Neuro-MS/D

Transcranial Magnetic Stimulator

1. DIAGNOSTICS of corticospinal pathway pathology

2. REHABILITATION of motor disorders after the stroke

3. TREATMENT of depression and Parkinson’s disease

STIMULATION with up to 100 Hz frequency, peak magnetic field up to 4 T and active coil cooling
One of the problems related to therapeutic magnetic stimulator use is quick overheating of coils during the stimulation. We designed special cooling unit and cooled coils to cope with this problem. The cooling unit allows increasing the running time without overheating up to 10,000 pulses iteratively. In practice it means that the device can operate for hours without overheating.

To achieve the therapeutic effect, it is required to perform stimulation with specified frequency. The researchers all over the world create and test continuously new therapeutic TMS protocols. Often it assumes that the high-frequency stimulation is required. Neuro-MS/D performs stimulation at up to 100 Hz frequency (up to 25 Hz with maximum intensity). All these allow using most advanced and modern treatment protocols.

Neurosoft Company is a world leader in development and manufacture of transcranial magnetic stimulators (TMS systems). Our first stimulator was created in 1996. Nowadays, in almost 20 years of continuous development, we produce extensive line of TMS devices. Neuro-MS/D is the magnetic stimulator of fourth generation. Thousands of Neurosoft TMS machines operate in scientific laboratories, neurological and psychiatric clinics all over the world and TMS technique becomes a routine practice of neurologists and psychiatrists.
During the stimulation it is very important to keep the coil in one and the same position relative to patient’s head. Only in this case one can be sure that the stimulus is delivered in the targeted brain area. Moreover, the location of cortex depends on individual anatomic features. Thus, at the beginning of the procedure the clinician must be free to move the coil relative to patient’s head to detect the stimulation area and then instantly fix the coil securely at any position. To ensure such fixation, Neuro-MS/D can be supplied with special flexible arm for coil positioning.

The Windows-based software intended to control the magnetic stimulator allows keeping the patient database, managing the treatment courses and the stimulation sessions, performing the stimulation using the predefined protocols and also creating and customizing the available stimulation protocols. The software is optimized for touchscreen interface.

The cooling unit is a significant part of therapeutic magnetic stimulator. There is a tank with cooling agent inside it, high-tech compressor-free cooler and the pump running continuously the cooling agent via the coil. The liquid cooling system is much more efficient and less noisy in comparison with the air one.

The main unit of the magnetic stimulator is designed to operate with up to 30 Hz frequency. However, the main unit alone can deliver maximum intensity only at 5-7 Hz frequency. The extra power supply unit makes it possible to increase the maximum frequency up to 100 Hz and obtain the maximum intensity at 20-25 Hz frequency depending on coil type.

The alternating magnetic field easily penetrates through skin, cranium bones, soft tissues and reaches the cortex. This field has extremely high intensity. If the coil is positioned over the motor cortex and the stimulus is delivered, the intensity of induced field is enough to activate big groups of motor neurons that results in a visible muscle twitch. Such impact is inaccessible for other types of stimulation and allows performing a wide range of diagnostic and therapeutic procedures.

If the recording electrodes placed on the peripheral muscle are plugged in the EMG machine, and the muscle representation in the motor cortex is stimulated with the coil, the motor evoked potential (MEP) can be recorded. The study of the obtained waveform, its amplitude and latency allow estimating the state of the motor pathway starting from the cortex. The repetitive transcranial magnetic stimulation performed for a long time (about 10-30 minutes) can modulate the cortex excitability.

Most clinicians, using the magnetic stimulators, apply anatomical landmarks to detect the stimulation area. Such stimulation, sometimes, is not enough accurate because of individual anatomical peculiarities of subjects. Recently there was developed a new technique that allows entering MRI data of a particular subject to computer before the stimulation session and perform MRI-guided stimulation using the 3D target markers on patient’s brain rendering. Neuro-MS/D stimulators can be used together with navigation system.

Neurosoft offers a wide range of EMG systems: 2-channel Neuro-EMG-MS and Neuro-MEP-Micro, 4-channel Neuro-MEP-4, 5-channel Skybox and 8-channel Neuro-MEP-8.
Stimulator Configurations

1 DIAGNOSTIC

The diagnostic variant of magnetic stimulator is intended to study the state of cerebral, spinal and peripheral motor pathways. The maximum diagnostic capabilities can be shown if the device is used together with EMG machine. Neurosoft Company manufactures a wide range of such devices.

2 THERAPEUTIC

The therapeutic magnetic stimulator is a complete solution for basic therapeutic practice. The cooling unit included in therapeutic configuration allows performing treatments for a long time (including TMS with high frequency and intensity) without coil overheating.

3 ADVANCED THERAPEUTIC

The advanced therapeutic configuration is a solution for advanced practices. Due to the extra power supply unit it is possible to use high-frequency stimulation protocols of 20, 50 and even 100 Hz.

4 RESEARCH

The research magnetic stimulator combines all options of other configurations that allow performing studies in different fields, especially neurophysiology, psychiatry, epiptology. This configuration is supplied with EMS machine and also includes Neuro-MSD monophasic magnetic stimulator to ensure paired stimulation.

TMS APPLICATION IN DIAGNOSTICS OF NEUROLOGICAL DISORDERS:

Multiple sclerosis (MS), amyotrophic lateral sclerosis (ALS), Parkinson's disease (PD), injury of corticospinal pathways of different genesis including vascular, tumorous, traumatic and at stroke; cervical myelopathy, dystonia, cerebellar ataxias, motor radiculopathy, phrenic nerve pathology.

DIAGNOSTIC TECHNIQUES

MSEP amplitude, motor threshold (MT), central motor conduction time (CMCT), silence period (SP), intracortical (IC) and interhemispheric (IH) inhibition, intracortical (IC) and interhemispheric (IH) facilitation, triple stimulation test (TST), inhibition/facilitation of motor response at repetitive stimulation, paired associative stimulation (PAS).
The Neuro-MS/D magnetic stimulators can be supplied with different coils. All coils have ergonomic handle. The device readiness indicator and pulse delivery button are integrated into this handle. The coil is equipped with the reliable high-voltage connector used to plug the coil to the main unit. The wide range of cooled coils is also available. The cooled coils are equipped with quick connect couplings that allow fast coil attachment to the cooling unit excluding cooling agent leakage. No tools are required for coil replacement. Thus, even the cooled coil replacement takes a few seconds.

Besides the classical coils the double cone coil is designed. It is intended for deep brain stimulation.

Neurosoft Company can design the special coils upon customer’s request.

**COILS OF NEW GENERATION**

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**Comparision of Configurations**

<table>
<thead>
<tr>
<th>Active cell cooling</th>
<th>MEP acquisition</th>
<th>Paired stimulation and monophasic stimulation</th>
<th>Stimulation frequency at maximum intensity, Hz</th>
<th>Maximum stimulation frequency, Hz</th>
</tr>
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<tbody>
<tr>
<td>Diagnostic</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>30</td>
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<tr>
<td>Therapeutic</td>
<td>+</td>
<td>-</td>
<td>5</td>
<td>30</td>
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<tr>
<td>Advanced therapeutic</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>100</td>
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<tr>
<td>Research</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
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**PEAK MAGNETIC FIELD**

At 100% stimulus amplitude, T

<table>
<thead>
<tr>
<th>IMAGE</th>
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<tbody>
<tr>
<td>1.5 (3.2)*</td>
</tr>
<tr>
<td>1.3 (2.8)*</td>
</tr>
<tr>
<td>2.5 (5.2)*</td>
</tr>
<tr>
<td>1.2 (2.6)*</td>
</tr>
<tr>
<td>1.5 (3.2)*</td>
</tr>
<tr>
<td>1.4 (3)*</td>
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**NON-COOLED COILS**

Small ring coil RC-02-100
Big ring coil RC-02-150
Small figure-of-eight coil SFEC-02-50
Figure-of-eight coil FEC-02-100
Figure-of-eight coil FEC-02-100-P
Angulated figure-of-eight coil (placebo) FEC-02-100-A
Angulated figure-of-eight coil (placebo) FEC-02-100-A-P
Double cone coil DCC-02-125

**COOLED COILS**

Cooled big ring coil RC-02-150-C
Cooled figure-of-eight coil FEC-02-100-C
Cooled angulated figure-of-eight coil AFEC-02-100-C
Cooled angulated figure-of-eight coil (placebo) AFEC-02-100-C-P
Cooled double cone coil DCC-02-125-C

*If research configuration is used.