

# OPERATION MANUAL

## SURGE-GENERATOR

### SURGE4-5



# Operation Manual

## SURGE/HYBRID GENERATOR

### SURGE4-5

#### **Warning:**

This equipment generates high voltages and currents and is inherently dangerous. The local, national and all applicable safety regulations must be obeyed for operation of this unit. The device must only be used by experienced electric technicians (see VDE 0140) respectively through qualified operating personnel (electrotechnical instructed person). People using cardiac pacemakers should be excluded from the test area.

**Important:** Please read this manual carefully **before** putting the SURGE4-5 into operation and mind the described security instructions.

**The safety instructions in section 3.2 must be strictly observed!**

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# Safety Instructions

## 1.1 General security instructions

**Warning ! This equipment generates high voltages and currents.**

This generator must be operated only with approved protection-earth-power jacks. Cutting the protection-earth-lead may cause seriously danger to life and is therefore forbidden. The unit enclosure and the grounding jacks are joined to the protection-earth-conductor.

In case the unit shows damage or a harmless operation is not ensured, it has to be retired from operation and must be protected against unauthorised use.

Also when the mains are disconnected it is possible to have lethal high voltages inside of the test generator (capacitors built in). Servicing this generator should only be done by experienced specialists, who have a good knowledge of this generator.

It is urgently suggested to include the generators security circuits in the test setup. For example the door opening contact of the test chamber or a security switch at the test site can be used to break the test.

Please mind the specific security instructions described in the individual chapters.

Before you use the HV-Out [41], please take care that the selection bridge [40] selects the mode B or C. The main must be disconnected [32].

The coupling network has no internal fuses. The user has to provide proper fusing for the test object and the coupling network according to its power consumption. Fuse size should not exceed 16 A, see also technical data.

**Warning !**

At the inputs of the coupling/decoupling network still dangerous pulse voltage occurs.

Therefore, since there is no contact protection at the Schuko plug, NEMA 5-15 (type B) plug or any other plug that may be used to feed power to the DUT/coupling network, it must always be ensured that the pulse voltage is only triggered when the power supply cable connected to feed the DUT / coupling/decoupling network (CDN) is securely connected to the power source.

Furthermore, the impulse release may only be activated when the absolute contact protection to the device under test (and any connected devices) is ensured.

## 1.2 Development of heat in Surge / Hybrid generator

### In connection with external coupling networks SURGE xxx

Due to the high coupling capacity (up to 18  $\mu$ F), a high cross current flows through the output circuit of the hybrid generator when the coupling is actuated. This is at coupling between the conductors (400 volts) about 2.2 amps. This current inevitably leads to a warming (maximum of about 50 watts) of the pulse-forming resistors in the high voltage part of the hybrid generator. These resistors are designed for this performance.

In order to minimize the wear of all electronic components in the hybrid generator, however, we recommend that the user only switch on the coupling paths on the coupling network SURGE xxx for as long as is necessary for carrying out the test.

Please note that when the coupling is activated on the SURGE xxx, the control unit must be supplied with power from the hybrid generator so that the built-in fan can also work.

## Introduction

The test generator SURGE4-5 simulates high energy pulses on supply mains like they appear for example after over-voltage events (e.g. lightning strikes). It can be used for EMC tests on installations and equipment according to the standards IEC 61000-4-5, 2014 and EN 61000-4-5, 2014.

The SURGE4-5 is a combined surge current / voltage generator creating a standard surge voltage with the pulse shape 1.2 / 50  $\mu$ s and a surge current with the pulse shape 8 / 20  $\mu$ s. The values for voltage and current are displayed. For oscillographic investigations BNC-jacks for voltage and current monitoring are located on the rear. With the built-in single-phase coupling network the interface pulses of the surge generator can be coupled on the mains of the connected EUTs.

With the aid of the memory function up to 32 adjustments can be directly activated - via serial interface the generator can also be operated through PC.

The easy operation allows a time saving and optimized testing in the fields of:

- **Research and design:** Test with fixed standard values and investigation with variable settings (search for worst case).
- **Quality assurance:** Test with fixed standard values, manual adjustable or automatic test procedures by remote computer control.
- **Service:** Handy and easy to be operated.

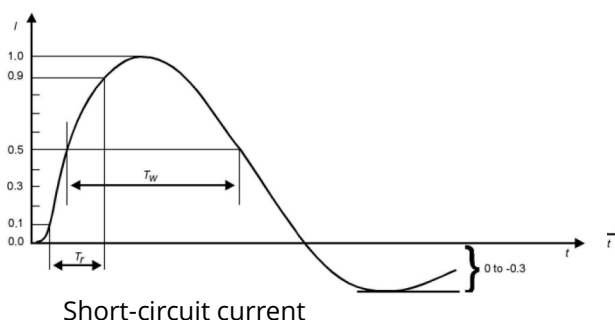
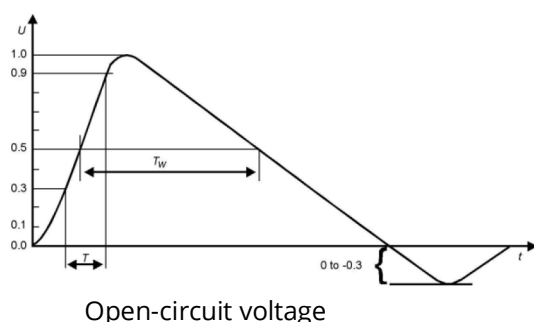
## 2 Definition of the waveforms 1.2/50 $\mu$ s and / 8/20 $\mu$ s

The Surge generator performs two wave forms at the output of the generator – with no CDN connected The request is defined in the standard IEC / EN 61000-4-5.

- Waveform of the open-circuit voltage 1.2 / 50  $\mu$ s
- Waveform of the short-circuit current 8 / 20  $\mu$ s

### Definition of the parameter – IEC 61000-4-5

	Front time $T_f$ $\mu$ s	Duration $T_d$ $\mu$ s
Open-circuit voltage	$T_f = 1.67 \times T = 1.2 \pm 30 \%$	$T_d = T_w = 50 \pm 20 \%$
Short-circuit current	$T_f = 1.25 \times T_r = 8 \pm 20 \%$	$T_d = 1.18 \times T_w = 20 \pm 20 \%$



**Note:**

The undershoot specification applies only at the generator output – at open circuit and short current. At the output of the coupling/decoupling network there is no limitation on undershoot or overshoot.

Open circuit: The value 1.67 is the reciprocal of the difference between the 0.9 and 0.3 thresholds.

Short circuit: The value 1.67 is the reciprocal of the difference between the 0.9 and 0.1 thresholds.

The value 1.18 is derived from empirical data.

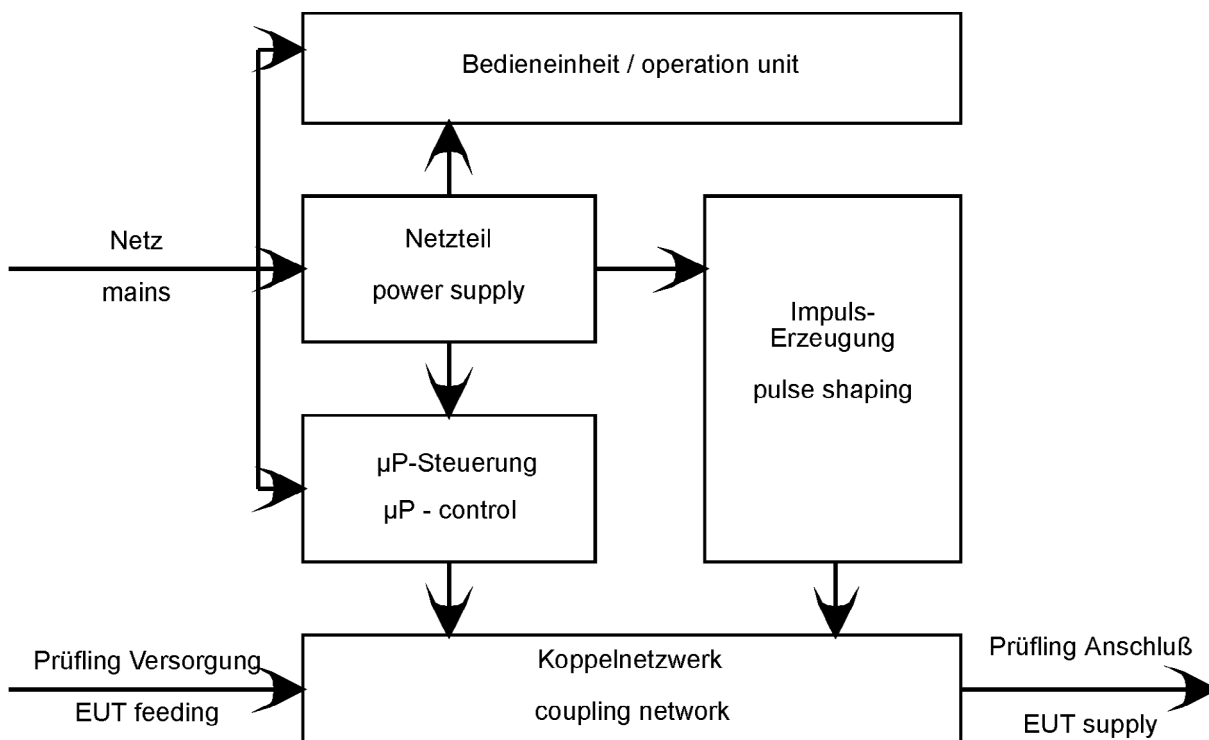
**Relationship between peak open-circuit voltage and peak short-circuit current**

Open circuit peak voltage $\pm 10\%$ at generator output	Short-circuit peak current $\pm 10\%$ at generator output
0.5 kV	0.25 kA
1.0 kV	0.5 kA
2.0 kV	1.0 kA
4.0 kV	2.0 kA

## 3 Description of functions

### 3.1 General

The conceptional structure of the SURGE4-5 is shown in the following drawing:



**Figure1: Surge generator SURGE4-5, schematic**

## 3.2 Front panel functions



### Front

Figure 2

- 1 Earth socket.
- 2 Laboratory sockets for DUT
- 3 Schuko sockets for DUT.
- 4 Function-Display (touch) – description under item 3.5
- 5 Digital Potentiometer for entering the data in the fields [6], [7], [12] and [13] (LED of the corresponding selection button lights up).
- 6 Triggering of a single impulse manually via push button or externally via BNC socket.
- 7 USB connectors for remote control via PC
- 8 Display of the phase position of the DUT supply by means of red and green lamp.
- 9 Optical interface for remote control (optional)

7 9



### 3.3 Connectors and short-circuit plug-ins on the rear

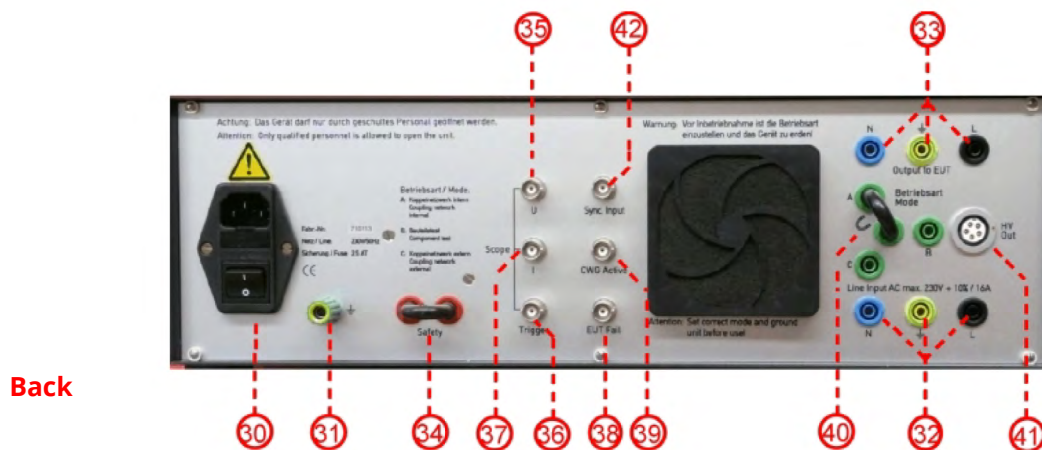


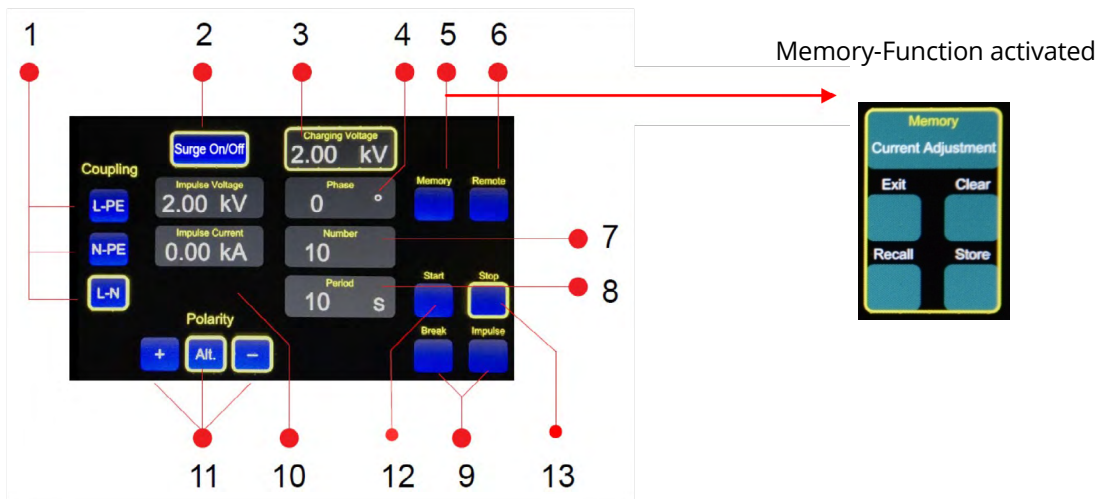
Figure2

- [30] Electronic feeding for the SURGE4-5 with RF-suppression filter.
- [31] Ground jack.
- [32] Jacks for EUT-feeding, AC or DC.
- [33] Jacks for EUT-connection, equivalent to the jacks [19] on the front.
- [34] Short-circuit plug-in / jacks for external security circuit. Test can only be done with a closed security-circuit.
- [35] BNC-jack for voltage measurement ( $1 V_{\text{output}} = 1000 V_{\text{input}}$ ).
- [36] BNC-jack for scope-triggering (TTL level).
- [37] BNC-jack for current measurement ( $1 V_{\text{output}} = 500 A_{\text{input}}$ ).
- [38] Operational input for an EUT's failure supervision.
- [39] Internal serial bus for the operation of several EMC Shop test generators in one setup.
- [40] Plug-in bridge to switch between the modes ( --> see chapter 8.1 )
  - A "internal coupling network"
  - B "component test" and verifying /calibration  
(with ext. 18  $\mu\text{F}$  capacitor)
  - C "external coupling network"
- [41] High voltage output
  - a) Connection for external coupling devices
  - b) Surge Impulse Verification - Calibration
  - c) Tests on cable shields
  - d) Component tests

Attention ! For b), c) and d) a 18  $\mu\text{F}$  coupling capacitor is required.
- [42] Sync. Input – BNC-jack for phase synchronization at using with an external coupling network.



### 3.4 Function-Display (Touch)



- [1] Select coupling paths (L, N, PE).
- [2] Unlocking the surge test
- [3] Selection of the Surge VOLTAGE, is set with encoder [Front 5].
- [4] Selection of PHASE ANGLE, is set with rotary encoder [Front 5].
- [5] Activation of the memory function.
- [6] Activation of the remote control.
- [7] Selection for NUMBER of test pulses to be triggered per test cycle, set with encoder [Front 5].
- [8] Selection of the DURATION for the Surge test cycle is set with the rotary encoder [Front 5].
- [9] Trigger start and stop
- [10] Display of the measured surge voltage / current of the last test
- [11] Polarity of the surge pulse: positive, negative or alternating.
- [12] Charging the energy storage unit or triggering the test cycle.
- [13] Internal discharge of the energy storage unit and stop in automatic mode.

The parameters can be changed in different speeds with the rotary encoder [Front 5]. With dashed marking, these are adjusted in larger steps:



1x touch



Double touch > larger steps

## 4 Putting into operation

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### Generally

Before the test, carefully determine which open circuit voltages of the test pulse (and consequently the short-circuit current) can be applied to your test object.

Note that overloaded components (capacitors!) Could possibly explode - take measures to protect the test personnel, including with regard to fire protection.

For safety reasons, the device must also be earthed at the earth sockets.

**If the device is operated with an external coupling network, the DUT supply [32] must be removed and the operating mode bridge [40] must be correctly inserted.**

### Operation

1. **Provide mains connection for the generators power supply**, use power connector on the rear of the generator (wide range power supply).
2. **Provide additional ground connection** on one of the ground connectors on the rear or front side of the unit. Ground connectors are marked with the ground sign.
3. **Connect the cable for the test objects supply** to the 3 connectors on the unit's rear side, first the 3 safety-connectors, then the protection-earth power plug. At DC-applications can used appropriate laboratory cables.
4. **At 230 V AC applications the power plug must be in a position that the green lamp [2] is on.** This ensures that the phase is connected to the connector "L" [19].
5. **Connect the test object to the power outlet or the laboratory jacks.**
6. **Switch on the mains switch on the rear.** Ready for operation after about 2 seconds. During this time the fan (temperature-controlled) is switched on.
7. **Select the desired operation mode with the memory function [5]** or use the potentiometer in the variable mode to set the desired parameters.
8. **Select desired polarity [11], positive, negative or alternating.**
9. **Select the desired coupling mode [1].**
10. **Pressing the key [12] "Start",** the interference pulses are superposed according to the adjusted coupling and the other parameters to the mains of the EUT.
11. **To interrupt or stop the test, see chapter 7.**

## 5 Tests

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### 5.1 EUT's power feeding

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Connectors [32] on the back side, feed either direct current or alternating current. Mind the maximum ratings shown in the "Technical data" (chap. 11).

### 5.2 EUT connection

---

Connection of the EUT via protection-earth-outlet [18] or laboratory jacks [19]. It's also possible on the rear side [33].

### 5.3 Adjustment of the test parameters and display

---

The functions of the touch panel are listed in chapter 3.5.

The individual settings are explained in more detail below (the numbers "[nn]" refer to the corresponding touch panel).

NOTE:

A double touch (creates a dashed frame around the field) can be used to adjust the parameters in larger increments. Charging voltage  $U_{cv}$  [6]

#### 5.3.1 Charging voltage [3]

The charging voltage determines the voltage applied to the input circuit of the device under test after the test pulse has been triggered. The height of the short-circuit current is determined by the input impedance of the device under test.

#### 5.3.2 Phase angle $\varphi$ [4]

The phase angle is adjusted by activating the touch panel and using the rotary encoder on the front of the generator. The values can be set in 1 ° increments from 0 ° - 359 °. This is possible both at 50 Hz and at 60 Hz DUT supply. The electronics detects the mains frequency and internally activates the correct time parameters. The synchronization of the phase angle refers to the feeding of the EUT voltage at the coupling network input [32].

If an external 3-phase coupling network (SURGE 520, 523 or 524) is connected, the synchronization is done via Sync. Input - BNC socket [42] on the back.

#### 5.3.3 Number of the pulses per test cycle [7]

Setting the number of pulses per test cycle. Activate touch panel [7] and set the rotary encoder [Front 5]. The values can be set from 1 - 999. If the number of test pulses equals one, "Single" appears in the display. The device is then in the "single-trip" test mode (see chapter 7.1.1).

#### 5.3.4 Test period [8]

Determines the time interval of the individual surge pulses within the test cycle. Adjustment is made with touch pad 8 and the encoder [Front 5]. The values can be set in 1 s increments from 10 - 999.

The minimum value of 10 seconds is determined by the charging characteristic of the storage capacitor.

## 6 Safety-lock of the trigger function

Due to the possible high currents and voltages, the SURGE4-5 must be able to be interlocked via an external safety circuit. The release is effected by bridging of the sockets "Safety" [34] on the back of the device. This should not be done by the supplied shorting bar but by external wiring such as door contacts of test hoods or safety switches.

When the safety interlock is open, there are two different options, which are defined by the state of the "SURGE on / off" display key [2]:

### 6.1 Safety-lock while "SURGE on"

If the surge generator is activated, the key is "SURGE on / off" [2]. provided with a yellow frame. When the safety interlock is open (short-circuit bar pulled or contact open), the message "SAFETY still active" appears in the display.



- The indication charging voltage [3], phase [4], test period [8] and the test pulses per test cycle [7] can still be set with the digital potentiometer [5] after selection.
- Coupling switch [1] and polarity switch [11] can be actuated and are displayed according to their selection. However, no relay switching of the coupling switch is performed.

Once the safety interlock is closed again, all set values are activated, the relays of coupling switches and polarity switches are switched according to the setting. Surge pulses can now be triggered again.

#### Important:

- When the warning message lights up, all parameters on the front panel can be adjusted.
- During automatic or manual load operation, the SURGE4-5 Surge Generator can not be set to "SURGE off".

#### Function "Memory":

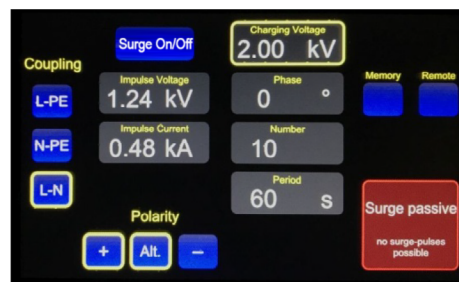
- When the "Memory Touch Panel [5] is pressed, the memories as described in Chapter 10 can be edited.

## 6.2 Trigger deactivation "SURGE off"

This function is important in the operation of the Surge Generator SURGE4-5 in conjunction with other test generators from The EMC Shop. When SURGE off is deactivated (Touch pad [2] is no longer framed), the coupling network of the SURGE4-5 is bridged. Operation of the generator behaves as described under point 6.1 'Safety interlock on' SURGE on ''.



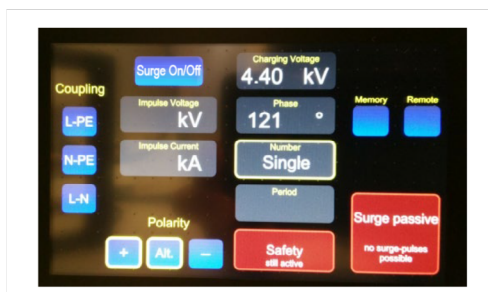
Surge activated



Surge disabled

## 6.3 Safety-lock at "SURGE off"

If both the safety circuit [34] is open and the Trigger is disabled (SURGE off), the warning messages shown below appear:



As described under point 6.1, all parameters can also be set here. The built-in coupling network is useful for other tests, e.g. Burst tests bridged.

## 6.4 Break of the safety-circuit during manual operation

If the safety circuit is interrupted during manual operation (single pulse, see Chapter 7.1.1), the charging process is aborted and displayed in the field. Voltage [4] shows the originally set charging voltage and simultaneously the high-voltage capacitor is discharged.

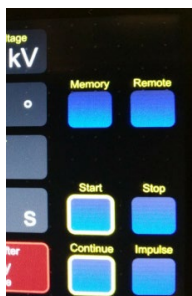


## 6.5 Break of the safety-circuit during automatic operation

If the safety circuit is interrupted during automatic mode (see chapter 7.1.2), the triggering / charging process is interrupted. The display shows as image below.

As long as the warning is displayed, no further impulse can be activated.

- The Continue button flashes.



### Important:

- The "Stop" button [13] can be pressed so that, for example, the display for a new start of the test can be set to the initial value.

If the interruption has been eliminated, the test can be continued with touching "Continue".

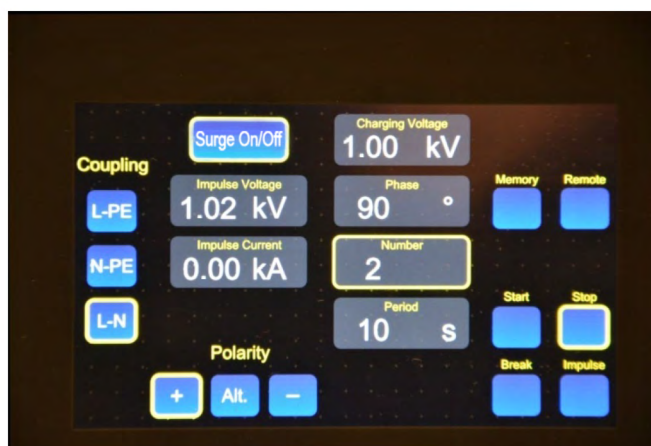
## 7 Control of the release / discharge

### 7.1 Selection of test mode (single or multiple discharges)

The choice of operating mode depends on the number of test pulses (Number) in the touch panel [7].



Single discharge



Automatic (2 discharges are adjusted)

The current flowing through the device under test and the occurring voltage is determined by the input impedance of the device under test and shown in the display [10] "Impulse Current" and "Impulse Voltage".



### 7.1.1 Single discharge

The single-discharge mode is activated by turning the rotary encoder [5] to the left until "Number" shows single in the display. The high voltage circuit is charged by pressing the charge button to the discharge voltage set in the "Charging Voltage" field.

The "single event" is triggered by pressing the trigger button or by applying a negative edge to the BNC socket [6] Front. If, after charging the HV circuit, there is no discharge, the high voltage circuit is automatically discharged after approx. 5 minutes for safety reasons.

The test is aborted with the "Discharge" key.

By separating the single triggering from the normal sequence control, critical process states of the DUT can be tested directly.

### 7.1.2 Automatic test mode

The operating mode "Automatic triggering" is achieved by turning the rotary encoder, as soon as a number greater than 1 (single) is selected.

After pressing the "Start" button, the charge voltage / surge voltage is charged to the previously set value. As soon as the setpoint value is reached, the first discharge of the high voltage circuit occurs automatically. The display "Number" is decremented by 1. The subsequent discharges are only dependent of the number of test pulses [7] and the set period [8]. After the set pulses have been processed, the automatic test cycle is ended - the display [7] returns to the value set at the start of the test.

## 7.2 Stop / discharge with the function "discharge"

### 7.2.1 Single discharge (adjustment as described in chapter 7.1.1)

Once the charging voltage has been reached, this voltage can be discharged internally by pressing the "Discharge" button. This is important if, for example, the charging voltage was set to 4 kV with the test specimen connected, and the examiner subsequently intended a lower test voltage for the test specimen. In this case it is possible to discharge internally without any damage for the test object. After that, a new value can be set.

### 7.2.2 Automatic test mode (see also chapter 7.1.2)

The process is interrupted by pressing the "Break" button during the automatic discharge process. And the break button changes to a flashing "Continue" button.

Pressing the flashing "Continue" button will continue the automatic process.

If the automatic sequence is to be ended, then the Stop key must be pressed. In this case, the display [7] is set to the value defined at the start of the test and the test is finished.

#### NOTE:

The "Impulse" field is only used to display the pulse triggering in automatic mode



## 8 Coupling/Decoupling network

With the help of the coupling network, the interference pulses of the surge generator can be superimposed to the power supply voltage. The coupling takes place by means of discrete coupling capacitors. According to IEC 61000-4-5, 18  $\mu\text{F}$  capacitors (balanced coupling) or 9  $\mu\text{F}$  / 10  $\Omega$  (unbalanced coupling) with sufficient dielectric strength are incorporated.

A coupling is only possible after activating the button [1]. The three buttons are exclusive, which means that only one coupling path can be activated at a time. The following types of coupling can be carried out:

- Phase L  $\square$  ground
- Phase N  $\square$  ground (unbalanced coupling)
- Phase N  $\square$  phase L (balanced coupling)

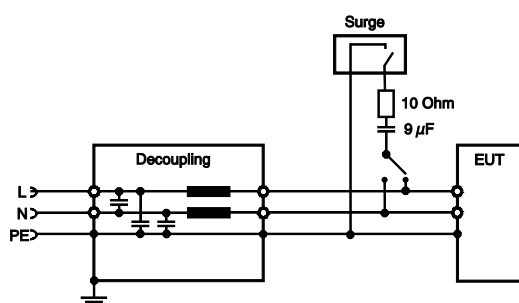


Figure3: Unbalanced coupling

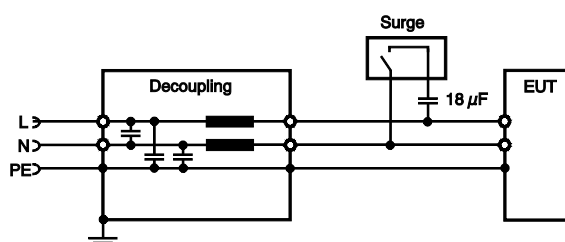


Figure4: Balanced coupling

The "interference energy" with connected power cable can easily influence other systems operated in the environment. A surge test should therefore be carried out in a screen cabin or Faraday cage.

The coupling network has no internal fuses. The user must ensure that the device under test and the coupling network are protected in accordance with the specimen current consumption. The maximum protection may not exceed 16 A – please also refer to the technical data.

## 8.1 Choice of the operation mode

With the star-shape-arranged plug-in bridge [40] on the rear of the SURGE4-5, the operation mode of the coupling (internal or external coupling units) is selected.

Standard mode is the position **A (internal coupling network)**. In this case the coupling paths can be selected with the corresponding buttons [1].



● **ATTENTION ! At the mode "A" the use of the HV-Out [41] is not allowed**

At the other positions B and C following points have to be considered:

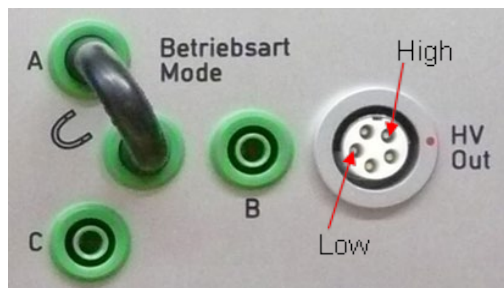


● **ATTENTION ! The main voltage must be disconnecting at this mode for safety reason.**

- If the generator is operated with the **external coupling network** SURGE-EFT-3PH-CDN (or SURGE-DLC) (**plug-in bridge = C**), then the BNC input "Sync. Input "[42] should be connected with the "Sync. L1" output from the SURGE-EFT-3PH-CDN. This ensures that phase is referenced to L1 from the CDN. If the BNC input [42] is not used, the pulse is triggered randomly.
- If the plug-in bridge is removed or plugged into the positions **B or C**, the coupling paths can not be selected with the button [1] at the SURGE4-5.
- All other parameters remain adjustable as in normal operation.
- In the position **plug-in bridge = B (component test)**, a suitable coupling device for component tests must be connected to the HV output [41]. The coupling is implemented earth-based.

## 8.2 High voltage output

The high voltage output "HV Out" [41] on the rear side has several functions:



- HV – connection for external coupling networks
- Verification of the Surge-pulse / calibration
- Tests on cable shields
- Component test

Referring to function I):

The external coupling networks (SURGE xxx) include the coupling impedances (18 $\mu$ F, 9 $\mu$ F+ 10 Ohm) acc. the standard.

**Operating mode = C**

At the function II), III) and IV):

**an external 18  $\mu$ F capacitor is absolutely necessary!**

See also chapter 12.2 Options and accessories. **Operating mode = B**

**The operating mode can be set at the patch panel [40] - see also chapter 8.1.**

## 8.2.1 Connecting an external coupling network

If the device is operated with an external coupling network or used to test components, the power cable [32] must be removed and the selection bridge [40] to be plugged in to the right position. In mode A the using of the HV jack [41] is not allowed.

There can be connected and operated external coupling networks:

- a) for 3-phase applications / power lines: SURGE-EFT-3PH-CDN
- b) for connecting cables / data cables: SURGE-DLC

The normative coupling impedances ( $18\mu\text{F}$ ,  $9\mu\text{F} + 10\text{ Ohm}$ ) are already incorporated in the coupling network.

## 8.2.2 Verifying the Surge-Pulse / Calibration

The normative requirements regarding the waveform can be checked with suitable measuring equipment (Scope, shunt).

In the measurement of the voltage pulse ( $1,2/50\text{ }\mu\text{s}$ ) and the current pulse ( $8/20\text{ }\mu\text{s}$ ) an external  $18\text{ }\mu\text{F}$  capacitor (SURGE- $18\mu\text{f}$ ) is to be connected in series with the HV output. Only with this capacitor, the normative requirements are fulfilled.

## 8.2.3 Tests on cable shields

The high voltage output must be connected a  $18\text{ }\mu\text{F}$  capacitor (SURGE- $18\mu\text{f}$ ) to have standardized pulses on the cable shield

## 8.2.4 Component tests

The surge-pulse can be coupled directly to components - but only with series  $18\text{ }\mu\text{F}$  capacitor (SURGE- $18\mu\text{f}$ ).

This ensures that the pulse shapes meet the requirements of IEC / EN 61000-4-5.

**Important:** We strongly recommend not to perform component test with a flying test setup. Please only under special test-cages with safety switches

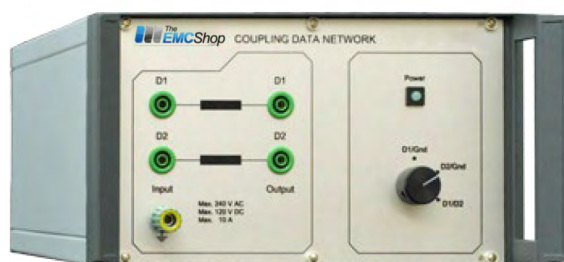
Due to the large amount of energy released, the components to be tested can be destroyed and possibly even explode. This is especially true for tests on capacitors and varistors.

If the test hoods are provided with safety switch (s), they should be connected (linked) to the "safety" socket [34]. As soon as the switches are interrupted by opening the test hood, the high voltage circuit is switched off immediately. It is no longer possible to carry out a test.



SURGE- $18\mu\text{f}$

$18\text{ }\mu\text{F}$ -capacitor



SURGE-DLC

ext. coupling network

## 9 Connectors for measurement and operation

### 9.1 „EUT fail“ input

If a test object monitoring is available for the test, then the trigger can be a suitable output on the test object itself or an external monitoring device. This means that the test sequence for automatic mode can be interrupted by a low signal at the signal input "EUT fail" [38].

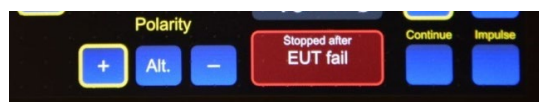
This requires a potential-free contact. If the test object fails, the "EUT fail input" of the burst generator requires a short circuit of at least 10 ms.

The SURGE4-5 behaves as if the Discharge key was pressed once (see chapter 7.2.2). In the display "Period" [12] the information appears to signify that the external EUT supervision has stopped the testing.

The display will show a warning message and continue flashing!



After eliminating the error ("still active" ) disappears, the test can be continued with „Continue“ (the warning message disappears).



### 9.2 Measurement outputs for current and voltage

For measurement purposes, the SURGE4-5 offers the possibility of displaying the current and voltage curves of the surge pulse on the test object.

For this, connect a memory oscilloscope on the back of the SURGE4-5 to the BNC sockets "I" [37], "U" [35] and "Trigger" [36].

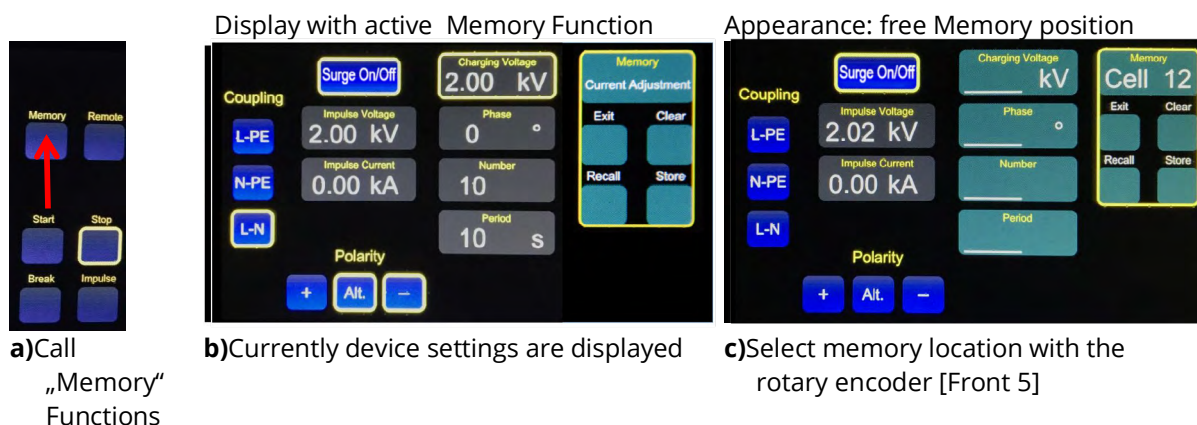
Current measurement:  $1 V_{\text{output}} = 500 A_{\text{input}}$   
 Voltage measurement:  $1 V_{\text{output}} = 1000 V_{\text{input}}$

## 10 Memory function

### 10.1 General description

With the memory function you can save up to 32 device settings. All variable parameters and key positions are recorded.

A first key press causes the memory function to be switched on.



The touch fields of the memory function:

- **Store** stores the generator setting in the previously selected memory location.
- With **Recall**, the stored parameters are taken over by the generator
- **Clear** erases the parameters in the selected memory location
- **Exit** leaves the memory function (no changes are accepted)

The memory location numbers 01...32 are freely adjustable.

Empty memory locations appear in the displays [2], [3], [4], [7] and [8] without values.

When memory space is used, the stored parameters, such as **Charging Voltage**, **Phase** angle, **Number** of pulses per test cycle and **Period**, including the stored values for **Coupling** and **Polarity**, appear.

#### 10.1.1 Examples of operation

- Store values, e.g. to position Cell 12
  - First set the desired values on the generator and call up the memory function
  - Set the desired memory location **Cell 12** with the help of the rotary encoder [Front 5].
  - The **Store** button is used to save the settings in memory and exit the memory function
- Call values from memory, e.g. from memory position Cell 03
  - Use rotary encoder [Front 5] to select the memory location **Cell 03**. The existing values are displayed.
  - With the key **Recall** the parameters from the memory are taken over by the generator and the **Memory** mode is left.
- Clear values, e.g. in memory position Cell 20
  - Call **Memory** function.
  - Call memory location **Cell 20** with rotary encoder [Front 5].
  - The **Clear** button clears all parameters in **Cell 20**.

Further storage locations can then be selected and deleted with Clear. Memory mode is only exited with the Exit button

## 11 Technical Specifications

### 11.1 Generator + coupling network

#### EUT feeding

- Nominal voltage AC - max. 230 V / 50 Hz or 60 Hz
- DC - max. 270 V
- Nominal current AC / DC- max. 16 A
- Display of the phase relation - lamp red / green

#### Pulse parameter acc. to IEC/EN61000-4-5

- Surge voltage - 0,2 - 4,4 kV (adjustable from 0.1 – 4.4 kV)
- Surge current - 0.1 - 2.2 kA

#### Time functions

- Phase / pulse release - = 0 - 359°, step 1°
- Period / charge time - 10 - 999 s, step 1 s
- Number of test pulses per test - 1 - 999

#### Trigger

- Single event by manual release
- Single event by external trigger via BNC jack
- Start of the test circle by charge-key

#### EUT supply

- Protection-earth-outlet
- Additionally laboratory jacks
- Ground jack on front and rear

**Measurement outputs** (rear) - BNC-jacks for voltage, current and scope-triggering

#### Rear general

- EUT power
- Electronic feeding for surge-generator

### 11.2 General

- Operation temperature - 0 to 40° C
- Power supply - 100 - 240 V AC / 47 - 63 Hz, 160 VA
- Housing - 19"-housing, 3 HE (450 x 430 x 150 mm)
- Weight - app. 18 kg

## Scope of delivery

- Surge-generator SURGE4-5
- Mains cable for the surge-generator
- Mains cable for test object, 2 m long, with PE-outlet and banana-plugs
- This manual
- USB / PC – cable (3m) for remote the generator (control software optionally)

### Attention!

The mains cable and especially the cables for the EUT power must be checked regularly for damaged areas - replace if necessary!

## 12 Accessories (optional)

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- **SURGE-EFT-3PH-CDN**      Three Phase Coupler/32 or 60 Amps Per Line
- **SURGE-DLC**              Data line Coupling Network (inquire for configurations)
- **SURGE-CAL-KIT**          Voltage Divider and Current Probe for Surge Waveform Verification
- **SURGE-18 $\mu$ f**            External 18 $\mu$ f Capacitor for HV output verification
- **TIG.Control**              Remote Control Software

## 13 Address of the Manufacturer

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E-mail: [sales@theemcshop.com](mailto:sales@theemcshop.com)  
[www.theemcshop.com](http://www.theemcshop.com)  
California HQ - 7401 Galilee Rd. #160 Roseville, CA 95678



## 14 Block schematic diagram SURGE4-5

Prüfling Versorgung

