инженерный центр
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Time sync module ENCS-2

Manual

ENCS.681730.001 Manual. Rev 07.2023

Contents

Introduction

This manual of the ENCS-2 Time Sync Module is intended to familiarize the consumer with the technical characteristics, functions and provide information necessary for the proper operation of the ENCS-2. The manual contains technical data, a description of the operation, instructions for installation, installation and use, maintenance, packaging, transportation and storage, as well as diagrams for connecting the ENCS-2 to power supply circuits and digital interfaces. Before starting to work with ENCS-2, it is necessary to read this manual.

Target group

This manual is intended for personnel involved in the design, installation, commissioning and operation of ENCS-2.

Scope of the document

The document applies to ENCS-2 based on the hardware platform produced since 2014 and firmware version 1.12.3 and higher.

Manufacturer

LLC " Engineering Center "Energoservice", Arkhangelsk, 163046, Kotlasskaya str., 26.

Support

If you have any questions related to ENCS-2, please contact technical support:

Official website:	enip2.ru
Telephone:	+7 (8182) 65-75-65
Email:	enip2@ens.ru

Note: Use ENCS-2 only for its intended purpose as specified in this manual.
Installation and maintenance of ENCS-2 is carried out only by qualified and trained personnel.
ENCS-2 must be preserved from impacts.
Connect the ENCS-2 only to a power supply with a voltage corresponding to that indicated on the marking.

Note: The ENCS-2 time sync module in the standard delivery is intended for use on stationary objects.

Attention! The software is constantly being improved and supplemented with new settings of the ENCS-2. The manufacturer reserves the right to make changes and improvements to the software without notifying consumers.

Glossary

- AIS – automated information and measurement system;
- ACS – automated control system;
- ADCS – automated dispatch control system;
- GLONASS – Global Navigation Satellite System;
- GNSS - Global Navigation Satellite System;
- IIS – information and measurement system;
- DAU – data acquisition unit;
- DAS – data acquisition system;
- PC – personal computer;
- HW - hardware;
- GPS - global positioning system;
- IRIG - Inter-range instrumentation group;
- UTC - Coordinated Universal Time;
- PTP – Precision Time Protocol.

1 General information

1.1 Purpose

The ENCS-2 time sync module is designed to measure the current values of time and date (with time correction according to the signals of navigation systems) and transmission of the measured values via digital interfaces.

The current values of time and date are transmitted via RS-232, RS-485 and Ethernet interfaces to automated information and measurement systems (AIS), to automated dispatch control systems (ADCS), personal computers (PC), data acquisition systems (DAQ System), telemechanic control points, DAQ devices, multifunctional measuring transducers to set or synchronize the current time and date values.

The source of time signals for the ENCS-2 is a navigation receiver.

1.2 Legend

Figure1.1. ENCS-2 front side

The current version of ENCS-2 is available in modifications ENCS-2 and ENCS-2T, which differ from each other in the reference oscillator (crystal oscillator and oven-controlled crystal oscillator, respectively). The ENCS-2 symbols also contain information about additional parameters: power, interfaces and other functions.

Symbol of modifications produced from 2022:

Additional options:

- PTPv2.encs2 –IEEE 1588-2008 protocol support;

1.3 Design and dimensions

1.3.1 ENCS-2 is made in a plastic case designed for mounting on a 35 mm DIN rail.

There are symbols of terminals and connectors (power, protective ground, ports), LED indicators (control of port operation), controls of the built-in display on the device front panel. Information about the device name, modifications, serial number, date of manufacture, the type of supply voltage in models manufactured after 2018 is presented in QR code on front panel and on the nameplate located on the device top panel.

The power should be connected to the screw terminals 1 and 2. It is necessary to have a protective ground, connected to the clamp 3, indicated by the symbol: ⊕

The device has an SMA connector for antenna, RJ45 connectors, and a 1 Hz pulse output (PPS) with an SMA connector.

1.3.2 The ENCS-2 dimensions are shown on fig. 1.2.

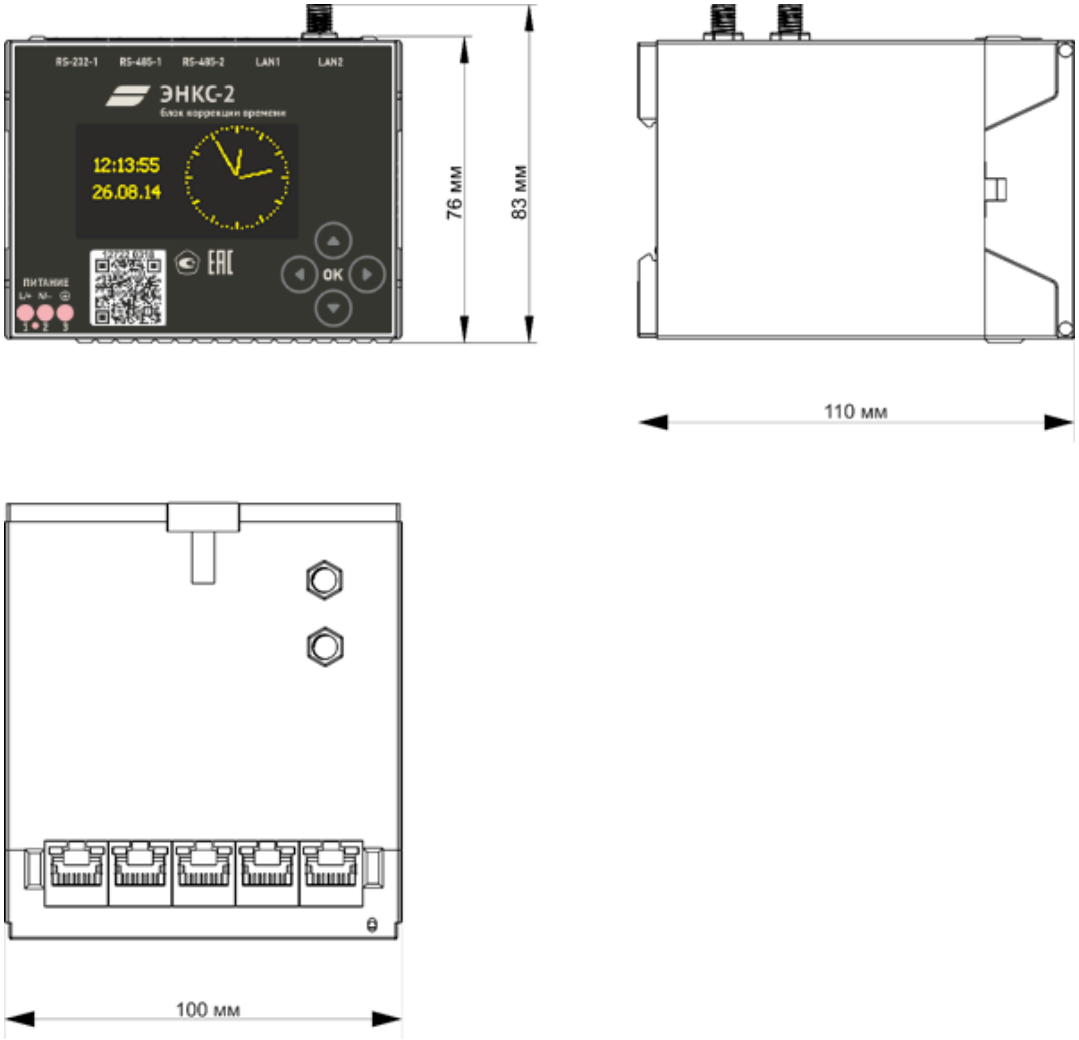


Figure 1.2. Dimensions of ENCS-2

1.4 Principle of operation

The device consists of a navigation receiver and the following modules:

- precise time signal processing unit,
- I/O unit,
- power supply unit.

A simplified block diagram of the device is shown on Fig. 1.3

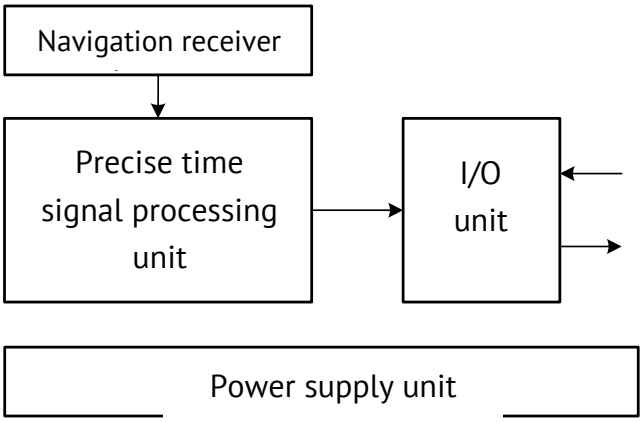


Figure 1.3. Block diagram of ENCS-2

After the power is applied, the navigation receiver collects information about the satellites and synchronizes the internal clock according to the signals received by the satellites. In bad conditions for a radio signal receiving (depending on the position of the satellites at the time of power supply), this process can take up to 600 seconds. The accuracy and quality of the navigation receiver located in the unit depends on the number of satellites simultaneously in the line of sight of the antenna. A minimum of four satellites are required for correct operation.

In case of loss of communication with satellites, or breakdown/malfunction of the antenna or cable, synchronization commands will not be stopped (except for IRIG and NMEA protocols, if the synchronization function without satellites is not active), but after 10 minutes the inauthenticity flag is set in the timestamps sent to the synced devices. Synced devices ignore such timestamps and after a specified period of time they assign a inauthenticity flag to the transmitted measurement and calculation results.

To check the status of the satellite signal, go to the Status menu on the device screen (see Fig. .5). If the signal from the satellites is successfully received, the synchronization status will be set to "yes".

2 Specifications

2.1 Metrological characteristics

The metrological characteristics of ENCS-2 are shown in Table 2.1.

Table 2.1

Parameter	Value
Limits of permissible absolute error of synchronization of the 1Hz output pulse signal edge to the national time scale UTC (SU) in the synchronization mode by GLONASS/GPS signals, ns	±150
Limits of permissible absolute error of synchronization of the **IRIG-A(B)** format code sequence front edge in the synchronization mode by GLONASS/GPS signals relative to the national time scale UTC (SU), ns	±150
Limits of permissible absolute error of synchronization of the generated time scale with the national time scale UTC (SU) via the **SNTP** protocol on the Ethernet interface in synchronization mode by GLONASS / GPS signals, μs	±100
Limits of permissible absolute error of synchronization of the generated time scale with the national time scale UTC (SU) via the **PTP protocol** on the Ethernet interface in synchronization mode by GLONASS/GPS signals, ns	±250
Limits of permissible absolute error of the generated time scale storage per day, ms for modification of ENCS-2 for modification of ENCS-2T	 ±20 ±1,0
Minimum quantum of correction and time scales, ns	11
Recalibration interval	2 years

2.2 Interfaces

2.2.1 The symbols and type of ENCS-2 connectors are shown on Fig. 2.1 and in table. 2.2.

Figure 2.1. ENCS-2 connectors and interfaces

Table 2.2

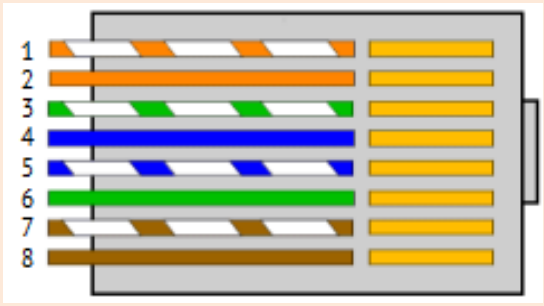
Symbols	Connector type	Interfaces	
		ЭНКС-2-...-**A2B1E2**	ЭНКС-2-...-**A2B2E1**
XP1	RJ45	RS-232-1	RS-232-1
XP2	RJ45	RS-485-1	RS-232-2
XP3	RJ45	RS-485-2	RS-485-1
XP4	RJ45	LAN 1 (Ethernet)	RS-485-2
XP5	RJ45	LAN 2 (Ethernet)	LAN 1 (Ethernet)
XP6	SMA	Antenna input	Antenna input
XP7	SMA	PPS Output	PPS Output
X1	Screw terminals	Power	Power

2.2.2 ENCS-2-...-A2B1E2 has two Ethernet ports that can operate in one of the following modes:

- Two independent ports, each with its own IP and MAC addresses;
- Redundancy PRP.

2.2.3 The RJ45 connectors pinout is shown in Table 2.3:

Table 2.3

Interface	Signal	RJ45 pins	
RS-485	A (data+)	7	
	B (data-)	8	
	GND	5	
RS-232	Rx	3	
	Tx	4	
	GND	5	
Ethernet	TX+ (Transmit Data+)	1	
	TX- (Transmit Data-)	2	
	RX+ (Receive Data+)	3	
	RX- (Receive Data-)	6	

2.2.4 Default interface settings:

- RS-232: 19200, even, IEC-60870-5-101 protocol;
- RS-485-1: 19200, even, NMEA protocol;
- RS-485-2: IRIG-A protocol;
- LAN1: 192.168.0.10;
- LAN2: 192.168.0.11.

2.3 Operating Conditions

The ENCS-2 operating conditions are shown in Table 2.4

Table 2.4

Parameter	Value
Ambient temperature, °C	-40...+70
Humidity without condensation, %, not more than	98
Atmospheric pressure, kPa	70... 106

In terms of resistance to ambient temperature and humidity during operation, according to GOST 26.205-88, corresponds to group B4.

The operation mode of ENCS-2 devices is continuous. The duration of continuous operation is unlimited. The time of the operating mode (preheating) setting in order to ensure metrological characteristics is not more than 15 minutes.

2.4 Power supply

The characteristics of the ENCS-2 power supply are shown in Table 2.5

Table 2.5

Parameter	Value
For modifications of ENCS-2-1.1.1-..., ENCS-2-220-...	
Power Supply AC Input Voltage Range	~100...265 V, 45... 55 Hz
Power Supply DC Input Voltage Range	=120... 370 V
Power consumption, not more than	10 VA
For modifications ENCS-2-2.1.1-..., ENCS-2-24-...	
Power Supply DC Input Voltage Range	=18...36 V
Power consumption, not more than	10 W
For modifications of ENCS-2-3.1.1-... , ENCS-2-110-...	
Power Supply DC Input Voltage Range	=55... 160 V
Power consumption, not more than	10 W

2.5 Reliability

The average time between failures of ENCS-2 devices under normal conditions is 120,000 hours.

The total average service life of ENCS-2 devices is at least 30 years.

2.6 Display

The display characteristics are shown in Table. 2.6.

Figure 2.2. The main display screen of the ENCS-2

Table 2.6

Parameter	Option 1	Option 2
Display type	Monochrome OLED	Monochrome OLED
Screen size, dots	128x64	128x64
Diagonal ″	2,42	0,96
Update period, sec	1	1

The main screen of ENCS-2 displays the current time and date in digital format, as well as the time in analog form. Additionally, the message "no sync" may be displayed when there is no synchronization, the message "sim" may be displayed when the satellite simulation mode is enabled. All screens are described in Section 6.4.

To preserve the lifetime of the display, it is recommended to use the screensaver mode. The display saving mode turns on after 1 hour, the display shows the date and time in digital form, which change their position on the screen every minute. The main screen turns on when you press any button on the device or after rebooting.

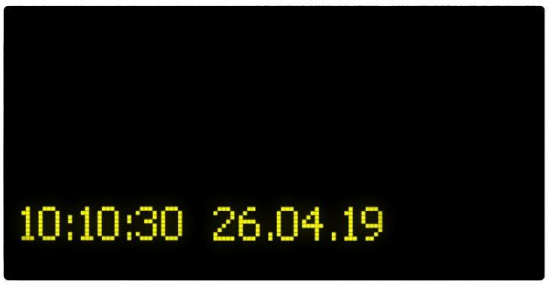


Figure 2.3. Screensaver mode

3 Synchronization protocols

3.1 General Information

The synchronization protocols available for each of the interfaces are shown in Table 3.1

Table 3.1

Interface	Protocols
RS-232-1	NMEA 0183, IEC 60870-5-101-2006
RS-232-2*	NMEA 0183, IEC 60870-5-101-2006
RS-485-1	NMEA 0183, IEC 60870-5-101-2006
RS-485-2	IRIG-A, IRIG-B, PPS
Ethernet	SNTP, PTPv2 (option for ENCS-2-...-A2B1E2)
TTL	PPS

* - the RS-232-2 interface is available only for ENCS-2-...-A2B2E1 modifications discontinued in December 2019, there is no RS-232-2 interface in the ENCS-2-...-A2B1E2 modification.
For ENCS-2 2014-2015 release (hardware version hw 1), only the NMEA 0183 protocol is available for RS-232-2.

To test the ENCS-2 protocols, when it is not possible to connect an antenna, the device provides for setting up a simulation of satellites. When it is turned on, all protocols of the device will transmit information about the date and time with signs of reliability. The display will show the message "sim".

3.2 IRIG

The ENCS-2 is able to convert the precise time signals received from GLONASS/ GPS into the following formats and forms of time codes according to the IRIG 200-04 standard:

- IRIG-A is a modified protocol for synchronizing devices manufactured by Energoservice: ENIP-2 PMU, ENMV-3, ENMU;
- IRIG-B is a standard protocol with a 004 frame format;

The ENCS-2 sends time codes according to the IRIG standard via the RS485-2 interface (the choice between PPS and IRIG is configurable), the signal level is 5 V.

3.3 NMEA 0183

As part of the NMEA 0183 protocol, the ENCS-2 supports the transmission of the following NMEA messages (v2.0 specification):

- **RMC (**Recommended Minimum) is a proprietary version of NMEA protocol messages that contains the required minimum information about location, speed and time (position, velocity, time), format and example message:

  *$--RMC,hhmmss.ss,A,GGMM.MM,P,gggmm.mm,J,v.v,b.b,ddmmyy,x.x,n,m*CC<CR><LF>*

Designation	Description
$--RMC	Header for RMC messages
hhmmss.ss	UTC location time: hours "hh", minutes "mm", seconds "ss. ss». The length of the second fraction varies.
A	Status: "A" - data is reliable, "V" data is unreliable
GGMM.MM,P	Latitude: "GG" - degrees, "MM.MM" - whole minutes, minutes fraction, "P" - "N" for north or "S" for south latitude
gggmm.mm,J	Longitude: "ggg" - degrees, "mm.mm" - whole minutes, minutes fraction, "J" - "E" for east or "W" for west longitude
v.v	Velocity relative to the ground in knots
b.b	Path angle (velocity direction) in degrees
ddmmyy	Date: Day, Month, Year
x.x,n,m	Magnetic declination
***CC**	The checksum, always starts with the "*" symbol
<CR><LF>	End of message LF (line feed, 0x0A) or CR (carriage return, 0 x0D)

- **ZDA** (Data and Time) – messages that transmit information about the date and time; message format and example:

  *$--ZDA,hhmmss.ss,dd,mm,yyyy,xx,yy*CC<CR><LF>*

Designation	Description
$--WHETHER	Header for ZDA messages
hhmmss.ss	Time in UTC: «hh» - hours, «mm» - minutes, «ss.ss» - seconds
dd,mm,yyy	Day, month, year
Xx	Clock correction for local time: -13...13
yy	Correction in minutes for local time: 0...59
***CC**	Checksum
<CR><LF>	End of message

- **GGA** (Global Positioning System Fix Data) – данные о последнем зафиксированном местоположении (координаты, диагностика):

  *$--GGA, hhmmss.ss, GGMM.MM,P, gggmm.mm,J, x6, xx7, x.x8, x.x9, x.x10, x.x11, xxxx12*CC<CR><LF>*

Designation	Description
$--GGA	Header for GGA messages
hhmmss.ss	Time of data capture in UTC: hours "hh", minutes "mm", seconds "ss. ss»
GGMM.MM,P	Latitude: Degrees "GG", whole minutes, after the dot fractional fraction of minutes "MM. MM", "P" - "N" for north or "S" for south latitude
gggmm.mm,J	Longitude: Degrees "ggg", whole minutes, after the fractional fraction of minutes "mm. mm", "J" to "E" for east or "W" for west longitude
x6	Method of coordinates calculating
xx7	Number of active satellites
x.x8	Geometric factor, HDOP
x.x9	Altitude above the sea level in meters
x.x10	Geoid height above the ellipsoid WGS 84. Empty field.
x.x11	The time since the last DGPS correction was received. Empty field.
xxxx12	The ID of the base station that provides the DGPS corrections. Empty field.
***CC**	Checksum
<CR><LF>	End of message

The time format for all supported frames types within the NMEA protocol can be selected between "hhmmss.ss" and "hhmmss".

3.4 PPS

The ENCS-2 supports 1PPS signal output, the characteristics are indicated in Table 3.2:

Table 3.2

Parameter	Value
Interfaces	RS-485-2, TTL
Pulse length, µs	0,01...600000; default is 100
Polarity	direct or reverse
Displacement, µs	-600000... 600000; default is 0

3.5 PTPv2

3.5.1 ENCS-2-X-A2B1E2 optionally support IEEE 1588-2008 protocol, also called as Precision Time Protocol version 2, or PTPv2.

3.5.2 Additional parameters for tuning of PTPv2 on the ENCS-2 are shown in the Table 3.3. The available options allow you to configure the PTPv2 protocol settings in accordance with IEC/IEEE 61850-9-3:2016: "Precision time protocol profile for power utility automation", known as Power Utility Profile.

Table 3.3

Parameter	Possible values	Recommended values
Type	Layer 2 (Ethernet)	Layer 2 (Ethernet)
Domain	0... 127	0
Delay mechanism	Peer-to-peer, end-to-end	Peer-to-peer
Operation mode	One step, two step	two step
Sync interval	0.125, 0.25, 0.5, 1, 2, 4, 8, 16 sec	1
Announce interval	0.125, 0.25, 0.5, 1, 2, 4, 8, 16 sec	1
VLAN ID	0... 4095	>1

3.5.3 Available modes of operation:

- Master Clock - ENCS-2 receives signals from satellite systems and sends synchronization commands to devices in the local network.
- Slave Clock – ENCS-2 receives signals from the PTP clock in the local network and synchronizes other devices using all available protocols: PPS, IRIG-A/B, SNTP, NMEA, etc. ENCS-2 receives time information from satellite systems and compares it with the time received from the local network via PTP. Information about the difference in hours is available in the "SNMP Diagnostics" section of "ENCS Configurator" software:

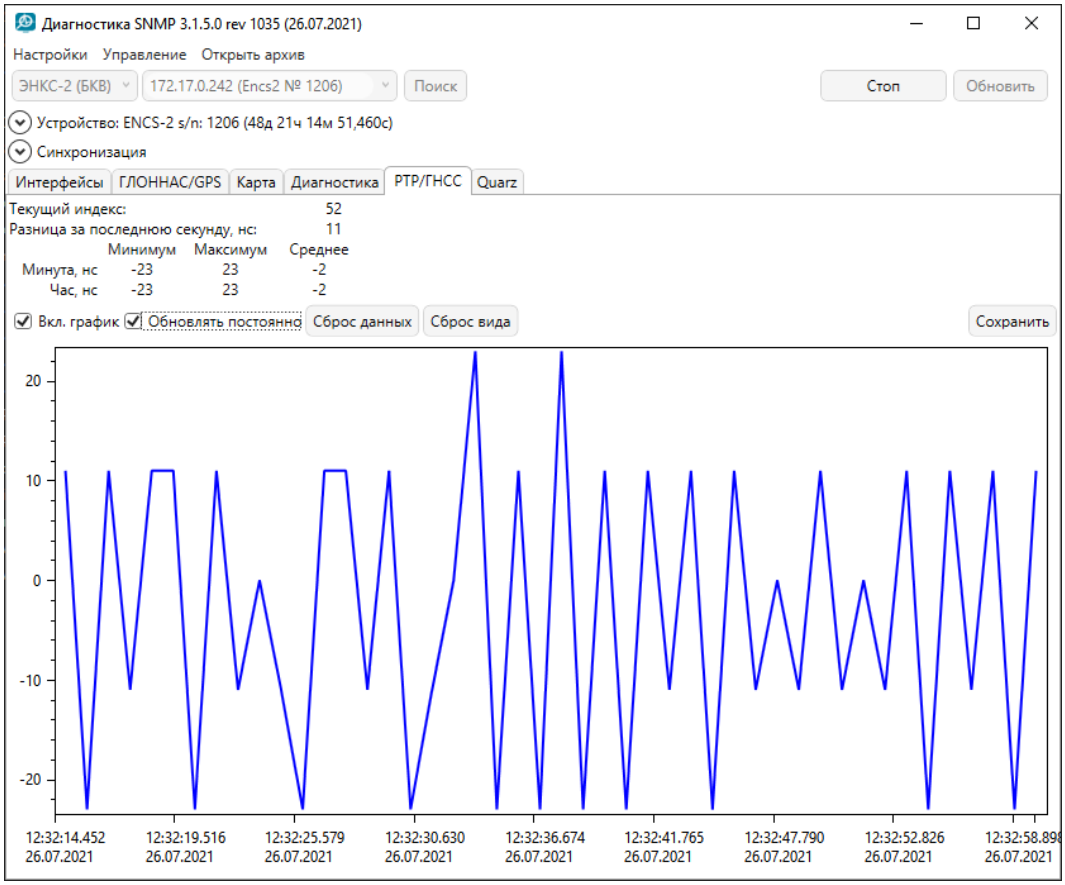


Figure 3.1. Statistics of the clock difference between PTP and GLONASS/GPS

3.5.4 For PTP to work correctly, all network equipment between the ENCS-2 and the synchronized device must support this protocol.

3.5.5 You can determine if there is an option in the device using the ENCS Configurator software during identification, or the corresponding marking on the top panel of ENCS-2:

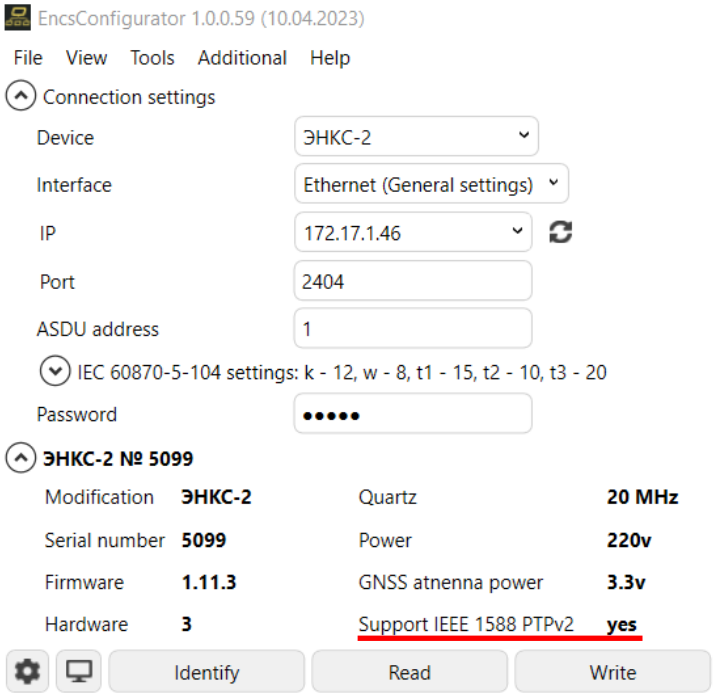


Figure 3.2. Identification of ENCS-2 with PTP support

3.6 SNTP

ENCS-2 supports SNTPv4 synchronization protocol. The ENCS-2 can act as an SNTP server or send Multicast packets.

ENCS-2 is capable to process up to 10,000 NTP requests per second.

3.7 IEC-60870-101

As part of the IEC-60870-101 protocol, ENCS-2 supports the C_CS_NA_1 (103) synchronization command. The synchronization interval is from 1 minute to 45 days.

Broadcast or address synchronization is available.

4 Package contents

Time sync module ENCS-2	-1
GNSS antenna* with optional cable (10, 20 or 50 m)	-1
ENCS-2. ENCS.681730.001 PC	-1

*Antenna, cable and bracket are optional extras and are not included in the base price.

The necessary documentation, as well as software updates, are always available on the website: enip2.ru

5 Operation

5.1 Operating instructions

5.1.1 Operation of ENCS-2 devices must be carried out in accordance with this operating manual.

5.1.2 ENCS-2 is not designed to operate in an explosive and chemically active environment that corrodes metals and coatings.

5.1.3 During operation, ENCS-2 should not be exposed to direct heating up to temperature of more than +70 °C. There should be no sharp temperature fluctuations in the room, there should be no sources of strong electromagnetic fields near the installation site of the device.

5.2 Before mounting

Make sure that packing has no defects.

Unpack, remove ENCS-2, perform an visual inspection, make sure that there is no visible mechanical damage and package contents is in accordance with section 4 of this manual.

Check the compliance of the characteristics specified in the passport with the characteristics indicated on the front side of the device.

5.3 General instructions and safety measures during mounting

5.3.1 All mounting and operation work should be carried out in compliance with the current rules that ensure the safe maintenance and operation of electrical installations. Installation must be carried out by personnel with appropriate qualifications.

Work on the roof of the building is a high-risk work and is carried out according to the work permit, with the use of protective equipment by employees against falling from a height (safety belt and safety rope).

Attention! It is forbidden to work on the roof in rain, snowfall and fog, at nightfall, during a thunderstorm and its approach, with a wind exceeding 12 m/s, in the presence of icing. In the dark, it is allowed to carry out work in the presence of sufficient artificial lighting of the workplace and under the guidance of the head of the structural unit.

- The device is mounted on a 35 mm DIN rail using the built-in mount.
- Connect the power supply circuits with a no more than 2.5 mm^2 wires.

5.3.2 Connection of information networks

Depending on the tasks, the ENCS-2 has several different interfaces to ensure clock synchronization on third-party devices. For a complete list of interfaces and supported protocols, see Section 2.2 In this regard, we can offer the following recommendations for the organization of information networks:

- TIA/EIA-485-based network;

To lay the information network, use a shielded cable (double screen - braid + foil is recommended) of the "twisted pair" type. The cores cross-section is 0.5-0.6 mm^2 (24 AWG).

With a long cable length, it is recommended to install terminating resistors (terminators) with a nominal value of 100 ... 120 ohms at the ends of the line.

- TIA/EIA-232-based network;

To lay the information network, use a shielded cable (double screen - braid + foil is recommended) of the "twisted pair" type. The cores cross-section is 0.5-0.6 mm^2 (24 AWG).

The communication line is no more than 15 m.

For a list and assignment of pins on the connectors, see section 2.2

5.3.3 Recommendations for protection

It is recommended to install appropriate types of surge protective devices on the power supply circuits and information interfaces.

For example, to protect RS-485 interface, use ESP-485-X (where X is the number of channels; it's manufactured for one or two channels).

To fully protect the equipment from surge voltages, it is also necessary to ensure the protection of the power supply circuits.

5.4 Antenna

The GNSS antenna shall be placed motionless outside the building at roof level so that there are no obstructions in all directions (e.g. buildings, radio masts, etc.) in the range from the antenna horizon to an angle of 10°. It is allowed to install the antenna using antenna masts, subject to the condition of its immobility, orientation and leveling.

The installation site of the antenna must be removed from objects that reflect signals from satellites (grids, extended metal surfaces, etc.). In addition, for reasons of lightning protection, the antenna should not be installed above grounded metal structures placed on the roof - antenna masts, exhaust pipes, lightning rods, etc.

When mounting the antenna bracket, the following requirements must be met:

- the vertical axis of the bracket is leveled;

- The mounting method provides a long-term (more than 5 years) stable position of the bracket.

5.5 Antenna cable

The following requirements must be met for the antenna cable:

- The length of the antenna cable should be as short as possible. The maximum permissible length is 50 meters when using GPS-P.X. When using other types of antennas and cables, the maximum length is calculated based on the antenna gain and attenuation characteristics of the cable.
- The cable entry into the building must be securely sealed;
- When laying the cable on the mounting structures, it must be rigidly fixed, cable breaks are not allowed;

To protect the antenna input, we recommend using protection devices:

- lightning protection for coaxial cable with DGA G SMA (DEHN) SMA connectors;
- ESP-GN;

It is recommended to place protection devices near the protected equipment. When designing cable routing to the protected equipment, it is necessary to avoid joint parallel runs of the protected and unprotected sections of the cable, as well as the protected cable and the grounding conductor. The grounding conductor (cross-section not less than 4 mm^2) shall be as long as possible.

5.6 Signal delay accounting

5.6.1 ENCS-2 can be used with various GLONASS/GPS receiving antennas, as well as cables of different types and lengths.

The timing accuracy is comparable to the signal delays in the cable, so it is recommended to consider the delay in the antenna and antenna cable.

5.6.2 When setting up ENCS-2, the total signal delay to the device is defined. It consists of a delay in the antenna P_a and a delay in the cable P_k. Moreover, both compensation for the signal delay in the connection cable P_{k1}, and, if necessary, in the interface cable P_{k2} of the pulse signal 1 Hz (1PPS TTL). The total signal delay is calculated using the following formula:

$P = P_a + P_{k1} + P_{k2}$

- The delay in the antenna (P_a) is indicated in the manufacturer's documentation. Usually this value is insignificant compared to the error of ENCS-2 and can be neglected.
- The delay in the cable (P_k):

– Specified in the manufacturer's documentation for the cable;

– It is calculated on the basis of known data on the length and type of cable according to the formula

T = (L·k)/C,
where T is the delay of the signal in the cable, s;
L – cable length, m;
k – wavelength shorting coefficient;
C – speed of light in vacuum, m/s
For example, in an RG-58 antenna cable with a length of 25 m, the delay will be T= (25*1,28)/299792458 = 106,7 ns;

– With unknown parameters, the cable is assumed to be equal to 5 ns for each meter of cable length.

5.6.3 In the ENCS-2 settings, using the ENCS Configurator software, the total value of the correction in nanoseconds is entered in the "Clock correction" field.

5.7 RS-485 networking

5.7.1 For the stable operation of the RS-485 line during commissioning, it is necessary to perform line conditioning and to eliminate uncertainty.

5.7.2 Example of RS-485 line conditioning

Below is an example of 150 meter length line conditioning, cable type UTP, 24 AWG. Synchronization pulses are transmitted along the line within the IRIG-A standard. For clock pulses, it is necessary to strictly maintain the frequency and filter out the pulses that occur in the result of reflection from the end of the line.

- The mismatched line is in the video (Fig. 5.1) shows that the pulse duration changes dramatically by 2 μs, which can lead to the discarding of the packets by the receiving devices, due to the lack of synchronicity of the transmitted pulses. There is also a "step" directly above the receiver operation threshold, which, under slightly worsened conditions, can add to a state of uncertainty and will also affect the time of fixation of the incoming pulse by the receiver. In general, in laboratory conditions, work on such a line is quite possible, but for real objects it will be useful to carry out measures to coordinate the line.

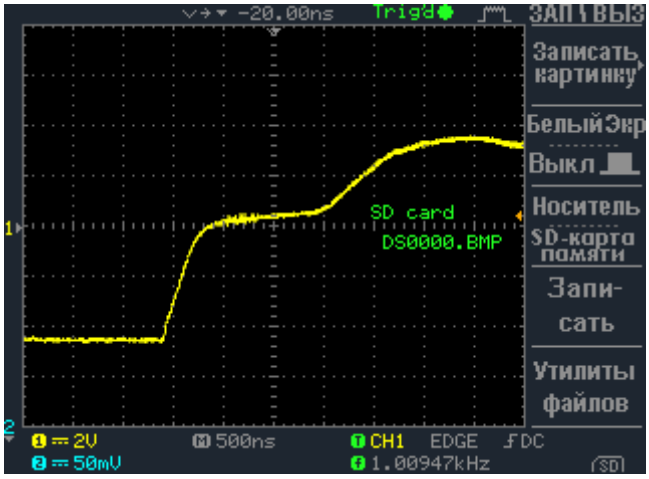


Figure 5.1. Mismatched line. Video: enip2. ru/files/rs485_01. zip

- Installation of "guy wires" at the end of the line - connecting 5 V through a resistance of 1 kohm to the signal cores allows you to slightly increase the pulse front above the trigger threshold and significantly stabilize the pulse time, but this picture is far from ideal.

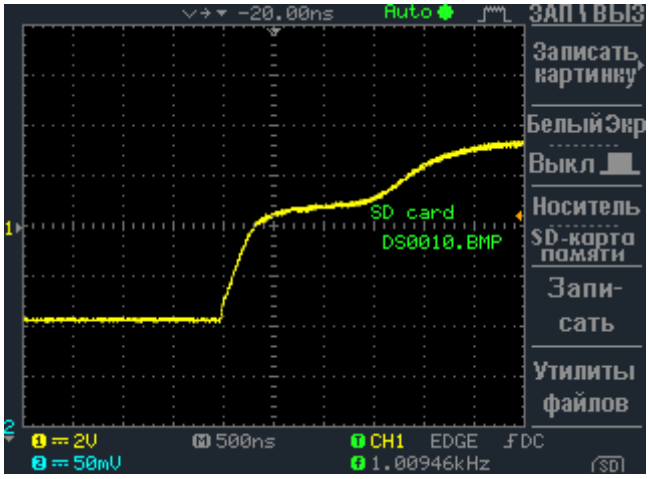


Figure 5.2. Line with “guy wires” 1 kohm. Video: enip2. ru/files/rs485_02. zip

- Line conditioning with a resistance of 1 kohm - the difference in the result with the previous method of improving the quality of signal reception on the line is small, which indicates that the resistance ratings for this line are not selected correctly.

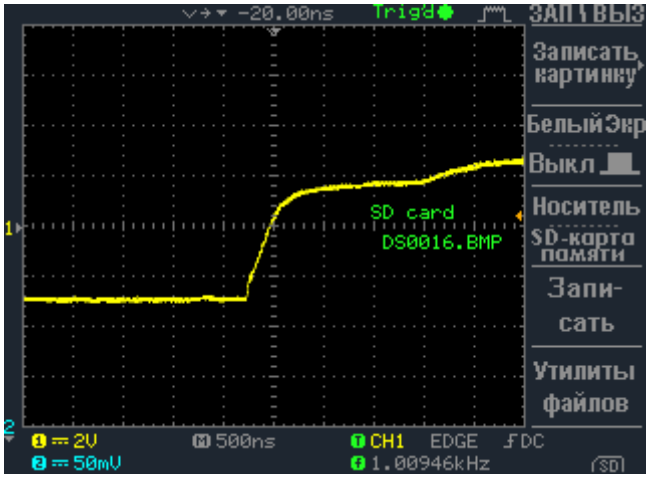


Рисунок 5.3. Line conditioning, 1 kohm. Видео: enip2. ru/files/rs485_03. zip

- Line conditioning with a resistance of 120 ohms - in the video we can observe an improvement in the shape and synchrony of the pulse, as well as a significant excess over the trigger threshold. In this case, we can say that the task of improving the quality of reception on the line has been completed.

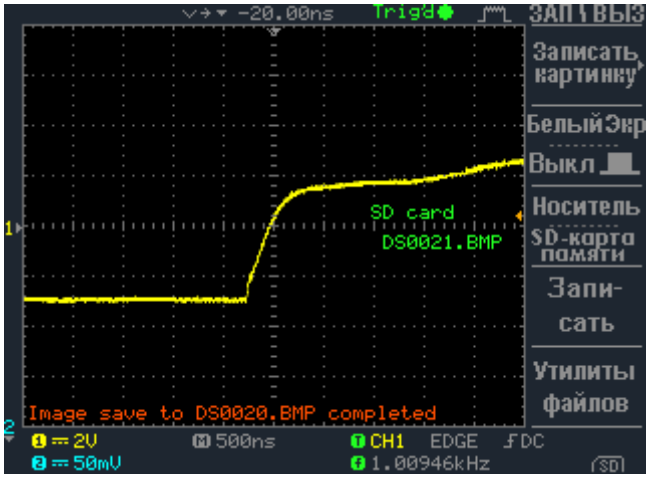


Рисунок 5.4. Line conditioning, 120 ohm. Video: enip2. ru/files/rs485_04. zip

5.8 Connecting to a local network

When using ENCS-2 as an SNTP server or PTP source, you need:

- enable the required protocol in the ENCS Configurator software;
- set the required IP address (or obtain it from the DHCP server) and port (for SNTP, the default is 123).

A gateway and subnet mask are not required to work in this mode, because the sender's IP address and MAC are taken from the incoming request. (see 5.5).

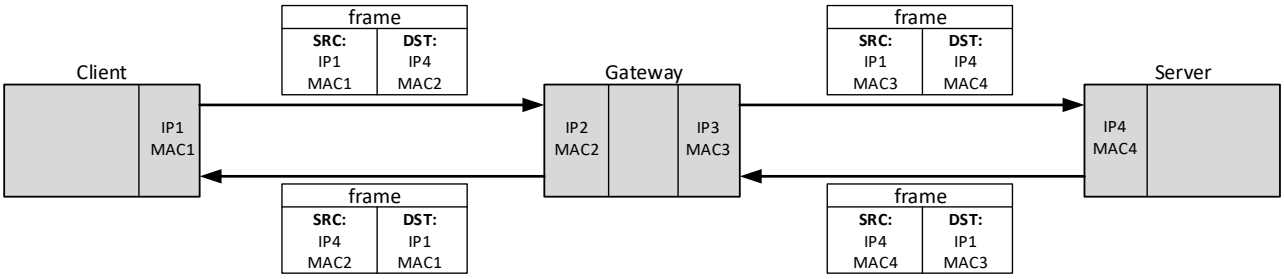


Figure 5.5. An example of passing frames when requesting from a different subneta

6 Configuration

You can configure the parameters of synchronization with satellites and protocols for communication interfaces in ENCS-2.

Note: To configure the ENCS-2, you need a computer equipped with an Ethernet port with the operating system Windows 7 or later.

6.1 Firmware update

ENCS-2 is constantly being improved, new features appear. The latest versions of software and firmware can be downloaded from our website https://enip2.ru/en/. Use ESBootloader software to update firmware and perform other service operations with devices.

To update the firmware in the ENCS-2 connect to device via on of following ports:

- RS-232-1;
- RS-485-1;
- LAN.

Run the program "ESBootloader". Select the desired device type, COM port interface or Ethernet.

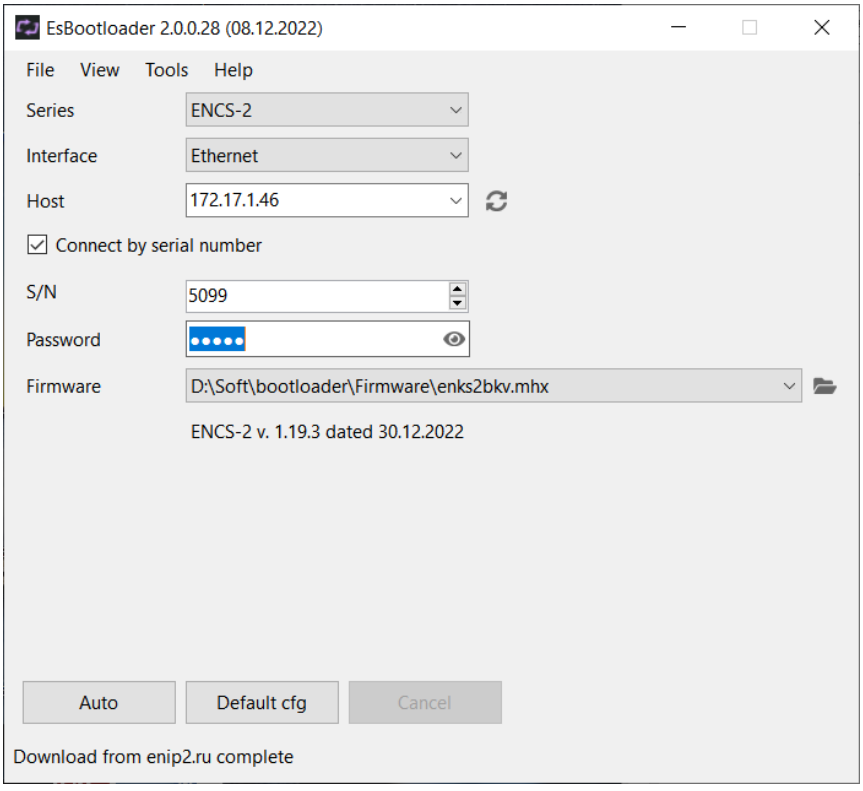
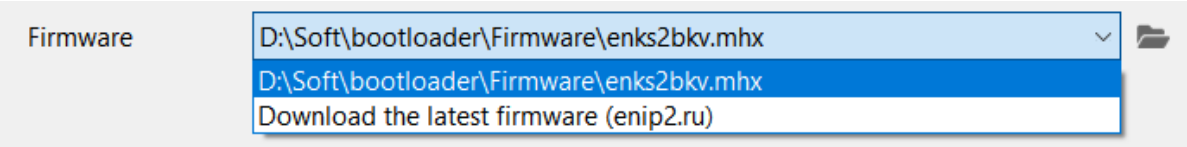


Figure 6.1. The interface of the "ESBootloader" software

- To connect via a serial port, specify the serial port number, you can leave 19200 baudrate, address 0;
- To connect via Ethernet, specify the IP address of the device, or its serial number (in this case, the device will be temporarily assigned the IP address specified in the IP field).
- Specify the path to the firmware file using the **File** -> **Open** menu, the button , the Drag-and-drop function, or automatically download the latest version:



In the Firmware line, the path to the firmware file will be displayed, below the device type and the new firmware version will be indicated (see Fig. 6.1).

To start flashing the device in automatic mode, click the "Update" button. The procedure for erasing the current firmware from the device, writing a new one, and checking the recorded firmware will begin. If, after clicking on the "Update" button, the flashing process has not started, remove and then apply power to the device again.

6.2 Finding a device on the local network

The "ES Find IP" utility is used to detect devices manufactured by Energoservice in the local network.

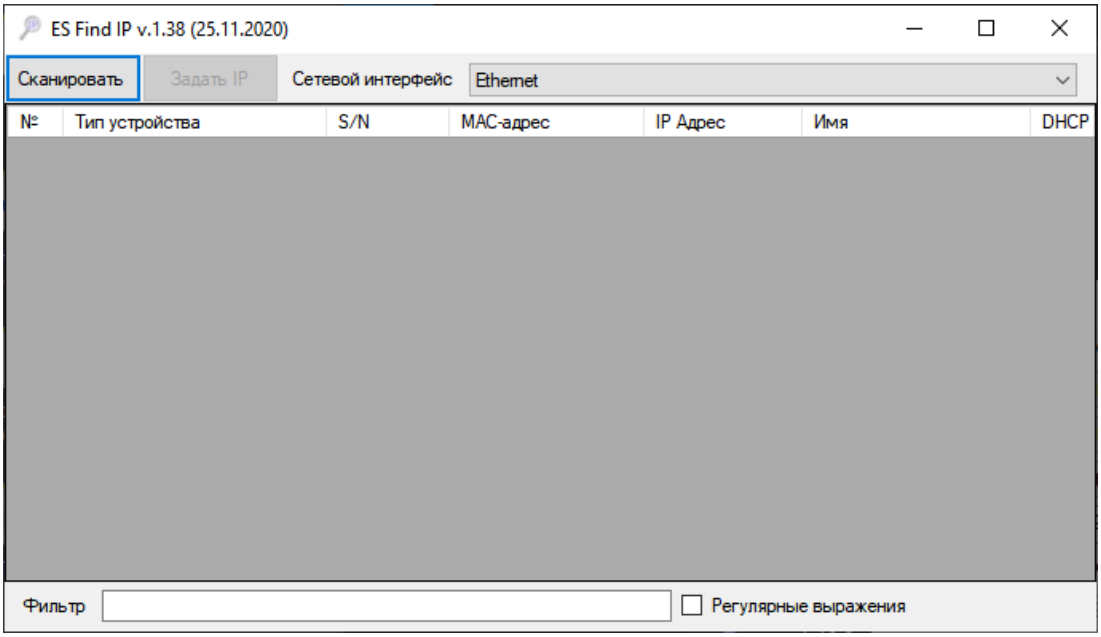


Figure 6.2. «ES Find IP» utility window

To start, you need to run the ESFindIP.exe. Next, you need to click the "Scan" button, after which all devices detected in the local network will be displayed.

To change the IP address, you must right-click on the line with the device and select the "Set IP" item in the context menu (see Fig. 6.3)

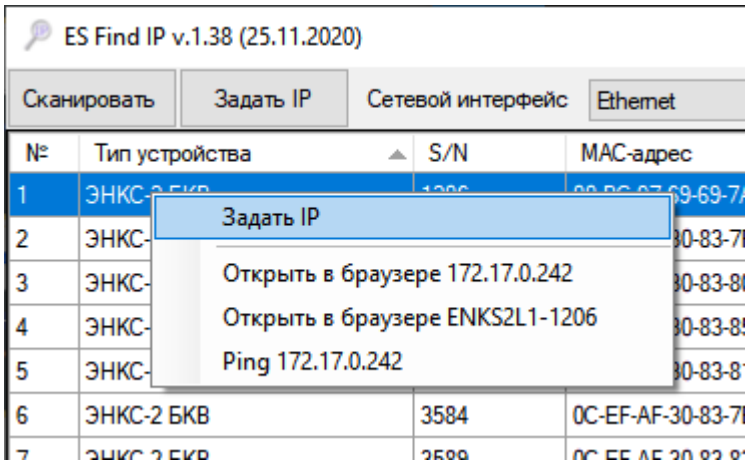


Figure 6.3. «ES Find IP» utility window

In the "Filter" field, you can enter a criterion for searching for any of the fields.

6.3 Reset settings to default values

To reset the device to default values, you need a PC with the ESBootloader utility installed.

Connect the device to the computer via the COM port, run the ESBootloader software, set the connection parameters, click the «Default" button. The device settings will become factory.

6.4 Control of ENCS-2 from the front panel

The time sync module is controlled by five buttons located in the lower right part of the front panel housing (see Fig. 6.4).

Figure 6.4. ENCS-2 control buttons

To switch between categories, use the buttons: "Up", "Down". To display the contents of the category, use the "OK" button, to exit the category to the list of categories - the "Left" button.

By default, the password 112 is used to enter the "Settings" menu. When typing a password, to change the characters, use the keys: "Up" and "Down", to move to the next character, use the "Right" key. At the moment, you can set the IP address, enable/disable DHCP on the LAN port, set speed for ports, time zone setting, protocol selection on the RS-485-2 port.

Below is a block diagram of the menu.

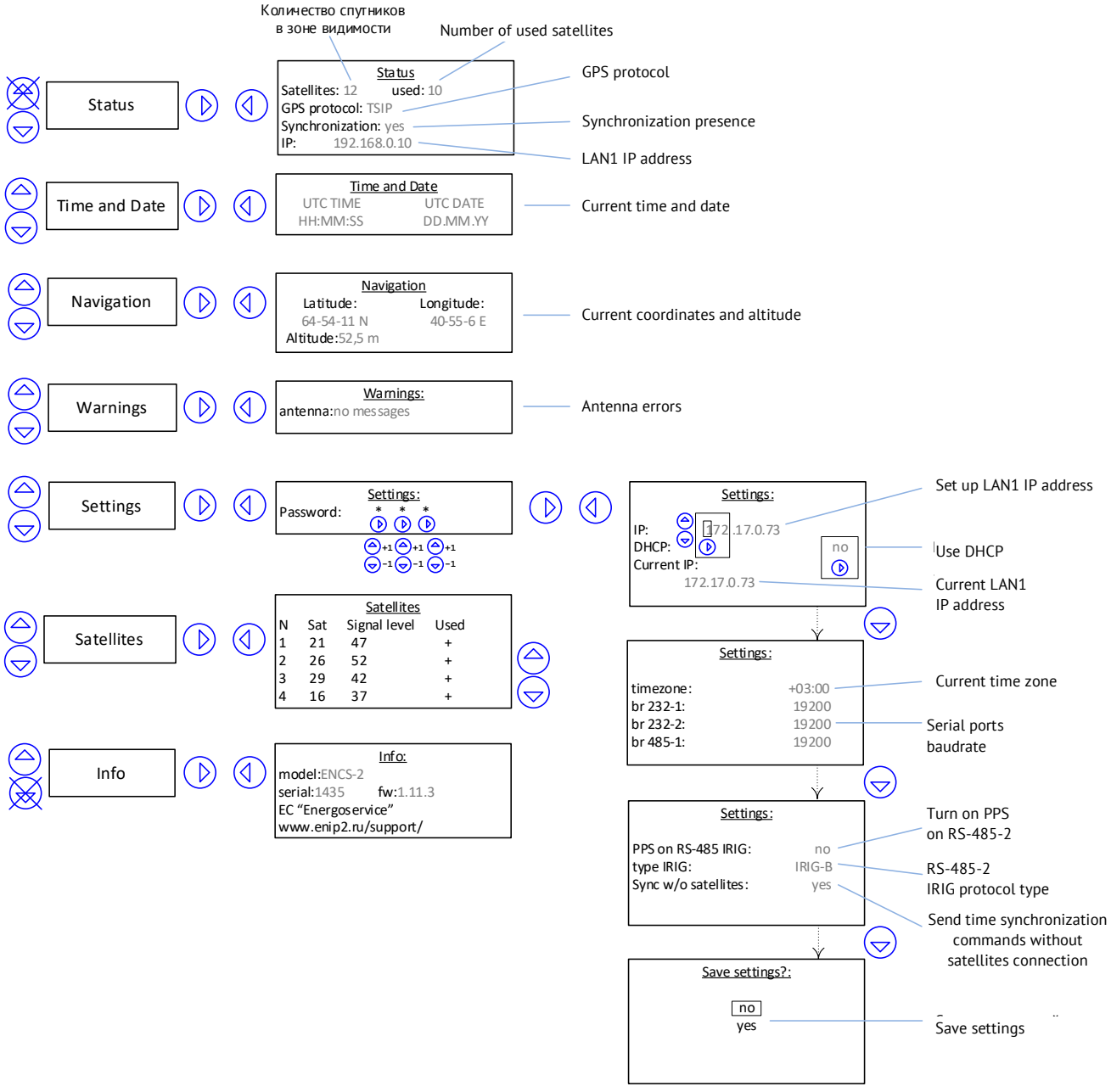


Figure 6.5. Block diagram of the ENCS-2 menu on built-in display

6.5 Configuring

The "ENCS Configurator" software is designed to configure devices of the ENCS series. For a full description of the ENCS Configurator software, see ENCS.411187.002 manual

Attention! The software is constantly being improved and supplemented with new functional settings. The manufacturer reserves the right to make changes and improvements to the software without notifying consumers.

To install, you need to copy the working folder of the program to any location in the directory of the computer's hard drive.

The .NET Framework 4 must be installed for the software to work. You can download it from the official website: www.microsoft.com/downloads.

To run the program, you must run the EncsConfigurator.exe.

When you start the program, the following window opens (see Fig. 6.6):

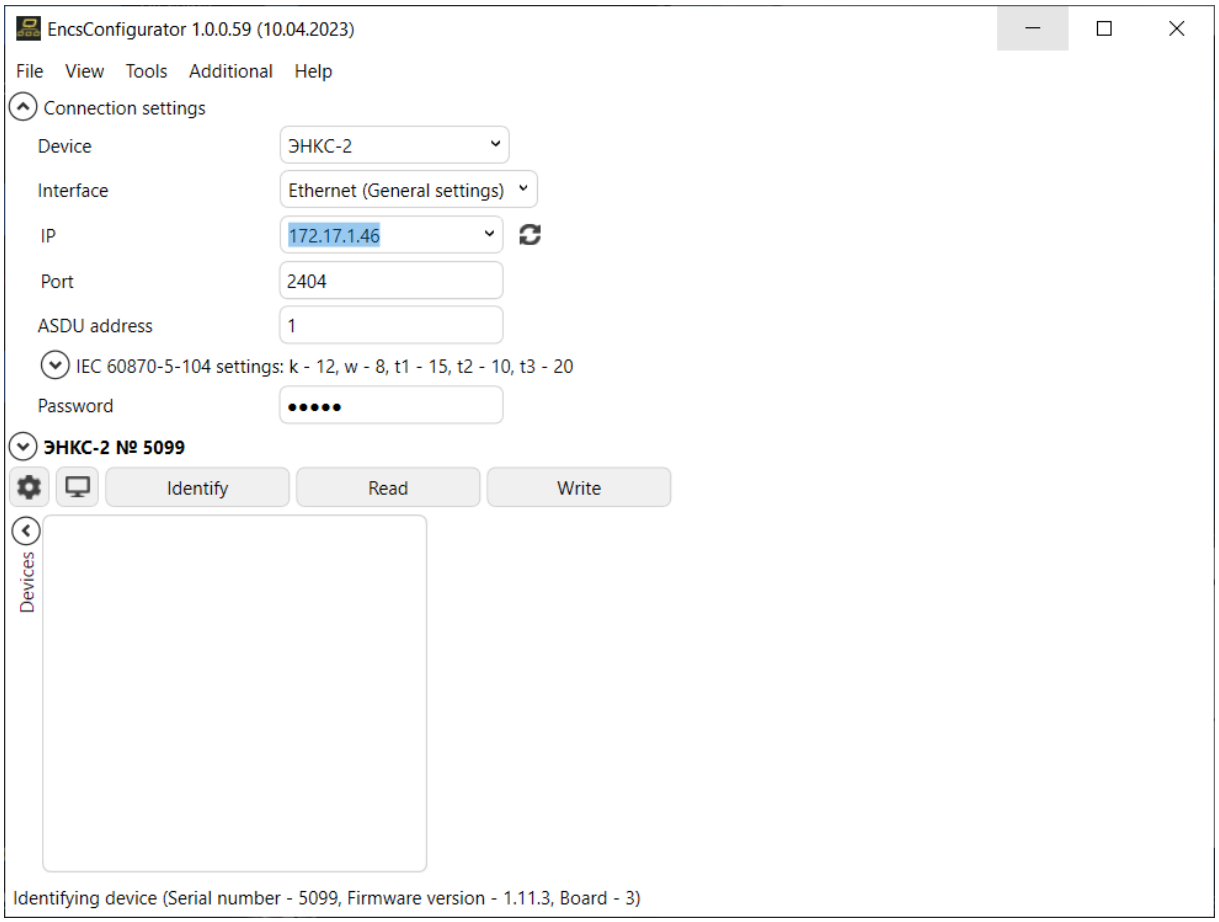


Figure 6.6. The start window of the configurator

You can configure ENCS-2 only via Ethernet interface. The communication between the configurator and the ENCS-2 is carried out using the IEC-104 protocol, so there must be at least one channel configured for this protocol (see Fig. 6.7). By default, several such channels are configured in the device.

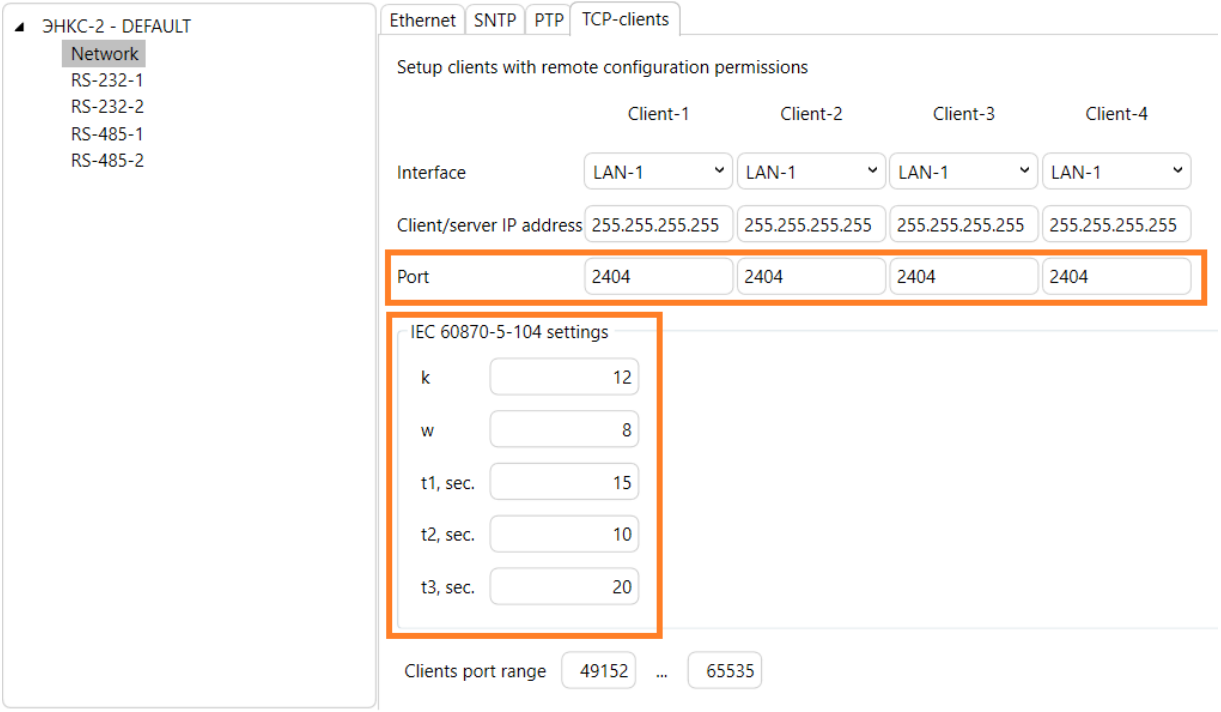


Figure 6.7. Channel settings for connection by the configurator
(orange – specified when connecting in the configurator)

The IP address of the client that can connect to the device should be indicated in corresponding field, or you can leave 255.255.255.255 to allow connection to any client.

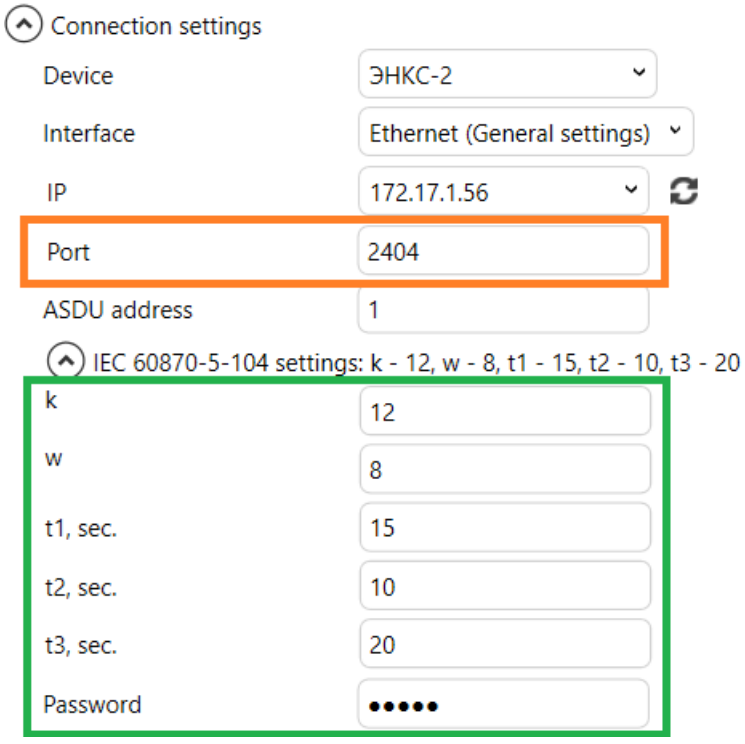


Figure 6.8. The settings for connecting to device
(orange - must match the parameters of the device in the Channels section; green – must match the IEC-104 settings in the Network section)

If there are no such channels, it is impossible to connect with the configurator, the device must be reset to default settings.

Make sure that the password specified in the connection parameters matches the device password. The default value is *admin*.

For a description of the operation of the ENCS Configurator software, see the user manual.

6.6 Synchronize your computer's clock

6.6.1 To synchronize the PC clock via a local network, you need to turn on the SNTP-server in the ENCS-2. Configure a standard NTP client or use any software with this functionality in your PC.

7 Maintenance & Repair

7.1 General instructions

Supervision of the device operation must be carried out by persons to whom this equipment is assigned.

ENCS-2 is guaranteed for 60 months from the date of delivery.

ENCS-2 devices should not be opened during operation. Violation of the warranty sticker integrity relieves the manufacturer of warranty obligations.

All malfunctions that occur during operation are eliminated by the manufacturer.

7.2 Safety

Maintenance work must be carried out by qualified personnel.

Personnel servicing ENCS-2 devices should be guided by this manual, as well as workplace safety rules during the operation of electrical installations.

7.3 Maintenance

Microprocessor devices manufactured by Energoservice do not require additional maintenance during operation under normal conditions. However, in accordance with the existing regulatory documents, standards for the operation of ADCS devices, etc., periodic and unscheduled equipment inspections are possible.

7.3.1 Initial calibration

ENCS-2 are measuring instruments of the approved type (FIF No. 37328-15).

Before delivery, all devices undergo an initial calibration procedure. The calibration interval is 2 years.

7.3.2 Firmware update

Most of the released devices have the ability to update the firmware. It is recommended to update firmware at the next scheduled maintenance.

A description of the firmware update process can be found in the operating manuals in the operation section of the ESBootloader software.

7.3.3 Repair

If the device is defective or damaged, you must:

- Dismount the device;
- Draw up a malfunction report, indicating the signs of the device malfunction, the contact details of the person who diagnosed the malfunction.

- Pack the device securely to eliminate the possibility of damage during transportation.
- Send the device together with the fault report and a cover letter containing the address and full name of the contact person for the return of the repaired devices.

The address and details for sending can be clarified with the technical support enip2@ens.ru, or in the sales department sales@enip2.ru

7.3.4 Equipment inspection

The following procedure for on-site inspection of equipment is recommended:

- check the operation of the existing indicators and display;
- check the housing condition, make sure there is no mechanical damage;
- check the condition of fasteners and external circuits;

7.3.5 Preventative maintenance

The list of works that can be included in the list of planned works:

- Check the presence of technical, software and operational documentation.
- Check for up-to-date versions of technological software used to configure and diagnose devices.
- Copy the current configuration.
- Compare of the current configuration of the device with the one in the archive.
- If necessary, update the firmware of devices with the firmware versions numbers recording.
- If necessary, test backup copies of settings for operability.
- Scheduled access password change.
- Checking the correct functioning of the devices:
  - the received and relayed information validity;
  - analysis of diagnostic messages (power loss, synchronization facts, device operation statistics, etc.);
- Filling out routine maintenance documentation.

8 Marking and sealing

8.1 Marking

On the front panel of the ENCS-2 devices is applied:

- the name of the device: "Time sync module ENCS-2";
- serial number and date of manufacture;
- symbols of terminals for power connection;
- symbols of interface connectors;
- type approval mark;
- EAC mark of conformity.

9 Transportation and storage

Storage of ENCS-2 in the warehouses of the manufacturer (consumer) - at an ambient temperature from 5 to 40 °C and a relative humidity of up to 80% at a temperature of 25 °C.

ENCS-2 is transported by all modes of transport in covered vehicles (rail, road, water transport in holds, in airplanes - in sealed compartments) at temperatures from minus 50 to plus 70 °C and relative humidity up to 98% at a temperature of plus 25 °C

10 Packaging

ENCS-2 devices are supplied in individual and transport containers.

The package contains 1 set of ENCS-2 device, specified in section 4. Typical dimensions of individual packaging:

- 125x125x175 mm.

The number of ENCS-2 devices stacked in shipping containers, overall dimensions, net and gross weight depend on the order. Typical shipping containers:

- corrugated box with dimensions of 375x350x250 mm, accommodating 12 individual packages of 125x125x175 mm;
- corrugated box with dimensions of 345x255x135 mm, accommodating 4 individual packages of 125x125x175 mm.

11 Environmental protection

Special measures for environmental protection are not provided, since the manufactured equipment has no harmful emissions and does not adversely affect the environment in the form of electromagnetic radiation.

The GNSS antenna is a receiving antenna and cannot be used for radio transmission of radio signals.

Appendix A. IEC 60870-5-101/ IEC 60870-5-104

IEC 60870-5-101/104 Protocol Implementation Conformance Statement

This companion standard presents sets of parameters and alternatives from which subsets have to be selected to implement particular telecontrol systems. Certain parameter values, such as the number of octets in the COMMON ADDRESS of ASDUs represent mutually exclusive alternatives. This means that only one value of the defined parameters is admitted per system. Other parameters, such as the listed set of different process information in command and in monitor direction allow the specification of the complete set or subsets, as appropriate for given applications. This Clause summarizes the parameters of the previous Clauses to facilitate a suitable selection for a specific application. If a system is composed of equipment stemming from different manufacturers, it is necessary that all partners agree on the selected parameters.

Designation:

☐ - Function or ASDU is not used;

☒ - Function or ASDU is used as standardized (default);

R - Function or ASDU is used in reverse mode;

B - Function or ASDU is used in standard and reverse mode/

The possible selection (blank, X, R, or B) is specified for each specific Clause or parameter.

1. System or device

(system-specific parameter, indicate the definition of a system or a device by marking one of the following with an «X»)

IEC 60870-5-101		IEC 60870-5-104	
☐	System definition	☐	System definition
☒	Controlling station definition (master)	☐	Controlling station definition (master)
☐	Controlled station definition (slave)	☐	Controlled station definition (slave)

2. Network configuration

IEC 60870-5-101			
☒	Point-to-point	☐	Multipoint-partyline
☒	Multiple point-to-point	☐	Multipoint-star

IEC 60870-5-104

■ ~~Point-to-point~~	■ ~~Multipoint-partyline~~
■ ~~Multiple point-to-point~~	■ ~~Multipoint-star~~

3. Physical layer

(network-specific parameter, all interfaces and data rates that are used are to be marked with an «X»)

Transmission speed (control direction)

IEC 60870-5-101		
Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 recommended if >1200 bit/s	Balanced interchange circuit X.24/X.27
☐ 100bit/s	☒ 2400bit/s	☐ 2400bit/s
☐ 200bit/s	☒ 4800bit/s	☐ 4800bit/s
☐ 300bit/s	☒ 9600bit/s	☐ 9600bit/s
☐ 600bit/s	☒ 19200bit/s	☐ 19200bit/s
☐ 1200bit/s	☐ 38400 bit/s	☐ 38400bit/s
	☐ 57600 bit/s	☐ 56000bit/s
	☒ 115200 bit/s	☐ 64000bit/s

IEC 60870-5-104		
Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 recommended if >1200 bit/s	Balanced interchange circuit X.24/X.27
■ ~~100bit/s~~ ■ ~~200bit/s~~ ■ ~~300bit/s~~ ■ ~~600bit/s~~ ■ ~~1200bit/s~~	■ ~~2400bit/s~~ ■ ~~4800bit/s~~ ■ ~~9600bit/s~~	■ ~~2400bit/s~~ ■ ~~4800bit/s~~ ■ ~~9600bit/s~~ ■ ~~19200bit/s~~ ■ ~~38400bit/s~~ ■ ~~56000bit/s~~ ■ ~~64000bit/s~~

Transmission speed (monitor direction)

IEC 60870-5-101		
Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 recommended if >1200 bit/s	Balanced interchange circuit X.24/X.27
☐ 100bit/s	☒ 2400bit/s	☐ 2400bit/s
☐ 200bit/s	☒ 4800bit/s	☐ 4800bit/s
☐ 300bit/s	☒ 9600bit/s	☐ 9600bit/s
☐ 600bit/s	☒ 19200bit/s	☐ 19200bit/s
☐ 1200bit/s	☐ 38400 bit/s	☐ 38400bit/s
	☐ 57600 bit/s	☐ 56000bit/s
	☒ 115200 bit/s	☐ 64000bit/s

IEC 60870-5-104		
Unbalanced interchange circuit V.24/V.28 Standard	Unbalanced interchange circuit V.24/V.28 recommended if >1200 bit/s	Balanced interchange circuit X.24/X.27

■ ~~100bit/s~~ ■ ~~200bit/s~~ ■ ~~300bit/s~~ ■ ~~600bit/s~~ ■ ~~1200bit/s~~	■ ~~2400bit/s~~ ■ ~~4800bit/s~~ ■ ~~9600bit/s~~	■~~2400bit/s~~ ■~~4800bit/s~~ ■~~9600bit/s~~ ■~~19200bit/s~~	■~~38400bit/s~~ ■~~56000bit/s~~ ■~~64000bit/s~~

4. Link layer

Network-specific parameter, all options that are used are to be marked with an "×". Specify the maximum frame length. If a non-standard assignment of class 2 messages is implemented for unbalanced transmission, indicate the type ID and COT of all messages assigned to class 2.

IEC 60870-5-101

Frame format FT 1.2, single character 1 and the fixed time out interval are used exclusively in this companion standard.

Link transmission procedure	Address field of the link
☐ Balanced transmission ☒ Unbalanced transmission	☐ Not present (balanced transmission only) ☒ One octet ☐ Two octets ☐ Structured ☒ Unstructured
Frame length 255 Maximum length L (control direction) 255 Maximum length L (monitor direction) 5 - repetitions Time during which repetitions are permitted (Trp) or number of repetitions	

When using an unbalanced link layer, the following ASDU types are returned in class 2 messages (low priority) with the indicated causes of transmission:

☐ The standard assignment of ASDUs to class 2 messages is used as follows:

Type identification	Cause of transmission

☒ A special assignment of ASDUs to class 2 messages is used as follows:

Type identification	Cause of transmission
1, 3, 11, 13, 15, 30, 31, 35, 36,37	<3>

~~NOTE: In response to a class 2 poll, a controlled station may respond with class 1 data when there is no class 2 data available.~~

IEC 60870-5-104

Frame format FT 1.2, single character 1 and the fixed time out interval are used exclusively in this companion standard.

Link transmission procedure	Address field of the link
■ ~~Balanced transmission~~	

■ ~~Unbalanced transmission~~	■ ~~Not present (balanced transmission only)~~
Frame length ■ ~~Maximum length L~~	■ ~~One octet~~ ■ ~~Two octets~~ ■ ~~Structured~~ ■ ~~Unstructured~~

When using an unbalanced link layer, the following ASDU types are returned in class 2 messages (low priority) with the indicated causes of transmission:

■ ~~The standard assignment of ASDUs to class 2 messages is used as follows:~~

Type identification	Cause of transmission

■ ~~A special assignment of ASDUs to class 2 messages is used as follows:~~

Type identification	Cause of transmission

5. Application layer

Transmission mode for application data Mode 1 (least significant octet first), as defined in 4.10 of IEC 60870-5-4, is used exclusively in this companion standard.

Common address of ASDU

(system-specific parameter, all configurations that are used are to be marked with an X).

IEC 60870-5-101	**IEC 60870-5-104**
☒ One octet ☒ Two octets	■ ~~One octet~~ ■ Two octets

Information object address

(system-specific parameter, all configurations that are used are to be marked with an X).

IEC 60870-5-101			
☐	One octet	☒	Structured
☒	Two octets	☒	Unstructured
☒	Three octets		

IEC 60870-5-104			
■	One octet	☐	Structured
■	Two octets	B	Unstructured
☒	Three octets		

Cause of transmission

(system-specific parameter, all configurations that are used are to be marked with an X).

IEC 60870-5-101			
☒	One octet	☒	Two octets (with originator address)

IEC 60870-5-104			
■	~~One octet~~	☒	Two octets (with originator address)

Originator address is set to zero if not used

Selection of standard ASDUs

Process information in monitor direction

Type identification and cause of transmission assignments

((station-specific parameters).

IEC 60870-5-104																	
Type identification		Cause of transmission															
		1	2	3	4	5	6	7	8	9	10	11	12	13	20-36	37-41	44-47
<1>	M_SP_NA_1																
<2>	M_SP_TA_1			■		■						■	■				
<3>	M_DP_NA_1																
<4>	M_DP_TA_1			■		■						■	■				
<5>	M_ST_NA_1																
<6>	M_ST_TA_1			■		■						■	■				
<7>	M_BO_NA_1																
<8>	M_BO_TA_1			■		■											
<9>	M_ME_NA_1																
<10>	M_ME_TA_1			■		■											
<11>	M_ME_NB_1																
<12>	M_ME_TB_1			■		■											
<13>	M_ME_NC_1																
<14>	M_ME_TC_1			■		■											
<15>	M_IT_NA_1																
<16>	M_IT_TA_1			■												■	
<17>	M_EP_TA_1			■													
<18>	M_EP_TB_1			■													
<19>	M_EP_TC_1			■													
<20>	M_PS_NA_1																
<21>	M_ME_ND_1																
<30>	M_SP_TB_1																
<31>	M_DP_TB_1																
<32>	M_ST_TB_1																
<33>	M_BO_TB_1																
<34>	M_ME_TD_1																
<35>	M_ME_TE_1																
<36>	M_ME_TF_1																
<37>	M_IT_TB_1																
<38>	M_EP_TD_1																
<39>	M_IT_TB_1																
<40>	M_EP_TD_1																
<45>	C_SC_NA_1																
<46>	C_DC_NA_1																
<47>	C_RC_NA_1																
<48>	C_SE_NA_1																

<49>	C_SE_NB_1																
<50>	C_SE_NC_1																
<51>	C_BO_NA_1																
<70>	M_EI_NA_1																
<100>	C_IC_NA_1																
<101>	C_CI_NA_1																
<102>	C_RD_NA_1																
<103>	C_CS_NA_1																
<104>	C_TS_NA_1																
<105>	C_RP_NA_1																
<106>	C_CD_NA_1																
<110>	P_ME_NA_1																
<111>	P_ME_NB_1																
<112>	P_ME_NC_1																
<113>	P_AC_NA_1																
<120>	F_FR_NA_1																
<121>	F_SR_NA_1																
<122>	F_SC_NA_1																
<123>	F_LS_NA_1																
<124>	F_AF_NA_1																
<125>	F_CG_NA_1																
<126>	F_DR_TA_1																

IEC 60870-5-101																	
Type identification		Cause of transmission															
		1	2	3	4	5	6	7	8	9	10	11	12	13	20-36	37-41	44-47
<1>	M_SP_NA_1																
<2>	M_SP_TA_1																
<3>	M_DP_NA_1																
<4>	M_DP_TA_1																
<5>	M_ST_NA_1																
<6>	M_ST_TA_1																
<7>	M_BO_NA_1																
<8>	M_BO_TA_1																
<9>	M_ME_NA_1																
<10>	M_ME_TA_1																
<11>	M_ME_NB_1																
<12>	M_ME_TB_1																
<13>	M_ME_NC_1																
<14>	M_ME_TC_1																
<15>	M_IT_NA_1																
<16>	M_IT_TA_1																
<17>	M_EP_TA_1																
<18>	M_EP_TB_1																
<19>	M_EP_TC_1																
<20>	M_PS_NA_1																
<21>	M_ME_ND_1																
<30>	M_SP_TB_1																
<31>	M_DP_TB_1																
<32>	M_ST_TB_1																
<33>	M_BO_TB_1																
<34>	M_ME_TD_1																
<35>	M_ME_TE_1																
<36>	M_ME_TF_1																

<37>	M_IT_TB_1																
<38>	M_EP_TD_1																
<39>	M_IT_TB_1																
<40>	M_EP_TD_1																
<45>	C_SC_NA_1																
<46>	C_DC_NA_1																
<47>	C_RC_NA_1																
<48>	C_SE_NA_1																
<49>	C_SE_NB_1																
<50>	C_SE_NC_1																
<51>	C_BO_NA_1																
<70>	M_EI_NA_1																
<100>	C_IC_NA_1																
<101>	C_CI_NA_1																
<102>	C_RD_NA_1																
<103>	C_CS_NA_1						X	X									X
<104>	C_TS_NA_1																
<105>	C_RP_NA_1																
<106>	C_CD_NA_1																
<110>	P_ME_NA_1																
<111>	P_ME_NB_1																
<112>	P_ME_NC_1																
<113>	P_AC_NA_1																
<120>	F_FR_NA_1																
<121>	F_SR_NA_1																
<122>	F_SC_NA_1																
<123>	F_LS_NA_1																
<124>	F_AF_NA_1																
<125>	F_CG_NA_1																
<126>	F_DR_TA_1																

6. Basic application functions

Station initialization

☐ Remote initialization

Cyclic data transmission

☒ Cyclic data transmission

Read procedure

☐ Read procedure

Spontaneous transmission

☒ Spontaneous transmission

Double transmission of information objects with cause of transmission spontaneous

(station-specific parameter, mark each information type with an “X” where both a type ID without time and corresponding type ID with time are issued in response to a single

spontaneous change of a monitored object) The following type identifications may be transmitted in succession caused by a single status change of an information object. The particular information object addresses for which double transmission is enabled are defined in a project-specific list.

☐ Single-point information M_SP_NA_1, M_SP_TA_1, M_SP_TB_1,

M_PS_NA_1

☐ Double-point information M_DP_NA_1, M_DP TA 1, M_DP_TB_1

☐ Step position information M_ST_NA_1, M_ST_TA_1, M_ST_TB_1

☐ Bitstring of 32 bit M_BO_NA_1, M_BO_TA_1, M_BO_TB_1 (if defined for a specific project, see 7.2.1.1)

☐ Measured value, normalized value M_ME_NA_1, M_ME_TA_1, M_ME_ND_1, M_ME_TD_1

☐ Measured value, scaled value M_ME_NB_1, M_ME_TB_1, M_ME_TE_1

☐ Measured value, short floating point number M_ME_NC_1, M_ME_TC_1, M_ME_TF_1

Station interrogation

☐ – Global

☐ – Group 1	☐ – Group 7	☐ – Group 13
☐ – Group 2	☐ – Group 8	☐ – Group 14
☐ – Group 3	☐ – Group 9	☐ – Group 15
☐ – Group 4	☐ – Group 10	☐ – Group 16
☐ – Group 5	☐ – Group 11	☐ – Information object addresses assigned to each group are configurable
☐ – Group 6	☐ – Group 12	

Clock synchronization

☒ – Clock synchronization

Command transmission

☐ Direct command transmission

☐ Direct set point command transmission

☐ Select and execute command

☐ Select and execute set point command

☐ C_SE ACTTERM used

☐ No additional definition

☐ Short-pulse duration (1 sec.)

☐ Long-pulse duration (1 sec.)

☐ Persistent output (255 sec.)

Transmission of integrated totals

☐ Mode A: local freeze with spontaneous transmission

☐ Mode B: local freeze with counter interrogation

☐ Mode C: freeze and transmit by counter interrogation commands

☐ Mode D: freeze by counter-interrogation command, frozen values reported spontaneously

☐ Counter read

☐ Counter freeze without reset

☐ Counter freeze with reset

☐ Counter reset

☐ Clock synchronization

☐ Request counter group 1

☐ Request counter group 2

☐ Request counter group 3

☐ Request counter group 4

Parameter loading

☐ Threshold value

☐ Smoothing factor

☐ Low limit for transmission of measured value

☐ High limit for transmission of measured

Parameter activation

☐ Act/deact of persistent cyclic or periodic transmission of the addressed object

Test procedure

☐ Test procedure

File transfer

File transfer in monitor direction

☐ Transparent file

☐ Transmission of disturbance data of protection equipmen

☐ Transmission of sequences of events

☐ Transmission of sequences of recorded analogue values

File transfer in control direction

☐ Transparent file

Background scan

☐ Background scan

For IEC 60870-5-104 only:

Definition of time outs

Parameter	Default value	Remarks	Selected value
t_0	30 s	Time-out of connection establishment	
t_1	15 s	Time-out of send or test APDUs	15
t_2	10 s	Time-out for acknowledges in case of no data messages t2 < t1	10
t_3	20 s	Time-out for sending test frames in case of a long idle state	20

Maximum range for timeouts t0 to t2: 1 s to 255 s, accuracy 1 s.

Maximum number of outstanding I format APDUs k and latest acknowledge APDUs (w):

Parameter	Default value	Remarks
K	1 APDU	Maximum difference receive sequence number to send state variable
W	1 APDU	Latest acknowledge after receiving w I format APDUs

K and W are not change.

Port number

Parameter	Value	Remarks
Port number	2404	In all cases

Appendix B. SNMP Protocol

As part of the SNMP v1 protocol, ENCS-2 supports the transfer of the following Management Information Base (MIB) (file *. mib for ENCS-2 is available at the link):

MIB object	Description	Value (example, type)
SysDescr.0	Device name	Time sync module ENCS-2
SysUpTime.0	Operating hours	XX hours, XX minutes, XX.XX seconds
SysContact.0	Contact Details	www.enip2.ru, ed@ens.ru, +7 (818-2) 64-60-00
SysName.0	Device Modification, Serial Number, Firmware Version	ENCS-2 s/n, f/w
IfNumber.0	Number of interfaces	5
IfTable.0:	Table of interface statistics:	
IfIndex.X	Interface Number	1... 5
ifDescr.X	Description	GPS (internal); rs485; rs232-1; rs232-2
ifInOctets.X	Bytes accepted	(UNSIGNED32)
ifOutOctets.X	Bytes sent	(UNSIGNED32)
diagSerialNumers.0	Serial number	s/n
diagFirmware.0	Firmware version	f/w
diag6Ccount.0	Number of frames 6C	*Service information*
diag6Dcount.0	Number of frames 6D	*Service information*
diag5Ccount.0	Number of frames 5C	*Service information*
diag5Dcount.0	Number of frames 5D	*Service information*
diag8FABcount.0	Number of frames 8FAB	*Service information*
diag8FACcount.0	Number of frames 8FAC	*Service information*
diag6Cerror.0	Number of frame errors 6C	*Service information*
diag6Derror.0	Number of 6D frame errors	*Service information*
diag5Cerror.0	Number of 5C frame errors	*Service information*
diag5Derror.0	Number of 5D frame errors	*Service information*
diag8FABerror.0	Number of 8FAB frame errors	*Service information*
diag8FACerror.0	Number of 8FAC frame errors	*Service information*
diagsynh.0	Status of communication with satellites	out of sync; sync with GPS
gpsStatusLatitude.0	Latitude	64.541039 (OCTET STRING)
gpsStatusLongitude.0	Longitude	40.550919 (OCTET STRING)
gpsStatusAltitude.0	Height	61.541935 (OCTET STRING)
gpsStatusPDOP.0	Reduced location accuracy	0 (OCTET STRING)
gpsStatusHDOP.0	Reduced accuracy in the horizontal plane	0 (OCTET STRING)
gpsStatusVDOP.0	Reduced accuracy in the vertical plane	0 (OCTET STRING)
gpsStatusTDOP.0	Reduced time accuracy	1 (OCTET STRING)
gpsStatusTemperature.0	Module temperature	38.137306 (OCTET STRING)
gpsDecodingStatus.0	Decryption status	Doing fixes; Don't have GPS time; PDOP is too high; No usable satellites; Only 1 usable sat; Only 2 usable sats; Only 3 usable sats; The chosen sat is unusable; TRAIM rejected the fix
gpsGetTime.0	Sync Status	GPS have not set a time; GPS set time
gpsGetUTCinfo.0	Status of receiving information	GPS not have UTC info; GPS have UTC info
gpsStatusNumSVsolution.0	Number of satellites in use	(UNSIGNED32)
gpsStatusNumTrackSV.0	Total number of satellites	(UNSIGNED32)

gpsSatTrackingTable.0	Satellite Information:	
gpsSatTrackingIndex.X	Table Item Index	1...n, where n is the total number of satellites
gpsSvPRN.X	Satellite sequence number	(INTEGER)
gpsSvChanel.X	Channel number	(INTEGER)
gpsSvSignalLevel.X	Signal level	40.000000 (INTEGER)
gpsSvAzimuthAngle.X	Satellite azimuth	296.000000 (OCTET STRING)
gpsSvElevationAngle.X	Satellite elevation	19.000000 (OCTET STRING)
gpsSvType.X	GNSS affiliation	GPS; GLONASS; Beidou; Galileo; QZSS
gpsSvUsed.X	Satellite Usage Status	used; not used; undefine
gpsSvTimeFix.X	The satellite is used to set the time	used; not used; undefine
gpsSvPosFix. X	The satellite is used to determine the coordinates	used; not used; undefine