

MAGSTIM[®]
RAPID²

P/N 3576-23-09

OPERATING MANUAL

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GUARANTEE

Equipment manufactured by the Magstim Company Limited is fully guaranteed covering materials and workmanship for a period of one year from the date of shipment. The capacitor is guaranteed for one year, or 1,000,000 discharges, whichever ever comes first. The Magstim Company Limited reserves the right to perform guarantee services in its factory, at an authorised repair station, or at the customer's installation.

The Magstim Company's obligations under this guarantee are limited to repairs or, at the company's option, replacement of any defective parts of our equipment, except batteries, without charge if said defects occur during normal service.

Claims for damages during shipment must be filed promptly with the transportation company. All correspondence concerning the equipment must specify both, name and/or number and serial number, as it appears on the invoice for said equipment.

Improper use, mishandling, tampering with, or operation of the equipment without following specific operating instructions will void this guarantee and release the Magstim Company Limited from any further guarantee obligations.

The Magstim Company Limited will only accept responsibility for the effects on safety, reliability and performance of the equipment if:

- modifications or repairs are carried out by persons authorised by The Magstim Company Limited.
- the electrical installation of the relevant room complies with local regulations, and
- the equipment is used in accordance with the instructions for use.

SECTION: 1. WARNINGS AND PRECAUTIONS

USA Only

CAUTION: Magnetic stimulation has not been cleared by the FDA for cortical stimulation. Investigational human uses require that the user complies with the FDA regulations regarding Investigational Devices.

Please visit www.fda.gov/cdrh or www.magstim-us.com for more information.

CAUTION: In the USA, Federal Law restricts this device to sale by or on the order of a practitioner licensed by the law of the State in which he/ she practices to use or order the use of the device.



Attention: Consult accompanying documentation before using the Magstim Rapid².

CAUTION: The Magstim Rapid² and its stimulating coils must not be used on, or in the vicinity of, patients or subjects with cardiac demand pacemakers, implanted defibrillators, or other electronic implants.

The Magstim Rapid², its coils and accessories generate high intensity magnetic pulses. The induced eddy current is of sufficient magnitude to stimulate nerves and muscle.

The strong magnetic pulses generated by stimulating coils induce eddy currents in any conductive medium such as the human body, nearby metallic objects or electronic devices.

NB Particular care must be taken to ensure that leads connected directly to the patient, or other equipment, are not in a position where the stimulating coil can couple resulting in currents being induced in them.

Caution: for safety reasons, do not leave patient cables attached to the MEP Pod if they are not being used. If an unused cable is left connected, and the patient is connected to the other channel, there is the possibility that the unused cable may touch an earthed surface which could allow current to flow through the patient to ground.

Caution: do not allow the coil or the coil cable to come into close proximity with the MEP Pod patient cables. During discharge, current may be induced in these cables.

Do not discharge the Magstim with the stimulating coil in the vicinity of metallic objects or these may be projected, moved and/or damaged.



The Magstim Rapid² must not be used in an explosive atmosphere or in the presence of flammable anaesthetics.

When the magnetic pulse is delivered, a discharge click is produced by the Magstim Rapid² and its stimulating coil. This discharge click may startle.



Where possible avoid the use of the stimulating coil near the ears. The use of ear plugs is recommended.

High voltages are present within this System. Do not remove covers. Refer servicing to qualified personnel. Ensure that the System is not subject to conditions where water/ liquid may be tipped on it, including the UI Controller.

To ensure grounding safety, all mains power connections should be made directly to wall power outlet sockets. All of the customer's electrical cabling must conform to local electrical standards. Do not use a terminal block if insufficient sockets are available, as this will form a potential electrical hazard.

The Magstim Rapid², its stimulating coil and accessories must not be used if there are any signs of external damage or if any parts are damp or wet.

Cortical magnetic stimulation runs the risk of inducing seizures.

Do not discharge the Stimulating Coil in the vicinity of objects sensitive to magnetic fields. Examples are credit cards, floppy disks and computer screens.

Protection circuits disable the equipment if the temperature of the Stimulating Coil exceeds 40°C.

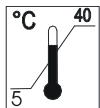
Coils must not be immersed in water, put in an ice bucket, or refrigerated, even if placed within a plastic bag, as condensation may be created within the coil. The coils do not have any specialised protection against the ingress of liquids; therefore conditions where ingress of liquid, or the forming of condensation within the coil, can occur must be avoided as the electrical insulation will be compromised. Cooling must only be performed by using a flow of cool air from a fan or air conditioning unit.

Coil Over Temperature

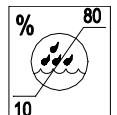
Due to thermal lag, the surface temperature of the Stimulating Coil may continue to rise following the coil over-temp activating and forcing the main unit into a standby condition. Therefore, the Coil must be removed from the patient as soon as the UI indicates that the coil is over-temperature.

If the Rapid system is externally triggered via a signal generator, the coil temperature algorithm is disabled. Under this condition, at high frequency/high power, it is possible for the coil temperature to reach levels well in excess of the 41°C limit specified in EN60601-1, before the hardware temperature cut-out operates. If the system is to be used under these conditions, it is essential that the intended protocol be run prior to use on a patient, to ensure that its temperature remains within the required limit.

There are currently few medical papers available regarding the effects of magnetic stimulation on the unborn child/ foetus or the expectant mother. As a result of this, we are unable to verify the safety of the Coil's use on, or by, pregnant women. We recommend that anyone wishing to use the Coil on a pregnant woman, or use it whilst pregnant, should contact the Magstim Company Ltd. for more information as new medical papers become available.



On no account must the Magstim Rapid² and its accessories be used in environmental conditions outside those specified in this operating manual.



No pins of connectors identified with the ESD warning symbol should be touched. The connectors involved are those to be found on the rear of the User Interface. Connections should not be made to these connectors unless ESD precautionary procedures are used. All staff responsible for using the Magstim Rapid² System should receive an explanation of the ESD warning symbol and receive training in ESD precautionary procedures – Connection should be made only by a person who is wearing a conductive wrist strap, which is connected to a suitable tested earth connection, or following the person grounding themselves by touching a part of the external casing connected to protective earth.

SECTION: 2. PRODUCT DESCRIPTION

2.1 RAPID²

Unit Power Status Indicator

- Flashes when the system is in STANDBY.
- On continuously when the system is ON.

ON/OFF/STANDBY

This switch toggles the operational state of the Rapid².

ARMED Indicator

This LED is continuously illuminated when the system is armed and high voltages are present in the system.

Coil OUTPUT Socket

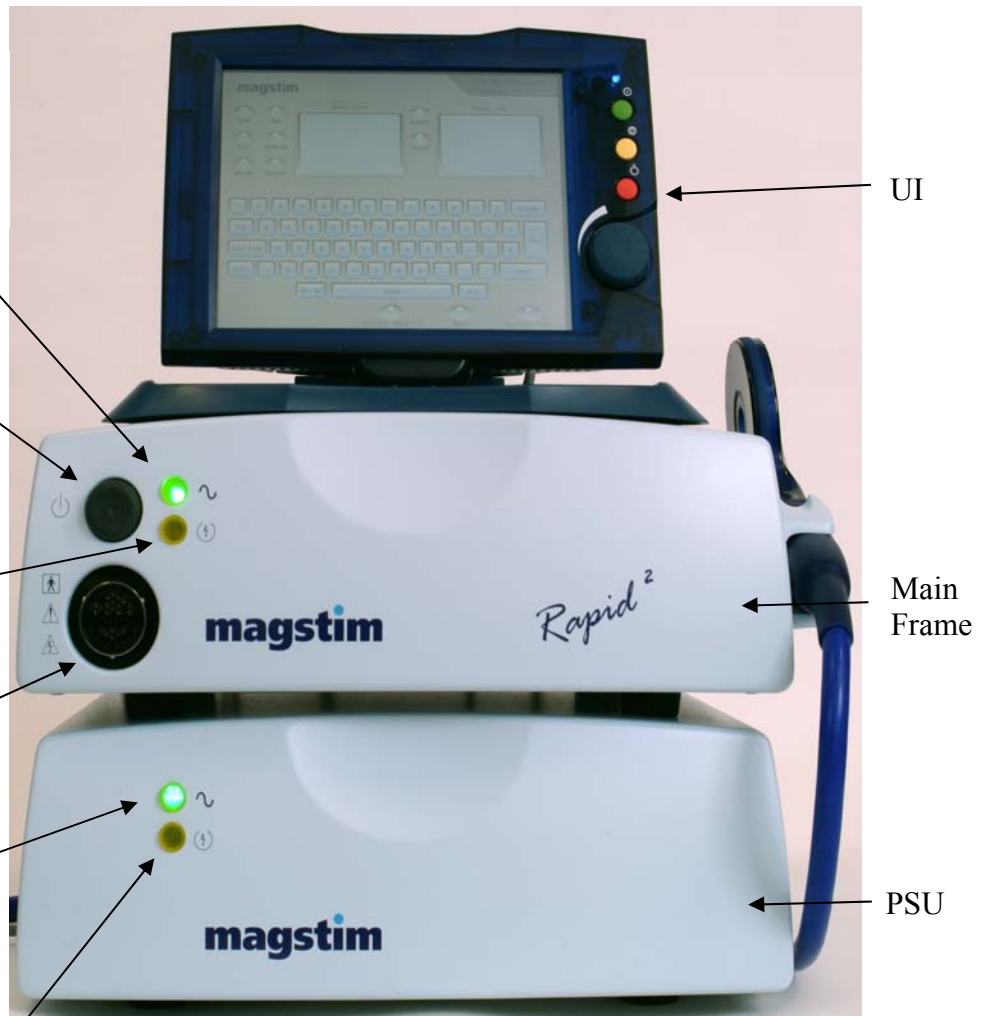
See below for description

PSU Power Status Indicator

- OFF when system is in STANDBY or OFF.
- On continuously when system is ON

ARMED/FAULT Indicator

This LED is continuously illuminated when the system is armed and high voltages are present in the system. This LED turns RED when a fault has been detected in the PSU.



Coil OUTPUT Socket Operation and SYMBOLS

This socket is used to connect the stimulating coil to the Magstim Rapid². Note that the unit cannot be armed and triggered unless the stimulating coil is connected to this output. Ensure that the locating pin in the coil plug is correctly lined up with the coil output socket before inserting the plug. When the coil plug is fully engaged in the socket, lock the plug in place by turning the black locking ring clockwise.

To remove the coil, put the Magstim Rapid² into standby and turn the black locking ring anti-clockwise.



HIGH VOLTAGE Symbol

This sign warns that voltages in excess of 1500V are present within the instrument.



ATTENTION Symbol – Consult Operating Manual

See warnings in Section 1 regarding the use of the Magstim Rapid².



APPLIED PART Symbol

BF Type Applied Part.

The applied parts of this device, namely the stimulating coil, MEP Pod and MEP Pod patient leads, are electrically isolated from the other parts of the equipment as required by the safety standards of BSEN60601-1.

2.2 INDICATIONS

The Rapid² works by inducing electrical currents in tissue using a non-invasive stimulating coil at frequencies of up to 100Hz. The stimulating coil is placed near the intended site of stimulation and trigger pulses initiate brief magnetic pulses. The magnetic fields can pass through clothing, tissue and bone to reach otherwise inaccessible areas. One feature of magnetic stimulation is that it is less likely to stimulate pain fibres at the skin surface, reducing the discomfort when compared with conventional electrical stimulation. Magstim Rapid² magnetic stimulators combine stimulation frequencies from 1Hz to 100Hz with a touch screen interface which controls every aspect of the stimulator's control and operation.

INDICATIONS FOR USE. The Magstim Rapid² magnetic nerve stimulator systems are intended for the stimulation of peripheral nerves and the human cortex for diagnostic and research purposes.

CONTRAINDICATIONS. Magstim Rapid² systems and their accessories should not be used on or in the vicinity of patients or users with cardiac demand pacemakers, implanted defibrillators and/or implanted neurostimulators.

CAUTION. Check the Magstim Rapid² System and its accessories for any signs of damage. If the Magstim Rapid² System or any of its accessories are damaged in any way they must not be used.

Federal law restricts this device to sale by or on the order of a practitioner licensed by the law of the State in which he/she practices to use or order the use of the device.

To avoid interference problems the Magstim Rapid², and its accessories, should not be used in the vicinity of any equipment that does not comply with EMC Standard EN 60601-1-2, including mobile phones.

For reasons of safety and reliability, if the system is set at 100% power, the user must not exceed 250 stimuli per minute, or 4000 stimuli per hour or 24,000 stimuli for every 24 hour period. This limitation is in addition to any other limitation imposed by the dedicated controller, or heating effects on the stimulating coil and charger circuitry.

The entire Operating Manual should be studied prior to use and users should be aware, in particular, that high voltages and currents, which can prove lethal, are present if the covers are removed. The Magstim Rapid² system's parts are detailed in Sections 3-6.

Each of the mains connections for the Rapid² System must be made via separate, permanent, mains outlets. On no account should a multi-way extension lead be used to connect more than one mains connector to a single mains outlet.

The Rapid² System must be used only with the supplied mains leads fitted with an integral filter, as they are required to maintain the System's compliance with EN 60601-1-2 regarding Electro-Magnetic emissions, as is the earth strap fitted between the stimulator and the power supply unit (PSU).

The MEP Pod is designed to be fitted to the Magstim Rapid² UI only. Do not attempt to connect it to a computer, or any other equipment, with a similar connector. To do so could result in electric shock/ burns to the patient at the site of electrode attachment. The MEP Pod connector has a hole deliberately blocked to prevent incorrect connection.

100Hz must not be used for cortical stimulation, it is for peripheral

use only. For safety guidelines relating to transcranial stimulation, see Section 9 of this Operating Manual.

The Stimulating Coil must not be discharged in the vicinity of the patient's heart.

2.3 COILS

A variety of coils is recommended to stimulate specific neural pathways. These coils have their coil heads labelled with blue arrows, which represent the direction of the coil discharge current. The virtual cathode for these coils is approximate to the valley or trough formed by the conjunction of the two coils, directly opposite the handle towards the leading edge of the coil.

Double 70mm Coil

2nd Generation Double 70mm Stimulating Coil P/N 3191-00. Also Standard Double 70mm Stimulating Coil P/N 9925-00.



The Double 70mm coil is capable of accurate stimulation of cortical areas and spinal nerve roots.

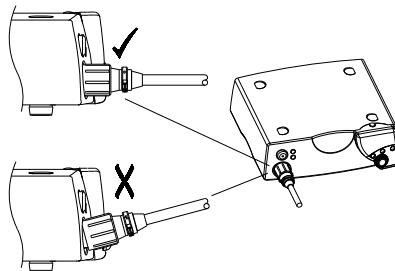
Applications Include:

- Selective monohemispheric transcranial stimulation
- Excitation of spinal roots
- Motor cortex
- Peripheral nerves

Coil Adapter



Coil P/N 9925-00 must be connected to the stimulator via the supplied coil adaptor (P/N 3110-00). This coil will not function if connected directly to the stimulator.



Please note: it is important that the coil is connected correctly. If the coil appears to be misaligned, remove and re-connect the coil. Do not use if the coil appears misaligned.

High Power 90mm Coil (additional item available)

P/N 3193-00



The High Power 90mm Coil can be used for central motor conduction studies. The design of the coil allows between 120 and 160 stimuli at the maximum power level before requiring a few minutes to cool.

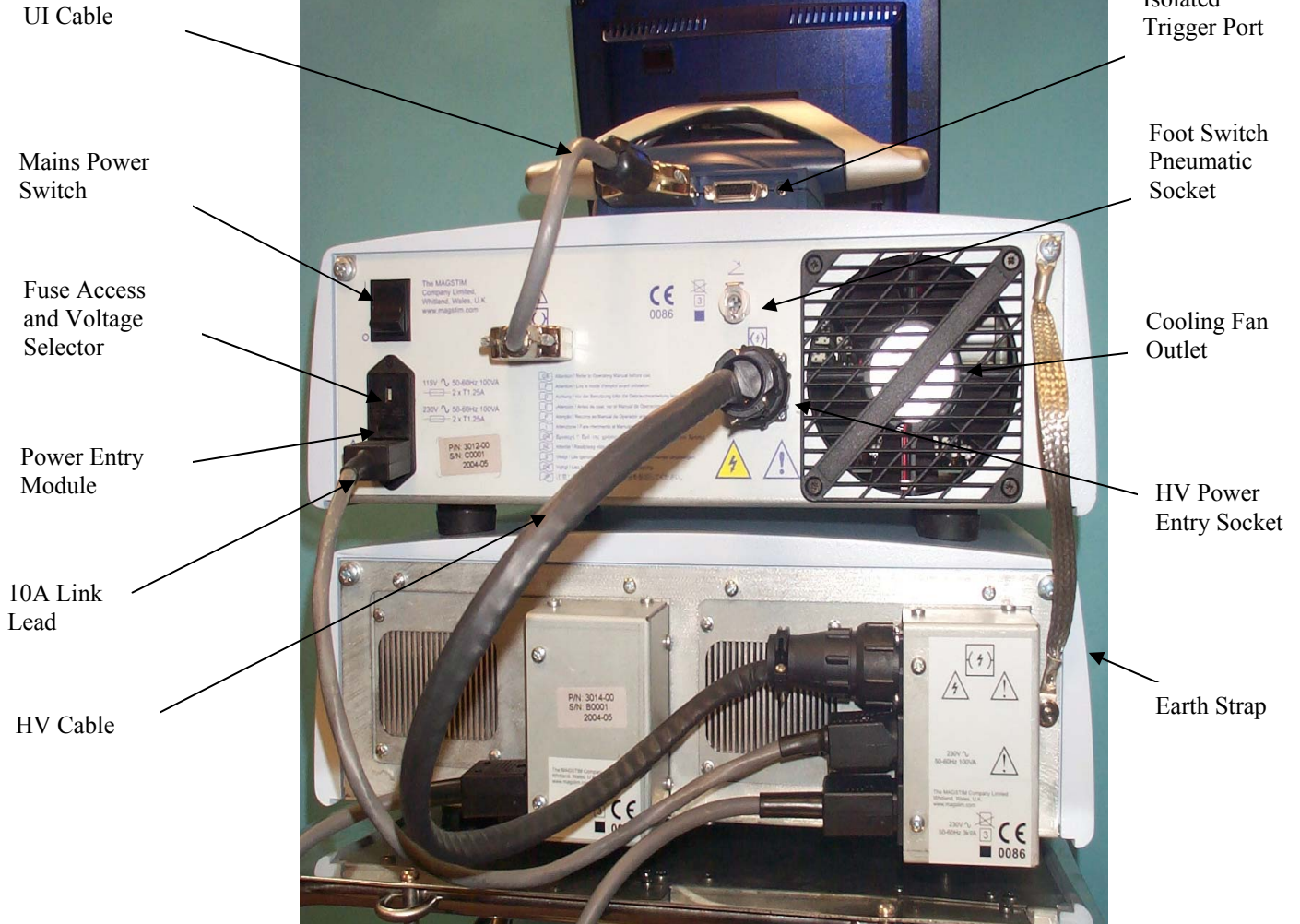
Location

The Double 70mm Coil is localised in its area of stimulation. For reproducible results from cortical stimulation, the most effective site of stimulation should be established and marked using the Brainsight Frameless Image-Guided TMS stereotactic 3D imaging system. For further information on this system please contact The Magstim Company Limited. For peripheral sites, the stimulation site can be marked with a suitable pen.

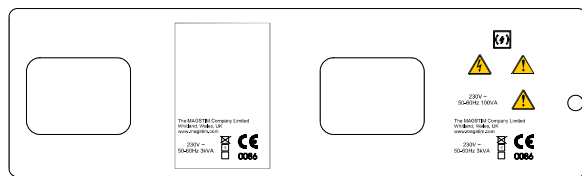
For further information regarding coils, see relevant coil operating manuals, or visit the Magstim website at www.magstim.com.

SECTION: 3. SYSTEM SETUP

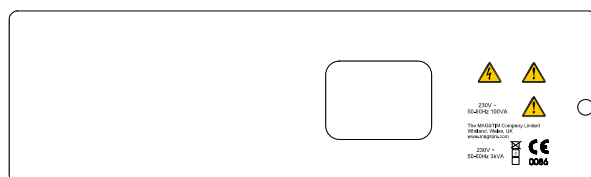
3.1 REAR VIEW



3.2 Power Supply Module (PSU – 3014-00)

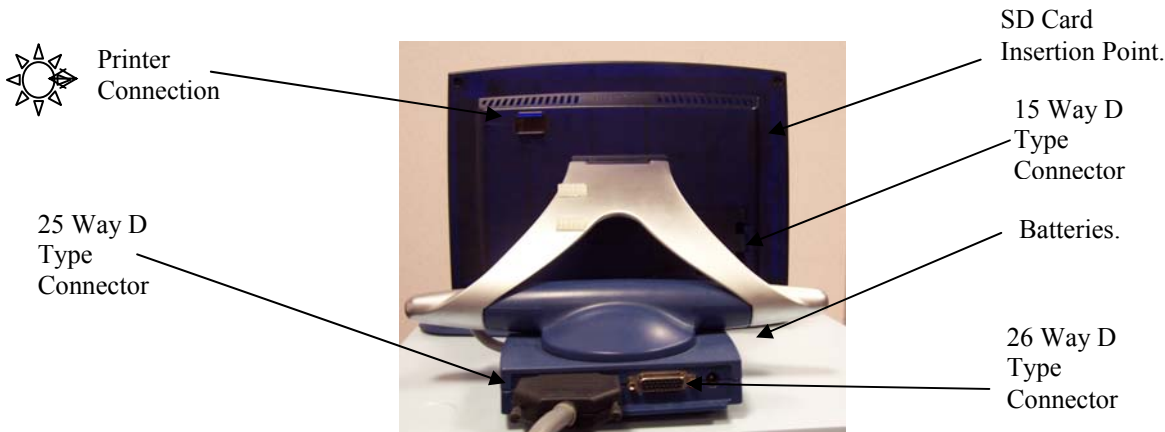


Power Supply Module (PSU – 3013-00)



230VPSU units shown.
115V units are identical in appearance to the 230V units, with the exception of the voltage/power rating labels sited on the rear of the units.

3.3 ADDITIONAL CONNECTIONS



25 Way D Type Connector (situated on rear of the UI, 2 rows of pins)



This connector is situated on the rear of the UI, and has 2 rows of pins. The connector links the UI to the Magstim Rapid² as shown on the diagram on the previous page.

26 Way D Type Connector (situated on rear of UI, 3 rows of pins)



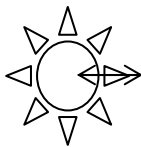
This connector is situated on the rear of the UI, and has 3 rows of pins. It provides trigger input and output signals (see page 54).

DC Power Jack (situated on rear of UI)



The DC Power Jack is situated on the rear of the UI. This connector allows an external 24V, 750mA DC power supply to be attached. A suitable medical grade supply must be used, conforming to IEC 60601-1. This is NOT required when the UI is connected to the Magstim Rapid².

Printer



The Printer is attached to the User Interface via an Optical/RS232 Interface Cable which slides into place on the right hand side at the rear of the UI.

SD Card Socket (situated on rear of the left side panel)



This socket is situated on the rear of the left hand side panel of the UI. This allows connection of an SD Card. This removable memory storage facility enables transfer of data between the UI and external devices, such as PCs.

15 Way D Type Connector (situated on rear of UI behind cover)



This connector is situated on the rear of the UI behind the removable cover. It is designed to accept the Motor Evoked Potential (MEP) pod, available as a separate item. It has type BF connection.

3.4 MEP POD CONNECTION

NOTE. The Rapid² must be switched off before connecting or disconnecting the MEP Pod.

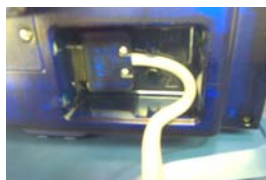
The Motor Evoked Potential (MEP) Pod is an optional component which allows the user to capture EMG signals and display them on the UI. 2 channels are available. The MEP Pod should be mounted as close as possible to the subject but should be kept away from sources of interference, such as power cables. It is recommended that all EMG cables are screened to minimise interference.

The MEP Pod is designed to be used with surface electrodes only.

The MEP Pod is designed to be fitted to the Magstim Rapid² UI only. Do not attempt to connect it to a computer, or any other equipment, with a similar connector. To do so could result in electric shock/ burns to the patient at the site of electrode attachment. The MEP Pod connector has a hole deliberately blocked to prevent incorrect connection.

CONNECTION

The MEP Pod is attached to the rear right hand side of the UI when viewed from the rear. Remove the plastic cover to expose a 15 way D Type socket. Attach the MEP Pod cable, ensuring that the plug is properly inserted. The plastic cover has a notch in its lower edge through which the cable must pass. This cover, when replaced, provides strain relief for the connector. Do not operate the equipment without replacing this cover, as damage to the connector and the internal electronics of the UI is likely.



USE

Attach the EMG cable to the MEP Pod and snap the free connectors onto surface type electrodes (for example, Kendall ARBO H124). Suitable electrodes are available from many medical supply companies, and no recommendation is made as to a particular type. Electrodes should be chosen which are suitable for the collection of EMG data, have snap connectors, and which are compliant with local regulations. When connecting the electrodes, follow the colour code on the MEP Pod.

The EMG connection cable should be screened and should be suitable for use when in direct contact with the skin. No latex should be present in the cable.

The electrodes should be positioned on the target muscle which is controlled by the neurons being stimulated. For example, if the area of the motor cortex which controls the hand is to be stimulated, the surface electrodes should be placed on abductor digiti minimi, about 1cm apart. The ground electrode should be placed on the wrist. Care should be exercised when placing surface electrodes. It is important that a consistent approach is observed, as the amplitude of the EMG signal is dependent on the position of the electrodes. Good practice in relation to skin cleaning should be observed.

CAUTION

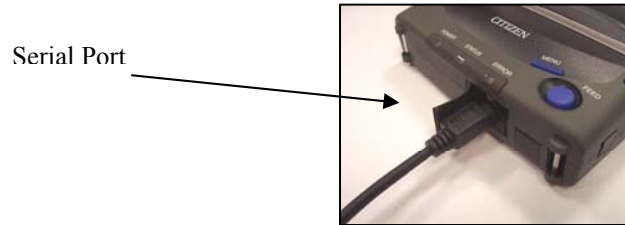
For safety reasons, do not leave patient cables attached to the MEP Pod if they are not being used. If an unused cable is left connected, and the patient is connected to the other channel, there is the possibility that the unused cable may touch an earthed surface which could allow current to flow through the patient to ground.

Do not allow the coil or the coil cable to come into close proximity with the MEP Pod patient cables. During discharge, current may be induced in these cables.

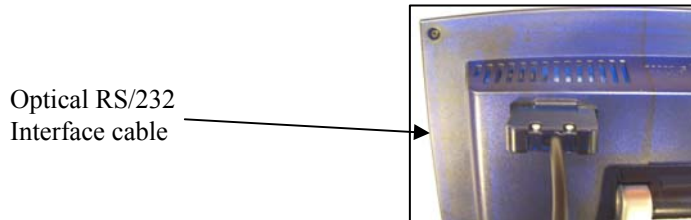
3.5 PRINTER

TO SET UP THE PRINTER

1. Insert the cable connector straight into the Printers Serial Port to power the printer via the Mains



2. Connect the other end of the cable to the back of the UI via an optical RS/232 Interface cable by sliding the connector into the slot until tight. Connect the printer to its power supply and the power supply to the mains.

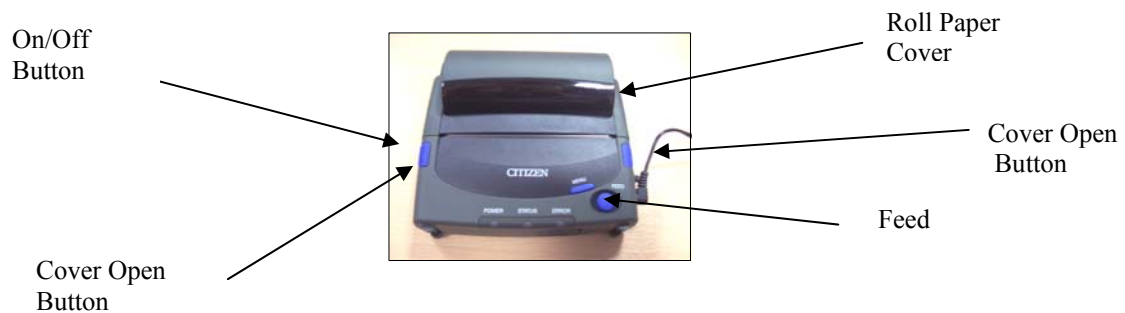


3. Switch the printer on via the green button on the left hand side of the printer. The 'Power' LED should now be illuminated green.

TO LOAD THE PAPER

1. Push the Cover Open buttons on the side of the printer; this should open the Roll Paper Cover.
2. Align the edges of the paper roll against the paper holders and push down gently.
3. Pull the paper through and close the cover.

The Printer is now ready to be used.



3.6 SET-UP

1. Before using the instrument, ensure that the correct fuses are fitted and that the voltage selector is set to suit the country's supply voltage (this statement applies to the Rapid² Main Frame only). There are 2 fuses, rated at T 1.25A for both 115V~ ±10% and 230V ~ ±10%. For information on changing the fuses, please see Section 9.
2. Place the system in a room near multiple power sockets and ensure easy access to and around the equipment.
3. Label the entrances to the room to warn of the presence of strong magnetic fields and to exclude those wearing pacemakers and/or electronic implants.
4. Connect the power cables provided to the power supply socket(s) on the rear of the PSU. The power requirement of the Magstim Rapid² depends on the PSU used and the parameters set by the UI.
5. **The power cables must be connected directly to wall power outlet sockets**, and not via a terminal block. **The Rapid² System must be used only with the supplied mains leads fitted with an integral filter**, as they are required to maintain the System's compliance with EN 60601-1-2 regarding Electro-Magnetic emissions, as is the earth strap fitted between the stimulator and the power supply unit (PSU).
6. Connect the HV cable from the PSU to the rear panel of the Main Frame. Connect the mains link between the PSU Module and the Main Frame.
7. Connect the UI Controller to the Magstim Rapid² via the interface cable supplied.
8. Connect the Stimulating Coil to the front panel connector of the Magstim Rapid².
9. Apply mains power to the Rapid² System by switching the mains power switch on the rear panel of the Rapid² Main Frame to the ON position.

3.7 USER INTERFACE (UI)



ARM Button



The Magstim Rapid² can be put into the **ARMED** mode by momentarily pushing the Green **RUN** button. This can only be achieved if the stimulating coil is connected to the **COIL OUTPUT** socket.

TRIGGER Button



The Magstim Rapid² can be triggered, and a magnetic pulse produced, by pushing the Yellow **TRIGGER** button.

SYSTEM STOP Button



The Magstim Rapid² can be put into the safe inactive default mode by momentarily pushing the Red **STOP** button. In this mode, the instrument will discharge internally.

OUTPUT CONTROL Knob

This control allows the user to change the screen-selected parameter to the desired value. It is therefore used to alter screen settings as well as changing the power output of the stimulator.

TOUCH-SENSITIVE SCREEN/ SYSTEM DISPLAY

All selections are made via the touch-screen. To select, touch the centre of the button symbol next to the desired menu option. Do not press hard, or use a sharp or pointed object to make the selection, as this may damage the touch screen.

In the set-up screens, all selectable items are coloured in pale blue; white items are non-selectable. The Rotary Control Knob can only be used to change parameters already selected. Details regarding the contents and operation of the UI Screens are given in Sections 4, 5 and 6

Note: If the UI is not used for 30 minutes it will go into a standby condition. In standby, the screen will appear blank and the blue LED in the upper right corner of the front bezel will pulse. Touch the screen to restore the UI.

3.8 STIMULATION

See Section 4 to select the desired mode, stimulating power, stimulation frequency, train duration and inter-train delay.

Activate the ARM button on the UI bezel to arm the unit. The system will charge and the UI will display READY in the system status window.

NOTE: The system cannot be armed if the footswitch is active.

Position the stimulating coil on the desired area of tissue. The system can be triggered by pressing a coil switch button and either pressing the footswitch on the trigger button or on the UI. A clicking noise will emanate from both the stimulating coil and the Magstim Rapid² each time the Magstim Rapid² is triggered. This indicates that a magnetic pulse is being delivered by the stimulating coil, which is stimulating the nerves beneath it.

When necessary, it is possible to reposition the stimulating coil and/or to modify the power level on the UI to suit the requirements for the next stimulus. Meanwhile, the system will have recharged and can be triggered once again in the normal manner.

When the stimulations have been completed, press the SYSTEM STOP button on the UI.

The system can only be fired when one of the following UI screens is displayed:

- Single Pulse Mode,
- Repetitive Mode
- Session Mode.

EXTERNAL TRIGGERING

If an external triggering device is used, the Rapid² uses the power set to govern the maximum discharge frequency. Therefore, if the external frequency is set higher than the power set will allow, the stimulator will discharge at the maximum rate the stimulator can achieve for the power set, and not at the rate from the external trigger source. In these situations, reducing the power will allow the discharge frequency to increase. However, during external triggering there are no duration limits on the trains. Therefore, it is probable under high frequency operation that enough energy will be discharged into the coil to result in its temperature rising rapidly above 40°C following the system going into a coil over-temp condition and reverting to its discharged state.

It is important that if this type of operation is intended the protocol be run prior to use on a patient and the surface temperature of the coil monitored to ensure that the patient is not exposed to excessive temperatures.

NOTE. If the external trigger is set to the level triggering option it is possible for auto-triggering to occur.

IMPORTANT

The temperature of the system internal components becomes elevated during operation. The system should be left on, and uncovered, for approximately ten minutes following completion of stimulation to enable the fan to cool the internal system components.

SECTION: 4. SYSTEM OPERATION INSTRUCTIONS.

Switch on the system using the ON/OFF/STANDBY button on the front of the Rapid² Main Frame.

4.1 WELCOME SCREEN

The UI will activate automatically. The 'Welcome Screen' will be displayed.



The system will fully initialise and the Options Menu will appear after 15 seconds.

Pressing the Continue button before the system has fully initialised gives access to the following options:

Single Pulse Mode

System

File Maintenance

The system needs to be fully initialised before *Repetitive Mode* and *Session Mode* are accessible.

4.2 MAIN OPTIONS MENU



All selections are made via the touch-screen. To select, touch the centre of the button symbols.

- | | |
|-------------------------|---|
| Single Pulse | Selecting this option will call up the <i>Single Pulse Mode</i> Screen.
This allows the system to be fired at a maximum rate of 1Hz, up to 100% power and 0.5 Hz from 101-110%. It also allows an MEP module to be configured. |
| Repetitive Mode | Selecting this option will call up the Repetitive Mode Set-up Screen. (See section 4.5) This allows the system to run a user defined train of pulses from a single trigger. |
| Session Mode | Selecting this option will call up the Session Mode Setup Screen. (See section 4.9) This allows the system to run a series of separately defined trains of pulses from a single trigger. |
| System | Selecting this option will call up the Systems Options Menu Screen. (See Section 5) |
| File Maintenance | Selecting this option will call up the File Maintenance Screen. (See section 6) |

4.3 SINGLE PULSE MODE

The trace window is always active on this screen and is intended to display EMG response information from the MEP Pod. If no MEP pod is connected, the screen message will show 'MEP NOT INSTALLED.'

To alter the settings, touch the window next to the required setting. A dark blue margin will appear within the selected window. The settings can be quickly altered using the Rotary Control Knob.

POWER PANEL



The Power Panel is selected by pressing the Power button. When Power is selected, the button turns green.

Power To adjust the system power level, touch the Stimulator Output window on the Power Panel. The power level is set to the default value of 30%. The power can be increased, or decreased, in 1% increments by using the Rotary Control Knob. Each complete 360° rotation changes the output level by approximately 20%.

%MT The %MT (Motor Threshold) window, displays the percentage of stimulator output which is to be transferred to the Protocol Intensity window. The %MT cannot be adjusted to give more than the 100% in the Protocol Intensity window.

Enhanced This option enables the power level to be increased up to 110% power. This option is only available in Single Pulse Mode.

If Repetitive Mode or Session Mode is accessed via Single Pulse Mode, the Protocol intensity value will be carried over into these modes.

All other configurable Single Pulse Mode options are available only when the MEP Pod is connected.

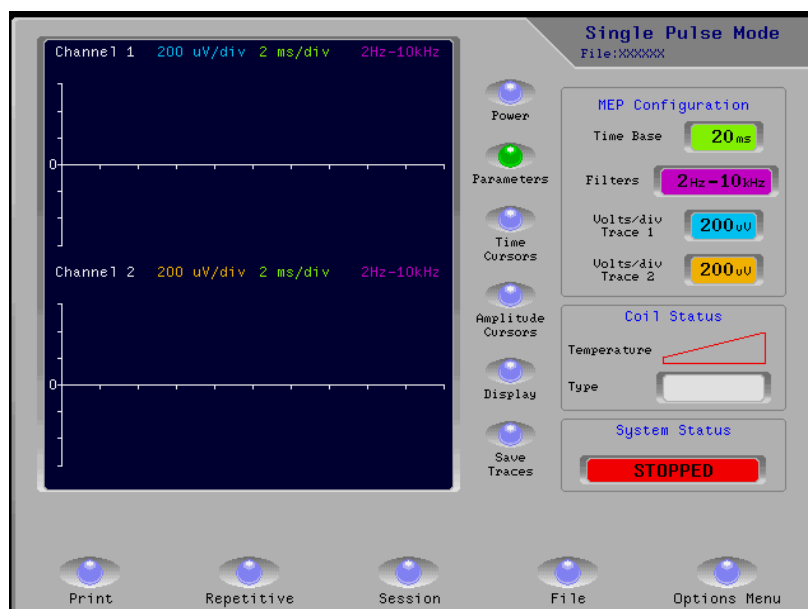
NOTE. The Rapid² must be switched off before connecting or disconnecting the MEP Pod.

4.4 SINGLE PULSE MODE (MEP POD CONNECTED.)

The MEP Pod must be connected to access the following options and to view the traces.

NOTE. The Rapid² must be switched off before connecting or disconnecting the MEP Pod.

PARAMETERS PANEL



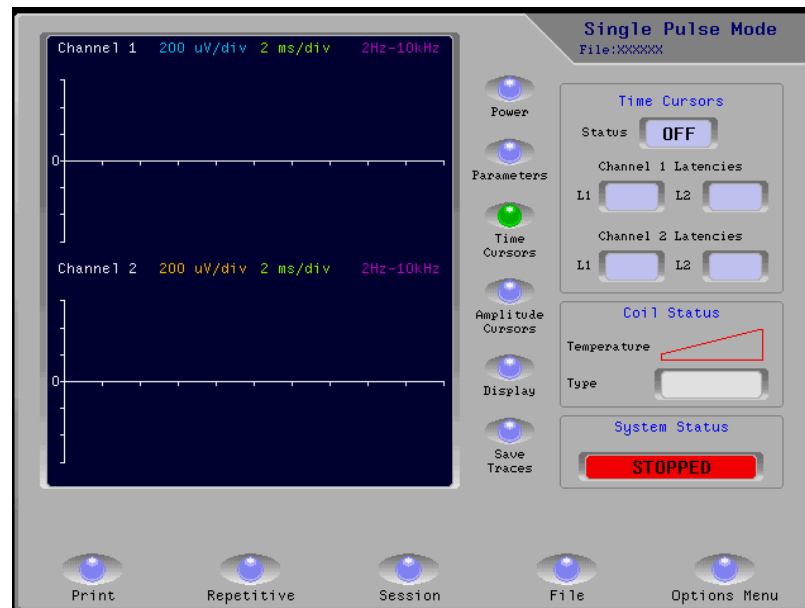
Press the Parameters button (green when selected) to access the MEP Configuration panel.

Time Base Selecting the Time Base window allows the user to set the MEP total sample period. The selectable options are; 20ms, 50ms, 100ms, 200ms and 500ms and are selected using the Rotary Control Knob. The trace width will show the whole of the selected sample period.

Filters Selecting the Filters window allows the user to set the MEP Filter using the Rotary Control Knob. Selectable options: 2Hz-10kHz and 20Hz-10kHz.

Volts/Div Trace 1 Selecting the Volts/Div Trace window allows the user to set the scaling factor for channel 1. Selectable options: 50 μ V, 100 μ V, 200 μ V, 500 μ V, 1mV, 2mV, 5mV and 10mV. The default setting is 200 μ V.

Volts/ Div Trace 2 Selecting the Volts/Div Trace window allows the user to set the scaling factor for channel 2. Selectable options: 50 μ V, 100 μ V, 200 μ V, 500 μ V, 1mV, 2mV, 5mV and 10mV. The default setting is 200 μ V.

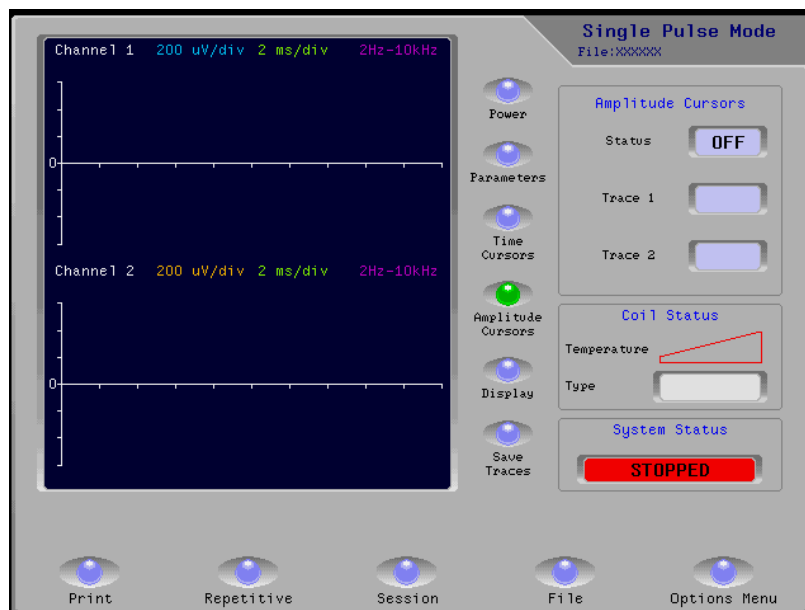
TIME CURSORS PANEL

Press the Time Cursors button (green when selected) to access the Time Cursors panel.

Status Select the Status window to turn the Latency Cursors on and off. The default setting is OFF.

Channel 1 Latencies Select L1 or L2 to activate a cursor for adjustment. When the cursors are active, their current screen time value will be displayed on the trace window. The trace of the selected cursor can be moved using the Rotary Control Knob, for example to identify the time of an event.

Channel 2 Latencies Select L1 or L2 to activate a cursor for adjustment. When the cursors are active, their current screen time value will be displayed on the trace window. The trace of the selected cursor can be moved using the Rotary Control Knob, for example to identify the time of an event.

AMPLITUDE CURSORS PANEL

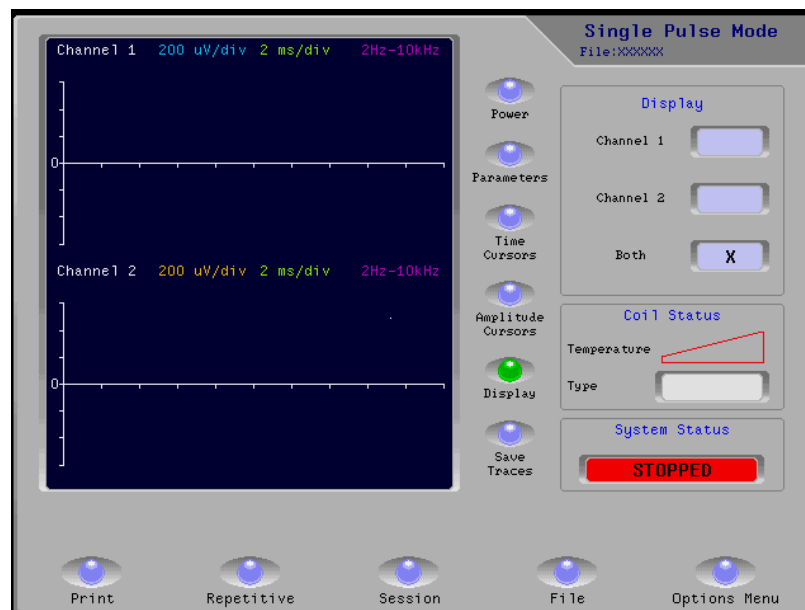
Press the Amplitude Cursors button (green when selected) to access the Amplitude Cursors panel.

Status Select the Status window to turn the Amplitude Cursors on and off. The default setting is OFF.

Trace 1 This window allows the Amplitude Cursor on Trace 1 to be moved, for example to mark peaks.

Trace 2 This window allows the Amplitude Cursor on Trace 2 to be moved, for example to mark peaks.

Each time a new set of MEP waveforms are displayed and the Amplitude Cursors are active, the cursors will automatically move to the peak values for each trace. In Repetitive Mode or Session Mode, the peak achieved in Single Pulse Mode will remain marked by the Amplitude Cursor on the trace.

DISPLAY PANEL

Press the Display button (green when selected) to access the Display panel.

Channel 1. Select the Channel 1 window to show Channel 1 only in the trace window.

Channel 2. Select the Channel 2 window to show Channel 2 only in the trace window.

Both. Select the Both window to show both traces simultaneously in the trace window.

SAVE TRACES

Select Save Traces to save the current trace. If a file is already open the trace will be saved to this file. Alternatively go to File Maintenance and save the trace to a file (See section 6).

COIL STATUS PANEL

The Coil Status panel will show the temperature and type of coil.

SYSTEM STATUS PANEL

The System Status panel shows the system status.

TRACE WINDOW

The Trace window will be updated when a stimulation occurs. The maximum update rate for the trace window is 4 times a second, depending on the amount of information to be displayed.

Print For Print operations see Section 6.

Repetitive This takes the user to the *Repetitive Setup* Screen. (See Section 4.5)

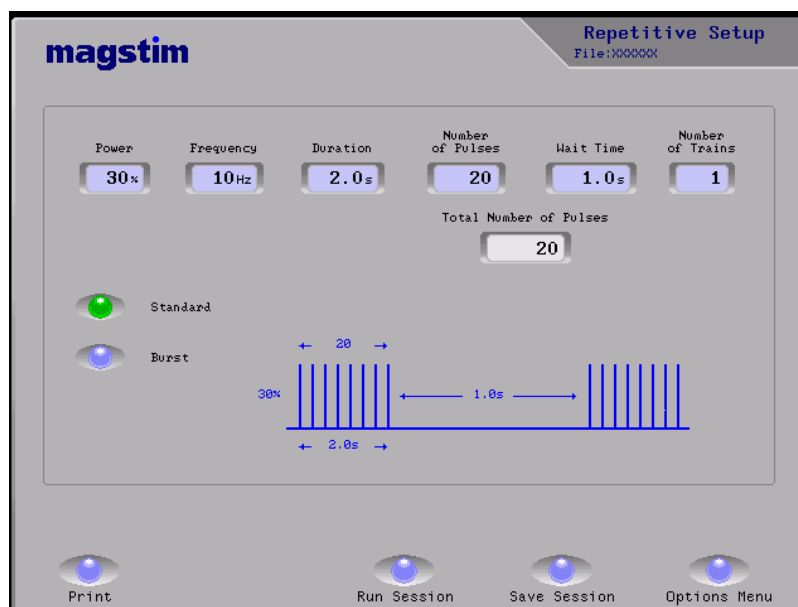
Session This takes the user to the *Session Setup* screen (see Section 4.9)

File This takes the user to the *File Maintenance* screen (see Section 6).

Options Menu Selection of this option will return the user to the *Options Menu* screen.

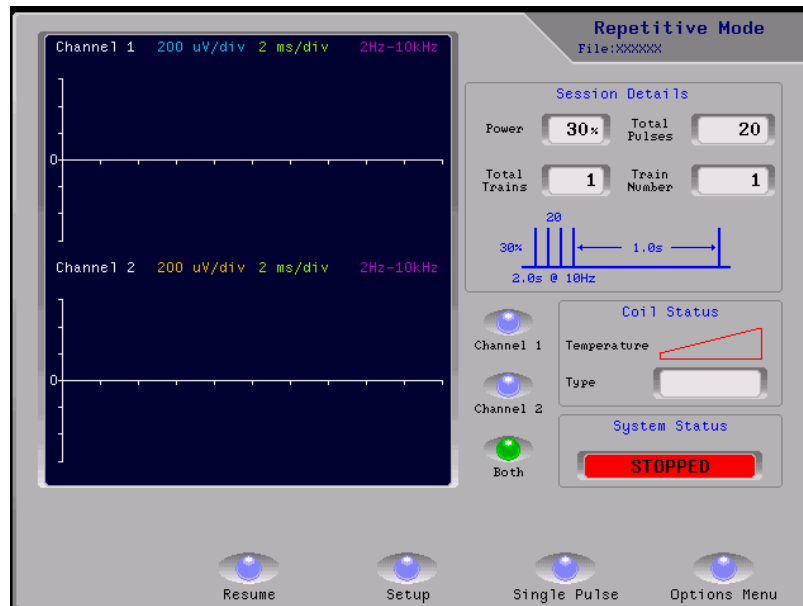
4.5 REPETITIVE MODE: STANDARD SETUP

The Repetitive Setup Screen allows the user to set the following adjustable parameters to the desired values to enable a session to be run. If Repetitive Setup is accessed from Single Pulse Mode, the protocol intensity value established in Single Pulse Mode will be carried over into the power window.



- Power** Select the power window and use the Rotary Control Knob to adjust the System Power Level. The power can be increased, or decreased, in 1% increments.
- Frequency** Selecting the Frequency window allows the user to set the frequency of the pulses to a value between 0 and F_{Max} Hz in 1Hz increments. The maximum frequency can be up to 100Hz depending on the power level set and the system configuration. A table detailing the available power/ frequency combinations is included in Section 10.
- Duration** Selecting the Duration window allows the user to set the duration of the pulse train to between 0.1 and 10 seconds, in 0.1 second increments. On entering the duration and frequency, the number of pulses is automatically calculated by the UI and displayed.
- Number of Pulses** Selecting the Number of Pulses window allows the user to set the number of pulses in a train to between 1 and 1000 in steps of 1. The number of pulses cannot be set to deliver more than 10 seconds stimulation. If the frequency is altered, the system will automatically adjust the duration to fit the current number of pulses.
- Wait Time** Selecting the 'Wait Time' allows the user to set the wait time to between 1 and 60 seconds, in 0.1 second steps. However, if the minimum wait time required for the selected protocol is greater than that selected, the UI will display a message 'Wait period too short, auto-set to minimum'. Select 'YES' to set the wait delay to the minimum allowed for the chosen protocol. Select 'NO' to reset the protocol parameters manually.
- No. of Trains** Selection of this option allows the user to set the number of times that the specified train runs to a value between 1 and 250 in steps of 1.
- Information Window** Appears at the base of the screen. The Information Window provides information such as 'Coil OK to run,' and alerts the user to actions required, protocols that are unable to be completed, or equipment which needs to be attached.
- Print** For Print operations see Section 6.
- Save Session** Save Session takes the user to the File Maintenance screen (See section 6)
- Options Menu** Selection of this option will return the user to the Options Menu screen.
- RUN SESSION** This screen takes the user to the Repetitive Mode screen in order to run a session.

4.6 REPETITIVE MODE: STANDARD



SESSION DETAILS

The Session Details panel shows a pictorial representation of the train currently running, and shows the settings established in Repetitive Setup.

Channels 1, 2 and Both Selecting Channel 1, Channel 2 or Both determines whether both traces are shown simultaneously or individually.

COIL STATUS PANEL

The Coil Status panel will show the temperature and type of coil.

SYSTEM STATUS PANEL

The System Status panel shows the system status.

Trace Window

The Trace window will be updated when a stimulation occurs. The maximum update rate for the trace window is, 4 times a second, depending on the amount of information to be displayed. If the amplitude cursors are active then the last position set for each cursor in Single Pulse Mode will be displayed. The cursor position will remain fixed until Single Pulse Mode is re-entered. In order to save the traces it is necessary to return to Single Pulse Mode and save the data as before. The information will remain on each trace window until a new trace is generated, when the new trace will overwrite the previous trace.

Resume

This option is available if the system is armed and the previous session was not completed. Selecting Resume will return the session to the point at which it was stopped, beginning at the start of the next train regardless of when the last train was stopped.

Setup

Selection of this option will return the user to the Repetitive Setup screen.

Single Pulse

Selecting this option will return the user to the Single Pulse Mode screen.

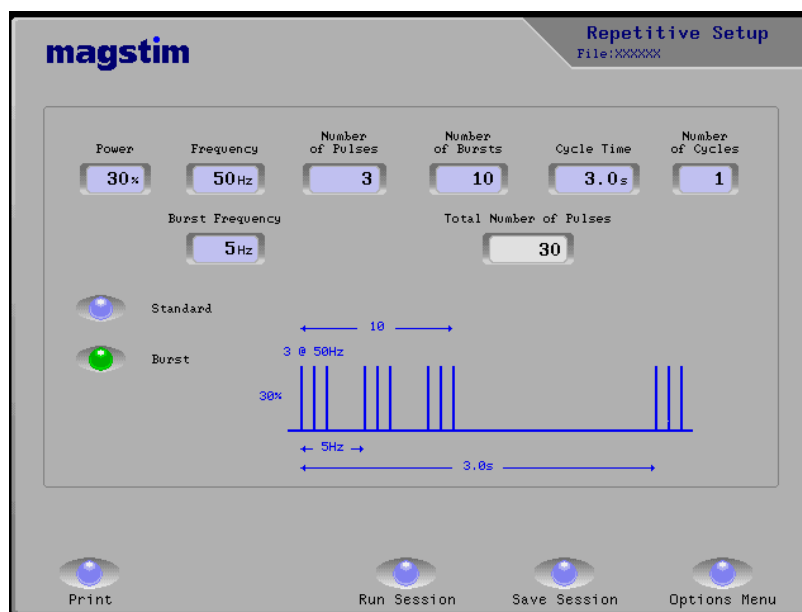
Options Menu

Selection of this option will return the user to the Options Menu screen.

4.7 REPETITIVE MODE: BURST SETUP

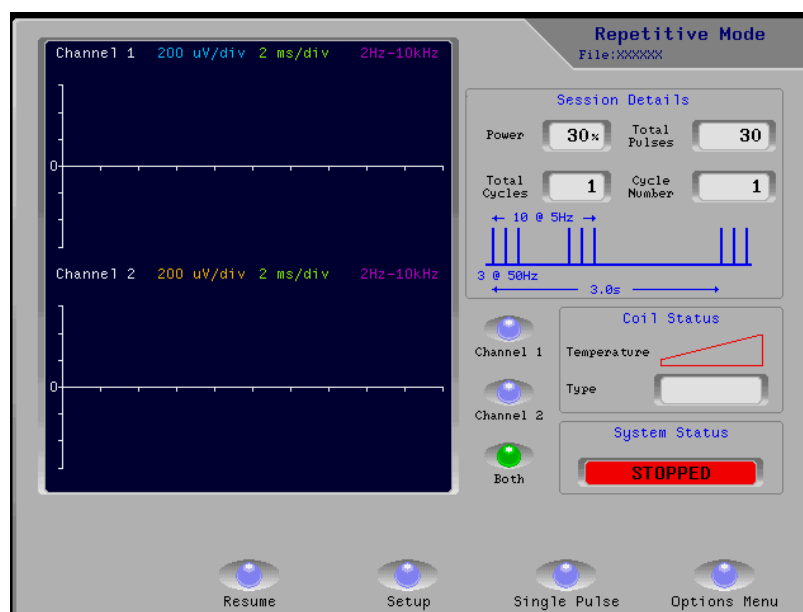
Select Burst Mode from the Repetitive Setup screen to allow the following adjustable parameters to be set.

If Repetitive Setup is accessed from Single Pulse Mode, the protocol intensity value established in Single Pulse Mode will be carried over into the power window.



- Power** Selecting the Power window allows you to adjust the power level between 0% and 100% using the Rotary Control Knob.
- Frequency** Selecting the Frequency window will allow the user to set the frequency of the pulses to a value between 0 and F_{Max} Hz in 1Hz increments. The maximum frequency can be up to 100Hz depending on the power level set and the system configuration. A table detailing the available power/ frequency combinations is included in Section 10.
- Number of Pulses** Selecting the 'Number of Pulses' window allows the user to set the number of pulses per Burst. The Number of Pulses can be set between 1 and 10 using the Rotary Control Knob.
- Number of Bursts** Selecting the 'Number of Bursts' window allows the user to set the number of bursts in a cycle. The number can be set between 1 and 500 in increments of 1.
- Burst Frequency** Selecting the 'Burst Frequency' window allows the user to set the Burst frequency between 1Hz and 10Hz.
- Cycle Time** Selecting the 'Cycle Time' window allows the user to set the time for each cycle in seconds. The time can be set between 1 and 60 seconds in increments of 0.1 seconds.
- Number of Cycles** Selecting the 'Number of Cycles' window allows the user to set the number of cycles in a session. The value may be set between 1 and 250 in increments of 1.
- Print** For Print operations See Section 6.
- Run Session** This screen takes the user to the Repetitive Mode Screen to run a session.
- Save Session** Save Session takes the user to the File Maintenance screen (See section 6).
- Options Menu** Selection of this option will return the user to the Options Menu screen.

4.8 REPETITIVE MODE: BURST



SESSION DETAILS PANEL.

The Session Details panel shows a pictorial representation of the cycle currently running, and shows the settings established in Repetitive Setup.

Channels 1, 2 and Both Selecting Channel 1, Channel 2 and Both determines whether both traces are shown simultaneously, or individually.

Trace Window The Trace Window will be updated when a stimulation occurs. The maximum update rate for the trace window is, 4 times a second, depending on the amount of information to be displayed.

If the amplitude cursors are active then the last position set for each cursor in Single Pulse Mode will be displayed. The cursor position will remain fixed until Single Pulse Mode is re-entered.

In order to save the trace, it is necessary to go back to Single Pulse Mode and save the data as before. The information will remain on each trace window until a new trace is generated, when the new trace will overwrite the previous trace.

Resume This Option is available if the system is armed and the previous session was not completed. Selecting Resume will return the session to the point at which it was stopped at the beginning, at the start of the next cycle regardless of when the last cycle was stopped.

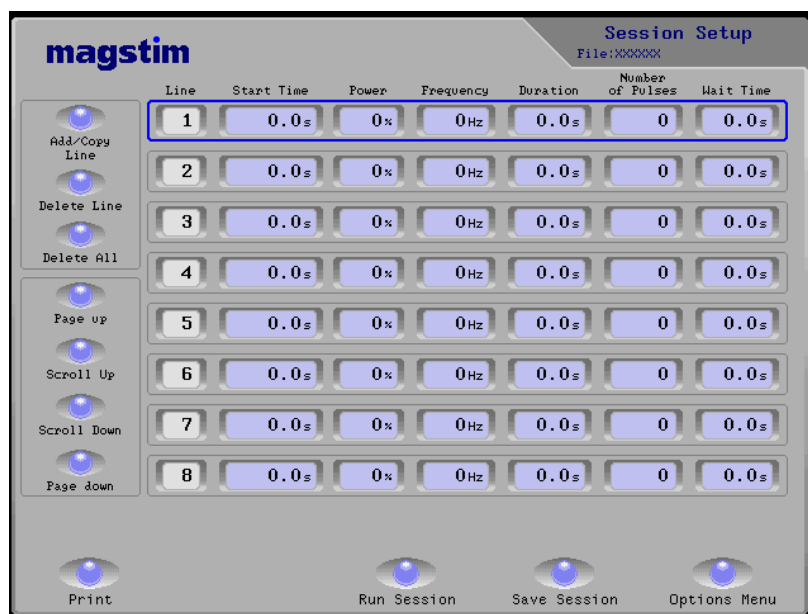
Setup Selection of this option will return the user to the Repetitive Setup screen.

Single Pulse Selecting this option will return the user to the Single Pulse Mode screen.

Options Menu Selection of this option will return the user to the Options Menu screen.

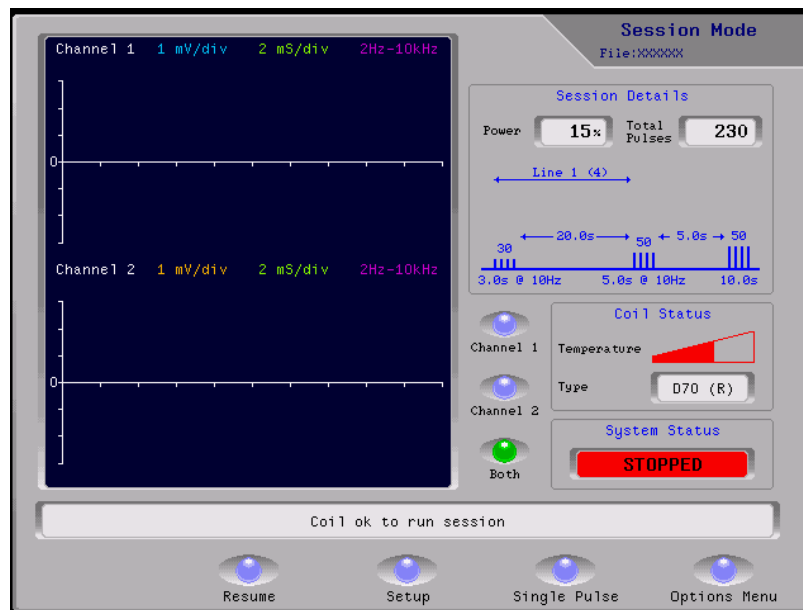
4.9 SESSION MODE: SETUP

This screen allows the user to set up a series of individual lines, each with different Power, Frequency, Duration and Number of Pulses parameters. See section 4.5 for limits. If Session Setup is accessed from Single Pulse Mode, the protocol intensity value established in Single Pulse Mode will be carried over into the power window.



- Add/Copy Line** Selection of this option (press the window to select) enables the user to copy the session line settings of the selected line and copy them into the next line.
- Delete Line** Selection of this option will delete the highlighted line.
- Delete All** This button will delete all lines, allowing the user to start writing a new protocol.
- Page Up** Pressing this button will allow the user to move up pages if the protocol has more lines than will fit on a single screen.
- Scroll Up** This allows the user to move up one line at a time.
- Scroll Down** Selection of this option allows the user to scroll down one line at the time to view train lines below those displayed on the screen. There are up to 30 lines available.
- Page Down** Moves down a page at a time if the Protocol has more lines than will fit on a single screen.
- Print** For Print operations see Section 6.
- Run Session** Selection of this option will call up the Session Mode screen.
- Save Session** Selection of this option will call up the File Maintenance screen (See section 6) and allows the user to save the session set up.
- Options Menu** Selection of this option will return the user to the Options Menu screen.

4.10 SESSION MODE



SESSION DETAILS

Session Details shows a pictorial representation of 3 lines of the session running currently.

Channels 1, 2 and Both Selecting Channel 1, Channel 2 and Both determines whether both traces are shown simultaneously, or individually.

Trace Window

The Trace Window will be updated when a stimulation occurs. The maximum update rate for the trace window is, 4 times a second, depending on the amount of information to be displayed.

If the amplitude cursors are active then the last position set for each cursor in Single Pulse Mode will be displayed. The cursor position will remain fixed until Single Pulse Mode is re-entered.

In order to save the trace, it is necessary to go back to Single Pulse Mode and save the data as before. The information will remain on each trace window until a new trace is generated, when the new trace will overwrite the previous trace.

Resume

This Option is available if the system is armed and the previous session was not completed. This option will return the session to the point at which it was stopped. This will always begin at the start of the next session line regardless of when the last session line was stopped.

In order to save the traces, it is necessary to go back to Single Pulse Mode and save the data as before. The information will remain on each trace window until a new trace is generated. Then it will be overwritten by a new one.

Setup

Selection of this option will return the user to the Repetitive Setup screen.

Single Pulse

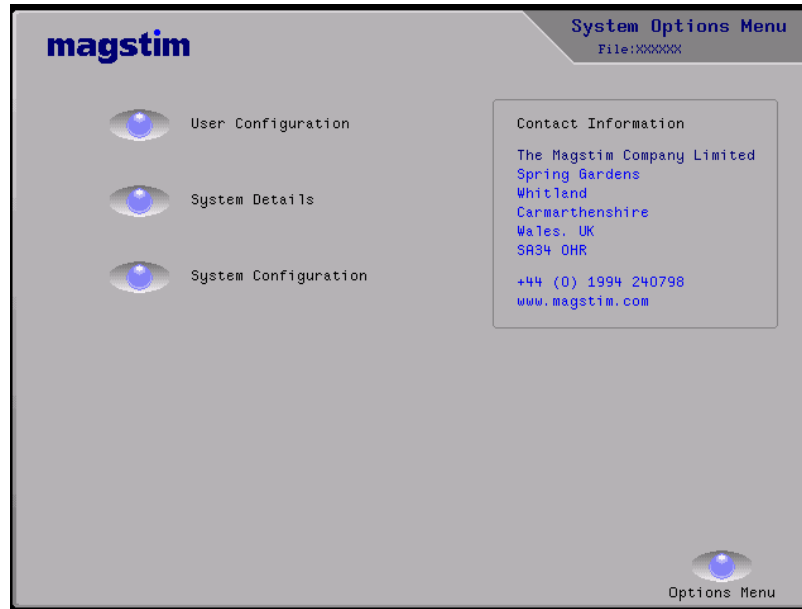
Selecting this option will return the user to the Single Pulse Mode screen.

Options Menu

Selection of this option will return the user to the Options Menu screen.

SECTION 5: SYSTEM

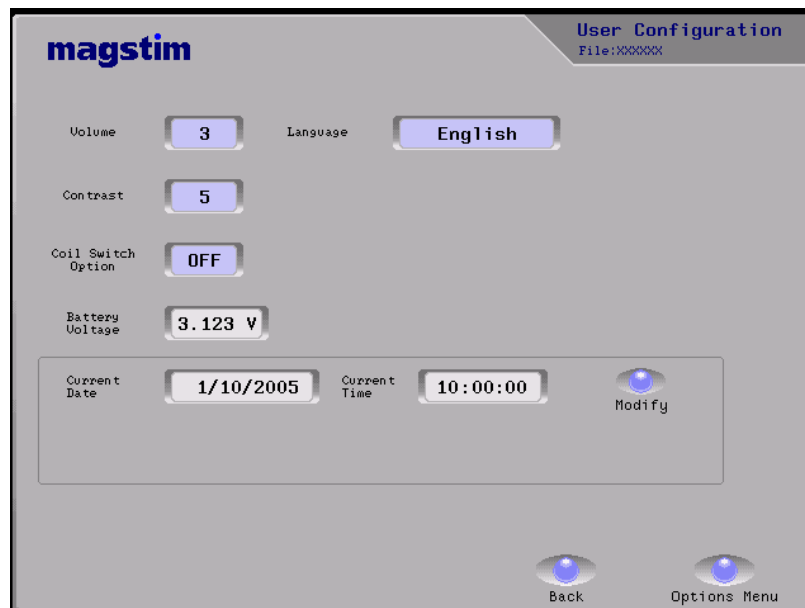
5.1 SYSTEM OPTIONS MENU.



- | | |
|-----------------------------|--|
| User Configuration | Selection of this option will call up the <i>User Configuration</i> Screen. |
| System Details | Selection of this option will call up the <i>System Details</i> Screen. |
| System Configuration | Selection of this option will call up the <i>System Configuration</i> Screen. |
| Options Menu | Selection of this option will return the user to the <i>Options Menu</i> Screen. |

5.2 USER CONFIGURATION

User Configuration This screen allows the user to set system parameters, which are stored in an area of the UI's memory which is battery powered.



Volume This allows the user to set the screen selection beep volume by selecting the window and using the Rotary Control Knob.

Contrast This allows the user to adjust the TFT contrast option from 1 - 10, in steps of 1.

Coil Switch Option This gives the user the choice to use the coil safety switch or not each time the system is armed. When ON the System will prompt the user on a Run Screen to state if they wish to use the coil safety switch.

Note: If the coil switch option is set to **ON**, each time the system is armed the user will have a **YES/NO** option on the screen to ignore the switches before the system can fire. When the '**YES**' button is selected a small yellow button will appear in the top right hand corner of the system status panel to indicate 'ignore' option is active.

It is important that those in the vicinity of the system are made aware that the system is in this mode of operation, to ensure that inadvertent triggering does not occur.

Date Use 'Modify' to alter the 'Date Settings'

Time Use 'Modify' to alter the 'Date Settings'

Modify To change the date and the time settings, select the Modify button. Individual windows appear to allow date, month, year, hour, minute and second to be altered. Press to select a window and alter the information using the Rotary Control Knob. To save press the Set Time button.

Language Setup This option allows the user to change the language of the displays. German, English and French are available. English is the Default language.

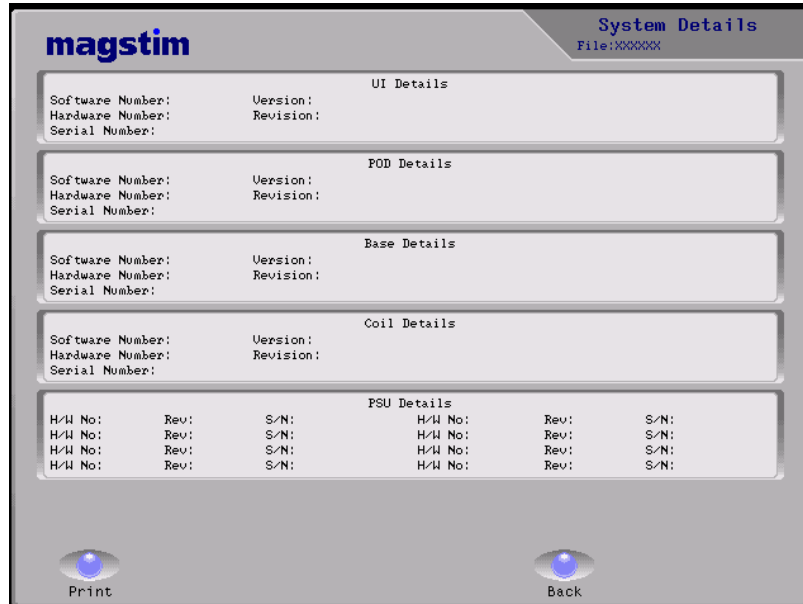
Battery Voltage This window displays the UI's backup battery voltage.

Back Selection of this option takes you back to Systems Options Menu.

Options Menu Selection of this option will return the user to the Options Menu Screen.

5.3 SYSTEMS DETAILS

System Details This screen shows the part numbers, revision and serial number information for UI, MEP Pod, Main Frame, PSU and attached coil.

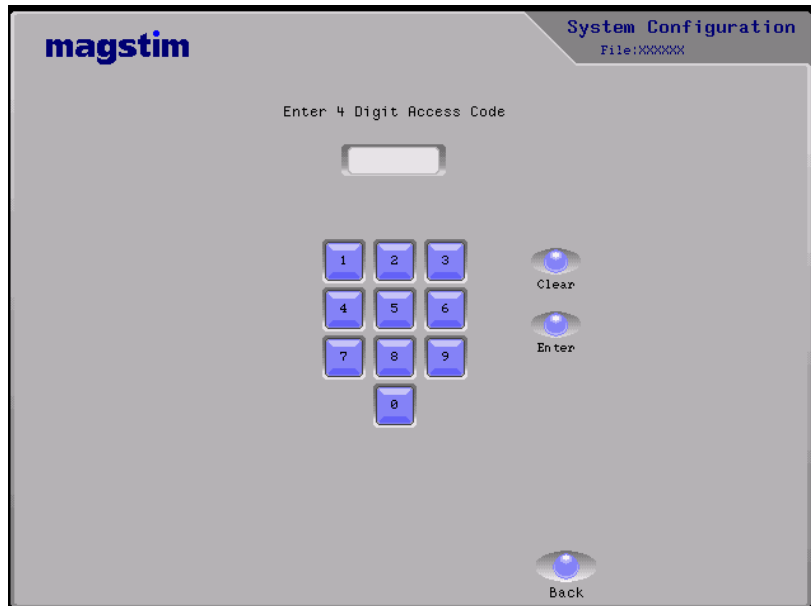


Print For Print Operations See Section 6.

Back Returns the user to the System Options Menu.

5.4 SYSTEM CONFIGURATION.

This screen is intended for Service Personnel.



Clear This button clears the password window.

Enter This button enters the current number in the password window for verification. If correct, the service menus are displayed.

Back This option returns the user to the System Options Menu screen.

SECTION 6: DATA RETRIEVAL

6.1 FILE MAINTENANCE WINDOW

The file maintenance window allows the user to enter a file name and store protocols. These may be generic protocols which are chosen for a patient. The protocols may be stored internally, or may be stored on a memory card. (See section 6.3)



Keyboard

The keyboard is touch sensitive. A file name needs to be selected in order to edit it. Select the Local Store screen and use the Rotary control knob to scroll between files.

View

Selection of 'View' reloads the data stored in the selected file located in the local store window. The file name will be displayed in the top right hand corner of the screen.

New

Selection of 'New' allows the user to create a new file in the local store window. The file name entered must be between 1 and 18 characters long, and different from any other file name.

Open

Selection of 'Open' will reload the data stored in the selected file. Once the file is opened the 'Open' button will change to 'Close' to enable the file to be closed. The file name will be displayed in the top right hand corner of the screen.

Rename

Selection of this option will allow the user to enter a new name for a chosen File Name. Use the keyboard to make changes to the file name and press save (on the keyboard) to confirm.

Delete

Selection of this option will allow the user to delete the selected file from the local store window after a 'Yes' confirmation.

Export

Export allows the user to export the selected File name in the Local Store window to the multi-media card. (See section 6.3)

Import

Import transfers the selected file from the multimedia card, to the Local Store window.

Print

For Print operations See Section 6.4.

Patient Details

Selection of this option will call up the Patient Details Screen.

Back Selection of this option returns the user to the previous screen.

Options Menu Selection of this option will return the user to the Options Menu Screen.

6.2 PATIENT DETAILS



Press **File** at any time to return to **File Maintenance**.

- Keyboard** The Keyboard is touch sensitive. To enter details into a field, first select the required field window so that it becomes active, showing a dark blue line around the window.
- Save** The 'Save' key on the keyboard de-selects the active window and saves the information is saved in the current window.
- Name** Press the window to select. The Patient 'Name' window can accept up to 40 characters. Enter details using the on-screen keyboard.
- Sex** Press the window to select. The Patient 'Sex' window can accept only 1 character. Enter details using the on-screen keyboard.
- ID#** Press the window to select. The Patient 'ID' window can accept up to 18 characters. Enter details using the on-screen keyboard.
- Date of Birth** Press the window to select. The Patient 'Date of Birth' window can accept up to 18 characters. Enter details using the on-screen keyboard.
- Protocol Description** Press the window to select. Enter details using the on-screen keyboard.
- Comments** Press the window to select. The 'Comments' window can accept up to 273 characters. Enter details using the on-screen keyboard. Once the details have been entered into a window, further selection of the window will produce a 'Save changes in the last window?' box. The changes made can be saved by selecting 'Yes.' To disregard the information entered, press 'No.'
- Print** For Print Operations See Section 6.4
- Delete All** Selection of this option will clear the contents of all the patient details windows, after a 'Yes' confirmation has been entered. If a patient file is open, the patient details will be removed from the file.
- File** Selection of this option will call up the File Maintenance screen.
- Options Menu** Selection of this option will return the user to the Options Menu Screen.

6.3 CREATING AND USING FILES



TO CREATE A FILE

- Go to File Maintenance
- Press the Local Store panel to select (a black line appears around the panel)
- Press New
- In the Local Store, an arrow will point to a blank line
- Enter the new file name, using the on screen keyboard
- Press Save on the Keyboard
- Make sure that the Local Store Screen is selected; use the Rotary control knob to move the arrow to point to a new file name
- Press Open, then Patient Details. The File name will appear in the top right-hand corner
- Select the required windows and enter details using the on- screen keyboard. Press Save on the Keyboard when the information is complete
- Press File to return to File Maintenance
- Press Close

TO VIEW A FILE

- In file Maintenance select the Local Store Window. Use the Rotary Control Knob to select a file
- Press View, then Patient Details.
- Press File to return to File Maintenance.

TO OPEN AND EDIT A FILE

- Select the Local Store Panel in File Maintenance
- Use the Rotary Control Knob to select a file
- Press 'Open', then Patient Details
- Select the required window and make changes using the on-screen keyboard.
- Press 'Save' on the keyboard to confirm
- Press 'File' to return to File Maintenance
- Press 'Close'

TO RENAME A FILE

- Select the File in the Local Store panel using the Rotary Control Knob
- Press 'rename' and use the on-screen keyboard to make changes
- Press 'Save' on the keyboard to confirm

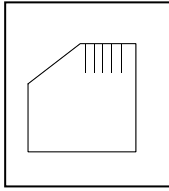
TO DELETE A FILE

- Select the file in the Local Store panel using the Rotary Control Knob
- Press 'Delete'
- The on screen prompt will ask 'Are you sure you wish to delete selected file?'
- Press 'Yes' or 'No'

TO MANAGE FILES FROM SINGLE PULSE MODE, REPETITIVE MODE, AND SESSION MODE

- To save settings created in, for example, Single Pulse Mode, go to File Maintenance
- Press New
- Select the Local Store Panel and add the new file name using the keyboard
- Press Save on the keyboard
- Move the arrow to the new file name using the Rotary Control Knob
- Press Save As
- The prompt 'Are you sure you wish to overwrite the selected file?' will appear whether the file currently contains information or not
- Select 'Yes'
- Use the on-screen buttons to navigate back to, for example, Single Pulse Mode

6.4 SD CARD



An SD Card provides the opportunity for information that is stored on the Magstim Rapid² to be transferred to a PC and viewed using any standard PC text editing software package. Information is transferred onto the SD Card via the 'File Maintenance' Screen.

To save a stored file onto an SD Card, insert the SD Card into the socket situated on the side of the UI (see Section 3). Select the 'File Maintenance' screen and select the 'Local Store' panel. Select a file by turning the Rotary Control Knob until the arrow points at the chosen file. Press the 'Export' Button. The screen will display the command 'Please wait, Data Transfer in Progress' the file will appear in the 'Memory Card' store panel. The file is now saved onto the SD Card.

The UI only supports the short DOS file name convention of 8 characters for the file name and 3 characters for the file extension when reading from or writing to the SD Card. Long file names on the UI will automatically be reduced down to 8 letters for export purposes onto the card. All Files exported from the UI onto the card will have the file extension 'MRF.' When the file is returned to the UI via the SD Card, its original file name will be displayed. See section 7.3 for saved data format.

The Rapid² is only compatible FAT 16 formatted SD cards.

The UI can only be used to read or to write a file from the card. It can not format, create directories or delete any data stored on the card

FORMATTING AN SD CARD WITH A PC

Make sure an SD Card Reader is connected to the system. Insert the SD card.

- Using Windows Explorer select the drive associated with the SD card.
- Select the Format option.
- Under File System select the FAT option.
- Follow the instructions on screen.

6.5 PRINT OPTIONS

The printer makes it possible to generate copies of the majority of the information that is stored within the Magstim Rapid². The Print option allows for screen or file information to be obtained on paper.

In any screen where the 'Print' Button is visible the Printer can produce a reproduction of the information that is displayed on screen. This option is available in:

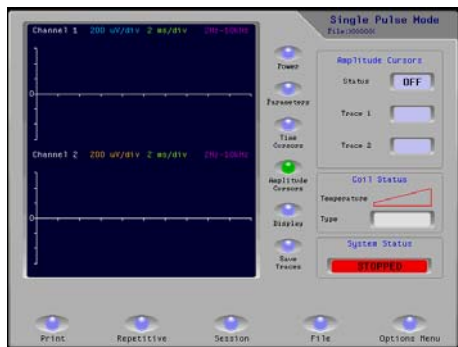
- Single Pulse Mode Power Screen
- Repetitive Setup
- Session Setup
- System Details
- File Maintenance and Patient Details

Once the 'Print' Button is pressed the selected item automatically begins to print, unless the previous print process was cancelled, in which case, follow the instructions on screen. The print process may be cancelled at any time by pressing the 'Cancel' button.

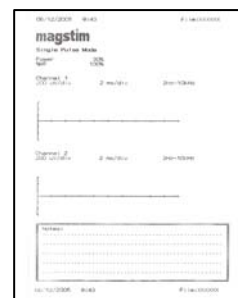
EXAMPLE: SINGLE PULSE MODE

Once the chosen information is generated up on screen the 'Print' button can be pressed to produce a printout, see below.

Screen



Printout

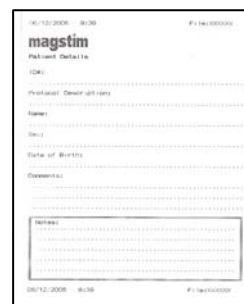


EXAMPLE: PATIENT DETAILS

Screen



Printout



SECTION: 7. SYSTEM STATUS CODES

BASE Controller Error Codes produced by the User Interface.

Error Codes	Description
U24	UI Power Supply Failure
U25	Stack underflow
U26	Stack overflow
U27	RTS overrun
U28	Watchdog Timeout
U29	ROM Checksum Incorrect
U34	No serial communications
U35	Loss of communication
U36	Bad NVRAM Checksum
U37	Battery Voltage Low
U38	Bad External Flash Checksum Detected.

Error codes produced by Coil.

Error Codes	Description
C01	ROM Checksum Incorrect.
C02	EEPROM Checksum Incorrect.
C03	Invalid coil Category.
C04	Invalid Power Identification .
C05	Temperature sensor circuit failure.
C06	Bad Serial command or received data checksum.
C07	Internal Software Error.
C08	Invalid Coil Temperature ID.
C09	Invalid temperature algorithm coefficient.
C10	Coil controller malfunction.

C21	Coil Disconnected/ Coil Under Temperature.
C22	Brown Out Detected.
C23	No serial Communications.
C24	Bad Serial command or received data checksum (outside TRIGGATE).
C25	EMC Detected (Coil adapter only).
C26	Invalid Coil Power Identification (Coil adapter only).
C27	Hardware Stop activated.
C28	Watchdog Timeout.
C29	Temperature Interlock 3 activation.
C30	Coil stop line fault.

Error codes produced by base system.

Error Codes	Description
E61	Power fail
E62	Stack underflow
E63	Stack overflow
E64	RTS overrun
E65	WD Timeout
E66	Unexpected reset
E67	Bad checksum
E68	SYS debug error
E70	Coil under temperature
E71	Coil max difference
E72	Stack over temperature
E73	Stack under temperature
E75	HVCAP over temperature
E77	Charge threshold failure
E78	VREF check failure

E79	HVCAP voltage comparison failure
E80	Charging fault
E81	HV over voltage
E82	Invalid system configuration
E83	Stop line fault
E84	Base coil stop line fault
E85	UI stop line fault
E86	Dump system fault WARNING – high voltage may be present up to 20 minutes after use on internal high voltage capacitor.
E87	Invalid coil category for current system configuration.
E88	Invalid NVRAM Checksum.
E90	Base arm LED drive failure
E91	External PSU Fault
E92	Base over temperature
E93	Snubber Board over temperature
E94	Base under temperature
E95	HC CAP under temperature
E96	Snubber Board under temperature
E97	Ambient over temperature
E98	System failed to produce protocol

7.2 ISOLATED TRIGGER I/O PORT (1)

WARNING

Only equipment complying with EN 60601-1, and configured in compliance with EN 60601-1, should be connected to the trigger output and/or trigger input. Connection must be via Trigger Input/ Output Cable P/N 600003 in order to maintain System EMC Compliance

I/O – 5V CMOS Logic Levels.

Pin Connections.

1. Aux GND	14. N/C
2. N/C	15. N/C
3. Tout- O/C	16. N/C
4. N/C	17. N/C
5. +ive Trigger In	18. N/C
6. -ive Trigger In	19. Aux GND
7. +ive Trigger Out	20. End Train
8. -ive Trigger Out	21. N/C
9. N/C	22. N/C
10. Aux +5V	23. N/C
11. Aux GND	24. Trigger Edge
12. N/C	25. N/C
13. N/C	26. N/C

7.3 SD CARD FILE DETAILS

- General

Each line of the file starts with a text string that describes the data that follows on that line.

Each line of data ends with a carriage return line feed request, <CR>.

- File Layout

The following details the order the data is stored in the Magstim UI generated file.

Version, <file format number>, <CR>

File, <system filename>, <CR>

Status, <system file status when exported>, <CR>

File Time, <seconds>, <minutes>, <hours>, <day>, <month>, <year>, <CR>

Name, <patient name>, <CR>

Sex, <patient sex>, <CR>

ID#, <patient ID>, <CR>

Date or birth, <patient date of birth>, <CR>

Protocol description, <patient protocol description text string>, <CR>

Comments, <patient comments string>, <CR>

Train, <power>, <frequency>, <duration>, <number of pulses>, <wait time>, <number of trains>, <CR>

Burst, <power>, <frequency>, <number of pulses>, <burst frequency>, <number of bursts>, <cycle time>, <number of cycles>, <CR> *see note1.

Session 1, <start time>, <power>, <frequency>, <duration>, <number of pulses>, <wait time>, <CR>

Session 2, <start time>, <power>, <frequency>, <duration>, <number of pulses>, <wait time>, <CR>

.....

Session 30, <start time>, <power>, <frequency>, <duration>, <number of pulses>, <wait time>, <CR>

MEP 0, Trace 1, Trace 2, <CR>

MEP 1, <reading 1 trace1>, <reading 1 trace2>, <CR>

MEP 2, <reading 2 trace1>, <reading 2 trace2>, <CR>

MEP 3, <reading 3 trace1>, <reading 3 trace2>, <CR>

MEP 4, <reading 4 trace1>, <reading 4 trace2>, <CR>

.....

MEP 300, <reading 300 trace1>, <reading 300 trace2>, <CR>

MEP Configuration, <time base index>, <channel 1 voltage range index>, <channel 2 voltage range index>, <special feature>, <filters index>, <CR>

Note 1. Line only added to files by UI software version V6.0 or greater.

- File line Details

The following details the content and data range limits for each data lines contained in the Magstim UI generated file.

Version. This number is created by the UI and must be present in the file and “**must not be altered**”. An invalid number will result in the file not being imported correctly.

File. This is the file name used on the UI and must contain at least one character and not more than 18 characters. The file name can contain any standard alphanumeric character except a comma.

Status. This number is used by the UI to determine what state the file was in when it was exported and “**must not be altered**”. An invalid number will result in the file not being imported correctly.

File Time. This line defines when the file was created on the UI. The range for each value is as follows: seconds 0-59, minutes 0-59, hours 1-23, day 1-31, month 1-12, year 1970 – 2100.

Name. This is the name that appears in the patient data name window on the UI and must not exceed 40 characters. The name can contain any character except a comma.

Sex. This is the character that appears in the patient data sex window and must not exceed 1 character. The character can be any character except a comma.

ID#. This is the string that appears in the patient ID window on the UI and must not exceed 18 characters. The string can contain any character except a comma.

Date of birth. This is the string that appears in the patient date of birth window on the UI and must not exceed 18 characters. The date string can contain any character except a comma.

Protocol description. This is the string that appears in the patient protocol description window on the UI and must not exceed 46 characters. The string can contain any character except a comma.

Comments. This is the string that appears in the patient comments window on the UI and must not exceed 273 characters. The string can contain any character except a comma.

Train. This line contains the parameters displayed on the repetitive set up screen on the UI, (Standard mode). The individual parameter value ranges are as follows:
Power 0 - 100% at a resolution of 1%.
Frequency 1 - 100 Hz at a resolution of 1Hz.
Note the settable power to frequency values is determined by the system configuration, see user manual for Rapid system for more details.
Duration 0.1 - 10.0 seconds at a resolution of 0.1 seconds.
Number of pulses 1 – 1000 at a resolution of 1.
Wait time 1.0 – 60.0 seconds at a resolution of 0.1 seconds.
Number of trains 1 – 250 at a resolution of 1.
Note all time periods are specified in multiples of tenths of a second i.e. if a time period of 6.5 seconds is required then a value of 65 is entered between the commas.

Burst. This line contains the parameters displayed on the repetitive set up screen on the UI, (Burst mode). The individual parameter value ranges are as follows:
Power 0 - 100% at a resolution of 1%.
Frequency 1 - 100 Hz at a resolution of 1Hz.
Note the settable power to frequency values is determined by the system configuration, see user manual for Rapid system for more details.
Number of pulses 1 – 10 at a resolution of 1.
Burst frequency 1 – 10 Hz at a resolution of 1Hz.
Number of bursts 1 – 500 at a resolution of 1.
Cycle time 1.0 – 500.0 seconds at a resolution of 0.1 seconds.
Number of cycles 1 – 250 at a resolution of 1.
Note all time periods are specified in multiples of tenths of a second i.e. if a time period of 6.5 seconds is required then a value of 65 is entered between the commas.

Session x. These lines contain the parameters displayed on the session set up screen on the UI. The individual parameter value ranges for line 1 are the same for all 30 lines and are as follows:

Start time for line 1 has to be zero. The start time on the other lines should be determined using the following equation, start time = previous line (start time + duration + wait time).

Power 0 - 100% at a resolution of 1%.

Frequency 1 - 100 Hz at a resolution of 1Hz.

Note the settable power to frequency values is determined by the system configuration, see user manual for Rapid system for more details.

Duration 0.1 - 10.0 seconds at a resolution of 0.1 seconds.

Number of pulses 1 – 1000 at a resolution of 1.

Wait time 1.0 – 60.0 seconds at a resolution of 0.1 seconds.

Note all time periods are specified in multiples of tenths of a second i.e. if a time period of 6.5 seconds is required then a value of 65 is entered between the commas.

MEP 0. This line contains the MEP data column headings.

MEPS x. These lines contain a single reading for each trace stored in the file.

Trace 1 column contains the MEP waveform that was displayed on the UI for channel 1 when the “save traces” button on the single pulse screen on the UI was selected and the exported file was open for modification. Each of the 300 data values is within the range 0 – 255.

Trace 2 column contains the MEP waveform that was displayed on the UI for channel 2 when the “save traces” button on the single pulse screen on the UI was selected and the exported file was open for modification. Each of the 300 data values is within the range 0 – 255.

To determine the actual voltage recorded for each MEP data value, the value has to be scaled according to the voltage range that was selected at the time the reading was made. The voltage range setting for each channel is recorded on the “MEP Configuration” data line of the file.

MEP Configuration. This line contains the details of how the MEP was configured when the MEP waveforms were saved using “save traces” button on the single pulse screen on the UI. The meaning for each value are as follows:

Time base index, possible values and meanings are as follow:

0 = 20 ms; 1 = 50 ms; 2 = 100 ms; 3 = 200 ms; 4 = 500 ms.

Channel 1 voltage range index, possible values and meanings are as follows:

0 = $\pm 150\mu\text{V}$; 1 = $\pm 300\mu\text{V}$; 2 = $\pm 600\mu\text{V}$; 3 = $\pm 1.5\text{mV}$; 4 = $\pm 3\text{mV}$; 5 = $\pm 6\text{mV}$;
6 = $\pm 15\text{mV}$; 7 = $\pm 30\text{mV}$.

Channel 2 voltage range index, possible values and meanings are as follows:

0 = $\pm 150\mu\text{V}$; 1 = $\pm 300\mu\text{V}$; 2 = $\pm 600\mu\text{V}$; 3 = $\pm 1.5\text{mV}$; 4 = $\pm 3\text{mV}$; 5 = $\pm 6\text{mV}$;
6 = $\pm 15\text{mV}$; 7 = $\pm 30\text{mV}$.

Special feature, always 0.

Filters index, possible values and meanings are as follows:

0 = 2Hz – 10KHz; 1 = 20Hz – 10KHz.

Note: The information stored on the SD Card is of the text format, comma delimited. The file can be imported into any text editor to view or to modify the contents. The files may also be imported into spreadsheets, make sure the delimited option is highlighted and the file origin is set to “Arial- western European”

SECTION 8: SAFETY FEATURES

8.1 COIL TEMPERATURE PROTECTION

An indication of the coil temperature is given by the Coil Temperature information display on the User Interface.

If the coil surface temperature reaches its set limit, the display information will inform the user that this condition has occurred.

The normal operation of the equipment can then be resumed by allowing the coil to cool, or alternatively, by replacing the coil with a cool one.

8.2 COIL DISCONNECTION

If the coil is disconnected from the unit while the unit is charged, the Rapid² system will detect a break in communications and will automatically select the default mode and discharge internally. At the same time a message will be displayed on the UI screen indicating that the coil has been disconnected.

The **ARMED** indicator will extinguish, indicating that the unit is discharged.

8.3 OTHER SAFETY MEASURES

If the instrument has not been triggered for over 10 minutes after the system status window has displayed **READY**, the unit will automatically select the default mode and discharge internally.

The Magstim Rapid² is capable of recognising automatically the type of stimulating coil being used.

SECTION 9: MAINTENANCE AND SERVICING

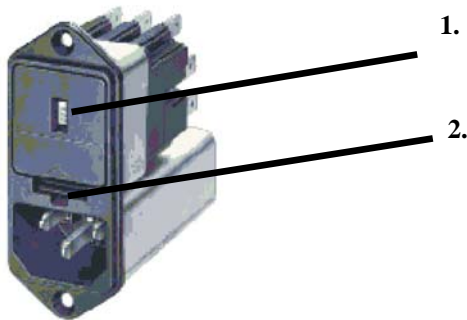
9.1 VOLTAGE SELECTION AND FUSE RATING

The Magstim Rapid² may be operated from supplies in the range of 115V \pm 10% ~ 60Hz, 230V \pm 10% ~ 50Hz and 240V \pm 10% ~ 60Hz. The voltage selector on the rear panel and the adjacent fuses must correspond to the supply voltage as indicated in the table below. The PSU, however, is not voltage selectable and is manufactured as either a 230V (240V) \pm 10% unit, or a 115V \pm 10% unit. The two are not interchangeable.

Supply Voltage	Set Voltage Selector To	Quantity	Fuse Rating
115V \pm 10% ~ 60Hz	115V	2	1.25A T*
230V \pm 10% ~ 50Hz	230V	2	1.25A T*
240V \pm 10% ~ 60Hz	230V	2	1.25A T*

T* denotes timed, or antisurge, fuses. The use of fast acting fuses is not recommended

VOLTAGE SELECTION INSTRUCTIONS



IMPORTANT –Ensure that the Magstim Rapid² is disconnected from the mains supply before changing the fuse, or setting the voltage selector.

- Insert the tip of a small blade screwdriver, or similar tool, into slot no. 2, shown in diagram above. Gently lever up the retaining lip of the fuse holder. The fuse holder will then slide out
- Using a pair of narrow nosed pliers, grip the voltage selector unit on one of the metal connection plates and remove it from the Power Entry Module.
- Orient the voltage selector unit, such that the desired voltage is facing out from the Power Entry Module.
- Re-insert the voltage selector unit into the Power Entry Module.
- Replace the fuse holder, ensuring that the retaining lip is properly home, and verify that the voltage window (1) displays the correct voltage value.

CHANGING FUSE TYPE

- Insert the tip of a small blade screwdriver, or similar tool, into slot no.2, shown in diagram on previous page. Gently lever up the retaining lip of the fuse holder. The fuse holder will then slide out.
- Replace damaged fuse(s) with a suitable replacement.
- Replace the fuse holder, ensuring that the retaining lip is properly home.

9.2 USER MAINTENANCE

At the start of each session the Operator must check the Magstim Rapid2, PSU, UI and the stimulating coil for any signs of damage, paying particular attention to the plastic casing. If there are any signs of physical damage to the Magnetic Stimulator, PSU, UI or the stimulating coil, they must not be used.

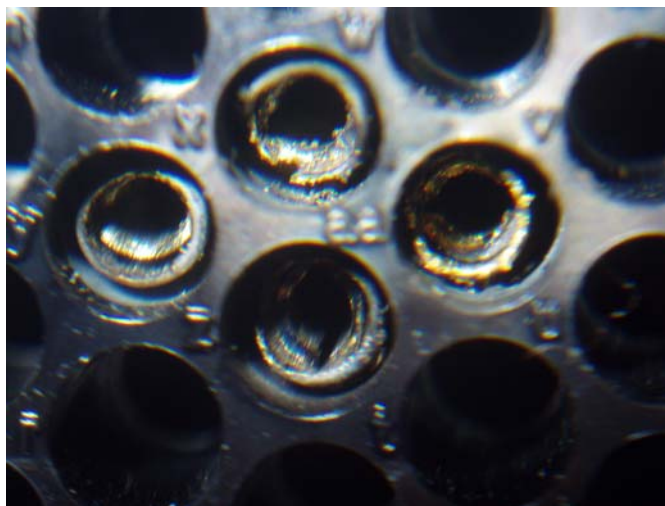
The cooling vents should also be checked to ensure that they have not become blocked, or obstructed.

The UI contains 2 AA cell batteries. These are not rechargeable, and will need to be replaced if patient information is stored on the system. It is important that regular checks are carried out to ensure that the batteries are replaced when necessary. Failure to do so will result in the information being lost. The Battery voltage can be viewed in the User Configuration Screen.

9.3 TECHNICAL MAINTENANCE

The coil pins should be checked before each session for any signs of pitting, or burning, as under conditions of exceptionally hard use at high energy levels, it is possible for the localised heating to manifest itself in the form of micro-welds. Continued use in this condition will eventually result in the coil pins/sockets becoming totally eroded and open circuit.

Note: The pin burning is communicable - any coil with good pins that are used on a stimulator with burned socket pins will have its pins damaged immediately. The reverse is also true; a socket with good pins that has a coil with burnt pins connected to it will have its pins damaged immediately. If damage is noticed on any coil connector or stimulator coil socket the complete system must not be used until all pins and sockets are carefully examined for any damage. If any contacts show damage, even if slight, they will need to be changed. If this is not done thoroughly there is the risk that the cycle of contact damage will continue.



As contact repair is a specialised procedure, it is recommended that contact replacement is undertaken by the Magstim Company, or one of its authorised service centres. If additional advice or information is required, please contact The Magstim Company.

BACKUP BATTERIES

Battery status can be checked on the user configuration screen and when low, is reported on the main Options Menu screen.

The batteries in the UI will require to be replaced every 2 years. To do so, unplug the UI connector, turn the UI upside down, remove the 4 cross-head screws visible, and detach the plastic bottom of the UI. Have the new batteries available. The UI has a small capacitor which will maintain the internal settings for about 20 seconds once the old batteries are removed. It is important that the batteries are replaced within the 20 seconds if data is not to be lost. Before removing the old batteries, ensure you have the correct replacements, and that you are clear about the orientation of the batteries. Once inserted, replace the bottom of the UI and fix using the screws. Do not over-tighten.

Do not use re-chargeable batteries.

When spent, the batteries should be disposed of under the appropriate environmental regulations.

It is advisable that the batteries be removed from the UI if the equipment is likely to be un-used for a long period of time.

9.4 CLEANING AND DISINFECTING

The stimulating coil, exterior of main frame, PSU, UI, foot switch, MEP Pod and MEP Pod patient cables may be cleaned using an isopropyl alcohol moistened cloth. Ensure that the equipment has dried thoroughly before use.

Note 1: The coil cannot be sterilised. Do not allow the coil to become contaminated with body fluids.

Note 2: Do not clean or wipe the touch screen with anything abrasive as it will cause permanent damage.

9.5 SERVICING

All servicing must be carried out by the Magstim Company Ltd, or one of its authorised service centres.

It is recommended that an annual PAT (Portable Appliance Test) test be carried out on the Magstim Rapid².

For further information or service contact:-

The Magstim Company Limited
Spring Gardens
Whitland
Carmarthenshire
SA34 0HR
Wales
United Kingdom

Tel: +44 (0) 1994 242900

Fax: +44 (0) 1994 242910

email: service@magstim.com

Website: www.magstim.com

Important: The Rapid², PSU and UI contain circuitry that is at mains/ HV potential during operation. Some HV/ hazardous potentials will continue to be present for some time after the system has stopped operating. Therefore, under no circumstances must un-authorised persons remove the screws securing the covers of the Magstim Rapid², PSU, or UI. In addition to the risk of electric shock, removal of any of the system covers will automatically render the guarantee void.

Service training courses are available on request. For further information contact the Magstim Company Service Manager.

PACKING INSTRUCTIONS

If, for any reason, it is necessary to return your Rapid² System to either the Magstim Company, or local Distributor, for repair, or upgrade, care should be taken to ensure that the equipment is adequately packed to prevent transit damage. Ideally the equipment should be returned in its original packing. If this or an adequate replacement is not available, replacement shipping cartons can be obtained from the Magstim Company Service Department.

IMPORTANT

The Rapid² System must be completely disconnected before shipping, including removal of the coil holder on the side of the Rapid². Failure to do so is likely to result in transit damage to the casing.

9.6 DEVICE LIFETIME

The lifetime of the Magstim Rapid² System is defined as being 5 years from the date of shipment. The Magstim Company Ltd. will support the product for the duration of its lifetime.

9.7 DISPOSAL

When the Magstim Rapid² System reaches the end of its serviceable life, the Magstim Company Limited should be contacted, at the above address, to arrange for its disposal in compliance with the appropriate environmental regulations.

SECTION 10: SPECIFICATIONS

10.1 GENERAL SPECIFICATIONS



This equipment is classified as Class 1, with type BF Applied Parts.

It is designed to comply with the requirements of the Safety Standard EN60601-1 (90), including amendment 1 (91) and amendment 2 (95) and EMC Standard EN 60601-1-2, with the exception of immunity clause 36.202.5 "Surges."

Protection against ingress of liquids

The Magstim Rapid² System and its accessories are classified as **IPXO (Not Protected)**, as there is **no** specialised protection provided against the ingress of liquids.

Protection against flammable anaesthetic mixtures

Not Protected. Therefore, the Magstim Rapid² System and its accessories are **not** suitable for use in the presence of a flammable anaesthetic mixture with air, oxygen or nitrous oxide.

Mode of Operation

Continuous

EMC General

The Magstim Rapid² System should not be used adjacent to, or stacked with, other equipment and that if adjacent or stacked use is necessary, the equipment should be observed to verify normal operation in the configuration in which it will be used.

EMC Susceptibility

The Magstim Rapid² System needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in Section 11 of this Operating Manual. NB. When the system is exposed to radiated RF between 80MHz and 100MHz, or conducted RF between 30MHz and 80MHz, when used with Coil Adapter P/N 3110-00 and Cooled Coil P/N 3380-00 system errors may occur, setting system into safe mode.

EMC Emissions

To avoid interference problems the Magstim Rapid² System, and its accessories, should not be used in the vicinity of any equipment that does not comply with EMC Standard EN 60601-1-2, including portable and mobile RF communications equipment, such as mobile phones.

The use of accessories, transducers and cables other than those specified by the Magstim Company Ltd., may result in increased emissions, or decreased immunity of the equipment. In order to ensure EMC compliance, the Magstim Rapid² System must be used only with those parts specified by the Magstim Company Ltd. for use with the Magstim Rapid² System.

10.2 POWER

Voltage: *115V±10% AC, 60Hz*
230V ±10% AC, 50Hz
240V ±10% AC, 60Hz

Power Input Fuse Rating: 1.25A T x 2

Equipment should be used with the line cord provided. Where a fused line cord is used, the appropriate fuse should be fitted.

Maximum Power Requirements

230V/240V Rapid² Systems	20VA
Standby	Option 1- 3kVA
During Discharge	Option 2- 6kVA
115V Rapid² Systems	20VA
Standby	Option 1- 2.3kVA
During Discharge	Option 2-4.6kVA

MEP Pod

Class Type:	Class 1, BF
Channels:	2
CMMR:	>90dB
Dynamic Range:	± 30mV ±10%
Amplitude accuracy:	±10% at ½ full scale
Display resolution:	<2%
Cursor resolution:	<2%
Timebase accuracy:	≤±1% of sample period
Timebase resolution:	0.33% of sample period

CALIBRATION

Calibration is not required.

10.3 AMBIENT TEMPERATURE**Permissible Environment Conditions for Transport**

Ambient Temperature Range:	-19°C to 60°C
Relative Humidity Range:	10% to 80% Non Condensing
Atmosphere Pressure Range:	50kPa to 106kPa

Storage and Operating Conditions:

Operating Temperature Range:	5°C to 40°C
Storage Temperature Range:	-19°C to 60°C
Coil Temperature Range:	5°C to 40°C

10.4 CAPACITOR LIFE EXPECTANCY

Life expectancy:	2 x 10 ⁶ discharges at 70% power level
	8 x 10 ⁵ discharges at 80% power level
	4 x 10 ⁵ discharges at 90% power level
	2 x 10 ⁵ discharges at 100% power level

10.5 OUTPUT SAFETY, REPETITION RATE OF STIMULUS:

The following Table is taken from Eric M. Wassermann's paper – Risk and Safety of Repetitive Transcranial Magnetic Stimulation: Report and recommendations from the International workshop on the safety of Repetitive Transcranial Magnetic Stimulation June 5-7, 1996. It gives the maximum safe duration (in seconds) of single trains of rTMS based on the NINDS experience.

Frequency Hz	Intensity (% of MEP threshold)												
	100	110	120	130	140	150	160	170	180	190	200	210	220
1	>1800	>1800	360	>50	>50	>50	>50	27	11	11	8	7	6
5	>10	>10	>10	>10	7.6	5.2	3.6	2.6	2.4	1.6	1.4	1.6	1.2
10	>5	>5	4.2	2.9	1.3	0.8	0.9	0.8	0.5	0.6	0.4	0.3	0.3
20	2.05	1.6	1.0	0.55	0.35	0.25	0.25	0.15	0.2	0.25	0.2	0.1	0.1
25	1.28	0.84	0.4	0.24	0.2	0.24	0.2	0.12	0.08	0.12	0.12	0.08	0.08

Numbers preceded by the symbol > are the longest durations tested. No after discharge or spread of excitation has been encountered with single trains of rTMS at these combinations of stimulus frequency and intensity.

Magnetic Field: The magnetic field produced by the Magstim Rapid² depends on the type of coil connected. In the case of the Double 70mm Coil supplied with the system, the field output is 1.2T at the surface of the coil.

Pulse Characteristics: Biphasic Single Cosine Cycle - 400µs period

230V/240V Rapid² Systems

Available Output Power	Operating Frequency (Hz) Max. 100Hz	
	Rapid ² Option 2	Rapid ² Option 1
0 – 30%	100	50
31	98	46
32	95	45
33	93	44
34	90	42
35	88	41
36	85	41
37	83	39
38	80	39
39	78	38
40	75	37
41	73	36
42	70	34
43	68	33
44	65	33
45	63	33
46	60	33
47	58	33
48	55	32
49	53	31
50	50	30
51	50	30
52	49	29
53	49	29
54	48	28
55	48	28
56	47	27
57	47	27
58	46	26
59	46	26
60	45	25
61	45	25
62	44	24
63	44	24
64	43	23
65	43	23
66	42	22
67	42	22
68	41	21
69	41	21
70	40	20
71	40	20
72	39	20
73	39	20
74	38	19
75	38	19
76	37	19
77	37	19
78	36	19
79	36	18
80	35	18
81	35	18
82	34	18
83	34	18
84	33	18
85	33	17
86	32	17
87	32	17

88	31	17
89	31	17
90	30	17
91	30	17
92	29	16
93	29	16
94	28	16
95	28	16
96	27	16
97	27	16
98	26	15
99	26	15
100	25	15

115V Rapid² Systems

Power (%)	Frequency (Hz) Max. 60Hz	
	Rapid ² (3463-00)	Super Rapid ² (3464-00)
0-30	36	60
31	35	60
32	35	60
33	34	60
34	33	60
35	32	60
36	32	60
37	31	60
38	30	59
39	29	57
40	28	55
41	28	54
42	27	53
43	26	52
44	26	51
45	25	50
46	25	49
47	24	47
48	24	46
49	23	45
50	23	44
51	22	43
52	22	42
53	21	42
54	21	41
55	21	40
56	20	40
57	20	39
58	19	38
59	19	38
60	19	37
61	18	36
62	18	36
63	18	35
64	18	35
65	17	34
66	17	34
67	17	33
68	16	33

69	16	32
70	16	32
71	16	31
72	16	31
73	15	30
74	15	30
75	15	29
76	15	29
77	14	28
78	14	28
79	14	28
80	14	27
81	14	27
82	13	27
83	13	26
84	13	26
85	13	26
86	13	26
87	12	25
88	12	25
89	12	25
90	12	24
91	12	24
92	12	24
93	12	24
94	12	23
95	11	23
96	11	23
97	11	22
98	11	22
99	11	22
100	11	22

10.6 COIL COMPATIBILITY

Only standard production coils can be used with our Rapid Rate Stimulators unless a compatible custom coil, with a high inductance, is specifically made for the customer. **All coils to be used with a Rapid² system must have an inductance of 15µH or more.** Low inductance coils are likely to damage the Rapid Rate Stimulator.

Only the Remote Control and 2nd Generation Coils can be connected directly to the Rapid² System. All other coils must be connected via Coil Adapter P/N 3110-00.

Coil Description	Part Number	Average Inductance	Use with Rapid System
90mm Coil	3193-00	23.47µH	Compatible
90mm Remote Control Coil	3192-00	23.47µH	Compatible
Double 70mm Remote Control Coil	3190-00	15.50µH	Compatible
Double 70mm 2 nd Generation Coil	3191-00	15.50µH	Compatible
2 nd Generation Double 70mm Cooled Coil	3530-00	15.00µH	Compatible
Small 50mm Coil	9999-00	13.50µH	Not Compatible
Medium 70mm Coil	9762-00	16.25µH	Compatible
Large HP 90mm Coil	9784-00	23.30µH	Compatible
Double 25mm Coil	1165-00	10.35µH	Not Compatible
Double 70mm Cooled Coil	1640-00	15.00µH	Not Compatible
Double 70mm Coil	9925-00	16.35µH	Compatible
110mm Double Cone Coil	9902-00	17.85µH	Compatible

Coil Operating Duration at 20°C in Single Shot Mode using the Rapid² System

Coil	Average Inductance	Max. No. of Stimulations at 50% Power	Max. No. of Stimulations at 80% Power	Max. No. of Stimulations at 100% Power
90mm Coil 3192-00/3193-00	23.47µH	927	420	311
Double 70mm Coil 3190-00/3191-00	15.50µH	638	264	212
HP 90mm 9784-00	23.30µH	1935	539	406
70mm 9762-00	16.25µH	428	282	155
Db 70mm 9925-00	16.35µH	1576	448	392
DC 110mm 9902-00	17.85µH	1419	806	406

10.7 UI REAR PANEL

ISOLATED TRIGGER I/O Port

The maximum non-destructive voltage that can be applied to the external connections with respect to ground:

Connection	Not Less Than	Not Greater Than
	Logic Low	Logic High
Trigger Input	- 0.3 – 0.8 V	4 – 5.3V
Trigger Output	- 0.3 – 0.8 V	4 – 5.3V

10.8 GENERAL

Rapid² Main Frame	Size:	Width	460mm
		Height	160mm
		Depth	375mm
PSU 3013-00	Weight	13.1kg	
	Size:	Width	460mm
		Height	160mm
		Depth	375mm
PSU 3014-00	Weight	13.2kg	
	Size:	Width	460mm
		Height	160mm
		Depth	375mm
UI	Weight	23.4kg	
	Size:	Width	360mm
		Height	240mm
		Depth	280mm
	Weight	2.6kg	

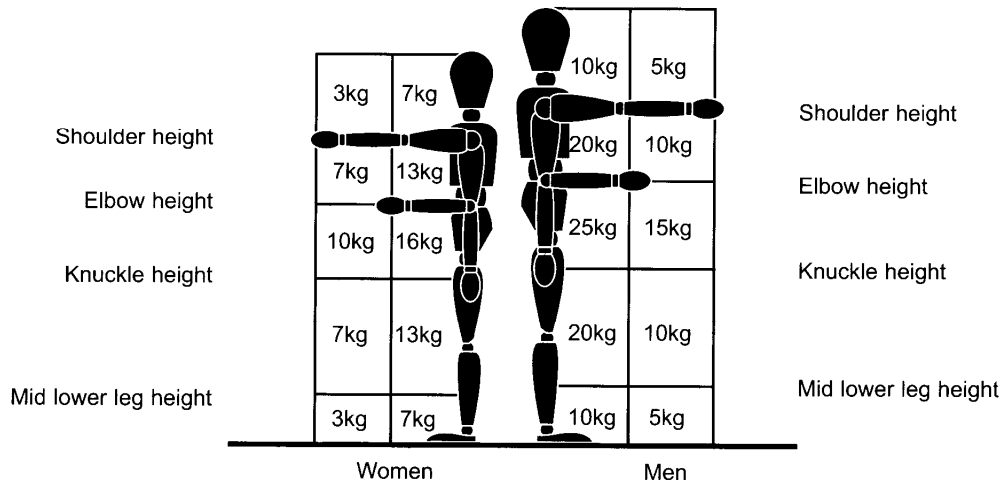
IMPORTANT

The system must be disassembled prior to being moved. The parts of the system are not locked together in any way and are likely to fall if moved together, resulting in damage to the equipment and possible injury to those near to or those transporting it.

10.9 HANDLING

CAUTION The Magstim Rapid² System Main Frame and PSU weigh in excess of 20kg. Therefore, if it is necessary to move the units for any reason, the weight must be distributed between at least two persons (see diagram below for recommended manual handling methods)

NOTE - The weight of PSU 3013-00 is unevenly distributed – the left hand side of the unit being considerably heavier than the right hand side. Care should be taken when transporting the unit to ensure that this heavier side is adequately supported.




SECTION 11: EMC EMISSIONS AND IMMUNITY

Guidance and Manufacturer's Declaration – Electromagnetic Emissions		
The Magstim Rapid ² System is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment should assure that it is used in such an environment.		
Emissions Test	Compliance	Electromagnetic environment - guidance
RF emissions EN55011	Group 1	The Magstim Rapid ² System must emit electromagnetic energy in order to perform its intended function. Nearby electronic equipment may be affected.
RF emissions EN55011	Class A	The Magstim Rapid ² System is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions IEC 61000-3-2	Class A (by equipment type)	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Guidance and Manufacturer's Declaration – Electromagnetic Immunity			
The Magstim Rapid ² System is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Magstim Rapid ² System can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Magstim Rapid ² System as recommended below, according to the maximum output power of the communications.			
Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz $d = \left[\frac{3,5}{V_1} \right] \sqrt{P}$ Where $V_1 = 3$	80 MHz to 800 MHz $d = \left[\frac{3,5}{E_1} \right] \sqrt{P}$ Where $E_1 = 3$	800 MHz to 2,5 GHz $d = \left[\frac{7}{E_1} \right] \sqrt{P}$ Where $E_1 = 3$
0,01	0,117	0,117	0,233
0,1	0,369	0,369	0,738
1	1,167	1,167	2,333
10	3,689	3,689	7,379
100	11,667	11,667	23.333
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

Guidance and Manufacturer's Declaration – Electromagnetic Immunity			
The Magstim Rapid ² System is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment should assure that it is used in such an environment.			
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-4	± 6 kV contact ± 8 kV air	Meets requirement	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast Transient/ burst IEC 61000-4-11	± 2 kV for power supply lines ± 1 kV for input/output lines	Meets requirement (Resetting of the MEP Pod may be experienced during single shot mode under these conditions.)	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	Differential mode compliant. Common mode compliant to ± 1kV only.	Anti surge protection needs to be incorporated into the main supply to the equipment if surge protection is to be guaranteed.
Voltage dips, short interruptions and voltage variations on power supply input lines. IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0,5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	Meets requirement	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Magstim Rapid ² System requires continued operation during power interruptions, it is recommended that the Magstim Rapid ² System be powered from an interruptible power supply.
Power Frequency (50/60Hz) Magnetic Field IEC 61000-4-8	3 A/m 50Hz	Meets requirement	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment
Radiated RF Immunity EN61000-4-3	80MHz – 2.5GHz 2Hz 80% amplitude modulation	Coil adapter P/N 3110-00 and Cooled Coil P/N 3380-00 between 80MHz and 100MHz may produce system errors setting system into safe mode.	Equipment should only be used in the vicinity of other equipment compliant with EN60601-1-2.
Conducted RF Immunity EN61000-4-6	0.15MHz – 80MHz 2Hz 80% amplitude modulation	Coil adapter P/N 3110-00 and Cooled Coil P/N 3380-00 between 30MHz and 80MHz may produce system errors setting system into safe mode.	Equipment should only be used in the vicinity of other equipment compliant with EN60601-1-2.
NOTE U_T is the a.c. mains voltage prior to application of the test level			

Guidance and Manufacturer's Declaration – Electromagnetic Immunity			
The Magstim Rapid ² System is intended for use in the electromagnetic environment specified below. The customer or the user of the equipment should assure that it is used in such an environment.			
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic environment - guidance
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 Vrms 150 kHz to 80 MHz 3 V/m 80 MHz to 2,5 GHz	[V ₁] V [E ₁] V/m	<p>Portable and mobile RF communications equipment should be used no closer to any part of the Magstim Rapid² System, including cables, than the recommended separation distance calculated from the equation applicable to the frequency transmitter.</p> <p>Recommended separation distance</p> $d = \left[\frac{3,5}{V_1} \right] \sqrt{P}$ $d = \left[\frac{3,5}{E_1} \right] \sqrt{P} \quad 80 \text{ MHz to } 800 \text{ MHz}$ $d = \left[\frac{7}{E_1} \right] \sqrt{P} \quad 800 \text{ MHz to } 2,5 \text{ GHz}$ <p>Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m).</p> <p>Field Strengths from fixed RF transmitters, as determined by an electromagnetic site survey,^a should be less than the compliance level in each frequency range.^b</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p> 
<p>NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.</p> <p>NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.</p>			
<p>^a Field strengths from fixed transmitters, such as base stations for radio (cellular/ cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Magstim Rapid² System is used exceeds the applicable RF compliance level above, the Magstim Rapid² System should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Magstim Rapid² System.</p> <p>^b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [V₁] V/m.</p>			

SECTION 12: RAPID² SYSTEM PACKAGES

Option 1 – Standard Rapid²

P/N 3004-00

1 x Rapid ² Main Frame	P/N 3012-00
1 x Power Supply, Single Module	P/N 3013-00
1 x User Interface (UI)	P/N 3022-00
1 x Footswitch	P/N 9525-01
1 x Coil Adapter	P/N 3110-00
1 x MEP Pod	P/N 3526-00
1 x 230V UK Mains Lead with integral filter OR	P/N 3719-01
1 x 230V European Mains Lead with integral filter OR	P/N 3726-01
1 x 240V North American Lead with Integral filter OR	P/N 3764-01
1 x 115V North American Lead with Integral filter	P/N 3801-01
1 x 10A Link Lead	P/N 600002
1 x HV Cable	P/N 3583-00
1 x UI Cable	P/N 3582-00
1 x Rapid ² UI Printer Package	P/N 3804-00

Option 2 – Super Rapid²

P/N 3005-00

1 x Rapid ² Main Frame	P/N 3012-00
1 x Power Supply, Dual Module	P/N 3014-00
1 x User Interface (UI)	P/N 3022-00
1 x Footswitch	P/N 9525-01
1 x Coil Adapter	P/N 3110-00
1 x MEP Pod	P/N 3526-00
2 x 230V UK Mains Lead with integral filter OR	P/N 3719-01
2 x 230V European Mains Lead with integral filter OR	P/N 3726-01
2 x 240V North American Lead with Integral filter OR	P/N 3764-01
2 x 115V North American Lead with Integral filter	P/N 3801-01
1 x 10A Link Lead	P/N 600002
1 x HV Cable	P/N 3583-00
1 x UI Cable	P/N 3582-00
1 x Rapid ² UI Printer Package	P/N 3804-00
1 x Magstim SD Card	P/N 3844-00

Additional Items Available

Trigger Input/ Output Cable	Available to Order
MEP Pod EMG cable	Available to Order
HP90 Coil. Standard	Available to Order
HP90 Coil. Double	Available to Order
Double 70mm Coil	P/N 9925-00
2 nd Generation Double 70mm Coil	P/N 3191-00