LKG 610

Electrical Safety Analyzer

With 10 ECG Connectors

INSTRUCTION MANUAL

Netech Corporation
110 Toledo St, Farmingdale, NY 11735,
http://www.NetechCorp.us
http://www.PressureMeter.com

Contents

General Overview

Maintenance and Storage

Warranty

Netech warrants the LKG 610 against defects in materials and workmanship for one year from the date of original purchase. The standard warranty is extended for a second year if the instrument is returned to Netech for its recommended yearly recalibration.

During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product shipping prepaid to Netech Corporation. Only serialized products are covered under this warranty.

This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than Netech Corporation, or if its serial number is defaced or removed.

Netech reserves the right to discontinue the LKG 610 at any time, and change its specifications, price, or design without notice and without incurring any obligation. Netech guarantees availability of service parts for 5 years after the manufacture of the unit is discontinued.

The warranty is void if you elect to have the unit serviced and / or calibrated by someone other than Netech Corporation.

The warranty covering your product becomes void when the tamper-resistant Quality Seal is removed or broken without proper factory authorization.

We strongly recommend, therefore, that you send your instrument to Netech Corporation for factory service and calibration, especially during the original warranty period.

The purchaser assumes all liability for any damages or bodily injury, which may result from the use or misuse of the unit by the purchaser, his employees, agents, or customers.
In no event shall Netech Corporation be liable for consequential damages

Warranty Registration
Please register to receive special offers, free software updates, and more. Plus, you'll qualify for exclusive complimentary benefits that vary by region. Any failure to complete and submit this registration will not diminish your rights found in the limited warranty that accompanied your product at purchase.

Netech Corporation
110 Toledo St, Farmingdale, NY 11735,
http://www.NetechCorp.us
http://www.PressureMeter.com

Notices

Patents / Copyright

Trademarks

LKG 610 is 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.

Quality Assurance

Netech is ISO 9001-2015 Certified. This instrument was thoroughly tested and inspected according to Netech's ISO 9001-2015 quality standards and test procedures are found to meet those specifications when it was shipped from the factory.

Calibration

LKG 610 is calibrated using standards traceable to National Institute of Standards and Technology (NIST) and the unit is shipped with a calibration certificate.

Safety Considerations

This manual contains operating and safety instructions for the safe operation and to maintain the equipment in a safe condition. The safety instructions are either warnings or cautions to protect the user and the equipment from injury or damage. Do not use this equipment for any other purpose than stated.

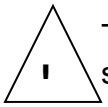
Safety Symbols

WARNING

The **"*WARNING*"** sign denotes a hazard. It calls attention to a procedure, practice or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **"*WARNING*"** sign until the indicated conditions are fully understood and met.

CAUTION

The **"*CAUTION*"** sign denotes a hazard. It calls attention to a procedure, practice or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or the entire instrument. Do not precede beyond a **"*CAUTION*"** sign until the indicated conditions are fully understood and met.



The symbol to the left is the operator's manual symbol. When you see this symbol on the instrument, refer to the operator's manual.

Returns and Credits

Please note that only serialized products and their accessory items (i.e., products and items bearing a distinct serial number tag) are eligible for partial refund and/or credit. Non-serialized parts and accessory items (e.g., cables, carrying cases, auxiliary modules, etc.) are not eligible for return or refund. Only products returned within 60 days from the date of original purchase are eligible for refund/credit.

In order to receive a partial refund/credit of a product purchase price on a serialized product, the product must not have been damaged by the customer or by the carrier chosen by the customer to return the goods, and the product must be returned complete (meaning with all manuals, cables, accessories, etc.) and in "as new" and resalable condition.

Products not returned within 60 days of purchase, or products, which are not in "as new", and resalable condition, are not eligible for credit return and will be returned to the customer. The Return Procedure (see below) must be followed to assure prompt refund / credit.

Restocking Charges

Products returned within 30 days of original purchase are subject to a minimum restocking fee of 15 %. Products returned in excess of 30 days after purchase, but prior to 60 days, are subject to a minimum restocking fee of 20 %. Additional charges for damage and / or missing parts and accessories will be applied to all returns.

Netech Corporation
110 Toledo St, Farmingdale, NY 11735,
http://www.NetechCorp.us
http://www.PressureMeter.com

Return Procedure

All items being returned (including all warranty-claim shipments) must be sent freight-prepaid to our factory location. When you return an instrument to Netech Corporation, we recommend using United Parcel Service, Federal Express, DHL or Air Parcel Post. We also recommend that you insure your shipment for its actual replacement cost. Netech Corporation will not be responsible for lost shipments or instruments that are received in damaged condition due to improper packaging or handling. Use the original carton and packaging material for shipment.

Returns for Refund / Credit

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.

Repair and Calibration

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 http://netechcorp.us/RmaRequests/index or contact:

Netech Corporation
Service Dept.
110 Toledo Street
New York, 11735
Email: Service@NetechCorp.us

Models and Part Numbers

Part Number	Description
535-110	10 Lead Electrical Safety Analyzer (110 V)
535-220	10 Lead Electrical Safety Analyzer (220 V)

Standard Accessories

Part Number	Description	Picture
503	Test Lead for electrical analyzer	
535-CASE	Hard Carrying Case	

Netech Corporation
110 Toledo St, Farmingdale, NY 11735,
http://www.NetechCorp.us
http://www.PressureMeter.com

General Overview

Introduction

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.

Key Features

- Fast, Accurate & Portable
- Easy to Use
- 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

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 1 KHz: 1% FS ± 1 LSD
1 Khz to 100 KHz: ± 2.5% FS ± 1 LSD
100 KHz to 1 MHz: ± 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.

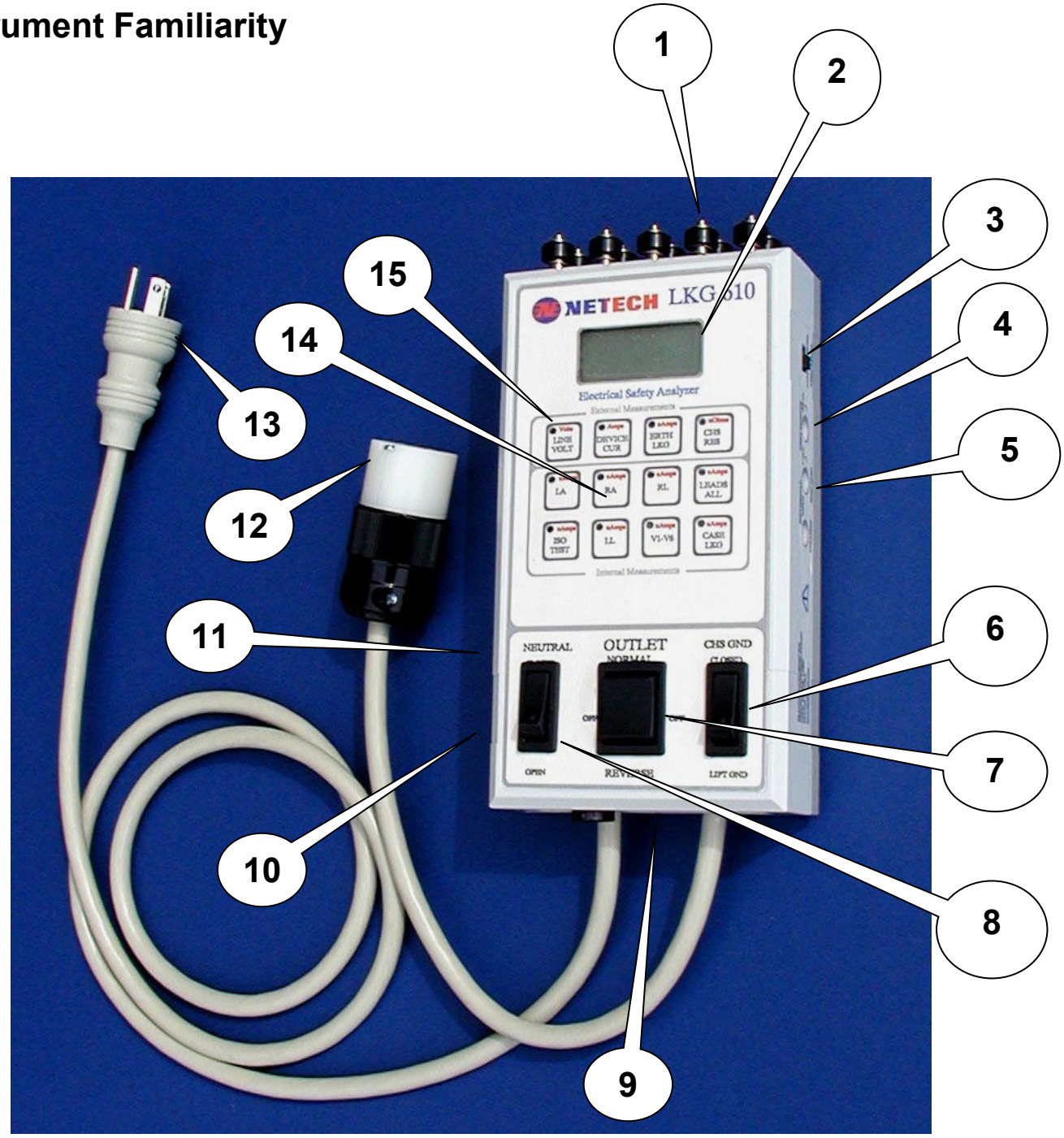
POWER REQUIREMENTS: 110 VAC 50-60Hz, 15 Amps or 220 VAC, 10 Amps maximum rated for the test outlet and 0.1 Amp rated for the unit.

PHYSICAL DIMENSIONS: Size: 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)

ENVIRONMENTAL: Operating range: 59 to 95°F (15 to 35°C)
Storage Temperature: 0 to 122°F (-18 to 50°C)
Relative Humidity: 90% (max) at temperatures

Netech Corporation
110 Toledo St, Farmingdale, NY 11735,
http://www.NetechCorp.us
http://www.PressureMeter.com

Instrument Familiarity



Controls & Indicators

Item	Name	Description
1	ECG Connectors	Universal connectors to connect ECG snaps or various sized posts
2	Display	A 3.5 digit LCD presents the result of the selected test measurement
3	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.
4	Test Jacks	Calibrated outputs are provided for resistance (1 Ohm) and leakage current (200 μA)
5	Chassis Input	Connection for the 503 test cable
6	Ground Switch	A switch to momentarily open the ground connection to the test receptacle
7	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.
8	Neutral Switch	A switch to momentarily open the neutral line to the test receptacle.
9	Fuse	20 Ampere fuse for 110 VAC model, 10 Ampere fuse for 230 VAC model
10	Serial Port	Optional RS 232 Serial Port
11	Zero Adjustment	Recessed adjustment to zero any test cable resistance variations
12	Test Receptacle	A 20 AMP power receptacle for the Device Under Test
13	Power Cord	The power cord supplies power to the analyzer and to the Device Under Test
14	Keypad	Twelve push button function keys to select the test measurement
15	LEDs	An LED in the corner of each function key indicates the selected test mode and the unit of measurement displayed

Netech Corporation
110 Toledo St, Farmingdale, NY 11735,
http://www.NetechCorp.us
http://www.PressureMeter.com

Preparation for Use

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.

CAUTION

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 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 610 is plugged to a 220 Volt out let using the adapter and connect the 220 Volt device to the LKG 610 using the universal adapter supplied

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.

Operating Instructions

1. Line Voltage Measurement:

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.

2. 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.

3. 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 μAmps. 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.

Caution

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

Netech Corporation
110 Toledo St, Farmingdale, NY 11735,
http://www.NetechCorp.us
http://www.PressureMeter.com

4. Chassis Resistance Measurement:

See Figure 2. Set the Polarity Switch to the OFF (center) position. Press the key marked “CHS RES”. Plug the DUT into the test receptacle. Using the 503 test lead, connect the chassis of the DUT to the CHASSIS jack on the LKG 610. The display will present the Cord Resistance in milliohms.

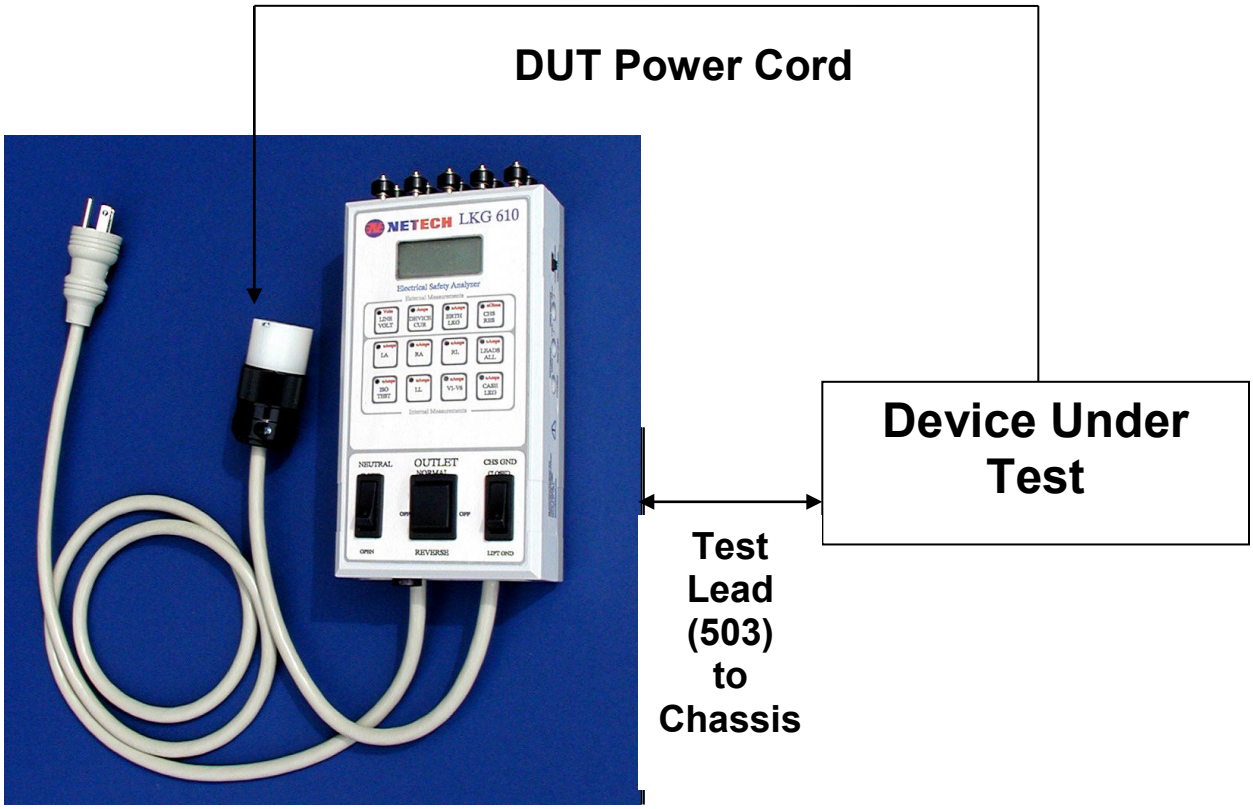


Figure 2
Block Diagram for Cord Resistance measurement and Case Leakage measurement (external)

5. 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.

6. 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:

Since 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.

7. 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.

8. 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 μA. Press the “EARTH LKG” key. The display will read 200 μA ± 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.

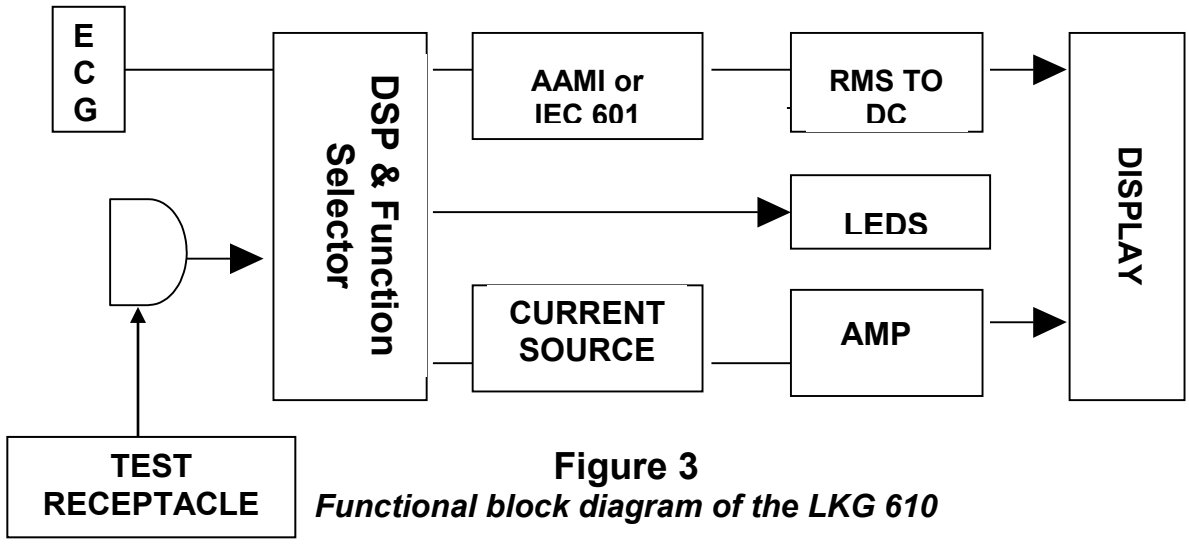


Figure 3
Functional block diagram of the LKG 610

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

Netech Corporation
110 Toledo St, Farmingdale, NY 11735,
http://www.NetechCorp.us
http://www.PressureMeter.com

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.

Annual calibration is recommended. If the LKG 610 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 610 is serviced by anyone other than Netech or if the warranty seal is broken.

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.
LKG 610 contains NO USER SERVICEABLE PARTS **and calibration/ service should be performed only by Netech.** Attempt to repair / service the unit outside Netech voids the warranty.

Returning the LKG 610 for Re-Calibration

Products returned to Netech for repair or recalibration requires a RMA (Return Authorization Number) for speedy processing of the service required.

To obtain a RMA number follow the link http://www.NetechCorp.us and fill in the required information, Email service@netechcorp.us or call 800-547-6557 (US & Canada), International 631-531-0100.

When shipping units to the factory enclose a copy of the RMA and the number should be on used as the reference in the shipping label.

The shipment should be addressed to:-

Attn: Service Department
Netech Corporation
110 Toledo St.
Farmingdale, New York 11735.

Appendix

This section is intentionally left blank for future use