EMC

# NSG 430

000866

# BEDIENUNGSANLEITUNG
# SIMULATOR FÜR
# STATISCHE ENTLADUNGEN

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# MANUAL
# STATIC DISCHARGE SIMULATOR



SCHAFFNER

CONTENTS PAGE



ATTENTION:

THIS EQUIPMENT AND ALL THE ACCESSORIES DESCRIBED THEREIN OPERATE AT HIGH VOLTAGE. IMPROPER HANDLING AND IGNORING INSTRUCTIONS IS DANGEROUS. ONLY TRAINED PERSONNEL SHOULD WORK WITH THE UNITS, EQUIPMENT COVER MUST NOT BE REMOVED. COMPONENT REPLACEMENT AND ALL INTERNAL ADJUSTMENTS MUST BE CARRIED OUT BY QUALIFIED PERSONNEL.

## 1) INTRODUCTION

In certain environmental conditions, objects - as well as human beings - can charge themselves with electrical energy.

This can be explained as follows:

When two insulating materials with different dielectric constants are rubbed against each other one material transfers electrons to the other. The resulting potential difference is discharged in a short compensating action when another metal object is approached, whereby an arc occurs and strong magnetic fields are built up.

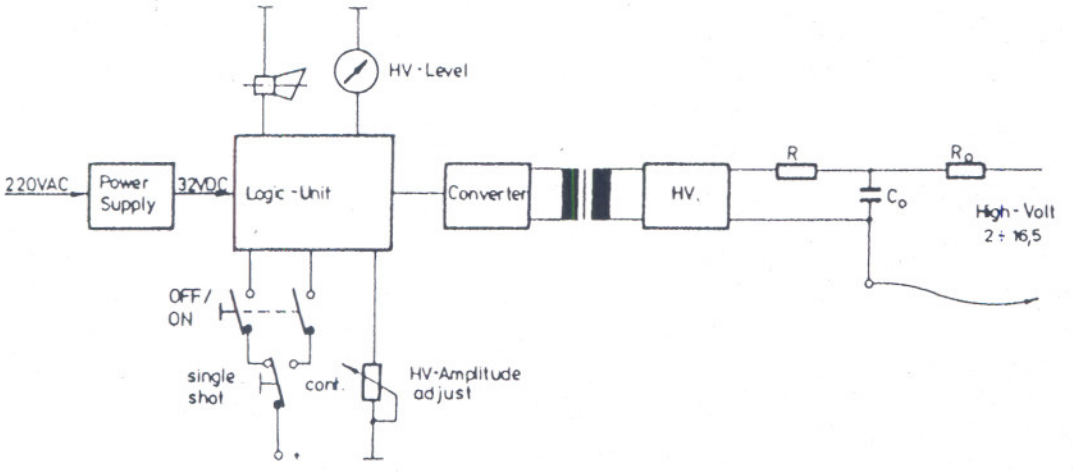
In areas where data processing equipments are installed the relative humidity can drop below 50 % due to the dissipation from the equipment which is given up to the surroundings. Since the danger exists that electrostatic charging takes place with decreasing humidity, it is possible that people also charge themselves up in such surroundings. This can take place through friction on a synthetic carpet or between two vestments. The resulting potential can reach several kV. When a conducting object is approached a compensating action occurs, which is felt as a slight shock. The compensating current which flows and the accompanying electromagnetic field leads to malfunctioning or destruction of components in installations which are not sufficiently protected. It is necessary to systematically test such systems which are subject to interference if the economic disadvantages cannot be accepted.

## 2) APPLICATION

The effect of electrostatics on the operation of components in data processing systems, control and regulating equipments, automobile electronics as well as measuring and weighing systems

must not be left to chance. For this reason a continuous control is necessary during development and in production. The NSG 430 was developed according to various provisional standards like EWG C.42, CIGRE, VG, VDE, PTT and IEC, TC 65/WG4 Working paper.

## 3. MODE OF OPERATION

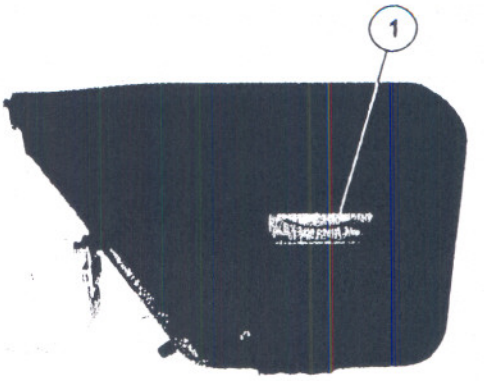



A power supply, which can be operated from 100, 120, 220, and 240 V, supplies a DC voltage (32 ÷ 36 VDC) to the generator. The output voltage can be continuously adjusted by means of the knob "HV-Level" in the range 2 KV to 16.5 KV and is indicated on a built-in voltmeter. With the change-over switch "Cont/Single" two modes of operation can be selected, these are:

"Cont" for repetitive discharges (approx 20 Hz)
"Single" for single discharges

The distance between test object and test probe, depending on the test voltage, can be set with the distance ring. High voltage is produced when the press switch located in the handle of the generator, is depressed.

## 4. Operating controls




① Indicator instrument

② Ground connection

③ Ground cable

④ Ground connection for laboratory cable

⑤ Change-over switch "cont/single"

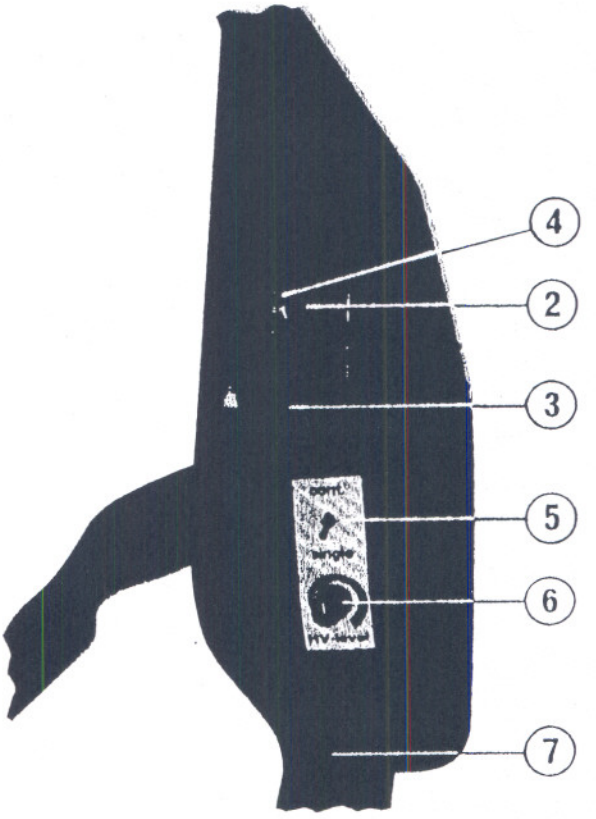
⑥ HV-Level adjustment

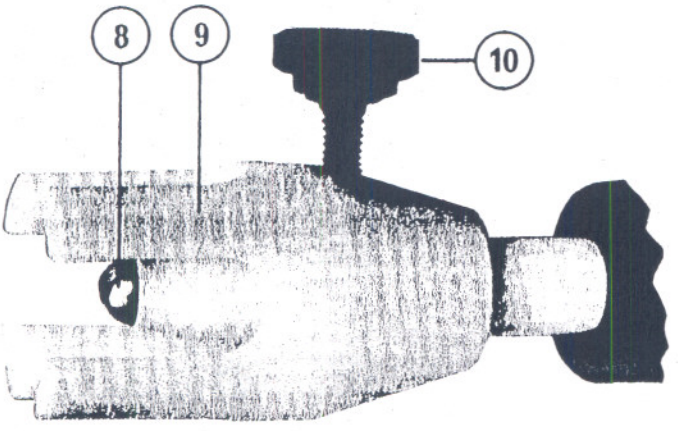
⑦ Switch "ON/OFF"

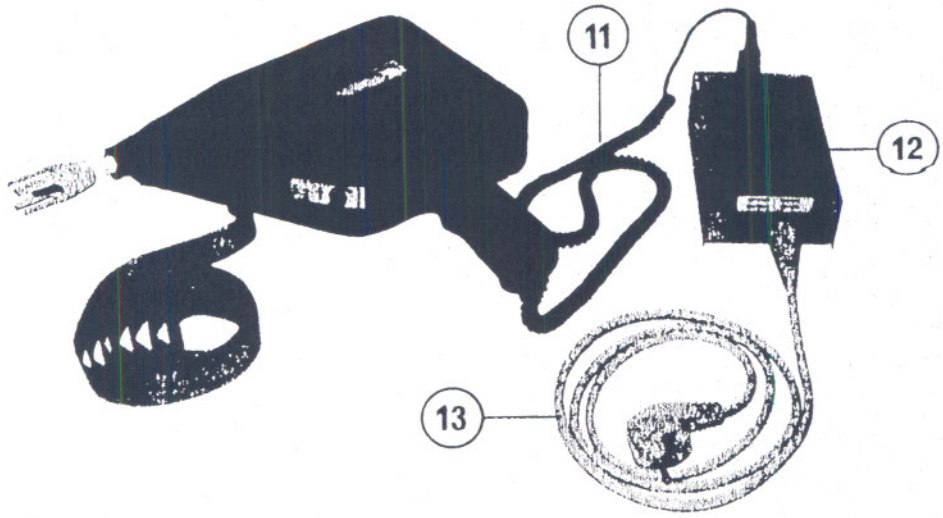
⑧ Test finger (IEC-Standard)

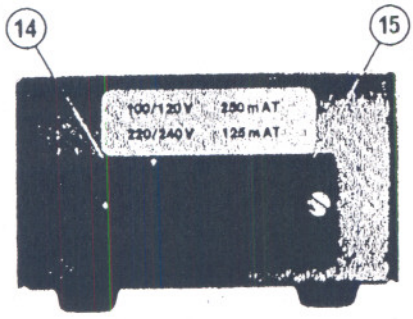
⑨ Distance ring

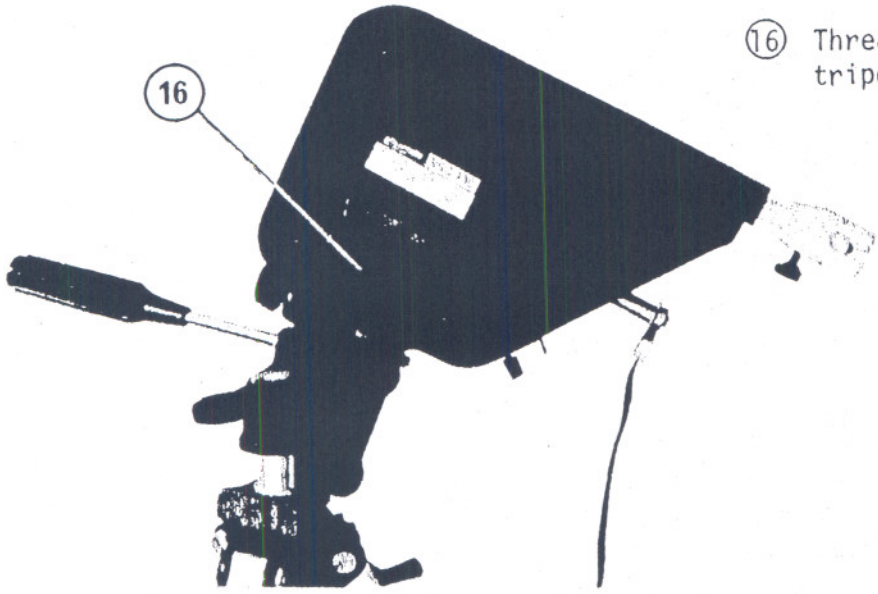
⑩ Test adjustment screw






⑪ Connection cable 32VDC

⑫ Power supply

⑬ Mains cable

⑭ Voltage selector whit fuse

⑮ Mains connection

⑯ Thread for fixation of tripod

## 5. OPERATION

### 5.1 Preparation

Before putting the generator into operation, the following points should be checked:

a) Set voltage selector (14) on power supply (12) to the correct value and put in the appropriate fuse.
b) Only connect power supply to a mains socket where a protecting earth line is available.
c) Connect ground cable (3) to ground connection (2) and to test object or ground.
d) Set HV Level to the minimum position.
e) Connect test pistol with cable (11) to power supply (12) .
f) As a safety measure the test finger (8) should be discharged by grounding it .

### 5.2 Adjustments

#### 5.2.1 Repetitive discharges

a) Set switch (5) to position "cont". The repetition frequency is approx 20Hz, depending on voltage setting and amplitude.
b) Select the desired discharge voltage with knob (6) . The value selected (2÷16.5kV ± 10%) can be read on the built-in voltmeter (1) .

c) After every reduction of the setting on (6) the test finger must be discharged to ground. (the condenser could still be charged to a higher voltage)
d) To ensure repetitive discharges a minimum distance (gen. 0.3÷1.5kV/mm) must be maintained, so that the discharge condenser can recharge itself. The required distance can be set with the distance ring (9) and a depth gauge.
e) To switch on the high voltage, press switch (7) must be depressed continuously.

### 5.2.2 Single discharges

a) Set switch (5) to position "single".
b) Select the desired voltage with knob (6) . The value selected (2÷16.5kV ± 10%) can be read on the built-in voltmeter (1) .
c) After every reduction of the setting (6) the test finger must be discharged to ground.
d) With switch (7) the discharge condenser $C_0$ will be charged once only.
e) Slowly approach test object with the test finger (0.1 m/s) until contact is made, in order that a guaranteed discharge takes place at low voltages.

### 5.2.3 Continuous operation

The test generator was not developed for continuous operation or long term investigations. Operating times in excess of 1Hr. should be avoided.

a) Set switch (5) to position "cont".
b) Select desired discharge voltage with knob (6) .
c) Press switch (7) and in this position set switch (5) to position "single". Continuous operation is switched on.
d) Release switch (7) . The unit remains in operation.
e) The test finger must be discharged to ground after every reduction of the discharge voltage.
f) Continuous operation can be switched off by switching over switch (5) to position "cont". The press switch (7) should not be depressed.

### 5.2.4 Tripod mounting

The generator can be mounted onto a tripod by means of thread (16) . When testing, the required distance is set with the distance ring and the tripod adjusted so that a slight pressure is obtained between the distance ring and the test object. Thread type: UNC 1/4"

## 5.3 Breakdown recognition

Above approx. 2000V discharge voltage, discharges to HV ground (4) are indicated by an acoustic signal when switch (6) is in position "single". (when several discharges occur consecutively however, each discharge cannot be indicated)

## 5.4 Safety

- The maximum discharge parameters are defined by IEC regulation 348.
- Discharge before use,HV condensers have no discharge resistances!
- Discharge after use (single discharges would otherwise not be possible)
- Grounding compulsory (Protection class I)
- Only use the unit in dry rooms.
- Units with faulty covers may not be put into operation. Emergency repairs do not fulfil the safety regulations.
- There is a high frequency current of approx 6 mA AC (measured between HV-ground (4) and distribution system ground)

**Attention**

The return line of the HV discharge should be always setted to the ground connection (2) / (4) . If there is a discharge directly to earth and the connection (2) / (4) is not connected to the same earth, electronic devices being close by may be disturbed or even destroyed. Also NSG 430 or 431 may be damaged.

## 6) TECHNICAL DATA

| | | |
|---|---|---|
| Discharge voltage $U_o$ | : | 2kV to 16.5kV ± 10% |
| Rise Time | : | 5ns ± 30% at 2kV |
| Half amplitude width | : | 30ns ± 30% at 2kV |
| Polarity | : | positive * |
| Discharge condenser $C_o$ | : | 150 pF * ± 10% |
| Discharge resistance $R_o$ | : | 150 ohm * ± 5% |
| Repetition frequency | : | approx. 20Hz |
| Source resistance HV generator $R_1$ | : | 100MΩ ± 10% |
| Hold time single (U -10%) | : | 5s |
| Supply voltages | | 100/120/220/240 VAC ± 10% 50/60Hz |
| Power consumption | : | approx. 25 VA |
| Temperature range | : | 5 - 40°C |
| Humidity | : | 20% - 80% (not condensing) |
| Suppression level | : | N (according to VDE 0875) |

* Other values on request

Dimensions:

| | | |
|---|---|---|
| Test finger | : | Ø 12x80 mm Ø 0.47x3.15" |
| Generator | : | 260x300x56 mm 10.23"x11.81"x2.20" |
| Power supply | : | 160x91x56 mm 6.3"x3.58"x2.20" |
| Ground cable | : | approx. 2m 78.75" |
| Carrying case | : | 520x375x125 mm 20.47"x14.76"x4.92" |

Weight:

| | | |
|---|---|---|
| Generator | : | approx. 1.2kg 2.65 lb |
| Power supply | : | approx. 1.1kg 2.43 lb |

Accessories (included):

| | |
|---|---|
| SL 402 194 | Carrying case |
| SL 402 193 | Fuse set |
| SL 402 170 | Power supply |
| SL 402 233 | Test finger |
| SL 402 229 | Distance set for test finger |
| SL 402 173 | Ground connecting cable (2m) |

Mains cable with plug according to order number:
SL 402 187 for D/F/NL/I/E/B/N/SF
SL 402 188 for Switzerland
SL 402 189 for USA and Canada
SL 402 033 without plug

Option

SL 402 283 Measuring adapter

## 7) EXAMPLES OF USAGE

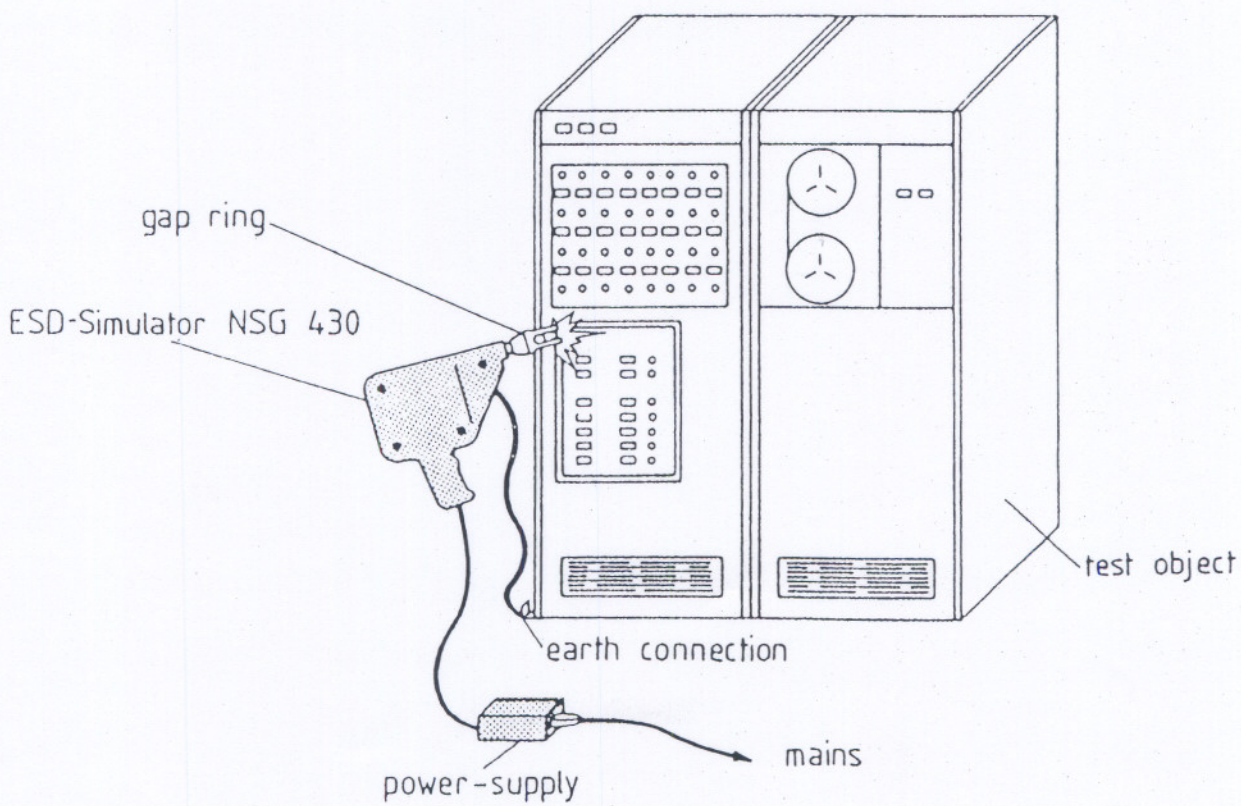
In general measurements are made with single discharges. For search and calibration a repetitive discharge is more useful.

The following examples are gathered together from recommendations and guide lines.

1) Setting of the desired voltage and slowly approaching the test object (approx. 0,1 m/s) until a discharge occurs.

2) Setting of the required distance (approx.0,3 ÷ 1,5 kV/mm) with the distance ring adjustment between the test finger and the test object and then raising the voltage until a discharge occurs.

### Typical test set-up



## 8. MAINTENANCE

**Attention:**

- Maintenance work may only be carried out by qualified personnel.
- Before opening unit pull out mains plug.
- Consider the high voltage condensers as charged until you have assured yourself otherwise.
- The unit may only be transported in the original packing.

### 8.1 Power supply

The power supply is maintenance free.
The fuse is in the voltage selector (15) , it can be removed with a screw driver from the plug side after removing the mains cable. Fuse type 5x20 mm according to IEC 127

| | |
|---|---|
| 220/240 V | 125mA slow blow |
| 100/120 V | 250mA slow blow |

### 8.2 Simulator

- Clean cover case only with soapy water cloth
- After removing the righthand cover casing the output voltage calibration is done with the trimmer $P_2$ (see Schematic and layout). The HV - Level is set to maximum and the voltage is measured with a suitable instrument ($R_i \geq 20G\Omega$)* in the operational mode "cont" and "on". If the voltage does not agree with the 16.5kVDC setting readjust with $P_2$. It must, however, be noted that the cascade input AC voltage may not exceed 6kVpp. When necessary the AC voltage can also be measured with an high impedance probe ($R_i \geq 100M\Omega$).
  Reasons for the fault could be the cascade, series resistances or the charging condenser when the voltage ist too low.
  (Class of the external calibration device better than ≥ 2%).

- To calibrate the indicator instruments the right-hand cover case has also to be removed. Then the output voltage must be measured with a high resistance external meter ($R_i$ 20G ) at the test finger with the unit in operation "cont" and "on". This measurement is then valid for the calibration with $P_3$ (see Schematic and layout) of the internal instrument. The calibration current-which controls the 1 kV indication-can be adjusted additionally by $P_4$. The tolerance between the indication value of the instrument in NSG 430/431 and the real output voltage is as follows.

for < 5 kV ± 500 V
for > 5 kV ± 10 %

- Fuse set after removing the right-hand cover case (400mAF/5 x 20mm according to IEC 127)
- When the cover case is damaged it must be replaced. It is not permitted to make a temporary repair, since the insulation can no longer be guaranteed.

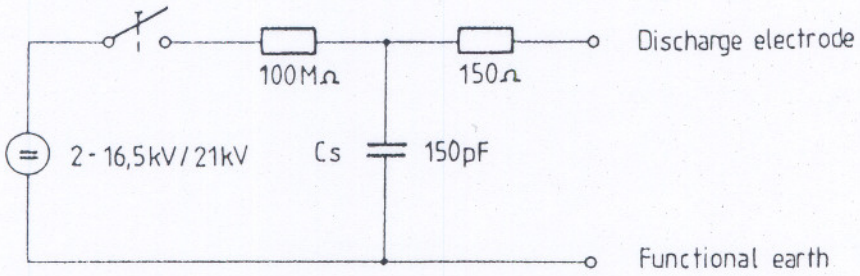
## 8.3 Parts list and layout

## 8.4 Schematics

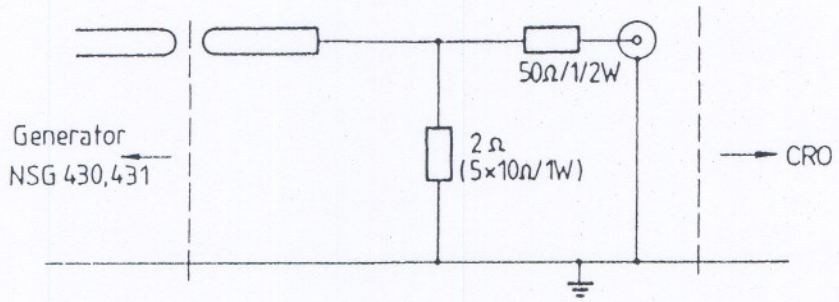
## 9. MEASURING ADAPTER

The measuring adapter SL 402-283 is intended (in the first instance) for use in measuring the discharge pulses of the NSG 430 and NSG 431 equipments. The development of the measuring is based on an IEC standards draft 65 (sec) 80. The following diagrams have been taken from this draft.

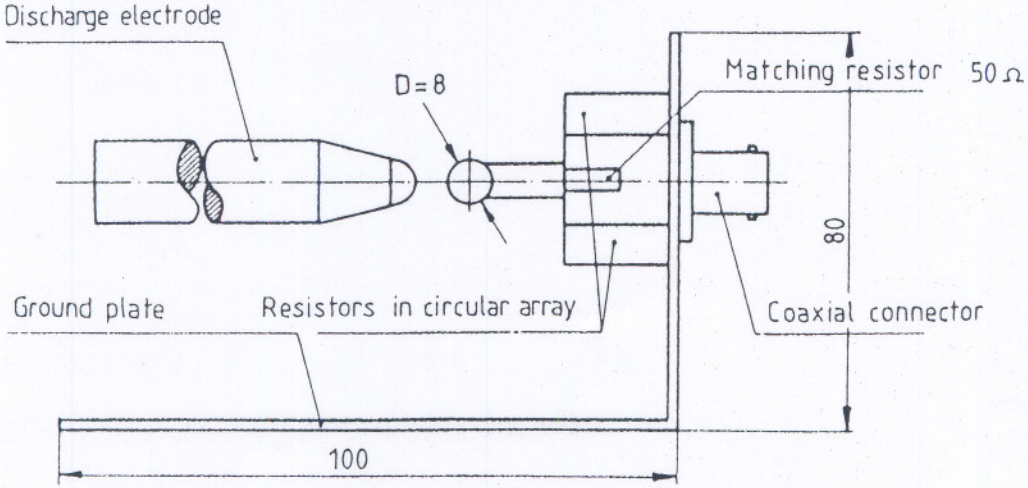
a) Equivalent electrical circuit of the generator



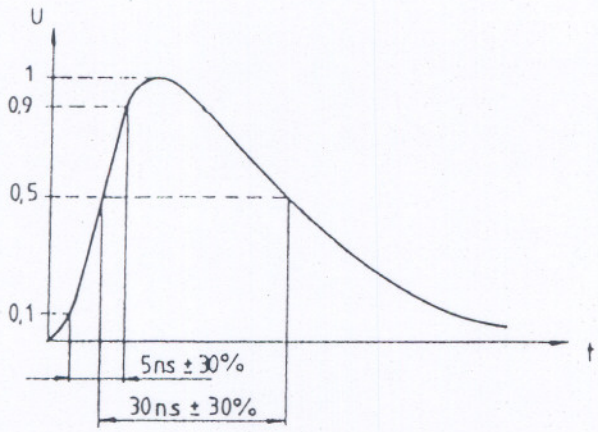

b) Equivalent electrical circuit of the measuring adapter



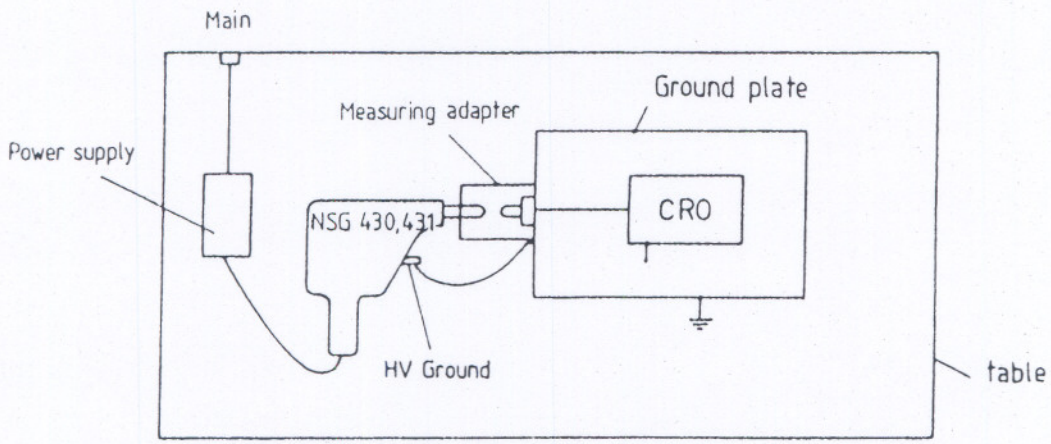

c) Mechanical construction of the measuring adapter (see mech. drg. 500 312)



d) Discharge pulse definition




e) Complete measuring set-up




The oscilloscope required for the measurements must meet the following specifications:

- Storage capability
- Rise time < 4.5 ns
- Good EMC screening (ie not portable model)

In order to obtain the specified data, proceed with the measurements as follows:

1. Switch (5) to "cont" position
2. Set discharge voltage to 2kV with knob (6)
3. Depress button (7) and hold, then switch (5) to "single" position
4. Release button (7) (=> operational mode: operation over a long period)
5. Place NSG 430/431 in line with measuring adapter
6. Rapidly approach the measuring adapter sphere with the test finger of the NSG 430/431 until they fully contact each other
7. Move test finter away from measuring adapter sphere
8. Read resulting measurement on CRO

Note

To avoid partial glow discharges and pre-ionisation, the test voltage should be low and the approach speed high.

Measurements which are made according to this procedure ("measuring adapter") and with necessary test set-up enable reproducable results to be obtained as laid down in the IEC draft.

| 42 | 1 | 142-002 | | Drehknopf | 021-2325 | |
|---|---|---|---|---|---|---|
| 43 | 1 | 142-303 | | Deckel | 040-1635 | |
| 44 | 1 | 200-357 | | Halteblech I | | |
| 45 | 1 | 200-358 | | " II | | |
| 46 | 460mm | 104-006 | | HV-Kabel | F25 HV 2219 | |
| 47 | | | | | | |
| 48 | 3 | 109-628 | | Schnorr-Sicherungsscheibe | M3 | |
| 49 | 3 | 109-004 | | 6-kt-Mutter | M3 | |
| 50 | | | | | | |
| 51 | 3 | 106-081 | | Pan-Head-Schraube | M 3x8 | |
| 52 | | | | | | |
| 53 | 1 | 402-234 | | Uebertrager | | |
| 54 | 1 | 110-025 | | Kohleschichtwid. | 100Ω/0,25W/5% | R14 |
| 55 | 1 | 120-561 | | Kondensator 1µF/63V= | | C9 |
| 56 | | | | | | |
| 57 | 1 | 136-013 | | IC D-Flip-Flops | IC 4013 | IC4 |
| 58 | | | | | | |
| 59 | 1 | 147-901 | | Warntongeber F/SMB 12 | | |
| 60 | 8cm | 103-000 | | Cu-Draht verzinnt | ø 0,8 | |
| 61 | 10cm | 103-613 | | TQ-Litze 0,22mm$^2$ r/w | ø 1,45 | |
| 62 | 1 | 133-502 | | Glimmerscheibe | 12x18 GS 220P | |
| 63 | 3 | 133-503 | | Isolierbüchse | ø5x3x1,9 | |
| 64 | 1 | 118-085 | | Trimmer 1MΩ/lin | 70 WTD-K-C | P4 |
| 65 | 1 | 110-075 | | Kohleschichtwid. | 1,5MΩ/0,25W/5% | R15 |

| Pos. | Stck. | Art. Nr./Lager Nr. | Auftr. | Bezeichnung | Bestell-Nr. | Schema Pos. |
|---|---|---|---|---|---|---|

**Elektronik-Print zu NSG 430 komplett**

| Pos. | Stck. | Art. Nr./Lager Nr. | Auftr. | Bezeichnung | Bestell-Nr. | Schema Pos. |
|---|---|---|---|---|---|---|
| 1 | 1 | 300'031 | | Leiterplatte | | |
| 2 | 1 | | | Elektrolytkond. 10µF/40V | 20637 | |
| 3 | 1 | | | " 470µF/100V | 20735 | |
| 4 | 1 | 120'426 | | MP-Kond. 150nF/250V~ | PM 271 M615 | |
| 5 | 1 | 114-704 | | PTC-Wid. 3,5kΩ/6mA/±16% | Q63 100- | |
| 6 | | | | | p5330 - B 405 | |
| 7 | 1 | 110'126 | | Kohleschichtwid. | 2,7kΩ/0,5W/5% | |
| 8 | 1 | | | Zenerdiode 36V/1,3W/±5% | ZPY36 06341 | |
| 9 | 1 | | | Transistor Darlington | 100V/8A BDW 73C | |
| 10 | 1 | | | Si-Gleichrichter W 04M | B 250 C 800 Si | |
| 11 | | | | | | |
| 12 | 1 | 200'062 | | Lötpilz einfach | | |
| 13 | 2 | 200'063 | | Lötpilz doppelt | | |
| 14 | 1 | 200'321 | | Winkel | | |
| 15 | 1 | | | Kabelbinder | SST 1M-M | |
| 16 | 1 | 106'082 | | Pan-Head-Schraube | M3x10 DIN 85A | |
| 17 | 1 | 109'004 | | 6kt-Mutter | M3 DIN 934 | |
| 18 | 1 | 109'628 | | Schnorr-Si-Scheibe | zu M3 | |
| 19 | 1 | | | Glimmerscheibe (12x18) | GS 220P | |
| 20 | 1 | | | Isolierbüchse | ø5xø3x1,9 | |
| 21 | | | | 10-31-483-076 Item 29 | Washer | |

Leiterplatte kompl. zu

Stromversorgung NSG 430/431

| Pos. | Stck. | Art. Nr./Lager Nr. | Auftr. | Bezeichnung | Bestell-Nr. | Schema Pos. |
|---|---|---|---|---|---|---|
| 1 | 1 | 402-337 | | HV-Kaskade kompl. | | |
| 2 | 1 | 300-038 | | HV-Print | | |
| 3 | 3 | 112-817 | | Widerstände VR 68 | 33MΩ/1W/5% | R1-R3 |
| 4 | 1 | 124-823 | | Keramikkond. | 470pF/6kV | C4 |
| 5 | 3 | 124-825 | | " | 680pF/6kV | C1,3 |
| 6 | 1 | 109-112 | | Kalei-Setzmutter M4x1 | (Messing)BN523 | |
| 7 | 1 | 200-360 | | Erdungsbolzen | | |
| 8 | 1 | 106-135 | | Pan-Head-Schraube | M4x16 | |
| 9 | 1 | 109-630 | | Schnorr-Si-Scheibe | M4 | |
| 10 | 4 | 200-062 | | Lötpilze einfach | | |
| 11 | 2 | 108-290 | | Blechschraube ø 2,2 | 2,2x4,5 BN 992 | |
| 12 | 1 | 124-803 | | Keramikkondensator | 10pF/6kV | C5 |
| 13 | 1 | 110-029 | | Kohleschichtwid. | 220Ω/1/4W | R5 |
| 14 | 2 | 112-787 | | Widerstand VR 68 | 100kΩ/1W/5% | R6 |
| 15 | | | | | | |
| 16 | | | | Zusammenstellung | 500-255 | |