HMS GROUP

HMS LIVGIDROMASH

ЛОЦМАН Plus L2

CONTROL AND PROTECTION STATION

OPERATING MANUAL
012.58.00.00.000 РЭ

Direct start
25 ... 200 A

Version 1.5

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Livny, 2025

This Operation Manual (OM) is a document certifying the main parameters and technical characteristics of the electric motor control and protection station (MCPS) guaranteed by the manufacturer.

The operating manual is intended to familiarize you with the MCPS, the principle of operation and contains information necessary for installation, correct and safe operation, maintenance, transportation and storage.

Example of writing down the designation of stations when ordering:

Лоцман+ L2 - XXX - IPXX - У2 ТУ 3432-112-00217975-2011

Degree of protection of the casing shell according to ГОСТ14254-96.
XX = 21, 54

Maximum operating current of the electric motor to be connected, A.
XXX = 25, 40, 80, 100, 160, 200

DEAR USER!

A specialized control and protection device L2 is used in this control station.

Sensor circuits in L2 are supplied with alternating current, which significantly reduces electrochemical corrosion of electrode sensors and prevents the deposition of salt deposits on them. The common wire of the level sensors (terminal COM) is connected to the neutral line (terminal “N”) through a current limiting resistor inside the L2 enclosure.

If you are using electrode level sensors galvanically connected to ground (e.g., a dry run sensor in a water well), check the **neutral wire connection to the “N” terminal** before plugging in the device!

L2 and starting equipment of the station are supplied from the mains with voltage ~220 V (terminals “F_A” and “ N”) and in case of absence or bad contact of neutral on the terminal “N”, the power supply of the station and L2 will be carried out from the phase wire F_A and from the grounded sensor through its measuring circuit, **which may lead to its failure!!!**

The manufacturer reserves the right to make changes in the design and equipment of the station without prior notice.

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1 DESCRIPTION AND OPERATION OF THE PRODUCT

1.1 Product designation

1.1.1 MCPS is designed for control and protection of borehole pump units of “High pressure electric centrifugal pump” type, submersible pumps of “Gnome” type, their analogs of both domestic and imported production, as well as any three-phase asynchronous electric motors with squirrel cage rotor by operator commands or signals from sensors and meets the requirements of technical conditions ТУ3432-112-00217975-2011.

1.1.2 MCPS corresponds to climatic execution У2 according to ГОСТ 15150-69. (У2 - operation in unheated premises or under a canopy at ambient air temperature from minus 40 to plus 40°С and relative humidity of 100% at 25о С).

1.1.3 MCPS protection degree against water and dust-IP21 or IP54 according to ГОСТ 14254-96.

1.1.4 According to the degree of protection of a person from electric shock MCPS belongs to Class 1 according to ГОСТ 12.2.007.0 -75.

1.1.5 Certificates of Conformity:

ТР ТС 004/2011 No. ЕАЭС RU C-RU.АД65.В.00202/21 (27.12.2021 - 26.12.2026), ТР ТС 020/2011 No.ЕАЭС RU C-RU.АЯ45.В.00109 /22 (17.10.2022 - 16.10.2027).

1.2 Specifications

Table 1

Number of sensors to be connected	Up to 4
Number of power channels	1
Rated voltage of the power circuit, V	~380
Number of phases	3
Frequency of supply voltage current, Hz	50 ±2
Rated voltage of microcontroller power supply, V	~220
Rated voltage of level sensor power supply circuits, V	~15
Permissible voltage deviations from nominal value, %	+10 -15
Maximum current of connected electric motor, A *(depending on version)*	200.0
Power consumption, VA, not more	30
Enclosure protection degree	IP21, IP54
Overall dimensions, mm	Appendix A
Weight, kg, not more	30
Installation method	hinged wall-mounted version

1.3 Version options

Table 2

Versions	Operating load current range, A	Recommended current of the motor to be connected, A	Degree of enclosure	Weight, kg, not more
MCPS Лоцман+ L2 - **25**	1...25	1...25	IP21 IP54	8
MCPS Лоцман+ L2 - **40**	1...40	20...40		8
MCPS Лоцман+ L2 - **80**	1...80	35...80		11
MCPS Лоцман+ L2 - **100**	1...100	75...100		16
MCPS Лоцман+ L2 - **160**	1...160	95...160		25
MCPS Лоцман+ L2 - **200**	1...205	155...205		27

Table 2 shows the recommended pump motor current **according to economic criteria**. It is possible to connect any motor with current from 1.0A up to the maximum range of the version.

When ordering it is recommended to choose the station version with 5...10% current reserve.

1.4 Supply kit

Table 3

No.	Designation	Quantity, pcs	Version	
			25 - 80	100 - 200
1	Control and protection station	1	●	●
2	SPTA kit: a) fusible insert 0.25 A b) fusible insert 2.0 A	 1 1	●	●
3	Cable end cap	6		●
4	Heat-shrink tube	3		●
5	Operating Manual	1	●	●
6	L2 Programming Manual	1	●	●
7	Packaging list	1	●	●
8	Packaging tare	1	●	●
9	Dry run sensor	1	●	●

1.5 Design and principle of operation

The control and protection station (Appendix Б) consists of a panel with a removable mounting plate, inside which a circuit breaker, an electromagnetic contactor, three terminal blocks (power and alarm), current sensors (current transformers) and a microcontroller control and protection device “L2” (hereinafter referred to as MC) are installed.

It is possible to connect 3 types of current sensors: type T03-90A (current up to 100A), type T2000:1 (current up to 125A) and sensors with unified output 5A with measuring range up to 600A. Description of current sensors is given in **Appendix A** of the “L2 Programming Manual”. When setting up the station, specify the type of current sensors and set it in item 4 of the L2 setup menu.

The panel door has a transparent window for monitoring the station status.

On the front panel of the MC there are control buttons “START”, “STOP”, “PROGR.”, “SELECT”, four-digit LED indicator and LEDs of sensors status, operation modes and alarm situations.

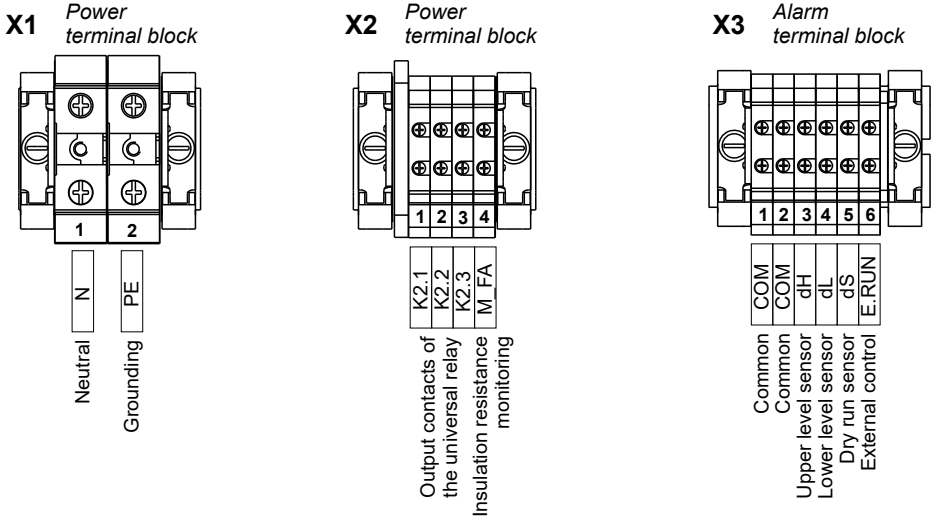
The principle of operation of MCPS is based on processing signals from external sources to MC and controlling the electromagnetic contactor that starts/stops the electric motor.

It is possible either manual mode of operation, in which the motor is started/stopped by pressing the buttons “START”/“STOP”, or one of the automatic modes, in which the motor is started/stopped by the signal(s) from the level or pressure sensor(s).

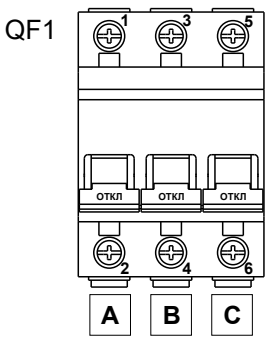
A full description of the operating modes, settings and alarms can be found in the L2 Programming Manual.

1.6 Station terminal markings

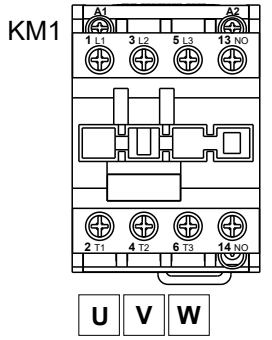
1.6.1 Marking of terminal blocks



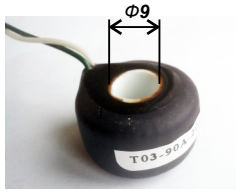
1.6.2 Marking of power equipment



Power input



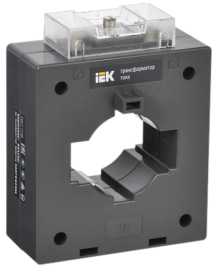
To electric motor



Current sensor T03-90A



Current sensor T2000:1



Current sensor with 5A output

1.6.3 Cross-section of wires to be connected

Table 4

Terminal		Option	Connection wire cross-section, mm²	Tightening torque, N * m
X2.1 - X2.4 X3.1 - X3.6		all options	0.5 - 2.5	1.2 - 2.0
X1.1		25...80	1.5 - 10.0	2.0 - 2.5
		100...200	6.0 - 35.0	2.5 - 3.0
X1.2		all options	1.5 - 10.0	2.0 - 2.5
QF1		25	1.0 - 25.0	2
		40...60	1.0 - 35.0	3.5
		80...100	10.0 - 50.0	6
		120...200	25.0 - 150.0	10
KM1	Power terminals	25...60	2.5 - 25.0	5
		80...100	4.0 - 50.0	9
		160	10.0 - 120.0	12
		200	150.0	18
	A1, A2 13, 14	all options	1.0 - 2.5	1.2

1.7 Station labeling

1.7.1 The plate attached to the MCPS enclosure is labeled with the following information:
- conventional designation of the product;
- trademark or name of the manufacturer;
- country - manufacturer;
- market mark (if there is a right to use it);
- nominal supply voltage and frequency of alternating current;
- designation of technical specifications;
- factory number;
- month and year of manufacture.

1.7.2 The transport tare is marked with cargo marking according to ГОСТ 14192-96 and design documentation of the manufacturing company.

1.8 Reliability indicators

1.8.1 Standardized indicators of station reliability:
- average time to failure - 20000 hours (taking into account in-service maintenance);
- average time to recovery - 3 hours;
- average shelf life - 2 years;
- average service life - 6 years.

1.8.2 Designated service life - 10 years, designated storage life - 5 years under condition of storage in group 5 (ОЖ4) p.10.1 according to ГОСТ 15150-69.

1.9 Packaging, storage and transportation

1.9.1 MCPS is packed in the packaging of the manufacturing plant.
1.9.2 MCPS should be stored in the packaging of the manufacturer in rooms with natural ventilation at ambient air temperature from minus 45°C to plus 50°C and relative humidity 98% at 25°C at a distance from heating devices not less than 0.5 m and in the absence of aggressive impurities in the air.
1.9.3 When loading and transporting packaged MCPS, the warning labels on the crates must be strictly adhered to and shocks and impacts that may affect the appearance and performance of the MCPS must be avoided.
1.9.4 MCPS can be transported by all types of transport, in covered vehicles, when transported by air in heated hermetically sealed compartments. It is allowed to be transported as a part of products.

2 STATION USAGE

2.1 Safety precautions in preparation for work

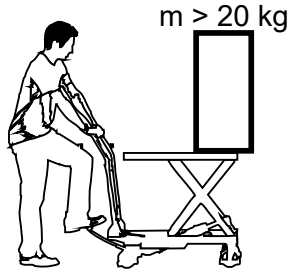
2.1.1 MCPS operators and maintenance and repair technicians must be trained in safety and familiarized with this “Operating Manual”.

2.1.2 Before being allowed to work with MCPS the operating personnel must be trained, instructed and certified according to the requirements of “Rules of technical operation of electrical installations of consumers” and “Safety rules for operation of electrical installations of consumers”.
2.1.3 When performing repair and adjustment works, the system in which MCPS is installed must be disconnected from the power supply network, and measures must be taken to exclude the possibility of its switching on until the end of the work.
2.1.4 The system in which the MCPS is installed must be reliably earthed in accordance with the Electrical Installation Regulations (EIR).
2.1.5 In case of emergency or malfunction of MCPS it is necessary to stop operation and turn off the circuit breaker of this installation in the power cabinet.
2.1.6 When operating MCPS there are no dangerous and harmful factors according to ГОСТ 12.0.003-2015.
2.1.7 The control station is a complete product with the use of natural cooling, has no moving mechanical parts that are a source of constant noise and vibration.
The station meets the requirements of ГОСТ 12.1.003-2014 for noise and ГОСТ 12.1.012-2004 for vibration.

2.2 Preparing the product for operation.

2.2.1 Unpacking should be performed from the side of the inscription “TOP” in the following order: open the package, check completeness.

In case of any defects or incompleteness of delivery, draw up an act and send it to the manufacturer.



Cabinets weighing more than 20 kg should be mounted using mechanical lifting devices, e.g. lifting carts.

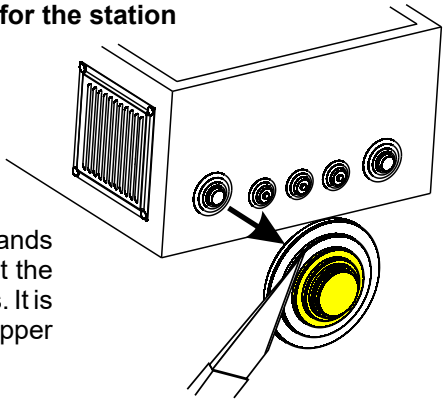
2.2.2 During installation, operation, maintenance and repair of MCPS must comply with the requirements of “Safety Rules for Operation of Electrical Installations of Consumers and Rules for Technical Operation of Electrical Installations of Consumers)”.
2.2.3 The MCPS may be installed and serviced by persons who are authorized at least by III level permit according to the “Safety Rules for Operation of Electrical Installations of Consumers and Rules for Technical Operation of Electrical Installations of Consumers” for installations up to 1000 V and who are familiarized with this manual.
2.2.4 Before connecting the MCPS it is necessary to make sure that the installation is de-energized.
2.2.5 Connect according to the wiring diagram (Appendix B).
2.2.6 MCPS is considered operable if after switching it on with the help of circuit breaker QF1 the device name and software version number are displayed on the indicator L2.

2.3 Basic parameters and characteristics of MCPS

• Setting of maximum/minimum protection currents depending on the type of applied electric motor from 0.5 to 400.0 Ampere (changeable by the user in the setup menu of L2);
• Motor disconnection at increase (decrease) of the preset maximum (minimum) current within 1 ...15 seconds (user changeable);
• Blocking of further motor starts in case of overload (it can be set by the user);
• Inrush current measurement inhibit for 1 to 15 seconds (user adjustable);
• Blocking of motor start-up in case of short-circuit to the chassis;
• Blocking of motor start-up in case of phase failure;
• Motor inhibit in the event of incorrect phase rotation;
• Motor shutdown in case of phase imbalance;
• Motor shutdown when mains voltage rises in the range of 230...270 V for 15 seconds (user adjustable);
• Motor shutdown when the mains voltage decreases in the range of 150...200 V within 15 seconds (changeable by the user);
• Emergency motor shutdown when the timer time exceeds 1 ...240 minutes (user adjustable);
• Display of operating current, phase voltages, motor running time, etc. on the LED display;
• LED display of the codes of the last three alarms that occurred in automatic mode;
• LED indication of sensor status;
• Audible and LED indication of operating modes and alarms;
• Re-activation, not earlier than 1 ... 30 minutes after the protection has been triggered (user adjustable);
• Counting of operating time (motor hours);
• Counting the number of motor starts that have taken place;
• Control of level (pressure) sensors:
  - “dry” running;
  - upper level;
  - lower level;
  - pressure sensor of ЭКМ type of any version;
• Control of additional inputs:
  - “external” control;
• Remote signaling (NO / NC relay contacts):
  - user-configurable event;
• AC powering of level and dry run sensor circuits to significantly reduce electrochemical corrosion of sensor electrodes.

Detailed description of functions and parameters can be found in the L2 Programm

2.4 Recommended installation procedure for the station

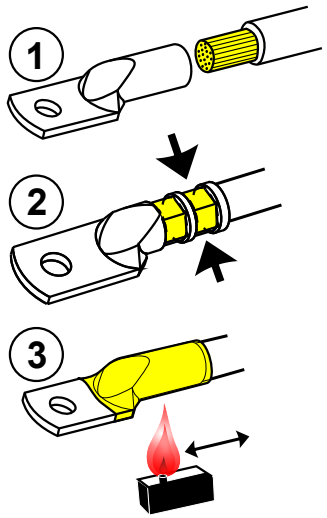


2.4.1 Attach the MCPS to the surface to be installed using the mounting holes on the rear panel. When mounting, ensure free air flow to the ventilation openings of the station (if available).

2.4.2 In IP21 versions, remove the cable glands from the holes in the bottom of the panel. Cut the rings to match the diameter of the cable glands. It is recommended to use power cables with copper conductors.

2.4.3 Connect power and signal cables (wires) of the required cross-section according to the electrical connection diagram (Appendix B)

<u>For MCPS of 100 – 200 options:</u>



2.4.3.1 Remove the enclosed cable lugs from the circuit breaker and contactor.
2.4.3.2 Strip the ends of the power cables to be connected to the MCPS, insert them into the lug and crimp them tightly with a suitable tool (or solder them with solder alloy ПОС-61).
2.4.3.3. Put the heat-shrink tubing from the kit on the pressed cable lugs of the **input cable** and heat with a thermofan or a lighter until the tubing shrinks.
2.4.3.4. Install cable glands and pass the cables to be connected through them.
2.4.3.5. Connect the cables according to the wiring diagram (Appendix B). It is necessary to pay attention to correct connection of the insulation resistance control wire. Put protective plastic covers (if any) on the diverter switch terminals with connected cables (wires).

2.4.3.6 Connect the signal cables (wires) according to the wiring diagram (Appendix B), passing them through the cable glands. Total resistance of the circuit “Cable - connected sensor” should not exceed 2 kOhm.
2.4.3.7 Tighten all screw connections of control and power circuits to ensure good contact.
Refer to Table 4 for recommended tightening torque.

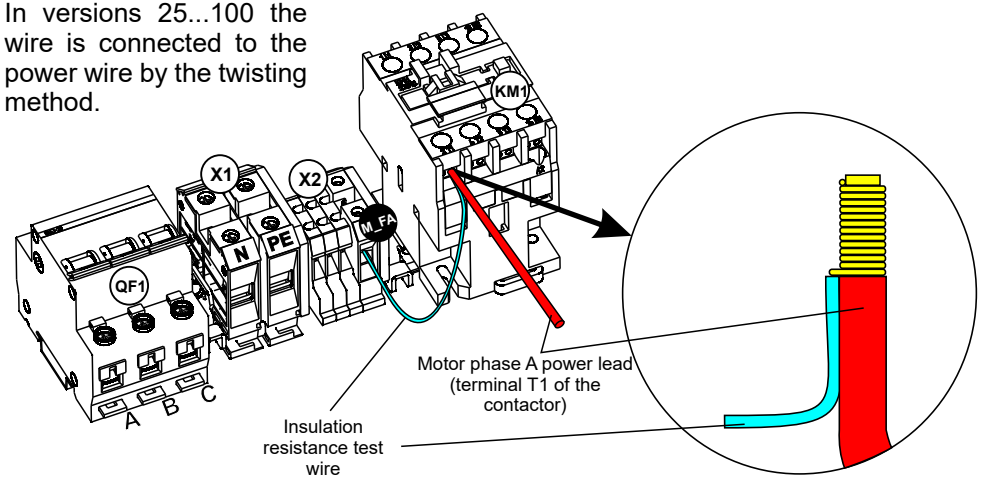
ATTENTION! ***Loose tightening of power terminals leads to terminal burnout and product failure!!!***

ATTENTION!

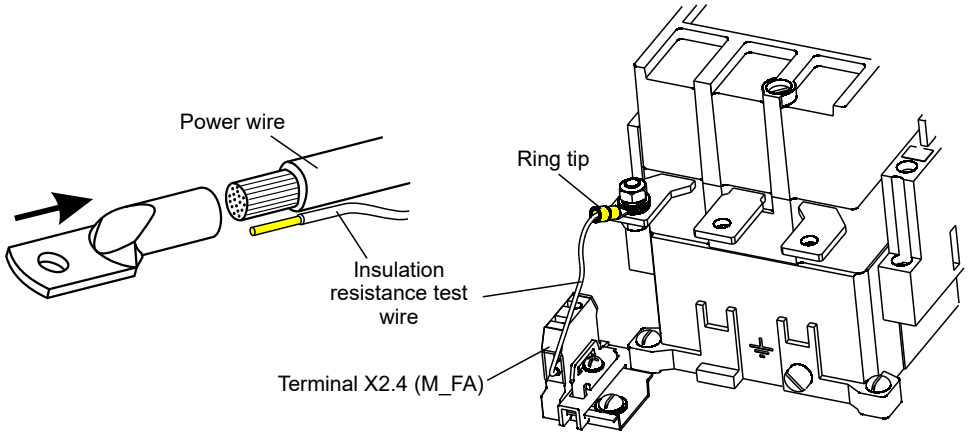
In order to ensure protection “Short circuit to body” it is necessary to connect the insulation resistance monitoring wire to the power wire “**U**” of the electric motor (terminal “**T1**” of the contactor).

It is strictly forbidden to connect it to other motor terminals. Incorrect connection will result in failure of the measuring circuit of the microcontroller!

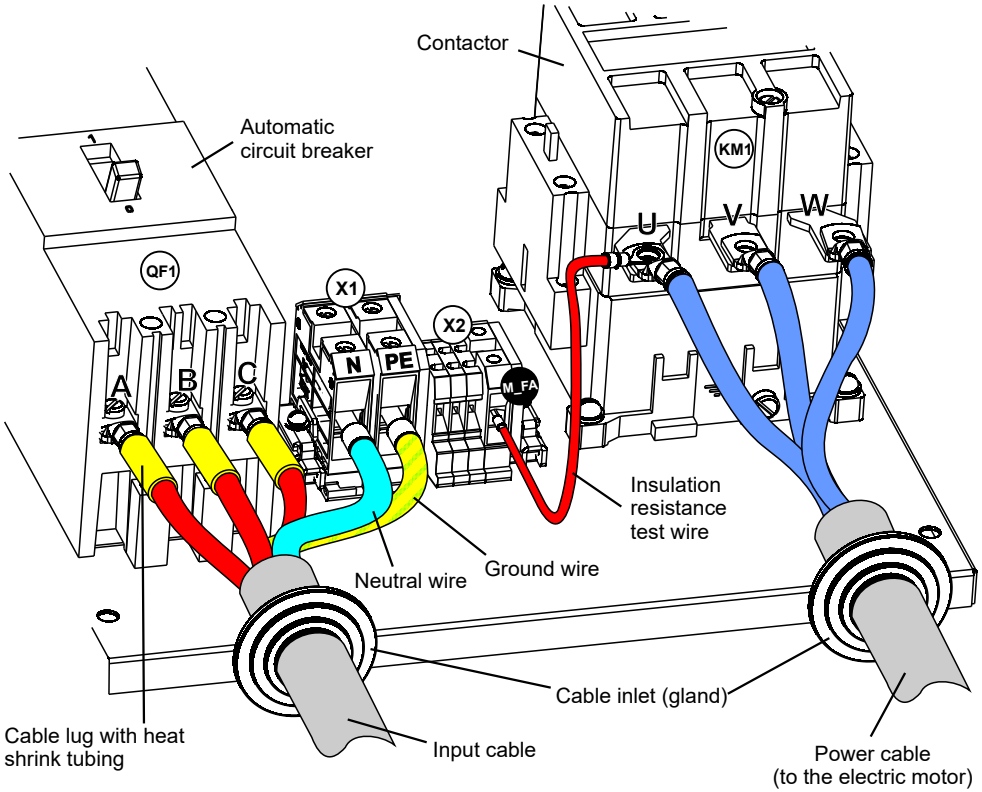
In versions 25...100 the wire is connected to the power wire by the twisting method.



In other versions, the wire connection is made either by crimping together with the power wire in the cable lug, or by attaching to the diverter switch terminal using a ring lug of НКИ type with the required diameter of the matching bore.



Due to the fact that the microcontroller and the contactor coil are powered from the mains voltage ~220V, it is mandatory to connect the neutral wire (terminal X1.1).



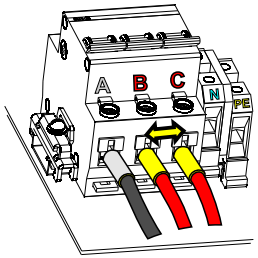
2.4.4 Check the correctness of connection of all circuits according to the wiring diagram (Appendix B).
If the installation of dry run sensor is not foreseen in the object, then for the station operation disable it in item 28 of the L2 setup menu, otherwise the Er.8 “Dry run” alarm will be constantly triggered.
2.4.5 Energize the circuit breaker and check for phase voltages.
2.4.6 Switch on the circuit breaker QF1. After the first switch-on, the station starts to operate in manual mode (factory setting), the controller display will show “OFF”, which means the invitation to manually start the engine.





If the correct phase sequence is not observed when connecting the supply line (or if the voltage on any phase is < 50V), the L2 display will show a fault with the code **Er.01** “Incorrect phase sequence”.

It is necessary to de-energize the circuit breaker QF1 and change the connection sequence of the supply phase wires (**at the input, interchange the wires of phases B and C**).



2.4.7 One of the main parameters of the protection is the control of the motor current consumption, so first of all it is necessary to set the protection currents.
Press the “START” button and turn on the motor.

Wait for the end of its acceleration time (the indicator displays running dashes during acceleration). After acceleration, the average motor current consumption in amperes will be displayed on the indicator.

2.4.8 Check the direction of rotation of the pump (motor) shaft.

If rotation is reversed, disconnect power to the station and reverse the sequence of motor wiring to the **contactor**. Adjust the operating parameters of the pump for normal operation with the gate valve and memorize the **average current value displayed by the controller**.

2.4.9 Press the “STOP” button to turn off the engine.

Enter the L2 parameter programming mode (L2 Programming Manual, Section 2.11). Set the value of parameter 6 “Maximum current” 10...15% higher than the average value you have memorized, and the value of parameter 7 “Minimum current” 10...15% lower. These will be the limits of the motor overload or underload protection. Using the “Minimum current” (underload) protection, it is possible to trace the pump operation “dry”, when the pump operating current drops to the idle current of the motor. This is particularly relevant in cases where a dry run sensor cannot be activated.

Note - Since the factory settings of the controller protection currents may not coincide with the actual current of the motor used, the current protection may be triggered after 5...30 seconds after acceleration. If there is not enough time before the protection is triggered to bring the pump to the operating mode, it is necessary to enter the Programming Mode and set the values of item 7 “Minimum current” - zero, and item 6 “Maximum current” - obviously more than the average current, which was displayed on the indicator during the manual start. It is also possible to make several consecutive starts of the motor to bring it to the operating mode.

Before start-up, specify the type of current sensors used in the station (p.1.6.2 “Power equipment labeling” or “L2 Programming Manual”, **Appendix A**). Set the required type in item 4 of the L2 setup menu.

2.4.10 In the L2 setup menu select the operating mode of the station, the function of the station and the type of level sensors connected to the station. If the timer operation mode is selected, you must also specify the timer operation time (item 15 of the L2 setup menu). This is the minimum required set of parameters that you need to set. After exiting the setup menu the station will start working in the mode set by you.

3 MAINTENANCE

3.1 Each MCPS must undergo maintenance from the moment it is put into operation. The MCPS does not require any special maintenance during operation. The station is designed for a long service life, however, to ensure trouble-free operation, the following requirements must be met:

- prevent contamination of the terminal blocks (between the contacts);
- the terminal blocks and the conductors connected to them must be firmly screwed and ensure reliable contact;
- the station must be protected against direct moisture penetration into its housing.

3.2 Maintenance work is carried out by the consumer or a specialized organization that has a contract with the consumer to carry out this work, at the expense of the consumer.

3.3 Warranty repair is performed by the manufacturer at the address:

303851 Oryol region, Livny, 231, Mira str. HMS Livgidromash JSC.
Tel./fax: +7(48677) **7-81-26**, e-mail: servise@hms-livgidromash.ru
or Service Centers, information about which is available on the website:
http://www.hms-livgidromash.ru/servis.shtml
Information about dealers of HMS Livgidromash JSC is available on the website:
http://www.hms-livgidromash.ru/diler.shtml

3.4 Post-warranty repairs are carried out by the consumer or a specialized organization at the request of the consumer and at his expense.

3.5 Maintenance of MCPS is performed simultaneously with maintenance of the equipment, which includes MCPS, and consists in inspection of the integrity of the case and reliability of fastening of connecting cables.

4 MANUFACTURER'S WARRANTIES

4.1 The manufacturer guarantees the compliance of MCPS with the requirements of technical specifications if the consumer complies with the conditions of transportation, storage, installation, maintenance and operation.

4.2 Warranty shelf life of MCPS is 12 months from the date of manufacture.

4.3 Warranty period of operation is 36 months from the date of MCPS commissioning, but not more than 42 months from the date of shipment by the manufacturing company.

4.4 The manufacturer may refuse warranty repair in the following cases:

- mechanical damage and defects of the product caused by non-compliance with the rules of transportation, storage, installation and operation;
- repair of the product or modification of its design by individuals or organizations without notifying the manufacturer or an authorized Service Center;
- alteration, erasure, deletion or illegibility of the serial number of the product or the stamp on the tag (labeling plate);
- defects caused by foreign objects, moisture, liquids, etc. getting inside the equipment.
- presence of defects caused by natural disasters or natural phenomena of an extraordinary nature and resulting in disruption of normal operation of the product, such as fires, floods, lightning, lightning discharges, etc.;
- use of the product other than for its intended purpose.

4.5 Claims will only be accepted if there is a complaint report (or statement) with the fault manifestations.

4.6 Transportation of the defective product shall be carried out by the Buyer.

4.7 The product to be transferred for warranty repair should be cleaned from contamination and fully completed.

4.8 The manufacturer is not liable for incorrect selection of MCPS version.

Appendix A
(for reference)
Overall dimensions

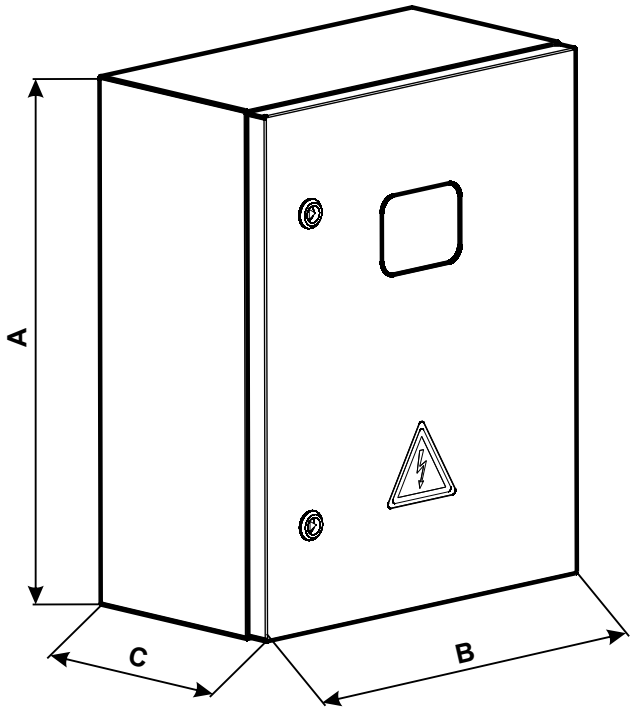


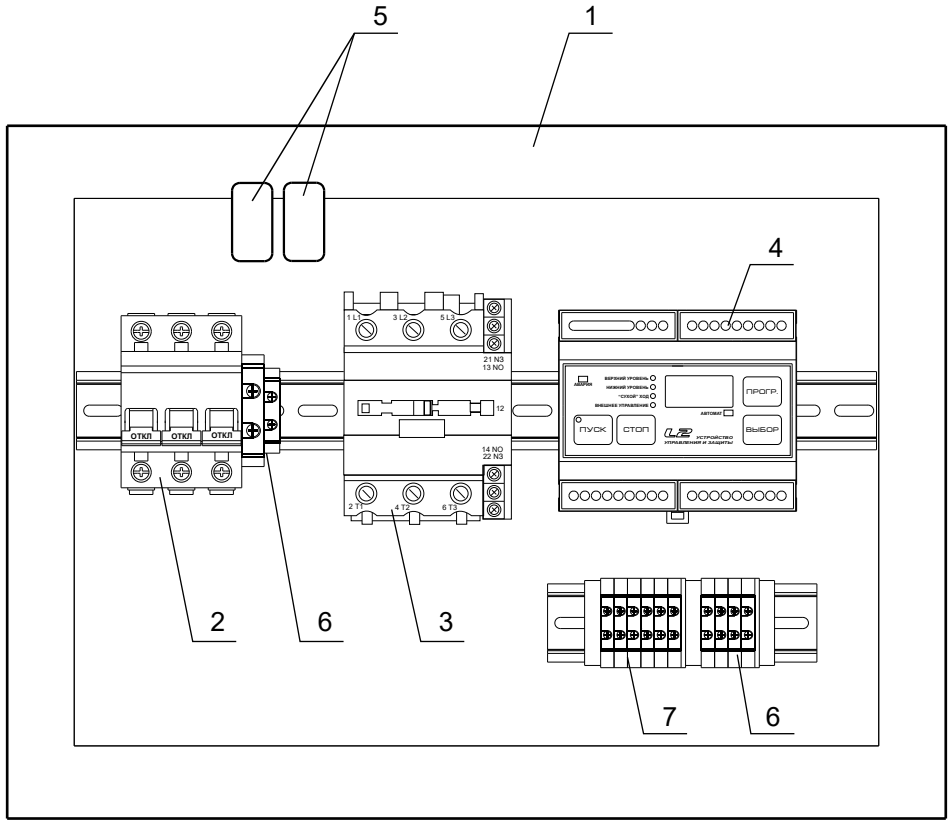
Table 5

Versions	Overall dimensions, mm		
	A	B	C
MCPS Лоцман+ L2 - **25** MCPS Лоцман+ L2 - **40**	310	420	150
MCPS Лоцман+ L2 - **80**	505	300	190
MCPS Лоцман+ L2 - **100**	500	400	220
MCPS Лоцман+ L2 - **160** MCPS Лоцман+ L2 - **200**	650	500	220

Appendix Б
(for reference)
Station design

Versions 25, 40

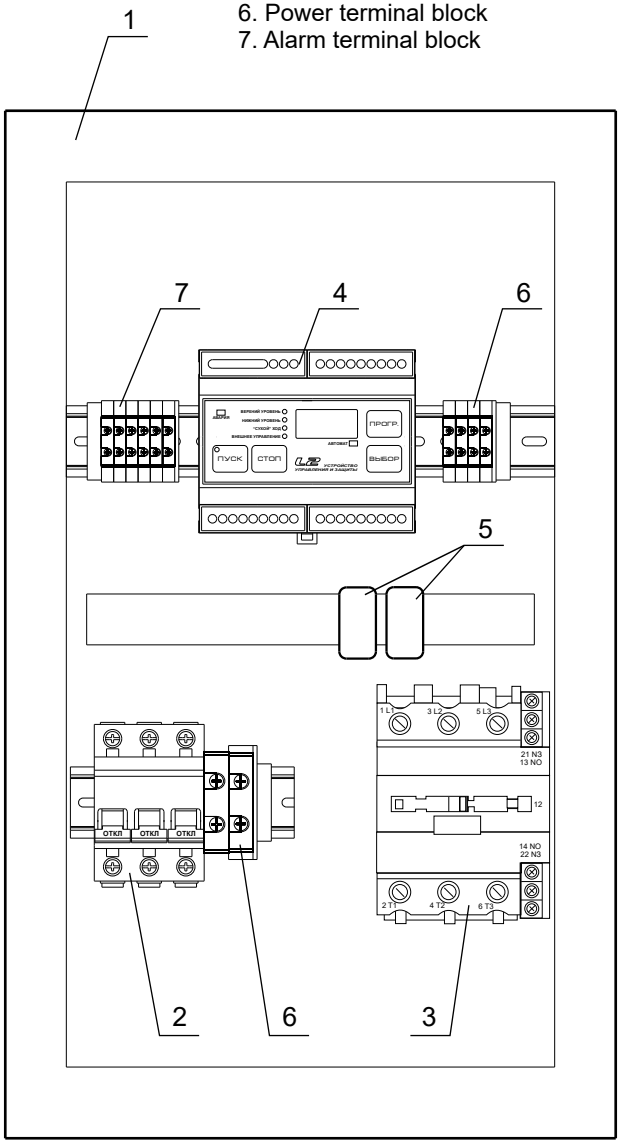
1. Panel with mounting plate
2. Circuit breaker
3. Contactor
4. Control and protection device L2
5. Current sensor type T03-90A or T2000:1 *
6. Power terminal block
7. Alarm terminal block



*Specify the type of current sensors used in the station (p.1.6.2 “Power equipment labeling” or “L2 Programming Manual”, **Appendix A**). When adjusting the station, set the required type in item 4 of the L2 setup menu.

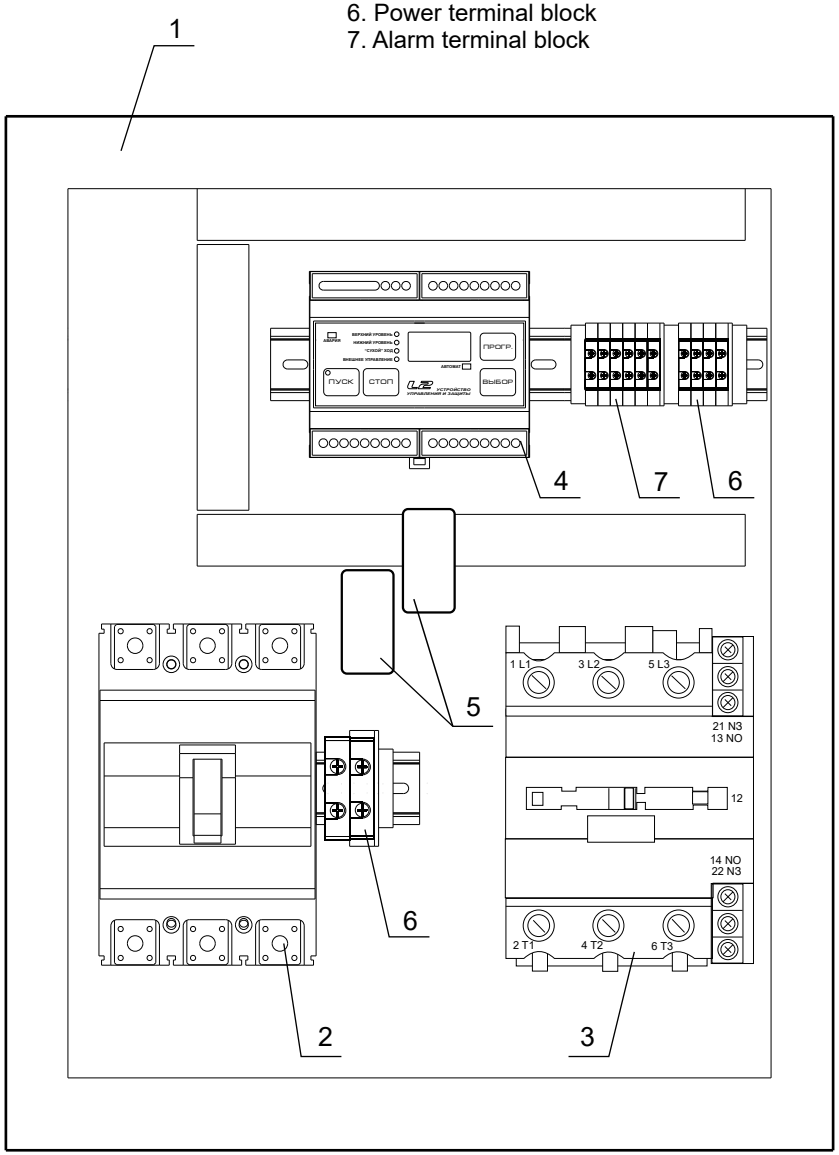
Version 80

1. Panel with mounting plate
2. Circuit breaker
3. Contactor
4. Control and protection device L2
5. Current sensor type T03-90A or T2000:1*
6. Power terminal block
7. Alarm terminal block



Version 100

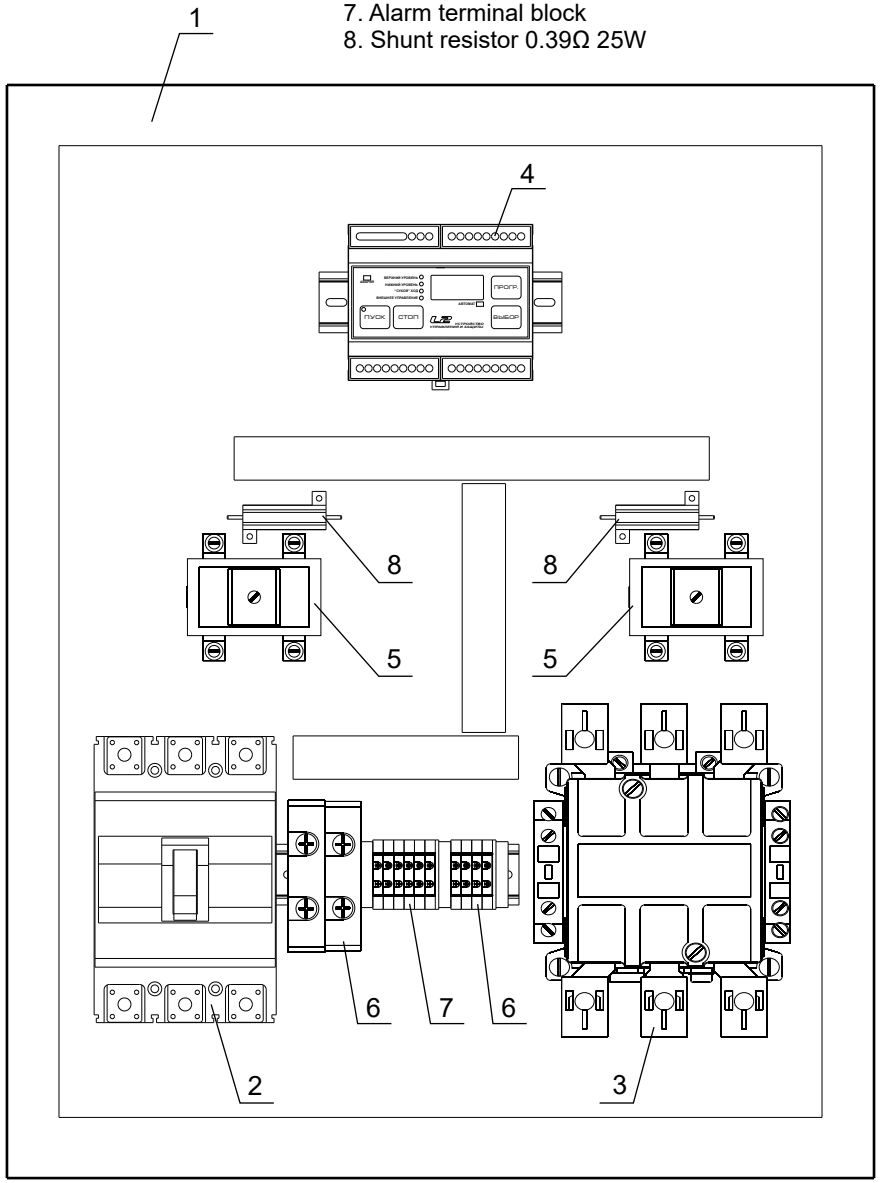
1. Panel with mounting plate
2. Circuit breaker
3. Contactor
4. Control and protection device L2
5. Current sensor type T03-90A or T2000:1*
6. Power terminal block
7. Alarm terminal block



*Specify the type of current sensors used in the station (p.1.6.2 “Power equipment labeling” or “L2 Programming Manual”, **Appendix A**). When adjusting the station, specify the required type in item 4 of the L2 setup menu.

Version 160...200

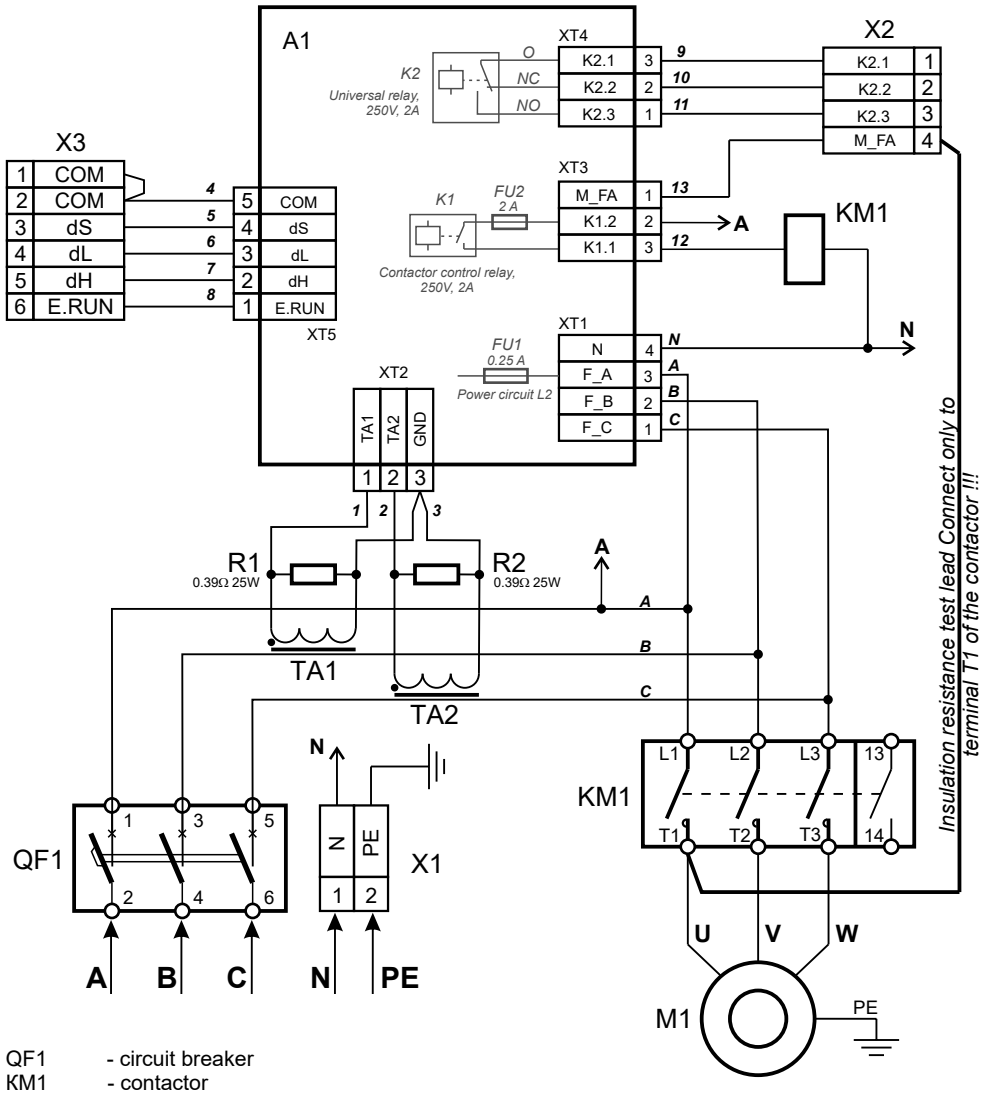
1. Panel with mounting plate
2. Circuit breaker
3. Contactor
4. Control and protection device L2
5. Current sensor with unified output 5A
6. Power terminal block
7. Alarm terminal block
8. Shunt resistor 0.39Ω 25W



*****Specify the type of current sensors used in the station (p.1.6.2 “Power equipment labeling” or “L2 Programming Manual”, **Appendix A**). When adjusting the station, specify the required type in item 4 of the L2 setup menu.

Appendix B
(for reference)
Electrical wiring diagram

General station wiring diagram



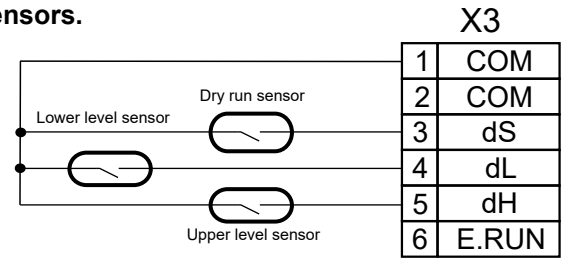
QF1 - circuit breaker
KM1 - contactor
A1 - control and protection device L2
TA1,TA2 - current transformer
R1, R2 - shunt resister
X1-X3 - terminal blocks

In versions **25...100** resistors R1 and R2 **are not installed**.

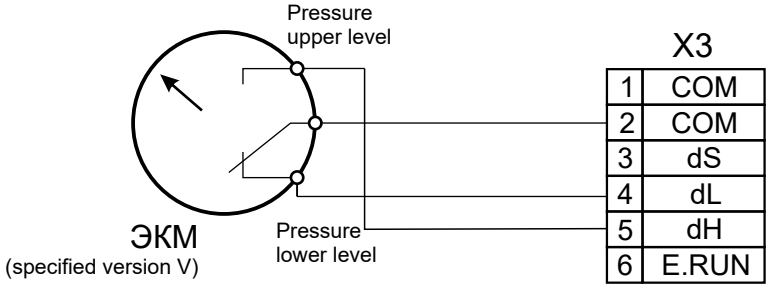
Due to the fact that the control and protection device L2 and the contactor are supplied from the mains with voltage ~220V, it is obligatory to connect the neutral conductor (line N).

Wiring diagram for level sensors.

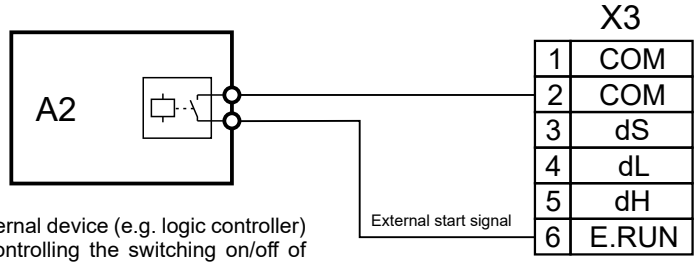
Single level sensors.



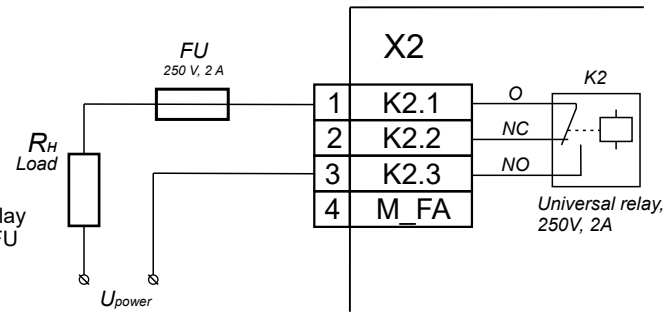
Electro contact pressure gauge (ЭКМ)



Wiring diagram of external components and devices



A2 - an external device (e.g. logic controller) remotely controlling the switching on/off of the electric motor.



Protect the contacts of relay K2, if used, with a fuse FU rated up to 2 A.