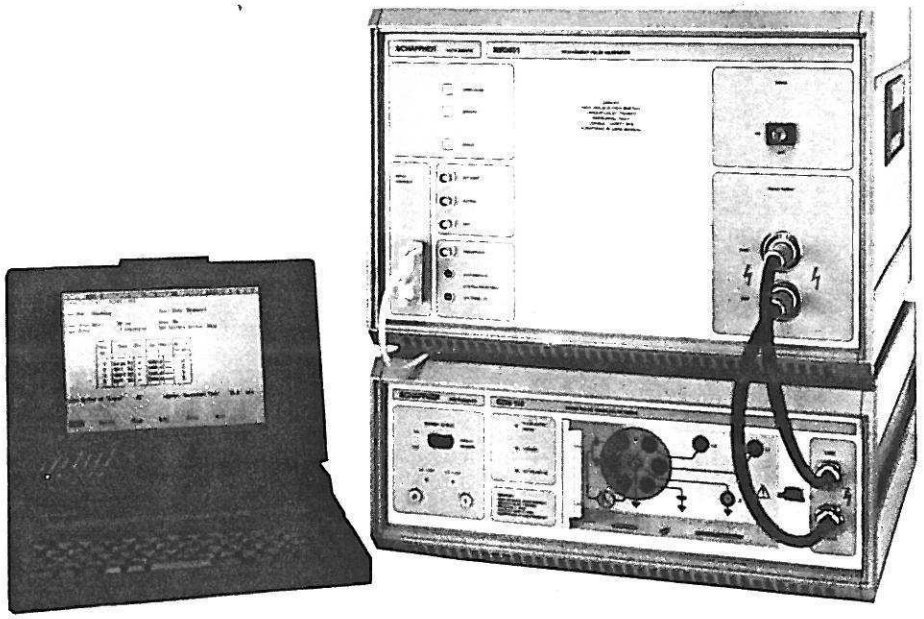
HIGH ENERGY PULSE GENERATOR

NSG 651

OPERATING INSTRUCTIONS



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1 Introduction

The High Energy Pulse Generator type NSG 651 offers a whole range of pulses from one unit:

Hybrid pulses: 1.2/50 µs (open-circuit) up to 6.6 kV
8/20 µs (short-circuit) up to 3.3 kA

Surge pulses: 10/700 µs, 100/700 µs, 0.5/700 µs } up to 6.6 kV

These cover the full range of pulse requirements specified in the draft IEC 801-5 standard.

The 1.2/50 µs - 8/20 µs hybrid pulse is also specified in the ANSI-IEEE C62.45, VDE 0109 and many other standards.

Typical telecommunications pulses of 10/700 µs, 100/700 µs and 0.5/700 µs are called for in the CCITT specifications K17 and K20 and, as a consequence, are now being incorporated in numerous national standards whereby some even foresee the use of the fast pulse rise time of 0.5 µs.

The generator meets the demands of the European specifications (EN 50082-1, 50082-2, etc.) which relate back to the IEC and CCITT publications.

All the functions of the instrument are controlled and supervised by an internal microprocessor. The generator is operated via a personal computer. Alternatively, the generator can be integrated into an existing automatic test environment.

The operating software supplied provides unique features which are otherwise not possible via front panel controls. This includes freely programmable test sequences which can be stored for further or repetitive use and the test parameters of which can be filed together with the test results.

The menu structure of the user-program guides the user in a logical manner through the development of a test sequence.

To ease the operator's task, the user-machine interface has been designed in the form of a menu structure.

Test parameters may be defined in four different modes, namely:

Single pulse
Incremental voltage sequence
Incremental phase angle sequence
User-defined sequence of test profiles

During the test the actual pulse peak values (V_p and I_p) at the output of the generator are measured and displayed. All the test-parameters, including the status of the EUT are recorded and can be printed out in the form of a table.

Optionally a digital I/O-board can be fitted to incorporate the control of associated coupling networks or other elements in the automatic test rig to which the generator is connected.

Matching coupling networks are available to couple the pulses into ac supply lines or data-lines.

In addition, a range of accessories such as test enclosures, warning lamps, etc. is available to simplify the test set-up.

Considerable attention has been paid to the matter of personnel protection. Software checks are backed by visual and audible alerts and by hardware interlocking mechanisms.

2 Safety considerations

The NSG 651 generator produces high voltage pulses having a high energy level.

Incorrect or careless operation can be lethal!

Neither Schaffner Elektronik AG, Luterbach, Switzerland nor any of the associated sales organisations can accept responsibility for personal injury or for material or any consequential damage that results through irresponsible operation of this instrument.

The construction of the instrument conforms to the safety requirements called for in VDE 100 and provides all the prerequisites for safe and reliable operation.

Strict and responsible observance of the following safety measures and recommendations is a must at all times.

Safety measures

These operating instructions form an integral part of the equipment and must be carefully studied before putting the equipment into operation and be available to the operating personnel at all times.

The equipment may only be used by trained personnel.

Personnel fitted with a heart pacemaker must not operate the instrument nor remain in the test vicinity when the generator is in operation.

The instrument is only to be used in dry rooms. In the event of any condensation occurring, this must be allowed to evaporate before the instrument is put into service.

The construction of the instrument is not designed for use in an explosive atmosphere.

The test rig is to be set up in conformity with the relevant safety standards (e.g. VDE 104).

The instrumentation may only be used with appropriate mains plugs connected to a mains supply which provides a protective earth. In addition, a duplicated protection earth connection is necessary. This requirement can be met by making a reliable connection directly between the earth terminal and the fixed installation (not via a mains distributor or similar items).

To ensure safe operation, only approved accessories, plugs, adapters, etc. are to be used.

The test rig must offer insulation protection against a voltage of at least 10 kV.

The pulse voltage must not be able to find its way to unearthed metallic objects even if the item under test (EUT) is faulty or fails.

The EUT must be tested only inside a protective cage or hood that provides protection against flying debris, fire and electric shock.

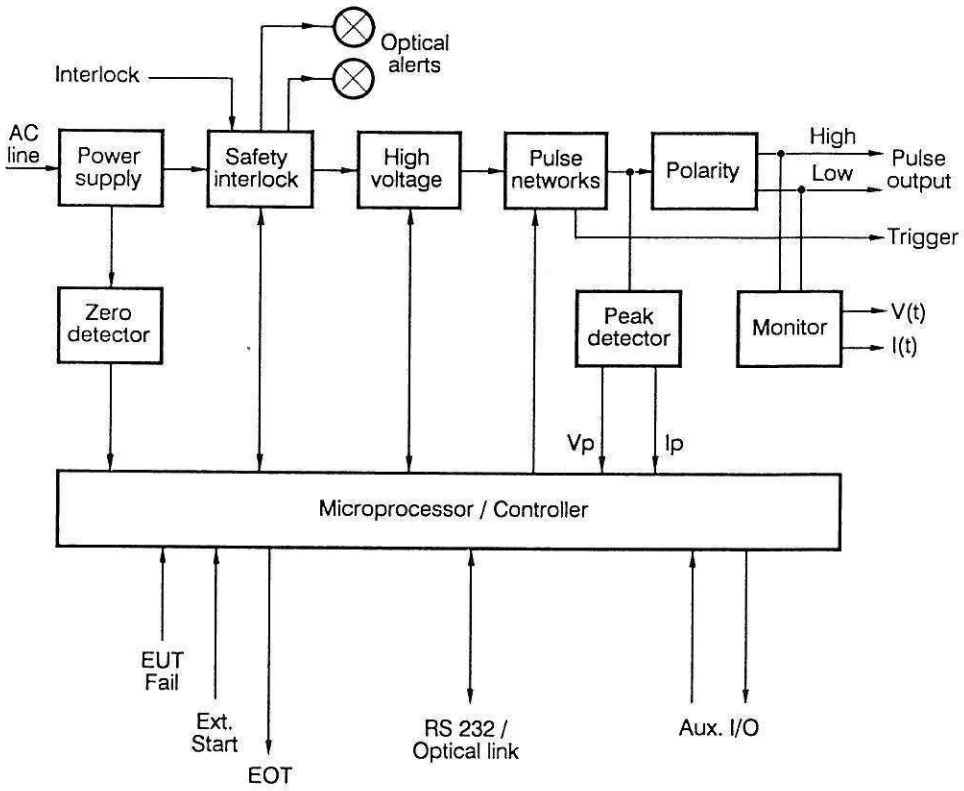
Depending on the type of test object (EUT) and especially on the cabling to it, a considerable amount of interference can be radiated which could affect nearby systems and radio communication. These interference effects on the surroundings are to be kept under control by the user through the use of suitable measures such as a Faraday cage, shielded cable runs, etc.

The instrument must never be left unattended while in operation. When not in use, the key should be removed and be put in a safe place.

The instrument housing must not be opened. Any repair or service work and any internal adjustments must only be carried out by appropriately qualified service personnel.

3 Concept of the instrument

3.1 Block diagram



3.2 Principle of operation

The widespread acceptance of personal computers and the reasonable price of the equipment makes it realistic to create test equipment for laboratory and production purposes that are simply user-interfaces to such PCs.

In so doing, the power of a local computer such as that for calculation purposes, program and data storage, file handling, application-orientated screen presentations, print-outs of protocols and lists, networking and communications possibilities with other parts of the plant, etc. can be made available to a test rig and its operation.

Such a concept demands that the test equipment itself incorporates the necessary processor intelligence in order to be able to carry out all the specific tasks and real-time procedures and to be able to understand the PC software as an integral part of the product.

The generator type NSG 651 contains a high performance microprocessor as the controlling element. This has the task of controlling and monitoring all the functions of the instrument, regulates the time-dependent generation of the pulses, secures and checks the statuses of switching elements, collects the results of measurements and constantly monitors the safety switches in the test set-up. In addition, the microprocessor handles the communications through the computer port together with other inputs and outputs besides checking all the entries for validity and plausibility.

As can be seen from the block diagram, the energy part of the instrument is made up of several sub-systems as described below.

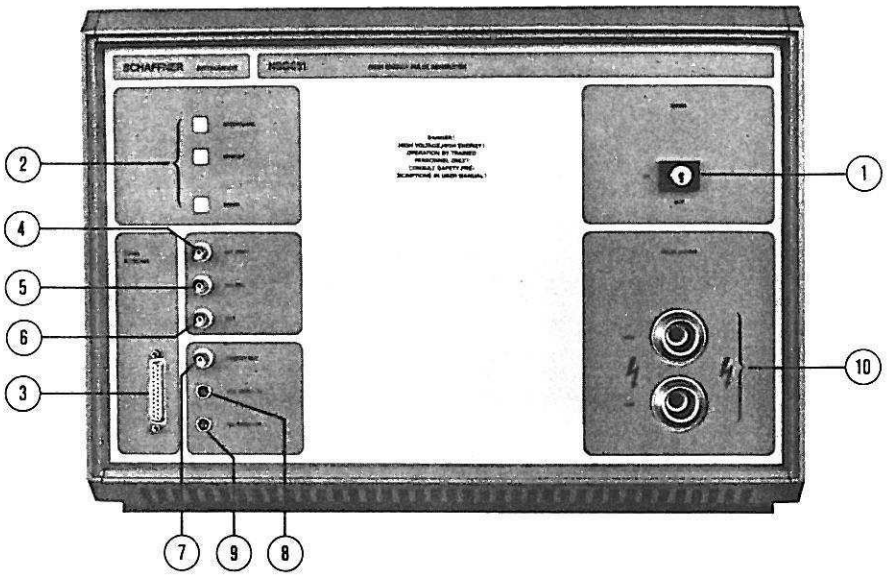
A mains-driven power unit supplies both the control section and the high voltage generator with stabilized dc.

The zero-crossing detector produces reference signals so that the pulses can be superimposed on the mains supply to the EUT at the programmed phase angle.

Safety circuits combine and interlock the status signals from the key-switch, the microprocessor, coupler and external protective gear to ensure that the demand for 'safety first' is met under all operating situations and abnormal conditions.

The high voltage supply charges the capacitors in the discharge network to the required voltage and then ensures that a constant charge is maintained until a pulse is triggered.

3.3 Operating elements and connections



1 MAINS — Safety key-switch and mains on/off switch.
The generator can hence only be activated by authorized personnel. The key can only be extracted in the OFF position. When it is switched ON, the generator goes into the STANDBY state while safety circuits prevent the generation of high voltages.

2 Generator status — Display field showing the status of the generator.

OPERATIONAL — The generator has been switched to the active state. High voltage generation has been activated; pulses can be triggered. This state can only be attained through the TEST program menu.

STANDBY — Generator is switched on and can communicate with the operating program. HV generation is not active.

The signals for these two indicators are also available in parallel at the connector **12** for external warning lamps.

ERROR — Indicates that the internal microprocessor has detected faulty operation in the instrument. A status message with error information also appears on the monitor screen.

3 SER. INTERFACE Socket (Cannon, 25p, neg.) for RS 232C connecting cable to the PC or another control computer. The NSG 651 is wired as a DCE so that a conventional RS 232C cable wired 1:1 can be used. (25p to 25p or 9p to 25p, depending on the type of computer used).

A null-modem is not required.

To prevent disturbances from interfering with communications between the computer and the generator, a fiber-optic (opto-link) can be used instead of a cable.

Further information regarding the opto-link and the connector pin-out can be found in Sections 4.2 and 8.2.

4 EXT. START BNC connector for the input of an external start signal. This input has to be firstly activated in the PARAMETER SETUP menu.

The start command for pulse generation or a whole sequence is triggered by applying a logic 0 signal. The input can hence be driven by either TTL or CMOS logic as well as by a mechanical contact.

5 EUT FAIL BNC connector for a status signal concerning the EUT. If the EUT is capable of producing a suitable signal in the event of a failure occurring, that signal can be applied to this input to terminate the current test sequence. The message "nok" appears on the monitor screen (and in the print-out). See also Sections 4.7.3 and 4.7.5.

The function is activated by applying a logic 0 signal. The input can hence be driven by either TTL or CMOS logic as well as by a mechanical contact.

6 EOT End of test signal. The isolated switch contact closes briefly when the chosen test has been completed. See Section 8.4 for the wiring details.

Automatic batch testing can be achieved by using the EXT. START, EUT FAIL and EOT connections.

7 TRIGGER OUT

BNC connector. Output for triggering an oscilloscope at the beginning of a pulse.

Accuracy:	< 1 μs
Pulse width:	2 to 4 μs
V_p:	3 to 5 V
Load impedance:	> 10 kΩ

8 V MONITOR

Measurement output for the pulse voltage.
The measuring circuit is electrically isolated from the pulse output and delivers a signal that is attenuated by a factor of 1000:1. The measuring circuit is designed for the 1.2/50 μs - 8/20 μs hybrid pulses.

The measurement is taken at the pulse output of the generator. A normal, asymmetric, high impedance CRO input can be connected to this output directly by means of the cable supplied.

9 I MONITOR

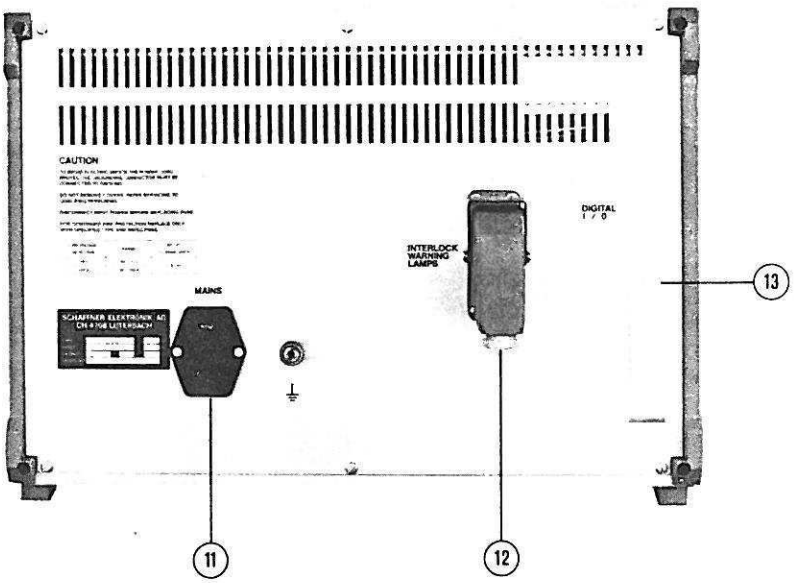
Measurement output for the pulse current.
The measuring circuit is electrically isolated from the pulse output and delivers a proportional signal in the ratio of 1000 A = 1 V. The measuring circuit is designed for the 1.2/50 μs - 8/20 μs hybrid pulses.

The measurement is taken at the pulse output of the generator. A normal, asymmetric, high impedance CRO input can be connected to this output directly by means of the cable supplied.

10 PULSE OUTPUT

High voltage coaxial connector at which the pulse is output. Symmetrical, floating coupling of HIGH and LOW via the inner conductor and screen with the protective earth connection via the outer sheath.

The connecting plugs are component parts of the coupling networks (CDN 110, CDN 116, etc.). Plugs and cables are available as accessories for component tests, etc. (see Section 12).



11 Mains input

Mains connector for powering the generator. A voltage selector for 110/230 Vac and a fuse are incorporated.
Fuse ratings: 115 Vac, 2 A slow-blow
230 Vac, 2 A slow-blow

12 Interlock

Plug and socket for the wiring of safety contacts and warning lights. The plug supplied with the instrument has a wire link inserted in the safety circuit. This has to be replaced by the actual safety contact in the final test rig (test hood, test enclosure, etc.).

When a coupling network is connected, this connector is needed for the extension of the safety circuit to the network. The NSG 651 will not work without the safety connector. See Section 8.5 for the connector pin-out.

13 Digital I/O

Cut-out for the optional circuit board with digital inputs and outputs. See Section 8.6 for a function description and technical details.

4 Operating principle

4.1 NSG 651 PC program

The software to run on the personal computer is a prerequisite for the operation of the NSG 651 and is hence considered to be an integral part of the instrument.

In place of a front panel with a wealth of control elements, the user is presented instead with a an operating surface on the computer screen which provides a considerably greater range of possibilities than knobs, buttons, switches and so on ever could, while enabling the test conditions and sequences to be input in a clear, unambiguous and error-free manner.

The PC program for the NSG 651 sends commands and parameters to the processor in the generator via the serial link and receives the results of measurements, status messages, etc. in return. The program supports and supervises the dialogue with the user. Non-valid parameter data and combinations of values are not accepted and erroneous operation is largely prevented.

The PC program does not have any direct control over the actual generation and triggering of the pulse itself. This is entirely the responsibility of the on-board microprocessor in the NSG 651. In this way, any faulty operation in the PC or disturbances on the data transmission link cannot lead to incorrect or dangerous operation on the part of the generator.

The programs

NSG 651 OPERATING SOFTWARE and
NSG 651 TRAINING SOFTWARE

supplied on the diskettes are for exclusive use with the SCHAFFNER NSG 651 Generator. It is forbidden to copy and give them to a third party for other purposes. The copyright is in the hands of SCHAFFNER ELEKTRONIK AG, in Luterbach, Switzerland.

The diskettes may be copied for backup purposes in connection with the operation of the generator. The diskettes are not copy-protected.

4.2 Hardware requirement

The following hardware must be available on the PC side to operate the generator:

IBM PC (XT or AT) or a compatible computer
640 kB memory minimum
1 or 2 floppy drives or 1 floppy drive + 1 hard-disk
monochrome or colour monitor
keyboard
serial port, COM 1
printer (for protocol print-out)
operating system, DOS version 2.2 or later

The NSG 651 PC software has been structured in such a way that it will run perfectly satisfactorily even on the simplest system configuration without any limitations. Initialisation and the establishment of the display happens more quickly with an AT and the availability of a hard-disk adds to the general convenience but this does not otherwise affect the work with the generator at all. Use of only operating system routines for inputs/outputs, etc. has been strictly observed to ensure that the program will run on all 'compatibles', but especially on lap-tops.

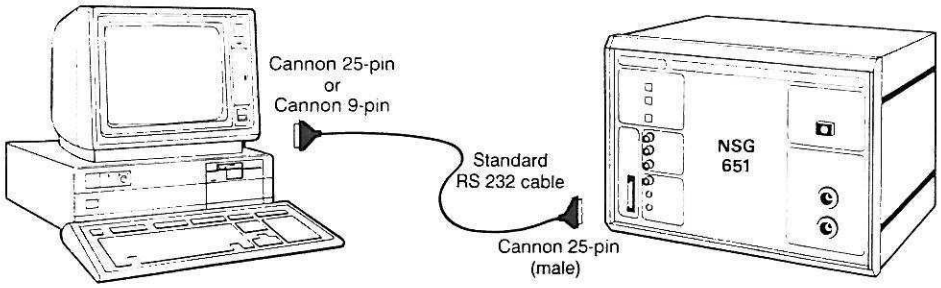
The program is available on two different diskette formats:

5¼", DS/DD, 360 kB
3½", DS/DD, 720 kB

When the program is started, it investigates the screen driver that has been installed and then automatically sets up the corresponding b/w or colour presentation.

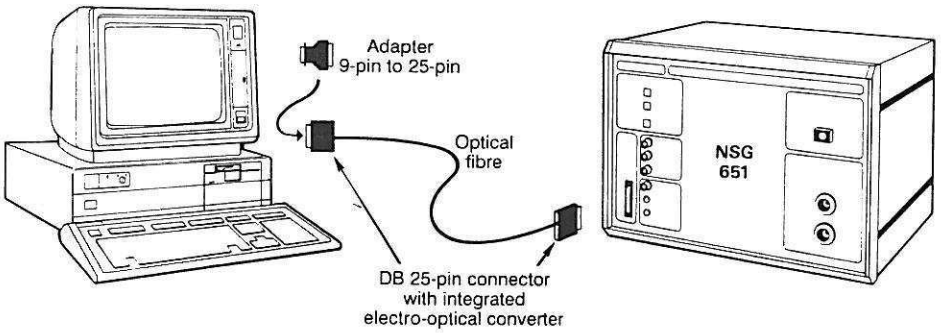
Command and data inputs for operating the generator are entered via the keyboard. A mouse is not supported.

The standard serial I/O port, COM 1, is used for the link to the NSG 651; all the necessary connections being made through any commercially available RS 232 cable. (The NSG 651 is set up as a DCE and hence a dummy modem is not required). The program automatically sets the COM 1 port to the correct settings (Baud-rate, parity, stop-bits, etc.).

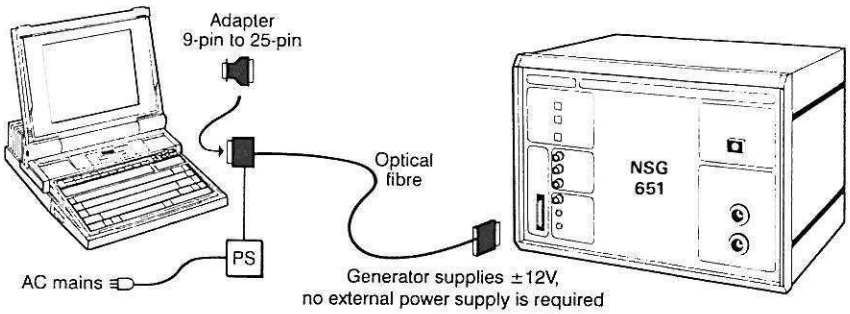


An optical link to the PC can also be used to prevent disturbances on the transmission path and hence in the computer system caused by pulse voltages in the test rig.

The opto-link type INA 301 electrically isolates the PC system from the test rig. Power for the electro-optical converter is obtained directly from the data lines in this model so that not supplementary power pack is necessary.

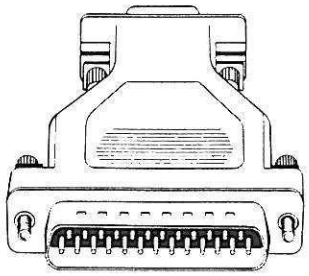


Some PC's, especially some of the lap-tops, do not supply enough power at the serial port to feed the converter as well. In such cases an opto link (type INA 303 or INA 304) has to be used which is equipped with an external power supply unit at the PC end. The NSG 651 supplies power for this model via the 25-pin connector.



Operation of the opto-link with a computer having only a nine-pin COM 1 connector requires the use of a conventional adapter.

Technical details concerning the port can be found in Section 7 of this manual.



A printer is necessary to print out the test programs and data. The NSG 651 PC program utilises the DOS-routines as a printer driver; the print-out presentation conforming to the default settings of the printer concerned.

4.3 Training software

The instrument is delivered with two program packages on either two 5¼" or two 3½" diskettes as appropriate, namely:

NSG 651 TRAINING SOFTWARE
NSG 651 OPERATING SOFTWARE

The training software enables operation of the NSG 651 Generator to be simulated without the instrument being present or having to be connected. Responses from the instrument, status signals and measured data are replaced by calculated standard values. In all other respects the program behaves just as the operating software would do so far as operation and reactions are concerned. This enables the user to practice working with the generator but without producing the high voltage pulses or having to have a safe test rig at his disposal.

The program can, however, be of even greater assistance. All the test sequences and files that are created have the same structure as those produced by the actual operating program. This means that test programs, protocol forms, test sequences, etc. can be created off-line in an office for subsequent transfer to the system proper by means of a diskette for example. Conversely, test result protocols can be handed back to the office for further processing.

This compatibility between the TRAINING SOFTWARE (off-line) and the OPERATING SOFTWARE (on-line) offers the additional advantage that the test programs can be created by specialists for use on the factory floor by operatives who only need to be instructed in the safety aspects and a few simple operations to start and stop a test procedure.

4.4 Operating software

The NSG 651 OPERATING SOFTWARE is the operating program for the generator itself. All of the functions that concern the NSG 651 are only able to work if the generator is correctly connected to the PC and is switched on at both the mains and the key switch. (Otherwise the program finds that responses and communications signals are missing which would lead to error messages being produced.

Attention: This program should only be started and be put into use if the necessary safety precautions for the operation of the generator have been taken.

4.5 Installation

This section details the procedure for installing the program on the relevant computer system. Other forms of installation are also possible, depending on the need and to suit specific working methods. Further information can be found in the DOS manual for the PC concerned in such cases.

Caution: To prevent data loss, file corruption and, above all, the introduction of a virus, the write-protect should never be removed from the original diskettes.

Installation on a system with two floppy drives:

- Prepare a work-copy of both the original diskettes (NSG 651 TRAINING SOFTWARE and NSG 651 OPERATING SOFTWARE), e.g. with:

  A:> **diskcopy a: b:**

  or, if the two diskettes have differing formats:

  A:> **copy a:*.* b:**

- Carry on working only with the work-copies. Besides the programs themselves (NSG651TR.EXE and NSG651.EXE), these diskettes will also carry all the files with the standard values for the parameters, protocol inputs, etc.

- The programs are started with the call:

  A:> **nsg651tr** for the TRAINING version, or

  A:> **nsg651** for the OPERATING version

Installation on a system with a hard-disk:

- If both the training and the operating software are to be installed on the same hard-disk, it is advisable to store them in different directories since only the main programs (NSG651TR.EXE and nsg651.exe) differ from one another but not the rest of the files which are present on both diskettes.

- Hence, create the directory C:\TRAIN by typing:

  C:> **md train**

  and copy the complete content of the NSG651 TRAINING SOFTWARE diskette into this directory with:

  C:\TRAIN> **copy a:*.* c:**

- Create another directory, e.g. C:\NSG651 by typing:

  C:> **md nsg651**

  and copy the complete content of the NSG651 OPERATING SOFTWARE diskette into this directory with:

  C:\NSG651> **copy a:*.* c:**

- Starting from the correct directory, the respective programs are started with the commands:

  C:\TRAIN> **nsg651tr** for the TRAINING version, or
  C:\NSG651 **nsg651** for the OPERATING version.

Note: Refer to the DOS manual to find how batch files can be created to call the programs directly from the operating system.

The program automatically configures the COM 1 port each time the program is started which incorporates the display and printer-drivers that are present.

Some lap-tops emulate colour displays with a range of grey-scales but with rather poor contrast. In such cases, the system command:

> **MODE BW80**

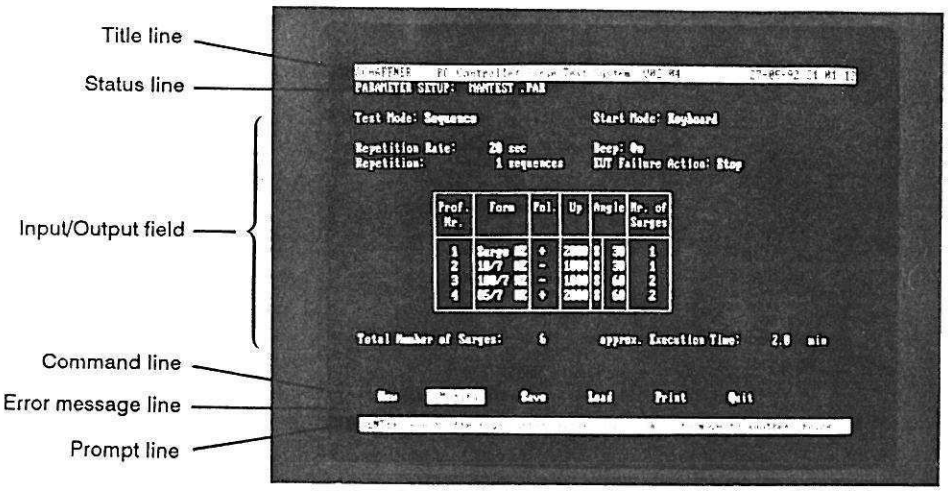
often gives a better monochrome presentation. This command can be incorporated in the batch file.

4.6 General operation

The training a preparation program NSG 651 TRAINING SOFTWARE and the operating program NSG 651 OPERATING SOFTWARE behave identically as far as the way that they are used and the screen displays are concerned. The following description thus applies to both programs.

The NSG 651 PC program is configured on a menu-driven structure. The various screen masks are based on a uniform concept regarding both presentation and use.

Typical screen presentation:



Title line:	Program name and version number Current date and time (taken from the system)
Status line:	Active menu and file name Generator status message
I/O field:	Fields for inputting commands Display of the value that has been set, or Measured value
Command line:	Summary of commands applicable to the current menu
Error line:	Shows any system errors
Prompt line:	Informs about the input possibilities corresponding to the position of the cursor.

Keyboard Inputs

The various input fields accept only entries that are meaningful to them, e.g. only the keys 0 ... 9 for numerical fields and only the switching function with the 'space' bar for toggle fields.

Selected menus, commands, toggle fields and data fields are highlighted. The prompt line gives information about logical keyboard entries for the relevant field in each case.

Key-functions

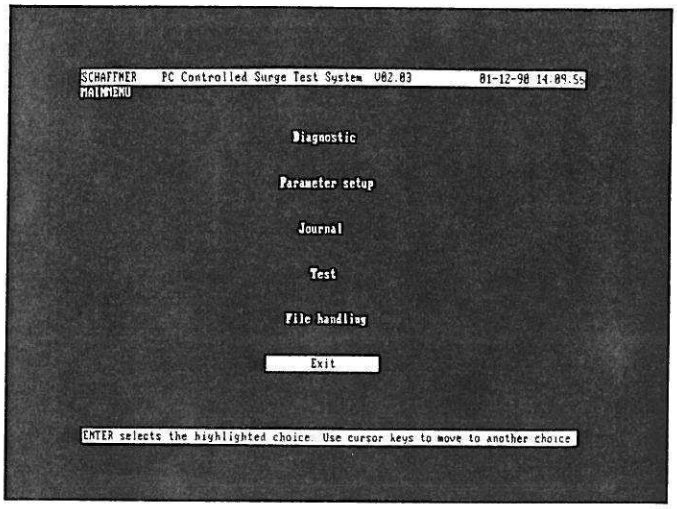
Cursor keys PgUp/PgDn Tab	</>/^/v	Move the cursor from field to field Page up/down
Enter key	ENTER or CR	Executes the selected menu or the command selected in the command line
Space bar	SPACE	Toggling or scrolling in the corresponding fields through the range of possibilities offered (e.g. Test mode single → Increment voltage → Increment angle → Sequence → Single)
Escape	ESC	To leave the input/output field and return to the command line
Number keys	0...9	To input numerical values in the foreseen fields
Letter keys/ special characters		Only accepted in editing fields (e.g. giving a file name, text fields in the JOURNAL menu)

Further key-functions that are only active in special cases are described in the corresponding menus.

4.7 Menus

4.7.1 Structure

When started, the NSG 651 PC software is loaded into the memory of the computer and reports on the screen with a start-display. The menu-structure of the program is displayed when the ENTER key is pressed.



Branches can be made from this main menu into the sub-menus and from these back into the main menu again to select the next menu item.

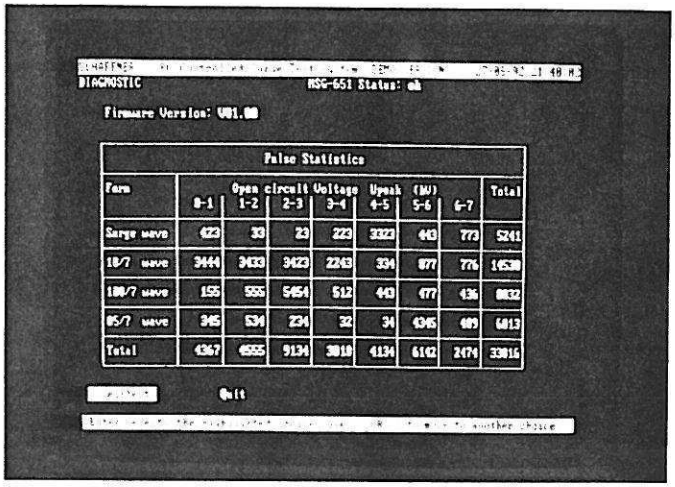
Selection of the individual menus is made by using the cursor keys with the execution of the choice being performed by the ENTER key. Alternatively, the initial letter of the sub-menu can be entered to execute it.

The sub-menus are listed in the order in which they are normally required although they are hierarchically all on one level and the observance of a particular order is not necessary.

The **Exit** command closes the program properly and returns the computer to the DOS level.

4.7.2 Diagnostics

A self-test on the NSG 651 Generator can be carried out at any time through the DIAGNOSTIC menu.



The **S**elf-test mainly checks the integrity of the processor part of the generator together with its memory.

In normal cases the status line reports: NSG 651 - Status **ok**

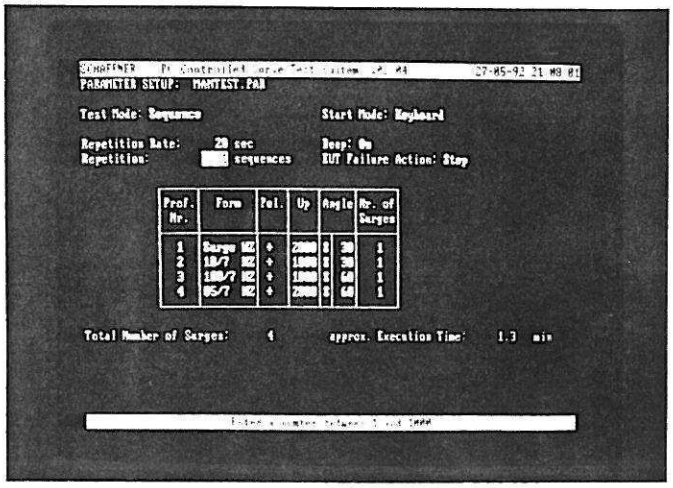
The instrument should be handed back to the responsible SCHAFFNER Service Centre in the event of a fault being reported instead.

The *self-test* also outputs statistical data. The number of times a pulse has been triggered is listed in groups according to the voltage range for the two pulse types. This information is taken from a non-volatile memory in the NSG 651 processor and indicates the total since the initial set-up of the instrument at the factory.

A jump back to the main menu can be made with **Q**uit.

4.7.3 Parameters

The test or test sequence to be carried out is programmed in the Parameter menu.



When this menu is called up, the computer automatically loads a default set of parameters: DEFAULT.PAR. (The values loaded are those that were last saved under this file name).

Selecting **New** in the command line causes the cursor to jump to the Input/ Output field so that new test conditions can be set up in the "test mode" field. Use the space bar to scroll through the various modes possible, thus:

Single	Single test pulse
Increment voltage	Sequence with incremented test voltage
Increment angle	Sequence with incremented phase angle
Sequence	Freely programmable set of test profiles

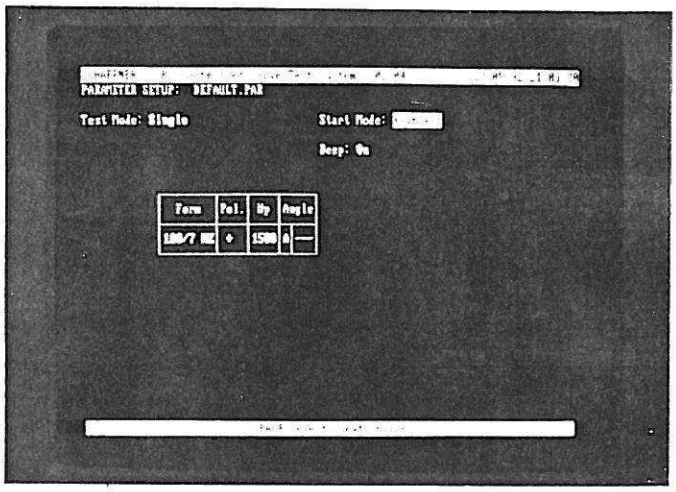
The input masks change according to the mode that has been set. Input fields are only displayed if they are logical and usable in the selected mode.

An unacceptable entry is rejected by the program. A message line displayed at the bottom of the screen shows the range of possible values.

The cursor can be moved around amongst the other input fields by means of the cursor keys, thus:

Start mode	Flips between 'Keyboard' (pulse triggering via the keyboard of the PC) and 'External' (pulse triggering by means of an external contact).
Beep	Flips between 'On' (warning tone before each pulse is triggered) and 'Off' (no acoustic warning).
EUT failure action	Defines the behaviour of the instrument in the event of a failure in the EUT. A choice of 'Stop' (breaks off the test) and 'Continue' (carry on with the test sequence) is provided.
Repetition rate	Numerical input in secs defining the pulse repetition frequency (minimum = 20 s, maximum = 10000 s).
Repetition	Numerical input defining the number of times that the entire sequence should be executed (minimum = 1, maximum = 1000).

Parameter Input in "Single" mode



"Form" Scrolls through the various pulse forms when the space bar is pressed, thus:

Symmetrical Surge LZ ~~Hybrid LZ~~ 1.2/50 µs hybrid pulse with low dynamic impedance (2 Ω)

Asymmetrical Surge HZ ~~Hybrid HZ~~ 1.2/50 µs hybrid pulse with higher dynamic impedance (12 Ω)

Surge LZ 10/700 µs surge pulse with low dynamic impedance (15 Ω)

Surge HZ 10/700 µs surge pulse with higher dynamic impedance (40 Ω)

Surge LZ 100/700 µs surge pulse with low dynamic impedance (15 Ω)

Surge HZ 100/700 µs surge pulse with higher dynamic impedance (40 Ω)

Surge LZ 0.5/700 µs surge pulse with low dynamic impedance (15 Ω)

Surge HZ 0.5/700 µs surge pulse with higher dynamic impedance (40 Ω)

Pol Selected pulse polarity (+ / –)

Up Numerical input for the peak pulse voltage (minimum = 200 V, maximum = 6600 V)

Angle Phase angle at which the pulse is injected relative to the zero-crossing point.

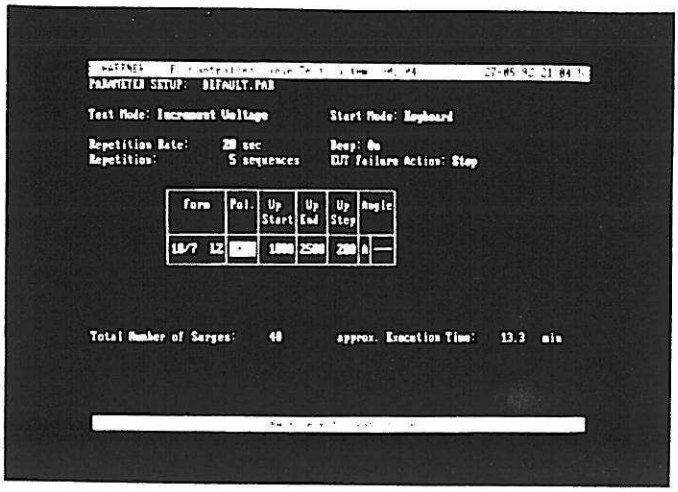
A/S selection field:

A : Asynchronous. True stochastic coupling.

S : Synchronous to the mains.

Data field : Indicates the phase angle in degrees (minimum = 0°, maximum = 359°)

Additional features in the "Increment voltage" mode:



V_p Start: Starting value at the beginning of a test sequence with incremental voltage increases.

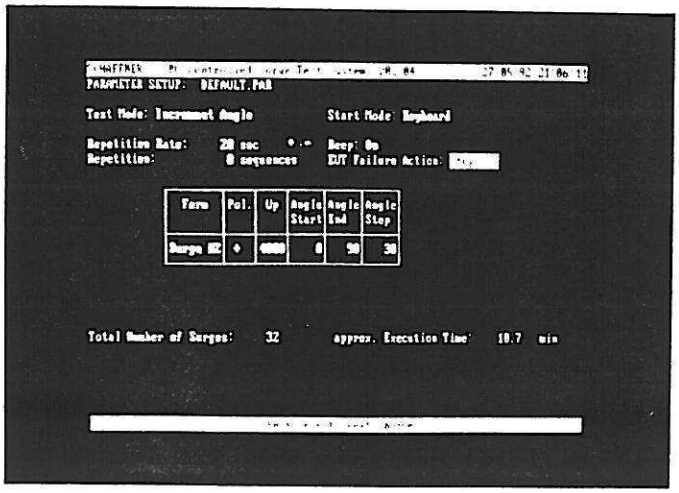
V_p End: Voltage at the end of the test sequence.

V_p Step: Incremental step voltage.
If the "V_p Step" is not an integer divisor of the difference V_p End - V_p Start, the test sequence is terminated after the last integer increment of V_p Step, i.e. V_p End can never be exceeded.

Total number of surges: Display field in which the computer writes the number of test pulses derived from "V_p Start", "V_p End", "V_p Step" and "Repetition".

Approx. execution time: Display field in which the computer writes the total execution time for the whole test sequence based on the Total number of surges and the "Repetition rate".

Additional features in the "Increment angle" mode:



Angle Start: Starting value for a test sequence with a fixed test voltage and incrementally increasing phase angle.

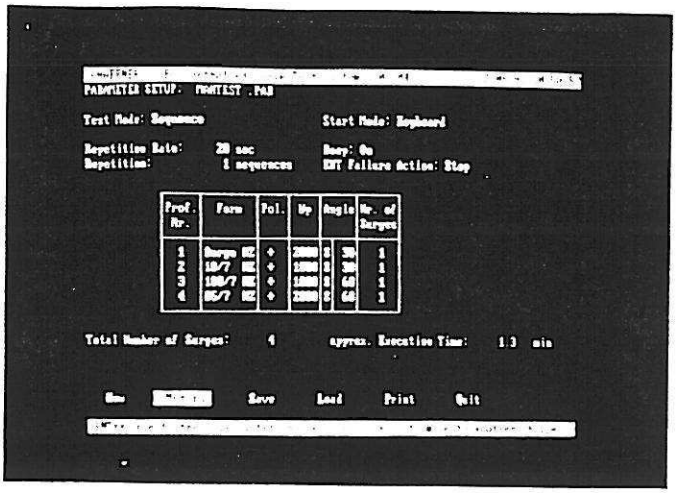
Angle End: Final value of the injection phase angle.

Angle Step: If the "Angle Step" is not an integer divisor of the difference Angle End between Angle Start, the test sequence is terminated after the last integer increment of Angle Step, i.e. Angle End can never be exceeded.

Total number of surges: Display field in which the computer writes the number of test pulses derived from "Angle Start", "Angle End", "Angle Step" and "Repetition".

Approx. execution time: Display field in which the computer writes the execution time for the whole test sequence based on the "Total number of surges" and the "Repetition rate".

Additional features in the "Sequence" mode



This mode enables arbitrary sequences of test pulses to be programmed with a wide variety of pulse types, polarity, pulse voltage and injection angle.

The definition of a single pulse is referred to as a profile and the combination of various profiles gives the test sequence.

Prof. No.: The various profiles are automatically and sequentially numbered. (One line corresponds to a complete pulse profile).

Use the "Ins" key to make way for a new profile between two existing ones or to start at the end of a new profile. In each case the values contains in the previous line are copied down into the new one where they can then be altered as required. This is a practical feature since, in most cases, only one value changes from profile to profile, e.g. the polarity or voltage.

Use the "Del" key to delete the line on which the cursor is positioned.

Moving the cursor around in the table and scrolling is achieved with the cursor and PgUp/PgDn keys.

No. of surges: The numerical entry made for each pulse profile defines how often that pulse is repeated before the program executes the next pulse profile.

Total number of surges: Display field in which the computer writes the total number of test pulses in the sequence derived from the number of profiles x the number of pulses per profile x "Repetition".

Approx. execution time: Display field in which the computer writes the total execution time for the whole test sequence based on the "Repetition rate".

The input/output field is exited with "Esc" and the cursor jumps back to the command line.

The test program can be backed-up in the current directory by means of the **S**ave command. The computer asks for a file name which, in keeping with DOS convention, can consist of up to eight characters. Special characters and spaces should not be used. The extension, .PAR, is added automatically by the software.

The current data-file can be printed out with the **P**rint command. All the profiles are listed. of course, not just the four lines that are shown at any one time on the screen.

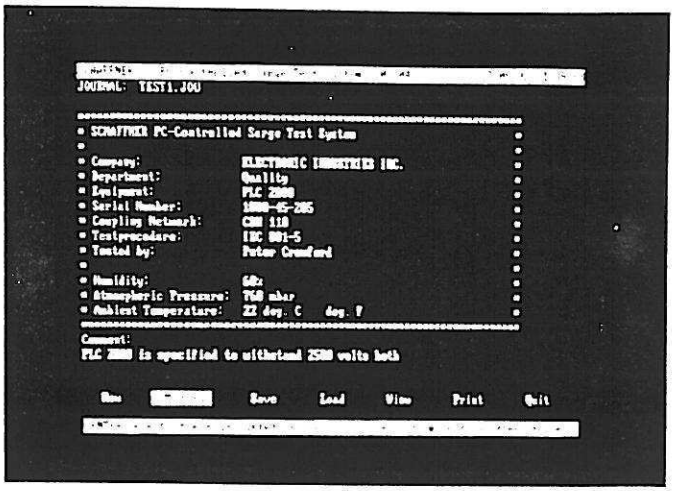
Load brings all the parameter data files in the current directory onto the screen. (Scrolling with the cursor or PgUp/PgDn keys). Pressing ENTER loads the chosen file which then becomes the active parameter set-up.

Use the **M**odify command to jump into the input/output field in order to alter an existing set-up. The manner in which it works is similar to **N**ew. The amended parameter settings can either be stored under the same name (by over-writing) or as a new file with a different name according to need.

A return to the main menu is made with **Q**uit. The current parameter settings are maintained and are automatically transferred into the test menu.

4.7.4 Journal

The measurement report print-out is prepared in the journaling menu. This menu item can be jumped over if no print-out is required.



The print-out has a header that contains a number of pieces of information that describe the conditions under which the test has been carried out.

The leading frame contains a summary of information that belongs in the definition of a test report such as company identification, EUT, test procedure, ambient conditions, etc.

Below this is a field for remarks which can be used like a text editor or a text processor to add further details about the EUT to the report. The length of the remarks is limited only by the amount of memory space available.

A default screen (DEFAULT.JOU) is shown by the computer when the menu is called up; the values given are those that were last stored under this name.

The cursor can be made to jump into the report frame by activating **New** in the command line after which the various predefined fields can be completed.

Use **Esc** to leave the input/output field and bring the cursor back into the command line. Executing the **Save** command stores the report text file in the current directory for which the computer requests a suitable file name. This can consist of up to 8 characters in keeping with the DOS-convention. Special characters and spaces should be avoided. The .JOU extension is automatically added by the software.

The current report can be printed out with the **Print** command. After a test run with data logging, the printout also contains the stored test data.

The **Load** command displays a list of all the reports that are in the current directory. Use the cursor keys or PgUp/PgDn to scroll through the list. Press ENTER to load the selected file which then becomes the current journal.

Use the **Modify** command to enter the input/output field to change an existing item. The function is similar to **New**. The modified text can either be stored under the same name (over-writing) or stored separately under a new name.

View brings the current journal onto the screen. This function shows the whole content of the report including data that has been recorded during one or more test runs. Use the cursor keys or PgUp and PgDn to scroll through the whole report. No text changes can be made in the **View** mode. If the current journal has not yet been put through a test run to have test result data added to it, a message saying "No measurements available" appears on the screen.

Use **Quit** to return to the main menu. The current journal is kept and is automatically transferred to the test menu.

Three different files relating to the journal are stored in the current directory automatically by the program. The files all have the same, chosen name, (such as TEST) but differ in the extension that is added by the program, thus:

TEST1.**JOU**	is the control-file for creating the journal
TEST1.**JO1**	contains the measurement data
TEST1.**PRN**	is a print-file which contains the whole journal, i.e. report header, text field and measurement data.

The files with the extension .JO1 and .PRN are pure ASCII files and can therefore be read and further treated in any editor program (under DOS or a utility program such as PC-Tools or Norton Commander) or, even better, in any text processing program (such as MS-Word, Framework, Wordstar, etc.).

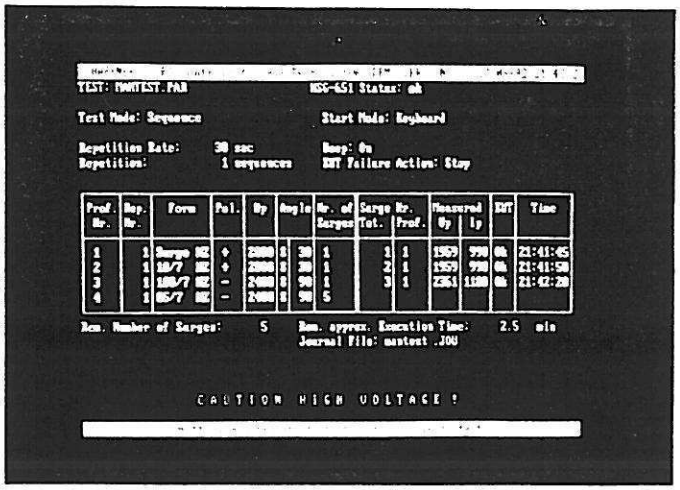
If a journal has to be removed from the data storage medium, care should be taken to delete all three files with the same name. The same remark applies to copying a journal to another directory or storage medium.

The special status of the journal-files DEFAULT.JOU, DEFAULT.JO1 and DEFAULT.PRN:

The DEFAULT file is required by the system in order to start up correctly. DEFAULT.JOU is called by the JOURNAL menu upon each new start and remains active until another journal is loaded (Load) or until the initial journal is renamed. The DEFAULT file only ever stores the latest activity, however, i.e. the results of several test runs are not kept. The DEFAULT file should therefore **not** be used as a work-file. (**S**ave with a new name after creating each **N**ew journal).

4.7.5 Test

The prepared test is run in the test menu. The pulse or pulse sequence defined in the foregoing preparatory steps is sent with the correct timing to the generator for execution. There is no way of altering the pulse or control parameters from within the test menu.



At the top left the screen shows the name of the current parameter-file. This is followed by the more important settings and then, in the table, the parameters of the first test pulse. The layout of the table corresponds to the operating mode chosen in the parameter menu.

The cursor jumps to the "Journaling: Yes/No" field when Test is selected (Yes/No: toggle function with the space bar). A decision can be taken here regarding whether reporting is required or not. Even in the case of a correctly prepared journal, prevention of the recording of pulse results can sometimes be useful such as for checking out the test rig.

The name of the current journal is displayed. If necessary, another journal can be called up in this field for the storage of the measurement data. The chosen journal must, of course, exist and be available from the current drive. If this is not the case, the test run cannot be started and an appropriate error message is displayed.

The settings for the test run are completed by setting the field "Do you want to start the test" to "yes" (toggle with the space bar). Up to this moment the generator is in the "Standby" state, that is, the high voltage circuit cannot in any way be activated.

As a final safety measure, the input of the key combination CTRL-G is now requested. This then starts the test run or the automatic sequence of pulses. (Unless the "Start mode" has been set to "External" whereby the generator also waits for an external start command or the interlock safety circuit has not been closed in which case the test is prevented and a relevant error message appears on the screen).

The progress of a test can be followed on the screen. The pulse parameters that have been set are shown together with the test results V_p and I_p as well as the EUT status and the time. Further columns identify the progress of the test sequence, thus:

Prof. Nr.	Corresponds to the number of the profile in the parameter set-up menu.
Rep. Nr.	Depicts the number of cycles in the test sequence.
Nr. of surges	Indicates the number of pulses per profile as selected in the parameter set-up menu.
Surge Nr./Tot.	Counts up the number of pulses triggered in the test sequence.
Surge Nr./Prof.	Indicates the number of pulses triggered per profile.

All the data are deposited in the journal in the same form.

Pressing **ANY KEY** stops the test immediately and sets the generator back to the "Standby" mode.

A test run can be interrupted with the key combination CTRL-I. Although this puts the generator back into the "Standby" state, the test routine can subsequently be continued again by entering CTRL-G. Opening the interlock safety circuit during a test run has the same effect as entering CTRL-I.

A return is made to the command line while inputting commands by means of ESC, by breaking off or terminating the test run according to the display by the program through pressing ENTER.

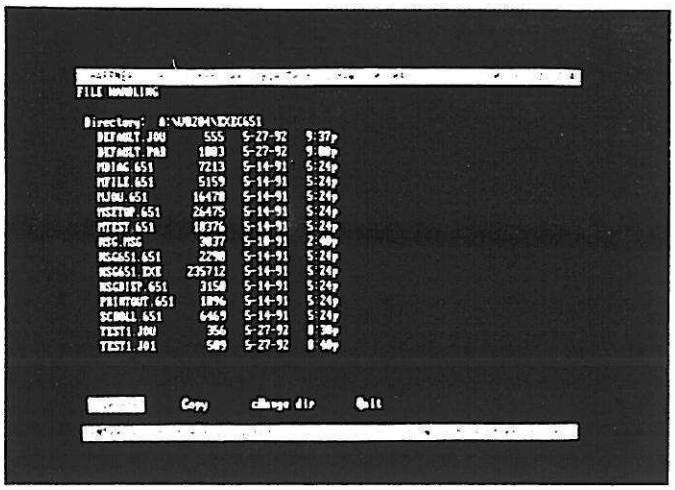
Use **Quit** to return to the main menu.

4.7.6 File handling

The "File handling" menu enables the user to administer his files without having to leave the program to manipulate the files at the DOS level.

The functions available help to maintain order in the various test files and enable them to be copied to other directories or storage media for archiving.

The first 15 of the files available in the current directory are shown on the screen. After executing a command from the command line and jumping into the data field, further files (provided that they are available) can be brought up on the screen by means of the cursor keys and PgUp/PgDn. The highlighted file is the one that is processed in each case.



The following files, at least, are in the NSG 651 PC software:

NSG651	.EXE	NSG651 PC-program
MSETUP	.651	
MTEST	.651	
MJOU	.651	
SCROLL	.651	
MDIAG	.651	.651 files are required by the program for
MFILE	.651	screen presentations.
NSGDISP	.651	
NSG651	.651	
PRINTOUT	.651	
NSG651	.MSG	Screen messages from the program
DEFAULT	.JOU	Start-file for the journal
DEFAULT	.PAR	Start-file for the parameter mask

All these files are needed by the program and must therefore not be deleted.

Files created by the user which can be manipulated as required (copying, renaming, deleting) carry the following extensions:

XXX .PAR	Parameter file
XXX .JOU	Journal control file
XXX .JO1	Measurement data for the journal
XXX .PRN	Print data for the journal

Delete Deletes the specified file. For safety's sake a confirmation is requested.

Copy Copies the specified file to another directory or drive, or duplicates the file under another name.

The instruction sequence that has to be given must follow the DOS-convention rigidly, i.e. drive, path, file name including the extension of the target file.

The greatest benefit of the copy function is to assemble parameter files and journal files that belong together onto a floppy disk that can then be stored separately.

cHange dir Enables a change to be made to another directory. The latter must be on the same drive as the NSG 651 program and must have been created previously.

The instruction sequence follows the DOS-convention strictly, i.e. the path definitions must be given as for the DOS "CHDIR" command.

To maintain order, it is recommended to create sub-directories for the acceptance of user-files and to change to the appropriate one immediately after starting the NSG 651 program. This prevents the system files from becoming mixed with the test program files. This operation can, of course, be accomplished automatically with a suitable batch file.

5 Measurement technique

5.1 General

High voltage pulse measurements fall into a specialist field which requires not just a fair amount of experience but also expensive equipment that is not commonly found in the average laboratory.

The NSG 651 generator contains circuitry for comparative measurements which both relieves the user from the task and simplifies the whole matter.

Auxiliary equipment used in such tests and the test rig itself can, however, make the measurements only relative so that the measurement results cannot be taken as absolute values but rather necessitate a certain amount of interpolation.

Measurements of voltage and current are taken at the high voltage output of the instrument. Within the framework of the given measurement tolerance, these figures thus represent real values at the device under test assuming that this is connected to the pulse output in such a way that cable losses and other effects can be neglected.

Generally speaking, this is true for component tests (varistors, gas-filled surge suppressors, etc.).

If further elements, e.g. coupling networks and non-defined cabling, are installed between the generator and the device under test then the values measured can no longer be taken to be the actual values at the test object. The impedances of the coupling elements and stray losses will correspondingly affect the results.

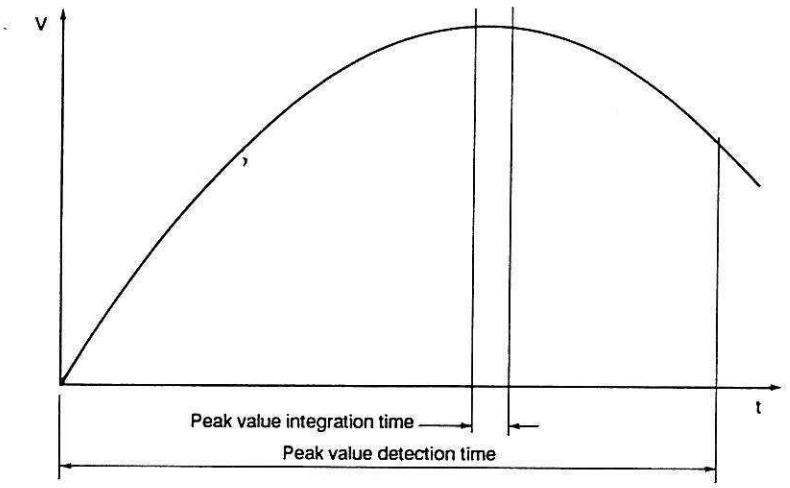
In spite of this, the results obtained can nevertheless be accepted as relative values. They enable comparative measurements to be made between various test objects and, especially, they show quite unmistakably any critical thresholds and the behaviour of the test object. Surge tests typically show up effects such as an electrical breakdown or arcing at a particular test voltage.

5.2 Peak value measurements

The pulse peak values of voltage (V_p) and current (I_p) are measured at the output of the generator, digitized by the instrument itself and displayed as a numerical value on the computer screen during the test procedure as well as being logged in the test report.

Even with the generator output not connected to anything, a peak current value of several Ampères can be recorded which is due to pick-up disturbances in this high impedance situation. This disturbance is eliminated when a network and/or test object is connected and hence the measured value will not be falsified.

A current can be measured when operating the generator with a network, even if no test object is connected. This is a true, voltage-dependent current which is caused by the by-pass elements in the mains filter. In principle, this open-circuit current should be subtracted from the value measured with the test object. In practice, however, the "error" is usually negligible.



Technical specifications: Peak voltage detector (V_p)

Measurement accuracy:	± 5% ± 10 digits (open-circuit)
Measurement range:	0 ... 7000 V
Peak value detection window:	0 ... 150 µs after pulse triggering
Peak value integration time:	1 µs

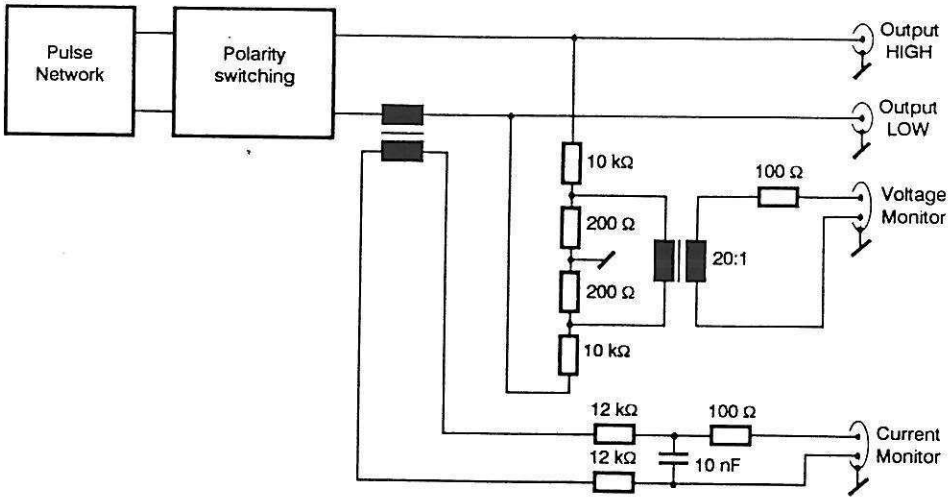
Technical specifications: Peak current detector (I_p)

Measurement accuracy:	± 5% ± 10 digits (short-circuit)
Measurement range:	0 ... 3500 A
Peak value detection window:	0 ... 150 µs after pulse triggering
Peak value integration time:	3 µs

5.3 Measurement monitor

The signals for the voltage and current monitors are taken from the pulse output but are electrically isolated by converters before being fed to the monitor outputs. These can be connected to the high impedance asymmetric inputs of a CRO via the cables supplied which contain filtering elements.

The monitor outputs are designed to handle the 1.2/50 μs - 8/20 μs hybrid pulse. In the case of the "long" telecommunications pulses, the effects that mostly occur during the first part of the pulse are also observable although the measurement pulse falls off rapidly after about 300 μs due to saturation of the transformer.



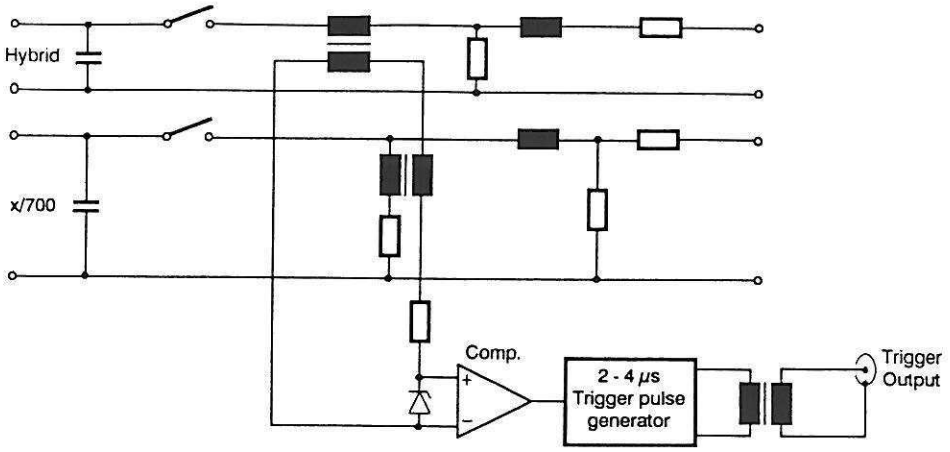
Technical specifications of the V MONITOR

Connection:	Use the cable supplied. BNC connector at the oscilloscope end
Attenuation:	1000:1
Accuracy:	± 5%
Load impedance:	> 10 kΩ

Technical specifications of the I MONITOR

Connection:	Use the cable supplied. BNC connector at the oscilloscope end
Attenuation:	1 V = 1000 A
Accuracy:	± 5%
Load impedance:	> 10 kΩ

A trigger output is provided to synchronize the CRO with the start of the pulse.



Technical specifications of the TRIGGER OUT

Connector:	BNC
Accuracy:	< 1 µs
Pulse width:	2 to 4 µs
V_H:	3 to 5 V
Load impedance:	> 10 kΩ

5.4 Phase angle

A phase-angle detector ensures that the pulse can be superimposed on the mains supply at the programmed phase angle. The mains input to the NSG 651 is taken as a reference so the supply to the equipment under test should be taken from the same phase.

The programmed phase angle represents an average value. The individual pulses are distributed about this value in a roughly Gaussian distribution with the following maximum spread:

HYBRID 1.2/50 µs	up to 4 kV:	± 15°
	over 4 kV:	± 25°

An external reference input can be added to the NSG 651 if the phase of the EUT supply is not identical with that of the generator supply (and the difference cannot be compensated by the computer). This modification may only be incorporated by a SCHAFFNER Service Center.

6 Operation

6.1 Installation

The following checks should be carried out before the instrument is installed for the first time or after it has been transported or had significant changes made to the associated test rig:

- Inspect the instrument as well as all the accessories and check for any transport damage. Any such damage found must be reported immediately to the transportation company.
- Check the setting of the voltage selector and the integrity of the fuse. Adjust the voltage selector if necessary to conform with the local mains supply:
- Set to 230 V: for mains supplies with a nominal value of between 220 Vac and 240 Vac, 50/60 Hz. Fuse: 2 A, slow-blow, 5 x 20 mm
- Set to 115 V: for mains supplies with a nominal value of between 100 Vac and 120 Vac, 50/60 Hz. Fuse: 2 A, slow-blow, 5 x 20 mm
- To change the fuse or reset the voltage selector, release the cover on the combi-connector with a screwdriver then hinge it out. Extract the drum of the voltage selector then replace it in the correct position.
- Allow the instrument to dry out thoroughly before installing it if any condensation has occurred.
- Operate the instrument only in a horizontal position.

6.2 Operation

The safety measures given in Section 2 are to be rigidly observed when operating the generator type NSG 651 or any of its accessories. Particular attention is drawn once again to matters concerning personal safety, cabling, **earthing** and disturbance in nearby installations.

When using coupling networks and additional system components, the safety precautions contained in the relevant operating instructions must be followed.

Coupling networks and connections to test enclosures and similar items must be correctly connected before the generator is switched on.

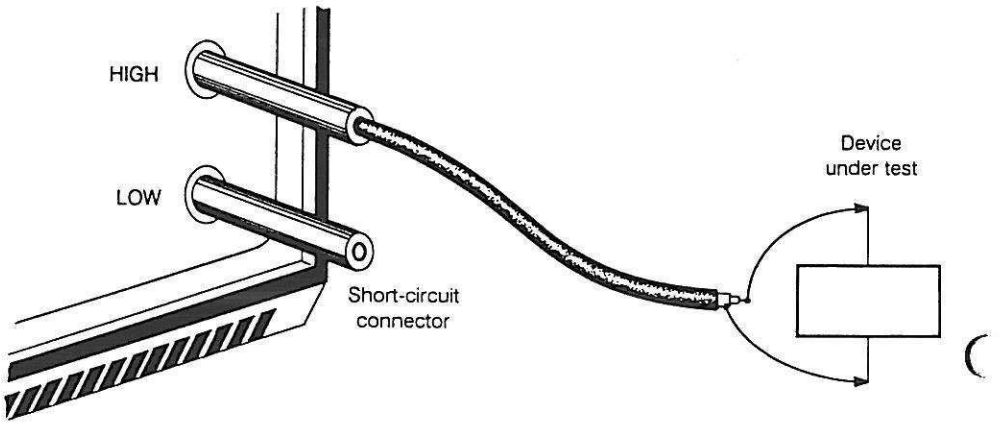
Earth leakage circuit breakers cannot be used in the supply as they will trip immediately due to the additional leakage current in the coupling elements.

The requirements concerning the control computer, the installation of the software and the handling of the diskettes are all described in Section 4.1.

6.3 Tests

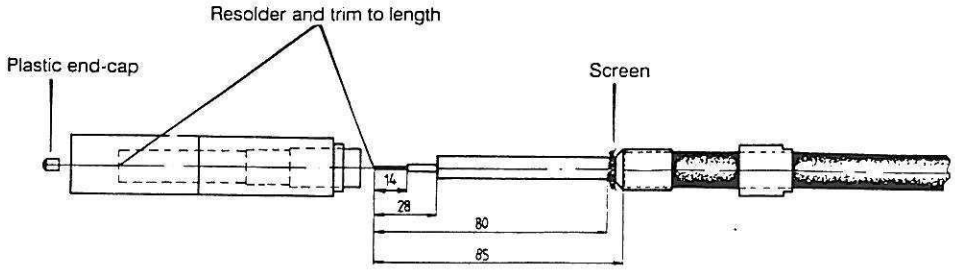
6.3.1 Component tests

Component tests are defined as those carried out on individual elements without the pulses being superimposed on a mains supply. The differential concept of the generator is not utilized for such work. For the sake of simplicity, the LOW output is short-circuited to earth and the component to be tested is connected between the core and screen of a coaxial cable.



A certain amount of care is needed with the wiring of the HV connectors. Once the connector has been taken apart, the plastic safety cap has to be removed and put safely aside. Prepare the cable as shown in the diagram and make sure that the pre-tinned central conductor protrudes a few mm through the solder sleeve. Flow a sufficient amount of solder carefully into the sleeve to make a good connection to the core of the cable while preventing any solder from coating the outside of the sleeve (otherwise the plastic cap cannot be re-mounted correctly). Trim the central conductor back so that it is flush with the edge of the insulating tube. Replace the plastic cap.

A short-circuit connector can be made by using a length of suitable diameter multi-strand wire soldered into place as above with its tail-end fanned out over the cone of the earthy outer sleeve.



See Section 8.5 for details of the wiring of the interlock connector.

The construction of complete and safe test rigs is simplified by the use of accessories such as connectors, cables, test enclosures, warning lamps, etc. as listed in Section 12.

6.3.2 With coupling network CDN 110

The surge voltage coupling network type CDN 110 serves to inject the pulses into a mains feed for tests on instruments and systems. It conforms to the Standards and Recommendations IEC 801-5, prEN 50082, ANSI-IEEE C62.41, VDE 0109, etc.

The requisite coupling modes and test parameters can be found in the relevant standards and test specifications.

The CDN 110 is supplied with the matching connectors for connection to the NSG 651. All the cable links must be correctly connected before the test system is switched on.

The NSG 651 safety circuits are looped through the coupling network. After connecting the two units together, the interlock plug from the NSG 651 must be inserted in the socket on the CDN 110 to complete the circuit. Wiring of the safety contacts can be found in Section 8.5.

Further details can be found in the documentation relating to the CDN 110.

6.3.3 With coupling network CDN 116

The coupling network type CDN 116 enables 1.2/50 μs surge voltage tests to be carried out on signal, data and control lines. It conforms to the requirements of IEC 801-5, prEN 50082-2, etc.

The CDN 116 is equipped to work with one pair of conductors. A number of CDN 116's can be linked together to cope with multi-core cables.

The test parameters can be found in the relevant standards and test specifications.

All the cable links must be correctly connected before the test system is switched on.

Matching connectors to mate with the NSG 651 and CDN 116 are available as accessories.

The CDN 116 is not suitable for x/700 μs pulses.

Further details can be found in the documentation relating to the CDN 116.

6.3.4 With other coupling arrangements

If the user's own coupling equipment is to be used this must be fitted with the correct connectors and cables. Suitable material is listed in Section 12.

Great attention must be paid to the wiring of the safety circuits in order to ensure that the safety philosophy implemented in the concept of the NSG 651 is not corrupted.

7 Communications-protocol

A user, who operates the generator with a PC and the software supplied, does not need to concern himself with the details of the information flow through the interface.

Knowledge of the communications-protocol is only necessary if:

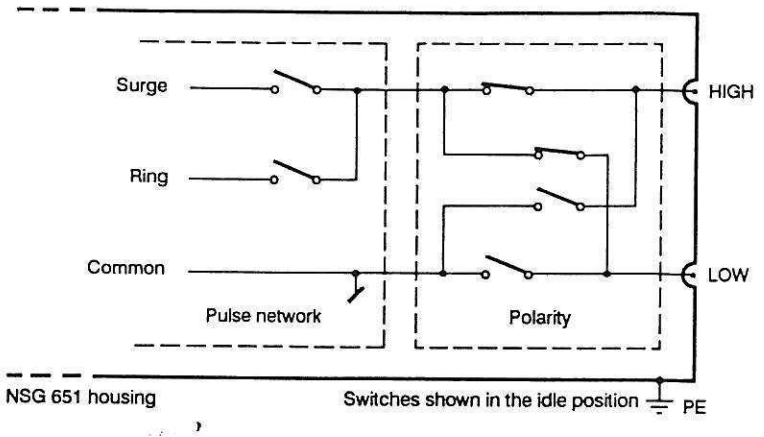
- The NSG 651 is to be integrated software-wise into a whole system concept.
- Another, non PC-compatible control computer is to be used.
- Special software is to be written for a particular application.
- Single commands are to be transferred to the generator from an ASCII-terminal.

The specification of the protocol, the command structure, error messages, etc. can be found in a separate publication:

NSG 651
Communications-protocol

8 Input /output connections

8.1 PULSE OUTPUT

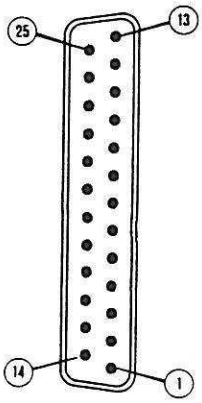


8.2 SERIAL INTERFACE

Instrument connector: Canon DB 25-pin, female

The NSG 651 is wired as a DCE so that a commercially available, 1:1 wired RS 232C cable can be utilized (25p-to-25p or 9p-to-25p depending on computer type used). A null-modem is not necessary.

Pin-out of the RS 232C port on the NSG 651:



Pin No.	Function
1	Protective earth
2	TXD: Transmit data
3	RXD: Receive data
7	Signal earth
18	+ 12 V } Supply to the
25	– 12 V } opto-link

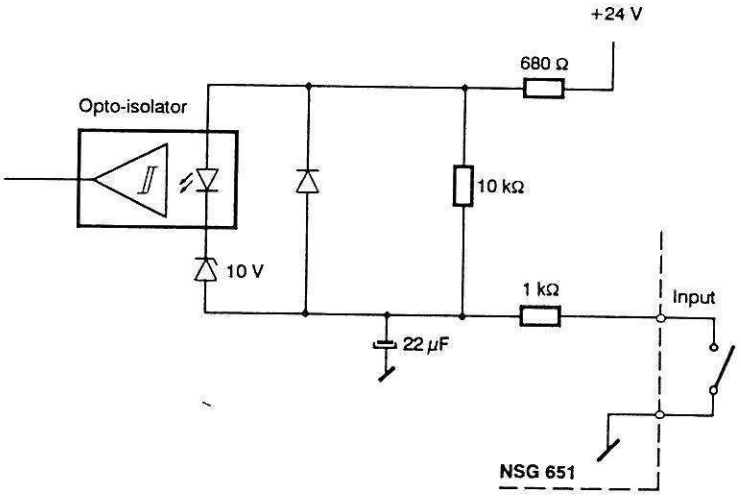
All the other pins are unused.

Technical specifications of the RS 232C interface:

* RS 232C	
* Transmission rate	9600 Baud
* Data bits	8
* Parity	Even
* Stop bits	1
* Control signal	None

8.3 EUT FAIL and EXT. START Input

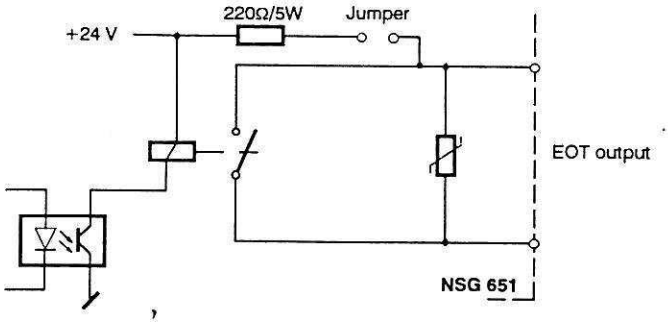
* Electrical isolation	Via opto-isolator
* Sink current	< 10 mA
* Input delay	10 ms typ.
* Electric strength of the opto-isolator	2000 V min.
* Operating mode	Control by transistor or contact to earth



8.4 EOT

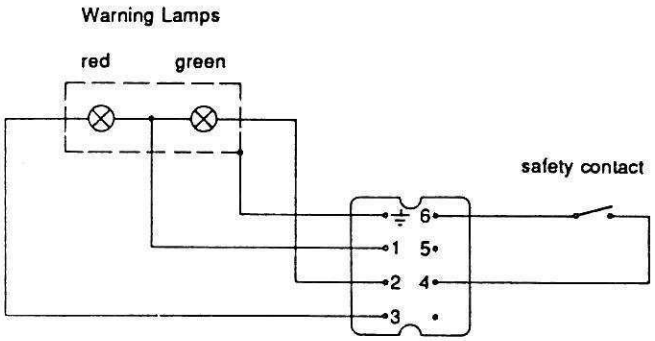
EOT output

* Electrical isolation via relay
* Normally open contact, switching capability 230 Vac / 1 A
* Built-in contact protection



8.5 INTERLOCK

Wiring of the interlock connector



INTERLOCK connector

Technical specification

Supply to the warning lamps 230 Vac, 60 W max.
Supply to the safety contacts 230 Vac, 100 mA max.

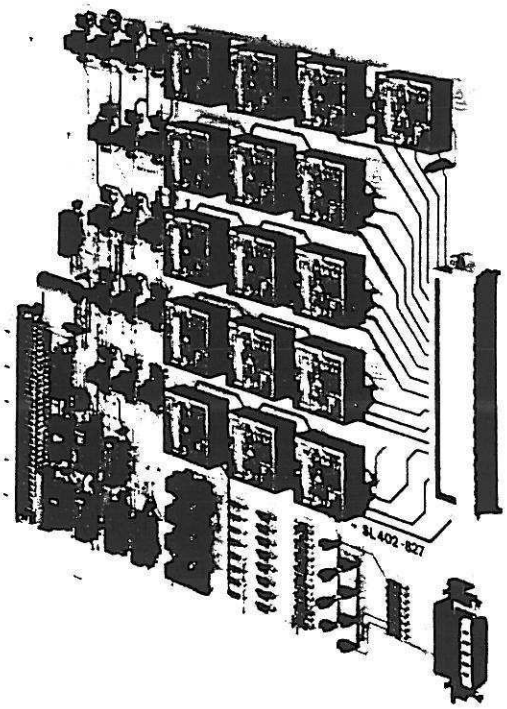
The generator cannot be operated without the INTERLOCK connector. If no safety contact is included in the test rig, a wire link must be inserted in the connector to simulate the existence of such a contact (this is how the connector is wired upon delivery from the factory).

8.6 I/O extension

Optionally, an I/O-board (INA 650) with 8 digital inputs and 16 digital outputs can be inserted at the rear of the generator.

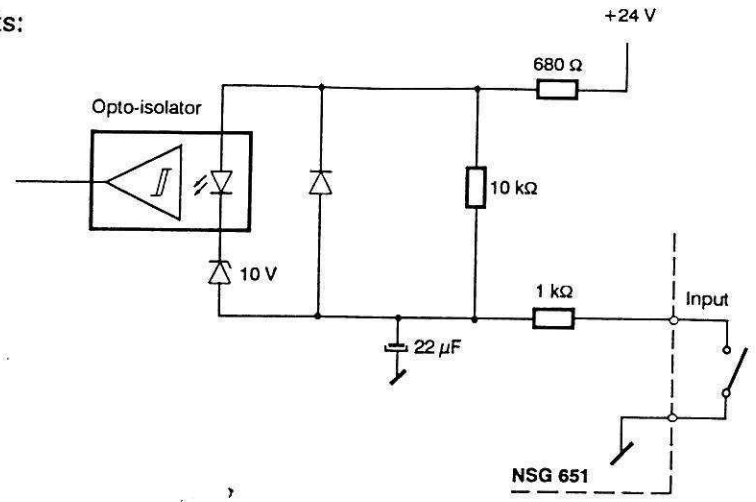
The extension facility is foreseen for widespread automation of the test procedure, e.g. for controlling coupling networks, component feeders or similar items.

The present NSG 651 program does not service these options. The relevant commands are, however, implemented in the NSG 651 communications protocol and are hence accessible for a specific control program (see also Section 7).



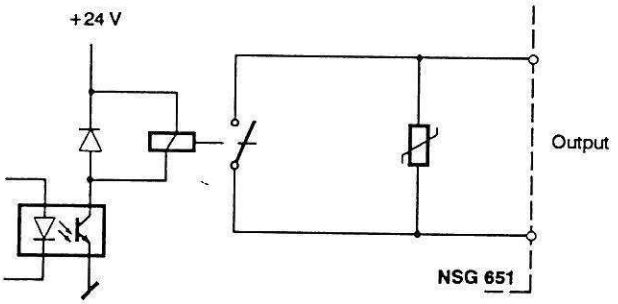
Technical specifications and wiring

Inputs:



* Electrical isolation: Via opto-isolator
* Sink current: < 10 mA
* Input delay: 10 ms typ.
* Electric strength of the opto-isolator: 2000 V min.
* Operating mode: Control by transistor or contact to earth

Outputs:



* Switching capability 250 Vac / 1 A
* Built-in contact protection
* Normally open contact

9 Technical specifications

Instrument supply	115 or 230 Vac, +15%/-20% 50/60 Hz, 115 W approx.
Type of pulses:	
Hybrid pulse	1.2/50 µs (open-circuit) 8/20 µs (short-circuit) 200 V to 6.6 kV ± 10% up to 3.3 kA at 6.6 kV dynamic impedance: low 2 Ω high 12 Ω
Surge pulse	10/700 µs 100/700 µs 0.5/700 µs 200 V to 6.6 kV up to 550 Amps dynamic impedance: low 15 Ω high 40 Ω
Polarity	+ / -
Pulse outputs	Floating
Controls	No front panel controls All functions controlled via PC with the NSG 651 operating software
Type of PC	IBM compatible with min. 640 kB of memory
Port	Serial, RS 232C (COM 1)
Program menus	Diagnostics Parameter setup Journal Test File handling
Operating modes	Single pulse Increment voltage sequence Increment phase angle sequence User-defined test profile sequences

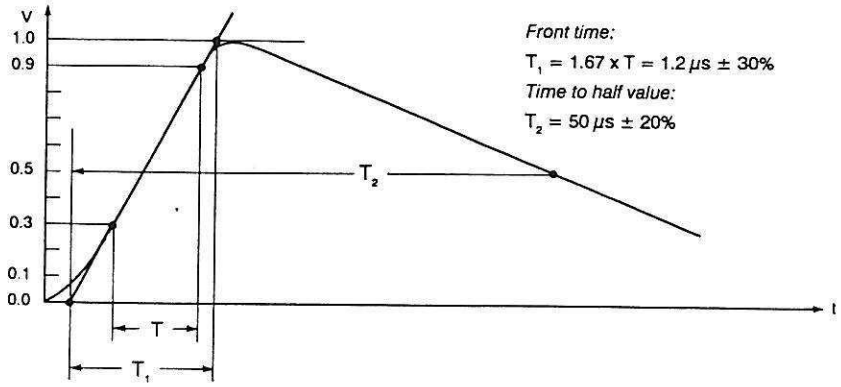
Parameters	Type of pulse: 1.2/50 µs 8/20 µs 10/700 µs 100/700 µs 0.5/700 µs Impedance Voltage Voltage step Polarity Synchronous / asynchronous Phase angle (relative to line) Phase angle step Repetition rate Number of surges Number of sequences
Start trigger	Keyboard and externally applied signal
Peak detector	V_p and I_p measured at output and logged digitally in the result table
EUT failure	Stop or continue mode
Optional aux. I/O	8 inputs, 16 outputs, isolated
Monitor outputs	V(t), I(t) for an oscilloscope
Test reports	Automatic recording of test setup and test results with user-definable header
Safety interlock	Hardware and software safety provisions
Self diagnosis	On power-up or on request, reports statistics
Dimensions	Width: 449 mm (17.7") Height: 310 mm (12.2") Depth: 500 mm (19.7")
Weight	42 kg (92.5 lbs) approx.

10 Pulse form definitions

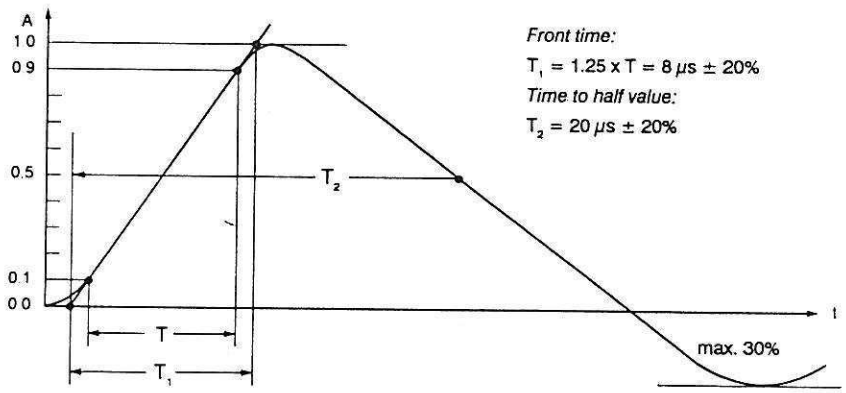
Idealized pulse specifications, as they appear in the corresponding Standards, are shown below by way of reference.

Further information and specifications regarding test procedures can be found in the relevant official documents.

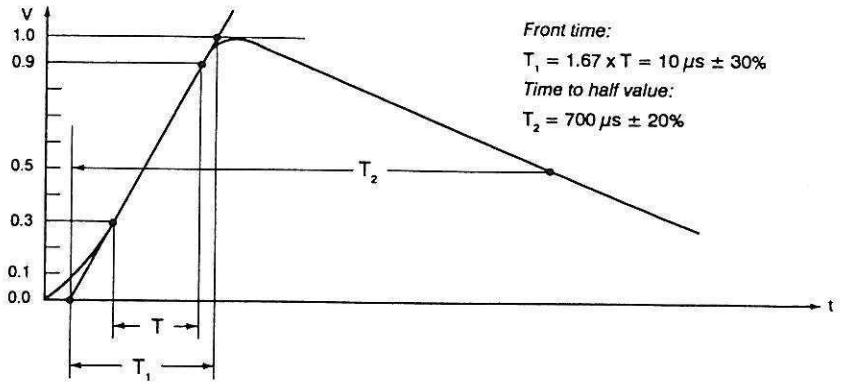
Surge pulse as per IEC 801-5 or IEC 60-2



1.2/50 µs pulse shape (open-circuit)



8/20 µs pulse shape (short-circuit)



10/700 µs pulse shape (open-circuit) as per IEC and CCITT

11 Maintenance and function check

There are no adjustable items inside the instrument, either for calibration or service purposes, that are accessible to the user.

The instrument housing must not be opened. In the event of any repair or adjustment work being necessary, the whole instrument should be returned to a SCHAFFNER Service Center accompanied by an order and/or a full description of the fault.

Maintenance work by the user is confined to cleaning the exterior and carrying out a function check:

Cleaning

A damp cloth is usually sufficient to clean the housing. A mild, non-abrasive household cleanser may be used if necessary.

No chemicals should be used for cleaning purposes. Switch the system off completely and disconnect the mains supply before cleaning is undertaken.

Function check

Attention: The safety measures already described must also be strictly observed during a function check!

A thorough function check is normally carried out automatically by the NSG 651 PC-program and reported by means of its status messages.

Once the system has been switched on, the generator goes into the STANDBY state (green LED) and the ERROR indicator (yellow LED) remains unlit. If this is not the case, check the mains connection, fuses and cabling taking the usual precautions.

The NSG 651 starts to communicate with the computer once the program is started. (Check carried out with the 'Selftest' in the diagnostics menu).

If there is no reaction, check all the connections and the cable to the RS 232C port or the opto-link.

A check should also be made to ensure that the correct program package is being used, namely the NSG 651 OPERATING SOFTWARE. (The simulation program, NSG 651 TRAINING SOFTWARE, does not access the interface port).

The generator cannot switch to its active state (OPERATIONAL) if the safety contact connected to the interlock connector is open circuit.

Pulse generation can be observed on an oscilloscope by means of the special cables connected to the MONITOR sockets. This can usefully be employed as a function check but should never be interpreted as a reference or as a calibration measurement.

12 Ordering information

NSG 651 High Energy Pulse Generator
The unit is supplied complete with operating software, training software (both running on an IBM-PC or compatible), filtered monitor cables for an oscilloscope and is ready to be interconnected with the optional pulse coupling networks.

Optional accessories

CDN 110	Surge coupling network, single phase
CDN 116	Signal-line coupling network
INA 120	Test enclosure
INA 121	Component test box
INA 140	Warning lamps
INA 161	Brackets for mounting in a 19" rack
INA 301	Opto-link set, 10 m, powered from data-lines
INA 303	Opto-link set, 10 m, with 230 Vac power supply
INA 304	Opto-link set, 10 m, with 115 Vac power supply
150-828	HV coaxial connector (to use unit without CDN 110, e.g. for component testing) 2 off are needed
402-741	HV coaxial cable, 2m

13 Warranty

SCHAFFNER grants a guarantee of 1 year on this instrument, effective from the date of purchase.

During this period, any defective component part will be repaired or replaced free of charge or, if necessary, the instrument will be replaced by another of equivalent value. The decision regarding the method of reinstating the functional capability is at the sole discretion of SCHAFFNER.

Excluded from the guarantee are damage or consequential damage caused through negligent operation or use as well as the replacement of parts subject to degradation.

The guarantee is rendered invalid by any intervention on the part of the customer or a third party.

The goods are to be returned in the original packing or other equivalent packing suitable for the purpose of the foreseen means of transport. The SCHAFFNER company can accept no responsibility for damage in transit.

Notes

Schaffner Elektronik AG
CH-4708 Luterbach
Switzerland
Telephone (065) 41 11 81
Telex 934 491 scha ch
Telefax (065) 42 14 04

Subsidiary companies
Tochtergesellschaften
Succursales

Schweiz:
ALTRAC AG
Mühlehaldenstrasse 6
CH-8953 Dietikon
Telephon (01) 741 46 44
Telefax (01) 741 19 60

Deutschland:
Schaffner Elektronik GmbH
Schoemperlenstr. 12
D-7500 Karlsruhe 21
Telephon (0721) 56 91- 0
Telex 7 826 671 schaf d
Telefax (0721) 56 91- 10

France:
Schaffner S.A.
5, rue Michel Carré
F-95100 Argenteuil
Téléphone (13) 947 86 36
Télex 608 723 schafra f
Télécopieur (13) 947 02 28

USA:
Schaffner EMC Inc.
9-B Fadem Road
Springfield, NJ 07081
Phone (201) 379 7778
Toll free 800 367 5566
Telex 910240 2985 schaff UQ
Telefax (201) 379 1151

United Kingdom:
Schaffner EMC Ltd.
Ashville Way
Molly Millar's Lane
Wokingham
Berkshire RG11 2PL
Phone (0734) 77 00 70
Telex 848 235 schemc g
Telefax (0734) 79 29 69