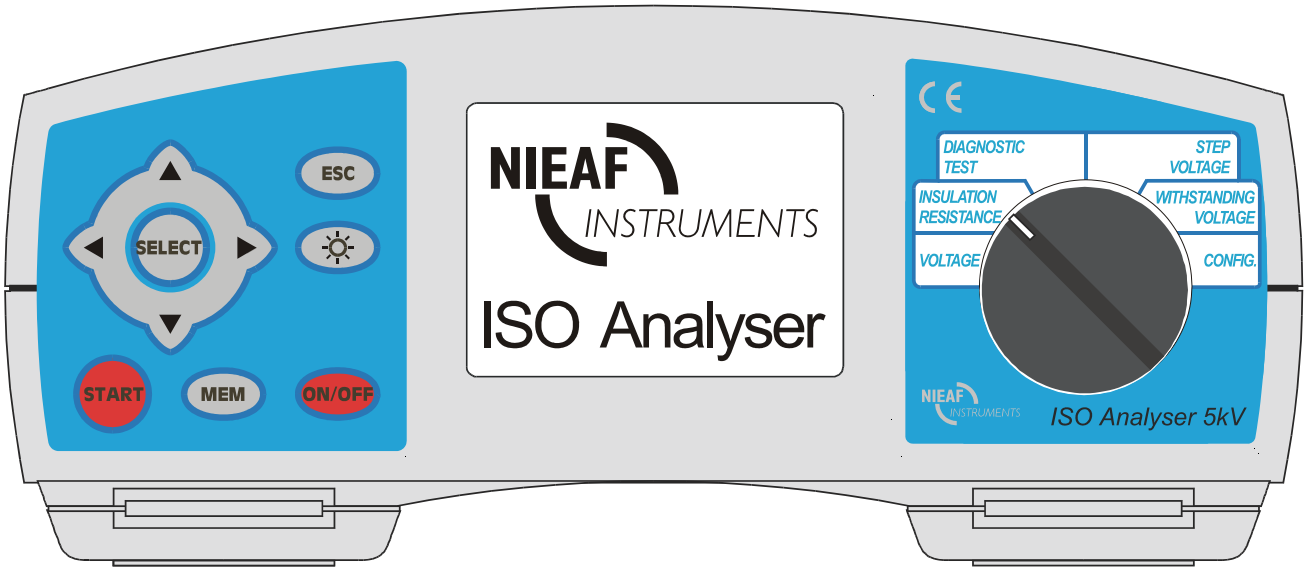
User manual
ISO Analyser 5kV



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Specifications of the equipment:	ISO Analyser 5kV
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Table of content

1. General introduction

1.1. Features

*The **ISO Analyser 5kV** Tester is a portable battery / mains powered test instrument intended for testing of Insulation Resistance using high test voltages of up to 5 kV. It operates on a SIMPLE and CLEAR basis.*

The instrument is designed and produced with the extensive knowledge and experience acquired through many years of dealing with similar test equipment.

*Available functions offered by the **ISO Analyser 5kV** Tester:*

- *High Insulation Resistance measurement up to 5 TΩ*
  - *Programmable test voltage 250 V up to 5 kV*
  - *Programmable timer 1s up to 30 min*
  - *Automatic discharge of tested object after measurement completion*
  - *Capacitance measurement*
- *Insulation Resistance measurement versus test voltage (step-up voltage)*
  - *Five discrete test voltages proportionately set within preset test voltage range*
  - *Programmable timer 1min up to 30 min per step*
- *Polarization Index PI and Dielectric Discharge ratio*
  - *PI = RINS (t2) / RINS (t1)*
  - *DD = Idis (1min) / C·U*
- *Withstanding voltage (DC) up to 5.5 kV*
  - *Programmable ramp test voltage 250 V up to 5 kV*
  - *High resolution ramp (approx. 20 V per step)*
  - *Programmable threshold current*
- *Voltage and frequency measurement up to 600 V AC/DC*

A matrix LCD offers easy to read results and all the belonging parameters. Operation is simple and clear, the operator does not need any special training (except reading and understanding this Users Manual) to operate the instrument.

The instrument allows storage of test results. Professional PC SW enables simple transfer of test results and other parameters in both directions between the test instrument and PC.

1.2. Applied Standards

Instrument operation:	*IEC / EN 61557-2*
Electromagnetic compatibility (EMC):	*EN 50081-1, EN 50082-1, IEC 61326 Class B*
Safety:	*EN/IEC 61010-1 (instrument), EN/IEC 61010-2-31 (accessories)*

2. Instrument Description

2.1. Instrument Casing

The instrument is housed in a plastic casing which maintains the protection class defined in general specifications. There is also a carrying strap fixed to the casing, intended for the instrument to be used hung around operator's neck. Short technical specification is available on bottom side of the housing.

2.2. Operator's Panel

The operator's panel consists of a matrix LCD, a rotary switch and a keypad, see the figure below.

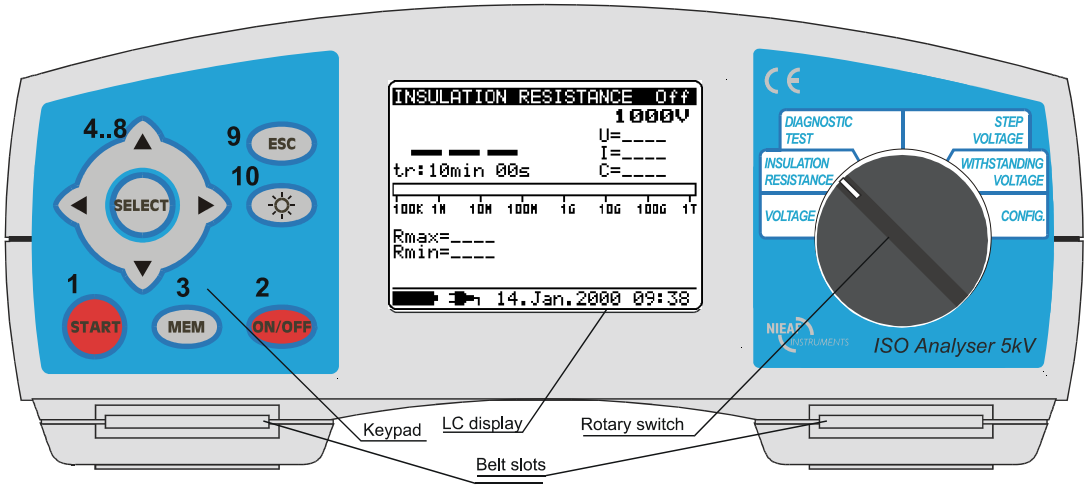


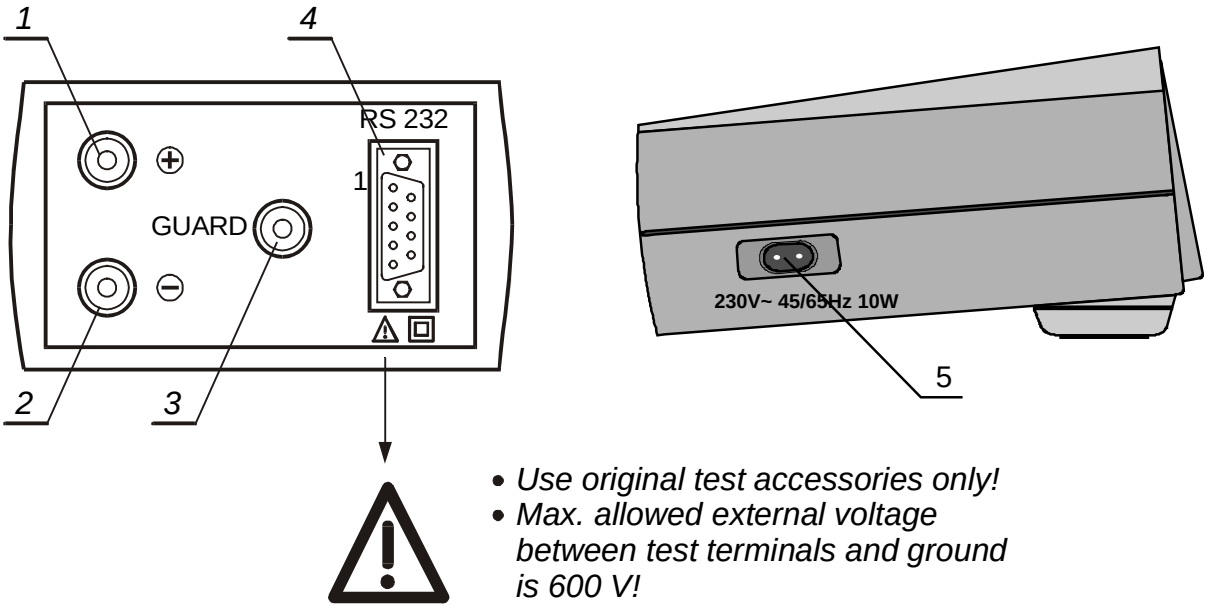
Fig. 1. *Front panel*

Legend:

*1..... **START** key to start any measurement.*
*2..... **ON/OFF** key to switch the instrument ON or OFF.*
*3..... **MEM** key to store, recall and clear results.*
*4..... **SELECT key** to enter set-up mode for selected function or to select active parameter to be set.*
*5..... ▲ **cursor** key to select an option upword.*
*6..... ▼ **cursor** key to select an option downword.*
*7..... ◀ **cursor** key to decrease selected parameter.*
*8..... ▶ **cursor** key to increase selected parameter.*
*9..... **ESC** key to exit selected mode.*
*10..... **Light** key to turn display backlight ON or OFF.*

2.3. Connectors

*The **ISO Analyser 5 kV** Tester contains the following connection possibilities:*
- *Connection of test leads to three banana safety sockets (1, 2, 3),*
- *Connection of communication cable to 9-pin RS 232 connector (4) and*
- *Mains supply cable connection to mains socket (5).*



- *Use original test accessories only!*
- *Max. allowed external voltage between test terminals and ground is 600 V!*
- *Max. allowed external voltage between test terminals is 600 V!*

***Fig. 2.** Connectors*

Legend:
*1..... Positive Insulation Resistance **test terminal**.*
*2..... Negative Insulation Resistance **test terminal**.*
*3..... **GUARD** test terminal intended to lead away potential leakage current while measuring Insulation Resistance.*
*4..... Galvanic separated **RS 232 connector** to connect the instrument to PC.*
5..... Mains connector to connect the instrument to mains supply voltage.

Warning!:
- *Do not connect the instrument to mains voltage different from the one defined on the label adjacent to mains connector otherwise the instrument may be damaged.*

2.4. Bottom Section

Bottom assembly is presented at the figure below. Carrying strap is fixed to bottom section by means of plastic cover (2).

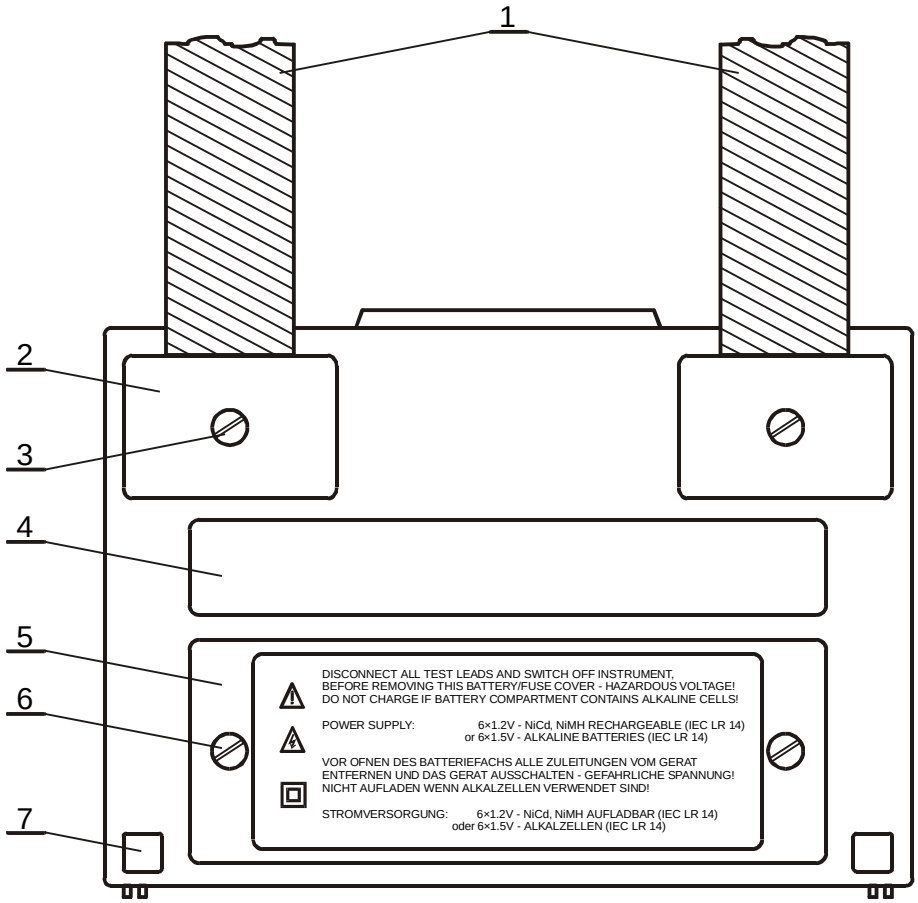


Fig. 3. *Bottom section*

Legend:

1..... Nylon strap (allows the operator to carry the instrument hung around the neck).
2..... Plastic cover (fixes nylon strap to the instrument).
3..... Screw (unscrew it to remove carrying strap or to open the instrument).
4..... Label with measurement ranges.
5..... Battery/fuse compartment cover.
6..... Screw (unscrew it to replace batteries or blown fuse.
7..... Rubber foot.

2.5. Accessories

The accessories consists of standard and optional accessories. Optional accessories can be delivered upon request.

3. Warnings

In order to reach highest level of operator's safety while carrying out various measurements and tests using the ***ISO Analyser 5kV*** *Tester, as well as to ensure the test equipment to remain undamaged, it is necessary to consider the following general warnings:*

- ***If the test equipment is used in a manner not specified in this Users Manual, the protection provided by the equipment may be impaired!***
- ***Do not use the instrument and accessories if any damage is noticed!***
- ***Service intervention or recalibration procedure is allowed to be carried out only by a competent, authorised person!***
- ***Consider all generally known precautions, in order to avoid risk of electric shock while dealing with electric installations!***
- ***Use only standard or optional test accessories supplied by your distributor!***
- ***⚠ symbol at the instrument means "Read the Users Manual with special care!" The symbol requires an action!***
- ***⚠ symbol at the instrument means "Hazardous voltage higher than 1000 V may be present at test terminals!"!***
- ***Disconnect all test leads and switch power off before opening Battery cover!***
- ***Do not charge when alkaline batteries are fitted!***
- ***Equipment under test must be switched off i.e. de-energized before test leads are connected to the equipment.***
- ***Do not touch conductive parts of equipment under test during the test is running on.***
- ***Suitably trained and competent persons may only operate the instrument.***

4. Before measurement

4. 1. Switching on the instrument

*The instrument is switched ON by pressing the **ON/OFF** key. As auto-calibration is automatically done always after switching ON the instrument, it is necessary test leads to be disconnected before pressing the **ON/OFF** key. In the opposite case the instrument will require disconnection of test leads and another switching OFF and ON.*

The two figures below present two display states displayed after switching ON the instrument.

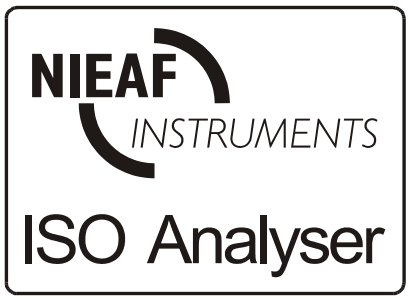


***Fig. 4.** First introduction*

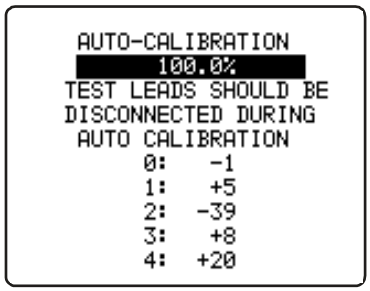


***Fig. 5.** Auto-calibration state*

After switching ON the instrument, displayed menu contains all information related to selected function including its name as well as general information of power supply, e.g.: battery charge state and connection to mains supply. Date/time information is also present.

*The LCD back-light is automatically turned on after turning power on. It can be turned OFF and ON simply clicking the **LIGHT** key.*

Notes:

- *New auto-calibration is required if temperature variation of more than 5℃ occurs.*
- *Back-light is turned off automatically approximately 10s after switching it ON if the instrument is supplied by internal battery.*
- *The instrument can be switched OFF only pressing the **ON/OFF** key. There is no auto OFF function because of possible long-term measurements.*

4.2. Configuration

Configuration function enables selection and adjustment of the parameters which are not directly involved in measurement procedure. Figure 6. presents entering menu and also standard display fields.

The following procedure is required to be carried out when adjusting some of configuration parameters:

1. *Use ↑ and ↓ arrows to select parameter (line) to be adjusted.*
2. *Use ← and → arrows to change the value of selected parameter. If there are two or more sub-parameters in one line (e.g. date and time) then use the **SELECT** key to skip to the next sub-parameters and back.*

To clear all memory locations:

1. *Select **Memory Clear** line using the ↑ and ↓ arrows.*
2. *Press the **SELECT** key, "**Press MEM to confirm!**" message will be displayed.*
3. *Press the **MEM** key to clear all memory locations or **ESC** to cancel the activity.*

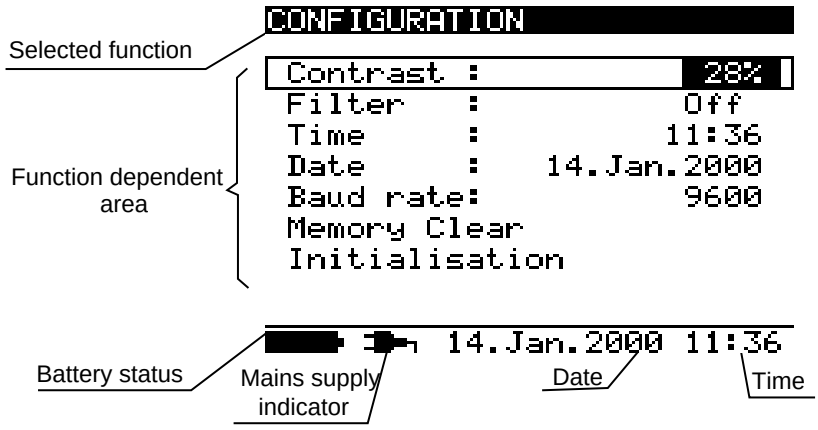


Fig. 6. *Configuration state*

Parameter	*Value*	*Note*
Contrast	*0%..100%*	*Adjustment of the LCD contrast*
Filter	*Fil1, Fil2, Fil3, Off*	*Selection of noise rejecting filter, see the chapter 5.3. Filter Option*
Time		*Set real time (hour : minute)*
Date		*Set current date (day-month-year)*
Baud rate	*2400, 4800, 9600, 19200*	*Speed of data transfer in communication mode*
Memory clear		*Clear all memory locations*
Initialization		*For internal factory and service maintenance only!*

Table 1. Configuration parameters

5. Measurements

5.1. Generally about DC High voltage testing

High voltage test methods using DC voltage are widely accepted as being useful for testing the Insulation Resistance. The actual test voltage to be used is defined with respect to individual product standard. Equipment designed for operation in low voltage areas are usually tested with test voltage of 500V and measured Insulation Resistance value should be at least 500 kΩ.

This instrument is intended to be used in areas where a higher DC test voltage is required, i.e. testing insulation on motors, cables, HV transformers etc.

Additional functions offered are aimed for testing the characteristics of insulation material, particularly when the material has been exposed to working conditions for a longer period. These characteristics show the dependence of insulation material versus test voltage or test period as well as charge recovery after standard discharge. The parameters show quality level of tested insulation and thus form the basis for decisions on maintenance or repair of tested material.

Over voltage protection devices can also be tested with this instrument. Trigger current for threshold detection or breakdown voltage is usually set to 1mA. The instrument measures and displays the breakdown voltage. It is advised to check manufacturer's markings at the device to be tested before carrying out the test.

Some standards allow DC voltage testing as an alternative to AC r.m.s. withstand voltage testing. For this purpose test voltage has to be present across the insulation under test for a specific time. Test result is positive if there is no breakdown or flash over.
An example from EN/IEC 61010-1: DC test voltage for CAT II 300V is 1880V (basic insulation) / 3060V (double insulation). This test is permitted if the insulation resistance is higher than the minimum value found in paragraph 8. Specifications.

5.2. Guard terminal

Purpose of the GUARD terminal is to lead away potential leakage current (e.g. surface current) which is not resulted by measured insulation material itself but by surface dirt and moisture. This current is not wished to be measured i.e. Insulation Resistance result is not wished to be influenced by the current. GUARD terminal is internally connected to the same potential as negative test terminal (black one). Test alligator shall be connected to measured object so as to collect most of the unwished leakage current, see the figure below.

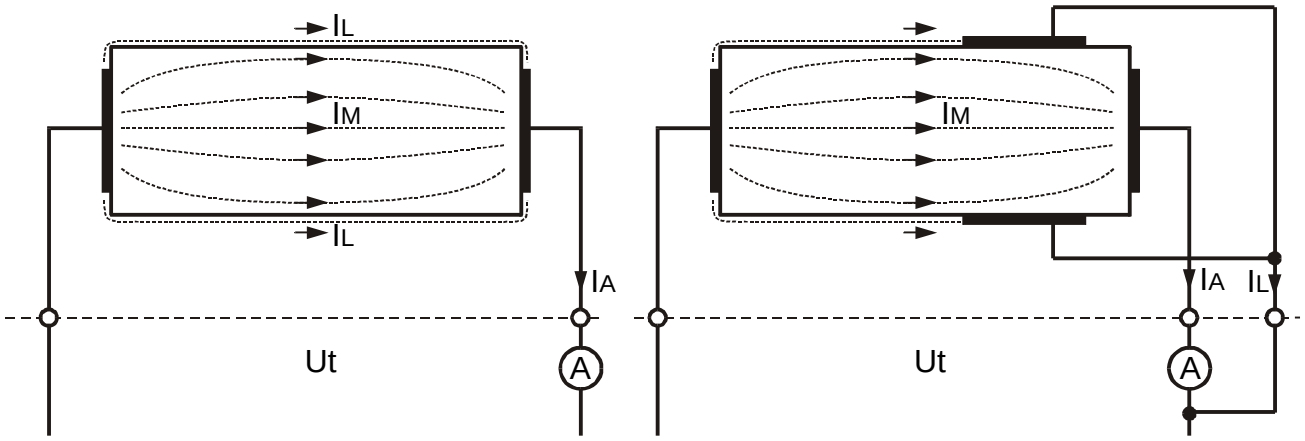


Fig. 7. *Connection of GUARD terminal to measured object*

where:
Ut ..... Test voltage
I_L ..... Leakage current (resulted by surface dirt and moisture)
I_M ..... Material current (resulted by material conditions)
I_A ..... A-meter current

Result without using GUARD terminal: $R_{INS} = Ut / I_A = Ut / (I_M + I_L)$……incorrect result

Result using GUARD terminal: ***$R_{INS} = Ut / I_A = Ut / I_M$*** *……correct result*

5.3. Filter option

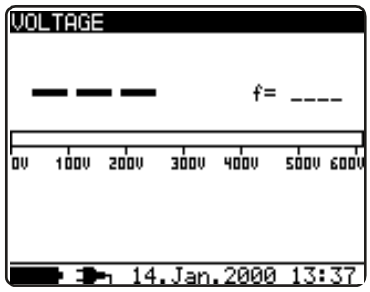
Filter option is built in to reduce noise influence to measurement results. This option enables more stabile results especially when dealing with high Insulation Resistances or Capacitance's (typical >0.5 μF), see the table below for meaning of individual filter:

Filter option	***Meaning***
Off	*Low pass filter with cut off frequency of 0.5 Hz in signal line.*
Fil1	*Additional low pass filter with cut off frequency of 0.05 Hz in signal line.*
Fil2	*Fil1 with increased integrating time (4s).*
Fil3	*Fil2 with additional cyclic averaging of 5 results.*

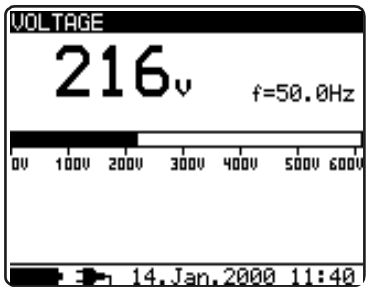
Table 2. Filter options

5.4. Voltage measurement

Selecting this function the following display states are given (initial state and state with results after finishing the measurement).



Initial display



Display with results

Fig. 8. *Voltage function display states*

Measurement procedure:

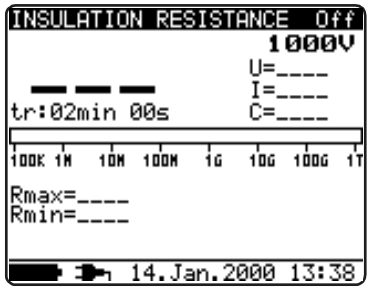
- *Connect test leads to the instrument and measured source.*
- *Press the **START** key to start the measurement, continuous measurement starts to run.*
- *Press the **START** key again to stop the measurement.*
- *The result (see the right figure above) can optionally be saved pressing the **MEM** key twice, see the chapter 6.1. Store, Recall and Clear Operation.*

Warning!

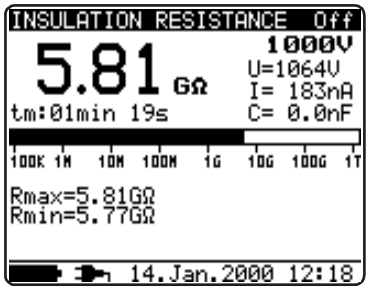
- ***Do not connect test terminals to external voltage higher than 600 V AC or DC in order not to damage the test instrument!***

5.5. Insulation Resistance measurement

Selecting this function the following display states are given (initial state and state with results after finishing the measurement).



Initial display



Display with results

Fig. 9. *Insulation Resistance function display states*

Measurement procedure:

- *Connect test leads to the instrument and to tested object.*
- *Select **INSULATION RESISTANCE** function by means of rotary switch knob.*
- *Press the **START** key and release it, continuous measurement starts to run.*
- *Wait until test result is stabilized then press the **START** key again to stop the measurement or until set timer runs out (if enabled).*
- *Wait test object to be discharged.*
- *The result (see the right figure above) can optionally be saved pressing the **MEM** key twice, see the chapter 6.1. Store, Recall and Clear Operation.*

Legend of displayed symbols:

INSULATION RESISTANCE	*Name of selected function*
Off (Fil1, Fil2, Fil3)	*Filter type enabled, see the chapter 4.2. Configuration*
1000V	*Set test voltage*
U=1056V	*Actual test voltage – measured value*
I=0.04nA	*Actual test current – measured value*
>1.00TΩ	*Insulation Resistance – **result***
C=1.3nF	*Capacitance of measured object*
tm:00min 15s	*Timer information – test duration*
bar	*Analog presentation of result*
Rmax=	*Maximum value of result (only if timer is enabled)*
Rmin=	*Minimum value of result (only if timer is enabled)*

Notes:
- *If timer is disabled then **OFF** is displayed instead of timer value.*
- *During measurement timer information displays time needed for completion of the measurement (tr) while after completion test duration (tm) is displayed.*
- *A high-voltage warning symbol appears on display during measurement to warn the operator against possible dangerous test voltage.*
- *Value of capacitance is measured during the final discharge of measured object.*

***Set-up parameters** for Insulation Resistance:*
- *Press the **SELECT** key, Set-up menu appears on display, see the figure 10.*
- *Select parameter (line) to be set using the ↑ and ↓ keys;*
- *Adjust set parameter using the ← and → keys. Skip to the next sub-parameter by pressing the **SELECT** key (if there are two or more sub-parameters) and repeat the adjustment.*
- *Complete the set-up adjustments pressing either the **ESC** key or **START** key (to run the measurement directly) or changing the rotary switch position. Last displayed settings are stored.*

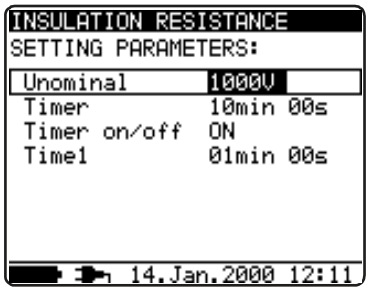


***Fig. 10.** Set-up menu in Insulation Resistance measurement*

Legend of displayed symbols:

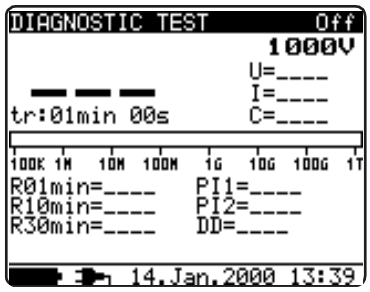
`INSULATION RESISTANCE`		*Name of selected function*
`SETTING PARAMETERS:`		
`Unominal`	`1000V`	*Set test voltage – step 50 V*
`Timer`	`10min 00s`	*Duration of measurement*
`Timer on/off`	`ON`	*ON: timer enabled, OFF: timer disabled*
`Time1`	`01min 00s`	*Time to accept and display first Rmin and Rmax result*

`Timer` *and* `Time1` *are independent timers. Maximum time for each of them is 30min 60s.*

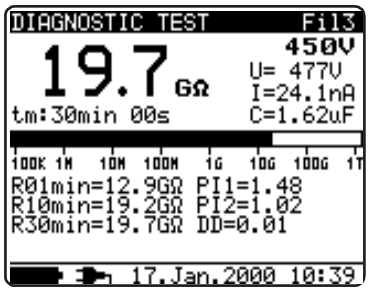
Warnings!
- ***Make sure tested object to be disconnected (mains voltage disconnected) before starting the Insulation Resistance measurement!***
- ***Do not touch tested object while testing it, risk of electric shock!***
- ***Do not connect test terminals to external voltage higher than 600 V AC or DC in order not to damage the test instrument!***
- ***In case of capacitive test object (capacitive compensation of reactive power, long tested cable etc.), automatic discharge of the object may not be done immediately after finishing the measurement – "Please wait, discharging" message will be displayed.***

5.6. Diagnostic test

Selecting this function the following display states are given (initial state and state with results after finishing the measurement).



Initial display



Display with results

Fig. 11. *Diagnostic test display states*

This is a long duration test for evaluation the quality of insulation material under test. The results of this test enables a decision to be made on the preventive replacement of the insulation material.

POLARIZATION INDEX (PI)

PI is ratio of Insulation Resistance values measured after 1minute and after 10minutes. The DC test voltage is present during the whole period of the measurement (also Insulation Resistance measurement is running). At the end PI ratio is displayed:

$$PI = \frac{R_{iso}(10\,\mathrm{min})}{R_{iso}(1\,\mathrm{min})}$$

Some applicable values:

PI value	*Tested material status*
1 to 1.5	*Not acceptable (older types)*
2 to 4 (typically 3)	*Considered as good insulation (older types)*
1 (very high insulation resistance)	*Modern type of (good) insulation systems*

Note: When determining Riso (1min) pay attention to the capacitance of tested object. It has to be charged-up in the first time section (1min). Approximate maximum capacitance using:

$$C_{\max}[\mu F] = \frac{t\,[s]\,10^3}{3 \cdot U\,[V]},$$

where:
t..... period of first time unit (e.g. 1min)
U..... test voltage.

DIELECTRIC DISCHARGE TESTING (DD)

DD is the diagnostic insulation test which follows on after completion of Insulation Resistance measurement. Typically the insulation material is left connected to the test voltage for 10 ÷ 30 min and then discharged before DD test is carried out. After 1 minute a discharge current is measured to detect charge re-absorption of insulation material. High re-absorption current indicates contaminated insulation mostly based on moisture:

$$DD = \frac{Idis1\min[mA]}{U[V].C[F]},$$

where:
Idis 1min ..... discharging current measured 1 min after regular discharge
U ..... test voltage
C ..... capacitance of tested object.

Grouping of DD:

DD value	*Tested material status*
>4	*bad*
2 - 4	*critical*
<2	*good*

Measurement procedure:
- *Connect test leads to the instrument and measured object.*
- *Press the **START** key to start the measurement.*
- *Wait until set timer runs out, result is displayed.*
- *Wait test object to be discharged*
- *The result (see the right part of the figure 11.) can optionally be saved pressing the **MEM** key twice, see the chapter 6.1. Store, Recall and Clear Operation.*

Legend of displayed symbols:

`DIAGNOSTIC TEST`	*Name of selected function*
`Off (Fil1, Fil2, Fil3)`	*Filter type enabled, see the chapter 5.3. Configuration*
`1000V`	*Set test voltage – step 50 V*
`U=1056V`	*Actual test voltage – measured value*
`I=0.04nA`	*Actual test current – measured value*
`>1.00TΩ`	*Insulation Resistance – **result***
`C=1.3nF`	*Capacitance of measured object*
`tr:00min 15s`	*Set timer value*
`bar`	*Analog presentation of Riso result*
`R01min=>1TΩ`	*Resistance value measured after set time 1*
`R02min=>1TΩ`	*Resistance value measured after set time 2*
`R03min=>1TΩ`	*Resistance value measured after set time 3*
`PI1=0.99`	*PI as ratio of R02/R01*
`PI2=1.21`	*PI as ratio of R03/R02*
`DD=__`	*DD result*

Notes:
- *A high-voltage warning symbol appears on display during measurement to warn the operator against possible dangerous test voltage.*
- *Value of capacitance is measured during the final discharge of measured object.*

***Set-up parameters** for Diagnostic Test:*
- *Press the **SELECT** key, Set-up menu appears on display, see the figure 12.*
- *Select parameter (line) to be set using the ↑ and ↓ keys;*
- *Adjust set parameter using the ← and → keys.*
- *Complete the set-up adjustments pressing either the **ESC** key or **START** key (to run the measurement directly) or changing the rotary switch position. Last displayed settings are stored.*

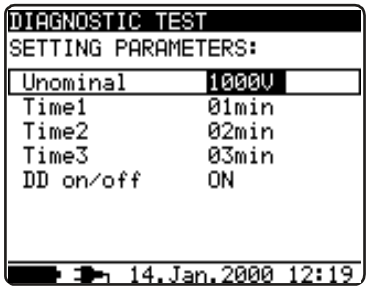


***Fig. 12.** Set-up menu in Diagnostic Test*

Legend of displayed symbols:

DIAGNOSTIC TEST		*Name of selected function*
SETTING PARAMETERS:		
Unominal	*1000V*	*Set test voltage – step 50 V*
Time1	*01min*	*Time node to take R01min result*
Time2	*02min*	*Time node to take R02min result and calculate PI1*
Time3	*03min*	*Time node to take R03min result and calculate PI2*
DD on/off	*ON*	*ON: DD enabled, OFF: DD disabled*

Time1, Time2 and Time3 are timers with the same start point. Value of each presents duration from start of the measurement. Maximum time is 30 min. The next figure shows timer relations.

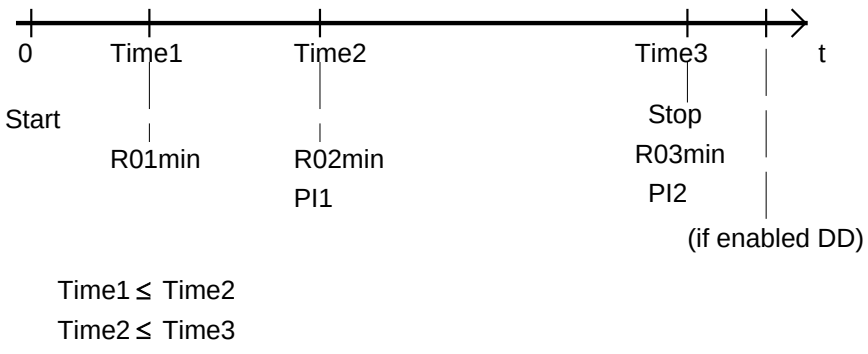
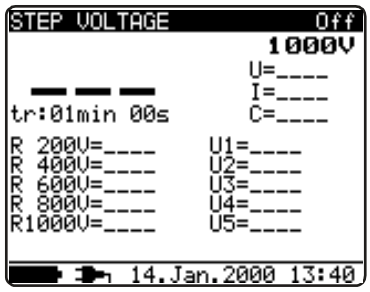


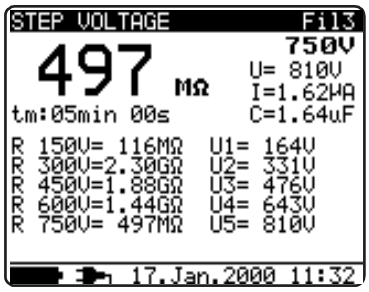
***Fig. 13.** Timer relations*

5.7. Step Voltage Insulation Resistance testing

Selecting this function the following display states are given (initial state and state with results after finishing the measurement).



Initial display



Display with results

Fig. 14. *Step Voltage Insulation Resistance function display states*

Insulation is measured in five equal time periods at test voltages from one fifth up to full scale, see the figure 15. This function shows the level of measured Insulation Resistance versus test voltage.

Measurement procedure:

- *Connect test leads to the instrument and measured object.*
- *Press the **START** key to start the measurement.*
- *Wait until set timer runs out, result is displayed.*
- *Wait test object to be discharged*
- *The result (see the right part of the figure 14.) can optionally be saved pressing the **MEM** key twice, see the chapter 6.1. Store, Recall and Clear Operation.*

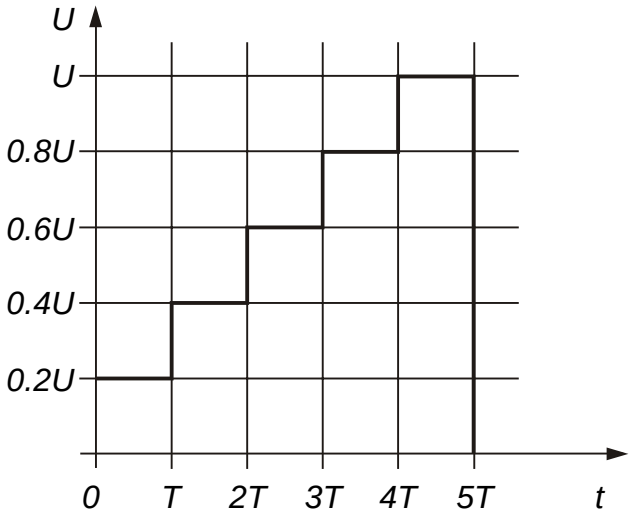


Fig. 15. *Step-up test voltage*

Legend of displayed symbols:

STEP VOLTAGE	*Name of selected function*
Off (Fil1, Fil2, Fil3)	*Filter type enabled, see the chapter 5.3. Configuration*
1500V	*Set test voltage – step 250 V*
U=1593V	*Actual test voltage – measured value*
I=0.00nA	*Actual test current – measured value*
>1.50TΩ	*Insulation Resistance –* ***result***
C=0.6nF	*Capacitance of measured object*
tm:05min 15s	*Actual test duration*
R 300V=>300GΩ	*Last result of 1st step*
R 600V=>600GΩ	*Last result of 2nd step*
R 900V=>900GΩ	*Last result of 3rd step*
R1200V=>1.2TGΩ	*Last result of 4th step*
R1500V=>1.5TΩ	*Last result of 5th step*
U1= 343V	*1st step voltage*
U2= 655V	*2nd step voltage*
U3= 948V	*3rd step voltage*
U4=1284V	*4th step voltage*
U5=1593V	*5th step voltage*

Notes:
- *Timer information is displayed since start of the measurement till completion of each step measurement.*
- *Timer information shows the complete measurement period after completion of measurement.*
- *A high-voltage warning symbol appears on display during measurement to warn the operator against possible dangerous test voltage.*
- *Value of capacitance is measured during the final discharge of measured object.*

Set-up parameters *for Step Voltage test:*
- *Press the* ***SELECT*** *key, Set-up menu appears on display, see the figure 16.*
- *Select parameter (line) to be set using the ↑ and ↓ keys;*
- *Adjust set parameter using the ← and → keys.*
- *Complete the set-up adjustments pressing either the* ***ESC*** *key or* ***START*** *key (to run the measurement directly) or changing the rotary switch position. Last displayed settings are stored.*

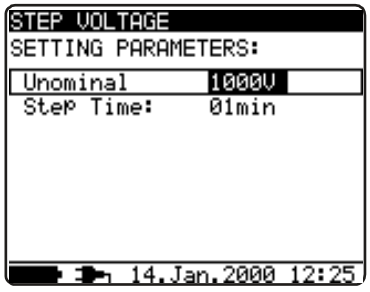


Fig. 16. *Set-up menu in Step Voltage Test*

Legend of displayed symbols:

STEP VOLTAGE		*Name of selected function*
SETTING PARAMETERS:		
Unominal	*1000V*	*Set test voltage – step 250 V*
Step Time	*01min*	*Duration of measurement per step*

Note:

- *Maximum value for* `Step Time` *is 30min.*

5.8. Withstanding voltage

This function offers Withstanding Voltage test of insulation material. It covers two types of tests:
a) Breakdown voltage testing of high voltage device, e.g. transient suppressors and
b) DC withstanding voltage test for insulation coordination purpose.

Both functions require breakdown current detection. The test voltage increases step by step from Start up to Stop value over a predefined time and it is kept at Stop value for predefined test time, see the figure below.

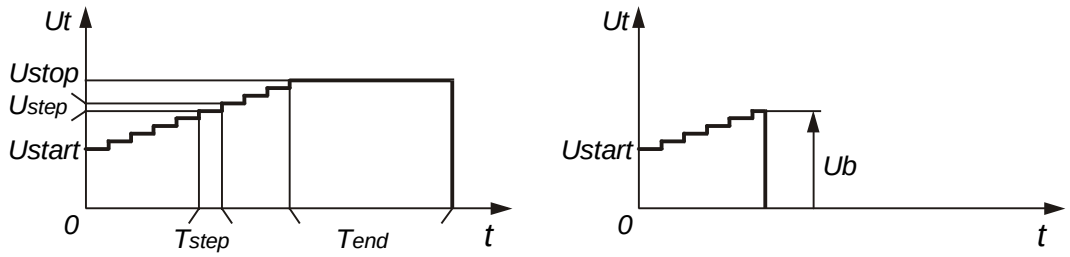
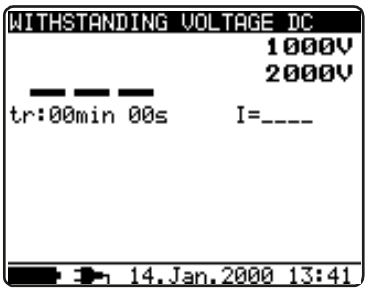


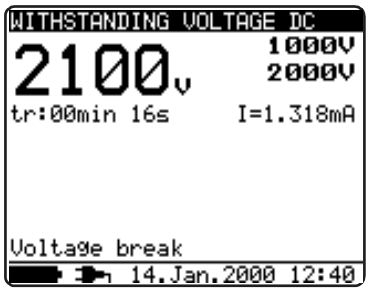
Fig. 17. *Test voltage presentation without breakdown (left part) and with breakdown (right part)*

Ut ..... Test voltage
Ustop .. End test voltage
Ustep .. Voltage step approx. 20 V (fixed value - not presetable)
Ustart .. Initial test voltage
Tstep... Test voltage duration per one step
Tend.... Constant test voltage duration after reaching End value
t..... Time
Ub ..... Breakdown voltage

Selecting this function the following display states are given (initial state and state with results after finishing the measurement).



Initial display



Display with results

Fig. 18. *Withstanding Voltage function display states*

Measuring procedure:

- *Connect test leads to the instrument and measured object.*
- *Press the **START** key to start the measurement.*
- *Wait until set timers run out or until breakdown occurs, result is displayed.*
- *Wait test object to be discharged.*
- *The result (see the right part of the figure 18.) can optionally be saved pressing the **MEM** key twice, see the chapter 6.1. Store, Recall and Clear Operation.*

Note:

- *Breakdown is detected when measured current reaches or exceeds the set current level* `Itrig`*.*

Legend of displayed symbols:

`WITHSTANDING VOLTAGE DC`	*Name of selected function*
`1000V`	*Start test voltage*
`2000V`	*Stop test voltage*
`2053V`	*Actual test voltage – measured value*
`I=0.04nA`	*Actual test current – measured value*
`tm:01min 00s`	*Timer information*

Notes:

- *Timer information shows needed time to accomplish each step until the measurement is on while it shows total measurement period after finishing the measurement.*
- *A high-voltage warning symbol appears on display during measurement to warn the operator against possible dangerous test voltage.*

Legend of displayed symbols:

`WITHSTANDING VOLTAGE DC`		*Name of selected function*
`SETTING PARAMETERS:`		
`Ustart`	`1000V`	*Start test voltage, step = 50 V*
`Ustop`	`2000V`	*Stop test voltage, step = 50V*
`Tstep`	`00min 00s`	*Duration of test voltage per one step*
`Tend`	`00min 00s`	*Duration of constant test voltage after reaching stop value*
`Itrigg`	`1.000mA`	*Set trigger leakage current, step = 10μA*

Set-up parameters *for Withstanding Voltage:*

- *Press the **SELECT** key, Set-up menu appears on display, see the figure 19.*
- *Select parameter (line) to be set using the ↑ and ↓ keys;*
- *Adjust set parameter using the ← and → keys. Skip to the next sub-parameter by pressing the **SELECT** key (if there are two or more sub-parameters) and repeat the adjustment.*
- *Complete the set-up adjustments pressing either the **ESC** key or **START** key (to run the measurement directly) or changing the rotary switch position. Last displayed settings are stored.*

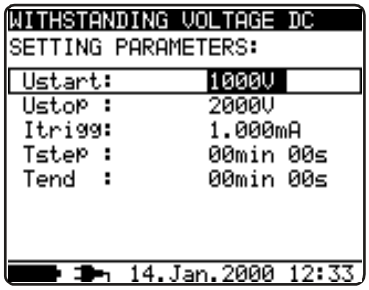


Fig. 19. *Set-up menu in Withstanding Voltage function*

`Tstep` *and* `Tend` *are independent timers. Maximum time for each timer is 30min 60s.* `Tend` *begins after completion of the ramp period. Ramp period can be calculated from:*

Tramp ≈ Tstep·(Ustop – Ustart) / 20V

If `Tstep` *is set to* `00min 00s` *then ramp voltage is increasing by approximately 20 V per 2s.*

6. Operation with Results

6.1. Store, Recall and Clear Operation

The instrument contains battery backup storage to retain the stored results. This is to enable the user to make the measurements first and later to recall them, analyze and print results or transfer them to a computer for further forming.

*After pressing the **MEM** key menu according to the figure 20. is displayed. Save, clear and recall operations are offered.*

SAVE	CLR	RCL	nnnn

*The **nnnn** means ser. number of stored result.*

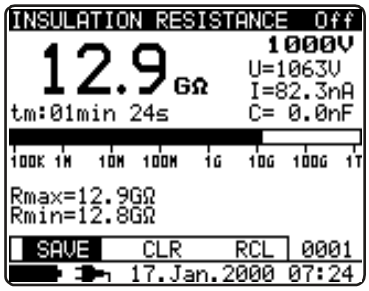


***Fig. 20.** Storage operation menu*

There are the following possibilities, selectable with ← or → arrow keys:

- *<u>To store result</u>: Select **SAVE** and confirm store operation by pressing the **MEM** key.*
- *<u>To recall stored result</u>: Select **RCL** and confirm recall operation by pressing the **MEM** key, last stored result will be displayed. Upper menu is replaced with:*

Recall: 0006

  *Figure 0006 presents ser. No. of stored result. Using the ↑ and ↓ keys also other stored results can be recalled. Press the **ESC** or **Start** key or turn rotary switch to exit this menu.*
- *<u>To clear **last** stored result</u>: select **CLR** and press the **MEM** key.*

To clear complete memory see the paragraph 4.2. Configuration.

Besides main result also subresults and parameters of selected function are stored when storing test results. There is a list of all data stored for each function.

Function	*List of stored data*
Voltage	*Function name* *Measured voltage* *Frequency of measured voltage* *Ser. number of stored result* *Date ** *Time **
Insulation resistance	*Function name* *Measured insulation resistance value* *Set test voltage* *Actual test voltage - measured value* *Actual test current - measured value* *Capacitance of tested object* *Duration of measurement* *Detected maximum value of measured resistance* *Detected minimum value of measured resistance* *Ser. number of stored result* *Date ** *Time **
Diagnostic test	*Function name* *Last measured insulation resistance* *Set test voltage* *Actual test voltage - measured value* *Actual test current - measured value* *Capacitance of tested object* *Complete duration of measurement* *Insulation Resistance value taken after elapsed T1* *Insulation Resistance value taken after elapsed T2* *Insulation Resistance value taken after elapsed T3* *First PI value* *Second PI value* *DD value* *Ser. number of stored result* *Date ** *Time **
Withstanding voltage DC	*Function name* *Last measured test voltage* *Set Start voltage* *Set Stop voltage* *Set trigger current value* *Actual test current - measured value* *Set Step test time* *Set End time* *Actual test time (at Stop test voltage)* *Ser. number of stored result* *Date ** *Time **

Step voltage	*Function name* *Last measured insulation resistance* *Set test voltage* *Actual test voltage - measured value* *Actual test current - measured value* *Capacitance of tested object* *Complete duration of measurement* *First step measured resistance with its nominal voltage* *First step actual test voltage - measured value* *Second step measured resistance with its nominal voltage* *Second step actual test voltage - measured value* *Third step measured resistance with its nominal voltage* *Third step actual test voltage - measured value* *Fourth step measured resistance with its nominal voltage* *Fourth step actual test voltage - measured value* *Last step measured resistance with its nominal voltage* *Last step actual test voltage - measured value* *Ser. number of stored result* *Date ** *Time **

Note:

- **Date and time **of storing** the test result are transferred to PC while date and time **of recalling** are displayed when recalling results.*

6.2. Data transfer

Stored results can be transferred to a PC. A special communication program has the ability to identify the instrument and download the data.

How to transfer stored data:

- Connect PC COM port to the instrument using the serial communication cable.
- Turn power on of PC and the instrument.
*- Run the program **isolink.exe**.*
- The PC and the instrument automatically recognise each other.
- The program on the PC enables the following possibilities:
-- download data;
-- clear storage;
-- change and download user data;
-- prepare a simple report form;
-- prepare a file to import to a spreadsheet.

*The program **isolink.exe** is a Windows 95/98 based PC software. Read file README.TXT for instructions on installing and running the program.*

7. Maintenance

7.1. Inspection

To maintain operator's safety and ensure reliability of the instrument it is good practice to inspect the instrument on regular basis. Check the instrument and accessories not to be damaged. If any defect is found please consult service centre, distributor or manufacturer.

7.2. Battery Replacement

The instrument is designed to be powered by internal alkaline battery or by rechargeable battery supported with mains supply. The LCD contains an indication of low battery condition. When the low-battery indication appears the battery has to be replaced or recharged, connect the instrument to mains power supply for 14 hours to recharge the rechargeable battery.

Note:

- *Operator does not need to disconnect the instrument from mains supply after full recharging period, it can be connected permanently.*

Battery cells are stored in the bottom section of instrument casing under battery cover. In case of defective battery please note the following:

- ***All six cells have to be replaced and they have to be of the same type.***
- ***Turn power off and disconnect any measurement accessory connected to the instrument before opening battery cover to avoid electric shock.***
- ***Do not operate the instrument by mains supply without rechargeable batteries to avoid permanent damage of internal circuit.***

Nominal power supply voltage is 7.2 V DC. Use six NiCd or NiMH cells with size equivalent to IEC LR14 (dimensions: diameter = 26 mm, height = 50 mm). See the next figure for correct polarity of batteries.

Fully charged rechargeable battery can supply the instrument for approx. 20 hours.

Note:

- *Standard IEC LR14 type alkaline cells can also be used to replace rechargeable battery.* ***Avoid connection to main supply when alkaline batteries are inserted.*** *High quality alkaline battery can supply the instrument for approx. 60 hours.*

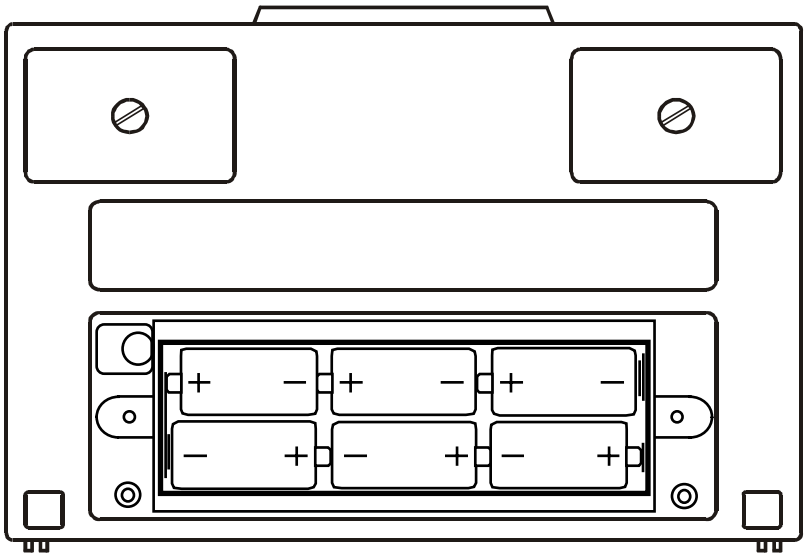


Fig. 21. *Correct polarity of inserted batteries*

Notes!

- *Insert cells correctly, otherwise test instrument will not operate and battery may be discharged!*
- *If the instrument is not to be used for a long period of time remove all batteries from battery compartment.*
- *Take into account handling and maintenance as defined by manufacturer of alkaline or rechargeable type of cells.*

7.3. Cleaning

Use a soft cloth slightly moistened with soapy water or spirit to clean the surface of the instrument and leave the instrument to dry totally before using it.

Notes!

- *Do not use liquids based on petrol or hydrocarbons!*
- *Do not spill cleaning liquid over the instrument!*

7.4. Calibration

It is essential that all measurement instruments are regularly calibrated. For occasional daily use, we recommend an annual calibration to be carried out. When the instrument is used continuously every day, we recommend calibrating the instrument every six months.

7.5. Service

For repairing under or out of warranty period contact your distributor for further information.

Manufacturer's address:

Nieaf-Smitt B.V.
Vrieslantlaan 6
3526 AA Utrecht
The Netherlands

Tel: *31(0) 30 288 13 11*
Fax: *31(0) 30 289 88 16*
E-mail: *sales@nieaf-smitt.nl*
Web site: *www.nieaf-instruments.com*

8. Specifications

8.1. Measurements

Insulation resistance

Nom. test voltage. *Any within 250 and 5000 V*
Current capability of test generator: *>1mA*
Short-circuit test current: *1.4mA max.*
Automatic discharge of tested object: *yes*

Measuring range Riso: 0.12 MΩ up to 5 TΩ)*

Display range Riso	*Resolution*	*Accuracy*
0 ÷ 999 kΩ	*1kΩ*	*±(5% of reading + 3digits)*
1.00 ÷ 9.99 MΩ	*10kΩ*	
10.0 ÷ 99.9 MΩ	*100kΩ*	
100 ÷ 999 MΩ	*1 MΩ*	
1.00 ÷ 9.99 GΩ	*10 MΩ*	
10.0 ÷ 99.9 GΩ	*100 MΩ*	
100 ÷ 999 GΩ	*1 GΩ*	
1.00 ÷ 5.00TΩ	*10 GΩ*	

**Full-scale value of insulation resistance is defined according the following equation:*

$R_{FS} = 1T\Omega * U_{test}[kV]$

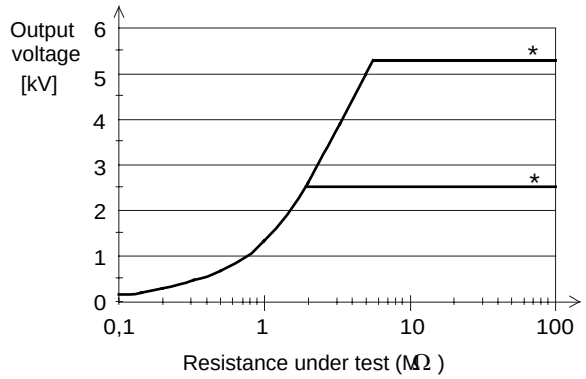
DC test voltage:
Voltage value: *Any value within 250V and 5000V, steps by 50V.*
Accuracy: *-0/+10% +20V.*
Output power: *5W max.*

Display range Test voltage (V)	*Resolution*	*Accuracy*
0 ÷ 5000	*1V*	*±(3% of reading + 3V)*

Current:

Display range I (mA)	*Resolution*	*Accuracy*
1 ÷ 1.4 mA	*10 μA*	*±(5% of reading + 0.05nA)*
100 ÷ 999 μA	*1 μA*	
10 ÷ 99.9 μA	*100 nA*	
1 ÷ 9.99 μA	*10 nA*	
100 ÷ 999 nA	*1 nA*	
10 ÷ 99.9 nA	*0.1 nA*	
0 ÷ 9.99 nA	*0.01 nA*	

Generator Capability vs. Resistance



* Note: examples of selected output voltage

Withstanding voltage

Voltage DC

Display range Withstanding voltage (V)	*Resolution*	*Accuracy*
0 ÷ 5500	*1V*	*±(3% of reading + 40V)*

Leakage current

Display range Itrigg (mA)	*Resolution*	*Accuracy*
0 ÷ 1.4	*1μA*	*±(3% of reading + 3digits)*

Voltage

Voltage AC or DC

Display range External Voltage (V)	*Resolution*	*Accuracy*
0 ÷ 600	*1V*	*±(3% of reading + 3V)*

Frequency of external voltage

Display range (Hz)	*Resolution*	*Accuracy*
0 and 45 ÷ 65	*0.1Hz*	*±0.2 Hz*

Note:

- *for frequency between 0 and 45Hz* *displayed <45 Hz*
- *for frequency over 65 Hz* *displayed >65 Hz*

Input resistance: 3MΩ ± 10%

Capacitance

*Measuring range C: 50 μF**

Display range C	*Resolution*	*Accuracy*
0 ÷ 99.9 nF	*0.1nF*	*±(5% of reading + 2digits)*
100 ÷ 999 nF	*1nF*	
1 ÷ 50 μF	*10nF*	

**Full-scale value of capacitance is defined according to the following equation:*

$C_{FS} = 10\mu F * U_{test}[kV]$

Polarization index PI

Display range PI	*Resolution*	*Accuracy**
0 ÷ 99.9	*0.01*	*±(5% of reading + 2digits)*

Dielectric discharge test DD

Display range DD	*Resolution*	*Accuracy**
0 ÷ 99.9	*0.01*	*±(5% of reading + 2digits)*

8.2. General specifications

Battery power supply ..... 9V DC (6 x 1.5V alkaline IEC LR14) or 7.2V DC (6 × 1.2V NiCd or NiMH IEC LR14)
Mains power supply ..... 230V AC (+6/-10%) 45Hz – 65Hz, 10VA
Protection classification ..... double insulation ⧈
Over-voltage category ..... CAT III 600V
Pollution degree 2
Degree of protection ..... IP 44
Dimensions (w × h × d) ..... 26.5 × 11 × 18.5 cm
Weight (without accessories, with batteries) .. 2.1 kg
Visual and sound warnings ..... yes
Display ..... LCD dot matrix with backlight - (160 x 116)
Memory ..... Non-volatile internal memory 1000 measurements with time and date.
Working temperature range ..... 0 ÷ 40 °C
Nominal (reference) temperature range ..... 10 ÷ 30 °C
Storage temperature range ..... -20 ÷ +70 °C.
Maximum humidity ..... 95 % RH (0 ÷ 40°C) non condensing
Nominal (reference) humidity range ..... 40 ÷ 60 % RH

AUTOCALIBRATION
Auto-calibration of measuring system ..... every time after turning power on

CONNECTING SYSTEM
Three safety banana sockets ..... +OUT, -OUT and GUARD.

DISCHARGING
Every time after measurement completion.
Discharging resistance: ..... 100kΩ ± 10%

SERIAL COMMUNICATION
RS232 serial communication ..... galvanic separated
Baud rates: ..... 2400, 4800, 9600, 19200 baud, 1 stop bit, no parity.
Connector: ..... standard RS232 9-pin D female.

CLOCK
Built in Real time clock ..... Displayed permanently and stored as parameter in combination with result.