Neuro-simulator
Neuro-simulator, power supply

65963-00
65963-93

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Operating instructions

The unit complies with the corresponding EC-guidelines.

Fig. 1: 65963-00 Neuro-simulator

Fig. 2: 65963-93 Neuro-simulator, power supply

INHALTSVERZEICHNIS

1 SAEFTY PRECAUTIONS

Caution!

- Carefully read these operating instructions completely before operating this instrument. This is necessary to avoi damage to it, as well as for user-safety.
- Check that your mains supply voltage corresponds to that given on the type plate fixed to the instrument.
- Install the instrument so that the on/off switch and the mains connecting plug are easily accessible.
- Do not cover the ventilation slots.
- Take care that no liquids or objects enter in through the ventilation slots.
  Vor Inbetriebnahme des Gerätes ist die Betriebsanleitung sorgfältig und vollständig zu lesen. Sie schützen sich und vermeiden Schäden an Ihrem Gerät.
- Only use the instrument in dry rooms in which there is no risk of explosion.
- Do not start up this instrument should there be visible signs of damage to it or to the line cord.
- Achten Sie darauf, dass die auf dem Typenschild des Gerätes angegebene Netzspannung mit der Ihres Stromnetzes übereinstimmt.
- Only use the instrument for the purpose for which it was designed.

2 PURPOSE AND CHARACTERISTICS

The electronic neuron component, the “Neuro-simulator” enables the active simulation, i.e. defined by the user, of electrophysiological experiments from the cellular level up to the network level. This is achieved in that the intracellular potentials and the effects of the synapses can be derived as in the experiment on an “intracellular electrode”. The same applies to the action potentials which can be derived through an “extracellular electrode” on the axon of the cell simulated by hardware. The cells are linked to one another and to a stimulation device with three buttons and an optical sensor. Therefore, signals picked up via the axon can be applied to one or more synapses of the following “neurons” (neuronary network). Each neuron component has a total of 9 synapses which can be connected. Here, axons (simulated by leads) of the sensors or other NEURO-SIMULATOR components can be terminated. An anatomical link is then possible. As in the nervous system, the effects of a signal that reaches a synapse of a following cell via an axon are solely determined by the synapse characteristics. The types of synapse are labelled by a colour code and can therefore by unambiguously identified. An adjustable threshold defines which proportion of the intracellular depolarisation is passed on as action potentials via the efferent axon. The action potentials can be obtained at a signal tapping which symbolises an extra-cellular electrode. They can then be displayed on an oscilloscope or a personal computer with a suitable interface. In addition, an acoustic monitor, which can be deactivated, is included in each Neuro-simulator component so that the action potentials can be monitored audibly as is usual in electrophysiological research laboratories. The negative resting potential and the post-synaptic potentials can be obtained at the tapping point for the symbolised intracellular electrodes. The level of this potential can also be read from the light intensity of the light emitting diode at the tip of the electrode.

3 FUNCTIONAL AND OPERATING ELEMENTS

The neuro-simulator and the power supply are accommodated in plastic (ABS) housings. The cover plate of the housing has a carrying handle that can be swung upwards. The base plate has a similar handle, which can be swung out to enable the instrument to stand in an inclined positioned. Four rubber feet ensure slip-resistance and stability. The instrument can be stacked on other instruments having the same type of housing, whereby the rubber feet stand in the pan-shaped hollows of the instrument below for increased security against displacement. When units are stacked, the sloped position is only permissible for the topmost unit. The unit is connected to the AC mains using the mains lead that is supplied with it. The lead is inserted into the equipment connection plug at the back of the unit. The mains switch to start operating the unit is situated in the immediate vicinity of the equipment connection plug at the back of the unit. The neuro-simulator does not have its own power supply but is instead supplied from the separate power supply. The front panels of the units are fitted with the following functional elements and controls (see Fig. 3 and 4).

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1 Indicating lamp
to indicate that the unit is switched on.

2 Stimulator synapses
(depolarising); 3 green 4-mm-sockets for signal input.

3 Presynaptic synapses
(quiescent inhibition); 3 brown 4 mm sockets for signal input.

4 Hebb’s synapse
(variable depolarising) blue 4 mm socket for signal input.

5 Inhibitory synapses
(hyperpolarising); 2 red 4 mm sockets for signal input.

6 Intracellular electrode (I)
yellow 4 mm socket for the measurement of the resting potential and the post-synaptic potential.

7 Illuminated display
for displaying level of the post-synaptic potential.

8 Control knob for threshold
for setting the proportion of the intracellular depolarisation which is passed as the action potential via the efferent axon.

9 Input/output
for the supply voltage; DIN socket for the input of the ±9V supply voltage produced in the power supply. The voltage can be looped through to another neurosimulator using the second DIN socket.

10 Ground
white 4 mm socket as ground connection for intracellular (I) and extra-cellular (E) measurements.

11 Efferent Axon
black 4 mm socket for obtaining the efferent (leading away) axon signal.

12 Extracellular electrode (E)
yellow 4 mm socket for the measurement of the action potential on the axon.

13 Loudspeaker button
for switching the loudspeaker on and off.

14 Loudspeaker
for the acoustic display of the action potentials.

15 Reset button
or resetting the Hebb’s synapse to the basic state (fast “synaptic memory loss”).

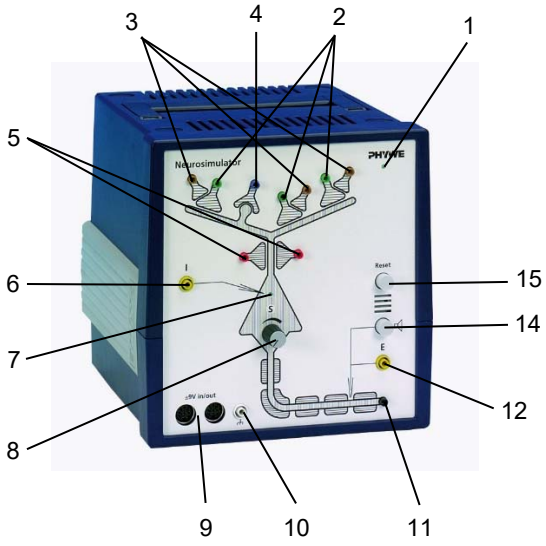

Fig. 3: Front view of the Neuro-simulator 65963-00

Neuro-simulator, power supply 65963-00

1 Indication lamp
for indicating that the unit is switched on.

2 Control knobs for stimulation intensity
for setting the level of stimulation in stimulation channels 1, 2 and 3.

3 Stimulation buttons
A stimulation signal is present on the two corresponding sockets when the stimulation button is pressed.

4 Stimulation outputs
4 yellow sockets for measuring the stimulation intensity.

5 Stimulation outputs
4 black 4 mm sockets for obtaining the stimulation voltage for the synapses of a neuro-simulator.

6 Ground
2 white 4 mm sockets as ground connection for the measurement of stimulation intensity.

7 Supply voltage output
DIN socket for the output of the ±9 V supply voltage for a maximum of 4 neuro-simulators.

8 Offset voltage
blue 4 mm socket for obtaining a voltage of -7 V. This is needed for the display of an intracellular potential on instruments not having any offset adjustment.

9 Photoelectric sensor
for picking up light stimuli (e.g. pocket torch). The output voltage present on the corresponding sockets is inversely proportional to the luminous intensity.

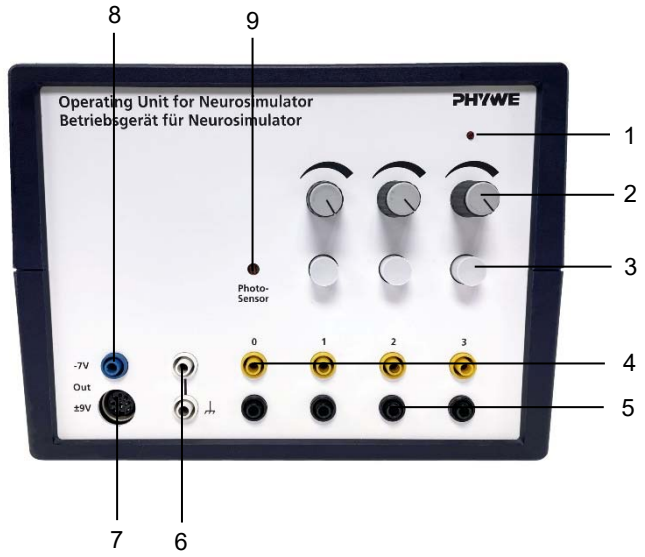

Fig. 4: Front view of the Neuro-simulator, power supply

Changing the primary safety fuse
The fuse holder is in the upper part of the mains socket of the instrument, and so is only accessible when the connecting cord is not plugged in. Unplug the connecting cord, open the fuse holder using a screwdriver, take out the defect fuse and replace it with a new one (first check the specification of this against the data on the type plate), then fit the fuse holder back in the mains socket.
Should this fuse blow when the instrument is switched on, never replace it with a more resistant fuse! A defect is indicated, and the instrument must be returned to the Phywe service department for repair.

4 NOTES ON OPERATION

This high-quality instrument fulfills all of the technical requirements that are compiled in current EC guidelines. The characteristics of this product qualify it for the CE mark. This instrument is only to be put into operation under specialist supervision in a controlled electromagnetic environment in research, educational and training facilities (schools, universities, institutes and laboratories). This means that in such an environment, no mobile phones etc. are to be used in the immediate vicinity. The individual connecting leads are each not to be longer than 2 m. The instrument can be so influenced by electrostatic charges and other electromagnetic phenomena that it no longer functions within the given technical specifications. The following measures reduce or do away with disturbances: Avoid fitted carpets; ensure potential equalization; carry out experiments on a conductive, earthed surface, use screened cables, do not operate high-frequency emitters (radios, mobile phones) in the immediate vicinity.

5 TECHNICAL DATA

(typical für 25°C)
Operating temperature range: 5 - 40°C
Relative humidity < 80%

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Intracellular electrode (I)
Resting potential approx. -7 V (-70 mV in the Nerve celle)

Depolarisation (stimulation) approx. 0 V (0 mV)

Hyperpolarisation
(inhibition) approx. -8.8 V (-88 mV)

Extra-cellular electrode (E)

Action potenzial (AP)	approx. 50 mV (500 µV)
Duration of an AP	approx. 1 ms
Membrantime constant	approx. 50 ms (rise time) ca. 400 ms (decay time)
Supply voltage	±9 V
Power consumption	2.5 W
Housing dimensions (mm)	230 × 236 × 236 (B, T, H)
Weight	ca. 2.8 kg

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Voltage output	±9 V (for max. 4 Neuro-simulators)
Stimulator outputs	0...7 V
Offset output	-7 V
Mains supply	
Protection class	I
Connecting voltage	see type plate (+6%/-10%)
Mains frequency	50/60 Hz
Power consumption	14 VA
Mains fuse	see type plate (5 mm × 20 mm)
Offset output (mm)	230 × 236 × 168 (B, T, H)
Weight	approx. 2.6 kg

5 SCOPE OF DELIVERY

A set of connecting leads is included with the neurosimulator:

Signal lead, l = 35 cm	11055-00
Connecting cord, l = 6 cm, white (2x)	168805
Connecting cord, l = 15 cm, white (2x)	168806
Connecting cord, l = 50 cm, white (2x)	168807
Commecting cord, l = 50 cm, yellow (2x)	07361-02

7 LIST OF EQUIPMENT

Set Neurobiology with one nerve cell with Cobra SMARTsense	65963-22
Demo expert Biology Manual Neurosimulator	01191-02

8 EXPERIMENTS

- The nerve cell with Cobra SMARTsense P4010769
- Nerve cell interactions with Cobra SMARTsense P4010869
- Neural networks with Cobra SMARTsense P4010969

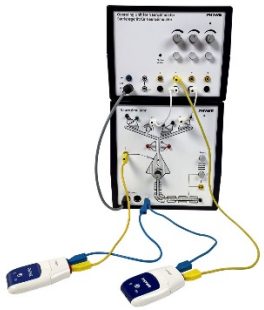

Fig. 5: Experimental set-up „The nerve cell with Cobra SMARTsense" P4010769"

6 WARRANTY

We give a warranty of 24 months for units that we have supplied inside the EU, and a warranty of 12 months outside the EU. The following is excluded from the warranty: damage that is due to non-compliance with the operating instructions, improper use or natural wear.

The manufacturer can only be held liable for the function and safety-relevant properties of the unit if the maintenance, service and modifications of the unit are performed by the manufacturer or by an institution that is expressly authorised by the manufacturer.

7 WASTE DISPOSAL

The packaging mainly consists of environmentally-friendly materials that should be returned to the local recycling stations.

Do not dispose of this product with normal household waste. If this unit needs to be disposed of, please return it to the address that is stated below for proper disposal.

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