

**INSTRUCTION MANUAL**  
for  
**THREE-PHASE**  
**LINE IMPEDANCE STABILIZATION NETWORK**  
**(LISN)**

**Model:**  
**LI-3P-132 V2.0 (32 Ampere)**



## Table of Contents

<b>1.0 Introduction .....</b>	<b>4</b>
<b>2.0 Products Available from Com-Power .....</b>	<b>5</b>
<b>3.0 Product Information .....</b>	<b>6</b>
3.1 Incoming Inspection.....	6
3.2 What is in the Package.....	6
3.3 Product Safety Information.....	7
3.3.1 Product Hazard Symbols Definitions .....	7
3.3.2 Product Warning/Caution Statements.....	7
3.3.3 General Safety Instructions.....	7
3.4 Product Features .....	9
3.5 Product Specifications.....	12
3.6 Product Reference Data.....	14
<b>4.0 LISN Installation .....</b>	<b>15</b>
4.1 LISN Theory .....	15
4.2 Safety Considerations .....	16
4.3 Test Equipment Setup & Connections .....	17
4.3.1 LISN Input Power Connections.....	18
4.3.2 LISN Output Power Connections.....	18
<b>5.0 LISN Operation .....</b>	<b>19</b>
5.1 Local (Front Panel) Operation.....	19
5.2 Remote Operation .....	19
<b>6.0 LISN Measurements.....</b>	<b>21</b>
6.1 LISN Insertion Loss Factors.....	21
6.1.1 Example Calculation.....	23
6.1.2 LISN Insertion Loss Calibration.....	24
6.1.3 Non-LISN Insertion Loss Calibration .....	25
<b>7.0 Warranty.....</b>	<b>26</b>
<b>8.0 Product Maintenance.....</b>	<b>27</b>

### TABLE OF CONTENTS

## *List of Figures*

FIGURE 1	Product Features – Front Panel and Top View	9
FIGURE 2	Product Features – LISN Rear Panel & RLI V2.0	10
FIGURE 3	Product Dimensions	13
FIGURE 4	Product Reference Data	14
FIGURE 5	Example Schematic of LI-3P-132 LISN	15
FIGURE 6	Typical Test Setup	17
FIGURE 7	Power Input Port Socket Connector (50 Amp)	18
FIGURE 8	EUT Power Port Plug Pin Connector (50 Amp)	18
FIGURE 9	Command Codes to Control the LISN	20
FIGURE 10	Typical Insertion Loss Factors for LI-3P-132 LISN	22
FIGURE 11	Setup Diagrams for LISN Insertion Loss Calibration	24
FIGURE 12	Setup Diagrams for Non-LISN Insertion Loss Calibration	25

## *LIST OF FIGURES*

## 1.0 Introduction

This manual includes product descriptions, controls and indicators, product specifications, dimensions, safety precautions, operational instructions, warranty information, guidelines, and instructions for its proper usage.

Information contained in this manual is the property of Com-Power Corporation. It is issued with the understanding that the material may not be reproduced or copied without the express written permission of Com-Power.



## 2.0 Products Available from Com-Power



Antennas



Antenna Kits



Absorbing Clamps



Coupling/Decoupling Networks (CDN)



Comb Generators



Current Probes & Bulk Current Injection Probes



Emissions Test Systems



Conducted Immunity Test Systems



Impedance Stabilization Networks (ISN)



Line Impedance Stabilization Networks (LISN)



Antenna Masts



Near-Field Probe Sets



Preamplifiers



Power Amplifiers



Spectrum Analyzers



Surge Generators



Transient Limiters



Turntables



Antenna Tripods



Telecom Test Systems

[www.com-power.com](http://www.com-power.com)

Section 2 – PRODUCTS AVAILABLE FROM COM-POWER

1679 Placentia Ave • Costa Mesa, CA 92627 • (949) 459-9600 • [com-power.com](http://com-power.com)

Rev. 022726

## 3.0 Product Information

### 3.1 Incoming Inspection



**WARNING** – To avoid the possibility of electrical shock, do not apply power to the LISN or any of its accessories if there is any evidence of shipping damage. If shipping damage to the product or any of the accessories is suspected, or if the package contents are incomplete, contact Com-Power or your Com-Power distributor.

Please check the contents of the shipment against the package contents in section 3.2 to ensure that you have received all applicable items.

### 3.2 What is in the Package

#### STANDARD ITEMS:

- ✓ **LI-3P-132 V2.0 Line Impedance Stabilization Network (LISN)**
- ✓ **CONN-KIT-LI3P32A**
- ✓ **RLI v2.0 Remote LISN Interface**
- ✓ **10-Meter Fiber Optic Cable**  
*(Duplex Latching POF Connector at each end)*
- ✓ **AC Power Adapter [6 Volts DC, 500 mA, unregulated]**  
*(for powering the LISN fiber optic interface circuit)*
- ✓ **AC Power Adapter [6 Volts DC, 500mA, unregulated]**  
*(for powering the RLI V2.0 Remote LISN Interface Box)*
- ✓ **Calibration Certificate and Data**

#### OPTIONAL ACCESSORIES:

- ✓ **LIA-COAX-E** Coaxial Adapter with plug pins for LISN EUT Port
- ✓ **LIA-COAX-M** Coaxial Adapter with plug sockets for LISN Mains Port

### 3.3 Product Safety Information

#### 3.3.1 Product Hazard Symbols Definitions

The hazard symbols appearing on the product exterior are defined below.



The yellow triangle with an exclamation mark indicates the presence of important operating and/or maintenance (servicing) instructions in the literature accompanying the product.



The yellow triangle with a lightning bolt indicates an alert to the user that uninsulated **dangerous voltages** are present within the product enclosure and on output connectors. These voltages may be of sufficient magnitude to constitute a risk of electric shock to people.



The Ground symbol inside a circle indicates terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth (ground) electrode.



To indicate on the rating plate that the equipment is suitable for AC current.



To indicate on the rating plate that the equipment is suitable for direct current (DC).

#### 3.3.2 Product Warning/Caution Statements

The following warnings/caution statements must be adhered to ensure safe operation of the product.

**WARNING: HIGH VOLTAGE!**



CONNECT PROTECTIVE EARTH BEFORE APPLYING POWER!

VERIFY INPUT POWER CONFIGURATION PRIOR TO MAKING CONNECTION.

**CAUTION:**



TO PREVENT ELECTRIC SHOCK, DO NOT OPEN COVER. CONNECT PROTECTIVE EARTH BEFORE APPLYING POWER. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL ONLY.

#### 3.3.3 General Safety Instructions

The following safety instructions have been included in compliance with safety standard regulations. Please read them carefully.

- **READ AND RETAIN INSTRUCTIONS** - Read all safety and operating instructions before operating the instrument. Retain all instructions for future reference.
- **HEED WARNINGS** - Adhere to all warnings on the instrument and operating instructions.
- **FOLLOW INSTRUCTIONS** - Follow all operations and use instructions.
- **WATER AND MOISTURE** - Do not use the instrument near water.
- **VENTILATION** - The instrument should be used/installed only in locations where the flow of air through the ventilation openings is not impeded.
- **MOUNTING** - The instrument can be used in horizontal or vertical orientation if the ventilation holes are not obstructed and the protective grounding is not defeated.



### Section 3 – PRODUCT INFORMATION



- **HEAT** - The instrument should be situated away from heat sources such as heat registers or other instruments which produce heat.
- **POWER SOURCES** - Connect the instrument only to the type of power source described in the operating instructions or as marked on the instrument.
- **GROUNDING** - Take precautions to ensure that the grounding of the instrument is not defeated. Grounding conductor with adequate cross-section must be connected between a grounding conductor connection for the measurement area and the grounding conductor connection (grounding bolt) on the back panel of the LISN and the LISN bottom plate, before applying any power to the LISN. At shutdown or before dismantling the LISN setup, ensure that the power to LISN is discontinued before the ground conductor connection is disconnected.



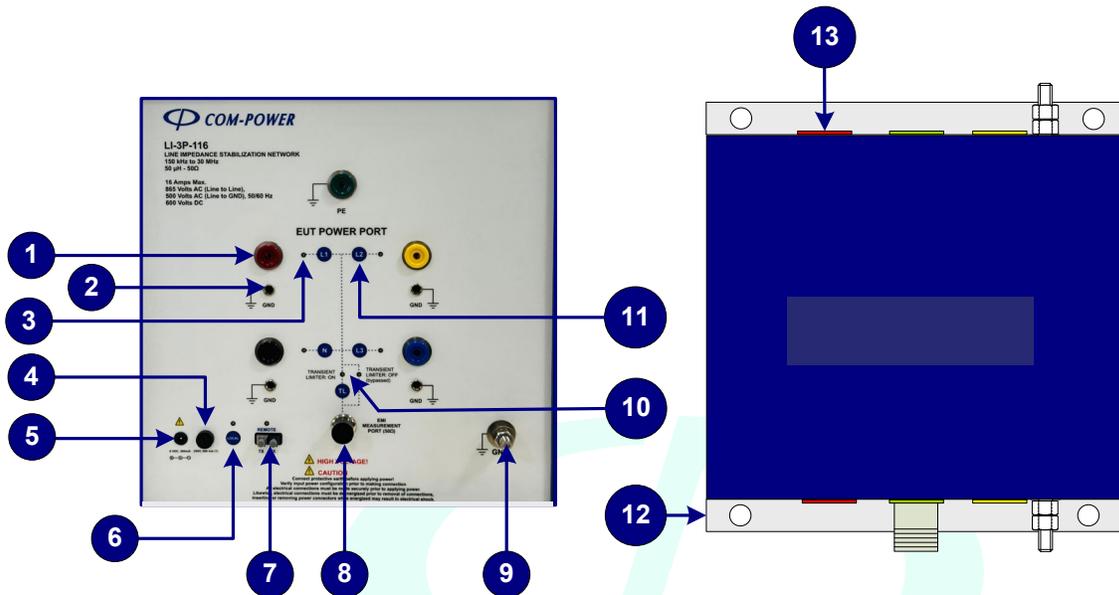
- CAUTION** - The specified minimum line to ground capacitance induces leakage currents more than the value permitted under EN 61010-1 standard – safety requirements for electrical equipment for measurement, control and laboratory use.
- In addition, the basic insulation required for a category I protection device cannot be assured. Therefore, it is imperative to provide additional measures safeguarding against direct or indirect contact by users.
  - Before using the LISN, a secure ground connection must be made to the LISN grounding bolt and/or the bottom metal plate (The bottom surface of the LISN is left unpainted for effective ground connection). It must not be removed until after the LISN has been disconnected from the mains power supply, to avoid electric shock.

The safety notes in the accompanying operating instructions and on the outside of the device must be always followed.

- **POWER CORD PROTECTION** - Place power supply cords so that they are not likely to be walked on or pinched by items placed on them or against them.
- **CLEANING** – Clean the instrument outside surfaces of the device with a soft, lint-free cloth. If necessary, a mild detergent may be used.
- **NON-USE PERIODS** - Unplug the power cords of the instrument when it is left unused for a long period of time.
- **OBJECT AND LIQUID ENTRY** - Take care that objects do not fall into instruments and that liquids are not spilled into the enclosure through openings.
- **DEFECTS AND ABNORMAL STRESS** - Whenever it is likely that the normal operation has been impaired, make the equipment inoperable and secure it against further operation.
- **ENVIRONMENTAL CONDITIONS** - This equipment is designed for indoor use. Ambient temperature range during operation should be between 5° C to 40° C.
- **STORAGE AND PACKAGING** - The device should only be stored at a temperature between –25 and +70 °C. During extended periods of storage, protect the device from dust accumulation. The original packaging should be used if the device is transported or shipped again.

### Section 3 – PRODUCT INFORMATION

### 3.4 Product Features

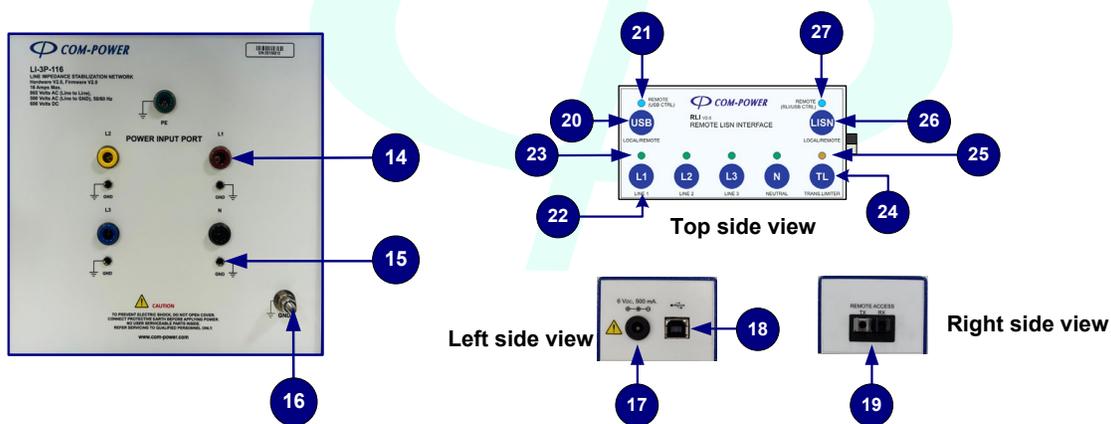


**FIGURE 1 - Product Features – Front Panel and Top View**

- 1 EUT Output Power Port**  
 Power port to which the EUT power input cable connects.
- 2 Grounding Test Jack**  
 Provides ground connection point for coaxial adapters (sold separately).
- 3 LED Indicators of Line Under Test**  
 These (4) LEDs, labeled L1, L2, L3 and N, are used to indicate which line is under test. Only one (1) LED is illuminated at any given time.
- 4 Fuse Mounting Assembly**  
 Provides access to input power fuse. Fuse Type 250V, 500 mA (T).
- 5 DC Power Port for Fiber Optic Interface Circuit**  
 This is the DC power Input port for the fiber optic interface circuit. The output cable of the included 6 VDC, 500 mA unregulated AC power adapter connects to this port.
- 6 Push Button LOCAL with Green Led**  
 Press this button for Local Operation while LISN is in Remote Mode.
- 7 Fiber Optic Port with REMOTE LED**  
 Fiber optic port for connection to RLI/Remote LISN Interface. When the REMOTE LED is illuminated, the LISN is in Remote Mode.

*Section 3 – PRODUCT INFORMATION*

- 8 **EMI Measurement Port**  
 Coaxial, female N-type connector intended to be connected to the 50Ω RF input of the measuring instrument.
- 9 **Ground Stud**  
 Provides a ground connection point at the same electrical potential as the base plate.
- 10 **PUSH Button (TL) with LED indicators for Transient Limiter**  
 The TL button toggles between TRANSIENT LIMITER ON state and TRANSIENT LIMITER OFF (bypassed) state. The two LEDs indicate which state is active.
- 11 **PUSH Buttons (L1, L2, L3, N)**  
 Press individual button for selection of Line.
- 12 **LISN Base Plate**  
 The unpainted LISN base plate is intended to be bonded to the site reference ground plane. Please refer to section 5.1 for installation information and grounding precautions.
- 13 **EUT Power Input Port**  
 Power port to which the EUT power source connects to the LISN.



**FIGURE 2 - Product Features – Rear Panel & RLI V2.0**

- 14 **EUT Power Input Port**  
 Power port to which the EUT power source connects to the LISN.
- 15 **Grounding Test Jack**  
 Provides reference ground connection point for coaxial adapters (sold separately).
- 16 **Ground Stud**  
 Provides a ground connection point at the same electrical potential as the base plate.
- 17 **DC Power Port**  
 This is the DC Power Input port for RLI. The output cable includes 6 VDC, 500 mA unregulated AC Power Adapter connects to this port.
- 18 **USB Port**  
 This USB port is for computer connection.

*Section 3 – PRODUCT INFORMATION*

- 19 **Fiber Optic Port**  
Fiber optic port for connection to LISN.
- 20 **USB Button**  
Pressing the USB button allows a connected computer to control which line is selected.
- 21 **USB LED Indicator**  
Indicates that the USB button is pressed, and computer control is enabled.
- 22 **Line Under Test Selection Buttons (L1, L2, L3, N)**  
These (4) buttons are used to select the Line Under Test.
- 23 **Line Under Test (L1, L2, L3, N) LED Indicators**  
These (4) LEDs correspond to the button immediately below each. The illuminated LED indicates the current line under test.
- 24 **Transient Limiter Button (TL)**  
This button is used to select the Transient Limiter. The TL button toggles between TRANSIENT LIMITER ON state and TRANSIENT LIMITER OFF (bypassed) state.
- 25 **Transient Limiter (TL) LED Indicator**  
When LED is illuminated, the LISN is in TRANSIENT LIMITER ON state.
- 26 **Local/Remote Button**  
This button is used for remote control operations.
- 27 **REMOTE (RLI/USB CTRL) LED Indicator**  
When LED is illuminated, LISN is in REMOTE mode.

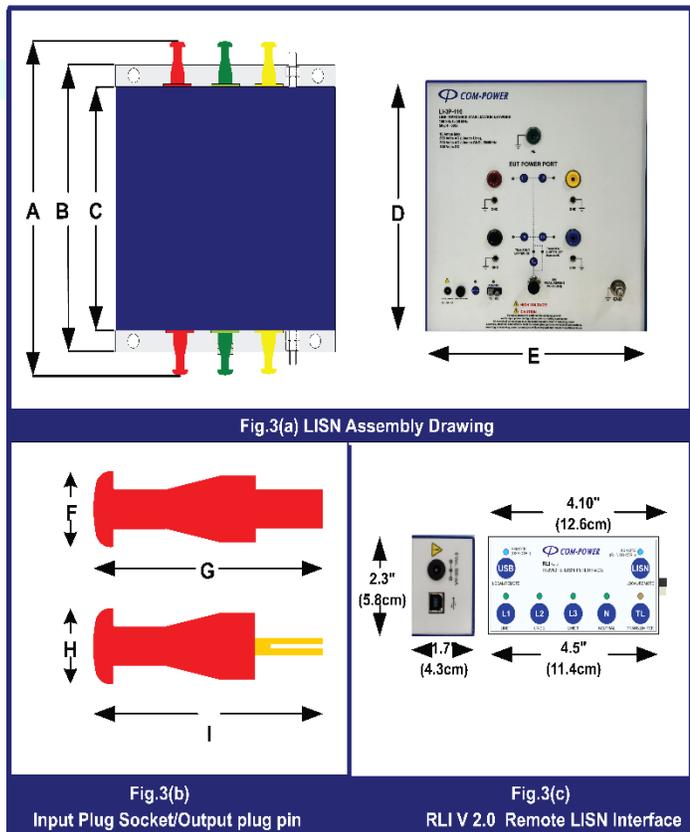
Section 3 – PRODUCT INFORMATION

### 3.5 Product Specifications

GENERAL	
Product Description	Three-Phase Line Impedance Stabilization Network (LISN)
Application	Power Line Conducted Emissions (Disturbance Voltages) Tests
Standards	ANSI C63.4 (FCC), CISPR 16-1-2 (CE)
LISN Type	50Ω, 50 μH (4) Conductor Network
Frequency Range	150 kHz to 30 MHz
Insertion Loss	<11 dB
Isolation	>40 dB
INPUT POWER RATINGS FOR EQUIPMENT UNDER TEST (EUT)	
Current (maximum continuous, per line)	32 Amperes per phase
AC Voltage (maximum)	865 Volts rms (line to line), 500 Volts rms (line to ground); 50/60Hz 270 Volts rms (line to ground); 400Hz 135 Volts rms (line to ground); 800Hz
DC Voltage (maximum)	600 Volts DC
ELECTRICAL	
Remote Interface Power Inputs	6 Volts DC (unregulated), 500 mA (LISN Front Panel and RLI-v2.0 Remote LISN Interface)
INPUT/OUTPUT CONNECTORS	
Power Input Port Plug (affixed to LISN chassis)	50A Receptacle Pins CONN-RP50GR [Red], CONN-RP50GY [Yellow], CONN-RP50GBL [Blue], CONN-RP50GB [Black], CONN-RP50GG [Green]
Power Input Socket (for power input cable)	50A Plug Sockets CONN-PS50GR [Red], CONN-PS50GY [Yellow], CONN-PS50GBL [Blue], CONN-PS50GB [Black], CONN-PS50GG [Green]
Power Output Port Socket (affixed to LISN chassis)	50A Receptacle Sockets CONN-RS50GR [Red], CONN-RS50GY [Yellow], CONN-RS50GBL [Blue], CONN-RS50GB [Black], CONN-RS50GG [Green]
Power Output Port Plug (for EUT power cable)	50A Plug Pins CONN-PP50GR [Red], CONN-PP50GY [Yellow], CONN-PP50GBL [Blue], CONN-PP50GB [Black], CONN-PP50GG [Green]
RF Measurement Port	50Ω - N-Type (female)
Fiber Optic Ports	Avago Duplex Latching POF Jack (LISN and RLI-v2.0 Remote LISN Interface)
Remote Interface Power Input Ports	5.5/2.1 mm Power Jack (LISN front panel and RLI-v2.0 Remote LISN Interface)
Optional Accessories	LIA-COAX-E Coaxial Adapter with Plug Pins for LISN EUT Port LIA-COAX-M Coaxial Adapter with Plug Sockets for LISN Mains Port
ENVIRONMENTAL	
Cooling	Louvered Side Panels

Section 3 – PRODUCT INFORMATION

DIMENSIONS & WEIGHT	
Figure 3a - Dimension A	21.43" [544.5 mm]
Figure 3a - Dimension B	16.88" [429 mm]
Figure 3a - Dimension C	14.84" [377 mm]
Figure 3a - Dimension D	14.25" [362 mm]
Figure 3a - Dimension E	14.60" [371 mm]
Figure 3b - Dimension F	1.24" [31.6 mm]
Figure 3b - Dimension G	3.14" [79.8mm]
Figure 3b - Dimension H	1.24" [31.6 mm]
Figure 3b - Dimension I	3.18" [80.8 mm]
LISN Weight	41 lbs. [18.6 kg]
Shipping Weight	95.01 lbs. [43.10 kg]
Shipping Dimensions (H)x(W)x(D)	23.86" x 21.30" x 26.86" [606 x 541 x 682 mm]

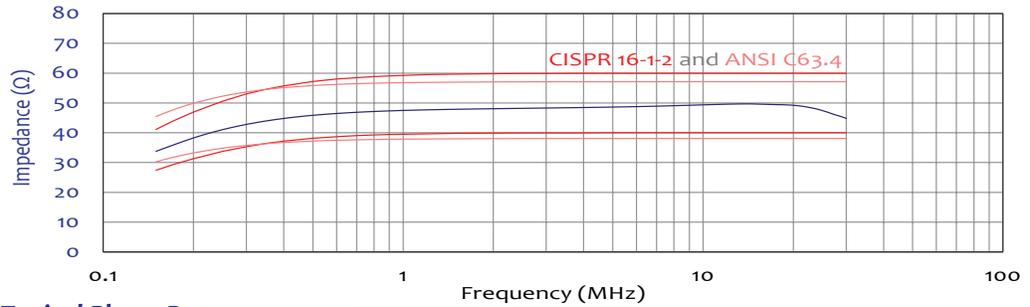


**FIGURE 3 - Product Dimensions**

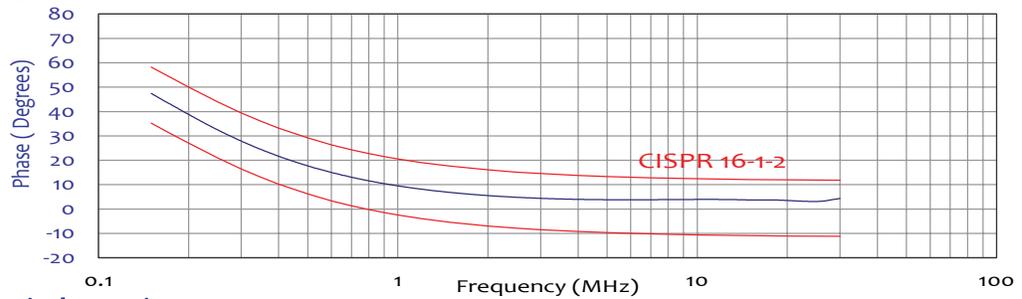
**Section 3 – PRODUCT INFORMATION**

### 3.6 Product Performance Data

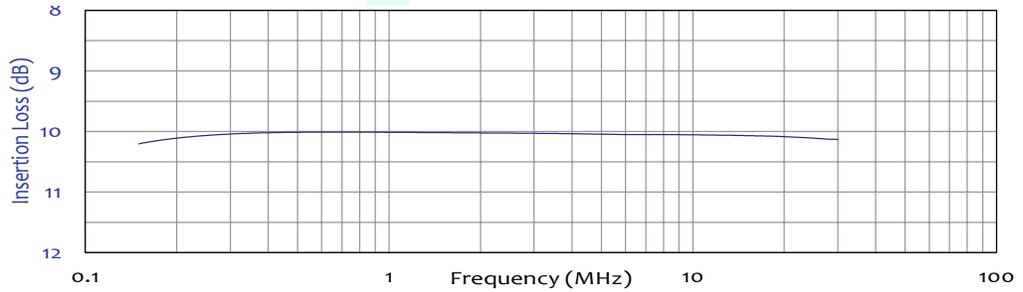
#### Typical Impedance Data



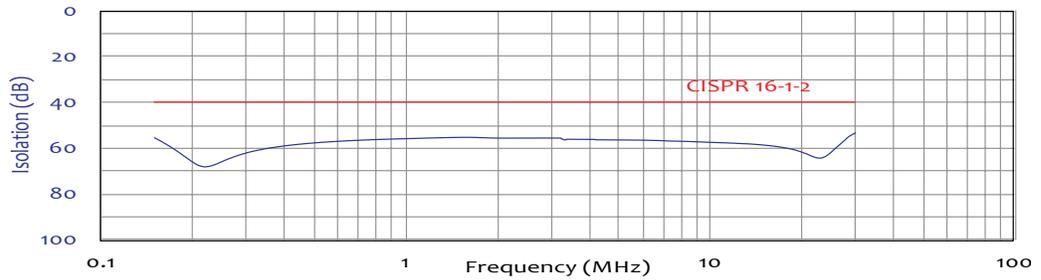
#### Typical Phase Data



#### Typical Insertion Loss



#### Typical Isolation Data



**FIGURE 4 - Product Performance Data**

## 4.0 LISN Installation

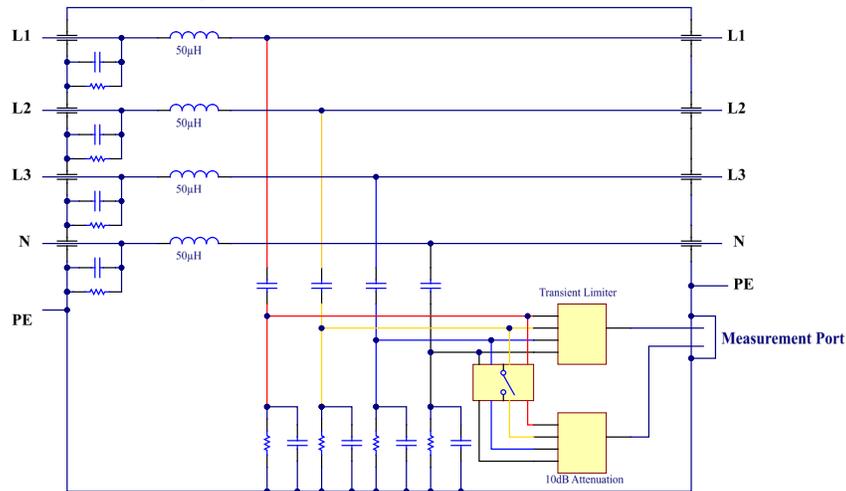
### 4.1 LISN Theory

The LI-3P-132 Line Impedance Stabilization Network is specifically designed to provide a measurement platform for power line conducted emissions (disturbance measurements) compliance testing as required for FCC regulations, CISPR/EN/ETSI and other worldwide standards for commercial products. The LISN is fully compliant with the requirements of both CISPR 16-1-2 and ANSI C63.4.

Line Impedance Stabilization Networks provide standardized line impedance to the EUT during conducted emissions testing, which is independent of the external power line impedance. The standardized impedance enables consistent readings for RF noise measurements on the power line.

In addition to providing a standardized impedance, the LISN also acts as a low-pass filter for the power to equipment under test. The LISN provides isolation between the power source or mains network to reduce the amplitude of unwanted ambient signals/noise while allowing the power to pass with minimal voltage drop. This filter is comprised of a single-stage low-pass LC filter. The inductors (L) in all Com-Power LISNs are air-core to eliminate saturation and provide stability.

The LISN also provides a low-impedance, capacitively coupled, low-loss path for RF noise from each EUT power conductor to the measurement port. The loss incurred along each of these paths is referred to as Insertion Loss. Insertion Loss factors are measured and the data is provided for each line in the network. These factors must be considered to achieve the highest measurement accuracy. The insertion loss factors (in dB) are added to the measured values (in dB $\mu$ V). A basic example schematic of the LISN is illustrated in Figure 5 below.



**FIGURE 5 – Schematic Diagram of LI-3P-132**

#### Section 4 – LISN INSTALLATION

## 4.2 Safety Considerations

It is critical that the LISN be installed in a manner which ensures that each of following conditions is satisfied:



The metal enclosure of the LISN must be connected to the reference ground plane of the site. The recommended connection method is via a direct, surface to surface connection between the LISN base plate and an exposed, conductive surface of the floor or wall of a shielded enclosure. The LISN base plate should be bolted to the surface using the mounting holes on the front and back of the LISN base plate.



Where installation as described in the previous paragraph is not possible, the LISN may be connected to earth ground via the ground lug located on the rear panel of the LISN. Thick metallic braid or heavy gauge wiring is recommended, and the length shall be kept as short as possible.

In cases where no ground plane is available, a Mains isolating transformer shall be used.

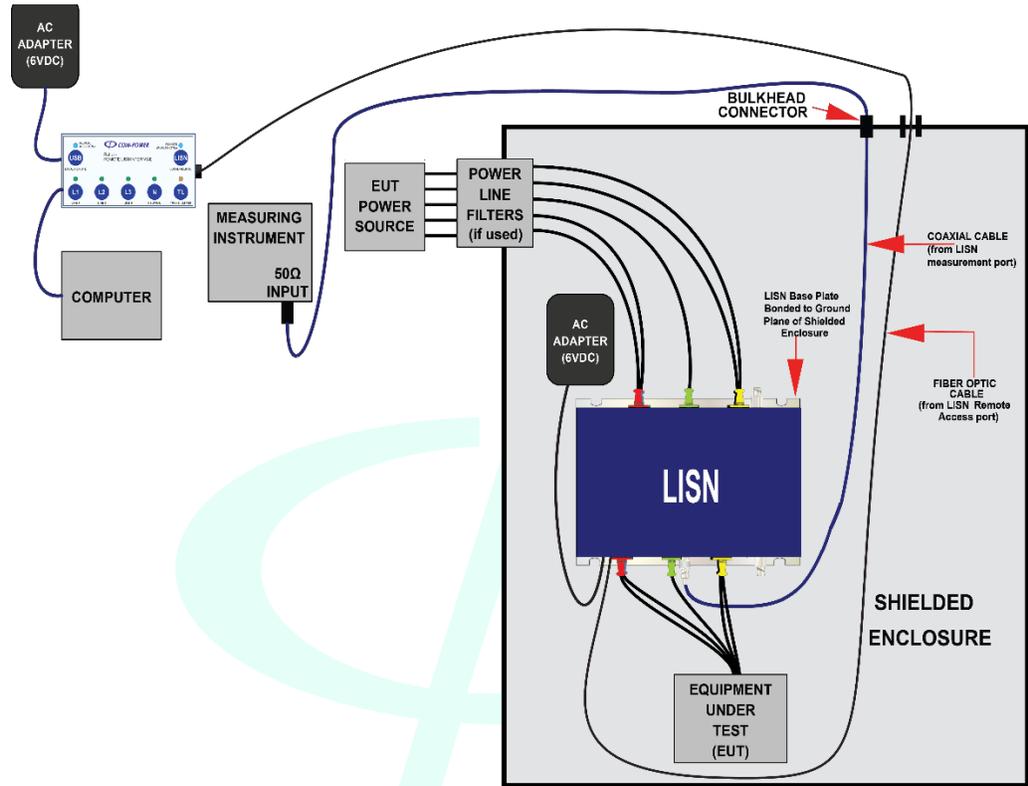
Please refer to the safety instructions in section 3.3 for more information on the importance of grounding. The grounding instructions are to be always followed.

- The ventilation openings in the LISN enclosure must be unobstructed.
- No signal or operating voltages/currents shall exceed those specified in the product specifications listed in section 3.5.
- The LISN power input port must connect to an appropriate power source protected by a circuit breaker with a current rating which is greater than or equal to the rating of the LISN.
- Due to the high level of earth leakage current, the device cannot be connected to any power source protected by a Ground Fault Circuit Interrupter (GFCI), also called Ground Fault Interrupter (GFI) or Residual Current Device (RCD).

Failure to comply with any of these points may damage the equipment and/or pose an electrical hazard.

### Section 4 – LISN INSTALLATION

### 4.3 Test Equipment Setup & Connections



**FIGURE 5 – Typical Test Setup**

Depending on the electromagnetic environment, the use of a shielded enclosure, power line filters and/or isolation transformers may or may not be necessary. The LISN will act as a filter, providing some isolation between the Mains Port and EUT Port. However, this may not be sufficient for some installations, and additional power line filtration may prove to be necessary.

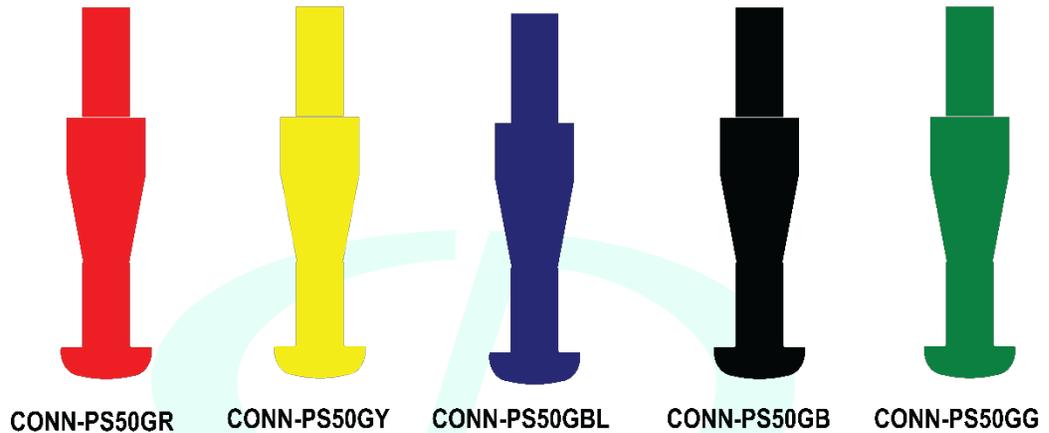
The standard CISPR 16-1-2 requires the use of a 10 dB attenuation pad between the LISN measurement port and the measuring instrument to assure accurate termination. The VSWR of the input and output port of the attenuation pad shall be less than or equal to 1.2:1. Com-Power Transient Limiters incorporate two 5 dB attenuation pads; thereby satisfying the 10 dB requirement. The transient limiter complies with the 1.2:1 VSWR requirement, as well.

Using a transient limiter will also protect the RF input of your EMI receiver or spectrum analyzer, which are extremely sensitive, and easily damaged by high voltage transients. The transient limiter includes 10 dB attenuation. When the transient limiter is bypassed, the signal is routed through a separate 10 dB attenuation pad.

#### Section 4 – LISN INSTALLATION

### 4.3.1 LISN Input Power Connections

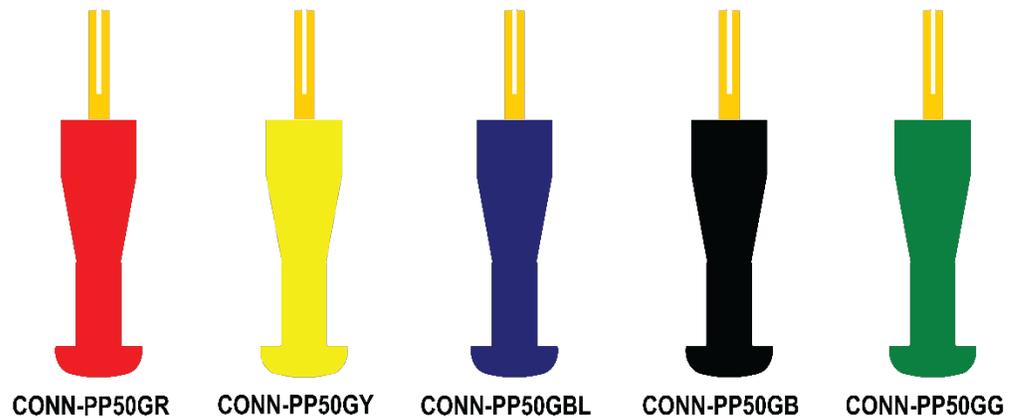
Your LI-3P-132 LISN is provided with five (5) 25A Plug Sockets: red, yellow, blue, black, green (with female contacts), which are used to connect the LISN to the Power Source of Equipment Under Test (EUT). The colors of these connectors match the input receptacles on the rear of the LISN. Figure 7 shows these connectors.



**FIGURE 7 – Power Input Port Plug Socket Connectors (50 Ampere)**

### 4.3.2 LISN Output Power Connections

Your LI-3P-132 LISN includes five (5) 25A Plug Pins: red, yellow, blue, black, and green (with male contacts), used to connect the LISN to the input power cable for the Equipment Under Test (EUT). The colors of these connectors match the output receptacles on the front of the LISN. Figure 8 shows these connectors.



**FIGURE 8 – EUT Power Port Plug Pin Connectors (50 Ampere)**

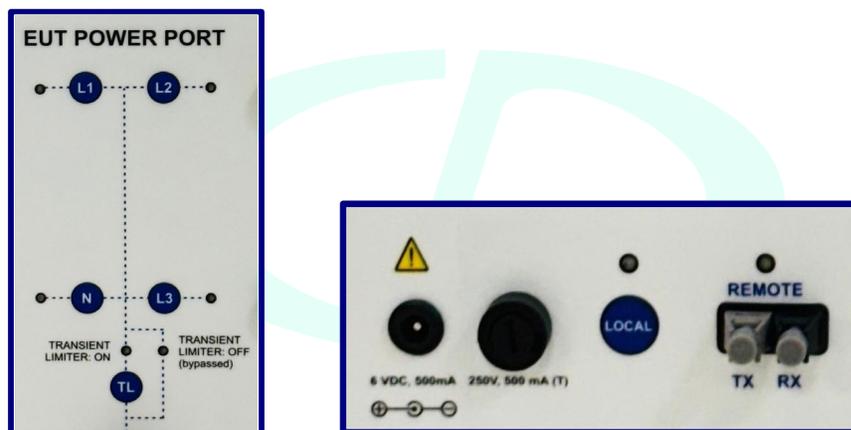
## Section 4 – LISN INSTALLATION

## 5.0 LISN Operation

The LI-3P-132 model can be operated locally via the front-panel interface and remotely via the RLI interface or an attached computer.

### 5.1 Local (Front Panel) Operation

When operated locally (from the front panel), the push buttons on the LISN front panel are used to select Line L1, L2, L3 and N as the line under test and to enable/bypass the transient limiter. The respective LEDs indicate which line is under test and whether the transient limiter is enabled or bypassed.



**TEST LINE SELECTION    DC input, Local Operation, Fiber Optic**

**NOTE:** The LISN can be operated from the front panel when the REMOTE LED is NOT lit, indicating there is no remote connection to the RLI V2.0 Remote LISN Interface. When operating from the front panel, 6 VDC input power is required.

### 5.2 Remote Operation



To enable remote operation, the 6 VDC AC power adapters must be plugged in and connected to the appropriate input power ports on the left side of the RLI V2.0 Remote LISN Interface and on the front panel of the LISN.

Then, connect one end of the fiber optic cable to the fiber optic port on the RLI V2.0, and connect the other end into the fiber optic port on the front panel of the LISN.

*Section 5 – LISN OPERATION*

Once the fiber optic cable is connected and both sides are powered, the link is established automatically. When linked, the REMOTE and L1 LEDs on the LISN front panel should illuminate, as well as the L1 LED on the RLI V2.0.

Once linked, you are now able to select the Line using the L1, L2, L3, and N push-buttons on the top surface of the RLI V2.0. The active (illuminated) line-under-test indicator LED on both the RLI V2.0 and the LISN front panel will correctly reflect the selected line.

The LISN can also be controlled via a computer. Simply connect RLI to the computer using a USB Type B to Type A cable. The command codes for the RLI V2.0 are given in Figure 9.

No.	Commands	Description	Return Value	Condition For Return Value
1	@CTS	To begin communication between PC & RLI .	@Access Granted\$	If RLI is in Remote Mode.
			@Access Denied\$	If RLI is in Manual Mode.
2	@DTS	To end communication between PC & RLI .	@Disconnected\$	If RLI is in Remote Mode.
			@Access Denied\$	If RLI is in Manual Mode.
3	@CSS	Query the connection status between RLI & LI-3P.	@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.
			@Connected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
4	@CHS	Query the Selected Channel on RLI .	@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.
			@L1\$	If L1 is Selected.
			@L2\$	If L2 is Selected.
			@L3\$	If L3 is Selected.
5	@L1S	Set the Channel Selection to L1 on RLI .	@Access Denied\$	If RLI is in Manual Mode.
			@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@L1-Selected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.
6	@L2S	Set the Channel Selection to L2 on RLI .	@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@L2-Selected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.
7	@L3S	Set the Channel Selection to L3 on RLI .	@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@L3-Selected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.
8	@NES	Set the Channel Selection to N on RLI .	@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@NE-Selected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.
9	@TTS	Set Transient Limiter ON	@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@TL-ONS\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.
10	@TBS	Set Transient Limiter OFF	@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@TL-OFFS\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.

**FIGURE 9 – Command Codes to Control the LISN**

**Section 5 – LISN OPERATION**

## 6.0 LISN Measurements

Measurements of conducted emissions, sometimes referred to as disturbance voltages, using the LI-3P-132 LISN, are made individually on each current-carrying conductor with reference to ground.

Measured values must be corrected to account for any losses incurred along the measurement path. These corrections usually include the insertion loss values for the LISN (with respect to the test lead being measured), coaxial measurement cables, attenuation pads or Transient Limiters, connecting adapters, etc.

### 6.1 LISN Insertion Loss Factors

The insertion loss for the LISN is essentially the difference, in dB, between the signal amplitude on the EUT power conductor at the entry point of the EUT Power Port into the LISN, and the amplitude of the same signal at the measurement port of the LISN. The insertion loss factors for the LI-3P-132 LISN include the insertion loss of the internal transient limiter and/or 10 dB attenuator.

All Com-Power LISNs are individually calibrated, and the insertion loss values are provided. There are eight (8) sets of Insertion Factors for each of the LI-3P-132 LISN, so there are two (2) sets for each line, TRANSIENT LIMITER ON and TRANSIENT LIMITER OFF (bypassed).

Typical Insertion Loss values for the LI-3P-132 LISN are listed in Figure 10 table.

Equipment:		Three-Phase Line Impedance Stabilization Network (LISN)						
Model:		LI-3P-132 V2.0						
Frequency (MHz)	LISN Insertion Loss Factors (Transient Limiter OFF & Transient Limiter ON Modes)							
	LINE 1		LINE 2		LINE 3		NEUTRAL	
	TL OFF (dB)	TL ON (dB)	TL OFF (dB)	TL ON (dB)	TL OFF (dB)	TL ON (dB)	TL OFF (dB)	TL ON (dB)
0.15	10.20	10.17	10.20	10.17	10.20	10.17	10.21	10.18
0.16	10.18	10.15	10.17	10.14	10.18	10.15	10.19	10.15
0.17	10.16	10.12	10.15	10.12	10.16	10.13	10.16	10.13
0.18	10.14	10.10	10.13	10.10	10.14	10.11	10.15	10.11
0.19	10.12	10.09	10.12	10.08	10.13	10.09	10.13	10.10
0.2	10.11	10.07	10.11	10.07	10.12	10.08	10.12	10.08
0.225	10.09	10.04	10.08	10.04	10.09	10.05	10.10	10.06
0.25	10.06	10.02	10.06	10.02	10.08	10.03	10.08	10.04
0.275	10.05	10.01	10.05	10.00	10.06	10.02	10.07	10.02
0.3	10.04	10.00	10.04	9.99	10.06	10.01	10.06	10.01
0.35	10.03	9.98	10.02	9.98	10.04	10.00	10.05	10.00
0.4	10.02	9.97	10.02	9.97	10.03	9.99	10.04	9.99
0.45	10.01	9.97	10.01	9.96	10.03	9.98	10.03	9.98
0.5	10.01	9.96	10.01	9.96	10.02	9.98	10.03	9.98
0.75	10.01	9.96	10.01	9.96	10.02	9.97	10.02	9.97
1	10.01	9.97	10.01	9.96	10.02	9.97	10.02	9.98
2	10.02	9.98	10.02	9.98	10.03	9.99	10.03	9.99
3	10.03	9.99	10.03	9.99	10.03	10.00	10.04	10.00
4	10.04	10.01	10.03	10.00	10.04	10.01	10.05	10.02
5	10.04	10.02	10.04	10.02	10.05	10.02	10.06	10.03
10	10.06	10.07	10.06	10.06	10.07	10.09	10.09	10.10
15	10.07	10.15	10.07	10.15	10.10	10.17	10.12	10.20
20	10.08	10.27	10.09	10.27	10.13	10.30	10.16	10.34
25	10.11	10.38	10.12	10.38	10.19	10.45	10.21	10.49
30	10.13	10.45	10.16	10.46	10.26	10.56	10.29	10.61
Insertion Loss value to be added to receiver reading: Meter Reading + Insertion Loss = Corrected Reading								

**FIGURE 10 – Typical Insertion Loss Factors for LI-3P-132 LISN**

Section 6 – LISN MEASUREMENTS

### 6.1.1 Example Calculation

An LI-3P-132 LISN was used to measure the conducted emissions of an EUT. The measurement port of the LISN was connected to the RF input of the measuring instrument via a coaxial cable. A signal is observed on LINE 2, with the transient limiter ON. The frequency of the signal is 20 MHz, and the measured amplitude is 40 dB $\mu$ V. What is the actual amplitude of this signal on the LINE 2 conductor of the EUT input power?

For the system shown above, there are two (2) correction factors needed:

- 1) The LISN Insertion Loss Factor at 20 MHz for LINE 2 with transient limiter (TL) ON.
- 2) The insertion loss value of the coaxial cable at 20 MHz.

We'll assume that the insertion loss of the coaxial cable at 20 MHz is 2 dB and, by referring to the typical insertion loss table shown in Figure 10, the LISN insertion loss factor for LINE 2 with transient limiter ON is 10.27 dB (in practice, you will use your actual calibrated factors rather than the typical factors).

Measured amplitude at 20 MHz = 40.0 dB $\mu$ V

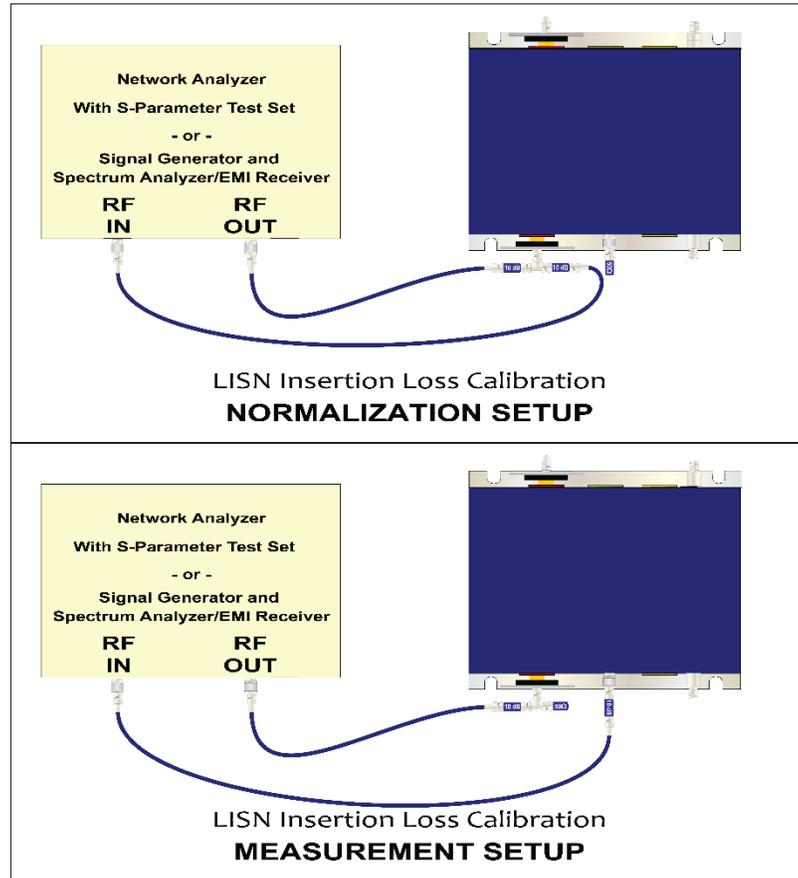
LISN Insertion Loss Factor at 20 MHz for LINE 2 with TL ON = 10.27 dB

Insertion Loss of Coaxial Cable at 20 MHz = 2.0 dB

**Measured Amplitude + Insertion Losses = Corrected Reading = 52.27dB $\mu$ V**

**6.1.2 LISN Insertion Loss Calibration**

The test setup for normalization and LISN Insertion Loss measurements are illustrated in Figure 11. The insertion loss factor is the difference (in dB) between the normalization measurements and the LISN insertion loss measurements.



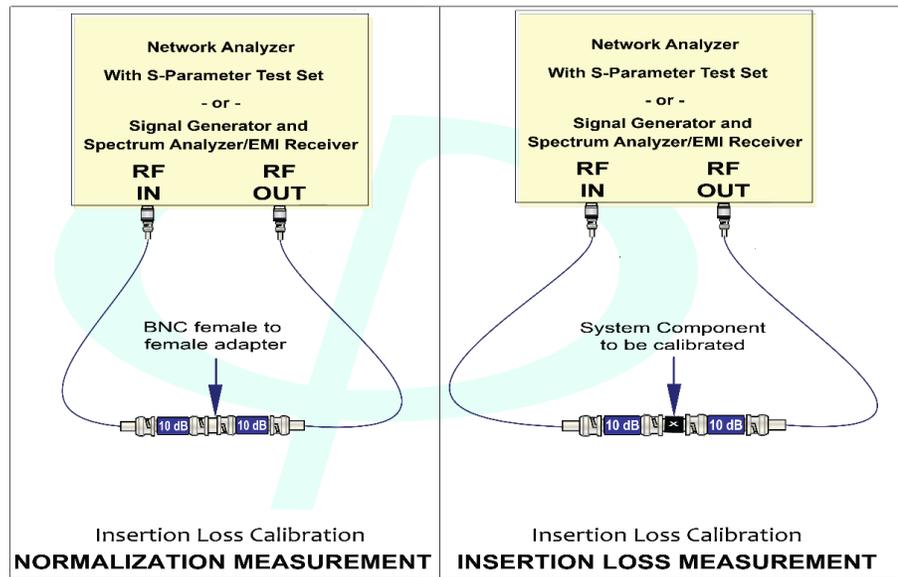
**FIGURE 11 – Setup Diagrams for LISN Insertion Loss Calibration**

*Section 6 – LISN MEASUREMENTS*

### 6.1.3 Non-LISN Insertion Loss Calibration

Insertion Loss values for coaxial cables and most measurement system components having a single coaxial input and output, such as attenuators, filters, dc blocks, etc., can be easily determined through a simple calibration process.

The test setup for normalization and insertion loss measurements is illustrated in Figure 12. The insertion loss factor is the difference (in dB) between the normalization measurements and the insertion loss measurements.



**FIGURE 12 – Setup Diagrams for Non-LISN Insertion Loss Calibration**

## 7.0 Warranty

Com-Power warrants to its customers that the products it manufactures will be free from defects in materials and workmanship for a period of three (3) years. This warranty shall not apply to:

- Transport damage during shipment from your plant.
- Damages due to poor packaging.
- Products operated outside their specifications.
- Products Improperly maintained or modified.
- Consumable items such as fuses, power cords, cables, etc.
- Normal wear
- Calibration
- Products shipped outside the United States without the prior knowledge of Com-Power.

In addition, Com-Power shall not be obliged to provide service under this warranty to repair damage resulting from attempts to install, repair, service or modify the instrument by personnel other than Com-Power service representatives.

Under no circumstances does Com-Power recognize or assume liability for any loss, damage or expense arising, either directly or indirectly, from the use or handling of this product, or any inability to use this product separately or in combination with any other equipment.

When requesting warranty services, it is recommended that the original packaging material be used for shipping. Damage due to improper packaging will be avoided in the warranty.

If you feel that the product is not working as intended, or is malfunctioning, please contact Com-Power for assistance. In the case of repairs or complaints, please visit our website at [www.com-power.com](http://www.com-power.com) and fill out an RMA form (<http://com-power.com/repairservicereq.asp>). The RMA number should be displayed in a prominent location on the packaging and on the product, along with a description of the problem, and your contact information.

### *Section 7 – WARRANTY*

## 8.0 Product Maintenance

This product contains no user serviceable parts. If the unit does not operate or needs calibration, please contact Com-Power Corporation. Any modifications or repairs performed on the unit by someone other than an authorized factory trained technician will void warranty.

The exterior surface may be cleaned with mild detergent and then be wiped with a dry, clean, lint-free cloth. Use care to avoid liquids or other foreign objects entering the chassis.

