BURST\SURGE GENERATOR
DNBGBS01

COUPLING\DECOUPLING NETWORK (CDN)
DNBCDN01

MANUAL

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1. INTRODUCTION

The generator DNBGBS01 is a versatile and compact tool, that allows to effect some tests of immunity conducted on electronic and/or electromechanical apparatuses , for verify the requisite of the electromagnetic compatibility (EMC).

The DNBGBS01 includes two equipments in one:

- **Burst Generator**
- **Surge Generator**

The tests that can be performed with the DNBGBS01 are:

- **Immunity test to fast transient (BURST) in accord with the norm EN 61000-4-4**
- **Immunity test to impulse (SURGE) in accord with the norm EN 61000-4-5**

The DNBGBS01 is complete with a CDN (Coupling Decoupling Network) DNBCDN01, that allows to couple the Burst or Surge produced by the generator to the EUT, (immunity test on the power supply input), and decoupling the generator from power supply.

Included in the packages are:

- **External power supply for the DNBGBS01**
- **Mains cable for the CDN DNBCDN01**
- **High voltage cable for connection between DNBGBS01 and CDN**
- **EUT output cable from the CDN, comprehensive of connector.**

Optional accessories:

- **Management software of the serial port RS232**
- **Isolation transformer for the CDN supply**

Conventionally, in the present manual, for tool will intend the couple Generator DNBGBS01 and CDN DNBCDN01.

2. PRECAUTIONS AND SAFETY MEASURES

2.1 GENERALITIES

The tool has been projected in conformity with the norms EN61010 and EN60950, related to the tests and measure electronic, for an use in an environment with pollution level 2 and can be used for tests of conducted immunity EMC on apparatuses and installations with category of overvoltage III 600V.

Before using the tool, it is essential to read attentively the instructions for its use and maintenance.
Make sure the staff employed to its use and maintenance must be adequately specialized and has read and understood the safety indications present in this manual.

2.2 PRELIMINARY INSTRUCTIONS

The tool generates in output high voltages, that can create a serious danger to the human life, therefore must be used from personal specialized in accord with VDE 0104.

Before and during the execution of the tests follow meticulously these indications:

- **Don't effect the tests in damp environments, in presence of gas or explosive materials, combustible or in dusty environments**
- **Avoid contacts with the circuit in examination**
- **Avoid contacts with exposed metallic parts, with terminal of measure unused, etc.**
- **Don't effect any test if anomalies are found in the tool as deformations, breakups, escape of substances, absence of signal on the indicative leds etc.**

People that use peace maker or they have other handicaps, don't have to be near the zone where tests are effectuated, because the tool is able to radiate a strong energy in the proximities in which work.

Possible interventions inside the instruments, must exclusively be performed from personal specialized and authorized.

Before opening the equipments verify that all cables, power supply and others, are completely disconnected.
To open the tool after its use, wait at least 10 minutes to allow the inside capacitors to discharge themselves completely.
The not respect of this norms could cause danger at operator life.
In case of not observance than exposed, or, interventions inside the tool performed without authorization written of the DENEB Elettronica, will extinct automatically every form of guarantee on the instrument.

The partial non observance of these norms, can generate malfunctions, equipment damages and personal lesions.
On the other hand, only meticulously following the prescriptions and the recommendations furnished by the builder, You can have the absolute certainty to always get the maximum results and receive in case of necessity, efficient technical service.
This instructions manual must be preserved in secure site and available for the use.
For further questions call DENEB Elettronica.

3. TECHNICAL SPECIFICATIONS

3.1 Burst Generator DNBGBS01

- **Norm of reference: IEC 1000-4-4 (EN 61000-4-4)**
- **Voltages selectable on the panel: 0,5-1-2 kV ± 10%**
- **Polarity: Positive/Negative**
- **Output impedance: 50 ohm ± 20%**
- **Impulse slope time: 15 ns**
- **Impulse length (reduction at half of the value): < 100 ns**
- **Waveform pulse on load of 50 ohm: 15/50 ns ± 20%**
- **Frequency of repetition of the impulses: 5 KHz**
- **Duration of the train of impulses (burst): 10 ms**
- **Period of repetition of the burst: 300 ms**

3.2 Surge Generator DNBGBS01

- **Norm of reference: IEC 1000-4-5 (EN 61000-4-5)**
- **Voltages selectable on the panel: 0,5-1-2 kV ± 10%**
- **Impulse slope time , at open circuit: 1,2 µs ± 20%**
- **Impulse length at open circuit: 50 µs ± 20%**
- **Impulse slope time at short circuit: 8 µs ± 20%**
- **Impulse length at short circuit: 20 µs ± 20%**
- **Voltage Impulse waveform without load : 1,2/50 µsec**
- **Current Impulse waveform in c.c. : 8/20 µs**
- **Output current : 0,1- 1,1 kA**
- **AC Frequency : 16, 40, 50, 60 (Hz) or DC**

3.3 Coupling decoupling Network (CDN) DNBCDN01

- **Imax = 5 A.**
- **Vin = 230 Vac 50/60 Hz monophase**
- **Coupling in common mode for BURST: L, N, PE**
- **Coupling in common mode for Surge: L-PE, N-PE**
- **Coupling in differential mode for Surge: L-N**

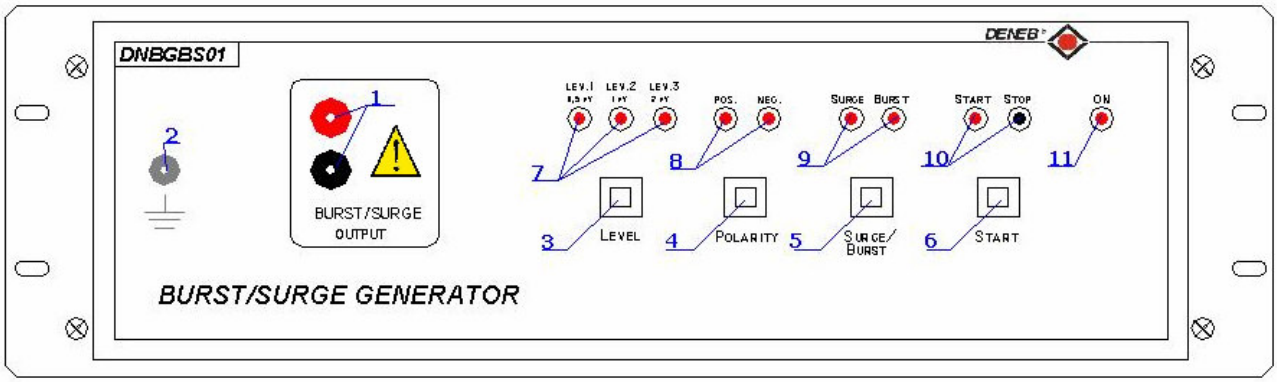
4. OPERATIONS DESCRIPTION

4.1 Generator DNBGBS01

The DNBGBS01 is contained in a metallic "RACK" and powered through a separate adapter, included with the tool.

On the frontal panel of the DNBGBS01 are present:

- **4 keys function: Level, Polarity, Mode, Start**
- **10 indication leds**
- **2 signal out connectors**
- **1 ground reference connector**



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1. **High voltage out connectors**
2. **Ground reference connector**
3. **Key function test Voltage Level**
4. **Key function select polarity**
5. **Key function select mode Surge/Burst**
6. **Key function Start/Stop**
7. **Voltage Level led**
8. **Polarity led**
9. **Mode (Surge/Burst) led**
10. **State of device (start/stop) led**
11. **Power on led**

On the back side are present the male connector of the adapter power supply , the switch on/off and the serial connector RS232.

Pressing the keys function 3, 4 and 5, it is possible to program the type and the Voltage level of the signal sent to the output connectors.

Every time one of these keys is pressed , the device's state is commuted in "Stop", independently from the previous state.
Led lighting indicates the relative level or the function selected.

- **The key 3 (Voltage Level) selects the desired level 1 (0,5 kV) - lev 2 (1 kV) - lev 3 (2 kV).**
- **The key 4 (Polarity) selects the polarity of the output voltage: positive or negative**
- **The key 5 (Burst/Surge) selects the type of out: "Burst" or "Surge."**

After setting the desired functions presses the key 6 (Start/Stop) to begin the test. The same key is used to finish the test.

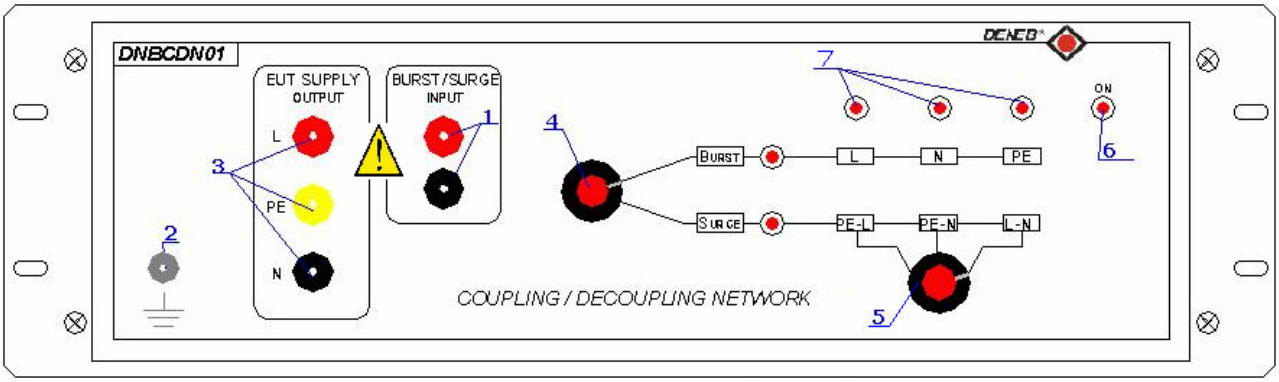
Note: through the serial port placed on the back of the tool, it is possible to select throught the software a voltage value variable at step of 10V between 500 and 2000V, independently from the level selected with the key function "level".

4.2 Coupling/Decoupling Network (CDN) DNBCDN01

The CDN monophase DNBCDN01 is contained in a metallic "RACK" and powered directly through the cable accluded.
The DNBCDN01 has two CDNs in one, respectively for the "Burst" and of the "Surge."

On the frontal panel of the DNBCDN01 are present:

- **Two positions selector to choice Burst or Surge mode**
- **Three positions selector to choice the coupling voltage to the EUT (F, N, PE when is selected "Burst", L-PE, N-PE, L-N when is selected "Surge")**
- **Leds indicating the selected mode**
- **Input connectors of signal from the Burst/Surge generator**
- **Output connectors to the EUT**
- **Ground reference connector**



1. **High voltage Burst/Surge input**
2. **Ground reference connector**
3. **EUT output**
4. **Two positions selector for Burst or Surge**
5. **Three positions selector (in case of Burst selected: L, N, PE; in case of Surge selected: PE- L, PE-N, L-N)**
6. **Led indication of presence of power supply**
7. **Led indication of select coupling (for Burst: L, N, PE - for Surge: PE-L, PE-N, L-N)**

On the back side is present the male connector of power supply.

5. PREPARATION FOR USE

5.1. Initial check

The tool, has been checked electrically and mechanically from Deneb, and all possible precautions for his delivery without damages has been taken.
Nevertheless it is recommend to the user to check the tool for verify possible damages suffered during the transport and contact the courier when anomalies are fount.
Check that the packing contains all the suitable parts to the paragraph 1. and in case of discrepancies contact DENEB Elettronica.
If it was necessary to return the tool, follow the instructions as in paragraph 7.

5.2. Powering the tool

The tool must be powered through 230 VAC 50/60 Hz. The electric plant must have ground cable and must be protected from the indirect contacts, accordingly to the norms CEI 64-8 or to the equivalent national norms in use in the country of installation.

5.2.1 Powering generator DNBGBS01

The generator is powered with 230 Vac 50/60 Hz, through a separate adapter. The output of the adapter must be connected to the connector on the back side of the generator.
The earth contact of the adapter output is directly connected to the earth contact of the main power, so to protect from indirect contacts it is necessary that the so power supply socket must have earth connection.
The tool's power supply has to be derived from the source that power the CDN and the EUT in examination.

5.2.2 Powering CDN DNBCDN01

The CDN is powered through mains voltage 230V 50/60Hz.
The power supply has to be derived from the source that powers the DNBGBS01 always using the same phase.
The CDN power the apparatus in examination (EUT) (5.2.3).
To power the CDN, it is opportune to use an isolation transformer adequate to the power of the EUT, because the presence of capacity connected to earth of reference, can provoke the involvement of the differential protections of the electric plant.

Important:
It is necessary to assure the earth connection of the tool's power supply cable, independently from the use of the isolation transformer.

5.2.3 Powering the EUT

When executing immunity tests on power supply input, the device under test must be powered through the output connectors of the CDN. The maximum current absorbed by the EUT must be 5A max. The CDN is monophase, but it is possible to perform the immunity tests on the power supply input of instruments threephase, connecting the EUT to the CDN one phase at a time and the remaining two phases directly to the power supply source.

5.3. Settings

The device is compliant with the technical characteristics written in this manual. The performances of the device are guaranteed for one year if the conditions of use written in the manual are respected.

5.4 Instrument's clean

To clean the tool use a soft and dry cloth. Never use damp cloths, solvents, water, etc.

5.5 Store

To guarantee precise test, after a long period of store under extreme environment conditions, attend that the tool returns to the normal conditions (see the environmental specifications listed to the paragraph 5.6).

5.6 Environment conditions for normal use

Temperature of reference: 18°C
Temperature of use: 0 ÷ 40 °C
Admitted relative humidity: < 80%
Storage Temperature : -5 ÷ 50 °C
Storage humidity : < 70%

6. TESTS EXECUTION

6.1 Theory and norms

6.1.1 Fast transient (Burst)

The Burst or fast transitory, represent a type of disturbance, defined by the norm EN 61000-4-4, that is applied to electronic and electromechanical apparatus to verify their immunity.
The Burst simulates the disturbances produced on the power supply lines by the commutation of inductive loads.
The single Burst previewed by the norm is constituted by a repeated series of impulses, of amplitude and frequency of repetition dependent from the test level.
The norm previews that the single Burst have a least duration of 15 ms, and to be repeated to a frequency of 3,3 Hz (period of repetition 300 ms).
In the following figure, extracted by the norm EN 61000-4-4, the impulses and the normalized fast trains are represented.

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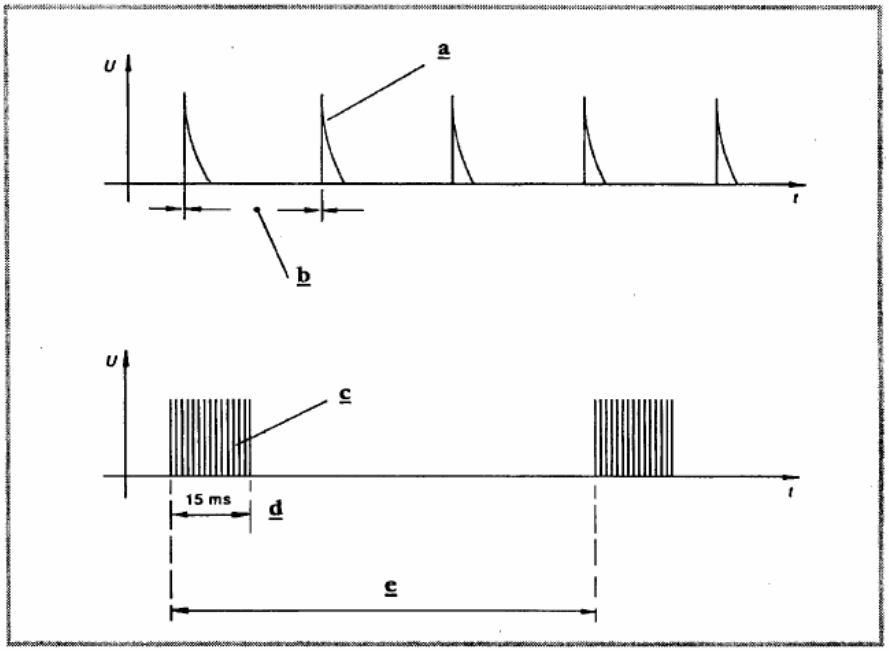
a Impulso
b Periodo di ripetizione (dipende dal livello di tensione di prova)
c Treno
d Durata del treno
e Periodo del treno 300 ms



The norm prescribes to apply the test signal to the power supply input of the EUT, and to any Input/Output and communication port of the EUT with other apparatuses and/or other separate components of the same EUT.

The desidered level of test voltage must be applied (coupled), through the CDN, between every conductor of the power supply input, included the conductor of protection, and the earth of reference.
For input/output and communication cables, the test voltage must be coupled, through a capacitive coupler type "CLAMP" specified by the norm between every conductor or every bundle of cables and the earth of reference.
In alternative to the use of the capacitive clamp, for tests of pre-conformity, the capacitive coupling can be realized through a metallic sheet wound around the conductor to test, or through a discreet capacitor, constituted by a ceramic condenser of 100 pF high voltage.

Here the test levels described by the norm:.

Test levels as indicated in the basic norm EN 61000-4-4				
Level	On power supply input, PE		On signal, data and control of I/O port	
	Voltage peak kV	Repetition frequency kHz	Voltage peak kV	Repetition frequency kHz
1	0,5	5	0,25	5
2	1	5	0,5	5
3	2	5	1	5
4	4	2,5	2	5
x	special	special	special	special

The choice of the test level depends on the degree of immunity that has to possess the EUT, determined by the environment in which is destined to operate, or specified from the generic norms of product related to the specific instrument, or determined by particular applications.

The test level 4 on the power supply input, applicable only to rare particular cases, is not executable with the generator DNBGBS01.

Established the test level to apply, the criterions of evaluation (degrees of immunity) described by the norm EN 61000-4-4 are summaries in the following table:

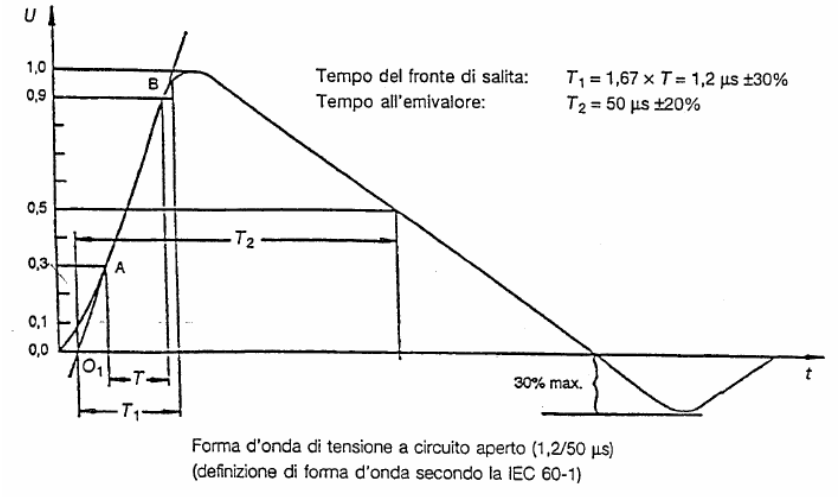
Evaluation criteria of immunity as described by norm EN 61000-4-4	
Immunity degree	**Performances**
1	Normal performances within the specified limits
2	Temporary degradation or loss of operation with autorestore
3	Temporary degradation or loss of operation with necessary intervention of the operator or reset of the system
4	Degradation or loss of function not recoverable because of damage to the equipment (components) or to the software, or of loss of data

Admissible immunity degree is established from the generic norms of product which the EUT is subject in examination.
As general rule, the test result positive if the equipment shows its immunity during the whole tests period, and at the end of the tests the EUT satisfies the established functional prescriptions of technical specifications.

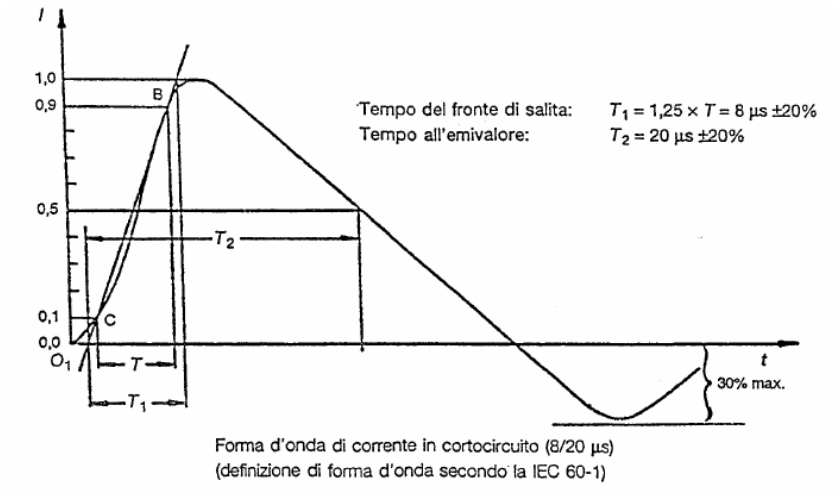
6.1.2 Overvoltage impulses (Surge)

The "Surge" represent a type of disturbance, defined by the norm EN 61000-4-5, that is applied to electronic and electromechanical apparatus to verify their immunity.
The “Surge” simulate the overvoltage transitory on the AC power net due to indirect and/or direct lightning on the net or to commutations of big loads.
The generator, must have characteristics to simulate these transitory. These disturbances are simulated with a “combined wave generator”, such to have a voltage waveform of 1,2/50 µsec in open-circuit conditions and a current waveform of 8/20 µsec in short-circuit condition.
The "surge" are transitory very slower then the "burst", but with a greater energetic content. The norm doesn't specify a fixed value of repetition, but it prescribes that minimum repetition frequency is at least 1 impulse per minute.

In the following figures, extracted by the norm EN 61000-4-5, the single impulse previewed by the norm is represented:



Forma d'onda di tensione a circuito aperto (1,2/50 µs)
(definizione di forma d'onda secondo la IEC 60-1)



Forma d'onda di corrente in cortocircuito (8/20 µs)
(definizione di forma d'onda secondo la IEC 60-1)

For the power supply inputm, the impulse must be applied (coupled), through the CDN, between conductors of the two lines (differential mode coupling), and between every conductor of line and the reference earth (common mode coupling).
The pulses number to apply to EUT has to be at least 5 for every polarity, with frequency of repetition less than 1 min.

The choice of test level depends on the immunity degree that has to possess the EUT, determined by the environment where is destined to operate, or specified from the generic norms of product related to the specific instrument, or determined by particular applications.

The test levels described by the norm are summaries in the following table:

Test levels as indicated by basic norm EN 61000-4-4	
Level	**Test at open circuit (kV)**
1	0,5
2	1
3	2
4	4
x	special

Test level 4 is not executable with the generator DNBGBS01.

Established the test level to apply, the evaluation criterions (immunity degrees) described by the norm EN 61000-4-5 are the followings:

Evaluation criterions of immunity indicated by norm EN 61000-4-5	
Immunity degree	**Performances**
a	Normal performances within the specified limits
b	Temporary degradation or loss of operation with autorestore
c	Temporary degradation or loss of operation with necessary intervention of the operator or reset of the system
d	Degradation or loss of function not recoverable because of damage of the equipment (components) or to the software, or of loss of data

The degree of admissible immunity is established from the generic norms of product where the EUT is subject in examination.
As general rule, the test result is positive if the equipment shows its immunity during the whole period of test application, and at the end of tests the EUT satisfies the established functional prescriptions of the specific technique.

6.2 Test preparation

6.2.1 Preparation for the burst immunity test on the EUT's power supply input, for laboratory tests (norm EN 61000-4-4)

For the execution of the immunity test to the "burst" on the power supply input, in laboratory, is necessary to prepare:

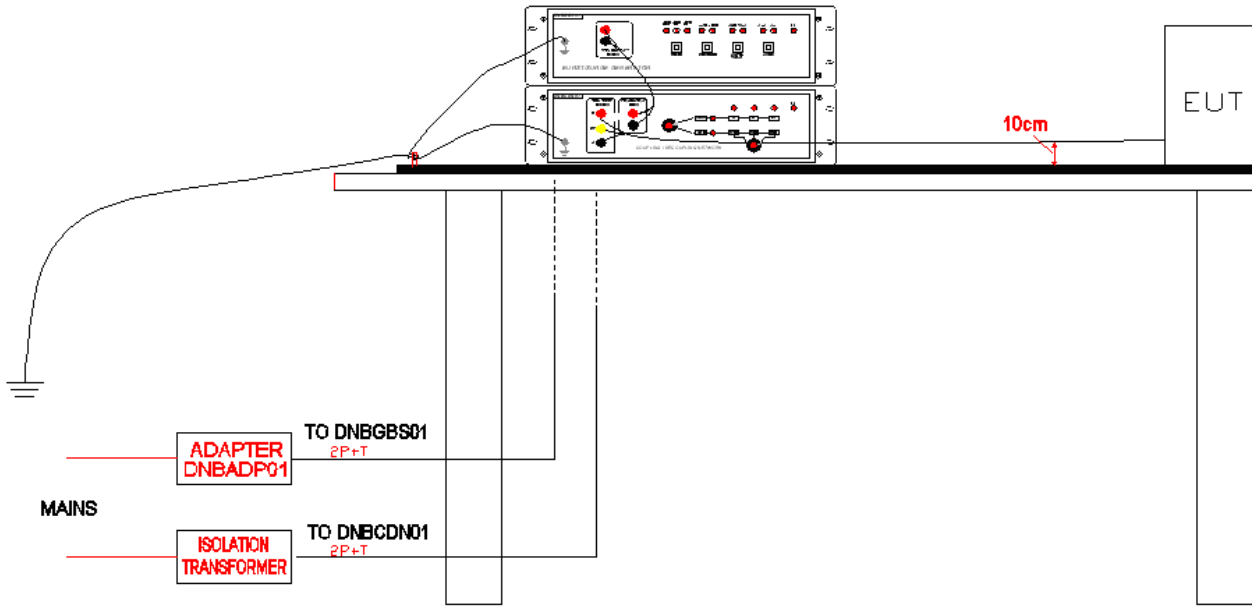
- **Plan of reference earth**
- **Device of Coupling/Decoupling (CDN)**
- **Burst Generator**

The earth plan of reference is a metallic sheet (copper or aluminum) with a minimum thickness of 0,25 mm. Other metallic materials can be used, but they must have a thickness of almost 0,65 mm.
Adequately with EUT's dimensions and the weight, a table in wood or other insulating material can be used for supporting earth's plan, the tool and the EUT.
The minimum dimensions of earth plan are 1 m x 1 m, and it have to stick out from the EUT at least 0,1 m on all sides; the real dimensions depend therefore from the EUT dimensions.
The earth plan of reference must be connected to the protection earth, the same one used for the power supply of the test tool and the EUT.
It's recommended to place the CDN directly on the plan of earth.
The generator can be placed above the CDN (see next figure).
The EUT must be placed on the earth plan, and has to be isolated from it through an insulating support of 10 cm, at distance not superior to 1 m from the tool.

The generator, the CDN and the EUT must be powered as descripted to the points 5.2.1, 5.2.2 and 5.2.3 of the present manual.
The output of the generator (connectors "1" of the DNBGBS01) must be connected to the input of the CDN (connectors "1" of the DNBCDN01), through the special wire included in the kit, by respecting the colours of the connectors (red with red and black with black).
The earth connections of DNBGBS01 and DNBCDN01 have to be connected to the reference earth plan, and this last has to be connected to the earth plant, the same earth used as protection of the tool and of the EUT.

If the EUT's power supply cable is type "fixed" and of length more then 1 m, the surplus length must be wrapped as "a coil" and placed 10 cm above the reference plan.

An example of test set-up, for tests on EUT's power supply input monophase, is explained in the following figure.



6.2.2 Preparation for SURGE immunity test on the EUT's power supply input, for laboratory tests (norm EN 61000-4-5)

For the immunity test to the "SURGE", the norm EN 61000-4-5 don't preview expressly the use of the earth plan of reference, as described in the previous paragraph.
Nevertheless, the same test preparation can also be used for this immunity test.

6.3 Operative Tests Execution

6.3.1 Test execution for BURST immunity on the EUT's power supply input

After predisposing test preparation, and connected the generator, the CDN and the EUT as described in the preceding paragraph, is it possible to begin the test.
Execute the following operations:

1. **Turn on the generator, the CDN and the EUT, and to set the EUT under normal operation conditions.**

2. **Select on the generator DNBGBS01 the mode "BURST" through the relative function key.**

3. **Select on the CDN in mode "BURST" through the relative switch. If it is selected on the CDN the mode "SURGE", nothing doesn't happen because the CDN is protected, however the test is not valid.**

4. **Select on the generator DNBGBS01 the level of severity required for the EUT (lev 1, lev 2 or lev 3), with the relative function key.**

5. **Select on the CDN the coupling "L" through the relative switch.**

6. **Select on the generator DNBGBS01 the polarity positive, using the relative function key.**

7. **At this point, press the key "Start" to begin the test; the tool will begin to send on the conductor "L" the programmed disturbance, coupled through the CDN to the earth of reference.**

8. **Use the EUT as in normal conditions for the period needed to check all functions, however for at least 1 minute, and note all eventually anomalies or problems found.**

9. **Press the key "Stop" of the DNBGBS01**

10 Change, on the generator DNBGBS01, the polarity from “positive” to “negative”, with the assigned key.

11 Press key “START” to repeat the test as described to the points 7, 8 and 9.

12 Repeat the points from 5 to 11, by selecting on the CDN the coupling “N” and subsequently “PE.”

6.3.2 Test execution for SURGE immunity on the EUT’s power supply input

Predisposed the test preparation, by connecting the generator, the CDN and the EUT as described in the preceding paragraph, it’s possible to begin the test.
Execute the following operations:

1 Turn on the generator, the CDN and the EUT, and set the EUT under normal operations.

2 Select on the generator DNBGBS01 the mode “SURGE” with the relative function key.

3 Select the CDN in mode “SURGE” using the switch. If it is selected on the CDN the mode “BURST”, nothing doesn't happen because the CDN is protected, however the test is not valid.

4 Select on the generator DNBGBS01 the level of severity required for the EUT (lev 1, lev 2 or lev 3), with the special function key.

5 Select on the CDN the coupling “PE-L” through the rotary switch (coupling in common mode phase-earth).

6 Select on the generator DNBGBS01 the polarity positive, with the special function key.

7 At this point, press key “Start” to begin the test; the tool will

begin to send between the conductor “L” and the conductor PE, the disturbance, coupled through the CDN.

8 **The EUT under normal conditions of use must work for a time necessary for a number of impulses equal to 5 for every polarity with a repetition frequency less than 1 minute, and note all eventually anomalies or problems found. Immunity levels are written in the paragraph 6.1.2. Note the immunity level showed by EUT.**

9 **Press key “Stop” of the DNBGBS01**

10 **Change, on the generator DNBGBS01, the polarity from “positive” to “negative”, with the relative key.**

11 **Press the key “START” to repeat the test as described in points 7, 8 and 9.**

12 **Repeat the points from 5 to 11, selecting on the CDN the coupling “PE-N” (common mode Neutral-earth) and subsequently “L-N” (coupling of differential mode).**

7. SERVICE AND GUARANTEE CONDITIONS

This tool is guaranteed against every defect of manufacture and used parts, in agreement with the sale general conditions. During the guarantee period, the defective parts can be replaced, but the builder reserves him the right to mend or to replace the product.
If the tool doesn't correctly work, before contacting the Service of Assistance, check the state of cables and connections, so replace them if necessary.
If the tool keeps on manifesting malfunctions check if the procedure of use is conforming to how described in the present manual.

If the tool must be returned, for whatever motive, to the DENEB Elettronica, the shipment is at charge of the owner and the delivery will be, in every case, discussed preventively with Deneb.
Attached to the tool must be always inserted an explanatory note about the motivations of the dispatch of the tool.
For the shipment use only the original packing; every damage caused by the use of non original packings will be charged to the Client.
The builder declines every responsibility for damages caused to people or objects.
The guarantee is not applied in the following cases:

- **Reparation e/o substitution accessories (not covered by guarantee).**
- **Reparations that are made because of a wrong use of the tool with non compatible equipments.**
- **Reparations that are made because of a non suitable packing .**
- **Reparations that are made because of interventions performed from personal not authorized.**
- **Changes to the tool without explicit authorization of the builder.**
- **Use not contemplated in the specifications of the tool or in the user manual.**

In case of not observance of previous written, or, interventions inside the tool performed without written authorization of DENEB Elettronica, will be extinct automatically every form of guarantee on the instrument.

The “DENEB Elettronica s.n.c.” reserve him the right to make changes to the specifications and the characteristics of the tool described in the present manual, if this is due to technological improvements.