MagVenture

MAGPRO FAMILY
User Guide

MagPro R30
MagPro R30 with MagOption
MagPro X100
MagPro X100 with MagOption

MagPro software v.5.0

US-edition

At the time of printing this manual correctly described the device and its functions. However, as modifications may have been carried out since the production of this manual, the system package may contain one or more addenda to the manual. This manual including any such addenda must be thoroughly read, before using the device.

The following situations void any guarantee(s) and obligations for Tonica Elektronik A/S:
- The device is not used according to the enclosed manuals and other accompanying documentation
- The device is installed or modified by persons other than Tonica Elektronik A/S or other authorized service technicians

Contents

Safety Information

Safety Requirements

This device has been designed and tested in accordance with IEC 60601-1 Medical Electrical Equipment. The present manual contains some information and warnings, which will have to be followed by the user to ensure safe operation and to retain the device in safe condition.

This device is intended to be used by qualified medical personnel, knowledgeable in the field of the device with the appropriate education and training.

This device has been designed for indoor use at room temperatures between +50°F to +86°F.

The mains plug must only be inserted in an appropriate mains socket outlet provided with a protective earth contact. It is forbidden to use extension cords.

WARNING Any interruption to the protective earth conductor inside or outside the device or disconnection of the protective earth connector terminal is likely to make the device dangerous. Intentional interruption is prohibited. The protective earth (ground) conductor should be checked regularly.

When the device is producing maximum output, power consumption is very high – up to 2300 VA. To prevent any equipment nearby from malfunctioning, the device must be supplied from a separate wall outlet. This is especially important if the total installed power is low. If a problem arises it is usually recommended to seek the advice of a local electrician on this matter. Before connecting the device, make sure that the separate "step-up" transformer (115V/230V) is installed, and make sure you use the correct power cord, supplied with the device.

For the combination of this device with other devices and / or for its connection to installations, the following applies:

- When connecting medical equipment being supplied from an outlet located in a non-medically used room, or when connecting non-medical electrical equipment to this device, please pay attention to the requirements of IEC 60601-1-1, Safety Requirements for medical electrical systems.

- When the device is connected to its mains supply, connectors may be live, and any opening of covers or removal of parts possible only with the aid of a tool is likely to expose live parts.

- The device must be disconnected from all voltage sources before being opened for any adjustment, replacement, maintenance or repair.

- Service must be referred to Tonica or other authorized service personnel, except for such works described in this manual as being performed by the operator.

- Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse holders are prohibited.

- Where more than one piece of equipment is connected to a patient, attention must be paid to the summation of patient leakage currents.

- Whenever it is likely that the protection has been impaired, the device must be disconnected and be secured against any unintended operation.

- In that case, call qualified service personnel to conduct at least a functional test and additionally a safety check including 1) an insulation test, 2) a ground continuity test and 3) a leakage current test, according to IEC 60601-1.

- The protection is likely to be impaired if, for example, the device:
  - Shows visible damage.
  - Fails to perform the intended function.
  - Has been subjected to severe transport stresses.
  - Insufficient Earth connection.
  - Has been subjected to moisture.

Intended use

The MagPro family is intended to be used for magnetic stimulation of peripheral nerves for diagnostic purposes.

The MagPro family is intended to be used by qualified medical personal, knowledgeable in the field of neurophysiology.

Target population: People with dysfunction in the peripheral nervous system.

Contraindications

Do not use the equipment on patients with cardiac pacemakers, cochlear implants or other implanted electronic devices. Do not apply the magnetic stimuli to the head, neck or abdomen of pregnant women.

Adverse Reaction

Do not use this equipment for anything else than it is intended for by the manufacturer.

General Warnings

⚠ See the accompanying documentation and carefully read the following warnings

Warnings

- Do not use this equipment for anything else than it is intended for by the manufacturer.
- The device is not compatible for use in an MR magnetic field. Please consult the manufacturer for available special solutions.
- To protect patients from excessive exposure to magnetic gradients keep the number of stimulations as low as possible.
- The device is not intended for use with anesthetic gases or any other flammable media – danger of electrical ignition.
- The operator must be protected against long-term magnetic fields (e.g. by using a holding device as the Flexible Arm).
- Hearing protection is recommended if the coil is used near the head or when operating with more than 100 stimuli a day.
- Not to be used on small children.
- Keep out of reach of children.
- Precautions should be taken when stimulating patients with suspected or diagnosed labile or hypertensive blood pressure.
- The field produced by this device can damage a cochlear implant, cardiac pacemaker and implanted electronic devices.
- The MagPro must only be used under the constant supervision of qualified medical personal, only on patients who are not anaesthetized and only for short term use.

Cautions

- Before connecting, please read the instructions for use.

- Always carefully examine the coil handle, housing and cables for cracks, marks, deformations, color changes and other signs of damage before using it. Do not use the coil if there is any evidence of stress failure; otherwise it may disintegrate.

- Metallic (conductive) objects in the field may be propelled forcibly by the stimulus pulse. Make sure there are no rings, coins or similar metal objects near the coil when it is activated.

- Do not place the stimulation coil on or near: video monitors, watches, calculators, credit cards or computer disks. Damage or erasure may occur.

- Disable the device when it is not being used by pressing the Enable/Disable button. (see page 13).

- Before changing the stimulation coil, press Disable to avoid damage on personnel and equipment.

- Always use the Flexible Arm to hold the Magnetic Stimulation Coils of Fluid- or Cool types during stimulations.

- Changes in noise level or sound frequency from the coil during stimulation may indicate beginning damages inside the coil. Stop using the coil and contact a Service Center; otherwise it may disintegrate.

- The coil must not be submersed into any conductive liquid, including water. The encapsulation tolerates low levels of surface moist - but in general care should be taken to **keep all surfaces clean and dry**.

- Federal (United States) law restricts this device to sale by or on the order of a licensed practitioner.

Introduction to Magnetic Stimulation

Magnetic stimulation is a non-invasive technique for stimulating neural tissue. The principle of magnetic stimulation is implicit in Faraday's law. The pulses of current are generated with a circuit containing a capacitor connected to the stimulating coil. With the capacitor charged to a certain level, the conducting state will cause the discharging of the capacitor through the coil. A magnetic field is generated proportional to this current. The rapid change in the magnetic field induces a current in conducting materials e.g. the neural tissue. If the current induced in the human body is of sufficient amplitude and duration, it will excite nerve fibers.

Selection Criteria for Magnetic Stimulation Coils

Large or Small Coils?

Large coils provide a high penetration depth, but cannot be very focused at the same time. The small coils, however, are more focused, but have a limited penetration depth.

The coils come in many sizes and shapes. The two most commonly used coils are the circular shaped coil and the butterfly shaped coil (or the "figure of 8" coil).

Circular Coils
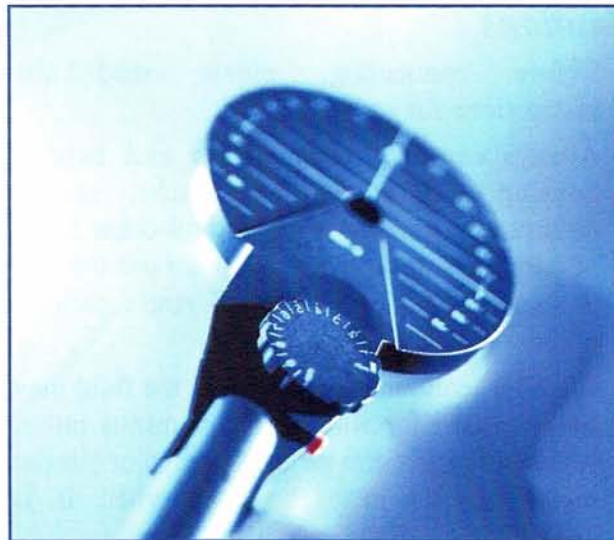
The induced current in the tissue occurs under the windings, when applying the circular coil. A fairly large area of body tissue will be stimulated. The circular coil may be positioned conveniently over many parts of the body, and usually serves well as a "general purpose coil".

Butterfly Coils
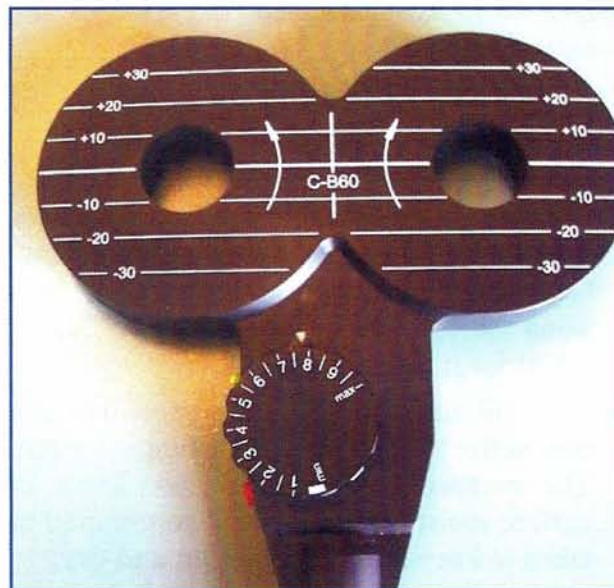
The Butterfly coils are more focused in comparison with the circular coils. The two windings are placed side-by-side, enabling the coil to stimulate structures with focus right under its center.

Coils with Fluid

Magnetic stimulating coils become warm during use, because energy is deposited in the coil due to electrical resistance. To prevent fast overheating in the coil, coils with a reservoir of fluid (F-coils) have been developed. The fluid partially absorbs the heat, enabling the coil to perform more stimuli.

When making more than a few stimuli, place the coil in a holding device.

Coils with External Cooling

Where a very high number of stimuli are required at High Repetition Rates and long pulse trains, extra cooling is necessary.

Cool-Coils with external Cooler Unit fulfill these requirements.

When making more than a few stimuli, place the coil in a holding device.

Useful Features

A trigger button in the handle is available in all coils for easy activation of stimulation. Some of the coils include a power control in the handle, making remote control of the amplitude possible.

For more information about magnetic coils and other accessories see the Appendix section.

Presentation

The MagPro family consists of different models with different level of features. This chapter describes the differences between the models.
The MagPro model name can be seen on the display during start-up.

All features are described in the following chapters. Pay attention to that not all models includes a given feature.

Working Modes

The device can work in following different modes:

MagPro model	Modes
R30	Standard
R30 + MagOption	Standard Dual Twin
X100	Standard
X100 + MagOption	Standard Power Dual Twin

Standard Mode

Typically chosen when operating with high repetition train sequence.

Twin/Dual Mode

When running in twin/dual mode, the MagPro can provide up to 20 twin pulses per second with an inter pulse interval down to 1ms.

Power Mode

The Power Pulse is the most powerful mode. It allows all waveforms to be extended in pulse width and peak with approximately 40%.

Current Direction

Current Direction in the Magnetic coil can be selected in following directions.

MagPro model	Current Direction
R30	Normal
R30 + MagOption	Normal
X100	Normal or Reverse
X100 + MagOption	Normal or Reverse

Waveforms

The devices feature the following waveforms:

MagPro model	Waveform
R30	Biphasic (Full-Sine)
R30 + MagOption	Monophasic Biphasic (Full-Sine)
X100	Monophasic Biphasic (Full-Sine) Biphasic Burst
X100 + MagOption	Monophasic Biphasic (Full-Sine) Halfsine Biphasic Burst

Repetition Rate

The device can operate up to following repetition rates:

MagPro model	Max. Rep. Rate
R30	30pps
R30 + MagOption	30pps
X100	100pps
X100 + MagOption	100pps

pps: pulses per second

Features

Software

The general user interface in MagPro is logical and well organized, enabling the operator to overview all functions.

The Status Area displays e.g. Coil Temperature, Available Stimuli and Coil Type. All the displayed information is easily readable.
MagPro can save and load customized settings, storing all parameters in a stimulation sequence. The device can show the actual as well as the predefined settings.

The MagPro has the ability to combine and control external equipment due to the advanced build-in trigger functions.

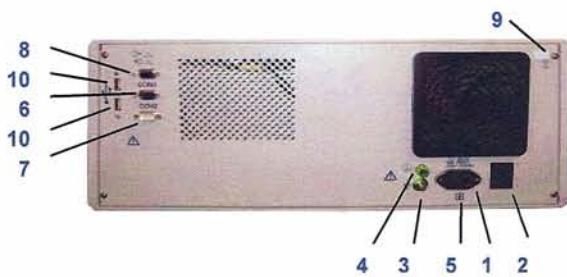|	
1	Magnetic Stimulating Coil
2	MagPro
3	MagOption
4	Cart
5	Flexible Arm for Coil

Symbols and Connections

Rear Panel

⚠ See the accompanying documentation.

CAUTION Electric shock hazard. Do not remove cover. Refer servicing to qualified service personnel.

	1	Mains Socket
I O	**2**	ON / OFF button
⏚	**3**	Equipotentiality
⏚	**4**	Earth Connector
🔲	**5**	Apparatus is of type BF, i.e. the applied part is electrically isolated.
COM1	**6**	COM1 Serial Port (MEP Monitor)
COM2	**7**	COM2 Serial Port (Data Export)
⊕→Π ⊸Π	**8**	Trig in/Trig out
⅄		Storage temperature range. Packaging label
SN xxx	**9**	Serial Number
P/N		Part Number
CE 0543		The device complies with the EC directive 93/42/EEC on medical device.
⊠		Waste Electrical and Electronic Equipment: Compliance information.
⟙	**10**	USB Port

Power ON/OFF button (2)

The power switch is located in the lower right part of the rear panel to allow easy access, when turning the device on.

Earth Connectors / Equipotentiality (3 + 4)

To ensure a safe patient environment, we strongly recommend effective grounding of the various items of the equipment. For this purpose, two connectors are provided. When connecting additional pieces of equipment to the device, please pay attention to the maximum permissible leakage currents as per IEC 60601-1.

Interference

Always use shielded power line cables to avoid line interference.

WARNING Electrical equipment for medical use requires special EMC precautions and needs to be installed and serviced according to the EMC documentation of the device.

Serial ports (6 + 7)

The serial COM1 and COM2 connectors are used for interface to other equipments. COM1 is used for interface to a MEP Monitor unit and COM2 for data export to an external computer.

Trig in/Trig out connector (8)

Triggering of other equipment from MagPro og triggering of MagPro from other equipment is possible. Special trigger cable must be used.
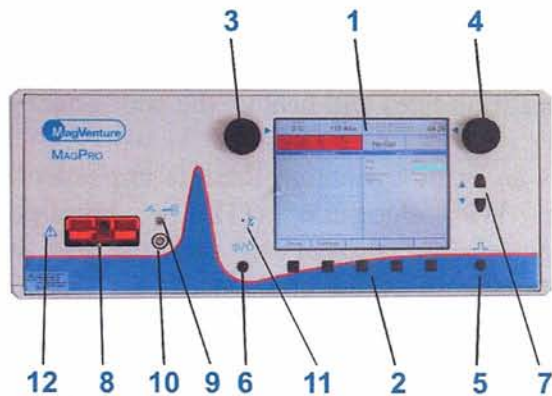
USB ports (10)

These ports must only be used for export of data supported by the Data Transfer program. See separate documentation.
The USB port is also used for updating of the MagPro software.
The USB memory stick must maximum be of size 2 GB and it must be formatted with the FAT16 file allocation system.

Controls

Front Panel

1	Display Area	7	Arrow Buttons
2	Soft Keys	8	Coil Connector
3	Pulse Wheel, Amplitude	9	Upper Lemo Connectors
4	Pulse Wheel, Options	10	Lower Lemo Connector
5	Trigger Button	11	Start Up Indicator
6	Disable/Enable Button	12	See the accompanying documentation

WARNING Never Touch the metal pads in the large orange connector.

Display and Soft Keys Area (1 + 2)

The device has a front panel including a TFT Display (1), and 5 Soft Keys (2). The functions of the Soft Keys are illustrated above in the bottom of the display.

Pulse Wheels (3 + 4)

There are two Pulse Wheels: one for adjusting the *Amplitude* (3), and one for toggling between the *Options* in each line (4).

Trigger Button (5)

On each side of the Soft Keys, two small black round buttons are situated. The button to the right of the Soft Keys, is the Trigger Button Function. The Trigger Function is also available in the coil handle enabling stimulation with single pulse.

Enable/Disable Button (6)

The Enable/Disable function is used to enable the device, when starting to operate and is used to disable the device, when operation is terminated. The device must be disabled, before changing the coils.

The Enable function can also be activated from the trigger button on the coil handle. See section for coils below.

Arrow Buttons (7)

The functions of the arrow buttons are to toggle between the lines in the display menu.

Coil Connector (8)

The large orange plug carries the very high current for stimulation as well as the coil temperature measurement signals.

Lemo Connectors (9 + 10)

The small Lemo connector carries control signals. The Lemo connection must be used, if the controls in the coil handle needs to be applied. The Lemo connector must always be connected to allow the measurement of "Available Stimuli" – and to enable TrainMode, if not only single stimuli is possible.

The *Upper Lemo Connection* (9) matches the standard coils without intensity control.

The *lower Lemo connection* (10) matches the standard coils with intensity control.

Start Up Indicator (11)

The green indicator next to the hourglass symbol flashes during the start up period.

Coils

Amplitude control button

Orange trigger button

LED Red: disabled
Green: enabled
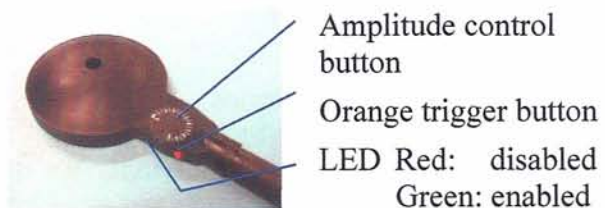
Enabling of MagPro from coil:
Coils with amplitude control button: Turn control button to minimum and press trigger button for 2 seconds.
Coils without amplitude control button: Press trigger button for 2 seconds.

Software Controls

Status Area (1)

Amplitude	Realized di/dt		2010-01-08
50 %	75 A/us	• 09:23:34 - Coil Type: MCF-75 • 09:23:35 - Coil Type: Unknown • 09:23:38 - Coil Type: MCF-B70	09:24
Status	Coil Temperature	Coil Type	Available Stimuli
Enabled	24°C	MCF-B70	2652

The *Status Area* in the upper section of the display consists of fixed states fields. In this section the following parameters can be read:

Amplitude

The amplitude is an expression for the power output level. When changing the coil the device will automatically turn the amplitude down to 0 %.

Realized di/dt

Realized di/dt is the actual measured value (A/µs) of the coil current gradient. When stimulating with twin pulses or biphasic burst pulses, the realized di/dt will show the parameters A and B, indicating the amplitude of the first pulse (A) and second pulse (B) for twin pulses and last burst pulse (B) for biphasic burst pulses.

Realized di/dt	
A:	82 A/usec
B:	66 A/usec

Status: Enable/Disable

Enable/Disable is a manual function which indicates whether, or not the device can be activated. The device must be Enabled before it can be activated. The device will automatically disable when one of the following things occur:

- Overheating of coils
- Overheating of the device
- Disconnection of the Stimulation Coil
- Auto Discharge Time, no activity for the selected time

Coil Temperature

The Coil Temperature shows the actual measured coil temperature. The field will turn yellow at 35°C (95°F), indicating a warning for overheating.

When the temperature exceeds 41°C (106°F), the system will automatically be disabled and the field change from yellow to red. To use the device again, simply change the coil or wait for the coil to cool down.

Be aware that high amplitude and high repetition rates will heat up the coil faster.

As an extra precaution there is implemented an ITP algorithm (ITP – Intelligent Temperature Prediction) that predicts the temperature of the coil even faster than the temperature sensor placed in the coil. It is indicated by a ! sign when ITP is active – see picture below.

Coil Temperature
! 38°C

Coil Type

All by, FDA cleared types of MagVenture Stimulating Coils can be used with the MagPro. The device automatically identifies the coil type connected to the coil connectors.

If a new coil type is released and the software on MagPro does not recognized it with its real name a coil group name will be displayed instead.

Available Stimuli

The number of available stimuli is calculated based on coil type, actual temperature and stimulation amplitude. See also "Defined Number of Stimuli" in the section on *Information Area*.
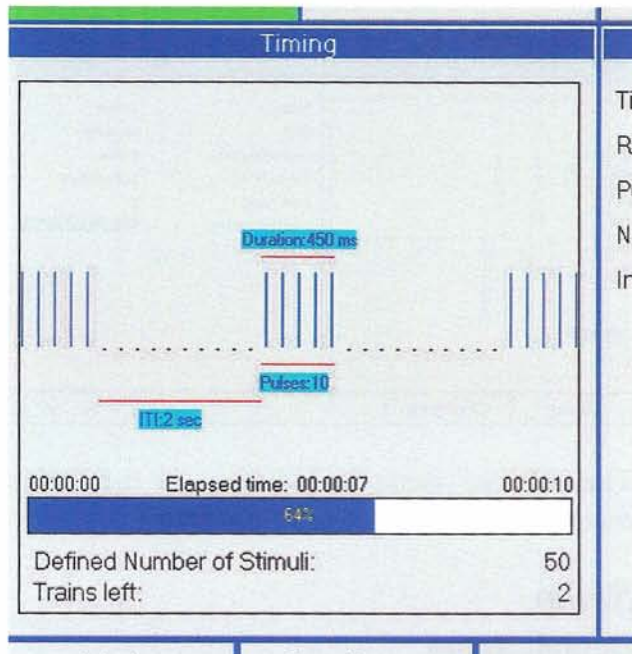
Event log information and date/time

In the upper right corner of the status area following information is shown:

- Availability of USB memory stick
- Log data (newest data on the bottom line)
- Time and date

For more information about USB memory stick and log data see accompanying documentation regarding Data Transfer.

Information Area (2)

The left-hand side of the display is the *Information Area*. This area is reserved for illustrations of chosen setups, i.e. waveform, amplitude and sequence. Information is concurrently given about, e.g. Defined Number of Stimuli and train duration.

On the right-hand side of the display, all possible options are listed.

This section is arranged in four different menus selectable with the appropriate Soft Key. The device always starts up in the Main Menu.

Each menu is subdivided into multiple lines of options (i.e. Rep.Rate and Number of Trains) can be controlled by the Arrow Buttons.

In each line, all settings are represented (controlled from the right-hand side Pulse Wheel). Please see the details in the section on "Getting Started", or see page 31 where all settings are scheduled.

Soft Key Area (4)

Main	Configure	Protocol		Start

The bottom area of the screen shows the five Soft Keys. The function of each soft key is shown in the display just above the key. See also the chapter on "Getting Started".

Selection Area (3)
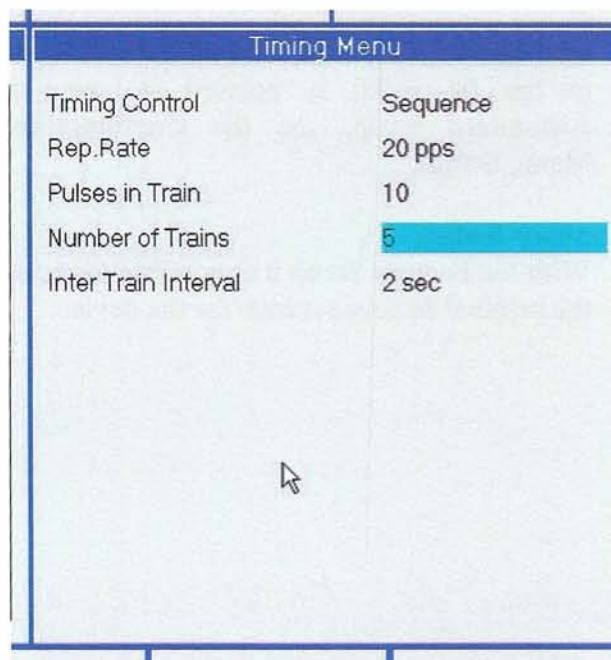
Getting Started

General Workflow

- Select the appropriate coil, and connect it to the device. Turn on the device.
- Choose a setup in the Main Menu, and position the coil near the stimulation spot. Enable the device.
- Press the trigger button to make a single stimulus, and gradually turn up the amplitude.

NOTE For an advanced use, stimulation sequences can be selected in the Timing Menu.

Single Stimulation

The single stimulation function is placed in the trigger button of the device. The user is always able to activate a single pulse, either from the trigger buttons of the device or the coil handle, even in the time period between two train sequences, e.g. for determining motor threshold.

Create Setup

When creating a setup, the operator is basically selecting from two menus: the Main Menu and the Timing Menu.
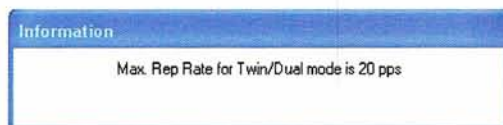
When setting fixed parameters, the operator must select from the Configuration Menu and the Timing Menu.

An overview of all selectable parameters can be found in the "Menu Tree" on page 27.

Information box

An Information Box will appear when operating with incompatible settings. The Information Box will contain a report of the error.

Example:

Information
Max. Rep Rate for Twin/Dual mode is 20 pps

Main Menu

Amplitude	Realized di/dt			2010-01-08
33 %	A: 50 A/usec	● 09:23:38 - Coil Type: MCF-B70		
	B: 0 A/usec	● 12:37:37 - Started in Pulse Mode		12 43
		● 12:37:43 - Stopped in Pulse Mode		

Status	Coil Temperature	Coil Type	Available Stimuli
Enabled	24°C	MCF-B70	13269

Waveform (Default) / **Main Menu**

Setup	Default
Mode	Standard
Current Direction	Normal
Waveform	Biphasic Burst
Burst Pulses	4
Inter Pulse Interval	10.0 msec
Pulse BA Ratio	1.0

Timing	Configure			Recall

The selected menu is indicated in the status section right above the selection area.

Setup

Default Setup

The device automatically starts in the Default setup. To stimulate with default settings, simply press the start button in the Timing Menu.

Predefined Setups

Besides the Default Setup, you can choose between 26 predefined setups created in the Configuration Menu (letter A-Z). The present setup can be seen in the Information Area. The setups listed in the information area shows the selected setup, but it is not loaded until the Recall button (one of the Soft Keys to the far right) is pressed (to save a customized setup, see the Configuration Menu, Setup).

Factory Setup

With the Factory Setup it is possible to recall the original factory settings for the device.

Mode

Standard Mode

Standard Mode can be chosen in all four waveforms:

- Monophasic
- Biphasic
- Halfsine
- Biphasic Burst

When choosing the Standard Mode, the device operates with one energy storage only. The Standard Mode is normally chosen, when running single stimulation, or train sequences, where power pulse and twin pulses are not required.

Power Mode

In this mode the two energy storages are added together. Power Pulses can be chosen in all four waveforms:

- Monophasic
- Biphasic
- Halfsine
- Biphasic Burst

The pulse width and the amplitude outlet are extended with approximately 40 % relative to Standard Mode.

Twin Mode

When stimulating with Twin Pulses (double Pulses), the two energy storages are working side by side. The device is able to fire 20 Twin Pulses per second (tpps) for X100 + MagOption and 5tpps for R30 + MagOption. Twin Pulses enable two pulses with a variable Inter Pulse Interval in each stimulation. When choosing the Twin Mode, the line *Ratio B/A amplitude* will automatically appear. The amplitude of the two pulses A and B are then controlled in an adjustable ratio between 0.2-5.0. "Pulse B" is now adjusting in a selected percent ratio proportional to "Pulse A". The B/A Ratio amplitude is calculated by dividing pulse B with Pulse A. The "Pulse A" amplitude is controlled with the amplitude pulse wheel.

Dual Mode

This mode is similar to Twin Mode. It differs from the Twin Mode in selecting the pulse amplitude. When choosing Dual Mode, the line *Pulse B Amplitude* will automatically appear in the selected Main menu indicating that both "Pulse A" and "Pulse B" are independently adjustable. "Pulse B" is the basic pulse in this selection choosing from 0-100%. The "Pulse A" amplitude is controlled with the amplitude pulse wheel.

Twin and Dual Mode can be selected in three different waveforms:

- Monophasic
- Biphasic
- Halfsine

Current Direction

Some use require a change in the Current Direction. Instead of changing the coil position the operator is able to choose between *Normal* and *Reverse*.

Normal

In Normal direction, the current flows through the coil following the direction of the arrows shown on the coil encapsulation.
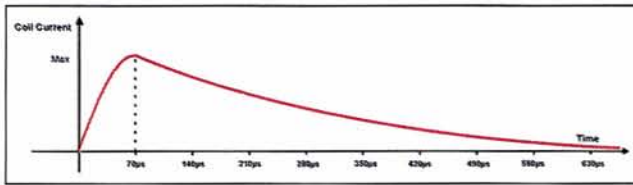
Reverse

In Reverse, the current flows through the coil opposite to the direction of the arrows shown on the coil encapsulation

The induced current direction in the tissue is always the opposite of the coil current direction.
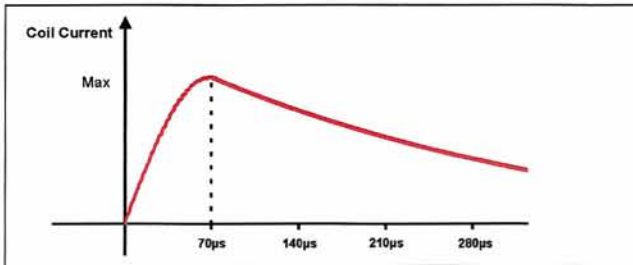
Waveform

In this line different waveforms can be selected:
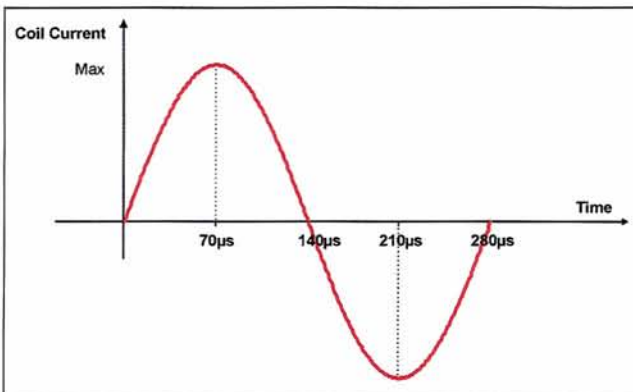
Monophasic

Monophasic, Full Length

The Monophasic waveform is typically chosen where single stimulus is needed. The Monophasic waveform deposes a large amount of energy in the coil, which explains the comparatively faster heating of the coil.


Monophasic, Shortened for Comparison with other Waveforms

Biphasic (Full-Sine)

The biphasic waveform is very powerful. There is a rather small amount of energy disposed in the coil, which means that the coil can provide a larger amount of stimulation, before it heats up. Consequently, the Biphasic waveform is relatively effective before roll off in comparison to the Monophasic waveform.

Halfsine
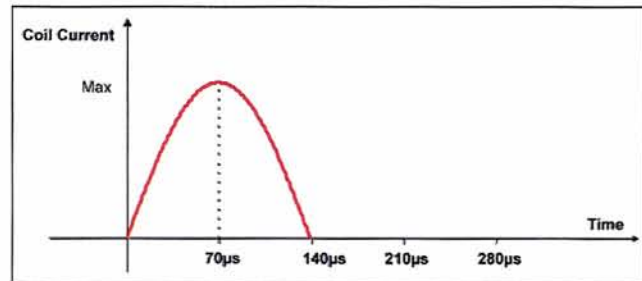
The Halfsine waveform requires a comparatively small amount of energy compared to all the other waveforms. The Halfsine waveform is not as powerful as the biphasic waveform, thus only a fairly small amount of energy is disposed in the coil (approximately half of the amount disposed by the biphasic waveform).

Biphasic Burst (Theta Burst)
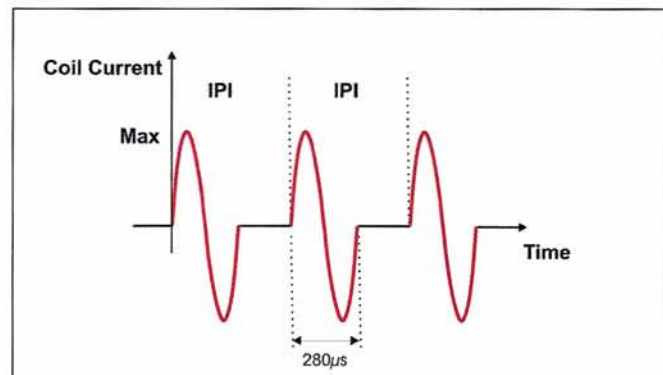
The biphasic burst waveform is able to provide a powerful stimulation. Biphasic Burst can be selected with 2, 3, 4 or 5 pulses in each stimulation with very low IPI (Inter Pulse Interval).

The biphasic burst mode can be used to define Theta Burst stimulations. For further description of Biphasic Burst and Theta Burst see page 21.

Inter Pulse Interval (IPI)

Inter Pulse Interval is the duration between the beginning of the first pulse to the beginning of the second pulse. The IPI is adjustable (Overview of setting possibilities on page 31).

Absolute Amplitude

Both pulses (A and B) are individually adjustable. In this example the B pulse is set to 70 % of max. output.
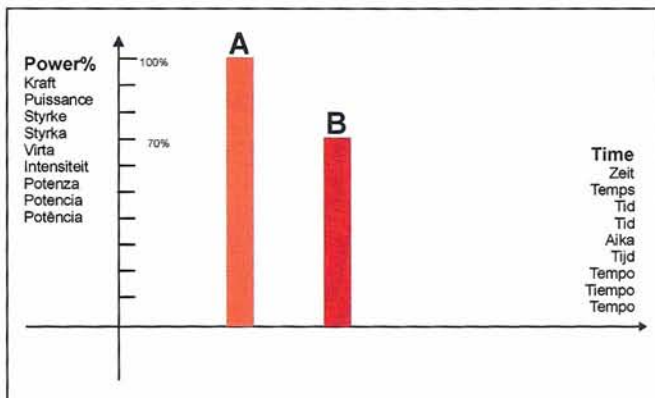
Relative Amplitude

The two pulses (A and B) are adjusted in a selected ratio. In this example the ratio is set to 1.4.

The first pulse can activate both inhibitory and facilitator mechanisms and modify the threshold and readiness of the second pulse.

Timing Menu

Amplitude	Realized di/dt		
60 %	91 A/us	● 13:52:44 - Stopped in Pulse Mode ● 13:52:51 - Started in Pulse Mode ● 13:53:01 - Stopped in Pulse Mode	2010-01-08 13 53

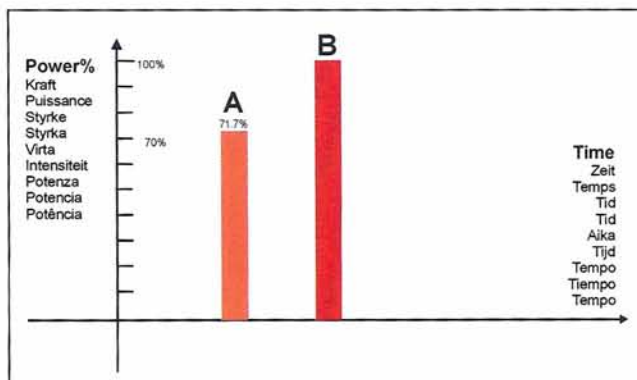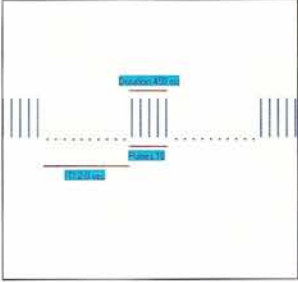| Status	Coil Temperature	Coil Type	Available Stimuli
Enabled	24°C	MCF-B70	4013

Timing (Default) | Timing Menu

Timing Control	Sequence
Rep.Rate	20 pps
Pulses in Train	10
Number of Trains	5
Inter Train Interval	2.0 sec

Main	Configure	Protocol		Start

The Timing Menu is chosen for multiple stimulation e.g for study or treatment.

Timing Control

External Triggers

If external triggers are selected, the device will now be controlled from an external device e.g. the Keypoint®.

With the external trigger it is possible to trigger start of a sequence line in the protocol tool. External Trig must be selected in the Timing Menu for this option in the Protocol Tool. For further information see separate User Guide for Protocol Tool.

Sequence

If Sequence is selected, the following options must be set:

Rep.Rate

The repetition rate refers to the number of pulses per second (pps.) at which the pulses are generated.

Pulses in Train

The number of pulses in each train. The Train Duration is automatically calculated by dividing the number of pulses in a train with the Rep. Rate.

Number of Trains

The total amount of trains arriving in one sequence.

Inter Train Interval (ITI)

The time interval between two trains described as the time period between the last pulse in the first train to the first pulse in the next train.

In the *Information Area*, the present actions will be illustrated. These pieces of information concern:

■ The time duration of a sequence
■ The train duration
■ Inter train interval (ITI)
■ The defined Number of Stimuli
■ The trains Remaining

Biphasic Burst (Theta Burst) stimulation

Biphasic Burst mode can be used in conjunction with the normal sequence timing.
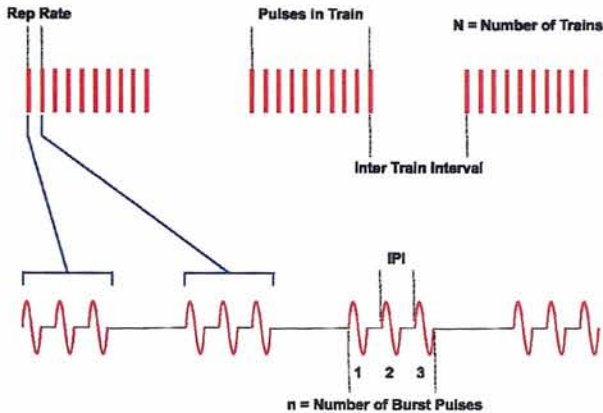
Special burst modes are also called Theta Burst and a very common used protocol is:

A Theta Burst of 3 pulses with 20ms (50Hz) interval repeated as a train of 10 bursts with a repetition rate of 5Hz. The trains are repeated 20 times with an interval of 8 seconds. Total number of bursts 200.

Following settings on the MagPro will generate the commonly used Theta Burst protocol.

Main Menu
Waveform:	Biphasic Burst
Burst Pulses:	3
Inter Pulse Interval:	20 msec

Timing Menu
Rep Rate:	5pps
Pulses in Train:	10
Number of Trains:	20
Inter Train Interval:	8.0 sec

Main Menu

In the Main Menu the Biphasic Burst Waveform is selected.

Number of pulses in the Theta burst is defined in the Burst Pulses selection.

The Inter Pulse Interval between each pulse is selected.

Timing Menu

In the Timing Menu the Rep Rate for the Theta Bursts is selected.

The number of Theta Burst pulses in each train is defined in the Pulses in Train selection.

Number of Trains and Inter Train Interval is selected.

When ready, enable the stimulator and turn up the Amplitude to the required level.

Press the Start button to start the protocol.

The amplitude of the first pulse (A) and last pulse (B) in the Biphasic Burst waveform is measured during stimulation and displayed on the display.

	Realized di/dt
A:	102 A/usec
B:	102 A/usec

For the commonly used TBS protocol the amplitude of the 3 Biphasic Burst pulses will be equal up to approximately 60% output power on MagPro.

The maximum output power where the first and the last pulse are equal is shown in table below. For output power above the curve the last pulse will begin to be lower than the first pulse.
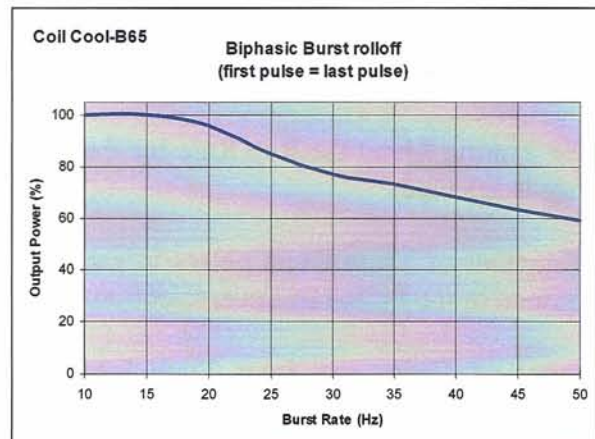
Coil type, output level and Inter Pulse Interval (IPI) will influence on the di/dt values.

Protocol Tool

From the Timing Menu it is possible to select the Protocol Tool for advanced sequencing of multiple stimulations. See separate User Guide for this software tool.

Data Transfer

The MagPro Data Transfer feature gives the possibility to extract data for documentation to an USB memory stick. The Event log contains details as:
- when did a train start
- how many stimuli did it produce
- and at which amplitude did the train run

Following data will be exported:
- Event log
- MEP log (if MEP monitor available)
- Amplitude log

For further information see separate Data Transfer User Guide.

Configuration Menu

Exit	Service	MEP	Trigger	Save

The *Configuration Menu* is selected when setting up the basic parameters. In this menu the Trigger Menu will appear in the Soft Key Area (see the "Menu tree" on page 27).

Save Setup

To save the present setup under a new letter in the setup list, choose a letter (A-Z) or Default. The setup to be saved is listed in the Information Area. Setups can only be saved in the Configuration Menu and then be recalled in the Main Menu.

The basic sequence setup of the most common study would be an obviously choice for the Default Setup.

NOTE Any previous setup saved using the letter you choose, will be overwritten.

After saving the settings on the MagPro, make sure not to switch off the MagPro within 30 seconds, to make sure the settings are saved.

Charge Delay

After each stimulation, the device recharges the energy storage. During the recharging period, the device consumes and transfers very high amounts of energy. This transfer can produce unwanted noise, interfering with signal pickup wires and electrodes. To suppress this noise, the Charge Delay feature can be used, i.e. making the device wait for a while, before recharging. For ordinary use, set the Charge Delay to zero.

Auto Discharge Time

To protect against non-intended stimulation of magnetic pulses, the device automatically discharges a preset time after the last stimulation is made or handling of buttons.
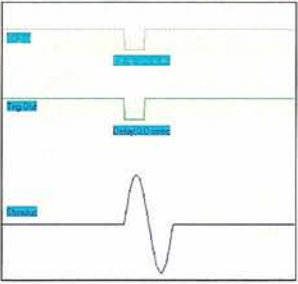
Prior Warning Sound

The "Train Warning" is a sound preparing the patient for the next train sequence, when ITI is greater than 5 seconds. When on, the Prior Warning will sound two seconds before each train starts. The Prior Warning only applies to train sequences.

Coil Type Display

The Coil Type Display can be set to On or Off. This function is relevant in relation to, e.g. double-blind tests. When turning the Coil Type Display off, the Coil Type area will be blank.

Trigger Menu

Amplitude	Realized di/dt			● 15:35:23 - Coil Type: Cool-B65	2010-01-08
0 %	A:	A/usec		● 15:35:30 - Model X100+Option	
	B:	A/usec		● 15:35:30 - Data 2010-01-08	15 36

Status	Coil Temperature	Coil Type	Available Stimuli
Disabled	22°C	Cool-B65	100000

Trigger (Default)	Trigger Menu	
	Trig Output	Enabled
	Twin Trig Output	Pulse A
	Twin Trig Input	Pulse A
	Polarity, Input	Falling Edge
	Polarity, Output	Falling Edge
	Delay, Input Trig	0.0 msec
	Delay, Output Trig	0.0 msec

Exit			

The *Trigger Menu* is selected when the device is combined with external devices.

Trigger Output

Enable

When the Trigger Output is *Enabled* an external trigger is given for each magnetic stimulus.

Disabled

When the Trigger Output is *Disabled*, no external trigger outputs are provided.

Twin Trig Output

Only enabled in Twin/Dual mode. When making twin pulses, this option selects the timing and number of external triggers provided.

Pulse A

Select Pulse A to have an external trig out, only at the time of the first stimulus (A).

Pulse B

Select Pulse B to have an external trig out, only at the time of the second stimulus (B).

Pulse A+B

Select Pulse A+B to enable trigger on both stimulus.

Twin Trig Input

Only enabled in Twin/Dual mode. When making twin pulses, this option selects the timing and number of external trigger inputs required:

Select Pulse A

Select Pulse A to require only one external trig input. The Inter Pulse Interval is then controlled by the device itself.

Select Pulse A+B

Select Pulse A+B to enable full external control of the timing: two external trigger inputs are required. Pulse A is provided at the time for the first external trigger to arrive – Pulse B accordingly, when the second trigger arrives.

Polarity Input

Choose between *Falling Edge* and *Rising Edge*. The magnetic stimulation can be selected to be either at the time, when the external trigger voltage is rising or falling.

Polarity Output

Choose between *Falling Edge* and *Rising Edge*. The external trigger output voltage can be selected to be either rising or falling at the time of the magnetic stimulation.

Delay, Input Trig

This feature allows setting a delay from the time of arrival of an external trigger input to the time for the magnetic stimulation to be provided.

Delay, Output Trig

When selecting the internal trigger generation, (i.e. when using trains generated by the device, or when pressing one of the manual trigger buttons) this feature allows setting a delay from the time of the magnetic stimulation to the time of the external trigger to be provided. Accordingly, the external trigger output can be provided prior to the magnetic stimulation. This feature allows other equipment to be activated, before the magnetic stimulation occurs.

Service Menu

Amplitude	Realized di/dt		
0 %	A/us		14:55

Status	Coil Temperature	Coil Type	Available Stimuli
Disabled	22°C	Cool-B65	100000

Service Mode		Service Mode	
Product Name:	Unknown	Language	English
Release Number:	Unknown	Event Log Enabled	ON
Release Date:	yyyy/mm/dd		
Model:	X100+Option	Amplitude Log Enabled	ON
Serial number:	Unconfigured	Coil Temperature events	OFF
GUI SW version:	5.0.1	Temperature scale	°C
PIC1 SW version:	255.255.255		
PIC2 SW version:	255.255.255		
Nimbus SW version:	255.255.255		24 hour representation
Language version:	English 1.1.0	2010 / 01 / 08	14 : 55 : 57
		Year Month Day	Hour Minute Second

| Exit | | | |

System Information

On the left side system information is displayed with information about the MagPro model, serial number and software versions.

Language

Select language in the list of available languages.

Event Log Enabled

Data export of event log to USB memory stick. Export of event log to RAM is also possible, which will store the data to RAM until the MagPro is disabled and the data in RAM will be exported to the USB memory stick. This will help the MagPro interface from slowing down.

Amplitude Log Enabled

Data export of Amplitude Log to USB memory stick.

Coil Temperature events

Data export of Coil Temperature data to USB memory stick.
Three different choices in Coil Temperature are available:

OFF
No coil Temperatures events are logged and saved

ON
Coil temperature events are only logged when the MagPro are active and running a sequence of stimulations

Advanced
All Coil temperature events are logged; also the temperature events between stimulations (For saving directly to memory stick: be aware that an error will occur if the memory stick is removed when the MagPro is writing data to it).

Temperature scale

Select temperature scale on the display in Celsius (°C) or Fahrenheit (°F).

Date and time

Adjust date and time by highlight the field that is to be changed and use the right wheel to adjust.

Export of data (COM2)

Export of data from the COM2 serial port on the rear panel to an external computer is possible. The used protocol consists of 8 bytes sent for di/dt values, amplitude changes or temperature/coil type changes.

Byte	Values	Description
1	0xFE	Start flag
2	4	Length (always value: 4)
3	0x01 .. 0x03	Type: 1: Amplitude 2: di/dt 3: Temperature
4	0 .. 199	Type 1: Value A amplitude in % Type 2: Value A di/dt Type 3: Temperature in °C
5	0 .. 199	Type 1: Value B amplitude in % Type 2: Value B di/dt Type 3: Coil type no
6	0..0x0F	Bit 0..1 Mode: 0: Standard 1: Power 2: Twin 3: Dual Bit 2..3 Waveform: 0: Monophasic 1: Biphasic 2: Halfsine 3: Biphasic Burst
7	0 .. 255	CRC8 calculated for byte 3,4,5,6 (see below)
8	0xFF	End flag

A checksum is calculated as follows:
The checksum is a CRC8 (Dallas/Maxim) checksum using the polynomial $X^8 + X^5 + X^4 + 1$.
(See: http://en.wikipedia.org/wiki/Cyclic_redundancy_check)

Examples (Hex values):

- FE 04 01 2A 41 07 AD FF CRC8 equals AD; calculated for 01, 2A, 41 and 07
  (amplitude A: 42%, amplitude B: 65%, Mode: Dual, Waveform: Biphasic)

- FE 04 02 33 19 02 DF FF CRC8 equals DF; calculated for 02, 33, 19 and 02
  (di/dt A: 51uA/S, di/dt B: 25uA/S, Mode: Twin, Waveform: Monophasic)

- FE 04 03 18 48 0C A9 FF CRC8 equals A9; calculated for 03, 18, 48 and 0C
  (Temp: 24 °C, CoilType: 72=C-B60, Mode: Standard, Waveform: Biphasic Burst)

NOTE:

- When MagPro starts up some bytes are sent on COM2 before the equipment is ready for stimulation. These bytes should be ignored.
- For Biphasic Burst waveform MagPro might send several di/dt values for each burst depending on timing settings.
- For Twin or Dual mode MagPro sends a di/dt value for each pulse where Value A (byte 4) should be used for the first pulse and Value B (byte 5) should be used for the second pulse.

Menu tree

MagPro R30

Main			Timing	Configure
Mode	Standard		Timing control	Save Setup
			Rep.Rate	Charge Delay
			Pulses in Train	Auto Discharge Time
			Number of Trains	Prior Warning Sound
			Inter Train Interval	Coil Type Display
			Protocol	**Trigger**
Current Direction	Normal		Delay	Trig Output
			Amplitude A	Polarity Input
			Rep.Rate	Polarity Output
Waveform	Biphasic		Train Pulses	Delay, Input Trig
				Delay, Output Trig
				Service
				Language
				Event Log Enabled
				Amplitude Log Enabled
				Coil Temperature events
				Temperature scale
				Date and Time
				MEP (option)
				Time Base
				Sensitivity
				Panning
				Curve No
				Common Baseline
				Lower Frequency Limit
				Upper Frequency Limit
				Trigger Mode
				Display Size
				Stay On Top
				Save

MagPro R30 incl. MagOption

Main			Timing	Configure
Mode	Standard		Timing control	Save Setup
			Rep.Rate	Charge Delay
	Twin	IPI B/A Ratio	Pulses in Train	Auto Discharge Time
	Dual	IPI B Amplitude %	Number of Trains	Prior Warning Sound
			Inter Train Interval	Coil Type Display
			Protocol	**Trigger**
Current Direction	Normal		Delay	Trig Output
			Amplitude A	Twin Trig Output
			Mode	Twin Trig Input
Waveform	Monophasic		Waveform	Polarity Input
			IPI	Polarity Output
	Biphasic		B/A Ratio	Delay, Input Trig
			Rep.Rate	Delay, Output Trig
			Train Pulses	**Service**
				Language
				Event Log Enabled
				Amplitude Log Enabled
				Coil Temperature events
				Temperature scale
				Date and Time
				MEP (option)
				Time Base
				Sensitivity
				Panning
				Curve No
				Common Baseline
				Lower Frequency Limit
				Upper Frequency Limit
				Trigger Mode
				Display Size
				Stay On Top
				Save

MagPro X100

Main			Timing	Configure
Mode	Standard		Timing control	Save Setup
			Rep.Rate	Charge Delay
			Pulses in Train	Auto Discharge Time
			Number of Trains	Prior Warning Sound
			Inter Train Interval	Coil Type Display
			Protocol	**Trigger**
Current Direction	Normal		Delay	Trig Output
	Reverse		Amplitude A	Polarity Input
Waveform	Monophasic		Current Direction	Polarity Output
	Biphasic		Waveform	Delay, Input Trig
	Biphasic Burst	IPI Burst Pulses	Burst Pulses	Delay, Output Trig
			IPI	**Service**
			Rep.Rate	Language
			Train Pulses	Event Log Enabled
				Amplitude Log Enabled
				Coil Temperature events
				Temperature scale
				Date and Time
				MEP (option)
				Time Base
				Sensitivity
				Panning
				Curve No
				Common Baseline
				Lower Frequency Limit
				Upper Frequency Limit
				Trigger Mode
				Display Size
				Stay On Top
				Save

MagPro X100 incl. MagOption

Main			Timing	Configure
Mode	Standard		Timing control	Save Setup
	Power		Rep.Rate	Charge Delay
	Twin*	IPI / B/A Ratio	Pulses in Train	Auto Discharge Time
	Dual*	IPI / B Amplitude %	Number of Trains	Prior Warning Sound
	*) Biphasic Burst not available		Inter Train Interval	Coil Type Display
			Protocol	**Trigger**
Current Direction	Normal		Delay	Trig Output
	Reverse		Amplitude A	Twin Trig Output
Waveform	Monophasic		Mode	Twin Trig Input
	Biphasic		Current Direction	Polarity Input
	Halfsine		Waveform	Polarity Output
	Biphasic Burst	IPI / Burst Pulses	Burst Pulses	Delay, Input Trig
			IPI	Delay, Output Trig
			B/A Ratio	**Service**
			Rep.Rate	Language
			Train Pulses	Event Log Enabled
				Amplitude Log Enabled
				Coil Temperature events
				Temperature scale
				Date and Time
				MEP (option)
				Time Base
				Sensitivity
				Panning
				Curve No
				Common Baseline
				Lower Frequency Limit
				Upper Frequency Limit
				Trigger Mode
				Display Size
				Stay On Top
				Save

Setting the Scale

MagPro R30

Main	
Timing	
Setup	A, B...Z and Default
Rep Rate	0.1, 0.2, 0.3, 0.4...1, 2, 3, 4, 5, 6...30pps
Pulses in Train	1, 2, 3, 4...1000
Number of Trains	1, 2, 3, 4...500
Inter Train Interval	0.1, 0.2, 0.3, 0.4...120s
Configure	
Charge Delay	0, 10, 20, 30...100, 200, 300...1000, 2000, 3000...10000ms
Auto Discharge Time	5, 10, 15 ... 60min
Trigger	
Delay, Input Trig	0, 0.1, 0.2 ... 1, 2, 3...100ms
Delay, Output Trig	-100, -99, -98...-10.0, -9.9, -9.8...0.0, 0.1, 0.2, 0.3...10 ,11, 12...100ms

MagPro R30 incl. MagOption

Main	
Twin and Dual	
Monophasic IPI	2.0, 2.1, 2.2...10.0, 10.5, 11.0...20, 21, 22... 100ms...3s
Biphasic IPI	1.0, 1.1, 1.2...10.0, 10.5, 11.0...20, 21, 22...100ms...3s
Pulse B/A Ratio	0.2, 0.3, 0.4 ... 5
Pulse B Amplitude	1, 2, 3...100%
Timing	
Setup	A, B...Z and Default
Rep Rate	0.1, 0.2, 0.3, 0.4...1, 2, 3, 4, 5, 6...30pps
Rep Rate in Twin and Dual mode	0.1, 0.2, 0.3, 0.4...1, 2, 3, 4, 5tpps
Pulses in Train	1, 2, 3, 4...1000
Number of Trains	1, 2, 3, 4...500
Inter Train Interval	0.1, 0.2, 0.3, 0.4...120s
Configure	
Charge Delay	0, 10, 20, 30...100, 200, 300...1000, 2000, 3000...10000ms
Auto Discharge Time	5, 10, 15 ... 60min
Trigger	
Delay, Input Trig	0, 0.1, 0.2 ... 1, 2, 3...100ms
Delay, Output Trig	-100, -99, -98...-10.0, -9.9, -9.8...0.0, 0.1, 0.2, 0.3...10 ,11, 12...100ms

MagPro X100

Main	
Biphasic Burst IPI	0.5, 0.6, 0.7...10.0, 10.5, 11.0... 20, 21, 22... 100ms
No of Biphasic Bursts	2, 3, 4 or 5
Timing	
Setup	A, B...Z and Default
Rep Rate	0.1, 0.2, 0.3, 0.4...1, 2, 3, 4, 5, 6...100pps
Rep Rate in Biphasic Burst mode	0.1, 0.2, 0.3, 0.4...1, 2, 3, 4, 5, 6...20tpps
Pulses in Train	1, 2, 3, 4...1000
Number of Trains	1, 2, 3, 4...500
Inter Train Interval	0.1, 0.2, 0.3, 0.4...120s
Configure	
Charge Delay	0, 10, 20, 30...100, 200, 300...1000, 2000, 3000...10000ms
Auto Discharge Time	5, 10, 15 ... 60min
Trigger	
Delay, Input Trig	0, 0.1, 0.2 ... 1, 2, 3...100ms
Delay, Output Trig	-100, -99, -98...-10.0, -9.9, -9.8...0.0, 0.1, 0.2, 0.3...10 ,11, 12...100ms

MagPro X100 incl. MagOption

Main	
Biphasic Burst IPI	0.5, 0.6, 0.7...10.0, 10.5, 11.0... 20, 21, 22... 100ms
No of Biphasic Bursts	2, 3, 4 or 5
Twin and Dual	
Monophasic IPI	2.0, 2.1, 2.2...10.0, 10.5, 11.0...20, 21, 22... 100ms...3s
Biphasic and Halfsine IPI	1.0, 1.1, 1.2...10.0, 10.5, 11.0...20, 21, 22...100ms....3s
Pulse B/A Ratio	0.2, 0.3, 0.4 ... 5
Pulse B Amplitude	1, 2, 3...100%
Timing	
Setup	A, B...Z and Default
Rep Rate	0.1, 0.2, 0.3, 0.4...1, 2, 3, 4, 5, 6...100pps
Rep Rate in Biphasic Burst, Twin and Dual mode	0.1, 0.2, 0.3, 0.4...1, 2, 3, 4, 5, 6...20tpps
Pulses in Train	1, 2, 3, 4...1000
Number of Trains	1, 2, 3, 4...500
Inter Train Interval	0.1, 0.2, 0.3, 0.4...120s
Configure	
Charge Delay	0, 10, 20, 30...100, 200, 300...1000, 2000, 3000...10000ms
Auto Discharge Time	5, 10, 15 ... 60min
Trigger	
Delay, Input Trig	0, 0.1, 0.2 ... 1, 2, 3...100ms
Delay, Output Trig	-100, -99, -98...-10.0, -9.9, -9.8...0.0, 0.1, 0.2, 0.3...10 ,11, 12...100ms

Technical Data

Electromagnetic Data

Stimulation Waveforms and Pulse width

Standard Mode:

Waveform	MagPro model	Pulse width
Biphasic	R30 R30 + MagOption X100 X100 + MagOption	280µs
Monophasic	R30 + MagOption X100 X100 + MagOption	70µs
Halfsine	X100 + MagOption	140µs

Power Mode:

Waveform	MagPro model	Pulse width
Biphasic	X100 + MagOption	400µs
Monophasic	X100 + MagOption	100µs
Halfsine	X100 + MagOption	200µs

Magnetic Gradient from Stimulation Coils

Magnetic Gradient and number of stimuli before coil overheats depend on the specific coil used.

Mechanical Data

Dimensions

MagPro: (HxWxD)   210 x 530 x 400mm
MagOption: (HxWxD)   130 x 530 x 400mm
Cart: (HxWxD)   800 x 610 x 550mm
System height with cart: 102cm

Weight

MagPro R30:   33kg / 73 lbs
MagPro X100:   35kg / 77 lbs
MagOption: 25kg / 55 lbs
Cart: 16kg / 35 lbs

Environmental Data

Operating Temperature: 10 – 30°C (50 – 86°F)
Storage Temperature: 5 – 50°C (41 – 122°F)

Operating Humidity: 30 – 60 % RH
Storage Humidity: 20 – 80 % RH

Power Supply

Mains Voltage: 230V~, 50/60Hz
                               according to IEC 60601-1

Mains impedance: < 1 Ω
Maximum Power Consumption: 2300VA
Standby Power Consumption: <150VA

Operation from 100-120V through Transformer.

Connections

Trigger Connector

DSUB 9 pin Female
Pin 1: Trigger Input
Pin 2: Trigger Output
Pin 3: Ground. (Reference)
Pin 6: +5VDC
Pin 7: +12VDC

9016E455- Trigger cable for Keypoint®
9016E456- Trigger cable with BNC connectors

Trigger Input

Pulse width > 5μs
TTL + CMOS levels accepted
Input Impedance > 10 kΩ
Polarity: User Defined
Default: Falling

Trigger Output

Pulse width: 50μs
TTL-levels
Output Impedance < 200 Ω
Polarity: User Defined
Default: Falling

Serial Ports

PC-style: COM1 for MEP Monitor Interface
DSUB Connector 9 pin Male
Standard RS232 connectivity

PC-style: COM2
DSUB Connector 9 pin Male
Standard RS232 connectivity

Setting	Value
Baudrate	38400
Databits	8
Parity	None
Stopbits	1
Flow control	None

USB Ports

PC-style: USB
Standard USB connectivity

Performance Data – Amplitude Roll-Off

Output Power versus Repetition Rate, depending on Waveform, shown for coil C-B60:

Standard and Power Pulses

Waveform	Repetition Rate						
	5 pps	10 pps	20 pps	30 pps	50 pps	75 pps	100 pps
Standard Mode							
Biphasic	100 %	100 %	80 %	65 %	50 %	35 %	30 %
Halfsine	100 %	100 %	80 %	65 %	50 %	35 %	30 %
Biphasic Burst (N=3)	100 %	100 %	70 %	50 %	35 %	25 %	20 %
Monophasic	100 %	70 %	50 %	40 %	30 %	25 %	20 %
Power Mode							
Biphasic	100 %	75 %	55 %	45 %	35 %	25 %	20 %
Halfsine	100 %	75 %	55 %	45 %	35 %	25 %	20 %
Biphasic Burst (N=3)	100 %	70 %	45 %	35 %	25 %	20 %	15 %
Monophasic	75 %	50 %	35 %	25 %	20 %	15 %	10 %

pps = Pulses Per. Second
N = Number of Pulses (N=2, 3, 4, 5)

Twin and Dual Pulses

Waveform	Repetition Rate					
	1 tpps	2 tpps	5 tpps	10 tpps	15 tpps	20 tpps
Twin and Dual Mode						
Biphasic	100 %	100 %	100 %	75 %	60 %	50 %
Halfsine	100 %	100 %	100 %	75 %	60 %	50 %
Monophasic	100 %	100 %	70 %	45 %	35 %	30 %

tpps = Twin Pulses Per. Second

Error messages

Different error messages can be displayed in the Enable/Disable status field.

Error message	Cause
Curr.Error	Power supply output is shorted or power supply is defective.
Disch1 hot	Discharging circuit is hot, should disappear within a few minutes after cooling down.
Disch hot	Discharging circuit in MagOption is hot, should disappear within a few minutes after cooling down.
MonoRes hot	Monophasic resistor is hot, should disappear within a few minutes after cooling down.
Reposition.	Internal power switch is moving should disappear within 10 sec.

Maintenance

Cleaning and Disinfecting Procedures

The maintenance that can be performed by the operator is limited to cleaning and disinfecting the device.

NOTE Any maintenance inside the device must be performed by qualified service personnel.

- The MagPro, Coil and Cart:
  - Before cleaning the device units, switch off the mains. Use a cloth gently wrung in a recommended disinfectant as listed below.
  - Dilute the disinfectant properly, as stated by the manufacturer.

For routine cleaning use

Phenoles (Bacillotex® etc.) or 70% alcohol, 0.5% chlorohexidine.

If hepatitis or any other dangerous virus contamination is suspected: Aldehydes (Cidex®, Korsolin®) or chlorinates (Diversol BX®).

Be careful not to drip water or disinfectant directly into the input and output plugs and other openings in the cover. Remove excess disinfectant with a dry cloth.

Do not use solvent silicon-based or abrasive cleaning agents.

Before using disinfectants other than those specified, please contact your local distributor for further information.

Waste Management

The device and its accessories must be disposed of separately as electronic waste.

Waste Electrical and Electronic Equipment, user information:
Do not dispose of this product in the unsorted municipal waste stream. Dispose of this product according to local regulations.

Safety Checks

The following safety checks should be conducted before use daily:

- Inspection for visible damage to device.
- Inspection of mains cord and connecting cables.
- Check the coil for damages, cracks, marks, deformations, color changes and other irregularities. Do not use the coil if there is any evidence of stress failure and contact a Service Center.

The following safety checks should be conducted (by qualified personnel) at least once a year and in the event of repair:

- Insulation resistance.
- Measurement of leakage currents.
- Measurement of resistance of protective earth conductor.
- Inspection and cleaning of the fan filter.

IEC 60601-1-1

CAUTION
When connecting, attention must be paid to:

IEC 60601-1-1
Medical Electrical Equipment, Part 1:
General Requirements for Safety.
1. Collateral Standard
Safety Requirements for Medical
Electrical Systems.

When connecting to a medical appliance with an F-type applied part or some additional equipment complying not with IEC 60601-1 but with the relevant safety standard for such equipment, the additional equipment:

1) Must either be placed outside the patient environment (the patient environment is any area in which intentional or unintentional contact can occur between patient and parts of the system (e.g. a printer) or as a result of some other person touching parts of the system)

or

2) If placed within the patient environment, must be:
   a) Provided with additional protective earthing,

or

   b) Supplied from an extra isolating transformer, limiting the enclosure leakage current to a value not exceeding 0.5 mA,

or

   c) Supplied from a floating power supply, limiting the enclosure leakage current to a value not exceeding 0.5 mA

Please refer to IEC 60601-1-1.

Classification

Classification requirements

IEC 60601-1

Type of protection against electric shock:

■ *Class I:* Equipment in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in that means are provided for the connection of the equipment to the protective earth conductor in the fixed wiring of the installation in such a way that accessible metal parts cannot become live in the event of a failure of the basic insulation.

Method(s) of sterilization or disinfecting recommended by the manufacturer:

■ Please, see section on "Maintenance".

Degree of protection against electric shock:

■ *Type BF:* Applied part providing a particular degree of protection against electric shock, Particularly regarding:
- Allowable leakage current
- The applied part is electrically isolated (floating).
- Not intended for direct cardiac application.

Degree of protection against harmful ingress of water:

■ *MagPro:*
IP20: Ordinary equipment (enclosed equipment without protection against ingress of water).

■ *Coils:*
IP24: Ordinary equipment (enclosed equipment with protection against liquid splashing).

Degree of safety of application in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide:

■ Equipment not suitable for use in the presence of such a mixture.
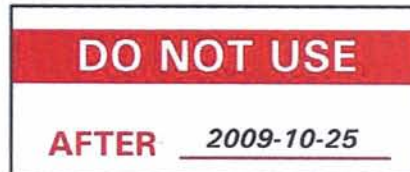
Mode of operation:

■ Continuous operation

Appendix A, Coils and Accessories

Operating period (Coils)

Danger
Due to the mechanical and thermal stress during stimulation, Magnetic Stimulating Coils must not be used after the expiration date.

DO NOT USE

AFTER *2009-10-25*

The expiration date is shown on the label, which is situated on top of the large orange coil connector, as YYYY-MM-DD.

The maximum operating period for the coils is:

Coil type	Maximum operating period
C-100 C-B60 MC-125 MC-B70 MMC-140 MMC-140-II RT-120 RT-120-II D-B80	5 years
MCF-B65 MCF-75 MCF-125	3 years
Cool-B65	5 years or 18.000.000 EPV see separate User Guide for Cool coils

Symbols

CE 0543 — The device complies with the EC directive 93/42/EEC on medical devices

The device is of Type BF, i.e. the applied part is electrically isolated.

Indicates the current direction on coils

Storage temperature range. Packaging label

SN xxx — Serial Number.

P/N — Part Number

Waste Electrical and Electronic Equipment: Compliance information.

User information: Do not dispose of this product in the unsorted municipal waste stream. Dispose of this product according to local regulations.
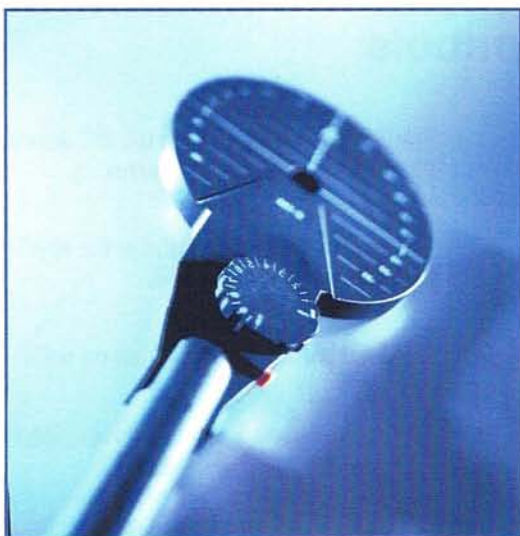
Classification

Magnetic Coils.
IEC 60601-1, IP24

Encapsulation of Coils

Minimum 2mm plastic material. Windings are placed symmetrically in the encapsulation.

C-100 Circular Coil

- The coil is suitable for general-purpose stimulation.
- Equipped with power control and trigger button to support easy operation.

Mechanical Properties

Weight of transducer head	0.6kg
Dimensions of transducer head	ø123 x 11.5 mm
Cable length	1.7m

Coil Winding Data

Inner diameter	20mm
Outer diameter	110mm
Winding height	6mm
Number of windings	14

Magnetic and Electrical Properties

Max initial dB/dt	35 kT/s near the coil surface.
Active pulse width	280µs (Biphasic)

Performance

Number of stimulations before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	400 pulses
Ordering Number	9016E058-

C-B60 Butterfly Coil

- The coil is suitable for focused stimulations.
- Equipped with power control and trigger button to support easy operation.

Mechanical Properties

Weight of transducer head	0.7kg
Cable length	1.7m
Dimensions of transducer head	165 x 85 x 19 mm

Coil Winding Data

Inner diameter	35mm
Outer diameter	75mm
Winding height	11mm
Number of windings	2 x 10

Magnetic and Electrical Properties

Max initial dB/dt	35 kT/s near the coil surface
Active pulse width	280µs (Biphasic)

Performance

Number of stimulations, before warm-up at ambient temperature 20°C:	350 pulses
Mean output 75% of maximum at 1pps.	
Ordering Number	9016E048-

MC-125 Circular Coil

Mechanical Properties

Weight of transducer head	0.6kg
Cable length	1.3m
Dimensions of transducer head	ø130 x 11.3 mm

Coil Winding Data

Inner diameter	28mm
Outer diameter	114mm
Winding height	6mm
Number of windings	13

Magnetic and Electrical Properties

Max initial dB/dt	41 kT/s near the coil surface
Active pulse width	280μs (Biphasic)

Performance

Number of stimulations, before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	450 pulses

Ordering Number   9016E055-

- The coil is suitable coil for general purpose stimulation.
- Equipped with trigger button to support easy operation.

MC-B70 Butterfly Coil

Mechanical Properties

Weight of transducer head	1.1kg
Cable length	1.7m
Dimensions of transducer head	169 x 112 x 33 mm

Coil Winding Data

Inner diameter	25mm
Outer diameter	97mm
Winding height	6mm
Number of windings	2 x 10

Magnetic and Electrical Properties

Max initial dB/dt	31 kT/s near the coil surface
Active pulse width	280μs (Biphasic)

Performance

Number of stimulations before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	400 pulses

Ordering Number   9016E056-

- The coil is suitable for focused stimulation.
- The coil is slight bend to closely follow curved shapes.
- Equipped with trigger button to support easy operation.

MMC-140 Parabolic Coil

- The coil is parabolic in shape to provide a powerful and focused stimulation.
- Equipped with trigger button to support clinical operation.

Mechanical Properties

Weight of transducer head	0.8kg
Cable length	1.5m
Dimensions of transducer head	ø143 x 14.5/33 mm

Coil Winding Data

Inner diameter	25mm
Outer diameter	120mm
Winding height	6mm
Number of windings	14

Magnetic and Electrical Properties

Max initial dB/dt	33 kT/s near the coil surface
Active pulse width	280µs (Biphasic)

Performance

Number of stimulations before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	650 pulses

Ordering Number	9016E057-

MMC-140-II Parabolic Coil with power control

- The coil is parabolic in shape to provide a powerful and focused stimulation.
- Equipped with power control and trigger button to support easy operation.

Mechanical Properties

Weight of transducer head	0.9kg
Cable length	2.5m
Dimensions of transducer head	ø143 x 17/39 mm

Coil Winding Data

Inner diameter	25mm
Outer diameter	126mm
Winding height	6mm
Number of windings	15

Magnetic and Electrical Properties

Max initial dB/dt	33 kT/s near the coil surface
Active pulse width	280µs (Biphasic)

Performance

Number of stimulations before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	650 pulses

Ordering Number	9016E063-

RT-120 Racetrack Coil
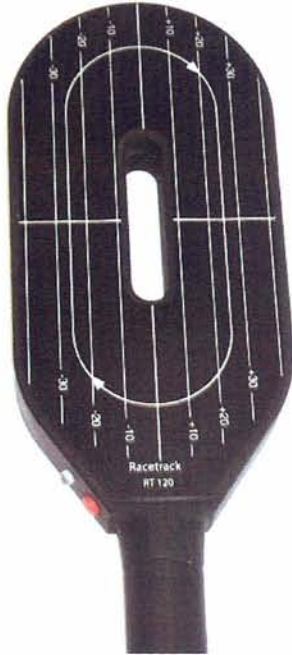
Mechanical Properties

Weight of transducer head	1.3 kg
Cable length	1.5 m
Dimensions of transducer head	ø90 x 200 x 26 mm

Coil Winding Data

Outer loop	ø80 x160 mm
Inner loop	ø30 x 110 mm
Winding height	15 mm
Number of windings	10

Magnetic and Electrical Properties

Max initial dB/dt	31 kT/s near the coil surface
Active pulse width	280μs (Biphasic)

Performance

Number of stimulations before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	1500 pulses

Ordering Number   9016E064-

■ The coil is elliptic in shape and is especially suitable for stimulation of wider areas such as bigger muscles.

■ Equipped with trigger button to support clinical operation.

RT-120-II Racetrack Coil

Mechanical Properties

Weight of transducer head	1,5 kg
Cable length	2,5 m
Dimensions of transducer head	ø90 x 175 x 26 mm

Coil Winding Data

Outer loop	ø80 x 160 mm
Inner loop	ø30 x 110 mm
Winding height	15 mm
Number of windings	10

Magnetic and Electrical Properties

Max initial dB/dt	31 kT/s near the coil surface
Active pulse width	280μs (Biphasic)

Performance

Number of stimulations before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	1500 pulses

Ordering Number   9016E065-

■ The coil is elliptic in shape and is especially suitable for stimulation of wider areas such as bigger muscles.

■ Equipped with power control and trigger button to support clinical operation

D-B80 Butterfly Coil

Mechanical Properties

Weight of transducer head	0.9kg
Cable length	1.7m

Coil winding data

Diameter	2 x ø80mm
Angle	120°
Winding height	12mm
Number of windings	2 x 7

Magnetic and Electrical Properties

Max initial dB/dt	31 kT/s near the coil surface
Active pulse width	280µs (Biphasic)

Performance

Number of stimulations before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	500 pulses

Ordering Number	9016E043-

- Opened butterfly design for powerful stimulation.
- The coil is suitable for deep stimulation.
- The coil is slight bend to closely follow curved shapes.
- Equipped with trigger button to support clinical operation.

MCF-B65 Butterfly Coil

Mechanical Properties

Weight of transducer head	1.5kg
Cable length	2m
Dimensions of transducer head	174 x 94 x 53 mm

Coil Winding Data

Inner diameter	35mm
Outer diameter	75mm
Winding height	12mm
Number of windings	2x (2 x 5)

Magnetic and Electrical Properties

Max initial dB/dt	32 kT/s near the coil surface
Active pulse width	280µs (Biphasic)

Performance

Number of stimulations, before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	2000 pulses

Ordering Number	9016E042-

- The Coil is designed for demanding clinical studies, requiring a high number of stimuli without the need for external cooling.
- Equipped with trigger button to support clinical operation.

MCF-75 Circular Coil

Mechanical Properties

Weight of transducer head	1kg
Cable length	1.3m
Dimensions of transducer head	ø88 x 41.5 mm

Coil Winding Data

Inner diameter	10mm
Outer diameter	65mm
Winding height	18mm
Number of windings	3 x 7

Magnetic and Electrical Properties

Max initial dB/dt	43 kT/s near the coil surface
Active pulse width	280µs (Biphasic)

Performance

Number of stimulations, before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	500 pulses

Ordering Number 9016E044-

- The Coil is designed for demanding clinical studies, requiring a high number of stimuli without the need for external cooling.
- Equipped with trigger button to support clinical operation.

MCF-125 Circular Coil

Mechanical Properties

Weight of transducer head	1.5kg
Cable length	2m
Dimensions of transducer head	ø140.5 x 41.5 mm

Coil Winding Data

Inner diameter	35mm
Outer diameter	121mm
Winding height	6mm
Number of windings	13

Magnetic and Electrical Properties

Max initial dB/dt	34 kT/s near the coil surface
Active pulse width	280µs (Biphasic)

Performance

Number of stimulations, before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 1pps.	2000 pulses

Ordering Number 9016E041-

- The Coil is designed for demanding clinical studies, requiring a high number of stimuli without the need for external cooling.
- Equipped with trigger button to support clinical operation.

Cool-B65 Butterfly Coil

- The coil has electrical and magnetic properties identical to the MCF-B65 and Cool-B65.

- The Coil is designed for demanding clinical studies, requiring a very high number of stimuli.

- The Coil is optimized for use with equipment enabling High Repetition Rates and long pulse trains.

- The Coil is cooled from an external Cooler Unit. See below.

- Equipped with trigger button to support clinical operation.

- Built in timer and counter with preset operating period (days and stimulations)

Mechanical Properties

Weight of transducer head	1.7kg
Cable length	1.3m
Dimensions of transducer head	174 x 94 x 41 mm

Coil Winding Data

Inner diameter	35mm
Outer diameter	75mm
Winding height	12mm
Number of windings	2x (2 x 5)

Magnetic and Electrical Properties

Max initial dB/dt	36 kT/s near the coil surface
Active pulse width	280µs (Biphasic)

Performance

Number of stimulations, before warm-up at ambient temperature 20°C: Mean output 75% of maximum at 2pps.	>20.000 pulses
Number of stimulations, before warm-up at ambient temperature 20°C with protocol: 60 trains @ 50 pulses/train @ 10pps @ Inter Train Interval: 25s @ Output=75%.	>10.000 pulses
Ordering Number	9016E049-

Coil Cooler Unit

- Used as external cooling system for Cool coils.

- Equipped with special liquid cooling media.

Mechanical Properties

Weight of unit	10kg
Height x width x depth	20 x 30 x 30 cm
Capacity of cooling media	1.8 liter
Mains power cable length	3m

Electrical Properties

Available Main Voltage	100-240V, 50-60Hz
Power consumptions	Maximum 40VA
Ordering Number	9016B015-

Additional cooling media

Volume	0.6 liter
Ordering Number	101-323-

Super Flex Arm for Magnetic Coil Positioning

- For easy and flexible positioning of the magnetic coils.

- The arm has three joints. Two ball joints which can rotate in multiple directions and one central joint which can rotate in one direction.

- All three joints can be locked and unlocked by the grip on the central joint.

- Designed for use with all types of coils.

Mechanical Properties

Coils	All coils
Max. height above the floor	1.6 m
Length of arm	80 cm
Weight of arm	6.5 kg
Ordering Number	9016B017-

Cart for MagPro R30

110V/230V Power Supply Option for MagPro

Mechanical Properties

Weight	13.5kg
Height x width x depth	80 x 61 x 55cm
Ordering Number	9016B010-

Extra Shelf

Weight	2.9kg
Height x width x depth	3 x 55 x 31cm
Ordering Number	9031B311-

Mechanical Properties

Weight of transformer	15kg
Cable length primary	1.5m
Cable length secondary	1.3m
Height x width x depth	20 x 30 x 30 cm
Encapsulation	Overall min 2 mm PS Non flammable Impact resistant

Electrical Properties

Available Main Voltage	100V, 110V, 120V
Max Energy Output	2300VA
Ordering Number	9016D001-

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