

# **MD-5075x**

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*5kV Insulation tester*

## **User's Guide**



## Safety warnings

- Before to use this instrument the User's guide and Safety warnings must be read and understood.
- Safety procedures and rules for working near high voltage energized systems must be observed during the use of this equipment. **The generated voltages may be dangerous.**
- Do not connect or disconnect the test leads during the measurement.
- Be careful not to make short-circuit between the terminals while a measurement is running, because it could be dangerous for the operator.
- Be sure that there are not any voltage difference between the points to which the megohmmeter will be connected to, neither between them and ground.
- The panel, terminals and connectors of the equipment must stay dry and clean.

***This equipment should be used only by a trained and competent person, strictly applying suitable safety rules.***

## Used symbols



Caution, risk of electric shock.



Caution, refer to User Guide.



Equipment complies with current EU Directives.



Battery



Printer



Capacitance



Backlight

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## 1. Description

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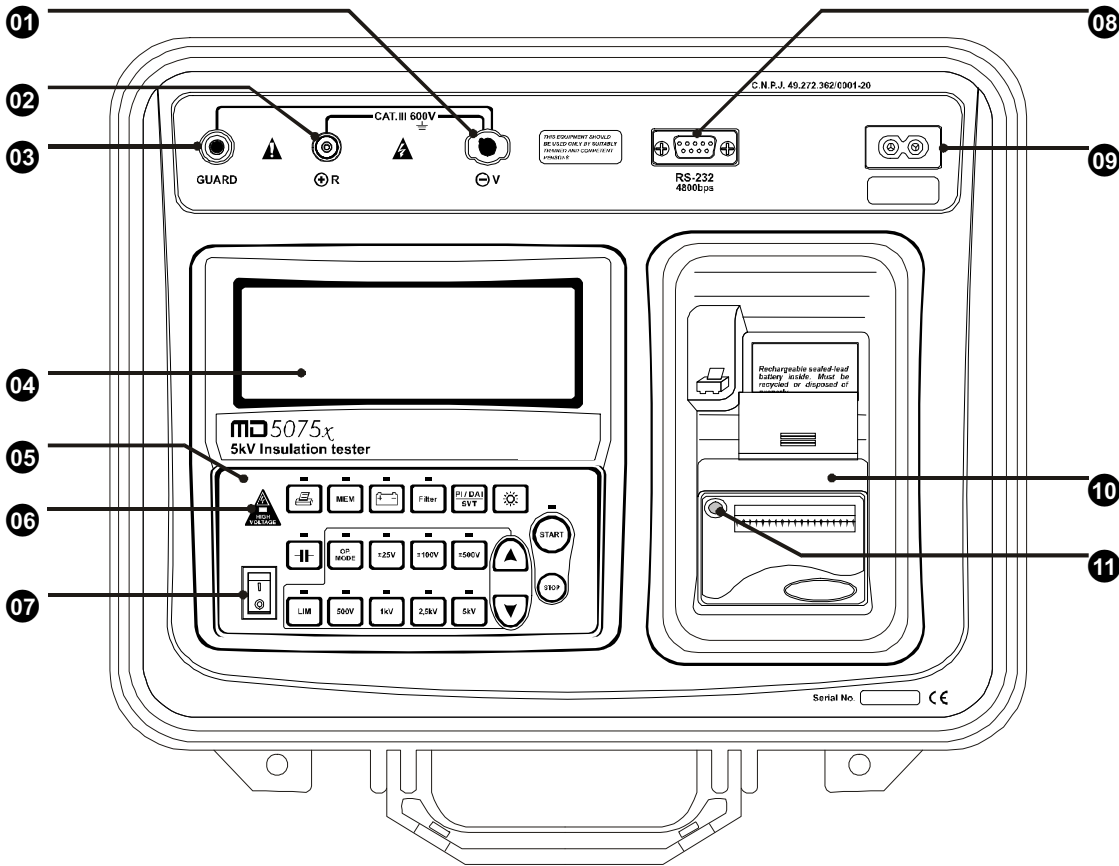
The digital insulation tester model **MD-5075x** is at the cutting edge of SOURCETRONIC insulation analyzer equipment and it is one of the more complete and sophisticated of the international market. It uses an efficient well experienced technology, which provides safe, reliable and accurate measurements of insulation resistances up to **5TΩ**, with 4 pre-selected test voltages, **500V - 1kV – 2.5kV - 5kV**. Other test voltages may be selected in steps of **25V, 100V, or 500V**.

A microprocessor controls the equipment, making the operation easier and enabling the incorporation of advanced features such as: Auto-range selection, Memory enabling storing up to 4000 readings, AC/DC voltmeter, Polarization and Dielectric absorption index automatic measurement, Measurement of Leakage Current and Capacitance, "TIMER" to program resistance test time, "Limit" allowing making test type "Pass / Fail" with programmable limit. Step Voltage Test, Built-in Printer, Real Time Clock and Calendar for measurement identification. Built-in chronometer, indicating elapsed time, in minutes and seconds, since the test started

RS-232 interface enables communication of the equipment with a computer to transmit registered data. MegaLogg2 software analyzes the results and shows through drawings and tables, automatically generating the test protocol. The built-in printer records values on paper every each 15 seconds, as a measurement taken document.

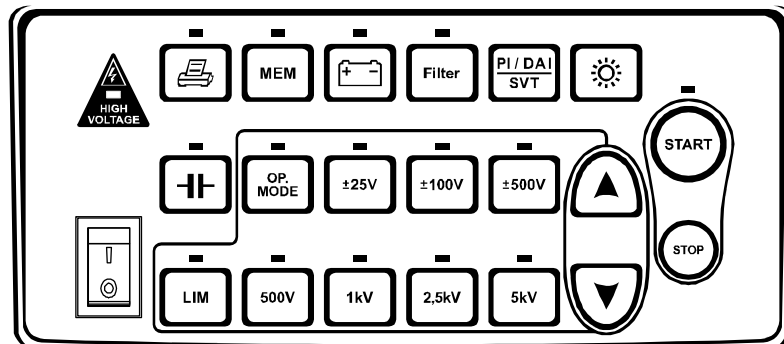
Owing to its constructive features, this instrument is strong delivering an excellent performance both with laboratory and field works, under hard environment conditions, typical from tropical regions.

## 2. Panel control functions



01	Voltage output terminal (-V)
02	Zero reference terminal (+R)
03	Guard (G) Terminal
04	Display
05	Keyboard
06	High Voltage led
07	On / Off key
08	RS-232 communication port
09	Power supply input
10	Printer
11	Paper feed control

### 3. Keyboard

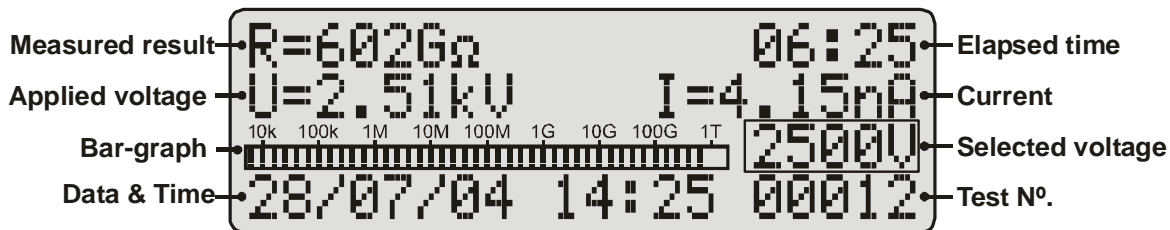


Key	Function	LED
A	Turns the printer on/off	Indicates that the printer is turned on.
B	<b>Hold</b> – Freeze the last reading on the display	The Hold function is on
X	<b>Battery</b> – exhibits the battery load status on the display	Indicates that the battery charger is on
Δ	<b>Filter</b> – Activates the filter that minimizes the interferences of the external noise	Indicates that the filter is on
E	Shows the calculated value on the display as a result of a Step Voltage Test (SVT), Polarization Index (PI) and Dielectric Absorption Index (DAI)	–
Φ	<b>Backlight</b> – activates the display light	–
Γ	<b>Capacitance</b> – exhibit the capacitance value	Indicates that the capacitance value is being exhibited
H	Activated enables the programming of the Operation Mode (Normal, SVT or with TIMER of selectable time)	Indicates that the selection of the <i>Operation Mode</i> is enabled
I	Activated, enables programming of 25V step tests voltages	25V steps activated
∅	Activated, enables programming of 100V step tests voltages	100V steps activated
K	Activated, enables programming of 500V step tests voltages	500V steps activated
M	Selection of 500V test voltage	Indicates 500V selected
N	Selection of 1kV test voltage	Indicates 1kV selected
O	Selection of 2.5kV test voltage	Indicates 2.5kV selected

Π	Selection of 5kV test voltage	Indicates 5kV selected
Θ P	These keys (decrease or increase) enable the selection of the value that is being programmed.	–
Λ	Activates/ enables programming of the limit for the “Pass / Fail” test	Indicates when the measured resistance is lower than programmed limit
Σ	<b>Start</b> – Start test	Indicates that the test is being executed
Υ	<b>Stop</b> – End of test	–

## 4. Display

Measurement results in the corresponding measuring unit, elapsed time since the measurement started, selected test voltage, analogue indication by means of a bar-graph and several messages to the operator are displayed on alphanumeric LCD.



## 5. Charging Battery

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The **MD-5075x** uses a rechargeable Ni-MH 12V – 3Ah battery. This battery should be recycled at the end of its service life or placed in an appropriate site, in order to protect the environment.

### Charging Procedure:

Test if the **MD-5075x** is off and connect it to the mains. The charging indicator (led over key X) will turn on red and will remain that way until the battery is totally charged. Then the light will remain green and keep in that way until the **MD-5075x** is disconnected of the mains. If the equipment is turned on, the charging procedure will be momentarily interrupted, with the mains supplying the operation of the **MD-5075x** till it is again turned off.

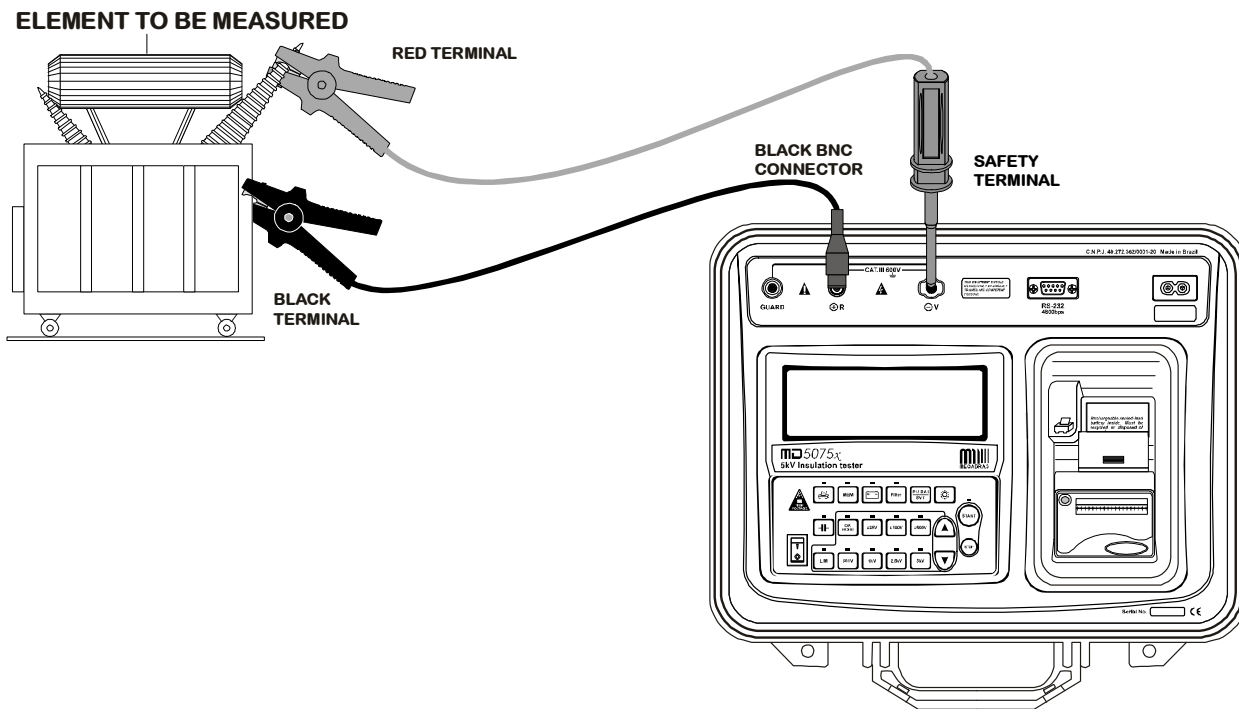
***Note:** the battery losses part of its charge slowly, even when it is not under use. Before using this device, or after not using it for a long time, the battery may need to be recharged.*

## 6. Connecting the MD-5075x

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**ATTENTION:** Bearing in mind operator's safe working conditions, procedures detailed below should be carried out with the device being in OFF position.

Please, do check there is no difference of potential voltages between the points where the **MD-5075x** shall be connected to. Please, check the same between those points and the ground. Connect the red cable security terminal to the megohmmeter **(-V) output terminal**, the BNC terminal of the black cable to the **zero reference (+R)** terminal and the "alligator" terminals to the element to be measured as indicated in the figure detailed below.



*The terminals in the picture are merely illustrative, so there can be differences between them and the ones which really come with the equipment.*

**Observation:** At the time of the connection, the equipment automatically enters in the voltmeter mode and begins to exhibit both the circuit voltage and current in the display.

## 7. Use of “Guard” (G) terminal

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Depending on the measurement to be made, the **Guard (G)** may be used or not. During measurements, the equipment should be electrically grounded to avoid unsteady readings. When insulation is measured regarding grounding, the **R** terminal is connected to earth and the condition by means of which the equipment potential setting is fulfilled. If the measurement is performed between two parts, which are not grounded (for example, between two phase conductors in a three-phase cable), the megohmmeter *GUARD* terminal must be grounded. This implies that **whenever a measurement is performed, one of the GUARD or R terminals must be grounded, but not both of them simultaneously.**

Technical Note #32, reproduced at the end of the manual, explains the usage of GUARD terminal in order to eliminate the parasite resistance effect over the result of measurements.

## 8. Setting tests

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The megohmmeter **MD-5075x** is an extremely versatile instrument that enables automatic performance of several types of insulation tests, and records them in its internal memory and/or prints the results. Thus, it is necessary to appropriately define the tests to be performed, setting the following parameters before starting the measurement:

- Test voltage
- Test duration for “TIMER” mode test
- Maximum Voltage for step voltage test (SVT)
- Minimum resistance limit for “Pass/ Fail” tests

## 8.1. Test voltage definition

In order to define the test voltage value, first it is necessary to select one of voltage adjustment keys: I,  $\vartheta$  or K. These keys enable both the pre-programmed voltage selection (M, N, O and II) and the  $\Theta$  and P keys which increase or decrease the value of the step voltage test for 25V, 100V or 500V, depending on the selected voltage adjustment key. As long as the equipment is on, the voltage adjustment key K will be selected. Please, press again the adjustment key selected at the moment with the aim of leaving the test voltage selection mode.

**Note:** *Test voltage is the only one parameter that may be modified during tests.*

## 8.2. Selection of the operation mode

The **MD-5075x** megohmmeter has four operation modes: Normal, with "TIMER", SVT and "Pass / Fail". The first three modes are selected using the H key; the "Pass/ Fail" test mode is activated pressing  $\Lambda$  key.

### 8.2.1. Normal mode

The normal mode is used in the resistance measurement with unique voltage, without time limit. When selected, there are no special indications in the display.

### 8.2.2. "TIMER" Mode

The use of H key allows the **MD-5075x** setting for the performance of a pre-set - duration test; when this mode is selected, the display shows the programmed time. Use  $\Theta$  and P keys to define the duration of the tests in 30 seconds, 1 minute, 3 minutes, 10 minutes or 30 minutes.

### 8.2.3. SVT Mode (step voltage tests)

The use of H key allows the **MD-5075x** setting for the performance of a step voltage test; when this mode is selected, the display shows the **SVT** abbreviation. Under this operation mode, the user does not define a specific voltage test, but a maximum voltage value the device will start tests applying a 500V voltage and increase this value in 500V steps each minute until reaching the programmed voltage. At each stage, the **MD-5075x** measures the resistance before advancing towards the following step.

The use of voltage adjusting keys, determines the value of the highest voltage – which will be, in all cases, a multiple of 500V, up to a 5000V limit. It is advisable to use the K key in order to select this value; I and ⌘ keys may be used, but if the selected value is not a multiple of 500, it will be rounded down. The test result is calculated according to the following formula:

$$SVT = \frac{R_{VMAX}}{R_{500}}$$

After test ending, the value may be recovered by pressing E key.

### 8.2.4. “Pass / Fail” Test mode

Press Λ key in order to determine the lower insulation limit for type “Pass / Fail” test. Select this value using Θ and P keys. Possible values are 10MΩ, 100MΩ, 1GΩ or 10GΩ.

During a “Pass/ Fail” test, the **MD-5075x** will indicate when the insulation resistance is lower than the programmed limit, both with an intermittent BIP and the Λ key led flashing . The Λ key led will remain flashing until the end of tests, or until the measurement of the resistance value is greater than the programmed limit.

## 9. How to perform tests

After having set the desired measurement, press  $\Sigma$  key. The **HIGH VOLTAGE** indicator will turn on indicating that the megohmmeter is applying high voltage to the element under test. During some seconds the intelligent auto- range system will search for the most convenient range for the value under measure. At this moment the display will show the message “**WAIT...**”. As soon as the **MD-5075x** selects the appropriate scale, the display will show the number of tests, the selected voltage value, exhibiting the value of the applied voltage and of the leakage current, date and time, will start counting the elapsed time and the resistance value indication will be exhibited with its corresponding unit, and the analogue indication will start by bar-graph. In order to end tests, press the Y key. At that moment, last measured values will remain frozen in the **MD-5075x** display. By pressing the Y key again, the equipment will return to the voltmeter function.

### Example:

The measured value is  $602\text{G}\Omega$  with voltage selected of  $2,500\text{V}$ . The display exhibits the number of tests (00012), the measured resistance value ( $602\text{G}\Omega$ ), the elapsed time (06:25 minutes), the applied voltage ( $2.51\text{kV}$ ), the leakage current ( $4.15\text{nA}$ ), both the date and time.



Note: If the resistance to be measured overpasses the  $5\text{T}\Omega @ 5\text{kV}$  limit, the following message will be exhibited: **R > 5TΩ**

*ATTENTION: Please, never connect or disconnect test cables with the megohmmeter under operation or while the High Voltage led is on. If there is a need to modify connections, this should be done with the equipment disconnected and with discharged potentials (High Voltage led off)*

## 9.1. Measurement of the Polarization Index (PI)

When pressing the E key during the tests, the Polarization Index (PI) value will be exhibited on the display. It is only possible to apply this function after a minimum of 10 minutes of measurement; in case the key is pressed before this minimum limit, the display will show the message of value exhibition of PI value, but will not show any value. The polarization index is the quotient between the values of the insulation resistance measured both in 10 minutes and 1 minute. This index is useful to detect the damage of the insulation resistance by the excessive presence of dust, dirt and greases or through the action of chemical and physical agents.

$$PI = \frac{R_{10 \text{ minutes}}}{R_{1 \text{ minute}}}$$

## 9.2. Measurement of the Dielectric Absorption Index (DAI)

When pressing the E key during the tests, the Dielectric Absorption Index (DAI) value will be exhibited on the display. It is only possible to apply this function after a minimum of 1 minute of measurement; in case the key is pressed before this minimum limit, the display will show the message of value exhibition of DAI value, but will not show any value. The polarization index is the quotient between the values of the insulation resistance measured at the 60 and 30 second, and it is useful for preventive and predictive maintenance of windings (present in transformers, motors, generators, etc.)

$$DAI = \frac{R_{60 \text{ seconds}}}{R_{30 \text{ seconds}}}$$

## 10. Other functions

### 10.1.1. Backlight

The equipment display has a backlight. In order to activate it, press  $\Phi$  key. After 10 seconds the backlight will auto-turn off in order to economize the battery charge. If you want to reactivate it, press  $\Phi$  key again.

### 10.1.2. Filter

When insulation measurements are carried out in transformers or in large dimension machines, in presence of strong electromagnetic fields, it is possible for the equipment reading to be unstable, especially for resistance values higher than 300M $\Omega$ . In these cases it is convenient to press the  $\Delta$  key before starting the measurement activating the filter which allows for the reaching of the insulation resistance value in an upward curve without significant oscillation.

### 10.1.3. True RMS AC/DC Voltmeter

In order to use this function, connect the test points and turn on **MD-5075x**. The measured value will be exhibited automatically in the display.

AC	DC
30V up to 600V r.m.s.	30V up to 600V

Precision:  $\pm$  (5% of the reading + 3 digits)

### 10.1.4. Leakage current measurement

During the tests, the megohmmeter measures and exhibits in the display the leakage current value within an interval of 1nA up to 1500nA, with a Precision of  $\pm$  (10% of the reading + 3 digits).

### 10.1.5. Capacitance Measurement

The capacitance value is obtained by measuring the insulation resistance. After finishing measuring (When the Y key has been pressed), press the  $\Gamma$  key and the capacitance value will be exhibited on the display.

Voltage	Capacitance
500V	50nF up to 10 $\mu$ F
1.000V	50nF up to 5 $\mu$ F
2.500V	30nF up to 2 $\mu$ F
5.000V	30nF up to 1 $\mu$ F

Precision:  $\pm 10\%$  of the measured value  $\pm 3$  digits

**Note:** “0” will be exhibited on the display when measuring values lower than 50nF

### 10.1.6. Memory

It allows holding the last performed reading on the display at the moment when pressing the B key without interrupting the tests. When this key is pressed again, the megohmmeter updates the resistance and chronometer values. The led on B key and the letter **H** on the display indicate that the function has been activated

### 10.1.7. Battery status check

Hold the X key pressed in order to check the battery status during measurements. The analogue bar-graph will give an approximate visual representation of the remaining charge percentage; additionally, the display will show the message “**Battery Status OK**” if the charge is enough, or “**Battery Status Low**” if the charge is low. In this last case, it is highly advisable to charge the battery before using the apparatus. If battery charge is under 20% of the total, the message **Battery Low** will automatically appears on the display.

### 10.1.8. Auto power-off

The **MD-5075x** auto-turns off after 10 minutes of inactivity, or after 35 minutes of measuring without checking the battery status.

## 11. Data Transfer

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In order to transfer data from the **MD-5075x** to a computer, please use the cable provided with the accessories. Connect it to the **RS 232** port of the **MD-5075x** and the computer.

Open Windows "Start" Menu, then go to "Programs", "Accessories", "Communications", and select the "Hyper Terminal" program. In order to create a new connection, enter a name, select an icon and click on OK. Choose the correct communication port in the next window. After clicking on OK, select the following data in the next window:

<i>Bits by second: 4800</i>
<i>Data bits: 8</i>
<i>Parity: none</i>
<i>Stop bits: 1</i>
<i>Flow control: none</i>

Now the PC is correctly set to receive the information obtained from measurements. If memory stored data transference to the computer is desirable, the **MegaLogg2** software must be used; in order to carry out data transference in real time, just start a test with the  $\Sigma$  key and the **MD-5075x** will send measured values.

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## 12. MegaLogg2 Software

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This software makes communication between **MD-5075x** and a computer with Windows operative system easier. It makes the transference of all the data recorded in the apparatus memory, enabling the user to synchronize the date and time of the equipment internal clock with the computer date and time, to generate graphics and reports of tests and to clear the memory of the megohmmeter. Installation and operation instructions are included in the software.

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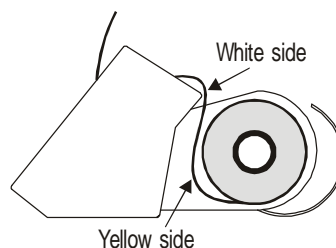
## 13. Printer

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Please, press A key in order to enable the results automatic printing. Measured values will be printed every 15 seconds, while the Dielectric Absorption Index and Polarization Index will be printed after 1 minute and 10 minutes respectively. Printing may be started or stopped at any time during the test. However, it is convenient to turn the printer on before starting the test in order to print it completely, including the heading. After last measurement, press PAPER FEED CONTROL key – placed in the printer - three times to see the last lines before cutting the paper.

***Attention:*** Do not pull the paper. Never try to put the paper back into the printer. In any of these cases, the printer may be easily damaged

This **MD-5075x** printer uses 37mm-wide thermal paper, which comes in a 33mm-diameter reel. The figure shown below indicates how to introduce the paper correctly.



Press the PAPER FEED CONTROL key until the paper turns up. In order to remove the old paper reel, cut the paper next to it and press the key PAPER FEED CONTROL.

## **14. Cleaning**

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The panel, terminals and connectors of the equipment must stay dry and clean. Cleaning should be made using a wet cloth in water and a soft detergent or isopropyl alcohol (be sure that the products to be used for cleaning does not affect plastic goods).

## 15. Technical specifications

<b>Test voltages</b>	: 500 - 1,000 - 2,500 - 5,000V with fast selection. From 500V to 5kV selectable in 25V, 100V or 500V steps. DC, negative in relation to grounding.
<b>Maximum resistance reading</b>	: 5T $\Omega$ @ 5kV
<b>DC Voltmeter</b>	: 30V up to 600Vcc Precision: $\pm$ (5% of the reading + 3 digits)
<b>AC voltmeter</b>	: 30V up to 600V r.m.s. Precision: $\pm$ (5% of the reading + 3 digits)
<b>Over voltage protection</b>	: CAT. III – 600V
<b>Current measurement</b>	: 1nA up to 1500nA $\pm$ (10% of the reading + 3 digits)
<b>Capacitance Measurement</b>	: 50nF up to 10 $\mu$ F @ 500V 50nF up to 5 $\mu$ F @ 1,000V 30nF up to 2 $\mu$ F @ 2,500V 30nF up to 1 $\mu$ F @ 5,000V  Precision: $\pm$ 10% of the reading $\pm$ 3 digits
<b>Short circuit current</b>	: Max. 2mA
<b>Display</b>	: Alphanumeric. It exhibits measurements both digitally and analogically by bar-graph.
<b>Test voltages accuracy</b>	: $\pm$ 3% of nominal value over a 10G $\Omega$ resistance
<b>Megohmmeter accuracy</b>	: $\pm$ 5% of reading between 1M $\Omega$ and 1T $\Omega$ @ 5kV $\pm$ 20% of reading between 1T $\Omega$ and 5T $\Omega$ @ 5kV (For minor test voltages, the superior limit is proportionally reduced) $\pm$ 20% of the reading between 10k $\Omega$ and 100k $\Omega$ $\pm$ 10% of the reading between 10k $\Omega$ and 1M $\Omega$
<b>Advanced features</b>	: • Automated Polarization Index computing • Automated Dielectric Absorption Index computing • “Pass-fail” and fixed time tests • Step Voltage Test • Memory for up to 4000 measurements • Filter to minimize interferences
<b>Printer</b>	: Prints elapsed time, actual voltage applied to the element under test and measured resistance
<b>PC Interface</b>	: Serial output of data RS-232 to 4800 b.p.s., opto-insulated.

<b>Built-in chronometer</b>	: Indicates elapsed time from the beginning of the measurement mm: ss format, up to 90:00
<b>Environmental protection index</b>	: IP-54 (with closed lid)
<b>Safety</b>	: Meets the requirements of IEC 61010-1/1990, IEC 61010 1/1992 amendment 2
<b>Electromagnetic compatibility (E.M.C)</b>	: In accordance with IEC 61326-1
<b>Electro magnetic irradiation immunity</b>	: In accordance with IEC 61000-4-3
<b>Electrostatic immunity</b>	: In accordance with IEC 1000-4-2
<b>Power supply</b>	: Internal rechargeable battery NI-MH 12 V - 3 Ah, mains of 100 - 240V~
<b>Battery charger</b>	: For 100 - 240V~
<b>Operating temperature</b>	: -5°C to 50°C
<b>Storage temperature</b>	: -25°C to 65°C
<b>Humidity</b>	: 95% RH (non condensing)
<b>Altitude</b>	: 3000m
<b>Equipment weight</b>	: Approx. 4,3 kg
<b>Dimensions</b>	: 340 x 295 x 152mm
<b>Supplied accessories</b>	: • 3 measurement cables (up to 25kV) • Power supply cable • Cable for RS-232 • Carrying bag • Operation manual • License for MegaLogg2 software use • 10 printer paper reels.

Subject to technical change without notice.

## 16. Application note 32

### Use of “Guard” terminal in megohmmeters

When insulation resistance measurements are performed with megohmmeters, specially with high sensitivity instruments measuring high resistance values, the use of the *GUARD* terminal avoids the harmful influence of stray resistances. In order to better explain the function of this terminal, let us start reviewing the megohmmeter basic circuit diagram of Fig. 1.

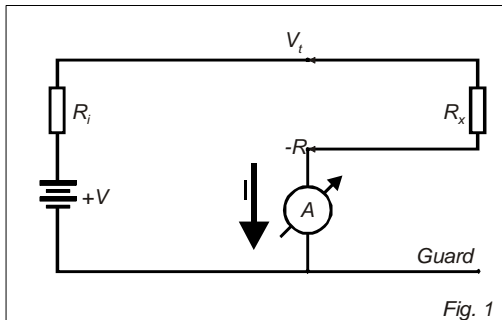


Fig. 1

Where:

- +V : DC high-voltage generator
- Ri : Generator internal resistance
- A : Indicator meter (microammeter)

The unknown resistance ( $R_x$ ) is connected between  $V_t$  and  $-R$  terminals. Its value determines the current passing through the circuit, which in turn is indicated by the microammeter. The value of  $R_x$  can be determined as follows:

$$R_x = \frac{V}{I} - R_i$$

In many cases the resistance to be measured is in parallel with other stray resistances which influence on  $R_x$  should be minimized. A typical example of this situation is when the insulation resistance between primary and secondary windings of a transformer mounted inside a metal housing is to be measured.

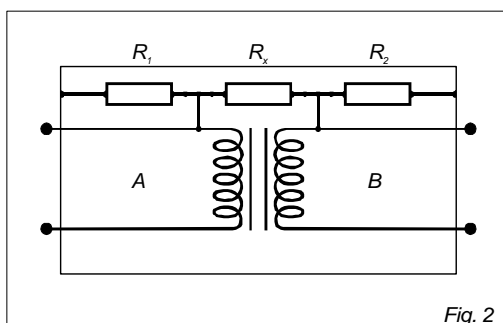


Fig. 2

$R_x$ : Insulation resistance between primary and secondary winding.

$R_1$ : Insulation resistance between primary winding and housing.

$R_2$ : Insulation resistance between secondary winding and housing.

If megohmmeter (terminals Vt and R) is connected to transformer terminals A and B, and considering that the resistance of the coils on each side of the transformer may be disregarded,  $R_x$  appears to be in parallel with  $(R_1 + R_2)$ . The situation is changed if we connect the transformer housing to GUARD terminal. Then the circuit will be:

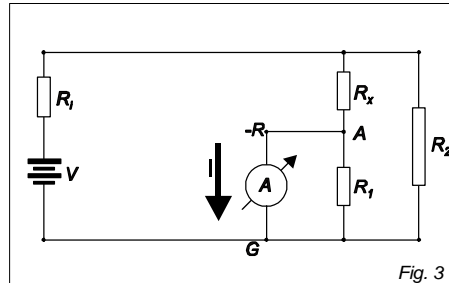


Fig. 3

In the circuit of Fig. 3 it may be noted that  $R_1$  is in parallel with a low-value resistance (the one from the microammeter) therefore its influence is reduced during reading.

Through resistance  $R_2$  circulates a current which is not passing through the meter and consequently does not affect the reading. In fact, current through  $R_2$  originates a certain error, since it creates an additional voltage drop in  $R_1$  which was not regarded during megohmmeter calibration. As regards the practical use of megohmmeter, it shall be considered that if  $R_1$  and  $R_2$  are higher than  $100M\Omega$ , any value of  $R_x$  will be measured with an insignificant error. For example: Let us consider  $R_x = 3.000M\Omega$  and  $R_1 = R_2 = 100M\Omega$ , the reading without using the GUARD terminal would be  $187.5M\Omega$ , which is quite wrong. On the other hand, if the GUARD terminal is properly used, we would have  $3.000M\Omega$ .

## 17. Warranty

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SOURCETRONIC GmbH warrants to the original purchaser that each equipment it manufactures will be free from defects in material and workmanship under normal use and service. The warranty period is valid for **12 months**, except the built-in rechargeable battery that has **06 months**, and begins on the date of shipment. The manufacturer's warranty does not apply to any product or accessories which, in the manufacturer's opinion, has been misused, altered, neglected, or damaged by accident or abnormal conditions of operation and handling.

To obtain warranty service, send the equipment, with a description of the difficult, shipping and insurance prepaid, to SOURCETRONIC. The manufacturer assumes no risk for damage in transit. SOURCETRONIC will, at its option, repair or replace the defective equipment free of charge or refund your purchase price. However, if SOURCETRONIC determines that the failure was caused by misuse, alteration, accident or abnormal condition or handling, you will be charged for the repair and the repaired equipment will be returned to you transportation prepaid.

This warranty is exclusive and is instead of all other warranties, express or implied, including but not limited to any implied warranty or merchantability or fitness for a particular purpose or use. SOURCETRONIC will not be responsible for any special, indirect, incidental, or consequential damages or loss of data, whether in contract, or otherwise.

For application or operation assistance or information on SOURCETRONIC products, contact:

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