Manual

For Operation

NSG 3000A series

The ultra-compact simulator
and its system modules

NSG 3040A series
NSG 3060A series
Sys App 6.0.0 or higher

The NSG 3000A series, is a versatile tester series to cover transient and power fail requirements, according to international standards (basic and generic standards) and product family standards. With the intuitive touch panel, the NSG 3000A series is the most economical solution for tests during development as well as for full-compliant immunity tests and CE Marking for single phase DUT with the ability to be extended for testing three-phase DUTs by means of an automatically controlled external coupling network up to 100 A.
AMETEK CTS supplies a large range of accessories for the various applications such as magnetic field tests and more.

EN/IEC 61000-4-4
EN/IEC 61000-4-5
EN/IEC 61000-4-8
EN/IEC 61000-4-9
EN/IEC 61000-4-11
EN/IEC 61000-4-12
EN/IEC 61000-4-29
EN 61000-6-1
EN 61000-6-2

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TESEQ

Exclusion for Documentation

Unless specifically agreed to in writing, AMETEK Compliance Test Solutions (AMETEK CTS):

(a) Makes no warranty as to the accuracy, sufficiency or suitability of any technical or other information provided in its manuals or other documentation.

(b) Assumes no responsibility or liability for losses, damages, cost or expenses, whether special, direct, indirect, consequential or incidental, which might arise out of the use of such information. The use of any such information will be entirely at the user's risk, and

(c) Reminds you that if this manual is in any language other than English, although steps have been taken to maintain the accuracy of the translation, the accuracy cannot be guaranteed. Approved AMETEK content is contained with English language version.

The present manual shows suggestions of test setups according the standards IEC 61000-4-x using equipment manufactured by AMETEK CTS.
The suggestions do certainly not replace the standards! Variations due to different interpretations of the standard are possible. The circuits shown in the figures supposed to illustrate the functional principles only and do not show every single detail of the components.

Manual information

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Contents

1. General

The following manual is written for the following equipment of Generators NSG 3000A series:

Available Generators NSG 3040A family	Burst	Surge	Power Fail
16 A models 300 V			
NSG 3040A-IEC	X	X	X
NSG 3040A-EFT-CWS	X	X	
NSG 3040A-EFT	X		
NSG 3040A-CWS		X	
NSG 3040A-DDV			X

Available Generators NSG 3060A family	Burst	Surge	Power Fail	Ring wave	Telecom Surge	Height [HU]
16 A models 300 V						
NSG 3060A-IEC	X	X	X			6
NSG 3060A-ANSI	X	X	X	X		6
NSG 3060A-FULL	X	X	X	X	X	9
NSG 3060A-EFT-CWS-RWG	X	X		X		6
NSG 3060A-EFT-CWS-TS	X	X			X	9
NSG 3060A-EFT-CWS	X	X				6
NSG 3060A-CWS-DDV		X	X			6
NSG 3060A-CWS-TS		X			X	9
NSG 3060A-CWS		X				6

Other equipment

This document is also the Manual for the following auxiliary equipment, that are necessary to operate together with NSG 3000A series generators:

Device	Description	Picture
TVT 1-250-16	Tapped autotransformer with 40/70/80/100 % output voltage, 16 A, manual control	
TVT 1-250-16.1	Tapped autotransformer with 40/70/80/100 % output voltage, 16 A, automatic control	

1.1. Purpose

The NSG 3040A / 3060A test system is a multifunction compact generator that simulates conducted electromagnetic interference effects for immunity testing according to international, national, and manufacturers' standards.

The system is designed for full compliance conducted electromagnetic compatibility (EMC) test requirements. The application range is for testing of industrial, light industrial, household or commercial equipment, including many product family and product standards as per following basic standards

- IEC 61000-4-4 EFT / Burst
- IEC 61000-4-5 Surge and Telecom Surge
- IEC 61000-4-8 50/60Hz Magnetic Field
- IEC 61000-4-9 Pulse Magnetic Field
- IEC 61000-4-11 Voltage Dips, Voltage Interruptions for ac power mains supply
- IEC 61000-4-12 Ring Wave
- IEC 61000-4-29 Voltage Interruptions
  Voltage Dips for dc power supply systems

PS: Only the NSG 3060A series covers all these phenomena.

1.2. Warranty Terms

AMETEK CTS provides this written warranty covering the product stated above, and if the buyer discovers and notifies AMETEK CTS in writing of any defect in material or workmanship within the applicable warranty period stated above, then AMETEK CTS may, at its option: repair or replace the product; or issue a credit note for the defective product; or provide the buyer with replacement parts for the product.

The buyer will, at its expense, return the defective product or parts thereof to AMETEK CTS in accordance with the return procedure specified below. AMETEK CTS will, at its expense, deliver the repaired or replaced product or parts to the buyer. Any warranty of AMETEK CTS will not apply if the buyer is in default under the purchase order agreement or where the product or any part thereof:

- is damaged by misuse, accident, negligence or failure to maintain the same as specified or required by AMETEK CTS;
- is damaged by modifications, alterations or attachments thereto which are not authorized by AMETEK CTS;
- is installed or operated contrary to the instructions of AMETEK CTS;
- is opened, modified or disassembled in any way without AMETEK CTS's consent; or
- is used in combination with items, articles or materials not authorized by AMETEK CTS.

The Buyer may not assert any claim that the products are not in conformity with any warranty until the buyer has made all payments to AMETEK CTS provided for in the purchase order agreement.

1.3. Product return procedure

1. Request a Return Material Authorization (RMA) number from the local AMETEK CTS representative
2. When requesting an RMA, have the following information ready:
   - Model number
   - Serial number
   - Description of the problem

NOTE: Unauthorized returns will not be accepted and will be returned at the shipper's expense.

NOTE: A returned product found upon inspection by AMETEK CTS, to be in specification is subject to an evaluation fee and applicable freight charges.

1.4. Recycling and Disposal

1.4.1. RoHS directive 2011/65/EU (RoHS 2)

RoHS directive *2011/65/EU* (RoHS 2)
The AMETEK CTS NSG 3000A series generators complies with the directive 2011/65/EU (RoHS - Restriction of certain Hazardous Substances).
From December 2005, all AMETEK CTS products either hand soldered or by machine are produced using lead-free solder.

1.4.2. WEEE directive 2012/19/EU

The AMETEK CTS NSG 3000A series generators, is dedicated under category 9 in the directive 2012/19/EU (WEEE).

The product should be recycled through a professional organization with appropriate experience for the disposal and recycling of electronic products. AMETEK CTS is also available to help with questions relating to the recycling of this equipment.

1.4.3. Dismantling information

Always remove power cord first. There is no special danger involved in dismantling the NSG 30x0 generator

1.4.4. Parts which can be recycled

The NSG 3000A series generators contains parts made from steel, aluminum, PVC, two-component sealing compound. The impulse capacitors are filled with non-poisonous mineral oil. The various parts can be separated and recycled.

1.4.5. Parts which cannot be recycled

All parts in the NSG 3000A series can be recycled.

2. Safety information

Attention

Before using this equipment, read the operating manual and the separate delivered **safety manual** carefully

2.1. General

- Use of the equipment of the NSG 3040A and NSG 3060A series is restricted to authorized and trained personnel only.
- The equipment of the NSG 3040A and NSG 3060A series can only be used for the applications described in the operating manual. When used for any other application, then stated in this manual, the protection of the device can no longer be guaranteed.
- Persons fitted with a heart pacemaker must not operate the instrument nor approach the test setup while it is in operation.

2.2. Connection to the mains and PE

- The instrument conforms to protection class 1.
- Operation without a protective earth connection is forbidden!
- Unplug the power cord when not using the unit for a long period of time
- Handle the power cord carefully. Hold the plug when unplugging the cord.
- Never use the product if the power cable is damaged.
- Ensure that a reliable return path for the interference current is provided between the equipment under test (EUT) and the generator. The reference ground plane and the earth connections to the instrument as described in the relevant test standard serve this purpose well.

2.3. Disconnection from the mains

- Always set the power switch to the “Off” position and wait few seconds before disconnecting the power cord.
- Disconnect the power cord and all connection cords when moving the unit.

2.4. Intended use of the equipment

The “NSG 3000A” test system is designed primarily for conducted transient interference tests as specified in the European generic standards IEC/EN 61000-6-1 to cover equipment for household, office and light industrial use, and IEC/EN 61000-6-2 for applications in industrial environments. The “NSG 3000A series” generates these tests in accordance with IEC/EN 61000-4-4, -4-5, -4-11, -4-12, and -4-29, depending of the model configuration. Accessories are available for generating optional tests to IEC/EN 61000-4-8 and -9.

The EMC Directive 2014/30/EU (for the assignment of the CE mark) refers to these standards and to this type of equipment.

2.5. Responsibility of the operator

These operating instructions form an essential part of the equipment and must always be available to the operator. The user must obey all safety instructions and warnings.

WARNING

The purpose of this instrument is the generation of defined interferences signals for EMI immunity testing. Depending on the arrangement of the test rig, the configuration, the cabling and the properties of the EUT itself, a significant amount of electromagnetic radiation may result that could also affect other equipment and systems.

The equipment is designed to operate in industrial environment. For operating in other or sensitive environment, such as light industry, airport area…, the user may use a shielded room for operate.

The user himself or herself is ultimately responsible for the correct and controlled operation of the rig. In case of doubt, the tests should be carried out in a Faraday cage.

2.6. General hazard

Before applying power to the system, verify that your product is configured properly for your application.

WARNING

The NSG 3000A-series, system and its accessories operate at high voltages.

Hazardous voltages may be present when covers are removed. Qualified personnel must use extreme caution when servicing this equipment.

Circuit boards, test points, and output voltages also may be floating above (below) chassis ground.

The design of external insulation must be such that it exceeds the maximum impulse voltages of the generator (4.8 kV or 6.6 kV).

Only *qualified personnel* who deal with attendant hazards in impulse generators, can perform installation and servicing.

Ensure that the AC power line ground is connected properly to the Power Rack input connector or chassis. Similarly, other power ground lines including those to application and maintenance equipment *must* be grounded properly for both personnel and equipment safety.

Always ensure that facility AC input power is de-energized prior to connecting or disconnecting any cable.

The user must ensure that the output power lines are labeled properly as to the safety hazards and that any inadvertent contact with hazardous voltages is eliminated.
Guard against risks of electrical shock during open cover checks by not touching any portion of the electrical circuits. Even when power is off, capacitors may retain an electrical charge. Use safety glasses during open cover checks to avoid personal injury by any sudden component failure.

Neither AMETEK CTS GmbH, nor any of the subsidiary sales organizations can accept any responsibility for personnel, material or inconsequential injury, loss or damage that results from improper use of the equipment and accessories.

WARNING **Personnel fitted with a heart pacemaker must neither operate the instrument nor approach the test setup while a test is being executed.**

Only approved accessories, connectors, adapters, etc. are to be used to ensure safe operation.

2.7. Safety label on the device

Please take note of the following explanations of the symbols used to achieve the optimum benefit from this manual and to ensure safety during operation of the equipment.

This symbol warns of a potential risk of shock hazard. The symbol on an instrument shows that that it can generate 1000 volt or more, including the combined effect of normal and common mode voltages. Use standard safety precautions to avoid personal contact with these voltages.

This symbol indicates where a caution is required. Refer to the operating instructions located in the manual to protect against personal injury or damage the equipment.

CAUTION CAUTION indicates the presence of a hazard that will or could cause minor personal injury or property damage if ignored.

WARNING WARNING Indicates the presence of a hazard that could cause severe personal injury, death, or substantial property damage if ignored.

2.8. Prohibition of unauthorized conversions and modifications

The user is not entitled to the device to perform its own modifications and adaptations. Modifying parts on the generator by unauthorized persons will void the warranty of the device and the correct functioning cannot be guaranteed.

2.9. Specific accessories required for safety reason

Only use accessories approved by AMETEK CTS for these generators and intended as accessories for these devices. Measuring instruments for the measurement of instrument parameters shall be designed for the maximum voltage and current from the generator. Otherwise safety cannot be guaranteed.

2.10. Procedure in case of hazard

If a hazard could exist due to an unintended condition of the generator, the following procedure is recommended: Disconnect the device- and EUT power supplies from the power supply and ensure that the generator is always earthed via the supply lines or a different ground connection. Wait at least 15 minutes and ground all outputs via a 10 kΩ, 15 W resistor. Call an AMETEK service center.

2.11. Temperatures at the surface

The components that generate heat in the device (resistors, etc.) are arranged inside the device in such a way that no temperatures higher than 50 °C occur on the surface.

3. Storage, transport, unpacking and delivery information

3.1. General

Save all packing materials! They will be needed to safely package the equipment for calibration service or repair.

Packaging materials

- Carton: Cardboard
- Padding: CFC-free polystyrene foam
- Plastic bags: Polyethylene
- Avoid risk of condensation!
  If a large temperature differential has occurred, allow time for the temperature to stabilize. This may take several hours.

3.2. Storage and transport

- Do not stack, either packed or unpacked.
- Do not stand on end; arrows on the packaging must always point upwards.
- Protect from dampness, heat, cold and rain.
- Do not throw.
- Do not sit or stand on the instrument and packaging.

3.3. Unpacking

Is the packaging damaged?	If YES	☎ transportation company
Are all the packages present and correct?	If NO	☎ transportation company
Open the packaging, remove the accessories.		
Lift the NSG 3000A test system out of its packaging.		
Are the instrument or accessories damaged?	If YES	☎ transportation company
Are the contents of the package complete?	If NO	☎ Representative sales office
Keep the instruction manual with the instrument.		

NOTE Do not dispose of packaging materials. All packaging should be retained in the event, that the instrument or any of its accessories should need to be returned to an AMETEK CTS service center for repair or calibration.

3.2.1. Lifting and carrying instructions

The generators usually weigh more than 20 kg. For lifting and carrying, two persons must always lift the equipment together or use a suitable lifting device.
The device must be gripped by the carrying handle and on the underside.

3.2.2. Scope of delivery

Using the following list, check that all the items ordered have been delivered:

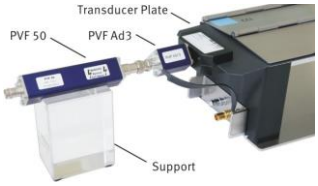
Item	Name	Remark	Picture
1	**NSG 3040A**	NSG 3040A generator including - Single phase coupling network 300 V / 16 A Including ordered Modules *- Burst Module* *- Surge Module* *- Power Fail Module*	
2	**NSG 3060A**	NSG 3060A generator including - Single phase coupling network 300 V / 16 A Including ordered Modules *- Burst Module* *- Surge Module* *- Ring wave Module* *- Power Fail Module* *- Telecom Surge Module*	
2	**Power Mains cable**	Power Mains cable - Connectors country coded	
3	**ESC**	EUT Supply Cable - Connectors country coded	
4	**ESA 1**	EUT Supply Adapter - Connectors country coded	
5	**STC** #112801	Safety Circuit Terminator (Sys. Link) Short circuit for Interlock (no ext. loop), Alternative with ext. loop: **SCC AD** (option)	
6	**SWL AD** #111241	Warning Lamp Adapter	
7	**Ethernet cable** #107460	Ethernet crossover network cable RJ45, Cat 6, SF/UTP, red	
8	**Cleaning tissue**		
9	**Safety Manual**	Safety Manual 200 / 500 / NX Series, NSG Series	
10	**USB Memory card**	Files on USB Memory card	
11	**User Manual**	User manual (pdf on the memory card)	
12	**Iec.control Software**	Software iec. control, (on the memory card)	
13	**Software license**	**If ordered** on a license sheet - UOC Optolink Converter USB to LWL - Optical fiber cable 5m	

3.2.3. Accessories

If additional equipment is ordered refer to the user manual of these devices

Name	Remark	Picture
SLC xxx	Sys Link Cable with various cable length	
UOC #111311	**USB Optolink Converter** (USB to LWL) Optical Fiber cable, 5m Remark: The USB Optolink is included in the software license	
Copper braid	Earth band connection NSG 3000A-generator to 3-ph CDN Dimension: 300 x 23 mm, 25mm², 4 x Screws M4 x 10mm	

3.2.4. Options

Name	Remark	Picture
PVF BKIT 1	**Pulse Verification Fast Burst Kit 1** **PVF 50**, Pulse Verification Fast 50 Ohm **PVF 1000**, Pulse Verification Fast 1000 Ohm **PVF AD 1** Pulse Verification Fast Adapter 1 – Multi Contact (MC) to SHV fix	 PVF AD1 PVF 50 or PVF 1000
CCI PVKIT 1	**Industrial Capacitive Coupling Clamp** **Pulse Verification Kit 1** **Transducer plate** **Support** **PVF AD3** Pulse Verification Fast Adapter 3 – MC to SHF	
ESS 1	**ESS 1 Interlock for NSG 30x0 generator system** Switches OFF High voltage and EUT power supply	
SCC AD #111240	**Safety Circuit Adapter** (Sys. Link) Short circuit for Interlock for external safety loop Alternative to: **SCT** Safety Circuit Terminator	
CDN 30x3…	**External 3-phase coupling network** AC voltage: 3 x 480 V DC voltage: up to 500 VDC Current: 16 A up to 100 A AC and or DC	
CCI	**Capacitive Coupling Clamp Industrial** For coupling of Burst impulses to signal and data-lines. **BCC 1000** Burst connection cable SHV 1000 mm	

4. Installation put in service

This chapter includes a checklist with steps that should be taken before the NSG 3000A generator is switched on and put into operation.

4.1. Safety instructions for installation and initial installation

National regulations in installation and operation of electrical equipment must be respected.

WARNING NSG 3000A test system is not suitable for use in an explosive atmosphere.

WARNING Connect the EUT only after the initial system setup has finished.

4.1.1. Qualifications of the staff

Basic knowledge of electrical engineering and electromagnetic compatibility is required to service the unit. The national regulations for installation of electrical equipment as well as the safety at work of electrical equipment must be known to the user.

4.1.2. Installation

The NSG 3000A system conforms to protection class 1. Local installation regulations must be respected to ensure the safe flow of leakage currents.

WARNING Operation without a ground connection is forbidden!

Two independent ground connections are necessary - one for the test system and one for the EUT. These must be connected back to the local permanent installation or to a fixed, permanent ground conductor.

Operate the equipment only in dry surroundings. Any condensation that occurs must be allowed to evaporate before putting the equipment into operation. Do not exceed the permissible ambient temperature or humidity levels. Use only officially approved connectors and accessory items.

Ensure that a reliable return path for the interference current is provided between the EUT and the generator. The ground reference plane and the ground connections to the instruments, as described in the relevant test standards, serve this purpose well.

The test system may only be opened by a qualified specialist upon specific instruction given by the manufacturer. The equipment works, on principle, with two independent power supplies, one for the generator and one for the EUT. The NSG 3000A generator must be disconnected from both sources before any modifications to the test setup are undertaken. Besides the mains connections themselves, certain components also operate at high voltages, and are not provided with any form of extra protection against accidental contact.

The system complies with the safety requirements of IEC/EN 61010-1 (Safety requirements for electrical equipment for measurement, control and laboratory use).

It is the user's responsibility to ensure that the test rig does not emit excessive electromagnetic interference (EMI) that might affect other equipment. The test system itself does not produce any excessive radiation; however, the injection of interference pulses into the EUT can result in the device and/or its associated cables radiating EMI. To avoid radiating unwanted interference the standards organizations recommend that the test setup be in a Faraday cage.

Since the purpose of the test system is to produce interference signals for interference immunity testing, the requirements in the IEC/EN 61000 series concerning limiting the radiated EMI can only be complied with by operating the test system inside a Faraday cage.

4.2. Installation of the NSG 3000A system

4.2.1. installation site

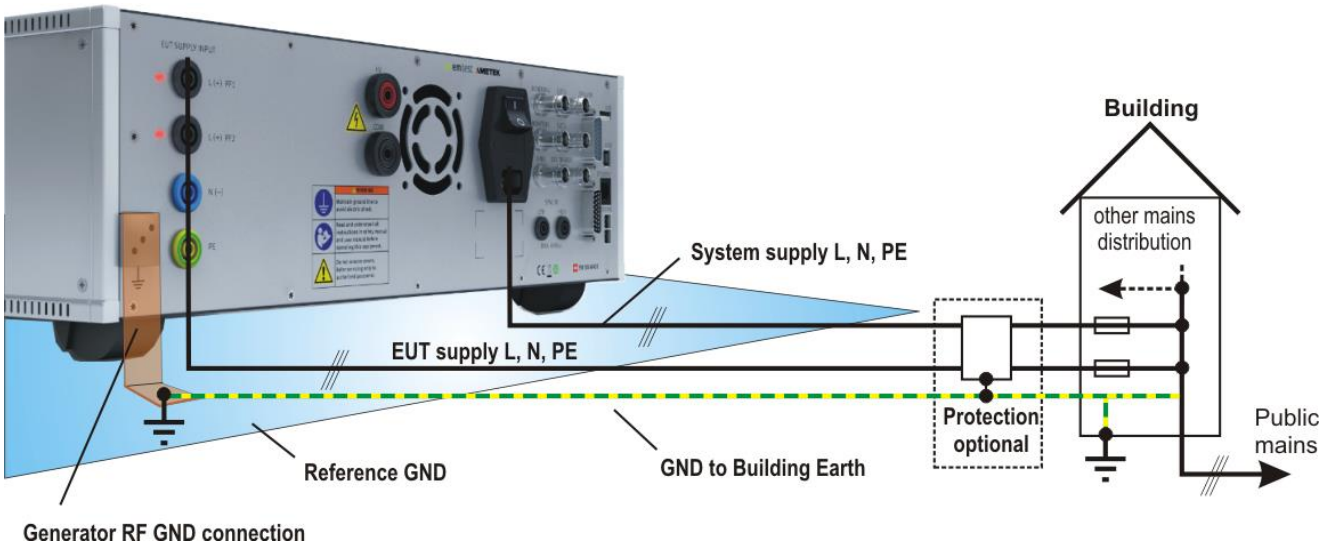
Place the test system so that there is enough free space around the cooling air inlets on both sides and behind the fan outlet on the rear panel.

4.2.2. Voltage free switching

Make sure that the cables can be connected without hindrance and disconnected without problems.
The complete voltage disconnection from the device is carried out by disconnecting the cables. Make sure that capacitors inside the device can still be under voltage, even in an emergency.

4.2.3. Grounding and power connection

Two independent ground connections are necessary- one for the test system and one for the EUT. These must be connected back to the local permanent installation or to a fixed, permanent ground conductor. To avoid electric shock the power cord protective grounding conductor must be connected to ground.



System GND

The system is connected to GND via the earth wire of the connected mains power cable for the generator and the EUT supply. A separate GND wire from the reference GND plane to the building earth point may be useful to avoid interferences to other areas.

EUT GND

Ensure that a reliable return path for the interference current is provided between the EUT and the generator. The GND wire from the generator to the reference GND and must be designed as a low inductance connection suitable for high frequencies. The reference ground plane and the ground connections to the instruments, as described in the relevant test standards, serve this purpose well.

Example of a 25 mm² earth connection Generator – Reference GND

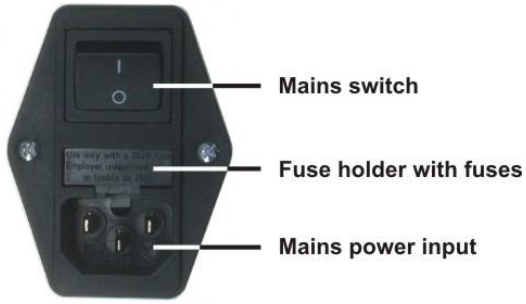
Protection (optional)

A proposal is to separate protection of the EMC system with filters, insulation transformer or fault current protection and other measures may be useful for the EMC installation. The advantage is the separation of the EMC system from all other installation.
A shielded room with adequate filters may be the best solution for avoid unwanted conducted and radiated interference to other areas.

4.2.4. Mains Switch and fuse

The mains power voltage indicated on the instrument must correspond with the local supply voltage (mains voltage: 85–265 VAC, universal power unit, mains frequency: 50–60 Hz).

WARNING **Do not replace the supplied power cord, rated for 10 A with another power cord of insufficient size.**



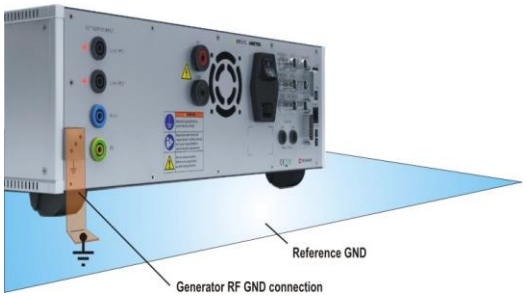
Mains Switch, fuse holder and power input

To replace a fuse:

1) Disconnect the mains cable
2) Pull the fuse holder out of the connector
3) Remove the damaged fuse(s)
4) Insert 1 or 2 fuses (4 A / 115V and 2 A / 230 V slow blow)
5) Replace the fuse holder
6) Plug the mains cable into a power outlet with a solid ground connection
7) Switch the system on and operate as instructed in this manual

4.2.5. Connecting the NSG 3040A / NSG 3060A system to the ground reference

The earth connection to the GRP should be low inductive and low ohmic. The cross-section of the earth connection should be at least 6 mm2. A braid of stranded wire or a flat copper or brass strip is better.

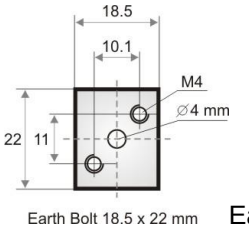


Connection to reference ground

Connection to reference ground

For burst tests, the generator must be placed on a ground reference plane which is connected to ground.

A low inductive high frequency ground connection between the test system and the ground reference plane (GRP) is essential for performing burst tests correctly.



Earth bolt dimension

Earth bolt dimensions:

Screws: Metric M4
Distance: 10.1 mm x 11 mm
Plug: Banana plug, ∅ 4 mm

4.3. Safety circuit, Warning lamps

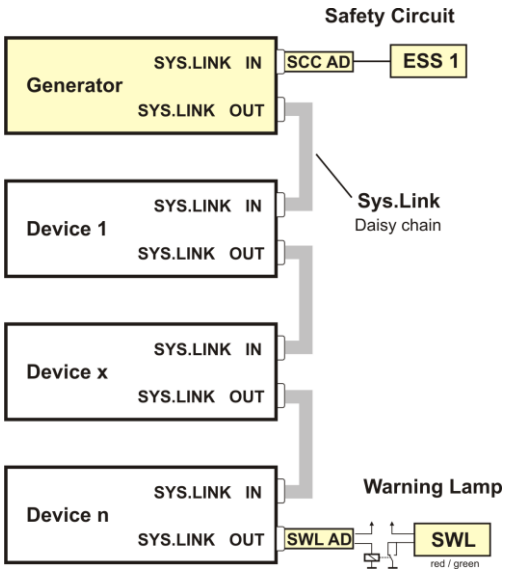
Safety circuit and warning lamps are located at each end of the Sys Link. Each End of the Sys.Link is terminated with an adapter.

Safety circuit

Plug position: **SYS.LINK IN** NSG 3000A generator
Connector: 2 screw contacts IN, OUT
Pin Sys Link: 7, 16
Operating: short circuit closed = operation
short circuit open = no operation
Voltage level: 24 Vdc (internal powered)

Warning Lamp

Plug position: **SYS.LINK OUT** Last device from daisy chain
Connector: 2 screw contacts IN, OUT
Pin Sys Link: 8, 17
Operating: Potential free contact
open = System is out of operation (green)
closed = System is operating (red)
Voltage level: 60 V, max. 2 A (external powered)



IMPORTANT

Important for operation

Connect the delivered Safety Circuit Terminal STC  or the optional **Safety Circuit Adapter SCC AD**  **to the SYSLINK plug.**

The NSG 30x0A generator does not start any test if the safety circuit is not connected and closed.

NOTE: *The short circuit is already short-circuited at the delivered Safety circuit terminal STC and Safety Circuit Adapter SCC AD*

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STC Safety Circuit terminal

The safety circuit terminal **STC** is part of the delivery and includes the short circuit for the Safety circuit. If an external safety circuit is required, please order the optional Safety Circuit Adapter **SCC AD**.

SCC AD option for external safety circuit loop.

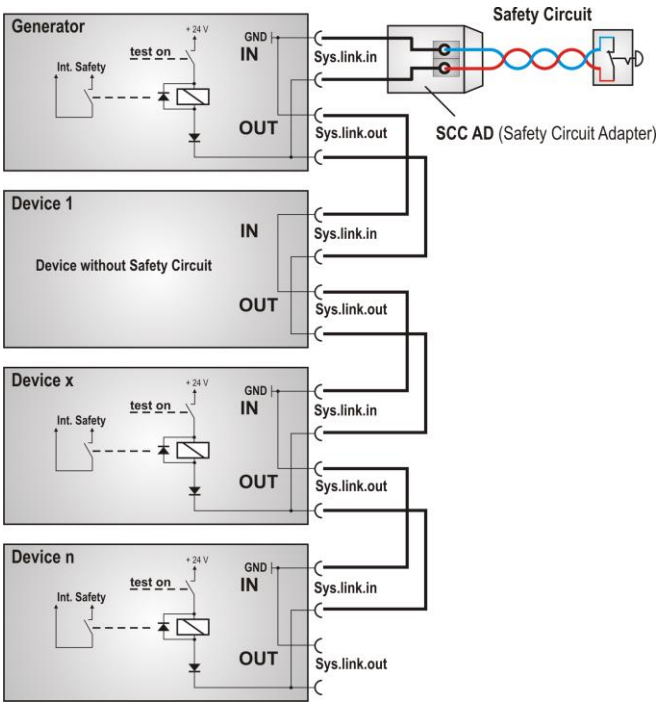
4.3.1. Safety circuit

The safety circuit locks the system and enables the generation of the high voltage impulses in the generators.

Design
Each device that has internal relevant high voltage unit, includes a safety circuit. The safety circuit works like an “open collector circuit”, where the external safety loop must be closed for switch on the high voltage.

Safety circuit closed
The device will generate high voltage pulses after start

Safety circuit open
The device will switch off the high voltage and discharges the high voltage circuit.



4.3.2. Warning Lamp

The warning lamp offers a voltage free contact that indicates the status of the generator system.

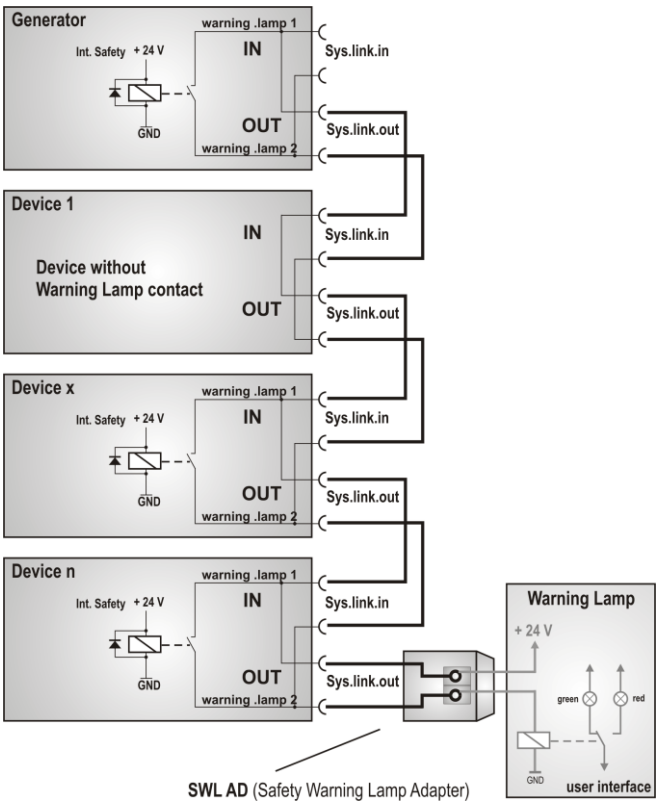
Design
Each device with warning lamp function can short the warning lamp contact. An external powered relays max. 60 V / 2 A controlling the lamp. The user is responsible for the warning lamp power supply

Warning Lamp switch closed (red):
- Safety circuit is closed and
- TEST ON is on

Status**:** RED Lamp, Power on EUT output,
High voltage can be “switched ON”

Warning Lamp switch opened (green):
- Safety circuit is open and / or
- TEST ON is off
- Generator is switched off

Status**:** GREEN Lamp, no danger, High voltage is off



4.4. EUT Power supply and power switch

The EUT input should be connected through a properly rated power switch device, which should be located close to the test setup. To ensure easy and quick access to the EUT power, the switch should be clearly and visibly labeled as “EUT power ON/OFF”.

The in-house power distribution must be equipped with a proper circuit breaker and an emergency off button as required for electrical installation standard.

Dimensioning of the mains supply, and rating of fuse protection of the AC or DC power supply must conform with local electrical codes and EUT requirements. Inappropriate arrangement, mounting, cabling or handling of the EUT or ground can reduce or negate the effectiveness of the NSG 300x0A’s safety features.

4.4.1. Notes on protective devices which need to install the operator

There are two different protective devices in a mains distribution system for safe operation.

A **Fault current protection**: A **residual-current device** (RCD), or residual-current circuit breaker (RCCB) is an electrical wiring device that disconnects a circuit whenever it detects that the electric current is not balanced between line and the return neutral. In normal circumstances, these two wires are balanced, and any difference current usually indicates a short circuit or other electrical anomaly like a surge impulse is present.

B **Circuit breaker protection:** A **circuit breaker** is an electrical switch designed to protect an electrical circuit by overload or short circuit. Its basic function is to detect a fault condition and interrupt current flow.

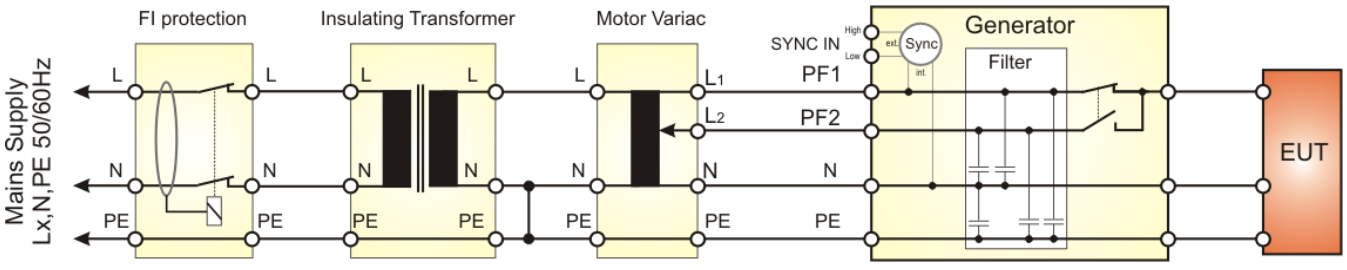
4.4.1.1. Fault current protection

The standards recommend decoupling and filter capacitors to PE for decoupling surge pulses. This is the reason for tripping fault current protection relays that interrupt the mains to the EUT supply. For eliminate the circumstance use one of the following options:

Remove the fault current protection
This solution does not limit the current to PE. The surge test as other EMC tests with higher currents to PE are possible. The user must take care to the circuit with no fault current protection. Only trained professional people can perform such tests. Some countries do not allow to operate without fault current protection.

Using of insulating transformers
An insulating transformer separates the circuit from the test circuit. The Fault current detector (FI protection) cannot detect the earth current in the EUT circuit.

The fault current safety detection function in the generator circuit is disabled. The user must respect this circumstance. For a safe operation, he must follow the electrical rulers.



Behind the insulating transformer, the neutral must be connected to PE. In case of a 3-phase system the user must connect similar.

In the generator, **the neutral layer (N) is not interrupted by an internal switch**. If neutral and earth are not connected together in the system supply, it is normal to measure a voltage between neutral and earth! (may be 115 V or more at 230 V mains)

4.4.1.2. Fuses for EUT with smaller nominal currents

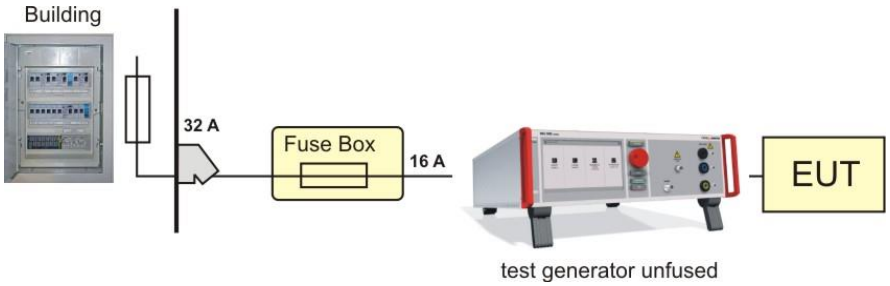
The AMETEK CTS pulse generators have no built-in fuse for the EUT power supply. It is in the scope of responsibility of the user to protect the EUT external for the rated current.

The design of the external fuse must be matching the following rules:

- fuse dimension must be **equal or smaller** than the **rated EUT current** of the connected **test generator**
- fuse must be designed for **protect the connected EUT** device under test in malfunction

Example of external circuit breaker

Circuit breakers in the building are designed for 32 A. A circuit breaker box with 16 A protection is installed between the building supply and the test generator.
Test generator and EUT are now fused for 16 A rated current



4.5. System configuration

This chapter describes how to configure the NSG 30x0 generator to work with the EUT and the connected accessories. The software library includes all accessories with their parameters. Some parameters must be matched to the current device. For device, that is not existing in the library, the user must create one by modify an existing equipment.

Procedure
The following system configuration is a short instruction guide. For detail setting refer to the related chapters in this manual.

1. Power ON the NSG 3000A generator
2. EUT configuration setup
3. System settings
4. Transformers settings
5. External coupler settings

NOTE: If you have ordered the complete NSG 30x0 System from AMETEK CTS, the System configuration was completed in the AMETEK CTS factory in Switzerland

4.5.1. Power ON the NSG 30x0A generator

Approx. 3-4 seconds after power on the generator will drive the ventilator at full speed during few seconds. Then the ventilator returns to a variable speed control concerning the temperature.

Booting

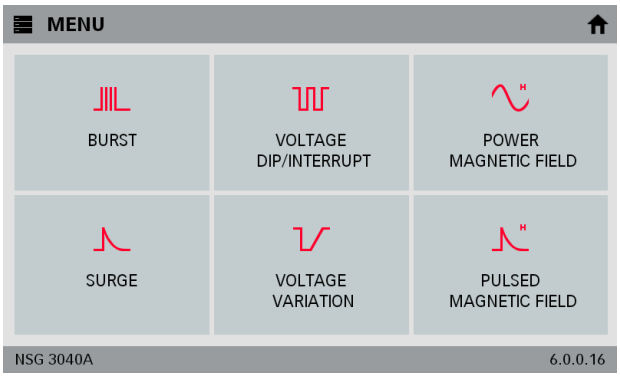
After the welcome screen the software scans the equipment for search all existing internal phenomenon's and external devices.

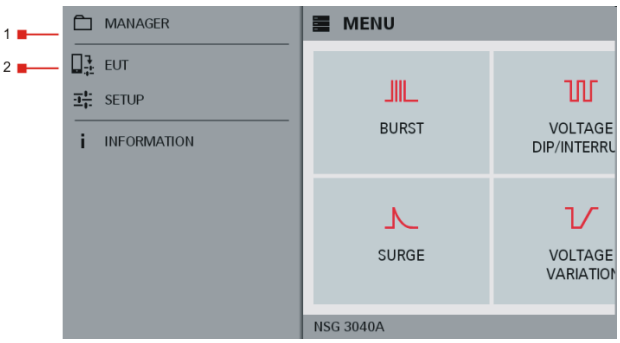
A list shows and lists all detected modules.

Home screen after booting

The home screen shows all symbols of the detected phenomenon like:

- Burst
- Surge
- Voltage DIP and interruption
- Voltage variation
- Power frequency magnetic field
- Pulsed magnetic field





Next steps:

1. **EUT configuration setup**

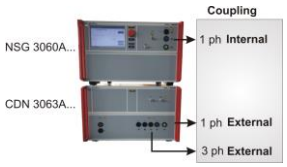
2. **Menu / Setup for**
   - System settings
   - Transformer settings
   - External coupler settings

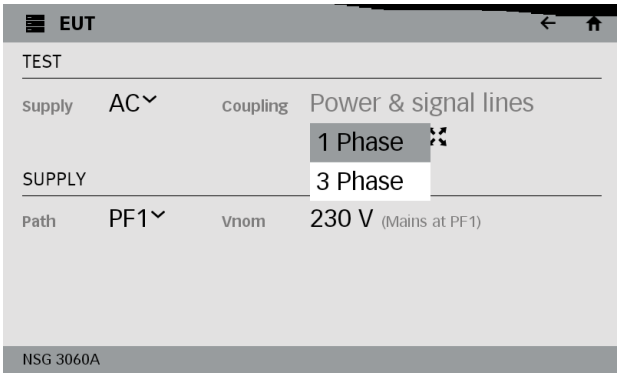
4.5.1.1. EUT configuration Setup

If an external coupling network is detected, the user can select 1/3 phase at AC coupling by *long press* to **1 Phase** / **3 Phase** as:

1 Phase set to L, N, PE
3 Phase to L1, L2, L3, N, PE

The output path for 1-ph EUT can be selected in the test menu by the user.





Supply: **AC**

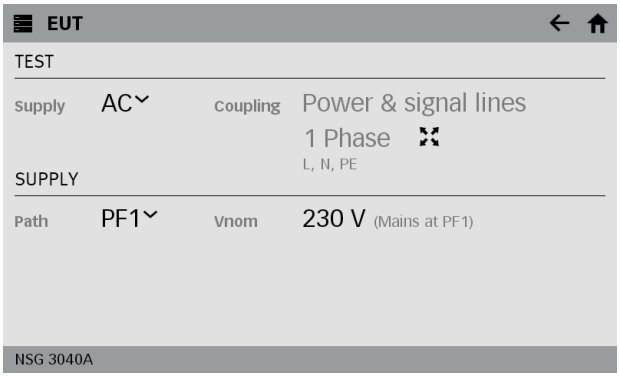
Coupling: 1 ph set to **L, N, PE**
3 phases to L1, L2, L3, N, PE

Path: **PF1**

Vnom: **230 V** (115 V)

Limit: all disabled

NOTE: For detailed information see chapter 6.5. EUT Setup



Example for 3-phase EUT

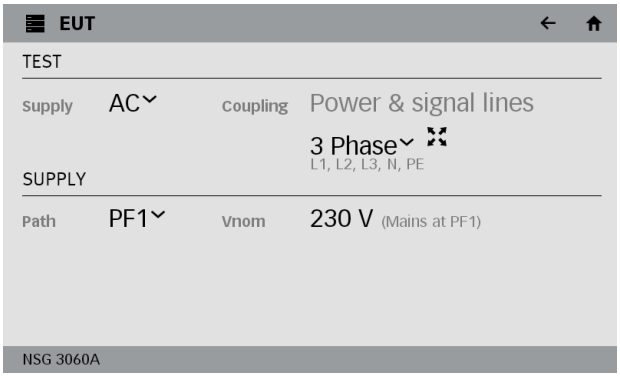
Supply: **AC**

Coupling: 1 ph set to L, N, PE
3 phases to **L1, L2, L3, N, PE**

Path: **PF1** *(not relevant for 3-ph application)*

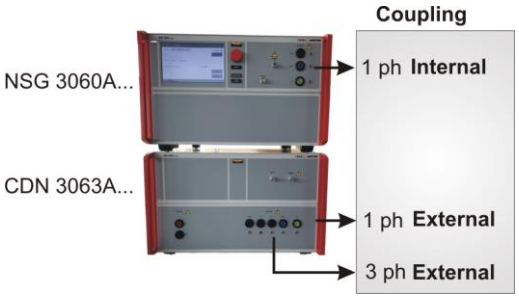
Vnom: **230 V** (115 V)

Limit: all disabled



4.5.1.2. Select the output path for impulse coupling

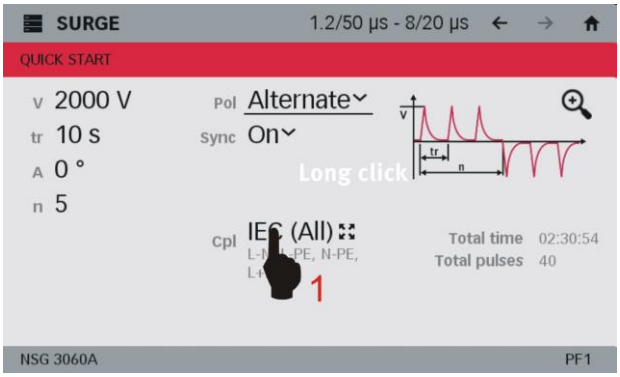
To define at which device the generated pulse to applies, the user must configure it in the system. This happens in **menu Devices and Modules**



Internal Pulse output at the **NSG 3000A CDN**
- 1 phase

External Pulse output at the **CDN 3000A CDN**
- 1 phase
- 3 phase

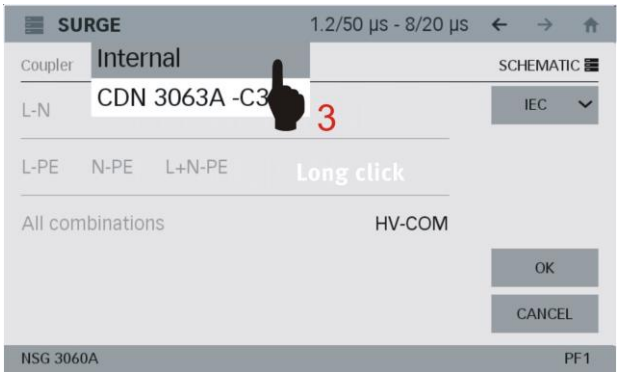
Select output path for the impulses



1. Select **Cpl**

To select the coupling path for other phenomenon like EFT Burst, pulsed magnetic field or other, the procedure is very similar

2. **Click** to the field Coupler for display all coupling devices.



3. Select the coupling device for testing:

- **Internal**
  using CDN from NSG 3060A generator

- **CDN 3063A-C32**
  using CDN from CDN 3060A-C32

NOTE: *The display will indicate all recognized coupling devices*

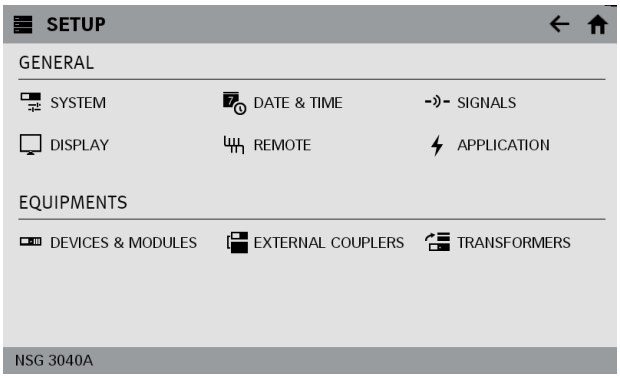
4.5.1.3. System Settings

Setup General

- System: **Language** if other than English
- Date / Time: modify
- etc.

Setup Equipment

- Transformers
- External coupler
- Devices & Modules

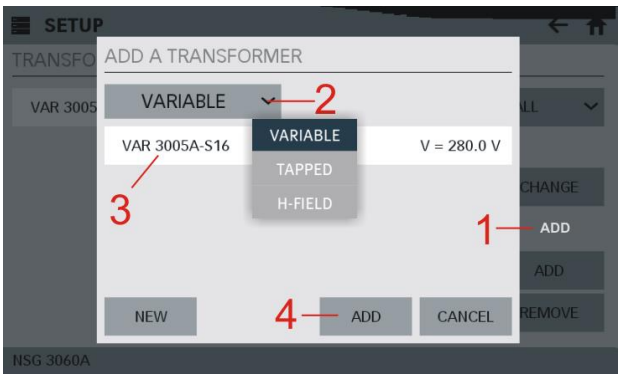


Transformers
If you have no variable- or tapped transformer, you can skip this paragraph.

Add a Transformer into the setup

1. Select **ADD** for open the add transformer window
2. Select **VARIABLE, TAPPED** or **H-FIELD**
3. Select the transformer (VAR 3005A-S16A)
4. Press **ADD** for close and exit

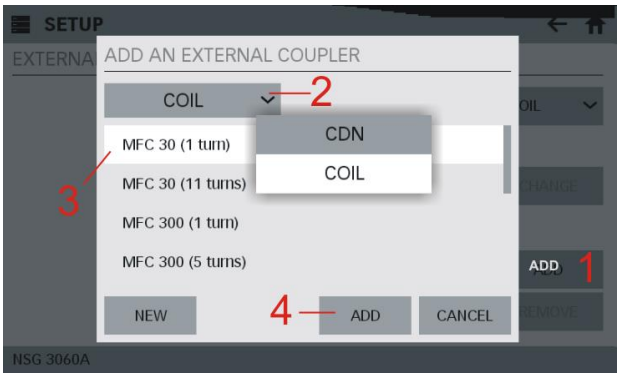
NOTE: See separate chapter for adjust the variable transformer parameters.



External couplers
External 3-phase coupling to NSG 3000A series devices are detected after power up the system automatically. If you have no magnetic field coil or external 3-phase coupling network, you can skip this paragraph.

Add an external coupler into the setup

1. Select **ADD** for open the add ext. couplers window
2. Select **VARIABLE** or **COIL**
3. Select the transformer (MFC 30 (1 turns)
4. Press **ADD** for close and exit
5. Select for return to the Home screen

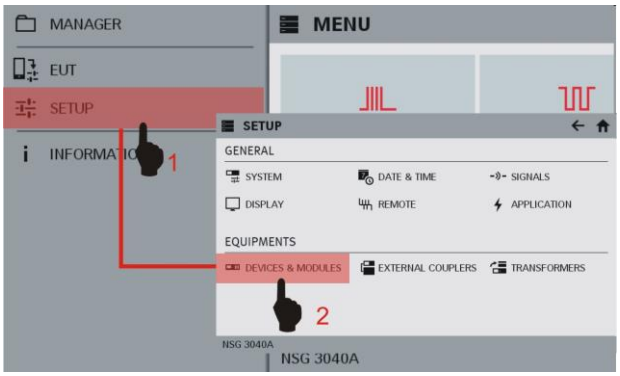


For operate a test see chapter and 5.3. Parameter setting

4.5.2. Software Number for iec.control software license

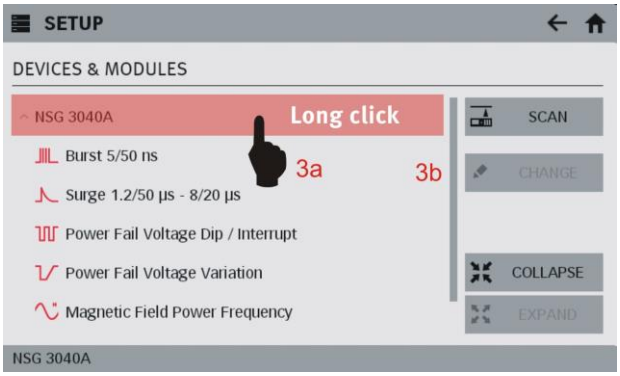
Software Update procedure

1. Select **MENU / Setup**



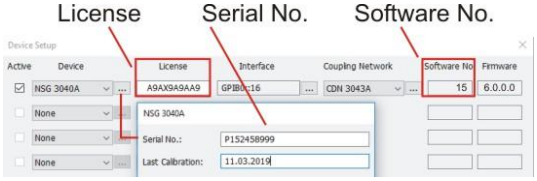
2. Select **DEVICES & MODULES**

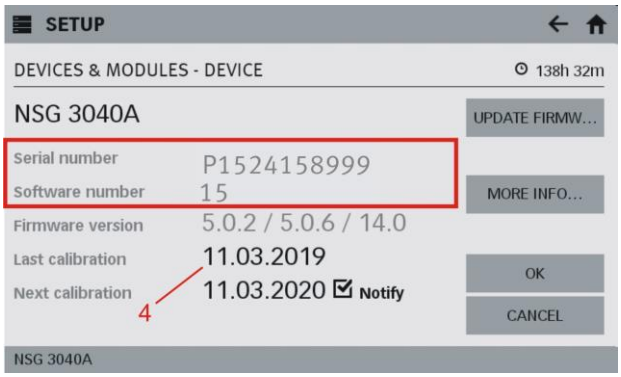
3. Make a **long click** to **NSG 3040A** or **click NSG 3040A** and press **change**



The yellow field indicates the information for:

- **Serial number**
- **Software number**
  This number is matched with the **license** code in the **iec.control** software

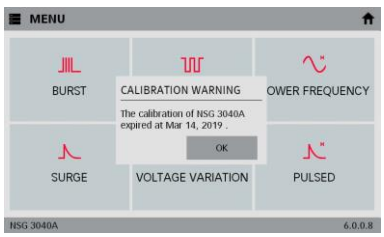


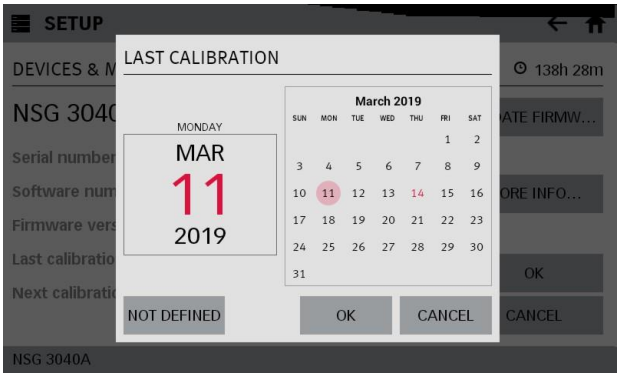


4. Click **Not defined** for enter a date for:

- **Last calibration** date
- **Next calibration** date

When expired, the following message appears after device power on.





4.6. Software Update

To update the NSG 3000A generator with a new software it is necessary to copy the new software to an empty USB memory stick.
The following software update, backup and restore procedures are described in this chapter.

A **3.6.1 Software update new version**

B **3.6.2 SysOS update**
This update overwrites the settings to the factory setting. A previous **Backup** with **Export Settings** is strongly recommended

C **3.6.3 Export actual settings**

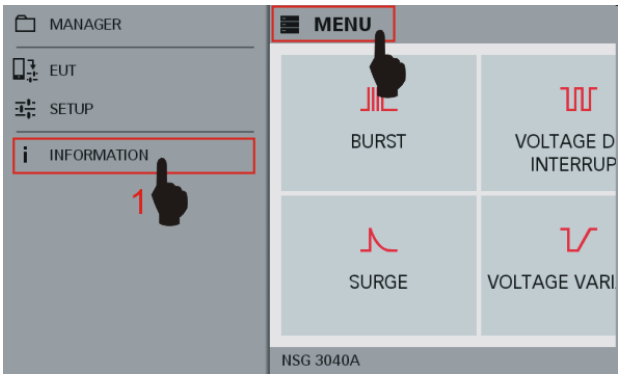
D **3.6.4 Import settings**

F **3.6.5 Firmware update**

4.6.1. Software Update new Version

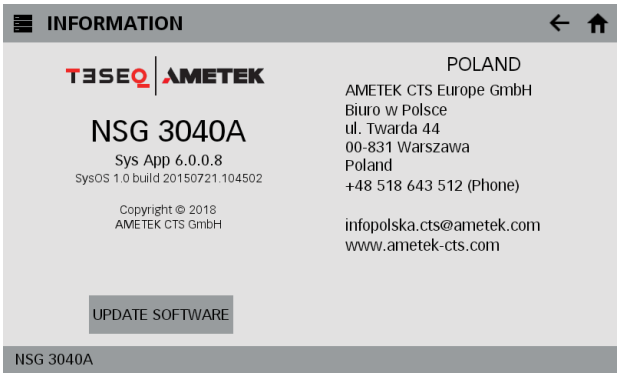
Software Update procedure

1. Select **MENU / INFORMATION**



Software Update procedure

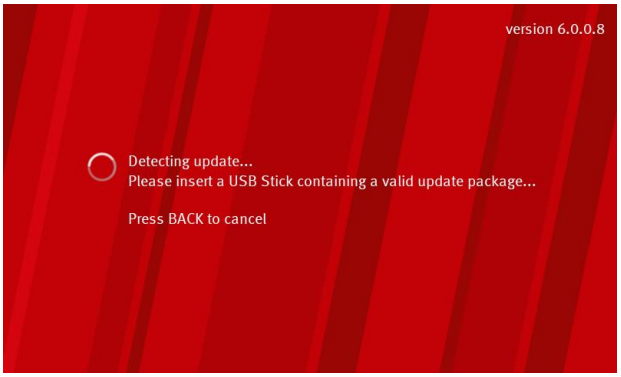
2. Press **Update Software**



A message appears to **insert an USB memory stick** with a valid update package to the **rear side** USB Port.

The update file will be automatically detected

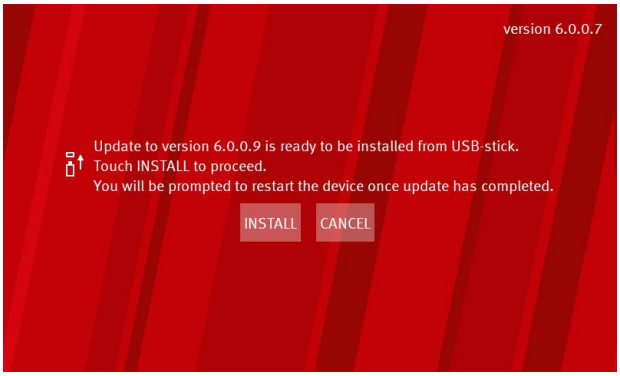
SW filename: **com.cts.appsw.apk**



3. Press **INSTALL** to start the update procedure. The update process is shown on the screen.

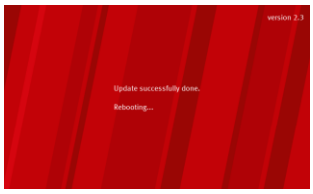
updating

Press **CANCEL** for exit

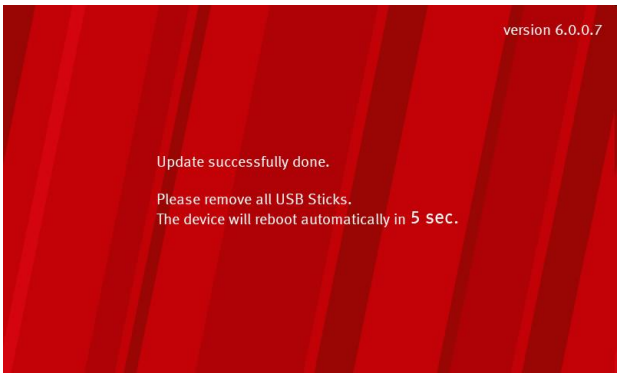


4. After display Update successfully done, **remove** the USB Sticks when indicated

A counter will indicate that the device will reboot after 10 seconds



System reboot

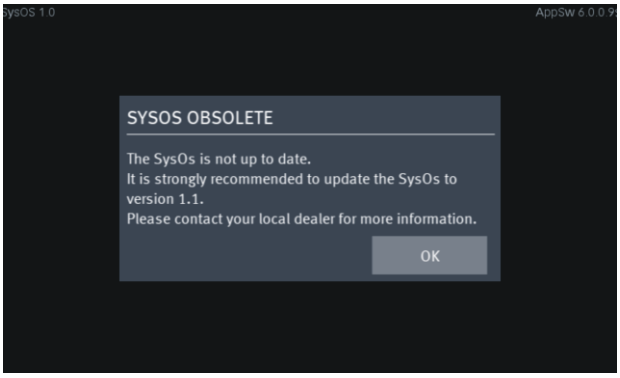


6. If you get the following message after rebooting,

a. Click **OK**,

b. Continue with **step 7 to 12** for the Phenomenon Firmware update to complete.

c. Then continue with the following steps:
- Save the settings on an USB Stick
- Proceed the SysOS upgrade
- Import the saved settings from the USB stick



7. After switching on,

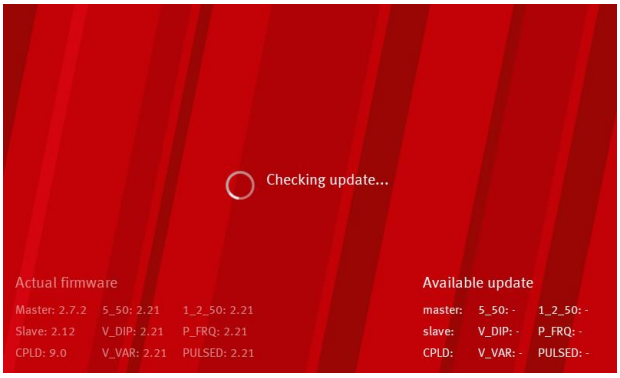
DO not switch OFF while updating

After the update the system is loading the devices

8. When starting a new app-sw version, the system checks the actual firmware versions and indicates the

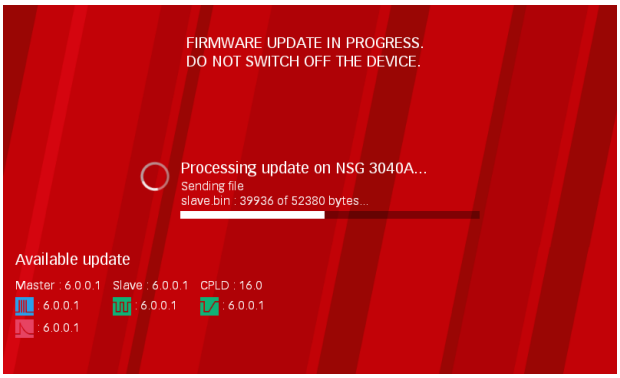
Actual firmware versions and

Available updates for install



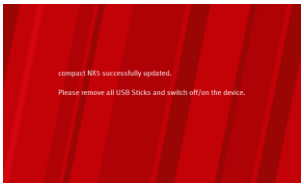
9. The available firmware updates are installed automatically on the NSG 3000A generator.

The update processing is indicated and may need several minutes to complete.



10. After successfully update remove all USB memory sticks and

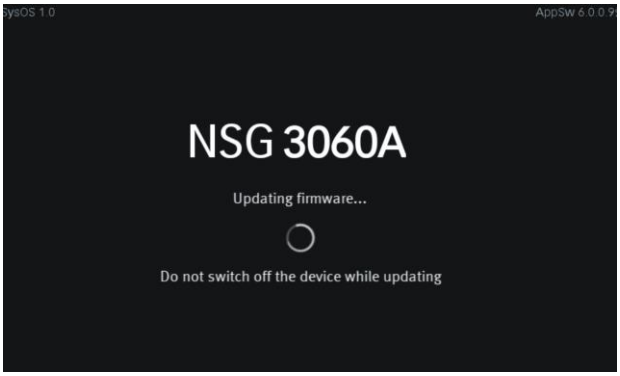
Switch OFF / ON the device



11. After switch on the final firmware update is installed and configured.

DO not switch OFF while updating

After the update the system is loading the devices



4.6.2. Software Update Install SysOS

Important

Before **install a new SysOS**,

Save the system settings on an external USB memory stick with the function **Export Settings**.

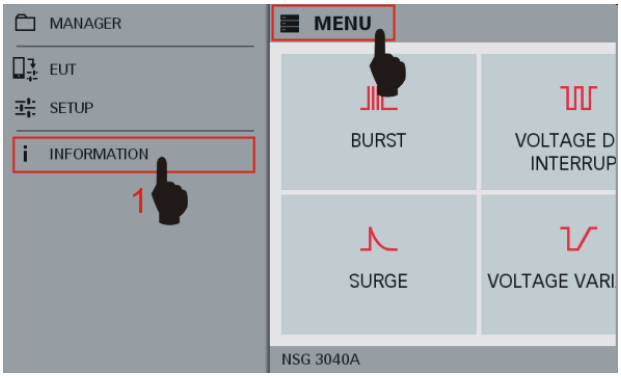
The update SysOS will **set all** settings **to factory setting**

- EUT settings
- All settings in SETUP GENERAL
- All settings in SETUP EQUIPMENTS
- All Link tests, User tests, Customized Standards

Make sure that you have done the Chapter 4.6.3. Export actual settings

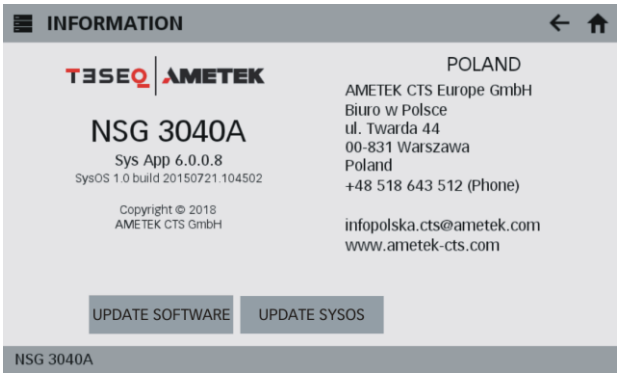
Software Update procedure

1. Select **MENU / SETUP**

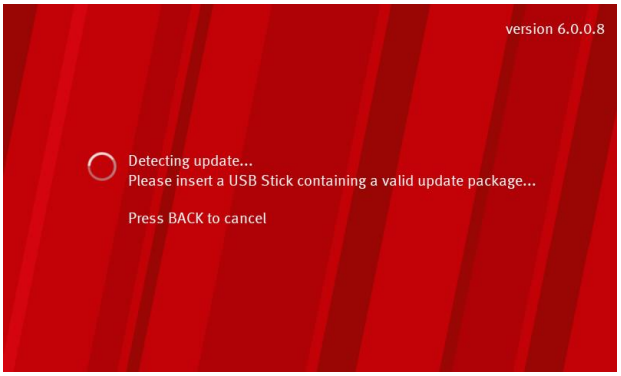


Software Update procedure

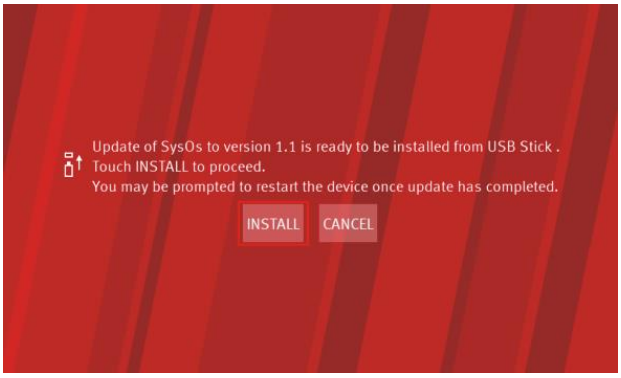
2. **Remove all USB Sticks** from the System and click on **UPDATE SYSOS**



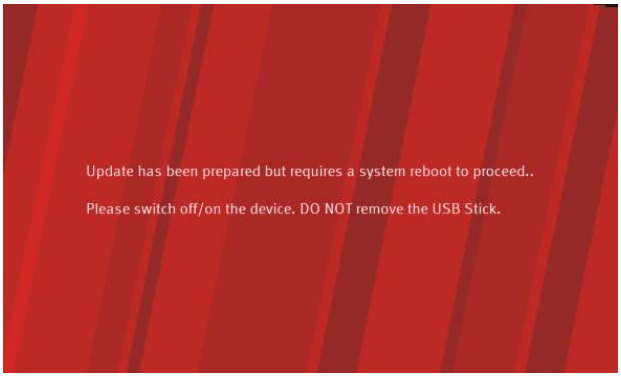
3. **Insert the USB Stick** containing the update files in the NSG 30x0 (back side). Update file will be automatically detected and analyzed. This may take a minute.



4. Once the update package has been checked, click **INSTALL** to proceed.



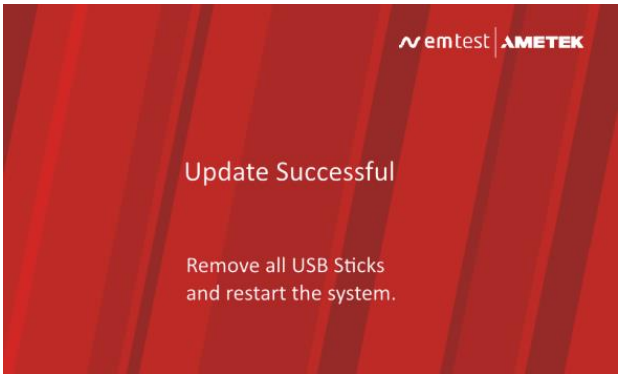
5. The update is then prepared but will need a system reboot to proceed.



6. **DO NOT REMOVE** the USB Stick from the device and
- **Switch OFF** the NSG 3000A,
- **wait 5 seconds** and
- **switch it ON** again.

7. A few seconds after restarting the device, you should see the following screen. Please wait until update process completed. This may take a few minutes.

8. Once update has completed and the following screen appears
- **remove all USB Sticks**,
- **Switch OFF** the NSG 3000A,
- **wait 5 seconds** and
- **switch it ON** again.

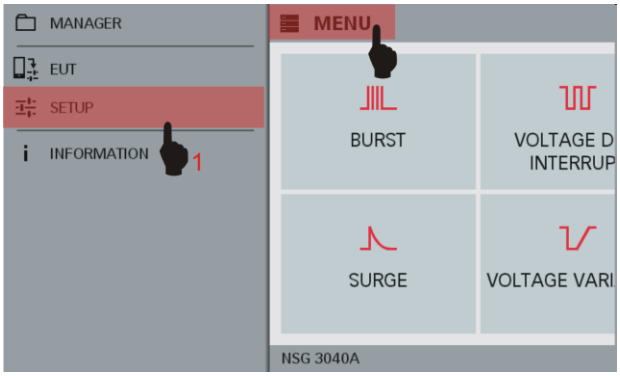


4.6.3. Export actual settings

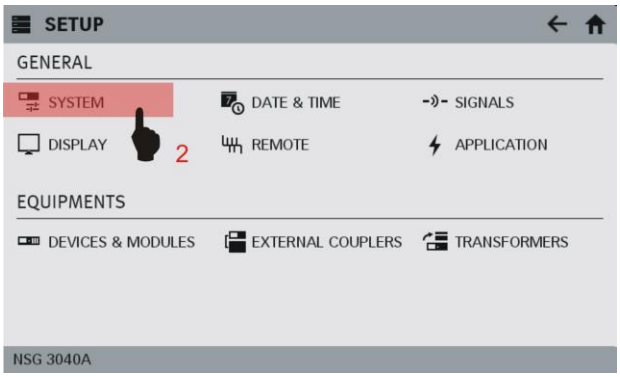
The Export settings saves all device settings on an external USB Stick. It is strongly recommended to export the settings before doing a SysOS update.

Export settings procedure

1. Select **MENU / SETUP**

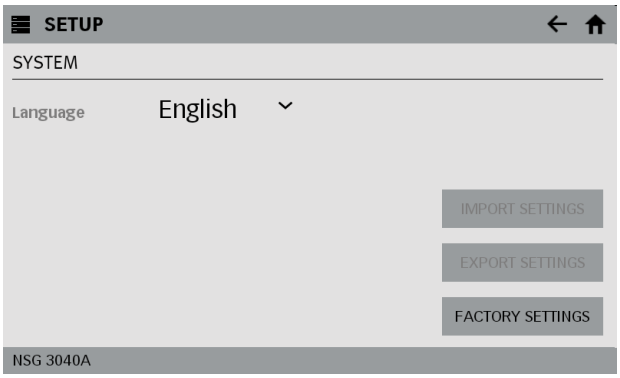


2. Press **System**

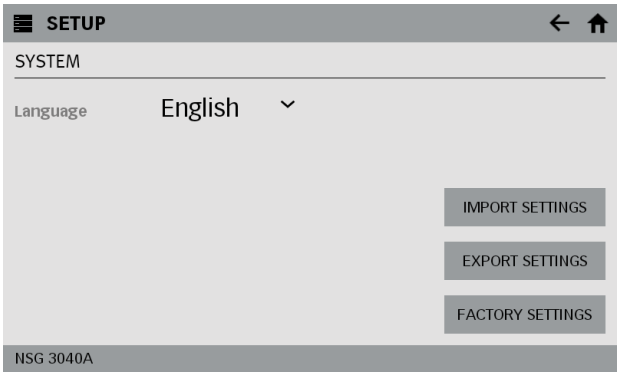


3. **Insert USB Stick** to the back USB slot

   After few seconds the Import/Export settings button will automatically be enabled.

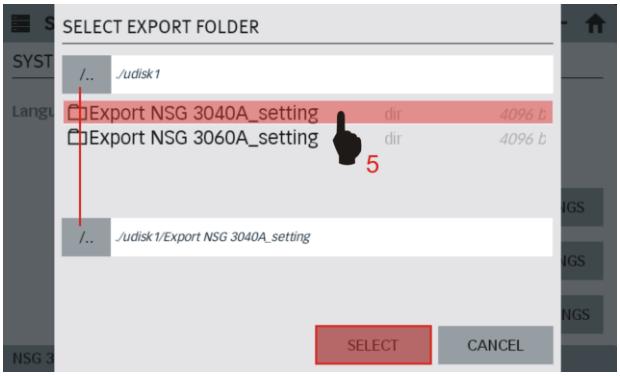


4. Click on **Export Settings**



5. Select the folder (5a) where you want save the backup setting files for export

Press **SELECT** for export the backup data

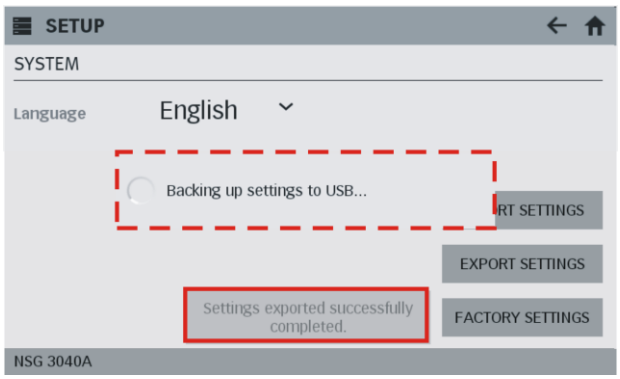


6. A message indicates the backup writing to the USB stick.

A message on the bottom of the screen confirms that the export has completed.

Filename is **syssettings.bkp**

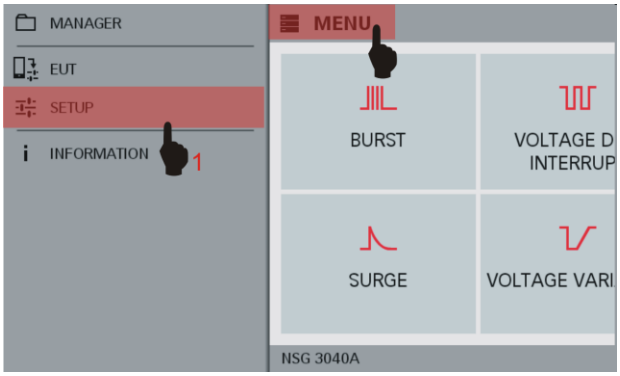
Remove the USB Stick from the NSG 3000A generator.



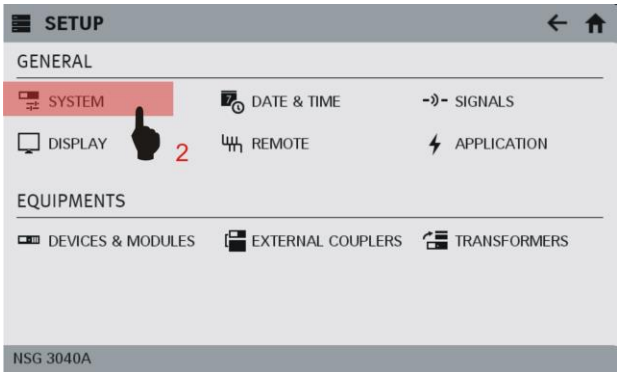
4.6.4. Import the settings

The Import settings restores all device settings from an external USB Stick. It will reinstall all device settings after a SysOS update.

1. Select **MENU / SETUP**

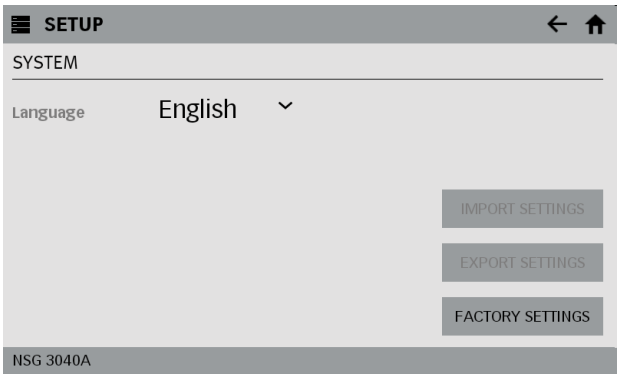


2. Press **Update Software**

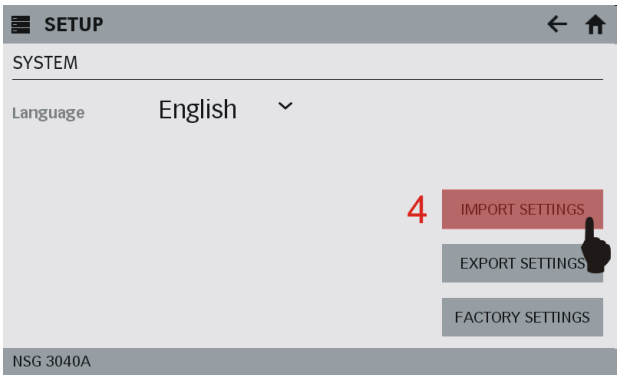


3. **Insert USB Stick** to the back USB slot

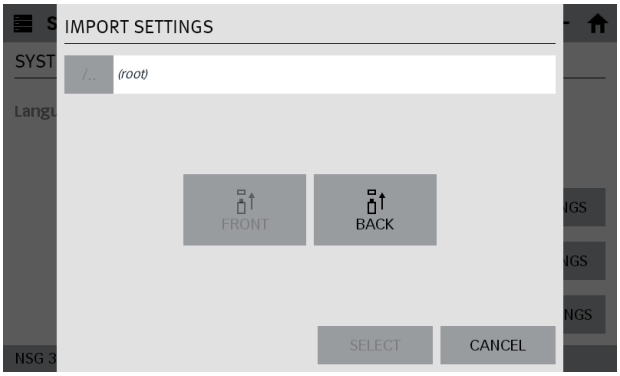
   After few seconds the Export/ Import settings button will automatically be enabled.



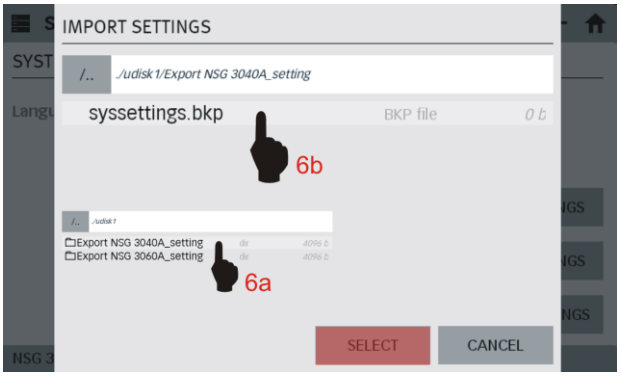
4. Click on **Import Settings**



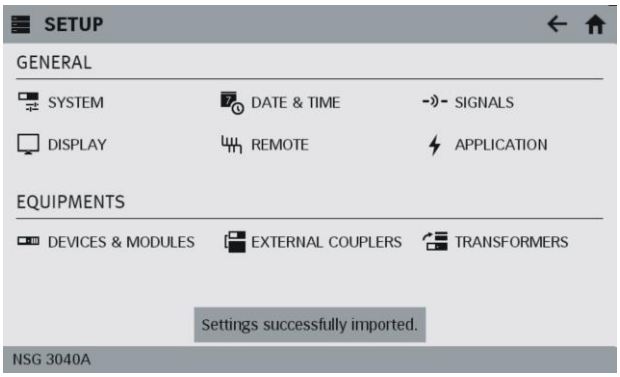
5. Press BACK



6. **Select the backup file** (syssettings.bkp) and click **SELECT**.



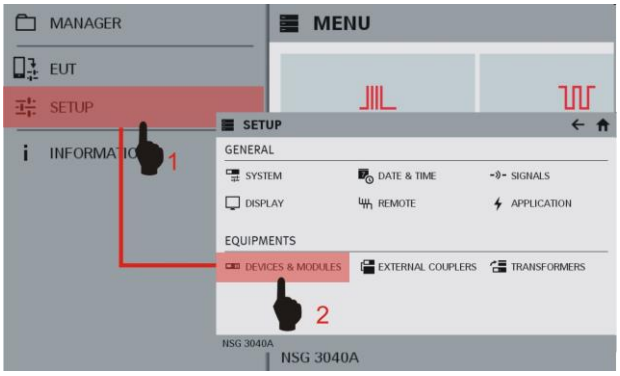
7. **Remove all USB Sticks** and **Restart** the NSG 3000A, the initialization process will start normally and take you to the Home Screen.

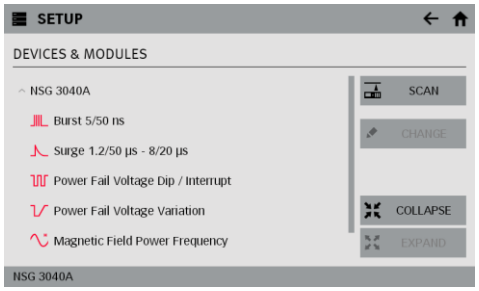


4.6.5. Manual Firmware Update

Firmware Update procedure

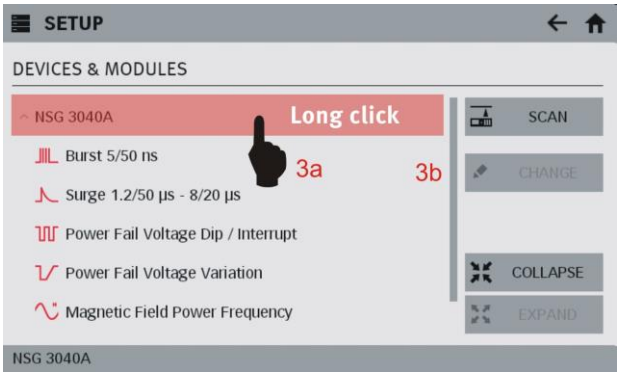
1. **Select MENU SETUP / DEVICE & MODULES**





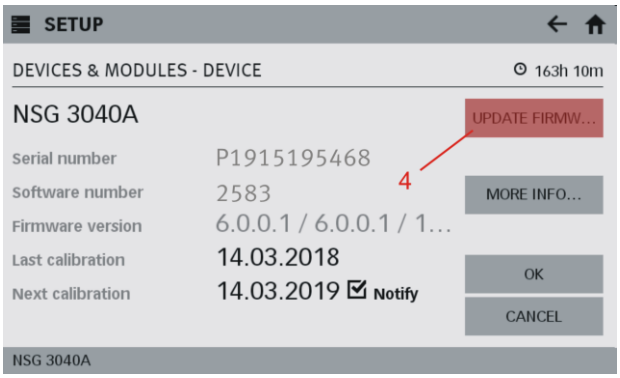
2. Insert the memory Stick at the rear USB port with the update software in the root. A message for searching the memory stick appears until the memory stick is recognized.

   Firmware filename: *.upt



3. Make a **long click to NSG 3000A** or **a click to NSG 3000A &** press **change**

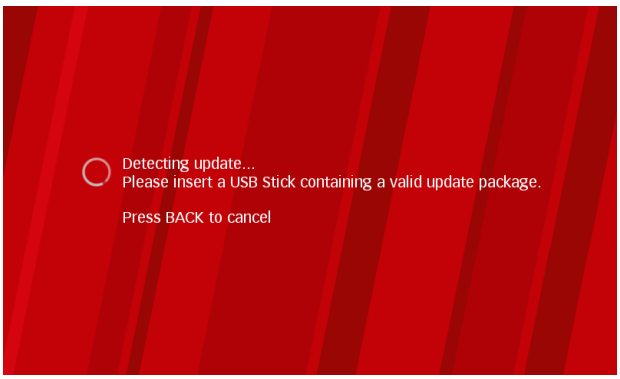
4. Press **Update Firmware**
   The program searches for the firmware update on the memory stick



The device shows the actual and recognized new firmware version

If no USB stick is detected

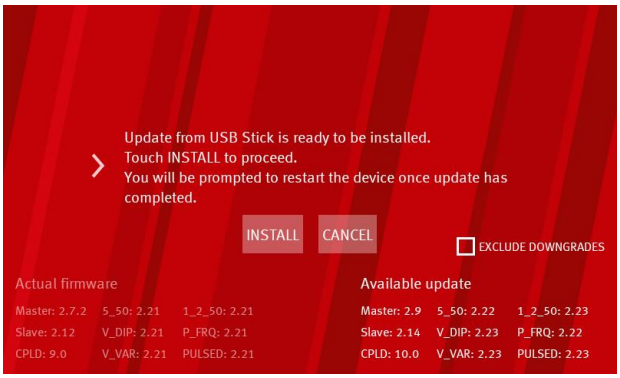
Insert a USB stick containing valid update package



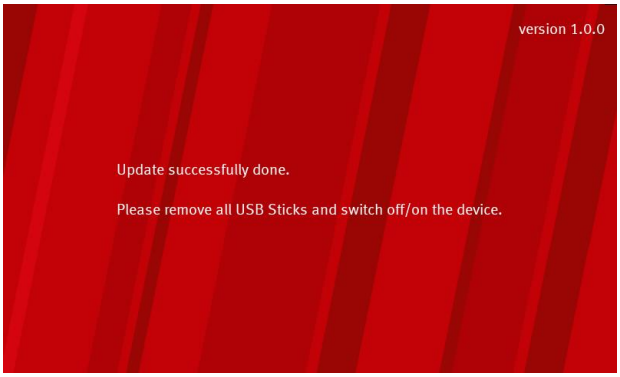
5. Press **INSTALL** for start the update procedure. The update process is shown on the screen and needs several minutes.

Press **CANCEL** to exit

Exclude Downgrades will not install older versions, when detected on the USB stick



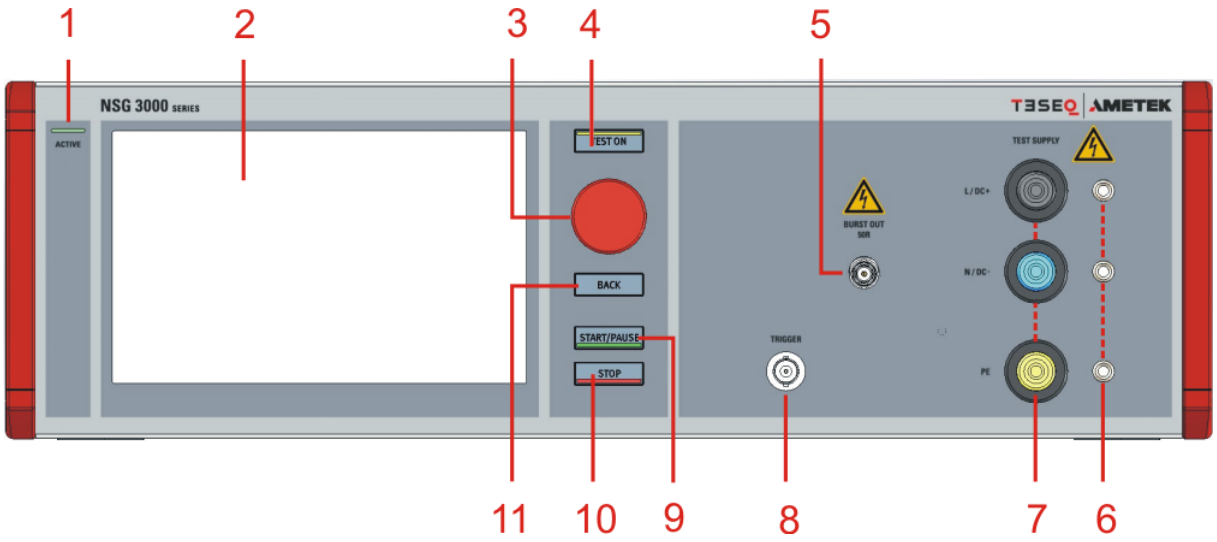
6. After display "*Update successfully done*",
- **remove** all USB Sticks
- **switch off / on** the device



After the rebooting the device starts with the new firmware.

5. Design and Functions

5.1. Front view NSG 3040A and NSG 3060A



1 ACTIVE indication
2 Touch display
3 Rotary wheel (Inc. / Dec /Enter)
4 "Test On"
5 HV pulse Burst output 50 Ω
6 Ground reference (calibration)
7 EUT test supply
8 CRO Trigger output ↑ 5V
9 Start / Pause
10 Stop
11 Back

1 ACTIVE
Indicates that this unit is active

2 Touch screen and user interface
With the 7” capacitive touch screen display the user controls the equipment. The display indicates the status of the generator.

3 Rotary wheel (Inc. / Dec / Enter)
Rotate for increments or decrements a selected parameter. Push change the digit and hold with a numeric value or selects from a list of parameters. Press to change adjustment range. Selected range will be shown briefly next to selected parameter. Push and hold to “zero” to nearest range.

4 Test On
After pressing the "Test On" key, the following actions are activated:
- Activate the high voltage power unit; HV is ready to start.
- Switches ON the supply to the EUT test supply (only with built in Power Fail module).

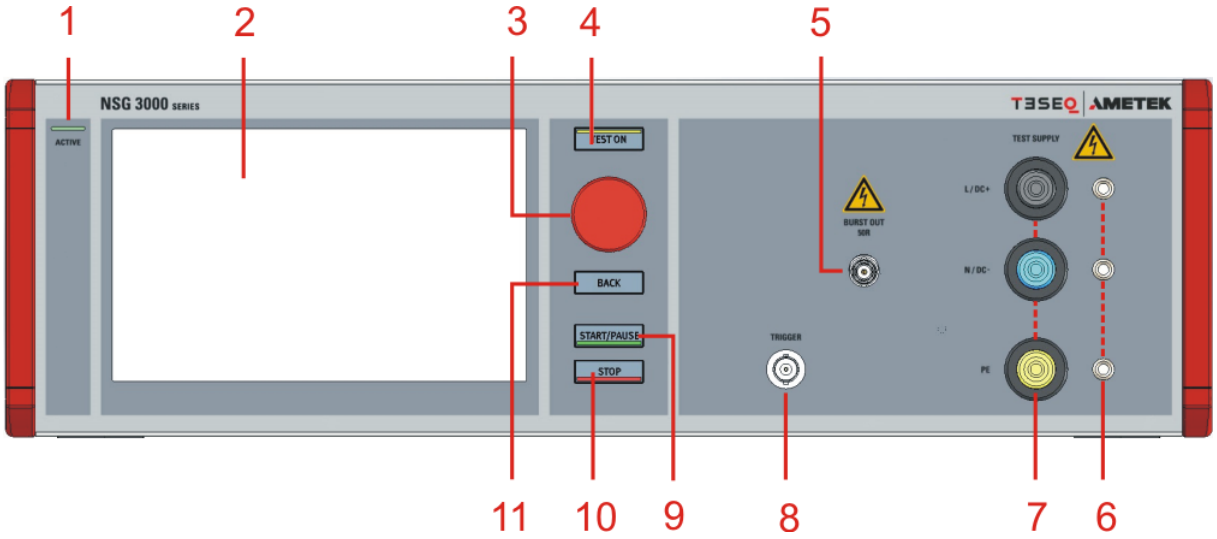
5 HV pulse burst output 50 Ω
External coupling devices such as the capacitive coupling clamp and the 3-phase coupling networks are connected to the coaxial 50 Ω output. Also, the calibration of the generator is handled at this output.
Note: The burst signal is present on this output at every coupling mode.

6 Ground reference
The ground reference (4mm) is used for EFT/Burst calibration adapters.

7 EUT test supply
For single-phase EUT the coupling/decoupling network is part of the generator. The EUT is powered via the safety banana plugs at the front panel of the simulator. Rated power max. 300V AC/DC 16 A

Attention

For verification or impulse measuring, you must take care, to use measuring instruments, which are able to handle the high voltages up to 6.6 kV and surge currents up to 3300 A.



1 ACTIVE indication
2 Touch display
3 Rotary wheel (Inc. / Dec /Enter)
4 "Test On"
5 HV pulse Burst output 50 Ω
6 Ground reference (calibration)
7 EUT test supply
8 CRO Trigger output ↑ 5V
9 Start / Pause
10 Stop
11 Back

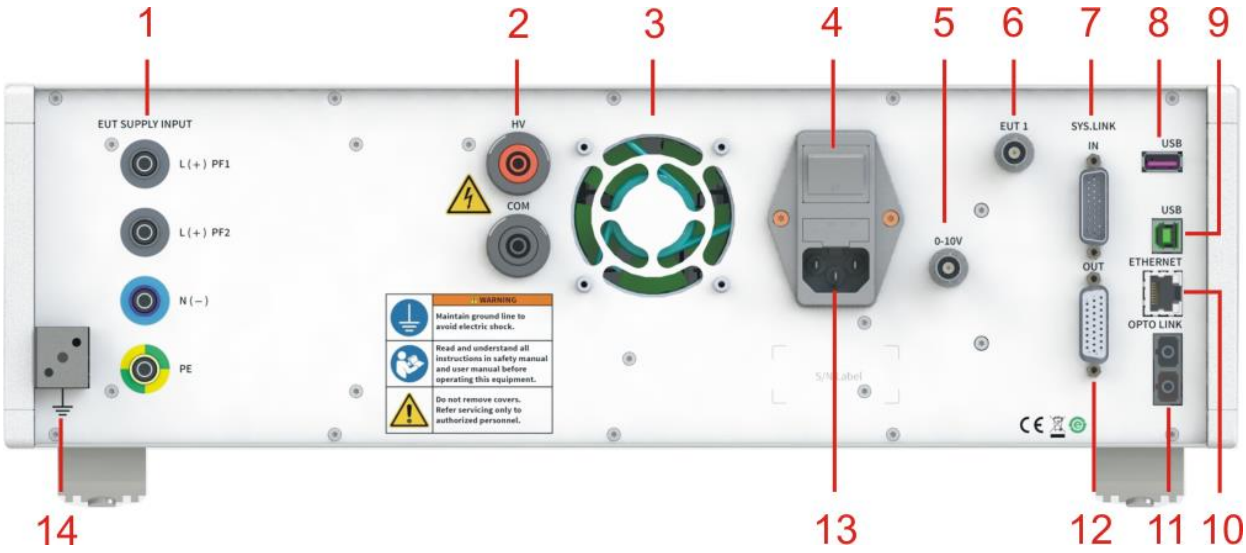
8 BNC - CRO Trigger
The generator trigger can be checked at the BNC output, e.g. the burst duration, the burst repetition rate and the spike frequency (+5 V rectangular). This output can be generally used as oscilloscope trigger output and is synchronous to the following events.
- Burst and surge release
- Voltage dip or interruption, start of the event.

9 START / PAUSE button
- Green indication: Start or continues a test
- Orange indication: Pause of a running test

10 STOP button
- Red indication: Stop a running or paused test.

11 BACK button
- Returns from a stopped test to the input screen.
- Same effect with two fingers swiping on the screen slide them from right to left

5.2. Rear view



1	EUT supply input	**6**	Fail, EUT 1	**10**	Ethernet interface
2	Surge output HV - COM	**7**	Sys Link IN	**11**	Opto Link Interface
3	Ventilator	**8**	USB A interface	**12**	Sys Link OUT
4	Mains Switch	**9**	USB B interface	**13**	Mains input device
5	DC output 0-10V			**14**	Reference earth connection

1 EUT supply Input PF1, PF2, N, PE

Input plug for the EUT power supply (4 mm safety banana plug). The input is not fused. The internal power fail switches (PF1, PF2) protect the system against overcurrent and are configurable.

- PF1:	Mains voltage to EUT phase L
- PF2:	Reduced dip voltage to EUT phase L (used for dip voltages as per IEC 61000-4-11)
- N:	Neutral to EUT supply
- PE:	Protected earth to EUT supply
- Rated power:	max. 300 V AC/DC 16 A
- Max peak	Max impulse voltage at EUT supply input plug < 1050 V (max. value for the residual voltage as defined in the standard), typical value “max impulse voltage, approx. 700 V

2 HV and COM output

The direct HV and COM outputs are floating output plugs for surge impulses. (max. 4.8 kV / 6.6 kV)

Attention

The direct HV and COM output of the surge generator is located at the rear panel of the generator. It is not allowed to connect these outputs to any other coupling/decoupling network than manufactured by AMETEK CTS. Before to connect any external networks to this output the operator must contact the manufacturer. Any damages due to this matter are not covered by warranty.

The direct pulse output shall also not be used to connect the generator directly to any power conducting lines

The wave shape measured at the direct pulse output must not be within the tolerances specified in IEC 61000-4-5. The pulse shape shall be verified at the CDN output directly, no matter whether it is an internal or external CDN.

3 Ventilation

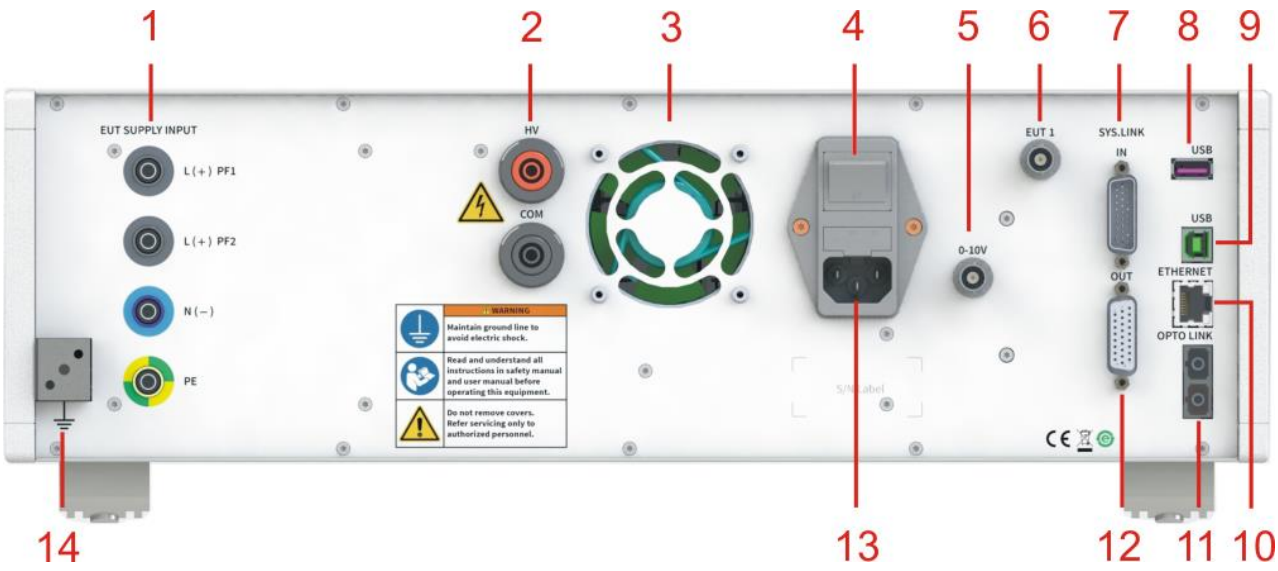
A power-controlled ventilator is cooling the compact NSG generator. During the most application the ventilator runs with variable speed depends the cooling requirement.
After long term duration tests the generator should keep on running for some minutes to cool down the system.

4 Power on switch and mains input

Wide range mains input (84 V – 254 V 50/60 Hz) for the device control. The switch is part of the mains filter. Mains fuses are part of the filter. (@ 230 V / 2 AT and @ 115 V / 4 AT)

5 DC output 0-10 V

DC BNC output for control an external AC source.
0.0 V = zero position
10.0 V = max. position for maximum voltage



1	EUT supply input	**6**	Fail, EUT 1	**10**	Ethernet interfaces
2	Surge output HV - COM	**7**	Sys Link IN	**11**	Opto Link Interface
3	Ventilator	**8**	USB A interface	**12**	Sys Link OUT
4	Mains Switch	**9**	USB B interface	**13**	Mains input device
5	DC output 0-10V			**14**	Reference earth connection

6 Fail input EUT 1
Programmable input monitors for fails events. Possible input settings: Notify, Stop, Break or Disabled
Input signal: 5 V neg. slope
Max- Input voltage: +20 V
Input protection 15 V: transzorb diode

7 Sys Link input
Sys link is the internal control bus to the connected NSG devices. The sys link is a daisy chain wired bus for connect the devices in series. The bus includes 26-pole high density connectors. This port is terminated with the **SSC AD** Safety circuit adapter with a short circuit.
The max power for the warning lamp signal lines is 60 V AC/DC, 2 A

8 USB A interface (Memory Stick)
Input plug for a memory stick for export / import data.

9 USB B interface (for service purpose ONLY)
USB interface “USB B” connector for service purpose with an external computer. Using the USB interface may cause EMC problems during burst tests at the computer or notebook side of the communication line. Therefore, only a high-quality USB cable shall be used.

10 Ethernet interfaces for REMOTE operation
Ethernet interface for remote control from an external computer.

11 Opto Link interface for REMOTE operation
USB to Opto Link interface for remote control from an external computer (Baud rate 9.600 Bd).

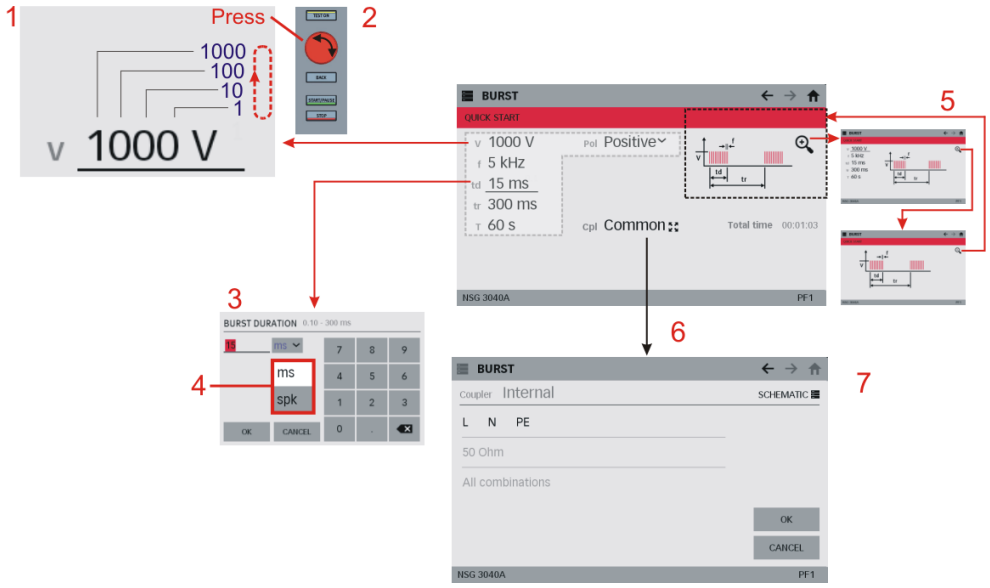
12 Sys Link output
Sys link is the internal control bus to the connected NSG 3000A devices. The sys link is a daisy chain wired bus for connect the devices in series. The bus includes the 26 poles high density connectors. This port is terminated if exist, with the **SWL AD** (Safety Warning Lamp Adapter).

13 Mains Input and Fuse
Mains input for the generator power supply.
Input voltage: 85 V – 254 V ac
Fuses: 115 V: 4 A slow blow, 5 x 20 mm.
230 V: 2 A slow blow, 5 x 20 mm
Rated power: 75 W

18 Reference earth connection
The generator must be connected to the reference earth plane of the test set up. The connection at the rear part of the generator is an alternative to the grounding point at the front panel.

5.3. Parameter setting

All phenomena offer similar parameter setting procedures. The figure below explains the different actions for parameter setting.

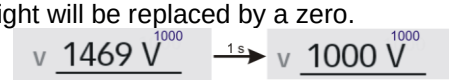


1 Parameter change

All white colored parameters are changeable. Blue colored parameters are normally defined by the used standard and fixed. For change a parameter proceed the following:
Touch into the parameter you like to modify
The selected parameter is marked with underline 1000 V[1]. The [1] indicates the digit that changes using the wheel.

2 Parameter modification with the wheel

- **Rotate** the wheel: **Increase** or **decrease** the selected digit. Depend on the parameter the digit is defined.
- **Press** the wheel: Will change the digit, press again for the next digit. This will rotate the digits cyclic (1, 10, 100, 1000, 1, 10 …). A small value indicates the selected digit that will be controlled by the wheel.
- **Long press** wheel: All digits right will be replaced by a zero.

  Example 

3 Parameter modification with the touch

A numeric display, with the parameter description and his limits appears at the screen.

- **Parameter**: **Enter** the new value of this parameter.
- **OK / CANCEL** Terminate the parameter input
  - **OK** replaces the parameter with the new input value
  - **CANCEL** keeps the old value

4 Parameter unit modification

Some parameters allow changing the unit as (ms / spikes) or (µs / ms / s) or (% / V) for the test procedure. Select the desired parameter unit for perform the test

5 Picture loupe function

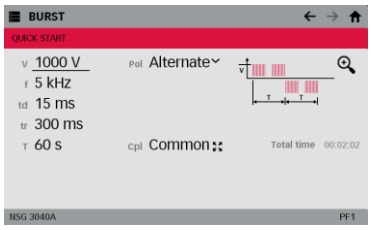
Touch the loupe symbol or **double tap** the figure for magnifying the picture. There are three magnifying steps rotating the size.

6 Coupling screen

Touch the coupling symbol Common for open the coupling screen. The screen offers all options for change the coupling.

5.4. Test setting and Run Window

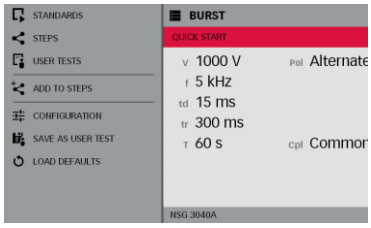
Test setting window
In the test window the user can enter the parameters of the test. Further it is possible to change in another test menu and to safe the test as Easy Link or User test.



Test setting window

The window shows all parameter settings for the test. The actual underlined parameter **1000 V** is the parameter that can be changed with the wheel. A graphic shows the focused parameter.

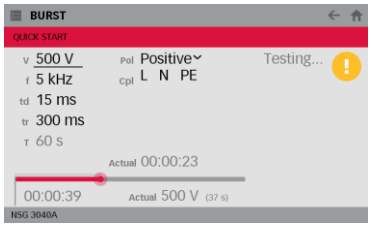
- Touch to a black colored parameter for select and change
- Rotate the wheel for parameter value change



Test window menu

Menu functions:
- Change to Standards, Steps, User tests
- Add the actual test to Steps
- Configuration menu
- Safe the test as User Test
- Load defaults

Run Window
The run window is active from the Start of the test until the user press the **Back** or ←button after a stop or when the test is finished. It is possible to return into the Run window with the button ➔ if no parameter has changed in the Test Window.
In the Run window the user can view the run information and save the report or run Information.

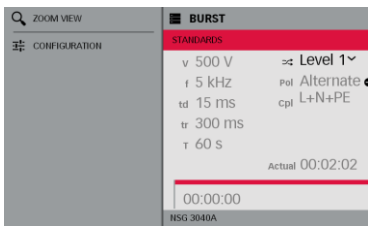


Run window

The run window shows the following information
- **Set parameters**: Parameter color; black changeable, grey fix parameters
- **Run Status**: Testing, Break, Stopped, Finished
- **Graphic bar**: Indicates running time of actual setting and total test time
- **Time**: Time of actual setting and total test

Test control buttons

START / PAUSE	Starts, pause and continues the test after a pause
STOP	Stops a test. The test is finished
BACK	Return to the test window for change parameters
▶|	Step to the next test sequence (e.g. voltage, coupling, polarity)



Run window menu

Menu functions:
- Zoom View
- Configuration menu

5.4.1. Set and test window

The screen for each phenomenon separated in two different screens. The figure below illustrates the state machine during the testing.

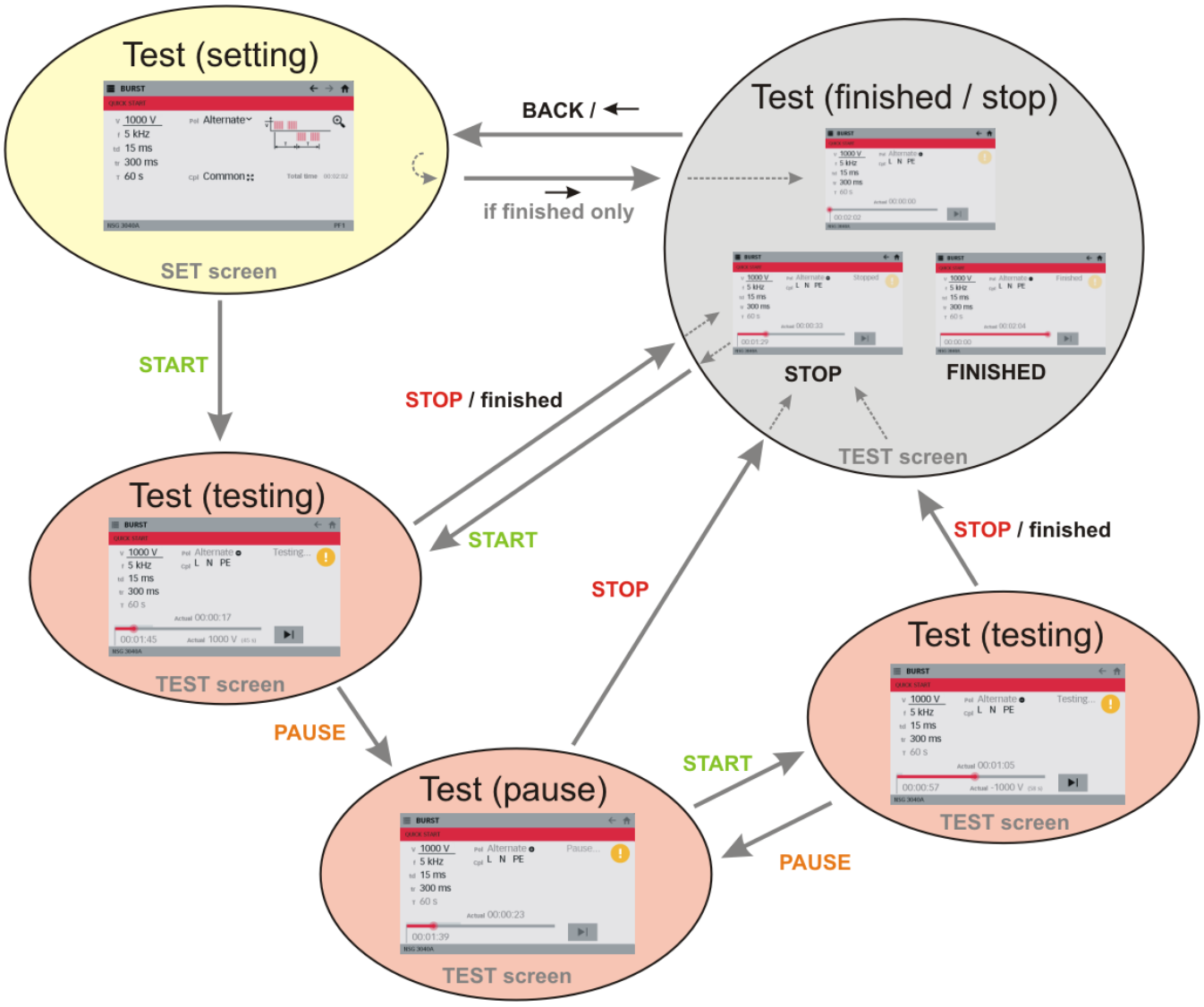
SET screen: Screen for setting all test parameters (yellow circle).

TEST screen: Screen during a test is running. After the **START** the user can **PAUSE** and **START** (Resume) or **STOP** the test (red circles)

Testing: Test is running
Break: Test is paused and can be continued with start
Resume: Test is running and continued after a break
Stop: Test is stopped during running or at a break. The test is not completed with all test sequences. A stopped test cannot be continued.
Finished: The test is completed and terminated with all test sequences

Block diagram for a test

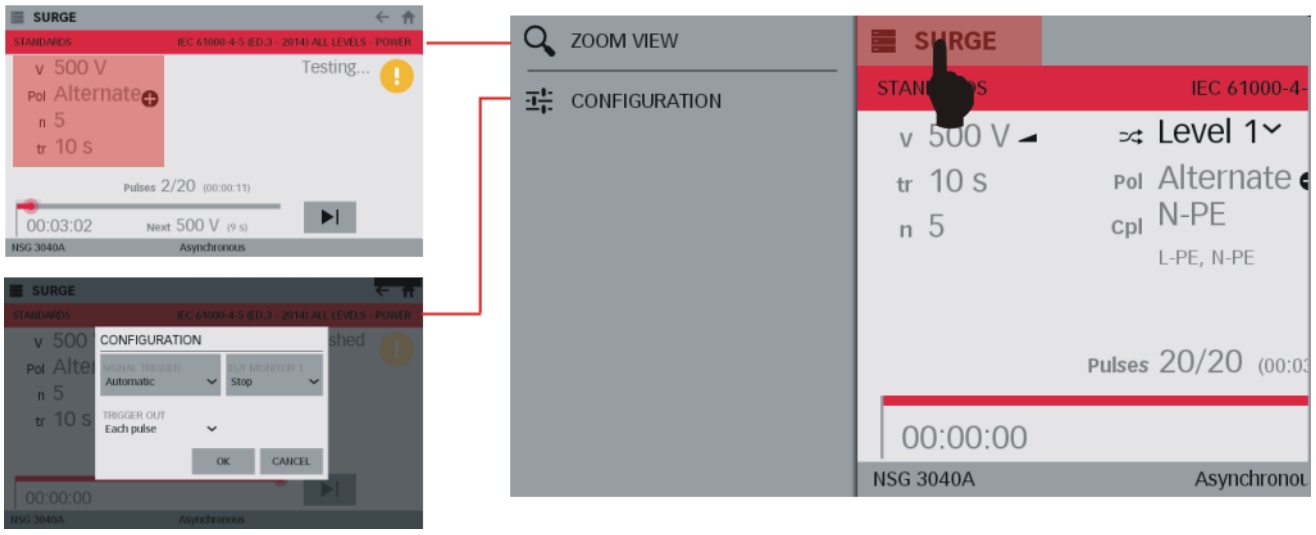
Test window: Yellow background
Run Window: Red/ grey background



State machine for the generator screen during a test sequence

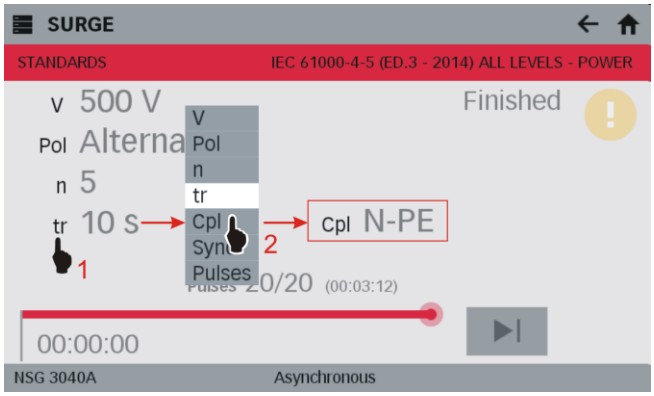
5.4.1.1. Run window menu

The run Window Menu offers the following functions during **Pause** and when **finished**. The most functions are available in all phenomenon.



Zoom view
Enables / disables the zoom view

Zoom parameter configuration

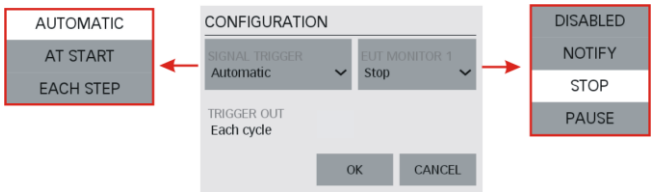


Change display parameter

1 **Click** the parameter you like to change.
A field with all possible parameters appears. The displayed parameter is inverse.

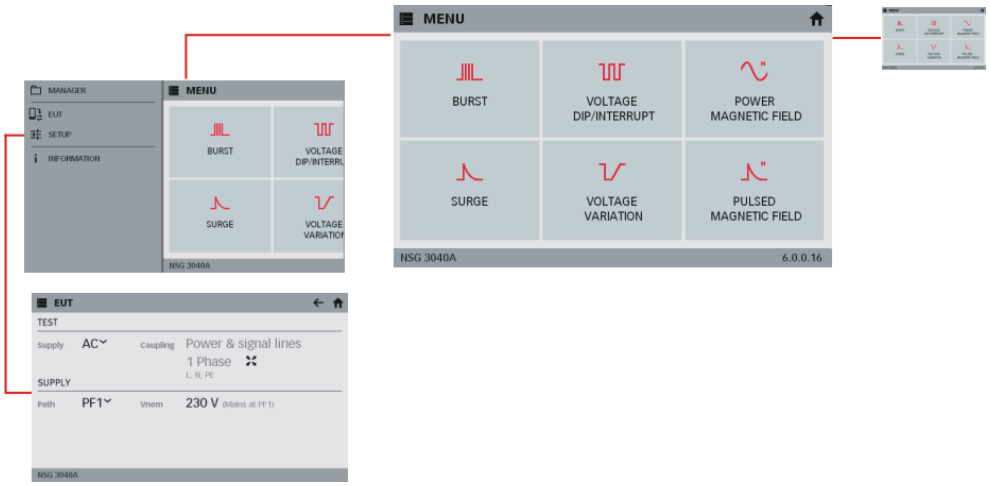
2 **Click** the new parameter you like to display.
The new parameter appears immediately in the display.

Configuration
Trigger- and Monitor configuration



For change the trigger / monitor configuration, press the field

6. Menu



Home
Returns to the Home screen

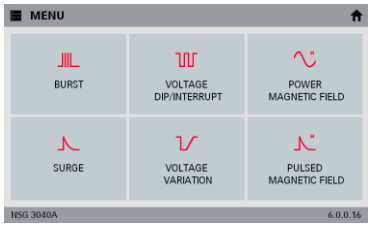
EUT and supply configuration
- EUT configuration (power line arrangement / data lines)
- Test supply and coupling
- Supply path and voltage
- Limiter for EUT current and voltage

Menu setting: Opens the menu for general settings

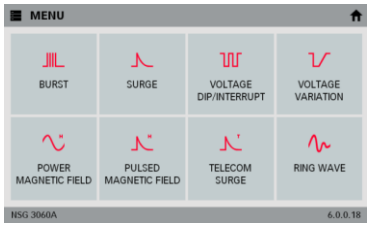
Manager	Test files management for test library configuration
EUT	Configuration and supply of the EUT
Setup	General setup NSG 3000A and configuration of auxiliary test equipment
Information	Device name, Software and firmware version, address of representatives

6.1. Test phenomenon Menu to start a test

Touch into a field of the NSG 3040A or NSG 3060A for select and load a test. The icon shows the kind of test phenomena.



NSG 3040A



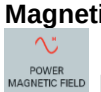
NSG 3060A

Burst impulse test 5/50 ns as per IEC 61000-4-4

Surge impulse test 1,2 /50 µs as per IEC 61000-4-5

Telecom surge test 10/700 µs as per IEC 61000-4-5

Magnetic field test



Power magnetic field as per IEC 61000-4-8

Pulsed magnetic field as per IEC 61000-4-9

Power Fail tests

Dips and interruptions IEC 61000-4-11 / 29

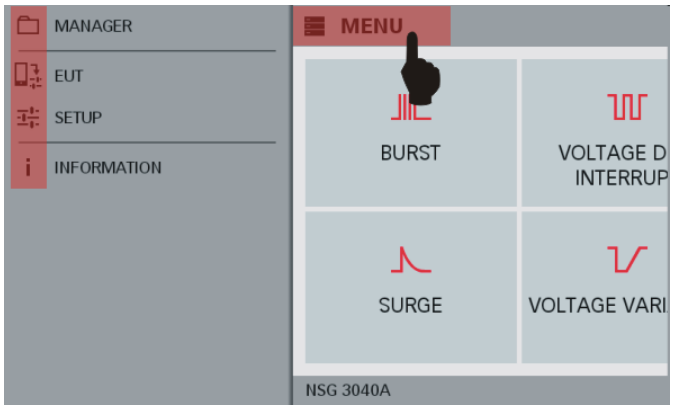
Voltage variation as per IEC 61000-4-11

Ring wave test 0.5 µs / 100 kHz

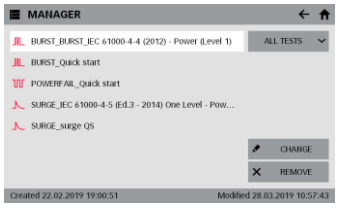
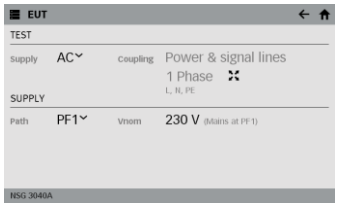
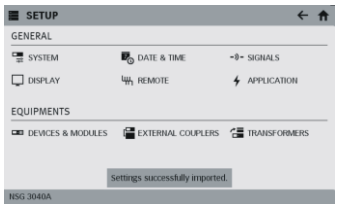
6.2. Menu for Settings

Overview

For any general setting, Press Menu and select one of the menus.

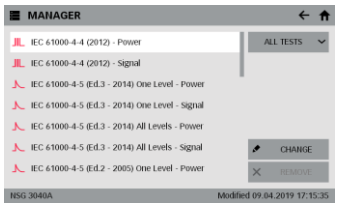


Screen after touch on

Manager		The user configures in this menu the library Manager of all existed test files. - Rename of tests - Mark as visible or hide - Remove test from the library
EUT *6.5. EUT Setup*		**EUT and supply configuration** EUT configuration and Setup for the test. The generator uses the settings and offers exact the needed information for the EUT. All needless information will not be displayed
Setup *6.6. Setup*		**Setup** **General setup** for NSG generator settings - System, Date/Time, Signals Display, Remote, Application, Report; Remote, **Equipment setup** for - Devices & Modules, External coupler, Transformers
Information		**System Information** - Device Version, Firmware, Software - Representative address AMETEK CTS offices, when touch the national flags - CH, Germany, USA, Poland, France, Italy, Austria, China, Japan - Software update (4.6. Software Update)

6.3. Manager

Manager



The user configures in this menu the library Manager of all existed test files.

- Rename of tests (Standards & User)
- Mark as visible or hide (Standards & User)
- Remove test from the library (User)

6.4. Information

Information

System Information

- Device Version, Firmware, Software
- Representative address AMETEK CTS offices, when wipe the address
- CH, Germany, USA, Poland, France, Italy, Austria, China, Japan
- Software update menu
  (see chapter software update) **4.6. Software Update**
  Press **"Update Software"** button for return when detecting update

6.5. EUT Setup

In the EUT setting the user specified his EUT. With this information the generator software will configure all settings to the EUT requirements.

The user defines:

- Mode of supply voltage (AC/DC)
- Configuration of the EUT supply wiring
- Default channel for the power supply
- The mains supply voltage

Advantages are:

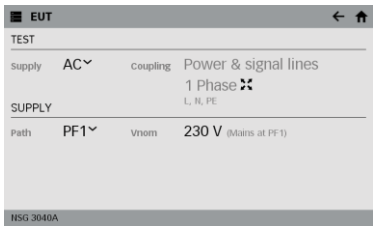
- Select only set the possible couplings and hides all unnecessary settings for the user
- Filters the standard tests adapted to the EUT like AC 50Hz, AC 60 Hz, DC.
- Set the VAR 3005A-S16 to the settled nominal voltage

Select EUT setting menu

Figure below shows to enter the EUT setting menu

EUT Setup

The generator uses the settings and offers exact the needed information for the EUT. All needless information will not be displayed



← EUT Configuration and Setup for the test.

← EUT and Supply path and mains voltage configuration

← EUT current and voltage limit

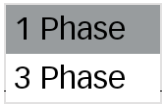
6.5.1. EUT Setup / TEST

TEST Power configuration for the actual connected EUT

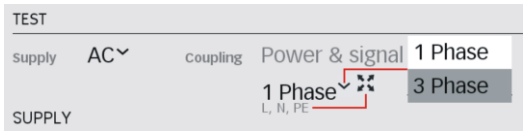
Supply: AC
DC
For CDN with AC/DC coupling the coupling mode will automatically **change between AC and DC**.

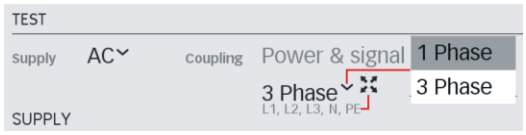
Coupling: Power lines & *data lines*

Phase Filter: Select the used lines
- 1-phase (L, N, PE)
- 3-phases (L1, L2, L3, N, PE)

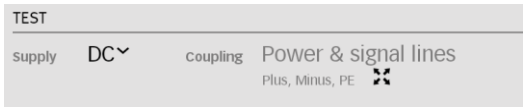


Coupling Select the used coupling Mode to the selected coupling device
- 1 phase for NSG 3040A / 3060A device
- 1 or 3 Phase for CDN 30X3_Cxxx





Supply **AC**	Coupling **Power Lines**	
1 Phase	L, N, PE	with PE
	L, N	no PE
3 Phases	L1, L2, L3, N, PE	Star with PE
	L1, L2, L3, N	Star no PE (PEN)
	L1, L2, L3, PE	Delta with PE
	L1, L2, L3	Delta np PE
	L1, L2, PE	Interphase
	Lx, Lx, …	other combination



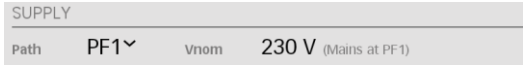
Supply **DC**	Coupling **Power Lines**	
	Plus, Minus, PE	with PE
	Plus, Minus	no PE

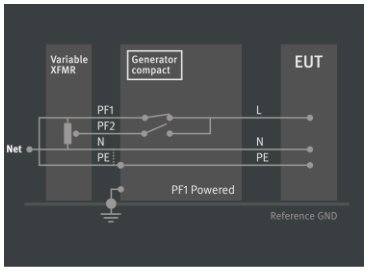
6.5.2. EUT Setup / SUPPLY

SUPPLY Defines the default supply path to the EUT and the nominal voltage. For DC application the user needs two DC sources for PF1 and PF2 voltage each.

Path: PF1 Mains voltage from the power grid
PF2 Voltage from the variable- or tapped transformer

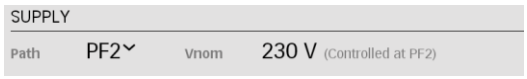
Vnom: Mains voltage or defined voltage

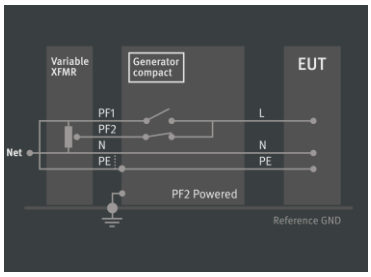




Path	**Vnom** (mains from the grid)
PF1	100 V, 115 V, 230 V, or any mains voltage

NOTE: PF1 is the default setting for general application for Burst, Surge and Power Fail testing.
The NSG 3000A generator uses this V*nom* voltage as **100% value for Dips** test as per IEC 61000-4-11.





Path	**Vnom** (controlled at PF2)
PF2	Any voltage (example 230 V- 10%) The voltage of the XFMR is set to the following voltages:
	Power Fail: settled DIP voltage Power magnetic field: 0 V All other phenomenon's: Vnom (PF2)

NOTE: PF2 is used for operating a EUT with different voltage than the actual mains voltage.
For power fail tests only PF2 mode with voltage interrupt tests are possible.

Internal hardware current limiter

The built-in internal hardware limiter operates as follow. In case of an overcurrent the **TEST ON** is switched off, and the user must confirm a message.

16 A models

I < 23 A	No action
23 A ≤ I < 40 A	Fail after 45 s
40 A ≤ I < 50 A	Fail after 30 s
50 A ≤ I	Fail after 5 s

32 A models

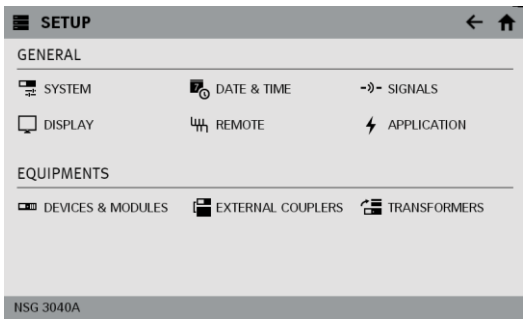
I < 46 A	No action
46 A ≤ I < 80 A	Fail after 45 s
80 A ≤ I < 100 A	Fail after 30 s
100 A ≤ I	Fail after 5 s

6.6. Setup

The Setup menu is the place where the user configures his test equipment and device behavior.

General: Setup menu for the NSG 3000A system

Equipment's: Setup menu for equipment's connected to the NSG 3000A test generator



Overview Setup

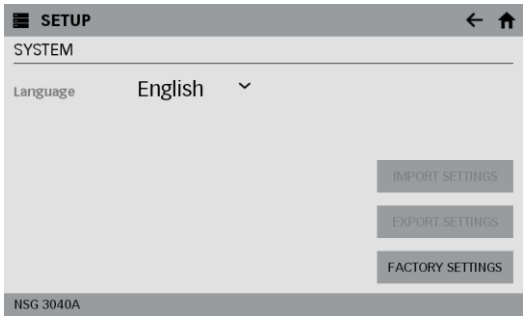
General

System:	Language, Display design, Home screen, Last test memory
Date & Time:	Setting date and time with format,
Process & Sync:	AC mains synchronization, timeout for sync and trigger, Power frequency detection, HV-COM 18 µF capacitor
Display:	Brightness
Sounds:	Loudspeaker volume; Sounds Test running; Test finish, enable/disable
Signals	Surge countdown; Waiting for trigger; warning signal, enable/disable
Application:	Surge coupling to HV-COM output with 18 µF enable/disable
Report:	Report settings implemented from V 3.0.0 and higher
Remote:	IP address, subnet mask, gateway, MAC address

Equipment's

Devices and Modules	List of all available Devices and Modules like Burst, Surge, Telecom Surge, Power Fail, Magnetic Field, Ring wave…
External Couplers:	3-phase coupling networks, Magnetic field antennas
Transformers:	Variac transformers, tapped transformers, H-field ac transformers

6.6.1. Setup / System menu



Language: Selection English (default), German, Espanol, Francais, Italian, Polish, Russia…

Import / Export Settings:
Export/ import the system settings to file *syssettings.bkp*

FACTORY SETTING:
Sets all parameters to the factory settings, even the messages.

6.6.2. Setup / Date and Time menu

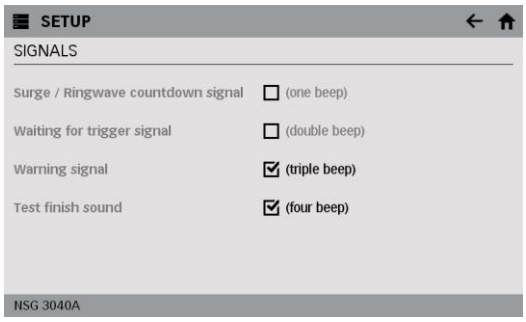
Set Date: Year; Month and Day from calendar
For set tap to the Year, Month (date)

Date format: dd.mm.yyy; dd-mm-yyyy, dd/mm/yyyy, yyyy-mm-dd

Set time: Hour; minute

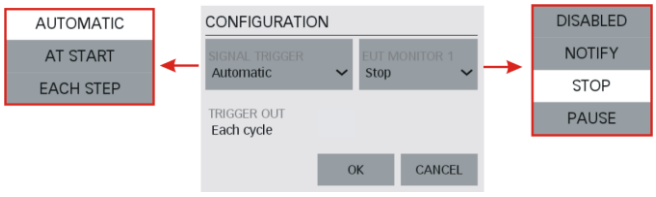
Time format: hh:mm:ss (24 h), hh:mm:ss (12 h)

6.6.3. Setup / Signals menu



Surge / Ring Wave countdown signal:
One beep 2 seconds before surge trigger
Disable: Default setting, no beep
Enable: Beep occurs 2 seconds before trigger release

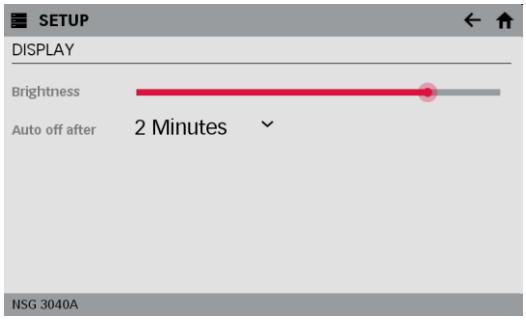
Waiting for trigger signal:
Waiting time to external trigger timeout
Disable: Default setting, no waiting (AUTOMATIC)
Enable: activate, request a setting of the SIGNAL TRIGGER (at start, each step).



Warning signal:
Disable: No warning signal
Enable: Triple beep for warning

Test finish sound:
Disable: No warning signal
Enable: Four beep for information that the test has finished

6.6.4. Setup / Display

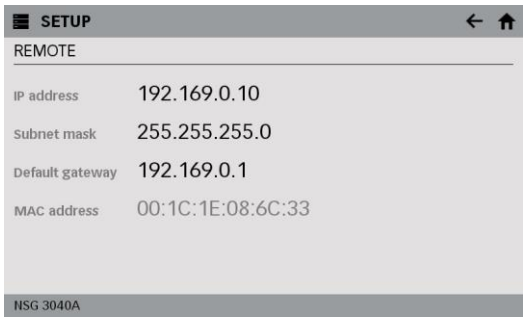


Brightness level:
Move the cursor to change

Timer: Dims the backlighting after the preset time if no touch is carried.

Setting:
1, 2, 10, 20 minutes
1 hour
never

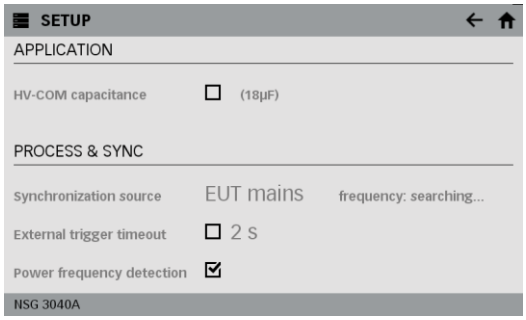
6.6.5. Setup / Remote



Individual setting for:
- IP Address
- Subnet Mask
- Standard Gateway

MAC Address: Device MAC address

6.6.6. Setup / Application / Process & Sync



HV – COM capacitance: HV – COM output at rear side direct or coupled with 18 µF

Synchronization: Phase angle sync form EUT line or from an external sync signal.

Internal: 1-phase: Phase L to N
10...300 VAC / 15...500 Hz
3-phases: Phase L1 to N

External trigger timeout: Waiting time to external trigger timeout

Disable: Default setting, no timeout

Enable: activate and set time [s]

Power Frequency detection:

Disable: No filter for Power Fail standard

Enable: Standard library is filtered to 50 Hz / 60 Hz

HV – COM capacitance: HV – COM output at rear side

Default setting is **"Enabled".** When using an AMETEK CTS coupling device with Sys.Link connection, the capacitor is automatically disabled. The recognized connected AMETEK CTS 3-phase CDN has already a built in 18 µF capacitor.

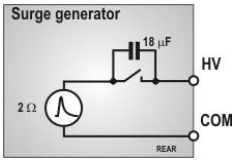
When using a CDN for signal and data lines, the user must consider, that the default settled capacitor of 18 µF is in series with the standard coupling capacitor of 0.5 µF. This reduces the total coupling capacity to 0.486 µF what is still inside the ±10% tolerance.

It is in the responsibility of the user to disable the default settled 18 µF capacitor.

Enable: - Generator impedance 2 Ω + **18 µF** coupling capacitor

Application: - External CDN without 18 µF capacitors

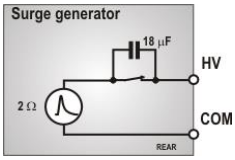
- Other application where 18 µF is required (pulsed H- field, surge verification at this output)



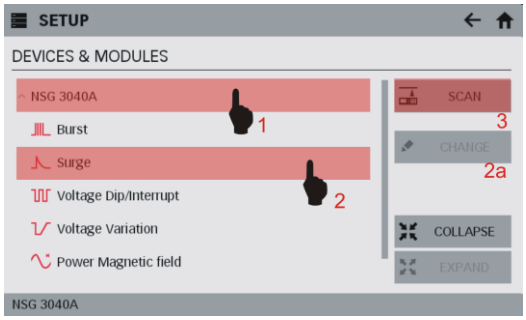
Disable: - Generator impedance is 2 Ω

Application: - External CDN with built in 18 µF capacitors

- Verification of the HV-COM output



6.6.7. Setup / Equipment / Devices & Modules

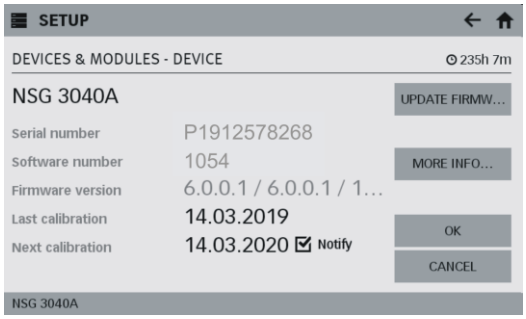


The Device & Modules screen shows all recognized modules in the present system.

System equipment's are displayed with his internal modules.

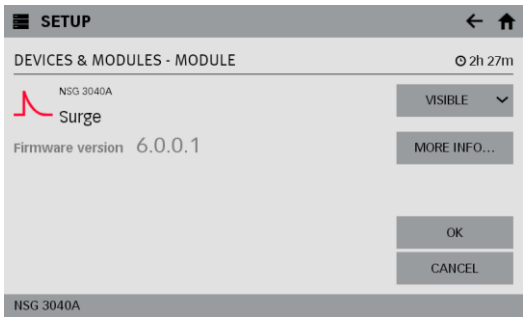
1 A "long press" to NSG 3040A will show the **serial number** and **software number** and **calibration info** of the NSG 3040A generator.

2 **Long press** or **click & CHANGE**
Will open the device & module – module information



Long press to NSG 3040A

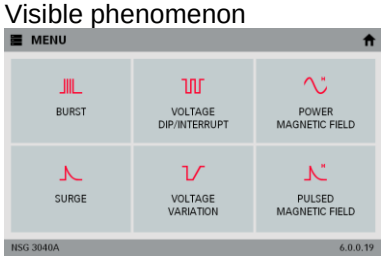
- Device name
- Serial number
- Software number
- Firmware version
- Calibration date / last - next
- Firmware Update NSG 3040A
-



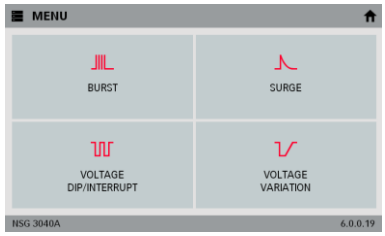
Long press to a module or **More Info** will show:

Module operating time:	hour, minutes
Phenomenon icon,	Pulse indication and name
Firmware version	Installed FW version
More Info	Module parameter
Visible:	Phenomenon **visible** or **hide** in the main menu.

Visible phenomenon

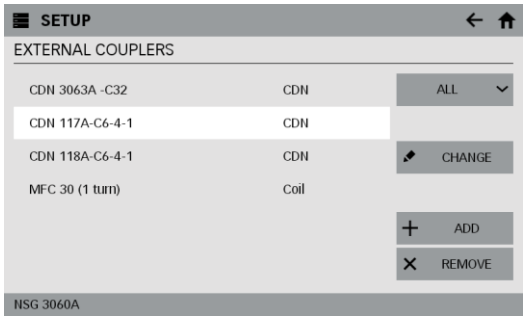


all NSG 3040A phenomenon



Hide of H-Field (pulse / power)

6.6.8. Setup / Equipment / External Couplers



Define and load an external coupler

ALL CDN & Coil

CDN external CDN or automatic detection, when connected

Coil Magnetic field coil

CDN coupling / decoupling network:

- CDN 117A C4-4-1
- CDN 117A C6-4-1
- CDN 118A C4-4-1
- CDN 118A C6-4-1
- CDN 3083-B100
- NSG 3040A: CDN 3043A-C32
- NSG 3060A: CDN 3063A-C32, CDN 3063A-C63, CDN 3063A-C100

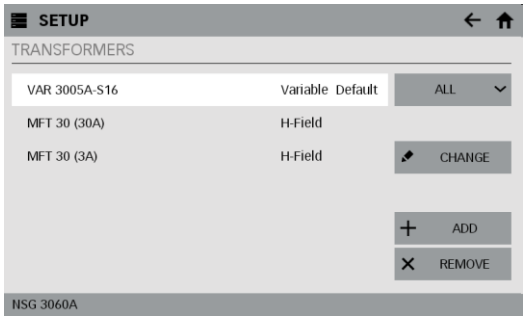
PS: Other CDN can be connected with HV - COM

Coil for magnetic field:

Actual device	replaced device
- MFC 30 (1 turn) pulse & power (power with MFG 40-100)	INA 702 (1 turn) pulse
- MFC 30 (11 turns) (power with MFG 40-100)	INA 702 (11 turns) power
- MFC 300 (1 turn)	INA 703 (1 turn)
- MFC 300 (5 turns) (power with MFG 40-100)	INA 703 (5 turn)
- MFC 300 (37 turns) (power with MFG 40-100)	INA 703 (37 turn)
- MFC 1000 for use with NSG 30x0A (pulse & power)	
- MFC 1000.1 for use with NSG 30x0A (pulse & power)	

PS: INA 701 can be simulated by an INA 702 (1 turn)

6.6.9. Setup / Equipment / Transformers



Define and load an external transformer

Variable Motorized variac transformer

Tapped Tapped transformer

H-Field Magnetic field current transformer

Default transformer Library that can selected by + ADD

Variable Transformer:

- Var 3005A-S16A

Tapped Transformer:

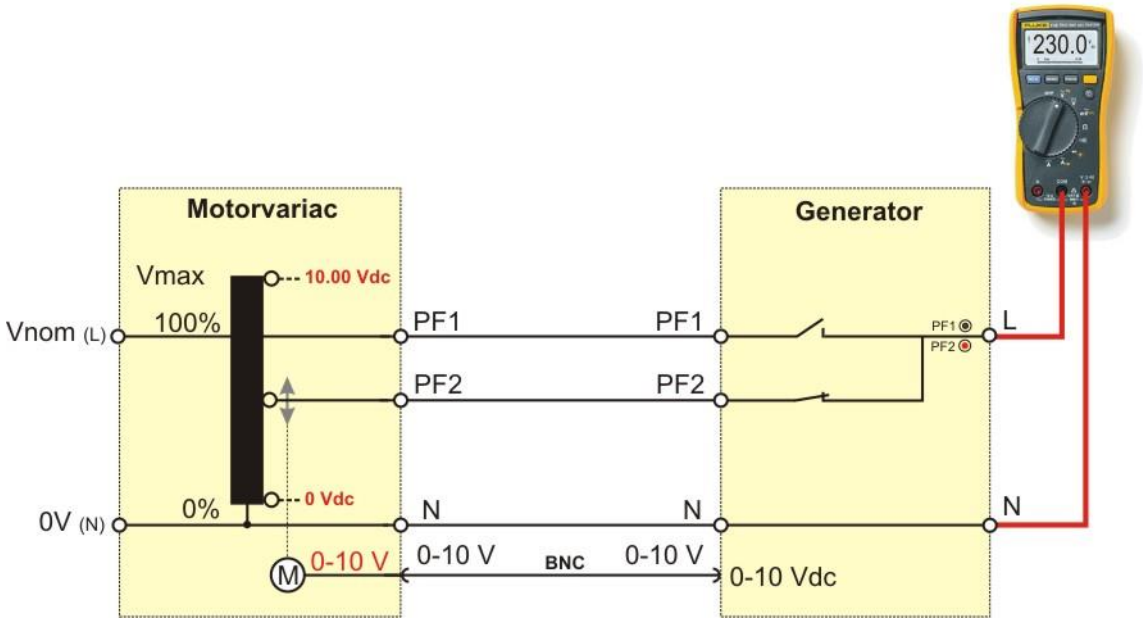
- TVT 1-250-16 previous V 4780
- TVT 1-250-16.1 previous V 4780 S2

H-Field Transformer

- MFT 30 (3 A) previous MC 2630 (3 A)
- MFT 30 (30 A) previous MC 2630 (30 A)

6.7. Variable voltage transformers adjustment procedure

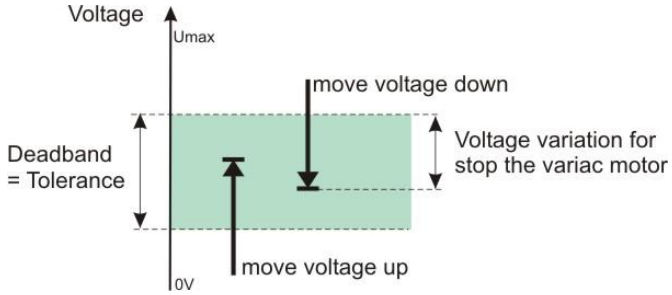
The NSG 3000A can control an external voltage source with a 0-10 V analogue DC signal.
The 10 V level corresponds to the max. output voltage of the connected VAR 3005A-S16. For the correct setting it is necessary to know the max. output voltage of the source. For setting for AC or DC source the same procedure is necessary.



Setup for adjust the external voltage variable transformer to the NSG 3000A

The voltage setting is a regulating procedure where one winding of the VAR 3005A-S16 is approx. 1.9 V. Additionally the control needs some mechanical tolerance for stop the step motor. Therefore, the selected voltage is normally in a tolerance of ±4 V

The VAR 3005A-S16 control has an internal dead-zone where the voltage will not be adjusted.



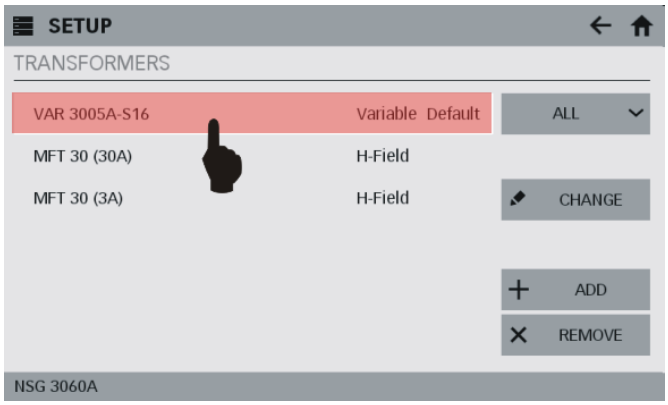
The following procedure will guide the user through the Set Voltage procedure.
The setting procedure for Vmax and Vnom is listed in the figures below.

If the output voltage is out of the tolerance, change the Vmax voltage and repeat the procedure.

6.7.1. Adjustment procedure for variable transformers

For adjust a variable transformer, select first the device to adjust in: **Menu / Setup / Transformers / Variable**

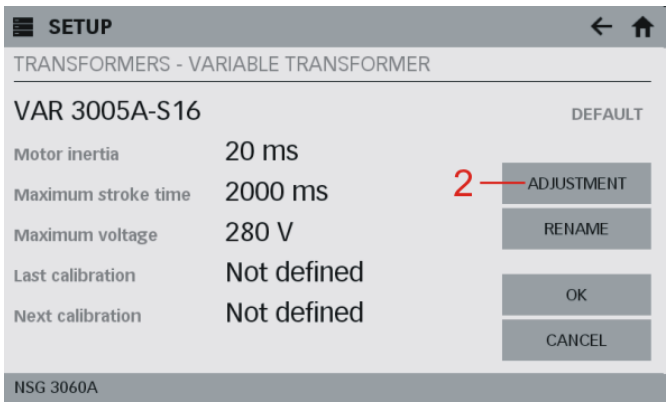
1. Select **CHANGE** or make a **Long click** into the device for change into the software setup.
   This will rotate the screen and opens the configuration parameter of the device.



Adjustment procedure

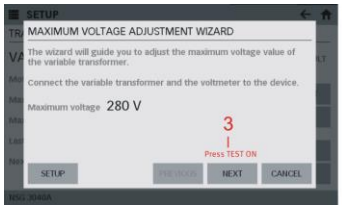
The adjustment procedure has the following structure:

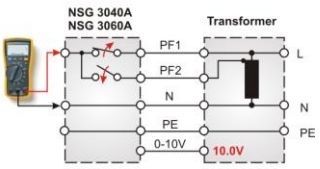
2. Press **ADJUSTMENT** for start the adjustment procedure.



Initialize the adjustment wizard

For prepare
- Press **TEST ON** (if not activated)
- Connect variable transformer at the rear side to the generator to plug PF1, PF2, N, PE
- Connect a multimeter to the front side connectors “Test supply” output L and N

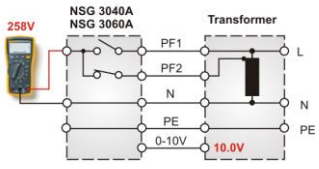




3. Press **Next** to continue or **Cancel** for exit.

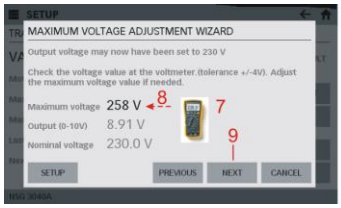
Detect the max. variable transformer output voltage
- Settled nominal voltage: to max. voltage
- Output (0-10 V) voltage: 10.00 V

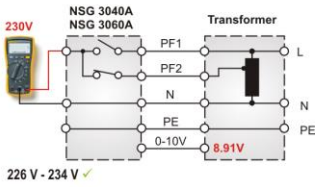
4. **Read the value** at the voltmeter and
5. Enter the value to **maximum voltage** field
6. Press **NEXT** to continue



Check at Vnom (230 V) level. variable transformer output voltage

- Settled nominal voltage: $=V_{nom}$ (230 V)
- Output (0-10 V) voltage: 230 V/Max. voltage *10.00 V

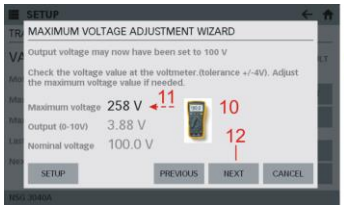


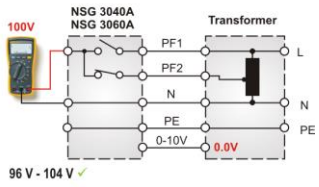


7. **Read the value** at the voltmeter and check if the value is inside the tolerance of ± 4 V
8. If needed correct the **maximum voltage**
   - **decrease** the value for higher voltage
   - **increase** the value for lower output
9. Press **NEXT** to continue

Check at Vnom (100 V) level. variable transformer output voltage

- Settled nominal voltage: = V_{nom} (100 V)
- Output (0-10 V) voltage: 100V/Max. voltage *10.00 V

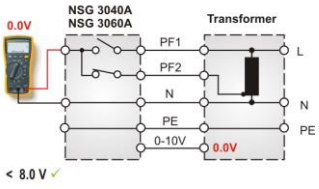




10. **Read the value** at the voltmeter and check if the value is inside the tolerance of ± 4 V
11. If needed correct the **maximum voltage**
    - **decrease** the value for higher voltage
    - **increase** the value for lower output
12. Press **NEXT** to continue

Check at Vnom (0 V) level at zero position

- Settled nominal voltage: = V_{nom} (0 V)
- Output (0-10 V) voltage: 0 V to 0.3 V

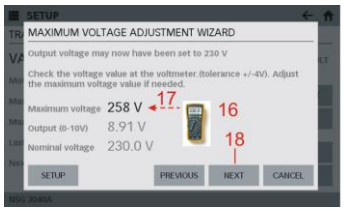


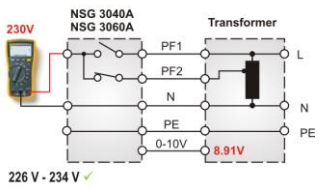
13. **Read the value** at the voltmeter and check if the value is below 8 V
14. If needed correct the **maximum voltage**
    - **decrease** the value for higher voltage
    - **increase** the value for lower output

    NOTE: The correction at this level will change the voltage only marginal. Note that one transformer winding is approx. 1.9 V
15. Press **NEXT** to continue

Check at Vnom (230 V) level. variable transformer output voltage

- Settled nominal voltage: $=V_{nom}$ (230 V)
- Output (0-10 V) voltage: 230 V/Max. voltage *10.00 V





16. **Read the value** at the voltmeter and check if the value is inside the tolerance of ± 4 V
17. If needed correct the **maximum voltage**
    - **decrease** the value for higher voltage
    - **increase** the value for lower output
18. Press **NEXT** to continue

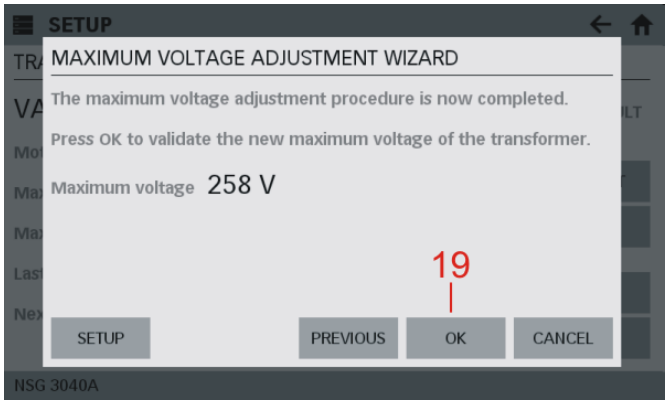
Final screen of max. voltage adjustment

- Settled nominal voltage: $=V_{nom}$ (230 V)
- Output (0-10 V) voltage: 230 V/Max. voltage *10.00 V

19. OK: Write the max. Voltage value into the parameter list and exit wizard.

Previous: Jumpers to the previous page

Cancel: Exit the wizard without change

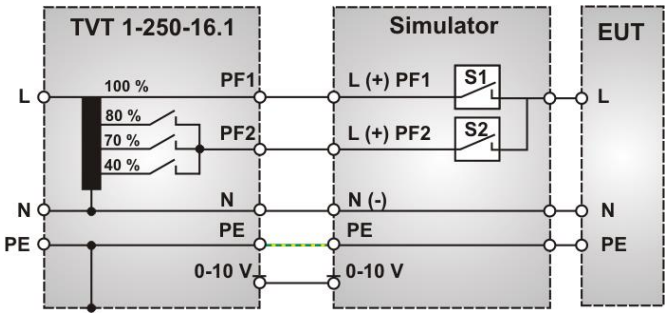


6.7.2. Adjustment procedure for tapped transformers with analogue DC control voltage

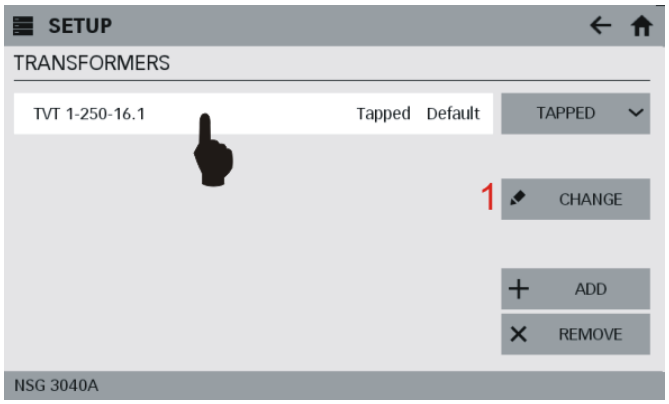
For adjust a tapped transformer, select first the device to adjust in: **Menu / Setup / Transformers / Variable**

The tapped transformer is programmed that the **nominal voltage** corresponds to **10.0V dc** as **100%** for set. The settings are defined as following:

Position	ref dc voltage
80%	8.00 V ± 0.35V
70%	7.00 V ± 0.35V
40%	4.00 V ± 0.35V



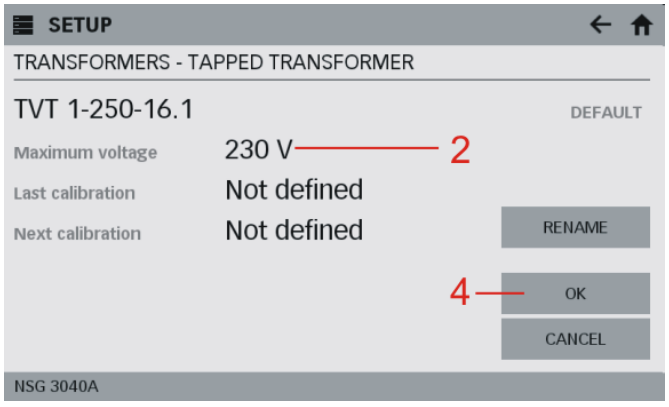
Example for automatic tapped transformer
TVT 1-250-16.1



1. Make a **click**, **Long click** into the device or press **CHANGE** button for change into the software setup.
   This will rotate the screen and opens the configuration parameter of the device.

Adjustment procedure

The 100% value of the tapped transformer must correspond to the actual nominal voltage of the EUT.

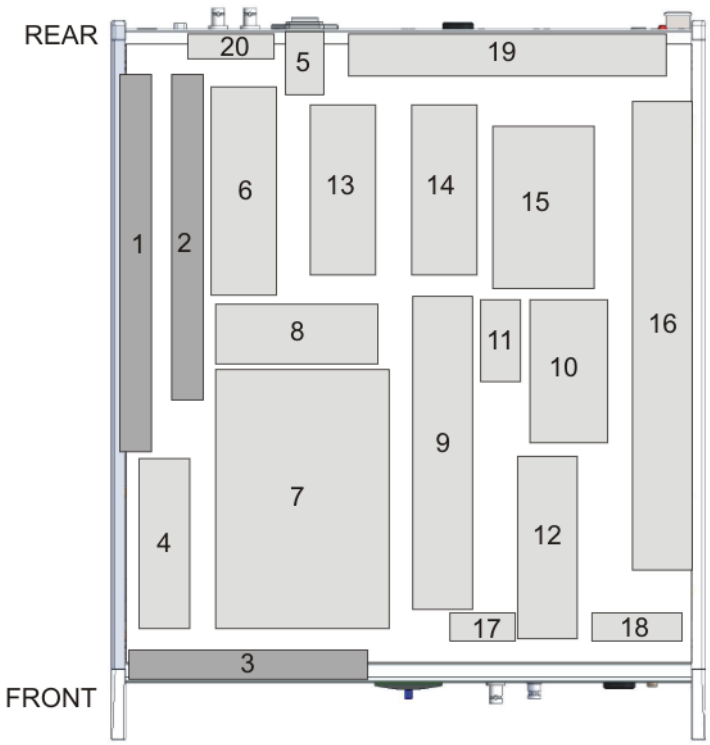


3. Press **230 V** for adjust the 100% voltage
4. Enter the nominal EUT voltage used for the test (**100 V, 115 V, 220 V or 230 V**) and confirm with **OK**.
5. Confirm and exit with **OK**

7. Test Equipment NSG 3040A and NSG 3060A series

The simulator NSG 3040A is separated in different main parts. The control unit is screened to all other parts.

7.1. NSG 3040A

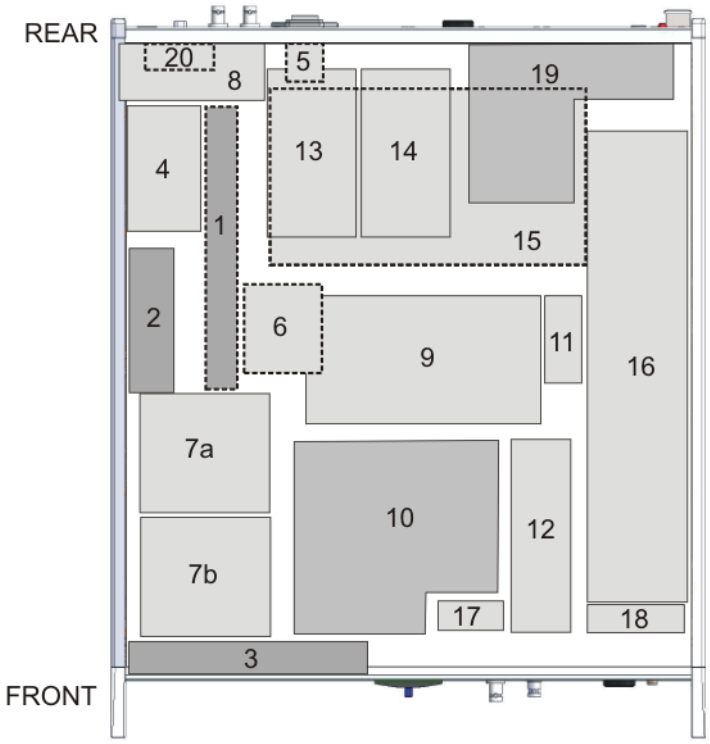


Control unit
1 App board controller
2 Device board controllers
3 HMI board, touch panel

Power supply
4 Power supply
5 Mains filter

High voltage unit
6 High voltage power supply
7 Energy storage capacitors, Pulse forming
8 Measuring Unit
9 Surge pulse forming unit
10 Surge coupling capacitor
11 Surge pulse measuring transformer
12 Burst pulse forming unit
13 Power Fail switch PF2
14 Power Fail switch PF1
15 decoupling inductors 1.5 mH
15 Measuring unit
16 Coupling relays surge
17 not used
18 Burst Coupling board
19 Back filter board
20 Rear panel interface board

7.2. NSG 3060A



Control unit
1 App board controller
2 Device board controllers
3 HMI board, touch panel

Power supply
4 Power supply
5 Mains filter

High voltage unit
6 High voltage power supply
7a Energy storage capacitor, Surge
7b Energy storage capacitor, Ring wave
8 not used
9 Surge pulse forming unit
10 Ring wave pulse forming unit
11 Surge pulse measuring transformer
12 Burst pulse forming unit
13 Power Fail switch PF2
14 Power Fail switch PF1
15 decoupling inductors 1.5 mH
15 Measuring unit
16 Coupling relays surge
17 not used
18 Burst Coupling board
19 Back filter board
20 Rear panel interface board

8. Technical data

8.1. EFT Electrical Fast Transients Burst as per IEC 61000-4-4

Test Level	**NSG 3040A series**	**NSG 3060A series**
Open circuit voltage V*	200 V – 4800 V ± 10% Step 1 V	Technical data for Burst is identical with the NSG 3040A devices
Wave shape into a 50Ω load	100 V – 2450 V	
Rise time tr	5 ns ± 30%	
Pulse duration td	50 ns ±30%	
Wave shape into a 1000Ω load	200 V – 4800 V	
Rise time tr	5 ns ± 30%	
Pulse duration td	35 ns – 150 ns	
Source impedance	Zq = 50 Ω ± 20%	
Polarity Pol	Positive / negative / alternate	
Trigger		
Trigger of bursts	AUTO, MANUAL	
Synchronization	0 - 360°, 10...300 VAC / 15...500 Hz	
Burst duration td	0.10 ms – 9999 ms	
Burst period rate tr	15 ms – 9999 ms	
Spike repetition frequency f	100 Hz – 1000 kHz	
Duration T (test)	1 s – 9999 s 1 min - 1600 min	
Output		
Direct via 50 Ω coaxial connector	To connect ext. coupling devices	
Coupling network Cpl	To L, N, PE all combinations	

Range	Step
< 10 kHz	1 Hz
10 – 1000 kHz	1.0 kHz

Test routines	
Quick Start	Immediate start, all parameters adjustable during a running test
Standard test as per	IEC 61000-4-4 level 1-4 to power lines
separated to (AC / DC)	IEC 61000-4-4 level 1-4 to signal lines

* With Burst pulses as per. IEC 61000-4-4 Ed 3: 2012 the max. output voltage with external CDN can be limited.

8.2. SURGE Immunity requirements as per IEC 61000-4-5

8.2.1. Technical data surge module for NSG 3040A series

Test Level	**NSG 3040A** (16A)				
Open circuit voltage V	200 V – 4800 V ± 10% Step 1 V				
Short circuit current	100 A – 2400 A ± 10%				
Wave shape open circuit					
coupling	18 µF line to line	9 µF line to ground			
Front time tr	1,2 µs ± 30%	1,2 µs ± 30%			
Pulse duration	50 µs +10 µs/-10 µs	50 µs +10 µs/-25 µs			
Wave shape short circuit					
coupling	18 µF line to line	9 µF line to ground			
Front time tr	8 µs ± 20%	2.5 µs ± 30%			
Pulse duration	20 µs ± 20%	25 µs ± 30%			
Polarity Pol	Pos., Neg., Alt				
Repetition (pulse) tr	10 s - 9999 s				
Number of cycles n	1 - 99'999				
Counter	1 – 1’000’000				
Trigger					
Trigger of pulses	AUTO, MAN				
Phase Angle synchronization A	0 - 360°, 10...300 VAC / 15...500 Hz				
Resolution	1°				
Trigger					
Trigger	5 V Trigger				
Output			**no capacitor**	**9 µF**	**18 µF**
Direct HV-COM	HV-Banana connector, Zi = 2Ω		x		x
Coupling network	L – N with Z = 2Ω				x
	L-PE, N-PE, L+N-PE with Z = 12Ω			x	
DUT supply	AC 300 V / 16 A / 50/60 Hz DC 300 V / 16 A				
Test Routines					
Quick Start	Immediate start, all parameters adjustable during a running test				
Standard test routines *separated to (AC / DC)*	IEC 61000-4-5 one level: Selectable level 1 to 4 IEC 61000-4-5 all levels: Starts from lowest level to selected level IEEE Std C62.41.2 ANSI A, ANSI B, NG				

8.2.2. Technical data surge module for NSG 3060A series

Test Level	NSG 3060A (16 A)				
Open circuit voltage V	200 V – 6600 V ± 10% Step 1 V				
Short circuit current	100 A – 3300 A ± 10%				
Wave shape open circuit					
coupling	18 µF line to line	9 µF line to ground			
Front time tr	1,2 µs ± 30%	1,2 µs ± 30%			
Pulse duration	50 µs +10 µs/-10 µs	50 µs +10 µs/-25 µs			
Wave shape short circuit					
coupling	18 µF line to line	9 µF line to ground			
Front time tr	8 µs ± 20%	2.5 µs ± 30%			
Pulse duration	20 µs ± 20%	25 µs ± 30%			
Polarity Pol	Pos., Neg., Alt				
Repetition (pulse) tr	10 s* - 9999 s				
Number of cycles n	1 - 99'999				
Counter	1 – 1’000’000				
Trigger					
Trigger of pulses	AUTO, MAN				
Phase Angle synchronization A	0 - 360°, 10...300 VAC / 15...500 Hz				
Resolution	1°				
Trigger					
Trigger	5 V Trigger				
Output			**no capacitor**	**9 µF**	**18 µF**
Direct HV-COM	HV-Banana connector, Zi = 2Ω		x		x
Coupling network	L – N with Z = 2Ω				x
	L-PE, N-PE, L+N-PE with Z = 12Ω			x	
DUT supply	AC 300 V / 16 A/ 32 A / 50/60 Hz				
	DC 300 V / 16 A/ 32 A				
Test Routines					
Quick Start	Immediate start, all parameters adjustable during a running test				
Standard test routines *separated to (AC / DC)*	IEC 61000-4-5 one level: Selectable level 1 to 4 IEC 61000-4-5 all levels: Starts from lowest level to selected level IEEE Std C62.41.2 ANSI A, ANSI B, NG				

* depends on charging voltage

8.3. Pulsed magnetic Field as per IEC 61000-4-9

Test Level	**NSG 3040A series**	**NSG 3060A series**
Generator charging voltage V	200 V – 4800 V ± 10% Step 1 V	200 V – 6600 V ± 10% Step 1 V
Input as H-Field H	approx. 1 – 2100 A/m depend magnetic factor setting	approx. 1 – 2100 A/m depend magnetic factor setting
Short circuit current	100 A – 2400 A ± 10%	Approx. 100 A to 3300 A ± 10%
Wave shape		
Rise time tr	8 µs ± 20%	
Pulse duration	20 µs ± 20%	
Polarity	Pos., Neg., Alt	
Repetition (pulse) tr	10 s* - 9999 s	
Number of cycles n	1 - 99'999	
Counter	1 – 1’000’000	
Trigger		
Trigger of pulses	AUTO, MAN	
Phase Angle synchronization	0 - 360° (15 – 500 Hz)	
Resolution	1°	1°
Trigger		
Trigger	5 V Trigger	

Output		**no**	**9 µF**	**18 µF**
Direct HV-COM	HV-Banana connector, Zi = 2Ω	x		x
Coupling network	L – N with Z = 2Ω (not preferred)			x

Settings		
Impedance factor [V/A]	0.01 to 100 setting range	typical 0.45 with INA 702
Coil factor setting [m^{-1}]	0.01 to 100 setting range	Typical 0.87
Test Routines		
Quick Start	Immediate start, all parameters adjustable during a running test	
Magnetic field test	test routine as per IEC 61000-4-9 test level 100, 300 and 1000 A/m cont. adjustable within Quick Start	

* depends on charging voltage

Magnetic field tests per IEC 61000-4-9

The test routines for handling the magnetic field tests are included in the internal NSG firmware. All functions to control external options as voltage/current sources or magnetic field antennas are included. In addition, the following hardware is required:

Option required for Magnetic Field Test per IEC 61000-4-9

- Magnetic field antenna (square 1 m x 1 m coil MFC 1000, MFC 1000.1, MFC 30)
- MFC 30: Adapter **Pulse** must be used for pulsed magnetic field test.

8.4. Power Fail Generator for DIPS, interruption and voltage variation as per IEC 61000-4-11

EUT supply	**Model NSG 3040A / NSG 3060A series**	
Channel PF1 and PF2		
AC voltage/current	max. 300V/ 16 A	
Mains frequency	50/60 Hz	
DC voltage/current	max. 300 V/ 16 A	
Inrush current	more than 500 A	
Protection	Electronic fuse for continuous overcurrent / inrush currents Electronic control of overheating PF1 and PF2 are safe against short circuit	
max. current channel PF1	nominal current continuous	
max. current channel PF2	nominal current continuous	
Trigger		
Events trigger	AUTO, MAN	
Reduced time td	0.01 ms – 9’999 ms 1 – 9999 s 0.5 – 9999 cycles	Accuracy 0.05 %
Repetition tr	10 ms - 9’999 ms 1 – 9999 s	Accuracy 0.05 % + phase sync
Number of cycles preselection n	1 - 99'999	
Counter	1 – 1’000’000	
Synchronization A	0 - 360°, 10...300 VAC / 15...500 Hz	
Max voltage	Max. 300 V or same as EUT voltage specs.	
Resolution	1°	

Trigger / Variable transformer control	
Trigger	positive going flank
0-10 V Control Output	0-10 Vdc for external voltage source

Test routines		
Quick Start	Immediate start, all parameters adjustable during a running test	
Standard test routines	as per IEC 61000-4-11 as per IEC 61000-4-29	ac power ports dc power ports

8.5. Power Magnetic Field as per IEC 61000-4-8

Parameter	**Value**	
H-Field	1 to approx. 40 A/m using MFT 30 depend magnetic factor setting	
Frequency	50/ 60 Hz depend on mains frequency	
Coil factor settable		
Settings		
Transformer factor [V/A]	0.01 to 100 setting range	
Coil factor setting [m^{-1}]	0.01 to 100 setting range	typical 0.87 for 1 m x 1 m coil
Protection	PF1: open, not connected by the user PF2 set to zero volt when not in operation	

Magnetic field tests per IEC 61000-4-8 and -9

The test routines for handling the magnetic field tests are included in the internal NSG firmware. All functions to control external options as voltage/current sources or magnetic field antennas are included. In addition, the following hardware is required:

Option required for Magnetic Field Test 50/60Hz per IEC 61000-4-8

- External transformer (VAR 3005A-S16) and magnetic field antenna (square 1 m x 1 m coil MFC 1000 or MFC 1000.1)
- External current transformer (MFT 30) with 1 turn to test 1, 3, 10 and 30 A/m levels
- External current transformer (MFT 100) with 1 turn to test 100, 300 and 1.000 A/m levels (300 and 1.000 A/m are short-term tests of 3 sec.)

8.6. Ring wave Generator as per IEC 61000-4-12

The ring wave module is only for NSG 3060A series available.

Test Level	**NSG 3060 series**
Open circuit voltage V	200 V – 6600 V ± 10% Step 1 V
Voltage	Wave shape (open circuit)
Rise time	0.5 µs ± 30% (first peak)
Oscillation frequency	100 kHz ± 10%
Decaying	Peak 2 to peak 1 = 40 - 110% Peak 3 to peak 2 = 40 - 80% Peak 4 to peak 3 = 40 - 80%
Current	Wave shape (short circuit)
Rise time	0.2 µs < tr <= 1.0 µs
Oscillation frequency	100 kHz ± 10%
Source impedance Z	12 Ω, 30 Ω, 50 Ω
Peak current	As per selected source impedance
Polarity	Positive, negative, alternate
Trigger	
Trigger of pulses	AUTO, MAN
Phase angle synchronization A	0° - 360°, resolution 1°
Repetition tr	10 s* - 9999 s
Number of cycles (event) n	1 - 99,999, selectable
Outputs	
Direct	Via HC-COM, safety lab connectors
Coupling mode	IEC: L-N, L-PE, N-PE, L+N-PE ANSI: L-N, L-G, N-G, L+N-G
CRO trigger	5 V trigger signal for oscilloscope

Test Routines	
Quick Start	Immediate start, all parameters adjustable during a running test
Standard test routines *separated to (AC / DC)*	IEC 61000-4-12 one level: Selectable level 1 to 4 IEC 61000-4-12 all levels: Starts from lowest level to selected level IEEE STD C 62.41.2 Cat A, B Power lines IEEE STD C 62.41.2 Cat A, B Signal lines IEEE STD C 62.41.2 Cat A, N_G Nearby Power / Signal IEEE STD C 62.41.2 Cat A, N_G Far Power / Signal IEEE STD C 62.41.2 Cat A, N_G All Power / Signal

* depends on charging voltage

8.7. Telecom Surge Generator as per IEC 61000-4-5 (T-Surge module)

The Telecom surge module is only for NSG 3060A series available.

As per ITU and ETS recommendations

	NSG 3060A
Output voltage open circuit V	200 V – 6'600 V ±10 %
Pulse 10/700µs	
Front time T_F (rise time tr)	10 µs ± 30 % (1.0 µs ± 30 %)
Pulse duration td	700 µs ± 20 %

As per FCC part 68 Pulse B

Output voltage open circuit V	200 V – 6'600 V ±10 %
Front time T_F	9 µs ± 30 %
Pulse duration td	720 µs ± 20 %
Output current short circuit	5 – 165 A
Rise time tr	5 µs ± 30 %
Pulse duration td	320 µs ± 20 %

As per IEC 61000-4-5

Pulse 10/700µs	
Open circuit output voltage V	200 V – 6'600 V ±10 %
Rise time tr	10 µs ± 30 %
Pulse duration td	700µs ± 20 %
Short circuit output current	5 – 165 A
Rise time tr	5 µs ± 20 %
Pulse duration td	320 µs ± 20 %

Coupling

As per ITU	For 2 wire T1 and T2 with 25 Ω each
As per FCC part 68	For 2 wire T1 and T2 with 25 Ω each
As per IEC 61000-4-5	For 4 wire T1, T2, T3, T4 with 25 Ω each External networks are required for other applications (options)

General

Polarity	Pos., Neg., Alt
Repetition ts	max. 0.1 Hz (10 s* - 9999 s)
Number of cycles (event) n	1 - 99'999
Counter	1 – 1'000'000

Pulse circuit	matched for meet the 10/700 µs - 5/320 µs waveshape
Energy storage capacitor	20 µF ± 20%
Rs Pulse duration resistor	50 Ω ± 20%
Rm Impedance matching resistor	15 Ω ± 20%

Dimensions

Housing	Additional 19", 3HU, 450 x 500 x 155 mm at the device bottom

* depends on charging voltage

8.8. EUT Supply Specifications

Standard models

Model	CDN	Remarks
NSG 3040A series	300 VAC* / DC 16 A 1- phase	
NSG 3060A series	300 VAC* / DC 16 A 1- phase	

* AC 50/60 Hz

EUT Fuse
The NSG 3040A and NSG 3060S models have **no internal fuse for the EUT** supply.
The user is responsible to adapt a suitable fuse for the EUT outside the generator

8.9. General Specifications

Mains supply	85 to 264 Vac, 50/60 Hz	
Power consumption	75 W	
Fuse	115 V: 2 x 4 AT slow blow	
	230 V: 2 x 2 AT slow blow	
Safety		
Safety circuit	External interlock capability	
Warning lamp	voltage free contact max. 60 V, 2 A	
Design	As per IEC 1010, EN 61010	
Interfaces		
Serial interface	1 x USB A rear side	for memory stick
	1 x USB B	for service purpose only
	1x opto-link	user remote interface (convert to USB port on computer, Baud rate 9.600 Bd)
LAN	Ethernet	user remote interface
SYS link IN, OUT	26 pin high density Sub D to control external devices	
Analog output	BNC 0-10V DC, to control an external power supply	

EUT1, input

Digital input	+ 15 V to 0 V, negative slope to zero
Trigger level	2 V ±1 V
Input impedance	> 10 kΩ
Max. Input voltage	+ 20 V

Device	Frame	Dimension (W x H x D)	Weight
NSG 3040 IEC	19" / 3 HU	448 x 154 x 500 mm	app 25 kg
NSG 3060 IEC	19" / 6 HU	448 x 286 x 500 mm	app 30 kg
NSG 3060 ANSI	19" / 6 HU	448 x 286 x 500 mm	app 34 kg
NSG 3060 FULL	19" / 9 HU	448 x 440 x 500 mm	app 45 kg

8.10. Environmental conditions

Operating temperature	10 °C to 35 °C
Storage temperature	-10 °C to 50 °C
Transport temperature	-10 °C to 50 °C
Humidity	30 % to 70 %; non-condensing
Atmospheric pressure	86 kPa (860 mbar) to 106 kPa (1 060 mbar)

=> Not relevant data for the standards can be changed by the manufacturer <=

9. Maintenance setup and service

9.1. General

Inside the test system there are no adjustable elements accessible to the user neither for calibration nor for maintenance purpose.
The housing of the test system must not be opened. Should any maintenance or adjustment become necessary, the whole test system, together with an order or fault report, should be sent to an AMETEK CTS service center.

9.2. Maintenance and cleaning

The generator is maintenance-free by using a solid-state semiconductor switch to generate transients. Maintenance by the user is restricted to cleaning the outer housing, performing a function check and verification of the pulse parameters.

In general, a moist cloth is enough for cleaning the outer housing, including the touch panel. If necessary add a small amount of a mild, non-foaming household cleanser.

No chemicals (acid, etc.) should be used for cleaning purposes.

Before beginning to clean the test system ensure that it is switched off and the mains power cable is unplugged from the supply.

9.3. Test setup

When setting up the test national and international regulations regarding human safety must be guaranteed.

It is recommended to connect the simulator to the ground reference plane of the test setup.

The generators of the NSG 3000A series and their coupling networks, can be linked together to a fully automotive test setup.

The setup communicates via the Ethernet / optical link is controlled by software. For setting up the system see the following figures:

9.4. Insulating- or external transformer for EUT power supply

The recommended power of an external transformer must be **> 500VA**. The reason is the capacitive current of the internal filter capacitors inside the NSG 3000A.

9.5. Calibration and verification

9.5.1. Factory calibration

Every AMETEK CTS generator is entirely checked and calibrated as per international standard regulations before delivery. A calibration certificate is issued and delivered along with a list of the equipment used for the calibration proving the traceability of the measuring equipment. All auxiliary equipment and accessories are checked to our internal manufacturer guidelines.

The calibration certificate and the certificate of compliance (if available) show the date of calibration.

The AMETEK CTS equipment is calibrated in the factory and marked with a calibration mark. The used measuring instruments are traceable to the Swiss Federal Office of Metrology.
The calibration date is marked. The validity of the calibration is to the responsibility of the user's quality system. Neither the certificate of calibration nor the corresponding label marks any due date for re-calibration.

Examples: Calibration mark

9.5.2. Guideline to determine the calibration period of AMETEK CTS instrumentation

Our International Service Departments and our QA Manager are frequently asked about the calibration interval of AMETEK CTS equipment.

AMETEK CTS doesn't know each customer's Quality Assurance Policy, nor do we know how often the equipment is used and what kind of tests is performed during the life cycle of test equipment. Only the customer knows all the details and therefore the customer needs to specify the calibration interval for his test equipment.

In reply to all these questions we like to approach this issue as follows:
AMETEK CTS make use of a solid-state semiconductor switch technique to generate high voltage transients. A precious advantage of this technique is the absolute lack of periodical maintenance effort. In consequence, thereof a useful calibration period must be defined based on two criteria:

- The first one is the customer's Quality Assurance Policy. Any existent internal regulation must be applied at highest priority. In the absence of such internal regulation the utilization rate of the test equipment must be taken into consideration.
- Based on the experience and observation collected over the years **AMETEK CTS recommends a calibration interval of 1 year** for frequently used equipment. A 2-years calibration interval is considered enough for rarely used test generators to assure proper performance and compliance to the standard specifications.

9.5.3. Calibration of Accessories made by passive components only

Passive components do not change their technical specification during storage. Consequently, the measured values and the plots stay valid throughout the storage time. The date of shipment shall be considered as the date of calibration.

9.5.4. Periodically In-house verification

Please refer to the corresponding standard before carrying out a calibration or verification. The standard describes the procedure, the tolerances and the necessary auxiliary means. Suitable calibration adapters are needed. To compare the verification results, AMETEK CTS suggests for refer to the waveshape and values of the original calibration certificate.

All calibrations and verifications are always done without mains supply voltage connected to the coupling network input.


Danger

Before starting the calibration or verification

remove the EUT Mains Supply

from the generator and from the coupling network

10. Delivery Groups

10.1. Basic equipment

- Generator model: NSG 3000A model with recommended modules (Burst, Surge, Power Fail, Magnetic Field, Telecom Surge)
- Mains cable
- Mains cable for the EUT supply
- Adapter for power cable
- Manual
- Calibration certificate

10.2. Accessories and options

- **ESA Adapter for adapt different power mains connectors**

As accessories adapters to different power mains connectors are part of the delivery of AMETEK CTS surge generators. E.g. these are adaptors for Schuko - US - AUS - UK power mains connectors.

Most of these commercially available power mains sockets cannot withstand surge voltages higher than 4000V. Therefore, each of these adaptors are labeled to be **used up to 4000V** maximum.

In case that the surge generator can generate higher surge voltages than 4000V a sparkover at the power mains socket may occur.

Customers shall be aware of this matter and shall **not use higher voltages than labeled** on the adapter.

For **testing higher voltage**, it is necessary to use high voltage cables with enough isolation and safety banana connectors connected direct to the generator output plugs (L-N-PE).

Burst

- **PVF BKIT 1** Calibration kit for Burst verification on EUT output including PVF 50 + PVF 1000 and PVF AD1 adapter

- **PVF AD1** adapter for calibration
- **PVF 50** Matching resistor 50 Ω with integrated attenuator (1:100)

- **PVF 1000** Matching resistor 1000 Ω with integrated attenuator (1:500)

- **CCI** Industrial capacitive coupling clamp as per IEC 61000-4-4 to couple the fast transients to signal and data lines.

- **CCI PVKIT 1** Calibration kit for capacitive coupling clamp as per IEC 61000-4-4 Ed.3
  - Flexible plate insulated
  - Support for PVF 50 and adapter to PVF 50

- ITP EF Radiating set for immunity and emission

- **A6dB** as additional 6 dB / 50 Ω attenuator of the test signal

- **PUW 500** EUT monitoring

Surge

Power Fail

- **TVT 1-250-16 tapped transformer**
  - Transformer with taps at 40 % &, 70 %, 80 %
  - 230 V / 16 A

- **TVT 1-250-16.1 tapped transformer**
  - Transformer with automatic controlled taps at 40 % &, 70 %, 80 %
  - 230 V / 16 A

- **VAR 3005A-S16**
  - Variable transformer 0-260 V / 16 A
  - Control signal 0-10 Vdc.

Magnetic field

MFC 30 Magnetic field antenna

- **MFT 30** Current transformer up to 30 A/m

MFT 30

General CDN for Burst and Surge

- **CDN 30X3 coupling network**
  - EUT AC mains 3 x 480 V rms max
  - EUT DC supply see derating in CDN manual
  - Nominal current Inom = 32A / 63A / 100 A rms / DC
  - Frequency 50/60 Hz
  - Coupling to all lines, N, PE
  - 50 Ω Burst output coupling will be controlled by the NSG 3000A generator
  - Output for Surge coupling to other coupling networks as CDN models.

- **User software " iec.control "**
  - Test, analysis and documentation with Windows
  - License version for testing according the most automotive standards
  - Report generator with export function to word-processing software

UOC optical Interface

- **USB-Optolink Converter**
  - USB Optolink converter
  - Optical Fiber cable, 5m

11. EFT Burst as per IEC 61000-4-4

Burst Module 5/50 ns

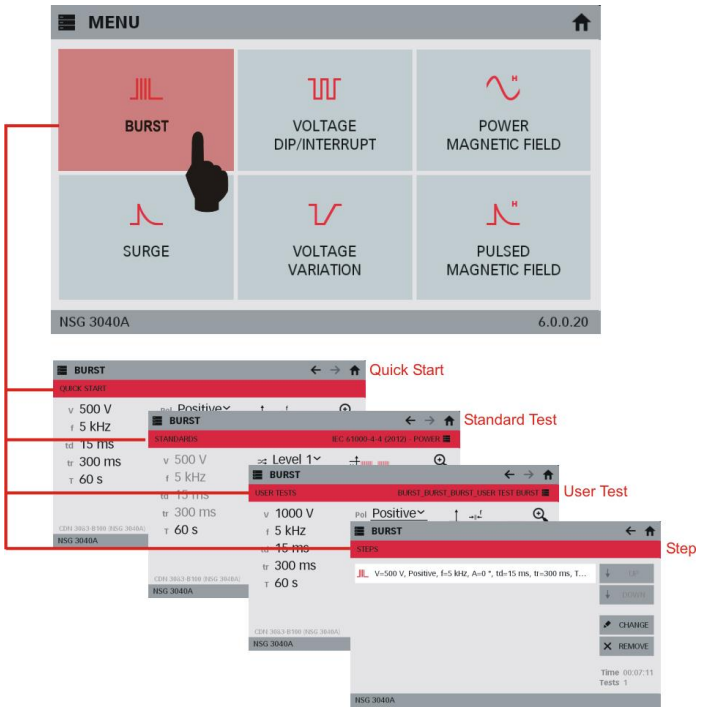
Warning

If the user reduces the test voltage in **Quick Start, Standards, STEP or User Test**, the **storage capacitor will be discharged only by the burst pulses**. The result is a higher test voltage on the EUT than indicated on the display until the storage capacitor is discharged to the preselected value.

If the voltage reduction is several 100V the discharge time to the correct test voltage can be some seconds. The discharge time depends on the repetition rate tr and the duration td of the burst pulse.

Pressing STOP / START will discharge the storage capacitor over the discharge resistor immediately. After the START the test will continue with the correct voltage level.

11.1. Operation



Click into Burst menu loads the **last used menu**. Of the following routines below.

Quick Start
Easy and fast online-operation with the phenomenon Burst. In this menu the user can operate all burst test manually with online change the most parameters during a test.

Standard
The operator can select between various preprogrammed test routines as required in different standards
The standard library is filtered according the EUT setting (AC, DC etc.)

User test routines
The user defined library where all created Burst tests are stored.

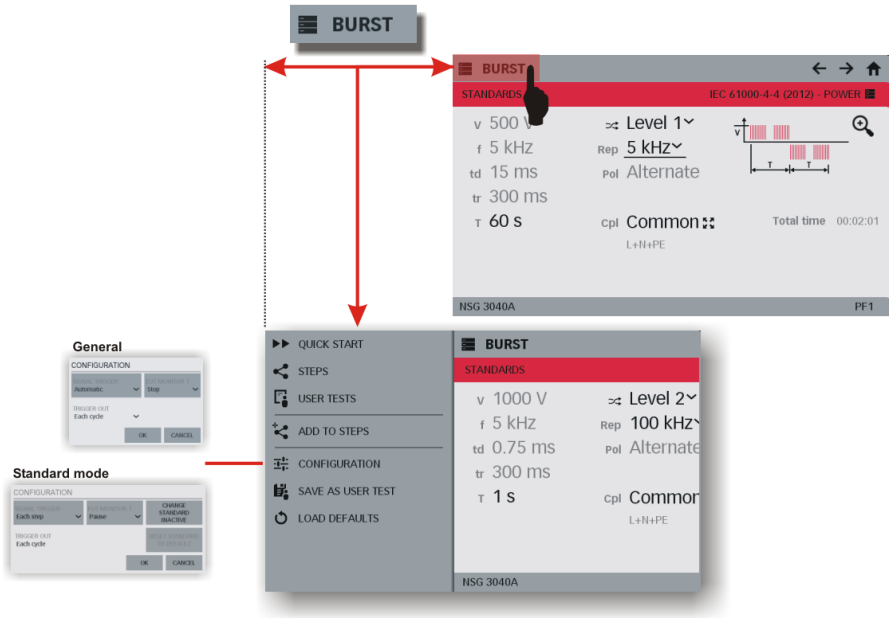
STEP
The STEP library created during the actual session. The user can easy save a test into the STEP library. After switching Off the Equipment all STEP tests are deleted. Use “SAVE AS USER TEST” for definitive save the test.

11.1.1. Burst Menu options from test setting

The In every test mode, the user can select the following options. routines.

Change to other test modes
- Quick Start
- STEPS
- User Test
- Standard Test

Other:
- Add to STEPS
- Configuration
- Save as User Test
- Load Defaults



ADD TO STEPS
STEP tests are temporary stored tests for a user, who don't need these settings after switching off the device. An actual test setting can be saved as a STEP test. Each phenomenon can save any number of sequences as STEP tests. The STEP tests are stored until the device is switched off.

CONFIGURATION
Configuration of the trigger, monitor and standard change activate/inactive settings

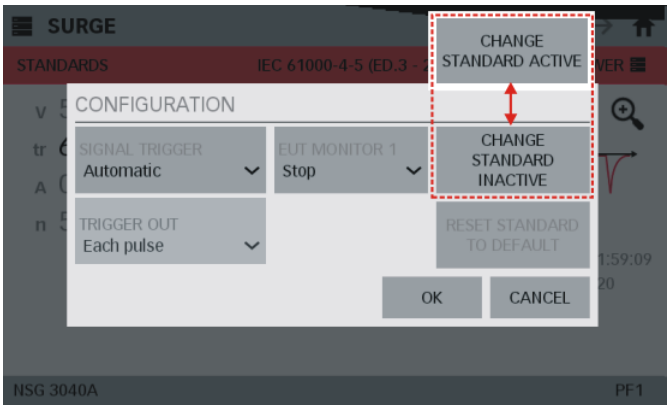
SAVE AS USER TEST
The user defined library where all created Burst tests are stored.

LOAD DEFAULTS
Restore the phenomenon settings of the actual test to the defaults.

Additional Configuration in Standard Mode

Change Standard ACTIVE
All parameters are free to change, even these which are fix defined in the standard as polarity, phase angel, number of impulses…

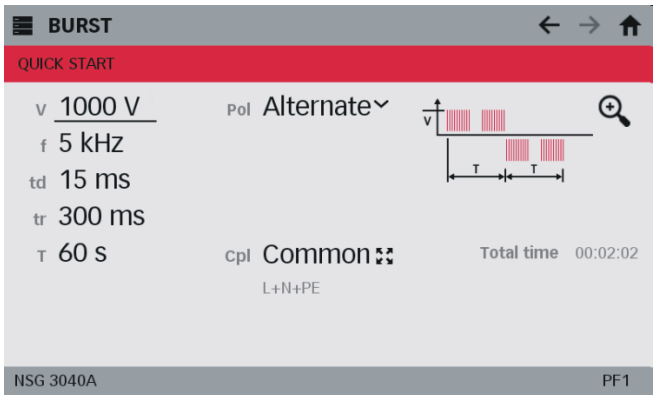
Reset standards to default
Reset the changed parameters to default value.



NOTE Menu settings for all other phenomenon are similar. These settings are no longer specifically described.

11.1.2. Quick Start

Easy and very fast operation of all standard functions of the equipment. The latest simulator settings are stored automatically and will be recalled when Quick Start is selected.



Quick Start Menu

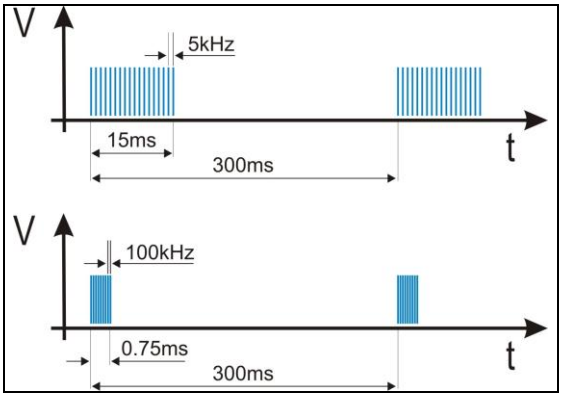
Quick Start testing

Devices: ***NSG 3040A***

Burst specification as per IEC 61000-4-4 Ed3 (2012)

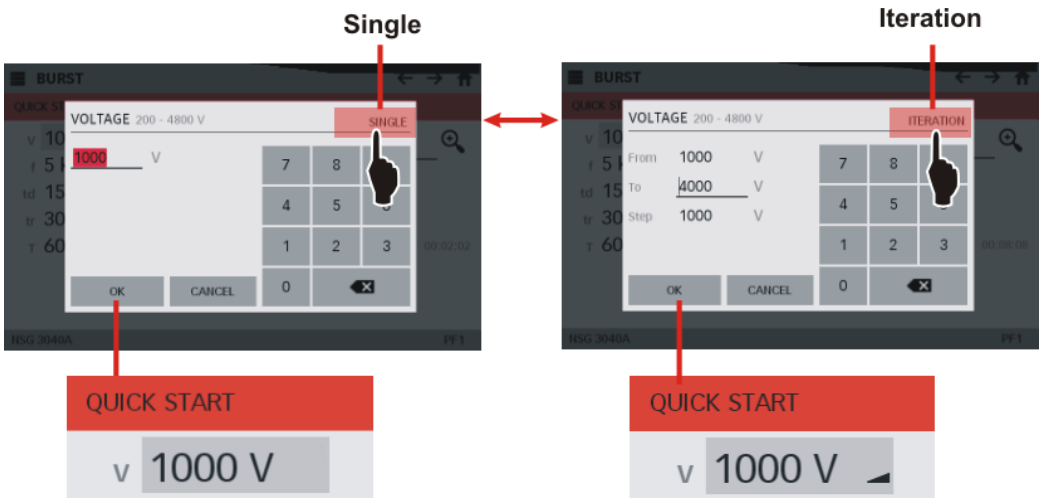
f = 5kHz
td = 15ms
tr = 300ms

f = 100kHz
td = 0.75ms
tr = 300ms



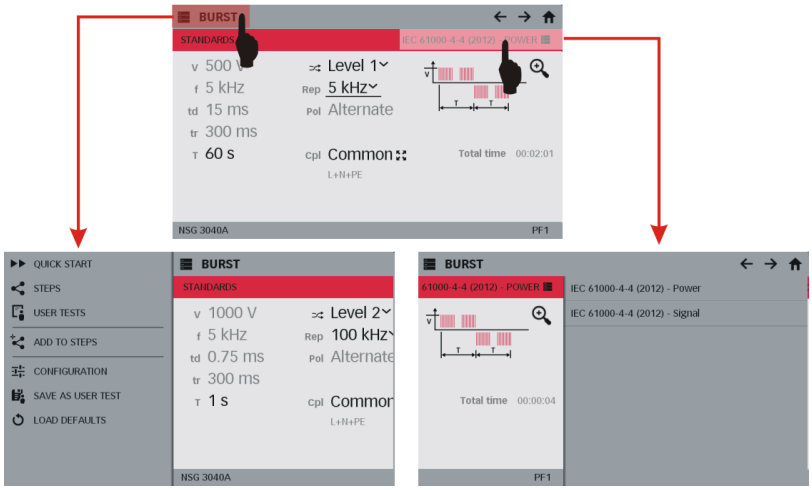
11.1.2.1. Voltage iteration

Click into field **SINGLE** or **ITERATION** for change between single and iteration mode. The ramp icon shows the Iteration mode.



11.1.3. Standard test routines

The user can select preprogrammed standard test routines.



Change to
Standard library

Change to
- Quick Start
- STEPS
- User Test

Other:
Add to STEPS
Configuration
Save as User Test
Load Defaults

Within this test routine all standard parameters can be changed online during testing. For change tip to the black marked parameters

The user can easy select the following parameters

T (test duration): 1 s to 999 s (standard minimum **60 s** or one cycle of the EUT process)

Level (voltage): Level 1 (500 V),
Level 2 (1000 V),
Level 3 (2000 V),
Level 4 (4000 V)

Rep (frequency): **5 kHz** (td= 15 ms),
100 kHz (td= 0.75 ms)

Coupling (Cpl): **Common** (L+N+PE),
All (All combinations from L, N, PE),
50 Ohm (coaxial output for capacitive coupling clamp)

11.1.4. User Test Routines

The user can program, save and recall his own specific user test routines, created by himself.

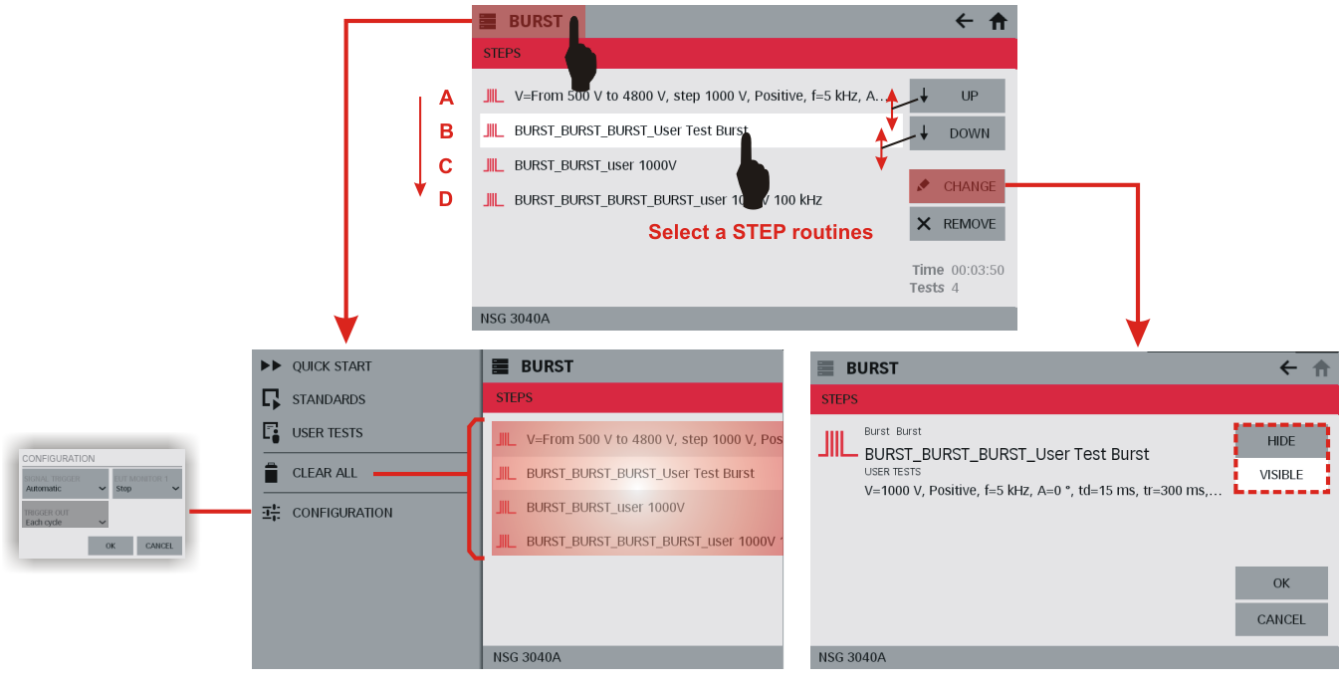
The user test routines library offers various useful self-created tests for testing and development.

11.1.5. STEP Routines

The user can store, his own specific test routines he need to repeat during his test session. After switch-off the generator all these routines are deleted.

If more than one STEP routine is in the library, the Program will run one sequence after the other and will stop when the last STEP sequence has finished.

In our case the test starts with **STEP B** and continue with **STEP D ... STEP D**. Then the test is finished.



UP / DOWN Changes the line of the STEP

CHANGE Shows the STEP test detail, change to **HIDE / VISIBLE** (not used for testing)

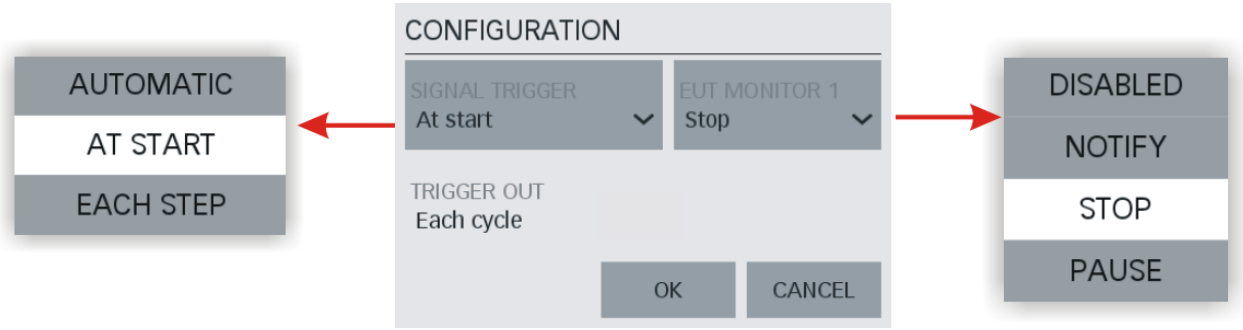
REMOVE Delete the STEP test

11.2. Burst Settings and limits

11.2.1. Configuration

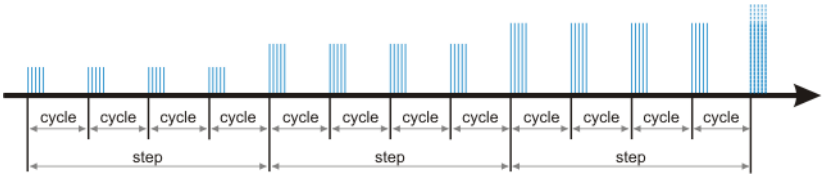
In the configuration menu the user set the following parameters:

- **Signal trigger** for start the test or step is indicated by the blinking Start button.
- **Trigger out signal** at the BNC plug on generator front side
- Behavior of the **EUT Monitor 1**, BNC plug at the rear side



Iterations

The voltage Iteration tests the parameters changes after each step/cycle as shown in the figure below.



Example with voltage iteration that illustrate trigger out for cycle and step

11.2.1.1. Signal Trigger

For start/continue the test press Start button:

- **Automatic** Test starts automatic after START
- At **Start** Press START again after running the test
- Each **Step** every burst parameter changing. (voltage, polarity)

11.2.1.2. Trigger OUT

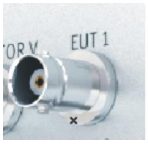
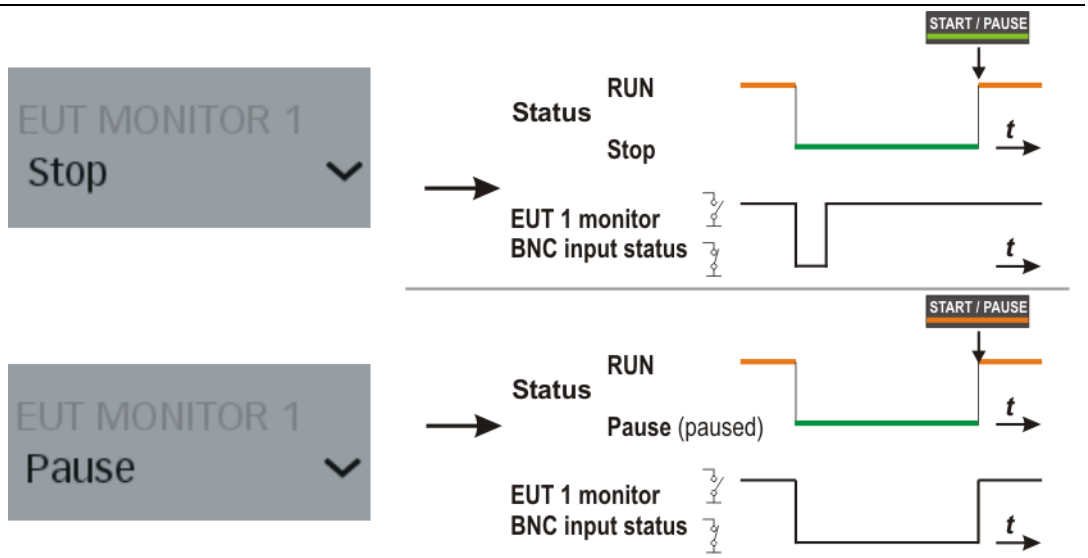
The trigger out signal is a programmable 5V edge signal located at the front side BNC Trigger plug. This signal is for trigger other devices like oscilloscopes or other devices.

11.2.1.3. EUT Monitor

Behavior of the **EUT Monitor 1**, BNC plug at the rear side:

- **Disabled** No function
- **Notify** Send a notify signal to iec.control for the report generation
- **Stop** The test will immediately **stop** and is finished.
- **Pause** The test breaks and can be continued with **START/PAUSE**

EUT Monitor input signal

EUT Monitor Input	BNC plug on rear side of the NSG 3000A series generator  **EUT Monitor 1**
Status of BNC input of EUT monitor 1	
Input signal	Open collector signal 15 V to 0 V negative slope
Triger level	2 V ±1 V
Input impedance	>10 kΩ
Max. Input	+ 15 V

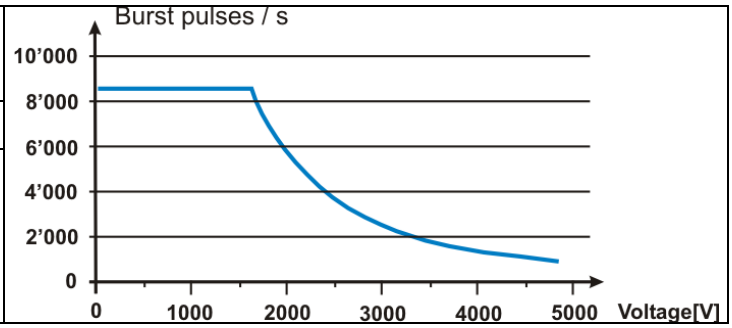
11.2.2. Max Burst impulses / s

Burst spike limit of the electrical burst switch:

The pulse switch is a highly reproducible semiconductor switch. Spike frequencies up to 1000 kHz are by a factor of 10 higher than recommended in the actual EFT standards. This means of course that also the pulse energy would be 10 times higher. This is not generally possible for the high voltage switch. Therefore, the following limitation protects the pulse forming circuit against overload:

Burst impulses / s

Voltage V	Max. pulses / s continuous burst
<= 1'880V	8,500
2'000 V 3'000 V 4'000 V 4'800 V	5680 2525 1420 1302

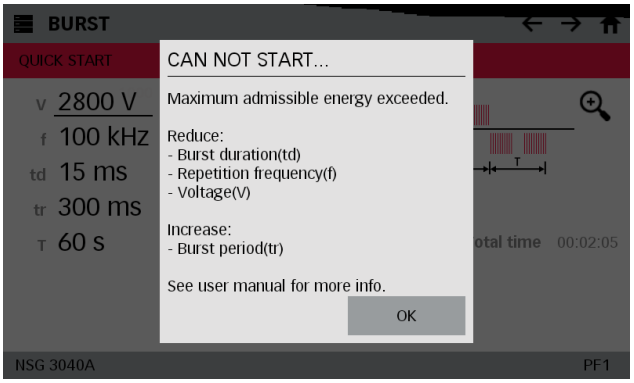


Error message: Cannot Start

The maximum energy of the burst impulses is limited to 25 J per second. This value is calculated by the formula:

$$\frac{U^2 * Td * f}{Trep} < 25\ J$$

U [kV]
f [kHz]
Td, Trep [ms]



In case of this message the user must reduce the energy by changing at least one parameter

Reduce:
- Burst duration (Td)
- Repetition frequency (f)
- Voltage (V)

Increase:
- Burst period (td)

11.3. Burst generation

11.4. Test voltage with Burst as per IEC 61000-4-4

Burst generators, which the specifications in accordance with IEC 61000-4-4 are limited at the maximum output voltage. The efficiency of the burst pulses decreases with the numbers of couplings.

Therefore, the maximum test voltage is limited depending on the number of tested lines.

Coupling	**NSG 3040A** **NSG 3060A**
50 Ω	4800V
1 coupling any	4800V
2 couplings any	4800V
3 couplings any	4800V

Generator with 3-phase CDN	
50 Ω output	4800V
1 coupling any	4800V
2 couplings any	4800V
3 couplings any	4800V
4 couplings any	4500V
5 couplings any	4500V

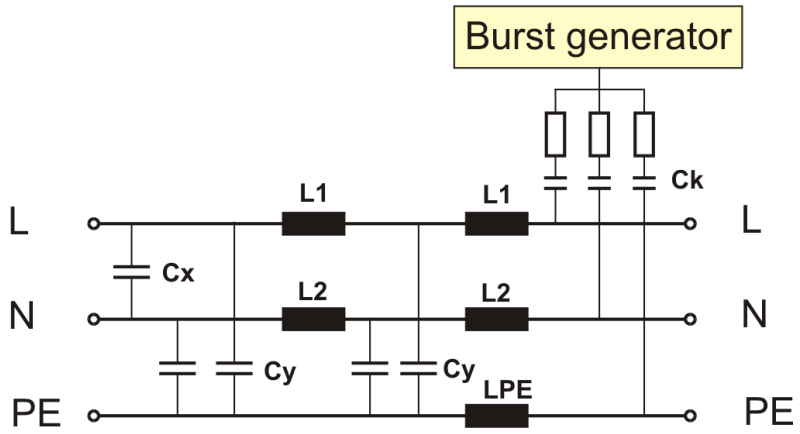
11.5. Coupling/decoupling network

The decoupling part of the coupling network must be:

- filter the interference pulses in the direction to the power supply;
- protect other systems that are connected to the same power supply and
- realize a high impedance of the power supply, e.g. battery supply.

11.5.1. Coupling/decoupling network for ac/dc power lines

The coupling network couples the EFT pulses via 33 nF capacitors onto the AC or DC power lines. As coupling devices capacitors of enough strength and bandwidth shall be used according to IEC 61000-4-4.



Coupling network as per IEC 61000-4-4

The coupling on signal lines can usually not be affected capacitive without interfering with the signal flow. It is often impossible to contact the required circuit (direct), e. g. coaxial or shielded cables. In this case the coupling is realized with the capacitive coupling clamp. The interference simulator can be connected on both sides of the coupling clamp.

Coupling method:

Test duration: At least 1 minute in positive and negative polarity. The test duration must be at least as long for examine all functions of the EUT

Coupling IEC 61000-4-4 edition 2 (2004) and later versions requires to couple all lines simultaneously in Common Mode coupling.
This means that a burst test needs **two tests with 60s** (positive and negative 60s each).

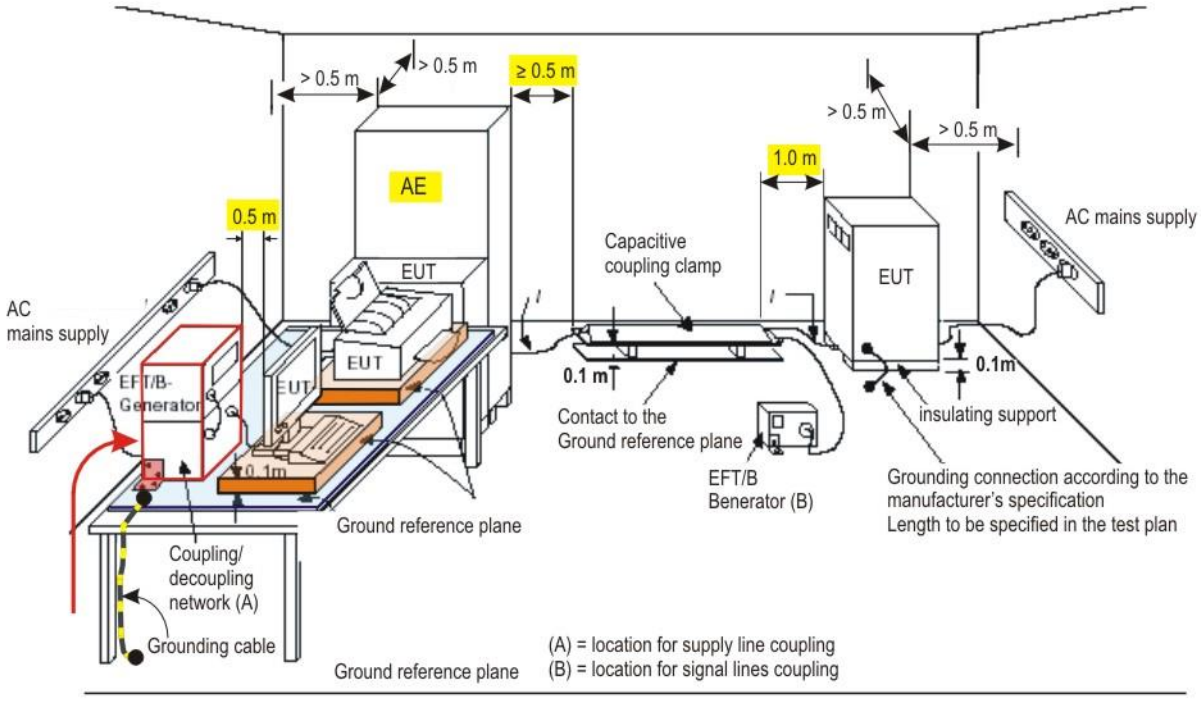
IEC 61000-4-4 (1995, 2001) requires **all line combination** to be tested individually.
A 1-phase EUT needs to test all combination L, N, PE, L+N, L+PE, N+PE, L+N+PE each with two tests with 60s (positive and negative 60s each). Total test time 14 x 60 seconds

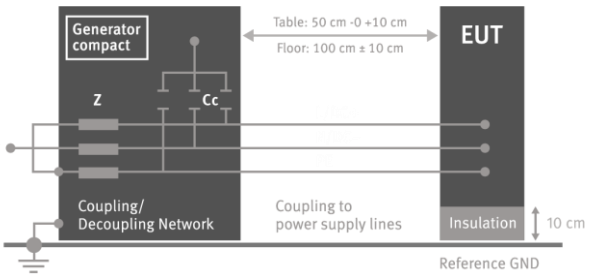
11.5.2. Capacitive coupling clamp

- The coupling clamp is not matched by 50 Ω. If the clamp is matched there exists an additional magnetic coupling, which may cause completely different test results.
- The clamp should be placed in a distance of 0.5 m to the equipment under test. When the distance is shorter distances, the EUT may be influenced by radiation.
- If the EUT is includes two separate equipment, the test should be conducted on each single equipment with the required distance.

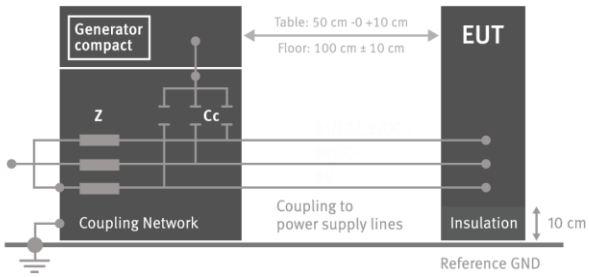
11.6. Burst Test Setup

- The test generator and the coupling network should be connected to the reference ground plane (acc. to high frequency requirements).
- The equipment under test must be isolated from the reference ground plane. The distance should be 10 cm. Being part of the EUT, these requirements are also recommended for all connected cables. The EUT should only be grounded if this is recommended by the installation guideline. For safety reasons, the test without any ground connection should be conducted as well (at 100 MHz 1 m ground cable length has an impedance of about 600 Ω)
- Whenever possible the test setup and the cabling should always be the same; e.g. for testing power lines it would be possible to fix the cables on the test table for all tests in the same way.
- Lines under test and all other lines should be decoupled strictly.





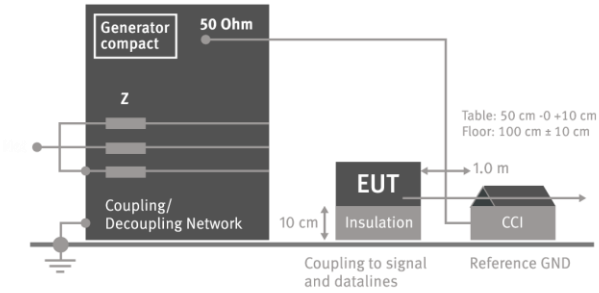
Coupling from NSG 3040A / 3060A generator



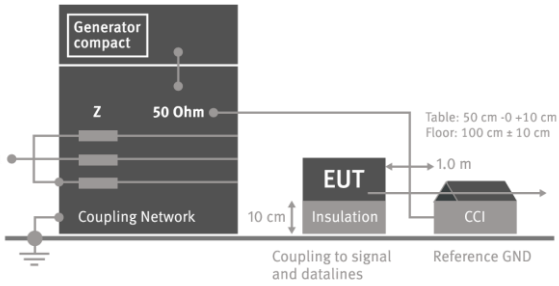
Coupling via 3-ph CDN to a 3-ph EUT

11.6.1. Test setup with capacitive coupling clamp

When using the coupling clamp, the minimum distance between the coupling plates and all other conductive surfaces (including the generator), except the ground reference plane beneath the coupling clamp and beneath the EUT, shall be at least 0.5 m.

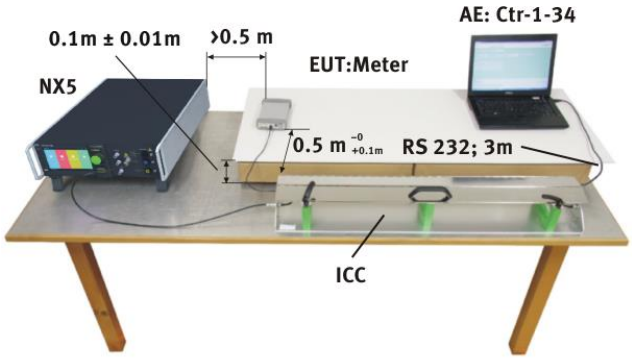


Coupling via 50 Ohm output generator



Coupling via 50 Ohm output 3-ph CDN

The distance between any coupling devices and the EUT shall be (0.5 − 0/+0,1) m for tabletop equipment testing, and (1,0 ± 0,1) m for floor standing equipment, unless otherwise specified in product standards. When it is not physically possible to apply the distances mentioned above, other distances can be used and shall be recorded in the test report.



12. Surge Immunity as per IEC 61000-4-5

Surge Module 1.2/50µs – 8/20µs

WARNING

The internal coupling network is designed for **mains frequency 50 Hz / 60 Hz**.

When L – N coupling is selected an **additional current of approx. 1.5 A** flows, caused by the 18 µF coupling capacitor and the pulse forming network. A similar current appears during the couplings to PE.

Tests with 400 Hz mains frequency **destroy the coupling network**. An external coupling network is recommended with inductors and capacitors matched to the 400 Hz mains frequency. Contact AMETEK CTS before using the generator and CDN for 400 Hz application.

12.1. Operation

The surge menu offers different test routines for surge testing.

Click into surge menu loads the **last used menu**. Of the following routines below.

Quick Start
Easy and fast online-operation with the phenomenon surge. In this menu the user can operate all surge test manually with online change the most parameters during a test.

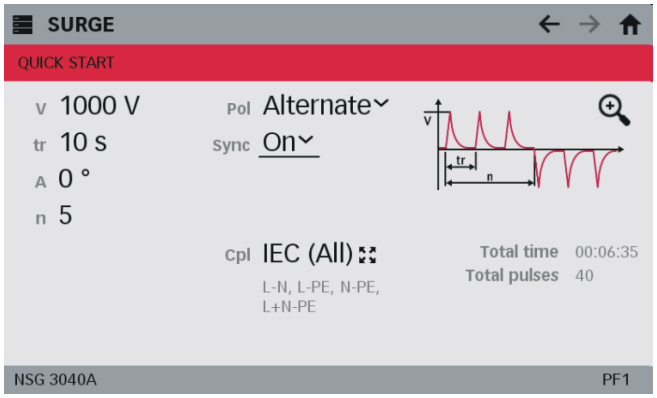
Standard
The operator can select between various preprogrammed test routines as required in different standards
The standard library is filtered according the EUT setting (AC, DC etc.)

User test routines
The user defined library where all created surge tests are stored.

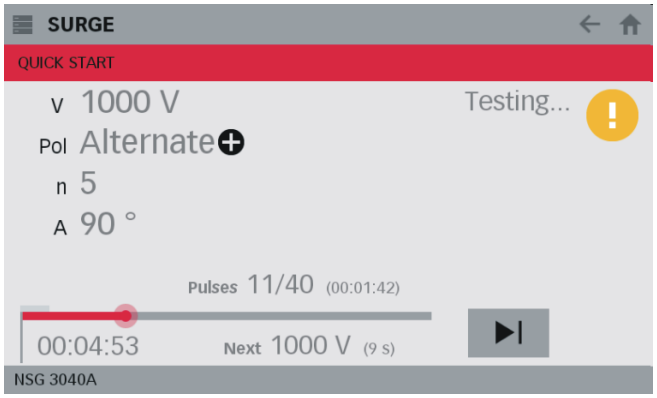
STEP
The STEP library created during the actual session. The user can easy save a test into the STEP library. After switching off the Equipment all STEP tests are deleted. Use “SAVE AS USER TEST” for definitive save the test.

12.1.1. Quick Start

Easy and very fast operation of all standard functions of the equipment. The latest simulator settings are stored automatically and will be recalled when Quick Start is selected.



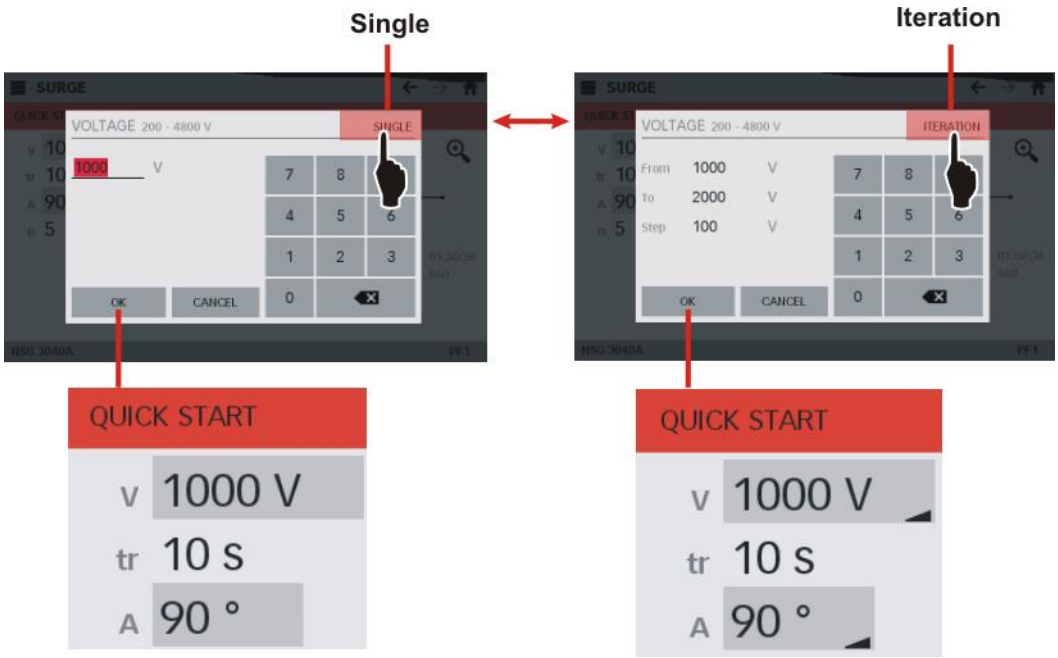
Quick Start Menu



Quick Start testing

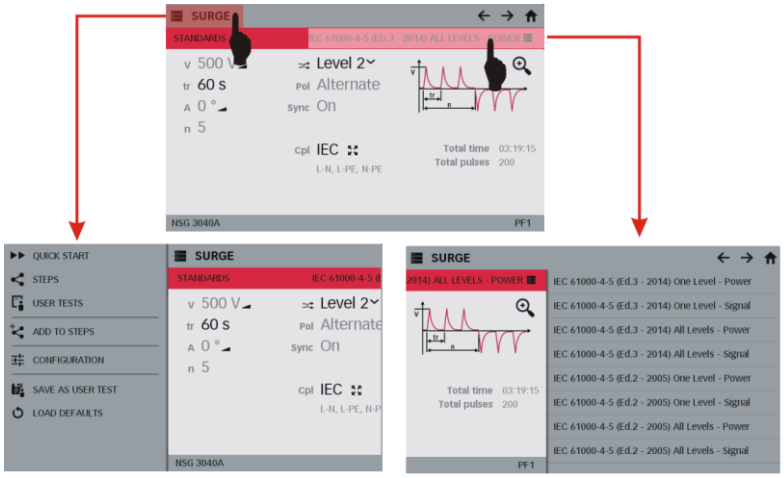
12.1.1.1. Voltage and phase angle iteration

Click into field **SINGLE** or **ITERATION** for change between single and iteration mode. The ramp icons show the Iteration mode.



12.1.2. Standard test Routine

The user can select preprogrammed standard test routines.



Change to
Standard library

Change to
- Quick Start
- STEPS
- User Test

Other:
- Add to STEPS
- Configuration
- Save as User Test
- Load Defaults

Within this test routine all standard parameters can be changed online during testing. For change tip to the black marked parameters

The user can easy select the following parameters

T (test duration): 1 s to 999 s (standard says **60 s** or faster depend on the protection devices power rate)

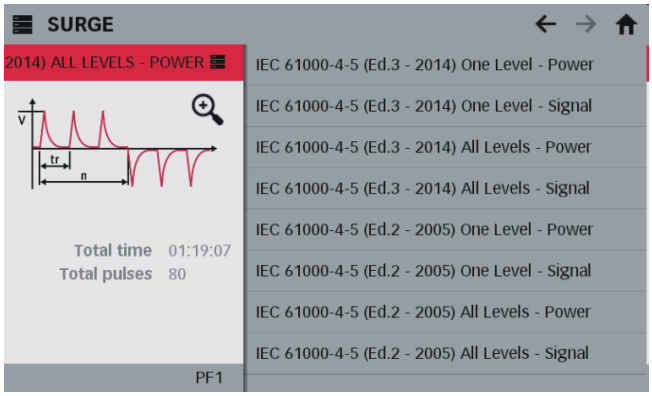
Level (voltage):	**All Levels**	**One Level**
	Level 1 (500 V),	500 V
	Level 2 (500 V to 1000 V),	1000 V
	Level 3 (500 V to 2000 V),	2000 V
	Level 4 (500 V to 4000 V)	4000 V

Coupling (Cpl): **IEC** (L+N+PE),
HV - COM (external for data lines),

12.1.2.1. Surge Standard library

The surge Standard menu offers a list of standards. The name of the standard defines the characteristic of the rulers that is given in the application of the standard.

The standard name has the character: **[Standard Family], [Standard number], [year]), [Application],** where



Standard Family
IEC: *International Electrotechnical Commission*
EN: European Committee for Standardization (CEN)

Standard Number
Indicates the official standard number defined in the standard.

Year
Year of standard publication. The year indicates the different standard publication. The year is used for following the definitions specified in this publication.

Application
Specifies different applications or EUT characteristics

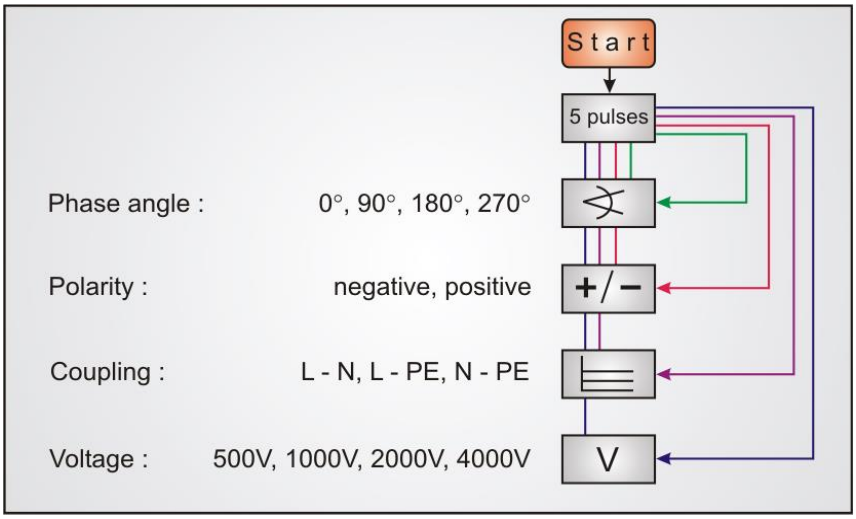
- One level: Only one test level will be in this test. The user can select the test level (level 1 to 4)
- All levels: The test procedures start at the lowest level and increase to the level specified.

12.1.2.2. Iteration of the standard test procedure as per IEC 61000-4-5

The surges must be applied synchronized to the voltage phase at the respective angle and the peak value of the AC. voltage wave (positive and negative).

The surges must be applied with coupling line to line and line to earth. When testing line to earth the test voltage must be applied successively between each of the lines and earth.

The test voltage must be increased by steps from the lowest test level up to the test level specified in the product standard or test plan.



List of settings EN 61000-6-1 (each setting with 5 pulses)

Setting	Voltage	Coupling	Polarity	Phase angle
1 2 3 4	500	L-N	pos	0 90 180 270
5 6 7 8			neg	0 90 180 270
9 10 11 12		L-PE	pos	0 90 180 270
13 14 15 16			neg	0 90 180 270
17 18 19 20		N-PE	pos	0 90 180 270
21 22 23 24			neg	0 90 180 270
25 26 27 28	1000	L-N	pos	0 90 180 270
29 30 31 32			neg	0 90 180 270

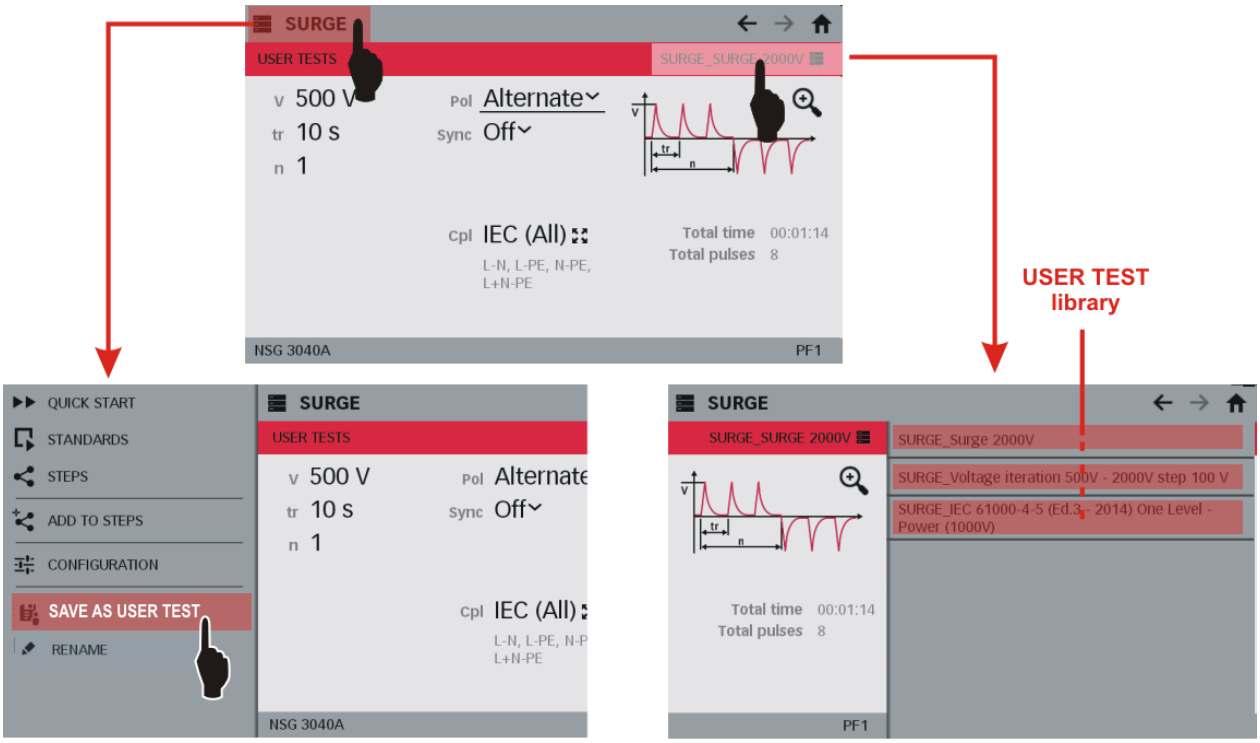
Setting	Voltage	Coupling	Polarity	Phase angle
33 34 35 36	1000	L-PE	pos	0 90 180 270
37 38 39 40			neg	0 90 180 270
41 42 43 44		N-PE	pos	0 90 180 270
45 46 47 48			neg	0 90 180 270
49 50 51 52	2000	L-PE	pos	0 90 180 270
53 53 55 56			neg	0 90 180 270
57 58 59 60		N-PE	pos	0 90 180 270
57 58 59 60			neg	0 90 180 270

Within this test routine all standard parameters can be changed online during testing. This procedure therefore is very easy and fast to use.

12.1.3. User Test Routines

The user can program, save and recall his own specific user test routines, created by himself.

The extended menu offers various useful tests for testing and development.



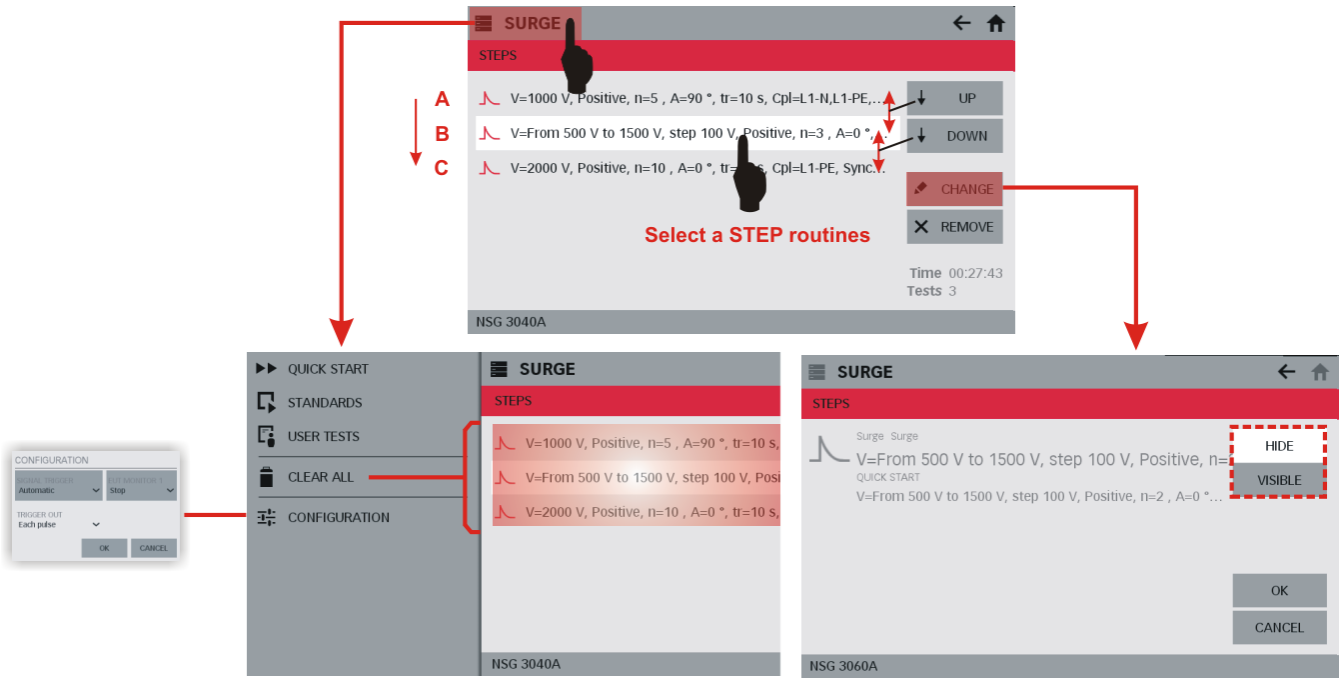
SAVE AS USER TEST Save the actual test as user test. The user defines the name of the test

12.1.4. STEP Routines

The user can store, his own specific test routines he need to repeat during his test session. After switching off the generator all these routines are deleted.

If more than one STEP routine is in the library, the Program will run one sequence after the other and will stop when the last STEP sequence has finished.

In our case the test starts with **STEP B** and continue with **STEP C**. Then the test is finished.



UP / DOWN Changes the line of the STEP

CHANGE Shows the STEP test detail, change to **HIDE / VISIBLE** (not used for testing)

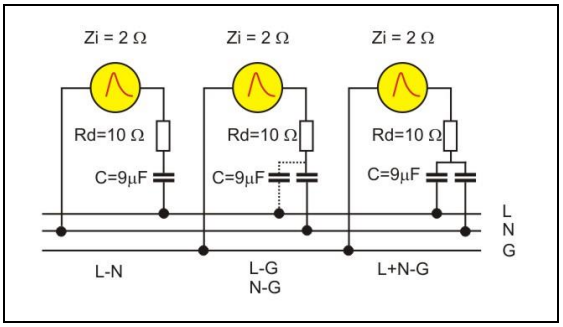
REMOVE Delete the STEP test

HIDE / VISIBLE Selection if the step is visible and active or hide and inactive is.

The ANSI coupling is only implemented in NSG 3060A models with built in surge module

ANSI A coupling after n pulses

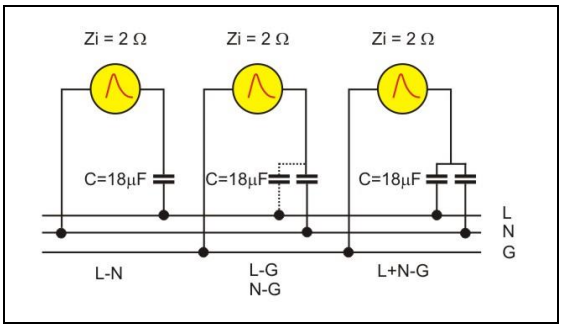
The coupling mode with 12 Ω und 9 µF will automatically be changed after the preselected number of pulses has been released. All possible coupling modes will be selected. The same parameters as under Quick Start can be selected.



ANSI B coupling after n pulses

The coupling mode with 2 Ω und 18 µF will automatically be changed after the preselected number of pulses has been released. All possible coupling modes will be selected. The same parameters as under Quick Start can be selected.

For coupling ANSI B **coupling L-N** is not **supported** with NSG system.



Surge Generator and coupling impedances

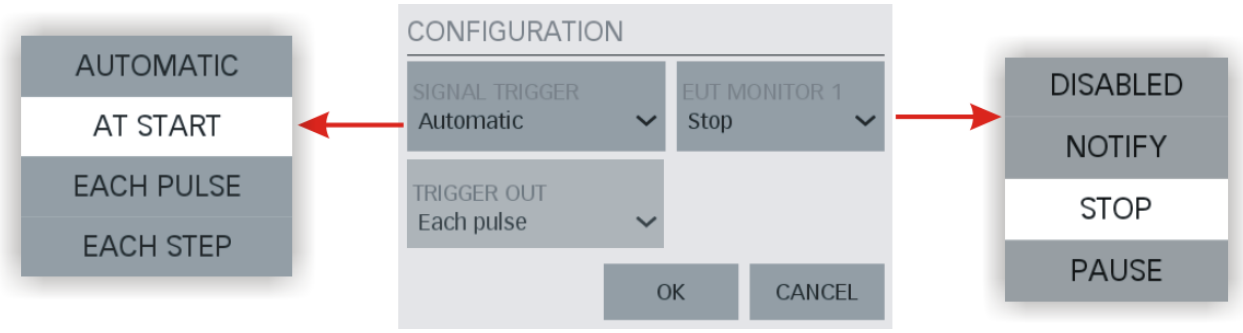
	Line to Line	**Line to PE** (IEC) **Line to GND** (ANSI**)**
IEC	2 Ω; 18 µF	12 Ω; 9 µF
ANSI A	12 Ω; 9 µF	12 Ω; 9 µF
ANSI B	2 Ω; 18 µF	2 Ω; 18 µF

12.2. Surge pulse settings

12.2.1. Configuration

In the configuration menu the user can set the following parameters:

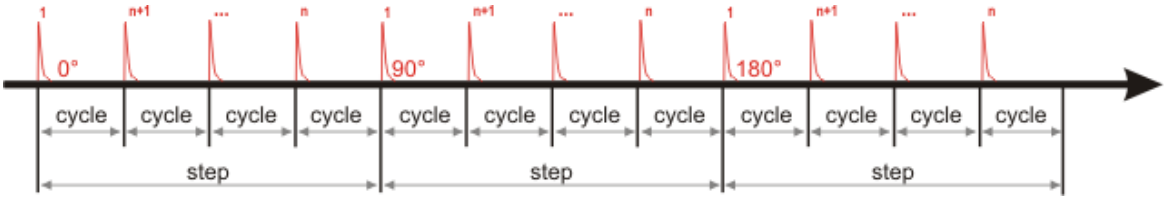
- **Trigger out signal** at the BNC plug on generator front side
- **Signal trigger** for the impulse or event when Start button is blinking
- Behavior of the **EUT Monitor 1** on BNC plug on rear side



12.2.1.1. Iterations

For Iteration tests the parameters changes after each step as shown in the figure below. Depends of the order and setting the following parameters can change:

- Polarity
- Voltage
- Phase angle



Example with voltage iteration that illustrate trigger out for cycle and step

12.2.1.2. Signal Trigger

The trigger out signal is a programmable 5V edge signal located at the front side BNC Trigger plug. This signal is for trigger other devices like oscilloscopes or other devices.

The generator offers the following trigger out options:
- At **Start**
- Each **Pulse** every surge impulse (cycle) release
- Each **Step** for tests with iteration

12.2.1.3. Trigger Out

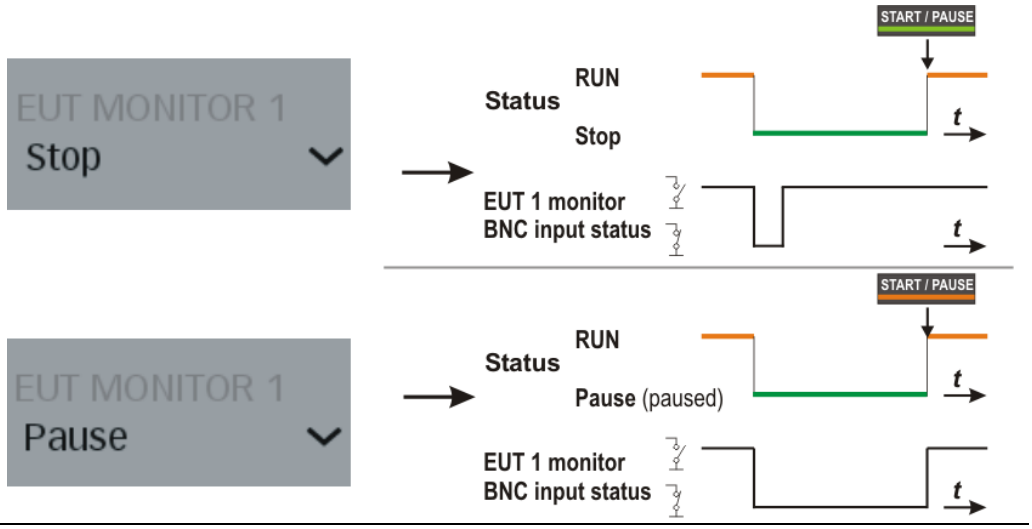
The trigger out signal is a programmable 5V edge signal located at the front side BNC Trigger plug. This signal is for trigger other devices like oscilloscopes or other devices.

12.2.1.4. EUT Monitor

Behavior of the EUT Monitor 1, BNC plug at the rear side:

- **Disabled** No function
- **Notify** Send a notify signal to iec.control for the report generation
- **Stop** The test will immediately stop and is finished.
- **Pause** The test breaks and can be continued with START/PAUSE

EUT Monitor input signal

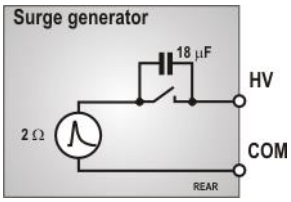
EUT Monitor Input	BNC plug on rear side of the NSG 3000A generator  **EUT Monitor 1**
Status of BNC input of EUT monitor 1 / 2	
Input signal	Open collector signal 15 V to 0 V negative slope
Triger level	2 V ±1 V
Input impedance	>10 kΩ
Max. Input	+ 15 V

12.2.2. **HV-COM capacitance** (18 µF capacitor)

The HV – COM output includes a configurable output capacity with 18 µF. Using AMETEK CTS coupling-decoupling networks, the coupling capacitor is part of the CDN. For other applications e.g., pulsed surge magnetic field or a surge verification requires an 18 µF capacitor in the circuit. The NSG generator includes a configurable 18 µF capacitor at the HV – COM output.

Application with 18 µF capacitor

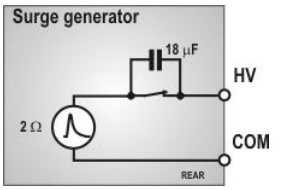
- Pulsed magnetic field application to a single turn antenna as per IEC 61000-4-9
- Generator pulse verification at the NSG 3000A HV-COM output
- Pulse verification at the coupler HV-COM output
- Application to any external CDN not from AMETEK CTS manufactured



Application without 18 µF capacitor

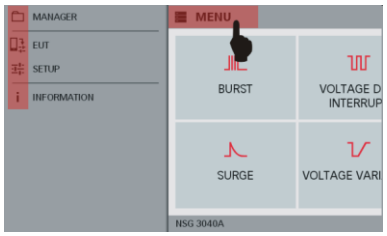
- Using a coupling decoupling network from AMETEK CTS.

REMARK: All CDN from AMETEK CTS includes a built-in coupling capacitor. The values are 18 µF, 9 µF, 0.5 µF or any other special value according the application.

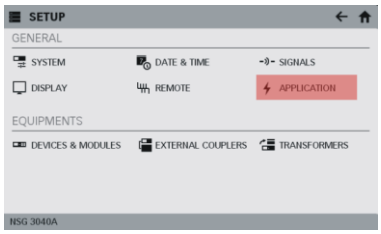


Capacitor setting

For set the 18 µF capacitor use menu



MENU / SETUP



APPLICATION

HV-COM capacitance

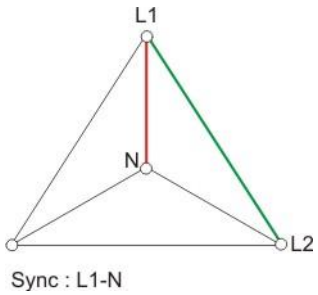
12.3. Surge pulse application

12.3.1. Phase synchronization in 3-phase system

The synchronization in a 3-phase coupler system is taken from the phase L1 and Neutral. In case of a delta supply without neutral connected, an artificial neutral point is defined by a high impedance network. This artificial neutral is taken for the phase synchronization.

For all couplings, the generator calculates the correct phase angle for phase triggering.

In case of too high phase shifting the user can connect a proper sync signal to the SYNC IN plugs at the rear side of the compact NSG generator



The table below illustrates the correction angels considering the phase in a 3-phase system with synchronization signal from L1-N lines. The generator firmware will automatically add the correction angle to the settled value.

Phase Synchronization correction for L1-N as sync signal

	Sync. Source	Correction angel added by the compact NSG firmware					
Coupling	**L1-N**	**L1-N**	**L2-N**	**L3-N**	**L1-L2**	**L1-L3**	**L2-L3**
Sync. - Angel	**0°**	0°	120°	240°	330°	30°	90°
	90°	0°	210°	300°	60°	120°	180°
	180°	0°	300°	30°	150°	210°	270°
	270°	0°	30°	150°	240°	300°	0°

The correct phase angle will be set automatically from the NSG 3000A.

12.4. Surge pulse application

Discharge switch:
The discharge switch is a highly reproducible semiconductor switch.

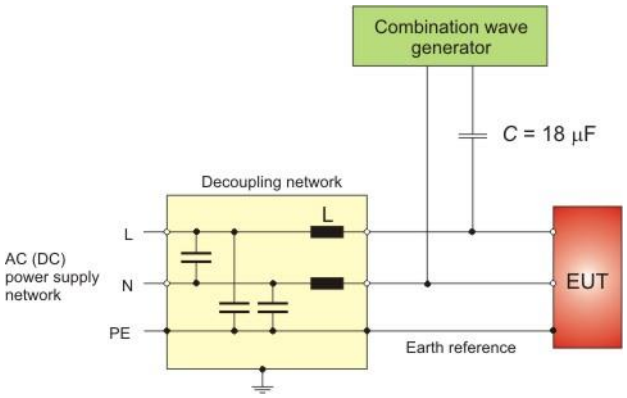
12.5. Coupling/decoupling network

The coupling network must couple the interference pulses to the lines of a power supply system (AC or DC). Capacitive coupling is the specified coupling mode for surge testing.

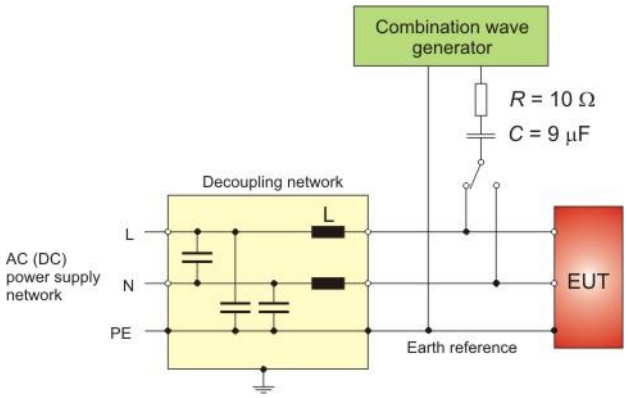
12.5.1. Coupling to AC/DC power supply lines

The surge generator NSG 3040A / 3060A has an integrated coupling network in accordance with IEC 61000-4-5. It must be possible to test with different coupling modes:

Line	→	Earth	(source impedance is 12 Ω)
Neutral	→	Earth	(source impedance is 12 Ω)
L + N	→	Earth	(source impedance is 12 Ω)
Line	→	Neutral	(source impedance is 2 Ω)



Coupling Line to Line



Coupling Line to Earth

The release of the surge pulses is mostly related to a certain phase angle. The surge pulses are synchronized to the EUT-supply input (10...300 VAC / 15...500 Hz).

Attention: The decoupling part of the coupling/decoupling network includes some capacitors for filtering of 20 µF related tp protective Earth (chassis of the generator). This is to be conform to the requirement of IEC 61000-4-5 concerning attenuation of the surge transients in direction to the power mains supply input of the CDN.
As consequence there will exist an increased current to PE (protective earth) which might be hazardous to the operator in case of a failure or wrong installation. Therefore, it is very important to take the following points into account before setting the generator into full operation.

1. **Due to this increased current into the PE system no earth fault current protectors can be used within a surge testing area.**

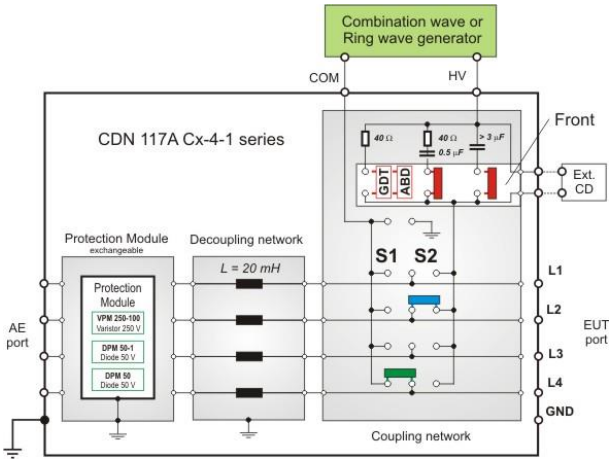
2. **As consequence the surge generator shall be connected always to Protective Earth, even if no test is conducted.**
   - **via plugged in power mains supply cable including the PE wire!!!!**
   - **via plugged in EUT power mains supply at the rear side of the generator, including the PE wire!!!!**
   - **via Ground Reference Connector, screwed to the chassis of the generator.**

These measures result in double safety in case of a fault

12.5.2. Coupling to I / O lines

The coupling to I/O lines is generally realized with other coupling networks than for power supply lines. The loading of the I/O lines with big coupling capacitors is mostly not possible. The data transmission may be disturbed.

For coupling to I/O lines special couplers according the Standard IEC 61000-4-5 are available, such as the CDN 117 series and CDN 118 series



Danger

Using coupling networks CDN series

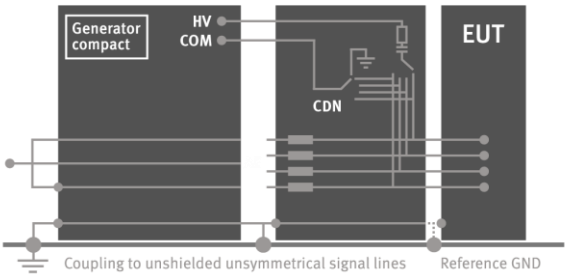
Switch OFF the high voltage during manual change of the coupling

12.6. Test setup

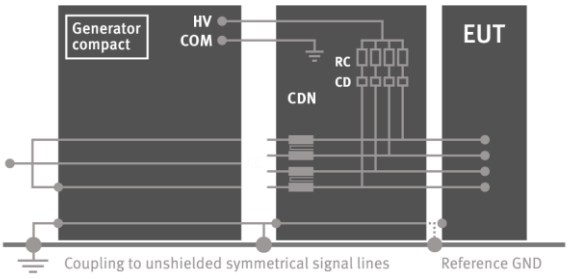
According to the specifications of IEC 61000-4-5, the surge generator has a source impedance of 12 Ω when the simulator is coupled between the lines and protective earth.

This will activate fault current detectors or protectors which may be installed in the laboratory.

Therefore, it is important
- not to disconnect the surge simulator form protective earth (power cable)
- to have an installation where the simulator is connected via its ground reference connector to earth



Setup for unsymmetrical data lines



Setup for symmetrical data lines

13. Magnetic field test as per IEC 61000-4-9

Pulse magnetic fields are generated by lightning strokes on buildings and other metal structures including aerial masts, earth conductors and earth networks and by initial fault transients in low, medium and high voltage electrical systems.
In high voltage sub-stations, an impulse magnetic field may also be generated by the switching of high voltage bus-bars and lines by circuit breakers.

The waveform used is defined in Figure 3 of IEC 61000-4-5 (waveform 8/20 µs).

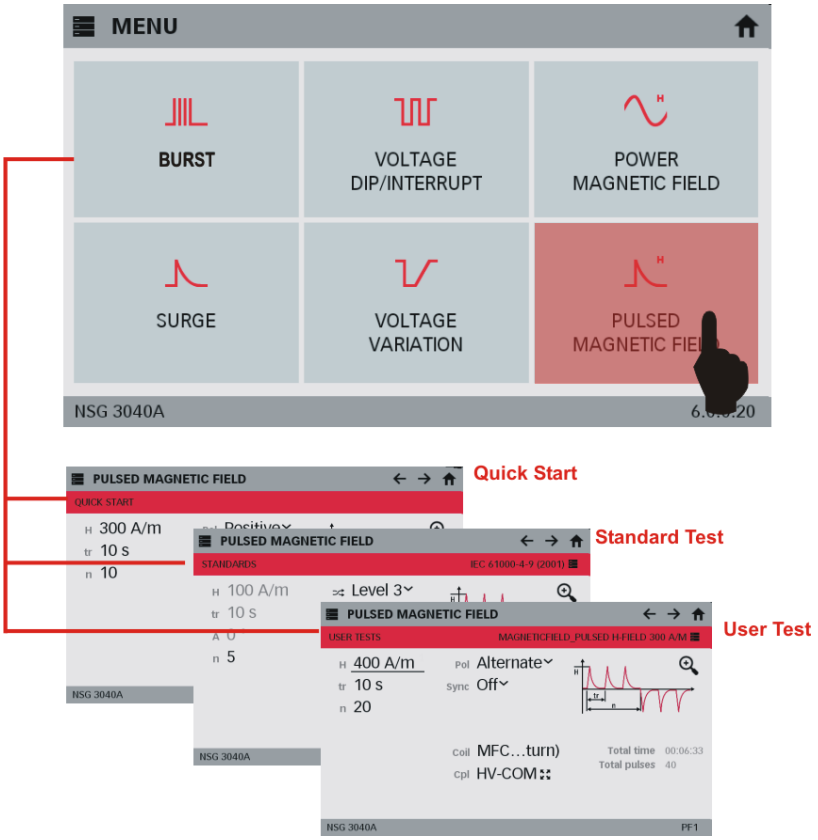
Caution

Only coils with 1 turn

can be used for pulsed magnetic field application.

13.1. Pulsed Magnetic field operation

The menu offers different test routines for pulsed magnetic field testing.



Main menu Pulsed Magnetic Field

The Magnetic Field menu offers different test routines for pulsed magnetic testing.

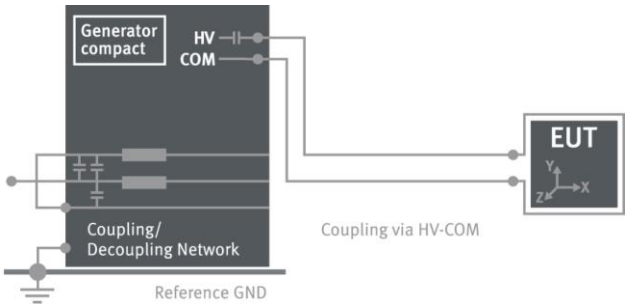
Quick Start
Easy and fast online-operation with the pulsed magnetic surge phenomenon. In this menu the user can operate all test manually with online change the most parameters during a test.

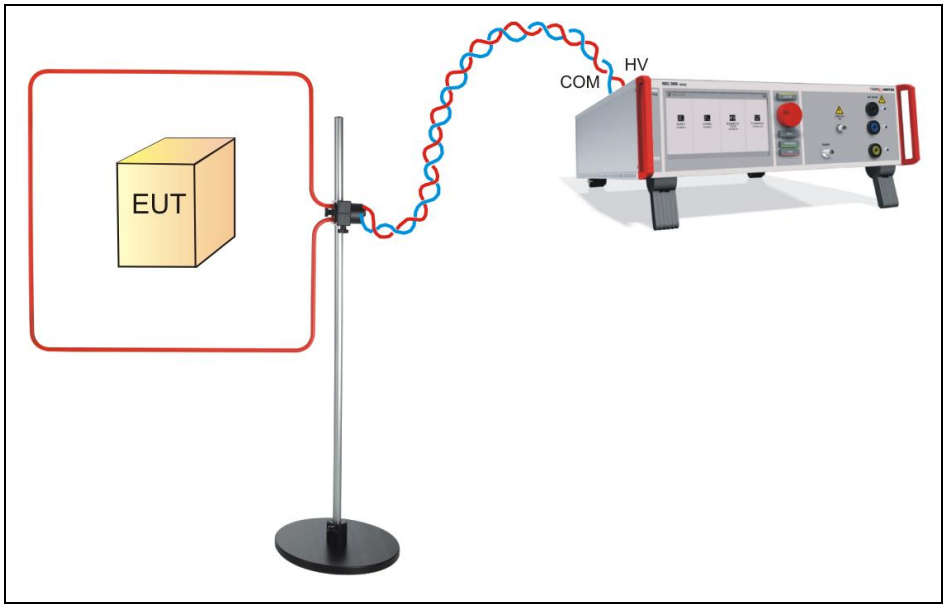
Standard
The operator can select between various preprogrammed test routines as required in different standards
The standard library is filtered according the EUT setting (AC, DC etc.)

User test routines
The user defined library where all created magnetic field tests are stored.

For magnetic field testing the antenna correction factor shall be included. The operator can enter this factor within the setup menu under the service routine.

Setup pulsed magnetic test field





The following coils can be used

	✓ Ok	✘ not Ok
MFC 1000	1 turn	
MFC 1000.1	1 turn	
MFC 30	1 turn (**pulsed**)	11 turns (**power**)
MFC 300	Not applicable	1, 5, 37 turns

Warning

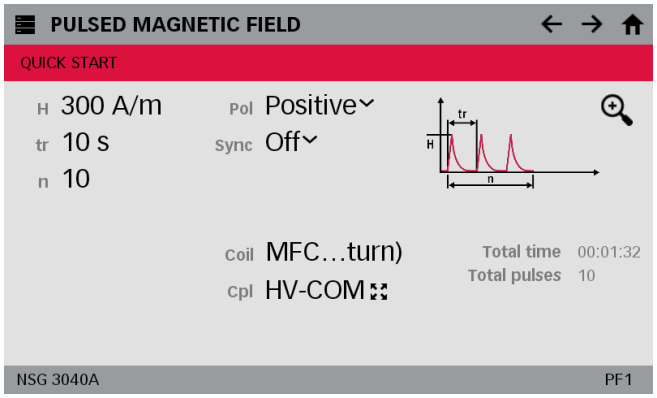
Disconnect all power cables on the rear side at the Test supply plugs.

PF1, PF2 and N

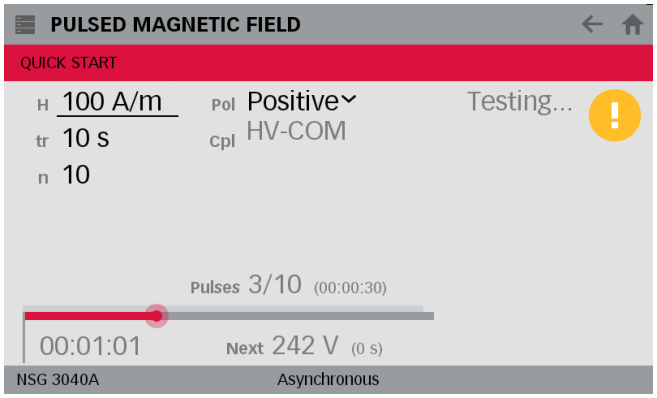
Don’t touch the antenna during the test!

13.1.1. Quick Start

Easy and very fast operation of all standard functions of the equipment. The latest simulator settings are stored automatically and will be recalled when Quick Start is next selected.



Quick Start Menu



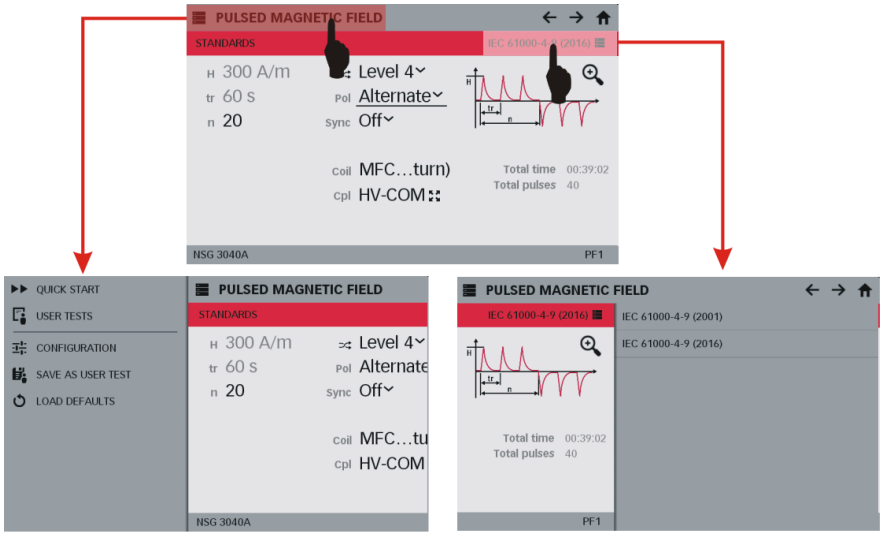
Quick Start testing for 100 A/m

13.1.2. Standard test Routine

The user can select preprogrammed standard test routines.

Change to
- Quick Start
- User Test

Other:
- Add to STEPS
- Configuration
- Save as User
- Load Defaults



Change to **Standard library**

Within this test routine all standard parameters can be changed online during testing. For change tip to the black marked parameters

The user can easy select the following parameters

T (test duration): 1 s to 999 s (standard says **60 s** or faster depend on the protection devices power rate)

Level (voltage): Level 3 (100 A/m)
Level 4 (300 A/m)
Level 5 (1000 A/m)

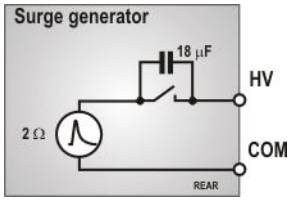
Coupling (Cpl): **HV - COM** (to antenna),

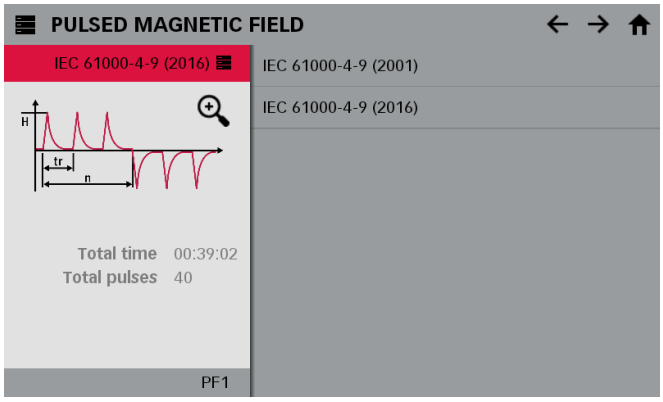
13.1.2.1. Pulsed Magnetic Field Standard library

The pulsed magnetic field standard menu offers a list of standards of edition 1 (2001) and edition 2 (2016).

The standard name has the character: **[Standard Family], [Standard number], [year]), [Application],** where

The standard IEC 61000-4-9 Ed2 (2016) requires mandatory an 18 µF capacitor, that is automatically internal switched in the circuit to output HC – COM

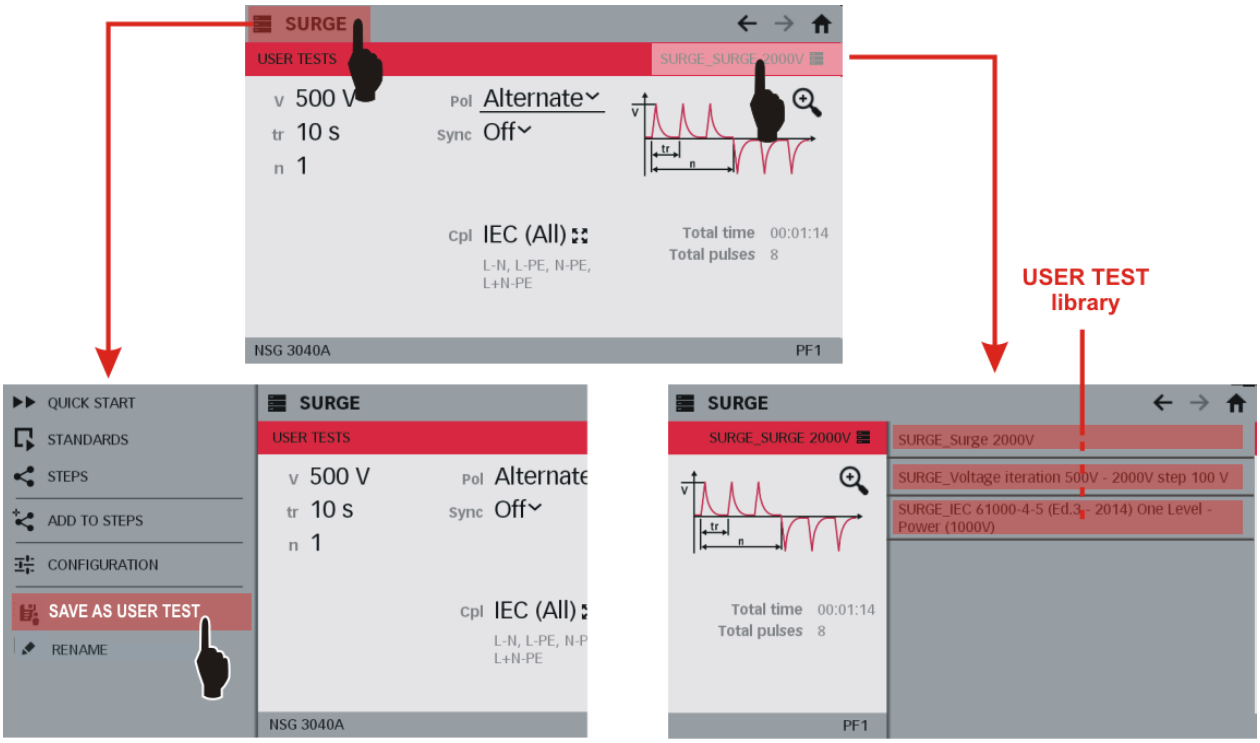




13.1.3. User Test Routines

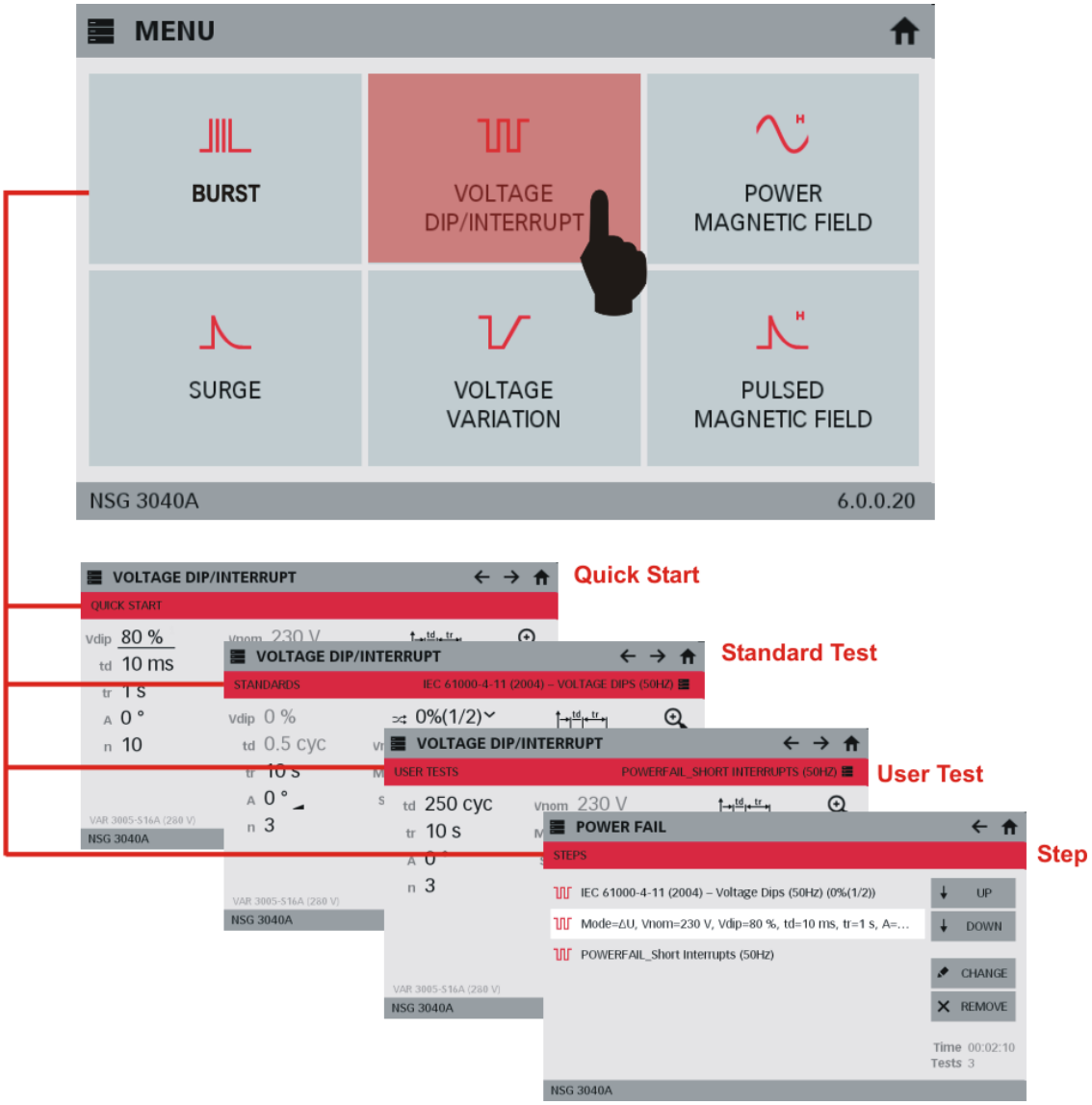
The user can program, save and recall his own specific user test routines, created by himself.

The extended menu offers various useful tests for testing and development.



SAVE AS USER TEST Save the actual test as user test. The user defines the name of the test

14. Voltage Dips and Interruptions & voltage variation as per IEC 61000-4-11

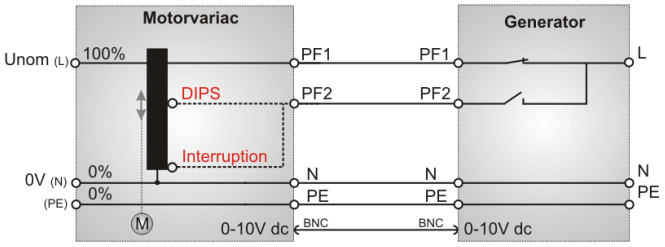


Main Menu Power Fail for voltage dips and interrupt tests and voltage variation

14.1. Test setup for DIPS and Interruption tests

Voltage DIPS

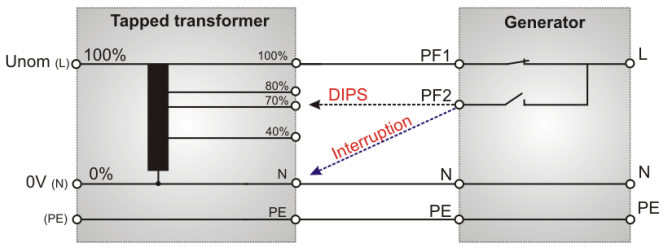
For voltage DIPS a connection must be made from the NSG 3000A PF2 input to the variable transformer PF2 or tapped transformer, where the reduced voltage is present.



Interruption tests

For Interrupts connect the generator PF2 input to the neutral as follows:

- **Variable transformer**: PF2 output (default setting) set variable transformer to zero volt.
- **TVT 1-250-16.1**: Connect the cable to the N output at the tapped transformer TVT series

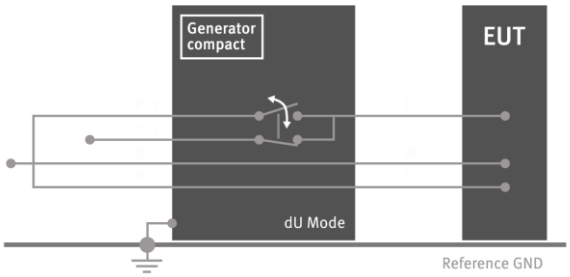


Setup for dU mode

The generator is connected as follow:

PF1: Mains voltage from the grid
PF2: Reduced voltage preset for the dip test. Mostly set to 40%, 70% or 80% of the mains voltage

The internal generator switch will change the EUT supply voltage between PF1 and reduced PF2 voltage.

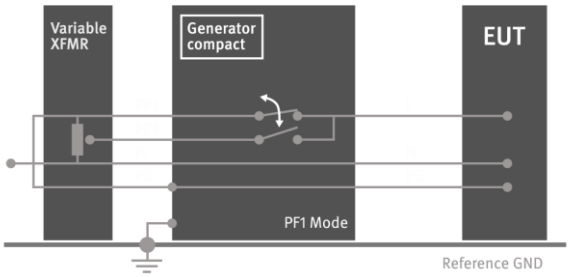


Setup for PF1 mode

The generator is connected as follow:

PF1: Mains voltage from the grid
PF2: Switch is open during the test

The generator switch will PF1 for interrupt the supply voltage to the EUT

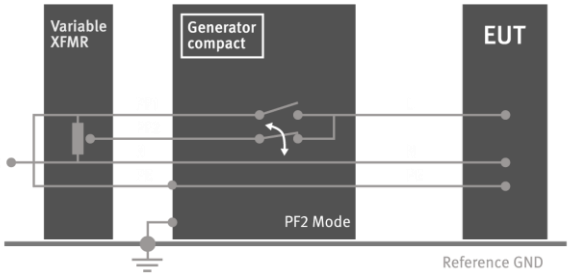


Setup for PF2 mode

The generator is connected as follow:

PF1: Switch is open during the test
PF2: EUT supply voltage from the variable XFMR during the test.

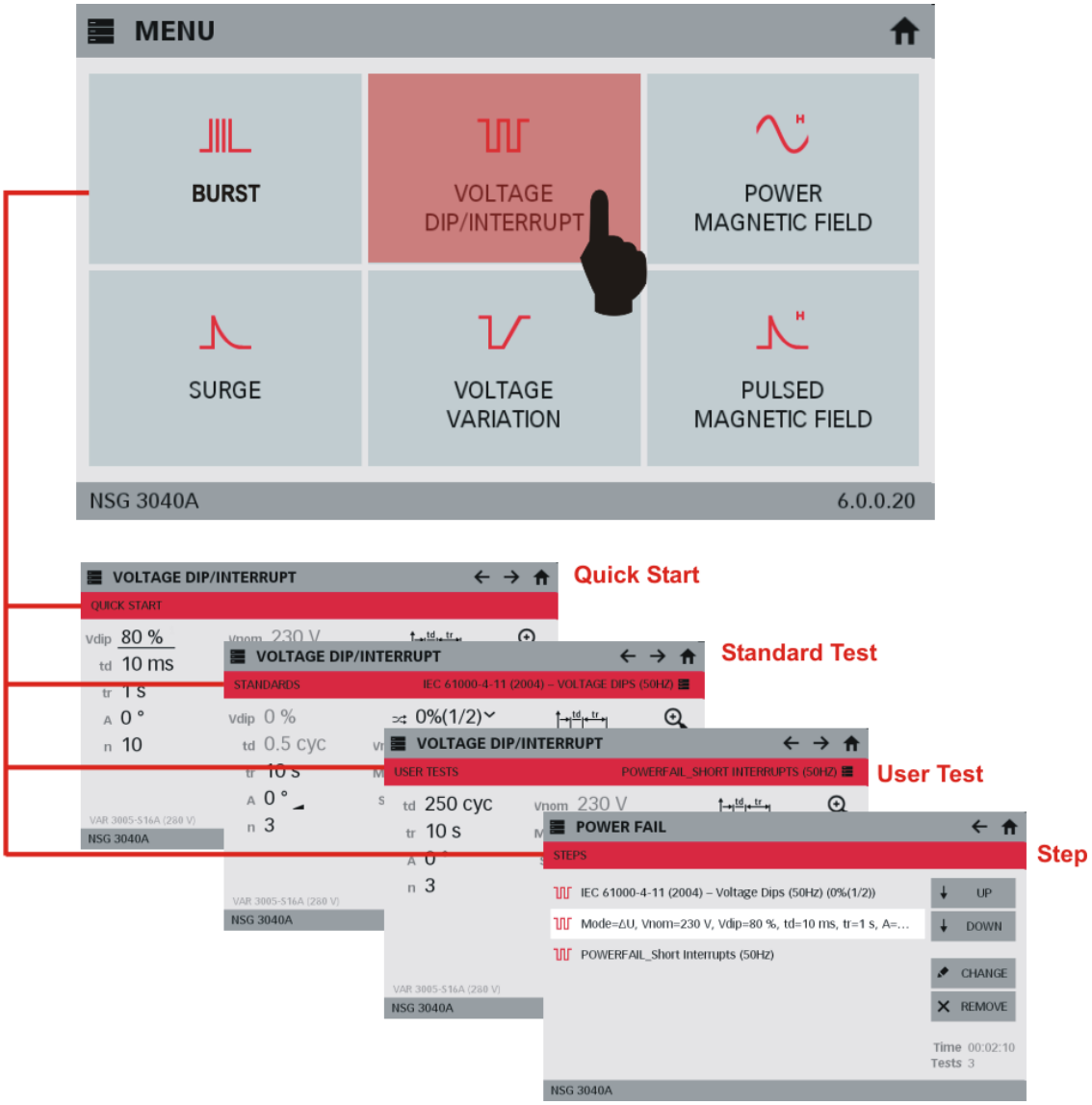
The variable XFMR starts at the default voltage and reduce to the settled voltage. Start the voltage interruptions with PF2. After the last interruption the variable XFMR returns to the default voltage.



14.2. Operation

Dips Module for voltage Dips and short interruptions.

The menu offers different test routines for pulsed magnetic field testing.



Click into Voltage / DIPS menu loads the **last used menu**. Of the following routines below.

Quick Start
Easy and fast online-operation of the equipment for voltage DIPS and power interruption tests.

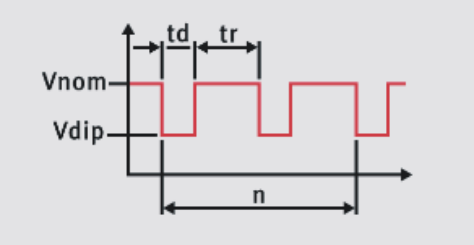
Standard
The operator can select between various preprogrammed test routines as required in different standards.
The operator can select the standard routine for 50/60Hz, depend of the measured frequency, testing as per IEC 61000-4-11.

User test routines
The user defined library where all created power fail tests are stored.

STEP
The STEP library created during the actual session. The user can easy save a test into the Easy Link library. After switching off the Equipment all STEP tests are deleted. Use “SAVE AS USER TEST” for definitive save the test.

14.2.1. Quick Start

Easy and very fast operation of all standard functions of the equipment. The latest simulator settings are stored automatically and will be recalled when Quick Start is next selected.



Explanations	
A	Phase angle
td	Duration of a single event
tr	Repetition rate (time between two events)
Mode	Channel select (PF1, PF2 or ΔV)
Vdip	Variable test voltage (controlled by 0-10 V analog voltage)
n	Number of events
sync	Trigger mode synchronization to mains (On / Off)

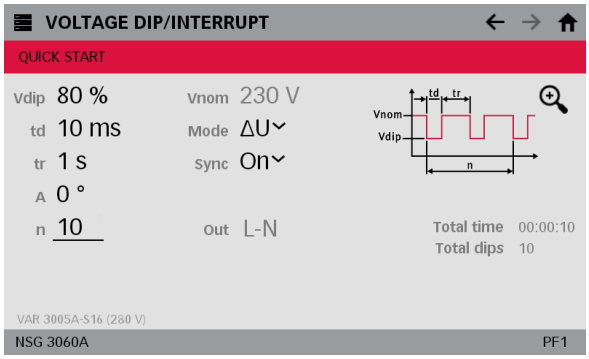
The parameter to change can be selected by pressing a function key. The corresponding range will then be displayed.

14.2.1.1. Voltage DIPS

For testing voltage DIPS select:

Mode **ΔU**: During the test the internal switch toggle the supply voltage between PF1 and PF2

Vdip: Dip voltage [%Vnom] or [V]
td: Duration of the dip
tr: Repetition time between two dips [ms, s]
Sync: Synchronization with **phase angle A** [°]
n: Number of events

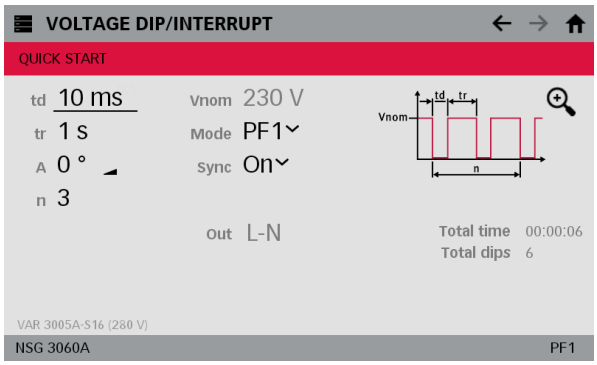


14.2.1.2. Voltage Interruption

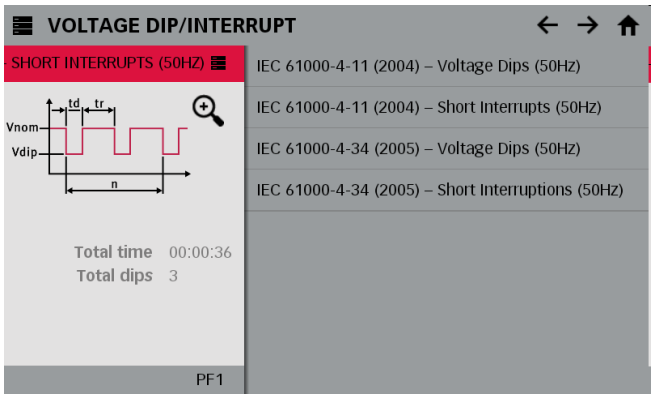
For testing voltage DIPS select:

Mode **PF1**: During the test the internal switch PF1 will switch ON and OFF during the test

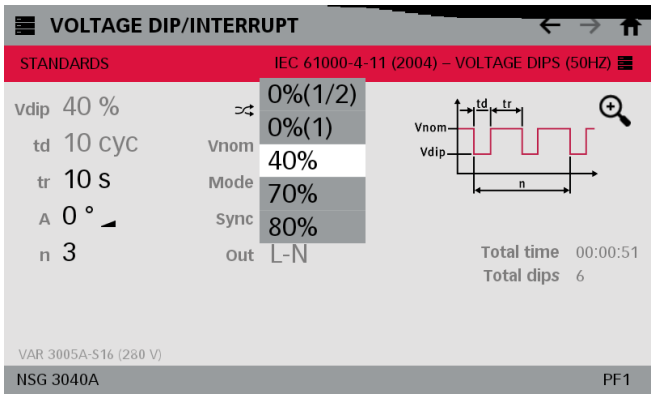
td: Duration of the interruption
tr: Repetition time between two interruption
Sync: Synchronization with **phase angle A** [°]
n: Number of events

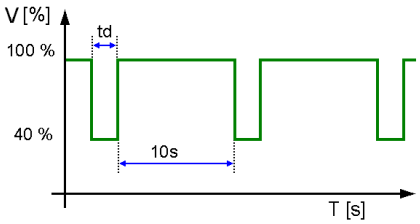


14.2.2. Standard Test Routines



14.2.2.1. IEC 61000-4-11 (AC power supply mains)

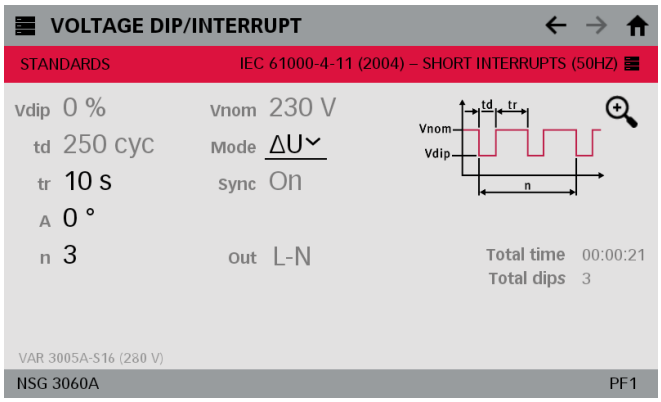


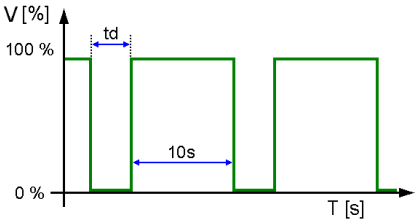


If the external transformer VAR 3005A-S16 is used, controlled by an analogue 0-10V control voltage, the test is conducted automatically. If this option is not available, the manual test routine shall be used.

Using a manual tapped transformer TVT 1-250-16, the user must connect the PF2 input with the correct plug at the TVT 1-250-16. At 0% selection the PF2 input must be connected to the neutral (0 V) plug for a low impedance voltage dip test. Otherwise, when the PF2 input is not connected, the voltage dip is with high impedance.

Short interruptions



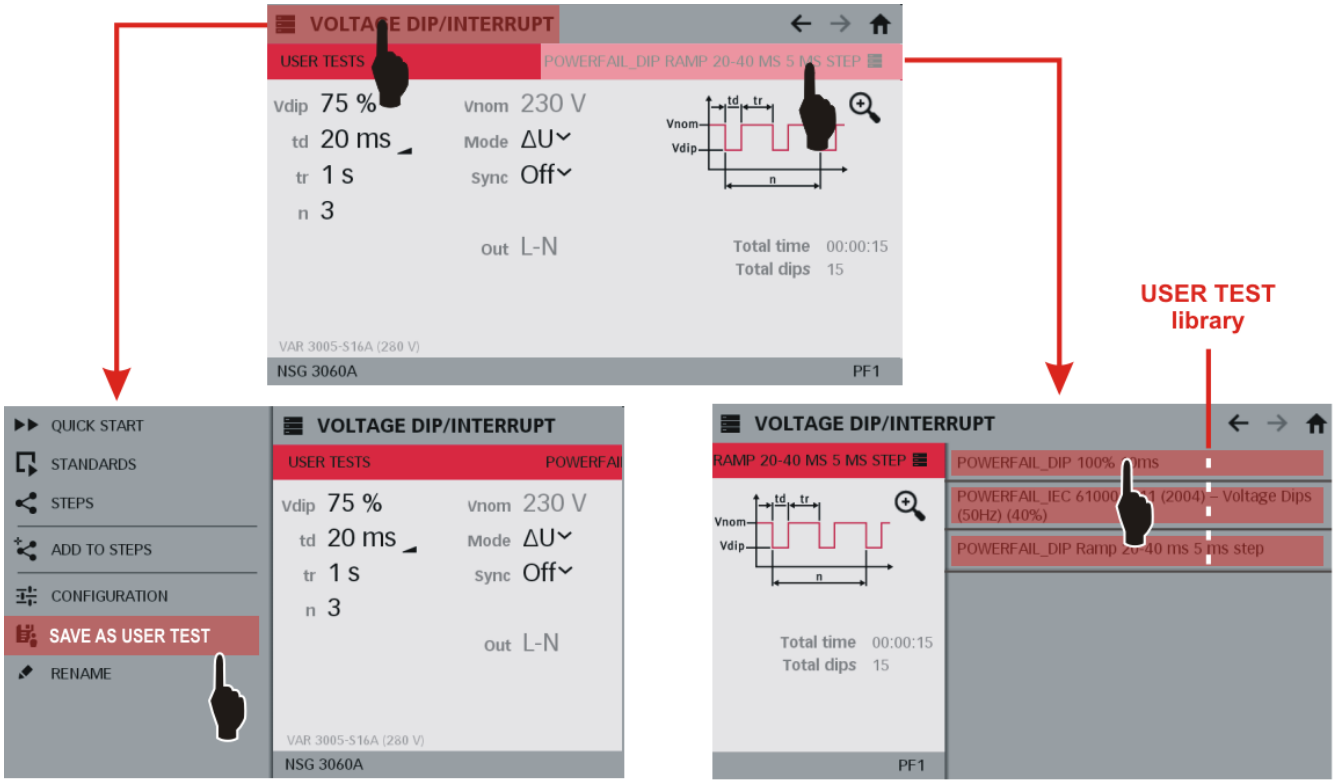


14.2.3. User Test Routines

The user can program, save and recall his own specific user test routines, created by himself.
The user test routines library offers various useful self-created tests for testing and development.

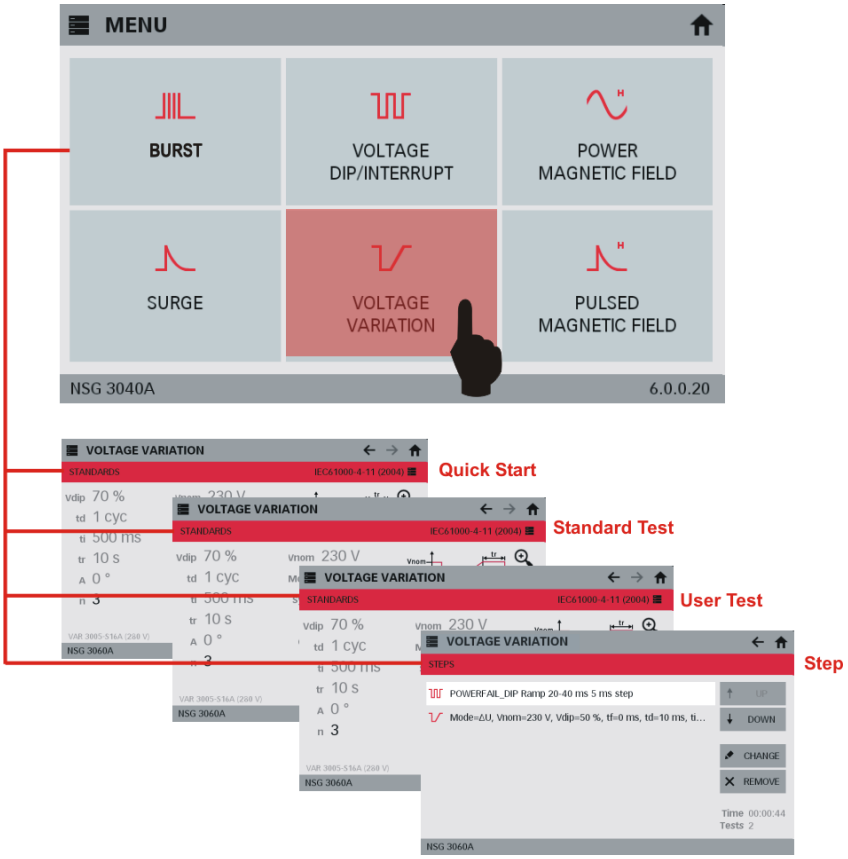
The user can program, save and recall his own specific user test routines, created by himself.

The extended menu offers various useful tests for testing and development.



SAVE AS USER TEST Save the actual test as user test. The user defines the name of the test

14.3. Voltage Variation

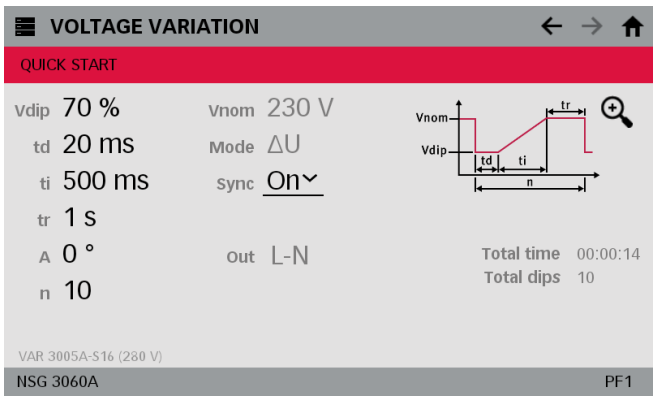


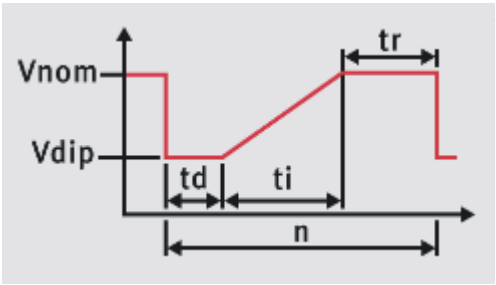
Main Menu Power Fail for voltage dips and interrupt tests and voltage variation

Attention

The voltage variation menu requires a **motorized variable transformer**

VAR 3005A-S16





14.4. The Power Fail Test

14.4.1. Test routines termination

The test routine for power fail starts with an event with the duration (td), followed by a repetition time (tr). For operating, the NSG generator has the following handling for the test routine

Single Test routine
Test routine in a test link implemented

Δ

14.4.2. Operating

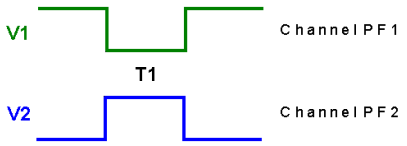
The power fail simulator operates in the following mode:

PF1: The voltage supply at channel PF1 will be interrupted for the preselected time T1.

PF2: The voltage supply at channel PF2 will be interrupted for the preselected time T1.

ΔU: Channels PF1 and PF2 are supplied with different voltages; e.g. channel PF1 with nominal voltage, channel PF2 with 15% under-voltage.

- channel PF1 is switched off for the preselected time T1.
- channel PF2 is switched on for T1.

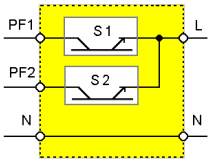


Voltage interference

To accelerate the test procedure, the voltage interference may be generated repetitively. In the operating mode „AUTO “, the events are released at a preselected interval time.

Power switches

The power unit of the simulator consists of two electronic power switches S1 and S2. The two separated input channels PF1 and PF2 are connected to each other at the front panel of the simulator via S1 and S2.



Input channels

The input channels PF1 and PF2 are located at the rear part of the equipment. Attention must be given to the following:

1. **The phase shall be connected correctly. When putting into operation check the lines with a phase tester or with the incorporated LED phase.**
2. **Phase must be set on L, neutral must be set on N.**
3. **This applies to both channels. If during installation phase and neutral is changed, the operator will cause a short-circuit at the input plug of the channel.**
4. **The neutral of both channels is connected internally and directly leads to the output.**
5. **The power switches can bear no more than a voltage of 300Veff.**
6. **If isolating transformers are used special care shall be taken to have both channels in phase. Otherwise too high voltages, in difference mode, may occur and destroy the internal protection devices (varistors).**

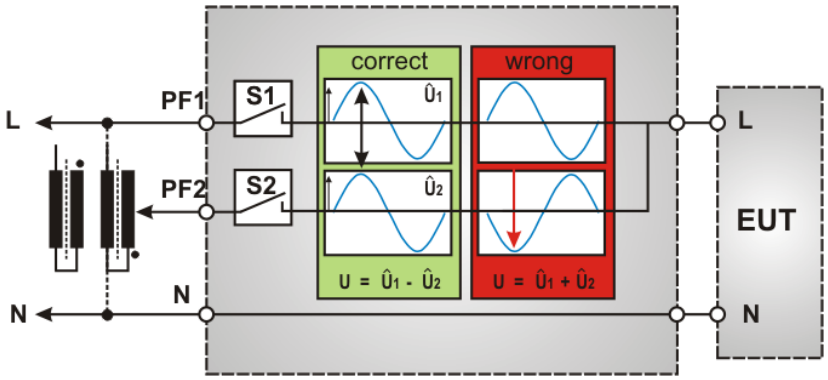
14.5. Overcurrent

Power switches

The power switches are electronically protected against overload and short-circuits. The nominal current of the switches is 25 A (16 A model).

Special protection requirements of the EUT must be separately assured by the user.

Inrush currents of < = 500 A are permitted. To avoid higher inrush currents of the EUT an electronic control limiting the inrush current is incorporated in the device.



Correct phase relation between PF1 and PF2

Over-voltage generated by connecting or disconnecting additional loads will be limited internally by varistors in parallel to the electronic switch.

Occurs an overcurrent during a test, The PF switches will switch off immediately and the display shows:

Attention

Overcurrent REMOVE SHORT CIRCUIT! at the generator

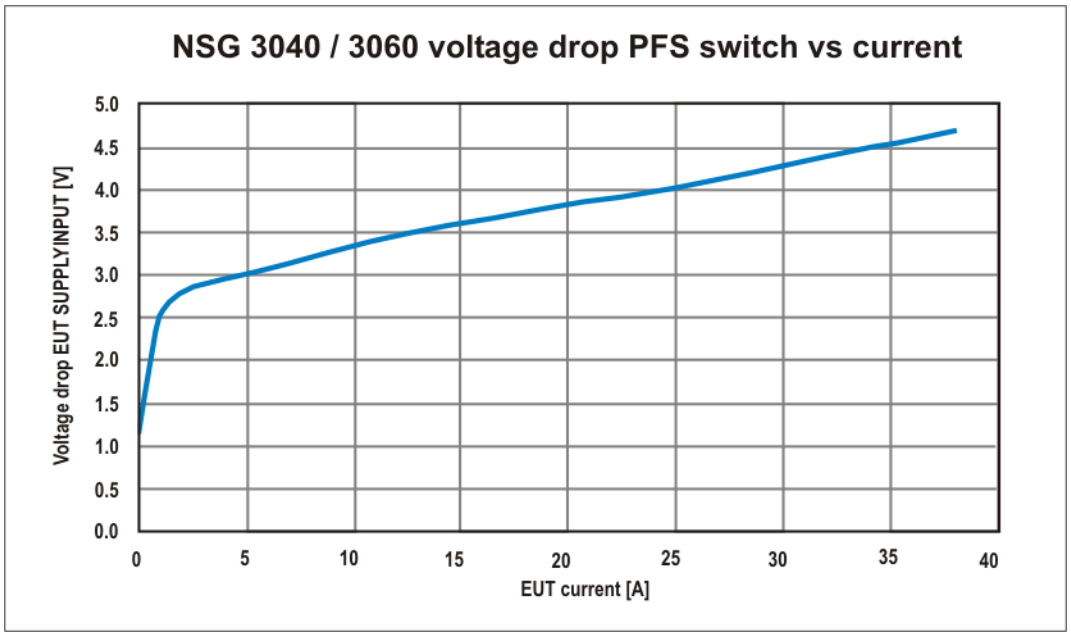
This error message appears after a short circuit at the EUT output plugs. This current can be up to 700 A during few µs and will be detect from the overcurrent detection.

For overcurrent handling proceed as follow:

1. **Disconnect the short circuit** and make sure to remove the failure.
2. Press **OK**. This will switch on the PF switch again and returns the power to the EUT output.
3. Continue in the start menu with START.

14.6. Voltage drop over the PFS switch

The voltage drop, over the internal PFS switch is shown in the diagram below.



current [A]	voltage drop [V]
0.01	1.18
0.1	1.62
0.5	2.43
1	2.60
2	2.75
3	2.82
4	2.90
5	2.97
6	3.05
7	3.12
8	3.18
9	3.25
10	3.30
11	3.37
12	3.43
13	3.49
14	3.54
15	3.60
16	3.66
18	3.77
20	3.88
22	3.99
24	4.10
26	4.22
28	4.34
30	4.46
32	4.58

14.7. The Power Fail Test

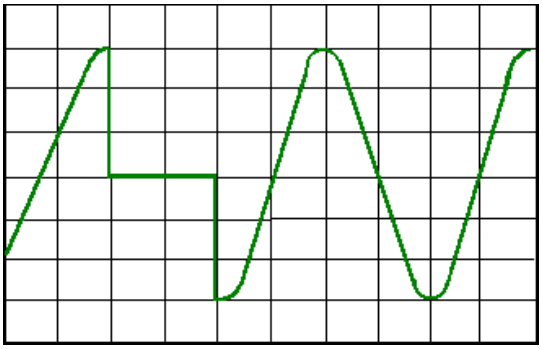
The generator type NSG 3000A simulates the following interference:

- Voltage dips
- Voltage interruptions
- Voltage variations
- Inverse

14.7.1. Voltage Interruptions

Depending on the preselected test parameters at the front panel of the simulator the power supply for the EUT is interrupted for a certain time and at a certain phase angle (AC power supplies).

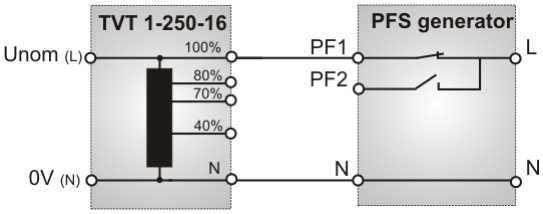
The power supply for the EUT is connected at the rear part of the simulator to channel PF1.
The power supply may be taken directly from the mains power supply or from a separate voltage source. Mostly used for these tests are motor driven variable transformers



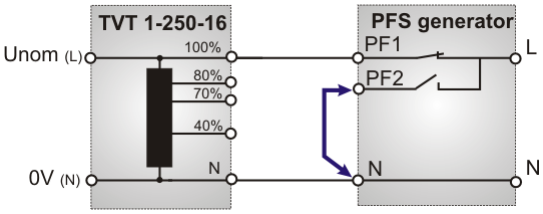
Power fail tests are normally carried out at a nominal voltage and at maximum tolerance under-voltage.
The nominal voltage may be connected to PF1 and the reduced dip voltage to PF2.

The power fail test may be carried out in various operating modes:

High impedance interruptions
With ΔU mode the EUT supply is interrupted by the electronic switch. The PF2 input is not connected. The EUT must discharge itself internally.



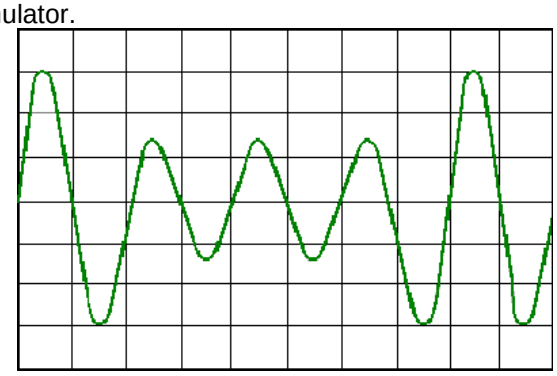
Low impedance interruptions
The EUT supply is connected to PF1. The channel PF2 is short-circuited (L-N). The EUT supply is disconnected by the electronic switch of PF1 and the EUT will be discharged into a low impedance via the electronic switch of PF2



14.7.2. Voltage dips, voltage variations

Depending on the preselected test parameters, the test voltage is changed to a higher or to a lower value for a certain duration and at a certain phase angle.

Voltage variations are normally related to the nominal value of the supply voltage. Therefore, two different variable transformers shall be connected at the rear side of the simulator.



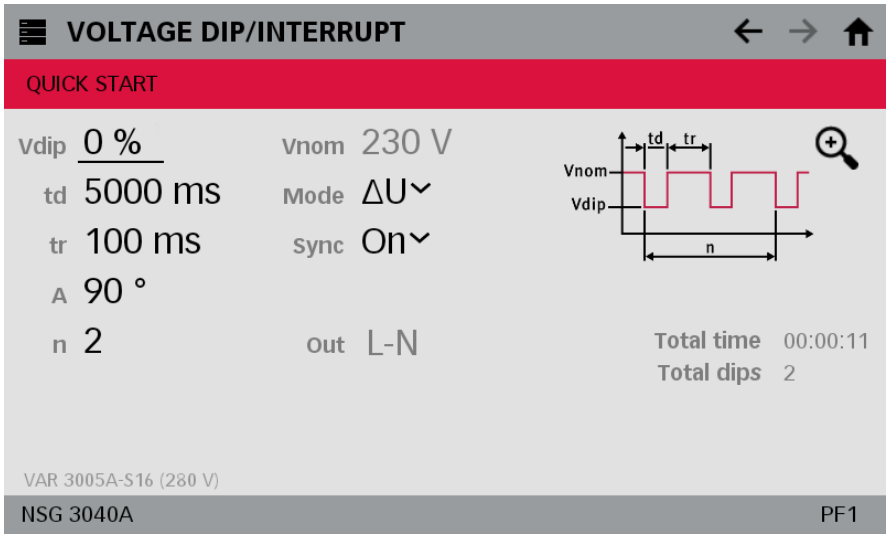
- PF1 → Nominal voltage
- PF2 → Under- / overvoltage

The operation mode ΔU shall be preselected. The voltage variation is realized by switching the power supply from channel PF1 to channel PF2.

If a motor driven variable transformer is available, it is also possible to drive the source by an analogue voltage 0 - 10V. This control voltage is available at the coaxial output at the rear part of the simulator
The control voltage is to be set via the operator menu or the interfaces of the Power Fail. A complete user software to drive ramps and functions is also available

14.8. The Power Fail Verification

Program setting:



During the test the power change to PF2 for 5 seconds. During these 5 seconds the user must connect the CA PFS to the output of the generator.

A. Preparation before the test starts:
- Make the setting as shown in the picture above
- Discharge the CA PFS box
- Do not power the PF2 input of the NSG generator at the rear side
- Connect only the N-wire to the NSG 3000A N-EUT output plug on front side
- Prepare the L wire to connect it after test start to the L-EUT output plug in a short time

B. Test procedure:
- Press start button. The white LED changes from PF1 to PF2
- The user has 5 seconds time to connect the L-wire of the CA PFS to the L-EUT output of the NSG 3000A
- After 5000 ms at the 90 deg phase angle, the generator will change the power from PF2 to PF1
- Measure and record the inrush current via PF1

Remark: If the 5 seconds are too short for connect the CA PFS to the compact NSG generator, the user can increase the td time. Take care that the td time is a multiple of the frequency period

14.9. Test setup and accessories

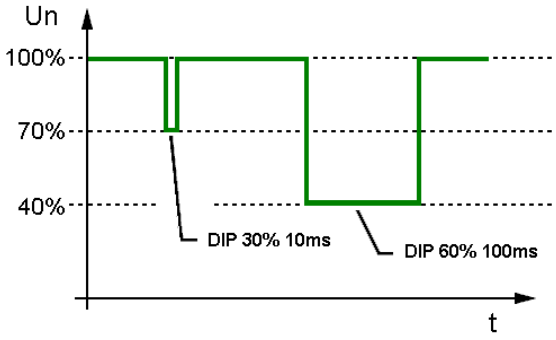
14.9.1. Transformer type TVT 1-250-16

The transformer shall be used to generate under-voltages in ac power supply systems. According to the IEC 61000-4-11 and the EN 50081-2 voltage dips shall be generated as shown in fig. below. Different test levels are recommended

14.9.1.1. Voltage interruptions (DIPS)

Voltage interruptions will cause a reduction of the power supply voltage for a certain period. Three different test levels are required:

- Voltage dip by 100% to 0% of the nominal voltage for 10ms or. ½ period
- Voltage dip by 100% to 0% of the nominal voltage for 20ms respectively 1 period
- Voltage dip by 60% to 40% of the nominal voltage for 200ms respectively 10 periods
- Voltage dip by 30% to 70% of the nominal voltage for 500ms respectively 25 periods
- Voltage dip by 20% to 80% of the nominal voltage for 5000ms respectively 250 periods



Standard voltage dips

TVT 1-250-16.1 with automatic tap control

The transformer is an accessory to the following devices
- NSG 3040A, NSG 3060A series

14.9.1.2. Device models TVT 1-250-16 series

TVT 1-250-16	250 V 16 A, manual control
TVT 1-250-16.1	250 V 16 A, automatic control

14.9.1.3. Control TVT 1-250-16.1

The TVT 1-250-16.1 is controlled through the analogue input (0...10Vdc). The control circuit switches to the related tap, 40%, 70% or 80%, proportional to the applied dc reference voltage (0...10V dc) to the output PF2. Is the reference dc voltage out of the tolerance (± 0.25V), the control will not switch to any tap to the PF2 output.

Operating with ramps the control circuit will not select a tap, if the ramp (0-100%) is shorter than approx. 4s. Programming longer ramps, each tap will switch on and off when the reference is in the valid range.

Voltage taps	**DC reference voltage**
80% of Vnom	8.00V ± 0.25V
70%	7.00V ± 0.25V
40%	4.00V ± 0.25V

Settings on NSG 3000A for TVT 1-250-16.1
The NSG 3040A must be matched to the 0-10V input of the TVT 1-250-16.1. Therefore, a **TVT 1-250-16.1 must be configured as a motor variable transformer.** For V and Vn must set to the same value which is the value of the voltage of your power supply.

Setup:

	EUT / SUPPLY			**Equipment tapped transformer**
Settings	**V**	**Vnom**	**Path**	**Maximum voltage**
Example for 230 V mains	230 V	230 V	PF1	230 V

14.9.1.4. Technical Data TVT 1-250-16 models

Design Tapped auto-transformer with 40%, 70%, 80%, 100 % output voltage

Input:

Voltage	Uin: max. 250 V
Frequency	50/60 Hz
Tap selection	manually (TVT 1-250-16) banana plugs for 40%, 70%, 80%
Remote control	0 to 10V dc (TVT 1-250-16.1) for 40%, 70%, 80%

Output:

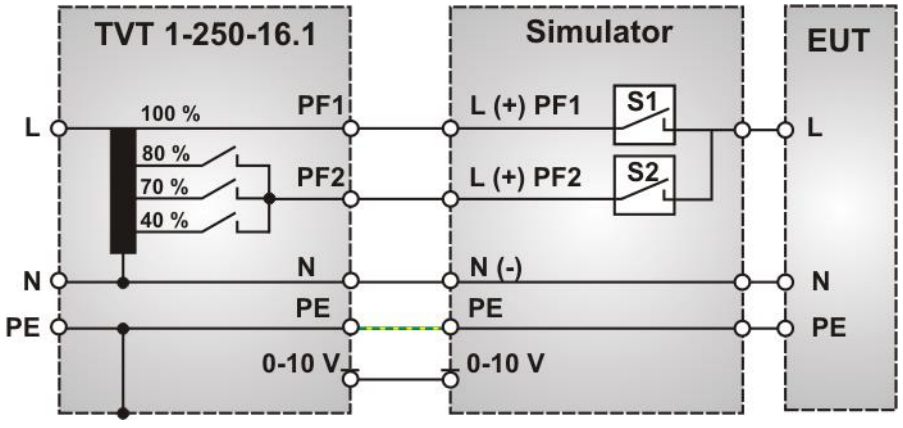
Voltage tap [% Unom]	100 % 80 % 70 % 40 %

	TVT 1-250-16	**TVT 1-250-16.1**
Current Imax.	16 A	16 A
Power	4.1 kVA	4.1 kVA
Fuse	2x 16 AM	2x 16 AM
Tap setting	manual	Automatic 0-10 VDC
Weights and measures		
Dimensions	95 x 170 x 190 mm (H x B x T)	95 x 170 x 190 mm (H x B x T)
Weights	ca. 7 kg	ca. 7 kg
Temp Ambiance	10°C - 35°C	10°C - 35°C

14.9.1.5. Setup TVT 1-250-16

The output voltages are available at safety banana plugs. For safety reasons the related safety cables shall be used.

The power supply input is realized with a power connector for L, N and PE. The voltage shall be 100% of the nominal voltage Vn.



Connection
TVT 1-250-16 / TVT 1-250-16.1

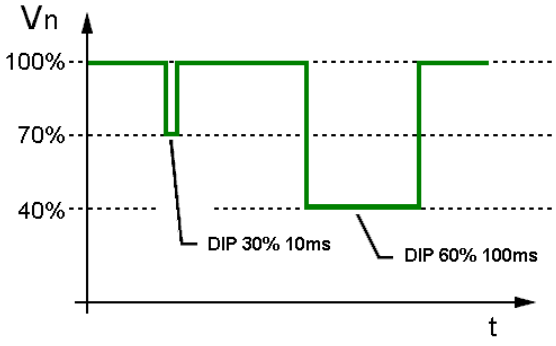
14.9.2. Variable Transformer variable transformer VAR 3005A-S16

The motor variable transformer can be used to simulate power supply failures as under-voltages, voltage interruptions and voltage variations. The basic standard IEC 61000-4-11 and the generic standard EN 61000-6-2 are specifying these phenomena.

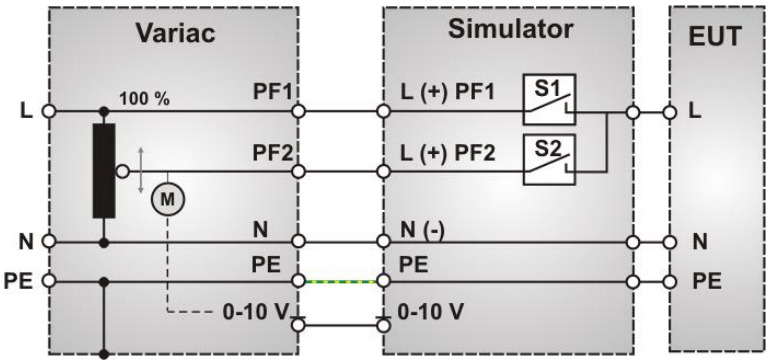
14.9.2.1. Voltage dips / interruptions

Voltage interruptions will cause a reduction of the power supply voltage for a certain period. Three different test levels are required:

- Voltage dip by 100% to 0% of the nominal voltage for 10 ms or. 0.5 cycle
- Voltage dip by 100% to 0% of the nominal voltage for 20 ms respectively 1 period
- Voltage dip by 60% to 40% of the nominal voltage for 200 ms respectively 10 periods
- Voltage dip by 30% to 70% of the nominal voltage for 500 ms respectively 25 periods
- Voltage dip by 20% to 80% of the nominal voltage for 5000 ms respectively 250 periods



Standard voltage dips



Connection diagram variable transformer VAR 3005A-S16

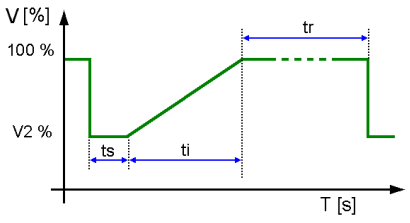
The unit must be connected at the rear part of the equipment. For connection safety labor cables shall be used.

14.9.2.2. Voltage variation

Additionally, it is possible to drive certain functions of variation, which also are required in IEC 61000-4-11. These functions can easily be programmed within the simulators itself or within the related windows software ISMIEC

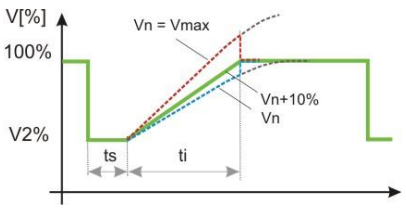
V2	Test level [%U1]:	40 %, 0 %
tf	Time for decreasing voltage [sec]	2 ± 20 %
t1	Time at retained voltage [sec]	1 ± 20 %
tr	Time for increasing [sec]	2 ± 20 %

For new FDIS IEC 61000-4-11 (2004) use a new procedure for voltage variation, who simulate a voltage dip during a motor start.



The variable transformer will be set previously to the voltage V2. The switch to PF2 happens in the NSG generator. Then the variable transformer increases the voltage controlled by the generator. After ti, the voltage changes back to PF1

The speed of the voltage variation depends on the max. speed of the variable transformer and the control setting of the integral action controller. The behavior can be influenced by the parameter Vnominal. Setting in the setup menu Setup / F5 Voltage setting.



The user can optimize his setting for the test.
Vn = Vmax of variable transformer Red curve the voltage rising is too fast.
Vn = 110% of Vnominal Green curve optimum setting
Vn = Vnominal Blue curve the voltage regulation is too slow.

14.9.2.3. Technical data variable transformer VAR 3005A-S16

Input:

Voltage	Vin: max. 250 V
Frequency	50/60 Hz

Output

Voltage variable	Vout: 0 – 260 V for channel PF2
Voltage fix	Vout: Vin for channel PF1
Current	max: 16 A
Power	0 - 4.1 kVA

Control

Main switch	On /Off for the output voltages
Control voltage	analogue 0 - 10V DC for 0-260V output voltage
Time 0 to 100%	< 2s

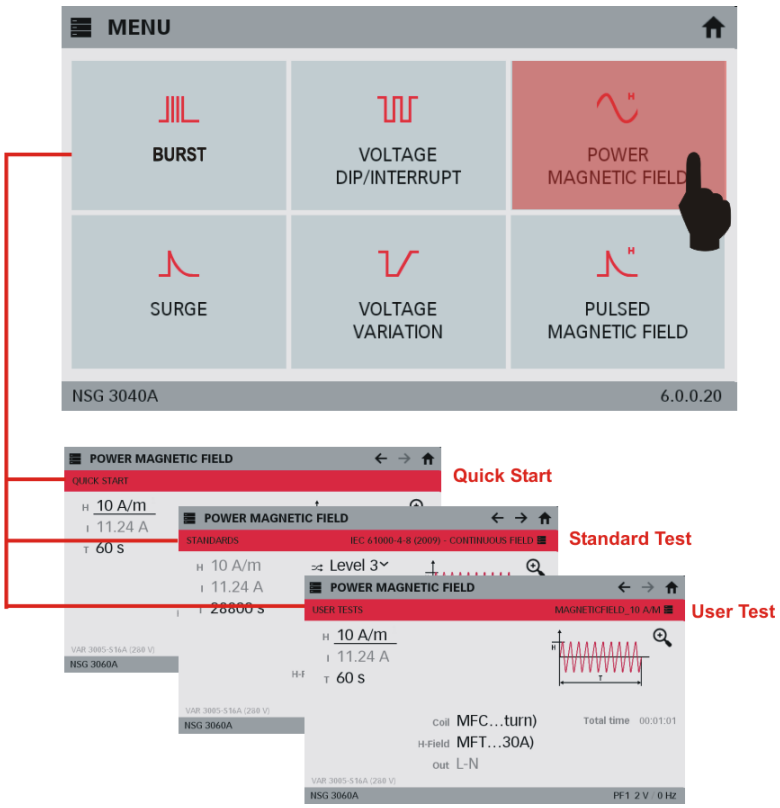
Dimensions and weight

Dimensions	19" 6HE 266x485x400mm (H x W x D)
Weight	app 27 kg
Power supply	115/230 V
Fuse	20 A (PF1), 16 A (PF2) slow blow
Environment Tmax	40 °C

15. Power frequency Magnetic Field as per IEC 61000-4-8

15.1. Operation

The Power magnetic menu offers different test routines for magnetic field testing.



Click into Power Magnetic Field menu loads the **last used menu**. Of the following routines below.

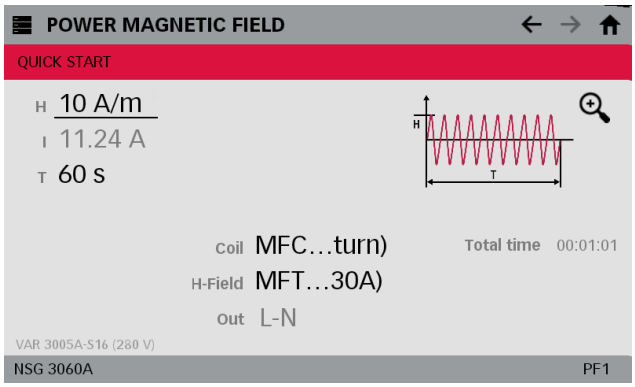
Quick Start
Easy and fast online-operation with the phenomenon Surge. In this menu the user can operate all surge test manually with online change the most parameters during a test.

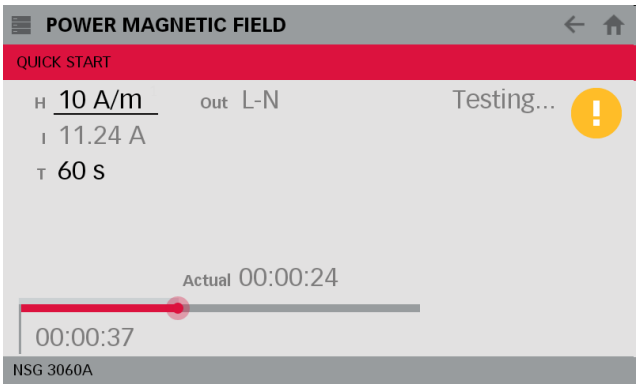
Standard
The operator can select between various preprogrammed test routines as required in different standards
The standard library is filtered according the EUT setting (AC, DC etc.)

User test routines
The user defined library where all created surge tests are stored.

15.1.1. Quick Start

Easy and very fast operation of all standard functions of the equipment. The latest simulator settings are stored automatically and will be recalled when Quick Start is selected.





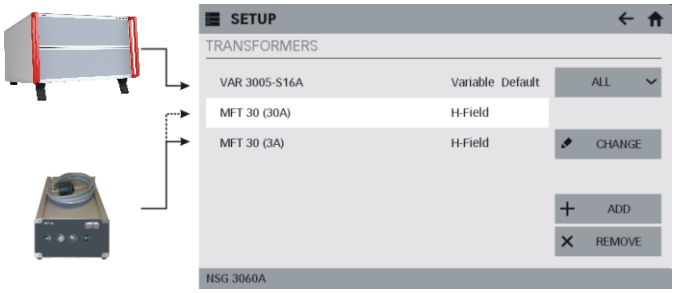
15.1.2. Required device setting to perform a power frequency magnetic field test

To perform a 50/60 Hz magnetic field test, the NSG generator must be configured with the used hardware in the menu:

Menu / SETUP / Equipment

1. **Variable transformer**:
   - VAR 3005A-S16

2. **Magnetic current transformer**
   - MFT 30 (3 A range) H-field 1 to 10 A/m
   - MFT 30 (30 A range) H-field 1 to 44 A/m
   - MFT 100 H-field 80 to 1.000 A/m



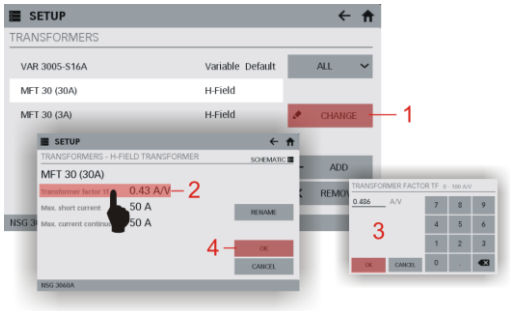
The MFT 30 has two ranges and therefore the NSG generator list this current transformer in the configuration for (3 A) and (30 A) range. Set the range switch of the MFT 30 to the correct position before starting the test.

To adjust the Transformer factor, use menu / SETUP / TRANSFORMERS

The transformer factor is defined as follow:

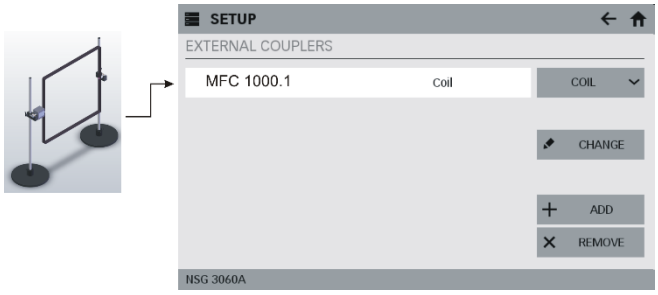
$$\text{Transformer factor} = \frac{\text{Antenna current [A]}}{\text{U prim MFT 30 [V]}}$$

For more information see chapter 1.4.2 current transformer MFT 30



Menu / SETUP / EXTERNAL COUPLERS

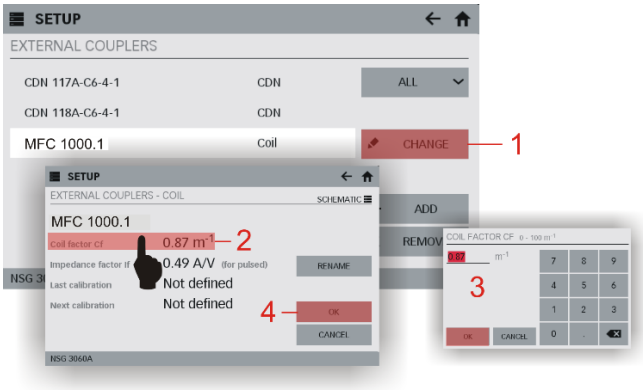
3. **Magnetic field antenna**:
   - MFC 1000.1



The coil or antenna factor is defined as follow:

$$\text{Coil factor} = \frac{\text{H-field antenna [A / m]}}{\text{I antenna [A]}}$$

For more information see chapter 1.2 Magnetic field antenna

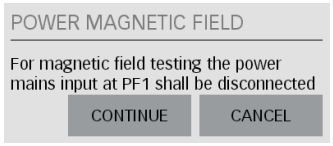


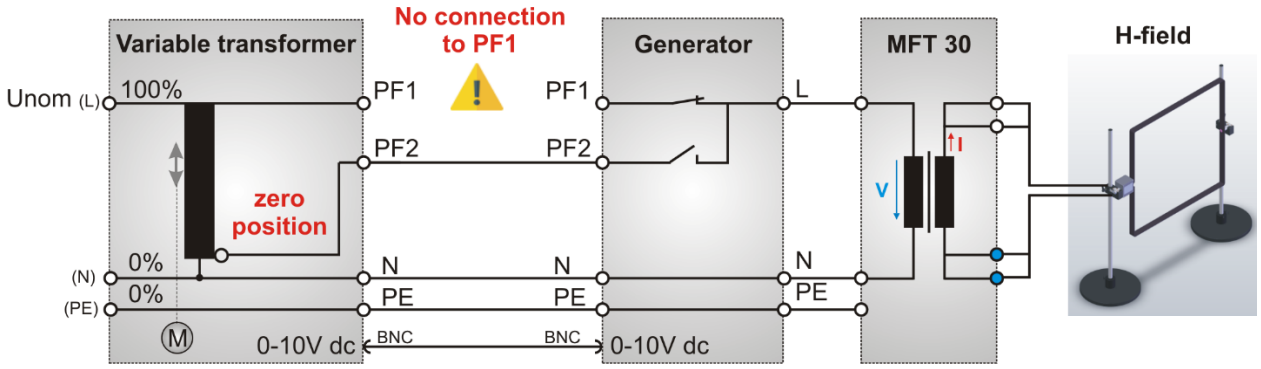
15.1.3. Test setup for power frequency magnetic field test

Warning

For magnetic field testing the power mains input at PF1 must be disconnected.

A message appears to confirm, that the PF1 generator input is disconnected from the mains. This guarantees that in the event of a fault, the 230 V mains voltage can never be applied to the MFT 30 and that a high H-field is present.

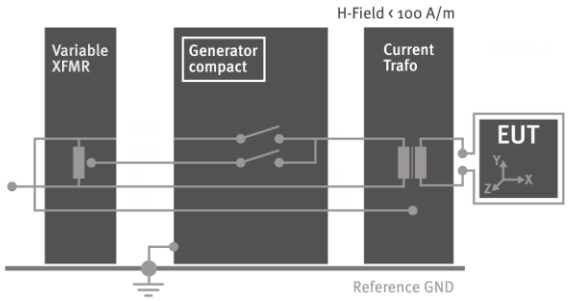




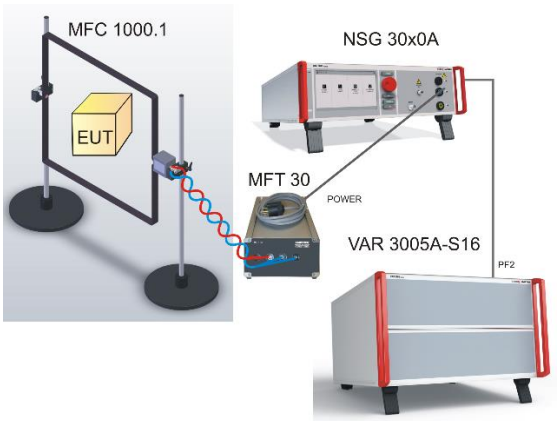
The voltage V is adjusted with a variable transformer. The MFT 30 is a short circuit transformer that generates the required current into the 1 m x 1 m loop antenna with one turn. For the standard antenna, the standard defines a current of 1,145A for a magnetic field of 1 m^{-1}.

The variable transformer VAR 3005A-S16 will be controlled automatically via the test generator. Any equivalent manual transformer available in the lab can be used to control the current manually. Please take care that the variable transformer has enough current capability.

15.1.4. Test setup with MFT 30 for H-Fields up to 30 A/m



Schematics



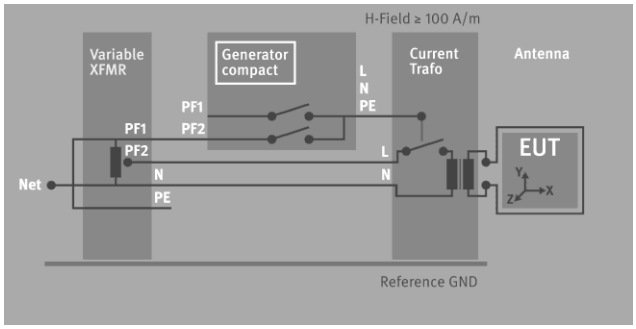
Test setup

Schematics and Test setup with NSG 3040A, VAR 3005A-S16, MFT 30 and MFC 1000.1

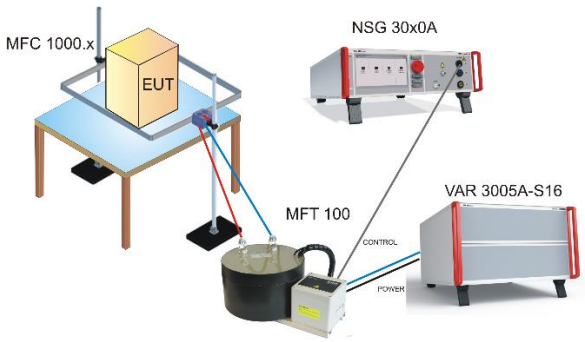
Options required for magnetic field tests as per IEC 61000-4-8

- External variable motor variac **VAR 3005A-S16**
- External magnetic field antenna **MFC 1000.x**
- External current transformer **MFT 30** to test 1, 3, 10 and 30 A/m levels (continuous)

15.1.5. Test setup with MFT 100 for H-Fields up to 1.000 A/m



Schematics



Test setup

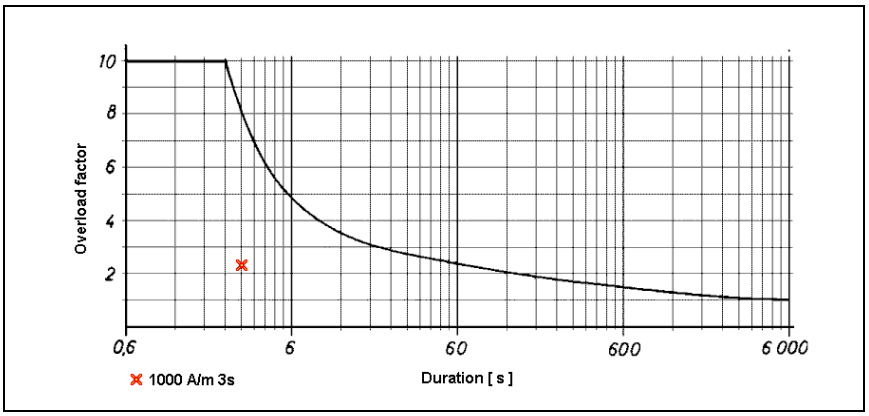
Schematics and Test setup with NSG 3040A, VAR 3005A-S16, MFT 100 and MFC 1000.1

Options required for magnetic field tests as per IEC 61000-4-8

- External variable motor variac **VAR 3005A-S16**
- External magnetic field antenna **MFC 1000.x**
- External current transformer **MFT 100** to test 100 A/m (continuous) and up to 1.000 A/m (short-term)

Tests with 1.000 A/m magnetic field

During tests with a field of 1.000 A/m the primary current of variac NX1-260-16 during the 3s testtime goes to approx. 39A. The motorvariac can withstand this load for this short time. The figure below shows the load diagram. Therefore the variac NX1-260-16 can withstand during approx. 45s a current of 39A. Normally the fuses do not break during the 3s test time.



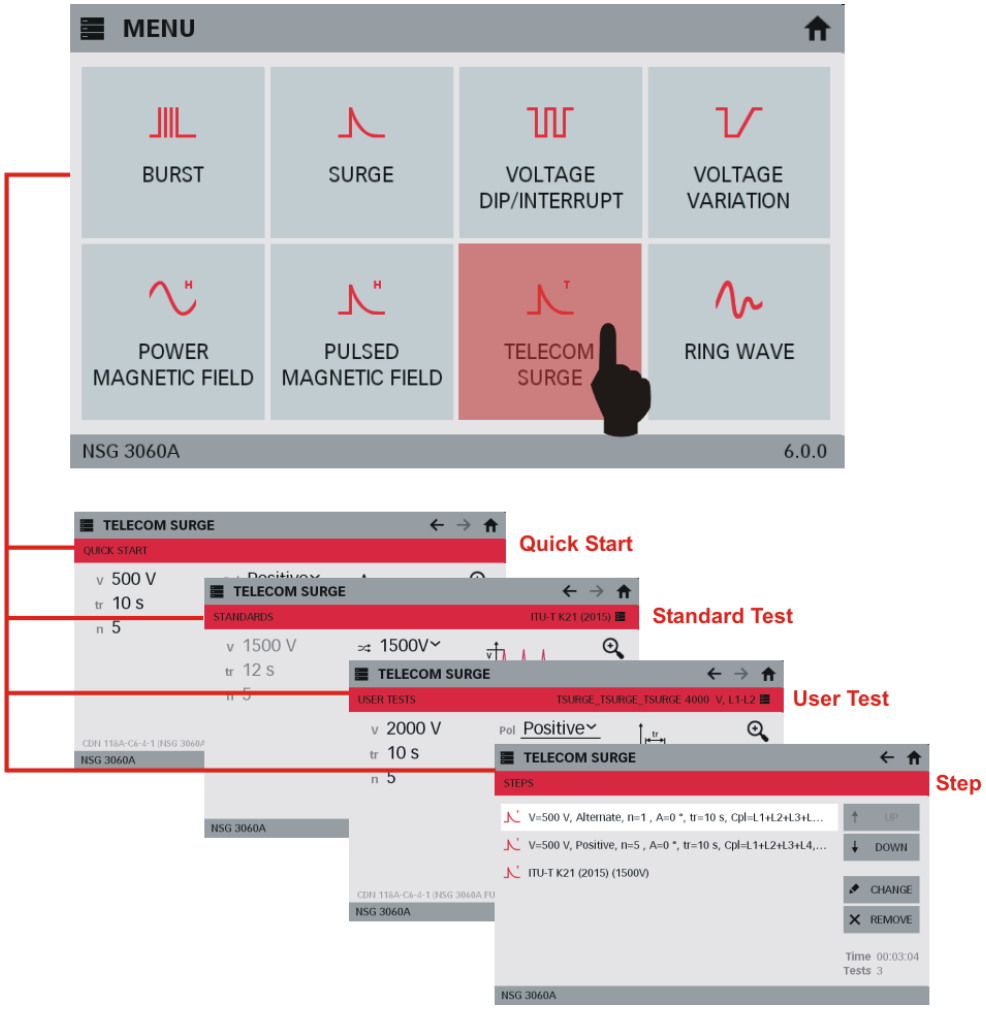
Load diagram variac NX1-260-16

16. Telecom Surge Immunity as per IEC 61000-4-5

Surge Module 10/700µs – 5/320µs

16.1. Operation

The surge menu offers different test routines for burst testing.



Click into Telecom surge menu loads the **last used menu**. Of the following routines below.
The surge menu offers different test routines for surge testing.

Quick Start
Easy and fast online-operation with the phenomenon Telecom Surge. In this menu the user can operate all surge test manually with online change the most parameters during a test.

Standard
The operator can select between various preprogrammed test routines as required in different standards
The standard library includes IEC, ITU and ETSI standards

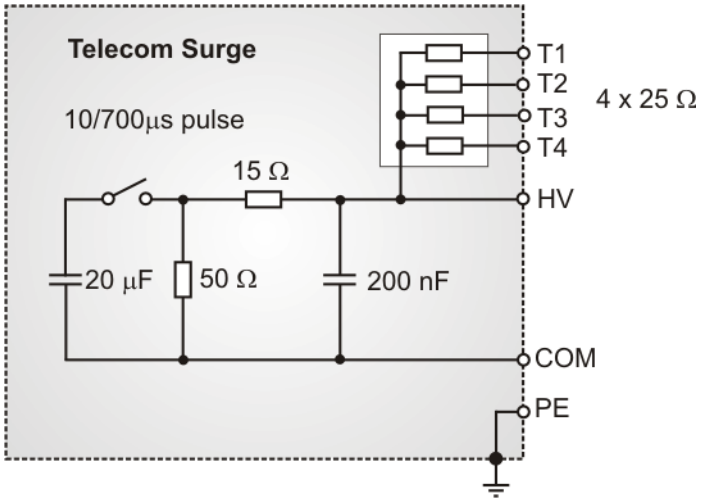
Extended Tests
The operator can select between various preprogrammed test routines which helps to accelerate testing and which are very helpful especially during design.

User test routines
The user defined library where all created surge tests are stored.

Easy Link
Link files library created during the actual session. The user can easy save a test into the Easy Link library. After switching off the Equipment all Easy Link tests are deleted. Use “SAVE AS USER TEST” for definitive save the test.

16.1.1. Generator Network for Telecom Surge

The figure below shows the elements and schematic of the Telecom surge pulse circuit



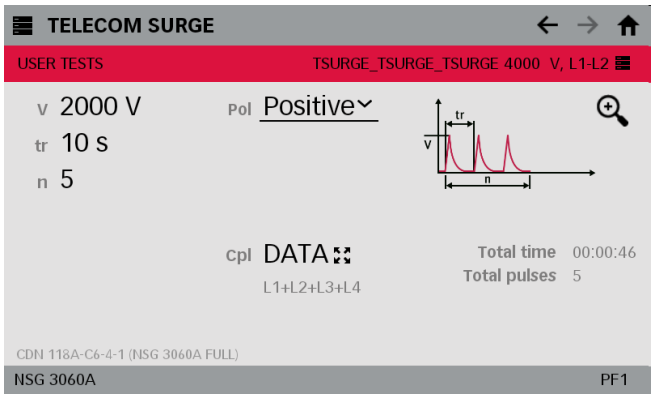
T1 to T4	Ports for direct application
HV, COM	Port to external coupling network

All telecon output are served when using telecom surge application. Anyway, the coupling menu offers a coupling to the following options. This is more to confirm when using the remote software iec.control.

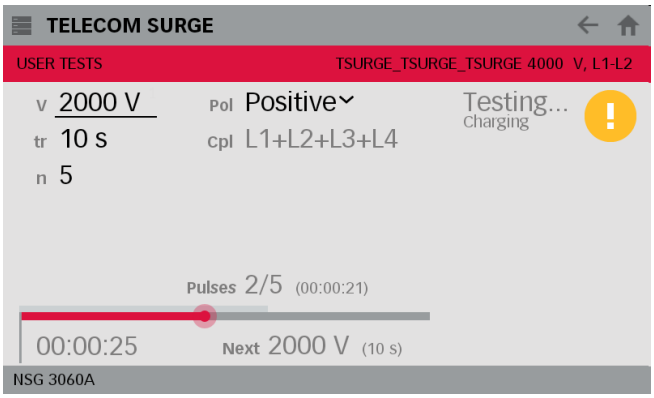
- HV – COM
- T1 + T2 + T3 + T4
- T1 + T2
- T3 + T4

16.1.2. Quick Start

Easy and very fast operation of all standard functions of the equipment. The latest simulator settings are stored automatically and will be recalled when Quick Start is next selected.



Quick Start Menu



Quick Start testing

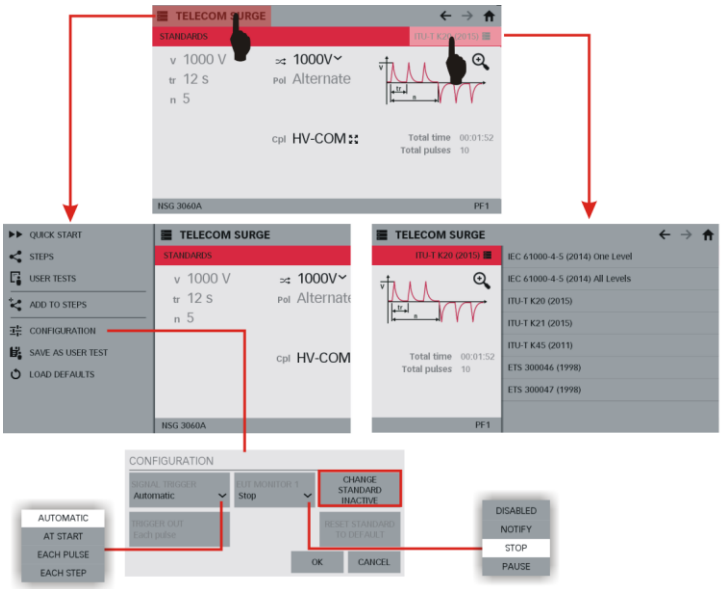
Coupling setting

The generator HC - COM

While a test is running the user can select parameters. The selected parameter then can be changed online with the inc/dec knob.

16.1.3. Standard test Routine

The user can select preprogrammed standard test routines.

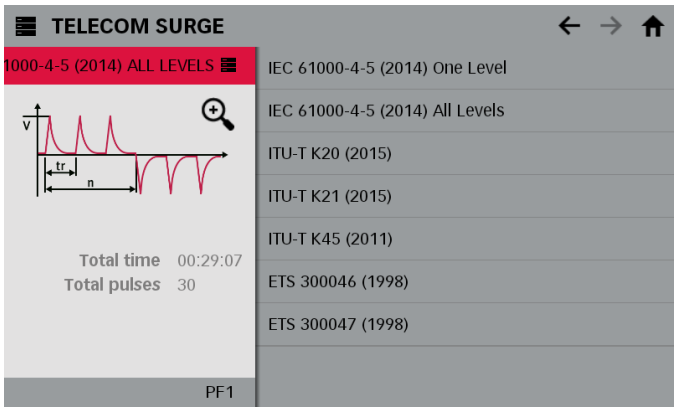


Change to
Standard library

Change to
- Quick Start
- STEPS
- User Test

Other:
- Add to STEPS
- Configuration
- Save as User Test
- Load Defaults

With configuration the user can **"CHANGE STANDARD TO INACTIVE"** for enable all parameters. Then all standard parameters can be changed online during testing. For change tip to the black marked parameters



The telecom surge standard menu offers a list of standards. The name of the standard defines the characteristic of the rulers that is given in the application of the standard.

The standard name has the character: **[Standard Family], [Standard number], [year]), [Application],** where

Standard Family
IEC: *International Electrotechnical Commission*
ITU: International Telecommunication Union
ETS: European Telecommunication Standard

Standard Number
Indicates the official standard number defined in the standard.

Year
Year of standard publication. The year indicates the different standard publication. The year is used for follow the definitions specified in this publication.

Application
Specifies different applications or EUT characteristics

- One level: only one test level will be in this test. The user can select the test level (level 1 to 4)
- All levels: The test procedures start at the lowest level and increase to the level specified.

16.1.4. STEP Test Routines

The user can store, his own specific test routines he need to repeat during his test session. After switching off the generator all these routines are deleted.

If more than one STEP routine is in the library, the Program will run one sequence after the other and will stop when the last STEP sequence has finished.

In our case the test starts with **STEP B** and continue with **STEP C**. Then the test is finished.

UP / DOWN Changes the line of the STEP

CHANGE Shows the STEP test detail, change to **HIDE / VISIBLE** (not used for testing)

REMOVE Delete the STEP test

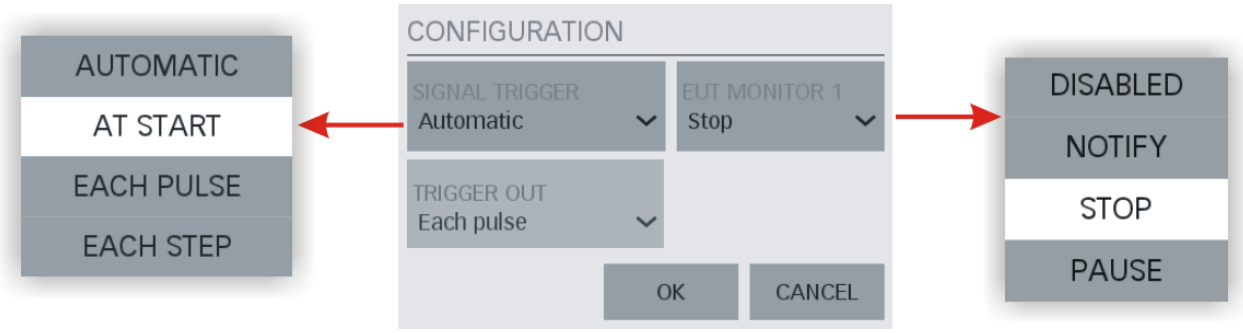
HIDE / VISIBLE Selection if the step is visible and active or hide and inactive is.

16.2. Telecom Surge pulse settings

16.2.1. Configuration

In the configuration menu the user set the following parameters:

- **Signal Trigger out signal** at the BNC plug on generator front side
- **Start trigger** for the impulse or event when Start button is blinking
- Behavior of the **EUT Monitor 1** on BNC plug on rear side

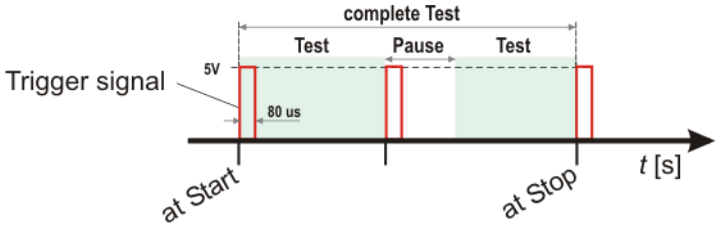


16.2.1.1. Signal Trigger

The trigger out signal is a programmable 5V edge signal located at the front side BNC Trigger plug. This signal is for trigger other devices like oscilloscopes or other devices.

If the start trigger is not set to Automatic, the trigger indicates with "**Waiting for trigger"** the recommended trigger signal. The waiting time for a trigger signal is endless if no trigger timeout is enabled.

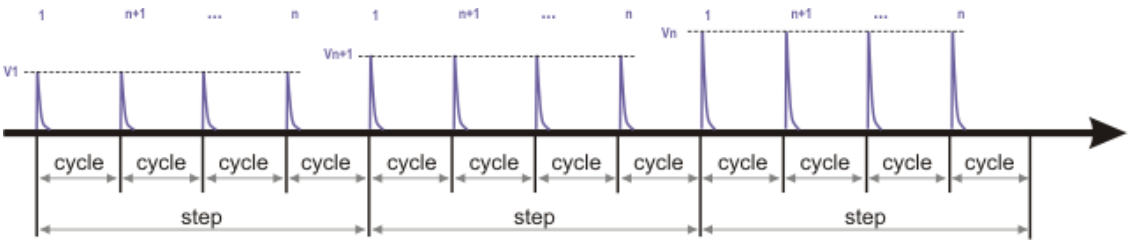
The generator offers the following status:
- **Automatic**
- At **Start** (starts after the trigger)
- Each **pulse** (same as trigger out)
- Each **step** (same as trigger out)



Iterations

For Iteration tests the parameters changes after each step as shown in the figure below. Depends of the order and setting the following parameters can change:

- Polarity
- Voltage



Example with voltage iteration that illustrate trigger out for cycle and step

17. Ring wave Immunity as per IEC 61000-4-12

Ring wave Module 0.5 µs – 100 kHz

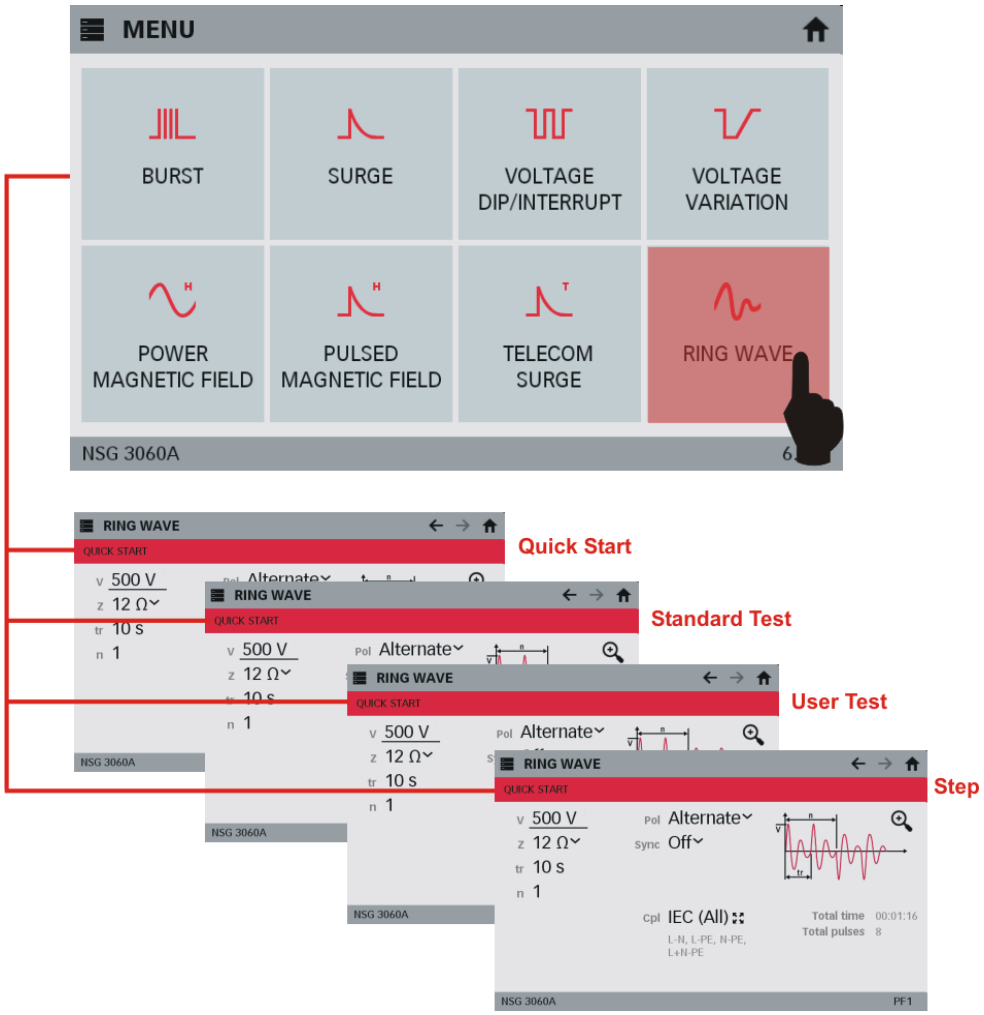
WARNING

The internal coupling network is designed for **mains frequency 50 Hz / 60 Hz**.

Tests with 400 Hz mains frequency **destroy the coupling network**. An external coupling network is recommended with inductors and capacitors matched to the 400 Hz mains frequency.

17.1. Operation

The Ring wave menu offers different test routines for ring wave testing.



Click into surge menu loads the **last used menu**. Of the following routines below.

Quick Start
Easy and fast online-operation with the phenomenon ring wave. In this menu the user can operate all ring wave test manually with online change the most parameters during a test.

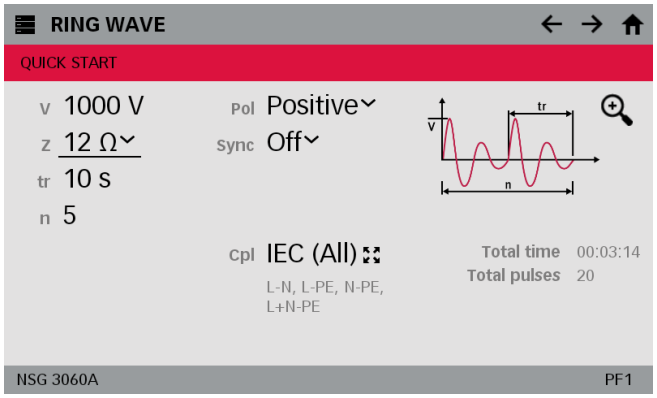
Standard
The operator can select between various preprogrammed test routines as required in different standards
The standard library is filtered according the EUT setting (AC, DC etc.)

User test routines
The user defined library where all created surge tests are stored.

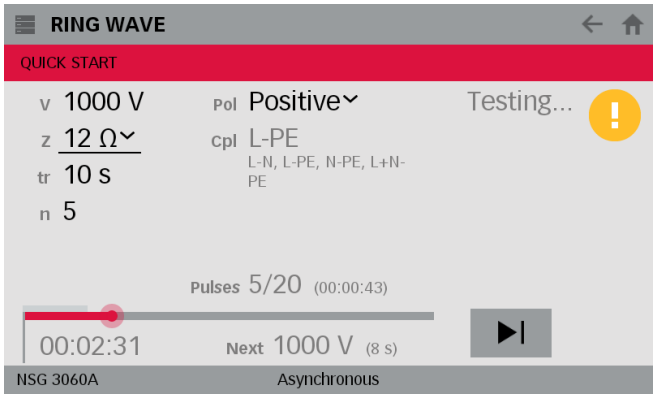
STEP
The STEP library created during the actual session. The user can easy save a test into the STEP library. After switching off the Equipment all STEP tests are deleted. Use “SAVE AS USER TEST” for definitive save the test.

17.1.1. Quick Start

Easy and very fast operation of all standard functions of the equipment. The latest simulator settings are stored automatically and will be recalled when Quick Start is next selected.



Quick Start Menu

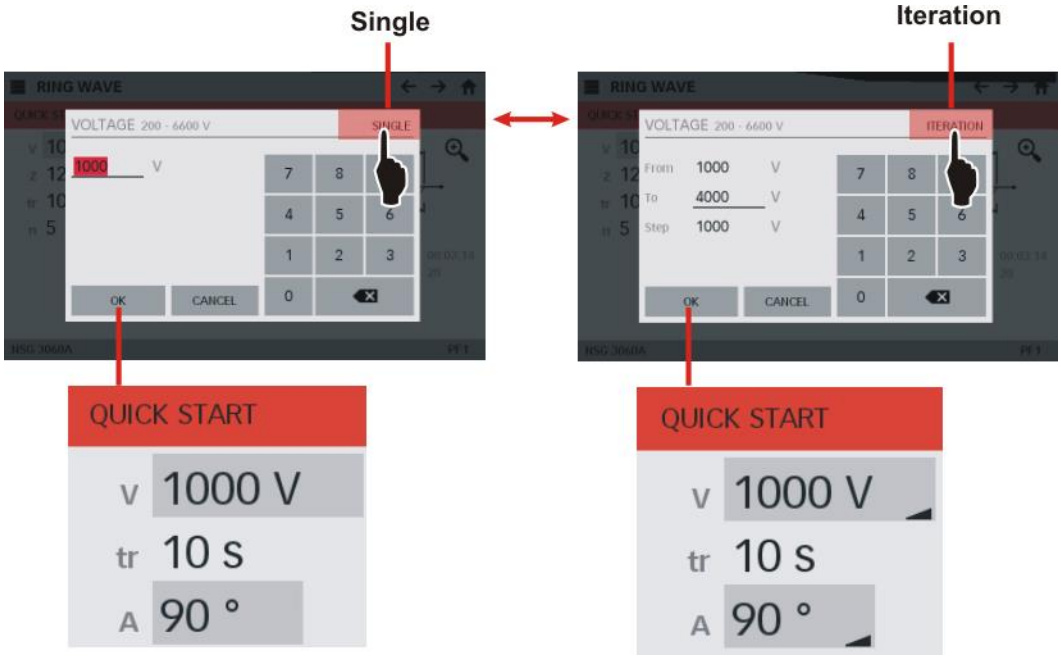


Quick Start testing

While a test runs, the user can select parameters. The selected parameter then can be changed online with the inc/dec knob.

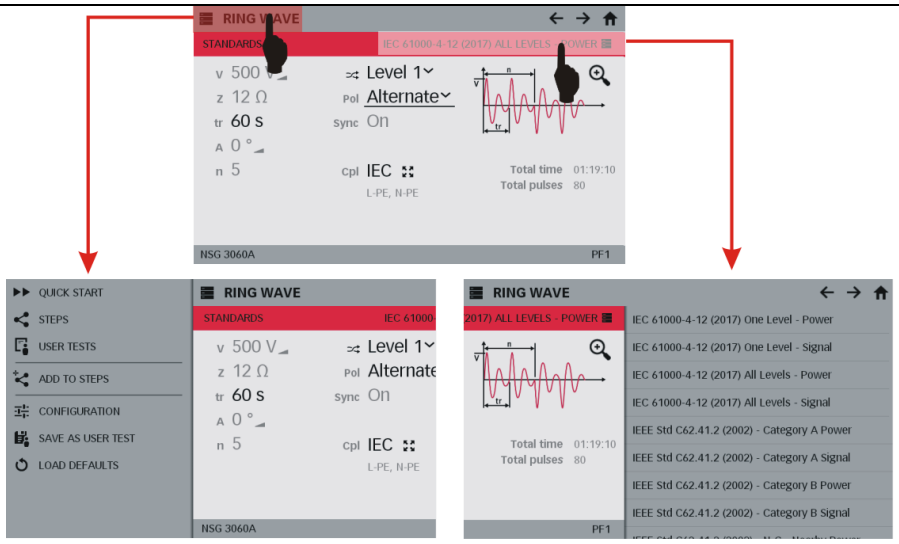
17.1.1.1. Voltage and phase angle iteration

Click into field **SINGLE** or **ITERATION** for change between single and iteration mode. The ramp icons show the Iteration mode.



17.1.2. Standard test Routine

The user can select preprogrammed standard test routines.

Change to - Quick Start - STEPS - User Test **Other:** - Add to STEPS - Configuration - Save as User Test - Load Defaults		Change to **Standard library**

Within this test routine all standard parameters can be changed online during testing. For change tip to the black marked parameters

The user can easy select the following parameters

T (test duration): 10 s to 999 s (standard says **60 s** or faster depend on the protection devices power rate)

Level (voltage):	**All Levels**	**One Level**
	Level 1 (500 V),	500 V
	Level 2 (500 V to 1000 V),	1000 V
	Level 3 (500 V to 2000 V),	2000 V
	Level 4 (500 V to 4000 V)	4000 V

Coupling (Cpl): **IEC** (L+N+PE),
HV - COM (external for data lines),

The standard name has the character: **[Standard Family], [Standard number], [year]), [Application],** where

Standard Family
IEC: *International Electrotechnical Commission*
IEEE: Institute of Electrical and Electronics Engineers Standards Association
EN: European Committee for Standardization (CEN)

Standard Number
Indicates the official standard number defined in the standard.

Year
Year of standard publication. The year indicates the different standard publication. The year is used to follow the definitions specified in this publication.

Application
Specifies different applications or EUT characteristics

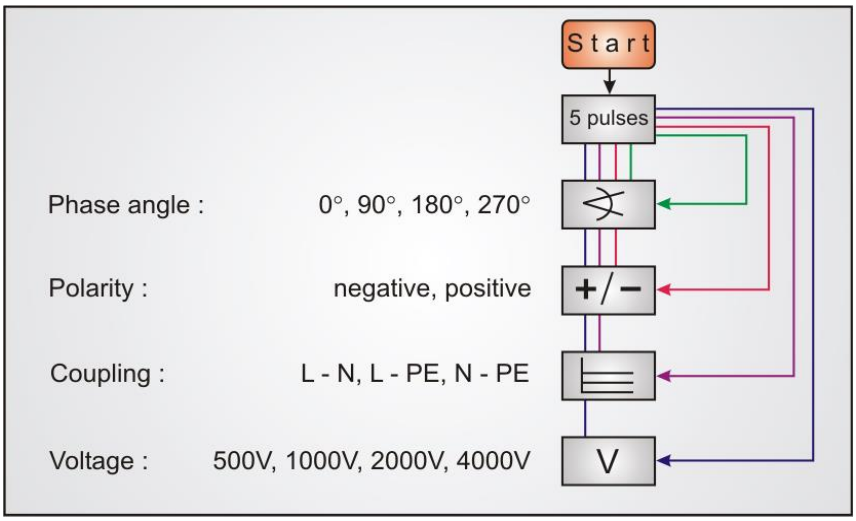
- One level: only one test level will be in this test. The user can select the test level (level 1 to 4)
- All levels: The test procedures start at the lowest level and increase to the level specified.

Iteration of the standard test procedure as per IEC 61000-4-12

The ring wave must be applied synchronized to the voltage phase at the respective angle and the peak value of the a.c. voltage wave (positive and negative).

The ring wave must be applied line to line and line(s) and earth. When testing line to earth the test voltage must be applied successively between each of the lines and earth.

The test voltage must be increased by steps from the lowest test level up to the test level specified in the product standard or test plan.



List of settings EN 61000-4-12 (each setting with 5 pulses)

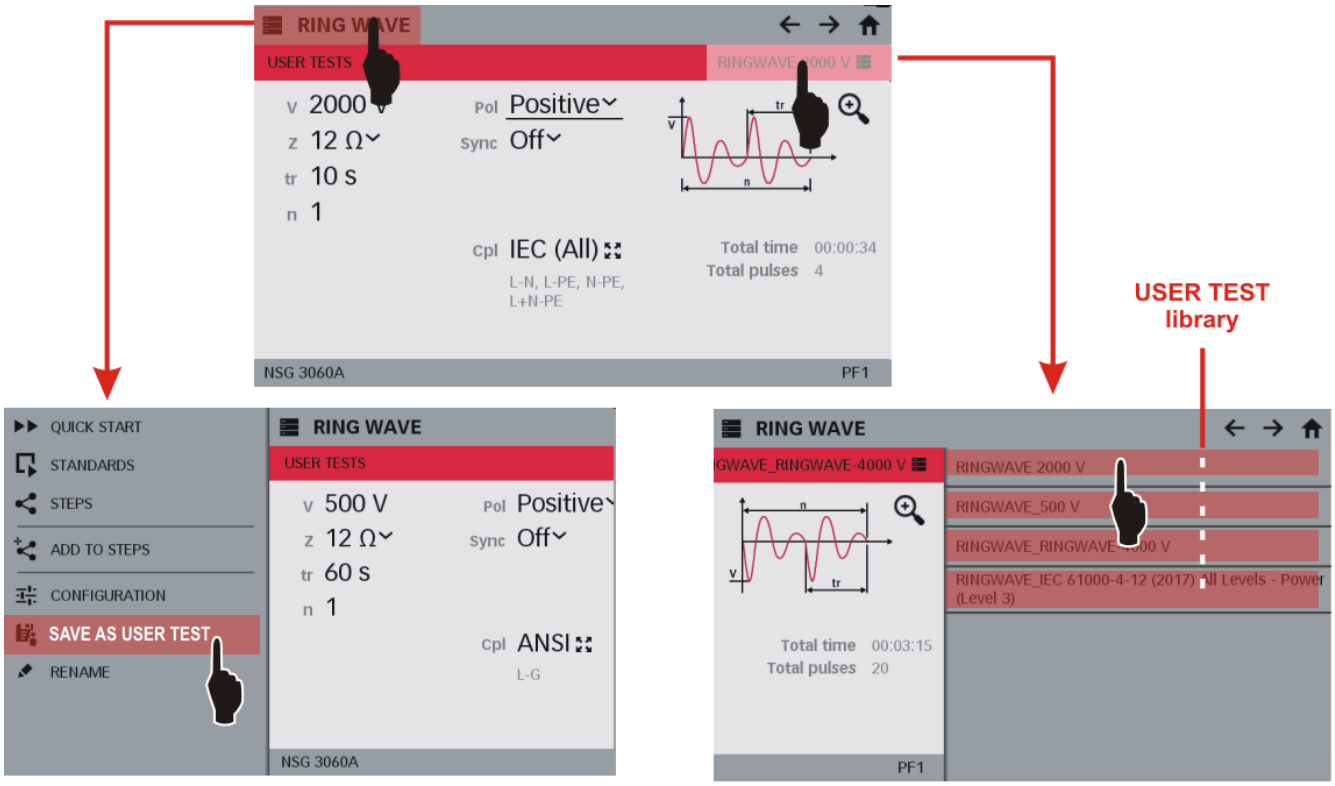
Setting	Voltage	Coupling	Polarity	Phase angle
1 2 3 4	500	L-N	pos	0 90 180 270
5 6 7 8			neg	0 90 180 270
9 10 11 12		L-PE	pos	0 90 180 270
13 14 15 16			neg	0 90 180 270
17 18 19 20		N-PE	pos	0 90 180 270
21 22 23 24			neg	0 90 180 270
25 26 27 28	1000	L-N	pos	0 90 180 270
29 30 31 32			neg	0 90 180 270

Setting	Voltage	Coupling	Polarity	Phase angle
33 34 35 36	1000	L-PE	pos	0 90 180 270
37 38 39 40			neg	0 90 180 270
41 42 43 44		N-PE	pos	0 90 180 270
45 46 47 48			neg	0 90 180 270
49 50 51 52	2000	L-PE	pos	0 90 180 270
53 53 55 56			neg	0 90 180 270
57 58 59 60		N-PE	pos	0 90 180 270
57 58 59 60			neg	0 90 180 270

Within this test routine all standard parameters can be changed online during testing. This procedure therefore is very easy and fast to use.

17.1.3. User Test Routines

The user can program, save and recall his own specific test routines. The next pages show the selection of the functions.



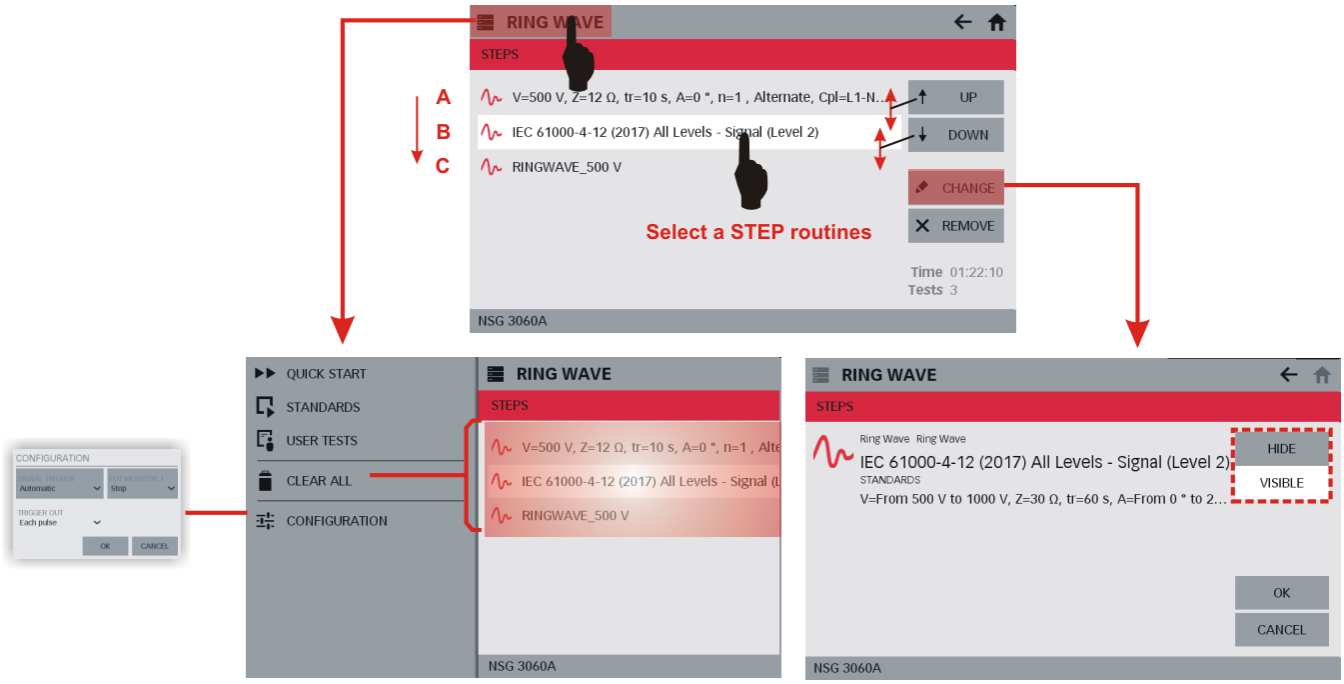
SAVE AS USER TEST Save the actual test as user test. The user defines the name of the test

17.1.4. STEP Routines

The user can store, his own specific test routines he need to repeat during his test session. After switching off the generator all these routines are deleted.

If more than one STEP routine is in the library, the Program will run one sequence after the other and will stop when the last STEP sequence has finished.

In our case the test starts with **STEP B** and continue with **STEP C**. Then the test is finished.



UP / DOWN Changes the line of the STEP

CHANGE Shows the STEP test detail, change to **HIDE / VISIBLE** (not used for testing)

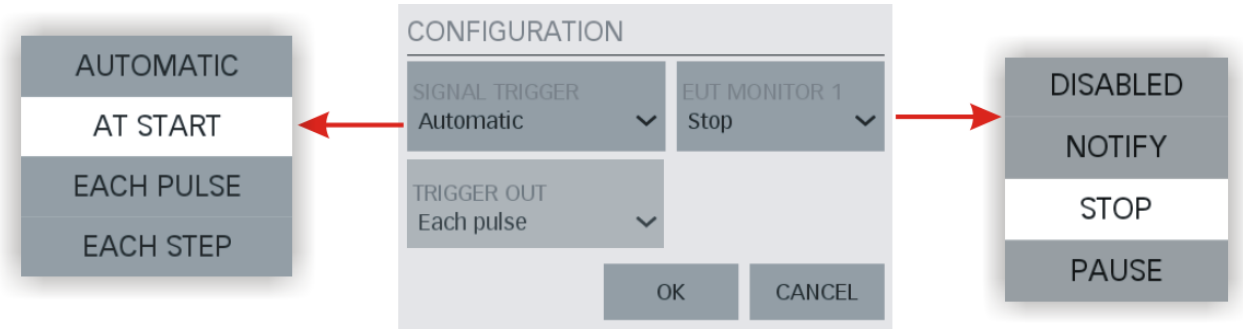
REMOVE Delete the STEP test

17.2. Ring wave pulse settings

17.2.1. Configuration

In the configuration menu the user set the following parameters:

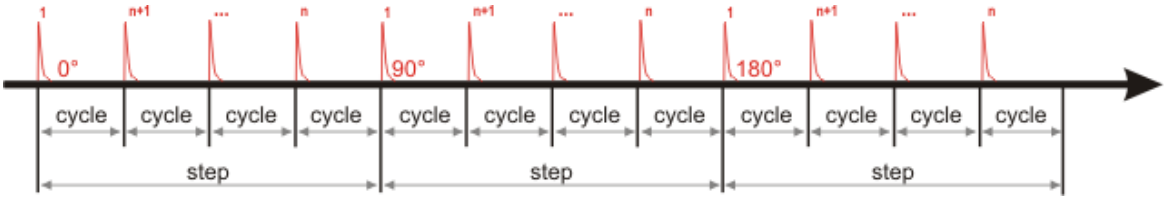
- **Signal Trigger** at the BNC plug on generator front side
- **Signal trigger** for the impulse or event when Start button is blinking
- Behavior of the **EUT Monitor 1** on BNC plug on rear side



17.2.1.1. Iteration

For Iteration tests the parameters changes after each step as shown in the figure below. Depends of the order and setting the following parameters can change:

- Polarity
- Voltage
- Phase angle



Example with voltage iteration that illustrate trigger out for cycle and step

17.2.1.2. Signal Trigger

The Start Trigger occurs by pressing the blinking **START / PAUSE** button or with an external trigger positive slope signal at the rear side BNC **Ext. Trigger** plug.

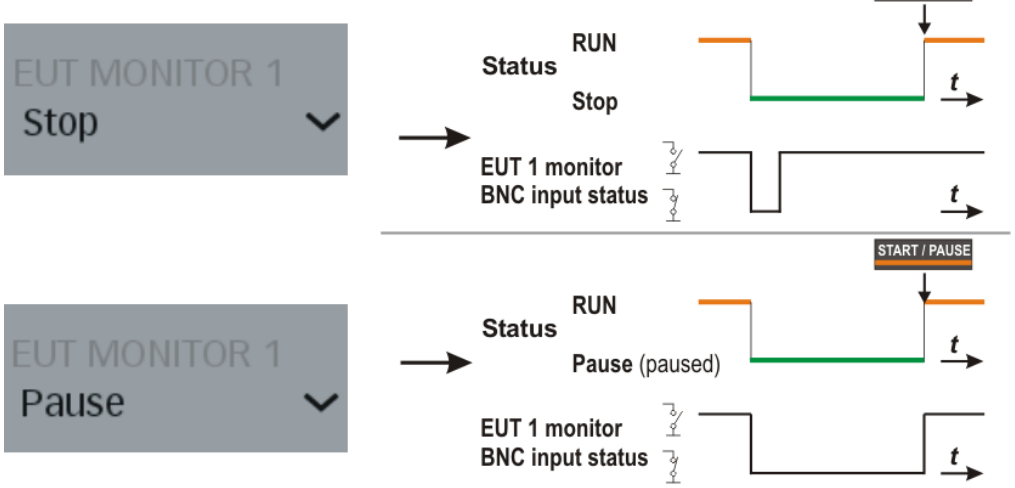
The start trigger offers the following status:
- **Automatic**
- At **Start** (starts after the trigger)
- Each **pulse** (same as trigger out)
- Each **step** (same as trigger out)

17.2.1.3. EUT Monitor

Behavior of the EUT Monitor 1, BNC plug at the rear side:

- **Disabled** No function
- **Notify** Send a notify signal to iec.control for the report generation
- **Stop** The test will immediately stop and is finished.
- **Pause** The test breaks and can be continued with START/PAUSE

EUT Monitor input signal

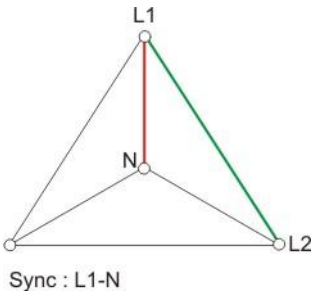
EUT Monitor Input	BNC plug on rear side of the NSG 3000A generator  **EUT Monitor 1**
Status of BNC input of EUT monitor 1 / 2	
Input signal	Open collector signal 15 V to 0 V negative slope
Triger level	2 V ±1 V
Input impedance	>10 kΩ
Max. Input	+ 15 V

17.3. Ring wave pulse application

17.3.1. Phase synchronization in 3-phase system

The synchronization in a 3-phase coupler system is taken from the phase L1 and neutral. In case of a delta supply without neutral connected, an artificial neutral point is defined by a high impedance network. This artificial neutral is taken for the phase synchronization.

For all couplings, the generator calculates the correct phase angle for phase triggering.



Sync : L1-N

The tables below illustrate the correction angels considering the phase in a 3-phase system with synchronization signal from L1-N lines. The generator firmware will automatically add the correction angle to the settled value.

Phase Synchronization correction for L1-N as sync signal

	Sync. Source	Correction angel added by the NSG 3000A firmware					
Coupling	**L1-N**	**L1-N**	**L2-N**	**L3-N**	**L1-L2**	**L1-L3**	**L2-L3**
Sync.-Angel	**0°**	0°	120°	240°	330°	30°	90°
	90°	0°	210°	300°	60°	120°	180°
	180°	0°	300°	30°	150°	210°	270°
	270°	0°	30°	150°	240°	300°	0°

The correct phase angle will be set automatically from the NSG 3000A.

17.4. Ring wave pulse application

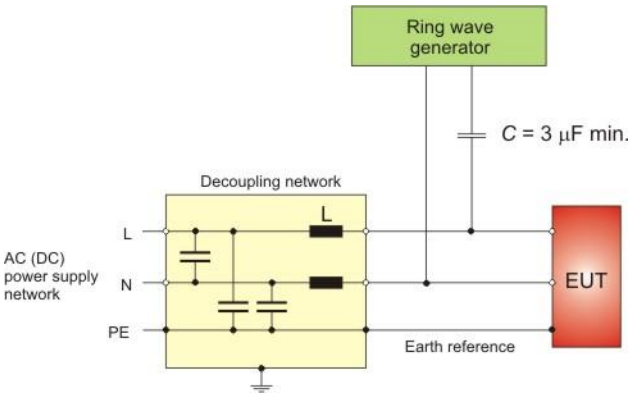
Discharge switch:
The discharge switch is a highly reproducible semiconductor switch.

17.5. Coupling/decoupling network

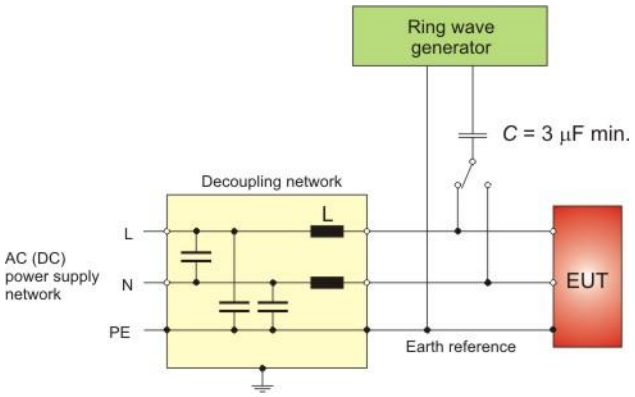
The coupling network must couple the interference pulses to the lines of a power supply system (AC or DC). Capacitive coupling is the specified coupling mode for surge testing.

17.5.1. Coupling to AC/DC power supply lines

The ring wave generator NSG 3060A has an integrated coupling network in accordance with IEC 61000-4-12. It must be possible to test with different coupling modes:



Coupling Line to Line



Coupling Line to Earth

The release of the surge pulses is mostly related to a certain phase angle. The Ringwave pulses are synchronized to the EUT-supply input (10...300 VAC / 15...500 Hz).

Attention: The decoupling part of the coupling/decoupling network includes some capacitors for filtering related tp protective Earth (chassis of the generator). This is to be conform to the requirement of IEC 61000-4-12 concerning attenuation of the surge transients in direction to the power mains supply input of the CDN.
As consequence there will exist an increased current to PE (protective earth) which might be hazardous to the operator in case of a failure or wrong installation. Therefore, it is very important to take the following points into account before setting the generator into full operation.

1. Due to this increased current into the PE system no earth fault current protectors can be used within a surge testing area.

3. As consequence the surge generator shall be connected always to Protective Earth, even if no test is conducted.
via plugged in power mains supply cable including the PE wire !!!!
via plugged in EUT power mains supply at the rear side of the generator, including the PE wire !!!!
via Ground Reference Connector, screwed to the chassis of the generator.

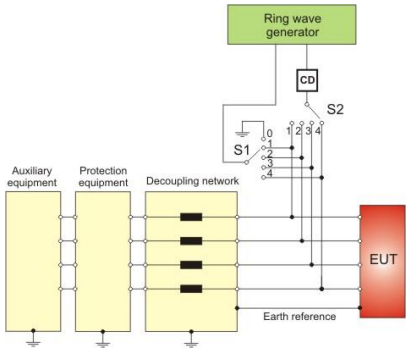
These measures result in double safety in case of a fault

17.5.2. Coupling to I / O lines

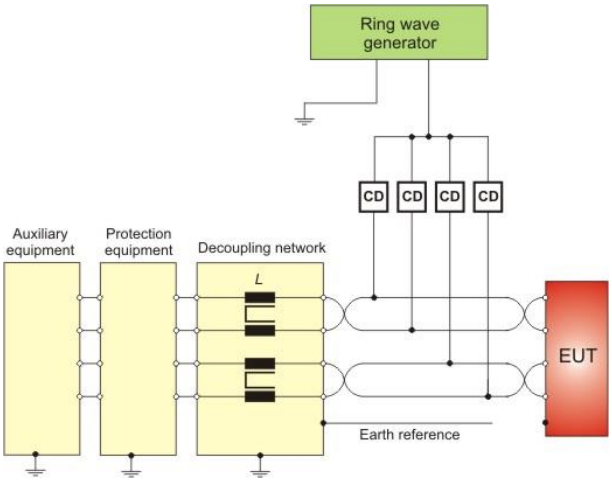
The coupling to I/O lines is generally realized with other coupling networks than for power supply lines. The loading of the I/O lines with high coupling capacitors is mostly not possible. The data transmission may be disturbed.

For coupling to I/O lines special couplers according the Standard IEC 61000-4-12 are available, such as the CDN117A-C6-4-1 and CDN118A-C6-4-1 series

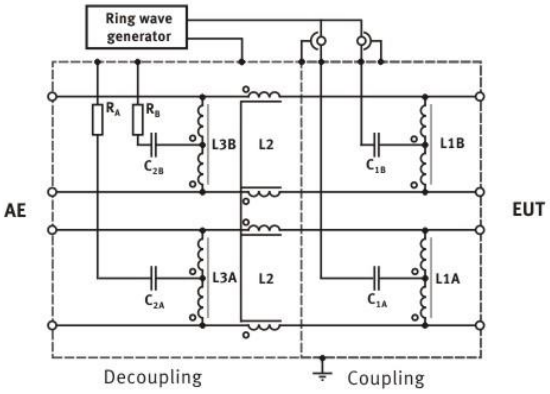
Example: Coupling to -unbalanced unshielded cables-shielded cables with shield at one end



Example: Coupling to shielded cables with shield at both ends



Example: Coupling to symmetrical unshielded high-speed data lines



Danger

Using coupling networks CDN 117A or CDN 118A series

Switch OFF the high voltage during manual change of the coupling

17.6. Test setup

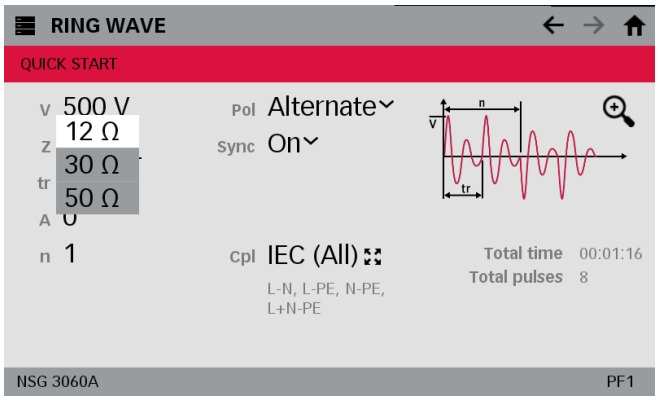
According to the specifications of IEC 61000-4-12, the Ring wave generator has a **source impedance** of

Generator impedance

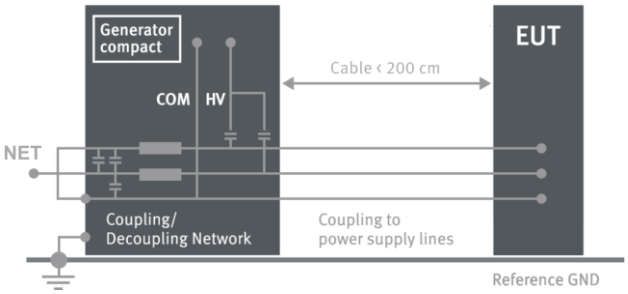
12 Ω for **a.c./d.c. power ports** and shielded interconnection lines

30 Ω for **interconnection lines**.

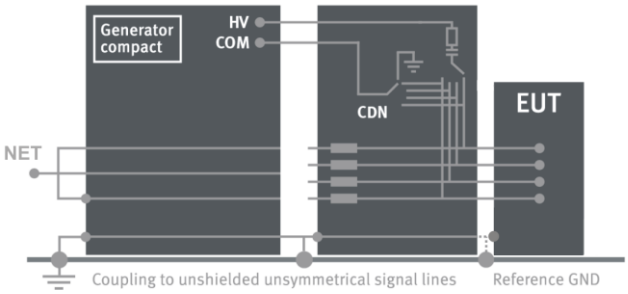
50 Ω as per UL 943.



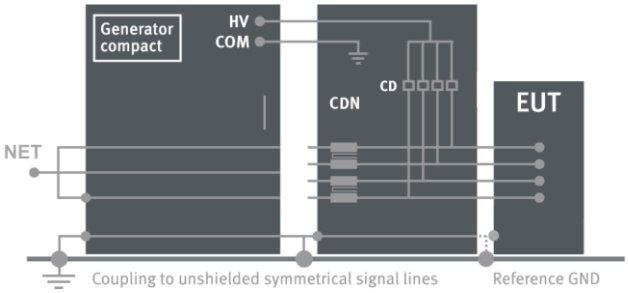
Impedance selection



Test setup coupling to a.c. / d.c. power lines



Setup for unsymmetrical data lines



Setup for symmetrical data lines

18. Appendix

18.1. Declaration of CE-Conformity

18.1.1. CE-Conformity NSG 3040A series

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product 's name:	NSG 3040A-IEC
Model Number(s)	NSG 3040A-EFT
	NSG 3040A-CWS
	NSG 3040A-DDV
	NSG 3040A-EFT-CWS

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use
	(Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

The purpose of this instrument is the generation of defined interferences signals for EMI immunity testing. Depending on the arrangement of the test rig, the configuration, the cabling and the properties of the EUT itself, a significant amount of electromagnetic radiation may result that could also affect other equipment and systems. The user himself or herself is ultimately responsible for the correct and controlled operation of the rig. In case of doubt, the tests should be carried out in a Faraday cage.

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AMETEK CTS GmbH
Sternenhofstrasse. 15
CH 4153 Reinach
Phone: +41 61 204 41 11
Fax: +41 61 204 41 00

By	A. Burger Design and Research
Place	Reinach BL, Switzerland
Date	20. Mai 2019

18.1.2. CE-Conformity NSG 3060A series

Manufacturer:	**AMETEK CTS GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product 's name:	NSG 3060A-IEC
Model Number(s)	NSG 3060A-ANSI NSG 3060A-FULL

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

The purpose of this instrument is the generation of defined interferences signals for EMI immunity testing. Depending on the arrangement of the test rig, the configuration, the cabling and the properties of the EUT itself, a significant amount of electromagnetic radiation may result that could also affect other equipment and systems. The user himself or herself is ultimately responsible for the correct and controlled operation of the rig. In case of doubt, the tests should be carried out in a Faraday cage.

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By	A. Burger Design and Research
Place	Reinach BL, Switzerland
Date	20. Mai 2019

18.1.3. CE-Conformity Tapped Voltage Transformer TVT 1-250-16

Manufacturer:	**AMETEK CTS GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product 's name:	Tapped transformer
Model Number(s)	TVT 1-250-16

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

Manufacturer
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Fax: +41 61 204 41 00

By	A. Burger Design and Research
Place	Reinach BL, Switzerland
Date	20. Mai 2019

18.1.4. CE-Conformity Tapped Voltage Transformer TVT 1-250-16.1

Manufacturer:	**AMETEK CTS GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product 's name:	Tapped transformer
Model Number(s)	TVT 1-250-16.1

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

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By	A. Burger Design and Research
Place	Reinach BL, Switzerland
Date	20. Mai 2019

18.1.5. CE-Conformity CCI (capacitive coupling clamp)

Manufacturer:	**AMETEK CTS GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product 's name:	Capacitive coupling clamp Industry
Model Number(s)	CCI

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)

The purpose of this device is to couple EFT burst impulses as per IEC 61000-4-4 to signal and data lines for EMI immunity testing. Depending on the design of the CCI, given in the standard IEC 61000-4-4, the arrangement of the test rig, the configuration, the cabling and the properties of the EUT itself, a significant amount of electromagnetic radiation may result that could also affect other equipment and systems. The user himself or herself is ultimately responsible for the correct and controlled operation of the rig. In case of doubt, the tests should be carried out in a faraday cage.

Manufacturer
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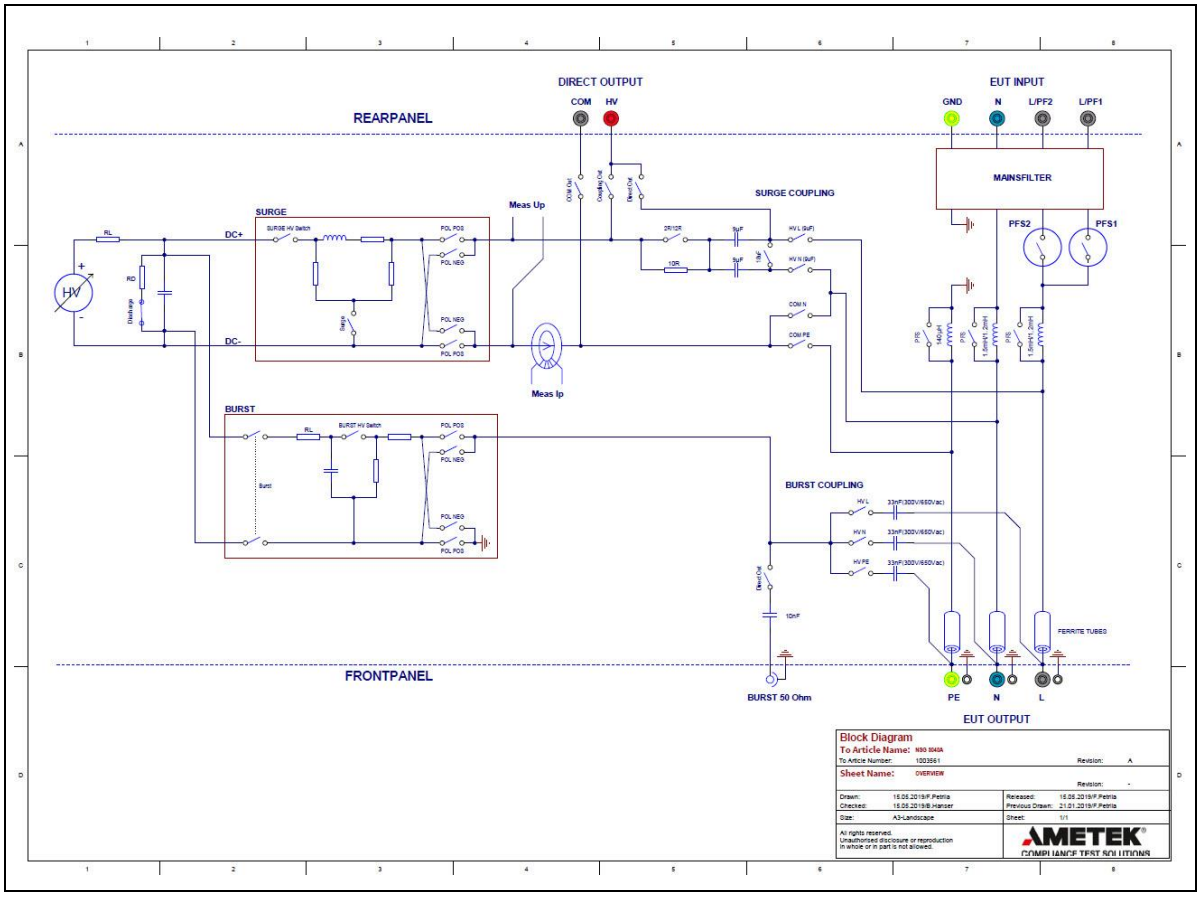
18.2. NSG 3040A series General Block Diagram



18.3. NSG 3060A series General Diagram