Product catalog 2025

ens

Engineering Center Energoservice is an R&D company located in Northwest Russia. Founded in 1992, Energoservice has grown into one of the largest privately held Russian companies producing electronic devices for power generation, transmission and distribution.

The history of our products operating in automated control systems at substations and power plants, as well as in automation of industrial power systems, spans two decades.

We always strive for excellence in technical features and seek innovative approaches when designing new products. We focus on customer feedback keeping firmware up to date.

We present our latest product catalog containing a wide range of intelligent electronic devices, measuring devices, input and output modules, and remote terminal units.

We thank our customers and partners for their trust and interest in our products.

ENIP-2

multifunctional measuring devices

ENIP-2 measures the parameters of a three-phase electric network at substations, power plants, industrial enterprises, and distribution power grids.

The accuracy of measurements and the performance of ENIP-2 meet the requirements of modern automatic control systems. The instrument provides

measurements of all harmonic components (True RMS) and separately of basic harmonics.

The ENIP-2 can have up to five interfaces providing data transmission to automated systems using standard exchange protocols. Any interface can be used for both data transmission and device configuration and firmware upgrade.

The USB port allows you to configure and update firmware even without external power.

The input of digital signals, the output of control commands, and analog signals are provided through built-in inputs and outputs or through up to 10 external I/O modules (e.g. ENMV-1). To visualize the measurements, an ENMI display module may connected to ENIP-2.

ENIP-2 is offered in four implementations:

- Standard - the main line of transducers for wide applications at power facilities;
- Panel - transducers with HMI;
- Compact - for remote control and monitoring of 6-20 kV switchgear;
- PMU - for WAMS and precise frequency measurement.

The ENIP-2 versions differ by functionality, interfaces, additional input-output combinations, exchange protocols, and designs.

ENIP-2 Standard

The ENIP-2 standard has a plastic housing and could be mounted on DIN-rail. If necessary, access to terminals can be restricted with a sealing cover.

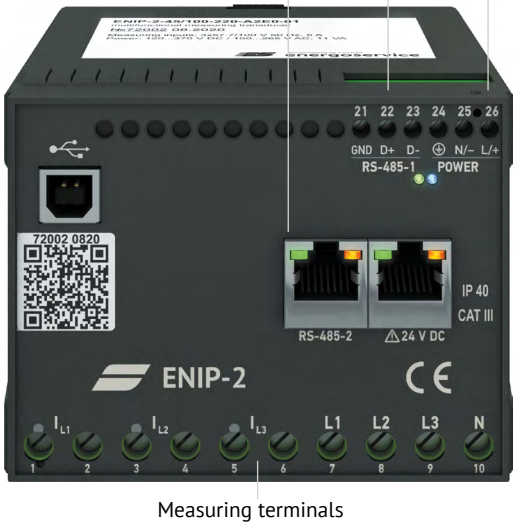
Modifications ENIP-2 Standard differ from each other in the composition of interfaces and sets of inputs and outputs for discrete input-output and analog output.

Only measuring inputs:
Minimum — 1(2) × RS-485

With additional input-output:
Minimum plus — 2 × RS-485
Optimal — 3 × RS-485, 1 × Ethernet
Maximum — 2 × RS-485, 2 × Ethernet

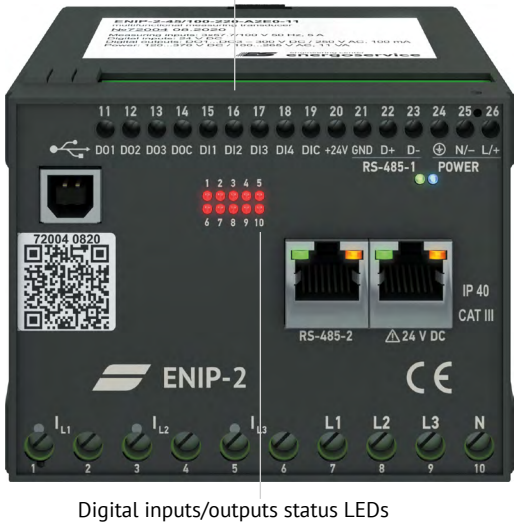
Minimum

One or two RS-485 ports. The second RS-485 port can be used for a redundant data transmission channel, or for connecting external devices.



Minimum plus

A set of digital inputs, digital inputs and outputs, or analog outputs. 10 LED indicators.



Optimal

Three RS-485 ports and one 100Base-TX.

Maximum

Two RS-485 ports and two 100Base-TX/FX (RSTP, PRP).

Specification

Nominal (rated) current and voltage	1 or 5 A; 57.7/100, 230/400, 400/690 V (phase /line)
Voltage measurement accuracy	Full Scale: ±0.2 % Readings: ±0.2 % ($0.2U_{nom} \leqslant U \leqslant 1.5U_{nom}$), ±0.75 % ($0.05U_{nom} \leqslant U < 0.2U_{nom}$)
Current measurement accuracy	Full Scale: ±0.2 % Readings: ±0.2 % ($0.1I_{nom} \leqslant I < 2I_{nom}$), ±0.75 % ($0.02I_{nom} \leqslant I < 0.1I_{nom}$), ±2.0 % ($0.01I_{nom} \leqslant I < 0.02I_{nom}$)
Power (active, reactive, apparent) measurement accuracy	Full Scale: ±0.5 % Readings: ±0.5 % ($0.2I_{nom} \leqslant I \leqslant 2I_{nom}$, $0.2U_{nom} \leqslant U \leqslant 1.5U_{nom}$)
Frequency measurement accuracy	±10 mHz
Measurement time / update time	50 msec (sliding window) / 20 msec, configurable averaging period
Additional measured and computable parameters	cos, tg, angles (phase and average), active and reactive energy, U_0, U_1, U_2, K_{2U}, K_U, I_0, I_1, I_2, K_{2I}, K_I, THD
Digital signals	up to 32 processed signals: statuses of built-in digital inputs and outputs, statuses of inputs and outputs of external ENMV-1 modules, logical expressions, GOOSE subscriptions, diagnostic signals
Digital inputs	0, 4 or 8 inputs (wet or dry contact, debounce filtering), U_{nom} / U_{max}: 24/250 VDC, 110/150 VDC, 220/250 VDC
Digital outputs	0 or 3 outputs: 300 VDC/250 VAC, 0.1 A
Logical expressions	up to 32 expressions in 32 functions (AND, OR, CMP, TIMER, VALID)
Analog outputs	4 customized outputs, signal range: ±5 mA, ±20 mA, ±24 mA, 0...5 mA, 0...20 mA, 0...24 mA, 4...20 mA
Event logging	I/O history, event log
Extension modules	display modules: ENMI-3, ENMI-4m, ENMI-4e, ENMI-7; digital inputs/outputs (up to 10 modules): ENMV-1, ITS2
Interfaces and protocols	1, 2 or 3 × RS-485 (600...115200 baud): Modbus RTU, IEC 60870-5-101; USB; 1 or 2 × 100Base-TX, 2 × 100Base-FX LC MM: IEC 61850 (ed. 2), IEC 60870-5-104, IEC 60870-5-101 (UDP), Modbus TCP, Modbus RTU, SNMP, web-console, RS-485 tunneling via TCP/IP; PRP, RSTP for 2 Ethernet ports modifications
Real-time clock	500 µs (error less than 5 s per day without sync); Time sync: IEC 60870-5-101, IEC 60870-5-104, SNTP
Power supply	18...36 VDC, 40...160 VDC, 120...370 VDC or 100...265 VAC (45...55 Hz), up to 13 VA (19 VA with ENMI)
Operating conditions	–40...+70 °C
Design	75 × 100 × 110 mm (IP40)
Mounting	DIN-rail TH35 mounting

Ordering Information

ENIP-2-4□/□-□-□□

Rated current

1 — 1 A
5 — 5 A

Rated voltage

100 — 57.7 (100) V
400 — 230 (400) V
690 — 400 (690) V

Power supply voltage

220 — 120...370 VDC or 100...265 VAC
110 — 40...160 VDC
24 — 18...36 VDC

Digital inputs operating voltage

(220) — 220 VDC
(110) — 110 VDC
if not specified — 24 VDC or without inputs

Interfaces and analog outputs (AO)

A2E0-41 — 2 × RS-485, 4 × AO
A3E4-41 — 3 × RS-485, 1 × 100Base-TX, 4 × AO
A2E4x2-41 — 2 × RS-485, 2 × 100Base-TX, 4 × AO
A2E4x2FX-41 — 2 × RS-485, 2 × 100Base-FX, 4 × AO

Interfaces, digital inputs (DI), digital outputs (DO)

A1E0-01 — 1 × RS-485
A2E0-01 — 2 × RS-485
A2E0-11 — 2 × RS-485, 4 × DI, 3 × DO
A2E0-21 — 2 × RS-485, 8 × DI
A3E4-11 — 3 × RS-485, 1 × 100Base-TX, 4 × DI, 3 × DO
A3E4-21 — 3 × RS-485, 1 × 100Base-TX, 8 × DI
A2E4x2-11 — 2 × RS-485, 2 × 100Base-TX, 4 × DI, 3 × DO
A2E4x2-21 — 2 × RS-485, 2 × 100Base-TX, 8 × DI
A2E4x2FX-11 — 2 × RS-485, 2 × 100Base-FX, 4 × DI, 3 × DO
A2E4x2FX-21 — 2 × RS-485, 2 × 100Base-FX, 8 × DI

Options and accessories

IEC 61850-8-1 activation — ES61850.enip
RS-485 splitter — EX...
Surge protection devices for RS-485 — ESP485-...
Surge protection devices for Ethernet — ESP-LAN
Sealing cover — PC1015
USB 2.0 cable, male A to male B, 1 m — USB-A-B

Certification

Conformance to IEC 61850 – UCAiug Level A Certificate IEC 61850 Ed.1, Ed.2 (DNV GL)

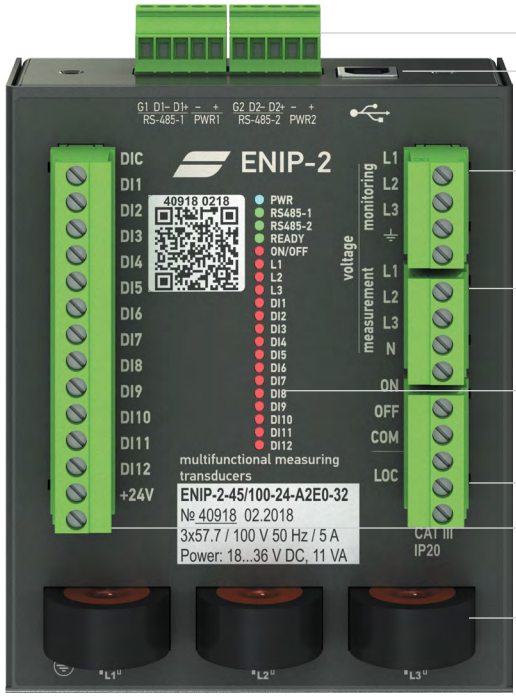
Conformance to LVS EN 61010-1:2011 (EN 61010-1:2010), EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11.

ENIP-2 Compact

ENIP-2 Compact is designed for medium voltage switchgear cells, for which compact size and rich I/O functionality are the key requirements.

ENIP-2 Compact has digital inputs and relay outputs, two redundant 24 VDC power inputs, and three analog inputs for monitoring voltage presence.

Basic



2 RS-485 ports, 2 power supply inputs

USB

3 voltage indication inputs

Voltage measuring inputs

LEDs (interfaces, I/O statuses)

3 built-in electromagnetic relay outputs

12 digital inputs (wet contact)

Current measuring inputs

Minimal

Single phase current measuring input

Specification

Measurements	Please, see page 4 + plus 3 voltage indication inputs (1...300 VAC)
Digital signals	up to 32 processed signals: statuses of built-in digital inputs and outputs, statuses of digital inputs and outputs of external modules ENMV-1, logical expressions, diagnostic signals
Digital inputs	12 (dry or wet contact 24 VDC), debounce filter
Digital outputs	3 outputs: 250 V, 6A DC / AC
Logical expressions	up to 32 expressions in 32 functions (AND, OR, CMP, TIMER, VALID)
Event logging	I/O history, event log
Extension modules	display modules: ENMI-3, ENMI-4m, ENMI-7; digital inputs/outputs (up to 10 modules): ENMV-1, ITS2
Interfaces and protocols	2 × RS-485 (600...115200 baud): Modbus RTU, IEC 60870-5-101; USB
Real-time clock	500 µs (error less than 5 s per day without sync); Time sync: IEC 60870-5-101, IEC 60870-5-104, SNTP
Power supply	18...36 VDC, 11 W
Operating conditions and Design	–40...+70 °C; 136 × 100 × 67 mm, IP20
Mounting	DIN-rail TH35 mounting, or special bracket (please see Options and Accessories)

Ordering Information

ENIP-2-□□/□-24-A2E0-32

Connection type
1 — single-phase (Minimal)
4 — three-phase (Basic)

Rated current
1 — 1 A
5 — 5 A

Rated voltage
0 — without measuring inputs voltage
100 — 57.7 V (L-L 100 V)
400 — 230 V (L-L 400 V)

Options and accessories

RS-485 splitter — EX...
Surge protection devices for RS-485 — ESP485-...
Bracket for ENIP-2-...-32 — RM6-KP
USB 2.0 cable, male A to male B, 1 m — USB-A-B

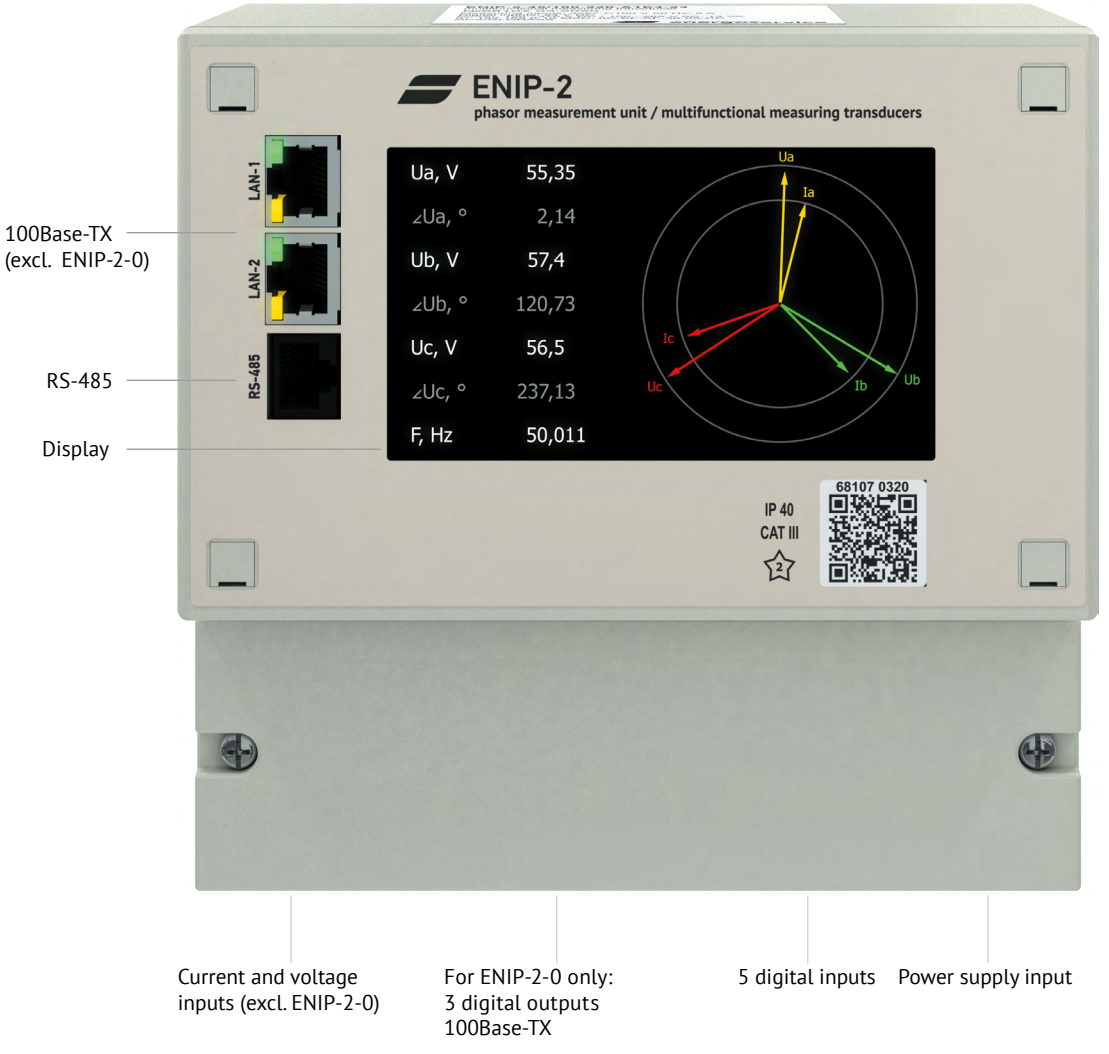
ENIP-2 PMU

ENIP-2 PMU performs phasor measurements in accordance with IEEE C37.118.1 classes P and M.

Built-in GPS/GLONASS receiver or an external ENCS-2 time sync module can be used for time synchronization. ENIP-2 PMU supports IEEE 1588v2 PTP and IRIG-A/B.

ENIP-2 PMU is equipped with a color touch-screen display for visualization of measurement data.

A modification of ENIP-2 PMU with IEC 61850-9-2 digital inputs is aimed for use at digital substations.



Specification

Synchrophasors of the voltages and currents (main harmonic), frequency	nominal frequency 50/60 Hz (operating range 45-55/55-65 Hz), the measurements in accordance with C37.118.1 (class P and M), TVE < 1%, FE ⩽ 0.001 Hz, RFE ⩽ 0.1 Hz/sec, the frequency of data transmission — 1/2/5/10/25/50/100 frames per second
The parameters of three-phase power grid (main harmonic, RMS)	Please, see page 4
Real-time clock	time accuracy: 1 μs with time sync (error less than 0.4 s per day without sync), time sync on IEEE 1588v2 PTP, RS-485 (IRIG-A/B) or built-in GPS/GLONASS-receiver
Interfaces and protocols	1 × RS-485 (IRIG A/B) 1 or 2 × 100Base-TX: C37.118.2, IEC 60870-5-104, IEC 60870-5-101 UDP, Modbus TCP, Modbus RTU UDP
Digital inputs/outputs	5 digital inputs (dry contact, 24 VDC), 3 digital outputs (only for ENIP-2-0)
Options	4,3" TFT color touch screen display, 480 × 272; built-in GPS/GLONASS-receiver; 8 GB storage
Power supply	18...36 VDC or 120...370 VDC / 100...265 VAC (45...55 Hz), 13 VA
Operating conditions and design	–40...+70 °C or –20...+70°C if equipped with TFT display / 160 × 165 × 83 mm, IP40

Ordering Information

ENIP-2-□-□-□

The type of input the measured signals

4I/U — analog inputs

I:	U:
1 — 1 A	100 — 57.7 (100) V
5 — 5 A	400 — 230 (400) V

0 — 100Base-T (IEC 61850-9-2LE)

Interfaces and options

A1E4-03 — 1 × RS-485, 1 × 100Base-TX, 5 digital inputs (3 digital outputs only for ENIP-2-0)
A1E4-13 — ... + TFT color touch screen display
A1E4-23 — ... + built-in GPS/GLONASS-receiver
A1E4-13-PTP — 1 × RS-485, 2 × 100Base-TX, IEEE 1588v2 PTP, TFT color touch screen display, 5 digital inputs

Power supply voltage

220 — 100...265 VAC (45...55 Hz) or 120...370 VDC
24 — 18...36 VDC

Options and accessories

Outdoor GPS/GLONASS antenna — GPS-P
Mounting brackets for GPS/GLONASS antenna — GPS-KP-...
Surge protection devices for Ethernet — ESP-LAN
Additional 8 GB memory for registration and storage — SD8G.pmu

ENIP-2 Panel

ENIP-2 Panel is a multifunctional measuring transducer with HMI, installed in the cells of switchgear, on the panel, and in the cabinets.

Measurements and other information are displayed on the color touch screen display (4.3" TFT, 480 × 272). Information display modes are controlled via a touch interface or buttons.

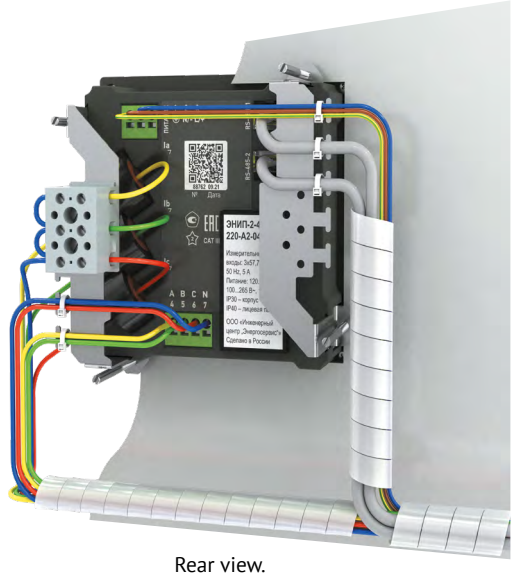
Unlike other versions of the ENIP-2 series, this modification has universal measuring inputs, to which it is possible to connect current circuits with rated values of 1 and 5 A, and voltage circuits with rated values of 57.7, 230, and 400 V (phase). Thus, when ordering ENIP-2 panel does not need to choose values of input signals.

On the back of the instrument, there are measuring inputs of current and voltage, power supply terminals, and RJ45 sockets of interfaces. Current circuits are inserted via built-in current sensors.

If it is necessary to provide a screw connection of current circuits, the device is supplemented by an organizer bracket with a thermally/transit screw terminal. The default instrument is for panel installation, but can also be installed on DIN rail with additional accessories.

From one to ten ENMV-1 or other modules can be connected to any of the RS-485 ports to process digital and analog signals and to output control commands.

Front view.
DIN-rail TH35 mounting
(with bracket organizer PDIN-KP)



Rear view.
Wiring example of external circuits
(with PXT-KP bracket organizer)

Specification

Nominal (rated) current and voltage	1 and 5 A; 57.7/100, 230/400 и 400/690 V (phase /line) 20 A; 1000 V	
Measurement range	2.8 V ⩽ U ⩽ 460 V (0.5 V ⩽ U ⩽ 1000 V)	0.01 A ⩽ I ⩽ 10 A (0.005 A ⩽ I ⩽ 20 A)
Measurement accuracy, % Reading	U: ±0.75 % (2.8 V ⩽ U < 11.54 V) ±0.2 % (11.54 V ⩽ U ⩽ 460 V)	I: ±2 % (0.01 A ⩽ I < 0.02 A) ±0.75 % (0.02 A ⩽ I < 0.1 A) ±0.2 % (0.1 A ⩽ I ⩽ 20 A)
	P (Q): ±0.5 % (0.1 A ⩽ I ⩽ 10 A, 2.8 V ⩽ U ⩽ 460 V, 0.25 ⩽ |cos| (|sin|) ⩽ 1) ±1.0 % (0.01 A ⩽ I < 0.1 A, 2.8 V ⩽ U ⩽ 460 V, 0.25 ⩽ |cos| (|sin|) ⩽ 1) S: ±0.5 % (0.1 A ⩽ I ⩽ 10 A, 2.8 V ⩽ U ⩽ 460 V)	
Measurement accuracy	f: ± 0.01 Hz; cosφ: 0.01 (0.1 A ⩽ I ⩽ 10 A, 2.8 V ⩽ U ⩽ 460 V); angle: ± 0.1 °	
Additional measured and computable parameters	cos, tg, angles (phase and average), active and reactive energy, U_0, U_1, U_2, K_{2U}, K_U, I_0, I_1, I_2, K_{2I}, K_I, THD	
Extension modules	display modules: ENMI-3, ENMI-4m, ENMI-4e, ENMI-7; digital inputs/outputs (up to 10 modules): ENMV-1, ITS2	
Digital signals	up to 32 processed signals: statuses of inputs and outputs of external ENMV-1 modules, logical expressions, diagnostic signals	
Event logging	I/O history, event log	
Interfaces and protocols	1 or 2 × RS-485 (600...115200 baud): Modbus RTU, IEC 60870-5-101; USB; 1 × 100Base-TX: IEC 60870-5-104, IEC 60870-5-101 (UDP), Modbus TCP, Modbus RTU, SNMP, web-console, RS-485 tunneling via TCP/IP	
Real-time clock	500 µs (error less than 5 s per day without sync); Time sync: IEC 60870-5-101, IEC 60870-5-104, SNTP	
Power supply	18...36 VDC, 40...160 VDC, 120...370 VDC or 100...265 VAC (45...55 Hz), up to 10 VA	
Operating conditions and Design	–40...+70 °C, 120 × 120 × 49 mm (IP40 front site, IP30 back site)	
Mounting	panel or DIN-rail TH35 mounting	

Ordering Information

ENIP-2-□-□-04

Interfaces

A2E0 — 2 × RS-485
A1E4 — 1 × RS-485, 1 × 100Base-TX

Power supply voltage

220 — 120...370 VDC or 100...265 VAC
110 — 40...160 VDC
24 — 18...36 VDC

Options and accessories

Bracket organizer — P-KP, PDIN-KP, PXT-KP
RS-485 splitter — EX...
Surge protection devices for RS-485 — ESP485-...
Surge protection devices for Ethernet — ESP-LAN
USB 2.0 cable, male A to male B, 1 m — USB-A-B

ESM

smart meters

ESM smart meter operates as a revenue meter (IEC 62052-11), power quality analyzer (IEC 61000-4-30), and a multifunctional measuring device.

As a revenue meter, ESM measures four-quadrant active and reactive energy, and uses its built-in memory to store power demand and energy readings by time-of-use (TOU) tariffs.

As a power quality analyzer, ESM conforms to Classes A and S of IEC 61000-4-30:2008. ESM provides immediate data and automatically generated power quality reports.

As a multifunctional measuring device, ESM provides measurement data via standard communication protocols for integration with automation systems. ESM supports IEC 61850 (ed. 2), the implementation of which is certified UCAiug Level A by DNV GL (KEMA).

Similar to ENIP-2, ESM can connect to ENMV-1 modules for digital input and output. ENMI display modules are used for visualization.

ESM is available in three modifications that differ in the type of connection to the measuring circuits. All modifications provide the same set of functions.

ESM-HV

Connects to conventional electromagnetic current and voltage transformers, as well as directly to the voltage circuits 230 V, 400 V.

ESM-ET

Connects to electronic current and voltage transformers: Rogowski coils, low-power current transformers, and voltage dividers.

ESM-SV

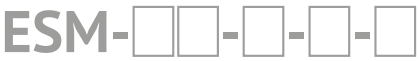
Connects to the process bus of the digital substation for receiving sampled values of current and voltage (IEC 61850-9-2) from digital current and voltage transformers or merging units (see ENMU on page 16).

ESM with ENMI-4m(e) display module

Specification

	ESM-HV	ESM-ET	ESM-SV
Connection type	to conventional instrument current and voltage transformers	to electronic instrument current and voltage transformers	to process bus network: 3 × 100Base-TX, PRP up 4 SV (SV240, SV256, SV288)
Rated (nominal) input values	I_{nom}: 1/5 A (I_{max} 10 A) (starts from 0.001I_{nom}) U_{nom}: 57.7 (100) V; 230 (400) V; 400 (690) V	I: 150 mV; 200 mV; 225 mV; 333 mV; 1 V; 1.625 V; 2 V; 4 V U: 200 mV; 333 mV; 1 V; 1.625 V; 2 V; 3.25 V; 4 V	according IEC 61850-9-2
TOU revenue metering	in accordance with IEC 62052-11, IEC 62053-22, IEC 62053-23		
Energy class (active / reactive)	0.2S / 0.5 or 0.5S / 1	0.5S / 1	0.2S / 0.5
Time of use (TOU) metering	programmable TOU records (255 seasons, 255 days, 8 tariff zones per day)		
Power loads profile	dayli — 366 records, monthly — 120 records with configurable intervals (period from 1 s to 12 hours): profile 1 — 5094 records, profile 2 — 1536 records		
Storage of readings (total and TOU)	since reset, at the beginning and for the current day (previous 30 days), for the beginning and for the current month (12 previous months), for the beginning and for the current year (10 previous years); the duration of data storage — 20 years without external power supply		
Power quality monitoring	in accordance with GOST 32144-2013, GOST 30804.4.7-2013 (class I), GOST R 8.655-2009, GOST R 51317.4.15-2012, GOST 33073-2014 (reports), EN 50160 (reports)		
in accordance with IEC 61000-4-30	class A	class S	class A
Measured parameters and accuracy	The parameters of three-phase power grid: RMS, 1...50 harmonics		
Measurement accuracy	% Reading: voltage RMS (phase, line-to-line, average), and harmonics from 1 to 50: ± 0.1%, currents (phase and average) ± 0.1%, power (active, reactive, apparent) ± 0.5% Frequency ± 0.01 Hz, power factor (phase and average) ± 0.1 °		
Fault Recorder	recording of instantaneous values: three current, three voltage (phase or linear); sampling 7.2 kHz; configurable trigger; recording time — 10 seconds of pre-history + 60 seconds of event		
Digital signals	up to 64 processed signals: statuses of inputs and outputs of up to 4 external ENMV-1 modules, logical expressions, GOOSE subscriptions, diagnostic signals		
Extension modules	display modules: ENMI-4m, ENMI-4e, ENMI-7; digital inputs/outputs: up to 4 modules ENMV-1		
Interfaces and protocols	2 × RS-485: Modbus RTU, IEC 60870-5-101, DLMS/COSEM USB 2(4) × 100Base-TX or 2 × 100Base-TX, 2 × 100Base-FX MM/SM (PRP, RSTP): IEC 61850 (ed. 2), IEC 60870-5-104, IEC 60870-5-101 (UDP), Modbus TCP, Modbus RTU, DLMS/COSEM, FTP, SNMP, web-console, RS-485 tunneling via TCP/IP; PRP, RSTP for 2/4 Ethernet ports modifications		
Power supply	18...36 VDC, 40...160 VDC, 120...370 VDC or 100...265 VAC (45...55 Hz), up to 12 VA (19 VA with ENMI)		
Operating conditions	–40...+70 °C		
Design	75 × 100 × 110 mm (IP40); transparent sealing cover; for ESM-ET and ESM-SV — lockable plug-out protection for RJ45 (RJ45PG) is optionally		
Mounting	DIN-rail TH35 mounting		

Ordering Information



Connection type
HV — conventional CT and VT
ET — electronic CT and VT
SV — according IEC 61850-9-2

Rated input values
ESM-HV — voltage phase (line)
100 – 57.7 (100) V
400 – 230 (400) V
690 – 400 (690) V
ESM-ET
— current, V: 1 – 0.15, 2 – 0.2, 3 – 0.225, 4 – 0.333, 5 – 1.0, 6 – 1.625, 7 – 2, 9 – 4
— voltage, V: 2 – 0.2, 4 – 0.333, 5 – 1.0, 6 – 1.625, 7 – 2.0, 8 – 3.25, 9 – 4

TOU revenue metering and PQM
ESM-HV
02A – energy class (active/reactive) 0.2S/0.5; PQM class A
05A – energy class (active/reactive) 0.5S/1.0; PQM class A
ESM-ET
05S – energy class (active/reactive) 0.5S/1.0; PQM class S
ESM-SV
02A – energy class (active/reactive) 0.2S/0.5; PQM class A

Interfaces
A2E2 – 2 × RS-485, 2 × 100Base-TX
A2E4 – 2 × RS-485, 4 × 100Base-TX
A2E2FX2 – 2 × RS-485, 2 × 100Base-TX, 2 × 100Base-FX MM
A2E2FS2 – 2 × RS-485, 2 × 100Base-TX, 2 × 100Base-FX SM

Power supply voltage
220 — 120...370 VDC or 100...265 VAC
110 — 40...160 VDC
24 — 18...36 VDC

Options and accessories

IEC 61850-8-1 activation — ES61850.esm
RS-485 splitter — EX...
Surge protection devices for RS-485 — ESP485-...
Surge protection devices for Ethernet — ESP-LAN
RJ45 plug lock-in and key — RJ45PG, RJ45PGK
USB 2.0 cable, male A to male B, 1 м — USB-A-B

Certification

Conformance to IEC 61850 – UCAiug Level A Certificate IEC 61850 Ed.2 (DNV GL)

Conformance to LVS EN 61010-1:2011 (EN 61010-1:2010), EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11.

ENMU

stand-alone merging units

ENMU meets IEC 61869-13 stand-alone merging unit standard. In addition to measuring inputs, ENMU may have digital inputs and outputs. Additional features of ENMU are synchrophasor measurement and digital fault recording.

ENMU digitizes input current and voltage signals and publishes up to 4 streams of IEC 61850-9-2 sampled values (SV) to the process bus for protection and measurement. High sample rate streams can be used for energy metering and power quality monitoring by ESM smart meters.

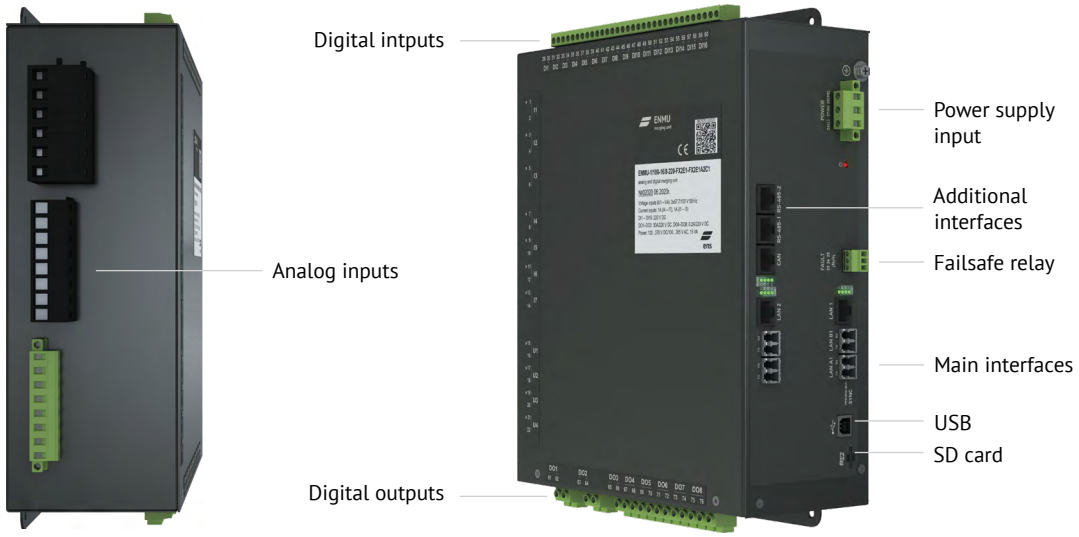
ENMU synchronizes the data using IEEE 1588v2 PTP.

The modification with built-in digital inputs and outputs provides remote monitoring and control via IEC 61850-8-1 (MMS, GOOSE). The number of digital and analog signals processed can be increased by connecting external devices such as ENMV-1.

ENMU provides IEEE C37.118 phasor measurements.

ENMU records and stores fault oscillograms and phasor measurements.

Pairs of interfaces for publishing SV streams, and communication via IEC 61850-8-1 (MMS, GOOSE) can operate in IEC 62439-3 PRP redundancy mode.



Specifications

Analog inputs / accuracy	Voltage, 4 inputs: 2...200% U_{rated} (57.7 V), 0.2%; Current measuring, 4 inputs: 1...200% I_{rated} (1/5 A), 0.2%; Current protection, 3 inputs: 10...4000% I_{rated} (1/5 A), 5%; IEC 61869-13: 0.2, 0.2DR5-200, 6TPM40, T_p = 120 ms
Configurable sampled values	2 × SV80/96 (protection), 2 × SV256/288 (measuring)
Digital inputs	16 inputs: 220 VDC, adjustable thresholds; 6 inputs: 24 VDC
Digital outputs	6...12 × DO EMR, 3 × DO TRIP or DO SSR: DO EMR — 400 VAC 6 A, 220 VDC 0.45 A, 6 ms DO SSR — 400 VAC 1.35 A, 5 ms DO TRIP — 250 VAC 10(40) A, 1 ms
Fault recorder	sampling rate up to 14,4 kHz, 8 GB storage, FTP access
Interfaces and protocols	USB + please see ordering information / IEC 61850-9-2, IEC 61850-8-1 (ed. 1), IEEE C37.118.2, IEC 60870-5-104, IEC 60870-5-101, IEEE 1588v2 PTP (time sync)
Power supply	120...370 VDC or 100...265 VAC (47...63 Hz), 30 VA
Operating conditions and design	–40...+70 °C; 303 × 254 × 100 mm, IP20

Ordering Information

Rated values

1/100 — 1 A / 57.7(100) V
5/100 — 5 A / 57.7(100) V

Interfaces group 1

E3 — 3 × 100Base-TX
FX2E1 — 2 × 100Base-FX LC MM, 1 × 100Base-TX

ENMU-□-□-220-□-□

Digital inputs/outputs

not specified — none
6/2 — 6 DI 24 V, 2 DO EMR
16/8 — 16 DI 220 V, 5 DO EMR, 3 DO TRIP
16/10 — 16 DI 220 V, 7 DO EMR, 3 DO SSR
22/12 — 16 DI 220 V, 6 DI 24 V, 9 DO EMR, 3 DO SSR

Interfaces group 2

not specified — none
FX2E1A2C1 — 2 × 100Base-FX MM, 1 × 100Base-TX, 2 × RS-485, 1 × CAN
E3A2C1 — 3 × 100Base-TX, 2 × RS-485, 1 × CAN

CE

2014/35/EU
2014/30/EU

ENMI

display modules

ENMI display modules serve as HMI and visualize data provided by ENIP-2, ESM, and ENMV-1 devices.

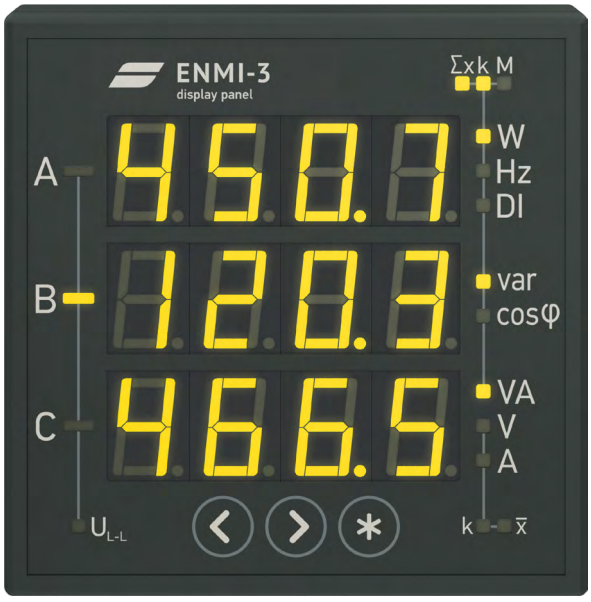
Modifications of ENMI differ in display technologies, information presentation methods and forms, interfaces, and types of housing. One of the housing type has a special dock adapter and allows to combination of ENIP-2 or ESM with ENMI in a single construct.

One ENMI can poll multiple devices, as well as multiple EMNIs can be used to display data from one device (ENIP-2 or ESM).

A single RJ-45 patch cord is used for serial connection to the master device, and in the case of ENIP-2 or ESM, an additional power supply is not needed for operation.

ENMI-3

Seven-segment LED indicators, push-button controls, two sizes, RS-485 interface.



120 × 120 × 49 mm

96 × 96 × 86 mm

ENMI-6

Color touch-screen display for WAMS, diagnostics via SNMP, Ethernet 100Base-TX interface.

120 × 120 × 49 mm

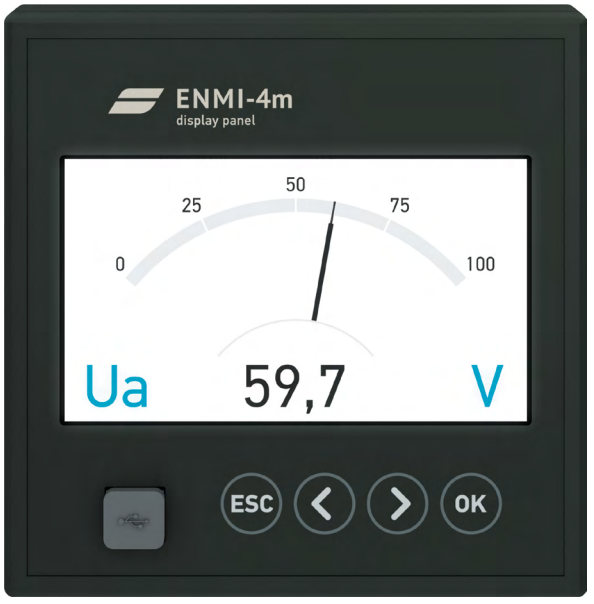
ENMI-7

Monochrome OLED display, push-button controls, RS-485 interface.

96 × 96 × 86 mm

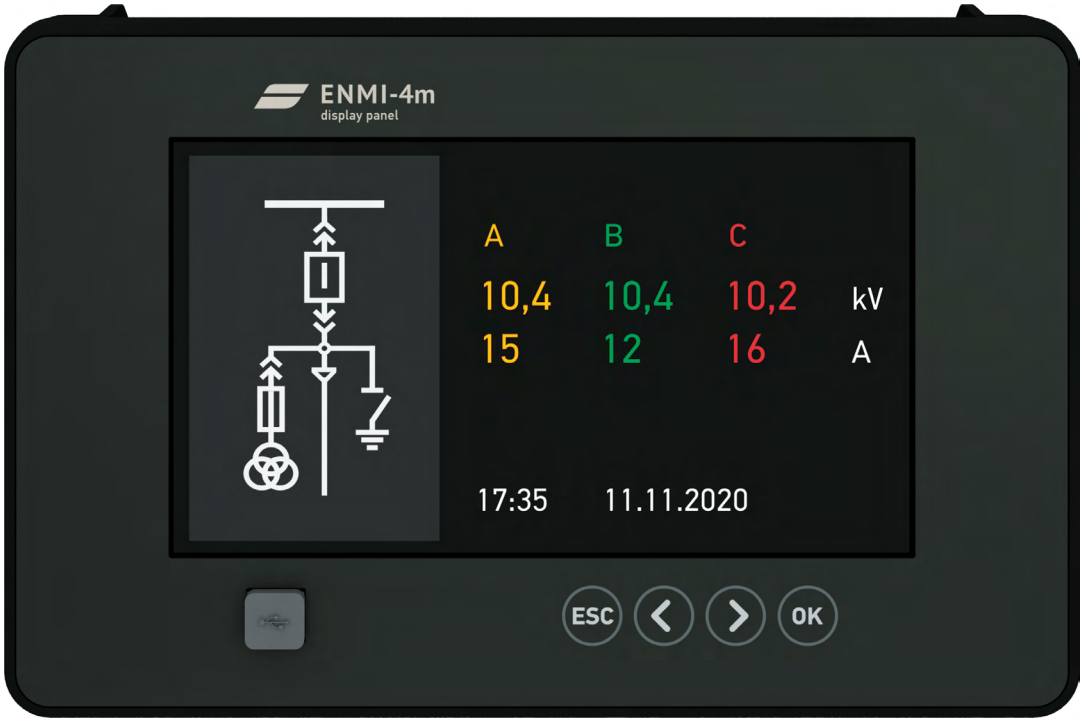
ENMI-4m, ENMI-4e

Color display, touch and push-button controls, RS-485 (ENMI-4m) or 100Base-TX (ENMI-4e) interface.



120 × 120 × 49 mm

Modules are available in two mounting dimensions with two different display sizes (4.3" and 7").



146 × 226 × 55 mm

Specifications

	ENMI-3-24-1 ENMI-3-24-2	ENMI-4m-24-2 ENMI-4e-24-2	ENMI-4m-24-4 ENMI-4m-220-4 ENMI-4e-24-4 ENMI-4e-220-4	ENMI-6-24-2	ENMI-7-24-1
Type of display	seven-segment LED (3 lines of 4 digits)	TFT 4.3" 480 × 272, touch screen	TFT 7" 800 × 480, touch screen	TFT 4.3" 480 × 272, touch screen	OLED 2.42" 128 × 64, monochrome
Application	ENIP-2	ENIP-2, ESM	ENIP-2, ESM	Diagnostic panel	ENIP-2, ESM
Interfaces and protocols	RS-485 (Modbus RTU)	RS-485, Modbus RTU (ENMI-4m) 100Base-TX, Modbus TCP (ENMI-4e)		100Base-TX SNMP, Modbus TCP, NTP	RS-485 Modbus RTU
Power supply	10...36 VDC, 10 W	10...36 VDC, 3 W	10...36 VDC, 120...370 VDC or 100...265 VAC (45...55 Hz), 10 W	10...36 VDC, 5 W	10...36 VDC, 2 W
Operating temperature	–40...+55 °C	–20...+55 °C	–20...+55 °C	–20...+55 °C	–40...+55 °C
Design and mounting	96 × 96 × 86 mm (ENMI-3-24-1), 120 × 120 × 49 mm (ENMI-3-24-2)	120 × 120 × 49 mm	146 × 226 × 55 mm	120 × 120 × 49 mm	96 × 96 × 86 mm

Ordering Information

ENMI-3
ENMI-7

ENMI-3, ENMI-4m, ENMI-4e
ENMI-6

ENMI-□-□-□

Housing type

1 — 96 × 96 × 86 mm
2 — 120 × 120 × 49 mm
2D — 120 × 120 × 49 mm, with dock-adaptor
4 — 146 × 226 × 55 mm

Display type, interface

3 — LED, RS-485
4m — touch screen TFT LCD, RS-485
4e — touch screen TFT LCD, 100Base-TX
6 — touch screen TFT LCD, 100Base-TX
7 — OLED, RS-485

Power supply voltage

24 — 10...36 VDC (all housing types)
220 — 220 VDC or 230 VAC (only type 4)

ENMI-4m, ENMI-4e

Options and accessories

Straight patch cord RJ45-RJ45 — CCR...
RS-485 splitter — EX5RJX
IP54 for front panel — IP54.enmi
Bracket organizer — P-KP, PDIN-KP
USB 2.0 cable, male A to male B, 1 m — USB-A-B

CE

2004/108/EC
2006/95/EC

ENMV

I/O modules

ENMV provides digital input-output and analog input for automated systems of power grids or industrial facilities. The input-output modules operate independently or in conjunction with the ENIP-2 and ESM measuring devices, supplementing their functionality.

The series includes:
- ENMV-1 – digital input-output modules, analog input modules;
- ENMV-1W – 1-Wire modules;
- ENMV-3 – DC analog input modules for WAMS.

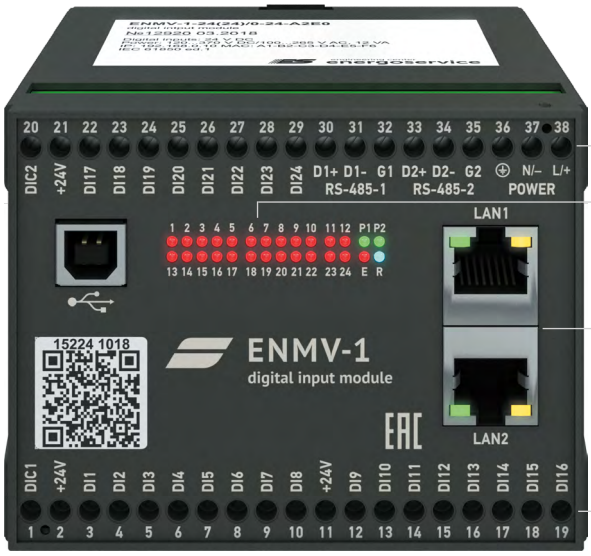
ENMV-1 digital inputs are protected from electromagnetic interference, and both wet and dry contacts are supported. Digital outputs execute control commands and can be activated by programmable logic.

ENMV-1W polls sensors connected to a 1-Wire bus, providing environmental conditions data.

ENMV-3 measures direct voltage and current in generator excitation circuits at power plants, and integrates into WAMS supplementing phasor measurement data.

ENMV-1 with four interfaces

– 2 × RS-485, 2 × 100Base-TX
– digital input and output, analog input, temperature



Inputs/outputs, 2 × RS-485, power supply inputs

Digital outputs, power, interface and diagnostic status LEDs

1 or 2 × 100Base-TX

Inputs/outputs

Specifications

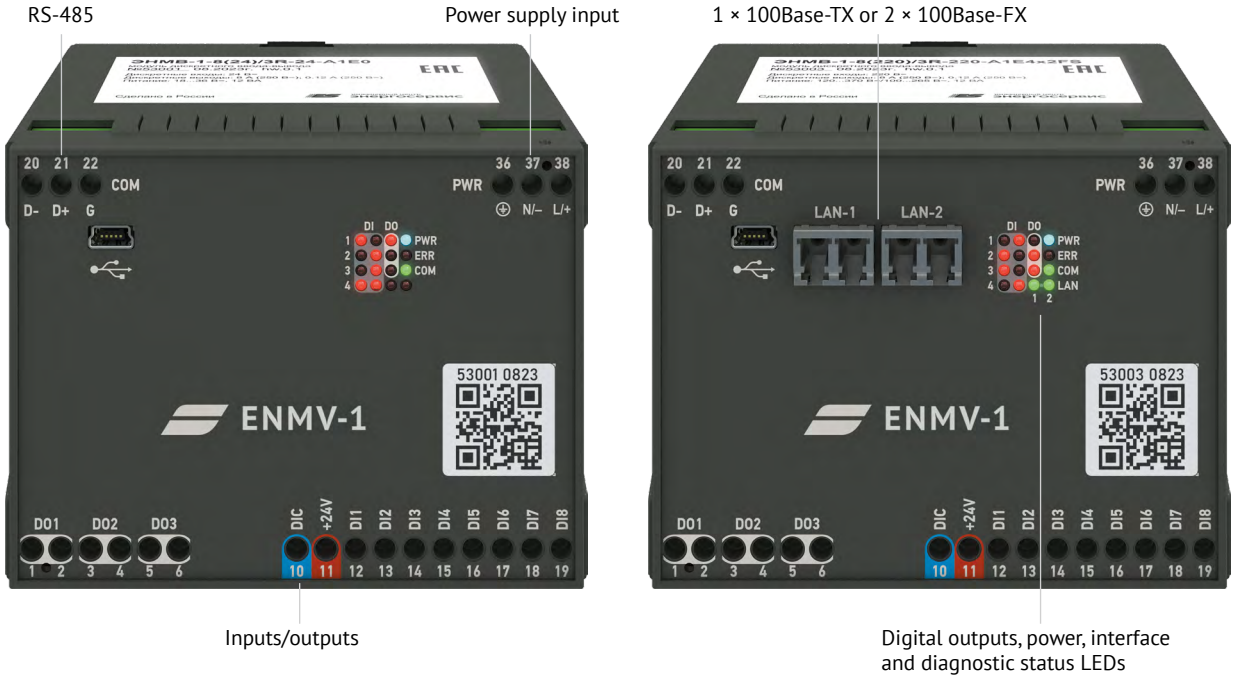
ENMV-1- ☐

	24/0	16/3R	16/6	0/20	0/22	8X8/0	8P2T/0
Number of digital inputs (dry/wet contacts: 24/110/220 VDC)	24	16	16	-	-	8	-
Number of digital outputs 300 VDC/0.12 A, 250 VAC/0.12 A	-	-	6	20	20	-	-
Number of digital outputs 250 VDC/3.4 A	-	-	-	-	2	-	-
Number of digital outputs 250 VAC/8 A, 250 VDC/0.2 A	-	3	-	-	-	-	-
Number of analog inputs ±250 V, ±10 V, ±200 mV, ±75 mV, ±20 mA, ±5 mA	-	-	-	-	-	8	-
Number of analog inputs 0...20 mA, ±20 mA, 0...5 mA, ±5 mA, 4...20 mA	-	-	-	-	-	-	8
Number of thermocouples type K, thermal resistance Pt	-	-	-	-	-	-	2

Interfaces and protocols	2 × RS-485: Modbus RTU, IEC 60870-5-101 1(2) × 100Base-TX (RSTP, PRP): IEC 61850 (ed. 2), IEC 60870-5-104, Modbus TCP, RS-TCP, SNMP
Event logging	I/O history — 1000 records
Time sync	IEC 60870-5-101, IEC 60870-5-104, SNTP
Power supply	18...36 VDC, 40...160 VDC, 120...370 VDC, 100...265 VAC (45...55 Hz), 12 VA
Operating conditions	–40...+70 °C
Design	75 × 100 × 110 mm, IP40
Mounting	DIN-rail TH35 mounting

ENMV-1 with three interfaces

– 1 × RS-485, 2 × 100Base-FX or 1 × 100Base-TX
– digital input and output, analog input



Specifications

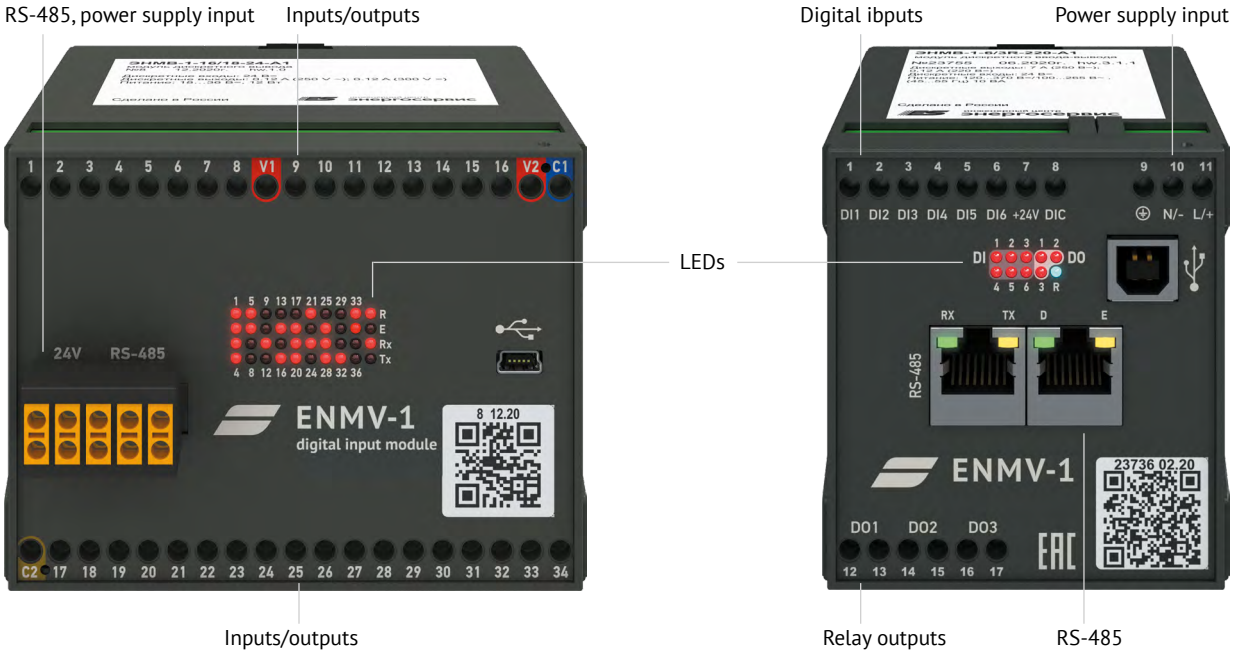
ENMV-1-☐

	8/3R	8/6	16/0	0/18	8P/0	8X/0
Number of digital inputs (dry/wet contacts: 24/110/220 VDC)	8	8	16	-	-	-
Number of digital outputs 300 VDC/0.12 A, 250 VAC/0.12 A	-	6	-	18	-	-
Number of digital outputs 250 VAC/8 A, 250 VDC/0.2 A	3	-	-	-	-	-
Number of analog inputs 0...20 mA, ±20 mA, 0...5 mA, ±5 mA, 4...20 mA	-	-	-	-	8	-
Number of analog inputs ±250 V, ±10 V, ±200 mV, ±75 mV, ±20 mA, ±5 mA	-	-	-	-	-	8

Interfaces and protocols	1 × RS-485: Modbus RTU, IEC 60870-5-101 1 × 100Base-TX or 2 × 100Base-FX MM/SM (PRP, RSTP): IEC 61850 (ed. 2), IEC 60870-5-104, Modbus TCP, RS-TCP, SNMP
Event logging	I/O history — 1000 records
Time sync	IEC 60870-5-101, IEC 60870-5-104, SNTP
Power supply	18...36 VDC, 40...160 VDC, 120...370 VDC, 100...265 VAC (45...55 Hz), 12 VA
Operating conditions	–40...+70 °C
Design	75 × 100 × 110 mm, IP40
Mounting	DIN-rail TH35 mounting

ENMV-1 with single interface

– 1 × RS-485
– digital input and output, analog input



Specifications

ENMV-1-☐

	32/0	24/6	16/12	16/18	8/24	0/36	16P/0	6/3R
Number of digital inputs (dry/wet contacts: 24/110/220 VDC)	32	24	16	16	8	-	-	6
Number of digital outputs 300 VDC/0.12 A, 250 VAC/0.12 A	-	6	12	18	24	36	-	-
Number of digital outputs 250 VAC/8 A, 250 VDC/0.2 A	-	-	-	-	-	-	-	3
Number of analog inputs 0...20 mA, ±20 mA, 0...5 mA, ±5 mA, 4...20 mA	-	-	-	-	-	-	16	-

Interfaces and protocols	1 × RS-485: Modbus RTU, IEC 60870-5-101
Event logging	I/O history — 1000 records
Time sync	IEC 60870-5-101
Power supply	18...36 VDC, 40...160 VDC, 12 W
Operating conditions	–40...+70 °C
Design	75 × 100 × 124 mm (6/3R — 75 × 70 × 110 mm), IP40
Mounting	DIN-rail TH35 mounting

ENMV-1W

– 2 × RS-485
– Environmental monitoring, digital outputs

ENMV-3

– 2 × 100Base-TX
– DC circuit measurement

Specifications

	ENMV-1W	ENMV-3
Inputs	1-Wire bus, poll up to 30 1-wire sensors (temperature, humidity and pressure)	2 measuring inputs (FS: ±0.1 %): Input AI-1: 10 V, 1000 V Input AI-2: 5 mA, 20 mA, 75 mV, 200 mV, 10 V
Outputs	2 digital outputs: 300 VDC/0.12 A, 250 VAC/0.12 A	-
Interfaces and protocols	2 × RS-485: Modbus RTU, IEC 60870-5-101	2 × 100Base-TX (PRP, RSTP): IEEE C37.118.2, IEC 60870-5-104, IEC 60870-5-101, SNMP
Time sync	IEC 60870-5-101	2 × 100Base-TX: IEEE 1588v2 PTP RS-485: PPS, IRIG-A/B
Power supply	18...36 VDC, 120...370 VDC, 100...265 VAC (45...55 Hz), 4 VA	18...36 VDC, 120...370 VDC, 100...265 VAC (45...55 Hz), 10 VA
Operating conditions	–40...+70 °C	–40...+70 °C
Design	75 × 70 × 110 mm, IP40	109 × 188 × 35 mm, IP20
Mounting	DIN-rail TH35 mounting	DIN-rail TH35 mounting

Ordering Information

Designations: **DI** — digital inputs, X_1 — DI voltage: 24 — 24 VDC (wet/dry), 110 — 110 VDC (wet), 220 — 220 VDC (wet); **DO EMR** — digital outputs 250 VAC 8 A, 250 VDC 0.2 A; **DO SSR** — digital outputs 300 VDC 0.12 A, 250 VAC 0.12 A; **DO TRIP** — digital outputs 250 VDC 3.4 A;
AI — analog inputs, X_2 — AI input range: A — ±250 V, B — ±10 V, C — ±200 mV, D — ±75 mV, E — ±20 mA, F — ±5 mA;
AIP — configurable analog input: 0(4)...20 mA, ±20 mA, 0...5 mA, ±5 mA; **TP** — inputs for thermocouples and thermal resistance.

ENMV-1-□-□-□

Power supply voltage

220 — 120...370 VDC or 100...265 VAC
110 — 40...160 VDC
24 — 18...36 VDC

Inputs and outputs

6(X_1)/3R — 6 × DI, 3 × DO EMR

24(X_1)/0 — 24 × DI
16(X_1)/3R — 16 × DI, 3 × DO EMR
16(X_1)/6 — 16 × DI, 6 × DO SSR
0/20 — 20 × DO SSR
0/22 — 20 × DO SSR, 2 × DO TRIP
8P2T/0 — 8 × AIP, 2 × TP
8$X_2$8(X_1)/0 — 8 × AI, 8 × DI

8(X_1)/3R — 8 × DI, 3 × DO EMR
8(X_1)/6 — 8 × DI, 6 × DO SSR
16(X_1)/0 — 16 × DI
0/18 — 18 × DO SSR
8P/0 — 8 × AIP
8X_2/0 — 8 × AI

Interfaces

A1 — 1 × RS-485

A2E0 — 2 × RS-485
A2E4 — 2 × RS-485, 1 × 100Base-TX
A2E4x2 — 2 × RS-485, 2 × 100Base-TX

A1E0 — 1 × RS-485
A1E4 — 1 × RS-485, 1 × 100Base-TX
A1E4x2FM — 1 × RS-485, 2 × 100Base-FX MM
A1E4x2FS — 1 × RS-485, 2 × 100Base-FX SM

ENMV-1-□-24-A1

Inputs and outputs

24(X_1)/6 — 24 × DI, 6 × DO SSR
16(X_1)/12 — 16 × DI, 12 × DO SSR
16(X_1)/18 — 16 × DI, 18 × DO SSR
8(X_1)/24 — 8 × DI, 24 × DO SSR
32(X_1)/0 — 32 × DI
0/36 — 36 × DO SSR
16P/0 — 16 × AIP

ENMV-1W-0/2-□-A2

Power supply voltage

220 — 120...370 VDC or 100...265 VAC
24 — 18...36 VDC

ENMV-3-□-□-A1E4x2

Power supply voltage

220 — 120...370 VDC or 100...265 VAC
24 — 18...36 VDC

Nominal values of input signals

AI-1/AI-2, where
AI-1: A — ±1000 V, B — ±10 V
AI-2: B — ±10 V, C — ±200 mV, D — ±75 mV, E — ±20 mA, F — ±5 mA

Options and accessories

IEC 61850-8-1 activation — ES61850.enmv
Detachable terminal (except 1W, 6/3R) — PLUG.enmv
RS-485 splitter — EX...
Surge protection — ESP485-..., ESP-LAN

Sealing cover — PC1015, PC0715
1-Wire sensors — TS-1W-55/70, HPTS-1W-5
Rain, wind and solar radiation protection screen — TS-SRS2
USB 2.0 cable — USB-A-B, USB-A-Bmini

ENLZ

short-circuit and earth fault controllers

ENLZ devices are used for the localization of short circuits and earth faults in cable distribution power grids. ENLZ in pair with the sensors detects short circuits and measures synchrophasor of zero-sequence currents and voltages. ENLZ transmits data for centralized processing to the control center of DSO.

The algorithm for the localization of earth faults is based on the analysis of the amplitudes and phases of the zero-sequence current and voltage phasors, measured by ENLZ at section boundaries of the distribution network.

Equipped with six optical inputs for short-circuit sensors, and two analog inputs, one ENLZ provides monitoring data for two cable lines. To measure $3I_0$ and $3U_0$, ENLZ connects to zero-sequence current transformer (SCSS), and instrument voltage transformer with $3U_0$ winding through a VMT step-down voltage transformer.

ENLZ uses ENCM-3 remote terminal unit for time synchronization from GPS/GLONASS. ENCM-3 transmits data from ENLZ to a data processing center via Ethernet or cellular network (4G/3G/2G).

When a short circuit occurs in one of the monitored bays, ENLZ devices receive and time-record signals from short-circuit current indicators (OCTT). Recorded events are sent to the SCADA data collection server via the data collection device as telemetering. ES Graph software analyzes $3I_0$ synchrophasors at the time of damage in the monitored network. By comparing the signals from pairs of SCSS sensors at the beginning and end of the cable line, the damaged network section is determined.

2 analog inputs, RS-485, power supply input

USB

clamps to connect the optic fiber of the short-circuit sensor

Specifications

Analog inputs	current: 0,5...70 A (through SCSS current sensor) voltage: 2...200 V (through VMT voltage transformer)
Optic inputs	6 optic inpits, POF 980/1000 mkm, wavelength 400...1000 nm, d — 2.2 mm
Interfaces and protocols	RS-485: IEC 60870-5-101
Power supply	18...36 VDC or 120...370 VDC / 100...265 VAC (45...55 Hz), 6 VA
Operating conditions and design	from −40 to +70 °C, 75 × 100 × 120 mm (IP40), DIN-rail TH35 mounting

Ordering Information

ENLZ-1-□/6-□-A1

Analog inputs

I2 — two current inputs
U2 — two voltage inputs
I1U1 — current input + voltage input

Power supply voltage

220 — 100...265 VAC (45...55 Hz) or 120...370 VDC
24 — 18...36 VDC

Options and accessories

RS-485 splitter — EX...
Threshold current sensor with optical output — OCTT
Summation current sensor, splittable — SCSS
Plastic optical fiber — CPOF
Voltage transformer — VMT
USB 2.0 cable, male A to male B mini, 1 m — USB-A-Bmini

ENCS-2

time sync modules

Receiving GPS/GLONASS time signals, ENCS-2 serves as a common time source for measuring devices, smart meters, I/O modules, phasor measurement units, merging units, servers and workstations.

ENCS-2 supports multiple time synchronization protocols and interfaces (RS-232, RS-485, and Ethernet). For devices connected to the process bus of the digital substation, ENCS-2 provides synchronization via PTPv2 in accordance with IEC/IEEE 61850-9-3, Power Utility Profile.

ENCS-2 has an OLED display and control buttons on its front panel, a set of interfaces, and a PPS output.

ENCS-2 operates in pair with GPS/GLONASS antenna, which is ordered separately. GPS-P antenna with cable and suitable mounting brackets are presented on page 47.

SMA connectors (GPS antenna input, PPS output)

1 × RS-232, 2 × RS-485, 2 × 100Base-TX

OLED display

Control buttons

Power supply input

Specifications

Timing accuracy (UTC)	1PPS and IRIG: ±150 ns; SNTP: ±100 mcs; PTPv2: ±250 ns
Timing error in the absence of satellites	ENCS-2: ±20 ms/day ENCS-2T: ±1 ms/day
Interfaces and protocols	2 × 100Base-TX (PRP or 2 MAC): PTPv2 (IEC/IEEE 61850-9-3), SNTP, SNMP; RS-232-1, RS-485-1: NMEA 0183, IEC 60870-5-101; RS-485-2: IRIG-A(B), 1PPS
Event logging	Timing functions: satellites signal receiving statuses, ports statuses, clock correction, PTP correction, BMCA operation Common events: power up, firmware update, changing settings, authorization
Power supply	18...36 VDC, 55...176 VDC, or 120...370 VDC / 100...265 VAC (45...55 Hz), 10 VA
Operating conditions and design	–40...+70 °C, 83 × 100 × 110 mm, IP40, DIN-rail TH35 mounting

Ordering Information

ENCS-2□-□-A2B1E2

Modification

not specified — with crystal oscillator
T — with oven controlled crystal oscillator (OCXO)

Power supply voltage

220 — 100...265 VAC (45...55 Hz) or 120...370 VDC
110 — 55...160 VDC
24 — 18...36 VDC

Options and accessories

IEEE 1588v2 PTP support — PTPv2.encs2
Outdoor GPS/GLONASS antenna — GPS-P
Mounting brackets for GPS/GLONASS antenna — GPS-KP-...

ENCS-3m
ENCM-3

remote terminal units

ENCS-3m and ENCM-3 remote terminal units (RTUs) provide a data communication channel between power facilities and control centers.

ENCM-3 is equipped with four interfaces, digital and analog inputs and outputs, and is used for automation of 6-20 kV substations and switchgear in distribution networks.

ENCS-3m are equipped with up to 14 interfaces and are used in automation systems of power plants and substations.

The RTUs function in real-time, acquiring data from up to 240 devices via RS-485, RS-232, and Ethernet interfaces. Collected data is aggregated and transmitted to automation systems with minimal delays.

The RTUs can be configured to perform logic operations and arithmetic calculations with the values collected.

Multiple proprietary and standard communication protocols are supported, including IEC 61850-8-1 (client/server, MMS/GOOSE). The RTUs act as protocol converters, and by demand can tunnel serial interfaces, providing direct access to devices connected to their RS-232/485 ports.

Modifications with a built-in GPS/GLONASS receiver and a 3G/2G module are available.

ENCS-3m

Remote terminal unit has ten asynchronous serial ports, and two or four Ethernet ports with support for RSTP and PRP redundancy according to IEC 62439-3. To be compatible with low-speed data links, some ports can be configured to exchange at 100 baud.

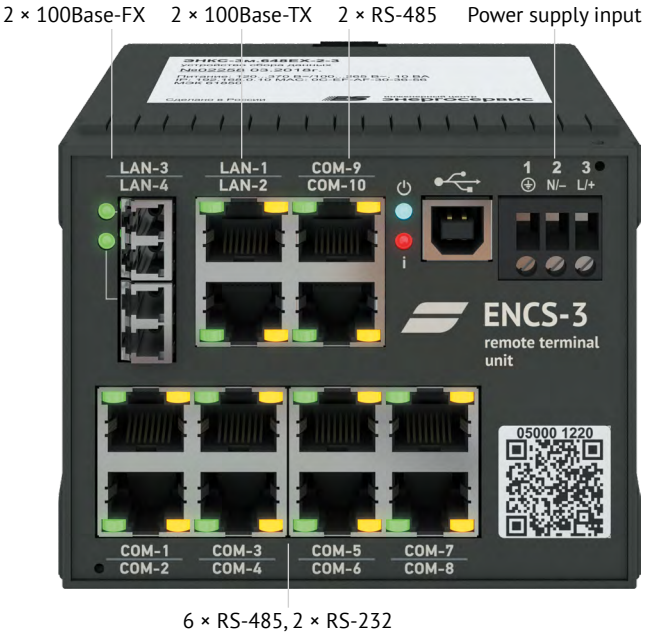
ENCS-3m..-1(2)

This modification is distinguished by the presence of a CAN, which is used for the "warm" standby mode. It can be ordered with options:

G — 4G/3G/2G module;
GT – ... + GPS/GLONASS module.

ENCS-3m...-3, ENCS-3m...-4(5)

Four Ethernet ports supporting RSTP and PRP redundancy in accordance with IEC 62439-3.



ENCM-3

Remote terminal unit is equipped with three serial ports and one Ethernet port.

ENCM-3 supports data transmission in cellular networks and receives GPS/GLONASS signals.

ENCM-3...-000

It is the basic modification has no additional inputs and outputs.

ENCM-3...-400(800)

4(8) digital inputs

ENCM-3...-430

4 digital inputs; 3 digital outputs 3/0.35/0.2 A (30/110/220 VDC), 6 A (250 VAC).

ENCM-3...-421(422)

1(2) analog inputs, 4 digital inputs,
2 digital outputs (3/0.2 A 30/220 VDC, 6 A 250 VAC)

Optionally, a super boost capacitor power buffer is available for all modifications of ENCM-3, guaranteeing transmission of the latest signals and measurements after the main power supply shutdown.

ENCM-3...-640

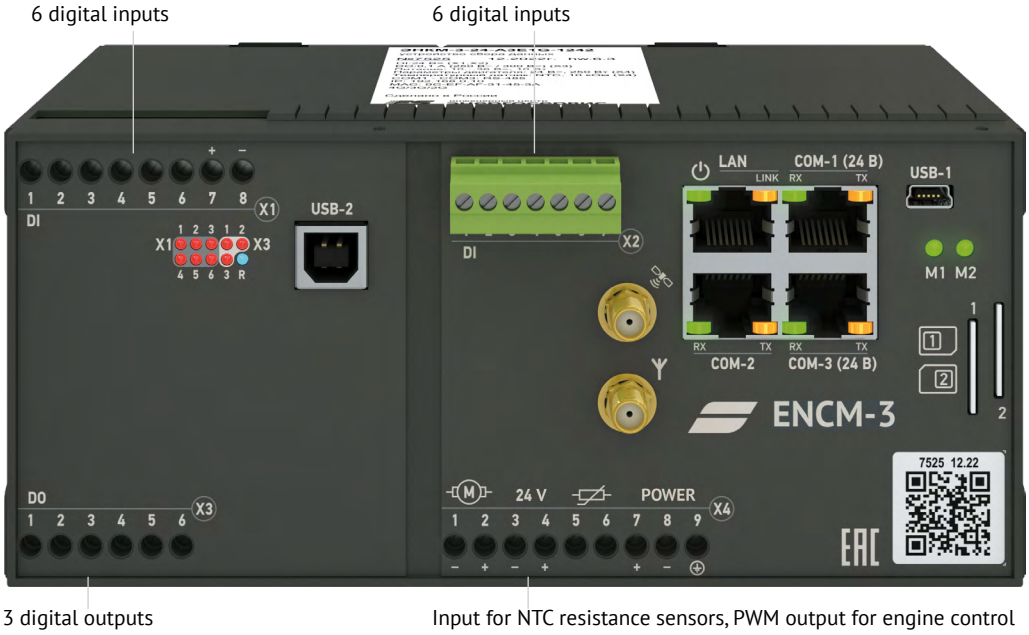
6 digital inputs; 4 digital outputs (0.1 A 300 VDC / 250 VAC).

ENCM-3...-612

6 digital inputs, input for NTC resistance sensors, PWM output (24 VDC,250 W) for engine control (smooth start, straight/reverse)

ENCM-3...-1242

12 digital inputs, 3 digital outputs (8 A 250 VAC, 0.2 A 250 VDC), input for NTC resistance sensors, PWM output (24 VDC, 250 W) for engine control (soft start, straight/reverse)



Specifications

	ENCS-3m...-1(2)	ENCS-3m...-3	ENCS-3m...-4(5)	ENCM-3
Interfaces	6(8) × RS-485, 4(2) × RS-232, 2 × 100Base-TX (PRP, RSTP), CAN	8 × RS-485, 2 × RS-232, 4 × 100Base-TX (PRP, RSTP)	8 × RS-485, 2 × RS-232, 2 × 100Base-TX, 2 × 100Base-FX LC SM (2 × 100Base-FX LC MM) (PRP, RSTP)	2(3) × RS-485, 1(0) × RS-232, 1 × 100Base-TX
Cellular	3G (option G)	n/a	n/a	3G, 1 sim (option G) 4G, 2 sim (option GT)
Built-in GPS-receiver	available (option GT)	n/a	n/a	available (option T)
Data polling	up to 240 devices	up to 240 devices	up to 240 devices	up to 64 devices
	up to 8192 measurement values, 4096 digital signals, 2048 commands			
	IEC 61850-8-1 (MMS, GOOSE), IEC 60870-5-101/103/104, DNP 3.0, Modbus RTU, Modbus TCP, SNMP; ENIP-2, ENMV-1, EMAX/TMAX, SE NSX, Sepam, SPA-Bus, DLMS/COSEM			
Upstream exchange	up to 16 connections Ethernet and 3G/2G: IEC 60870-5-104, IEC 61850 (MMS, GOOSE), Modbus TCP, SNMP	up to 16 connections Ethernet: IEC 60870-5-104, IEC 61850 (MMS, GOOSE), Modbus TCP, SNMP		up to 14 connections Ethernet and 4G/3G/2G: IEC 60870-5-104, IEC 61850 (MMS, GOOSE), Modbus TCP, SNMP
	up to 10 connections RS-485, RS-232: IEC 60870-5-101, Modbus RTU			up to 3 connections RS-485, RS-232: IEC 60870-5-101, Modbus RTU
Built-in inputs and outputs	n/a	n/a	n/a	see ENCM-3 ordering information
Event logging	status of digital inputs and outputs, diagnostic messages; software upgrade, configuration update, power supply events			status of digital inputs and outputs
Time sync	according to IEC 60870-5-101, IEC 60870-5-104, SNTP (client and server)			
Logical expressions	logical functions: AND, OR, XOR, CMP, RS FF, TIMER			
Power supply	18...36 VDC, 42...176 VDC, 120...370 VDC or 100...265 VAC (45...55 Hz), 10 VA	18...36 VDC, 40...160 VDC, 120...370 VDC or 100...265 VAC (45...55 Hz), 10 VA	18...36 VDC, 40...160 VDC, 120...370 VDC or 100...265 VAC (45...55 Hz), 10 VA	10(18)...36 VDC, 55...176 VDC, 120...370 VDC, 100...265 VAC (45...55 Hz), 13 VA Power buffer — optional
Operating conditions	–40...+70 °C	–40...+70 °C	–40...+70 °C	–40...+70 °C
Design	75(83) × 100 × 110 mm, IP40	75 × 100 × 110 mm, IP40	75 × 100 × 110 mm, IP40	75 × 70 × 110 (119) mm, 75 × 100 × 110 (119) mm, 75 × 170 × 110 (119) mm, IP40
Mounting	DIN-rail TH35 mounting	DIN-rail TH35 mounting	DIN-rail TH35 mounting	DIN-rail TH35 mounting

Ordering Information

ENCS-3m-□-□□

Power supply voltage

24 — 18...36 VDC
110 — 42...160 VDC
220 — 120...370 VDC or 100...265 VAC

Interfaces

1 — 6 × RS-485, 4 × RS-232, 2 × 100Base-TX
2 — 8 × RS-485, 2 × RS-232, 2 × 100Base-TX
3 — 8 × RS-485, 2 × RS-232, 4 × 100Base-TX
4 — 8 × RS-485, 2 × RS-232, 2 × 100Base-TX, 2 × 100Base-FX SM
5 — 8 × RS-485, 2 × RS-232, 2 × 100Base-TX, 2 × 100Base-FX MM

ENCS-3m-..-1(2) optional:

G — 3G/2G
GT — 3G/2G, GPS/GLONASS

ENCM-3-□□-□□-□

Power supply voltage

220 — 120...370 VDC or 100...265 VAC
110 — 55...176 VDC
24 — 10...36 VDC

Power buffer

- — NA
C — super boost capacitor power buffer

Interfaces

A2B1E1 — 2 × RS-485, 1 × RS-232, 1 × 100Base-TX
A3E1 — 3 × RS-485, 1 × 100Base-TX

Inputs and outputs

000 — NA
400 — 4 × DI dry contact
800 — 8 × DI dry contact
430 — 4 × DI dry contact, 3 × DO EMR
640 — 6 × DI wet contact (24 VDC), 4 × DO SSR
421 — 4 × DI dry contact, 2 × DO EMR, 1 × AI ±20 mA
422 — 4 × DI dry contact, 2 × DO EMR, 2 × AI 0...20 mA
612 — 6 × DI wet contact (24 VDC), 1 × AI NTC 10 kOhm, PWM (24 VDC, 250 W)
1242 — 12 × DI wet/dry contact (24 VDC), 3 × DO EMR, 1 × AI NTC 10 kOhm, PWM (24 VDC, 250 W)

Optional

G — 3G, 1 sim
T — GPS/GLONASS
GT — 4G, 2 sim, GPS/GLONASS

Designations:
DI — digital inputs, **AI** — analog inputs,
DO EMR — digital outputs 250 VAC 6 A, 30/110/220 VDC 3/0.35/0.2 A, DO SSR — digital outputs 300 VDC 0.1 A,
AI NTC — input for NTC resistance sensors 10 kOhm,
PWM — PWM output (24 VDC,250 W) for engine control (smooth start, straight/reverse)

Note:
Modifications ENCM-3...-612, -1242 are available only with power supply 24 VDC (18...36 VDC)

Options and accessories

IEC 61850-8-1 activation for ENCS-3m — ES61850.encs3
IEC 61850-8-1 activation for ENCM-3 — ES61850.encm3
RS-485 splitter — EX...
Surge protection devices for RS-485— ESP485-...
Surge protection devices for Ethernet — ESP-LAN
Outdoor GPS/GLONASS antenna — GPS-P
Mounting brackets for GPS/GLONASS antenna — GPS-KP-...
4G/3G/2G antenna — 4G...

Certification

Conformance to IEC 61850 – UCAiug Level A Certificate IEC 61850 Ed.2 (DNV GL)

WAMS

synchrophasors acquisition
and real-time data analysis

Wide Area Measurement System (WAMS) uses measurements of voltage and current synchrophasors and provides state assessment and dynamic properties of power systems. WAMS data allows power system operators to identify power system conditions and monitor its dynamics. Real-time data provide an instantaneous overview of the power system, allowing the operator to detect the abnormal conditions and to determine their source.

To build the best performance WAMS it is necessary to cover main power facilities such as power stations and substations and equip them with phasor measurement units (PMU ENIP-2, see page 8), phasor data concentrators (PDC ES-PDC), and timing systems for global synchronization (ENCS-2).

Phasor data concentrators are installed at power plants to collect data from phasor measurement units and stream it to data processing centers. ES-PDC is software running on rugged industrial PCs.

ES-PDC supports data exchange via IEEE C37.118.2, calculates the values of additional electrical quantities on the fly, and records cyclic and emergency archives of a configurable depth.

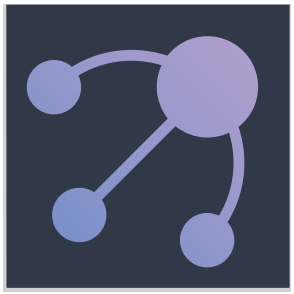
ES Phasor is a data analysis software for information that arrives at WAMS data centers. ES Phasor provides low-frequency oscillation monitoring and detects their sources.

ES Phasor analyses both online and offline data. Online analysis provides high process performance with a given accuracy. More detailed research is carried out by analyzing offline data.

The analysis of WASM data requires a large amount of computing, and with ES Phasor software the process is rationalized: the plan of computation is presented in the form of a generalized scheme and formed at the level of the user, and then assigned «performers» for each stage. By this scaling of computing resources, the software performs fast processing of WAMS data.

ES-PDC

Phasor Data Concentrator software



- data acquisition from up to 20 PMUs
- up to 6 upstreaming channels
- Additional measured and computable parameters: U_1, U_2, U_0, U_{AB}, U_{BC} U_{CA}, I_1, I_2, I_0, P, Q, S, P_1, P_2, P_0, Q_1, Q_2, Q_0, S_1, S_2, S_0, P_A, P_B, P_C, Q_A, Q_B, Q_C, S_A, S_B, S_C, φ_A, φ_B, φ_C, φ
- Minimum processing delay — receiving and uploading of the PMU frames less than 1 second
- Cyclical data archive up to 180 days: 1 TB for 10 × PMU, 2 TB for 20 × PMU
- Emergency data archive with adjustable length and number of emergency records recorded
- Exchange protocols and data formats:
- IEEE C37.118.2, IEC 60870-5-104, SOAP (HTTP), FTP; CSV, COMTRADE (IEEE/IEC C37.111-2013)
- time synchronization with SNTP
- optional computing modules

The ES-PDC software is supplied as pre-installed on industrial computers, corresponding to the project requirements.

Ordering Information

ES-PDC-☐ — **Storage:**

1000 — 1 TB for 10 × PMU
2000 — 2 TB for 20 × PMU

ES Phasor

Software for synchrophasor data analysis

- Online and offline data analysis
- Application of methods based on the comparative analysis of the amplitude-phase characteristics of oscillating components (mod) signals and assessment of energy oscillation (DEF, dissipation energy flow)
- Input data: current and voltage synchrophasors, frequency, and active and reactive power
- Presenting of analysis results as a map of controlled objects (power stations and lines) with highlighting of detected oscillation sources, incoming and outgoing energy flows, and their value.
- Big data management
- Optimization of the process of analysis and scaling of computing resources: presentation of the plan of computing in the form of a user schema with the purpose of the «executors» processes for each stage of the scheme

Certification

PDC ES-PDC is certified to the requirements of the Russian Power System Operator

CABINETS

typical and customized cabinets for automation systems

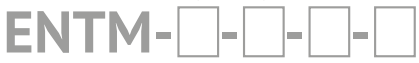
The application of typical cabinets allows to reduce the time of design, installation, and commissioning of automated systems.

Typical cabinets include microprocessor devices presented in this catalog, as well as proven third-party components.

Typical and customized cabinets assembled at our factory meet the requirements for safety and electromagnetic compatibility at power facilities.

The next page shows a product line of typical cabinets. To order a customized cabinet, please build your order code using the formula below or send the documentation on sales@ens.ru.

Ordering Information



Set of signals processed

PIx — number (x) of measuring devices (ENIP-2, ESM, etc)
DPx — number (x) of display modules
DIx(24) — number (x) of digital inputs 24 VDC
DIx(220) — number (x) of digital inputs 220 VDC
DOx — number (x) of digital outputs (300 VDC/0.12 A, 250 VAC/0.12 A)
DORx — number (x) of digital outputs (220 VAC/6 A, 220 VDC/0.1 A)
AIx — number (x) of analog inputs
Tx — number (x) of temperature sensors

Interfaces

Ax — number (x) of RS-485
Bx — number (x) of RS-232
Ex — number (x) of Ethernet 100Base-TX
Fx — number (x) of Ethernet 100Base-FX
G1 — cellular 3G, 1 sim
G2 — cellular 4G, 2 sim
GR — 3G/4G router
T1 — RTU with GPS/GLONASS support
T2 — cabinet equiped with ENCS-2 (GPS/GLONASS)
R — redundancy RTU

Operating conditions and design

XY — specify climate conditions and required IP

Power supply

DC24 — 24 VDC
AC230 — 230 VAC
DC220 — 220 VDC
UPS — with UPS
x2 — two power feeding

Example of a combined code for power supply:
DC220AC230UPS — 220 VDC, 230 VAC, UPS
AC230UPS — 230 VAC, UPS
AC230x2UPS — two power feeding 230 VAC, UPS
DC24x2 — two power feeding 24 VDC

Typical cabinets

Data acquisition and transmition

ENTM-1.0

ENCM-3-...-800

8 × DI 24 VDC

2 × RS-485, 1 × RS-232,
1 × 100Base-TX,
cellular

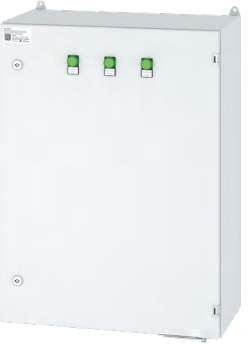
100...265 VAC,
10 VA (without external load)

IP54
500 × 400 × 220 mm

Data acquisition and transmission, centralized I/O

ENTM-1.1

ENTM-1.2



ENCM-3-...-430
1 × ENMV-1-24/0 (ENTM-1.1)
3 × ENMV-1-24/0 (ENTM-1.2)

27 × DI 24 VDC (ENTM-1.1)
75 × DI 24 VDC (ENTM-1.2)
3 × DO, 6 A 250 VAC, 0.2 A 220VDC

2 × RS-485, 1 × RS-232,
1 × 100Base-TX,
cellular, GPS/GLONASS

2 × 120...264 VAC, UPS 600 VA, up to 150 VA (without external load)

IP54
600 × 600 × 250 mm (ENTM-1.1)
800 × 600 × 300 mm (ENTM-1.2)

Centralized I/O

ENTM-2.1(2.2)

20 × ENMV-1-24/0 (ENTM-2.1)
220 VDC, 2 A power module (ENTM-2.1)
16 × ENMV-1-0/20 (ENTM-2.2)

22 × DI 24 VDC (ENTM-2.1)
456 × DI 220 VDC (ENTM-2.1)
320 × DO, 6 A 250 VAC, 0.1 A 220VDC (ENTM-2.2)

2 × RS-485

100...265 VAC,
up to 720 VA

IP54
2200 × 800 × 600 mm

Measurements

ENTM-2.3

20 × ENIP-2 + ENMI-3

measurements for 20 feeders/bays
158 × DI 24 VDC

2 × RS-485
100Base-TX

2 × 100...265 VAC, up to 440 VA

IP54
2200 × 800 × 600 mm

WAMS

ENTM-2.4

4 × PMU ENIP-2
2 × ES-PDC
ENCS-2
ENMI-6

PMU for 4 feeders/bays
18 × DI 24 VDC

2 × 100Base-FX (SM, SC)
1 × GPS/GLONASS

2 × 100...265 VAC, UPS 1000 VA,
up to 340 VA

IP54
2200 × 800 × 600 mm

Time sync

ENTM-1.5(2.5)

2 × ENCS-2
2 × switch L2
ENMI-6

GPS/GLONASS

4 × RS-485, 2 × RS-232
2 × 100Base-TX
2 × 100Base-FX SC SM

2 × 100...265 VAC,
up to 55 VA

IP54
600 × 600 × 250 mm (ENTM-1.5),
2200 × 800 × 600 mm (ENTM-2.5)

Options and Accessories

Expand the capabilities of devices and simplify their maintenance with options and accessories.

The full list is on enip2.com.

ES61850.encs3
IEC 61850-8-1 activation
for ENCS-3m

ES61850.encm3
IEC 61850-8-1 activation
for ENCM-3

ES61850.enip
IEC 61850-8-1 activation
for ENIP-2 Standard

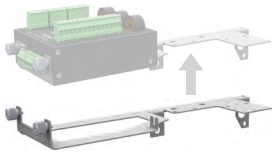
ES61850.esm
IEC 61850-8-1 activation
for ESM

ES61850.enmv
IEC 61850-8-1 activation
for ENMV-1

PTPv2.encs2
IEEE 1588v2 PTP activation
for ENCS-2

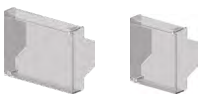
IP54.enmi
IP54 for front panel
of ENMI

SD8G.pmu
Additional 8 GB memory
for PMU ENIP-2

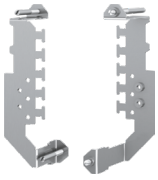


RM6-KP
Bracket for ENIP-2-..-32,
stainless steel 1.5 mm

PLUG.enmv
Detachable terminal
for ENMV-1 (except 1W, 6/3R)

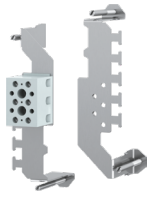


PC1015, PC0715
Sealing cover
for ENIP-2 Standard or ENMV-1

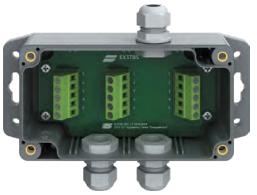


P-KP
Bracket organizer
for ENIP-2 Panel or ENMI
for panel mounting

PDIN-KP
Bracket organizer for mounting
of ENIP-2 Panel, ENMI
on DIN-rail TH35



PXT-KP
Bracket organizer with terminals
for ENIP-2 Panel
for transiting/terminating current wires



EX3TBS

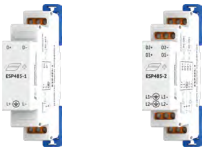
RS-485 splitter
for 3 connections
(IP54, screw)

EX4TB

RS-485 splitter
for 4 connections
(screw, DIN-rail TH35)

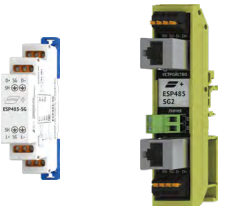
EX4(6)RJ(S), EX5RJX, EX6RJT

RS-485 splitter
for 4, 5 or 6 connections
(RJ45, screw/push-in, DIN-rail TH35)



ESP485-1, ESP485-2

Surge protection for RS-485,
1 or 2 line (screw, DIN-rail TH35)



ESP485-SG, ESP485-SG2

Surge protection for RS-485 line with
protection of signal ground (RJ45, screw/
push-in, DIN-rail TH35)

TR120RJ

RS-485 Terminator
(RJ45, 120 Ohm)

ESP-LAN

Surge protection for Ethernet
10/100/1000 Base-TX
(RJ45, screw/push-in, DIN-rail TH35)

EMP-GN

Surge protection for GPS/GLONASS
antenna feeder (DIN-rail TH35)

ITS2

Non-contact temperature sensor
(RJ45, DIN-rail TH35)

TS-1W-55/70-5 (TS-1W-55/125-5)

1-Wire temperature sensors
−55...+70 °C (−55...+125 °C), 5 m

HPTS-1W-5

1-Wire humidity, pressure
and temperature sensor, 5 m

TS-SRS2

Rain, wind and solar radiation
protection screen for 1-Wire sensors

GPS-P

Outdoor GPS/GLONASS-antenna,
D111 mm, h50 mm, G3/4, SMA (m),
10/20/50 m feeder

4G.S3

4G/3G/2G antenna
SMA connector, 3 m feeder,
screw fastening

4G.M3

4G/3G/2G antenna
SMA connector, 3 m feeder,
magnetic base

GPS-KP-LITE

Mounting bracket for GPS/GLONASS
antenna, stainless steel,
83 × 60 × 82 mm

GPS-KP-MINI

Mounting bracket for GPS/GLONASS
antenna, stainless steel,
125 × 60 × 186 mm

GPS-KP

Mounting bracket for GPS/GLONASS
antenna, painted steel,
h × 300 mm × G3/4,
h 300, 500 or 1000 mm

SCSS

Summation current sensor,
splittable

OCTT, CPOF

Threshold current sensor
with optical output,
plastic optical fiber

VMT

Voltage transformer
for connecting ENLZ to VT

CCRJ05, CCRJ10, CCRJ30

Straight patch-cord RJ45-RJ45,
length 0.5/1.0/3.0 m

RJ45PG, RJ45PGK

Lockable plug-out protection for RJ45
connector, key for for RJ45PG

USB-A-B, USB-A-Bmini

USB 2.0 cable, male A to male B
(male B mini), 1 m

Solutions

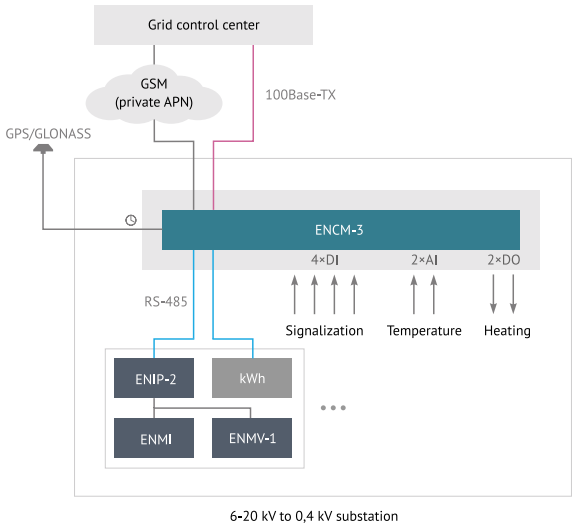
More than 200000 ENS devices already operate at thousands of power facilities.
Our customers are satisfied with the experience of using them.
If you are searching for reliable and effective solutions then take a look at some examples of applications for automation systems:

- remote monitoring and control of distribution networks;
- power station and substation automation;
- digital substations and smart grids;
- smart metering and power quality monitoring;
- wide area measurement and control systems.

It doesn't matter if are you building a new or if you are retrofitting an existing automation system — supporting the standard industrial protocols and simplicity of configuration make it to easy integrate our products into projects and systems with any complexity.

Remote monitoring and control of distribution networks

Monitoring and control of small power facilities



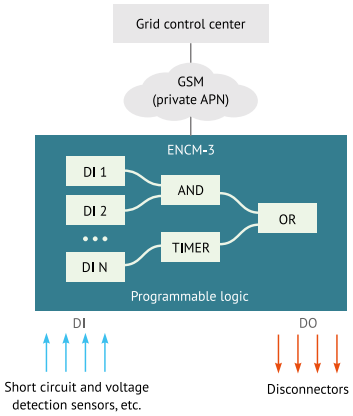
ENCM-3 processes a part of the data amount by built-in digital inputs and analog inputs and also gives controls through built-in digital outputs.

The system could be extended with up to 64 ENIP-2, ESM, and ENMV-1.

ENCM-3 can provide access to revenue meters and other devices installed on facilities by tunneling RS-485/232.

On-site time sync is provided by ENCM-3 with a built-in GLONASS/GPS receiver.

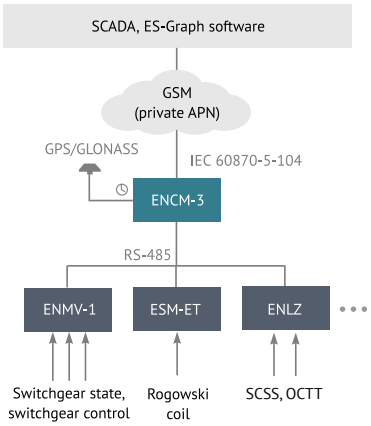
Automation of switching equipment



ENCM-3 is installed in the control cabinet of the switching equipment of the overhead transmission line (e.g. recloser, load switch, disconnector) and provides remote control and monitoring.

Programmable logic expressions of ENCM-3 turn it into a programmable logic controller and make easy automation of switching equipment (e.g. autoreclosing).

Fault localization



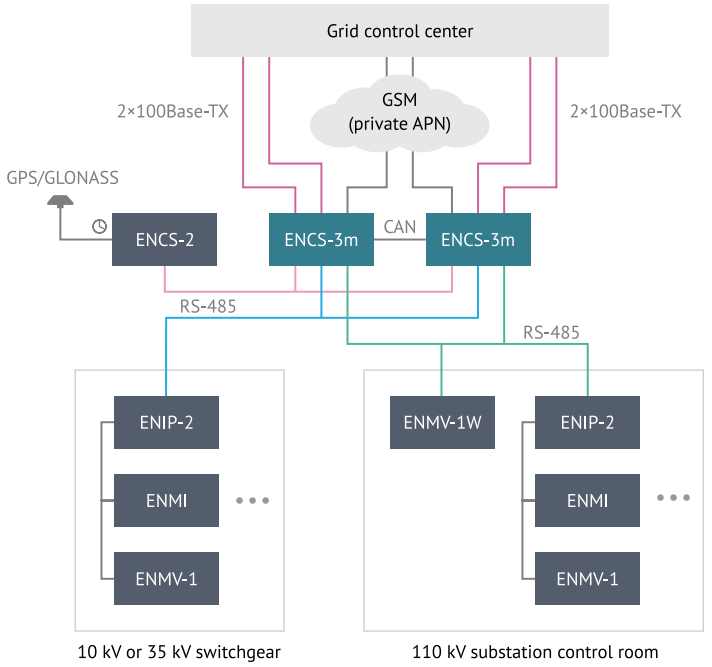
ENLZ receives the statuses of the short-circuit current indicators and performs measurements of $3I_0$ and $3U_0$ synchrophasors. ESM-ET measures network parameters, ENMV-1 processes digital signals, and controls switching devices.

ENCM-3 synchronizes devices and provides communication with the power grid control center.

The software ES-Graph analyzes the obtained data and identifies the damaged sections of the cable power grid.

Substation monitoring and control

SCADA

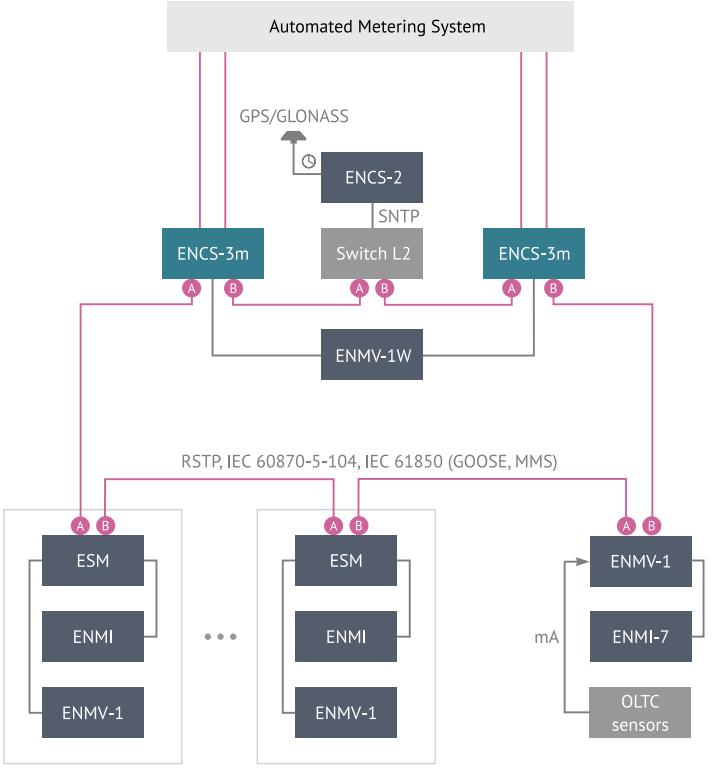


ENIP-2 measures network and feeder (bay) parameters, ENMI displays measurements, ENMV-1 controls the switching equipment and processes digital signals, and ENMV-1W with 1-Wire temperature sensors provides environmental conditions data at the substation.

ENCS-3m polls devices via RS-485 and transmits data to the upper control level.

ENCS-2 provides timing for all devices.

SCADA, power metering, and power quality monitoring



ESM performs power metering, monitors power quality, and provides the measurement of network parameters.

ENMV-1 controls the switching equipment, processes digital signals, and defines the on-load tap-changer position of the transformer.

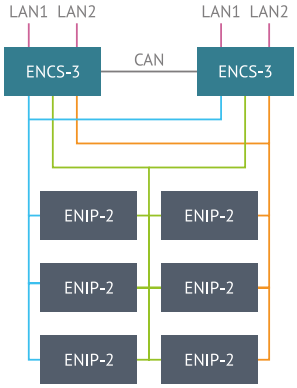
ENMV-1W with 1-Wire temperature sensors provides environmental conditions data at the substation.

ENCS-3m polls devices via the local network and transmits data to the upper control level.

ENCS-2 provides timing for all devices.

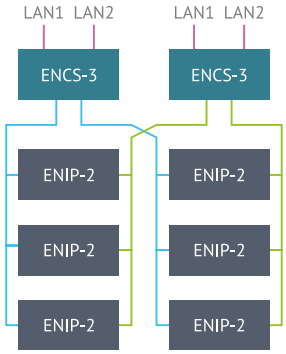
RTU Redundancy methods

«Warm» redundancy, data acquisition via RS-485



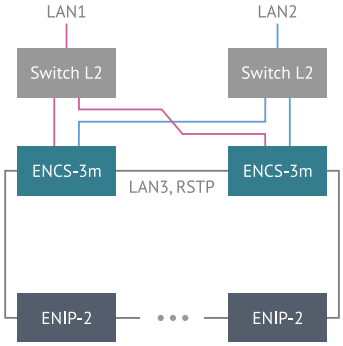
Two ENCS-3's are coupled with a CAN. Only one of the RTUs is active at any time. It polls devices and communicates with the upper level. The active RTU reports its status to the inactive one and switches roles if it loses connection with the polled devices.

«Hot» redundancy, data acquisition via RS-485



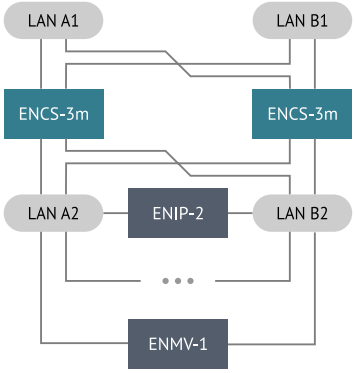
Two and more ENCS-3's operate independently and poll the same devices being connected to the different ports.

«Hot» redundancy, data acquisition via network with ring topology (RSTP)



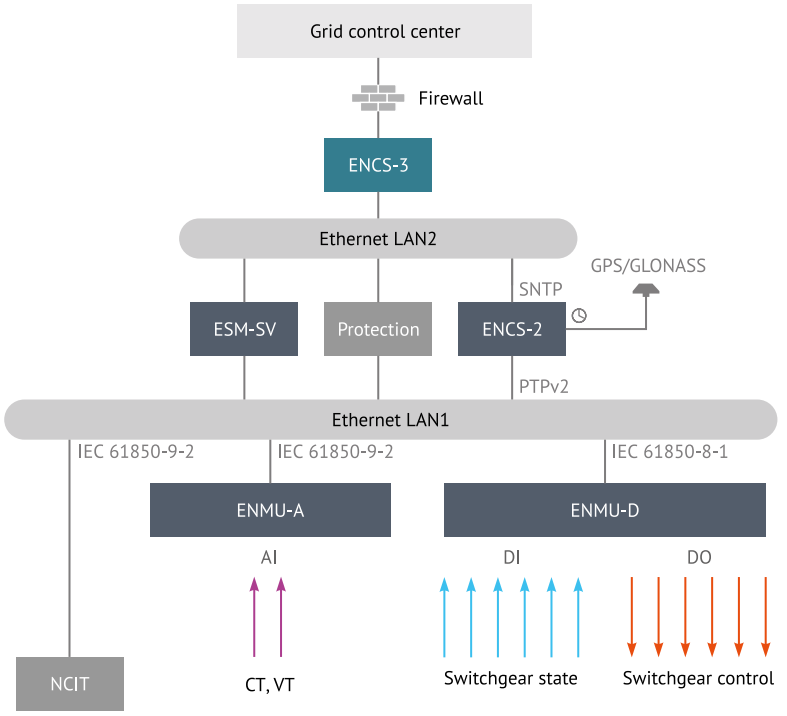
Two and more ENCS-3's poll the same devices via LAN (ring topology). Data are transmitted to the higher level to two independent networks.

«Hot» redundancy, data acquisition via two separated networks (PRP)



Two and more ENCS-3's operate in «hot» redundancy, data are transmitted to the higher level to two independent networks or via PRP (IEC 62439-3 Clause 4).

Digital substation



ENMU publishes SV and GOOSE and controls switching equipment.

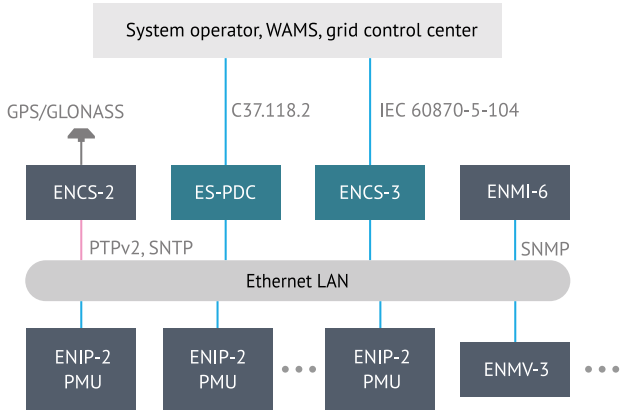
Additionally ENMU calculates synchronized current and voltage phasors.

ESM-SV operates as a revenue meter, power quality analyzer, and a multifunctional measuring device. ESM-SV receives SV from ENMU and/or NCIT.

ENCS-3m communicates in accordance with IEC 61850-8-1 or IEC 60870-5-104.

ENCS-2 provides timing for all devices. For reliable time synchronization it is recommended to use multiple ENCS-2 (SNTP; IEEE 15888 PTPv2, BMCA).

Wide Area Measurement Systems (WAMS)



ENIP-2 PMU performs phasor current and voltage measurements и calculates grid parameters.

ENMV-3 provides DC circuit measurement in generator excitation circuits.

ES-PDC aggregates and transmits data via IEEE C37.118.2, and records cyclic and emergency archives of a configurable depth.

ENCS-3m transmits data to the higher level via IEC 60870-5-104.

ENMI-6 diagnostic panel controls the health of each system element.

ENCS-2 provides timing for all devices.

Warranty and Support

Our products and their components pass rigorous quality control at all stages from development to serial production. We provide our customers with a 5-year warranty for ENIP-2, ESM, ENMI, ENMV, ENCS-2, ENCS-3m, ENCM-3, ENMU. We guarantee to deliver high-quality technical support that won't leave our customers dissatisfied. We regularly organize free technical seminars, both online and offline, which serve as a great learning tool for our users.

You can find more information about our products and solutions at www.enip2.com.

Please, feel free to contact us if you've got questions or you would like to place an order.

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