LKG 601

User Manual

▶Compact ▶Lightweight ▶Easy to Use

Electrical Safety Analyzer

(Safety Tester)

NETECH

Innovative Instruments Since 1987

Table of Contents

Notices

Copyright

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 601 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 601, 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 601. 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 601 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

Introduction

Description

The LKG 601 is a compact, low cost Electrical Safety Analyzer designed to evaluate the basic electrical safety of all electrical systems including medical devices and physiological instrumentation.

The LKG 601 measures Electrical Leakage Current, Power Cord Ground Resistance, and Device Current.

The LKG 601 is simple to operate. A three- position switch selects the test to be performed. The user may select either the AAMI ESI-1993 or the IEC 601-1 test load to compensate for high frequency components in the measurement.

Accurate resistance measurements are made via a simple method using a single conductor cable. No special cables are required. A calibrated output is provided through a test jack to verify the performance of the LKG 601.

LKG 601 Features

- Compact, Lightweight, and Easy to Use
- Measures: Device Current, Cord (Ground) Resistance, Ground Leakage Current, and Case (Chassis) Leakage Current
- Test Jack for Calibrated Outputs
- True RMS Measurement
- AAMI or IEC 601-1 Test Loads
- Accessible Line Fuse
- Selectable Test Loads
- 15 and 20 Amp capability
- Soft carrying case an red resistance test cables included

Preparation for Use

The LKG 601 is shipped with the following items included in the customized hard case:

- LKG 601 Electrical Safety Analyzer
- Li-Ion Rechargeable Battery Charger (110/220 V input)
- User Manual

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:

± 1% of reading, + 1 LSD: DC to 1 KHz,
± 2.5% of reading + 1 LSD
1 KHz to 100 KHz,
± 5% of reading + 1 LSD
100 KHz to 1 MHz

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

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.

Dimensions:

Size: 5.5x 3.25 x 2.5 Inches

Weight: 1 lbs (.45kg)

Environmental:

Operating Range: 59 to 950 F (15 to 400 C) Storage

Temperature: 0 to 1220 F (-20 to 600 C) Relative Humidity: 90% (max) at temperatures

Part Numbers and Ordering Information

Part Number:

510-110: LKG 601 Electrical Safety Analyzer (110 VAC Operating Voltage)

510-220: LKG 601 Electrical Safety Analyzer (220 VAC Operating Voltage)

510-110-220: LKG 601 Electrical Safety Analyzer (110 & 220 VAC Operating Voltage)

Standard Accessories (Included with the unit)

503: Test Lead for Electrical Safety Analyzer

535-CASE: Hard Carrying Case

30250: Universal Plug Adapter NEMA 5 – 15P

30255: Universal Plug Adapter NEMA 6 – 15P

Instrument Familiarization

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

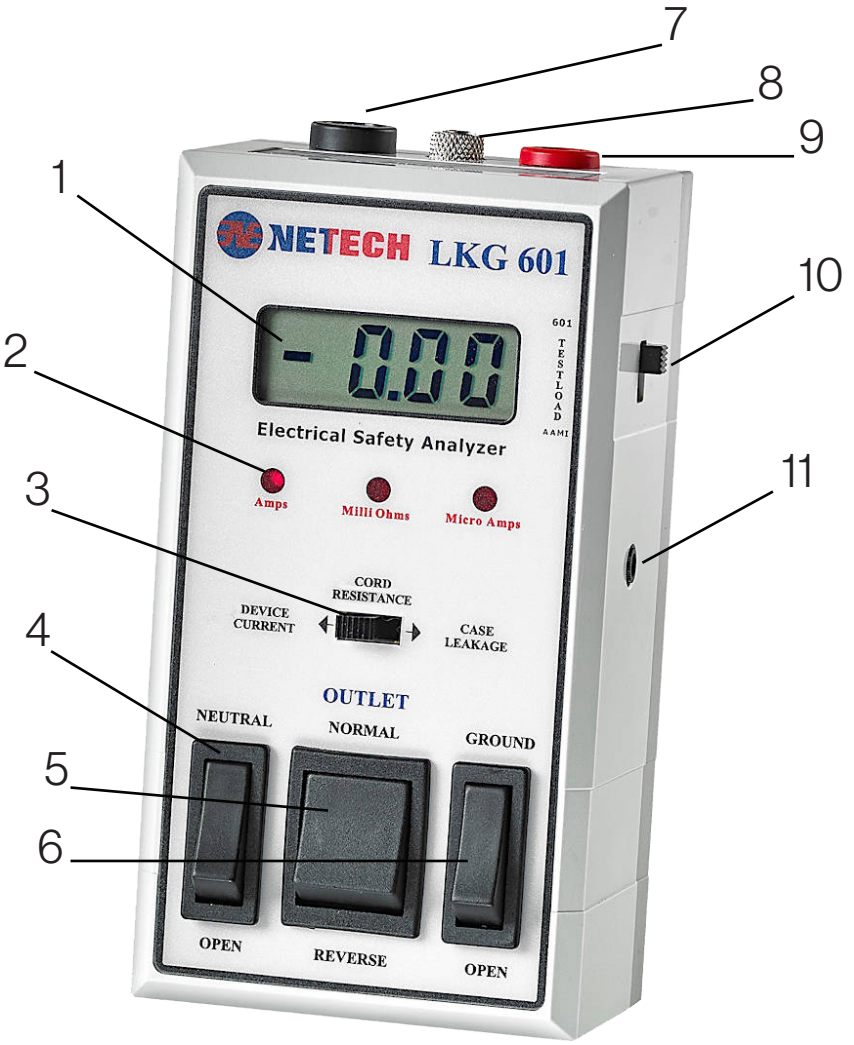

Figure 1. LKG 601 Controls

Number	Description
1	**Graphics LCD Window** - A 3½ Digit LCD indicates the result of the measurement being made.
2	**Red LEDS** - 3 red LEDS indicate the selected test mode.
3	**Mode Switch** - Three-position slide switch to select the test measurement.
4	**Neutral Switch** - A switch to momentarily open the neutral line to the test receptacle.
5	**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.
6	**Ground Switch** - A switch to momentarily open the ground connection to the test receptacle.
7	**Fuse** - 15 Ampere fuse is in an accessible fuse holder for 110 Volt model. The 230 Volt model uses a 10-Ampere fuse.
8	**Test Jacks** - A calibrated output is provided at the test jack for resistance and current functions. This performs a self-check of the LKG 601.
9	**Case Ground** - A red jack is provided for connecting the test lead to the case (chassis) of the Device Under Test. The Cord Resistance and Case Leakage are measured using this cable.
10	**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.
11	**Zero Adjustment** - This recessed adjustment allows for the zeroing of the display to eliminate test cable resistance variations.

Operating Instructions

The LKG 601 includes a test lead (PN: 503) for measuring Cord Resistance and Case Leakage. No other cables are required to perform measurements.

There are three models of LKG 601 available. Prior to using the device identify the Part Number and the model purchased.

The following are the part numbers and the operational voltages.

- **PN: 510-110** - 110 Volt devices only.
- **PN: 510-220** - 220 Volt devices only.
- **510-110-220** - Dual voltage operation.

Please refer to **page 18** for the preparation, setup and safe operation of the dual voltage LKG 601.

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

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.

CAUTION

Make sure that the power requirements of the Device Under Test are within the power ratings of the LKG 601, 15 amps at 110 volts and 10 amps at 230 volts.

Do not leave the Device Under Test continuously turned on and connected to the LKG601.

Before testing 220 Volt devices make sure the LKG 601 is plugged to a 220 Volt out let using the adapter and connect the 220 Volt device to the LKG 601 using the universal adapter supplied.

Cord Resistance Measurement

- Set the polarity switch to the off (center) position.
- Move the MODE switch to CORD RESISTANCE. Plug the Device Under Test into the test outlet.
- Using the test lead provided, connect the chassis of the Device Under Test to the Case Ground jack on the LKG 601.
- The display will indicate the Power Cord Resistance in milliohms.

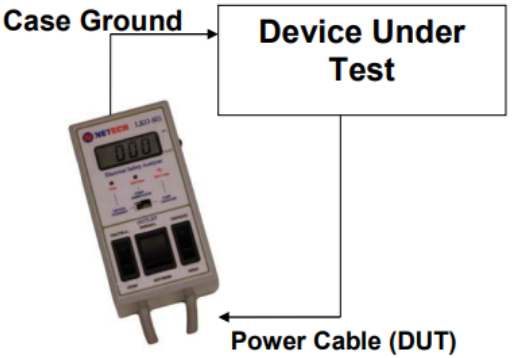

Figure 2. Block Diagram for Cord Resistance measurement and Case Leakage measurement (external)

Case Leakage Current Measurements:

Move the Mode switch to CASE LEAKAGE. See Figure 2.

The Earth Leakage (or 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 Ground switch is momentarily opened. The LCD will display the measurement in Micro Amps. There is no other connection required.

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

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 Ground switch is momentarily opened. The LCD will display the measurement in Micro Amps.

Both Earth and Case Leakage Current measurements should be made in all power switch combinations with the Polarity switch in Normal and Reverse, and the Neutral switch Open and with the DUT On and Off.

CAUTION

When switching from Normal to Reverse or vice versa, make sure to pause the rocker switch in the off (middle position). Power to the outlet will be OFF in the open neutral position.

Device Current Measurements:

Move the Mode switch to DEVICE CURRENT. Set the polarity switch to normal. Turn the DUT On. The LCD will display the Device Current in Amps.

CAUTION

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

Performance Check

1. Connect the LKG 601 to a live 110 VAC (or 220 VAC for the LKG 601-220) outlet. Display will turn on and read 0 ± 1 when the Mode switch is in the Case Leakage position. In the CORD RESISTANCE position the display will show the numeral one (1) in the left position indicating that the cord circuit is open.
2. Move the Mode selector switch to all three positions and test the LED indication.
3. Check the continuity between receptacle ground and case ground using the test cable. If necessary adjust the display to zero. When the open ground switch is pressed down the connection will be open.
4. Connect the Test Lead to the TEST JACK
5. Move the selector switch to CORD RESISTANCE. The reading should be 1010 milliohms + 5%.
6. Move the switch to CASE LEAKAGE. The display will indicate 200 Micro Amps + 2%.

These tests will confirm that the LKG 601 is working properly.

Theory of Operation

The LKG 601 circuitry can be divided into main functional blocks as shown in Figure 3 on the following page.

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

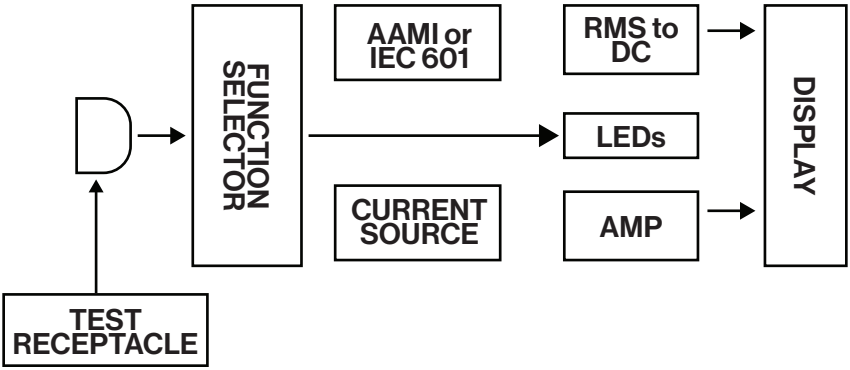

Figure 3. Functional Block Diagram of the LKG 601

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.

Dual Voltage Unit (110-220)

Preparation for Use

LKG 601 dual voltage model (PN: 510-110-220) designed for use in 110 Volt AC powered equipments or 220 AC powered equipments.

For 220 volt devices make sure the device is 220 Volt AC and the wall outlet is 220 Volt.

Plug the 220 Volt adapters to the wall outlet and connect the 220 volt AC device in to the LKG 601 using the second adapter.

Maintenance/Storage

Maintenance

The LKG 601 requires only minimum maintenance.

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

In order to ensure the accuracy, it is recommended that the unit be checked periodically. A calibrated output is provided at the TEST JACK for Case Leakage and Cord Resistance functions. This feature is useful to check the integrity of the unit.

When making a resistance measurement with a Test Cable other than the one supplied with the LKG 601, the user can zero the leads by adjusting the zero adjustment potentiometer. This will not affect the internal calibration of the unit.

Annual calibration is recommended. If the LKG 601 is returned to Netech for recalibration before the first year warranty expires Netech will provide a second year warranty. The warranty is void if the LKG 601 is serviced by anyone other than Netech or if the warranty seal is broken.

Additional Calibration/Service Information

The mechanical assembly of LKG 601 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.

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 601 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 601 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 601 has not been misused, altered, or damaged due to the abnormal handling and/or operation.*
5. *Repairs to the LKG 601 and/or its components have not been made by anyone other than Netech or one of its authorized repair agents.*
6. *The LKG 601 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 06/19/2025
Pages revised from the previous Revision (R1).

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