

# Neuro-MS/D

Series of Transcranial Magnetic Stimulators for Diagnostic, Therapeutic and Research Purposes



- Peak magnetic field – up to 4 Tesla
- Number of pulses generated during one session – up to 10 000
- Several delivery set variants
- Pulse waveform: monophasic, biphasic, theta-burst (TBS), paired stimulation
- 2-channel digital EMG system for motor threshold detection
- Neuro-MS.NET software for magnetic stimulator control
- Set of different coils (non-cooled, cooled, placebo)
- “Delayed charging” mode
- Multistage device protection system
- Connection to computer via USB port



# Neuro-MS/D Features

## Modular Construction

New version of magnetic stimulator consists of several separate units, thus you can select the configuration required for you. We offer you several ready-made configuration variants that can be most conveniently applied for the practical use.

### Main Unit

Main unit is the basis of any configuration. The main stimulator unit is intended for stimulator operation control and can be used as an independent device (if it is equipped with coils). The front panel contains digital indicators displaying all parameters of stimulator operation and controls used to adjust stimulation parameters.

### Cooling Unit

One of the problems of magnetic stimulator application is quick overheating of coils during the stimulation performing. In **Neuro-MS/D** this problem is solved with the use of special cooling unit and cooled coils. In fact, this is a tank with the cooling liquid, the pump running the cooling liquid through the coil and the fridge. The unit allows increasing continuous operation time up to 10 000 pulses without overheating. Actually, it means that stimulator can operate for a long time without overheating.

### Expansion Unit

The expansion unit allows increasing the stimulation intensity by 40% and also perform paired and monophasic stimulation.

### Extra Power Supply Unit

The main unit of the magnetic stimulator allows operating with up to 30 Hz frequency. However, the stimulator does not generate the maximal induction at 30 Hz frequency. It can be achieved only at 5 Hz (or less) frequency. Also there is a term "maximal effective stimulation frequency". This term indicates the frequency at which transcranial magnetic stimulation can be performed and each pulse in series is higher than motor threshold for most people. For main unit it equals 10 Hz. The extra power supply unit makes it possible to increase this frequency twice (up to 20 Hz).

## Neuro-EMG-MS is a Special Device to Record Motor Evoked Potentials

This device is EMG amplifier. If you connect it to computer, you can record the motor evoked potentials obtained at TMS stimulation of motor areas of cerebral cortex and peripheral nervous system. When you record the motor evoked potentials, you can define the so called motor threshold (MT). This is a very important parameter. As far the stimulation amplitude at performing of treatment procedures is often set relative to obtained MT.



# Delivery Set Variants

## 1<sup>st</sup> Variant: Diagnostic

The **diagnostic variant** of magnetic stimulator is intended first of all for joint operation with neurophysiological (EMG) equipment to study the state of cerebral, spinal and peripheral pathways.

The maximum diagnostic capabilities can be shown if the device is used together with neurophysiological digital system manufactured by **Neurosoft Ltd.** However, the magnetic stimulator can operate with devices of other manufacturers.

### Neuro-MS/D (Diagnostic Variant)

#### Applications:

##### Neurology:

- study of motor response at magnetic stimulation of peripheral nerves;
- determination of central motor conduction time in patients suffering from demyelinating diseases of nervous system, in particular, multiple sclerosis;
- assessment of excitability and flexibility of cortex motor zones;
- assessment of root conduction time (F-wave and segmental magnetic stimulation) at osteochondrosis.

##### Ophthalmology:

- diagnostics of visual pathway defects.

##### Epileptology:

- study of epilepsy by means of noninvasive location of epileptic focuses and determination of lateralization of speech center before the brain surgery.

##### Pulmonology:

- stimulation of phrenic nerve for study of diaphragm response.

To avoid artifacts during neurophysiological responses acquisition, the stimulator provides the possibility of delayed charging of high-voltage capacitor.



The **diagnostic variant** can be applied partially with therapeutic purposes to perform transcranial stimulation and almost without any limits to stimulate peripheral nerves and muscles.

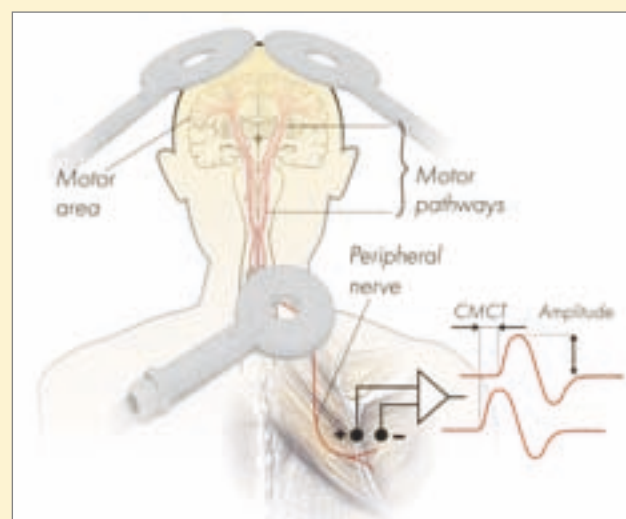


## TMS Use to Make Prognosis for Rehabilitation of Stroke Patients

The magnetic stimulator can be successfully used to make rehabilitation prognosis for stroke patients. At that the following parameters are studied:

- **Amplitude of motor evoked potential (MEP)** recorded at cortex stimulation is characterized by the number of undamaged motoneurons in cortex structures.
- **Central motor conduction time** (conduction time from cortex to cervical part) reveals the integrity of motor pathways.
- **Amplitude ratio** (motor evoked potential/M-wave) is used to assess the excitability of motor cortex.
- **Motor evoked potential facilitation** is used when the response is not obtained without facilitation. The obtained response at facilitation and missed one without facilitation can evidence high level of motoneurons and (or) pathways injury. At that the integrity of the given structures is still obvious.

All parameters are recorded separately from right and left sides.



## 2<sup>nd</sup> and 3<sup>rd</sup> Variants. Therapeutic and Advanced Therapeutic

The principle of therapeutic magnetic stimulation is based on the following. The magnetic stimulator uses the magnetic pulses of short duration and emerging high-intensity electromagnetic field easily penetrates through clothes, cranium bones and soft tissues. They exert influence upon deep nerve centers, peripheral nerves, cerebral and spinal cord, which are inaccessible for other kinds of stimulation.

The distinctive feature of **Neuro-MS/D** device is possibility to perform transcranial magnetic stimulation (TMS). However, the well-known problem is quick coil overheating.

The cooling unit included in **therapeutic** delivery set variant allows performing long-term therapeutic impacts (also transcranial magnetic stimulation with high frequency and intensity) without coil overheating.

**Advanced therapeutic variant** provides the possibility to increase the so called maximal effective stimulation frequency (the frequency when each stimulus in series has 100% intensity of motor threshold for most people) twice (up to 20 Hz) owing to extra power supply unit.

Most often these stimulator variants are used to treat depressions (including severe and drug-resistant), tinnitus. Besides, there are positive and encouraging results obtained at rehabilitation of stroke patients.

### **Neuro-MS/D (Therapeutic) Applications:**

#### **Neurology:**

- treatment of central and peripheral nervous system disorders: vascular and vertegragenic pathologies, consequences of stroke, neuropathies, demyelinating disorders of nervous system, spinocerebellar degeneration, spasticity, pain syndrome, radiculopathies, hemicrania, Alzheimer's disease.

#### **Ophthalmology:**

- partial atrophy of visual nerve owing to different etiology.

#### **Psychiatry:**

- treatment of depressions, schizophrenia, obsessive-compulsive disorders, manias and other psychiatric disorders.

The delivery set of **therapeutic variant** includes **Neuro-MS.NET** software allowing to program any stimulation algorithms. It also provides theta-burst mode with up to 100 Hz stimulation frequency.



In case the **therapeutic variant** is equipped with neurophysiological equipment, it will receive all capabilities of diagnostic variant.



## 4<sup>th</sup> Variant. Research

The **research variant** of the magnetic stimulator combines all features of other variants allowing to perform scientific researches in neurophysiology, psychiatry, epileptology, etc.

During the research of therapy effectiveness for different diseases it is often required to perform sham stimulation along with common stimulation. To fulfill it, **Neurosoft Ltd.** produces placebo coils supplied on special order.

The distinctive feature of research variant is availability of expansion unit. It increases the magnetic field induction by 40% in comparison with the use of main unit only. Besides, the expansion unit allows performing monophasic and paired stimulation. In paired stimulation mode two stimuli are delivered one after another with very short interstimulus interval (from 2 up to 990 ms). The amplitude of each stimulus in pair can be specified separately.

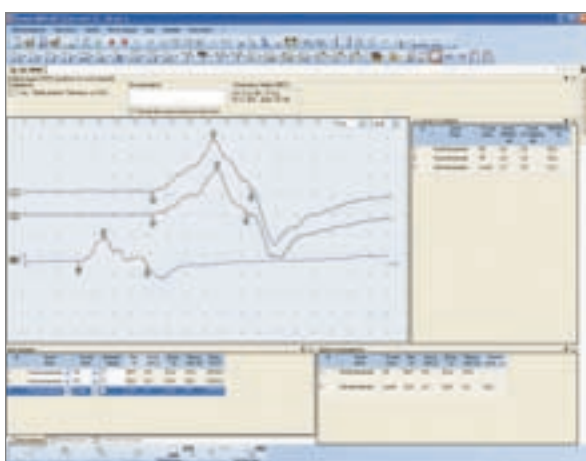
If the stimulator is equipped with second main unit and second coil, you can perform the paired stimulation using two coils. First, the pulse is transferred from one coil and then from another one with the specified delay (from 0 to 1 s).

The techniques being available if you use research variant of magnetic stimulator (in case it is used together with neurophysiological equipment):

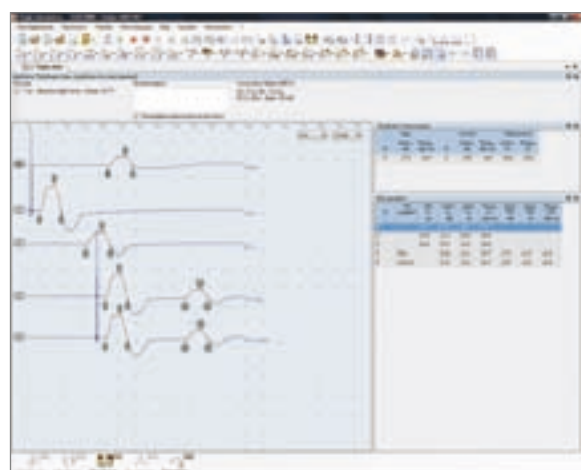
- central motor conduction time (CMCT);
- silence period assessment (SP);
- interhemispheric inhibition (IHI);
- facilitation;
- root delay;
- triple stimulation test (TST);
- repetitive stimulation with 5-10 Hz frequency to assess the cortical response exhaustion.



## Examples of Techniques



Study of central motor conduction time



Triple stimulation test

## New Coils

Nine different types of coils (including cooled ones and placebo ones) allow achieving different intensity, depth and duration of impact depending on study or treatment purpose.

Coil Types	Function	Maximal Induction at 100% Stimulus Amplitude	Non-cooled	Cooled
				
	Intended for stimulation of spacious areas of cerebral cortex and peripheral nerves located rather superficially	2 (2.8)*	Small ring coil RC-02-100	-
	Intended for stimulation of spacious areas of cerebral cortex and deep-lying structures	1.2 (1.68)*	Big ring coil RC-02-150	Cooled big ring coil RC-02-150-C
	Intended for focused stimulation of nerves located rather superficially	2.9 (4.06)*	Small figure-of-eight coil SFEC-02-50	-
	Intended for focused stimulation of central and peripheral nervous system	1.1 (1.6)*	Figure-of-eight coil FEC-02-100	-
			Figure-of-eight coil (placebo) FEC-01-100-P	
	Intended for focused stimulation of cerebral cortex	1.6 (2.24)*	Angulated figure-of-eight coil AFEC-02-100	Cooled angulated figure-of-eight coil AFEC-02-100-C
			Angulated figure-of-eight coil (placebo) AFEC-02-100-P	

\* When expansion unit is used

## Neuro-MS.NET Software

The delivery set includes the special software for magnetic stimulator control with the use of computer. This software allows keeping the patient database, detecting motor threshold, controlling the stimulation courses and sessions. A user can perform the stimulation according to already specified stimulation programs and also create own ones or edit the available stimulation programs.



## New Coil Holder

Now **Neuro-MS/D** delivery set (research variant) includes FISSO holder to fix the magnetic stimulator coil. It is very convenient as it can be fixed in any position by rotating one screw.

You can order this coil holder for other delivery set variants.



## Specialized Computer

The device can be both equipped with common computer and specialized one with touchscreen interface.

**Neuro-MS.NET** is specially adapted finger-controlled software. It allows controlling the magnetic stimulator operation quickly and conveniently.



## Operation with Any Neurophysiological Equipment

**Neuro-MS/D** magnetic stimulator can operate jointly with neurophysiological equipment manufactured by **Neurosoft Ltd.** and also digital EMG systems of third-party manufacturers. To connect to EMG systems of third-party manufacturers, the trigger socket is provided. The special trigger unit can also be applied to adjust the trigger pulse parameters.



## Delivery Set

List of Components	Diagnostic	Therapeutic	Advanced Therapeutic	Research
<b>Neuro-MS/D</b> main unit	1	1	1	1
<b>Neuro-MS/D</b> expansion unit	–	–	–	1
<b>Neuro-MS/D</b> cooling unit	–	1	1	1
<b>Neuro-MS/D</b> extra power supply unit	–	–	1	1
Trolley with castors for magnetic stimulator (4 shelves)	–	1	1	1
Coil holder	–	1	–	–
FISSO coil holder	–	–	1	1
Big ring coil RC-02-150	1	–	–	–
Small ring coil RC-02-100	1	–	–	–
Figure-of-eight coil FEC-02-100	1	–	–	–
Cooled angulated figure-of-eight coil AFEC-02-100-C	–	1	1	1
HV cable for <b>Neuro-MS/D</b> expansion unit connection	–	–	–	1
Control cable for <b>Neuro-MS/D</b> cooling unit	–	1	1	–
HV cable for extra power supply unit connection to <b>Neuro-MS/D</b>	–	–	1	–
Control cable for <b>Neuro-MS/D</b> cooling and expansion units	–	–	–	1
Equipotential cable	–	1	2	2
End cap	1	1	1	1
<b>Neuro-EMG-MS</b> digital system	–	–	–	1
<b>Neuro-MS.NET</b> software	–	1	1	1
Technical manual	1	1	1	1
User manual	1	1	1	1

If you want to know more about magnetic stimulation, we recommend reading the following books:

- Marcolin M.A., Padberg F. Transcranial Brain Stimulation for Treatment of Psychiatric Disorders.
- Hallett M., Chokroverty S. Magnetic Stimulation in Clinical Neurophysiology.
- Wassermann E.M., Epstein C.M., Ziemann U., Walsh V., Paus T., Lisanby S.H. The Oxford Handbook of Transcranial Stimulation.
- The Repetitive Transcranial Magnetic Stimulation (rTMS) in the Treatment and Rehabilitation of Central Nervous Diseases / Ed. by Judit Málly.



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