

Line Impedance Stabilization Network HM6050-2

Manual

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General information regarding the CE marking

HAMEG instruments fulfill the regulations of the EMC directive. The conformity test made by HAMEG is based on the actual generic- and product standards. In cases where different limit values are applicable, HAMEG applies the severer standard. For emission the limits for residential, commercial and light industry are applied. Regarding the immunity (susceptibility) the limits for industrial environment have been used.

The measuring- and data lines of the instrument have much influence on emission and immunity and therefore on meeting the acceptance limits. For different applications the lines and/or cables used may be different. For measurement operation the following hints and conditions regarding emission and immunity should be observed:

1. Data cables

For the connection between instruments resp. their interfaces and external devices, (computer, printer etc.) sufficiently screened cables must be used. Without a special instruction in the manual for a reduced cable length, the maximum cable length of a dataline must be less than 3 meters. If an interface has several connectors only one connector must have a connection to a cable.

Basically interconnections must have double screening. For IEEE-bus purposes the double screened cables HZ72S and HZ72L from HAMEG are suitable.

2. Signal cables

Basically test leads for signal interconnection between test point and instrument should be as short as possible. Without instruction in the manual for a shorter length, signal lines must be less than 3 meters long.

Signal lines must be screened (coaxial cable - RG58/U). A proper ground connection is required. In combination with signal generators double screened cables (RG223/U, RG214/U) must be used.

3. Influence on measuring instruments.

Under the presence of strong high frequency electric or magnetic fields, even with careful setup of the measuring equipment an influence of such signals is unavoidable. This will not cause damage or put the instrument out of operation. Small deviations of the measuring value (reading) exceeding the instruments specifications may result from such conditions in individual cases.

HAMEG Instruments GmbH

**KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY
DECLARATION DE CONFORMITE
DECLARACION DE CONFORMIDAD**



HAMEG®
Instruments

Name und Adresse des Herstellers
Manufacturer's name and address
Nom et adresse du fabricant
Nombre y dirección del fabricante

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Industriestraß 6
D - 63533 Mainhausen

Die HAMEG GmbH / HAMEG S.a.r.l bescheinigt die Konformität für das Produkt
The HAMEG GmbH / HAMEG S.a.r.l herewith declares conformity of the product
HAMEG GmbH / HAMEG S.a.r.l déclare la conformite du produit
La empresa HAMEG GmbH / HAMEG S.a.r.l. declara la conformidad del producto

Bezeichnung / Product name /
Designation/ Artículo:

Netznachbildung /
Line Impedance Stabilisation Network /
Réseau fictis (RSIL) /
Reproductor de red (LISN)

Typ /Type /Type /Tipo:

HM6050-2

mit / with / avec / con:

-

Optionen / Options / Options/ Opciones:

-

mit den folgenden Bestimmungen /
with applicable regulations /
avec les directives suivantes /
con las siguientes normativas:

EMV Richtlinie 89/336/EWG ergänzt durch 91/263/EWG, 92/31/EWG
EMC Directive 89/336/EEC amended by 91/263/EWG, 92/31/EEC
Directive EMC 89/336/CEE amendée par 91/263/EWG, 92/31/CEE
Directriz EMC 89/336/CEE enmendada por 91/263/CE, 92/91/CEE

Niederspannungsrichtlinie 73/23/EWG ergänzt durch 93/68/EWG
Low-Voltage Equipment Directive 73/23/EEC amended by 93/68/EEC
Directive des équipements basse tension 73/23/CEE amendée par 93/68/CEE
Directriz de equipos de baja tensión 73/23/CEE enmendada por 93/68/CEE

Angewendete harmonisierte Normen / Harmonized standards applied /
Normes harmonisées utilisées / Normas utilizadas

Sicherheit / Safety / Sécurité / Seguridad

EN 61010-1: 1993 / IEC (CEI) 1010-1: 1990 A 1: 1992 / VDE 0411: 1994
Überspannungskategorie / Overvoltage category / Catégorie de surtension /
categoría de sobretensión: II

Verschmutzungsgrad / Degree of pollution / Degré de pollution / Grado de polución: 2

Elektromagnetische Verträglichkeit / Electromagnetic compatibility /
Compatibilité électromagnétique / Compatibilidad Electromagnética:

EN 50082-2: 1995 / VDE 0839T82-2

EN 61000-4-2: 1995 / IEC (CEI) 1000-4-2: 1995 / VDE 0847 T4-2: Prüfschärfe / Level / Niveau / Nivel = 2

Datum / Date / Date / Fecha
09.02.1998

Unterschrift / Signature /Signature/ Firma:

E. Baumgartner
Technical Manager
Directeur Technique



Line Impedance Stabilization Network HM6050-2

- **Maximum continuous current: 16A**
- **Phase indication via LED on front panel**
- **BNC test signal output, L1 or N**
- **Artificial Hand**
- **Protective earth simulation circuit**
- **Remote control (EIA-232 interface)**
- **Transient Limiter**

The HM6050-2 Line Impedance Stabilization Network (LISN) meets standards VDE 0876 and CISPR Publ. 16. It contains air core inductance coils and features an Artificial Hand and a PE simulating network which can be bridged.

Conducted emissions on AC power lines, which are typically generated by electrical equipment, can be verified with the help of a LISN together with a Spectrum Analyzer/EMC Receiver. The DUT (device under test) must be connected directly to the LISN. Inside the LISN the power lines are terminated with a well-defined impedance network, against each other and against ground.

The HM6050-2 Line Impedance Stabilization Network (LISN) in principle is a filter network. Through a low pass filter the

DUT is connected to the AC power lines. The LISN also presents a well-defined impedance to the signal. For measurements with a Spectrum Analyzer/EMC Receiver the EMC signal is available after having passed a high pass filter.

Two identical networks provide the asymmetric noise emission signals of the DUT's power lines L1 and N. The user can choose between the signals, the selected one will be available at the HM6050-2's test signal outlet. The stabilization network (simulation for the AC power lines) is arranged in form of a "V".

When working with a Spectrum Analyzer/EMC Receiver it is highly recommended to enable the built-in Transient Limiter of the HM6050-2.

Specifications HM6050-2

Frequency range:	9 kHz to 30 MHz
Network inductance:	$Z = 50 \Omega \parallel (50 \mu\text{H} + 5 \Omega)$ error < 20% acc. to VDE 0876T1
Max. current:	2 x 16 A continuous
Voltage:	230 V~ at 50/60 Hz (factory setting)
Artificial hand:	220 pF + 511 Ω
PE simulating network:	50 $\Omega \parallel$ 50 μH

Connections

Front panel:	
Artificial hand:	banana jack 4 mm (Artificial Hand)
Ground:	banana jack 4 mm
DUT:	Female AC supply voltage output with PE
Test signal output:	50 Ω BNC jack (Test Receiver)
Rear panel:	
Power:	line cable 3 x 1,5 mm ² male with PE
Ground:	Alu-Block with tread 4 mm 40 x 20 x 20 mm
RS-232 Interface:	9-pin Sub-D, female

Transient Limiter

Frequency range:	150 kHz – 30 MHz
Transmission loss:	f = 150 kHz – 30 MHz a = 10 dB + 1,5/ -0,5dB f < 1 kHz – a > 90 dB f > 100 MHz – a > 50 dB
Max. Input voltage:	bei P = 2 W (average) \triangleq +33 dBm U = \pm 50 V _{DC}
Standing wave ration (VSWR):	1,5:1 or better

Miscellaneous

Ambient temperature:	10 °C to 40 °C
Power:	230 V / 115 V, 50 – 60 Hz
Safety:	Safety class I (IEC 1010-01/VDE 0411)
Dimensions (W x H x D):	285 x 125 x 380 mm
Weight:	6 kg
Color:	technobrown

Operating Manual

Introduction

It is highly recommended to read this operating manual before using the HM6050-2. After unpacking the equipment check for any mechanical damage or loose parts inside. Should there be a transportation damage, inform the supplier immediately. Do not put the equipment into operation.

Used Symbols



ATTENTION – refer to manual



Protective ground (earth) terminal



L1/N – identification of power lines
(Lit, if the power cable connector is plugged in correctly (phase))

Operation according to rules

The Line Impedance Stabilization Network HM6050-2 has to be operated according to the regulations as defined in VDE 0876 Part1 ("Measurement of radiated emissions"). It conforms to the regulations as defined in CISPR Publ.16 or. EN55011.

Safety

This instrument has been designed and tested in accordance with VDE 0411 Part 1, Safety requirements for electrical equipment for measurement, control, and laboratory use. The CENELEC regulations EN 61010-1, international standard IEC 1010-1 res. correspond to this standard. All case and chassis parts are connected to the safety earth connector of the power line plug, corresponding to the Safety Class 1 regulations.



To put the HM6050-2 to operation it has to be connected to an AC power outlet (with protective ground) according to VDE-0100. Due to the relative high leakage current (ca. 800 mA) the equipment cannot be operated in combination with a leakage current circuit breaker. Thus, "protective ground" is equivalent to "earth".

Any interruption of the protective ground conductor inside or outside the instrument is prohibited.

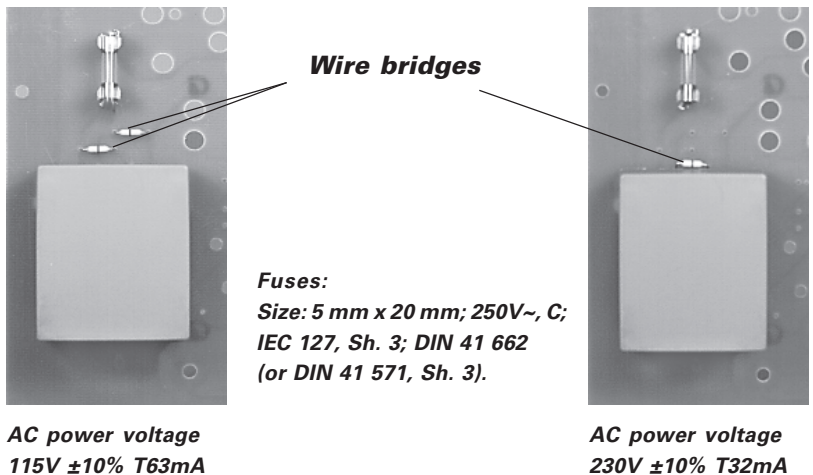
If there is any suggestion that safe operation is not possible, the instrument must be disconnected and secured against unintentional operation. This may occur:

- if the instrument has visible damage,
- if the instrument has loose parts,
- if the instrument does not function,
- after long storage under unfavorable circumstances (outdoors or in moist environments),
- after excessive transportation stress (e.g. in poor packaging).

Replacement of fuses

The internal power supply unit of the HM6050-2 contains a fuse. Ex factory the HM6050-2 is set to 230V $\pm 10\%$ (50-60Hz). If the instrument shall operate at a mains voltage of 115 V $\pm 10\%$, the wire bridges have to be changed by soldering.

Insert or replace fuses according to the selected AC voltage!



For fuse replacement the instrument has to be opened by unscrewing the two cap nuts at the rear panel. Then remove the two handle and the handle covers itself. The cover now can be moved to the backside of the instrument. The fuse is located at the rear side of the encapsulated power transformer on the main PCB.

Operating conditions

The permissible ambient temperature range for operation is +10°C ...+40°C. During storage and transportation the temperature may be in the range of -40°C...+70°C. In case of condensation buildup during transport or storage the instrument may not be set in operation before two hours of acclimatization. The instrument is intended to be used in a clean and dry environment. It may not be operated in a heavily dust laden, moist or explosive atmosphere or aggressive chemical effects. There are no limitations for the operating position. A sufficient free air circulation (cooling by convection) has to be kept for the instrument.

Warranty and repair

HAMEG instruments are subject to a strict quality control. All instruments are burned in for 10 hrs prior to shipment. By intermittent operation almost all early failures are detected. After burn-in a thorough test of all functions and of quality is run, all specifications and operating modes are checked.

In case of reclamations during the two years warranty period please contact the dealer from whom you purchased your HAMEG instrument. Customers from the Federal Republic of Germany may directly contact HAMEG for warranty processing in order to speed up the procedure.

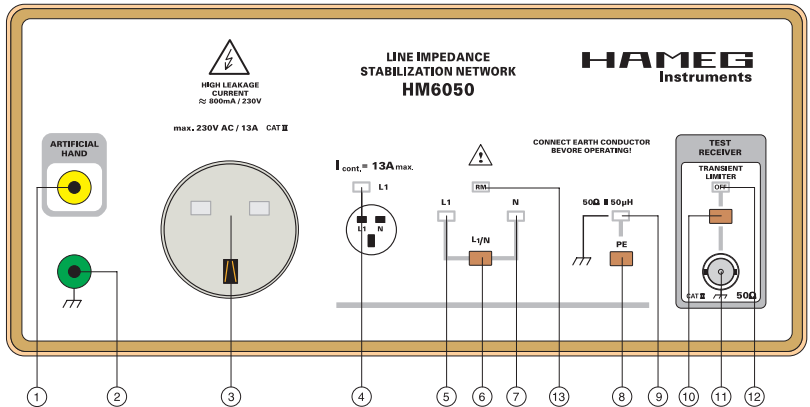
The proceeding of repairs during the warranty period is subject to our terms of warranty which are available on our web-site <http://www.hameg.com>

Even after expiry of the warranty period please do not hesitate to contact our HAMEG customer service for repairs and spare parts.

Return Material Authorization (RMA):

Before sending back your instrument to HAMEG do apply for a RMA number either by fax or on the Internet: <http://www.hameg.de>.

If you do not have suitable packaging for the instrument on hand please contact the HAMAG sales department (Tel.: +49 (0) 6182/800 300, E-mail: vertrieb@hameg.de) to order an empty original cardboard box.



Operating controls of the HM6050-2

(1) Artificial Hand

This feature simulates the influence of the human hand. When performing EMC measurements for devices, which are held in hand during use (for example: electrical drilling machines, hairdryer etc.) the Artificial Hand simulates the influence of the human hand on the EMC behavior of the equipment.

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 1. 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.

(2) Ground jack

This jack is used for testing DUTs, which don't have a protective ground line in their AC power cable, but do have a separate ground connection. The DUT's ground connector has to be linked to banana jack 2 via a test lead. This lead should be placed in parallel to the two-line AC power cable.

(3) Mains power outlet for the DUT

The DUT will be connected to the HM6050-2's Mains power outlet with its AC power cable. The maximum supply current of the DUT must not exceed a continuous current of 16 A at an ambient temperature of 23 °C. At higher ambient temperatures a fan has to be used for cooling. In any case a sufficient free air circulation has to be kept for the HM6050-2.

(4) LED L1

If the mains plug connected in correctly in phase, the LED L1 is lit. If it does not, the mains plug has to be turned by 180°. There is no risk

related to the phase status, but the correspondence to the indication for L1 (line) and N (neutral) might be incorrect. In case an asymmetric mains plug is used, lines L1 and N have to be changed inside the plug of the power cable.

(6) L1/N selector switch

Provided that the HM605-2 is correctly connected to the mains power outlet (point **(4)** LED **(5)** is lit after power-on. The EMC signal immediately will be available at output jack "Test Receiver" **(11)**. By pushing button **(6)** the signal source toggles to line N, which is indicated by a LED **(7)** lit.

(8) PE selector switch

After setting HM6050-1 to operation (power on) the protective ground simulation circuit is bypassed by default. After pushing button "PE" **(8)** the direct grounding of the protective earth line (according to VDE 0877 Part 1/03.89) will be replaced by a protective ground simulation circuit (according to VDE 0877 Part 1/03.989 (89 (50 μ H || 50 Ω to ground)).

(10) Transient Limiter selector switch

After turn-on the transient limiter circuit is enabled by default, to protect the attached Test Receiver's or Spectrum Analyzer's input circuitry from high transient voltages. After pushing button **(10)** the transient limiter circuit will be bypassed. A blinking red LED **(12)** indicates this operating status.

(11) Test Receiver (test signal output)

The output impedance Z of the HM6050-2's test signal output is 50 Ω . The shielding connection of the BNC jack is connected to the housing and thus to ground. A two plug broadband BNC cable is used to attach the HM6050-2 to a Test Receiver or Spectrum Analyzer. The built-in transient limiter is enabled by default. Pushing button **(10)** provides deactivation; LED **(12)** indicates this status by blinking.

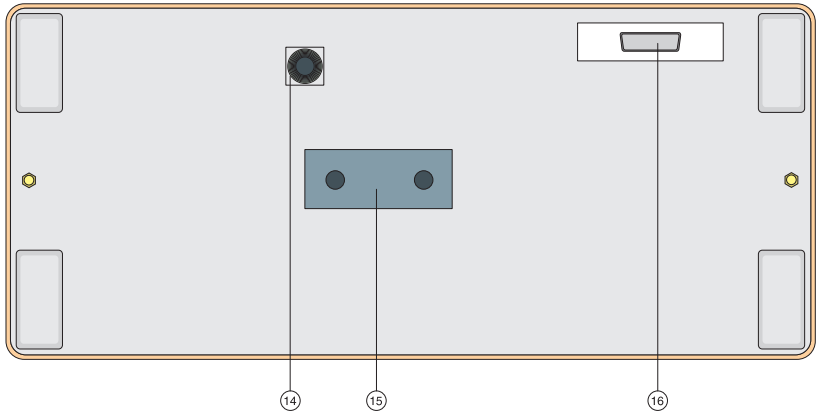
(13) RM - LED

In remote control mode „RM“ LED is lit.



Attention!

Because of their test principles Test Receivers and Spectrum Analyzers (i.e. HM5012/14) are extremely sensitive at their input circuitry. To protect the input circuits from damage by high voltage transients, it is highly recommended to use the equipment with the transient limiter enabled (red LED off)! Due to switching the DUT on and off, transients might arise, that possibly can damage the input circuit of the Spectrum Analyzer or Test Receiver. Damages of the input circuitry resulting from transient voltages are not covered by HAMEG's warranty.



Rear panel

(14) AC power cable

The power cable is used to attach the HM6050-2 to the mains outlet. (See: "Setting into operation").

(15) Ground block

The ground block is made of aluminum and fastened to the backside of the housing by two screws (below the mains cable outlet). Terminal "PE" may not be used as reference ground because it is connected to the PE line of the mains cable via a filter. If tests are performed outside an EMC chamber only a short ground cable may be used. Inside a chamber the ground cable has to be connected between the ground block and the chamber's shielding material (VDE 0877, Part1).

(16) RS-232 interface

Safety hints



Attention!

All interface lines are galvanic coupled to the LISN.

As mentioned in paragraph "Safety" the LISN has to be operated on a three line mains outlet (with protective ground line). An interface cable between the RS-232 interface of the LISN and the COM port of a PC causes a galvanic connection between the two devices. To exclude negative effects on other safety provisions the PC's power cable must be connected to the same mains outlet as the LISN.



Disregarding these safety hints (also see "Safety") will result in the loss of HAMEG's warranty in case of damages. HAMEG is not liable for any injuries to personnel or any equipment.

RS-232 Interface

A bi-directional interface is available for remote controlling. A D-Sub connector (9-pin, female) is located at the back panel of the LISN; the communication with a computer according to the RS-232 standard is supported.

Pin

- 2** Tx Data (data from LISN to computer)
- 3** Rx Data (data from computer to LISN)
- 5** Ground
- 9** +5V supply voltage for external devices (max. 30 mA).

The standard voltage level at the Tx, Rx terminals is ± 12 Volts. Interface configuration:

- 9600 baud
- 8 data bits
- 2 stop bits
- no hardware protocol

RS-232 Commands

The LISN interprets the following remote control commands.

Please consider the lower/upper case letters.

Command	Function	Indication
R	Remote control enabled	RM LED lit
O	Local control	RM LED dark
P	Protect. ground line sim. circuit on	PE LED lit
p	Protect. ground line sim. circuit off (bypass)	PE LED dark
N	EMC test signal of line N	N LED lit
n	EMC test signal of line L1	L1 LED lit
L	Transient Limiter off	OFF LED blinking
I	Transient Limiter activated	OFF LED dark

Setting into operation



Read the operator's manual before setting up the HM6050-2!

Only qualified personnel are allowed to set up the LISN for operation. HM6050-2 has been designed in conformity to regulations VDE 9876 and CISPR Publ. 16. The leakage current of the instrument exceeds the allowed value of $0.5 \text{ mA}_{\text{eff}}$ as defined in IEC 348 and VDE 411 for normally operating measurement instruments. Thus, the safety requirements have to be accomplished by additional provisions

according to IEC364-4-41 (CENELEC HD 384.4.41 and VDE 0100 Part 410). Due to the circuitry of the HM6050-2 a maximum leakage current of 800 mA can occur.

It is not possible to operate the HM6050-2 at a mains outlet with a leakage current circuit breaker.



Attention! Danger of death!

The LISN has to be grounded according to the regulations (Cenelec HD384/DIN VDE0100) separately; otherwise conductive parts of the housing, which may be touched by the user, lie on a dangerous high voltage level.

EMC measurement procedures for LISN HM6050-2

Measurements have to be performed according to the VDE regulations VDE 0877 Part 1.

After the test setup is completed according to the regulations one can begin with the measurement procedures.

Follow these procedure steps:

1. Set HM6050-2 to operation (power on)
(Transient limiter in active status (LED off))
2. Set DUT (Equipment under test) to operation
3. Set Spectrum Analyzer/Test Receiver to operation
4. Connect HM6050-2 to the input jack of the Spectrum Analyzer/Test Receiver via a coaxial HF cable.