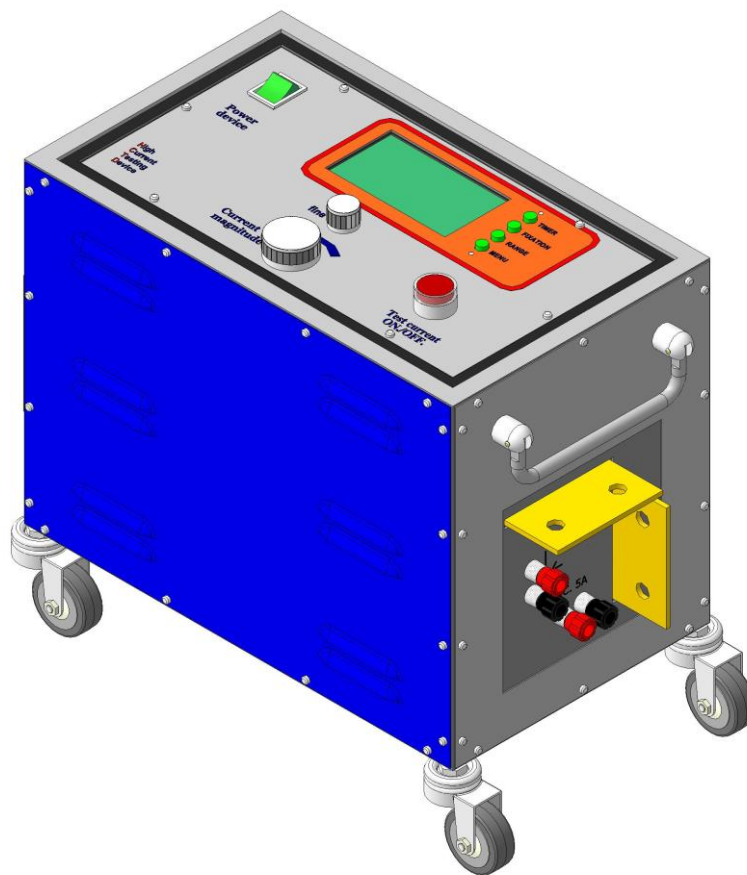


HCTD-10

High current testing device

User Manual



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1. Designation

Current injector for testing automatic circuit breakers (hereinafter referred to as "device") is intended:

1.1 to test the functionality and control of ampere-second characteristics of AC circuit breakers in the range of 20A up to 10kA, and measuring and storing of values of time and current flowing through the circuit breaker, hereinafter CB;

1.2 for the verification and certification of the current, measurement and protection current transformers with primary current;

1.3 for testing and calibration of current relays;

1.4 for testing and calibration of thermal current relays;

1.5 to check the fuses;

1.6 can be used as a source of regulated AC current up to 10kA in a low-impedance power circuits for laboratory works.

To ensure the electrical safety of personnel, conducting output circuits has galvanic (electric) isolation from the power line.

The voltage on the output lines of device with fully opened thyristor key is less than 7V, which is beneficial to the contacts of circuit breakers during the off the device - significantly reduce its wear during repeated tests.

User manual has following abbreviations:

CB – circuit breaker;

SVR - single-phase voltage regulator;

TRC - thyristor current regulator;

The manufacturer reserves the right to change the construction of the device without impairing its technical and operational characteristics, without notice to the user.

2. Technical parameters

2.1 Supply voltage, V*	380 ±10%
2.2 Frequency, Hz	50 - 60
2.3 Max voltage output on busbars, V	7
2.4 Max current on output busbars (rms), kA	11
2.5 Max power consumption of the device, kVA	55
2.6** Range True RMS of measurements and registration of output current, A, at reduced error ≤ 3%	20 - 11000
2.7 Range of measurements and registration of duration of output current, sec, at reduced error of such measurements ≤ 1,5%	0,01 - 9999
2.8 Temperature protection tripping, °C	96±5%
2.9 Dimensions, mm	480x250x310
2.10 Weight (without flexible busbars), kg, max	53
2.11 Lifespan, years	10

* You can power the unit from voltage 220V, but maximum output current will be 9 kA.

** Specifications correspond to the RMS values during operation the device with a single-phase voltage regulator (SVR).

3. Operating conditions

3.1 Ambient temp range, °C	-5 – +35
3.2 Relative humidity at t=25°C, %	≤ 85
3.3 Pressure, mm.Hg.	630 - 800

4. Package contents

4.1 HCTD-10 tester	1 item
4.2 Flexible busbars, length - 0,75m, cross section - 120mm ²	6 piece
4.3 Power cable with three-phase power plug and portable socket	1 item
4.4 Connection bolt M8	4 piece
4.5 User Manual	1 item
4.6 Current sensor 1kA, 10kA /5A	1 item
4.7 SVR, single phase voltage regulator, Inom. = 10, 20, 40, 80A not included in package contents and can be purchased separately.	

5. Safety precautions

5.1 Please note that in order to ensure electrical safety of personnel, which operates the device, provide device with network power supply only with mains socket that has good protective earth.

5.2 Do not operate the device with removed housing panels.

5.3 Use the device only with electrical personnel familiar with the device manual and knowing how to work with the device.

5.4 Current source at the output terminals of the device is galvanically isolated from the mains supply. During the presence of voltage at the output terminals of the device, strictly prohibited touching the electrically uninsulated live parts of the device and perform connections to the current output terminals of the device.

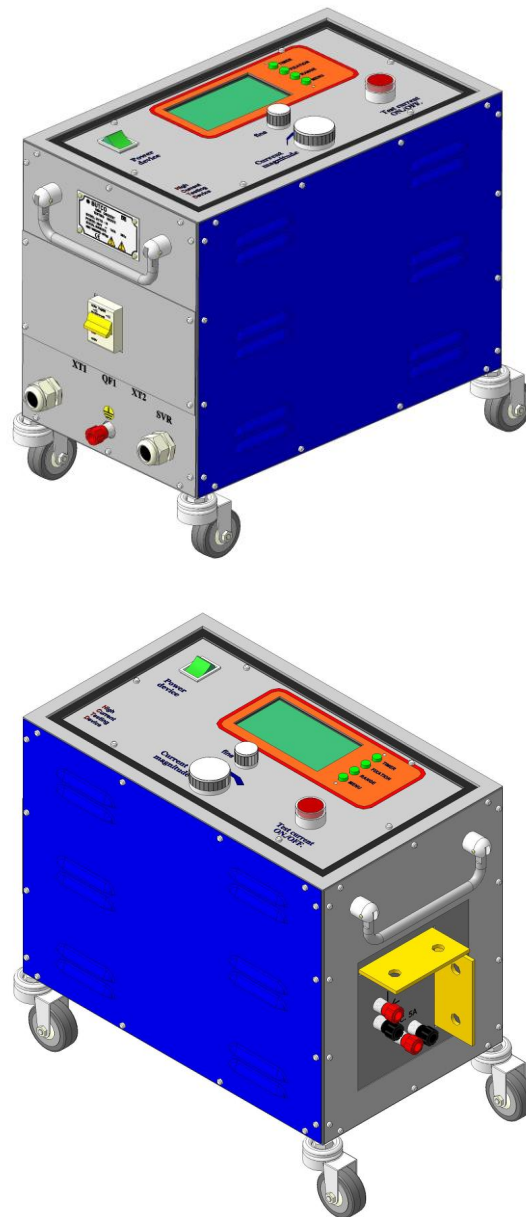
5.5 Operating the device with currents above 500A output rigid and flexible copper bars can be heated up to temperatures exceeding 60 °C, that requires personnel safety precautions.

5.6 Do not connect to the device custom, home-made parts or wires. It is prohibited to make any custom modifications to the equipment or accessories, as this could lead to additional risk. In order to be fully confident in the safe use of the device, provide any repair or modification made only by the manufacturer or an authorized service.

6. Design and operating principles

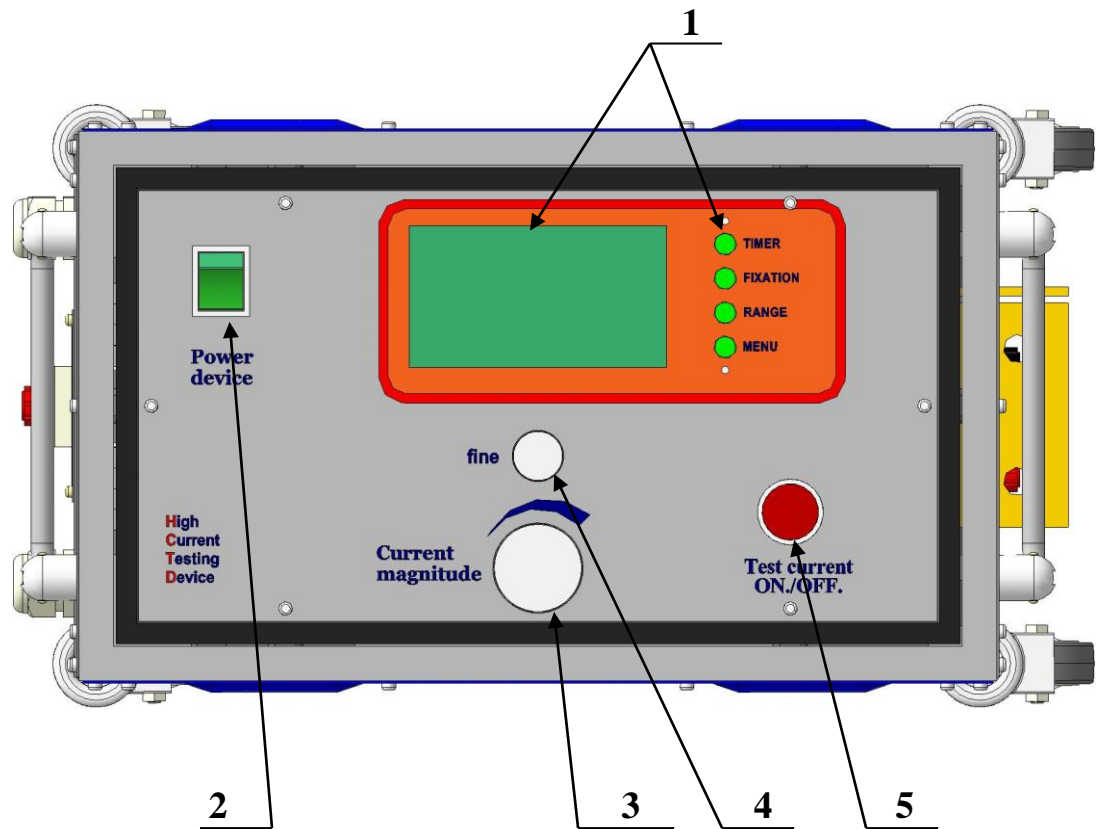
The device HCTD-10M is designed in a single housing. External design and types of panels are shown in Fig. №1, 2, 4. Schematic circuit diagram of the device is shown on page. 22. Normal operating position of the device - horizontally,. For transportation provided handles located on the front panel and rotary wheels,-mounted down the device. Housing is functionally and structurally is divided into three control panels.

Figure 1. External design



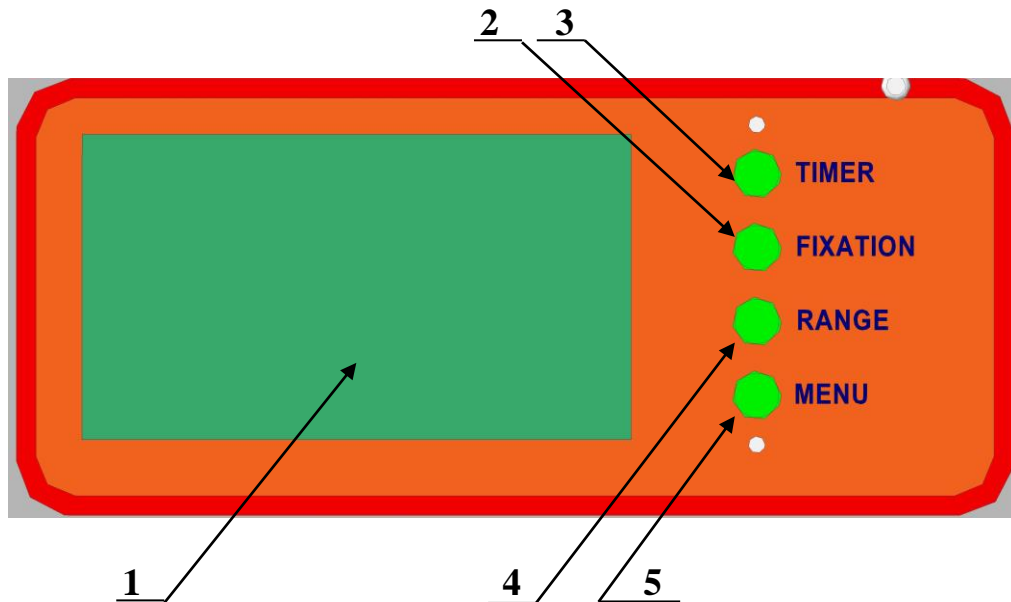
The front panel of the device is shown in the form fig.No2, designed for control of test process and the output the test results on the display of the operator panel. In the lower left corner of the front panel located push button "power to the unit," with light. This switch switches power supply to the main control board and measuring devices. In the center of the front panel the operator panel is located with a graphic display and panel with buttons, arranged vertically to the right of the display. Operator panel is designed to control the operating modes of the device and display text and graphic information on the operating mode and the measured values of current and tripping time. Buttons of operator panel to the right of the display are used to select the operating mode, the current measurement range, the logic of the fixation and displaying measured values of current tripping time, time setting of the timer. Each button has text symbols that characterize its function. Lower the operator panel on the front panel are located regulator of test current that generated by the device. For convenience and accuracy of the value of the test current added fine tuning knob, a text symbol on the front "FINE". Right at the bottom of the front panel is the main operating button "CURRENT ON / OFF.". Pressing this button sequentially enables or disables the generation of current at the output terminals of the power unit, located on the right side of the device, shown in the fig.No5. Control of all modes and measurement values of current tripping time of the device is constructed on the basis of the control program of the microcontroller with a 12-bit ADC. Circuit solutions and modern element base, applied in the device provides reliable and accurate True RMS measurements, simplicity and reliability.

Fig №2. Front panel of the device



- 1— Front (operator) panel of the device
- 2—“**POWER**” switch turns on and turns off power supply for PCB of the device
- 3, 4— Output current regulator knobs
- 5— Light button “**Current On/Off**” sequentially enables or disables the output current device

Fig №3. Operator panel



1— Display

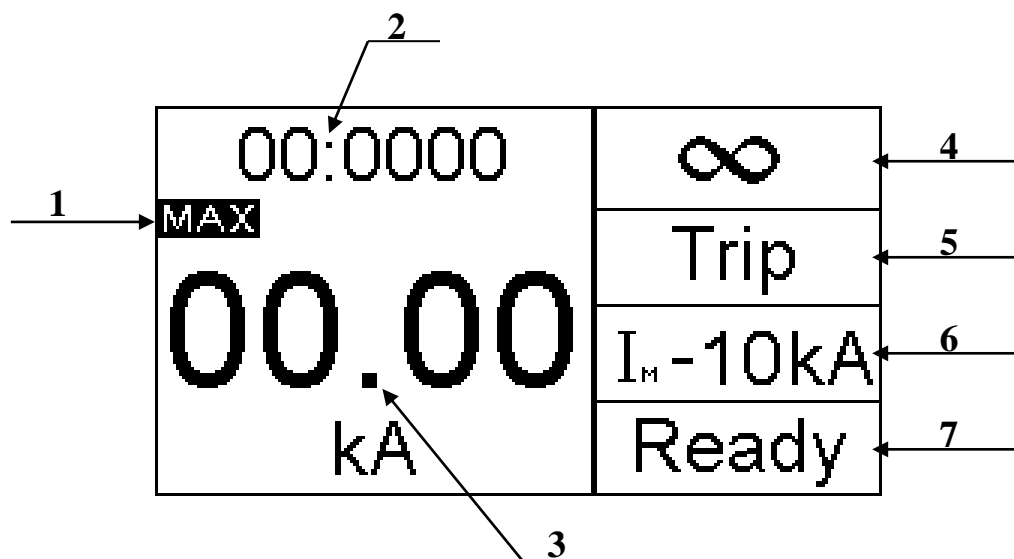
2—«**Fixation**» button, selection of fixation mode of measured values of current and tripping time

3—«**TIMER**» button, selection of duration of test current pulse

4—«**RANGE**» button, selection of test current range

5—«**MENU**» button, language selection, memory type and calibration of device's current meter.

Fig №4. Operator panel display



1– Memory type of current measured value during fixation.

2– Measured value of pulse duration of the test current.

3– Value of test current.

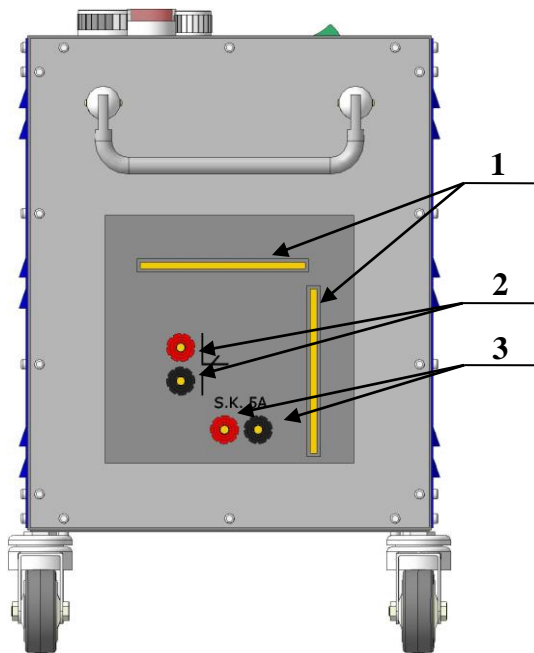
4– Test current pulse duration preset. Use the "TIMER" button to set the following values of the test current pulse duration: 20ms; 40ms; 100ms; 0,2s; 0.5s; 0.8 sec; 1,0s and unlimited.

5– Programs of fixation of measured values of current and tripping time. Use the button "FIXATION" to specify the following types of fixation programs: "TRIP" – fixation of the measured values of current and tripping time on the fact of tripping a test circuit (such as automatic current tripping of circuit breaker); "CONTACT" - fixation of measured values of current and tripping time on the fact of condition changing a of external "dry" contact, for example tripping of the contact group of current relay by a predetermined value of test current; "NO" fixation function is disabled.

6– Value of test current range. Use the button "RANGE" to set following ranges: 1,0kA; 10kA.

7– Device status.

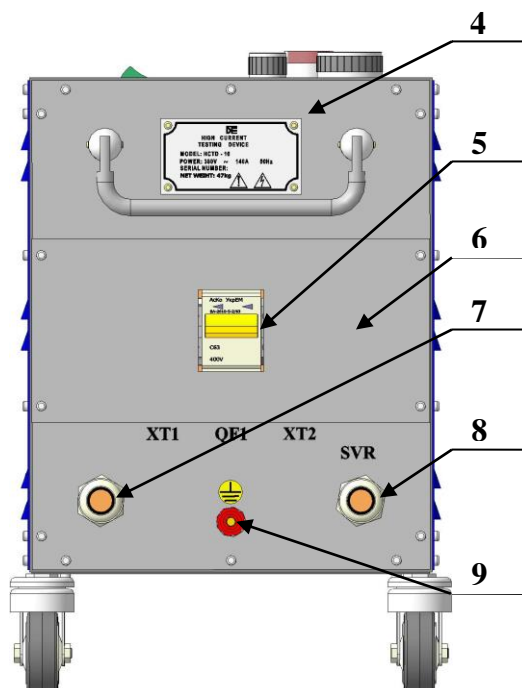
Fig. №5 Side panels



1 – output power busbars, with bolt connection M8, for connection of object under test.

2- terminals for connection of additional contact of object under test, for fixation of meters readings at fact of changing condition of contact.

3 – Terminals for connection of external current sensor, with secondary current 5A.



4 – Serial number factory plate with manufacturing date.

5 – Automatic circuit breaker of power circuits of the device.

6 – removable housing panel.

7– power cable input

8 – Voltage regulator cable input,

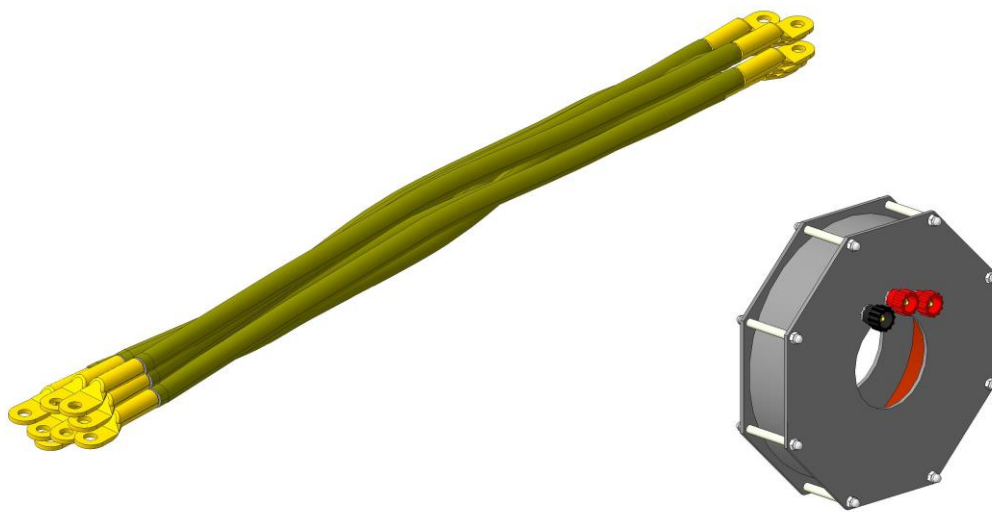
9 – grounding circuit terminal

The right housing panel of the device shown in Fig. №5, functionally intended for connection object under test by means of flexible copper busbars. Package of flexible copper busbars allows to obtain the desired test current during the load using parallel or series connection.

Auxiliary terminals "SC 5A "are used to connect external measuring current sensor included in package. External design of flexible busbars set and current sensor shown in Fig. №6.

Auxiliary terminals " — / — " intended for fixation of measured values of current and tripping time, when the state of the external "dry" contacts of the test object.

Fig. №6



Left side of the device shown in Fig. №5, functionally designed for switching and short-circuit protection of power circuits of device with circuit breaker (5), as well as for connection external single-phase voltage regulator (SVR), if necessary to use it.

Removable panel (6) in Fig. №5 is designed to access the power terminal groups when an external SVR voltage regulator connected. How to connect SVR see chapter №7, operating the device.

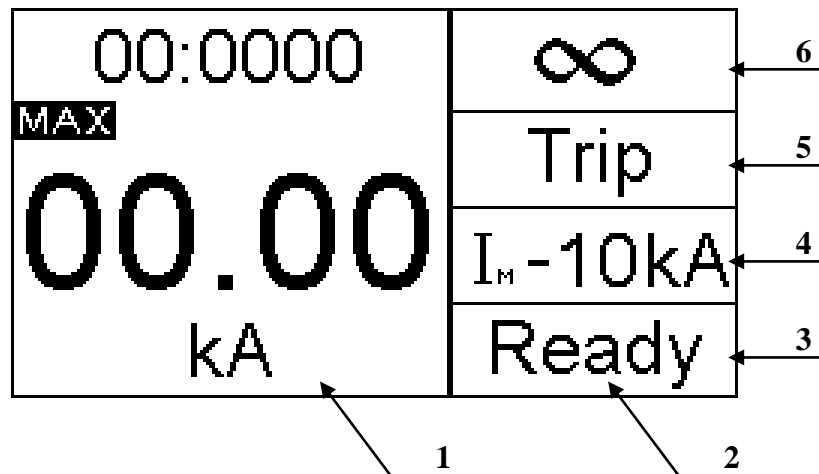
7. Operating the device

7.1 Before operating the device, check compliance with safety precautions of the device, described on page. №5 of present user manual.

7.2 Connect the electrical circuit of protective grounding to the device.

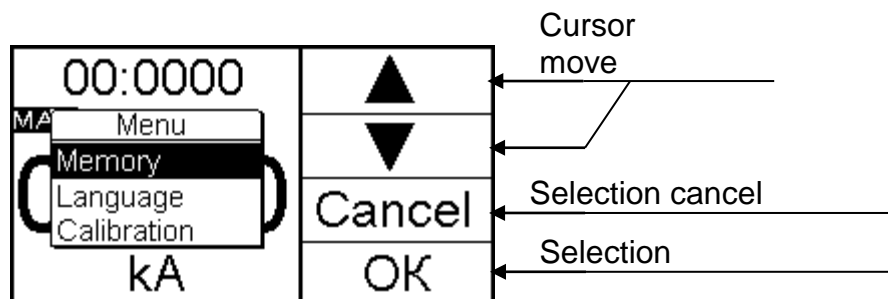
7.3 Before supplying power to the device, switch OFF the "POWER" button and automatic circuit breaker "QF1".

7.4 Feed the network power to the device, by connecting network plug of the device into an external power outlet. Switch on the power supply of the device with switch button "POWER ". This button will light up. Display screen-saver will show device model and firmware version. After three seconds, the display shows the main operational image, Fig. №7.



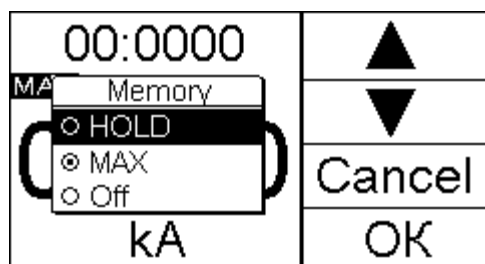
Display divided into two main areas. Zone 1 – measuring, see. Fig. №6, designated to show measured values of tripping times and currents. Zone 2 – operating zone, operating all modes of the device. Zone 2 is divided into four information areas 3-6. Each information area has corresponding button on the operator panel to the right of display, see Fig.2, page 8. Functional buttons and corresponding information fields of the display are explained on pages. №8-9.

7.5 "**MENU**" button of operator panel. See Fig. 2, page. 8 is used to access the system and optional features of the device. Short pressing "**MENU**" button shows additional window, with the screenshot below:



Buttons to the right changes its functionality in accordance with the display screens. MENU window allows to select one of three items:

- "MEMORY" - this item allows selecting the desired algorithm of fixation of tripping time and test current. Short pressing "OK" display shows screenshot below:




Turning on the device a program sets fixation at «MAX» as default. This type fixates and display maximum measured values of test current. This algorithm is necessary during tests of automatic circuit breakers, to measure and save value of current that flows via circuit breaker. «FIXATION» algorithm is recommended for testing of inertial current protections, for example, thermal current relays. Selecting "OFF" algorithm, saving function is not active.


- "LANG" - this option allows t to choose language. Current version of firmware allows choose among three languages: Russian, Ukrainian and English.



— «CALIBRATION» – This point is intended calibration of test current meter inside the device. Calibration is performed only by manufacturer or the metrological service which has a certificate for carrying out this type of works. Calibrate the device only with manufacturer’s approval and with manual on device calibration.

7.6 The device has overload protection of primary current and overheating protection of the of the power transformer, and also if current exceeds more than 10% of the current value range. If one of protections trips, display shows below:

05:2375		∞	
MAY			
 Overload transformer		kA	
kA		Current	

05:2375		∞	
MAY			
 Overheat transformer		kA	
kA		Current	

01:2500		∞	
OVL		No	
kA		I _m -10kA	
		Current	

7.7 Please note, that device essentially operates in one of two modes:

- Mode of test current value adjustment with thyristor power regulator (TRC).
- Mode of test current value adjustment with a single-phase voltage regulator (SVR).

Thyristor regulator adjustment mode is used for accurate measurement of values of thermal protection settings and evaluation of performance of electromagnetic tripping of circuit breakers. In this mode, the output current is regulated by a built-in thyristor power regulator, and has a pulse shape with a ratio of harmonics 5. Note, the device is supplied by the manufacturer, prepared for use in adjustment mode with power thyristor regulator.

Second mode - adjustment the value of the test current with a single-phase voltage regulator assumes external SVR voltage regulator. In this mode, thyristor regulator works as a solid power relay, which connects primary winding of the SVR voltage regulator with network voltage during voltage transition through zero. The current, generated at the output of SVR, has a sinusoidal shape that provides accurate measurements of tripping current setting of electromagnetic and electronic circuit.

Please note! HCTD-10 tester to be supplied only with thyristor regulator. Optional voltage regulator is not included in standard package and to be ordered separately.

Operating the device using inbuilt thyristor regulator for current adjustment.

7.8 Follow steps 7.1-7.4.

7.9 Using sets of flexible busbars connect the object under test with output busbars of the device.

7.10 Depending on the range of test currents connect the current sensor to the terminals marked as "SC 5A "on the right side of the device.

7.11 Pressing shortly "RANGE" button on the operator panel select the desired range of test currents: 1,0kA or 10kA.

7.12 By pressing shortly "FIXATION" button on the operator panel select the desired algorithm of fixation of current and tripping time measured values.

7.13 By pressing shortly "TIMER" button on the operator panel select the desired value of test current pulse duration. For the initial setting of the precise value of test current it is recommended to set the duration value as unlimited.

7.14 Turn current regulator knobs fully counter clockwise. This provides the minimum value of the test current, approximate to zero.

7.15 Prepare the test object to be tested, for example, turn on the circuit breaker under test.

7.16 Display must have text message "READY".

7.17 Turn on the main power circuit breaker of the devices QF1, located on the left side of the device.

7.18 Pressing "Current On/Off" button enables generation of test current at the output busbars of the device. At the same time LED, integrated in "Current On. / Off." button, light up continuously, and the display shows text message "Current".

7.19 Turning the current regulator knob set the current value according to specific test procedures of object under test. Monitor current level on the display.

During initial inspection of electromagnetic trip of circuit breaker, it is recommended to rotate the knob of current controller with speed that ensures minimum thermal heating of tested CB. After tripping of electromagnetic protection of CB, the display will save and show values of tripping time and current and display word "TRIP". LED indicator of "Current On. / Off." button light off.

Turn on CB under test. Then, without turning the knobs of current, press "Current On/Off" re-enable generation of test current. After a short protection tripping of CB the device will save values of current and tripping time. Above mentioned CB test procedure has the character of a recommendation. For compliant test of circuit breakers or any other object follow test procedures given by manufacturers of products under test.

7.20 After finishing works with the device, switch off main power circuit breaker unit QF1. Then, turn the power off by key switch "POWER". Disconnect power flexible busbars from the object under test.

Operating the device with external voltage regulator (RNO) for current value adjustment.

7.21 Follow steps 7.1-7.3.

7.22 In the case operating SVR for voltage 220V, it is necessary to rewire electrical circuit of phase voltage L2, to circuit neutral on distributing board.

7.23 Connect SVR with electric cable to the device, according to the wiring diagram on page. 22.

For this:

7.24 Unscrew four screws of cover panel (1) on the left side of the device, see Fig. 5 page. 11. Remove the covering panel of housing.

7.25 Remove jumper J1 (2) to the right of circuit-breaker QF1 on terminal group XT2, see fig 8. Please note that when connecting SVR - J1 jumper must be removed always.

(Jumper must be set in operation mode "without SVR".- In this mode, adjustable voltage and current at the output terminals is carried out by thyristor power regulator - TRC).

7.26 Provide electrical connections between the SVR and the device by a cable via cable entry with the mark SVR, (3) fig. 8.

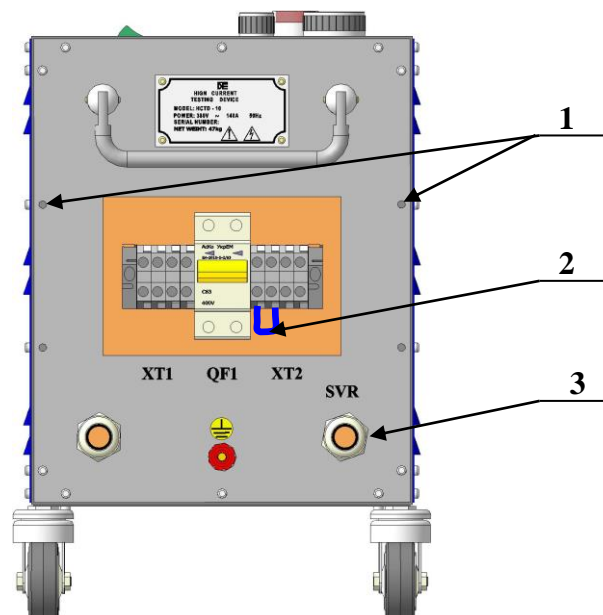
7.27 Connect cable conductors to cable entry group XT2 according to wiring diagram on page 22.

7.28 Using sets of flexible busbars connect the object under test with output terminals of the device.

7.29 Connect the current sensor to the terminals with markings "DT 5A" on the right side of the device, depending on a range of test currents.

7.30 Select the desired range of meter of test currents: 1,0kA or 10kA by short pressing "**RANGE**" button.

Fig. 8 Dismantled panel on the left side.



7.31 Select the desired algorithm of measured values of current and tripping time fixation by short pressing "FIXATION" button.

7.32 By short pressing "TIMER" button, select the desired value of test current pulse duration. For the initial setting of the precise value of test current it is recommended to set the duration value as unlimited.

7.33 Turn current regulator knobs fully counter clockwise. This provides thyristor regulator act as solid-state power relay. Contact commutation of solid-state relay occurs during passing network voltage through zero..

7.34 Turn single-phase voltage regulator knob fully counter clockwise. This provides the minimum value of the test current, approximate to zero.

7.35 Prepare the test object to be tested, for example, turn on automatic circuit breaker.

7.36 Display shows "READY" message.

7.37 Turn on main power circuit breaker QF1, located on the left side of the device.

7.38 Pressing "Current On/Off" button enables generation of test current at the output busbars of the device. At the same time LED, integrated in "Current On/Off" button, light up continuously, and the display shows text message "Current".

7.39 Turning the voltage regulator knob set the current value according to specific test procedures of object under test. Monitor current level on the display.

During initial inspection of electromagnetic trip of circuit breaker, it is recommended to rotate the knob of current controller with speed that ensures minimum thermal heating of tested CB. After tripping of electromagnetic protection of CB, the display will save and show values of tripping time and current and display word "TRIP". LED indicator of "Current On. / Off." button light off.

7.40 Turn on CB under test. Then, without turning the knobs of current, press "Current On/Off" re-enable generation of test current. After a short protection tripping of CB the device will save values of current and tripping time. Above mentioned CB test procedure has the character of a recommendation. For compliant test of circuit breakers or any other object follow test procedures given by manufacturers of products under test.

7.41 After finishing works with the device, switch off main power circuit breaker unit QF1. Then, turn the power off by key switch "POWER". Disconnect power flexible busbars from the object under test.

Follow next recommendations to check operability and adjustment procedures of circuit breaker in table №1..

Table №1

№	Test current range	Control contents	Parameters of control
1	CB testing with nominal (rated) primary current (20A...≈ 1kA)	<ul style="list-style-type: none"> - Heating of one or more poles of CB with rated current for controlling of thermal state of system “current lead - CB - ambient area”, or as a preliminary operation prior to test of thermal tripping in overload zone; - Clarification of rated current of CB (continuous max current non-tripping); - Assessment of transient resistances in the poles of circuits of CB. 	<p>Nominal current, temperature</p> <p>Current, time, tripping fact</p> <p>Test current, voltage decreasing</p>
2	CB testing in overload currents zone (100A...≈5kA)	<ul style="list-style-type: none"> - Control of tripping time from cold state with 2x-3x current (fast check of thermal release device); - Control of points of time-current characteristic of CB (starting from heated state) in overcurrents zone. 	Tripping time at presetted ambient temperature and current
3	CB testing in short-circuit currents zone (100A...10kA)	<ul style="list-style-type: none"> - operability test of electromagnet (semiconductor) release device; - control (setting) of level of electromagnet tripping (of semiconductor) release device; - control (setting) of delay of tripping for selective switchers 	<p>Tripping fact coarse, current, time</p> <p>Tripping current value</p> <p>Tripping current value, switch off delay</p>

8. Technical maintenance

Note! All maintenance actions perform only on previously deenergized tester.

Technical maintenance includes:

If contact surfaces are fouled, wash them with alcohol or aviation gasoline.

Once a year dismantle front and side panels Tighten bolt connections of the power transformer busbars, bolts of power transformer, as well as perform tightening all electrical connections to the switching node.

9. Technical examination.

The technical examination of HCTD-10M is to be carried out at least once a year by an organization authorized to conduct such works.

The technical examination of HCTD-10M is to be carried out according to GOST R 8.568-97.

