Manual

Hipot Tester
HA 3600D

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Content

1 General Information

1.1 Information on this operating manual

This operating manual is part of the technical documentation for the high voltage tester *HA 3600* of *SPS electronic GmbH*.
This operating manual contains all the information on how to operate this device properly, safely and economically, how to prevent dangerous situations, how to reduce repair costs and downtimes and how to prolong the service life of these devices.

Should you, while perusing this operating manual, find any misprints, any information you do not understand or which are incorrect please do not hesitate to inform *SPS electronic GmbH* about same.

Structure

This operating manual is divided into nine chapters and one annex.

The annex contains additional information.

The headline shows you which chapter you are reading.

In the middle of the footnote you will find the type of the device and at the end of the line the page number.

Pictographs and Symbols

- **Warnings** are characterized by warning triangles with danger symbol and warn of dangers which can lead to personal injury and/or material damage:

General Warning

Danger caused by electric current or voltage

- **Information** on same are characterized by the Information Pictograph and give advice or additional information:

You can order accessories directly from *SPS electronic GmbH*.

... *PICTOGRAPHS AND SYMBOLS*

Enumerations are characterized by the symbol "●".

Example:
- ● Protective conductor test (PE-test)
- ● Insulation test (IS-test)

Operations are divided into consecutively numbered sequences of operations.

Example:
1. Switch on key switch
2. Push key ON
3. Turn hand wheel

Results are characterized by the symbol "⇒"

Example: ⇒ LC-display indicates current programme number.

1.2 Requirements for the operation of this device

1.2.1 Regulations for application

The tester must be in an operational and reliable condition.

Only personnel having completely read and understood this operating manual and who are authorized skilled electricians or who have been instructed in electrical engineering are allowed to perform any operations with and at the testers.

The tester is not to be operated if or for:

- operations are performed which are not specified in this operating manual or which have not been recommended by *SPS electronic GmbH* concerning installation, operation, maintenance and service.
- unauthorized alterations and/or repairs
- dismantling and/or avoiding of safety devices
- use of components, tools, additional installations, supplements and working material which have not been approved or recommended by *SPS electronic GmbH*
- building in of spare parts which are not original *SPS electronic GmbH* spare parts or of spare parts from suppliers not recommended by *SPS electronic GmbH*

1.2.2 Product liability

The testers have been produced, adjusted and tested according to the state of the art and the approved safety requirements.
The devices comply with the conditions agreed upon by contract of the confirmation of order concerning execution, single parts and accessories selection.

SPS electronic GmbH will be liable for errors or omissions to the extent of the guarantee liabilities of the confirmation of order.
Applicable are the general conditions of delivery of the Central Association of Electrical Engineering and the Electronics Industry, registered association (ZVEI).

The contents of this operating manual is in compliance with the condition of the tester on the date when same was drawn up.
Subject to change are technical alterations because of further developments and improvements of these products by *SPS electronic GmbH*.
Liability claims can therefore not be derived from the contents of this operating manual (data, descriptions, graphs, misprints, etc.).

Errors and omissions excepted!

SPS electronic GmbH will only be liable in case of application of the testers according to regulations (pl. see 1.2.1).
If those regulations have not been applied the operator is solely responsible for risks of hazard to body and life of the user or a third party and impairments of the tester and other material assets!

1.3 General safety regulations

This safety tester HA 3600 has been manufactured according to the state of the art at the time of its delivery.

Nevertheless the tester is not without hazards if it is applied by untrained personnel, applied improperly or not applied according to regulations.

In addition to this operating manual the generally applicable legal regulations and other binding instructions concerning safety regulations, regulations for preventing accidents and regulations for the protection of the environment must be adhered to.

1.3.1 Obligations of the operator

- The tester is only to be operated according to regulations and in operational condition (see chap. 1.2.1)
- Protective and safety devices, locking devices and couplings, etc. have to be inspected by an expert at least once a year.
- A protocol on the test results has to be drawn up in form of a **test report** same has to be retained.
- Instructions on operations with or at a machine or installation as to hazards to health and/or life of persons are obligatory.
- Persons who operate with or at an *HA 3600* have to confirm by their signature to have read and comprehended this operating manual especially in regard to the operating instructions.
- Dangerous zones resulting from the integration of the tester into a system or a device have to be located by the operator and safeguarded against.
  When assembling or installing devices, systems or items of equipment of different manufacturers or suppliers and after modifications by company or service personnel where changes within the electric equipement were made the operator has, before putting into operation, to perform a precise inspection according to the accident prevention regulations VBG 4 in compliance with the individually applicable rules of electrical engineering.

1.3.2 Operating instructions for personnel

- Operating instructions, general instructions and regulations are part of the tester and have to be accessible, readable and complete for all those who operate with or at the HA 3600.
- Before operating with or at the HA 3600 questions have to be answered or uncertainties have to be explained by the personnel in charge.
- Any operations with or at the HA 3600 may only be performed by workers skilled in electrical engineering or trained in electronic engineering and who have been given instructions for such operations and thus been authorized by the operator..
- Test personnel may only operate the HA 3600 when a skilled electrician is in charge.
- Adjustments, service and inspections have to be performed according to the instructions specified and according to schedule.

1.3.3 Information on further publications

For the protection of persons the trade associations and unions have published below literature:

- DIN EN 50191 — Installation and Operation of Electrical Installations
- DIN EN 50274 — Protection against Electric Shock – Protection against unintended direct contact of dangerous active parts
- DIN 40 008 part 3 — Safety Signs for Electrical Engineering; Warning Signs and Additional Signs
- DIN 40 050 — IP-Protective System, Protection against Contact, Foreign Matter and Water for Production Equipment
- DIN 57100 — Specifications for the Installation of Power Plants with Nominal Voltages of up to 1000 V

1.4 Safety equipment

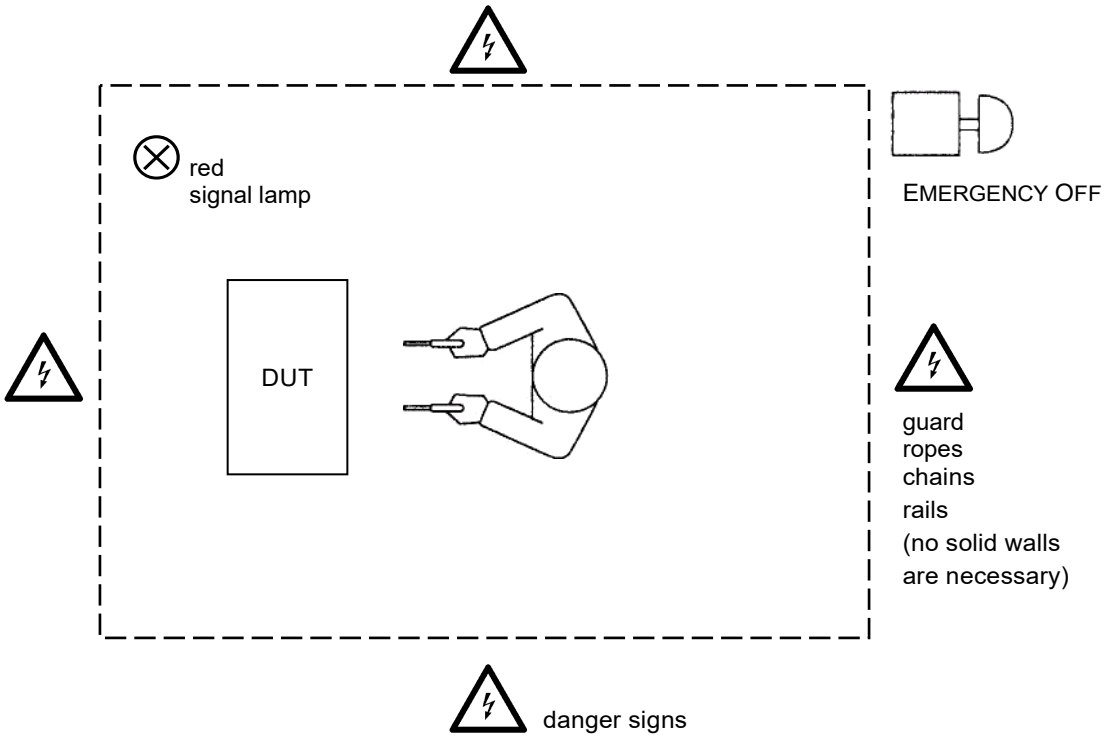
The high voltage testers HA3600 offer the following constructional safety measures:

- potential free voltage
- transformer and instrument transformer with double insulation
- status indicator
- external set of warning lights possible
- integrated buzzer
- shock-proof connection sockets
- Safety-switch-on panel according to VDE 0104

Setup of a test station without positive protection against electric shock hazard[1]

(excerpt from the memorandum on accident prevention, copy 4/89, of the trade association of precision mechanics and electrical engineering, Köln.)

With test prods (High voltage pistols SP02/SP03)



Tidiness of the test station has to be guaranteed by means of respective instructions and regular supervision!

[1] Test stations without positive protection against electric shock hazard are test stations where parts of test objects or active parts of a test installation are not completely protected against direct contact during a test.

2 Description

2.1 Device Series HA3600 at a Glance

Model	Design	Equipment
HA 3600A	14" / 3 HU	High voltage tester with the operating modes: – "test" – "burn" Steplessly adjustable voltage setting up to 5000 VAC. tripping current up to 100 mAAC, steplessly adjustable internally in the device Display unit for voltage.
HA 3600D	14" / 3 HU	High voltage tester with the operating modes: – "test" – "burn" – "time base" Steplessly adjustable voltage setting in two ranges: up to 2500 VAC / up to 5000 VAC. Steplessly adjustable tripping current setting in two ranges: 10 mAAC and 100 mAAC. Display units for voltage and current.

ATTENTION: Measurement failures can result if the DUTs are under a capacitive load.

2.2 Technical Data

Measurements

HA3600A, HA3600D

width: 360 mm
depth: 330 mm
height: 157 mm (=14" / 3 HU)

Weight

HA3600A: 180 N (gross)

HA3600D: 180 N (gross)

Power supply

Safety class I

voltage: 230 V ± 10%
frequency: 50 – 60 Hz
capacity: 400 VA max.
fuse: 6.3 A slow

Voltage measurement

HA3600A:

range: 0 – 5 kV_{eff}
scale 105 degrees
class 1.5
potential free

HA3600D:

range 1: 0 – 2.5 kV_{eff}
scale 105 degrees
class 1.5
potential free

range 2: 0 – 5 kV_{eff}
scale 105 degrees
class 1.5
potential free

☞ The measuring range is automatically changed with the voltage range.

Tripping current [1) 2)]

HA3600A: 0 – 100 mA (internally adjustable, 40 mA ex works)

HA3600D: 0 – 10 mA (switchable with
0 – 100 mA toggle switch [12])

Output voltage

HA3600A:

range: 0 – 5 kV_{eff}
distortion: < 5%
frequency: 50 Hz – 60 Hz

☞ potential free to housing and mains

HA3600D:

range 1: 0 – 2.5 kV_{eff}
range 2: 0 – 5 kV_{eff}
distortion: < 5%
frequency: 50 Hz – 60 Hz

☞ potential free to housing and mains

Environmental requirements

- outside temperature +15°C to +40°C
- humidity up to 70% (non-condensing)
- storage temperature +5°C to +50°C
- vibration free position

Device fuses

main fuse: 6.3 A, slow
ext. warning lamp: 1 A, slow

Device fuses are on the device's rear panel.

☞ In case of failure (main fuse only):

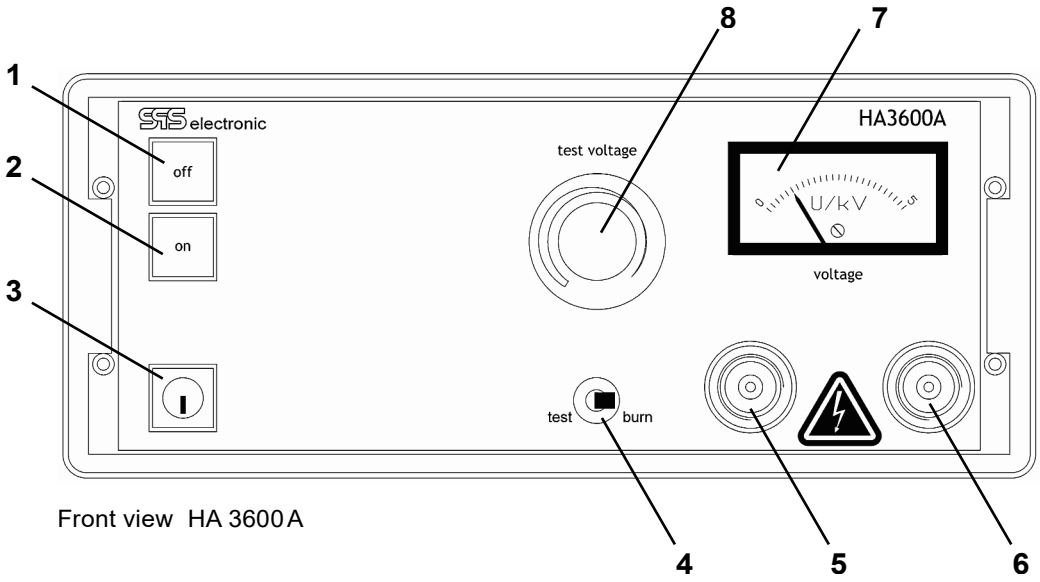
– high voltage decreases
– tester cannot be operated any more.

Notes:

1) The maximum tripping current is only reached with voltages >1000V.

2) The measuring range of HA3600D is always 100 mA. Switching to the 10 mA range will limit the scale and enables setting of tripping current ≤10 mA, but will not change the measuring accuracy (1.5% of 100 mA).

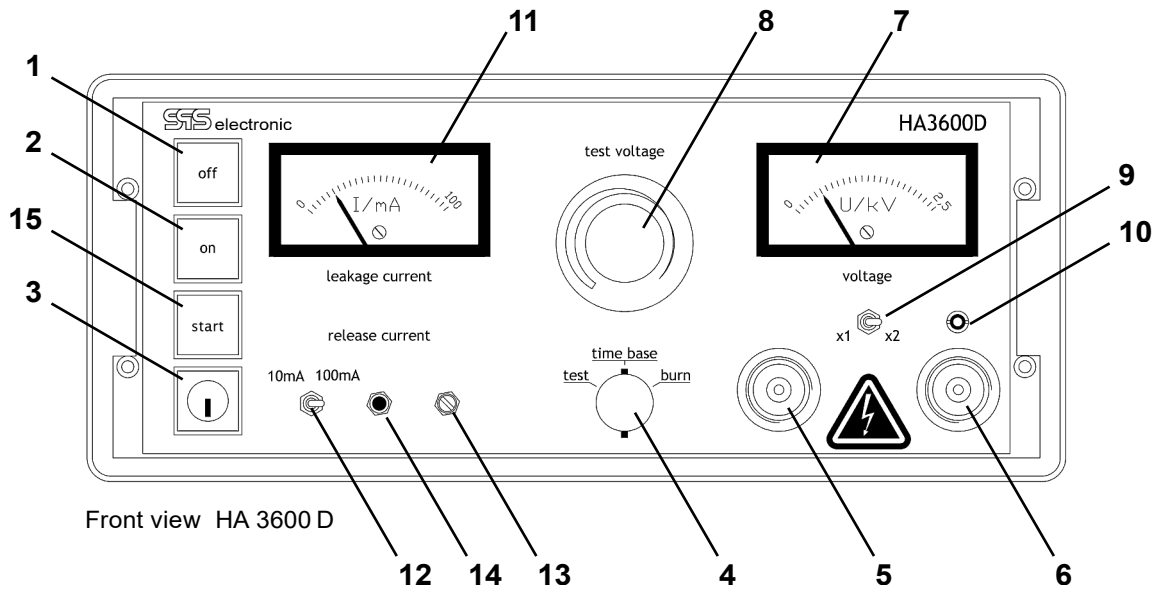
2.3 Operating controls – Front side



Front view HA 3600 A

Pos	Description	Function	HA3600A	HA3600D
1	Illuminated button "off"	Interrupts generation of high voltage. In addition this key serves as a kind of **emergency switch**. Automatic interruption As soon as the internally set current limit (1 mA – 100 mA) is exceeded.	■	■
2	Illuminated button "on"	To make ready for operation.	■	■
3	Key switch	Protection against unauthorized operation.	■	■
4	Operating-mode selector toggle or rotary switch	Setting of operating mode.	■ –	– ■
5	High voltage connection	Connection socket for test pistol.	■	■
6	High voltage connection	Connection socket for test pistol.	■	■
7	Display unit "voltage"	Display of obtained voltage values in kV	■	■
8	Control knob "test voltage"	Preselection of test voltage 0 – 2.5 kV 0 – 5 kV	 – ■	 ■ ■

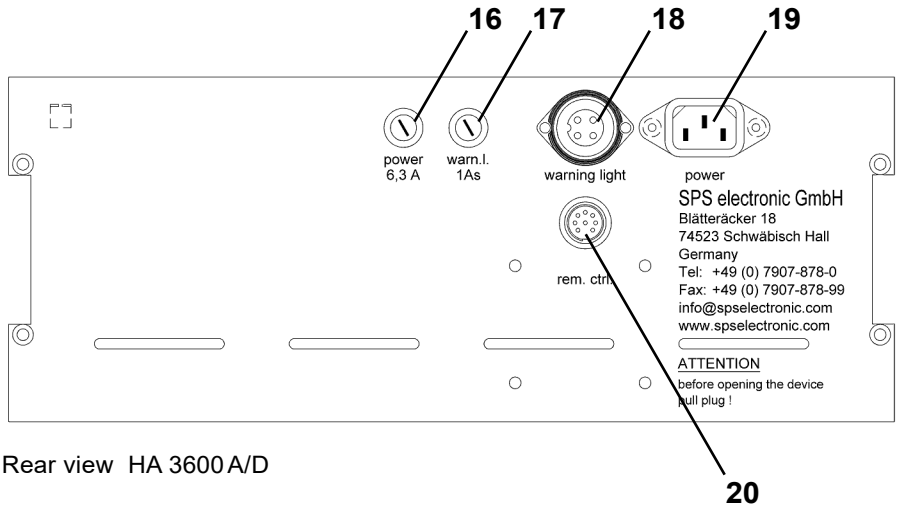
2.4 Operating controls – Front side



Front view HA 3600 D

Pos	Description	Function	HA3600A	HA3600D
9	Toggle switch "x1/x2"	To change the range of the test voltage. Switch position range: x1: 0 kV – 2.5 kV x2: 0 kV – 5.0 kV	–	■
10	Connection socket	For controlling line of HV-pistol SP03	–	■
11	Display unit "current"	Display of obtained current values in mA	–	■
12	Toggle switch 10mA/100mA	To change the range of the tripping current and the display unit (11).	–	■
13	Potentiometer	Set tripping current (10 mA – 100 mA) The tripping current must exceed **10%** of the upper limit value of the set range, i.e. in toggle switch position 10 mA – at least 1 mA 100 mA – at least 10 mA	–	■
14	Push button	Shows actually set tripping current.	–	■
15	Illuminated button "start"	Start of "time base" test cycle.	–	■
	Time base	Installed inside the tester. Adjustment possible after opening the tester, only by qualified personnel.	–	■

2.5 Operating Controls – Rear side



Rear view HA 3600 A/D

Pos	Description	Function	HA3600A	HA3600D
16	Fuse holder F1	Main fuse for tester, 6.3 As	■	■
17	Fuse holder F2	Fuse for the warning lamps, 1 As	■	■
18	Connection socket X1	Connection socket for external warning light (accessories WL23) (pin configuration see p. 29)	■	■
19	Cold appliance socket X0	Power supply (230 V / 50 Hz).	■	■
20	Phono socket "rem.ctrl." (only HA3600D)	Connection socket for foot switch (pin configuration see p. 30) fail signal tripping current, start of "time base" test run, start of test, Pass-, Fail- and Test - signal	–	■

2.6 Operating Controls - Accessories

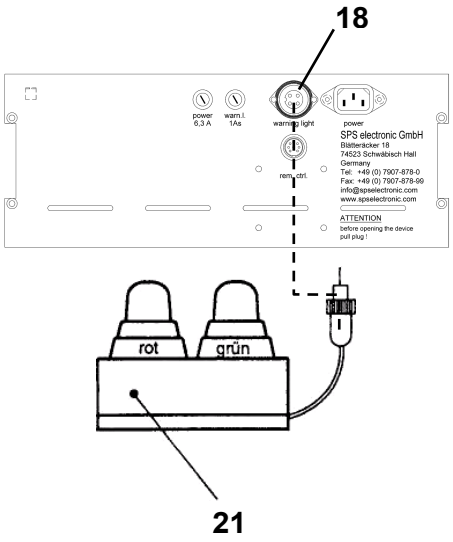
2.6.1 External warning light set (21)

Type: WL 23 / WL 25

Connection: To warning light socket (18)

Function: display of operation condition

For pin configuration please see p. 29



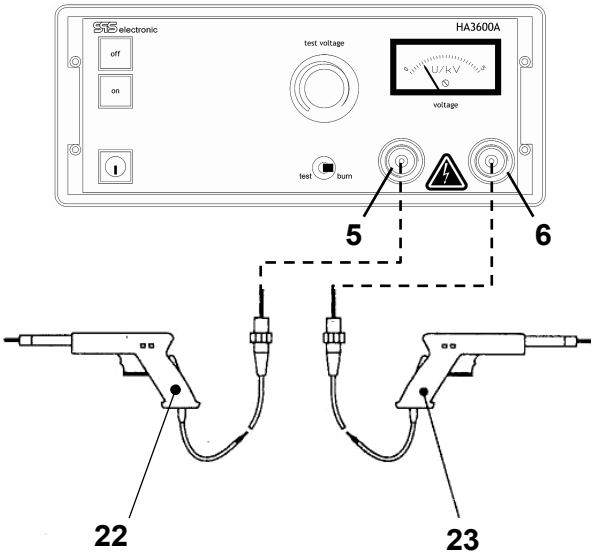
Caution – danger of life!
Connection carries mains voltage (230 V) !

2.6.2 Test pistols (22, 23)

Type: SP 02, SP03

Connection: To both high voltage sockets (5, 6)

Function: transmission of test voltage to the DUT



2.6.3 Foot switch (24)

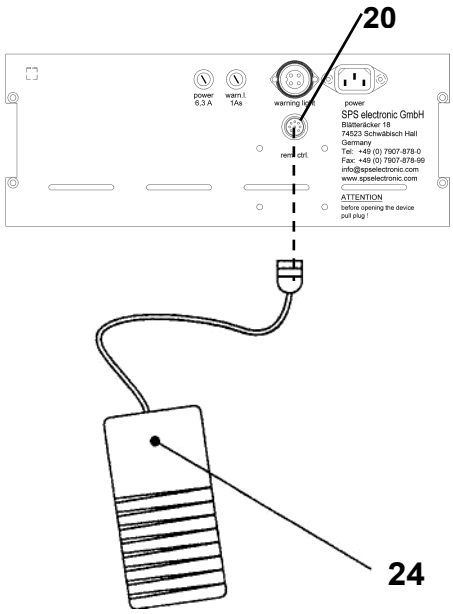
(only HA3600D)

Type: FS 01-5

Connection: to phono socket "rem.ctrl." (20)

Function: start of test in operating mode "time base"

For pin configuration please see p. 30



2.7 Putting into operation

2.7.1 Requirements

Tester *HA 3600* as well as all of the elelctric connections and lines must be in operational and reliable condition.
The General Safety Regulations (pl. see chapter 1.3) and the generally applicable legal rules as well as other binding directives for industrial safety, for accident prevention and for the protection of the environment have to be adhered to and persons staying in the area of operation must be informed respectively.

There is danger to life caused by electric current or voltage in case of handling electric installations inappropriately!

2.7.2 Connecting the device

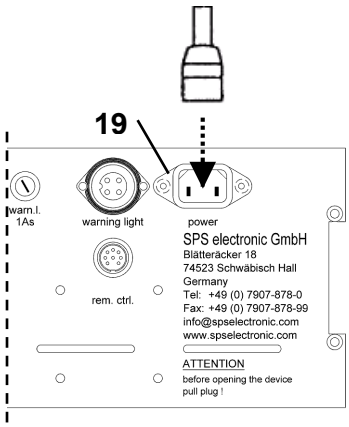
Be cautious when operating with electric current – there always exists danger of life!

Connecting supply cable:

- to cold appliance socket (19) (on device's rear panel),

  and

- supply socket with 230 V / 50 Hz.

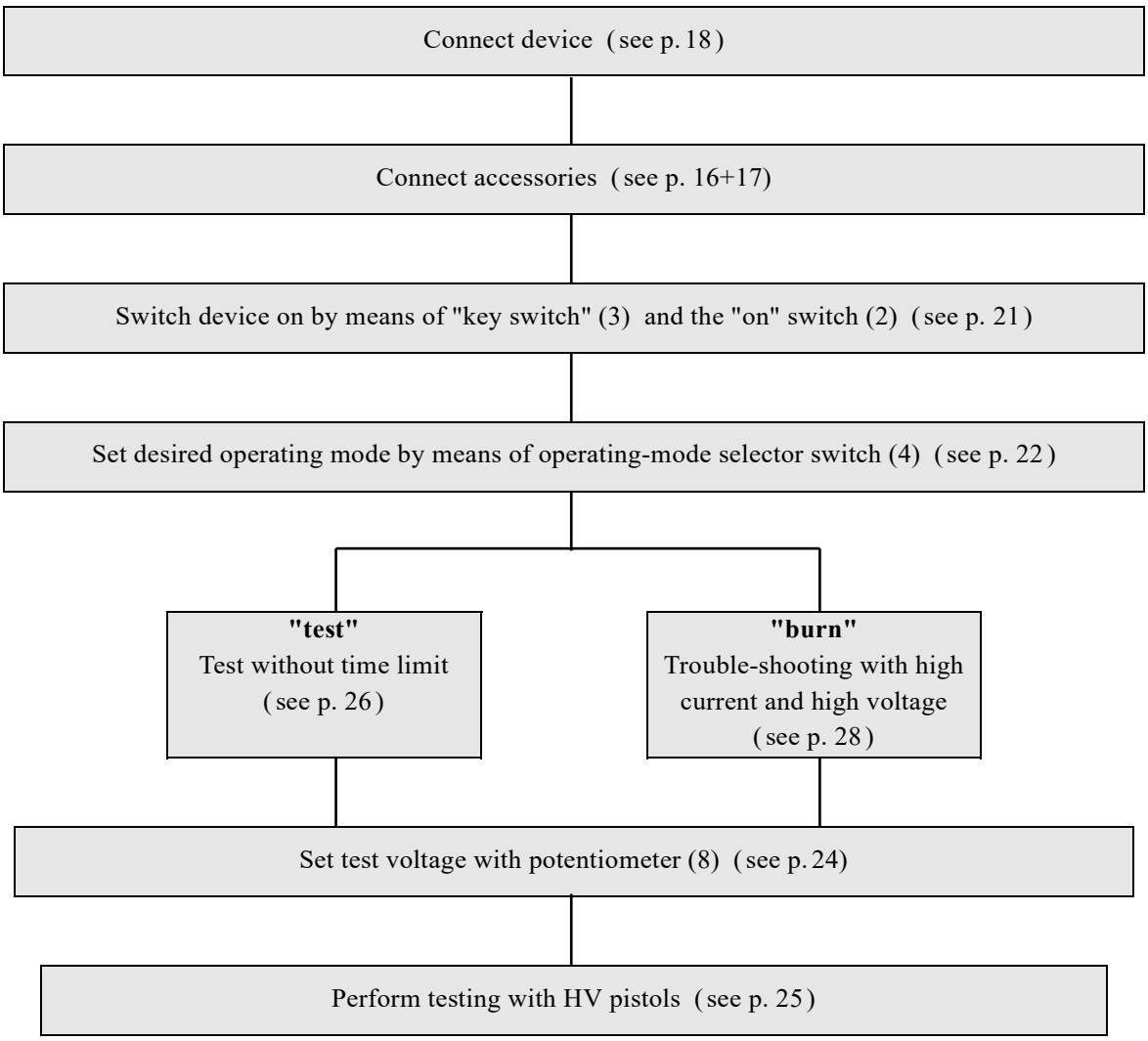


3 Operation

3.1 Abbridged operating instructions for a quick start

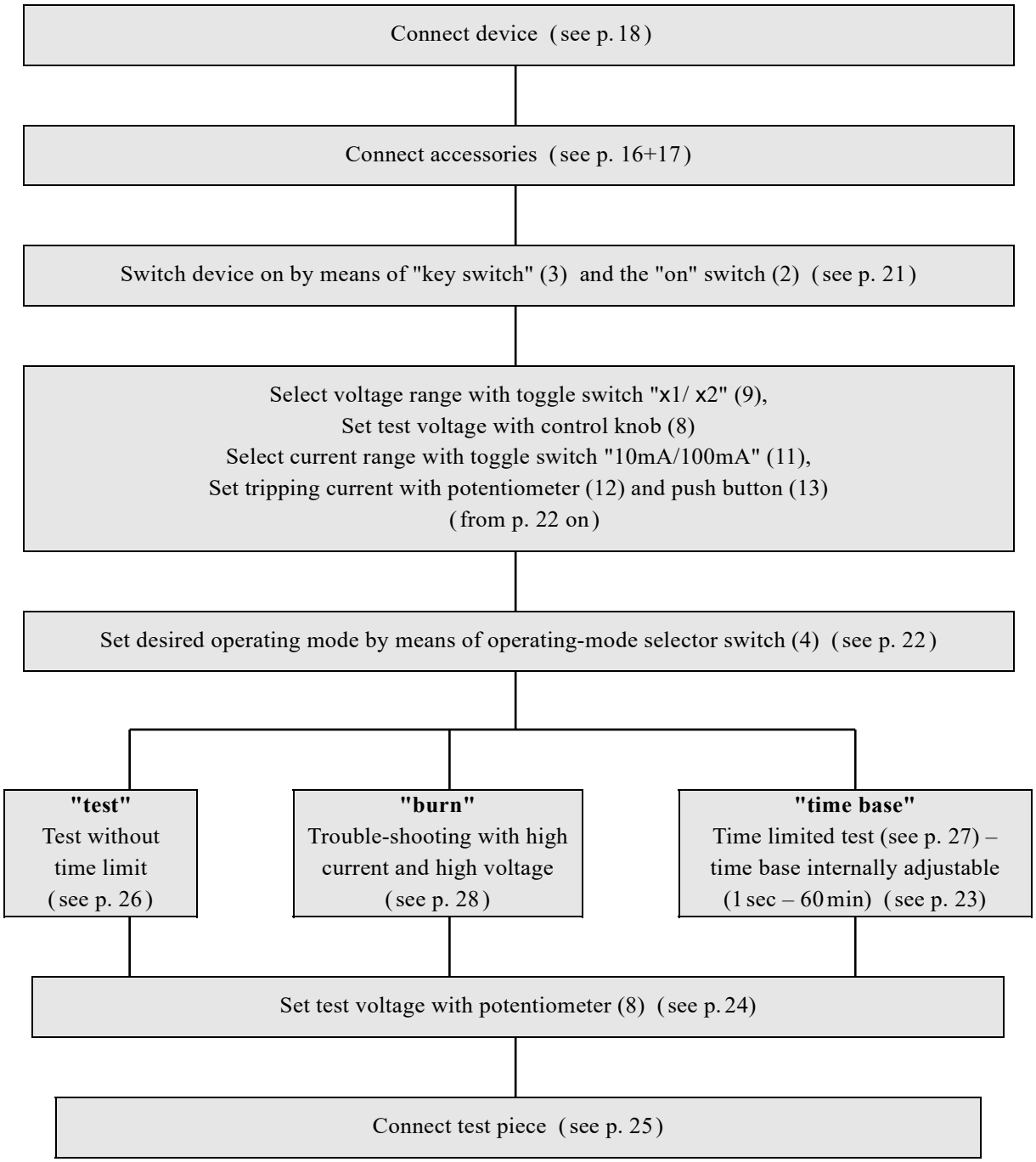
For HA3600A:

Use this abridged instruction only if the full operating manual has been read and understood!



For HA3600D:

Use this abridged instruction only if the full operating manual has been read and understood!



3.2 Switching on the device

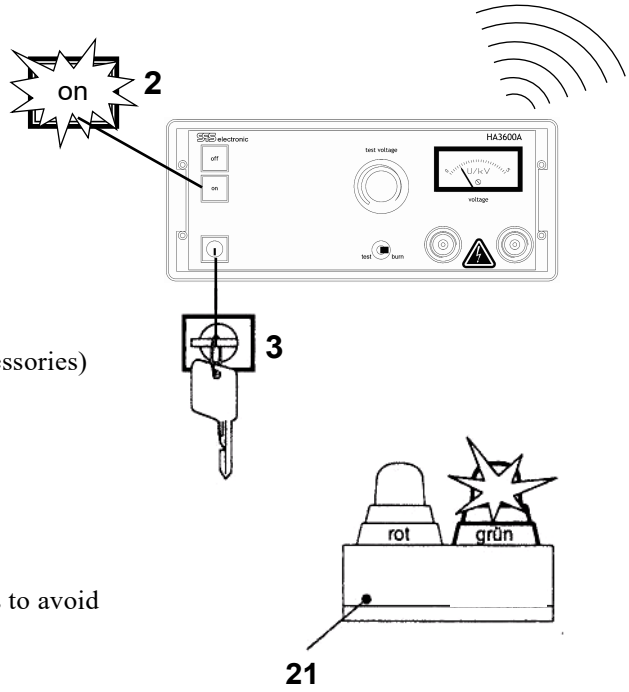
- turn key switch (3) to the right

When

- key switch (3) has been turned

then

- the green signal light of key "on" (2),
  as well as
- green signal light of external warning lamps (21) (accessories)
  will light up



besides

- an acoustical warning sound

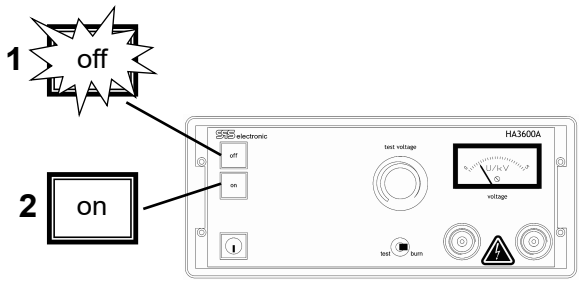
  indicating that high voltage is not yet available. This is to avoid testing without voltage

then

- press key "on" (2)

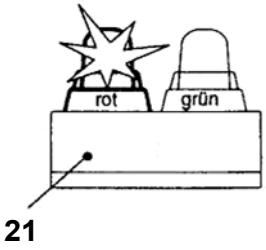
will go out

- the green signal light of key "on" (2)
- the green signal light of ext. warning lamps



and light up

- red signal light of key "off" (1)
- as well as the red signal light of external warning lamps (21) (accessories)

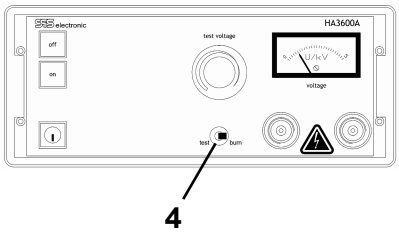


The high voltage tester HA 3600A / HA 3600D is now generating high voltage!

Only HA3600D: when selector switch (4) is set to "time base", it is additionally necessary to activate the time base by means of key "start" (14) or via the phono socket "rem.ctrl.".

This is not required when selector (4) is set to "test" or "burn".

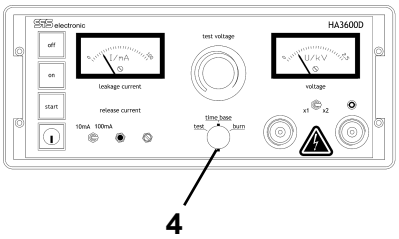
3.3 Selection of operating mode



- Set operating-mode selector switch (4) to the desired operating mode.

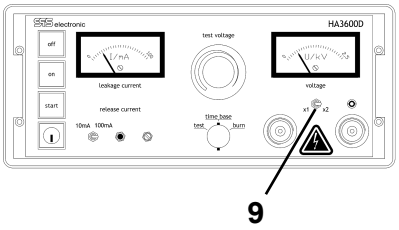
☞ The individual operating modes are described from page 26 on.

☞ If the operating mode "burn" is selected, continue with "Connection of DUT"



3.4 Selection of voltage range

(only HA3600D)



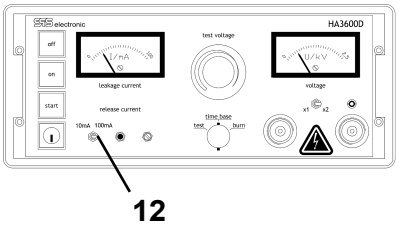
- Set toggle switch "x1/x2" (9) to the desired measuring range:

  x1 = 0 – 2.5 kV

  x2 = 0 – 5 kV

3.5 Selection of current range

(only HA3600D)



- Set toggle switch (12) to the desired current range:

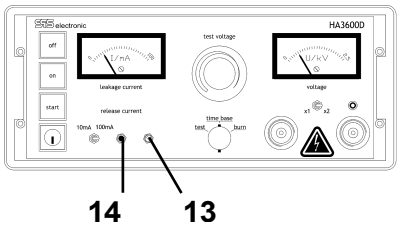
  "10 mA" = 0 – 10 mA

  "100 mA" = 0 – 100 mA

☞ In operating mode "burn" the current range is automatically set to "100 mA", to protect the device.

3.6 Setting of tripping current

(only HA3600D)

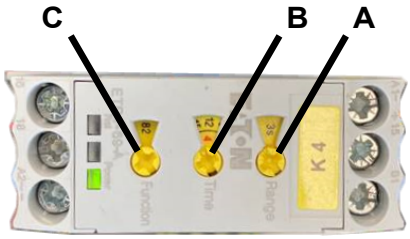


- push key (14) and set the desired tripping current with the potentiometer (13).

The tripping current must exceed the limit value of the set test range by **10%**, i.e.
– in switch position **"10 mA" – at least 1 mA**,
– in switch position "**100 mA" – at least 10 mA**.

3.7 Setting of test time

(only HA3600D)



- The test time is set at 3 seconds in the factory.
- To change the test time, the device must be opened.
  To do so, unscrew the upper half of the housing.

Pull mains plug before opening the device!

- The test time can be set on the multi-functional relay which is at the rear in the center.
- Screw (A) deals for tuning the time base (range end value).
- Screw (B) serves to set the exact test time.
  The test time can be adjusted as shown in the example below:

  Examples:

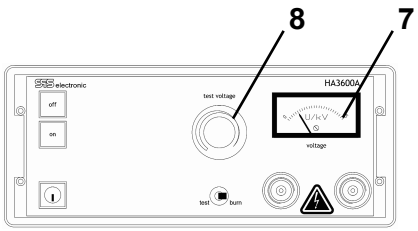
  With screw (A) at "3s" and screw (B) at "12", the preselected test time is 1.2 sek. (3/30 * 12)
  With screw (A) at "100s" and screw (B) at "2", the preselected test time is 20 sek. (100/10 * 2)

  For calculations, always either the black numbers should be used together on both scales, or the red numbers should be used together. The divisor (scale B) is /30 for the black numbers and /10 for the red numbers.

- **Screw (C) serves to select the functional mode of the relay.**
  It is set at "82" (pulse forming) and should never be changed!

3.8 Setting of test voltage

- Control knob "test voltage" (8) is used to set the desired test voltage.



The test voltage must exceed the limit value of the actually set test range by at least **10%**.

HA3600A: **by at least 0.5 kV**

HA3600D: in toggle switch (9) position –
"x1" – by at least 0.25 kV,
"x2" – by at least 0.5 kV

The adjusted test voltage is shown on the diplay unit "voltage" (7).

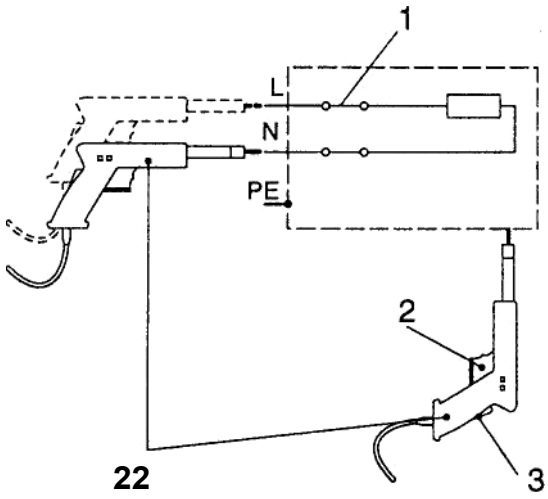
Since the test voltage is dependent on the mains voltage, the correct high-voltage value should be checked regularly.

3.9 Connection of DUT

In the operating modes "test" and "burn" high-voltage is transferred as soon as the test pistols are connected!

☞ In case there is a **power switch (1)** at the DUT, same has to be closed!

- Extend test prods of high voltage test pistols (22) – by simultaneously pressing both safety buttons (2 and 3)
- Connect DUT with the prods of the high voltage pistols (22).



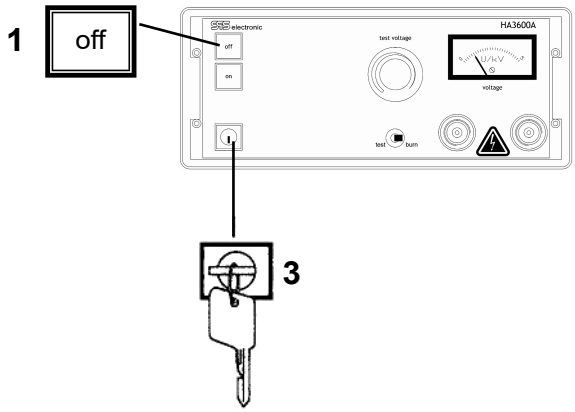
☞ It is of advantage to short-circuit the active parts (L, N) during the high voltage test, to prevent eventual damage to the DUT.

3.10 Testing with high voltage

High voltage can be produced with the high voltage tester provided that::

- power supply voltage is available
- key switch (3) is turned on
- key "on" (2) is pressed
- test voltage is bigger than 10% of limit value of set voltage range
- time base activated (only HA3600D)

3.11 Switching off the tester



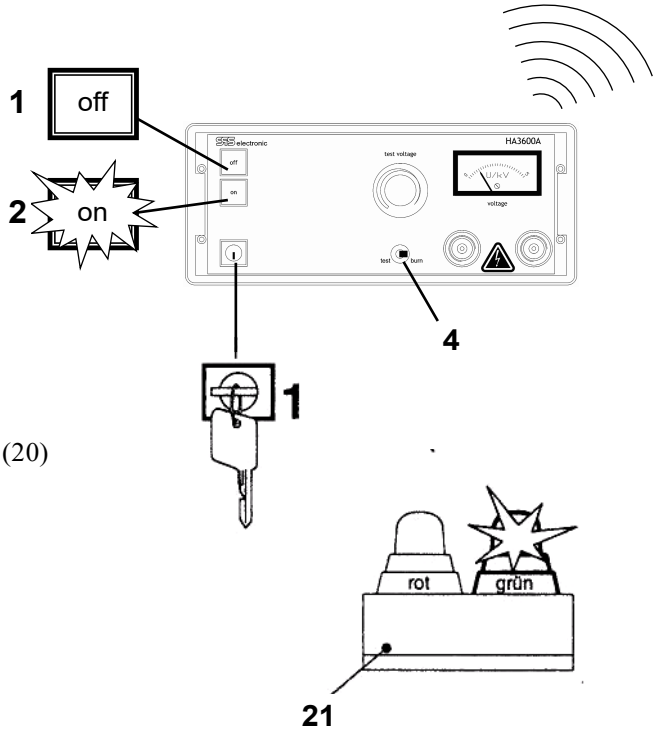
- press key "off" (1),
- turn key switch (3) to the left,
- pull power plug from power socket.

3.12 Operating modes (switch 4)

3.12.1 "test"

Allows careful testing because the high voltage is switched off by an electronic circuit breaker as soon as fault current (exceeding of set current limit) has occured.

The response of the circuit breaker causes



- **sounding**
  of an audible alarm
- **extinguishing**
  - of the red control lamp in the key "off" (1)
  - of the red lamp of the external warning lamp set
- **lighting-up**
  - of the green control lamp in the key "on" (2),
  - of the green lamp of the external warning lamp set (20)

Prepare device for new operation by:

- removing the load (removal of test prods)

and

- pressing the key "on" (2)

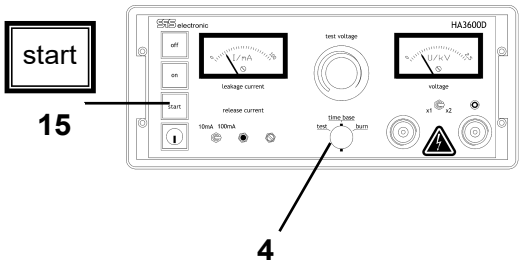
3.12.2 "time base" [test (t)] (only HA3600D)

This operating mode permits a testing as in the "test" operating mode, however testing is possible over a specified time range.

Preselection of test time

- see page 23, "Preselection of test time"

Start time base



- set operating mode selector (4) at "time base"
- press push button "start" (15)

or

- activate the connected foot switch (24)

or

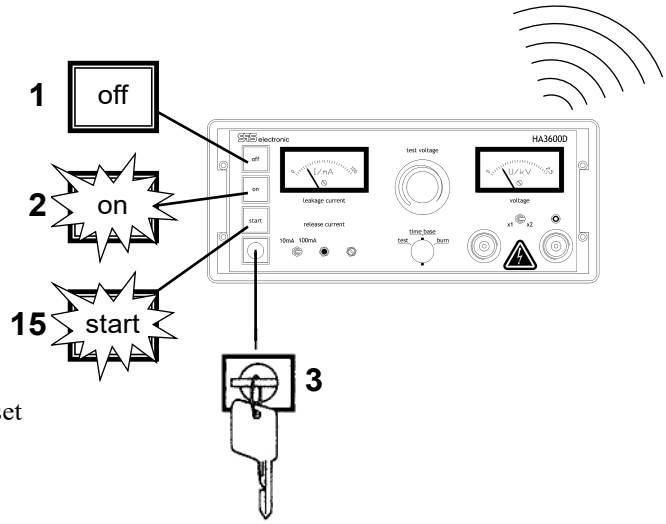
- remote-control the device via phono connector "rem.ctrl." (20)

The pre-set test time now counts down.

The test voltage is switched off when:

- the test time has expired, or
- the electronic circuit breaker responds (exceeding of pre-set current limit).

The response of the electronic circuit breaker causes



- **sounding**
  of an audible alarm (continuous tone)
- **extinguishing**
  - of the red control lamp in the key "off" (1)
  - of the red lamp of the external warning lamp set
- **lighting - up**
  - of the green control lamp in the key "on" (2)
  - of the green lamp of the external warning lamp set

Prepare device for new operation by:

- removing the load (removal of test prods),

and

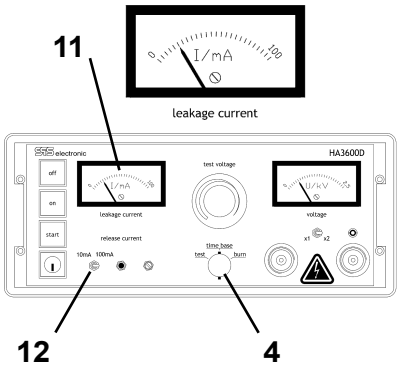
- pressing the key "on" (2)
- and the possibilities mentioned under "start time base" (page **Fehl**...

3.12.3 Operating mode "burn"

Caution!
The maximum test time for operating mode "burn" is 3 minutes!

If an error has to be located, more often then not it is advisable to combine a high current with a high voltage.

The current is limited to ca. 150 mA.



In this operating mode the audible warning signal and the electronic circuit breaker are switched off.

(only HA3600D)

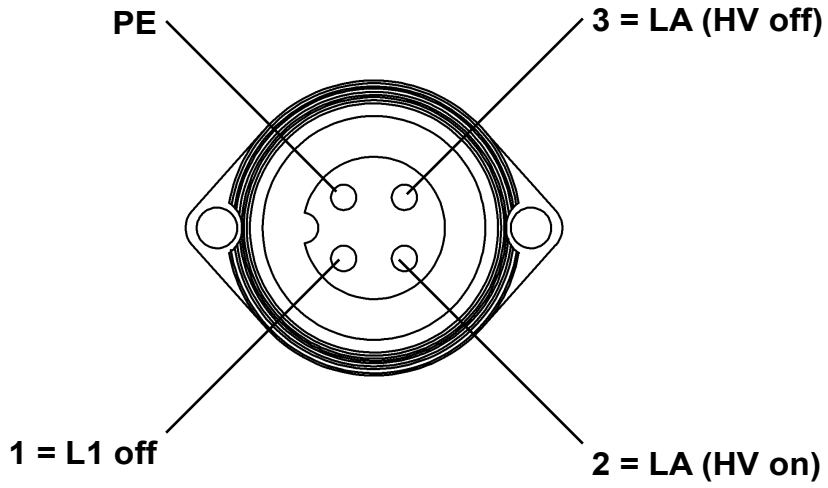
In the operating mode "burn" the current range is automatically set to 100 mA, in order to protect the device from eventual damage.

During the testing

- the current can be observed on the display unit "current" (11). (only HA3600D)

4 Interface configuration

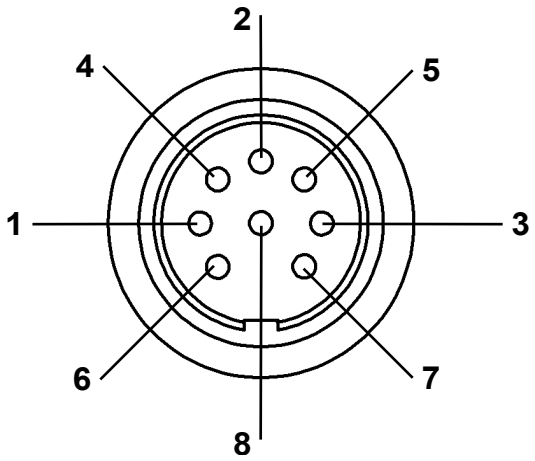
4.1 Warning light connector (17)



Caution – Danger of life!
Connection via supply voltage (230 V)

PIN	Description	Configuration
1	L1 off	Reference potential for warning lights [LA (HV on) / LA (HV off)]
2	LA (HV on)	Connection for warning lights (red). Technical data: voltage: 230 V power supply current: max. 0.1 A (fused in the tester)
3	LA (HV off)	Connection for warning lamps (green). Technical data: voltage: 230 V power supply current: max. 0.1 A (fused in the tester)
PE	PE	Protective wire connection

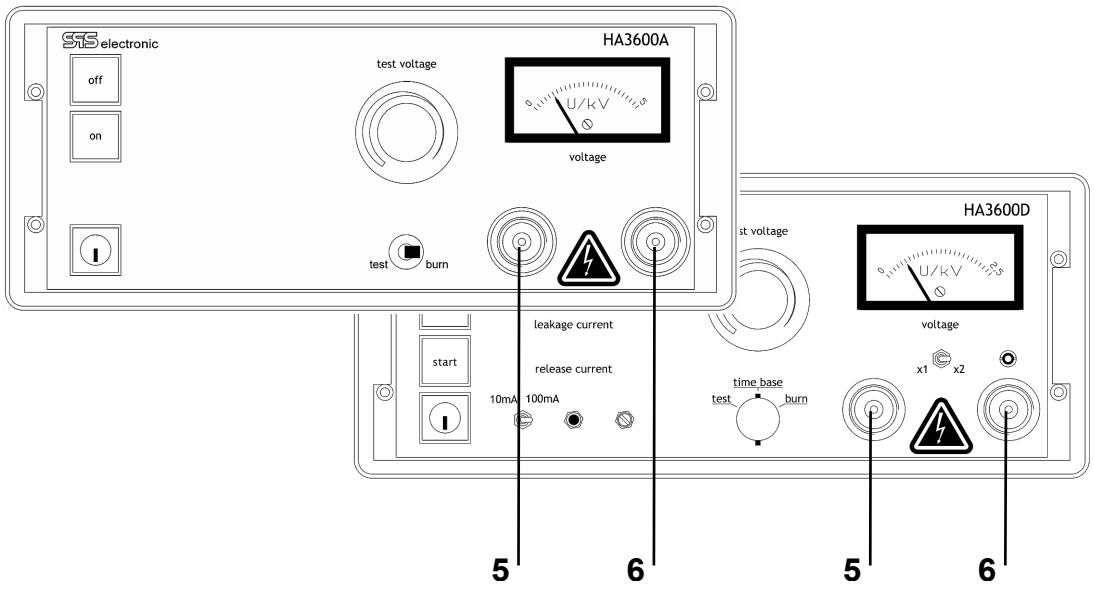
4.2 Phono socket "rem.ctrl." (only HA3600D)



PIN	Description	Configuration
1	Start TB	Start of time base (input 24V: max. 10 mA).
2	Com	Shared contact for outputs Fail, Pass, Test
3	Fail	FAIL signal
4	Test	TEST signal (active during a test)
5	Pass	PASS signal
6	+ UN	+24V, for inputs "Start" or "Start TB"
7	GND	
8	Start	Start without time base (input 24V: max. 10 mA) (test runs as long as the signal applies)

4.3 High voltage sockets

For test voltage
Pos. 5
Pos. 6



EU-Konformitätserklärung
EU Declaration of Conformity

Wir / *we* :

SPS electronic GmbH
The Electrical Safety Test Company
Eugen-Bolz-Straße 8
D-74523 Schwäbisch Hall

erklären hiermit, dass das nachfolgend genannte Gerät den einschlägigen grundlegenden Sicherheitsforderungen der EU-Richtlinien entspricht.

declare, that the following unit complies with all essential safety requirements of the EU Directives.

Geräteart: *Description of device:*	Hochspannungsprüfgerät *High Voltage Tester*
Typ / *Type* :	HA 3600 A/D

EU Richtlinien / *EU Directives:*

☐ EG Maschinenrichtlinie 2006/42/EG mit Änderungen
EC Directive for machinery 2006/42/EC with amendments

☒ EU Niederspannungsrichtlinie 2014/35/EU
EU Directive for low voltage 2014/35/EU

☒ EU Richtlinie Elektromagnetische Verträglichkeit 2014/30/EU mit Änderungen
EU Directive electromagnetic compatibility 2014/30/EU with amendments

Angewandte harmonisierte Normen:
Applicable harmonized standards:

- EN 61 000-3-2; EN 61 000-3-3; EN 55 014-1; EN 55 014-2; EN 50 191

Angewandte nationale Normen und technische Spezifikationen:
Applicable national standards and technical specifications:

SPS electronic
SPS electronic GmbH
Blätteräcker 18 • 74523 Schwäbisch Hall-Sulzdorf
Telefon 0 79 07 / 878-0 • Fax 0 79 07 / 878-99

30.06.2017
Datum / date:

ppa. Dipl. Ing. Stefan Ruhl

Dieser Konformitätserklärung unterliegt grundsätzlich nur das von uns gelieferte oder in Betrieb genommene Gerät.
Für Änderungen und Erweiterungen ist der Betreiber verantwortlich und damit für die Sicherstellung der Übereinstimmung der veränderten Anlage mit der betreffenden EU-Richtlinie.

Subject to this declaration of conformity is the device as supplied or placed into operation by us.
The operator is responsible for subsequent alterations and extensions, and therefore has to ensure the altered unit complies with the corresponding EU directives.