

## NSG 200 Line Interference Simulation System



*The Classic Line*

## Introduction

Electrical supply networks are, unfortunately, not free from interference. Influences on the supply system such as lightning strikes, defects and switching operations necessitated for operational reasons are just a few of the effects that ultimately affect the cleanliness of the electrical supply. Added to this, all loads are also sources of interference to some extent or another. The same loads are, however, usually also victims of the interference inasmuch as problem-free operation can be intermittently or permanently disrupted. Modern items of electronic apparatus in the home, the office and in industry are particularly sensitive to uncleanliness in the power supplied to them.

Interference on the mains and the effects caused, i.e. the incorrect behaviour of the electronic apparatus, occur only sporadically and are therefore correspondingly difficult to identify. Manufacturers of equipment hence have to take concerted measures, such as filtering, screening, etc., during both the development and manufacture of their products to ensure immunity against the known interference factors.

These effects are simulated by interference generators in a concentrated and exactly reproducible manner. They provide a means for analysing the interference immunity of equipment and systems during development, for examining the effectiveness of improvement measures as well as for assuring electromagnetic compatibility (EMC) during manufacture and quality control.

SCHAFFNER Generators in the NSG 200 series includes a complete range of instruments for the simulation of the most important line-borne types of interference. Through the use of the concept of a main-frame and a selection of plug-in generator modules, application-oriented test sets can be assembled with the possibility of subsequent extensions.

Many test procedures have been set down as Standards by international and national committees such as ANSI-IEEE, IEC, ECMA, CENELEC, NAMUR, etc. The generators in the NSG 200 series conform to these specifications and are furnished with additional features to provide the user with extended analysis possibilities.

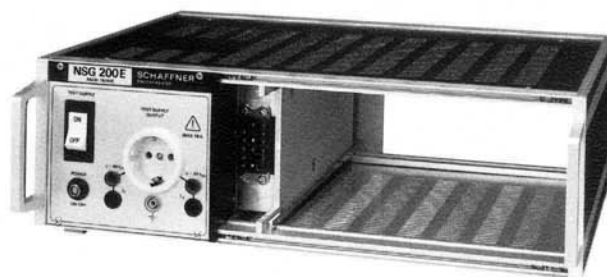
SCHAFFNER instruments have had a considerable influence on the practical side of testing in the EMC field.

Configuration and operation of the NSG 200 generator system has been engineered for simple handling under practical working conditions. A wide range of accessories is available to help the user arrange his test set-up in a safe and rational manner.



## NSG 200E Main-frame

- **Main-frame in a table-top housing**
- **Country-specific versions**
- **Switchable EUT supply**
- **Phase monitoring**



The NSG 200E main-frame serves as an enclosure for the 6 different types of plug-in generators. The main-frame provides common facilities for the generator modules such as the mains input connection, connector for the EUT supply, overload trip, filtering, phase indicator, EUT connector with interference pulse injection, etc.

Although built as a table-top housing, the main-frame can also be installed in a 19" rack by adding a pair of mounting flanges.

### Technical specifications

#### Instrument power supply

|                   |                               |
|-------------------|-------------------------------|
| Mains voltage     | 100 ... 120 V / 220 ... 240 V |
| Frequency         | 50 / 60 Hz                    |
| Power consumption | <300 VA                       |

#### EUT power supply

|             |                                       |
|-------------|---------------------------------------|
| AC 50/60 Hz | 12 ... 250 V, 16A <sub>rms</sub> max. |
| AC 400 Hz   | 24 ... 250 V, 6A <sub>rms</sub> max.  |
| DC          | 5 ... 50 V (250 V),<br>16 A max.      |

|              |  |
|--------------|--|
| Impedance    | $Z = 0.4 \Omega + j\omega 0.001 \Omega$  |
| Voltage drop | AC 50/60 Hz,<br>16 A: approx. 9 V<br>AC 400 Hz,<br>6 A: approx. 15 V<br>DC 16 A: approx. 7 V |

|              |   |
|--------------|---|
| Signal lamps | For phase indication  |
| Power input  | 3-pin 16 A apparatus<br>connector<br>(IEC 320, VDE 0626/78) |

|            |                                |
|------------|--------------------------------|
| Protection | Thermal cut-out<br>2-pole/16 A |
|------------|--------------------------------|

|                       |   |
|-----------------------|---|
| Earth leakage current | Up to 10 mA<br>at 220 V 50 Hz   |
| EUT connector         | SCHUKO or UL 498/13,<br>country-specific adapters<br>and laboratory safety<br>sockets |

#### Dimensions

|         |                               |
|---------|-------------------------------|
| Width:  | 437 mm or 17.2" (19" chassis) |
| Height: | 150 mm or 5.9"                |
| Depth:  | 345 mm or 13.6"               |
| Weight: | 10.5 kg or 23 lbs             |

#### Accessories ( included)

|                                   |
|-----------------------------------|
| Mains cable                       |
| Cable for power to EUT            |
| Socket for EUT (country specific) |

#### Optional accessories

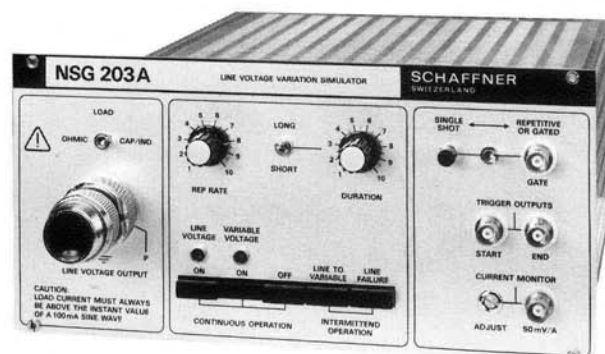
|         |  |
|---------|--|
| 402-227 | Universal safety connectors<br>(set of 3 pieces) |
| 402-251 | Measurement adapter                              |

## NSG 203A Mains Dropout and Variation

- *Simulates mains drop-outs in the ms range*
- *Under/over-voltage test*
- *Single triggering or Repetitive operation*

The NSG 203A module generates brief supply interruptions to the EUT such as those that frequently occur in supply networks through switching operations. The drop-out period and the repetition interval can both be varied over wide ranges.

Electronic equipment with semiconductor memories have to be subjected to such tests in order to determine their "holding time" and to be able to guarantee their reliable operation.



Further, by means of an additional regulating transformer, sudden voltage changes can be simulated typical of those that are caused on supply lines when heavy loads are switched on or off. Direct jumps from over-voltage to under-voltage or vice-versa can be achieved through the use of two variable transformers.

### Standards

IEC204-1 (1981) IEC TC 77 A&B  
NAMUR Part 1 (1988) NW&M Lab 0320 (1981)  
etc.

### Technical specifications

|                        |   |
|------------------------|---|
| Mains input voltage    | 250 Vac max. 50/60 Hz                           |
| Output voltage         | 600 Vac max. (after the regulating transformer) |
| Current to EUT         | 0.1 ... 16 A <sub>rms</sub>                     |
| Mains drop-out, short  | 1.5 ms ... 30 ms                                |
| long                   | 25 ms ... 500 ms                                |
| Repetition interval    | 0.6 s ... 25 s                                  |
| Line voltage variation |   |
| short                  | 10 ms ... 300 ms                                |
| long                   | 0.25 s ... 5 s                                  |
| Repetition interval    | 0.6 s ... 25 s                                  |
| Monitor output         | 50 mV/A current converter                       |
| Drop-out triggering    | single pulse or continuous                      |
| Gate                   | ext. gate/inhibit                               |
| Trigger output         | start/end, for oscilloscope or MD 203           |

|            |   |
|------------|---|
| Dimensions | 265 x 130 x 340 mm<br>(10.43 x 5.12 x 13.39") |
| Weight     | 5.2 kg or 11.45 lbs approx.                   |

### Accessories (included)

|         |                 |
|---------|-----------------|
| 431-818 | Dummy connector |
|---------|-----------------|

### Optional accessories

|         |  |
|---------|--|
| 431-828 | Connecting cable for 1 regulating transformer  |
| 431-829 | Connecting cable for 2 regulating transformers |
| MD 203  | Interval counter                               |
| 402-737 | Pair of BNC cable, 0.5 m for MD 203            |



## NSG 204 DC Dropout

- *Simulates ms drop-outs in DC supplies*
- *Fast load-change tests*
- *Test circuit is opto-isolated*
- *Test range from 5 to 220V DC/ 10A*

The NSG 204 module simulates interruptions in DC power supplies such as those that can occur in the operation of electronic equipment through switching over to emergency power supplies, buffer batteries, etc. Drop-outs caused originally by interruptions in the mains supply can thus be simulated on the dc side of systems using decentralized DC/DC converters. The period and repetition interval of the drop-outs can be varied over wide ranges.

### Technical specifications

Test voltage 5 ... 220 Vdc  
Test current 10 A max.

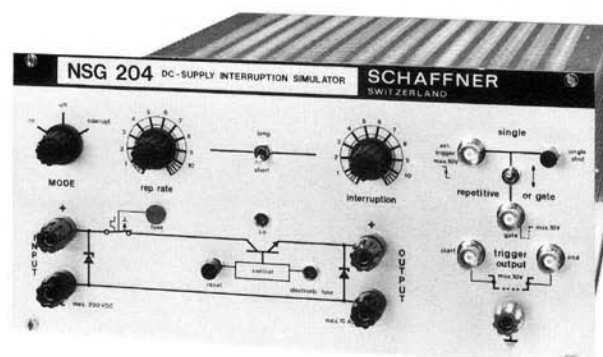
Drop-out time, short 1 ... 60 ms  
long 30 ... 2000 ms  
Cycle time, short 0.2 ... 2 s  
long 0.8 ... 10 s

Switching time at 100 V/2 A On -> Off < 2  $\mu$ s  
Off -> On < 1  $\mu$ s  
at 15 V/10 A On -> Off < 2  $\mu$ s  
Off -> On < 1  $\mu$ s

Max. voltage drop at 10 A 2 V

Drop-out triggering Single pulse or repetitive  
Gate ext. gate/inhibit  
Trigger output Start/End, for oscilloscope or MD 203

Overload cut-out magnetic Switch off time  
at 20 A < 1 min  
at 30 A < 20 ms  
at 40 A < 10  $\mu$ s  
electronic



Voltage variation tests can also be carried out by connecting two suitable supply voltages. The module can also be used to test the behaviour of parts of a circuit under abrupt load change conditions. Electronic fuses protect the instrument and the test circuit against overloads. The test circuit is insulated from the instrument supply by an opto-isolator.

### Standards

NAMUR Part 1 (1988) etc.

Dimensions: 265 x 130 x 340 mm  
(10.43 x 5.12 x 13.39")

Weight 6.8 kg or 15 lbs approx.

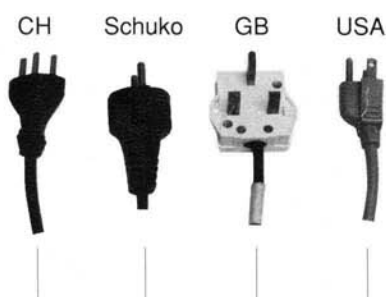
### Optional accessories

MD 203 Interval counter  
402-737 Pair of BNC cable, 0.5 m  
for MD 203

test & measurement instruments

## Accessories

### Plugs for mains and test cables



Instr.  
supply



EUT  
supply



### NSG 200E

Option  
Rack



402-227  
Universal safety  
connectors



150-114  
Adapter CH



150-111  
Adapter-F



402-223  
Adapter GB



402-251  
Measuring  
adapter  
1000 : 1

## Ordering Information

### NSG 200E

In accordance with the order number, the instrument is set to the appropriate line voltage before leaving the factory and is fitted with the country- specific outlet sockets (or adapters) as well as mains cables for the instrument supply and the power feed to the EUT.

| Order No.     | Country                  | Plug type  | Mains                   |
|---------------|--------------------------|------------|-------------------------|
| NSG 200E - 01 | D/S/NL/I/E/<br>N/SF/etc. | Schuko     | 220 ... 240 V; 50/60 Hz |
| NSG 200E - 02 | CH                       | Typ 13     | 220 ... 240 V; 50/60 Hz |
| NSG 200E - 03 | F/B                      | Typ 530 19 | 220 ... 240 V; 50/60 Hz |
| NSG 200E - 04 | USA/CAN/FE               | UL 498/13  | 100 ... 120 V; 50/60 Hz |
| NSG 200E - 05 | GB                       | BS 1363    | 220 ... 240 V; 50/60 Hz |

Please add the designation RACK for the flanged version intended for installation in a 19" cabinet.

Example: NSG 200E - 01/RACK

### Generators

The plug-ins are set to the correct line voltage and frequency at the factory. The appropriate mains socket (or adapter) must also be stated for the NSG 222A and NSG 225A.

The full ordering information is as follows:

| Type     | Voltage  | Frequency | Plug type |
|----------|----------|-----------|-----------|
| NSG 203A | 100 V or |           | Schuko or |
| NSG 204  | 110 V or |           | CH or     |
| NSG 222A | 120 V or | 50 Hz or  | F or      |
| NSG 223A | 220 V or | 60 Hz     | USA or    |
| NSG 224A | 230 V or |           | GB        |
| NSG 225A | 240 V    |           |           |

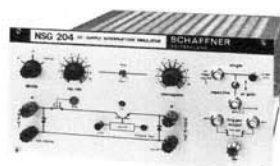
Example: NSG 225A/220V/50Hz/F

## NSG 203 A



431-828 Connecting  
cable for 1 regulating tr.  
431-829 Connecting  
cable for 2 regulating tr.

## NSG 204



## NSG 222A



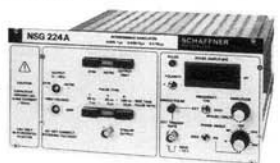
## NSG 225A



## NSG 223A



## NSG 224A

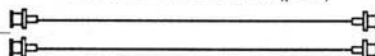


## MD 203



Interval counter

402-737 BNC cable (pair)



## NSG 426



Data lines  
Coupling unit  
(incl. cables)



400-063  
Coupl. clamp  
(for NSG 426)



CDN 125 Coupling clamp IEC 801-4 (incl. cable)

402-379



Attenuator  
6 dB

## CDN 300

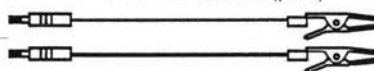


3-phase FT/Burst coupling network  
(incl. cables)

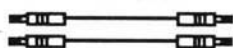


400-070  
Additional  
impedance  
(IEC255-4)

402-089 HV cables (pair)



431-958



HV cables (Pair)

## NSG 523



3-phase coupling network



402-139  
Distribution  
box



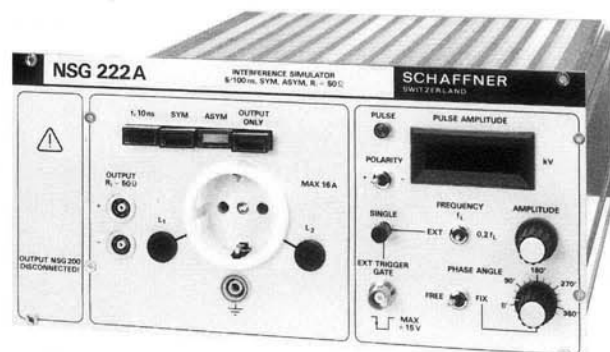
## NSG 222A Fast Transients

- *Fast interference pulses in the ns range*
- *Built-in coupling network*
- *Accessories enable extended applications*
- *Suitable for detailed analyses*

Switches, relays and other contacting devices produce fast interference pulses through contact bouncing and sparking. These pulses spread throughout supply networks and linking cables, and can find their way into neighboring equipment. The pulses have steep rising edges and hence generate a wide interference spectrum to which fast logic circuits are particularly susceptible.

The NSG 222A generator simulates these sources of interference with pulses in the form 5 ns/100 ns.

A built-in coupling network designed for both symmetrical and asymmetrical pulse injection enables apparatus to be tested on the mains side. Through the use



of accessories, the pulse output can be utilised to carry out various tests on data lines, 3-phase supplies, at the sub-assembly level, etc.

The continuously setting of the pulse amplitude, the choice of two different pulse rise times, the phase-related coupling and the single pulse function make the generator eminently suitable for detailed analyses of the interference susceptibility of electronic devices.

### Standards

EEC 4517/79 COM (78) 766 Final  
NW&M Lab 0320 (1981)  
Lloyd's Register's Type Approval Scheme (1985)  
etc.

### Technical specifications

|                      |  |
|----------------------|--|
| Pulse amplitude      | 50V ... 2500V (unloaded)   |
| Rise time            | 5 ns $\pm$ 20% and<br>10 ns $\pm$ 20%                              |
| Pulse duration       | 100 ns $\pm$ 20% (unloaded)<br>80 ns $\pm$ 15% (into 50 $\Omega$ ) |
| Polarity             | pos./neg.  |
| Digital display      | 3-digit $\pm$ 5%, $\pm$ 1 Digit                                    |
| Internal impedance   | 50 $\Omega$ $\pm$ 10%  |
| Repetition frequency | Mains freq., $\frac{1}{5}$ mains freq.                             |
| Single triggering    | Manual or ext. trigger   |
| Phase angle          | 0 ... 360° adjust. $\pm$ 20%<br>or free running                    |
| Coupling             | symmetrical, asymmetrical  |

|            |  |
|------------|--|
| Dimensions | 265 x 130 x 340mm<br>(10.43 x 5.12 x 13.39") |
| Weight     | 3.2kg or 7 lbs                               |

### Optional accessories

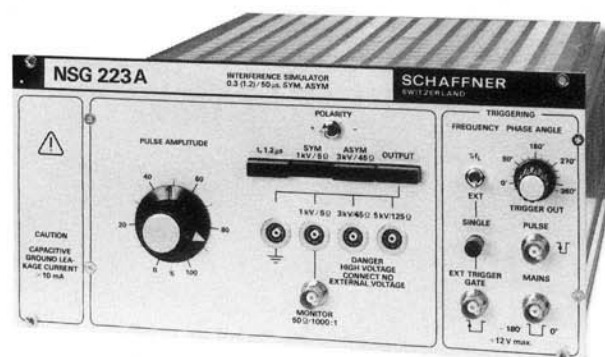
|         |   |
|---------|---|
| NSG 426 | Coupling unit for signal lines                |
| 400-063 | Coupling clamp for signal cables              |
| CDN 125 | Coupling clamp according to IEC 801-4         |
| CDN 300 | FT/Burst coupling unit, 3-phase               |
| 156-154 | HV coaxial plug                               |
| 402-227 | Universal safety connectors (set of 3 pieces) |



## NSG 223A High energy pulses

- **High energy standard pulses**  
1.2/50  $\mu$ s
- **Symmetrical and asymmetrical mains coupling**
- **Component tests up to 5 kV**

The NSG 223A module generates high energy pulses typical of those produced by switching inductive and capacitive loads, lightning strikes, etc. The pulses can be symmetrically or asymmetrically superimposed on the mains supply by means of the coupler in the main-frame as well as being available via separate sockets for component testing purposes. Because of their relatively high energy of about 2 Joules, the pulses can result in damage to unprotected or unsuitably arranged elements in input circuits.



This type of pulse is defined by various standards, IEC 801-5 among them. Compared to this specification, the NSG 223A generator has a somewhat higher internal impedance of 45  $\Omega$  in keeping with the wishes of many instrument manufacturers and test departments to overcome the danger of stressing components too much.

Clearly arranged operating elements enable the various test parameters such as the pulse amplitude, phase angle, polarity, repetition mode, etc. to be readily adjusted as desired.

### Standards

|                     |                  |
|---------------------|------------------|
| IEC 801-5 (limited) | NAMUR, Part 1    |
| IEC 60-2            | VDE 0433, Part 3 |
| VDE 0432, Part 22   |                  |

### Technical specifications

#### Pulse data

| Operating mode          | SYM                      | ASYM                     | OUTPUT                   | Tol.        |
|-------------------------|--------------------------|--------------------------|--------------------------|-------------|
| Amplitude max. unloaded | 1000 V                   | 3000 V                   | 1/3/5 kV                 | $\pm 10 \%$ |
| Rise time $t_r$         | 1,2 $\mu$ s              | 1,2 $\mu$ s              | 1,2 $\mu$ s              | $\pm 30 \%$ |
| switchable $t_r$        | 150 ns                   | 500 ns                   | 500 ns                   | $\pm 30 \%$ |
| Pulse durat. $t_w$      | 50 $\mu$ s <sup>1)</sup> | 50 $\mu$ s <sup>1)</sup> | 50 $\mu$ s <sup>1)</sup> | $\pm 20 \%$ |
| Impedance $R_i$         | 5 $\Omega$               | 45 $\Omega$              | 5/45/125 $\Omega$        | $\pm 10 \%$ |

1) at 100 % amplitude

|                 |   |
|-----------------|---|
| Pulse energy    | 2 Joules approx.  |
| Polarity        | pos./neg.   |
| Phase angle     | 0 ... 360°  |
| Repetition rate | 1/8 mains frequency                                       |
| Single pulse    | manual triggering or ext. trigger                         |
| Trigger input   | ext. trigger/gate   |
| Monitor output  | 1000 : 1  |
| Trigger output  | pulse and phase zero crossing for oscilloscope triggering |

Dimensions: 265 x 130 x 340 mm  
(10.43 x 5.12 x 13.39")

Weight: 5.4kg or 11.9 lbs

### Accessories (included)

156-154 HV coaxial plug

### Optional accessories

|         |   |
|---------|---|
| 402-089 | HV cable set with universal connectors for EUT connection |
| 400-070 | Additional impedance for insulation testing (IEC 255-4)   |
| NSG 523 | 3-phase coupling network                                  |
| 431-958 | HV cable, 0.4 m (pair)                                    |
| 402-139 | Distribution box  |





## NSG 225A Burst simulator

- **Test in conformity with IEC 801-4**
- **Test classes I to IV**
- **Built-in coupler**

Inductively loaded mechanical switches, relays, etc. produce interference signals in the form of pulse bursts. The pulses have a fast rise time and hence generate a wide interference spectrum extending to over 200MHz to which digital and analogue electronic circuits are particularly sensitive. The summing effect of a burst of pulses serve to increase the demand for interference immunity for analogue circuitry.

Important Standards, such as the IEC 801-4, VDE 0843/4 and CENELEC HD 481/4 define the necessary interference immunity for various categories of instrument. The burst test are relevant not just to the mains connections but also to data and control lines.

### Technical specifications

Pulse data (unloaded)\*

| Test level      | I     | II     | III    | IV      | Tol.  |
|-----------------|-------|--------|--------|---------|-------|
| Amplitude       | 500 V | 1000 V | 2000 V | 4000 V  | ±10 % |
| Burst frequency | 5 kHz | 5 kHz  | 5 kHz  | 2,5 kHz | ±20 % |

|                            |  |
|----------------------------|--|
| Rise time $t_r$            | 5 ns ± 30 % into 50 Ω  |
| Pulse duration $t_p$       | 50 ns ± 30 % into 50 Ω   |
| Burst duration $t_{Burst}$ | 15 ms ± 20 %   |
| Repetition $t_{Rep}$       | 300 ms ± 20 %  |
| Polarity                   | pos / neg  |
| Generator impedance        | 50 Ω ± 20 % (dynamic)  |
| Pulse output               | HV coaxial connector   |
| Coupling                   | 1-phase mains coupling<br>L1 => Reference earth<br>L2 => Reference earth<br>SL => Reference earth<br>L1 und L2 => Ref. earth<br>L1 und L2 und SL => R. earth |

|                        |                            |
|------------------------|----------------------------|
| Cross talk attenuation | > 30 dB (between lines)    |
| Monitor                | for pulse rate measurement |
| Gate                   | pulse inhibit              |



The NSG 225A generator simulates these pulse bursts for the specified test classes. The pulse is superimposed on the EUT supply via an incorporated single phase coupler so that the EUT can be connected directly to the built-in mains socket.

The pulses are also available at a HV output for connection to auxiliary devices for coupling into 3-phase supplies, data lines, etc.

### Standards

IEC 801-4  
NAMUR (1988)  
etc.

CENELEC HD 481/4  
VDE 0843/4

Dimensions 270x130x340mm  
(10.62 x 5.12 x 13.39")

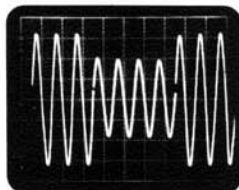
Weight 3.9kg or 8.6 lbs approx.

### Optional accessories

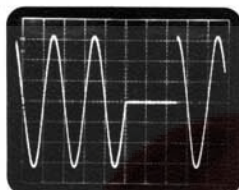
|         |  |
|---------|--|
| CDN 125 | Coupling clamp conforming to IEC 801-4       |
| 402-379 | Attenuator 6dB, for coupling clamp           |
| CDN 300 | 3-phase FT/burst coupler                     |
| NSG 426 | Coupler unit for data lines                  |
| 400-063 | Coupling clamp, small, for use with NSG 426  |
| 402-378 | Attenuator 100:1, for pulse measurements     |
| 156-154 | HV coaxial plug                              |
| 402-227 | Universal safety connectors (set of 3 items) |

## Typical pulse shapes

### NSG 203A



Under-voltage test

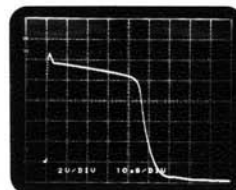


Short dropout

### NSG 204

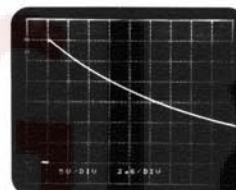
(as NSG 203A but  
for DC-Supplies)

### NSG 223A



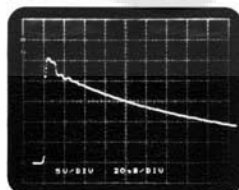
Pulse shape 1,2/50  $\mu$ s

### NSG 224A



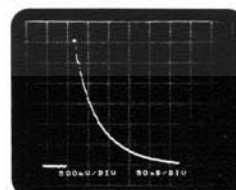
Pulse shape 100 ns/10  $\mu$ s

### NSG 222A



Pulse shape 5/100 ns

### NSG 225A



Bursts - single pulse shape  
5/50 ns

test & measurement instruments

Change without notice

## International sales and production subsidiaries

### Switzerland:

SCHAFFNER ELEKTRONIK AG  
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