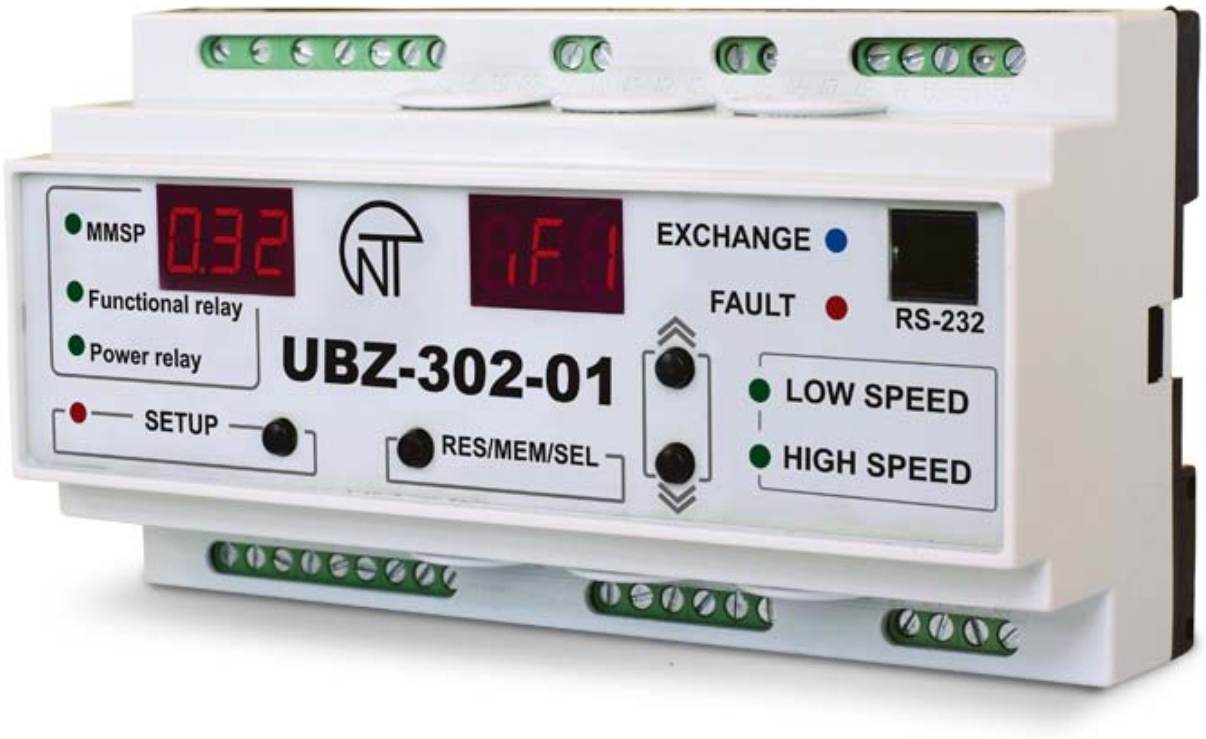
NOVATEK-ELECTRO LTD
Research-and-Manufacture Company

UNIVERSAL ELECTRIC MOTOR PROTECTION DEVICE

UBZ-302-01



OPERATING MANUAL

Quality control system on the production complies with requirements ISO 9001:2008

Review the Operating manual before using the unit.
Store the unit in the operating environment for 2 hours before switching to the mains.
Do not use abrasives or organic compounds for cleaning (spirit, gasoline, solvents, etc.).

UKRAINE, Odessa

www.novatek-electro.com

1. DESCRIPTION AND OPERATION

1.1 APPLICATION

1.1.1The UBZ-302-01 universal electric motor protection device (further referred to as UBZ) is designed for protection of dual-speed (double-coil) asynchronous induction motors, for continuous monitoring of the mains voltage parameters and RMS phase/line currents, as well as for the motor insulation resistance test.

The UBZ device provides for protection of dual-speed (double-coil) asynchronous induction electric motors of 5 to 50 A rated current when type external current transformers are used.

The UBZ device provides for electric motor protection in the following cases:

- mains voltage is of poor quality (unallowable voltage surges, phase loss and phase/line voltage imbalance, incorrect phase sequence and phase "coincidence");
- mechanical overloads (symmetrical phase/line current overload) occur;
- exceeding of the negative sequence current threshold (current imbalance) occurs;
- long lasting start or locked rotor ;
- insulation level between the fixed coil and frame is abnormally low (insulation resistance test before motor startup);
- earth leakage current protection when stator winding has the earth fault connection;
- motor thermal overload takes place;

For each separate type of fault, the device allows to enable or disable an automatic load reset.

The device provides for electric equipment protection by means of a contactor coil operation.

The device detects motor currents when power relay is open. In this case the UBZ indicates the fault of external contactor until the moment when UBZ will not be totally de-energized.

The UBZ device provides data transfer to PC via RS-485 interface using MODBUS protocol.

For connection PC and UBZ you can use original software tool “Control panel UBZ-302-01” which you may download using the following link http://www.novatekelectro.com/production_ubz.htm.

The program “Control panel UBZ-302-01” uses for monitoring and information collection from

UBZ-302-01, using connection (RS-232 or RS-485). This program allows save different adjustments of UBZ, monitoring and information collection and save them for further using. The saved information can be used for display of diagram and compare parameters to each other.

The graphic interface of PC allows to watch current state different parameters of UBZ in real time.

The flexible adjustment of interface allows to be used by any users.

1.1.2 Internal relays output terminals specification

The internal relays output terminals specification is outlined in Table 1.1

Table 1.1

	Max. current for ~ 250 V A. C.	Number of trips x1000	Max switching power	Max sustained safe voltage ~	Max. current for U = 30V D.C. # trips
Power relay					
Cos φ = 0,4 Cos φ = 1.0	2 A 5 A	100 100	1000 VA	460 V	3 A (50000)
Signal relay					
Cos φ = 0.4 Cos φ = 1.0	5 A 16 A	100 100	4000 VA	440/300 V	3 A

1.1.3 List of abbreviations

AR – automatic reset

MC – magnetic contactor

CT – current transformer

MSPM – mode with minimal number of setting parameters

In1, In2 – rated motor current for the 1st and 2nd speed (As a rule, these are currents values shown on the motor plate, but subject to specific operating conditions, different currents values may be set).

If S2S=0 (table 1.4) and the contacts are closed and unclosed on terminals 49, 50 (picture 2.1), In assumes a value of nominal current for small (parameter “Id1” table 1.4) or big (parameter “Id2”) speed.

If S2S=1 (table 1.4) and the contacts are closed and unclosed on terminals 49, 50 (picture 2.1), In assumes a value of nominal current for small (parameter “Id1” table 1.4) or big (parameter “Id2”) speed.

1.2 Technical Brief

1.2.1 Basic technical parameters are shown below in table 1.2.

UBZ-302-01 complies with requirements:

IEC 60947-1:2004, IDT; IEC 60947-6-2:1992, IDT; CISPR 11:2004, IDT; IEC 61000-4-2:2001, IDT

No harmful substances in excess of the maximum permissible concentration is available.

Table 1.2 - Basic Technical Brief

Rated supply voltage, three phase:	400V 50Hz
Mains frequency, Hz	48-62
Rated Currents Range, A	5-50
Voltage hysteresis, (phase/line), V	10/17
Thermal hysteresis, % of accumulated heat at shutdown	33
Tripping threshold accuracy for current, ≤, % of rated current	2
Tripping threshold accuracy for voltage, ≤, V	3
Phase imbalance detection accuracy for voltage, ≤, V	3
Temperature permission of temperature sensors, °C	1
Minimum operational voltage: -single-phase voltage power supply when one phase and neutral wires are connected, ≥ V - three-phase power supply voltage, ≤ , V	 180 450
Digital input for signal to switch to higher speed (dry contact).. Analog input to connect differential current transformer (zero sequence transformer). Three analog inputs to connect external CT (current transformers)* There are two analog input for connection temperature sensors (type PT100, Ni100, Ni120)	
Main outputs: load relay – two groups of changeover contacts (5A 250V cos φ=1), to control motor starter;	
Power consumption (under load), ≤, VA	5,0
Enclosure protection degree: -case - terminal block	IP40 IP20
Operating temperature range, °C	from -35 to +55
Storage temperature range, °C	from -45 to +70
Weight, ≤, kg	0,5
Case dimensions (diagram 1.1) nine S-type modules Mounting on to standard 35 mm DIN-rail Mounting position any	
* - optional	

1.2.2 Measured and calculated parameters output to the display unit, their effective range limits and tolerances are given below in Table 1.3

*__Note__: the display unit is represented by two pieces of three-digit, seven segment indicators on the device's front panel

Table 1.3 Measured and displayed parameters

Controlled functions	Range	Accuracy	Mnemonic	Address	Measurement units used at data transfer
Currents					1/10 of an ampere
Phase currents RMS values, A	0,5 - 50	2%	iF1, iF2, iF3	100,101, 102	
Zero sequence RMS value, A	0,3 - 5,0	2%	i0P	103	
Each phase average current value at time specified in tSi parameter			iS1, iS2, iS3	104,105, 106	
Max each phase average current value obtained since last power on *All average values can be reset with (RECORD/RESET/SELECT) button at time of max average current value output for any phase (real-time average current value for corresponding phase is assigned)*	< 50A > 50A	2% 10%	in1, in2, in3	107,108, 109	

Controlled functions	Range	Accuracy	Mnemonic	Address	Measurement units used at data transfer
Motor start current (phase average) Overload current (phase average) Start time, sec *Start time is the period of time from the moment when three phase currents exceed 1,2 In and up to the moment when the three currents drop below 1,2 In. Max phase current achieved during this period is the max start current. In – depending on the condition, the inS takes the value of the 1st or the 2nd speed current.*	< 50A > 50A 0,1-600	2% 10%	iPU iPE tPU	110 111 112	
Negative sequence current (current imbalance), A.	0,2-20	5%	i2P	113	
Voltages					Volts
Phase voltages RMS values (*defined by connecting zero wire to the device*), V	100-450	3 V	UF1, UF2, UF3	114,115 116	
Power voltage RMS values, V	100-450	5 V	UL1, UL2, UL3	117,118 119	
Positive-sequence voltage, V	100-300	3 V	U1P	120	
Negative-sequence voltage, V	3 -300	3 V	U2P	121	
Zero-sequence voltage (*vector sum of three phase voltages, divided by three*), V. Accurate measurement is possible only when zero wire is connected.	3-100	3 V	U0P	122	
Miscellaneous					
Equipment operation time counter, days	0-999		Str	124	
Equipment operation time counter from power on, hours	0-999		Ltr	123	
Mains frequency, Hz	45-65	1%	FFF	125	1/10 Hz
Operation time before overload de-energizing (*indicates time left before protection system triggers thermal overload de-energizing*), sec	0-600	1sec	tOP	126	seconds
Time before AR delay termination, sec**	0-900	1sec	tAP	127	seconds
Wait time after overload deenergizing (indicates wait time before permit of system restart after thermal overload de-energizing), sec **	0-900	1sec	ttP	128	seconds
Motor insulation resistance***,MOhm	0-19,9	10%	rid	129	100s kOhm
Sensor temperature 1 (sensor type is given in accordance with table 1.6.), ºC ****	from -40 to 220	1 ºC	td1	130	5000 – the sensor is switch off 1000±10 – short curcuit 2000±10 – transducer breakout
Sensor temperature 2 (sensor type is given in accordance with table 1.6.), ºC ****	from - 40 to 220	1 ºC	td2	131	
Motor temperature balance This parameter is using for reading by interface RS-232, RS-485	Number 1100000 is according to 100% of saved warm, whereby happen motor switch off with power on shutdown thermal overload (п.1.2.5.6)			132. 133	

Note:

* - when automatic reset is forbidden, "not" message is displayed.

** - if time before thermal overload safety de-energizing (tAP) or wait time before system start permit (ttP) has not been defined, “---“ code is displayed. * - in case protection operation is forbidden, "not" message is displayed.

*** - if motor resistance exceeds 20MOhm, then the value indicator displays “1.“ (figure “one” with a dot in high-order position).

1.2.3 Programmable parameters and their variability ranges are shown below in table 1.4.

Table 1.4 - Programmable parameters

Settings and read-off parameters	Code parameters	Min. values	Max. values	Default setting	Operation	Address
MISCELLANEOUS						
Rated current of the 1st speed 1, A	id1	0	50	0	0-current not set: UBZ device will not engage load relay (2.3.5).	150
of the 2nd speed, A	id2	0	50	0	0-current not set: UBZ device will not engage load relay (2.3.5).	151
Time to switch from one speed to the other, sec	t12	0,1	5,0	0,5		152
Time within which average current value is measured, sec	tSi	10	600	60	Time within which average current value is measured (parameters iS1, iS2, iS3 from Table 1.5)	153
Maximum current protection						
Maximum current protection type	i = P	0	5	0	0-protection with independent time delay Dependent time delay protectttion types: 1-SIT; 2-VIT (LTI); 3-EIT; 4-UIT; 5-RI	154
Max current protection tripping setting value, ratio	i = S	0,8	9,0	4,0	ratio to the motor rated current is assigned	155
Current protection tripping delay, sec	i = t	0,1	600	10,0		156
Protection operation permission	i = r	0	2	2	0- protection operation prohibited 1- protection function permitted, after-tripping automatic reset prohibited 2- protection operation permitted, after-tripping automatic reset permitted	157
Order of current protection tripping as relative to thermal overload protection	i = n	0	1	1	0- protection trips independently of the thermal overload protection 1-when the thermal overload condition is not in place, then current exceeding indication is present, but the load relay does not open	158
Earth fault protection						
Current fault tripping setting, A	i0P	0,3	5,0	0,5		159
Protection tripping delay, sec	i0t	0,1	2,0	1,0		160
Earth fault protection function permission	i0r	0	2	1	0- protection function prohibited 1- protection function permitted, after-tripping automatic reset prohibited 2- protection function permitted, after-tripping automatic reset permitted	161

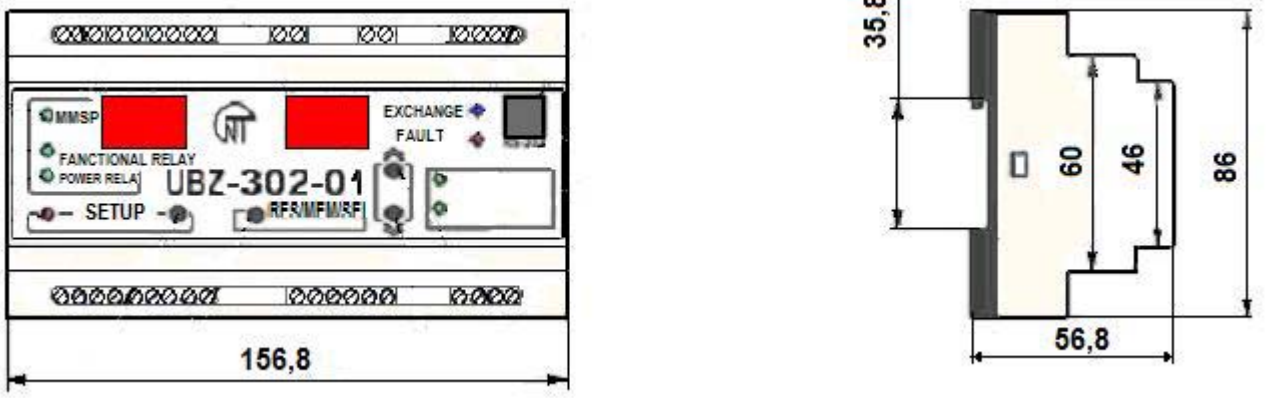
Settings and read-off parameters	Code parameters	Min. values	Max. values	Default setting	Operation	Address
Negative-sequence current protection						
Tripping setting, %	i2S	5	20	10	Set in percentage of rated current	162
Protection tripping delay, sec	i2t	0,2	10,0	5,0		163
Negative-sequence protection function permission	i2r	0	2	2	0- protection function prohibited 1- protection function permitted, after-tripping automatic reset prohibited 2- protection function permitted, after-tripping automatic reset permitted	164
Analysis of causes for negative-sequence current protection tripping						
Excess rate of current negative sequence ratio relative to voltage negative sequence ratio	icS	2	4	2		165
Analysis function permission	icr	0	1	1	0- analysis is off 1- analysis is on	166
Thermal overload (motor thermal model)						
Thermal overload protection function permission	dtr	0	2	2	0- protection function prohibited 1- protection function permitted, after-tripping automatic reset prohibited 2- protection function permitted, after-tripping automatic reset permitted	167
Double current overload protection tripping time, sec	dtt	10	120	60		168
Time increase ratio while motor is stopped	dtP	1,0	4,0	1,0	Cooling time increase compensation while motor is stopped	169
Long lasting start, rotor blocked						
Tripping setting, ratio	PPS	1,5	7,0	5,0	ratio relative to rated current is assigned	170
Long lasting start protection tripping delay, sec	PPt	1	600	10	time of motor startup	171
Rotor blocking protection tripping delay, sec	Pbt	0,1	300	1.0		172
Protection function permission	PPr	0	2	1	0- protection function prohibited 1- protection function permitted, after-tripping automatic reset prohibited 2- protection function permitted, after-tripping automatic reset permitted	173
Voltage protection						
Minimum line voltage, V	$U_{=}S$	270	415	320		174
Min voltage de-energize tripping delay time, sec	$U_{=}t$	5	30	10		175
Voltage min protection function permission	$U_{=}r$	0	2	2	0- protection function prohibited 1- protection function permitted, after-tripping automatic reset prohibited 2- protection function permitted, after-tripping automatic reset permitted	176
Maximum line voltage, V	$U^{=}S$	330	475	415		177

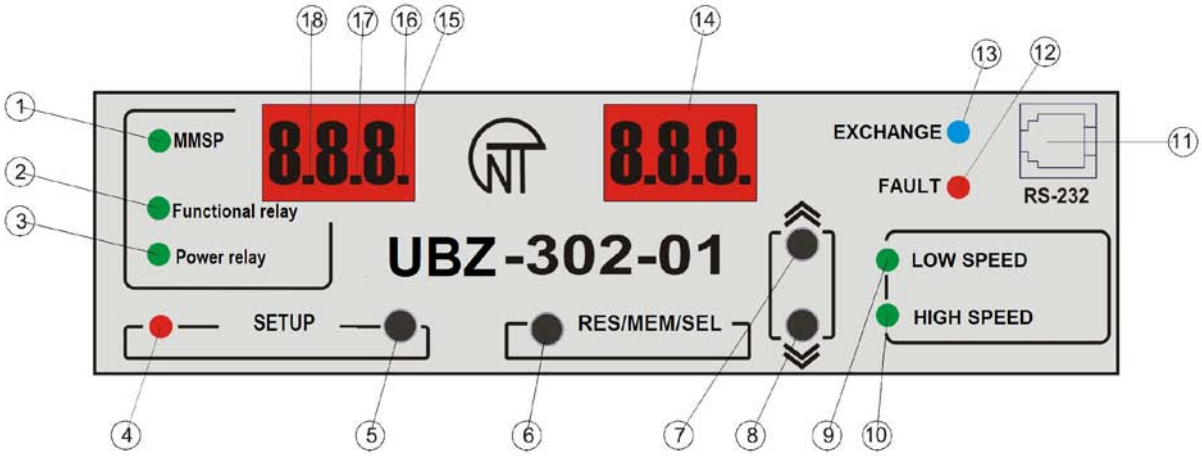
Settings and read-off parameters	Code parameters	Min. values	Max. values	Default setting	Operation	Address
Max line voltage de-energize tripping delay time, sec	U = t	1	10	2		178
Max line voltage protection function permission	U = r	0	2	2	0- protection function prohibited 1- protection function permitted, after-tripping automatic reset prohibited 2- protection function permitted, after-tripping automatic reset permitted	179
Line voltage imbalance, V	U П S	15	120	35	negative sequence	180
Line voltage imbalance de-energize tripping delay time, sec	U П t	1	30	5		181
Line voltage imbalance protection function permission	U П r	0	2	2	0- protection function prohibited 1- protection function permitted, after-tripping automatic reset prohibited 2- protection function permitted, after-tripping automatic reset permitted	182
Phase sequence protection function permission	UЧr	0	2	1	0- protection function prohibited 1- protection function permitted, after-tripping automatic reset prohibited 2- protection function permitted, after-tripping automatic reset permitted	183
Motor operation and automatic reset control						
Automatic reset (AR) time, sec	Att	0	900	5		184
AR prohibited for all faults	Arr	0	1	1	0 - AR prohibited 1- AR permitted	185
Motor operation permitted after UBZ device power-on	APd	0	2	1	0 – manual motor startup 1- motor restart after AR delay time 2- motor restart after 2 sec dwell	186
Electric motor control	ACd	0	3	0	0 - prohibited 1-motor start permitted 2-emergency stall permitted 3-motor startup and stall permitted See ref. 2.4.5	187
Motor insulation resistance						
Min motor insulation resistance protection	rid	0	20	5	0-disabled 5 - motor will not start when insulation resistance is < 500k, AR permitted 10 - motor will not start when insulation resistance is < 1000k, AR permitted 15 - motor will not start when insulation resistance is < 500k, AR prohibited 20 - motor will not start when insulation resistance is < 1000k, AR prohibited	188
System parameters						
Signal of switching to higher speed	S2S	0	1	0	0-contact open 1-contact close	189
Min number of setting parameters mode enable	Sin	0	1	1	0-mode disabled 1- mode enabled	190

Settings and read-off parameters	Code parameters	Min. values	Max. values	Default setting	Operation	Address
Indication on UBZ display panel before motor energize	SiP	0	2	0	0- line voltage Uab 1- insulation resistance rid 2-AR time countdown	191
Parameter indication mode	SiC	0	1	1	0-parameter value indicated continuously 1-parameter value indicated within 15 sec	192
Equipment operation time counter, days	tbU	0	999	0		193
Motor operation time, days	tCO	0	999	0		194
User access code	LOC	0	9	0	0 – keyboard unlocked 1-9 – user password	195
Service engineer access code	PAS	000	999	123	000-access to service engineer level - granted 000-999 – service engineer password	196
System reset to factory settings	PPP	0	1	0	After value 1 has been recorded and parameter setup mode exited, the factory set parameters will be restored	197
RS-485 serial interface parameters						
UBZ device communication address	rSA	1	247	1		198
Transfer rate	rSS	0	1	0	0: 9600 baud; 1: 19200 baud;	199
Converter reaction to loss of connection	rSP	0	3	0	0-continue without warning 1- warning message, continue operation 2-warning message and motor stall, AR permitted after communication has been restored 3-warning message and motor stall, AR prohibited after communication has been restored	200
Response timeout detection, sec	rSO	0	120	0	0 - prohibited	201
UBZ device communication via serial channel permitted	rPP	0	2	0	0- communication prohibited 1- communication permitted via RS-232 2- permitted via RS-485	202
Device version	rEL			21		203
Temperature control						
Control permission of temperature and sensor type of temperature 1	C1r	0	2	0	0 – turn off 1- integral to motor (shutdown is acted if sensor resistance higher 1,7 κOhm 2 – PTC (1κOhm at 25 ºC)	204
Trip temperature of motor	C1S	0	100	80		205
Temperature correction of first sensor	C1c	-9	9	0		206
Control permission of temperature and sensor type of temperature 2	C2r	0	3	0	0 – turn OFF 1 –type Pt100 2- ττype Ni100 3- type Ni120	207
Motor Tripping temperature	C2S	0	220	180		208
Temperature warning	C2A	0	220	170		209
Temperature correction of second sensor	C2c	-9	9	0		210

Settings and read-off parameters	Code parameters	Min. values	Max. values	Default setting	Operation	Address
Autoreclosing after protection operation	CPA	1	2	2	1- Autoreclosing after protection opereration is forbidden 2- Autoreclosing after protection opereration is approved	211
Response to defect temperature detectors	CCr	0	1	0	0- warning and continuation of work; 1- warning and engine stopping	212

Operating controls and the dimensions of the UBZ device are shown in fig.1.





1 – green LED MSPM (mode with minimal number of setting parameters) glows when the relay is in MSPM mode
2 – green LED – FUNCTIONAL RELAY glows when the signal relay is on;
3 – green LED – POWER RELAY glows when the load relay is on;
4 – red LED - SETUP glows when the relay is in parameter setup mode;
5 – SETUP button engages the parameter setup mode;
6 - Res/Mem/Sel – used to record parameters in setup mode; switch between groups of parameters displayed in view mode, reset;
7 – button ⩓ (marked in text as UP) – used to scroll through indicated parameters in the parameter view mode and scroll through menus in the parameter setup mode;
8 – button ⩔ (marked in text as DOWN) – used to scroll through indicated parameters in the parameter view mode and scroll through menus in the parameter setup mode;
9 - indication of motor speed 1 operation;
10 - indication of motor speed 2 operation;
11 – socket for the connection of the UBZ-302-01 to computer by RS-232 protocol
12 - red LED – FAULT:

- while load relay is off, the LED glows, when UBZ device is in fault mode, (flickers, when AR after fault is possible)
- while load relay is on, the LED flickers when the motor is in max current overload, or thermal overload condition, but the relay de-energizing tripping time threshold has not been reached

13 - Blue LED “EXCHANGE” – glows during the data exchange between the UBZ-302 and computer

14 – three-digit parameter value indication display;
15 - three-digit parameter mnemonic indication display;
16 – glows when UBZ device is in service engineer access mode.
17 - glows when a setup parameter value is secured via service engineer password;
18 - glows when a setup parameter is not included in the MSPM (mode with minimal number of setting parameters) list

Figure 1.1 - UBZ device controls and dimensions

Note: - For the purpose reliability creation UBZ , for input contacts of circuit voltage is used terminals at a pitch of 7,5 мм. Standard numbering of contacts at device case (5мм) is not mismatch with these contacts , so the shown contacts 2.1 are marked intermediate value.

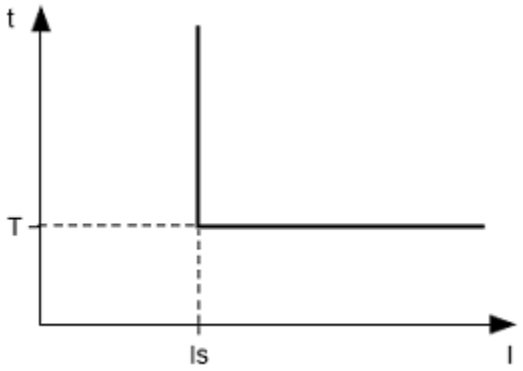
1.2.5 Protection functions

1.2.5.1 UBZ device provides the following types of induction motor protection:

- maximum phase current ;
- against line-to-earth fault (based on zero sequence current):
- for negative sequence (current imbalance);
- for excess rate of current negative sequence ratio relative to voltage negative sequence ratio;
- for thermal overload;
- for long lasting start (rotor block);
- for minimum line voltage;
- for maximum line voltage;
- for line voltages imbalance (voltage negative sequence);
- for phase sequence order;
- for minimum resistance protection of motor windings insulation.

1.2.5.2 The maximum phase current protection is of three-phase type. It is engaged when one, two, or three current values reach the tripping threshold.

The protection has a time delay setting. The delay can be independent (constant), or dependent (*the tripping curves are displayed in Appendix 1*):



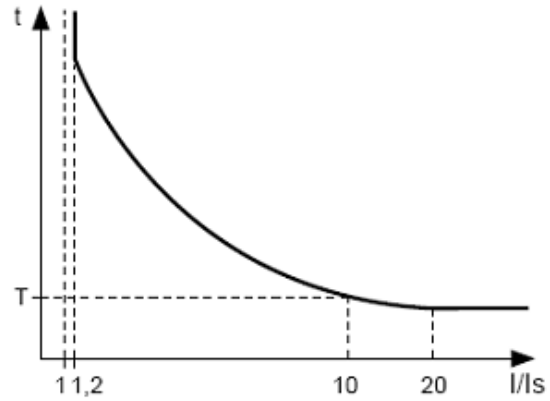
SIT - reverse dependent;
VIT or **LTI** – very reverse dependent;
EIT – extremely reverse dependent;
UIT – ultra reverse dependent;
RI – delay time**.**

Figure 1.2 - Principle of protection with an independent time delay

When independent time delay protection is activated, the motor is de-energized if one of the phases current exceeds the threshold value within T period of time (parameter “i ⁼ t”).

Is = “i⁼S” (tripping ratio) * “id1” (“id2”) (induction motor rated current at low and high speed accordingly), and T – protection tripping time delay

EXAMPLE. When i⁼S = 4.0, id1 = 10, id2=12, i ⁼ t = 10.0, the motor shall shut down 10 sec after one of the phase currents exceeds 40 A at low speed or 48 A at high speed.



The operation of the dependent time delay protection conforms to IEC 60255-3 and BS 142 standards.

Is corresponds to “i⁼S” trip setting, T- corresponds to the trip delay time for “i⁼S” =10.

To deal with very high amperage currents the protection has a feature with an independent time delay:

- if I>10In, then de-energizing time of is the time that corresponds to 10In.

Figure 1.3 - Principle of protection with dependent time delay

1.2.5.3 Earth fault protection

- is activated when earth fault current reaches the trip threshold (“i0S” parameter);
- the motor is de-energized if the earth fault current exceeds the trip threshold within T time period (“i0t” parameter).

1.2.5.4 Motor protection on negative sequence current (imbalance) turn ON when negative sequence component is more than thresholds (“ioS”) and switch OFF the motor, when the time of this exceed is more than intended (“iot”).

If analysis of causes of protection operation is switch on (iOr=1), so after protection operation on excess of negative sequence current (not because imbalance delta voltage this is trouble engine case) auto reclosing after protection operation is not going to happen (independent from delta voltage “ior”).

The coefficient of reverse sequence on voltage (current) is characteristic of unbalance of three-phase voltage (current). Approximate the coefficient of reverse sequence on voltage is computed using the following formula:

$$K_{2Ui}=\frac{U_{2(1)i}}{U_{1(1)i}}\cdot 100\ ,$$

$U_{2(1)i}$ — RMS value negative sequence voltage of actual frequency three phase voltage system at *i*-th supervision, V;

$U_{l(l)i.}$ — RMS value positive sequence voltage of actual frequency at *i*-th supervision, V.

$U_{2(1)i}$ calculates on appr. formula:

$U_{2(1)i} = 0{,}62\ (U_{нб(1)i}) - U_{нм(1)i})$,

$U_{нб(1)i}$, $U_{нм(1)i}$ — *maximal and minimum RMS value from three line to line voltage actua; frequency at i*-th supervision, V.

Calculation of coefficient reverse sequence by current is the similar $K_{2Ii.}$

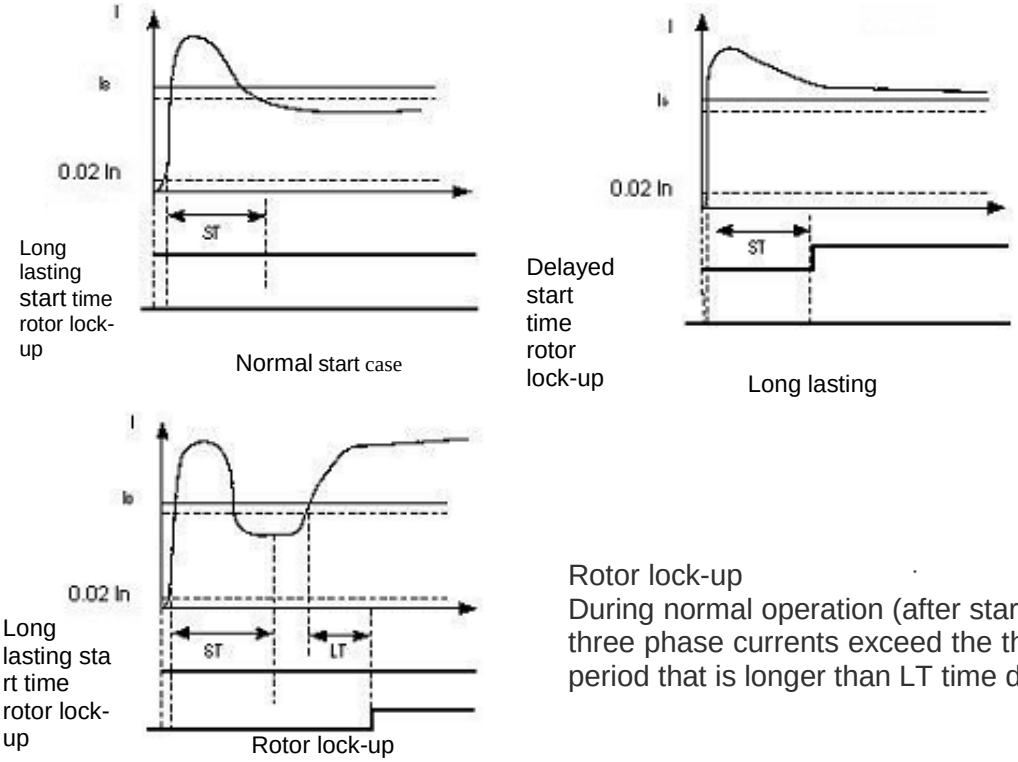
When current lack caused not voltage lack you need to check engine fault. For searching reason of current lack you need to calculate ratio frequency of reverse sequence by current to reverse sequence coefficient by voltage (K_{2Ii} / K_{2Ui}). If the ratio more setting “iOS” - the engine maintenance is broken.

1.2.5.5 Long lasting start, rotor block.

The principle of protection operation for the long lasting start and rotor block is displayed in Fig 1.4.

Long lasting start.

During startup the protection trips, all three phase currents exceed the Is threshold (“PPS” parameter) within time period that is longer than ST time delay (“PPt” parameter).



Rotor lock-up

During normal operation (after startup) the protection trips, all three phase currents exceed the threshold setting within time period that is longer than LT time delay (“Pbt” parameter).

Figure 1.4 - Long lasting start and rotor block

1.2.5.6 Thermal overload protection

The thermal overload protection is designed on the basis of electromotor thermal balance equation under the following assumptions:

- the motor was cold before first start;
- during operation the motor releases the amount of heat proportional to the square value of the current;
- after the stop, the motor cools down exponentially.

For the protection to function the double overload tripping time T2 ("dtt" parameter) has to be set up

Below is the current-to-time characteristic curve with different T2 values shown in Fig 1.5.

The current-time characteristic dependence shown in table 1.5 below is given for the standard recommended T2 value (60 sec when double overload occurs).

Table 1.5 - Current-time characteristic

I/Inom	1,1	1,2	1,4	1,7	**2**	2,7	3
Tsec	365	247	148	88,6	**60**	36.4	24.6

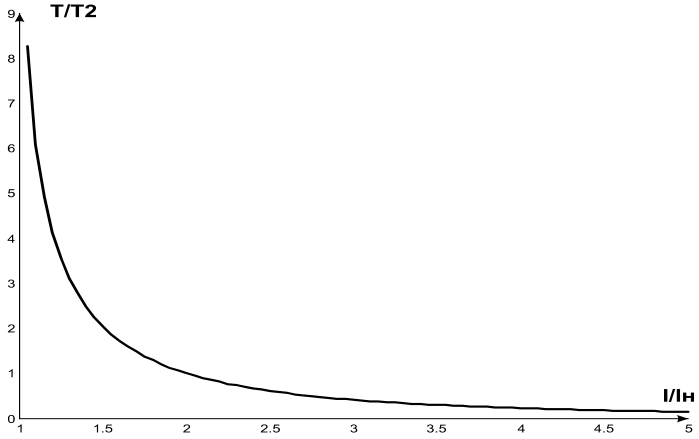
I/Inom	4	5	6	7	8	10	15
Tsec	13.5	8,5	5,9	4,3	3,3	2,1	0,9

Cooling rotating machines is more effective during operation, rather than at time of motor stall, that is why dtP parameter – the cooling constant increase rate during motor stall is introduced.

After load relay de-energizing at thermal overload with automatic reset permitted, the relay will re-energize after time period that is longer than one of the two:

- thermal hysteresis time, i. e. the motor must cool down 33% of the accumulated heat;
- AR time.

By suitable selection of different AR values, thermal hysteresis considered, one can reduce number of starts per time unit because in the intermittent cycle the device accumulates heat amount that is released at the start of the motor.



I/In - current ratio relative to the rated current;
T/T2 -- actual trip delay relative to T2.

Figure 1.5 - Current-to-time characteristic

1.2.5.7 Overtemperature control of coils

Depending on selected thresholds the maintenance can work in first MIDI input with following temperature sensors:

1) temperature sensors are built into motor (C1r=1). In this case the threshold C1S is not active and short circuit and sensor loss are not under control. The maintenance acts when probe resistance is more 1700 Ohm.

2) with sensors PTC (1кОm at 25 ºС) (the temperature can't be more 100 ºС).

In second MIDI input the maintenance is using temperature sensors Pt100 (platinum100 Ohm at 0 ºС) or Ni100 (Ni120) (nickel 100 Ohm (120 Ohm) at 0 ºС) up to standard МЭК 60751 и DIN 43760.

Maintenance in second MIDI input:

- is active when the control temperature is more threshold;
- has two independent thresholds: alarm signaling and tripping set points.

The maintenance determines cases breaking-down and short circuit temperature sensors:

-breaking down at temperature more 220 °C;

-short circuit at temperature less - 45°C.

1.2.5.8 Voltage maintenance

Before load starting the UBZ is checking thresholds and depending of their meaning permit or forbid the

load starting. After load starting the voltage control is continue but decision on cut off start on current.

Voltage maintenance consists:

- Min delta voltage (Acts if one of the delta voltages less threshold (parameter “U = S”) during time “U = t”);.
- max delta voltage (Acts if one of the delta voltage more threshold (parameter ” U = S”) during time “U = t”);
- imbalance delta voltage (Acts if difference between RMS of delta voltage is more threshold (parametr “U П S”) during time “U П t”).

1.2.5.9 Protection based on minimum resistance of motor windings insulation.

After the device voltage energizing and before output relay closure, the level of stator winding insulation relative to casing is checked. The level of stator winding insulation relative to casing is checked also when the load relay is closed, but motor currents are less than 10% of rated current (in such case it is supposed that the motor is off).

When rid=5 (15) load is not energized, if insulation resistance falls below 500 kOhm ± 20 kOhm, and when rid=10 (20), if it falls below 1000 kOhm ± 50 kOhm. When rid=5 and rid=10, the load will be energized after insulation resistance resumption and AR time expiration. When rid=15 and rid=20, automatic reset will not take place.

1.3 Product package contents

The product package contents are shown in Table 1.6.

Table 1.6 - Product contents

Description	Abbreviation
UBZ-302-01 device	UBZ-302-01
External current transformer (CT)*	TR-7-1 (5-50A)
Differential current transformer (zero sequence transformer)	TR-7-5 (5-50A)
Tempearature sensor (Pt100, Ni100, Ni120) *	
Teemperature sensor – PTC-1кOhm *	

* - supplied optionally.

1.4 Equipment features and operation

The device is a microprocessor-based digital device that provides a high degree of reliability and accuracy. The device doesn't need any auxiliary supply because it retrieves it's energy demand out of the measurement signal: it's self-powered by the voltage to be monitored.

2. PROPER USE

2.1. Safety

All connections must be performed on dead device.

2.2 UBZ device control

2.2.1 UBZ has five control modes:

-keyboard lock level;

- mode with minimal number of setting parameters (further on referred to as MSPM);

-user level;

-service engineer level;

In all operation modes the following features are available:

-viewing the measured and displayed parameters. Scrolling within a group is performed by DOWN and UP buttons;

-faults log view (п.2.4.6).

2.2.2 When keypad is locked, viewing and resetting programmable parameters is not possible.

When keypad is locked, pushing– SETUP button will result in LOC message display. To unlock the keyboard the SETUP button shall be pressed again. The "SETUP" LED lights up, and label "0" is blinking on the indicator. With the UP and DOWN buttons user enters a password digit from 1 to 9 and presses the Res/Mem/Sel button. If the password is correct, the keypad is unlocked. If after the keypad was unlocked no button is pressed during 15 sec and the lockage setting is not released by user, the keypad will relock.

Note: - If any sensor is switched off by program way so instead temperature value (resistance) the indicator will show “not”.

2.2.3 Unlocked keypad allows:

- to operate in MSPM mode;
- to change and to view the user level parameters;
- to view the service engineer level parameters.

2.2.3.1 MSPM was devised to ease the service personnel operations with the UBZ device.

To employ MSPM mode, the user needs to set Sin=1 parameter, or perform resetting to factory settings. (2.2.4). When UBZ device is in this operation mode, green LED *“РМКУП”* (MSPM) is on.

In MSPM mode, to provide for normal operation of the device, the following parameters must be set:

- Motor 1st speed rated (working) current.
- Motor 2nd speed rated (working) current.
- thermal overload (motor thermal model).
- signal of switching to higher speed.

The difference between MSPM mode and the user mode is that the parameters not included in the MSPM register are set to default factory values.

ATTENTION! If some programmable parameters have been modified by the user or service engineer, but not included in the MSPM register, switching to MSPM mode will reset such parameters to factory settings.

The parameters included in this register cannot be viewed or modified. Operations with the MSPM register parameters are similar to the user level operations.

Adding parameters to the MSPM register and MSPM mode disabling is possible only in service engineer access mode.

2.2.3.2 To view and to change the user level parameters one needs to press the SETUP button, then "SETUP" LED will glow. Scroll parameters with DOWN and UP buttons, enter parameter change mode – repeat push SETUP button , Res/Mem/Sel (the parameter value starts to flicker), changing parameters – with DOWN and UP buttons, record parameter - Res/Mem/Sel, return to menu without change –press SETUP button again. If no button is pressed during 15 sec the UBZ device goes into the initial state.

If a parameter change is forbidden (a dot in the middle digit field of the parameter mnemonic indicator glows), then the parameter change is possible only in Service Engineer level after the prohibition has been released.

2.2.3.3. Service Engineer Level

Access to the Service Engineer level.

Push SETUP button and hold for 5 sec. If the level is protected by a password, the label PAS appears on the indicator. The "SETUP" LED lights up, and indication "000" flickers on the parameter value indicator. With the UP and DOWN buttons enter the three-digit service engineer password, digits from 1 to 9 and separate dialing with pressing the Res/Mem/Sel button. If the password is incorrect, the PAS label lights on blinking in the higher position of the value indicator, and the UBZ device goes back to the initial state after 15 sec, otherwise the first parameter of the service engineer menu appears on the indicator.

Scroll parameters with DOWN and UP buttons, enter parameter change mode – repeat push SETUP button (the parameter value starts to flicker), change parameters – with DOWN and UP buttons, record parameter - Res/Mem/Sel, to return to menu without change – press SETUP button again. If no button is pressed during 15 sec the UBZ device goes into the initial state.

While UBZ is in Service Engineer mode, the decimal point in the lower digit position of the mnemonic indicator is on.

In the Service Engineer level the access to any user level parameter can be prohibited or permitted by simultaneous the SET and DOWN buttons pressing. Access denial is indicated by decimal point in the middle digit position of the mnemonic indicator.

While in Service Engineer access mode, any additional parameter can be added to the MSPM parameter register. Action:

- with DOWN and UP buttons choose the parameter to be added;
- push buttons DOWN and UP simultaneously.

When a parameter is excluded form the MSPM mode register, a decimal point glows in the higher digit position of the mnemonic indicator.

2.2.4 Restoring factory settings.

There are two ways to restore the factory settings.

Way 1. Set up parameter PPP = 1. Upon exit from the parameter setup mode all factory settings will be restored (excluding the Service Engineer Password).

Way 2. When powering UBZ on, hold down SETUP and Res/Mem/Sel buttons. All factory settings including the Service Engineer will be restored (Service Engineer password – 123).

After completion of the factory settings setup, the UBZ will start operation in MSPM mode, which shall include the following parameters:

- motor 1st speed rated current, id1;
- motor 2nd speed rated current, id2;

These parameters are selected as background in Table 1.4.

2.3 Preliminary starting procedure

2.3.1 Connect current transformer in accordance with illustration 2.1.

Note: - Compulsory using of current transformers which are delivered as a set of UBZ. Using another type of TT lead to damage UBZ.

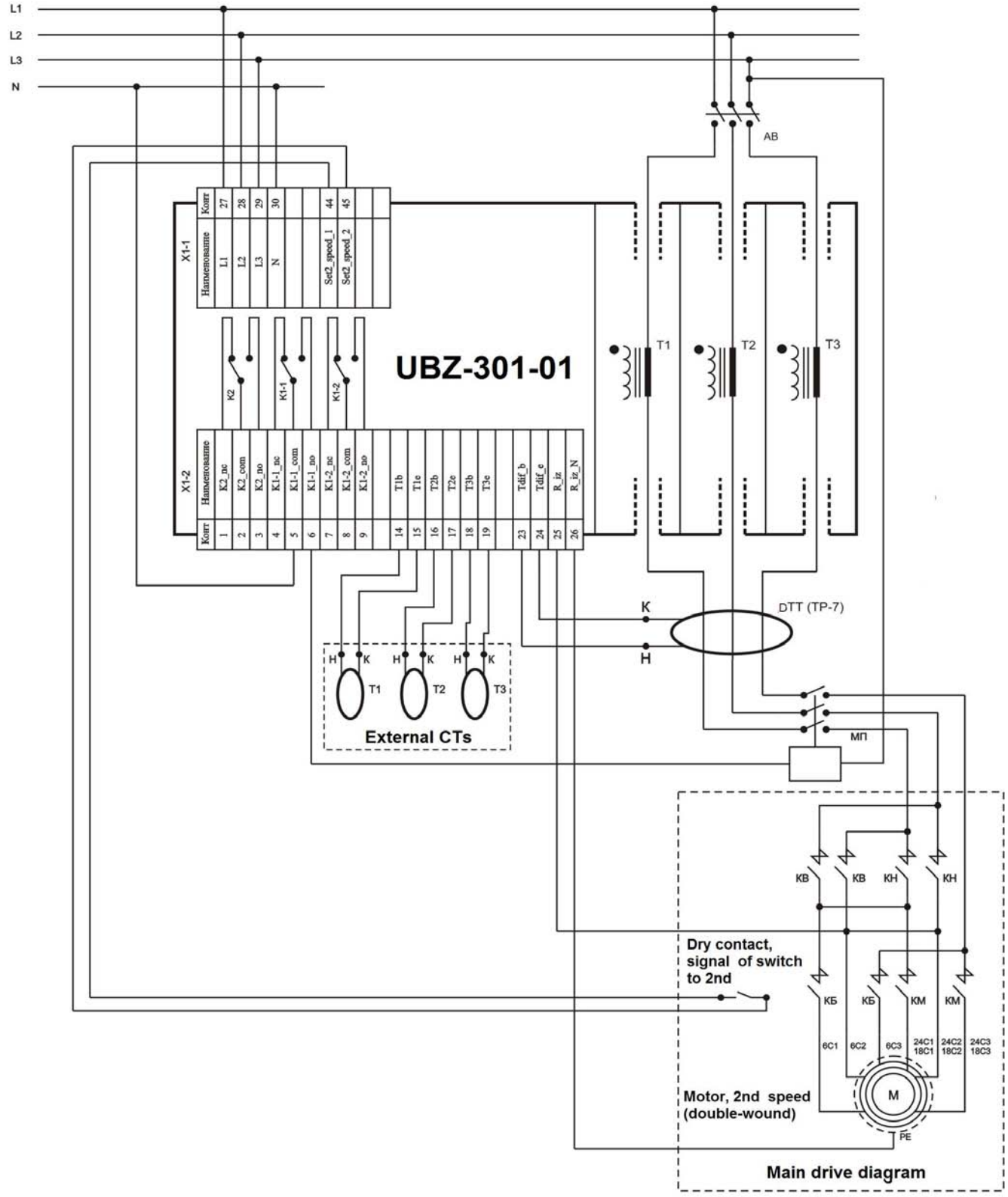


Figure 2.1 - UBZ connection diagram

2.3.2 Run through differential current transformer (zero sequence transformer) all three power phase cables and connect the DCT to UBZ device.

2.3.3 For insulation test and control, connect insulation control terminal **25** to one of the Magnetic Starter (MS) outputs. Make an electrical connection of the frame to terminal **26** of UBZ device incase if:

- the motor case is not earthed; or
- power mains with an isolated neural terminal are used; or
- neutral wire is not connected to UBZ terminal.

2.3.4. Connect UBZ to power mains in accordance with figure 2.1.

2.3.5 Using PC for monitoring is required:

-install to PC the program “UBZ control board”, before setup_UBZ302lift.msi;

-connect contact socket “ЭВМ” on control board to RS-232 of PC using the cable КС-01 or contact socket USB of PC using the cable КС-USB-01.

Note:

1. The program setup_UBZ302.msi , is placed on the company web site (http://www.novatek-electro.com/production_ubz.htm).

2. The cables КС-01, KC-USB-01 package according the order. There is possibility of individual manufacture the cable КС-01 according file 2.2.

3. It's possible to use the programs manufactured by individual users.

2.3.6 Using MODBUS should connect communication lines to terminals **33, 34, 35** of UBZ.

2.3.7 Energize UBZ by applying AC.

Note:The threshold of motor nominal current (Id1,Id2) is equal to zero. In this case UBZ load relay will not reach the thresholds of motor nominal currents .

Order of connection load relay depends option settings Arr , APd, ACd (p. 2.4.1.).

2.3.8 Set in menu necessary option settings.

2.3.9 Switch off UBZ.

2.3.10 Connect motor magnetic contactor according file 2.1.

Note: When relay is switched on the terminals **5-6** and **8-9 are closed**, when relay is switched off the terminals **4-5** and **7-8 are closed**.

2.4 Proper use

Note: In the UBZ operation description, it is supposed that the protections described are enabled and all necessary sensors are connected.

2.4.1 UBZ operation before load relay closure

2.4.1.1. UBZ operation after power-on (first start)

After power-on, the mnemonic indicator displays StA for 1-2 seconds, and then before load energizing the device tests:

- the level of stator insulation to frame (when insulation resistance is below 500 ± 20 kOhm at rid=5 (1000 ± 50 kOhm at rid=10) load is not energized);
- mains voltage quality: whether voltage is present on all three phases, if the mains voltage is symmetrical, what the RMS line voltage value is like;
- a correct phase sequence, and phase «non-coincidence».

When any of inhibiting factors is present, the load relay is not closed, and on the mnemonics indicator FAULT LED glows.

Depending on the SiP parameter, the indicator displays:

- line voltage Uab (SiP=0);
- insulation resistance rid (SiP=1);
- AR time countdown in seconds, (Att) while SiP=2.

When inhibiting factors are not present, the load relay closure is defined by APd (UBZ device operation after power-on) and Arr (AR forbidden after all faults) parameters:

1) When APd=0 the load relay will not close. **TO close load relay in this case both DOWN and UP buttons have to be pressed simultaneously.**
2) When APd=1 the load relay will close after AR time.
3) When APd=2 the load relay will close in 2 sec after power-on.

Simultaneously with the load relay closure, green LED LOAD starts to glow.

After the load relay closure and before the motor start (the moment of motor start is defined when the load current exceeds the level of 1,2 rated current), the monitoring and decision making for the voltage quality continue. If during the dead time inhibiting factors appear, then the load relay opens.

2.4.1.2. UBZ device operation after a fault-caused de-energizing

The UBZ device operation in such case is similar to the first start operation , but the load relay closure is not dependent on the APd parameter value.

2.4.2 The device operation after load relay closure and motor start (currents that exceed 10% of the motor rated current appear).

UBZ device provides monitoring for voltage and currents. The load relay will be open when any protection from table 2.7 trips, excluding:

-protection for voltage;

-protection for maximum current when i = n =1 (in such case the overload indication is present, but the load relay does not open).

Control of exceeding currents is conducted concerning the current In. If S2S=0 (list 1.4) and closed and opened contacts on terminals 49, 50 (file 2.1), In becomes the meaning of nominal current "Id1" - list 1.4 or "Id2" list 1.4.

To exclude false protection tripping for motor currents that are caused by switching surges at time of transfer from one speed to the other, "t12" parameter is introduced. If time after the moment of switching from one speed to the other is less than the 't12 value, then zero sequence current (iOP) is considered to be zero, and phase currents that are higher than the corresponding rated motor current are considered equal to the rated motor current (id2 when switching to higher speed or id1 when switching to lower speed).

The indicator can display either motor phase current (A) or a user-selected parameter value. The value of the user-selected parameter can be displayed either constantly (SiC=0), or within 15 sec, and then motor phase current (A) (SiC=1) indication is back.

2.4.3 Signal relay operation.

The relay contacts are closed in case of any fault specified in Table 2.7.

Note: When signal relay is closed, then contacts **1-2** are open, and contacts **2-3** are closed.

2.4.4 Work with RS-485 interface under MODBUS protocol in RTU mode.

The UBZ device allows for data exchange with an external device via serial interface under MODBUS protocol. During data exchange via RS-485 or RS-232 blue LED "*ОБМЕН" "EXCHANGE"* glows.

2.4.4.1 Communication parameters:

- device address: 1-247 (rSA parameter);
- data transfer speed: 9600 baud, 19200 baud (rSS parameter);
- reaction to loss of carrier: warning and continue operation, warning and motor stall, continue operation without warning (rSP parameter);
- response timeout detection: 1sec –120sec (rSO parameter);
- transmission word format – 8 bit, no parity check, two stop bits.

2.4.4.2 UBZ control from PC

Communication between PC and UBZ is fulfilled through serial interface. The connection diagram is shown in Fig. Each UBZ device has an individual communication address. PC controls each UBZ device recognizing them by their address.

UBZ can operate within RTU mode controlled Modbus networks.

2.4.4.3. Communication protocol

Data packet exchange between PC and UBZ is established. Data packet format is given in Table 2.1.

Table 2.1

START	silence interval – over 2msec at 9600 baud transfer rate, or over 4 msec at 19200 baud transfer rate
ADR	UBZ device communication address (8 bit)
CMD	Command code 8 bit
DATA (n-1)	Data contents: N*8 data bit (n<=24)
….	
DATA 0	
CRC CHK low	CRC checksum 16 bit
CRC CHK high	
END	silence interval – over 2msec at 9600 baud transfer rate, or over 1.6 msec at 19200 baud transfer rate

2.4.4.4 CMD (command code) and DATA (data symbols)

Data symbols forma depends on command codes.

Command code –0x03, n-words read.

For example, read 2 continuous words swapped from 2102H UBZ initial address with 01H communication address (Table 2.2)

Table 2.2

Command message		**Response message**	
ADR	0x01	ADR	0x01
CMD	0x03	CMD	0x03
Start data address	0x21 0x02	Data amount, bytes	0x04
Data amount in words	0x00 0x02	Data contents by address	0x17 0x70
CRC CHK low	0x6F	Data contents by address	0x00 0x00
CRC CHK high	0xF7	CRC CHK low	0xFE
		CRC CHK high	0x5C

Command code 0x06, record – one word

Use of the given command is not recommended, as record of the incorrect data can lead to refusal UBZ.

Data recording is possible only pointed programmable parameters (list 1.4), except for tabulated parameters 2.3.

Table 2.3

Adjustment and readable parameters	Key characterestics	Address
Device total time of working, days	tbU	193
Motor exploitation time ,days	tCO	194
User access code	LOC	195
Access code of skilled operator	PAS	196

Reconstruction of factory parameters	PPP	197
Device version	rEL	203

Parameters recording is independent from adjusted maintenance of skilled opearator.

By recording the new option setting into cell, that protected by РМКУП, parameter automatically come out from this mode.

Example: Recording 1000 (0x03E8) to register with address 0x00A0 to UBZ with communication address 01H (list 2.4).

Command code 08h – diagnostics.

08h function provides a number of tests for checking communication system between PC and UBZ device, and for UBZ integrity control.

The function uses the sub function field to specify the action performed (test).

Sub function 00h – data request return.

Data transferred in the request field must return in the response data field.

Request and response example is given in Fig. 2.3

Request

Address	Function	Subfunction HB	Subfunction LB	Data HB	Data HB	CRC LB	CRC HB
01h	08h	00h	00h	A0h	3Ch	98h	1Ah

Response

Address	Function	Subfunction HB	Subfunction LB	Data HB	Data HB	CRC LB	CRC HB
01h	08h	00h	00h	A0h	3Ch	98h	1Ah

Figure 2.3 - Example of sub function request and return 00h – data request return.

01h sub function – communication options restart

UBZ peripheral port shall be initialized and restarted.

Request and response example is given in Fig. 2.4.

Request

Address	Function	Subfunction HB	Subfunction LB	Data HB	Data HB	CRC LB	CRC HB
01h	08h	00h	01h	00h	00h	B1h	CBh

Response not returned

Figure 2.4 - Example of sub function request and return 01h – communication options restart.

2.4.4.5 CRC - Cyclic redundancy check code

The checksum (CRC16) is a cyclic redundancy check code based on A001h polynomial. The transmitting device forms the checksum for all bytes of the message transmitted. The receiving device similarly forms the checksum for all bytes of the message received, and compares it to the checksum received form the transmission device. When received and transmitted checksums do not match, an error message is generated.

The checksum field size occupies two bytes. The checksum within message is transferred with low byte coming first.

The checksum is registered under the following algorithm:

1) load CRC register (16 bit) with units (FFFFh);
2) exclusive OR with first 8 bytes of message and CRC register contents;
3) offset the result one bit to the right;
4) if the offset bit =1, the exclusive OR of the register contents with A001h value;
5) if the offset bit=0, repeat step 3;
6) repeat steps 3, 4, 5 until 8 offsets have been completed;
7) exclusive OR with the next 8 bits of the message byte and CRC register contents;
8) repeat steps 3 – 7, until all bytes of the message have been processed;
9) the finite register contents will contain the checksum.

Here is an example of CRC code generation with use of C programming language. The function takes two arguments:

Unsigned char* data <- a pointer to the message buffer

Unsigned char length <- the quantity of bytes in the message buffer

The function returns the CRC value as a type of unsigned integer.

```
Unsigned int crc_chk(unsigned char* data, unsigned char length)
{int j;
 unsigned int reg_crc=0xFFFF;
 while(length--)
  {
    reg_crc ^= *data++;
    for(j=0;j<8;j++)
     {
       if(reg_crc & 0x01)   reg_crc=(reg_crc>>1) ^ 0xA001;  // LSB(b0)=1
          else reg_crc=reg_crc>>1;
      }
  }
       return reg_crc;
       }
```

2.4.4.6 Register addresses

The addresses of the measured and calculated parameters of the UBZ device are given in table 1.3. The addresses of the programmable parameters are given in table 1.4.

Additional registers and their functions are shown below in table 2.5

Table 2.5

Description	Address	Application		Comment
UBZ status register 240		Bit 0	0-no fault 1- fault (fault code in register 241)	
		Bit 1	0- load relay open 1- load relay closed	
		Bit 2	0- functional relay open 1- functional relay closed	
		Bit 3	0 – restart not activated 1- AR expected	
		Bit 4	0- low speed 1- high speed	
		Bit 5	reserved	
		Bit 6	0- MSPM mode disabled 1- MSPM mode enabled	
ault register 1	241	bit mapping shown in table 2.7		0 - no fault
Fault register 2	242	bit mapping shown in table 2.7		1 - fault
Fault log				
Fault code 1	243	fault code according to table 2.7		
value of parameter 1	244	parameter value according to table 2.7		
Fault time 1	245	two upper bytes		
	246	two lower bytes		
Fault code 2	247	fault code according to table 2.7		
value of parameter 2	248	parameter value according to table 2.7		
Fault time 2	249	two upper bytes		
	250	two lower bytes		
Fault code 3	251	fault code according to table 2.7		
value of parameter 3	252	parameter value according to table 2.7		
Fault time 3	253	two upper bytes		
	254	two lower bytes		
Fault code 4	255	fault code according to table 2.7		
value of parameter 4	256	parameter value according to table 2.7		
Fault time 4	257	two upper bytes		
	258	two lower bytes		
Fault code 5	259	fault code according to table 2.7		
value of parameter 5	260	parameter value according to table 2.7		
Fault time 5	261	two upper bytes		
	262	two lower bytes		

2.4.4.7 Communication error handling

When an error situation occurs at time of a frame receipt (parity error, frame error, checksum error), the UBZ device does not return a response.

When an error occurs in the format or in the value of the data transferred (unsupported function code, etc.), UBZ received the request frame and forms a response with the error indicator and code. A high-order function field bit inserted in the unit serves as error indicator. A separate field in the response is allocated for the error code. A response example is given in Fig. 2.5. Error codes are shown in Table 2.6.

Request – 30h function not supported

Address	Function	Data	CRC LB	CRC HB
01h	30h		XXh	XXh

Response

Address	Function	Data	CRC LB	CRC HB
01h	Boh	01h	94h	00h

Figure 2.5 - Example of after-error response.

Table 2.6

Error code	Title	Description
01h	ILLEGAL FUNCTION	Function code received cannot be processed by UBZ
02h	ILLEGAL DATA ADDRESS	Data address in the request is not accessible by the given subordinate
03h	ILLEGAL DATA VALUE	Value contained in the request data field is not a valid value for UBZ
04h	SLAVE DEVICE FAILURE	While UBZ attempted to perform the requested action, unrecoverable error occurred
05h	ACKNOWLEDGE	UBZ accepted request and is processing it, but it requires a long time. Such response prevents master from timeout error generation.
06h	SLAVE DEVICE BUSY	UBZ device is busy with command processing. Master must repeat message later when the slave is free.
07h	NEGATIVE ACKNOWLEDGE	UBZ cannot perform the program function received in the request

2.4.5 Fault conditions system

In case of fault condition occurrence, the UBZ device performs following actions:

- mnemonic indicator displays error code according to Table 2.7;
- value indicator displays value of the faulty parameter (if given fault does not have numeric value, the indicator displays "---");
- red LED FAULT lights (glows continuously if AR will not initiate, and flickers if AR is expected);
- load relay opens;
- signal relay closes

If UBZ defines several types of faults simultaneously, the error codes and parameter values are displayed consecutively, one after one.

When AR is permitted, the indicator displays fault codes and time left till AR (if thermal overload delay time exceeds the AR value, the delay time is displayed).

Table 2.7 - Fault codes

Fault description	Fault mnemonic	Parameter value	Parameter value register address	Fault code	Register address bit #
maximum phase current fault	Ai =	maximum phase current	300	1	241:0
thermal overload fault	Adt		301	2	241:1
against line-to-earth fault (based on zero sequence current)	A0i	zero sequence current	302	3	241:2
excess rate of current negative sequence ratio relative to voltage negative sequence ratio	Aci	ratio	303	4	241:3
negative-sequence current fault	A2i	negative sequence current	304	5	241:4
minimum phase current fault	Ai =	absent	305	6	241:5
Long lasting start	APP		306	7	241:6
rotor block	APb		307	8	241:7

phase sequence order fault	АUЧ		308	9	241:8
currents present when load relay is de-energized (contactor fault)	ACo	current	309	10	241:9
minimum line voltage fault	AU $_{=}$	voltage	310	11	241:10
maximum line voltage fault	AU $^{=}$	voltage	311	12	241:11
phase imbalance fault	AU ^{П}	imbalance	312	13	241:12
minimum resistance protection of motor winding insulation fault	Ari	insulation resistance	313	14	241:13
remote control channel fault	Adu			15	241:14
emergency motor stall, automatic restart not possible	EAd			16	241:15
emergency motor stall, automatic restart possible by simultaneous pressing buttons UP and DOWN	EOd			17	242:0
Upon reaching the threshold of first sensor temperature	At1	Temperature in degrees	308	18	242:1
Upon reaching the threshold of second sensor temperature	At2	Temperature in degrees	309	19	242:2
By short circuit to temperature sensor	EoS			20	242:3
By loss temperature sensor 1	Eoo			21	242:4
By short circuit to temperature sensor 2	EoS			22	242:5
By loss temperature sensor 2	Eoo			23	242:6

2.4.6 Faulty conditions log

When load relay in case of fault opens, the UBZ device stores the fault code, the parameter value, and time of occurrence.

NOTE: Time of fault is defined by the device's internal clock. As UBZ device has no integral power source, the time when the device was not powered, is not accounted.

Number of synchronously stored fault codes is five. When next following faults occur, the information of this fault is recorded over the latest fault.

To view log press RES/MEM/SEL button.

The SETUP LED will start to flicker, and the device's indicator panels will display line 1 from Table 2.8. Log scrolling performed with UP and DOWN buttons.

To exit log view mode press RES/MEM/SEL button, or the log will close automatically after 30 sec since last button was pressed.

Fault information is displayed on UBZ device indicators as shown below in table 2.8.

Table 2.8

Mnemonic indicator output	Value indicator output
"Adi"	number of log record (1- latest record)
XXX – fault mnemonic according to table 2.6	YYY - parameter value according to table 2.6 (if parameter value is negative, "---" is displayed)
XXX - hours since fault	YY - number of minutes since fault occurrence

2.4.7 Motor control with use of UBZ front panel

Depending on the ACd parameter value, the load relay can be controlled by pressing buttons UP and DOWN simultaneously (unless UBZ device is in keypad lock-up mode):

ACd=0 – no reaction;

ACd=1 (motor start permitted) – load relay will close, if AR time has not expired;

ACd=2 (emergency motor halt) –load relay will open and produce "AAd" fault code. Motor restart is possible after disconnecting and re-connecting power to UBZ device.

ACd=3 (motor start and stall permitted) – load relay will open and produce "AOd" fault code. To close, press UP and DOWN buttons again.

3 MAINTENANCE AND SAFETY PRECAUTIONS

3.1 SAFETY PRECAUTIONS

UNPLUG THE UNIT BY DISCONNECTING THE POWER CORD FOR TROUBLESHOOTING, MAINTENANCE, OR INSTALLATION WORKS.

Never attempt to operate UBZ-301-01 with the mechanical damage of the housing.

Do not operate the unit under conditions of high humidity.

Installation, adjustment and maintenance of the unit should only be provided by the qualified personnel, having reviewed this Operating manual.

3.2 ORDER OF MAINTENANCE

Recommended interval of maintenance is each 6 months.

Maintenance scheduled operations consist of visual observation, during which wiring connection to terminals is checked, frame and casing integrity check for cracking and chipping.

4. TRANSPORTATION AND STORAGE

The device in manufacturer package should be stored in enclosed rooms at –45° -- +70°C and exposed to no more than 80% of relative humidity when there are no fumes in the air that have a damaging effect on package and the equipment material. The customer shall provide for the UBZ-L equipment protection against mechanical damage while in transit.

10 WARRANTY AND CLAIMS CONDITIONS

Warranty period is 36 month upon the day of sale.

The manufacturer shall repair the unit, in the compliance with the operating manual by the user, within the warranty period.

UBZ-301-01 is not subject to the warranty service in the following cases: expiry of the warranty period;

availability of mechanical damages;

attempts to open and repair;

traces of moisture attack or in the presence of foreign items inside the unit:

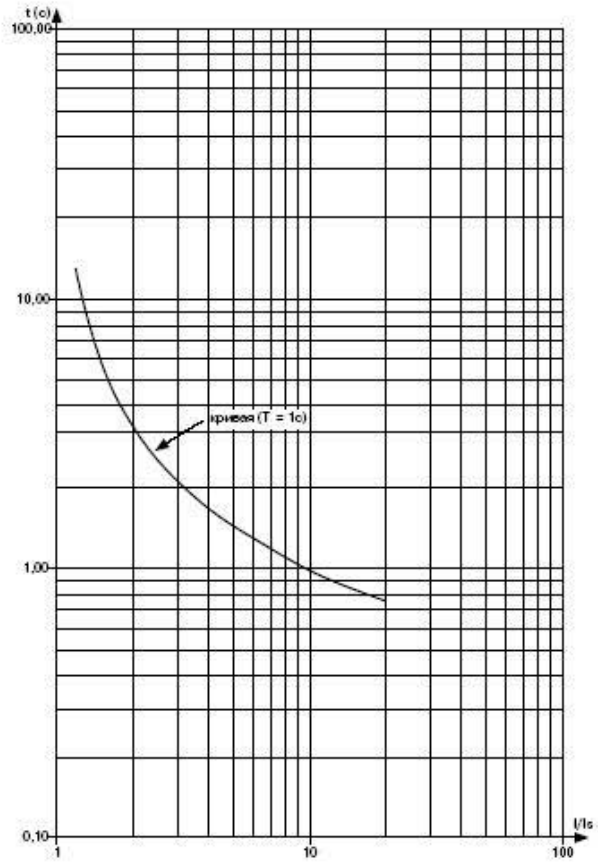
damage is caused by electric current or voltage in excess to the permissible values as indicated in the Operating manual

Warranty service is provided in the place of purchase Post-warranty service shall be provided by the manufacturer.

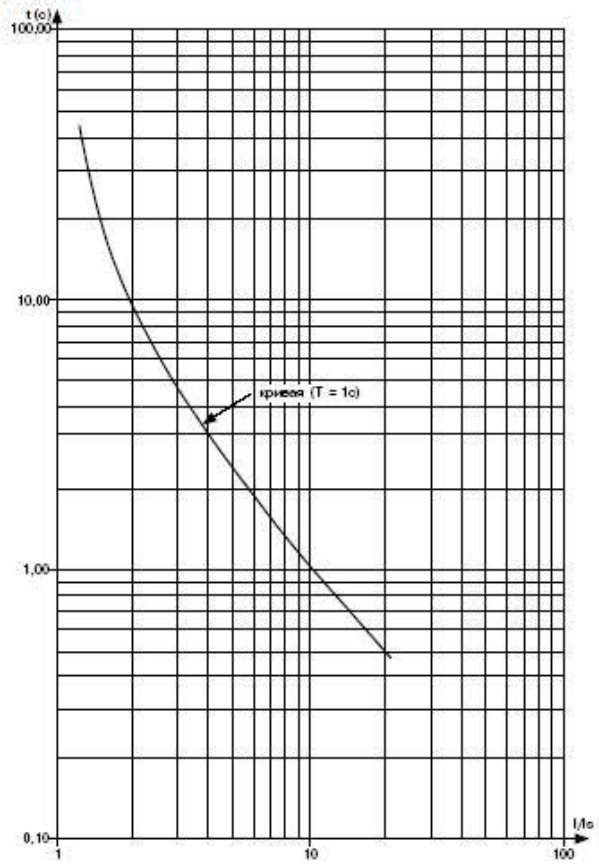
The manufacturer's warranty does not cover compensation for direct or indirect losses associated with the unit transportation to the place of purchase or manufacturer’s plant.

APPENDIX 1 - Dependent time delay current based protection types:

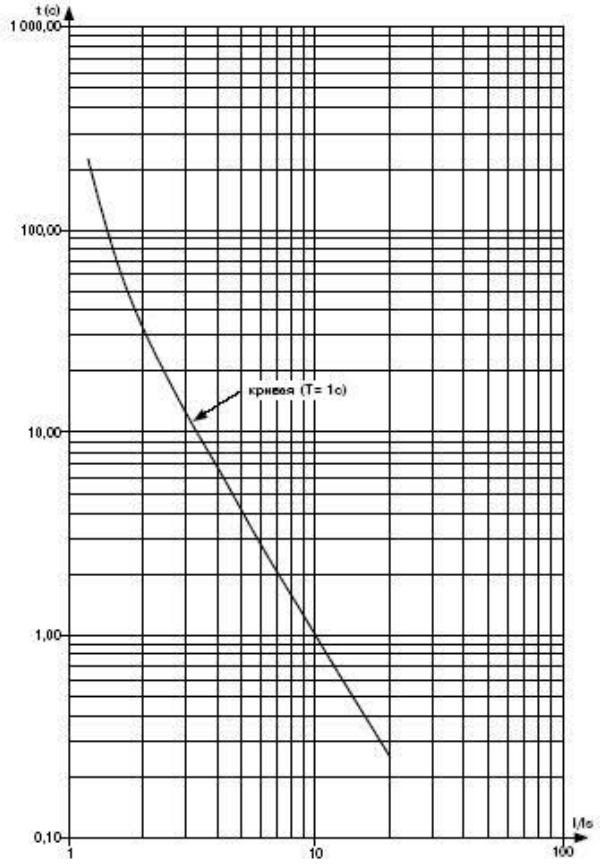
SIT - reverse dependent standard time delay curve;



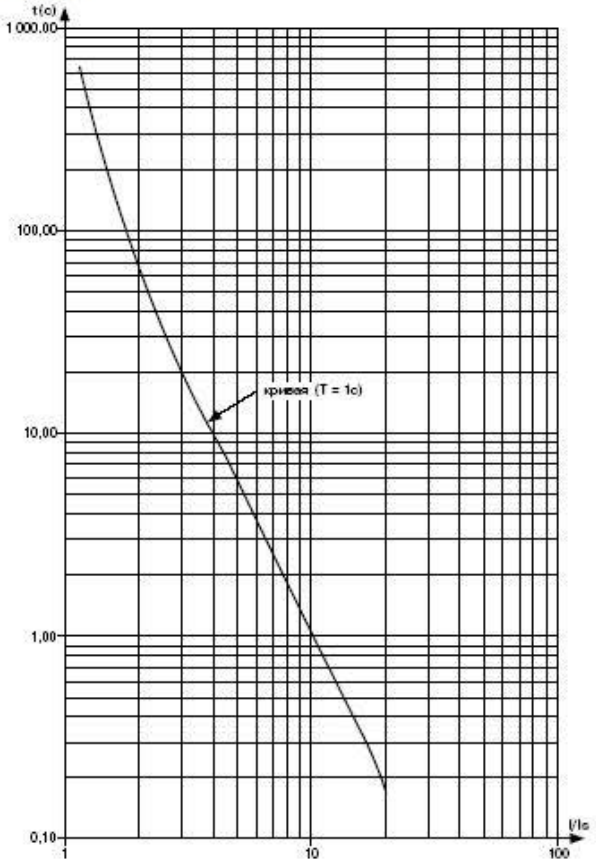
VIT very much reverse dependent curve or LTI – lengthy reverse dependent time delay curve



EIT – extremely reverse dependent time delay curve;



UIT – ultra reverse dependent time delay curve;



RI – time delay curve