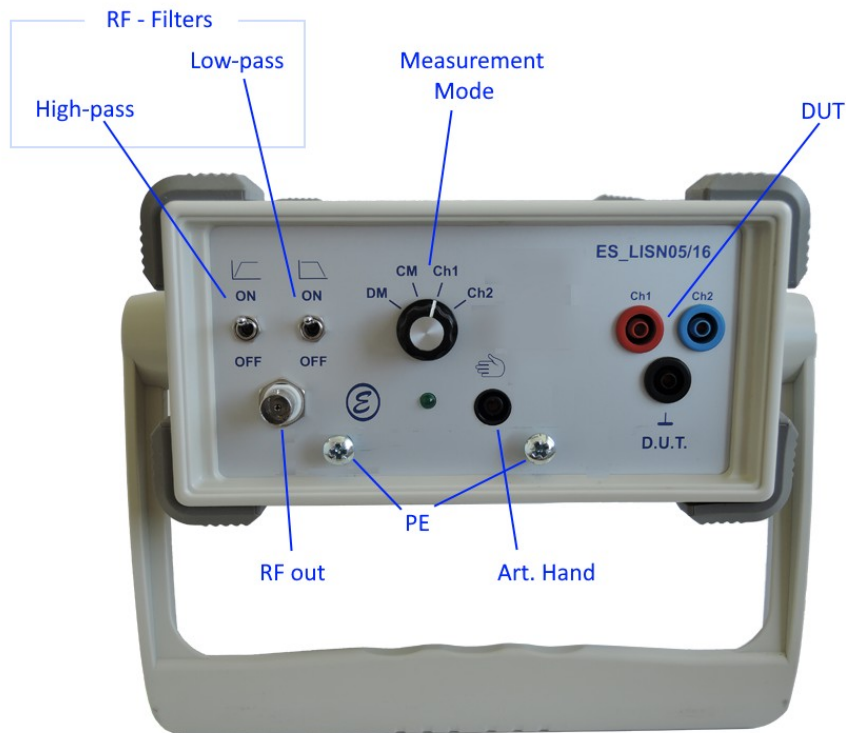


# LISN05/16 DC

The LISN05/16 is a Line Impedance Stabilization Network (LISN) for pre-compliance conducted EMI testing in the range of 9kHz till 110MHz and is compliant with CISPR 25. The extended frequency range (till 110MHz) and the use for V-,  $\Delta$ - and T-networks make it ideal for developers for testing and solving EMC problems.



## Specifications

- 50 $\mu$ H 16A network
- Differential mode (DM)
- Common mode (CM)
- L or N
- Artificial hand
- Low-pass filter 35MHz
- High-pass filter 9kHz
- Built-in limiter
- Measurement range 9kHz - 110MHz
- Attn 10dB
- Power 200-250Vac 50/60Hz IEC 60320 C19
- 22 x 10 x 24 cm



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## LISN Internals

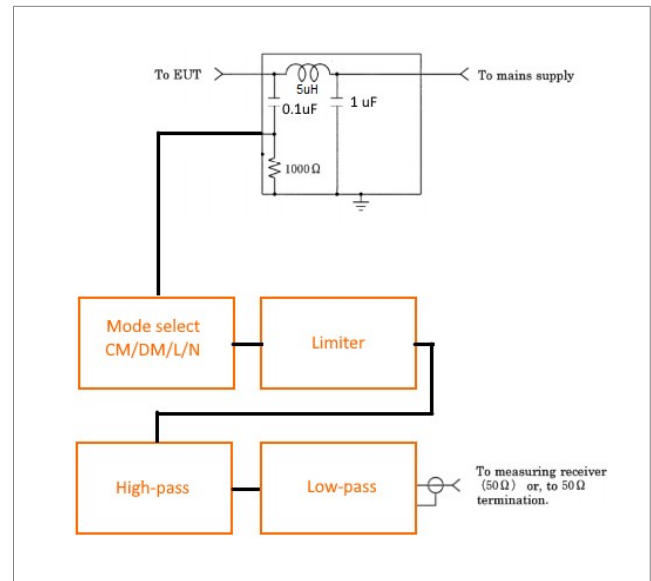
The circuit of a LISN is described in the standard CISPR 25. Important are the series inductance and the filter capacitance.

The circuit presented, shows the network for 1 phase. The LISN has this network for both phases and the RF tap can be switched.

The 5uH inductor is important for the actual measurement. Optionally a 250uH pre-filter may be ordered to reduce noise coming from the power supply.

The RF measurement output in the LISN05/16 has extended functionality to make it more safe and allow different measurements.

By using RF-relays to switch filters and optimized layout, the RF path has been made flat upto 110MHz.



# Connections & Controls

Names are shown in the picture of page 1.

## PE terminals

Connect both PE terminals to the ground reference plane using a broad and short conductor, preferably metal strip(s). This reduces the impedance to the reference plane, which is important for the higher frequencies.

## Artificial Hand

The Artificial Hand simulates the influence of the human hand on the EMC behaviour of devices, which are held in hand during use (for example: electrical drilling machines, hairdryer etc.).

If the DUT has a plastic housing, a conductive film should be used to cover the housing at the location, where it is held in hand. A test lead is used to connect the film to banana jack 'Art. Hand'. DUTs with a metal housing are connected directly to banana jack 1, if they don't have a protective ground connection according to Class 1.

## DUT connections

The DUT (Device Under Test) is connected with banana jacks to the power supply and the device.

## Measurement mode

The 'measurement mode' selects which signal is fed to the RF out connection. Conducted noise can be measured on the phase and on the neutral conductor.

The Common Mode (CM) provides a combined signal and Differential mode (DM) provides a difference signal.

- N: one of the phases (Neutral)
- L: one of the phases (Line)
- CM: Common mode signal:  $\frac{V_L + V_N}{2}$
- DM: Differential mode signal  $V_L - V_N$

The L and N are used for a measurement according to the standard (CISPR/VDE). The DM and CM modes are used to find the root of any interference. If the L or N measurement gives high levels, there are several cases:

CM levels	DM Levels	Possible cause
High	Low	High coupling of the circuit to PE or environment. Check the circuits other connections for proper filtering.
High	High	Possibly insufficient filtering inside the circuit (between power lines with switching elements) and possible insufficient I/O line filtering.
Low	High	Possibly insufficient filtering inside the circuit (between power lines with switching elements).

## High-pass and Low-pass filter

The high-pass filter attenuates frequencies below 9kHz, the Low-pass filter starts attenuation above 35MHz.

If your measurement range is 9kHz to 30MHz, out-of-band noise may introduce cross-modulated signals if the spectrum analyzer or measurement receiver is over-driven. If there is a significant difference when using or not using the filters, the cause should be investigated.

The frequency curves without and with filtering are shown in fig. 1.

HP: -3dB @ 7kHz

LP: -3dB @ 35MHz

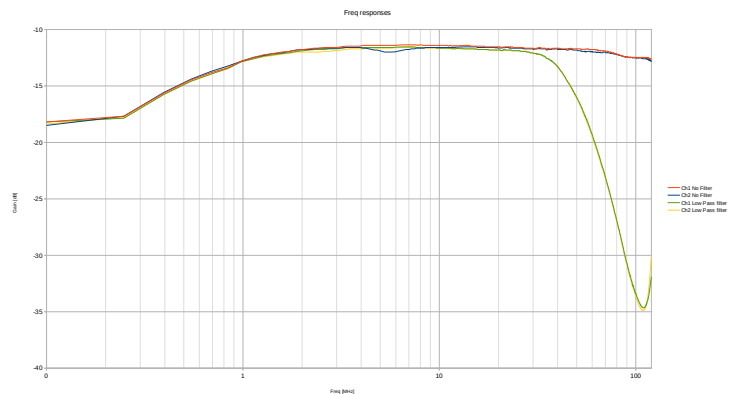


Figure 1: Frequency response with and without filtering

## Built-in Limiter

The built-in limiter protects the connected spectrum analyzer or measurement receiver from high voltage transients that occur when the power supply is switched on or off. The voltage step will propagate directly through the coupling capacitor to the RF out. The limiter is permanently placed in the path, reducing such spikes to below 1200mV (~122dBuV / 15 dBm).

The limiter has a fixed attenuation of 10dB.

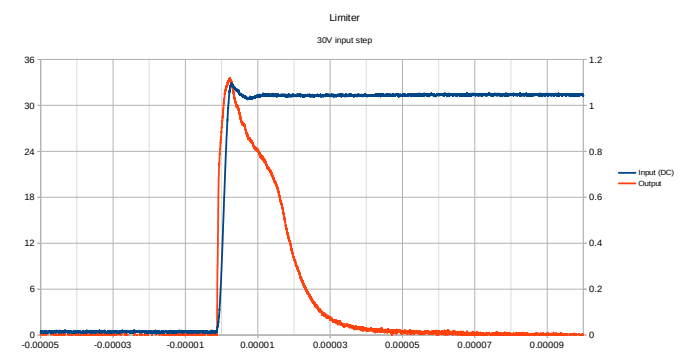


Figure 2: Effect of the limiter

## Automation control

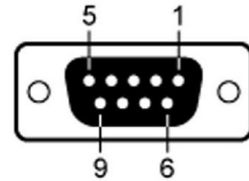
The LISN may be operated remotely through the 9pol (Female) Sub-D connector on the back. The remote functions are:

- Measurement Mode (CM/DM/L/N)
- High-pass filter
- Low-pass filter

*Note that the filters are 'bridged' if the relay is activated.*

To operate remotely set:

- Measurement Mode to DM (on front panel)
- High-pass filter ON
- Low-pass filter ON



Pin Nr	Function	Level
1	CM mode	Act. Low
2	L mode	Act. Low
3	HP filter	Act. High/Open
4	LP filter	Act. High/Open
5	+24V	
6	N mode	Act. Low
7	Ret (GND)	
8	Ret (GND)	
9	Ret (GND)	

## Signal levels

By pulling a signal line one of the CM mode, L mode, N mode low, that function is activated. By pulling HP filter or LP filter low the filter is disabled.

## Calibration

For calibration, power must be provided to activate the relays. Since powering the Mains input is not convenient for the measurement, an external 24V (and GND) may be provided on the Remote control connector (remember to pull HP/LP low to deactivate the filter).

Subsequent calibration shall be done for CH1 and CH2 separately according to CISPR 25.

## Measurement setup

### Power connection



Note: The Mains power to the LISN05/16 DC is only used to drive the internal relays.

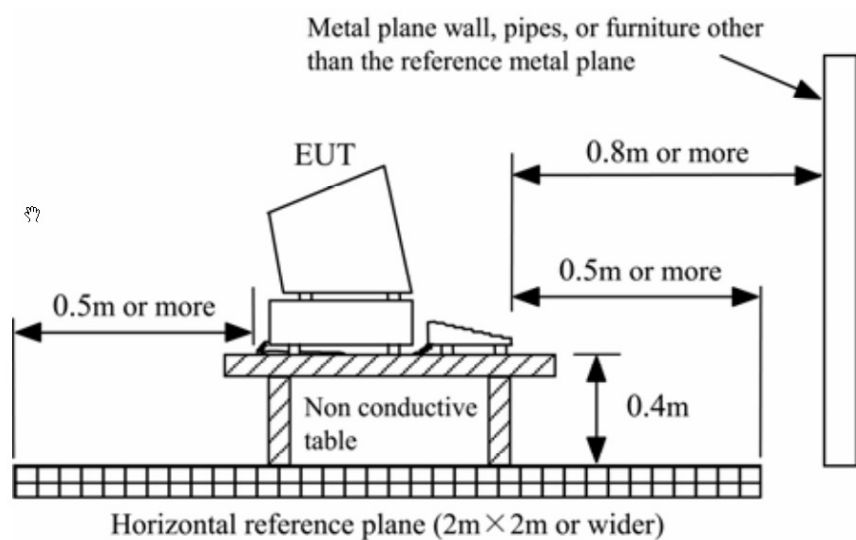
### RF setup and connections

The measurement setup is described in the CISPR 25 and other relevant documents. Most important is the use of a ground reference plane and solid connections to it.

There are 2 'standard' setup methods:

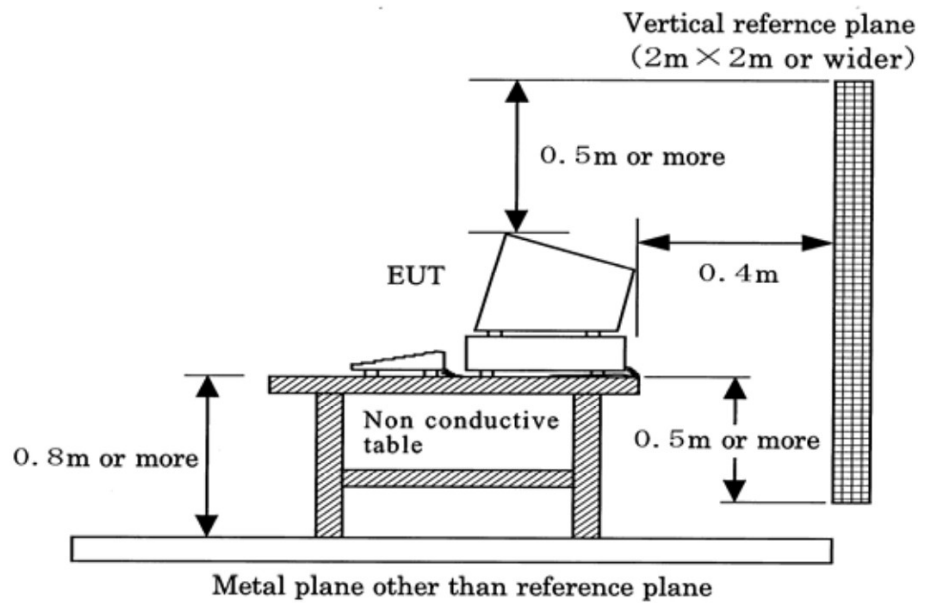
#### A floor reference plane

All equipment is placed above and inside the plane. Any other influences shall be kept at a distance.



### **Wall mount reference plane**

Now the reference plane is on the wall. In all cases, use a fully non conductive table.



### **Initial settings for Spectrum analyzer / measurement receiver**

The recommended settings for the spectrum analyzer or measurement receiver can be recalled from a stored configuration file.

- Frequency span: 150kHz – 30MHz (depending on the requirements)
- Detector max. peak
- Displayed amplitude unit dB $\mu$ V
- Compensate the reading for the 10dB attenuation of the LISN.

Typ. Data

Frequency response

kHz	No filter	HP + LP
100	-18.5	-18.4
248	-17.7	-17.8
543	-14.4	-14.6
838	-13.2	-13.3
2019	-11.8	-12.0
2904	-11.7	-11.9
4085	-11.7	-11.7
6003	-12.0	-11.6
8069	-11.7	-11.6
10283	-11.6	-11.7
16039	-11.6	-11.8
20023	-11.7	-11.8
24155	-11.7	-11.9
29911	-11.7	-12.1
40094	-11.8	-13.3
50277	-11.8	-16.2
60460	-12.0	-19.7
70052	-12.0	-23.2
80088	-12.2	-27.0
90123	-12.4	-30.9
95141	-12.5	-32.4
100011	-12.5	-33.6
105176	-12.5	-34.6
110046	-12.6	-34.8