

LKG 610

User Manual



- ▶ **Compact**
- ▶ **Lightweight**
- ▶ **Easy to Use**

Electrical Safety Analyzer (Safety Tester)



NETECH

Innovative Instruments Since 1987

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Notices

Copyright

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Quality Assurance

Netech is ISO 9001-2015 Registered. This instrument was thoroughly tested and inspected according to Netech's ISO 9001-2015 quality system and test procedures and found to meet those specifications when it was shipped from the factory. Calibration measurement Instruments are traceable to the NIST (National Institute of Standards and Technology).

Trade Mark

Netech and LKG 610 are trademarks of Netech Corporation. Any other trademark names used in this manual are only for editorial purposes and the benefit of the respective trademark owner with no intention of improperly using that trademark

Unpacking and Inspection of the Unit

Before unpacking the LKG 610, inspect the shipping box for any visual damage. If damage is found, do not unpack the unit and immediately notify the shipping carrier. If no damage is found to the shipping box, open the box and perform a visual inspection of the LKG 610. If any damage to the unit is observed please contact Netech Customer Service.

Technical Support

For technical support questions, either email

Techsupport@NetechBiomedical.com or Call 1-800-547-6557

or (1-631-531-0100)

Refunds and Credits

A Return Material Authorization (RMA) number must be obtained from our service or customer service dept, before a product is returned for refund or credit. The RMA number should be clearly marked on the package along with a statement indicating the reason for return.

Restocking Charges

Products returned within 30 days after purchase are subject to a restocking charge of 15%. Products must be shipped prepaid in original shipping cartons with all accessories and parts. Additional charges will be applied for any missing parts or accessories.

Repair and Recalibration

Products returned for repair or recalibration must obtain a RMA (Return Material Authorization) from our service department after completing a service request form our website <https://www.NetechBiomedical.com/repair> or contact Netech Customer Service

Department at CustomerService@NetechBiomedical.com

Calibration

The LKG 610 is factory calibrated, thoroughly tested, and meets Netech's ISO 9001-2015 quality standards.

Any attempt to remove or tamper with the calibration seal will void the warranty.

General Contact Information



Netech Corporation, 110 Toledo St, Farmingdale, NY 11735.

Phone: 631-531-0100, (or) 1-800-547-6557

Website: www.NetechBiomedical.com

Email: sales@NetechBiomedical.com

Warnings

SYMBOL	DESCRIPTION
	Caution: Important Safety Information
	Hazardous Voltage

WARNINGS



Make sure that the power requirements of the Device Under Test are within the power ratings of the LKG 610, 15 amps at 110 volts and 10 amps at 220 volts.



Do not leave the Device Under Test continuously turned on and connected to the LKG 610.



Before testing 220 Volt devices make sure the LKG 610 is plugged to a 220 Volt outlet using the adapter and connect the 220 Volt device to the LKG 610 using the supplied universal adapter.



Do not attempt to open the LKG 610. There are no user serviceable parts inside. Further, the warranty will be void if the unit is opened by anybody other than Netech trained personnel..

Introduction

Description

The LKG 610 is a compact Electrical Safety Analyzer designed to evaluate the electrical safety of all electrical equipment including medical devices and physiological Instrumentation.

The LKG 610 measures line voltage, outlet polarity, device current, earth leakage, chassis resistance, leads leakage, case leakage, and performs lead ISO tests and point to point measurements.

Each measurement is quickly and easily performed when its function key is pressed. The function selected and the unit of measure is indicated by an individual LED. Either the AAMI ESI -1993 or the IEC 601-1 test load may be selected.

Resistance measurements are made using the included model 503 single conductor test lead. A unique feature of the LKG 610 is its ability to verify the test readings with calibrated outputs of 200 μ Amps and 1 Ohm.

The comprehensive LKG 610 provides the best combination of features, performance, and value in a portable electrical safety analyzer.

LKG 610 Features

- Fast and Accurate
- Large LCD Display
- Accessible Line Fuse
- Calibrated Test Points
- 15 & 20 Amp Capability

- Point to Point Testing
- 10 Lead ECG Connector
- Complies with both AAMI & IEC 601 Test Loads
- LED unit of measure Indicator

Preparation for Use

The LKG 610 is shipped with the following items included in the customized hard case:

- LKG 610 Electrical Safety Analyzer
- 503 Test Lead
- Hard Carrying Case
- User Manual

The LKG 610 includes a test lead, part # 503, for measuring Cord Resistance and Case Leakage. Connect the LKG 610 to a 110 VAC outlet (or 220 VAC outlets for the 220 Volt Model).

During the initial setup the last digit of the LCD will change gradually due to the time constant of the RMS to DC converter. The display will stabilize to zero in a few seconds.

There are 2 models of LKG 610 available. Prior to using the device identify the Part number and the model purchased. The following are the part numbers and the operational voltages.

1. PN: 535-110, for 110 Volt devices only.

2. PN: 535-220, for 220 Volt devices only.

Before proceeding with any measurement become familiar with the measurements and the function selector switch.

Specifications

Display: 3-1/2 Digit LCD Display

Leakage Current: 0-1999 Micro Amps. All Current measurements are made through the AAMI/ANSI ES1-1985 or IEC 601-1 test load. The meter readings correspond to the true RMS value of the current.

Accuracy: DC to 1KHz: 1% FS + 1 LSD
1 KHz to 100 KHz: $\pm 2.5\%$ FS + 1 LSD
100 KHz to 1MHz: $\pm 4\%$ FS + 1 LSD

Resistance: 0 TO 1999 Milli Ohms.

Accuracy: + 1 % of reading + 1 LSD

Device Current: 0 to 19.99 Amps

Accuracy: + 2% Full Scale + 1 LSD

Line Voltage: 1 to 300 Volts

Accuracy: + 2% + 1 Volt

Test Receptacle: Hospital Grade 110 VAC -15 Amp or 220 VAC 10 Amp. The rocker polarity switch selects NORMAL, OFF and REVERSE polarity to the test receptacle, and a momentary Neutral switch will open the neutral line to the test receptacle.

Power Requirements: 110 VAC 50-60Hz, 15 Amps or 220 VAC, 10 Amps maximum rated for the test outlet and 0.1 Amp rated for the unit.

Physical Dimensions: 8.0 X 4.5 X 2.0 inches (20.3 X 11.4 X 5.0 cm)

Weight: 2.5 lbs (1.1 kg)

Instrument Familiarization

Before getting started, it is important to get familiar with the control and operation of the unit.

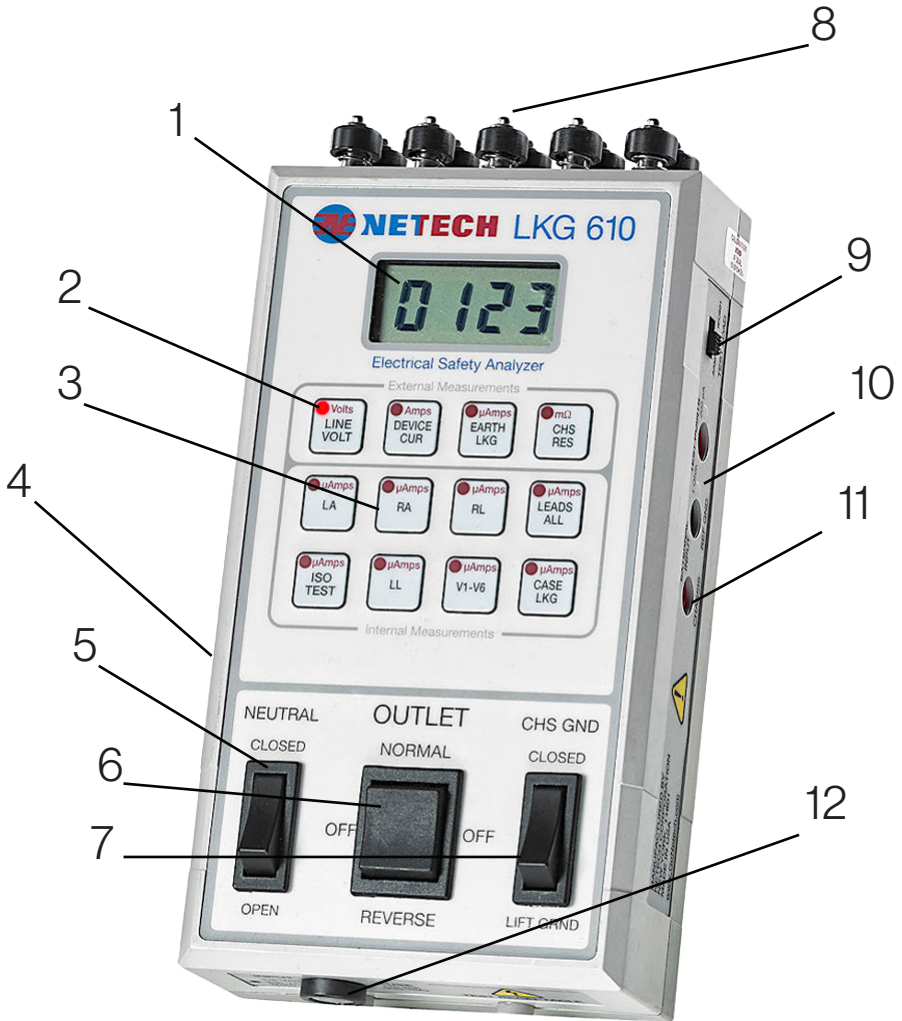


Figure 1. LKG 610 Controls

Number	Description
1	Display - A 3.5 digit LCD presents the result of the selected test measurement.
2	LEDs - An LED in the corner of each function key indicates the selected test mode and the unit of measurement displayed.
3	Keypad - Twelve push button function keys to select the test measurement
4	Zero Adjustment - Recessed adjustment to zero any test cable resistance variations
5	Neutral Switch - A switch to momentarily open the neutral line to the test receptacle.
6	Polarity Switch - A three-position switch to select the normal and reverse polarity of the test receptacle. The center position shuts the power off to the test receptacle.
7	Ground Switch - A switch to momentarily open the ground connection to the test receptacle.
8	ECG Connectors - Universal connectors to connect ECG snaps or various sized posts
9	Load Selector Switch - A slide switch on the right side of the instrument to select either the AAMI or the IEC 601-1 test load.
10	Test Jacks - Calibrated outputs are provided for resistance (1 Ohm) and leakage current (200 μ A)
11	Chassis Input - Connection for the 503 test cable
12	Fuse - 20 Ampere fuse for 110 VAC model, 10 Ampere fuse for 220 VAC model

Operating Instructions

Line Voltage Measurements

The default measurement setting is line voltage (LINE VOLT). When the LKG 610 is plugged into an AC outlet, the LCD will display the measured line voltage in Volts. If the outlet polarity is reversed the display will indicate ‘ - POL’ and line voltage will not be displayed.

Device Current Measurement:

Plug the Device Under Test (DUT) into the test receptacle. Set the polarity switch to normal. Press the “DEVICE CUR” key. Turn the Device Under Test (DUT) On. The display will present the Device Current in Amps.

Earth Leakage Current Measurement:

Press the “EARTH LKG” key. See Figure 2. The Earth Leakage (Ground Leakage) Current is measured through the ground conductor of the Device Under Test. This is only applicable to devices with a three-conductor power cord. The leakage measurement is made internally when the CHS GND switch is momentarily pushed to the LIFT GRND position. The display will present the measurement in μ Amps. No other connection is required.

Both Earth and Case Leakage Current measurements should be made in all power switch combinations: the Polarity Switch in Normal, Reverse, and off; and with the Neutral Switch Open and Closed.

Leads Leakage Measurement:

Leakage current of ECG leads may be measured individually or combined. To measure the leakage press the appropriate function key LA, RA, RL, LEADS ALL, LL, or V1-V6. The display will present the selected test measurement result in μAmps .

Leads Isolation Test:

Plug the ECG device into the LKG 610. Connect the ECG leads. Press the "ISO TEST" key. The isolation leakage will be presented on the display in μAmps .

After 30 seconds the LED will begin flashing to indicate that the applied isolation voltage has been removed. The previous leakage measurement will be displayed. To perform another ISO test press the "ISO TEST" key again.

WARNING



The test method injects potentially hazardous current levels into the ECG and related power system; do not conduct tests in an occupied patient location or while the patient is connected to a related power system branch.

CAUTION



During Isolation leakage measurements the LKG 610 introduces line voltage into the patient leads. Even though it is current limited to 1milliAmp, it is potentially lethal.

Case Leakage Current:

The Case Leakage Current is measured through the test lead cable. Connect the test

Lead to the case of the DUT(Device under test). The leakage measurement is made when the CHS GND switch is momentarily switched to the LIFT GRND position. The display will present the measurement in Micro Amps. No other connection is required.

To measure the Case Leakage of devices with plastic enclosures, wrap aluminum foil around the case of the DUT and connect the test lead to the foil.

Point To Point Testing:

Use two 503 test leads plugged into the “REF GND” and “CHASSIS” EXTERNAL INPUT jacks. Push the CASE LKG key. The display will present the measurement in microAmps.

Note: “OL” displayed in any measurement function indicates an over range condition.

Performance Check

The following tests will confirm that the LKG 610 is performing properly.

1. Connect the LKG 610 to a 110 VAC outlet (220 VAC for the LKG 610-220).

The power on default function is “Line Volt”. The LCD display will present the line voltage in Volts. If the outlet polarity is reversed the LCD will indicate ‘-POL’.

2. The Test Lead resistance is offset internally and adjusted at the factory. The Test Lead resistance can be checked by connecting the Test Lead between the receptacle ground and the case ground (CHASSIS). When the CHS GND switch is momentarily pressed, the connection will be open and the display will read zero.

A test lead other than the 503 may require adjustment with the zero adjustment control.

3. Connect the Test Lead to the REF GND jack. Press the switch “CHS RES”.

The display will read 1000 milliOhms + 5% (1 Ohm).

4. Connect the Test Lead to the TEST POINTS marked 200 μ A.

Press the “EARTH LKG” key. The display will read 200 μ A + 2%.

Theory of Operation

The LKG 610 circuitry can be divided into main functional blocks as shown in Figure 3.

Each performs a key role in the operation of the instrument.

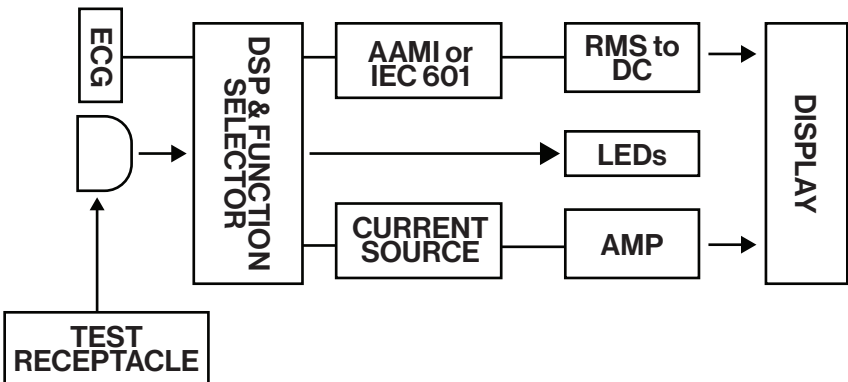


Figure 3. Functional Block Diagram of the LKG 610

Block Diagram Description

Test Load: The input test load is user selectable to AAMI ESI –1993 or to IEC 601.

RMS Converter and Amplifier: The input amplifier buffers the input. The RMS converter generates a DC voltage equal to the RMS value at its input. The gain Amplifier sets the gain for the measurements. When the MODE switch selects leakage current measurement, the AAMI LOAD is connected in front of the INPUT AMPLIFIER, and the voltage developed across it from the leakage current is measured.

Current Source and Amplifier: Resistance is measured by connecting the current source to the resistance to be measured and measuring the voltage with the input amplifier.

Test Receptacle: This supplies power to the unit under test, 110 VAC rated at 15 Amps (220 VAC). The rocker polarity switch selects NORMAL, OFF and REVERSES polarity in the test receptacle.

Display: All measurements are displayed on a 3-1/2 digit LED display. Over range is indicated by showing a 1 in the most significant digit

Maintenance and Storage

Maintenance

The LKG 610 requires minimum maintenance.

Periodically check the inlet plug, outlet receptacle, and wiring for any damage, wear, cracks, cuts, or other defects. Also check the case for any damage or cracks.

In order to ensure accuracy, the LKG 610 should be checked periodically. A calibrated output is provided at the TEST JACK for both Case Leakage and Cord Resistance functions.

When making a resistance measurement with a Test Cable other than the one supplied with the LKG 610, the user can zero the leads with the zero adjustment potentiometer. This will not affect the internal calibration of the unit.

Calibration / Service

The mechanical assembly of LKG 610 contains no parts that can be serviced by the user. The unit should be returned to Netech Corporation for repair or calibration. The alignment and adjustment parameters are critical to the robust and efficient performance of the unit and can be performed only at the factory.

The unit is factory calibrated with NIST traceable standards and recommended to be calibrated once a year.

Netech maintains a complete repair and recalibration service at a very low cost and fast turnaround. Estimates for repair and recalibration are available upon request.

Warranty

Netech warrants this instrument to the original purchaser, as purchased from a Netech distributor or dealer, will conform to the written specification as of the date of its manufacture, for two years from the date of purchase. The second-year warranty is contingent upon returning the unit to the factory for the annual recalibration at the end of the first year warranty. Netech warrants this instrument against defects in materials and workmanship. If the instrument fails to conform to these warranties, Netech will repair or replace the unit and/or its components within a reasonable period; if the LKG 610 is returned, shipping prepaid, to Netech's facility at Farmingdale, NY, USA within the warranty period as expressed above. These warranties are made upon the expressed condition that:

- 1. The purchaser promptly notifies Netech in writing of any nonconformity with the above warranty including a detailed explanation of the alleged deficiencies.*
- 2. The LKG 610 is returned to Netech at the buyer's expenses only after obtaining the proper RMA authorization from Netech.*
- 3. Netech will not be liable for any incidental or consequential damages.*
- 4. In the opinion of Netech upon inspection, the LKG 610 has not been misused, altered, or damaged due to the abnormal handling and/or operation.*
- 5. Repairs to the LKG 610 and/or its components have not been made by anyone other than Netech or one of its authorized repair agents.*
- 6. The LKG 610 has not been modified, altered, or changed in any manner by anyone other than Netech or one of its authorized repair agents.*
- 7. All shipping and handling charges will be billed to the purchaser.*

THIS WARRANTY EXCLUDES ALL OTHER WARRANTIES, WHETHER EXPRESSED OR IMPLIED, ORAL OR WRITTEN, INCLUDING WITHOUT LIMITATION WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE. NETECH IS NOT LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES FROM ANY MISUSE OF THE INSTRUMENT.

To receive free software and firmware updates, please fill out and send the warranty registration card or fill out online warranty registration: - <http://www.NetechBiomedical.com/warranties>

Appendix: A

Current Revision: R2 07/24/2025

Pages revised from the previous Revision (R1).



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