

# User Manual

## ESD Generators



SESD 216 | SESD 230

## Electrostatic Discharge Generators

SESD 216	16,5 kV
SESD 230	30,0 kV

### ATTENTION

This unit generates high voltages 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 personal (electrotechnical instructed person). People using cardiac pacemakers should be removed from the test area.

**Before using the generator please read this manual and the warnings to the safety points.**

**This generator contains a Li-Ion battery.**

Please note also Section 5.13.1 “**Note / Internal battery**”

### **Scope of delivery:**

Transport case with

- ESD generator SESD 216 / 230
- Charger with connecting cable
- Test probes for air discharge (SESD 3020)
- Test probes for contact discharge (SESD 3021)
- Ground strap (SESD 231)
- User manual



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## 1 Introduction

The ESD simulator SESD 216 / SESD 230 is suitable for performing EMC tests on systems and equipment in accordance with the IEC / EN 61000-4 Part 2 standard. This test is concerned with the immunity behavior to electrostatic discharge. Depending on the DUT and test setup, two test procedures are to be used:

### a) Air Discharge

The discharge electrode with the domed point should first be connected to the SESD. The high voltage discharge of the generator is into an air gap. The very short rise time of each single pulse generates a wide RF spectrum and interference's. This can be the reason for an influenced EUT.

### b) Contact Discharge

The discharge electrode with a sharp point is connected to the EUT. The discharge switch is operated by a vacuum relay allowing a better reproduction of the test results.

If the probe is not in electrical contact with the EUT (e.g. varnished or oxidized surfaces) there will be no triggering of impulses. The display will show "NO contact". This feature makes sure that a discharge took place in the contact discharge mode



#### **Important Note !**

The approach to air discharge should be from a distance of at least 20 cm, otherwise there is a risk of multiple discharges in single-shot mode (discharge voltage cannot build up completely and is recharged).

In the event of contact discharge, the pulses are not triggered if there is no contact (e.g. painted or oxidized surface)! The display shows "No contact". This ensures that a discharge process actually takes place in the event of contact discharge.

The concept of the ESD generator is designed to work in battery mode. The included power supply unit enables timely charging or "mains operation". In addition to the controlled contact discharge, value was also placed on a clear and simple operation of the generator.

Automatic test sequences are programmable and easy to activate.



## 2 Safety Instructions

### 2.1 Symbols used



#### Note

This symbol points out additional hints, application tips or information.



#### Warning / Danger

is used if not following the instructions may cause personal injury, material damage or environmental damage.

Danger is used if not following the instructions may result in danger of life. **Regard these instructions and take care of your actions.**



#### Electric shock

This symbol warns against danger for life caused by electric shock. **Regard these instructions and take care of your actions.**

### 2.2 Safety Regulations

The SESD 216 and SESD 230 test generators generate high voltages of **up to 16,500 volts and up to 30,000 volts** respectively. The energy of this high voltage is so limited that it is normally not life-threatening for humans. Nevertheless, consequential damage may possibly be caused by contact (e.g. shock, etc.).



#### Warning / Danger

**The handling of the generator is only allowed to experienced and instructed persons according to DIN 570105 / VDE 0105 part 1.**

**Persons with a cardiac pacemaker are not allowed to handle this unit.**

The use of the ESD generator assumes, like all measurement tasks and verifications, that the local and branch specific directions are considered. Precautions should be taken that any part that carries high voltage and can be touched should be shielded. This is important with both the ESD Generator and the object under test.



#### Warning / Danger

While using the ESD generators it must be made sure that the ground / earth connection is fastened at the generators ground and connected to earth potential.

**It is not allowed to use the tripod connector for grounding!**

The tests with the SESD generator on test specimens shall be carried out by a qualified electrician as defined in DIN 570105 / VDE 0105 part 1 or VBG 4. Care must be taken to ensure that the power supply unit is operated only with the appropriate protective grounded sockets; the breaking of the grounding connection is not permitted. The housing and the grounding jack are connected to the protective conductor of the mains. Attention is drawn to the observance of the accident prevention regulations "Electrical systems and equipment" (VBG1 and VBG2) with implementing instructions.





**Warning / Danger**

The absence of a protective earth connection presents **a danger to the user** and can also **destroy the power supply** of the ESD generator. Damage to the power supply due to lack of protective earth is not covered by the warranty.

The ESD generators SESD 216 and SESD 230 are according to its specifications designed only for laboratory use in the industrial surrounding (tests in a Faraday's cage).

### 2.3 Impairment of safety

If the unit has visible damage so that a safe operation is no longer possible, it has to be set out of operation. It has to be ensured against unauthorized usage. The unit has to be send immediately to the manufacture / dealer with a description of the damage!



**Electric shock !**

We warn from untrained staff opening the unit. There is high voltage inside EVEN WHEN SWITCHED OFF. **The warranty will be void if the unit is opened.**



## 3 ESD - Definition

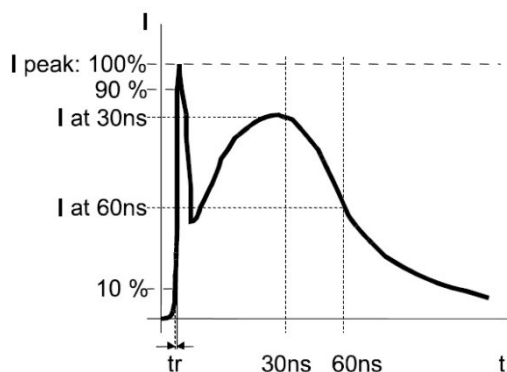


Figure 1: Representation of the ESD pulse according to the standard

Test level	Test voltage Air discharge	Test voltage Con discharge	Rise Time „CON“ (± 25 %)	1. peak current (± 15 %)	Current after 30 ns (± 30 %)	Current after 60 ns (± 30 %)
1	2 kV	2 kV	0,8 ns	7,5 A	4 A	2 A
2	4 kV	4 kV	0,8 ns	15,0 A	8 A	4 A
3	8 kV	6 kV	0,8 ns	22,5 A	12 A	6 A
4	15 kV	8 kV	0,8 ns	30,0 A	16 A	8 A
X*	special	special				

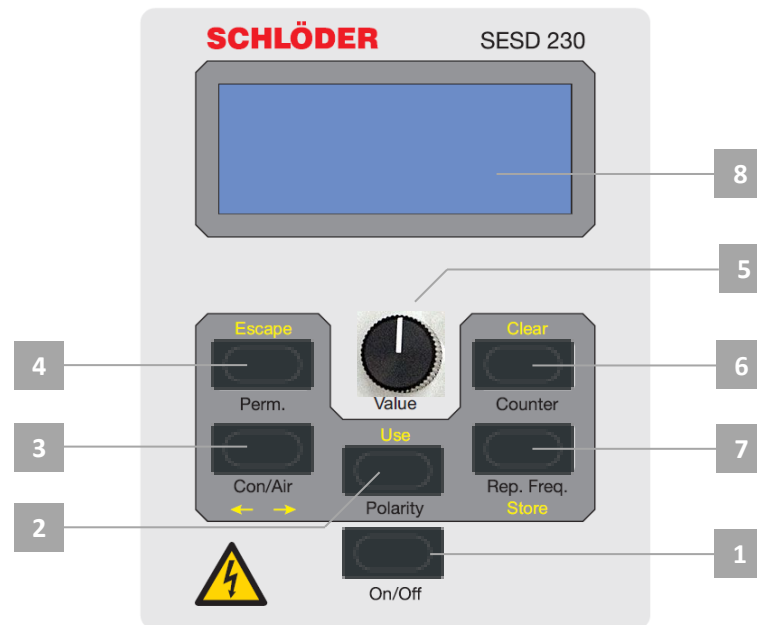
\* Level „X“ is an open level.

Table 1: Severity level and waveform parameters at contact discharge



## 4 Device functions

### 4.1 Front panel



Nr.	Normal Mode		Setup Mode	
[1]	On / Off	ON / OFF switch		
[2]	Polarity	Polarity of the pulse, positive and negative	Use	Use the adjusted parameters
[3]	Con/Air	Mode CON / AIR Contact discharge or air discharge	← →	Selection of various parameters
[4]	Perm	Selection test level, Continuous mode and Setup - Mode	Escape	Back without saving the adjusted parameters
[5]	Value	Potentiometer for output voltage adjust	Value	Adjustment test level 1 – 4 and pre-selection parameters
[6]	Counter	Counter pre-selectable	Clear	Clear of the setup values
[7]	Rep. Freq.	Repetition frequency	Store	Store of the setup values
[8]	LCD Display	4 lines		



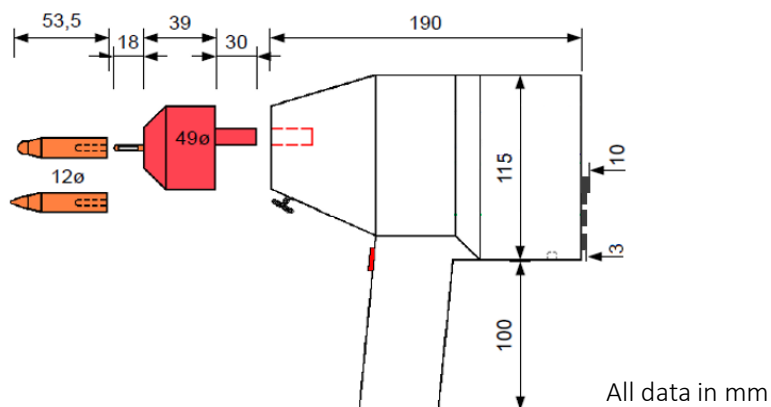
## 4.2 Casing



Figure 2: Housing functions

- [9] Connector for an optical RS 232 converter
- [10] Test tip for: a) AIR discharge b) Contact discharge
- [11] Connector for the discharge return cable
- [12] Trigger button
- [13] Connector for the power supply
- [14] Connector for a tripod

### Technical drawing



## 5 Function description

### 5.1 ON / OFF - switch

After switching on the generator, the LCD display shows the last used parameters. The bottom line shows the charge status of the accumulator (drawing 3). The accumulator should be charged if the bottom line shows two boxes only. An operation of the generator during the charging process is possible at any time.

In accumulator mode the generator should be switched off after usage.



Figure 3

### 5.2 Output voltage adjust

With the potentiometer [5] the output voltage amplitude can be adjust in a range of:

<b>SESD 216</b>	<b>± 0,2 kV to ± 16,5 kV</b>	<b>AIR discharge</b>
	<b>± 0,2 kV to ± 10,0 kV</b>	<b>Contact discharge</b>
<b>SESD 230</b>	<b>± 0,5 kV to ± 30,0 kV</b>	<b>AIR discharge and Contact discharge</b>

The voltage value is shown in the upper line of the LCD display. The voltage can be changed in steps of 100 Volts by turning the potentiometer slowly. Turning the potentiometer fast will increase the voltage steps.

On the left hand of the voltage display the respective test level "L1" to "L4" is shown.

### 5.3 Polarity switching

During the standard test, the electrostatic discharges are to be tested with both polarities - "Positive (+) and Negative (-)". This changeover is performed by simply pressing the [2] Polarity key. In the display, the voltage value is preceded by "+" or "-".

### 5.4 Mode CON / AIR

With this key the test mode can be changed between Contact Discharge and Air Discharge. While pressing the key the display shows in the third line the information "CON DISCHARGE" or "AIR DISCHARGE". Simultaneously the admissible voltage ranges are changed - see point [5.2].

Make sure that the right test tips are connected to the generator - air discharge "round" and contact discharge "sharp".



## Air Discharge:

1. Setup the ESD Generator to the discharge mode and the voltage you want
2. Press the trigger so that the ESD Gun can charge up (this takes 50ms) and KEEP THE TRIGGER BUTTON PRESSED! A \* appears in the upper left corner of the display.
3. Move the tip of the ESD Generator from a distance of at least 20 cm to the surface of the EUT and move slowly to the EUT until the discharge happens.
4. In the test mode "single" the "real discharge voltage" can be shown in the display. When keeping the trigger button pressed after the discharge, the voltage in the display changes from the set voltage to the real discharge voltage.

Example: Adjusted voltage 12.0 kV: 9.7 kV is flashing. That means the value 9.7 kV is the actual discharge voltage and the difference between the value of the adjusted voltage (12.0 kV) and the residual voltage on the capacitor (2.3 kV).

## Contact Discharge:

1. Setup the ESD Generator to air discharge and the voltage you want.
2. Touch the EUT with the tip of the ESD Generator.
3. Press the trigger and the discharge of the adjusted voltage will happen.
4. If the discharge does not happen, e.g. due to high electrical resistance of the EUT, a message "NO CONTACT" is shown on the display (see point 5.4.1).

### 5.4.1 Special function - contact control at Contact Discharge

If the test mode is set to "CON" the triggering can only be detected if the serial resistance in the test circuit is lower than 4 MΩ. In other cases the display shows "NO CONTACT".

At the level < 1,0 kV (SESD 216) or < 1,5 kV (SESD 230) the display doesn't show "NO CONTACT". At these levels the discharge occur even if the serial resistance is lower than 4 MΩ..

### Switch OFF contact control at CON

- If you don't want the special function "CM (Contact Mode)", you can "switch OFF" and "switch ON" the function as below:
- Switch OFF the ESD generator. Now press and hold the buttons [Perm], [Polarity] and [Counter] and switch on the generator by pressing the button [ON/OFF]. The bottom line shows on the left side CM = ON. With the button Con/Air [3] you can select between ON and OF. With the button „Perm“ [4] = „Escape“ you leave this menu and goes to the normal mode.



### 5.4.2 Special function – displaying of the real discharge voltage at AIR mode

In the test mode “AIR” and “Single” the “real discharge voltage” can be shown in the display. After the discharge and hold-on the trigger button [9] the voltage in the display changes from the adjusted voltage to the real discharge voltage. This voltage is shown as sparkled information.

#### Example:

Adjusted voltage: 12.0 kV -> after the discharge the value 9.7 kV is flashing.

That means the value 9.7 kV is the actual discharging voltage and is the difference between the value of the adjusted voltage (12.0 kV) and the residual voltage on the capacitor (2.3 kV).

## 5.5 Repetition frequency

By pressing the button „Rep. Freq.“ [7], the following repetition frequencies (shown on the right hand in the third line of the display) can be chosen:

**Air discharge:**                    **SINGLE or REP (single pulse or repeat).**  
**Contact discharge:**            **SINGLE, 0,1 Hz; 0,2 Hz; 1 Hz; 2 Hz; 5 Hz; 10 Hz or 20 Hz.**

## 5.6 Counter Mode

### 5.6.1 Standard „Counter – Mode“

After pressing the button „Counter“ [6] the display shows in the first and second line

**"COUNTER SET"**

**C:    XXXX".**

The last selected value appears, e.g. C: 140. Using the potentiometer [5] the values can be changed from C: 00 up to C: 9999. After pressing the button „Counter“ [6] again the displayed value is stored in the pre-select counter.

For example the second line shows            **C:        140/ 140.**

Now you can start the test by pressing the trigger button [12]. Depending of the adjusted repetition frequency the counter counts down the first value of the displayed 140/ 140.

The second value will never change. It shows always the adjusted total number of pulses. When the counter counts to zero "00", no discharge is possible. After releasing the trigger button, the display show again the originally value, e.g.

**C:        140/ 140.**

A further test with is possible by pressing the trigger button again. The test voltage can change every time.

To change the counter adjustment, press the button „Counter“ [6] to go into the „Counter Set-Program“. Now you can change the values.

For further usage of the generator, the pre-select counter must either be programmed again or cleared. By pressing and holding button [6] for > 1 sec the pre-select counter will be cleared after the key is released and when the key is released, the normal display appears without the information **C: XXXX**.



## 5.6.2 Polarity changing during the „Counter-Mode“

In the standard mode the ESD pulse discharge positive „+“ or negative „-“. The display shows:

**+ 6,5 kV**  
**C: 140/ 140**

By using the counter mode it is possible to change the polarity after half of the nominal discharges happened:

1. Activate the „Counter“ mode with button [6].
2. On the right side in the second line the last selection is shown.
3. Push the button „Polarity“ [2]. Behind the letter “C” the symbols + - or - +.
4. By pressing the button „Counter“ [6] the display show:

**+ 6,5 kV**                      **or**                      **- 6,5 kV**  
**C: + - 140/ 140**                                      **C: - + 140/ 140**

With this setting and pressing the trigger key [12] the counter is reduced and after half of the triggered pulses the polarity is changed automatically.



### Note !

We recommend using the counter function only with contact discharge, because only in this mode is correct counting guaranteed. With air discharges, even partial discharges can cause a counting process and thus falsify the number of actual test cycles.

## 5.7 Continuous discharge

At longer tests or by using the tripod it is useful to work in automatic mode.

**Switch on:** Push button "Perm." [4]. The display show the picture below. Push the trigger button [12] and release it. The function "continuous discharge" is activated. The display shows in the first line „Perm“.



**Switch off:** Press the trigger button [12] – the function "continuous discharge" is stopped.

The function "continuous discharge" is always possible – in a normal mode and in the counter mode.

Simply press the button „Perm“ [4] and the trigger button [12]. In the counter mode the information „Perm“ is also displayed.

Information:

Regarding the function „RECALL → MOVE POT FOR SETUP“ please see chapter 6 and 7.

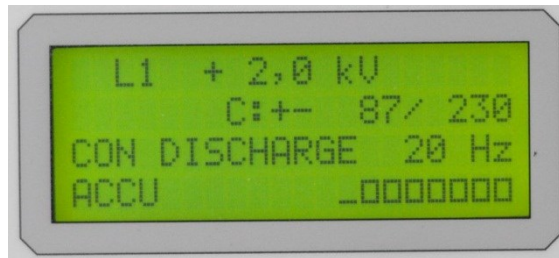


## 5.8 LCD - Display

The upper line of the display shows the test voltage in kV and polarity. The second line is empty. In the counter mode – see chapter 5.6 – the display shows the quantity of discharged pulses.

The left side of the third line gives information about the test mode (CON / AIR), the right side shows the selected repetition frequency.

The bottom line informs about the status of the accumulator charge. The accumulator should be charged if the display shows two squares only.



### Special information " \* " and " \_ " :

The " \* "- sign in the left hand side of the upper line signifies "Attention! High Voltage" at the test tip. The information is displayed as long as the trigger button [12] is pressed. After releasing the button [12] the sign " \_ " appears for two or three seconds. During this time the high voltage is discharged internally. While the symbol " \_ " is displayed, you should not try to change the test tips.

## 5.9 Trigger button

With the button [12] the discharge is released. There are also special functions that are shown in previous chapters.

## 5.10 Discharge return cable

The discharge return cable has to be connected to the ground connector [11]. The other end has to be connected to ground, either to the ground plane of the test bay or directly to the EUT

## 5.11 Discharge electrodes CON / AIR



### Attention!

Before the discharge electrodes are changed, please switch the generator off and wait for two or three seconds to allow the high voltages to be internally discharged.

The test probes can then be changed by simply pulling and plugging them on. Please ensure that the correct test probes are used according to the selected test mode ("pointed" for contact discharge, "round" for air discharge). If the "wrong" test probes are used, the triggered pulses will not comply with the technical specification and the standard.



## 5.12 Power supply

The generator is connected to the power supply via the socket [13]. The ESD generator can be used either independently, using the built in batteries or while connected to the mains supply.

After the charging of the accumulator (the charge line is than showing full on the display), the power supply can be removed and the testing can go on with the accumulator only.

The charging of the accumulator can be interrupted at any time in case the power supply cord is hindering the use of the generator.

The default usage of the generator is in the accumulator-supply

The power supply can be used in a wide range of voltage (85 V to 264 V) and frequency (47 Hz to 63 Hz).

## 5.13 Display battery charge

The ESD generator has a Lithium-Ion accumulator. A special electronic is responsible to control and charge the batteries.

During the charging of the accumulator the display shows in the bottom line:

**LINE CHARGE**      \_ \_ \_ \_ \_ □□□

The continuous under lines shows the charge function. During the charging the ESD generator can be used without restrictions.

In case the generator is switched off during the charging, the display continuously shows the charging procedure.

### 5.13.1 Note / Internal battery

The generator is equipped with a high-quality lithium-ion battery. This battery has a long lifetime and is designed for several hundred charging cycles. However, the battery shall never be deeply discharged. For this reason the generator is switched off automatically at a certain minimum voltage and only a small technically related leakage current of approx. 100  $\mu$ A flows. This however has the consequence that, after a certain time, the self-discharge of the battery would still cause the deep discharge. For safety reasons, a deeply discharged battery will be protected permanently from further charging by an internal protection circuit and thus must be replaced by the manufacturer.

To prevent this from occurring, the user has to ensure that, when not using the generator, the battery has always to be charged previously. We recommend in addition the check the charge level at least every 8 weeks and reload in case of need.

## 5.14 Connector for a tripod

Normal tripods can be used for continuous testing. The continuous discharge is explained in chapter 5.7



### 5.15 Adjustment LCD – Display contrast

- Switch OFF the ESD generator. Press the [Rep. Req.] button [7] and hold down, then press shortly the "ON / OFF" button.

The display shows "ADJUSTMENT OF CONTRAST".

With the potentiometer [5] the contrast can be changed. By pressing the button [Rep. Freq.] again, the new parameters are saved.

### 5.16 Serial number

Each ESD generator has a serial number written into the software. You can display the number on the LCD display as follows:

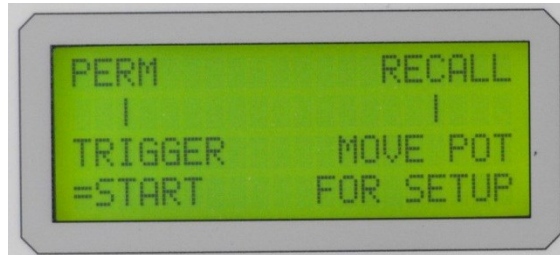
Switch OFF the ESD generator. Press and hold down the buttons [Perm], [Polarity] and [Counter], then press shortly the "ON/OFF" button. The display shows now the serial number in the upper line on the right side. This will be displayed for some seconds.



## 6 RECALL – Test levels 1 – 4 according to IEC/EN 61000-4-2

### 6.1 Activation of the function

Push button „Perm“ [4], the display shows:



Turn the potentiometer [5] to left for activating the test level according to the standard. Successively the test level 4, 3, 2, 1 are displayed. Turn the potentiometer to right, the test level are displayed increasing.



By selecting test level 4 and pressing the key „Polarity“ [5] the test parameters according the standard level 4 will displayed.

A test can be started directly by pressing the trigger button [12]. The adjustment can be changed at any time. The basic parameters of the test levels cannot be changed.

### 6.2 Standard test in Counter mode

Press button „Perm“ [4] and follow the instruction in chapter 6.1 and set the parameters in the display. Now press button „Counter“ [6] and adjust the quantity of the discharge pulses – see chapter 5.6 “Counter Mode”.



## 7 Setup functions

### 7.1 Activation of the function

After pressing the button „Perm“ [4] the display shows the picture below:



Turn the potentiometer [5] to right for activating several setups. Successively the setups SET 01, SET 02 and so on are displayed. There are maximum 20 setups possible. The picture below shows an example with SET 01.



### 7.2 Automatic test

After selecting the appropriate setup program - e.g. SET 02 - the stored values are transferred to the display by means of the "Polarity" button [2] - see the following example:



In addition to the usual view, the display shows SET 02 in the second line on the left and the total number of test steps (SP) in the third line next to "CON". The number of test steps "SP" is a calculatory value which results from the parameters initial voltage (STA), final voltage (END) and step size (STE). In the example shown, there are a total of 46 steps, with five ESD discharges per step.

The total test time depends on the selected repetition frequency.

The automatic test procedure is started by means of the release button [12].



## 7.3 Programming the automatic tests

After activating the setup function - chapter 7.1 - select a memory location that you want to program. In principle, existing memory locations SET 01 - SET 20 can be overwritten or, if not yet occupied, rewritten. All 20 memory locations are numbered, these numbers - SET 01 to SET 20 - cannot be changed.

The 5 buttons and the potentiometer are double assigned. In setup mode they get another function.

Nr.	Normal Mode		Setup Mode	
2	Polarity	Polarity of the pulse, positive and negative	Use	Take over the adjusted parameters
3	Con/Air	Mode CON / AIR Contact discharge or air discharge	← →	Selection of parameters
4	Perm	Selection test level, Continuous mode and Setup - Mode	Escape	Back without saving the adjusted parameters
5	Value	Potentiometer for output voltage adjust	Value	Adjustment test level 1 – 4 and Setup
6	Counter	Counter pre-selectable	Clear	Clear of the setup values
7	Rep. Freq.	Repetition frequency	Store	Store of the setup values

### 7.3.1 Parameters input

The example describes programming an empty memory location - e.g. SET 10.

To the right of "SET 10" an arrow (arrow direction left) can be seen. This arrow marks the position of the input fields. The arrow can be "scanned" to any position using the "Con / Air" button. Values on the individual positions can be adjusted with the aid of the potentiometer.

Example:

MOD	The rotation of the potentiometers causes the indication AIR or CON. Similarly some parameters are activated, depending on the choice AIR or CON.
REP	The repetition frequencies are stored and can be selected.
POL	Choice of the polarity
SPA	The arrow points to the right, the „Starting voltage“ can be set.
STE	Enter the „voltage step“ or „ increment “.
END	Entering the „final voltage“ or the maximum test voltage.
NBSTEP	„Number of steps“ – indicating the number of test pulses per increment.  Depending on the voltage swing (beginning and end) and the step size results in a maximum possible number of discharges per step. A higher number cannot be set.



### 7.3.2 Storage of the parameters

If all settings have been made as described under 7.3.1, these values can be saved. Using the "Rep. Freq." [7] all parameters are saved. The display briefly shows the message "Writing Data - READY".

If a test is to be carried out immediately with the newly entered values, the data is transferred to the display by means of the "Polarity" key [2]. Start with the trigger button [12].

By pressing the Perm button [4] twice, you return to the normal setting menu.

### 7.3.3 Clear entry

If the entries of a memory location are to be deleted, proceed as follows:  
Select the appropriate memory location - e.g. SET 10.

Press the "Counter" key. A security prompt prevents memory from being erased by accidentally pressing a key twice. The display shows:

**CLEAR SETUP 10 ?**  
**COUNTER = NO**  
**REP.FREQ. = YES**

Mit der Bestätigung YES = Rep. Freq. werden die Daten im Setup 10 gelöscht, es erscheinen nur noch Striche ---.

With the confirmation YES = Rep. Freq. the data in setup 10 is deleted, only dashes appear ---.

With NO = Counter, no data is changed and you return to the setup menu 10.



## 8 Self-test – function test

### 8.1 Description of the self-test

The SESD 216/230 is equipped with an internal self-test function. Within approx. 30 seconds, the generator checks the most important operating parameters and determines whether the device is working properly or not. The self-test consists of 14 steps:

- Step 1 - 4 checks internal power supply properties. A battery level below 35% may cause this test to fail.
- Step 5 - 9 checks high voltage parameters with positive polarity
- Step 10 - 14 checks high voltage parameters in negative polarity

**During the self-check the discharge tip of the ESD generator must be grounded.**



Discharge electrode grounded

Switch off the device. Hold down the [Perm.], [Polarity] and [Counter] buttons and press the [On / Off] button. The configuration menu with the factory number appears in the top line on the right and in the bottom line "SELFTEST".

The self-test is switched on via the [Polarity] key.

Before the test starts, the display shows:

**SELFTEST  
GROUND DISCHARGE  
ELECTRODE AND PRESS  
TRIGGER TO START**

The release key to the ESD - simulator starts the self-test. During the self-test in the 3rd line of the display the measured value including the permissible range of tolerance is short indicated.

After the procedure is terminated, a result list is indicated in the display according to the following pattern:

**SELFTEST RESULT  
0000-00000-11111  
1234-56789-01234  
\*\*\*F-\*\*\*\*\*-\*\*\*\*\***



Line 2 and 3 of the display indicate the step numbers, whilst line 4 gives the result of each step:

- \* means everything is alright, measured value within the tolerance
- f error, measured value too small
- F means error, measured value too high.

The example above shows an error while discharging the internal power supply  
To leave the menu press PERM.

## 8.2 Individual description of the steps

### 8.2.1 Check of the power supply

- Step 1: Check the voltage of the battery. A battery level below 35% may cause this test to fail.
- Step 2: Check the internal controllable power supply at minimum voltage
- Step 3: Check the internal controllable power supply at maximum voltage
- Step 4: Check if controllable power supply is capable within a given

### 8.2.2 Check at positive polarity

- Step 5: Check whether the maximum high voltage of 30 kV positive is reached within a given time, which is different depending on the charge capacity used. If there is an error message, there is a defect in the high-voltage generation, or there is an insulation problem in the high-voltage circuit.
- Step 6: Check the remaining charging voltage after switching off the high voltage generation. It checks the time in which the voltage (depending on the C) should have fallen to 75% (decaying E-function). The high-voltage capacitor and the insulation resistance is checked by the discharge relay.
- Step 7: As Step 6, however, voltage measurement after the time in which 25% of the Discharge voltage should be present.
- Step 8: The device is charged positively to 30 kV, the pulse relay is actuated and then the remaining voltage in the generator is measured. The function is checked by the discharge relay at maximum voltage.
- Step 9: The device is charged positively to 0.5 kV, the pulse relay is actuated and then the residual voltage in the generator is measured. The function is checked by the discharge relay at low voltage. As a result, it can be determined whether the contact resistance has increased due to relay aging.

### 8.2.3 Check at negative polarity

Steps 10 – 14:

The procedure is the same as steps 5 - 9, with the polarity switched to negative.



## 9 Calibration

### 9.1 Test equipment for the calibration procedure

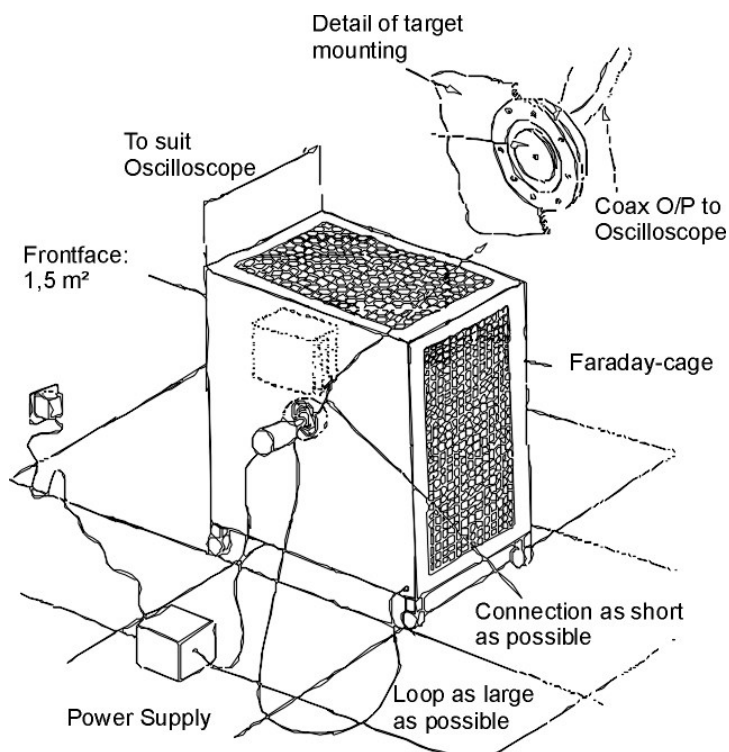


Figure 4

### 9.2 Checking the ESD-pulse

The waveform of the output current must be verified with an oscilloscope with a minimum bandwidth of 2 GHz. The test setup should correspond to the picture in 8.1. Details of the structure can be found in the standard IEC 61000-4-2 / EN 61000-4-2 - ESD measuring target.

The critical parameters such as rise time and pulse width are defined by standards with a tolerance of  $\pm 25\%$  and  $\pm 30\%$ .

**Therefore we recommend a calibration every two years !!**

## 10 Test setup

The correct test setup can be found in the standard:

- a) Industrial IEC 61000-4-2  
EN 61000-4-2
- b) Automotive ISO 10605



## 11 Technical data

SESD Simulator 216 / 230			
Output - voltage	adjustable in 100 V steps via potentiometer (SESD 230) Rotary encoder (SESD 216)	Holding time	≥ 5 sec
Test modes	air- and contact discharge	Pre selectable counter	1 - 9999
Air discharge AIR	<b>SESD 216:</b> ±0,2 kV to ±16,5 kV <b>SESD 230:</b> 0,5 kV to 30 kV	<b>Air and contact discharge</b>	
Contact discharge CON	<b>SESD 216:</b> ±0,2 kV to ±10,0 kV <b>SESD 230:</b> 0,5 kV to 30 kV	Shock capacitance	150 pF ± 10 %
Polarity of the out-put voltage	positive and negative Special function: in "counter mode" optional polarity changeover after half of the set pulses	Discharge resistor	330 Ohm ± 5 %
<b>Repetition frequency</b>		Discharge electrodes	according to IEC / EN 61000-4-2 AIR: 1 x 8 mm round CON: 1 x sharp
Air discharge	single pulse or repeated (frequency depends on the distance between the discharge electrodes and the DUT)	Rise time for contact discharge	0,8 ns +/- 25% (0,6 - 1,0 ns)
Contact discharge	single pulse, 0,1 Hz, 0,2 Hz, 1 Hz, 2 Hz, 5 Hz, 10 Hz, 20 Hz	<b>General data</b>	
Continuous operation	possible at air- and contact discharge	Self test	in 14 steps, can be activated via interface
		Working temperature	0 - 40° Celsius
		Relative humidity	0 - 60 %
		Weight	<b>SESD 216:</b> appr. 1260 g <b>SESD 230:</b> appr. 1470 g
		<b>Electrical supply</b>	
		Power supply	IN: 100-240 VAC/ 47-63 Hz; OUT: 9 VDC / 3 A
		Weight of power supply	appr. 200 g
		Battery (integrated in generator)	Li-Ion 7.2 V; 14,04 Wh / 1,95 Ah



## Scope of supply SESD 216 / 230 with accessories

- Battery charger incl. cable
- Standard discharge electrodes for air discharge (SESD 3020)
- Standard discharge electrodes for contact discharge (SESD 3021)
- Weight (with content): 3,2 kg
- Ground cable (SESD 231)
- User Manual
- Battery charger incl. cable



## 12 Options

### Options

SESD 3025	Test tip, length 50 mm, for air contact
SESD 3026	Test tip, length 50 mm with spring pin, for contact discharge
SESD 3027	Test tip, length 70 mm with spring pin, for contact discharge
SESD 3036	Hook on the generator for hanging on a balancer
SESD 231	Discharge return cable
SESD 270	HCP – Horizontal coupling plane, ground reference plane
SESD 271	VCP – vertical coupling plane, include earth cable SESD 272
SESD 272	Earth cable include 2 x 470 kOhm resistor, 2 m long
SESD 280/281	Silicon sheet 0,5 mm / 3 mm (IEC/EN 61000-4-2 / ISO 10605 )
SESD 30 T 1000	Support arm with balancer
SESD 8800-4	ESD verification set 2 Ohm (4 GHz) to verify the ESD pulse
SESD 30 S120	Remote control software and optical fiber set

## 13 Schematic block diagram

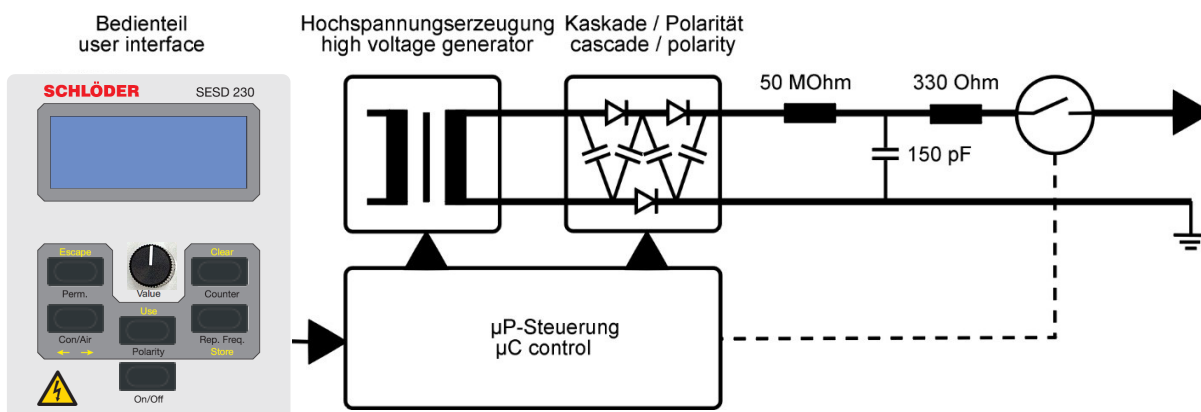


Figure 5



## 14 Maintenance / calibration

The instrument is largely maintenance-free.

We recommend having the instrument calibrated at our premises every two years, e.g. for ISO 9001 certification.

## 15 Packing / transport

If you return the device to the manufacturer for calibration or repair, use the foam inserts for shipping that you received with the delivery.

## 16 Disposal



**Dispose of waste electrical equipment in an environmentally friendly manner !**

Dispose of the device in accordance with national regulations.

## 17 Manufacturer

### **Schlöder GmbH**

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*All information on the appearance and technical data correspond to the current development status at the time of release of these operating instructions. We reserve the right to make technical changes.*

082209

