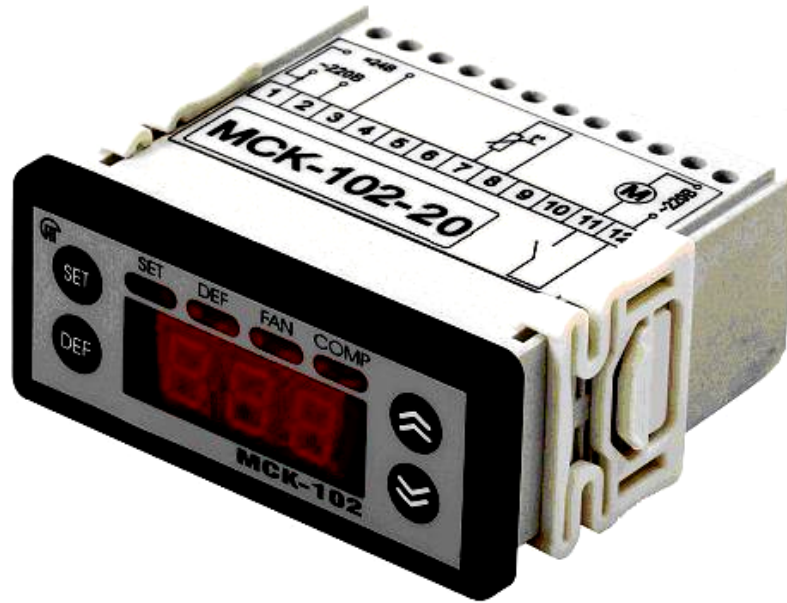
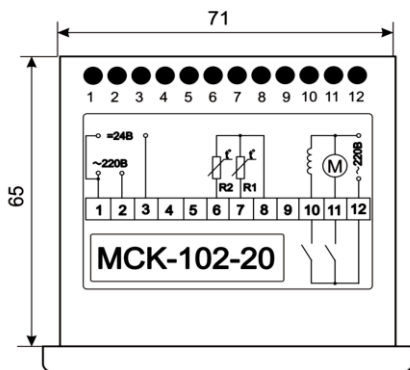
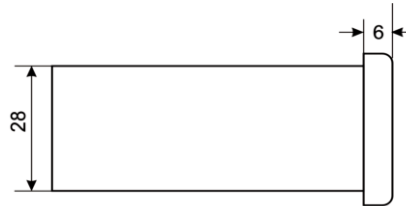
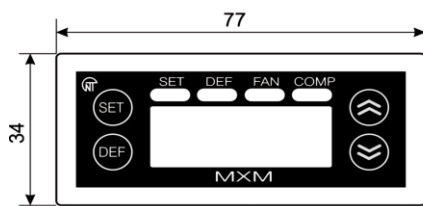


MCK-102-20
TEMPERATURE CONTROLLER FOR THE OPERATION BY MIDDLE
TEMPERATURE AND DEEP-FREEZING
MACHINES WITH AUTOMATIC DEFROST FUNCTION



SERVICE MANUAL



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

Note:
 ⤴ button hereinafter in text – “UP”, ⤵ button – “DOWN”

Figure 1 - Front panel, wiring diagram, operation knobs and outer dimensions of MCK-102-20.

1 THE DESCRIPTION AND OPERATION

1.1 APPLICATION

Temperature controller MCK-102-20 (hereinafter MCK-102-20) 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-102-20 are the following:

- control of compressor for maintaining of assign freezer temperature;
- monitor freezer and evaporator temperature;
- automatic defrost by electric heater or by hot gas;
- 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.

ATTENTION! If MCK-102-20 is powered by 24V DC, then the power supply unit must necessarily be galvanically isolated from mains voltage (it should withstand testing RMS voltage of 1500V during 1 minute).

Please also pay attention that in case of powering the MCK-102-20 with 24V DC the voltage monitoring function should necessarily be disabled (parameter U_{D} I should be set to “0”).

Notice - On special request it is possible to supply the programming device for the MCK-102-20 to change default factory settings.

1.2 TECHNICAL FEATURES

1.2.1 Main technical features are in Table 1.1.

Table 1.1

Designation	Significance
Analog input for connection of the NTC temperature sensor with reinforced insulation for the precise temperature control in refrigerated zone	
Analog input for connection of the NTC temperature sensor with reinforced insulation for the precise temperature control in evaporator	
Normally open relay output for the operation by refrigeration compressor	250V 16A at $\cos\varphi=1$;
Normally open relay output for the operation by electric heater	250V 16A at $\cos\varphi=1$;
Temperature measurement discrimination, C	0,1
Rated power supply voltage	Single phase ~240V 50 Hz or alternatively –24V DC ($\pm 10\%$)
Maximal allowed operational voltage	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, °C	from –35 to +55
Storage temperature, °C	from –45 to +75
Weight: not more than	150 grams
Wall mounting position	arbitrary as per requirement

1.2.2 Programmable parameters and adjustable functions are in table 1.2.

Table1.2

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 $SP+d$ °C. Compressor turns OFF when the temperature reaches the value of SP				
Differential, °C	d °C	1	20	2	The difference value between Setting Point (SP) temperature and the temperature when the compressor should turn ON

Parameters and functions	Display indication	Min. value	Max. value	Default settings	Actions
Temperature sensor calibration, °C	<i>CA1</i>	-9,9	9,9	0	Scale offset to the value of <i>CA1</i> in reference to the value measured by temperature sensor
Temperature sensor calibration of evaporator, °C	<i>CA2</i>	-9,9	9,9	0	Scale offset to the value of <i>CA2</i> in reference to the value measured by temperature sensor of evaporator
Reaction time of digital of temperature sensor	<i>CFP</i>	5	60	10	Set bigger value for electrical noises on sensor circuits of temperature or big non uniformity air temperature variation
Signalization					
The way to set alarm temperature: 0 – absolute value 1 – relative value basing the set point	<i>Att</i>	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+ d rF+HAL or lower temperature reach SP-LAL
Deviation of positive temperature	<i>HRL</i> Att=0 Att=1	LAL +1	50 50	50 5	
Deviation of negative temperature	<i>LAL</i> Att=0 Att=1	-45 1	HAL-1 50	-45 5	
Time delay in case of temperature alarm situation, min	<i>tRD</i>	0	90	30	
Time delay for the temperature alarm after turning ON, hours	<i>PRD</i>	0	48	2	
Time delay for the temperature alarm after defrost, hours	<i>dRo</i>	0	10	1	
Compressor					
Minimal operation time for the compressor, min	<i>cD1</i>	1	15	5	Protection against frequent turns ON
Minimal pause between consequential turns ON of compressor, min	<i>cD2</i>	1	15	5	
Compressor turn ON time in case of the temperature sensor fault, min	<i>CDn</i>	5	120	20	
Duration of the OFF state of the compressor in case of the temperature sensor fault, min	<i>COF</i>	5	120	30	
Compressor protection from temperature sensor fault	<i>cPP</i>	0	2	2	0 – compressor permanently OFF 1 – compressor permanently ON 2 – operation using <i>CDn</i> and <i>COF</i> parameters

Parameters and functions	Display indication	Min. value	Max. value	Default settings	Actions
Compressor ON-time in refrigeration mode, hours	<i>CCt</i>	1	24	6	
Defrost					
Defrost method	<i>t dF</i>	0	2	0	0 - compressor is OFF, electric heater is ON 1 - hot steam defrost - compressor is ON, electric heater is ON 2 - compressor is ON, electric heater is OFF
Defrost stop temperature, °C	<i>dSt</i>	0	25	6	Temperature is measured on the evaporator
Time interval between defrosts, hours	<i>d It</i>	1	48	6	
Method of the Timing countdown between defrosts	<i>d Ct</i>	0	2	1	0 – basing the real time – the frequency of defrosts depend basing the real time. Thus time interval between 2 defrosts will be the same 1- DG-Frost method when the defrost starts (<i>d It</i>) depending the total operating time of the compressor 2- compressor shut down; defrost starts every time when compressor turns OFF
Maximal duration of the defrost, min	<i>dEt</i>	0	180	30	
First defrost start delay after the refrigeration mode has been completed, min	<i>dRF</i>	0	60	0	
Condensate drip-off time, min	<i>ddt</i>	0	90	3	
Defrost sensor	<i>d IQ</i>	0	1	1	0 – no; 1 - yes
Display indication during defrost	<i>ddl</i>	0	3	0	0 – actual temperature 1 – temperature at the beginning of the defrost 2 – value of Setting point (<i>SP</i>) 3 – indication “ <i>dEF</i> ”
Start of the defrost after turning ON	<i>dPO</i>	0	1	0	0 – No 1 – Yes
Defrost stop type	<i>EdF</i>	0	2	0	<i>EdF</i> =0 - according to time (parameter <i>dEt</i>) <i>EdF</i> =1 - when preset evaporator temperature is reached (parameter <i>dSt</i>) <i>EdF</i> =2 - according to time and temperature (depending on which of the parameter value is reached first).
Voltage control and timing settings					
Voltage monitoring relay function	<i>UOI</i>	0	1	1	0 – voltage control disabled 1 – voltage control enabled
Minimal voltage, V	<i>U--</i>	150	240	185	
Maximal voltage, V	<i>U--</i>	200	285	245	

Parameters and functions	Display indication	Min. value	Max. value	Default settings	Actions
Autoreclosing time delay, sec	tPP	1	600	10	
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					
Compressor ON time	tCO	0 u.	999 u.	0 u.	(1 unit == twenty four hours)
MCK-102-20 ON time	tBU	0 u.	999 u.	0 u.	(1 unit == twenty four hours)
Adjuster access code	PAS	0	999	123	
Program version	rEL			20	

2 USAGE

2.1 SAFETY

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

2.1.2 Mounting MCK-102-20 must be produced in the enclosure of refrigeration unit or other place eliminating hit of moisture into a device.

2.1.3 During setting the device in good all wires must be envisaged and their fastening must be executed so that it off-loaded explorers from mechanical damages from a wiring and protected the isolation of wires from elimination.

2.2 PRE-STARTING PROCEDURE

2.2.1 Connect compressor starter, electric heater, temperature sensors to the MCK-102-20 according to fig.1. If the rated power of the compressor is more than 500W or three phase compressor is being used – then the MCK-102-20 should operate with compressor via contactor.

2.2.2 Connect power supply wires to the MCK-102-20.

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

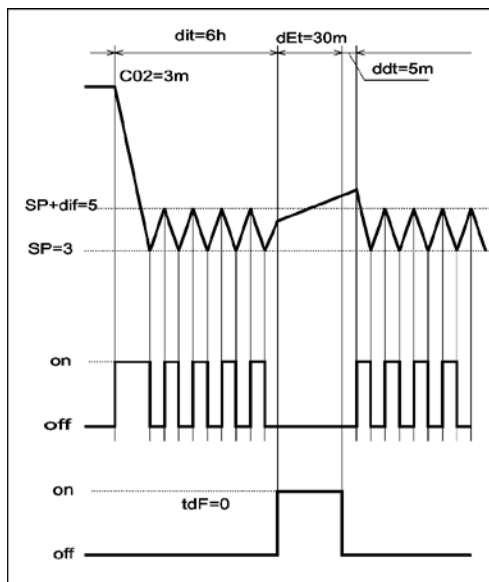
2.3 APPLICATION MCK-102-20

2.3.1 Operation modes

MCK-102-20 has 3 modes of operation: thermostat mode; defrost mode and refrigeration conditions.

2.3.1.2 Thermostat mode

In thermostat mode of operation MCK-102-20 maintains necessary user-specified temperature inside the refrigeration chamber by operating the compressor. Please see below the scheme showing how MCK-102-20 relay output contacts operate by compressor depending on time and temperature inside the refrigeration chamber (scheme is shown for the default factory settings).



tCO - compressor start delay

$d t$ – chamber temperature maintenance

dEt – defrost

ddt – drip- off

SP – setting (temperature set by user)

$d iF$ – differential

Compressor relay

Electric heater relay (defrost by the electric heater ($t dF=0$))

Parameters SP (setting point) and $d iF$ (differential) determine the temperature conditions in refrigerated chamber. If temperature value becomes higher then $SP+d iF$ 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-102-20 operates with the compressor in alarm mode using parameters CO_n and CO_F 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.

2.3.1.3 Defrost mode

The MCK-102-20 allows to specify defrost type, defrost stop type and between-defrost delay count method.

The defrost type can be specified according to EdF parameter:

$EdF=0$ - defrost by electric heater (compressor is off, electric heater is on);

$EdF=1$ - defrost by hot gas (compressor is on, electric heater is on);

$EdF=2$ - compressor is on, electric heater is off;

Defrost stop type is specified according to $dEdF$ parameter:

$dEdF=0$ - according to time ($dEEd$ parameter specifies defrost duration, min);

$dEdF=1$ - when preset evaporator temperature is reached ($dSEt$ parameter specifies defrost stop temperature, °C);

$dEdF=2$ - according to time and when preset evaporator temperature is reached (defrost stop is specified by $dEEd$ or $dSEt$ parameter depending on the parameter value which is reached first).

On defrost stop the MCK-102-20 starts time delay for condensate drip-off ($ddEt$ parameter). Besides, it's specified the fan start delay after defrost ($FdEt$ parameter, min). The compressor and the electric heater are also off. The label $5LI$ appears on the indicator.

At breakage of sensor of temperature of evaporator a report hatches on an indicator $Er4$ or $Er5$ and duration of defrosting is determined by a parameter $dEEd$.

2.3.1.4 Refrigeration conditions

In this mode of operation compressor is operate during the determined of parameter CCt . The FrE label appears on the indicator for the short time.

DEF button should be double pressed to premature stop refrigeration mode (first pressed button - start the defrost mode and second pressed button - stop defrost mode).

2.3.1.5 When the refrigeration mode or defrost be over the MCK-102-20 automatically turn to thermostat mode.

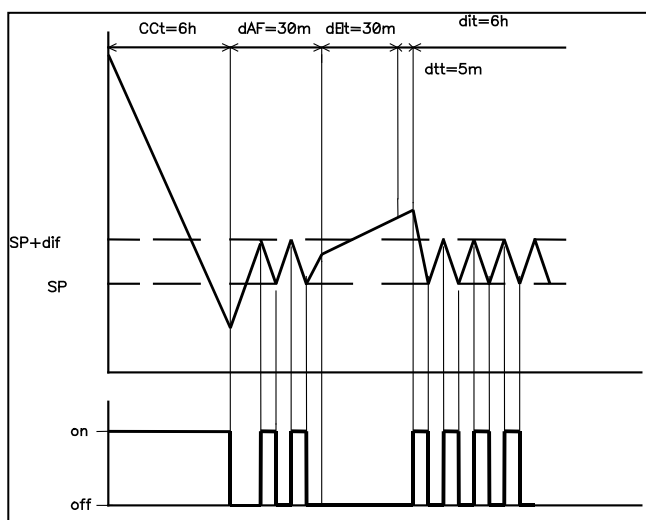
2.3.1.6 First start up features

When power supply is given to the input terminals of the MCK-102-20 on the display it is shown $5tR$ within first 5 seconds. Then further MCK-102-20 operation algorithm will depend on the value of dPD parameter:

if $dPD=0$ then after time defined by parameter $tPP+10$ seconds MCK-102-20 will switch to thermostat mode;

if $dPD=1$ then after time defined by parameter $tPP+10$ seconds MCK-102-20 will switch to defrost mode.

The MCK-1-2-20 operation diagram in the refrigeration conditions (for the parameter values preset by producer).



CCt parameter specifies the refrigeration time.

dAF parameter specifies the start-of-defrost delay, i.e. the time before the start of the first defrost after the refrigeration time has expired.

Compressor relay

2.3.2 The MCK-102-20 control levels

2.3.2.1 In the initial state the MCK-102-20 indicator displays an actual temperature of refrigerating chamber. The MCK-102-20 provides two control levels: adjuster level and user level. User level can be password-protected.

2.3.2.2 User level

Action of user necessary for the change of the modes of MCK-102 operation and viewing of parameters at the level of user transferred in a table 2.1.

2.3.2.3 Adjuster level

To access the adjuster level one needs to press and hold down SET button for 5sec. If the level is protected by a password, the label *PAS* appears on the indicator. Then press the SET button again. The «SET» LED lights up and the label «000» starts blinking on the indicator. Step-by-step enter three digits (from 1 to 9) of the adjuster password, pressing the DEF button on each digit entry. If the password is incorrect, the PAS label lights on (**S** is blinking), and the MCK-102 goes back to the initial state in 15 sec, otherwise the first parameter of the adjuster menu appears on the indicator;

The basic actions at operation from the menu in this mode are similar to operation from the menu at the adjuster level.

On the adjuster level the access to any user level parameter can be inhibited or permitted by simultaneous the SET and DOWN buttons pressing. If the access is inhibited a point indication appears on the right digital indicator when one is viewing the parameter value.

Table 2.1

To view and to change operation modes	Necessary action	Notes
Quickly viewing of the following parameters: temperature setting, <i>5P</i> ; evaporator temperature, <i>t5 l</i> ; operating value of power supply voltage; operation time of compressor; common time of MCK-102-20 operation	To view parameters one needs to press simultaneously the DOWN or the UP buttons, The parameters scrolling is performed by the DOWN and the UP buttons, To access a parameter it's necessary to press the SET button.	
To start defrost or to stop defrost ahead-of-schedule and to go into the thermostat conditions	By the DEF button pressing	
To start refrigeration conditions	By simultaneous the SET and DOWN buttons pressing	Short time lights up the <i>FrE</i>
To change and to view the user level parameters	To access a mode one needs to press the SET button at short time; Parameters scrolling is performed by the DOWN and UP buttons. To access a parameter one needs to press the SET button; Parameter changing is effected by the DOWN and UP buttons; To set the parameter and go back into the MENU one needs to press the DEF button.	then «SET» LED will glow. If no button is pressed during 15sec the MCK-102-20 goes into the initial state.
To view parameters which is locked at the adjuster level	Operation from the menu is similar, but record of new value of parameter is impossible	The same

2.3.2.4 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-102-20;
- b) Keep buttons pressed not less than 2 seconds and then release the buttons;
- c) On the display should appear "*nRU*";
- d) Then turn OFF the MCK-102-20;
- e) Default factory settings are successfully restored.

2.3.3 System of control over alarm state

In thermostat mode MCK-102-20 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.

To disable premature alarm signalization about temperature alarm situations the following parameters are

used: t_{RD} , P_{RD} and dR_{α} .

If voltage monitoring mode is enabled (parameter UD $l=1$) – then MCK-102-20 performs permanent control over the voltage parameters in all modes of operation. If unallowable voltage levels are detected MCK-102-20 turns the compressor OFF. When voltage parameters return back to normal values then further operation will depend on time elapsed since voltage interruption was detected:

- If this time is less then $t_{PP}+1$ minute then after the t_{PP} time MCK-102-20 will continue working in the same operation mode that it was running at the moment when voltage problem occurred;
- If this time is more than $t_{PP}+1$ minute then MCK-102-20 immediately begins its operation as if the device has just been turned ON

All alarm situation codes are shown in table below:

Table 2.2 - Fault codes

Fault signals on the indicator		Alarm signals on the indicator	
Fault in controller	Er1	High temperature	$A = =$
Disconnected refrigerating chamber sensor	Er2	Low temperature	$A = =$
Short-circuited refrigerating chamber sensor	Er3	Minimum voltage	$U = =$
Disconnected (evaporator) defrost sensor	Er4	Maximum voltage	$U = =$
Short-circuited (evaporator) defrost sensor	Er5		

3 MAINTENANCE

3.1 Safety precautions

ATTENTION! During maintenance Supply power MUST BE CUT OFF.

3.2 Order of maintenance

Recommended interval of maintenance is each 6 months.

Maintenance consists of visual examination, during which reliability of wires to MCK-102-20 clamps connections and absence of spalls and crack on the MCK-102-20 case must be check.

4 STORAGE AND SHIPPING CONDITIONS

The MCK-102-20 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-102-20 components.

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

5 WARRANTY

Manufacturer assures 10 years operation lifetime for the MCK-102-20. On the expiration of this time kindly contact to the manufacturer.

Novatek-Electro LTD. company warrants a trouble-free operation of the MCK-102-20 device within three years 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.

6 QUALITY ASSURANCE NOTES

Digital temperature relay MCK-102-20 was inspected and approved for the safe operation and use by the quality assurance department.