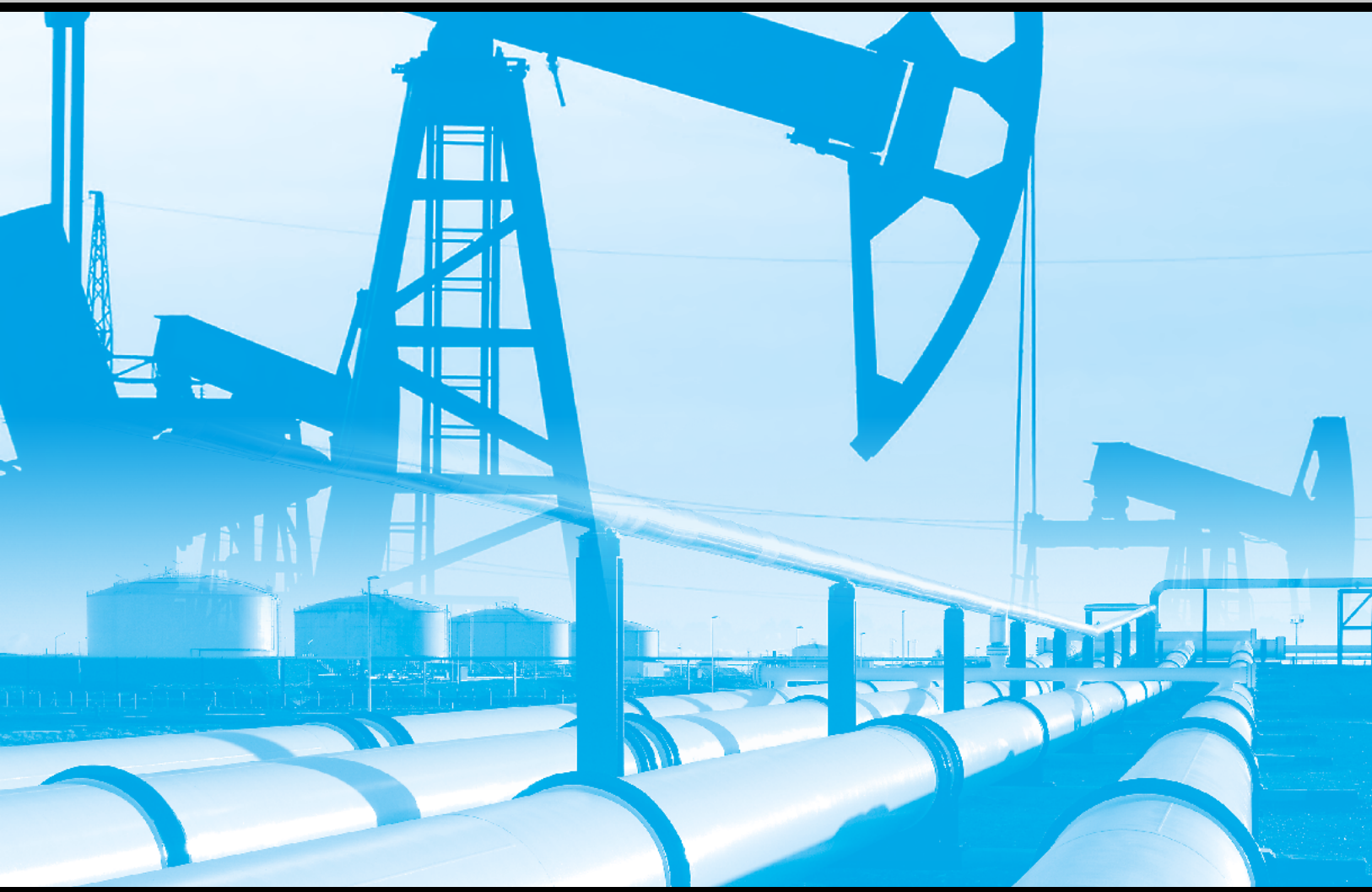


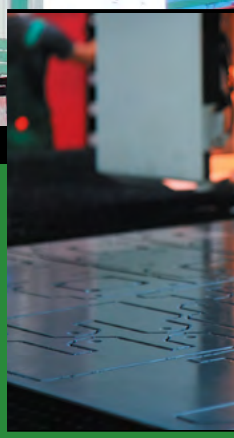
ELEKTON

Oilfield Equipment

Automation Systems

- DEVELOPMENT
- MANUFACTURE
- SOFTWARE
- INSTALLATION
- MAINTENANCE

Contents



ELEKTON

The founder of ELEKTON CJSC
Vladislav I. LEPEKHIN

For the last 25 years, ELEKTON has been developing, manufacturing and implementing complex electrical systems and microprocessor-controlled electronic devices that facilitate the optimization of technological processes in the oil industry.

Today ELEKTON is one of the Top leaders in the manufacture of electrical equipment for the oil industry in Russia. The manufacturing areas exceed 10 thousand m², and the total manpower is over 500 persons.

THE COMPANY'S DYNAMIC DEVELOPMENT, ITS COMMITMENT TO CONTINUOUS IMPROVEMENT AND INTERNATIONAL QUALITY STANDARDS ARE AMONG THE FACTORS STIMULATING THE STEADY GROWTH OF PRODUCTION COMMERCIAL VOLUMES UNDER THE ELEKTON TRADEMARK.

ELEKTON JSC has been manufacturing oilfield equipment since 1994. Today, ELEKTON is a modern company incorporating the best international practices of high-tech equipment production for oil industry.

ELEKTON's surface and downhole oilfield equipment is successfully used by leading Russian oil companies such as Gazpromneft, LUKoil, Rosneft, Surgutneftegas, Bashneft, Tatneft, as well as by oil companies of Kazakhstan.

The main business lines of ELEKTON include development and manufacture of the following types of products:

1. Electrical systems and electronic devices for oil production optimization;
2. Variable speed drives- VSD and Switchboards for ESP motors of various capacities, associated devices and equipment;
3. Downhole oilfield equipment. (such as DHS, flow meters, water cut meters, etc).

Design engineering department of ELEKTON handles development, testing and implementation of new equipment and technologies. The software engineering department, converter equipment department, and electronic modules and hardware engineering department constantly focus on upgrading, improvement and enhancement of functionality of the equipment manufactured by the company.

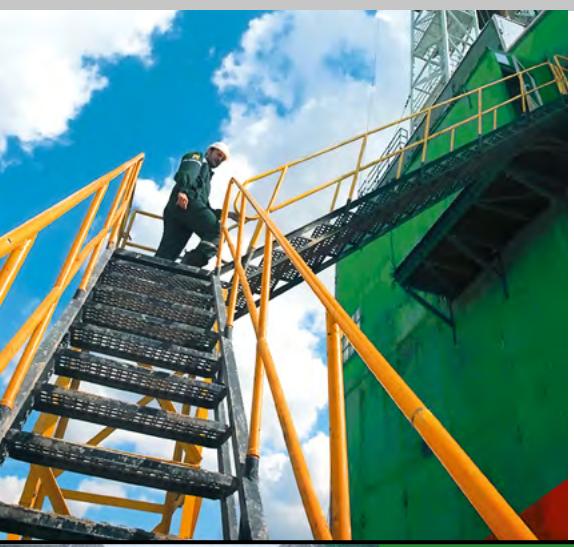
The operations base of the company includes a machine shop, a metal product powder coating shop, and workshops for manufacture of metal switchboard cabinets and associated components. The manufacturing areas exceed 20 000 m².

The total manpower is over 500 persons. Engineering and technical prowess of ELEKTON staff is proven by over 30 patents on produced equipment.

The Quality Management System of ELEKTON has been certified by ISO 9001-2015 for the design, manufacture, supply and maintenance of VSD, switchboards for ESP motors, DHS - downhole sensors, soft start couplings, anti-backspin couplings, chemical dosing systems, ELEKTON-Active Power Filters.

Over 80 000 ELEKTON – VSD and switchboards have been successfully installed at different oilfields in Russia, CIS and other foreign countries. These include a wide range of equipment, from simple devices to intellectual complexes. All series of VSD and switchboards have a wide range of functions to ensure the control, security, and automation of oil production process.

ELEKTON provides installation supervision, maintenance, full service and warranty technical training. Service, manintance, as well as warranty and post-warranty service are provided by regional service centers and operations bases opened by the company in the cities and regions where ELEKTON equipment is mainly used.



ELEKTON'S PHILOSOPHY IS BASED ON A COMPREHENSIVE APPROACH TO AUTOMATION AND OPTIMIZATION OF OIL PRODUCTION PROCESS, AND MANUFACTURE OF OILFIELD EQUIPMENT COMPETING WITH THE BEST WORLD ANALOGUES.

Apart from oilfield equipment, ELEKTON develops other high-tech products, such as professional digital audio recorders much needed today in civil aviation, by electric grid operators, power supply and power generation companies, independent security companies, Emercom, and transport police.

Complete technological process, professionalism and competence of the staff ensure effective production in a closed cycle: from development of systems and devices to shipment of finished goods to the consumer.

ELEKTON GUARANTEES YOU HIGH QUALITY SERVICES AT OPTIMAL PRICES.

ELEKTON-04 Switchboards

ELEKTON-04-160 (250, 400, 500, 630)кVA

ELEKTON-04 switchboards are designed for the control and protection of ESP motors.

ELEKTON-04 switchboards measure the current in the primary circuit of the step-up transformer, the controller using a special software recalculates the obtained value into the operating current for the motor. Due to such design the input of cables fromsecondary circuit of step-up transformer is eliminated, which ensures simpler installation and higher degree of maintenance safety.

Certificate of conformity: ЕАЭ RU C-RU.ME68.B.00008/19.

DESIGN FEATURES OF ELEKTON-04 SWITCHBOARDS

- Cables are connected at the rear of the switchboard, in its upper section. This makes it easy to install the switchboard at the well pad. This design is protected by several patents.
- The design of the switchboard ensures a high degree of maintainability and safety of maintenance: main units are easy to replace thanks to the use of plug connections and appropriate design solutions.
- The communication ports of the DHS and the neutral point connection terminals of the transformer are located in a special separate compartments at the rear of the switchboard. Because of this all external connections can be made by the technical staff without the need to open the switchboard.
- The door of the switchboard has a window opposite to the controller light indicators showing the status of the switch-board. This facilitates visual monitoring of the switchboard without opening its door.
- The switchboard has an own or built-in meter for control of consumed active and reactive power.
- USB port for recording information to a standard USB drive.
- LAN port for connecting to Ethernet network via Modbus TCP protocol.

ELEKTON-04-160(250) switchboard provides for installation of a soft starter.

ELEKTON-04K switchboard with a reactive compensator

BASIC TECHNICAL SPECIFICATIONS OF ELEKTON-04-160 (250, 400, 500, 630) кVA SWITCHBOARDS

PARAMETER	VALUE
Rated supply voltage, V	380 (50±1 Hz)
Maximum voltage deviation from average, %	-50... +25
Primary circuit rated current, A, max	250 (400, 630, 800, 1000)
Transducer›s rated power, kVA	160(250,400, 500, 630)
Electric motor power, kW, max	100 (160, 240, 320, 400)
Temperature range, °C	-60... +40
Enclosure type	NEMA3R, NEMA4, NEMA4X
Switching device	Contactor 250 A (400 A, 630 A, 800 A, 1000 A)
Control circuit of the switching device	ELEKTON-10.1 Controller
Overall dimensions, mm / weight, kg, max	
• ELEKTON-04-250 (400)	1735 x 800 x 640 / 165 (180)
• ELEKTON-04-630	1735 x 850 x 752 / 210
• ELEKTON-04-800 (1000)	1860 x 950 x 1000 / 370 (380)

ELEKTON-04SK Switchboards for Sucker Rod Pumps

ELEKTON-04SK-63

ELEKTON-04SK-100 switchboards with an ELEKTON-08 controller are designed for the control and protection of sucker rod pumps (SRP), pumping jacks and its drives (380V UN/50Hz three phase induction motor).

The built-in controller stores and displays the following data on SRP operation on the LCD display: unit status, shutdown time and cause, run time since the last start or remaining time to start in minutes and seconds, current parameters, setpoints and protections. The controller stores a chronological listing of events, 10 dynamometer charts and wattmetrograms with the recording period defined by setpoints. The switchboard has a set of protections (input voltage, current, polished-rod load, belt rip protection).

The ELEKTON-04SK switchboard has three 3 user-configurable analogue inputs for connection of stationary dynamometer, pressure gauge, etc.

The switchboard is connected to the DHS – downhole sensor via the Modbus RTU protocol through the built-in RS-485 interface. Information on the switchboard operation can be read out to a laptop or a compact read-out unit for subsequent performance analysis and diagnostics of the pumping unit.

Certificate of conformity: ЕАЭ RU C-RU.ME68.B.00008/19.

ELEKTON-04SK-63(R) – a modified switchboard with a 380V/60A socket for connection of external devices

BASIC TECHNICAL SPECIFICATIONS OF ELEKTON-04SK-63кVA SWITCHBOARD

PARAMETER	VALUE
Rated supply voltage, V	380 (50±1 Hz)
Maximum voltage deviation from average,, %	-50... +25
Primary circuit rated current, A	100
Transducer›s rated power, kVA	63
Electric motor power, kW	55
Temperature range, °C	-60... +40
Enclosure type	NEMA3R, NEMA4, NEMA4X
Switching device	KEM-100
Control circuit on the switching device	ELEKTON-10.1 controller
Standard input signal from external sensors	0÷10 V; 4÷20 mA
Interface	RS-485
Data exchange	• notebook • BSI-04 Read-Out Unit • telemetry control system, Modbus RTU communication protocol
Overall dimensions, mm	660x560x376 / 960x584x367
Weight, kg	42
Climatic version as per IEC 60721-2-1	UXL1

ELEKTON-07 Softstarter

ELEKTON-07-250 (400, 500, 630, 1000)кVA

ELEKTON-07 softstarter is designed for the control and protection of electric submersible motors. It´s main difference between with ELEKTON-04 is that the former has a thyristor soft starter.

In addition to the standard algorithms accounting for the large static moment, the soft starter installed in the ELEKTON-07 switchboard has a quasi-frequency motor starting mode: short-term motor operation at low frequencies (12.5, 25 Hz, discontinuous).

Built-in RS-485 interface is used for connection of the switchboard with external devices via the Modbus RTU protocol. For further analysis of the pumping unit performance and for data retention, the information on the switchboard operation is read out to a laptop, to removable memory unit like ELEKTON BSI-04, or to a standard USB stick. The switchboard has a LAN port for connecting to Ethernet network via Modbus TCP protocol.

Certificate of conformity: ЕАЭ RU C-RU.ME68.B.00008/19.

THE SOFT STARTER IS SET UP USING TWO SETPOINTS:

- starting current – 100% ...500%;
- motor acceleration time – 0 ...10 s.

and selecting a start mode:

- soft start (for regular motor start);
- kick-start (for start that requires higher starting moment and then proceeds in the soft start mode);
- quasi-frequency mode (for start that requires higher starting moment and then proceeds in the soft start mode);
- full-on start (for modes that require direct start of the motor).

THE SOFT STARTER ALLOWS:

- limiting peak mechanical loads of the motor and the machine;
- limiting the starting current;
- in certain cases, eliminating the need to use soft start couplings;
- switch the contactor in absence of current.

ELEKTON-07K softstarter with a reactive power compensator

BASIC TECHNICAL SPECIFICATIONS OF ELEKTON-07-250 (400, 500, 630, 1000)kVA SOFTSTARTER

PARAMETER	VALUE
Rated supply voltage, V	380 (50±1 Hz)
Maximum voltage deviation from average, %	-50... +25
Rated current, A, max	400 (630, 800, 1000, 1600)
Transducer›s rated power, kVA	250 (400, 500, 630, 1000)
Electric motor power, kW	160 (240, 320, 400, 520)
Temperature range, °C	-60... +40
Enclosure type	IP43, NEMA3, NEMA4
Overall dimensions, mm	
• ELEKTON-07-250 (400)A	1735 x 800 x 640
• ELEKTON-07-630A	1735 x 850 x 752
• ELEKTON-07-800 (1000)A	1860 x 950 x 1000
Weight, kg, max	180 (195, 235, 450, 460)
Climatic version as per IEC 60721-2-1	UXL1

Switchboards can be supplied with auxiliary equipment:

- surface panel Elekton-TMS-SP of the downhole monitoring system;
- Watt-Hour Meter;
- wireless devices for communication with a control room (well pad cellular communications unit ELEKTON-FCM, Nevod radio modem).

ELEKTON-05 Variable Speed Drive - VSD

ELEKTON-05-1200 switchboard with a built-in output filter (frontal view)

VSD ELEKTON-05 (20 - 1250) кVA

Elekton-05 VSD are designed for the control and protection ESP motor:

- **Three-phase submersible induction motors with a squirrel-cage type rotor;**
- **Three phase submersible permanent magnet motors PMM .**

The VSD conform to:

- Technical specifications (TU) 3416-003-43174012-2001
- Technical Regulations CU TR 004/2011 and 020/2011.
- Customs Union Certificate of Conformity No. RU C-RU.АУ05.В.05285.

ADVANTAGES OF ELEKTRON-05 VSD

⇨ **WELL FLOW RATE INCREASE through the use of intelligent algorithms:**

- **ESP commissioning automation achieved by**

  Varying motor rotation speed till a set process parameter is reached.

  ESP Auto restart
- **Autoreclosing**

  The motor is restarted as soon as the conditions for proper operation of equipment get back to normal.
- **ESP back spin protection**

  It enables restoring the required operating mode of the motor in a well in case of backspin effect
- **Flow rate maximization**

  The motor rotation speed changes depending on the set process parameters, including. Prevention of gas locking effect and overheating.

⇨ **IMPROVE ESP RUN LIFE AND RELIABILITY**

through the use of the following hardware and software solutions:

- **Insulation resistance monitoring in the Cable-ESP Motor circuit**

  Continuous measurement and monitoring on the insulation resistentce of the Cable-ESP Motor circuit.
- **Backspin monitoring**

  Prevents the start-up in case of motor backspin caused by the liquid column.
- **Current limiting settings**

  Reduces heating of motor and transformer windings and thus prolongs the service life of downhole and surface equipment.

⇨ **REDUCED POWER CONSUMPTION**

- **Voltage optimization**

  This mode selects the optimum motor parameters to keep electricity consumption to the minimum.
- **Operation with permanent magnet motors**

  Ensures the most efficient mode of PMM's operation.

EASY SETUP AND QUICK WELL COMMISIONING

Intuitive interface and high reliability of the equipment will allow the Customer's specialists to commision a well of any complexity quickly and easily.

SAFE OPERATION OF ELEKTON VSD's

Lights on the controller's front side indicate the status of equipment: STOP, STAND-BY, IN OPERATION.

- **Electronic door interlock**

  Automatically stops the motor, de-energizes it and prevents restarting.
- **Indication on the electronic modules**

  All electronics modules have LEDs that indicate the operating status of the equipment and the presence of voltage.
- **Residual DC voltage indication**

  The switchboard has a special unit showing the residual voltage of DC bus PWW convertor after a stop.
- **Protective screens**

  All live components of the switchboard are covered with transparent screens protecting them against accidental contact.
- **Special testing modes**

  Functional testing of equipment can be performed in field conditions.

ELEKTON-05 VSD ARE UNDENIABLY USEFUL TO PROCESS ENGINEERS

- Process automation
- Automatic analysis of equipment status
- Adaptive tuning of process parameters
- Optimization of operating modes
- Event logging
- Analysis of data logged to a PC and assistance in real-time decision making
- Remote control of equipment

COMPATBILITY FOR DIFFERENT DHS

- Elekton VSD is fully compatible with DHS from different manufacturers: Elekton, Triol, Borets, IRZ, Alnas, Novomet, Etalon, Orion, Zenit, Schlumberger, WoodGroup, Baker Hughes

TSU TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, š.p.
Product Certification Body
Krajinská cesta 2929/9, 921 01 Piešťany
Slovak Republic

SNAS

CONFORMITY CERTIFICATE

No. 201299206

Manufacturer: "Elekton" GJSC
12 Aviamotornaya str, room № 511
Moscow, 111924
Russia

Product: Variable Speed Drive

Type: ELEKTON-05

This conformity certificate confirms the conformity of the product with essential safety requirements of the following EC/EU New Approach Directive(s) as amended:

2014/30/EU EMC Directive
2014/35/EU Low Voltage Directive

Harmonized standards used for the conformity assessment:

EN 61800-5-1:2007
EN 61800-3:2004/A1:2012

The certificate has been issued on the basis of the tests of the product type sample. The results are recorded in the Conformity assessment report No. 200500183 dated 14.08.2020.

CE mark can be used only in the case of conformity assessment according to all relevant EC/EU Directives

This certificate is issued under the following conditions:
The certificate applies to the product type and its variations specified in the above mentioned Conformity Assessment report.
The production process/factory production control is not covered by this certificate.
The certificate does not imply that the certification body has performed any surveillance or control of the production process.
The manufacturer shall ensure the conformity of subsequent production items with the certified type.
Changes that may have an impact on maintaining conformity with the certification requirements may require confirmation of the validity of the certificate by demonstrating compliance with the conditions under which the certificate was issued or by conducting an additional evaluation.
The holder of this certificate must keep the conditions specified in the General Rules for Product Certification, which are freely available at www.tsu.eu.

Issue date: 15. 08. 2020
Expiry date: 14. 08. 2023
Issue: 1

Ing. Dušan HANKO
Head of Product Certification Body

TSU Piešťany, š.p. is EU Notified Body number 1299

121959

Certificate of Conformity with EU Directives

DESIGN ADVANTAGES OF ELEKTON-05 VSD

- Cable clamps configuration allows connecting cables of different diameters without special tools;
- During short-term voltage drops in the mains, the controller continues its operation with records of operating parameters in the emergency mode;
- Pocket for storing the ESP operation datasheet;
- Possibility to install an electricity meter with unhindered access for taking readings;
- The case, removable covers, cabinet doors and locking devices provide reliable protection of internal equipment, external connection elements and control bodies of the switchboards;
- Protection of power and control electronics from atmospheric precipitation during operation, maintenance and other works requiring opening the doors of the power compartment;
- The switchboard ventilation openings have shutters (for winter/summer operation modes) that prevent atmospheric precipitations from getting into the power and control electronics compartments under adverse climatic conditions (snow storms, rain with snow, etc.);
- In addition, if necessary, the design also allows connecting to the back panel of the switchboard several power cables of different diameters without using lugs, at any time of the year, taking into account its rated output current.

SPECIFIC FEATURES OF VSD ELEKTON 05 ENCLOSURE - CLIMATIC VERSION T2 (GOST 15150-69) OR 5.1 EC (IEC 60721-2-1):

- Rated output current: 100 to 2000 A;
- Pulse number of the input rectifier: 6/12/18/24;
- Operating temperature range: -20 °C to +60 °C;
- Enclosure type NEMA3, NEMA4;
- Input voltage range: ~ 415, 435, 480 V
  -15% …+15% long-term;
- Line frequency: 50/60 Hz.

SCOPE OF APPLICATION:

- for the control of ESP induction and permanent magnet motors for oil production in tropical and marine environments;
- for the control of general purpose industrial-grade induction electric motors in tropical and marine climates.

TECHNICAL SPECIFICATIONS OF ELEKTON-05RXX-XXXX-0,4-50-T2 F2, NEMA3R, NEMA4, NEMA4X VSD

PARAMETER	VALUE									
Supply voltage, V	415, 435, 480 ±15%									
Frequency	50/60±2.5 Hz									
Input rectifier type:	6, 12, 18, 24-pulse									
Power factor	>0.95									
Primary circuit rated current, A, max	400	500	630	800	1000	1200	1400	1600	1800	2000
Transducer's rated power, kVA	200	300	400	500	600	750	900	1000	1150	1250
Overall dimensions, HxLxW, mm	2010 x 1154 x 1200		2010 x 1250 x 1605			2300 x 2610 x 1250				
Inverter	IGBT									
Inverter control type	Pulse-width modulation (PWM)									
Output signal	Output sinus filter									
PWM frequency	2.5 to 5 kHz									
Switchboard efficiency	<96%									
cos φ	<95%									
Output frequency	In asynchronous mode: 3.5 to 80 Hz ± 0.05% In PMM mode: 5 to 200 Hz ± 0.05%									
Total harmonic distortion (THD) at the switchboard input and output	<5%									
Enclosure type	IP55/NEMA3R, NEMA4, NEMA4X									
Temperature range, °C	-20...+55°C protected from sunlight and rain									
Relative air humidity	98%									
Discrete inputs	8 pcs.									
Relay outputs	4 pcs.									
Analogue inputs	8 pcs., 0 ... 10 V, 4...20 mA									
User's power supply	~110/220 V									
Interface	USB, RS-485, RS-232									
Protocol	Modbus RTU									
Bit rate	up to 230,400 bps									
Ethernet	10BASE-T, 100BASE-TX									
Ethernet protocol	Modbus TCP									

SPECIFIC FEATURES OF VSD ELEKTON 05 ENCLOSURE - CLIMATIC VERSION UXL (GOST 15150-69) OR 5.2 EC (IEC 60721-2-1):

- Rated output current: 32 to 2000 A;
- Operating temperature range: -60 °C to +40 °C;
- Enclosure rating NEMA3, NEMA4;
- Input voltage range: ~ 380 V
  -15% …+15% long-term,
  -50% … + 25% for 1 min.
- Overload capacity 125% for 5 min;
- The VSD design also allows starting the pumping unit using the preset program, both in the manual and automated mode, as well as to maintain a certain process parameter (frequency, current, pressure) using a PID controller.

SCOPE OF APPLICATION:

- for the control of ESP induction and permanent magnet motors for oil production in the severe Arctic and Siberian environments;
- for the control of general purpose industrial-grade induction electric motors in the severe Arctic and Siberian climates.

BASIC TECHNICAL SPECIFICATIONS OF ELEKTON-05-20 (40, 47, 63, 100, 160, 250, 400, 500, 630, 750, 900, 1000, 1150, 1250) кVA VSD

PARAMETER	VALUE														
Rated supply voltage, V	380 (50-60 Hz)														
Frequency	50/60±2.5 Hz														
Power factor	>0.95														
Primary circuit rated current, A, max	32	63	75	100	160	250	400	630	800	1000	1200	1400	1600	1800	2000
Transducer's rated power, kVA	20	40	47	63	100	160	250	400	500	630	750	900	1000	1150	1250
Overall dimensions, HxLxW, mm	1727 x 841 x 737				1995 x 976 x 905			1973 x 1204 x 1208	2016 x 1204 x 1603		2058 x 1960 x 1267	2364 x 2278 x 1174			
Weight, kg, max	280				380	390	465	805	970		1430	1430	1590	1640	1700
Inverter control type	Pulse-width modulation (PWM)														
Output signal	Output sinus filter														
PWM frequency	2.5 to 5 kHz														
Switchboard efficiency	<96%														
cos φ	<95%														
Output frequency	In asynchronous mode: 3.5 to 80 Hz ± 0.1% (±0.08Hz) In PMM mode: 5 to 200 Hz ± 0.5% with output current changing from 0.5 RC to RC														
Total harmonic distortion (THD) at the switchboard input and output	<5%														
Enclosure type	IP43 (IP54) as per GOST 14254-80														
Relative air humidity	98%														
Discrete inputs	8 pcs.														
Relay outputs	4 pcs.														
Analogue inputs	8 pcs., 0 ... 10 V, 4...20 mA														
User's power supply	~110/220 V														
Interface	USB, RS-485, RS-232														
Protocol	Modbus RTU														
Bit rate	up to 230,400 bps														
Ethernet	10BASE-T, 100BASE-TX														
Ethernet protocol	Modbus TCP														

Elekton-05 VSD can be supplied with auxiliary equipment (options):

1. Integrated bypass contactor switch (B).
2. Integrated (F1) or separate external (F1O) input power filter.
3. Integrated (F2) or separate external (F2O) output filter.
4. ELEKTON-TMS-SP surface panel for the downhole sensor.
5. Watt-Hour Meter (PSCh, SET).
6. Wireless devices for communication with a control room (well pad cellular communications unit ELEKTON-FCM, Nevod radio modem).

ELEKTON-10.1 Controller for ELEKTON-04 switchboard, softstarter (-07, VSD-05)

The ELEKTON-10.1 controller enables automating the operation of the pumping unit as much as possible and optimizing the oil production process.

The controller is installed on the front panel and has a built-in HMI (20 characters per line). A large number of symbols allow displaying messages not in coded form, but with the full term which makes it easy to understand the information.

SPECIFIC FEATURES OF THE CONTROLLER

- Functions, modes and set points are entered via a membrane keypad.
- The controller has a 16 Mbyte non-volatile memory (128 000 records) and thus can store information for an extended period of switchboard operation.
- The controller has a built-in Watt-Hour Meter. A daily log of power consumption is kept covering the last 2 months of operation. The power consumption log also shows daily operating time and the daily flow rate (if a flow meter is installed).
- Two built-in RS-485 interfaces are used for used for communication via Modbus RTU protocol.
- The switchboard operation data can be read out to a laptop via the RS-232 interface or to an external USB stick for further analysis of the pumping unit operation.
- Current parameters are recorded at four adjustable intervals.
- The controller hads an HMI-LCD display with increased brightness and contrast.
- The controller has a reliable internal heating system and additional heating for the LCD indicator for operation at low temperatures.
- The controller keys are backlit to ensure easy operation in the dark.
- Windows compatible software is used for data acquisition and processing, setpoint adjustment, and database organization in the controller that allows presenting and printing various parameters in tabular and graphic form for statistic purposes.
- Various devices can be connected to the controller, such as the downhole monitoring system (17 various types), GSM-modem, Watt-Hour Meters (SET-4TM.03M, Merkuriy-230), analogue sensors (pressure, temperature, flow, etc.), electric contact pressure gauge.
- The controller can be reprogrammed using an external USB stick without having to stop the artificial lift equipment.
- LAN port for connecting to Ethernet network via Modbus TCP protocol.

**The ELEKTON-05 VSD controller is structurally and functionally divided into 2 units:
frequency converter control unit and ELEKTON-10.1 interface unit**

CONTROLLER ELEKTON-10.1

THE CONTROLLER PERFOMS FOLLOWING FUNCTIONS:

- control of motor speed from the built-in control panel;
- auto starting after elimination of the cause of shut-down;
- soft acceleration of the electric motor at the set rate;
- reversal of the electric motor rotation direction;
- backspin reversal;
- voltage optimizer at the frequency converter control system output;
- programmable frequency variation at a given ramp rate to ensure automatic well commissioning;
- gradual deceleration of the electric motor by setting the voltage limit in the DC link;
- automatic maintenance of process parameters (pressure, temperature, level, etc.) set from one of 8 analogue inputs;
- data exchange via one RS-232 channel and two RS-485 channels, connection to the telemetry control system for remote and real-time control – starting, stopping, setpoint changing;
- possibility to change U/F characteristic (for different types of loads) without shutting down the switchboard;
- recording the switchboard operation parameters at the time of shut-down (power voltage, current, output frequency, etc.) and an option to promptly view such parameters directly on the display of the controller;
- registering the time of supply voltage disconnection, and the time of supply voltage reconnection;
- registering changes of setpoints in the event log, including the date and time of parameter variation before and after setpoint changes, and the way the changes were made (remotely or by operator);
- showing in the event log the cause that prevents the switchboard turning on;
- showing the date and time of setpoint changes in the event log, including the previous and subsequent values;
- logging of active and reactive power consumed (daily and total from the time of resetting);
- periodic preset recording the values of supply voltage if it does not allow turning on the switchboard;
- displaying the name of protection that will cause tripping with indication of minutes and seconds left till the tripping of the ESP motor;
- automatic frequency change to a preset value over a specified period of time;
- Two modes to unlock ESP:

  1. specified number of voltage surges with preset output current frequency, forward direction of rotation;

  2. specified number of voltage surges with preset output current frequency, various directions of rotation – “surging”.
- programming of analogue inputs on any of the standard levels: 0-4 V; 0-10 V, 4-20 mA;
- setting passwords to prevent unauthorized access to the switchboard programming, password authorization available for 8 users;
- possibility to operate VSD in PWM mode or in 6-pulse mode.

THE CONTROLLER ENABLES PROGRAMMING THE FOLLOWING BASIC PARAMETERS:

- manual or automatic mode;
- motor acceleration time;
- motor deceleration time;
- deceleration method (runout or dynamic frequency reduction);
- initial direction of rotation;
- time for automatic reclosing after supply voltage recovery;
- time and frequency of motor "surges" for high starting torques;
- values of monitored parameters in automatic mode;
- range of controlled parameter variations;
- proportional, integral and differential factors applied when using a PID controller, and the range of allowable frequency variation when using parametric control;
- U/F curve parameters (set by four points) for the control of actuators under different loads;
- maximum output phase currents for current protection;
- output phase current at which the acceleration speed limiting algorithm is initiated;
- maximum permissible current in the DC link;
- real time clock setting.

THE CONTROLLER ENSURES THE FOLLOWING MAIN TYPES OF PROTECTIONS:

- protection against temporary voltage surge;
- protection against internal and external faults;
- programmable trip threshold for the protection against power overvoltage;
- programmable trip threshold for the protection against power undervoltage;
- protection against reduction of insulation resistance of the submersible induction motor;
- protection against overheating of IGBT modules of the inverter or loss of cooling air flow;
- time-current protection against overload currents;
- protection against no-flow conditions.

ADVANTAGES OF THE CONTROLLER:

- reliable operation and resistance to electrical interference;
- modern microprocessor;
- reliable hardware components;
- full galvanic isolation of the power supply circuit;
- menu setpoints grouped by functional purpose;
- new option of default setpoint adjustment;
- informative display (4 lines 20 characters each);
- metering of consumed active and reactive power;
- supply voltage measured directly at the switchboard input which allows determining the cause of undervoltage in the DC link (faulty input rectifier or reduction of the power voltage below the permissible level);
- option to configure individual menu of the process engineer using the controller's keyboard;
- USB port for recording information to a standard USB drive.

ELEKTON-RPC Reactive Power Compensator

ELEKTON-RPC reactive power compensators are designed to compensate for the inductive component of reactive power consumed by the load.

Reactive power is compensated by connecting delta-connected capacitors parallel to the load.

The highest efficiency of RPC application is achieved by connecting it directly to 0.4 kV buses of the transformer substation. This ensures compensation of reactive power of all inductive loads connected to such substation. An RPC may also be connected to the input terminals of the switchboard.

The reactive power compensator reduces current loads on powerlines, transformers and distribution equipment that helps reducing power losses. RPC ensures automatic reactive power compensation as per the controller's setpoint entered in the preset mode.

RPC is contained in a front access welded cabinet. The cabinet has capacitors, contactors, circuit breakers, a disconnector switch with fuses, and a controller on the control panel.

Declaration of Conformity: ЕАЭС N RU Д-RU. АЖ.33.В.00139/19

BASIC TECHNICAL SPECIFICATIONS OF ELEKTON-RPC-150/25

PARAMETER	VALUE
Rated supply voltage, V	380 (50±1 Hz)
Maximum voltage deviation from average, %	-25... +10
Voltage unbalance, %, max	10
Load current unbalance, %, max	10
Rated reactive power, kVAr	150
Stage power, kVAr	25
Cos φ during normal operation, min	0.95
Temperature range, °C	-60…+40
Enclosure type	IP 43, NEMA3, NEMA4
Climatic version as per IEC 60721-2-1	UXL1
Overall dimensions, mm	1700 x 730 x 475
Weight, kg	136

ELEKTON-Smart Chemical Dosing Unit

The smart chemical dosing unit is designed to receive, storee and to inject chemicals in controlled manner into oil wells.

COMPONENTS

- ELEKTON-Smart CDU Unit ;
- Element for entry through UVKB-65 wellhead side outlet;
- TGP 5/20-15-M14x1.5 heated surface pipeline;
- Back-moving springs of the electrohydraulic pusher;
- Intake screens for the pump;
- Operating manual;
- Data sheets for the unit and its components.

TECHNICAL SPECIFICATIONS

PARAMETER	VALUE		
Rated capacity, l/hr	1.5	3.8	6.0
Maximum capacity no less than, l/hr	1.65	4.2	6.6
Minimum capacity, l/hr	0.01	0.01	0.01
Pump chamber volume, cm^3 (±5%)	1.57	4.02	6.28
Maximum allowable pressure in the discharge line, atm	250	100	60
Dosed chemical type	Scale, corrosion, paraffin inhibitors, incl. aromatic hydrocarbons, hydrate growth inhibitors		
Service tank volume, m^3	0.5		
Kinematic viscosity of dosed media, cSt, max	800		
Maximum density of dosed media, kg/m^3	2000		
Maximum chemical heating temperature, °C	+80		
Power of the supply tank electric heaters, kW	1.04		
Power consumption of the unit, kW, max	2.0		
Rated voltage in three-phase power circuit, V	380, -50...+25%		
Rated power frequency, Hz	50±1		
Rated motor power, kW	0.25		
Pressure protection of the dosing pump	Upper and lower thresholds		
Overall dimensions, mm, max, height x width x depth	1800 X 1004 X 1000		
Zero-reagent weight, kg, max	335		
Operating mode	Continuous and cyclic, unmanned		
Operating conditions:			
• Ambient temperature, °C	-50...+60		
• Relative humidity at +25°C, %, max	100		
Climatic version as per IEC 60721-2-1	UXL1		
Enclosure type	NEMA3, NEMA4		
Explosion and fire hazard category as per NPB 105-03	D_N		
Housing fire resistance as per SNiP 21-01-03	IV		

CDU-12 Controller

The CDU-12 controller is designed to operate as part of the Chemical Dosing Unit used for controlled injection of chemicals into the annulus of oil wells, and into the oil gathering pipeline.

CONTROLLER'S SPECIFICATIONS

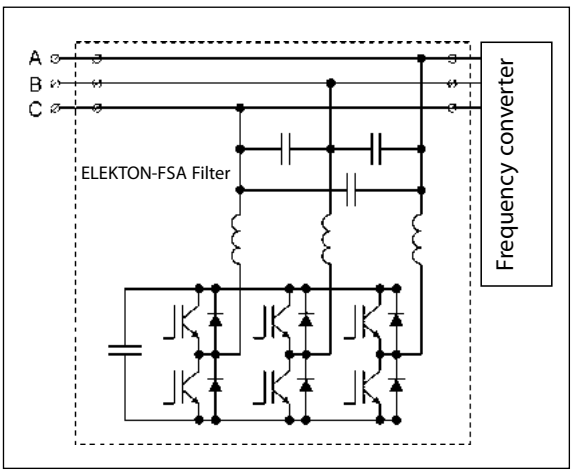
PARAMETER		VALUE
Rated supply voltage, V		10 (50 Hz), 25 (50 Hz)
Maximum voltage deviation from average , %		-50... +50
Power consumption, W, max		40
Ranges of controlled parameter variations and measurement errors relative to the upper range limit:		
• current, A		0... 5 (±1.0%)
• voltage, V		0... 380 (±1.0%)
• chemical temperature, °C • line temperature, °C		-50... +150 (±1.0%)
Ranges of analogue input variations and measurement errors relative to the upper range limit:		
• chemical level, mA • line pressure, mA		4... 20 (±1.0%)
Discrete inputs		8
Relay outputs		7
Switching capacity		
• 4 outputs	Voltage, V, max	250
	Current, A, max	6
• 3 outputs	Voltage, V, max	125
	Current, A, max	3
Interfaces		RS-232, RS-485 (2 pcs.), USB-Host
Weight, kg, max		2.0
Overall dimensions, mm, max		210 X 230 X 78
Climatic version		UKhL2
Enclosure type		IP43, NEMA3, NEMA4

THE CONTROLLER PERFORMS THE FOLLOWING FUNCTIONS:

- control of the plunger pump drive for chemicals dosing in the manual and automatic mode;
- chemicals flow rate control;
- cyclic operation of the chemical dosing unit at the required flow rate;
- automatic restart of the unit in case of power supply failure;
- light indication of the unit operation modes: "STOP", "STAND-BY", "IN OPERATION";
- tank level control, including calculation of the volume and weight of the chemical;
- chemical's temperature control in the tank;
- chemical's heating control in the tank;
- control of pressure in the discharge line (contact pressure gauge or pressure sensor);
- electrohydraulic pusher motor protection (motor current and power voltage control);
- discharge line temperature control;
- control of discharge line heating;
- control of the production well switchboard status;
- control of the chemical dosing unit operation from the production well switchboard;
- indication of unauthorized access to the chemical dosing unit;
- reporting the unit status to the dispatch system;
- chemicals flow rate control via RS-485 interface;
- unit operation control via RS-485 interface;
- transmission of current parameters and the event log to the telemetry control system via RS-485 interface;
- event logging (65536 records with adjustable period);
- copying the event log to a standard USB stick via the USB-Host interface;
- recording the number of plunger pump strokes;
- recording daily and total chemicals consumption since the start of the system operation;
- recording the operating time of the unit.

ELEKTON-Active Power Filters for VSD

Activ Power Filter connection diagram



The increase of higher harmonics in power circuit are caused, first of all, by the wide use of converting equipment.

The Active Power Filters is the most effective way of elimination of the higher harmonics.

The Active Power Filter represents a controlled current source connected in parallel with loading, generating higher harmonics.

The Active power filter generates the same higher harmonics but on opposite phase to the load, ensuring that only the first harmonic current - 50 Hz is consumed by the load.

The power factor is adjusted through accumulation of reactive energy by the filter during the first half of the period of voltage supply and returning it to the mains during the second half of this period.

The active power filter "ELEKTON" is designed for the suppression of the high harmonics (current and load) from the VSD and for the compensation of reactive power consumed by the load.

ELEKTON filter is connected between the substation transformer and the VSD input. No special settings or adjustment is necessary.

SPECIFIC FEATURES

- Three-phase current higher harmonics compensation up to the 40th harmonic.
- Low power losses (3...5% of rated load power).
- Built-in electronic overload protection.
- RS-485 port for communication with remote telemetry units (RTU).
- USB port for connection a standard USB flash drive.
- ELEKTON-10.1 controller displays spectral composition, voltage waveform distortion factors, power current and load current.
- Archiving.

MAIN TECHNICAL SPECIFICATIONS

Filter type	Rated operating current, A*	Maximum load current, A**	Voltage and current waveform distortion factor using filter***		Overall dimensions, mm	Weight, kg
			K_{Uin}	K_{Iin}		
ELEKTON-FSA-100/250	100	250	5% max		1845 x 840 x 830	290
ELEKTON-FSA-160/400	160	400			1943 x 944 x 1003	420
ELEKTON-FSA-250/630	250	630				405
ELEKTON-FSA-400/1000	400	1000				485
ELEKTON-FSA-630/1600	630	1600			2016 x 1204 x 1603	840

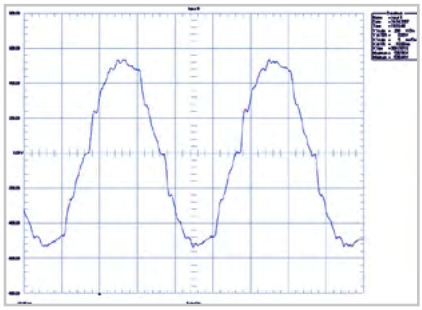
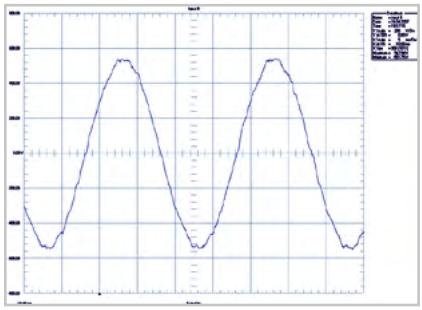
* - maximum higher harmonic current value applied
** - maximum current consumed by ELEKTON-05 VSD operating in PWM mode.
*** - provided that the voltage waveform distortion factor without the use of a frequency converter is less than 2%, and the filter operates under the rated load.

The rated operating current of the active power filter determines the maximum compensated power of the higher harmonics generated in the power sypply network.

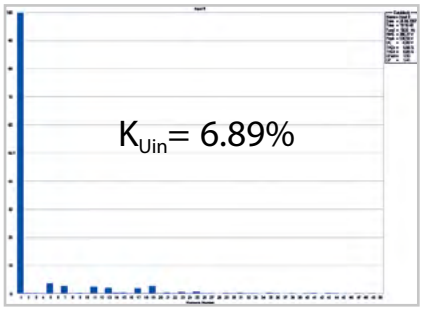
MEASURED INPUT VOLTAGE KU_{IN} AND CURRENT KL_{IN} WAVEFORM DISTORTION OF THE VSD ELEKTON-05-400

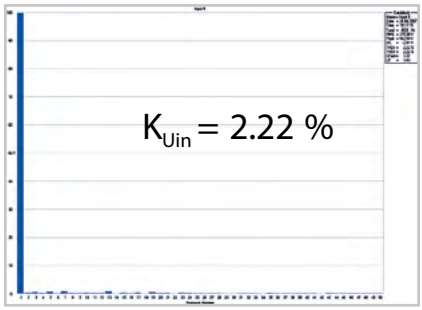
VSD ELEKTON-05 without an input filter	VSD ELEKTON-05 with an input filter

Input voltage

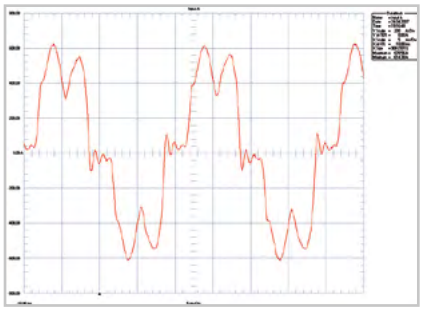
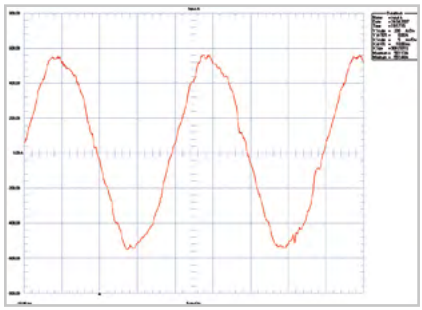



Harmonic composition of input voltage

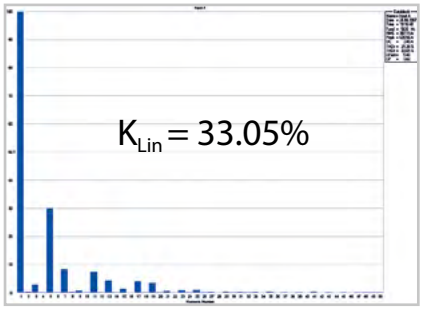


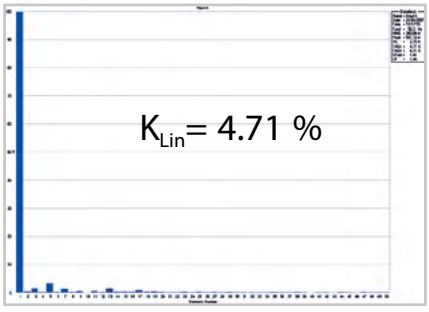


Input current

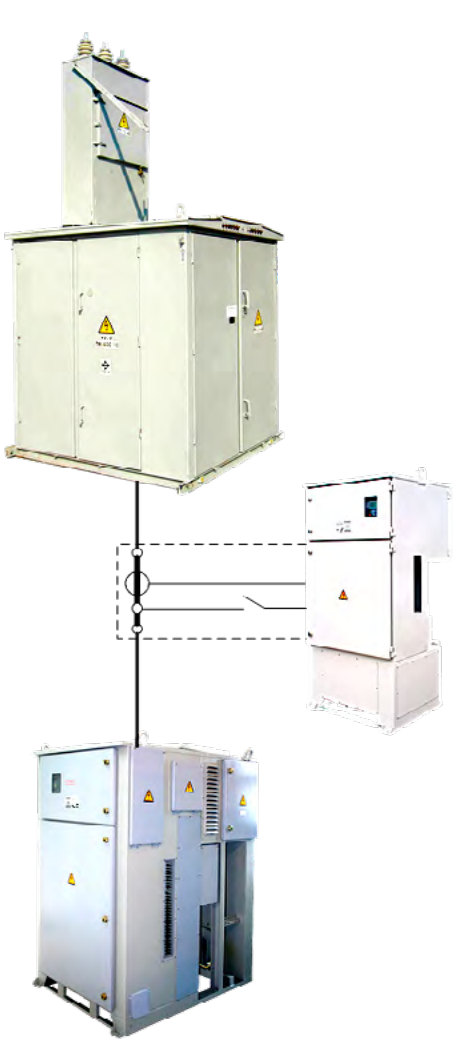
Harmonic composition of input current



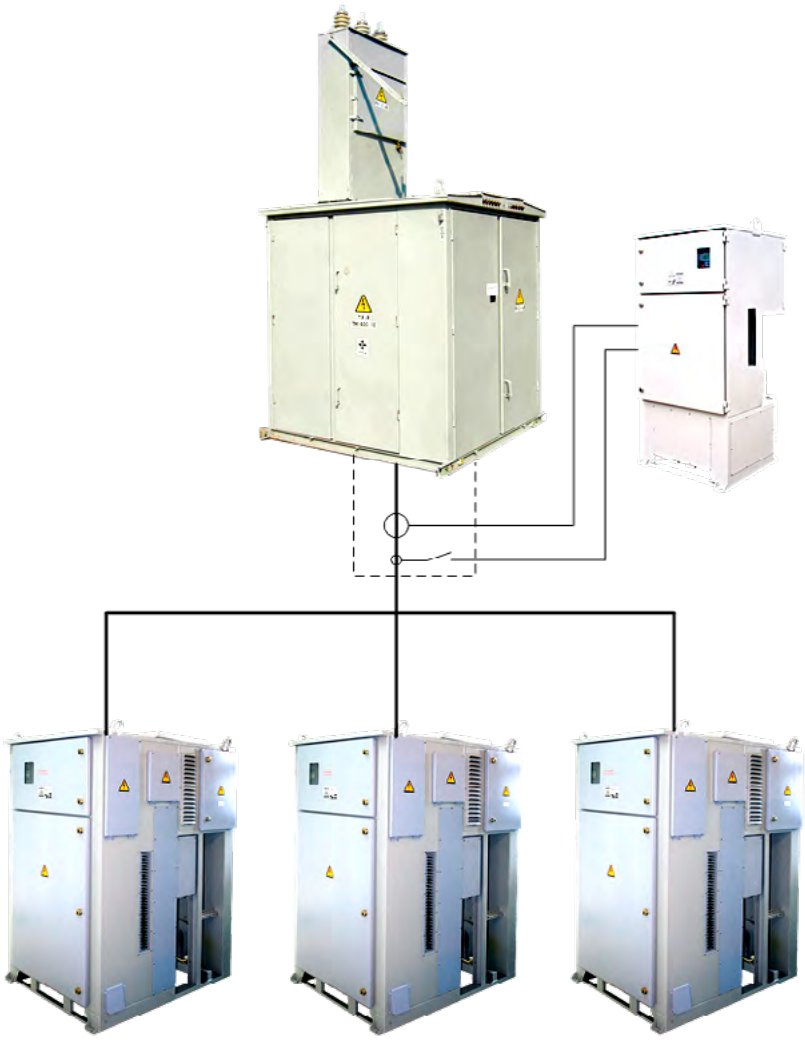


ELEKTON-Active Power Filters usage options

Individual



Group

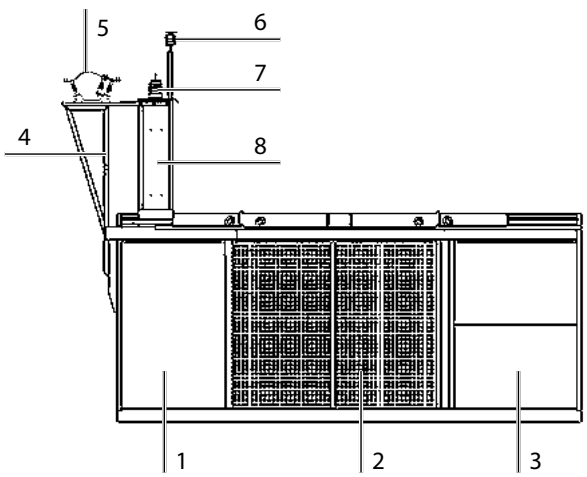


ELEKTON High Voltage Motor Driven System

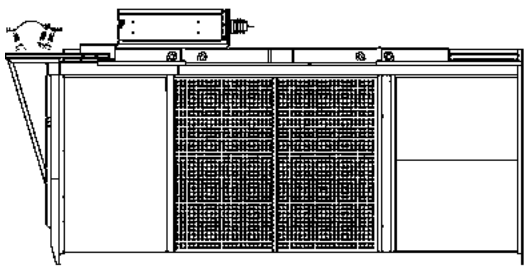
The ELEKTON-High Voltage MDS outdoor 6 or 10 kV high voltage drive is intended for receiving, conversion and distribution of electric power and serves for protection and control of three-phase induction motors (IM) or permanent magnet motors (PMM) of submersible pumps for oil production.

Where necessary, high voltage MDS may be used for the connection of a 380V/250A external consumer.

High voltage MDS in working position



High voltage MDS in transportation position

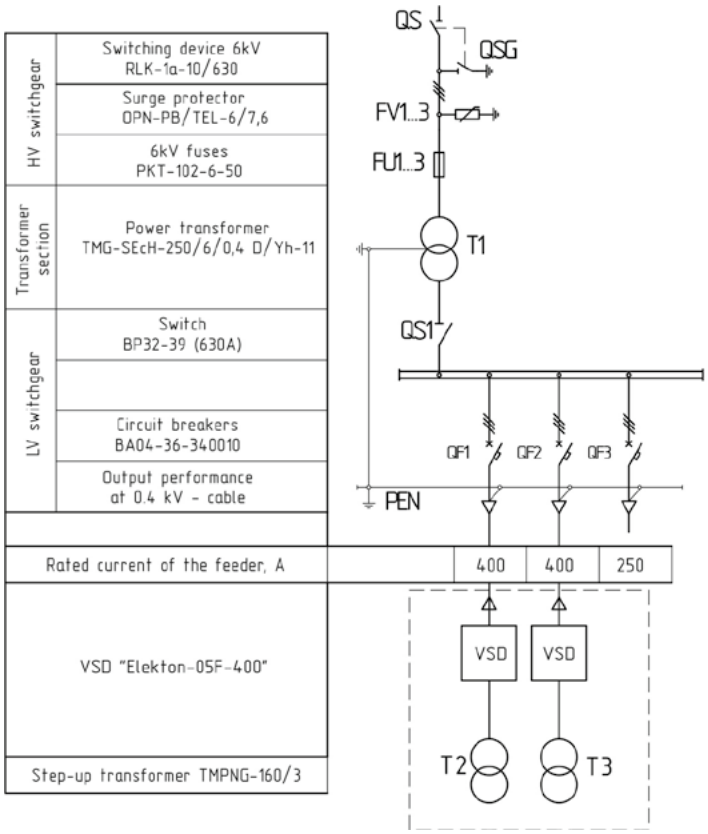


ELEKTON HV MDS COMPONENTS:

1. HV chamber of the oil-instulated step-down transformer.
2. LV chamber of the VSD.
3. HV chamber of the three phase oil-insulated step-up transformer.
4. HV disconnector switch module.
5. HV disconnector switch.
6. Overhead line receiving traverse.
7. HV feedthrough insulator.
8. HV bus chamber.

The climatic version is shown in the picture is – NEMA3.

ELEKTON HV MDS connection diagram



№	Name	Designation on the diagram	Quantity
1	Switching device 6kV RLK-1a-10/630	QS	1
2	Surge protector OPN-PB/TEL-6/7,6	FV1..3	3
3	6kV fuses PKT-102-6-50	FU1..3	3
4	Power transformer TMG-SEcH-250/6/0,4	T1	1
5	Switch BP32-39 (630A)	QS1	1
6	Circuit breakers BA04-36-340010	QF1..3	3
7	VSD "Elekton-05F-400"	VSD	2
8	Step-up transformer TMPNG-160/3	T2, T3	2

ELEKTON-TMS-8 Telemetry System for downhole applications

Fig 1.
ELEKTON-TMS-8-XXX-1F103-0-V5 type 1 downhole unit complete with an adapter assembly

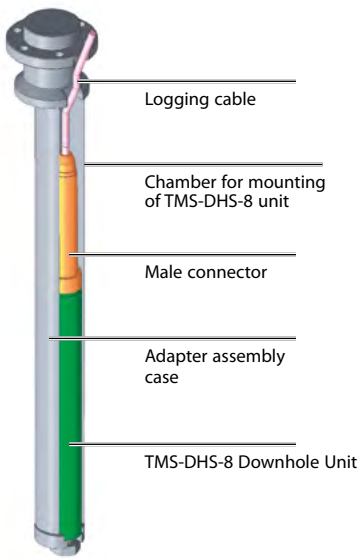
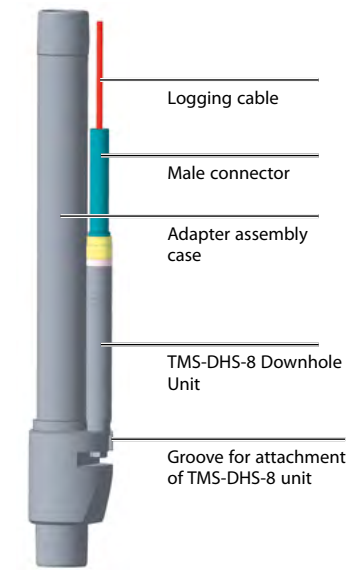


Fig 2.
ELEKTON-TMS-8-XXX-2N73-0-V5 type 2 downhole unit complete with an adapter assembly



ELEKTON-TMS-8 Telemetry system is designed for completions with Sucker rod pumping units (SRP), to record and transmit to external devices the current values of the following parameters:

- formation fluid pressure at pump intake;
- formation fluid temperature at pump intake;
- insulation resistance.

In addition to the measured parameters, information about DHS status, type, measuring range is transmitted to the surface panel.

Digital signal is transmitted from the surface panel to the VSD through RS-485 port via Modbus RTU protocol. To the computer, the signal is transmitted via RS-232 interface.

PARAMETER RANGE AND MEASUREMENT ERROR

PARAMETER	Range	Accuracy	Tolerance
Formation fluid pressure at pump intake	0-2200 PSI or 0-3670 PSI	0.5 % (1)	0.001 (1)
Formation fluid temperature at pump intake	0 to 150°C	1.5% (1)	1°C
Insulation resistance	30 to 1000 kOhm	5% (2)	1 kOhm

1) From upper range value.
2) From the measured value.

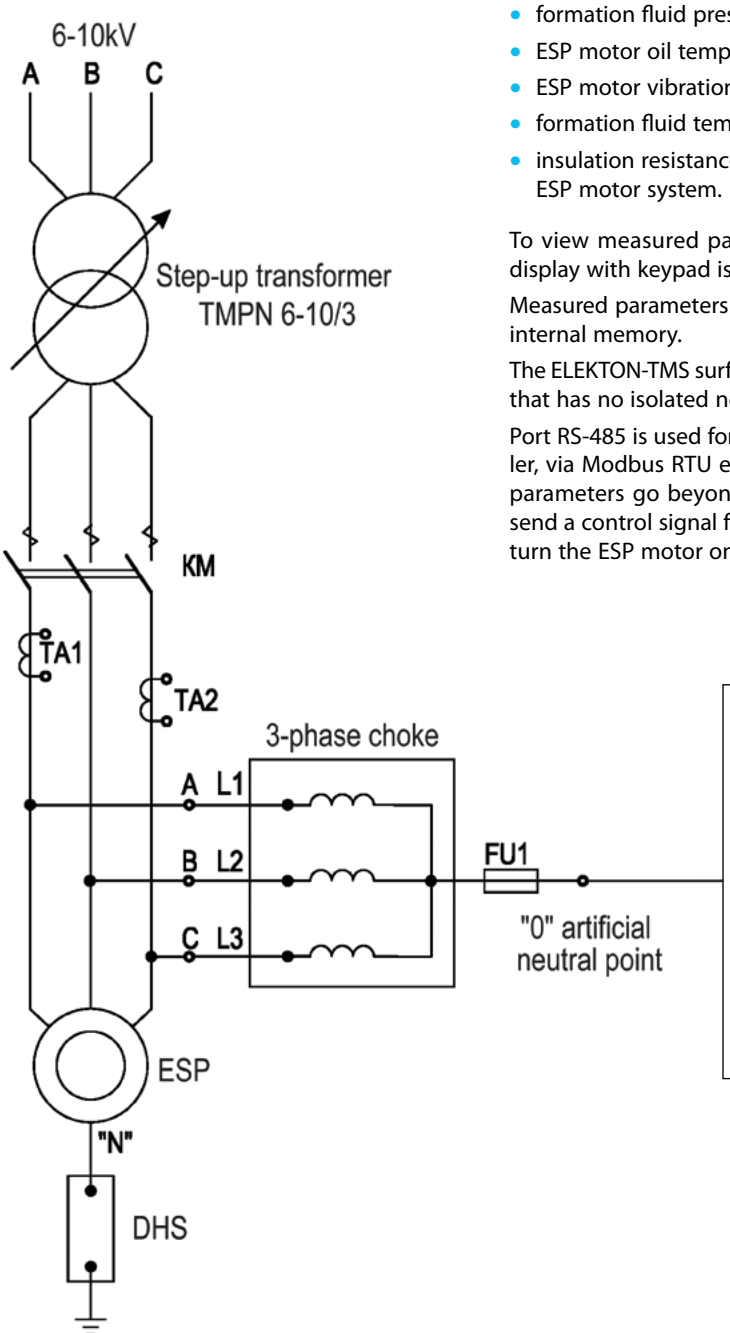
ELEKTON-TMS-8 DOWNHOLE MONITORING SYSTEM COMPONENTS:

- surface panel ELEKTON-TMS-SP-8 or ELEKTON-TMS-SP-3 installed into the ELEKTON-05V VSD for progressive cavity pumping units, or into the ELEKTON-05SK VSD for sucker rod pumping units;
- ELEKTON-TMS-DHS-8 downhole sensor installed at the bottom of submersible pump via an adapter assembly;
- logging cable KG 1X0.75-20-130Oa for connection between between DHS and the surface panel.

System's overall dimensions, mm, max	
ELEKTON-TMS-SP-3	245 X 205 X 168
ELEKTON-TMS-SP-8	245 X 205 X 77
ELEKTON-TMS-DHS-8*	∅36, L 310
Weight of system units, kg, max	
ELEKTON-TMS-SP-3	5.5
ELEKTON-TMS-SP-8	2.0
ELEKTON-TMS-DHS-8*	1.6

*– w/o adapter assembly

ELEKTON-TMS Surface Panel



The ELEKTON-TMS Surface panels are intended for the registration and transmission of the following current parameters of the pumping unit to external devices:

- formation fluid pressure at pump unit suction;
- ESP motor oil temperature;
- ESP motor vibration in radial and axial directions;
- formation fluid temperature;
- insulation resistance or leakage current (optionally) in the DHS – ESP cable – ESP motor system.

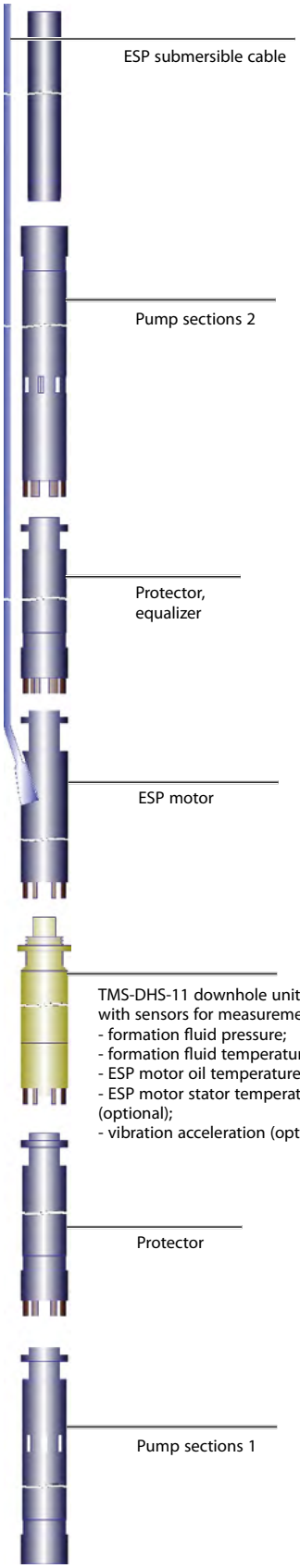
To view measured parameters and control the surface equipment, the built-in LCD display with keypad is used.

Measured parameters and the status of the equipment are kept chronologically in the internal memory.

The ELEKTON-TMS surface panel can be connected to the ESP motor power supply circuit that has no isolated neutral point, e.g., via ELEKTON HV DMS High voltage softstarter.

Port RS-485 is used for communication with external devices, e.g. switchboard controller, via Modbus RTU exchange protocol. If RS-485 cannot be used, and the monitored parameters go beyond the normal values defined by setpoints, the surface unit will send a control signal for potential-free contacts make/brake. This signal can be used to turn the ESP motor on/off.

ELEKTON-TMS-11 Telemetry System for downhole applications



ELEKTON-TMS-11 downhole telemetry system is designed for ESP normal completions or for ESP dual completions. The system measures well data and parameters of the pumping unit.

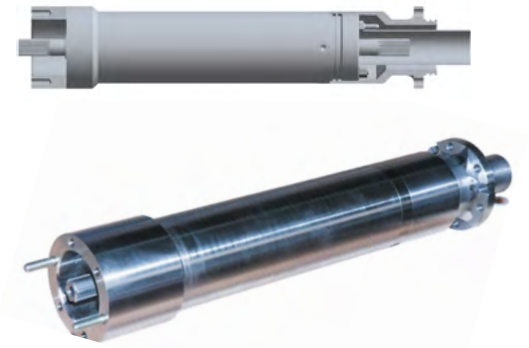
ELEKTON-TMS-SP-12 surface panel is installed inside ELEKTON 05 VSD and connected to the controller.

ELEKTON-TMS-DHS-11 is installed from bellow the ESP motor having shafts on both sides.

The ELEKTON-TMS-DHS-11 downhole sensor, in its most complete configuration, is intended for the measurement of ESP motor oil temperature, formation fluid pressure and temperature, and ESP motor vibration.

Certain configurations support universal Transfer v.1 protocol for data exchange between the surface and downhole components, as well as between the surface panel and the VSD controller.

ELEKTON-TMS-SP-12



ELEKTON-TMS-DHS-11

OVERALL DIMENSIONS AND WEIGHTS OF THE COMPONENTS

DESCRIPTION	Overall dimensions, mm, max	Weight, kg
ELEKTON-TMS-SP-12	245 × 205 × 168	6
TMS-DHS-11 DHS for size 103 ESP motor	∅103 × 636	23.4
TMS-DHS-11 DHS for size 117 ESP motor	∅117 × 642	24.4

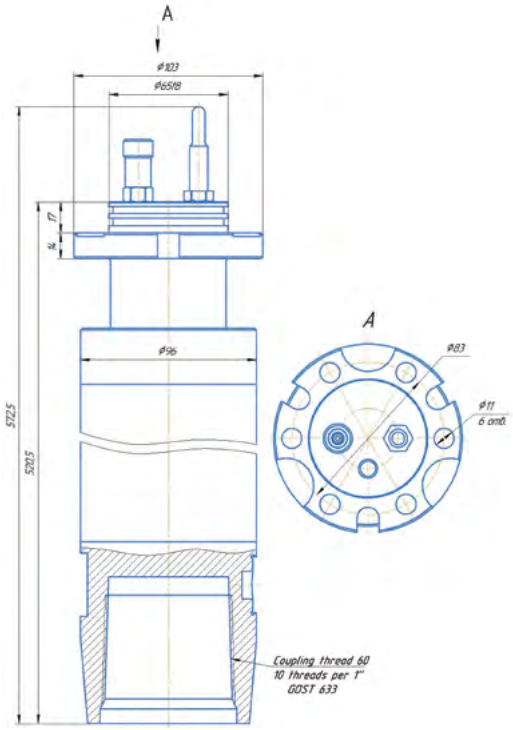
PARAMETER RANGE AND MEASUREMENT ACCURACY OF ALL SURFACE UNIT CONFIGURATIONS OF ELEKTON-TMSP-11:

PARAMETER	Range	Accuracy [1]	Tolerance
Formation fluid pressure at pump suction, PSI	0-4700 0-8800	±0.5%	0.01
ESP motor oil temperature, °C	0-200	±1.5%	1
Formation fluid temperature at the main pump suction, °C	0-150	±1.5%	1
ESP motor vibration acceleration in radial direction, m/s²	0-30	±5% [2]	0.1
ESP motor vibration acceleration in axial direction, m/s²	0-30	±5%	0.1
Insulation resistance, kOhm	10-1000	±5%	1
	1000-9999	±10%	1

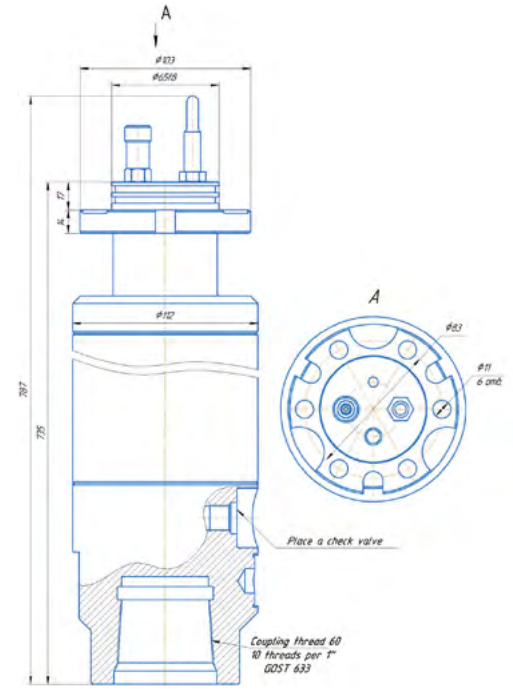
[1] For insulation resistance, the error will be determined relative to the measured value, for other parameters – relative to the upper range limit.

[2] For vibration acceleration range from 10 to 70 Hz.

ELEKTON-TMS-12 Telemetry System for downhole applications



Appearance, overall dimensions and connecting dimensions of the basic configuration of TMS-DHS-12 downhole sensor, climatic version B5



Appearance, overall dimensions and connecting dimensions of the basic configuration of TMS-DHS-12 downhole sensor, climatic version B5.1

ELEKTON-TMS-12 is designed for normal completions, its main field of application: automation of electric drive operating modes for oil production equipment. ELEKTON-TMS-12 downhole telemetry system is designed to control, record and transmit to external devices current values of the following parameters:

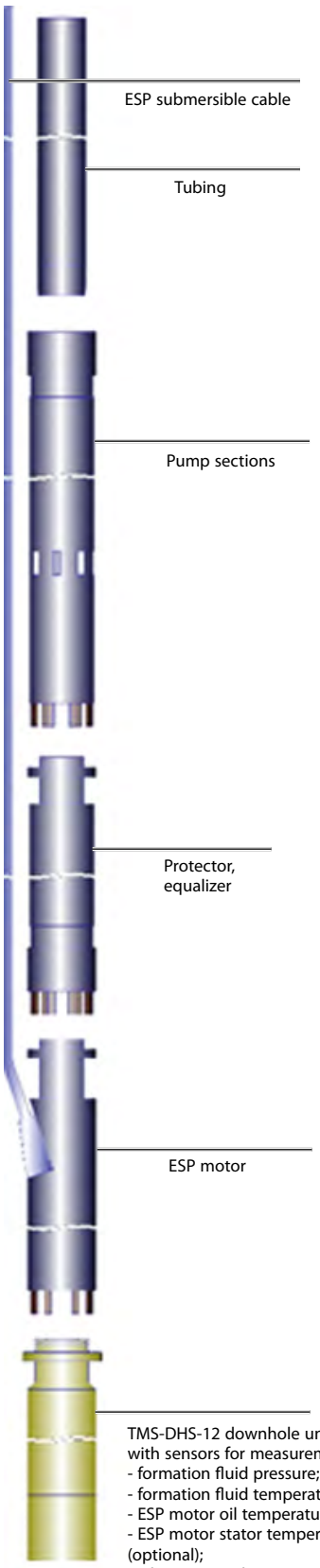
- ESP motor oil temperature;
- formation fluid temperature;
- ESP motor stator temperature measured by a separate sensor;
- ESP motor oil pressure;
- vibration along X, Y and Z axes (if respective sensors are installed);
- insulation resistance of the circuit "neutral point of step-up transformer HV star-connected winding – ESP cable – neutral point of ESP motor star".

The system remains operative with the cable length up to 6000 m.

The system supports universal Transfer v. 1 protocol for data exchange between the surface and downhole components, as well as between the surface panel and the VSD controller.

Specific features and additional functionality of the ELEKTON-TMS-12 downhole telemetry system

- Low power consumption by the downhole sensor this optimizes operating temperatures of the unit and increases reliability at high ambient temperatures.
- It is possible to determine in which part of the downhole unit the insulation resistance dropped to zero: in the TMS-DHS itself or in the cable-ESP motor circuit.
- Increased speed and noise immunity of the data link.
- Information (commands) can be transmitted from the surface panel to the DHS, including during ESP operation. This allows to control the operation modes of the downhole sensor in real-time (selective data transfer, service information request, solenoid valve control, etc). Selective data transfer allows, for example, receiving the pressure readings at the pump suction more frequent than formation fluid temperature readings.
- The surface unit has a built-in USB-host and USB Type-A connector which makes it possible to use virtually any flash drive to copy the event log and update internal software.
- Software of the surface unit can be updated via the USB connector of the ELEKTON-10.1 controller.
- The surface panel has two analogue inputs for the connection of external sensors, e.g. wellhead pressure sensors.



ELEKTON-TMS-DHS-12

ELEKTON-TMS-SP-12 Surface panel

OVERALL DIMENSIONS AND WEIGHTS OF THE COMPONENTS

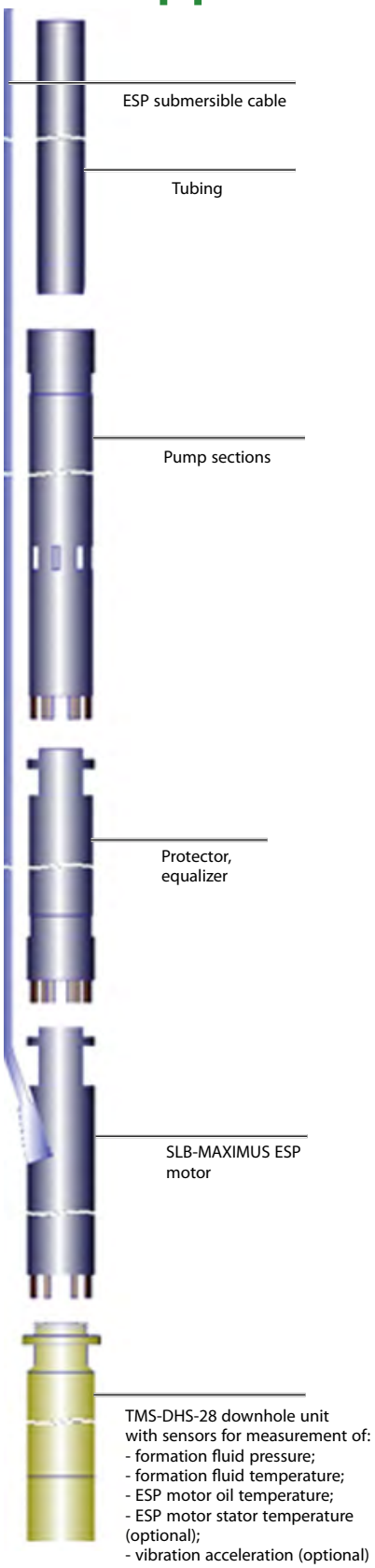
DESCRIPTION	Overall dimensions, mm	Weight, kg
TMS-DHS-12 downhole sensor	∅103x572.5	17.33
TMS-SP-12 surface panel	245×205×168	5

PARAMETER RANGE AND MEASUREMENT ACCURACY

PARAMETER	Measurement range	Accuracy	Tolerance
Formation fluid pressure at pump intake, PSI [1)]	0-5880, 0-8800	±0.5%	0.001
ESP motor oil temperature, °C	0 to +200	±1.5%	0.01°C
Formation fluid temperature at pump intake, °C	0 to +200	±1.5%	0.01°C
ESP motor stator temperature measured by separate sensor, °C	0 to +200	±1.5%	0.01°C
ESP motor vibration acceleration in radial and axial directions, m/s^2 [2)]	0-30	±5%[2)]	0.1 m/s^2
Insulation resistance, kOhm [3)]	10-9999	±5%	1 kOhm
VAC in the common point of the DHS HV winding, actual value, V	50-2000	±10%	10V

Notes:
[1)] Allowable annual pressure drift – no more than 1%;
[2)] For the vibration acceleration range from 10 to 70 Hz, if the respective sensors are available;
[3)] Insulation resistance is measured by the surface unit.

ELEKTON-TMS-28 Telemetry System for downhole applications



ELEKTON-TMS-28 is designed to operate with motors type SLB-Maximus. Main field of application: automation of electric drive operating modes for oil production equipment. Elekton-TMS-28 downhole monitoring system is designed to control, record and transmit to external devices current values of the following parameters:

- ESP motor oil temperature;
- electric submersible motor oil pressure;
- formation fluid temperature;
- electric submersible motor stator temperature measured by a separate thermocouple J-type sensor;
- vibration acceleration on X, Y and Z axes;
- insulation resistance of the circuit "neutral point of DHS HV star-connected winding – ESP cable – neutral point of ESP motor star".

The system remains operative with the cable length up to 6000 m.

OVERALL DIMENSIONS AND WEIGHTS OF THE COMPONENTS

DESCRIPTION	Overall dimensions, mm	Weight, kg
TMS-DHS-28 downhole sensor	∅114x620	18.7
TMS-SP-12 surface panel	245×205×168	5

PARAMETER RANGE AND MEASUREMENT ERROR

PARAMETER	Measurement range	Accuracy	Tolerance
Formation fluid temperature at pump intake, °C	0 to +150	±1.5%[1)]	0.01°C
Electric submersible motor windings temperature measured by separated sensor, °C	0 to +200	±1.5%[1)]	0.01°C
ESP motor vibration in radial and axial directions, m/s^2	0-30	±5%[2)]	0.1 m/s2
Insulation resistance, kOhm	10-9999	±10%[1)]	1 kOhm

Notes:
[1)] For insulation resistance, the error will be determined relative to the measured value, for other parameters – relative to the upper range limit.
[2)] For vibration acceleration range from 10 to 70 Hz.

ELEKTON-TMS-TU-12A Portable Testing Units

Portable testing units TMS-TU-12A

TMS-TU-12A are portable testing units for the respective DHS series intended for onsite operability test of downhole sensorsdownhole flowmeters, both in shop and field conditions prior RIH installation or repair operations.

Portable testing units can be connected to the sealed lead-in of the DHS at any accessible connection point of the communication link with the surface unit, with live components de-energized at the time of connection.

Poetable testing units ensure onsite testing of downhole sensors and downhole flowmeters without having to connect them to the VSD.

SPECIFIC FEATURES:

- portable testing units are designed in a shock resistant plastic case;
- not intended for testing of energized equipment.

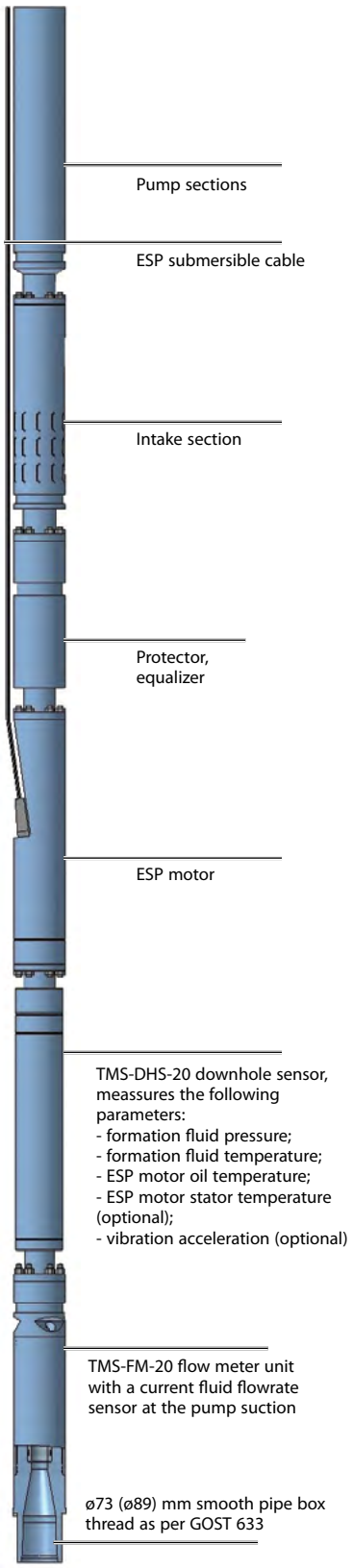
The following power supply options are available for units:

- from the built-in battery;
- from 220V/50Hz network;
- from a vehicle's on-board electric system.

Displayed parameters if available in the DHS:

- pump intake pressure (ESP motor oil pressure);
- formation fluid temperature at the pump intake;
- ESP motor oil temperature;
- ESP motor vibration in axial and radial directions;
- ESP motor sensor's temperature;
- pump capacity, fluid pressure and temperature at pump discharge (if the downhole flowmeter is available).

ELEKTON-TMS-DF-20 Downhole Flow meter



ELEKTON-TMS-DF-20 downhole flowmeter is designed for normal completions, for recording and transmission of current values of the following parameters to external devices:

- formation fluid pressure at pump intake;
- ESP motor oil temperature (or ESP motor winding temperature measured by a separated sensor);
- formation fluid temperature at pump intake;
- ESP motor vibration in radial direction;
- ESP motor vibration in axial direction;
- current volumetric flow rate;
- insulation resistance.

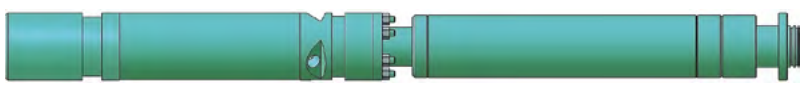
PARAMETER RANGE AND MEASUREMENT ACCURACY

PARAMETER	Range	Accuracy[1]	Tolerance
Formation fluid pressure at pump suction, PSI	0-370 0-2200 0-3670 0-4700 0-8800	±1%	±0.15
ESP motor oil temperature (or ESP motor winding temperature measured by remote sensor), °C	0-200	±1.5%	1%
Formation fluid temperature at pump suction, °C	0-150	±1.5%	1%
ESP motor vibration in radial direction, m/s²	0-30	±5% [2]	0.1
ESP motor vibration in axial direction, m/s²	0-30	±5%	0.1
Volumetric flow rate, bar/d.	63-250 125-630 250-1260 630-3145	±2,5%	1
Insulation resistance, kOhm	10-1000	±5%	1
	1000-9999	±10%	1

[1] For insulation resistance, the error will be determined relative to the measured value, for other parameters – relative to the upper range limit.

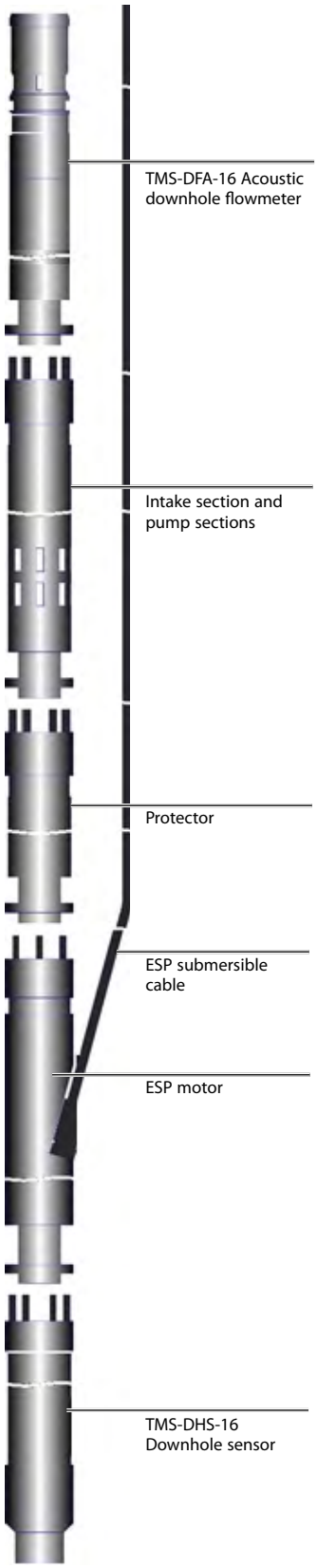
[2] For vibration acceleration range from 10 to 70 Hz.

The system has independent 1RS-232, RS-485 interfaces for connection to a computer and for transmission of data to other devices via the MODBUS protocol.



ELEKTON-TMS-DF-20 Downhole flow meter

ELEKTON-TMS-DFA-16 Acoustic Downhole Flow meter



Main field of application: automation of operating modes for ESP motor. TMS-DFA-16 is designed to control the following parameters:

- formation fluid pressure;
- formation fluid pressure at pump discharge;
- ESP motor oil temperature;
- formation fluid temperature;
- formation fluid temperature at pump discharge;
- vibration on X, Y and Z axes (if respective sensors are installed);
- ESP motor shaft speed (if respective sensors are installed);
- formation fluid flowrate;
- insulation resistance of the circuit "neutral point of DHS HV star-connected winding – ESP cable – neutral point of ESP motor star".

PARAMETER RANGE AND MEASUREMENT ACCURACY

PARAMETER	Range	Accuracy	Tolerance
Formation fluid pressure at pump suction, PSI [1]	0-5880, 0-8800	±0.5%	0.001
ESP motor oil temperature, °C	0 to +200	±1.5%	0.01°C
Formation fluid temperature at pump suction and discharge, °C	0 to +200	±1.5%	0.01°C
ESP motor vibration acceleration in radial and axial directions, m/s^2	0-30	±5%[2]	0.1
Formation fluid pressure at pump discharge, PSI [1]	0-5880, 0-8800	±0.5%	0.001
ESP motor shaft speed, RPM	2400 to 3600	±0.1%	1
Formation fluid flowrate, bar/d.	0-0 [4] 125-1260 315-3140 786-7860	±2%	0.1
Insulation resistance, kOhm [3]	10-9999	±5%	1
VAC in the common point of the DHS HV winding, actual value, V	50-2000	±10%	10

[1] Allowable annual pressure drift – no more than 1%;

[2] For vibration range from 10 to 70 Hz;

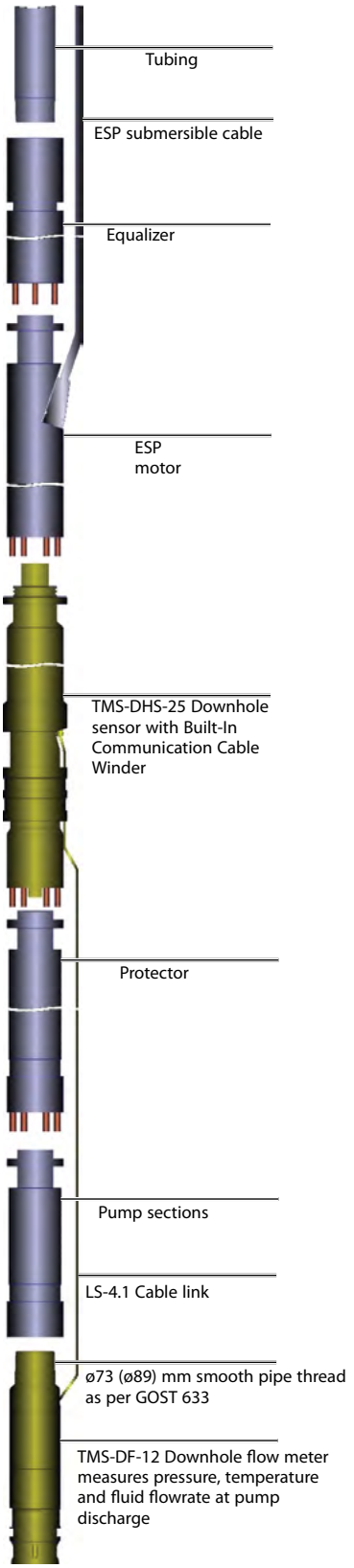
[3] Insulation resistance is measured by the surface unit;

[4] The TMSDF unit has no fluid flowrate sensor.

Specific design features:

- Data is transferred from the flowmeter unit to the downhole monitoring unit without using the wireline;
- The maximum length of the pumping unit is 25 meters;
- Uninterrupted operation of the flowmeter is ensured by its own power generator driven by the shaft of the ESP motor;
- RPM meter can be supplied additionally to measure current operating parameters of the pump;
- TMS-DFA-16 acoustic downhole flowmeter has a MTBF of over 300 days.

ELEKTON-TMS-DF-25 Downhole Flow meter



ELEKTON-TMS-DF-25 downhole flowmeter has two applications:

- Horizontal pumping systems for water injection;
- Inverted ESP dual-completion for oil production.

ELEKTON-TMS-DF-25 is intended for recording and transmission of the following parameters to external devices:

- insulation resistance of the circuit "DHS HV winding – ESP cable – ESP motor"
- pressure at pump intake;
- ESP motor oil temperature;
- formation fluid temperature;
- ESP motor vibration;
- pressure at pump discharge;
- temperature at pump discharge;
- flowrate at pump discharge (pumping unit capacity).

TMS-DF-25 Telemetry system - downhole flow meter consists of three units:

- TMS-SP-12 Surface panel, it can be installed separately or inside of ELEKTON-05 VSD;
- TMS-DHS-25 downhole sensor installed below the ESP motor;
- TMS-DF-12 downhole flowmeter installed at the pump discharge and connected to the TMS-DHS-25 Downhole sensor contains a communication line LS-4.1.

Signals are transmitted between the downhole flow meter TMS-DF-12 and TMS-DHS-25 by the communication line "neutral point of DHS HV winding – power cable wires – neutral point of stator winding of ESP motor" relative to the grounding sheath of the ESP motor power cable.

PARAMETER RANGE AND MEASUREMENT ACCURACY

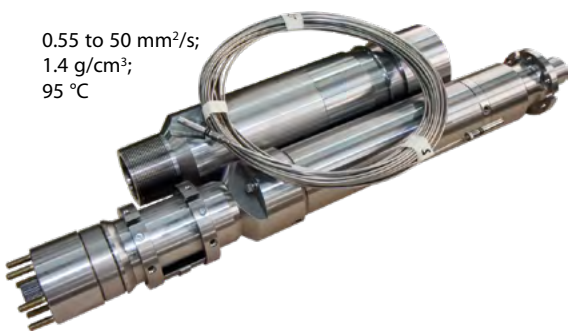
PARAMETER	Range	Accuracy[1]	Tolerance
Fluid pressure at pump intake, PSI	0-5880, 0-8800	±0.5%	±0.01
Fluid pressure at pump discharge, PSI	0-8800	±0.5%	0.001
ESP motor stator temperature, °C	200	±1.5%	0.01
Fluid temperature at pump suction and discharge, °C	150	±1.5%	0.01
ESP motor vibration in radial and axial directions, m/s^2	0-30	±5%[2]	0.1
Current volumetric flowrate, bar/d.	120-1250 315-3150 780-7800 1570-5700	±2%[3]	0.1
Fluid volume, bar	For overall units' service life	±2.5%[3]	0.1
Insulation resistance, kOhm	10-1000	±5%	1
	1000-9999	±10%	1

[1] For insulation resistance, the error will be determined relative to the measured value, for other parameters – relative to the upper range limit.

[2] For vibration acceleration range from 10 to 70 Hz.

[3] For the following fluid parameters:

- viscosity 0.55 to 50 mm^2/s;
- density, max 1.4 g/cm^3;
- temperature for TMS-DHS-25 system, max 95 °C



Surface Panel Portable Testing Unit PTU-12U

PTU-12U is used to simulate connection from DHS and downhole flow meters to surface panels in order to check its operability and verify VSD settings inputs on the controllers.

It can be used for testing of any other surface units operating under the Transfer protocol (IRZ, Borets, Etalon, Triol, etc.).

The PTU-12U is designed in a plastic case. Two alligator clips are used for connection to the surface panel.

Red “In-Operation” LED indicates the transfer of simulated borehole parameters. The LED is not lit when insulation resistance is measured.

A dress sticker is attached onto the front surface of the testing unit. It contains information on simulated parameter values. The PTU-12U is powered by the surface panel unit to which it is connected.

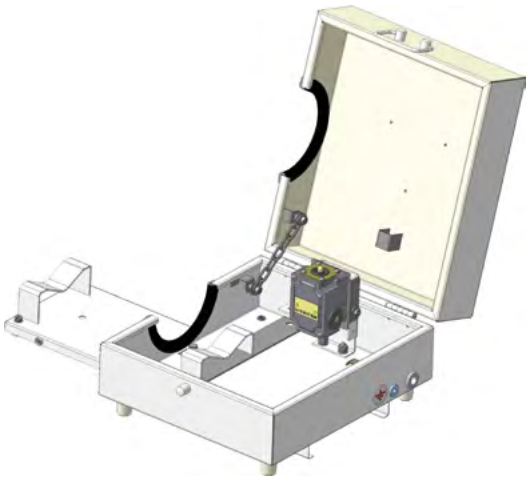
The maximum overall dimensions of the PTU-12U are 52x95x15 mm.

The maximum weight PTU-12 is 70g.

TRANSMITTED PARAMETERS

PARAMETER	Value
Insulation resistance	1000 kOhm
Pressure at pump suction	12.345 MPa
Temperature at pump suction	111.11 °C
ESP motor oil temperature	122.22 °C
Vibration along X axis	3.0 m/s^2
Vibration along Y axis	4.0 m/s^2
Vibration along Z axis	5.0 m/s^2
Pressure at pump discharge	23.456 MPa
Temperature at pump discharge	133.33 °C
Flowrate at pump discharge	444.4 $m^3/d.$

ELEKTON-DHS-TU-12 Downhole Sensors Testing Unit



Case for DHS

The DHS testing units are designed for all series of ELEKTON DHS to conduct input quality control for new equipment or after POOH.

BASIC SPECIFICATIONS

PARAMETER	VALUE
Rated supply voltage, V	220 ±25%
Rated power frequency, Hz	50
Power consumption, W, max	70
Net weight, kg	
• Control unit	13.2
• Stand for ELEKTON-DHS unit	2.2
• PUM-60 press	5.0
• Cables set	0.3
Overall dimensions, mm, max	
• Control unit	464 x 328 x 167
• Stand for ELEKTON-DHS unit	280 x 136 x 81
• PUM-60 press	500 x 232 x 275

COMPONENTS

- Control unit;
- Control unit – TMS-DHS communication line;
- Control unit power cable;
- Case for DHS;
- PUM-60 general purpose compact press;
- Operating manual.

BSI-04 Read-Out Unit

The BSI-04 read-out unit is used for information retrieval from controllers of ELEKTON systems: switchboards, surface panels and for transmission of this information to a stationary computer.

The BSI is powered from the device it is connected to for data retrieval or transmission.

BPI is connected to the switchboard controller and to a computer via standard RS-232 or USB interfaces.

BSI has up to 4 GB nonvolatile memory.

The software runs under Windows XP/7/8/10 and allows retrieving information from the BSI and displaying it on PC in graphic and tabular forms.

The maximum overall dimensions of the BSI are 71x33x17 mm.

The maximum weight is 100 g.

The BSI supports the following functions:

- reading out setpoints and event chronology from ELEKTON VSD and switchboard controllers and surface panels of the downhole monitoring system;
- copying the setpoints and event chronologies retrieved from controllers from the BSI to a computer.

Computer interaction:

To readout data from the BSI, it must be connected to the USB-port of the computer through an appropriate connector.

The computer treats the BSI as a Flash-type storage device.

The same procedures must be observed for the removal of the BSI from the computer as for the USB flash drive removal.

To view and process the event chronologies retrieved from the BSI, ElektonUV software is used:

The BSI memory is formatted using standard Windows tools with the following settings:

- file system: FAT32;
- cluster size: 4096 bite.

SCOPE OF SUPPLY:

- BSI-04 Read-Out Unit – 1 pc.;
- USB A-A extension, L=1.8 m – 1 pc. ;
- Datasheet – 1 copy.
- Operating manual – 1 copy for a 1 to 10 pcs lot.

ELEKTON-PCS Production Control System

Production Control System (Elekton-PCS) is a SaaS system (software as a service). It is a form of cloud service model provided to the clients through subscription, it is ready to be used and is fully serviced by the vendor. The supplier independently maintains the servers and the software, providing access to the customers through internet.

The main advantage of the SaaS model for the client is that there are no costs associated with installing, updating and maintaining the equipment and the software running on it.

In the SaaS model:

- the application is adapted for remote use;
- payment is charged either in the form of a monthly subscription fee, or based on the volume of transactions;
- technical support for the application is included in the payment;
- modernization and updating of the application is carried out promptly and transparently for customers.

As with all forms of cloud computing, customers do not pay to own the software as such, but to rent it (that is, to use it through a web interface). Thus, in contrast to the classical scheme, the customer incurs in relatively small recurring cost, and he does not need to make big investments in the purchase of an application program, the necessary software, hardware and its maintenance.

A server or a system of servers can be installed in the JSC ELEKTON data center, or if requested, it can be installed in other data centers in the customer›s country (to comply with the local laws and regulations). JSC ELEKTON provides the service for accessing to server resources.

The server software has been developed and supported by ELEKTON specialists. The server's administration and operation control is carried out by ELEKTON specialists. JSC ELEKTON is responsible for the protection and integrity of information. The information protection is carried out using the latest available technologies. The server software has been developed in compliance with OWASP recommendations.

ELEKTON PCS allows the operator to have remotely access, from any part of the world where Internet is available, in order to monitor well parameters, control VSD and ESP parameters, change VSD settings, and also get access to archived data for the entire period of the system operation. The data is displayed in any convenient form: graphs, charts, tables.

The system includes ELEKTON-FCM - Field Cellular Modem with a specialized software developed by ELEKTON, which, using cellular networks, provides access to RS-485, RS-232, ethernet interfaces. If the customer already has access to the Internet on the end devices (VSD, surface panels), then ELEKTON-FCM is not necesary. To increase the security of the system, the data transmission channel between the ELEKTON-FCM and the server is protected by encryption. ELEKTON-FCM can be used for one equipment or for all units in the well pad, any device with the specified interfaces, using any protocol can be connected to the system. This allows quickly connection to any VSD or surface panel from different brands (for example: Centrilift, Borets, Novomet, Triol, etc.

ELEKTON-PCS is especially convenient when working with equipment located on remote areas, where it is difficult to reach for performance monitoring, checking the general technical condition, for starting / stopping and monitoring parameters.

The system includes the following functions:

⇨ **Monitoring:**

- Data from the downhole sensor - the temperature of the motor and the well, vibration, pressure at the pump intake, pressure at the pump discharge;
- ESP parameters supported by the VSD controller;
- Operation parameters of additional equipment (if any);
- Notification criteria for VSD critical parameters;
- Uploading the general chronology of VSD events to the server for storage.

⇨ **Management:**

- Remote change of VSD settings, including remote ESP start and stop;
- Remote control of additional equipment (if any).

⇨ **Notifications:**

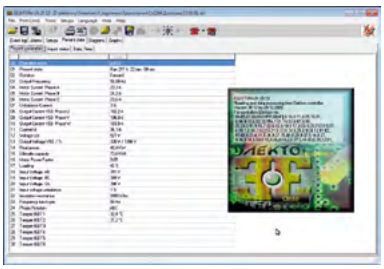
- Warning operators about any deviations on the VSD parameters from the established criteria in order to prevent emergencies, these events can be stored in the archive.

Tasks solved by the system:

- Implementation of optimal ESP operation modes, this can be achieved by constant monitoring of operating parameters and timely regulation by operators;
- Prevention of emergency situations due to timely intervention by the operator and, consequently, reducing the time for their localization and elimination;
- Accumulation of statistical archival data for their subsequent use for planning and forming the optimal operating ESP parameters;
- Providing operators with necessary real-time information on the VSD and ESP operation;
- Travel expenses reduction for on-site VSD monitoring.

ELEKTON PCS has been successfully tested by HCL Security AppScan Standard (formerly IBM Security AppScan) and SSL Server Test (Qualys SSL Labs). As a result of the testing, it received the highest safety rating A +.

ELEKTON Sofware Tool



The software is implemented in Windows environment and has a convenient and user-friendly interface. The software is intended for reading out and processing of data from all ELEKTON controllers.

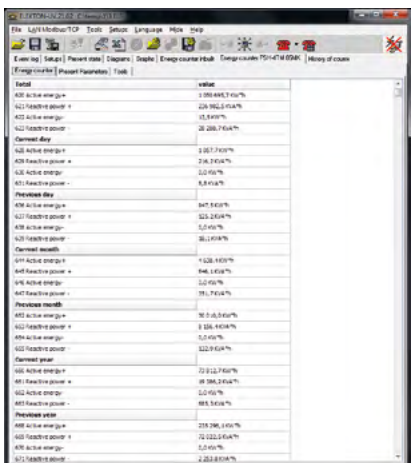
The software can be used to print out event logs, graphs and charts, or to save information to a text file and export it to Microsoft Excel file for further processing. Accumulated data on the downhole unit operation is retrieved from the controller's memory unit to a computer or to a BSI read-out unit for control and further processing.

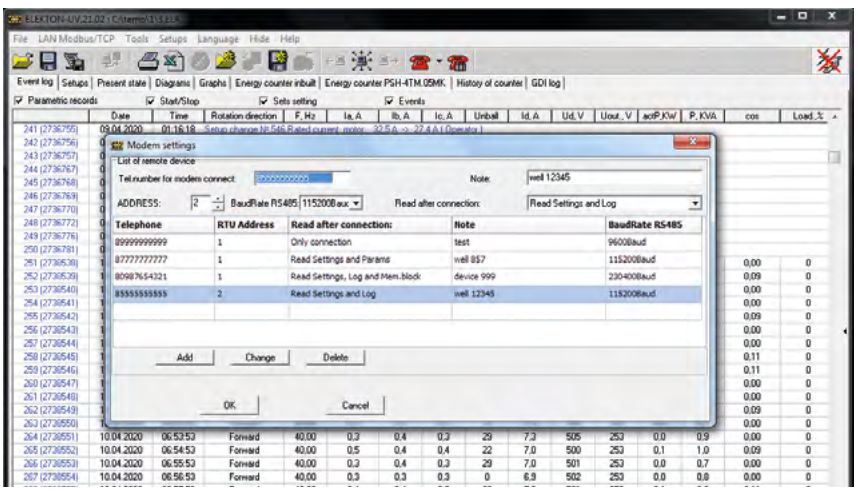
THE SOFTWARE IS USED TO:

- read out the event log with required parameters sorted by date and time, such as line voltages, phase currents, loads, insulation resistance, pressure, temperature, power factor, as well as instances of pumping unit turning on and off with cause indication, and setpoint changes with indication of old and new values;
- view the current status of the switchboard and its operating parameters;
- view and change the controller setpoints that determine the switchboard operation mode and response to deviations from the rated parameters.

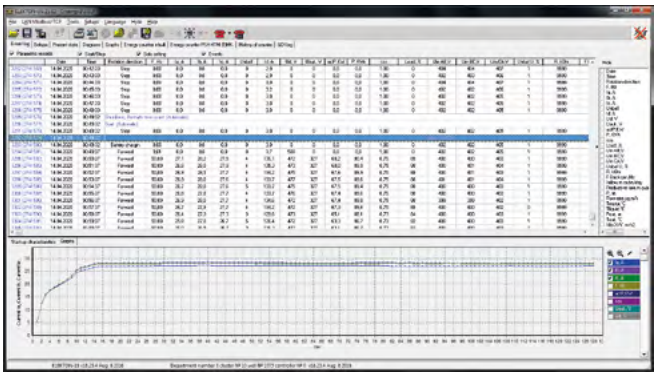
The parameters in the event log, and the list of setpoints and parameters are automatically updated depending on the version of the displayed data. The software has tools enabling interaction with the ELEKTON controllers via PC COM/Ethernet port or via a GSM modem connected to PC, which makes it possible both collecting data from the controllers and managing them (start, stop, change setpoints).

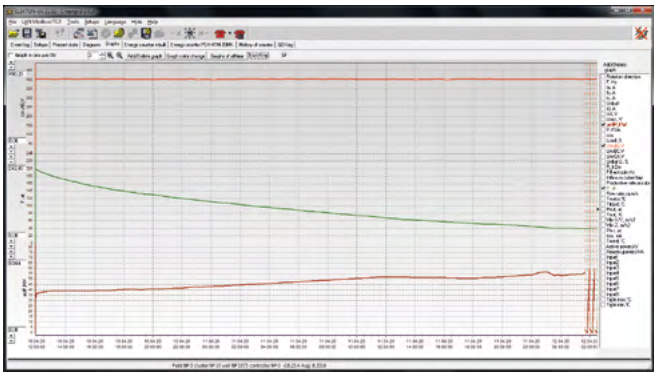
The software has interface in two languages (Russian and English).

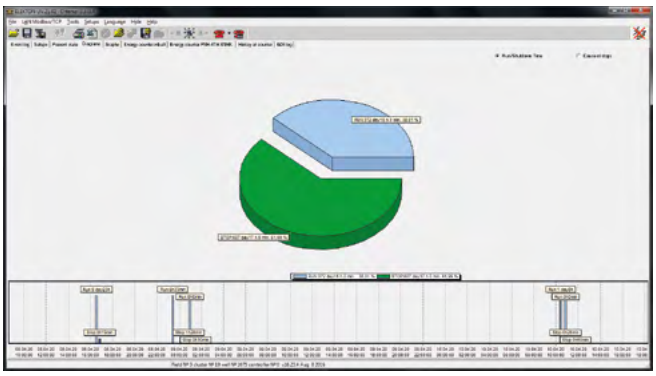


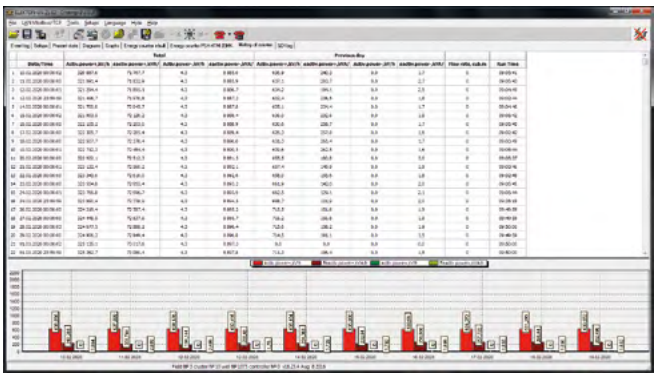


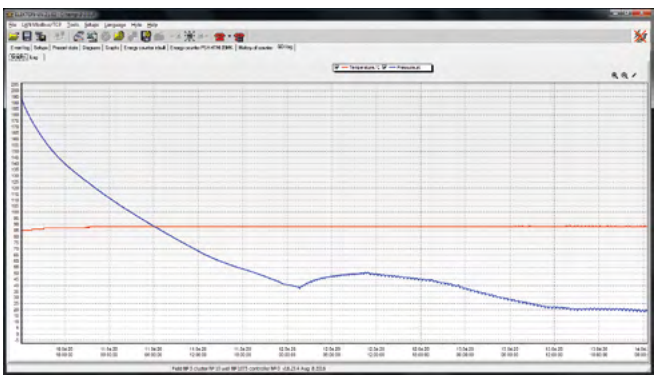
The up-to-date version of the general purpose software for data reading out from all ELEKTON products can be downloaded at: **http://www.elekton.ru/soft/elek_uv.zip**

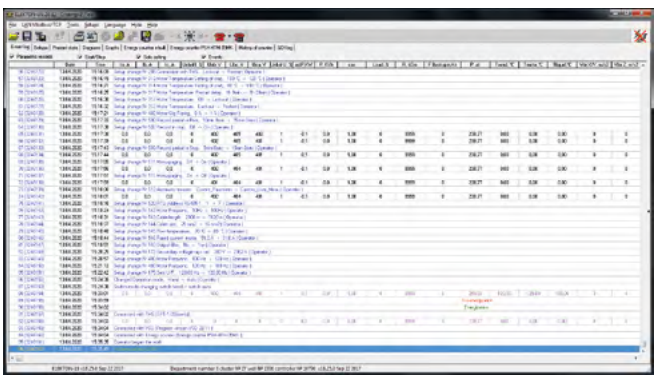










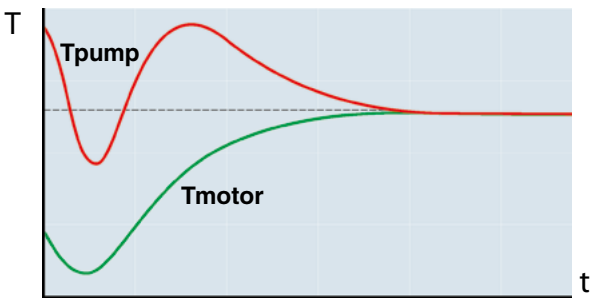


The "Graphs" tab represents a general purpose tool that allows displaying graphs of any parameters in the event log on a single coordinate grid, which together with the scaling feature facilitates the analysis of the pumping unit performance.

ELEKTON-SSC Soft-Start Coupling for ESP and PCP

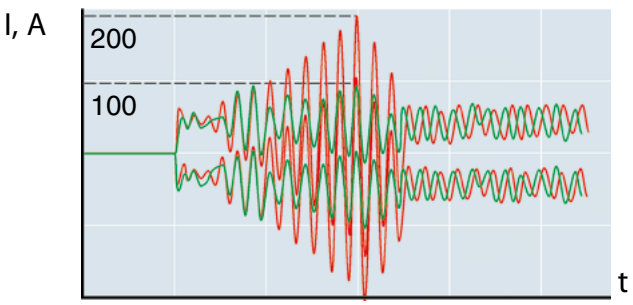
The ELEKTON-SSC soft-start coupling facilitates the start of an electric submersible motor on ESP and PCP, and prevent the backspin effect.

The soft-start coupling reduces the starting resistive torque on the motor shaft be seven times, which in turn reduces the starting-torque on the motor shaft and, ultimately, the starting currents.



Tpump, Tmotor – Pump shaft's torque or ESP motor's shaft torque, respectively

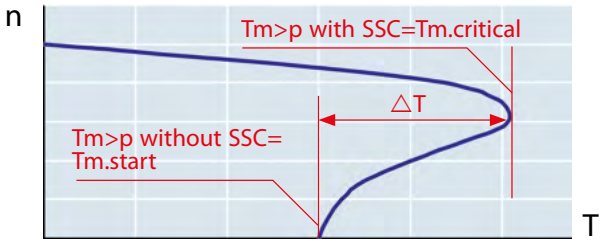
t – electric submersible pump starting time



Starting currents without SSC

Starting currents with SSC

t – electric submersible pump starting time



n – ESP motor's RPM, **T** – ESP motor's shaft torque

Tm.start	– Starting torque from motor direct start
Tm.critical	– ESP motor critical torque
Tm>p without SSC	– Pump torque overcome by motor starting torque (without SSC)
Tm>p with SSC	– Pump torque overcome by motor torque with SSC
△T	– Torque increment on the motor›s shaft with SSC

MAIN TECHNICAL SPECIFICATIONS

PARAMETER	ELEKTON-SSC-1-92-125-V5	ELEKTON-SSC-1-103-250-V5
Rotation speed, RPM, rated/maximum	3000/4000	
Starting torque-to-nominal torque ratio, minimum	7	
Maximum transmitted power	125	250
Maximum torque at output shaft at pump stall, Nm	600	800
Filling oil volume	4	5
Ambient temperature, maximum, °C	150	
Overall dimensions, mm	∅=92, L=1550	∅=103, L=1650
Weight, kg	60	75

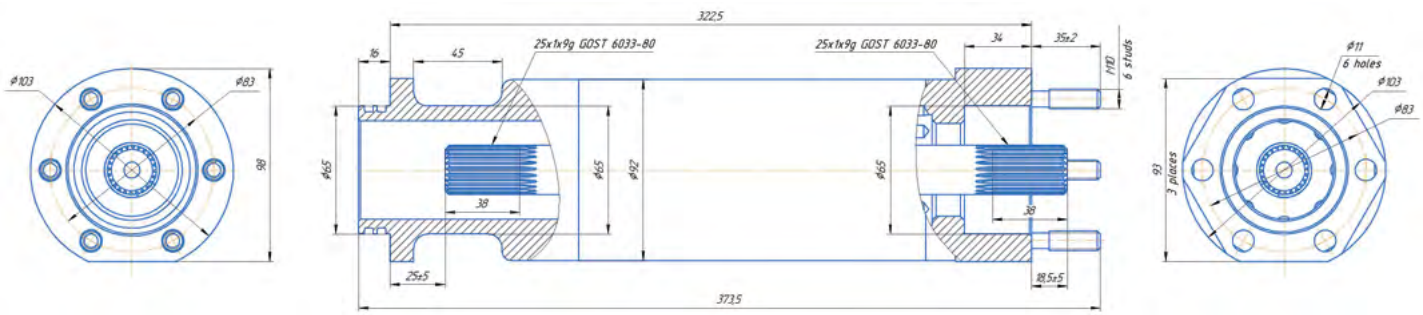
ELEKTON-ABC (Anti-Backspin Coupling)

FUNCTIONS:

- blocks reverse rotation of the ESP shaft in case of electric motor stoppage and check valve;
- provides torque transfer from the electric motor both in the forward and reverse directions;
- when used with an ESP unit with a permanent magnet motor, helps preventing the motor from generating current during backspinning and, accordingly, ensures the protection of the VSD and the staff;
- The use of the antibackspin coupling enables starting the pump fluid drainage from the tubing in case of the check valve or its absence;
- The use of anti backspin coupling in the ESP string with no check valve enables direct through-tubing flushing of the pump, and reduces the well killing time.

BASIC SPECIFICATIONS

PARAMETER	VALUE
Shaft rotation speed, RPM, max	6000
Maximum transmitted power, kWt	125
Filling oil volume	1
Weight, kg, max	12.5
Overall dimensions, mm, max	Ø103, length 377
Allowed rotation direction	Direct when the ESP motor is switched off Direct and reverse rotation with operating ESP motor



The anti backspin consists of a housing holding input and output shaft, and a disk self-stopping gear. The housing has flanges for the coupling installation between the ESP motor and the protector. The shafts are mounted on the bearing assemblies. A self-stopping gear is located between the shafts. Some elements of this gear interact with the input shaft and others – with the output shaft. When the input shaft rotates in both forward and reverse directions, the self-stopping gear does not prevent the transfer of rotation to the output shaft. When the output shaft rotates in the forward direction, the ESP operates in the normal mode, and in case of reverse rotation (backspin) it is immediately retarded and stopped. The deceleration parameters (gripping time, braking force) remain unchanged over the entire service life. The service life is determined by the durability of the bearing assemblies.

Mobile Commisioning Unit MCU

PURPOSE AND FIELD OF APPLICATION

Mobile Commissioning Unit (MCU) is designed for well commissioning operations in new oil fields, as well as for ensuring the protection of operating personnefrom adverse climatic conditions.

ELEKTON mobile commisioning are designed and manufactured in accordance with the requirements applicable to regions with with tropical climate.

BASIC MCU CONFIGURATION

- Enclosure;
- ELEKTON-05 PCh-TTPT-1000-380-50-1-UXL1 VSD, TU 3416-003-43174012-2001;
- Transformer cabinet;
- TMPNG-400/6-UXL1 or TMPNG-630/6-UXL1 transformer;
- OBUZLAR electric cabinet;
- KLP-25 junction box.

MCU can be used with ELEKTON-05VSD-1000 with ouput frecuency from 5 to 600 hz, and step-up transformer ER3FH-500 .

ET3FH-500 TRANSFORMER PARAMETERS

- Power – 500 kVA.
- Input voltage – 3 x 380V+20%.
- Output voltage – 3 x 2800V, 2 x 250V.
- Frequency – 283-600 Hz.
- Ambient temperature – -60... +40°C.
- Input current – 765 A.
- Output current – 103 A.
- Ingress Protection – IP33.
- Weight – 2327 kg.

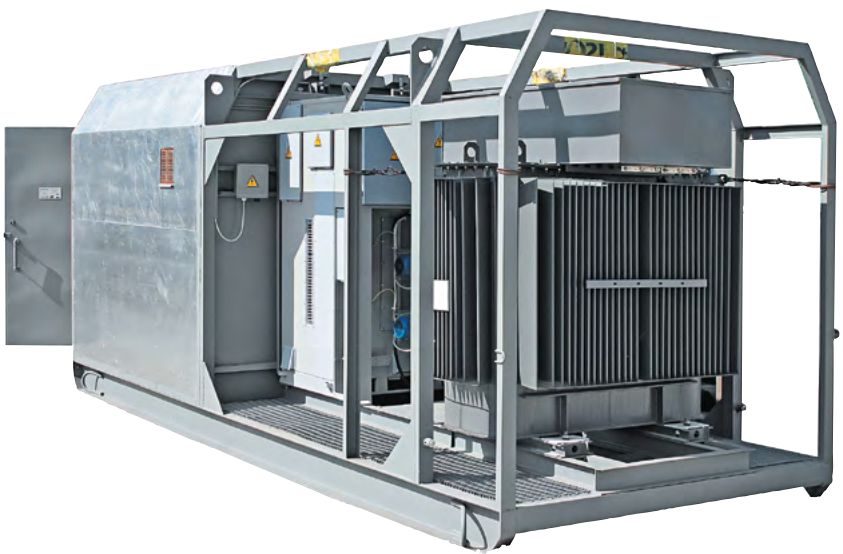
MCU-2-05/1000-630 based on drop-side trailer MAZ 8926-017-02

MCU-05VD/1000» with automatic PMM drive control system

MCU SPECIFICATIONS

Overall dimensions	Length, max – 5900 mm Width, max – 2200 mm Height, max – 2440 mm
Weight	4000 kg
Base	2 x 24P sole bars connected by crossbeams from 10P bar
Heat-insulated box	Structure – metal frame Roof and walls – 0.8 mm galvanized iron sheathing Bottom – 1.5 mm full metal, with corrosion-resistant, primer and paint coating
Thermal insulation	Isover insulation Floor thickness – 100 mm, covered by linoleum, wall thickness – 90 mm Interior paneling – 6 mm plywood treated with antiseptic solution, oil varnish and painted
Windows	Window frame structure– 600x600 double glazed
Heating	VT-1731 fan heater
Air conditioning	LG LWJO561FCG air conditioner
Transformer	TMPNG 400/6-UXL1, TMPNG 630/6-UXL1, TMPNG 1000/6-UXL1
VSD ELEKTON-05-1000	**Designation: PCh-TTPT-1000-380-50-1-UXL1** • power voltage: 3x380V • output voltage: 3 phase, 0 to 380V • output frequency: 3.5 to 70 Hz • rated output current: 1000 A **Operating modes:** • frequency maintenance • current maintenance • programmed operation • pressure maintenance Inclosure type: IP43 Climatic version – UXL1

INTERNAL COMPONENTS AND LOCATIONS CAN BE CHANGED OR SUPPLEMENTED BASED ON THE CUSTOMER'S NEEDS AND REQUIREMENTS.



MCU-05/1000-630

MCU-2-05F/400-300-UXL1 Mobile Commissioning Unit

PURPOSE AND FIELD OF APPLICATION

The main purpose of the MCU is for to mobile applications of ELEKTON-05F-400 VSD with a step-up transformer, in order to commissioning a well, and protect the operating personnel from unfavorable climatic conditions.

The MCU is used in oil production. MCU is connected to the ESP unit driven with motor <125 kW ESP.

The MCU is designed to be operated in the periods of:

- ESP commissioning;
- routine ESP backspin operations;
- well production testing by adjusting the frequency of the ESP motor supply voltage in the range from 3.5 to 70±1% Hz.

The MCU ensures protection of the ESP equipment, and enables displaying and transmissiononing of DHS real-time data from the ESP VSD controller.

BASIC COMPONENTS

The basic configuration of MCU-2 includes a MAZ-892600-017-02 drop-side trailer on which a platform is mounted with the equipment listed below:

- ELEKTON-05F-400 VSD (enabling data reading out and recording from the VSD controller, and data (event chronology) transmission to PC via USB-port). The VSD has built-in input and output voltage filters;
- TMPNG-SESch-300/3-11 UHL1 step-up transformer manufactured by Samara Plant Elektroshchit OJSC;
- Two 4x70 mm2 cable lines (KG HL type), 36.7 m each. The cables are wound on a drum and fastened with cable ties. The drum is held in a closed metal cabinet. The cables are used to connect the MCU to the transformer substation. One (main) cable is permanently connected to the VSD input. The other (standby) cable is connected to the VSD input in parallel with the main cable when the line cross-section needs to be increased;
- PVZ-25 wire is used for grounding the MCU enclosure. The length of the wire is 30 m, it has lugs for connection to the grounding loop of the well pad (stored in a locked metal box during transportation);
- Rigid type shelter protecting from atmospheric precipitation and wind and permitting stand-up switchboard panel operation;
- Folding ladder;
- Technical and operational documentation package.

NOTE:

- The MCU may only be operated with the closed doors of the following components: power compartment, I/O compartments of the ELEKTON-05F switchboard, I/O compartments of the power transformer, and HV cabinet.
- Only personnel certified to operate electrical equipment (above 1000V) may be permitted to service the MCU.
- After installing the MCU at the work site, it must be connected to the earthing circuit using the earthing clamps supplied with the MCU.
- Inspection, routine maintenance and repair of the MCU shall be carried out in completely deenergized state.

WEIGHT AND OVERALL DIMENSIONS

PARAMETER	VALUE
Overall dimensions, mm, max	Height 3700 Length 5600 (without tow bar), 7650 (with tow bar) Width 2500
Weight without trailer, max, kg	3675
Weight of MAZ-892600-017-02 trailer, max, kg	3760

IS-10 Test Bench

The IS-10 test bench is used for functional testing of ELEKTON-10 controllers of ELEKTON VSD.

THE IS-10 TEST BENCH ENSURES:

Functional testing of supply voltage monitoring circuits and voltage protection of the tested ELEKTON-04(07) series switchboard controller:

- tripping of high voltage protection;
- delayed tripping of high voltage protection;
- delayed activation of high voltage protection after start;
- tripping of low voltage protection;
- delayed tripping of low voltage protection;
- delayed activation of low voltage protection after start;
- tripping of voltage unbalance protection;
- delayed tripping of voltage unbalance protection;
- delayed activation of voltage imbalance protection after start;
- time to autoreclosing after voltage recovery to the selected setpoints or after voltage disconnection.

Functional testing of the operating current monitoring circuits and current protection of the tested ELEKTON-04(07) series switchboard controller:

- tripping of underload protection;
- delayed tripping of underload protection;
- delayed activation of underload protection after start;
- tripping of overload protection;
- delayed tripping of overload protection;
- delayed activation of overload protection after start-up;
- time to autoreclosing after switchboard tripping caused by underload or overload protection.

Functional testing mode of the insulation resistance monitoring circuit and tripping against low insulation resistance.

Operability testing:

- device for automatic heating of the space inside the controller;
- protection against switchboard turning-on in case of pump unit backspinning;
- protection against switchboard turning-on during the inverse phase sequence;
- electrical locking of the power compartment door (protection against unauthorized opening);
- RS-485 port operation;
- circuits for measuring input signals from No.1 and No. 2 analogue inputs;
- circuit for the power factor determination (cosφ).

Testing the communication line with external devices via RS-485 communication protocol.

TECHNICAL SPECIFICATIONS

PARAMETER	VALUE
Rated supply voltage, V	220 (50 Hz)
Maximum voltage deviation from average, %	-15... +10
Consumed power current, A, max	0.5
Output voltage range in phase voltage monitoring mode, V	45... 230
Output current range in phase current monitoring mode, V	0... 5.5
Output voltage range in insulation resistance monitoring mode, V	0... 4.1
Output voltage range in electric motor RPM monitoring mode, V	0... 220
Overall dimensions, mm, max	370 x 280 x 110
Weight, kg, max	4.5
Ingress protection from environmental factors	IP00

Water Flow Calibration Unit

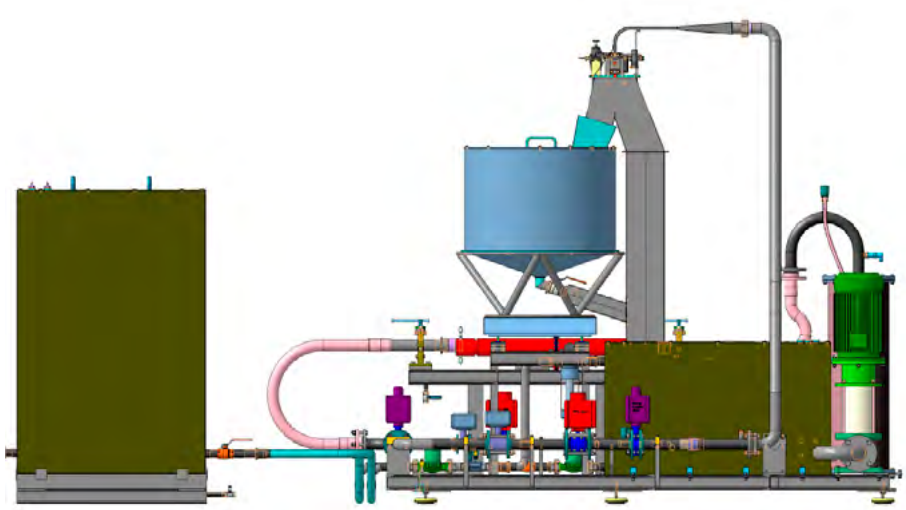
Water flow calibration unit is used for verification (calibration) of volumetric flowrate measuring channels of the ELEKTON-TMSF downhole flowmeters in the flowrate ranges between 0.4 m3/^{h}r and 52 m3/^{h}r (from 10 m3/^{d}. to 1250 m3/^{d}.).

The unit is an approved type measuring device:

- No. in the State Register: 59936-15;
- certificate of conformity RU.C.29.006A No. 57948.

The unit is comprised of the following components:

- systems for water storage, treatment and feeding to the circulation system;
- systems of water circulation and flowrate stabilization at control sections;
- control section for measuring instruments of the Elekton-TMSF downhole flowmeter (work table);
- two control sections for reference flowmeters;
- heating and temperature adjustment devices in the gathering tank;
- hardware and software of the system controlling the executive devices and installation equipment (control panel, measuring unit for environmental parameters, personal computer with special software)
- verification devices



Hydraulic part of the MFC unit

Test Bench for VSD-Load Testing up to 2000A

The test bench is used for load testing of switchboards for pump, fan, and other motors. The test bench enables testing switchboards in any modes, such as direct start, soft start, frequency-controlled mode for induction motors and other devices based on a voltage inverter.

The test bench is comprised by two separate test benches 1000A each that can operate in parallel making up the load of up to 2000A and each separately under load up to 1000A.

The distinctive feature of the test bench is that it includes an energy recovery system that helps drastically reducing power consumption during testing of switchboards. For example, dissipated thermal power will amount to approx. 500kW if a standard load device (heating elements) is used for testing of a VSD switchboard with output current of 1000A. When our recuperation system is used, the power consumption from the mains will not exceed 50kW, which significantly reduces the requirements to the power supply network and, accordingly, the power consumption during testing. This, in turn, will help quickly recover the costs of a test bench with this system.

During the operation of the test bench with a recuperation system, the electricity costs associated with testing of switchboards have reduced 8-fold.

The test bench has no moving mechanical parts, except for cooling fans. Its hardware and software package enable simulating different types of loads, such as heavy start, motor stalling, phase failure or voltage unbalance, underloading, reduced insulation resistance, etc. as per the customer›s request.

Due to the bench's design, no heat generating load modules need to be used.

The bench has two operating modes: manual and automatic.

Its hardware and software package ensures reading out and storing test results and issuing of test protocols.

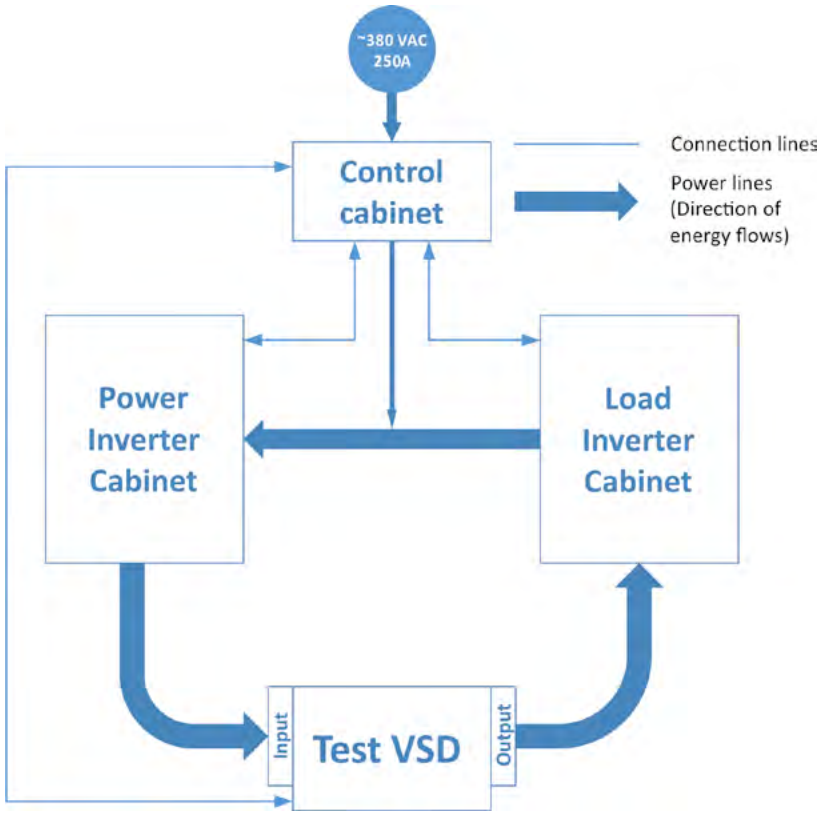
The test bench is comprised of the following components:

- Control cabinet;
- Voltage source inverter cabinet;
- Load inverter cabinet;
- Connection cable package.

TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS OF THE CONTROL CABINET AND THE VOLTAGE SOURCE INVERTER CABINET	VALUE
Input voltage	380V (-15% +20%)
Input current	250A
Consumed power current, A, max	0.5
Output voltage	380V
Output current	0-1000

HARMONIC GENERATION FOR SIMULATION OF A NETWORK WITH A LARGE HARMONIC DISTORTION (THD)	
1st harmonic	0-100%
5th harmonic	0-30%
7th harmonic	0-30%
Input voltage measurement	Yes
Output voltage measurement	Yes
Output current measurement	Yes
Measurement of active and reactive power consumed by switchboard	Yes
Measurement of harmonic components generated by switchboard in the power network	Yes
Switchboard overload mode testing	Yes
Power sagging and short-term failure mode testing with adjustment of sag interval	Yes
Full information shown on a color display	Yes
PC controlled in automatic mode	Yes
Data archiving	Yes
Switchboard test protocol printing	Yes
TECHNICAL SPECIFICATIONS OF THE LOAD INVERTER CABINET	
Input voltage	380V (-15% +20%)
Input current consumed from switchboard	0-700A
Input voltage measurement	Yes
Input current measurement	Yes



Structured schematic of the load testing unit for VSD

DHS Test Bench

The IS-05.1 test bench is designed for acceptance testing of ELEKTON DHS and downhole flowmeters, including the effect of external pressure on the downhole units housing during pressure testing.

The thermostat test chamber is mounted on a frame that ensures the specified structural rigidity. The frame is made of a square tube. All walls are covered by a layer of thermal insulation to reduce heat exchange with the environment. The inner walls of the chamber are made of stainless steel. The chamber is accessed through a door. Door seal and a lever door handle ensure the proper tightness of the closed door. A viewing port can be installed in the door for visual observation of the test process. A dressing outer casing of the chamber is mounted on the frame, its panels are fastened with a finishing angle. The outer sheets and the finishing angle are powder-coated.

Active circulation of heated air inside the thermostat chamber is provided by the built-in fan. Tested products are placed on special stacks of TsTKD 046.10. Up to ten TMSP downhole units or up to six TMSDF downhole units fit the thermostat chamber of the IS-05.1 test bench.

PERFORMANCE AND METROLOGICAL SPECIFICATIONS

IS-05.1 PARAMETERS	VALUE
Pressure simulation and measurement range in the hydraulic circuit of the test bench, PSI	0…8800
Limits of allowed basic percentage error of pressure measurement by reference AIR-20/M2-MV transducer in the hydraulic circuit of the test bench, %	0.1
Temperature simulation range in the test bench thermostat, °C	30…150
Setting temperature increment in the thermostat, °C	0.1
Tolerance class of DTS 064-100P temperature sensors	A
Limits of allowed basic percentage error of pressure measurement by TRM 200 gauge used with DTS 064-100P, %	0.25
Pressure simulation and monitoring range in a hydrotesting vessel using pumping unit, PSI	0…8800
Thermostat rated supply voltage, V	3x220, 50 Hz
Electronic scale capacity, kg	30 (32)
Rated source voltage of gauge package, V	220, 50 Hz
Volume of the thermostat chamber, dm3	250 (500)
Weight of SM30/150-250 TS thermostat, kg	120
Weight of SM30/150-500 TS thermostat, kg	150
Overall dimensions of SM30/150-250 TS, mm	750x800x750
Overall dimensions of SM30/150-500 TS, mm	850x1200x950
Thermostat chamber heating time to Tmax, hrs	max 1.2
Uninterrupted operation of the bench, hrs	at least 8

Elekton-U Motor Lead Extension

Elekton-U Motor Lead Extension (MLE) with an electric cable connector is intended for splicing with a power cable supplying voltage from surface equipment to the ESP motor used in oil production.

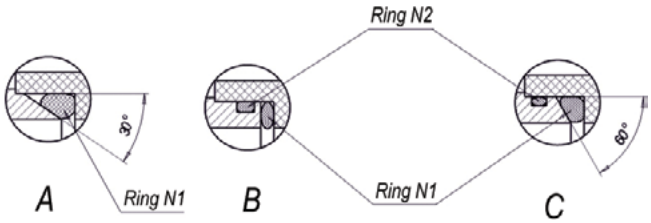
The Motor Lead Extension is made of KIFBP-200 or KIFBP-250 cable. The following range of cable lengths is available: 0.5; 1.0; 25; 50m. Length tolerance ±0.1m for the first two, and ±0.5m for the last two length options.

MAIN TECHNICAL SPECIFICATIONS

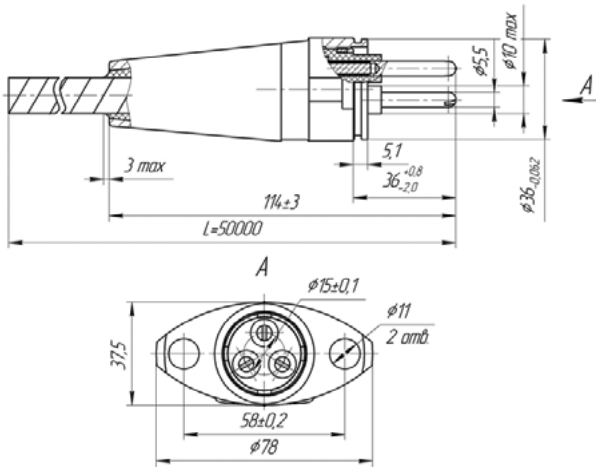
MLE OPERATING CONDITIONS	VALUE
MLE cable and connector temperature, max	200°C or 250°C
Formation fluid temperature, max	150°C
Formation fluid GOR, max	500m^3/m^3
H2S concentration, max	0.01 g/l
Hydrostatic pressure, max	35 MPa, 350 kgf/cm^3
Produced water weight content, max	99%
Formation fluid pressure, MPa	up to 35
Produced water pH factor	5.0 to 9.0pH

COMPONENTS

- MLE in configuration ordered by the Customer;
- plastic protective cover (attached to the connector flange) with fasteners and transportation o-rings (1 or 2 pcs depending on the sealing shoulder option); Improved cable connector sealing;
- mounting O-rings depending on the connector series;
- data sheet;
- packaging.



Flange sealing shoulder options



Overall dimensions and coupling dimensions

Elekton-U Motor Lead Extension

Electromagnetic contactor

Triple-pole electromagnetic contactors are used in electric drive control circuits at voltages up to 690 V AC 50/60 Hz, in the AC-3 utilization category for remote start-up and shut-down of three-phase squirrel-cage induction motors.

Contactor climatic version – U3.

MAIN TECHNICAL SPECIFICATIONS

Catalog No.	Maximum operating current, A		Allowed induction motor power, kW					Control logic	Overall dimensions, mm	Weight, kg
	Non-inductive load AC1	Electric motor up to 440 V, 3 phase, 50/60 Hz, AC3	220 V 230 V	380 V 400 V	415 V	440 V	500 V			
KEM-63	110	110	18.5	30	37	40	45	AC/DC	119 x 66.5 x 116	1.2
KEM-100	200	200	30	55	55	65	65	AC/DC	119 x 75.5 x 126	1.5
KEM-160	250	250	55	90	100	110	132	AC/DC	178 x 124 x 164	3.65
KEM-250	315	250	75	132	132	132	160	AC/DC	219 x 163 x 213	6.4
KEM-400	600	420	125	220	230	230	300	AC/DC	243 x 173 x 231	11.5
KEM-630	1000	700	220	375	400	425	480	AC/DC	270 x 238 x 265	18.0

ELEKTON products geography

RUSSIA
KAZAKHSTAN
UZBEKISTAN
TURKMENISTAN
UKRAINE
INDIA
INDONESIA
LIBYA
OMAN
COLOMBIA

ELEKTON IN RUSSIA

- Buzuluk
- Volgograd
- Gubkinsky
- Izhevsk
- Kogalym
- Krasnodar
- Langepas
- Megion
- Muravlenko
- Nadym
- Naryan-Mar
- Neftekamsk
- Nefteyugansk
- Nizhnevartovsk
- Novoagansk
- Novosibirsk
- Noyabrsk
- Nurlat
- Nyagan
- Omsk
- Otradny
- Penza
- Perm
- Pokachi
- Pyt-Yakh
- Raduzhny
- Samara
- Saratov
- Stavropol
- Strezhevoy
- Surgut
- Tomsk
- Tyumen
- Ulyanovsk
- Uray
- Usinsk
- Ust-Kut
- Ukhta
- Khanty-Mansiysk
- Yuzhno-Sakhalinsk

COMPANIES USING ELEKTON EQUIPMENT IN RUSSIA

Gazprom Neft
LUKOIL
NK Rosneft
NK RussNeft
Surgutneftegas
Tatneft named after V.D. Shashin
Alliance Oil Company

- Gazprom Neft-Vostok
- Gazprom Neft-Noyabrskneftegaz
- Gazprom Neft-Khantos
- Gazprom Neft-Orenburg
- LUKOIL-West Siberia
- LUKOIL-Komi
- LUKOIL-Nizhnevolzhskneft
- LUKOIL-Perm
- LUKOIL-North
- LUKOIL-EPU Service
- RITEK
- RN-Vankor
- RN-Remont NPO
- RN-Nyagganneftegaz
- RN-Snabzheniye
- Orenburgneft
- Bashneft-Dobycha
- RN-Purneftegaz
- RN-Krasnodarneftegaz
- RN-Sakhalinmorneftegaz
- RN-Stavropolneftegaz
- RN-Severnaya Neft
- RN-Yuganskneftegaz
- Varyegganneftegaz
- Varyenganneft
- Sredne-Vasyuganskoye
- Slavneft-Megionneftegaz
- Zapadno-Malobalykskoye
- Tomskneft
- Tomskgazprom
- Severnoyeneftegaz
- Sorochinskneft
- Buguruslanneft
- Udmurneft
- Belkamneft
- Penzaneft
- Ulyanovskneft
- Samara-nafta
- Saratovneftegaz
- Eastern Transnational Company
- Orenburgnefteotdacha
- Oilpump Service

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- Marketing Dept. Tel.: (49254) 3-23-50
- Contracts Tel.: (49254) 3-25-19
  Fax: (49254) 3-68-88
- https://www.elekton.ru

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- RADUZHNY, Vladimir Region
  Tel.: (49254) 3-27-38
  service@elekton.ru

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- **STREZHEVOY, Tomsk Region**
  Tel./Fax: (38259) 3-85-59

ЭЛЕКТОН
ELEKTON

OILFIELD EQUIPMENT

CONTROL SYSTEMS