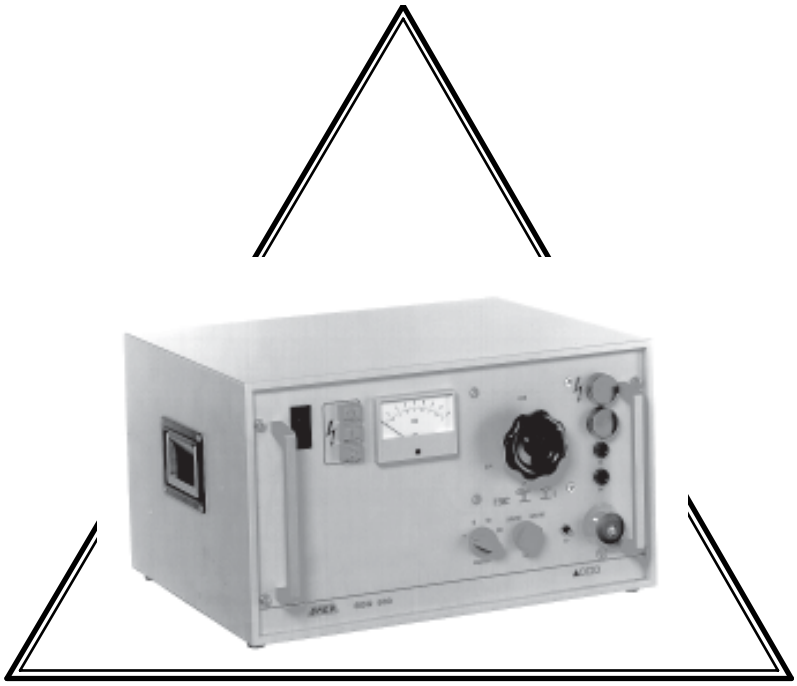
Operating Instructions

Surge Voltage Generator
SSG 500



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Guide to this Operating Instruction

Observe info signs!

For fast finding of important information the corresponding text passages are marked with symbols (symbols not stated here are self-explaining).

More and special information concerning the respective subject are available from BAUR.

Important unit information!
In any case, read carefully!

Important information text.

Copyright

Subject to modification!

In the interest of our customers we reserve the rights for modifications due to technical progress.
Illustrations, descriptions and delivery content are therefore not binding.

Preface

This manual contains all information necessary for the correct handling and use of the surge voltage generator SSG 500. Before using the surge voltage generator, please read carfully this Operating Instruction:

If you have any question, please contact directly:

BAUR Prüf- und Messtechnik GmbH, Raiffeisenstrasse 8
A-6832 Sulz / Austria

Tel +43 / 55 22 / 49 41-0
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or refer to your nearest BAUR representative.

Safety Precautions

The surge voltage generator SSG 500 is built in accordance with today's state of engineering and is safe to operate. Individual components and the finished unit are inspected continually by our qualified staff within the framework of our Quality Assurance Provisions. Each unit is subjected to thorough testing prior to shipment.

Safety Precautions, Continued

Please read now and avoid damage and injury later!

It is imperative to every person who is involved with the installation, start-up, operation and maintenance of the SSG 500 to have read and understood the complete Operating Instruction.

It is the responsibility of the customer to ensure that only authorized persons may be allowed to use the surge voltage generator SSG 500.

Only authorized personnel!

The user
- is qualivied and properly instructed and has the necessary experience.
- knows the relevant standards, accident prevention rules and operating conditions.
- is able to carry out the necessary operations and is aware of the possible dangers involved.
- must immediately inform his superior about any conditions of the unit that coult affect safety.

Use the SSG 500 unit as directed!

The surge voltage generator SSG 500 is used for cable fault location at layed power cables.

Any other or additional use is deemed to be in contravention of the intended use. The manufacturer shall not be liable for damage resulting from any such us. In such a case the risk shall be borne solely by the user.

The local safety and accident prevention regulations are always applicable to the operation of the surge voltage generator unit.
Especially the surge voltage generators may not be used in potentially explosive atmosphere or at test objekts which are in service.

Garantie

At the customer's **written request** we undertake to repair or replace at our discretion and as quickly as possible allparts that become faulty or useless as the demonstrable result of poor material, faulty design or defective execution.
We bear the costs for repairs and replaced parts, exclusive transportation of the goods, packing and insurance.

12 month warranty time

The **12 month** warranty time starts with delivery.
We shall bear the costs of any faulty parts requiring replacement, but not the costs of transport to us an back to the customer, not the costs of packing and insurance! We shall not be liable for any damage resulting from normal wear and tear, improper handling, non-observance of Operating Instruction and safety regulations. We shall also refuse to accept any liability if the customer carries out repairs or changes to the unit himself or has others carry out them! The warranty does not cover damage in transit, batteries, fuses and any readjustments in accordance with the Operating Instruction!
We draw attention in addition to the **"General Terms of Sales and Delivery"**.

Contents

Notes

1. Product Information

Overview

In this section you will find all necessary product information for the Surge Voltage Generator SSG 500.

This section covers the following subjects:

Design and function

Design

Instruments of the SSG family are rack mounting units in the 19" format. Various operating and indicating elements are mounted on the front panel, connecting elements are mounted on the back-plate. The instruments contain their own high voltage generator, impulse-proof surge capacitors, automatic and manually triggered spark gaps and an internal discharge device.The instrument control contains the necessary safety circuits also for connection of an external Emergency Stop unit and for the operation of the SA 32 option.

High voltage generation

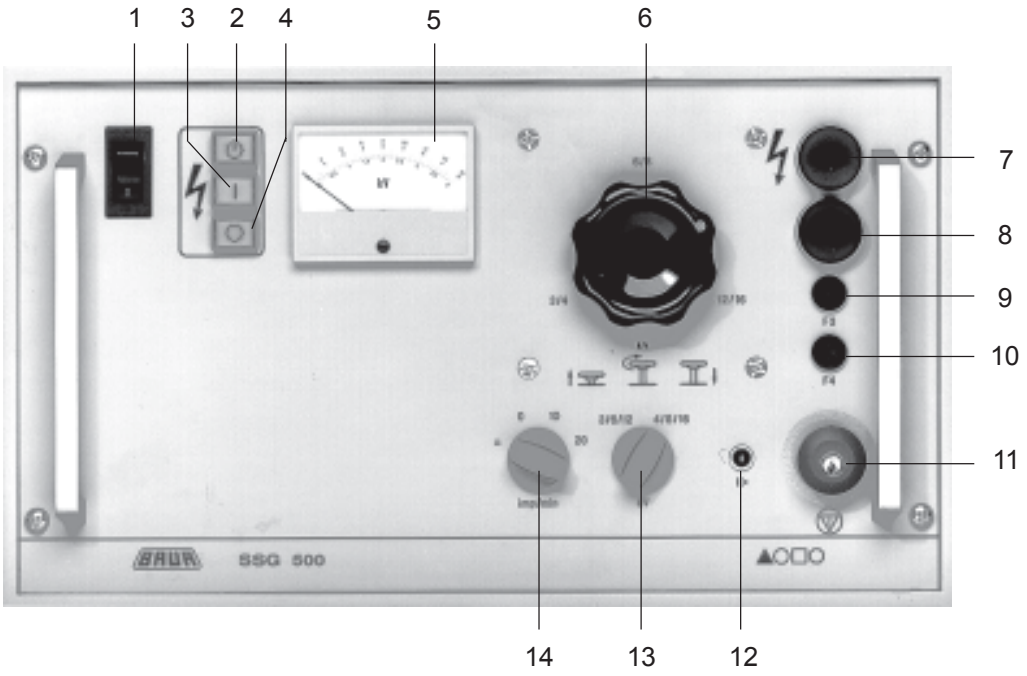
The mains voltage is applied to the primary winding or a tapping of the primary winding of the high voltage transformer via the reduction switch (13), depending on its position.The secondary windings of the high voltage transformer features four high voltage windings, fully isolated of each other, which are connected each to a partial capacitor through a half-wave rectifier. With the aid of the range selector switch (6) the partial capacitors become connected to each other. The series connection allows a maximum voltage of 16kV. The connection of two capacitors each in series and parallel allows a maximum 8kV and the complete parallel connection of the capacitors leads to a maximum voltage of 4kV. In this configuration it can be accomplished, that the maximum surge energy of the capacitors is available in three voltage ranges. Through the selection of the three ranges 3 / 6 / 12kV using the reduction switch (13) 56% of the surge energy are available.

Function

The Surge Voltage Generator SSG 500 is designed in such a way that it generates pulse-shaped voltages with a steep edge, which should start to break down the cable fault. The high surge current flowing at the cable fault generates electromagnetic and acoustic waves which radiate from the cable fault. These waves can be detected on the ground surface with appropriate detection devices such as search coils or ground microphones. The SSG 500 however can also be implemented for pre-location. In this case it is used as burn down device for short time operation or it can be used with an echometer and the SA 32.

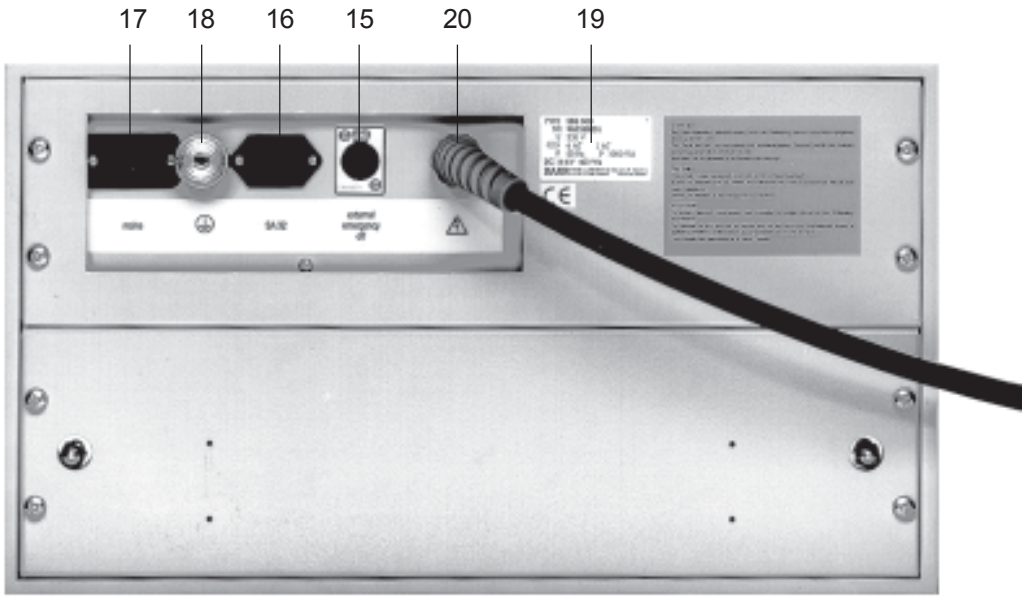
Display and operating elementes

Front panel



1 **Mains switch** as overload protection switch with thermal release
2 **Pushbutton switch „Ready to switch on“** (⏻)
3 **Pushbutton switch „H.V. On“** (**I**) with warning lamp for high voltage clearance. The indicator lamp serves as feedback for the operating state „IN OPERATION“
4 **Pushbutton switch „H.V. Off“** (◯) returns the instrument into the operating condition "READY FOR OPERATION“.
5 **Voltmeter** of class 1.5 for display of output voltage in kV
6 **w** 4 / 8 / 16kV
7 **Red indicator lamp** for feedback of operating condition „READY TO SWITCH ON“ and „IN OPERATION“
8 **Green indicator lamp** for feedback of operating condition „READY FOR OPERATION“
9 **Fuse F3** (3,15A slow-blow) for control of lifting magnet and control of SA 32 (option)
10 **Fuse F4** (3,15A slow-blow) for control of lifting magnet and control of SA 32 (option)
11 **EMERGENCY OFF SWITCH pushbutton (lockable)** for activating the EMERGENCY OFF function and to protect against unauthorized switching on
12 **Overload protection switch** with thermal and magnetic tripping
13 **Reduction switch** for voltage reduction to 3 / 6 / 12 kV (56% surge energy)
14 **Mode selector switch** for selecting operating modes „D.C. operation“, „Zero position“, „Impulse sequence 10/min“, „Impulse sequence 20/min“.

Backplate



15 **Connection socket for external EMERGENCY OFF unit with jumper plug**
16 **Connection for mains to SA 32**
17 **Connection for mains**
18 **Terminal for connection of protective earth lead**
19 **Type plate**
20 **High voltage connecting lead**

Technical data

	SSG 500	unit
Mains voltage	see type plate	
Mains frequency	45 to 60	Hz
Max. power consumption (at short ciruit condition)	1.500	VA
Max. output voltage	16	kV
Max. surge energy	512	Ws
Accuracy of kV-meter	1,5	%
Dimensions of housing (W x H x D)	502 x 286 x 390 mm	
Weight	48	kg

Notes

2. Packing and Shipping

The instruments are shipped in robust cardboard cartons on wooden pallets. If the instruments are not used immediately, always keep in closed carton and store in dry rooms!

Damage during transport

Complaints concerning damages should be made to us without delay, using a standard transport damage claims form.

Confirmation of visible damage should immediately be obtained from the carrier.
The extent and the probable cause of damage should be stated.

If damage is discovered during unpacking, contact the responsible transportation company **immediately**. Request a written loss assessment and make them responsible for the damage!

We also refer to the “General Terms of Sale and Delivery„ of:

BAUR Prüf- und Messtechnik GmbH,
A-6832 Sulz / Austria

Notes

3. Placing into operation

Overview

In this section you will find all necessary information to put the Surge Voltage Generator SSG 500 into operation.

This section describes the following subjects:

The surge voltage generators of the SSG family are primarily intended for use in the field of power cables. Do not use them for data transmission cables or communication cables!

Operating modes

Impulse operation

The impulse operation serves first of all for fault locating and is divided into manual and automatic impulse triggering.The mode selector switch (14) allows to switch between positions „Zero position“, „Slow impulse sequence“ and „Fast impulse sequence“ even during operation and under voltage.

Manual impulse triggering

Manual impulse triggering is primarily intended for application of the surge voltage generator in pre- locating, as for example in connection with the Intercom SA 32 (option) and the echometer. By applying the secondary impulse method in high resistance faults, an assessment of the fault distance with one or a few impulse trigger actions can already be made.

- If instrument is in operating condition „IN OPERATION“ place operating mode selector switch (14) from zero position into = position momentarily and reset again.

Automatic impulse triggering

Automatic impulse triggering is primarily used for pin-pointing a cable fault.

The SSG 500 is equipped with a timer coupled to the mains frequency which allows automatic impulse triggering with impulse frequencies of 10/min and 20/min. The regularity of the subsequent impulses serves to better differentiate between the signals of the fault location and interferences.

- Switch operating mode selector switch (14) to impulse sequence 10/min or 20/min.
  - If the instrument is in the operating condition „READY TO SWITCH ON“ it closes the spark gap automatically according to the appropriately selected impulse sequence.

DC Operation

The Surge Voltage Generator can be put into D.C. operation via the mode selector switch (14).

- Turn mode selector switch (14) to the fully left position =.
  - The spark gap will be permanently closed and therefore connects the high voltage output directly with the surge capacitor.

Fault location

In D.C. operation, with the surge capacitors connected, the voltage is increased until the cable fault breaks down. This mode of operation is recommended especially for estimating the breakdown voltage in order to conduct an optimal range selection for the impulse operation. In combination with the SA 32 option and the echometer, the D.C. operation can also be implemented in pre-locating of cable faults.

Testing

D.C. voltage tests can also be conducted in the D.C. operation.It is however important that the connected surge capacity, in case of a breakdown, is discharged through the fault location and that the surge generator switches to burn down operation. The instrument protects itself from overloads switching off automatically after a certain time by the overload protection switch (12). During short-term operation, maximum output currents can be found during the burn down process according to the following table.

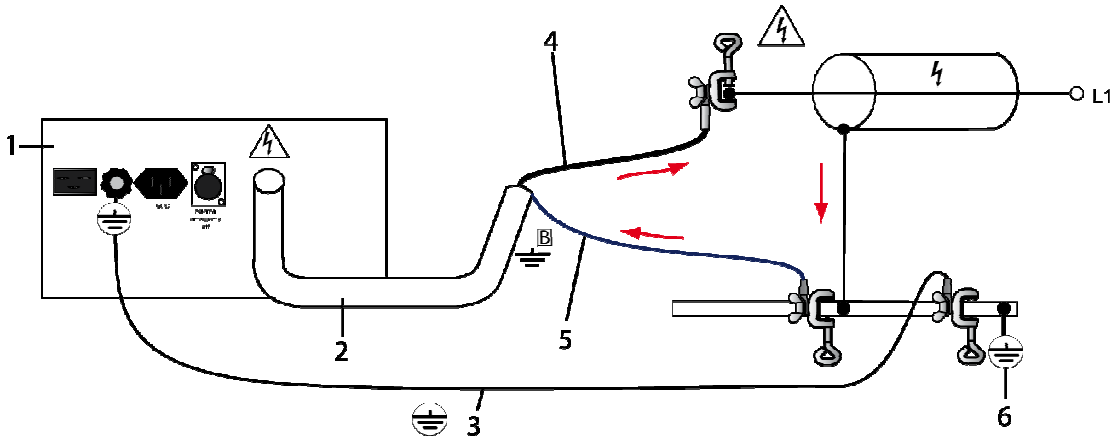
Range selector switch	**max. output current (I_{MAX})**
in 4 kV position	480 mA
in 8 kV position	240 mA
in 16 kV position	120 mA

In connection with the Intercom SA 32 (option) with mA-meter the output current can be measured and be limited by activating the reduction switch (13). Additionally, there is a possibility to limit the output current by a high-power resistor.

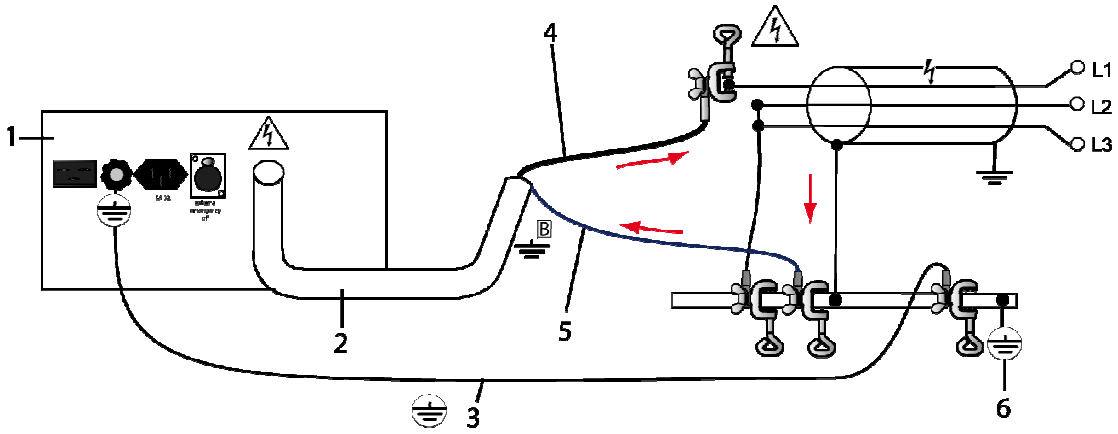
Connection of instrument

Observe correct position of connection terminals!
(also see Note on page 3-5)

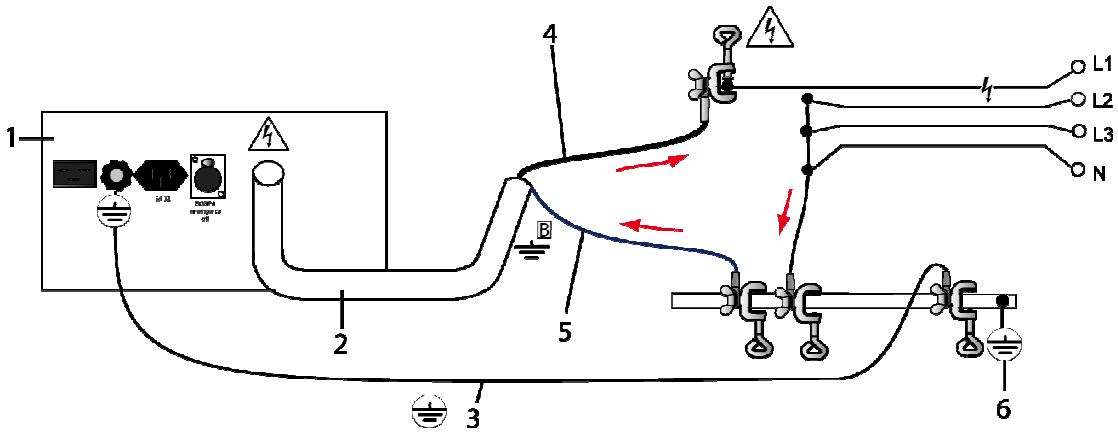
Connection to a single-phase shielded cable



Connection of a three-phase shielded cable



Connection to a three-phase unshielded cable with neutral



1. Rear view of device
2. High voltage connection cable
3. Protective ground cable
4. High voltage connection cable conductor
5. High voltage connection cable screen
6. Station ground

- Protective ground connection

- Operating ground connection

Pulse current flow

Preparing test object

- Isolate the test object
- Lock against reconnection
- Make sure that zero voltage condition exists.
- Insulate nearby items which are under voltage
- It must be assured that nearby items of the station or cable system under voltage do not result in breakovers or breakdowns, due to applying surge or D.C. voltage of the surge generator to the test object.
- Connect all strands in the cable station, with the exception of the fault afflicted strand, to the station earth.

  Attention! Wire size and insulating capacity of the cable system must be in an appropriate relationship to the amplitude of surge voltage and to the surge energy. Otherwise, overloading to the still intact parts of the system might occur.

Connecting the protective ground

- Connect the surge voltage generator with the station ground through the protective ground connection on the rear plate of the device (18)

  Attention! Connect the protective ground cable as close to the station ground connection as possible (see connection examples on page 3-4).

  The protective earth lead should be kept as short as possible and must have low impedance (min. cross section 10 mm^2, copper).

Connecting the operating ground

The high voltage connection cable screen is used as operating ground.

The operating ground closes the electric circuit and is used for the return cable of the impulse current!

Connect the operating ground carefully because it must withstand the full surge current. Observe the correct terminal position!

- Connect the high voltage connection cable screen (operating ground connection) to the station ground. Select the location for the connection of the screen to the station ground as follows:
  - as close as possible to the location where the test object screen is connected to the station ground and
  - as close as possible to the location where the test object conductors that will not be tested are connected to the station ground (see connection examples on page 3-4

Estabilshing H.V. connection

- Connect strand of the high voltage connecting lead with the fault afflicted strand of the test object.

  It is very important that all connections are of low resistance as possible. Bad connections can lead to weldings or contact wear.

- Install external EMERGENCY OFF unit (option) at appropriate location and plug in the connection plug instead of the jumper plug (15) on back plate of surge generator.

Connection to mains

Mains operation

- Connect instrument to mains supply using appropriate mains voltage and minimum fuse rating.

☞ **The protective conductor of the mains supply must have the same potential as the station earth!**

Operation with emergency power generator

The generator must have adequate power to meet the maximum power requirements of the instrument (see technical data) without break down of voltage or frequency, due to its load. Otherwise, it could happen that the instrument will be switched off automatically.

- Set generator voltage according to mains voltage as indicated on type plate and connect instrument.

☞ **The separate network may not be electrical isolated but must be connected to protective earth!**

Switch on

- Select 3 / 6 / 12 kV (56%) or 4 / 8 / 16 kV (100% surge energy) using the reduction switch.
- Set range selector switch (6) to the desired range 3 / 6 / 12 kV or 4 / 8 / 16 kV. Pull out knob, turn to desired position and push back to its stop.

Before going into operation, local safety regulations and safety precautions for the protection against direct or indirect contact of live parts have to be met accordingly!

Danger! High-voltage
When using surge mode:
⇨ Cordon off surge voltage generator at a distance of 1.5 m
⇨ Persons must stand only outside the barrier

- Switch on mains switch (1)
  The instrument is in operating condition "READY FOR OPERATION"
  ⇨ the green indicator lamp (8) is illuminated

- Press pushbutton switch „Ready for switching on“ ⏻. In case the overcurrent protection switch (12) has tripped, a buzzing sound occurs during depression of the „Ready for switching on“ ⏻ pushbutton switch. Activating the pushbutton switch is accepted by the instrument only if
  ⇨ the overcurrent protection switch (12) has not been tripped,
  ⇨ the EMERGENCY OFF switch (11) is not activated,
  ⇨ the external EMERGENCY OFF unit (option) was not activated resp. the jumper plug is plugged in on the backplate.
  The instrument is in operating condition „READY FOR SWITCHING ON“.
  ⇨ the green indicator lamp (8) is out
  ⇨ the red indicator lamp (7) is illuminated
  ⇨ the discharge unit no longer affects the high voltage output
  ⇨ if the automatic impulse sequence is selected, the triggerable sparkgap will be activated at regular intervals. Other possibilities are tripping of a single impulse or in the D.C. position a contiuously closed spark gap.

- Press pushbutton switch „High Voltage On“ **I** (3).
  The high voltage transformer will be connected to the mains voltage only, if
  ⇨ the range selector switch (6) is depressed to its stop
  The instrument is in operating condition „IN OPERATION“.
  ⇨ the indicator lamp „In Operation“ of the pushbutton switch „High Voltage On“ **I** (3) is illuminated

With the reduction switch (13) it is also possible to switch under load during condition „IN OPERATION“.
⇨ On the kV-meter the valid scale is the one pertaining the voltage range selected by the range selector switch (6).

Switch off

- Press pushbutton switch „High Voltage Off“ ◯ (4).
- The instrument returns into the operating condition „READY FOR OPERATION“. The high voltage transformer is disconnected from the supply voltage.
  - the indication lamp „IN OPERATION“ of pushbutton switch (3) is out
  - the red indication lamp (7) is out
  - the green indication lamp (8) is illuminated
  - the discharge unit affects the internal high voltage capacitors and connected high voltage cables
  - the discharge process can be monitored on the kV-meter
- Live parts must be discharged, earthed and shorted.

The Surge Voltage Generator SSG 500 features an internal discharge unit, but not an internal earthing unit. Before cancelling the safety precautions, it is essential that all live parts are discharged, earthed and shorted, because they could have residual charges, caused by possible interruptions. Pay attention that during discharge, different and rather high discharge time constants can occur depending on the position of the range selector switch (6), the connected test object capacity and the selected discharge rod, resulting in discharge times in the range of minutes.

Discharge

$\tau = R \cdot (C_i + C_p)$

Minimum discharge time: $5 \cdot \tau$

τ	Discharge time constant
R	Discharge resistance
C_i	internal surge capacitor
C_p	Test object capacity

Instrument	**SSG 500**
C_i in 16 kV position	4 µF
C_i in 8 kV position	16 µF
C_i in 4 kV position	64 µF
internal discharge resistance	68 kOhm
recommended discharge rod	ES 45
max. permissible voltage	45 kV
max. perm. discharge energy	6000 Ws
time between two discharges	10 min
nominal resistance	250 kOhm

EMERGENCY OFF

- Press EMERGENCY OFF pushbutton switch (11).
- The instrument returns to the operating condition „READY FOR OPERATION“.
  The high voltage transformer will be isolated from the supply voltage.
  - the indicator lamp „In Operation“ of pushbutton switch (3) is out
  - the red indicator lamp (7) is out
  - the green indicator lamp (8) is illuminated
- The instrument can only be placed in the operating condition „READY FOR SWITCHING ON“ ⏻ by pressing the push-button switch (2) „Ready for switching on“ if the EMERGENCY OFF pushbutton switch (11) has been unlocked with the key.

By pressing the EMERGENCY OFF pushbutton switch and taking out the key, unauthorized use of the instrument can be prevented.

Notes

4. Servicing / Maintenance

Overview

In this section you will find all necessary information for servicing / maintenance of the Surge Voltage Generator SSG 500.

This section describes the following subjects:

Safety precautions

The Surge Voltage Generator SSG 500 has a surge capacitor available which consists of four isolated partial capacitors. Even in the turned off condition these partial capacitors can show substantial residual charges. For safety reasons, actions which involve opening the instrument may therefore be only carried out by instructed and authorized service personnel.

Service Personnel

- has appropriate training and experience,
- has knowledge about relevant standards, regulations, accident prevention rules and operating conditions,
- is in a position to perform the required activities and recognize and prevent possible danger,
- is responsible to immediately report occurring changes in the instrument which could impair its safe operation,
- is familiar with the instrument, its function and possible sources of danger,
- has adequate knowledge for maintaining and servicing the SSG 500
- has been authorized explicitly by BAUR to open the SSG 500 and perform changes on the instrument.

Fuses

external fuses

The two fuses F3 and F4 on the front panel of the surge voltage generator protect the controls of the lifting magnets and the controls of the optionally connected Intercom SA 32 (option).

internal fuses

The internal fuses F1, F2, F3 and F4 may be replaced by instructed personnel only.

Description	Value	Dimension	Ident.No.	Remarks
F1, F2	0,16 AT	Ø 5 x 20 mm	563-005	Mains transformer, primary
F3, F4 internal	2 AF	Ø 5 x 20 mm	563-020	+ 12V control
F3, F4 external	3,15 AT	Ø 5 x 20 mm	563-021	Lifting magnet control and control of SA 32
(S4, F10)	16 AT			Mains switch (1)
F11 (110-120V)	8 A			High voltage transformer, primary (12)
F11 (220-240V)	4 A			High voltage transformer, primary (12)

Checking the discharge unit

Periodic checking of the discharge unit is for the purpose of safety. It should be performed before placing the instrument into operation in order to avoid influence on the resistance measurement caused by residual charges in the surge capacitors and temperature increase in the resistors.

- with instrument switched off, connect ohmmeter to the open terminals of the high voltage connecting lead
- measure resistance between terminals

The resistance value should be approx. 68 kOhm. At deviations of more than 20%, the instrument has to be serviced only by an instructed service technician before putting it into operation (see safety rules).

Replacing high voltage connecting lead

Replacing the high voltage connecting lead may be only performed by instructed service personnel (see safety rules).

Notes

Overview

5. Options, Accessories and Ordering Information

In this section you will find all neccessary information about options, accessories and ordering information for the Surge Voltage Generator SSG 500.

This section describes the following subjects:

Options

Intercom SA 32

The primary application of the Intercom SA 32 is as „aid“ for pre-locating of cable faults. It allows locating of high-resistance faults utilizing the secondary impulse method (SIM).

This allows for transformation of high-resistance faults into low-resistance faults. The surge voltage impulse of the SSG is consequently led to the test object via the high-performance resistors. The subsequently optained extension of the surge voltage impulse allows triggering the echometer, which sends the „secondary impulse“ via capacitive coupling, for pre-locating of the, at this moment, low-resistance cable fault.

Additionally, the SA 32 features a mA-meter with a decade measuring range switching. The high-performance resistor and the mA-meter can be shorted via the pull switch. In the SA 32 the discharge unit of the surge voltage generator is enhanced by a built-in earthing unit which is tripped with a time delay.
The SA 32 is supplied by the SSG and is included in the safety system.

Folding tripod

The folding tripod can be supplied as an additional special accessory. It allows for convenient working conditions in case a working table is not available. The working height is approx. 90cm.

external EMERGENCY STOP unit

The EMERGENCY OFF unit serves as part of the safety precautions around the danger area. Signal lamps and EMERGENCY OFF pushbutton switch are mounted on a cable drum. The EMERGENCY OFF unit is available with a 25 m or 50 m connecting lead.

Accessories

High voltage connecting cables

The supplied coaxial H.V. connecting lead has a length of 5 m. Conductor and shield have a cross-section of 6 mm². At the test object end 45 mm wide terminals are mounted.

Protective earth lead

For the protective earth connection between the instrument and the cable station, a stranded wire lead of 3 m length and with a cross-section of 10 mm² is supplied. At the instrument end a cable socket with a hole diameter of 8,5 mm is attached. At the test object end a 45 mm wide earth terminal is mounted.

Jumper plug

For bridging the contacts in socket (15), used for connection to the external EMERGENCY OFF unit (option), the instrument is shipped with the jumper plug installed. If neither the jumper plug or the EMERGENCY OFF unit is plugged in the instrument will not be operational.

Ordering information

		Mains voltage		
		220-230V	110-120V*)	240V
Items included	Surge voltage generator SSG 500 with accessories	414-005	414-105	414-205
	Surge voltage generator SSG 500 without accessories	470-283	470-282	470-284
	Protective earth lead SSG 500	460-434	460-434	460-434
	Power cord	554-015	554-016	554-017
	Jumper plug ext. EMERGENCY OFF	462-378	462-378	462-378
Options	Folding tripod for 19" instruments, working height 90cm	411-536	411-536	411-536
	Discharge rod ES 45	411-501	411-501	411-501
	EMERG. OFF unit with warning lamps on drum, 25m	471-219	471-219	471-219
	EMERG. OFF unit with warning lamps on drum, 50m	470-809	470-809	470-809
	Intercom SA 32	470-346	470-346	470-346

*): Delivery includes external autotransformer; mains connection cable without termination, fix mounted

Notes