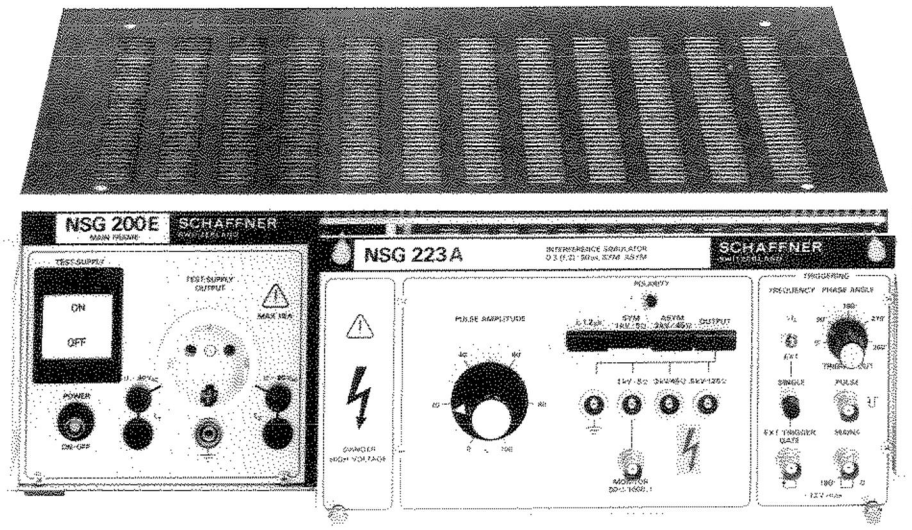
NSG 223A


NSG 200E
SCHAFFNER
TEST SUPPLY
ON
OFF
POWER
ON-OFF
NSG 223A
SCHAFFNER
PULSE AMPLITUDE
POLARITY
TRIGGERING
FREQUENCY
PHASE ANGLE
SINGLE
PULSE
EXT TRIGGER GATE
MAINS

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ATTENTION

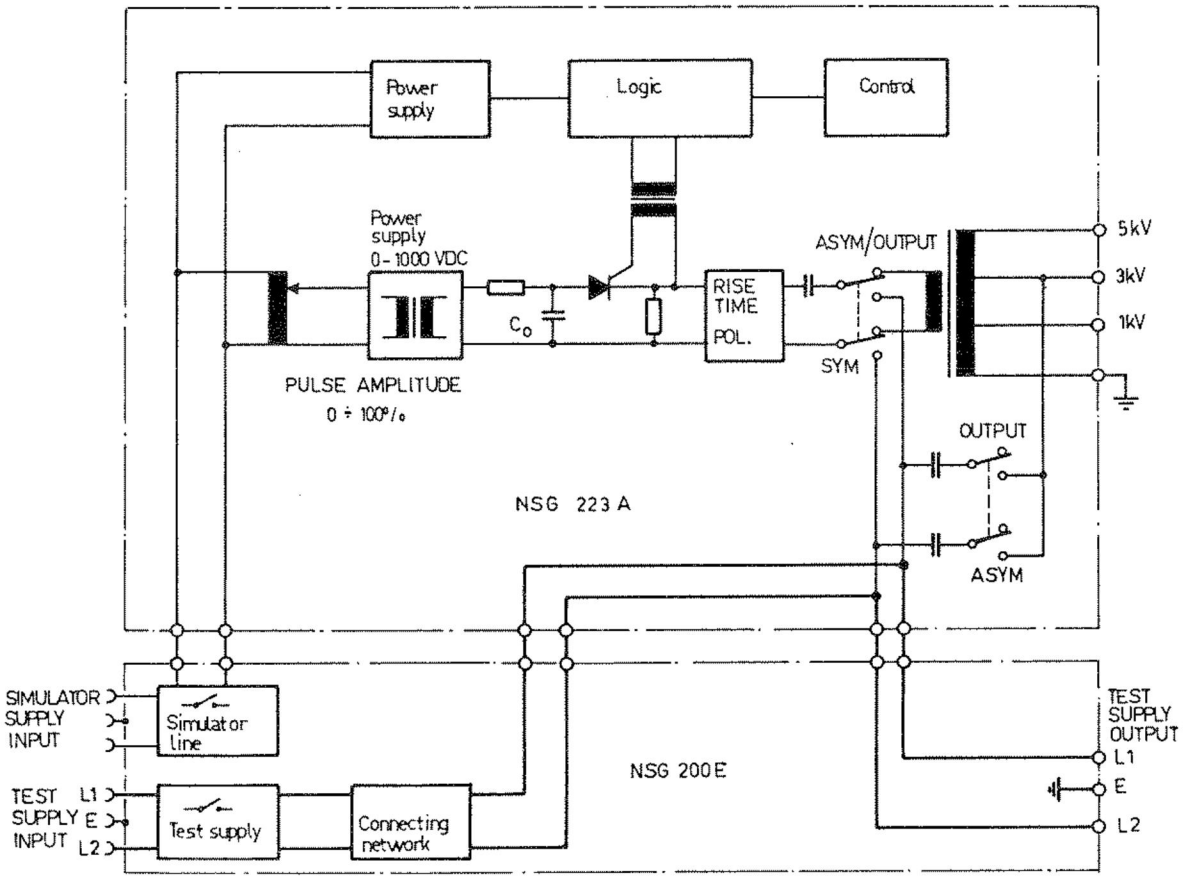
THIS EQUIPMENT AND ALL ACCESSORIES DESCRIBED HEREIN WORK ON HIGH VOLTAGE. MISUSE AND IGNORING INSTRUCTIONS CAN ENDANGER LIFE. ONLY TRAINED PERSONNEL SHOULD WORK WITH THE UNITS, THE COVER MUST NOT BE REMOVED, REPLACEMENT OF COMPONENTS AND INTERNAL ADJUSTMENTS MUST BE CARRIED OUT BY QUALIFIED SERVICE PERSONNEL.

1. GENERAL

1.1 Introduction

The plug-in NSG 223 A of the mains interference simulator system NSG 200 generates high energy interference pulses, as occur when switching inductive or capacitive loads, or as produced by lightning flashes. The pulses are superposed symmetrically or asymmetrically on the line voltage or are available externally for component testing. The high pulse energy of approx. 2 Joules can destroy capacitors or semiconductors, or cause malfunctioning of thyristors and electronic circuits. Due to voltage flash-over on the test object interference can occur with rise times in the ns region.

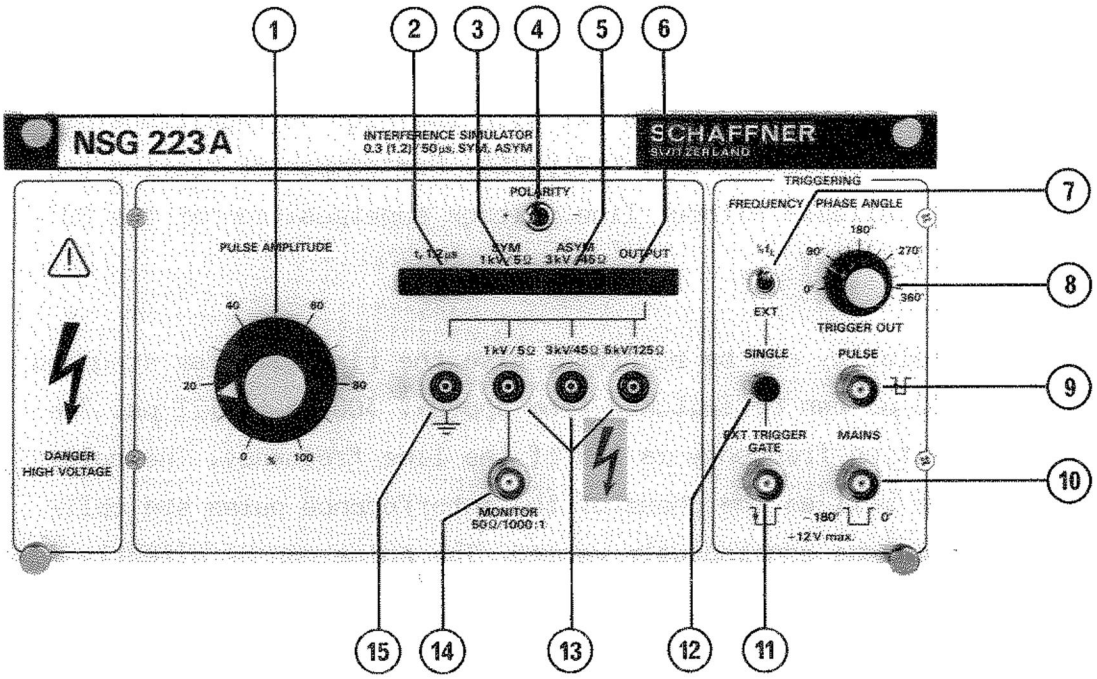
1.2 Description



By means of the Variac and converting transformer depending on the setting of the amplitude control, the charging capacitor C_o can be charged to a maximum of 1kV. A thyristor discharges C_o, depending on the switch setting, directly into the line (symmetrically L2,L1/E). or the pulse is transformed to 3kV with the high voltage transformer and coupled in asymmetrically (L2,L1/E). For component testing the pulses are available without line voltage superposition at the OUTPUT socket 1/3/5 kV.

The pulse polarity can be reversed, also the rise time for standard tests 1.2/50 µs can be switched from approx. 300 ns to 1.2 µs. The pulse repetition frequency is 1/8 of the line frequency. The pulse amplitude as well as the phase of the interference pulse are calibrated and can be continuously varied. The pulse can be directly triggered via the trigger input.

2. OPERATING CONTROLS



(1) Pulse amplitude setting knob calibrated in percent

(2) Operating the push button switches the rise time from normal approx. 300ns to 1.2µs.

(3) Interference coupled symmetrically to test object output on NSG 200 (L2/L1 or P/N). 100% pulse amplitude corresponds to 1000V, simulator internal resistance R_i = 5 Ohm

(4) Polarity change-over switch for interference pulse
Is to be activated ONLY currentless (pulse generation blocked, FREQUENCY switch on EXT or PULSE AMPLITUDE 0 %) otherwise the contacts may be welded.

(5) Interference coupled asymmetrically to output of NSG 200 (L2,L1/E or P, N/E). 100% amplitude corresponds to 3000V, R_i = 45 Ohm.

(6) Interference pulse only available on the output sockets (13) and (15) (influence of line coupling network eliminated). Pulse voltage and R_i as lettering.

(7) Change-over switch for pulse repetition frequency 1/8 line frequency as well as external drive 0 to 6Hz via EXT TRIGGER input (11) or SINGLE push-button (12).

(8) Continuously variable setting of the phase of the interference pulse, referred to the line voltage of the simulator supply.

(9) BNC Trigger output PULSE, approx. 20µs negative flank when pulse triggered.

(10) BNC-Trigger output MAINS. Mains reference signal, negative flank with negative, positive with positive zero crossing of the mains voltage. Operates from -180° bis +540° referred to the phase of the interference pulse.

(11) BNC input drive EXT TRIGGER/GATE for TTL/CMOS-logic max. + 12V or ground contact. Pulse release on negative flank, when change-over switch (7) in position EXT (ext. Trigger operation). In position 1/8 f_L of (7) the drive input acts as pulse blocking at log 0 (Gate-function).

(12) Ground contact parallel to drive input (11) which enables the corresponding function to be triggered when operated.

(13) OUTPUT-sockets for external pulse application (without superposed mains). In operation in push-button position OUTPUT (6) (in ASYM (5) pulse shape affected due to mains coupling). 100% pulse amplitude and simulator internal resistance depending on socket 1kV/5 ohm, 3kV/45 ohm, 5kV/125 ohm. Do not apply any external voltage!

(14) BNC-Monitor output 50 Ohm, attenuation 1000:1 at 1kV-OUTPUT (3000:1 for 3kV-output and 5000:1 for 5kV). Attenuation for asymmetrical coupling 3000:1 (at Monitor without superposed mains). Designed for high impedance termination.

(15) Grounded pulse feedback for pulse output (13).

3. OPERATING INSTRUCTIONS

3.1 Safety precautions

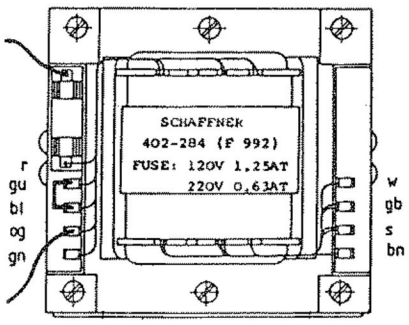
ATTENTION:

- two protection line connections compulsory (protection class 1, earth leakage current with basic unit up to 10mA).
- Use the unit in dry room atmosphere only.
- In case of condensation (after transportation) dry unit before use.
- Protected connectors in operation of the basic unit NSG 200 E by using MC-safety banana plugs (SL Nr. 402-227), Schuko plug or adapter for other mains plugs. It is possible with NSG 200 B/C/D to connect MC-safety plugs by using the adapter set SL 402-271.
- This equipment and all accessories described herein work on high voltage. Misuse and ignoring instructions can endanger life. Only trained personnel should work with the units, the cover must not be removed, replacement of components and internal adjustments must be carried out by qualified service personnel.

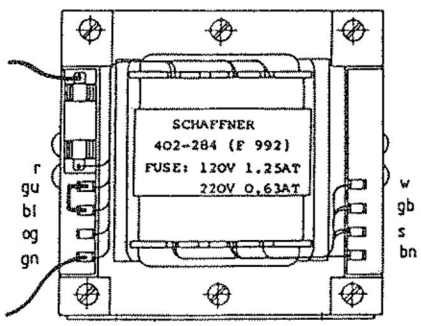
3.2 Installation

After unpacking the plug-in please inspect it for mechanical damage and check setting of mains voltage and frequency.
For frequency changing set LP-switch (right above on print) to 50 Hz (left) or 60 Hz (right).

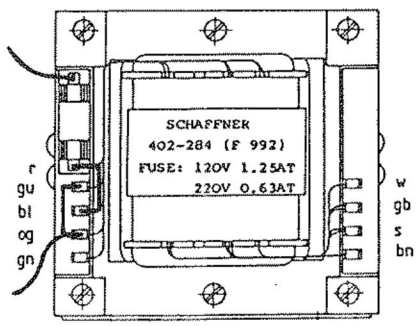
220V



240V



110V Spec. version



requires a 110V variac

- Ensure that a good earth point is made. It is necessary to have two earth connections from the basic NSG 200 unit directly to the building earth system (not via a mains distributor or a similar common line).
- Remove or install plug-in only when the basic unit is switched off. Should it not be possible to plug in the module into the basic unit due to projecting screw heads (insufficient countersinking on a number of NSG 200 B/C/D), suitable screws are obtainable under SL Nr. 200-390. It is possible to turn off the excess metal from the under side of the screw head.
- The NSG 200 interference simulator system is roughly suppressed on the line side without the test object connected (according to VDE 0875 limit G). Depending on the test object connector and the impedance, the interference can increase. Avoid if possible disturbing other people by the interference generated.

The following measures will help:

1) Build test set-up in a Faraday cage
2) Set up test as far away as possible from receiving equipment, calculators etc. and in the lower floor of the building (cellar).
3) Build a temporary Faraday cage.

The interference voltage on the line side can only be reduced with large Y - condensers, not with line filters with current compensated chokes. However attention must be given to the high leakage currents which can flow.

3.3 Operation

- Connect the basic unit according to manual NSG 200, check the two essential ground leads. Insert plug-in into the basic unit with the unit switched off.
- Select operational mode SYM (3), ASYM (5) or OUTPUT (6). t_r 1.2µs (2) switch on only for standard tests 1.2/50, set FREQUENCY (7) to 1/8 f_L.
- Connect test object to test output NSG 200 or when testing components connect to OUTPUT sockets (13) and (15).
- Set PULSE AMPLITUDE (1) to the desired value, switch on simulator and test object. Correct functioning of the test object is ensured only when the tests have been conducted for every PHASE ANGLE - setting (8) and both positions (4) POLARITY. (see also 3.4 Applications)

ATTENTION

The POLARITY-switch is to be activated ONLY currentless (pulse generation blocked or amplitude 0 %), otherwise the contacts may be welded.

- The trigger outputs PULSE (9) (signal at pulse release) and MAINS (10) (Mains reference) enable triggering of a double time base oscilloscope.

  The pulse can be triggered externally via BNC drive input (11) (ext. Trigger-function, change-over switch (7) EXT) or the pulse triggering can be blocked with log 0 (Gate-function, Change-over switch (7) 1/8 f_L).

3.4 Applications

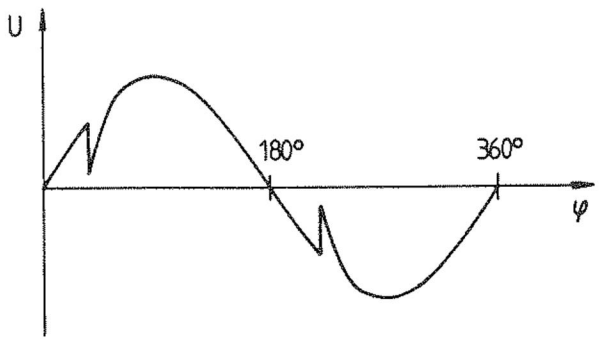
3.4.1 Symmetrical superposition on mains
3.4.2 Asymmetrical superposition on mains
3.4.3 External pulse use
3.4.4 Supply to test object with special mains supply
3.4.5 Standards
3.4.6 Triggering possibilities

3.4.1 Symmetrical superposition on mains

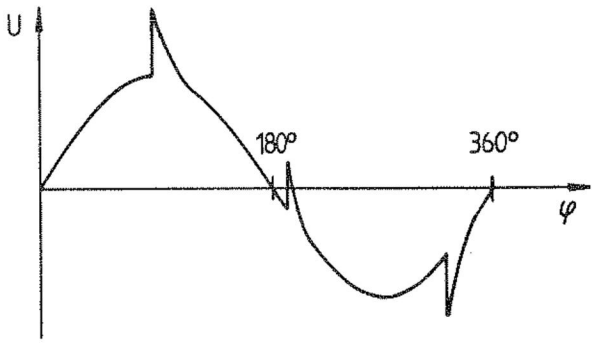
General:

The symmetrically superposed pulse on the mains (L2/L1 and P/N) are mainly caused by switching and load surges. Capacitive loads and also thyristors cause short term voltage drops up to so-called microsecond drop-outs. Inductive loads on the other hand cause short term voltage peaks when switched off, whereby the polarity and amplitude depends on the instantaneous current value at the instant of switch off.

The interference pulses can fire thyristors and cause additional triggering in zero cross-over circuits and lead in general to short term overload conditions in other equipment connected to the same mains.



Voltage-drops caused by starting current-pulse

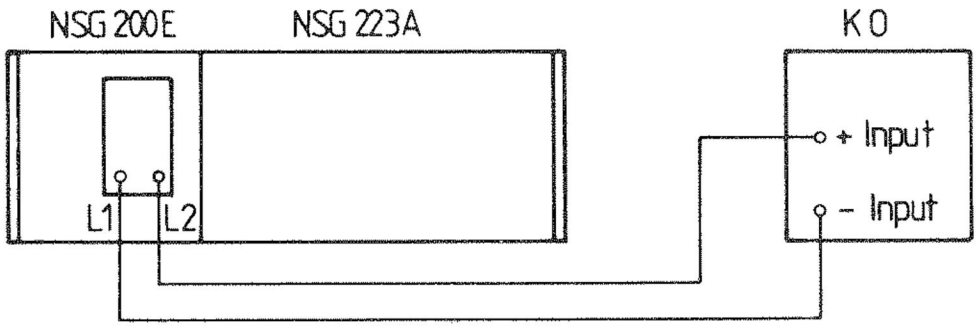


Overvoltages produced by circuit-breaking transients

Simulation and measurement:

The NSG 223 A is operated in the symmetrically coupled mode (push-button (3) SYM depressed) so that the pulse is symmetrically superposed on the mains output of the basic unit NSG 200.

For simplified simulation tests the desired pulse voltage is set and the test object operated in every phase angle and both polarities (the critical regions for trigger circuits are mainly those around the zero cross-over of the mains voltage). Voltage measurements must in any case be made differentially (L2-L1 and P-N) since grounding the neutral shorts out half the pulse voltage. It is recommended to use our measuring adapter SL 402-251, which has been specially developed for the new basic unit NSG 200 E. It can be connected directly to the Schuko socket and has two 1000:1 attenuators for L1 and L2 with 50 ohm -BNC-output and a Schuko socket for connecting the test object (supplementary adapters for connecting to NSG 200 C/D are available on request).



With the aid of the voltage measurement any possible realistic conceivable interference pulse can be simulated. It is possible for example to exactly reproduce voltage drop-outs. It must be noted that the phase angle of the interference pulse coupled in, is displaced by 180° with reference to the calibrated phase angle on the simulator, when L1 on NSG 200 E is connected to the phase. This can be corrected by reversing the polarity of the cable plug on the connecting cable to the TEST SUPPLY INPUT:

3.4.2 Asymmetrical superposition on mains

General:

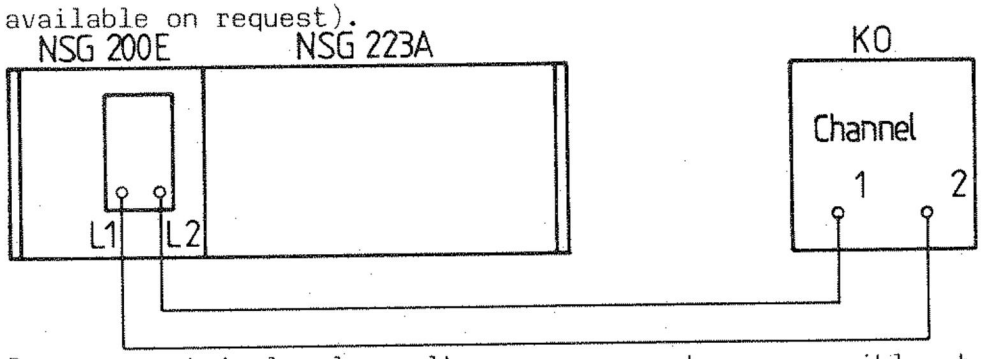
Asymmetrical pulses superposed on the mains (L2, L1/E and P, N/E) are caused mainly by earth currents, induced lightning etc. and lead due to the pulse voltage produced, which can be several kilovolts, very soon to insulation problems.

Ceramic Y-condensers among others are susceptible to breakdown when used in mains filters, since with over voltage, in contrast to selfhealing condensers, they can be permanently damaged, also signal and data line input and outputs in equipments which are not earthed.

Simulation and Measurement:

The NSG 223 A is operated asymmetrically (push-button (5) ASYM depressed). Particularly critical for insulation reasons are interference pulses at the crest of a mains supply half-wave (90° and 270°) of the same polarity. It should be noted that the phase angle is displaced 180° with respect to the scale setting, when L1 on the basic unit NSG 200 E is connected to the phase. This can be corrected by reversing the polarity of the cable plug on the connecting cable to the TEST SUPPLY INPUT.

For measurements the measuring adapter SL 402-241 is recommended. The two 1000:1 attenuators for the phase and neutral lines are adequately insulated and enable, with BNC outputs, simplified measurements. The adapter is connected directly to the Schuko output on the NSG 200 E and has a built-in Schuko socket for connecting the test object (supplementary adapter for NSG 200 C/D available on request).



Pure asymmetrical pulse voltage measurements are possible at Monitor output (14) (without superposed mains), since the OUTPUT sockets are also in operation when coupled in on the asymmetrical mode. Attenuation with reference to the asym. pulse 3000:1.

3.4.3 External pulse application

For component testing the interference pulses without superposed mains are accessible at the OUTPUT sockets (13) and (15). The pulse can be fed out coaxially from socket (13) i.e. the shielding may be used as the return line. The pulses are earthed on one side, connection to external lines carrying voltage is not permitted without a coupling condenser.

Possible applications are insulation tests (condensers, line filters, thyristors etc) and also functional tests on voltage suppressors (varistors, avalanche, diodes etc). A cable set with connecting clamps for the OUTPUT sockets for component tests is obtainable as an accessory (see 5. Accessories). The monitor output (14) enables measurement of the pulse voltages on the test object for all OUTPUT sockets directly and hence detection of malfunctioning. The attenuation for 1/3/5 kV output is 1000/3000/5000:1.

When additional elements are built into the test set-up (e.g. additional resistors for matching the internal resistance of the simulator to special standards) then the pulse voltage and pulse shape on test object and monitor are no longer identical.

3.4.4 Supply to test object with special mains supply

Test object fed with D.C.

It is possible to feed the test object with D.C. The two poles + and - of the D.C. supply are connected to L1 and L2 on the TEST SUPPLY UNIT of the NSG 200 E (or P and N on EXT IN for NSG 200 B/C/D). In order to avoid shorting out the chokes of the mains matching network no further earth connection may be made at the output of the basic unit.

The interference pulses are attenuated by the generally large condensers between + and - poles. It should always be determined, if they belong to the object under test or if they influence the test results.

Maximum rating:	up to 24 VDC	16 A
	up to 48 VDC	8 A

As long as it is ensured that no switching is done on the basic unit then 400 V/16 A is permitted.

WARNING: If this instruction is ignored then the associated switching element will burn out!

Test object fed with other frequencies

The interference pulses are synchronised with the mains frequency of the simulator supply. Because of the frequency difference between the simulator and test object supplies, the pulses occur consecutively at every possible phase angle. The phase angle setting has no defined function, it can only be synchronised to test object mains via the external trigger input.

If the frequency of the test object supply is synchronous with the simulator supply, then phase angle of the interference pulse is constant on the test supply, but does not correspond to the calibration of the phase anlge scale. The function for phase shift is, however, maintained.

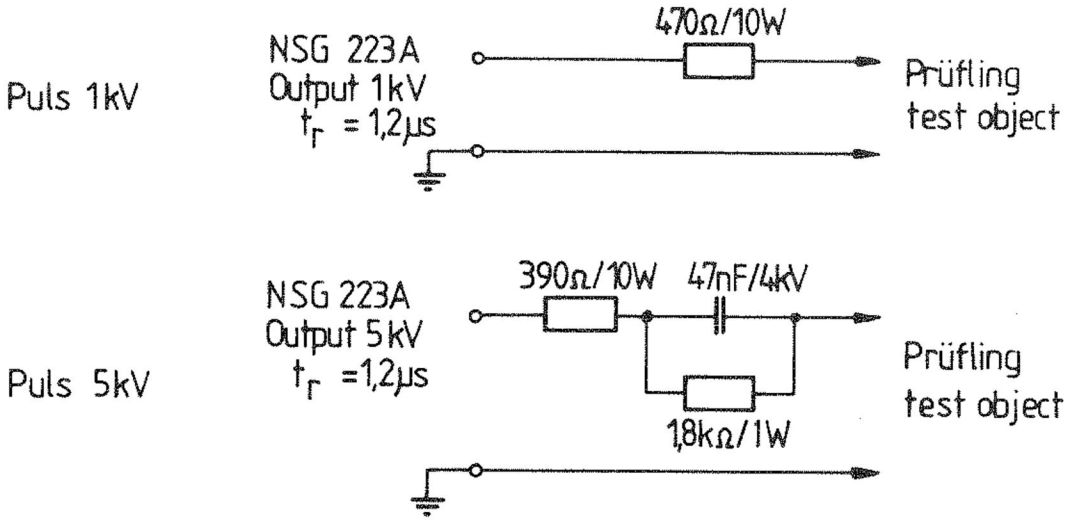
3.4.5 Standards

The published standards for interference voltage simulation are very incomplete and the military standards cannot be applied to industrial electronics. Until now the high energy mains superposed interference pulse is not contained in any standard.

In practice such pulses, as are generated by NSG 223 A, can appear on the public supply network. Therefore many companies include this test in their recommendations.

For insulation tests, however, (without superposition on the mains) many standards have included a 1.2/50 µs pulse test. The most important of these is IEC 255-4 for solid state relays and similar components.

The rise time setting 1.2 µs covers the standards requirement in respect to voltage rise time. To match the internal resistance to 500 ohm and the pulse energy to 0.5 Joule the following additional is needed:



The 47 nF/4 kV condenser can be ordered under Nr. 128-039.
This additional circuit allows a generation of pulses which correspond close to the IEC 255-4 standard. This circuit is available as an option SL 400-070 (see accessories chapt. 5).
It is to be connected at the corresponding outputs of the NSG 223 A (rise time on pos. 1.2 µs). The test object is to be connected at the additional circuit .

3.4.6 Triggering possibilities

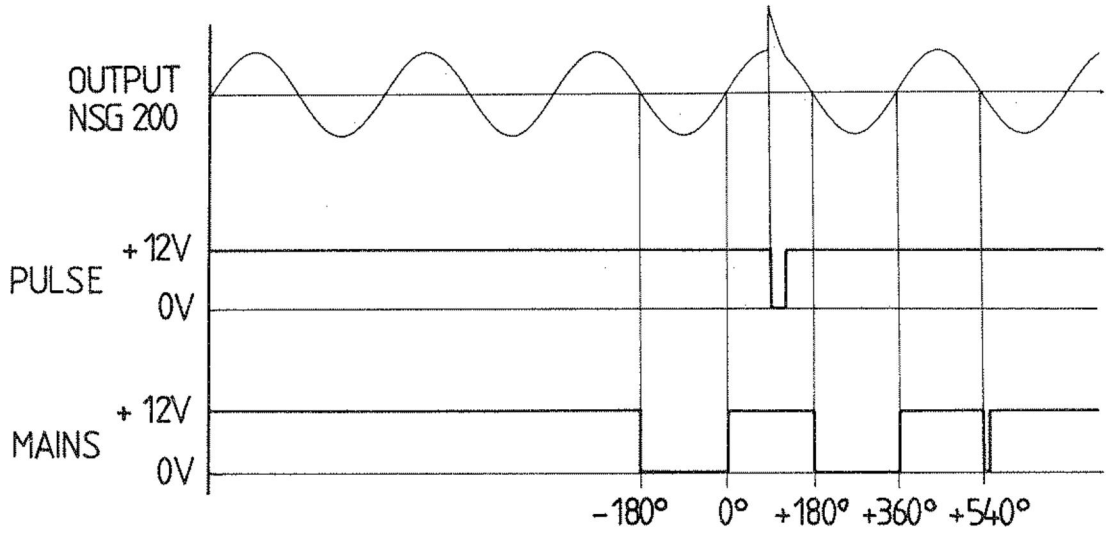
External pulse drive:

Generation of the pulse can be blocked with log. 0 via the BNC input (11) EXT TRIGGER GATE or with an earth contact, when the FREQUENCY-change-over switch (7) is in position 1/8 f_L (gate-function). In position EXT the negative flank of the input signal or closing the earth contact generates a pulse. It is possible to set the repetition frequency up to 1/8 f_L, it is limited internally to this value.

Both functions can be initiated by pressing the SINGLE - push-button (12) (earth contact) in parallel to BNC input. It should be noted that the SINGLE push-button shorts the BNC input.

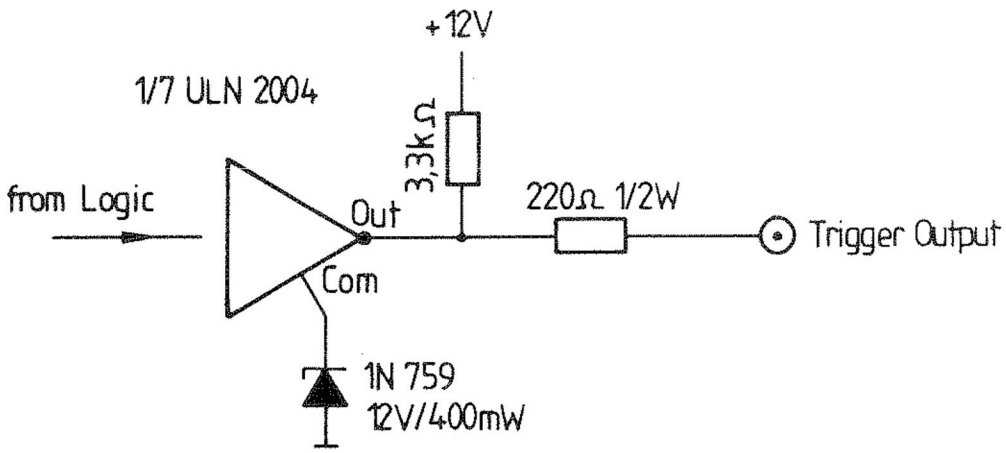
Trigger outputs:

The NSG 223 A has two BNC trigger-outputs PULSE (9) and MAINS (10). The voltage diagram shows the relationship when operating the simulator at 1/8 f_L:



In this diagram the pulse is generated at a phase angle of 90°. The angle setting range is from -30° to +390°. The trigger signal PULSE is generated synchronously with the interference pulse and is used for triggering. The trigger signal MAINS is used mainly as reference for the mains cross-over, but enables for example a double time base oscilloscope to be triggered. When the interference pulse is generated via EXT TRIGGER INPUT, then in general MAINS can only be used as mains reference, since the trigger signal is produced when the pulse is generated.

The trigger outputs are short circuit proof to ground and + 15V and enable unit to be driven from logic circuits.



4. TECHNICAL DATA

Construction: System NSG 200 plug-in, for use with NSG 200 E, but also compatible with NSG 200 C/D

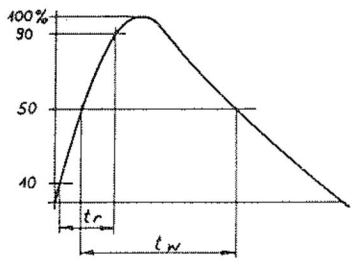
Supply: from NSG 200. 220/240V ± 10 % solder internally
110V ± 10 % special version

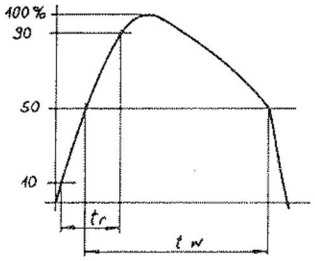
Guaranteed operation to 20 % low voltage. The pulse amplitude setting variation is proportional to the mains variation.

Internal Frequency change-over switch 50 to 60 Hz.

Power consumption: 60 VA, Peak 120 VA

Pulse Data: Pulse shape sym Pulse shape asym/Output





	SYM	ASYM	OUTPUT
Amplitude no load max	1000V	3000V	1/3/5kV
Rise time t_r	100 ns	500 ns	500 ns
Rise time t_r 1.2us depressed	1.2 µs	1.2 µs	1.2 µs
Pulse duration t_w no load at 100 % voltage setting*	50 µs	50 µs	50 µs
Internal resistance	5 Ω	45 Ω	5/45/125 Ω

Polarity + or -

* Pulse width is determined by saturation of the high voltage transformer. Pulse width changes in amplitude for values less than 100 % according to the formula

Amplitude x Pulse width ≈ constant

Symmetrical (L2/L1 & P/N) or asymmetrical (L2,L1/E & P,N/E), coupling in to test output on NSG 200, without mains superposition on OUTPUT-sockets on NSG 223 A.

Interference pulse repetition frequency : 1/8 mains frequency, single pulse triggering SINGLE also up to 6 Hz externally. Phase angle calibrated setting -30° to +390° ± 30° (referred to simulator supply)

Operation: Adjust pulse amplitude calibrated 5 to 100 %
Switch rise time t_r 1.2 µs (or as in table)
Change-over switch symmetrical/asymmetrical/output
Change-over switch pulse polarity + or -
Change-over switch repetition frequency external / 1/8 mains frequency
Single trigger push-button
Adjust phase angle calibrated 0 to 360°

Inputs/outputs:
- Pulse output sym/asym mains superposed on NSG 200 basic unit
- Pulse outputs 1/3/5 kV and earth with coaxial sockets
- BNC-monitor output 50 Ω , attenuation 1000:1 at 1kV - output resp. 3000:1 at 3kV - output and 5000:1 at 5kV. Usable also as monitor (without mains superposition for coupling in pulse asymmetrically, attenuation 3000:1.
- BNC-trigger output PULSE. Trigger signal approx. 20µs by oscilloscope triggering, changes from normal log 1 (+12V) to log 0 when pulse triggered.
- BNC-trigger output MAINS. Mains reference signal, negative flank when negative cross-over or positive flank when positive phase cross-over. Operates from -180° to +540° referred to interference pulse phase angle.

- BNC-input EXT TRIGGER/GATE for external pulse triggering 0 to 1/8 f_L (ext, trigger function) combined with gate-function (pulse blocking) when FREQUENCY 1/8 f_L.
  Drive from TTL/CMOS-logic + 12V max. or mech. earth contact. Triggering on log 0 (negative flank) or closing the contact.

Dimensions:	Width:	269 mm	10.6"
	Height:	129 mm	5.6"
	Depth:	315 mm	12.4"
Weight:	5,5 kg		12.1 lb

Interference limit G
to VDE 0875

5. ACCESSORIES

not included	Order Nr.
- Plug for OUTPUT (Fischer Apples, Type S 103A 023)	156-154
- Cable set 1 m for component testing (2 pcs OUTPUT-Plug to banana plug and clamp)	SL 402-089
- Additional circuits for generation of pulses which correspond close to the IEC 255-4 standard (1.2/50 µs, 500 ohm, energy = 0.5 Joule). Is to be connected on the corresponding outputs of the NSG 223 A.	SL 400-070
- Measuring adapter 1000:1 for pulse and mains voltage measurement with oscilloscope at NSG 200 E output	SL 402-251
- Adapter set for NSG 200B/C/D for MC-safety banana plugs and the following accessories	SL 402-271
- Adapter for connection to test object	

for	Adapter for plug	
D/S/NL/I/E/N/SF	Schuko	SL 402-270
CH	Type 13 SEV	SL 402-221
F/B	Type 530 19	150-111
GB	Type BS 1363	SL 402-223
other countries	Safety banana plug set	SL 402-227

The adapters for the basic unit NSG 200 E are included, corresponding to the country of usage. For the basic units NSG 200B/C/D, SL 402-271 will be required also.

ATTENTION

When connecting adapters for mains plugs, connect the red banana plug to the phase connection. Only in this way can the phase on the adapter connector correspond to the regulations of the country concerned.

6. MAINTENANCE

WARNING This unit and all the accessories described herein work on high voltage. Misuse and ignoring instructions can endanger life. Only trained personnel should work with the units. Replacement of components and internal adjustments must be carried out by qualified service personnel. When working on unit, disconnect from mains, if not possible, switch on simulator supply only and set pulse amplitude to minimum value.

6.1 Warranty conditions

For claims against warranty contact your Schaffner representative. To claim against warranty the following conditions apply in all cases:

- no unauthorised work on the unit
- Use only Schaffner original parts
- Post consignments in original packing cartons only accepted
- Parts which degrade in normal operation as well as faults due to misuse do not constitute a claim under the warranty.

6.2 Calibration

Equipment required

- 2 channel oscilloscope at least 20 MHz high impedance with 20 MHz single pulse storage.
- Probe 1000:1, voltage insulation at least 6kV
- Measuring adapter SL 402-251, BNC-cable
- Basic unit NSG 200 E