

# OptiSave

## Automatic transfer switch units

OptiSave L Automatic transfer switch unit of simplified functional characteristics	495
OptiSave H Automatic transfer switch unit of extended functional characteristics	501

**OptiSave ATS units** are designed to control automatic switching from the primary supply to the standby source in the event of a failure or disconnection of the primary supply. Used as a part of ATS cabinets in guaranteed and uninterruptible power supply systems for reliability categories I and II electrical consumers in accordance with the EIC requirements.

## Automatic transfer switch unit of simplified functional characteristics

### OptiSave L

495



Switched line: 400 V (L1, L2, L3, N)  
ATSU supply voltage: 220 V  
Maximum load current: 5 A  
Switching units: contactors  
Status of inputs and operating modes:  
LED indication  
Din-rail mountable

## Automatic transfer switch unit of extended functional characteristics

### OptiSave H

501



Switched line: 400 V (L1, L2, L3, N)  
ATSU supply voltage: 220 V AC or 12-24 V DC  
Switching units: load switches and circuit breakers with electromagnetic and motor drives, contactors  
Remote control and dispatching via Modbus

# OptiSave

## ➤ Automatic transfer switch units





OptiSave H automatic transfer switch unit is a control unit designed for automatic transfer to a standby line in the event of a fault or interruption of the operating line. The device is designed to operate as a part of control cabinets for automatic switching of backup power supply in systems of guaranteed and uninterruptible power supply of three-phase electric consumers of I and II connection category according to the EIC requirements.

### ► Designation

## OptiSave H - 2 4 3 - U3

		1	2	3	4	5	7
1	Series	OptiSave					
2	Classification by functionality and characteristics	L — simplified design			H — extended features		
3	Supported no. of inputs	2					
4	Supported number of controllable switching devices	2 — switching devices (for the «2 inputs no sectionalizing» diagrams)	3 — switching devices (for the «2 inputs no sectionalizing with non-priority load») diagrams for OptiSave H 3 - switching devices (for the «2 inputs with sectionalizing» diagrams) for OptiSave L		4 — four switching devices (input switching device, sectional switching device and switching device for non-priority load)		
5	Supports switching device status indication	0 — none	1 — available «on / off»	2 — available «on/off», «emergency operation», «removed»		3 — indication of the state of the switching unit and the mains on the LCD display is added to paragraph 2	
6	Supported as one of the generator inputs	C — yes		In the absence of designation - none			
7	Climatic and placement category	UHL4			U3		

## ► Selection guide

	OptiSave L-220	OptiSave L-230	OptiSave H-243	OptiSave H-233-C
Appearance				
Code	248974	248956	281763	285581
Full-load current, A (AC1 at 250 V)	5	5	16	16
Switching device control				
Contactors control	+	+	+	+
Control of electromagnetic drive circuit breakers			+	+
Control of motor-driven circuit breakers			+	+
Control of motor-driven load break switches			+	+
Input type				
Supply to primary and standby input from transformer substation	+	+	+	+
Power supply of one of the inputs from generator set				+
Functionality				
Voltage control	+	+	+	+
Phase loss monitoring	+	+	+	+
Phase sequence control	+	+	+	+
Voltage unbalance monitoring	+	+	+	+
Alarm indication	+	+	+	+
Option to connect an external alarm device via dry relay contacts			+	+
Option of remote locking of front panel buttons			+	+
Supported no. of inputs	2	2	2	2
Supported number of controllable switching devices	2	3	4	3
Input status indication	+	+	+	+
«On/off» status indication of switching devices			+	+
«Emergency shutoff», «removed» status indication of switching devices			+	+
LCD display			+	+
Control and dispatching via Modbus			+	+
Mounting				
din-rail	+	+	+	+
mounting plate	+	+		
switchboard door			+	+
Protection class as per GOST 14254				
housing, front panel side	IP 20		IP 54	IP 54
terminals	IP 20		IP 20	IP 20
Electromagnetic compatibility				
Classification of operating conditions according to GOST R 51317.4.5	-		Level 3	Level 3
Impulse noise and overvoltage immunity per GOST R 51317.4.5	-		Level 3	Level 3
Electrostatic discharge immunity per GOST 30804.4.2	-		Level 3	Level 3
Operating temperature range, °C	+1 to +40		-40 to +45	-40 to +45



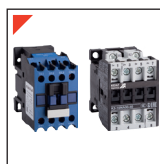
## OptiSave L Automatic transfer unit of simplified functional characteristics

The OptiSave L automatic transfer unit is designed for building various low-cost solutions based on contactors.

### ► Series advantages



Easy to set up. The units are configured from the front panel and do not require specialized software or additional tools.



Guaranteed compatibility with OptiStart K and PML, OptiDin MK contactors.



Made in Russia. Suitable for import substitution.



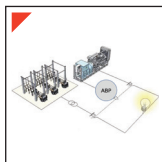
Ease of installation. Compact dimensions, can be mounted on a din-rail or mounting panel.



Convenient operation. Indication of input status and emergency modes on the front panel.



Adjustable hysteresis. Elimination of looping in weak networks.



Operation support of the main electrical schemes.  
2 operating inputs without sectionalizing; 2 operating inputs with sectionalizing.

### ► Technical specification

Parameter	Value	
Design version	OptiSave L-220	OptiSave L-230
Switched line type	three-phase four-wire L1, L2, L3, N	
Number of switched units	2	3
Rated operating voltage ( $U_e$ ), V	220/380	
Mains frequency (f), Hz	50	
Overvoltage (phase) trip settings $>U_{\Delta}$ , V	230...270	
Undervoltage (phase) trip settings $<U_{\Delta}$ , V	150...200	
Hysteresis of the low threshold « $\Delta U_{\Delta}$ », V	5...30	
Phase skew: difference between $U_{\Delta}$ in one of the phases and $U_{\Delta}$ in any other, V	10...100	
Trip delay of the main input relay in the event of the controlled parameters exceeding the allowable range ( $t_{\Delta}$ ), s	0...20	
Delayed actuation of the automatic transfer relay ( $t_{\Delta}$ ), s	0...10	
Delayed reverse switching to the main input in the event of the parameter recovery ( $t_{\text{return}}$ ), s	0...30, no reset	0...10
Maximum load current of AC1 utilization category at 250 V, A	5*	
Switching wear resistance, cycles	$>10^6$	
Overall dimensions, mm	71 x 90 x 65	
Weight, kg, max.	0,3	

\* it is recommended to apply protection circuits against commutation surges, the universal parameters are 100 Ohm and 0.1μF

► Operating conditions

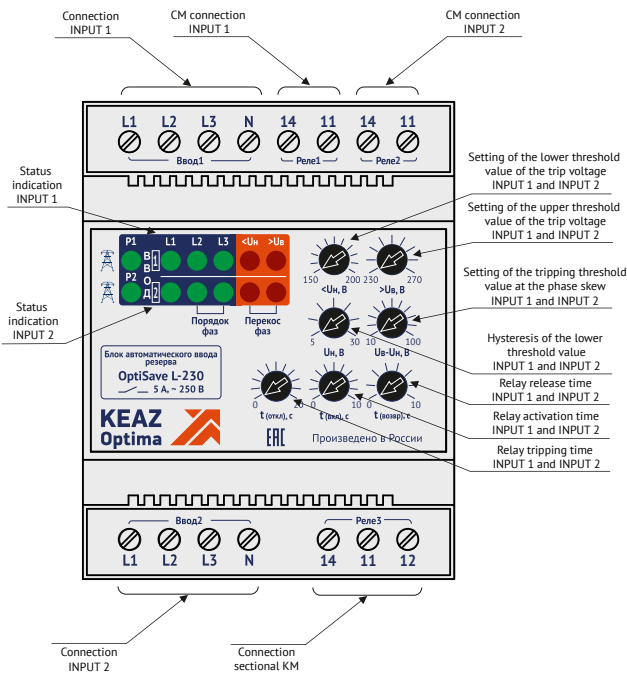
OptiSave L is manufactured in the climatic version of UHL with the location class 4 in compliance with the requirements of GOST 15150 and is designed for operation under the conditions specified in the table.

Parameter	Value
Operating temperature range, °C	+1...+40
Environmental pollution degree according to GOST 9920	2
Relative humidity at +25 °C, %	up to 80
Height above the sea level, m	up to 2000
Nominal working values of mechanical influencing factors according to GOST 30631	M4
EMC protection class according to GOST R 51318.14.1	0
Operating position in space	random
Operating mode	continuous
Protection class as per GOST 14254	IP20

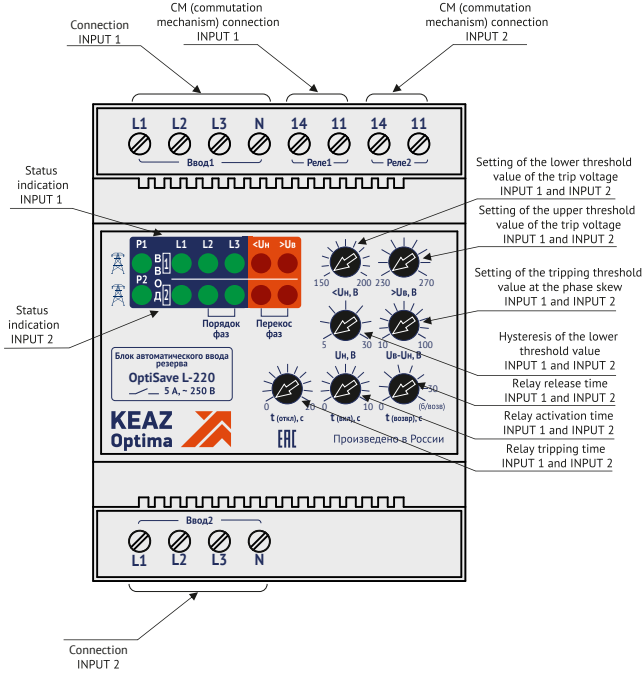
► Purpose of controls and LEDs

On the front panel of the ATSU (figure below) there are knobs for setting the relay operating mode and indicators of the mains status for input 1 and input 2. The top and bottom of the ATSU has terminal blocks for connecting external circuits to the ATSU.

Front panel of OptiSave L-220



Front panel of OptiSave L-230

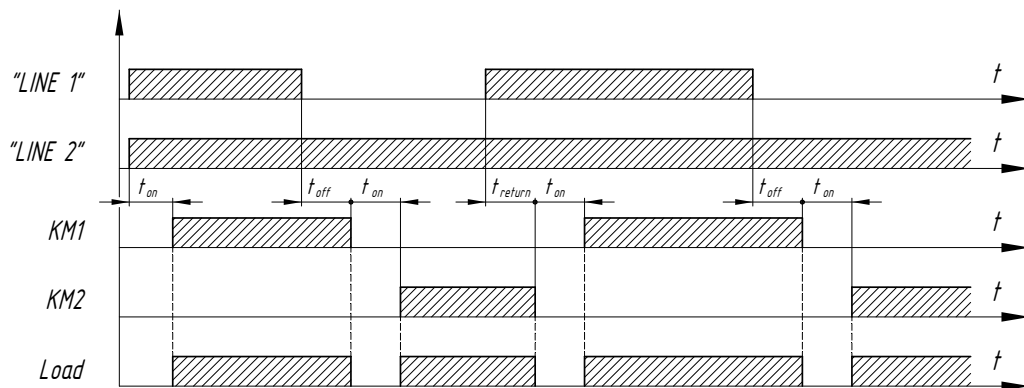


Indication of operating modes by LEDs located on the front panel

LED	Mode
«P1» (green)	Relay P1 turned on
«P2» (green)	Relay P2 turned on
«L1», «L2», «L3» (green)	The input voltage corresponds to the set parameters
«<U>» (red)	Input voltage below the set threshold / phase skew
«>U>» (red)	Input voltage is above the set threshold / phase skew

## ► Timing charts and operation description

OptiSave L-220 time diagram



### Description of OptiSave L-220 operation

After the power has been applied to the device, when the mains voltage is within the allowable range, LEDs L1, L2, L3 - «LINE 1» and L1, L2, L3 - «LINE 2» are activated. Then, with the delay of  $t_{on}$ , the input relay 1 is actuated, LED «P1» is turned on, and the power is supplied to the load.

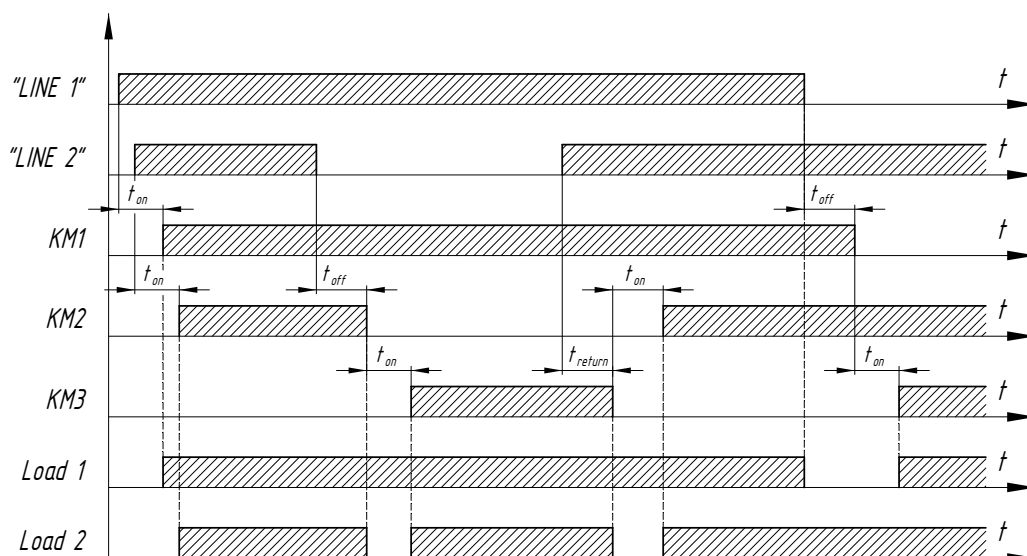
If during the connection of the controlled network, the sequence of the phases on «LINE 1» or «LINE 2» inputs has been broken, «L2», «L3» LEDs of the corresponding input flash.

In the event of a fault on input 1 (the voltage at any phase is less than the tripping setpoint when the voltage is low «UH»), the «U» LED is turned on, after the tripping time delay  $t_{off}$  count has been performed, LED «P1» and LED L1, L2, L3 corresponding to the emergency phase are turned off. Then the input relay 1 is actuated and the load is cut off from input 1. If the voltage at any of the phases is above the tripping setpoint at an increased voltage «> UB», «> U» LED is turned on and the tripping goes without delay. If the voltage on the input «LINE 2» is within the norm, then after the  $t_{on}$  the input relay 2 is actuated, «P2» LED is turned on and the load is connected to «LINE 2». When the power supply is recovered on the input «LINE 1» after the release time -  $t_{return}$ , switching to input «LINE 1» is performed.

The tripping time -  $t_{off}$  - is set in such a way that in the case of short-term voltage slumps on the line with the duration  $t < t_{off}$  there was no switching of the line.

In the event of a phase loss on «LINE 1», the actuation of input relay 1 and the disconnection of the load from input 1 occur without any time delay, and the actuation of input relay 2 and the load connection - with the make-time delay -  $t_{on}$ .

OptiSave L-230 time diagram



KM — commutation mechanism (a contactor, a starter) (or switching device (SD))

### Description of OptiSave L-230 operation

After the power has been applied to the device, when the mains voltage is within the allowable range, LEDs L1, L2, L3 - «LINE 1» and L1, L2, L3 - «LINE 2» are activated. Then, with the delay of the make time -  $t_{on}$ , the input relay 1 and the input relay 2 are actuated, LEDs «P1» and «P2» are turned on.

If during the connection of the controlled network, the sequence of the phases on «LINE 1» or «LINE 2» inputs has been broken, «L2», «L3» LEDs of the corresponding input flash.

In the event of a fault on input 1 or input 2 (the voltage at any phase is less than the tripping setpoint when the voltage is low «UH»), the «U» LED is turned on, after the tripping time delay -  $t_{off}$  - count has been performed, emergency input relays (P1 or P2) are disconnected. If the voltage at any of the phases is above the tripping setpoint at an increased voltage «> UB», «> U» LED is turned on and the tripping goes without delay. Further on, with a delay determined by the make-time setpoint -  $t_{on}$ , input relay P3 is actuated, that controls the activation of the sectional switching device.

When the voltage on the emergency input is recovered with a delay determined by the setpoint  $t_{return}$ , the relay P3 is disconnected and the corresponding relay P1 or P2 are actuated. The high-speed ATS returns to the initial condition.

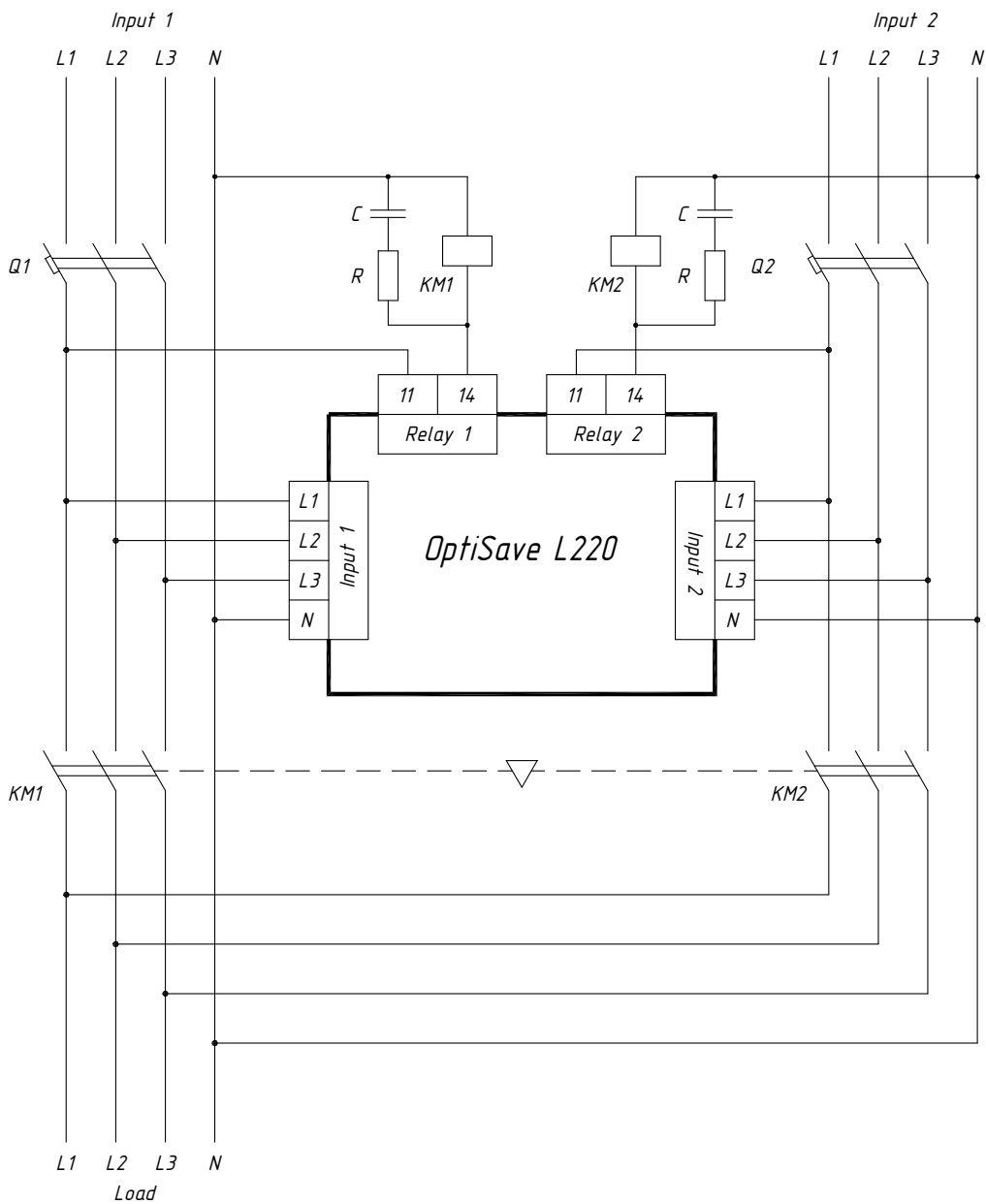
Possible malfunctions of OptiSave L and troubleshooting

Potential malfunction	Cause	Remedy
No indication at switching on the network	Contact fault in the terminal block	Disconnect the network and check the quality of the contacts in the terminal block
	Malfunction in the ATSU scheme	Disconnect the network, dismount the high-speed ATS and contact the services department of the manufacturer
No indication of one of the operating modes	Malfunctioning LED	Disconnect the network, dismount the high-speed ATS and contact the service department of the manufacturer

► Connection diagrams

The solution is advisory. The manufacturer of the LVCD, conducting acceptance tests, is held liable for the performance of the LVCD on the basis of the given complex, in compliance with the requirements of GOST R 51321-2007. KEAZ reserves the right to introduce changes to this document, as well as the materials specified therein, without prior notice.

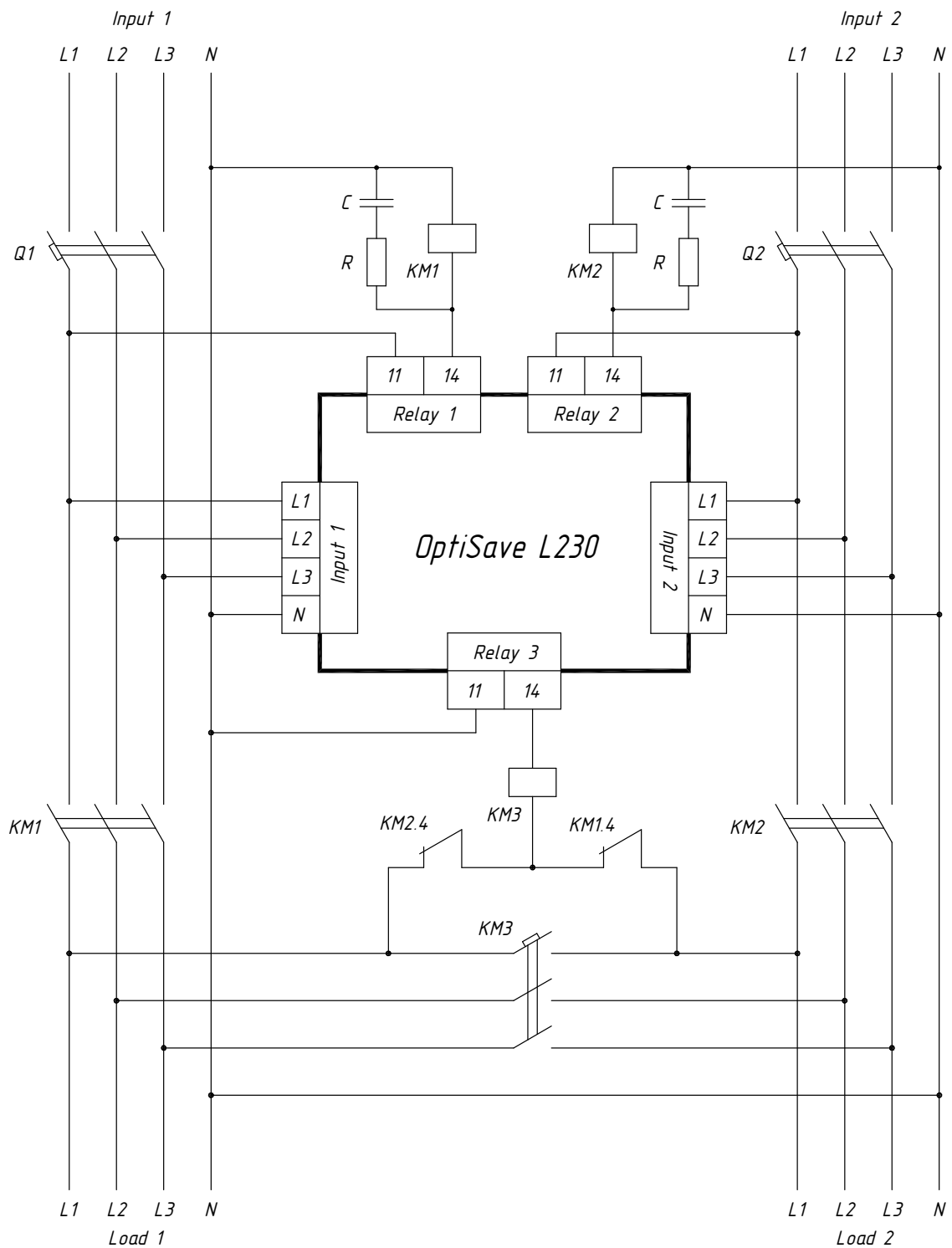
A recommended connection diagram for connecting switchgear to the ATSU OptiSave L-220



Q1, Q2 — circuit breakers  
KM1, KM2 — switching units (contactors, starters);  
RC — protection circuit against switching surges.



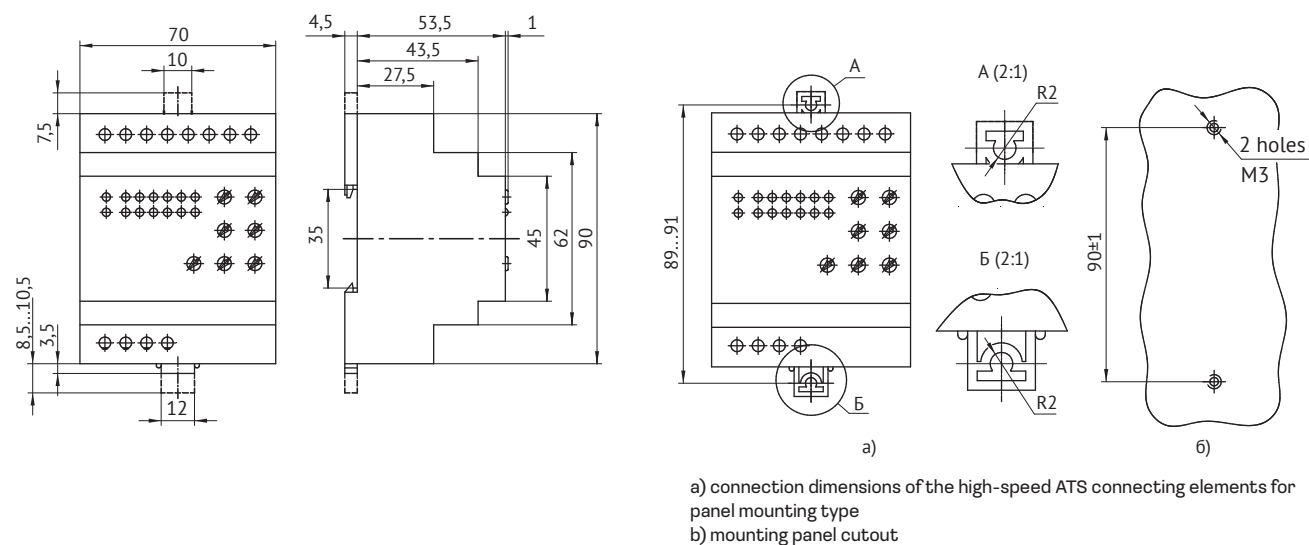
A recommended connection diagram for connecting switchgear to the ATSU OptiSave L-230



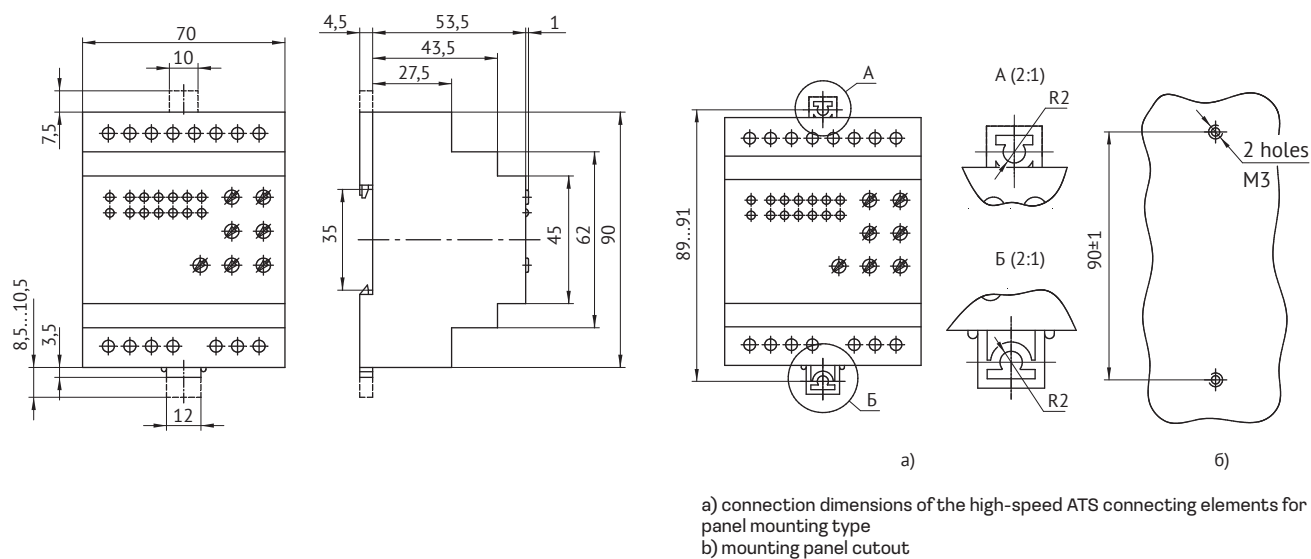
Q1, Q2 — circuit breakers  
KM1, KM2, KM3 — switching units (contactors, starters);  
RC — protection circuit against switching surges.

## ► Overall and connection dimensions (mm)

### OptiSave L-220



### OptiSave L-230





## OptiSave H Automatic transfer switch unit of extended functional characteristics

OptiSave H automatic transfer switch unit is designed to build various ATS functional solutions based on contactors, load switches and electromagnetic and motor driven circuit breakers with the option of being integrated into dispatching systems via Modbus protocol.

### ► Series advantages



Simple and quick installation both on the switchboard door and on the din-rail.



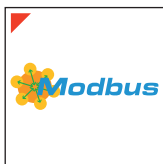
Compatibility with KEAZ switching equipment.



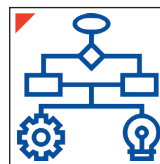
- Electromagnetic interference resistance and low interference emission.
- Temperature range: -40 to +45°C:
- Protection class: IP54 (front panel).



Made in Russia. Suitable for import substitution.



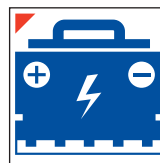
Remote control and dispatching via Modbus.



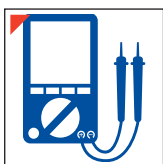
Great configurability potential for various tasks that requires no programming skills, algorithm flexibility.



Shock-proof, front panel locking, password setting.



Use in uninterruptible power supply systems - provision of DC power supply of the ATS unit.



Network and switching equipment status is displayed on LCD display, mnemonic diagram.

► Technical specification

Parameter	Value
Switched line type	three-phase four-wire L1, L2, L3, N
Number of monitored power supply inputs	2
INPUT 1 and INPUT 2 supply voltages ( $U_e$ ), V	180...400
AC frequency across input terminals (f), Hz	50
Maximum switching voltage at 50 Hz 5 A AC, V	400 *
Maximum load current of AC1 utilization category at 250 V, A	16 *
Overvoltage trip settings for INPUT 1 and INPUT 2 ( $U_{max}$ ), V	235...280 <sup>1)</sup>
Undervoltage trip settings for INPUT 1 and INPUT 2 ( $U_{min}$ ), V	165...225 <sup>1)</sup>
Trip settings for input phases voltage unbalance ( $U_{\%}$ ), V	10...115 <sup>1)</sup>
Voltage hysteresis ( $U_h$ ), V	5...15 <sup>1)</sup>
Switching device switch-on time settings ( $t_{on}$ ), s	0.1...360 <sup>3)</sup>
Infinite loop protection time settings ( $t_{loop}$ ), c	0.1...900 <sup>3)</sup>
Trip time settings for voltage over Umax ( $t_{trip.u.max}$ ), s	0.1...900 <sup>3)</sup>
Trip time settings for voltage under Umin ( $t_{trip.u.min}$ ), s	0.1...900 <sup>3)</sup>
Trip time settings for phase reversal failure ( $t_{trip.ph.r.}$ ), s	0.1...900 <sup>3)</sup>
Trip time settings for input phase asymmetry ( $t_{trip.ph.as.}$ ), s	0.1...900 <sup>3)</sup>
Switching wear resistance, cycles	> 106
Overall dimensions, mm	155 x 155 x 72 **
Weight, kg, max.	0,85

\* use of switching surge protection circuits is recommended;  
\*\* overall and connection dimensions for mounting on a TN35 rail in accordance with COST R IEC 60715 or for mounting in a window on a panel are given in Appendix B;  
<sup>1)</sup> parameter setting step: 5 V;  
<sup>2)</sup> parameter setting step: 1 Hz;  
<sup>3)</sup> parameter setting step:  
0.1 s in the 0.1 to 1 s range;  
1 s in the 1 to 10 s range;  
5 s in the 10 to 100 s range;  
20 s in the 100 to 400 s range;  
50 s in the 400 to 1000 s range.

**Attention!** The ATSU does not provide for frequency control, and the frequency in the range from 40 to 65 Hz is considered the norm by default.

Modbus protocol data transmission parameters

Parameter	Value
Physical protocol	RS-485
Data transfer protocol	Modbus RTU
Supported access addresses	1...247
Data transfer rate, bit/s	9600
Stop bit	1
Parity	NONE

► Operating conditions

Parameter	Value
Operating temperature range, °C	-40...+45
Environmental pollution degree according to COST IEC 60947-1	3
Relative air humidity, %	up to 98 (at 25 °C)
Height above the sea level, m	up to 2000
Nominal working values of mechanical influencing factors according to COST 30631	M4
Electrostatic discharge immunity according to COST 30804.4.2 (IEC 61000-4-2)	Level 3
Nanosecond impulse noise immunity in accordance with COST 30804.4.4 (IEC 61000-4-4)	Level 3
High-energy microsecond impulse noise immunity in accordance with COST R 51317.4.5 (IEC 61000-4-5)	Level 3
Immunity from voltage dips and short interruptions in accordance with COST 30804.4.11 (IEC 61000-4-11)	Level 3
Operating position in space	random
Operating mode	continuous
Protection class as per COST 14254 – housing – terminals	IP54 IP20

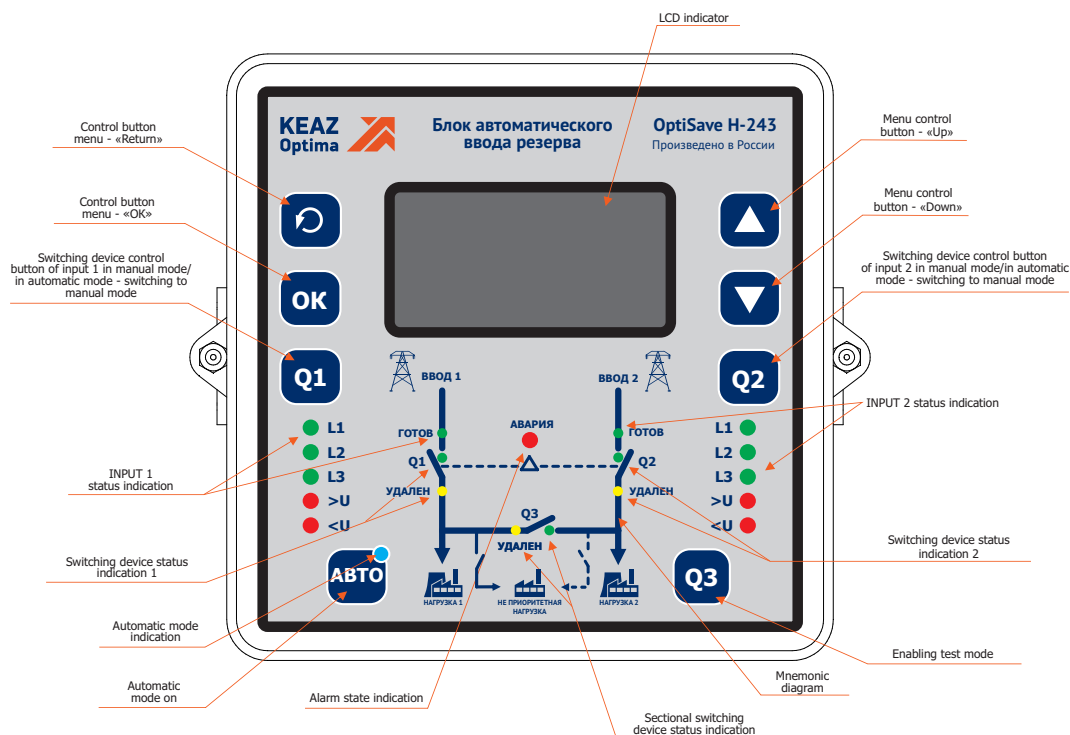
## ► Purpose of controls and LEDs of OptiSave H-243

The ATSU is an independent device and features a housing made of non-combustible thermoplastic material, printed circuit boards with electronic components placed inside it, and fasteners.

The controls and indication elements are placed on the front panel, and connectors for connecting external devices are placed on the patch panels.

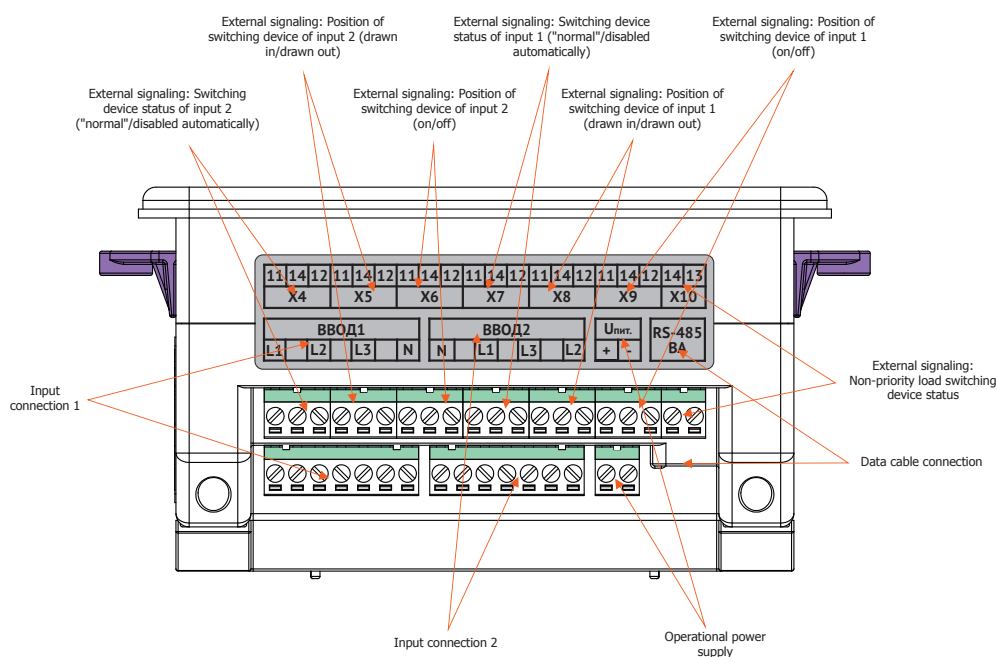
The front panel of the ATSU has a mnemonic scheme, LCD-indicator, LED indicators of phase voltages, voltage thresholds, readiness of inputs, switching devices status, alarm state and control buttons.

### Front panel of OptiSave H-243



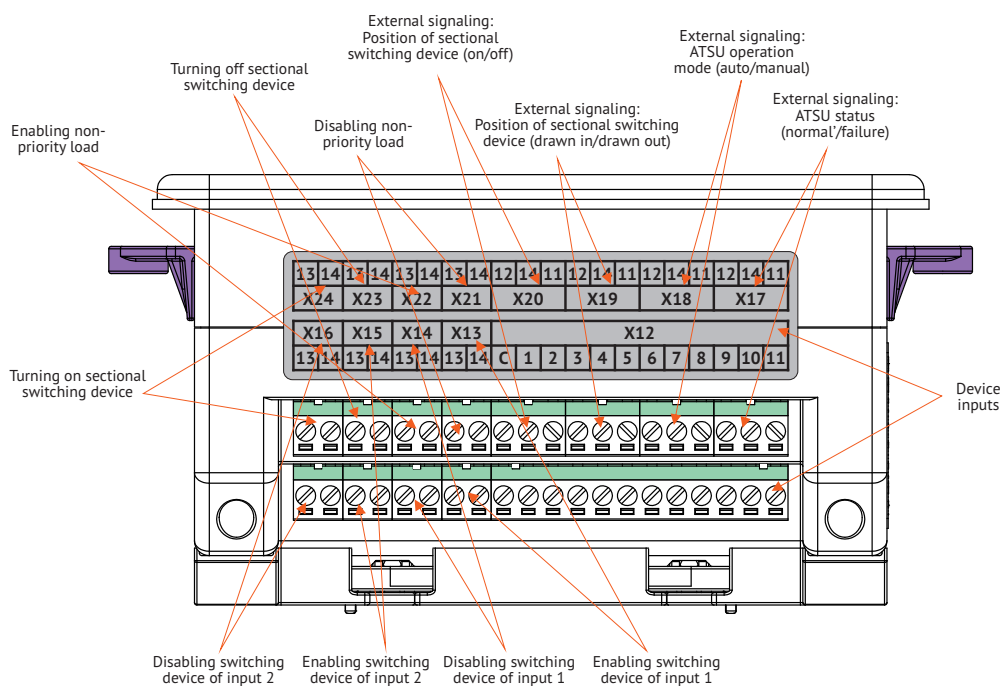
### Upper patch panel of OptiSave H-243

The upper patch panel of the ATSU contains connectors for connecting power supply inputs («INPUT 1» and «INPUT 2»), external operational power supply  $U_{\text{supply}}$ , a bus for data transmission via the Modbus protocol and an external alarm device.



Lower patch panel of OptiSave H-243

The lower patch panel contains connectors for connecting an external alarm device, control contacts for external switching devices, as well as for control devices for switching devices. Purpose of the «X12» connector contacts is shown in the table.



Purpose of inputs X12

Pin number	Purpose
C	Common
1	Status of switching device of INPUT 1 When closed, it signals the ON state of the INPUT 1 switching device.
2	Emergency trip contact. When closed, it signals the emergency trip of INPUT 1 safety device.
3	«Removed» status contact. In the closed state, it signals the removal of INPUT 1 switching device (withdrawable version).
4	Status of switching device of INPUT 2. When closed, it signals the ON state of the INPUT 2 switching device.
5	Emergency trip contact. When closed, it signals the emergency trip of the safety device of INPUT 2.
6	«Removed» status contact. In the closed state, it signals the removal of INPUT 2 switching device (withdrawable version).
7	Status of the sectional switching device When closed, it signals the ON state of the sectional switching device.
8	Emergency trip contact. When closed, it signals the emergency trip of the sectional safety device.
9	«Removed» status contact. In the closed state, it signals the removal of sectional switching device (withdrawable version).
10	Non-priority load switching device status When closed, it signals the ON state of the non-priority load switching device.
11	Front panel locking. In the closed state, it locks the control buttons on the module's front panel.

**Note:** Inputs of the X12 connector are discrete. Combining the neutral and terminal «C» of connector X12 can cause the device to malfunction. Use a voltmeter to diagnose the connector - a voltage in the range from 0 to 3.2 V between the diagnosed contact and the common contact «C» indicates the closed state of the corresponding contact.

## ► Timing charts and operation description

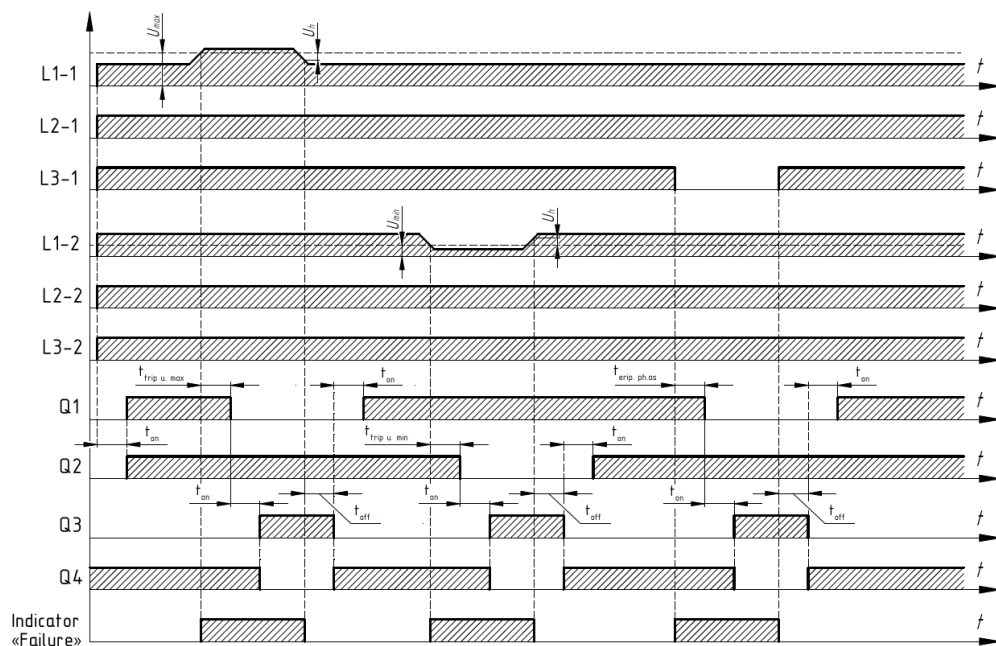
The ATSU has 2 operating modes: manual and automatic. By default, the ATSU is switched on in the manual mode.

In the automatic and manual ATSU operation modes, background control of the parameters of the inputs and switching devices is carried out. The voltage is measured separately for each phase of each input.

The decision about the input readiness is made under the following conditions:

- the voltage of each input phase does not exceed the value of the difference of setpoint  $U_{max}$  and the hysteresis value ( $U_h$ ) for a time greater than the setpoint value  $t_{trip\ u, max}$ ;
- the voltage of each input phase is not less than the sum of the setpoint  $U_{min}$  and the hysteresis value ( $U_h$ ) for a time greater than  $t_{trip\ u, min}$ ;
- the voltage difference between the input phases does not exceed the setpoint value  $U_{as}$  for a time greater than the setpoint value  $t_{trip\ as, ph}$  in the presence of input phase alternation during the setpoint time  $t_{trip\ a, ph}$ .

**Timing diagram in automatic mode with overvoltage, undervoltage of the input and phase asymmetry with the enabled «non-priority load control in automatic mode» function**



The decision about the failure of the switching device (SD) is made when the SD status changes without the ATSU issuing controlling actions. The ATSU in the automatic mode does not restore the SD's health attribute without the operator's intervention. After the SD failure causes have been eliminated, error reset must be performed in the ATSU menu. In case of the «SD Deleted» signal, the ATSU operation algorithm is blocked.

### Automatic mode

The ATSU is switched to the automatic mode by pressing the «AUTO» button for 5 seconds (the corresponding LED will light up). When the ATSU operates in automatic mode, the power supply parameters on inputs 1 and 2 are checked. If the monitored parameters are within the set limits, the ATSU, with a delay of  $t_{on}$  (ON time) connects the loads to the corresponding inputs via «Q1» and «Q2». In case of failure at one of the inputs, the load is disconnected from the faulty input and connected to the serviceable input through sectional switching device «Q3». When the power supply is restored to the emergency input, with the self-recovery mode («Input recovery - AUTO») enabled, the ATSU switches to the mode that preceded the emergency: the bus section breaker is turned off, and after the time  $t_{on}$  the load is connected to the recovered input. If the non-priority load control mode is enabled, then simultaneously with the sectional switching device, the non-priority load device «Q4» will change its status (it will turn off when the bus section breaker is turned on, and turn on when the bus section breaker is turned off).

Attention! If, in the event of a failure at INPUT 1, the ATSU is switched to INPUT 2, which is also in an failure state, the ATSU turns off the switching devices KM1 and KM2, the «FAILURE» indicator on the front panel turns on and the «dry» contact for controlling the external alarm device is closed.

### Manual mode

Switching to manual mode is done by pressing the «AUTO» button when the automatic mode is active or via Modbus protocol. During this switching, the power supply parameters are monitored. The manual mode is used to switch on the selected input directly using the front panel buttons «Q1» or «Q2» and to switch on the bus section breaker using the button «Q3».

INPUT recovery in manual mode can be done under the following conditions:

- «Recover input in manual mode» is enabled in the ATSU settings;
- The INPUT is operational and ready (green LED is on);
- The switching device of the corresponding INPUT is operational;
- The sectional switching device is open.

Recovery occurs while button «Q1» or «Q2» respectively is held down for more than 2 seconds.

The manual operation option for the sectional SD is set in the ATSU menu («Manual Section Control» parameter). The sectional SD is used to connect the load of the faulty INPUT to the serviceable INPUT. The SD is turned on/off by pressing the «Q3» for more than 2 seconds.

Attention! In manual mode, the ATSU allows the simultaneous switching on of the INPUTS and the section (provided that the section control is allowed in the ATSU menu and the SD is operable), therefore, this function can lead to an emergency situation associated with a short circuit of two inputs and the loss of the facility!

## Resetting errors and alarms

If necessary, the errors and accidents that occurred during the operation of the ATS can be reset from the appropriate menu of the ATSU.

## Indication

Operation modes are indicated by an LCD indicator and LED indicators both in automatic mode and in manual control mode.

The indication displayed on the front panel can be duplicated by signals on external ATS unit connectors and via Modbus protocol.

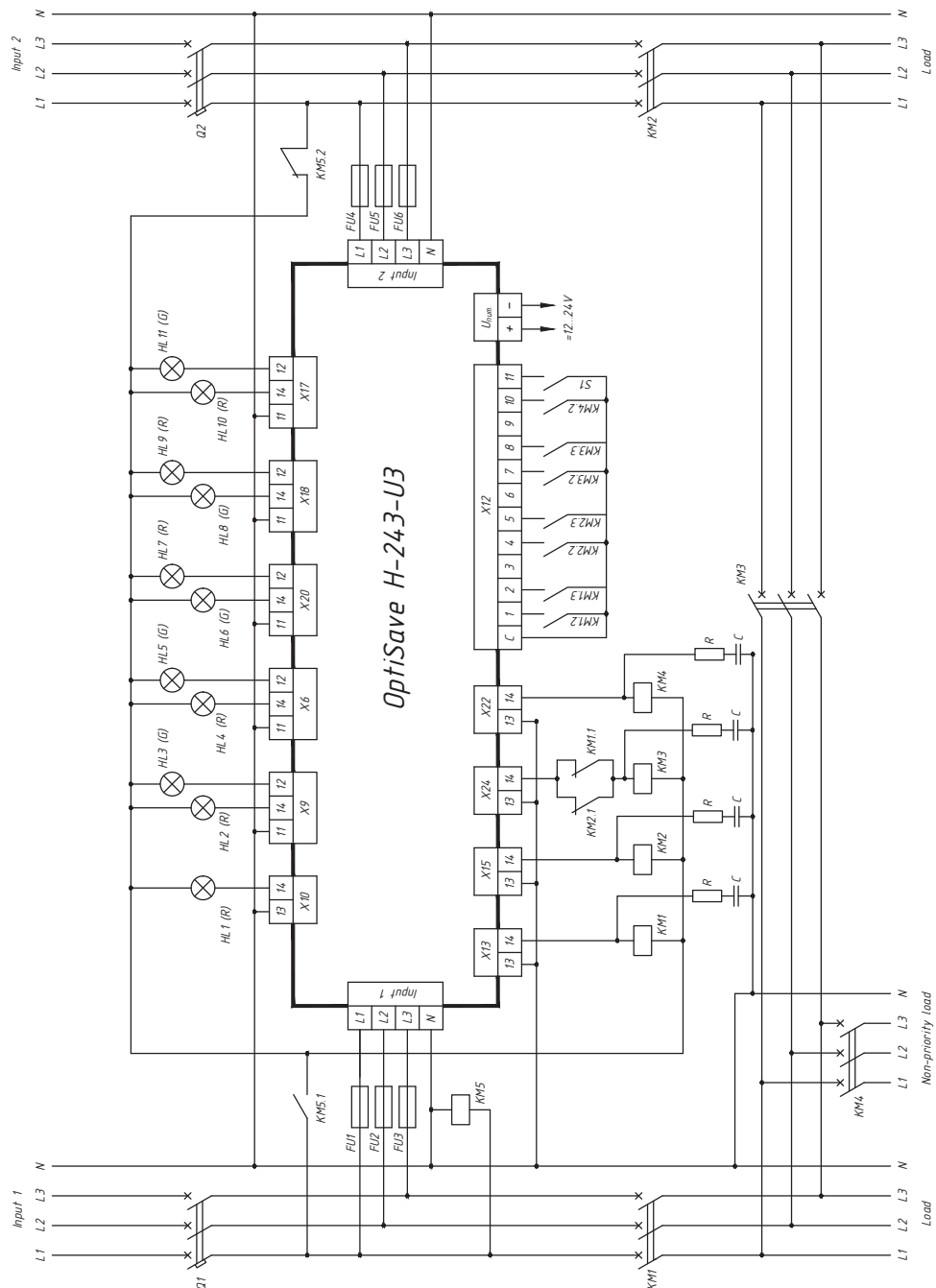
Nº	Failure category	Possible cause	Signaling methods	Troubleshooting method
1	Malfunction of the three-phase line of one or two inputs	1) Unacceptable voltage deviation in the phases; 2) Change in phase sequence, emergence of phase asymmetry; 3) Breakage of one or more phases; redundancy switching.	1) Turning on the LED «U» or «U <»; 2) Flashing of phase indicators «L1», «L2», «L3»; the indicator of the corresponding phase has gone off; 4) In all types of faults switching on of the «Failure» LED, closure of the «dry» contact «Failure», switching off of the indicator «Ready», message on the LCD-indicator.	Elimination of the fault in the faulty three-phase line.
2	Switching device control	Change in SD status without the ATSU issuing controlling actions	The ATSU recognizes such an SD as faulty and a red LED of the corresponding SD lights up. Switching on of the «Failure» LED, closure «dry» contact «Failure», message on the LCD display.	Elimination of inconsistencies and error resetting through the menu.
3	Removing the switching device	«SD removed» signal	Turning on of the LEDs «Failure», «Removed», «dry» contact «Failure».	Switching device recovery.
4	Failure on the line of one or two inputs	Short circuit, overload or other emergency situation that caused the circuit breaker to trip and its emergency contacts to close	Flashing red LED of the corresponding SD. Switching on of the «Failure» LED, closure of the «dry» contact «Failure», switching off of the «Ready» indicator, message on the LCD display.	Elimination of the failure and error resetting through the menu.

For a more detailed description of the menu, settings and connections of the ATSU, see the operation manual.



## ► Connection diagrams

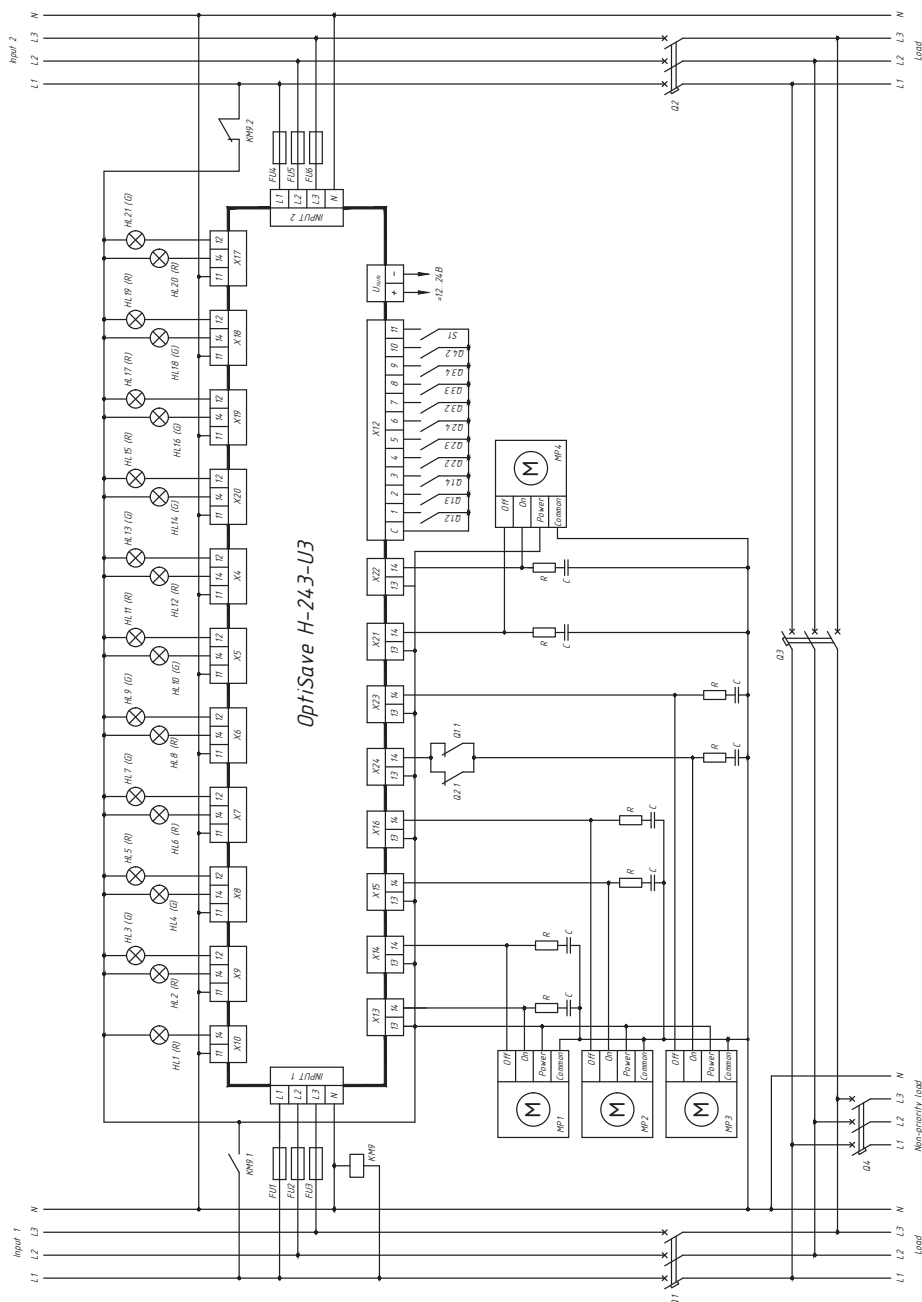
Recommended connection diagram of electromagnetic switching devices to ATSU



KM1, KM2, KM3, KM4 - switching units (contactors, starters);  
 KM1.1, KM2.1 - blocking contacts for switching on the sectional switching device;  
 KM1.2, KM1.3, KM2.2, KM2.3, KM3.2, KM3.3, KM4.2 - signal contacts of switching devices;  
 KM5 - relays for switching the power supply of external control and signaling devices;  
 KM5.1, KM5.2 - contacts for blocking simultaneous connection to inputs;  
 FU1 ... FU6 - fuses;  
 HL1 - signaling «non-priority load switching device is on»;  
 HL2 - signaling «Switching device of Input 1 is on»;

HL3 - signaling «Input 1 switching device is off»;  
 HL4 - signaling «Switching device of Input 2 is on»;  
 HL5 - signaling «Switching device of Input 2 is off»;  
 HL6 - signaling «Sectional switching device is on»;  
 HL7 - signaling «Sectional switching device is off»;  
 HL8 - signaling «ATSU in automatic mode»;  
 HL9 - signaling «ATSU in manual mode»;  
 HL10 - indicator «Normal»;  
 HL11 - indicator «Failure»;  
 S1 - front panel locking.

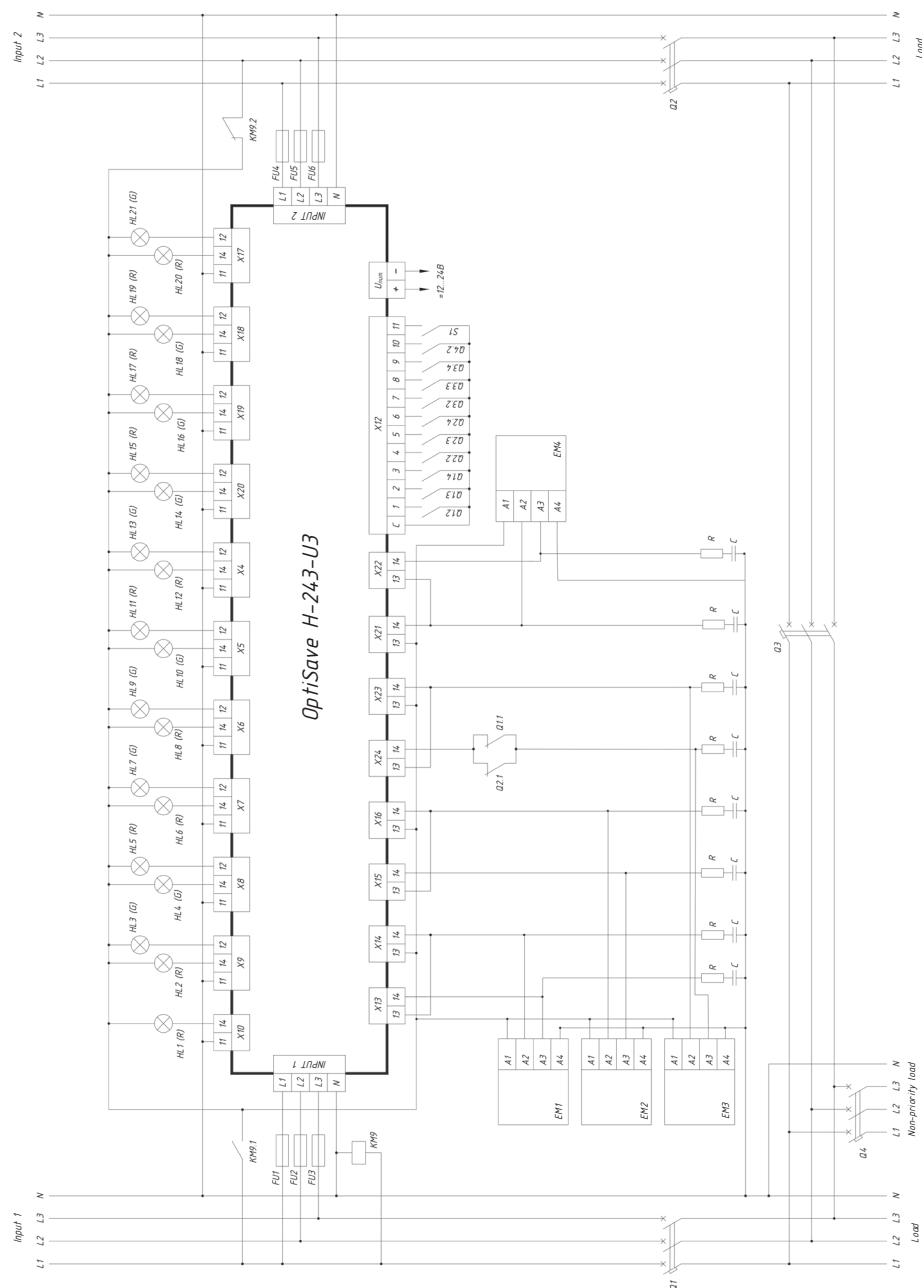
## Recommended connection diagram of motor-driven circuit breakers to ATSU



Q1, Q2, Q3, – automatic circuit breakers;  
 MP1, MP2, MP3 – motor drives for breakers Q1, Q2, Q3;  
 MP4 – motor of the non-priority load breaker;  
 Q1.1, Q2.1 – contacts blocking bus section breaker switch-on;  
 Q1.2, Q2.2, Q3.2, Q4.2 – switching devices status control;  
 Q1.3, Q2.3, Q3.3 – control of emergency operation of circuit breakers;  
 Q1.4, Q2.4, Q3.4 – «Removed» status contact;  
 KM9 – relays for switching the power supply of external control and signaling devices;  
 KM9.1, KM9.2 – contacts for blocking simultaneous connection to inputs;  
 FU1 ... FU6 – fuses;  
 HL1 – signaling «non-priority load switching device on»;  
 HL2 – indicator «Input 1 switching device is on»;  
 HL3 – indicator «Input 1 switching device is off»;  
 HL4 – indicator «Input 1 switching device removed»;  
 HL5 – indicator «Input 1 switching device installed»;  
 HL6 – indicator «Input 1 switching device tripped automatically»;

HL7 – indicator «Input 1 switching device in normal mode»;  
 HL8 – indicator «Input 2 switching device is on»;  
 HL9 – indicator «Input 2 switching device is off»;  
 HL10 – indicator «Input 2 switching device removed»;  
 HL11 – indicator «Input 2 switching device tripped automatically»;  
 HL12 – indicator «Input 2 switching device in normal mode»;  
 HL13 – indicator «sectional switching device is on»;  
 HL14 – indicator «sectional switching device is off»;  
 HL15 – indicator «sectional switching device removed»;  
 HL16 – indicator «sectional switching device installed»;  
 HL17 – indicator «ATSU in auto mode»;  
 HL18 – indicator «ATSU in manual mode»;  
 HL19 – indicator «Failure» indicator;  
 HL20 – indicator «Normal» indicator;  
 HL21 – front panel locking.

# Recommended connection diagram of electromagnetic-driven circuit breakers to ATSU



Q1, Q2, Q3, – automatic circuit breakers;  
EM1, EM2, EM3 – electromagnetic drives of breakers Q1, Q2, Q3;  
EM4 – motor drive of the non-priority load breaker;  
Q1.1, Q2.1 – contacts blocking bus section breaker switch-on;  
Q1.2, Q2.2, Q3.2, Q4.2 – switching devices status control;  
Q1.3, Q2.3, Q3.3 – control of emergency operation of circuit breakers;  
Q1.4, Q2.4, Q3.4 – «Removed» status contact;  
S1 – front panel locking;  
KM9 – relays for switching the power supply of external control and signaling devices;  
KM9.1, KM9.2 – contacts for blocking simultaneous connection to inputs;  
FU1 ... FU6 – fuses;  
HL1 – signaling «non-priority load switching device on»;  
HL2 – indicator «Switching device of Input 1 is on»;  
HL3 – indicator «Input 1 switching device is off»;  
HL4 – indicator «Input 1 switching device removed»;  
HL5 – indicator «Input 1 switching device installed»;

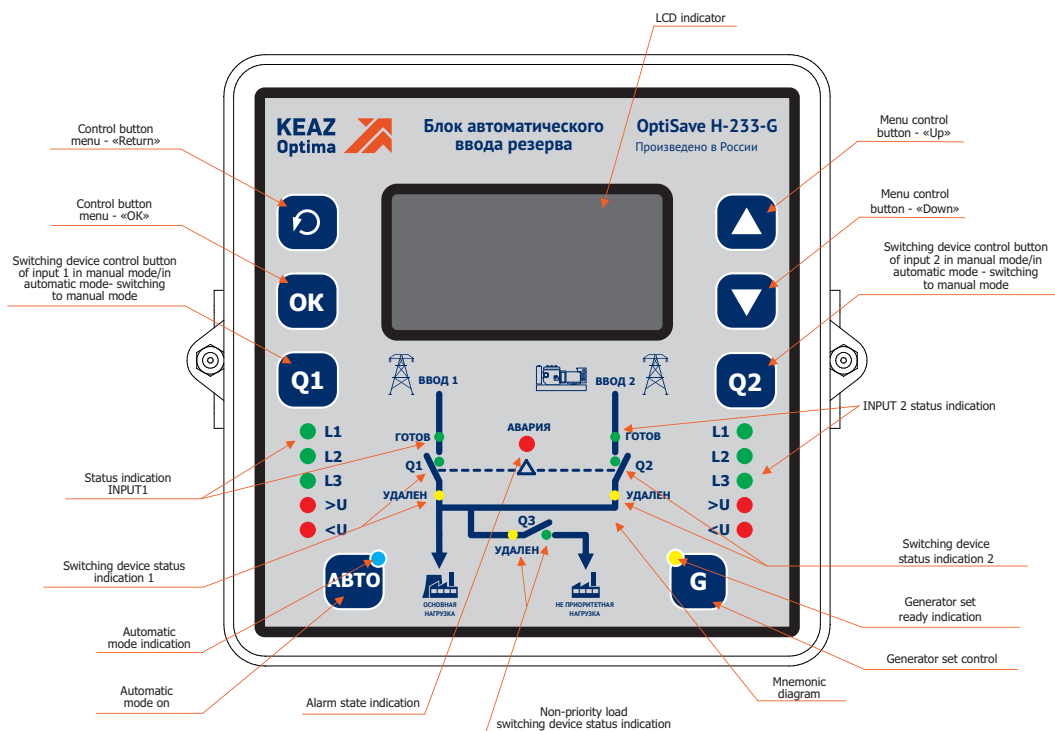
HL6 – indicator «Input 1 switching device tripped automatically»;  
HL7 – indicator «Input 1 switching device is normal mode»;  
HL8 – indicator «Input 2 switching device is on»;  
HL9 – indicator «Input 2 switching device is off»;  
HL10 – indicator «Input 2 switching device removed»;  
HL11 – indicator «Input 2 switching device installed»;  
HL12 – indicator «Input 2 switching device tripped automatically»;  
HL13 – indicator «Input 2 switching device in normal mode»;  
HL14 – indicator «sectional switching device is on»;  
HL15 – indicator «sectional switching device is off»;  
HL16 – indicator «sectional switching device removed»;  
HL17 – indicator «sectional switching device installed»;  
HL18 – indicator «ATSU in auto mode»;  
HL19 – indicator «ATSU in manual mode»;  
HL20 – «Failure» indicator;  
HL21 – «Normal» indicator;  
S1 – front panel locking.

## ► Purpose of controls and LEDs of OptiSave H-233-G

The ATSU is an independent device and features a housing made of non-combustible thermoplastic material, printed circuit boards with electronic components placed inside it, and fasteners.

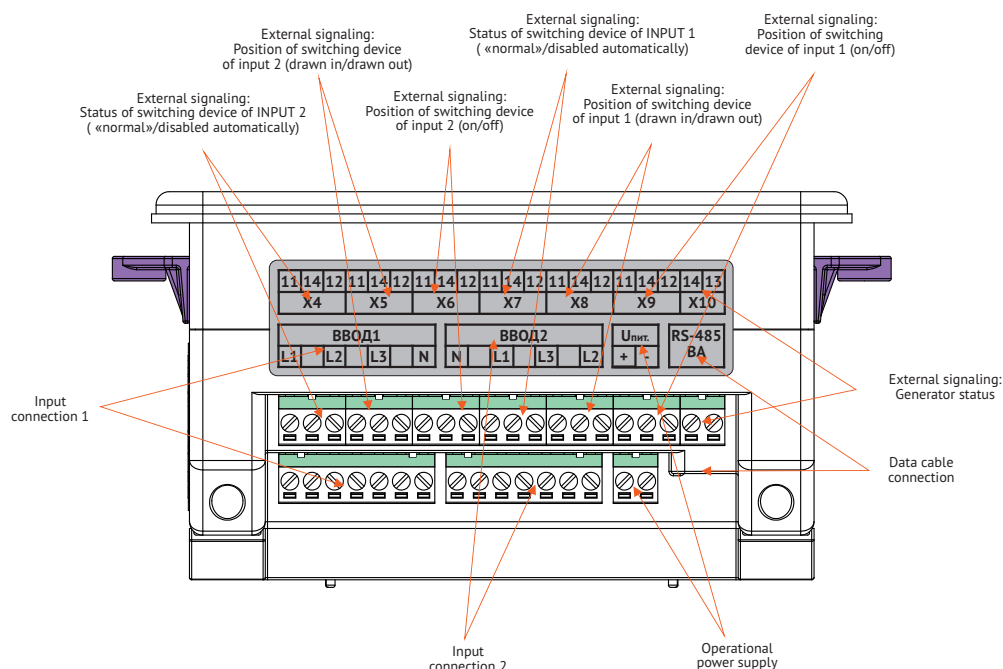
The controls and indication elements are placed on the front panel, and connectors for connecting external devices are placed on the patch panels. The front panel of the ATSU has a mnemonic scheme, LCD-indicator, LED indicators of phase voltages, voltage thresholds, readiness of inputs, switching devices status, alarm state and control buttons.

### Front panel of OptiSave H-233-G



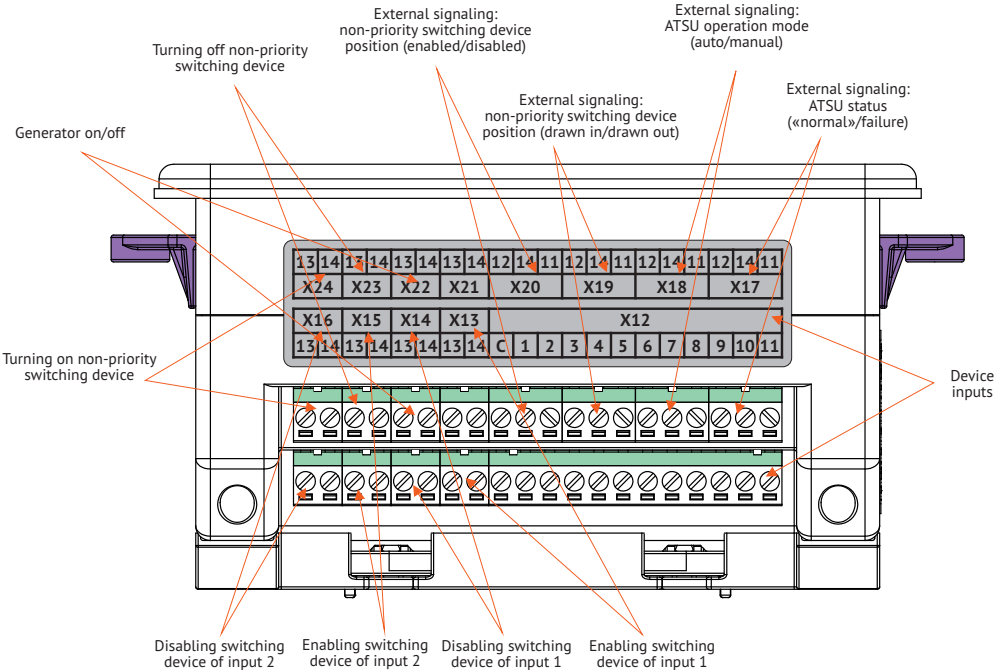
### Appearance of the upper patch panel of OptiSave H-233-G

The upper patch panel of the ATSU contains connectors for connecting power supply inputs («INPUT 1» and «INPUT 2»), external operational power supply  $U_{oper}$ , a bus for data transmission via the Modbus protocol and an external alarm device. The appearance of the top patch panel and the location and function of the connectors are shown in the figure below.



Appearance of the lower patch panel of OptiSave H-233-G

The lower patch panel contains connectors for connecting an external alarm device, control contacts for external switching devices, as well as for control devices for switching devices. The appearance of the lower patch panel and the location and function of the connectors are shown in the illustration below. Purpose of the «X12» connector contacts is shown in the table.



Purpose of inputs X12

Pin number	Purpose
C	Common
1	Status of switching device of INPUT 1. When closed, it signals the ON state of the INPUT 1 switching device.
2	Emergency trip contact. When closed, it signals the emergency trip of INPUT 1 safety device.
3	«Removed» status contact. In the closed state, it signals the removal of INPUT 1 switching device (withdrawable version).
4	Status of switching device of INPUT 2. When closed, it signals the ON state of the INPUT 2 switching device.
5	Emergency trip contact. When closed, it signals the emergency trip of the safety device of INPUT 2.
6	«Removed» status contact. In the closed state, it signals the removal of INPUT 2 switching device (withdrawable version).
7	Status of the sectional switching device. When closed, it signals the ON state of the non-priority load switching device.
8	Emergency trip contact. When closed, it signals the emergency disconnection of the non-priority load switching device.
9	«Removed» status contact. In the closed state, it signals the removal of non-priority load switching device (withdrawable version).
10	Not used
11	Front panel locking. In the closed state, it locks the control buttons on the module's front panel.

**Note:** Inputs of the X12 connector are discrete. Combining the neutral and terminal «C» of connector X12 can cause the unit to malfunction. Use a voltmeter to diagnose the connector, - a voltage in the range from 0 to 3.2 V between the diagnosed contact and the common contact «C» indicates the closed state of the corresponding contact.

## ► Timing charts and operation description

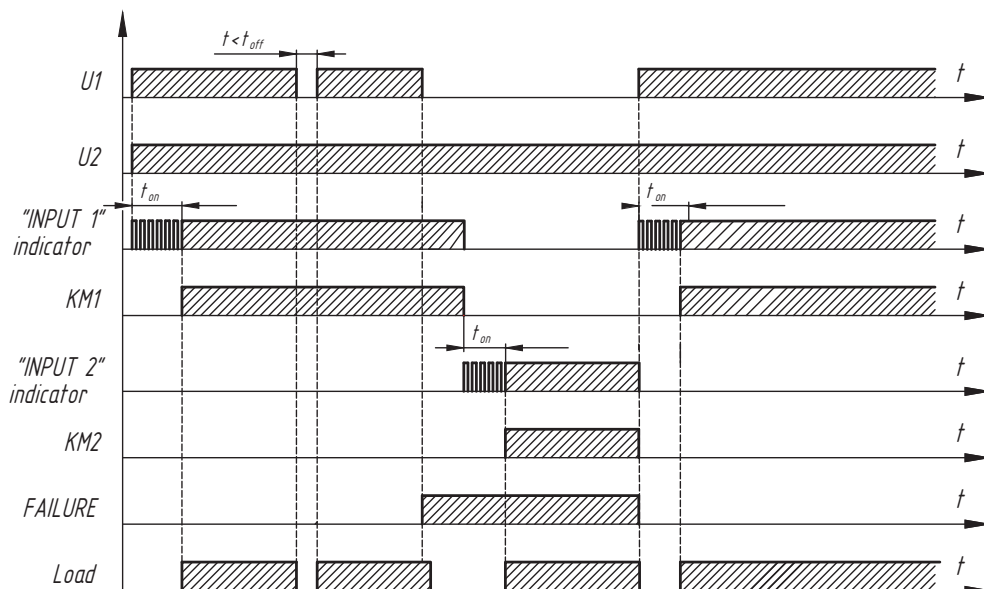
The ATSU has 2 operating modes: manual and automatic. By default, the ATSU is switched on in the manual mode.

In the automatic and manual ATSU operation modes, background control of the parameters of the inputs and switching devices is carried out. The voltage is measured separately for each phase of each input.

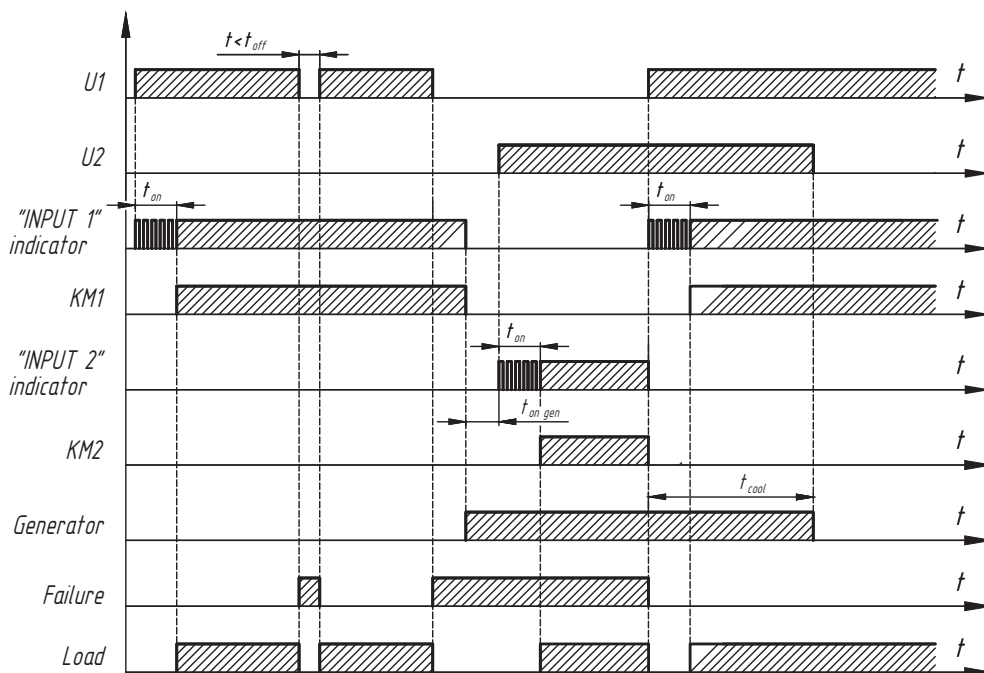
The decision about the input readiness is made under the following conditions:

- the voltage of each input phase does not exceed the value of the difference of setpoint  $U_{max}$  and the hysteresis value ( $U_h$ ) for a time greater than the setpoint value  $t_{trip\ u, max}$ ;
- the voltage of each input phase is not less than the sum of the setpoint  $U_{min}$  and the hysteresis value ( $U_h$ ) for a time greater than  $t_{trip\ u, min}$ ;
- the voltage difference between the input phases does not exceed the setpoint value  $U_{as}$  for a time greater than the setpoint value  $t_{trip\ as, ph}$ ;
- in the presence of input phase alternation during the setpoint time  $t_{trip\ a, ph}$ .

**Timing diagram of ATSU operation in AUTO mode with the preset INPUT 2 value of Mains using the example of voltage loss on Input 1**



**Timing diagram of ATSU operation in AUTO mode with the preset INPUT 2 value of Generator using the example of voltage loss on Input 1**



The decision about the failure of the switching device (SD) is made when the SD status changes without the ATSU issuing controlling actions. The ATSU in the automatic mode does not restore the SD's health attribute without the operator's intervention. After the SD failure causes have been eliminated, error reset must be performed in the ATSU menu. In case of the «SD Deleted» signal, the ATSU operation algorithm is blocked.

## Automatic mode

The ATSU is switched to the automatic mode by pressing the «AUTO» button for 5 seconds (the corresponding LED will light up). The logic of the ATSU operation in AUTO mode depends on the following settings:

**INPUT priority.** If there is a priority, the ATSU checks the readiness of the priority INPUT. If this INPUT is ready, the ATSU turns on the corresponding SD. Otherwise, the ATSU sets the failure attribute, turns off the priority INPUT SD and waits for the standby INPUT to become ready for turning on the standby INPUT SD and connect the priority load.

If the user has not set the INPUT's priority, the ATSU does not attempt to switch the load to the priority INPUT when switching to the «AUTO» mode. If both INPUTS are operational and ready at this moment of time and no SD is switched on, ATSU will connect the load to INPUT 1. Otherwise, the ready and operational INPUT will remain connected.

**INPUT 2 type.** There are 2 configurable options for INPUT 2 — Mains and Generator. In the «Mains» mode, INPUT 2 behaves symmetrically to INPUT 1. In the «generator» mode, the ATSU controls the start and stop of the generator, handles the time settings. The generator is started by closing the «dry» contact of connector X22. The generator is stopped by opening the «dry» contact of connector X22. The ATSU counts the generator warm-up time, generator cooling time, controls the output voltage, gives or removes the generator on/off commands and controls the SD of the corresponding INPUT.

**Presence of non-priority load.** The user can indicate the presence of a non-priority load and the INPUT to which it is connected. If there is a non-priority load, the corresponding load SD is switched on/off symmetrically with the selected input.

**WARNING!** If INPUT priority is specified, and there is a non-priority load indicated to be present on the standby INPUT, the non-priority load SD will never turn on, since, in accordance with the ATSU operation logic, when a load is connected to the reserve INPUT, the non-priority load must be disconnected!

## Manual mode

Switching to manual mode is done by pressing the «AUTO» button when the automatic mode is active or via Modbus protocol. During this switching, the power supply parameters are monitored. The manual mode is used to switch on the selected input directly using the front panel buttons «Q1» or «Q2» and to switch on the generator using the button «G»

INPUT recovery in manual mode can be done under the following conditions:

- «Recover input in manual mode» is enabled in the ATSU settings;
- the INPUT is operational and ready (green LED is on);
- the switching device of the corresponding INPUT is operational.

Recovery occurs while button «Q1» or «Q2» respectively is held down for more than 2 seconds.

**WARNING!** Simultaneous switching on of switching devices is impossible to eliminate short-circuit. When the switching device is turned on, a check is made for the status of the opposite switching device and, if necessary, it is turned off.

## Resetting errors and alarms

If necessary, the errors and accidents that occurred during the operation of the ATS can be reset from the appropriate menu of the ATSU.

## Indication

Operation modes are indicated by an LCD indicator and LED indicators both in automatic mode and in manual control mode. In the «INPUT 2 - generator» mode and when the generator is off, there is no indication of INPUT 2.

In the normal operating mode in the switched SD state, the LED of the corresponding SD is lit green. In the off state, the SD LED is off. Flashing green LED indicates the process of the SD turning on.

The «FAILURE» Indicator turns on in case of any emergency situation (busbar breakage, phase reversal failure, no voltage, voltage out of the specified range, switching to standby). The «FAILURE» indicator turns off automatically after the normal parameters of the monitored network are restored. Indication of emergency operation modes is shown in the table.

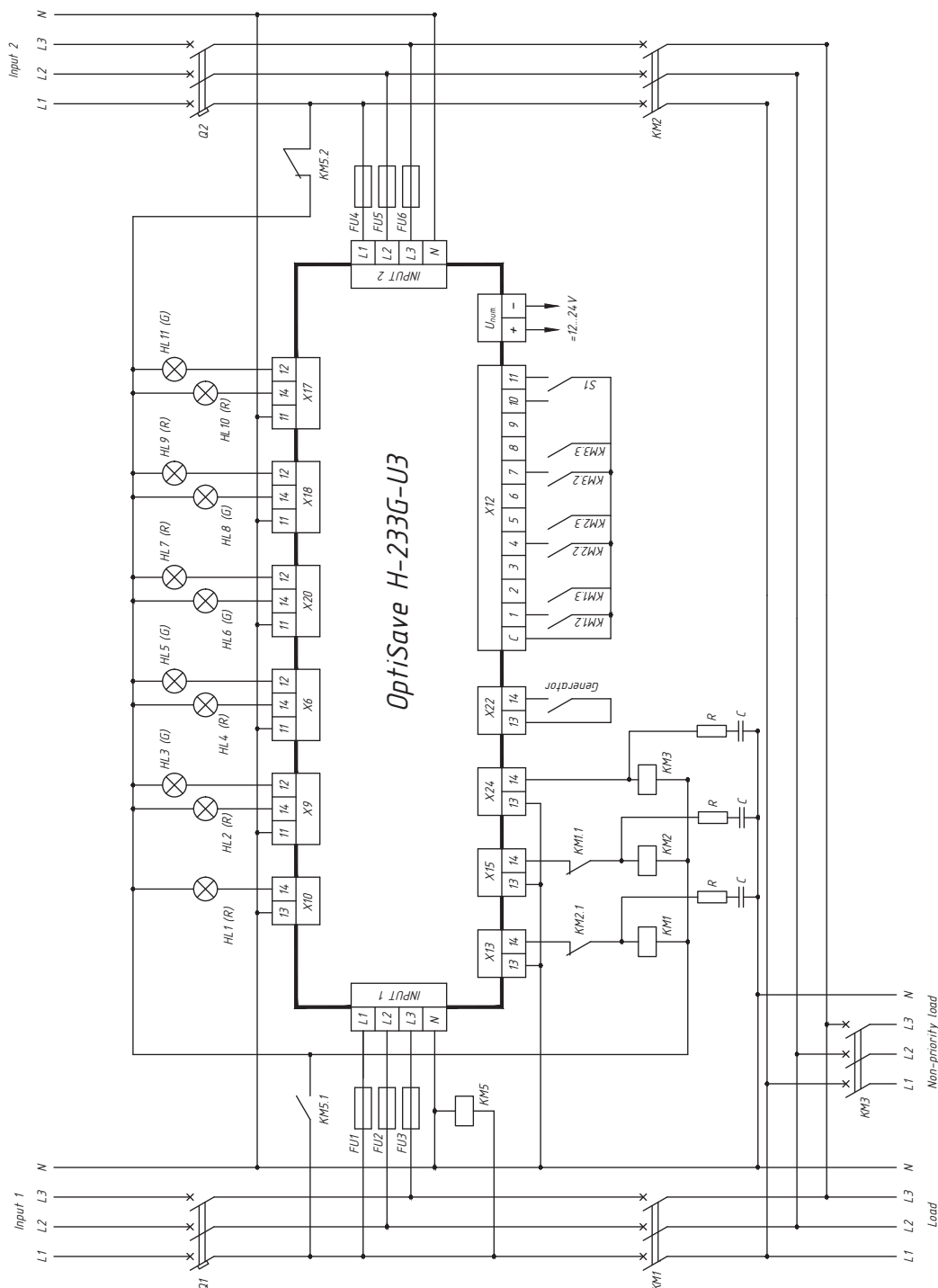
The indication displayed on the front panel can be duplicated by signals on external ATS unit connectors and via Modbus protocol.

№	Failure category	Возможная причина	Способы сигнализации	Способ устранения
1	Malfunction of the three-phase line of one or two inputs	1) unacceptable voltage deviation in the phases; 2) change in phase sequence, emergence of phase asymmetry; 3) breakage of one or more phases; 4) redundancy switching.	1) turning on the LED «U» or «U <»; 2) flashing of phase indicators «L1», «L2», «L3»; 3) the indicator of the corresponding phase has gone off 4) in all types of faults switching on of the «Failure» LED, closure of the «dry» contact «Failure», switching off of the indicator «Ready», message on the LCD-indicator.	Elimination of the fault in the faulty three-phase line
2	Switching device control	Change in SD status without the ATSU issuing controlling actions	The ATSU recognizes such an SD as faulty and a red LED of the corresponding SD lights up. Switching on of the «Failure» LED, closure of the dry contact «Failure», message on the LCD display.	Elimination of inconsistencies and error resetting through the menu
3	Removing the switching device	«SD removed» signal	Turning on of the LEDs «Failure», «Removed», dry contact «Failure»	Switching device recovery
4	Failure on the line of one or two inputs	short circuit, overload or other emergency situation that caused the circuit breaker to trip and its emergency contacts to close	Flashing red LED of the corresponding SD. Switching on of the «Failure» LED, closure of the dry contact «Failure», switching off of the «Ready» indicator, message on the LCD display	Elimination of the failure and error resetting through the menu

For a more detailed description of the menu, settings and connections of the ATSU, see the operation manual.

## ► Connection diagrams

Recommended connection diagram of electromagnetic switching devices to ATSU

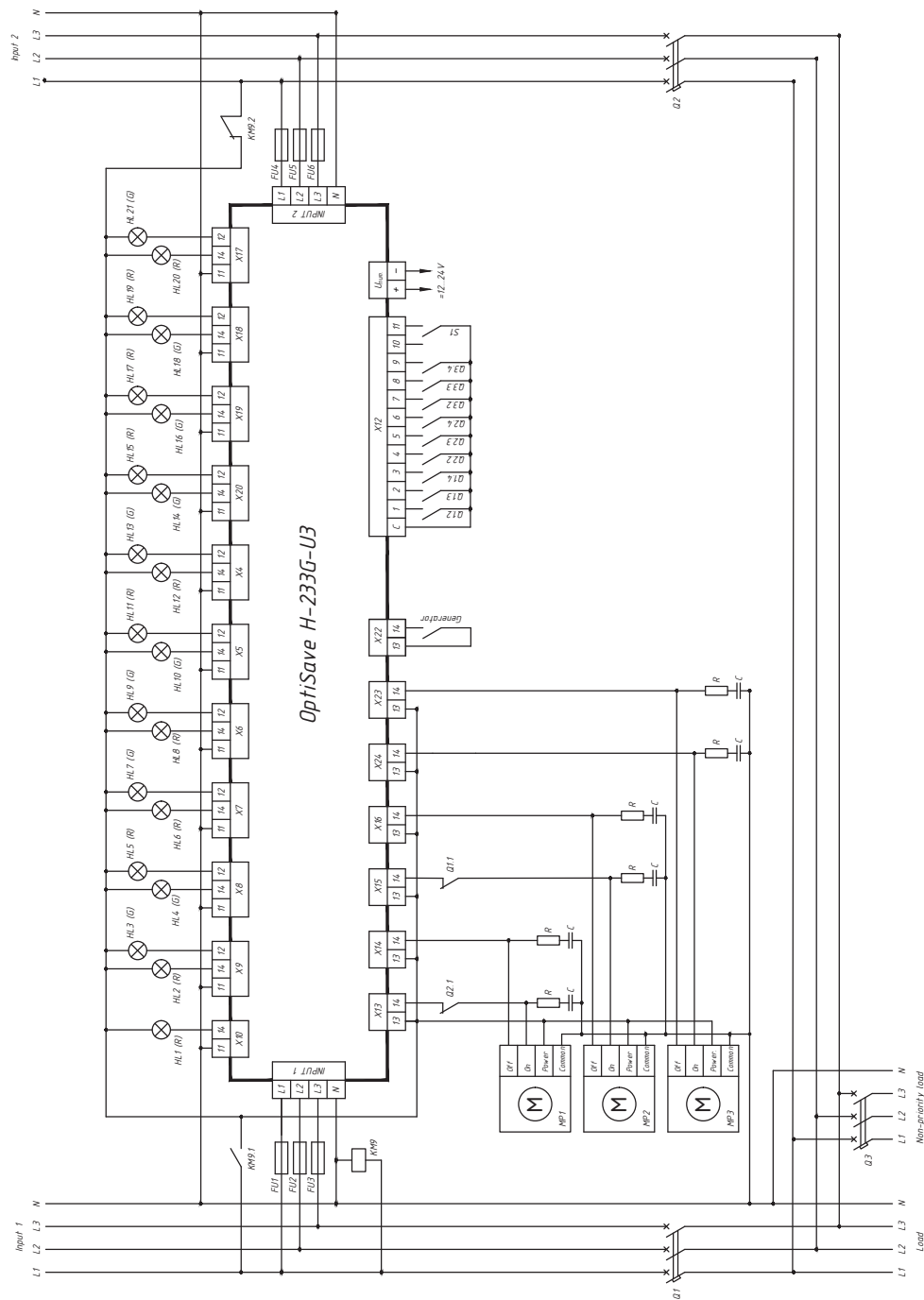


KM1, KM2, KM3 – switching devices (contactors, starters);  
 KM1.1, KM1.2 – contacts for blocking simultaneous switching on of input SDs  
 KM1.2, KM2.2, KM3.2 – signaling contacts of switching devices;  
 KM5 – relays for switching the power supply of external control and signaling devices;  
 KM5.1, KM5.2 – contacts for blocking simultaneous connection to inputs;  
 FU1 ... FU6 – fuses;  
 HL1 – signaling «non-priority load switching device on»;  
 HL2 – signaling «Switching device of Input 1 on»;  
 HL3 – signaling «Switching device of Input 1 is off»;

HL4 – signaling «Switching device of Input 2 is on»;  
 HL5 – signaling «Switching device of Input 2 is off»;  
 HL6 – signaling «non-priority switching device is on»;  
 HL7 – signaling «non-priority switching device is off»;  
 HL8 – signaling «ATSU in automatic mode»;  
 HL9 – signaling «ATSU in manual mode»;  
 HL10 – indicator «Normal»;  
 HL11 – indicator «Failure»;  
 S1 – front panel locking.



Recommended connection diagram of motor-driven circuit breakers to ATSU



Q1, Q2, Q3, – circuit breakers;  
MP1, MP2, MP3 – motor drives for breakers Q1, Q2, Q3;  
Q1.1, Q2.1 – contacts for blocking simultaneous switching on of input SDs;  
Q1.2, Q2.2, Q3.2 – switching devices status control;  
Q1.3, Q2.3, Q3.3 – control of emergency operation of circuit breakers;  
Q1.4, Q2.4, Q3.4 – «Removed» status contact;  
KM9 – relays for switching the power supply of external control and signaling devices;  
KM9.1, KM9.2 – contacts for blocking simultaneous connection to inputs;  
FU1 ... FU6 – fuses;  
HL1 – signaling «non-priority load switching device is on»;  
HL2 – indicator «Switching device of Input 1 is on»;  
HL3 – indicator «Input 1 switching device is off»;  
HL4 – indicator «Input 1 switching device removed»;  
HL5 – indicator «Input 1 switching device installed»;  
HL6 – indicator «Input 1 switching device tripped automatically»;

HL7 – indicator «Input 1 switching device in normal mode»;  
HL8 – indicator «Input 2 switching device is off»;  
HL9 – indicator «Input 2 switching device is on»;  
HL10 – indicator «Input 2 switching device removed»;  
HL11 – indicator «Input 2 switching device installed»;  
HL12 – indicator «Input 2 switching device tripped automatically»;  
HL13 – indicator «Input 2 switching device in normal mode»;  
HL14 – indicator «non-priority switching device is on»;  
HL15 – indicator «non-priority switching device is off»;  
HL16 – indicator «non-priority switching device removed»;  
HL17 – indicator «non-priority switching device installed»;  
HL18 – indicator «ATSU in auto mode»;  
HL19 – indicator «ATSU in manual mode»;  
HL20 – «Failure» indicator;  
HL21 – «Normal» indicator;  
S1 – front panel locking.

## Recommended connection diagram of electromagnetic-driven circuit breakers to ATSU



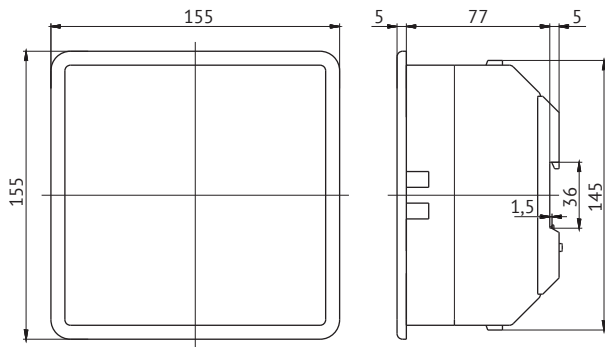
Q1, Q2, Q3, – automatic circuit breakers;  
 EM1, EM2, EM3 – electromagnetic drives of breakers Q1, Q2, Q3;  
 Q1.1, Q2.1 – contacts for blocking simultaneous switching on of input SDs;  
 Q1.2, Q2.2, Q3.2 – switching devices status control;  
 Q1.3, Q2.3, Q3.3 – control of emergency operation of circuit breakers;  
 Q1.4, Q2.4, Q3.4 – «Removed» status contact;  
 S1 – front panel locking;  
 KM9 – relays for switching the power supply of external control and signaling devices;  
 KM9.1, KM9.2 – contacts for blocking simultaneous connection to inputs;  
 FU1 ... FU6 – fuses;  
 HL1 – signaling «non-priority load switching device on»;  
 HL2 – indicator «Input 1 switching device is on»;  
 HL3 – indicator «Input 1 switching device is off»;  
 HL4 – indicator «Input 1 switching device removed»;  
 HL5 – indicator «Input 1 switching device installed»;  
 HL6 – indicator «Input 1 switching device tripped automatically»;

HL7 – indicator «Input 1 switching device in normal mode»;  
 HL8 – indicator «Input 2 switching device is on»;  
 HL9 – indicator «Input 2 switching device is off»;  
 HL10 – indicator «Input 2 switching device removed»;  
 HL11 – indicator «Input 2 switching device removed»;  
 HL12 – indicator «Input 2 switching device tripped automatically»;  
 HL13 – indicator «Input 2 switching device in normal mode»;  
 HL14 – indicator «non-priority switching device is on»;  
 HL15 – indicator «non-priority switching device is off»;  
 HL16 – indicator «non-priority switching device removed»;  
 HL17 – indicator «non-priority switching device installed»;  
 HL18 – indicator «ATSU in auto mode»;  
 HL19 – indicator «ATSU in manual mode»;  
 HL20 – «Failure» indicator;  
 HL21 – «Norm» indicator;  
 S1 – front panel locking.

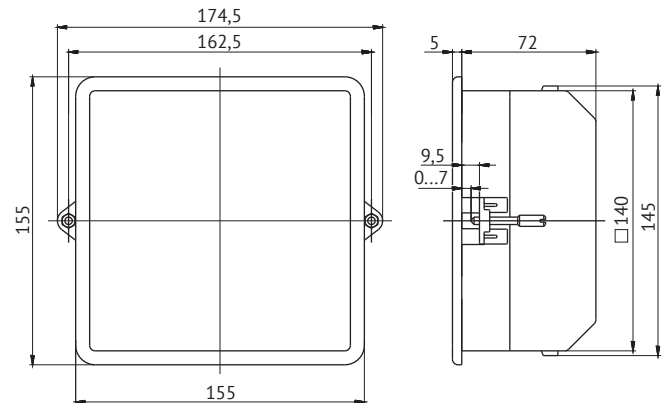
## ► Overall and connection dimensions (mm)

ATSU design provides for its installation in the 1 to 6 mm thick mounting plate window or on a standard rail using the mounting parts included in the delivery.

### Mounting on a TN35 rail in accordance with GOST R IEC 60715



### Mounting in a window on a panel



ATSU weight: 0.840 kg

## ► KEAZ switching equipment for the implementation of ready-made solutions

KEAZ offers a wide range of circuit breakers with both electromagnetic and motor drives for building ready-made ATS solutions:



The advantages of the circuit breaker ATS solution include the following:

- option of build a solution in a wide range of rated currents (16 to 4000 A);
- built-in overcurrent protection;
- no power consumption in the ON state.

KEAZ offers various series of contactors for building turnkey ATS solutions:

- PML
- OptiStart K (page 000)
- OptiStart MK (page 000)

ATS contactor systems offer number of advantages:

- simple design;
- high switching speed, which is especially important when powering critical technological processes;
- lower financial costs for implementation in the range of currents up to 250A;
- reliability of contactors compared to motor and electromagnetic drives.