NOVATEK-ELECTRO LTD
Research-and-Manufacture Company

MCK-102-14

TEMPERATURE CONTROLLER FOR THE OPERATION BY MIDDLE TEMPERATURE AND DEEP-FREEZING MACHINES WITH AUTOMATIC DEFROST FUNCTION

SERVICE MANUAL

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1 APPLICATION

Temperature controller MCK-102-14 (hereinafter MCK-102-14) is designed for the control and operation by deep-freezing machines, commercial refrigeration displays, monoblock units and other similar refrigeration equipment.

Basic functions that performs MCK-102-14are the following:

- temperature control over refrigerated zone;
- automatic defrost by turning **OFF** the compressor for certain time adjusted by user;
- compressor protection from voltage drops and unallowable voltage fluctuations – this is achieved by permanent control of the acting voltage measurement and control;
- automatic restart of the compressor when the voltage parameters returned back to normal values after the voltage interruption. Auto-restarting time delay could be adjusted by user as necessary.
- digital filtration of signal is added from the sensor of temperature (menu item "CFP").

ATTENTION! If MCK-102-14 is powered by 24V DC, then the power supply unit must necessarily be galvanically isolated from mains 220V/50Hz voltage (it should withstand testing RMS voltage of 1500V during 1 minute).

Please also pay attention that in case of powering the MCK-102-14 with 24V DC the voltage monitoring function should necessarily be disabled (parameter U0 1 should be set to "0").

N o t i c e - *On special request it is possible to supply the programming device for the MCK-102-11 to change default factory settings.*

2 MAIN FEATURES

- Analog input for connection of the NTC temperature sensor with reinforced insulation for the precise temperature control in refrigerated zone;
- Temperature measurement discrimination – 0,1 ^{o}C;
- Normally open relay output for the operation by refrigeration compressor – 250V 16A at cosφ=1;
- Accuracy for the measurement of voltage tripping thresholds – not more than 3V;
- Rated power supply voltage: Single phase ~240V, 50 Hz or alternatively –24V DC (±10%);
- Maximal allowed operational voltage is up to 400V 50 Hz;
- Rated power is not more than 5W;
- Frontal side protection degree: IP65;
- Wiring terminals protection degree: IP20;
- Operational temperature range: from –35 to +55 ^{o}C;
- Storage temperature: from –45 to +65 ^{o}C;
- Weight: not more than 150 grams;
- Wall mounting position – arbitrary as per requirement;
- Control knobs, dimensions and wiring diagram are shown on Figure 1.
- Program version – 14.

3 INSTALLATION AND START UP PROCEDURES

3.1 MCK-102-14 should be installed into the case of refrigeration installation or any other suitable place that excludes the ingress of moisture inside the case of MCK-102-14.

During installation special attention should be paid so that all wiring connections must be fixed well such a way to avoid twisting and abrasion of the wires.

4 PREPARING FOR OPERATION

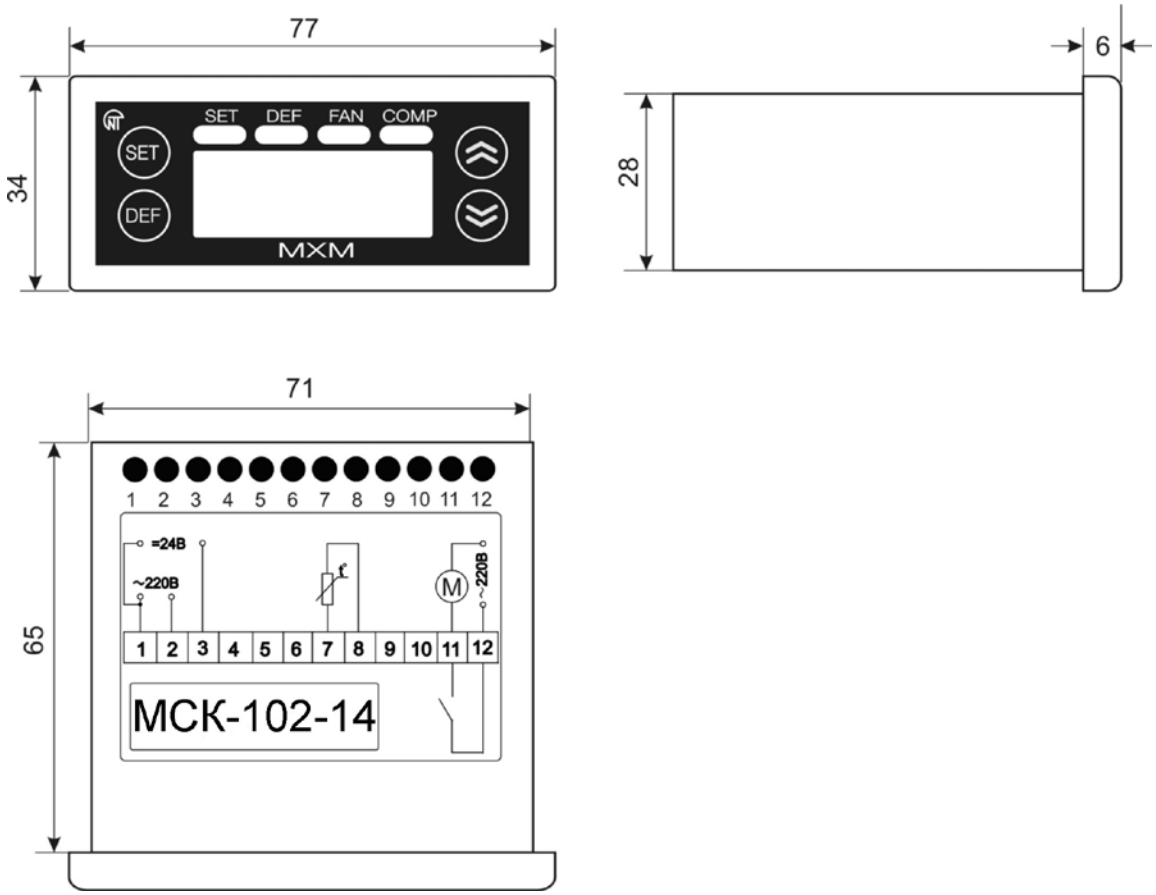
4.1 Connect compressor and temperature sensors to corresponding terminals of MCK-102-14 as shown one Figure 1.

If the rated power of the compressor is more than 1000W or three phase compressor is being used in refrigeration installation – then the MCK-102-14 should operate with compressor via contactor. So that MCK-102-14 will operate with the magnetic coil of the contactor of corresponding rated parameters and contactor in its turn will commutate (turn **ON**/**OFF**) the compressor.

4.2 Connect power supply wires to the MCK-102-14.

4.3 Turn **ON** the power and adjust all necessary parameters and operation modes in accordance with Table 2.

ATTENTION! All wiring connections must be performed only on fully deenergized device.



LED **COMP** is ON when the compressor is working;
LED **DEF** is ON at the process of defrost;
LED **SET is** ON at the moment of adjusting the required parameters

Figure 1 - Front panel, wiring diagram, operation knobs and outer dimensions of MCK-102-14.

N o t e: ⌃⌃ button hereinafter in text – "**UP**", ⌄⌄ button – "**DOWN**"

5 OPERATION GUIDELINES

5.1 Initially MCK-102-14 digital display shows current temperature in refrigerated chamber.
5.2 **Operation by** the MCK-102-14 should be performed as follows:
- On pressing **UP** and **DOWN** buttons simultaneously on the digital display within 5 seconds will be indicated Set Point temperature (**SP**), and then within 5 seconds will be shown voltage value on the input of the MCK-102-15;
- **DEF** button should be pressed to start the defrost ahead-of-schedule or premature stop the defrost and switch to thermostat mode;
- **SET** button is used to enter to setting menu to view and adjust necessary parameters.
- To view and change any parameter **SET** button should be pressed and LED indicator "SET" will turn **ON**. To scroll the parameters use **UP** and **DOWN** buttons. To change the parameter value press **SET** button again and set the required value using **UP** and **DOWN** buttons. To save the parameter and return back to menu press **DEF** button. To exit menu without saving press **SET**.

If none of the buttons are pressed within 15 seconds MCK-102-14 automatically return to its initial state.
5.3 **To restore default factory settings quickly** it is necessary to take the following actions:
a) Press **UP** and **DOWN** buttons simultaneously and while keeping the buttons pressed turn ON power supply to the MCK-102-14;

b) Keep buttons pressed not less than 2 seconds and then release the buttons;
c) On the display should appear "**nAU**";
d) Then turn OFF the MCK-102-14. Default factory settings are successfully restored.

6 OPERATION MODES

6.1 MCK-102-14 has 3 modes of operation: thermostat mode; defrost mode and the mode to control and set the required parameters.

6.2 THERMOSTAT MODE

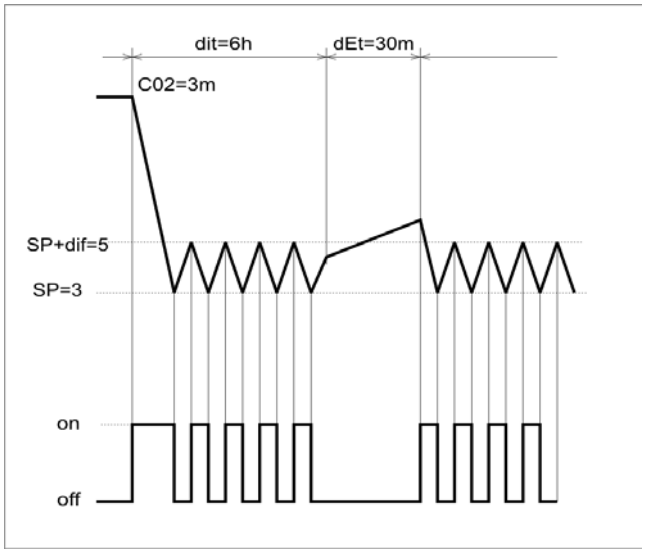
6.2.1 In thermostat mode of operation MCK-102-14 maintains necessary user-specified temperature inside the refrigeration chamber by operating the compressor. Please see below the scheme showing how MCK-102-14 relay output contacts operate by compressor depending on time and temperature inside the refrigeration chamber (scheme is shown for the default factory settings).

6.2.2 Compressor operation. Parameters **SP** (setting point) and **dif** (differential) determine the temperature conditions in refrigerated chamber. If temperature value becomes higher then **SP**+**dif** then the compressor will turn ON and will keep working until the temperature reaches the value of **SP** parameter.

In case of malfunction or failure of the temperature sensors MCK-102-11 operates with the compressor in alarm mode using parameters **COn** and **COF** which determine the time intervals for ON/OFF state of the compressor. This alarm situation is indicated by alarm codes **Er2** or **Er3** shown on display.

6.3 DEFROST MODE

To perform the defrost of the refrigerated chamber MCK-102-14 turns OFF the compressor for the user preset time (parameter dEt). Time interval between defrosts is determined by parameter d it.



C02 – turn ON time delay for the compressor
d it – thermostat mode duration time
dEt – defrost time

SP –setting point temperature adjusted by user
d iF – differential

relay of **MCK-102-14**

6.4 FIRST START UP FEATURES

When power supply is given to the input terminals of the MCK-102-14 on the display it is shown StA within first 5 seconds. Then further MCK-102-14 operation algorithm will depend on the value of U0 1 and dP0 parameters.

If U0 1=1 □□□

- if dP0=0 then after time defined by parameter tPP+30 seconds MCK-102-14 will switch to thermostat mode;
- if dP0=1 then after time defined by parameter tPP+30 seconds MCK-102-14 will switch to defrost mode.

The first switching ON compressor will happen not early than time of autoreclosing (parameter tPP**)** or time of no load trip of compressor (parameter 02) depending on whether which time is more.

If U0 1=0 autoreclosing time delay is equal 0.

7 SYSTEM OF CONTROL OVER ALARM STATES

In thermostat mode MCK-102-14 permanently controls so that the temperature inside refrigeration chamber will not go out the preset limits (parameters **LAL** and **HAL**). These parameters are not under control during defrost mode and in case of voltage interruptions.

To disable premature alarm signalization about temperature alarm situations the following parameters are used: tAO, PAO and dAo.

If voltage monitoring mode is enabled (parameter UO I=1) – then MCK-102-14 performs permanent control over the voltage parameters in all modes of operation. If unallowable voltage levels are detected MCK-102-11 turns the compressor OFF.

In case of removal emergency situation on voltage the MCK-102-14 begins processing of program from start.

All alarm situation codes are shown in table 1 below:

Fault signals on the indicator		Alarm signals on the indicator	
[illegible]	**Er1**	[illegible]	A--
[illegible]	**Er2**	[illegible]	A--
[illegible]	**Er3**	Minimal voltage	U--
		Maximal voltage	U--

8 PROGRAMMABLE PARAMETERS AND ADJUSTABLE FUNCTIONS

Table 2

Parameters and functions	Display indication	Min. value	Max. value	Default settings	Actions
Temperature operation setting point, °C	SP	-45	50	3	Temperature value should be adjusted by user as per requirement
Thermostat mode	In thermostat mode compressor turns ON when the temperature reaches the value of **SP**+**diF**. Compressor turns OFF when the temperature reaches the value of **SP**				
Differential, °C	diF	1	20	3	The difference value between Setting Point (**SP**) temperature and the temperature when the compressor should turn ON
Temperature sensor calibration, °C	CA1	-9,9	9,9	0	Scale offset to the value of **CA1** in reference to the value measured by temperature sensor
Temperature indication	itt	0	1	0	0-value indication without decimal units 1-value indication with decimals
Signalization					
The way to set alarm temperature: 0 – absolute value 1 – relative value basing the set point	Att	0	1	1	Interpretation of the **HAL** and **LAL** parameters **Alarm indication turns ON depending the mode values:** 0 – when the temperature value reaches **HAL** or **LAL** thresholds 1 – when upper temperature reaches SP+ diF+HAL or lower temperature reach SP-LAL
Deviation of positive temperature	HAL Att=0 Att=1	 **LAL** +1	 50 50	 10	
Deviation of negative temperature	LAL Att=0 Att=1	 -45 1	 **HAL**-1 50	 10	

Parameters and functions	Display indication	Min. value	Max. value	Default settings	Actions
Time delay in case of temperature alarm situation, min	tA0	0	90	30	
Time delay for the temperature alarm after turning ON, hours	PA0	0	48	2	
Time delay for the temperature alarm after defrost, hour	dAo	0	10	1	
Compressor					
Minimal operation time for the compressor, min	c01	1	15	1	Protection against frequent turns ON
Minimal pause between consequential turns ON of compressor, min	c02	1	15	4	Protection against frequent turns ON
Compressor turn ON time in case of the temperature sensor fault, min	COn	5	120	10	
Duration of the OFF state of the compressor in case of the temperature sensor fault, min	COF	5	120	10	
Compressor protection from temperature sensor fault	cPP	0	2	2	0 – compressor permanently OFF 1 – compressor permanently ON 2 – operation using COn and COF parameters
Defrost					
Time interval between defrosts, hours	d it	1	48	6	
Method of the Timing countdown between defrosts	dCt	0	2	0	1- DG-Frost method when the defrost starts (**dit**) depending the total operating time of the compressor 0 – basing the real time – the frequency of defrosts depend basing the real time. Thus time interval between 2 defrosts will be the same 2- compressor shut down; defrost starts every time when compressor turns OFF
Maximal duration of the defrost, min	dEt	0	180	30	
Display indication during defrost	ddL	0	3	1	0 – actual temperature 1 – temperature at the beginning of the defrost 2 – value of Setting point (**SP**) 3 – indication "dEF"
Start of the defrost after turning ON	dP0	0	1	0	0 – No 1 – Yes

Parameters and functions	Display indication	Min. value	Max. value	Default settings	Actions
Voltage control and timing settings					
Voltage monitoring relay function	U01	0	1	1	0 – voltage control disabled 1 – voltage control enabled
Minimal voltage, V	U--	185	210	185	
Maximal voltage, V	U--	220	285	245	
Autoreclosing time delay, sec	tPP	1	600	300	
Tripping time delay when voltage becomes lower than minimal voltage threshold, sec	t--	1	30	12	
Tripping time delay when voltage becomes higher than maximal voltage threshold, sec	t--	1	30	1	
Other notes					
Program version	**rEL**			11	
Reaction time of digital filter of temperature sensor					Set bigger value for electrical noises on sensor circuits of temperature or big non uniformity air temperature variation.

ATTENTION!!!

In case of significant voltage decrease more than 30V MCK-102-14 has fixed tripping time delay of 1 second to protect the equipment from serious voltage drops.

9 STORAGE AND SHIPPING CONDITIONS

The MCK-102-14 in manufacturers package should be stored in enclosed rooms with ambient temperature from -45 to +75°C and exposed to not more than 80% of relative humidity. There should be no fumes in the air that may exert a deleterious effect on package and the internal MCK-102-14 components.

The Buyer must provide the protection of the relay against possible mechanical damages in transit.

9 WARRANTY

Novatek-Electro LTD. company warrants a trouble-free operation of the MCK-102-14 device within 36 months from the date of sale, on condition that following terms are provided:

-- the proper connection;

-- the safety of the inspection quality control department seal;

-- the integrity of the case, no traces of an opening, cracks, spalls etc.

10 QUALITY ASSURANCE NOTES

[illegible] MCK-102-14 [illegible]

[illegible] _____ [illegible] _____

[illegible] _____ [illegible] _____