

# Elekta Neuromag<sup>®</sup> TRIUX

Functional brain mapping

Not for USA



*The next level in  
functional mapping*



ELEKTA

# Technical specifications

Elekta Neuromag® TRIUX (art. no. NM23900N) is a comprehensive bio-electromagnetic measurement system for functional brain studies:

- 306-channel neuromagnetometer, which optimally combines both planar gradiometers as well as magnetometers
- Highest available information capture
- Uniquely effective interference elimination technologies with unparalleled robustness even in the presence of intense, nearby sources of interference
- Utmost flexibility in tailoring the system for the particular clinical and/or research needs thanks to a wide range of options

## Sensor array

State of the art sensor array featuring densest spatial sampling and lowest intrinsic noise in the industry:

- Whole-head sensor array with realistic helmet shape
- 1,220 cm<sup>2</sup> sensor coverage
- 102 high-precision triple-sensor elements
- 204 planar gradiometers
- 102 magnetometers
- 35 mm average distance between each sensor element
- 20 mm effective channel separation
- 17.0 mm base length (planar gradiometers)
- <0.1 % geometrical imbalance
- ±20 nT dynamic range
- 18 mm average distance between pick-up coils and room temperature surface
- <1 second detrapping cycle for individual channels with integrated thin-film heaters
- 2.5 minute detrapping cycle for all channels
- Typical white noise levels:

Sensor type	White noise
Gradiometer	3.6 fT/cm/√Hz
Magnetometer	3.5 fT/√Hz

- Guaranteed gradiometer noise levels (percentage of sensors):

Frequency	Noise <sup>1</sup>
1–10 Hz	<20 (100 %)
	<12 (96 %)
60–70 Hz	<10 (100 %)
	<5 (96 %)

<sup>1</sup> fT/cm/√Hz

- Guaranteed magnetometer noise levels (percentage of sensors):

Frequency	Noise <sup>1</sup>
1–10 Hz	<20 (100 %)
	<12 (96 %)
60–70 Hz	<10 (100 %)
	<5 (96 %)

<sup>1</sup> fT/√Hz

- <0.1 % residual crosstalk between sensors (corrected)

## Data acquisition

- Up to 474 simultaneously sampled channels
- 306 MEG channels
- Up to 128 EEG channels
- 12 bipolar analog input channels for physiological signals
- 12 auxiliary analog input channels (±10 V)
- 16 trigger (TTL) channels

- 1–5 kHz sampling rate, configurable by the user
- 24-bit output
- 2.0 fT/cm least significant bit (gradiometer channels)
- 2.5 fT least significant bit (magnetometer channels)
- MEG high-pass filter cutoff frequencies: DC–10 Hz
- EEG high-pass filter cutoff frequencies: DC, 0.03, 0.1, and 10 Hz

## Interference elimination

Proprietary MaxFilter™ and signal space projection technologies for elimination of spatial and spatiotemporal interferences:

- Online signal space projection (SSP) for adaptive elimination of external interferences with up to 40 dB attenuation
- MaxFilter™ technology for offline spatial suppression of interferences with up to 40 dB attenuation for frequencies up to 100 Hz
- MaxFilter™ technology for offline spatiotemporal elimination of even intense artifacts from distant and nearby sources with up to 130 dB attenuation
- Automatic offline detection and exclusion of defective channels

## Movement compensation

Patented movement compensation technology for continuous elimination of motion artifacts:

- Continuous head position tracking
- User-defined update frequency up to 1 kHz
- Offline compensation for temporary movements of the patient's head
- Offline transformation of data between different head positions

## Gantry

Motorized gantry with integrated connectors for auxiliary electrodes and stimuli:

- Reclined measurement positions (30° recline)
- Upright measurement position (22° recline)
- Supine measurement position
- Button-operated electric lifting motor
- Safety locking latch
- Integrated connectors for EEG and auxiliary channels
- Automatic detection of gantry position
- Weight (empty): 350 kg (772 lb)
- Dimensions (upright): 950 × 1,660 × 2,220 mm (37.4 × 65.4 × 87.4 in)
- Dimensions (supine): 950 × 1,340 × 1,990 mm (37.4 × 52.8 × 78.3 in)

## Cryogenics

Cryogenics featuring industry-lowest helium boil-off and fastest stabilization after refill or change of measurement position:

- 78-liter (20.6 gal) liquid helium dewar
- <70 l/week (<18.5 gal/week) boil-off rate (excluding transfer loss)
- 7-day refill interval
- <48-hour warmup-cooldown cycle
- Exhaust line for venting evaporating helium
- Safety exhaust line to an outdoor vent
- Helium level indicator on the gantry (readable via the acquisition system)
- Continuous logging of helium level
- Two liquid helium transfer siphons
- Liquid helium gauge for storage dewars
- Helium transfer accessories

## Head phantom

Precision-engineered head phantom with both current and magnetic dipoles for verification of localization accuracy:

- 32 current dipoles
- 4 magnetic dipoles

- 89 mm (3.5 in) radius
- Guaranteed localization accuracy (aggregate): ≤5.0 mm (≤0.2 in)
- Typical localization accuracy (aggregate): ≤2.0 mm (≤0.08 in) for current dipoles

## Co-registration

Landmark-based co-registration of patient's anatomy with magnetic resonance images:

- Co-registration using anatomical landmarks
- Digitization of additional surface points for visual verification

## Acquisition workstation

Powerful workstation for data acquisition and post-processing of measurements:

- High-end graphical quad-core workstation
- Linux operating system
- 6 GB RAM
- 1 TB SCSI hard disk
- CD/DVD+RW writer
- 30" TFT monitor
- Real-time visualization of raw data for user-selected channels
- Recording of raw data
- Programmable stimulation sequences and timing
- Online averaging of 1–32 categories
- Automatic rejection of signal epochs containing artifacts
- Visualization of online averages
- Noise level monitoring
- Automatic and manual noise optimization
- Loadable acquisition presets
- Post-acquisition interference elimination

## Operating environment

Required operating environment within the magnetically shielded room:

- Air temperature: 20–28 °C (68–82 °F)
- Minimum air flow: 30 l/s (8 gal/s)
- Relative humidity: 40–70 %

Required operating environment within the equipment and operator area:

- Air temperature: 20–24 °C (68–75 °F)
- Relative humidity: 40–70 % (non-condensing)

## Power

- Input voltage: 100, 115, 200, 230, or 240 V (47–63 Hz)
- Power consumption: 4,700 W (typical) or 6,000 W (max)

# Built-to-order options

## 32-channel EEG

Art. no. NM23904N

Integrated EEG subsystem with 32 channels:

- 32 unipolar EEG channels
- $<0.4 \mu\text{Vrms}$  (0.5–100 Hz) noise at 10 k $\Omega$  impedance
- 100 M $\Omega$  input impedance at DC
- Software-controllable gain for individual channels (640, 2,000, or 20,000)
- 100 dB common-mode rejection ratio (with active ground)
- Fixed analog high-pass filters: 0 Hz (DC), 0.03 Hz, 0.1 Hz, and 10 Hz

## 64-channel EEG

Art. no. NM23889N

Integrated EEG subsystem with 64 channels:

- 64 unipolar EEG channels
- $<0.4 \mu\text{Vrms}$  (0.5–100 Hz) noise at 10 k $\Omega$  impedance
- 100 M $\Omega$  input impedance at DC
- Software-controllable gain for individual channels (640, 2,000, or 20,000)
- 100 dB common-mode rejection ratio (with active ground)
- Fixed analog high-pass filters: 0 Hz (DC), 0.03 Hz, 0.1 Hz, and 10 Hz

## 128-channel EEG

Art. no. NM23893N

Integrated EEG subsystem with 128 channels:

- 128 unipolar EEG channels
- $<0.4 \mu\text{Vrms}$  (0.5–100 Hz) noise at 10 k $\Omega$  impedance
- 100 M $\Omega$  input impedance at DC
- Software-controllable gain for individual channels (640, 2,000, or 20,000)
- 100 dB common-mode rejection ratio (with active ground)

# Accessories

## Patient couch

Art. no. NM23125N

Roll-away patient couch on wheels:

- Moveable (length-wise) mattress and bottom
- Removable sidewalls
- Safety belt
- Detachable neck support
- Weight: 75 kg (165 lb)
- Dimensions: 2,220 × 740 × 760 mm (87.4 × 29.1 × 29.9 in)
- Maximum load: 135 kg (298 lb)



## Patient chair

Art. no. NM23124N

Roll-away patient chair on wheels:

- Adjustable height
- Removable table
- Safety belt
- Weight: 80 kg (176 lb)
- Dimensions: 1990 × 620 × 790–910 mm (78.3 × 24.4 × 31.1–35.8 in)
- Maximum load: 135 kg (298 lb)

## Pediatric chair insert

Art. no. BC20899N

Non-magnetic booster seat for pediatric patients and subjects.

## Stim<sup>2</sup> stimulus presentation workstation

Art. no. NM21711N

Stimulus presentation system:

- Stim<sup>2</sup> (Compumedics Inc., El Paso, Texas, United States of America) stimulus generation software
- Dedicated stimulation workstation
- TTL-based synchronization with data acquisition

## High-fidelity visual stimulator

Art. no. NM24034N

High-fidelity video projection system:

- Native 16:9 three-panel DLP video projector
- Symmetric black-to-white and white-to-black transition time
- 26 ms delay from trigger presentation
- <1 ms jitter (frame-to-frame) at 60 Hz refresh rate
- 1,400 × 1,050 pixel native resolution
- 16-bit color depth
- 24–120 Hz refresh rate
- 112 cm (44 in) standalone back-projection screen on wheels



## Auditory stimulator

Art. no. NM24035N

Stereophonic auditory stimulus delivery system:

- Non-magnetic tubal-insert ear-phone set
- Independent delivery of auditory stimuli to each ear
- >80 dB sound pressure level (SPL)
- >60 dB channel separation
- <1 ms jitter between trigger and stimulus onset
- 50 disposable foam eartips

## Somatosensory stimulator

Art. no. NM21709N

Somatosensory stimulus delivery system:

- One electric somatosensory stimulator with controllable amplitude
- 0–99.9 mA output current
- 50, 100, 200, 500, 1,000, or 2,000 μs pulse duration
- Triggered via the acquisition workstation or from within the stimulus presentation workstation

## Response device

Art. no. NM20999N

Non-magnetic, single-finger optical response pad:

- Finger-press mode
- Finger-lift mode
- Trigger output
- <1 ms delay between response and recorded event

## Video monitoring system

Art. no. NM21712N

A CCTV video monitoring system.

- CCTV video camera
- Monitor
- Cabling

### **Bidirectional intercom system**

Art. no. NM21632N

A bidirectional intercom system for two-way communication between the patient, operator, and nurse.

- Intercom system with half-duplex and simplex modes
- Microphone
- Cabling

### **Acquisition system UPS**

Art. no. NM24062N

An uninterruptible power supply unit for maintaining the Elekta Neuro-mag<sup>®</sup> TRIUX data acquisition system operational during power outage or voltage fluctuation.

- A 3,000 VA uninterruptible power supply for the data acquisition electronics
- Cabling

### **Workstation UPS**

Art. no. NM24063N

An uninterruptible power supply unit for maintaining a workstation operational during power outage or voltage fluctuation.

- A 1,000 VA uninterruptible power supply for a single workstation and peripherals
- Cabling



# Consumables

## Head position coils

- Head position coil set with five coils in a ready-to-use assembly (art. no. NM23880N)

## 32-channel EEG caps

- Small (size 46–52 cm) 32-channel EEG cap (art. no. NM23905N)
- Medium (size 52–58 cm) 32-channel EEG cap (art. no. NM23906N)
- Large (size 58–64 cm) 32-channel EEG cap (art. no. NM23907N)

## 64-channel EEG caps

- Small (size 46–52 cm) 64-channel EEG cap (art. no. NM23890N)
- Medium (size 52–58 cm) 64-channel EEG cap (art. no. NM23891N)
- Large (size 58–64 cm) 64-channel EEG cap (art. no. NM23892N)

## 128-channel EEG caps

- Small (size 46–52 cm) 128-channel EEG cap (art. no. NM23894N)
- Medium (size 52–58 cm) 128-channel EEG cap (art. no. NM23895N)
- Large (size 58–64 cm) 128-channel EEG cap (art. no. NM23896N)

Elekta is a global human care company pioneering significant innovations and clinical solutions for treating cancer and brain disorders. Elekta provides intelligent and resource-efficient technologies that improve, prolong and save patient lives.

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