.

ENILIT RTU configuration software has the ability to assign features to specific users. At a minimum, the following functions and features could be assignable on an individual user basis:

- View Configuration Data – in this mode, a user can only view configuration data. No changes to the configuration can be made.
- Change Configuration Data – in this mode, the user can change and save configuration data to be uploaded to Enilit RTU at a later point in time.
- Full Access – in this mode, all functions, including password changes and user assignment levels can be made.

The configuration software is password controlled so that the software cannot be accessed without the proper password.

All communication ports on Enilit RTU can be enabled or disabled through configuration of Enilit RTU. When disabled through configuration, no communication will be possible through that port.

Abbreviations

ADU	Application Data Unit
APDU	Application Protocol Data Unit
CMS	Configuration and Management Software
CPU	Central processing unit
CS	Clock synchronization
DPC	Double point command
DPS	Double point signal
GI	General interrogation
ICD	IED Capability Description
IED	Intelligent Electronic Device
MV	Measurement value
PLC	Programmable logic controller
PRP	Parallel Redundancy Protocol
RTU	Remote terminal unit
SCADA	Supervisory control and data acquisition
SCL	Substation Configuration Language
SNTP	Simple Network Time Protocol
SPC	Single point command
SPS	Single point signal
TCP	Transmission Control Protocol
UTC	Coordinated Universal Time

Contacts

UAB Enilit	Tel. +370 655 53155
Julijanavos str. 2	Tel. / Fax +370 37 291708
LT-46352 Kaunas	info@enilit.lt
Lithuania	www.enilit.eu
Support e-mail:	support@enilit.lt

