OPERATING INSTRUCTIONS

for the

Universal Isolated Stimulator Output

UISO Type 263

Version 1.0 / June 2000 St.

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1.0 Introduction, manufacturer's details

These Operating Instructions describe the function and the use of the UISO Type 263. They represent an essential part of the apparatus and must be kept close to the apparatus, accessible to all users.

All the information in these Instructions have been assembled after careful examination but it does not represent any warranty of product properties. Alterations in line with technical progress are reserved.

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1.1 Copyright

1.2 Trademarks

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2.0 Safety notes

- The **UISO** is designed with Class I protection and must only be operated from a properly installed earthed supply socket.
- Operation in hazardous areas and/or in a flammable atmosphere is not permitted.
- The **UISO** must be protected against moisture. The unit is not suitable for use outdoors.
- If any liquid has passed into the unit, the mains plug must be pulled out immediately. Switching off the mains switch does not offer adequate protection against possible electrical hazard. Any salt solution must be removed immediately from the unit. This usually involves opening up the unit and this work should therefore only be carried out by a suitably qualified person.
- With appropriate adjustment of the amplitude the unit is intended to produce an output voltage up to 100 V; this represents an electrical hazard to the touch. Appropriate care is therefore required when using the unit: do not touch any conducting points connected to the output!

3.0 Unpacking

It is usually the case that the unit has already been unpacked when these Operating Instructions come to hand and can be read. As you have noted, the unit does not come with any special packing; it is packed in a carton with padding material in the usual way. It is therefore particularly important to ensure that you do not inadvertently „discard“ small accessory items together with the packing material.

4.0 List of items

The UISO is supplied with an accessory bag which contains the following items:

1 mains supply cable
2 safety banana plugs for connecting the stimulation electrodes
1 Operating Instructions

5.0 General description, applications

The UISO represents an isolated high-power stimulator output stage for use in physiological and pharmacological research. The unit incorporates its own power supply; special measures are used to ensure that any interference voltage or current introduced into the output stage through capacitive coupling is very low. The required stimulation signal (square-wave pulse) can be provided by any stimulator. A built-in microcomputer monitors the stimulation signal input and suppresses stimulus patterns which could cause the unit to overheat. DC stimuli (= DC voltage) can not be produced.

IMPORTANT: this unit is <u>not approved for use on humans</u>!

6.0 Starting up

6.1 Choice of location

- The UISO should preferable be placed close to the stimulated object. The unit should be easily accessible so that its settings can, when required, be easily adjusted to suit the experiment. Brightness and visibility should be such that the selected settings can easily be read.
- It is important to set up the unit so that it is protected against moisture. No liquid should be stored above the unit. Also avoid positioning the unit so that it can be affected by splashes from a water tap.
- In order to prevent overheating of the unit during operation it is important that the ventilation slots of the housing are kept free (do not place any paper on the unit!) so that air circulation is not obstructed. Also protect the unit against direct sunlight.

6.2 First start-up

- Before connecting the unit to the supply socket, check that the supply voltage agrees with the voltage stated on the unit label (230 V or 115 V). When required, the operating voltage can be altered inside the unit by a suitably qualified person (see Section 9.7, Mains supply - fuses).
- Connect the unit only to a properly installed earthed supply socket!
- If the supply voltage is correct, connect the unit to the supply using the mains cable supplied. On the unit the socket for the mains cable is located on the back of the unit.
- Switch off the output (switch set to „OFF“) and initially do not connect a cable to the stimulation output sockets and do not connect an electrode.
- Connect the signal input of the UISO to the output of the stimulation generator; note the signal level and the polarity (see Section 9.1)!
- Then switch on the unit and familiarise yourself with the various unit functions as described in the subsequent sections. The mains switch is located on the back of the unit next to the socket for the supply cable.

NOTE: after it has been switched on, the unit waits about 3 seconds until all the internal voltages have become fully stabilised; it then performs a self-test which is terminated by a beep lasting about 1 second (no pause). The unit is then ready for immediate use.

7.0 Description of the front panel

Legend for the item numbers on the front panel illustration:

1 LED to indicate the power supply for the output circuit.

2 RANGE switch for selecting the output voltage range: 0 to 50 or 0 to 100 Volt.

3 Knob for adjusting the stimulation amplitude on a 10-turn potentiometer. Adjustment range 0 to 50 Volt or 0 to 100 Volt depending on the setting of switch (2).

3a Lock on knob 3 to prevent unintentional changes in amplitude.

4 POLARITY switch to select the **polarity** of the output voltage. The polarity refers to the upper of the two output sockets (7).

POS.: positive stimulation pulses. Only positive stimulation pulses are produced.

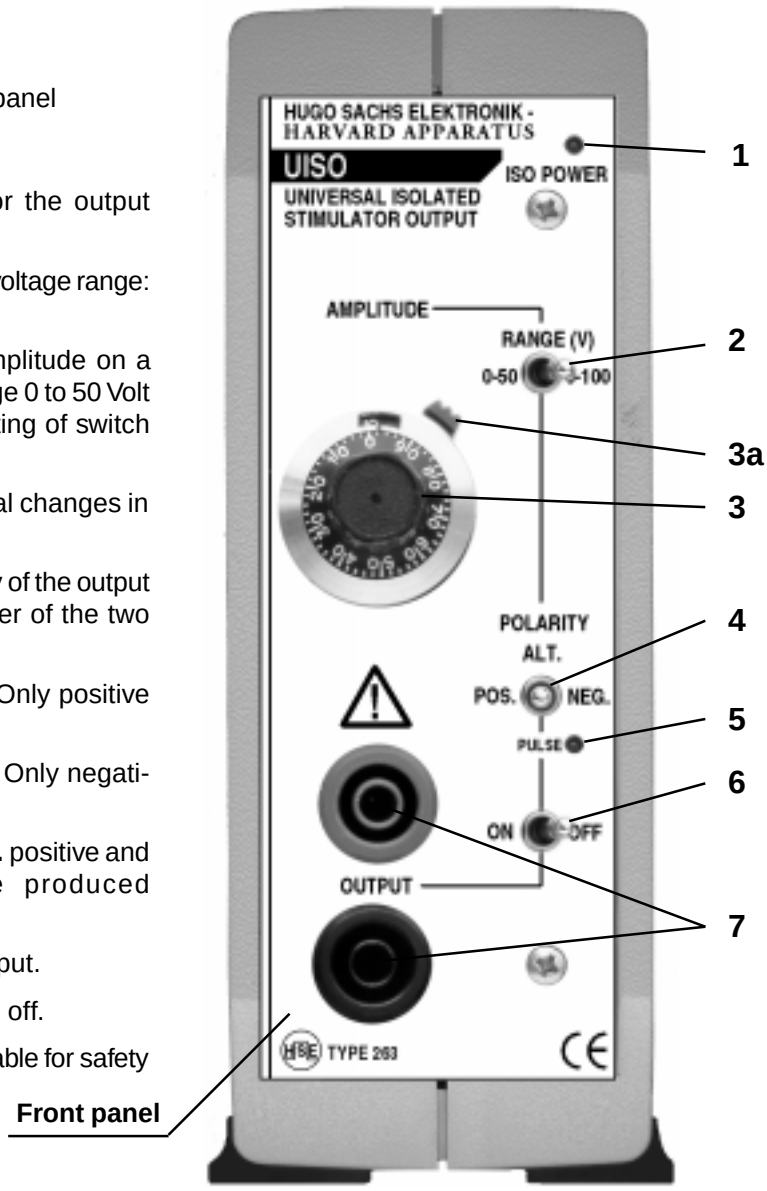
NEG.: negative stimulation pulses. Only negative stimulation pulses are produced.

ALT.: alternating stimulation pulses. positive and negative stimulation pulses are produced alternatively.

5 „PULSE“ LED to indicate stimulus output.

6 Switch for switching the output on and off.

7 Stimulus output sockets, shielded, suitable for safety banana plugs 4 mm dia.



Front panel

8.0 Description of the back panel

Legend for the item numbers on the back panel illustration:

1 Input socket for connecting the supply cable. A suitable supply cable is included with the unit accessory pack.

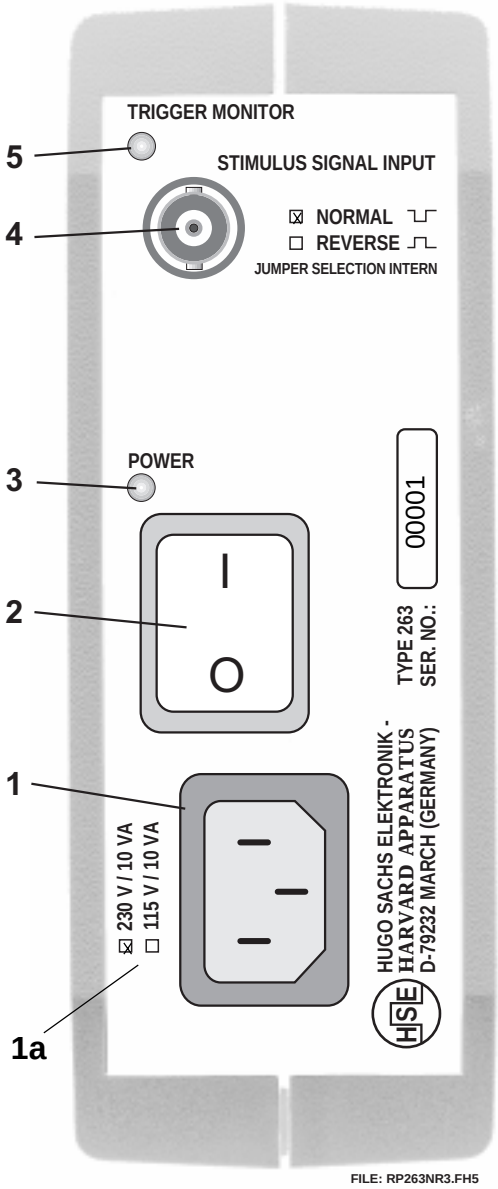
1a Marker fields for the internal supply voltage setting: 230 V - 115 V.

2 ON-OFF switch for the supply.

3 LED to indicate the supply.

4 Input socket (BNC socket) for feeding in the stimulus signal supplied by a stimulus generator. Any stimulator providing the necessary voltage can be used as stimulus generator. The amplitude of the square-wave signal feed must be in the range from 3 to 15 Volt. The necessary input signal is normally an „active low“ signal. This can be changed to „active high“ by altering a jumper. Unless otherwise specified when ordering, the unit is supplied as „active low“ and the corresponding field „NORMAL“ is marked (cf. Section 9.1).

5 The „TRIGGER MONITOR“ LED serves to monitor the input signal. This LED starts to light up when the input signal falls below the threshold of the input circuit.



Back panel

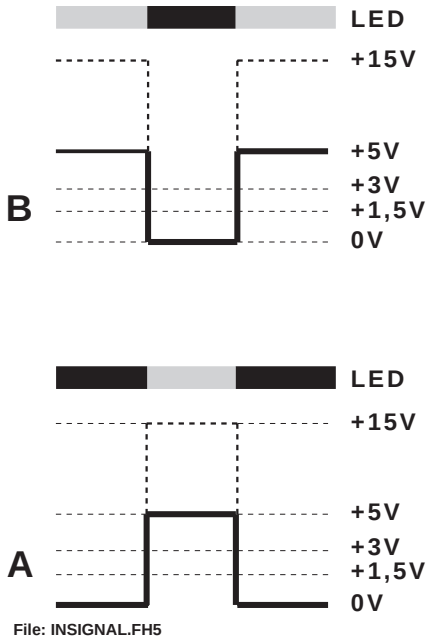
9.0 Technical details

9.1 Stimulation signal input

The stimulation signal input (BNC socket „STIMULUS SIGNAL INPUT“) is located on the back of the unit. The stimulus signal generated by a stimulator or some other pulse generator is fed in at this input. The pulse pattern and the permitted voltage levels are shown in the diagram alongside. It is possible to switch between the two pattern A and B by changing a jumper inside the unit. This involves opening up the unit which should only be done by a suitably qualified person.

Unless otherwise specified in the order, the unit is set to pattern B and the corresponding box „Normal“ next to the input socket is marked.

When the input circuit responds correctly, the LED „TRIGGER MONITOR“ above the input socket flashes with each pulse. The LED is alight when the signal is below the switching level (1.5 V), and dark when the signal exceeds this level, irrespective of the selected pulse pattern A or B.



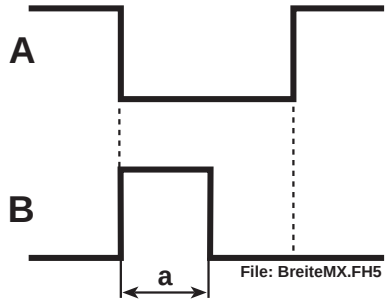
Stimulus input signal
A: „reverse“ stimulus pattern (= active high)
B: „normal“ stimulus pattern (= active low)
LED: pulse monitor. Voltage levels: switching level 1.5 V; minimum input amplitude 3 V; normal TTL level 5 V; maximum input amplitude 15 V.

9.2 Stimulus width and repetition time

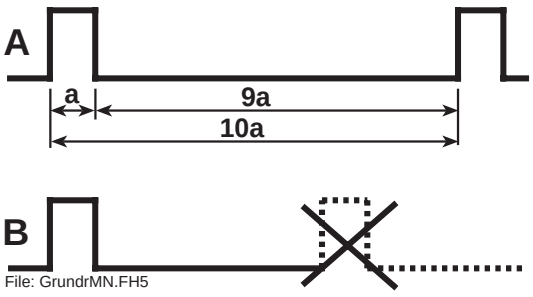
The output circuit of the UISO is optimised for the maximum possible output current so that it can produce successful stimulation even with a relatively low-resistance electrode system (see also Section 9.3). In order to protect the unit against overload through incorrect operation, an internal microcomputer monitors the stimulus width and the repetition time (basic rhythm or T=1/frequency) of the input signal. The stimulus width is limited to 10 msec. The repetition time is limited dynamically to 10 times the pulse width. The shortest permitted gap between two stimulus pulses is therefore equal to 9 times the stimulus width.

When the maximum permitted stimulus width is exceeded the stimulus is automatically shortened appropriately and a built-in beep warns the user that this fault is present.

When the repetition time is shorter than the permitted minimum value (shorter than 10 times stimulus width) the stimulus output is stopped immediately and the warning tone is activated. The next stimulus is produced only when the warning tone has stopped.



Limitation of stimulus width
A: stimulus input signal; **B**: stimulus output signal; a = maximum permitted stimulus width 10 msec
a = maximum permitted stimulus width 10 msec



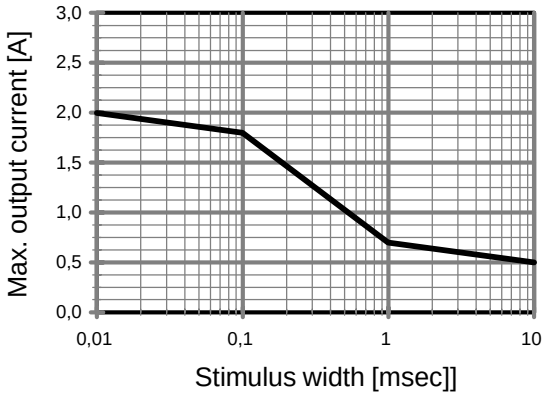
Limitation of repetition time
A: minimum, just acceptable repetition time
B: repetition time too short

9.3 Stimulus output

The internal electronic output circuit is linked by the ON - OFF switch to the two output sockets. When switched off (switch set to OFF) the two sockets are physically isolated from the output circuit.

The output circuit is isolated from earth and has a low capacity to the housing. This means that the quality of the stimulus pulses produced is similar to that of a battery-operated unit.

The output circuit has the characteristic of a constant-voltage supply, i.e. the source resistance is low (less than 1 Ohm) so that high output currents can be produced. In order to protect the electronic components against overload, e.g. through incorrect operation, the stimulation current is limited. The limitation is related to the set stimulus width as shown in the diagram (dynamic current limitation).



Limitation of the output current
depending on the stimulus width

9.4 Selection of amplitude range: 50 V - 100 V

The switch „RANGE (V)“ is used to select the adjustment range of the output voltage: „0 - 50“ or „0 - 100“. In order to avoid unnecessary heating of the internal circuit it is advisable to work in the range 0 - 50 V whenever possible. For safety reasons, too, it is advisable to work in the 50 V range: voltages above 50 V are considered to be hazardous to the touch!

Range 0 - 50 V: select where possible the lower range 0 - 50 V. It is especially in field stimulation of isolated muscle tissue (muscle strips, vascular rings ...) in a perfusion solution that a relatively low voltage (often in the range 20 - 40 V) is appropriate for successful stimulation. Because of the arrangement of the field stimulation electrodes this system has a relatively low electrode resistance. Depending on the size and spacing of the field stimulation electrodes the resulting electrical resistance can be in the range below 30 Ohm. This means that a relatively large stimulation current is produced. If under these conditions the unit is operated in the range 0 - 100 V, the internal losses inside the unit are large, resulting in unnecessary heating of the unit. Under extreme conditions this leads to the unit switching itself off due to overheating.

Range 0 - 100 V: select the range 0 - 100 V only if 50 V is not sufficiently large for successful and reliable stimulation.

☞ **Danger:** voltages above 50 Volt are considered to be **hazardous to the touch!**

Stimulation voltages above 50 V are usually required when working with small-area electrodes and where direct contact with the stimulus object is not possible (surface electrodes, stimulation through the skin ...). The electrical resistance of the entire stimulation circuit can be in the range from a few 100 Ohm up to a few kOhm. This requires a higher voltage in order to overcome the electrode contact resistance, so that a sufficiently large pulse stimulation currents flows in the target object.

9.5 Polarity

The polarity of the stimuli is selected with the POLARITY switch. The polarity refers to the upper of the two output sockets. The illustration alongside shows graphically the corresponding stimulus patterns which are explained below:

(a) stimulus pattern at the stimulus signal input on the back of the unit (STIMULUS SIGNAL INPUT).

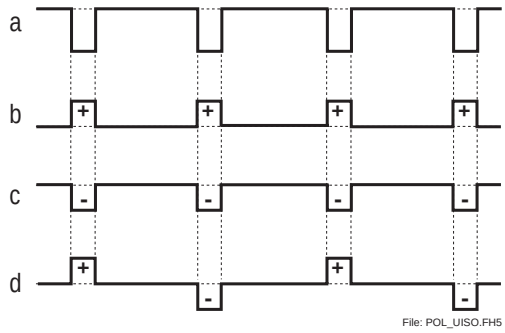
(b) **POS.: positive stimulus pulses.** Only positive stimulus pulses are produced.

(c) **NEG.: negative stimulus pulses.** Only negative stimulus pulses are produced.

(d) **ALT.: alternating stimulus pulses.** Positive and negative stimulus pulses are produced alternatively.

NOTE: stimuli with alternating polarity are recommended where electrolysis at the electrodes has to be avoided.

IMPORTANT: the polarity at the stimulus output is independent of the polarity of the input signal!



Polarity at the stimulus output

a: signal at the stimulus signal input (back of unit)
b: POS = positive only
c: NEG = negative only
d: ALT = alternating stimuli

9.6 Warning tone

A warning tone is produced in case of an error:
- when the permitted stimulus pulse width is exceeded (see Section 9.2);
- when the repetition time is shorter than the permitted value (10x stimulus width, see Section 9.2).

NOTE: there is no stimulus output while the warning tone is produced. The warning tone lasts approximately 1 second (3 beeps of 100 msec with corresponding pauses).

9.7 Mains supply - fuses

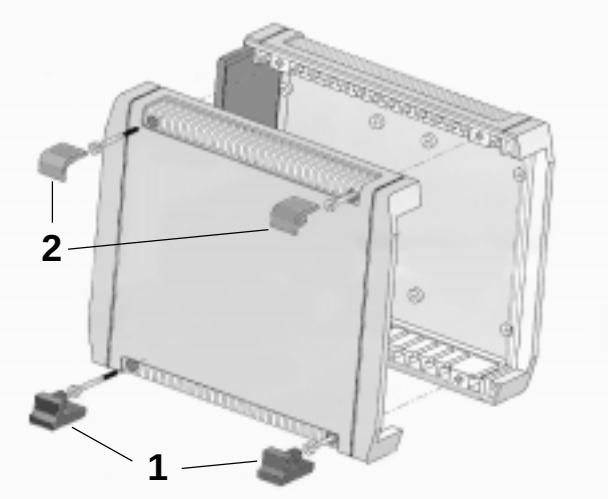
The connection for the mains supply is located on the back of the unit. The unit power supply is designed for supply voltages of 115 V or 230 V AC (50 - 60 Hz) and can be suitably set inside the unit. As this involves opening up the unit housing, the change of the supply voltage must only be carried out by a suitably qualified person.

10.0 Opening the housing

WARNING: pull out the supply plug before opening up the housing and before carrying out any work on the open unit.

The housing should only be opened up by a suitably qualified person!

To open the housing, place the unit so that the front panel faces towards the front. Using a suitable tool, e.g. a small screwdriver, remove the feet on the left side of the housing (1, bottom) and the two covers (2, top). After unscrewing the 4 fixing screws which are now accessible, the left plastic half-shell of the housing can be removed.



Opening the housing

The jumper for changing the polarity of the stimulus input signal is now accessible (see Section 10.1).

To change the supply from 230 V to 115 V or vice versa (see Section 10.2) the printed circuit board (PCB) has to be separated from the right half of the housing.

The PCB and the right half housing are connected by a screw (countersunk head screw M4x16). The screw is visible from outside. A plastic spacer (L=5 mm) ensures correct spacing between the inside of the housing and the PCB. Ensure that the spacer is not lost when dismantling PCB and housing.

IMPORTANT: when re-assembling PCB and right housing shell it is essential that the spacer is fitted again at the appropriate position (see above). Otherwise it is possible for the PCB and/or the housing shell to be damaged when tightening up the screw. If the plastic spacer has been lost, it is essential for safety reasons not to replace it by another spacer made of metal.

10.1 Changing the polarity for the stimulus signal input

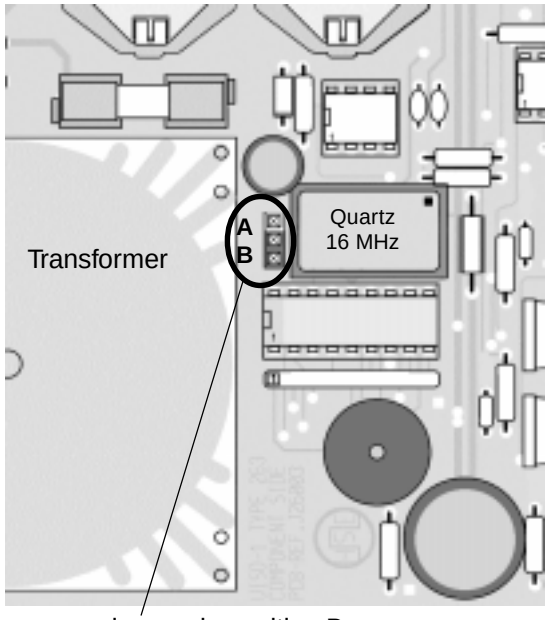
In order to change the polarity of the stimulus signal input it is necessary to open up the unit housing (see Section 10.0).
The polarity change is made be moving a jumper which can be found on the circuit board between quartz oscillator and transformer after opening up the housing. The illustration alongside shows the position of the jumper in the two settings A and B on the circuit board (part view!).

Pos. **A**: input signal REVERSE (active high)

Pos. **B**: input signal NORMAL (active low)

For removing and repositioning the jumper it is convenient to use forceps (tweezers) or small flat nose pliers.

Do not forget: mark the selected polarity in the appropriate field on the back panel of the unit (NORMAL or REVERSE).



Jumper positions A and B
on the printed circuit board, for changing the polarity of the stimulus input signal

10.2 Changing the supply voltage (230 - 115 V AC)

To alter the supply voltage from 230 V to 115 V or vice versa it is necessary to open up the housing and unscrew the circuit board from the housing shell (see Section 10.0).

The voltage is altered by changing the soldered wire links on the circuit board. The solder points are on the solder face of the board, opposite the mains transformer, and are marked A, B and C:

- **for 230 V:** solder in link C, omit or remove links A and B.
- **for 115 V:** solder in links A and B, omit or remove link C.

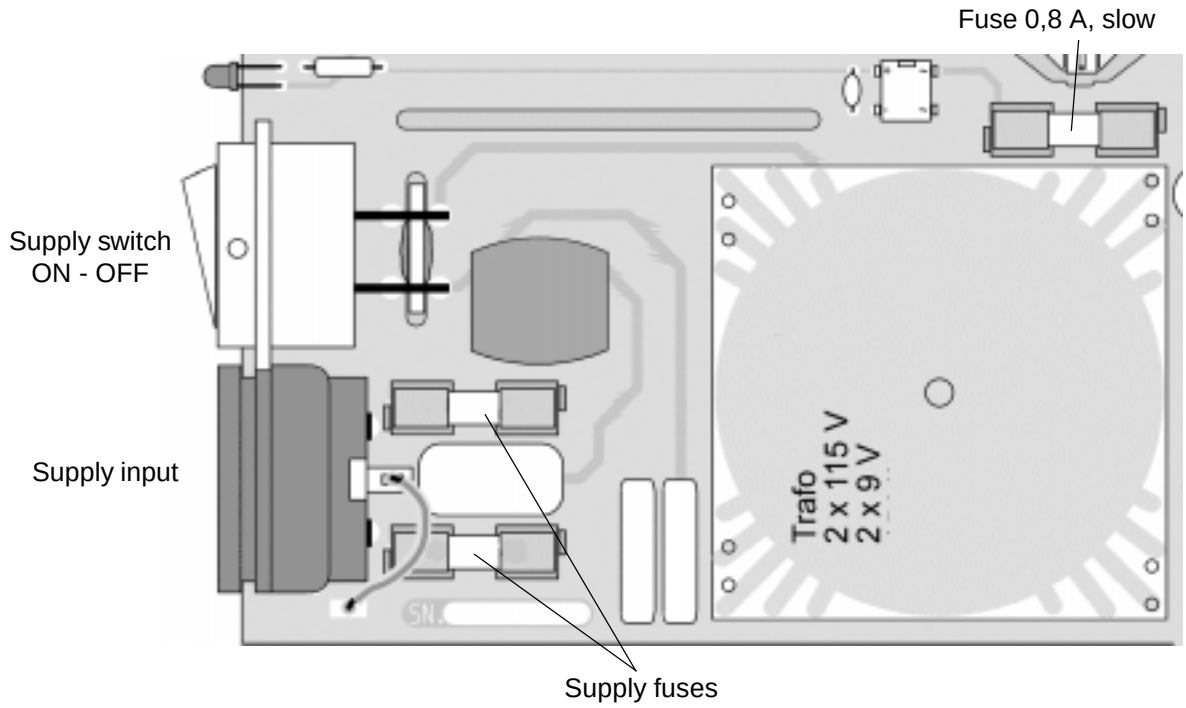
Important: when altering the supply voltage it is necessary to fit the correct supply fuses (see Section 10.3).

Do not forget: mark the altered supply voltage in the appropriate field on the back panel of the unit (230 V or 115 V),

10.3 Fuses

In general it should be noted that failure of a fuse is in most cases an indication that there is some fault in the unit. Replacing the fuse obviously does not rectify the fault which has caused the fuse to fail. It is therefore advisable to return the unit for repair if a fuse on the unit has failed.

The fuses are located on the circuit board (PCB) and are therefore accessible only after opening up the housing (see Section 10.0).



Location of the fuses on the circuit board (part view)

There are two fuses for the supply input (supply fuses) and one fuse for the internal power supply (0.8 A, slow). These are standard fuses (5 x 20) which are fitted into open fuse holder clips.

The supply fuses have to be suitable for the supply voltage (230 or 115 V). When changing the supply voltage it is therefore essential to fit the correct supply fuse:

- 230 V: 2 off 0.1 AT (=0.1 Amp, slow blow)
- 115 V: 2 off 0.2 AT (=0.2 Amp, slow blow)

WARNING: use only fuses with the specified rating and the indicated action (T = slow blow). Otherwise there is a fire risk in case of a fault inside the unit!

11.0 Faults and remedies

Fault: **„POWER“ LED (on the back) does not light up.**
Cause: supply cable faulty or no supply or internal unit fuse blown.
Remedy: change supply cable, use another supply socket, arrange for unit to be repaired.

Fault: **no stimulus, „POWER“ LED on the back lights up. „ISO POWER“ LED does not light up.**
Cause: the unit has probably overheated.
Remedy: switch off and allow unit to cool down. Rectify cause, ensure adequate cooling!

Fault: **the warning tone can be heard on each stimulus.**
Cause: the stimulus input signal has excessive width (>10 msec) or the repetition time is too short (shorter than 10 x width).
Remedy: reduce the stimulus input signal to the maximum permitted width or increase the repetition time.

11.1 Test program

The internal memory contains a test program which permits testing the function of the output circuit independently of the input signal at the „STIMULUS SIGNAL INPUT“.

After the test program has been started, stimuli with the following parameters appear at the output:

Stimulus widthe:	10 ms
Repetition rate:	5 Hz (repetition time 200 msec)
Polarity:	according to the setting of the POLARITY switch
Amplitude:	as set on the AMPLITUDE potentiometer and the switch „RANGE (V)“ 0 - 100 V

☞ **NOTE:** for safety reasons pull out the plugs of the electrode cables before starting the test program!

To start the test program: immediately after switching on the unit with the mains switch (within the first 3 seconds) switch the POLARITY switch forwards and backwards.

To terminate the test program: briefly switch off the unit (for about 2 seconds) with the mains switch (on the back of the unit).

12.0 Maintenance notes

☞ **WARNING:** for safety reasons pull out the supply plug before carrying out any cleaning operations on the unit!

Any splashes of salt solution should be removed immediately with a moist cloth in order to prevent corrosion damage to the metal parts, the connectors and the electronics.

For cleaning never use scouring powder or any cleaning agents which attack plastics.

Any dust should be removed with a lint-free cloth or with a fine dust brush.

Heavier dirt can be removed with a soft cloth moistened with soapy water or a mild domestic cleaning agent. Then wipe up with a cloth moistened with clean water. Never allow any liquid to find its way inside the unit. Protect also the controls on the front panel and on the back of the unit against ingress of liquid.

Any spots on the front panel can usually be removed with an ordinary plastic eraser.

13.0 Transport

If you have to ship the unit (e.g. for repair), wrap it first in plastic foil or packing paper. Then pack the wrapped unit inside a strong carton large enough to provide at least 10 cm space all round, and pad the unit well all round with a soft material (foam plastics, cellulose, paper ...). Mark the carton that its contents are fragile.

14.0 Conformity

CE

This product and accessories conform to the requirements of the Low-Voltage Guideline 73/23/EWG as well as the EMC Directive 89/336/EWG and are accordingly marked with the CE symbol. For conformity with the standard it is essential that the details in these Instructions are strictly observed during operation.

15.0 Technical data

Unit designation:	Universal Isolated Stimulator Output (**UISO**) Type 263
Function:	electrnic isolation stage for any square-wave stimulator for electrophysiological research
Construction:	plastics shell housing with plastics front panel
Input signal:	square-wave signal, NORMAL active low or REVERSE active high, selected internally
Input amplitude:	3 to 15 Volt, switching level 1.5 V approx.
Input impedance:	10 kOhm (on +5 Volt)
Permitted pulse width (W):	10 µsec to 10 msec, larger width are suppressed (warning beep!)
Minimum repetition time:	10 times pulse width; shorter repetition times: shut-down and warning beep!
Stimulus output:	floating, no reference to ground
Stimulus amplitude:	0 to 50 Volt, can be switched to 0 to 100 Volt
Pulse currents:	up to approx. 2 A possible with minimum pulse width (10 µsec) up to 0.5 A at maximum pulse widths (10 msec)
Stimulus polarity:	positive only, negative only, or alternating (alternatively positive and negative)
Ambient conditions:	laboratory indoors
Operating temperature:	15 - 35°C
Storage temperature:	-10 to 50°C
Relative humidity:	20 - 80%, no condensation
Supply:	230 or 115 Volt, 50 - 60 Hz, 50 VA (change of supply voltage (by technician only) through re-soldering wire links)
Supply fuses:	on 230 V: 0.1 A slow; on 115 V: 0.2 A slow
Protection:	Class I
Protection type:	IP40
Dimensions:	(W x H x D) 5.5 cm x 16 cm x 25 cm
Weight:	1.3 kg

16.0 Index

17.0 Reply form

Please take a few minutes of your time in order to write to us on any difficulties in understanding the Operating Instructions or in the use of the apparatus. With your feedback you will help to improve our products and the system documentation and make them more user-friendly.

Please tell us

☞ where you have found mistakes,

☞ where the arrangement was not clear and what you did not understand,

☞ and where you would like to see improvements.

Your critical notes will always be welcome.

Many thanks for your kind assistance.
Yours HUGO SACHS ELEKTRONIK -
HARVARD APPARATUS GmbH

Your name _____

Organisation _____

Street _____

Town _____

Phone / Fax _____

e-mail _____

Please send this sheet or a copy to:

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